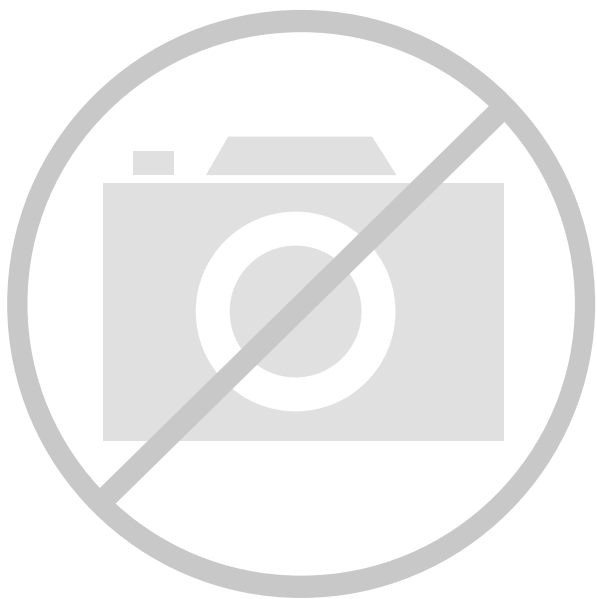




Welcome to [E-XFL.COM](#)

What is "[Embedded - Microcontrollers](#)"?

"[Embedded - Microcontrollers](#)" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

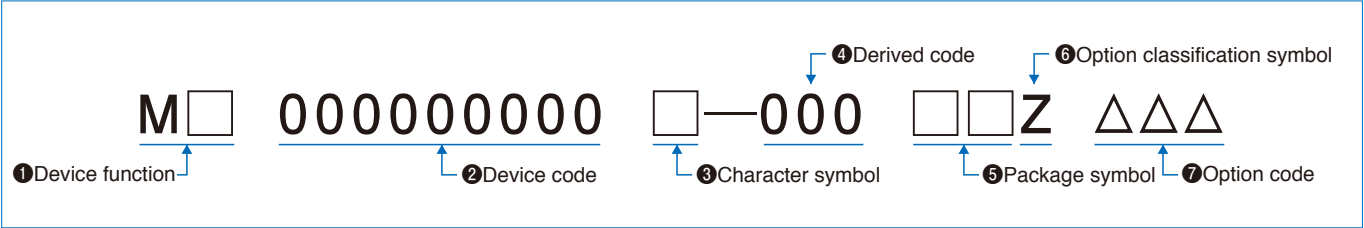
Applications of "[Embedded - Microcontrollers](#)"

Details

Product Status	Obsolete
Core Processor	nX-U8/100
Core Size	8-Bit
Speed	4.096MHz
Connectivity	I ² C, IrDA, SPI, UART/USART
Peripherals	POR, WDT
Number of I/O	21
Program Memory Size	64KB (32K x 16)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	4K x 8
Voltage - Supply (Vcc/Vdd)	2.5V ~ 3.6V
Data Converters	A/D 2x12b
Oscillator Type	External
Operating Temperature	-30°C ~ 85°C
Mounting Type	-
Package / Case	-
Supplier Device Package	-
Purchase URL	https://www.e-xfl.com/product-detail/rohm-semi/ml610q794g-nnntpz0bx

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

Structure of Product Name



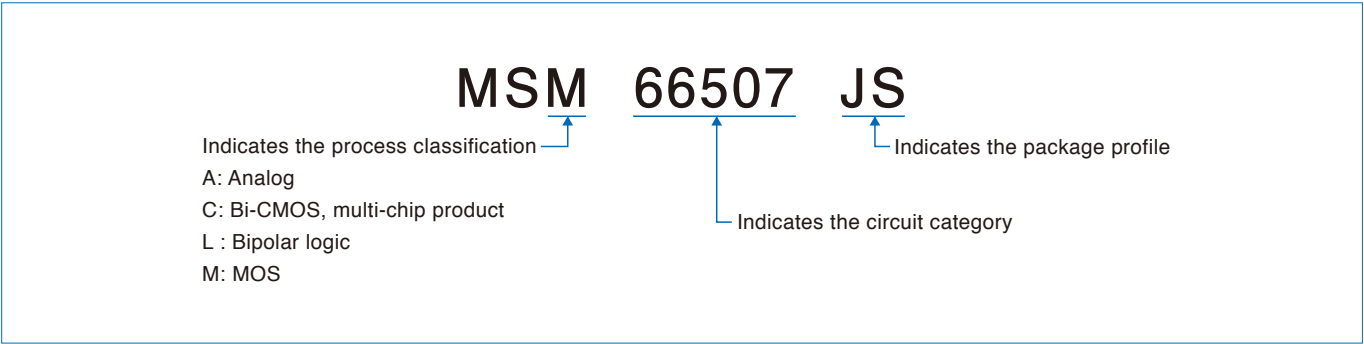
Assignment of Symbols

① Device function The device functions are classified as follows: MD: DRAM MR: P2ROM™, OTPROM MS: SRAM MG: Gate array, standard cell ML: Logic MK: Module, chip set MT: Driver	② Device code The device code expresses a function specific to a device using a combination of numbers and alphanumeric characters. ③ Character 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. ④ Derived code The derived code indicates the speed ranking for DRAM products and is used as a derived code for logic products.	⑤ Package symbol The package symbol expresses the type and lead bending profile of a package in two digits. ⑥ Option classification symbol The option classification symbol is used to distinguish between the option symbol and the package symbol. ⑦ Option code The option code indicates a symbol that identifies the specification of a product with an option.
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* Items from ① "Device function", to ④, "Derived code", are indicated in this catalog.

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

Product Name of Conventional Products



* The actual package profile is not shown here.

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Communication LSI

Communication LSI Overview

Product Overview

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

- Suitable for a range of applications, from toys and consumer devices to industrial equipment and automotive systems.
- Broad lineup utilizing a number of technologies.
- Offers multiple development tools that provide complete support.

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...



CMOS-RF Technology

- IEEE 802.15.4
- Specified low power radio
- Bluetooth® Low Energy
- Reception of Digital Terrestrial Broadcasting

Network Technology

- ZigBee®
- ZigBee® RF4CE
- Simple NWK

Customer Support

- Provide development tools
- Provide advice based on rich experiences

※ZigBee® is a registered trademark of ZigBee® Alliance.

※Bluetooth® is a registered trademark of Bluetooth® SIG.

Product Line-up

A variety of functions provide support for your applications.

Digital terrestrial broadcasting reception LSI

LSIs for Full-Segment/One-Segment broadcasting reception suitable for portable devices and car devices with superior mobile reception features, and LSIs for Chinese-standard digital terrestrial broadcasting reception with highly stable reception performance and low power consumption.

ML7147
ML7138
ML7109S

Wireless communication LSI

LSIs suitable for various applications including IEEE802.15.4/ZigBee®, Bluetooth® Low Energy and specified low-power radio system. Module products that can be easily integrated into applications are also available.

ML7105-00x ML7386x MK71050-02
ML7275 ML7396x MK72750A-01
ML7344x ML7406

VoIP LSI

This is a multifunctional LSI, suitable for VoIP phones and broadband routers with built-in VoIP functions.

ML7204-003
ML7234-021
ML7304-0x2

Echo Canceller LSI

This product is suitable for hands-free communication in mobile phones and door phones.

ML7037-003
ML7247-001
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.

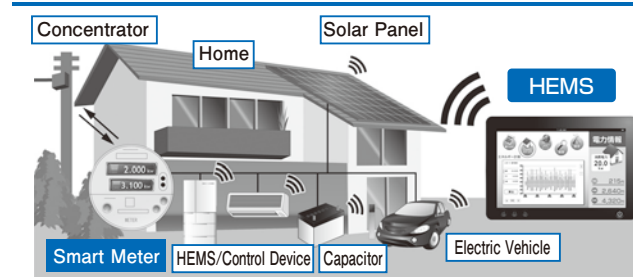
Application Examples

This is a "Communication" LSI to be connected to anyone in any time and anywhere.

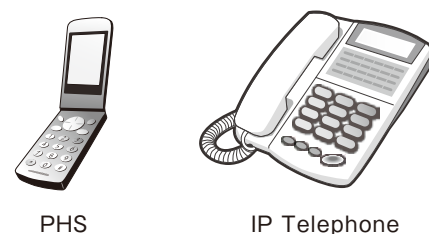
Bluetooth® Low Energy ▶ Health care/Fitness Equipment



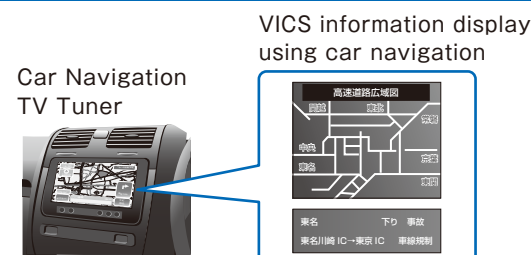
Special low power wireless communication ▶ Consumer electronics, housing facilities



VoIP LSI/PHS LSI ▶ Communication Devices



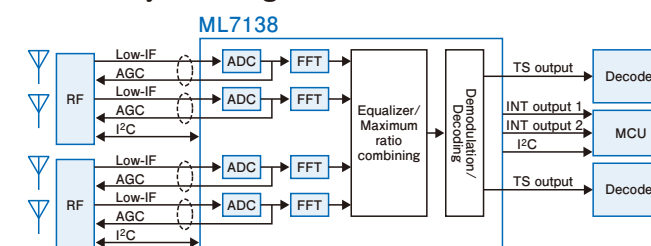
Digital Terrestrial Broadcasting Reception LSI/FM Data Broadcasting Reception LSI ▶ On-Vehicle Devices



Applied to Digital Terrestrial Broadcasting Reception/Remote Controller/Data Communication/Voice Communication

Applied Circuit

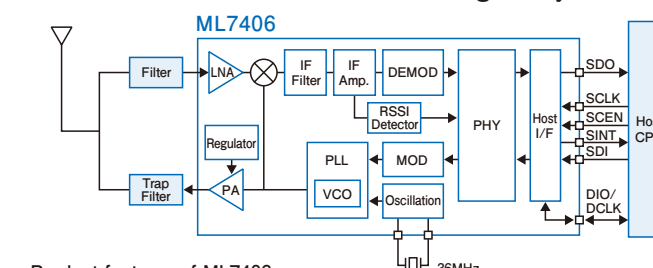
4 Diversity/Full Segment OFDM Demodulation LSI



Product features of ML7138

- High sensitive reception with 4 diversity reception
- 2 diversity x 2CH reception (2TS output) supported
- Low Power Consumption, small size
- Noise canceller function available

Transceiver LSI for the Smart metering Utility Network



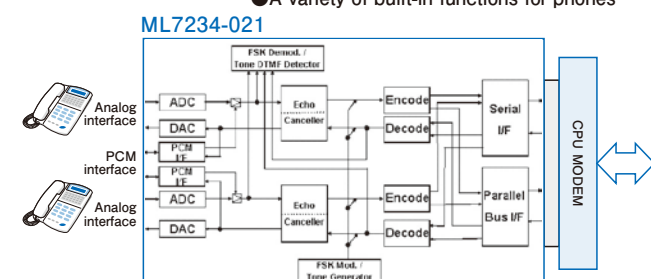
Product features of ML7406

- EN300-220 and EN13575-4:2011(Wireless M-bus) compliant
- Built-in packet handler for Wireless M-bus and general purpose
- High-speed carrier checking function

VoIP LSI

Product features of ML7234-021

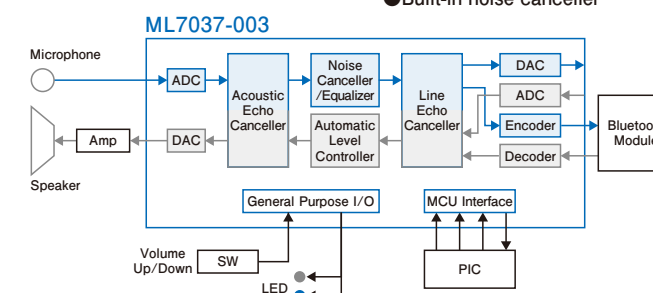
- Superior sound quality CODEC for 2ch VoIP
- A variety of built-in functions for phones



Echo Canceller LSI

Product features of ML7037-003

- Two systems of echo canceller
- Built-in noise canceller



Microcontroller

Microcontroller

8-bit Microcontroller with Built-in Original Core Specifications

ML610300 Series

Part Number	Operating Condition					ROM/RAM					Function / Feature															Package	Chip support	Remarks	
	Operating Voltage(V)	Operating Frequency (Max.)	Minimum Instruction Execution Time	Current (*1) Consumption (Typ.@HALT)	Operating Temperature (°C)	ROM Type	ROM Capacity (Byte)	Data Flash Capacity (Byte)	P2ROM™ Capacity (bit)	RAM Capacity (Byte)	Port (*2)			8bit Timer	1kHz Timer	PWM	Capture	WDT	ADC (Method)	Serial Ports			Supply Voltage Detection	LCD Driver	Interrupt Sources Internal:External				Additional Functions
											Input	Output	Input/Output							I2C	SSIO(*3)	UART(*4)							
* Product name with underline: Application is limited to consumer devices. Product name without underline: For both consumer devices and industrial devices. For applications to industrial devices, please contact ROHM sales representatives in advance.																													
ML610Q304 NEW	2.0 (*18) ~5.5	8.192MHz(Internal PLL) 32.768kHz(Internal RC oscillation)	0.122μs/ 30.5μs	1.7μA	-40~+85	Flash	96K (*21)	2K (Self-rewritable)	—	1K	1	3	11	4 (16bit×2)	—	—	—	1	10bit×3 (Sequential)	1	2	1	—	—	17:9	Built-in sound playback/ADPCM decoder/speaker amplifier	P-QFP28-0505-0.50	—	—
ML610340	2.2~5.5	4.096MHz(Crystal oscillation/ceramic oscillation/external output)	0.25μs/	—	-40~+85	Mask	96K (*21)	—	—	512	4	4	4	2 (16bit×1)	—	—	—	1	—	—	1	—	—	9:5	Built-in sound playback/ADPCM decoder/speaker amplifier	P-SSOP30-56-0.65	—	—	
ML610Q340	2.2~5.5	4.096MHz(Crystal oscillation/ceramic oscillation/external output)	0.25μs/	—	-40~+85	Flash	96K (*21)	—	—	512	4	4	4	2 (16bit×1)	—	—	—	1	—	—	1	—	—	9:5	Built-in sound playback/ADPCM decoder/speaker amplifier	P-SSOP30-56-0.65	—	—	
ML610346	2.2~5.5	4.096MHz(Crystal oscillation/ceramic oscillation/external output)32kHz(Internal RC oscillation)	0.25μs/ 31.25μs	1.2μA	-40~+85	Mask	128K(*21)	—	—	1K	8	4	16	2 (16bit×1)	—	—	—	1	12bit×3 (Sequential)	—	1	1	—	—	11:9	Built-in sound playback/ADPCMdecoder/speaker amplifier/3-ch OP amplifier	P-TQFP64-1010-0.50	—	—
ML610Q346	2.2~5.5	4.096MHz(Crystal oscillation/ceramic oscillation/external output)32kHz(Internal RC oscillation)	0.25μs/ 31.25μs	1.5μA	-40~+85	Flash	128K(*21)	—	—	1K	8	4	16	2 (16bit×1)	—	—	—	1	12bit×3 (Sequential)	—	1	1	—	—	11:9	Built-in sound playback/ADPCMdecoder/speaker amplifier/3-ch OP amplifier	P-TQFP64-1010-0.50	—	—
ML610347	2.2~5.5	4.096MHz(Crystal oscillation/ceramic oscillation/external output)32kHz(Internal RC oscillation)	0.25μs/ 31.25μs	1.2μA	-40~+85	Mask	128K(*21)	—	—	1K	8	4	16	2 (16bit×1)	—	—	—	1	12bit×12 (Sequential)	—	1	1	—	—	11:9	Built-in sound playback/ADPCM decoder/speaker amplifier	P-TQFP64-1010-0.50	—	—
ML610Q347	2.2~5.5	4.096MHz(Crystal oscillation/ceramic oscillation/external output)32kHz(Internal RC oscillation)	0.25μs/ 31.25μs	1.5μA	-40~+85	Flash	128K(*21)	—	—	1K	8	4	16	2 (16bit×1)	—	—	—	1	12bit×12 (Sequential)	—	1	1	—	—	11:9	Built-in sound playback/ADPCM decoder/speaker amplifier	P-TQFP64-1010-0.50	—	—
ML610Q355	2.2~3.6	8MHz(Internal PLL/external output)4kHz(Internal RC oscillation)	0.122μs/ 250μs	1.2μA	-40~+85	Flash	88K (*22)	1K (Self-rewritable)	—	1K	4	3	8	4 (16bit×2)	—	—	—	1	12bit×4 (Sequential)	—	2	2	VLS×1	—	16:3	Built-in sound playback/ADPCMdecoder/speaker amplifier/3-ch OP amplifier	P-TQFP48-0707-0.50	—	—
ML610Q356	2.2~3.6	8MHz(Internal PLL/external output)4kHz(Internal RC oscillation)	0.122μs/ 250μs	1.2μA	-40~+85	Flash	88K (*22)	1K (Self-rewritable)	—	2K	6	3	12	8 (16bit×4)	—	—	—	1	12bit×4 (Sequential)	—	2	2	VLS×1	—	20:5	Built-in sound playback/ADPCMdecoder/speaker amplifier/3-ch OP amplifier	P-TQFP64-1010-0.50	—	—
ML610Q359	2.2~3.6	8.192MHz(Internal PLL/external output)32.768kHz(Crystal oscillation)	0.122μs/ 30.5μs	1.7μA	-40~+85	Flash	160K(*22)	3K (Self-rewritable)	—	2K	8	3	29	8 (16bit×4)	—	—	—	1	12bit×4 (Sequential)	—	2	2	VLS×1	—	20:7	Built-in sound playback/ADPCM decoder/speaker amplifier	P-TQFP64-1010-0.50	—	—
ML610Q360	2.2~3.6	8.192MHz(Internal PLL/external output)32.768kHz(Crystal oscillation)	0.122μs/ 30.5μs	1.7μA	-40~+85	Flash	160K(*22)	3K (Self-rewritable)	16M	2K	8	3	29	8 (16bit×4)	—	—	—	1	12bit×4 (Sequential)	—	2	2	VLS×1	—	20:7	Built-in sound playback/ADPCM decoder/speaker amplifier	P-TQFP64-1010-0.50	—	—
ML610Q380	2.2 (*7) ~5.5	8.192MHz(Internal PLL/Crystal oscillation/ceramic oscillation/external output) 32.768kHz (Internal RC oscillation/Crystal oscillation)	0.122μs/ 30.5μs	2.0μA	-40~+70	Flash	128K(*21)	—	—	2K	7	4	34	6 (16bit×3)	—	16bit (*6) ×2	—	1	10bit×8 (Sequential)	1 (*11)	2	2	BLD×1	Max. 96dot 24seg.×4com.	21:5	Built-in sound playback/ADPCM decoder/speaker amplifier	P-QFP80-1414-0.65	—	—
ML610Q383	2.2 (*7) ~5.5	8.192MHz(Internal PLL/Crystal oscillation/ceramic oscillation/external output) 32.768kHz (Internal RC oscillation/Crystal oscillation)	0.122μs/ 30.5μs	2.0μA	-40~+70	Flash	128K(*21)	4M	2K	2K	7	4	34	6 (16bit×3)	—	16bit (*6) ×2	—	1	10bit×8 (Sequential)	1 (*11)	2 (*8)	2	BLD×1	Max. 96dot 24seg.×4com.	21:5	Built-in sound playback/ADPCM decoder/speaker amplifier	P-QFP80-1414-0.65	—	—
ML610Q384	2.2 (*7) ~5.5	8.192MHz(Internal PLL/Crystal oscillation/ceramic oscillation/external output) 32.768kHz (Internal RC oscillation/Crystal oscillation)	0.122μs/ 30.5μs	2.0μA	-40~+70	Flash	128K(*21)	8M	2K	2K	7	4	34	6 (16bit×3)	—	16bit (*6) ×2	—	1	10bit×8 (Sequential)	1 (*11)	2 (*8)	2	BLD×1	Max. 96dot 24seg.×4com.	21:5	Built-in sound playback/ADPCM decoder/speaker amplifier	P-QFP80-1414-0.65	—	—
ML610Q385	2.2 (*7) ~5.5	8.192MHz(Internal PLL/Crystal oscillation/ceramic oscillation/external output) 32.768kHz (Internal RC oscillation/Crystal oscillation)	0.122μs/ 30.5μs	2.0μA	-40~+70	Flash	128K(*21)	16M	2K	2K	7	4	34	6 (16bit×3)	—	16bit (*6) ×2	—	1	10bit×8 (Sequential)	1 (*11)	2 (*8)	2	BLD×1	Max. 96dot 24seg.×4com.	21:5	Built-in sound playback/ADPCM decoder/speaker amplifier	P-QFP80-1414-0.65	—	—

