# MC1413, MC1413B, NCV1413B

# High Voltage, High Current Darlington Transistor Arrays

The seven NPN Darlington connected transistors in these arrays are well suited for driving lamps, relays, or printer hammers in a variety of industrial and consumer applications. Their high breakdown voltage and internal suppression diodes insure freedom from problems associated with inductive loads. Peak inrush currents to 500 mA permit them to drive incandescent lamps.

The MC1413, B with a 2.7 kΩ series input resistor is well suited for systems utilizing a 5.0 V TTL or CMOS Logic.

**Features**

- Pb−Free Packages are Available*
- NCV Prefix for Automotive and Other Applications Requiring Site and Control Changes

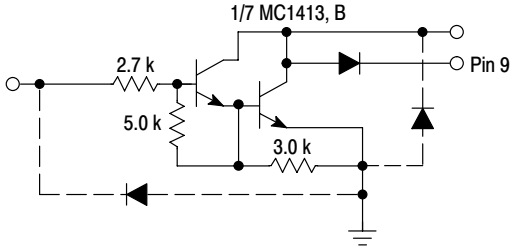
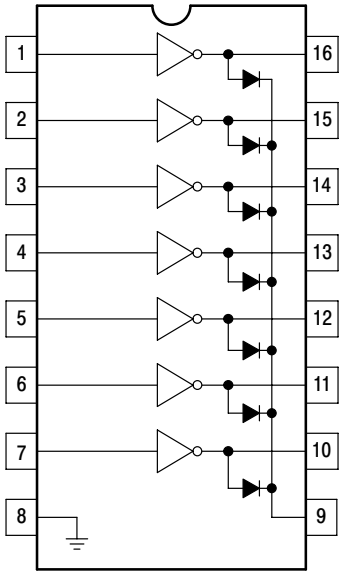



**Figure 1. Representative Schematic Diagram**




(Top View)

**Figure 2. PIN CONNECTIONS**

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

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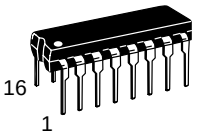
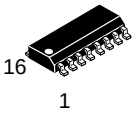
**http://onsemi.com**




**PDIP−16**
**P SUFFIX**
**CASE 648**




**SOIC−16**
**D SUFFIX**
**CASE 751B**

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| MC1413D | SOIC−16 | 48 Units/Rail |
| MC1413DG | SOIC−16 (Pb−Free) | 48 Units/Tube |
| MC1413DR2 | SOIC−16 | 2500 Tape & Reel |
| MC1413DR2G | SOIC−16 (Pb−Free) | 2500 Tape & Reel |
| MC1413P | PDIP−16 | 25 Units/Rail |
| MC1413PG | PDIP−16 (Pb−Free) | 25 Units/Rail |
| MC1413BD | SOIC−16 | 48 Units/Rail |
| MC1413BDG | SOIC−16 (Pb−Free) | 48 Units/Rail |
| MC1413BDR2 | SOIC−16 | 2500 Tape & Reel |
| MC1413BDR2G | SOIC−16 (Pb−Free) | 2500 Tape & Reel |
| MC1413BP | PDIP−16 | 25 Units/Rail |
| MC1413BPG | PDIP−16 (Pb−Free) | 25 Units/Rail |
| NCV1413BDR2 | SOIC−16 | 2500 Tape & Reel |
| NCV1413BDR2G | SOIC−16 (Pb−Free) | 2500 Tape & Reel |

†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.

**DEVICE MARKING INFORMATION**

See general marking information in the device marking section on page 5 of this data sheet.

