This version: May. 2000
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OKI Semiconductor

MSC1210

Clock For 1/2 Duty VFD

GENERAL DESCRIPTION

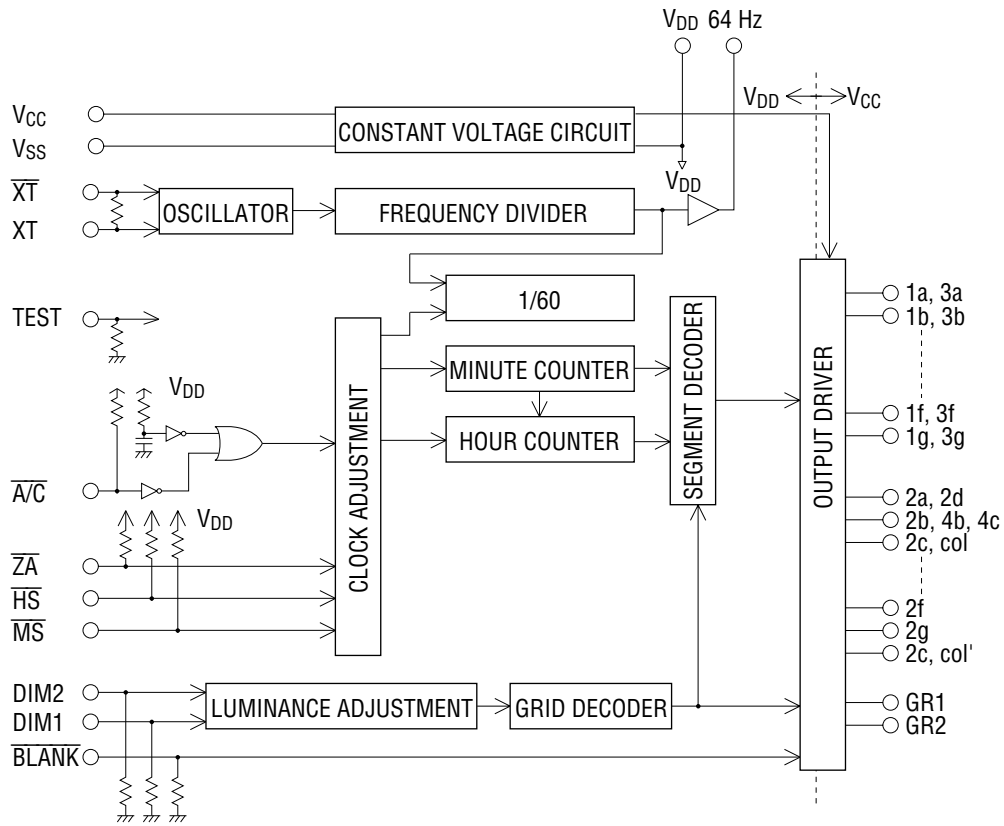
The MSC1210 is a clock for use in 1/2 duty VFD applications, featuring 4.194304 MHz crystal controlled oscillator time base, wide ranges of power supply, and 12-hour format. The clock correction rages are minutes, hours, and a 30-min ADJ (30-minute adjustment). The two clock correction modes are available; one is 1Push-1ADJ correction mode, the other is 2 Hz fast advance correction mode.
The MSC1210 is also provided with a function of 4-degree-switchable VFD luminance adjustment.

