OKI

OKI SEMICONDUCTOR

2011 SHORT FORM CATALOG

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OKI SEMICONDUCTOR

OKI SEMICONDUCTOR CO., LTD.

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OKI SEMICONDUCTOR CO., LTD.

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We appreciate your patronage of our semiconductor devices and other electronic devices.

We appreciate your patronage of our semiconductor devices. The application field of semiconductors is diversified and varied, demanding higher performance and functionality as well as segmentation and higher density.
We therefore present this comprehensive catalog, which has been compiled for the purpose of selecting optimal varieties for given applications. We will be pleased if you can make use of this catalog. In addition to the catalog, we also provide data sheets, manuals and other information on a per-product basis in response to our customers' requests. If you need any of these, please contact us.

OKI SEMICONDUCTOR CO., LTD.

2011 SHORT FORM CATALOG

Convention of Product Name Assignment for Semiconductor devices

Product names are assigned to our semiconductor devices using the following convention, starting with the character "M".

■Structure of Product Name

M□ 000000000 □—000 □□Z △△△

❹Derived code
❻Option classification symbol
❶Device function
❷Device code
❸Character symbol
❺Package symbol
❼Option code
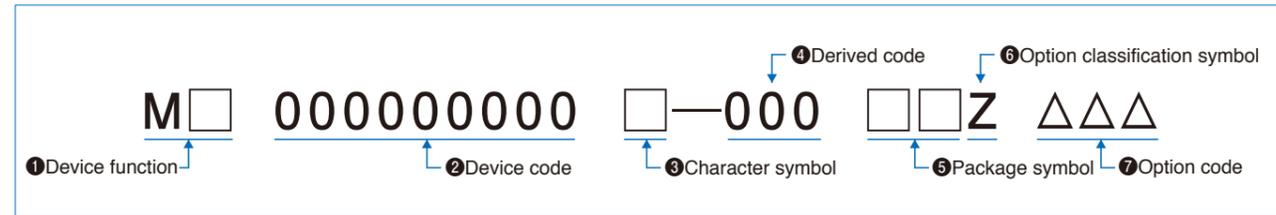
■Assignment of Symbols

❶Device function

The device functions are classified as follows:
MD: DRAM
MR: P2ROM, OTPROM
MS: SRAM, VRAM, FIFO
MG: Gate array, standard cell
ML: Logic
MK: Module, chip set
MT: Driver

❷Device code

The device code expresses a function specific to a device using a combination of numbers and alphanumeric characters.

❸Character symbol

The character symbol is added to indicate the modification of an existing product, to emphasize a specification that differs from the standard specification of an existing product, or to indicate a design standard.

❹Derived code

The derived code indicates the speed ranking for DRAM products and is used as a derived code for logic products.

❺Package symbol

The package symbol expresses the type and lead bending profile of a package in two digits.

❻Option classification symbol

The option classification symbol is used to distinguish between the option symbol and the package symbol.

❼Option code

The option code indicates a symbol that identifies the specification of a product with an option.

* Items from ❶ "Device function", to ❹, "Derived code", are indicated in this catalog.

The following shows the convention of item name assignment for conventional products.

■Product Name of Former Products

MSM 66507 JS

Indicates the process classification
A: Analog
C: Bi-CMOS, multi-chip product
L : Bipolar logic
M: MOS

Indicates the circuit category

Indicates the package profile
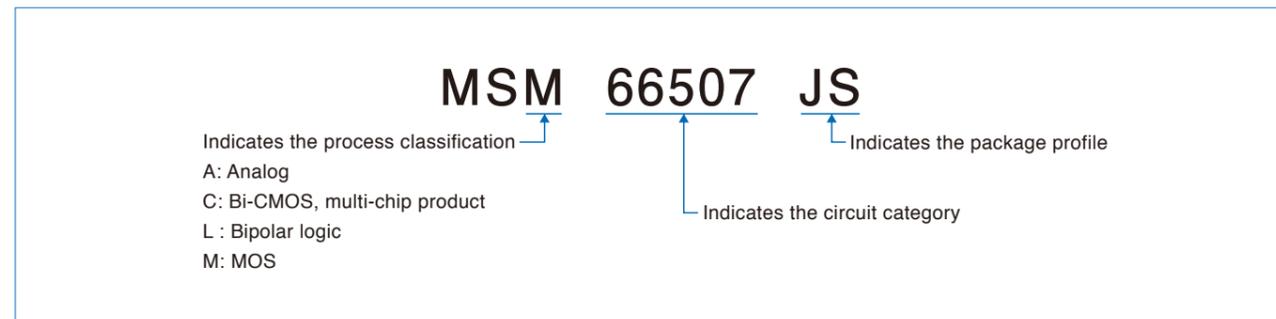
* The actual package profile is not shown here.

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CONTENTS

Communication LSI

Communication LSI Overview

Product Overview

This is a Communication LSI to connect and to be connected.

● This product is used in a variety of applications, such as toys, consumer equipment, industrial equipment, and car equipment.
● Based on a variety of communication LSI technology, we offer wide selection of products.
● In addition to offering development tools, we provide advise based on our rich experience to support your development activities.

OFDM Technology
・Reception of Digital Terrestrial Broadcasting

CODEC Technology
・VoIP CODEC ・PCM CODEC
・ADPCM CODEC

MODEM Technology
・Tele-control IC

Abundant Market Achievement
Home Electronics/Consumer Electronics/
Car Electronics/Industrial Electronics/Toy…

RF-CMOS Technology
・IEEE 802.15.4
・Specified low power radio
・Reception of Digital Terrestrial Broadcasting

Network Technology
・ZigBee
・RF4CE
・Simple NWK

Customer Support
・Provide development tools
・Provide advice based on rich experiences

(Venn diagram: Abundant Communication LSI Technology / Market Achievement / Customer Support)

Product Line-up

A variety of functions provide support for your applications.

Digital terrestrial broadcasting reception LSI With superior mobile reception features, this product is suitable for one-seg broadcasting reception, portable device, and car device.	ML7107 ML7147 ML7137
Wireless communication LSI This product can be used in a variety of applications for products of IEEE 802.15.4/ZigBee and specified low power radio. We also offer it as a module, which can easily be integrated into applications.	ML7246 ML7066 ML7265 ML7386-0□ ML7266 MK72220-01 ML7275 MK72660-01
VoIP LSI This is a multifunctional LSI, suitable for VoIP phones and broadband routers with built-in VoIP functions.	ML7204-003 ML7234-021 ML7304-0□2
Echo Canceller LSI This product is suitable for hands-free communication in mobile phones and door phones.	ML7037-003 ML7202-001
PHS LSI Reliable market achievement	The products are limited for the user who has the development experience in the PHS devices. For details, please inquire to the sales (ROHM Co., Ltd.).

This product list shows main products of communication LSI.

Application Examples

This is a "Communication" LSI to be connected to anyone in any time and anywhere.
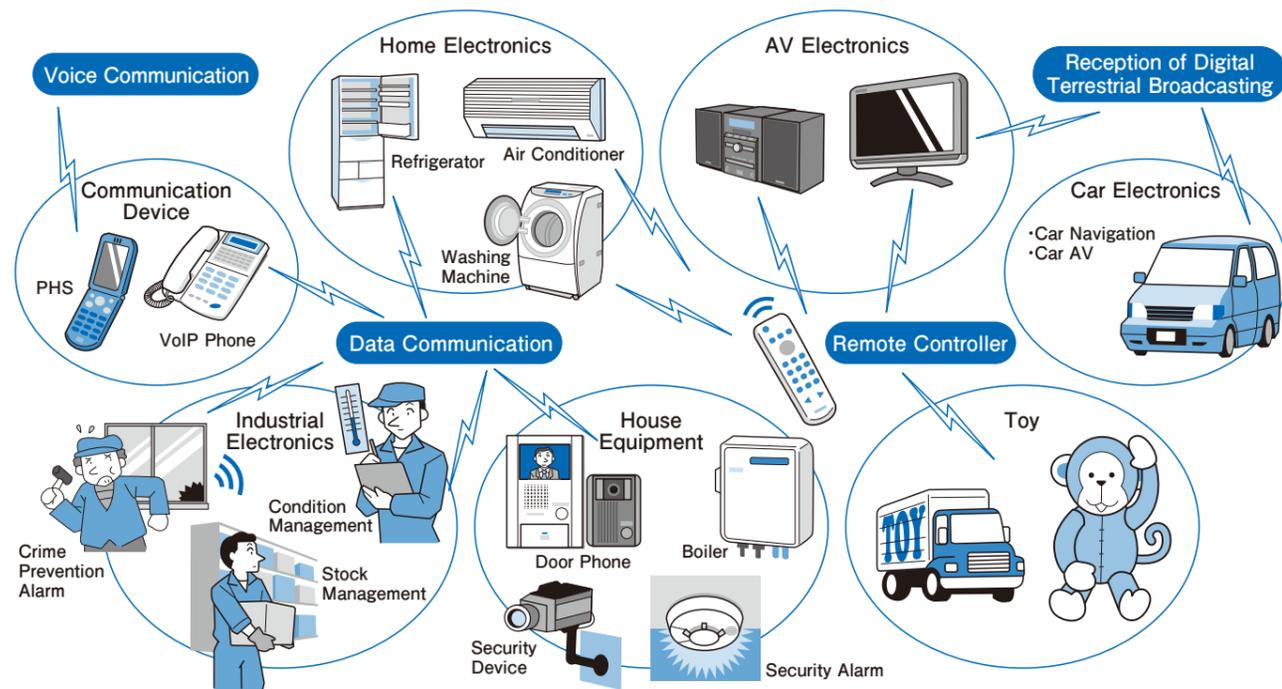
This product is used in applications, such as one-seg reception, remote controller, and voice communication.

Applied Circuit

Digital terrestrial broadcasting reception LSI

Product features of ML7147
● SoC with built-in RF tuner
● High-speed mobile reception feature
● Self-control function

Wireless communication LSI

Product features of ML7275
● Compliant with IEEE 802.15.4
● Built-in RF4CE Network Low power
● Low power consumption
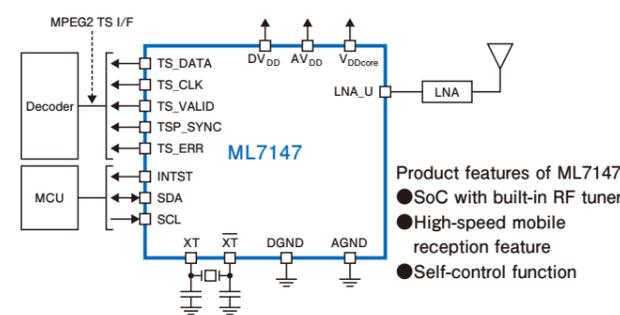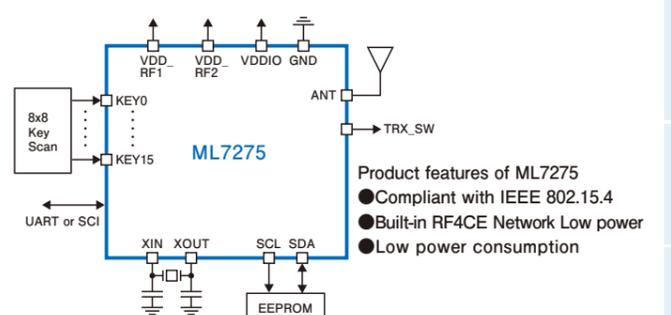
VoIP LSI

Product features of ML7234-021
● Superior sound quality CODEC for 2ch VoIP
● A variety of built-in functions for phones
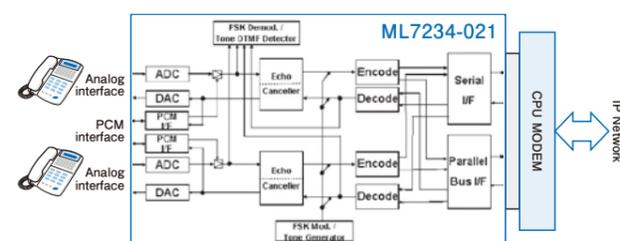
Echo Canceller LSI

Product features of ML7037-003
● Two systems of echo canceller
● Built-in noise canceller

Communication LSI

※ZigBeer® is a registered trademark of ZigBee Alliance.
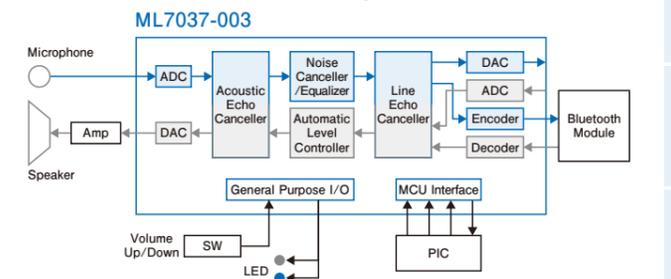
Digital terrestrial broadcasting reception LSI

Description	Part Number
OFDM demodulator for 1/3 segment digital terrestrial broadcasting	ML7107
RF tuner + OFDM demodulator for 1 segment digital terrestrial broadcasting	ML7147
2 diversity/Full-Seg OFDM demodulator for digital terrestrial broadcasting	ML7137 (under development)

Digital terrestrial broadcasting reception LSI

Part Number	Transmission Standard	Package	Feature	Supply Voltage (V)	Power Consumption	Operating Temperature (℃)
ML7107	ISDB-T ISDB-TSB	W-CSP53	Compliant to One-Seg broadcasting of ISDB-T(ARIB STD-B31) digital terrestrial television broadcasting and ISDB-TSB(ARIB STD-B29) digital terrestrial audio broadcasting. OFDM demodulate, error correction function. Serial, TS output.	2.5～3.3 1.65～3.6 1.35～1.65	18mW (at 1seg reception)	-25～+85
ML7147	ISDB-T	W-CSP61 WQFN80	Compliant to One-Seg broadcasting of ISDB-T(ARIB STD-B31) digital terrestrial television broadcasting. RF tuner, OFDM demodulate, error correction function. Serial, parallel TS output.	2.3～3.0 1.5～3.6 1.1～1.3	70mW (at 1seg reception)	-40～+90
ML7137 (under development)	ISDB-T	TFBGA84	Support for reception of Full-Seg/One-Seg broadcasting of ISDB-T (ARIB STD-B31) digital terrestrial television broadcasting. 2 diversity maximum ratio combining. OFDM demodulate, error correction function.	2.7～3.47 1.5～3.47 1.1～1.3	180mW (at 2 diversity full seg reception)	-40～+85

Wireless communication LSI

IEEE802.15.4/ZigBee®

Description	Part Number
USB interface send/receive LSI	ML7246
Serial interface send/receive LSI (NOT support AES function)	ML7265
Serial interface send/receive LSI (Support AES function)	ML7266
Serial interface send/receive LSI (Supports RF4CE)	ML7275

Wireless communication LSI

IEEE802.15.4/ZigBee®

Part Number	Transmission Standard	Package	Frequency Band Used	Supply Voltage (V)	Modulation Method	Transmission Rate	Transmission Output (dBm)	Reception Sensitivity	Operating Temperature (℃)
ML7246	IEEE 802.15.4	WQFN48	2.4GHz ISM Band	3.0～3.6 (Connect USB)	O-QPSK (Offset-QPSK)	250Kbps	0	-92dBm [PER<1%] (*1)	-40～+85
ML7265				2.1～3.6					
ML7266							-45 to 0 (4 step)		
ML7275		WQFN40		1.8～3.6			-40 to 0 (3 step)		

*1: PER means Packet Error Rate.

Specified low power radio

Description	Part Number
UHF Transceiver LSI	ML7066 J
UHF Transmitter LSI	ML7386-0□ (under development)

J : This LSI is limited to the market in Japan.

Specified low power radio

Part Number	Transmission Standard	Package	Frequency Band Used	Supply Voltage (V)	Modulation Method	Transmission Rate	Transmission Output (dBm)	Reception Sensitivity	Operating Temperature (℃)
ML7066	ARIB STD-T67, RCR STD-30	VQFN48	426MHz band 429MHz band	2.1～3.6	BFSK	1.2kbps 2.4kbps 4.8kbps [NRZ] (3-step setting function)	1mW/10mW	-116dBm [BER<1%] (*2)	-25～+65
ML7386-0□ (under development)	—	VQFN28	420～450MHz	1.8～3.6	BFSK	2.4kbps、4.8kbps [NRZ]	10mW typ.	—	-25～+85

*2: BER means Bit Error Rate.

Wireless communication module

IEEE802.15.4

Description	Part Number
2.4GHz wireless communication module	MK72220-01
	MK72660-01

Wireless communication module

IEEE802.15.4

Part Number	Transmission Standard	Size	Frequency Band Used	Supply Voltage (V)	HOST I/F	Built-in Antenna	Network Software	Transmission Output (dBm)	Reception Sensitivity	Operating Temperature (℃)
MK72220-01	IEEE 802.15.4	21.5×32.8×2.1mm	2.4GHz ISM Band	2.7～3.6	UART	Chip	Built-in	1mW	-92dBm [PER<1%] (*1)	-20～+60
MK72660-01		30.0×32.0×3.1mm		2.1～3.6	Synchronous serial	Pattern	External control			-20～+70

*1: PER means Packet Error Rate.

Communication LSI

VoIP LSI

VoIP CODEC

Description	Part Number
VoIP Codec	ML7074-003
	ML7074-004
	ML7204-003
2ch VoIP Codec	ML7214A-001
4ch VoIP Codec	ML7224A-001
2ch VoIP Codec	ML7234-021

VoIP Processor

Description	Part Number
VoIP Processor	ML7304-0□2

VoIP LSI

VoIP CODEC

Part Number	Package	Speech Compression Method	Operating Frequency	Supply Voltage (V)	Supply Current (Max.)	Operating Temperature (℃)
ML7074-003	QFP64	G.729.A/G.726/G.711	4.096MHz	3.0〜3.6	65mA	-20〜+60
ML7074-004	QFP64	G.729.A/G.711	4.096MHz	3.0〜3.6	65mA	
ML7204-003	QFP64	G.729.A/G.711	12.288MHz	3.0〜3.6	65mA	
ML7214A-001	TQFP100	G.711	12.288MHz	3.0〜3.6	65mA	
ML7224A-001	LQFP176	G.711	12.288MHz	3.0〜3.6	125mA	
ML7234-021	TQFP100	G.711/G.722	12.288MHz	3.0〜3.6	120mA	

VoIP Processor

Part Number	Package	Speech Compression Method	Operating Frequency	Supply Voltage (V)	Supply Current (Max.)	Operating Temperature (℃)
ML7304-0□2	QFP208	G.729.A/G.711/G.722	12.288MHz	3.0〜3.6	210mA	-20〜+60

Echo Canceller LSI

Echo Canceller

Description	Part Number
Dual echo canceller + ADPCM transcoder	ML7202-001

Echo Canceller / Noise Canceller

Description	Part Number
Dual echo canceller/noise canceller with dual Codec	ML7037-003

Echo Canceller LSI

Echo Canceller

Part Number	Package	Cancelable Echo Delay Time	Voice Signal Interface	Supply Voltage (V)	Operating Frequency	Notes
ML7202-001	TQFP64	64ms/channel	μ-law, A-law	3.0〜3.6	19.2MHz	Tone Gen/Det., VOX, Gain Control, Time Slot Assignment, etc.

Echo Canceller / Noise Canceller

Part Number	Package	Cancelable Echo Delay Time	Voice Signal Interface	Supply Voltage (V)	Operating Frequency	Notes
ML7037-003	TQFP64	Acoustic side 64ms, Line side 20ms	Acoustic side : analog, Line side : analog, 16-bit linear, μ-law PCM	3.0〜3.6	12.288MHz	Noise cancellation = 6〜18dB

CODEC LSI

PCM CODEC

Description	Part Number
2-ch PCM Codec for SLIC	ML7033-01
3V linear PCM Codec	ML7041
	MSM7732A

ADPCM CODEC

Description	Part Number
ADPCM Codec compliant with G.726	ML7029

CODEC LSI

PCM CODEC

Part Number	Package	PCM sign			Number of Channels	Supply Voltage (V)	PCM Synchronous Type		Analog Output			Notes
		μ-law	A-law	14-bit linear			long	short	full swing	output load	differential	
ML7033-01	QFP64	○	○	○	2	4.75〜5.25	○	○	3.4Vp-p	20kΩ	×	Best suited to Intersil Corp's RSLIC™series
ML7041	TQFP48	○	○	○	1	2.4〜3.3	○	○	2.6Vp-p	8Ω	○	With tone generators, regulators, and I2C I/F
MSM7732A	TQFP48, BGA48	○	○	○	1	2.4〜3.3	○	○	3.0Vp-p	32Ω	○	With tone generators

ADPCM CODEC

Part Number	Package	PCM Interface	Operating Frequency	Supply Voltage (V)	Analog Output	Supply Current (Max.)	Operating Temperature (℃)
ML7029	SSOP30	μ-Law	10.368MHz	2.7〜3.6	1.3Vp-p、20kΩ	12mA	-25〜+70

Communication LSI

Modem LSI

Tele-control IC

Description	Part Number
1200bps, HDX modem, DTMF transceiver, CPT	ML7020

Modem LSI
Tele-control IC

Part Number	Package	Standard	Supply Voltage (V)	Supply Current (Max.)	Operating Temperature (℃)
ML7020	SOP32	ITU-T V.23	4.5~5.5	5mA	-40~+85

PHS LSI

Baseband IC for PHS

Description	Part Number
Baseband for PHS	ML7098C-01
	ML7207-01
	ML7338-01
Baseband for PHS supporting W-OAM	ML7257-01

PHS LSI
Baseband IC for PHS

Part Number	Package	CPU Performance	SLOT	Built-in Memory	Supply Voltage (V)
ML7098C-01	BGA208		2	16KB	3.0V/2.5V
ML7207-01	BGA208	19.2MHz		128KB	
ML7338-01	BGA176		4	64KB	3.0V/1.5V
ML7257-01	BGA208	57.6MHz		32KB	

*The products are limited for the user who has the development experience in the PHS devices.
For details, please inquire to the sales (ROHM Co., Ltd.).

Low Power Microcontroller

ML610400/ML610300 Series Overview

Product Overview

These ultra-low power consumption microcontrollers ensure longer operating times in battery-driven applications.
The increasing concern over global warming demands components and devices that minimize energy consumption. OKI EMICONDUCTOR meets these needs by offering a low-power microcontroller equipped with Flash memory that enables reading at only 1V and features industry-leading operating, suspend, and stop current levels. In addition, the a high-performance CPU is utilized capable of processing one instruction per clock cycle for high performance operation.

Product Line-up

ROM Capacity(Byte)

	30pin	48pin	64pin	80pin	100pin	120pin	128pin	144pin
128K			ML610(Q)346 ML610(Q)347 ML610(Q)348 (56pin)					ML610Q438(P) ML610Q439(P)
96K	ML610(Q)340							ML610Q435 ML610Q436
64K		ML610(Q)482(P)						ML610Q431 ML610Q432
48K		ML610Q487(P) ML610Q488(P) ML610Q489(P)				ML610Q428(P) ML610Q429(P)		
32K		ML610Q486(P)		ML610(Q)421(P) ML610(Q)422(P)				
16K		ML610(Q)413(P)	ML610(Q)407(P) ML610(Q)408(P) ML610(Q)409(P)	ML610(Q)411(P) ML610(Q)412(P) ML610Q415				
8K			ML610404(P) ML610405(P) ML610406(P)					
6K			ML610401(P) ML610402(P) ML610403(P)					

Speech function type

Built-in Dot Matrix LCD Driver

Standard type

Built-in Segment LCD Driver

Package pins

Application Examples

Speech function type

Car Horn   Gas Sensor   Indoor Fire Alarm

Standard type

Remote Controller for Boiler   Range   Electric bicycle

Segment Type

Clock   Thermostat   Pedometer

Digital Thermometer   Token Machine

Dot Matrix Type

Pedometer with graph   Bicycle meter   Performance Weather Station

Electronic Sports (Multifunction) Watch   Electronic Wristwatch   Temperature logger

Applied Circuit

ML610Q431
Digital thermometer/hygrometer

LCD panel

15:32
18.5℃

LCD driver

EEPROM — I²C or SSIO — RC oscillation type ADC0 — Temperature sensor (thermistor)

PC communication — UART — RC oscillation type ADC1 — Temperature sensor

LED display

Switches — Port — Successive type ADC0 — Air pressure sensor, etc.

ML610Q346
Fire alarm

EEPROM — SPI — Speaker amplifier — Speaker

PC communication — UART

Temperature sensor — ADC — Port — Switches

Detection IC — OP-Amp — LED display — LED×3

Low Power Microcontroller

ML610400/ML610300 Series

Part Number	Operating Voltage(V)	Operating Frequency (*1) (Max.)	Minimum Instruction Execution Time	Current (*2) Consumption (Typ.@HALT)	Operating Temperature (°C)	ROM Capacity (Byte)	RAM Capacity (Byte)	Port Input	Port Output	Port Input/Output	8bit Timer	1kHz Timer	PWM	Capture	WDT	ADC (Method)	I2C	SSIO(*6)	UART	Supply Voltage Detection	LCD Driver	Interrupt Sources Internal/External	Additional Functions	Package	Chip support
Standard																									
ML610Q486/ML610Q486P (NEW)	1.6~3.6	500kHz	2µs	15µA	-20~+70/-40~+85	Flash 32K (*7)	1K	6	5	21	4 (16bit×2)	—	16bit×1	—	1	4 (Successive approximation)	1 (*5)	1	1	1	—	14:5	—	TQFP48	○
ML610Q487/ML610Q487P (NEW)	1.8~3.8	1MHz/32.768kHz	1µs/30.5µs	1.7µA	-20~+70/-40~+85	Flash 48K (*7)	1.5K	8	4	24	8 (16bit×4)	—	16bit×2	—	1	—	1	1	2	—	—	19:6	Low speed frequency correction	TQFP48	○
ML610Q488/ML610Q488P (Under development)	1.8~3.8	4MHz/32.768kHz	0.25µs/30.5µs	1.7µA	-20~+70/-40~+85	Flash 48K (*7)	1.5K	8	4	24	8 (16bit×4)	—	16bit×2	2	1	—	1	1	2	—	—	19:6	Low speed frequency correction	TQFP48	○
ML610Q489/ML610Q489P (Under development)	1.8~3.8	4MHz/31.25kHz (Divided frequency of 4MHz)	0.25µs/30.5µs	—	-20~+70/-40~+85	Flash 48K (*7)	1.5K	8	4	24	8 (16bit×4)	—	16bit×2	2	1	—	1	1	2	—	—	19:6	Low speed frequency correction	TQFP48	○
ML610482/ML610482P (NEW)	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70/-40~+85	Mask 64K (*7)	4K	6	4	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	1 (*4)	1	1	1	—	15:5	Low speed frequency correction/buzzer	TQFP48	○
ML610Q482/ML610Q482P (NEW)	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70/-40~+85	Flash 64K (*7)	4K	6	4	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	1 (*4)	1	1	1	—	15:5	Low speed frequency correction/buzzer	TQFP48	○
Speech function type																									
ML610340 (NEW)	2.2~5.5	4.096MHz	0.25µs	—	-40~+85	Mask 96K	512	4	4	4	2 (16bit×1)	—	—	—	1	—	—	1	—	—	—	9:5	Built-in sound playback/ADPCM decoder/speaker amplifier	SSOP30	—
ML610Q340 (NEW)	2.2~5.5	4.096MHz	0.25µs	—	-40~+85	Flash 96K	512	4	4	4	2 (16bit×1)	—	—	—	1	—	—	1	—	—	—	9:5	Built-in sound playback/ADPCM decoder/speaker amplifier	SSOP30	—
ML610346 (NEW)	2.2~5.5	4.096MHz/32kHz	0.25µs/31µs	1.5µA	-40~+85	Mask 128K	1K	8	4	16	2 (16bit×1)	—	—	—	1	12bit×3ch (Successive approximation)	—	1	1	—	—	11:9	Built-in sound playback/ADPCM decoder/speaker amplifier/3ch OP decoder	TQFP64	—
ML610Q346 (NEW)	2.2~5.5	4.096MHz/32kHz	0.25µs/31µs	1.5µA	-40~+85	Flash 128K	1K	8	4	16	2 (16bit×1)	—	—	—	1	12bit×3ch (Successive approximation)	—	1	1	—	—	11:9	Built-in sound playback/ADPCM decoder/speaker amplifier/3ch OP decoder	TQFP64	—
ML610347 (NEW)	2.2~5.5	4.096MHz/32kHz	0.25µs/31µs	1.5µA	-40~+85	Mask 128K	1K	8	4	16	2 (16bit×1)	—	—	—	1	12bit×3ch (Successive approximation)	—	1	1	—	—	11:9	Built-in sound playback/ADPCM decoder/speaker amplifier	TQFP64	—
ML610Q347 (NEW)	2.2~5.5	4.096MHz/32kHz	0.25µs/31µs	1.5µA	-40~+85	Flash 128K	1K	8	4	16	2 (16bit×1)	—	—	—	1	12bit×3ch (Successive approximation)	—	1	1	—	—	11:9	Built-in sound playback/ADPCM decoder/speaker amplifier	TQFP64	—
ML610348 (NEW)	2.2~3.6	4.096MHz/32kHz	0.25µs/31µs	1.5µA	-40~+85	Mask 128K	1K	4	4	8	2 (16bit×1)	—	—	—	1	12bit×3ch (Successive approximation)	—	1	1	—	—	11:5	Built-in sound playback/ADPCM decoder/speaker amplifier/2ch OP amplifier	QFP56	—
ML610Q348 (NEW)	2.2~3.6	4.096MHz/32kHz	0.25µs/31µs	1.5µA	-40~+85	Flash 128K	1K	4	4	8	2 (16bit×1)	—	—	—	1	12bit×3ch (Successive approximation)	—	1	1	—	—	11:5	Built-in sound playback/ADPCM decoder/speaker amplifier/2ch OP amplifier	QFP56	—
Dot matrix type with LCD driver																									
ML610421/ML610421P (Under development)	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70/-40~+85	Mask 32K (*7)	2K (*9)	6	3	22	4 (16bit×2)	1	16bit×1	2	1	2(RC oscillation) 2(Successive approximation)	1 (*4)	1	1	1	Max. 400dot 50seg×8com.	17:5	Low speed frequency correction/melody/buzzer	TQFP120	○
ML610Q421/ML610Q421P	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70/-40~+85	Flash 32K (*7)	2K (*9)	6	3	22	4 (16bit×2)	1	16bit×1	2	1	2(RC oscillation) 2(Successive approximation)	1 (*4)	1	1	1	Max. 400dot 50seg×8com.	17:5	Low speed frequency correction/melody/buzzer	TQFP120	○
ML610422/ML610422P (Under development)	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70/-40~+85	Mask 32K (*7)	2K (*9)	6	3	14	4 (16bit×2)	1	16bit×1	2	1	2(RC oscillation) 2(Successive approximation)	1 (*4)	1	1	1	Max. 800dot 50seg×16com.	17:5	Low speed frequency correction/melody/buzzer	TQFP120	○
ML610422/ML610Q422P	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70/-40~+85	Flash 32K (*7)	2K (*9)	6	3	14	4 (16bit×2)	1	16bit×1	2	1	2(RC oscillation) 2(Successive approximation)	1 (*4)	1	1	1	Max. 800dot 50seg×16com.	17:5	Low speed frequency correction/melody/buzzer	TQFP120	○
ML610Q428/ML610Q428P	1.1~3.6	4.096MHz/2MHz/32.768kHz	0.244µs/2µs(@2MHz)/30.5µs	0.5µA	-20~+70/-40~+85	Flash 48K (*7)	4K (*9)	6	3	14	2 (16bit×1)	1	16bit×3	—	1	2 (RC oscillation)	1 (*4)	1	1	1	Max. 1392dot 58seg×24com.	20:5	RTC/low speed frequency correction/melody/buzzer	TQFP128	○
ML610Q429/ML610Q429P	1.1~3.6	4.096MHz/2MHz/32.768kHz	0.244µs/2µs(@2MHz)/30.5µs	0.5µA	-20~+70/-40~+85	Flash 48K (*7)	4K (*9)	10	3	20	2 (16bit×1)	1	16bit×3	—	1	2 (RC oscillation)	1 (*4)	1	1	1	Max. 512dot 64seg×8com.	20:9	RTC/low speed frequency correction/melody/buzzer	TQFP128	○
ML610Q431	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70	Flash 64K (*7)	3K (*9)	6	3	22	4 (16bit×2)	1	16bit×3	2	1	2(RC oscillation)	1 (*4)	1	1	1	Max. 1024dot 64seg×16com.	20:5	RTC/low speed frequency correction/melody/buzzer	LQFP144	○
ML610Q432	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70	Flash 64K (*7)	3K (*9)	6	3	14	4 (16bit×2)	1	16bit×2	2	1	2(RC oscillation)	1 (*4)	1	1	1	Max. 1536dot 64seg×24com.	20:5	RTC/low speed frequency correction/melody/buzzer	LQFP144	○
ML610Q435 (NEW)	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70	Flash 96K (*7)	3K (*9)	6	3	22	4 (16bit×2)	1	16bit×2	2	1	2(RC oscillation)	1 (*4)	1	1	1	Max. 1024dot 64seg×16com.	20:5	RTC/low speed frequency correction/melody/buzzer	LQFP144	○
ML610Q436 (NEW)	1.1~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	0.5µA	-20~+70	Flash 96K (*7)	3K (*9)	6	3	14	4 (16bit×2)	1	16bit×2	2	1	2(RC oscillation)	1 (*4)	1	1	1	Max. 1536dot 64seg×24com.	20:5	RTC/low speed frequency correction/melody/buzzer	LQFP144	○
ML610Q438/ML610Q438P (NEW)	1.1~3.6	4.096MHz/2MHz/32.768kHz	0.244µs/2µs(@2MHz)/30.5µs	0.5µA	-20~+70/-40~+85	Flash 128K (*7)	7K (*9)	10	3	20	4 (16bit×2)	1	16bit×2	2	1	2(RC oscillation) 2(Successive approximation)	1 (*4)	1	1	1	Max. 1344dot 56seg×24com.	23:9	Low speed frequency correction/melody/buzzer	LQFP144	○
ML610Q439/ML610Q439P (NEW)	1.1~3.6	4.096MHz/2MHz/32.768kHz	0.244µs/2µs(@2MHz)/30.5µs	0.5µA	-20~+70/-40~+85	Flash 128K (*7)	7K (*9)	10	3	20	4 (16bit×2)	1	16bit×3	2	1	2(RC oscillation) 2(Successive approximation)	1 (*4)	1	1	1	Max. 1024dot 64seg×16com.	23:9	Low speed frequency correction/melody/buzzer	LQFP144	○
Segment type with LCD driver																									
ML610401/ML610401P (NEW)	1.25~3.6	500kHz/32.768kHz	2µs/30.5µs	0.9µA	-20~+70/-40~+85	Mask 6K (*7)	192	4	12	18	2 (16bit×1)	—	—	2	1	2 (RC oscillation)	—	—	1	—	Max. 55dot 11seg×5com.	8:9 (Include 4 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP64	○
ML610402/ML610402P (NEW)	1.25~3.6	500kHz/32.768kHz	2µs/30.5µs	0.9µA	-20~+70/-40~+85	Mask 6K (*7)	192	4	8	18	2 (16bit×1)	—	—	2	1	2 (RC oscillation)	—	—	1	—	Max. 75dot 15seg×5com.	8:9 (Include 4 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP64	○
ML610403/ML610403P (NEW)	1.25~3.6	500kHz/32.768kHz	2µs/30.5µs	0.9µA	-20~+70/-40~+85	Mask 6K (*7)	192	4	4	18	2 (16bit×1)	—	—	2	1	2 (RC oscillation)	—	—	1	—	Max. 95dot 19seg×5com.	8:9 (Include 4 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP64	○
ML610404/ML610404P (NEW)	1.25~3.6	2MHz/32.768kHz	0.5µs/30.5µs	0.9µA	-20~+70/-40~+85	Mask 8K (*7)	256	5	12	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	—	2	1	—	Max. 105dot 21seg×5com.	15:13 (Include 4 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP80	○
ML610405/ML610405P (NEW)	1.25~3.6	2MHz/32.768kHz	0.5µs/30.5µs	0.9µA	-20~+70/-40~+85	Mask 8K (*7)	256	5	8	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	—	2	1	—	Max. 125dot 25seg×5com.	15:13 (Include 4 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP80	○
ML610406/ML610406P (NEW)	1.25~3.6	2MHz/32.768kHz	0.5µs/30.5µs	0.9µA	-20~+70/-40~+85	Mask 8K (*7)	256	5	4	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	—	2	1	—	Max. 145dot 29seg×5com.	15:13 (Include 4 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP80	○
ML610407/ML610407P (NEW)	1.25~3.6	2MHz/32.768kHz	0.5µs/30.5µs	0.9µA	-20~+70/-40~+85	Mask 16K (*8)	1K	5	12	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	—	2	1	—	Max. 145dot 29seg×5com.	15:13 (Include 8 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP100	○
ML610408/ML610408P (NEW)	1.25~3.6	2MHz/32.768kHz	0.5µs/30.5µs	0.9µA	-20~+70/-40~+85	Mask 16K (*8)	1K	5	8	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	—	2	1	—	Max. 165dot 33seg×5com.	15:13 (Include 8 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP100	○
ML610409/ML610409P (NEW)	1.25~3.6	2MHz/32.768kHz	0.5µs/30.5µs	0.9µA	-20~+70/-40~+85	Mask 16K (*8)	1K	5	4	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	—	2	1	—	Max. 185dot 37seg×5com.	15:13 (Include 8 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP100	○
ML610Q407/ML610Q407P (NEW)	1.25~3.6	2MHz/32.768kHz	0.5µs/30.5µs	0.9µA	-20~+70/-40~+85	Flash 16K (*8)	1K	5	12	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	—	2	1	—	Max. 145dot 29seg×5com.	15:13 (Include 8 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP100	○
ML610Q408/ML610Q408P (NEW)	1.25~3.6	2MHz/32.768kHz	0.5µs/30.5µs	0.9µA	-20~+70/-40~+85	Flash 16K (*8)	1K	5	8	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	—	2	1	—	Max. 165dot 33seg×5com.	15:13 (Include 8 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP100	○
ML610Q409/ML610Q409P (NEW)	1.25~3.6	2MHz/32.768kHz	0.5µs/30.5µs	0.9µA	-20~+70/-40~+85	Flash 16K (*8)	1K	5	4	22	4 (16bit×2)	—	16bit×1	2	1	2 (RC oscillation)	—	2	1	—	Max. 185dot 37seg×5com.	15:13 (Include 8 bit-OR input)	Low speed frequency correction/melody/buzzer	TQFP100	○
ML610Q411/ML610Q411P	1.1~3.6	500kHz/32.768kHz	2µs/30.5µs	0.5µA	-20~+70/-40~+85	Flash 16K (*7)	1K	6	3	22	4 (16bit×2)	1	16bit×1	2	1	2(RC oscillation) 2(Successive approximation)	1 (*5)	1	1	1	Max. 144dot 36seg×4com.	16:5	Low speed frequency correction/buzzer	TQFP120	○
ML610Q412/ML610Q412P	1.1~3.6	500kHz/32.768kHz	2µs/30.5µs	0.5µA	-20~+70/-40~+85	Flash 16K (*7)	1K	6	3	14	4 (16bit×2)	1	16bit×1	2	1	2(RC oscillation) 2(Successive approximation)	1 (*5)	1	1	1	Max. 176dot 44seg×4com.	16:5	Low speed frequency correction/buzzer	TQFP120	○
ML610413/ML610413P (Under development)	2.4~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	1.0µA(T.B.D)	-40~+85	Mask 16K (*7)	512	—	2	20	2 (16bit×1)	—	—	2	1	—	—	—	1	—	Max. 80dot 20seg×4com.	7:9	RTC/low speed frequency correction/random number generator	TQFP64	○
ML610Q413/ML610Q413P (Under development)	2.4~3.6	4.096MHz/500kHz/32.768kHz	0.244µs/2µs/30.5µs	1.0µA(T.B.D)	-40~+85	Flash 16K (*7)	512	—	2	20	2 (16bit×1)	—	—	2	1	—	—	—	1	—	Max. 80dot 20seg×4com.	7:9	RTC/low speed frequency correction/random number generator	TQFP64	○
ML610Q415	1.1~3.6	500kHz	2µs	5.5µA	-20~+70/...	Flash 16K (*7)	1K	6	3	22	4 (16bit×2)	1	16bit×1	2	1	2(RC oscillation) 2(Successive approximation)	1 (*5)	1	1	1	Max. 144dot 36seg×4com.	16:5	Low speed frequency correction/buzzer	TQFP120	○

*1: 4MHz generated via internal PLL/ceramic/crystal oscillation, 500kHz via RC oscillation, 32kHz via crystal oscillation
*2: Low current consumption during Suspend (HALT) Mode via low-speed 32kHz crystal oscillation. Suspend (HALT) Mode: Low-speed oscillation - only a time-based counter and watchdog timer are active. The CPU, LCD bias circuit, and high-speed operation are stopped. The internal regulator is ON.
*3: Including secondary functions
*4: Only master function can support fast mode (400kbps) / standard mode (100kbps)
*5: Only the Master function supports Standard Mode (50kbps)
*6: No compatible chip select signals exist for 8bit/16bit SPI bus
*7: includes 256Byte test area
*8: includes 1KByte test area
*9: 1kByte LCD RAM allocation included

Low Power Microcontroller

Program Development Support System Overview

Product Overview

OKI SEMICONDUCTOR's development support system consists of hardware and software tools that aid in program development for the ML610400/ML610300 series. The software tool utilizes an easy-to-understand GUI and facilitates the debugging operation from program creation.

