PEDL66573-02

OKI Semiconductor

This version: Aug. 1999
Previous version: Jun.1999

MSM66573 Family

Preliminary

16-Bit Microcontroller

GENERAL DESCRIPTION

The MSM66573 family of highly functional CMOS 16-bit single chip microcontrollers utilize the nX-8/500S, Oki's proprietary CPU core.

A wide variety of internal multi-functioned timers provide timer functions such as compare out, capture, event counter, auto reload, and PWM, and can be used for periodic and timed measurements. In addition to the main clock and clock gear functions, there is a sub clock (32.768 kHz) that is suitable for low power applications. A three channel serial interface and a high-speed bus interface that has separate address and data buses and does not require external address latches are provided as interfaces to external devices.

With a 16-bit CPU core that enables high-speed 16-bit arithmetic computations and a variety of bit processing functions, this general-purpose microcontroller is optimally suited for Digital Audio devices such as a Mini-Disc and an MP3 player.

The flash ROM version (MSM66Q573L) programmable with a single 2.4 V (minimum) power supply and flash ROM version (MSM66Q573) programmable with a single 5 V power supply are also included in the family. These versions are easily adaptable to sudden specification changes and to new product versions.

APPLICATIONS

Digital Audio Control Systems
PC peripheral Control Systems
Office Electronics Control Systems

ORDERING INFORMATION

Order Code or Product Name	Package	Remark
MSM66573L-TB	100-pin plastic TQFP (TQFP 100-P-1414-0.50-K)	Low voltage version (2.4 to 3.6 V)
MSM66573-TB		5V mask ROM version (4.5 to 5.5 V)
MSM66Q573L-TB		MSM66573L flash ROM version
MSM66Q573-TB		MSM66573 flash ROM version
MSM66P573-TB		MSM66573 OTP ROM version (2.7 to 5.5 V)

FEATURES

Name	MSM66573L	MSM66573
Operating temperature	–30°C to +70°C	
Power supply voltage/ maximum frequency	V_{DD}=2.4 to 3.6 V/f=14 MHz	V_{DD}=4.5 to 5.5 V/f=30 MHz
Minimum instruction execution time	143 ns at 14 MHz (2.4 to 3.6 V)	67ns at 30 MHz (4.5 to 5.5 V)
	61μs at 32.768 kHz (2.4 to 3.6/4.5 to 5.5 V)	
Internal ROM size (max. external)	64 KB (1 MB)	
Internal RAM size (max. external)	4 KB (1 MB)	
I/Oports	75 I/O pins (with programmable pull-up resistors) 8 input-only pins	
Timers	16-bit free running timer × 1ch Compare out/capture input × 2ch	
	16-bit timer (auto reload/timer out) × 1ch 8-bit auto reload timer × 1ch	
	8-bit auto reload timer × 3ch (also fumctions as serial communication baud rate generator)	
	Watchdog timer (also functions as 8-bit auto reload timer)	
	Watch timer (real-time counter) × 1ch	
	8-bit PWM × 4ch (can also be used as 16-bit PWM × 2ch)	
Serial port	UART × 1ch Synchronous × 1ch UART/ Synchronous × 1ch	
A/D converter	10-bit A/D converter, 8-ch multiplexer × 1ch	
External interrupt	Non-maskable × 1ch Maskable × 6ch	
Interrrupt priority	3 levels	
Others	Separate address and data busses	
	Bus release function	
	Dual clocks	
OTP ROM version	MSM66P573 (Max. f = 24 MHz)	
Flash ROM version	MSM66Q573L	MSM66Q573

SPECIAL FEATURES

1. High-performance CPU
The family includes the high-performance CPU, powerful bit manipulation instruction set, full symmetrical addressing mode, and ROM WINDOW function, and also provides the best optimized C compiler support.

2. A variety of power saving modes
Attaching a 32.768-kHz crystal produces a real-time clock signal from the internal clock timer. Use of a single clock in place of dual clocks is possible. Switching the CPU clock to this clock signal, 1/2 × main clock, or 1/4 × main clock, then produces operation in a low power consumption mode. The clock gear function allows a 1/2 × or 1/4 × main clock to be selected for the CPU operating clock.
The family provides a wide range of standby control functions. In addition to the usual STOP mode that stops the oscillator, there are the quick restart STOP mode that shuts down the CPU and peripherals but leaves the oscillator running, and the HALT mode that shuts down the CPU but leaves the peripherals running.

3. MSM66Q573L and MSM66Q573 with flash memory programmable with single power supply
In addition to the regular mask ROM version, the family includes these versions with 64KB of flash memory that can be programmed using a single power supply. For the MSM66Q573L, an internal booster circuit derives the necessary program voltage from the device's low (2.4 V min) power supply, and the program voltage for the MSM66Q573 is provided with a single 5 V power supply.

4. Multifunction, high-precision analog-to-digital converter
The family includes a high-precision 10-bit analog-to-digital converter with eight channels and is ideal for such analog control functions as processing audio signals, processing sensor inputs, detecting key switch states, and controlling battery use in portable equipment. Each channel has its own result register readily accessible from the software. In addition to single-channel conversions, there is also a scan function offering automatic conversion from the user's choice of starting channel through to the last channel.

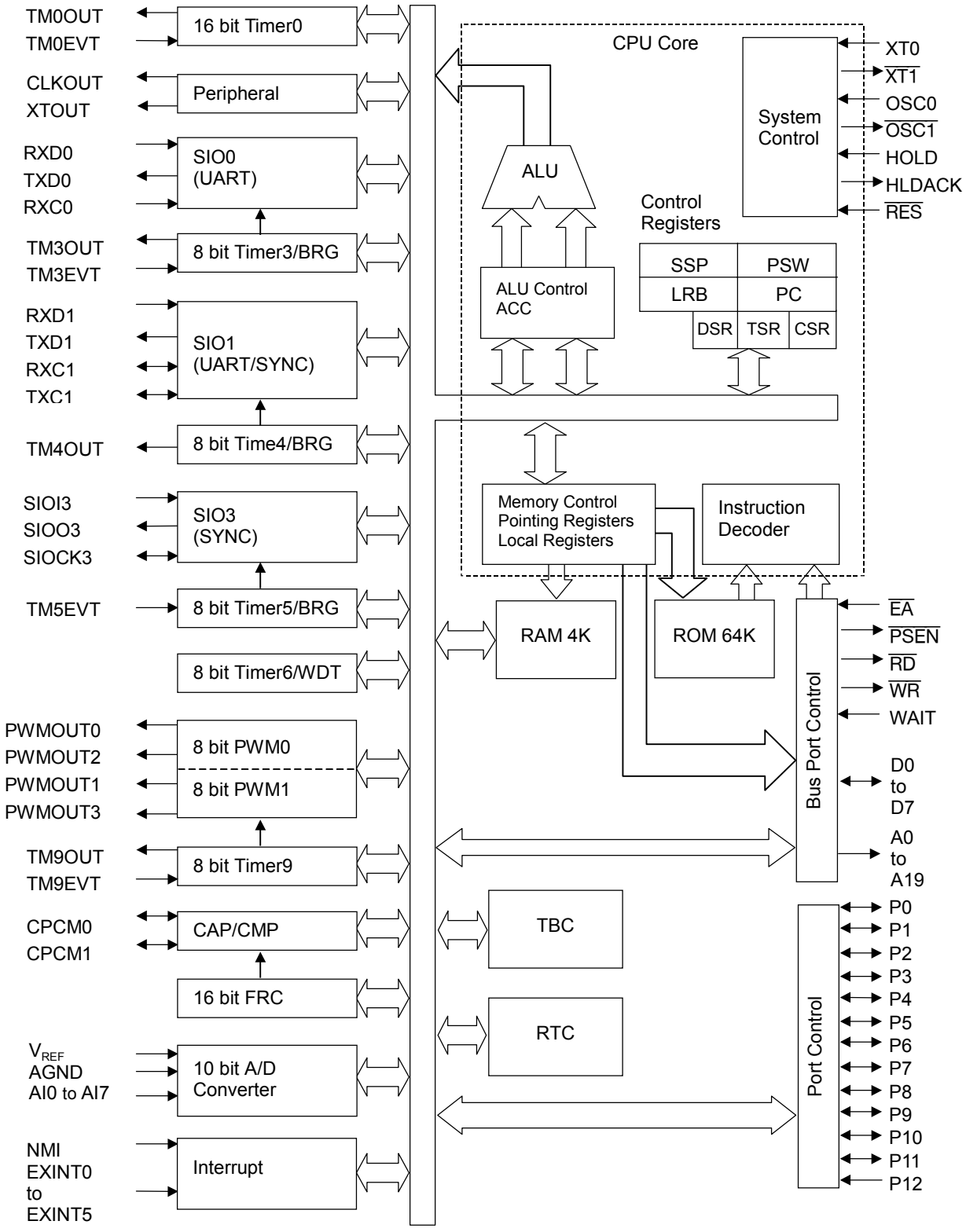
5. Multifunction PWM
The family supports both 8- and 16-bit PWM operation. Choosing between the time-base counter output or overflow from an 8-bit auto-reload timer as the PWM counter clock source provides a wide number of possibilities over a broad frequency range. The 16-bit PWM configuration supports a high-speed synchronization mode that generates a high-precision output signal with less ripple suitable for digital-to-analog control applications.

