

NTLGF3402P

MOSFET – Power, P-Channel, Schottky Diode, Schottky Barrier Diode, FETKY, DFN6

-20 V, -3.9 A, 2.0 A

Features

- Flat Lead 6 Terminal Package 3x3x1 mm
- Enhanced Thermal Characteristics
- Low V_F and Low Leakage Schottky Diode
- Reduced Gate Charge to Improve Switching Response
- This is a Pb-Free Device

Applications

- Buck Converter
- High Side DC-DC Conversion Circuits
- Power Management in Portable, HDD and Computing

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

| Parameter | | Symbol | Value | Unit | |
|---|-------------------------|--------------------------|--------------------------|------------------|---|
| Drain-to-Source Voltage | | V_{DSS} | -20 | V | |
| Gate-to-Source Voltage | | V_{GS} | ± 12 | V | |
| Continuous Drain Current (Note 1) | Steady State | $T_A = 25^\circ\text{C}$ | I_D | -2.7 | A |
| | | | $T_A = 85^\circ\text{C}$ | -2.0 | |
| | $t \leq 10\text{ s}$ | $T_A = 25^\circ\text{C}$ | I_D | -3.9 | |
| Power Dissipation (Note 1) | Steady State | $T_A = 25^\circ\text{C}$ | P_D | 1.6 | W |
| | $t \leq 10\text{ s}$ | | P_D | 3.0 | |
| Continuous Drain Current (Note 2) | Steady State | $T_A = 25^\circ\text{C}$ | I_D | -2.3 | A |
| | | $T_A = 85^\circ\text{C}$ | I_D | -1.7 | |
| | | $T_A = 25^\circ\text{C}$ | P_D | 1.14 | |
| Pulsed Drain Current | $t_p = 10\ \mu\text{s}$ | I_{DM} | 11 | A | |
| Operating Junction and Storage Temperature | | T_J, T_{STG} | -55 to 150 | $^\circ\text{C}$ | |
| Source Current (Body Diode) | | I_S | 1.1 | A | |
| 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 [1 oz] including traces).
2. Surface Mounted on FR4 Board using the minimum recommended pad size (Cu area = 0.5 in sq).



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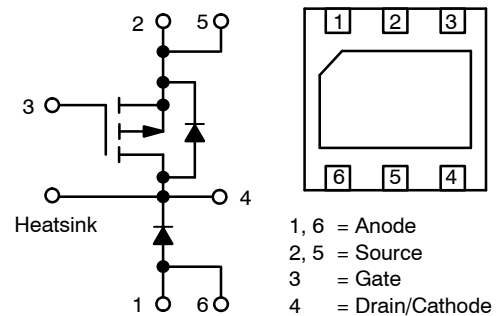
<http://onsemi.com>

MOSFET

| $V_{(BR)DSS}$ | $R_{DS(on)}$ TYP | I_D MAX |
|---------------|-------------------------|-----------|
| -20 V | 110 m Ω @ -4.5 V | -3.9 A |

SCHOTTKY DIODE

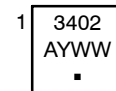
| V_R MAX | V_F TYP | I_F MAX |
|-----------|-----------|-----------|
| 20 V | 0.36 V | 2.0 A |



MARKING DIAGRAMS



**DFN6
CASE 506AH**



3402 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package

ORDERING INFORMATION

| Device | Package | Shipping† |
|---------------|----------------|--------------------|
| NTLGF3402PT1G | DFN6 (Pb-Free) | 3000 / Tape & Reel |
| NTLGF3402PT2G | DFN6 (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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SCHOTTKY DIODE MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Max | Unit |
|-----------------------------------|-----------|-----|------|
| Peak Repetitive Reverse Voltage | V_{RRM} | 20 | V |
| DC Blocking Voltage | V_R | 20 | V |
| Average Rectified Forward Current | I_F | 2.0 | A |

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Unit |
|--|-----------------|-----|---------------------------|
| Junction-to-Ambient – Steady State (Note 2) | $R_{\theta JA}$ | 110 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – $t \leq 10$ s (Note 2) | $R_{\theta JA}$ | 58 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – Steady State (Note 3) | $R_{\theta JA}$ | 79 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – $t \leq 10$ s (Note 3) | $R_{\theta JA}$ | 41 | $^\circ\text{C}/\text{W}$ |

