Undervoltage Sensing Circuit

MC34064, MC33064, NCV33064

The MC34064 is an undervoltage sensing circuit specifically designed for use as a reset controller in microprocessor–based systems. It offers the designer an economical solution for low voltage detection with a single external resistor. The MC34064 features a trimmed–in–package bandgap reference, and a comparator with precise thresholds and built-in hysteresis to prevent erratic reset operation. The open collector reset output is capable of sinking in excess of 10 mA, and operation is guaranteed down to 1.0 V input with low standby current. The MC devices are packaged in 3–pin TO–92, micro size TSOP–5, 8–pin SOIC–8 and Micro8 surface mount packages. The NCV device is packaged in SOIC–8 and TO–92.

Applications include direct monitoring of the 5.0 V MPU/logic power supply used in appliance, automotive, consumer and industrial equipment.

Features

• Trimmed–In–Package Temperature Compensated Reference
• Comparator Threshold of 4.6 V at 25°C
• Precise Comparator Thresholds Guaranteed Over Temperature
• Comparator Hysteresis Prevents Erratic Reset
• Reset Output Capable of Sinking in Excess of 10 mA
• Internal Clamp Diode for Discharging Delay Capacitor
• Guaranteed Reset Operation with 1.0 V Input
• Low Standby Current
• Economical TO–92, TSOP–5, SOIC–8 and Micro8 Surface Mount Packages
• NCV Prefix for Automotive and Other Applications Requiring Site and Control Changes
• These Devices are Pb–Free and are RoHS Compliant

Figure 1. Representative Block Diagram

This device contains 21 active transistors.
## MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Input Supply Voltage</td>
<td>$V_{\text{in}}$</td>
<td>−1.0 to 10</td>
<td>V</td>
</tr>
<tr>
<td>Reset Output Voltage</td>
<td>$V_O$</td>
<td>10</td>
<td>V</td>
</tr>
<tr>
<td>Reset Output Sink Current (Note 2)</td>
<td>$I_{\text{Sink}}$</td>
<td>Internally Limited</td>
<td>mA</td>
</tr>
<tr>
<td>Clamp Diode Forward Current, Reset to Input Pin (Note 2)</td>
<td>$I_F$</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td><strong>Power Dissipation and Thermal Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P Suffix, Plastic Package</td>
<td>$P_D$</td>
<td>625</td>
<td>mW</td>
</tr>
<tr>
<td>Thermal Resistance, Junction-to-Air</td>
<td>$R_{\text{JUA}}$</td>
<td>200</td>
<td>°C/W</td>
</tr>
<tr>
<td>D Suffix, Plastic Package</td>
<td>$P_D$</td>
<td>625</td>
<td>mW</td>
</tr>
<tr>
<td>Thermal Resistance, Junction-to-Air</td>
<td>$R_{\text{JUA}}$</td>
<td>200</td>
<td>°C/W</td>
</tr>
<tr>
<td>DM Suffix, Plastic Package</td>
<td>$P_D$</td>
<td>520</td>
<td>mW</td>
</tr>
<tr>
<td>Maximum Power Dissipation @ $T_A = 25^\circ C$</td>
<td>$R_{\text{JUA}}$</td>
<td>240</td>
<td>°C/W</td>
</tr>
<tr>
<td>Operating Junction Temperature</td>
<td>$T_J$</td>
<td>+150</td>
<td>°C</td>
</tr>
<tr>
<td>Operating Ambient Temperature</td>
<td>$T_A$</td>
<td>0 to +70</td>
<td>°C</td>
</tr>
<tr>
<td>MC34064</td>
<td></td>
<td>−40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>MC33064</td>
<td></td>
<td>−40 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>NCV33064</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>$T_{\text{stg}}$</td>
<td>−65 to +150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. ESD data available upon request.

## ELECTRICAL CHARACTERISTICS

(For typical values $T_A = 25^\circ C$, for min/max values $T_A$ is the operating ambient temperature range that applies [Notes 3 and 4] unless otherwise noted.)

