

NTD20P06L

Power MOSFET

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



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<http://onsemi.com>

Features

- Withstands High Energy in Avalanche and Commutation Modes
- Low Gate Charge for Fast Switching
- These are Pb-Free Devices

Applications

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

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

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}	± 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		$^\circ\text{C}$

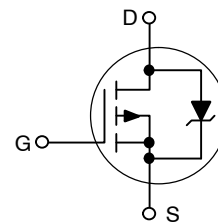
THERMAL RESISTANCE RATINGS

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	

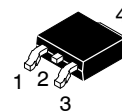
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. 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.)

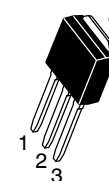
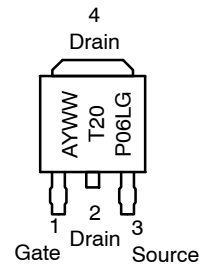
P-Channel



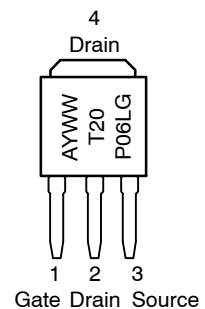
MARKING DIAGRAMS



DPAK
CASE 369C
STYLE 2



IPAK/DPAK
CASE 369D
STYLE 2



20P06L Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb-Free Package

ORDERING INFORMATION

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

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	V _{(BR)DSS}	V _{GS} = 0 V, I _D = -250 μA	-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 V, V _{DS} = -60 V	T _J = 25°C		-1.0	μA
			T _J = 150°C		-10	
Gate-to-Source Leakage Current	I _{GSS}	V _{DS} = 0 V, V _{GS} = ±20 V			±100	nA

ON CHARACTERISTICS (Note 3)

Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _D = -250 μA	-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 V, I _D = -7.5 A		0.130	0.150	Ω
		V _{GS} = -5.0 V, I _D = -15 A		0.143		
Forward Transconductance	g _{FS}	V _{DS} = -10 V, I _D = -7.5 A		11		S
Drain-to-Source On-Voltage	V _{DS(on)}	V _{GS} = -5.0 V, I _D = -7.5 A	T _J = 25°C		-1.2	V
			T _J = 150°C		-1.9	

CHARGES AND CAPACITANCES

Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1 MHz, V _{DS} = -25 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 V, V _{DS} = -48 V, I _D = -18 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 V, V _{DD} = -30 V, I _D = -15 A, R _G = 9.1 Ω		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 _{iS} /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		