ML610100 Series

Part Number	Operating Condition					ROM/RAM				Function / Feature																Package	Chip support	Remarks
	Operating Voltage(V)	Operating Frequency (Max.)	Minimum Instruction Execution Time	Current (*1) Consumption (Typ.@HALT)	Operating Temperature (°C)	ROM Type	ROM Capacity (Byte)	Data Flash Capacity (Byte)	RAM Capacity (Byte)	Port (*2)		8bit Timer	1kHz Timer	PWM	Capture	WDT	ADC (Method)	Serial Ports			Supply Voltage Detection	LCD Driver	Interrupt Sources Internal:External	Additional Functions				
										Input	Output							Input/Output	I2C	SSIO(*3)					UART(*4)			
5V Driven Type	* Product name with underline: Application is limited to consumer devices. Product name without underline: For both consumer devices and industrial devices. For applications to industrial devices, please contact ROHM sales representatives in advance.																											
ML610Q101 NEW	2.7~5.5	8.192MHz(Internal PLL/external output) 32.768kHz(Internal RC oscillation)	0.122μs/ 30.5μs	—	-40~+85	Flash	4K (*24)	—	256	—	—	11	6 (16bit×3)	—	16bit×1	—	1	10bit×6 (Sequential)	—	—	1	VLS×2	—	17:5	Comparator	P-SSOP16-0225-0.65/P-WQFN16-0404-0.50	Under development	—
ML610Q102 NEW	2.7~5.5	8.192MHz(Internal PLL/external output) 32.768kHz(Internal RC oscillation)	0.122μs/ 30.5μs	—	-40~+85	Flash	6K (*24)	—	256	—	—	11	6 (16bit×3)	—	16bit×1	—	1	10bit×6 (Sequential)	—	—	1	VLS×2	—	17:5	Comparator	P-SSOP16-0225-0.65/P-WQFN16-0404-0.50	Under development	—
ML610Q111 NEW	2.7~5.5	8.192MHz(Internal PLL/external output) 32.768kHz(Internal RC oscillation)	0.122μs/ 30.5μs	—	Under normal operation -40~+105/ during FLASH ROM write/delete: -20~+85	Flash	24K (*24)	4K (Self-rewritable)	2K	—	—	15	6 (16bit×3)	—	16bit×6	—	1	10bit×6 (Sequential)	1 (*14)	1	2	VLS×2	—	23:7	Comparator	P-TSSOP20-0225-0.65	—	—
ML610Q112 NEW	2.7~5.5	8.192MHz(Internal PLL/external output) 32.768kHz(Internal RC oscillation)	0.122μs/ 30.5μs	—	Under normal operation -40~+105/ during FLASH ROM write/delete: -20~+85	Flash	32K (*24)	4K (Self-rewritable)	4K	—	—	25	6 (16bit×3)	—	16bit×6	—	1	10bit×8 (Sequential)	1 (*14)	1	2	VLS×2	—	23:7	Comparator	P-LQFP32-0707-0.80	—	—
ML610Q172 NEW	2.2~5.5	8.192MHz(Internal PLL/Crystal oscillation/ ceramic oscillation/external output) 32.768kHz (Internal RC oscillation/Crystal oscillation)	0.122μs/ 30.5μs	2.0μA	Under normal operation -40~+85/ during FLASH ROM write/delete: 0~+40	Flash	128K (*21) (Self-rewritable)	2K (Self-rewritable)	4K	6	2	37	6 (16bit×3)	—	16bit (*6) ×3	—	1	10bit×12 (Sequential)	1 (*11)	2	2	BLD×1	Max. 96dot 24seg.×4com.	21:4	Low speed frequency correction	QFP64-P-1414-0.80	—	—
ML610Q173 NEW	2.2~5.5	8.192MHz(Internal PLL/Crystal oscillation/ ceramic oscillation/external output) 32.768kHz (Internal RC oscillation/Crystal oscillation)	0.122μs/ 30.5μs	2.0μA	Under normal operation -40~+85/ during FLASH ROM write/delete: 0~+40	Flash	128K (*21) (Self-rewritable)	2K (Self-rewritable)	4K	6	2	37	6 (16bit×3)	—	16bit (*6) ×3	—	1	10bit×8 (Sequential)	1 (*11)	2	2	BLD×1	Max. 96dot 24seg.×4com.	23:4	Low speed frequency correction/Comparator	QFP64-P-1414-0.80	—	—
ML610Q174 NEW	2.2~5.5	8.192MHz(Internal PLL/Crystal oscillation/ ceramic oscillation/external output) 32.768kHz (Internal RC oscillation/Crystal oscillation)	0.122μs/ 30.5μs	2.0μA	Under normal operation -40~+85/ during FLASH ROM write/delete: 0~+40	Flash	128K (*21) (Self-rewritable)	2K (Self-rewritable)	4K	6	6	49	6 (16bit×3)	—	16bit (*6) ×3	—	1	10bit×12 (Sequential)	1 (*11)	2	2	BLD×1	Max. 128dot 32seg.×4com.	23:4	Low speed frequency correction/Comparator	P-QFP80-P-1420-0.80	—	—
ML610Q178	2.2~5.5	8.192MHz(Internal PLL/Crystal oscillation/ ceramic oscillation/external output) 32.768kHz (Internal RC oscillation/Crystal oscillation)	0.122μs/ 30.5μs	2.0μA	-40~+85	Flash	128K(*21)	—	4K	7	8	59	6 (16bit×3)	—	16bit (*6) ×2	—	1	10bit×16 (Sequential)	1 (*11)	2	2	BLD×1	Max. 160dot 40seg.×4com.	20:5	Low speed frequency correction	P-QFP100-1420-0.65	—	—

ML610790 Family

Part Number	Operating Condition					ROM/RAM				Function / Feature																Package	Chip support	Remarks																									
	Operating Voltage(V)	Operating Frequency (Max.)	Minimum Instruction Execution Time	Current (*1) Consumption (Typ.@HALT)	Operating Temperature (°C)	ROM Type	ROM Capacity (Byte)	Data Flash Capacity (Byte)	RAM Capacity (Byte)	Port (*2)		8bit Timer	1kHz Timer	PWM	Capture	WDT	ADC (Method)	Serial Ports					Interrupt Sources Internal:External	Additional Functions																													
										Input	Output							Input/Output	I2C	SSIO(*3)	UART(*4)	I2C/SPI(*16) (Host Communication)			UART/IrDA(*17)																												
Sensor control type																											* Product name with underline: Application is limited to consumer devices. Product name without underline: For both consumer devices and industrial devices. For applications to industrial devices, please contact ROHM sales representatives in advance.																										
ML610Q793 NEW	VDD:1.7~1.9 AVDD:2.5~3.6		4.096MHz(Internal PLL) 32.768kHz(external output)		0.25μs/ 30.5μs	0.6μA	Flash	64K (*21) (Self-rewritable)	—	4K	—	—	21	6 (16bit×3)	—	—	—	1	12bit×3 (Sequential)	1 (*11)	1	1	1	1	1 (IrDA not allowed)	14:16	16-bit multiplication, division, sum-of-product operation, pool operation, host interface (SPI/I2C/logging RAM: 8KB)	S-UFLGA48-3.06×2.96-0.40 (WCSP48)	—	—																							
ML610Q794G NEW	2.5~3.6		4.096MHz(Internal PLL)/3.6864MHz(Crystal oscillation) 32.768kHz(Crystal oscillation)		0.25μs/0.27μs/ 30.5μs	0.7μA	Flash	64K (*21) (Self-rewritable)	—	4K	—	—	21	6 (16bit×3)	—	—	—	1	12bit×2 (Sequential)	1 (*11)	1	1	1	1	1	14:16	16-bit multiplication, division, sum-of-product operation, pool operation, host interface (SPI/I2C/logging RAM: 8KB)	TQFP-48-P-0707-0.50	—	—																							

- *1 : Low current consumption during Suspended (HALT) Mode via low-speed oscillation
*2 : Including secondary functions
*3 : No compatible chip select signals for 8-/16-bit SPI bus
*4 : Half-duplex communication system is used.
*5 : No resistive/capacitive sensor connecting terminal
*6 : IGBT control is also supported.
*7 : Operating voltage for ADC and sound playback function is 4.5V to 5.5V.
*8 : 1ch is used for P2ROM access
*9 : Flash ROM can be rewritten only by Flash writer.
*10 : Required when using IrDA
*11 : Only the Master function can support Fast mode (400kbps)/Standard mode (100kbps).
*12 : Only the Master function can support Standard mode (50kbps).
*13 : Master: Standard Mode (100kbit/s, 25kbit/s) support,
Slave: Standard Mode (100kbit/s) support

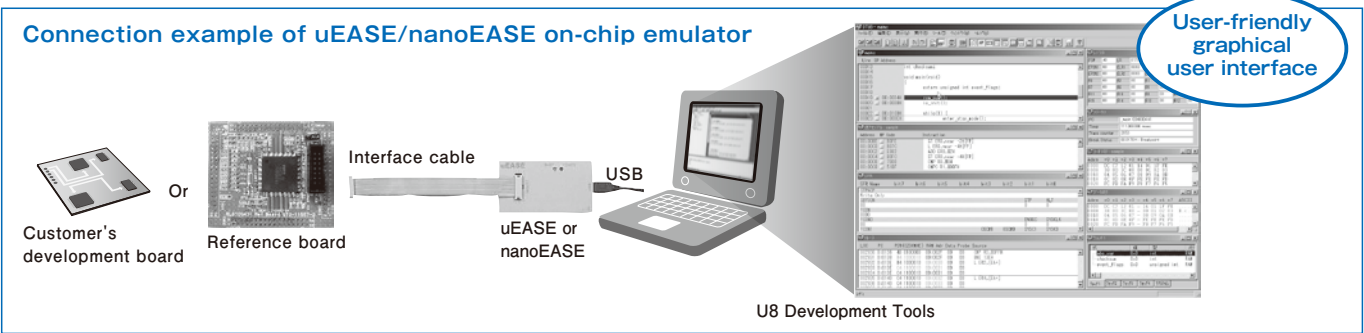
- *14 : Master - Fast Mode (400kbps)/Standard Mode (100kbps) support,
Slave - Standard Mode (100kbit/s) support
*15 : Master - Standard Mode (100kbit/s, 25kbit/s) support
*16 : Slave module for Host communication. Function switchable between I²C and SPI
*17 : UART uses full-duplex communication system. IrDA uses SIR system.
*18 : Operating voltage for ADC and 8.192MHz operation is 2.2V to 5.5V.
*21 : 1K-byte test area included
*22 : 544-byte test area included
*23 : 256-byte test area included
*24 : 32-byte test area included
*31 : 1K-byte LCD RAM allocation included
*32 : 240×9-bit LCD allocation RAM included

Microcontroller

Microcontroller

8-bit Microcontroller Program Development Support System

Development Support System's Tool Screen and Connection Example



On-chip debug emulator uEASE/nanoEASE

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.

U8 Development Tools

This software suite consists of project management tools, build tools, debug tools and Flash programming tools and provides effective support for program development. Users can smoothly perform programming to debug process using the package's intuitive graphical user interface.

Reference board with built-in microcomputer

This is a board with a built-in microcomputer and minimum essential components. Users can connect this board to uEASE/nanoEASE to test operation of ML610400/ML610300/ML610100 series products as well as ML610790 family products. Users also can develop software and process Flash writing using this board.

On-chip Emulator uEASE/nanoEASE Specification Overview

	uEASE	nanoEASE
Support device	Microcomputer with on-chip debug functions	Microcomputer with built-in single power Flash memory and on-chip debug functions
Operating voltage	VTref=1.55V~5.5V(Input voltage to VTref signal)	3.3V (Input voltage to VTref signal)
Emulation	Real-time emulation, step emulation Step in/Step out/Step over	
Break	Go to Cursor / Break point Address path count Path count: 1 to 65,536 RAM data match 1 point Conditions: Mask setting - Address and data, Access method - Read, write, Access unit: Byte, Word Establishment conditions: Equal, Not Equal, Path count: 1 to 65,536	
Display/change	Program space/Data space/SFR/Register	
Run time measurement	Unit: 100μs Maximum measurement time: 119 hours (free run)	
Flash writing function	Functions for downloading programs to the Flash memory built in the target microcomputer (when using a microcomputer with a built-in Flash memory)	
Host interface	USB2.0 High-Speed	USB2.0 Full-Speed
Supply voltage	+5V, 500mA (Supplied by USB VBUS on the HOST PC)	
Outside dimension	50.0(D)90.0(W)17.0(H)[mm]	50.0(D)60.0(W)7.0(H)[mm]
Weight	50g	15g

About LAPIS Semiconductor's Support on the Web

LAPIS Semiconductor provides latest information on a dedicated Web site for registered users. Registered users can receive the following benefits:

- Downloading latest data sheets/users manuals including preliminary versions.
- Downloading latest software tools.
- Receiving e-mail regarding product update information from LAPIS Semiconductor



LAPIS Semiconductor's Support site main screen

To access to the support page, users are required to register for obtaining an ID and password. Open the support page from the LAPIS Semiconductor's Web site or enter the following URL and click [New Registration] button. Support page URL <https://www.lapis-semi.com/cgi-bin/MyLAPIS/regi/login.cgi>

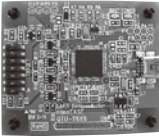


LAPIS Semiconductor's Web site



Support site login screen

Product Line-up

Product	Main Contents		Support Microcontrollers	
uEASE	 On-chip emulator uEASE (main unit)  uEASE Interface cable	 U8 Development Tools  USB cable  uEASE Interface cable	uEASE main unit	ML610400/ ML610300/ ML610100 Series, and ML610790 Family
			uEASE interface cable	
			USB cable	
			U8 Development Tools(*) •Project management tool •Build tool •Debug tool •Flash programming tool (FWuEASE Flash writer) •LcdAtU8LCD image tool •ROM code generation tool for code entry •Each tool's user's manuals	
uEASE is a general on-chip emulator and support all the 8bit Flash microcomputers. "U8 Development Tools" software suit is included. This suit provides program build, debug and Flash writing functions.			<U8 Development Tools operating environment> •Windows XP, Windows Vista*, Windows 7* *32bit(x86)/64bit(x64) are supported.	
nanoEASE	 On-chip emulator nanoEASE (main unit)  nanoEASE Interface cable	 U8 Development Tools  USB cable	nanoEASE main unit	Please contact LAPIS Semiconductor for applicable microcontrollers.
			nanoEASE interface cable	
			USB cable	
			U8 Development Tools(*) •Project management tool •Build tool •Debug tool •Flash programming tool (FWuEASE Flash writer) •LcdAtU8LCD image tool •ROM code generation tool for code entry •Each tool's user's manuals	
nanoEASE an on-chip emulator and supports 8-bit Flash microcomputers that is operated with a single power supply (voltage developed internally). "U8 Development Tools" software suit is included. This suit provides program build, debug and Flash writing functions.			<U8 Development Tools operating environment> •Windows XP, Windows Vista*, Windows 7* *32bit(x86)/64bit(x64) are supported.	
Reference Board	 Reference board with built-in microcomputer	Reference board main unit User's manual (*)		Please contact LAPIS Semiconductor for details.
This is a board with a built-in microcomputer and minimum essential components. Users can test operation of microcomputers. Users also can develop software and process Flash writing using this board.				
ML610400 Series Demo kit	 ML610Q431 Reference board + ML610400 Series Demo board  Sample Peripheral drivers	ML610Q431 Reference board +ML610400 Series Demo board		ML610400 Series
		Sample peripheral drivers (*) API manual, AP note, manuals for each board		
This demo kit includes "ML610Q431 Reference Board", which consists of various additional devices including on-board temperature and humidity sensors as a standard component. If you need to use another reference board other than "ML610Q431 Reference Board", please purchase a necessary reference board and components.				
MWuEASE	 MWuEASE Flash multi writer	MWuEASE Flash multi writer (*) •Flash programming tool •User's manual		ML610400/ ML610300/ ML610100 Series, and ML610790 Family
MWuEASE Flash multi writer can write program files to multiple Flash memory units (maximum 32 units) of a single type. If you use MWuEASE, please purchase corresponding number of uEASE units.				
Speech LSI Utility	 Speech synthesis utility tool Speech LSI Utility	Speech LSI Utility (*) •Speech synthesis utility tool •User's manual		ML610300 Series
This tool enables users to convert a WAV format file to LAPIS Semiconductor's original ADPCM2 format and to edit phrases. In addition, users can easily manipulate voice data such as sound clipping/connection and fade-in/fade-out.			<Speech LSI Utility operating environment> •Windows XP, Windows Vista*, Windows 7* *32bit(x86)/64bit(x64) are supported. •Windows compatible 16-bit or higher sound card and speaker	

* Software and manuals can be downloaded from member's Web site "LAPIS Semiconductor Low Power Microcontroller Support Page"

Speech synthesis LSI

Speech synthesis LSI Overview

Product Overview

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

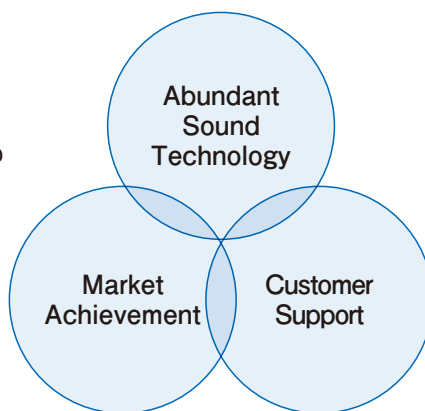
- Abundant Market Achievement: This product has been used in a variety of applications, such as toys and cars, for around 30 years.
- We offer a wide selection of products, focusing on superior sound quality ADPCM method.
- We provide a wide range of customer support covering recording and sample creation

Peripheral Technology

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

Abundant Market Achievement

Home Electronics/Consumer electronics/
Car Electronics/Industrial Electronics/
Toy/Communication Device/Security...



