



MOTOROLA

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# MC33464

## Micropower Undervoltage Sensing Circuits

The MC33464 series are micropower undervoltage sensing circuits that are specifically designed for use with battery powered microprocessor based systems, where extended battery life is required. A choice of several threshold voltages from 0.9 V to 4.5 V are available. These devices feature a very low quiescent bias current of 0.8  $\mu$ A typical.

The MC33464 series features a highly accurate voltage reference, a comparator with precise thresholds and built-in hysteresis to prevent erratic reset operation, a choice of output configurations between open drain or complementary MOS, and guaranteed operation below 1.0 V with extremely low standby current. These devices are available in either SOT-89 3-pin or SOT-23 5-pin surface mount packages.

Applications include direct monitoring of the MPU/logic power supply used in portable, appliance, automotive and industrial equipment.

### MC33464 Features:

- Extremely Low Standby Current of 0.8  $\mu$ A at  $V_{in} = 1.5$  V
- Wide Input Voltage Range (0.7 V to 10 V)
- Monitors Power Supply Voltages from 1.1 V to 5.0 V
- High Accuracy Detector Threshold ( $\pm 2.5\%$ )
- Two  $\overline{\text{Reset}}$  Output Types (Open Drain or Complementary Drive)
- Two Surface Mount Packages (SOT-89 or SOT-23 5-Pin)

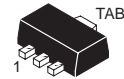
### ORDERING INFORMATION

| Device         | Threshold Voltage | Type                                    | Marking | Package (Qty/Reel) |
|----------------|-------------------|---|---------|--------------------|
| MC33464H-09AT1 | 0.9               | Open Drain<br>$\overline{\text{Reset}}$ | T09A    | SOT-89<br>(1000)   |
| MC33464H-20AT1 | 2.0               |   | T20A    |                    |
| MC33464H-27AT1 | 2.7               |   | T27A    |                    |
| MC33464H-30AT1 | 3.0               |   | T30A    |                    |
| MC33464H-45AT1 | 4.5               |   | T45A    |                    |
| MC33464H-09CT1 | 0.9               | Compl. MOS<br>$\overline{\text{Reset}}$ | T09C    |                    |
| MC33464H-20CT1 | 2.0               |   | T20C    |                    |
| MC33464H-27CT1 | 2.7               |   | T27C    |                    |
| MC33464H-30CT1 | 3.0               |   | T30C    |                    |
| MC33464H-43CT1 | 4.3               |   | T43C    |                    |
| MC33464H-45CT1 | 4.5               | T45C                                    |         |                    |
| MC33464N-09ATR | 0.9               | Open Drain<br>$\overline{\text{Reset}}$ | 9N      | SOT-23<br>(3000)   |
| MC33464N-20ATR | 2.0               |   | 0R      |                    |
| MC33464N-21ATR | 2.1               |   | 1R      |                    |
| MC33464N-27ATR | 2.7               |   | 7R      |                    |
| MC33464N-30ATR | 3.0               |   | 0S      |                    |
| MC33464N-45ATR | 4.5               |   | 5T      |                    |
| MC33464N-48ATR | 4.8               | 8T                                      |         |                    |
| MC33464N-09CTR | 0.9               | Compl. MOS<br>$\overline{\text{Reset}}$ | 9F      |                    |
| MC33464N-20CTR | 2.0               |   | 0J      |                    |
| MC33464N-27CTR | 2.7               |   | 7J      |                    |
| MC33464N-30CTR | 3.0               |   | 0K      |                    |
| MC33464N-45CTR | 4.5               |   | 5L      |                    |

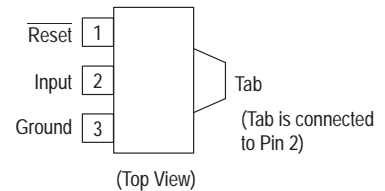
Other voltages from 0.9 to 6.0 V, in 0.1 V increments, are available. Consult factory for information.

