NTP45N06L, NTB45N06L

Power MOSFET

45 Amps, 60 Volts, Logic Level, N−Channel TO−220 and D^{2}PAK

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

Features

- Pb−Free Packages are Available
- Higher Current Rating
- Lower $R_{DS(on)}$
- Lower $V_{DS(on)}$
- Lower Capacitances
- Lower Total Gate Charge
- Tighter V_{SD} Specification
- Lower Diode Reverse Recovery Time
- Lower Reverse Recovery Stored Charge

Typical Applications

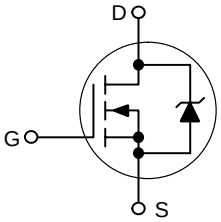
- Power Supplies
- Converters
- Power Motor Controls
- Bridge Circuits

ON Semiconductor®

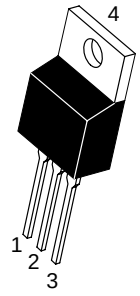
http://onsemi.com

45 AMPERES, 60 VOLTS
$R_{DS(on)}$ = 28 mΩ

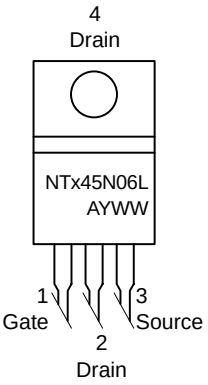
N−Channel

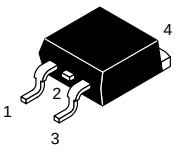


MARKING DIAGRAMS

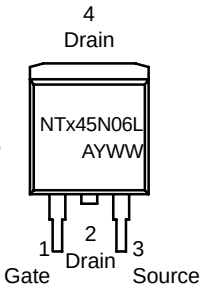


TO−220
CASE 221A
STYLE 5





D^{2}PAK
CASE 418B
STYLE 2



NTx45N06L	= Device Code
x	= P or B
A	= Assembly Location
Y	= Year
WW	= Work Week

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

Rating	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	60	Vdc
Drain−to−Gate Voltage (R_{GS} = 10 MΩ)	V_{DGR}	60	Vdc
Gate−to−Source Voltage − Continuous − Non−Repetitive ($t_p \le 10$ ms)	 V_{GS} V_{GS}	 ±15 ±20	Vdc
Drain Current − Continuous @ T_A = 25°C − Continuous @ T_A = 100°C − Single Pulse ($t_p \le 10$ μs)	 I_D I_D I_{DM}	 45 30 150	 Adc Apk
Total Power Dissipation @ T_A = 25°C Derate above 25°C Total Power Dissipation @ T_A = 25°C (Note 1) Total Power Dissipation @ T_A = 25°C (Note 2)	P_D	125 0.83 3.2 2.4	W W/°C W W
Operating and Storage Temperature Range	T_J, T_{stg}	−55 to +175	°C
Single Pulse Drain−to−Source Avalanche Energy − Starting T_J = 25°C (V_{DD} = 50 Vdc, V_{GS} = 5.0 Vdc, L = 0.3 mH $I_{L(pk)}$ = 40 A, V_{DS} = 60 Vdc, R_G = 25 Ω)	E_{AS}	240	mJ
Thermal Resistance − Junction−to−Case − Junction−to−Ambient (Note 1) − Junction−to−Ambient (Note 2)	 $R_{\theta JC}$ $R_{\theta JA}$ $R_{\theta JA}$	 1.2 46.8 63.2	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 10 seconds	T_L	260	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. When surface mounted to an FR4 board using 1″ pad size, (Cu Area 1.127 in^2).
2. When surface mounted to an FR4 board using the minimum recommended pad size, (Cu Area 0.412 in^2).

ORDERING INFORMATION

Device	Package	Shipping†
NTP45N06L	TO−220	50 Units/Rail
NTB45N06L	D^2PAK	50 Units/Rail
NTB45N06LG	D^2PAK (Pb−Free)	50 Units/Rail
NTB45N06LT4	D^2PAK	800 Tape & Reel
NTB45N06LT4G	D^2PAK (Pb−Free)	800 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.

