

Smart Multi-Voltage Detector

General Description

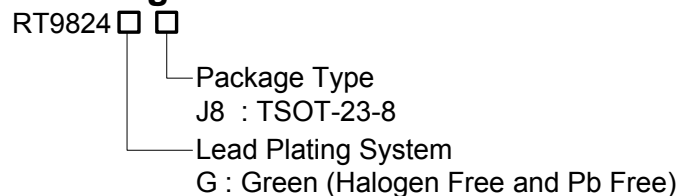
The RT9824 is an integrated smart multi-voltage detector supervising three power supply voltage levels including 5V, 5.4V and additional 3.3V, 12V or other voltage which can be determined by external divided resistors.

The RT9824 performs supervisory function by sending out $\overline{\text{RESET}}$ and CTR signals whenever the monitored voltages fall below 80% of voltage levels. The $\overline{\text{RESET}}$ and CTR signals will last the whole period before VCC recovering. Once the supervising voltages are recovered to higher than 80% of the voltage levels, the $\overline{\text{RESET}}$ and CTR signal will be released after 300ms delay time.

MR (Manual Reset) controls CTR signal during three monitored power supply voltages at normal voltage levels. When MR signal is in logic high, the CTR signal will be pulled low immediately. However the $\overline{\text{RESET}}$ will not be interfered and will be kept at high level.

The RT9824 is available in the TSOT-23-8 package.

Ordering Information

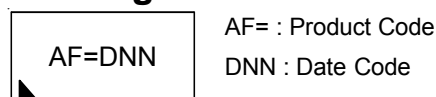


Note :

Richtek products are :

- ▶ RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- ▶ Suitable for use in SnPb or Pb-free soldering processes.

Marking Information



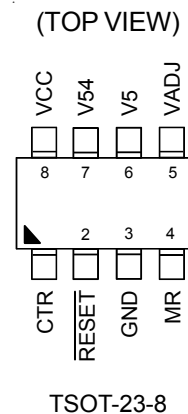
Features

- Capable of Monitoring Three Inputs Precisely
- Detection Threshold Voltages
 - ▶ VCC Connect to 5V or 3.3V Standby Power
 - ▶ V5 : 5V x 80%
 - ▶ V54 : 5.4V x 80%
 - ▶ VADJ : 1V (Using Resistor Divider)
- Accuracy : $\pm 2\%$
- $\overline{\text{RESET}}$ (Open Drain Output Active Low)
- Built-in Recovery Delay 300ms
- CTR (Open Drain Output Active Low)
- Manual Reset (MR) Function
- TSOT-23-8 Package
- RoHS Compliant and Halogen Free