## MICROPOWER UNDERVOLTAGE SENSING CIRCUITS

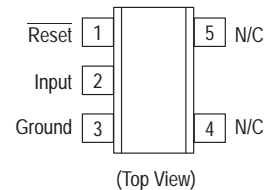
### SEMICONDUCTOR TECHNICAL DATA



**H SUFFIX**  
PLASTIC PACKAGE  
CASE 1213  
(SOT-89)



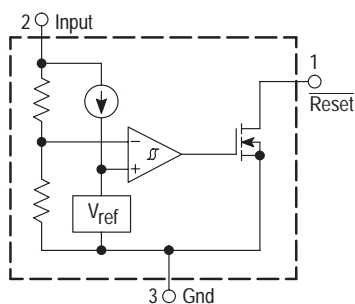
**N SUFFIX**  
PLASTIC PACKAGE  
CASE 1212  
(SOT-23-5)



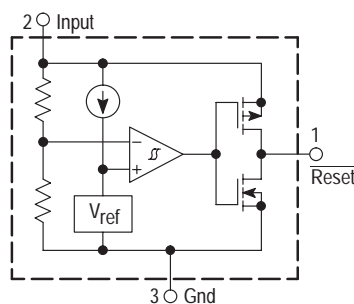
# MC33464

## Representative Block Diagrams

**MC33464X-YYATZ**  
Open Drain Configuration



**MC33464X-YYCTZ**  
Complementary Drive Configuration



X Denotes Package Type  
YY Denotes Threshold Voltage  
TZ Denotes Taping Type

This device contains 25 active transistors.

### MAXIMUM RATINGS (T<sub>C</sub> = 25°C, unless otherwise noted.)

| Rating  | Symbol              | Value       | Unit |
|---|---------------------|-------------|------|
| Power Input Supply Voltage                    | V <sub>in</sub>     | 0 to 10     | V    |
| Reset Output Voltage                          | V <sub>O</sub>      | -0.3 to 10  | V    |
| Reset Output Current (Source or Sink)         | I <sub>O</sub>      | 70          | mA   |
| Power Dissipation and Thermal Characteristics |                     |             |      |
| Maximum Power Dissipation                     | P <sub>D</sub>      | 150         | mW   |
| Case 1212 (SOT-23) N Suffix                   | R <sub>θJA</sub>    | 667         | °C/W |
| Thermal Resistance, Junction-to-Ambient       |                     |             |      |
| Maximum Power Dissipation                     | P <sub>D</sub>      | 300         | mW   |
| Case 1213 (SOT-89) H suffix                   | R <sub>θJA</sub>    | 333         | °C/W |
| Thermal Resistance, Junction-to-Ambient       |                     |             |      |
| Operating Junction Temperature                | T <sub>J</sub>      | +125        | °C   |
| Operating Ambient Temperature                 | T <sub>A</sub>      | -40 to +85  | °C   |
| Storage Temperature Range                     | T <sub>stg</sub>    | -40 to +125 | °C   |
| Lead Temperature (Soldering)                  | T <sub>solder</sub> | 260°C, 10 s | -    |