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%

4. Switching characteristics are independent of operating junction temperatures

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TYPICAL PERFORMANCE CURVES

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

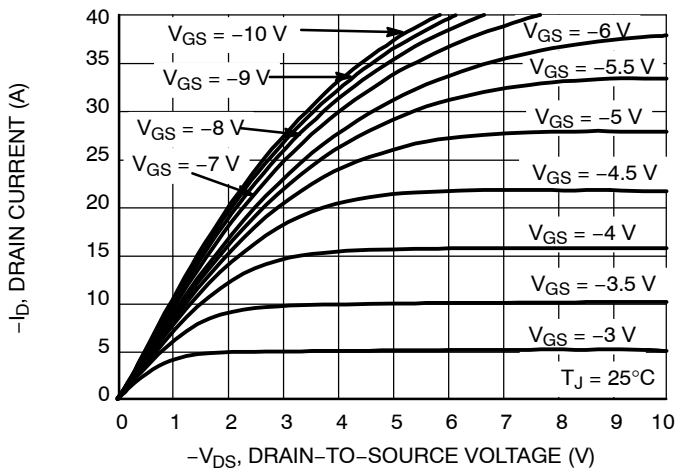


Figure 1. On-Region Characteristics

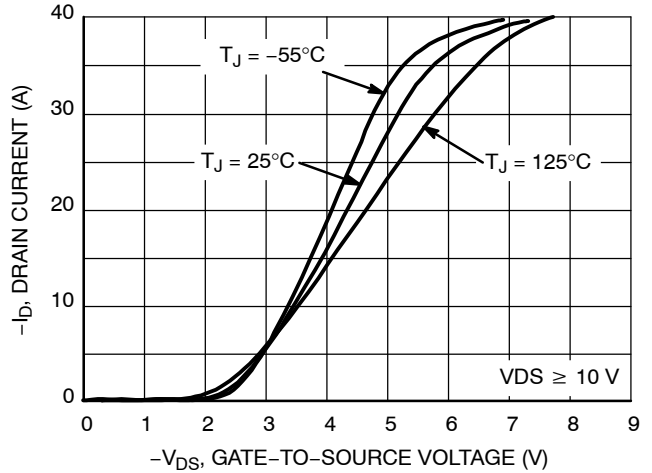


Figure 2. Transfer Characteristics

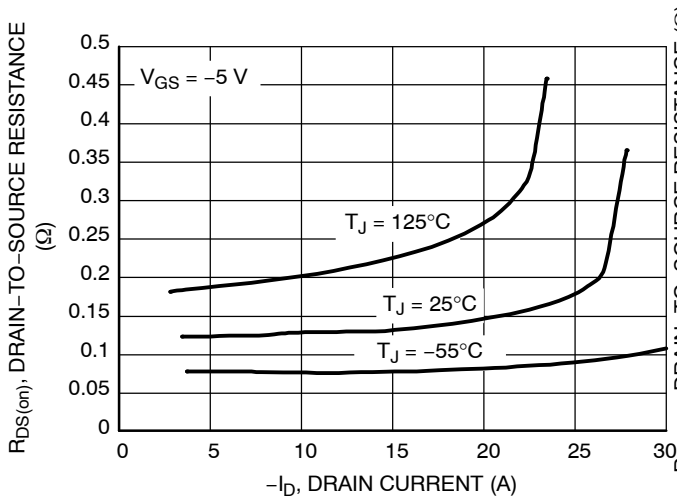


