

NTGS3136P

Power MOSFET

-20 V, -5.8 A, Single P-Channel, TSOP-6

Features

- Low $R_{DS(on)}$ in TSOP-6 Package
- 1.8 V Gate Rating
- Fast Switching
- This is a Pb-Free Device

Applications

- Optimized for Battery and Load Management Applications in Portable Equipment
- High Side Load Switch
- Switching Circuits for Game Consoles, Camera Phone, etc.

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise stated)

| Parameter | | Symbol | Value | Unit | |
|---|------------------------|--------------------------|--------------------------|------------------|---|
| Drain-to-Source Voltage | | V_{DSS} | -20 | V | |
| Gate-to-Source Voltage | | V_{GS} | ± 8.0 | V | |
| Continuous Drain Current (Note 1) | Steady State | I_D | $T_A = 25^\circ\text{C}$ | -5.1 | A |
| | | | $T_A = 85^\circ\text{C}$ | -3.6 | |
| | $t \leq 5 \text{ s}$ | $T_A = 25^\circ\text{C}$ | -5.8 | | |
| Power Dissipation (Note 1) | Steady State | P_D | $T_A = 25^\circ\text{C}$ | 1.25 | W |
| | $t \leq 5 \text{ s}$ | | | 1.6 | |
| Continuous Drain Current (Note 2) | Steady State | I_D | $T_A = 25^\circ\text{C}$ | -3.7 | A |
| | | | $T_A = 85^\circ\text{C}$ | -2.7 | |
| Power Dissipation (Note 2) | Steady State | P_D | $T_A = 25^\circ\text{C}$ | 0.7 | W |
| Pulsed Drain Current | $t_p = 10 \mu\text{s}$ | I_{DM} | -20 | A | |
| Operating Junction and Storage Temperature | | T_J, T_{STG} | -55 to 150 | $^\circ\text{C}$ | |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | T_L | 260 | $^\circ\text{C}$ | |

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.

1. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces)
2. Surface-mounted on FR4 board using the minimum recommended pad size (Cu area = 0.0775 in sq).

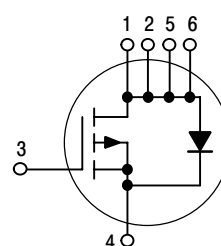


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| $V_{(BR)DSS}$ | $R_{DS(ON)}$ TYP | I_D MAX |
|---------------|------------------------|-----------|
| -20 V | 25 m Ω @ -4.5 V | -5.1 A |
| | 32 m Ω @ -2.5 V | -4.5 A |
| | 41 m Ω @ -1.8 V | -2.5 A |

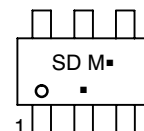
P-Channel



MARKING DIAGRAM

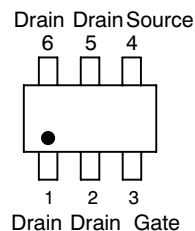


TSOP-6
CASE 318G
STYLE 1



SD = Device Code
M = Date Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

PIN ASSIGNMENT



ORDERING INFORMATION

| Device | Package | Shipping† |
|--------------|------------------|--------------------|
| NTGS3136PT1G | TSOP-6 (Pb-Free) | 3000 / 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.

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THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|---|-----------------|-------|------|
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 100 | °C/W |
| Junction-to-Ambient – $t = 5$ s (Note 3) | $R_{\theta JA}$ | 77 | |
| Junction-to-Ambient – Steady State (Note 4) | $R_{\theta JA}$ | 185 | |

3. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces)
 4. Surface-mounted on FR4 board using the minimum recommended pad size (Cu area = 0.0775 in sq).

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

| 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 | -20 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = -250$ μA , Reference 25°C | | -13 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0$ V, $V_{DS} = -20$ V | | | -1.0 | μA |
| | | $T_J = 25^\circ\text{C}$ | | | | |
| | | $T_J = 85^\circ\text{C}$ | | | -5.0 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0$ V, $V_{GS} = \pm 8.0$ V | | | ± 0.1 | μA |

ON CHARACTERISTICS (Note 5)

| | | | | | | |
|--|------------------|--|------|----|------|------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}$, $I_D = -250$ μA | -0.4 | | -1.0 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | 3 | | mV/°C |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = -4.5$ V, $I_D = -5.1$ A | | 25 | 33 | m Ω |
| | | $V_{GS} = -2.5$ V, $I_D = -4.5$ A | | 32 | 40 | |
| | | $V_{GS} = -1.8$ V, $I_D = -2.5$ A | | 41 | 51 | |
| Forward Transconductance | g_{FS} | $V_{DS} = -5.0$ V, $I_D = -5.1$ A | | 22 | | S |

