

NTHD3101F

MOSFET – Power, P-Channel, Schottky Diode, ChipFET, FETKY, Schottky Barrier Diode -20 V, -4.4 A, 4.1 A

Features

- Leadless SMD Package Featuring a MOSFET and Schottky Diode
- 40% Smaller than TSOP-6 Package
- Leadless SMD Package Provides Great Thermal Characteristics
- Independent Pinout to each Device to Ease Circuit Design
- Trench P-Channel for Low On Resistance
- Ultra Low V_F Schottky
- Pb-Free Packages are Available

Applications

- Li-Ion Battery Charging
- High Side DC-DC Conversion Circuits
- High Side Drive for Small Brushless DC Motors
- Power Management in Portable, Battery Powered Products

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

| Parameter | Symbol | Value | Units |
|---|------------------------|---|----------------------|
| Drain-to-Source Voltage | V_{DS} | -20 | V |
| Gate-to-Source Voltage | V_{GS} | ± 8.0 | V |
| Continuous Drain Current (Note 1) | Steady State | $T_J = 25^\circ\text{C}$ | -3.2 |
| | | $T_J = 85^\circ\text{C}$ | -2.3 |
| | | $t \leq 5 \text{ s}$, $T_J = 25^\circ\text{C}$ | -4.4 |
| Power Dissipation (Note 1) | Steady State | $T_J = 25^\circ\text{C}$ | 1.1 |
| | | | $t \leq 5 \text{ s}$ |
| Pulsed Drain Current | $t_p = 10 \mu\text{s}$ | I_{DM} | -13 |
| Operating Junction and Storage Temperature | T_J, T_{STG} | -55 to 150 | $^\circ\text{C}$ |
| Source Current (Body Diode) | I_S | 2.5 | A |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | T_L | 260 | $^\circ\text{C}$ |

SCHOTTKY DIODE MAXIMUM RATINGS

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

| Parameter | Symbol | Value | Units |
|---------------------------------|-----------|-------|-------|
| Peak Repetitive Reverse Voltage | V_{RRM} | 20 | V |
| DC Blocking Voltage | V_R | 20 | V |



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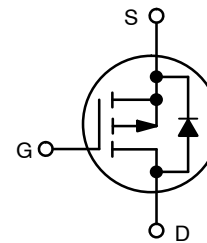
<http://onsemi.com>

MOSFET

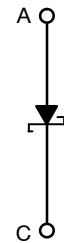
| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | I_D MAX |
|---------------|------------------------|-----------|
| -20 V | 64 m Ω @ -4.5 V | -4.4 A |
| | 85 m Ω @ -2.5 V | |

SCHOTTKY DIODE

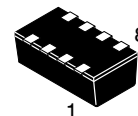
| V_R MAX | V_F TYP | I_F MAX |
|-----------|-----------|-----------|
| 20 V | 0.510 V | 4.1 A |



P-Channel MOSFET

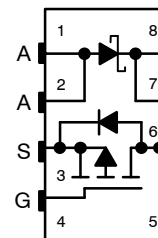


Schottky Diode

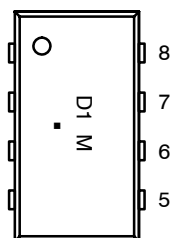


ChipFET
CASE 1206A
STYLE 3

PIN CONNECTIONS



MARKING DIAGRAM



- D1 = Specific Device Code
- M = Month Code
- = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

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SCHOTTKY DIODE MAXIMUM RATINGS

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

| Parameter | | Symbol | Value | Units |
|-----------------------------------|--------------|--------|-------|-------|
| Average Rectified Forward Current | Steady State | I_F | 2.2 | V |
| | $t \leq 5$ s | | 4.1 | A |

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 [1 oz] including traces).

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Units |
|--|-----------------|-----|--------------------|
| Junction-to-Ambient – Steady State (Note 2) | $R_{\theta JA}$ | 113 | $^\circ\text{C/W}$ |
| Junction-to-Ambient – $t \leq 10$ s (Note 2) | $R_{\theta JA}$ | 60 | $^\circ\text{C/W}$ |

2. Surface Mounted on FR4 Board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).

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

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|-------------------|--|-----|-----|-----------|----------------------------|
| 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 | $V_{(BR)DSS}/T_J$ | | | -15 | | $\text{mV}/^\circ\text{C}$ |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = -16$ V, $V_{GS} = 0$ V | | | -1.0 | μA |
| | | | | | -5.0 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0$ V, $V_{GS} = \pm 8.0$ V | | | ± 100 | nA |

