

NTD20P06L

Power MOSFET

–60 V, –15.5 A, Single P–Channel, DPAK

Features

- Withstands High Energy in Avalanche and Commutation Modes
- Low Gate Charge for Fast Switching
- Pb–Free Packages are Available

Applications

- Bridge Circuits
- Power Supplies, Power Motor Controls
- DC–DC Conversion

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

Parameter	Symbol	Value	Unit
Drain–to–Source Voltage	V_{DS}	–60	V
Gate–to–Source Voltage	Continuous	V_{GS}	± 20 V
	Non–Repetitive $t_p \leq 10$ ms	V_{GSM}	± 30
Continuous Drain Current (Note 1)	Steady State $T_A = 25^\circ\text{C}$	I_D	–15.5 A
Power Dissipation (Note 1)	Steady State $T_A = 25^\circ\text{C}$	P_D	65 W
Pulsed Drain Current	$t_p = 10$ μs	I_{DM}	± 50 A
Operating Junction and Storage Temperature	T_J, T_{STG}	–55 to 175	$^\circ\text{C}$
Single Pulse Drain–to–Source Avalanche Energy ($V_{DD} = 25$ V, $V_{GS} = 5$ V, $I_{PK} = 15$ A, $L = 2.7$ mH, $R_G = 25$ Ω)	E_{AS}	304	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T_L	260	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction–to–Case (Drain)	$R_{\theta JC}$	2.3	$^\circ\text{C/W}$
Junction–to–Ambient – Steady State (Note 1)	$R_{\theta JA}$	80	
Junction–to–Ambient – Steady State (Note 2)	$R_{\theta JA}$	110	

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Surface–mounted on FR4 board using 1 in sq. pad size (Cu area = 1.127 in sq. [1 oz] including traces)
2. Surface–mounted on FR4 board using the minimum recommended pad size (Cu area = 0.412 in sq.)

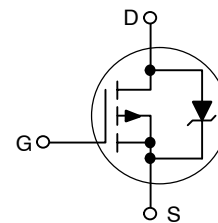


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$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX (Note 1)
–60 V	130 m Ω @ –5.0 V	–15.5 A

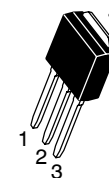
P–Channel



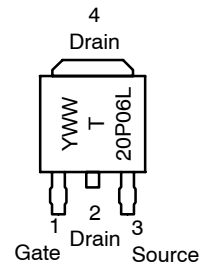
MARKING DIAGRAMS



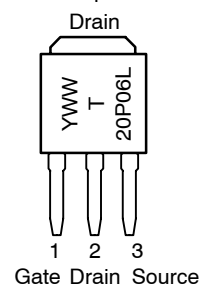
DPAC
CASE 369C
Style 2



DPAC
CASE 369D
Style 2



Gate Drain Source



Gate Drain Source

20P06L Device Code
Y = Year
WW = Work Week

ORDERING INFORMATION

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

NTD20P06L

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-60	-74		V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			-64		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = -60\text{ V}$	$T_J = 25^\circ\text{C}$		-1.0	μA
			$T_J = 150^\circ\text{C}$		-10	
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	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = -250\text{ }\mu\text{A}$	-1.0	-1.5	-2.0	V
Gate Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			3.1		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = -5.0\text{ V}, I_D = -7.5\text{ A}$		0.130	0.150	Ω
		$V_{GS} = -5.0\text{ V}, I_D = -15\text{ A}$		0.143		
Forward Transconductance	g_{FS}	$V_{DS} = -10\text{ V}, I_D = -7.5\text{ A}$		11		S
Drain-to-Source On-Voltage	$V_{DS(on)}$	$V_{GS} = -5.0\text{ V}, I_D = -7.5\text{ A}$	$T_J = 25^\circ\text{C}$		-1.2	V
			$T_J = 150^\circ\text{C}$		-1.9	

