

NTD20P06L

Power MOSFET

60 V, 15 A, Single P-Channel, DPAK

Features

- Withstands High Energy in Avalanche and Commutation Modes
- Low Gate Charge for Fast Switching
- Pb-Free Package May be Available. The G-Suffix Denotes a Pb-Free Lead Finish

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 _{DSS}	−60	V
Gate-to-Source Voltage	Continuous		V _{GS}	± 15	V
	Non-Repetitive	t _p ≤ 10 ms	V _{GSM}	± 20	
Continuous Drain Current (Note 1)	Steady State	T _A = 25°C	I _D	−15	A
Power Dissipation (Note 1)	Steady State	T _A = 25°C	P _D	54	W
Pulsed Drain Current	t _p = 10 μs		I _{DM}	± 50	A
Operating Junction and Storage Temperature			T _J , T _{STG}	−55 to 150	°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	°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	

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.)

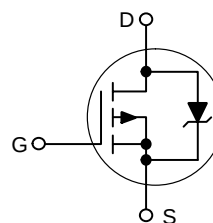


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$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX Note 1
-60 V	130 m Ω @ -5.0 V	-15 A

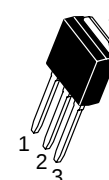
P-Channel



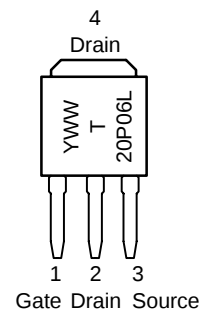
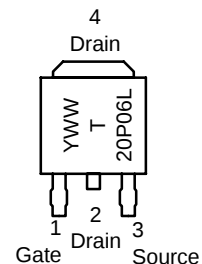
MARKING DIAGRAMS



DPAK
CASE 369C
Style 2



DPAK
CASE 369D
Style 2



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}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 15\text{ V}$			± 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}	$V_{GS} = 0\text{ V}, I_S = -15\text{ A}$	$T_J = 25^\circ\text{C}$		1.5	2.5	V
			$T_J = 150^\circ\text{C}$		1.3		
Reverse Recovery Time	t_{RR}	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s}, I_S = -12\text{ A}$		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)