ON CHARACTERISTICS (Note 3)

| | | | | | | |
|--|------------------|--|-------|-----|------|----------------------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}$, $I_D = -250$ μA | -0.45 | | -1.5 | V |
| Gate Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | 2.7 | | $\text{mV}/^\circ\text{C}$ |
| Drain-to-Source On-Resistance | $R_{DS(on)}$ | $V_{GS} = -4.5$ V, $I_D = -3.2$ A | | 64 | 80 | m Ω |
| | | $V_{GS} = -2.5$ V, $I_D = -2.2$ A | | 85 | 110 | |
| | | $V_{GS} = -1.8$ V, $I_D = -1.0$ A | | 120 | 170 | |
| Forward Transconductance | g_{FS} | $V_{DS} = -10$ V, $I_D = -2.9$ A | | 8.0 | | S |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|--------------|---|--|-----|--|----|
| Input Capacitance | C_{ISS} | $V_{GS} = 0$ V, $f = 1.0$ MHz, $V_{DS} = -10$ V | | 680 | | pF |
| Output Capacitance | C_{OSS} | | | 100 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 70 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = -4.5$ V, $V_{DS} = -10$ V, $I_D = -3.2$ A | | 7.4 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 0.6 | | |
| Gate-to-Source Charge | Q_{GS} | | | 1.4 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 2.5 | | |

SWITCHING CHARACTERISTICS (Note 4)

| | | | | | | |
|---------------------|--------------|---|--|------|--|----|
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = -4.5$ V, $V_{DD} = -10$ V, $I_D = -3.2$ A, $R_G = 2.4$ Ω | | 5.8 | | ns |
| Rise Time | t_r | | | 11.7 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 16 | | |
| Fall Time | t_f | | | 12.4 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-----------------------|----------|--------------------------------|--------------------------|--|------|------|---|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0$ V, $I_S = -2.5$ A | $T_J = 25^\circ\text{C}$ | | -0.8 | -1.2 | V |
|-----------------------|----------|--------------------------------|--------------------------|--|------|------|---|

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

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|-----------|--------|-----------------|-----|-----|-----|-------|
|-----------|--------|-----------------|-----|-----|-----|-------|

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | |
|-------------------------|----------|---|--|------|--|----|
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, I_S = -1.0\text{ A},$ $dI_S/dt = 100\text{ A}/\mu\text{s}$ | | 13.5 | | ns |
| Charge Time | t_a | | | 9.5 | | |
| Discharge Time | t_b | | | 4.0 | | |
| Reverse Recovery Charge | Q_{RR} | | | 6.5 | | nC |

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

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---------------------------------------|--------|----------------------|-----|-------|-------|---------------|
| Maximum Instantaneous Forward Voltage | V_F | $I_F = 0.1\text{ A}$ | | 0.425 | | V |
| | | $I_F = 1.0\text{ A}$ | | 0.510 | 0.575 | |
| Maximum Instantaneous Reverse Current | I_R | $V_R = 10\text{ V}$ | | | 1.0 | μA |
| | | $V_R = 20\text{ V}$ | | | 5.0 | |

3. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.
4. Switching characteristics are independent of operating junction temperatures.

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TYPICAL P-CHANNEL PERFORMANCE CURVES