### COMPARATOR

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold Voltage</td>
<td>$V_{\text{IH}}$</td>
<td>4.5</td>
<td>4.61</td>
<td>4.7</td>
<td>V</td>
</tr>
<tr>
<td>High State Output ($V_{\text{in}}$ Increasing)</td>
<td>$V_{\text{IL}}$</td>
<td>4.5</td>
<td>4.59</td>
<td>4.7</td>
<td>V</td>
</tr>
<tr>
<td>Low State Output ($V_{\text{in}}$ Decreasing)</td>
<td>$V_H$</td>
<td>0.01</td>
<td>0.02</td>
<td>0.05</td>
<td>V</td>
</tr>
<tr>
<td>Hysteresis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### RESET OUTPUT

| Output Sink Saturation ($V_{\text{in}} = 4.0 \text{ V}, I_{\text{Sink}} = 8.0 \text{ mA}$) | $V_{OL}$ | − | 0.46 | 1.0 | V    |
| ($V_{\text{in}} = 4.0 \text{ V}, I_{\text{Sink}} = 2.0 \text{ mA}$) | − | 0.15 | 0.4 |      | V    |
| ($V_{\text{in}} = 1.0 \text{ V}, I_{\text{Sink}} = 0.1 \text{ mA}$) | − | − | 0.1 |      | V    |
| Output Sink Current ($V_{\text{in}}$, Reset = 4.0 V) | $I_{\text{Sink}}$ | 10 | 27 | 60 | mA   |
| Output Off-State Leakage ($V_{\text{in}}$, Reset = 5.0 V) | $I_{\text{OH}}$ | − | 0.02 | 0.5 | μA   |
| Clamp Diode Forward Voltage, Reset to Input Pin ($I_F = 10 \text{ mA}$) | $V_F$ | 0.6 | 0.9 | 1.2 | V    |

### TOTAL DEVICE

| Operating Input Voltage Range | $V_{\text{in}}$ | 1.0 to 6.5 | − | − | V    |
| Quiescent Input Current ($V_{\text{in}} = 5.0 \text{ V}$) | $I_{\text{in}}$ | − | 390 | 500 | μA   |

2. Maximum package power dissipation limits must be observed.
3. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.
4. $T_{\text{low}} = 0^\circ C$ for MC34064, $T_{\text{high}} = +70^\circ C$ for MC34064
   $−40^\circ C$ for MC33064, $+85^\circ C$ for NCV33064
   $−40^\circ C$ for NCV33064, $+125^\circ C$ for NCV33064
5. NCV prefix is for automotive and other applications requiring site and change control.
Figure 2. Reset Output Voltage versus Input Voltage

Figure 3. Reset Output Voltage versus Input Voltage

Figure 4. Comparator Threshold Voltage versus Temperature

Figure 5. Input Current versus Input Voltage

Figure 6. Reset Output Saturation versus Sink Current

Figure 7. Reset Delay Time
Figure 8. Clamp Diode Forward Current versus Voltage

Figure 9. Low Voltage Microprocessor Reset

A time delayed reset can be accomplished with the addition of C_{DLY}. For systems with extremely fast power supply rise times (<500 ns) it is recommended that the RC_{DLY} time constant be greater than 5.0 \mu s. V_{TH(MPU)} is the microprocessor reset input threshold.

\[
t_{DLY} = RC_{DLY} \ln \left( \frac{1}{1 - \frac{V_{TH(MPU)}}{V_{IN}}} \right)
\]

Figure 10. Low Voltage Microprocessor Reset with Additional Hysteresis

Comparator hysteresis can be increased with the addition of resistor R_{H}. The hysteresis equation has been simplified and does not account for the change of input current I_{IN} as V_{CC} crosses the comparator threshold (Figure 4). An increase of the lower threshold \(\Delta V_{TH(lower)}\) will be observed due to I_{IN} which is typically 340 \mu A at 4.59 V. The equations are accurate to ±10% with R_{H} less than 150 \Omega and R_{L} between 1.5k\Omega and 10k\Omega.

