# NTMD3P03, NVMD3P03

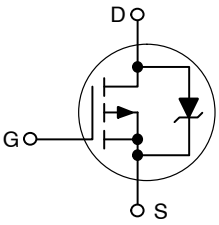
# MOSFET – Power, Dual, P-Channel, SOIC-8 -3.05 A, -30 V

**ON Semiconductor®**

**http://onsemi.com**

| $V_{DSS}$ | $R_{DS(ON)}$ Typ | $I_D$ Max |
|---|---|---|
| −30 V | 85 mΩ @ −10 V | −3.05 A |

**P−Channel**




### Features

- High Efficiency Components in a Dual SOIC−8 Package
- High Density Power MOSFET with Low $R_{DS(on)}$
- Miniature SOIC−8 Surface Mount Package − Saves Board Space
- Diode Exhibits High Speed with Soft Recovery
- $I_{DSS}$ Specified at Elevated Temperature
- Avalanche Energy Specified
- Mounting Information for the SOIC−8 Package is Provided
- AEC−Q101 Qualified − NVMD3P03R2G
- These Devices are Pb−Free and are RoHS Compliant

### Applications

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

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

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain−to−Source Voltage | $V_{DSS}$ | −30 | V |
| Gate−to−Source Voltage − Continuous | $V_{GS}$ | ±20 | V |
| Thermal Resistance − Junction−to−Ambient (Note 1)<br>Total Power Dissipation @ $T_A$ = 25°C<br>Continuous Drain Current @ 25°C<br>Continuous Drain Current @ 70°C<br>Pulsed Drain Current (Note 4) | $R_{\theta JA}$<br>$P_D$<br>$I_D$<br>$I_D$<br>$I_{DM}$ | 171<br>0.73<br>−2.34<br>−1.87<br>−8.0 | °C/W<br>W<br>A<br>A<br>A |
| Thermal Resistance − Junction−to−Ambient (Note 2)<br>Total Power Dissipation @ $T_A$ = 25°C<br>Continuous Drain Current @ 25°C<br>Continuous Drain Current @ 70°C<br>Pulsed Drain Current (Note 4) | $R_{\theta JA}$<br>$P_D$<br>$I_D$<br>$I_D$<br>$I_{DM}$ | 100<br>1.25<br>−3.05<br>−2.44<br>−12 | °C/W<br>W<br>A<br>A<br>A |
| Thermal Resistance − Junction−to−Ambient (Note 3)<br>Total Power Dissipation @ $T_A$ = 25°C<br>Continuous Drain Current @ 25°C<br>Continuous Drain Current @ 70°C<br>Pulsed Drain Current (Note 4) | $R_{\theta JA}$<br>$P_D$<br>$I_D$<br>$I_D$<br>$I_{DM}$ | 62.5<br>2.0<br>−3.86<br>−3.1<br>−15 | °C/W<br>W<br>A<br>A<br>A |
| Operating and Storage Temperature Range | $T_J$, $T_{stg}$ | −55 to +150 | °C |
| Single Pulse Drain−to−Source Avalanche Energy − Starting $T_J$ = 25°C ($V_{DD}$ = −30 Vdc, $V_{GS}$ = −4.5 Vdc, Peak $I_L$ = −7.5 Apk, L = 5 mH, $R_G$ = 25 Ω) | $E_{AS}$ | 140 | mJ |
| Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 10 seconds | $T_L$ | 260 | °C |

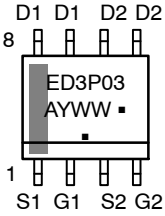
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Minimum FR−4 or G−10 PCB, t = Steady State.
2. Mounted onto a 2″ square FR−4 Board (1 in sq, 2 oz Cu 0.06″ thick single sided), t = steady state.




**SOIC−8**
**SUFFIX NB**
**CASE 751**
**STYLE 11**

**MARKING DIAGRAM* AND PIN ASSIGNMENT**




ED3P03= Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*For additional marking information, refer to Application Note AND8002/D.

