Discontinued Product

Preliminary

OKI Semiconductor

This version: Jan. 1998
Previous version: Mar. 1996

MSM64422/64424

Built-in 256/512-Bit EEPROM and LCD Driver 4-Bit Microcontroller

GENERAL DESCRIPTION

The MSM64422/64424 is a low power 4-bit microcontroller using OKI original CPU core nX-4/20. Integrated into a single chip are 64/128 nibbles of EEPROM, PWM generation circuit, 8-bit timer counter, 8-bit synchronous serial port, time base counter, low voltage detection circuit, watchdog timer, 4-bit input port, one or two input-output port(s). For the oscillator circuit, it is possible to choose from the crystal oscillation circuit or the 3-pin RC oscillation circuit (resistor R and capacitor C are externally connected).
Most suitable for small-sized security systems such as the key-less entry.

FEATURES

- **Operating range**

CPU operating voltage	: 2.5 to 5.5V (crystal oscillation mode)
	: 1.7 to 5.5V (RC oscillation mode)
EEPROM write voltage	: 2.2 to 5.5V
Operating frequencies	: f_{max} = 2.4 MHz (crystal oscillation mode)
	: f_{max} = 1.2 MHz (RC oscillation mode)
Operating temperature	: Ta=–40 to +85°C

- **Memory space**

<MSM64422>

ROM (program memory)	: 2048 bytes
RAM (data memory)	: 64 nibbles
EEPROM	: 64 nibbles (Number of data rewriting cycles to EEPROM: 10,000) (EEPROM data retaining years: 10 Years)

<MSM64424>

ROM (program memory)	: 4096 bytes
RAM (data memory)	: 128 nibbles
EEPROM	: 128 nibbles (Number of data rewriting cycles to EEPROM: 10,000) (EEPROM data retaining years: 10 Years)

- **Functions**

PWM generation circuit (each pulse width, and pulse period is set by a 4-bit counter)
8-bit timer counter (automatic reload timer)
8-bit synchronous serial port
Standby functions
Low voltage detection circuit built in.
Watchdog timer

- **Interrupt sources** : internal 5 sources
: external 1 source

- **I/O Port**

  Input port : 1 port × 4 bits
  Input-output port : 1 port × 4 bits (MSM64422)
  2 ports × 4 bits (MSM64424)
  (Two of them provide 10mA sink current when $V_{DD} \geq 2.5V$)

