

# NTBS2D7N06M7

## N-Channel PowerTrench<sup>®</sup> MOSFET

60 V, 110 A, 2.7 mΩ

### Features

- Typical  $R_{DS(on)} = 2.2\text{ m}\Omega$  at  $V_{GS} = 10\text{ V}$ ,  $I_D = 80\text{ A}$
- Typical  $Q_{g(tot)} = 80\text{ nC}$  at  $V_{GS} = 10\text{ V}$ ,  $I_D = 80\text{ A}$
- UIS Capability
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- Industrial Motor Drive
- Industrial Power Supply
- Industrial Automation
- Battery Operated Tools
- Battery Protection
- Solar Inverters
- UPS and Energy Inverters
- Energy Storage
- Load Switch

### ABSOLUTE MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ , Unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	60	V
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current – Continuous ( $T_C = 25^\circ\text{C}$ ) ( $V_{GS} = 10$ ) (Note 1)	$I_D$	110	A
Pulsed Drain Current ( $T_C = 25^\circ\text{C}$ )		See Figure 4	
Single Pulse Avalanche Energy (Note 2)	$E_{AS}$	193	mJ
Power Dissipation	$P_D$	176	W
Derate Above $25^\circ\text{C}$		1.2	W/ $^\circ\text{C}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	$-55$ to $+175$	$^\circ\text{C}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.85	$^\circ\text{C/W}$
Maximum Thermal Resistance, Junction to Ambient (Note 3)	$R_{\theta JA}$	43	$^\circ\text{C/W}$

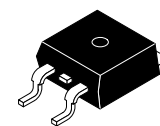
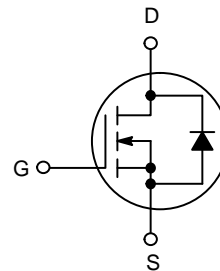
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Current is limited by bondwire configuration.
2. Starting  $T_J = 25^\circ\text{C}$ ,  $L = 50\text{ }\mu\text{H}$ ,  $I_{AS} = 88\text{ A}$ ,  $V_{DD} = 60\text{ V}$  during inductor charging and  $V_{DD} = 0\text{ V}$  during time in avalanche.
3.  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance, where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design, while  $R_{\theta JA}$  is determined by the board design. The maximum rating presented here is based on mounting on a 1 in<sup>2</sup> pad of 2oz copper.



ON Semiconductor<sup>®</sup>

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D<sup>2</sup>PAK-3  
TO-263  
CASE 418AJ

### MARKING DIAGRAM



NTBS2D7N06M7 = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# NTBS2D7N06M7

## PACKAGE MARKING AND ORDERING INFORMATION

Device	Device Marking	Package	Reel Size	Tape Width	Quantity
NTBS2D7N06M7	NTBS2D7N	D <sup>2</sup> PAK (TO-263)	330 mm	24 mm	800 Units

†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](#).

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

BV <sub>DSS</sub>	Drain-to-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60	–	–	V
I <sub>DSS</sub>	Drain-to-Source Leakage Current	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 25°C	–	–	1	μA
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175°C (Note 4)	–	–	1	mA
I <sub>GSS</sub>	Gate-to-Source Leakage Current	V <sub>GS</sub> = ±20 V	–	–	±100	nA

### ON CHARACTERISTICS

V <sub>GS(th)</sub>	Gate-to-Source Threshold Voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	2.0	3.2	4.0	V
R <sub>DS(on)</sub>	Drain-to-Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 80 A, T <sub>J</sub> = 25°C	–	2.2	2.7	mΩ
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 80 A, T <sub>J</sub> = 175°C (Note 4)	–	4.1	5.0	mΩ

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, f = 1 MHz	–	6655	–	pF
C <sub>oss</sub>	Output Capacitance		–	1745	–	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		–	57	–	pF
R <sub>g</sub>	Gate Resistance	f = 1 MHz	–	2.2	–	Ω
Q <sub>g(tot)</sub>	Total Gate Charge at 10 V	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A, V <sub>GS</sub> = 0 to 10 V	–	80	110	nC
Q <sub>g(th)</sub>	Threshold Gate Charge	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A, V <sub>GS</sub> = 0 to 2 V	–	12	–	nC
Q <sub>gs</sub>	Gate-to-Source Gate Charge	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A	–	35	–	nC
Q <sub>gd</sub>	Gate-to-Drain "Miller" Charge	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A	–	10	–	nC