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain−to−Source Breakdown Voltage (Note 3) (V_{GS} = 0 Vdc, I_D = 250 μAdc) Temperature Coefficient (Positive)		$V_{(BR)DSS}$	 60 −	 67 67.2	 − −	Vdc mV/°C
Zero Gate Voltage Drain Current (V_{DS} = 60 Vdc, V_{GS} = 0 Vdc) (V_{DS} = 60 Vdc, V_{GS} = 0 Vdc, T_J = 150°C)		I_{DSS}	 − −	 − −	 1.0 10	μAdc
Gate−Body Leakage Current (V_{GS} = ±15 Vdc, V_{DS} = 0 Vdc)		I_{GSS}	−	−	±100	nAdc
ON CHARACTERISTICS (Note 4)						
Gate Threshold Voltage (Note 4) (V_{DS} = V_{GS}, I_D = 250 μAdc) Threshold Temperature Coefficient (Negative)		$V_{GS(th)}$	 1.0 −	 1.8 4.7	 2.0 −	Vdc mV/°C
Static Drain−to−Source On−Resistance (Note 4) (V_{GS} = 5.0 Vdc, I_D = 22.5 Adc)		$R_{DS(on)}$	 −	 23	 28	mΩ
Static Drain−to−Source On−Voltage (Note 4) (V_{GS} = 5.0 Vdc, I_D = 45 Adc) (V_{GS} = 5.0 Vdc, I_D = 22.5 Adc, T_J = 150°C)		$V_{DS(on)}$	 − −	 1.03 0.93	 1.51 −	Vdc
Forward Transconductance (Note 4) (V_{DS} = 8.0 Vdc, I_D = 12 Adc)		g_{FS}	−	22.8	−	mhos
DYNAMIC CHARACTERISTICS						
Input Capacitance	(V_{DS} = 25 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	−	1212	1700	pF
Output Capacitance		C_{oss}	−	352	480	
Transfer Capacitance		C_{rss}	−	90	180	
SWITCHING CHARACTERISTICS (Note 5)						
Turn−On Delay Time	(V_{DD} = 30 Vdc, I_D = 45 Adc, V_{GS} = 5.0 Vdc, R_G = 9.1 Ω) (Note 4)	$t_{d(on)}$	−	13	30	ns
Rise Time		t_r	−	341	680	
Turn−Off Delay Time		$t_{d(off)}$	−	36	75	
Fall Time		t_f	−	158	320	
Gate Charge	(V_{DS} = 48 Vdc, I_D = 45 Adc, V_{GS} = 5.0 Vdc) (Note 4)	Q_T	−	23	32	nC
		Q_1	−	4.6	−	
		Q_2	−	14.1	−	
SOURCE−DRAIN DIODE CHARACTERISTICS						
Forward On−Voltage	(I_S = 45 Adc, V_{GS} = 0 Vdc) (Note 4) (I_S = 45 Adc, V_{GS} = 0 Vdc, T_J = 150°C)	V_{SD}	 − −	 1.01 0.92	 1.15 −	Vdc
Reverse Recovery Time	(I_S = 45 Adc, V_{GS} = 0 Vdc, dI_S/dt = 100 A/μs) (Note 4)	t_{rr}	−	56	−	ns
		t_a	−	30	−	
		t_b	−	26	−	
Reverse Recovery Stored Charge		Q_{RR}	−	0.09	−	μC

3. When surface mounted to an FR4 board using the minimum recommended pad size, (Cu Area 0.412 in^2).
4. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
5. Switching characteristics are independent of operating junction temperatures.

