

# ASSP

# TIMER

# MB4214

## LONG PERIOD TIMER

The Fujitsu MB4214 is designed for a long period timer. It contains oscillator, divider (13 stages of flip-flop), output circuit, power supply circuit and comparator (2-ch). Arbitrary period is set by external resistor  $R_T$ , capacitor  $C_T$  and  $V_S$  input voltage.

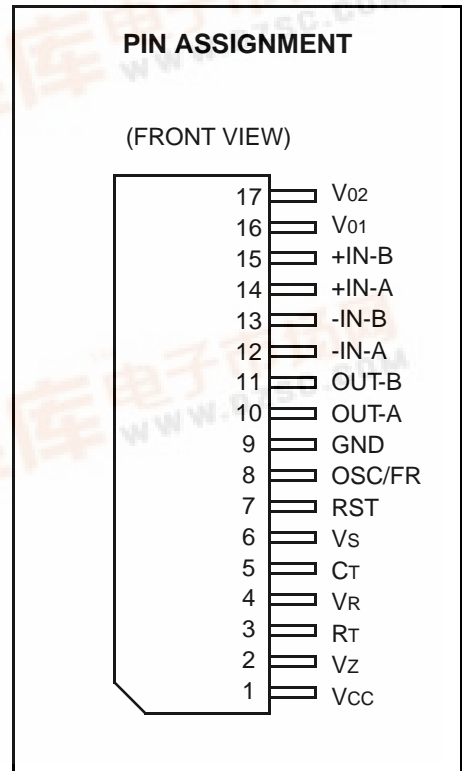
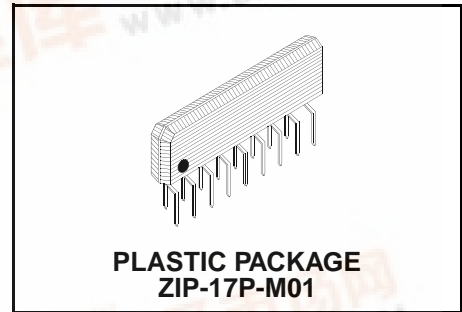
- Time adjustable: 500ms to 100hours
- Oscillator period is controlled by  $V_S$  input voltage
- Free running oscillation is achieved
- On-chip low power IIL (Integrated Injection Logic) divider
- On-chip zener diode to keep stability
- On-chip two-pair of comparators
- Timer output level: TTL level (open collector)
- Plastic 17-pin ZIP Package (Suffix: -PSZ)

## ABSOLUTE MAXIMUM RATINGS

(See NOTE) ( $T_A=25^\circ\text{C}$ )

Rating	Symbol	Value	Unit
Power Supply Voltage	VCC	18	V
Zener Current	I <sub>Z</sub>	20	mA
Input Voltage	V <sub>IN</sub>	-0.3 to 18 ( $V_{IN} \leq V_{CC}$ )	V
Output Voltage	V <sub>O</sub>	18	V
Power Dissipation	PD	620 ( $T_A \leq 85^\circ\text{C}$ )	mW
Operating Temperature	T <sub>A</sub>	-30 to +85	°C
Storage Temperature	T <sub>STG</sub>	-55 to +125	°C

