

# M62021L/P/FP

## System Reset IC with Switch for Memory Backup

REJ03D0784-0200

Rev.2.00

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### Description

The M62021 is a system IC that controls the memory backup function of microcomputer (internal RAM).

The IC outputs reset signals ( $\overline{\text{RES}}/\overline{\text{RES}}$ ) to a microcomputer at power-down and power failure. It also shifts the power supply to RAM from main to backup, outputs a signal ( $\overline{\text{CS}}$ ) that invokes standby mode, and alters RAM to backup circuit mode.

The M62021 contains, in a single chip, power supply monitor and RAM backup functions needed for a microcomputer system, so that the IC makes it possible to construct a system easily and with fewer components compared with a conventional case that uses individual ICs and discrete components.

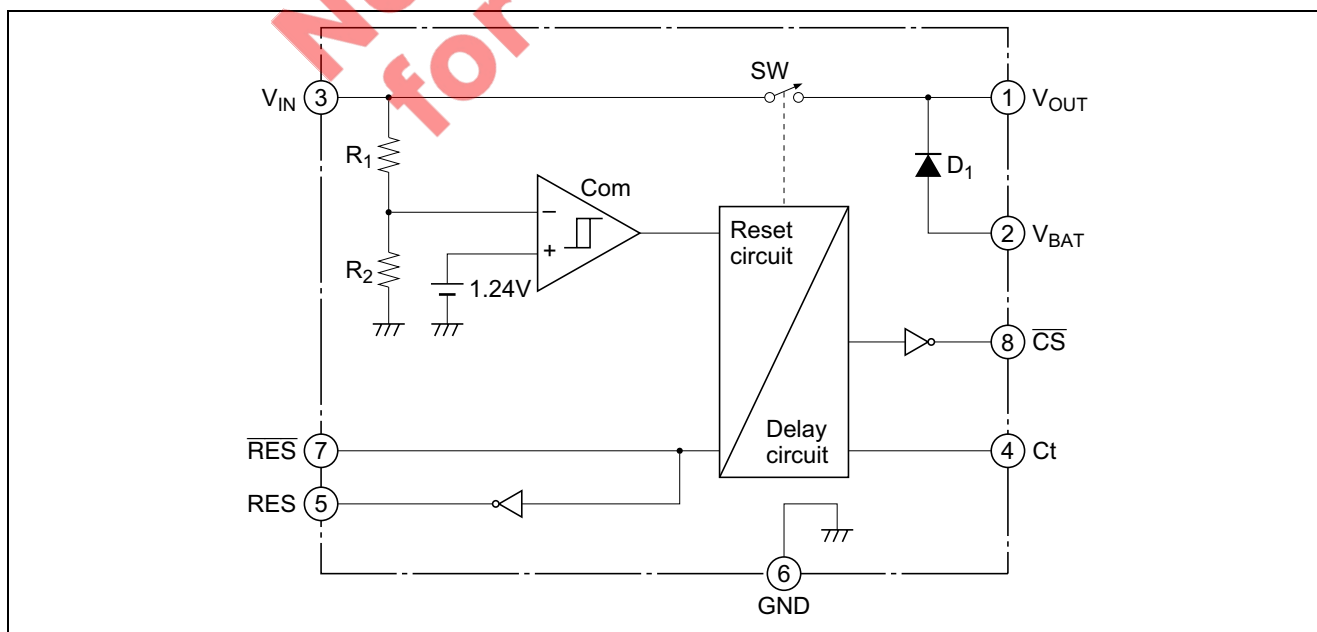
### Features

- Built-in switch for selection between main power supply and backup power supply to RAM.
- Small difference between input and output voltage ( $I_{\text{OUT}} = 80 \text{ mA}$ ,  $V_{\text{IN}} = 5 \text{ V}$ )  $0.2 \text{ V Typ}$
- Detection voltage (power supply monitor voltage)  $4.40 \text{ V} \pm 0.2 \text{ V}$
- Chip select signal output ( $\overline{\text{CS}}$ )
- Two channels of reset outputs ( $\overline{\text{RES}}/\overline{\text{RES}}$ )
- Power on reset circuit built-in
- Delay time variable by an external capacitance connected to Ct pin
- Facilitates to form backup function with a few number of components

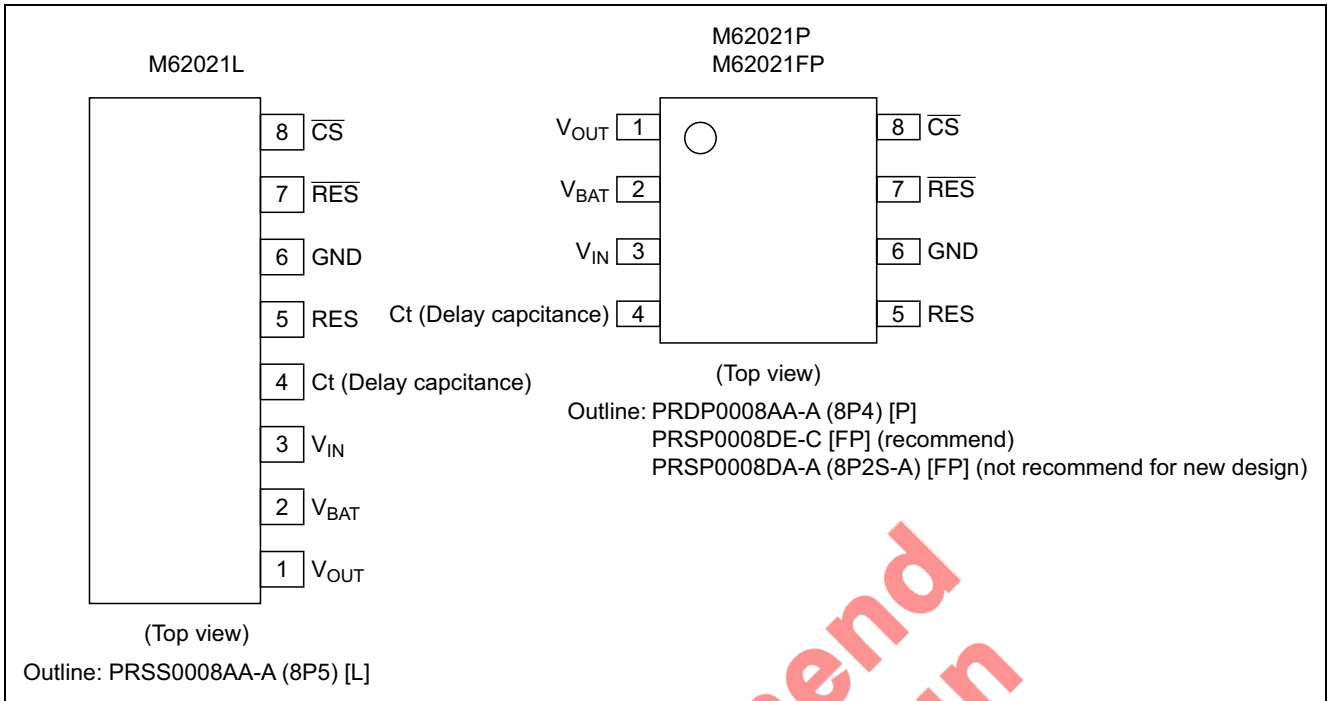
### Application

- Power supply control systems for memory backup of microcomputer system and SRAM boards with built-in backup function that require switching between external power supply and battery.

