

# NTD110N02R

## 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
- Pb-Free Packages are Available

#### 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			
– 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			
– Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	32	A
Limited by Wires			
– Single Pulse ( $t_p = 10 \mu\text{s}$ )	$I_D$	110	A
Thermal Resistance			
– 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			
– 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 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.

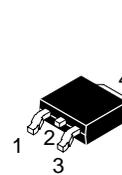
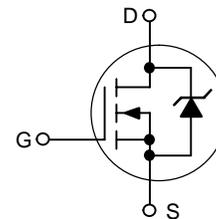


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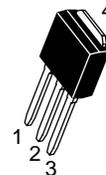
<http://onsemi.com>

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

#### N-Channel

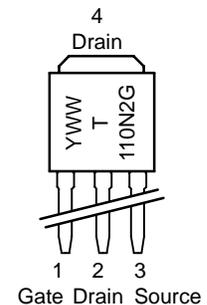
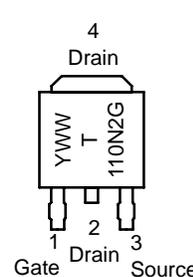


**CASE 369AA  
DPAK  
(Surface Mount)  
STYLE 2**



**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.

# NTD110N02R

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (Note 3) (V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA) Positive Temperature Coefficient	V <sub>(BR)DSS</sub>	24	28 15		V mV/°C
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V) (V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125°C)	I <sub>DSS</sub>			1.5 10	μA
Gate-Body Leakage Current (V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V)	I <sub>GSS</sub>			±100	nA

### ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage (Note 3) (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA) Negative Threshold Temperature Coefficient	V <sub>GS(th)</sub>	1.0	1.5 5.0	2.0	V mV/°C
Static Drain-to-Source On-Resistance (Note 3) (V <sub>GS</sub> = 10 V, I <sub>D</sub> = 110 A) (V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 55 A) (V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A) (V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 20 A)	R <sub>DS(on)</sub>		4.1 5.5 3.9 5.5	4.6 6.2	mΩ
Forward Transconductance (V <sub>DS</sub> = 10 V, I <sub>D</sub> = 15 A) (Note 3)	g <sub>FS</sub>		44		Mhos

### DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz)	C <sub>iss</sub>		2710	3440	pF
Output Capacitance		C <sub>oss</sub>		1105	1670	
Transfer Capacitance		C <sub>rss</sub>		450	640	

### SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	(V <sub>GS</sub> = 10 V, V <sub>DD</sub> = 10 V, I <sub>D</sub> = 40 A, R <sub>G</sub> = 3.0 Ω)	t <sub>d(on)</sub>		11	22	ns
Rise Time		t <sub>r</sub>		39	80	
Turn-Off Delay Time		t <sub>d(off)</sub>		27	40	
Fall Time		t <sub>f</sub>		21	40	
Gate Charge	(V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 40 A, V <sub>DS</sub> = 10 V) (Note 3)	Q <sub>T</sub>		23.6	28	nC
		Q <sub>GS</sub>		5.1		
		Q <sub>DS</sub>		11		

### SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage	(I <sub>S</sub> = 20 A, V <sub>GS</sub> = 0 V) (Note 3) (I <sub>S</sub> = 55 A, V <sub>GS</sub> = 0 V) (I <sub>S</sub> = 20 A, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125°C)	V <sub>SD</sub>		0.82 0.99 0.65	1.2	V
Reverse Recovery Time	(I <sub>S</sub> = 30 A, V <sub>GS</sub> = 0 V, di <sub>S</sub> /dt = 100 A/μs) (Note 3)	t <sub>rr</sub>		36.5		ns
		t <sub>a</sub>		30		
		t <sub>b</sub>		25		
Reverse Recovery Stored Charge		Q <sub>rr</sub>		0.048		μC

