

NTD20P06L, NTDV20P06L

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
- AEC Q101 Qualified – NTDV20P06L
- These Devices are Pb–Free and are RoHS Compliant

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	$^\circ\text{C}/\text{W}$
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.)

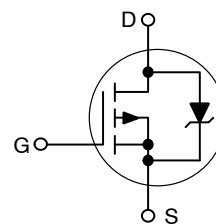


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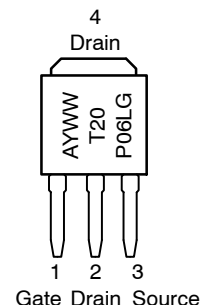
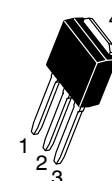
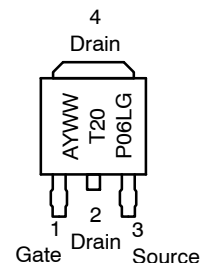
<http://onsemi.com>

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

P–Channel



MARKING DIAGRAMS



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 5 of this data sheet.

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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/ $^\circ\text{C}$
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/ $^\circ\text{C}$
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)

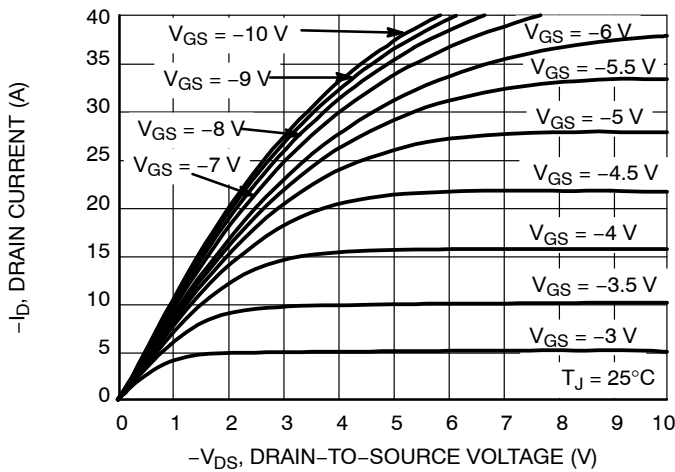


Figure 1. On-Region Characteristics

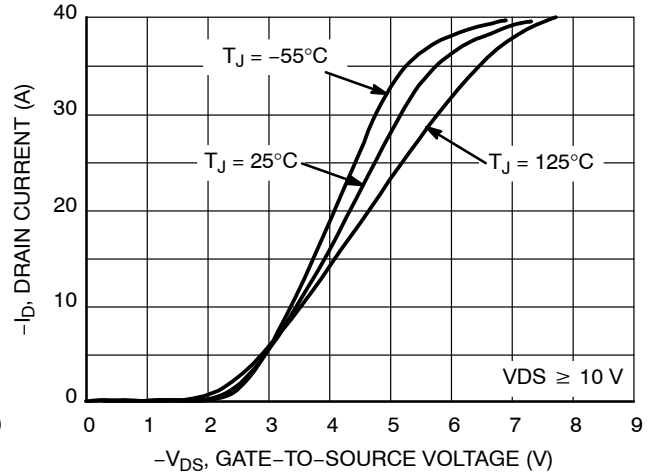


Figure 2. Transfer Characteristics

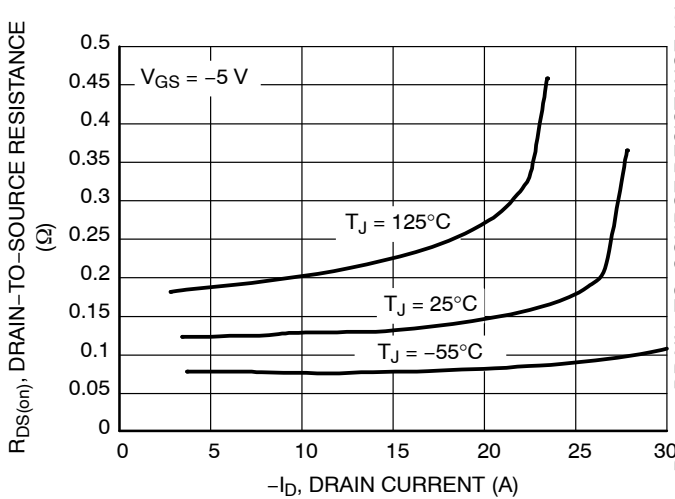


Figure 3. On-Resistance versus Drain Current and Temperature

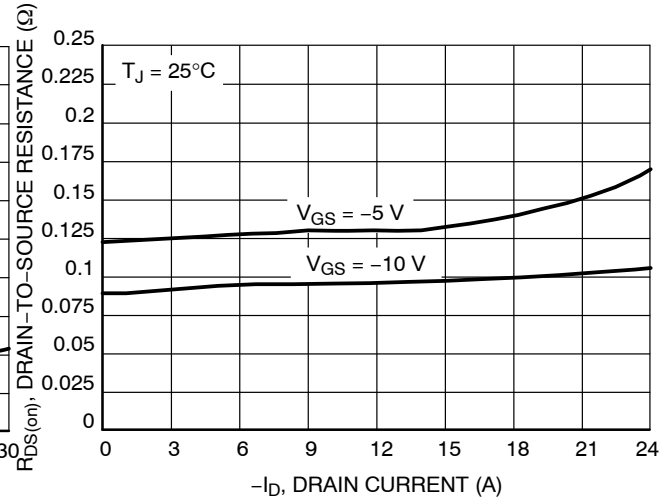


Figure 4. On-Resistance versus Drain Current and Gate Voltage

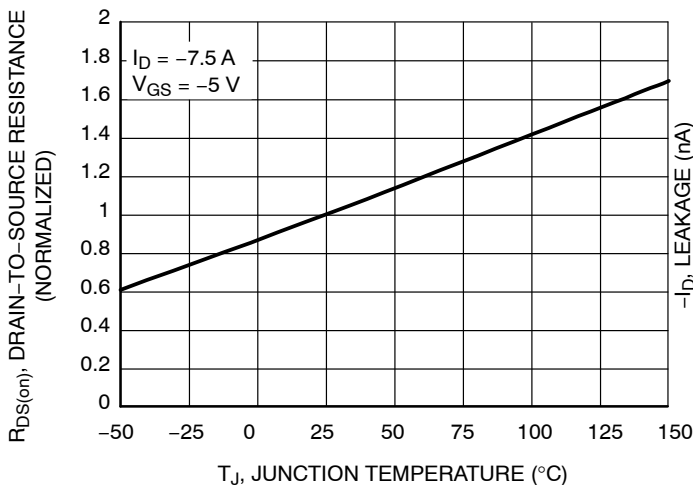


Figure 5. On-Resistance Variation with Temperature

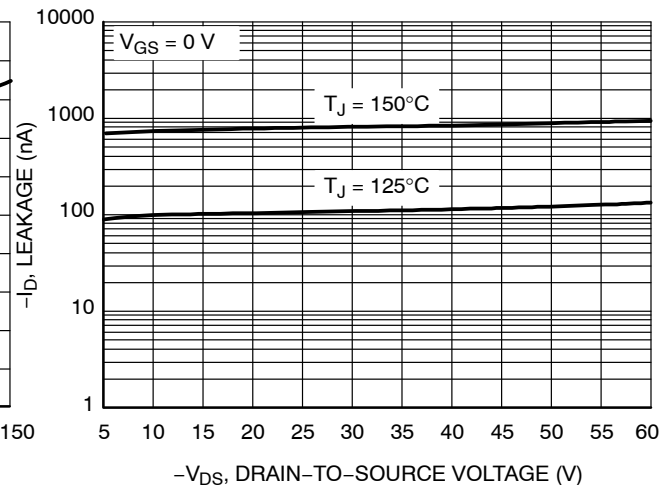


Figure 6. Drain-to-Source Leakage Current versus Voltage

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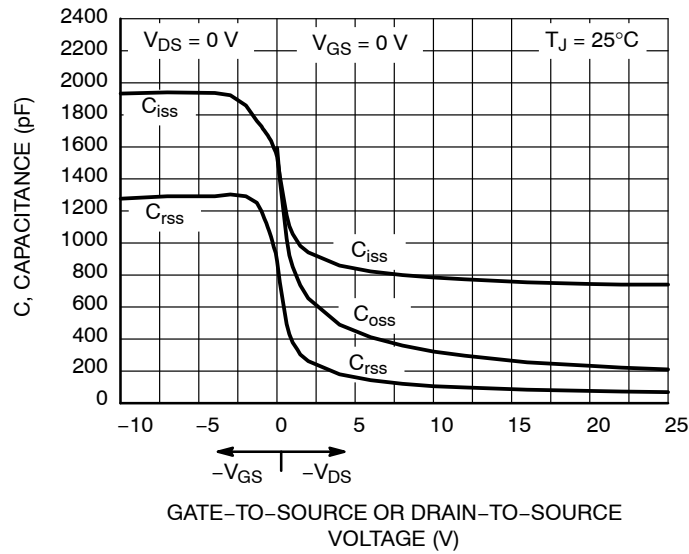