### Block Diagram



Pin Arrangement



Not recommend  
for new design

## Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

Item	Symbol	Ratings	Unit	Conditions	
Input voltage	V <sub>IN</sub>	7	V		
Output current	I <sub>OUT</sub>	100	mA		
Power dissipation	Pd	800	mW	8-pin SIP	
		625		8-pin DIP	
		440		8-pin SOP	
Thermal derating	K $\theta$	8	mW/°C	Ta $\geq$ 25°C	8-pin SIP
		6.25			8-pin DIP
		4.4			8-pin SOP
Operating temperature	Topr	-20 to +75	°C		
Storage temperature	Tstg	-40 to +125	°C		

## Electrical Characteristics

(Ta = 25°C, unless otherwise noted)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions	
Detection voltage	V <sub>S</sub>	4.2	4.4	4.6	V	V <sub>IN</sub> (at the change from H→L)	
Hysteresis voltage	$\Delta V_S$	50	100	200	mV	$\Delta V_S = V_{SH} - V_{SL}$	
Temperature coefficient of detection voltage	V <sub>S</sub> / $\Delta T$	—	0.005	—	%/°C		
Circuit current	I <sub>CC</sub>	—	2.0	4.0	mA	I <sub>OUT</sub> = 0mA	V <sub>IN</sub> = 4V
		—	7.5	12.0			V <sub>IN</sub> = 5V
Difference between input and output voltage	V <sub>DROP</sub>	—	0.125	0.25	V	V <sub>IN</sub> = 5V	I <sub>OUT</sub> = 50mA
		—	0.2	0.4			I <sub>OUT</sub> = 80mA
Ct output voltage (high level)	V <sub>OH(Ct)</sub>	4.5	5.0	—	V	V <sub>IN</sub> = 5V * <sup>1</sup>	
Ct output voltage (low level)	V <sub>OL(Ct)</sub>	—	0.02	0.1	V	V <sub>IN</sub> = 4V * <sup>1</sup>	
RES output voltage (high level)	V <sub>OH(RES)</sub>	3.5	4.0	—	V	V <sub>IN</sub> = 4V * <sup>1</sup>	
RES output voltage (low level)	V <sub>OL(RES)</sub>	—	0.02	—	V	V <sub>IN</sub> = 5V	* <sup>1</sup>
		—	0.05	0.2			I <sub>sink</sub> = 1mA
RES output voltage (high level)	V <sub>OH(RES)</sub>	4.5	5.0	—	V	V <sub>IN</sub> = 5V * <sup>1</sup>	
RES output voltage (low level)	V <sub>OL(RES)</sub>	—	0.02	—	V	V <sub>IN</sub> = 4V	* <sup>1</sup>
		—	0.05	0.2			I <sub>sink</sub> = 1mA
CS output voltage (high level)	V <sub>OH(CS)</sub>	3.50	3.57	—	V	V <sub>IN</sub> = 4V * <sup>2</sup>	
		2.40	2.47	—		V <sub>IN</sub> = 0V, V <sub>BAT</sub> = 3V * <sup>2</sup>	
CS output voltage (low level)	V <sub>OL(CS)</sub>	—	0.08	—	V	V <sub>IN</sub> = 5V	* <sup>1</sup>
		—	0.1	0.3			I <sub>sink</sub> = 1mA
Backup diode leakage current	I <sub>R</sub>	—	—	$\pm 0.5$	$\mu A$	V <sub>BAT</sub> = 3V	V <sub>IN</sub> = 5V
		—	—	$\pm 0.5$			V <sub>IN</sub> = 0V
Backup diode forward direction voltage	V <sub>F</sub>	—	0.54	0.6	V	I <sub>F</sub> = 10 $\mu A$	
Delay time	t <sub>pd</sub>	10	27	55	ms	V <sub>IN</sub> = 0V→5V, Ct = 4.7 $\mu F$	
Response time	t <sub>d</sub>	—	5.0	25.0	$\mu s$	V <sub>IN</sub> = 5V→4V	
RES limit voltage of operation	V <sub>OPL(RES)</sub>	—	0.65	—	V	* <sup>3</sup>	

Notes: 1. Regarding conditions to measure V<sub>OH</sub> and V<sub>OL</sub>, voltage values are to be generated by internal resistance only and no external resistor is used.

2. These values are produced inserting an external resistor, R<sub>C $\bar{S}$</sub>  = 1 M $\Omega$ , between the  $\bar{C}\bar{S}$  pin and GND.

3. With no external resistor (10 k $\Omega$  internal resistance only)

## Test Circuit

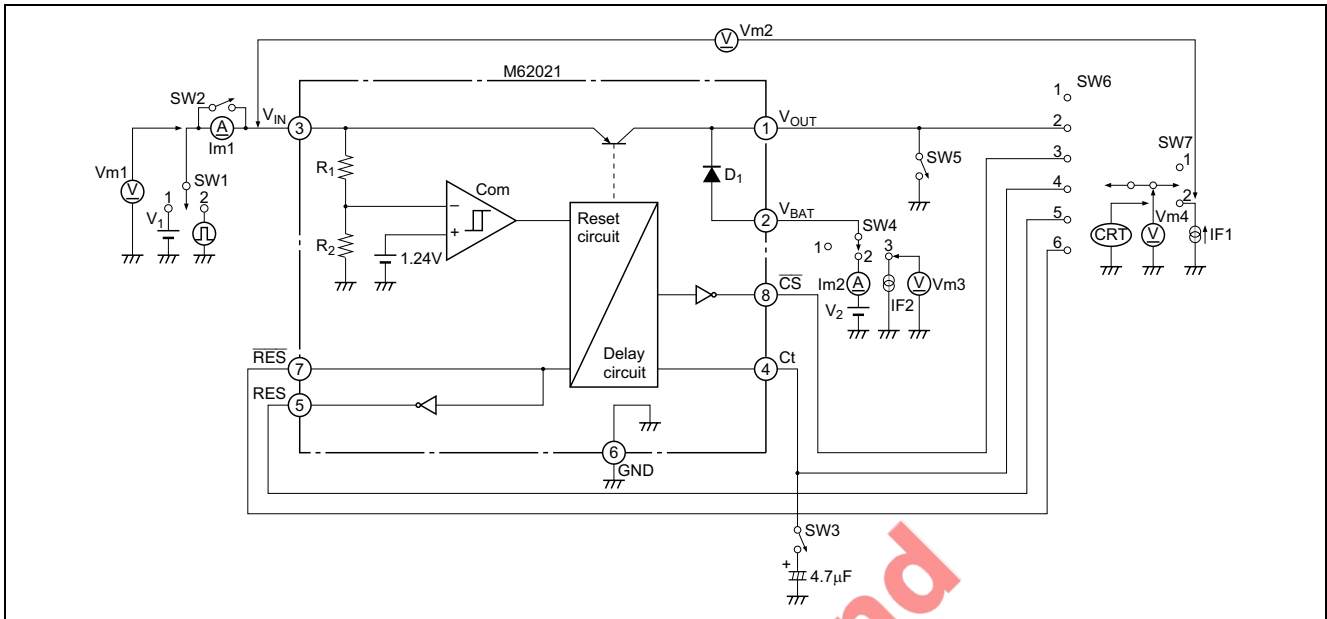


Figure 1 Test Circuit

## Switch Matrix

Item	Symbol	V1	V2	IF1	IF2	SW							Measuring Instrument		
						1	2	3	4	5	6	7			
Circuit current	$I_{CC}$	4V	—	—	—	1	ON	OFF	1	OFF	1	1	Im1		
		5V				1	ON	OFF	1	OFF	1	1			
Detection voltage ( $V_{IN}$ negative-going)	$V_{OUT}$	Decrease from 5V	—	—	—	1	ON	OFF	1	OFF	2	1	*2 Vm4 CRT Vm1		
	CS										3				
	Ct										4				
	RES										5				
RES	6														
Difference between input and output voltage	$V_{DROP}$	5V	—	-50mA -80mA	—	1	ON	OFF	1	OFF	2	2	Vm2		
Ct output voltage (high level)	$V_{OH(Ct)}$	5V	—	—	—	1	ON	OFF	1	OFF	4	1	Vm4		
Ct output voltage (low level)	$V_{OL(Ct)}$	4V	—	—	—	1	ON	OFF	1	OFF	4	1	Vm4		
RES output voltage (high level)	$V_{OH(RES)}$	4V	—	—	—	1	ON	OFF	1	OFF	5	1	Vm4		
RES output voltage (low level)	$V_{OL(RES)}$	5V	—	1mA	—	1	ON	OFF	1	OFF	5	2			
RES output voltage (high level)	$V_{OH(RES)}$	5V	—	—	—	1	ON	OFF	1	OFF	6	1	Vm4		
RES output voltage (low level)	$V_{OL(RES)}$	4V	—	1mA	—	1	ON	OFF	1	OFF	6	2			
CS output voltage (high level) *1	$V_{OH(CS)}$	4V	—	—	—	1	ON	OFF	1	OFF	3	1	Vm4		
		0V	3V	—	—										
CS output voltage (low level)	$V_{OL(CS)}$	5V	—	1mA	—	1	ON	OFF	1	OFF	3	2	Vm4		
Backup diode leakage current	$I_R$	5V	3V	—	—	1	ON	OFF	2	OFF	1	1	Im2		
		0V													
Backup diode forward direction voltage	$V_F$	0V	—	—	10μA	1	ON	OFF	3	ON	1	1	Vm3		
Delay time Response time	$V_{OUT}$	—	—	—	—	2	*3	ON	ON	*4	1	OFF	1	CRT	
	CS														$t_{pd}$
	RES														$t_d$
	RES														
											2				
											3				
											5				
											6				

Notes: 1. To measure  $V_{OH(CS)}$ , insert a 1 MΩ resistor between the CS pin and GND.