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

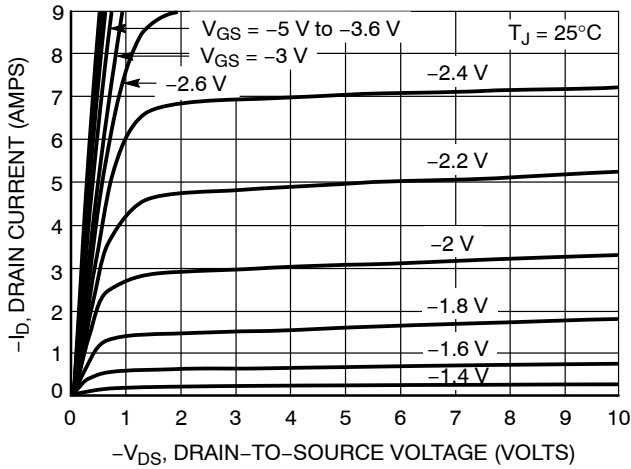


Figure 1. On-Region Characteristics

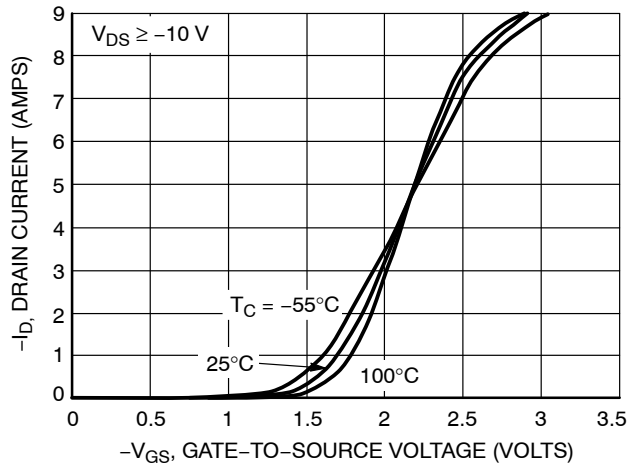


Figure 2. Transfer Characteristics

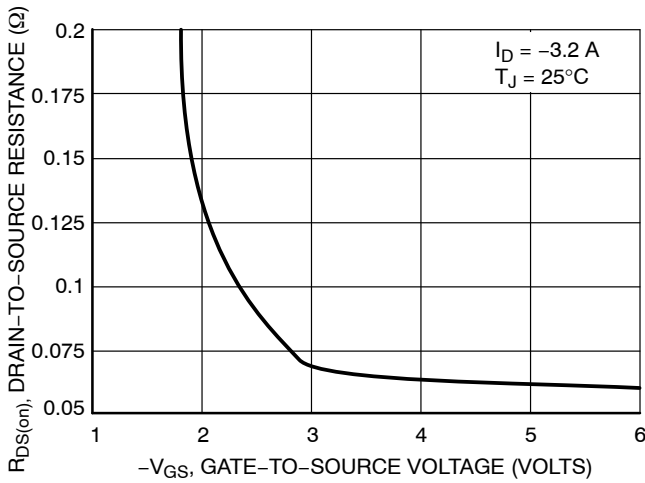


Figure 3. On-Resistance vs. Gate-to-Source Voltage

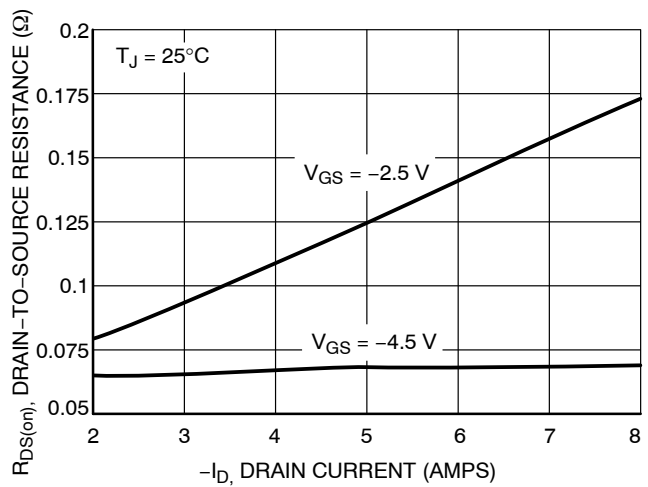


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

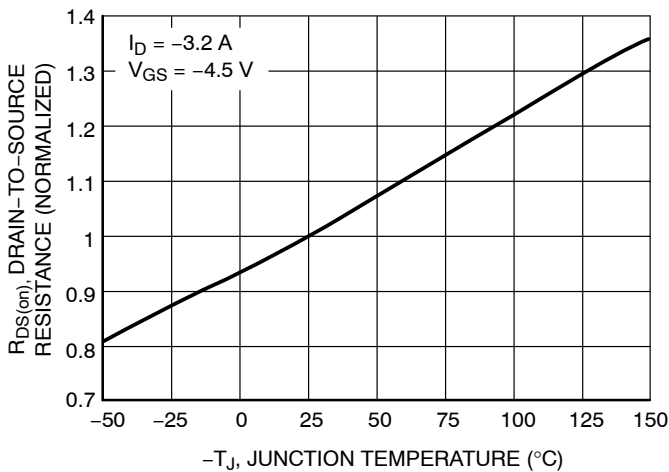


Figure 5. On-Resistance Variation with Temperature

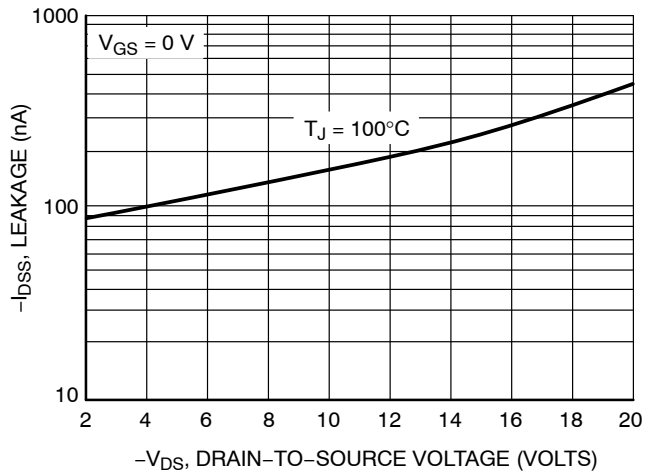


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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TYPICAL P-CHANNEL PERFORMANCE CURVES