Figure 3. On-Resistance versus Drain Current and Temperature

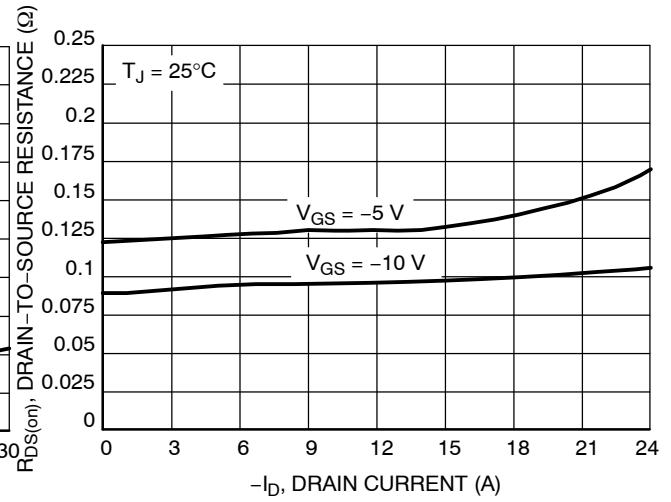


Figure 4. On-Resistance versus Drain Current and Gate Voltage

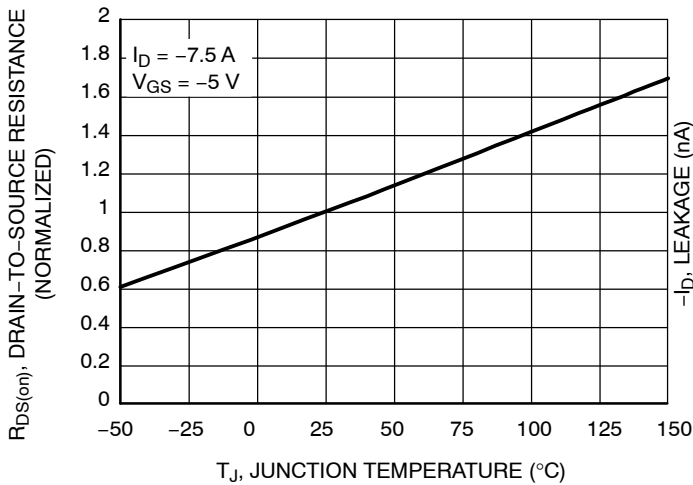


Figure 5. On-Resistance Variation with Temperature

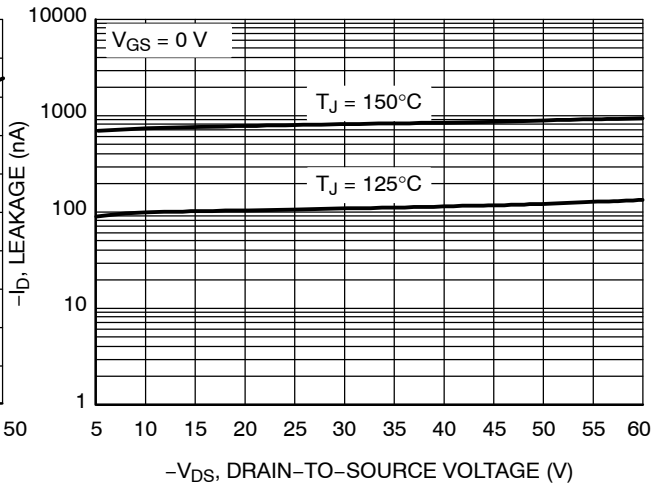


Figure 6. Drain-to-Source Leakage Current versus Voltage

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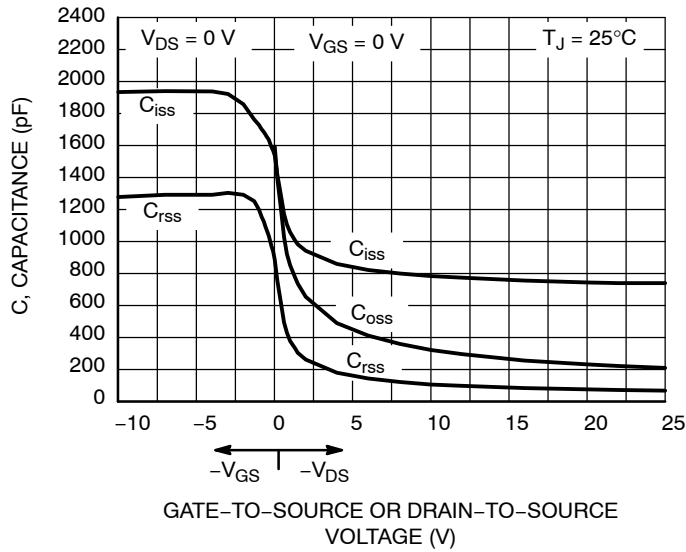


