

# NTD110N02R, STD110N02R

## Power MOSFET

### 24 V, 110 A, N-Channel DPAK

#### Features

- Planar HD3e Process for Fast Switching Performance
- Low  $R_{DS(on)}$  to Minimize Conduction Loss
- Low  $C_{iss}$  to Minimize Driver Loss
- Low Gate Charge
- Optimized for High Side Switching Requirements in High-Efficiency DC-DC Converters
- S Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	24	V
Gate-to-Source Voltage – Continuous	$V_{GS}$	$\pm 20$	V
Thermal Resistance – Junction-to-Case	$R_{\theta JC}$	1.35	$^\circ\text{C/W}$
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	$P_D$	110	W
Drain Current	$I_D$	110	A
– Continuous @ $T_C = 25^\circ\text{C}$ , Chip	$I_D$	110	A
– Continuous @ $T_C = 25^\circ\text{C}$	$I_D$	110	A
Limited by Package	$I_D$	32	A
– Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	32	A
Limited by Wires	$I_D$	110	A
– Single Pulse ( $t_p = 10 \mu\text{s}$ )	$I_D$	110	A
Thermal Resistance	$R_{\theta JA}$	52	$^\circ\text{C/W}$
– Junction-to-Ambient (Note 1)	$R_{\theta JA}$	52	$^\circ\text{C/W}$
– Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	2.88	W
– Drain Current – Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	17.5	A
Thermal Resistance	$R_{\theta JA}$	100	$^\circ\text{C/W}$
– Junction-to-Ambient (Note 2)	$R_{\theta JA}$	100	$^\circ\text{C/W}$
– Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	1.5	W
– Drain Current – Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	12.5	A
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to 175	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$ ( $V_{DD} = 50 \text{ Vdc}$ , $V_{GS} = 10 \text{ Vdc}$ , $I_L = 15.5 \text{ Apk}$ , $L = 1.0 \text{ mH}$ , $R_G = 25 \Omega$ )	$E_{AS}$	120	mJ
Maximum 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.

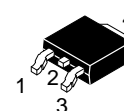
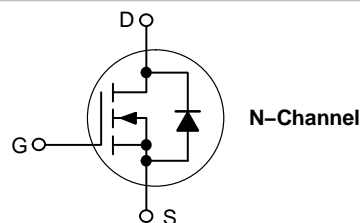
1. When surface mounted to an FR4 board using 0.5 sq in drain pad size.
2. When surface mounted to an FR4 board using the minimum recommended pad size.



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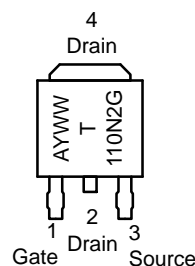
<http://onsemi.com>

$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	$I_D$ MAX
24 V	4.1 m $\Omega$ @ 10 V	110 A



**DPAK  
CASE 369AA  
(Surface Mount)  
STYLE 2**

#### MARKING DIAGRAM & PIN ASSIGNMENT



- A = Assembly Location\*
- Y = Year
- WW = Work Week
- T110N2 = 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, the front side assembly code may be blank.

#### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# NTD110N02R, STD110N02R

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-to-Source Breakdown Voltage (Note 3) ( $V_{GS} = 0\text{ V}$ , $I_D = 250\ \mu\text{A}$ )	$V_{(BR)DSS}$	24	28		V
Positive Temperature Coefficient			15		mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current ( $V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$ ) ( $V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125^\circ\text{C}$ )	$I_{DSS}$			1.5 10	$\mu\text{A}$
Gate-Body Leakage Current ( $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$ )	$I_{GSS}$			$\pm 100$	nA

## ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage (Note 3) ( $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$ )	$V_{GS(th)}$	1.0	1.5 5.0	2.0	V mV/ $^\circ\text{C}$
Negative Threshold Temperature Coefficient					
Static Drain-to-Source On-Resistance (Note 3) ( $V_{GS} = 10\text{ V}$ , $I_D = 110\text{ A}$ ) ( $V_{GS} = 4.5\text{ V}$ , $I_D = 55\text{ A}$ ) ( $V_{GS} = 10\text{ V}$ , $I_D = 20\text{ A}$ ) ( $V_{GS} = 4.5\text{ V}$ , $I_D = 20\text{ A}$ )	$R_{DS(on)}$		4.1 5.5 3.9 5.5	4.6 6.2	m $\Omega$
Forward Transconductance ( $V_{DS} = 10\text{ V}$ , $I_D = 15\text{ A}$ ) (Note 3)	$g_{FS}$		44		Mhos

## DYNAMIC CHARACTERISTICS

Input Capacitance	$(V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz})$	$C_{iss}$	2710	3440	pF
Output Capacitance		$C_{oss}$	1105	1670	
Transfer Capacitance		$C_{rss}$	450	640	

## SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$(V_{GS} = 10\text{ V}, V_{DD} = 10\text{ V}, I_D = 40\text{ A}, R_G = 3.0\ \Omega)$	$t_{d(on)}$	11	22	ns
Rise Time		$t_r$	39	80	
Turn-Off Delay Time		$t_{d(off)}$	27	40	
Fall Time		$t_f$	21	40	
Gate Charge	$(V_{GS} = 4.5\text{ V}, I_D = 40\text{ A}, V_{DS} = 10\text{ V})$ (Note 3)	$Q_T$	23.6	28	nC
		$Q_{GS}$	5.1		
		$Q_{GD}$	11		

## SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage	$(I_S = 20\text{ A}, V_{GS} = 0\text{ V})$ (Note 3) $(I_S = 55\text{ A}, V_{GS} = 0\text{ V})$ $(I_S = 20\text{ A}, V_{GS} = 0\text{ V}, T_J = 125^\circ\text{C})$	$V_{SD}$	0.82 0.99 0.65	1.2	V
Reverse Recovery Time	$(I_S = 30\text{ A}, V_{GS} = 0\text{ V}, di_S/dt = 100\text{ A}/\mu\text{s})$ (Note 3)	$t_{rr}$	36.5		ns
		$t_a$	30		
		$t_b$	25		
Reverse Recovery Stored Charge		$Q_{rr}$	0.048		$\mu\text{C}$

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.