● Integrated software simplifies repeated work during software development, including programming, building (object creation), and debugging
● User-friendly graphical user interface
● Optimized C compiler maximizes microcontroller performance (minimizing ROM code/increasing processing speed)
● Cost-effective, lightweight, compact debugging emulator

Compact, lightweight debugging emulator μEASE (50mm×90mm×9mm 50g)

High-performance optimization C compiler which helps a microcontroller to achieve the highest performance.

Program Development System Details

OKI SEMICONDUCTOR provides software tools for program building, Flash writing, and debugging. Build tool design and debugging startup is performed in an integrated IDEU8 environment. In addition, built-in project management and editor functions make software development more user-friendly. On the hardware side an emulator and reference board are offered that allows for on-chip debugging and writing to Flash memory while connected to the actual device.

Software tool

Project management tool	Build tool	Program development support tool for LCD control
IDEU8 Integrated development environment	CCU8 C Compiler RASU8 Assembler RLU8 Linker LIBU8 Librarian OHU8 Object converter	LcdAtU8 LCD image tool
Flash programming tool		ROM code generator tool for code entry
FWμEASE Flash writer		HTU8 HEX converter
MWμEASE Flash multi-writer	**Debugging Tool**	
	DTU8 Debugger	Instruction Set Simulator

Hardware tool

On-chip debug emulator μEASE

Reference board with built-in microcontroller

Examples of Tool Screen and Connection

On-chip debug emulator μEASE

This compact, cost-saving emulator supports onboard debugging and writing to Flash memory by utilizing on-chip debugging functions when connected to the actual device.

DTU8 debugger operation screen
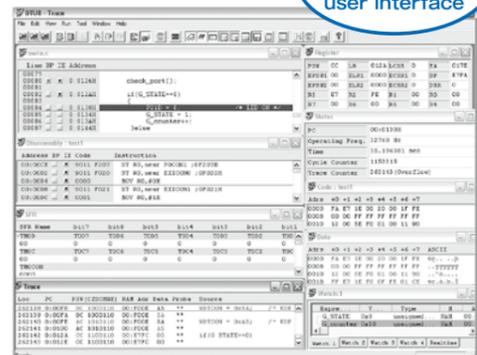
User-friendly graphical user interface

LcdAtU8 LCD image tool

Inputting a bitmap file of an LCD panel image and LCD panel layout information automatically generates table data for LCD allocation RAM along with a sample control program. The LCD image tools simplifies complicated mapping operation.
The LCD image tool is divided into 2 tools, one for LCD image assignment and the other for LCD image verification.
The LCD image assignment tool facilitates LCD panel image mapping with the microcontroller terminal using the LCD image displayed on the PC.
The image verification tool aids in checking that the mapping was correctly performed.

LCD Image Tool Screenshots

LCD image verification tool

LCD image assignment tool
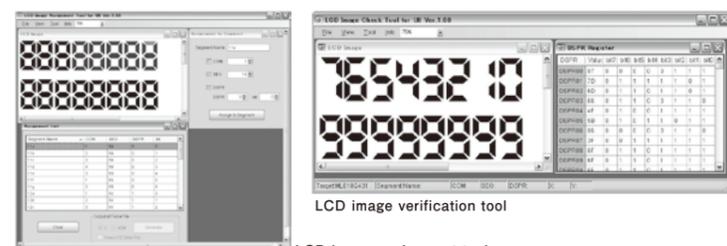
Reference board with built-in microcontroller

The reference board contains the microcontroller and the minimum number of parts required. Connection with μEASE allows evaluation of the operation of ML610400/ML610300 series products. Software development and Flash programming are possible.
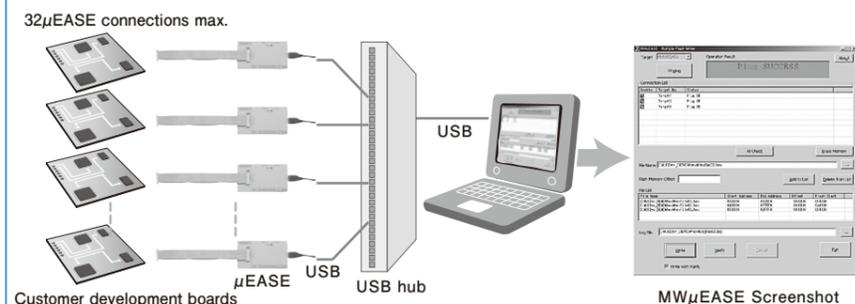
μEASE Connection Method

Reference board   Customer's development board

Interface cable   USB

μEASE

Software tool
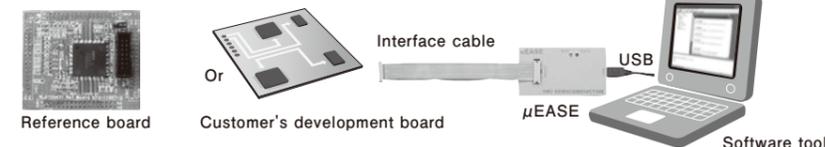
MWμEASE Flash multi-writer [1]

Supports simultaneous Flash programming of multiple boards of the same type.

μEASE Connection Method Using MWμEASE

32μEASE connections max.

USB

Customer development boards

μEASE   USB   USB hub

MWμEASE Screenshot

[1]: The requisite number of μEASE units must be purchased to use MWμEASE.

HTU8 HEXconverter

A tool for creating ROM code data when writing the customer's code into the Flash memory (performed at OKI SEMICONDUCTOR's facility)

FWμEASE Flash writer

A software tool that acts a Flash writer for controlling the on-chip debugging emulator μEASE.

Demo Kit Connection Method

μEASE   USB

Software tool
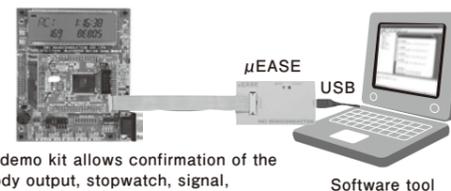
The demo kit allows confirmation of the melody output, stopwatch, signal, temperature/humidity measurements, LCD display, and debugging operation.

The demo kit contains an ML610Q431 reference board, a demo board, and sample program[2], and enables users to verify a host of parameters/functions, including temperature/humidity measurements, LCD display, UART signals, melody output, and the stopwatch.
Connecting to μEASE enables confirmation of the included sample program via the DTU8 debugger.

ML610Q431 reference board + demonstration board

[2]: The demo kit includes the ML610Q431 reference board with integrated temperature and humidity sensors. For other types of reference boards, OKI SEMICONDUCTOR recommends that the user prepare all required parts after purchasing the desired reference board.

Speech synthesis utility simplifies editing and data creation

OKI SEMICONDUCTOR's speech synthesis utility, along with a reference board and audio microcontroller, enable easy editing of the voice data and ROM data generation while listening to the actual audio. In addition, the application program is developed using a program development support system, while a Flash programming software (FWμEASE or MWμEASE), along with the μEASE on-chip debugging emulator, enable evaluation of application ROM codes and voice ROM data in the user's actual set.

Utility
· Sound clipping/connection
· No sound insert
· Fade-in/Fade-out

Reference Board (Provided by OKI SEMICONDUCTOR)

Write sound data

Write program data

USB cable

Create sound data

μEASE sold by OKI SEMICONDUCTOR

IDEU8 (Integrated development environment)

Flash-type speech microcontroller

Set assessment available

Operating environment for speech synthesis utility tool

· OS: Microsoft® Windows
  Windows 2000 (service pack 4 or later)/Windows XP (service pack 2 or later)/Windows Vista
· Processor and memory: 1GHz Intel® Pentium III or equivalent, 512MB RAM
· Hard disk space : 1GB of free space
· Audio system : Windows-compatible sound card supporting at least 16bit and speaker

※Program data should be developed under "IDEU8 integrated development environment" separately.
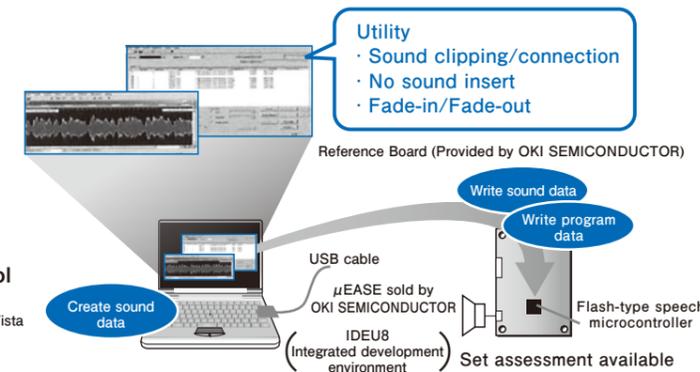
Easy development with OKI SEMICONDUCTOR's speech synthesis utility

Low Power Microcontroller

Program Development Support System

Part number	Software tool	Hardware tool	
		Development tool	Reference board
Standard type			
ML610Q486 / ML610Q486P	·Project management tool (IDEU8 integrated development environment) ·Build tool ·Debugging Tool ·Flash programming tool (*2) ·ROM code generation tool for code entry <Required environment> ·Windows 2000/XP/Windows 7 (32-bit version) ·Graphic adapter and display of SVGA (800×600) or more ·At least 20MB of free hard disk space	µEASE (*1)	ML610Q486 Reference board
ML610Q487/ML610Q487P			ML610Q487 Reference board
ML610Q488/ML610Q488P			ML610Q488 Reference board
ML610Q489/ML610Q489P			ML610Q489 Reference board
ML610482/ML610482P/ML610Q482/ML610Q482P			ML610Q482 Reference board
Speech function type			
ML610340/ML610Q340			ML610Q340 Reference board
ML610346/ML610Q346/ML610348/ML610Q348			ML610Q346 Reference board
ML610347/ML610Q347			ML610Q347 Reference board
Dot matrix type with built-in LCD driver			
ML610421/ML610421P/ML610Q421/ML610Q421P	·Project management tool (IDEU8 integrated development environment) ·Build tool ·Debugging Tool ·Flash programming tool (*2) ·Program development support tool for LCD control ·ROM code generation tool for code entry <Required environment> ·Windows 2000/XP/Windows 7 (32-bit version) ·Graphic adapter and display of SVGA (800×600) or more ·At least 20MB of free hard disk space	µEASE (*1)	ML610Q421 Reference board
ML610422/ML610422P/ML610Q422/ML610Q422P			ML610Q422 Reference board
ML610Q428/ML610Q428P			ML610Q428 Reference board
ML610Q429/ML610Q429P			ML610Q429 Reference board
ML610Q431			ML610Q431 Reference board
ML610Q432			ML610Q432 Reference board
ML610Q435			ML610Q435 Reference board
ML610Q436			ML610Q436 Reference board
ML610Q438/ML610Q438P			ML610Q438 Reference board
ML610Q439/ML610Q439P			ML610Q439 Reference board
Segment type with built-in LCD driver			
ML610401/ML610401P			ML610Q407 Reference board (*3)
ML610402/ML610402P			ML610Q407 Reference board (*4)
ML610403/ML610403P			ML610Q407 Reference board (*5)
ML610404/ML610404P			ML610Q407 Reference board (*6)
ML610405/ML610405P			ML610Q407 Reference board (*7)
ML610406/ML610406P			ML610Q407 Reference board (*8)
ML610407/ML610407P/ML610Q407/ML610Q407P			ML610Q407 Reference board
ML610408/ML610408P/ML610Q408/ML610Q408P			ML610Q408 Reference board
ML610409/ML610409P/ML610Q409/ML610Q409P			ML610Q409 Reference board
ML610Q411/ML610Q411P			ML610Q411 Reference board
ML610Q412/ML610Q412P			ML610Q412 Reference board
ML610413/ML610413P/ML610Q413/ML610Q413P			ML610Q413 Reference board
ML610Q415			ML610Q415 Reference board

*1: All software except for MWuEASE is bundled in µEASE.
*2: All required µEASE units must be purchased when using MWµEASE.
*3: Setting the ML610Q407 reference board to "ML610Q401 mode" enables operation equivalent to the Mask version ML610401.
*4: Setting the ML610Q407 reference board to "ML610Q402 mode" enables operation equivalent to the Mask version ML610402.
*5: Setting the ML610Q407 reference board to "ML610Q403 mode" enables operation equivalent to the Mask version ML610403.
*6: Setting the ML610Q407 reference board to "ML610Q404 mode" enables operation equivalent to the Mask version ML610404.
*7: Setting the ML610Q407 reference board to "ML610Q405 mode" enables operation equivalent to the Mask version ML610405.
*8: Setting the ML610Q407 reference board to "ML610Q406 mode" enables operation equivalent to the Mask version ML610406.

ARM-Based Microcontroller

ARM-Based Microcontroller Overview

Product Overview

● **De facto standard ARM core**
ARM7TDMI™ or ARM946E™ is used for a CPU core. This provides a superior reusability of software.

● **Wide selection of products**
Based on the customers application, the customer can choose the most suitable microcontroller from wide selection of products.

● ML674000 — ARM7TDMI™, which is suitable for a small system.
● ML674001/Q4002/Q4003 — Enhanced function version of ML674000 and models that include built-in flash ROM are also available.
● ML675001/Q5002/Q5003 — ARM7TDMI™ with 8 Kbyte of unified cache, operating at 60MHz provides high performance.
● ML67Q4060/61/50/51 — ARM7TDMI™ These models have a built-in flash memory.
The customer can choose from wide selection of packages.
WCSP (Wafer level Chip Size Package) delivers the smallest package of ARM microcontroller in the world.
● ML675050 — ARM7TDMI™ includes 8 Kbytes of unified cache. The operating frequency of 64MHz provides high performance.
A variety of peripheral circuits such as USB Full-Speed HOST/DEVICE are included as a product feature.
● ML696201/Q6203 — ARM946E™ operating at 120MHz, provides high performance, and supports very rich peripherals,
such as USB2.0 High Speed Device, ATA, and NAND Flash interface.
● ML675011/5021/5013 J — ARM7TDMI™ includes 8 Kbyte of unified cache. Peripheral circuits best suited for VDP (Video Display
Processor) and LED control are included as a product feature.

● **Software development kit**
The customer can start software development and microcontroller evaluation immediately.

Product Line-up

● We offer wide selection of products with a de facto standard ARM chip onboard.

Performance

Built-in USB
Faster processing

(Q5003:512KB Flash)
(Q5002:256KB Flash)
ML675001
ARM7TDMI
f=60MHz
8KB Cache

ML675050
ARM7TDMI
f=64MHz
8KB Cache
Built-in USB

For general-purpose applications

Faster processing

(Q4003:512KB Flash)
(Q4002:256KB Flash)
ML674000/4001
ARM7TDMI
f=33MHz

(Q4050/1:External bus expansion)
ML67Q4060/1
ARM7TDMI
f=33MHz

For space saving applications

Built-in ARM9

(Q6203:512KB Flash)
ML696201
ARM946
f=120MHz
For USB storage

ML675013 (Hybrid)
ML675021 (Peripheral control)
ML675011 (VDP control)
ARM7TDMI
f=60MHz
8KB Cache J
For amusement

Function

J : This LSI is limited to the market in Japan.

Application Examples

Portable Audio Player
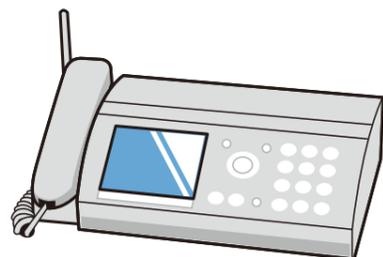
Phone, FAX, Multifunction Machine

USB Memory, USB One-Seg Tuner
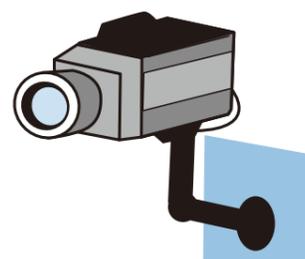
Surveillance Camera

Remote Controller, Short-Range Communication Device

Mobile Phone, PHS

Development Tool

Target LSI products	Evaluation Board	Software development environment	
		Code generator tool	Debug tool
ML674000	ML674000 CPU Board		
ML674001/Q4002/Q4003	ML67Q4003 CPU Board		
ML675001/Q5002/Q5003	ML67Q5003 CPU Board		
ML67Q4050/Q4051	ML67Q4051 CPU Board	● RealView® Development Suite (RVDS) (*1)	● RealView® ICE (RVI) (*1)
ML67Q4060/Q4061	ML67Q4061 CPU Board	● ARM® Developer Suite (ADS) (*1)	● Third-party tool (*2)
ML675050	ML675050 CPU Board	● Third-party tool (*2)	
ML696201/Q6203	ML69Q6203 CPU Board		
ML675021 J	ML675021 CPU Board		
ML675013 J	ML675013 CPU Board		

*1: RVDS and RVI are proprietary products of ARM Ltd. For information on proprietary products of ARM Ltd., contact the following companies.
ARM Ltd. http://www.jp.arm.com/
Yokogawa Digital Computer Corporation http://www.yokogawa-digital.com/arm/index.html
*2: Form information on third-party tools, contact the following companies.
IAR Systems AB http://www.iarsys.co.jp/   Lauterbach Datentechnik GmbH http://www.lauterbach.co.jp/
COMPUTEX CO., LTD. http://www.computex.co.jp/   Advanced Data Controls Corp. http://www.adac.co.jp/
Sophia Systems Co., Ltd. http://www.sophia-systems.co.jp/   Mentor Graphics Japan Co., Ltd. http://www.mentorg.co.jp/embedded/
Yokogawa Digital Computer Corporation http://www.yokogawa-digital.com/emb/index.html   GAIO TECHNOLOGY CO., LTD http://www.gaio.co.jp/home.html

* For information on "partners" with which we have announced collaboration in press releases or other publications, contact the following company.
Data Technology Inc. http://www.datec.co.jp/
Product offered: middleware "Cente® Middleware Series"

*Described product names are trademark or registered trademark of their respective owners.

J : This LSI is limited to the market in Japan.

ARM-Based Microcontroller

ARM-Based Microcontroller

Description	Part Number	Built-in Memory ROM /Flash	RAM	Cash	CPU Core	Operating Frequency (Max.)	Supply Voltage (V)	Operating Temperature (℃)	Supply Currency (Typ.)	General-purpose Ports	Timer	PWM	WDT	A/D	Serial Ports	Interrupt Internal/External	Additional Peripheral Functions	Package
For General-purpose Applications	ML674000	—	8KByte	—	ARM7TDMI	33MHz	I/O:3.0～3.6 core:2.25～2.75	-40～85	55mA (Operating at 16MHz)	32	7			10bit A/D 8ch	UART 2ch	19/5	DMA controller 2ch External memory controller 〔ROM(Flash)、SRAM、DRAM(EDO/SDRAM)、IO〕STOP mode	TQFP128 LFBGA144
	ML674001	—	32KByte	8KByte unified					52mA (33MHz, when using external ROM)	42		16bit×2	16bit×1	10bit A/D 4ch	UART 2ch SSIO 2ch I²C 1ch	23/5	DMA controller 2ch External memory controller 〔ROM(Flash)、SRAM、DRAM(EDO/SDRAM)、IO〕STOP mode	LQFP144 LFBGA144
	ML67Q4002	256KByte(Flash)																
	ML67Q4003	512KByte(Flash)																
	ML675001	—				60MHz			92mA (60MHz, when using external ROM)									
	ML67Q5002	256KByte(Flash)																
	ML67Q5003	512KByte(Flash)																
	ML675050	—	32KByte (maximum)	8KByte unified		64MHz	I/O:3.0～3.6 core:1.35～1.65		92mA (Operating at 64MHz)	62	7 (6 share the circuit with PWM as muiti-functional timer)	6 (share with timer as multi-functional timer)	16bit×1	12bit A/D 8ch	USB2.0 FS/LS Host 1ch (*1) USB2.0 FS Device 1ch (*1) I²C 2ch UART 3ch SPI 2ch	35/7	DMA controller 6ch External memory controller 〔ROM(Flash)、SRAM、SDRAM、IO〕LCD controller RTC 1ch	LQFP176 LFBGA144
For Space Saving Applications	ML67Q4050	64KByte(Flash)	16KByte	—	ARM7TDMI	33MHz	I/O:3.0～3.6 core:2.25～2.75	-40～85	70mA (Operating at 33MHz)	105	7 (6 share the circuit with PWM as muiti-functional timer)	6 (share the circuit with timer as multi-functional timer)	16bit×1	10bit A/D 4ch	UART 3ch I²C 1ch SPI 2ch	35/5	DMA controller 2ch External memory controller 〔ROM(Flash)、SRAM、IO〕RTC, I²C (send, receive) 1ch STOP mode	LQFP144 LFBGA144
	ML67Q4051	128KByte(Flash)																
	ML67Q4060	64KByte(Flash)					I/O:2.25～3.6 core:2.25～2.75		65mA (Operating at 33MHz)	40						26/5	DMA controller 2ch RTC I²C (send, receive) 1ch STOP mode	TQFP64 WCSP64 LFBGA84
	ML67Q4061	128KByte(Flash)																
For USB Storage	ML696201	—	128KByte	I=8KByte D=8KByte	ARM946E	120MHz	I/O:2.7～3.6 core:1.35～1.65	-30～70	95mA (Operating at 120MHz)	87	3	16bit×1	16bit×1	10bit A/D 4ch	USB2.0 HS Device 1ch (*1) UART 1ch SSIO 2ch I²C 1ch	23/4	DMA controller 4ch External memory controller 〔ROM(Flash)、SRAM、SDRAM、IO〕RTC NAND Flash controller I²C (send, receive) 1ch IDE controller STOP mode	LFBGA272
	ML69Q6203	512KByte(Flash)																
For Amusement	ML675011 [J]	—	64KByte	8KByte unified	ARM7TDMI	60MHz	I/O:3.0～3.6 core:1.35～1.65	0～70	126mA (60MHz, when using external ROM)	26	7	16bit×2	16bit×1	—	UART 1ch SSIO 1ch	18/5	DMA controller 2ch External memory controller 〔ROM(Flash)、SRAM、DRAM(EDO/SDRAM)、IO〕	LQFP144
	ML675021 [J]	—	32KByte	8KByte unified	ARM7TDMI	64MHz	I/O:3.0～3.6 core:1.35～1.65	-40～85	92mA (Operating at 64MHz)	62	7 (6 share the circuit with PWM as muiti-functional timer)	6 (share the circuit with timer as multi-functional timer)	16bit×1	12bit A/D 8ch	I²C 2ch UART 3ch SPI 2ch	35/7	DMA controller 6ch External memory controller 〔ROM(Flash)、SRAM、SDRAM、IO〕RTC 1ch	LQFP176
	ML675013 [J]	—	64KByte	8KByte unified	ARM7TDMI	56MHz	I/O:3.0～3.6 core:1.35～1.65	0～70	In ES evaluation	34	7 (6 share the circuit with PWM as muiti-functional timer)	8 (6 share the circuit with timer as multi-functional timer)	16bit×1	—	UART 3ch SPI 2ch I²C 2ch SSIO 1ch SBTX (*2) 6ch	39/5	DMA controller 10ch (2ch compatible with ML675011) External memory controller 〔ROM(Flash)、SRAM、DRAM(SDRAM)、IO〕	LQFP144

[J] : This LSI is limited to the market in Japan.

*1: USB2.0 HS means HIGH SPEED (480Mbps). USB2.0 FS means FULL SPEED (12Mbps). USB2.0 LS means LOW SPEED (1.5Mbps).
*2: SBTX is a serial bus dedicated for output.

Speech synthesis LSI

Speech synthesis LSI Overview

Product Overview
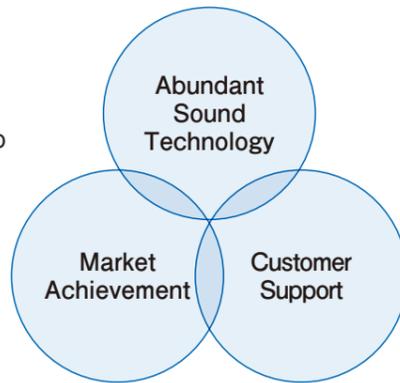
Playbacks "human voice" and "sound effect" in clear sound

● Abundant Market Achievement: This product has been used in a variety of applications, such as toys and cars, for around 30 years.
● We offer a wide selection of products, focusing on superior sound quality ADPCM method.
● We help the customers to create sound, including recording, sample creation, and sound adjustment.

Peripheral Technology
・Ultra low power
・P2ROM™/Flash/Mask ROM
・High-output speaker amplifier class AB/class D
・8bit RISC CPU

Sound Technology
・ADPCM2/Non-linear PCM/HQ-ADPCM
・High frequency compensation filter
・Speech speed conversion/
 music interval conversion

Abundant Sound Technology

Market Achievement

Customer Support

Abundant Market Achievement
Home Electronics/Consumer electronics/
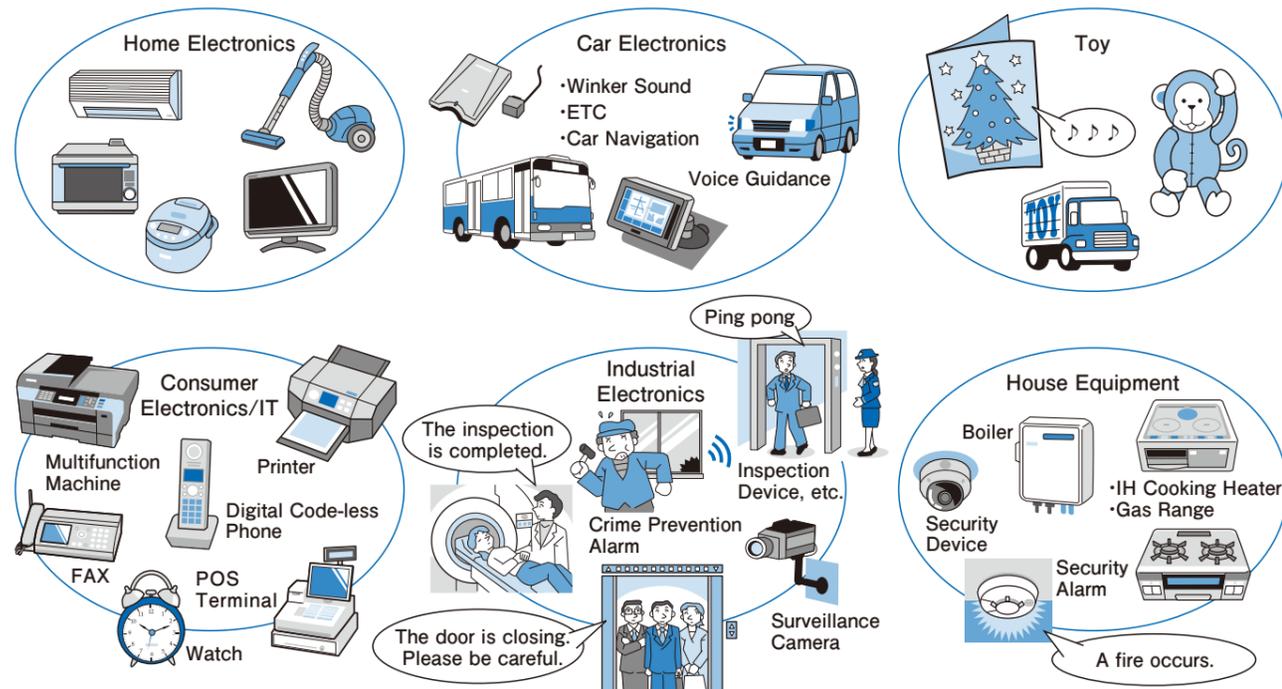Car Electronics/Industrial Electronics/
Toy/Communication Device/Security…

Customer Support
・Contract Narrator with rich experience in
 LSI processing
・Recording support/Voice analysis, Editing/
 Sound effect creation/Volume adjustment
・TTS service

Product Line-up

A variety of functions provide support for your applications.
We also offer products for universal design.

Speech synthesis LSI with built-in large-capacity P2ROM™
This product can be used in a variety of applications, including home and industrial electronics.

ML228□□Series
ML227□□Series

Speech synthesis LSI with built-in medium/small-capacity Flash/Mask ROM
Suitable for applications that need short sounds or sound effects, such as security alarms and toys.

ML2256□Series
ML223□□Series

Speech synthesis LSI for automotive
Suitable for in-vehicle applications, such as indicator sound, ETC, and meter panel.

ML2257□Series
ML2255□Series
ML223□□Series

Low power microcontroller with speech function
Suitable for security alarms, toys, etc. Simple control and high-quality speech playback functions are integrated on a single chip.

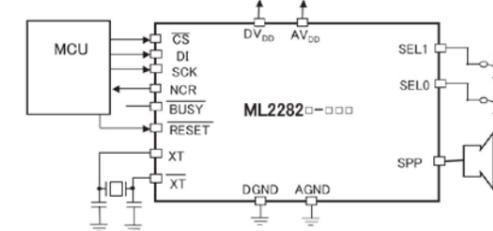ML61034□Series

Speech synthesis LSI with external memory
Memory of 128M bits with a built-in speaker amplifier can be connected for long-time playback.

ML224□□Series

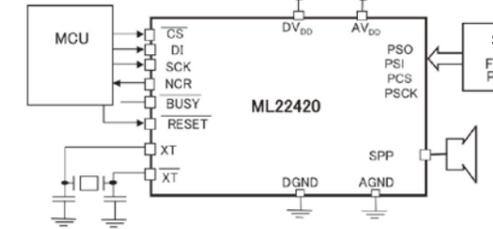This product list shows main products of speech synthesis LSI.

Application Examples

This is a "Speech LSI" which has superior features in reproducing and recording natural sound.

Home Electronics

Car Electronics
・Winker Sound
・ETC
・Car Navigation
Voice Guidance

Toy

Consumer Electronics/IT
Multifunction Machine
Printer
Digital Code-less Phone
FAX
POS Terminal
Watch

Ping pong

Industrial Electronics
The inspection is completed.
Inspection Device, etc.
Crime Prevention Alarm
The door is closing. Please be careful.
Surveillance Camera

House Equipment
Boiler
・IH Cooking Heater
・Gas Range
Security Device
Security Alarm
A fire occurs.

This product is used in voice guidance, sound effect, and melody functions.

Applied Circuit

Speech synthesis LSI with built-in large-capacity P2ROM™

MCU — ML2282□-□□□
CS, DI, SCK, NCR, BUSY, RESET, XT, XT
DVDD, AVDD, SEL1, SEL0, SPP
DGND, AGND

Product features of ML2282□-□□□
● Built-in speaker amplifier
 0.7W (at 5.0V)
● We offer wide selection of products suitable
 for CPU I/F.
 SPI : ML2282□-□□□
 I²C : ML2286□-□□□
● Wide selection of P2ROM memory capacity
 4 Mbit/8 Mbit/16 Mbit

Speech synthesis LSI with external memory

MCU — ML22420 — Serial Flash or P2ROM™
CS, DI, SCK, NCR, BUSY, RESET, XT, XT
DVDD, AVDD, PSO, PSI, PCS, PSCK, SPP
DGND, AGND

Product features of ML22420
● Built-in speaker amplifier
 0.7W (at 5.0V)
● We offer wide selection of products suitable
 for CPU I/F.
 SPI : ML22420
 I²C : ML22460
● Long-time playback
 ～128Mbit serial Flash/P2ROM™ supported

Speech synthesis LSI with built-in medium/small-capacity Flash/Mask ROM

ML22340/341
DVDD AVDD
XT, XT
DGND AGND
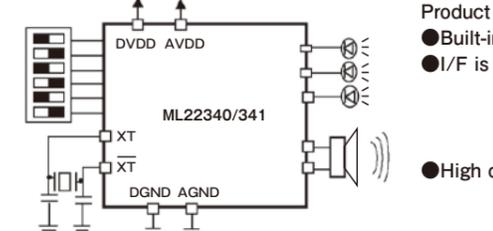
Product features of ML2234□-□□□
● Built-in speaker amplifier 1.0W (at 5.0V)
● I/F is also selectable.
 Standalone: ML2234□-□□□
 CPU I/F : ML2233□-□□□
 ML22321-□□□
 ML2256□-□□□
● High quality speech playback Built-in 16bitDAC,
 built-in HQ-ADPCM

Speech synthesis LSI

Speech synthesis LSI with built-in large-capacity P2ROM™

Description	Part Number
I²C interface 2ch simultaneous playback/ speaker amplifier installed	ML22863
	ML22864
	ML22865
I²C interface Speech-speed and pitch conversion function installed/speaker amplifier installed	ML22763
	ML22764
	ML22765
SPI interface 2ch simultaneous playback/ speaker amplifier installed	ML22823
	ML22824
	ML22825
SPI interface Speech-speed and pitch conversion function installed/speaker amplifier installed	ML22723
	ML22724
	ML22725
SPI interface Built-in P2ROM/OTP	ML22802/ML22P802
	ML22804/ML22P804
	ML22808/ML22P808

Speech synthesis LSI with built-in large-capacity P2ROM™

Part Number	Operating Voltage(V)	Operating Frequency	Operating Temperature (°C)	ROM Capacity(bit)	Number of Phrases	Maximum Playback Time(sec)(*1)	CPU I/F	SP Amp (W)	Number of Mixing (Internal)	DAC	Others	Package
ML22863	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 4M	4096	258	I²C	0.7	2ch	16bit	—	SSOP30
ML22864	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 8M	4096	520	I²C	0.7	2ch	16bit	—	SSOP30
ML22865	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 16M	4096	1044	I²C	0.7	2ch	16bit	—	SSOP30
ML22763	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 4M	4096	258	I²C	0.7	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22764	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 8M	4096	520	I²C	0.7	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22765	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 16M	4096	1044	I²C	0.7	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22823	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 4M	4096	258	SPI	0.7	2ch	16bit	—	SSOP30
ML22824	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 8M	4096	520	SPI	0.7	2ch	16bit	—	SSOP30
ML22825	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 16M	4096	1044	SPI	0.7	2ch	16bit	—	SSOP30
ML22723	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 4M	4096	258	SPI	0.7	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22724	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 8M	4096	520	SPI	0.7	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22725	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 16M	4096	1044	SPI	0.7	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22802/ML22P802	2.7~3.6	4.096MHz	-20~+85	P2ROM™ /OTP 2M	512	131	SPI	—	1ch	12bit	—	SSOP30
ML22804/ML22P804	2.7~3.6	4.096MHz	-20~+85	P2ROM™ /OTP 4M	1024	262	SPI	—	1ch	12bit	—	SSOP30
ML22808/ML22P808	2.7~3.6	4.096MHz	-20~+85	P2ROM™ /OTP 8M	1024	524	SPI	—	1ch	12bit	—	SSOP30

*1 : Maximum playback time when the sampling frequency is 4kHz in ADPCM2.