### SWITCHING CHARACTERISTICS

t <sub>(on)</sub>	Turn-On Time	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 80 A, V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω	–	–	115	ns
t <sub>d(on)</sub>	Turn-On Delay		–	36	–	ns
t <sub>r</sub>	Rise Time		–	52	–	ns
t <sub>d(off)</sub>	Turn-Off Delay		–	36	–	ns
t <sub>f</sub>	Fall Time		–	13	–	ns
t <sub>off</sub>	Turn-Off Time		–	–	64	ns

### DRAIN-SOURCE DIODE CHARACTERISTICS

V <sub>SD</sub>	Source-to-Drain Diode Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 80 A	–	–	1.25	V
		V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 40 A	–	–	1.2	V
t <sub>rr</sub>	Reverse-Recovery Time	V <sub>DD</sub> = 48 V, I <sub>F</sub> = 80 A, dI <sub>SD</sub> /dt = 100 A/μs	–	78	102	ns
Q <sub>rr</sub>	Reverse-Recovery Charge		–	100	130	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. The maximum value is specified by design at T<sub>J</sub> = 175°C. Product is not tested to this condition in production.

# NTBS2D7N06M7

## TYPICAL PERFORMANCE CHARACTERISTICS

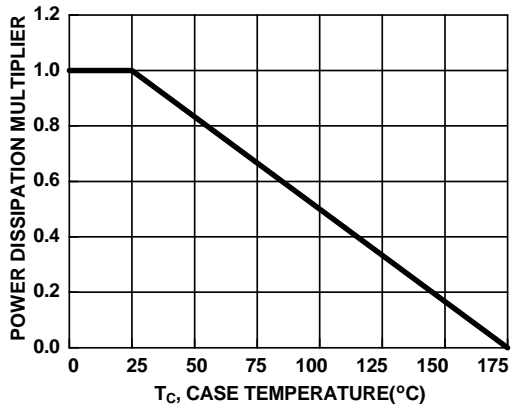


Figure 1. Normalized Power Dissipation vs. Case Temperature

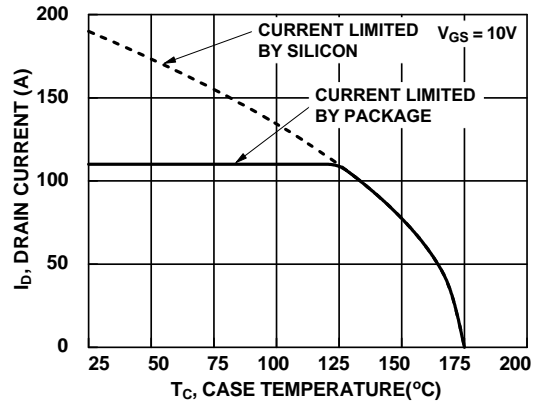


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

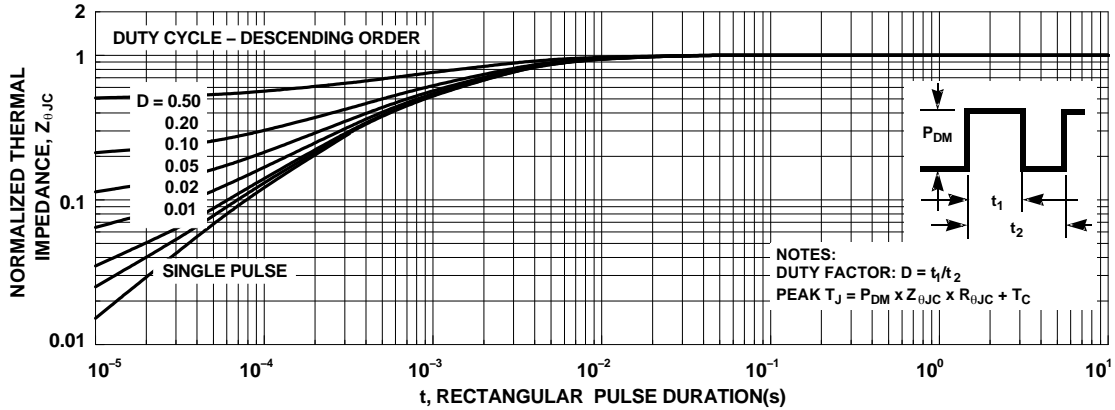


Figure 3. Normalized Maximum Transient Thermal Impedance

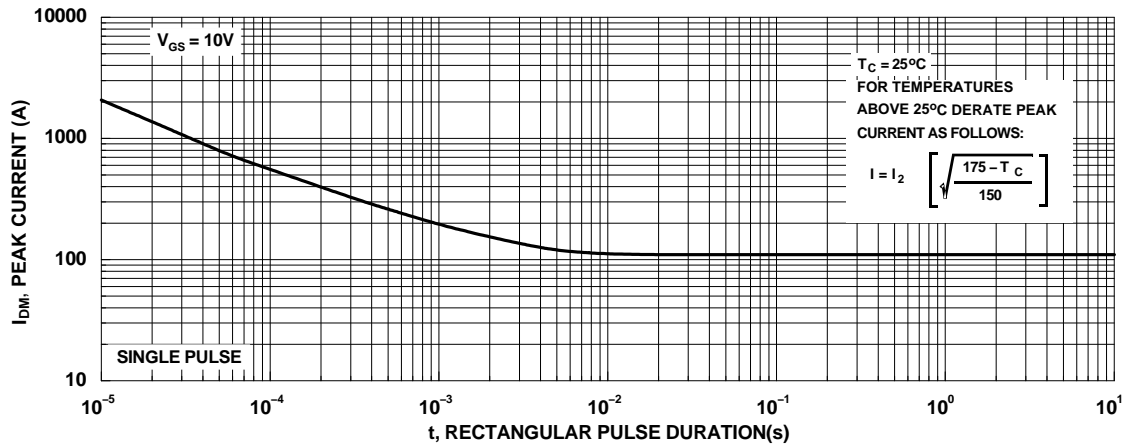


Figure 4. Peak Current Capability

TYPICAL PERFORMANCE CHARACTERISTICS

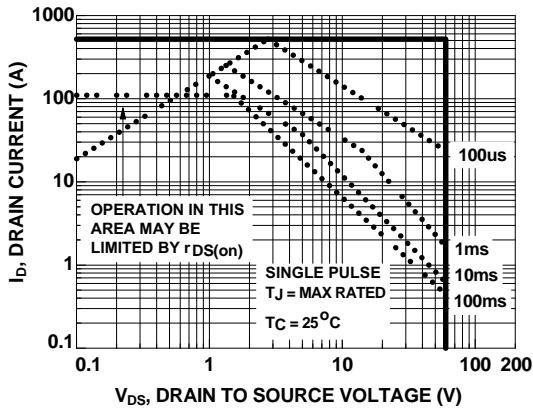
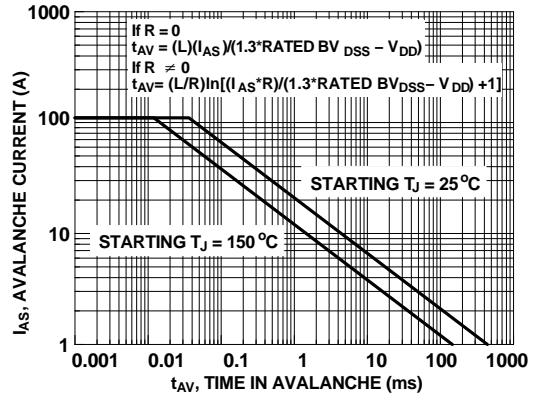


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to ON Semiconductor Application Notes AN7514 and AN7515  
 Figure 6. Unclamped Inductive Switching Capability