3. 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 | 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 | $V_{(BR)DSS}/T_J$ | | | -9.0 | | $\text{mV}/^\circ\text{C}$ |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = -16$ V, $V_{GS} = 0$ V | $T_J = 25^\circ\text{C}$ | | -1.0 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | -5.0 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0$ V, $V_{GS} = \pm 12$ V | | | ± 100 | nA |

ON CHARACTERISTICS (Note 4)

| | | | | | | |
|--|------------------|--|------|-----|------|----------------------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}$, $I_D = -250$ μA | -0.6 | | -2.0 | 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, $I_D = -2.7$ A | | 110 | 140 | $\text{m}\Omega$ |
| | | $V_{GS} = -2.5$ V, $I_D = -1.0$ A | | 190 | 225 | |
| Forward Transconductance | g_{FS} | $V_{DS} = -10$ V, $I_D = -2.7$ A | | 4.8 | | S |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|--------------|--|--|------|-----|----|
| Input Capacitance | C_{ISS} | $V_{GS} = 0$ V, $f = 1.0$ MHz, $V_{DS} = -10$ V | | 230 | 350 | pF |
| Output Capacitance | C_{OSS} | | | 105 | 225 | |
| Reverse Transfer Capacitance | C_{RSS} | | | 40 | 75 | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = -4.5$ V, $V_{DS} = -10$ V, $I_D = -2.7$ A | | 3.8 | 10 | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 0.32 | | |
| Gate-to-Source Charge | Q_{GS} | | | 0.7 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 1.6 | | |

SWITCHING CHARACTERISTICS (Note 5)

| | | | | | | |
|---------------------|--------------|--|--|-----|----|----|
| Turn-On Delay Time | $t_{d(ON)}$ | $V_{GS} = -4.5$ V, $V_{DD} = -16$ V, $I_D = -2.7$ A, $R_G = 2.4$ Ω | | 6.2 | 15 | ns |
| Rise Time | t_r | | | 22 | 30 | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | 25 | 45 | |
| Fall Time | t_f | | | 34 | 60 | |

4. Pulse Test: Pulse Width ≤ 300 μs , Duty Cycle $\leq 2\%$.

5. Switching characteristics are independent of operating junction temperatures.

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

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

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|----------|---|--------------------------|--|------|------|----|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V}, I_S = -1.1\text{ A}$ | $T_J = 25^\circ\text{C}$ | | -0.8 | -1.2 | V |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, I_S = -1.1\text{ A},$ $di_S/dt = 100\text{ A}/\mu\text{s}$ | | | 53 | | ns |
| Charge Time | t_a | | | | 15 | | |
| Discharge Time | t_b | | | | 38 | | |
| Reverse Recovery Charge | Q_{RR} | | | | 37 | | |

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

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|---------------------------------------|--------|---|-----|------|------|---------------|
| Maximum Instantaneous Forward Voltage | V_F | $I_F = 0.1\text{ A}$ | | 0.32 | 0.34 | V |
| | | $I_F = 1.0\text{ A}$ | | 0.36 | 0.39 | |
| Maximum Instantaneous Reverse Current | I_R | $V_R = 5\text{ V}, T_J = 100^\circ\text{C}$ | | | 12 | mA |
| | | $V_R = 10\text{ V}$ | | 70 | | μA |
| | | $V_R = 20\text{ V}$ | | 225 | | |

6. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

7. 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)