Figure 7. Capacitance Variation

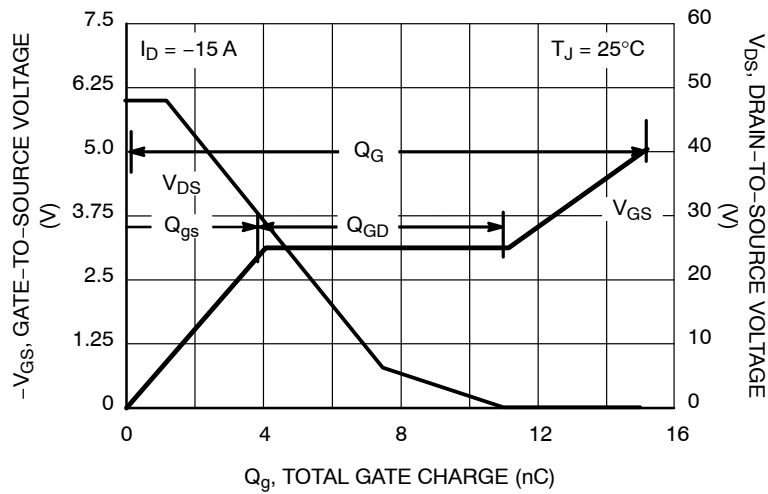


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

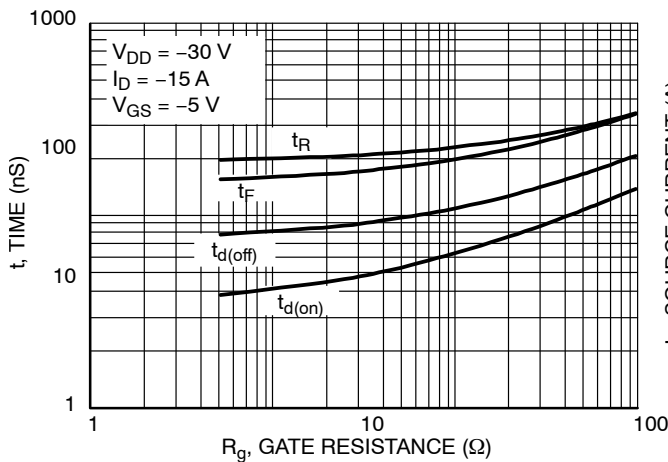


Figure 9. Resistive Switching Time Variation versus Gate Resistance

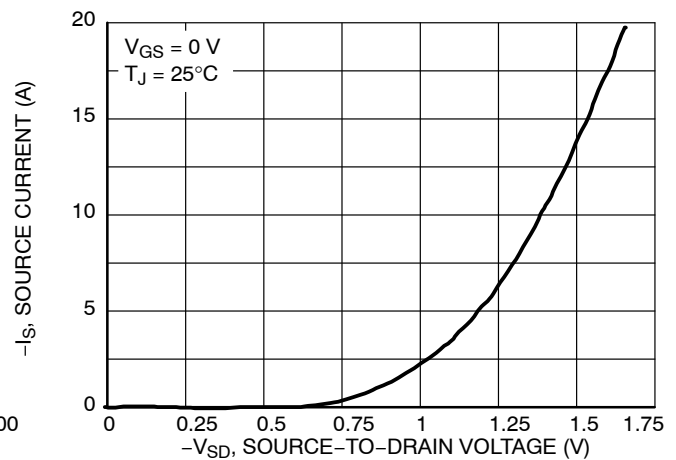


Figure 10. Diode Forward Voltage versus Current

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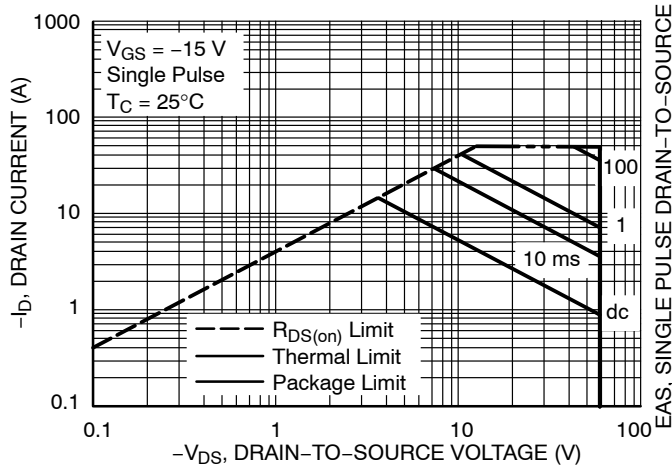


