Inverting Regulator - Buck, Boost, Switching

1.5 A

MC34063A, MC33063A, SC34063A, SC33063A, NCV33063A

The MC34063A Series is a monolithic control circuit containing the primary functions required for DC-to-DC converters. These devices consist of an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch. This series was specifically designed to be incorporated in Step-Down and Step-Up and Voltage-Inverting applications with a minimum number of external components. Refer to Application Notes AN920A/D and AN954/D for additional design information.

Features
• Operation from 3.0 V to 40 V Input
• Low Standby Current
• Current Limiting
• Output Switch Current to 1.5 A
• Output Voltage Adjustable
• Frequency Operation to 100 kHz
• Precision 2% Reference
• NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
• These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

This device contains 79 active transistors.

Figure 1. Representative Schematic Diagram

MARKING DIAGRAMS

ORDERING INFORMATION
See detailed ordering and shipping information in the package dimensions section on page 12 of this data sheet.

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August, 2021 – Rev. 25
Figure 2. Pin Connections

MAXIMUM RATINGS

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply Voltage</td>
<td>$V_{CC}$</td>
<td>40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Comparator Input Voltage Range</td>
<td>$V_{IR}$</td>
<td>–0.3 to +40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Switch Collector Voltage</td>
<td>$V_{C(switch)}$</td>
<td>40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Switch Emitter Voltage ($V_{Pin 1}$ = 40 V)</td>
<td>$V_{E(switch)}$</td>
<td>40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Switch Collector to Emitter Voltage</td>
<td>$V_{CE(switch)}$</td>
<td>40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Driver Collector Voltage</td>
<td>$V_{C(driver)}$</td>
<td>40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Driver Collector Current (Note 1)</td>
<td>$I_{C(driver)}$</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Switch Current</td>
<td>$I_{SW}$</td>
<td>1.5</td>
<td>A</td>
</tr>
<tr>
<td>Power Dissipation and Thermal Characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic Package, P, P1 Suffix</td>
<td>$T_{A}$ = 25°C</td>
<td>$P_D$</td>
<td>1.25</td>
</tr>
<tr>
<td>Thermal Resistance</td>
<td>$R_{IJA}$</td>
<td>115</td>
<td>°C/W</td>
</tr>
<tr>
<td>SOIC Package, D Suffix</td>
<td>$T_{A}$ = 25°C</td>
<td>$P_D$</td>
<td>625</td>
</tr>
<tr>
<td>Thermal Resistance</td>
<td>$R_{IJA}$</td>
<td>160</td>
<td>°C/W</td>
</tr>
<tr>
<td>Thermal Resistance</td>
<td>$R_{IUC}$</td>
<td>45</td>
<td>°C/W</td>
</tr>
<tr>
<td>DFN Package</td>
<td>$T_{A}$ = 25°C</td>
<td>$P_D$</td>
<td>1.25</td>
</tr>
<tr>
<td>Thermal Resistance</td>
<td>$R_{IJA}$</td>
<td>80</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 Range</td>
<td>$T_A$</td>
<td>0 to +70</td>
<td>°C</td>
</tr>
<tr>
<td>MC34063A, SC34063A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MC33063A, NCV33063A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MC33063A, SC33063A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>$T_{stg}$</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. Maximum package power dissipation limits must be observed.
2. This device series contains ESD protection and exceeds the following tests: Human Body Model 4000 V per MIL–STD–883, Method 3015. Machine Model Method 400 V.
3. NCV prefix is for automotive and other applications requiring site and change control.
### Electrical Characteristics

(VCC = 5.0 V, TA = Tlow to Thigh [Note 4], unless otherwise specified.)