<table>
<thead>
<tr>
<th>V_{IN} (mV)</th>
<th>\Delta V_{TH} (mV)</th>
<th>R_H (\Omega)</th>
<th>R_L (k\Omega)</th>
</tr>
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<tbody>
<tr>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>51</td>
<td>3.4</td>
<td>10</td>
<td>1.5</td>
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<tr>
<td>40</td>
<td>6.8</td>
<td>20</td>
<td>4.7</td>
</tr>
<tr>
<td>81</td>
<td>6.8</td>
<td>20</td>
<td>1.5</td>
</tr>
<tr>
<td>71</td>
<td>10</td>
<td>30</td>
<td>2.7</td>
</tr>
<tr>
<td>112</td>
<td>10</td>
<td>30</td>
<td>1.5</td>
</tr>
<tr>
<td>100</td>
<td>16</td>
<td>40</td>
<td>2.7</td>
</tr>
<tr>
<td>164</td>
<td>16</td>
<td>40</td>
<td>1.5</td>
</tr>
<tr>
<td>190</td>
<td>34</td>
<td>100</td>
<td>2.7</td>
</tr>
<tr>
<td>327</td>
<td>34</td>
<td>100</td>
<td>1.5</td>
</tr>
<tr>
<td>276</td>
<td>51</td>
<td>150</td>
<td>2.7</td>
</tr>
<tr>
<td>480</td>
<td>51</td>
<td>150</td>
<td>1.5</td>
</tr>
</tbody>
</table>
Overheating of the logic level power MOSFET due to insufficient gate voltage can be prevented with the above circuit. When the input signal is below the 4.6 V threshold of the MC34064, its output grounds the gate of the L2 MOSFET.
## ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Device</th>
<th>Operating Temperature Range</th>
<th>Package</th>
<th>Shipping†</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC34064D–5G</td>
<td>TA = 0°C to +70°C</td>
<td>SOIC–8 (Pb–Free)</td>
<td>98 Units / Rail</td>
</tr>
<tr>
<td>MC34064D–5R2G</td>
<td></td>
<td>SOIC–8 (Pb–Free)</td>
<td>2500 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>MC34064DM–5R2G</td>
<td></td>
<td>Micro8 (Pb–Free)</td>
<td>4000 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>MC34064P–5G</td>
<td></td>
<td>TO–92 (Pb–Free)</td>
<td>2000 Units / Bag</td>
</tr>
<tr>
<td>MC34064P–5RAG</td>
<td></td>
<td>TO–92 (Pb–Free)</td>
<td>2000 Units / Tape &amp; Reel</td>
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<tr>
<td>MC34064P–5RPG</td>
<td></td>
<td>TO–92 (Pb–Free)</td>
<td>2000 Units / Ammo Pack</td>
</tr>
<tr>
<td>MC34064P–5RMG</td>
<td></td>
<td>TO–92 (Pb–Free)</td>
<td></td>
</tr>
<tr>
<td>MC34064SN–5T1G</td>
<td></td>
<td>TSOP–5 (Pb–Free)</td>
<td>3000 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>MC33064D–5G</td>
<td>TA = −40°C to +85°C</td>
<td>SOIC–8 (Pb–Free)</td>
<td>98 Units / Rail</td>
</tr>
<tr>
<td>MC33064D–5R2G</td>
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<td>SOIC–8 (Pb–Free)</td>
<td>2500 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>MC33064DM–5R2G</td>
<td></td>
<td>Micro8 (Pb–Free)</td>
<td>4000 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>MC33064P–5G</td>
<td></td>
<td>TO–92 (Pb–Free)</td>
<td>2000 Units / Bag</td>
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<tr>
<td>MC33064P–5RAG</td>
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<td>TO–92 (Pb–Free)</td>
<td>2000 Units / Tape &amp; Reel</td>
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<tr>
<td>MC33064P–5RPG</td>
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<td>TO–92 (Pb–Free)</td>
<td>2000 Units / Ammo Pack</td>
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<tr>
<td>MC33064SN–5T1G</td>
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<td>TSOP–5 (Pb–Free)</td>
<td>3000 Units / Tape &amp; Reel</td>
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<tr>
<td>NCV33064D–5R2G*</td>
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<td>SOIC–8 (Pb–Free)</td>
<td>2500 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>NCV33064P–5RAG*</td>
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<td>TO–92 (Pb–Free)</td>
<td>2000 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>NCV33064P–5RPG*</td>
<td></td>
<td>TO–92 (Pb–Free)</td>
<td>2000 Units / Ammo Pack</td>
</tr>
<tr>
<td>NCV33064DM–5R2G*</td>
<td></td>
<td>Micro8 (Pb–Free)</td>
<td>4000 Units / Tape &amp; Reel</td>
</tr>
</tbody>
</table>