CHARGES AND CAPACITANCES

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = -25\text{ V}$		740	1190	pF
Output Capacitance	C_{OSS}			207	300	
Reverse Transfer Capacitance	C_{RSS}			66	120	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5.0\text{ V}, V_{DS} = -48\text{ V}, I_D = -18\text{ A}$		15	26	nC
Gate-to-Source Charge	Q_{GS}			4.0		
Gate-to-Drain Charge	Q_{GD}			7.0		

SWITCHING CHARACTERISTICS (Note 4)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -5.0\text{ V}, V_{DD} = -30\text{ V}, I_D = -15\text{ A}, R_G = 9.1\text{ }\Omega$		11	20	ns
Rise Time	t_r			90	180	
Turn-Off Delay Time	$t_{d(OFF)}$			28	50	
Fall Time	t_f			70	135	

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = -15 A	T _J = 25°C		1.5	2.5	V
			T _J = 150°C		1.3		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, d _I S/d _t = 100 A/μs, I _S = -12 A			60		ns
Charge Time	t _a				39		
Discharge Time	t _b				21		
Reverse Recovery Charge	Q _{RR}				0.13		nC

3. Pulse Test: pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$

4. Switching characteristics are independent of operating junction temperatures

TYPICAL PERFORMANCE CURVES

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

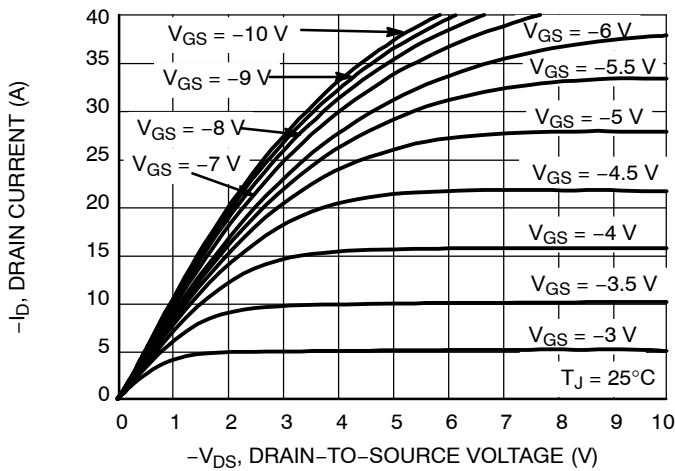


