

NTD5865NL

MOSFET – Power, N-Channel 60 V, 46 A, 16 mΩ

Features

- Low Gate Charge
- Fast Switching
- High Current Capability
- 100% Avalanche Tested
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

| Parameter | Symbol | Value | Unit | |
|---|-----------------------------------|------------------------|---------------------|----|
| Drain-to-Source Voltage | V _{DSS} | 60 | V | |
| Gate-to-Source Voltage – Continuous | V _{GS} | ±20 | V | |
| Gate-to-Source Voltage – Non-Repetitive (t _p < 10 μs) | V _{GS} | ±30 | V | |
| Continuous Drain Current (R _{θJC}) | Steady State | T _C = 25°C | I _D = 46 | A |
| | | T _C = 100°C | 33 | |
| Power Dissipation (R _{θJC}) | | T _C = 25°C | P _D = 71 | W |
| Pulsed Drain Current | t _p = 10 μs | I _{DM} | 203 | A |
| Operating Junction and Storage Temperature | T _J , T _{stg} | -55 to 175 | °C | |
| Source Current (Body Diode) | I _S | 46 | A | |
| Single Pulse Drain-to-Source Avalanche Energy | (L = 0.1 mH) | E _{AS} | 36 | mJ |
| | | I _{AS} | 27 | A |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | T _L | 260 | °C | |

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.

THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|---|------------------|-------|------|
| Junction-to-Case (Drain) | R _{θJC} | 2.1 | °C/W |
| Junction-to-Ambient – Steady State (Note 1) | R _{θJA} | 49 | |

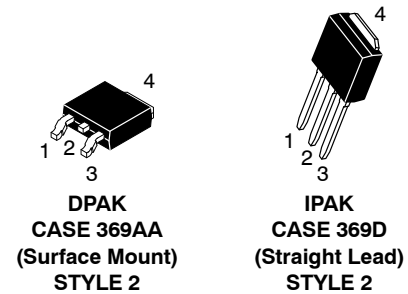
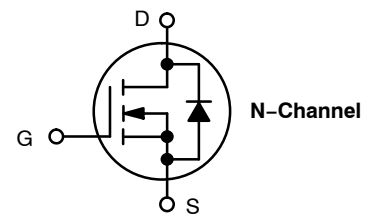
1. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.



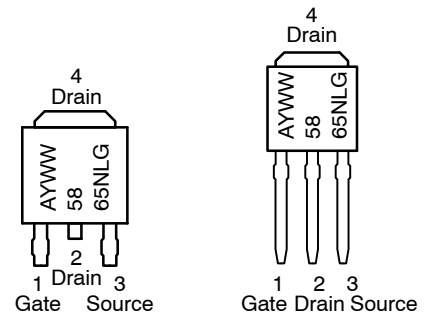
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| V _{(BR)DSS} | R _{DS(on)} MAX | I _D MAX |
|----------------------|-------------------------|--------------------|
| 60 V | 16 mΩ @ 10 V | 46 A |
| | 19 mΩ @ 4.5 V | |



MARKING DIAGRAMS & PIN ASSIGNMENT



- A = Assembly Location*
- Y = Year
- WW = Work Week
- 5865NL = Device Code
- G = Pb-Free Package

* The Assembly Location code (A) is front side optional. In cases where the Assembly Location is stamped in the package, the front side assembly code may be blank.

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

NTD5865NL

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|--------------------------------------|--|------------------------|-----|------|-------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-to-Source Breakdown Voltage | V _{(BR)DSS} | V _{GS} = 0 V, I _D = 250 μA | 60 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | V _{(BR)DSS} /T _J | | | 55 | | mV/°C |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{GS} = 0 V, V _{DS} = 60 V | T _J = 25°C | | 1.0 | μA |
| | | | T _J = 150°C | | 100 | |
| Gate-to-Source Leakage Current | I _{GSS} | V _{DS} = 0 V, V _{GS} = ±20 V | | | ±100 | nA |