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| NTMD3P03R2G | SOIC−8 (Pb−Free) | 2500 / Tape & Reel |
| NVMD3P03R2G | SOIC−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 Specifications Brochure, BRD8011/D

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3. Mounted onto a 2″ square FR−4 Board (1 in sq, 2 oz Cu 0.06″ thick single sided), t ≤ 10 seconds.
4. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2%.

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted) (Note 5)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain−to−Source Breakdown Voltage<br>($V_{GS}$ = 0 Vdc, $I_D$ = −250 μAdc)<br>Temperature Coefficient (Positive) | | $V_{(BR)DSS}$ | <br>−30<br>− | <br>−<br>−30 | <br>−<br>− | Vdc<br><br>mV/°C |
| Zero Gate Voltage Drain Current<br>($V_{DS}$ = −24 Vdc, $V_{GS}$ = 0 Vdc, $T_J$ = 25°C)<br>($V_{DS}$ = −24 Vdc, $V_{GS}$ = 0 Vdc, $T_J$ = 125°C)<br>($V_{DS}$ = −30 Vdc, $V_{GS}$ = 0 Vdc, $T_J$ = 25°C) | | $I_{DSS}$ | <br>−<br>−<br>− | <br>−<br>−<br>− | <br>−1.0<br>−20<br>−2.0 | μAdc |
| Gate−Body Leakage Current<br>($V_{GS}$ = −20 Vdc, $V_{DS}$ = 0 Vdc) | | $I_{GSS}$ | <br>− | <br>− | <br>−100 | nAdc |
| Gate−Body Leakage Current<br>($V_{GS}$ = +20 Vdc, $V_{DS}$ = 0 Vdc) | | $I_{GSS}$ | <br>− | <br>− | <br>100 | nAdc |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage<br>($V_{DS}$ = $V_{GS}$, $I_D$ = −250 μAdc)<br>Temperature Coefficient (Negative) | | $V_{GS(th)}$ | <br>−1.0<br>− | <br>−1.7<br>3.6 | <br>−2.5<br>− | Vdc |
| Static Drain−to−Source On−State Resistance<br>($V_{GS}$ = −10 Vdc, $I_D$ = −3.05 Adc)<br>($V_{GS}$ = −4.5 Vdc, $I_D$ = −1.5 Adc) | | $R_{DS(on)}$ | <br>−<br>− | <br>0.063<br>0.090 | <br>0.085<br>0.125 | Ω |
| Forward Transconductance ($V_{DS}$ = −15 Vdc, $I_D$ = −3.05 Adc) | | $g_{FS}$ | − | 5.0 | − | Mhos |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | ($V_{DS}$ = −24 Vdc, $V_{GS}$ = 0 Vdc, f = 1.0 MHz) | $C_{iss}$ | − | 520 | 750 | pF |
| Output Capacitance | | $C_{oss}$ | − | 170 | 325 | |
| Reverse Transfer Capacitance | | $C_{rss}$ | − | 70 | 135 | |
| **SWITCHING CHARACTERISTICS** (Notes 6 and 7) | | | | | | |
| Turn−On Delay Time | ($V_{DD}$ = −24 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 | ($V_{DD}$ = −24 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 | ($V_{DS}$ = −24 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 6) | | | | | | |
| Diode Forward On−Voltage | ($I_S$ = −3.05 Adc, $V_{GS}$ = 0 V)<br>($I_S$ = −3.05 Adc, $V_{GS}$ = 0 V, $T_J$ = 125°C) | $V_{SD}$ | <br>− | <br>−0.96<br>−0.78 | <br>−1.25<br>− | 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 |

5. Handling precautions to protect against electrostatic discharge is mandatory.
6. Indicates Pulse Test: Pulse Width = 300 μs max, Duty Cycle = 2%.
7. Switching characteristics are independent of operating junction temperature.

