

NTMSD3P102R2

FETKY™

P-Channel Enhancement-Mode Power MOSFET and Schottky Diode Dual SO-8 Package

Features

- High Efficiency Components in a Single SO-8 Package
- High Density Power MOSFET with Low $R_{DS(on)}$, Schottky Diode with Low V_F
- Independent Pin-Outs for MOSFET and Schottky Die Allowing for Flexibility in Application Use
- Less Component Placement for Board Space Savings
- SO-8 Surface Mount Package, Mounting Information for SO-8 Package Provided
- Pb-Free Packages are Available

Applications

- DC-DC Converters
- Low Voltage Motor Control
- Power Management in Portable and Battery-Powered Products, i.e.: Computers, Printers, PCMCIA Cards, Cellular and Cordless Telephones

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

| Rating | Symbol | Value | Unit |
|---|--|---------------------------------------|--|
| Drain-to-Source Voltage | V_{DS} | -20 | V |
| Gate-to-Source Voltage - Continuous | V_{GS} | ± 20 | V |
| Thermal Resistance - Junction-to-Ambient (Note 1) Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 70^\circ\text{C}$ Pulsed Drain Current (Note 4) | $R_{\theta JA}$ P_D I_D I_D I_{DM} | 171 0.73 -2.34 -1.87 -8.0 | $^\circ\text{C/W}$ W A A A |
| Thermal Resistance - Junction-to-Ambient (Note 2) Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 70^\circ\text{C}$ Pulsed Drain Current (Note 4) | $R_{\theta JA}$ P_D I_D I_D I_{DM} | 100 1.25 -3.05 -2.44 -12 | $^\circ\text{C/W}$ W A A A |
| Thermal Resistance - Junction-to-Ambient (Note 3) Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $T_A = 70^\circ\text{C}$ Pulsed Drain Current (Note 4) | $R_{\theta JA}$ P_D I_D I_D I_{DM} | 62.5 2.0 -3.86 -3.10 -15 | $^\circ\text{C/W}$ W A A A |
| Operating and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |
| Single Pulse Drain-to-Source Avalanche Energy - Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = -20\text{ Vdc}$, $V_{GS} = -4.5\text{ Vdc}$, Peak $I_L = -7.5\text{ Apk}$, $L = 5\text{ mH}$, $R_G = 25\ \Omega$) | E_{AS} | 140 | mJ |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | 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. Minimum FR-4 or G-10 PCB, Steady State.
2. Mounted onto a 2" square FR-4 Board (1 in sq, 2 oz Cu 0.06" thick single-sided), Steady State.
3. Mounted onto a 2" square FR-4 Board (1 in sq, 2 oz Cu 0.06" thick single sided), $t \leq 10$ seconds.
4. Pulse Test: Pulse Width = 300 μs , Duty Cycle = 2%.

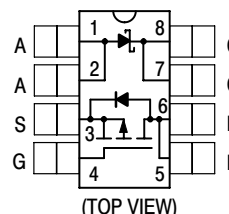


ON Semiconductor®

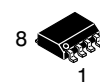
<http://onsemi.com>

MOSFET
-3.05 AMPERES
-20 VOLTS
0.085 Ω @ $V_{GS} = -10\text{ V}$

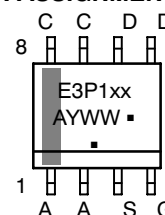
SCHOTTKY DIODE
1.0 AMPERE
20 VOLTS
470 mV @ $I_F = 1.0\text{ A}$



MARKING DIAGRAM & PIN ASSIGNMENT



SO-8
CASE 751
STYLE 18



E3P1 = Device Code
xx = 02 or S
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb-Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping† |
|----------------|-------------------|------------------|
| NTMSD3P102R2 | SO-8 | 2500/Tape & Reel |
| NTMSD3P102R2G | SO-8 (Pb-Free) | 2500/Tape & Reel |
| NTMSD3P102R2SG | SO-8 (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 Specification Brochure, BRD8011/D.

NTMSD3P102R2

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

| Rating | Symbol | Value | Unit |
|--|------------------------------------|-------|------|
| Peak Repetitive Reverse Voltage DC Blocking Voltage | V _{RRM} V _R | 20 | V |
| Thermal Resistance - Junction-to-Ambient (Note 5) | R _{θJA} | 204 | °C/W |
| Thermal Resistance - Junction-to-Ambient (Note 6) | R _{θJA} | 122 | °C/W |
| Thermal Resistance - Junction-to-Ambient (Note 7) | R _{θJA} | 83 | °C/W |
| Average Forward Current (Note 7) (Rated V _R , T _A = 100°C) | I _O | 1.0 | A |
| Peak Repetitive Forward Current (Note 7) (Rated V _R , Square Wave, 20 kHz, T _A = 105°C) | I _{FRM} | 2.0 | A |
| Non-Repetitive Peak Surge Current (Note 7) (Surge Applied at Rated Load Conditions, Half-Wave, Single Phase, 60 Hz) | I _{FSM} | 20 | 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.

