# 3-Pin Microprocessor Reset Circuit

## Description

The V6309 and V6319 are microprocessor supervisory circuits used to monitor the power supplies in µP and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with 5V powered or 3V powered circuits.

These circuits perform a single function: they assert a reset signal whenever the $V_{DD}$ supply voltage declines below a preset threshold, keeping it asserted for at least 140ms after $V_{DD}$ has risen above the reset threshold. The only difference between the two devices is that the V6309 has an active-low $\overline{RESET}$ output (which is guaranteed to be in the correct state for $V_{DD}$ down to 1V), while the V6319 has an active-high RESET output. The reset comparator is designed to ignore fast transients on $V_{DD}$. Reset thresholds suitable for operation with a variety of supply voltages are available.

Low supply current makes the V6309/V6319 ideal for use in portable equipment. The V6309/V6319 come in a 3-pin SOT23 package.

## Features

- Precision monitoring of 3V, 3.3V and 5V power supply voltages
- Fully specified over the temperature range of -40 to +125°C
- 140ms minimum power-on reset pulse width:
  $\overline{RESET}$ output for V6309
  RESET output for V6319
- 16 µA supply current
- Guaranteed $\overline{RESET}$/RESET valid to $V_{DD}$ = 1V
- Power supply transient immunity
- No external components needed
- 3-pin SOT23 package
- Fully compatible with MAX809/MAX810

## Applications

- Computer
- Controllers
- Intelligent instruments
- Critical µP and µC power monitoring
- Portable/battery-powered equipment

### Typical Operating Configuration

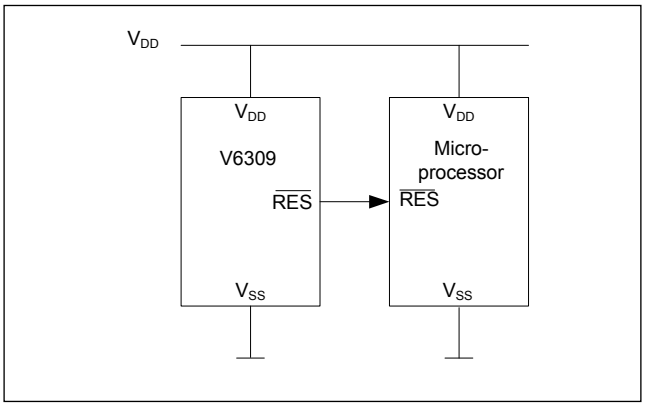



Fig. 1

### Pin Assignment

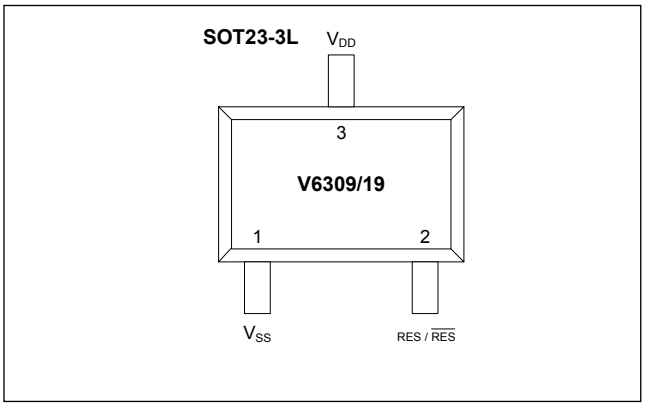



Fig. 2

### Pin Description

| Pin | Name | Function |
|---|---|---|
| 1 | $V_{SS}$ | Ground |
| 2 | for V6309 $\overline{RESET}$ | $\overline{RESET}$ Output remains low while $V_{DD}$ is below the reset threshold and rises for 240ms after $V_{DD}$ above the reset threshold |
| 2 | for V6319 RESET | RESET Output remains high while $V_{DD}$ is below the reset threshold and rises for 240ms after $V_{DD}$ above the reset threshold |
| 3 | VDD | Supply voltage (+5V, +3.3V or +3.0V) |