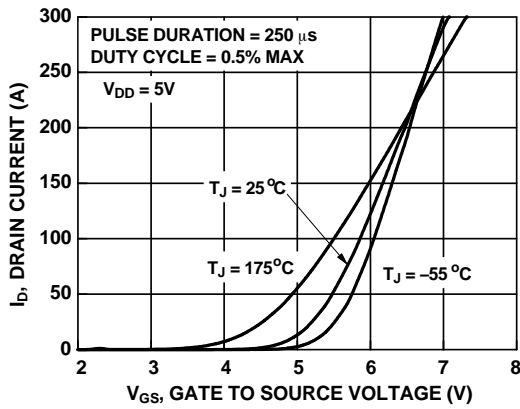


Figure 7. Transfer Characteristics

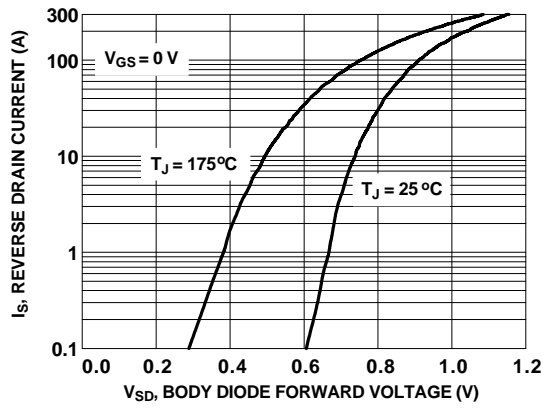


Figure 8. Forward Diode Characteristics

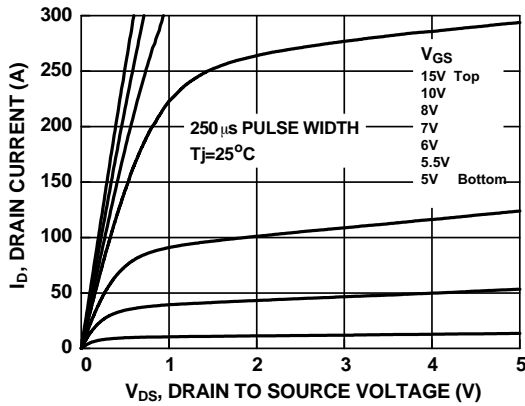


Figure 9. Saturation Characteristics

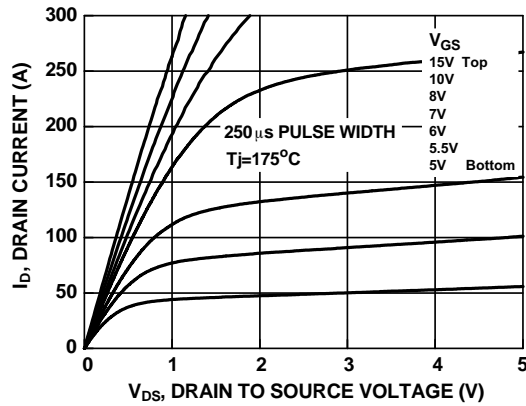


Figure 10. Saturation Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS

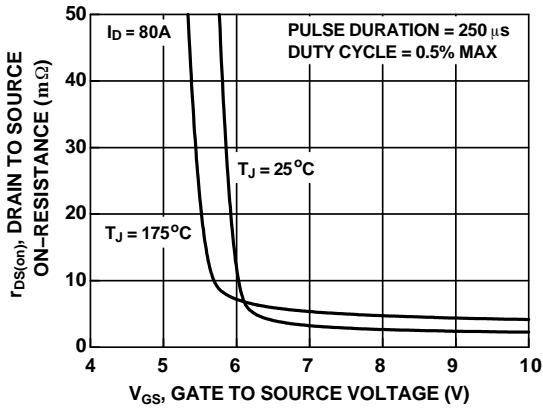


Figure 11.  $R_{DS(on)}$  vs. Gate Voltage

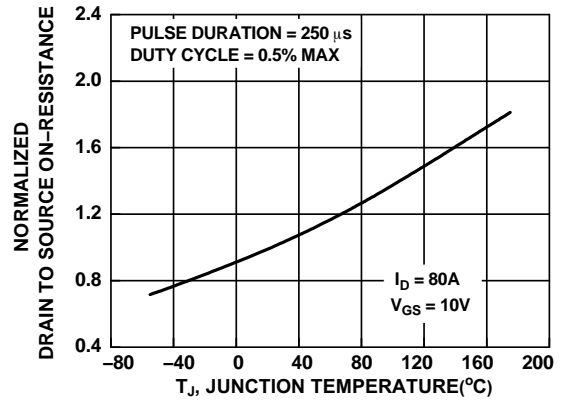