## TYPICAL ELECTRICAL CHARACTERISTICS

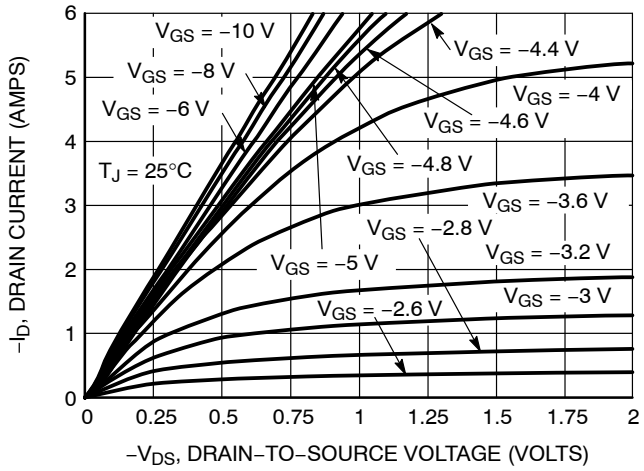



**Figure 1. On−Region Characteristics**

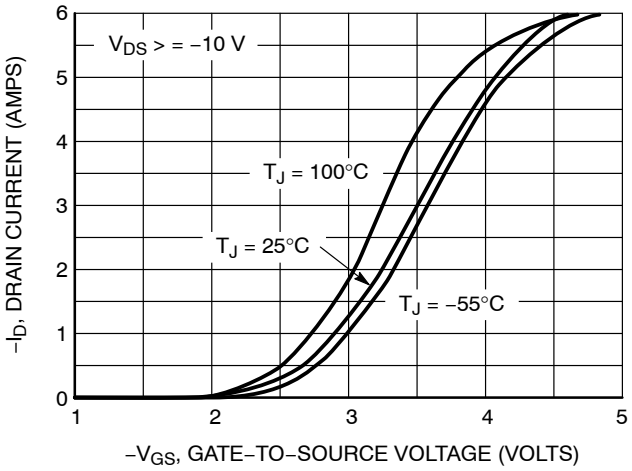



**Figure 2. Transfer Characteristics**

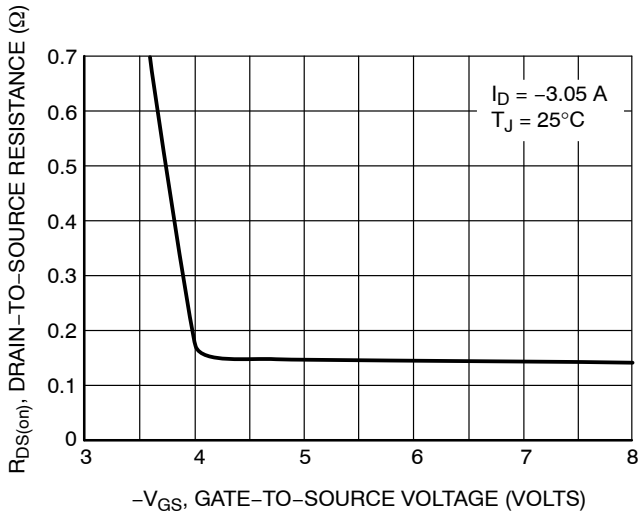



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

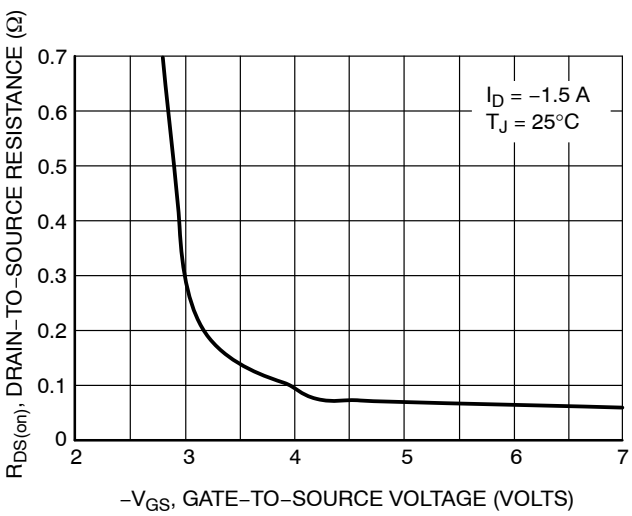



**Figure 4. On−Resistance vs. Gate−to−Source Voltage**

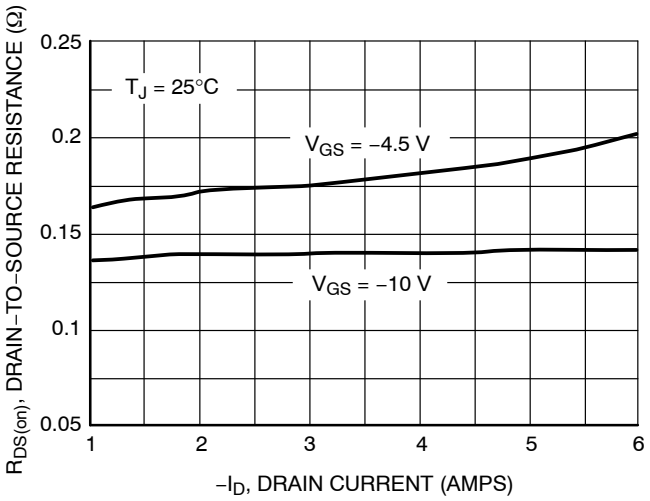



