

To our customers,

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## Old Company Name in Catalogs and Other Documents

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# M51945A,B/M51946A,B

## Voltage Detecting, System Resetting IC Series

REJ03D0774-0300

Rev.3.00

Sep 18, 2007

### Description

M51945A,B/M51946A,B are semiconductor integrated circuits for resetting of all types of logic circuits such as CPUs, and has the feature of setting the detection voltage by adding external resistance.

They find extensive applications, including battery checking circuit, level detecting circuit and waveform shaping circuit.

### Features

- Few external parts
- Low threshold operating voltage (Supply voltage to keep low-state at low supply voltage): 0.6 V (Typ) at  $R_L = 22\text{ k}\Omega$
- Wide supply voltage range: 2 V to 17 V
- Wide application range

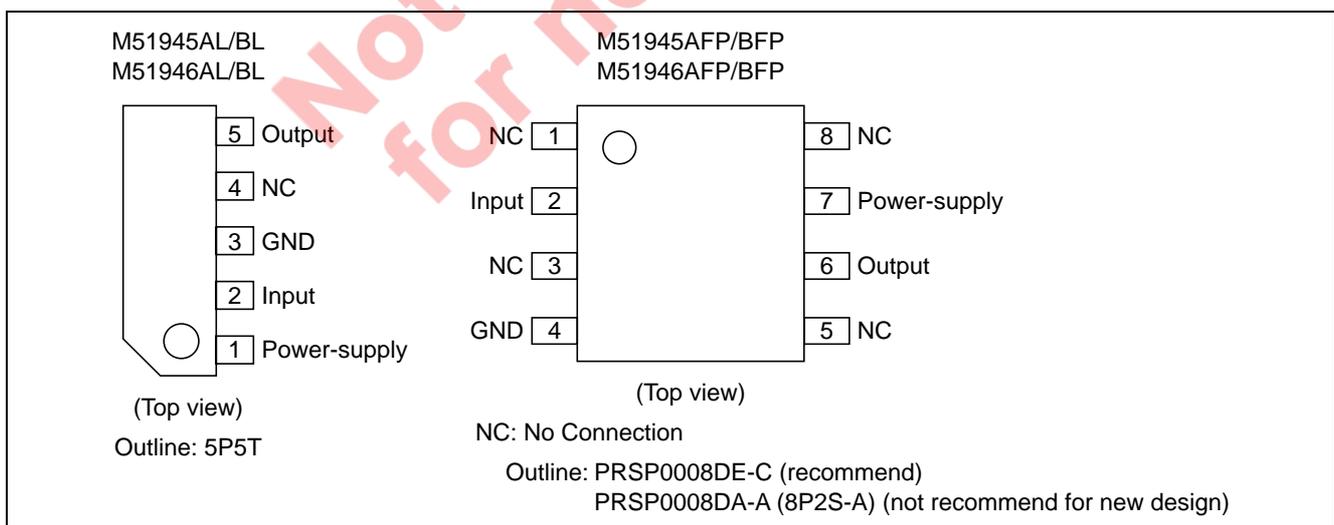
### Application

- Reset circuit of Pch, Nch, CMOS, microcomputer, CPU and MCU, Reset of logic circuit, Battery check circuit, switching circuit back-up voltage, level detecting circuit, waveform shaping circuit, delay waveform generating circuit, DC/DC converter, over voltage protection circuit