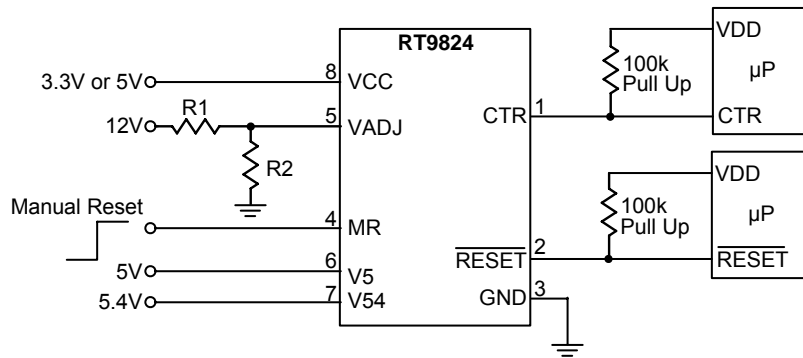
Applications

- LCD TV or Monitors
- Consumer Electronic Products
- System Voltage Detector

Pin Configurations



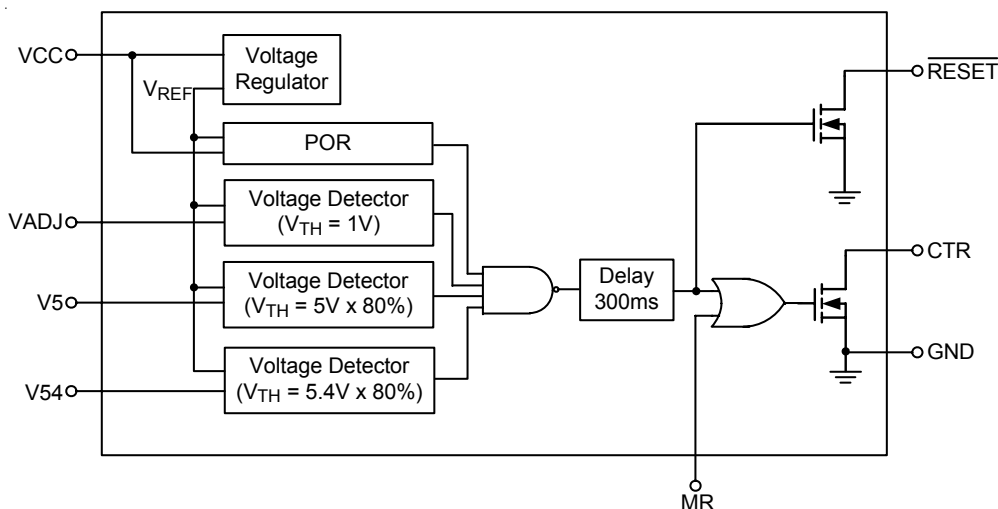
Typical Application Circuit



Functional Pin Description

Pin No.	Pin Name	Pin Function
1	CTR	Control Output (Open Drain, Active-Low). Only when V_{CC} is $> POR$, V_5 is $> 80\%$, V_{54} is $> 80\%$, and V_{ADJ} is $> 1V$, the CTR will delay 300ms and become high. Once V_5 or V_{54} or V_{ADJ} is $< 80\%$, the signal will become low. When MR is high, CTR will become low.
2	\overline{RESET}	\overline{RESET} Output (Open Drain, Active-Low). Only when V_{CC} is $> POR$, V_5 is $> 80\%$, V_{54} is $> 80\%$, and V_{ADJ} is $> 1V$, the \overline{RESET} will delay 300ms and become high. Once V_5 or V_{54} or V_{ADJ} is $< 80\%$, the signal will become low.
3	GND	Ground.
4	MR	Manual Reset Input. Manual reset with internal pull high resistor ($1M\Omega$), H : CTR = Low; L : CTR signal is dependent on voltage detector output.
5	VADJ	Voltage Detection Input. Connect 12V or other power with external resistor divider to this pin. The V_{ADJ} logic-high threshold voltage is 1V.
6	V5	5V Voltage Detection Input. The detection threshold is $5V \times 80\%$.
7	V54	54V Voltage Detection Input. The detection threshold is $5.4V \times 80\%$.
8	VCC	Connect this Pin to Standby Power from system.

Function Block Diagram



Absolute Maximum Ratings (Note 1)

- VCC, CTR, MR, $\overline{\text{RESET}}$, V5, V54, VADJ ----- -0.3V to 6.5V
- Power Dissipation, P_D @ $T_A = 25^\circ\text{C}$
 TSOT-23-8 ----- 0.435W
- Package Thermal Resistance (Note 2)
 TSOT-23-8, θ_{JA} ----- 230°C/W
- Junction Temperature ----- 150°C
- Lead Temperature (Soldering, 10 sec.) ----- 260°C
- Storage Temperature Range ----- -65°C to 150°C
- ESD Susceptibility (Note 3)
 HBM (Human Body Mode) ----- 2kV
 MM (Machine Mode) ----- 200V

Recommended Operating Conditions (Note 4)