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

# NTD110N02R

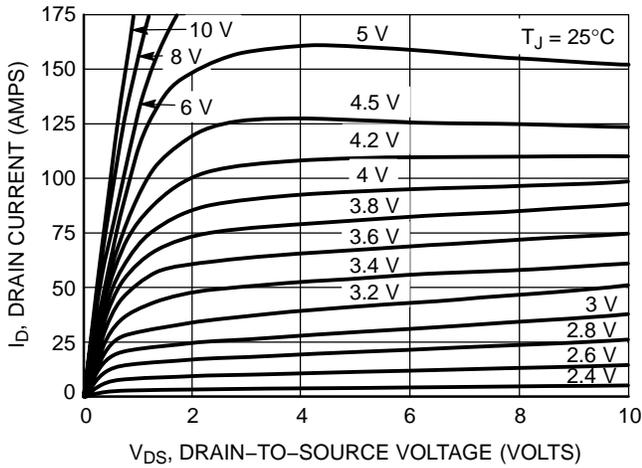


Figure 1. On-Region Characteristics

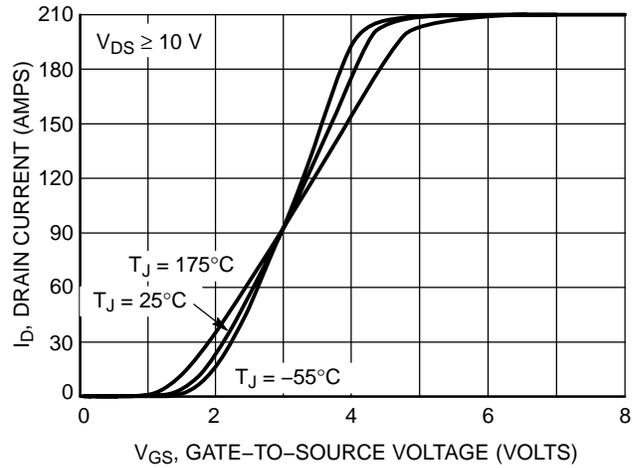


Figure 2. Transfer Characteristics

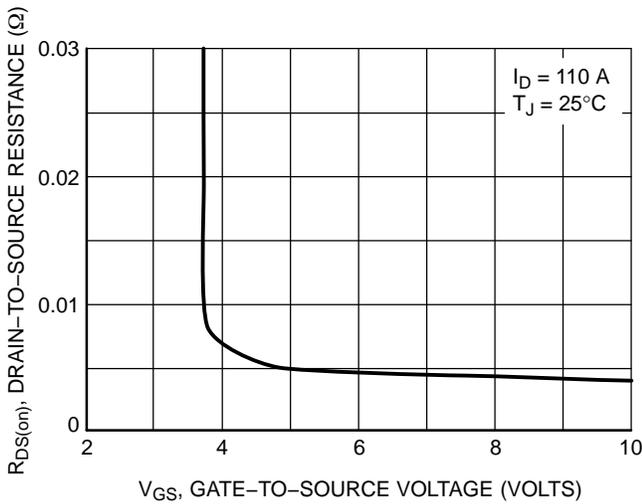


Figure 3. On-Resistance versus Gate-to-Source Voltage

