M51945A,B/M51946A,B

VOLTAGE DETECTING, SYSTEM RESETTING IC SERIES

DESCRIPTION

M51945A,B/M51946A,B are semiconductor integrated circuits designed for input voltage detection and for resetting of all types of logic circuits such as CPUs.

Possible applications are extensive, including circuits for battery checking, level detecting and waveform shaping.

FEATURES

- Few external parts
- Low threshold operating voltage (Supply voltage to keep low-state at low supply voltage) . . . . . 0.6V (TYP.) at R_L = 22kΩ
- Wide supply voltage range . . . . . 2 ~ 17V
- Sudden change in power supply has minimal effect on the ICs
- Wide operation range of detecting input pin . . . . Narrower ranges of −0.3V ~ V_{CC} or −0.3V ~ 7V (Input voltage detecting type)
- Suitable for high supply voltage circuit with simple circuit structure (M51945B, M51946B)
- Permits easy configuration of a circuit for protection against reverse connection or surges. (M51945B, M51946B)
- Wide application range
- SIL package of the same height as DIP (5-pin SIP)

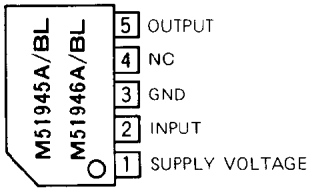
APPLICATION

Reset circuit of Pch, Nch, CMOS, microcomputer, CPU and microcomputer, 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.

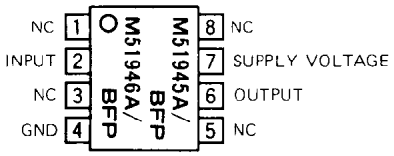
RECOMMENDED OPERATING CONDITION

Supply voltage range . . . . . 2 ~ 17V

PIN CONFIGURATION (TOP VIEW)



Outline 5P5T

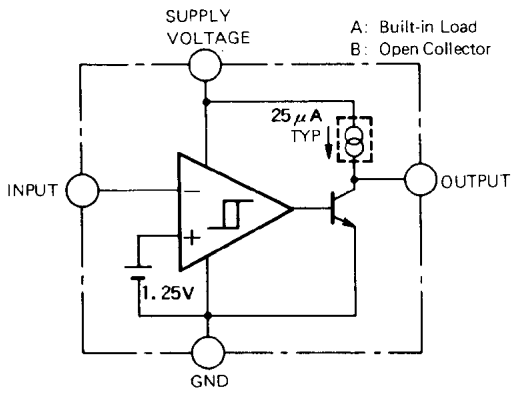


Outline 8P2S-A

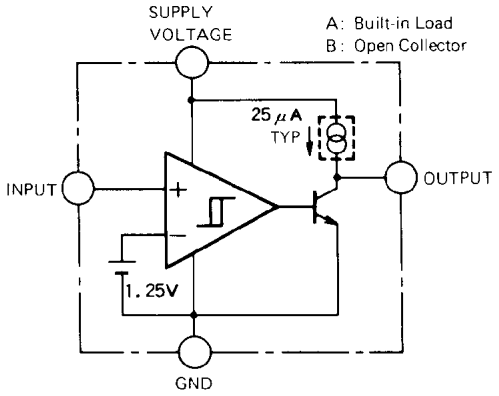
NC: NO CONNECTION

BLOCK DIAGRAM

M51945A, B

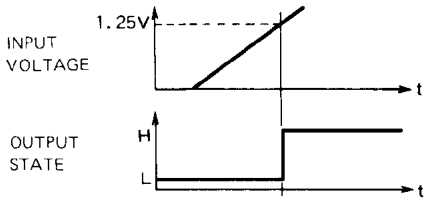


M51946A, B

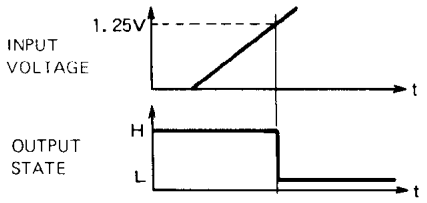


FUNCTION DIAGRAM

M51945A, B



M51946A, B



ABSOLUTE MAXIMUM RATINGS (Ta = 25℃, unless otherwise noted)