FEATURES

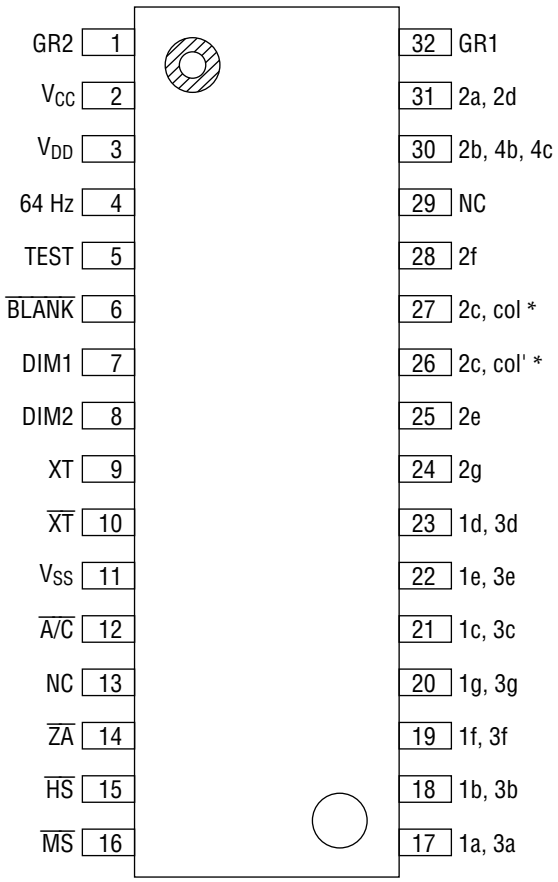
- 12-hour format
- Wide ranges of power supply: 4 V to 18 V (Built-in constant-voltage circuit)
- Usable for 1/2 Duty VFD
- 4.194304 MHz (crystal oscillation)
- Luminance: Switchable among 4 degrees
- Package options:

32-pin plastic SSOP	(SSOP32-P-430-1.00-K)	(Product name: MSC1210GS-K)
30-pin plastic shrink DIP	(SDIP30-P-400-1.778)	(Product name: MSC1210SS)

BLOCK DIAGRAM

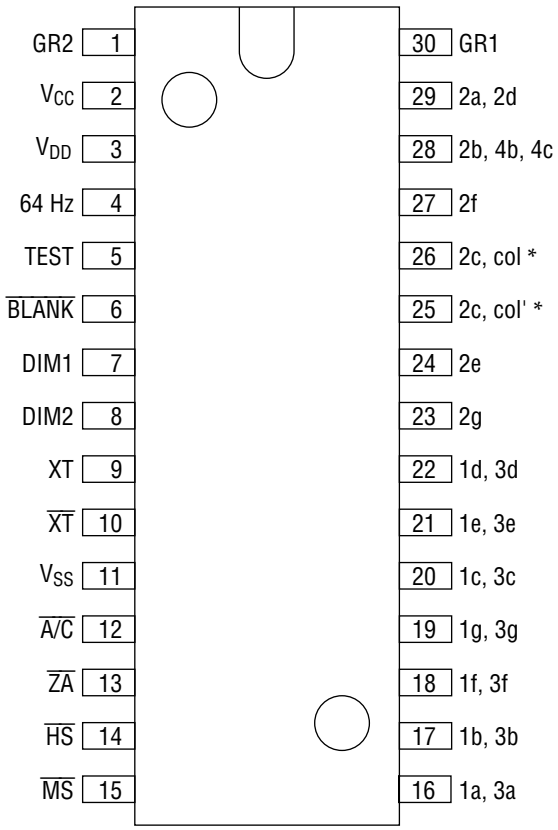


PIN CONFIGURATION (TOP VIEW)



32-Pin Plastic SSOP

* col indicates a blink colon and col' indicates a light colon.



30-Pin Plastic Shrink DIP

* col indicates a blink colon and col' indicates a continuous light colon.

PIN DESCRIPTION

Symbol	Type	Description
DIM1	I	Luminance switchover pins
DIM2	I	
$\overline{A/C}$	I	When this pin "0", the internal circuit is reset. The reset pulse width should be more than 2μs. This pin is internally connected to a pull-up resistor.
$\overline{ZA}$	I	Zero adjustment pin. This pin is internally connected to a pull-up resistor
$\overline{HS}$	I	Hour adjustment pin. This pin is internally connected to a pull-up resistor
$\overline{MS}$	I	Minute adjustment pin. This pin is internally connected to a pull-up resistor
$\overline{BLANK}$	I	Blank input pin. When this pin is "0", the display disappears. This pin is internally connected to a pull-down resistor.
XT $\overline{XT}$	I/O	These pins are used for crystal oscillation.
TEST	I	This pin is used to test the IC.
64 Hz	O	64 Hz signal output pin for oscillation frequency adjustment
GR1 GR2	O	Grid output pins for 1/2 duty VFD
1a, 3a to 2b, 4b, 4c	O	Anode output pins for 1/2 duty VFD