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

4. Switching characteristics are independent of operating junction temperatures.

# NTD110N02R, STD110N02R

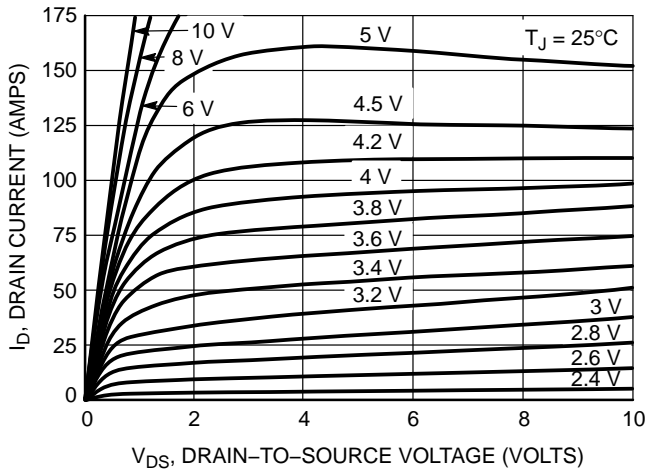


Figure 1. On-Region Characteristics

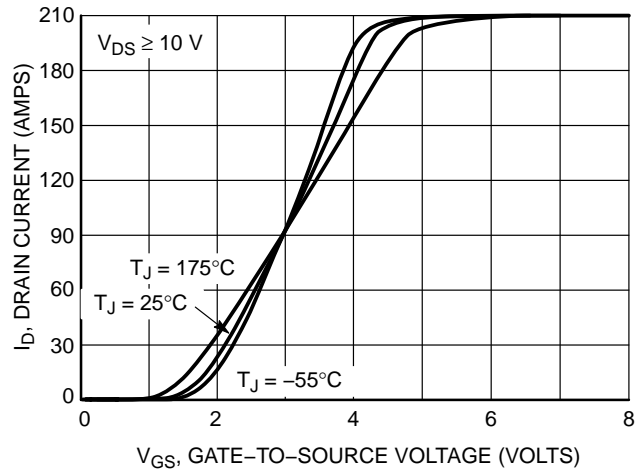


Figure 2. Transfer Characteristics

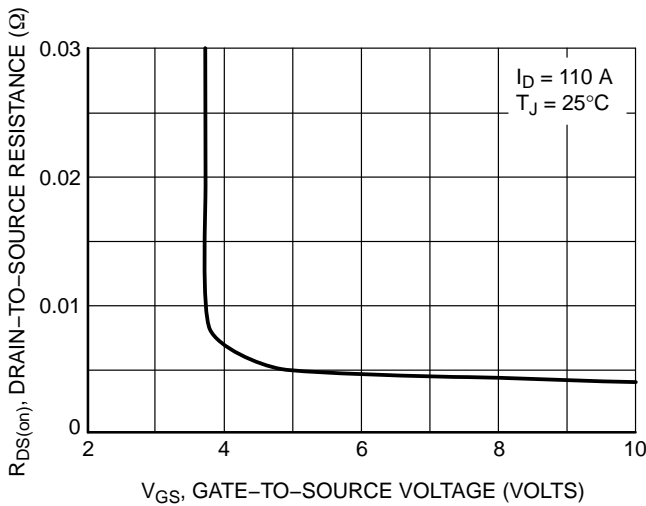