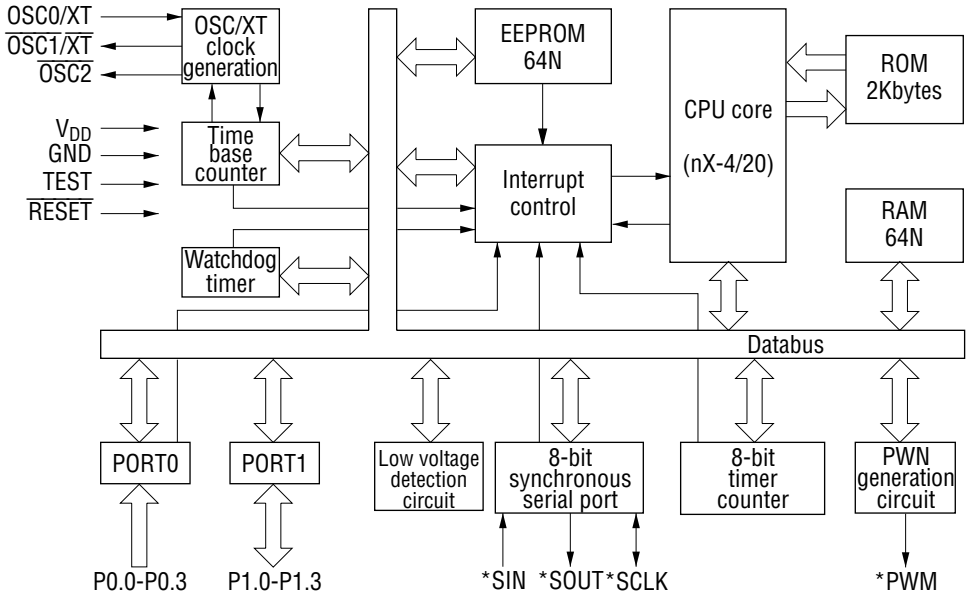
- **Package Options:**

  <MSM64422>
  16-pin plastic SOP (SOP16-P-300-1.27-K) (Product name: MSM64422-×××MS-K)
  <MSM64424>
  20-pin plastic SSOP (SSOP20-P-250-0.95-K) (Product name: MSM64424-×××MS-K)
  24-pin plastic SOP (SOP24-P-430-1.27-K) (Product name: MSM64424-×××GS-K)

- **MTP Version**

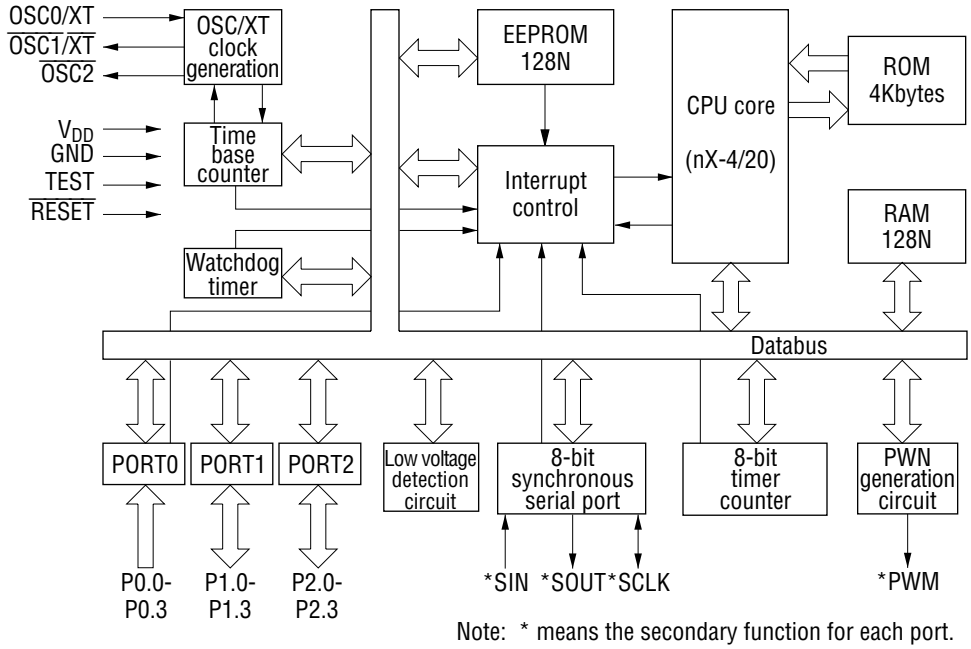
  The MTP version MSM64Q424 (24-pin plastic SOP only) using EEPROM in place of the internal program memory is available.
  <MSM64Q424>
  24-pin plastic SOP (SOP24-P-430-1.27-K) (Product name: MSM64Q424-N GS-K)

BLOCK DIAGRAM



Note: * means the secondary function for each port.