Speech synthesis LSI with external memory

Description	Part Number
4ch simultaneous playback Serial external memory	ML22460
	ML22420

Speech synthesis LSI with external memory

Part Number	Operating Frequency	Operating Temperature (°C)	ROM Capacity(bit)	Number of Phrase	Maximum Playback Time(sec)(*1)	CPU I/F	SP Amp (W)	Number of Mixing (Internal)	DAC	Others	Package
ML22460	4.096MHz	-40~+85	External	1024	139	I²C	0.7	4ch	16bit	—	SSOP30
ML22420	4.096MHz	-40~+85	External	1024	139	SPI	0.7	4ch	16bit	—	SSOP30

*1 : Maximum playback time when the sampling frequency is 4kHz in ADPCM2.

Speech synthesis LSI

Speech synthesis LSI with built-in medium/small-capacity Flash/Mask ROM

Description	Part Number
Serial interface type Built-in Mask ROM	ML22562 NEW
Serial interface type Built-in Flash/Mask ROM	ML22563/ML22Q563 NEW
	ML22330/ML22Q330 NEW
	ML22331/ML22Q331 NEW
Stand alone type Built-in Flash/Mask ROM	ML22340/ML22Q340 NEW
	ML22341/ML22Q341 NEW
Serial interface type Built-in Flash/Mask ROM	ML22321/ML22Q321 NEW

Speech synthesis LSI with built-in medium/small-capacity Flash/Mask ROM

Part Number	Operating Voltage(V)	Operating Frequency	Operating Temperature (℃)	ROM Capacity(bit)	Number of Phrases	Maximum Playback Time(sec)	CPU I/F	SP Amp (W)	Number of Mixing (Internal)	DAC	Others	Package
ML22562 NEW	2.7~5.5	4.096MHz	-40~+85	Mask/Flash 2M	1024	98 (*1)	Serial	1.0	2ch	16bit	Fail-safe	SSOP30
ML22563/ML22Q563 NEW	2.7~5.5	4.096MHz	-40~+85	Mask/Flash 4M	1024	201 (*1)	Serial	1.0	2ch	16bit	Fail-safe	SSOP30
ML22330/ML22Q330 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 640K	30	25 (*2)	Serial	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22331/ML22Q331 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	30	43 (*1)	Serial	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22340/ML22Q340 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 640K	30	25 (*2)	Stand alone	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22341/ML22Q341 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	30	43 (*1)	Stand alone	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22321/ML22Q321 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	62	43 (*1)	Serial	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30

*1 : Longest playback time when the sampling frequency is 6.4kHz in HQ-ADPCM.

*2 : Longest playback time when the sampling frequency is 6.4kHz in ADPCM2.

Speech synthesis LSI for automotive

Description	Part Number
Support for 105℃, 4ch simultaneous playback, built-in Mask ROM	ML22572 NEW
Support for 105℃, 4ch simultaneous playback, built-in Flash/Mask ROM	ML22573/ML22Q573 NEW
	ML22553/ML22Q553 NEW
Support for 85℃, built-in Flash/Mask ROM	ML22330/ML22Q330 NEW
	ML22331/ML22Q331 NEW
	ML22340/ML22Q340 NEW
	ML22341/ML22Q341 NEW
	ML22321/ML22Q321 NEW

Speech synthesis LSI for automotive

Part Number	Operating Voltage(V)	Operating Frequency	Operating Temperature (℃)	ROM Capacity(bit)	Number of Phrases	Maximum Playback Time(sec)	CPU I/F	SP Amp (W)	Number of Mixing (Internal)	DAC	Others	Package
ML22572 NEW	2.7~5.5	4.096MHz	-40~+105	Mask 2M	1024	98 (*1)	Serial	1.0	4ch	16bit	Fail-safe	SSOP30
ML22573/ML22Q573 NEW	2.7~5.5	4.096MHz	-40~+105	Mask/Flash 4M	1024	201 (*1)	Serial	1.0	4ch	16bit	Fail-safe	SSOP30
ML22553/ML22Q553 NEW	2.7~5.5	4.096MHz	-40~+105	Mask/Flash 4M	1024	201 (*1)	Serial	1.0	4ch	16bit	Overcurrent prevention Fail-safe	SSOP30
ML22330/ML22Q330 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 640K	30	25 (*2)	Serial	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22331/ML22Q331 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	30	43 (*1)	Serial	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22340/ML22Q340 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 640K	30	25 (*2)	Stand alone	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22341/ML22Q341 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	30	43 (*1)	Stand alone	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22321/ML22Q321 NEW	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	62	43 (*1)	Serial	1.0	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30

*1 : Longest playback time when the sampling frequency is 6.4kHz in HQ-ADPCM.

*2 : Longest playback time when the sampling frequency is 6.4kHz in ADPCM2.

Low power microcontroller with speech function

Description	Part Number
Built-in Mask ROM	ML610340 NEW
Built-in Flash memory	ML610Q340 NEW
OP amplifier and 12-bit ADC 3ch installed Built-in Mask ROM	ML610346 NEW
OP amplifier and 12-bit ADC 3ch installed Built-in Flash memory	ML610Q346 NEW
12-bit ADC 12ch installed Built-in Mask ROM	ML610347 NEW
12-bit ADC 12ch installed Built-in Flash memory	ML610Q347 NEW
OP amplifier and 12-bit ADC 2ch installed Built-in Mask ROM	ML610348 NEW
OP amplifier and 12-bit ADC 2ch installed Built-in Flash memory	ML610Q348 NEW

Low power microcontroller with speech function

Part Number	Operating Voltage(V)	Operating (*1) Frequency	Current (*2) Consumption (Typ.@HALT)	Operating Temperature (℃)	ROM Capacity(bit)	RAM Capacity(Byte)	WDT	ADC (Method)	OP Amplifier	SSIO (*3)	UART	Package
ML610340 NEW	2.2~5.5	4.096MHz	—	-40~+85	Mask 96K	512	1	—	—	1	—	SSOP30
ML610Q340 NEW	2.2~5.5	4.096MHz	—	-40~+85	Flash 96K	512	1	—	—	1	—	SSOP30
ML610346 NEW	2.2~5.5	4.096MHz 32KHz	1.5µA	-40~+85	Mask 128K	1K	1	12bit×3ch (Sequential)	3	1	1	TQFP64
ML610Q346 NEW	2.2~5.5	4.096MHz 32KHz	1.5µA	-40~+85	Flash 128K	1K	1	12bit×3ch (Sequential)	3	1	1	TQFP64
ML610347 NEW	2.2~5.5	4.096MHz 32KHz	1.5µA	-40~+85	Mask 128K	1K	1	12bit×12ch (Sequential)	—	1	1	TQFP64
ML610Q347 NEW	2.2~5.5	4.096MHz 32KHz	1.5µA	-40~+85	Flash 128K	1K	1	12bit×12ch (Sequential)	—	1	1	TQFP64
ML610348 NEW	2.2~3.6	4.096MHz 32KHz	1.5µA	-40~+85	Mask 128K	1K	1	12bit×3ch (Sequential)	2	1	1	QFP56
ML610Q348 NEW	2.2~3.6	4.096MHz 32KHz	1.5µA	-40~+85	Flash 128K	1K	1	12bit×3ch (Sequential)	2	1	1	QFP56

*1 : 4MHz supports built-in PLL oscillation/ceramic/crystal oscillation. 32kHz supports RC oscillation.

*2 : Current consumption in HALT mode at low speed RC oscillation of 32kHz.

*3 : As SPI compatible of 8bits/16bits, usable chip select signal does not exist.

Audio LSI for Portable Devices

Audio LSI for Portable Devices Overview

Product Overview

OKI SEMICONDUCTOR's Audio LSI series for portable devices allows audio analog circuits that cannot be mounted on the increasingly high-speed and small-sized CPU and DSP, to all be integrated on a single chip. A range of acoustic technologies suited for your application can also be integrated on a single chip to deliver superior sound quality for your device.
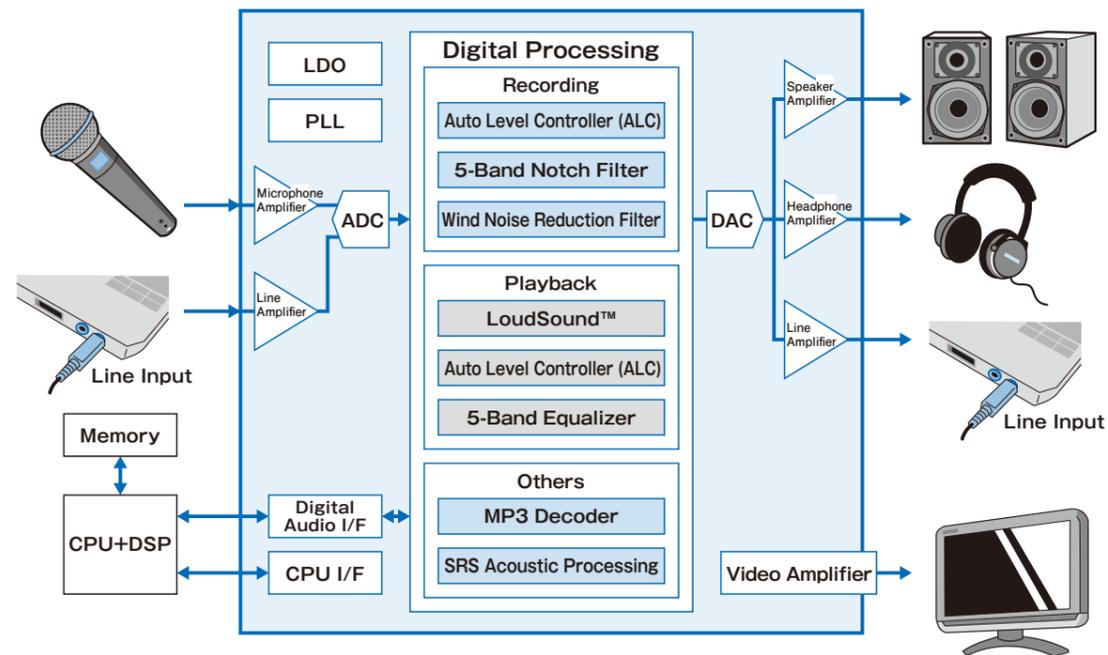
Product Line-up

Part Number	AD/DA Channel	Number of Microphone Inputs	Speaker Output		Effect					Other Function
			Type	Output(W)	Loud Sound™	EQ	Wind Cut	Notch	ALC	
ML26128HB	2/2	6	Monaural Class AB	0.5	○	○	○ (Auto)	○	○ (Fast)	VIDEO、LDO
ML26121AHB	2/2	4	Monaural Class AB	0.5	○	○	○	○	○	—
ML26121AGD	2/2	4	Monaural Class AB	0.5	○	○	○	○	○	—
ML26127HB	1/1	1	Monaural Class AB	0.5	○	○	○ (Auto)	○	○ (Fast)	VIDEO、LDO
ML26125HB	1/1	1	Monaural Class AB	0.5	○	○	○	○	○	VIDEO、LDO
ML26125GD	1/1	2	Monaural Class AB	0.5	○	○	○	○	○	VIDEO、LDO
ML26125CHB	1/1	2	Monaural Class AB	0.5	○	○	○	○	○	LDO
ML26124-00HB	1/1	1	Monaural Class AB	0.5	—	○	○	○	○	VIDEO、LDO
ML26124-02GD	1/1	2	Monaural Class AB	0.5	—	○	○	○	○	VIDEO、LDO
ML2612GD	1/1	1	Monaural Class AB	0.5	—	○	○	○	○	—
ML2614HB	1/1	1	Monaural Class AB	0.5	—	○	○	○	○	—
ML26211EGD	0/1	—	Monaural Class D	2	○	○	—	—	○	—
ML26211DHB	0/1	—	Monaural Class D	2	○	○	—	—	○	—
ML2611GD	0/2	—	Stereo Class AB	0.8	—	○	—	—	—	SRS
ML2611HB	0/2	—	Stereo Class AB	0.8	—	○	—	—	—	SRS
ML2620GD	0/0	—	Monaural Class AB	0.8	○	○	—	—	○	—
ML2620HP	0/0	—	Monaural Class AB	0.8	○	○	—	—	○	—
ML26203TB	0/0	—	Monaural Class D	4	—	—	—	—	—	Low EMI
ML2011GD	0/2	—	Monaural Class AB	0.8	—	—	—	—	—	LowPower MP3 Decoder
ML2011HB	0/2	—	Monaural Class AB	0.8	—	—	—	—	—	LowPower MP3 Decoder

Application Examples

DSC/DVC

Mobile Phone

Home electronics, Toys

Portable Navigation Device

Example of Acoustic Processing Technology

LoudSound™
A small speaker plays back loud sound

Power supply noise reduction ratio (PSRR)
Improved power supply noise reduction

Conventional product

ML26124

PSRR[dB]

Frequency [Hz]

Programmable EQ
Provides a free filter features

ALC
Loud sound (when a large signal is input)

Soft sound (when a small signal is input)

Mute

Automatically adjusted to appropriate sound volume

Automatic background noise reduction
The gain of low frequency sound is controlled according to the level difference between low frequency sound and high frequency sound.

Level

Frequency

Audio LSI for Portable Devices

High performance audio CODEC

Description	Part Number
Stereo CODEC WCSP type with automatic wind noise reduction filter and LoudSound™	ML26128HB (Under development)
Ultra compact stereo CODEC WCSP type	ML26121AHB (NEW)
Ultra compact stereo CODEC	ML26121AGD (Under development)
Monaural CODEC WCSP type with automatic wind noise reduction filter and LoudSound™	ML26127HB (Under development)
Monaural CODEC WCSP type with noise tolerance/LoudSound™	ML26125HB (NEW)
Monaural CODEC with noise tolerance/LoudSound™	ML26125GD (Under development)
Monaural CODEC WCSP type with noise tolerance/LoudSound™	ML26125CHB (Under development)
Monaural CODEC WCSP type with noise tolerance	ML26124-00HB
Monaural CODEC with noise tolerance	ML26124-02GD (NEW)
Ultra compact monaural CODEC	ML2612GD
Ultra compact monaural CODEC WCSP type	ML2614HB

High performance audio CODEC

Part Number	Supply Voltage (V)	ADC Number of Channels	ADC S/N (dB)	DAC Number of Channels	DAC S/N (dB)	Full/Half Duplex	Microphone Input Type	Microphone Input Number of Inputs	Speaker Output Type	Speaker Output Monaural/Stereo	Maximum Output	Line Output	Head phone Output	CPU I/F	Serial Audio I/F	Effect Loud Sound™	Effect EQ	Effect Wind Cut	Effect Notch	Effect ALC	Other Function	Operating Temperature (°C)	Package	Size (mm×mm)
ML26128HB (Under development)	2.7-3.6	2	92	2	95	Full	Single Differential	6	Class AB	Monaural	500mW	Stereo	Stereo	I²C/SPI	I²S, DSP, LJ, RJ, a-low, μ-low	○	○	○ (Auto)	○	○ (Fast)	VIDEO LDO	-20〜+85	WCSP34	2.96×2.96
ML26121AHB (NEW)	HVDD 2.7-3.6 LVDD 1.65-2.75	2	92	2	95	Full	Single Differential	4	Class AB	Monaural	500mW	Stereo	Stereo	I²C/SPI	I²S, DSP, LJ, RJ, a-low, μ-low	○	○	○	○	—		-20〜+85	WCSP34	2.96×2.96
ML26121AGD (Under development)	HVDD 2.7-3.6 LVDD 1.65-2.75	2	92	2	95	Full	Single Differential Digital	4	Class AB	Monaural	500mW	Stereo	Stereo	I²C/SPI	I²S, DSP, LJ, RJ, a-low, μ-low	○	○	○	○	—		-20〜+85	WQFN36	6.0×6.0
ML26127HB (Under development)	2.7-3.6	1	92	1	95	Full	Single	1	Class AB	Monaural	500mW	Monaural	—	SPI	I²S, DSP, LJ, RJ, a-low, μ-low	○	○	○ (Auto)	○	○ (Fast)	VIDEO LDO	-20〜+85	WCSP34	2.48×2.48
ML26125HB (NEW)	2.7-3.6	1	92	1	95	Full	Single	1	Class AB	Monaural	500mW	Monaural	—	SPI	I²S, DSP, LJ, RJ, a-low, μ-low	○	○	○	○	○	VIDEO LDO	-20〜+85	WCSP25	2.58×2.48
ML26125GD (Under development)	2.7-3.6	1	92	1	95	Full	Single Differential Digital	2	Class AB	Monaural	500mW	Monaural	—	I²C/SPI	I²S, DSP, LJ, RJ, a-low, μ-low	○	○	○	○	○	VIDEO LDO	-20〜+85	WQFN32	5.0×5.0
ML26125CHB (Under development)	2.7-3.6	1	92	1	95	Full	Single Differential	2	Class AB	Monaural	500mW	Monaural	—	I²C/SPI	I²S, DSP, LJ, RJ, a-low, μ-low	○	○	○	○	○	LDO	-20〜+85	WCSP25	2.58×2.48
ML26124-00HB	2.7-3.6	1	92	1	95	Full	Single	1	Class AB	Monaural	500mW	Monaural	—	SPI	I²S, DSP, LJ, RJ, a-low, μ-low	○	○	○	○	○	VIDEO LDO	-20〜+85	WCSP25	2.56×2.46
ML26124-02GD (NEW)	2.7-3.6	1	92	2	95	Full	Single Differential Digital	2	Class AB	Monaural	500mW	Monaural	—	I²C/SPI	I²S, DSP, LJ, RJ, a-low, μ-low	○	○	○	○	○	VIDEO LDO	-20〜+85	WQFN32	5.0×5.0
ML2612GD	HVDD 2.7-3.6 LVDD 1.65-2.75	1	92	1	95	Half	Single Differential		Class AB	Monaural	500mW	—	—	I²C/SPI	I²S, DSP, LJ, RJ	○	○	○	○	○		-20〜+85	WQFN24	4.0×4.0
ML2614HB	HVDD 2.7-3.6 LVDD 1.65-2.75	1	92	1	95	Half	Single	1	Class AB	Monaural	500mW	—	—	SPI	I²S, DSP, LJ, RJ	○	○	○	○	○		-20〜+85	WCSP20	2.46×1.96

Audio DAC/Speaker amplifier

Description	Part Number
DAC + filterless class D monaural speaker amplifier	ML26211EGD (Under development)
DAC + filterless class D monaural speaker amplifier WCSP type	ML26211DHB (NEW)
DAC + class AB stereo speaker amplifier with SRS acoustic processing	ML2611GD
DAC + class AB stereo speaker amplifier WCSP type with SRS acoustic processing	ML2611HB
Class AB monaural speaker amplifier with LoudSound™	ML2620GD
Class AB monaural speaker amplifier with LoudSound™, WCSP type	ML2620HP
Low EMI filterless class D monaural speaker amplifier	ML26203TB (Under development)

Audio DAC/Speaker amplifier

Part Number	Supply Voltage (V)	ADC Number of Channels	ADC S/N (dB)	DAC Number of Channels	DAC S/N (dB)	Full/Half Duplex	Microphone Input Type	Microphone Input Number of Inputs	Speaker Output Type	Speaker Output Monaural/Stereo	Maximum Output	Line Output	Head phone Output	CPU I/F	Serial Audio I/F	Effect Loud Sound™	Effect EQ	Effect Notch	Effect ALC	Other Function	Operating Temperature (°C)	Package	Size (mm×mm)
ML26211EGD (Under development)	SPVDD 2.7-5.5 IOVDD 1.65-3.6 Other 2.25-2.75	—	—	1	95	—	—	—	Class D	Monaural	2W	—	—	I²C/SPI	I²S, DSP, LJ, RJ	○	○	—	○		-20〜+85	WQFN24	4.0×4.0
ML26211DHB (NEW)	SPVDD 2.7-5.5 IOVDD 1.65-3.6 Other 2.25-2.75	—	—	1	95	—	—	—	Class D	Monaural	2W	—	—	I²C	I²S, DSP, LJ, RJ	○	○	—	○		-20〜+85	WCSP20	2.46×1.96
ML2611GD	SPVDD 2.7-4.5 HVDD 2.7-3.6 LVDD 2.25-2.75	—	—	2	90	—	—	—	Class AB	Stereo	800mW	Stereo	Stereo	I²C	I²S, DSP, LJ, RJ	—	○	—	—	SRS	-20〜+75	WQFN36	6.0×6.0
ML2611HB	SPVDD 2.7-4.5 HVDD 2.7-3.6 LVDD 2.25-2.75	—	—	2	90	—	—	—	Class AB	Stereo	800mW	Stereo	Stereo	I²C	I²S, DSP, LJ, RJ	—	○	—	—	SRS	-20〜+75	WCSP36	3.16×2.96
ML2620GD	SPVDD 2.7-5.5 IOVDD 1.65-3.6 Other 2.25-2.75	—	—	—	—	—	—	—	Class AB	Monaural	800mW	—	—	I²C/SPI	—	○	○	—	○		-20〜+85	WQFN20	4.0×4.0
ML2620HP	SPVDD 2.7-5.5 IOVDD 1.65-3.6 Other 2.25-2.75	—	—	—	—	—	—	—	Class AB	Monaural	800mW	—	—	I²C/SPI	—	○	○	—	○		-20〜+85	WCSP20	2.42×2.54
ML26203TB (Under development)	2.7-5.5	—	—	—	—	—	—	—	Class D	Monaural	4W	—	—	—	—	—	—	—	—	Low EMI	-40〜+105	TSSOP16	4.40×5.00 (Without lead)

Audio MP3 decoder

Description	Part Number
Low power MP3 decoder	ML2011GD
Low power MP3 decoder WCSP type	ML2011HB

Audio MP3 decoder

Part Number	Supply Voltage (V)	ADC Number of Channels	ADC S/N (dB)	DAC Number of Channels	DAC S/N (dB)	Full/Half Duplex	Microphone Input Type	Microphone Input Number of Inputs	Speaker Output Type	Speaker Output Monaural/Stereo	Maximum Output	Line Output	Head phone Output	CPU I/F	Serial Audio I/F	Effect Loud Sound™	Effect EQ	Effect Notch	Effect ALC	Other Function	Operating Temperature (°C)	Package	Size (mm×mm)
ML2011GD	SPVDD 2.7-4.5 Other 2.7-3.6	—	—	2	90	—	—	—	Class AB	Monaural	800mW	Stereo	—	SPI/8bit	—	—	—	—	—	Low power 2KB FIFO	-20〜+85	WQFN32	5.0×6.0
ML2011HB	SPVDD 2.7-4.5 Other 2.7-3.6	—	—	2	90	—	—	—	Class AB	Monaural	800mW	Stereo	—	SPI/8bit	—	—	—	—	—	Low power 2KB FIFO	-20〜+85	WCSP35	3.56×4.17

Security LSI

Fingerprint authentication LSI Overview

Product Overview

● **Low system cost & space saving**

It has a built-in flash memory for storing fingerprint data, which eliminates external memories.

● **Fast fingerprint authentication**

Authentication time: 0.8s (1:1)

● **High security**

Its security functions can efficiently prevent unauthorized access to enrolled fingerprint data.

● **Easy to use**

Built-in algorithm enables easy to use this LSI without the detailed knowledge on fingerprint authentication.

● **Rich development environment**

Software development kit (SDK) with demo source programs is available.

● **Support for mouse functionality**

Smooth mouse functionality can be realized by combining sensors from AuthenTec.

Development Tool

LSI	Evaluation kit	Software development environment	
		Code generator tool	Debug tool
ML67Q5250	ML67Q5250 (*2) Software Development Kit	RealView® Development Suite (RVDS) (*1) RealView® Microcontroller Development Kit (RVMDK) (*1) ARM® Developer Suite(ADS) (*1)	RealView® ICE (RVI) (*1) ULINK-ME® (*1)
ML67Q5260 ML67Q5270	ML67Q5260 (*3) Software Development Kit	RealView® Development Suite (RVDS) (*1) RealView® Microcontroller Development Kit (RVMDK) (*1) ARM® Developer Suite(ADS) (*1)	RealView® ICE (RVI) (*1) ULINK-ME® (*1)

*1: RVDS, ADS, RVMDK, RVI, and ULINK-ME are proprietary products of ARM Ltd.
  For information on proprietary products of ARM Ltd., contact the following companies.
  ARM Ltd.   http://www.jp.arm.com/
  Yokogawa Digital Computer Corporation   http://www.yokogawa-digital.com/arm/index.html
*2: We provide 2 products, each of which has a different sensor.
  ML67Q5250-SDK-2510 (AES2510)
  ML67Q5250-SDK-1711 (AES1711)
*3: We provide 2 products, each of which has a different sensor.
  ML67Q5260-SDK-1751 (AES1751)
  ML67Q5260-SDK-1711 (AES1711)

*Described product names are trademark or registered trademark of their respective owners.

Application Examples

● Door Lock
● Room Access Management
● Handy Terminal
● Health equipment
● Locker/Safety Box
● Garage Opener
● POS
● PC/Server
● USB Dongle/Token
● Removable Storage
● OA Equipment
● Access Control

● **Application Example: USB Token**
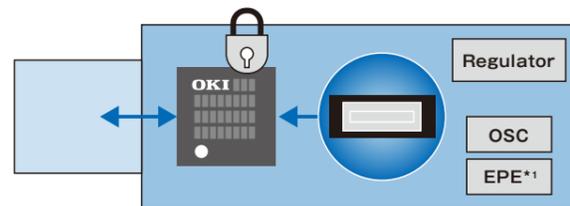
*1:Electrostatic Preventing Element

Security LSI

Fingerprint authentication LSI

Description	Part Number	Operating Conditions				Built-in Memory			Peripheral Functions								Package
		Supply Voltage (V)	Operating Frequency (Max.)	Instruction Execution Time	Operating Temperature(℃)	ROM /Flash	RAM	Cache	General-Purpose Ports	Timer	PWM	WDT	A/D	Serial Ports	Interrupt Sources Internal/ External	Other Peripherals	
Adopted DFT based fingerprint authentication algorithm 32bit Microcontrollers for fingerprint authentication	ML67Q5250	I/O: 3.0~3.6 core: 2.25~2.75	32MHz	15.6ns	-40~85 (*2)	128KByte Flash	16KByte	—	43	4 (3 share the circuit with PWM as multi-functional timer)	3 (share the circuit with timer as multi-functional timer)	16bit×1	—	Synchronous SIO 1ch USB2.0 FS Device 1ch (*1) UART 1ch SPI 2ch	18/5	DFT based algorithm-fingerprint authentication accelerator DMA Controller x 2ch External Memory Controller (ROM(Flash), SRAM, SDRAM, IO) Random number generator Smart card interface	LFBGA144
Adopted DFT based fingerprint authentication algorithm 32bit Microcontrollers for fingerprint authentication	ML67Q5260	I/O: 3.0~3.6 core: 1.62~1.98	32MHz	15.6ns	-40~85	128KByte Flash 8kByte MASKROM	16KByte	—	25	4	—	16bit×1	—	Synchronous SIO 1ch USB2.0 FS Device 1ch (*1) UART 1ch SPI 1ch	17/4	DFT based algorithm-fingerprint authentication accelerator DMA controller x 2ch Random number generator Smart card interface	WCSP63
Adopted DFT based fingerprint authentication algorithm 32bit Microcontrollers for fingerprint authentication	ML67Q5270	I/O: 3.0~3.6 core: 1.62~1.98	32MHz	15.6ns	-40~85	128KByte Flash 8kByte MASKROM	16KByte	—	37	4 (3 share the circuit with PWM as multi-functional timer)	3 (share the circuit with timer as multi-functional timer)	16bit×1	—	Synchronous SIO 1ch USB2.0 FS Device 1ch (*1) UART 1ch SPI 2ch	18/5	DFT based algorithm-fingerprint authentication accelerator DMA controller x 2ch External memory controller (ROM (Flash), SRAM, SDRAM, IO) Random number generator Smart card interface	LFBGA144

*1 : USB2.0 FS means FULL SPEED (12Mbps)

*2 : When writing Flash memory : -40℃~70℃

Video LSI

Video LSI Overview

Product Overview

Video LSI is used in a variety of applications, such as car accessories (e.g. navigation system and rear seat monitor), surveillance cameras, and portable game machines. Based on the signal processing technology required for video and display, along with the excellent reliability, we will offer a further selection of products.

- ● Digital video decoder
- ● Digital video encoder
- ● Image correction LSI with built-in video memory
- ● MPEG4 encoder
- ● Display controller
- ● Evaluation board support

Product Line-up

● **Digital video decoder**

Multi-input	ML86V7668A	ML86V76654	ML86V7672 NEW	ML86V7673	ML86V7674

Single-input	ML86V7665	ML86V76652 NEW	ML86V76653 NEW

☐ : In mass production

☐ : Under development or planning

● **Digital video encoder**

MSM7652	MSM7654	ML86V7655 ML86V7656

● **Image correction LSI with built-in video memory**

ML87V2103	ML87V2107	ML87V21071	ML87V21072

● **MPEG4 encoder**

ML86410

● **Display controller**

ML86V8101	ML86V8102	ML86V8202 NEW	ML86V8207	ML86V8209	ML86V8401 NEW

Application Examples

Rear seat monitor
- ·Video decoder
- ·Display controller

Rearview mirror monitor
- ·Video decoder
- ·Display controller

Monitoring system of surrounding environment
- ·Video encoder
- ·Video decoder

Surveillance camera system
- ·Video encoder
- ·Video decoder

Car navigation system
- ·Video decoder/encoder

Application Examples

- Tuner
- Out-vehicle camera
- Image correction
- Video decoder
- Video encoder
- Image quality adjustment
- Display controller
- Rear seat monitor
- Navigation monitor / Rear view monitor
- Car NAVI System
- HDD DVD

Video LSI

Digital video decoder

Input Format	Part Number
CVBS	ML86V7665
	ML86V76652
	ML86V76653
CVBS or S-Video	ML86V7668A
	ML86V76654
CVBS&S-Video&Component& RGB	ML86V7672
	ML86V7673
	ML86V7674 (Under development)

Digital video decoder

Part Number	Feature	Package	Supply Voltage (V) (Max.)	Operating Current (Max.)	Operating Temperature (℃)
ML86V7665	NTSC/PAL/SECAM Small sized video decoder, 10-bit ADC Input: CVBS, Output: BT.656 8 bits, Y/CbCr 8 bits multiplexed	TQFP48	I/O:3.0~3.6 Core:1.35~1.65	86mA	-40~85
ML86V76652	NTSC/PAL/SECAM Small sized video decoder, 10bit ADC, Input: CVBS Output: BT.656 8bit, Y/CbCr 8 bits multiplexed, Crystal oscillator supported	TQFP48 WQFN36 W-CSP36	I/O:1.7~2.0 3.0~3.6 Core:1.7~2.0	62mA (I/O:2.0V) 67mA (I/O:3.6V)	-40~85
ML86V76653	NTSC/PAL/SECAM Small sized video decoder, 10bit ADC, Input: CVBS Output: BT.656 8bit, Y/CbCr 8 bits multiplexed, Crystal oscillator supported, NTSC4fsc supported	TQFP48	I/O:1.7~2.0 3.0~3.6 Core:1.7~2.0	35mA	-40~85
ML86V7668A	NTSC/PAL/SECAM Video decoder (The version in which the image synchronization characteristics of the ML86V7668 are improved) 10-bit ADC x2, Input: CVBS, S-Video Output: BT.656 8bit, Y/CbCr 8 bits multiplexed, Y/CbCr 16 bits, R/G/B 18bit	TQFP100	I/O:3.0~3.6 Core:2.25~2.75	200mA	-40~85
ML86V76654	NTSC/PAL/SECAM Video decoder, 10bit ADC Input: CVBS or S-Video, Output: BT.656 8bit, Y/CbCr 8 bits multiplexed, NTSC4fsc supported	TQFP48 WQFN48	I/O:3.0~3.6 Core:1.35~1.65 Analog:3.0~3.6	TBD	-40~85
ML86V7672	NTSC/PAL Video decoder, 10bit ADC Input: CVBS, S-Video, Component, RGB, NTSC→WQVGA Scaling Output:BT.601/656, R/G/B 24 bits	TQFP100	I/O:3.0~3.6 Core:1.7~2.0	240mA	-40~85
ML86V7673	NTSC/PAL/SECAM Video decoder, 10bit ADC Input: CVBS, S-Video, Component, RGB (WVGA), NTSC→WQVGA Scaling Output: BT.656 8bit, Y/CbCr 8 bits multiplexed	TQFP64	I/O:3.0~3.6 Core:1.7~2.0	TBD	-40~85
ML86V7674 (Under development)	NTSC/PAL/SECAM Video decoder, 10bit ADC Input: CVBS, S-Video, Component, RGB, Output: BT.656	TQFP64	I/O:3.0~3.6 Core:1.35~1.65	TBD	-40~85

Digital video encoder

Output Format	Part Number
CVBS／S-Video	MSM7652
	MSM7654
CVBS／S-Video／Component or RGB	ML86V7655
	ML86V7656(*1)

Digital video encoder

Part Number	Feature	Package	Supply Voltage (V)	Operating Current (Max.)	Operating Temperature (℃)
MSM7652	NTSC/PAL video encoder, 10-bit DAC x3, ITU-R BT.601 Input: BT.656, Y/CbCr 16 bits Output: CVBS/S-Video or YUV outputs	QFP56	3.0~3.6	140mA	0~70
MSM7654	NTSC/PAL video encoder, 10-bit DAC x3 Input: BT.656, Y/CbCr 16 bits, Y/Cb/Cr 24 bits or R/G/B 24 bits Output: CVBS/S-Video or RGB	QFP64	3.0~3.6	200mA	0~70
ML86V7655	NTSC/PAL video encoder 11-bit DAC x6, I/P conversion and P/I conversion functions Input: BT.656 10 bits, Y/CbCr 10 bits, Y/CbCr 20 bits, Y/Cb/Cr 30 bits, RGB 30 bits Output: CVBS/S-Video/Component or RGB simultaneous output	TQFP100	I/O:3.0~3.6 Core:2.25~2.75	200mA	-40~85
ML86V7656(*1)	NTSC/PAL video encoder 11-bit DAC x6, I/P conversion and P/I conversion functions Input: BT.656 10 bits, Y/CbCr 10 bits, Y/CbCr 20 bits, Y/Cb/Cr 30 bits, RGB 30 bits Output: CVBS/S-Video/Component or RGB simultaneous output, Macrovision copyguard	TQFP100	I/O:3.0~3.6 Core:2.25~2.75	200mA	-40~85

*1 : Products with Macrovision copyguard output. These products, including sample products, can only be sold to the users licensed with Macrovision.