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NCV33064: T_{low} = −40°C, T_{high} = +125°C. Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.
MC34064, MC33064, NCV33064

MARKING DIAGRAMS

SOIC-8
D SUFFIX
CASE 751

Micro8
DM SUFFIX
CASE 846A

TO-92
P SUFFIX
CASE 029

TSOP-5
SN SUFFIX
CASE 483

MC34064
MC33064

x = 3 or 4
y = C or I
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
• = Pb-Free Package

(Note: Microdot may be in either location)
FORMED LEAD

NOTES:
2. CONTROLLING DIMENSIONS MILLIMETERS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS.
4. DIMENSION b AND b2 DOES NOT INCLUDE DAMBAR PROTRUSION. LEAD WIDTH INCLUDING PROTRUSION SHALL NOT EXCEED 0.20.
   DIMENSION b2 LOCATED ABOVE THE DAMBAR PORTION OF MIDDLE LEAD.

<table>
<thead>
<tr>
<th>MILLIMETERS</th>
<th>MIN.</th>
<th>NOM.</th>
<th>MAX.</th>
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<tr>
<td>A</td>
<td>3.75</td>
<td>3.90</td>
<td>4.05</td>
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<tr>
<td>A1</td>
<td>1.28</td>
<td>1.43</td>
<td>1.58</td>
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<tr>
<td>b</td>
<td>0.38</td>
<td>0.465</td>
<td>0.55</td>
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<tr>
<td>b2</td>
<td>0.62</td>
<td>0.70</td>
<td>0.78</td>
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<tr>
<td>c</td>
<td>0.35</td>
<td>0.40</td>
<td>0.45</td>
</tr>
<tr>
<td>D</td>
<td>7.85</td>
<td>8.00</td>
<td>8.15</td>
</tr>
<tr>
<td>E</td>
<td>4.75</td>
<td>4.90</td>
<td>5.05</td>
</tr>
<tr>
<td>E2</td>
<td>3.90</td>
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<td>---</td>
</tr>
<tr>
<td>e</td>
<td>2.50</td>
<td>---</td>
<td>---</td>
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<tr>
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<td>3.00</td>
<td>REF</td>
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<table>
<thead>
<tr>
<th>Style</th>
<th>PIN 1</th>
<th>PIN 2</th>
<th>PIN 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emitter</td>
<td>Base</td>
<td>Collector</td>
</tr>
<tr>
<td>2</td>
<td>GATE</td>
<td>Source &amp; Substrate</td>
<td>Drain</td>
</tr>
<tr>
<td>3</td>
<td>Anode</td>
<td>Collector</td>
<td>Base</td>
</tr>
</tbody>
</table>

**Generic Marking Diagram**

```
XXXXX XXXXX ALYW* 

XXXXX = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
* = Pb-Free Indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.
```

*This information is generic. Please refer to device data sheet for actual part marking, Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.*
NOTES:
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSION A.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

<table>
<thead>
<tr>
<th>DIM</th>
<th>MIN</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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<tr>
<td>B</td>
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<td>1.65</td>
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<tr>
<td>C</td>
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<tr>
<td>D</td>
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<td>0.50</td>
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<tr>
<td>G</td>
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<td>0.6C</td>
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<td>J</td>
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<td>0.60</td>
</tr>
<tr>
<td>M</td>
<td>0</td>
<td>0.60</td>
</tr>
<tr>
<td>S</td>
<td>2.50</td>
<td>3.00</td>
</tr>
</tbody>
</table>