<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><strong>Oscillator</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency (VPin 5 = 0 V, CT = 1.0 nF, TA = 25°C)</td>
<td>fosc</td>
<td>24</td>
<td>33</td>
<td>42</td>
<td>kHz</td>
</tr>
<tr>
<td>Charge Current (VCC = 5.0 V to 40 V, TA = 25°C)</td>
<td>Ichg</td>
<td>24</td>
<td>35</td>
<td>42</td>
<td>μA</td>
</tr>
<tr>
<td>Discharge Current (VCC = 5.0 V to 40 V, TA = 25°C)</td>
<td>Idischg</td>
<td>140</td>
<td>220</td>
<td>260</td>
<td>μA</td>
</tr>
<tr>
<td>Discharge to Charge Current Ratio (Pin 7 to VCC, TA = 25°C)</td>
<td>Vdischg/Ichrg</td>
<td>5.2</td>
<td>6.5</td>
<td>7.5</td>
<td>–</td>
</tr>
<tr>
<td>Current Limit Sense Voltage (Ichg = Idischg, TA = 25°C)</td>
<td>Vipk(sense)</td>
<td>250</td>
<td>300</td>
<td>350</td>
<td>mV</td>
</tr>
<tr>
<td><strong>Output Switch</strong> (Note 5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturation Voltage, Darlington Connection (ISW = 1.0 A, Pins 1, 8 connected)</td>
<td>VCE(sat)</td>
<td>–</td>
<td>1.0</td>
<td>1.3</td>
<td>V</td>
</tr>
<tr>
<td>Saturation Voltage (Note 6) (ISW = 1.0 A, RPin 8 = 82 Ω to VCC, Forced β = 20)</td>
<td>VCE(sat)</td>
<td>–</td>
<td>0.45</td>
<td>0.7</td>
<td>V</td>
</tr>
<tr>
<td>DC Current Gain (ISW = 1.0 A, VCE = 5.0 V, TA = 25°C)</td>
<td>hFE</td>
<td>50</td>
<td>75</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Collector Off-State Current (VCE = 40 V)</td>
<td>IC(off)</td>
<td>–</td>
<td>0.01</td>
<td>100</td>
<td>μA</td>
</tr>
<tr>
<td><strong>Comparator</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threshold Voltage</td>
<td>Vth</td>
<td>1.225</td>
<td>1.25</td>
<td>1.275</td>
<td>V</td>
</tr>
<tr>
<td>Threshold Voltage Line Regulation (VCC = 3.0 V to 40 V)</td>
<td>Regline</td>
<td>–</td>
<td>1.4</td>
<td>5.0</td>
<td>mV</td>
</tr>
<tr>
<td>Supply Current (VCC = 5.0 V to 40 V, CT = 1.0 nF, Pin 7 = VCC, VPin 5 &gt; Vd, Pin 2 = GND, remaining pins open)</td>
<td>ICC</td>
<td>–</td>
<td>–</td>
<td>4.0</td>
<td>mA</td>
</tr>
</tbody>
</table>

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Tlow = 0°C for MC34063, SC34063; −40°C for MC33063, SC33063, MC33063V, NCV33063
Thigh = +70°C for MC34063, SC34063; +85°C for MC33063, SC33063; +125°C for MC33063V, NCV33063

5. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.

6. If the output switch is driven into hard saturation (non–Darlington configuration) at low switch currents (≤ 300 mA) and high driver currents (≥ 30 mA), it may take up to 2.0 μs for it to come out of saturation. This condition will shorten the off time at frequencies ≥ 30 kHz, and is magnified at high temperatures. This condition does not occur with a Darlington configuration, since the output switch cannot saturate. If a non–Darlington configuration is used, the following output drive condition is recommended:

   Forced β of output switch: \( I_{\text{C output}} / I_{\text{C driver}} - 7.0 \text{ mA} \) ≥ 10

* The 100 Ω resistor in the emitter of the driver device requires about 7.0 mA before the output switch conducts.
Figure 3. Oscillator Frequency

Figure 4. Timing Capacitor Waveform

Figure 5. Emitter Follower Configuration Output
Saturation Voltage versus Emitter Current

Figure 6. Common Emitter Configuration Output
Switch Saturation Voltage versus Collector Current

Figure 7. Current Limit Sense Voltage versus Temperature

Figure 8. Standby Supply Current versus Supply Voltage

7. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.
<table>
<thead>
<tr>
<th>Test</th>
<th>Conditions</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Regulation</td>
<td>$V_{in} = 8.0\ V$ to $16\ V$, $I_O = 175\ mA$</td>
<td>$30\ mV = \pm 0.05%$</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>$V_{in} = 12\ V$, $I_O = 75\ mA$ to $175\ mA$</td>
<td>$10\ mV = \pm 0.017%$</td>
</tr>
<tr>
<td>Output Ripple</td>
<td>$V_{in} = 12\ V$, $I_O = 175\ mA$</td>
<td>$400\ mV_{pp}$</td>
</tr>
<tr>
<td>Efficiency</td>
<td>$V_{in} = 12\ V$, $I_O = 175\ mA$</td>
<td>$87.7%$</td>
</tr>
<tr>
<td>Output Ripple With Optional Filter</td>
<td>$V_{in} = 12\ V$, $I_O = 175\ mA$</td>
<td>$40\ mV_{pp}$</td>
</tr>
</tbody>
</table>

Figure 9. Step-Up Converter
8. If the output switch is driven into hard saturation (non–Darlington configuration) at low switch currents (≤ 300 mA) and high driver currents (≥ 3 mA), it may take up to 2.0 μs to come out of saturation. This condition will shorten the off time at frequencies ≥ 30 kHz, and is magnified at high temperatures. This condition does not occur with a Darlington configuration, since the output switch cannot saturate. If a non–Darlington configuration is used, the following output drive condition is recommended.