Symbol	Parameter	Conditions		Ratings	Unit
V_{CC}	Supply voltage			18	V
I_{sink}	Output Sink Current			6	mA
V_O	Output voltage	A Type (Output with constant current load)		V_{CC}	V
		B Type (Open collector output)		18	
P_d	Power dissipation	5P SIP		450	mW
		8P SOP		300	
K_θ	Thermal Derating	Ta ≧ 25℃	5P SIP	4.5	mW/℃
			8P SOP	3	
T_{opr}	Operating temperature			−30 ~ +85	℃
T_{stg}	Storage temperature			−40 ~ +125	℃

ELECTRICAL CHARACTERISTICS (Ta = 25℃, unless otherwise noted)

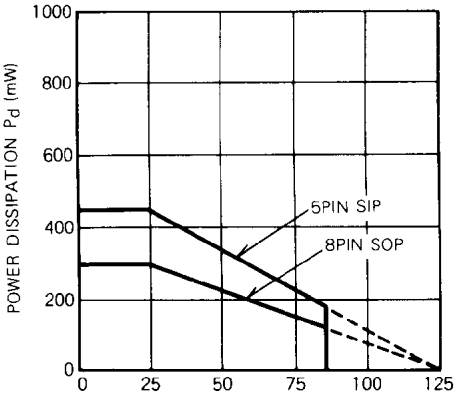
"L" reset type	"H" reset type
M51945A	**M51946A**
M51945B	**M51946B**

Symbol	Parameter	Test condition		Limits			Unit
				Min	Typ	Max	
V_S	Detecting voltage			1.20	1.25	1.30	V
ΔV_S	Hysterisis voltage	V_{CC} = 5V		9	15	23	mV
$V_S/\Delta T$	Detecting Voltage Temperature Coefficient			—	0.01	—	%/℃
V_{CC}	Supply Voltage Range	Ta = −30 ~ +85℃		2	—	17	V
V_{IN}	Input voltage Range	Ta = −30 ~ +85℃, V_{CC} ≦ 7V		−0.3	—	V_{CC}	V
		Ta = −30 ~ +85℃, V_{CC} > 7V		−0.3	—	7	
I_{IN}	Input Current	V_{IN} = 1.25V		—	100	500	nA
I_{CC}	Circuit Current	Type A V_{CC} = 5V		—	310	470	μA
		Type B V_{CC} = 5V		—	280	420	
Vsat	Output Saturation Voltage	L reset type V_{CC} = 5V, V_{IN} < 1.2V, Isink = 4mA		—	0.2	0.4	V
		H reset type V_{CC} = 5V, V_{IN} > 1.35V, Isink = 4mA					
V_{OPL}	Threshold Operating Voltage	L reset type minimum supply voltage for IC operation	R_L = 2.2kΩ, Vsat ≦ 0.4V	—	0.67	0.8	V
			R_L = 100kΩ, Vsat ≦ 0.4V	—	0.55	0.7	
I_{OH}	Output Leakage Current	Type B		—	—	30	nA
		Type B, Ta = −30 ~ +85℃		—	—	1	μA
I_{OC}	Output Load Current	Type A V_{CC} = 5V, V_O = 1/2 V_{CC}		−40	−25	−17	μA
V_{OH}	Output High Voltage	Type A		V_{CC} − 0.2	V_{CC} − 0.06	—	V
t_{PHL}	Propagation Deray Time	Response time when V_{CC} changes H → L		—	4	—	μs
t_{PLH}		Response time when V_{CC} changes L → H		—	2	—	μs

