FUJITSU SEMICONDUCTOR
DATA SHEET

DS04-29106-2E

ASSP

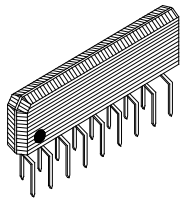
TIMER

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.

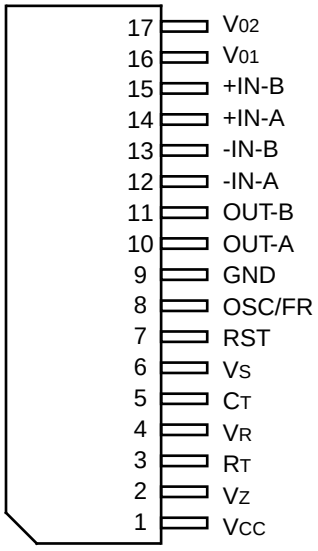
- Time adjustable: 500ms to 100hours
- Oscillator period is controlled by V_S input voltage
- Free running oscillation is achieved
- On-chip low power IIL (Integrated Injection Logic) divider
- On-chip zener diode to keep stability
- On-chip two-pair of comparators
- Timer output level: TTL level (open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



PLASTIC PACKAGE
ZIP-17P-M01

PIN ASSIGNMENT

(FRONT VIEW)



ABSOLUTE MAXIMUM RATINGS

(See NOTE) (T_A=25°C)

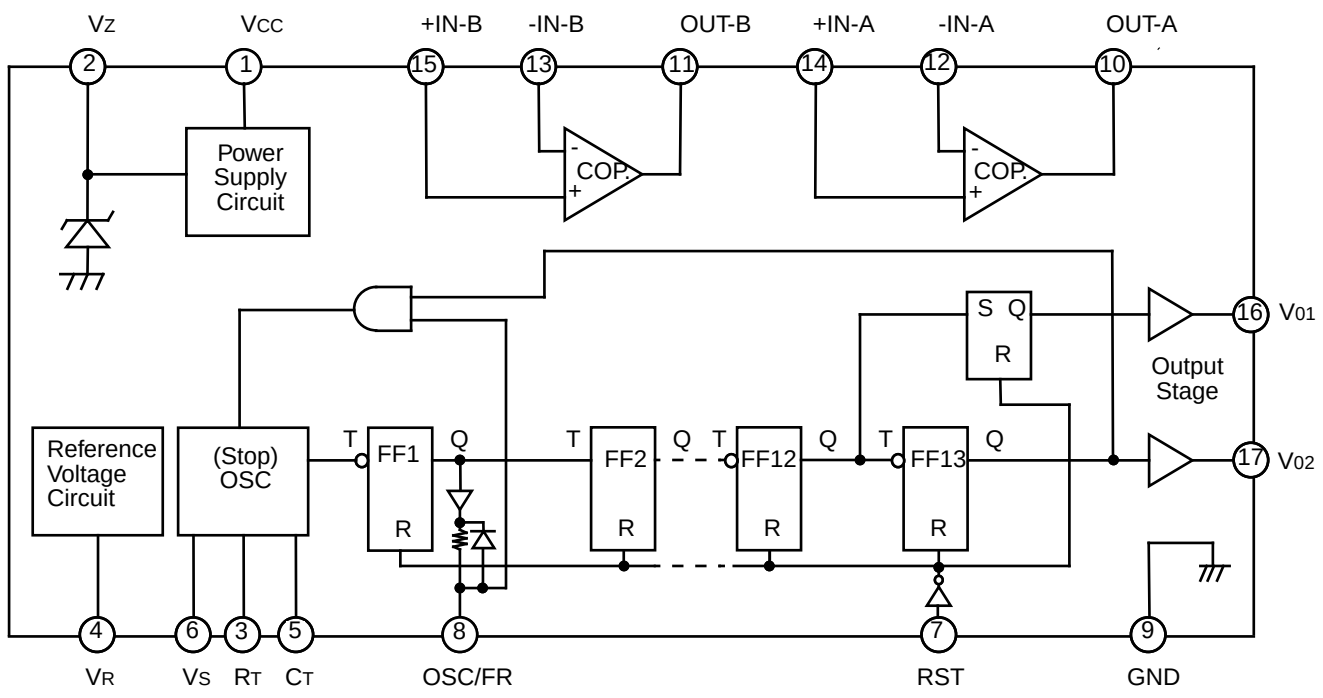
Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	18	V
Zener Current	I_Z	20	mA
Input Voltage	V_{IN}	-0.3 to 18 ($V_{IN} \leq V_{CC}$)	V
Output Voltage	V_O	18	V
Power Dissipation	P_D	620 ($T_A \leq 85°C$)	mW
Operating Temperature	T_A	-30 to +85	°C
Storage Temperature	T_{STG}	-55 to +125	°C

