

# NTP45N06, NTB45N06

## Power MOSFET 45 Amps, 60 Volts N-Channel TO-220 and D<sup>2</sup>PAK

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

### Features

- 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

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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	60	Vdc
Drain-to-Gate Voltage ( $R_{GS} = 10\text{ M}\Omega$ )	$V_{DGR}$	60	Vdc
Gate-to-Source Voltage	$V_{GS}$		Vdc
– Continuous	$V_{GS}$	$\pm 20$	
– Non-Repetitive ( $t_p \leq 10\text{ ms}$ )	$V_{GS}$	$\pm 30$	
Drain Current			
– Continuous @ $T_A = 25^\circ\text{C}$	$I_D$	45	Adc
– Continuous @ $T_A = 100^\circ\text{C}$	$I_D$	30	
– Single Pulse ( $t_p \leq 10\text{ }\mu\text{s}$ )	$I_{DM}$	150	Apk
Total Power Dissipation @ $T_A = 25^\circ\text{C}$	$P_D$	125	W
Derate above $25^\circ\text{C}$		0.83	W/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 1.)		3.2	W
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ (Note 2.)		2.4	W
Operating and Storage Temperature Range	$T_J, T_{stg}$	$-55$ to $+175$	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$ ( $V_{DD} = 50\text{ Vdc}$ , $V_{GS} = 10\text{ Vdc}$ , $R_G = 25\text{ }\Omega$ , $I_L(pk) = 40\text{ A}$ , $L = 0.3\text{ mH}$ , $V_{DS} = 60\text{ Vdc}$ )	$E_{AS}$	240	mJ

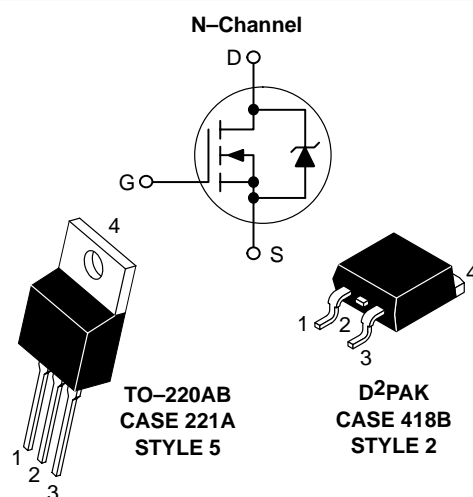
1. When surface mounted to an FR4 board using 1" pad size, (Cu Area 1.127 in<sup>2</sup>).
2. When surface mounted to an FR4 board using the minimum recommended pad size, (Cu Area 0.412 in<sup>2</sup>).



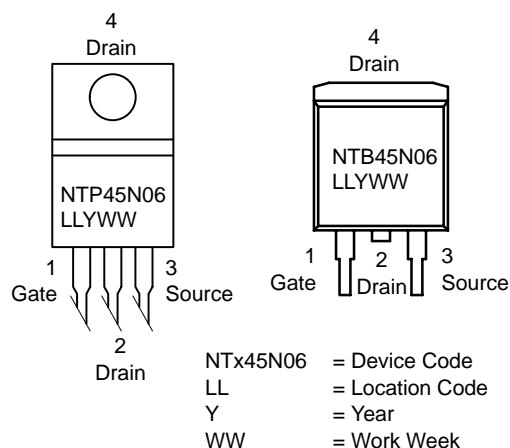
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**45 AMPERES**  
**60 VOLTS**  
 **$R_{DS(on)} = 26\text{ m}\Omega$**



### MARKING DIAGRAMS & PIN ASSIGNMENTS



### ORDERING INFORMATION

Device	Package	Shipping
NTP45N06	TO-220AB	50 Units/Rail
NTB45N06	D <sup>2</sup> PAK	50 Units/Rail
NTB45N06T4	D <sup>2</sup> PAK	800/Tape & Reel