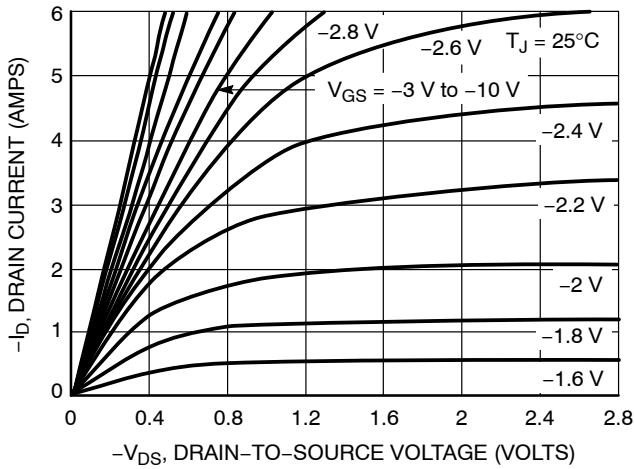


Figure 1. On-Region Characteristics

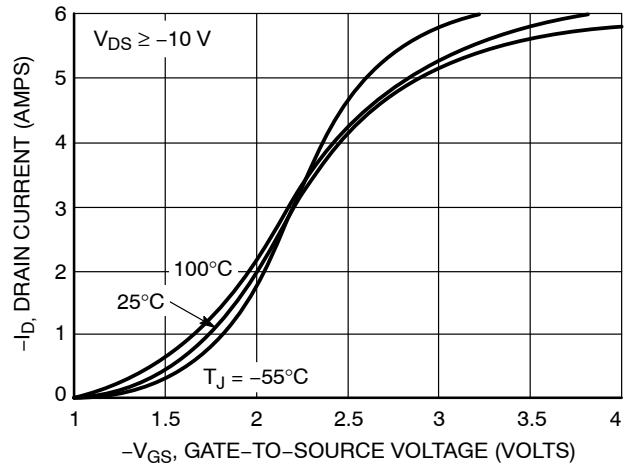


Figure 2. Transfer Characteristics

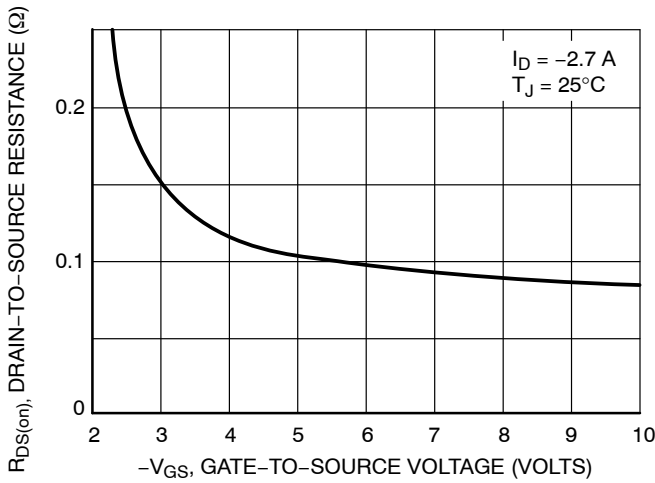


Figure 3. On-Resistance vs. Gate-to-Source Voltage

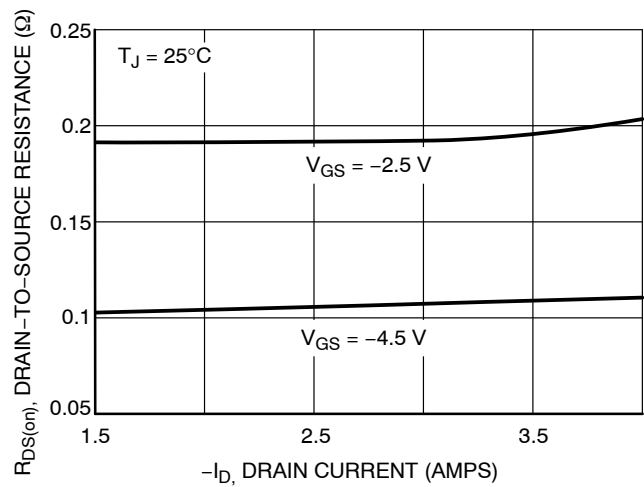


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

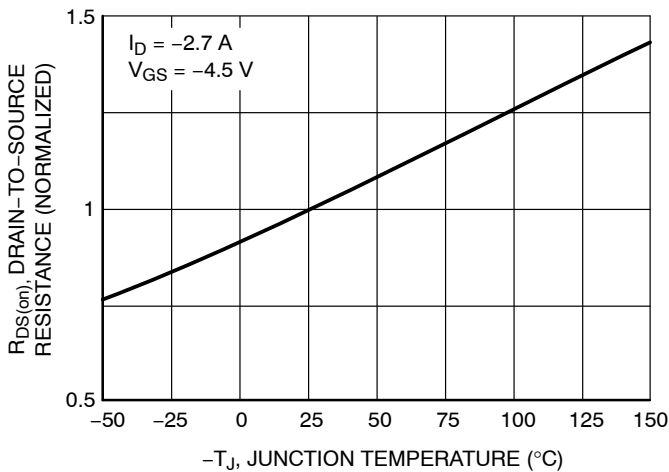


Figure 5. On-Resistance Variation with Temperature

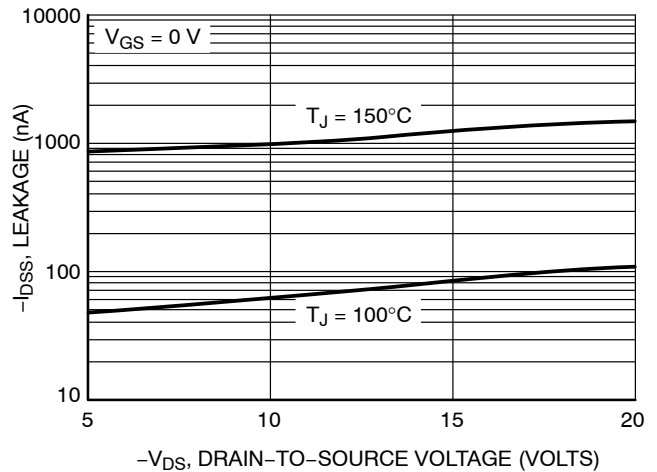


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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TYPICAL P-CHANNEL PERFORMANCE CURVES