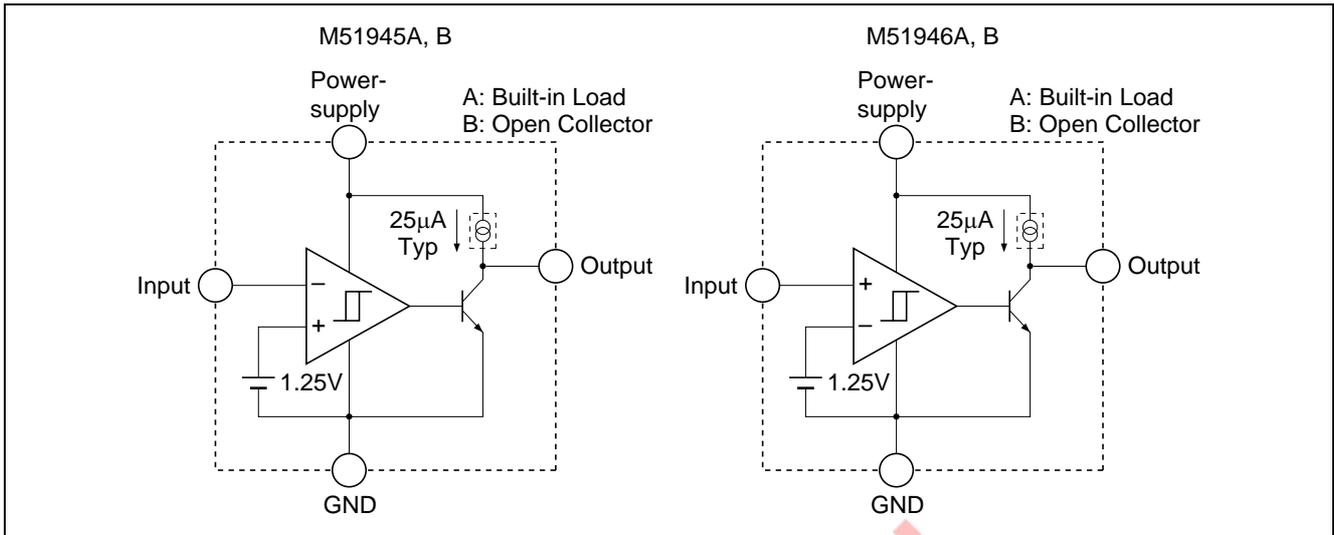
### Recommended Operating Condition

- Supply voltage range: 2 V to 17 V

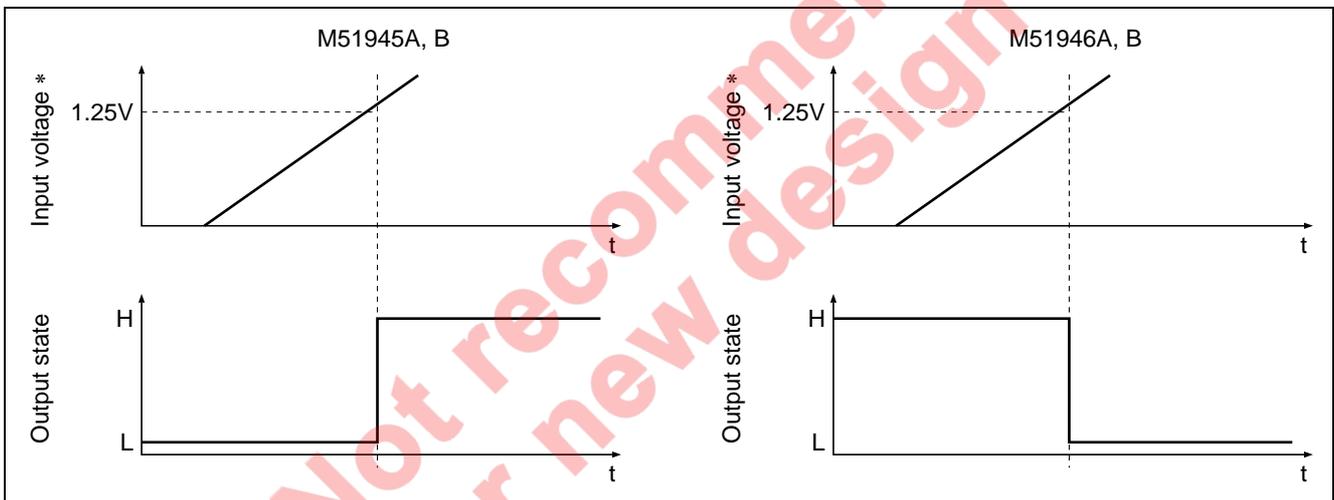
### Pin Arrangement



### Block Diagram



### Operating Waveform



## Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

Item	Symbol	Ratings	Unit	Conditions	
Supply voltage	V <sub>CC</sub>	18	V		
Output sink current	I <sub>sink</sub>	6	mA		
Output voltage	V <sub>O</sub>	V <sub>CC</sub>	V	Type A (output with constant current load)	
		18		Type B (open collector output)	
Power dissipation	P <sub>d</sub>	450	mW	5-pin SIP	
		400		8-pin SOP (PRSP0008DE-C): recommend	
		300		8-pin SOP (PRSP0008DA-A): not recommend	
Thermal derating	K <sub>θ</sub>	4.5	mW/°C	Refer to the thermal derating curve.	5-pin SIP
		4.4			8-pin SOP (PRSP0008DE-C): recommend
		3			8-pin SOP (PRSP0008DA-A): not recommend
Operating temperature	T <sub>opr</sub>	-30 to +85	°C		
Storage temperature	T <sub>stg</sub>	-40 to +125	°C		
Input voltage range	V <sub>IN</sub>	-0.3 to V <sub>CC</sub>	V	V <sub>CC</sub> ≤ 7 V	
		-0.3 to +7		V <sub>CC</sub> > 7 V	

