OKI SEMICONDUCTOR

Dear customers,

About the change in the name such as "Oki Electric Industry Co. Ltd." and "OKI" in documents to OKI Semiconductor Co., Ltd.

The semiconductor business of Oki Electric Industry Co., Ltd. was succeeded to OKI Semiconductor Co., Ltd. on October 1, 2008. Therefore, please accept that although the terms and marks of "Oki Electric Industry Co., Ltd.", “Oki Electric”, and "OKI" remain in the documents, they all have been changed to "OKI Semiconductor Co., Ltd.". It is a change of the company name, the company trademark, and the logo, etc. , and NOT a content change in documents.

October 1, 2008
OKI Semiconductor Co., Ltd.

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OKI Semiconductor

This version: May. 2000
Previous version: Nov. 1999

MSM5547

Digital Clock

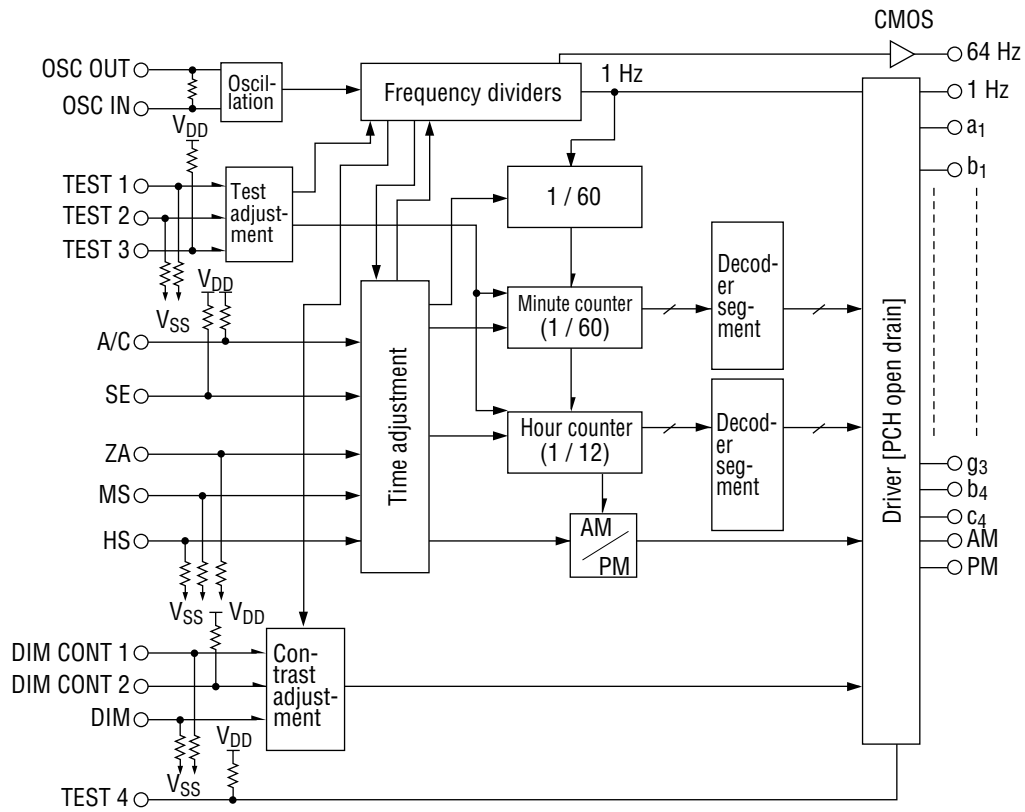
GENERAL DESCRIPTION

MSM5547 is a clock IC having a wide power supply range with 4.194304 MHz original oscillation. MSM5547 is a 12 hour cycle AM/PM clock for a static fluorescent character display tube. Time correction is in hour, minute and 30 minute adjustments. Hour and minute are corrected by a 2 Hz fast-forward function. MSM5547 also has a contrast adjustment function for the fluorescent character display tube, which can set four levels of contrast, including 100% duty.