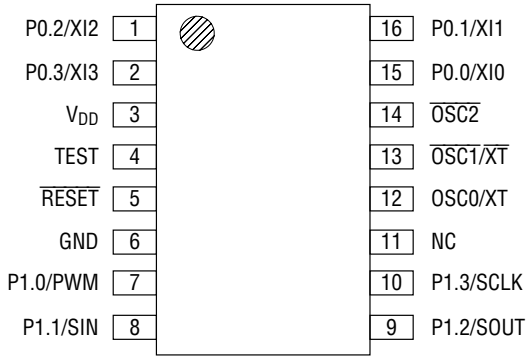
MSM64422 Block Diagram



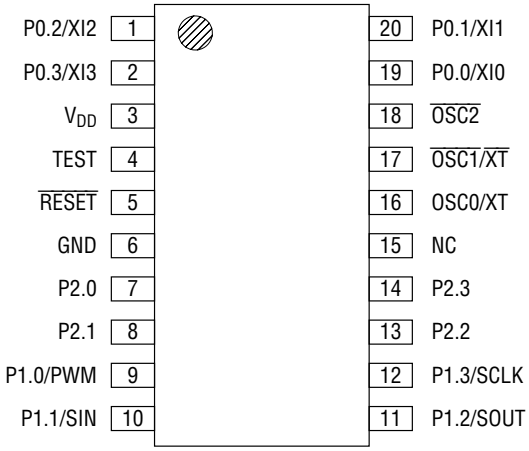
Note: * means the secondary function for each port.

MSM64424 Block Diagram

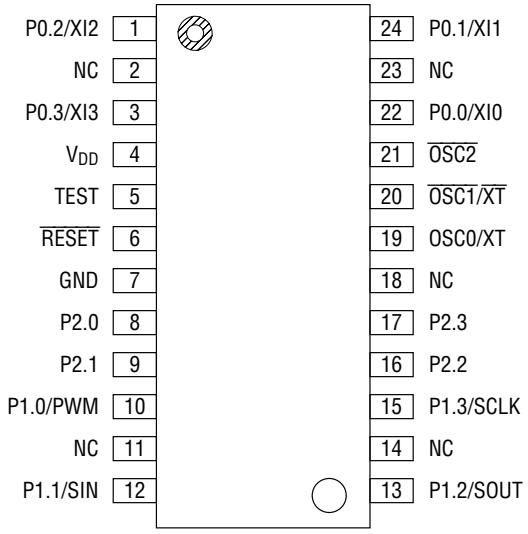
PIN CONFIGURATION (TOP VIEW)



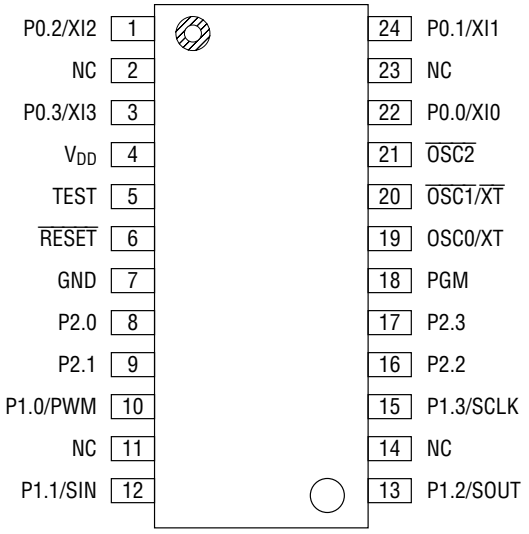
MSM64422 (16-Pin Plastic SOP)



MSM64424 (20-Pin Plastic SSOP)



MSM64424 (24-Pin Plastic SOP)



MSM64Q424 (24-Pin Plastic SOP)

