NTD20P06L

Power MOSFET

60 V, 15 A, Single P−Channel, DPAK

ON Semiconductor®

http://onsemi.com

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

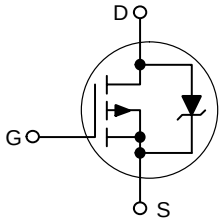
Features

- 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

P−Channel



Maximum Ratings (T_J = 25°C unless otherwise noted)

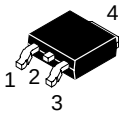
Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	−60	V
Gate−to−Source Voltage	Continuous		V_{GS}	±15	V
	Non−Repetitive	$t_p \le 10$ ms	V_{GSM}	±20	
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	−15	A
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	54	W
Pulsed Drain 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

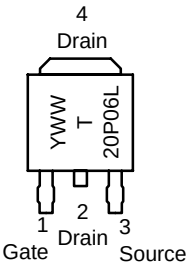
Parameter	Symbol	Max	Unit
Junction−to−Case (Drain)	$R_{\theta JC}$	2.3	°C/W
Junction−to−Ambient – Steady State (Note 1)	$R_{\theta JA}$	80	
Junction−to−Ambient – Steady State (Note 2)	$R_{\theta JA}$	110	

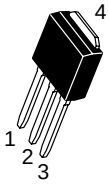
1. Surface−mounted on FR4 board using 1 in sq. pad size (Cu area = 1.127 in sq. [1 oz] including traces)
2. Surface−mounted on FR4 board using the minimum recommended pad size (Cu area = 0.412 in sq.)

MARKING DIAGRAMS

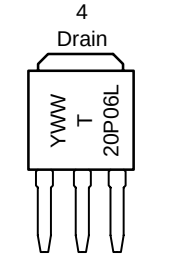


DPAK
CASE 369C
Style 2





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.

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} = ±15 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		nC

3. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%
4. Switching characteristics are independent of operating junction temperatures

TYPICAL PERFORMANCE CURVES

(T_J = 25°C unless otherwise noted)