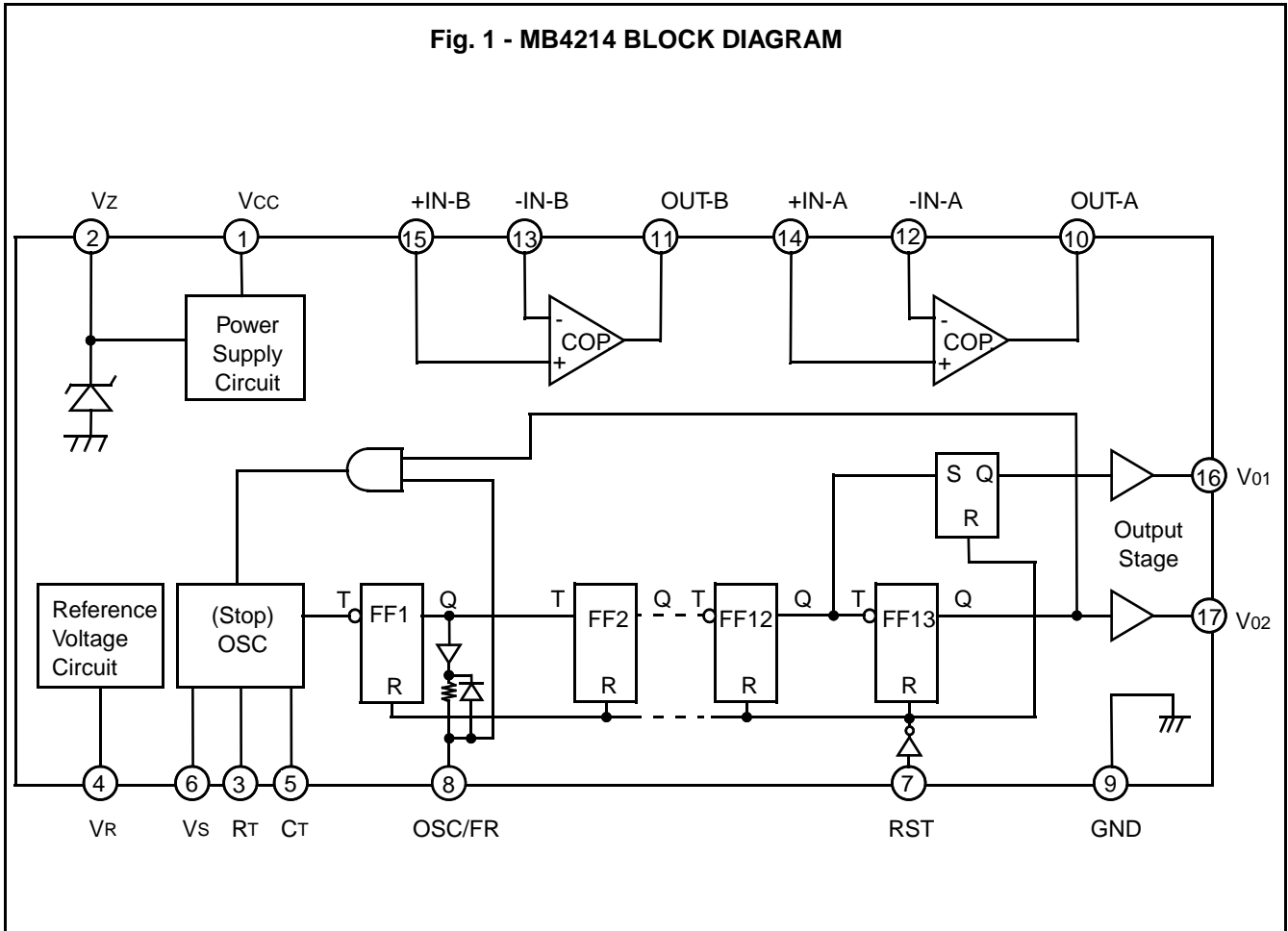
NOTE: Permanent device damage may occur if the above Absolute Maximum Ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high