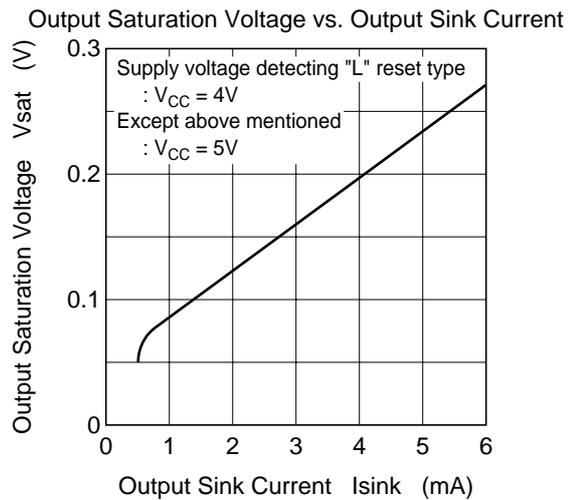
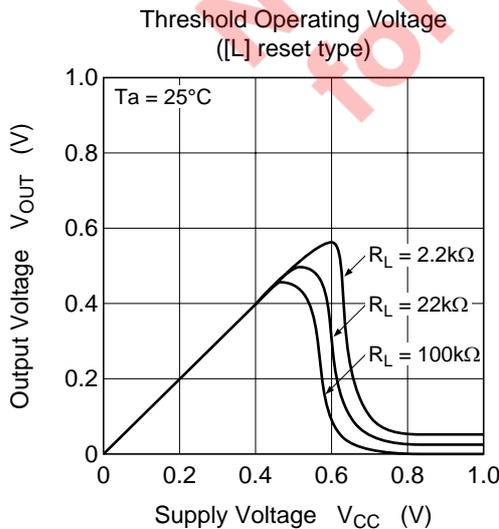
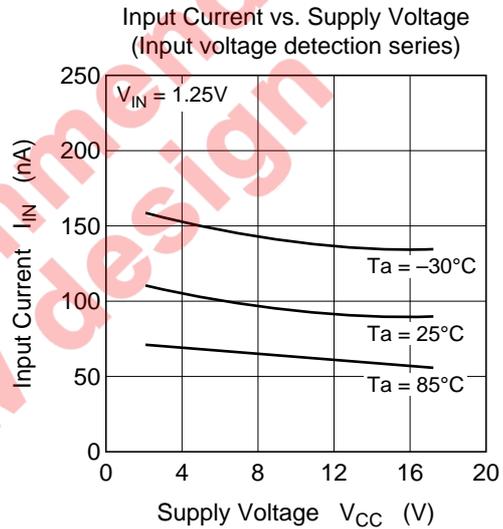
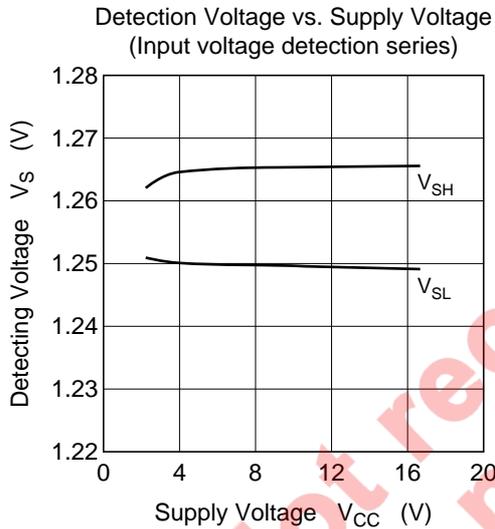
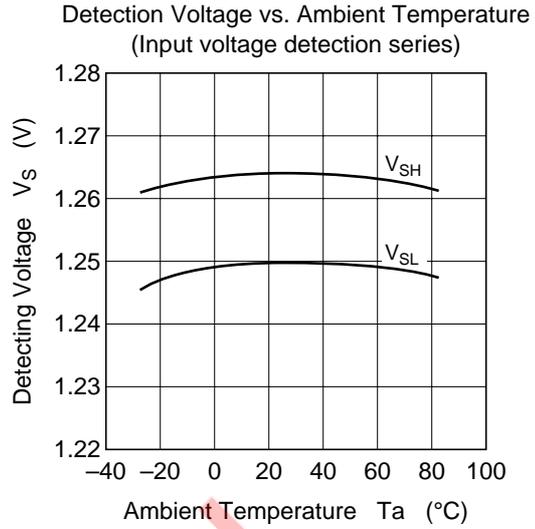
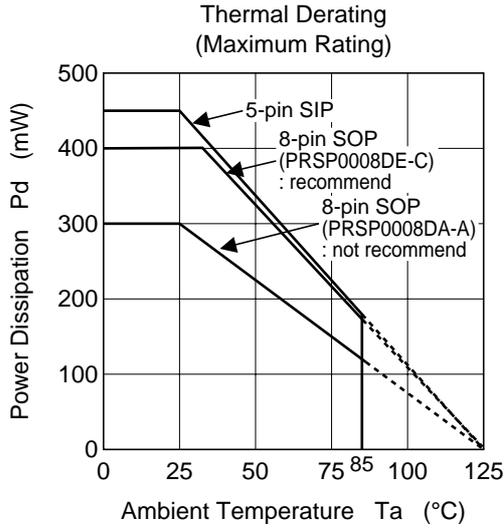
## Electrical Characteristics

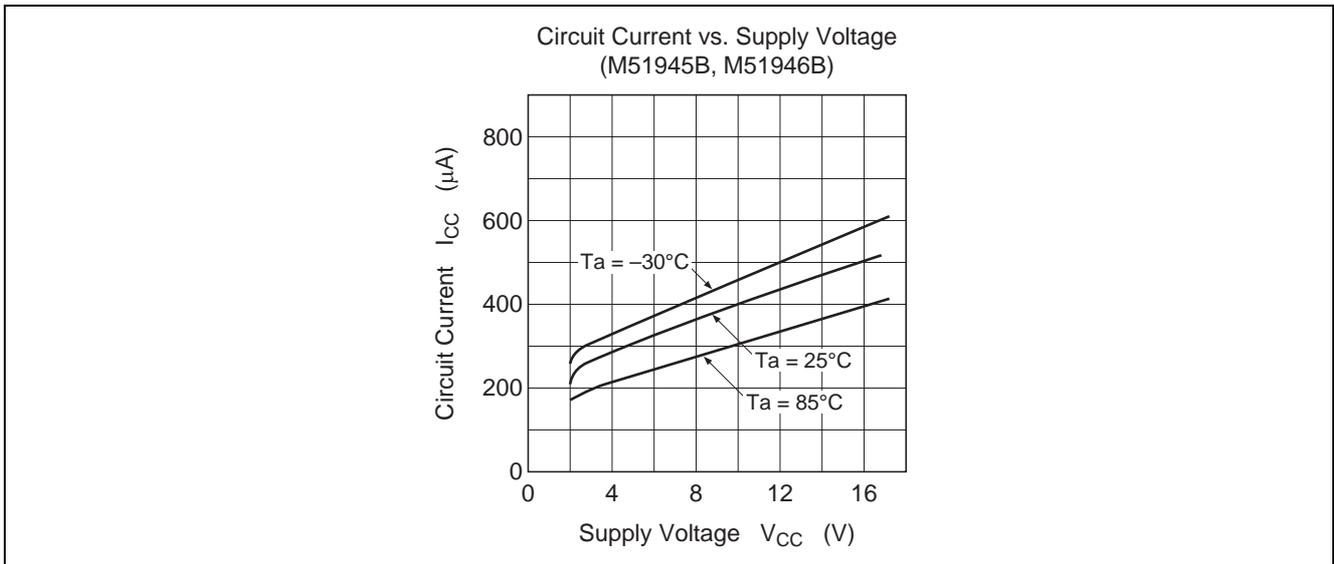
(Ta = 25°C, unless otherwise noted)