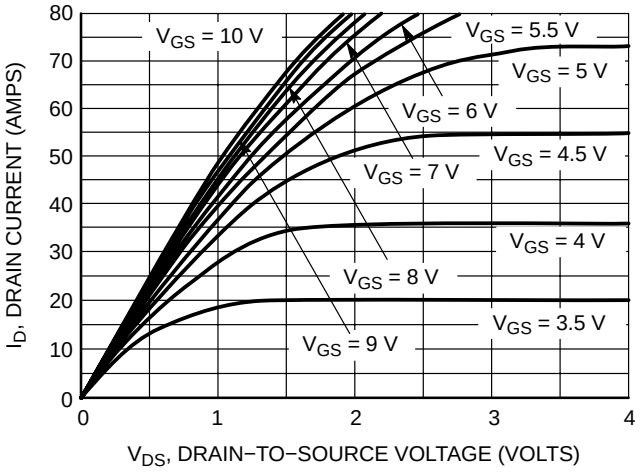


Figure 1. On−Region Characteristics

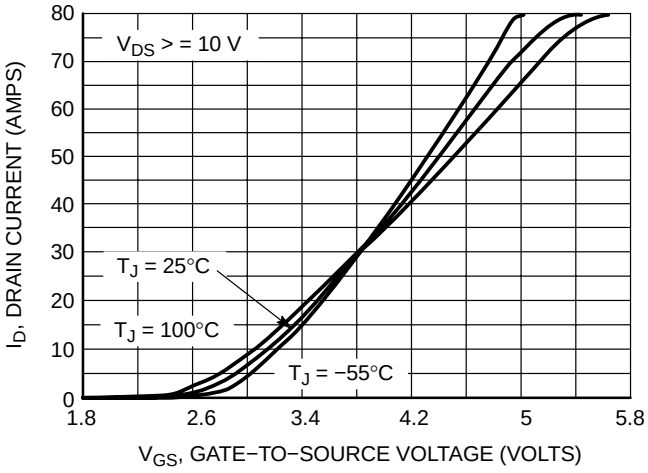


Figure 2. Transfer Characteristics

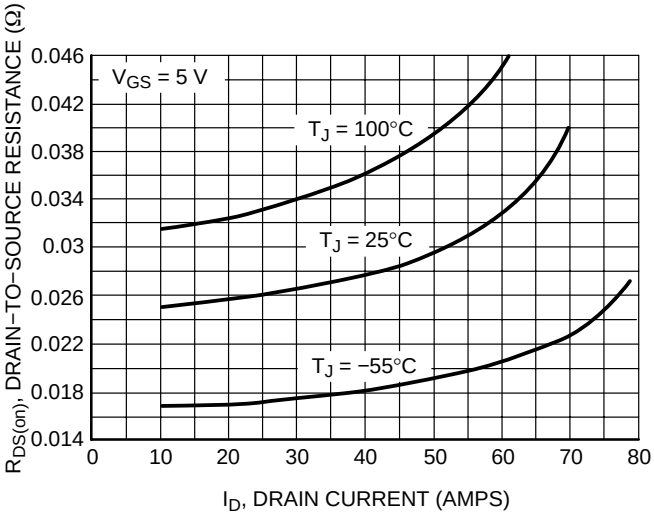


Figure 3. On−Resistance vs. Gate−to−Source Voltage