NC: No-connection pin

PIN CONFIGURATIONS

Basic Functions

Function	Symbol	Type	Description
Power Supply	V_{DD}	—	Pin (5V)
	GND	—	Pin (0V)
Test	TEST	I	Input pin for IC test
Reset	$\overline{RESET}$	I	A system reset input pin. When this pin changes to "L" level from "H", the internal condition is initialized, and with the level change to "H" from "L", the command execution is started from the address 000H.
Port*	P0.0/XI0	I	4-bit input port (P0). Each bit can be configured to be a pull-down resistor input or high impedance input. As the secondary function, an external interrupt is allocated to each pin.
	P0.1/XI1	I	
	P0.2/XI2	I	
	P0.3/XI3	I	
	P1.0/PWM	I/O	4-bit input/output port (P1). At the time of input mode, each bit can be configured to be a pull-down resistor input or high impedance input. At the time of output mode, each bit can be configured to be an Nch open drain output or CMOS output. As the secondary function, it becomes an input-output pin that is related to serial port and PWM output.
	P1.1/SIN	I/O	
	P1.2/SOUT	I/O	
	P1.3/SCLK	I/O	
	P2.0	I/O	4-bit input-output port (P2). At the time of input mode, each bit can be configured to be a pull-down resistor input or high impedance input. At the time of output mode, each bit can be configured to be an Nch open drain output or CMOS output.
	P2.1	I/O	
	P2.2	I/O	
	P2.3	I/O	
Oscillation	OSC0/XT	I	Pins for connectiong an oscillator or RC (capacitor C, resistor R is externally connected).
	$\overline{OSC1}/\overline{XT}$	O	
	$\overline{OSC2}$	O	
PGM	PGM	I/O	Pin for setting a EEPROM write/read mode. The device enters a EEPROM write/read mode, when a logic "1" is input to this pin to release a reset. This pin is left open in a normal operating mode.

* The P2.0-2.3 pins are only built into MSM64424.

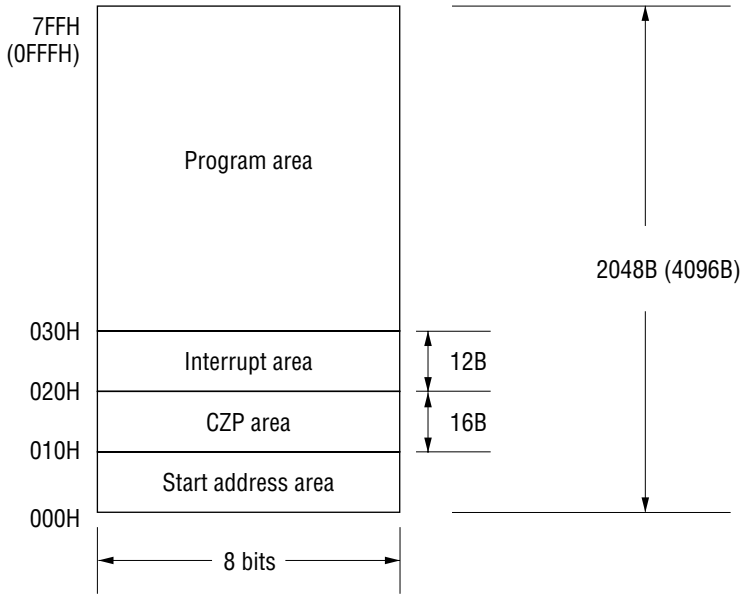
Secondary Functions

Functions	Symbol	Type	Description
External Interrupt	P0.0/XI0	I	This is an input pin for external interrupt. Interrupt by level change is possible. Each bit can be configured to be an interrupt disable or enable by the port 0 interrupt enable register.
	P0.1/XI1		
	P0.2/XI2		
	P0.3/XI3		
PWM	P1.0/PWM	O	PWM output waveform pin
Serial port	P1.1/SIN	I	Receive data input pin of the serial port.
	P1.2/SOUT	O	Transmit data output pin of the serial port.
	P1.3/SCLK	I/O	Synchronous clock input-output pin for the serial port.

MEMORY MAPS

Program Memory

The program memory is a memory area for the program data, the interrupt area, the CZP area, and the start address area.
The data length is 8 bits. For the MSM64422 addresses 0 to 2047 are assigned to the program memory. For the MSM64424 address 0 to 4095 are assigned to the program memory.