Table 1

## Absolute Maximum Ratings

| Parameter | Symbol | Conditions |
|---|---|---|
| Terminal voltage to $V_{SS}$ | $V_{DD}$ | -0.3V to + 6.0V |
| Min. voltage at RESET or $\overline{RESET}$ | $V_{min}$ | -0.3V |
| Maximum voltage at RESET or $\overline{RESET}$ | $V_{max}$ | $V_{CC}$ + 0.3V |
| Input current at $V_{DD}$ | $I_{min}$ | 20 mA |
| Output current at RESET or $\overline{RESET}$ | $I_{max}$ | 20 mA |
| Rate of rise at $V_{DD}$ | $t_R$ | 100Vµs |
| Continuous power dissipation at $T_A$ = +70°C for SOT-23 (>70°C derate by 4 mW/°C) | $P_{max}$ | 320 mW |
| Operating temperature range | $T_A$ | -40 to +125°C |
| Storage temperature range | $T_{ST}$ | -65°C to +150°C |

**Table 2**

Stresses above these listed maximum ratings may cause permanent damages to the device. Exposure beyond specified operating conditions may affect device reliability or cause malfunction.

### Handling Procedures

This device has built-in protection against high static voltages or electric fields; however, it is advised that normal precautions be taken as for any other CMOS component. Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the voltage range.

## Electrical Characteristics

$V_{DD}$ = full range, $T_A$ = -40 to +125°C, unless otherwise specified, typical values at $T_A$ = +25°C, $V_{DD}$ = 5V for versions L and M, $V_{DD}$ = 3.3V for versions T and S, $V_{DD}$ = 3 V for R. (Production testing done at $T_A$ = +25°C and 85°C, over temperature limits guaranteed by design only)

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{DD}$ range | $V_{DD}$ | $T_A$ = 0 to +70°C | 1.0 | | 5.5 | V |
| | | $T_A$ = -40 to +105C | 1.2 | | 5.5 | V |
| | | $T_A$ = -40 to +125°C | 1.6 | | 5.5 | V |
| Supply current | | | | | | |
| versions L, M | $I_{CC}$ | $V_{DD}$ < 5.5V | | 26 | 60 | µA |
| versions R, S, T | | $V_{DD}$ < 3.6V | | 16 | 50 | µA |
| RESET threshold [1] | | | | | | |
| version L | $V_{TH}$ | $T_A$ = +25°C | 4.56 | 4.63 | 4.70 | V |
| | | $T_A$ = -40 to +125°C | 4.40 | | 4.79 | V |
| version M | | $T_A$ = +25°C | 4.31 | 4.38 | 4.45 | V |
| | | $T_A$ = -40 to +125°C | 4.16 | | 4.53 | V |
| version T | | $T_A$ = +25°C | 3.04 | 3.08 | 3.11 | V |
| | | $T_A$ = -40 to +125°C | 2.92 | | 3.17 | V |
| version S | | $T_A$ = +25°C | 2.89 | 2.93 | 2.96 | V |
| | | $T_A$ = -40 to +125°C | 2.78 | | 3.02 | V |
| version R | | $T_A$ = +25°C | 2.59 | 2.63 | 2.66 | V |
| | | $T_A$ = -40 to +125°C | 2.50 | | 2.72 | V |
| Reset threshold temp. coefficient | | | | -200 | | ppm/°C |
| $V_{DD}$ to reset delay [1] | | $V_{DD}$ = $V_{TH}$ to ($V_{TH}$ – 100mV) | | 7 | | µs |
| Reset active timeout period | | $T_A$ = -40 to °125°C | 140 | 330 | 590 | ms |
| $\overline{RESET}$ output voltage low for V6309 | $V_{OL}$ | $V_{DD}$ > 1.0V, $I_{SINK}$ = 50µA | | | 0.3 | V |
| versions R, S, T | | $V_{DD}$ = $V_{TH}$ min., $I_{SINK}$ = 1.2mA | | | 0.3 | V |
| versions L, M | | $V_{DD}$ = $V_{TH}$ min., $I_{SINK}$ = 3.2mA | | | 0.4 | V |
| $\overline{RESET}$ output voltage high for V6309 | | | | | | |
| versions R, S, T | $V_{OH}$ | $V_{DD}$ = $V_{TH}$ max., $I_{SOURCE}$ = 500µA | 0.8 $V_{DD}$ | | | V |
| versions L, M | | $V_{DD}$ = $V_{TH}$ max., $I_{SOURCE}$ = 800µA | $V_{DD}$-1.5V | | | V |
| RESET output voltage low for V6319 | | | | | | |
| versions R, S, T | $V_{OL}$ | $V_{DD}$ = $V_{TH}$ max., $I_{SINK}$ = 1.2mA | | | 0.3 | V |
| versions L, M | | $V_{DD}$ = $V_{TH}$ max., $I_{SINK}$ = 3.2mA | | | 0.4 | V |
| RESET output voltage high for V6319 | $V_{OH}$ | 1.8V < $V_{DD}$ < $V_{TH}$ min., $I_{SOURCE}$ = 150µA | 0.8 $V_{DD}$ | | | V |