*This information is generic. Please refer to device data sheet for actual part marking. Pb–Free indicator, “G” or microdot “*”, may or may not be present. Some products may not follow the Generic Marking.
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

SOIC−8 NB
CASE 751−07
ISSUE AK

DATE 16 FEB 2011

NOTES:
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

CONTROLLING DIMENSION: MILLIMETER.
DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

GENERAL MARKING DIAGRAM*

IC (Pb−Free)

XXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
* = Pb−Free Package

Discrete (Pb−Free)

XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
* = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking.

Pb−Free indicator, “G” or microdot “*”, may or may not be present. Some products may not follow the Generic Marking.

*SOLDERING FOOTPRINT*

IC

Discrete

XXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
* = Pb−Free Package

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styles on page 2
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |

**DESCRIPTION:**

- **STYLE 5:**
  - PIN 1. | Drain |
  - 2. | Drain |
  - 3. | Drain |
  - 4. | Drain |
  - 5. | Gate |
  - 6. | Gate |
  - 7. | Source |
  - 8. | Source |

- **STYLE 6:**
  - PIN 1. | Source |
  - 2. | Drain |
  - 3. | Source |
  - 4. | Source |
  - 5. | Source |
  - 6. | Gate |
  - 7. | Gate |
  - 8. | Source |

- **STYLE 7:**
  - PIN 1. | Anode |
  - 2. | Drain |
  - 3. | Drain |
  - 4. | Drain |
  - 5. | Gate |
  - 6. | Gate |
  - 7. | Base |
  - 8. | Base |

- **STYLE 8:**
  - PIN 1. | Collector, Die, #1 |
  - 2. | Collector, Die |

- **STYLE 9:**
  - PIN 1. | Emitter, Common |
  - 2. | Collector, Die, #1 |
  - 3. | Collector, Die #2 |
  - 4. | Emitter, Common |
  - 5. | Emitter, Common |
  - 6. | Base, Die #2 |
  - 7. | Base, Die #1 |
  - 8. | Emitter, Common |

- **STYLE 10:**
  - PIN 1. | Collector, Die, #1 |
  - 2. | Collector, Die |

- **STYLE 11:**
  - PIN 1. | Output |
  - 2. | Output |
  - 3. | Output |
  - 4. | Output |
  - 5. | Gate |
  - 6. | Gate |
  - 7. | Drain |
  - 8. | Drain |

- **STYLE 12:**
  - PIN 1. | Source |
  - 2. | Source |

- **STYLE 13:**
  - PIN 1. | N.C. |
  - 2. | Source |
  - 3. | Source |
  - 4. | Source |
  - 5. | Gate |
  - 6. | Drain |
  - 7. | Drain |
  - 8. | Drain |

- **STYLE 14:**
  - PIN 1. | N-Source |
  - 2. | N-Source |
  - 3. | P-Source |
  - 4. | P-Source |
  - 5. | P-Drain |
  - 6. | P-Drain |
  - 7. | N-Drain |
  - 8. | N-Drain |

- **STYLE 15:**
  - PIN 1. | Anode |
  - 2. | Anode |
  - 3. | Source |
  - 4. | Source |
  - 5. | Gate |
  - 6. | Gate |
  - 7. | Drain |
  - 8. | Drain |

- **STYLE 16:**
  - PIN 1. | Anode |
  - 2. | Anode |
  - 3. | Source |
  - 4. | Source |
  - 5. | Gate |
  - 6. | Gate |
  - 7. | Drain |
  - 8. | Drain |

- **STYLE 17:**
  - PIN 1. | Vcc |
  - 2. | Vcc |
  - 3. | Vcc |
  - 4. | Vcc |
  - 5. | Vcc |
  - 6. | Vcc |
  - 7. | Vcc |
  - 8. | Acc |