# MB4214

Fig. 1 - MB4214 BLOCK DIAGRAM



## ■ PIN DESCRIPTIONS

Pin No.	Pin Name	
1	VCC	Power Supply Voltage, 4.5 to 16V
2	VZ	Zener Pin VZ pin outputs zener current 20mA max. Unless it is used as stability power supply source, it should be connected to VCC pin through a resistor about 100k $\Omega$ .
3	RT	RT Input Pin This pin is provided to connect the time constant of a resistor which controls the oscillator period.
4	VR	Reference Voltage Output Reference voltage of 3.5V is output. This pin can supply the current up to 3mA.
5	CT	C <sub>T</sub> Input pin This pin is provided to connect a capacitor which controls the oscillator period.
6	Vs	V <sub>s</sub> Input Voltage Input Voltage to this pin controls the oscillator period.
7	RST	Reset Pin Counter operation is interrupted by the instruction of RST pin input level. All counter is cleared when this pin is connected to GND. Power on reset is achieved by connecting a external capacitor.
8	OSC/FR	Free Running Oscillator Output When this pin is connected to GND, 4096 times as long as normal oscillator frequency is output.
9	GND	Ground
10 11	OUT-A OUT-B	Open Collector outputs
12 13 14 15	-IN-A -IN-B +IN-A +IN-B	Comparator Inputs
16	V01	Timer Output Pin NO. 1 The 2048times as long as fundamental oscillator period is kept.
17	V02	Time Output Pin NO. 2 The 4096 times as long as fundamental oscillator period is kept. Owing to free running oscillation, the 4096times as long as oscillator frequency is output.

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## ■ FUNCTIONAL DESCRIPTIONS

The MB4214 contains reference voltage circuit, oscillator, divider and comparator as shown in Fig. 1. Oscillator frequency is arbitrary controlled by external resistor  $R_T$ , capacitor  $C_T$  and  $V_S$  input voltage.

Divider consists of 13 stages of divider circuit which is constructed by IIL (Intergrated Injection Logic) technique. It expands the oscillator period up to 4096times. About 100hours period is achieved by a small capacitor.

Free Running Oscillation (Long period low frequency) is achieved when OSC/FR pin is connected to GND.

### START RESISTOR $R_S$

$R_S$  is a start resistor which controls zener diode current. Zener current is 20mA max and stability zener voltage 6.2V is generated.

### RESET FUNCTION

Counter operation is interrupted by the instruction of reset pin (7pin). All counter is cleared when this pin is connected to GND. Power on reset is available by connecting a external capacitor  $C_{RS}$ . Power on reset time  $t_{POR}$  is formulated:

$$t_{POR} \cong 3.5 \frac{C_{RS}}{I_{RS}} \text{ (s)}$$

### OSCILLATOR PERIOD

Two kinds of oscillator period selecting ways are provided.

Divide internal reference voltage by external resistor, to be the  $V_S$  voltage.

$R_T$  pin voltage and reference voltage has the 2 : 3.5 ratio.

Oscillator period is formulated:

$$t_{OSC} \cong \frac{3.5}{2} R_T C_T \frac{R_2}{R_1 + R_2} \text{ (s)}$$

Providing  $V_S$  voltage in other power supply source.

$$t_{OSC} \cong K \frac{R_T C_T}{2} V_S \text{ (s)}$$

Note:

Conversion value  $K \cong 1$

### FREE RUNNING OSCILLATION

Free running oscillation is achieved when OSC/FR pin is connected to GND.

$V_{O2}$  pin outputs 4096times as long as fundamental oscillator frequency.

After the voltage is applied or reset is released,  $V_{O2}$  keeps 2048times as long as fundamental period. When OSC/FR pin is left open, first divider data is output.

## ■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Power Supply Voltage	V <sub>CC</sub>	4.5 to 16	V
Timing Resistance	R <sub>T</sub>	10 to 220	kΩ
Timing Capacitance	C <sub>T</sub>	0.001 to 100	μF
Operating Temperature	T <sub>A</sub>	-30 to +85	°C

## ■ ELECTRICAL CHARACTERISTICS

### Comparator Section

( T<sub>A</sub>=25°C, V<sub>CC</sub>=12V, R<sub>S</sub>=100kΩ)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Input Offset Voltage	V <sub>IO</sub>		-	2.0	5.0	mV
Input Offset Current	I <sub>IO</sub>		-	5	50	nA
Input Bias Current	I <sub>I</sub>		-250	-25	-	nA
Common-Mode Input Voltage	V <sub>CM</sub>		0	-	V <sub>CC</sub> -1.5	V
Voltage Gain	A <sub>V</sub>	R <sub>L</sub> =15kΩ	25	200	-	V/mV
Output Saturation Voltage	V <sub>OL</sub>	I <sub>OL</sub> =10mA	-	0.2	0.4	V
Output Sink Current	I <sub>SINK</sub>	V <sub>OL</sub> =1.5V	20	-	-	mA
Output Leakage Current	I <sub>OH</sub>	V <sub>OH</sub> =18V	-	-	1.0	μA
Response Time	t <sub>R</sub>	R <sub>L</sub> =5.1kΩ, V <sub>R</sub> =5V	-	1.3	-	μA
Large Signal Response Time	t <sub>RL</sub>	R <sub>L</sub> =5.1kΩ, V <sub>R</sub> =5V	-	300	-	ns