- “L” reset type M51945A, M51945B
- “H” reset type M51946A, M51946B

Item	Symbol	Min	Typ	Max	Unit	Test Conditions	
Detecting voltage	V <sub>s</sub>	1.20	1.25	1.30	V		
Hysteresis voltage	ΔV <sub>s</sub>	9	15	23	mV		
Detecting voltage temperature coefficient	V <sub>s</sub> /ΔT	—	0.01	—	%/°C		
Supply voltage range	V <sub>CC</sub>	2	—	17	V		
Input voltage range	V <sub>in</sub>	-0.3	—	V <sub>CC</sub>	V	V <sub>CC</sub> ≤ 7V	
		-0.3	—	7		V <sub>CC</sub> > 7V	
Input current	I <sub>IN</sub>	—	100	500	nA	V <sub>IN</sub> = 1.25V	
Circuit current	I <sub>CC</sub>	—	310	470	μA	Type A, V <sub>CC</sub> = 5V	
		—	280	420		Type B, V <sub>CC</sub> = 5V	
Output saturation voltage	V <sub>sat</sub>	—	0.2	0.4	V	L reset type, V <sub>CC</sub> = 5V, V <sub>IN</sub> < 1.2V, I <sub>sink</sub> = 4mA	
		—	0.2	0.4		H reset type, V <sub>CC</sub> = 5V, V <sub>IN</sub> > 1.35V, I <sub>sink</sub> = 4mA	
Threshold operating voltage	V <sub>OPL</sub>	—	0.67	0.8	V	L reset type minimum supply voltage for IC operation	R <sub>L</sub> = 2.2kΩ, V <sub>sat</sub> ≤ 0.4V
		—	0.55	0.7			R <sub>L</sub> = 100kΩ, V <sub>sat</sub> ≤ 0.4V
Output leakage current	I <sub>OH</sub>	—	—	30	nA	Type B	
Output load current	I <sub>OC</sub>	-40	-25	-17	μA	Type A, V <sub>CC</sub> = 5V, V <sub>O</sub> = 1/2 × V <sub>CC</sub>	
Output high voltage	V <sub>OH</sub>	V <sub>CC</sub> -0.2	V <sub>CC</sub> -0.06	—	V	Type A	
Propagation delay time	t <sub>PHL</sub>	—	4	—	μs	Response time when V <sub>CC</sub> changes H → L	
	t <sub>PLH</sub>	—	2	—		Response time when V <sub>CC</sub> changes L → H	

