

NVD5890N

Power MOSFET

40 V, 123 A, Single N-Channel DPAK

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- MSL 1/260°C
- AEC Q101 Qualified and PPAP Capable
- 100% Avalanche Tested
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- Motor Drivers
- Pump Drivers for Automotive Braking, Steering and Other High Current Systems

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

Parameter	Symbol	Value	Unit		
Drain-to-Source Voltage	V_{DSS}	40	V		
Gate-to-Source Voltage	V_{GS}	± 20	V		
Continuous Drain Current ($R_{\theta JC}$)	I_D	$T_C = 25^\circ\text{C}$	123		
		$T_C = 85^\circ\text{C}$	95		
Power Dissipation ($R_{\theta JC}$)	P_D	$T_C = 25^\circ\text{C}$	107		
Continuous Drain Current ($R_{\theta JA}$) (Note 1)	I_D	$T_A = 25^\circ\text{C}$	24		
		$T_A = 85^\circ\text{C}$	18.5		
Power Dissipation ($R_{\theta JA}$) (Note 1)	P_D	$T_A = 25^\circ\text{C}$	4.0		
Pulsed Drain Current	$t_p = 10\mu\text{s}$	$T_A = 25^\circ\text{C}$	I_{DM}	400	A
Current Limited by Package		$T_A = 25^\circ\text{C}$	$I_{DmaxPkg}$	100	A
Operating Junction and Storage Temperature	T_J, T_{stg}	-55 to 175			$^\circ\text{C}$
Source Current (Body Diode)	I_S	100			A
Drain to Source dV/dt	dV/dt	6.0			V/ns
Single Pulse Drain-to-Source Avalanche Energy ($V_{DD} = 32\text{ V}$, $V_{GS} = 10\text{ V}$, $L = 0.3\text{ mH}$, $I_{L(pk)} = 40\text{ A}$, $R_G = 25\ \Omega$)	E_{AS}	240			mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T_L	260			$^\circ\text{C}$

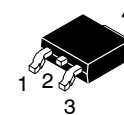
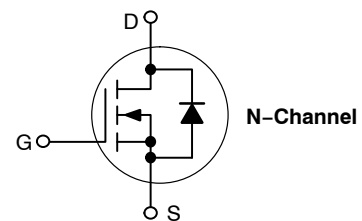
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



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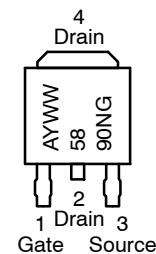
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$V_{(BR)DSS}$	$R_{DS(on)}$	I_D
40 V	3.7 m Ω @ 10 V	123 A



CASE 369C
DPAK
(Bent Lead)
STYLE 2

MARKING DIAGRAMS & PIN ASSIGNMENT



A = Assembly Location*
Y = Year
WW = Work Week
5890N = Device Code
G = Pb-Free Package

* The Assembly Location Code (A) is front side optional. In cases where the Assembly Location is stamped in the package bottom (molding ejector pin), the front side assembly code may be blank.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

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THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case (Drain)	$R_{\theta JC}$	1.4	°C/W
Junction-to-Ambient - Steady State (Note 1)	$R_{\theta JA}$	37	
Junction-to-Ambient - Steady State (Note 2)	$R_{\theta JA}$	76	

- Surface-mounted on FR4 board using 650 mm² pad size, 2 oz Cu.
- Surface-mounted on FR4 board using 36 mm² pad size.

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			40		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 40\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	μA
			$T_J = 150^\circ\text{C}$		100	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$	1.5		3.5	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			7.4		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 50\text{ A}$		2.9	3.7	m Ω
Forward Transconductance	gFS	$V_{DS} = 15\text{ V}, I_D = 15\text{ A}$		16.8		S

CHARGES AND CAPACITANCES

Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 12\text{ V}$		4975		pF
Output Capacitance	C_{oss}			785		
Reverse Transfer Capacitance	C_{rss}			490		
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 25\text{ V}$		4760		pF
Output Capacitance	C_{oss}			580		
Reverse Transfer Capacitance	C_{rss}			385		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}, I_D = 50\text{ A}$		74	100	nC
Threshold Gate Charge	$Q_{G(TH)}$			5.0		
Gate-to-Source Charge	Q_{GS}			17		
Gate-to-Drain Charge	Q_{GD}			16		

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = 10\text{ V}, V_{DS} = 20\text{ V}, I_D = 50\text{ A}, R_G = 2.0\ \Omega$		14		ns
Rise Time	t_r			55		
Turn-Off Delay Time	$t_{d(off)}$			35		
Fall Time	t_f			7.0		