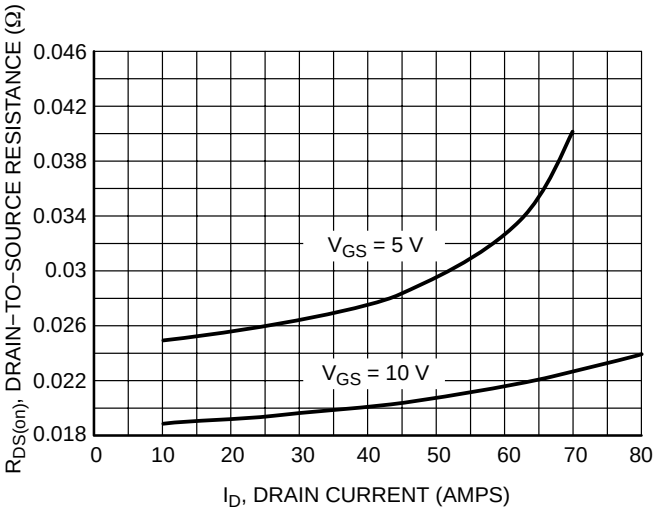


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

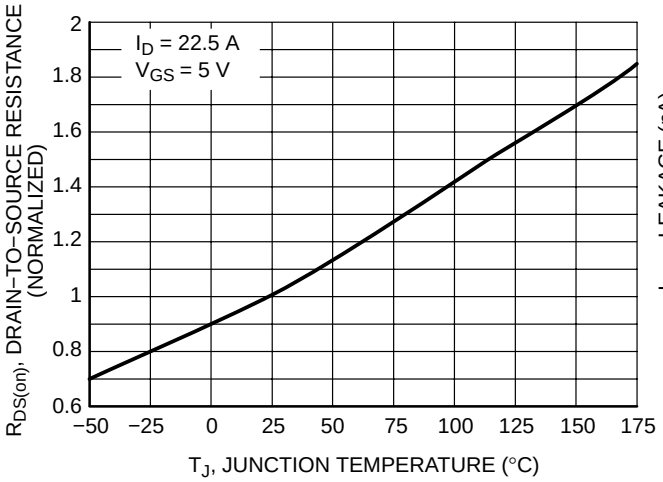


Figure 5. On−Resistance Variation with Temperature

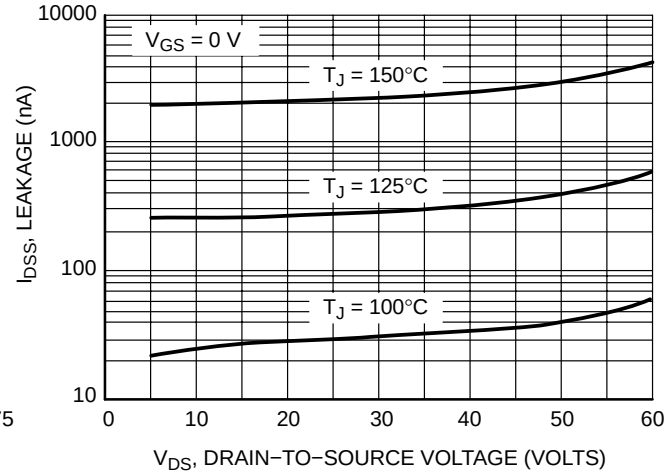