ON CHARACTERISTICS (Note 2)

| | | | | | | |
|--|-------------------------------------|---|-----|-----|-----|-------|
| Gate Threshold Voltage | V _{GS(TH)} | V _{GS} = V _{DS} , I _D = 250 μA | 1.0 | | 2.0 | V |
| Negative Threshold Temperature Coefficient | V _{GS(TH)} /T _J | | | 5.6 | | mV/°C |
| Drain-to-Source on Resistance | R _{DS(on)} | V _{GS} = 10 V, I _D = 20 A | | 13 | 16 | mΩ |
| Drain-to-Source on Resistance | R _{DS(on)} | V _{GS} = 4.5 V, I _D = 20 A | | 16 | 19 | mΩ |
| Forward Transconductance | g _{FS} | V _{DS} = 15 V, I _D = 20 A | | 15 | | S |

CHARGES, CAPACITANCES AND GATE RESISTANCES

| | | | | | | |
|------------------------------|---------------------|---|--|------|--|----|
| Input Capacitance | C _{iss} | V _{GS} = 0 V, f = 1.0 MHz, V _{DS} = 25 V | | 1400 | | pF |
| Output Capacitance | C _{oss} | | | 137 | | |
| Reverse Transfer Capacitance | C _{rss} | | | 95 | | |
| Total Gate Charge | Q _{G(TOT)} | V _{GS} = 10 V, V _{DS} = 48 V, I _D = 40 A | | 29 | | nC |
| Threshold Gate Charge | Q _{G(TH)} | | | 1.1 | | |
| Gate-to-Source Charge | Q _{GS} | | | 4 | | |
| Gate-to-Drain Charge | Q _{GD} | | | 8 | | |
| Total Gate Charge | Q _{G(TOT)} | V _{GS} = 4.5 V, V _{DS} = 48 V, I _D = 40 A | | 15 | | nC |
| Gate Resistance | R _G | | | 1.3 | | Ω |

SWITCHING CHARACTERISTICS (Note 3)

| | | | | | | |
|---------------------|---------------------|--|--|------|--|----|
| Turn-On Delay Time | t _{d(on)} | V _{GS} = 10 V, V _{DD} = 48 V, I _D = 40 A, R _G = 2.5 Ω | | 8.4 | | ns |
| Rise Time | t _r | | | 12.4 | | |
| Turn-Off Delay Time | t _{d(off)} | | | 26 | | |
| Fall Time | t _f | | | 4.4 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