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

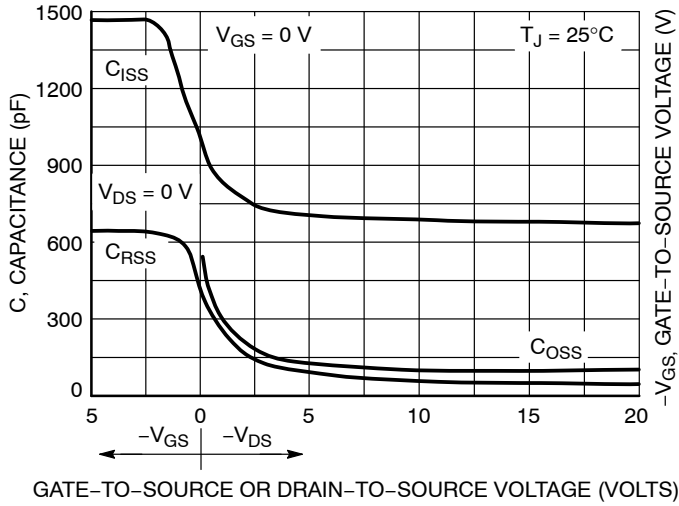


Figure 7. Capacitance Variation

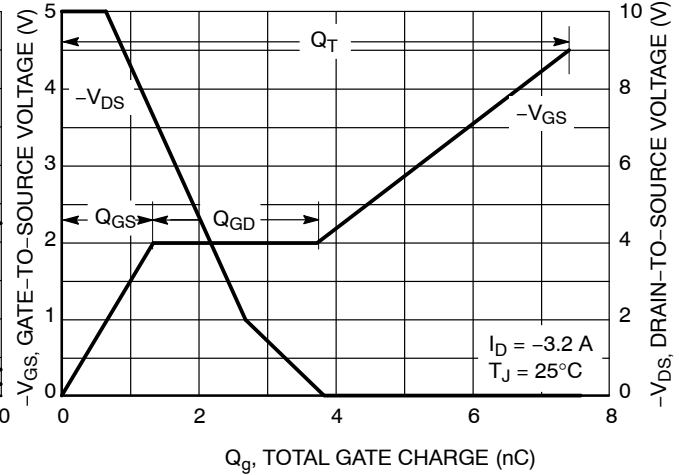


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

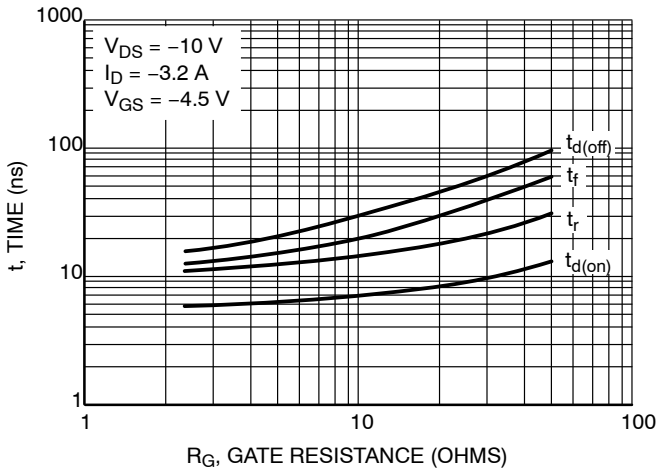


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

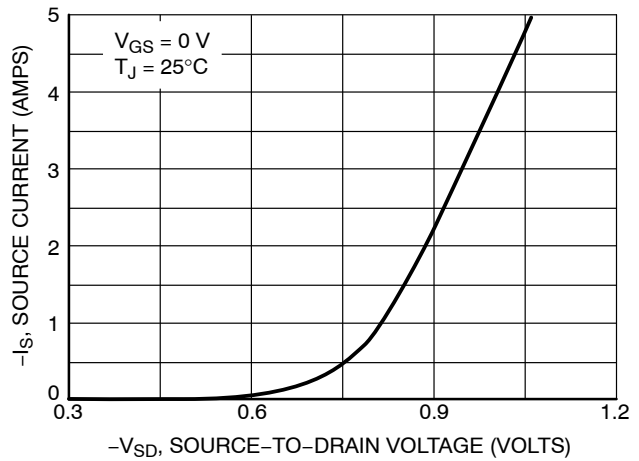


Figure 10. Diode Forward Voltage vs. Current

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