Image correction LSI with built-in video memory

Description	Part Number
Field recursive type 3D-NR, IP conversion	ML87V2103
Recursive type 3D-NR, Frame synchronize	ML87V2107
Frame recursive type 3D-NR, Cross color canceler	ML87V21071
Frame recursive Automatic detection of motion or still image 3D-NR, Analog video encoder	ML87V21072

Image correction LSI with built-in video memory

Part Number	Feature	Density	Package	Supply Voltage (V)	Operating Current (Max.)	Operating Temperature (℃)
ML87V2103	Noise reduction function, Progressive conversion function	3.9Mb Field memory	QFP100	3.0~3.6	150mA	0~70
ML87V2107	Noise reduction function ·Motion-adaptive 3D noise reduction ·Edge-adaptive 2D noise reduction Frame synchronize function	7Mb Frame memory	TQFP100	3.0~3.6	70mA	0~70
ML87V21071	Noise reduction function ·Motion-adaptive 3D noise reduction ·Edge-adaptive 2D noise reduction Cross color cancel function	7Mb Frame memory	TQFP100	3.0~3.6	90mA	0~70
ML87V21072	Noise reduction function ·Motion-adaptive 3D noise reduction ·Edge-adaptive 2D noise reduction ·Noise Reduction with automatic detection of motion or still image Low light intensity correction function, vertical mirror function, Re-sampling function, digital output data shrink function, Analog video encoder function, 2-2 pull-down output function, Jaggy-less frame output function	7Mb Frame memory	BGA90	3.0~3.6	92mA	-20~75

MPEG4 encoder

Description	Part Number
MPEG4	ML86410

MPEG4 encoder

Part Number	Feature	Package	Supply Voltage (V)	Operating Current (Max.)	Operating Temperature (℃)
ML86410	Encoding format: MPEG4 Simple Profile @L3,MPEG4 Advanced Simple Profile @L5 Input Video format: QCIF/CIF/QVGA/VGA progressive, NTSC/PAL interlace Coding Type: IIII/IPPP··· Encode mode: CBR(Up to 6Mbps)/ VBR Host CPU Interface: 8/16-bit general-purpose data bus (DMA supported) External SDRAM interface: 2MW x 32 bit	LQFP144	I/O: 3.0~3.6 Core: 1.35~1.65	130mA	-20~85

Video LSI

Display controller

Description	Part Number
T-CON, Video decoder included	ML86V8202
	ML86V8207
	ML86V8209
TCON, Image adjustment functions included	ML86V8101
	ML86V8102 (Under development)
Video decoder, 8051MCU included	ML86V8401

Display controller

Part Number	Display Size (with limitations)	Feature	Operating Frequency (Max.)	Color Display	Package	Supply Voltage (V)	Operating Current (Max.)	Operating Temperature (℃)
ML86V8202	QVGA~ WVGA	Video decoder included (NTSC/PAL/SECAM supported), Analog video input (composite, S-Video, RGB, Y/CbCr), Digital video input, Scaling, SSCG, Gamma correction, Built-in T-CON for LCD	50MHz	16,770k colors (RGB 24 bits)	TQFP100	3.0~3.6 1.7~2.0	Analog 67mA Logic 135mA	-40~85
ML86V8207	QVGA~ WVGA	Video decoder included (NTSC/PAL/SECAM supported) Analog video input (composite/S video/525i/625i/525p/625p) Digital video input, Scaling, Gamma correction, OSD line overlay function, Built-in T-CON for LCD, general-purpose I/O	50MHz	16,770k colors	LQFP144	3.0~3.6 2.25~2.75	Analog 130mA Logic 145mA	-40~85
ML86V8209	QVGA~ XGA	Video decoder included(NTSC/PAL/SECAM supported) Analog video input (composite/S video/525i/625i/525p/625p) Digital video input, Scaling, Gamma correction, OSD 2-screen synthesis, title screen, line overlay function Built-in T-CON for LCD, general-purpose I/O	65MHz	16,770k colors (RGB 24 bits)	LQFP176	3.0~3.6 2.25~2.75	Analog 130mA Logic 175mA	-40~85
ML86V8101	QVGA~ QHD	Shared RGB and independent R/B contrast adjustments, Shared RGB and independent R/B brightness adjustments, Independent RGB gamma correction, Multi-gradation color, Built-in T-CON for LCD	50MHz	260k colors (RGB 24 bits)	TQFP64	3.0~3.6	180mA	-40~85
ML86V8102 (Under development)	QVGA~ QHD	Input: 24-bit digital RGB input Output: RGB 24 bits or 18-bit FRC multi-gradation color YUV gain adjustment, Hue adjustment, RGB contrast, Brightness, Gamma correction, Built-in T-CON for LCD	50MHz	16,770k colors (RGB 24 bits)	TQFP80	3.0~3.6	TBD	-40~85
ML86V8401	QVGA~ WVGA	Video decoder included (NTSC/PAL/SECAM supported) Analog video input (composite/S video), Digital video input, Scaling, 8051MCU, SSCG, CCFL/LED control, Gamma correction, ADC for Key-Scan, Built-in T-CON for LCD	50MHz	16,770k colors (RGB 24 bits)	TQFP100	3.0~3.6 1.7~2.0	TBD	-40~85

Video LSI

Evaluation board support

Description	Part Number	Contents	Notes
Digital Video Decoder	ML86V7666 Evaluation Board ML86V7667 Evaluation Board ML86V7668A Evaluation Board ML86V7665 Evaluation Board ML86V76652 Evaluation Board ML86V76653 Evaluation Board ML86V7673 Evaluation Board	·Evaluation board x 1 ·Power cable x 1 ·Serial cable x 1 ·CD-ROM x 1 (VAStudio (LSI control software), evaluation board manual, evaluation board circuit diagram)	
Digital Video Encoder	MSM7654 Evaluation Board ML86V7655 Evaluation Board	·Evaluation board x 1 ·CD-ROM x 1 (Evaluation board manual, evaluation board circuit diagram)	
Display Controller	ML86V8207 Evaluation Board ML86V8209 Evaluation Board ML86V8401 Evaluation Board ML86V8202 Evaluation Board	·Evaluation board x 1 ·I2C control board x 1 (ML86V8401 only) ·AC adapter x 1 ·USB cable x 1 ·CD-ROM x 1 (VAStudio (LSI control software), OSDBuilder (OSD data development support tool) (ML86V8401 only) Evaluation board manual, evaluation board circuit diagram)	Lending (Please contact the sales.)
Image Correction LSI with Built-in Frame Memory	ML87V21072 Evaluation Board Board with a CCD camera ML87V21072 Evaluation Board Multifunction board with video input supported	·Evaluation board x 1 ·AC adapter x 1 ·Serial cable ·CD-ROM x 1 (I2C_CTRL (LSI control software), evaluation board manual, evaluation board circuit diagram)	
MPEG4 Encoder	ML86410 Evaluation Board LAN interface board	·Evaluation board x 1 ·AC adapter x 1 ·LAN cable x 1 ·CD-ROM x 1 (MP-RM100 (MPEG4 viewer software), evaluation board manual, evaluation board circuit diagram)	Lending (Please contact the sales.) Images can be checked on PC using the attached viewer software.

Evaluation Board Example (ML86V8401 Evaluation Board)

Features:
- The ML86V8401 evaluation board (MLEB8307) is an evaluation board for the display controller ML86V8401.
- Video signals can be displayed on the LCD panel via the ML86V8401.
- NTSC/PAL composite video signals or S video/digital video signals are supported as video signal inputs.
- The function to display still images from the external FLASH memory and data input/output to the SPI-FLASH memory is enabled.
- Functions of the LED backlight control in the external LCD panel can be checked.
- The panel interface provides two types of connectors for 50 pins and 40 pins.
- The interface has connecters for SPI, I2C, and UART.
- A PC can be used to change registers in the ML86V8401 on the development support software screen.
- The OSD (On-Screen Display) can be easily generated using the development support software.

ML86V8401 Evaluation Board Configuration

Main Screen of Development Support Software
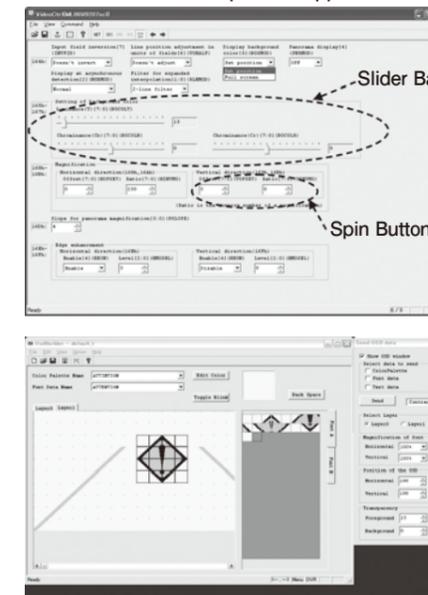
Characters can be easily placed and checked.

Other Evaluation Boards

Video decoder ML86V7665 — Video decoder/encoder board
Image correction LSI ML87V2107 — Video decoder/encoder board
Video encoder ML86V7655 — Video decoder/encoder board
LCD controller ML86V8209 — ML86V8209 Board
Image correction LSI ML87V21072 — Image correction LSI board
MPEG4 encoder ML86410 — MPEG4 encoder board
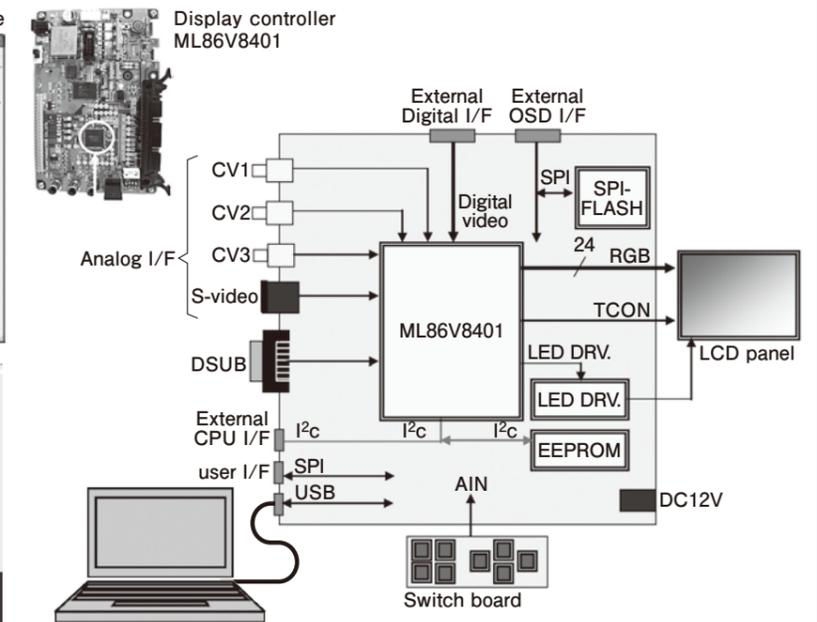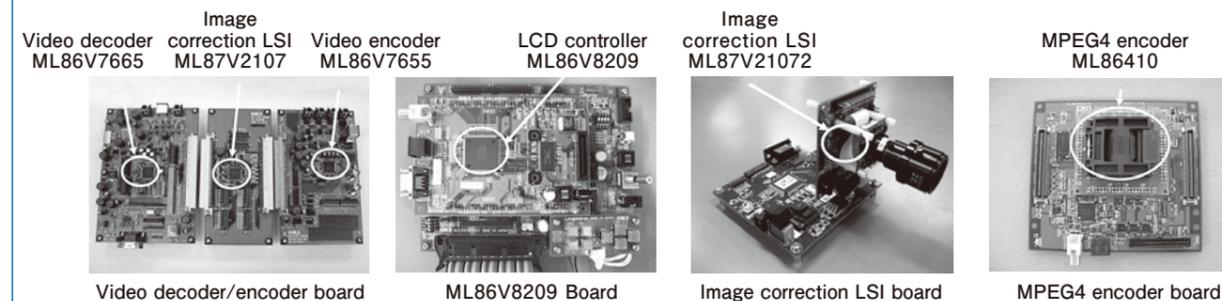
P2ROM™ Overview

Features

- Short TAT ··· Because a custom code is programmed during the final test process, P2ROMs are definitely more beneficial than mask ROMs in which the code is programmed during preprocessing.
- Stock free for customers ································ Customers are free from keeping unprogrammed memory in stock.
- No need of additional cost for programming ··· The writing cost, which is required for OTP or Flash memory, is eliminated.
- Free of mask charge ······································ Mask change does not accrue for P2ROM.
- Support for special marking ··························· Similar to mask ROM, customer specific marking can be put on the package.
- Compatible with NOR Flash memory ·············· Compatible package available, TSOP(I)56 and TSOP(I)48.

Packages

- SOP44
- SOP16
- SSOP70
- TSOP(I)56
- TSOP(I)48
- TSOP(II)50
- BGA48

Applications

- Consumer Electronics (Game, Toy, Educational Toy, Amusement, Electric Musical Instrument, TV, STB, etc.)
- Information equipment (Printer, etc.)
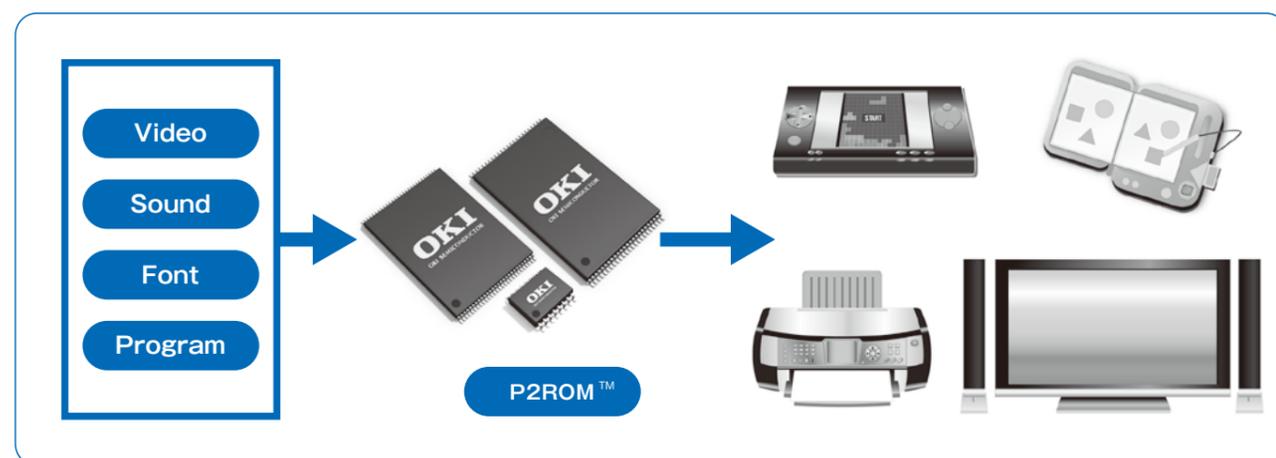
Comparison of Production Processes between P2ROM™ and Flash/MROM
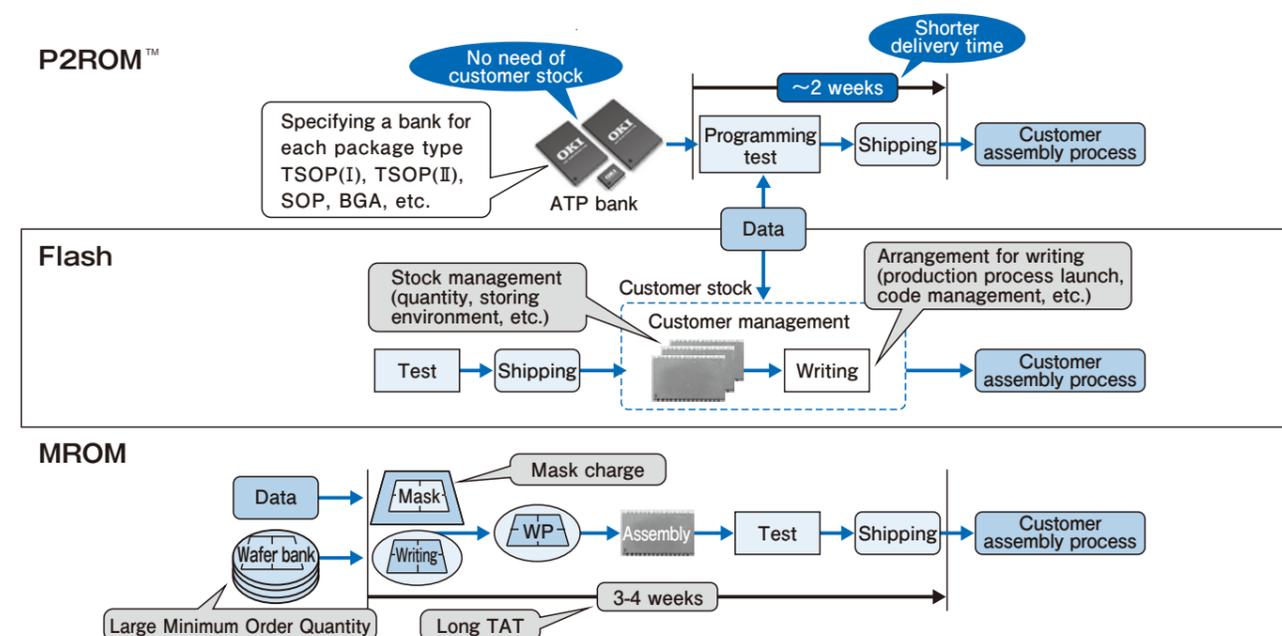
Product Series of P2ROM™

Based on technology of large capacity and high speed, we provide space-saving and multifunction products on a constant basis.
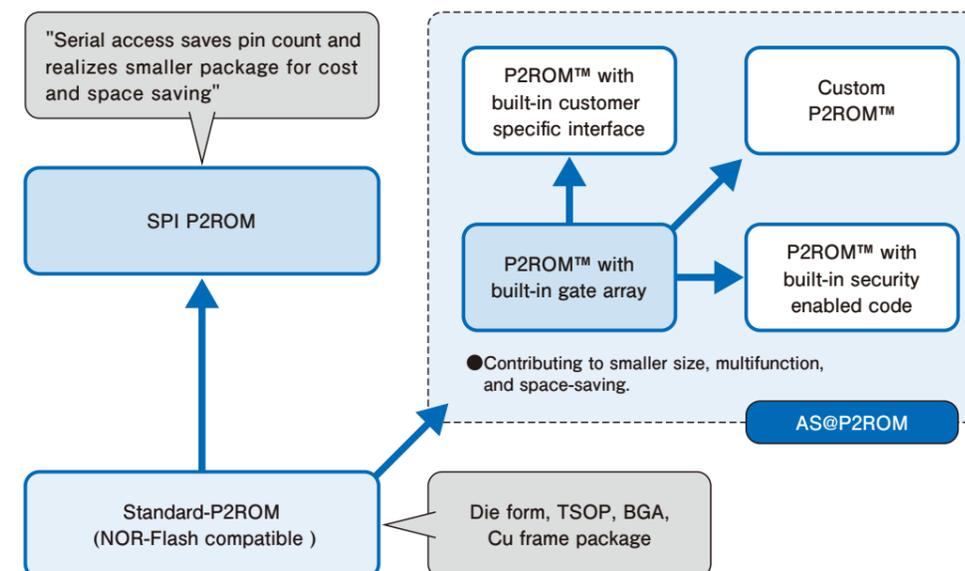
P2ROM™

AS@P2ROM

MR25T□□□□□ Series

Equipped with Gate Array of 25 K Gates typ.
Supply Voltage : 2.7V~3.6V
Operating Temperature : 0℃~+70℃

Density (bit)	Part Number	Supply Voltage (V)
128M	MR25T1287□L	2.7~3.6
64M	MR25T647□L	2.7~3.6
16M	MR25T167□L	2.7~3.6
	MR25T1671L	2.7~3.6

AS@P2ROM

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage (V)	Feature	Access Time(ns)	Standby Current (Max.)	Operating Temperature (℃)	Package
128M	MR25T1287□L	8M×16 16M×8	2.7~3.6	Embedded Gate Array [*1] 26 input & 16 inout	80~100	100μA	0~+70	TSOP(II)44/TSOP(I)48
64M	MR25T647□L	4M×16 8M×8	2.7~3.6	Embedded Gate Array [*1] 26 input & 16 inout	80~100	100μA	0~+70	TSOP(II)44/TSOP(I)48
16M	MR25T167□L	1M×16 2M×8	2.7~3.6	Embedded Gate Array [*1] 26 input & 16 inout	70~100	100μA	0~+70	TSOP(II)44/TSOP(I)48
16M	MR25T1671L	1M×16 2M×8	2.7~3.6	Password authentication	80~90	30μA	0~+70	TSOP(I)48

*1: Has a gate array of 25K Gate (typ.) built in. The design interface supports any of spec, RTL, and Netlist.

P2ROM for wide operating temperature range

MR27T□□□□□ Series

Supply Voltage : 3.0V~3.6V / 2.7V~3.6V
Operating Temperature : -40℃~+85℃

Density (bit)	Part Number	Supply Voltage (V)
64M	MR27T6402L	3.0~3.6
		2.7~3.6
32M	MR27T3202L	3.0~3.6
		2.7~3.6
16M	MR27T1602L	2.7~3.6

P2ROM for wide operating temperature range

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage (V)	Access Time (ns)	Current Consumption(Max.) Operating	Standby	Operating Temperature (℃)	Package
64M	MR27T6402L	4M×16 8M×8	3.0~3.6 2.7~3.6	80 90	20mA	10μA	-40~+85	TSOP(I)48
32M	MR27T3202L	2M×16 4M×8	3.0~3.6 2.7~3.6	80 90	20mA	10μA	-40~+85	TSOP(I)48
16M	MR27T1602L	1M×16 2M×8	2.7~3.6	70	16mA	10μA	-40~+85	TSOP(I)48

Standard P2ROM

MR26T□□□□□□ Series   512Mbit
MR37T□□□□□□ Series   256Mbit
MR27T□□□□□□ Series   8M~256Mbit
MR27V□□□□□□ Series   8Mbit

Supply Voltage : 3.0V~3.6V / 2.7V~3.6V
Operating Temperature : 0℃~+70℃

Density (bit)	Part Number	Supply Voltage (V)
512M	MR26T51203L	3.0~3.6
		2.7~3.6
256M	MR37T25602T (Under development)	3.0~3.6
		2.7~3.6
	MR27T25603L	3.0~3.6
		2.7~3.6
128M	MR27T12800L	2.7~3.6
	MR27T12802L	3.0~3.6
		2.7~3.6
64M	MR27T6402L	3.0~3.6
		2.7~3.6
32M	MR27T3202L	3.0~3.6
		2.7~3.6
16M	MR27T1602L	2.7~3.6
8M	MR27V802F	3.0~3.6
	MR27T802F	2.7~3.6

Standard P2ROM

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage (V)	Access Time (ns)	Current Consumption(Max.) Operating	Standby	Operating Temperature (℃)	Package
512M	MR26T51203L	32M×16 64M×8	3.0~3.6 2.7~3.6	100 120	35mA	10μA	0~+70	TSOP(II)50
256M	MR37T25602T (Under development)	16M×16 32M×8	3.0~3.6 2.7~3.6	100 150	35mA	10μA	0~+70	TSOP(I)56
	MR27T25603L	16M×16 32M×8	3.0~3.6 2.7~3.6	100 120	35mA	10μA	0~+70	TSOP(II)50
128M	MR27T12800L	8M×16 16M×8	2.7~3.6	90	25mA	10μA	0~+70	TSOP(I)48
	MR27T12802L	8M×16 16M×8	3.0~3.6 2.7~3.6	80 90	25mA	10μA	0~+70	TSOP(I)56
64M	MR27T6402L	4M×16 8M×8	3.0~3.6 2.7~3.6	70 90	20mA	10μA	0~+70	SOP44/TSOP(I)48 BGA48
32M	MR27T3202L	2M×16 4M×8	3.0~3.6 2.7~3.6	70~80 90	20mA	10μA	0~+70	SOP44/TSOP(I)48 BGA48
16M	MR27T1602L	1M×16 2M×8	2.7~3.6	70	16mA	10μA	0~+70	SOP44/TSOP(I)48 BGA48
8M	MR27V802F	512K×16 1M×8	3.0~3.6	70	18mA	5μA	0~+70	SOP44/TSOP(I)48
	MR27T802F	512K×16 1M×8	2.7~3.6	80	18mA	5μA	0~+70	SOP44/TSOP(I)48

Page mode P2ROM

MR36V□□□□□ Series	1G~8Gbit
MR37V□□□□□ Series	64Mbit~256Mbit
MR26V□□□□ Series	64Mbit、512Mbit
	1Gbit、2Gbit
MR27V□□□□□ Series	16M~256Mbit

Page Size：8-word×16 / 8-word×32
Supply Voltage：3.0V~3.6V
Operating Temperature：0℃~+70℃

Density (bit)	Part Number	Supply Voltage(V)
8G	MR36V08G54C (Under development)	3.0~3.6
	MR36V08G64C (Under development)	3.0~3.6
	MR36V08G57C (Under development)	3.0~3.6
4G	MR36V04G54B	3.0~3.6
	MR36V04G54S NEW	3.0~3.6
2G	MR36V02G54B	3.0~3.6
	MR26V02G54R	3.0~3.6
1G	MR36V01G52B	3.0~3.6
	MR26V01G53L	3.0~3.6
512M	MR26V51252R	3.0~3.6
	MR26V51253L	3.0~3.6
256M	MR37V25653T (Under development)	3.0~3.6
	MR37V25652T (Under development)	3.0~3.6
	MR27V25653L	3.0~3.6
128M	MR37V12852B (Under development)	3.0~3.6
	MR27V12850L	3.0~3.6
	MR27V12852L	3.0~3.6
64M	MR37V6452B (Under development)	3.0~3.6
	MR27V6452L	3.0~3.6
	MR26V6455J	3.0~3.6
32M	MR27V3252J	3.0~3.6
16M	MR27V1652L	3.0~3.6

Page mode P2ROM

Density (bit)	Part Number	Configuration (word×bit)	Page Size	Supply Voltage(V)	Access Time (Address/Page) (ns)	Current Consumption(Max.) Operating	Standby	Operating Temperature (℃)	Package
8G	MR36V08G54C (Under development)	256M×32	8-word×32	3.0~3.6	400/40	150mA	85mA	0~+70	SSOP70 (*1)
	MR36V08G64C (Under development)	128M×64	8-word×32	3.0~3.6	110/25	100mA	85mA	0~+70	SSOP70 (*1)
	MR36V08G57C (Under development)	256M×32	endless	3.0~3.6	1000/40	180mA	60mA	0~+70	SSOP70 (*1)
4G	MR36V04G54B	128M×32 256M×16	8-word×32	3.0~3.6	105/25	100mA	85mA	0~+70	SSOP70 (*1)
	MR36V04G54S NEW	128M×32 256M×16	8-word×32	3.0~3.6	130/25	100mA	85mA	0~+70	SSOP70 (*1)
2G	MR36V02G54B	64M×32 128M×16	8-word×32	3.0~3.6	105/25	100mA	50mA	0~+70	SSOP70 (*1)
	MR26V02G54R	64M×32 128M×16	8-word×32	3.0~3.6	105/25	100mA	45mA	0~+70	SSOP70 (*1)
1G	MR36V01G52B	64M×16 128M×8	8-word×16	3.0~3.6	105/25	100mA	25mA	0~+70	TSOP(I)56
	MR26V01G53L	64M×16 128M×8	8-word×16	3.0~3.6	105/35	100mA	10mA	0~+70	SSOP70 (*1)
512M	MR26V51252R	32M×16 64M×8	8-word×16	3.0~3.6	105/25	50mA	4mA	0~+70	TSOP(I)56
	MR26V51253L	32M×16 64M×8	8-word×16	3.0~3.6	100/35	80mA	5mA	0~+70	SSOP70 (*1)
256M	MR37V25653T (Under development)	16M×16 32M×8	8-word×16	3.0~3.6	100/25	35mA	5mA	0~+70	SSOP70 (*1)
	MR37V25652T (Under development)	16M×16 32M×8	8-word×16	3.0~3.6	100/25	35mA	10μA	0~+70	TSOP(I)56
	MR27V25653L	16M×16 32M×8	8-word×16	3.0~3.6	100/35	60mA	5mA	0~+70	SSOP70 (*1)
128M	MR37V12852B (Under development)	8M×16 16M×8	8-word×16	3.0~3.6	90/30	50mA	10μA	0~+70	TSOP(I)56
	MR27V12850L	8M×16 16M×8	8-word×16	3.0~3.6	85/30	50mA	10μA	0~+70	TSOP(I)48
	MR27V12852L	8M×16 16M×8	8-word×16	3.0~3.6	85/30	50mA	10μA	0~+70	TSOP(I)56
64M	MR37V6452B (Under development)	4M×16 8M×8	8-word×16	3.0~3.6	90/30	50mA	10μA	0~+70	TSOP(I)48
	MR27V6452L	4M×16 8M×8	8-word×16	3.0~3.6	90/30	50mA	10μA	0~+70	SOP44/TSOP(I)48 TSOP(I)56
	MR26V6455J	2M×32 4M×16	8-word×32	3.0~3.6	100/30	100mA	20μA	0~+70	SSOP70
32M	MR27V3252J	2M×16 4M×8	8-word×16	3.0~3.6	70/25	50mA	10μA	0~+70	SOP44/TSOP(I)48
16M	MR27V1652L	1M×16 2M×8	8-word×16	3.0~3.6	80/25	60mA	10μA	0~+70	SOP44/TSOP(I)48

*1: For sockets. Package is not suitable for reflow soldering.

SPI P2ROM

MR37T□□□□□ Series	64Mbit、128Mbit
MR37V□□□□□ Series	128Mbit
MR27V□□□□□ Series	16M~64Mbit

Supply Voltage：3.0V~3.6V / 2.7V~3.6V
Operating Temperature：0℃~+70℃

Density (bit)	Part Number	Supply Voltage(V)
128M	MR37T12841B (Under development)	2.7~3.6
	MR37T12843B (Under development)	2.7~3.6
	MR37V12841A	3.0~3.6
64M	MR37T6441B (Under development)	2.7~3.6
	MR37T6443B (Under development)	2.7~3.6
	MR27V6441L	3.0~3.6
32M	MR27V3241L	3.0~3.6
16M	MR27V1641L	3.0~3.6

SPI P2ROM

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage(V)	Operating (*2) Frequency(MHz)	Current Consumption(Max.) Operating (*2)	Standby	Operating Temperature (℃)	Package
128M	MR37T12841B (Under development)	128M×1	2.7~3.6	80/50	20mA/10mA	10μA	0~+70	SOP16
	MR37T12843B (Under development)	128M×1/64M×2 /32M×4	2.7~3.6	80/50	20mA/10mA	10μA	0~+70	SOP16
	MR37V12841A	128M×1	3.0~3.6	33/20	30mA/20mA	50μA	0~+70	SOP16
64M	MR37T6441B (Under development)	64M×1	2.7~3.6	80/50	20mA/10mA	10μA	0~+70	SOP16
	MR37T6443B (Under development)	64M×1/32M×2 /176M×4	2.7~3.6	80/50	20mA/10mA	10μA	0~+70	SOP16
	MR27V6441L	64M×1	3.0~3.6	33/20	30mA/20mA	50μA	0~+70	SOP16
32M	MR27V3241L	32M×1	3.0~3.6	33/20	40mA/20mA	50μA	0~+70	SOP16
16M	MR27V1641L	16M×1	3.0~3.6	33/20	25mA/20mA	50μA	0~+70	SOP16

*2：FAST-READ/READ

DRAM

Legacy DRAM Overview

Types of DRAM

Clock-unsynchronized DRAM ● FP DRAM (Fast Page mode)
● EDO DRAM (Extended Data Out)

Clock-synchronized DRAM ● SDRAM (synchronous DRAM)
● DDR-SDRAM (Double-Data-Rate SDRAM)
● DDR2-SDRAM
● DDR3-SDRAM
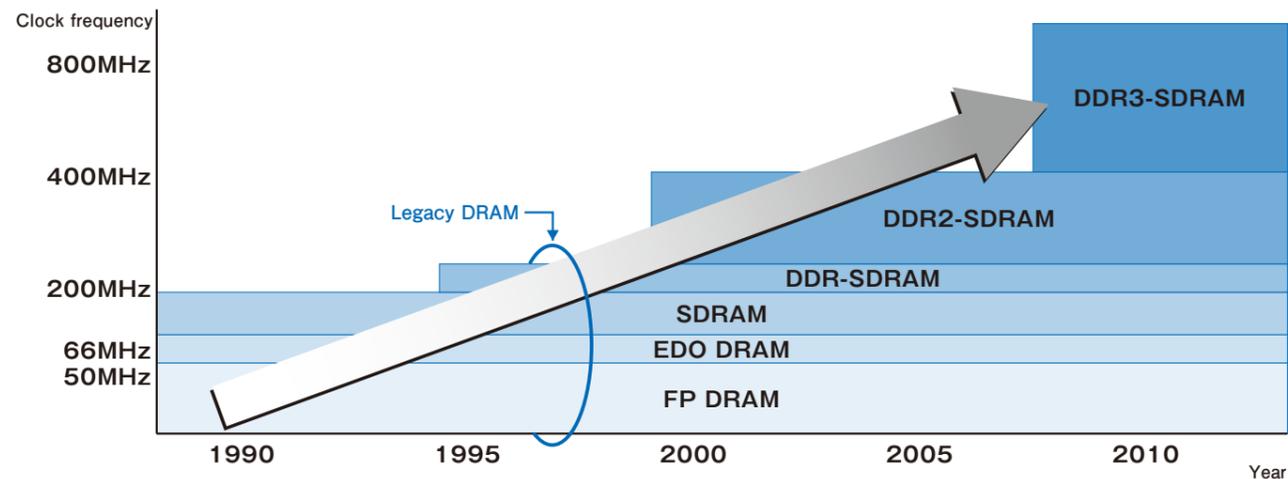
In addition, memories specifically designed for image processing are standardized.

We supply legacy DRAM and SDRAM for SiP on a long-term stable basis.

Application Examples

● AV Electronics: LCD TV, DVD player, digital camera, etc.
● IT Device: printer, hard disk drive, optical disk drive, etc.
● Car Electronics: car audio and navigation system
● Communication Device: router, FAX, etc.
This product is also used in many other applications.
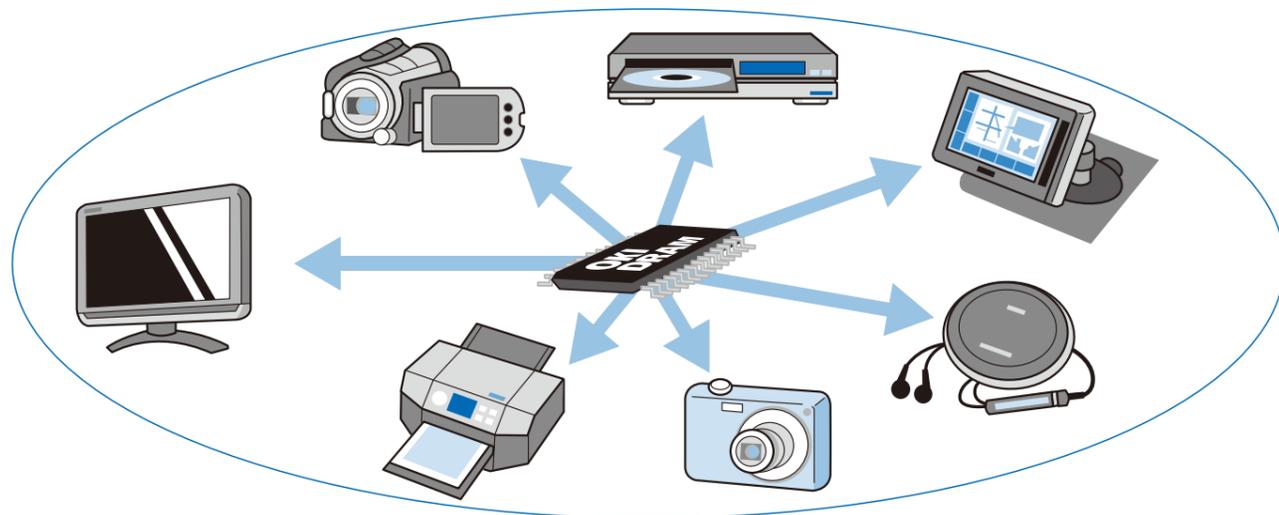
Product Line-up

Legacy DRAM

While larger and faster DRAM occupies a larger market share, we provide smaller DRAM, which is difficult to obtain in these days, on a long-term stable basis. We provide not only standard products, which feature a wider range of operating temperatures and a smaller package, but also customized products in accordance with requirements by customers.
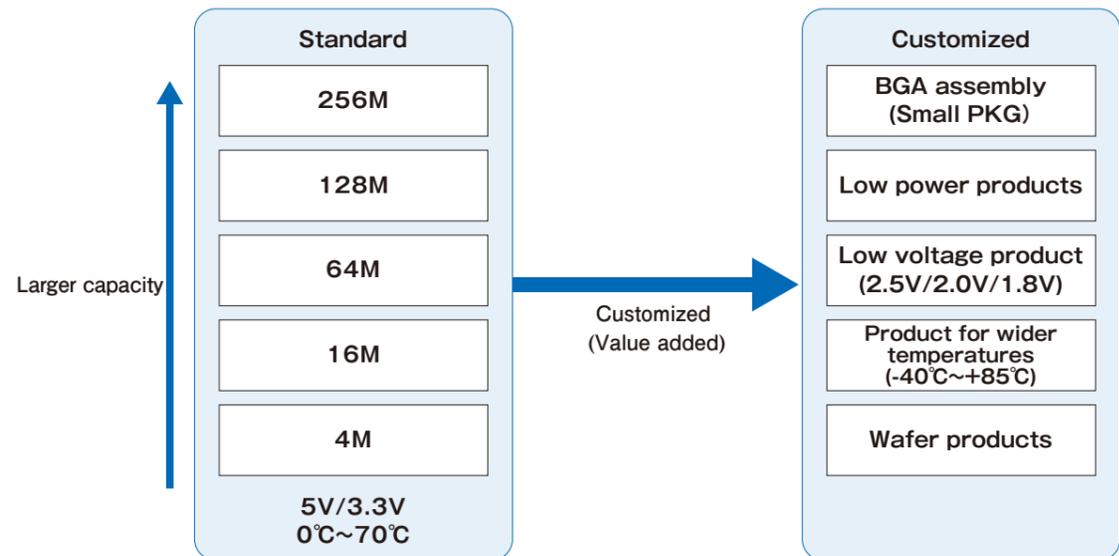
Synchronous DRAM for SiP

Most suitable for SiP! World's smallest 16Mbit SDRAM chip

Achieved the world's smallest 16Mbit SDRAM chip using the 90nm process to contribute to the SiP total cost reduction.
Because the chip size of the controller is small, it can be integrated in the product having a difficulty in implementing Chip on Chip (CoC) structure, or having a need of spacer chip.
Implementing SiP with 16Mbit SDRAM instead of the large SRAM embedded in a controller chip will reduce the controller chip area and total cost. Using this sophisticated process will help you reduce the development cost as well.