Figure 6. Drain−to−Source Leakage Current vs. Voltage

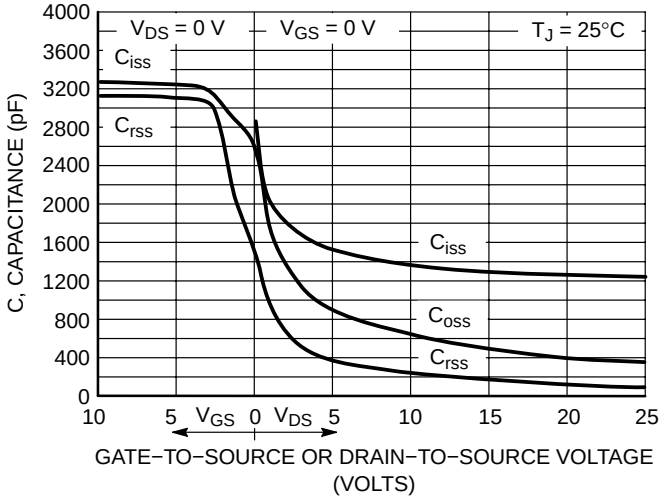


Figure 7. Capacitance Variation

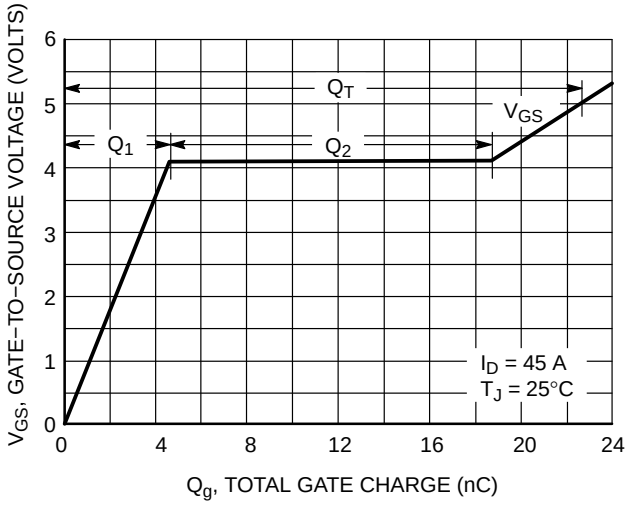


Figure 8. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge

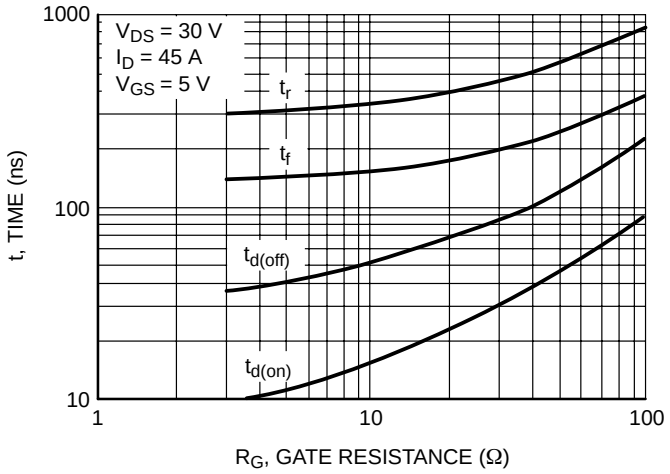