CHARGES, CAPACITANCES AND GATE RESISTANCE

| | | | | | | |
|------------------------------|--------------|--|--|------|----|----|
| Input Capacitance | C_{ISS} | $V_{GS} = 0$ V, $f = 1$ MHz, $V_{DS} = -10$ V | | 1901 | | pF |
| Output Capacitance | C_{OSS} | | | 274 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 175 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = -4.5$ V, $V_{DS} = -10$ V; $I_D = -5.1$ A | | 18 | 29 | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 0.7 | | |
| Gate-to-Source Charge | Q_{GS} | | | 2.4 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 4.3 | | |
| Gate Resistance | R_G | | | 7.6 | | |

SWITCHING CHARACTERISTICS (Note 6)

| | | | | | | |
|---------------------|--------------|---|--|----|-----|----|
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = 4.5$ V, $V_{DD} = -10$ V, $I_D = -1.0$ A, $R_G = 6.0$ Ω | | 9 | 19 | ns |
| Rise Time | T_r | | | 9 | 19 | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 99 | 160 | |
| Fall Time | T_f | | | 48 | 79 | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | |
|-----------------------|----------|--|---------------------------|------|------|----|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0$ V, $I_S = -1.7$ A | $T_J = 25^\circ\text{C}$ | -0.7 | -1.2 | V |
| | | | $T_J = 125^\circ\text{C}$ | -0.6 | | |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0$ V, $dI_S/dt = 100$ A/ μs , $I_S = -1.7$ A | | 37 | 60 | ns |

5. Pulse Test: pulse width ≤ 300 μs , duty cycle $\leq 2\%$
 6. Switching characteristics are independent of operating junction temperatures

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TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