## MC33464

### ELECTRICAL CHARACTERISTICS (For all values $T_A = 25^\circ\text{C}$ (Note 1), unless otherwise noted.)

| Characteristic   | Symbol               | Min                 | Typ                     | Max              | Unit                  |
|--|----------------------|---------------------|-------------------------|------------------|-----------------------|
| <b>COMPARATOR</b>  |                      |                     |                         |                  |                       |
| Threshold Voltage<br>High State Output ( $V_{in}$ Decreasing)  | $V_{IH}$             |                     |                         |                  | V                     |
| 09 Suffix  |                      | 0.878               | 0.9                     | 0.922            |                       |
| 20 Suffix  |                      | 1.95                | 2.0                     | 2.05             |                       |
| 21 Suffix  |                      | 2.048               | 2.1                     | 2.152            |                       |
| 27 Suffix  |                      | 2.633               | 2.7                     | 2.768            |                       |
| 30 Suffix  |                      | 2.925               | 3.0                     | 3.075            |                       |
| 43 Suffix  |                      | 4.193               | 4.3                     | 4.407            |                       |
| 45 Suffix  |                      | 4.388               | 4.5                     | 4.613            |                       |
| 48 Suffix  | 4.680                | 4.8                 | 4.920                   |                  |                       |
| Threshold Hysteresis   | $V_H$                |                     |                         |                  | V                     |
| 09 Suffix  |                      | 0.027               | 0.045                   | 0.063            |                       |
| 20 Suffix  |                      | 0.060               | 0.100                   | 0.140            |                       |
| 21 Suffix  |                      | 0.063               | 0.105                   | 0.147            |                       |
| 27 Suffix  |                      | 0.081               | 0.135                   | 0.189            |                       |
| 30 Suffix  |                      | 0.090               | 0.150                   | 0.210            |                       |
| 43 Suffix  |                      | 0.129               | 0.215                   | 0.301            |                       |
| 45 Suffix  |                      | 0.135               | 0.225                   | 0.315            |                       |
| 48 Suffix  | 0.144                | 0.240               | 0.336                   |                  |                       |
| Threshold Voltage Temperature Coefficient  | $T_C$                | –                   | $\pm 100$               | –                | PPM/ $^\circ\text{C}$ |
| <b>RESET OUTPUT</b>  |                      |                     |                         |                  |                       |
| Output Voltage<br>High State (Complementary Output: $I_{source} = 1.0\text{ mA}$ )<br>Low State (Complementary or Open Drain: $I_{sink} = 1.0\text{ mA}$ ) | $V_{OH}$<br>$V_{OL}$ | $V_{in} - 2.1$<br>– | $V_{in} - 1.0$<br>0.025 | $V_{in}$<br>0.05 | V                     |
| Output Sink Current ( $V_{in} = 1.5\text{ V}$ , $V_{OL} = 0.5\text{ V}$ )  | $I_{OL}$             | 1.0                 | 2.0                     | –                |                       |
| Output Source Current ( $V_{in} = 4.5\text{ V}$ , $V_{OL} = 2.4\text{ V}$ )  | $I_{OH}$             | 1.0                 | 2.0                     | –                | mA                    |
| <b>TOTAL DEVICE</b>  |                      |                     |                         |                  |                       |
| Operating Input Voltage Range  | $V_{in}$             | 0.7 to 10           | –                       | –                | V                     |
| Quiescent Input Current<br>$V_{in} = 2.9\text{ V}$<br>$V_{in} = 5.6\text{ V}$  | $I_{in}$             | –                   | 0.9                     | 2.7              | $\mu\text{A}$         |
|  |                      | –                   | 1.2                     | 3.6              |                       |
| Propagation Delay Time (Note 2)  | $t_p$                | –                   | –                       | 100              | $\mu\text{s}$         |

**NOTES:** 1. Low duty pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

2. Propagation delay time is measured from the rising or falling edge of the input voltage to the point where the output voltage has transitioned to 50% of its final value.