Sound Technology

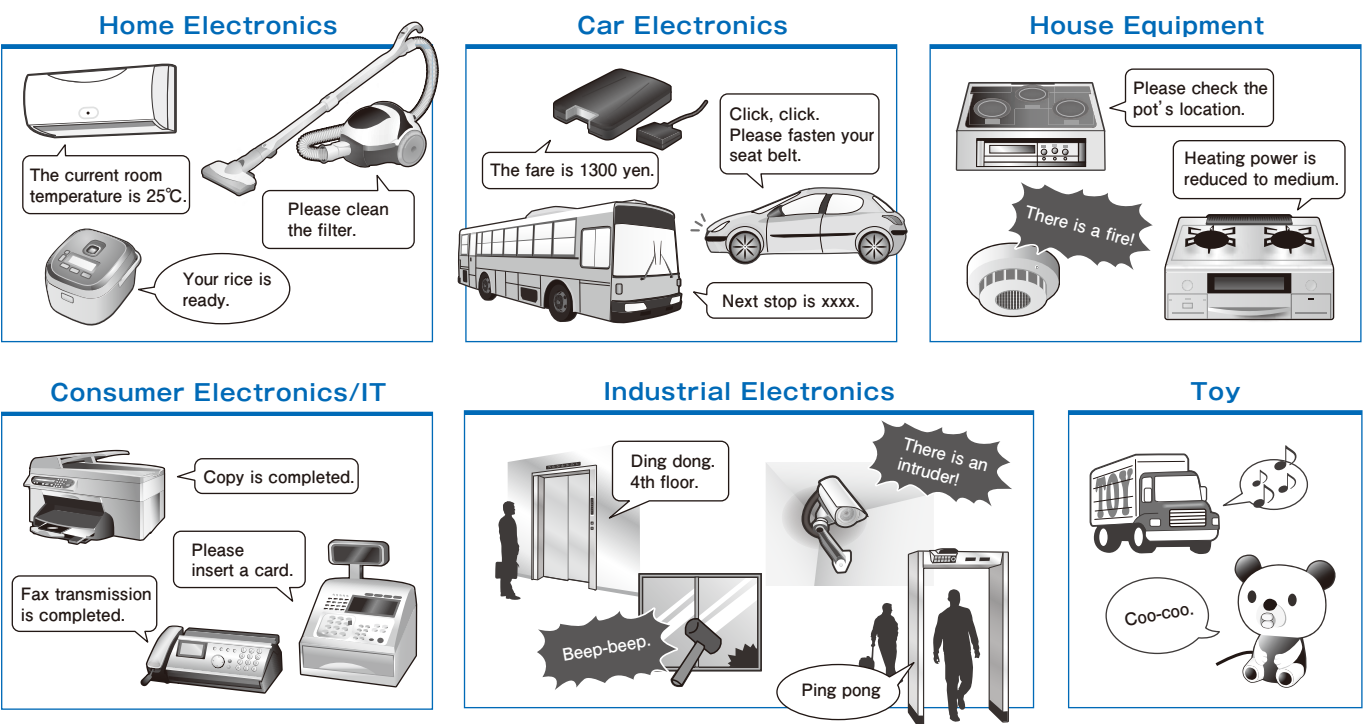
- ADPCM2/Non-linear PCM/HQ-ADPCM
- High frequency compensation filter
- Speech speed conversion/pitch conversion

Customer Support

- Contract Narrator with rich experience in LSI processing
- Recording support/Voice analysis, Editing/Sound effect creation

Application Examples

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



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

Product Line-up

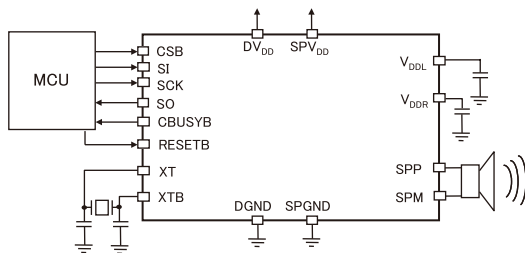
A variety of functions provide support for your applications.
We also offer products for universal design.

Speech synthesis LSI with built-in large-capacity P2ROM™ This product can be used in a variety of applications, including home and industrial electronics.	ML228xxSeries ML227xxSeries
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.	ML2256xSeries ML223xxSeries
Speech synthesis LSI for automotive Suitable for in-vehicle applications, such as indicator sound, ETC, and meter panel.	ML2257xSeries ML223xxSeries
8-bit microcontroller with speech function Suitable for security alarms, toys, etc. Simple control and high-quality speech playback functions are integrated on a single chip.	ML61034xSeries ML61035xSeries ML61038xSeries
Speech synthesis LSI with external memory Memory of 128M bits with a built-in speaker amplifier can be connected for long-time playback.	ML224xxSeries

This product list shows main products of speech synthesis LSI.

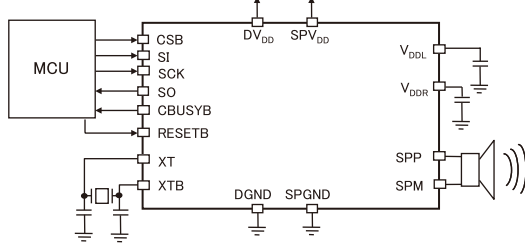
Applied Circuit

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



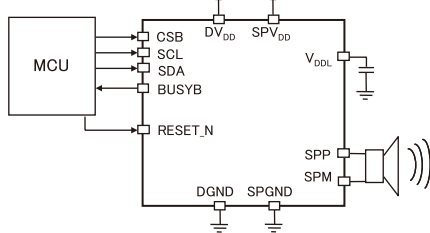
- Product features of ML2282x
- Built-in speaker amplifier
0.7W AB-class (at 5.0V)
 - Various products for different CPU I/Fs
SPI : ML2282x
I²C : ML2286x
 - Wide selection of P2ROM™ memory capacity
4 Mbit/8 Mbit/16 Mbit

Speech synthesis LSI
for automotive



- Product features of ML22Q5xx
- Built-in speaker amplifier
1.0W AB-class (at 5.0V)
 - Rated operating temperature
-40°C ~ +105°C
 - High quality speech playback
Built-in HQ-ADPCM

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



- Product features of ML22Q3x4
- Built-in speaker amplifier
1.0W D-class (at 5.0V)
 - Various products for different CPU I/Fs
SPI: ML22Q374
I²C: ML22Q394
 - Reduced mounting space/parts
Small pin PKG (SSOP16)/built-in oscillator

Video LSI

Video LSI Overview

Product Overview

Video LSI is used in a variety of applications including on-vehicle accessory products such as car navigation system, display audio and rear-seat monitor as well as surveillance camera and portable gaming consoles. Based on the signal processing technology for video and display, along with the excellent reliability, we will offer a further selection of products.

- Video Decoder Series
- Video Encoder Series
- Video Interface Series
- Display Controller Series for Small to Medium-Sized TFT LCD
- Evaluation board support

Product Line-up

●Video Decoder Series

Composite supported	ML86V76655	ML86V76652/3
Composite/S-video/ supported	ML86101A	ML86V7668A
Composite/S-video/ Component supported	ML86V7675	

●Video Encoder Series

ML86V76580	ML86V7655
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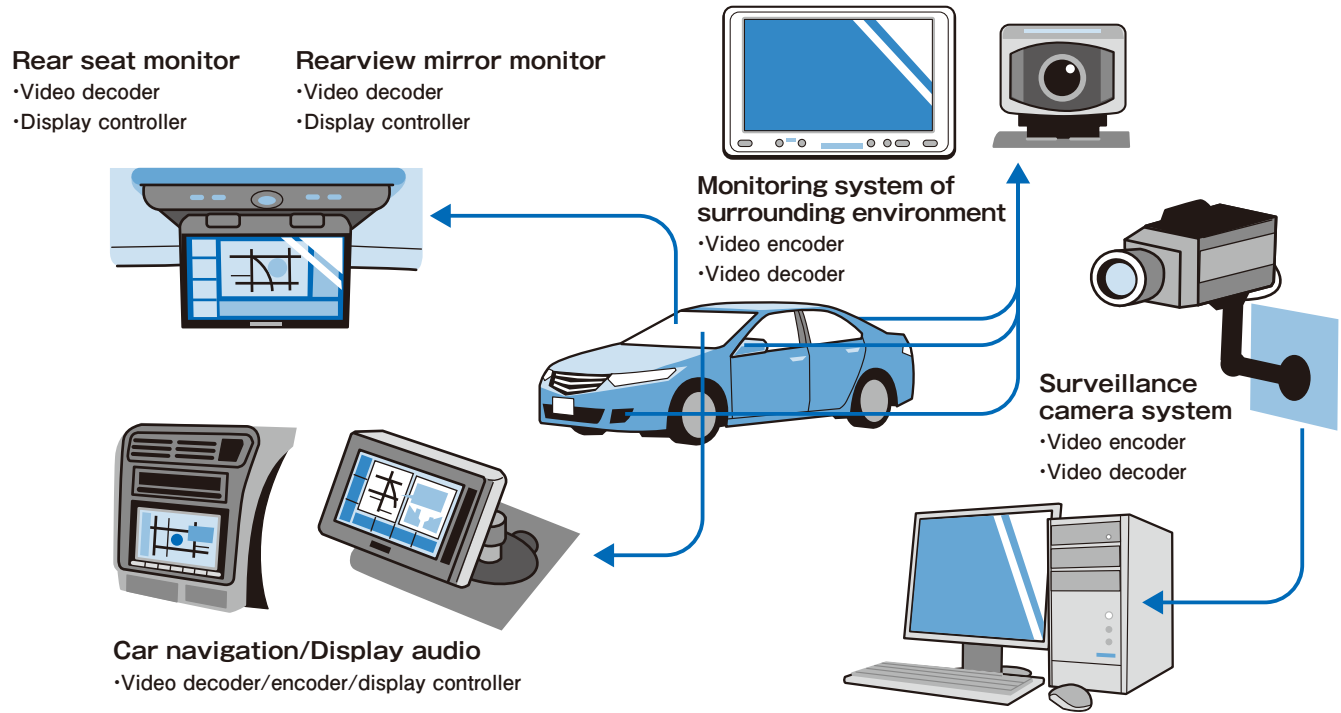
●Video Interface Series

NEW ML86790

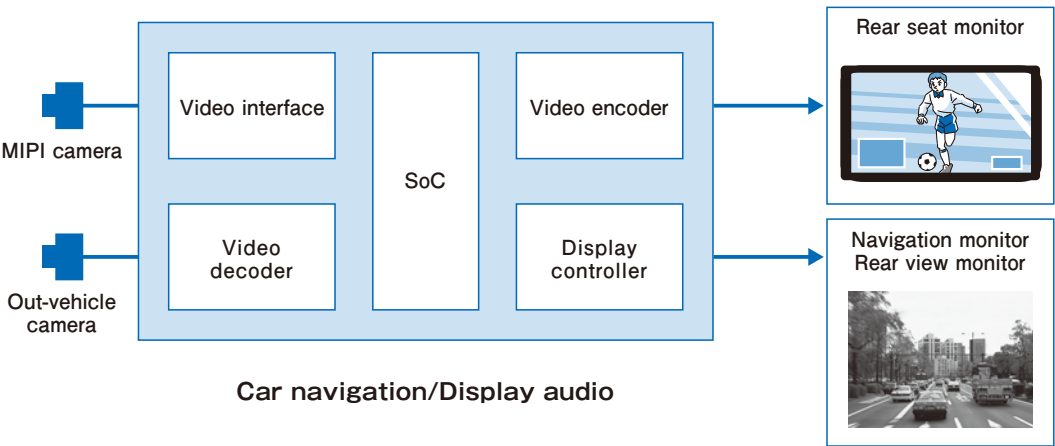
●Display Controller Series for Small to Medium-Sized TFT LCD

ML86V8101	ML86V8102			
ML86V8201	ML86V8202C	ML86V8207	ML86V8209	ML86V8401

Application Examples



Application Examples



Video LSI

Video Decoder Series

Input Format	Part Number
CVBS	ML86V76655
	ML86V76652
	ML86V76653
CVBS or S-video	ML86101A
	ML86V7668A
CVBS&S-video&Component&RGB	ML86V7675

Video Decoder Series

Part Number	Supply Voltage(V)	Operating Temperature (°C)	Input Format	Video Format	Output Format	Pixel Frequency	Sampling Frequency	Crystal Oscillator supported	Feature	Package
ML86V76655	I/O 3.3 or 1.8 Core 1.8	-40~+85	CVBS×2	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	13.5MHz、12.272727MHz、14.75MHz、14.318182MHz	27MHz、24.545454MHz、29.5MHz、28.6363MHz	—	CVBS detection function Dither	WCSP36
ML86V76652	I/O 3.3 or 1.8 Core 1.8	-40~+85	CVBS×2	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	13.5MHz、12.272727MHz、14.75MHz	27MHz、24.545454MHz、29.5MHz	○	Small Low power consumption	WCSP36
ML86V76653	I/O 3.3 or 1.8 Core 1.8	-40~+85	CVBS×2	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	13.5MHz、12.272727MHz、14.75MHz、14.318182MHz	27MHz、24.545454MHz、29.5MHz、28.6363MHz	○	Dither	TQFP48
ML86101A	I/O 3.3 Core 1.5	-40~+85	CVBS×4 or CVBS×2 +S-video×1 or S-video×2	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	13.5MHz、12.272727MHz、14.75MHz、14.318182MHz	27MHz、24.545454MHz、29.5MHz、28.6363MHz	○	Dither AEC-Q100 supported	TQFP48
ML86V7668A	I/O 3.3 Core 2.5	-40~+85	CVBS×4 or CVBS×1 +S-video×3	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16bit or RGB 18bit	13.5MHz、12.272727MHz	27MHz、24.545454MHz、	—	RGB output	TQFP100
ML86V7675	I/O 3.3 Core 1.5	-40~+85	CVBS×4+Component×2 or CVBS×4+S-video×1 +Component×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	7.99300MHz ~ 33.333MHz	7.99300MHz ~ 33.333MHz	○	WVGA sampling component input	TQFP64

Video Encoder Series

Output Format	Part Number
CVBS	ML86V76580
CVBS/S-video/Component or RGB	ML86V7655

Video Encoder Series

Part Number	Supply Voltage(V)	Operating Temperature (°C)	Input Format	Video Format	Output Format	Pixel Frequency	Sampling Frequency	Crystal Oscillator supported	Feature	Package
ML86V76580	I/O 3.3 or 1.8 Core 1.8	-40~+85	ITU-R.BT.656 or YCbCr 8bit	NTSC PAL	CVBS	13.5MHz、12.272727MHz、14.75MHz、14.318182MHz	27MHz、24.545454MHz、29.5MHz、28.6363MHz	—	No need of LPF	TQFP48 WCSP25
ML86V7655	I/O 3.3 Core 2.5	-40~+85	ITU-R.BT.656 or YCbCr 8/16/24bit or RGB 24bit	NTSC PAL	CVBS+ S-video+ Component	13.5MHz、12.272727MHz、14.75MHz、14.318182MHz、18MHz	27MHz、24.545454MHz、29.5MHz、28.6363MHz、36MHz	—	I/P、P/I conversion	TQFP100

Video Interface Series

Description	Part Number
MIPI→MIPI/LVTTL Video Interface	ML86790

Video Interface Series

Part Number	Supply Voltage(V)	Operating Temperature (°C)	Input Format	Output Format (LVTTL)	Output Format (MIPI)	Feature	Package
ML86790	I/O 3.3 or 1.8 Core 1.5	-20~+85	MIPI/CSI-2 (2Lane) YUV422 8bit, JPEG 650Mbps/Lane max	YCbCr 16bit (4:2:2) 81MHz (typ)	MIPI/CSI-2 (2Lane) YUV422 8bit, JPEG 650Mbps/Lane max	MIPI/CSI-2 receiver/transmitter、MIPI to LVTTL translate	WCSP63

Video LSI

Display Controller Series for Small to Medium-Sized TFT LCD

Description	Part Number
TCON, Image adjustment functions included	ML86V8101
	ML86V8102
T-CON, Video decoder included	ML86V8201
	ML86V8202C
	ML86V8207
	ML86V8209
Built-in video decoder and microcomputer	ML86V8401