Figure 10. External Current Boost Connections for $I_C$ Peak Greater than 1.5 A

9a. External NPN Switch

9b. External NPN Saturated Switch

(See Note 8)
<table>
<thead>
<tr>
<th>Test</th>
<th>Conditions</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Regulation</td>
<td>$V_{in} = 15$ V to 25 V, $I_O = 500$ mA</td>
<td>12 mV = ±0.12%</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>$V_{in} = 25$ V, $I_O = 50$ mA to 500 mA</td>
<td>3.0 mV = ±0.03%</td>
</tr>
<tr>
<td>Output Ripple</td>
<td>$V_{in} = 25$ V, $I_O = 500$ mA</td>
<td>120 mVpp</td>
</tr>
<tr>
<td>Short Circuit Current</td>
<td>$V_{in} = 25$ V, $R_L = 0.1$ $\Omega$</td>
<td>1.1 A</td>
</tr>
<tr>
<td>Efficiency</td>
<td>$V_{in} = 25$ V, $I_O = 500$ mA</td>
<td>83.7%</td>
</tr>
<tr>
<td>Output Ripple With Optional Filter</td>
<td>$V_{in} = 25$ V, $I_O = 500$ mA</td>
<td>40 mVpp</td>
</tr>
</tbody>
</table>

**Figure 11. Step-Down Converter**

**Figure 12. External Current Boost Connections for $I_C$ Peak Greater than 1.5 A**

11a. External NPN Switch  
11b. External PNP Saturated Switch
### Test Conditions

<table>
<thead>
<tr>
<th>Test</th>
<th>Conditions</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line Regulation</td>
<td>$V_{in} = 4.5$ V to 6.0 V, $I_O = 100$ mA</td>
<td>$3.0$ mV = ± $0.012%$</td>
</tr>
<tr>
<td>Load Regulation</td>
<td>$V_{in} = 5.0$ V, $I_O = 10$ mA to 100 mA</td>
<td>$0.022$ V = ± $0.09%$</td>
</tr>
<tr>
<td>Output Ripple</td>
<td>$V_{in} = 5.0$ V, $I_O = 100$ mA</td>
<td>$500$ mVpp</td>
</tr>
<tr>
<td>Short Circuit Current</td>
<td>$V_{in} = 5.0$ V, $R_L = 0.1$ Ω</td>
<td>$910$ mA</td>
</tr>
<tr>
<td>Efficiency</td>
<td>$V_{in} = 5.0$ V, $I_O = 100$ mA</td>
<td>$62.2%$</td>
</tr>
<tr>
<td>Output Ripple With Optional Filter</td>
<td>$V_{in} = 5.0$ V, $I_O = 100$ mA</td>
<td>$70$ mVpp</td>
</tr>
</tbody>
</table>

**Figure 13. Voltage Inverting Converter**

**Figure 14. External Current Boost Connections for $I_C$ Peak Greater than 1.5 A**

13a. External NPN Switch  
13b. External PNP Saturated Switch
Figure 15. Printed Circuit Board and Component Layout
(Circuits of Figures 9, 11, 13)

INDUCTOR DATA

<table>
<thead>
<tr>
<th>Converter</th>
<th>Inductance (μH)</th>
<th>Turns/Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step–Up</td>
<td>170</td>
<td>38 Turns of #22 AWG</td>
</tr>
<tr>
<td>Step–Down</td>
<td>220</td>
<td>48 Turns of #22 AWG</td>
</tr>
<tr>
<td>Voltage–Inverting</td>
<td>88</td>
<td>28 Turns of #22 AWG</td>
</tr>
</tbody>
</table>