Figure 1. Quiescent Current versus Input Voltage

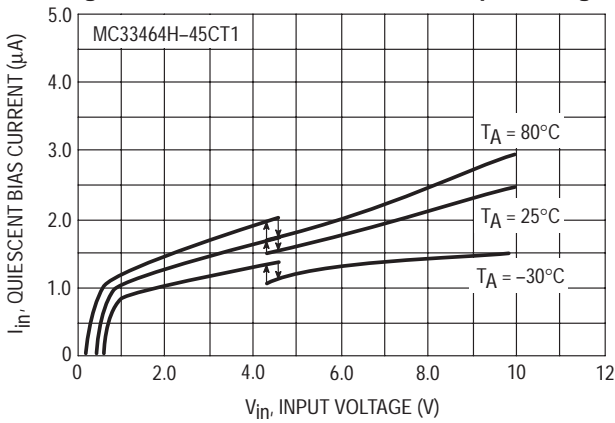


Figure 2. Detector Threshold versus Temperature

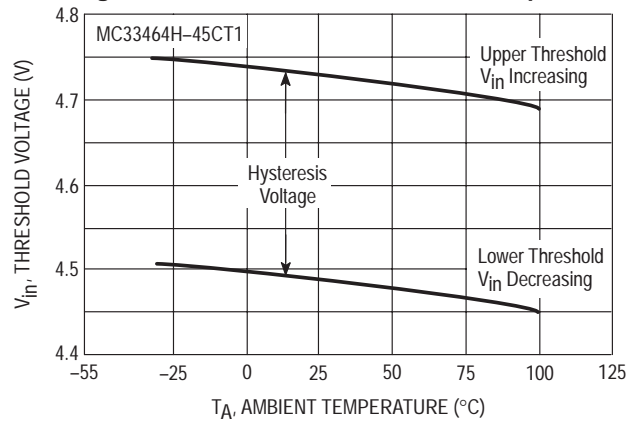


Figure 3. Reset Output Voltage versus Input Voltage

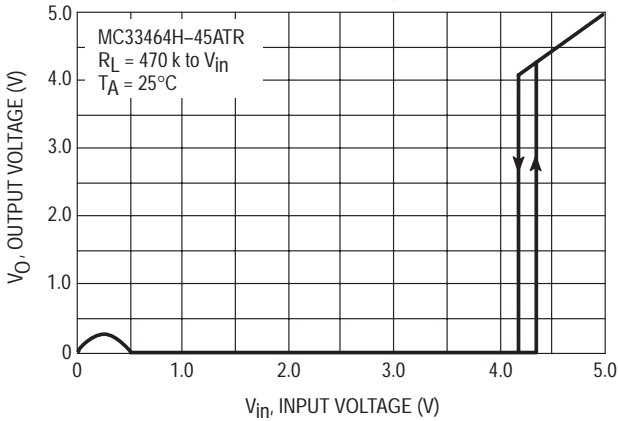


Figure 4. Reset Output Voltage versus Sink Current

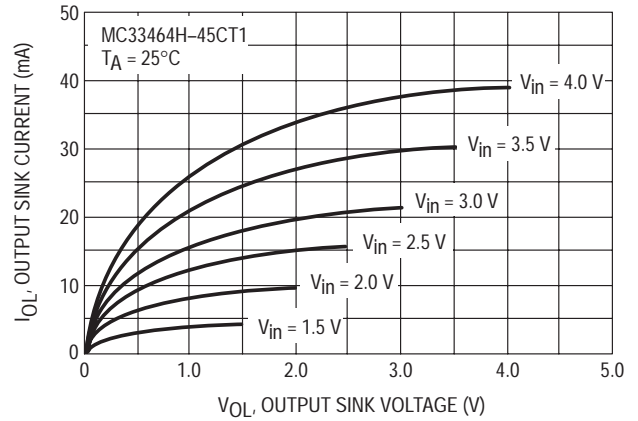


Figure 5. Output Delay Time versus Load Capacitance

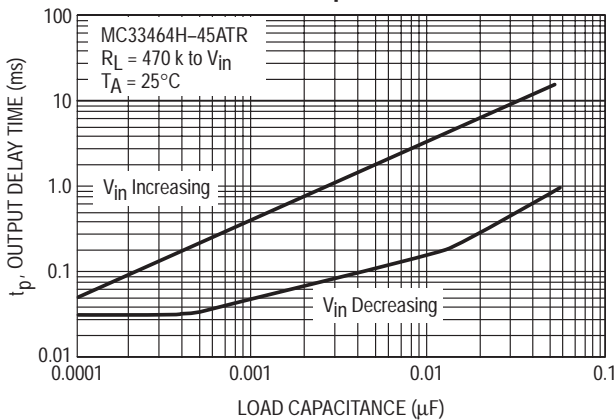
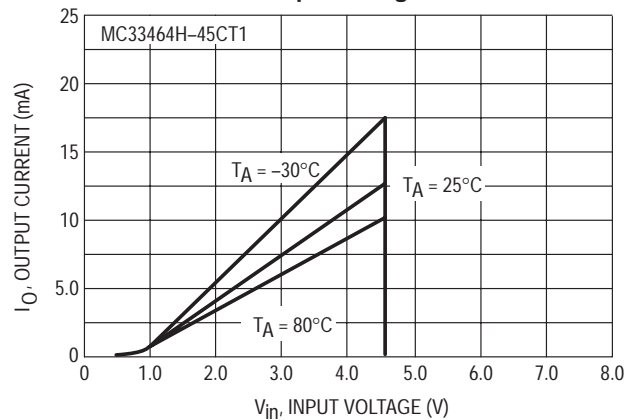
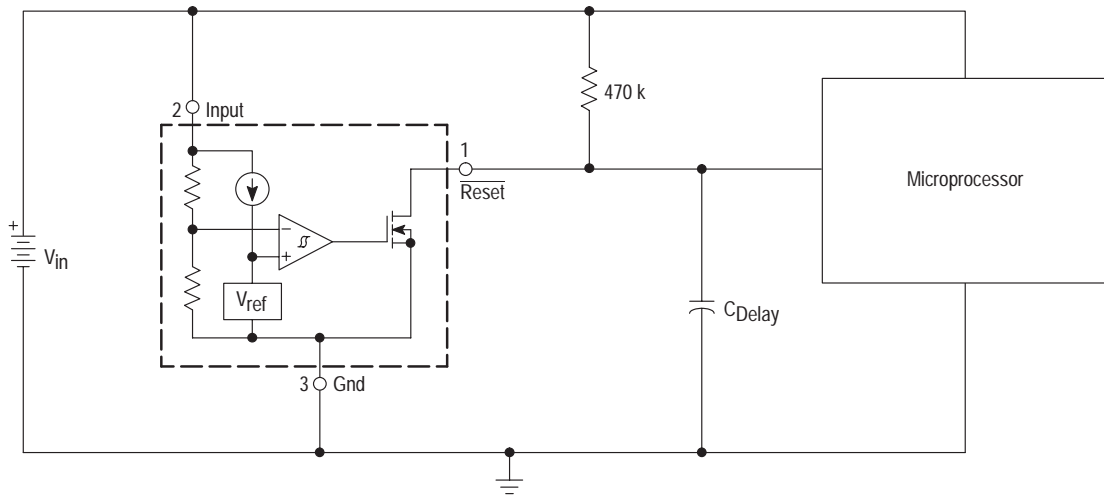