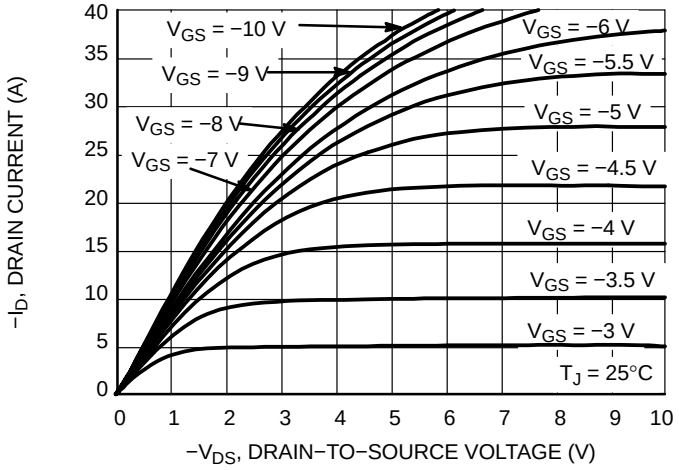


Figure 1. On−Region Characteristics

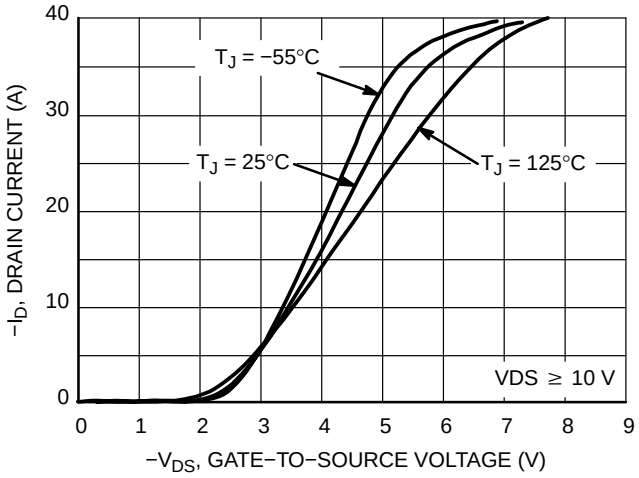


Figure 2. Transfer Characteristics

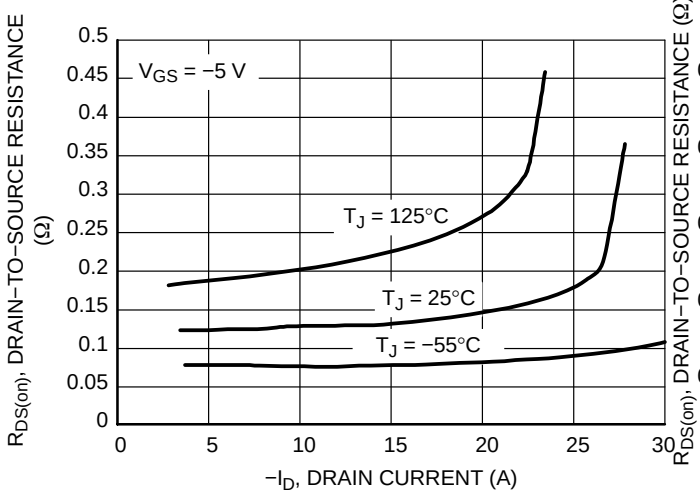


Figure 3. On−Resistance versus Drain Current and Temperature

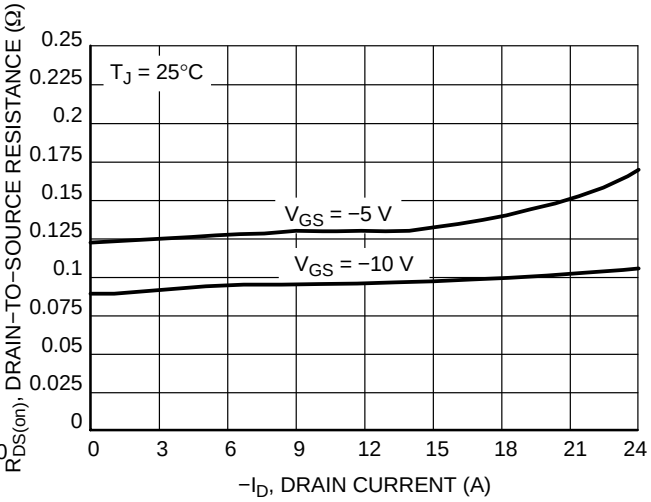


Figure 4. On−Resistance versus Drain Current and Gate Voltage

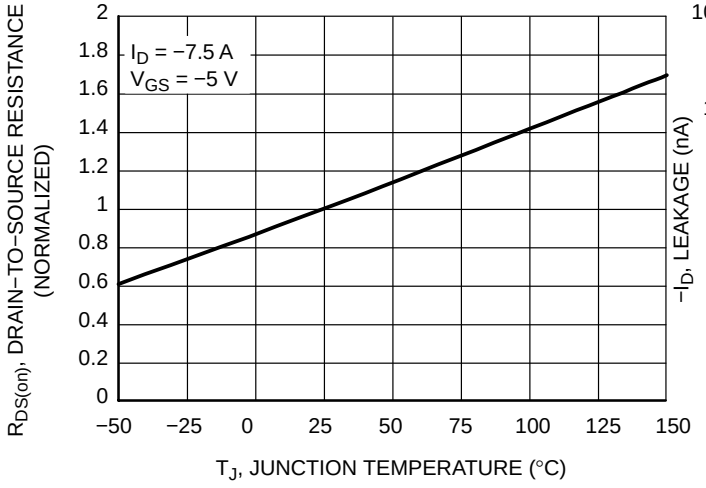


Figure 5. On−Resistance Variation with Temperature