5. Minimum FR-4 or G-10 PCB, Steady State.

6. Mounted onto a 2" square FR-4 Board (1 in sq, 2 oz Cu 0.06" thick single-sided), Steady State.

7. Mounted onto a 2" square FR-4 Board (1 in sq, 2 oz Cu 0.06" thick single sided), t ≤ 10 seconds.

SCHOTTKY ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (Note 8)

| Characteristic | Symbol | Value | | Unit |
|---|----------------|-------------------------------|------------------------------|-------|
| Maximum Instantaneous Forward Voltage I _F = 1.0 Adc I _F = 2.0 Adc | V _F | T _J = 25°C | T _J = 125°C | Volts |
| Maximum Instantaneous Forward Voltage I _F = 1.0 Adc I _F = 2.0 Adc | V _F | 0.47 0.58 | 0.39 0.53 | Volts |
| Maximum Instantaneous Reverse Current V _R = 20 Vdc | I _R | T _J = 25°C 0.05 | T _J = 125°C 10 | mA |
| Maximum Voltage Rate of Change V _R = 20 Vdc | dV/dt | 10,000 | | V/μs |

8. Indicates Pulse Test: Pulse Width = 300 μs max, Duty Cycle = 2%.

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MOSFET ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (Note 9)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|--|----------------------|----------|----------|-------------|--------------|
| Drain-to-Source Breakdown Voltage (V _{GS} = 0 Vdc, I _D = -250 µAdc) Temperature Coefficient (Positive) | V _{(BR)DSS} | -20 - | - -30 | - - | Vdc mV/°C |
| Zero Gate Voltage Drain Current (V _{DS} = -20 Vdc, V _{GS} = 0 Vdc, T _J = 25°C) (V _{DS} = -20 Vdc, V _{GS} = 0 Vdc, T _J = 125°C) | I _{DSS} | - - | - - | -1.0 -25 | µAdc |
| Gate-Body Leakage Current (V _{GS} = -20 Vdc, V _{DS} = 0 Vdc) | I _{GSS} | - | - | -100 | nAdc |
| Gate-Body Leakage Current (V _{GS} = +20 Vdc, V _{DS} = 0 Vdc) | I _{GSS} | - | - | 100 | nAdc |

ON CHARACTERISTICS

| | | | | | |
|--|---------------------|-----------|----------------|----------------|------|
| Gate Threshold Voltage (V _{DS} = V _{GS} , I _D = -250 µAdc) Temperature Coefficient (Negative) | V _{GS(th)} | -1.0 - | -1.7 3.6 | -2.5 - | Vdc |
| Static Drain-to-Source On-State Resistance (V _{GS} = -10 Vdc, I _D = -3.05 Adc) (V _{GS} = -4.5 Vdc, I _D = -1.5 Adc) | R _{DS(on)} | - - | 0.063 0.090 | 0.085 0.125 | Ω |
| Forward Transconductance (V _{DS} = -15 Vdc, I _D = -3.05 Adc) | g _{FS} | - | 5.0 | - | Mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|------------------------------|--|------------------|---|-----|-----|----|
| Input Capacitance | (V _{DS} = -16 Vdc, V _{GS} = 0 Vdc, f = 1.0 MHz) | C _{iss} | - | 518 | 750 | pF |
| Output Capacitance | | C _{oss} | - | 190 | 350 | |
| Reverse Transfer Capacitance | | C _{rss} | - | 70 | 135 | |

SWITCHING CHARACTERISTICS (Notes 10 & 11)

| | | | | | | |
|---------------------|--|---------------------|---|-----|----|----|
| Turn-On Delay Time | (V _{DD} = -20 Vdc, I _D = -3.05 Adc, V _{GS} = -10 Vdc, R _G = 6.0 Ω) | t _{d(on)} | - | 12 | 22 | ns |
| Rise Time | | t _r | - | 16 | 30 | |
| Turn-Off Delay Time | | t _{d(off)} | - | 45 | 80 | |
| Fall Time | | t _f | - | 45 | 80 | |
| Turn-On Delay Time | (V _{DD} = -20 Vdc, I _D = -1.5 Adc, V _{GS} = -4.5 Vdc, R _G = 6.0 Ω) | t _{d(on)} | - | 16 | - | ns |
| Rise Time | | t _r | - | 42 | - | |
| Turn-Off Delay Time | | t _{d(off)} | - | 32 | - | |
| Fall Time | | t _f | - | 35 | - | |
| Total Gate Charge | (V _{DS} = -20 Vdc, V _{GS} = -10 Vdc, I _D = -3.05 Adc) | Q _{tot} | - | 16 | 25 | nC |
| Gate-Source Charge | | Q _{gs} | - | 2.0 | - | |
| Gate-Drain Charge | | Q _{gd} | - | 4.5 | - | |

BODY-DRAIN DIODE RATINGS (Note 10)

| | | | | | | |
|--------------------------------|--|-----------------|--------|----------------|------------|-----|
| Diode Forward On-Voltage | (I _S = -3.05 Adc, V _{GS} = 0 Vdc) (I _S = -3.05 Adc, V _{GS} = 0 Vdc, T _J = 125°C) | V _{SD} | - - | -0.96 -0.78 | -1.25 - | Vdc |
| Reverse Recovery Time | (I _S = -3.05 Adc, V _{GS} = 0 Vdc, dI _S /dt = 100 A/µs) | t _{rr} | - | 34 | - | ns |
| | | t _a | - | 18 | - | |
| | | t _b | - | 16 | - | |
| Reverse Recovery Stored Charge | | Q _{RR} | - | 0.03 | - | µC |