Figure 12. Normalized  $R_{DS(on)}$  vs. Junction Temperature

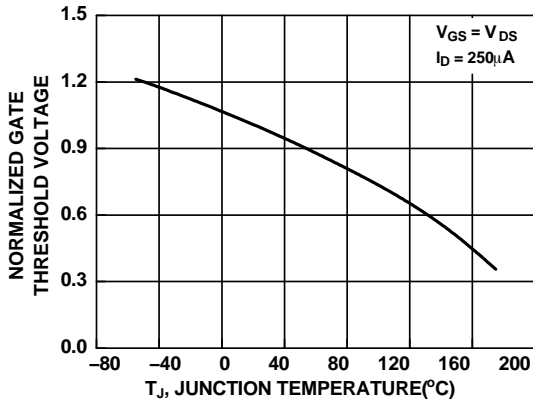


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

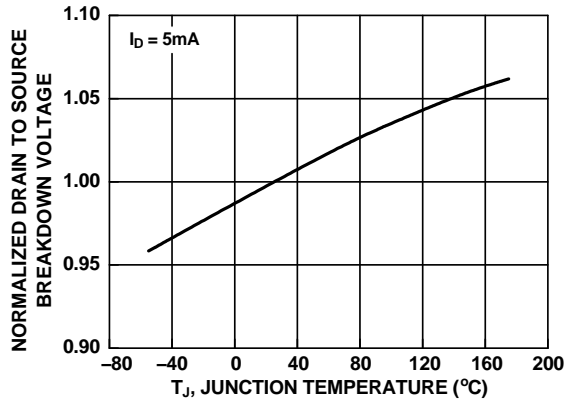


Figure 14. Normalized Drain-to-Source Breakdown Voltage vs. Junction Temperature

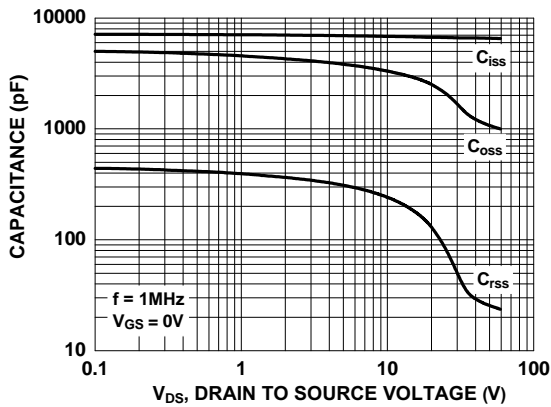


Figure 15. Capacitance vs. Drain-to-Source Voltage

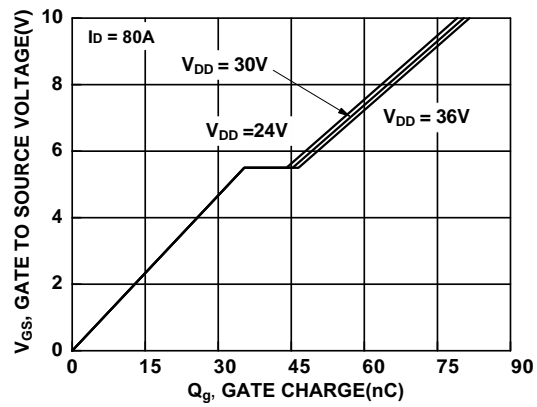
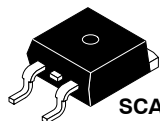