Display Controller Series for Small to Medium-Sized TFT LCD

Part Number	Supply Voltage (V)		Analog Video Input		Digital Video Input	Digital Video Output	Resolution	OSD	MCU	Feature	Package
			Terminal	Type							
ML86V8101	3.3	-40~+85	—	—	RGB 18bit	RGB 18bit	QVGA ~QHD	—	—	Built-in image quality adjustment function (digital input only)	TQFP64
ML86V8102	3.3	-40~+85	—	—	RGB 18/24bit	RGB 18/24bit	QVGA ~QHD	—	—	RGB 24 bits supported image quality adjustment function	TQFP80
ML86V8201	I/O 3.3 Core 1.5	-40~+85	CVBS×2 or S-video×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	(ITU-R BT.656 or YCbCr 8bit) +RGB 18/24bit	QVGA ~WVGA	Line	—	Rear camera supported	TQFP100
ML86V8202C	I/O 3.3 Core 1.8	-40~+85	CVBS×2 + Component×2 or CVBS×2 + S-video×1 + Component×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	ITU-R BT.656 style or YCbCr 8/16/24bit or RGB 18/24bit	QVGA ~WVGA	—	—	Component input supported	TQFP100
ML86V8207	I/O 3.3 Core 2.5	-40~+85	CVBS×4 or CVBS×3+(Component or S-video)×1 or CVBS×2 + S-video×1 +(Component or S-video)×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	RGB 18/24bit	QVGA ~WVGA	Text Line	—	Built-in OSD function, such as text and icon	LQFP144
ML86V8209	I/O 3.3 Core 2.5	-40~+85	CVBS×4 or CVBS×3+(Comp or S-video)×1 or CVBS×2 + S-video×1 +(Comp or S-video)×1 or CVBS×1 + S-video×2 +(Comp or S-video)×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	RGB 18/24bit	QVGA ~XGA	Text Line	—	Built-in Picture In Picture function for video synthesis	LQFP176
ML86V8401	I/O 3.3 Core 1.8	-40~+85	CVBS×3 or CVBS×2 + S-video×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	ITU-R BT.656 or YCbCr 8/16bit or RGB 18/24bit	QVGA ~WVGA	Text	8051 (8bit)	System control MCU installed	TQFP100

Evaluation board support

Description	Part Number	Contents	Notes
Video Decoder	ML86V76655 Evaluation Board ML86V76652/3 Evaluation Board ML86101A Evaluation Board ML86V7668A Evaluation Board ML86V7675 Evaluation Board	•Evaluation board x 1 •Power cable x 1 •Serial cable x 1 •CD-ROM x 1 (VAsudio (LSI control software), evaluation board manual, evaluation board circuit diagram)	Lending Please contact the sales. (ROHM Co., Ltd.).
Video Encoder	ML86V76580 Evaluation Board ML86V7655 Evaluation Board	•Evaluation board x 1 •CD-ROM x 1 (Evaluation board manual, evaluation board circuit diagram)	
Display Controller	ML86V8101 Evaluation Board ML86V8102 Evaluation Board ML86V8201 Evaluation Board ML86V8202C Evaluation Board ML86V8207 Evaluation Board ML86V8209 Evaluation Board ML86V8401 Evaluation Board	•Evaluation board x 1 •AC adapter x 1 •USB cable x 1 •CD-ROM x 1 (VAsudio (LSI control software), OSDBuilder (OSD data development support tool) (ML86V8401 only) Evaluation board manual, evaluation board circuit diagram)	

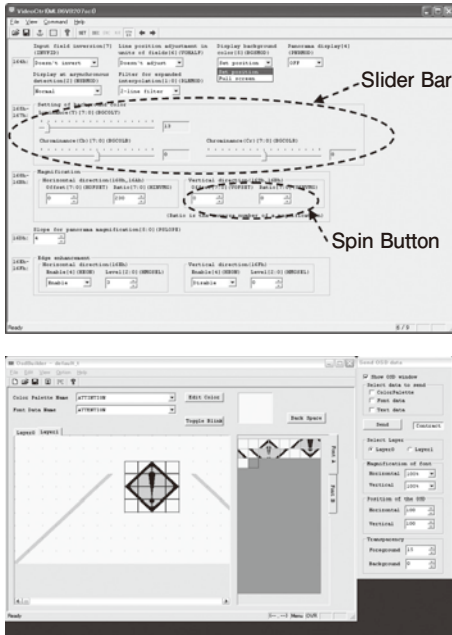
Evaluation Board Example (ML86V8401 Evaluation Board)

Features:

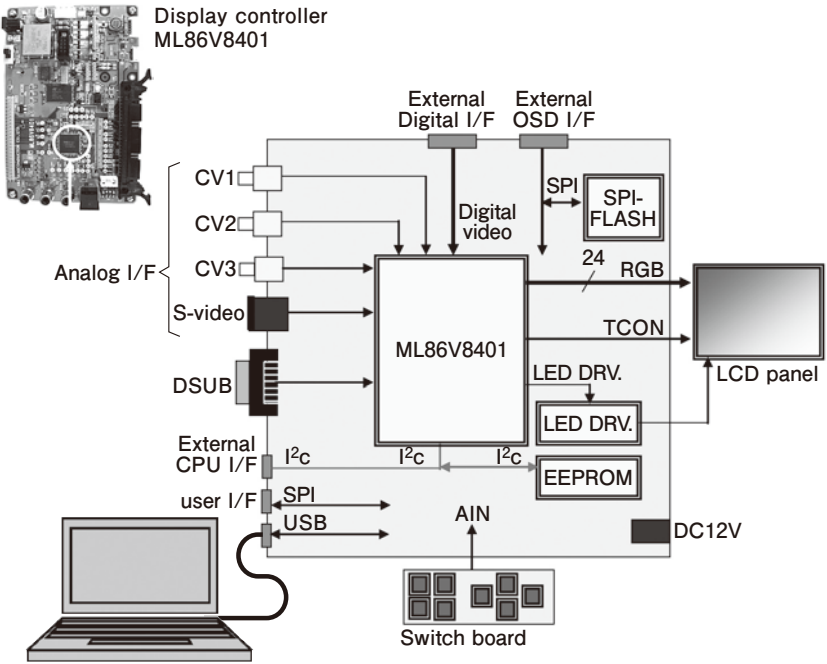
- ML86V8401 evaluation board is an evaluation board for the display controller ML86V8401.
- Video signals can be displayed on the LCD panel via the ML86V8401.
- Video signal inputs can be applied to NTSC/PAL composite or S-video and digital video signals.
- The function to display still images from the 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 connectors 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.



AS@ P2ROM™ Series with built-in Gate Array

MR35V□□□□□□	256M~1Gbit
MR25T□□□□□□	16M~128Mbps

Equipped with Gate Array of 30K/25K gate typ.
Supply Voltage : 3.0V~3.6V / 2.7V~3.6V
Operating Temperature : 0℃~+70℃

Density (bit)	Part Number	Supply Voltage (V)
1G	MR35V01G7xB	3.0~3.6
512M	MR35V5127xB	3.0~3.6
256M	MR35V2567xB	3.0~3.6
128M	MR25T1287xL	2.7~3.6
64M	MR25T647xL	2.7~3.6
16M	MR25T167xL	2.7~3.6
	MR25T1671L	2.7~3.6

AS@ P2ROM™ Series with built-in Gate Array

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage (V)	Feature	Access Time Random/ Page (ns)	Standby current consumption (Max.)	Operating Temperature (℃)	Package
1G	MR35V01G7xB	128M×8	3.0~3.6	Embedded Gate Array of 30K Gate typ. ^(*1) 3 input & 8 inout	920/320	10μA	0~+70	TSOP(I)48
512M	MR35V5127xB	64M×8	3.0~3.6	Embedded Gate Array of 30K Gate typ. ^(*1) 26 input & 8 inout	240/25	10μA	0~+70	TSOP(II)44
256M	MR35V2567xB	32M×8	3.0~3.6	Embedded Gate Array of 30K Gate typ. ^(*1) 3 input & 8 inout	920/320	50μA	0~+70	TSOP(II)44
128M	MR25T1287xL	8M×16 16M×8	2.7~3.6	Embedded Gate Array of 30K Gate typ. ^(*1) 26 input & 16 inout	80~100/25	10μA	0~+70	TSOP(I)48 TSOP(II)44
64M	MR25T647xL	4M×16 8M×8	2.7~3.6	Embedded Gate Array of 30K Gate typ. ^(*1) 26 input & 16 inout	80~100/25	10μA	0~+70	TSOP(I)48 TSOP(II)44
16M	MR25T167xL	1M×16 2M×8	2.7~3.6	Embedded Gate Array of 30K Gate typ. ^(*1) 26 input & 16 inout	70~100/25	50μA	0~+70	TSOP(I)48 TSOP(II)44
	MR25T1671L	1M×16 2M×8	2.7~3.6	Password authentication	70/25	50μA	0~+70	TSOP(I)48

*1: The design interface of gate array supports any of spec., RTL, and Netlist.

Parallel Standard P2ROM™ Series

MR26T□□□□□□	512Mbit
MR37T□□□□□□	256Mbit
MR27T□□□□□□	8M~256Mbit
MR27V□□□□□□	8M~128Mbit

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	MR27T25603L	3.0~3.6
		2.7~3.6
128M	MR27T12800L	2.7~3.6
		3.0~3.6
	MR27T12802L	2.7~3.6
		3.0~3.6
64M	MR27V12800L	3.0~3.6
		3.0~3.6
	MR27T6402L	3.0~3.6
		2.7~3.6
32M	MR27V6402L	3.0~3.6
		3.0~3.6
	MR27T3202L	3.0~3.6
		2.7~3.6
16M	MR27V3202L	3.0~3.6
		3.0~3.6
	MR27T1602L	2.7~3.6
		3.0~3.6
8M	MR27V1602L	3.0~3.6
		3.0~3.6
	MR27T802F	2.7~3.6
		3.0~3.6
8M	MR27V802F	2.7~3.6
		3.0~3.6

Parallel Standard P2ROM™ Series

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage (V)	Access Time (ns)	Current Consumption (Max.)		Operating Temperature (℃)	Package	Socket mounting package	Package Frame
					Operating	Standby				
512M	MR26T51203L	32M×16/ 64M×8	3.0~3.6 2.7~3.6	100 120	35mA	10μA	0~+70	TSOP(II)50	—	—
256M	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	—	—
		8M×16/ 16M×8	3.0~3.6 2.7~3.6	80 90	25mA	10μA	0~+70	TSOP(II)56	—	—
	MR27V12800L	8M×16/ 16M×8	3.0~3.6	85	25mA	10μA	0~+70	Chip	—	—
								Chip	—	—
64M	MR27T6402L	4M×16/ 8M×8	3.0~3.6	70	20mA	10μA	0~+70	SOP44/TSOP(I)48/ TFBGA48	CG/ SOP44	Cu/ TSOP(I)48
			2.7~3.6	90				TSOP(I)48		
			3.0~3.6	80	20mA	10μA	-40~+85	TSOP(I)48	CG/ SOP44	Cu/ TSOP(I)48
			2.7~3.6	90				Chip		
32M	MR27T3202L	2M×16/ 4M×8	3.0~3.6	70	20mA	10μA	0~+70	SOP44/TSOP(I)48/ TFBGA48	CG/ SOP44	—
			2.7~3.6	90				TSOP(I)48		
			3.0~3.6	80	20mA	10μA	-40~+85	TSOP(I)48	CG/ SOP44	—
			2.7~3.6	90				Chip		
16M	MR27T1602L	1M×16/ 2M×8	2.7~3.6	70	16mA	10μA	0~+70	SOP44/TSOP(I)48/ TFBGA48	CG/ SOP44	Cu/ TSOP(I)48
			3.0~3.6	70				TSOP(I)48		
	MR27V1602L	1M×16/ 2M×8	3.0~3.6	70	16mA	10μA	0~+70	Chip	—	—
								Chip		
8M	MR27T802F	512K×16/ 1M×8	2.7~3.6	80	18mA	5μA	0~+70	SOP44/TSOP(I)48	—	—
			3.0~3.6	70				SOP44/TSOP(I)48		
	MR27V802F	512K×16/ 1M×8	3.0~3.6	90	18mA	5μA	0~+70	Chip	—	—
								Chip		

SPI BUS P2ROM™ Series

MR37T□□□□□□	64M~128Mbit
MR37V□□□□□□	128Mbit
MR27V□□□□□□	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)	3.0~3.6
	MR37T12843B NEW	3.0~3.6
	MR37V12841A	3.0~3.6
64M	MR37T6441B (Under development)	3.0~3.6
	MR37T6443B (Under development)	3.0~3.6
	MR27V6441L	3.0~3.6
32M	MR27V3241L	3.0~3.6
16M	MR27V1641L	3.0~3.6

SPI BUS P2ROM™ シリーズ

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage (V)	Operating Frequency(MHz)		Current Consumption(Max.)		Operating Temperature (℃)	Package
				FAST-READ	READ	Operating (*3)	Standby		
128M	MR37T12841B (Under development)	128M×1	3.0~3.6	86	50	30mA/20mA (*3)	10μA	0~+70	SOP16
	MR37T12843B NEW	128M×1	3.0~3.6	86	50	30mA/20mA (*3)	10μA	0~+70	SOP16
		64M×2		80/68	50	30mA/20mA (*3)			
		32M×4		80/68	50	40mA/20mA (*3)			
64M	MR37V12841A	128M×1	3.0~3.6	33	20	30mA/20mA (*3)	50μA	0~+70	SOP16
	MR37T6441B (Under development)	64M×1	3.0~3.6	86	50	30mA/20mA (*3)	10μA	0~+70	SOP16
	MR37T6443B (Under development)	64M×1	3.0~3.6	80/68	50	30mA/20mA (*3)			
		16M×4		80/68	50	40mA/20mA (*3)			
32M	MR27V6441L	64M×1	3.0~3.6	33	20	30mA/20mA (*3)	50μA	0~+70	SOP16/Chip
	MR27V3241L	32M×1	3.0~3.6	33	20	40mA/20mA (*3)	50μA	0~+70	SOP16/Chip
16M	MR27V1641L	16M×1	3.0~3.6	30	20	25mA/20mA (*3)	50μA	0~+70	SOP16/Chip

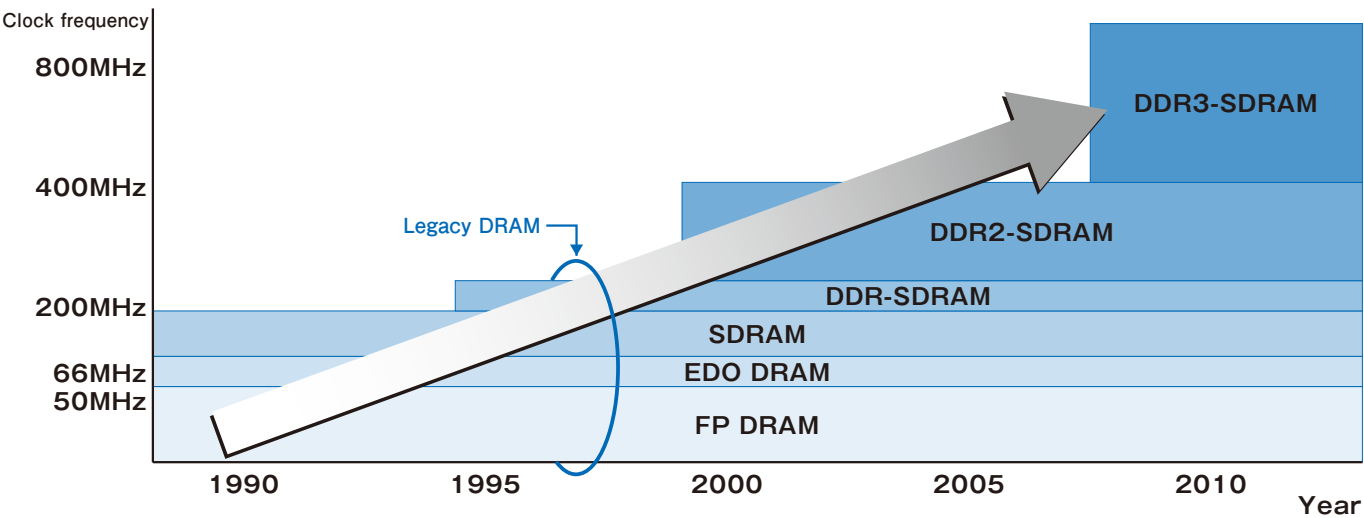
*3 : FAST-READ/READ

DRAM

Legacy DRAM Overview

Types of DRAM

- Asynchronous clock DRAM
- FP DRAM (Fast Page mode)
 - EDO DRAM (Extended Data Out)
- Synchronous clock DRAM
- SDRAM (synchronous DRAM)
 - DDR-SDRAM (Double-Data-Rate SDRAM)
 - DDR2-SDRAM
 - DDR3-SDRAM

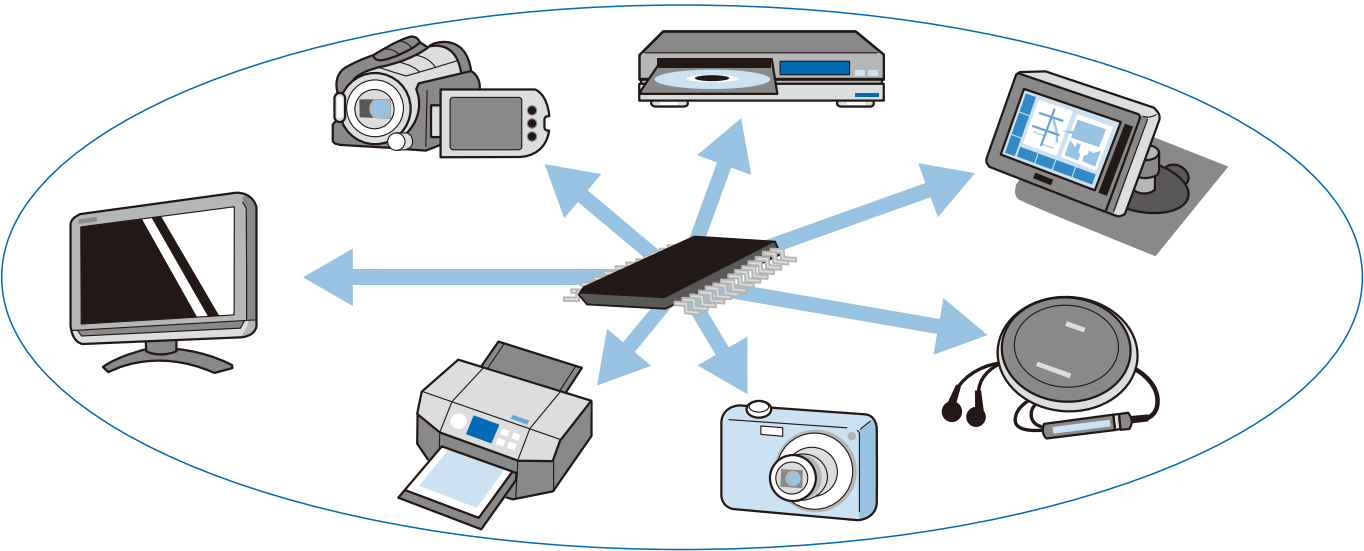


In addition, memories specifically designed for image processing are standardized.