2. While monitoring each output by Vm4 or CRT, measure the input voltage Vm1 when the output goes from H to L and L to H. Regarding  $V_{SH}$ , raise  $V_{IN}$  from 4 V and measure the input voltage Vm1 when the output goes from H to L and L to H.  $\Delta V_S$  is  $V_{SH} - V_{SL}$ .

3. To measure delay time, change  $V_{IN}$  from 0 V to 5 V and compare, with respect to each pin, the positive-going edge observed on a monitor with that of  $V_{IN}$ . To measure response time, change  $V_{IN}$  from 5 V to 4 V and compare, with respect to each pin, the negative-going edge observed on a monitor with that of  $V_{IN}$ .

4. Set the switch to OFF when measuring response time.

## Pin Description

Pin No.	Pin Name	Symbol	Function
1	Power supply output	$V_{OUT}$	$V_{IN}$ and $V_{BAT}$ are controlled by means of an internal switch and output through $V_{OUT}$ . The pin is capable of outputting up to 100 mA. Use it as $V_{DD}$ of CMOS RAM and the like.
2	Backup power supply input	$V_{BAT}$	Backup power supply is connected to this pin. If a lithium battery is used, insert a resistor in series for safety purposes.
3	Power supply input	$V_{IN}$	+5 V input pin. Connect to a logic power supply.
4	Delay capacitor connection pin	$C_t$	A delay capacitor is connected to this pin. By connecting a capacitor, it is possible to delay each output.
5	Positive reset output	RES	Connect to the positive reset input of a microcomputer. The pin is capable of flowing 1 mA sink current.
6	Ground	GND	Reference for all signals.
7	Negative reset output	$\overline{RES}$	Connect to the negative reset input of a microcomputer. The pin is capable of flowing 1 mA sink current.
8	Chip select output	$\overline{CS}$	Connect to the chip select of RAM. The CS output is at low level in normal state thereby letting RAM be active. Under failure or backup condition, the CS output is set to high level, then RAM enters standby state disabling read/write function. The pin is capable of flowing a 1 mA sink current.

## Application Example

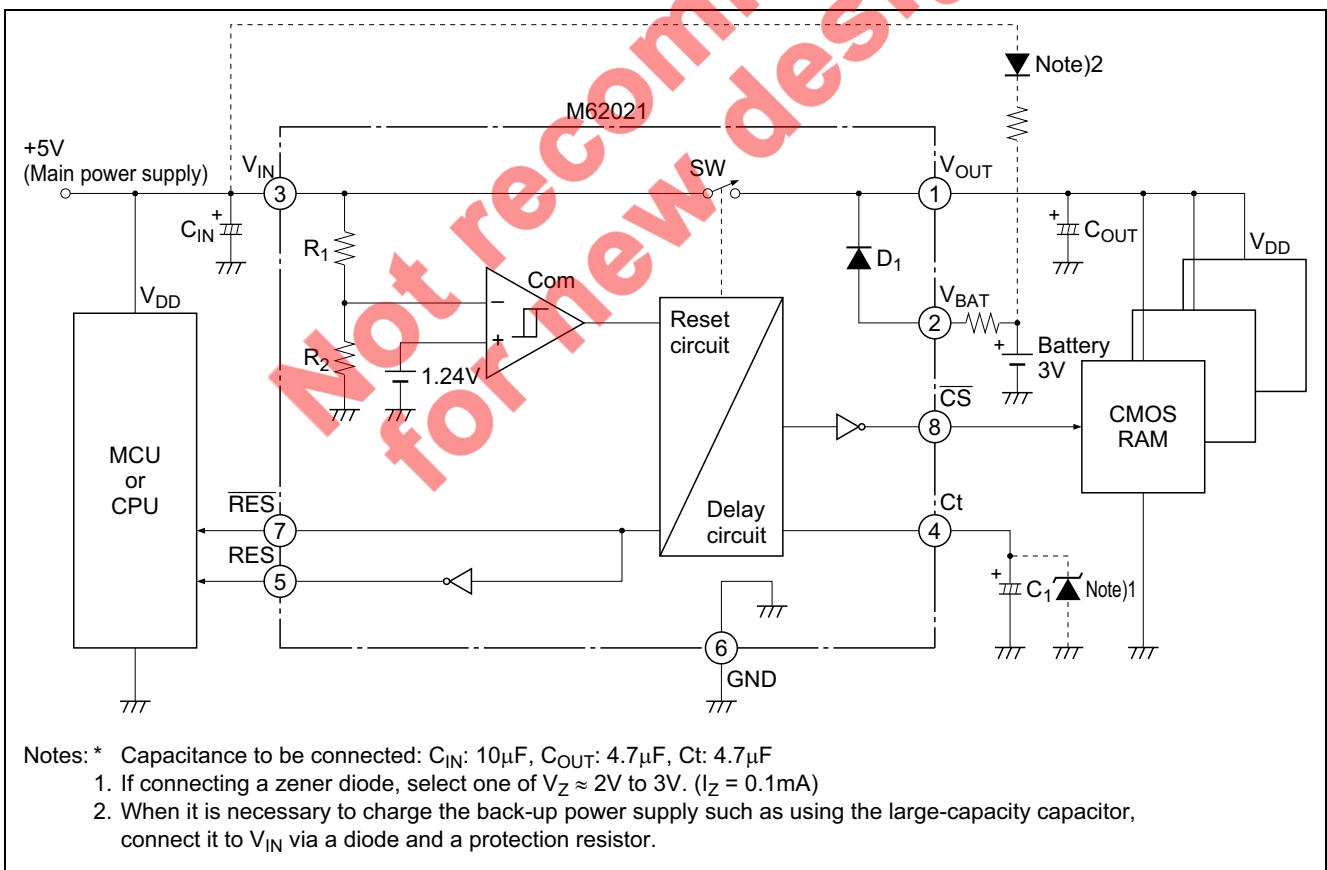


Figure 2 Application Example

## Configuration

### Power Supply Detection

The internal reference voltage  $V_{ref}$  is compared by means of a comparator with resistor-divided voltage  $V_R$  (resistor-divided voltage produced by  $R_1$  and  $R_2$  from  $V_{IN}$ ).

If the input voltage is 5 V,  $V_R$  is set to 1.24 V or higher, so the comparator output is at low level and the Ct output ( $Q_1$  collector output) is set to high level. If the input voltage drops to below 4.4 V in an abnormal condition,  $V_R$  becomes below 1.24 V, so the comparator output goes from low to high level and the Ct output, from high to low. The input voltage at this point is called  $V_{SL}$ . Next, when the input voltage, restored from abnormal state, has a rise, the comparator output goes from high to low level and the Ct output, from low to high.

The comparator used for detection has 100 mV hysteresis ( $\Delta V_S$ ), so that malfunctioning is prevented in case that the input voltage slowly drops or  $V_R$  nearly equals  $V_{ref}$ .