Figure 7. Capacitance Variation

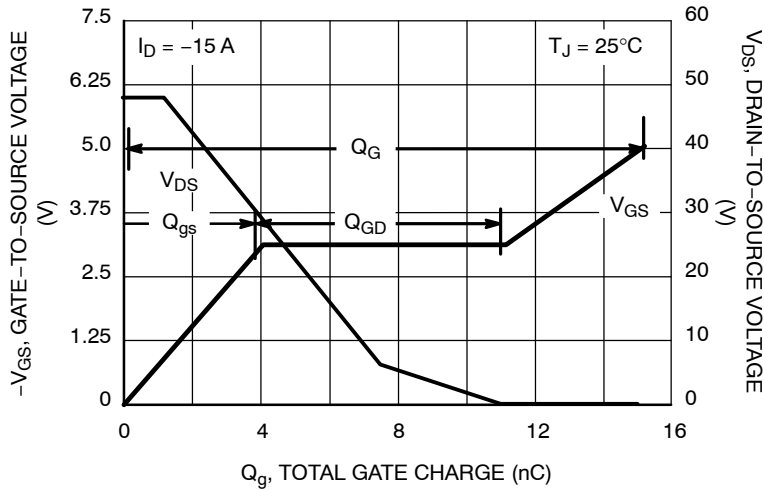


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

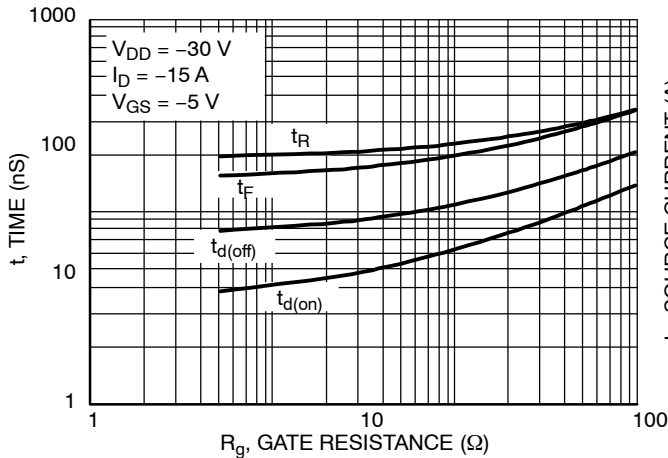


Figure 9. Resistive Switching Time Variation versus Gate Resistance

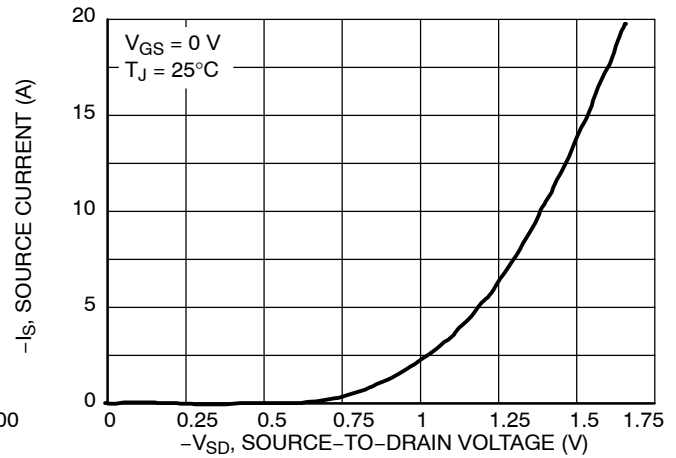


Figure 10. Diode Forward Voltage versus Current

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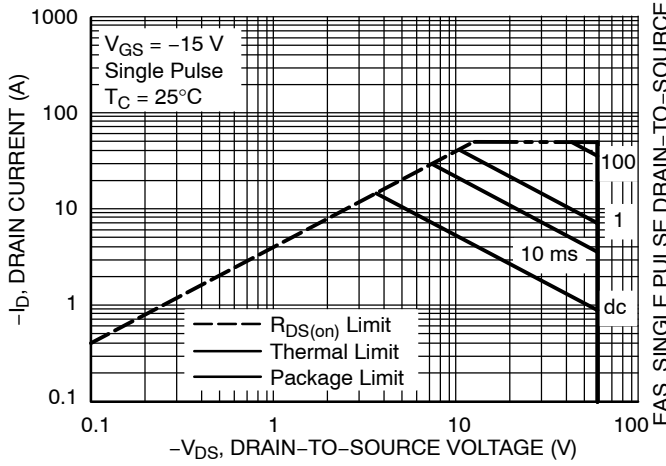