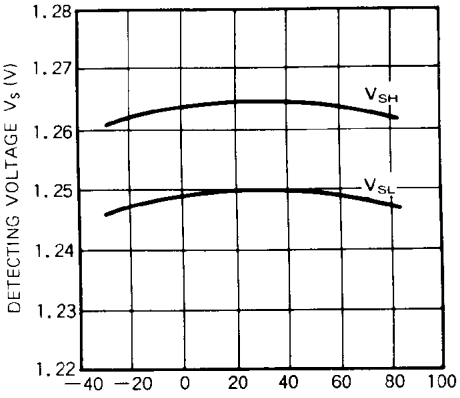
MITSUBISHI ELECTRIC

TYPICAL CHARACTERISTICS

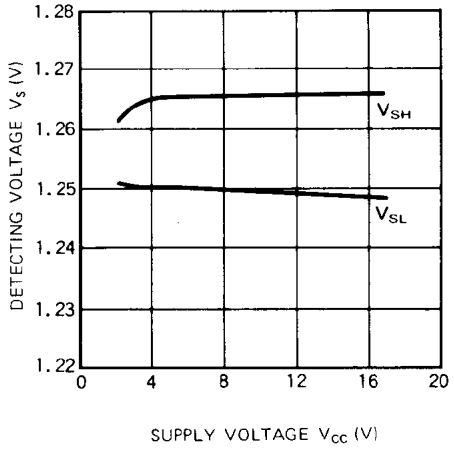
TYPICAL CHARACTERISTICS THERMAL DERATING (MAXIMUM RATING)



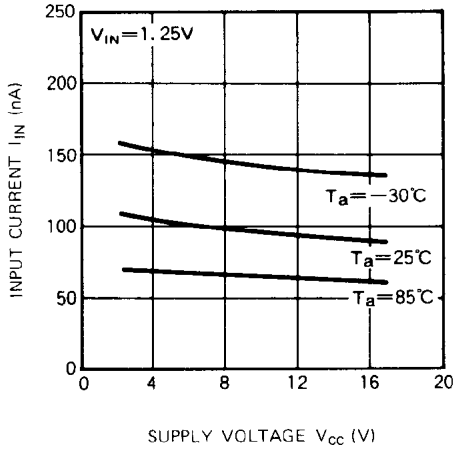
DETECTING VOLTAGE VS. AMBIENT TEMPERATURE (Input voltage detecting series)



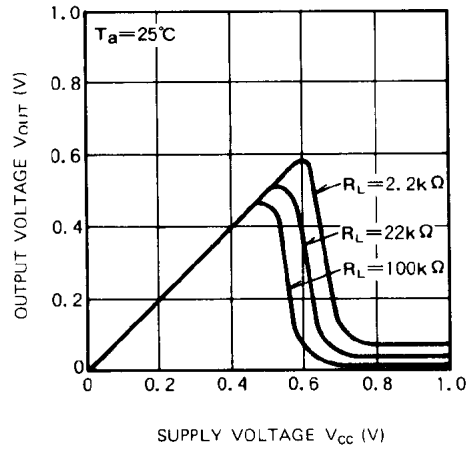
DETECTION VOLTAGE VS. SUPPLY VOLTAGE (Input voltage detection series)



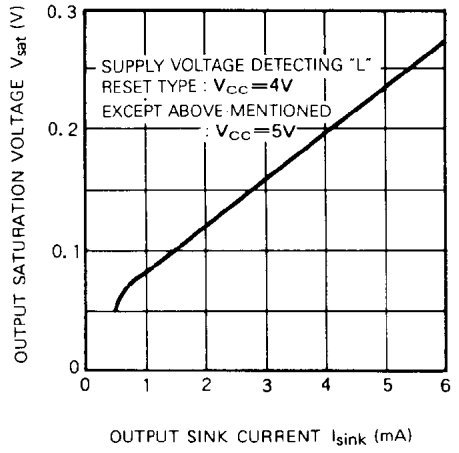
INPUT CURRENT VS. SUPPLY VOLTAGE (Input voltage detecting series)



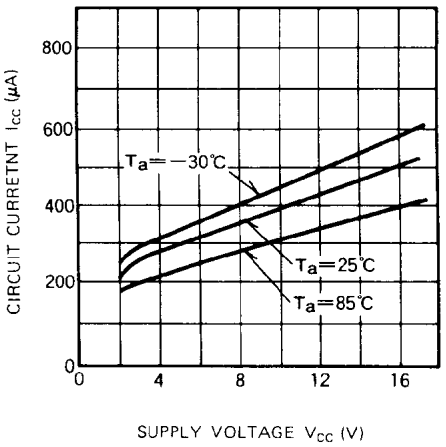
THRESHOLD OPERATING VOLTAGE ([L] reset type)



