

# NTD20N03L27

## Power MOSFET 20 Amps, 30 Volts, N-Channel DPAK

This logic level vertical power MOSFET is a general purpose part that provides the “best of design” available today in a low cost power package. Avalanche energy issues make this part an ideal design in. The drain-to-source diode has a ideal fast but soft recovery.

### Features

- Ultra-Low  $R_{DS(on)}$ , Single Base, Advanced Technology
- SPICE Parameters Available
- Diode is Characterized for use in Bridge Circuits
- $I_{DSS}$  and  $V_{DS(on)}$  Specified at Elevated Temperatures
- High Avalanche Energy Specified
- ESD JEDAC rated HBM Class 1, MM Class A, CDM Class 0
- Pb-Free Packages are Available

### Typical Applications

- Power Supplies
- Inductive Loads
- PWM Motor Controls
- Replaces MTD20N03L in many Applications

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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DS}$	30	Vdc
Drain-to-Gate Voltage ( $R_{GS} = 1.0\text{ M}\Omega$ )	$V_{DGR}$	30	Vdc
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	Vdc
- Continuous	$V_{GS}$	$\pm 24$	
- Non-Repetitive ( $t_p \leq 10\text{ ms}$ )			
Drain Current	$I_D$	20	Adc
- Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	16	
- Continuous @ $T_A = 100^\circ\text{C}$	$I_{DM}$	60	Apk
- Single Pulse ( $t_p \leq 10\text{ }\mu\text{s}$ )			
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	74	W
Derate above $25^\circ\text{C}$		0.6	W/ $^\circ\text{C}$
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ (Note 1)		1.75	
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy - Starting $T_J = 25^\circ\text{C}$ ( $V_{DD} = 30\text{ Vdc}$ , $V_{GS} = 5\text{ Vdc}$ , $L = 1.0\text{ mH}$ , $I_{L(pk)} = 24\text{ A}$ , $V_{DS} = 34\text{ Vdc}$ )	$E_{AS}$	288	mJ
Thermal Resistance	$R_{\theta JC}$	1.67	$^\circ\text{C/W}$
- Junction-to-Case	$R_{\theta JA}$	100	
- Junction-to-Ambient (Note 1)	$R_{\theta JA}$	71.4	
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	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.

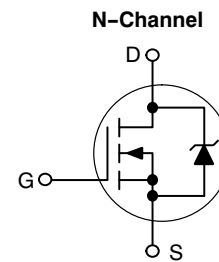
1. When surface mounted to an FR4 board using the minimum recommended pad size and repetitive rating; pulse width limited by maximum junction temperature.



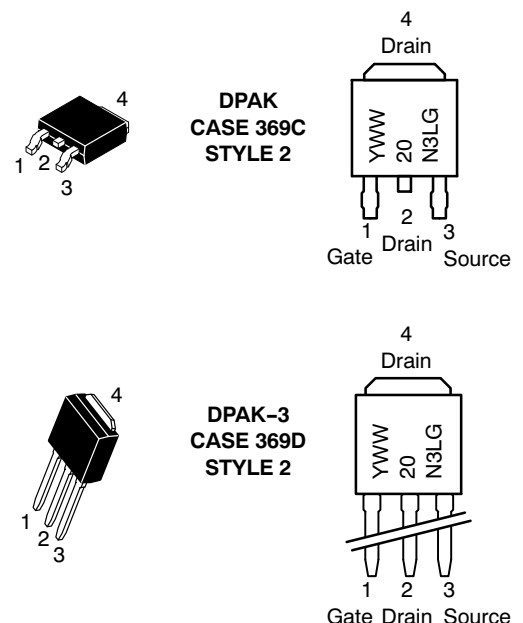
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20 A, 30 V,  $R_{DS(on)} = 27\text{ m}\Omega$