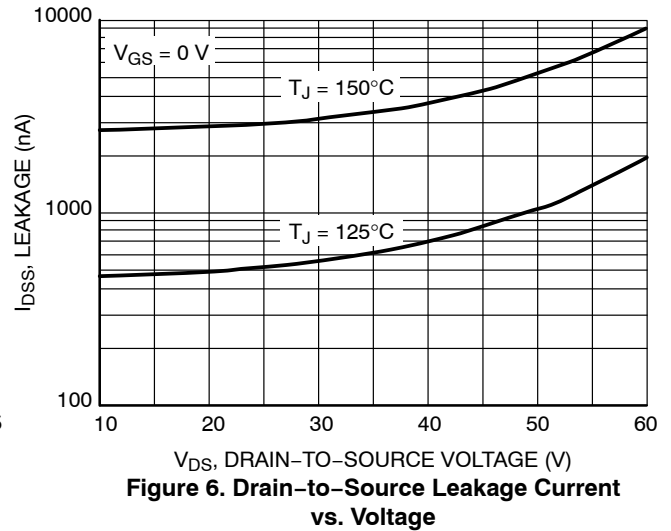
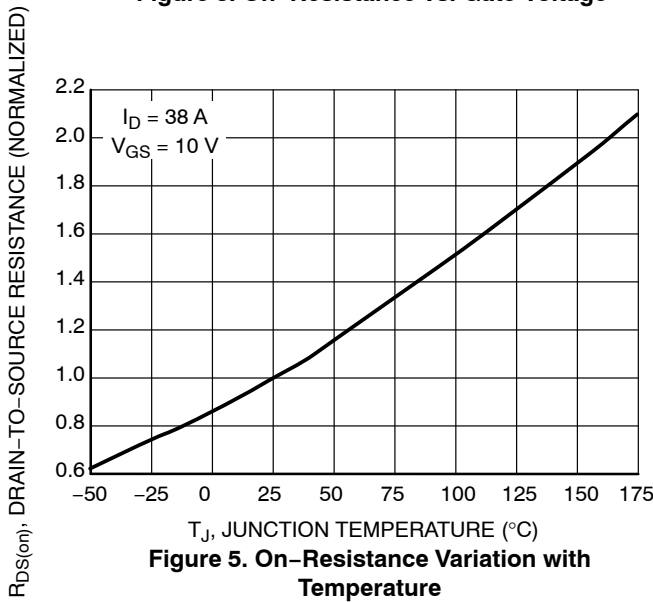
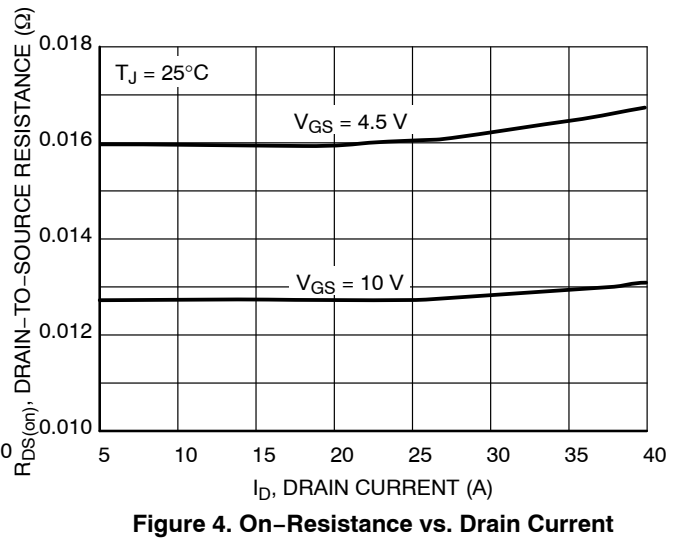
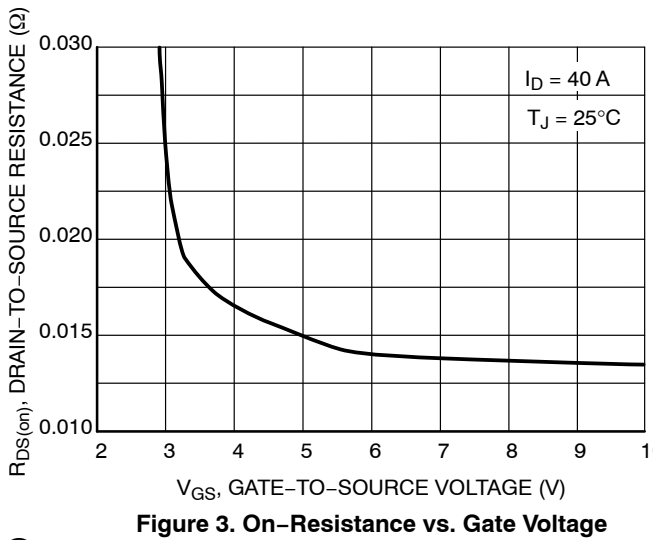
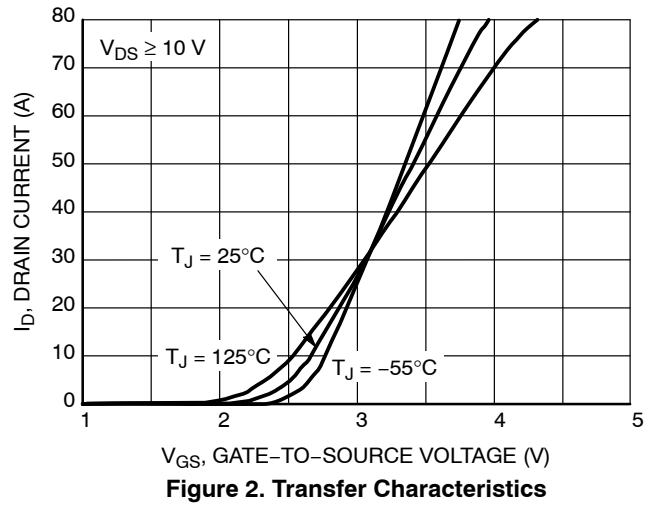
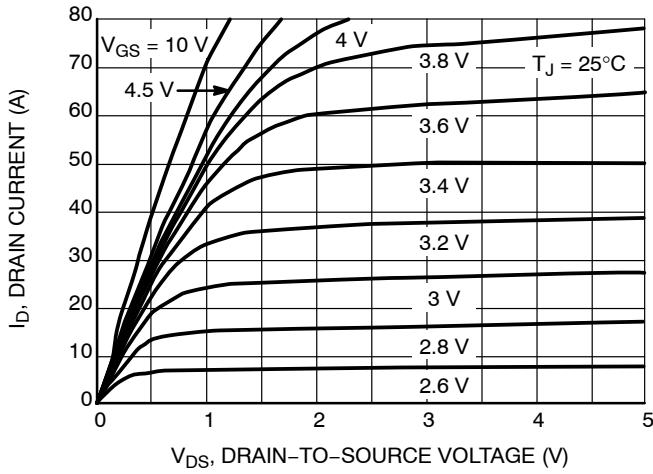
| | | | | | | | |
|-------------------------|-----------------|---|------------------------|----|------|-----|----|
| Forward Diode Voltage | V _{SD} | V _{GS} = 0 V, I _S = 40 A | T _J = 25°C | | 0.95 | 1.2 | V |
| | | | T _J = 125°C | | 0.85 | | |
| Reverse Recovery Time | t _{RR} | V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 40 A | | 20 | | ns | |
| Charge Time | t _a | | | 13 | | | |
| Discharge Time | t _b | | | 7 | | | |
| Reverse Recovery Charge | Q _{RR} | | | 13 | | | nC |