OUTPUT SATURATION VOLTAGE VS. OUTPUT SINK CURRENT

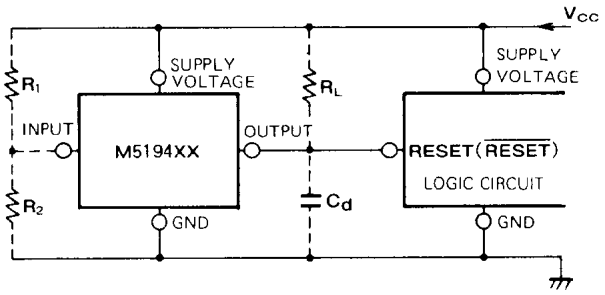


CIRCUIT CURRENT VS. SUPPLY VOLTAGE (M51945B, M51946B)



EXAMPLE OF APPLICATION CIRCUIT

Reset Circuit of M5194XX Series



Note 1. When the detecting supply voltage is 4.25V, M51943 and M51944 are used and R_1 and R_2 are not necessary.
When the voltage is anything except 4.25V, M51945 and M51946 are used. In this case, the detecting supply voltage is $1.25 \times \frac{(R_1 + R_2)}{R_2}$ (V) approximately. The detecting supply voltage can be set between 2V and 15V.

Note 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 resister is included in the logic circuit or not.

Note 3. The logic circuit preferably should not have a pull-down resistor, but if one is present, add load resistor R_L to overcome the pull-down resistor.

Note 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 Cd is applied between the output and GND.

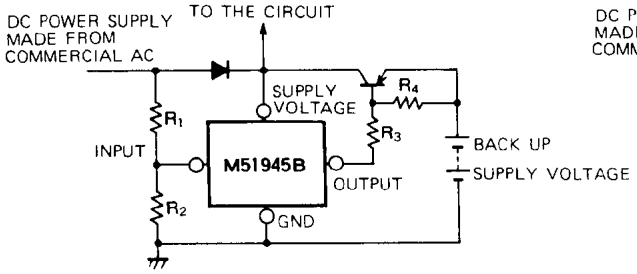
Note 5. When the reset terminal in the logic circuit is of the low reset type, M51943 and M51945 are used and when the terminal is of the high reset type, M51944 and M51946 are used.

Note 6. When a delay is necessary at both rise time and fall time, M51945 and M51946 are used and the series resistors (R_{11}, R_{12}) are applied between the output and GND or instead of R_1, 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.

Note 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.

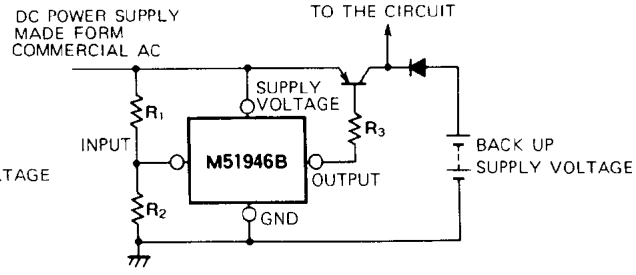
Switching Circuit to Back-up Power Supply

(a)



$$\text{SWITCHING VOLTAGE} \approx 1.25 \times \frac{R_1+R_2}{R_2}(V)$$

(b)