### MARKING DIAGRAMS



20N3L = Device Code  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-to-Source Breakdown Voltage (Note 2) ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 250\text{ }\mu\text{Adc}$ ) Temperature Coefficient (Positive)	$V_{(BR)DSS}$	30 -	- 43	- -	Vdc mV/ $^\circ\text{C}$
Zero Gate Voltage Drain Current ( $V_{DS} = 30\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) ( $V_{DS} = 30\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $T_J = 150^\circ\text{C}$ )	$I_{DSS}$	- -	- -	10 100	$\mu\text{Adc}$
Gate-Body Leakage Current ( $V_{GS} = \pm 20\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	-	-	$\pm 100$	nAdc

**ON CHARACTERISTICS** (Note 2)

Gate Threshold Voltage (Note 2) ( $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{Adc}$ ) Threshold Temperature Coefficient (Negative)	$V_{GS(th)}$	1.0 -	1.6 5.0	2.0 -	Vdc mV/ $^\circ\text{C}$
Static Drain-to-Source On-Resistance (Note 2) ( $V_{GS} = 4.0\text{ Vdc}$ , $I_D = 10\text{ Adc}$ ) ( $V_{GS} = 5.0\text{ Vdc}$ , $I_D = 10\text{ Adc}$ )	$R_{DS(on)}$	- -	28 23	31 27	m $\Omega$
Static Drain-to-Source On-Voltage (Note 2) ( $V_{GS} = 5.0\text{ Vdc}$ , $I_D = 20\text{ Adc}$ ) ( $V_{GS} = 5.0\text{ Vdc}$ , $I_D = 10\text{ Adc}$ , $T_J = 150^\circ\text{C}$ )	$V_{DS(on)}$	- -	0.48 0.40	0.54 -	Vdc
Forward Transconductance (Note 2) ( $V_{DS} = 5.0\text{ Vdc}$ , $I_D = 10\text{ Adc}$ )	$g_{FS}$	-	21	-	mhos

**DYNAMIC CHARACTERISTICS**

Input Capacitance	( $V_{DS} = 25\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$	-	1005	1260	pF
Output Capacitance		$C_{oss}$	-	271	420	
Transfer Capacitance		$C_{rss}$	-	87	112	

**SWITCHING CHARACTERISTICS** (Note 3)

Turn-On Delay Time	( $V_{DD} = 20\text{ Vdc}$ , $I_D = 20\text{ Adc}$ , $V_{GS} = 5.0\text{ Vdc}$ , $R_G = 9.1\text{ }\Omega$ ) (Note 2)	$t_{d(on)}$	-	17	25	ns
Rise Time		$t_r$	-	137	160	
Turn-Off Delay Time		$t_{d(off)}$	-	38	45	
Fall Time		$t_f$	-	31	40	
Gate Charge	( $V_{DS} = 48\text{ Vdc}$ , $I_D = 15\text{ Adc}$ , $V_{GS} = 10\text{ Vdc}$ ) (Note 2)	$Q_T$	-	13.8	18.9	nC
		$Q_1$	-	2.8	-	
		$Q_2$	-	6.6	-	

**SOURCE-DRAIN DIODE CHARACTERISTICS**

Forward On-Voltage	( $I_S = 20\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ ) (Note 2) ( $I_S = 20\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ , $T_J = 125^\circ\text{C}$ )	$V_{SD}$	- -	1.0 0.9	1.15 -	Vdc
Reverse Recovery Time	( $I_S = 15\text{ Adc}$ , $V_{GS} = 0\text{ Vdc}$ , $di_S/dt = 100\text{ A}/\mu\text{s}$ ) (Note 2)	$t_{rr}$	-	23	-	ns
		$t_a$	-	13	-	
		$t_b$	-	10	-	
Reverse Recovery Stored Charge		$Q_{RR}$	-	0.017	-	$\mu\text{C}$

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

3. Switching characteristics are independent of operating junction temperature.

**ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
NTD20N03L27	DPAK	75 Units/Rail
NTD20N03L27G	DPAK (Pb-Free)	75 Units/Rail
NTD20N03L27-1	DPAK-3	75 Units/Rail
NTD20N03L27-1G	DPAK-3 (Pb-Free)	75 Units/Rail
NTD20N03L27T4	DPAK	2500 Tape & Reel
NTD20N03L27T4G	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.