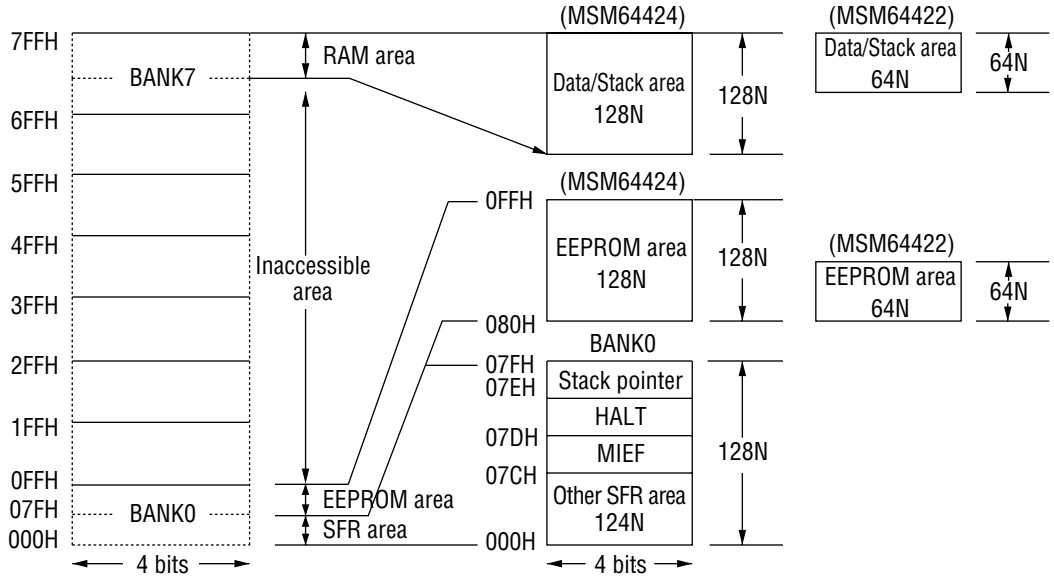
Note : "B" means data length of 8 bits.

Program Memory Address Space

The address 000H is the instruction execution start address after system reset. The CZP area from address 010H to address 01FH is the start address for the CZP subroutine of 1-byte call instruction and a maximum of eight commands can be held. The interrupt address from address 020H to 02FH is assigned the start address of interrupt subroutines.

Data Memory

RAM, EEPROM and special function registers (SFRs) are assigned to the Data Memory Address Space. These Memory are located in a different address space from program memory.
The data length of the Data Memory is 4 bits (1 nibble). The Data Memory uses two banks (256 nibbles/bank): one for the SFR and EEPROM areas using part of the bank 0 and the other for the RAM area, containing the stack in the bank 7.



Note : "N" means data length of 4 bits.

Data Memory Address Space

The Data Memory Address Space configuration is shown in the figure alove.
The stack area is a data save area for subroutines and interrupts from the address 7FFH toward the lower-order addresses (64N max. for MSM64422, 128N max. for MSM64424) by subroutine call instruction.
For the bank 0, the special function register area from the addresses from 000H to 07FH and 64 nibble EEPROM area from the addresses 080H to 0BFH for MSM64422 or 128 nibble EEPROM area from the addresses 080H to 0FFH for MSM64424 are assigned.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Rating	Unit
Power Supply Voltage	V_{DD}	Ta=25°C	–0.3 to 6	V
Interrupt Voltage	V_{IN}		–0.3 to V_{DD}+0.3	
Output Voltage	V_{OUT}		–0.3 to V_{DD}+0.3	
Storage Temperature	T_{STG}	—	–55 to +150	°C

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Range	Unit
Power Supply Voltage 1 (Crystal oscillation mode)	V_{DD}	2.5 to 5.5	V
Power Supply Voltage 2 (RC oscillation mode)		1.7 to 5.5	
Power Supply Voltage 3 (EEPROM write mode)		2.2 to 5.5	
Operating Frequency 1 (Crystal oscillation mode)	f_{OSC}	0.5 to 2.4	MHz
Operating Frequency 2 (RC oscillation mode)		0.1 to 1.2	MHz
RC Oscillation Resistance	R_{OSC}		kΩ
RC Oscillation Capacitance	C_{OSC}		pF
RC Oscillation Time Constant	C*R		—
Operating Temperature	Ta	–40 to +85	°C

