NTP10N60, NTB10N60

Preferred Devices

Advance Information

Power MOSFET
10 Amps, 600 Volts
N–Channel TO–220 and D²PAK

Designed for high voltage, high speed switching applications in power supplies, converters, power motor controls and bridge circuits.

Features

- Higher Current Rating
- Lower $R_{DS(on)}$
- Lower Capacitances
- Lower Total Gate Charge
- Tighter V_{SD} Specifications
- Avalanche Energy Specified

Typical Applications

- Switch Mode Power Supplies
- PWM Motor Controls
- Converters
- Bridge Circuits

MAXIMUM RATINGS (T_C = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DSS}	600	Vdc
Drain–Gate Voltage (R_{GS} = 1.0 MΩ)	V_{DGR}	600	Vdc
Gate–Source Voltage – Continuous – Non–Repetitive ($t_p \le 10$ ms)	 V_{GS} V_{GSM}	 ±20 ±40	Vdc
Drain – Continuous – Continuous @ 100°C – Single Pulse ($t_p \le 10$ μs)	I_D I_D I_{DM}	10 8.0 35	Adc
Total Power Dissipation Derate above 25°C	P_D	201 1.61	Watts W/°C
Operating and Storage Temperature Range	T_J, T_{stg}	–55 to +150	°C
Single Drain–to–Source Avalanche Energy – Starting T_J = 25°C (V_{DD} = 100 V, V_{GS} = 10 Vdc, I_L = 10 A, L = 10 mH, R_G = 25 Ω)	E_{AS}	500	mJ
Thermal Resistance – Junction–to–Case – Junction–to–Ambient – Junction–to–Ambient (Note 1.)	 $R_{\theta JC}$ $R_{\theta JA}$ $R_{\theta JA}$	 0.62 62.5 50	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 10 seconds	T_L	260	°C

1. When surface mounted to an FR4 board using the minimum recommended pad size.

This document contains information on a new product. Specifications and information herein are subject to change without notice.

ON Semiconductor™

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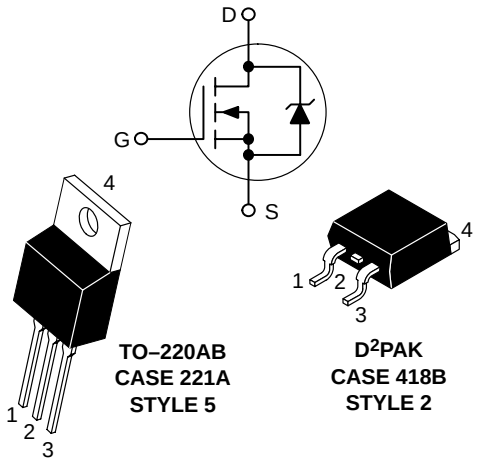
10 AMPERES
600 VOLTS
$R_{DS(on)}$ = 0.75 Ω