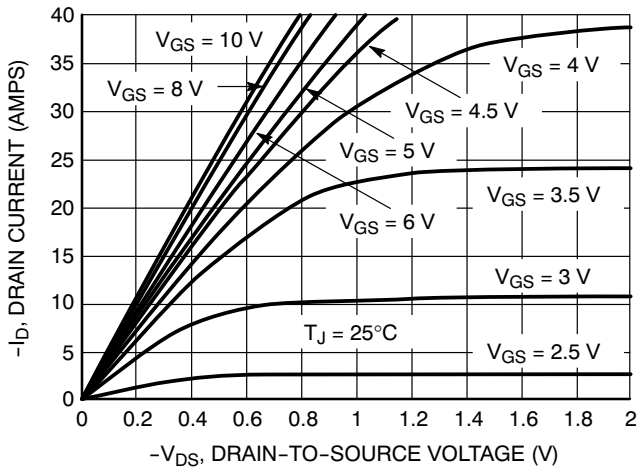


Figure 1. On-Region Characteristics

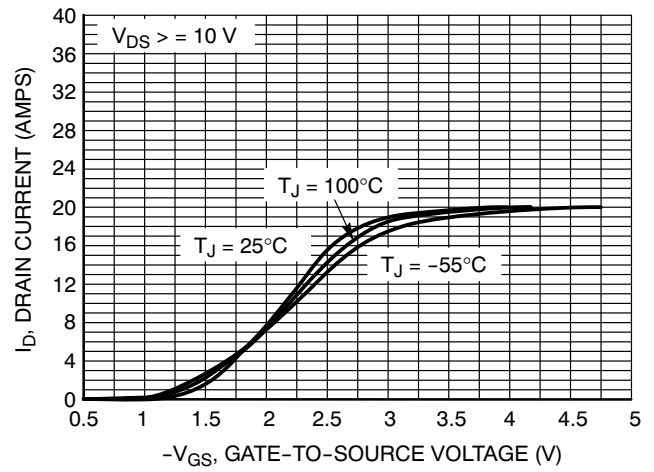


Figure 2. Transfer Characteristics

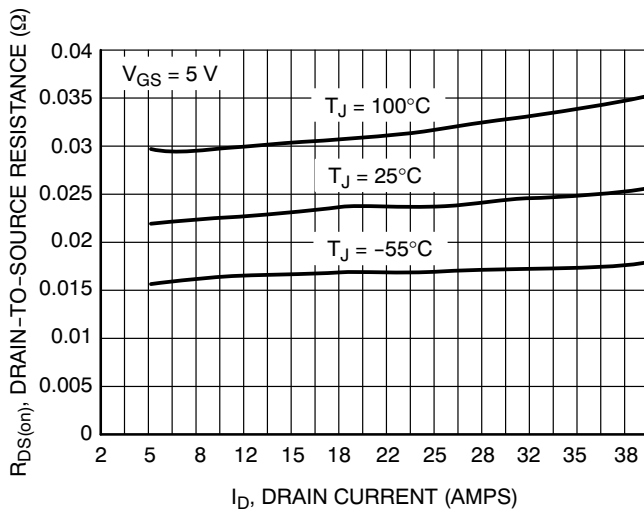


Figure 3. On-Resistance vs. Drain Current and Temperature

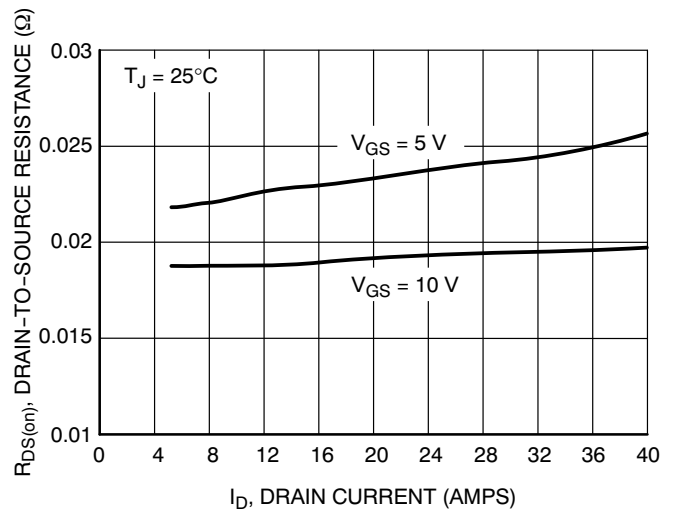


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

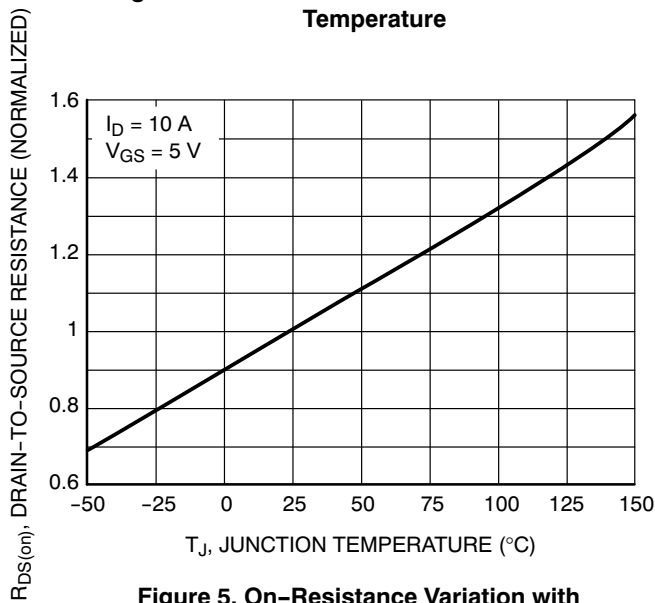


Figure 5. On-Resistance Variation with Temperature