ELECTRICAL CHARACTERISTICS

(Ta=–40 to +85°C)

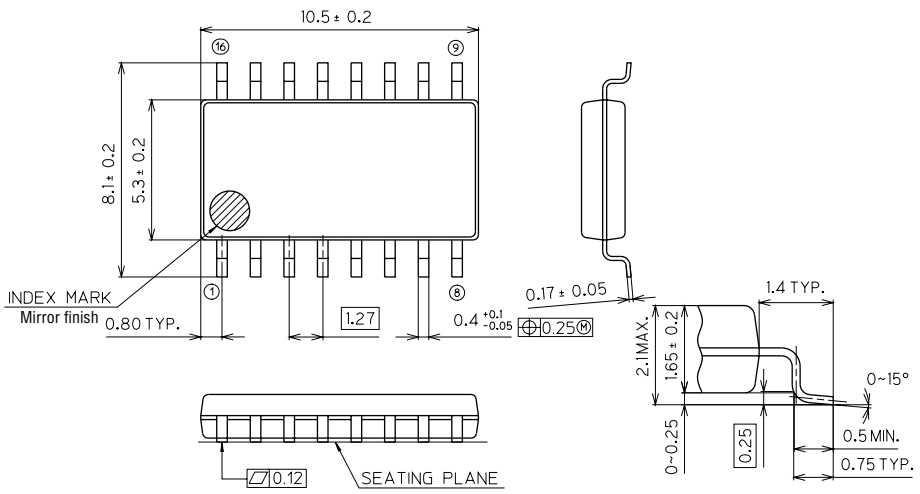
Parameter	Symbol	Condition	Min.	Max.	Unit
Input Voltage	V_{IH}	—	$0.7 \times V_{DD}$	—	V
	V_{IL}	—	—	$0.2 \times V_{DD}$	
Input Current 1 [*1] (P0.0 to P0.3) (P1.0 to P1.3) (P2.0 to P2.3)	I_{IH1}	$V_{IH}=V_{DD}$	—	1	µA
	I_{IL1}	V_{IL}=GND	–1	—	
Input Current 2 ($\overline{RESET}$)	I_{IH2}	$V_{IH}=V_{DD}$	—	1	µA
	I_{IL2}	V_{IL}=GND	– 200	– 50	
Pull-down Resistance (P0.0 to P0.3) (P1.0 to P1.3) (P2.0 to P2.3)	R_{ON}	V_{DD}=2.5V V_I=2.5V	50	200	kΩ
Output Current 1 (P1.0, P1.1)	I_{OH1}	V_{DD}=2.5V $V_O=V_{DD}$–0.5V	—	– 0.5	mA
	I_{OL1}	V_{DD}=2.5V, V_O=1.0V	10	—	
Output Current 2 (P1.2, P1.3) (P2.0 to P2.3)	I_{OH2}	V_{DD}=2.5V $V_O=V_{DD}$–0.5V	—	– 0.5	mA
	I_{OL2}	V_{DD}=2.5V, V_O=0.5V	0.5	—	
Static Current Consumption	I_{DDS}	[*2] V_{DD}=5.5V, f_{OSC}=0Hz	—	0.3	µA
		V_{DD}=5.5V, f_{OSC}=0Hz	—	1.0	
Dynamic Current Consumption	I_{DD1}	CPU in operation; V_{DD}=5.0V, f_{OSC}=500kHz	—	2.0	mA
	I_{DD2}	During write to EEPROM; V_{DD}=5.0V, f_{OSC}=500kHz	—	4.0	mA

*1 No pull-down resistor during input state.
*2 Ta=–40 to +50°C

PACKAGE DIMENSIONS

(Unit : mm)