6. Programmable pull-up resistors
Building the pull-up resistors into the chip contributes to overall design compactness. Making them programmable on a per-bit basis allows complete flexibility in circuit board layout and system design. These programmable pull-up resistors are available for all I/O pins not already assigned specific functions (such as the oscillator connection pins).

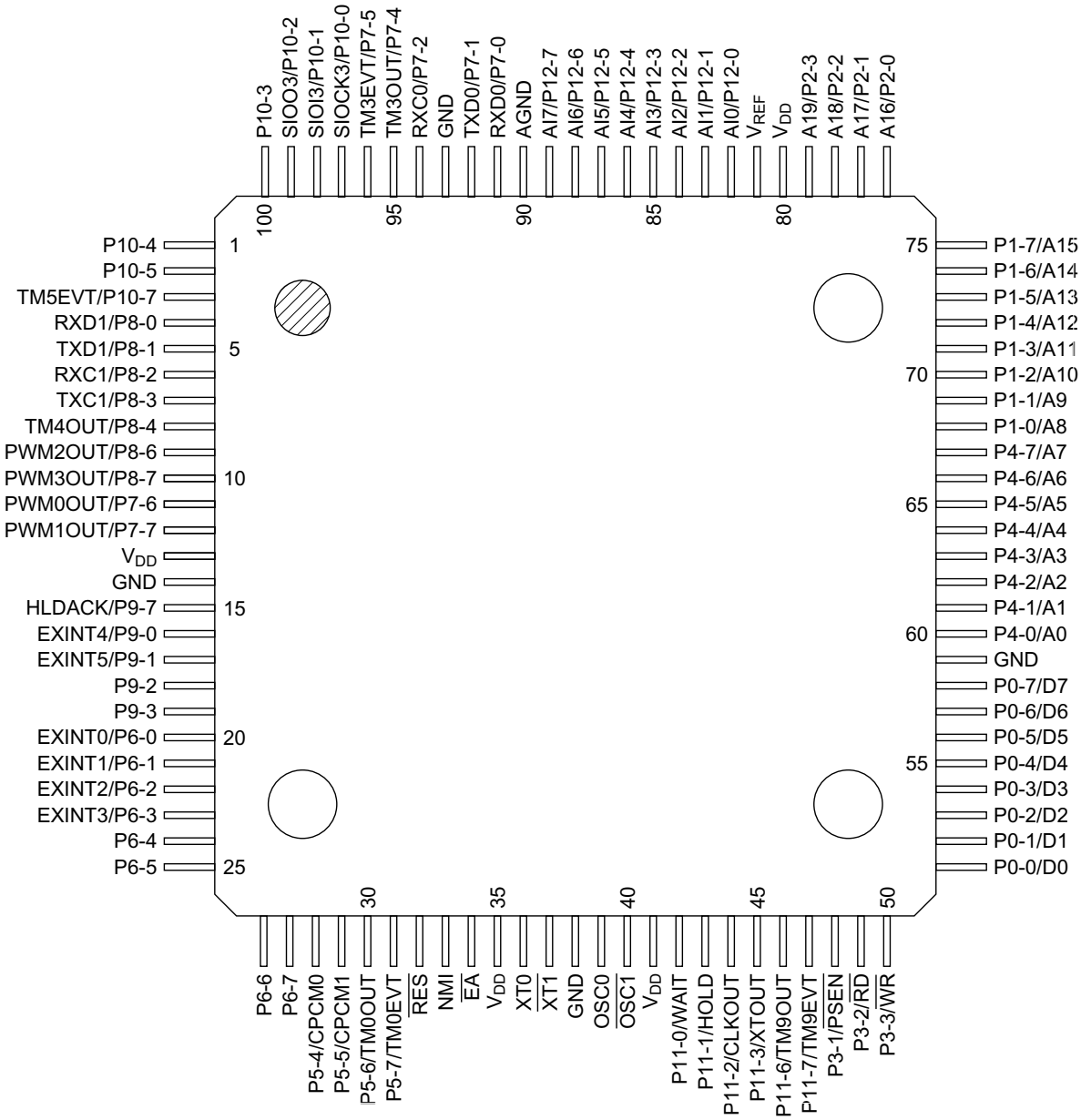
7. High-speed bus interface
The interface to external devices uses separate data and address buses. This arrangement permits rapid bus access for controlling the system from the microcontroller.

8. Wide support for external interrupts
There are a total of seven interrupt channels for use in communicating with external devices: six for maskable interrupts and one for non-maskable interrupts.

BLOCK DIAGRAM

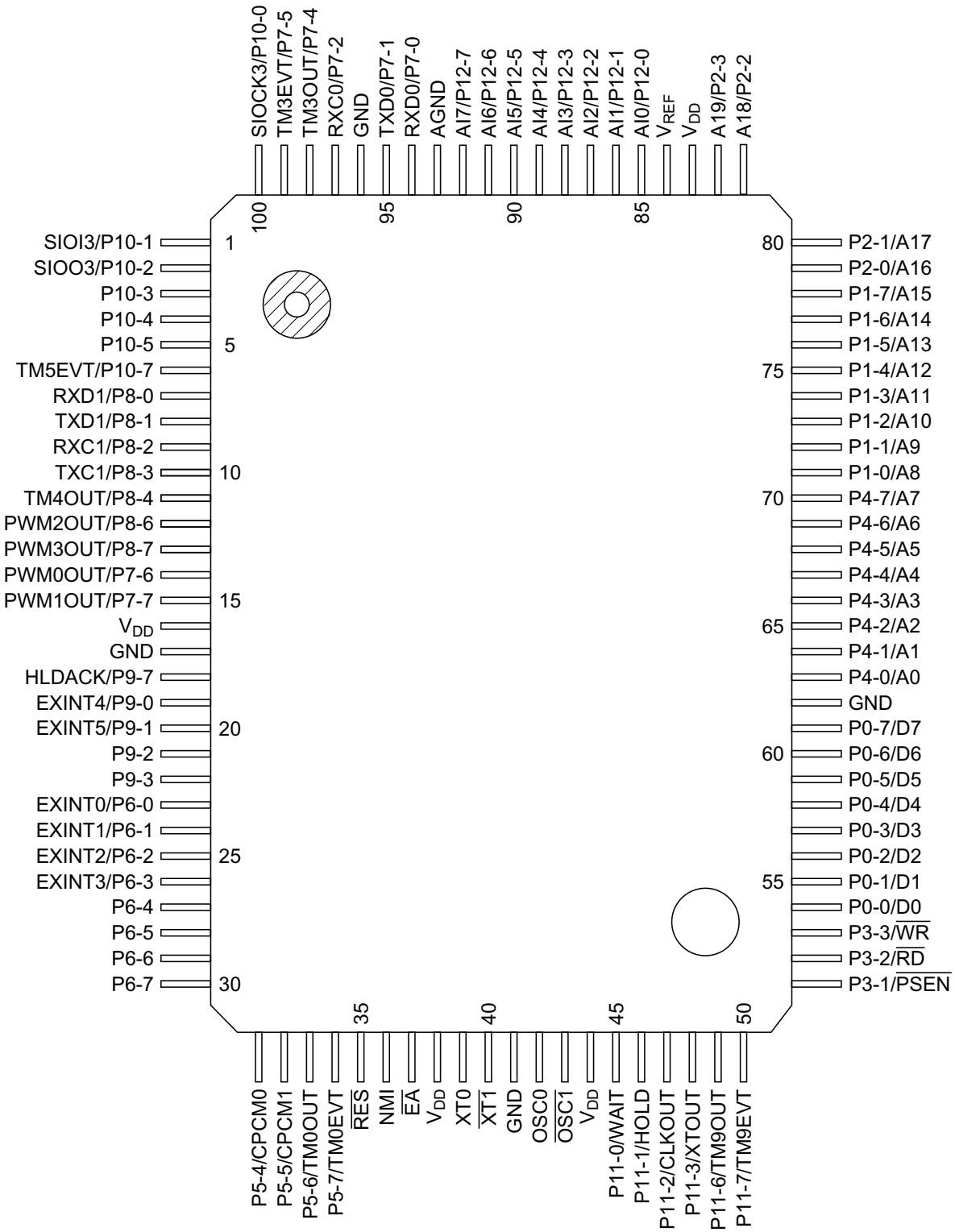


PIN CONFIGURATION (TOP VIEW)



100-pin Plastic TQFP

PIN CONFIGURATION (TOP VIEW) (continued)



100-pin Plastic QFP

PIN DESCRIPTIONS

In the Type column, "I" indicates an input pin, "O" indicates an output pin, and "I/O" indicates an I/O pin.

