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
- AEC Q101 Qualified − STD110N02R
- These Devices are Pb−Free and are RoHS Compliant

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

Rating	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	24	V
Gate−to−Source Voltage − Continuous	V_{GS}	±20	V
Thermal Resistance − Junction−to−Case Total Power Dissipation @ T_C = 25°C Drain Current − Continuous @ T_C = 25°C, Chip − Continuous @ T_C = 25°C Limited by Package − Continuous @ T_A = 25°C Limited by Wires − Single Pulse (t_p = 10 μs)	$R_{\theta JC}$ P_D I_D I_D I_D I_D	1.35 110 110 110 32 110	°C/W W A A A A
Thermal Resistance − Junction−to−Ambient (Note 1) − Total Power Dissipation @ T_A = 25°C − Drain Current − Continuous @ T_A = 25°C	 $R_{\theta JA}$ P_D I_D	 52 2.88 17.5	 °C/W W A
Thermal Resistance − Junction−to−Ambient (Note 2) − Total Power Dissipation @ T_A = 25°C − Drain Current − Continuous @ T_A = 25°C	 $R_{\theta JA}$ P_D I_D	 100 1.5 12.5	 °C/W W A
Operating and Storage Temperature Range	T_J, T_{stg}	−55 to 175	°C
Single Pulse Drain−to−Source Avalanche Energy − Starting T_J = 25°C (V_{DD} = 50 Vdc, V_{GS} = 10 Vdc, I_L = 15.5 Apk, L = 1.0 mH, R_G = 25 Ω)	E_{AS}	120	mJ
Maximum Lead Temperature for Soldering Purposes, (1/8″ from case for 10 s)	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. 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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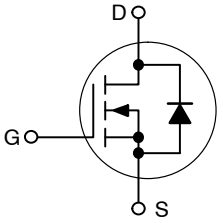
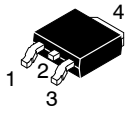
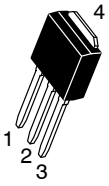
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX
24 V	4.1 mΩ @ 10 V	110 A

N−Channel



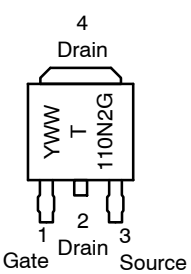


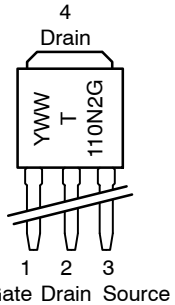
CASE 369AA
DPAK
(Surface Mount)
STYLE 2



CASE 369D
DPAK
(Straight Lead)
STYLE 2

MARKING DIAGRAM & PIN ASSIGNMENTS





Y = Year
WW = Work Week
T110N2 = Device Code
G = Pb−Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain−to−Source Breakdown Voltage (Note 3) (V_{GS} = 0 V, I_D = 250 μA) Positive Temperature Coefficient		$V_{(BR)DSS}$	24	28 15		V mV/°C
Zero Gate Voltage Drain Current (V_{DS} = 20 V, V_{GS} = 0 V) (V_{DS} = 20 V, V_{GS} = 0 V, T_J = 125°C)		I_{DSS}			1.5 10	μA
Gate−Body Leakage Current (V_{GS} = ±20 V, V_{DS} = 0 V)		I_{GSS}			±100	nA
ON CHARACTERISTICS (Note 3)						
Gate Threshold Voltage (Note 3) (V_{DS} = V_{GS}, I_D = 250 μA) Negative Threshold Temperature Coefficient		$V_{GS(th)}$	1.0	1.5 5.0	2.0	V mV/°C
Static Drain−to−Source On−Resistance (Note 3) (V_{GS} = 10 V, I_D = 110 A) (V_{GS} = 4.5 V, I_D = 55 A) (V_{GS} = 10 V, I_D = 20 A) (V_{GS} = 4.5 V, I_D = 20 A)		$R_{DS(on)}$		4.1 5.5 3.9 5.5	 4.6 6.2	mΩ
Forward Transconductance (V_{DS} = 10 V, I_D = 15 A) (Note 3)		g_{FS}		44		Mhos
DYNAMIC CHARACTERISTICS						
Input Capacitance	(V_{DS} = 20 V, V_{GS} = 0 V, f = 1.0 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 V, V_{DD} = 10 V, I_D = 40 A, R_G = 3.0 Ω)	$t_{d(on)}$		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 V, I_D = 40 A, V_{DS} = 10 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 A, V_{GS} = 0 V) (Note 3) (I_S = 55 A, V_{GS} = 0 V) (I_S = 20 A, V_{GS} = 0 V, T_J = 125°C)	V_{SD}		0.82 0.99 0.65	1.2	V
Reverse Recovery Time	(I_S = 30 A, V_{GS} = 0 V, dI_S/dt = 100 A/μs) (Note 3)	t_{rr}		36.5		ns
		t_a		30		
		t_b		25		
Reverse Recovery Stored Charge		Q_{rr}		0.048		μC