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**MAXIMUM RATINGS** ($T_A$ = 25°C, and rating apply to any one device in the package, unless otherwise noted.)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Output Voltage | $V_O$ | 50 | V |
| Input Voltage | $V_I$ | 30 | V |
| Collector Current − Continuous | $I_C$ | 500 | mA |
| Base Current − Continuous | $I_B$ | 25 | mA |
| Operating Ambient Temperature Range<br>MC1413<br>MC1413B<br>NCV1413B | $T_A$ | <br>−20 to +85<br>−40 to +85<br>−40 to +125 | °C |
| Storage Temperature Range | $T_{stg}$ | −55 to +150 | °C |
| Junction Temperature | $T_J$ | 150 | °C |
| Thermal Resistance, Junction−to−Ambient<br>Case 648, P Suffix<br>Case 751B, D Suffix | $R_{\theta JA}$ | <br>67<br>100 | °C/W |
| Thermal Resistance, Junction−to−Case<br>Case 648, P Suffix<br>Case 751B, D Suffix | $R_{\theta JC}$ | <br>22<br>20 | °C/W |
| Electrostatic Discharge Sensitivity (ESD)<br>Human Body Model (HBM)<br>Machine Model (MM)<br>Charged Device Model (CDM) | ESD | <br>2000<br>400<br>1500 | V |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C, unless otherwise noted)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Output Leakage Current | | $I_{CEX}$ | | | | μA |
| ($V_O$ = 50 V, $T_A$ = +85°C) | All Types | | − | − | 100 | |
| ($V_O$ = 50 V, $T_A$ = +25°C) | All Types | | − | − | 50 | |
| Collector−Emitter Saturation Voltage | | $V_{CE(sat)}$ | | | | V |
| ($I_C$ = 350 mA, $I_B$ = 500 μA) | All Types | | − | 1.1 | 1.6 | |
| ($I_C$ = 200 mA, $I_B$ = 350 μA) | All Types | | − | 0.95 | 1.3 | |
| ($I_C$ = 100 mA, $I_B$ = 250 μA) | All Types | | − | 0.85 | 1.1 | |
| Input Current − On Condition | | $I_{I(on)}$ | | | | mA |
| ($V_I$ = 3.85 V) | MC1413, B | | − | 0.93 | 1.35 | |
| Input Voltage − On Condition | | $V_{I(on)}$ | | | | V |
| ($V_{CE}$ = 2.0 V, $I_C$ = 200 mA) | MC1413, B | | − | − | 2.4 | |
| ($V_{CE}$ = 2.0 V, $I_C$ = 250 mA) | MC1413, B | | − | − | 2.7 | |
| ($V_{CE}$ = 2.0 V, $I_C$ = 300 mA) | MC1413, B | | − | − | 3.0 | |
| Input Current − Off Condition ($I_C$ = 500 μA, $T_A$ = 85°C) | All Types | $I_{I(off)}$ | 50 | 100 | − | μA |
| DC Current Gain ($V_{CE}$ = 2.0 V, $I_C$ = 350 mA) | | $h_{FE}$ | 1000 | − | − | − |
| Input Capacitance | | $C_I$ | − | 15 | 30 | pF |
| Turn−On Delay Time (50% $E_I$ to 50% $E_O$) | | $t_{on}$ | − | 0.25 | 1.0 | μs |
| Turn−Off Delay Time (50% $E_I$ to 50% $E_O$) | | $t_{off}$ | − | 0.25 | 1.0 | μs |
| Clamp Diode Leakage Current | $T_A$ = +25°C | $I_R$ | − | − | 50 | μA |
| ($V_R$ = 50 V) | $T_A$ = +85°C | | − | − | 100 | |
| Clamp Diode Forward Voltage ($I_F$ = 350 mA) | | $V_F$ | − | 1.5 | 2.0 | V |

NOTE: NCV1413B $T_{low}$ = −40°C, $T_{high}$ = +125°C. Guaranteed by design. NCV prefix is for automotive and other applications requiring site and change control.