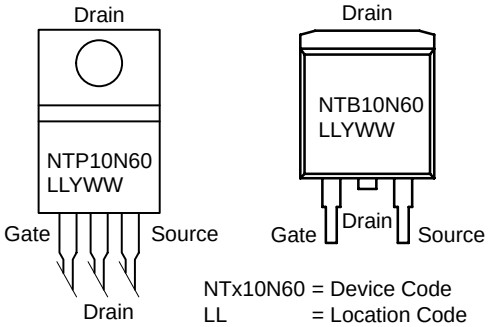
N–Channel



TO–220AB
CASE 221A
STYLE 5

D²PAK
CASE 418B
STYLE 2

MARKING DIAGRAMS AND PIN ASSIGNMENTS



NTx10N60 = Device Code
LL = Location Code
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
NTP10N60	TO–220AB	50 Units/Rail
NTB10N60	D²PAK	50 Units/Rail
NTB10N60T4	D²PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain–to–Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 0.25 mAdc) Temperature Coefficient (Positive)	$V_{(BR)DSS}$	 600 –	 – 585	 – –	Vdc mV/°C
Zero Gate Voltage Collector Current (V_{DS} = 600 Vdc, V_{GS} = 0 Vdc) (V_{DS} = 600 Vdc, V_{GS} = 0 Vdc, T_J =125°C)	I_{DSS}	 – –	 – –	 10 100	μAdc
Gate–Body Leakage Current (V_{GS} = ±20 Vdc, V_{DS} = 0)	$I_{GSS(f)}$ $I_{GSS(r)}$	– –	– –	100 100	nAdc
ON CHARACTERISTICS (Note 1.)					
Gate Threshold Voltage I_D = 0.25 mA, V_{DS} = V_{GS} Temperature Coefficient (Negative)	$V_{GS(th)}$	 2.0 –	 2.5 5.8	 4.0 –	Vdc mV/°C
Static Drain–to–Source On–Resistance (V_{GS} = 10 Vdc, I_D = 5 Adc)	$R_{DS(on)}$	–	0.6	0.75	Ohm
Drain–to–Source On–Voltage (V_{GS} = 10 Vdc, I_D = 10 Adc) (V_{GS} = 10 Vdc, I_D = 5 Adc, T_J = 125°C)	$V_{DS(on)}$	 – –	 – –	 9.0 7.9	Vdc
Forward Transconductance (V_{DS} = 8 Vdc, I_D = 5 Adc)	g_{FS}	3.0	10	–	mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance	(V_{DS} = 25 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	–	1840	2580	pF
Output Capacitance		C_{oss}	–	470	660	
Transfer Capacitance		C_{rss}	–	20	40	
SWITCHING CHARACTERISTICS (Note 2.)						
Turn–On Delay Time	(V_{DD} = 300 Vdc, I_D = 10 Adc, V_{GS} = 10 Vdc, R_G = 9.1 Ω)	$t_{d(on)}$	–	11.5	20	ns
Rise Time		t_r	–	20	40	
Turn–Off Delay Time		$t_{d(off)}$	–	50	100	
Fall Time		t_f	–	30	60	
Gate Charge	(V_{DS} = 400 Vdc, I_D = 10 Adc, V_{GS} = 10 Vdc)	Q_T	–	36	50	nC
		Q_1	–	8.0	–	
		Q_2	–	11	–	
		Q_3	–	20	–	
SOURCE–DRAIN DIODE CHARACTERISTICS						
Forward On–Voltage (Note 1.)	(I_S = 10 Adc, V_{GS} = 0 Vdc) (I_S = 10 Adc, V_{GS} = 0 Vdc, T_J = 125°C)	V_{SD}	 –	 0.85 0.75	 1.0 –	Vdc
Reverse Recovery Time	(I_S = 10 Adc, V_{GS} = 0 Vdc, di_S/dt = 100 A/μs)	t_{rr}	–	510	–	ns
		t_a	–	165	–	
		t_b	–	345	–	
Reverse Recovery Stored Charge		Q_{RR}	–	4.1	–	μC
INTERNAL PACKAGE INDUCTANCE						
Internal Drain Inductance (Measured from contact screw on tab to center of die) (Measured from the drain lead 0.25″ from package to center of die)	L_D	 – –	 3.5 4.5	 – –	nH
Internal Source Inductance (Measured from the source lead 0.25″ from package to source bond pad)	L_S	–	7.5	–	

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
2. Switching characteristics are independent of operating junction temperature.