Figure 11. Maximum Rated Forward Biased Safe Operating Area

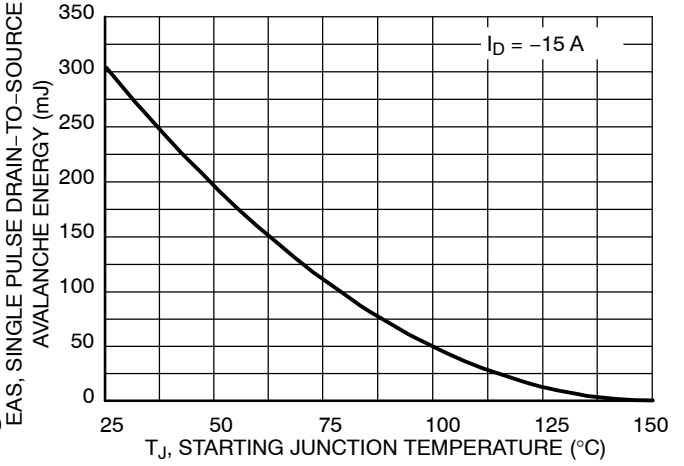


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

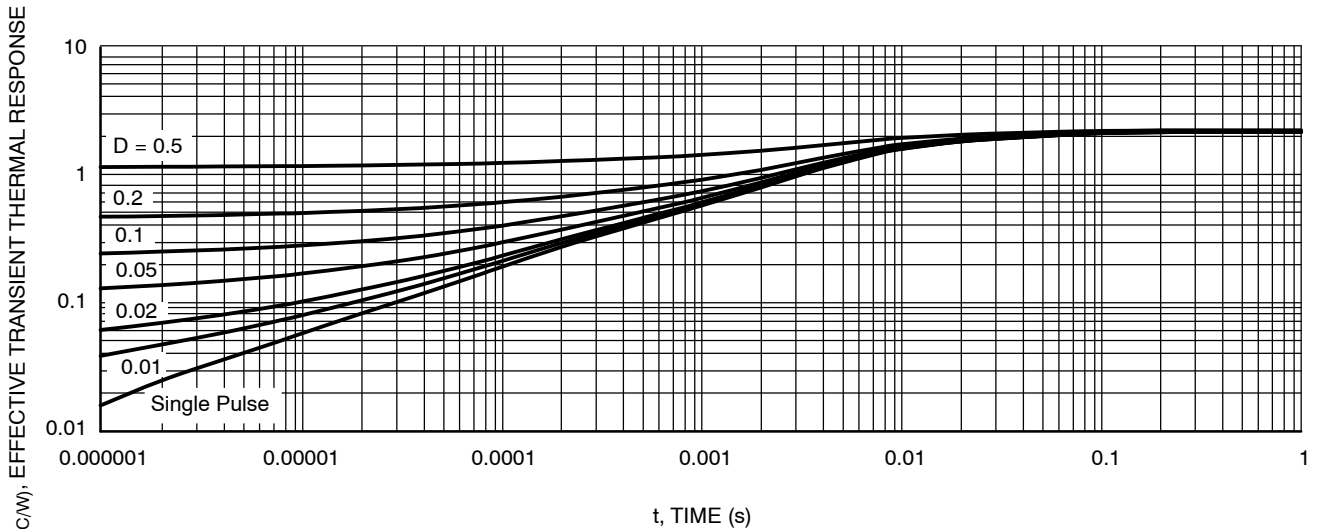


Figure 13. Thermal Response

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ORDERING INFORMATION

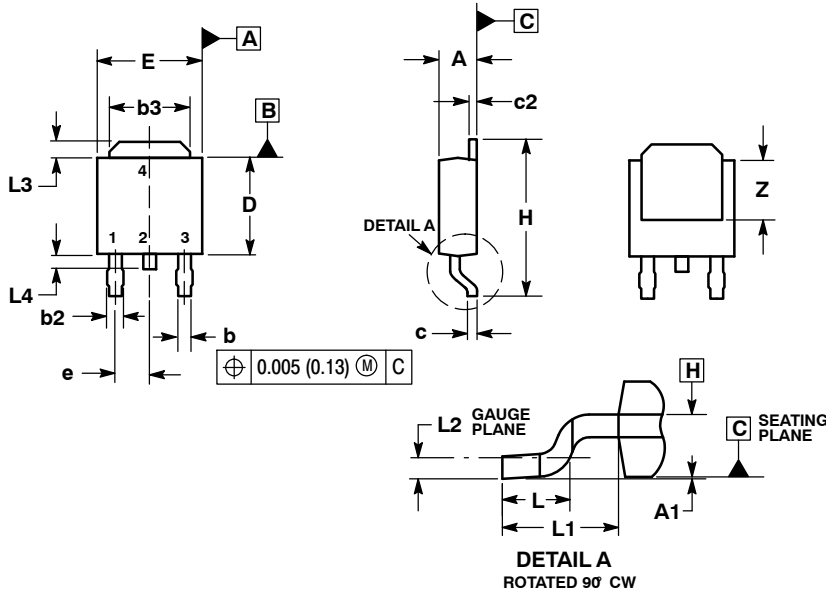
Device	Package	Shipping†
NTD20P06L-1G	DPAK (Pb-Free)	75 Units / Rail
NTD20P06LG		75 Units / Rail
NTD20P06LT4G		2500 / Tape & Reel

†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 (SINGLE GAUGE) CASE 369C-01 ISSUE D

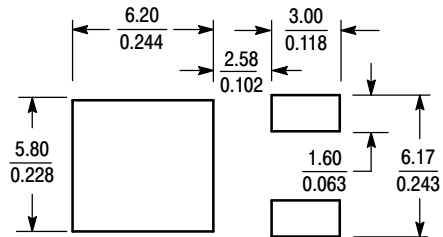


NOTES:

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.

DIM	INCHES		MILLIMETERS	
	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	---

SOLDERING FOOTPRINT*



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

STYLE 2:

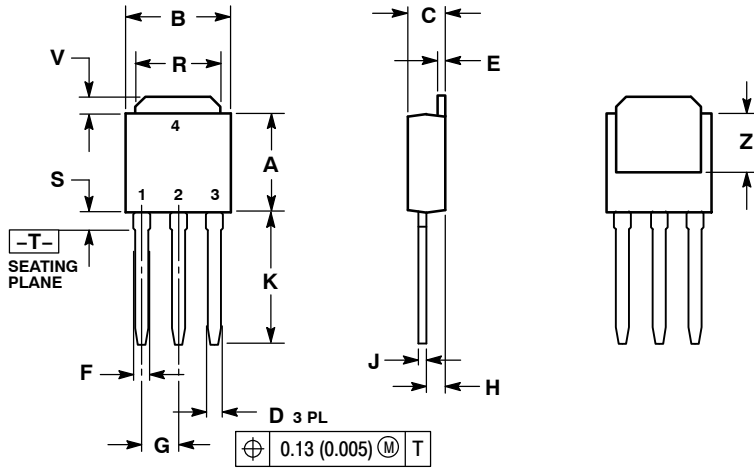
- PIN 1. GATE
- DRAIN
- SOURCE
- DRAIN

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

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PACKAGE DIMENSIONS

IPAK
CASE 369D-01
ISSUE C



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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