# NTP45N06, NTB45N06

## MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Thermal Resistance – Junction-to-Case – Junction-to-Ambient (Note 3.) – Junction-to-Ambient (Note 4.)	R <sub>θJC</sub> R <sub>θJA</sub> R <sub>θJA</sub>	1.2 46.8 63.2	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	T <sub>L</sub>	260	°C

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (Note 5.) (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 μAdc) Temperature Coefficient (Positive)	V <sub>(BR)DSS</sub>	60 –	70 57	– –	Vdc mV/°C
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 60 Vdc, V <sub>GS</sub> = 0 Vdc) (V <sub>DS</sub> = 60 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 150°C)	I <sub>DSS</sub>	– –	– –	1.0 10	μAdc
Gate-Body Leakage Current (V <sub>GS</sub> = ±20 Vdc, V <sub>DS</sub> = 0 Vdc)	I <sub>GSS</sub>	–	–	±100	nAdc

### ON CHARACTERISTICS (Note 5.)

Gate Threshold Voltage (Note 5.) (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc) Threshold Temperature Coefficient (Negative)	V <sub>GS(th)</sub>	2.0 –	2.8 7.2	4.0 –	Vdc mV/°C
Static Drain-to-Source On-Resistance (Note 5.) (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 22.5 Adc)	R <sub>DS(on)</sub>	–	21	26	mOhm
Static Drain-to-Source On-Voltage (Note 5.) (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 45 Adc) (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 22.5 Adc, T <sub>J</sub> = 150°C)	V <sub>DS(on)</sub>	– –	0.93 0.93	1.4 –	Vdc
Forward Transconductance (Note 5.) (V <sub>DS</sub> = 8.0 Vdc, I <sub>D</sub> = 12 Adc)	g <sub>FS</sub>	–	16.6	–	mhos

### DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = 25 Vdc, V <sub>GS</sub> = 0 Vdc, f = 1.0 MHz)	C <sub>iss</sub>	–	1224	1725	pF
Output Capacitance		C <sub>oss</sub>	–	345	485	
Transfer Capacitance		C <sub>rss</sub>	–	76	160	

### SWITCHING CHARACTERISTICS (Note 6.)

Turn-On Delay Time	(V <sub>DD</sub> = 30 Vdc, I <sub>D</sub> = 45 Adc, V <sub>GS</sub> = 10 Vdc, R <sub>G</sub> = 9.1 Ω) (Note 5.)	t <sub>d(on)</sub>	–	10	25	ns
Rise Time		t <sub>r</sub>	–	101	200	
Turn-Off Delay Time		t <sub>d(off)</sub>	–	33	70	
Fall Time		t <sub>f</sub>	–	106	220	
Gate Charge	(V <sub>DS</sub> = 48 Vdc, I <sub>D</sub> = 45 Adc, V <sub>GS</sub> = 10 Vdc) (Note 5.)	Q <sub>T</sub>	–	33	46	nC
		Q <sub>1</sub>	–	6.4	–	
		Q <sub>2</sub>	–	15	–	

### SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage	(I <sub>S</sub> = 45 Adc, V <sub>GS</sub> = 0 Vdc) (Note 5.) (I <sub>S</sub> = 45 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 150°C)	V <sub>SD</sub>	– –	1.08 0.93	1.2 –	Vdc
Reverse Recovery Time	(I <sub>S</sub> = 45 Adc, V <sub>GS</sub> = 0 Vdc, diS/dt = 100 A/μs) (Note 5.)	t <sub>rr</sub>	–	53.1	–	ns
		t <sub>a</sub>	–	36	–	
		t <sub>b</sub>	–	16.9	–	
Reverse Recovery Stored Charge		Q <sub>R</sub>	–	0.087	–	μC

3. When surface mounted to an FR4 board using 1" pad size, (Cu Area 1.127 in<sup>2</sup>).

4. When surface mounted to an FR4 board using the minimum recommended pad size, (Cu Area 0.412 in<sup>2</sup>).

5. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.