Figure 16. Gate Charge vs. Gate-to-Source Voltage

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



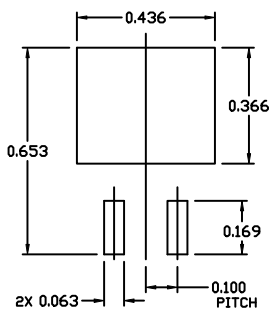
SCALE 1:1

### D<sup>2</sup>PAK-3 (TO-263, 3-LEAD)

#### CASE 418AJ

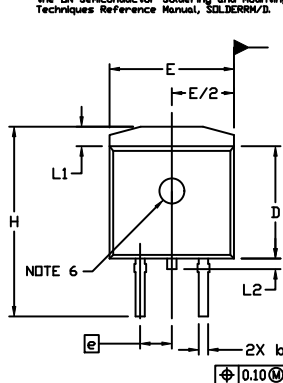
#### ISSUE F

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#### RECOMMENDED MOUNTING FOOTPRINT

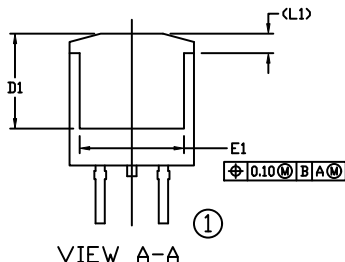
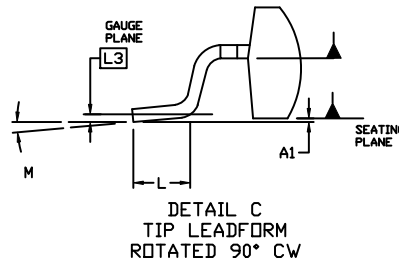
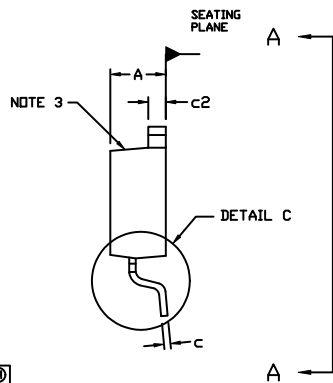
For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



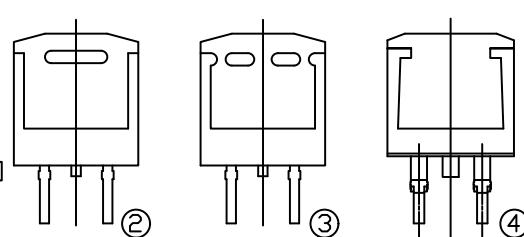
#### NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
- CONTROLLING DIMENSION: INCHES
- CHAMFER OPTIONAL.
- DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
- THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
- OPTIONAL MOLD FEATURE.
- ①, ② ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
c	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260	---	6.60	---
E	0.380	0.420	9.65	10.67
E1	0.245	---	6.22	---
e	0.100	BSC	2.54	BSC
H	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1	---	0.066	---	1.68
L2	---	0.070	---	1.78
L3	0.010	BSC	0.25	BSC
M	0*	8*	0*	8*

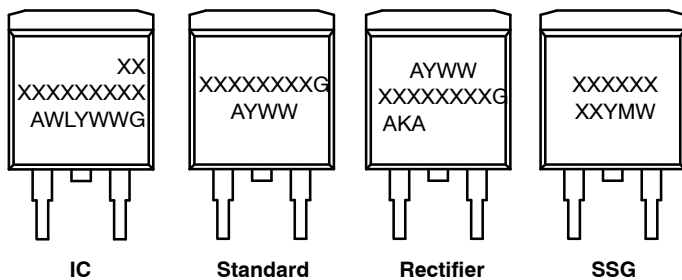


VIEW A-A



VIEW A-A  
OPTIONAL CONSTRUCTIONS

#### GENERIC MARKING DIAGRAMS\*



IC

Standard

Rectifier

SSG

- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- W = Week Code (SSG)
- M = Month Code (SSG)
- G = Pb-Free Package
- AKA = Polarity Indicator

\*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.

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DESCRIPTION:	D <sup>2</sup> PAK-3 (TO-263, 3-LEAD)	PAGE 1 OF 1

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