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

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
DRAIN-SOURCE DIODE CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V},$ $I_S = 50\text{ A}$		0.9	1.2	V
		$V_{GS} = 0\text{ V},$ $I_S = 20\text{ A}$		0.8	1.0	
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V},$ $dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 50\text{ A}$		35		ns
Charge Time	t_a			20		
Discharge Time	t_b			15		
Reverse Recovery Charge	Q_{RR}			40		

TYPICAL PERFORMANCE CURVES

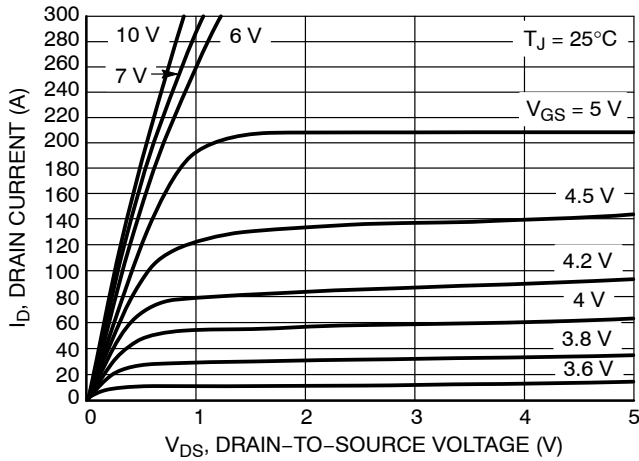


Figure 1. On-Region Characteristics

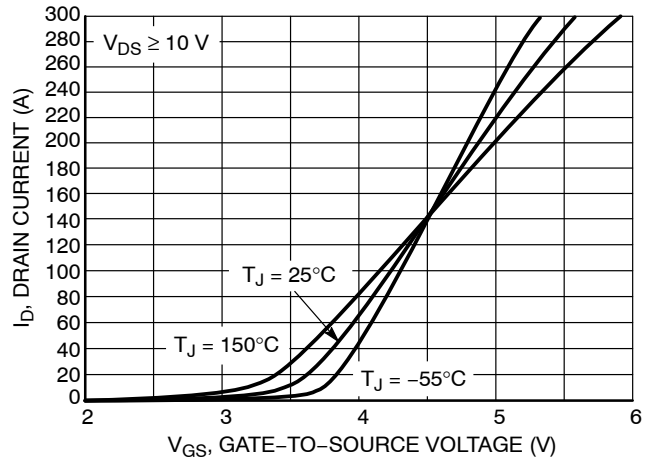


Figure 2. Transfer Characteristics