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

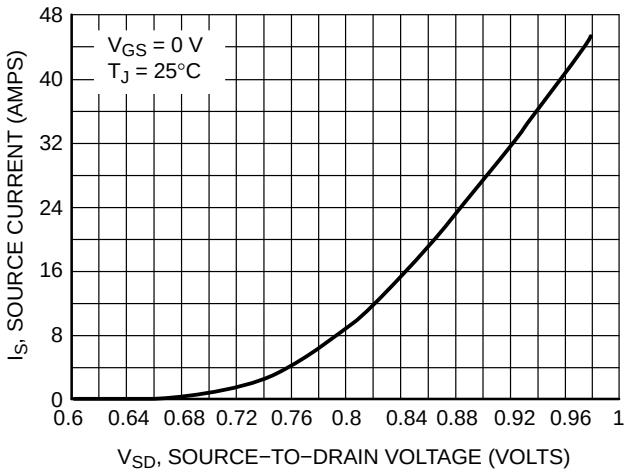


Figure 10. Diode Forward Voltage vs. Current

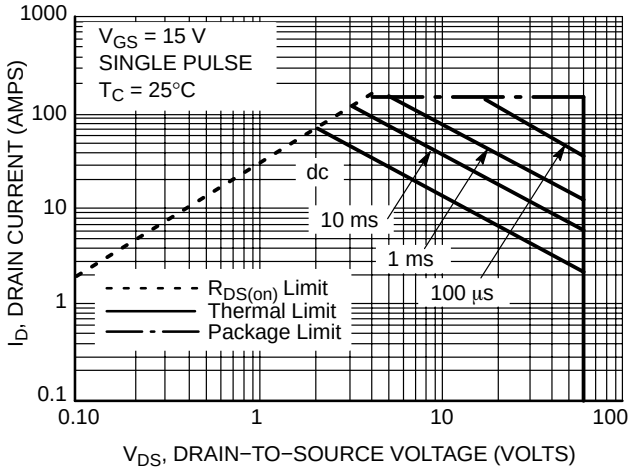


Figure 11. Maximum Rated Forward Biased Safe Operating Area