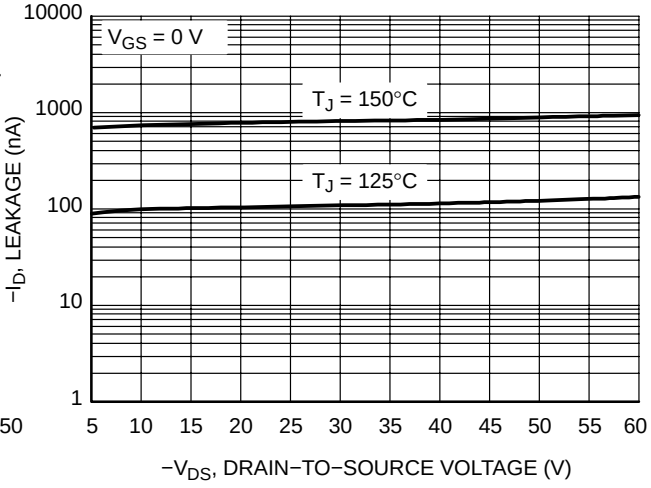


Figure 6. Drain−to−Source Leakage Current versus Voltage

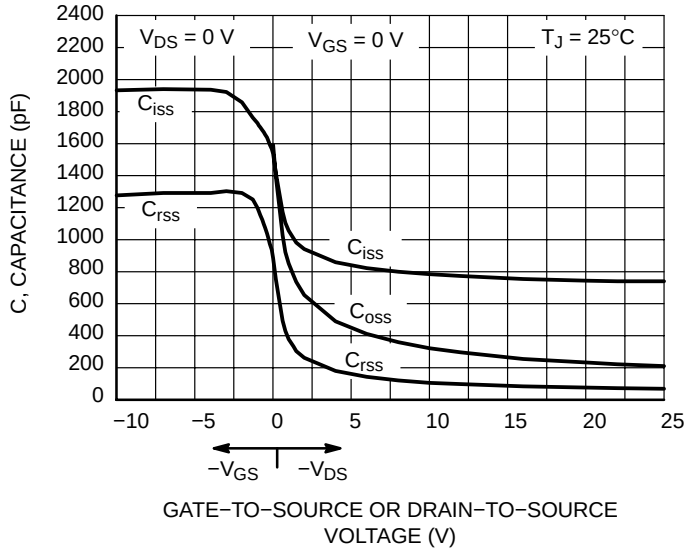


Figure 7. Capacitance Variation

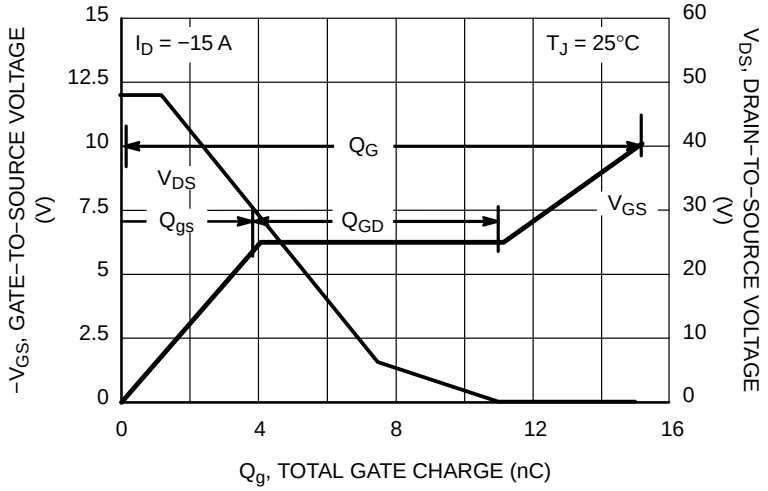


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

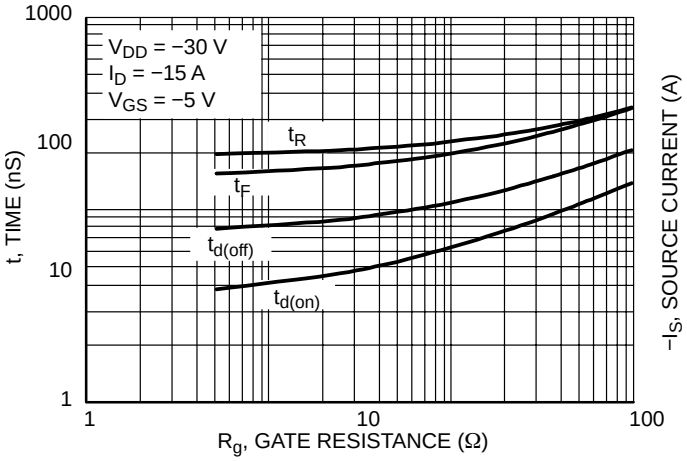


Figure 9. Resistive Switching Time Variation versus Gate Resistance

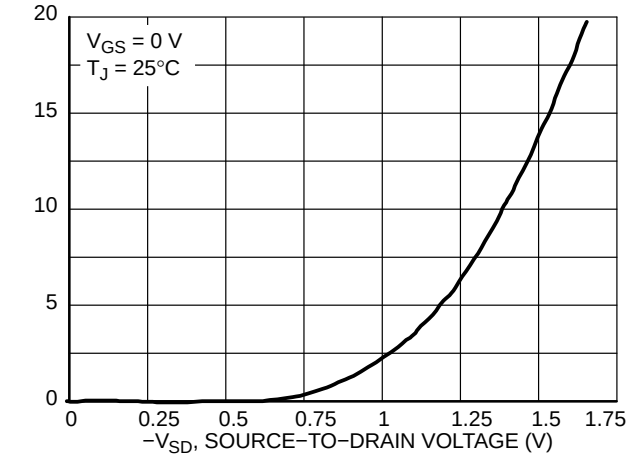


Figure 10. Diode Forward Voltage versus Current