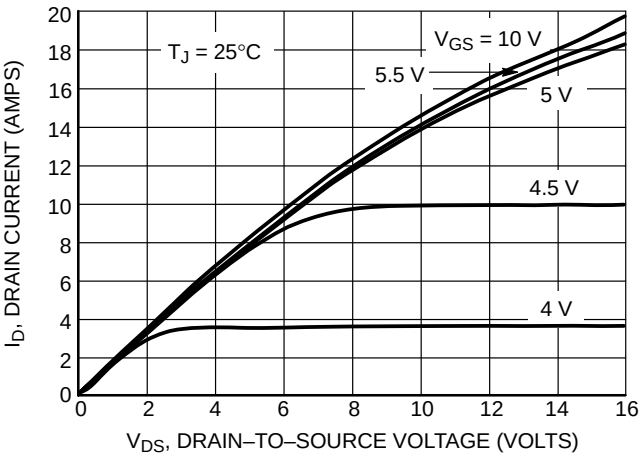


Figure 1. On–Region Characteristics

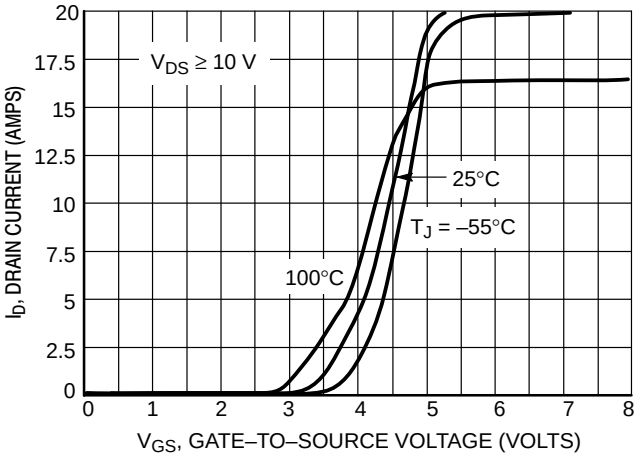


Figure 2. Transfer Characteristics

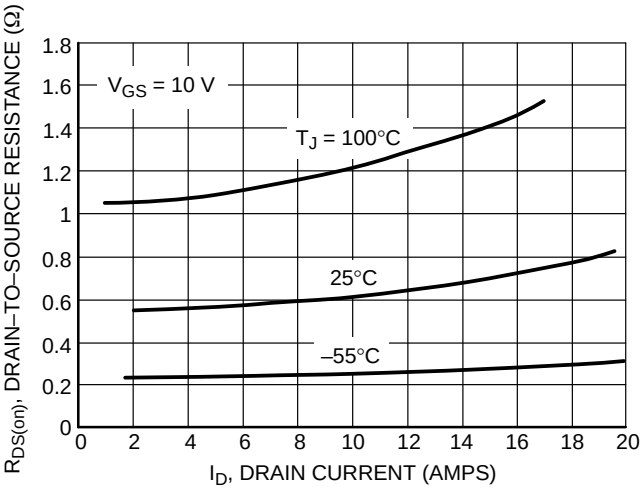


Figure 3. On–Resistance versus Drain Current and Temperature

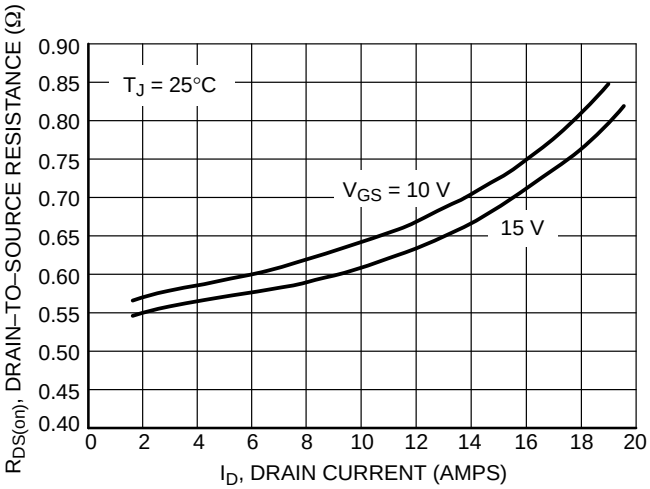


Figure 4. On–Resistance versus Drain Current and Gate Voltage

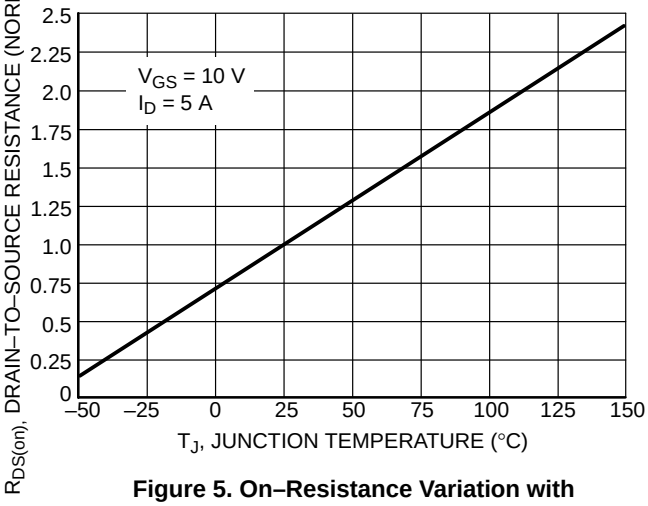