6. Switching characteristics are independent of operating junction temperatures.

# NTP45N06, NTB45N06

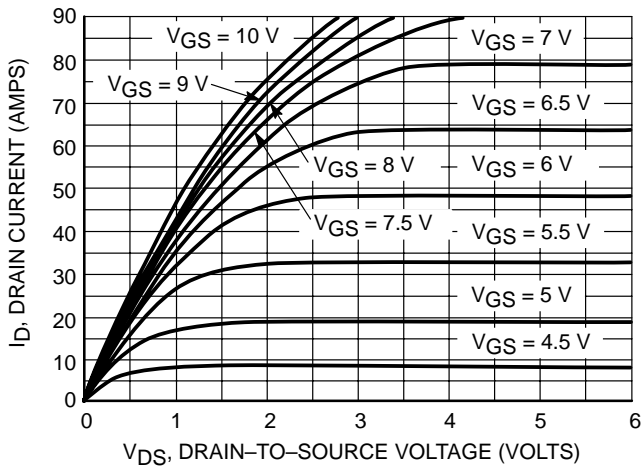


Figure 1. On-Region Characteristics

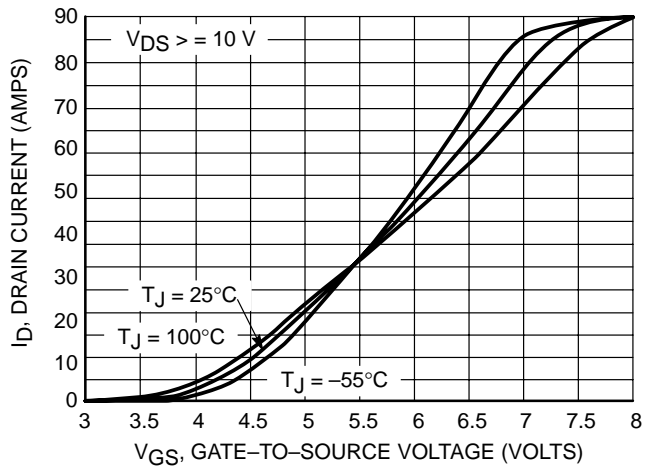


Figure 2. Transfer Characteristics

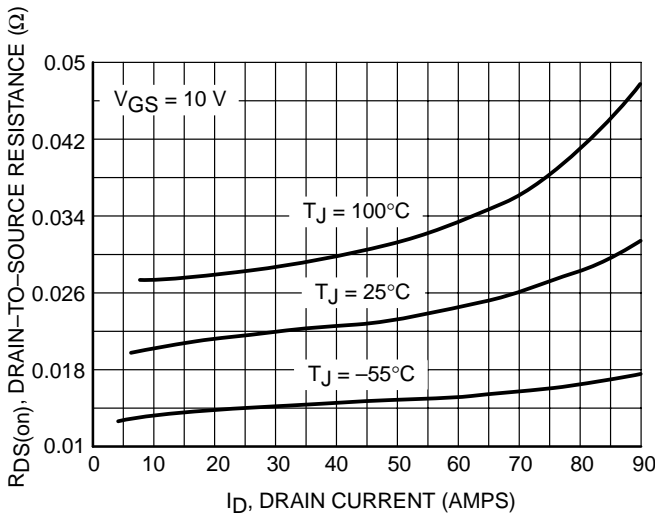


Figure 3. On-Resistance vs. Gate-to-Source Voltage