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

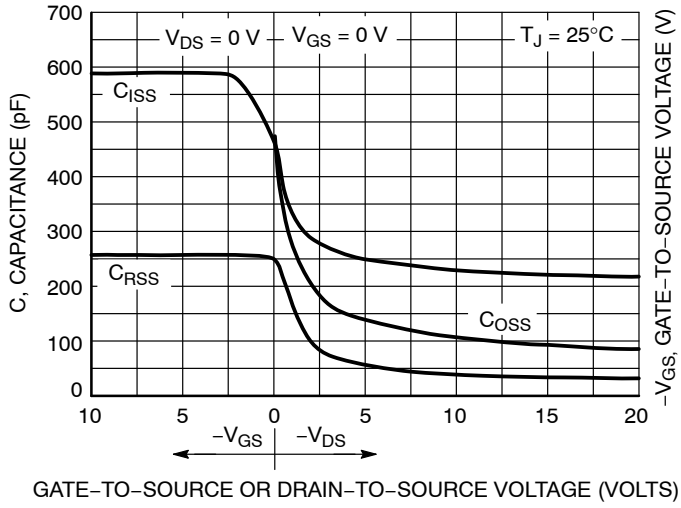


Figure 7. Capacitance Variation

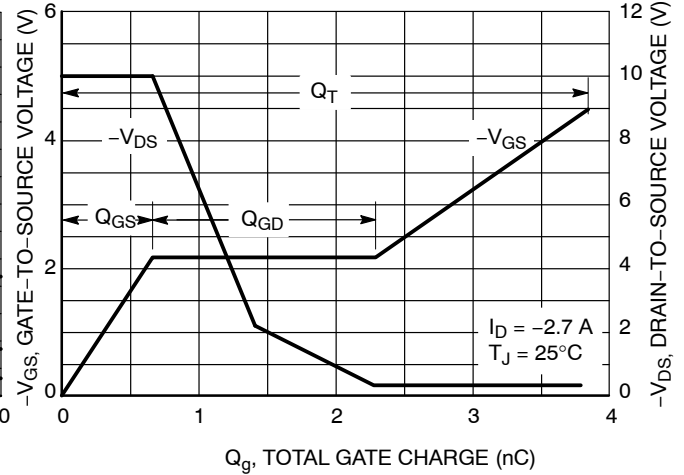


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

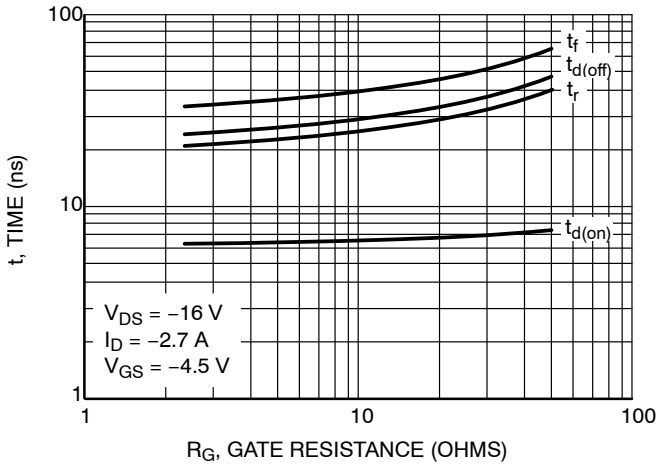