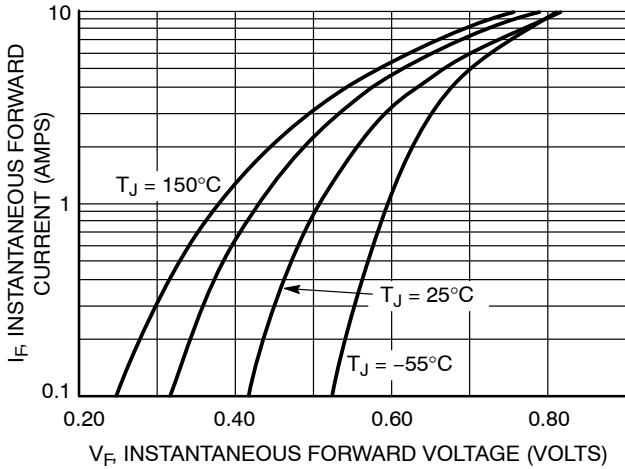


Figure 11. Typical Forward Voltage

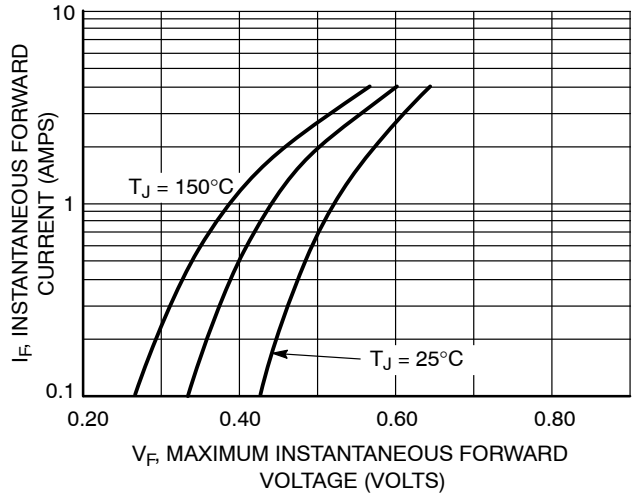


Figure 12. Maximum Forward Voltage

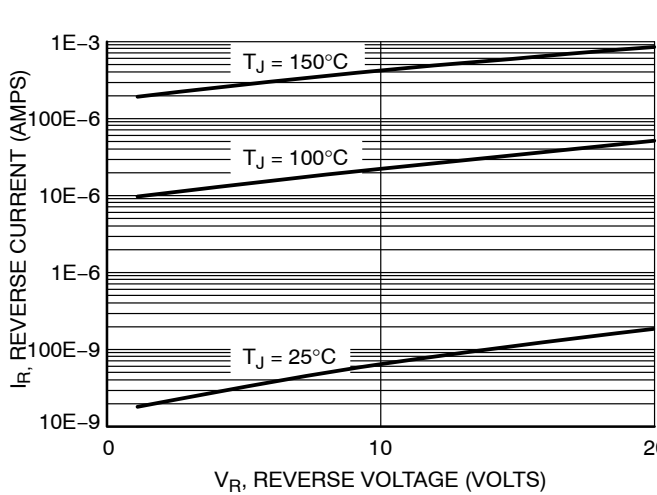


Figure 13. Typical Reverse Current

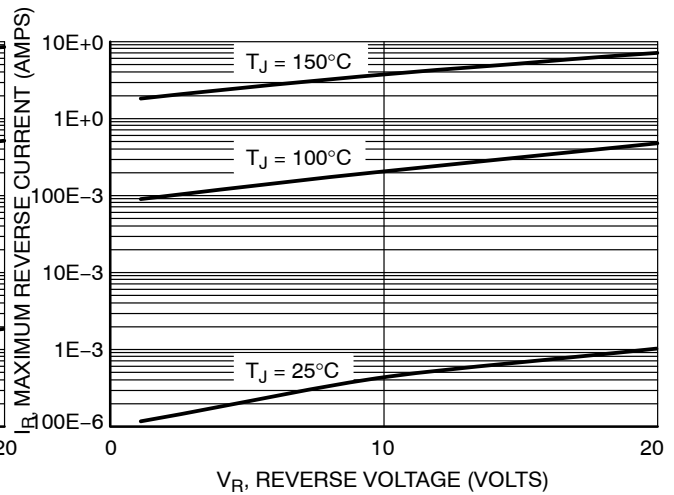


Figure 14. Maximum Reverse Current

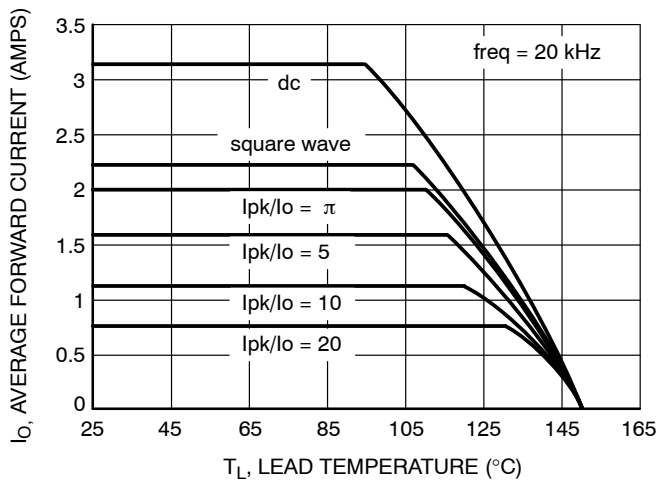


Figure 15. Current Derating

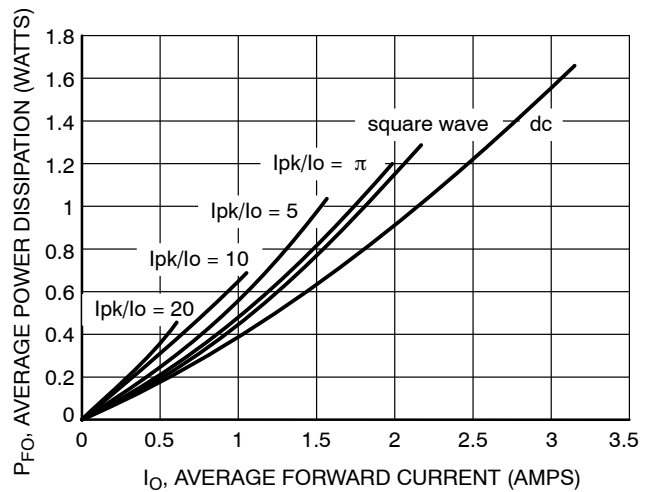


Figure 16. Forward Power Dissipation

NTHD3101F

DEVICE ORDERING INFORMATION

| Device | Package | Shipping† |
|--------------|----------------------|---------------------|
| NTHD3101FT1 | ChipFET | 3000 / Tape & Reel |
| NTHD3101FT1G | ChipFET (Pb-Free) | 3000 / Tape & Reel |
| NTHD3101FT3 | ChipFET | 10000 / Tape & Reel |
| NTHD3101FT3G | ChipFET (Pb-Free) | 10000 / 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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FETKY is a registered trademark of International Rectifier Corporation.