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

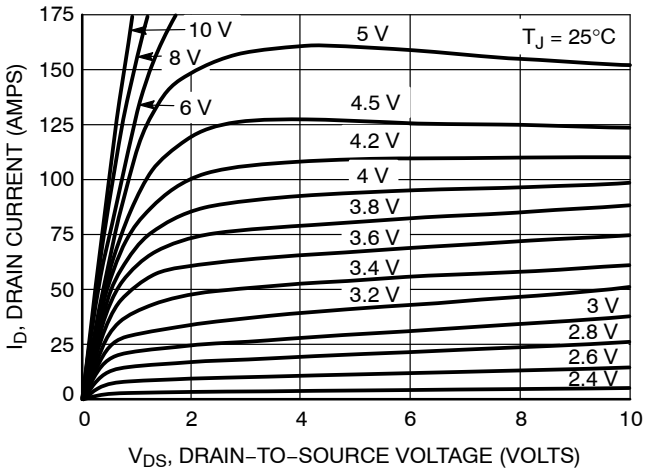


Figure 1. On−Region Characteristics

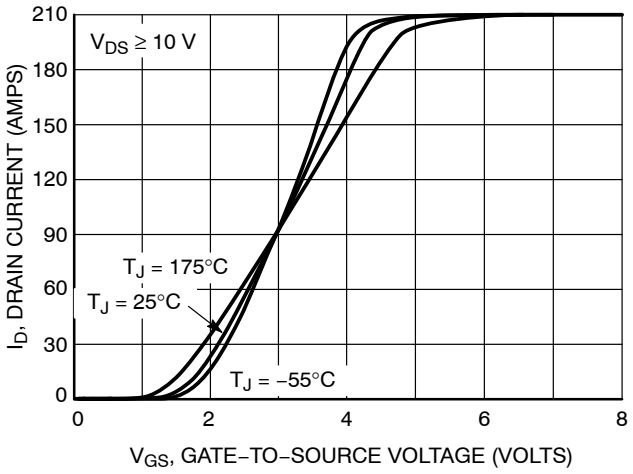


Figure 2. Transfer Characteristics

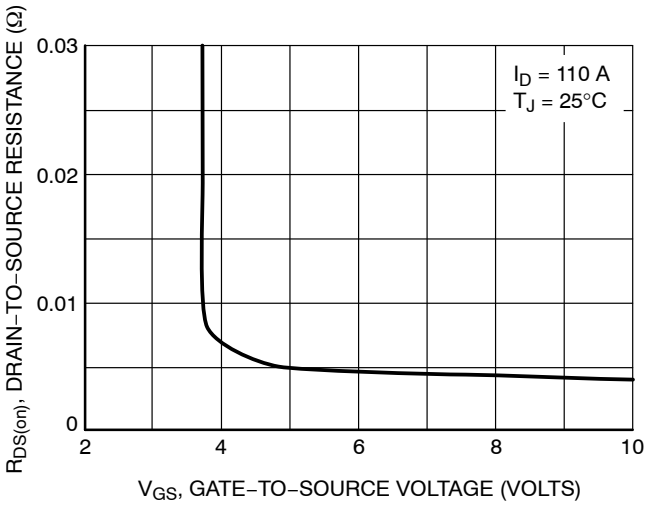


Figure 3. On−Resistance versus Gate−to−Source Voltage

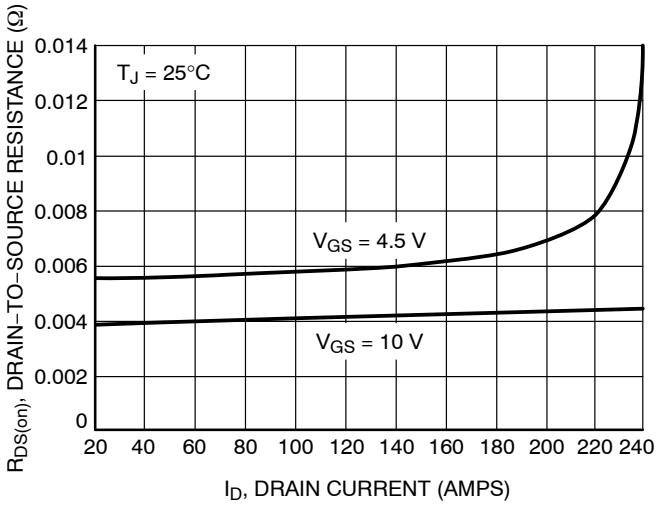


Figure 4. On−Resistance versus Drain Current and Gate Voltage

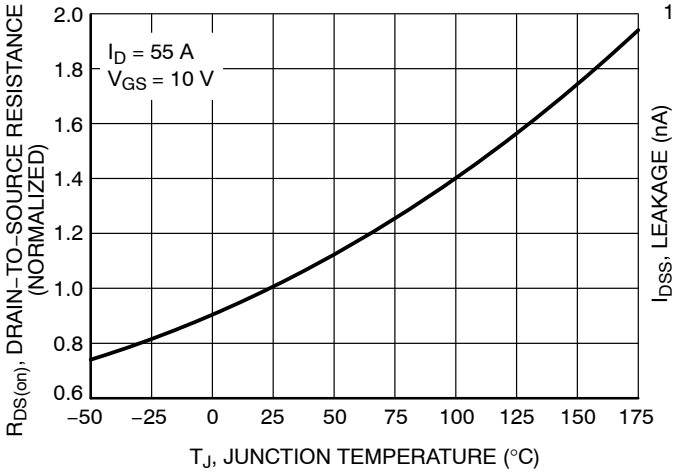


Figure 5. On−Resistance Variation with Temperature