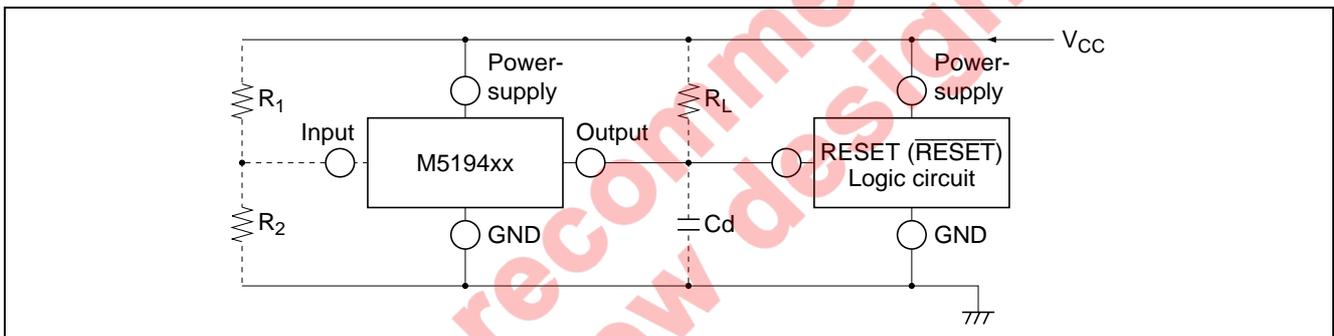
Typical Characteristics





## Example of Application Circuit

### Reset Circuit of M5194xx Series



**Figure 1 Reset Circuit of M5194xx Series**

- Notes:
1. When the detecting supply voltage is 4.25 V, M51943 and M51944 are used and R<sub>1</sub> and R<sub>2</sub> are not necessary. When the voltage is anything except 4.25 V, M51945 and M51946 are used. In this case, the detecting supply voltage is  $1.25 \times (R_1 + R_2) / R_2$  (V) approximately. The detecting supply voltage can be set between 2 V and 15 V.
  2. If the M5194xx and the logic circuit share a common power source, type A (built-in load type) can be used whether a pull-up resistor is included in the logic circuit or not.
  3. The logic circuit preferably should not have a pull-down resistor, but if one is present, add load resistor R<sub>L</sub> to overcome the pull-down resistor.
  4. It is better to use the M5195xx series to cause a delay, but if the delay is caused by the M5194xx series, the delay capacitor C<sub>d</sub> is applied between the output and GND.
  5. When the reset terminal in the logic circuit is of the low reset type, M51943 and M51945 are used and when the terminal is of the high reset type, M51944 and M51946 are used.
  6. When a delay is necessary at both rise time and fall time, M51945 and M51946 are used and the series resistors (R<sub>11</sub>, R<sub>12</sub>) are applied between the output and GND or instead of R<sub>1</sub>, and these connect the capacitor between the connection point and GND. The connection point of the capacitor is fixed according to the ratio of delay at fall/rise time.
  7. When a negative supply voltage is used, the supply voltage side of M5194xx and the GND side are connected to GND and the negative supply voltage respectively.

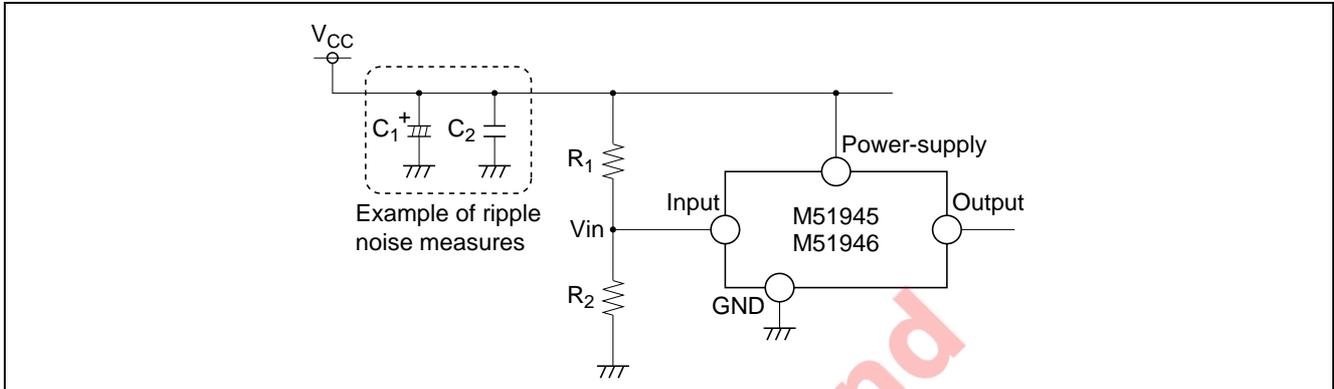
## Notice for use

### About the Power Supply Line

#### 1. About bypass capacitor

Because the ripple and the spike of the high frequency noise and the low frequency are superimposed to the power supply line, it is necessary to remove these.

Therefore, please install  $C_1$  and  $C_2$  for the low frequency and for the high frequency between the power supply line and the GND line as shown in following figure 2.



**Figure 2 Example of Ripple Noise Measures**

#### 2. The sequence of voltage impression

Please do not impress the voltages to the input terminals earlier than the power supply terminal. Moreover, please do not open the power supply terminal with the voltage impressed to the input terminal.

(The setting of the bias of an internal circuit collapses, and a parasitic element might operate.)

### About the Input Terminal

#### 1. Setting range of input voltage

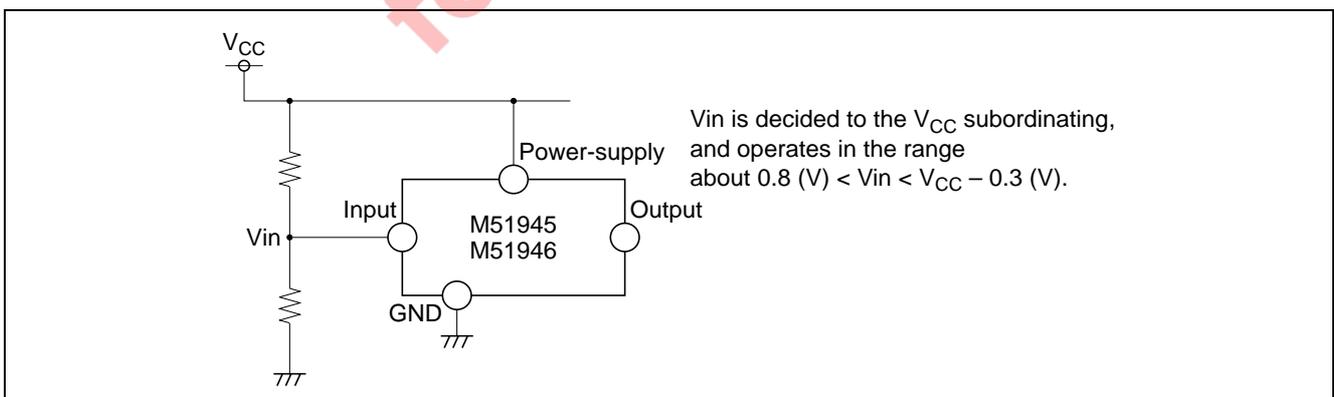
The following voltage is recommended to be input to the input terminal (pin 2).

about  $0.8 \text{ (V)} < V_{in} < V_{CC} - 0.3 \text{ (V)}$  .... at  $V_{CC} \leq 7 \text{ V}$

about  $0.8 \text{ (V)} < V_{in} < 6.7 \text{ (V)}$  ..... at  $V_{CC} > 7 \text{ V}$

#### 2. About using input terminal

Please do an enough verification to the transition characteristic etc. of the power supply when using independent power supply to input terminal (pin 2).