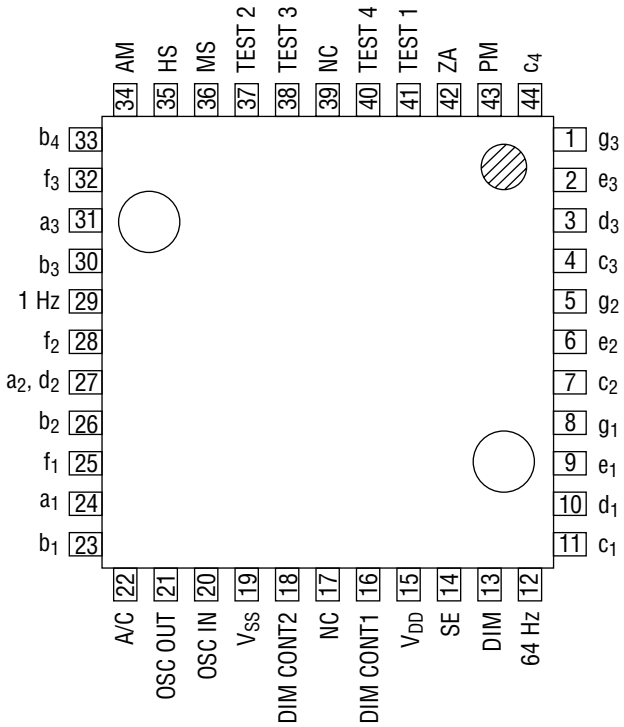
FEATURES

- 12 hour clock (AM/PM)
- Applied for static fluorescent character display tube
- Wide power supply range: 4 to 16V
- 4.194304 MHz original oscillation
- 4 levels of contrast can be selected
- Package options:
  44-pin plastic QFP (QFP44-P-910-0.80-L2) (Product name: MSM5547GS-L2)

BLOCK DIAGRAM



PIN CONFIGURATION (TOP VIEW)



44-pin plastic QFP

(Model name indicated on actual product is M5547)

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Rating	Unit
Power Supply Voltage	V_{DD} - V_{SS}	Ta = 25°C	–0.3 to +18	V
Input Voltage	V_I		V_{SS} – 0.3 ≤ V_I ≤ V_{DD} + 0.3	V
Input Current	I_I		±10	mA
P Channel Open Drain Output Pin Withstanding Voltage	V_O		V_{DD} – 26	V
P Channel Open Drain Output Current	I_O		–10	mA
Power Dissipation	P_D		200	mW
Storage Temperature Range	T_{STG}	—	–55 to +150	°C

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition	Range	Unit
Power Supply Voltage	V_{DD} - V_{SS}	—	4 to 16	V
Operating Temperature	T_{OP}	—	–30 to +85	°C
Crystal Frequency	f(x'tal)	—	4.194304	MHz

ELECTRICAL CHARACTERISTICS

DC Characteristics

(V_{DD} = 6.0 V, V_{SS} = 0 V, Ta = –30 to +85°C)

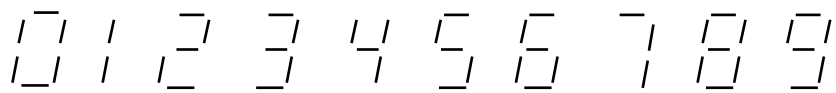
Parameter		Symbol	Condition	Min	Typ	Max	Unit
Input Voltage	"1" level	V_{IH}	—	4.3	—	—	V
	"0" level	V_{IL}	—	—	—	1.0	
"H" Input Current	TEST 1 TEST 2 ZA, MS, HS, DIM DIM CONT1	I_{IH1}	V_I = V_{DD}	30	—	150	µA
"L" Input Current	TEST 3, 4	I_{IL1}	V_I = V_{SS}	–120	—	–800	µA
"L" Input Current	A/C	I_{IL2}		–3	—	–12	
"L" Input Current	SE, DIM CONT2	I_{IL3}		–30	—	–150	
Output Voltage	"1" level (All output)	V_{OH}	I_{OH} = 0A	5.9	—	—	V
	"0" level (64 Hz output)	V_{OL}	I_{OL} = 0A	—	—	0.1	
Output Current	1 Hz, a_2, d_2, AM, PM output pins	I_{OH1}	V_{OH} = 4.0 V	–2000	—	—	µA
		I_{OL1}	V_{OL} = 0 V	—	—	–1.0	
Output Current	Other segment output pins except above	I_{OH2}	V_{OH} = 4.0 V	–1000	—	—	µA
		I_{OL2}	V_{OL} = 0 V	—	—	–1.0	
Output Current	64 Hz output pin	I_{OH3}	V_{OH} = 5.5 V	–100	—	—	µA
		I_{OL3}	V_{OL} = 0.5 V	100	—	—	
Dynamic Operating Current		I_{DD}	C_{IN} = 39 pF ±5% C_{OUT} = 33 pF ±5% C_I = 70 Ω ±5% f(x'tal) = 4.194304 MHz No load	—	—	2	mA