**Figure 5. On−Resistance vs. Drain Current and Gate Voltage**

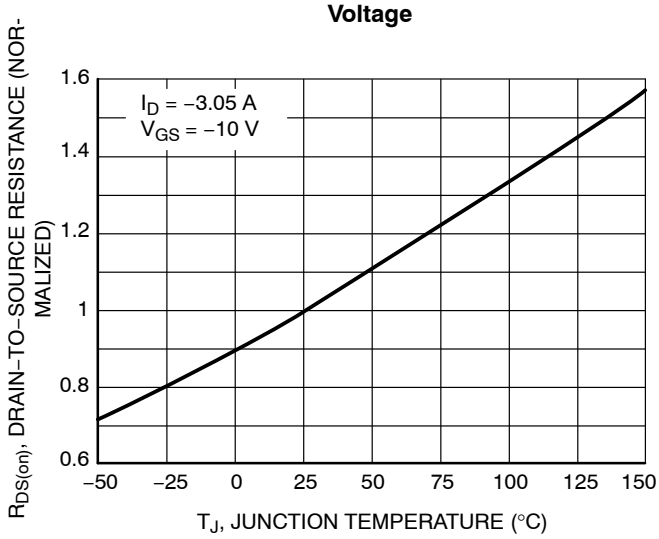



**Figure 6. On Resistance Variation with Temperature**

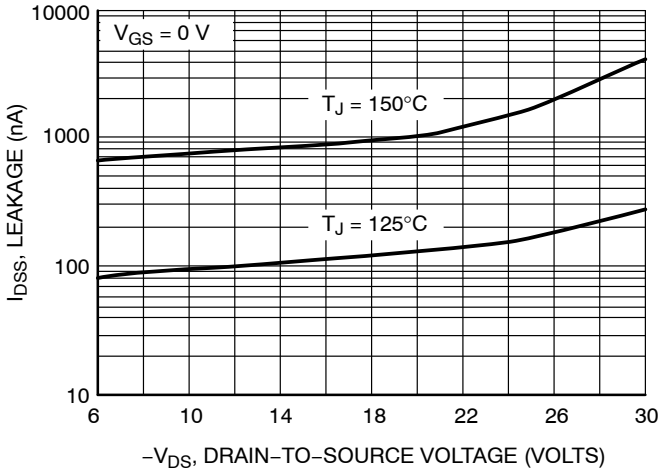



**Figure 7. Drain−to−Source Leakage Current vs. Voltage**

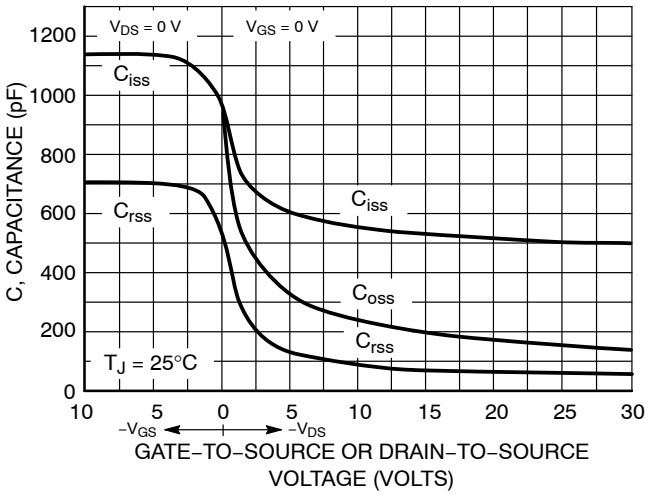



**Figure 8. Capacitance Variation**

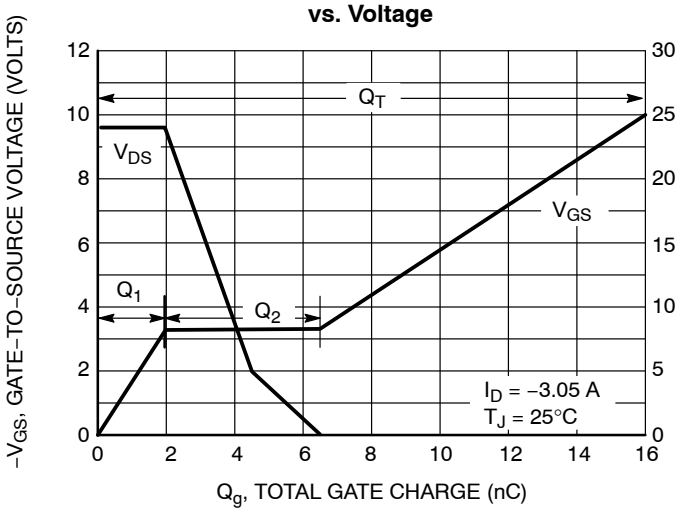



**Figure 9. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge**

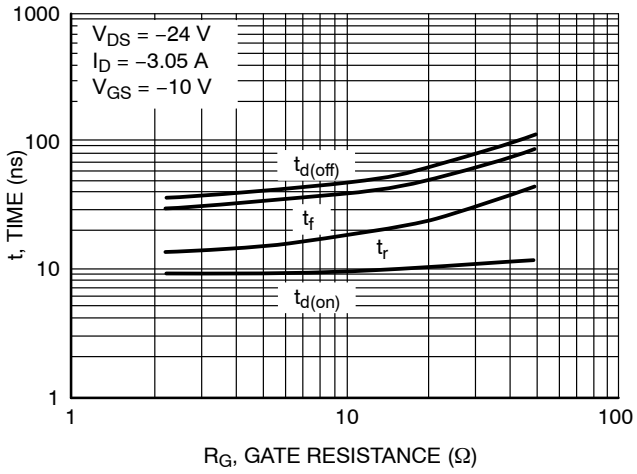