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## ■ ELECTRICAL CHARACTERISTICS (Continued)

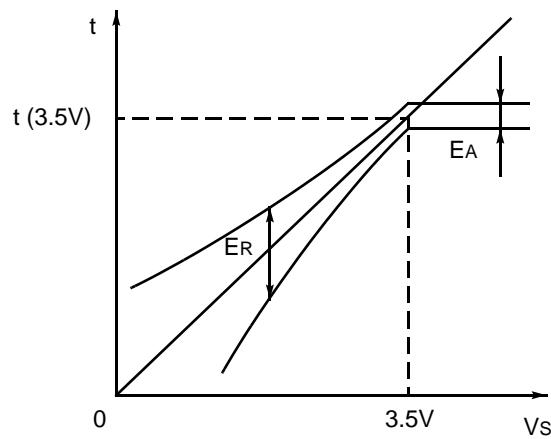
### Timer Section

( $T_A=25^{\circ}\text{C}$ ,  $V_{CC}=12\text{V}$ ,  $R_S=100\text{k}\Omega$ )

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Power Supply Current	$I_{CC}$	$V_{CC}=12\text{V}$	50.	8.0	12	mA
Zener Voltage	$V_Z$	$I_Z=0.3$ to $5\text{mA}$	5.7	6.2	6.7	V
Reference Voltage	$V_R$	$V_{CC}=4.5$ to $16\text{V}$ , $I_R=0$ to $-3\text{m}$	3.3	3.5	3.7	V
	$V_{RT}$	$I_{RT}=-200\mu\text{A}$	1.88	2.0	2.12	V
Charge Current	$I_{CT1}$	$I_{RT}=-10\mu\text{A}$	-11	-10	-9	$\mu\text{A}$
	$I_{CT2}$	$I_{RT}=-200\mu\text{A}$	-220	-200	-180	$\mu\text{A}$
Maximum Oscillation Frequency	$f_{MAX}$		10	100	-	kHz
Reset Input Threshold Voltage	$V_{IL}$		1.1	1.4	1.7	V
	$V_{IH}$		3.2	3.5	3.8	V
Reset Charge Current	$I_{RS}$	$V_{RS}=0\text{V}$	-160	-100	-60	$\mu\text{A}$
OSC/FR Output Voltage	$V_{OL}$		1.1	1.4	1.7	V
	$V_{OH}$		3.7	4.2	4.7	V
Stop Input Current	$I_{IST}$	$V_{ST}=0.4\text{V}$	-200	-100	-	$\mu\text{A}$
Output Saturation Voltage	$V_{OL}$	$I_{OL}=10\text{mA}$	-	0.2	0.4	V
Output Sink Current	$I_{SINK}$	$V_{OL}=1.5\text{V}$	20	-	-	mA
Output Leakage Current	$I_{OH}$	$V_{OH}=18\text{V}$	-	-	1.0	$\mu\text{A}$
$V_S$ Input Current	$I_{IS}$	$V_S=0.4\text{V}$	-5	-1	-	$\mu\text{A}$
$V_S$ Input Voltage	$V_{INS}$		0.1	-	$V_{CC}-2$	V
$V_T$ Setting Error	$E_A$	$C_T=0.01\mu\text{F}$ , $R_T=100\text{k}\Omega$ , $V_S=V_R$	-10	-	10	%
Linearity Error	$E_R$	$C_T=0.01\mu\text{F}$ , $R_T=100\text{k}\Omega$ ,	-2.5	-	2.5	%