Figure 1. On-Region Characteristics

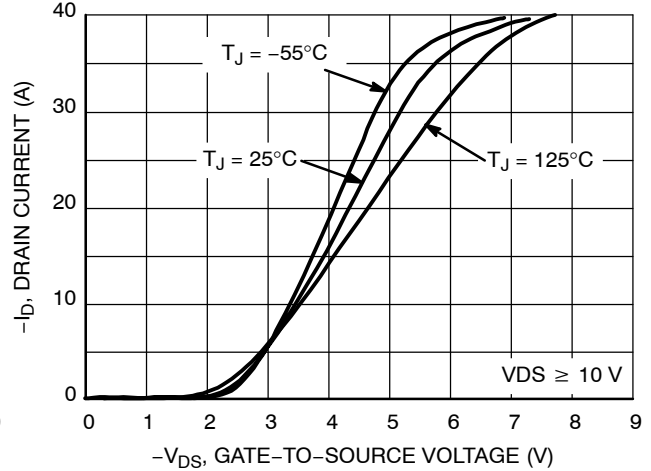


Figure 2. Transfer Characteristics

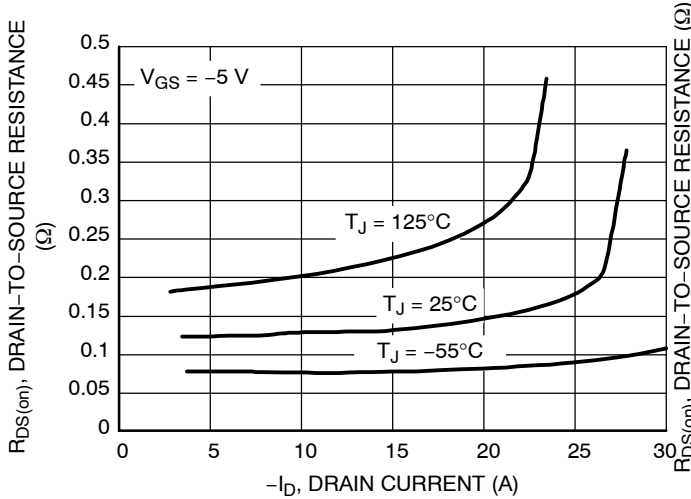


Figure 3. On-Resistance versus Drain Current and Temperature

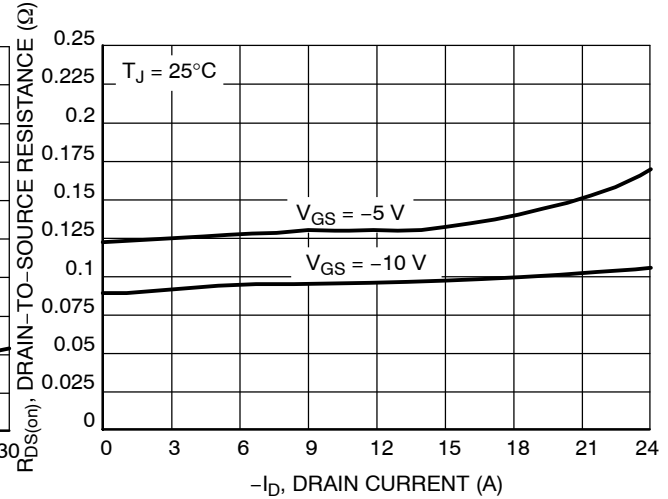


Figure 4. On-Resistance versus Drain Current and Gate Voltage

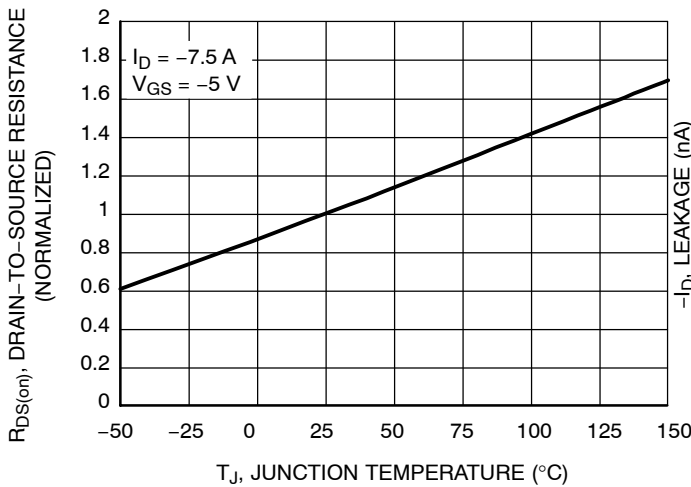


Figure 5. On-Resistance Variation with Temperature

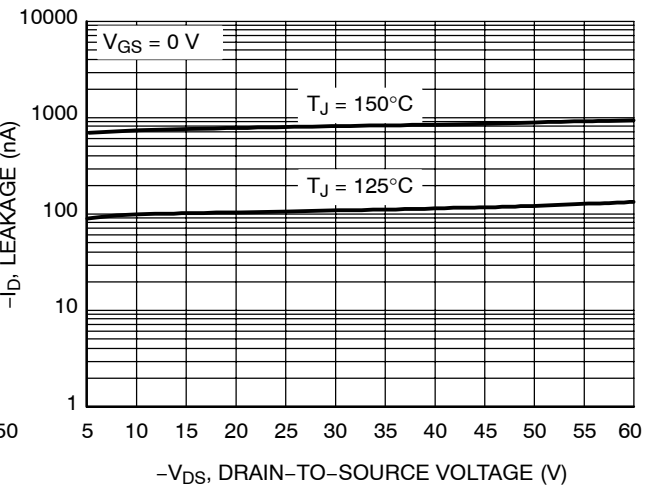
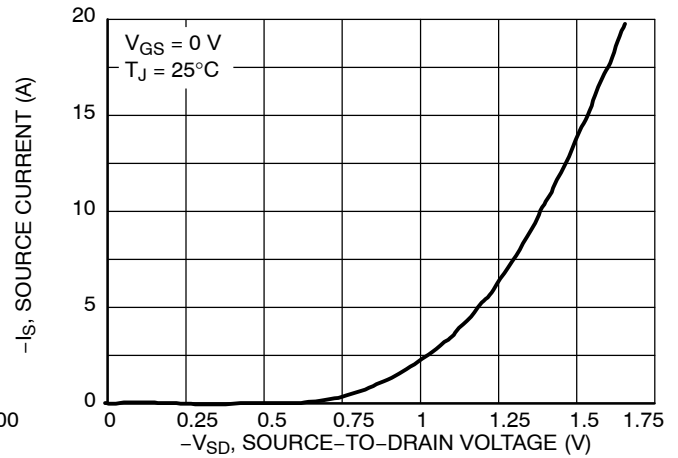
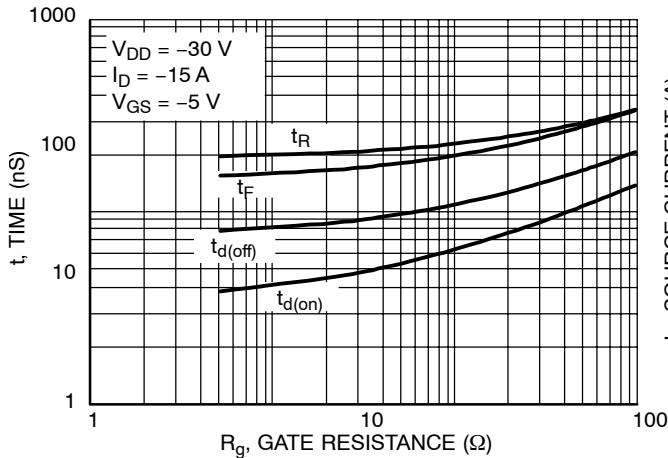
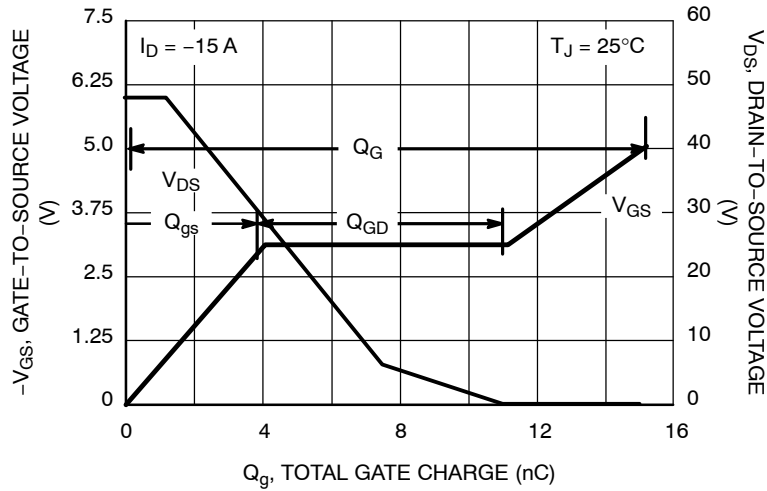
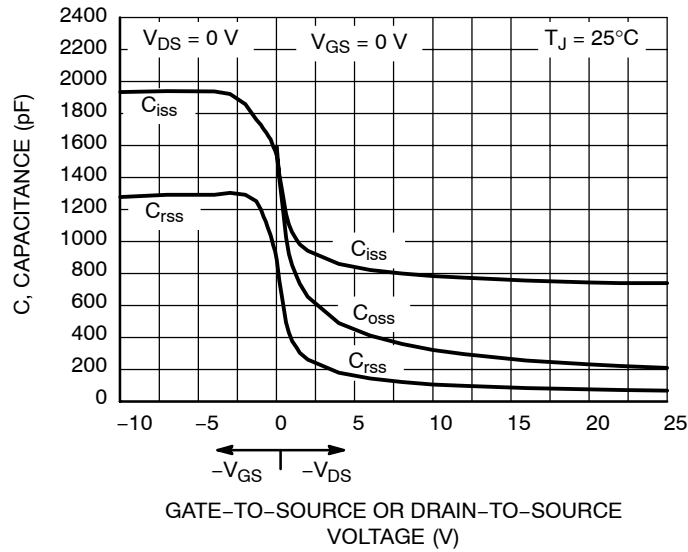