MECHANICAL CASE OUTLINE

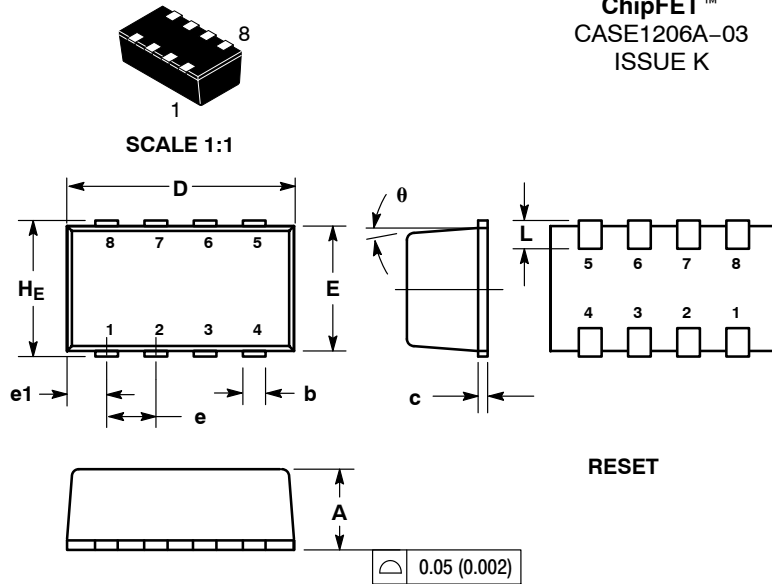
PACKAGE DIMENSIONS

ON Semiconductor®



ChipFET™
CASE1206A-03
ISSUE K

DATE 19 MAY 2009



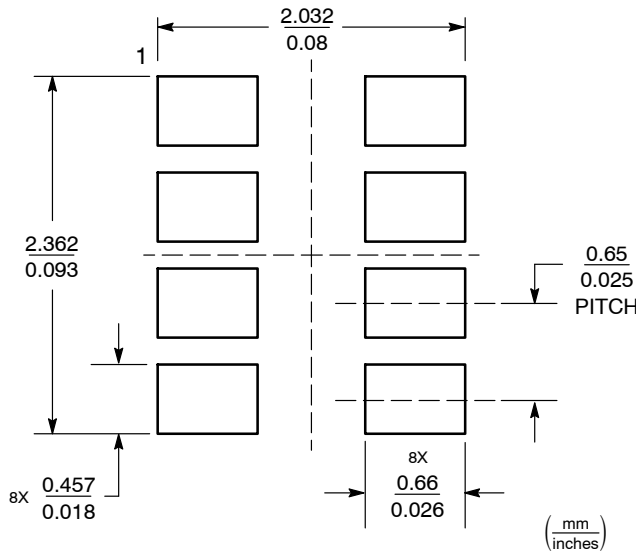
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MOLD GATE BURRS SHALL NOT EXCEED 0.13 MM PER SIDE.
4. LEADFRAME TO MOLDED BODY OFFSET IN HORIZONTAL AND VERTICAL SHALL NOT EXCEED 0.08 MM.
5. DIMENSIONS A AND B EXCLUSIVE OF MOLD GATE BURRS.
6. NO MOLD FLASH ALLOWED ON THE TOP AND BOTTOM LEAD SURFACE.

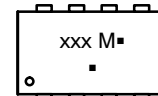
| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|-----------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.00 | 1.05 | 1.10 | 0.039 | 0.041 | 0.043 |
| b | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |
| c | 0.10 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| D | 2.95 | 3.05 | 3.10 | 0.116 | 0.120 | 0.122 |
| E | 1.55 | 1.65 | 1.70 | 0.061 | 0.065 | 0.067 |
| e | 0.65 BSC | | | 0.025 BSC | | |
| e1 | 0.55 BSC | | | 0.022 BSC | | |
| L | 0.28 | 0.35 | 0.42 | 0.011 | 0.014 | 0.017 |
| HE | 1.80 | 1.90 | 2.00 | 0.071 | 0.075 | 0.079 |
| θ | 5° NOM | | | 5° NOM | | |

- | | | | | | |
|---|---|---|--|---|---|
| <p>STYLE 1: PIN 1. DRAIN 2. DRAIN 3. DRAIN 4. GATE 5. SOURCE 6. DRAIN 7. DRAIN 8. DRAIN</p> | <p>STYLE 2: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. DRAIN 2 7. DRAIN 1 8. DRAIN 1</p> | <p>STYLE 3: PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE</p> | <p>STYLE 4: PIN 1. COLLECTOR 2. COLLECTOR 3. COLLECTOR 4. BASE 5. EMITTER 6. COLLECTOR 7. COLLECTOR 8. COLLECTOR</p> | <p>STYLE 5: PIN 1. ANODE 2. ANODE 3. DRAIN 4. DRAIN 5. SOURCE 6. GATE 7. CATHODE 8. CATHODE</p> | <p>STYLE 6: PIN 1. ANODE 2. DRAIN 3. DRAIN 4. GATE 5. SOURCE 6. DRAIN 7. DRAIN 8. CATHODE / DRAIN</p> |
|---|---|---|--|---|---|

SOLDERING FOOTPRINT



GENERIC MARKING DIAGRAM*



- xxx = Specific Device Code
 - M = Month Code
 - = Pb-Free Package
- (Note: Microdot may be in either location)