**Figure 3 Recommended Example**

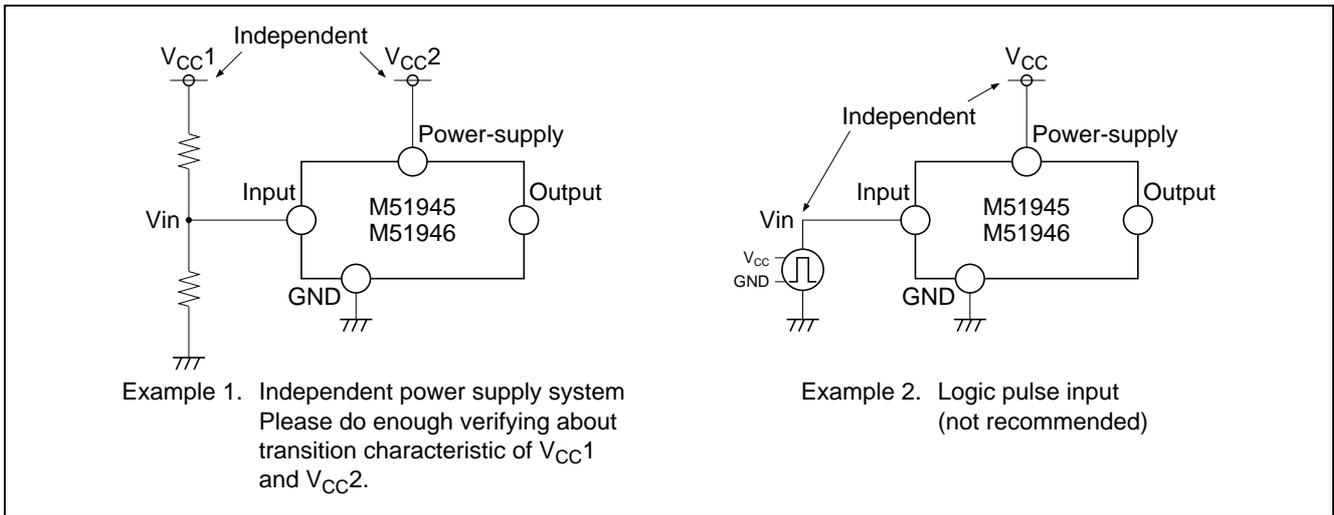


Figure 4

3. Calculation of detecting voltage

Detecting voltage V<sub>S</sub> can be calculated by the following expression.

However, the error margin is caused in the detecting voltage because input current I<sub>in</sub> (standard 100 nA) exists if it sets too big resistance.

Please set the constant to disregard this error margin.

$$V_S = 1.25 \times \left( \frac{R_1 + R_2}{R_2} \right) + \frac{I_{in} \times R_1}{\text{error margin}}$$

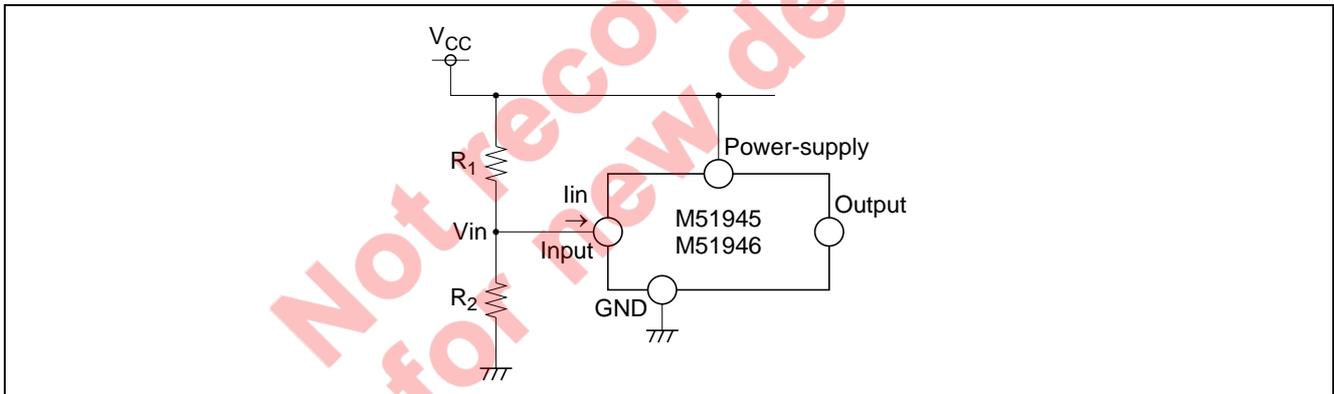


Figure 5 Influence of Input Current

4. About the voltage input outside ratings

Please do not input the voltage outside ratings to the input terminal.