**Figure 10. Resistive Switching Time Variation vs. Gate Resistance**

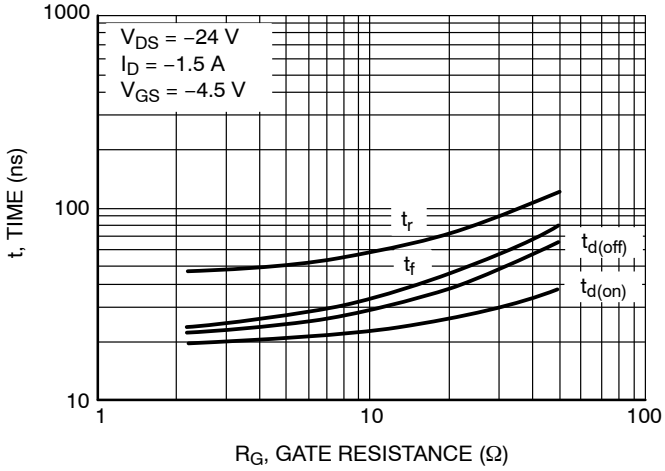



**Figure 11. Resistive Switching Time Variation vs. Gate Resistance**

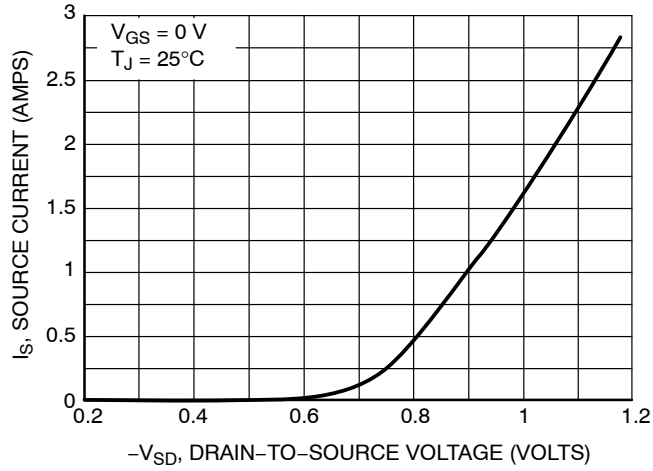



**Figure 12. Diode Forward Voltage vs. Current**

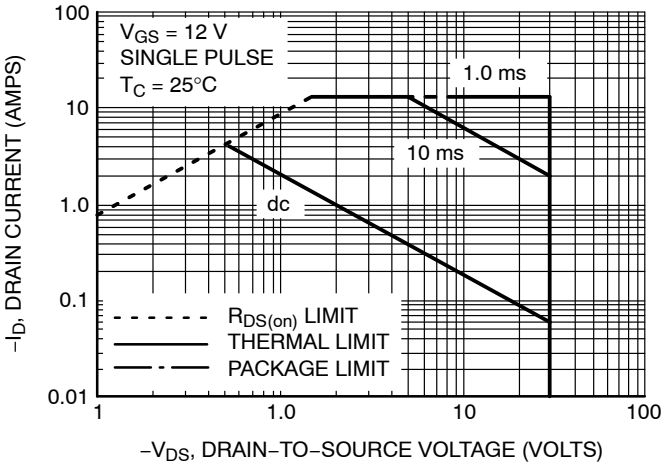



**Figure 13. Maximum Rated Forward Biased Safe Operating Area**

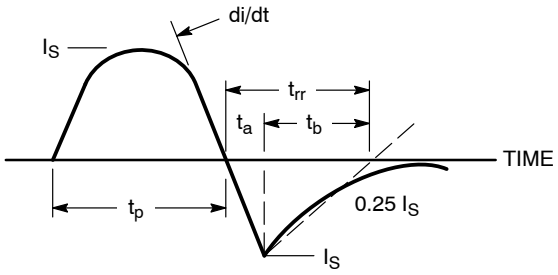



**Figure 14. Diode Reverse Recovery Waveform**

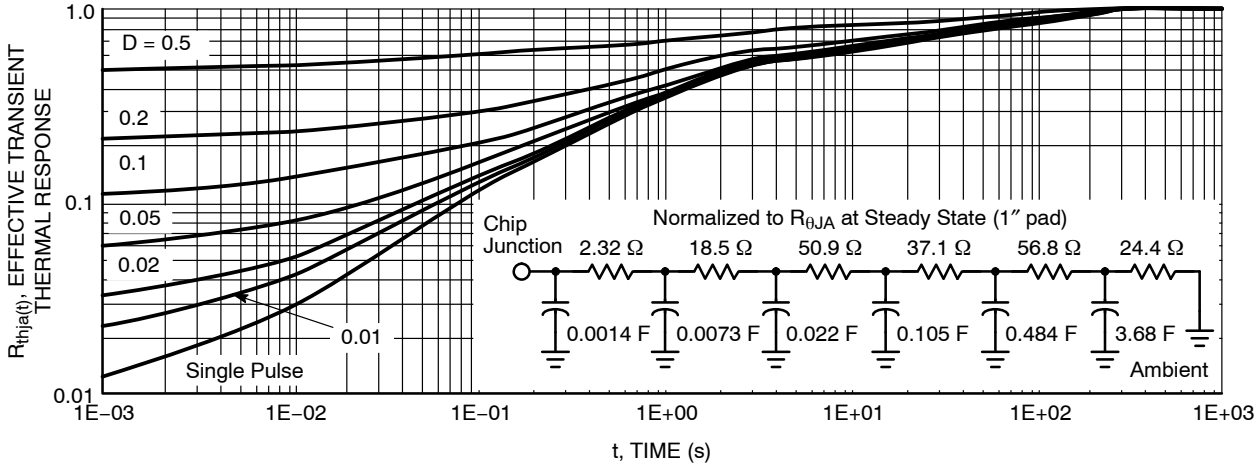