9. Handling precautions to protect against electrostatic discharge are mandatory.

10. Indicates Pulse Test: Pulse Width = 300 µs max, Duty Cycle = 2%.

11. Switching characteristics are independent of operating junction temperature.

TYPICAL MOSFET ELECTRICAL CHARACTERISTICS

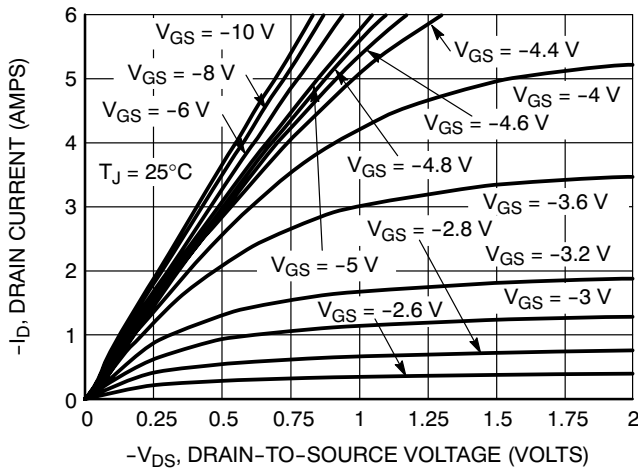


Figure 1. On-Region Characteristics

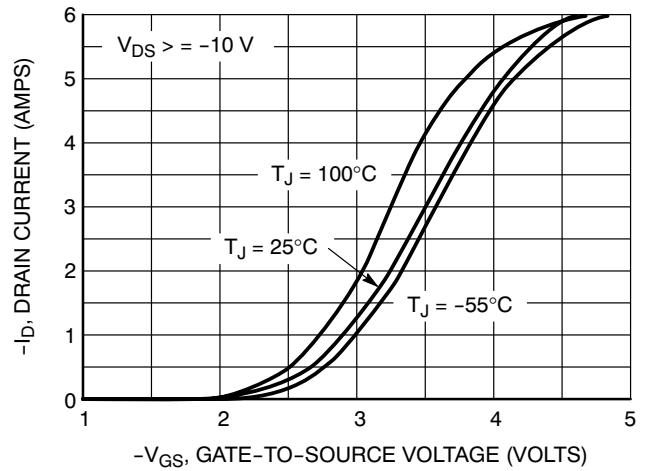


Figure 2. Transfer Characteristics

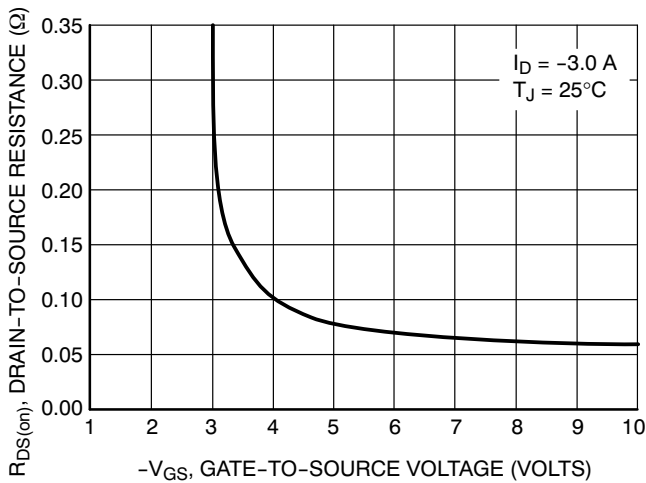


Figure 3. On-Resistance vs. Gate-to-Source Voltage

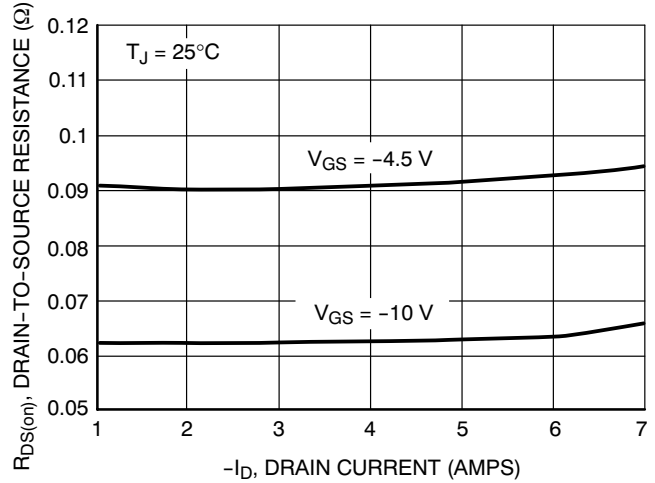


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

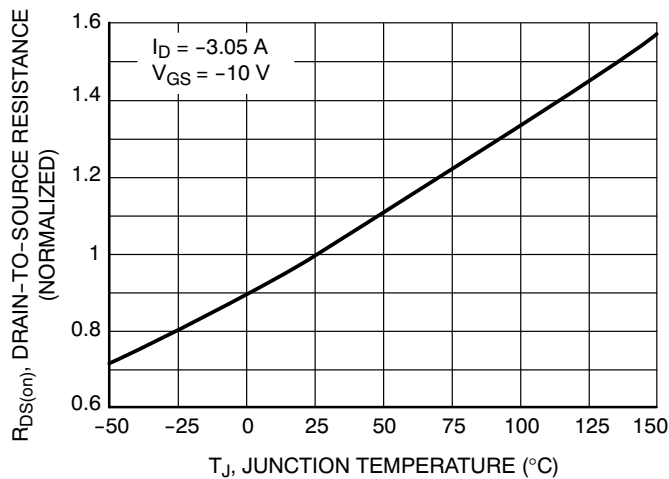


Figure 5. On Resistance Variation with Temperature

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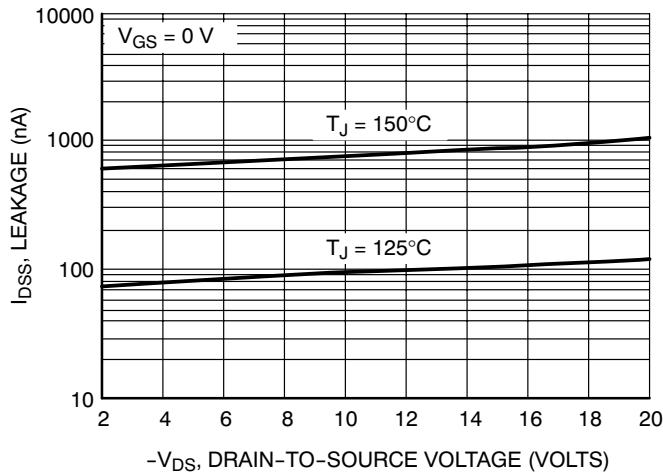