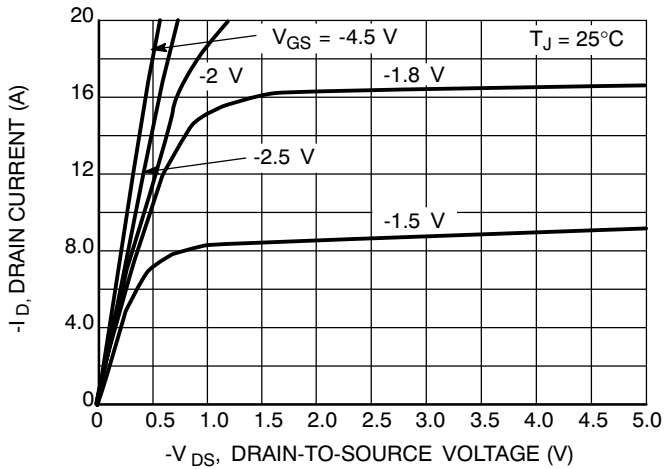


Figure 1. On-Region Characteristics

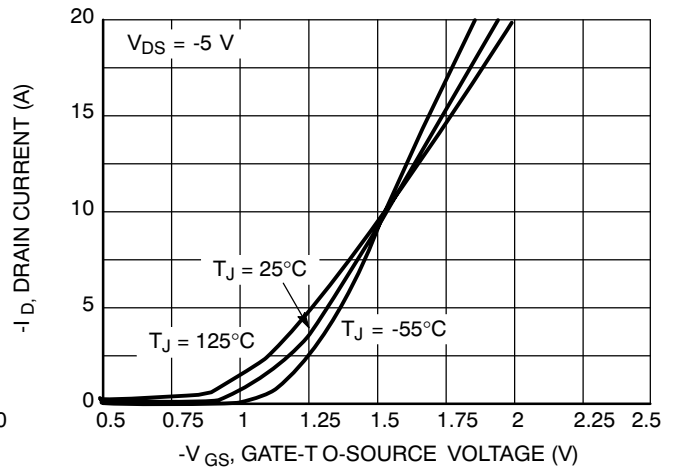


Figure 2. Transfer Characteristics

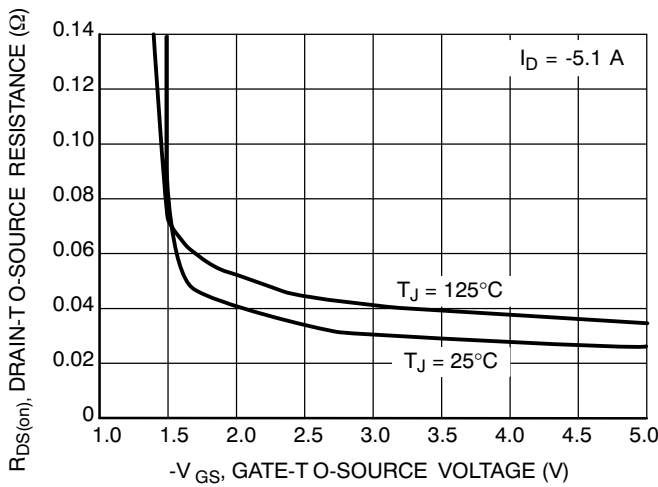


Figure 3. On-Resistance vs. Gate-to-Source Voltage

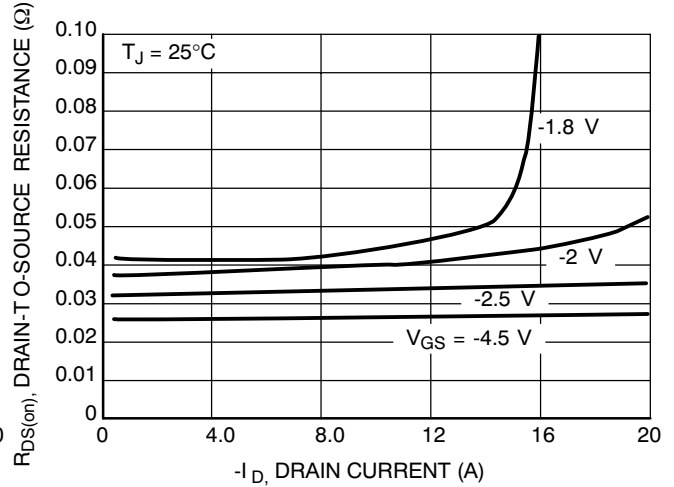


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

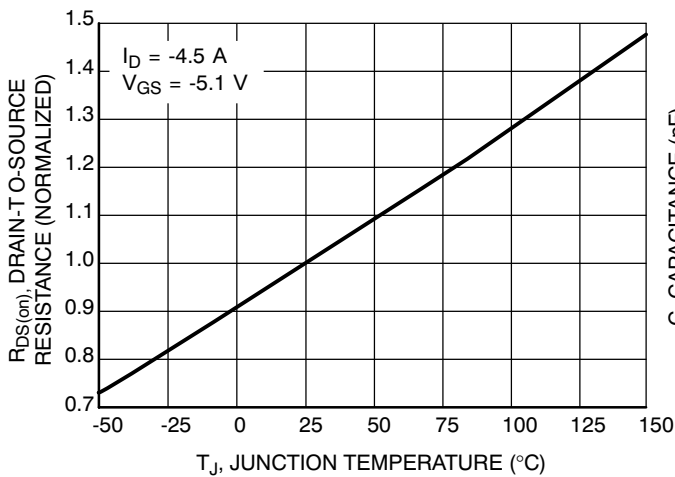


Figure 5. On-Resistance Variation with Temperature

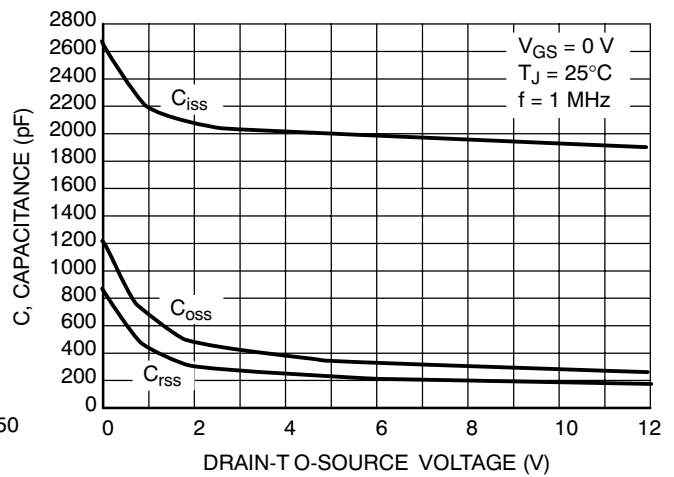


Figure 6. Capacitance Variation

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TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