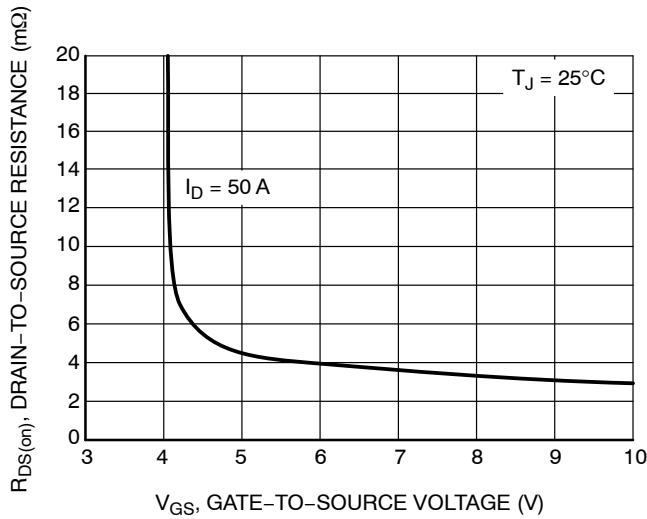


Figure 3. On-Resistance vs. Drain Current

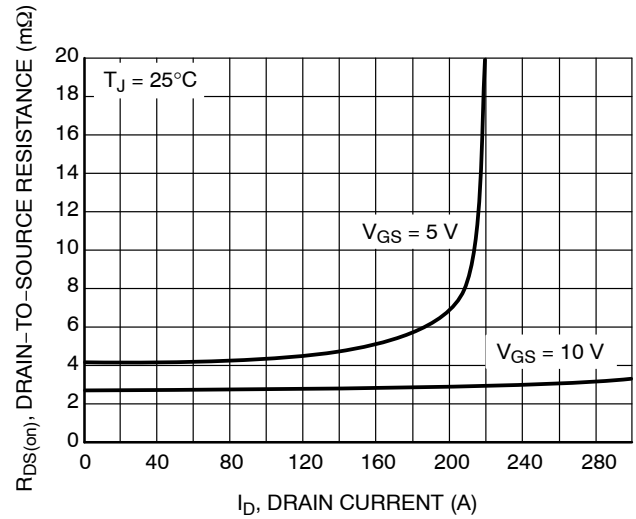


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

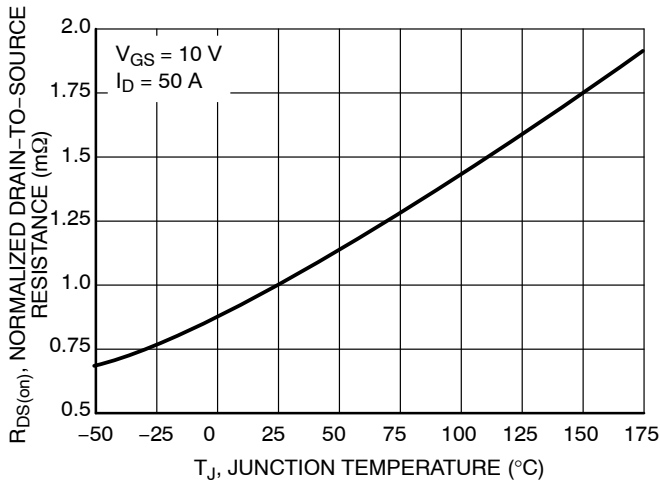


Figure 5. On-Resistance Variation with Temperature

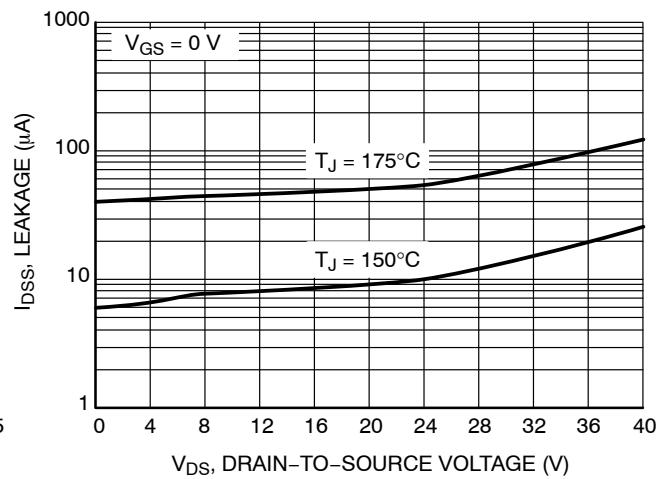


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

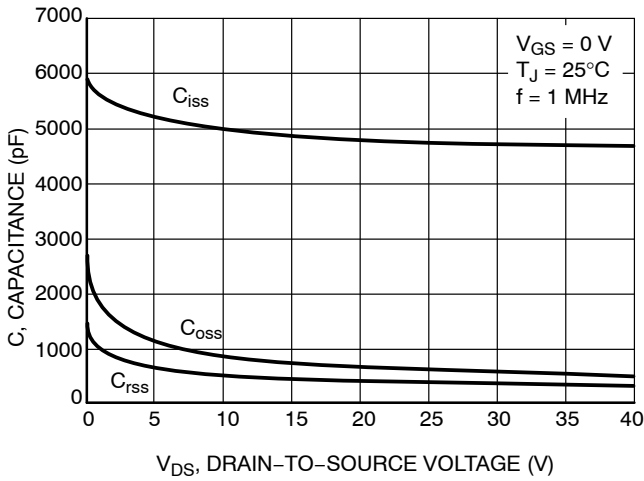


Figure 7. Capacitance Variation

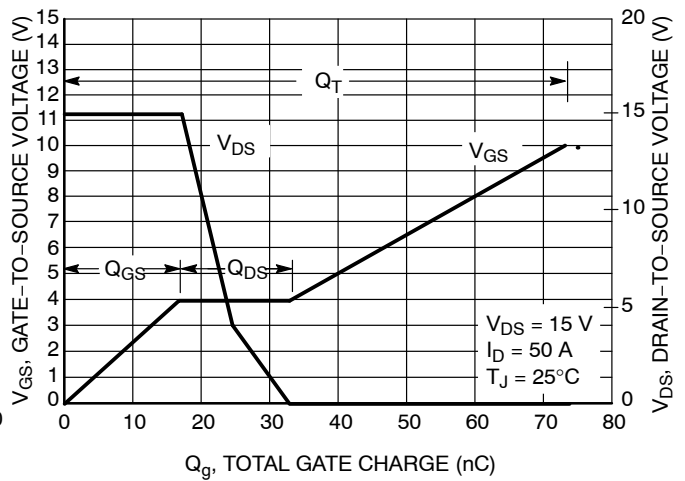


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

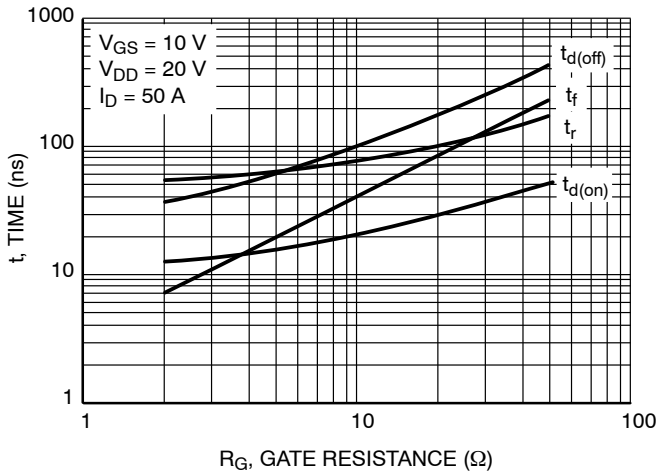


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

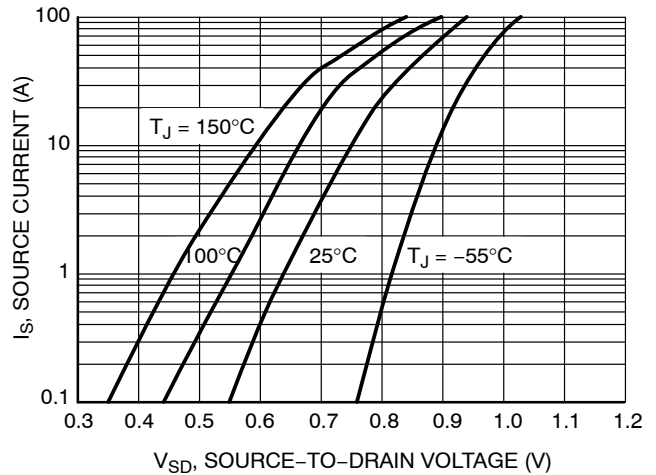