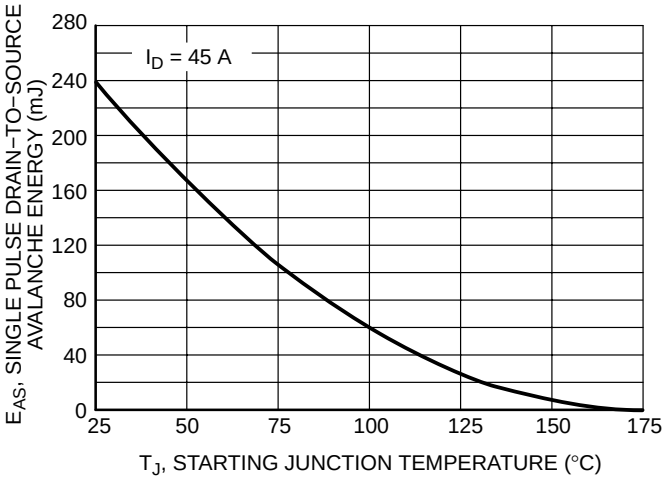


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

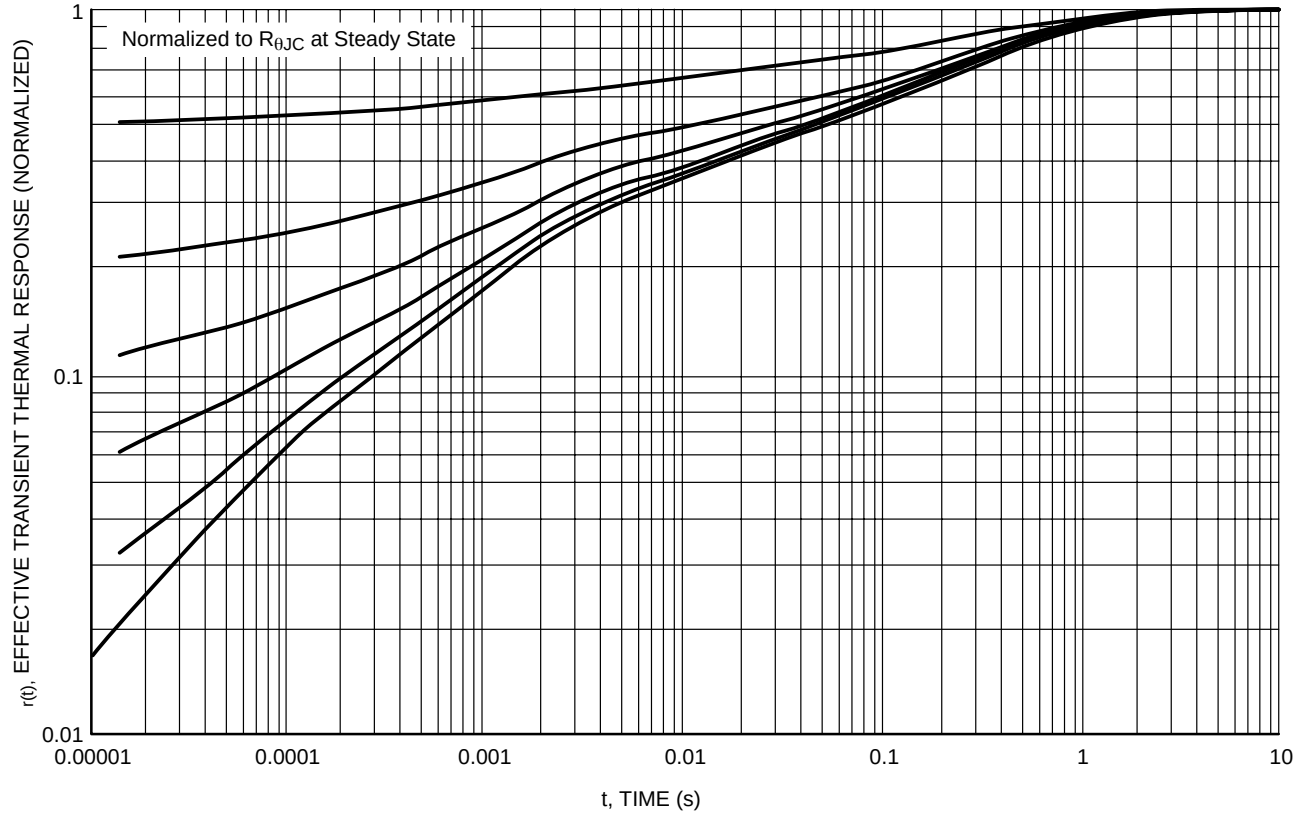


Figure 13. Thermal Response

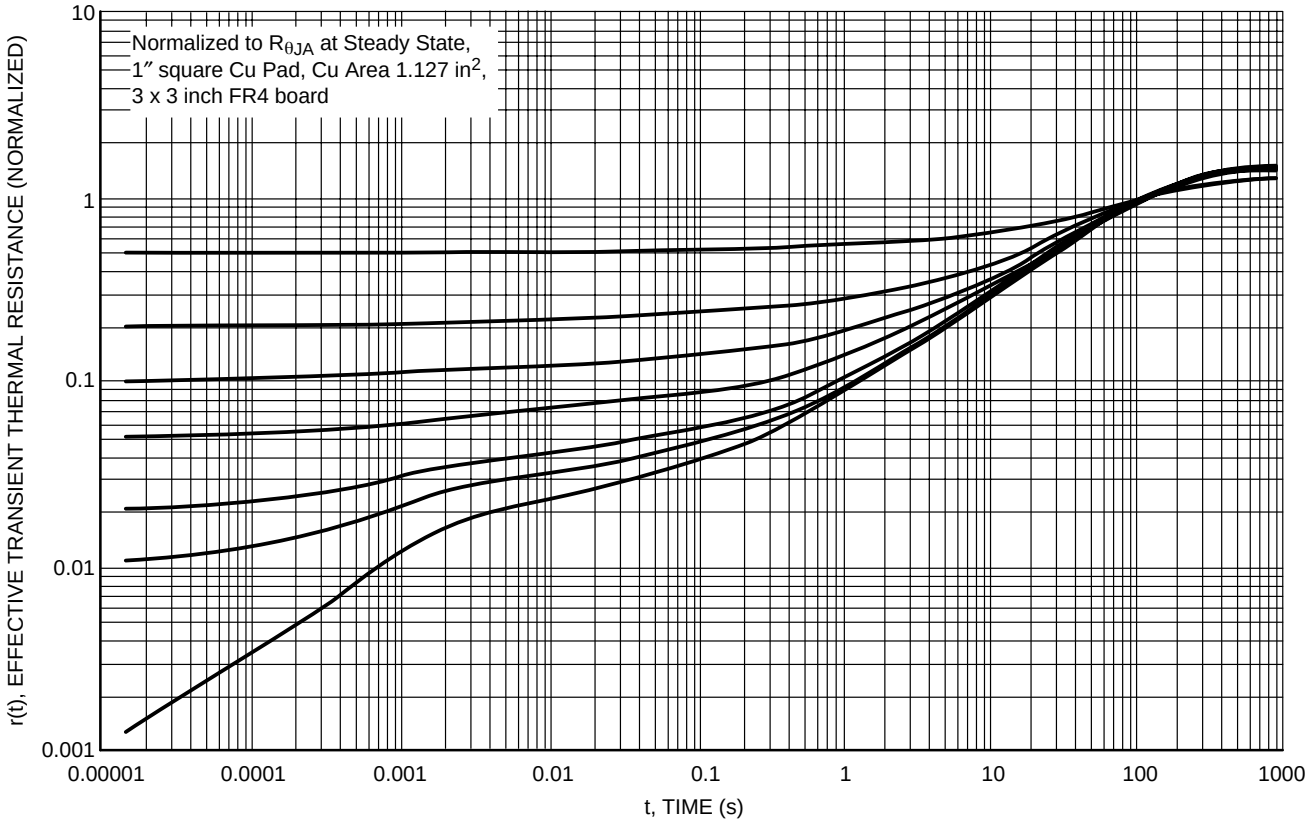
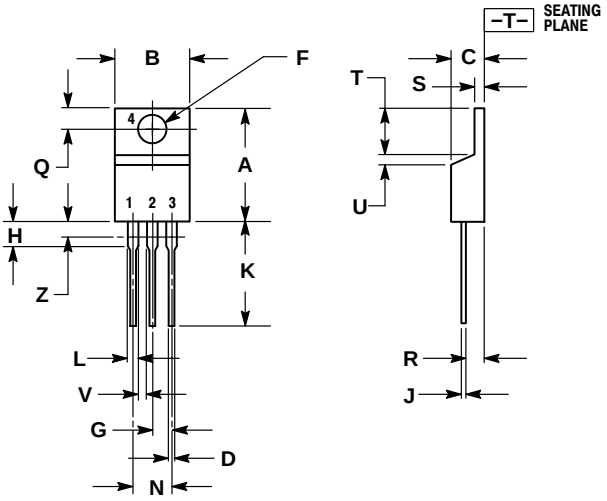