Figure 6. Drain-to-Source Leakage Current vs. Voltage

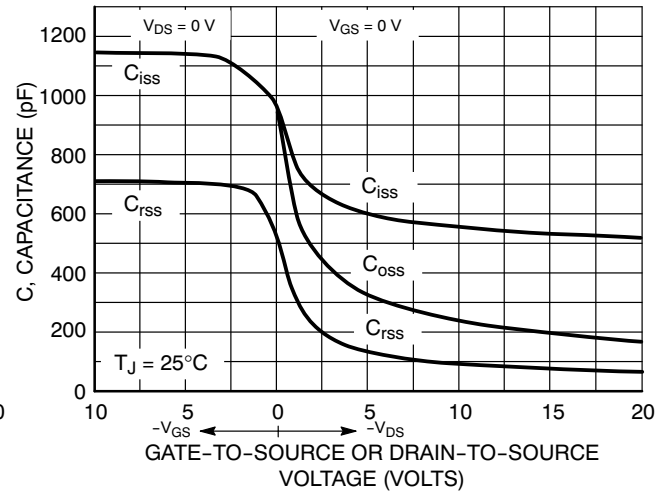


Figure 7. Capacitance Variation

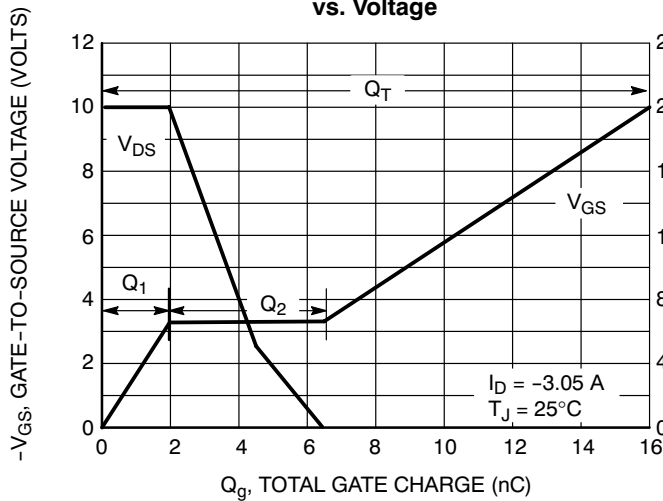


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

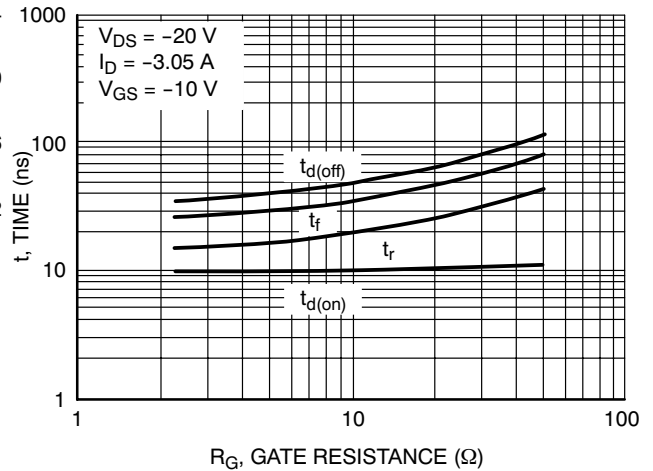


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

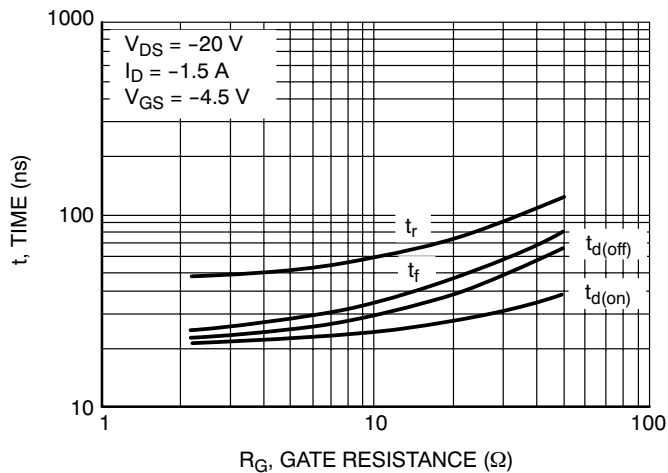


Figure 10. Resistive Switching Time Variation vs. Gate Resistance

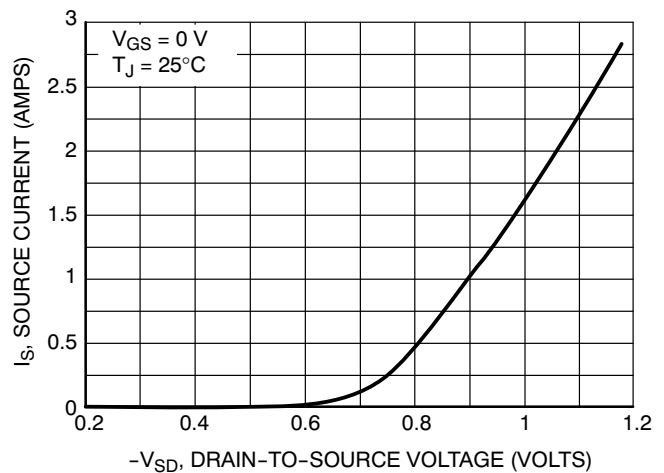


Figure 11. Diode Forward Voltage vs. Current

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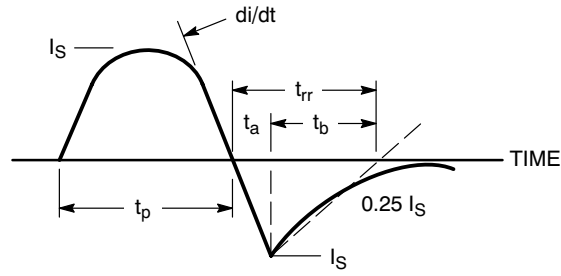