FUNCTIONAL DESCRIPTION

Time Base

- 4.194304 MHz crystal oscillator
- Internal crystal oscillation circuit (AMP, feedback resistance)

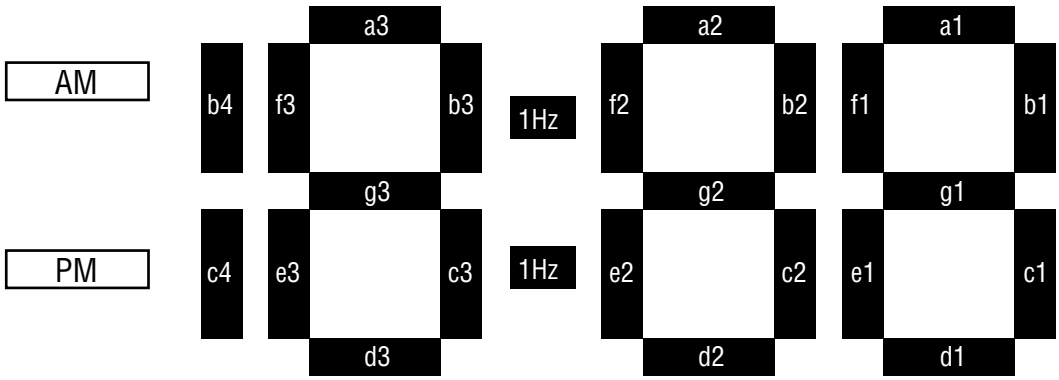
7 Segment Display Format



Display Device

- 4 digit static fluorescent character display tube (with AM, PM, colon)
- Colon display blinks at 1 Hz with a 50% duty ratio
- Relationship between Driver Outputs and DF Display Tube

Relationship between Driver Output and DF Display Tobe



Contrast Selecting Function

Selector pin name			Operation mode
DIM	DIM CONT1	DIM CONT2	
"0" (or open)	*	*	100% duty display
"1"	"0" (or open)	"1" (or open)	25% (1/4) duty display at 4096 Hz
"1"	"0" (or open)	"0"	12.5% (1/8) duty display at 4096 Hz
"1"	"1"	"1" (or open)	6.25% (1/16) duty display at 4096 Hz

"1": high level, "0": low level, *: don't care

Display Mode

- For 12 hour display, hour-minute 4-digit display
  Hour display: 1 to 12
  Minute display: 0 to 59
- 0 at highest digit is not displayed.
  (Highest digit zero suppress function)

Time Correction

Hour-minute fast-forward function

- Hour or minute can be fast-forwarded individually. The HS (hours set) pin fast-forwards the hour digit and the MS (minutes set) pin forwards the minute digit at 2 Hz.
- In open status, the HS and MS pins are held to "0" level by a pull-down resistor, and are in inactive status.
  These pins become active by being set to "1" level externally.
- It takes 0.242 to 0.5 sec from when the HS and MS pins become active to when +1 is counted. After a +1 count, time is counted in 0.5 sec (2 Hz) units.
- Hour digit and minute digits can be fast-forwarded in parallel.
- To fast-forward hour digit, the lower counter continues normal operation but does not carry from minute to hour digit.
- For fast-forwarding minute digit, the counter does not carry to the hour digit. The second digit continues normal operation but does not carry to the minute digit.

Time Setting Function (±30 minutes reset to zero)

- In open status, the ZA (zero adjust) pin is held to "0" level by a pull-down resistor and is in inactive status. This pin becomes active and enables time setting by being set to "1" level externally.
- Time is set at Min. 0.00 sec to Max. 0.0312 sec after the ZA pin becomes "1" level.
- For time setting, minute and second digits are reset to 00' 00". The colon output starts with "1". If the minute digit is less than 30, minute and second digits are reset to 00'00" . The counters for seconds are reset up to 16 Hz.

(Example of Setting)

(X - 1) hour 30 minutes 00 seconds
≀
X hour 00 minutes 00 seconds → X hour 00 minutes 00 seconds
≀
X hour 29 minutes 59 seconds

X hour 30 minutes 00 seconds
≀
X hour 59 minutes 59 seconds → (X + 1) hours 00 minutes 00 seconds
≀
(X + 1) hour 29 minutes 59 seconds

SE (set enable) Pin

In open status, the SE pin is held to "1" level by a pull-up resistor, enabling input from MS, HS and ZA pins. These inputs become invalid by setting this pin to "0" level externally.