Figure 11. Maximum Rated Forward Biased Safe Operating Area

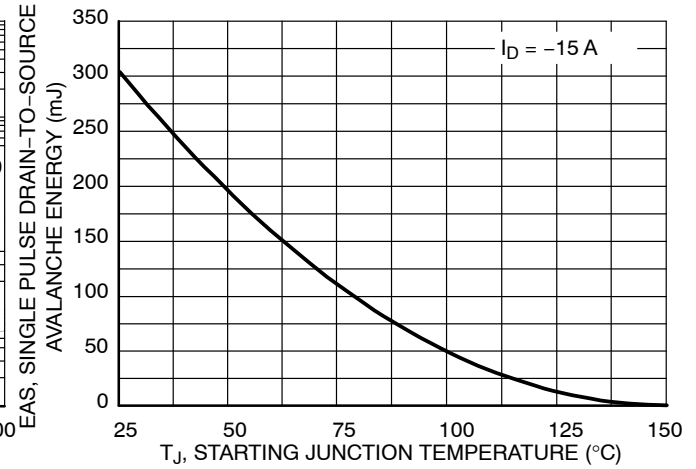


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

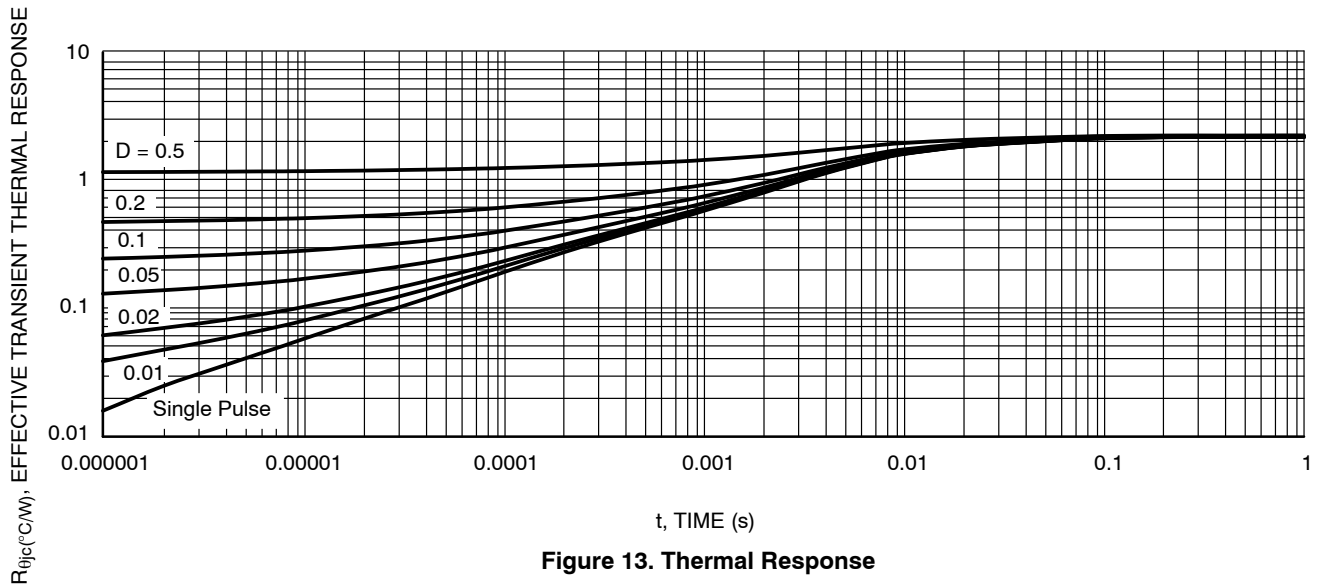


Figure 13. Thermal Response

ORDERING INFORMATION

Device	Package	Shipping†
NTD20P06LG	DPAK (Pb-Free)	75 Units / Rail
NTD20P06LT4G		2500 / Tape & Reel
NTDV20P06LT4G		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.