Classification	Symbol	Function			
		Type	Primary function	Type	Secondary function
Port	P0_0/D0 to P0_7/D7	I/O	8-bit I/O port 10 mA sink capability Pull-up resistors can be specified for each individual bit	I/O	External memory access Data I/O port
	P1_0/A8 to P1_7/A15	I/O	8-bit I/O port Pull-up resistors can be specified for each individual bit	O	External memory access Address output port
	P2_0/A16 to P2_3/A19	I/O	4-bit I/O port Pull-up resistors can be specified for each individual bit	O	External memory access Address output port
	P3_1/$\overline{\text{PSEN}}$	I/O	3-bit I/O port 10 mA sink capability Pull-up resistors can be specified for each individual bit	O	External program memory access Read strobe output pin
	P3_2/$\overline{\text{RD}}$			O	External memory access Read strobe output pin
	P3_3/$\overline{\text{WR}}$			O	External memory access Write strobe output pin
	P4_0/A0 to P4_7/A7	I/O	8-bit I/O port Pull-up resistors can be specified for each individual bit	O	External memory access Address output port
	P5_4/CPCM0	I/O	4-bit I/O port Pull-up resistors can be specified for each individual bit	I/O	Capture 0 input / Compare 0 output pin
	P5_5/CPCM1			I/O	Capture 1 input / Compare 1 output pin
	P5_6/TM0OUT			O	Timer 0 timer output pin
	P5_7/TM0EVT			I	Timer 0 external event input pin
	P6_0/EXINT0	I/O	8-bit I/O port Pull-up resistors can be specified for each individual bit	I	External interrupt 0 input pin
	P6_1/EXINT1			I	External interrupt 1 input pin
	P6_2/EXINT2			I	External interrupt 2 input pin
	P6_3/EXINT3			I	External interrupt 3 input pin
	P6_4 to P6_7			—	None

Classification	Symbol	Function			
		Type	Primary function	Type	Secondary function
Port	P7_0/RXD0	I/O	7-bit I/O port Pull-up resistors can be specified for each individual bit	I	SIO0 receive data input pin
	P7_1/TXD0			O	SIO0 transmit data output pin
	P7_2/RXC0			I	SIO0 external clock input pin
	P7_4/TM3OUT			O	Timer 3 timer output pin
	P7_5/TM3EVT			I	Timer 3 external event input pin
	P7_6/PWM0OUT			O	PWM0 output pin
	P7_7/PWM1OUT			O	PWM1 output pin
	P8_0/RXD1	I/O	7-bit I/O port Pull-up resistors can be specified for each individual bit	I	SIO1 receive data input pin
	P8_1/TXD1			O	SIO1 transmit data output pin
	P8_2/RXC1			I/O	SIO1 receive clock I/O pin
	P8_3/TXC1			I/O	SIO1 transmit clock I/O pin
	P8_4/TM4OUT			O	Timer 4 timer output pin
	P8_6/PWM2OUT			O	PWM2 output pin
	P8_7/PWM3OUT			O	PWM3 output pin
	P9_0/EXINT4	I/O	5-bit I/O port Pull-up resistors can be specified for each individual bit	I	External Interrupt 4 input pin
	P9_1/EXINT5			I	External Interrupt 5 input pin
	P9_2, P9_3			—	None
	P9_7/HLDACK			O	HOLD mode output pin
	P10_0/SIOCK3	I/O	7-bit I/O port Pull-up resistors can be specified for each individual bit	I/O	SIO3 transmit-receive clock I/O pin
	P10_1/SIOCI3			I	SIO3 receive data input pin
	P10_2/SIOO3			O	SIO3 transmit data output pin
	P10_3 to P10_5			—	None
	P10_7/TM5EVT			I	Timer 5 external event input pin
	P11_0/WAIT	I/O	6-bit I/O port 10 mA sink capability Pull-up resistors can be specified for each individual bit	I	External data memory access wait input pin
	P11_1/HOLD			I	HOLD mode request input pin
	P11_2/CLKOUT			O	Main clock pulse output pin
	P11_3/XTOUT			O	Sub clock pulse output pin
	P11_6/TM9OUT			O	Timer 9 timer output pin
	P11_7/TM9EVT			I	Timer 9 external event input pin
	P12_0/AI0 to P12_7/AI7	I	8-bit input port	I	A/D converter analog input port

Classification	Symbol	Type	Function
Power supply	V_{DD}	I	Power supply pin Connect all V_{DD} pins to the power supply.
	GND	I	GND pin Connect all GND pins to GND.
	V_{REF}	I	Analog reference voltage pin
	AGND	I	Analog GND pin
Oscillation	XT0	I	Sub clock oscillation input pin Connect to a crystal oscillator of f = 32.768 kHz.
	$\overline{XT1}$	O	Sub clock oscillation output pin Connect to a crystal oscillator of f = 32.768 kHz. The clock output is opposite in phase to XT0.
	OSC0	I	Main clock oscillation input pin Connect to a crystal or ceramic oscillator. Or, input an external clock.
	$\overline{OSC1}$	O	Main clock oscillation output pin Connect to a crystal or ceramic oscillator. The clock output is opposite in phase to OSC0. Leave this pin unconnected when an external clock is used.
Reset	$\overline{RES}$	I	Reset input pin
Other	NMI	I	Non-maskable interrupt input pin
	$\overline{EA}$	I	External program memory access input pin If the $\overline{EA}$ pin is enabled (low level), the internal program memory is masked and the CPU executes the program code in external program memory through all address space.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition		Rated value	Unit
Digital power supply voltage	V_{DD}	GND=AGND=0V Ta=25°C		–0.3 to +7.0	V
Input voltage	V_I			–0.3 to V_{DD}+0.3	V
Output voltage	V_O			–0.3 to V_{DD}+0.3	V
Analog reference voltage	V_{REF}			–0.3 to V_{DD}+0.3	V
Analog input voltage	V_{AI}			–0.3 to V_{REF}	V
Power dissipation	P_D	Ta=70°C per package	100-pin TQFP	650	mW
			100-pin QFP	750	mW
Storage temperature	T_{STG}	—		–50 to +150	°C

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition		Rated value	Unit
Dogital power supply voltage	V_{DD}	MSM66573 MSM66Q573	f_{OSC}≤30 MHz	4.5 to 5.5	V
		MSM66573L MSM66Q573L	f_{OSC}≤14 MHz	2.4 to 3.6	
		MSM66P573	f_{OSC}≤24 MHz	4.5 to 5.5	
			f_{OSC}≤12 MHz	2.7 to 3.6	
Analog reference voltage	V_{REF}	—		V_{DD}–0.3 to V_{DD}	V
Analog input voltage	V_{AI}	—		AGND to V_{REF}	V
Memory hold voltage	V_{DDH}	f_{OSC}=0Hz		2.0 to 5.5	V
Operating frequency	f_{OSC}	MSM66573 MSM66Q573	V_{DD}=4.5 to 5.5 V	2 to 30	MHz
		MSM66573L MSM66Q573L	V_{DD}=2.4 to 3.6 V	2 to 14	
		MSM66P573	V_{DD}=4.5 to 5.5 V	2 to 24	
			V_{DD}=2.7 to 3.6 V	2 to 12	
Ambient temperature	Ta	—		–30 to +70	°C
Fan out	N	MOS load		20	—
		TTL load	P0, P3, P11	6	—
			P1, P2, P4, P5, P6, P7, P8, P9, P10	1	—

ALLOWABLE OUTPUT CURRENT VALUES

MSM66573L/Q573L (V_{DD}=2.4 to 3.6 V, Ta=–30 to +70°C)
MSM66573/Q573 (V_{DD}=4.5 to 5.5 V, Ta=–30 to +70°C)
MSM66P573 (V_{DD}=2.7 to 3.6V/4.5 to 5.5 V, Ta=–30 to +70°C)

Parameter	Pin	Symbol	Min.	Typ.	Max.	Unit
"H" output pin (1 pin)	All output pins	I_{OH}	—	—	–2	mA
"H" output pins (sum total)	Sum total of all output pins	ΣI_{OH}	—	—	–40	
"L" output pin (1 pin)	P0, P3, P11	I_{OL}	—	—	10	
	Other ports				5	
"L" output pins (sum total)	Sum total of P0, P3, P11	ΣI_{OL}	—	—	80	
	Sum total of P1, P2, P4				50	
	Sum total of P5, P6, P9					
	Sum total of P7, P8, P10					
	Sum total of all output pins				140	

[Note]
Connect the power supply voltage to all V_{DD} pins and the ground voltage to all GND pins.