All inductors are wound on Magnetics Inc. 55117 toroidal core.
Figure 16. Printed Circuit Board for DFN Device
<table>
<thead>
<tr>
<th>Calculation</th>
<th>Step-Up</th>
<th>Step-Down</th>
<th>Voltage-Inverting</th>
</tr>
</thead>
<tbody>
<tr>
<td>$t_{on}/t_{off}$</td>
<td>$\frac{V_{out} + V_F - V_{in(min)}}{V_{in(min)} - V_{sat}}$</td>
<td>$\frac{V_{out} + V_F}{V_{in} - V_{sat}} - V_{out}$</td>
<td>$\frac{</td>
</tr>
<tr>
<td>$(t_{on} + t_{off})$</td>
<td>$\frac{1}{T}$</td>
<td>$\frac{1}{T}$</td>
<td>$\frac{1}{T}$</td>
</tr>
<tr>
<td>$t_{off}$</td>
<td>$t_{on} + t_{off}$</td>
<td>$t_{on} + t_{off}$</td>
<td>$t_{on} + t_{off}$</td>
</tr>
<tr>
<td>$t_{on}$</td>
<td>$(t_{on} + t_{off}) - t_{off}$</td>
<td>$(t_{on} + t_{off}) - t_{off}$</td>
<td>$(t_{on} + t_{off}) - t_{off}$</td>
</tr>
<tr>
<td>$C_T$</td>
<td>$4.0 \times 10^{-5}$ $t_{on}$</td>
<td>$4.0 \times 10^{-5}$ $t_{on}$</td>
<td>$4.0 \times 10^{-5}$ $t_{off}$</td>
</tr>
<tr>
<td>$I_{pk(switch)}$</td>
<td>$2I_{out(max)} \left( \frac{t_{on}}{t_{off}} + 1 \right)$</td>
<td>$2I_{out(max)}$</td>
<td>$2I_{out(max)} \left( \frac{t_{on}}{t_{off}} + 1 \right)$</td>
</tr>
<tr>
<td>$R_{sc}$</td>
<td>$0.3/I_{pk(switch)}$</td>
<td>$0.3/I_{pk(switch)}$</td>
<td>$0.3/I_{pk(switch)}$</td>
</tr>
<tr>
<td>$L_{(min)}$</td>
<td>$\left( \frac{V_{in(min)} - V_{sat}}{I_{pk(switch)}} \right) t_{on(max)}$</td>
<td>$\left( \frac{V_{in(min)} - V_{sat} - V_{out}}{I_{pk(switch)}} \right) t_{on(max)}$</td>
<td>$\left( \frac{V_{in(min)} - V_{sat}}{I_{pk(switch)}} \right) t_{on(max)}$</td>
</tr>
<tr>
<td>$C_O$</td>
<td>$9 I_{out(ton)} \frac{1}{V_{ripple(pp)}}$</td>
<td>$I_{pk(switch)} \frac{t_{on} + t_{off}}{8V_{ripple(pp)}}$</td>
<td>$9 I_{out(ton)} \frac{1}{V_{ripple(pp)}}$</td>
</tr>
</tbody>
</table>

$V_{sat} = $ Saturation voltage of the output switch.  
$V_F = $ Forward voltage drop of the output rectifier.

**The following power supply characteristics must be chosen:**

- $V_{in}$ – Nominal input voltage.
- $V_{out}$ – Desired output voltage, $|V_{out}| = 1.25 \left( 1 + \frac{R_2}{R_T} \right)$.
- $I_{out}$ – Desired output current.
- $f_{min}$ – Minimum desired output switching frequency at the selected values of $V_{in}$ and $I_{out}$.
- $V_{ripple(pp)}$ – Desired peak-to-peak output ripple voltage. In practice, the calculated capacitor value will need to be increased due to its equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly affect the line and load regulation.