Figure 10. Diode Forward Voltage vs. Current

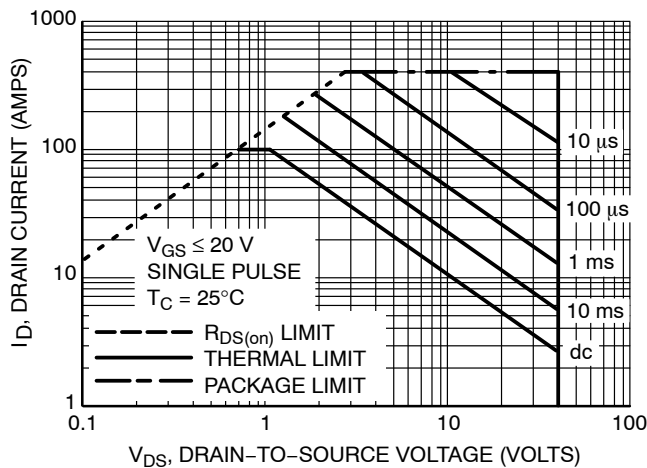


Figure 11. Maximum Rated Forward Biased Safe Operating Area

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TYPICAL PERFORMANCE CURVES

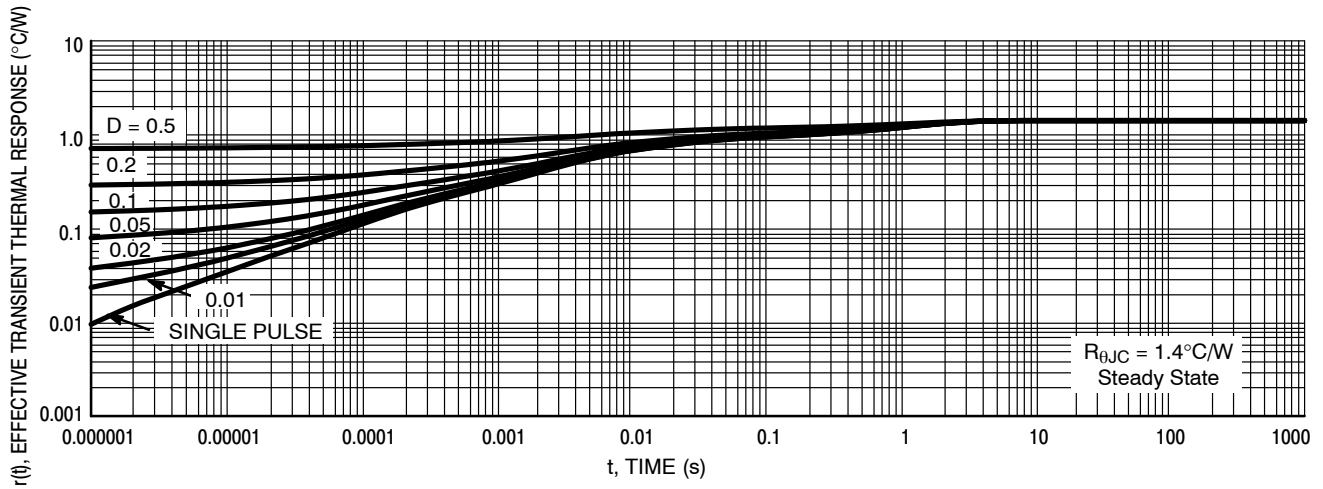


Figure 12. Thermal Response

ORDERING INFORMATION

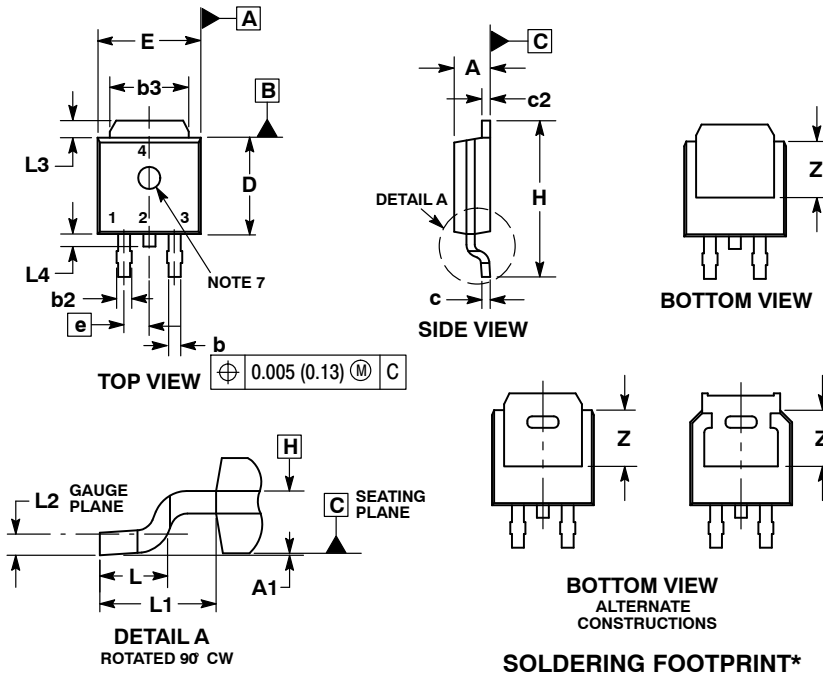
Order Number	Package	Shipping [†]
NVD5890NT4G	DPAK (Pb-Free)	2500/Tape & Reel
NVD5890NT4G-VF01	DPAK (Pb-Free)	2500/Tape & Reel

[†]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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PACKAGE DIMENSIONS

DPAK (SINGLE GAUGE) CASE 369C ISSUE F



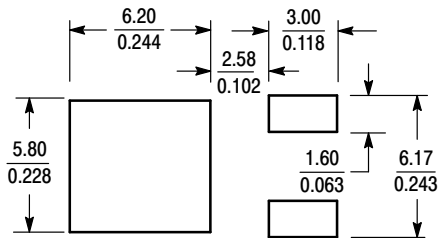
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.086	0.094	2.18	2.38
A1	0.000	0.005	0.00	0.13
b	0.025	0.035	0.63	0.89
b2	0.028	0.045	0.72	1.14
b3	0.180	0.215	4.57	5.46
c	0.018	0.024	0.46	0.61
c2	0.018	0.024	0.46	0.61
D	0.235	0.245	5.97	6.22
E	0.250	0.265	6.35	6.73
e	0.090 BSC		2.29 BSC	
H	0.370	0.410	9.40	10.41
L	0.055	0.070	1.40	1.78
L1	0.114 REF		2.90 REF	
L2	0.020 BSC		0.51 BSC	
L3	0.035	0.050	0.89	1.27
L4	---	0.040	---	1.01
Z	0.155	---	3.93	---

STYLE 2:

1. GATE
2. DRAIN
3. SOURCE
4. DRAIN



SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*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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