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.

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS

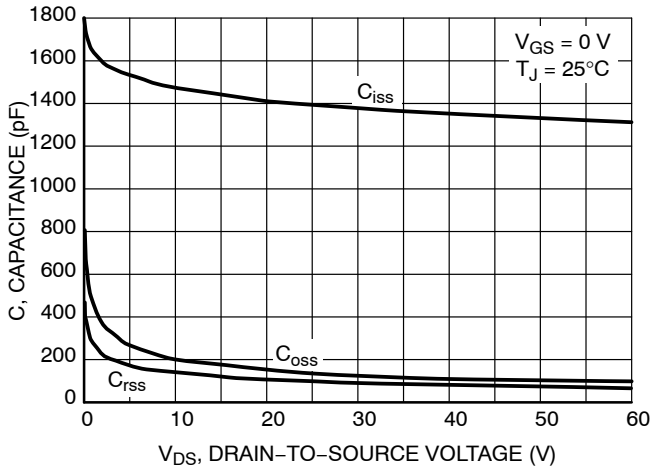


Figure 7. Capacitance Variation

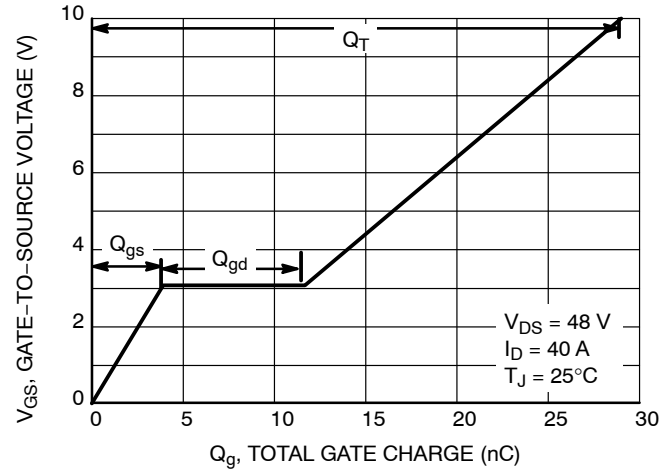


Figure 8. Gate-to-Source vs. Total Charge

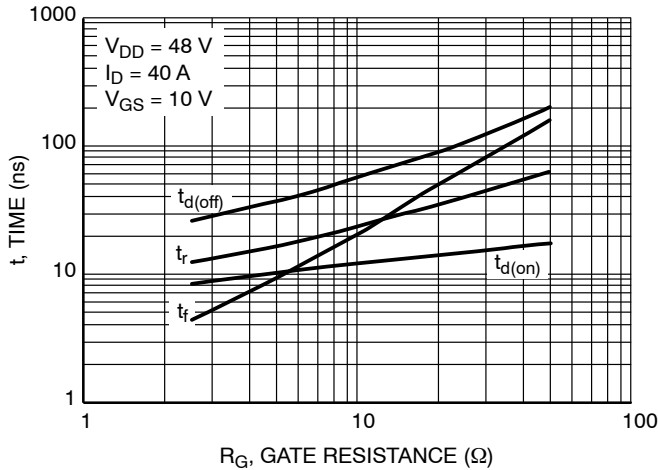


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

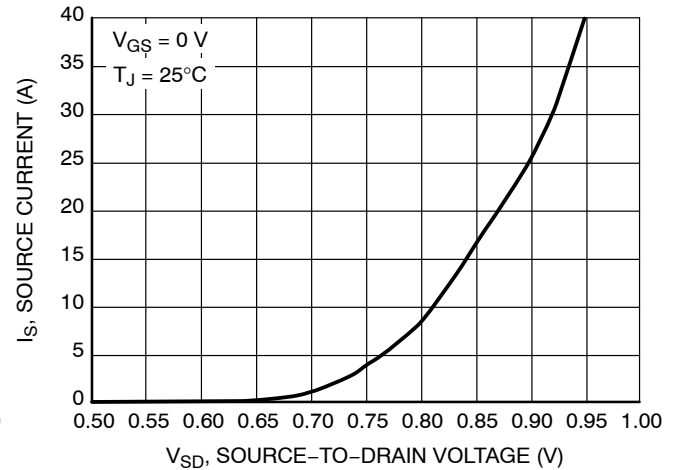


Figure 10. Diode Forward Voltage vs. Current

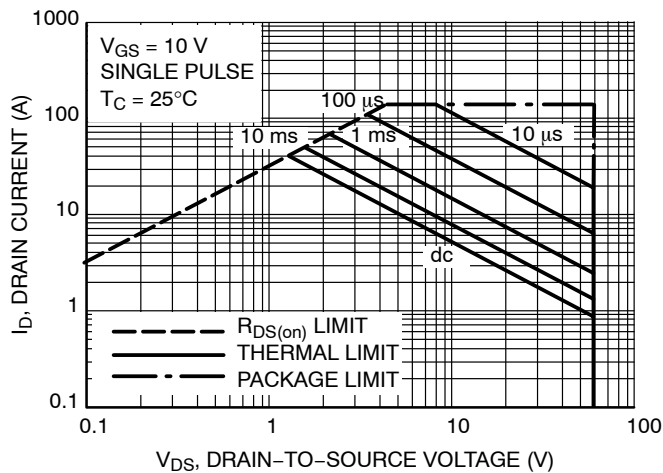


Figure 11. Maximum Rated Forward Biased Safe Operating Area

NTD5865NL

TYPICAL CHARACTERISTICS

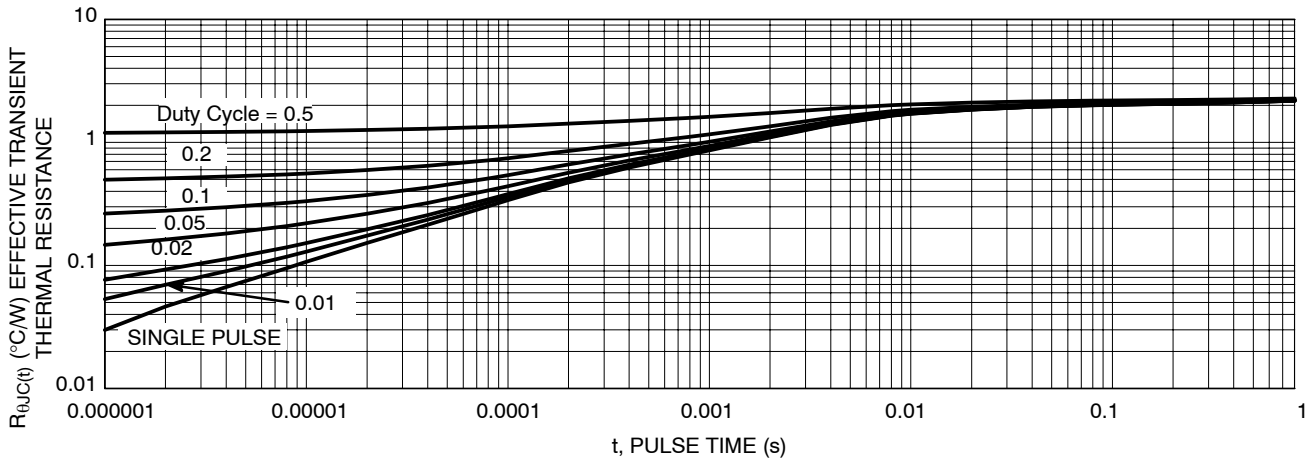


Figure 12. Thermal Response

ORDERING INFORMATION

| Order Number | Package | Shipping [†] |
|--------------|-----------------------------------|-----------------------|
| NTD5865NL-1G | IPAK (Straight Lead) (Pb-Free) | 75 Units / Rail |
| NTD5865NLT4G | DPAK (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.

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

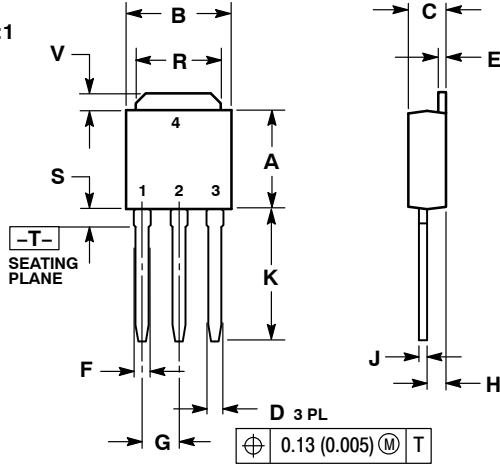
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IPAK CASE 369D-01 ISSUE C