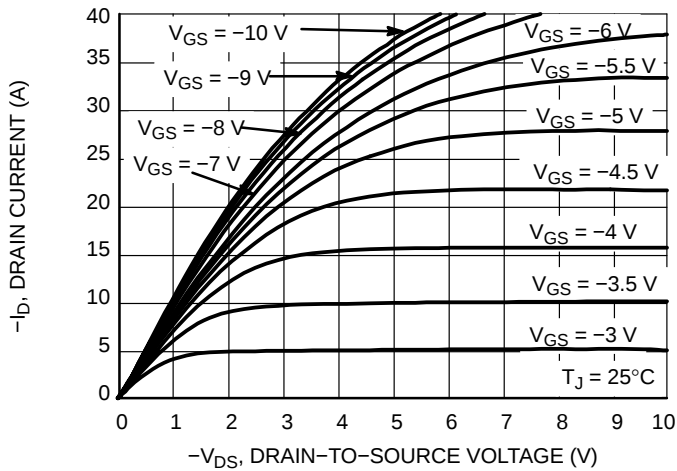


Figure 1. On-Region Characteristics

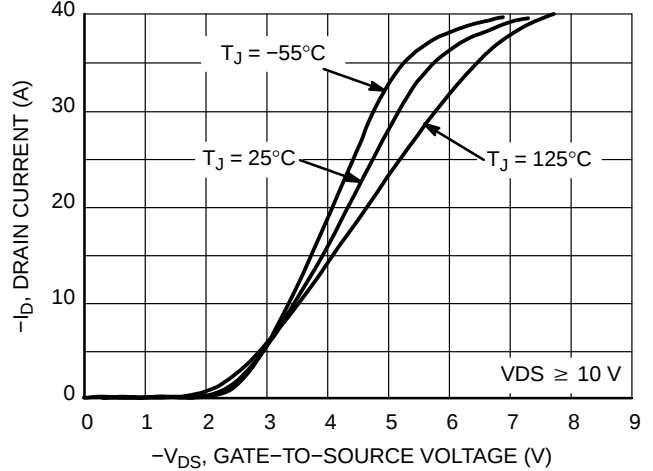


Figure 2. Transfer Characteristics

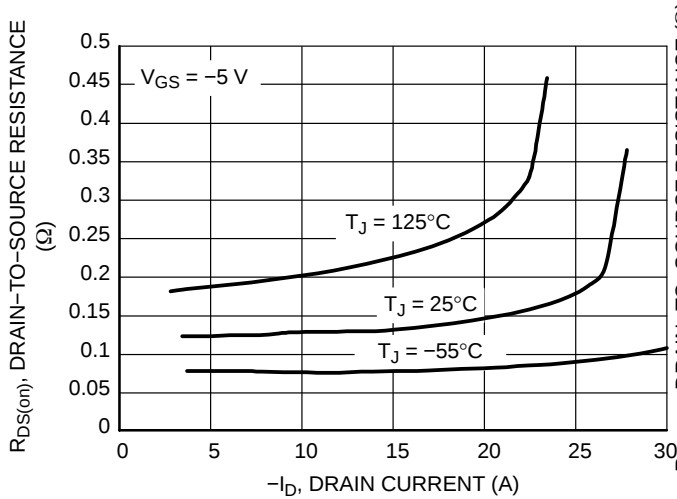


Figure 3. On-Resistance versus Drain Current and Temperature

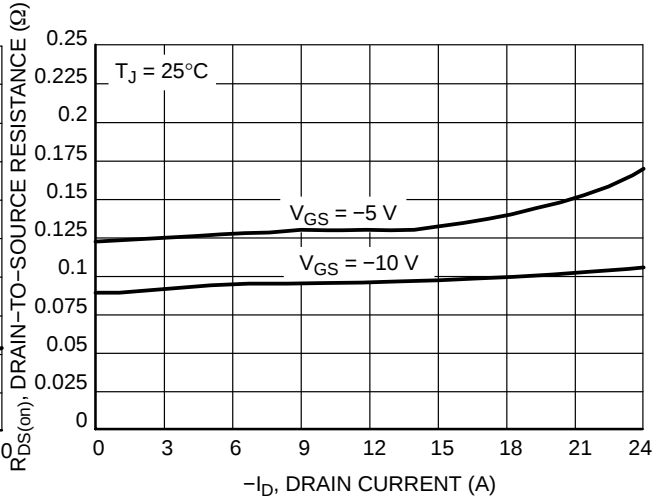