Figure 12. Diode Reverse Recovery Waveform

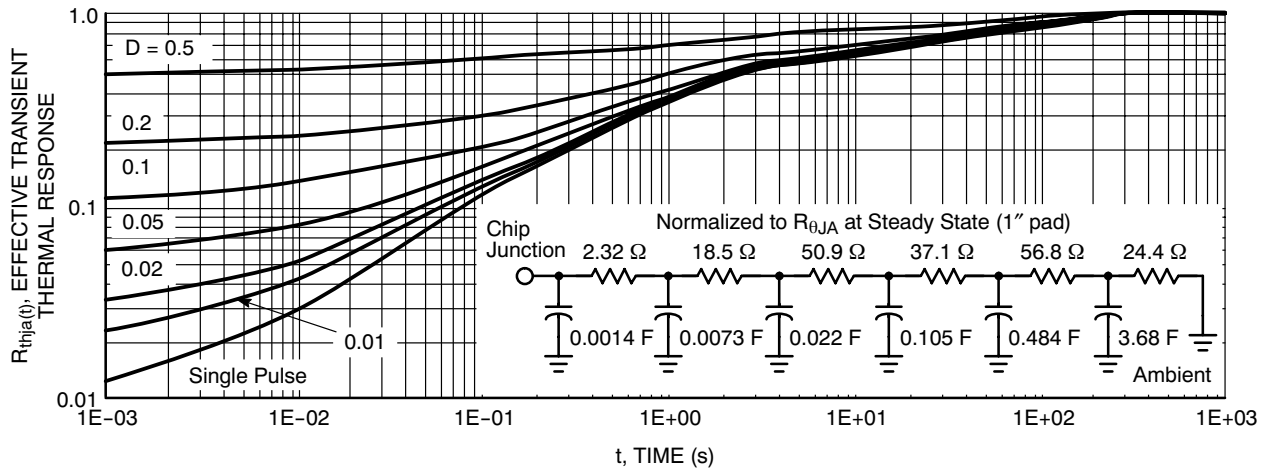


Figure 13. FET Thermal Response

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

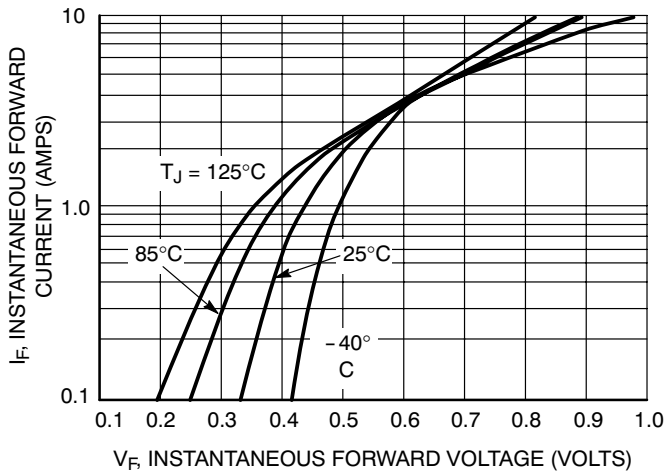


Figure 14. Typical Forward Voltage

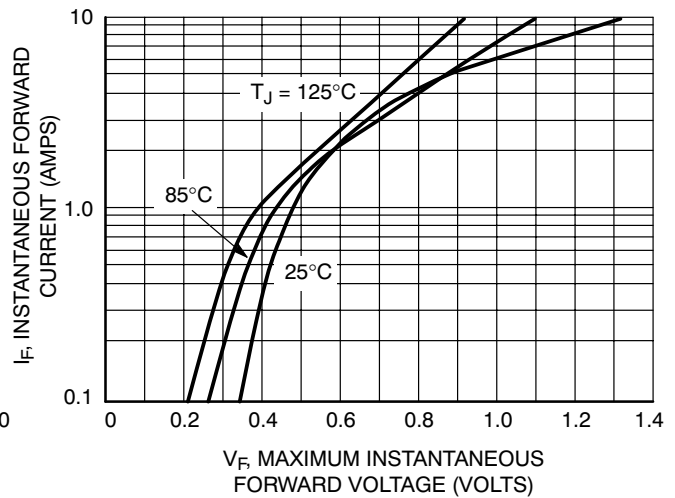


Figure 15. Maximum Forward Voltage

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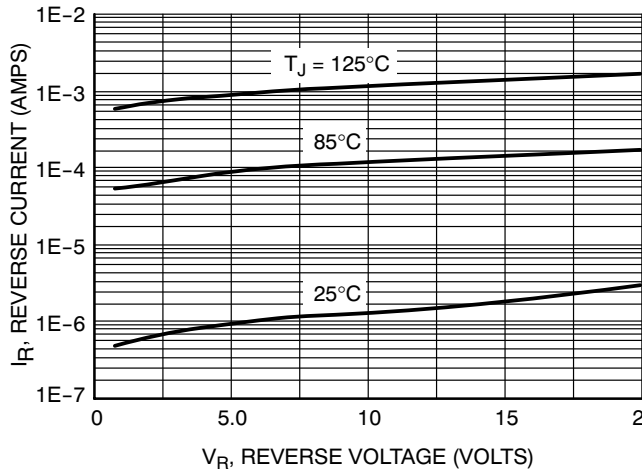