DATE 15 DEC 2010

SCALE 1:1



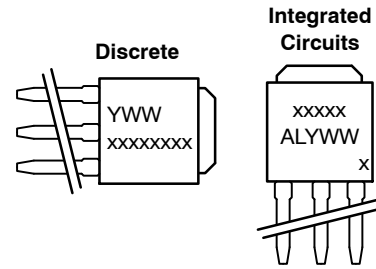
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.35 |
| B | 0.250 | 0.265 | 6.35 | 6.73 |
| C | 0.086 | 0.094 | 2.19 | 2.38 |
| D | 0.027 | 0.035 | 0.69 | 0.88 |
| E | 0.018 | 0.023 | 0.46 | 0.58 |
| F | 0.037 | 0.045 | 0.94 | 1.14 |
| G | 0.090 | BSC | 2.29 | BSC |
| H | 0.034 | 0.040 | 0.87 | 1.01 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| K | 0.350 | 0.380 | 8.89 | 9.65 |
| R | 0.180 | 0.215 | 4.45 | 5.45 |
| S | 0.025 | 0.040 | 0.63 | 1.01 |
| V | 0.035 | 0.050 | 0.89 | 1.27 |
| Z | 0.155 | --- | 3.93 | --- |

MARKING DIAGRAMS

- | | | | |
|--|---|--|--|
| <p>STYLE 1: PIN 1. BASE 2. COLLECTOR 3. EMITTER 4. COLLECTOR</p> | <p>STYLE 2: PIN 1. GATE 2. DRAIN 3. SOURCE 4. DRAIN</p> | <p>STYLE 3: PIN 1. ANODE 2. CATHODE 3. ANODE 4. CATHODE</p> | <p>STYLE 4: PIN 1. CATHODE 2. ANODE 3. GATE 4. ANODE</p> |
| <p>STYLE 5: PIN 1. GATE 2. ANODE 3. CATHODE 4. ANODE</p> | <p>STYLE 6: PIN 1. MT1 2. MT2 3. GATE 4. MT2</p> | <p>STYLE 7: PIN 1. GATE 2. COLLECTOR 3. EMITTER 4. COLLECTOR</p> | |