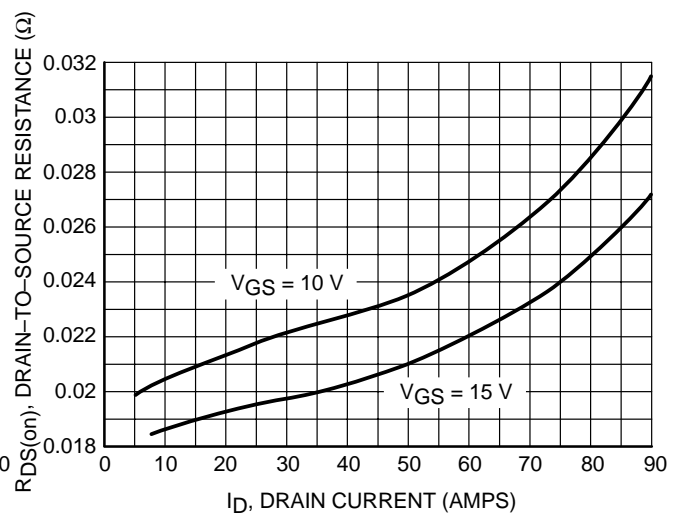


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

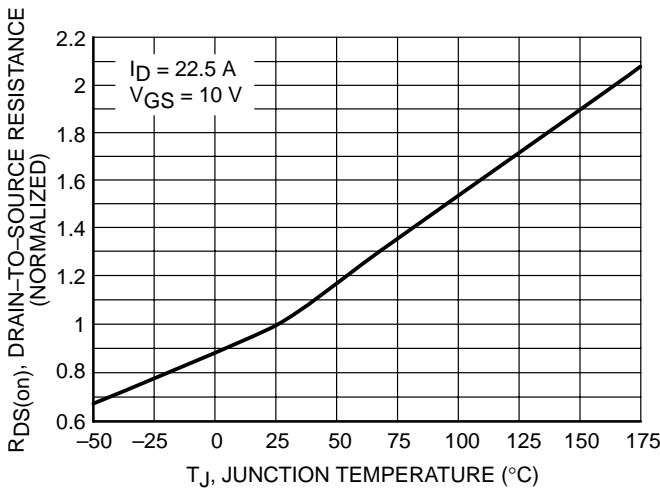


Figure 5. On-Resistance Variation with Temperature

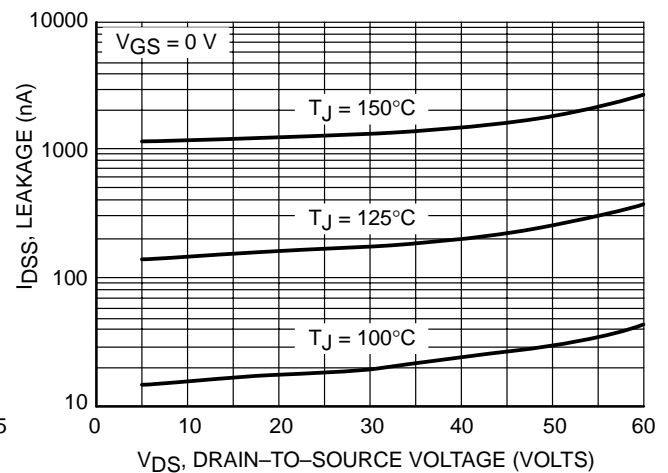


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTP45N06, NTB45N06

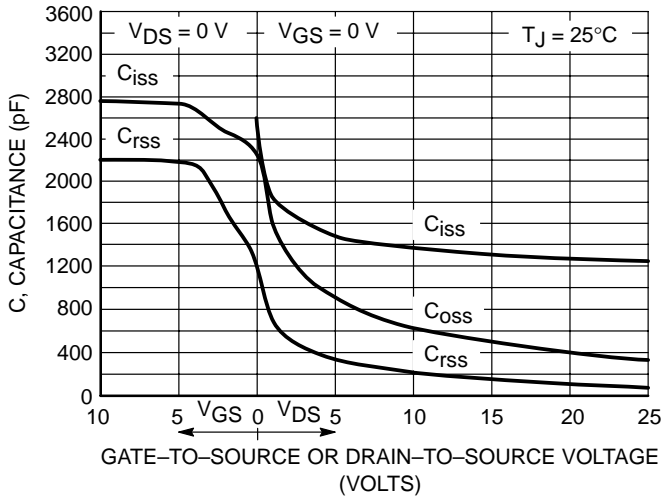


Figure 7. Capacitance Variation