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

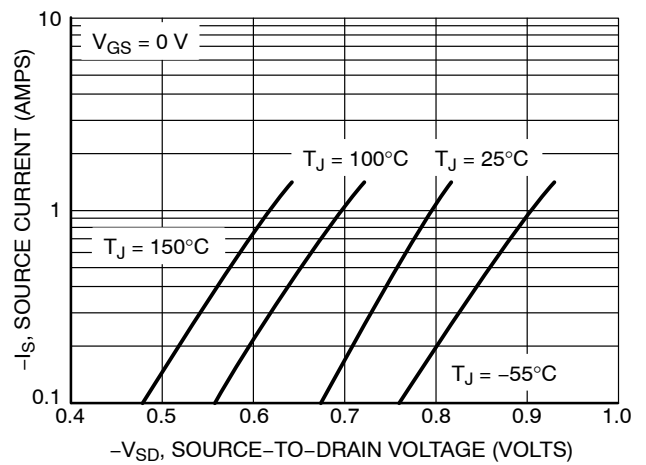


Figure 10. Diode Forward Voltage vs. Current

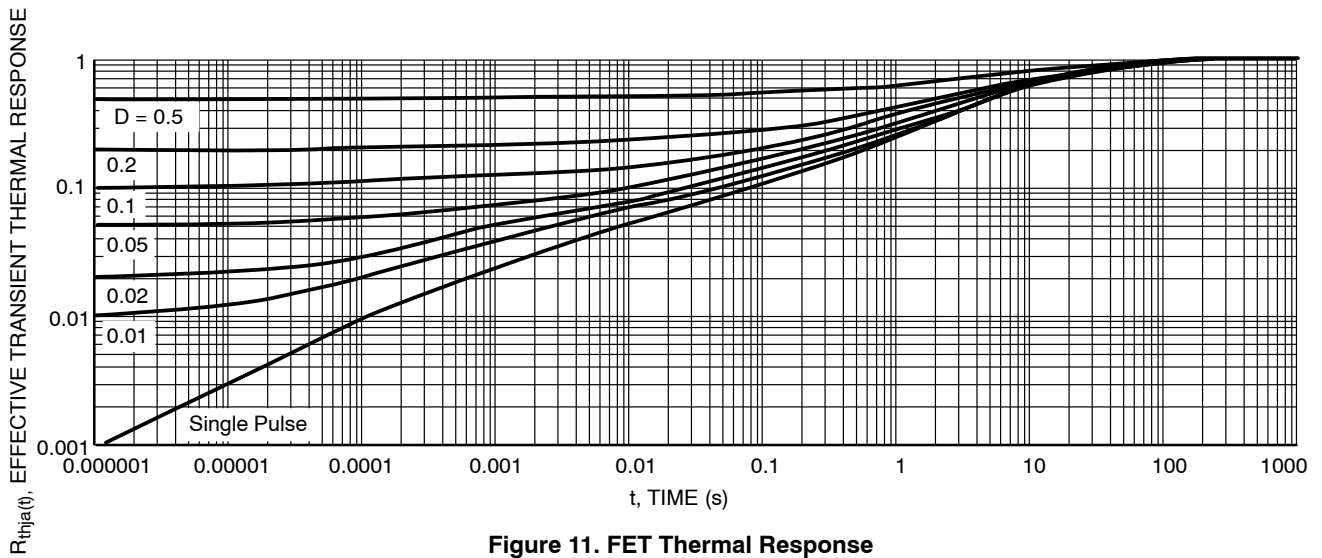


Figure 11. FET Thermal Response

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