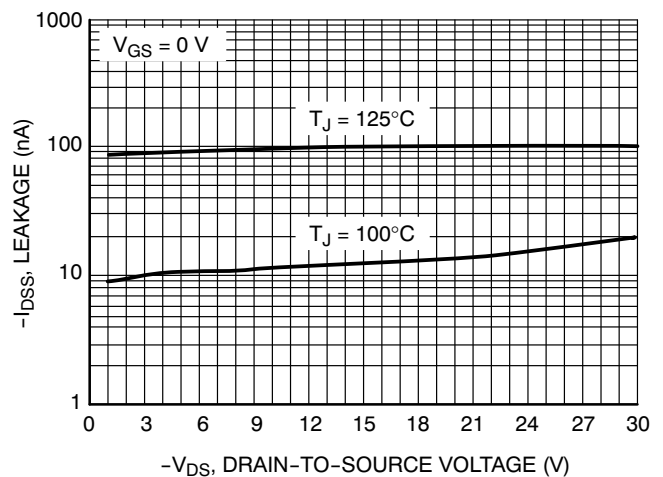


Figure 6. Drain-to-Source Leakage Current vs. Voltage

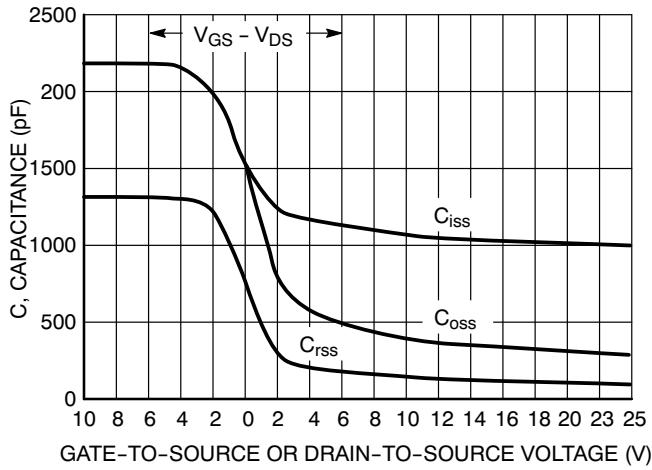


Figure 7. Capacitance Variation

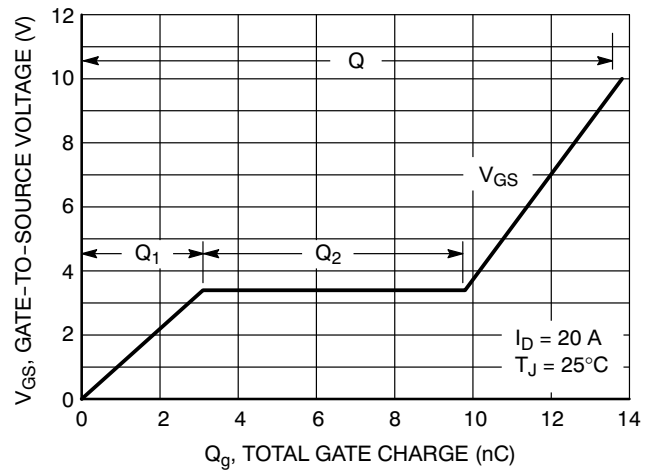


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

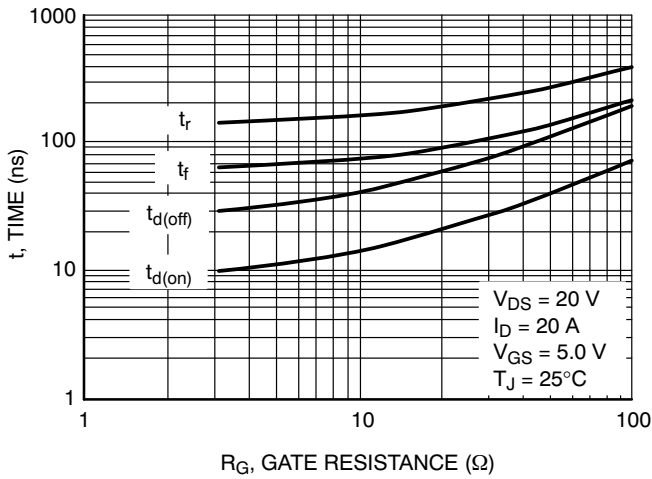


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

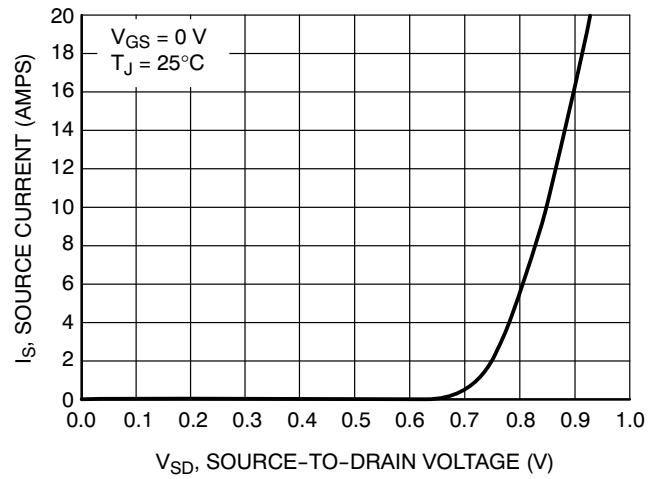


Figure 10. Diode Forward Voltage vs. Current