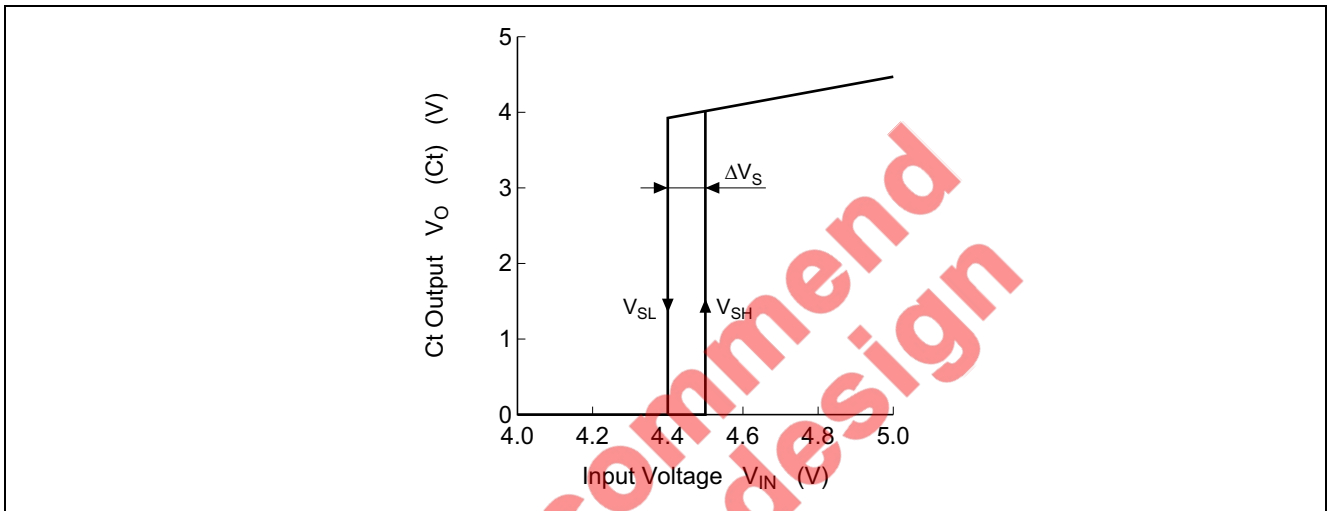


Figure 3

### Delay Circuit

Connecting an external capacitor to the Ct pin lets  $\overline{RES}$ ,  $\overline{RES}$ ,  $\overline{CS}$ , and  $V_{OUT}$  be delayed due to RC transient phenomenon (electric charge).

Delay time is determined as follows.

$$\begin{aligned} \text{Delay time } (t_{pd}) &= C_1 \times (R_3 + R_4) \times 1n \frac{[V_{OH}(Ct) - V_{OL}(Ct)]}{[V_{OH}(Ct) - INV1(V_{TH})]} \\ &= C_1 \times 22k\Omega \times 0.2614 \\ &\approx 5.75 \times 10^3 \times C_1 \end{aligned}$$

\* C is an external capacitance.

Taking into consideration the time taken by the oscillator of microcomputer to be stable, connect a 4.7  $\mu F$  capacitor to the Ct pin. (As the response time of detection can be slowed due to internal structure depending in the rising rate of power supply, avoid connecting a too large capacitance.)

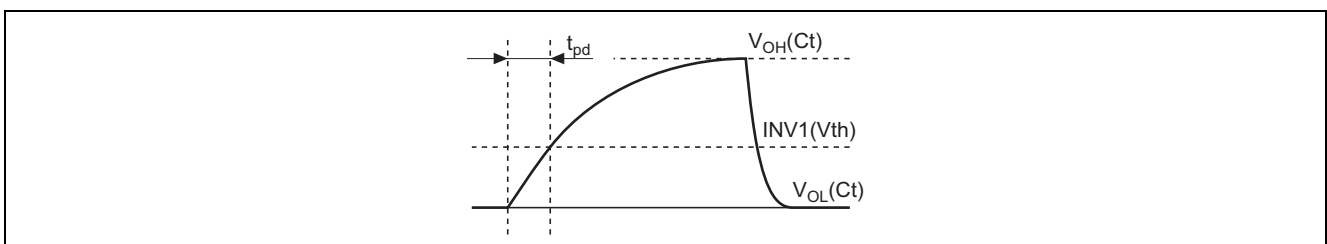


Figure 4 Delayed Output Waveforms of Ct

### Schmitt Trigger Circuit

Since waveforms show a gentle rise due to the RC delay circuit, INV1, INV2, R5, and R6 constitute a Schmitt trigger circuit to produce hysteresis so as to prevent each output from chattering.