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Condition	Rating	Unit
Supply voltage	$V_{CC} - V_{SS}$	Ta = 25°C	–0.3 to +24	V
Input voltage	V_I	Ta = 25°C	–0.3 to V_{CC} + 0.3	V
Output voltage	V_O	Ta = 25°C	–0.3 to V_{CC} + 0.3	V
Power dissipation	P_D	Ta = 25°C	200	mW
Storage temperature	T_{STG}	—	–55 to +150	°C

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Condition	Range	Unit
Supply voltage	$V_{CC} - V_{SS}$	—	4 to 18	V
Operating temperature	T_{op}	—	–40 to +85	°C
Crystal frequency	f (X'tal)	—	4.194304	MHz

ELECTRICAL CHARACTERISTICS

DC Characteristics

(Ta = –40 to +85°C)

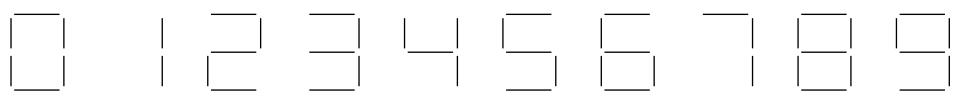
Parameter	Applicable pin	Symbol	Condition	Rating		Unit
				Min.	Max.	
"H" input voltage		V_{IH}	V_{CC} = 18 to 8 V	3.6	—	V
"L" input voltage		V_{IL}	V_{CC} = 18 to 8 V	—	1	V
Input current 1	DIM1, DIM2 BLANK, TEST	I_{IL1}	V_{CC} = 18 V V_{IN} = 0 V	–1	—	µA
Input current 2	XT	I_{IH2} I_{IL2}	V_{CC} = 18 V V_{IN} = 5 V / 0 V	–3	+3	µA
Input current 3	$\overline{ZA}$, $\overline{HS}$, $\overline{MS}$, $\overline{A/C}$	I_{IL3}	V_{CC} = 18 V V_{IN} = 0 V	–200	–50	µA
Input current 4	DIM1, DIM2 BLANK, TEST	I_{IH3}	V_{CC} = 18 V V_{IN} = 5 V	50	200	µA
Output current	SEGMENT	I_{OH1}	V_{CC} = 12 V V_{OH} = 11.3 V	—	–1	mA
		I_{OL1}	V_{CC} = 12 V V_{OL} = 0.7 V	15	—	µA
	GRID1, GRID2	I_{OH2}	V_{CC} = 12 V V_{OH} = 11.3 V	—	–15	mA
		I_{OL2}	V_{CC} = 12 V V_{OL} = 0.7 V	15	—	µA
	64 Hz	I_{OH3}	V_{CC} = 12 V V_{OH} = 4 V	—	–100	µA
		I_{OL3}	V_{CC} = 12 V V_{OL} = 0.5 V	100	—	
Dynamic current consumption		I_{CC}	f = 4.19 MHz Cg, Cd = 22 pF V_{CC} = 12 V	—	1.0	mA

EXPLANATION OF FUNCTIONS

• Time Base

Built-in 4.194304 MHz crystal oscillator circuit (AMP, feedback resistor)