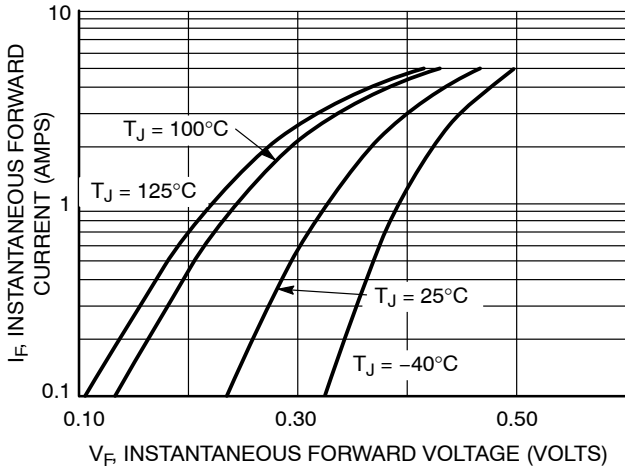


Figure 12. Typical Forward Voltage

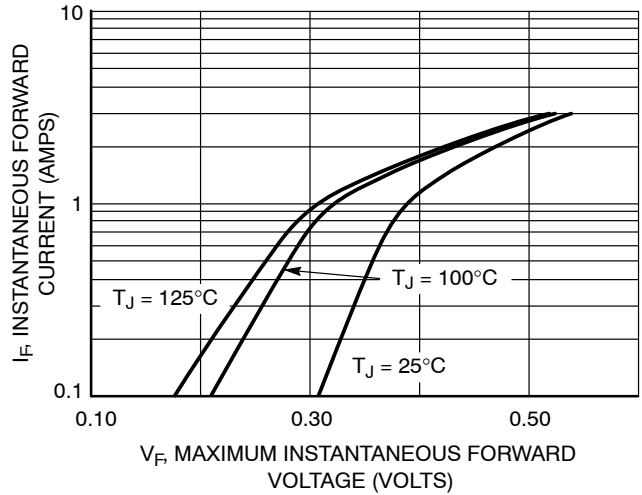


Figure 13. Maximum Forward Voltage

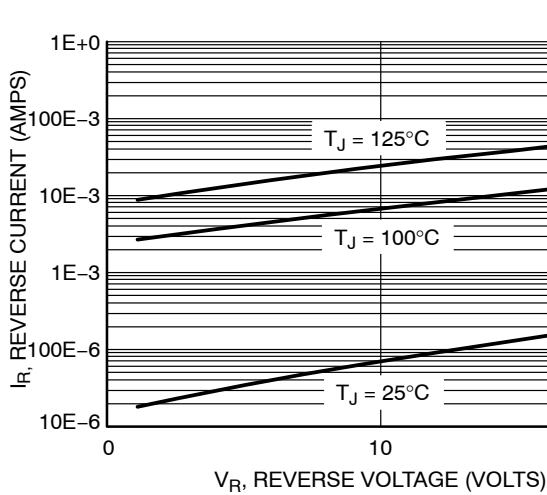


Figure 14. Typical Reverse Current

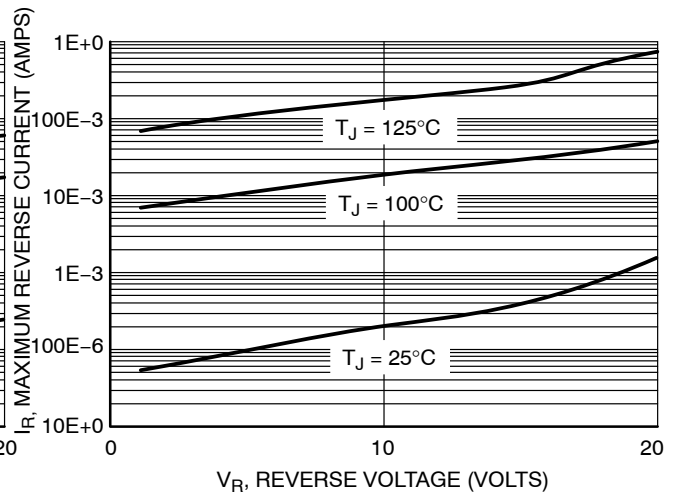