ELECTRICAL CHARACTERISTICS

DC Characteristics 1 (V_{DD}=4.5 to 5.5 V)

MSM66573/Q573/P573 (V_{DD}=4.5 to 5.5 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
"H" input voltage *1	V_{IH}	—	0.44 V_{DD}	—	V_{DD}+0.3	V
"H" input voltage *2, *3, *4, *5, *6, *7			0.80 V_{DD}	—	V_{DD}+0.3	
"L" input voltage *1	V_{IL}	—	–0.3	—	0.16 V_{DD}	
"L" input voltage *2, *3, *4, *5, *6, *7			–0.3	—	0.2 V_{DD}	
"H" output voltage *1, *4	V_{OH}	I_O=–400 µA	V_{DD}–0.4	—	—	
		I_O=–2.0 mA	V_{DD}–0.6	—	—	
"H" output voltage *2		I_O=–200 µA	V_{DD}–0.4	—	—	
		I_O=–2.0 mA	V_{DD}–0.6	—	—	
"L" output voltage *1, *4	V_{OL}	I_O=3.2 mA	—	—	0.4	
		I_O=10.0 mA	—	—	0.8	
"L" output voltage *2		I_O=1.6 mA	—	—	0.4	
		I_O=5.0 mA	—	—	0.8	
Input leakage current *3, *6	I_{IH}/I_{IL}	V_I=V_{DD}/0 V	—	—	1/–1	µA
Input current *5			—	—	1/–250	
Input current *7			—	—	15/–15	
output leakage current *1, *2, *4	I_{LO}	V_O=V_{DD}/0 V	—	—	±10	µA
Pull-up resistance	R_{pull}	V_I= 0 V	25	50	100	kΩ
Input capacitance	C_I	f=1 MHz, Ta=25°C	—	5	—	pF
Output capacitance	C_O		—	7	—	
Analog reference supply current	I_{REF}	During A/D operation	—	—	4	mA
		When A/D is stopped	—	—	10	µA

*1: Applicable to P0
*2: Applicable to P1, P2, P4, P5, P6, P7, P8, P9, P10
*3: Applicable to P12
*4: Applicable to P3, P11
*5: Applicable to $\overline{RES}$
*6: Applicable to $\overline{EA}$, NMI
*7: Applicable to OSC0

Supply current (V_{DD}=4.5 to 5.5 V)

• MSM66573

(V_{DD}=4.5 to 5.5 V, Ta=–30 to +70°C)

Mode	Symbol	Condition		Min.	Typ.	Max.	Unit
CPU operation mode	I_{DD}	f=30 MHz, No Load		—	36	55	mA
		f=32.768 kHz, No Load		—	60	160	µA
HALT mode	I_{DDH}	f=30 MHz, No Load		—	23	35	mA
STOP mode	I_{DDS}	OSC is stopped	XT is used*	—	5	110	µA
			XT is not used*	—	1	100	
		OSC is stopped, XT is not used V_{DD}=2 V, Ta=25°C*		—	0.2	10	

*: Ports used as inputs are at V_{DD} or 0 V. Other ports are unloaded.

• MSM66Q573

(V_{DD}=4.5 to 5.5 V, Ta=–30 to +70°C)

Mode	Symbol	Condition		Min.	Typ.	Max.	Unit
CPU operation mode	I_{DD}	f=30 MHz, No Load		—	42	70	mA
		f=32.768 kHz, No Load		—	60	160	µA
HALT mode	I_{DDH}	f=30 MHz, No Load		—	24	40	mA
STOP mode	I_{DDS}	OSC is stopped	XT is used*	—	5	110	µA
			XT is not used*	—	1	100	
		OSC is stopped, XT is not used V_{DD}=2 V, Ta=25°C*		—	0.2	10	

*: Ports used as inputs are at V_{DD} or 0 V. Other ports are unloaded.

• MSM66P573

(V_{DD}=4.5 to 5.5 V, Ta=–30 to +70°C)

Mode	Symbol	Condition		Min.	Typ.	Max.	Unit
CPU operation mode	I_{DD}	f=24 MHz, No Load		—	60	80	mA
		f=32.768 kHz, No Load		—	114	300	µA
HALT mode	I_{DDH}	f=24 MHz, No Load		—	30	40	mA
STOP mode	I_{DDS}	OSC is stopped	XT is used*	—	6	120	µA
			XT is not used*	—	1	100	
		OSC is stopped, XT is not used V_{DD}=2 V, Ta=25°C*		—	0.2	10	

*: Ports used as inputs are at V_{DD} or 0 V. Other ports are unloaded.

DC Characteristics 2 (V_{DD}=2.4 to 3.6 V)

MSM66573L/Q573L (V_{DD}=2.4 to 3.6 V, Ta=–30 to +70°C)
MSM66P573 (V_{DD}=2.7 to 3.6 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
"H" input voltage *1	V_{IH}	—	0.44V_{DD}	—	V_{DD}+0.3	V
"H" input voltage *2, *3, *4, *5, *6, *7			0.80V_{DD}	—	V_{DD}+0.3	
"L" input voltage *1	V_{IL}	—	–0.3	—	0.16 V_{DD}	
"L" input voltage *2, *3, *4, *5, *6, *7			–0.3	—	0.2 V_{DD}	
"H" output voltage *1, *4	V_{OH}	I_O=–400 µA	V_{DD}–0.4	—	—	
		I_O=–2.0 mA	V_{DD}–0.8	—	—	
"H" output voltage *2		I_O=–200 µA	V_{DD}–0.4	—	—	
		I_O=–1.0 mA	V_{DD}–0.8	—	—	
"L" output voltage *1, *4	V_{OL}	I_O=3.2 mA	—	—	0.5	
		I_O=5.0 mA	—	—	0.9	
"L" output voltage *2		I_O=1.6 mA	—	—	0.5	
		I_O=2.5 mA	—	—	0.9	
Input leakage current*3, *6	I_{IH}/I_{IL}	V_I=V_{DD}/0 V	—	—	1/–1	µA
Input current *5			—	—	1/–250	
Input current *7			—	—	15/–15	
output leakage current *1, *2, *4	I_{LO}	V_O=V_{DD}/0 V	—	—	±10	µA
Pull-up resistance	R_{pull}	V_I= 0 V	40	100	200	kΩ
Input capacitance	C_I	f=1 MHz, Ta=25°C	—	5	—	pF
Output capacitance	C_O		—	7	—	
Analog reference supply current	I_{REF}	During A/D operation	—	—	2	mA
		When A/D is stopped	—	—	5	µA

*1: Applicable to P0
*2: Applicable to P1, P2, P4, P5, P6, P7, P8, P9, P10
*3: Applicable to P12
*4: Applicable to P3, P11
*5: Applicable to $\overline{RES}$
*6: Applicable to $\overline{EA}$, NMI
*7: Applicable to OSC0

Supply current (V_{DD}=2.4 to 3.6 V)

• MSM66573L

(V_{DD}=2.4 to 3.6 V, Ta=–30 to +70°C)

Mode	Symbol	Condition		Min.	Typ.	Max.	Unit
CPU operation mode	I_{DD}	f=14 MHz, No Load		—	12	20	mA
		f=32.768 kHz, No Load		—	30	130	µA
HALT mode	I_{DDH}	f=14 MHz, No Load		—	7	11	mA
STOP mode	I_{DDS}	OSC is stopped	XT is used*	—	2	110	µA
			XT is not used*	—	1	100	
		OSC is stopped, XT is not used V_{DD}=2 V, Ta=25°C*		—	0.2	10	

*: Ports used as inputs are at V_{DD} or 0 V. Other ports are unloaded.