Figure 6. Output Sink Current versus Input Voltage



## MC33464

Figure 7. Microprocessor Reset Circuit with Delay

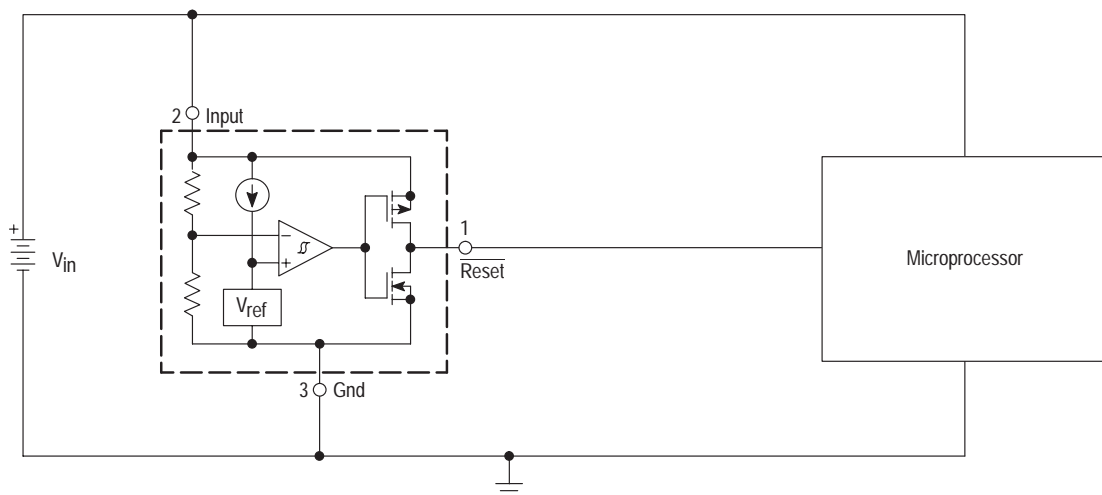


A time delayed reset can be accomplished with the addition of  $C_{Delay}$ . Figure 5 provides a graph of time delays, for both rising and falling output waveform edges, as a function of  $C_{Delay}$ . If another value of pullup resistance is used, the time delay can be calculated by using the equation:

$$t_{Delay} = R C_{Delay} \left[ \frac{1}{\left( 1 - \frac{V_{th(MPU)}}{V_{in}} \right)} \right] + t_p$$

where  $V_{thMPU}$  is the microprocessor reset input threshold voltage and  $t_p$  is the propagation delay internal to the MC33464.