Figure 15. Maximum Reverse Current

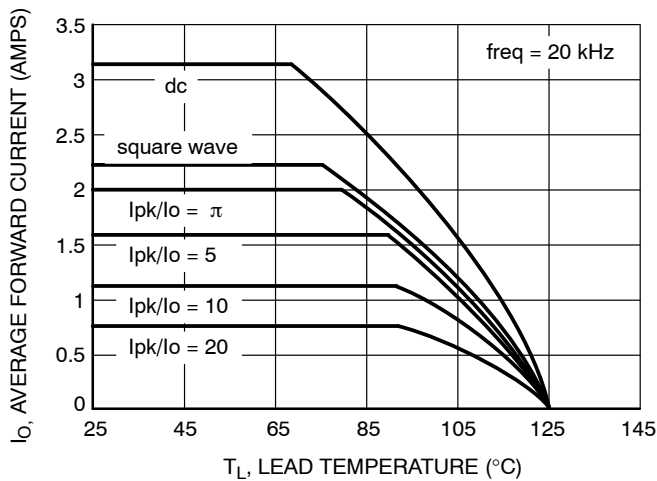


Figure 16. Current Derating

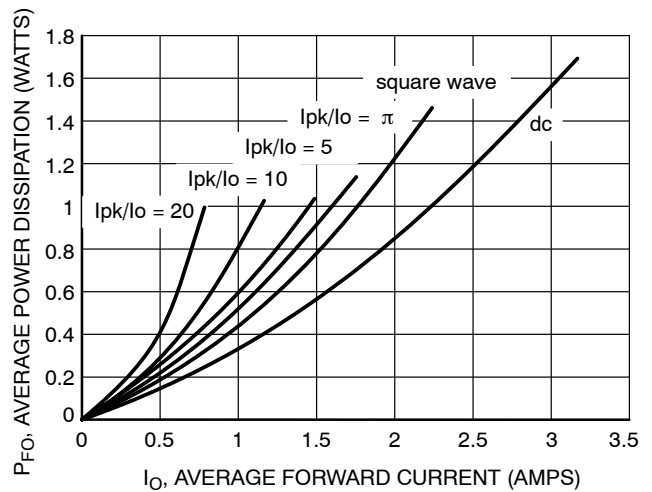


Figure 17. Forward Power Dissipation

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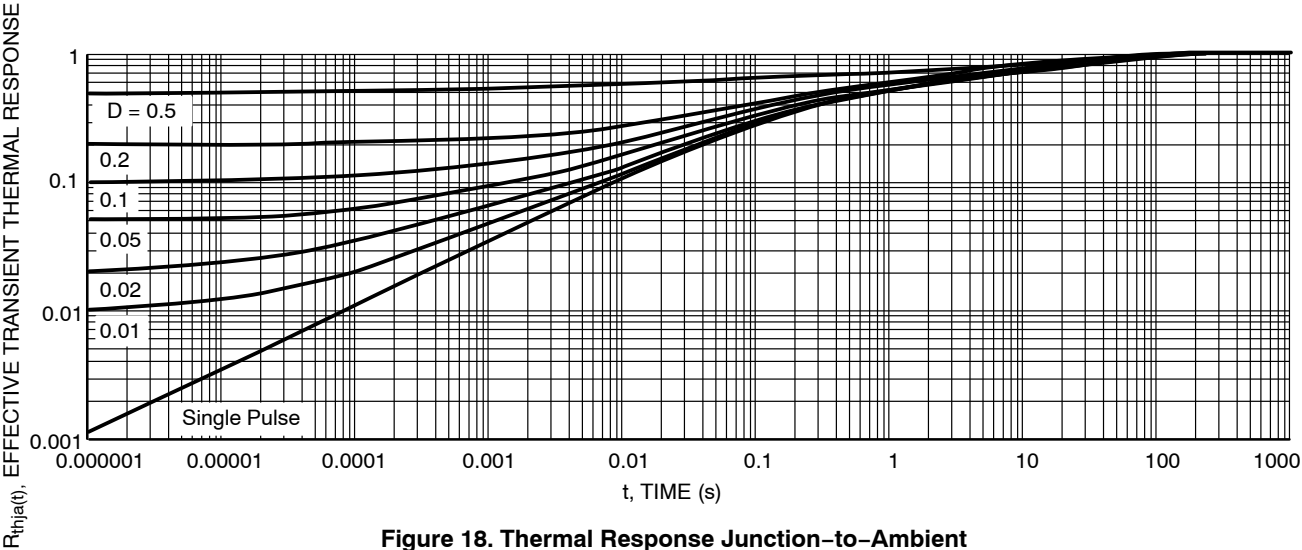