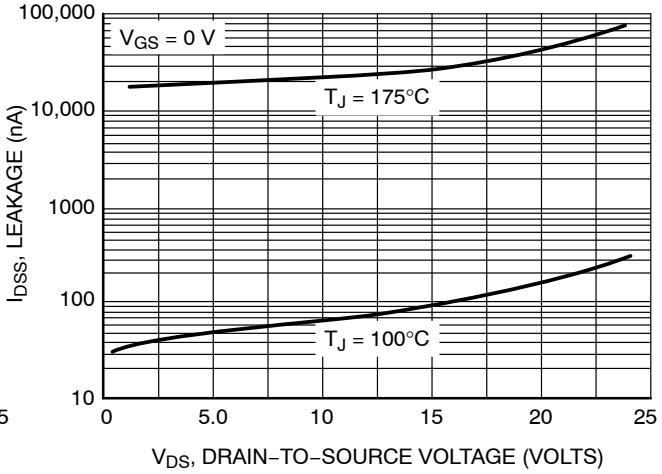


Figure 6. Drain−to−Source Leakage Current versus Voltage

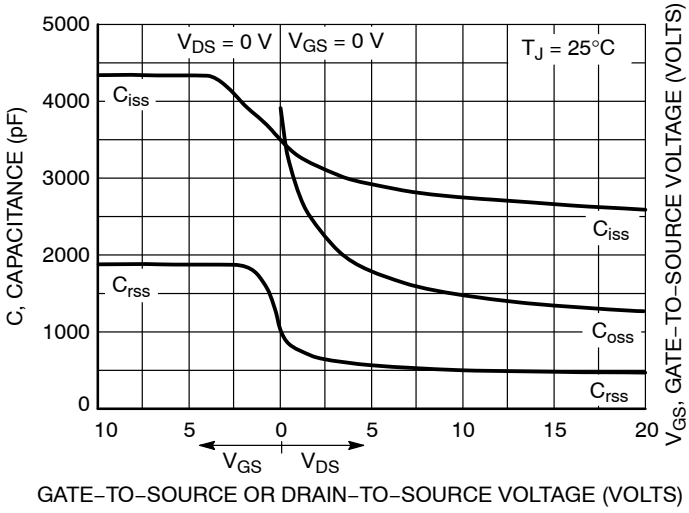


Figure 7. Capacitance Variation

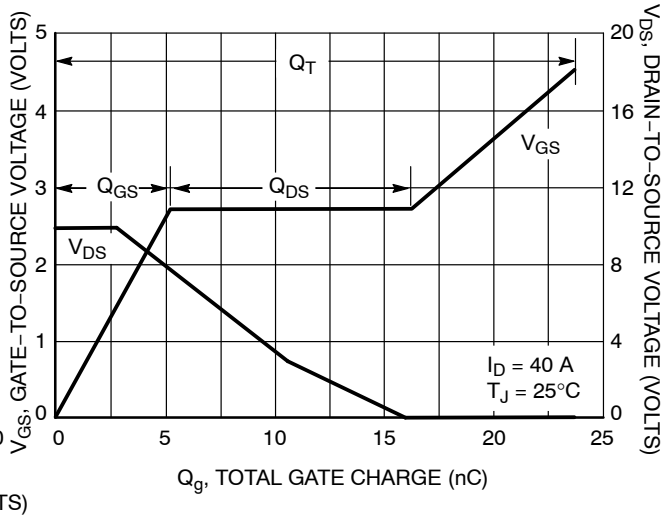


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

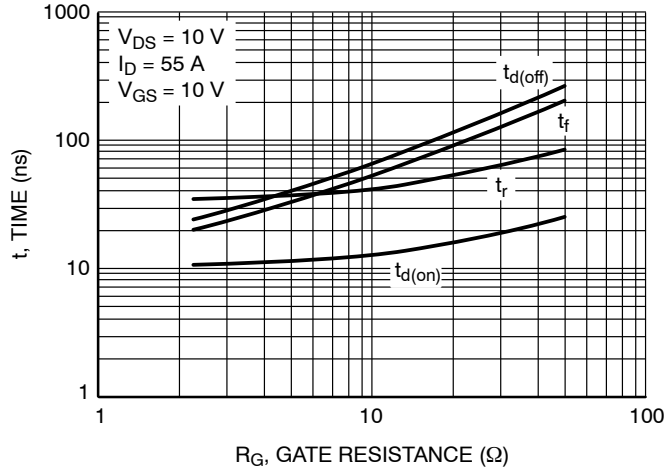


Figure 9. Resistive Switching Time Variation versus Gate Resistance

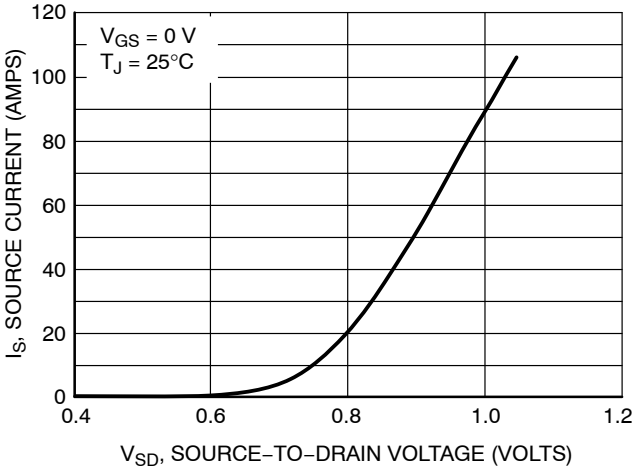


Figure 10. Diode Forward Voltage versus Current