## TYPICAL PERFORMANCE CURVES − $T_A$ = 25°C

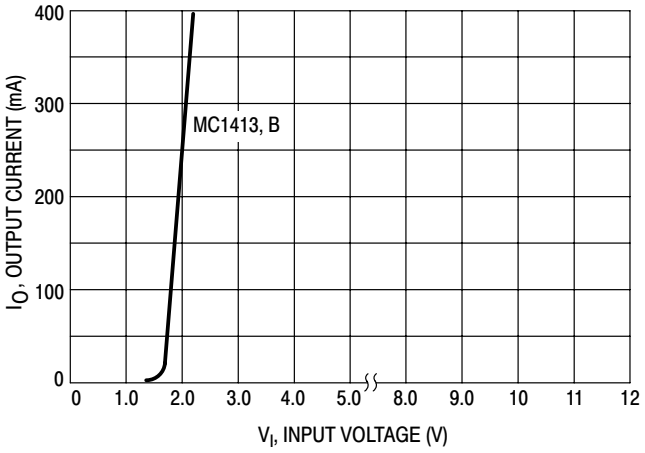



**Figure 3. Output Current versus Input Voltage**

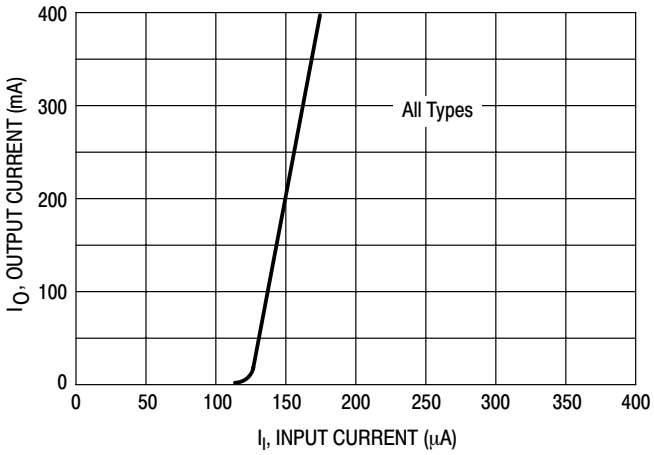



**Figure 4. Output Current versus Input Current**

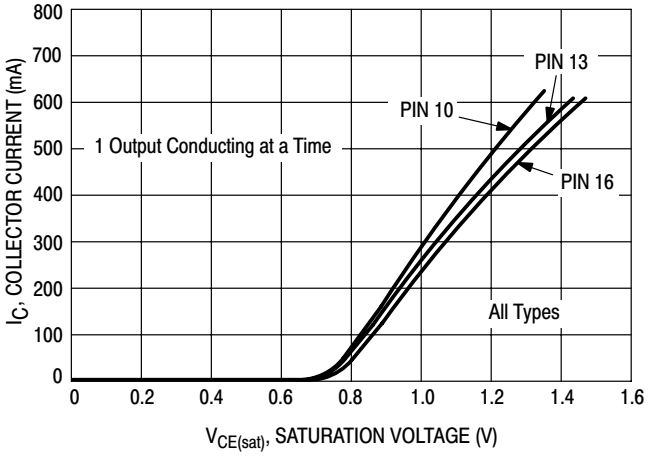



**Figure 5. Typical Output Characteristics**

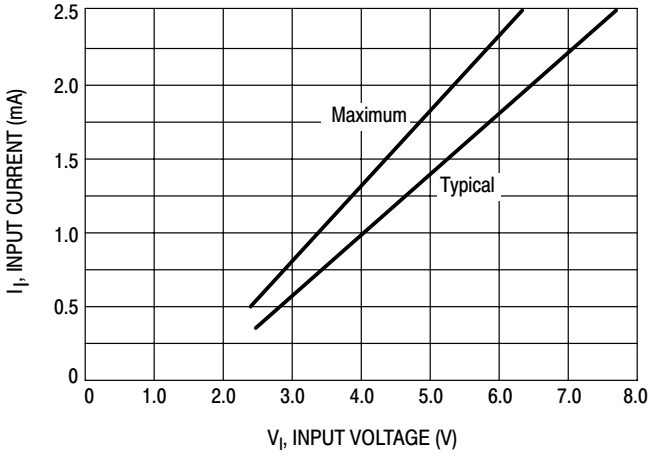



**Figure 6. Input Characteristics − MC1413, B**

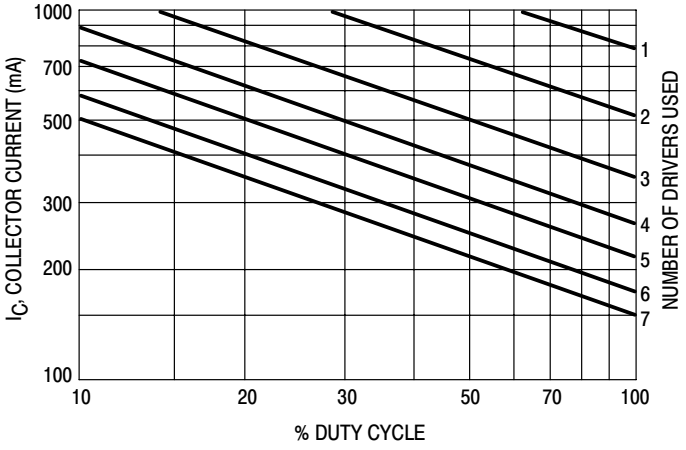
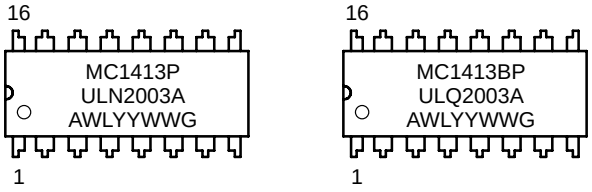


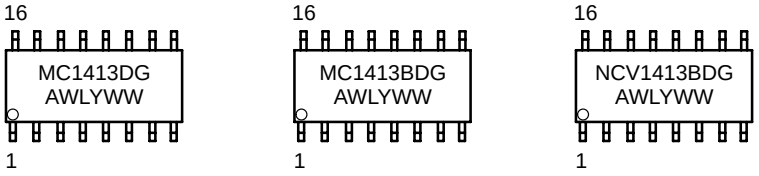

**Figure 7. Maximum Collector Current versus Duty Cycle (and Number of Drivers in Use)**

## MARKING DIAGRAMS

**PDIP−16**
**P SUFFIX**
**CASE 648**




**SOIC−16**
**D SUFFIX**
**CASE 751B**




A = Assembly Location
WL = Wafer Lot
YY, Y = Year
WW = Work Week
G = Pb−Free Package

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

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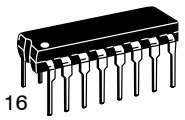
**PDIP−16**
CASE 648−08
ISSUE V

DATE 22 APR 2015