Figure 16. Typical Reverse Current

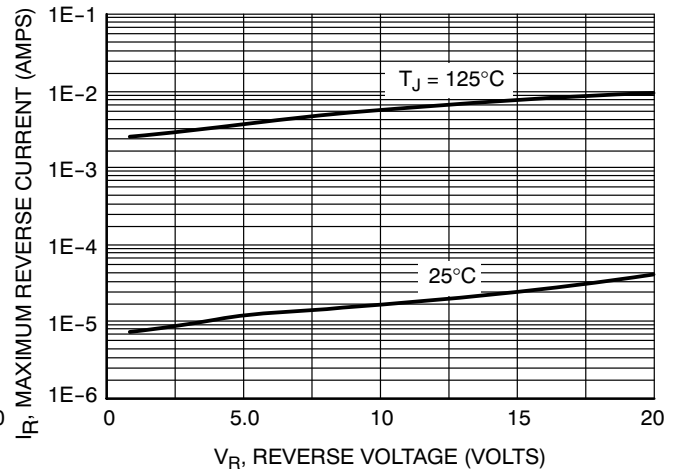


Figure 17. Maximum Reverse Current

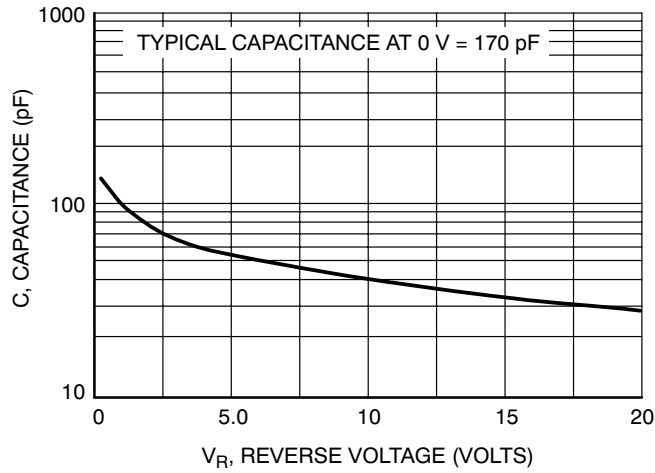


Figure 18. Typical Capacitance

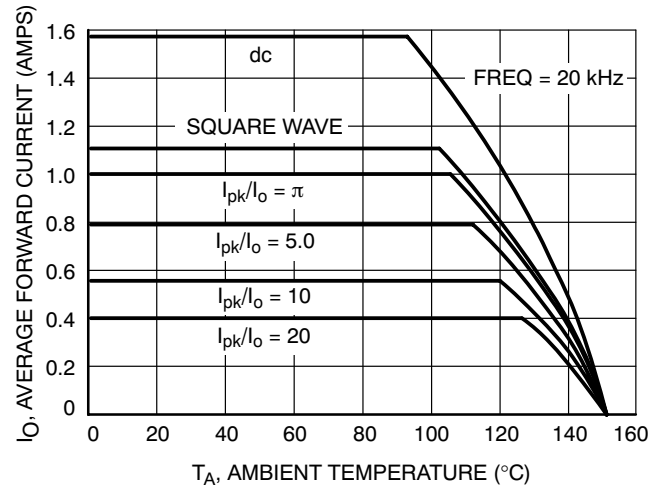


Figure 19. Current Derating

TYPICAL SCHOTTKY ELECTRICAL CHARACTERISTICS

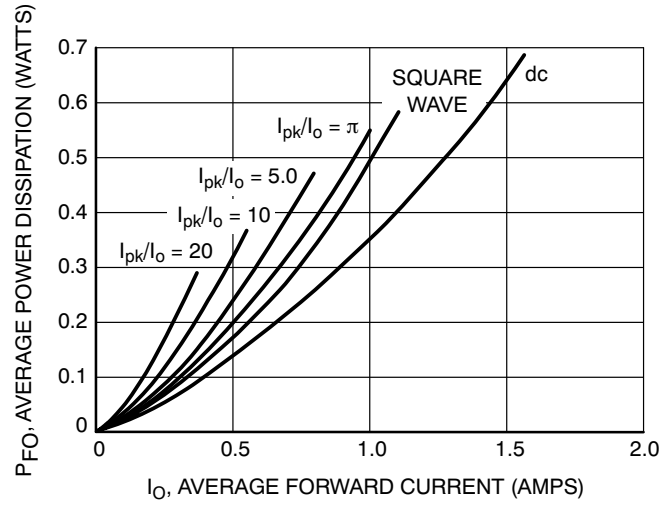


Figure 20. Forward Power Dissipation

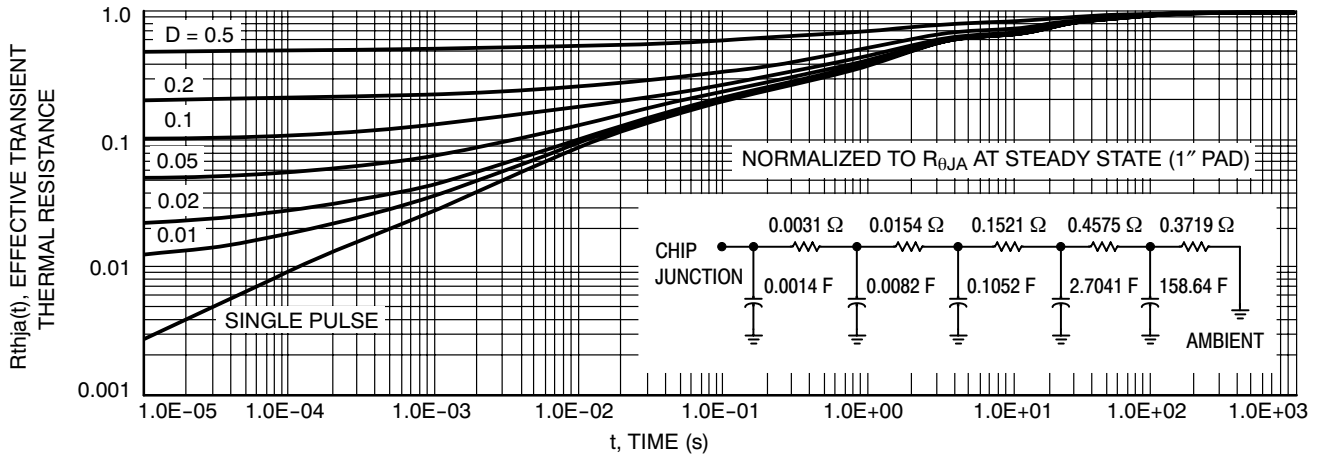


Figure 21. Schottky Thermal Response

MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-8 NB
CASE 751-07
ISSUE AK

DATE 16 FEB 2011



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION 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.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.80 | 5.00 | 0.189 | 0.197 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.053 | 0.069 |
| D | 0.33 | 0.51 | 0.013 | 0.020 |
| G | 1.27 BSC | | 0.050 BSC | |
| H | 0.10 | 0.25 | 0.004 | 0.010 |
| J | 0.19 | 0.25 | 0.007 | 0.010 |
| K | 0.40 | 1.27 | 0.016 | 0.050 |
| M | 0° | 8° | 0° | 8° |
| N | 0.25 | 0.50 | 0.010 | 0.020 |
| S | 5.80 | 6.20 | 0.228 | 0.244 |

GENERIC MARKING DIAGRAM*



SCALE 6:1 (mm/inches)



XXXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb-Free Package

XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = 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. Some products may not follow the Generic Marking.

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

STYLES ON PAGE 2

| | | |
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SOIC-8 NB
CASE 751-07
ISSUE AK