Applicable model : MSM56V16160K

Reduces total cost by reducing controller chip size

Total cost reduction can be achieved by selecting the world's smallest SDRAM for SiP instead of the large, embedded SRAM.
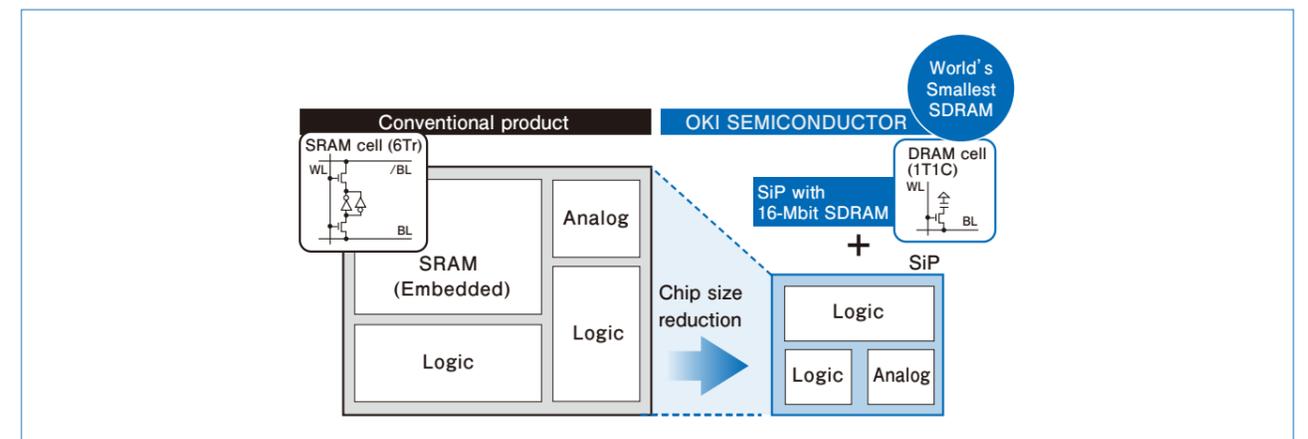
Legacy DRAM FP/EDO

Supply Voltage(V)	Density (bit)	Number of data bits	Refresh Cycle	Part Number
Standard				
5.0	4M	×4	1K	MSM514400D
				MSM514400E
		×8	1K	MSM514800E
				MSM514800ESL
		×16	512	MSM514260E
				MSM514265E
				MSM5416258B
	16M	×4	4K	MSM5116400F
			2K	MSM5117400F
				MSM5117405F
		×8	2K	MSM5117800F
				MSM5117805F
		×16	4K	MSM5116160F
			1K	MSM5118160F
				MSM5118165F
3.3	4M	×4	1K	MSM51V4400E
		×8	1K	MSM51V4800E
		×16	512	MSM54V16258B
				MSM54V16258BSL
				MSM51V4265E
	16M	×4	4K	MSM51V16400F
				MSM51V16405F
			2K	MSM51V17400F
				MSM51V17400J
				MSM51V17405F
		×8		MSM51V17800F
				MSM51V17805F
		×16	4K	MSM51V16160F
				MSM51V16165F
			1K	MSM51V18160F
				MSM51V18165F
	64M		4K	MSM51V65165E
Automotive				
5.0	4M	×4	1K	MSM514400DP
				MSM514400EP
			512	MSM514260EP
	16M	×16	1K	MSM5118160FP
				MSM5118165FP
3.3	4M	×4	1K	MSM51V4400EP
		×16	512	MSM54V16258BP
				MSM51V4265EP
	16M	×4	2K	MSM51V17400FP
				MSM51V17400JP
		×16	1K	MSM51V18165FP

Part Number	Supply Voltage(V)	Density (bit)	Configuration (word×bit)	Feature	Access Time (ns)	Refresh Cycle (cycles/ms)	Operating Temperature Ta (°C)	Package
Standard								
MSM514400D	5.0±0.5	4M	1M×4	Fast Page Mode	60/70	1024/16	0~+70	SOJ26/20
MSM514400E								TSOP(II)26/2
MSM514800E			512K×8	Fast Page Mode	60/70	1024/16		SOJ28、TSOP(II)28
MSM514800ESL						1024/128		SOJ28
MSM514260E			256K×16	Fast Page Mode	60/70	512/8		SOJ40、TSOP(II)44/40
MSM514265E				EDO	60/70			
MSM5416258B	5.0±0.5	4M	256K×16	High Speed EDO	28/30/35	512/8	0~+70	SOJ40、TSOP(II)44/40
MSM5116400F	5.0±0.5	16M	4M×4	Fast Page Mode	60	4096/64	0~+70	SOJ26/24、TSOP(II)26/24
MSM5117400F					50/60	2048/32		
MSM5117405F				EDO				
MSM5117800F			2M×8	Fast Page Mode	60	2048/32		SOJ28、TSOP(II)28
MSM5117805F				EDO				
MSM5116160F			1M×16	Fast Page Mode	60	4096/64		SOJ42
MSM5118160F				Fast Page Mode	50/60	1024/16		SOJ42、TSOP(II)50/44
MSM5118165F				EDO				
MSM51V4400E	3.0±0.3	4M	1M×4	Fast Page Mode	70/100	1024/16	0~+70	SOJ26/20、TSOP(II)26/20
MSM51V4800E			512M×8	Fast Page Mode	70	1024/16		SOJ28
MSM54V16258B	3.0±0.3	4M	256M×16	EDO	40/45/50	512/64	0~+70	SOJ40、TSOP(II)44/40
MSM54V16258BSL	3.0±0.3	4M	256M×16	EDO	40/45/50	512/64	0~+70	TSOP(II)44/40
MSM51V4265E	3.0±0.3	4M	256M×16	EDO	60/70	512/8	0~+70	TSOP(II)44/40
MSM51V16400F	3.0±0.3	16M	4M×4	Fast Page Mode	60	4096/64	0~+70	SOJ26/24
MSM51V16405F				EDO	50/60			TSOP(II)26/24
MSM51V17400F				Fast Page Mode	50/60	2048/32		
MSM51V17400J					60			
MSM51V17405F				EDO	50/60			SOJ26/24、TSOP(II)26/24
MSM51V17800F			2M×8	Fast Page Mode	60	2048/32		TSOP(II)28
MSM51V17805F				EDO				
MSM51V16160F			1M×16	Fast Page Mode	50/60	4096/64		TSOP(II)50/44
MSM51V16165F				EDO	60			
MSM51V18160F				Fast Page Mode	50/60	1024/16		
MSM51V18165F				EDO				SOJ42、TSOP(II)50/44
MSM51V65165E	3.0±0.3	64M	4M×16	EDO	50/60	4096/64	0~+70	TSOP(II)50
Automotive								
MSM514400DP	5.0±0.5	4M	1M×4	Fast Page Mode	60/70	1024/16	-40~+85	TSOP(II)26/20
MSM514400EP								
MSM514260EP	5.0±0.5	4M	256M×16	Fast Page Mode	60/70	512/8	-40~+85	SOJ40、TSOP(II)44/40
MSM5118160FP	5.0±0.5	16M	1M×16	Fast Page Mode	60	1024/16	-40~+85	SOJ42
MSM5118165FP				EDO				TSOP(II)50/44
MSM51V4400EP	3.0±0.3	4M	1M×4	Fast Page Mode	70/100	1024/16	-40~+85	TSOP(II)26/20
MSM54V16258BP	3.0±0.3	4M	256M×16	EDO	40/45/50	512/64	-40~+85	TSOP(II)44/40
MSM51V4265EP	3.0±0.3	4M	256M×16	EDO	60/70	512/8	-40~+85	TSOP(II)44/40
MSM51V17400FP	3.0±0.3	16M	4M×4	Fast Page Mode	60	2048/32	-40~+85	SOJ26/24
MSM51V17400JP								TSOP(II)26/24 Cu
MSM51V18165FP			1M×16	EDO	60	1024/16		TSOP(II)50/44

DRAM

Legacy DRAM SDRAM

Supply Voltage(V)	Density (bit)	Number of data bits	Refresh Cycle	Part Number
Standard				
3.3	16M	×8	4K	MSM56V16800F
		×16		MSM56V16160F
				MSM56V16160J
				MSM56V16160K (NEW)
				MD56V16160F
				MD56V16160J
	64M			MD56V62160E
				MD56V62162J
		×32		MD56V62320E
				MD56V62320K
	128M	×16		MD56V72160B
				MD56V72160C (Under development)
	256M		8K	MD56V82160
				MD56V82160A (Under development)
Automotive				
3.3	16M	×16	4K	MSM56V16160FP
				MSM56V16160JP
				MSM56V16160KP (NEW)
	64M			MD56V62160E-10TAZP3
				MD56V62162J-xxTAZP3
		×32		MD56V62320K-75TAZP3

Legacy DRAM SDRAM

Part Number	Supply Voltage(V)	Density (bit)	Configuration (bank×word×bit)	Max. Operating Frequency(MHz)	Refresh Cycle (cycles/ms)	Cycle Time (ns)	Operating Temperature Ta (℃)	Package
Standard								
MSM56V16800F	3.3±0.3	16M	2×1M×8	125	4096/64	8/10	0～+70	TSOP(Ⅱ)44
MSM56V16160F				125		8/10		TSOP(Ⅱ)50
MSM56V16160J	3.3±0.3	16M	2×512K×16	143	4096/64	7/7.5/8/10	0～+70	
MSM56V16160K (NEW)				166		6/7/7.5/8/10		TSOP(Ⅱ)50 Cu
MD56V16160F	3.3±0.3	16M	2×512K×16	100	4096/64	10	0～+70	TFBGA60
MD56V16160J				125		8/10		TFBGA60
MD56V62160E	3.3±0.3	64M	4×1M×16	100	4096/64	10	0～+70	TSOP(Ⅱ)54/TFBGA60
MD56V62162J				143		7/7.5/8/10		TSOP(Ⅱ)54
MD56V62320E	3.3±0.3	64M	4×512K×32	125	4096/64	8/10	-10～+70	TFBGA90
MD56V62320K	3.3±0.3	64M	4×512K×32	166	4096/64	6/7/7.5	0～+70	TSOP(Ⅱ)86
MD56V72160B	3.3±0.3	128M	4×2M×16	166	4096/64	6	0～+70	TSOP(Ⅱ)54
MD56V72160C (Under development)	3.3±0.3	128M	4×2M×16	166	4096/64	6	0～+70	TSOP(Ⅱ)54
MD56V82160	3.3±0.3	256M	4×4M×16	166	8192/64	6	0～+70	TSOP(Ⅱ)54
MD56V82160A (Under development)	3.3±0.3	256M	4×4M×16	166	8192/64	6	0～+70	TSOP(Ⅱ)54
Automotive								
MSM56V16160FP				100		10		TSOP(Ⅱ)50
MSM56V16160JP	3.3±0.3	16M	2×512K×16	125	4096/64	8/10	-40～+85	
MSM56V16160KP (NEW)				166		6/8/10		TSOP(Ⅱ)50 Cu
MD56V62160E-10TAZP3			4×1M×16	100		10		TSOP(Ⅱ)54
MD56V62162J-xxTAZP3	3.3±0.3	64M		133	4096/64	7.5/8/10	-40～+85	
MD56V62320K-75TAZP3			4×512K×32	133		7.5		TSOP86

SDRAM for SiP (chip package product)

Supply Voltage(V)	Density (bit)	Number of data bits	Refresh Cycle	Part Number
Standard				
3.3	16M	×16	4K	MSM56V16160J
				MSM56V16160K (NEW)
Automotive				
3.3	16M	×16	4K	MSM56V16160K (NEW)

SDRAM for SiP (chip package product)

Part Number	Supply Voltage(V)	Density (bit)	Configuration (bank×word×bit)	Max. Operating Frequency(MHz)	Refresh Cycle (cycles/ms)	Cycle Time (ns)	Operating Temperature Ta (℃)	Notes
Standard								
MSM56V16160J	3.3±0.3	16M	2×512K×16	133	4096/64	7.5/8/10	0～+70	—
MSM56V16160K (NEW)	3.3±0.3	16M	2×512K×16	166	4096/32	6/7/7.5/10	-40～+125	—
Automotive								
MSM56V16160K (NEW)	3.3±0.3	16M	2×512K×16	166	4096/32	6/7/7.5/10	-40～+125	—

DRAM

Video Memory Overview

Product Overview

FIFO memory is suitable if frame delay or multi-line delay is required for image processing.

What is First In First Out memory?

Advantage of FIFO
● Serial access without specifying an address
● Unsynchronized operation of READ/WRITE is supported.
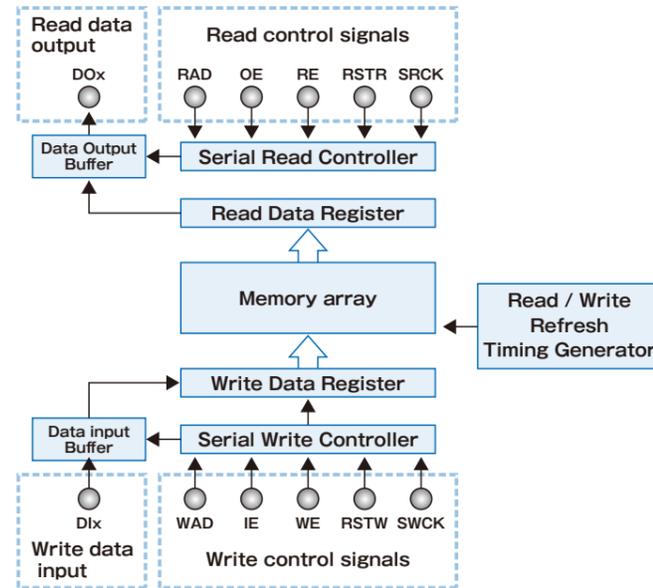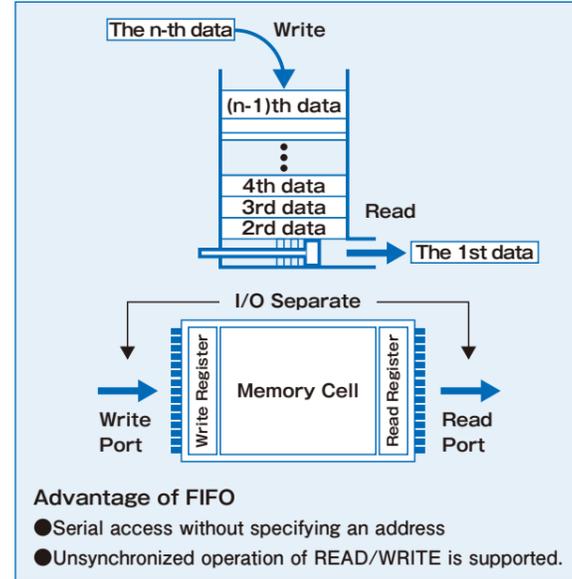
Benefits

① Cost-Saving
● Elimination of SDRAM controller and FIFO (built-in RAM) in the controller (SoC, ASIC, and FPGA) results in a smaller area/size of a circuit.
● With the independent I/O port, the same data transmission rate as DDR SDRAM can be achieved at a lower clock frequency, thus eliminating costly multi-layered board.

② Shorter Development Time
● No need of time for designing complicated SDRAM controller, such as Read/Write arbitration.
● It can be operated at a clock frequency lower than DDR SDRAM, thus simplifying the board designing and shortening the board designing time.

Need of built-in RAM
・Transfer to the internal clock
・Data arrangement

Need of complicated DRAM management
・Address management
・READ/WRITE management
・Refresh management
・Command issue

No need of DRAM controller
・No need of address management
・No need of refresh management
・Independence of data input/data output
・Unsynchronized operation of READ/WRITE
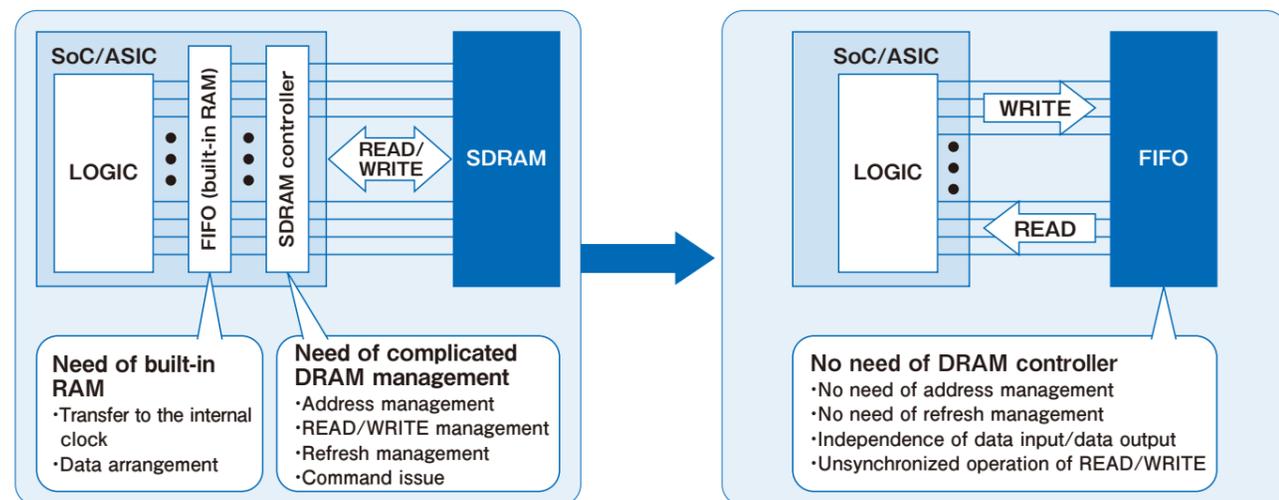
Example of Usage

● If delayed data of multi-frame is required, it can be easily obtained by cascade connection.
● If a large-capacity is required, a large-capacity FIFO memory can also be obtained by cascade connection.
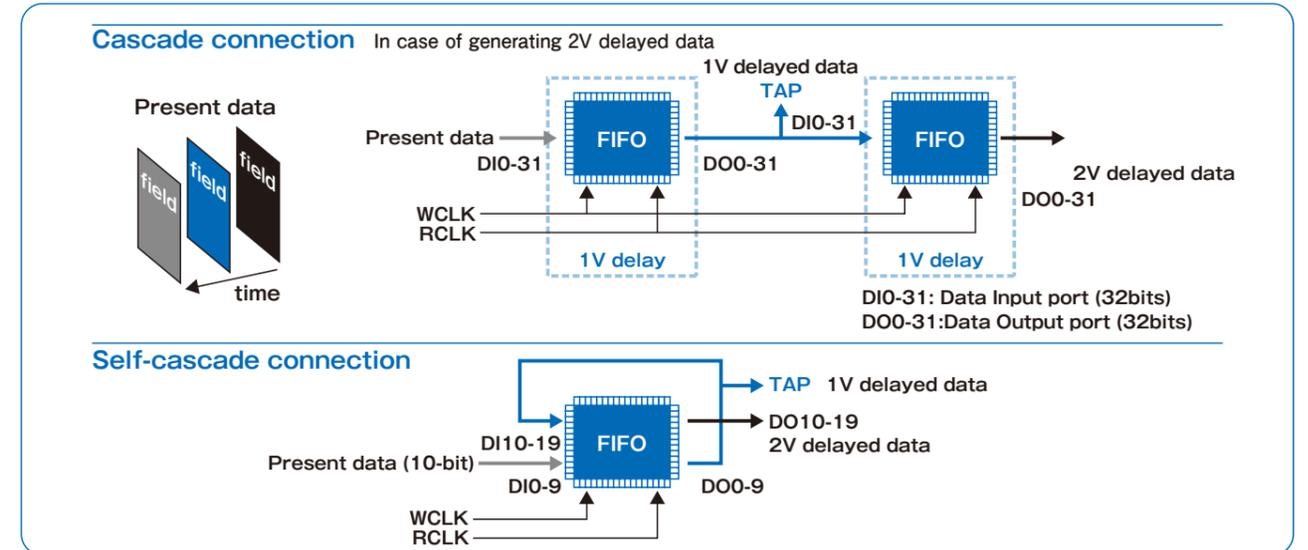
Application Examples

The memory provides the following functions for flat-panel display, surveillance camera, video camera, video capture, digital still camera, graphic data transmission system, graphic conversion system, etc.

● 3-D Y/C separation
● Compensation between frames
● LVDS transmission buffer
● Frame synchronizer
● Noise reduction
● Data compression/expansion
● Motion detection
● On-screen display
● IP conversion
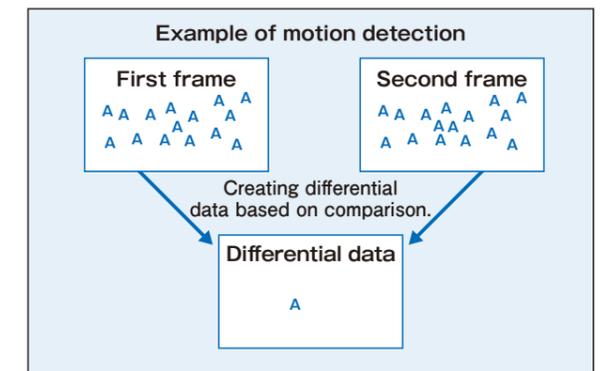
Other Video Memory

● LINE BY LINE type
● Multiport DRAM

DRAM

Memory for image

Supply Voltage(V)	Density (bit)	Number of data bits	Part Number
Standard			
5.0	2M	×8	MSM518221A
5.0	2M	×8	MSM518222A
5.0	3M	×12	MSM5412222B
5.0	4M	×16	MS8104160A
5.0	4M	×16	MS8104166A
3.3	2M	×8	MSM51V8221A
3.3	2M	×8	MSM51V8222A
3.3	3M	×12	MSM54V12222B
3.3	3M	×12	MS81V03120
3.3	4M	×16	MS81V04160A
3.3	4M	×16	MS81V04166A
3.3	5M	×10	MS81V05200
3.3	6M	×16	MS81V06160
3.3	10M	×16	MS81V10160
3.3	26M	×24	MS81V26000
3.3	32M	×32	MS81V32322
Automotive			
3.3	4M	×16	MS81V04160AP
3.3	26M	×24	MS81V26000-25TPZP3

Memory for image

Part Number	Supply Voltage(V)	Density (bit)	Configuration (word×bit)×port	Max. Operating Frequency(MHz)	Access Time(ns)	Cycle Time(ns)	Power Consumption(mW) Operating	Standby	Operating Temperatur Ta(℃)	Package	Notes
Standard											
MSM518221A	5.0±0.5	2M	262,214×8	40	25/25/30	25/30/40	330/275/200	28	0~+70	SOJ28	Asynchronous serial read/write, Output data control
MSM518222A											Asynchronous serial read/write, Write mask function, Output data control, Cascading
MSM5412222B	5.0±0.5	3M	262,214×12	40	23/25	25/30	330	27.5	0~+70	TSOP(II)44	Asynchronous serial read/write, Write mask function, Output data control, Cascading
MS8104160A	5.0±0.5	4M	(262,214×8)×2	50	18/23	20/25	935	27.5	0~+70	TSOP(II)100	Asynchronous serial read/write, Output data control, Cascading, 2 ports, WCLK2 port shared
MS8104166A											Asynchronous serial read/write, Write mask function, Output data control, Cascading, 2 ports, WCLK2 port independent
MSM51V8221A	3.3±0.3	2M	262,214×8	33	30/35	30/40	126	10.8	0~+70	SOJ28	Asynchronous serial read/write, Write mask function, Output data control
MSM51V8222A											Asynchronous serial read/write, Write mask function, Output data control, Cascading
MSM54V12222B	3.3±0.3	3M	262,214×12	50	18/23	20/25	216	10.8	0~+70	TSOP(II)44	Asynchronous serial read/write, Write mask function, Output data control, Cascading
MS81V03120	3.3±0.3	3M	262,214×12	100	7.5/8	10/12	360	14.4	0~+70	TSOP(II)70	Asynchronous serial read/write, Write mask function, Output data control, Cascading
MS81V04160A	3.3±0.3	4M	(262,214×8)×2	50	18/23	20/25	288	10.8	0~+70	TSOP(II)100	Asynchronous serial read/write, Write mask function, Output data control, Cascading, 2 ports, WCLK2 port shared
MS81V04166A											Asynchronous serial read/write, Write mask function, Output data control, Cascading, 2 ports, WCLK2 port independent
MS81V05200	3.3±0.3	5M	583,680×10	77	8	13	780	21.6	0~+70	TSOP(II)70	Asynchronous serial read/write, Write mask function, Output data control, Cascading
MS81V06160	3.3±0.3	6M	401,408×16	83	9/12	12/15	756/612	21.6	0~+70	TSOP(II)70	Asynchronous serial read/write, Write mask function, Output data control, Cascading
MS81V10160	3.3±0.3	10M	664,320×16	83	9/12	12/15	756/612	21.6	0~+70	TSOP(II)70	Asynchronous serial read/write, Write mask function, Output data control, Cascading
MS81V26000	3.3±0.3	26M	1,114,112×24	100	8/9	10/12	648/576	18	0~+70	TSOP(II)100	Asynchronous serial read/write, Write mask function, Output data control, The top address can be specified
MS81V32322	3.3±0.3	32M	1,114,112×32	150	6/6.5	6.6/7	576	72	0~+70	TSOP(II)128	Asynchronous serial read/write, Write mask function, Output data control, Cascading, The top address can be specified
Automotive											
MS81V04160AP	3.3±0.3	4M	(262,214×8)×2	50	18/23	20/25	288	10.8	-40~+85	TSOP(II)100	Asynchronous serial read/write, Write mask function, Output data control, Cascading, 2 ports, WCLK2 port shared
MS81V26000-25TPZP3	3.3±0.3	26M	1,114,112×24	40	12	25	576	18	-40~+85	TSOP(II)100Cu	Asynchronous serial read/write, Write mask function, Output data control, Cascading, The top address can be specified

Multiport DRAM

Supply Voltage(V)	Density (bit)	Number of data bits	Part Number
5.0	4M	×16	MSM5416273
5.0	4M	×16	MSM5416282
5.0	4M	×16	MSM5416283
3.3	4M	×16	MSM54V16273
3.3	4M	×16	MSM54V16283

Multiport DRAM

Density (bit)	Part Number	Configuration	Access Time Max.(ns)	Power Consumption(mW) Operating	Standby	Supply Voltage(V)	Package	Notes
4M	MSM5416273	262,144×16(RAM) 512×16(SAM)	50/60/70(RAM) 17/18/20(SAM)	770/715/660(RAM) 330/303/275(SAM)	44	4.5~5.5	SSOP64	New extended function, 2-CAS, 8 Column Block write
	MSM5416282							2-WE, 8 Column Block write
	MSM5416283							New extended function, 2-WE, 8 Column Block write
	MSM54V16273		60/70(RAM) 18/20(SAM)	432/396(RAM) 198/198(SAM)	29	3.0~3.6		New extended function, 3.3V, 2-CAS, 8 Column Block write
	MSM54V16283							New extended function, 3.3V, 2-WE, 8 Column Block write

Display LSI

Display LSI Overview

Product Overview

Display LSI is used in a variety of applications, such as large TV, PC monitor, electronic dictionary, calculator, vehicle odotrip meter, industrial machinery monitor. Each application employs a different display panel technology. OKI SEMICONDUCTOR meets customers' needs by offering a wide selection of products, such as LCD, organic EL (OLED), and Vacuum Fluorescent Display (VFD).

- ●LCD driver
- ●VFD driver
- ●OLED driver
- ●Car Clock driver
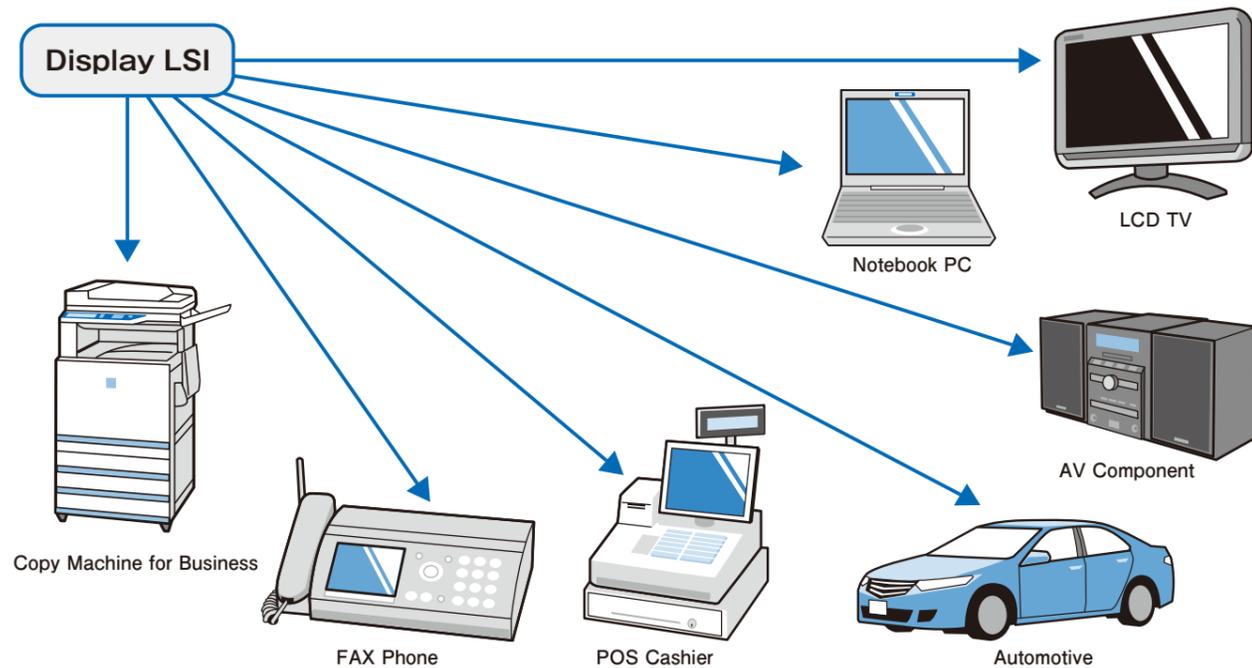
Product Line-up

LCD driver
- ●Source driver for small-medium TFT-LCD ：ML986□ Series
- ●Common/Segment driver for matrix LCD ：ML946□ Series
- ●Controller driver for graphic LCD ：ML90□□ Series
- ●Controller driver for character LCD ：ML90□□ Series
- ●Controller driver for low Duty LCD ：ML947□ Series

VFD driver
- ●Anode/Grid driver for VFD ：ML92□□ Series
- ●Controller driver for character VFD ：ML92□□ Series

OLED driver
- ●Driver for OLED ：ML93□□ Series

Car Clock driver
- ●Car Clock driver ：ML9298（VFD）、ML9098B（LCD）

Application Examples

Display LSI

LCD TV

Notebook PC

AV Component

Copy Machine for Business

FAX Phone

POS Cashier

Automotive

Application Examples in a Car

OKI SEMICONDUCTOR meets customers' needs for every automotive display to be used in Car Clock, meter panel, etc.

Meter
ML9058/59（LCD:STN）
ML947□（LCD:TN）
ML92□□（VFD）
ML93□□（OLED）
ML9860B(TFT source)

Car Clock
ML9298（VFD）
ML9098B（LCD）

Navi Center Panel
ML9860 (TFT source)

Air Conditioner
ML947□（LCD:TN）
ML92□□（VFD）
ML93□□（OLED）

AM 12:35

Car Audio
ML92□□（VFD）
ML93□□（OLED）
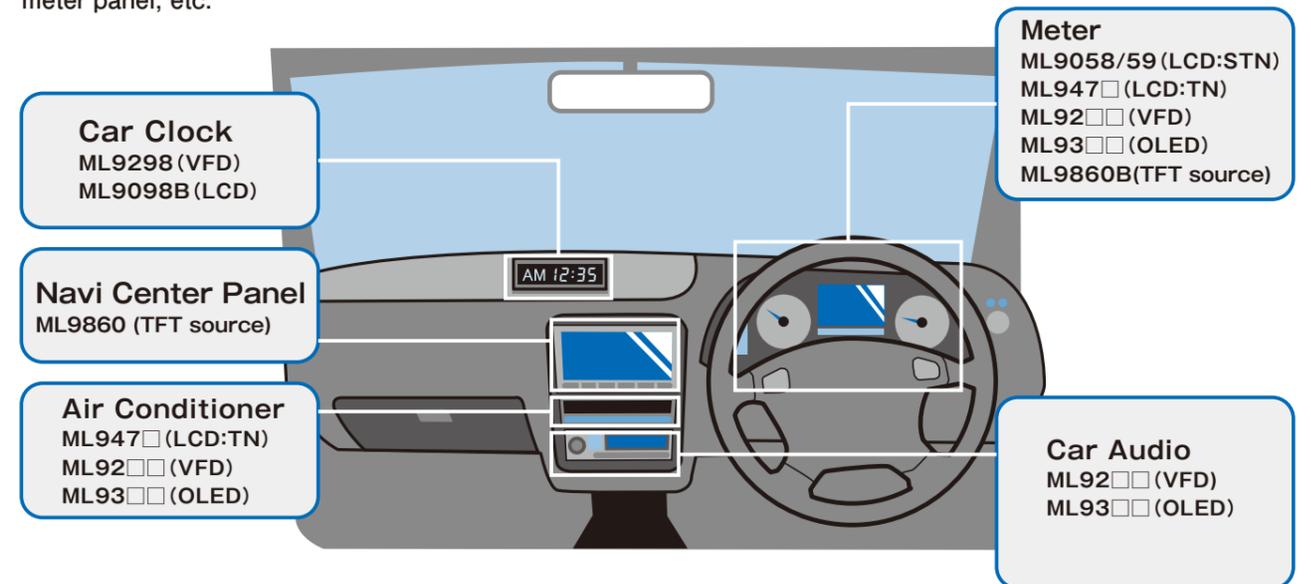
Display LSI

Display LSI

Large TFT-LCD Driver Overview

Product Overview

OKI SEMICONDUCTOR offers wide selection of display driver ICs for large TFT LCD on LCD TVs, notebook PCs, and monitors.
These ICs are used in a variety of markets.
Because this product is often customized, contact us for more information on customization.

Example of Applied Products
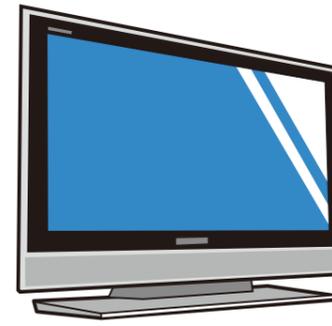
| LCD TV | Notebook PC | Monitor |

Large TFT-LCD Driver

Function overview
Source Driver

Function overview
Gate Driver

Large TFT-LCD Driver

Function overview	Gradation (bit)	Number of outputs (*1)	I/F	Logic voltage (V)	LCD voltage (V)	Package
Source Driver	6bit 8bit 10bit	384～420 480～516 576～645 684～720 864～966	CMOS RSDS mini-LVDS	2.3～3.6	12 13.5 16.5 18.5	COF COG

*1: The number of outputs corresponds to a typical value.

Function overview	Output level	Number of outputs (*1)	I/F	Logic voltage (V)	LCD voltage (V)	Package
Gate Driver	2Value, others	200～272 ～300 ～400	CMOS	2.3～3.6V	40 43 45	COF COG

*1: The number of outputs corresponds to a typical value.