Figure 4. On-Resistance versus Drain Current and Gate Voltage

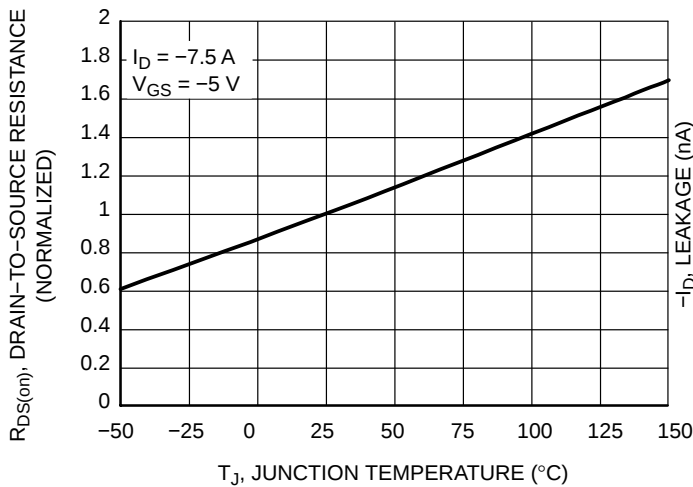


Figure 5. On-Resistance Variation with Temperature

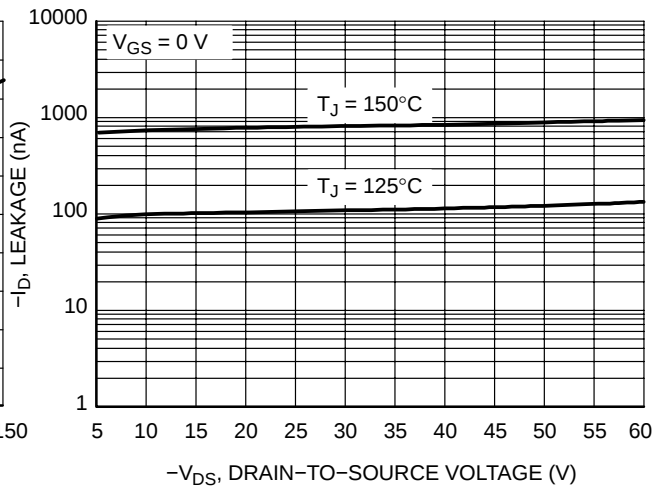
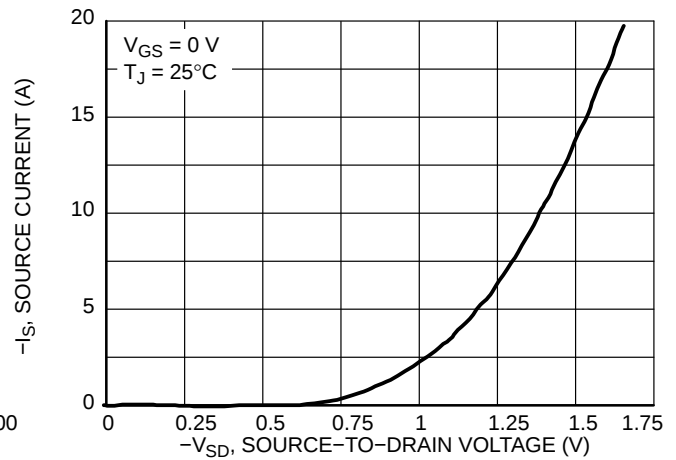
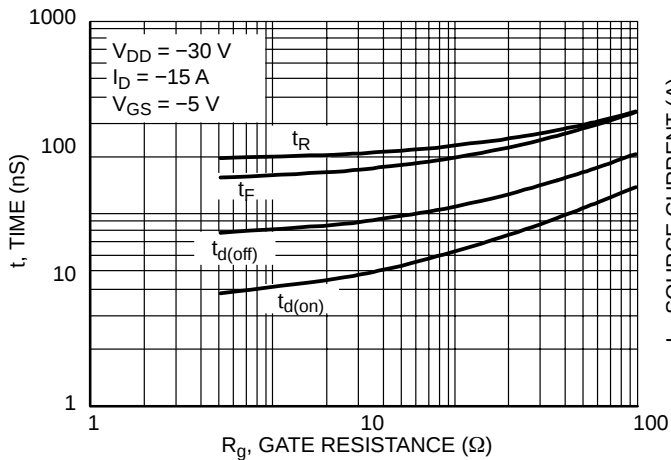
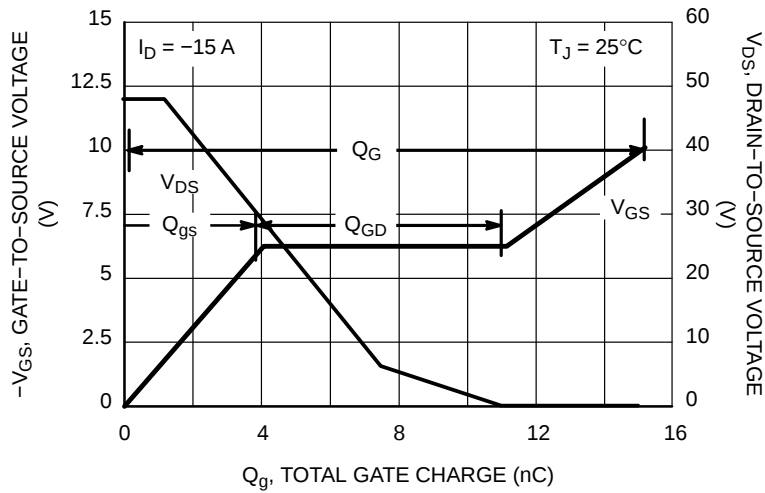
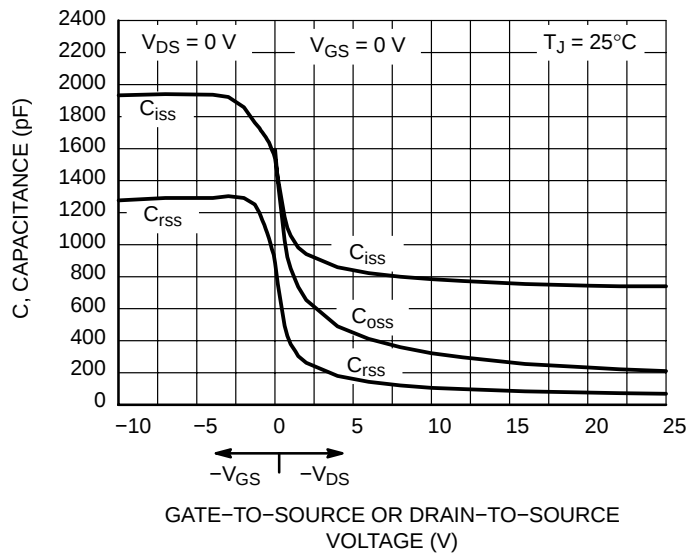