Fig. 2 - LINEARITY ERROR

$$E_R = \frac{t(0.1V) - t(3.5V)/35}{t(3.5V)} \times 100 (\%)$$



**OSCILLATOR PERIOD**

$$1. t_{osc} \approx K \cdot \frac{R_T C_T}{2} \cdot V_S (s)$$

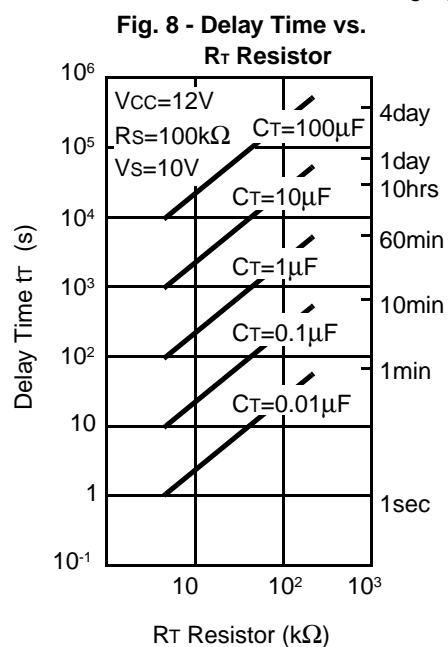
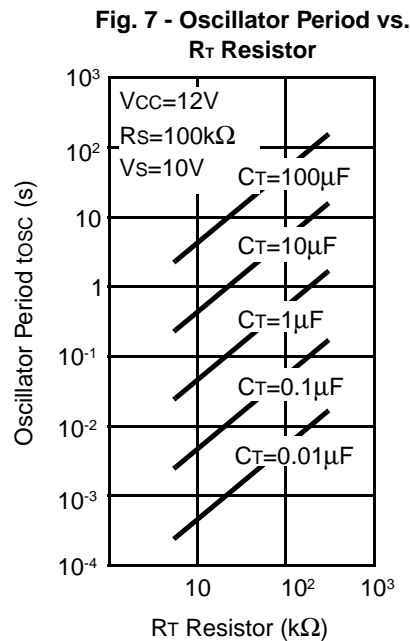
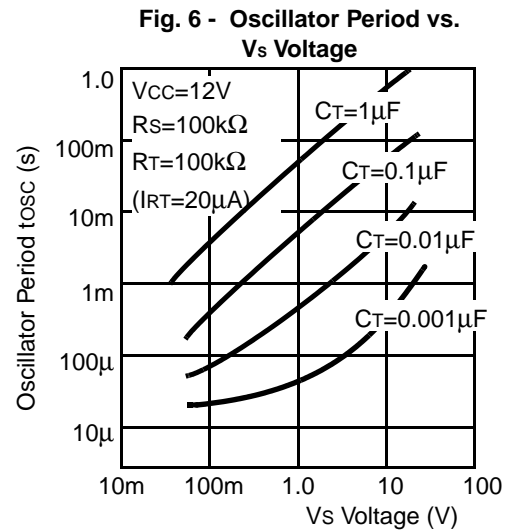
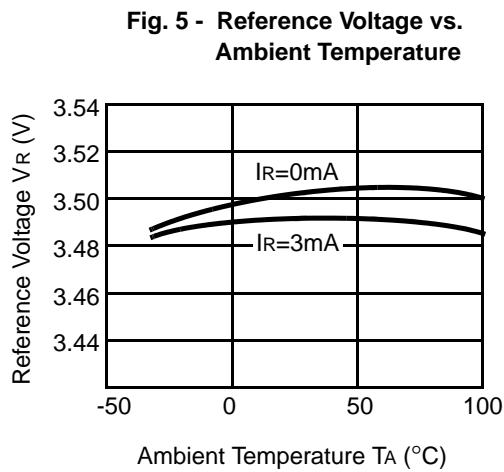
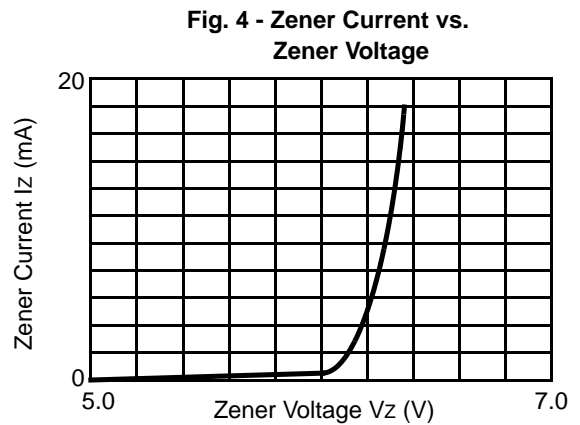
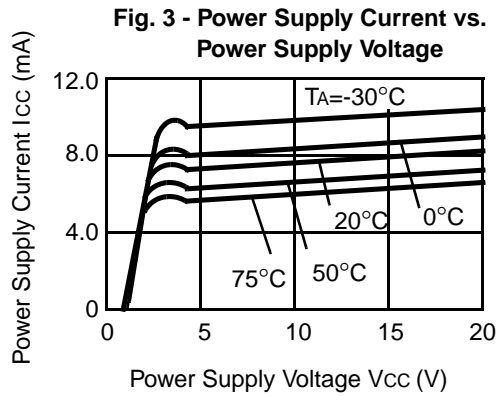
$$2. t_{osc} \approx \frac{3.5}{2} R_T C_T \frac{R_2}{R_1 + R_2} (s)$$