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

Application Examples

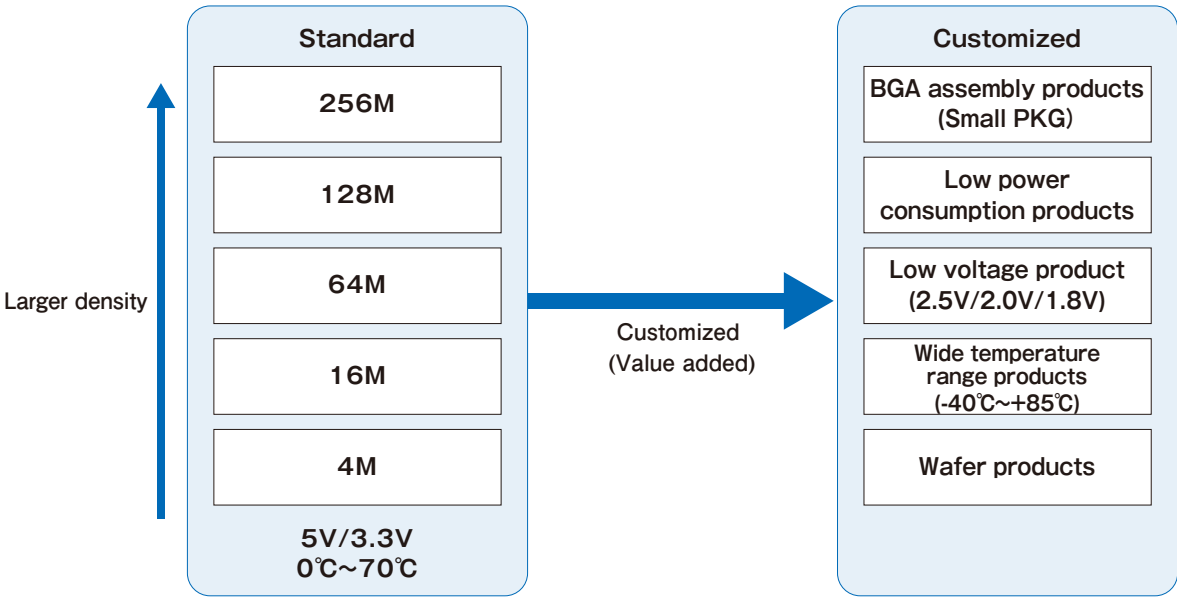
- AV Electronics: LCD TV, DVD player, digital camera, etc.
 - IT Device: printer, hard disk drive, optical disk drive, etc.
 - Car Electronics: car audio and navigation system
 - Communication Device: router, FAX, etc.
- This product is also used in many other applications.



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.



DRAM

Legacy DRAM FP/EDO

Supply Voltage(V)	Density (bit)	Number of data bits	Refresh Cycle	Part Number
Standard				
5.0	4M	×4	1K	MSM514400E
		×8		MSM514800E
				MSM514800ESL
		×16	512	MSM514260E
				MSM514265E
				MSM5416258B
	16M	×4	4K	MSM5116400F
			2K	MSM5117400F
				MSM5117405F
				MSM5117800F
		×8	2K	MSM5117805F
				MSM5116160F
				MSM5118160F
		×16	1K	MSM5118165F
				MSM51V4400E
				MSM51V4800E
		×16	512	MSM54V16258B
				MD54V16258BSL
				MSM51V4265E
3.3	4M	×4	1K	MSM51V16400F
		×8		MSM51V16405F
				MSM51V17400F
		×16	512	MSM51V17405F
				MSM51V17800F
				MSM51V17805F
	16M	×4	4K	MSM51V16160F
			2K	MSM51V16165F
				MSM51V18160F
		×8	2K	MSM51V18165F
				MSM51V16160F
				MSM51V16165F
		×16	1K	MSM51V18160F
				MSM51V18165F
				MD51V65165E
	64M		4K	MD51V65165E
Automotive grade				
5.0	4M	×4	1K	MSM514400DP
				MSM514400EP
		×16	512	MSM514260EP
	16M	×16	1K	MSM5118160FP
				MSM5118165FP
				MSM51V4400EP
3.3	4M	×4	1K	MSM51V4400EP
		×16	512	MSM54V16258BP
				MSM51V4265EP
	16M	×4	2K	MSM51V17400FP
		×16	1K	MSM51V18165FP
				MSM51V18165FP

Legacy DRAM FP/EDO

Part Number	Supply Voltage(V)	Density (bit)	Configuration (word×bit)	Circuit function	Access Time (ns)	Cycle Time (cycles/ms)	Operating Temperature Ta (°C)	Package	
Standard									
MSM514400E	5.0±0.5	4M	1M×4	Fast Page Mode	60/70	1024/16	0~+70	TSOP(II)26/20Cu	
MSM514800E			512K×8	Fast Page Mode	60/70	1024/16		TSOP(II)28	
MSM514800ESL						1024/128			
MSM514260E			256K×16	Fast Page Mode	60/70	512/8		TSOP(II)44/40	
MSM514265E				EDO					
MSM5416258B				High Speed EDO	28/30/35				
MSM5116400F		16M	4M×4	Fast Page Mode	60	4096/64		2048/32	TSOP(II)26/24Cu
MSM5117400F				EDO	50/60				
MSM5117405F			2M×8	Fast Page Mode	60			TSOP(II)28	
MSM5117800F				EDO					
MSM5116160F			1M×16	Fast Page Mode	60	4096/64		TSOP(II)50/44	
MSM5118160F									
MSM5118165F				EDO	50/60	1024/16			
MSM51V4400E			3.3±0.3	4M	1M×4	Fast Page Mode		70/100	1024/16
MSM51V4800E		512K×8			Fast Page Mode	70			TSOP(II)28
MSM54V16258B	256K×16	EDO			40/45/50	512/64	TSOP(II)44/40		
MD54V16258BSL		EDO			60/70	512/8			
MSM51V16400F	16M	4M×4		Fast Page Mode	60	4096/64	2048/32	TSOP(II)26/24Cu	
MSM51V16405F				EDO	50/60				
MSM51V17400F				Fast Page Mode	50/60				
MSM51V17405F				EDO	50/60				
MSM51V17800F		2M×8		Fast Page Mode	60		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			50/60					
MD51V65165E	64M	4M×16	EDO	50/60	4096/54	TSOP(II)50			
Automotive grade									
MSM514400DP	5.0±0.5	4M	1M×4	Fast Page Mode	60/70	1024/16	-40~+85	TSOP(II)26/20Cu	
MSM514400EP			256K×16	Fast Page Mode	60/70	512/8		TSOP(II)44/40	
MSM514260EP		16M	1M×16	Fast Page Mode	60	1024/16		TSOP(II)50/44	
MSM5118160FP			EDO						
MSM5118165FP	3.3±0.3	4M	1M×4	Fast Page Mode	70/100	1024/16		TSOP(II)26/20Cu	
MSM54V16258BP			256K×16	EDO	40/45/50	512/64		TSOP(II)44/40	
MSM51V4265EP				EDO	60/70	512/8			
MSM51V17400FP		16M	4M×4	Fast Page Mode	60	2048/32		TSOP(II)26/24Cu	
MSM51V18165FP			1M×16	EDO	60	1024/16			

Display Driver

TFT Driver Series

Drivers for small to medium-sized TFT LCD

Description	Part Number
TFT-LCD driver	ML9860B
	ML9863A
	ML9870

Drivers for small to medium-sized TFT LCD

Part Number	Feature	Package	Logic Supply Voltage(V)	LCD Voltage(V)	Operating Temperature(°C)	Number of 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
ML9863A	TFT LCD source driver (960outputs)	Au bump chip	2.4~3.6	8.0~14.6	-40 ~ +95	960/804/792/768	CMOS/RSDS
ML9870	TFT LCD gate driver (540outputs)	Au bump chip	2.7~3.6	~40	-40 ~ +95	540/480/400/384/360/300/240	CMOS

TN/STN LCD Driver Series

Common/Segment driver for dot matrix LCD

Description	Part Number
LCD driver	ML9460
	ML9461B

Common/Segment driver for dot matrix LCD

Part Number	Max. No. of Common Outputs	Max. No. of Segment Outputs	Max. Driving Display size	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Operating Temperature(°C)	Feature	Package
ML9460	240	—	320×240 (QVGA)	2.5~5.5	~43	-30~+75	Output change 240/200/160/120	Au bump chip
ML9461B	—	320		2.5~5.5	2.6~5.5	-30~+75	Output change 320/240/200	Au bump chip

Controller driver for graphic LCD

Description	Part Number
LCD controller driver	ML9058E
	ML9059E
	ML9445
	ML9092-01
	ML9092-02 ML9092-03 ML9092-04

Controller driver for graphic LCD

Part Number	Max. No. of Common Outputs	Max. No. of Segment Outputs	Max. Driving Display size	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Operating Temperature(°C)	Feature	Package
ML9058E	65	132	132×65 dot	3.7~5.5	6~18	-40~+85	Integrated RAM/Boost circuit	Au bump chip
ML9059E	49	132	132×49 dot	3.7~5.5	6~18	-40~+85	Integrated RAM/Boost circuit	Au bump chip
ML9445	65	180	180×65 dot	2.7~5.5	6~18.5	-40~+105	Integrated RAM/Boost circuit	Au bump chip
ML9092-01	8/9/10	56	56×10 dot	4.5~5.5	4.5~16.5	-40~+85	Integrated RAM/Boost circuit	TQFP100
ML9092-02 ML9092-03 ML9092-04	8/9/10	60	60×10 dot	4.5~5.5	4.5~16.5	-40~+85	Integrated RAM/Boost circuit	TQFP100

Controller driver for character LCD

Description	Part Number
LCD controller driver	ML9042-0x
	ML9042-1x
	ML9042-2x

Controller driver for character LCD

Part Number	Max. No. of Common Outputs	Max. No. of Segment Outputs	Digits/Lines	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Operating Temperature(°C)	Feature	Package
ML9042-0x	17	100	5×8 dots, 20 characters×2 lines	2.7~5.5	2.7~5.5	-40~+85	Built-in bias register 2KΩ	Au bump chip
ML9042-1x	17	100	5×8 dots, 20 characters×2 lines	2.7~5.5	2.7~5.5	-40~+85	Built-in bias register 4KΩ	Au bump chip
ML9042-2x	17	100	5×8 dots, 20 characters×2 lines	2.7~5.5	2.7~5.5	-40~+85	Built-in bias register 10KΩ	Au bump chip

Controller driver for low duty LCD

Description	Part Number
LCD controller driver (Package product)	ML9470-12
	ML9471
	ML9472
	ML9473
	ML9475
	ML9476
	ML9477
LCD controller driver (Gold bump product)	ML9480
	ML9478C
	ML9479E
	ML9488 NEW
	ML9489 NEW

Controller driver for low duty LCD

Part Number	Max. No. of Segment Outputs	Max. No. of Driving Segments					Internal Oscillation Frame Frequency (Hz)	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Operating Temperature(°C)	Feature	Package
		static	1/2	1/3	1/4	1/5						
ML9470-12	80	80	160	—	—	—	—	3.0~5.5 (single)	—	-40~+105	Supports external clock input	QFP100
ML9471	80	—	—	240	320	400	—	3.0~5.5 (single)	—	-40~+105	Supports external clock input	TQFP100
ML9472	60	60	120	—	—	—	—	3.0~5.5 (single)	—	-40~+105	Supports external clock input	P-TQFP80-1212-0.50
ML9473	60	—	—	180	240	300	—	3.0~5.5 (single)	—	-40~+105	Supports external clock input	P-TQFP80-1212-0.50
ML9475	40	—	—	120	160	—	—	2.7~5.5	3.5~5.5	-40~+105	Supports external clock input Bias generator built in	QFP56
ML9476	16	—	—	48	64	—	—	2.7~5.5	3.5~5.5	-40~+105	Supports external clock input Bias generator built in	TQFP48
ML9477	32	—	—	96	128	—	—	2.7~5.5	3.5~5.5	-40~+105	Supports external clock input Bias generator built in	TQFP48
ML9480	40	40	80	120	160	—	65/75/85/95/130/150/170/190/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip
ML9478C	80	80	160	240	320	—	65/75/85/95/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip
ML9479E	160	160	320	480	640	—	65/75/85/95/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip
ML9488 NEW	80	80	160	240	320	—	130/150/170/190/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip
ML9489 NEW	160	160	320	480	640	—	130/150/170/190/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip

Battery Monitoring LSI

Battery Monitoring LSI Overview

Product Overview

This product is designed to monitor voltage of Lithium-ion batteries with high accuracy and prevent overcharge or over-discharge by controlling the charge and the discharge in order to ensuring battery safety and longevity.

- Support to multi-cell series-connected Lithium-ion battery packs.
Support maximum of 16 series coupling cell battery packs
- A highly accurate voltage detection circuit to each cell ensures overcharge / over-discharge.
- Include cell balancing function
Built-in bypass switches for the cell-balancing function to reduce connection pins.
- Low power consumption.
- Built-in driving circuit of external FET for charge / discharge control.
- System protection functions if irregularities occur.
 - ・ Short detection and protection
 - ・ Abnormal operation detection and protection with using watch dog timer.
- Temperature detection function
- Internal regulator acts as power supply to an external MCU.
- On-board LED driver for displaying battery balance

Products line-up includes stand-alone type/chipset (AFE + dedicated controller)

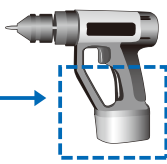
Product Line-up

Description	Part Number
Battery Monitoring LSIs for Power Tools, Electric bicycles, Uninterruptible Power Supply (UPS)	ML5203 NEW
	ML5235
	ML5238 NEW
	ML5208
Description	Part Number
Dedicated controller	ML610Q486P NEW
	ML5227

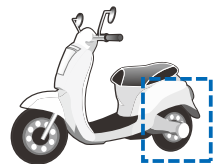
Application Examples

Lithium-ion Battery Monitoring LSI
for Power Tools

The monitoring LSI
protects Li-ion batteries
by detecting the
overcharge and
over-discharge.

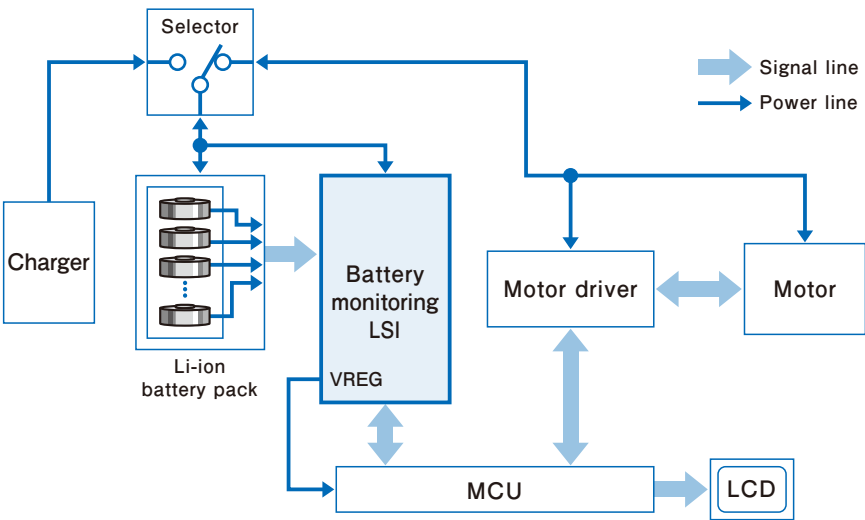
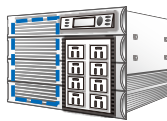


Lithium-ion Battery Monitoring LSI
for Electrically Assisted Bicycles



Lithium-ion Battery Monitoring LSI
for Uninterruptible Power Supply (UPS)

The monitoring LSI
(with MCU) protects
Li-ion batteries by
detecting the overcharge
and over-discharge.



Part Number	Description	Supply Voltage	Voltage Measurement Error (typ)*	FET Driver for Charge-Discharge Control	Current Consumption		Package
					Operating	Power-down	
ML5203 NEW	4 to 7 cells supported battery monitoring LSI, Stand-alone type	+5V~+42V	±10mV	N-MOS	30μA	0.1μA	SSOP30
ML5235	5 to 13 cells supported battery monitoring LSI, Stand-alone type	+7V~+80V	±10mV	N-MOS	25μA	0.1μA	SSOP30
ML5238 NEW	5 to 16 cells supported battery monitoring LSI, Chipset type	+7V~+80V	±10mV	N-MOS	50μA	0.1μA	QFP44
ML5208	5 to 13 cells supported battery monitoring LSI, Chipset type	+7V~+80V	±10mV	N-MOS	150μA	50μA	QFP44

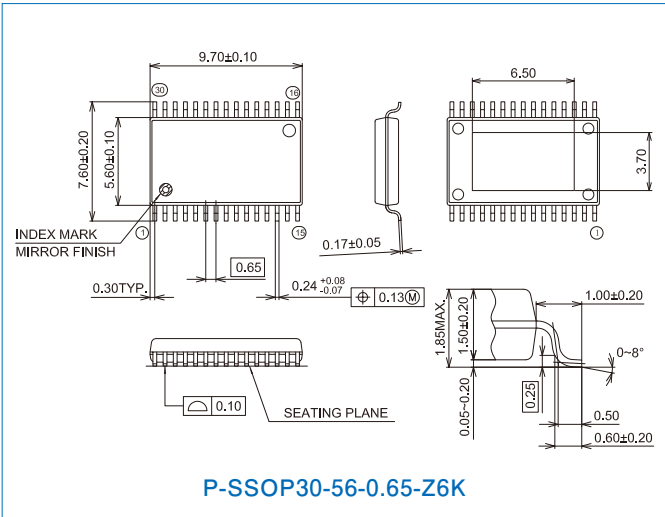
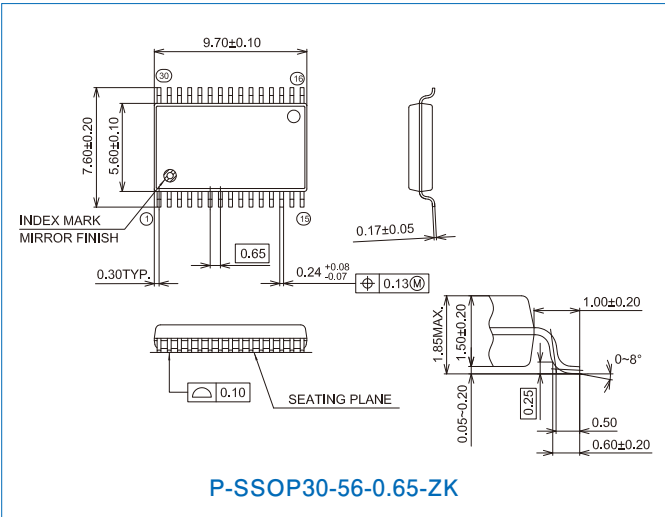
*:The voltage measurement error of ML5207,ML5208 and ML5238 were measured using a dedicated controller for each device.