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 impedance circuit.

MB4214

Fig. 1 - MB4214 BLOCK DIAGRAM



MB4214

■ PIN DESCRIPTIONS

Pin No.	Pin Name	
1	V_{CC}	Power Supply Voltage, 4.5 to 16V
2	V_Z	Zener Pin V_Z pin outputs zener current 20mA max. Unless it is used as stability power supply source, it should be connected to V_{CC} pin through a resistor about 100kΩ.
3	R_T	R_T Input Pin This pin is provided to connect the time constant of a resistor which controls the oscillator period.
4	V_R	Reference Voltage Output Reference voltage of 3.5V is output. This pin can supply the current up to 3mA.
5	C_T	C_T Input pin This pin is provided to connect a capacitor which controls the oscillator period.
6	V_S	V_S 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	V_{01}	Timer Output Pin NO. 1 The 2048times as long as fundamental oscillator period is kept.
17	V_{02}	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.

■ 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:

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

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:

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

Providing V_S voltage in other power supply source.

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

Note:
Conversion value $K \fallingdotseq 1$

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_{CC}	4.5 to 16	V
Timing Resistance	R_T	10 to 220	kΩ
Timing Capacitance	C_T	0.001 to 100	µF
Operating Temperature	T_A	-30 to +85	°C

■ ELECTRICAL CHARACTERISTICS

Comparator Section

(T_A=25°C, V_{CC}=12V, R_S=100kΩ)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Input Offset Voltage	V_{IO}		-	2.0	5.0	mV
Input Offset Current	I_{IO}		-	5	50	nA
Input Bias Current	I_I		-250	-25	-	nA
Common-Mode Input Voltage	V_{CM}		0	-	V_{CC}-1.5	V
Voltage Gain	A_V	R_L=15kΩ	25	200	-	V/mV
Output Saturation Voltage	V_{OL}	I_{OL}=10mA	-	0.2	0.4	V
Output Sink Current	I_{SINK}	V_{OL}=1.5V	20	-	-	mA
Output Leakage Current	I_{OH}	V_{OH}=18V	-	-	1.0	µA
Response Time	t_R	R_L=5.1kΩ, V_{RL}=5V	-	1.3	-	µA
Large Signal Response Time	t_{RL}	R_L=5.1kΩ, V_{RL}=5V	-	300	-	ns

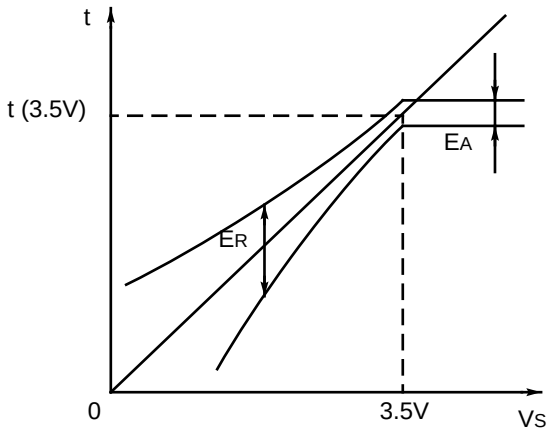
■ ELECTRICAL CHARACTERISTICS (Continued)