Figure 6. Drain-to-Source Leakage Current versus Voltage

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NTD20P06L

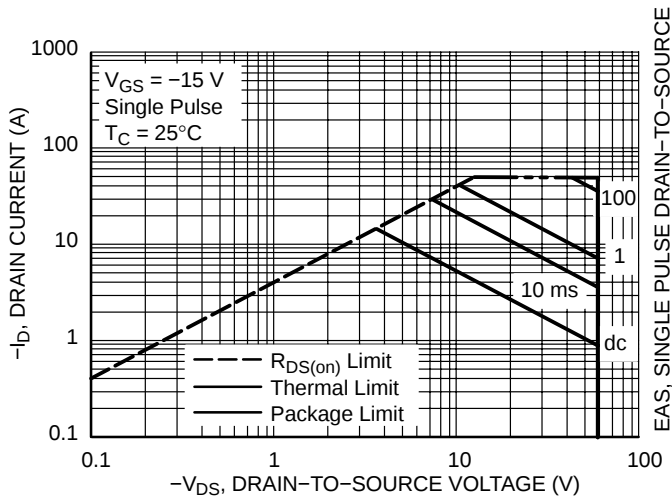


Figure 11. Maximum Rated Forward Biased Safe Operating Area

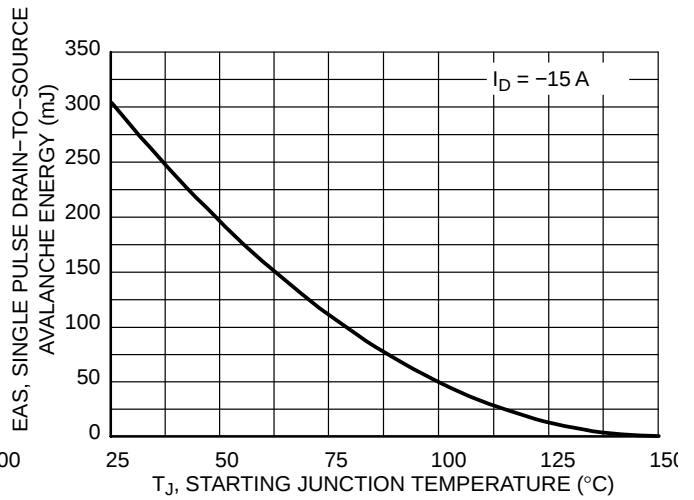


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

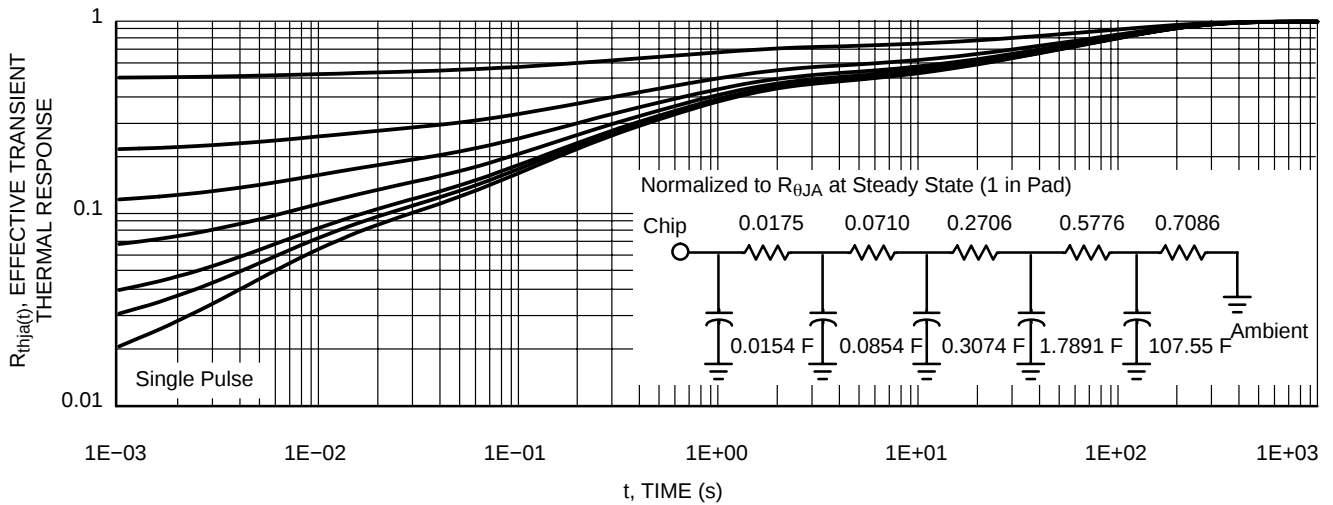


Figure 13. Thermal Response

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ORDERING INFORMATION

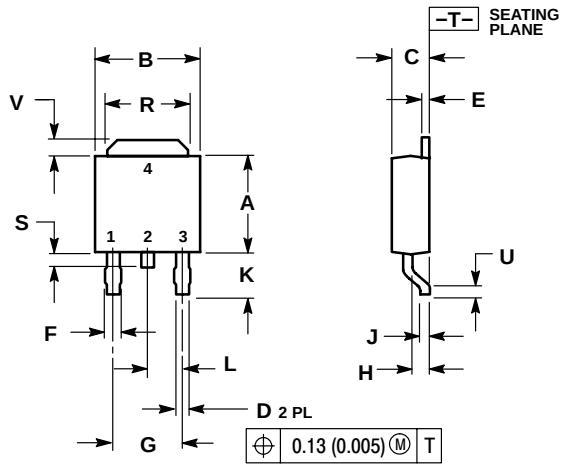
Device	Package	Shipping [†]
NTD20P06L-1	DPAK	75 Units / Rail
NTD20P06L		75 Units / Rail
NTD20P06LT4		2500 /Tape & Reel
NTD20P06L-1G	DPAK (Pb-Free)	75 Units / Rail