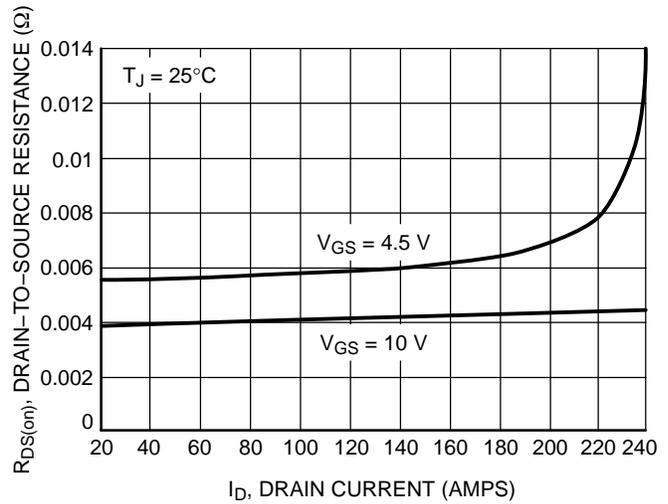


Figure 4. On-Resistance versus Drain Current and Gate Voltage

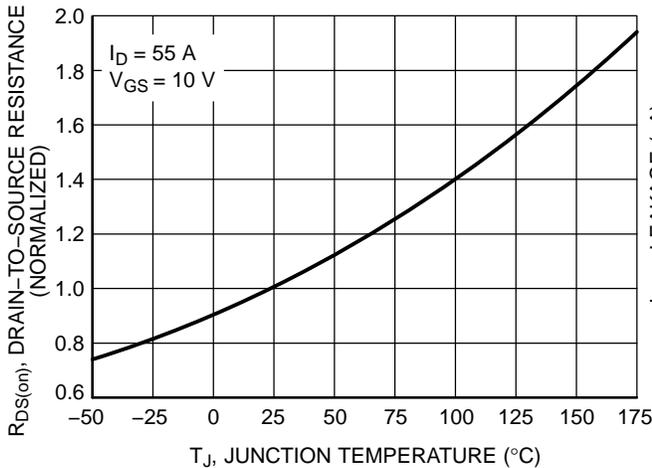


Figure 5. On-Resistance Variation with Temperature

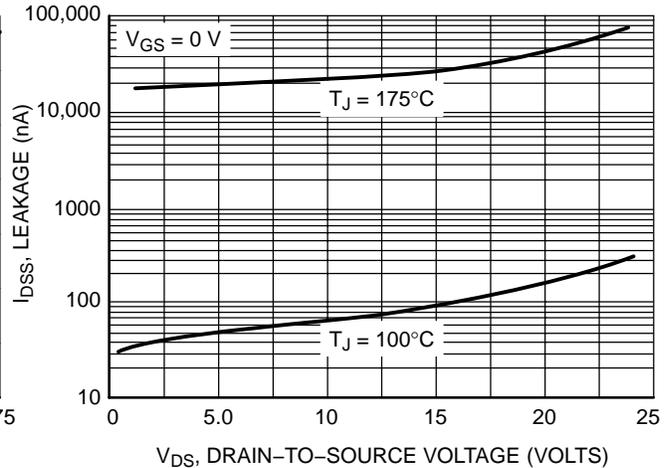
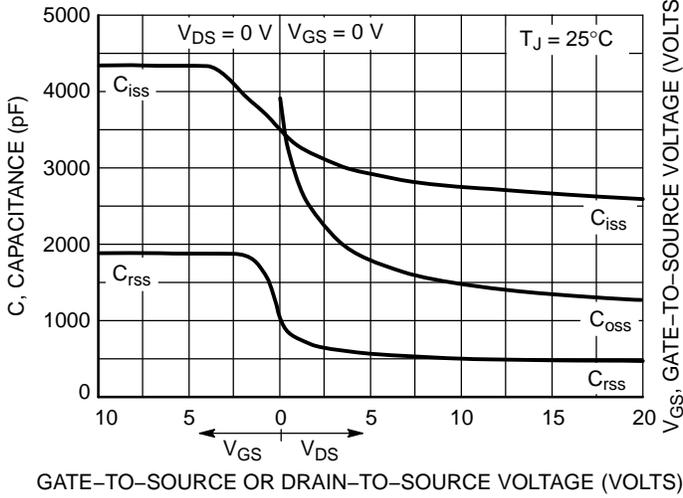
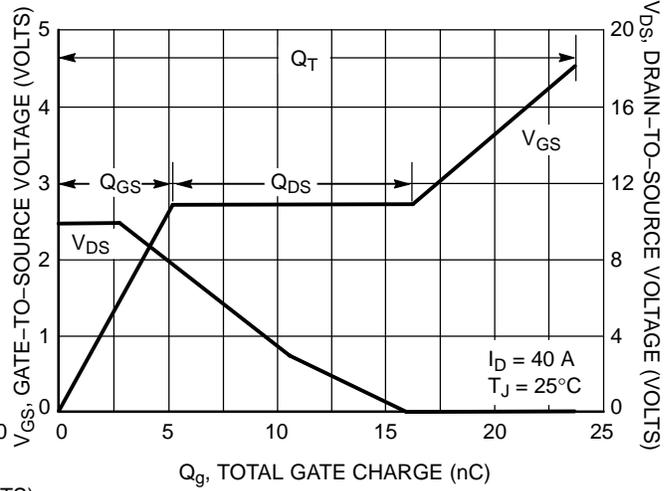