• 7 Segment Display

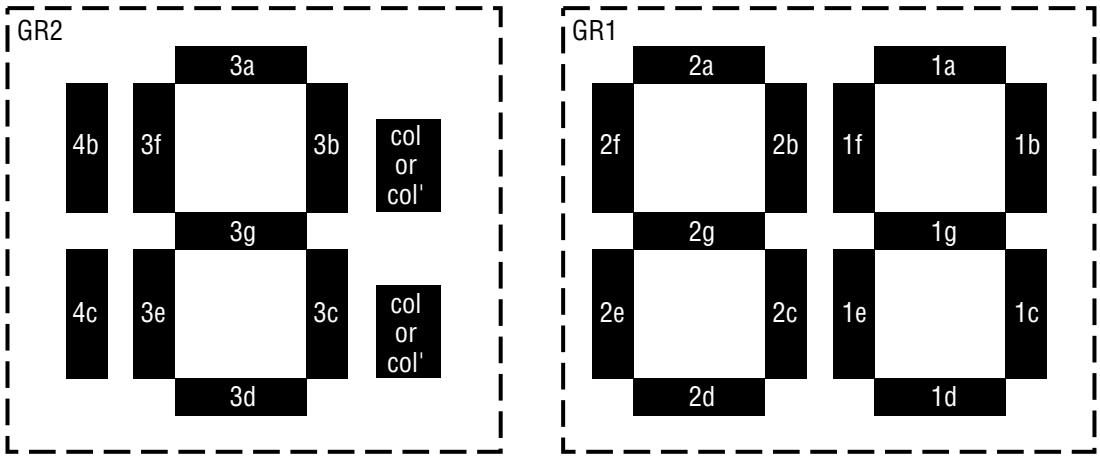


• Display Device

Dynamic drive 4-digit fluorescent display (with colons)

• Relationship between Amode & Grid Outputs and VF display Tube

RELATIONSHIP BETWEEN ANODE & GRID OUTPUTS AND VF DISPLAY TUBE



• Luminance Switch Function

4-degree switchable luminance (frequency = 250 Hz, gap width between GR1 and GR2 = 30 µs)

Switch pin name		Operation mode
DIM1	DIM2	
L	L	f = 250 Hz 1/2 Duty (50% display)
H	L	(25% display)
L	H	(12.5% display)
H	H	(6.25% display)

• Display Mode

4-digit display of hours/minutes on a 12-hour format.

Hours display ..... between 1 and 12
Minutes display ..... between 00 and 59

The most significant digit will not appear if it is zero. (Most significant digit zero suppress mechanism)

• Correcting Clock

Hour/minute fast advance function.
Hour digits and minute digits can fast advance, separately.
The hour digit can fast advance via $\overline{HS}$ pin (Hour Set), and the minute digit via $\overline{MS}$ pin (Minute Set) with 2 Hz period.
The hour counter or minute counter is incremented by 1 each time of pressing.
If keeping it depressed, these counters are incremented continuously with 2 Hz intervals.
The $\overline{HS}$ and $\overline{MS}$ pins, when they are open, are kept at "1" level with a pull-up resistor, and become non-active.
These pins become active when "0" level voltage is supplied from the external source.
The hour digit and minute digit can fast advance simultaneously.
In doing the fast advance operation, the low order digit of the counter continues a normal operation, but a carry out of the minute digit into the hour digit does not occur.
In doing the minute digit fast advance, a carry into the hour digit does not occur.

• Zero Adjust Function (±30 minutes Zero Reset)

The $\overline{ZA}$ pin (Zero Adjust), when it is open, is kept at "1" level thith a pull-up resisitor, and becomes non-active.
This pin becomes active when "0" level voltage is supplied from the external source in order to execute Zero Adjust operation.
If the minute digits are smaller than 30, the minute digits and second digits are reset to 00'00".
If the minute digits are larger than 30, the minute digits and second digits are reset to 00'00", and a carry into the hour digit is executed.
Pre-second resetting of the counter is performed up to 16 Hz.

(Zero Adjust Example)

(X – 1) (hour) 30'00"
X (hour) 00'00" ⟶ X (hour) 00'00"
X (hour) 29'59"

X (hour) 30'00"
X (hour) 59'59" ⟶ (X + 1) (hour) 00'00"
(X + 1) (hour) 29'59"

- Blanking of Display

  The display is blanked by externally applying "0" level voltage to $\overline{\text{BLANK}}$ pin.

- 64 Hz Pin

  Output pin for oscillation frequency adjustment.
  This pin always outputs a frequency of 64 Hz.

- Constant-Voltage Circuit

  The constant-voltagae circuit supplys the logic section with a voltage down to between 3.4 V and 5 V from between 4 V and 18 V.

- Power On Reset

  No external capacitor is needed since the IC contains a capacitor.

- Test Pin

  Used to test the IC.