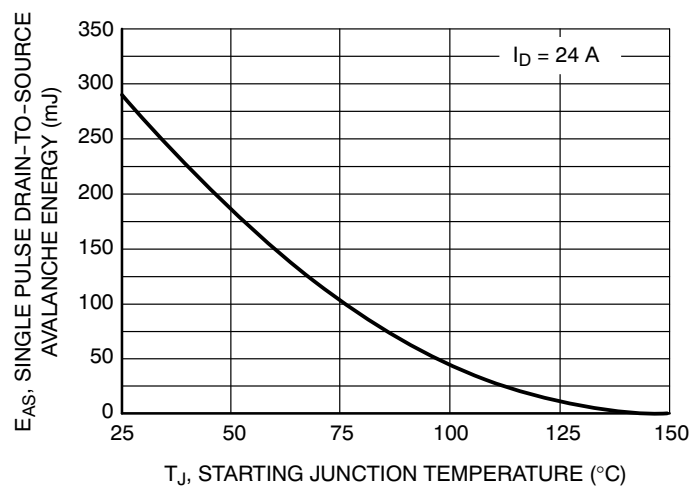
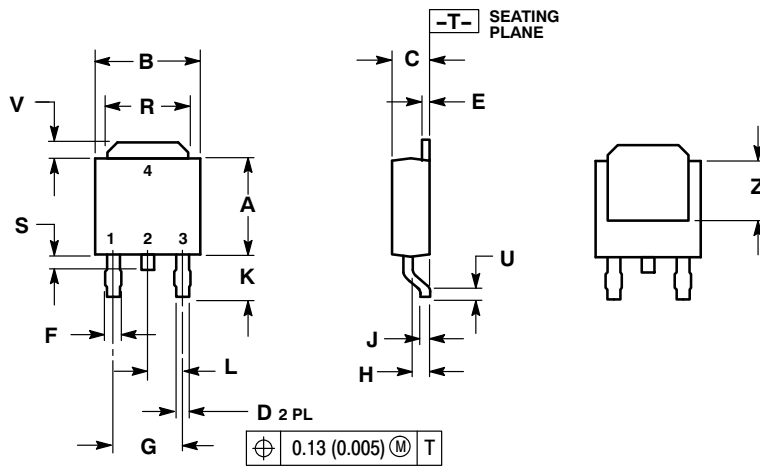


Figure 11. Maximum Avalanche Energy vs. Starting Junction Temperature

## PACKAGE DIMENSIONS

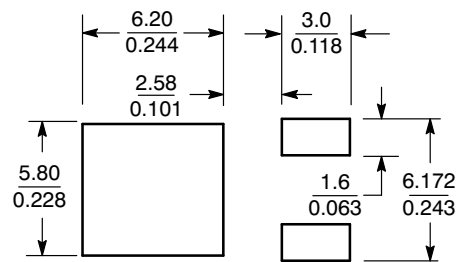
 DPAK  
 CASE 369C-01  
 ISSUE O


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	0.027	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	0.180	BSC	4.58	BSC
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090	BSC	2.29	BSC