### Internal Circuit

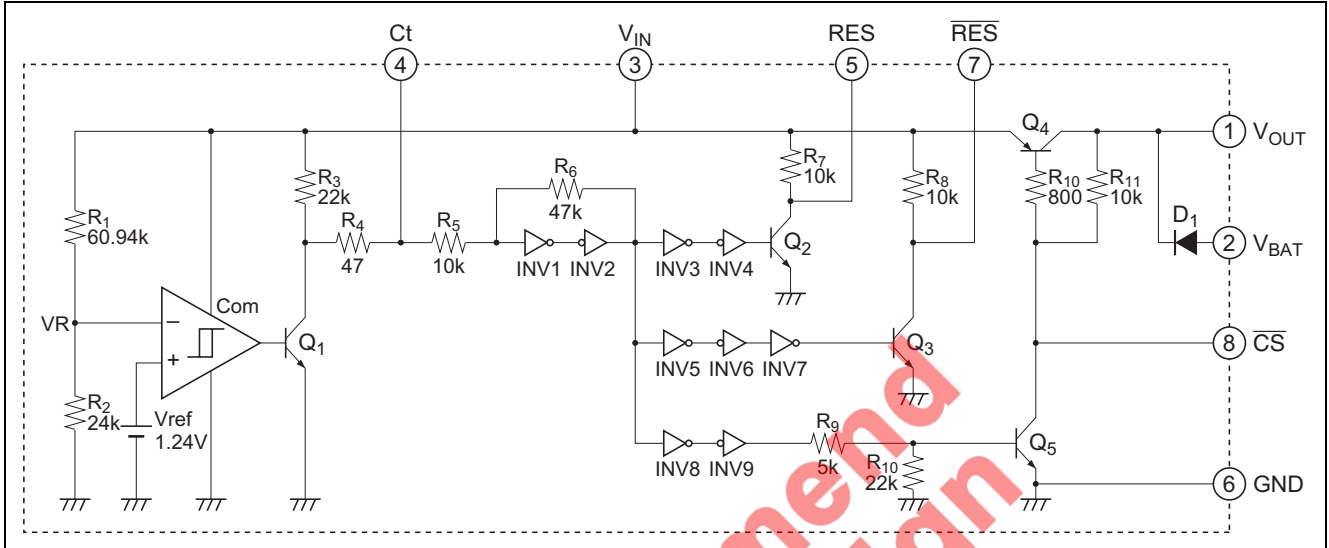


Figure 5 Internal Circuit

Not recommended for new design

Timing Chart

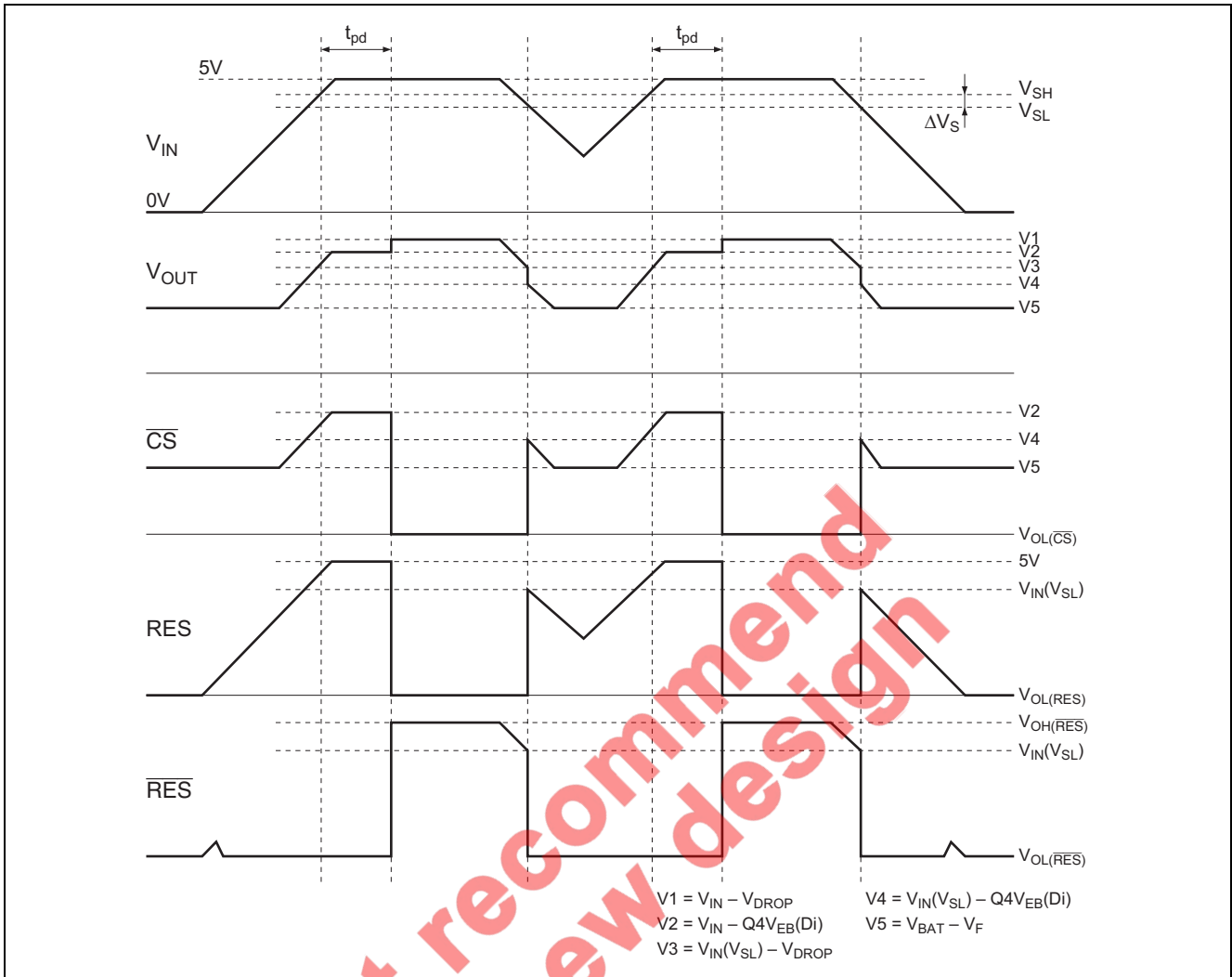
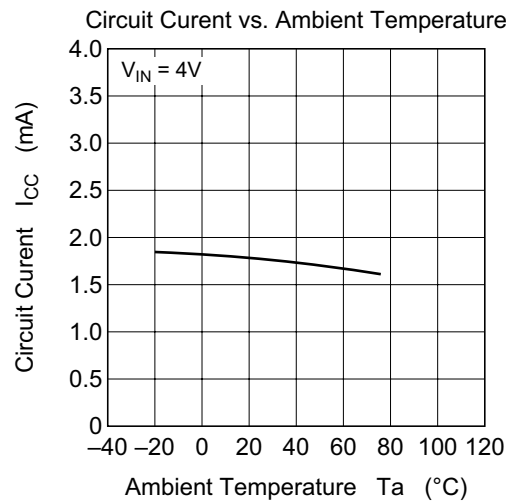
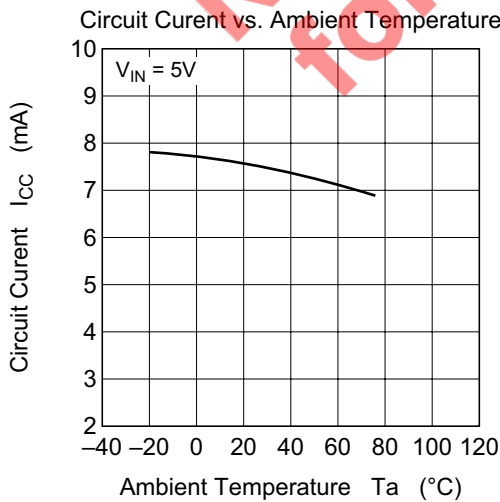
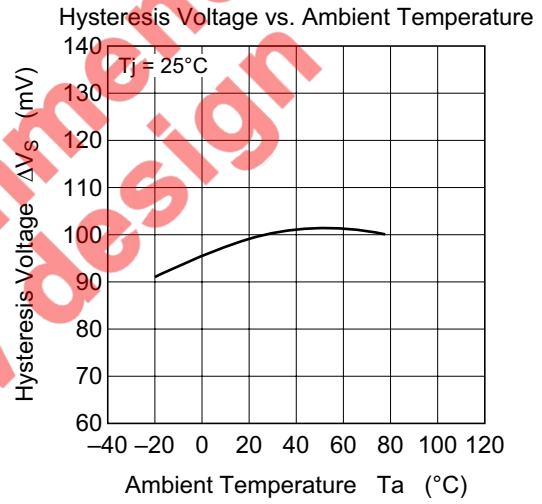
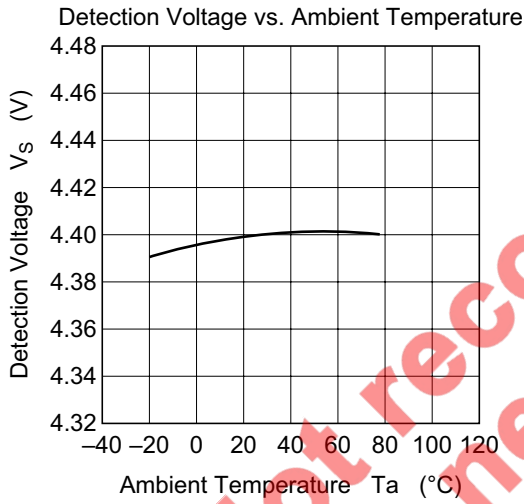
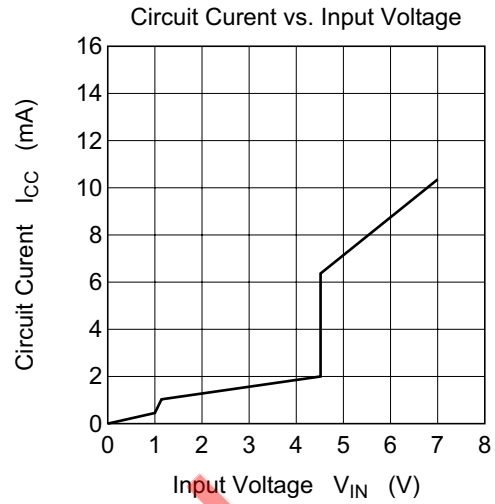
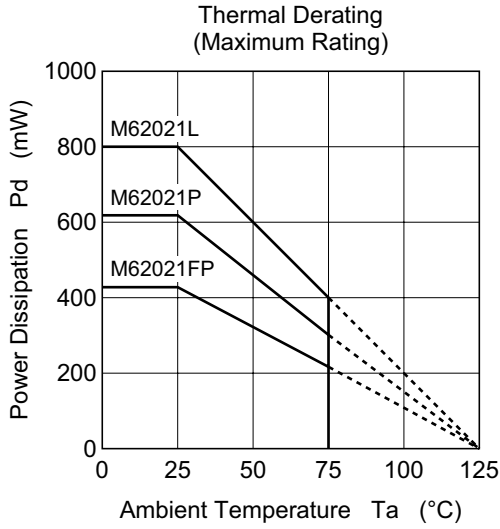