DATE 16 FEB 2011

| | | | |
|---|--|--|--|
| STYLE 1: PIN 1. EMITTER 2. COLLECTOR 3. COLLECTOR 4. EMITTER 5. EMITTER 6. BASE 7. BASE 8. EMITTER | STYLE 2: PIN 1. COLLECTOR, DIE, #1 2. COLLECTOR, #1 3. COLLECTOR, #2 4. COLLECTOR, #2 5. BASE, #2 6. EMITTER, #2 7. BASE, #1 8. EMITTER, #1 | STYLE 3: PIN 1. DRAIN, DIE #1 2. DRAIN, #1 3. DRAIN, #2 4. DRAIN, #2 5. GATE, #2 6. SOURCE, #2 7. GATE, #1 8. SOURCE, #1 | STYLE 4: PIN 1. ANODE 2. ANODE 3. ANODE 4. ANODE 5. ANODE 6. ANODE 7. ANODE 8. COMMON CATHODE |
| STYLE 5: PIN 1. DRAIN 2. DRAIN 3. DRAIN 4. DRAIN 5. GATE 6. GATE 7. SOURCE 8. SOURCE | STYLE 6: PIN 1. SOURCE 2. DRAIN 3. DRAIN 4. SOURCE 5. SOURCE 6. GATE 7. GATE 8. SOURCE | STYLE 7: PIN 1. INPUT 2. EXTERNAL BYPASS 3. THIRD STAGE SOURCE 4. GROUND 5. DRAIN 6. GATE 3 7. SECOND STAGE Vd 8. FIRST STAGE Vd | STYLE 8: PIN 1. COLLECTOR, DIE #1 2. BASE, #1 3. BASE, #2 4. COLLECTOR, #2 5. COLLECTOR, #2 6. EMITTER, #2 7. EMITTER, #1 8. COLLECTOR, #1 |
| STYLE 9: PIN 1. EMITTER, COMMON 2. COLLECTOR, DIE #1 3. COLLECTOR, DIE #2 4. EMITTER, COMMON 5. EMITTER, COMMON 6. BASE, DIE #2 7. BASE, DIE #1 8. EMITTER, COMMON | STYLE 10: PIN 1. GROUND 2. BIAS 1 3. OUTPUT 4. GROUND 5. GROUND 6. BIAS 2 7. INPUT 8. GROUND | STYLE 11: 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 | STYLE 12: PIN 1. SOURCE 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN |
| STYLE 13: PIN 1. N.C. 2. SOURCE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN | STYLE 14: PIN 1. N-SOURCE 2. N-GATE 3. P-SOURCE 4. P-GATE 5. P-DRAIN 6. P-DRAIN 7. N-DRAIN 8. N-DRAIN | STYLE 15: PIN 1. ANODE 1 2. ANODE 1 3. ANODE 1 4. ANODE 1 5. CATHODE, COMMON 6. CATHODE, COMMON 7. CATHODE, COMMON 8. CATHODE, COMMON | STYLE 16: PIN 1. EMITTER, DIE #1 2. BASE, DIE #1 3. EMITTER, DIE #2 4. BASE, DIE #2 5. COLLECTOR, DIE #2 6. COLLECTOR, DIE #2 7. COLLECTOR, DIE #1 8. COLLECTOR, DIE #1 |
| STYLE 17: PIN 1. VCC 2. V2OUT 3. V1OUT 4. TXE 5. RXE 6. VEE 7. GND 8. ACC | STYLE 18: PIN 1. ANODE 2. ANODE 3. SOURCE 4. GATE 5. DRAIN 6. DRAIN 7. CATHODE 8. CATHODE | STYLE 19: PIN 1. SOURCE 1 2. GATE 1 3. SOURCE 2 4. GATE 2 5. DRAIN 2 6. MIRROR 2 7. DRAIN 1 8. MIRROR 1 | STYLE 20: PIN 1. SOURCE (N) 2. GATE (N) 3. SOURCE (P) 4. GATE (P) 5. DRAIN 6. DRAIN 7. DRAIN 8. DRAIN |
| STYLE 21: PIN 1. CATHODE 1 2. CATHODE 2 3. CATHODE 3 4. CATHODE 4 5. CATHODE 5 6. COMMON ANODE 7. COMMON ANODE 8. CATHODE 6 | STYLE 22: PIN 1. I/O LINE 1 2. COMMON CATHODE/VCC 3. COMMON CATHODE/VCC 4. I/O LINE 3 5. COMMON ANODE/GND 6. I/O LINE 4 7. I/O LINE 5 8. COMMON ANODE/GND | STYLE 23: PIN 1. LINE 1 IN 2. COMMON ANODE/GND 3. COMMON ANODE/GND 4. LINE 2 IN 5. LINE 2 OUT 6. COMMON ANODE/GND 7. COMMON ANODE/GND 8. LINE 1 OUT | STYLE 24: PIN 1. BASE 2. EMITTER 3. COLLECTOR/ANODE 4. COLLECTOR/ANODE 5. CATHODE 6. CATHODE 7. COLLECTOR/ANODE 8. COLLECTOR/ANODE |
| STYLE 25: PIN 1. VIN 2. N/C 3. REXT 4. GND 5. IOUT 6. IOUT 7. IOUT 8. IOUT | STYLE 26: PIN 1. GND 2. dv/dt 3. ENABLE 4. ILIMIT 5. SOURCE 6. SOURCE 7. SOURCE 8. VCC | STYLE 27: PIN 1. ILIMIT 2. OVLO 3. UVLO 4. INPUT+ 5. SOURCE 6. SOURCE 7. SOURCE 8. DRAIN | STYLE 28: PIN 1. SW_TO_GND 2. DASIC_OFF 3. DASIC_SW_DET 4. GND 5. V_MON 6. VBULK 7. VBULK 8. VIN |
| STYLE 29: PIN 1. BASE, DIE #1 2. EMITTER, #1 3. BASE, #2 4. EMITTER, #2 5. COLLECTOR, #2 6. COLLECTOR, #2 7. COLLECTOR, #1 8. COLLECTOR, #1 | STYLE 30: PIN 1. DRAIN 1 2. DRAIN 1 3. GATE 2 4. SOURCE 2 5. SOURCE 1/DRAIN 2 6. SOURCE 1/DRAIN 2 7. SOURCE 1/DRAIN 2 8. GATE 1 | | |

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