NTD20P06LG		75 Units / Rail
NTD20P06LT4G		2500 / Tape & Reel

[†]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.

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PACKAGE DIMENSIONS

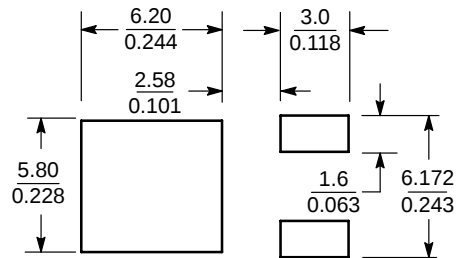
DPAK CASE 369C-01 ISSUE O



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 $\left(\frac{\text{mm}}{\text{inches}} \right)$

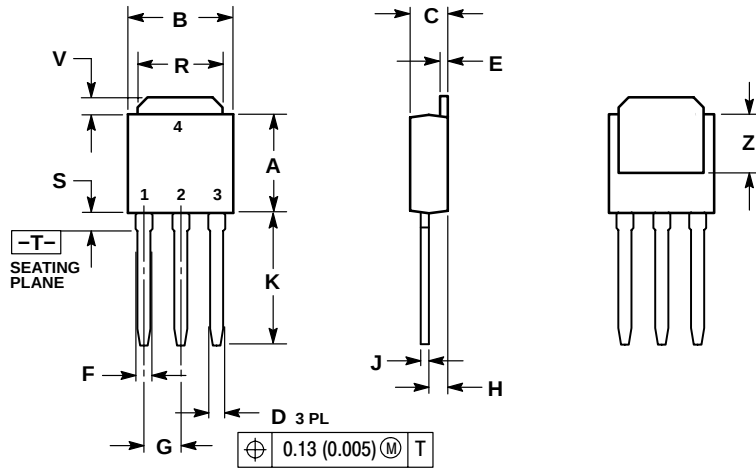
Figure 14. DPAK

*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 CASE 369D-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	6.35
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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