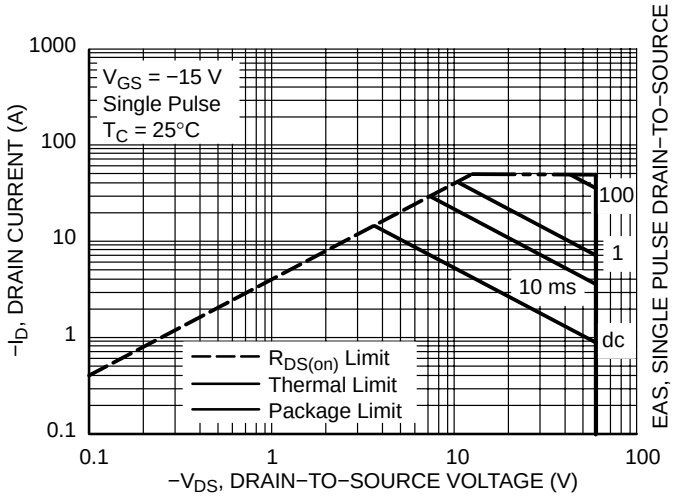


Figure 11. Maximum Rated Forward Biased Safe Operating Area

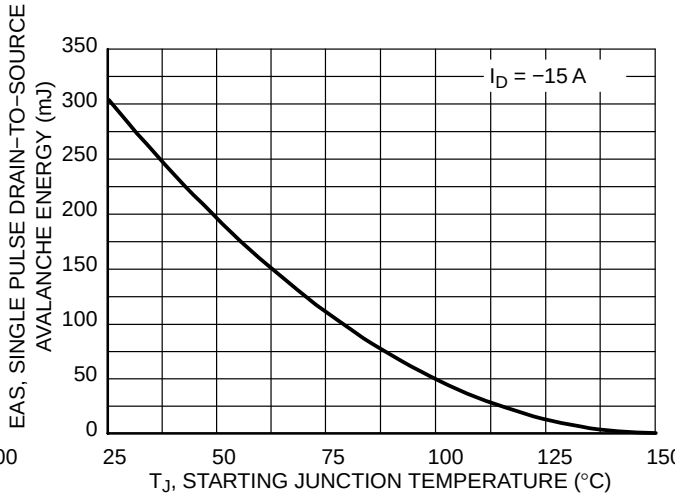


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

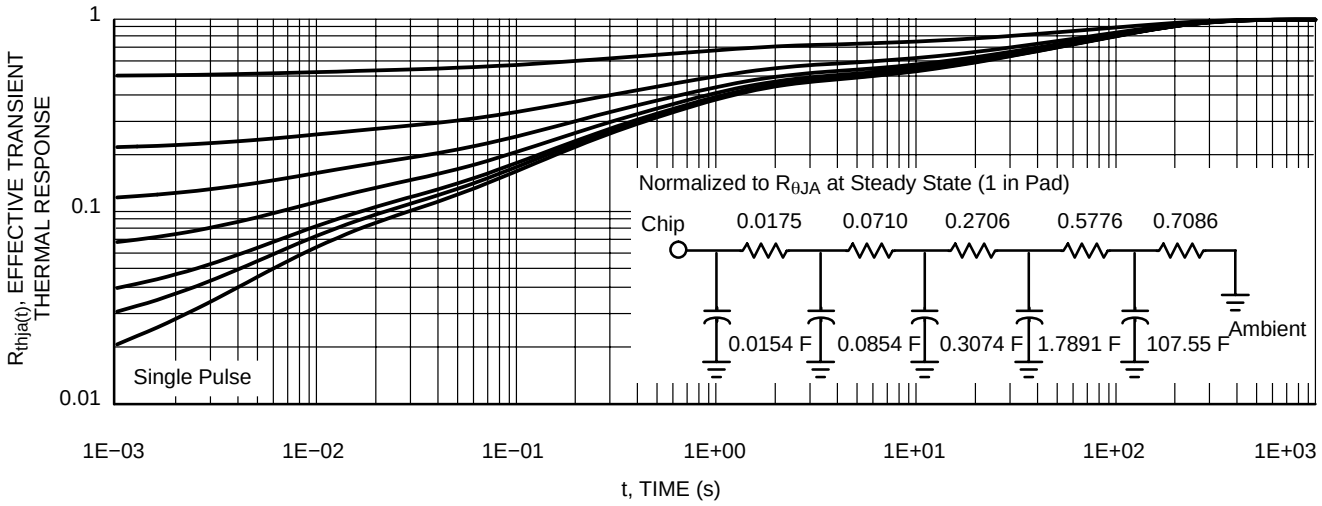


Figure 13. Thermal Response

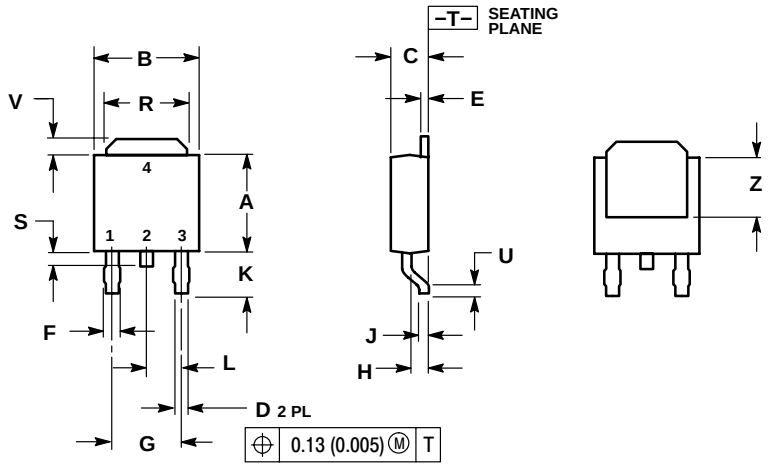
ORDERING INFORMATION

Device	Package	Shipping†
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.

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*