**Table 3**

[1] $\overline{RESET}$ output for V6309 , RESET output for V6319

**Supply Current vs Temperature**
No load, V63xxR/S/T

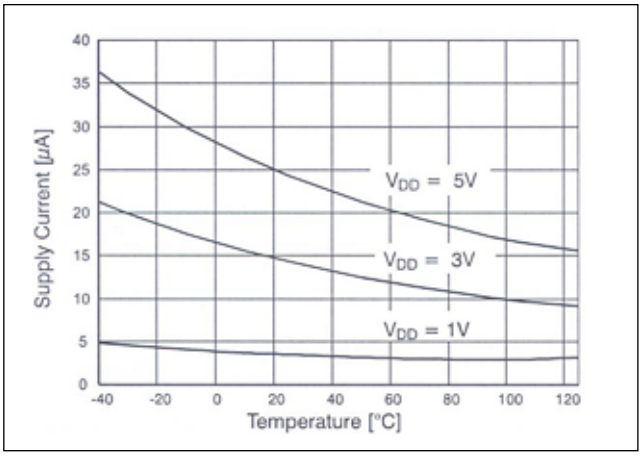



**Fig. 3**

**Supply Current vs Temperature**
No load, V63xxL/M

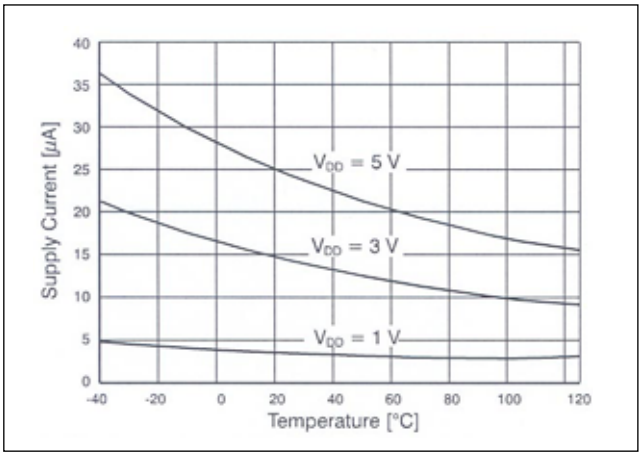



**Fig. 4**

**Power-Up Reset Timeout vs Temperature**
All versions

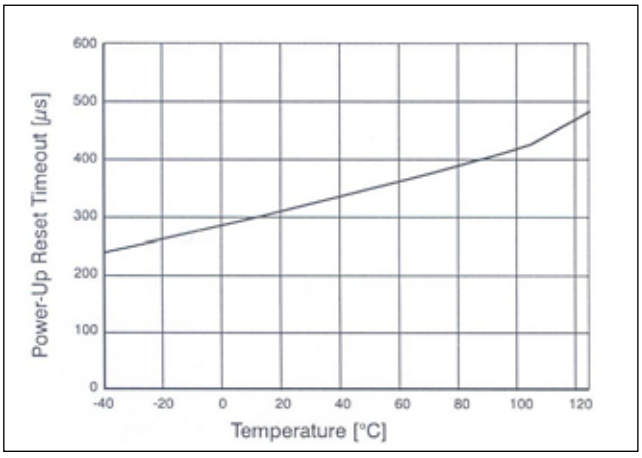



**Fig. 5**

**Power-Down Reset Delay vs Temperature**
V63xxR/S/T

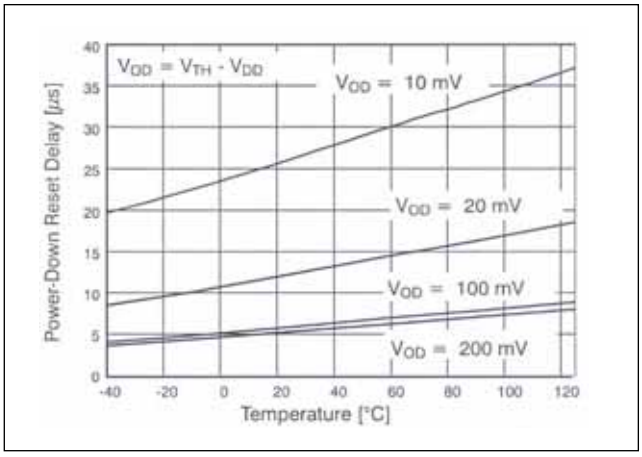



**Fig. 6**

**Power-Down Reset Delay vs Temperature**
V63xxL/M

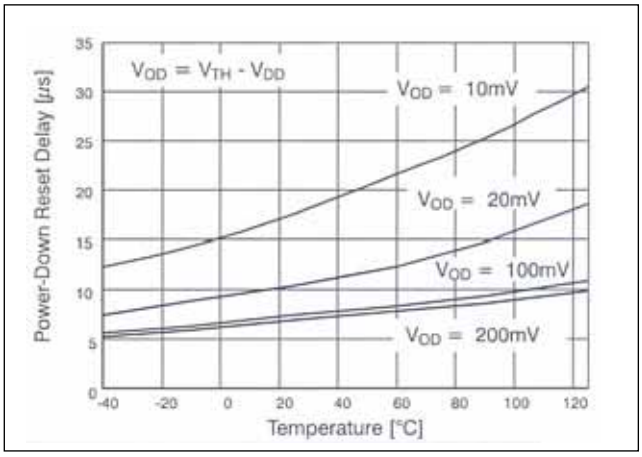



**Fig. 7**

**Normalized Reset Threshold vs Temperature**
All versions

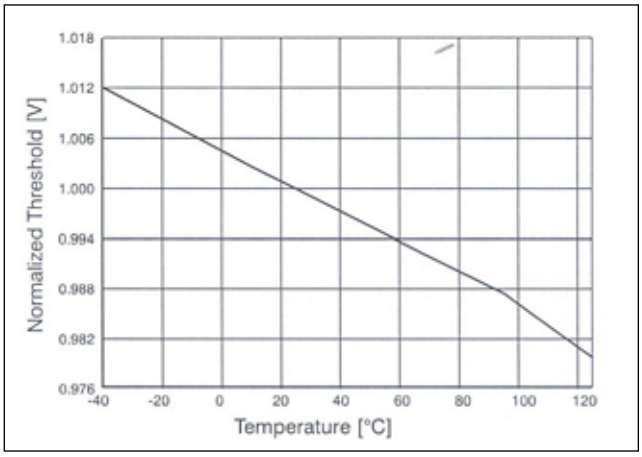



**Fig. 8**

## Application Information

### Negative-Going $V_{DD}$ Transients

In addition to issuing a reset to the microprocessor during power-up, power-down and brownout conditions, the V6309/V6319 are relatively immune to short duration negative-doing $V_{DD}$ transients (glitches). Fig. 8 shows typical transient duration vs. Reset comparator overdrive, for which the V6309/V6319 do not generate a reset pulse. The graph was generated using a