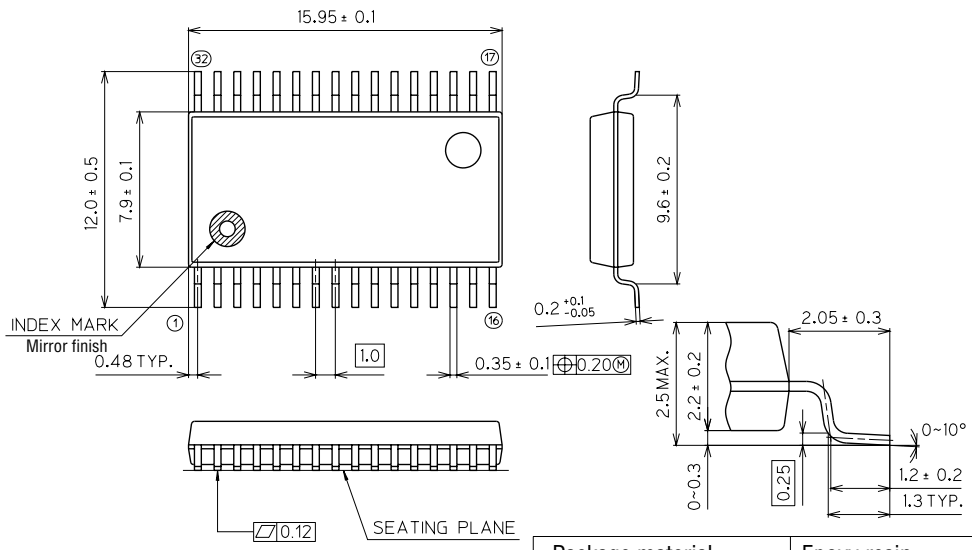
- Removal of Chattering

  The $\overline{\text{MS}}$, $\overline{\text{HS}}$, and $\overline{\text{ZA}}$ input pins contains a chattering removal circuit, so that chattering of less than 31.25 msec is removable inside of the IC.

PACKAGE DIMENSIONS

(Unit : mm)

SSOP32-P-430-1.00-K



Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating (≥5 μm)
Package weight (g)	0.60 TYP.
Rev. No./Last Revised	3/Dec. 5, 1996

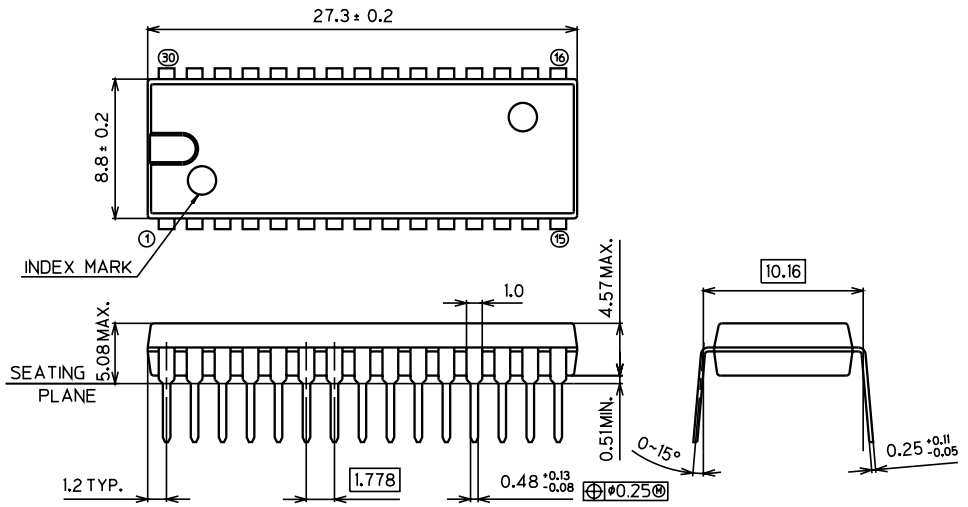
Oki Electric Industry Co., Ltd.

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).

(Unit : mm)

SDIP30-P-400-1.778



Package material	Epoxy resin
Lead frame material	42 alloy
Pin treatment	Solder plating (≥5 μm)
Package weight (g)	1.80 TYP.
Rev. No./Last Revised	2/Dec. 11, 1996

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