• MSM66Q573L

(V_{DD}=2.4 to 3.6 V, Ta=–30 to +70°C)

Mode	Symbol	Condition		Min.	Typ.	Max.	Unit
CPU operation mode	I_{DD}	f=14 MHz, No Load		—	13	22	mA
		f=32.768 kHz, No Load		—	30	130	µA
HALT mode	I_{DDH}	f=14 MHz, No Load		—	7	11	mA
STOP mode	I_{DDS}	OSC is stopped	XT is used*	—	3	110	µA
			XT is not used*	—	1	100	
		OSC is stopped, XT is not used V_{DD}=2 V, Ta=25°C*		—	0.2	10	

*: Ports used as inputs are at V_{DD} or 0 V. Other ports are unloaded.

• MSM66P573

(V_{DD}=2.7 to 3.6 V, Ta=–30 to +70°C)

Mode	Symbol	Condition		Min.	Typ.	Max.	Unit
CPU operation mode	I_{DD}	f=12 MHz, No Load		—	17	24	mA
		f=32.768 kHz, No Load		—	65	160	µA
HALT mode	I_{DDH}	f=12 MHz, No Load		—	8	12	mA
STOP mode	I_{DDS}	OSC is stopped	XT is used*	—	3	110	µA
			XT is not used*	—	1	100	
		OSC is stopped, XT is not used V_{DD}=2 V, Ta=25°C*		—	0.2	10	

*: Ports used as inputs are at V_{DD} or 0 V. Other ports are unloaded.

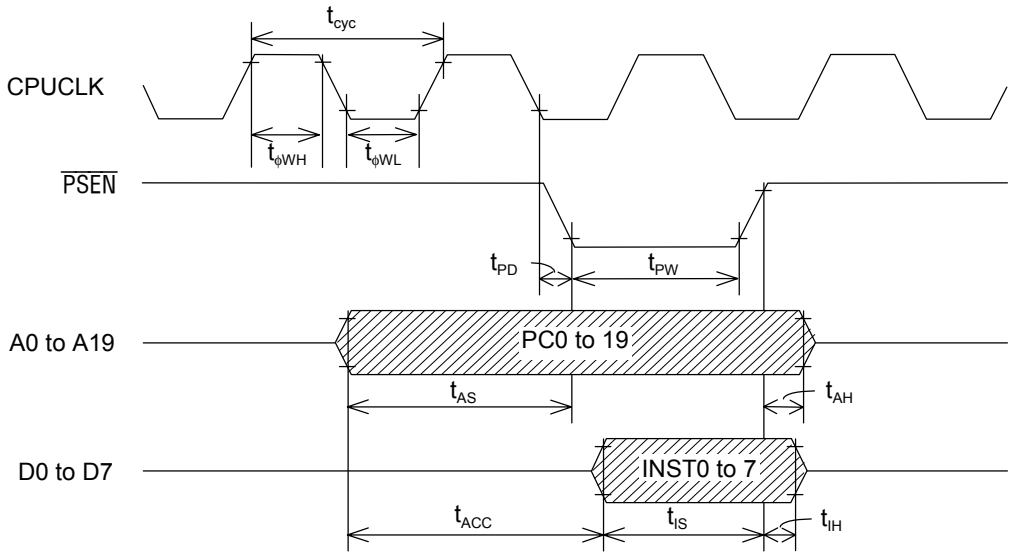
AC Characteristics 1 (VDD = 4.5 to 5.5 V)

(1) External program memory control

MSM66573/Q573/P573 (V_{DD}=4.5 to 5.5 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Cycle time	t_{cyc}	f_{OSC}=30 MHz	33.3	—	ns
Clock pulse width (HIGH level)	$t_{\phi WH}$	C_L=50 pF	13	—	
Clock pulse width (LOW level)	$t_{\phi WL}$		13	—	
$\overline{PSEN}$ pulse width	t_{PW}		2tϕ–15	—	
$\overline{PSEN}$ pulse delay time	t_{PD}		—	45	
Address setup time	t_{AS}		tϕ–25	—	
Address hold time	t_{AH}		0	—	
Instruction setup time	t_{IS}		25*1	—	
Instruction hold time	t_{IH}		0	—	
Read data access time	t_{ACC}		—	3tϕ–65*2	

Note: t□=t_{cyc}/2
*1: MSM66P573=30
*2: MSM66P573=3t□–70



Bus timing during no wait cycle time

(2) External data memory control

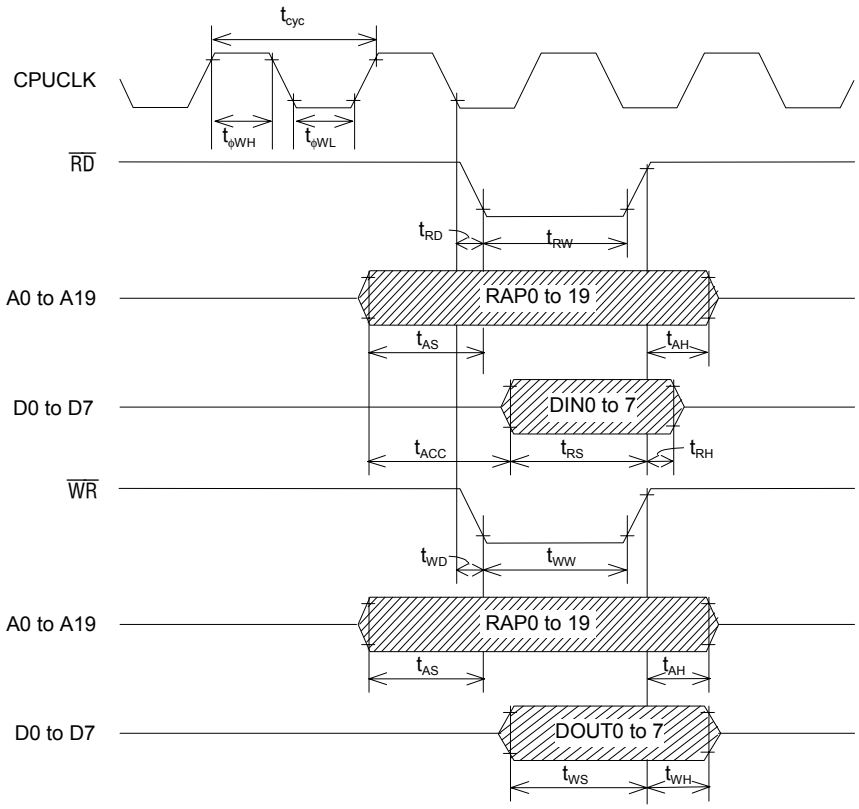
MSM66573/Q573/P573 (V_{DD}=4.5 to 5.5 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Cycle time	t_{cyc}	f_{OSC}=30 MHz	33.3	—	ns
Clock pulse width (HIGH level)	$t_{\phi WH}$	C_L=50 pF	13	—	
Clock pulse width (LOW level)	$t_{\phi WL}$		13	—	
$\overline{RD}$ pulse width	t_{RW}		2tϕ–15	—	
$\overline{WR}$ pulse width	t_{WW}		2tϕ–15	—	
$\overline{RD}$ pulse delay time	t_{RD}		—	45	
$\overline{WR}$ pulse delay time	t_{WD}		—	45	
Address setup time	t_{AS}		tϕ–25	—	
Address hold time	t_{AH}		tϕ–3	—	
Read data setup time	t_{RS}		25*1	—	
Read data hold time	t_{RH}		0	—	
Read data access time	t_{ACC}		—	3tϕ–65*2	
Write data setup time	t_{WS}		2tϕ–30	—	
Write data hold time	t_{WH}		tϕ–3	—	