**NOTE:** For further information refer to Application Note AN920A/D and AN954/D.

**Figure 17. Design Formula Table**
### ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Device</th>
<th>Package</th>
<th>Shipping</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC33063ADG</td>
<td>SOIC–8</td>
<td>98 Units / Rail</td>
</tr>
<tr>
<td>MC33063ADR2G</td>
<td>SOIC–8</td>
<td>2500 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>SC33063ADR2G</td>
<td>SOIC–8</td>
<td>2500 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>MC33063AP1G</td>
<td>PDIP–8</td>
<td>50 Units / Rail</td>
</tr>
<tr>
<td>MC33063AVDG</td>
<td>SOIC–8</td>
<td>98 Units / Rail</td>
</tr>
<tr>
<td>MC33063AVDR2G</td>
<td>SOIC–8</td>
<td>2500 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>NCV33063AVDR2G*</td>
<td>SOIC–8</td>
<td>2500 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>MC33063AVPG</td>
<td>PDIP–8</td>
<td>50 Units / Rail</td>
</tr>
<tr>
<td>MC34063ADG</td>
<td>SOIC–8</td>
<td>98 Units / Rail</td>
</tr>
<tr>
<td>MC34063ADR2G</td>
<td>SOIC–8</td>
<td>2500 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>SC34063ADR2G</td>
<td>SOIC–8</td>
<td>2500 Units / Tape &amp; Reel</td>
</tr>
<tr>
<td>MC34063AP1G</td>
<td>PDIP–8</td>
<td>50 Units / Rail</td>
</tr>
<tr>
<td>SC34063AP1G</td>
<td>PDIP–8</td>
<td>50 Units / Rail</td>
</tr>
<tr>
<td>MC33063MNTXG</td>
<td>DFN8</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 Specification Brochure, BRD8011/D.

*NCV33063A: $T_{\text{low}} = -40^\circ \text{C}$, $T_{\text{high}} = +125^\circ \text{C}$. Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.

SENSEFET is a trademark of Semiconductor Components Industries, LLC dba “onsemi” or its affiliates and/or subsidiaries in the United States and/or other countries.
NOTE 2: CONTROLLING DIMENSION: MILLIMETERS.
NOTE 3: DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30MM FROM TERMINAL TIP.
NOTE 4: COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
NOTE 5: DETAILS A AND B SHOW OPTIONAL CONSTRUCTIONS FOR TERMINALS.

DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.
**MECHANICAL CASE OUTLINE**

**PACKAGE DIMENSIONS**

**PDIP-8**

CASE 626–05

ISSUE P

**DATE 22 APR 2015**

**NOTE 8**

**TOP VIEW**

**SIDE VIEW**

**END VIEW**

WITH LEADS CONSTRAINED

NOTE 5

**END VIEW**

NOTE 6

**NOTES:**

2. CONTROLLING DIMENSION: INCHES.
4. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 0.10 INCH.
5. DIMENSION E IS MEASURED AT A POINT 0.015 BELOW DATUM PLANE H WITH THE LEADS CONSTRAINED PERPENDICULAR TO DATUM C.
6. DIMENSION eb IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
7. DATUM PLANE H IS COINCIDENT WITH THE BOTTOM OF THE LEADS, WHERE THE LEADS EXIT THE BODY.
8. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).

**INCHES**

<table>
<thead>
<tr>
<th>DIM</th>
<th>MIN</th>
<th>MAX</th>
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**MILLIMETERS**

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**MECHANICAL CASE OUTLINE**

**PACKAGE DIMENSIONS**

**PDIP-8**

CASE 626–05

ISSUE P

**DATE 22 APR 2015**

**NOTE 8**

**TOP VIEW**

**SIDE VIEW**

**END VIEW**

WITH LEADS CONSTRAINED

NOTE 5

**END VIEW**

NOTE 6

**NOTES:**

2. CONTROLLING DIMENSION: INCHES.
4. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 0.10 INCH.
5. DIMENSION E IS MEASURED AT A POINT 0.015 BELOW DATUM PLANE H WITH THE LEADS CONSTRAINED PERPENDICULAR TO DATUM C.
6. DIMENSION eb IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
7. DATUM PLANE H IS COINCIDENT WITH THE BOTTOM OF THE LEADS, WHERE THE LEADS EXIT THE BODY.
8. PACKAGE CONTOUR IS OPTIONAL (ROUNDED OR SQUARE CORNERS).

**INCHES**

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**GENERIC MARKING DIAGRAM***

XXXX = Specific Device Code

A = Assembly Location

WL = Wafer Lot

YY = Year

WW = Work Week

G = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "C", may or may not be present.

**DOCUMENT NUMBER:** 98ASB42420B

**DESCRIPTION:** PDIP-8

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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.