Figure 5. On–Resistance Variation with Temperature

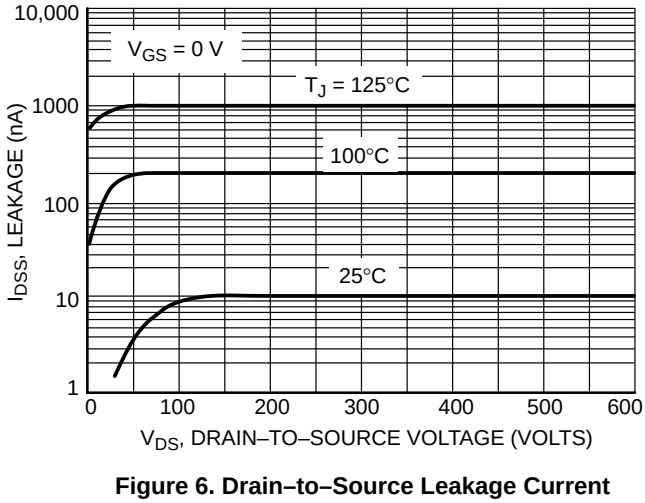


Figure 6. Drain–to–Source Leakage Current versus Voltage

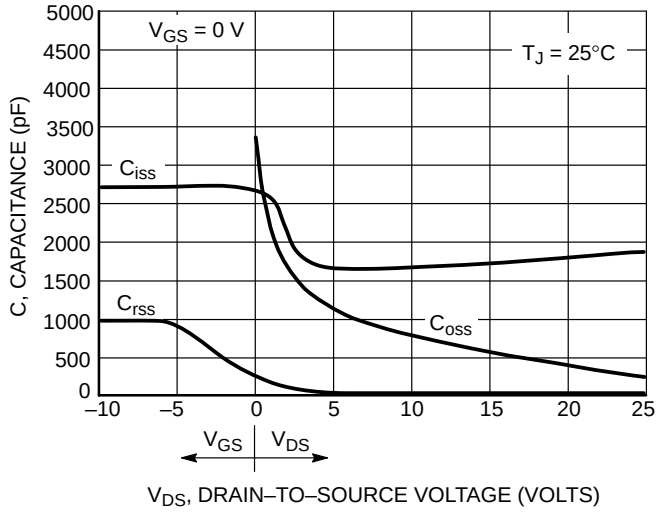


Figure 7. Capacitance Variation

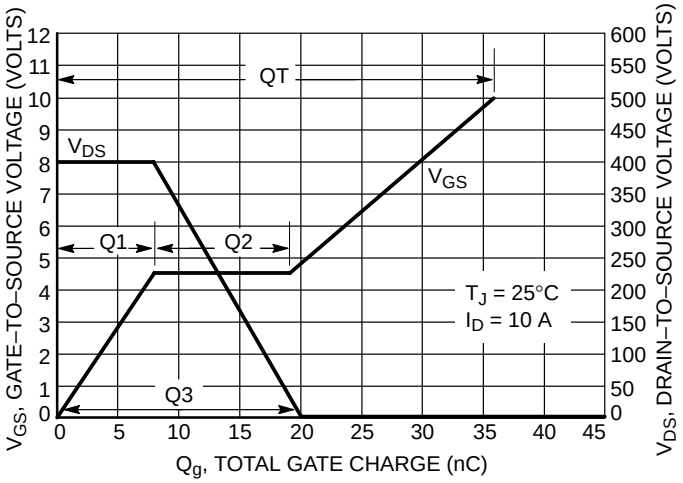


Figure 8. Gate–to–Source and Drain–to–Source Voltage versus Total Charge

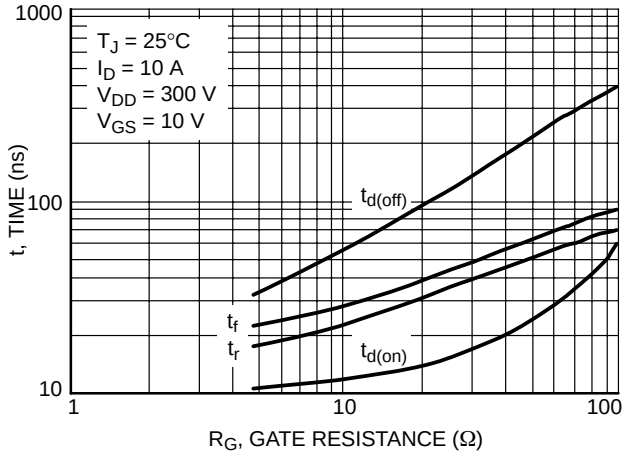