Part Number	Description	Supply Voltage		AD Converter	Current Consumption			Package
		VDD	AVDD		Operating	Suspended (HALT)	Shutdown	
ML610Q486P NEW	Microcontroller for ML5238 only	1.6V~3.6V	2.2V~3.6V	12bit	400μA	15μA	0.2μA	TQFP48
ML5227	Microcontroller for ML5208 only	1.6V~3.6V	2.2V~3.6V	12bit	400μA	15μA	0.2μA	TQFP48

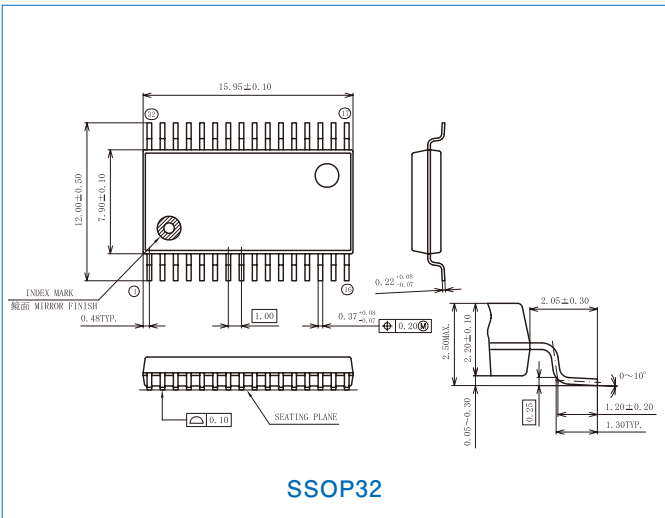
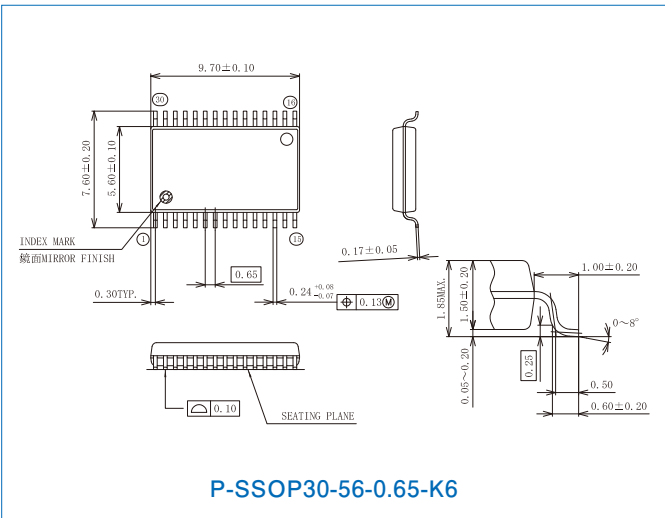
LSI Packages

Package size

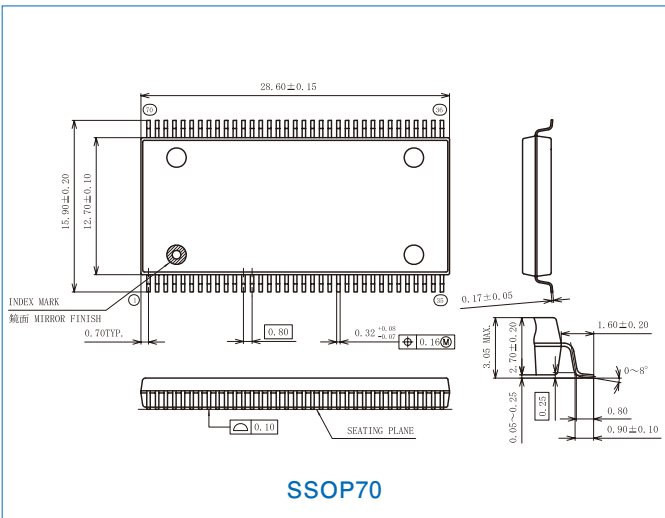
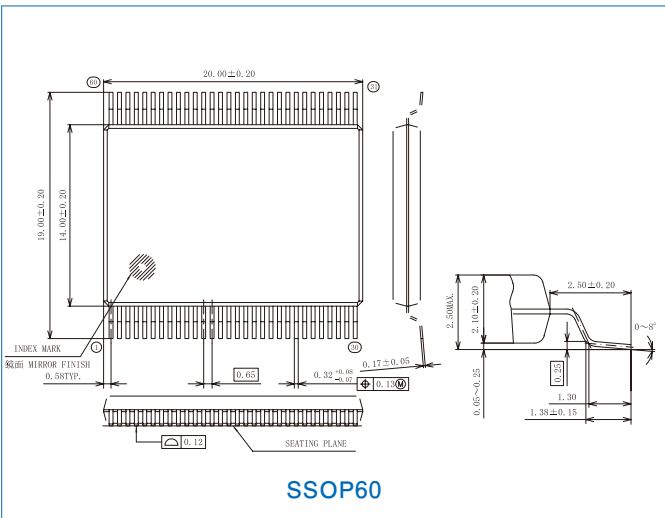
SSOP



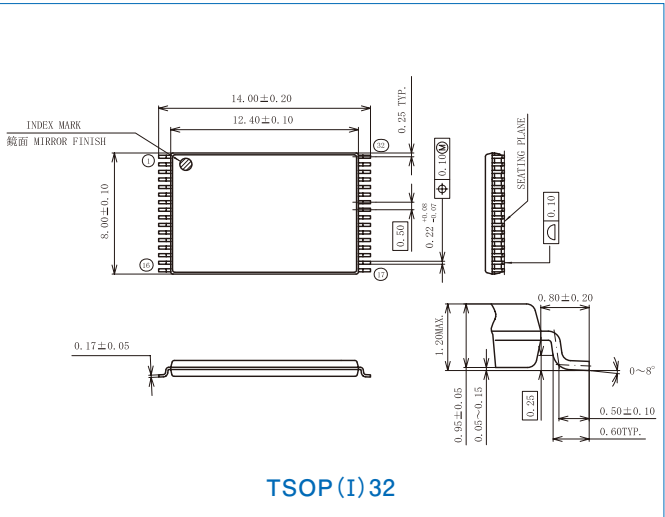
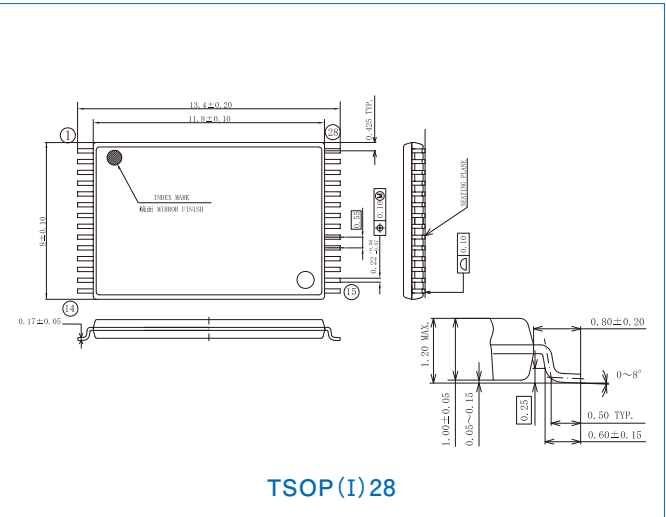
SSOP



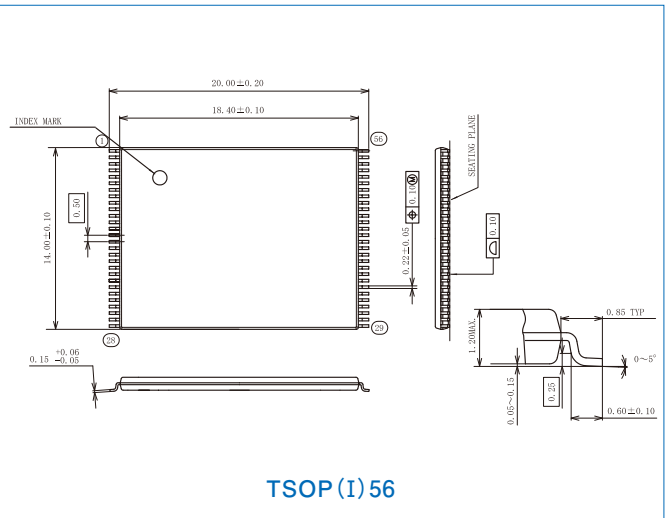
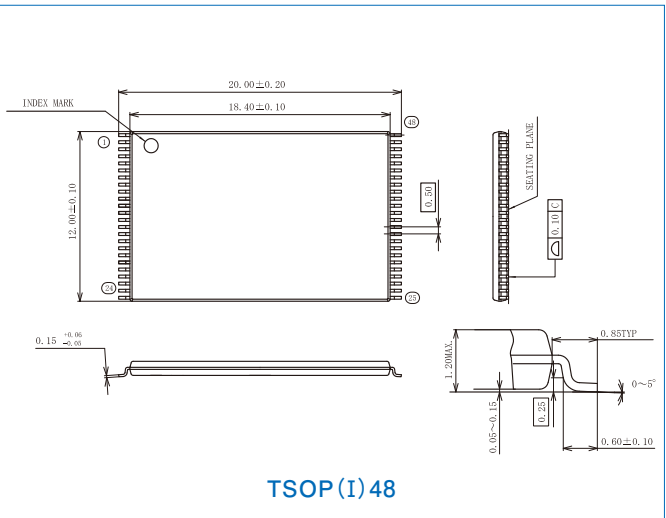
SSOP



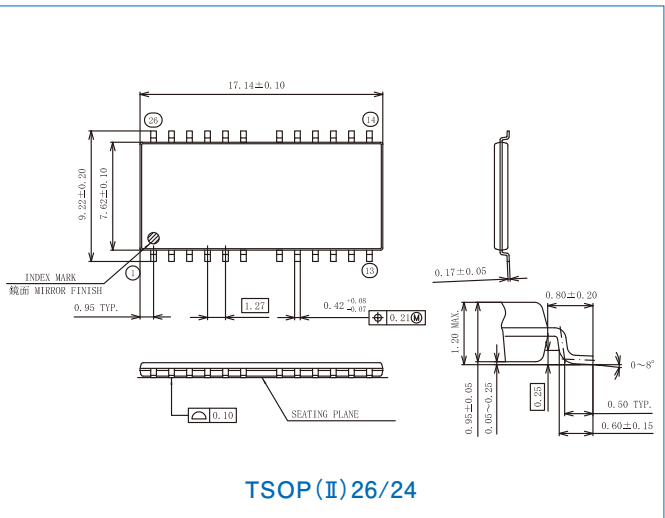
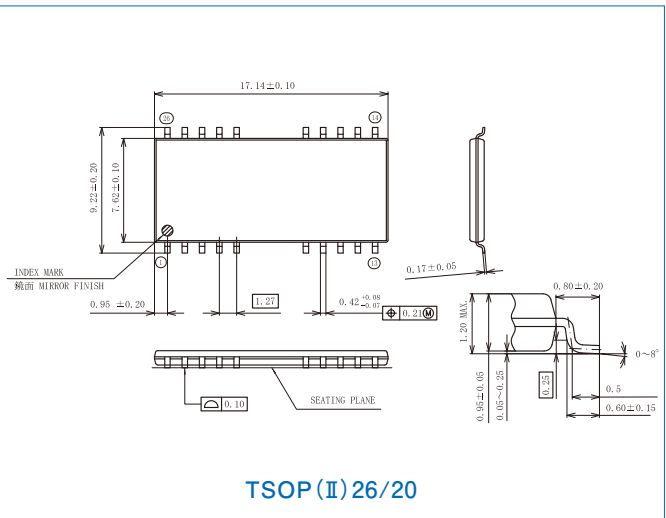
TSOP (Type I)



TSOP (Type I)



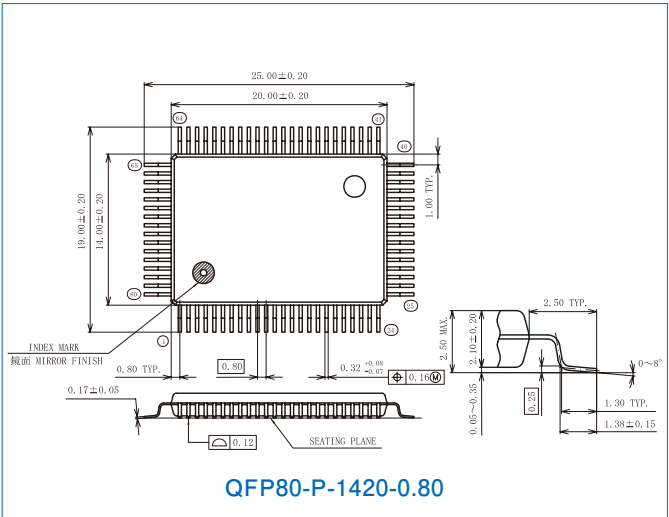
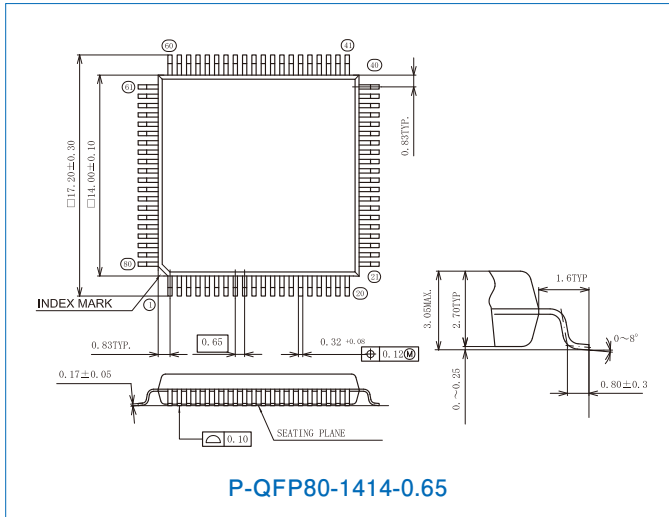
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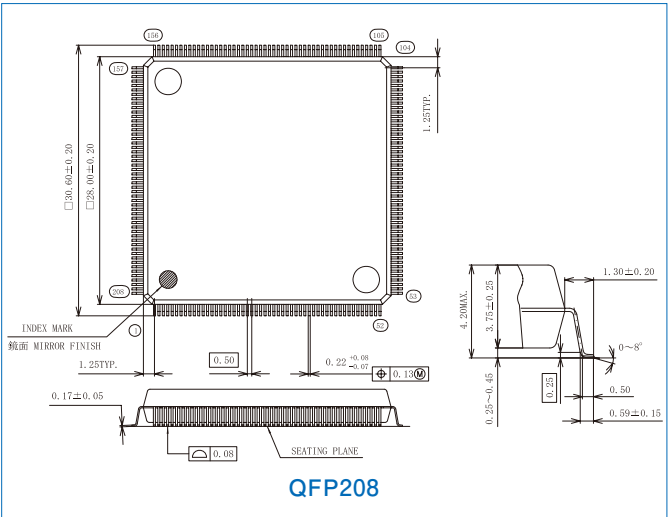
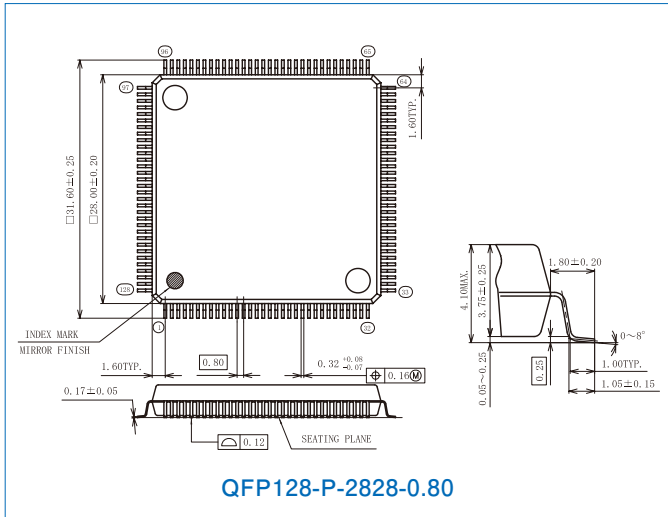
LSI Packages