Figure 18. Thermal Response Junction-to-Ambient

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MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

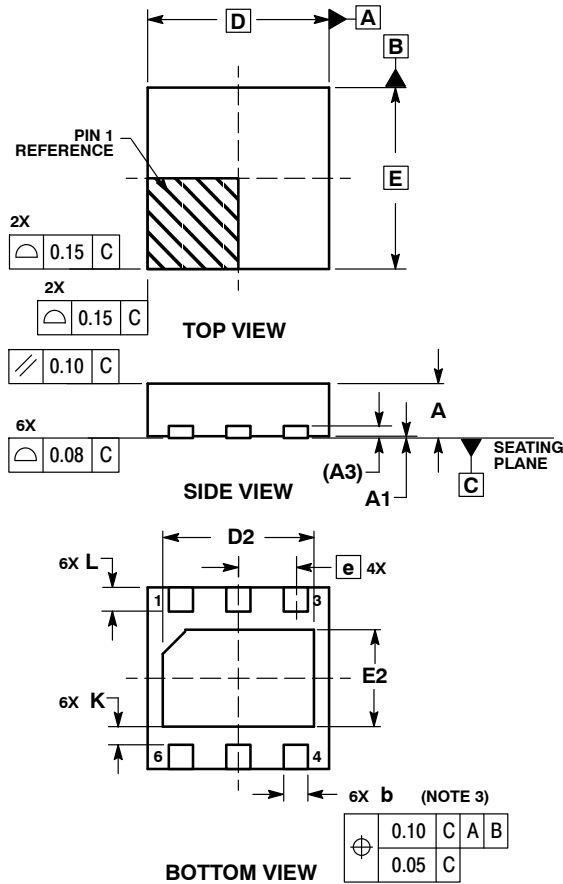
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1
SCALE 2:1

DFN6 3*3 MM, 0.95 PITCH
CASE 506AH-01
ISSUE O

DATE 17 NOV 2004

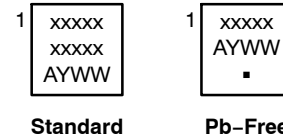


NOTES:

1. DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

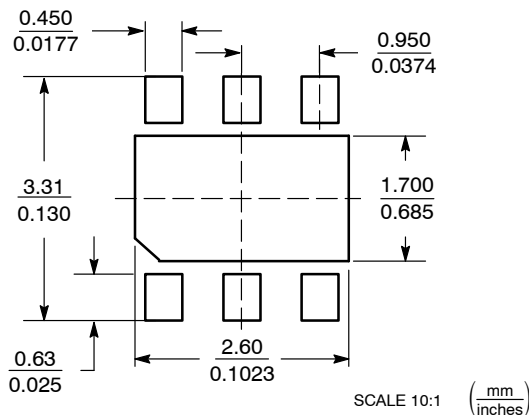
| MILLIMETERS | | | |
|-------------|----------|------|------|
| DIM | MIN | NOM | MAX |
| A | 0.80 | 0.90 | 1.00 |
| A1 | 0.00 | 0.03 | 0.05 |
| A3 | 0.20 REF | | |
| b | 0.35 | 0.40 | 0.45 |
| D | 3.00 BSC | | |
| D2 | 2.40 | 2.50 | 2.60 |
| E | 3.00 BSC | | |
| E2 | 1.50 | 1.60 | 1.70 |
| e | 0.95 BSC | | |
| K | 0.21 | --- | --- |
| L | 0.30 | 0.40 | 0.50 |

GENERIC MARKING DIAGRAM*



- xxxxx = Specific Device Code
 A = Assembly Location
 Y = Year
 WW = Work Week
 ■ = Pb-Free Package

SOLDERING FOOTPRINT*



*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.

*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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| DESCRIPTION: | DFN6 3*3 MM, 0.95 PITCH, SINGLE FLAG | PAGE 1 OF 1 |

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