An internal protection diode becomes order bias, and a large current flows.

**Setting of Output Load Resistance (M51945B/M51946B)**

High level output voltage can be set without depending on the power-supply voltage because the output terminal is an open collector type. However, please guard the following notes.

1. Please set it in value (2 V to 17 V) within the range of the power-supply voltage recommendation. Moreover, please never impress the voltage of maximum ratings 18 V or more even momentarily either.
2. Please set output load resistance (pull-up resistance)  $R_L$  so that the output current (output inflow current  $I_L$ ) at L level may become 4 mA or less. Moreover, please never exceed absolute maximum rating (6 mA).

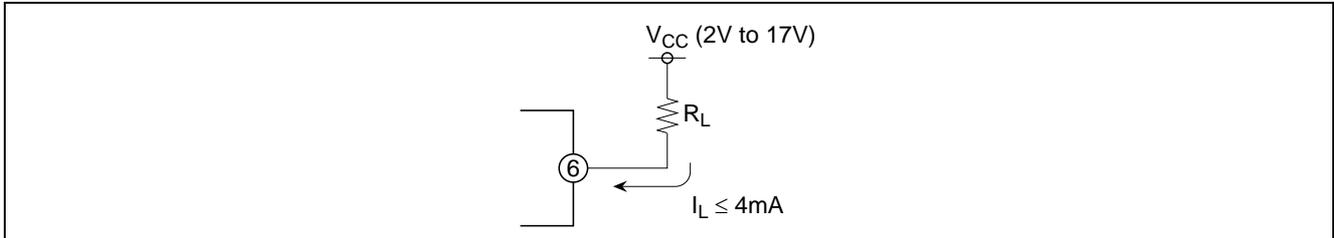


Figure 6 Output Load Resistance  $R_L$

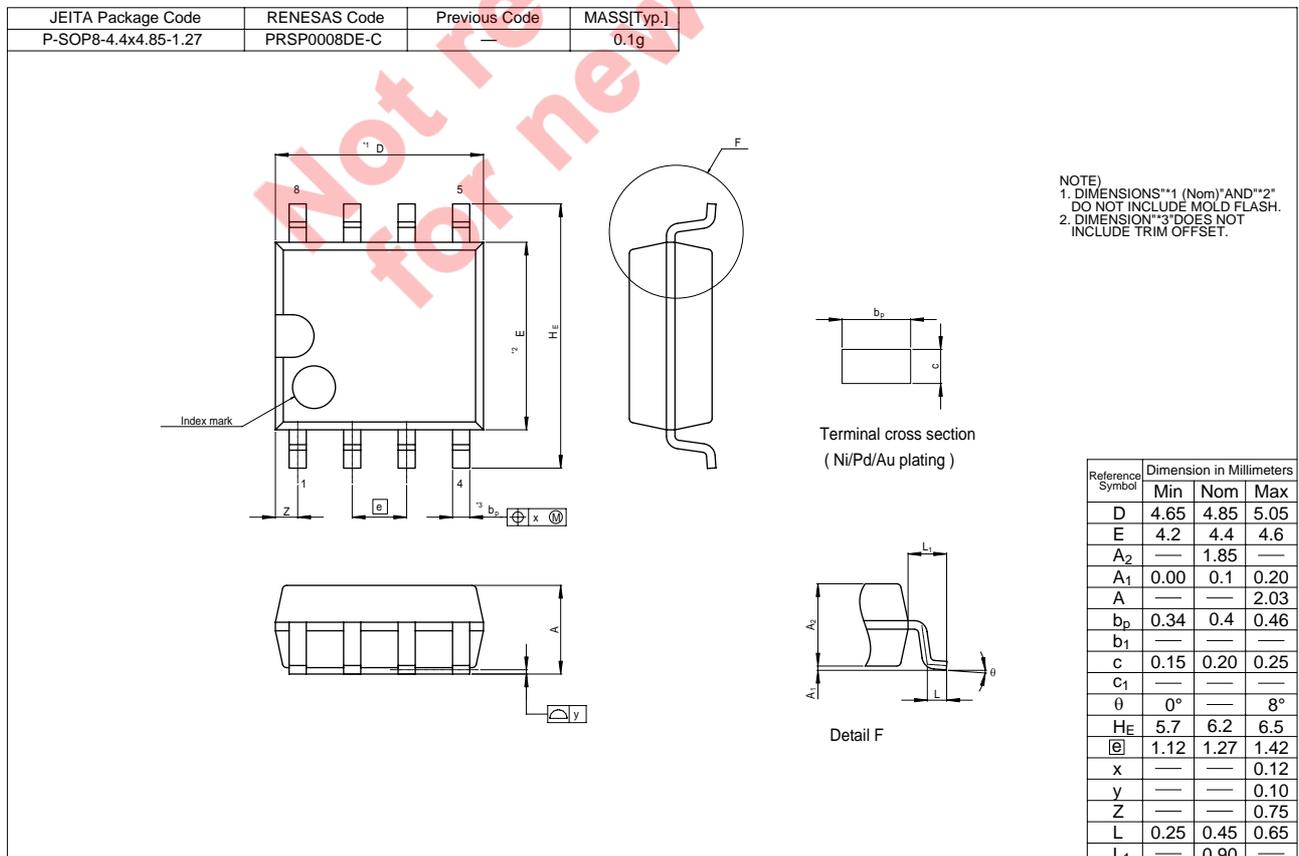