negative-going pulse applied to $V_{DD}$, starting 0.5V above the actual reset threshold and ending below it by the magnitude indicated (reset comparator overdrive). The graph indicates the maximum pulse width a negative-going $V_{DD}$ transient can have without causing a reset pulse. As the magnitude of the transient increases (goes farther below the reset threshold), the maximum allowable pulse width decreases. Typically, for the V6309L and V6319M, a $V_{DD}$ transient that goes 100V below the reset threshold and lasts 20µs or less will not cause a reset pulse. A 0.1µF bypass capacitor mounted as close as possible to the $V_{DD}$ pin provides additional transient immunity.

**Max. Transient Duration without causing a Reset Pulse versus Reset Comparator Overdrive**

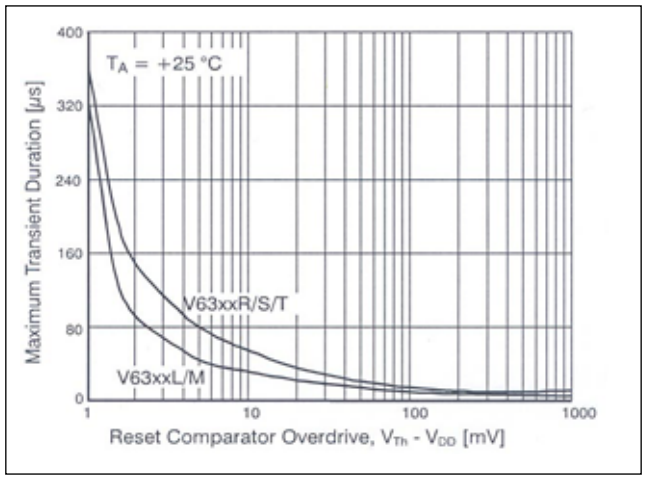



**Fig .9**

### Ensuring a Valid Reset Output down to $V_{DD}$ = 0V

When $V_{DD}$ falls below 1V, the V6309 $\overline{\text{RESET}}$ output no longer sinks current, it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to $\overline{\text{RESET}}$ can drift to undetermined voltages. This presents no problem in most applications, since most µP and other circuitry is