- Junction Temperature Range ----- -40°C to 125°C

Electrical Characteristics

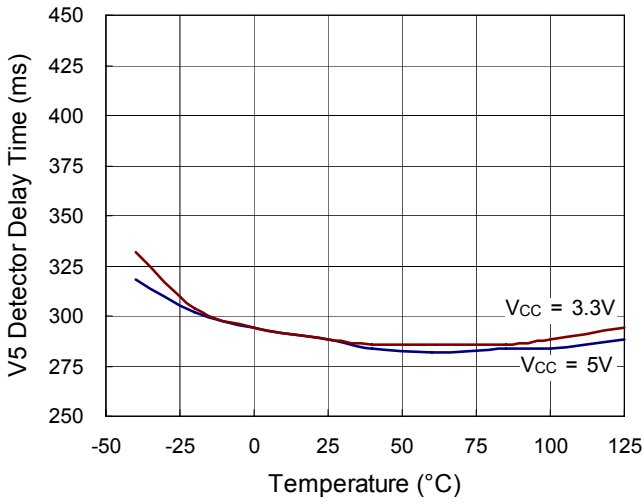
($V_{CC} = 5V$, $T_A = 25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
VCC Supply Current	I_{VCC}	Without load	--	--	200	μA
VCC Operating Voltage	V_{CC}		2.97	5	5.94	V
VCC POR Rising	V_{POR}		--	2.8	--	V
VCC POR Hysteresis	V_{POR_Hys}		--	0.15	--	V
Voltage Detector & MUTE Threshold						
V5 High Threshold Voltage	$V5_{TH}$		3.92	4	4.08	V
V54 High Threshold Voltage	$V54_{TH}$		4.23	4.32	4.41	V
VADJ High Threshold Voltage	$VADJ_{TH}$		0.98	1	1.02	V
Manual Reset High Voltage	V_{IH}		2	--	--	V
Manual Reset Low Voltage	V_{IL}		--	--	0.8	V
Voltage Detector Deglitch and Delay						
Voltage Detectors Delay Time	T_{DELAY}		200	300	--	ms
Voltage Detectors Deglitch Time	$T_{DEGLITCH}$		--	20	--	μs
Output : Open Drain						
$\overline{\text{RESET}}$ Output Low Voltage	V_{OL_RESET}	$V_{CC} = 3.3V$, 5mA sinking current at $\overline{\text{RESET}}$ output	--	--	0.3	V
CTR Output Low Voltage	V_{OL_CTR}	$V_{CC} = 3.3V$, 5mA sinking current at CTR output	--	--	0.3	V

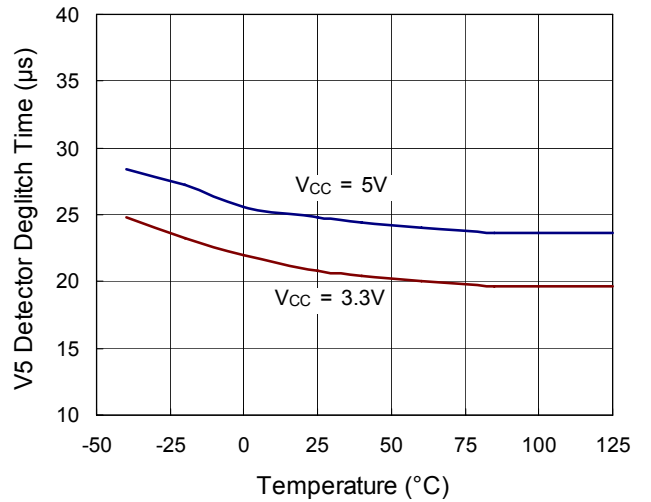
- Note 1.** Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
- Note 2.** θ_{JA} is measured in the natural convection at $T_A = 25^\circ\text{C}$ on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.
- Note 3.** Devices are ESD sensitive. Handling precaution is recommended.
- Note 4.** The device is not guaranteed to function outside its operating conditions.