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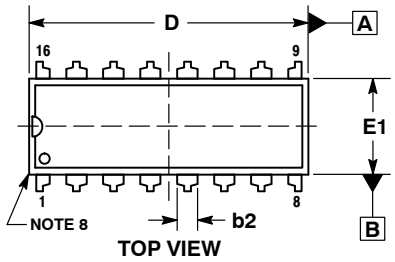
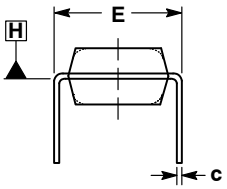
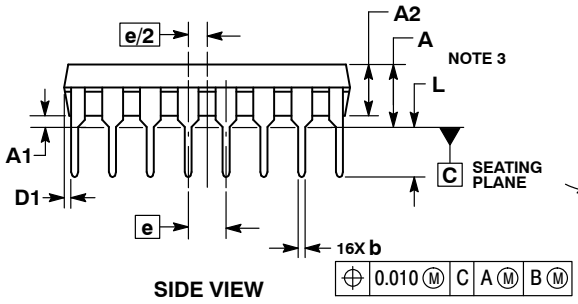


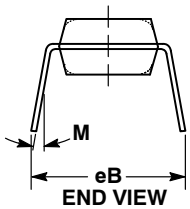

TOP VIEW




END VIEW
WITH LEADS CONSTRAINED
NOTE 5




SIDE VIEW




END VIEW
NOTE 6

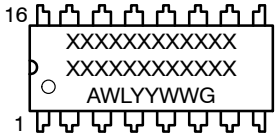
NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS−3.
4. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS ARE NOT TO EXCEED 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 | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | ---- | 0.210 | --- | 5.33 |
| A1 | 0.015 | ---- | 0.38 | --- |
| A2 | 0.115 | 0.195 | 2.92 | 4.95 |
| b | 0.014 | 0.022 | 0.35 | 0.56 |
| b2 | 0.060 TYP | | 1.52 TYP | |
| C | 0.008 | 0.014 | 0.20 | 0.36 |
| D | 0.735 | 0.775 | 18.67 | 19.69 |
| D1 | 0.005 | ---- | 0.13 | --- |
| E | 0.300 | 0.325 | 7.62 | 8.26 |
| E1 | 0.240 | 0.280 | 6.10 | 7.11 |
| e | 0.100 BSC | | 2.54 BSC | |
| eB | ---- | 0.430 | --- | 10.92 |
| L | 0.115 | 0.150 | 2.92 | 3.81 |
| M | ---- | 10° | --- | 10° |