inoperative with $V_{DD}$ below 1V. However, in applications where $\overline{\text{RESET}}$ must be valid down to 0V, adding a pull-down resistor to $\overline{\text{RESET}}$ causes any stray leakage currents to flow to ground, holding $\overline{\text{RESET}}$ low (Fig. 10). R1's value is not critical; 100 kΩ is large enough not to load $\overline{\text{RESET}}$ and small enough to pull $\overline{\text{RESET}}$ to ground. A 100 kΩ pull-up resistor to $V_{DD}$ is also recommended for the V6319, if RESET is required to remain valid for $V_{DD}$ < 1V.

**RESET Valid for $V_{DD}$ = Ground Circuit**

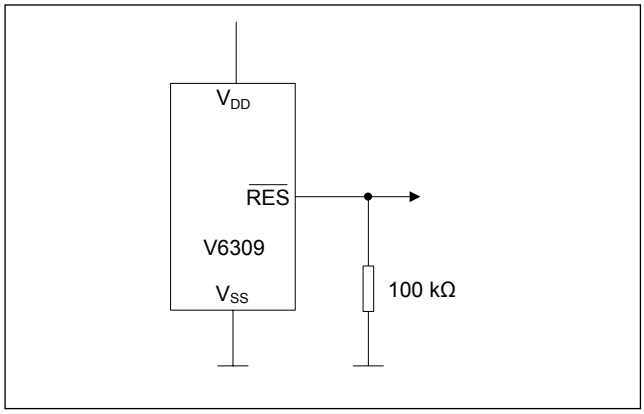



**Fig. 10**

### Interfacing to µPs with Bidirectional Reset Pins

Microprocessors with bidirectional reset pins (such as the Motorola 68HC11 series) can connect to the V6309 reset output. If, for example, the V6309 $\overline{\text{RESET}}$ output is asserted high and the µP wants to pull it low, indeterminate logic levels may result. To correct this, connect a 4.7 kΩ resistor between the V6309 $\overline{\text{RESET}}$ and the µP reset I/O (Fig. 11). Buffer the V6309 $\overline{\text{RESET}}$ output to other system components.