Typical Operating Characteristics

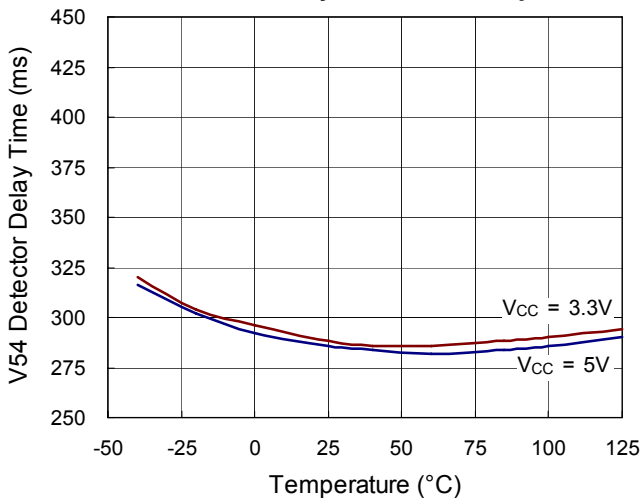
V5 Detector Delay Time vs. Temperature



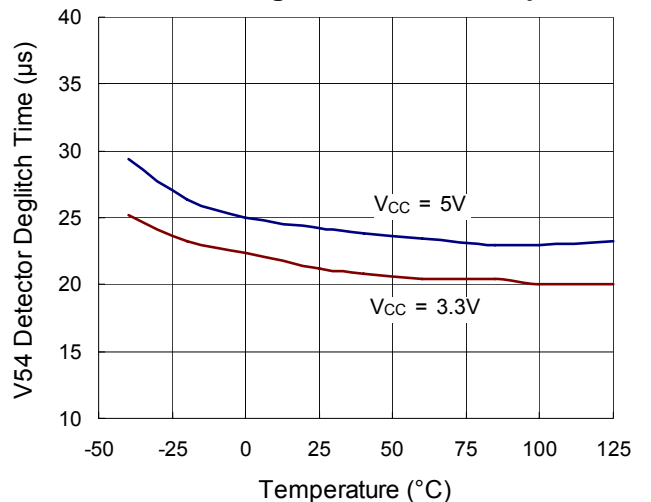
V5 Detector Deglitch Time vs. Temperature



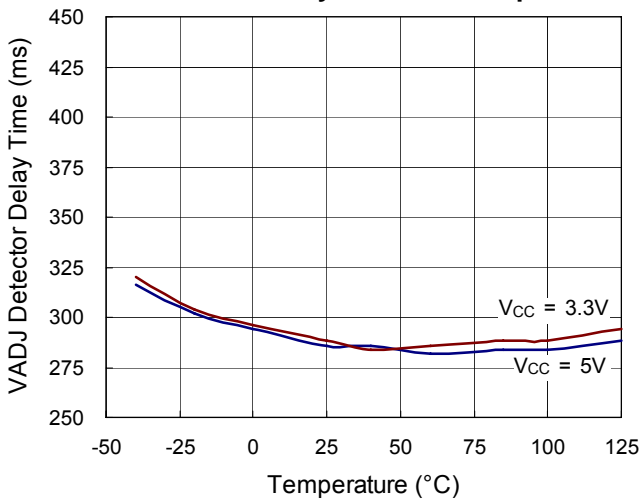
V54 Detector Delay Time vs. Temperature



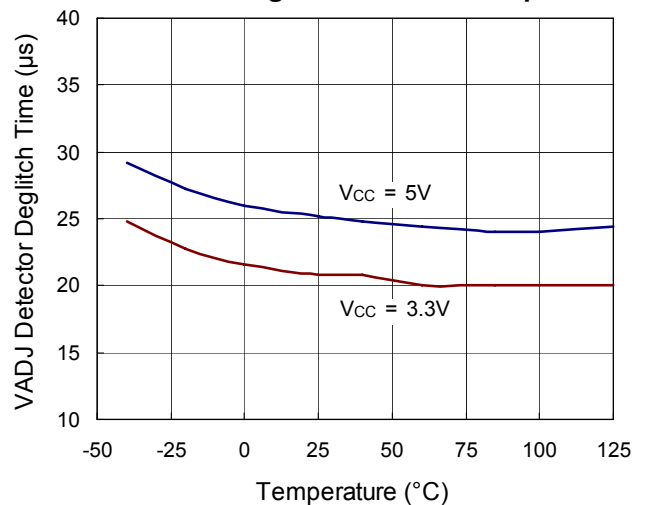
V54 Detector Deglitch Time vs. Temperature



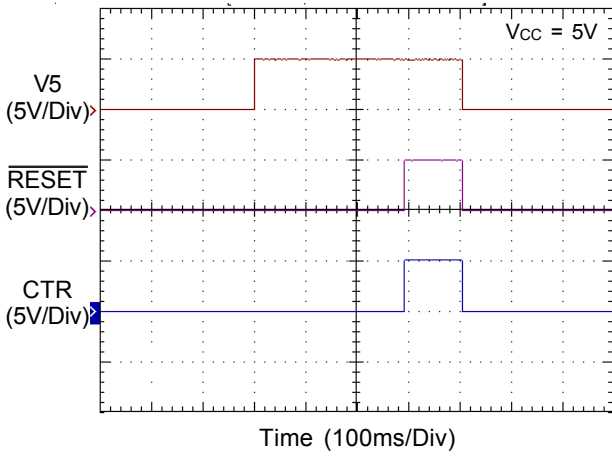
VADJ Detector Delay Time vs. Temperature