Package size

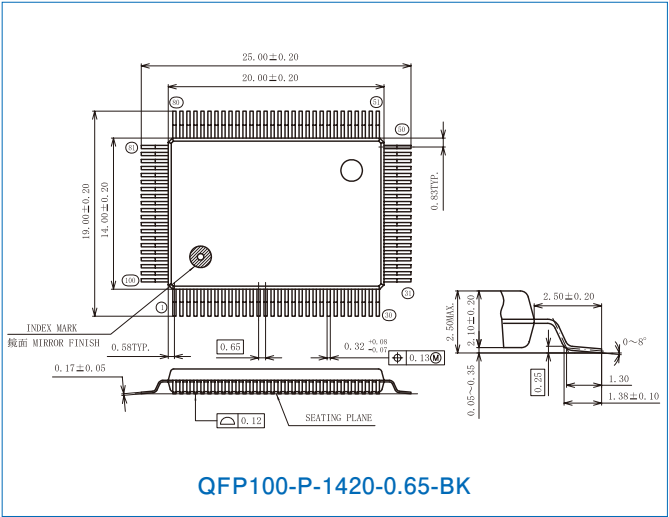
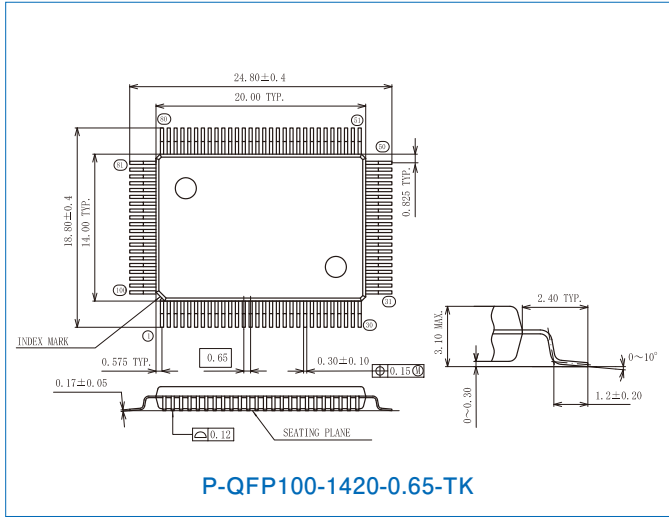
QFP



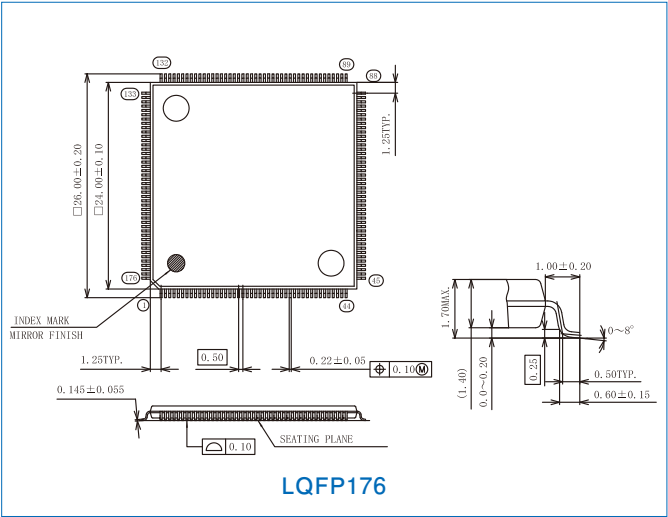
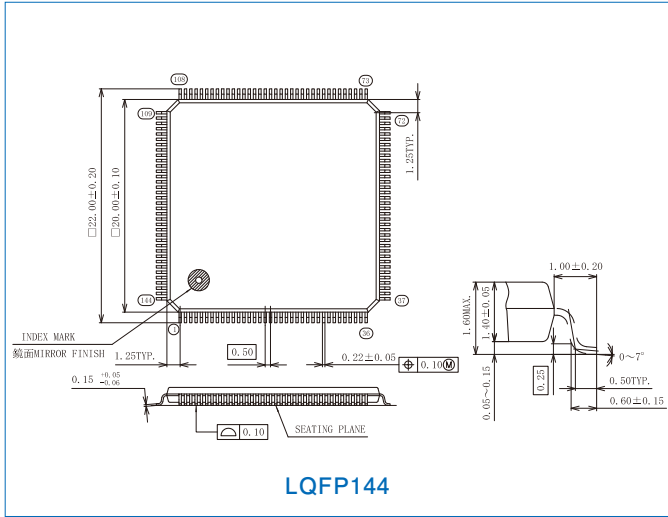
QFP



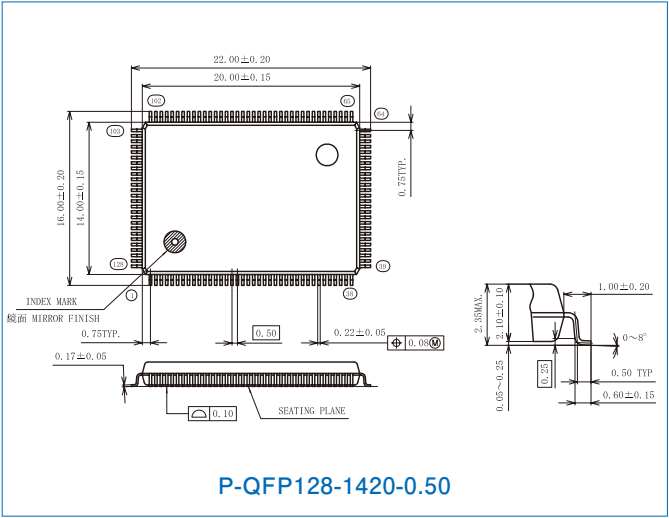
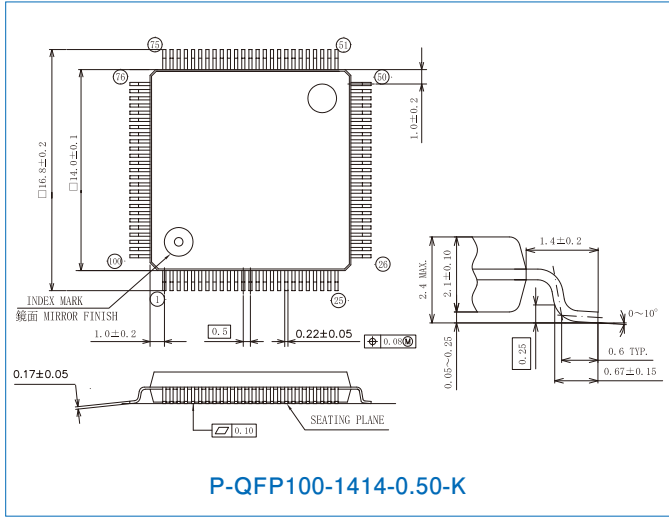
QFP



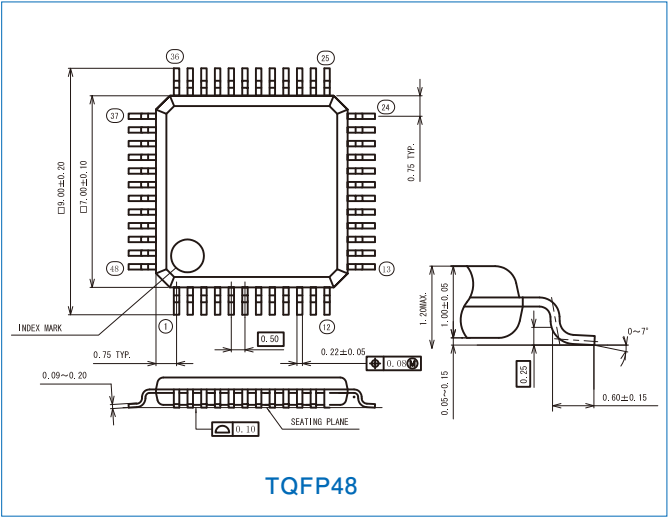
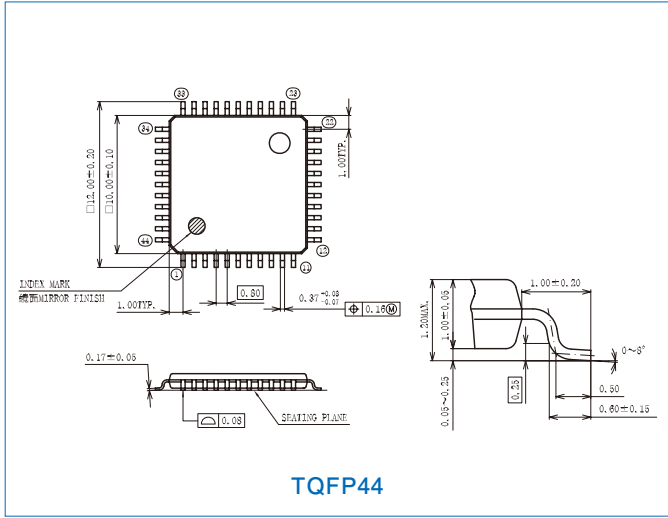
LQFP



QFP

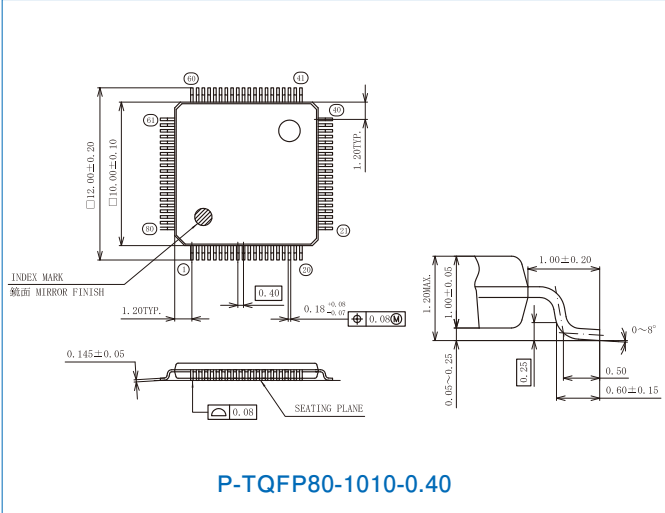
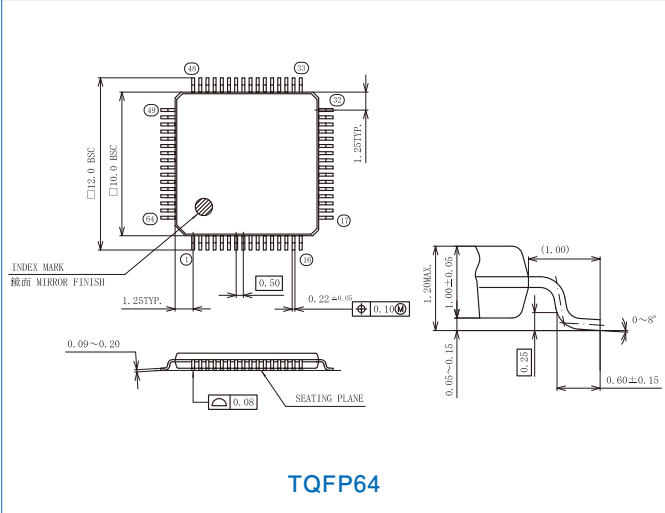


TQFP

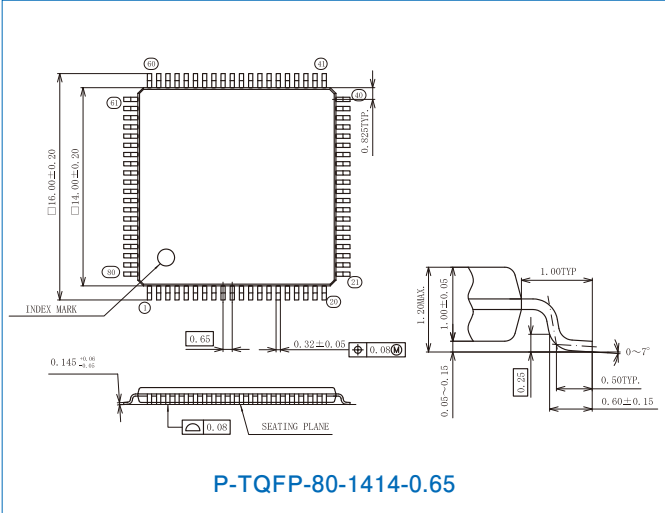
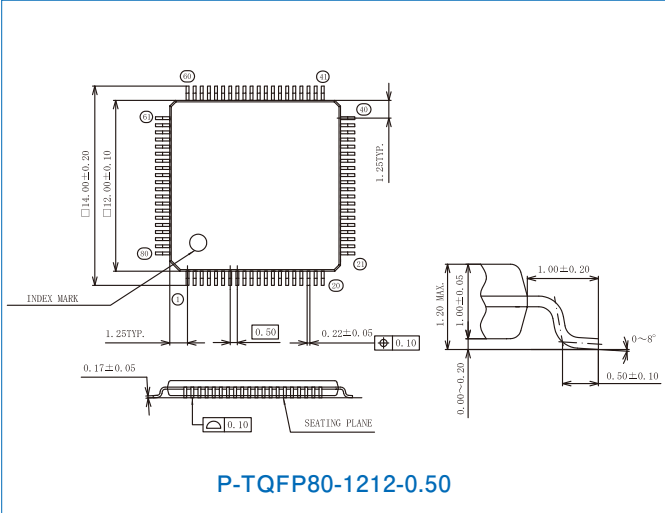


Package size

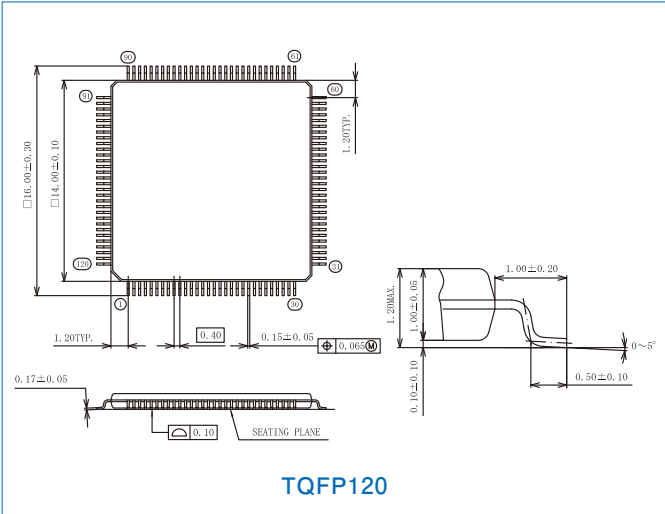
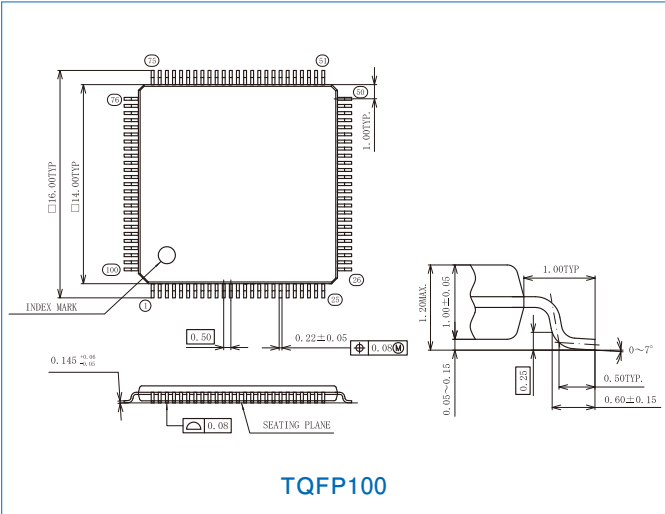
TQFP



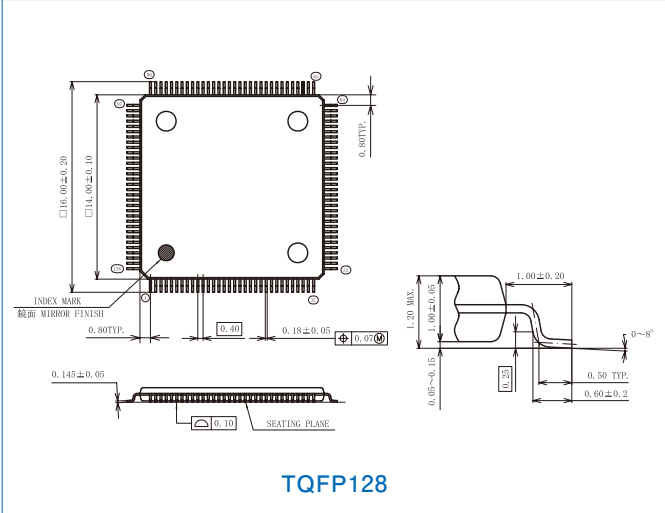
TQFP



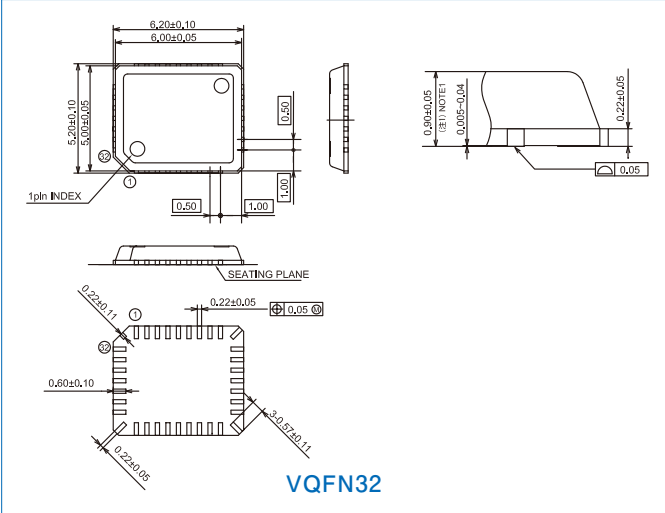
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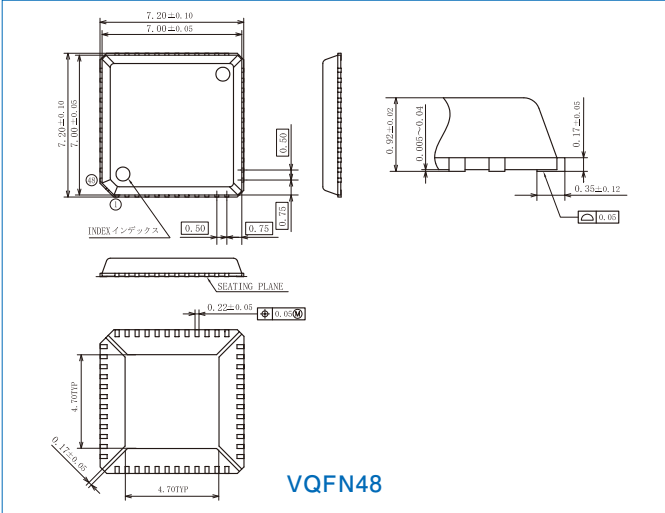
TQFP