A/C (all clear) Pin

- In open status, the A/C pin is held to "1" level by a pull-up resistor, and is in inactive status. The time counter is set at 1 hour 00 minutes 00 seconds AM by setting this pin to "0" level externally. The counter for seconds is reset up to 16 Hz.
- If a capacitor is connected between this pin and the Vss pin, 1 hour 00 minutes AM is displayed when power is turned on. Connect a capacitor of 4700 pF or more.

TEST Pin

- In open status, TEST 1 and 2 pins are held to "0" level by a pull-down resistor.
- In open status, TEST 3 and 4 pins are held to "1" level by a pull-up resistor.

TEST Select Function 1

Selector pin name			Operation mode
TEST1	TEST2	TEST3	
"0" (or open)	"0" (or open)	"1" (or open)	Normal function
ϕ (Pulse)	"1"	"1" (or open)	Input pulses to 16.384 KHz system of the circuit.
"1"	"ϕ (Pulse)	"1" (or open)	Input pulses to 16.384 KHz system of the circuit.
"1"	ϕ (Pulse)	"0"	Input pulses to 64 Hz system of the circuit.
ϕ (Pulse)	"1"	"0"	Input pulses to 64 Hz system of the circuit.
ϕ (Pulse)	"0" (or open)	"0"	Input pulses to minute counter and hour counter, and advances 1 count with 1 pulse. (Do not carry hour and minute counters.)

TEST Select Function 2

Selector pin name				Operation mode
TEST4	DIM	DIM CONT1	DIM CONT2	
"0"	ϕ (Pulse)	*	*	The pulse widths of the all segment outputs are controlled by the pulse width of DIM signal
	"0"			Sets all segment outputs to high impedance

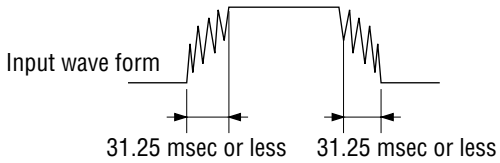
* Indicates that input level can be "0" and "1".

64 Hz Pin

This is the output pin for oscillation frequency adjustment, which constantly outputs 64 Hz.

Chattering Removal

A chattering removal circuit is included on three input pins: MS, HS and ZA.
Less than 31.25 msec chattering is neglected.



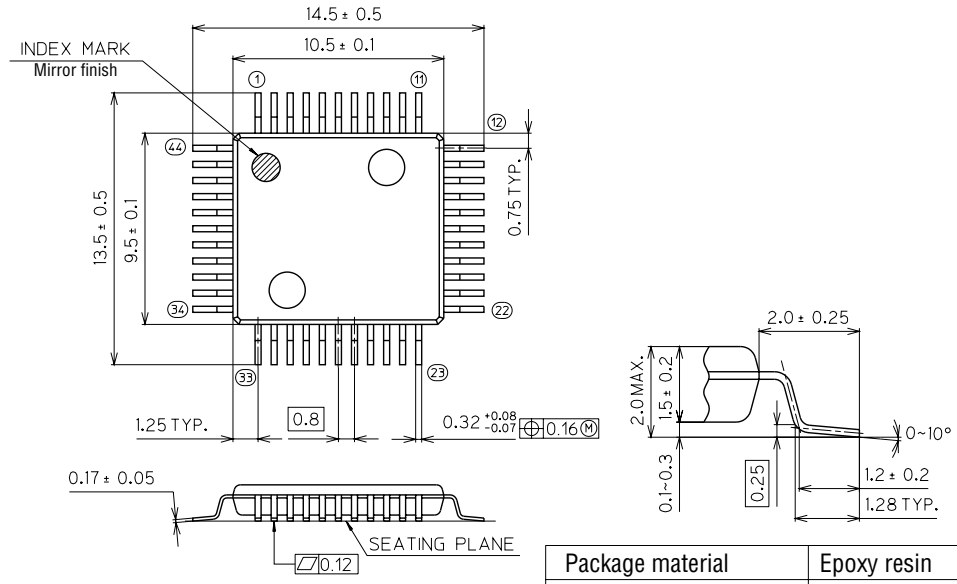
Treatment of NC Pin

Since the NC pin of 17 pin and 39 pin are connected to the substrate, set the pins to V_{DD} voltage or to open status.

PACKAGE DIMENSIONS

(Unit : mm)

QFP44-P-910-0.80-L2



Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating (≥5 μm)
Package weight (g)	0.35 TYP.
Rev. No./Last Revised	3/Nov. 28, 1996

Oki Electric Industry Co., Ltd.

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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