Timer Section (T_A=25°C, V_{CC}=12V, R_S=100kΩ)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Power Supply Current	I_{CC}	V_{CC}=12V	50.	8.0	12	mA
Zener Voltage	V_Z	I_Z=0.3 to 5mA	5.7	6.2	6.7	V
Reference Voltage	V_R	V_{CC}=4.5 to 16V, I_R=0 to -3m	3.3	3.5	3.7	V
	V_{RT}	I_{RT}=-200µA	1.88	2.0	2.12	V
Charge Current	I_{CT1}	I_{RT}=-10µA	-11	-10	-9	µA
	I_{CT2}	I_{RT}=-200µA	-220	-200	-180	µA
Maximum Oscillation Frequency	f_{MAX}		10	100	-	kHz
Reset Input Threshould 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}=0V	-160	-100	-60	µA
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}=0.4V	-200	-100	-	µA
Output Saturation Voltage	V_{OL}	I_{OL}=10mA	-	0.2	0.4	V
Output Sink Current	I_{SINK}	V_{OL}=1.5V	20	-	-	mA
Output Leakage Current	I_{OH}	V_{OH}=18V	-	-	1.0	µA
V_S Input Current	I_{IS}	V_S=0.4V	-5	-1	-	µA
V_S Input Voltage	V_{INS}		0.1	-	V_{CC}-2	V
V_T Setting Error	E_A	C_T=0.01µF, R_T=100kΩ, V_S=V_R	-10	-	10	%
Linearity Error	E_R	C_T=0.01µF, R_T=100kΩ,	-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. $t_{OSC} \fallingdotseq K \cdot \frac{R_T C_T}{2} \cdot V_S\ (s)$