Note: Divide internal reference voltage  $V_R$  by external resistor, to be the  $V_S$  Voltage.

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## ■ TYPICAL CHARACTERISTICS CURVES

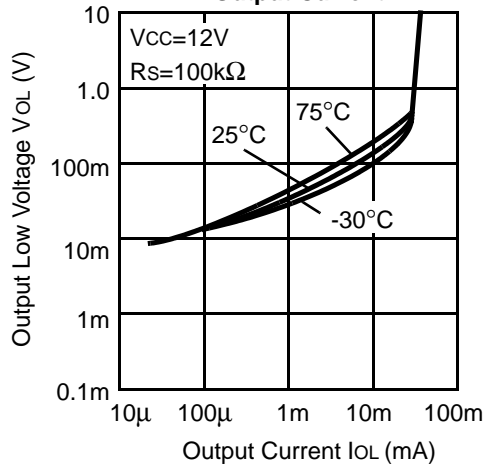
### TIMER SECTION





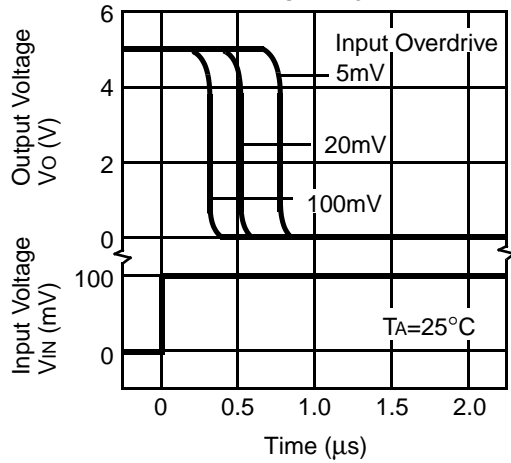
## TIMER SECTION (continued)