Note: t□=t_{cyc}/2

*1: MSM66P573=30

*2: MSM66P573=3t□–70



Bus timing during no wait cycle time

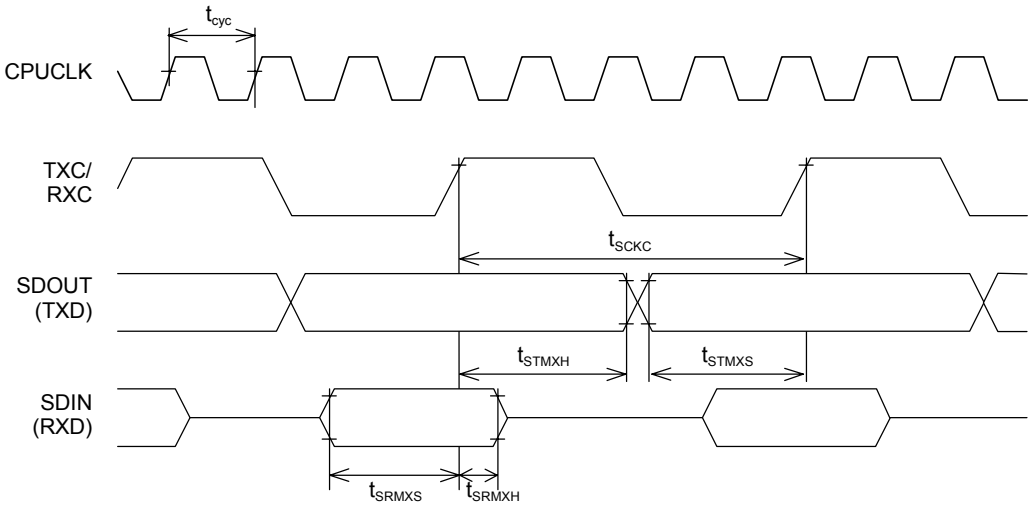
(3) Serial port control

Master mode

MSM66573/Q573/P573 (V_{DD}=4.5 to 5.5 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Cycle time	t_{cyc}	f_{OSC}=30 MHz	33.3	—	ns
Serial clock cycle time	t_{SCKC}	C_L=50 pF	$4t_{cyc}$	—	
Output data setup time	t_{STMXS}		$2t\phi$–5	—	
Output data hold time	t_{STMXH}		$5t\phi$–10	—	
Input data setup time	t_{SRMXS}		13	—	
Input data hold time	t_{SRMXH}		0	—	

Note: $t\phi=t_{cyc}/2$

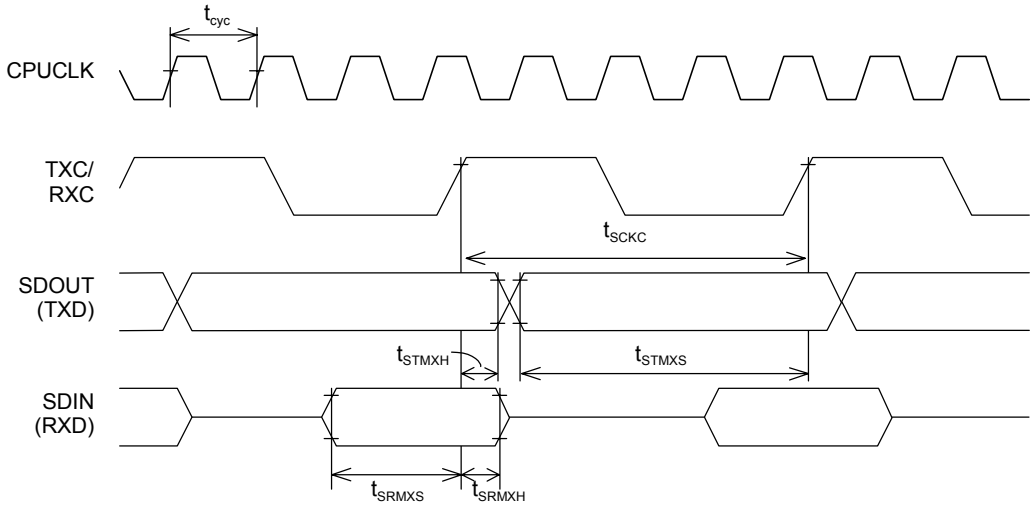


Slave mode

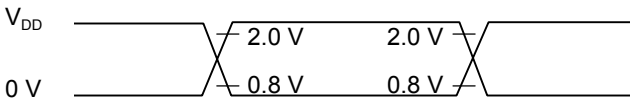
MSM66573/Q573/P573 (V_{DD}=4.5 to 5.5 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Cycle time	t_{cyc}	f_{OSC}=30 MHz	33.3	—	ns
Serial clock cycle time	t_{SCKC}	C_L=50 pF	$4t_{cyc}$	—	
Output data setup time	t_{STMXS}		$2t\phi$–15	—	
Output data hold time	t_{STMXH}		$4t\phi$–10	—	
Input data setup time	t_{SRMXS}		13	—	
Input data hold time	t_{SRMXH}		3	—	

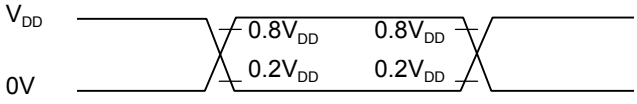
Note: $t\phi=t_{cyc}/2$



Measurement points for AC timing (except the serial port)



Measurement points for AC timing (the serial port)



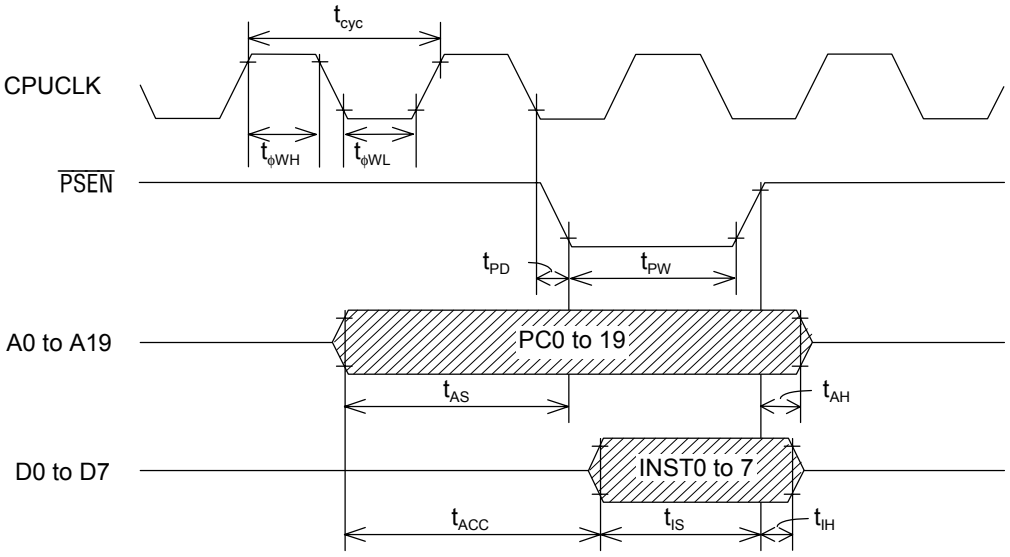
AC Characteristics 2 (VDD = 2.4 to 3.6 V)

(1) External program memory control

MSM66573L/Q573L (VDD=2.4 to 3.6 V, Ta=–30 to +70°C)
MSM66P573 (VDD=2.7 to 3.6 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Cycle time	t_{cyc}	f_{OSC}=14 MHz	71.4	—	ns
Clock pulse width (HIGH level)	$t_{\phi WH}$	C_L=50 pF	28	—	
Clock pulse width (LOW level)	$t_{\phi WL}$		28	—	
$\overline{PSEN}$ pulse width	t_{PW}		2tϕ–25*1	—	
$\overline{PSEN}$ pulse delay time	t_{PD}		—	75	
Address setup time	t_{AS}		tϕ–40	—	
Address hold time	t_{AH}		-8*2	—	
Instruction setup time	t_{IS}		60	—	
Instruction hold time	t_{IH}		-8*2	—	
Read data access time	t_{ACC}		—	3tϕ–120	