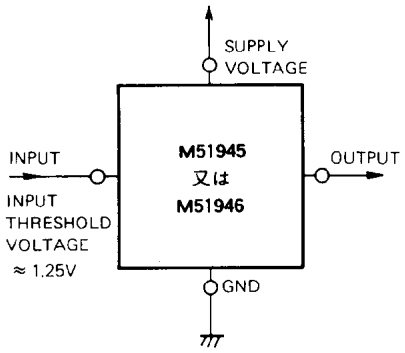


$$\text{SWITCHING VOLTAGE} \approx 1.25 \times \frac{R_1+R_2}{R_2}(V)$$

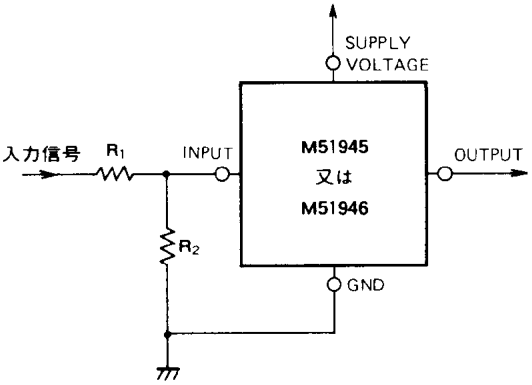
Level Detecting Circuit, Waveform Shaping Circuit

Because the input threshold of M51945 and M51946 is little dependent on supply voltage and temperature and has hysterisis of 15mV approximately, these ICs can be used in level detecting circuits and waveform shaping circuits.

(a)



(b)

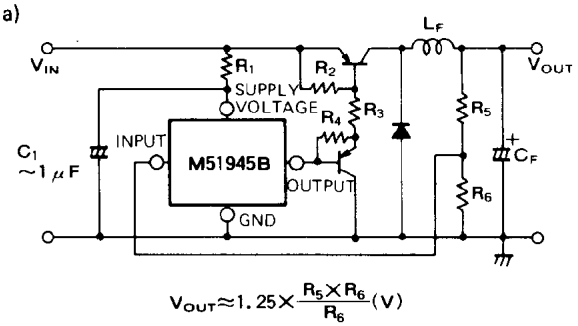


$$\text{THRESHOLD VOLTAGE} \approx 1.25 \times \frac{R_1+R_2}{R_2}(V)$$

DC-DC Converter

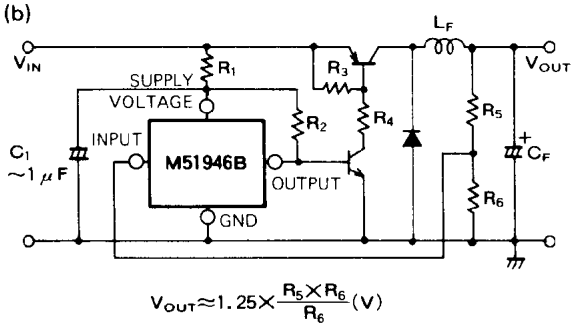
Step Down Regulator

(a)



$$V_{OUT} \approx 1.25 \times \frac{R_5 \times R_6}{R_6}(V)$$

(b)

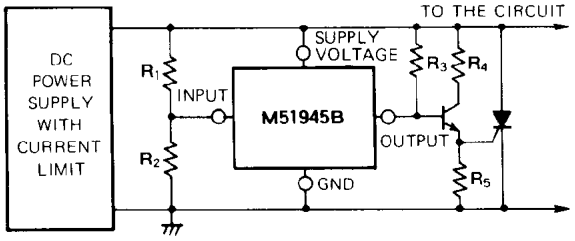


$$V_{OUT} \approx 1.25 \times \frac{R_5 \times R_6}{R_6}(V)$$

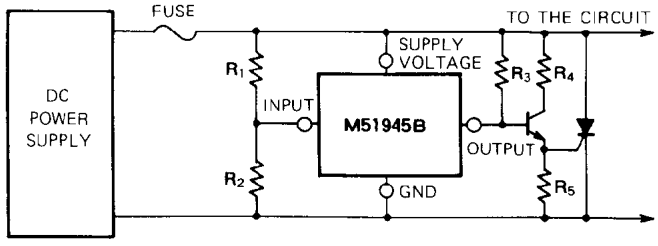
In (b) above, the power supply for M51946B is provided by both R_1 and R_2 (and the M51946B internal resistor) and so a high input voltage can be used.