STYLE 1:
PIN 1. CATHODE
2. CATHODE
3. CATHODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. CATHODE
9. ANODE
10. ANODE
11. ANODE
12. ANODE
13. ANODE
14. ANODE
15. ANODE
16. ANODE

STYLE 2:
PIN 1. COMMON DRAIN
2. COMMON DRAIN
3. COMMON DRAIN
4. COMMON DRAIN
5. COMMON DRAIN
6. COMMON DRAIN
7. COMMON DRAIN
8. COMMON DRAIN
9. GATE
10. SOURCE
11. GATE
12. SOURCE
13. GATE
14. SOURCE
15. GATE
16. SOURCE

### GENERIC MARKING DIAGRAM*




XXXXX = 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 “ ▪”, may or may not be present.

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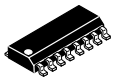
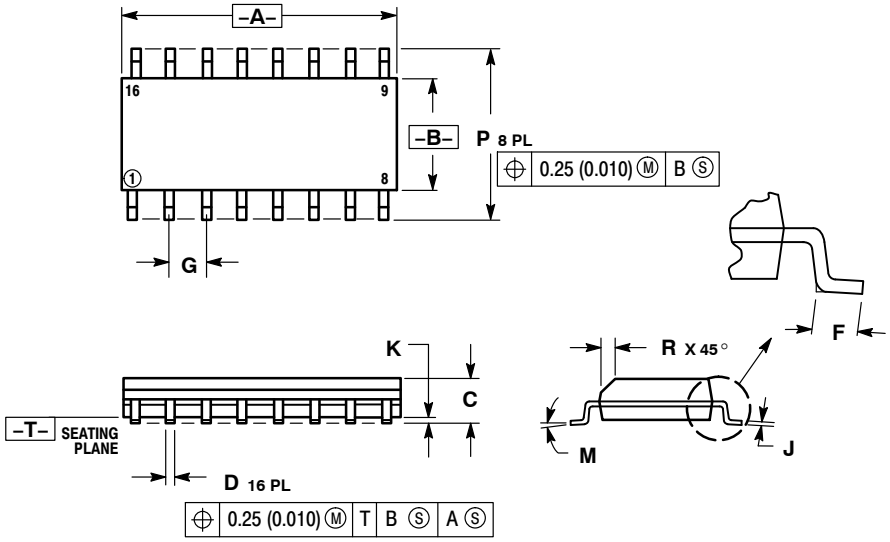
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS



SCALE 1:1

**SOIC−16**
CASE 751B−05
ISSUE K

DATE 29 DEC 2006



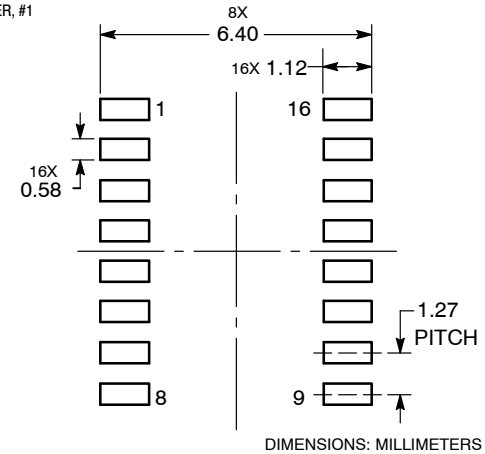

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 9.80 | 10.00 | 0.386 | 0.393 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0° | 7° | 0° | 7° |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