**Figure 15. FET Thermal Response**

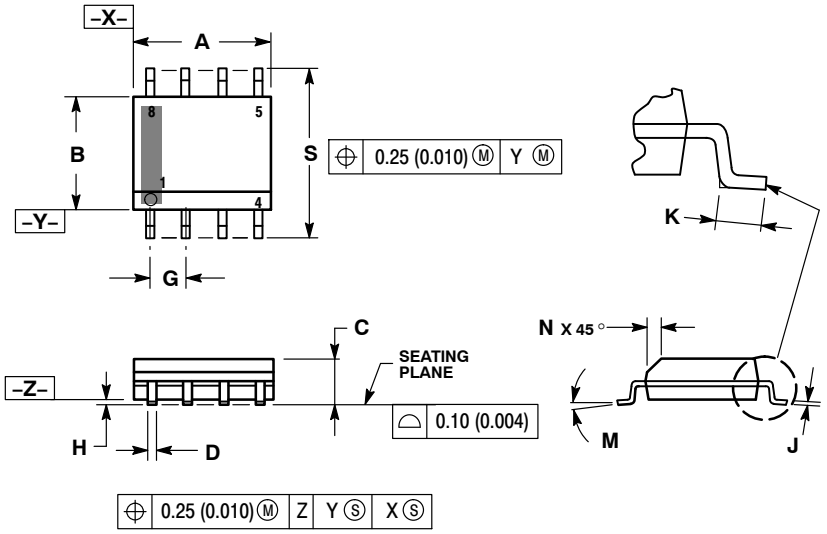
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS



**SCALE 1:1**

**SOIC−8 NB**
CASE 751−07
ISSUE AK

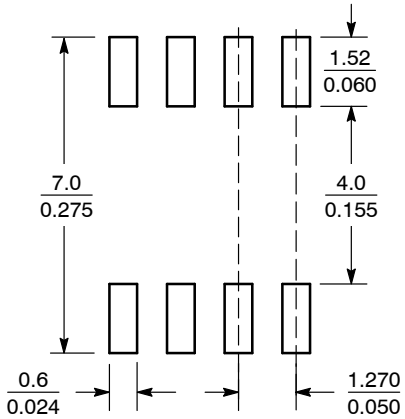
DATE 16 FEB 2011




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.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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 |

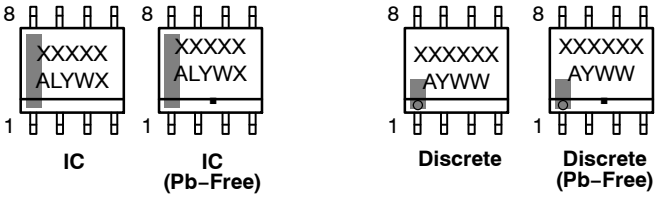
### SOLDERING FOOTPRINT*




SCALE 6:1 (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.

### GENERIC MARKING DIAGRAM*




IC | IC (Pb−Free) | Discrete | Discrete (Pb−Free)

XXXXX = 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.

**STYLES ON PAGE 2**

| | | |
|---|---|---|
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| **DESCRIPTION:** | **SOIC−8 NB** | **PAGE 1 OF 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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