Figure 6. Drain-to-Source Leakage Current versus Voltage

NTD20P06L



NTD20P06L

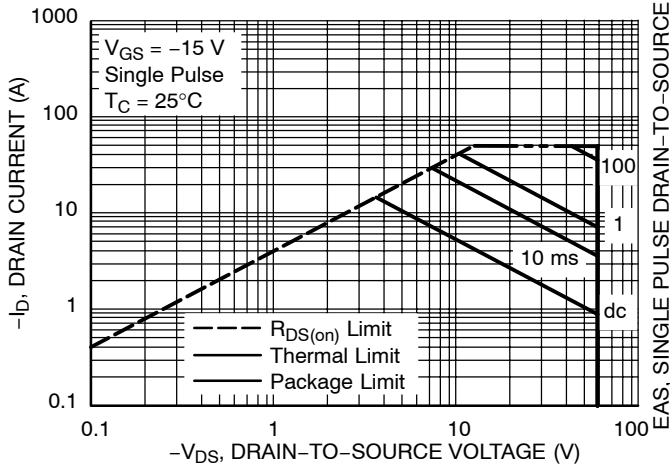


Figure 11. Maximum Rated Forward Biased Safe Operating Area

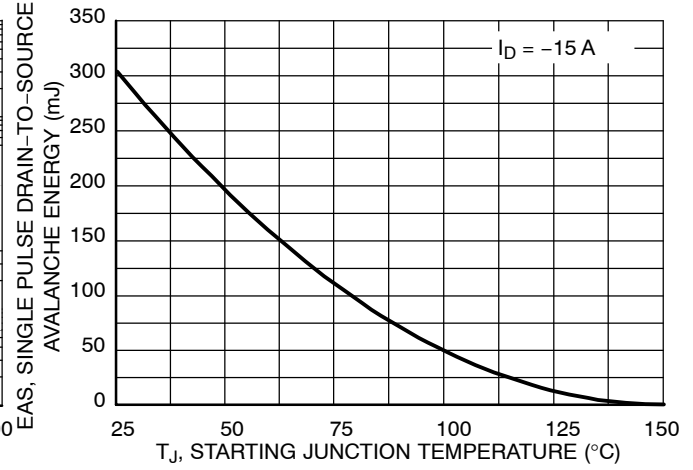


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

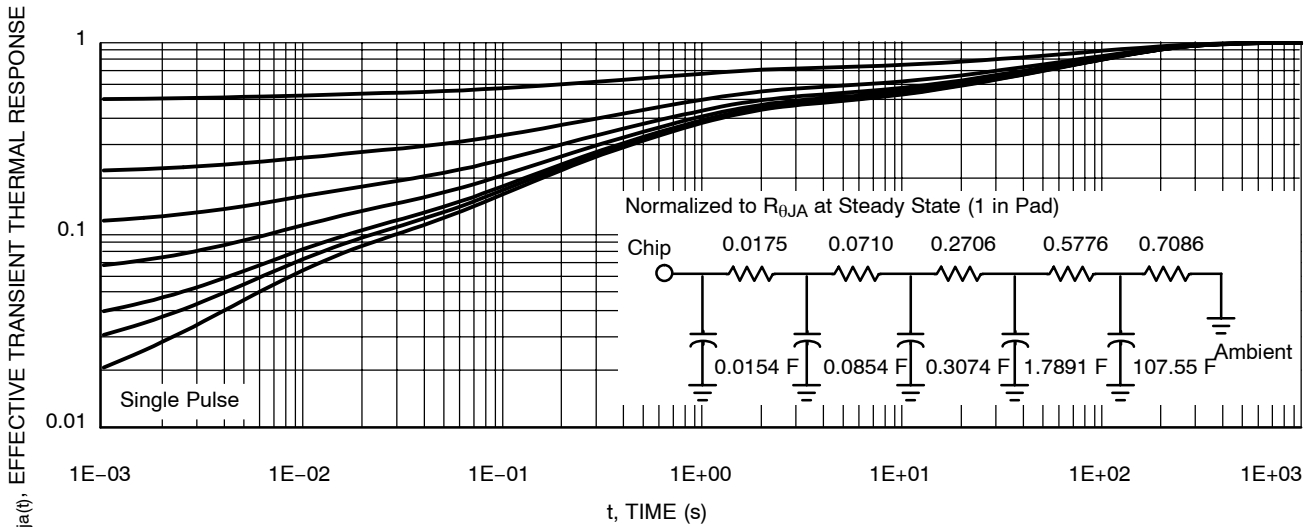


Figure 13. Thermal Response

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ORDERING INFORMATION

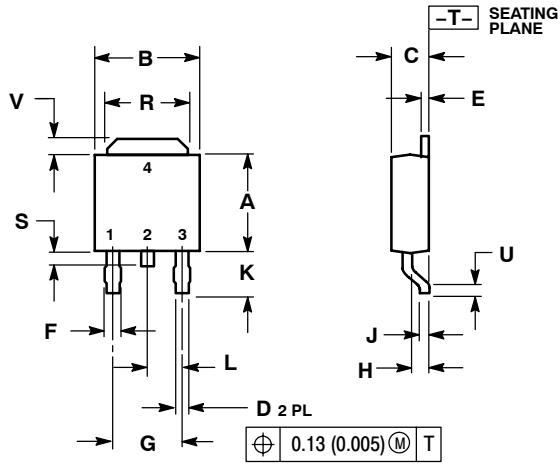
Device	Package	Shipping†
NTD20P06L-1	DPAK	75 Units / Rail
NTD20P06L		75 Units / Rail
NTD20P06LT4		2500 /Tape & Reel
NTD20P06L-1G	DPAK (Pb-Free)	75 Units / Rail
NTD20P06LG		75 Units / Rail
NTD20P06LT4G		2500 / Tape & Reel