**Interfacing to µPs with Bidirectional Reset I/O**

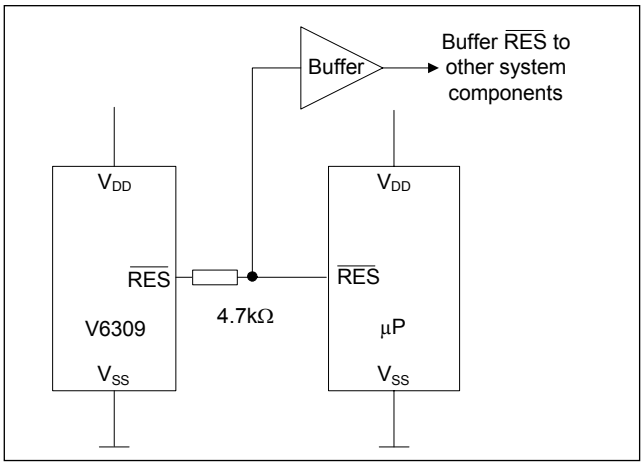



**Fig. 11**

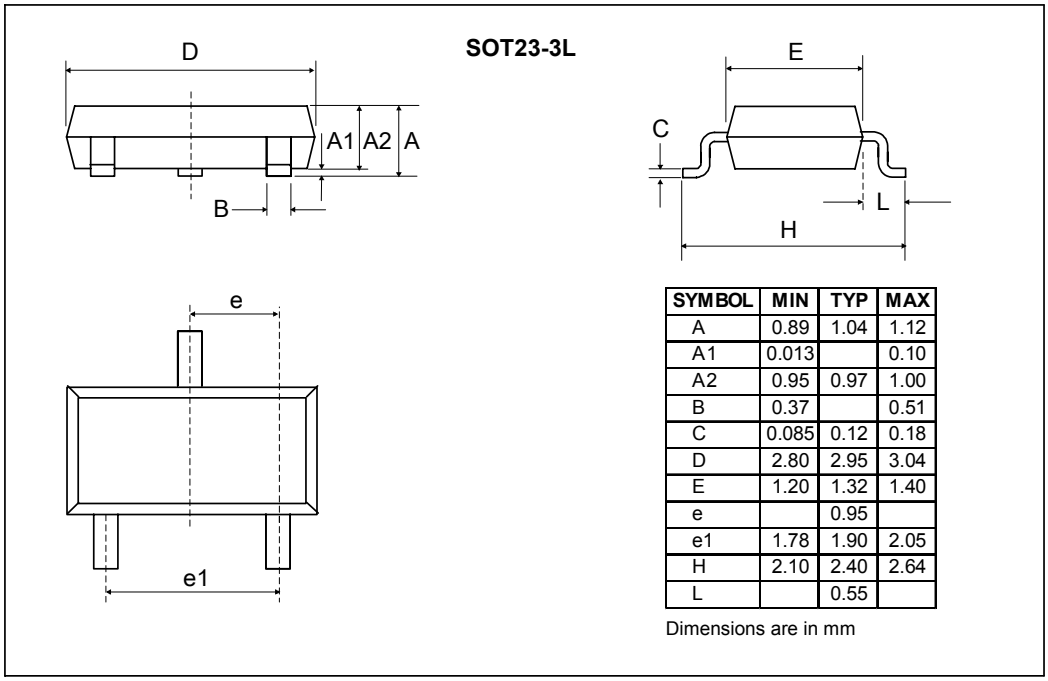
### Benefits of Highly Accurate Reset Threshold

Most µP supervisor ICs have reset threshold voltages between 5% and 10% below the value of nominal supply voltages. This ensures a reset will not occur within 5% of the nominal supply, but will occur when the supply is 10% below nominal. When using ICs rated at only the nominal supply ±5%, this leaves a zone of uncertainty where the supply is between 5% and 10% low, and where the reset may or may not be asserted.