<table>
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**SOLDERING FOOTPRINT**

**GENERIC MARKING DIAGRAM**

*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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

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

**STYLE 3:**
- PIN 1. Drain, Die #1
- PIN 2. Drain
- PIN 3. Drain
- PIN 4. Drain
- PIN 5. Drain
- PIN 6. Drain
- PIN 7. Drain
- PIN 8. Drain

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

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

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

**STYLE 7:**
- PIN 1. Input
- PIN 2. External Bypass
- PIN 3. Third Stage Source
- PIN 4. Ground
- PIN 5. Collector, #2
- PIN 6. Collector, #2
- PIN 7. Collector, #2
- PIN 8. Collector, #2

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

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

**STYLE 10:**
- PIN 1. Ground
- PIN 2. Emitter, Die #1
- PIN 3. Collector, Die #1
- PIN 4. Collector, Die #1
- PIN 5. Collector, Die #1
- PIN 6. Collector, Die #1
- PIN 7. Collector, Die #1
- PIN 8. Collector, Die #1

**STYLE 11:**
- PIN 1. Source
- PIN 2. Collector, Die #1
- PIN 3. Collector, Die #1
- PIN 4. Collector, Die #1
- PIN 5. Collector, Die #1
- PIN 6. Collector, Die #1
- PIN 7. Collector, Die #1
- PIN 8. Collector, Die #1

**STYLE 12:**
- PIN 1. Source
- PIN 2. Collector, Die #1
- PIN 3. Collector, Die #1
- PIN 4. Collector, Die #1
- PIN 5. Collector, Die #1
- PIN 6. Collector, Die #1
- PIN 7. Collector, Die #1
- PIN 8. Collector, Die #1

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

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

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

**STYLE 16:**
- PIN 1. Collector, Die #1
- PIN 2. Collector, Die #1
- PIN 3. Collector, Die #1
- PIN 4. Collector, Die #1
- PIN 5. Collector, Die #1
- PIN 6. Collector, Die #1
- PIN 7. Collector, Die #1
- PIN 8. Collector, Die #1

**STYLE 17:**
- PIN 1. Vcc
- PIN 2. V2Out
- PIN 3. V2Out
- PIN 4. Txe
- PIN 5. Rxe
- PIN 6. Vee
- PIN 7. Gnd
- PIN 8. Acc

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

**STYLE 19:**
- PIN 1. Line 1 In
- PIN 2. Common Cathode/Vcc
- PIN 3. Common Cathode/Vcc
- PIN 4. Line 1 In
- PIN 5. Common Anode/Gnd
- PIN 6. Common Cathode/Gnd
- PIN 7. Common Cathode/Gnd
- PIN 8. Common Cathode/Gnd

**STYLE 20:**
- PIN 1. Line 1 In
- PIN 2. Common Anode/Gnd
- PIN 3. Collector/Anode
- PIN 4. Collector/Anode
- PIN 5. Collector
- PIN 6. Collector
- PIN 7. Collector
- PIN 8. Collector

**STYLE 21:**
- PIN 1. Vin
- PIN 2. N/C
- PIN 3. Nex
- PIN 4. Gnd
- PIN 5. Iout
- PIN 6. Iout
- PIN 7. Iout
- PIN 8. Iout

**STYLE 22:**
- PIN 1. Ground
- PIN 2. Gnd
- PIN 3. Gnd
- PIN 4. I Limit
- PIN 5. Source
- PIN 6. Source
- PIN 7. Source
- PIN 8. Drain

**STYLE 23:**
- PIN 1. Drain
- PIN 2. Drain
- PIN 3. Drain
- PIN 4. Drain
- PIN 5. Source
- PIN 6. Source
- PIN 7. Source
- PIN 8. Gate

**STYLE 24:**
- PIN 1. Drain
- PIN 2. Drain
- PIN 3. Drain
- PIN 4. Drain
- PIN 5. Source
- PIN 6. Source
- PIN 7. Source
- PIN 8. Drain

**STYLE 25:**
- PIN 1. Base, Die #1
- PIN 2. Emitter, #1
- PIN 3. Base, #2
- PIN 4. Emitter, #2
- PIN 5. Collector, #2
- PIN 6. Collector, #2
- PIN 7. Collector, #2
- PIN 8. Collector, #2

**STYLE 26:**
- PIN 1. Drain
- PIN 2. Drain
- PIN 3. Drain
- PIN 4. Drain
- PIN 5. Source
- PIN 6. Source
- PIN 7. Source
- PIN 8. Drain

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

**STYLE 28:**
- PIN 1. Sw To Gnd
- PIN 2. Dasic Off
- PIN 3. Dasic Sw Det
- PIN 4. Gnd
- PIN 5. V Mon
- PIN 6. V Bulk
- PIN 7. V Bulk
- PIN 8. Vin

**DOCUMENT NUMBER:** 98ASB42564B

**DESCRIPTION:** SOIC–8 NB

**DATE:** 16 FEB 2011

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