Figure 14. Thermal Response

PACKAGE DIMENSIONS

TO−220
CASE 221A−09
ISSUE AA



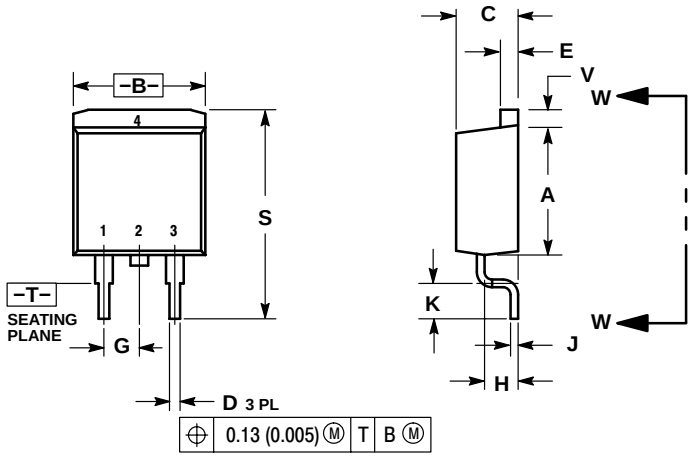
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

	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−04
ISSUE J

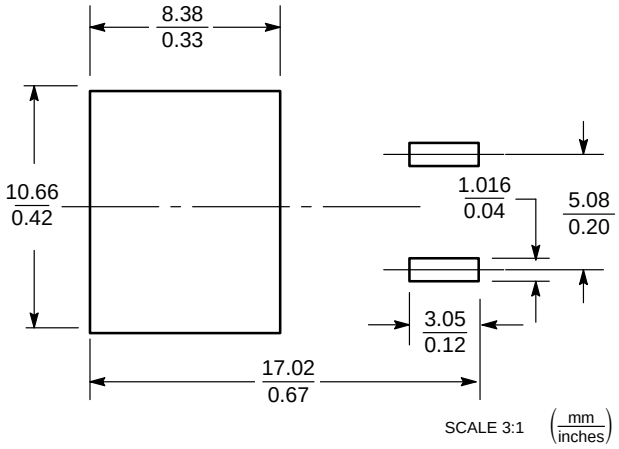


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 418B−01 THRU 418B−03 OBSOLETE, NEW STANDARD 418B−04.

	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
F	0.310	0.350	7.87	8.89
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
L	0.052	0.072	1.32	1.83
M	0.280	0.320	7.11	8.13
N	0.197 REF		5.00 REF	
P	0.079 REF		2.00 REF	
R	0.039 REF		0.99 REF	
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

SOLDERING FOOTPRINT*



*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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