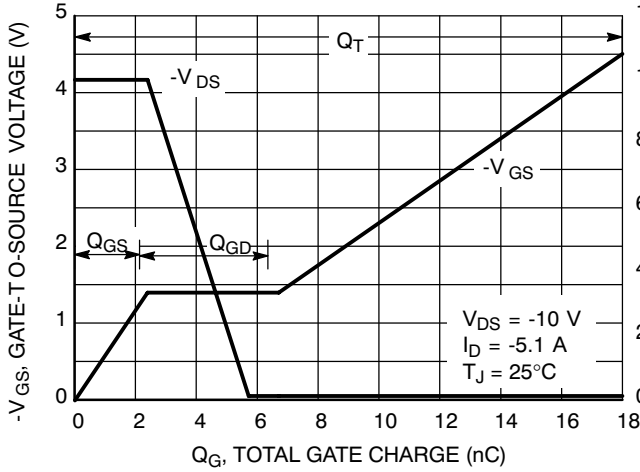


Figure 7. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

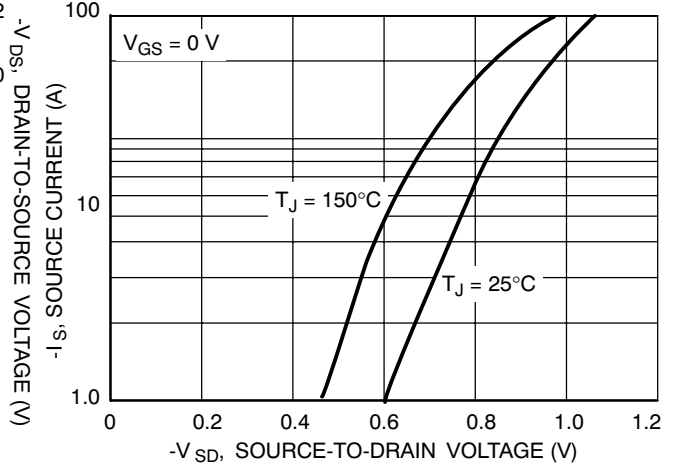


Figure 8. Diode Forward Voltage vs. Current

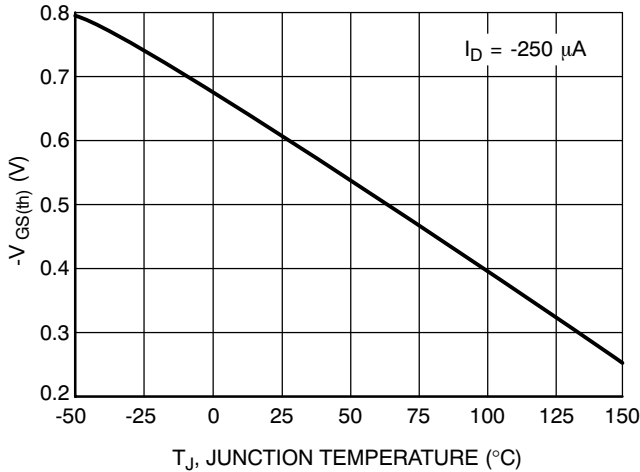


Figure 9. Threshold Voltage

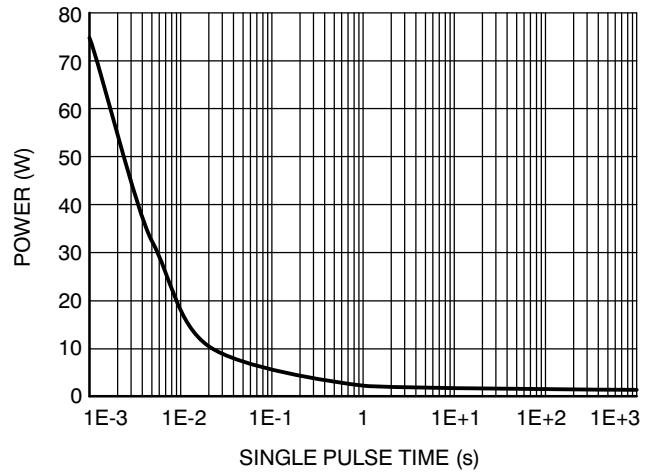


Figure 10. Single Pulse Maximum Power Dissipation

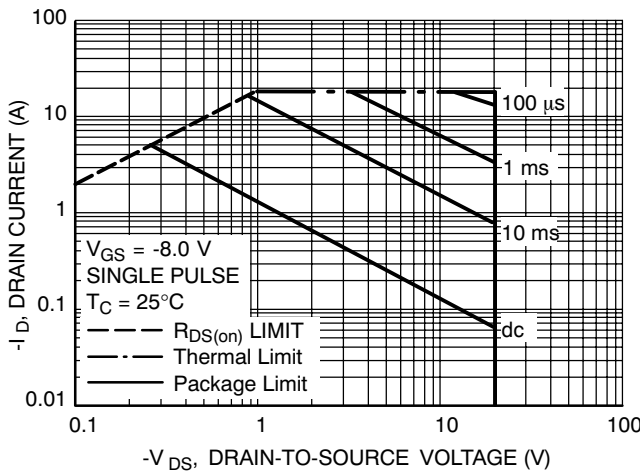


Figure 11. Maximum Rated Forward Biased Safe Operating Area

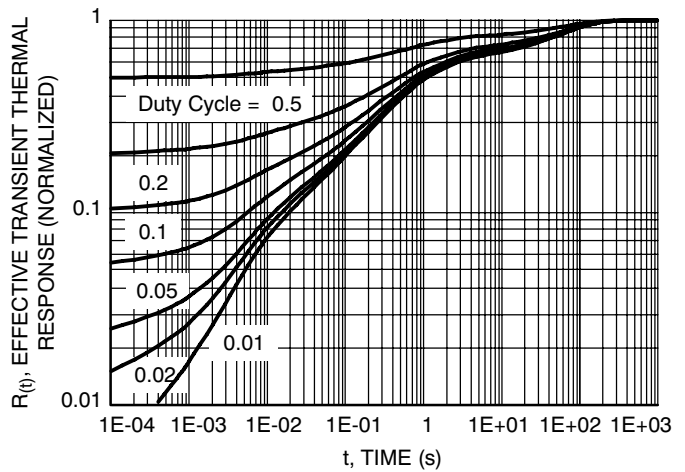
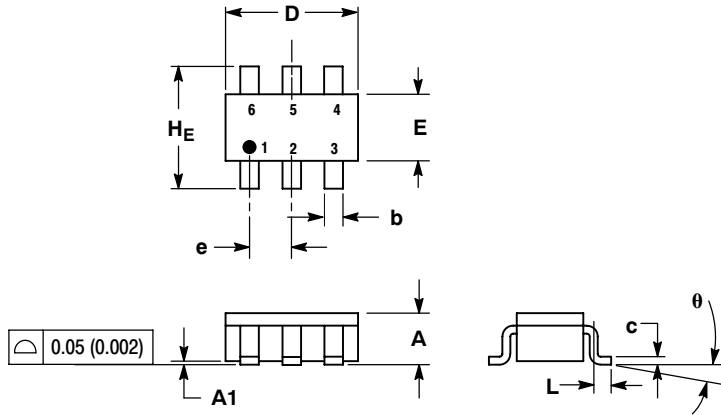


Figure 12. FET Thermal Response

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PACKAGE DIMENSIONS

TSOP-6 CASE 318G-02 ISSUE S

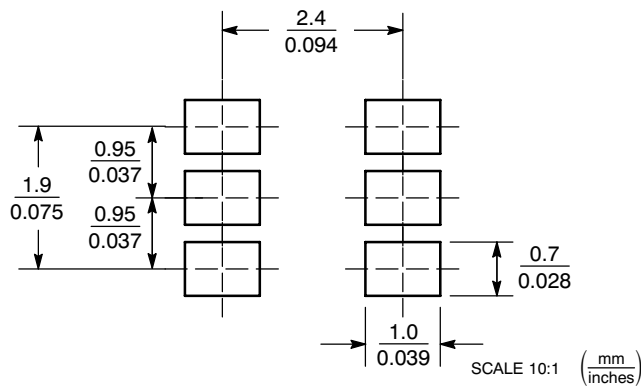


NOTES:

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

| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|--------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.90 | 1.00 | 1.10 | 0.035 | 0.039 | 0.043 |
| A1 | 0.01 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| b | 0.25 | 0.38 | 0.50 | 0.010 | 0.014 | 0.020 |
| c | 0.10 | 0.18 | 0.26 | 0.004 | 0.007 | 0.010 |
| D | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| E | 1.30 | 1.50 | 1.70 | 0.051 | 0.059 | 0.067 |
| e | 0.85 | 0.95 | 1.05 | 0.034 | 0.037 | 0.041 |
| L | 0.20 | 0.40 | 0.60 | 0.008 | 0.016 | 0.024 |
| HE | 2.50 | 2.75 | 3.00 | 0.099 | 0.108 | 0.118 |
| θ | 0° | - | 10° | 0° | - | 10° |

SOLDERING FOOTPRINT*



STYLE 1:

- PIN 1: DRAIN
 2: DRAIN
 3: GATE
 4: SOURCE
 5: DRAIN
 6: DRAIN

*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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