Display LSI

LCD driver

Source driver for small-medium TFT-LCD

Description	Part Number
TFT-LCD driver	ML9860B

Source driver for small-medium TFT-LCD

Part Number	Feature	Package	Logic Supply Voltage(V)	LCD Voltage(V)	Operating Temperature(℃)	Driver Outputs	I/F
ML9860B	TFT LCD source driver (480outputs)	Au bump chip	2.1～3.6	10.0～14.6	-40 ～ 95	480	RSDS

Common/Segment driver for matrix LCD

Description	Part Number
LCD driver	ML9460
	ML9461B

Common/Segment driver for matrix LCD

Part Number	Feature	Package	Logic Supply Voltage(V)	LCD Voltage(V)	Operating Temperature(℃)	Driver Outputs	Duty Ratio
ML9460	LCD dot-matrix common	Au bump chip	2.5～5.5	43（Max）	-30～+75	common 240	～1/240
ML9461B	LCD dot-matrix segment	Au bump chip	2.5～5.5	2.6～5.5	-30～+75	segment 320	～1/240

Controller driver for graphic LCD

Description	Part Number
LCD controller driver	ML9058
	ML9059
	ML9092-01
	ML9092-02 ML9092-03 ML9092-04

Controller driver for graphic LCD

Part Number	Feature	Package	Logic Supply Voltage(V)	LCD Voltage(V)	Operating Temperature(℃)	Driver Outputs (common)	Driver Outputs (segment)	Duty Ratio
ML9058	LCD driver with built-in RAM for LCD dot-matrix display	Au bump chip	3.7～5.5	6～18	-40～+85	65	132	1/65
ML9059		Au bump chip	3.7～5.5	6～18	-40～+85	49	132	1/49
ML9092-01 ML9092-02 ML9092-03 ML9092-04	LCD driver with key scanner and RAM	TQFP100	4.5～5.5	4.5～16.5	-40～+85	10	56 / 60	1/8、1/9、1/10

Controller driver for character LCD

Description	Part Number
LCD controller driver	ML9042-xx

Controller driver for character LCD

Part Number	Feature	Package	Logic Supply Voltage(V)	LCD Voltage(V)	Operating Temperature(℃)	Display Type (Character)	General-Purpose Code	Custom Code	No. of Digits	Duty Ratio
ML9042-xx	LCD controller /driver	Au bump chip	2.7～5.5	2.7～5.5	-40～+85	5×8dots	01、11、21	Available	20 Characters ×2 lines	1/9、1/17

Controller driver for low Duty LCD

Description	Part Number
LCD controller driver	ML9470-11 ML9470-12
	ML9471
	ML9472
	ML9473
	ML9475 NEW
	ML9476 NEW
	ML9477 NEW
	ML9478 NEW
	ML9479B NEW

Controller driver for low Duty LCD

Part Number	Feature	Package	Logic Supply Voltage(V)	LCD Voltage(V)	Operating Temperature(℃)	Max. No. of Driving Segments	Duty Ratio
ML9470-11 ML9470-12	160-dot LCD driver	QFP100	3.0～5.5		-40～+105	80 (static)、160 (1/2duty)	Static、1/2
ML9471	400-dot LCD driver	TQFP100	3.0～5.5		-40～+105	240 (1/3duty)、320 (1/4duty)、400 (1/5duty)	1/3、1/4、1/5
ML9472	120-dot LCD driver	TQFP80	3.0～5.5		-40～+105	60 (static)、120 (1/2duty)	Static、1/2
ML9473	300-dot LCD driver	TQFP80	3.0～5.5		-40～+105	180 (1/3duty)、240 (1/4duty)、300 (1/5duty)	1/3、1/4、1/5
ML9475 NEW	160-dot LCD driver	QFP56	2.7～3.6 4.5～5.5	3.5～5.5	-40～+105	120 (1/3duty)、160 (1/4duty)	1/3、1/4
ML9476 NEW	64dot LCD driver	TQFP48	2.7～3.6 4.5～5.5	3.5～5.5	-40～+105	48 (1/3duty)、64 (1/4duty)	1/3、1/4
ML9477 NEW	128-dot LCD driver	TQFP48	2.7～3.6 4.5～5.5	3.5～5.5	-40～+105	96 (1/3duty)、128 (1/4duty)	1/3、1/4
ML9478 NEW	320-dot LCD driver	Au Bump Chip	2.7～5.5	4.5～5.5	-40～+105	80 (static)、160 (1/2duty)、240 (1/3duty)、320 (1/4duty)	Static、1/2、1/3、1/4
ML9479B NEW	640-dot LCD driver	Au Bump Chip	2.7～5.5	4.5～5.5	-40～+105	160 (static)、320 (1/2duty)、480 (1/3duty)、640 (1/4duty)	Static、1/2、1/3、1/4

Display LSI

VFD driver

Anode/Grid driver for VFD

Description	Part Number
VFD driver	ML9270-xx
	ML9271
	ML9272

Anode/Grid driver for VFD

Part Number	Feature	Package	Type (anode/grid)	Driver Outputs	Display Voltage (V)
ML9270-xx	33-bit VFD grid/anode driver	QFP44	Anode/Grid	33	8〜18
ML9271	48-bit VFD grid/anode driver	QFP64	Anode/Grid	48	8〜18
ML9272	40-bit VFD grid/anode driver	SSOP60	Anode/Grid	40	10〜65

Controller driver for character VFD

Description	Part Number
VFD controller driver	ML9208-xx
	ML9208A-xx
	ML9209-xx
	ML9289-xx
	ML9286-xx NEW

Controller driver for character VFD

Part Number	Feature	Package	General-Purpose Code	Custom Code	No. of Digit
ML9208-xx	5×7-dot character×16-digit VFD controller/driver	QFP64、SSOP64	01	Available	9〜16 characters×1 line
ML9208A-xx	5×7-dot character×16-digit VFD controller/driver	TQFP64	01	Available	9〜16 characters×1 line
ML9209-xx	16-Segment × 1〜16-digit VFD controller/driver	QFP44	01	Available	1〜16 characters×1 line
ML9289-xx	16-Segment × 1〜16-digit VFD controller/driver	TQFP48	01	Available	1〜16 characters×1 line
ML9286-xx NEW	5×7-dot character×20-digit VFD controller/driver	TQFP80	01	Available	9〜20 characters×1 line

OLED driver

Controller driver for OLED

Description	Part Number
OLED Controller Driver	ML9351A
	ML9353A

Controller driver for OLED

Part Number	Feature	Package	Driver Outputs (anode)	Driver Outputs (cathode)	Panel Supply Voltage(V)	Logic Supply Voltage(V)	Operating Temperature(℃)	Internal Memory(RAM)
ML9351A	OEL controller/driver (156 (52RGB) × 38dots)	Au bump chip TCP	156	38	12〜20	2.7〜3.3	-40〜+125(Tj)	5,928bit (156×38)
ML9353A	OEL controller/driver (132 × 64dots)	Au bump chip、TCP	132	64	10〜24	5.0±0.5	-40〜+125(Tj)	33,792bit (132×64×4)

Anode/Cathode driver for OLED

Description	Part Number
OLED driver	ML9362A
	ML9372A

Anode/Cathode driver for OLED

Part Number	Feature	Package	Driver Outputs (anode)	Driver Outputs (cathode)	Panel Supply Voltage(V)	Logic Supply Voltage(V)	Operating Temperature(℃)	Internal Memory(RAM)
ML9362A	86RGB output OEL anode driver	Au bump chip、TCP	258	-	8〜20	2.7〜5.5	-40〜+125(Tj)	—
ML9372A	64 output OEL cathode driver	Au bump chip、TCP	-	64	8〜20	2.7〜5.5	-40〜+125(Tj)	—

Segment driver for OLED

Description	Part Number
OLED driver	ML9380B

Segment driver for OLED

Part Number	Feature	Package	Driver Outputs (anode)	Driver Outputs (cathode)	Panel Supply Voltage(V)	Logic Supply Voltage(V)	Operating Temperature(℃)	Internal Memory(RAM)
ML9380B	96 output OEL driver	Au bump chip、Bare chip、TCP	96	1	8〜20	3.3〜5.5	-40〜125(Tj)	—

Car Clock driver

Description	Part Number
Car clock	ML9298
	ML9098B

Car Clock driver

Part Number	Feature	Package	Display Duty	Display Voltage(V)	Logic Supply Voltage(V)	Operating Temperature(℃)	Supply Current(Max.)	No. of Digit
ML9298	1/2 duty VFD digital clock、12H	SSOP32	1/2	4.0〜18	No need	-40〜+85	0.6mA	4digits×1line and col.
ML9098B	Static、1/2 duty LCD clock、12H、24H	TQFP48	Static、1/2	3.0〜5.5	3.0〜5.5	-40〜+105	0.6mA	4digits×1line and col、AM、PM

Other LSI

Car communication LSI

FM multiplexing demodulate LSI

Description	Part Number
FM multiplexing demodulate for VICS	MSM9564
	MSM9565
	ML9574

FM multiplexing demodulate LSI

Part Number	Feature	Package	Supply Voltage(V)	Operating Temperature(℃)	Supply Current(Max.)
MSM9564	FM multiplexing demodulate LSI for VICS (DARC), built-in BPF & frame memory VICS descrambler, Frames　A, B, C, 8-bit bus interface	QFP44	4.5～5.5V	-40～+85℃	34mA
MSM9565	FM multiplexing demodulate LSI for VICS (DARC), built-in BPF & frame memory VICS descrambler, Frames　A, B, C, 8-bit bus interface	QFP44	3.0～3.6V	-40～+85℃	28mA
ML9574	FM multiplexing demodulate LSI for VICS (DARC), built-in BPF & frame memory VICS descrambler, Frames　A, B, C, 16-bit bus interface	TQFP64	3.0～3.6V	-40～+85℃	35mA

DSRC RF IC

Description	Part Number
DSRC Transceiver	ML9636

DSRC RF IC

Part Number	Feature	Package	Radio Frequency	Supply Voltage(V)	Operating Temperature(℃)	Supply Current(Max.)
ML9636	DSRC Transceiver (ARIB STD-T75)	WQFN48	5.8GHz	1.6V typ. 3.3V typ.	-30～+85℃	115mA max

Other LSI

Other LSI

MEMS/Sensor

MEMS Acceleration Sensor Overview

Product Overview

This product can precisely detect the movement and position of every device.

● Provides versatile functions by converging MEMS (Micro-Electro-Mechanical-Systems) and LSI technologies.

● Has a built-in flash microcontroller. Thus, application programs can be installed.

● We help you to create a motion application.

MEMS Technology
・Formation of 3 dimensional structure
・Smaller movable parts

LSI Technology
・Flash microcontroller
・Sensor ASIC

Support
・Application development support
・Application software production
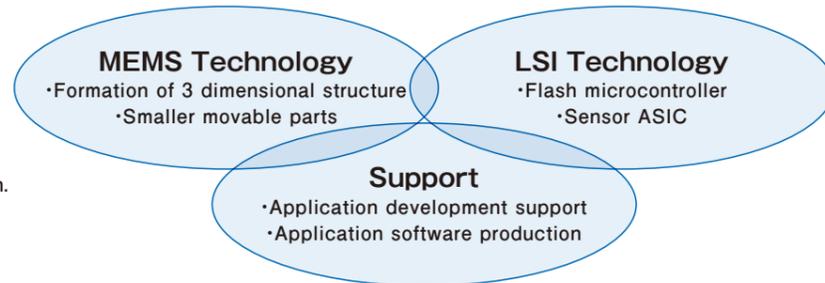
Application Examples

MEMS Acceleration Sensor's versatile functions bring you opportunities for introducing your products in various markets.

Health monitor
・Pedometer

Mobile device
・Screen rotation

Input device
・Motion input

Security
・Anti-theft detection
・Intrusion detection

Portable device
・HDD drop protection

■ Acceleration detection
■ Tilt detection
■ Motion detection
■ Vibration/shock detection
■ Drop/shock detection

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8953B
-03A
9501J
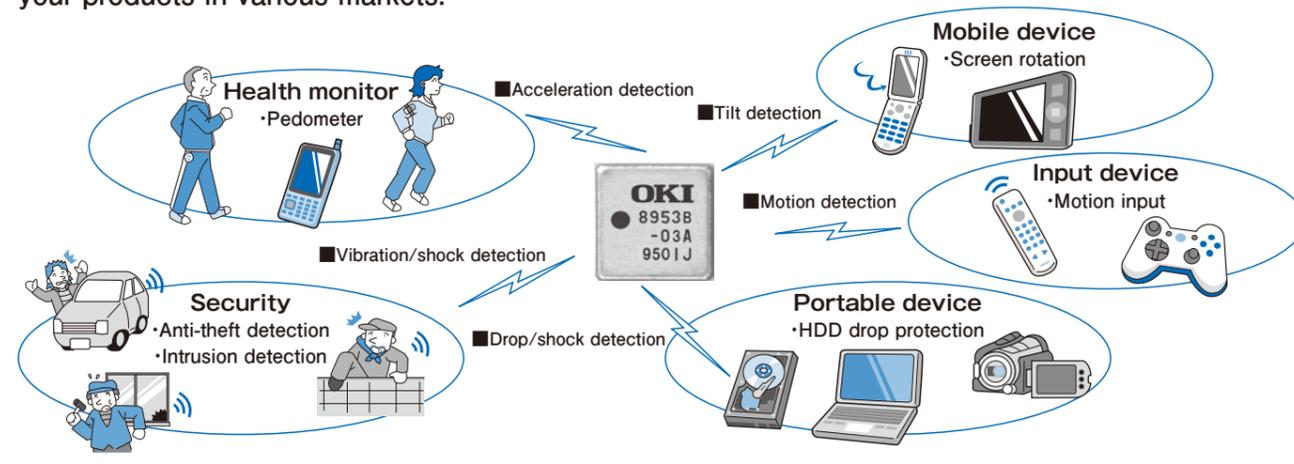
Applied Circuit

MEMS Acceleration Sensor

■ Example of I^{2}C mode
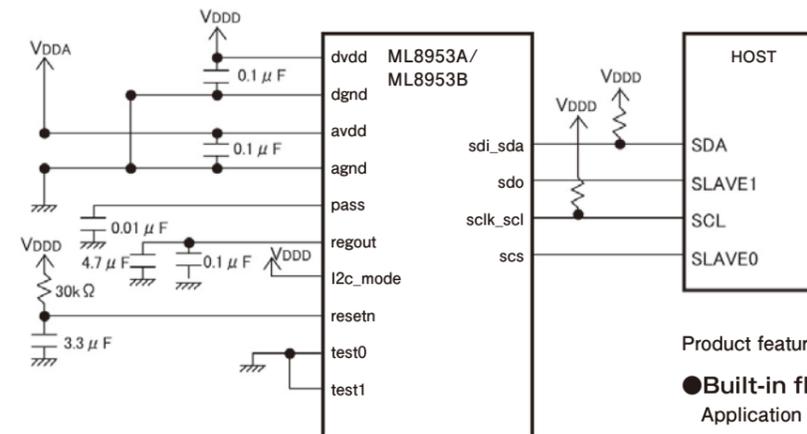
Product features of ML8953A/ML8953B

● **Built-in flash microcontroller**
Application software can be installed.

● **Digital I/F (SPI/I^{2}C)**
- SPI (compatible with 3-line serial/4-line serial)
- I^{2}C

● **Built-in intelligent functions**
1) A roll angle and pitch angle can be output.
2) The preciseness is improved by average value output.
3) In the auto measurement mode, a drop and shock can be automatically detected, and then notified to the host.

MEMS/Sensor

MEMS Acceleration Sensor

Description	Part Number
3-Axis Accelerometer Equipped with Flash Microcontroller	ML8953A
Low Power Version 3-Axis Accelerometer Equipped with Flash Microcontroller	ML8953B **NEW**

MEMS Acceleration Sensor

Part Number	Feature	Package	Rated Acceleration	Supply Voltage (V)	Typical Current (*1) Consumption(Typ.)	Output Type	Temperature Sensor	Impact Resistance	Operating Temperature(℃)
ML8953A	3-Axis Accelerometer Equipped with Flash Microcontroller	18C-TQFN	±3g	Analogue : 2.5~3.6 Digital : 1.74~3.6	250μA	SPI、I^{2}C	Built-in	5000g	-20~+70
ML8953B **NEW**	Low Power Version 3-Axis Accelerometer Equipped with Flash Microcontroller	18C-TQFN	±3g	Analogue : 2.5~3.6 Digital : 1.65~3.6	120μA	SPI、I^{2}C	Built-in	5000g	-20~+70

*1: When the current consumption is measured in the interval of 30 msec.

Optical Component

Optical Component Overview

Product Overview

We offer optical modules and ICs to deliver high-quality optical transmission.

- Based on advanced compound semiconductor technology, we offer more reliable, faster, higher-performance products.
- We offer products ranging from slower optical communication to faster optical communication such as 40G and 100G.
- We offer wide selection of products ranging from those for access lines to those for longer trunk lines.

EML — 10G, 40G, 25G
Laser — DFB-LD, FP-LD
PIN-PD/APD — 10G APD, 10G PIN
GaAs Drivers — 10G LD, 10G EA, 10G MZ
InP Drivers — 25G EA, 40G EA
GaAs Amp — TIA, AGC

High output and high extinction ratio
Wider range of operating temperatures

High sensitivity
Low noise

Superior driving ability
Small-size, low power

InP crystal-growth technology

GaAs, InP HEMT technology
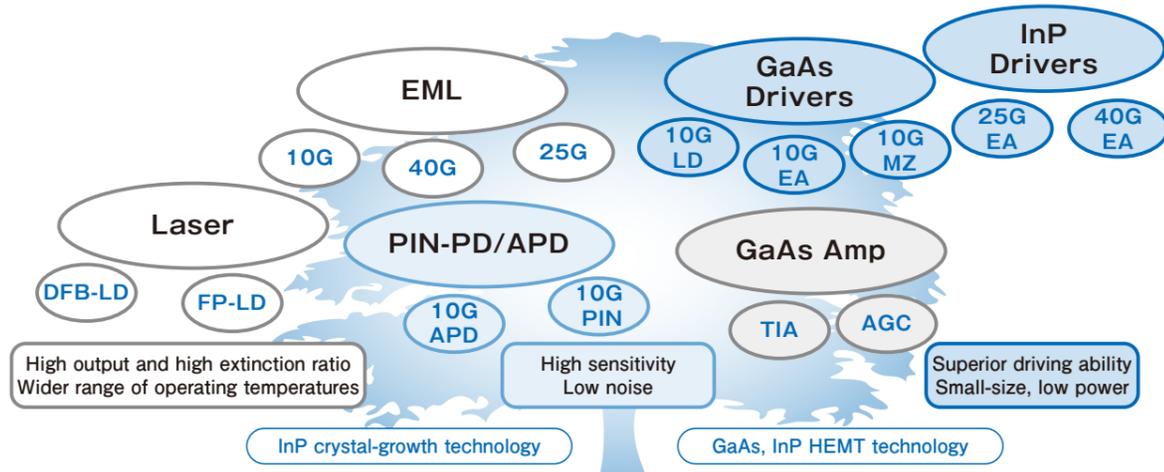
Product Line-up

We offer wide selection of products ranging from 10G to an advanced level of 40G/100G as a package in accordance with applications.

Laser Modules / EML Modules
We offer products suitable for operational speed ranging from 10G to an advance level of 40G.
We offer products in different packages suitable for the application, such as one with built-in driver IC and XMD-TOSA.

OL519☐ Series
OL515☐ Series
OL517☐ Series
OL319☐ Series

PIN PD / APD Modules
We offer 2 types of photo diode: PINPD and APD.
We offer the products as a package in accordance with applications, such as SMT and XMD-ROSA.

OF32☐☐ Series
OF36☐☐ Series
OD92☐☐ Series

Optical Modulator Driver IC
We offer products suitable for operational speed ranging from 10G to an advance level of 40G.
We offer wide selection of products, such as those for driving an MZ modulator and those for driving a direct modulating laser.

KGL41☐5 Series
KGL41☐6 Series
KGL81☐5 Series
KGA82☐5 Series

Optical Communication Receiver IC
Trans-impedance amplifier, automatic gain control amplifier, etc.
We offer wide selection of high-sensitivity and linearity products.

KGA41☐3 Series
KGL41☐2 Series

This product list shows main products of optical components.

Market for Optical Communication Applications

Optical communication network	Distance	Application	Product

Metro Core
Terrestrial / Submarine
Metro Core
Metro Access
IP Network
SAN
FTTx

80km — DWDM — LineCard 300PinMSA
40km — Sonet — LineCard 300PinMSA
10km
2km — 10GE — 300PinMSA XENPAK X2 XFP SFP+
PON Access Networking

LN Driver
EA Driver
LD Driver
TIA
EML
PIN-PD/APD
OSC-LD/APD
OTDR-LD

Optical communication IC   Optical module

Applied Block Diagram

Application example of 10Gbps 300pin MSA

Automatic gain control amplifier
- Product features of KGL41☐2 Series
  Wide gain variable range (KGL4142KD)
  Low power 0.3W (KGL4152KD)

Trans-impedance amplifier
- Product features of KGL41☐3 Series
  High sensitivity: -21dBm (KGA4153)
  High linearity: AGC (KGA4193) attached

Receiver optical module
- Product features of OF32☐☐ Series
  High sensitivity: -28dBm (OF3242N)
  High linearity: (OF3248N)
- Product features of OD92☐☐ Series
  High sensitivity: -20dBm (OD9245N)

Transmitter
Standard MSA I/O pin-out
DeMUX with CDR
AGC/POST Amp.
TIA PD
Monitor/Alarms
300pin Berg MegArray
MUX with CMU
Driver
LD/Modulator
Receiver

Block diagram of 300pin MSA

Optical Signal

Optical modulator driver
- Product features of KGX41☐5 Series
  Small/Low power: 4mm sq./0.45W (KGX5115)
  Suitable for driving an EA modulator or direct modulating LD
- Product features of KGL41☐6 Series
  High output amplitude: 6Vpp - 7Vpp
  Suitable for driving an MZ modulator
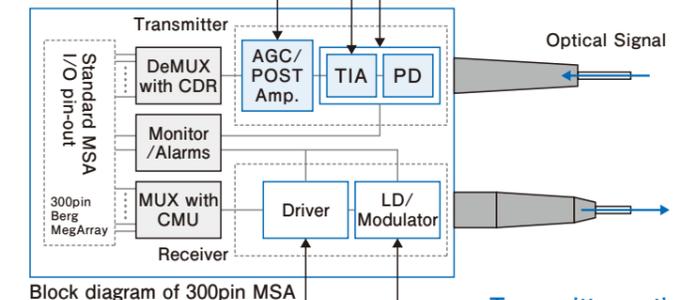
Transmitter optical module
- Product features of OL517☐ Series
  High extinction ratio: 10dB

Optical Component

Optical Component

Optical module
Laser modules / EML modules

40G EML Modules

Description	Part Number
40G EML Modules	OL5157M
	OL5158M
	OL5191M
	OL3191M

40G EML Modules

Part Number	Transmission Speed	Application	Wavelength	Optical Output Power (Min.)	Transmission Distance (Max.)	Operating Temperature (°C)	Package	Notes	Status
OL5157M	40Gbps	OC-768	1530~1565nm	5dBm (CW)	2Km	0~75	7pin- V connector, SMF	w/ TEC,mPD	MP
OL5158M	40Gbps	OC-768	1530~1565nm	5dBm (CW)	2Km	0~75	7pin - GPPO connector, SMF	w/ TEC,mPD	MP
OL5191M	40Gbps	OC-768	1530~1565nm	1dBm (mod)	2Km	-5~75	XLMD MSA	w/ Driver	ES
OL3191M	40Gbps	OC-768	1290~1330nm	1dBm (mod)	10Km	-5~75	XLMD MSA	w/ Driver	Under development

10G EML Modules

Description	Part Number
10G EML Modules	OL5170M
	OL5172M

10G EML Modules

Part Number	Transmission Speed	Application	Wavelength	Optical Output Power (Min.)	Transmission Distance (Max.)	Operating Temperature (°C)	Package	Notes	Status
OL5170M	10Gbps	OC-192 (XFP)	1530~1565nm	0dBm (average)	40Km	0~75	XMD-TOSA	w/ TEC,mPD	MP
OL5172M	10Gbps	OC-192 (300pin MSA)	1530~1565nm	0dBm (average)	40Km	0~75	TOSA-pigtailed, w/ FPC	w/ TEC,mPD	MP

Coaxial DFB Laser

Description	Part Number
Coaxial DFB Laser	OL345□L-2
	OL545□L-2

Coaxial DFB Laser

Part Number	Transmission Speed	Application	Wavelength	Optical Output Power (Min.)	Transmission Distance (Max.)	Operating Temperature (°C)	Package	Notes	Status
OL345□L-2	2.5Gbps	OC-48	1263~1360nm	0dBm (average)	40Km	0~70	Coaxial w/ SMF	w/ mPD	MP
OL545□L-2	2.5Gbps	OC-48	1500~1580nm	0dBm (average)	40Km	0~85	Coaxial w/ SMF	w/ mPD	MP

Optical Service Channel Laser

Description	Part Number
Optical Service Channel Laser	OL545□L-A
	OL535□L-3-A10
	OL645□L-A
	OL4109L-5
	OL5109L-5A
	OL6109L-5A
	OL6109L-10B

Optical Service Channel Laser

Part Number	Transmission Speed	Application	Wavelength (Typ.)	Optical Output Power (Min.)	LD type	Operating Temperature (°C)	Package	Notes	Status
OL545□L-A	155Mbps	supervisory channel	1510nm	2mW(CW)	DFB	0~70	Coaxial w/ SMF	w/ mPD	MP
OL535□L-3-A10	155Mbps	supervisory channel	1510nm	3mW(CW)	DFB	0~70	Coaxial w/ SMF	w/ mPD	MP
OL645□L-A	155Mbps	supervisory channel	1630nm	2mW(CW)	DFB	0~70	Coaxial w/ SMF	w/ mPD	MP
OL4109L-5	155Mbps	supervisory channel	1480nm	5mW(CW)	DFB	-5~70	Butterfly	w/ TEC,mPD	MP
OL5109L-5A	155Mbps	supervisory channel	1510nm	5mW(CW)	DFB	-5~70	Butterfly	w/ TEC,mPD	MP
OL6109L-5A	155Mbps	supervisory channel	1625nm	5mW(CW)	DFB	-5~70	Butterfly	w/ TEC,mPD	MP
OL6109L-10B	155Mbps	supervisory channel	1650nm	10mW(CW)	DFB	-5~70	Butterfly	w/ TEC,mPD	MP

High Output Pulse Laser

Description	Part Number
High Output Pulse Laser	OL5206N-120-P20
	OL6204N-30-AP10
	OL6204N-80-AP10
	OL6204N-100-AP10
	OL6206N-100-AP15
	OL399N-150-P20
	OL495N-80-P20-W90

High Output Pulse Laser

Part Number	Application	Wavelength (Typ.)	Pulse Optical Output Power	LD type	Operating Temperature (°C)	Package	TEC	Notes	Status
OL5206N-120-P20	OTDR	1550nm	120mW	FP	10~40	DIL w/ SMF	Uncooled	—	MP
OL6204N-30-AP10	OTDR	1625nm	30mW	FP	-20~65	DIL w/ SMF	Cooled	—	MP
OL6204N-80-AP10	OTDR	1625nm	80mW	FP	-20~65	DIL w/ SMF	Cooled	—	MP
OL6204N-100-AP10	OTDR	1625nm	100mW	FP	-20~65	DIL w/ SMF	Cooled	—	MP
OL6206N-100-AP15	OTDR	1625nm	100mW	FP	10~40	DIL w/ SMF	Uncooled	—	MP
OL399N-150-P20	OTDR	1300nm	150mW	FP	-20~60	Coaxial w/ MMF	Uncooled	MMF	MP
OL495N-80-P20-W90	OTDR	1490nm	80mW	FP	-20~60	Coaxial w/ SMF	Uncooled	—	MP

Optical Component

Optical module

PIN PD / APD modules

10G APD

Description	Part Number
10G APD	OF3241N
	OF3242N-MS
	OF3249N-MS
	OF3248N-MS
	OF3647R

10G APD

Part Number	Transmission Speed	Application	Sensitivity (Typ.)	Overload (Typ.)	Trans impedance (Typ.)	Operating Temperature (°C)	Package	Notes	Status
OF3241N	10Gbps	OC-192	-27dBm	-5dBm	4KΩ	-20～85	17pin-MSA, SMF	—	MP
OF3242N-MS	10Gbps	OC-192	-27.5dBm	-5dBm	1.4KΩ	-20～85	17pin-MSA, SMF	—	MP
OF3249N-MS	10Gbps	OC-192	-27dBm	-3dBm	0.2KΩ～7.0KΩ	-20～85	17pin-MSA, SMF	TIA w/AGC	MP
OF3248N-MS	10Gbps	OC-192	-28dBm	-3dBm	0.2KΩ～9.0KΩ	-20～85	17pin-MSA, SMF	TIA w/AGC	MP
OF3647R	10Gbps	OC-192 (XFP)	-27.5dBm	-3dBm	12KΩ	-5～85	XMD-ROSA	—	MP

10G PIN-PD

Description	Part Number
10G PIN-PD	OD9245N-MS
	OD9249N
	OD9248N-MS

10G PIN-PD

Part Number	Transmission Speed	Application	Sensitivity (Typ.)	Overload (Typ.)	Trans impedance (Typ.)	Operating Temperature (°C)	Package	Notes	Status
OD9245N-MS	10Gbps	OC-192	-19.5dBm	+2dBm	1.4KΩ	-10～85	17pin-MSA, SMF	—	MP
OD9249N	10Gbps	OC-192	-19.0dBm	+3dBm	0.2KΩ～7.0KΩ	-20～85	17pin-MSA, SMF	TIA w/AGC	MP
OD9248N-MS	10Gbps	OC-192	-20.0dBm	+2dBm	0.2KΩ～9.0KΩ	-20～85	17pin-MSA, SMF	TIA w/AGC	ES

155M APD

Description	Part Number
155M APD	OF3500B
	OF3507B

155M APD

Part Number	Transmission Speed	Application	Sensitivity (Typ.)	Overload (Typ.)	Sensitivity (Typ.)	Operating Temperature (°C)	Package	Notes	Status
OF3500B	155Mbps	OC-3 supervisory channel	-47.5dBm	-5dBm	0.85 A/W	-40～85	Coaxial w/SMF	different PIN assignment	MP
OF3507B	155Mbps	OC-3 supervisory channel	-47.5dBm	-5dBm	0.85 A/W	-40～85	Coaxial w/SMF	different PIN assignment	MP

Optical Component

Optical communication IC
Optical modulator driver IC

10G Mach-zehnder Modulator Drivers

Description	Part Number
10G Mach-zehnder Modulator Drivers	KGL4146
	KGL4166
	KGL4186KD

10G Mach-zehnder Modulator Drivers

Part Number	Transmission Speed	Typical Application	Operating Temperature (°C)	Operating Voltage (Typ.)	Circuit Current (Typ.)	Output Amplitude (Typ.)	Rise/Fall Time (Typ.)	Cross Point (Typ.)	Package	RoHS Compliance
KGL4146	11.3Gbps	OC-192 Tx	0~85	-5.2/+5V	110/180mA	6.0Vpp	23ps	40 to 60%	38pin QFP 10.9 X 8.0mm	Yes
KGL4166	11.3Gbps	OC-192 Tx	-5~85	-5.2/+6V	110/280mA	8.0Vpp	23ps	45 to 55%	38pin QFP 10.9 X 8.0mm	Yes
KGL4186KD	11.3Gbps	OC-192 Tx	-5~85	+3.3/+5V	115/110mA	3.5Vpp (7.0Vpp Diff.)	31ps	40 to 60%	24pin QFN 4mm sq.	Yes

10G EA Modulator Drivers

Description	Part Number
10G EA Modulator Drivers	KGA4145
	KGL4145KW
	KGA4195
	KGL4195KD
	KGA5115
	KGL5115KD

10G EA Modulator Drivers

Part Number	Transmission Speed	Typical Application	Operating Temperature (°C)	Operating Voltage (Typ.)	Circuit Current (Typ.)	Output Amplitude (Typ.)	Rise/Fall Time (Typ.)	Cross Point (Typ.)	Package	RoHS Compliance
KGA4145	11.1Gps	OC-192 Tx	-5~90	-5.2V	220mA	2.7Vpp	21ps	35 to 80%	Die 1.8 X 1.3 mm	Yes
KGL4145KW	11.3Gps	OC-192 Tx	0~85						24pin QFN (4mm Sq.)	Yes
KGA4195	11.3Gps	OC-192 Tx	-5~90	+3.3V (*1) +3.3/ +5V (*2)	90/120mA (*1) 90/160mA (*2)	2.6Vpp (*1) 2.7Vpp (*2)	27ps	35 to 80%	Die 1.7 X 1.2 mm	Yes
KGL4195KD	11.3Gps	OC-192 Tx	-40~95						24pin QFN (4mm Sq.)	Yes
KGA5115	11.3Gps	OC-192 Tx	-5~90	+3.3V (*1) +3.3/ +5V (*2)	50/80mA (*1) 50/120mA (*2)	2.3Vpp	28ps	35 to 80%	Die 1.7 X 1.1 mm	Yes
KGL5115KD	11.3Gps	OC-192 Tx	-40~95						24pin QFN (4mm Sq.)	Yes

*1 Output AC Couple,   *2 Output DC Couple

10G Direct Modulate Laser Drivers

Description	Part Number
10G Direct Modulate Laser Drivers	KGA4185
	KGL4185KD
	KGA4155
	KGL4155KD

10G Direct Modulate Laser Drivers

Part Number	Transmission Speed	Typical Application	Operating Temperature (°C)	Operating Voltage (Typ.)	Power Dissipation (Typ.)	Modulation Current (Typ.)	Bias Current (Typ.)	Rise/Fall Time (Typ.)	Package	RoHS Compliance
KGA4185	11.3Gps	OC-192 Tx	-5~90	+3.3V (*1) +3.3/ +5V (*2)	0.65W	20 to 80mApp (@50Ω Diff.)	2 to 85mA	27ps	Die 1.7 X 1.2 mm	Yes
KGL4185KD	11.3Gps	OC-192 Tx	-40~95						24pin QFN (4mm Sq.)	Yes
KGA4155	11.3Gps	OC-192 Tx	-40~85	+3.3	0.4W	25 to 100mApp (@10Ω Diff.)	2 to 85mA	27ps	Die 1.7 X 1.2 mm	Yes
KGL4155KD	11.3Gps	OC-192 Tx	-5~85						24pin QFN (4mm Sq.)	Yes

*1 Output AC Couple,   *2 Output DC Couple

25G EA Modulator Drivers

Description	Part Number
25G EA Modulator Drivers	KGA8105
	KGL8105KW

25G EA Modulator Drivers

Part Number	Transmission Speed	Typical Application	Operating Temperature (°C)	Operating Voltage (Typ.)	Power Dissipation (Typ.)	Output Amplitude (Typ.)	Rise/Fall Time (Typ.)	Cross Point (Typ.)	Package	RoHS Compliance
KGA8105	25.8Gps	100GbE	-5~90	- 5.2V	1.25W	2.5Vpp	12ps	35 to 75%	Die 1.7 X 1.2mm	Yes
KGL8105KW	25.8Gps	100GbE	-5~90	- 5.2V	1.25W	2.5Vpp	TBD	35 to 75%	24pin QFN (4mm Sq.)	Yes

40G EA Modulator Drivers

Description	Part Number
40G EA Modulator Drivers	KGA8205

40G EA Modulator Drivers

Part Number	Transmission Speed	Typical Application	Operating Temperature (°C)	Operating Voltage (Typ.)	Power Dissipation (Typ.)	Output Amplitude (Typ.)	Rise/Fall Time (Typ.)	Cross Point (Typ.)	Package	RoHS Compliance
KGA8205	43 Gps	OC-768 Tx	-5~75	- 5.2V	1.1W	2.5Vpp	7.5ps	35 to 70%	Die	Yes

Optical Component

Optical communication IC
Optical communication receiver IC

10G Transimpedance Amplifier

Description	Part Number
10G Transimpedance Amplifier	KGA4153
	KGA4163
	KGA4183
	KGA4193

10G Transimpedance Amplifier

Part Number	Transmission Speed	Typical Application	Operating Temperature (°C)	Operating Voltage (Typ.)	Power Dissipation (Typ.)	Trans impedance (Typ.)	Sensitivity (Typ.)	Frequency Bandwidth (Typ.)	Package	RoHS Compliance
KGA4153	11.3Gps	OC-192 Rx	-10~90	+3.3V	0.2W	4.5k Ω (diff.)	-21.5dBm	10GHz	Die 1.09X 0.8 mm	Yes
KGA4163	11.3Gps	OC-192 Rx	-10~90	+3.3V	0.2W	1.4k Ω (diff.)	-20.5dBm	11GHz	Die 1.09 X 0.8 mm	Yes
KGA4183	11.3Gps	OC-192 Rx	-10~90	+3.3V	0.17W	0.84k Ω (diff.)	-18.5dBm	9.5GHz	Die 0.99 X 0.8 mm	Yes
KGA4193	11.3Gps	OC-192 Rx	-10~90	+3.3V	0.23W	0.2~8k Ω (diff.) AGC	-21.5dBm	9GHz	Die 1.2 X 0.8 mm	Yes

10G Automatic Gain Control Amplifier

Description	Part Number
10G Automatic Gain Control Amplifier	KGL4142KD
	KGL4152KD

10G Automatic Gain Control Amplifier

Part Number	Transmission Speed	Typical Application	Operating Temperature (°C)	Operating Voltage (Typ.)	Power Dissipation (Typ.)	Maximum Gain(Typ.)	Minimum Gain(Typ.)	Input Sensitivity (Typ.)	Package	RoHS Compliance
KGL4142KD	11.3Gps	OC-192 Rx	-5~85	+5V	0.6W	28dB	- 10dBm	10mVpp	24pin QFN (4mm Sq.)	Yes
KGL4152KD	11.3Gps	OC-192 Rx	-5~85	+3.3V	0.3W	28dB	0dBm	10mVpp	24pin QFN (4mm Sq.)	Yes

Optical communication IC
Wideband amplifier IC

Wideband Amplifier

Description	Part Number
Wideband Amplifier	KGA4117N
	KGL4117H
	KGA8011

Wideband Amplifier

Part Number	Frequency Bandwidth	Typical Application	Operating Temperature (°C)	Operating Voltage (Typ.)	Power Dissipation (Typ.)	Small Signal Gain(Typ.)	Satulated Output Amplitude (Typ.)	Output Power(Typ.)	Package	RoHS Compliance
KGA4117N	15GHz	OC-192 Rx	0~75	- 5.2V	0.7W	15dB	1Vpp	—	Die	Yes
KGL4117H	15GHz	OC-192 Rx	0~85						32pin QFP (7mm Sq.)	Yes
KGA8011	>40GHz	OC-768 Tx	0~75	+ 3.3V	0.36W	14.0dB	—	14dBm	Die 3.16 X 1.40mm	Yes

LSI Packages

Package type

Type	Package Type		Package Symbol		Pin Count
Insertion Type	Shrink DIP *Only ATP foundry	—	RB		64
Surface Mount Type	SOP		MA	GS, MS	16, 24, 44
	SSOP		MB	GS, MS	30, 32, 64, 70
	TSOP (Type I)		TA	TS	32, 48, 56
	TSOP (Type II)				26/20, 26/24, 32, 44/40, 44, 50/44, 50, 70
	TSSOP		TD		16, 56
	QFP		GA	GS	44, 56, 64, 80, 100, 128, 160, 208
	LQFP		TC	GS	144, 176, 216
	TQFP		TB	TS	44, 48, 64, 80, 100, 120, 128
	VQFN				32
	WQFN				12, 16, 20, 24, 28, 32, 36, 40, 48, 52, 56, 64
	WSON	—			8, 10