SOP16-P-300-1.27-K



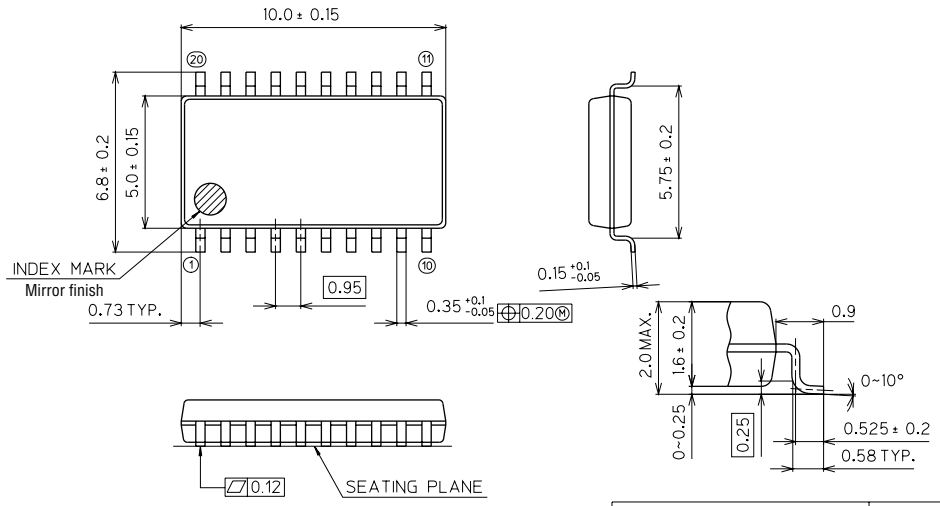
Package material	Epoxy resin
Lead frame material	Cu alloy
Pin treatment	Solder plating
Solder plate thickness	5 μm or more
Package weight (g)	0.21 TYP.

Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, SOJ, QFJ (PLCC), SHP and BGA are surface mount type packages, which are very susceptible to heat in reflow mounting and humidity absorbed in storage.
Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

(Unit : mm)

SSOP20-P-250-0.95-K



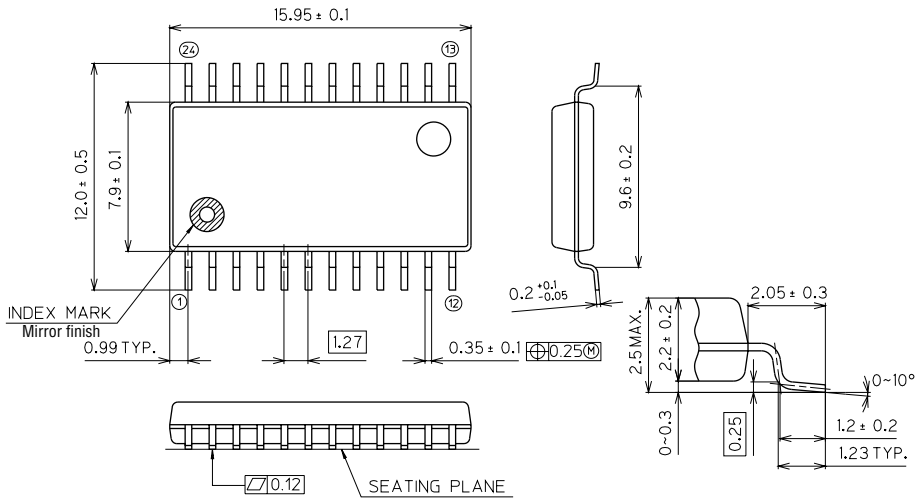
Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating
Solder plate thickness	5 μm or more
Package weight (g)	0.18 TYP.

Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, SOJ, QFJ (PLCC), SHP and BGA are surface mount type packages, which are very susceptible to heat in reflow mounting and humidity absorbed in storage.
Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

(Unit : mm)

SOP24-P-430-1.27-K



Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating
Solder plate thickness	5 μm or more
Package weight (g)	0.58 TYP.

Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, SOJ, QFJ (PLCC), SHP and BGA are surface mount type packages, which are very susceptible to heat in reflow mounting and humidity absorbed in storage.
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