**Fig. 9 - Output Low Voltage vs. Output Current**

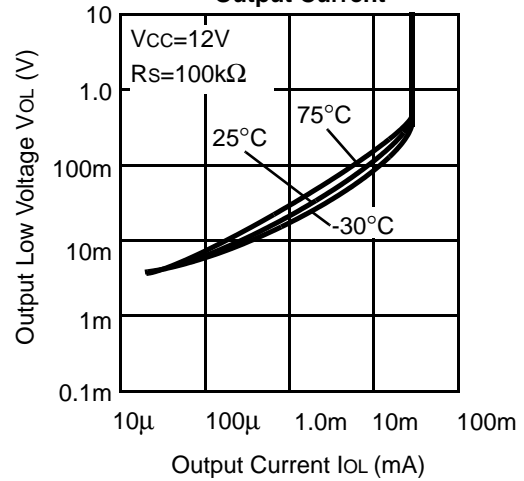


## COMPARATOR SECTION

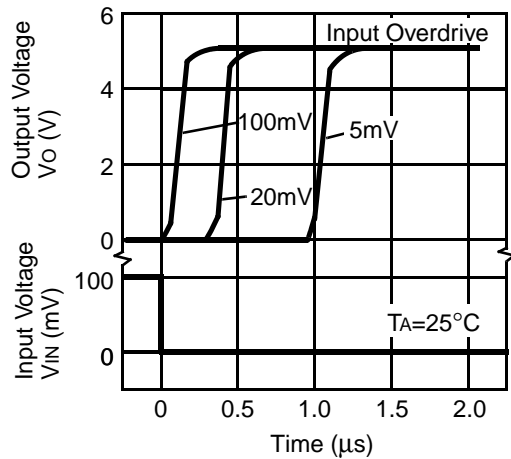
**Fig. 10 - Input Voltage/Output Voltage vs. Time**



**Fig. 11 - Output Low Voltage vs. Output Current**



**Fig. 12 - Input Voltage/Output Voltage vs. Time**



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## APPLICATION EXAMPLES

Fig. 13 - Timer

$$t_{osc} = \frac{3.5}{2} \cdot R_T \cdot C_T \cdot \frac{R_2}{R_1 + R_2} [s]$$

Start timing: Rising edge of reset signal  
 Stop timing: Rising edge of V01 output

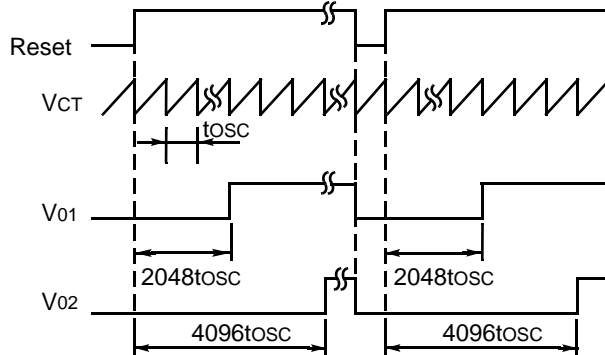
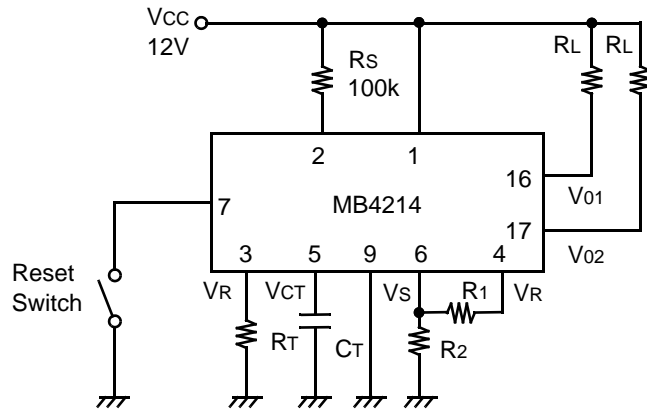
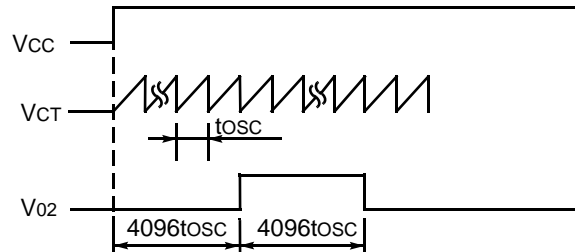
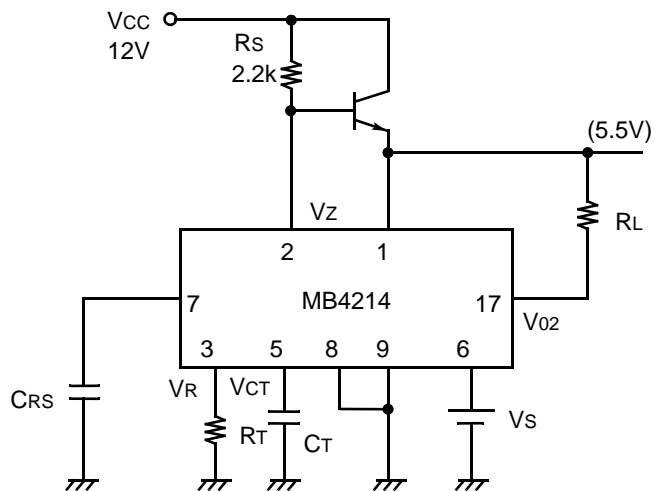