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

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

■ TYPICAL CHARACTERISTICS CURVES

TIMER SECTION

Fig. 3 - Power Supply Current vs. Power Supply Voltage

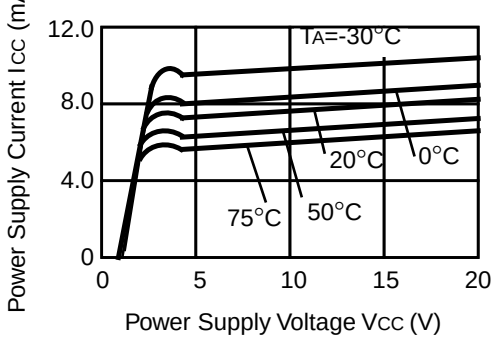


Fig. 4 - Zener Current vs. Zener Voltage

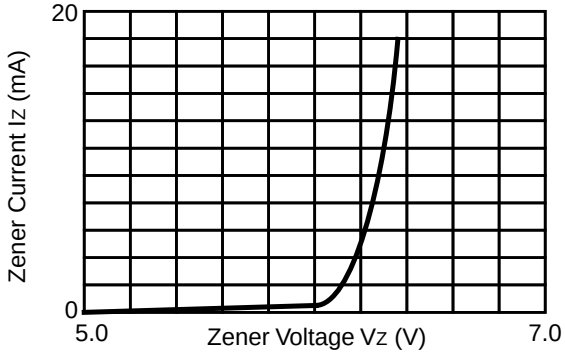


Fig. 5 - Reference Voltage vs. Ambient Temperature

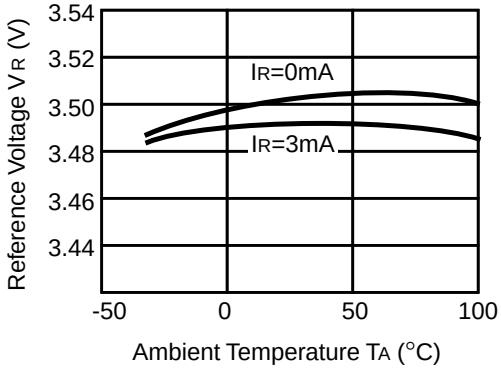


Fig. 6 - Oscillator Period vs. VS Voltage

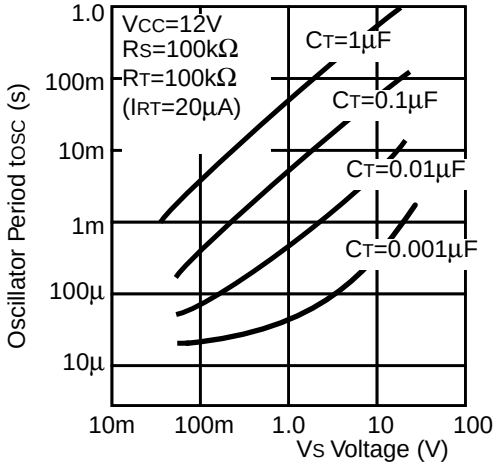


Fig. 7 - Oscillator Period vs. RT Resistor

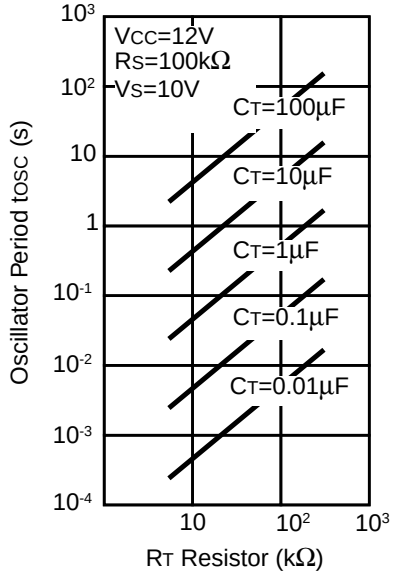
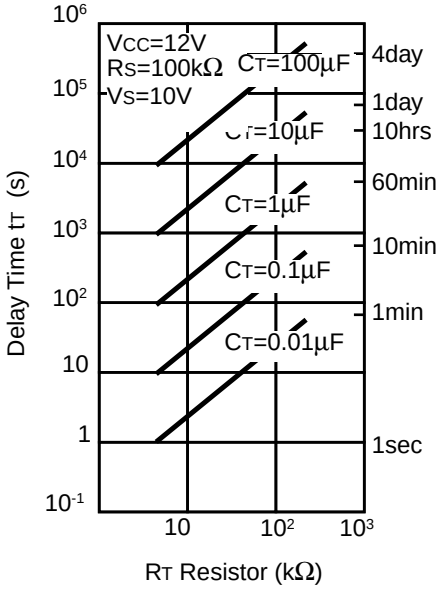
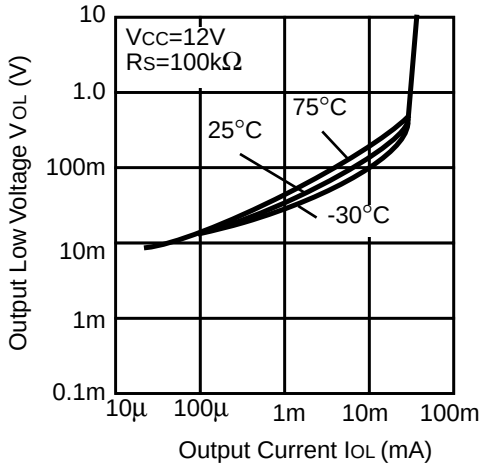


Fig. 8 - Delay Time vs. RT Resistor



TIMER SECTION (continued)