†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.

NTD20P06L

PACKAGE DIMENSIONS

DDPAK-3
CASE 369C-01
ISSUE O

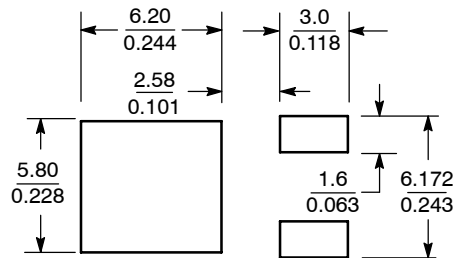


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

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	0.027	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
 - DRAIN
 - SOURCE
 - DRAIN

SOLDERING FOOTPRINT*



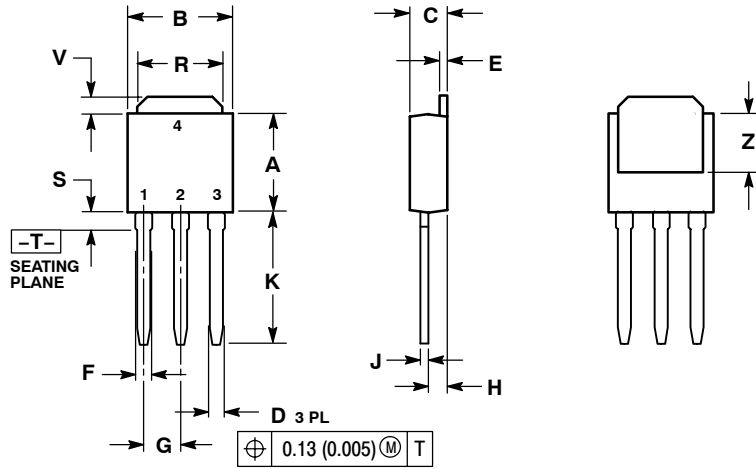
SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}} \right)$

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

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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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