Figure 6. Drain-to-Source Leakage Current versus Voltage

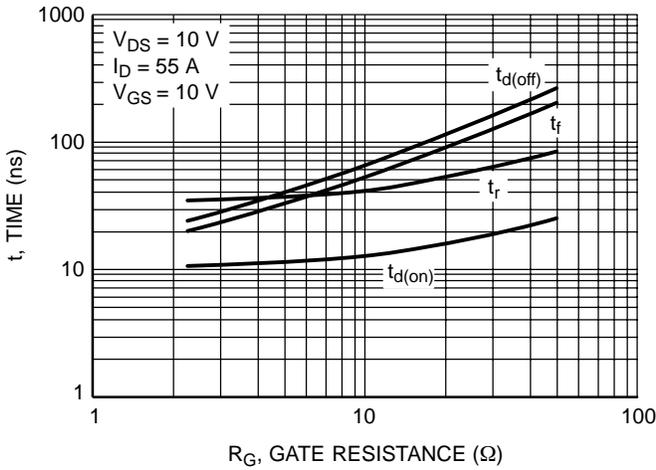
# NTD110N02R



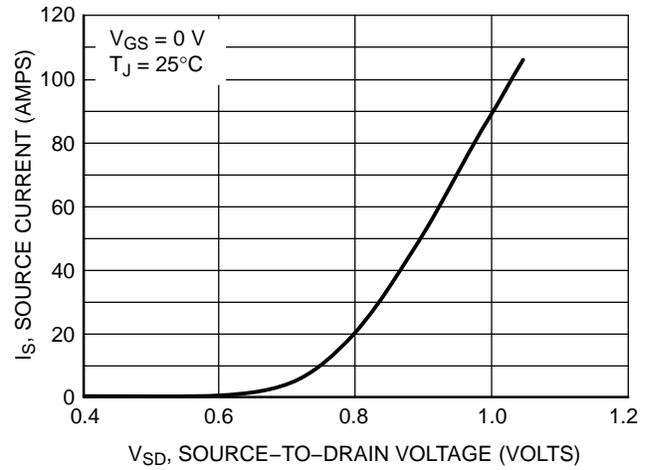
**Figure 7. Capacitance Variation**



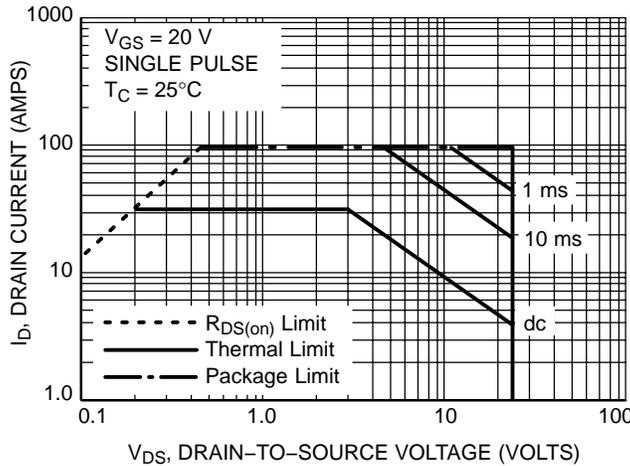
**Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge**