R	0.180	0.215	4.57	5.45
S	0.025	0.040	0.63	1.01
U	0.020	---	0.51	---
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

STYLE 2:

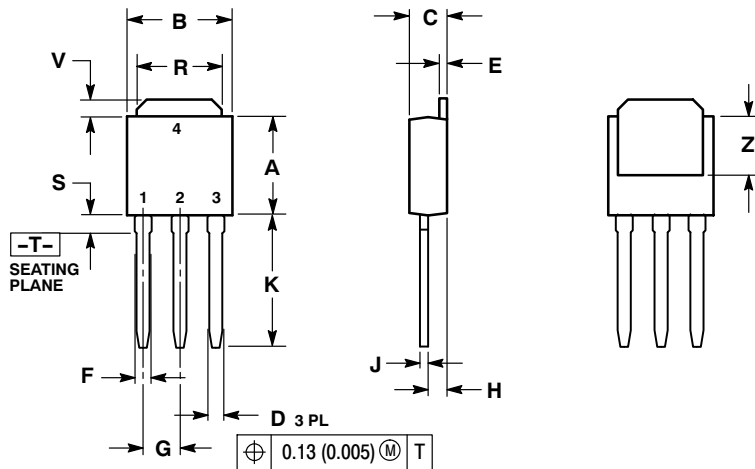
- PIN 1. GATE  
 2. DRAIN  
 3. SOURCE  
 4. DRAIN

## 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.

## PACKAGE DIMENSIONS

DPAK-3  
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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