Figure 9. Resistive Switching Time Variation versus Gate Resistance

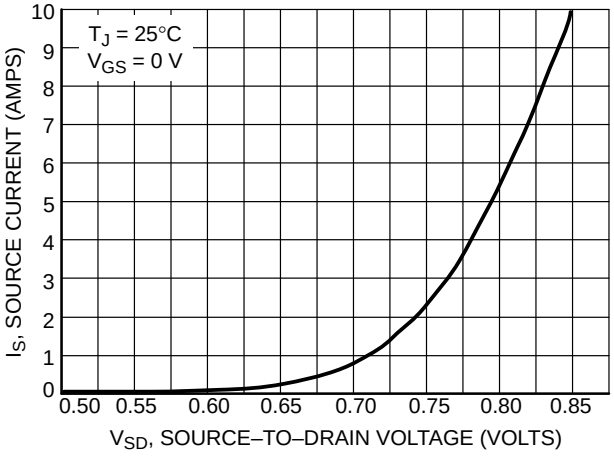


Figure 10. Diode Forward Voltage versus Current

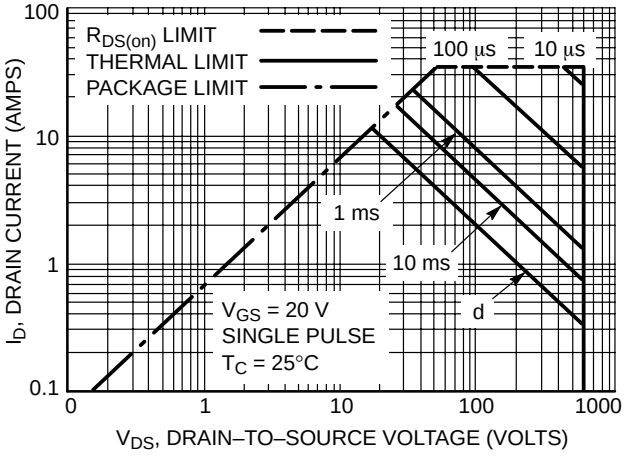


Figure 11. Maximum Rated Forward Biased Safe Operating Area

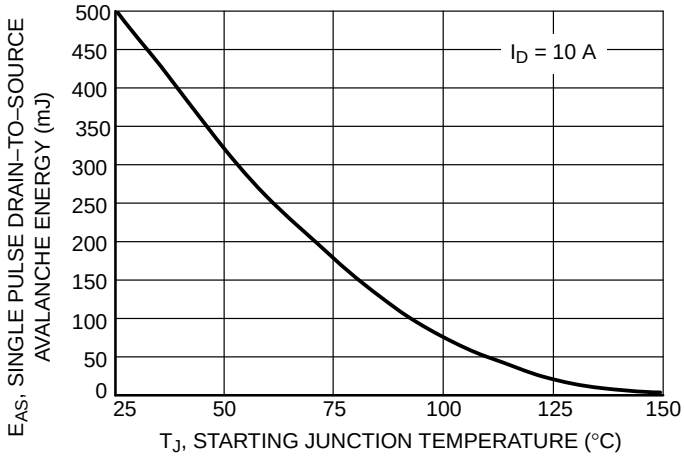


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

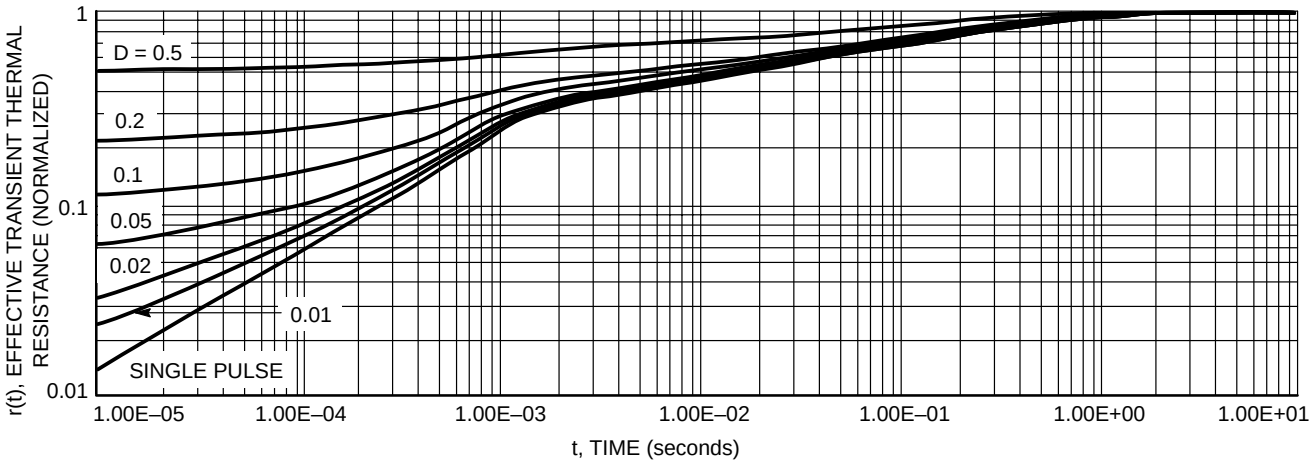
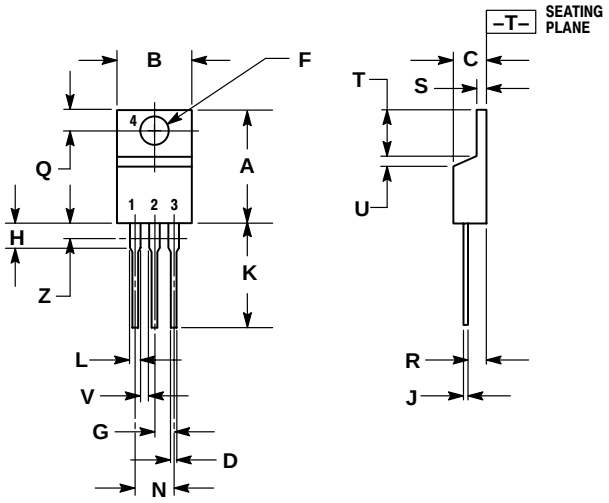


Figure 13. Thermal Response

PACKAGE DIMENSIONS

TO–220 THREE–LEAD
TO–220AB
CASE 221A–09
ISSUE AA



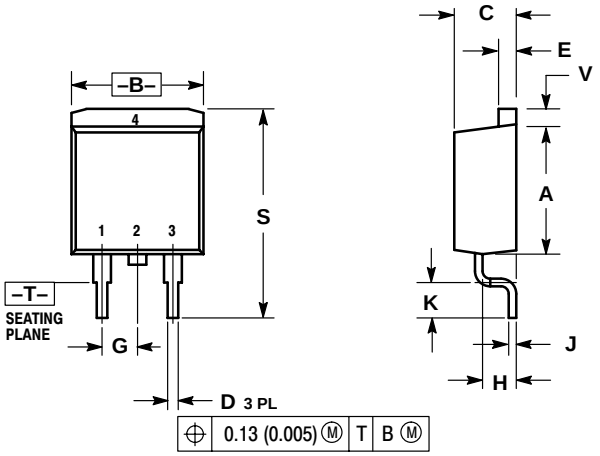
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

PACKAGE DIMENSIONS

D²PAK
CASE 418B–03
ISSUE D



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

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

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