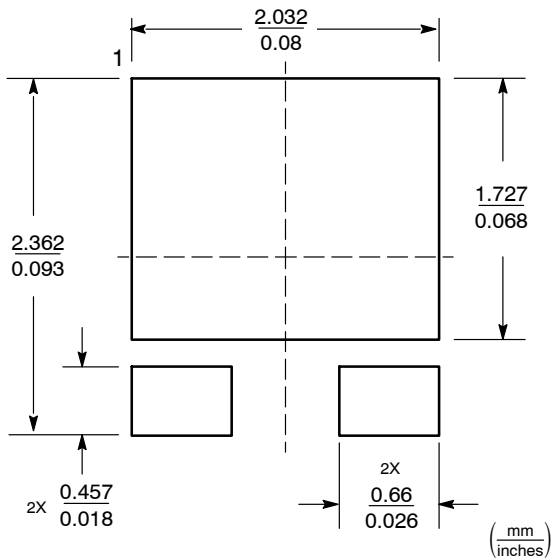
*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

OPTIONAL SOLDERING FOOTPRINTS ON PAGE 2

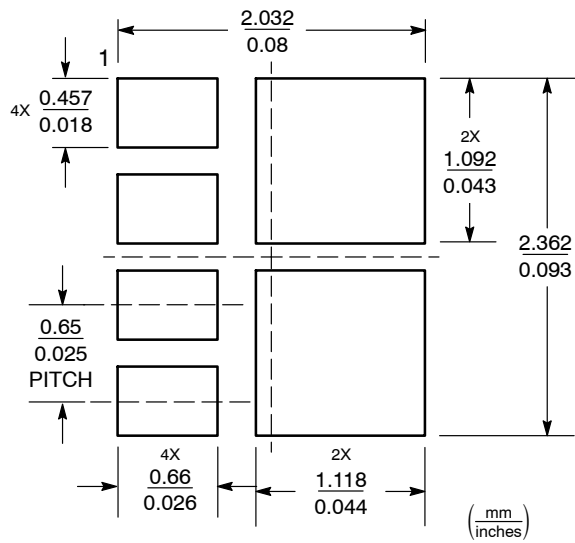
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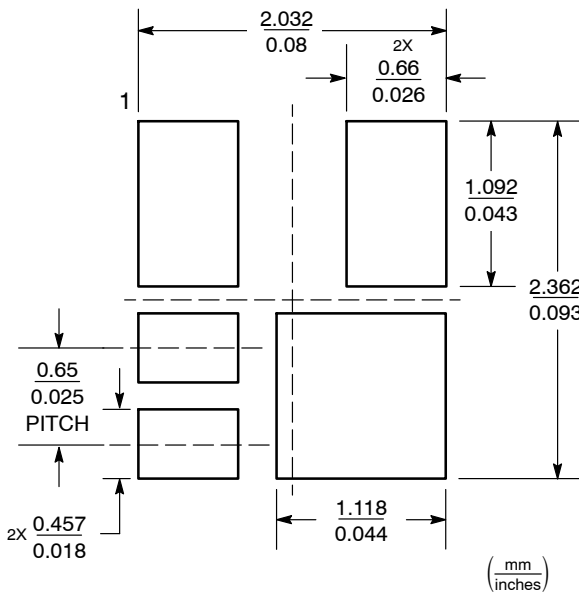
ADDITIONAL SOLDERING FOOTPRINTS*



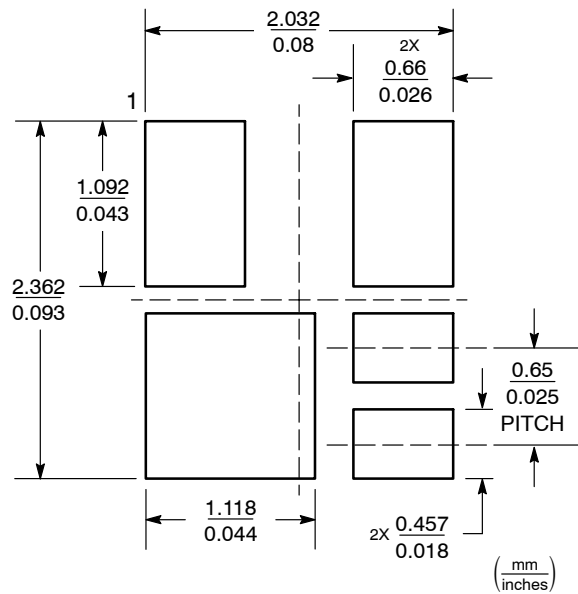
Styles 1 and 4



Style 2



Style 3



Style 5

*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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