Fig. 9 - Output Low Voltage vs. Output Current



COMPARATOR SECTION

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

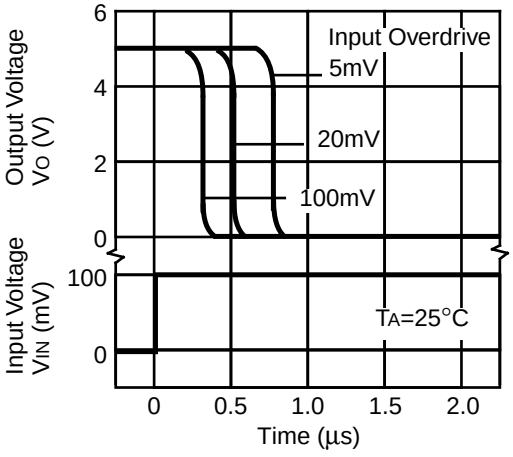


Fig. 11 - Output Low Voltage vs. Output Current

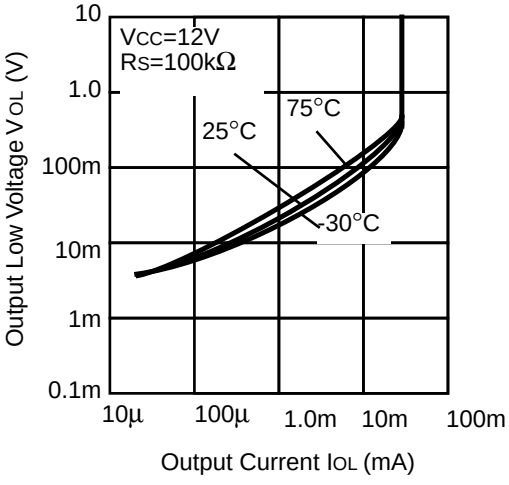
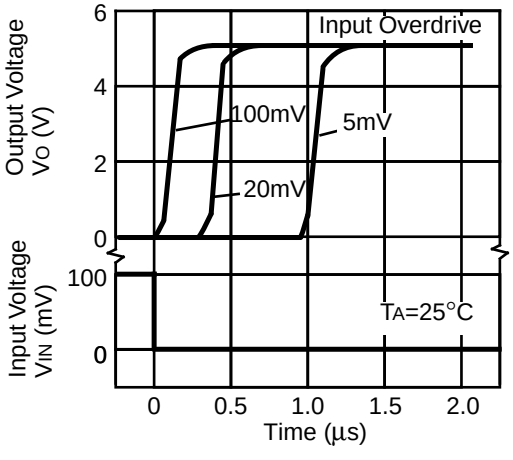


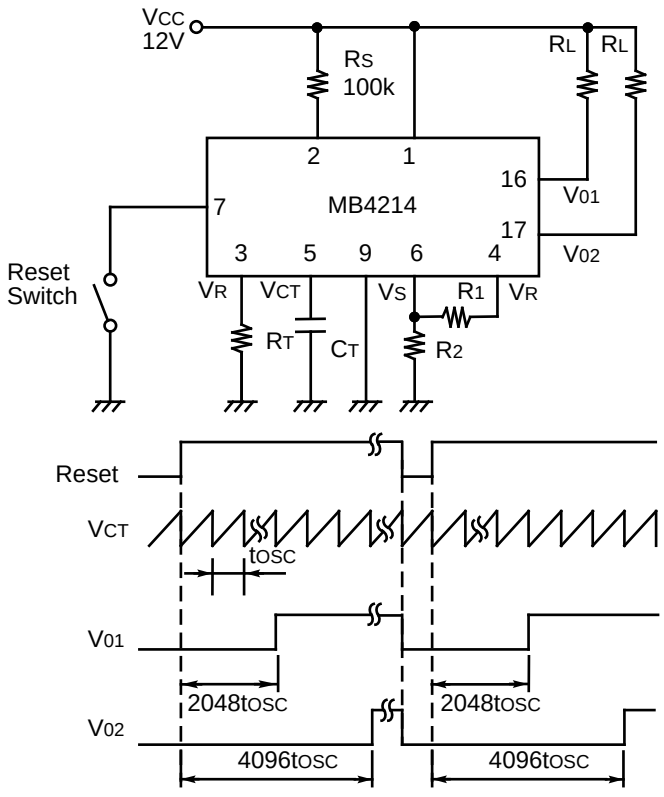
Fig. 12 - Input Voltage/Output Voltage vs. Time