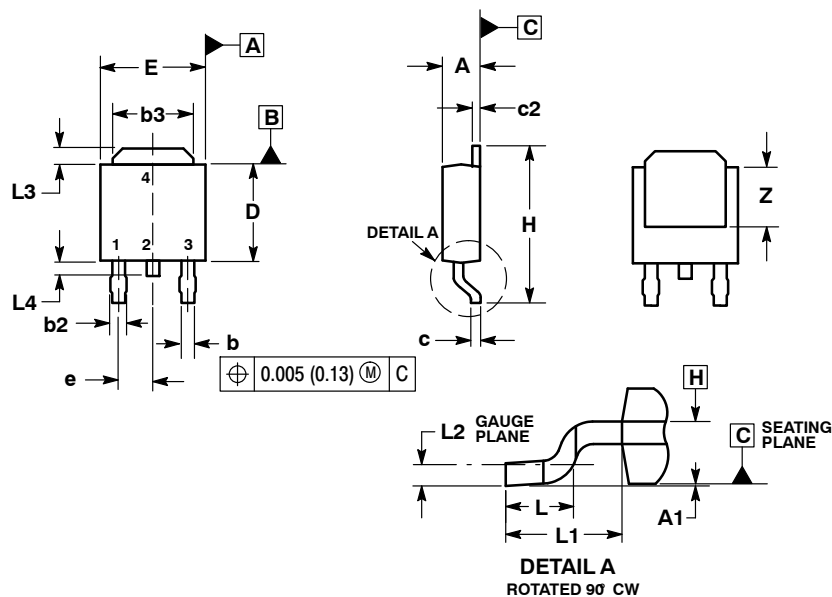
NTD20P06L, NTDV20P06L

PACKAGE DIMENSIONS

DPAK (SINGLE GAUGE)

CASE 369C-01

ISSUE D

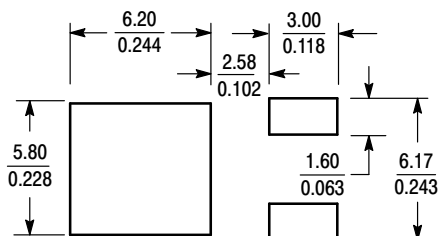


NOTES:

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

STYLE 2:

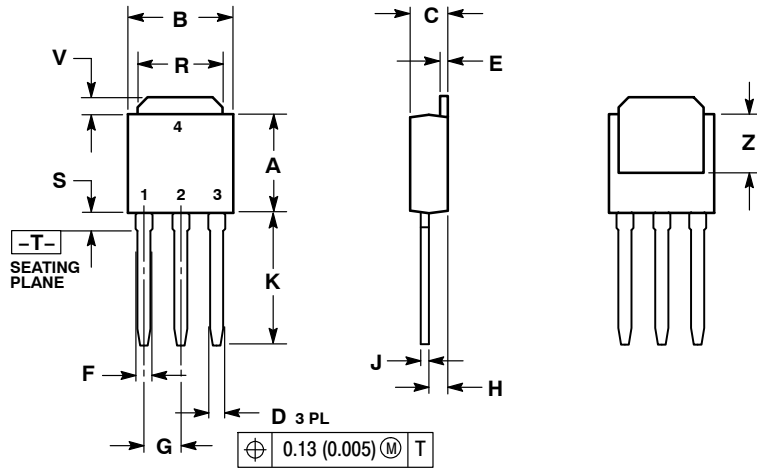
- PIN 1. GATE
- DRAIN
- SOURCE
- DRAIN

*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
- DRAIN
- SOURCE
- DRAIN

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