- **STYLE 18:**
  - PIN 1. | Source |
  - 2. | Source |
  - 3. | Source |
  - 4. | Source |
  - 5. | Gate |
  - 6. | Gate |
  - 7. | Drain |
  - 8. | Drain |

- **STYLE 19:**
  - PIN 1. | Line 1 In |
  - 2. | Line 1 In |

- **STYLE 20:**
  - PIN 1. | Source |
  - 2. | Source |
  - 3. | Source |
  - 4. | Source |
  - 5. | Gate |
  - 6. | Gate |
  - 7. | Drain |
  - 8. | Drain |

- **STYLE 21:**
  - PIN 1. | Cathode 1 |
  - 2. | Cathode 1 |
  - 3. | Cathode 3 |
  - 4. | Cathode 4 |
  - 5. | Cathode 5 |
  - 6. | COMMON ANODE |
  - 7. | COMMON ANODE |
  - 8. | COMMON ANODE |

- **STYLE 22:**
  - PIN 1. | I/O Line 1 |
  - 2. | COMMON CATHODE/VCC |
  - 3. | COMMON CATHODE/VCC |
  - 4. | COMMON CATHODE/VCC |
  - 5. | COMMON CATHODE/VCC |
  - 6. | COMMON CATHODE/VCC |
  - 7. | COMMON CATHODE/VCC |
  - 8. | COMMON CATHODE/VCC |

- **STYLE 23:**
  - PIN 1. | Source |
  - 2. | Source |

- **STYLE 24:**
  - PIN 1. | Base |
  - 2. | Emitter |
  - 3. | Collector/Anode |
  - 4. | Collector/Anode |
  - 5. | Collector/Anode |
  - 6. | Collector/Anode |
  - 7. | Collector/Anode |
  - 8. | Collector/Anode |

- **STYLE 25:**
  - PIN 1. | Vin |
  - 2. | N/C |
  - 3. | Next |
  - 4. | Gnd |
  - 5. | Dout |
  - 6. | Iout |
  - 7. | Iout |
  - 8. | Iout |

- **STYLE 26:**
  - PIN 1. | Gnd |
  - 2. | Dout |
  - 3. | Iout |
  - 4. | Source |
  - 5. | Source |
  - 6. | Source |
  - 7. | Source |
  - 8. | Source |

- **STYLE 27:**
  - PIN 1. | Drain |
  - 2. | Drain |
  - 3. | Drain |
  - 4. | Drain |
  - 5. | Source |
  - 6. | Source |
  - 7. | Source |
  - 8. | Source |

- **STYLE 28:**
  - PIN 1. | Anode |
  - 2. | Anode |
  - 3. | Anode |
  - 4. | Anode |
  - 5. | Anode |
  - 6. | Anode |
  - 7. | Anode |
  - 8. | Anode |

- **STYLE 29:**
  - PIN 1. | Base, Die #1 |
  - 2. | Emitter, #1 |
  - 3. | Base, #2 |
  - 4. | Emitter, #2 |
  - 5. | Collector, #2 |
  - 6. | Collector, #2 |
  - 7. | Collector, #1 |
  - 8. | Collector, #1 |

- **STYLE 30:**
  - PIN 1. | Drain |
  - 2. | Drain |
  - 3. | Drain |
  - 4. | Source |
  - 5. | Source |
  - 6. | Source |
  - 7. | Source |
  - 8. | Source |

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Micro8
CASE 846A-02
ISSUE K

DATE 16 JUL 2020

NOTES:
2. CONTROLLING DIMENSION MILLIMETERS.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.010 mm IN EXCESS OF MAXIMUM MATERIAL CONDITION.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 mm PER SIDE. DIMENSION E DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 mm PER SIDE.
5. DATUMS A AND B ARE TO BE DETERMINED AT DATUM F.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

RECOMMENDED MOUNTING FOOTPRINT

*For additional information on our lead-free packaging and strategies, please refer to the Reference Manual, ON0009A.

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DESCRIPTION: MICRO8

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