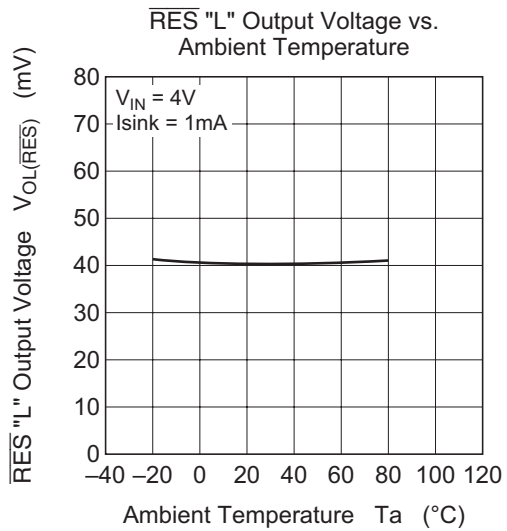
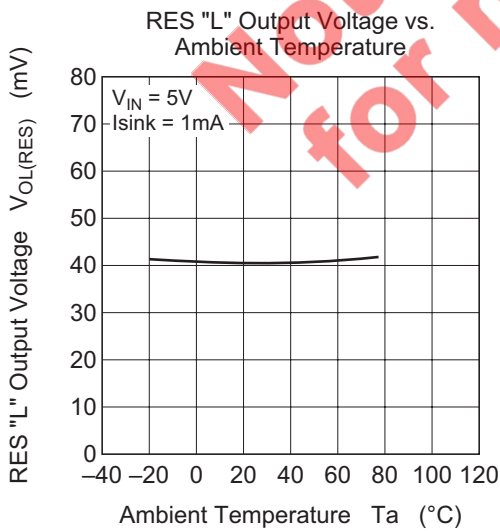
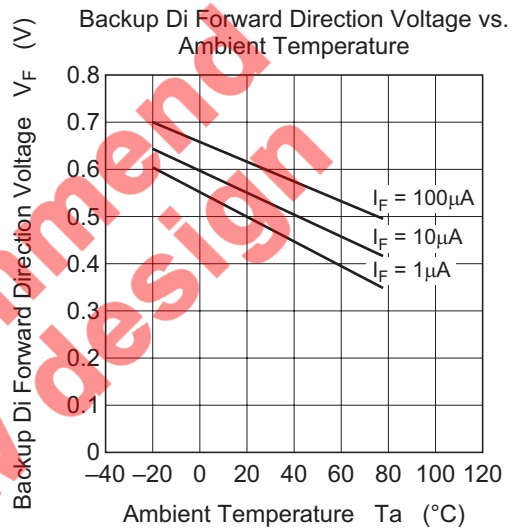
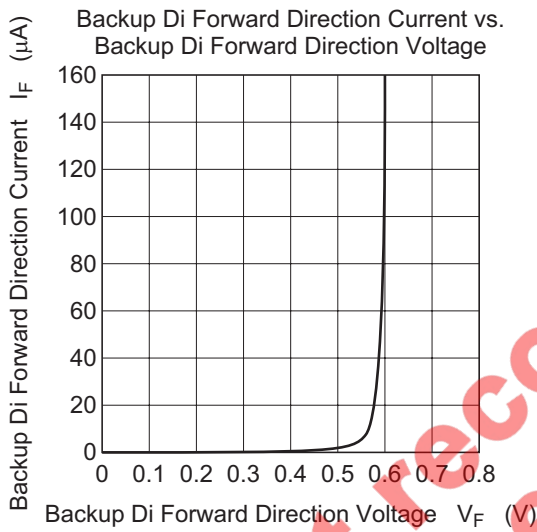
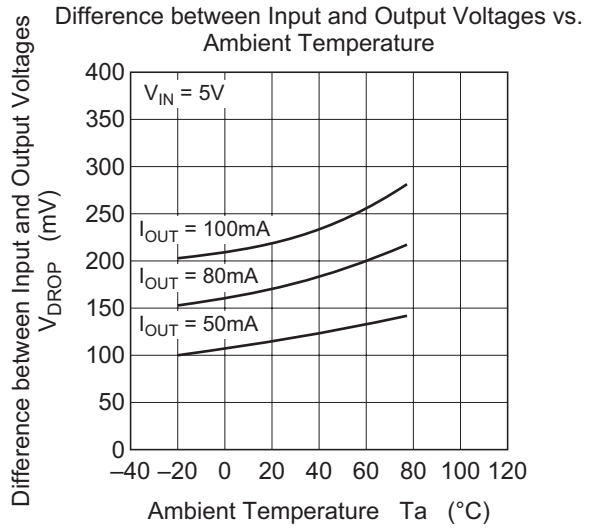
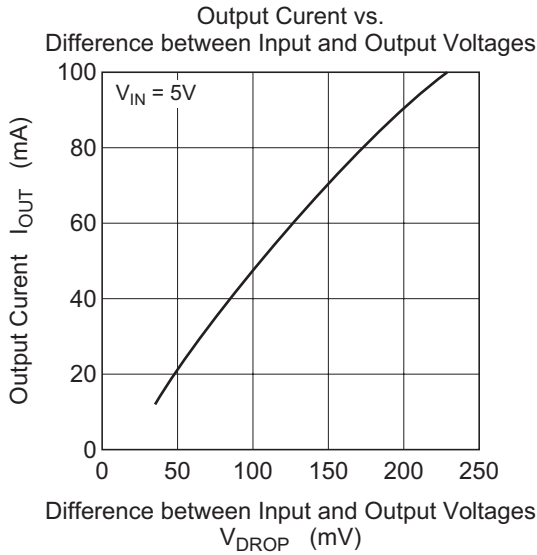
Figure 6 Timing Chart

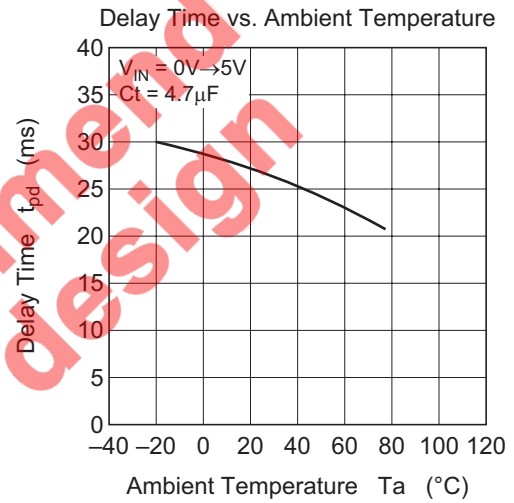
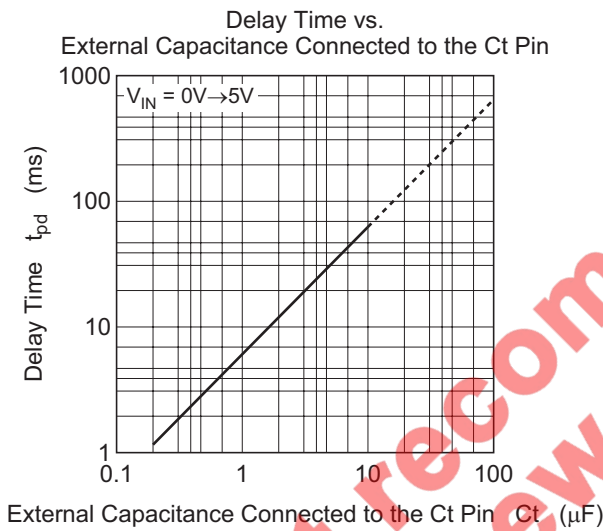
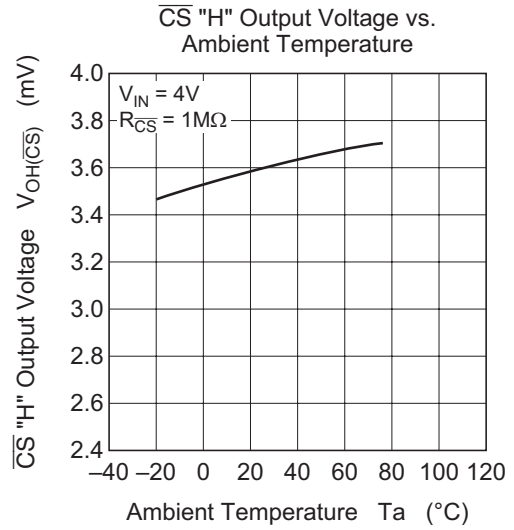
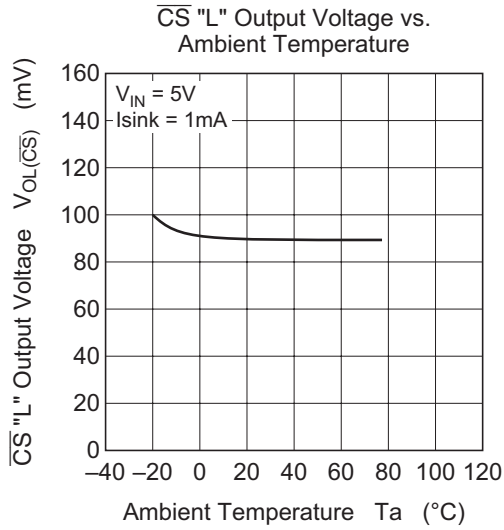
Input Voltage / Output Pin	In Normal Operation	In Failure (Instantaneous Drop)	Restoration from Failure (Instantaneous Drop)	In Backup State
		Input voltage: 5V	Input voltage: 5V→4V Each output varies if the input voltage drops to $V_{SL}$ or under	Input voltage: 4V→5V If the input voltage goes higher than $V_{SL}$ by 100mV, each output varies after delay produced by the delay circuit
$V_{OUT}$	With Q4 set to ON, a voltage ( $V_{IN} - V_{DROD}$ ) is output	Q4 is turned OFF. A voltage ( $V_{IN} - Q4V_{EB}(Di)$ ) is output by the diode between E and B of Q4.	Q4 is turned ON after delay and a voltage ( $V_{IN} - V_{DROD}$ ) is output.	$V_{BAT} - V_F$
$RES$	The output level is $V_{OL}(\overline{RES})$ with a logic low	As the state shifts from a logic low to logic high, the output level becomes approximately equal to the input voltage.	A logic high is maintained, and then shifts to a logic high.	—
$\overline{RES}$	The output level is $V_{OH}(RES)$ with a logic low	As the state shifts from a logic high to logic low, the output level becomes $V_{OL}(RES)$ .	A logic low is held, and then shifts to a logic high.	—
$\overline{CS}$	The output level is $V_{OL}(CS)$ with a logic low	As the state shifts from a logic low to logic high, the output level becomes the voltage $V_{IN} - Q4V_{EB}(Di)$ .	A logic high is maintained, and then shifts to a logic high.	The output is a logic high and the output level is $V_{BAT} - V_F$