MB4214

■ APPLICATION EXAMPLES

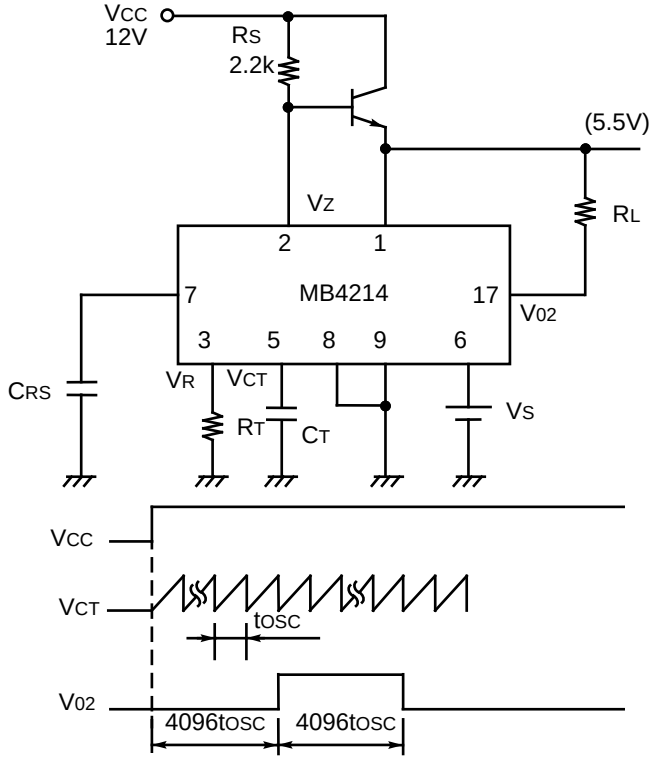
Fig. 13 - Timer



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

Start timing: Rising edge of reset signal
Stop timing: Rising edge of V_{01} output

Fig. 14 - Super Low FrequencyOscillator



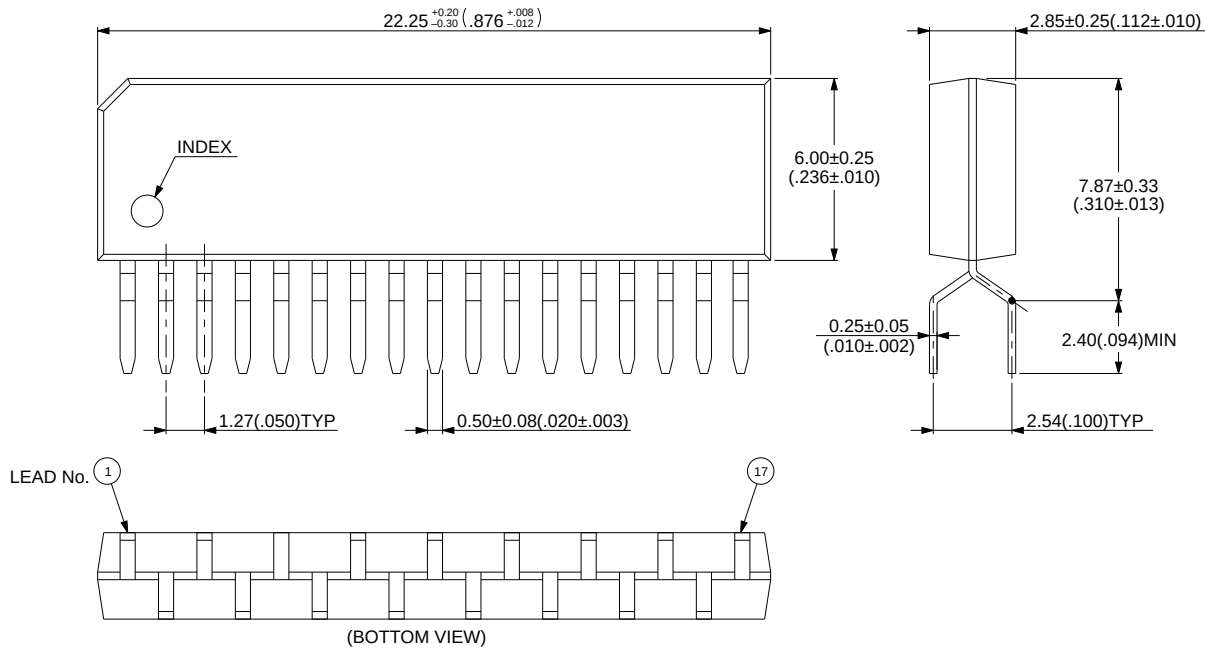
$$t_{OSC} = K \cdot \frac{R_T \cdot C_T}{2} \cdot V_S \quad [s]$$

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

MB4214

■ PACKAGE DIMENSIONS

17 pin, Plastic ZIP
(ZIP-17P-M01)



Dimensions in mm (inches).

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