Type	Package Type		Package Symbol		Pin Count
Surface Mount Type	LFBGA		LA	LS	48, 84, 144, 176, 224
	TFBGA				48, 60, 64, 70, 90, 120, 132, 176, 208
	W-CSP (Wafer-level CSP)				Custom Design
	COB (Chip On Board)				Custom Design
Special Package (Examples)	COF (Chip On Film)				Packege for LCD Drivers
	Ceramic QFN		—		Package for Sensors
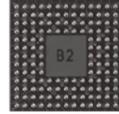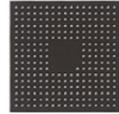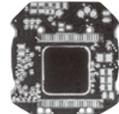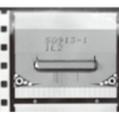
LSI Packages

Package size

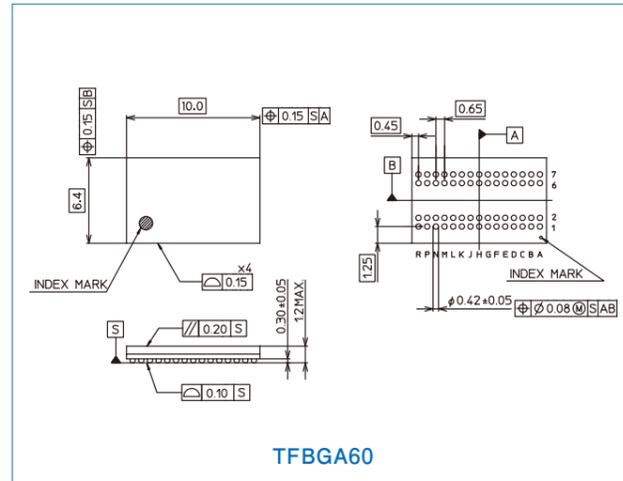### Shrink DIP

SDIP64

SOP

SOP16

SSOP

SSOP64

SSOP70

SOP

SOP24

SOP44

TSOP（Type I）

TSOP（I）32

TSOP（I）48

SSOP

SSOP30

SSOP32

TSOP（Type I）

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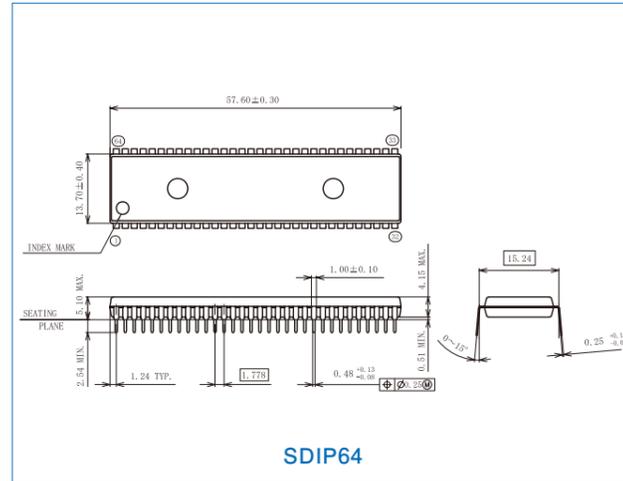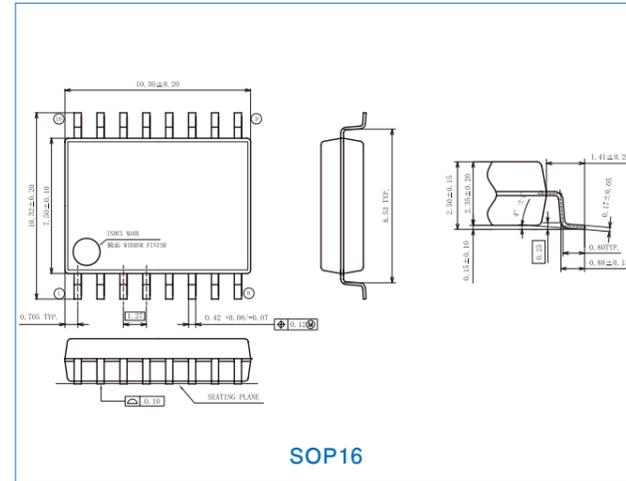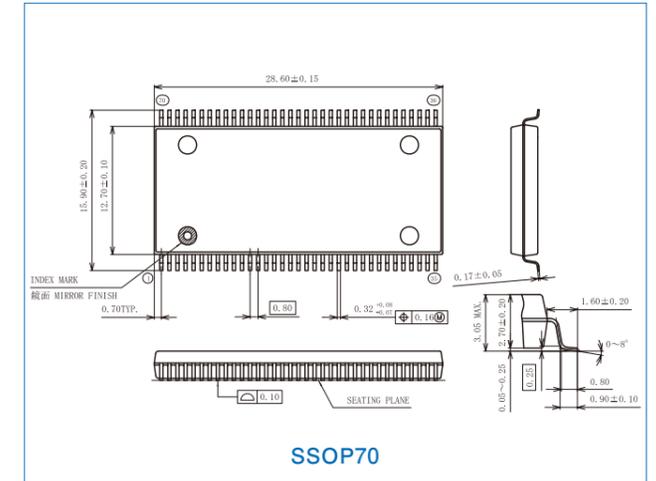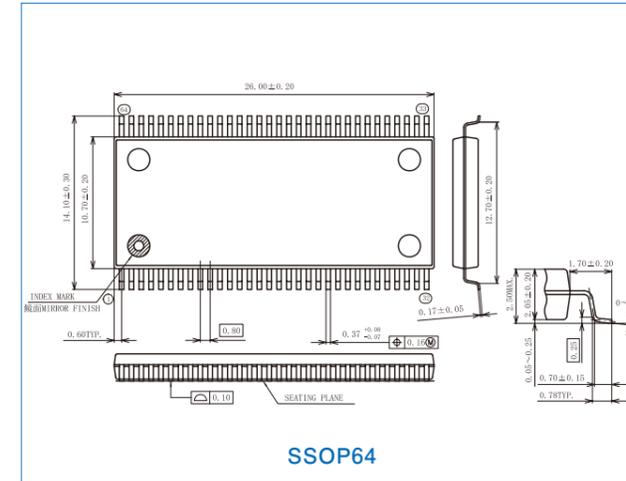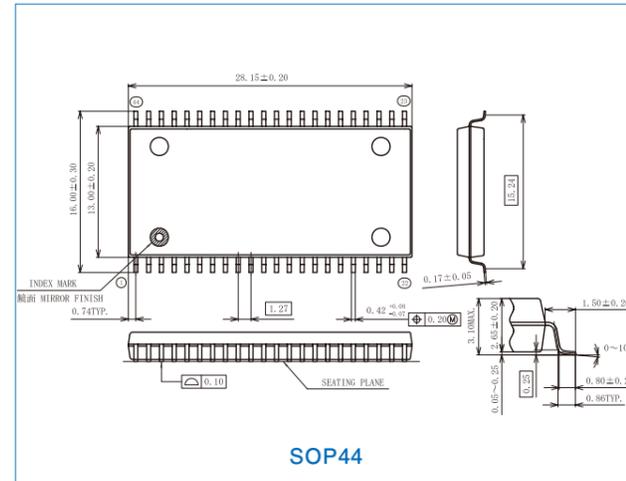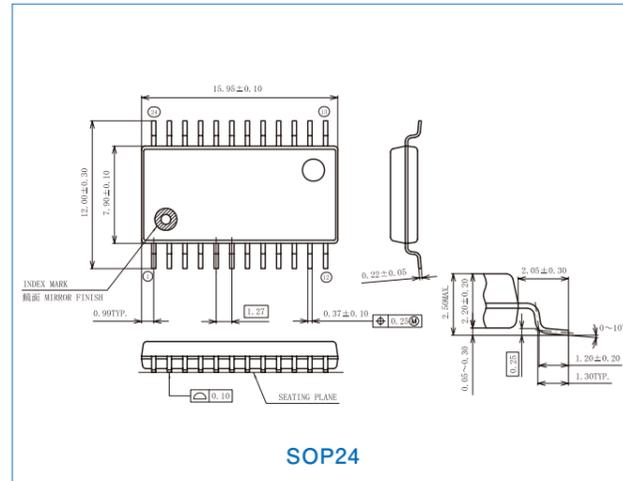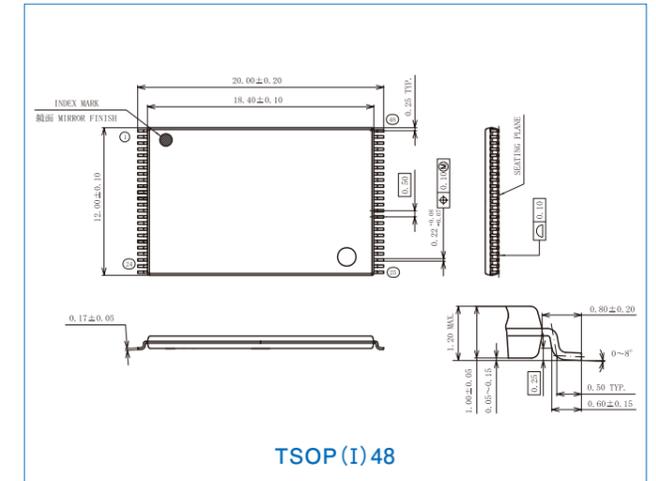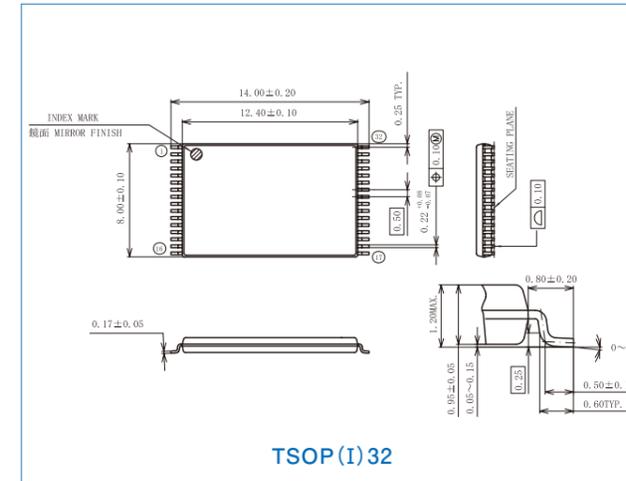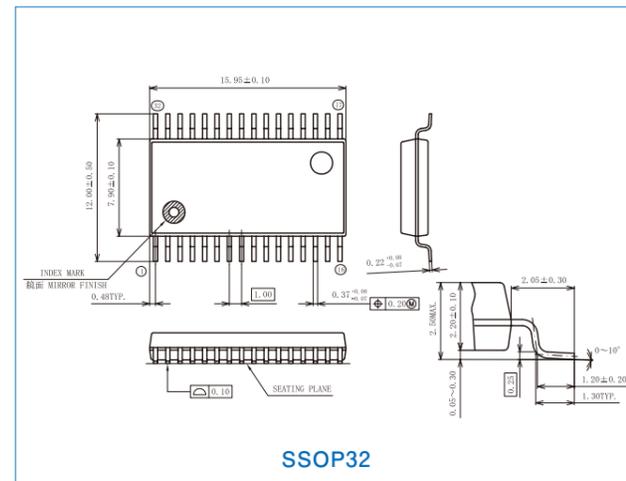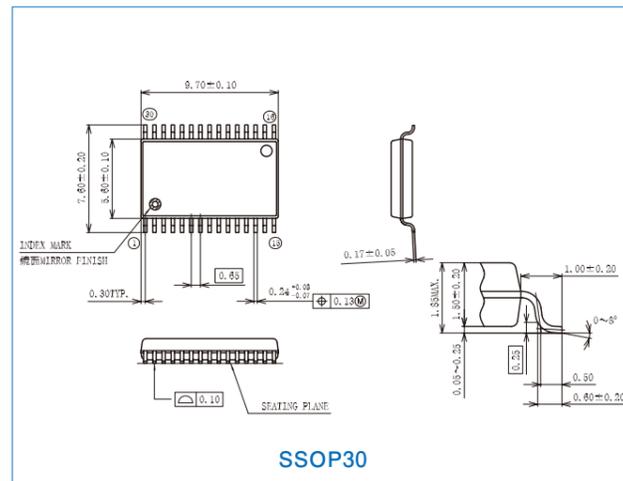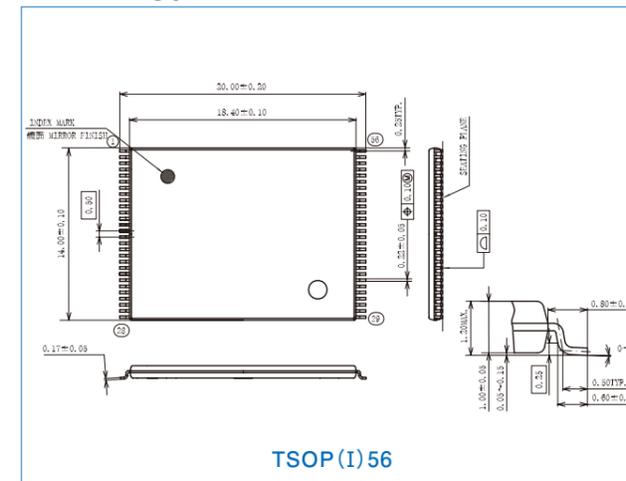
LSI Packages

Package size

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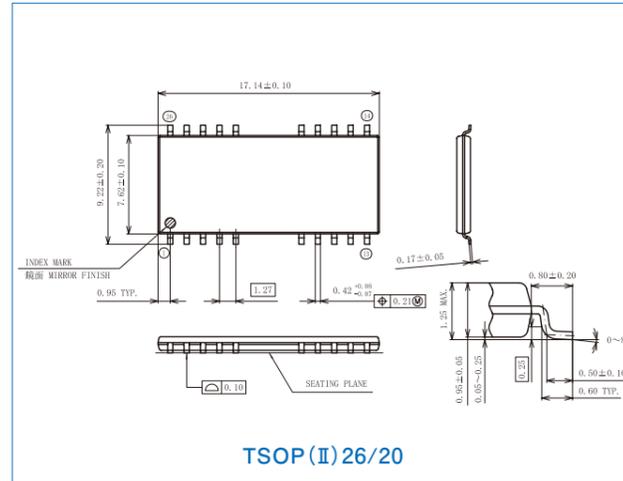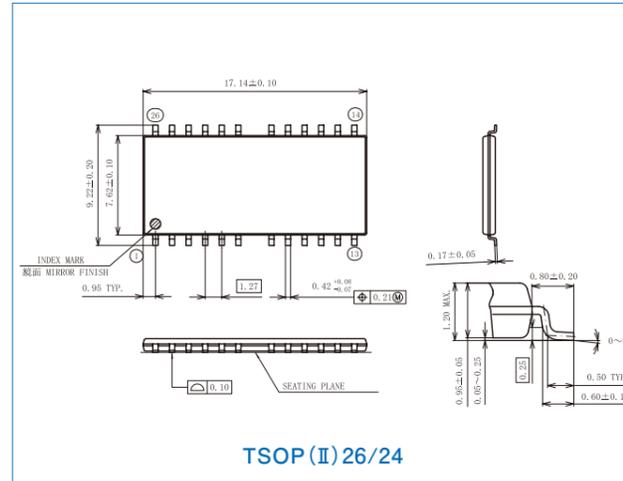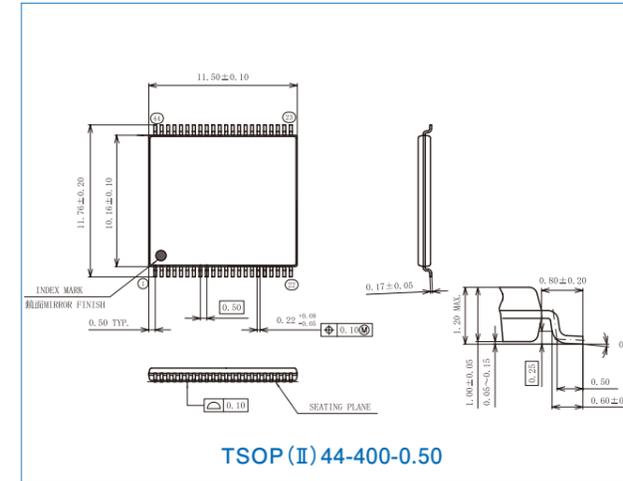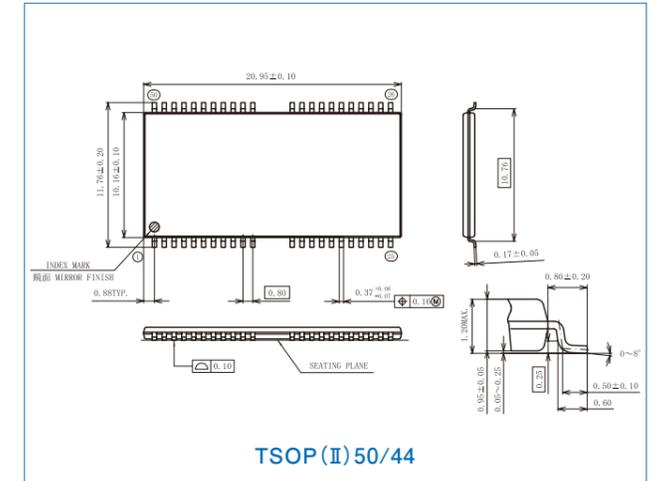
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TSOP（Ⅱ）26/24

TSOP（Type Ⅱ）

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TSOP（Ⅱ）50/44

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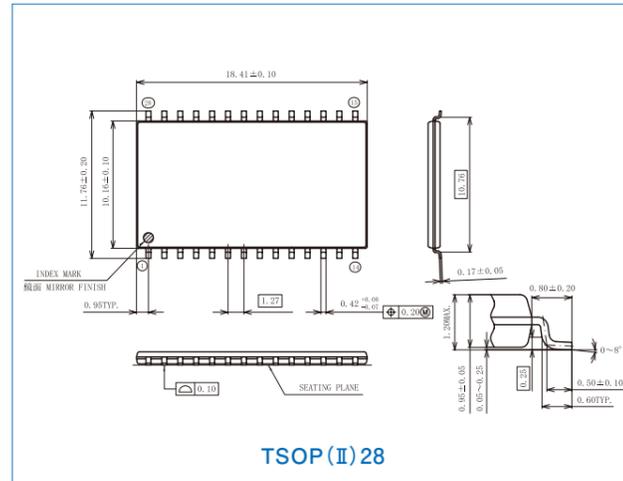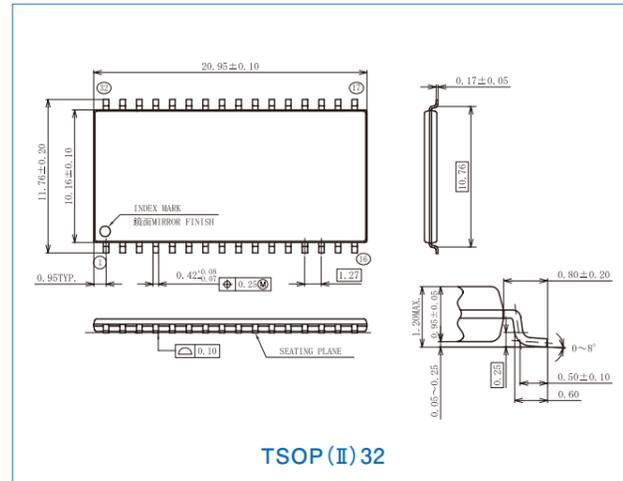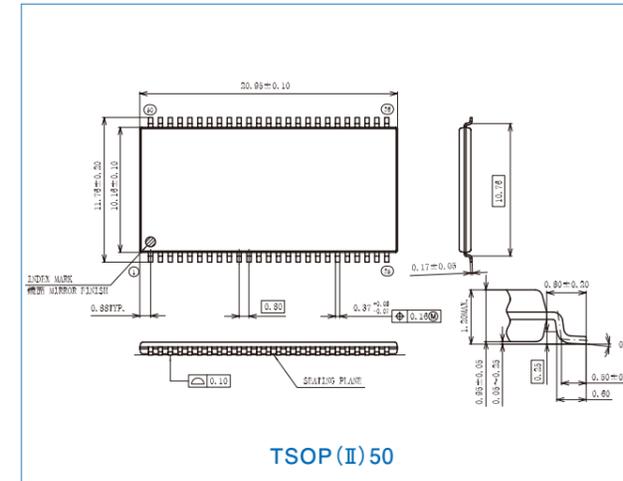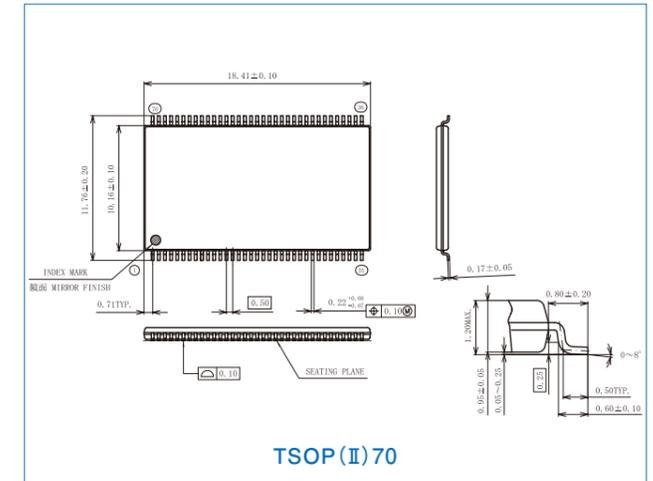
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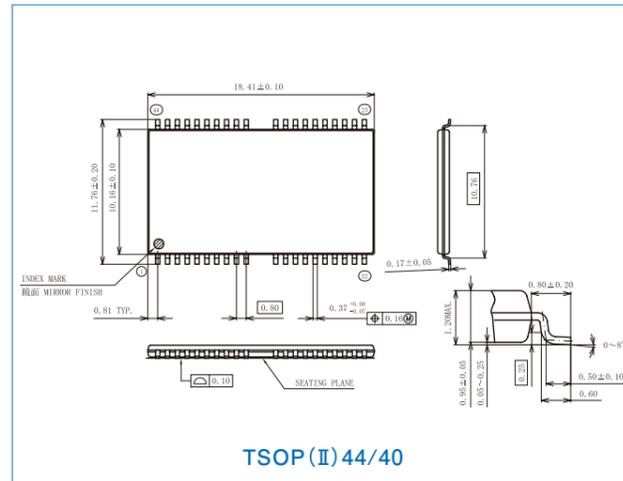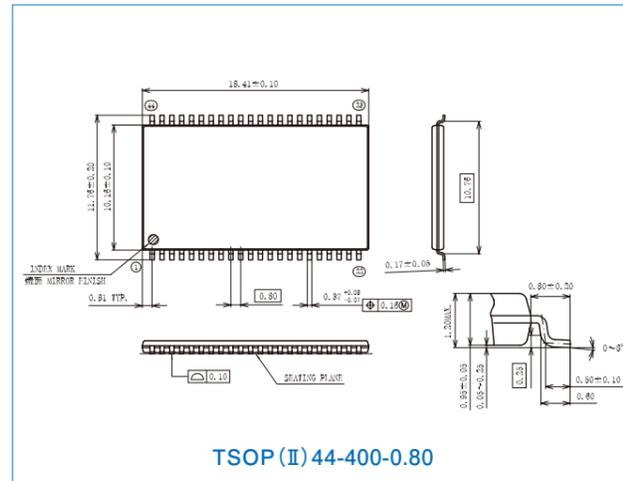
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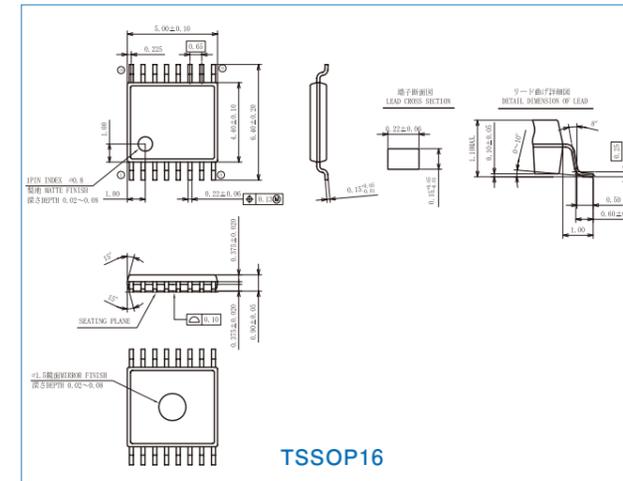
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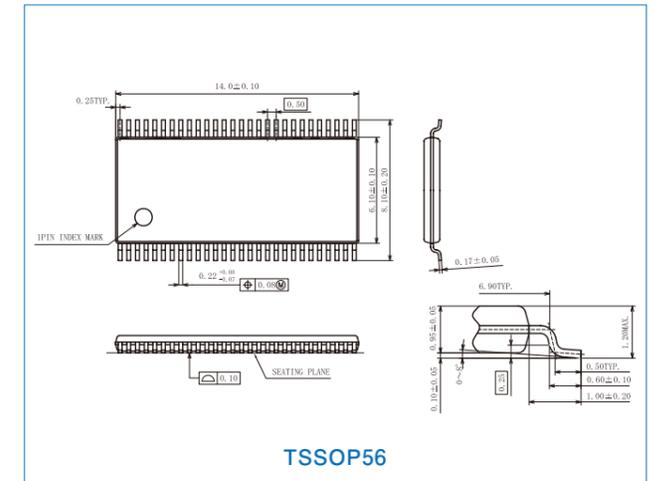
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LSI Packages

Package size

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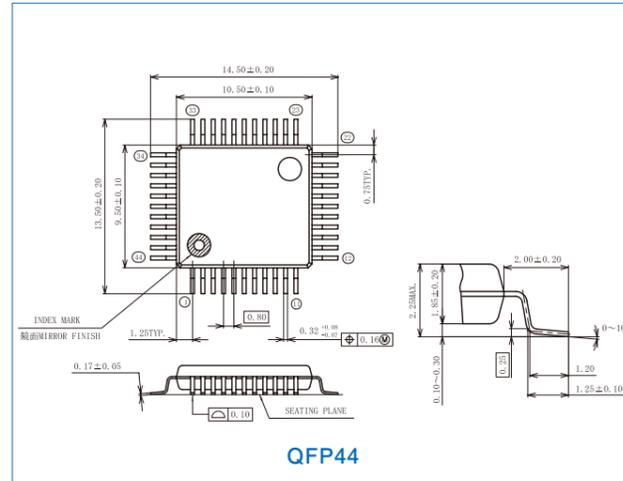
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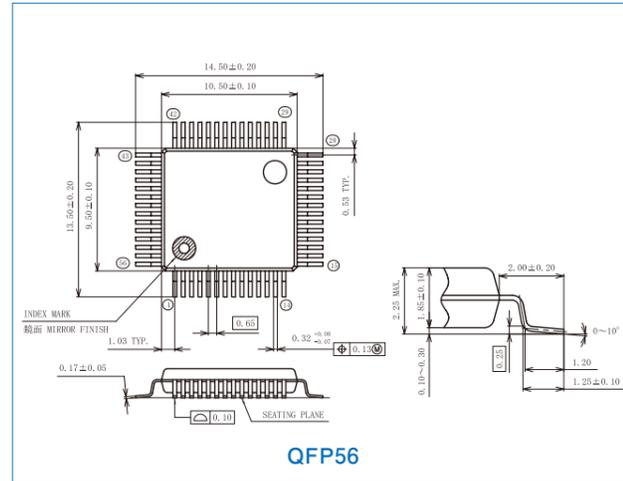
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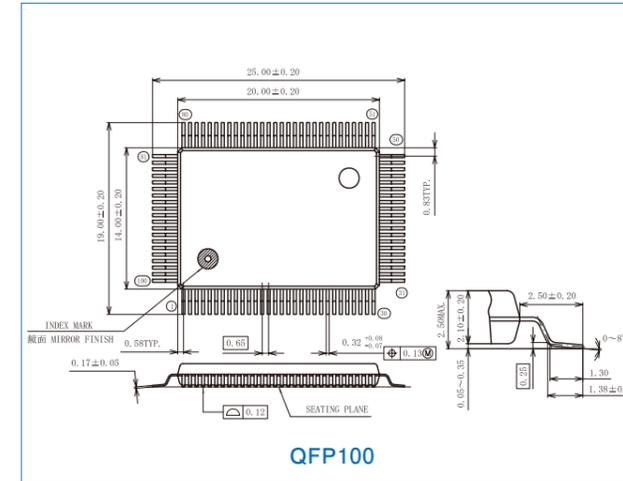
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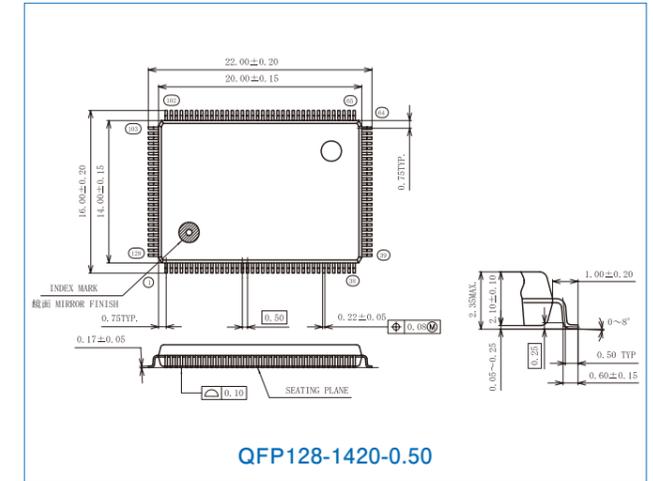
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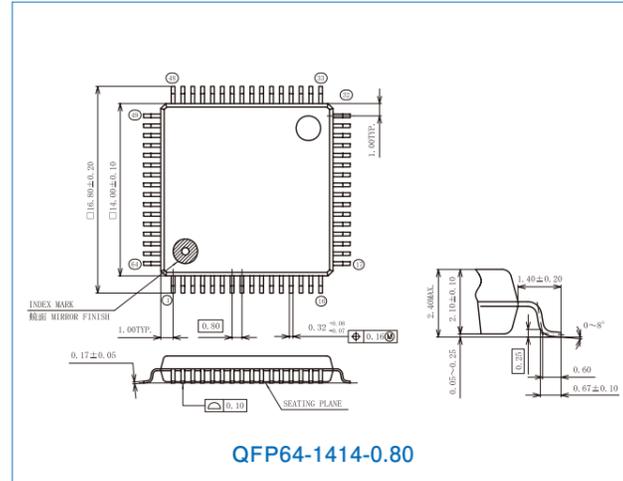
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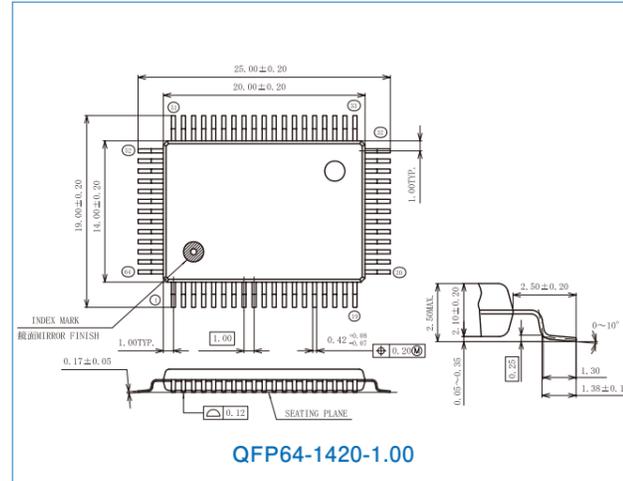
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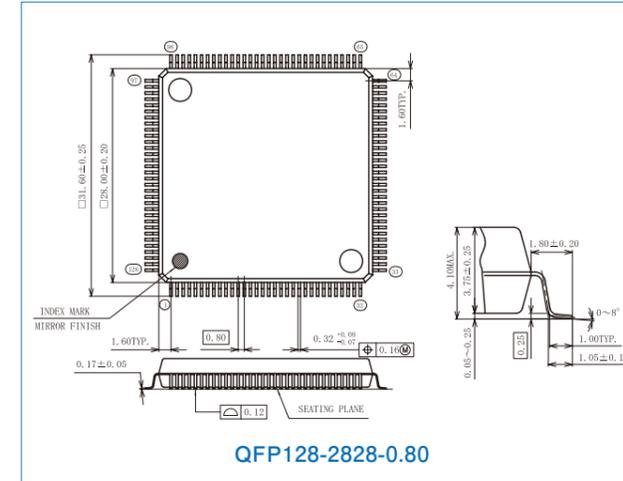
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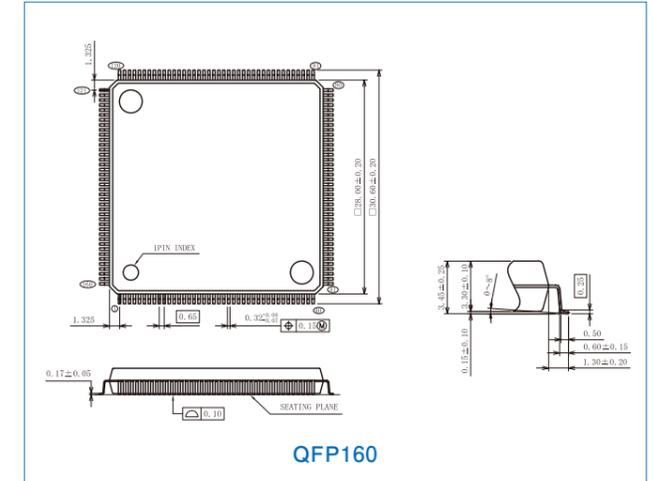
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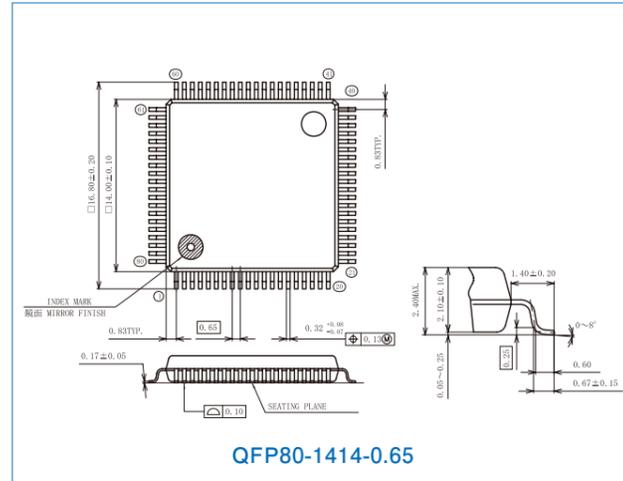
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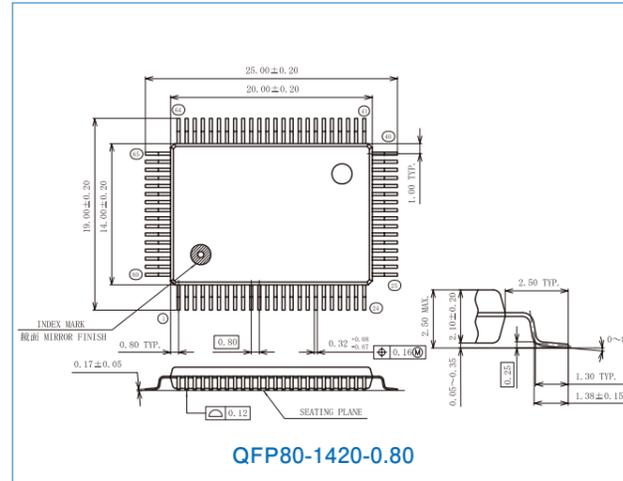
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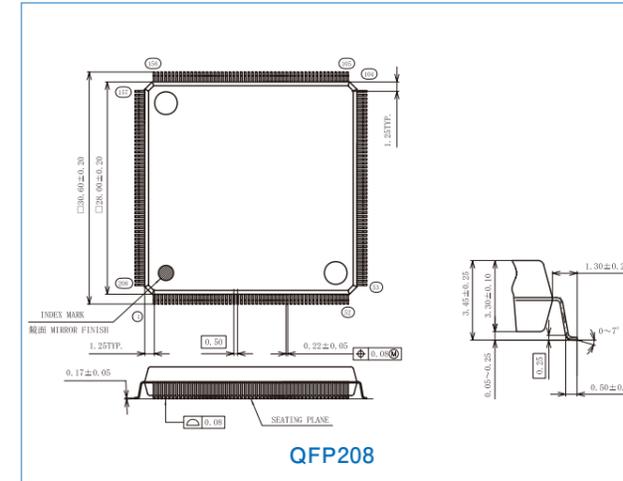
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LSI Packages