Typical Characteristics

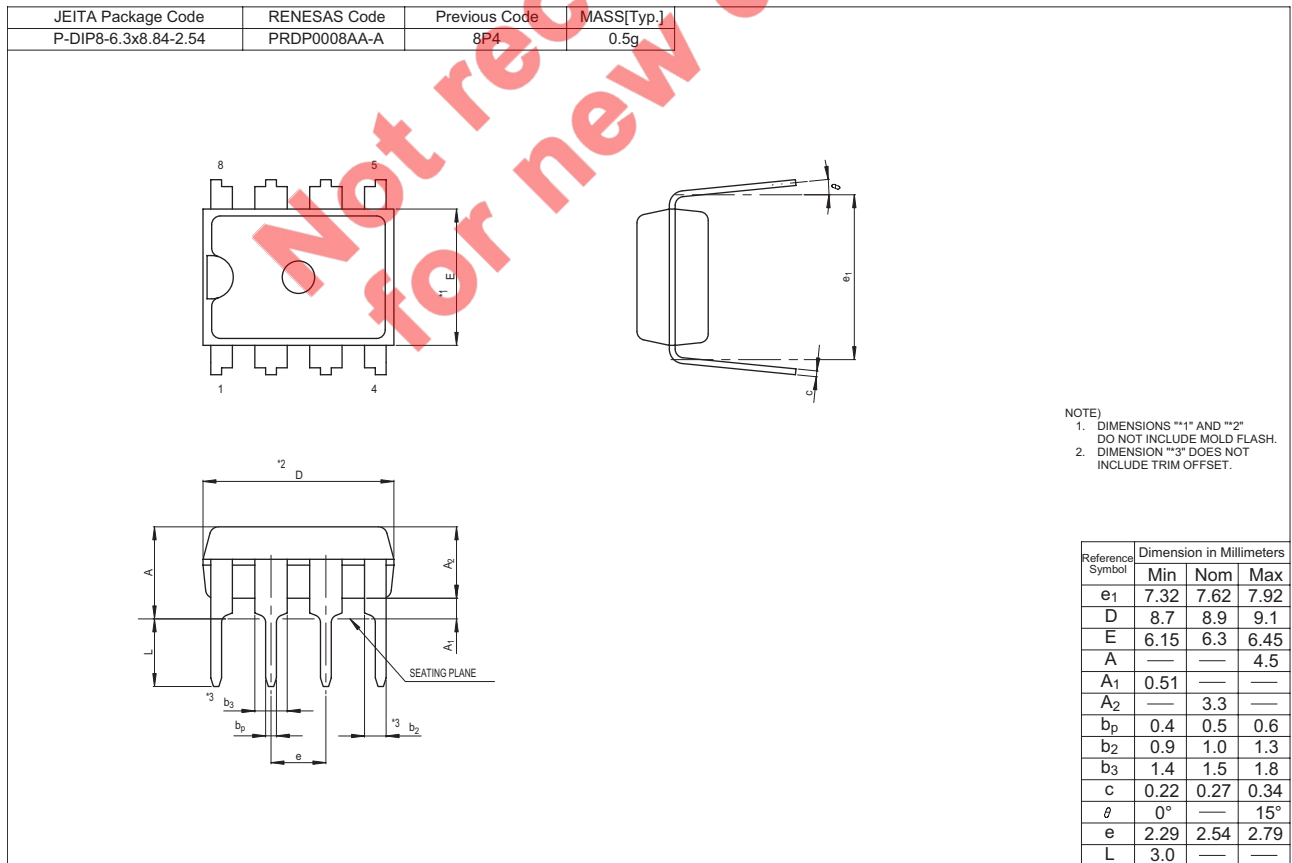
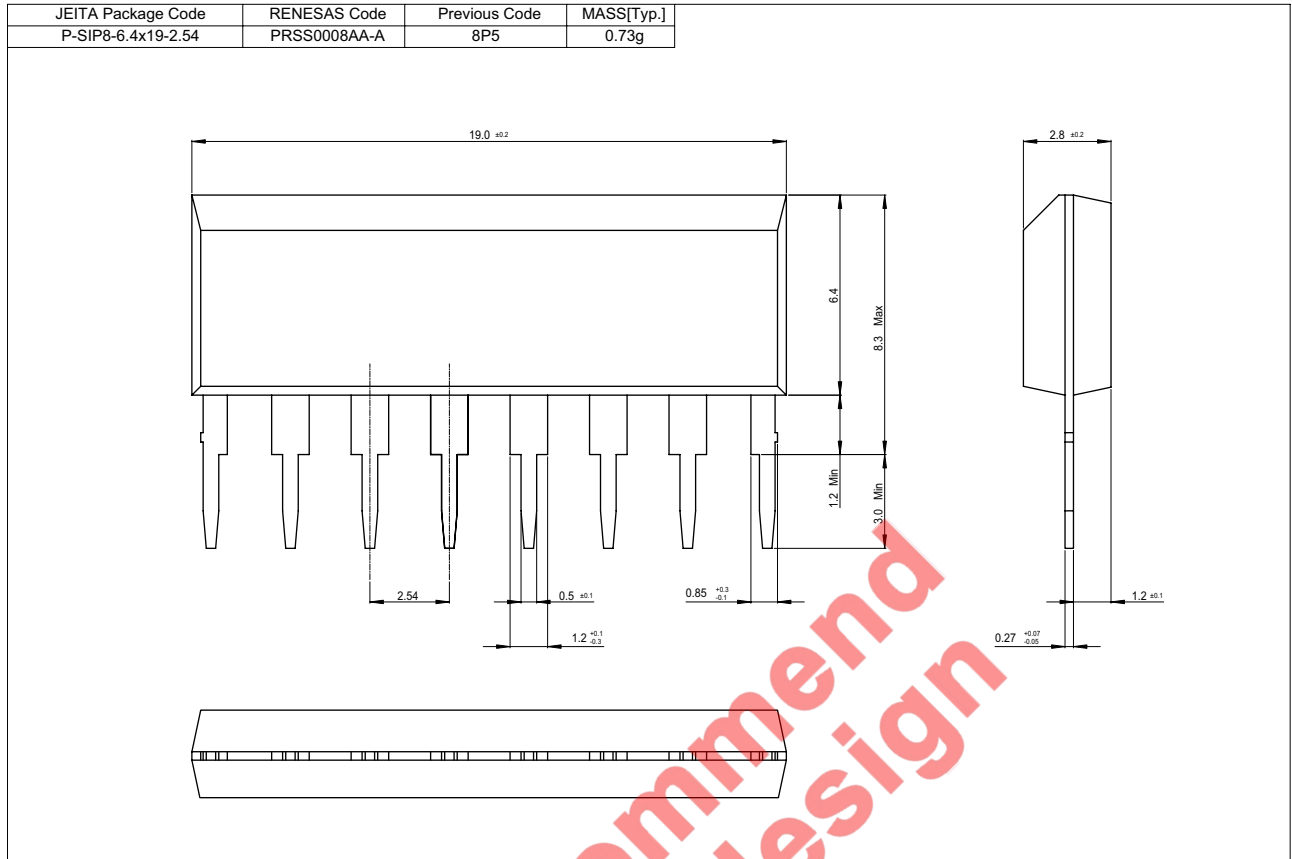