| STYLE 1: | | STYLE 2: | | STYLE 3: | | STYLE 4: | |
|---|---|---|---|---|---|---|---|
| PIN 1. | COLLECTOR | PIN 1. | CATHODE | PIN 1. | COLLECTOR, DYE #1 | PIN 1. | COLLECTOR, DYE #1 |
| 2. | BASE | 2. | ANODE | 2. | BASE, #1 | 2. | COLLECTOR, #1 |
| 3. | EMITTER | 3. | NO CONNECTION | 3. | EMITTER, #1 | 3. | COLLECTOR, #2 |
| 4. | NO CONNECTION | 4. | CATHODE | 4. | COLLECTOR, #1 | 4. | COLLECTOR, #2 |
| 5. | EMITTER | 5. | CATHODE | 5. | COLLECTOR, #2 | 5. | COLLECTOR, #3 |
| 6. | BASE | 6. | NO CONNECTION | 6. | BASE, #2 | 6. | COLLECTOR, #3 |
| 7. | COLLECTOR | 7. | ANODE | 7. | EMITTER, #2 | 7. | COLLECTOR, #4 |
| 8. | COLLECTOR | 8. | CATHODE | 8. | COLLECTOR, #2 | 8. | COLLECTOR, #4 |
| 9. | BASE | 9. | CATHODE | 9. | COLLECTOR, #3 | 9. | BASE, #4 |
| 10. | EMITTER | 10. | ANODE | 10. | BASE, #3 | 10. | EMITTER, #4 |
| 11. | NO CONNECTION | 11. | NO CONNECTION | 11. | EMITTER, #3 | 11. | BASE, #3 |
| 12. | EMITTER | 12. | CATHODE | 12. | COLLECTOR, #3 | 12. | EMITTER, #3 |
| 13. | BASE | 13. | CATHODE | 13. | COLLECTOR, #4 | 13. | BASE, #2 |
| 14. | COLLECTOR | 14. | NO CONNECTION | 14. | BASE, #4 | 14. | EMITTER, #2 |
| 15. | EMITTER | 15. | ANODE | 15. | EMITTER, #4 | 15. | BASE, #1 |
| 16. | COLLECTOR | 16. | CATHODE | 16. | COLLECTOR, #4 | 16. | EMITTER, #1 |

| STYLE 5: | | STYLE 6: | | STYLE 7: | |
|---|---|---|---|---|---|
| PIN 1. | DRAIN, DYE #1 | PIN 1. | CATHODE | PIN 1. | SOURCE N-CH |
| 2. | DRAIN, #1 | 2. | CATHODE | 2. | COMMON DRAIN (OUTPUT) |
| 3. | DRAIN, #2 | 3. | CATHODE | 3. | COMMON DRAIN (OUTPUT) |
| 4. | DRAIN, #2 | 4. | CATHODE | 4. | GATE P-CH |
| 5. | DRAIN, #3 | 5. | CATHODE | 5. | COMMON DRAIN (OUTPUT) |
| 6. | DRAIN, #3 | 6. | CATHODE | 6. | COMMON DRAIN (OUTPUT) |
| 7. | DRAIN, #4 | 7. | CATHODE | 7. | COMMON DRAIN (OUTPUT) |
| 8. | DRAIN, #4 | 8. | CATHODE | 8. | SOURCE P-CH |
| 9. | GATE, #4 | 9. | ANODE | 9. | SOURCE P-CH |
| 10. | SOURCE, #4 | 10. | ANODE | 10. | COMMON DRAIN (OUTPUT) |
| 11. | GATE, #3 | 11. | ANODE | 11. | COMMON DRAIN (OUTPUT) |
| 12. | SOURCE, #3 | 12. | ANODE | 12. | COMMON DRAIN (OUTPUT) |
| 13. | GATE, #2 | 13. | ANODE | 13. | GATE N-CH |
| 14. | SOURCE, #2 | 14. | ANODE | 14. | COMMON DRAIN (OUTPUT) |
| 15. | GATE, #1 | 15. | ANODE | 15. | COMMON DRAIN (OUTPUT) |
| 16. | SOURCE, #1 | 16. | ANODE | 16. | SOURCE N-CH |

**RECOMMENDED SOLDERING FOOTPRINT***




DIMENSIONS: MILLIMETERS

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

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