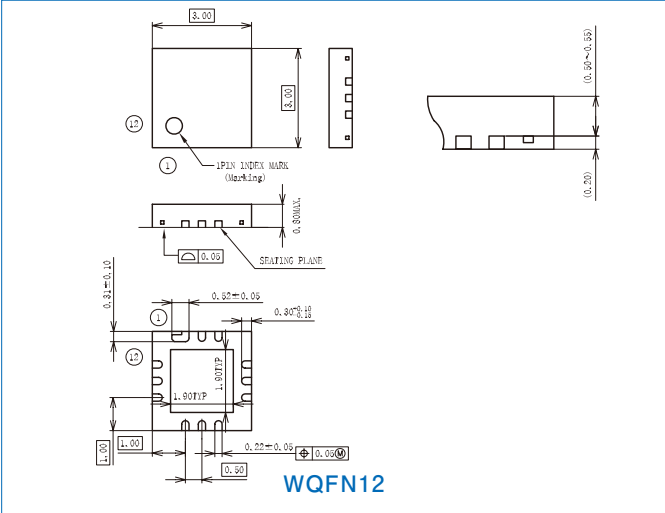
VQFN



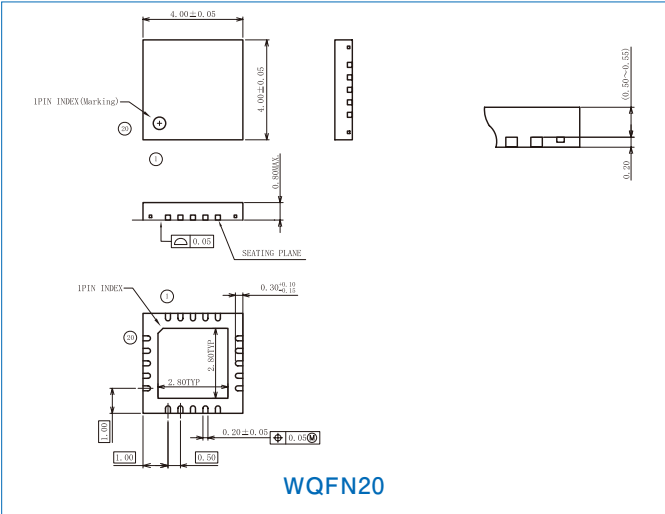
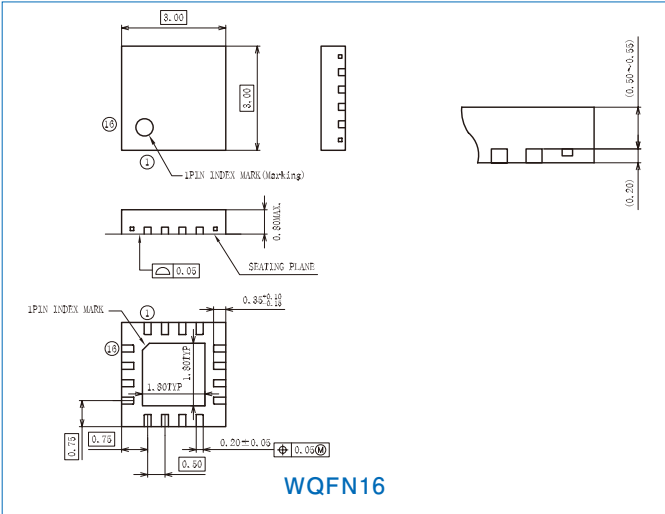
VQFN



WQFN

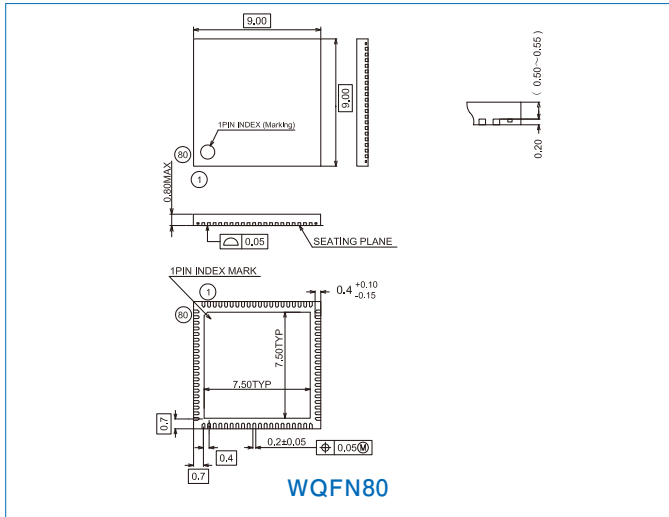


WQFN

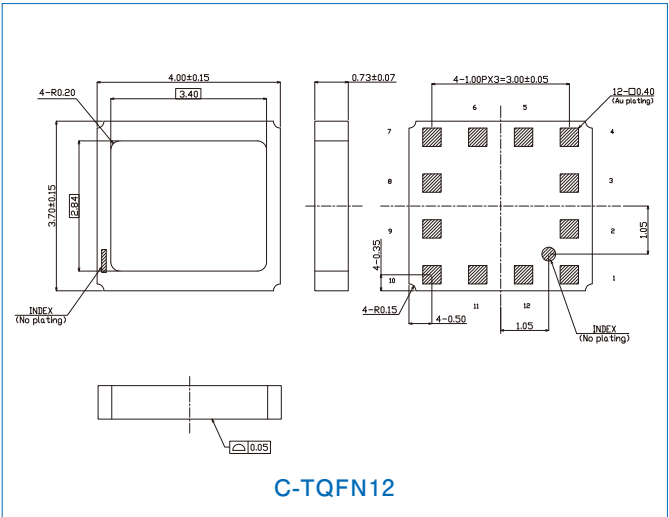


Package size

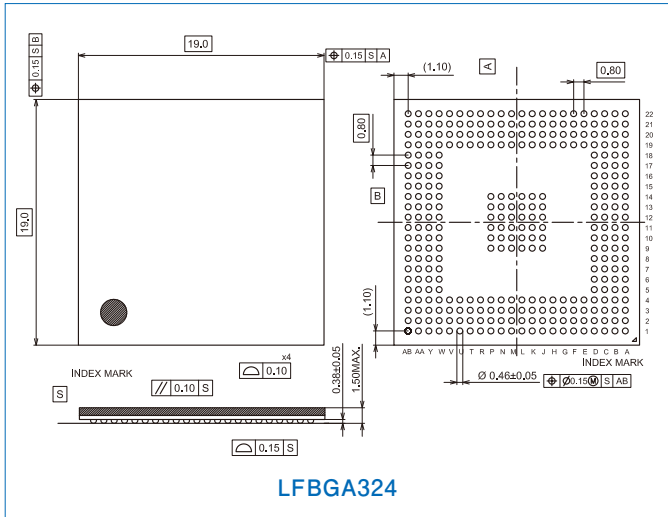
WQFN



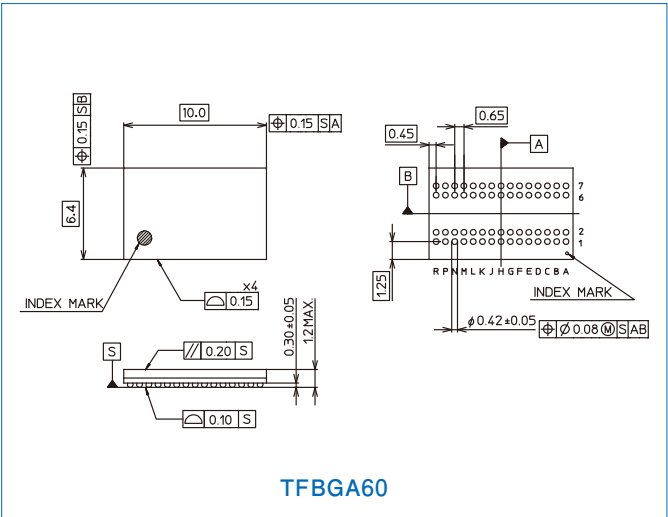
C-TQFN



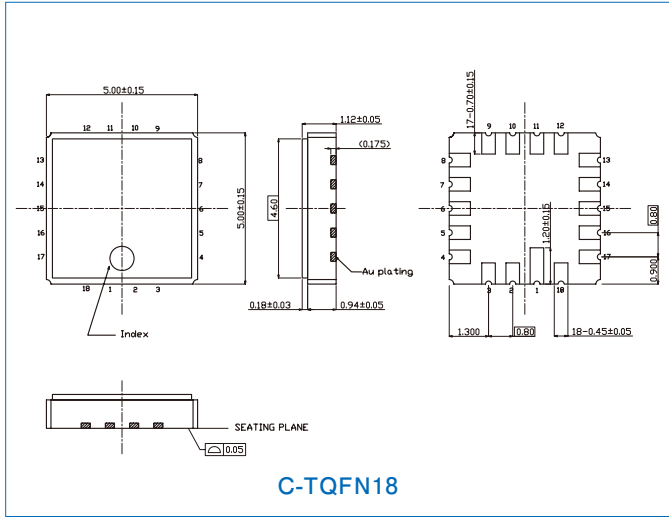
LFBGA



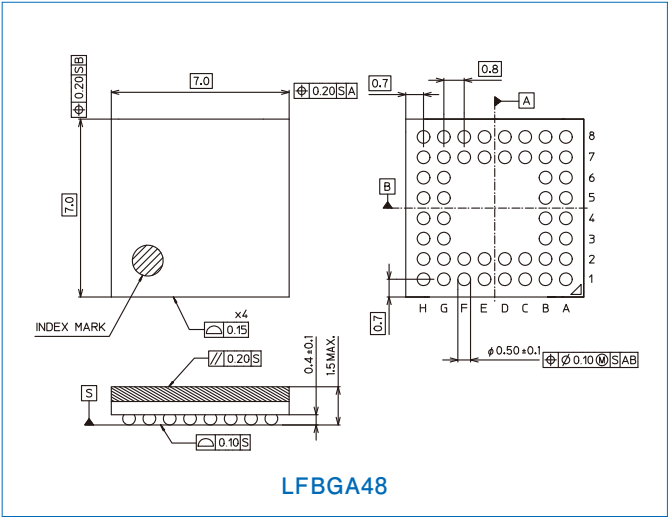
TFBGA



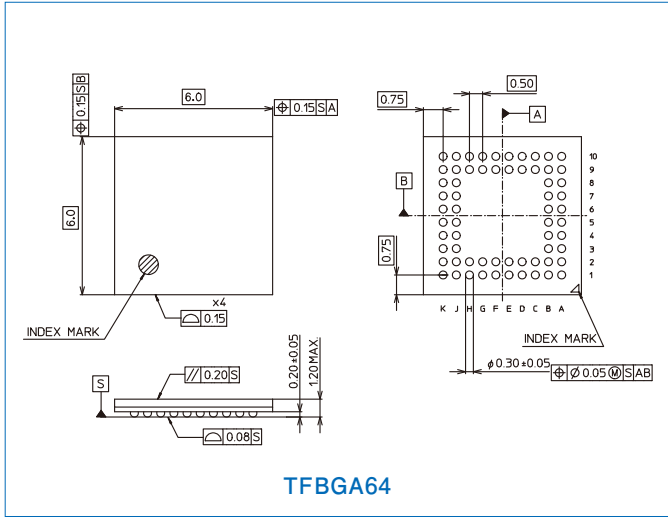
C-TQFN



LFBGA



TFBGA



Technical drawing of the TFPGA84 package showing top and side views with dimensions and tolerances.

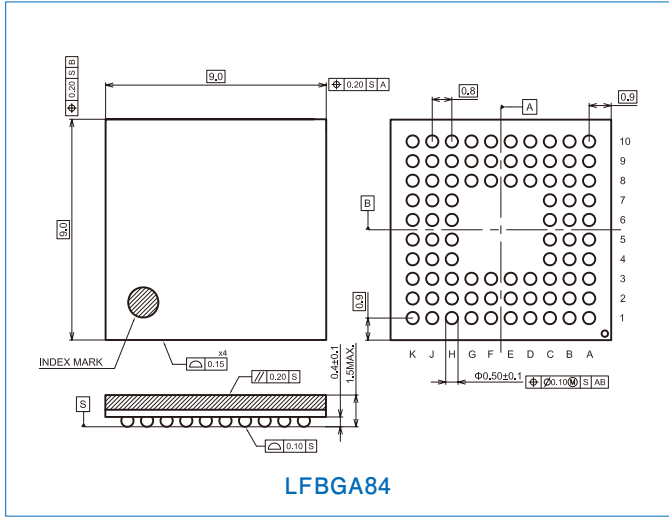
Top View Dimensions:

- Overall width: 8.0
- Overall height: 8.0
- Pin pitch (horizontal): 0.65
- Pin pitch (vertical): 0.65
- Pin 1 location: INDEX MARK
- Pin 10 location: INDEX MARK
- Pin 1 location: $\phi 0.15$ S A
- Pin 10 location: $\phi 0.15$ S B

Side View Dimensions:

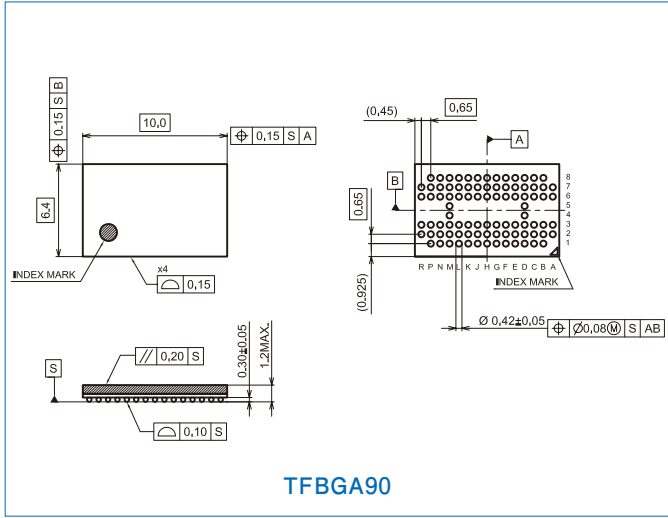
- Package height: 0.314 ± 0.05
- Pin height: 0.10
- Pin diameter: $\phi 0.42 \pm 0.05$
- Pin pitch (horizontal): 0.65
- Pin pitch (vertical): 0.65
- Pin 1 location: INDEX MARK
- Pin 10 location: INDEX MARK
- Pin 1 location: $\phi 0.15$ S A
- Pin 10 location: $\phi 0.15$ S B

LFBGA



The drawing illustrates the LFBGA144 package geometry. The top view shows a square body with 11.0 mm side lengths and a 0.15 mm pin pitch. The side view shows a maximum height of 0.4 mm and a 0.10 mm thickness. The detail view shows the pin array with 14 pins per side and a 0.7 mm pin height.

TFBGA



Technical drawing of the P-TFBA144 package showing top, side, and detail views with dimensions and tolerances.

Top View:

- Overall width: 11.0
- Overall height: 11.0
- Pin pitch: 0.15 S
- Pin diameter: $\varnothing 0.15 \pm 0.01$
- Pin 1 location: 0.70 from the right edge.
- Pin 14 location: 0.80 from the right edge.
- Pin 12 location: 0.70 from the left edge.
- Pin 11 location: 0.70 from the left edge.
- Pin 10 location: 0.70 from the left edge.
- Pin 9 location: 0.70 from the left edge.
- Pin 8 location: 0.70 from the left edge.
- Pin 7 location: 0.70 from the left edge.
- Pin 6 location: 0.70 from the left edge.
- Pin 5 location: 0.70 from the left edge.
- Pin 4 location: 0.70 from the left edge.
- Pin 3 location: 0.70 from the left edge.
- Pin 2 location: 0.70 from the left edge.
- Pin 1 location: 0.70 from the left edge.
- Pin 14 location: 0.80 from the right edge.
- Pin 13 location: 0.80 from the right edge.
- Pin 12 location: 0.80 from the right edge.
- Pin 11 location: 0.80 from the right edge.
- Pin 10 location: 0.80 from the right edge.
- Pin 9 location: 0.80 from the right edge.
- Pin 8 location: 0.80 from the right edge.
- Pin 7 location: 0.80 from the right edge.
- Pin 6 location: 0.80 from the right edge.
- Pin 5 location: 0.80 from the right edge.
- Pin 4 location: 0.80 from the right edge.
- Pin 3 location: 0.80 from the right edge.
- Pin 2 location: 0.80 from the right edge.
- Pin 1 location: 0.80 from the right edge.

Side View:

- Package height: 0.40 ± 0.10
- Lead height: 1.4 MAX.
- Lead thickness: 0.10 S
- Lead width: 0.20 S
- Lead angle: 45°
- Lead position: 0.10 S
- Lead diameter: $\varnothing 0.10 \pm 0.01$

Detail View:

- Pin diameter: $\varnothing 0.10 \pm 0.01$
- Pin pitch: 0.15 S
- Pin 1 location: 0.70 from the right edge.
- Pin 14 location: 0.80 from the right edge.
- Pin 12 location: 0.70 from the left edge.
- Pin 11 location: 0.70 from the left edge.
- Pin 10 location: 0.70 from the left edge.
- Pin 9 location: 0.70 from the left edge.
- Pin 8 location: 0.70 from the left edge.
- Pin 7 location: 0.70 from the left edge.
- Pin 6 location: 0.70 from the left edge.
- Pin 5 location: 0.70 from the left edge.
- Pin 4 location: 0.70 from the left edge.
- Pin 3 location: 0.70 from the left edge.
- Pin 2 location: 0.70 from the left edge.
- Pin 1 location: 0.70 from the left edge.
- Pin 14 location: 0.80 from the right edge.
- Pin 13 location: 0.80 from the right edge.
- Pin 12 location: 0.80 from the right edge.
- Pin 11 location: 0.80 from the right edge.
- Pin 10 location: 0.80 from the right edge.
- Pin 9 location: 0.80 from the right edge.
- Pin 8 location: 0.80 from the right edge.
- Pin 7 location: 0.80 from the right edge.
- Pin 6 location: 0.80 from the right edge.
- Pin 5 location: 0.80 from the right edge.
- Pin 4 location: 0.80 from the right edge.
- Pin 3 location: 0.80 from the right edge.
- Pin 2 location: 0.80 from the right edge.
- Pin 1 location: 0.80 from the right edge.

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