- xxxxxxxx = Device Code
- A = Assembly Location
- IL = Wafer Lot
- Y = Year
- WW = Work Week

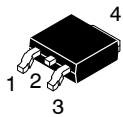
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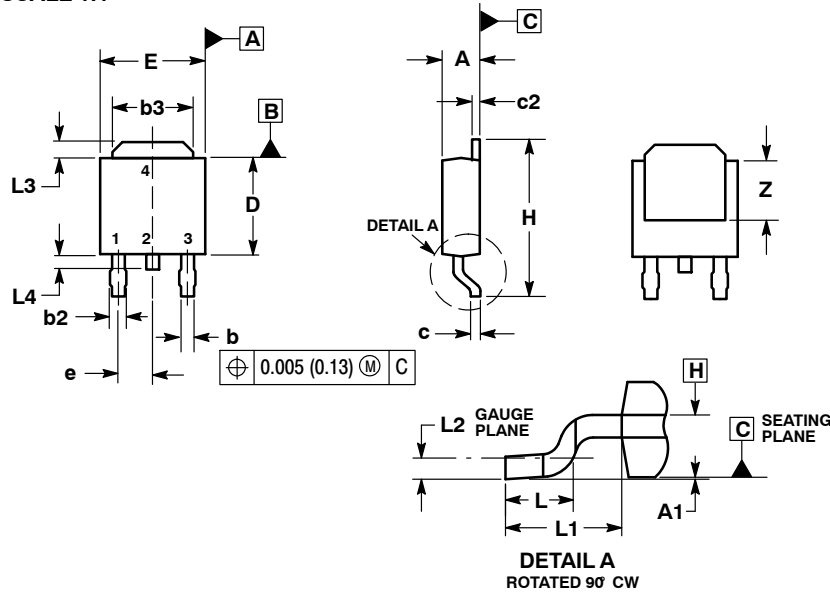
MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

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SCALE 1:1



DPAK (SINGLE GAUGE)

CASE 369AA-01

ISSUE B

DATE 03 JUN 2010

NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: INCHES.
- THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b₃, L₃ and Z.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
- DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
- DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

| DIM | INCHES | | MILLIMETERS | |
|----------------|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.086 | 0.094 | 2.18 | 2.38 |
| A1 | 0.000 | 0.005 | 0.00 | 0.13 |
| b | 0.025 | 0.035 | 0.63 | 0.89 |
| b ₂ | 0.030 | 0.045 | 0.76 | 1.14 |
| b ₃ | 0.180 | 0.215 | 4.57 | 5.46 |
| c | 0.018 | 0.024 | 0.46 | 0.61 |
| c ₂ | 0.018 | 0.024 | 0.46 | 0.61 |
| D | 0.235 | 0.245 | 5.97 | 6.22 |
| E | 0.250 | 0.265 | 6.35 | 6.73 |
| e | 0.090 BSC | | 2.29 BSC | |
| H | 0.370 | 0.410 | 9.40 | 10.41 |
| L | 0.055 | 0.070 | 1.40 | 1.78 |
| L ₁ | 0.108 REF | | 2.74 REF | |
| L ₂ | 0.020 BSC | | 0.51 BSC | |
| L ₃ | 0.035 | 0.050 | 0.89 | 1.27 |
| L ₄ | --- | 0.040 | --- | 1.01 |
| Z | 0.155 | --- | 3.93 | --- |

- | | | | |
|--|---|--|--|
| <p>STYLE 1: PIN 1. BASE 2. COLLECTOR 3. EMITTER 4. COLLECTOR</p> | <p>STYLE 2: PIN 1. GATE 2. DRAIN 3. SOURCE 4. DRAIN</p> | <p>STYLE 3: PIN 1. ANODE 2. CATHODE 3. ANODE 4. CATHODE</p> | <p>STYLE 4: PIN 1. CATHODE 2. ANODE 3. GATE 4. ANODE</p> |
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GENERIC MARKING DIAGRAM*



IC Discrete

- XXXXXX = Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

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

SOLDERING FOOTPRINT*



SCALE 3:1 (mm/inches)

*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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