Figure 3. On-Resistance versus Gate-to-Source Voltage

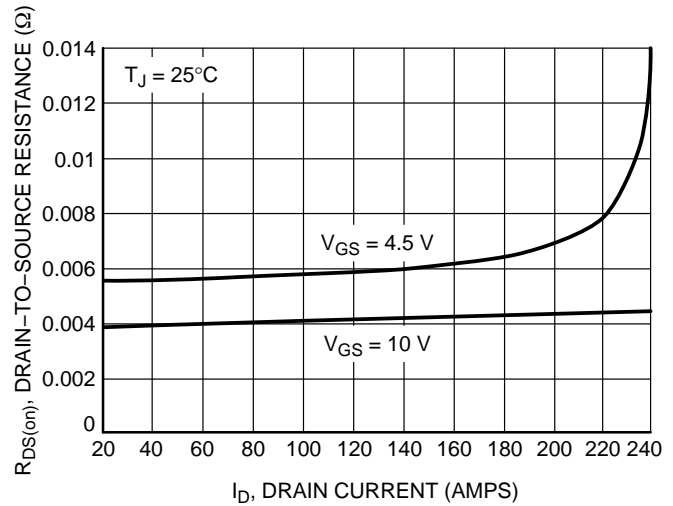


Figure 4. On-Resistance versus Drain Current and Gate Voltage

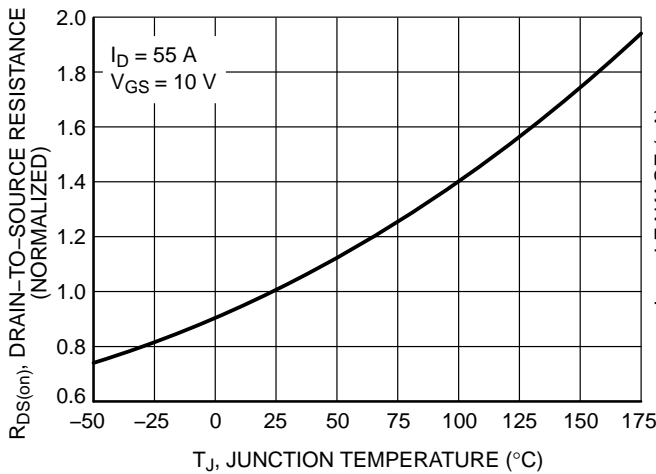


Figure 5. On-Resistance Variation with Temperature

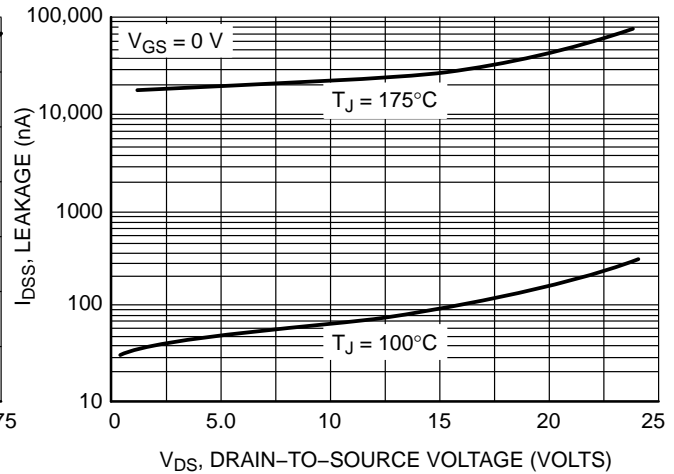
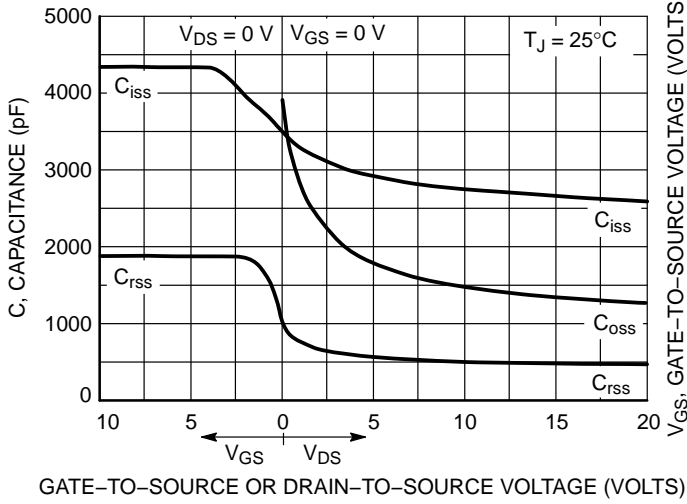
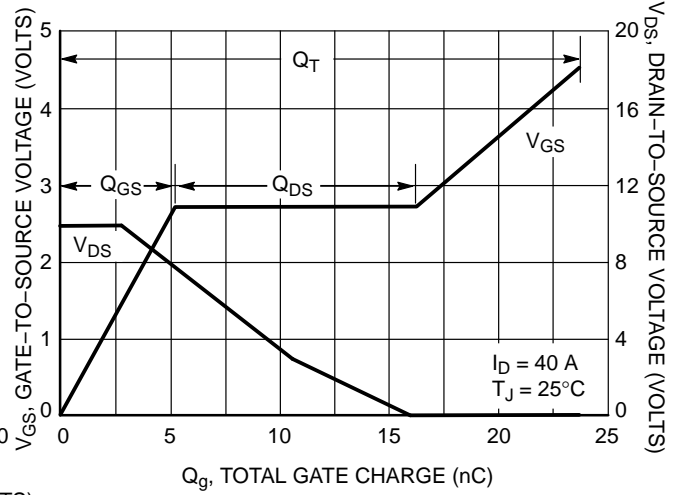