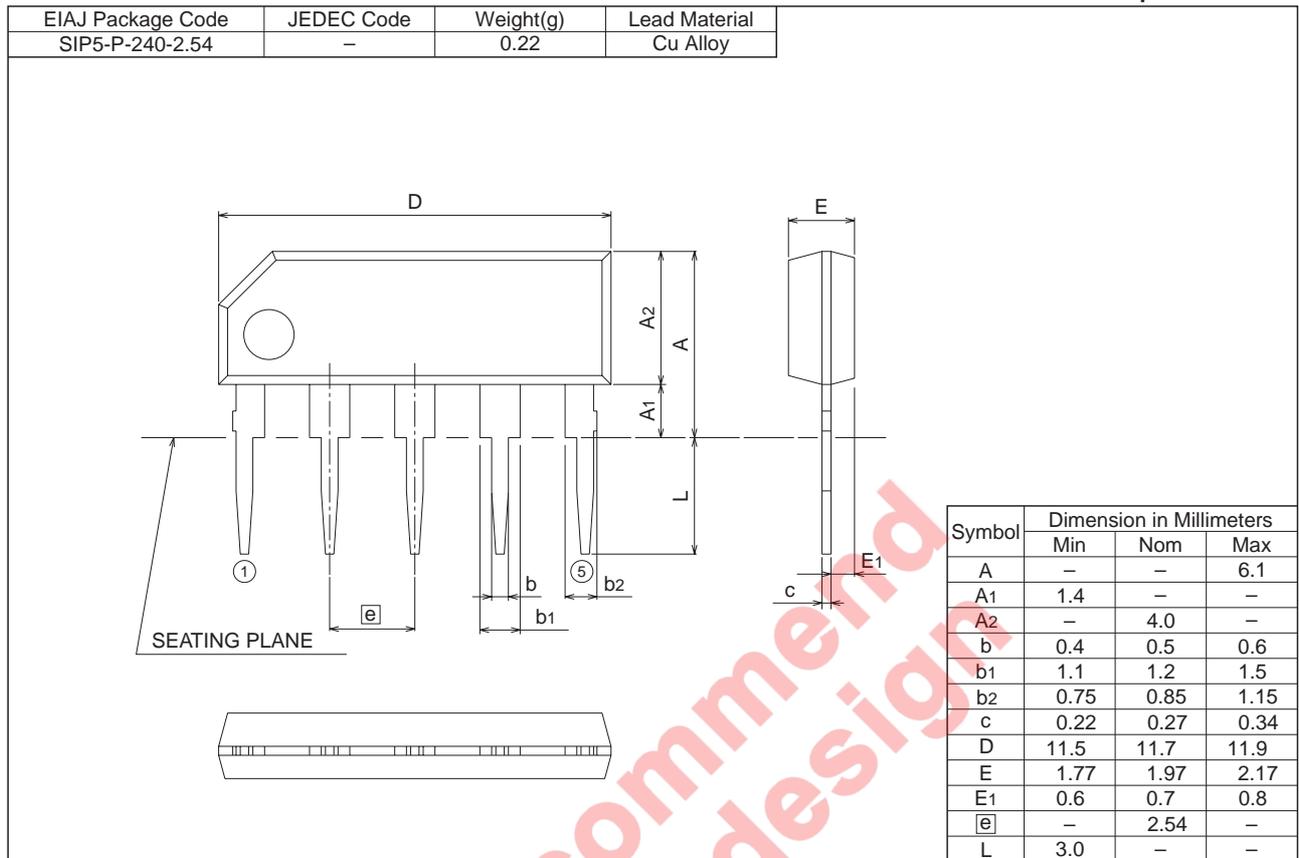
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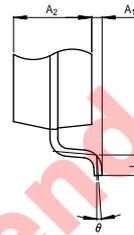
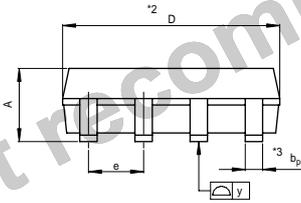
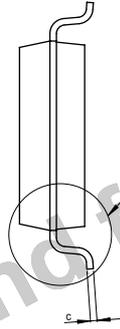
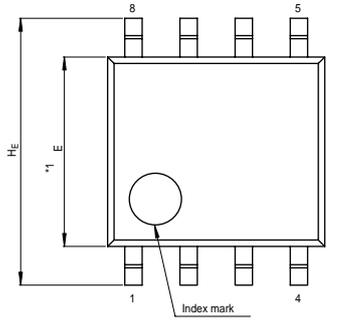
5P5T

Plastic 5pin 240mil SIP



M51945A,B/M51946A,B

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP8-4.4x5-1.27	PRSP0008DA-A	8P2S-A	0.07g



NOTE)  
 1. DIMENSIONS \*\*1\* AND \*\*2\* DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION \*\*3\* DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	4.8	5.0	5.2
E	4.2	4.4	4.6
A <sub>2</sub>	—	1.5	—
A <sub>1</sub>	0.05	—	—
A	—	—	1.9
b <sub>p</sub>	0.35	0.4	0.5
c	0.13	0.15	0.2
θ	0°	—	10°
H <sub>E</sub>	5.9	6.2	6.5
e	1.12	1.27	1.42
y	—	—	0.1
L	0.2	0.4	0.6

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