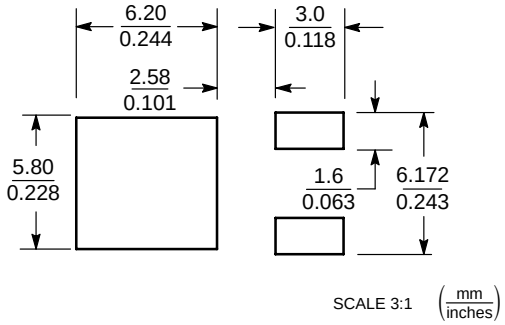
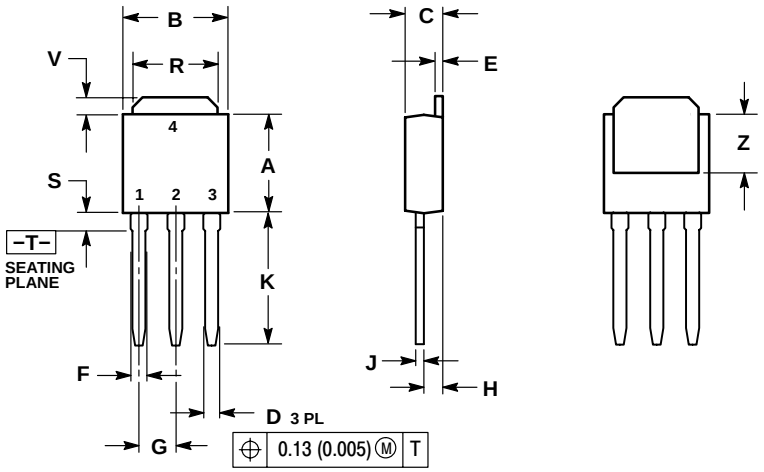


Figure 14. DPAK

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

PACKAGE DIMENSIONS

DPAK
CASE 369D−01
ISSUE O



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

	INCHES		MILLIMETERS	
DIM	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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

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NTD20P06L/D