Figure 6. Drain-to-Source Leakage Current versus Voltage

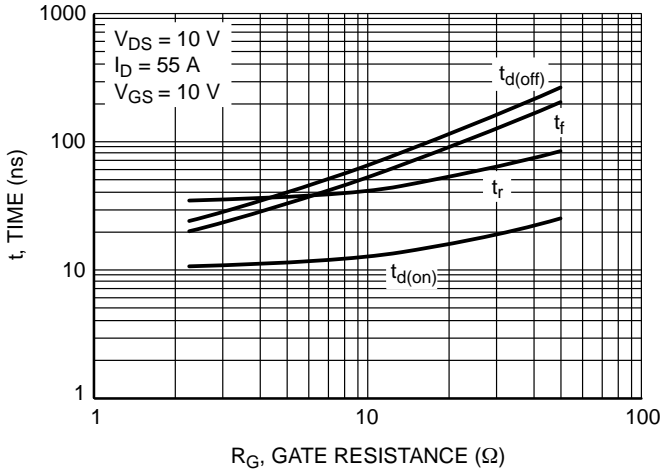
# NTD110N02R, STD110N02R



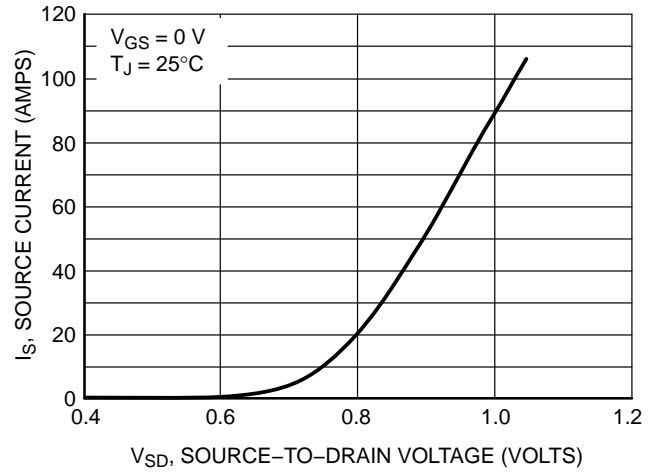
**Figure 7. Capacitance Variation**



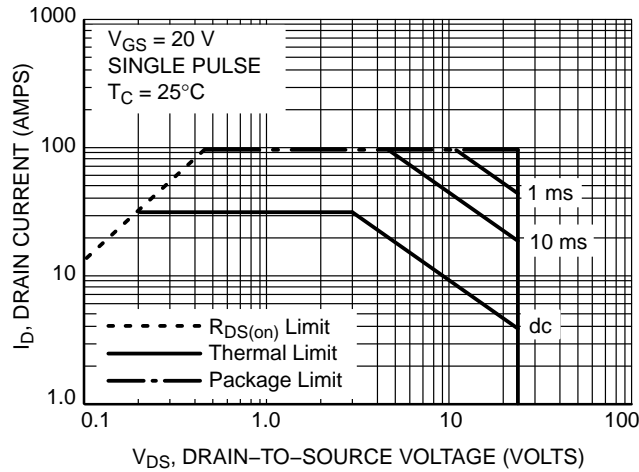
**Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge**