Over Voltage "Crowbar" Circuit

(a)

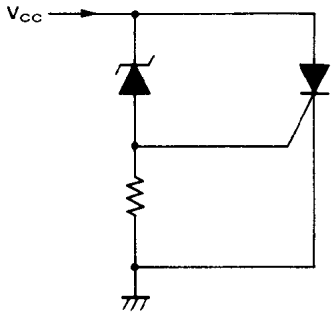


(b)

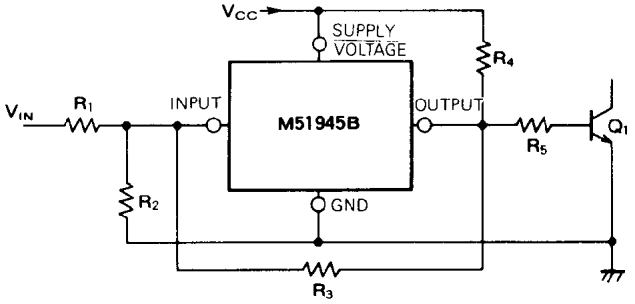


$$\text{DETECTING VOLTAGE} \approx 1.25 \times \frac{R_1 \times R_2}{R_2} \text{(V)}$$

The over voltage "crowbar" circuit, using a zener diode as shown below, offers lower drive capacity and decreases the capacity for di/dt of SCR. (Enough gate current is needed to turn on SCR.)



Expansion of Hysteresis Using M51945B



Q_1: OFF → ON
Threshold voltage

$$= \frac{(R_1 + R_2)}{R_2 \cdot R_3} [1.265(V) \cdot (R_1 // R_2 + R_3) - V_{sat} \cdot (R_1 // R_2)]$$

Q_1: ON → OFF
Threshold voltage

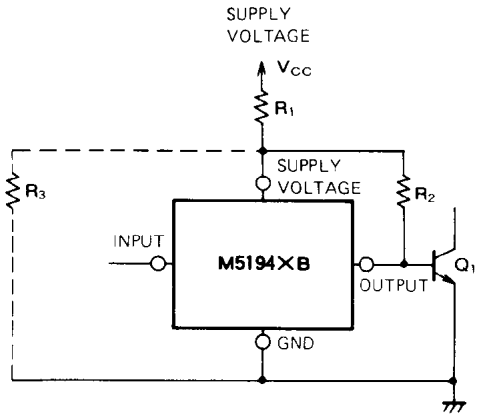
$$= \frac{(R_1 + R_2)}{R_2 \cdot (R_3 + R_4 // R_5)} \cdot [1.25(V) \cdot (R_3 + R_1 // R_2 + R_4 // R_5) - \frac{R_1 // R_2}{R_4 + R_5} \cdot (R_4 \cdot V_{BEI} + R_5 \cdot V_{CC})]$$

Where V_{sat}: M51945B output saturation voltage
V_{BEI}: Base-emitter voltage ≈ 0.7V (Transister Q_1)

$$R_1 // R_2 \equiv \frac{R_1 \cdot R_2}{R_1 + R_2}, \quad R_4 // R_5 \equiv \frac{R_4 \cdot R_5}{R_4 + R_5}$$

Application to High Supply Voltage Circuit

The absolute maximum rating of supply voltage for M51945B, M51946B is 18V. By diving supply voltage using resistors, these ICs can be used in high supply voltage circuit.



In the above figure, the voltage applied to M5194XB is as follows. The voltage range is set between 2V and 17V.

$$\text{at } Q_1 \text{ ON: } \frac{R_2 \cdot \left[\frac{R_3}{(R_1+R_3)} \cdot V_{CC} - (R_1 // R_3) \cdot I_{CC}\right] + (R_1 // R_3) \cdot V_{BEI}}{R_2 + (R_1 // R_3)}$$

$$\text{at } Q_1 \text{ OFF: } \frac{R_2 \cdot \left[\frac{R_3}{(R_1+R_3)} \cdot V_{CC} - (R_1 // R_3) \cdot I_{CC}\right]}{R_2 + (R_1 // R_3)}$$

$$R_1 // R_3 \equiv \frac{R_1 \cdot R_3}{R_1 + R_3}$$

V_{CC}: Circuit current of M5194XB

V_{BEI}: Base-emitter voltage $\approx$ 0.7V (Transistor Q_1)

This circuit provides reverse protection (in case of reverse connection of power supply) and surge protection.

Using this application circuit, the directly rectified or smoothing commercial voltage can be applied as shown below.