Note: t□=t_{cyc}/2
*1: MSM66P573=2t□–20
*2: MSM66P573=0



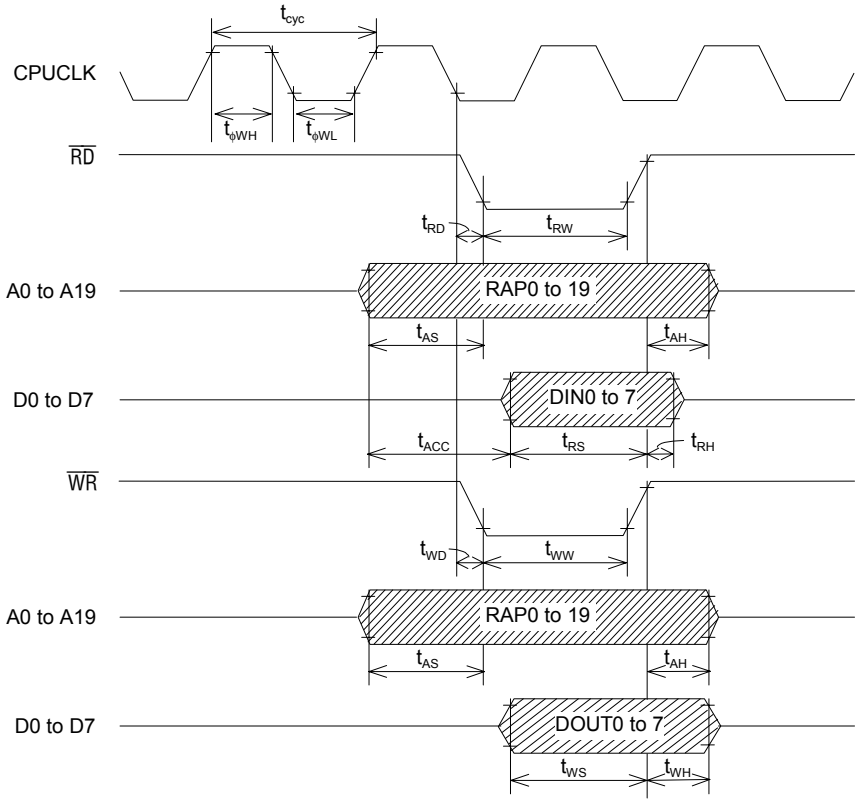
Bus timing during no wait cycle time

(2) External data memory control

MSM66573L/Q573L (VDD=2.4 to 3.6 V, Ta=–30 to +70°C)
MSM66P573 (VDD=2.7 to 3.6 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Cycle time	t_{cyc}	f_{OSC}=14 MHz	71.4	—	ns
Clock pulse width (HIGH level)	$t_{\phi WH}$	C_L=50 pF	28	—	
Clock pulse width (LOW level)	$t_{\phi WL}$		28	—	
$\overline{RD}$ pulse width	t_{RW}		2tϕ–25*1	—	
$\overline{WR}$ pulse width	t_{WW}		2tϕ–25*1	—	
$\overline{RD}$ pulse delay time	t_{RD}		—	75	
$\overline{WR}$ pulse delay time	t_{WD}		—	75	
Address setup time	t_{AS}		tϕ–40	—	
Address hold time	t_{AH}		tϕ–8*2	—	
Read data setup time	t_{RS}		60	—	
Read data hold time	t_{RH}		0	—	
Read data access time	t_{ACC}		—	3tϕ–120	
Write data setup time	t_{WS}		2tϕ–40	—	
Write data hold time	t_{WH}		tϕ–6	—	

Note: t□=t_{cyc}/2
*1: MSM66P573=2t□–20
*2: MSM66P573=t□–6



Bus timing during no wait cycle time

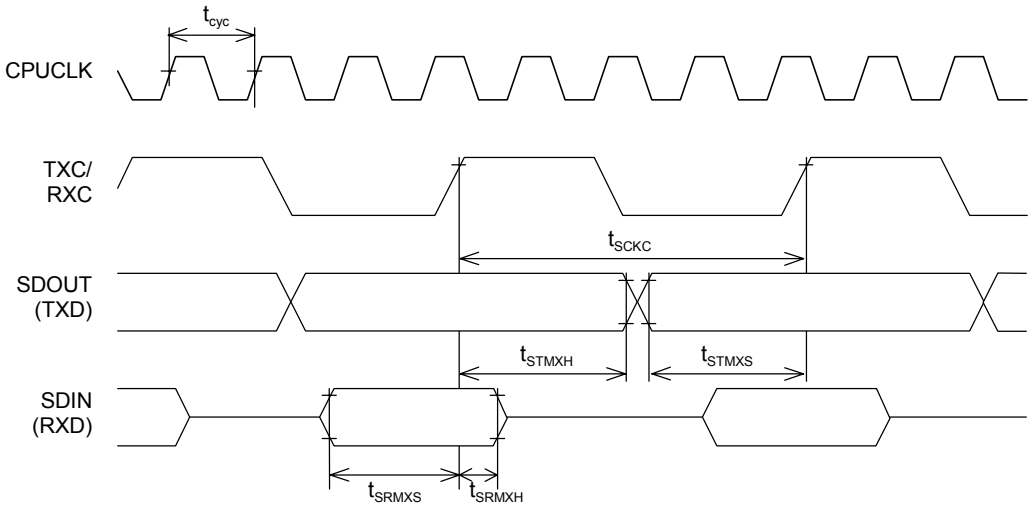
(3) Serial port control

Master mode

MSM66573L/Q573L (V_{DD}=2.4 to 3.6 V, Ta=–30 to +70°C)
MSM66P573 (V_{DD}=2.7 to 3.6 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Cycle time	t_{cyc}	f_{OSC}=14 MHz	71.4	—	ns
Serial clock cycle time	t_{SCKC}	C_L=50 pF	4tcyc	—	
Output data setup time	t_{STMXS}		2tϕ–10	—	
Output data hold time	t_{STMXH}		5tϕ–20	—	
Input data setup time	t_{SRMXS}		21	—	
Input data hold time	t_{SRMXH}		0	—	

Note: t□=t_{cyc}/2

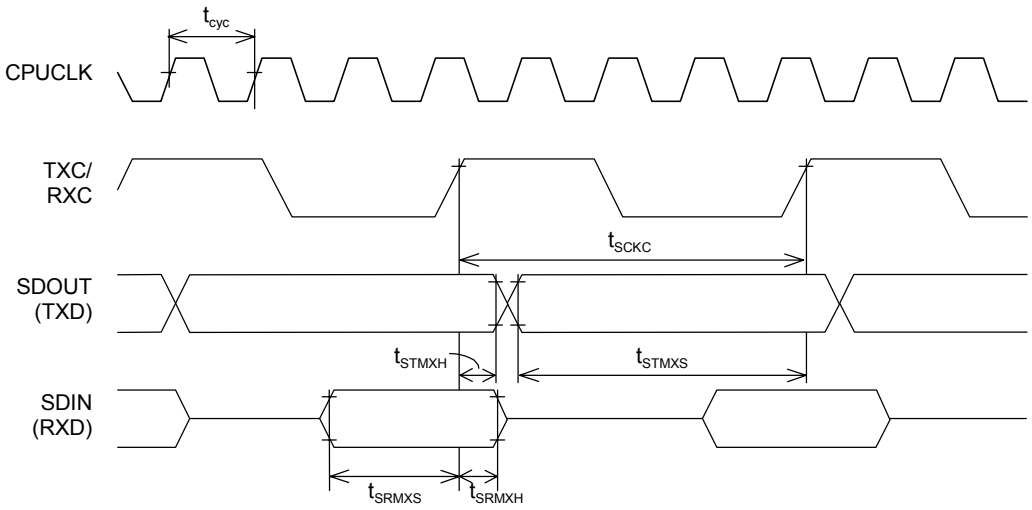


Slave mode

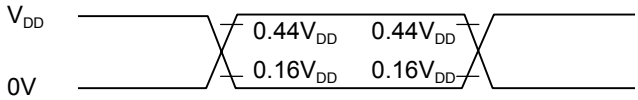
MSM66573L/Q573L (V_{DD}=2.4 to 3.6 V, Ta=–30 to +70°C)
MSM66P573 (V_{DD}=2.7 to 3.6 V, Ta=–30 to +70°C)

Parameter	Symbol	Condition	Min.	Max.	Unit
Cycle time	t_{cyc}	f_{OSC}=14 MHz	71.4	—	ns
Serial clock cycle time	t_{SCKC}	C_L=50 pF	$4t_{cyc}$	—	
Output data setup time	t_{STMXS}		$2t\phi$–30	—	
Output data hold time	t_{STMXH}		$4t\phi$–20	—	
Input data setup time	t_{SRMXS}		21	—	
Input data hold time	t_{SRMXH}		7	—	

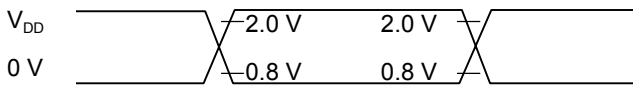
Note: $t\phi=t_{cyc}/2$



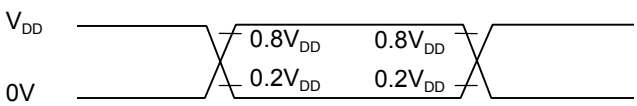
Measurement points for AC timing of MSM66573L/Q573L



Measurement points for AC timing of MSM66P573 (except the serial port)



Measurement points for AC timing (the serial port)



A/D Converter Characteristics 1 (V_{DD}=4.5 to 5.5 V)