The V6209/T and V6319/T use highly accurate circuitry to ensure that reset is asserted close to the 5% limit, and long before the supply has declined to 10% below nominal.

## Packaging and Ordering Information

### Dimensions of SOT23-3L Package




| SYMBOL | MIN | TYP | MAX |
|---|---|---|---|
| A | 0.89 | 1.04 | 1.12 |
| A1 | 0.013 | | 0.10 |
| A2 | 0.95 | 0.97 | 1.00 |
| B | 0.37 | | 0.51 |
| C | 0.085 | 0.12 | 0.18 |
| D | 2.80 | 2.95 | 3.04 |
| E | 1.20 | 1.32 | 1.40 |
| e | | 0.95 | |
| e1 | 1.78 | 1.90 | 2.05 |
| H | 2.10 | 2.40 | 2.64 |
| L | | 0.55 | |

Dimensions are in mm

### Ordering Information

When ordering, please always specify the complete Part Number. Please contact EM Microelectronic for availability.

| Part Number | Threshold Voltage | Output Type | Package & Delivery Form | Top Marking [1] | Top Marking [2] with 4 Characters | Top Marking [3] with 3 Characters |
|---|---|---|---|---|---|---|
| V6309RSP3B | 2.63V | Active low push-pull | SOT23-3L, Tape & Reel 3000 pces | | AEAR | ER# |
| V6309RSP3B+ | 2.63V | | | EK## | BEAR | |
| V6309SSP3B | 2.93V | | | AT## | AEAS | ES# |
| V6309SSP3B+ | 2.93V | | | BT## | BEAS | |
| V6309TSP3B | 3.08V | | | | AEAT | ET# |
| V6309TSP3B+ | 3.08V | | | EF## | BEAT | |
| V6309MSP3B | 4.38V | | | | AEAM | EM# |
| V6309MSP3B+ | 4.38V | | | E9## | BEAM | |
| V6309LSP3B | 4.63V | | | | AEAL | EL# |
| V6309LSP3B+ | 4.63V | | | E6## | BEAL | |
| V6319RSP3B | 2.63V | Active high push-pull | SOT23-3L, Tape & Reel 3000 pces | | AFAR | FR# |
| V6319SSP3B | 2.93V | | | | AFAS | FS# |
| V6319TSP3B | 3.08V | | | | AFAT | FT# |
| V6319MSP3B | 4.38V | | | P0## | AFAM | FM# |
| V6319MSP3B+ | 4.38V | | | E5## | BFAM | |
| V6319LSP3B | 4.63V | | | | AFAL | FL# |

[1] Top marking is the standard from 2006. No bottom marking exists. Where ## refers to the lot number (EM internal reference only)

[2] Top marking with 4 characters is standard from 2003. For lead-free/green mold (RoHS) parts, the first letter of top marking with 4 characters begins with letter “B” instead of letter “A”. Bottom marking indicates the lot number.

[3] Top marking with 3 characters is kept as information since it was used until 2002. Where # refers to the lot number (EM internal reference only)

### Traceability for Small Packages

Due to the limited space on the package surface, the bottom marking contains a limited number of characters that provide only partial information for lot traceability. Full information for complete traceability is however provided on the packing labels of the product at delivery from EM. It is highly recommended that the customer insures full lot traceability of EM product in his final product.

## Samples

| Part Number |
|---|
| V6309LSP3B+ |
| V6309MSP3B+ |
| V6309RSP3B+ |
| V6309SSP3B+ |
| V6309TSP3B+ |

| Part Number |
|---|
| V6319TSP3B |
| V6319MSP3B+ |

Sample stock is generally held on versions list above. Please contact factory for other versions not shown here.