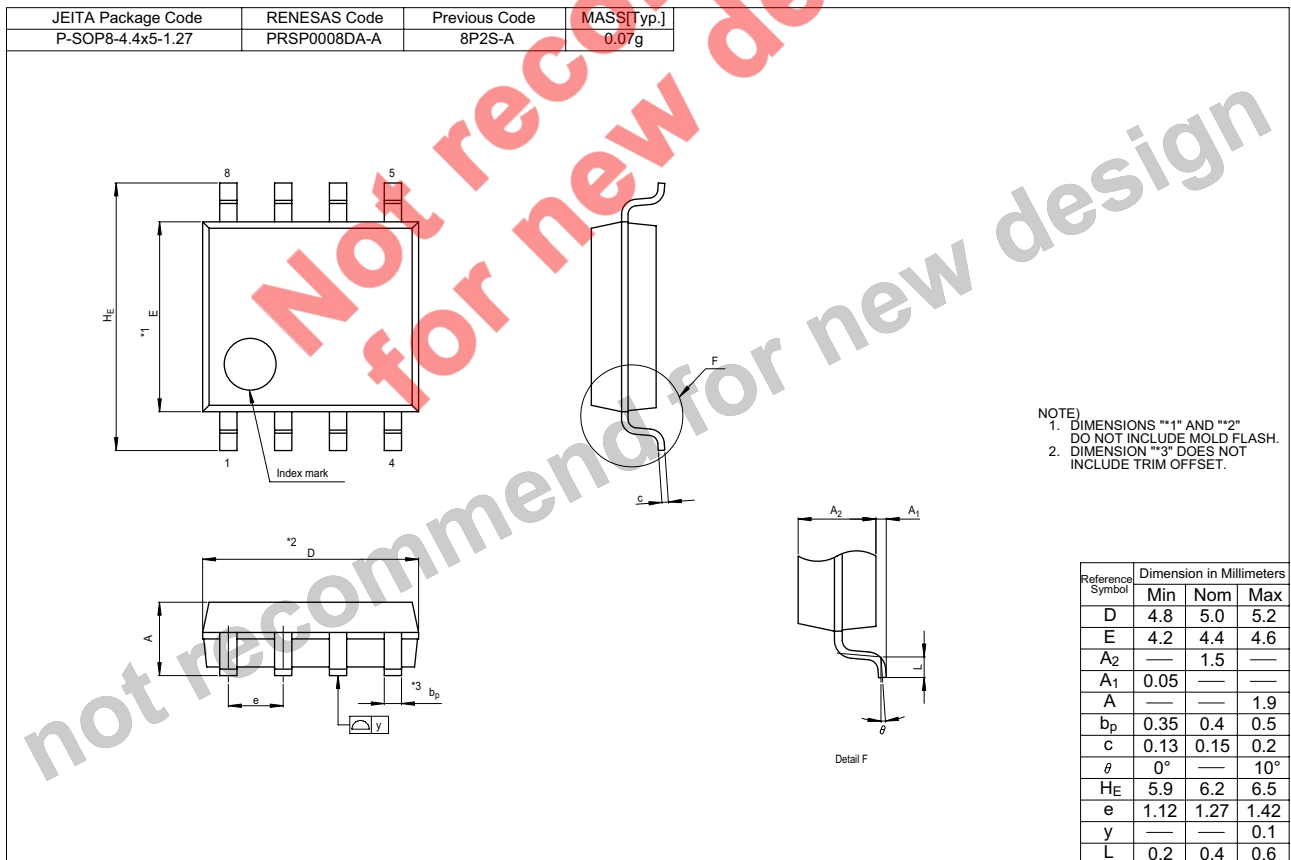
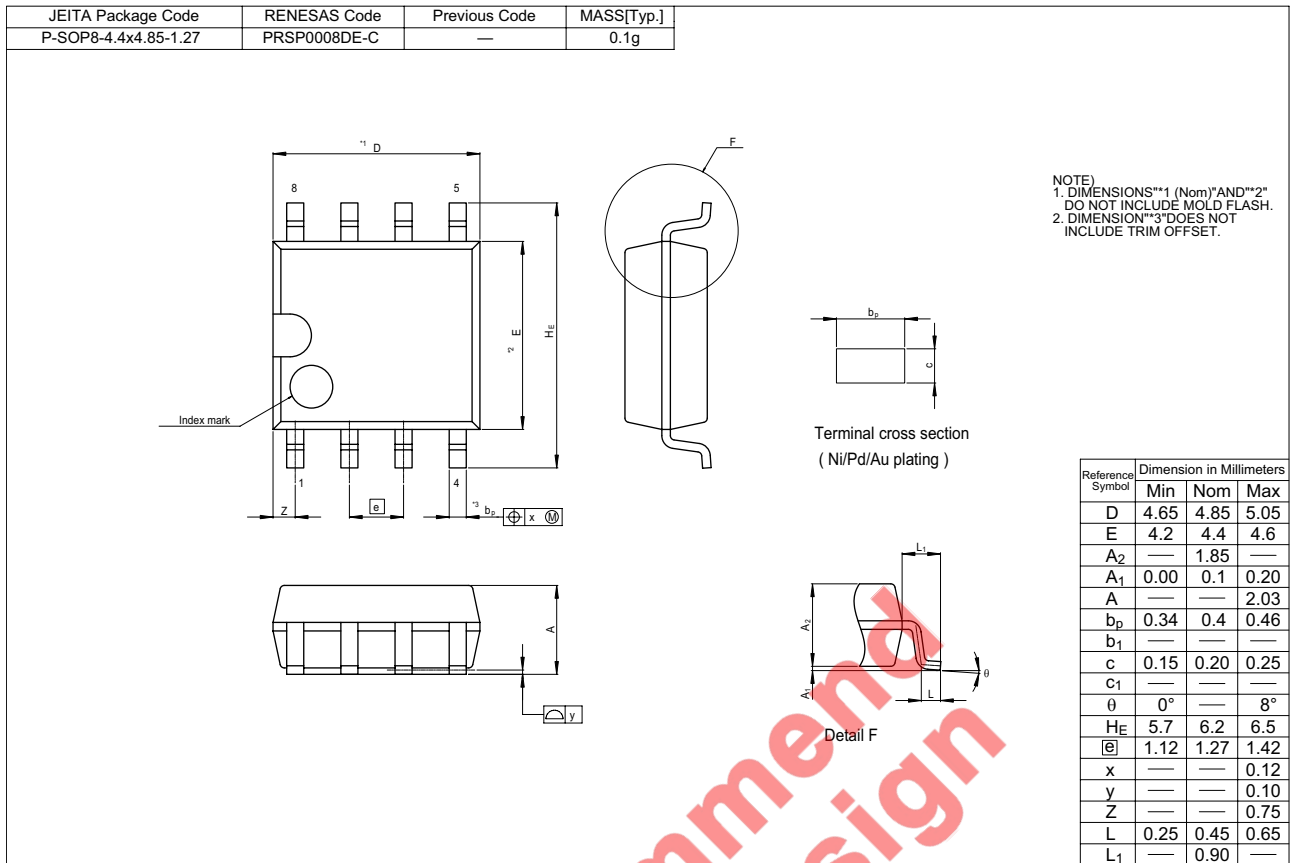




Not recommended for new design

### Package Dimensions





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