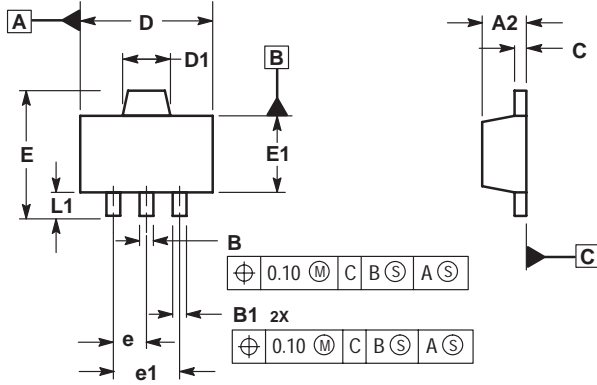
Figure 8. Microprocessor Reset Circuit



# MC33464

## OUTLINE DIMENSIONS

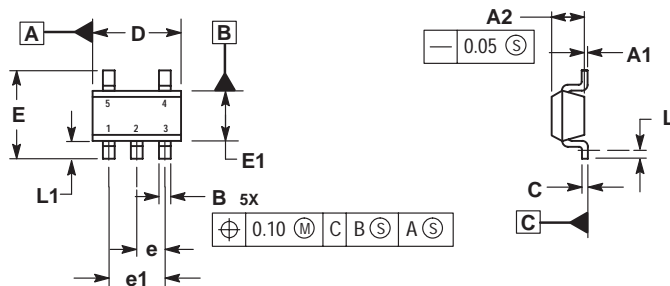
**H SUFFIX**  
 PLASTIC PACKAGE  
 CASE 1213-01  
 (SOT-89)  
 ISSUE O



- NOTES:  
 1. DIMENSIONS ARE IN MILLIMETERS.  
 2. INTERPRET DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.  
 3. DATUM C IS A SEATING PLANE.

| MILLIMETERS |          |      |
|-------------|----------|------|
| DIM         | MIN      | MAX  |
| A2          | 1.40     | 1.60 |
| B           | 0.37     | 0.57 |
| B1          | 0.32     | 0.52 |
| C           | 0.30     | 0.50 |
| D           | 4.40     | 4.60 |
| D1          | 1.50     | 1.70 |
| E           | ---      | 4.25 |
| E1          | 2.40     | 2.60 |
| e           | 1.50 BSC |      |
| e1          | 3.00 BSC |      |
| L1          | 0.80     | ---  |

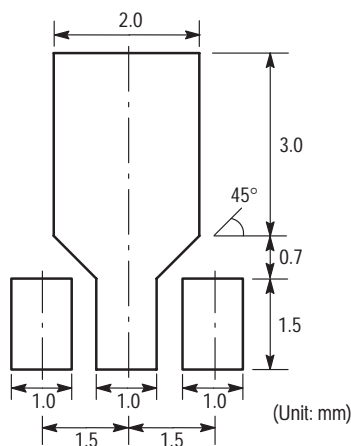
**N SUFFIX**  
 PLASTIC PACKAGE  
 CASE 1212-01  
 (SOT-23-5)  
 ISSUE O



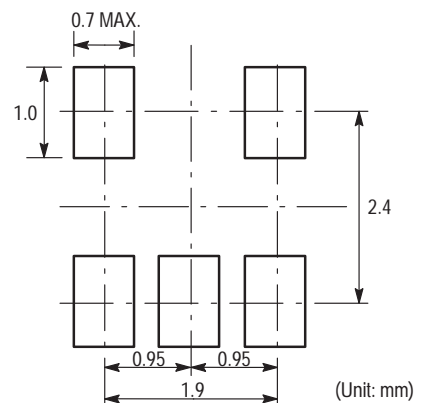
- NOTES:  
 1. DIMENSIONS ARE IN MILLIMETERS.  
 2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.  
 3. DATUM C IS A SEATING PLANE.

| MILLIMETERS |          |      |
|-------------|----------|------|
| DIM         | MIN      | MAX  |
| A1          | 0.00     | 0.10 |
| A2          | 1.00     | 1.30 |
| B           | 0.30     | 0.50 |
| C           | 0.10     | 0.25 |
| D           | 2.80     | 3.00 |
| E           | 2.50     | 3.10 |
| E1          | 1.50     | 1.80 |
| e           | 0.95 BSC |      |
| e1          | 1.90 BSC |      |
| L           | 0.20     | ---  |
| L1          | 0.45     | 0.75 |

### Recommended Footprint for Surface Mount Applications




**SOT-89**



**SOT-23-5**

MC33464  
**NOTES**

## MC33464

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