Fig. 14 - Super Low Frequency Oscillator

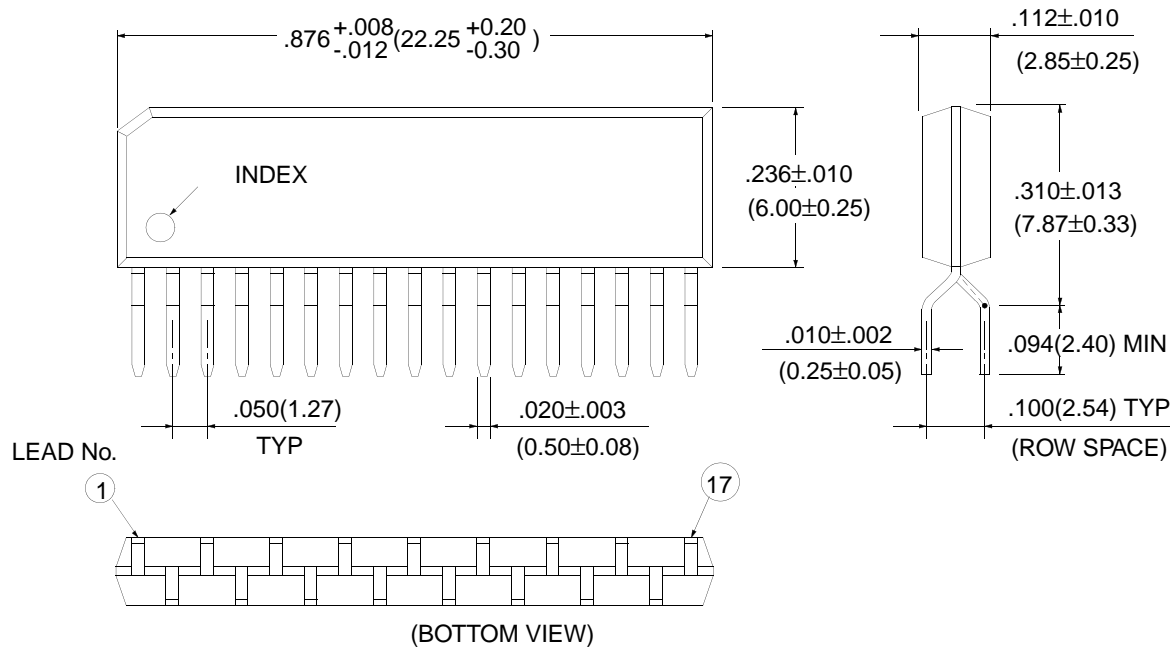
$$t_{osc} = K \cdot \frac{R_T \cdot C_T}{2} \cdot V_s [s]$$

$$t_{POR} = 3.5 \cdot \frac{C_{RS}}{I_{RS}} [s]$$



## ■ PACKAGE DIMENSIONS

### 17-LEAD PLASTIC ZIGZAG-IN-LINE PACKAGE (CASE No. : ZIP-17P-M01)



©1991 FUJITSU LIMITED Z17001Z-3C

Dimensions in  
inches (millimeters)

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