**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

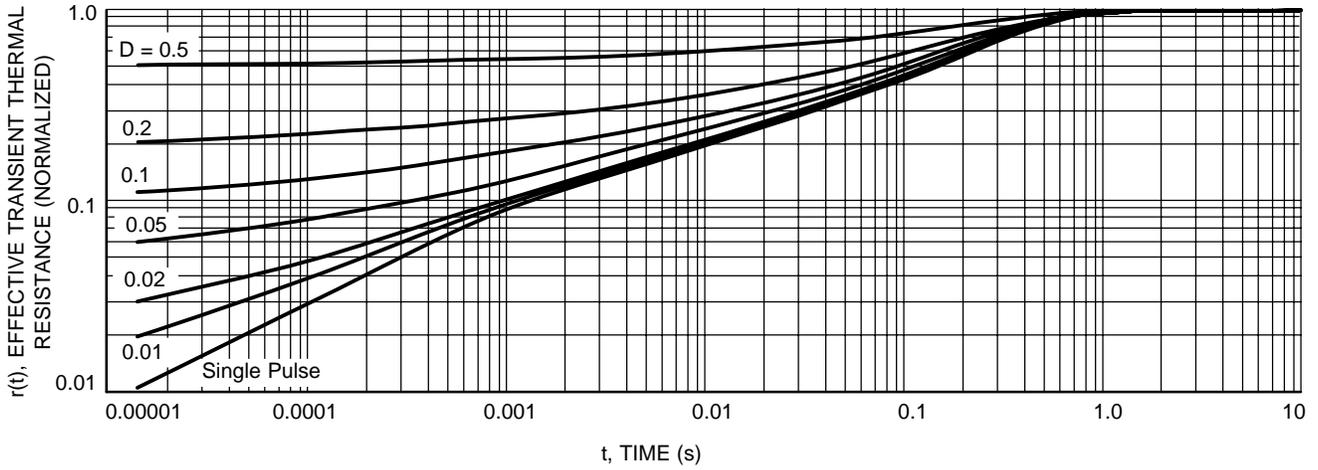


Figure 12. Thermal Response

## ORDERING INFORMATION

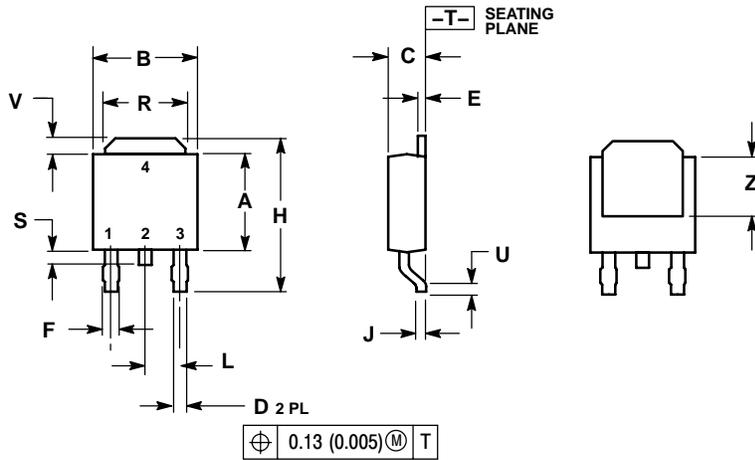
Device	Package	Shipping <sup>†</sup>
NTD110N02R	DPAK	75 Units/Rail
NTD110N02RG	DPAK (Pb-Free)	
NTD110N02R-001	DPAK (Straight Lead)	
NTD110N02R-001G	DPAK (Straight Lead) (Pb-Free)	
NTD110N02RT4	DPAK	2500/Tape & Reel
NTD110N02RT4G	DPAK (Pb-Free)	

<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.

# NTD110N02R

## PACKAGE DIMENSIONS

### DPAK (SINGLE GUAGE) CASE 369AA-01 ISSUE A

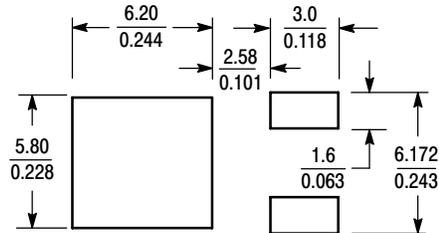


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.025	0.035	0.63	0.89
E	0.018	0.024	0.46	0.61
F	0.030	0.045	0.77	1.14
H	0.386	0.410	9.80	10.40
J	0.018	0.023	0.46	0.58
L	0.090 BSC		2.29 BSC	
R	0.180	0.215	4.57	5.45
S	0.024	0.040	0.60	1.01
U	0.020	---	0.51	---
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

### SOLDERING FOOTPRINT\*



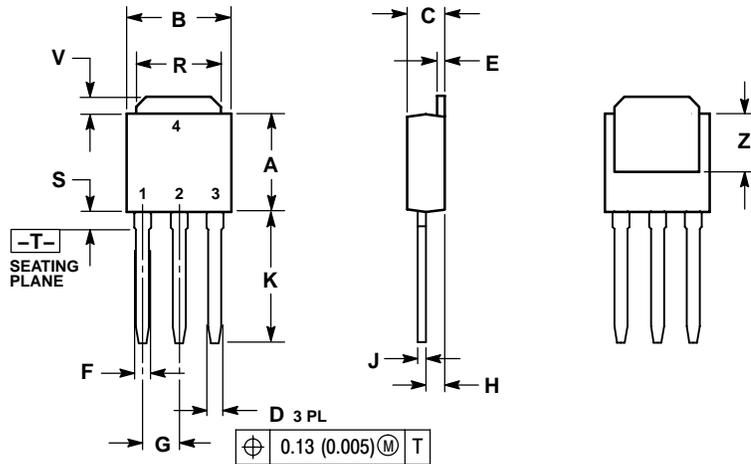
SCALE 3:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

# NTD110N02R

## PACKAGE DIMENSIONS

### DPAK-3 (SINGLE GAUGE) CASE 369D-01 ISSUE B



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

DIM	INCHES		MILLIMETERS	
	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

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