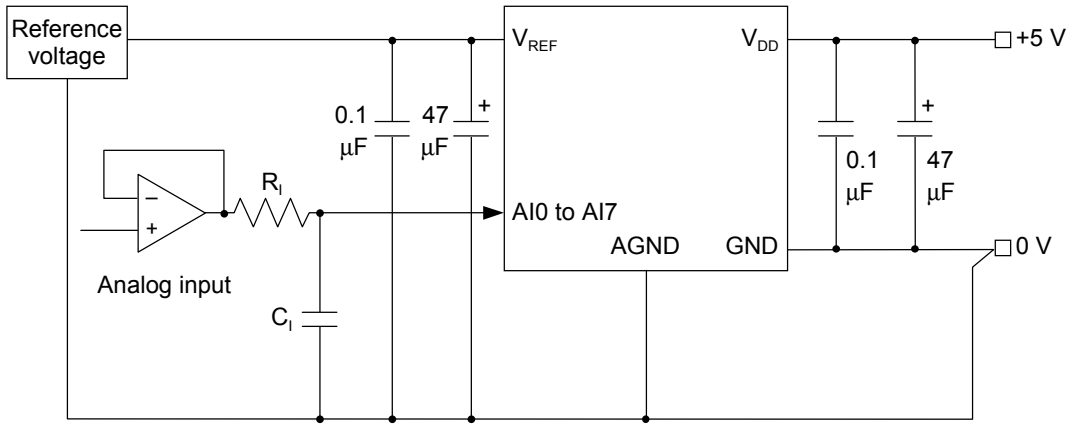
MSM6573/Q573/P573 (Ta=–30 to +70°C, V_{DD}=V_{REF}=4.5 to 5.5 V, AGND=GND=0 V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Resolution	n	Refer to measurement circuit 1 Analog input source impedance R_I≤5 kΩ t_{CONV}=10.7 µs	—	10	—	Bit
Linearity error	E_L		—	—	±3	LSB
Differential Linearity error	E_D		—	—	±2	
Zero scale error	E_{ZS}		—	—	+3	
Full-scale error	E_{FS}		—	—	–3	
Cross talk	E_{CT}	Refer to measurement circuit 2	—	—	±1	
Conversion time	t_{CONV}	Set according to ADTM set data	10.7	—	—	µs/ch

A/D Converter Characteristics 2 (V_{DD}=2.4 to 3.6 V)

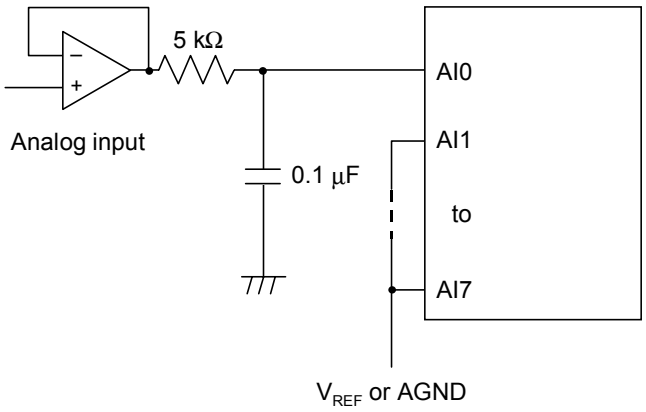
MSM66573L/Q573L (Ta=–30 to +70°C, V_{DD}=V_{REF}=2.4 to 3.6 V, AGND=GND=0 V)
MSM66P573 (Ta=–30 to +70°C, V_{DD}=V_{REF}=2.7 to 3.6 V, AGND=GND=0 V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Resolution	n	Refer to measurement circuit 1 Analog input source impedance R_I≤5 kΩ t_{CONV}=27.4 µs	—	10	—	Bit
Linearity error	E_L		—	—	±4	LSB
Differential Linearity error	E_D		—	—	±3	
Zero scale error	E_{ZS}		—	—	+4	
Full-scale error	E_{FS}		—	—	–4	
Cross talk	E_{CT}	Refer to measurement circuit 2	—	—	±2	
Conversion time	t_{CONV}	Set according to ADTM set data	27.4	—	—	□s/ch



R_I (impedance of analog input source) ≤5 kΩ
C_I ≅ 0.1 µF

Measurement Circuit 1



Cross talk is the difference between the A/D conversion results when the same analog input is applied to AI0 through AI7 and the A/D conversion results of the circuit to the left.

Measurement Circuit 2

Definition of Terminology

1. Resolution
   Resolution is the value of minimum discernible analog input.
   With 10 bits, since $2^{10} = 1024$, resolution of $(V_{REF} - AGND) \div 1024$ is possible.

2. Linearity error
   Linearity error is the difference between ideal conversion characteristics and actual conversion c haracteristics of a 10-bit A/D converter (not including quantization error).
   Ideal conversion characteristics can be obtained by dividing the voltage between V_{REF} and AGND into 1024 equal steps.

3. Differential linearity error
   Differential linearity error indicates the smoothness of conversion characteristics. Ideally, the range of analog input voltage that corresponds to 1 converted bit of digital output is $1LSB = (V_{REF} - AGND) \div 1024$. Differential error is the difference between this ideal bit size and bit size of an arbitrary point in the conversion range.

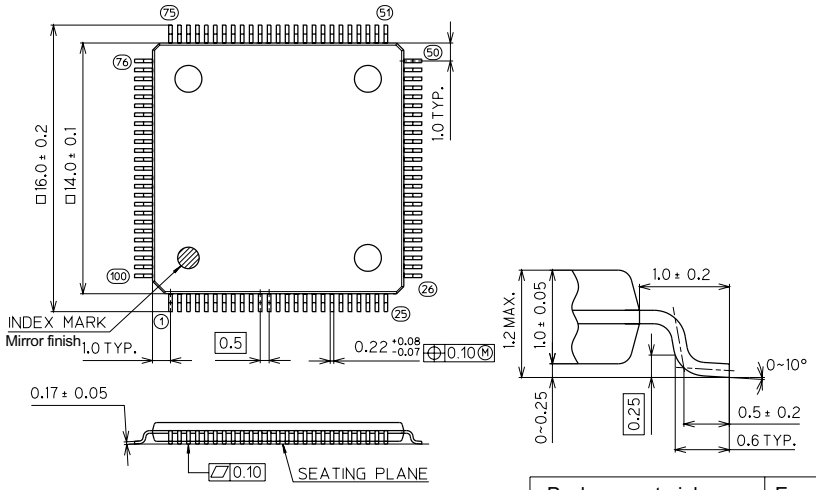
4. Zero scale error
   Zero scale error is the difference between ideal conversion characteristics and actual conversion characteristics at the point where the digital output changes from 000H to 001H.

5. Full-scale error
   Full-scale error is the difference between ideal conversion characteristics and actual conversion characteristics at the point where the digital output changes from 3FEH to 3FFH.

PACKAGE DIMENSIONS

(Unit: mm)

TQFP100-P-1414-0.50-K



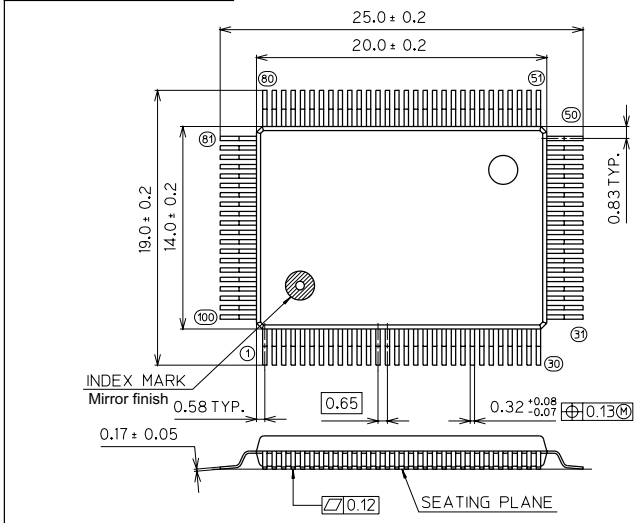
Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating
Solder plate thickness	5 μm or more
Package weight (g)	0.55 TYP.

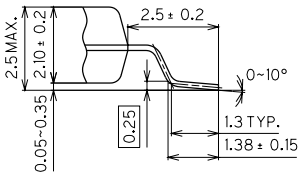
Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, TQFP, LQFP, 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 on the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

(Unit: mm)

QFP100-P-1420-0.65-BK





Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating
Solder plate thickness	5 μm or more
Package weight (g)	1.29 TYP.

Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, TQFP, LQFP, 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 on the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).

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