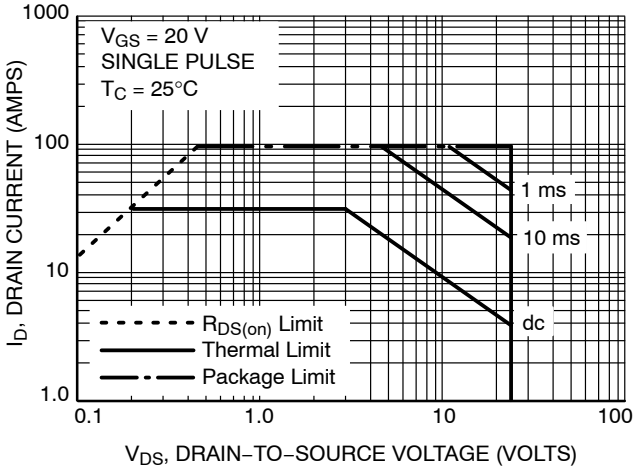


Figure 11. Maximum Rated Forward Biased Safe Operating Area

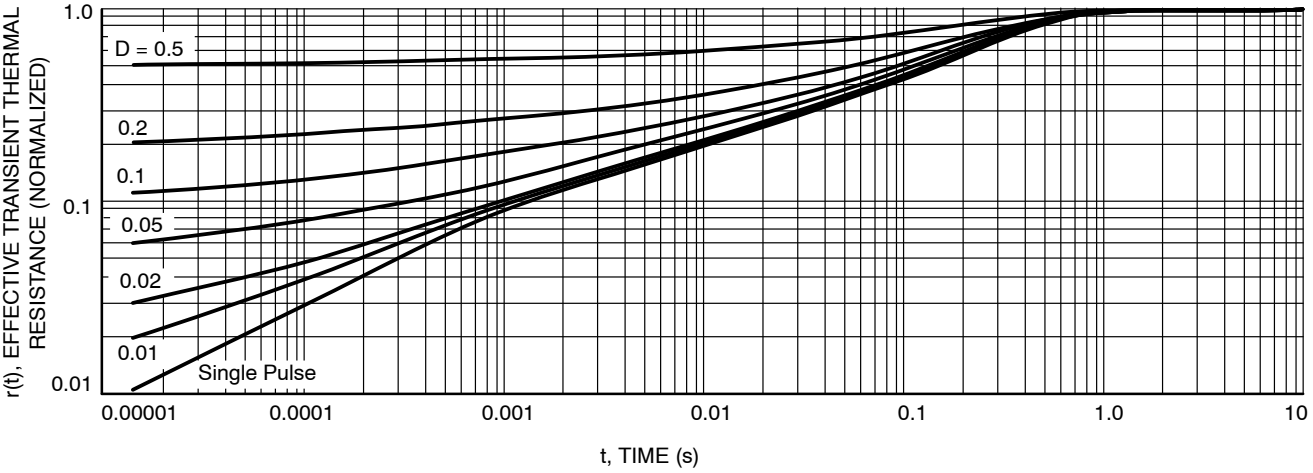


Figure 12. Thermal Response

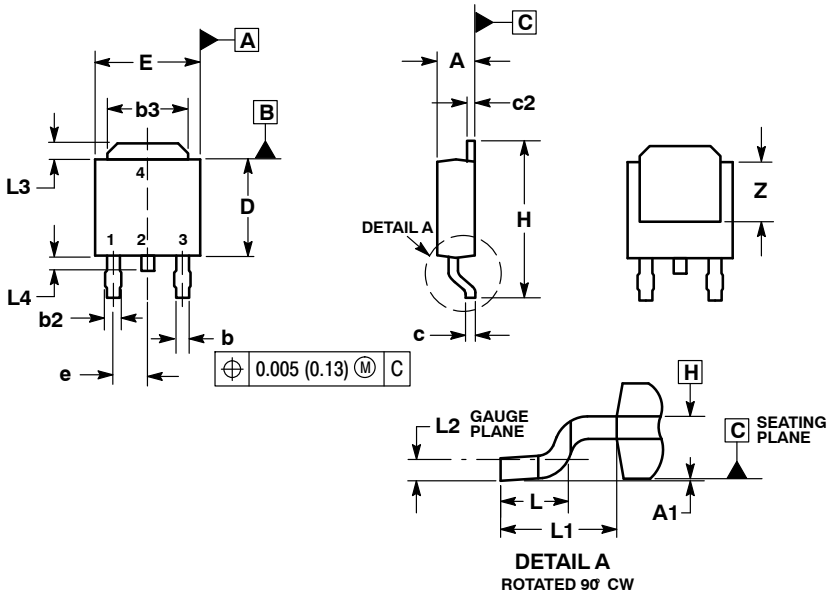
ORDERING INFORMATION

Device	Package	Shipping†
NTD110N02RT4G	DPAK (Pb−Free)	2500 / Tape & Reel
STD110N02RT4G	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.

PACKAGE DIMENSIONS

DPAK (SINGLE GUAGE)
CASE 369AA−01
ISSUE B

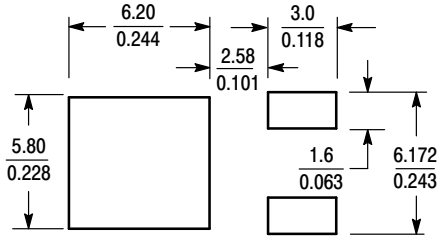


NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES 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.

	INCHES		MILLIMETERS	
DIM	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	−−−

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

SOLDERING FOOTPRINT*

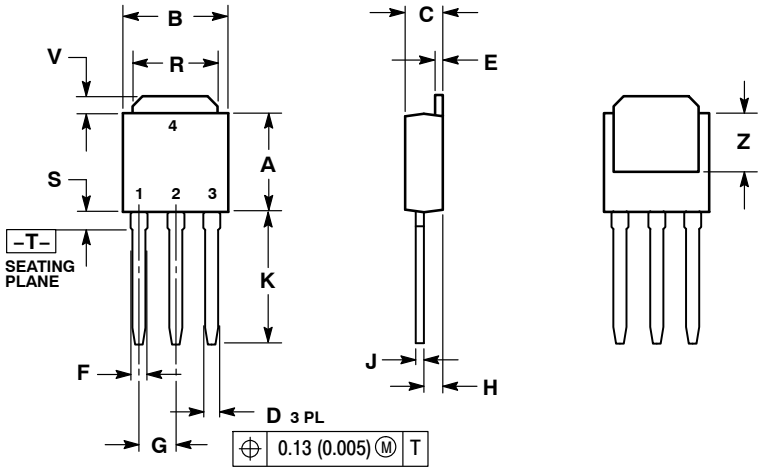


SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

PACKAGE DIMENSIONS

IPAK
CASE 369D−01
ISSUE C



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
G	0.090 BSC		2.29 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.350	0.380	8.89	9.65
R	0.180	0.215	4.45	5.45
S	0.025	0.040	0.63	1.01
V	0.035	0.050	0.89	1.27
Z	0.155	−−−	3.93	−−−

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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
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Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
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Japan Customer Focus Center
Phone: 81−3−5773−3850

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NTD110N02R/D