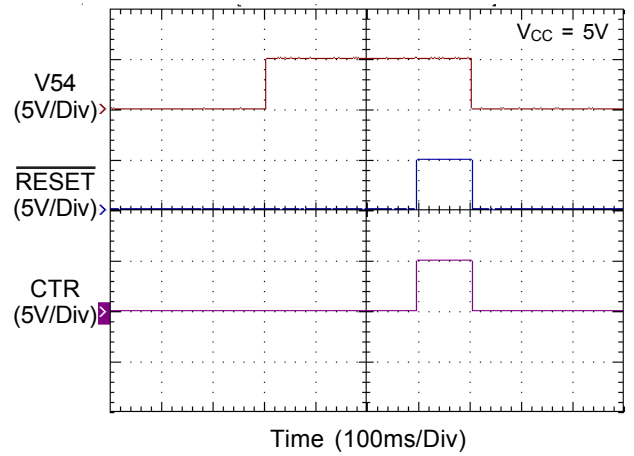
VADJ Detector Deglitch Time vs. Temperature



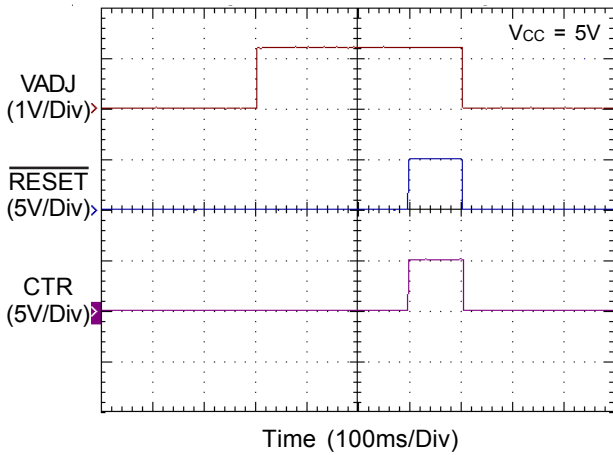
V5 Pin Response



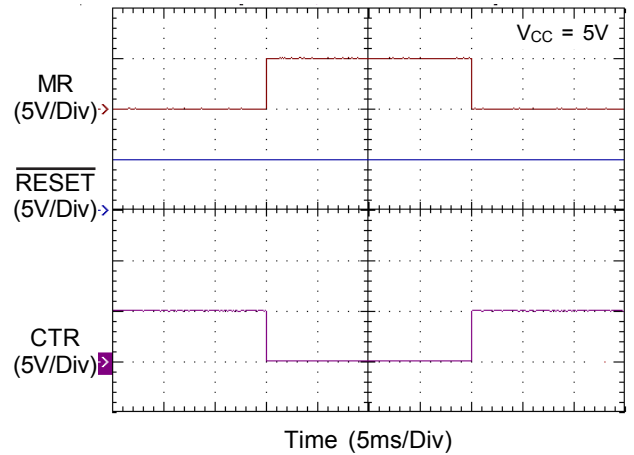
V54 Pin Response



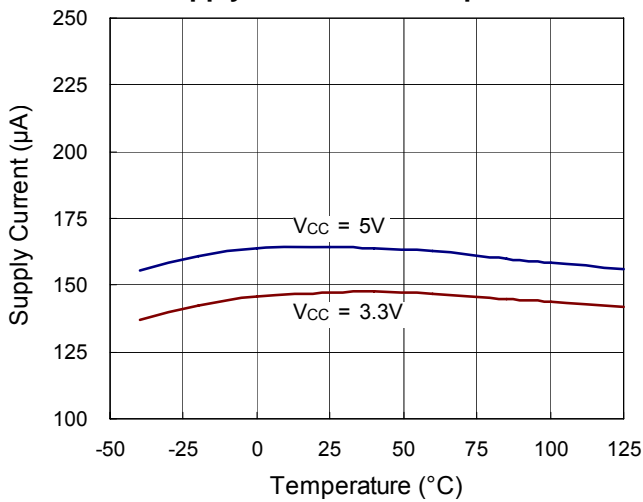
VADJ Pin Response



MR Pin Response



Supply Current vs. Temperature



Application Information

The RT9824 smart voltage detector monitors three voltage levels at the same time to ensure the micro-processor is operated within the recommended input voltage range. In conventional reset IC application, to monitor one power rail needs one reset IC. The RT9824 can monitor three power rails simultaneously, by using just one reset IC. The RT9824 also provides a Manual Reset (MR) function for application easily. Glitch-rejection is implemented in the RT9824 to prevent it from false operation and to eliminate the additional de-bouncing circuitry.

Thermal Considerations

For continuous operation, do not exceed absolute maximum operation junction temperature. The maximum power dissipation depends on the thermal resistance of IC package, PCB layout, the rate of surroundings airflow and temperature difference between junction to ambient. The maximum power dissipation can be calculated by following formula :

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

Where $T_{J(MAX)}$ is the maximum operation junction temperature, T_A is the ambient temperature and the θ_{JA} is the junction to ambient thermal resistance.