**Figure 9. Resistive Switching Time Variation versus Gate Resistance**

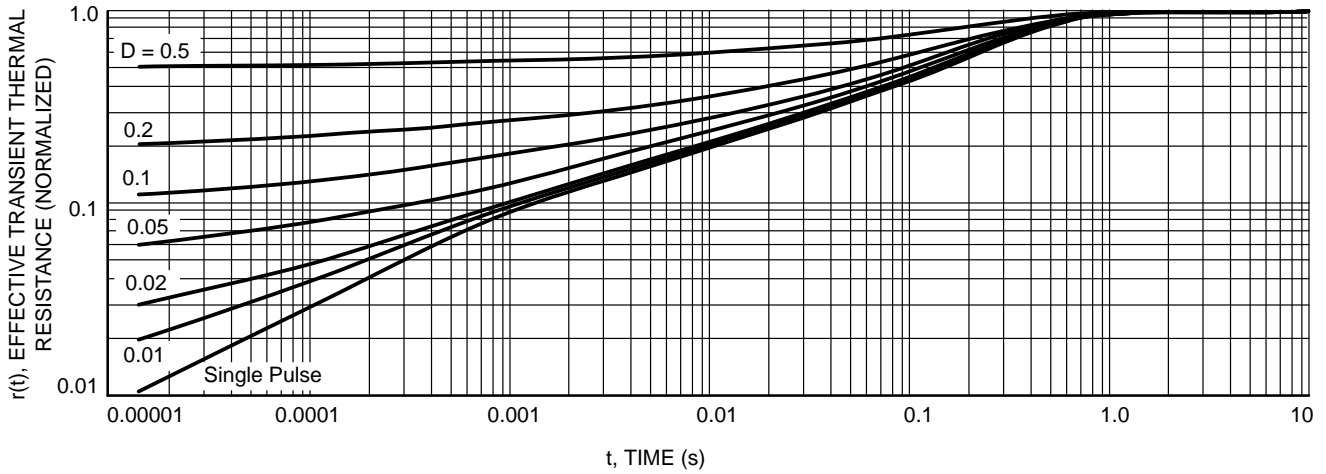


**Figure 10. Diode Forward Voltage versus Current**



**Figure 11. Maximum Rated Forward Biased Safe Operating Area**

# NTD110N02R, STD110N02R



**Figure 12. Thermal Response**

## ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NTD110N02RT4G	DPAK (Pb-Free)	2500 / Tape & Reel
STD110N02RT4G*	DPAK (Pb-Free)	2500 / Tape & Reel

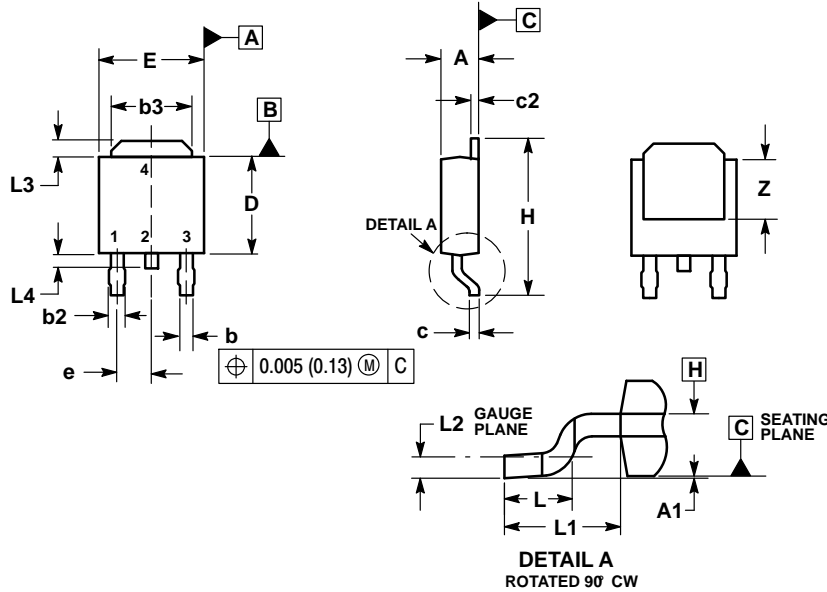
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*S Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

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## PACKAGE DIMENSIONS

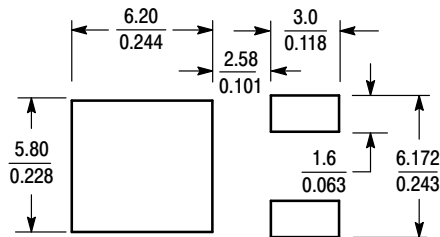
### DPAK (SINGLE GUAGE) CASE 369AA ISSUE B



- 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.

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	0.030	0.045	0.76	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	0.108 REF		2.74 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	---

### SOLDERING FOOTPRINT\*



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

- STYLE 2:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

\*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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