Package size

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LQFP

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LQFP216-2424-0.40-6K

TQFP

TQFP80-1414-0.65

TQFP100

TQFP

TQFP44

TQFP48

TQFP

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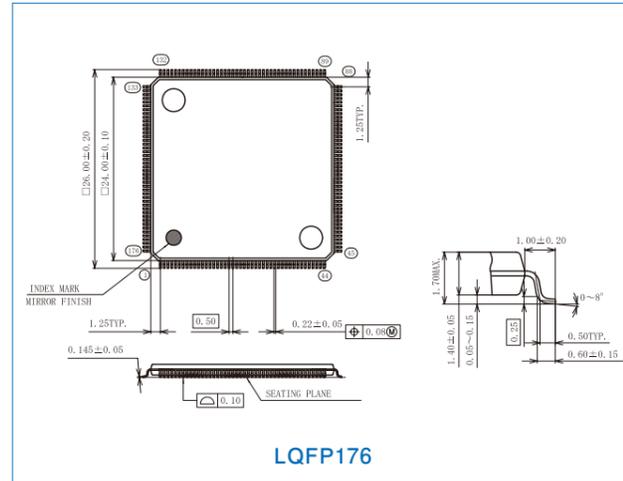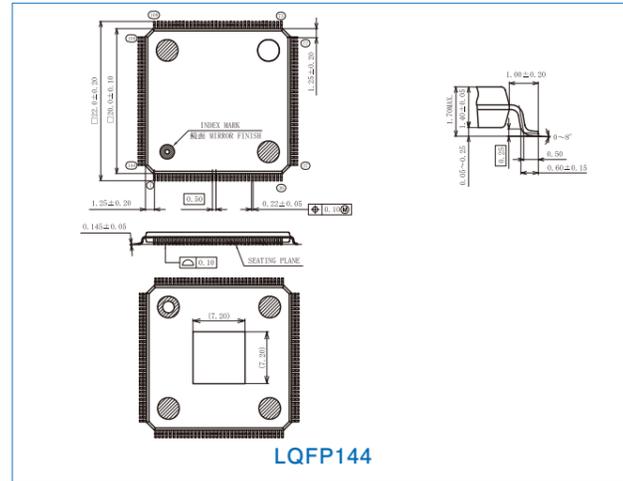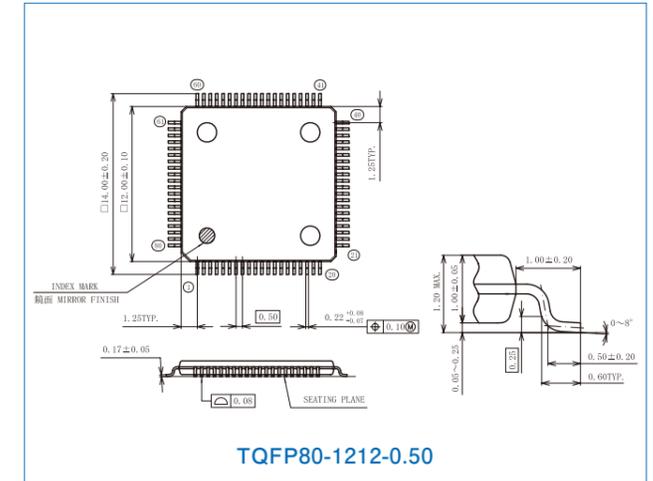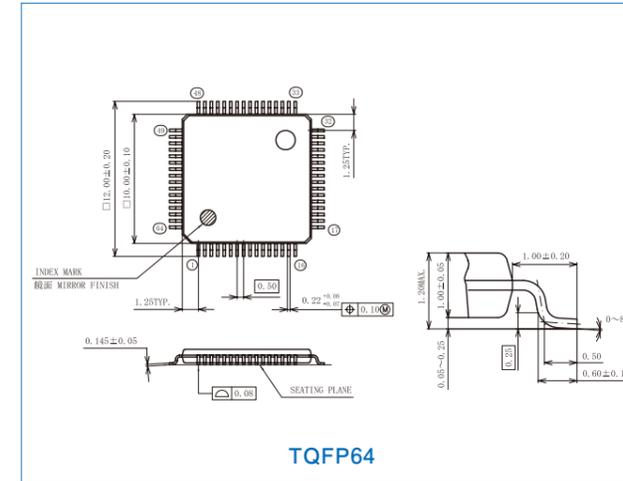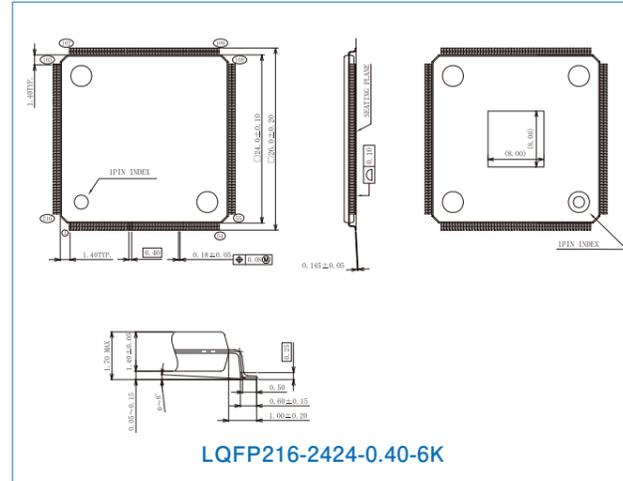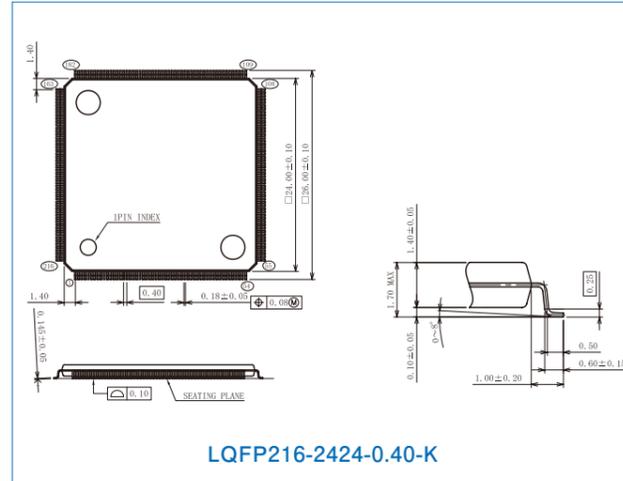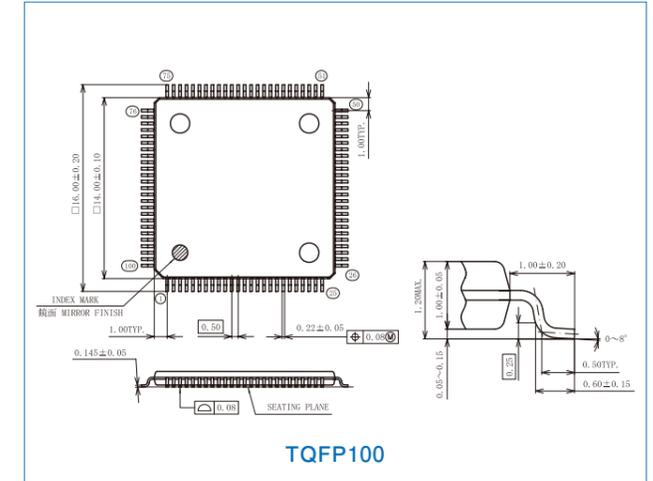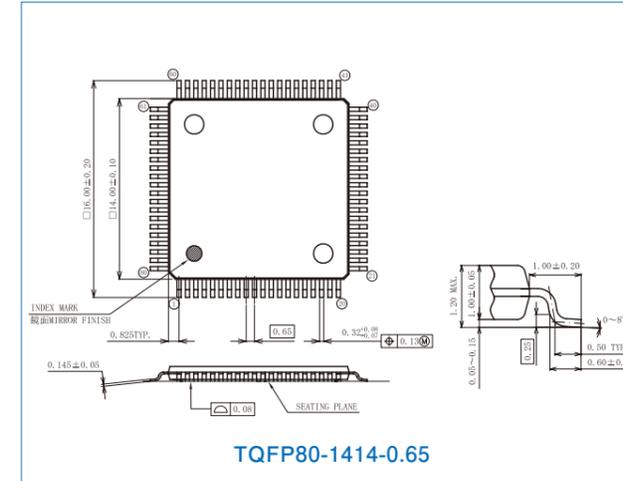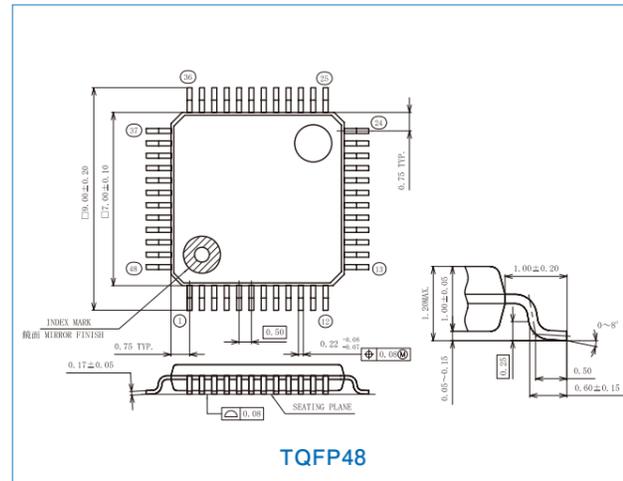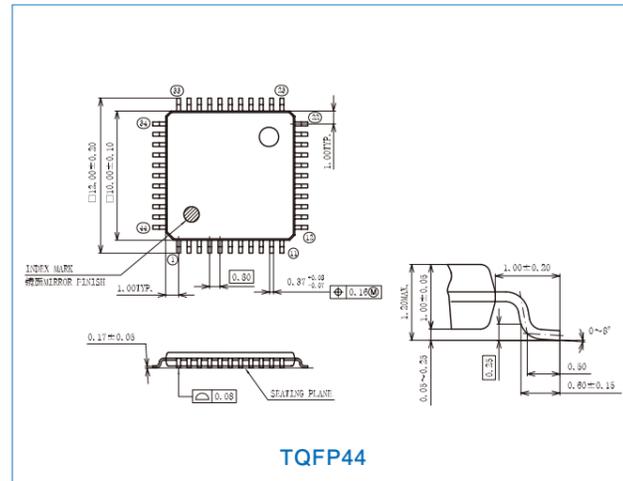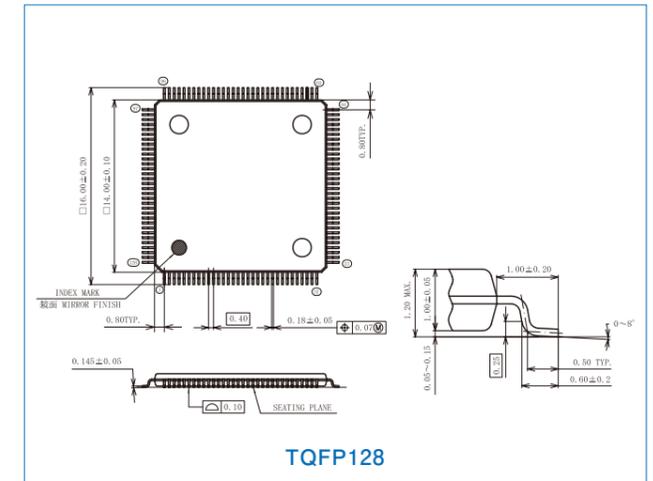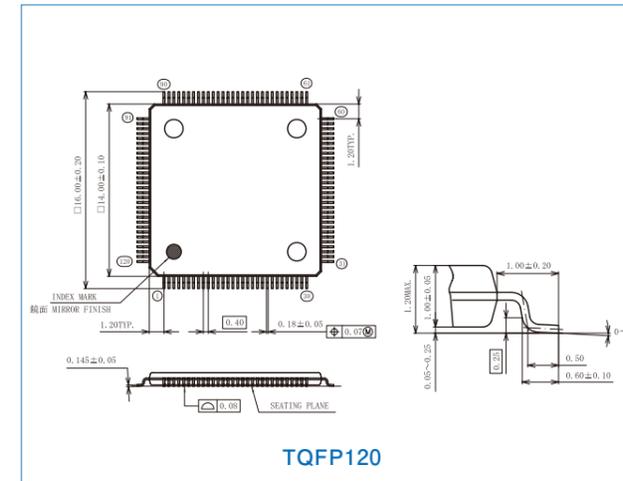
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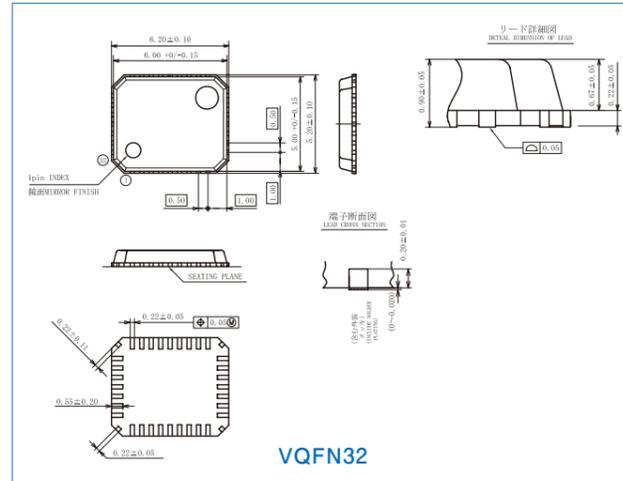
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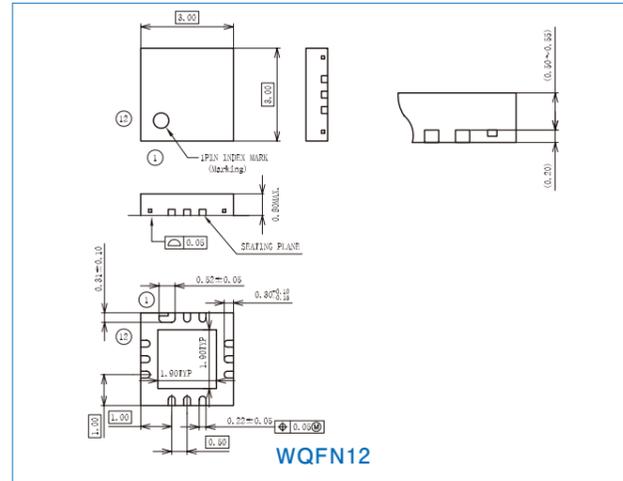
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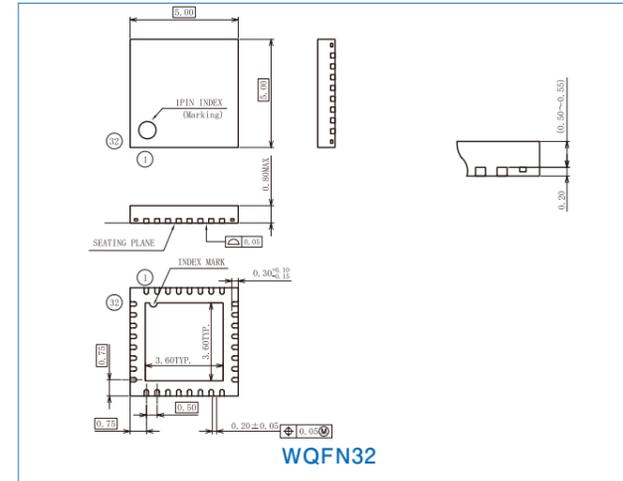
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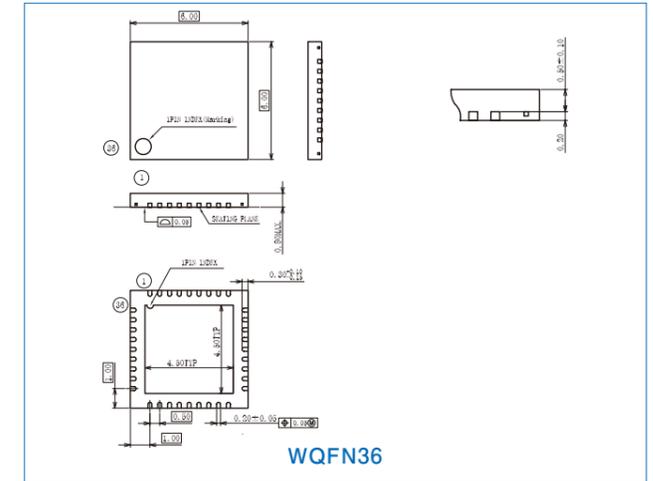
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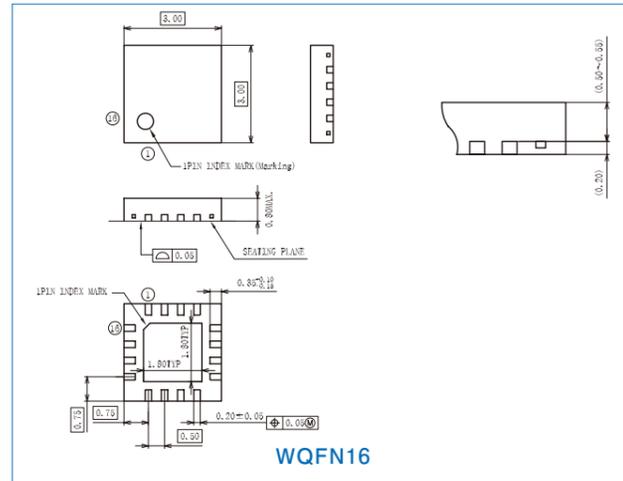
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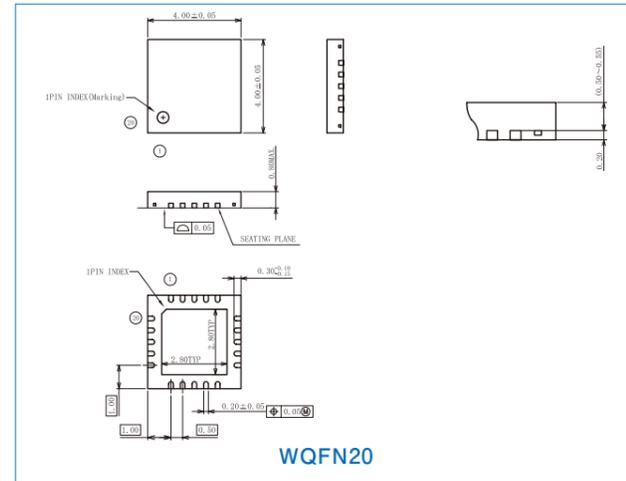
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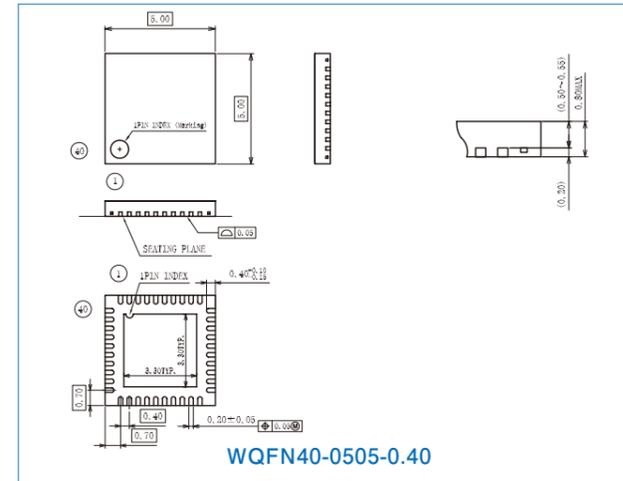
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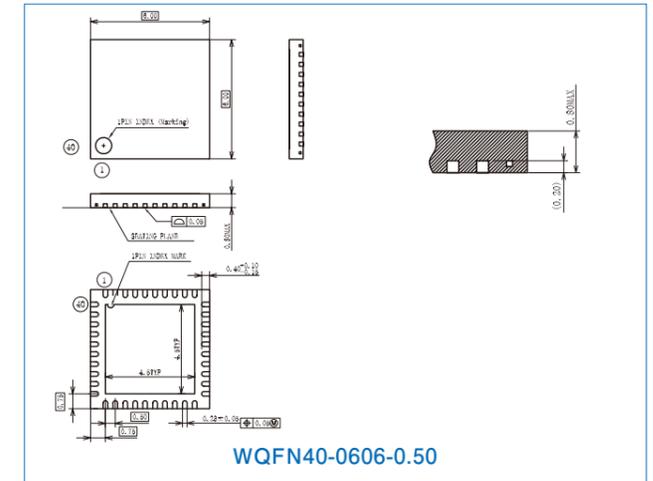
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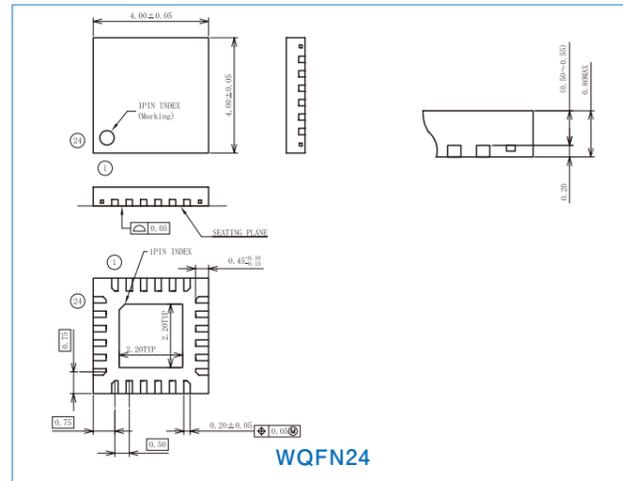
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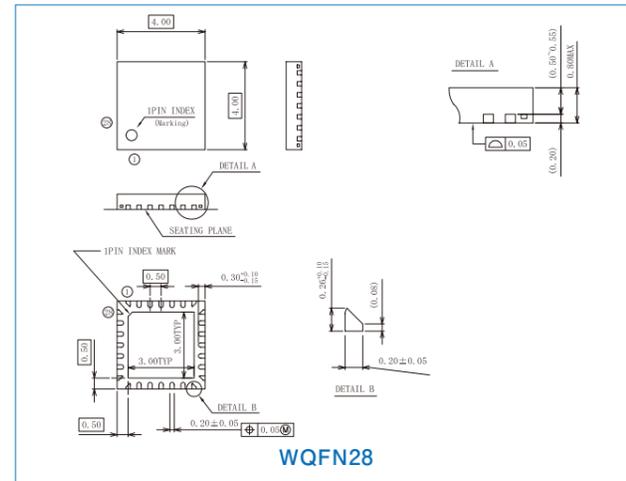
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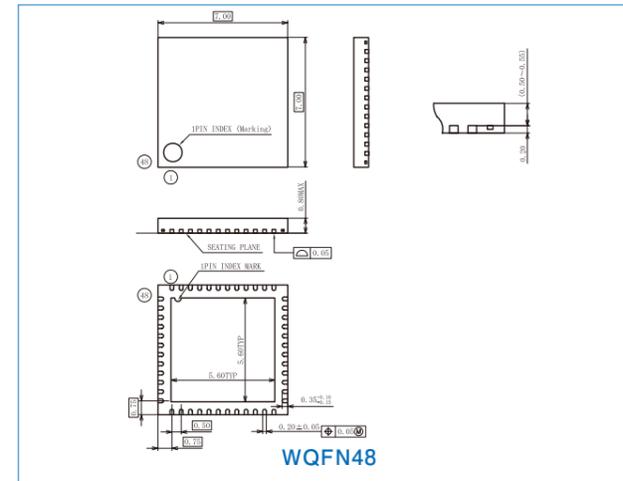
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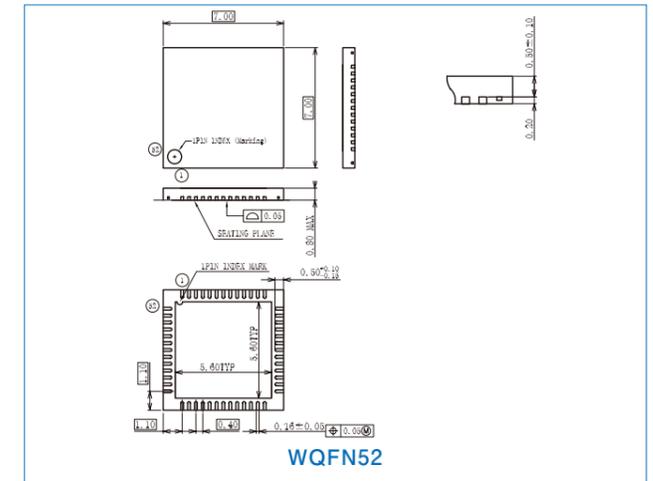
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LSI Packages

Package size

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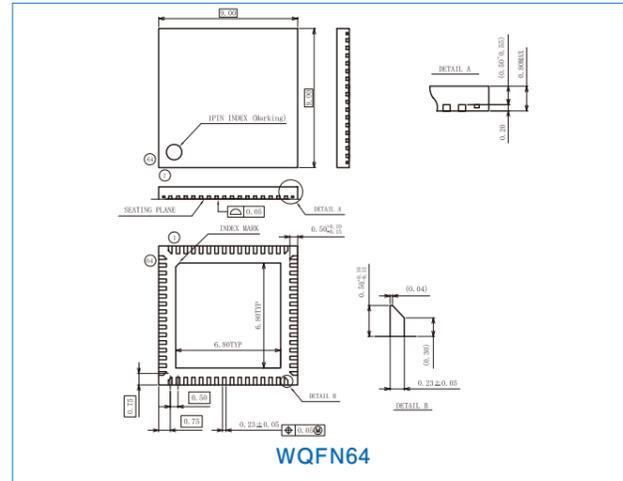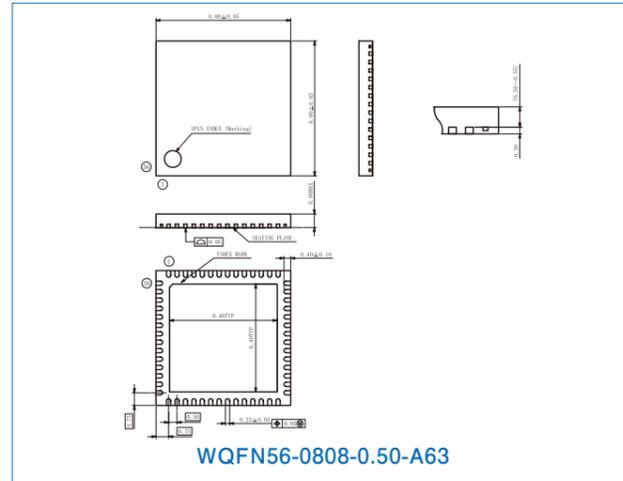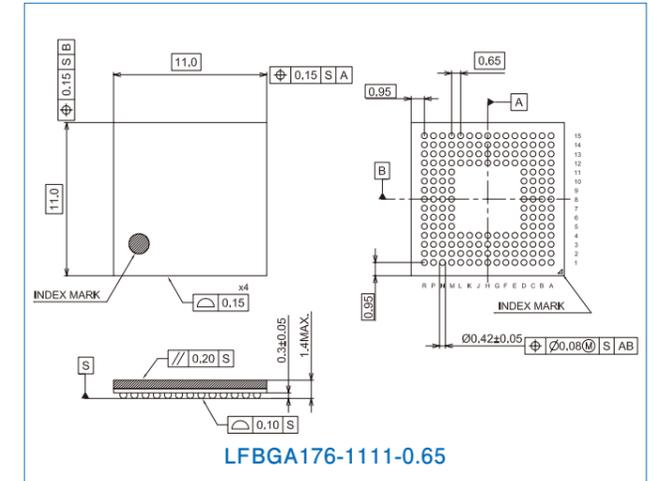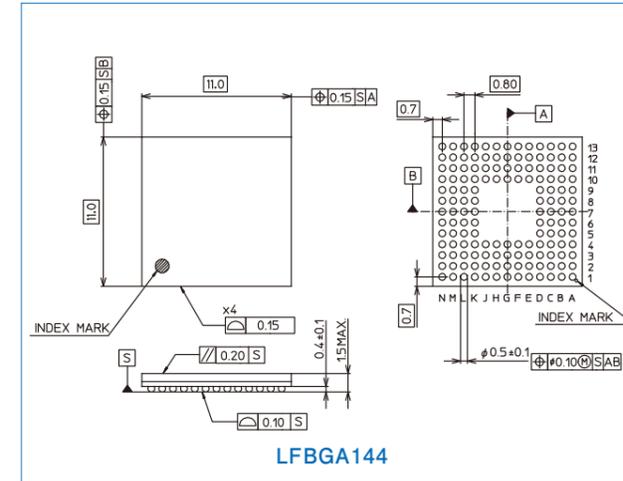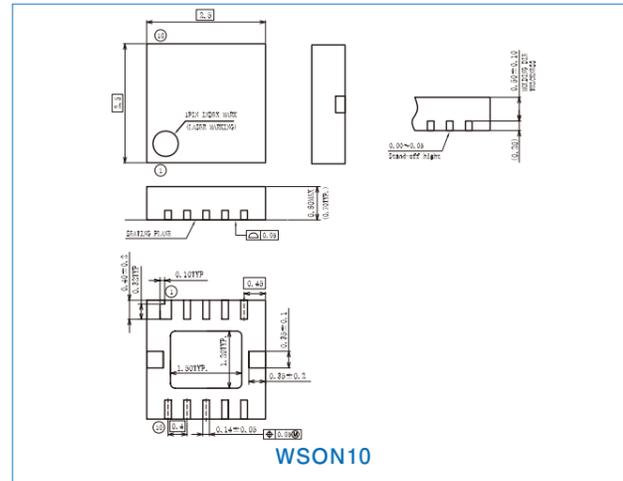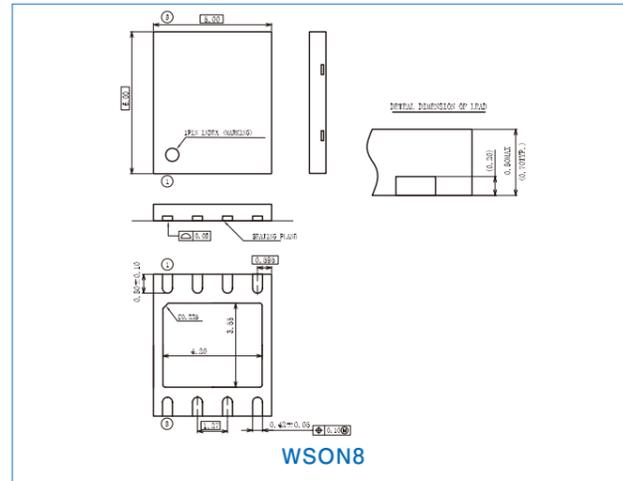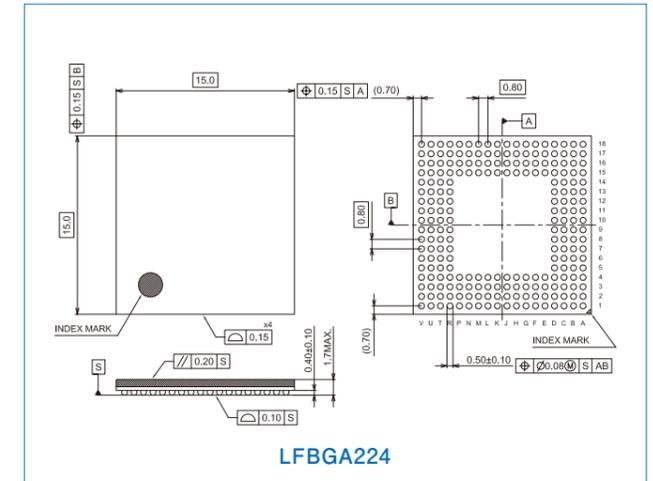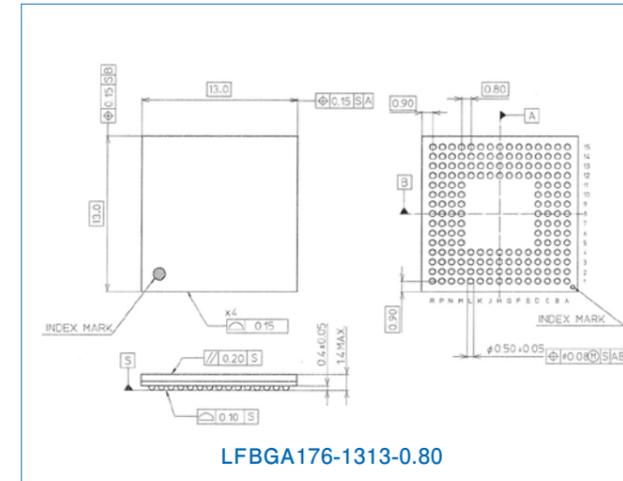
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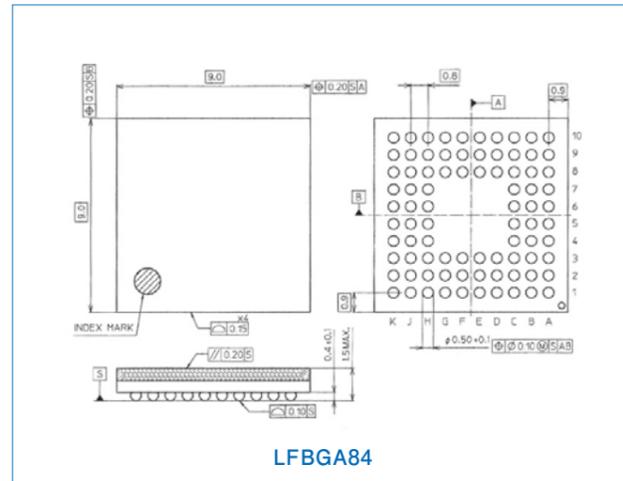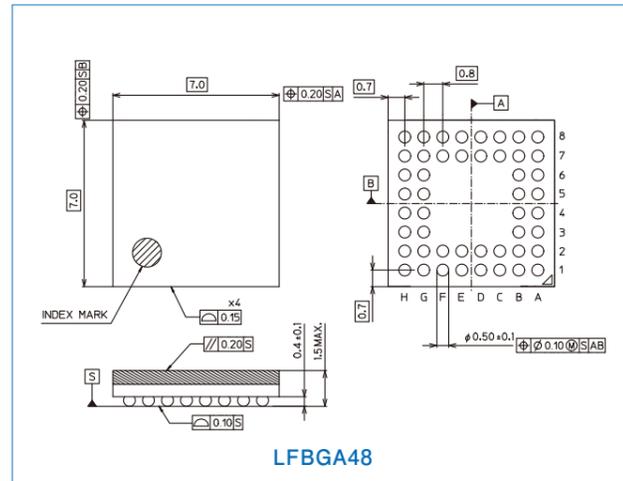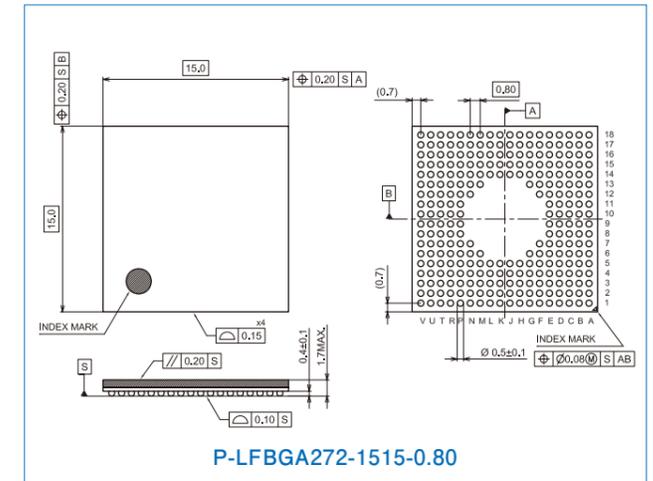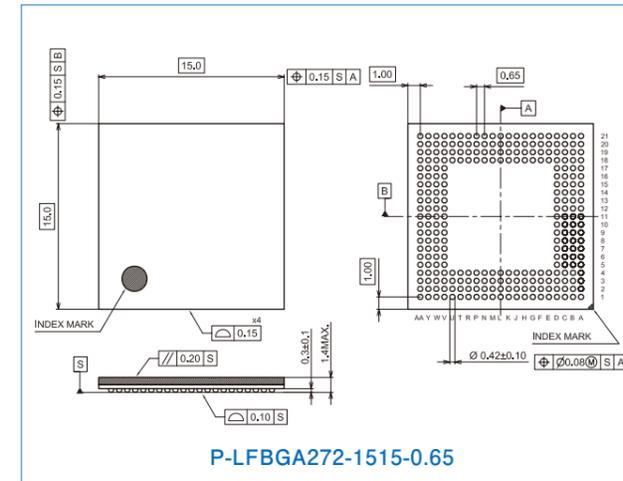
LSI Packages

LSI Packages

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OKI SEMICONDUCTOR Sales Network

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18: Western Japan Sales Headquarters	579-32 Higashi Shiokoji-cho, Karasuma Nishi-iru, Shiokoji-dori, Shimogyo-ku, Kyoto 600-8216 Japan TEL: +81-75-365-1077 FAX: +81-75-365-1079	**21: Euro-American Sales Headquarters**	579-32 Higashi Shiokoji-cho, Karasuma Nishi-iru, Shiokoji-dori, Shimogyo-ku, Kyoto 600-8216 Japan TEL: +81-75-365-1218 FAX: +81-75-365-1228
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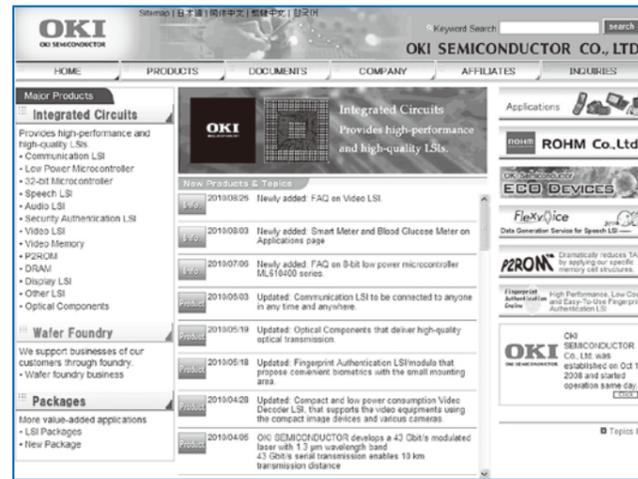TEL: +63-2-807-6872 FAX: +63-2-809-1422

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