For recommended operating conditions specification of RT9824, the maximum junction temperature is 125°C and T_A is the maximum ambient temperature. The junction to ambient thermal resistance θ_{JA} is layout dependent. For TSOT-23-8 package, the thermal resistance θ_{JA} is 250°C/W on the standard JEDEC 51-3 single layer thermal test board. The maximum power dissipation at $T_A = 25^\circ\text{C}$ can be calculated by following formula :

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / (250^\circ\text{C/W}) = 0.435\text{W for TSOT-23-8 package}$$

The maximum power dissipation depends on operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance θ_{JA} . For RT9824 package, the Figure 1 of derating curve allows the designer to see the effect of rising ambient temperature on the maximum power dissipation allowed.

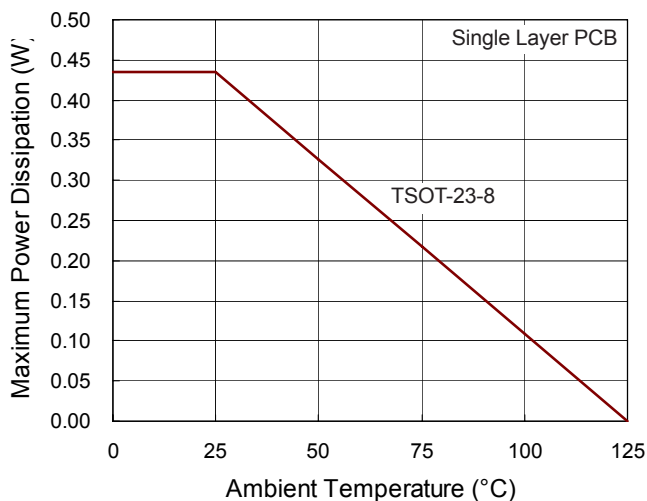
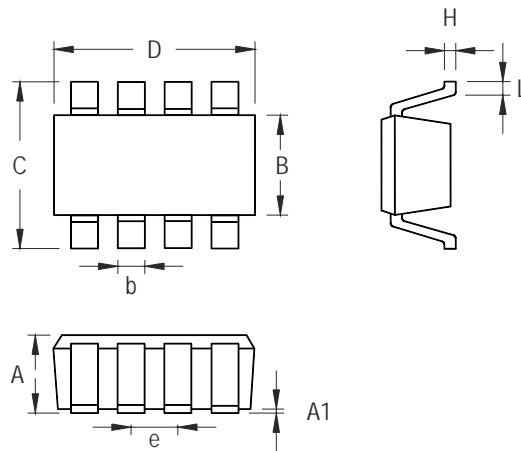


Figure 1. Derating Curves for RT9824 Package

Outline Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	1.000	0.028	0.039
A1	0.000	0.100	0.000	0.004
B	1.397	1.803	0.055	0.071
b	0.220	0.380	0.009	0.015
C	2.591	3.000	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.585	0.715	0.023	0.028
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

TSOT-23-8 Surface Mount Package

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