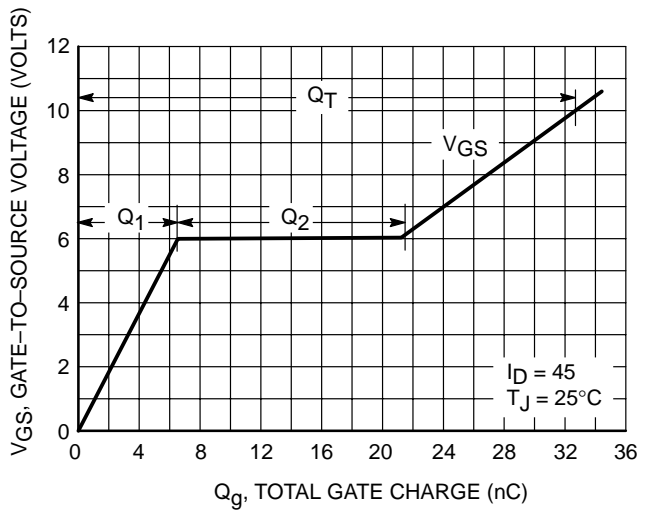


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

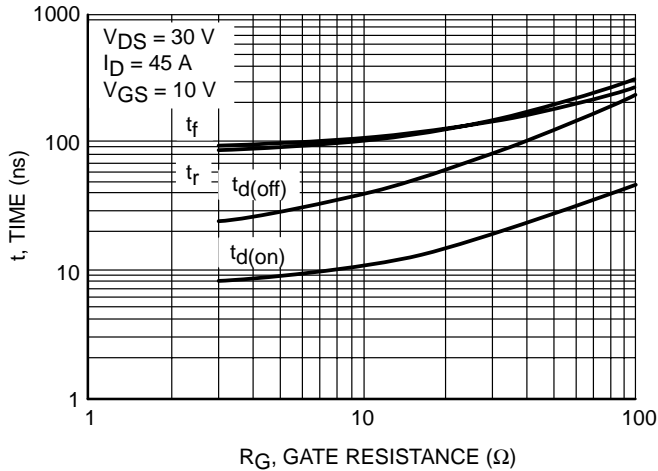


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

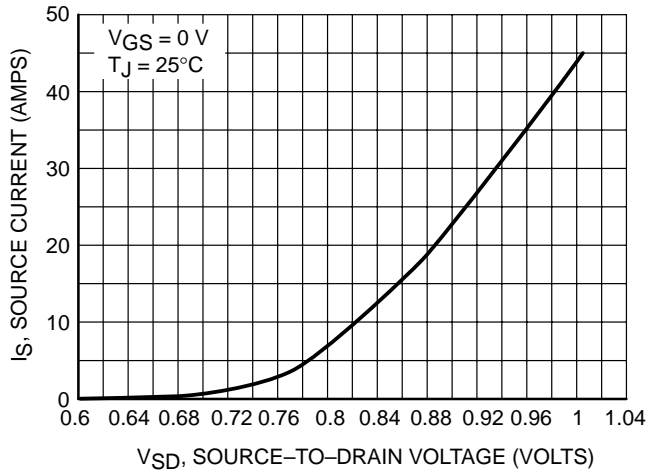


Figure 10. Diode Forward Voltage vs. Current

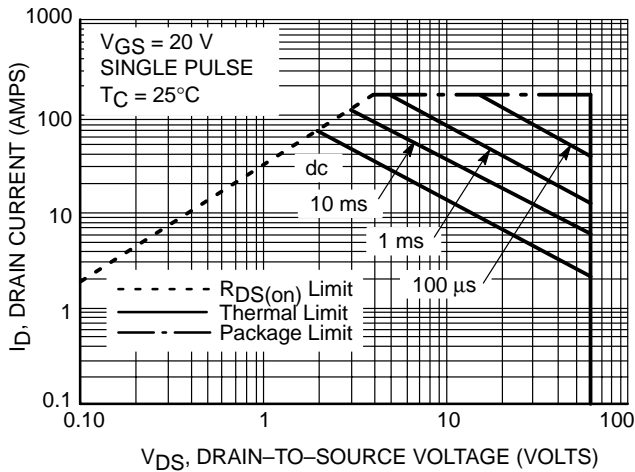


Figure 11. Maximum Rated Forward Biased Safe Operating Area

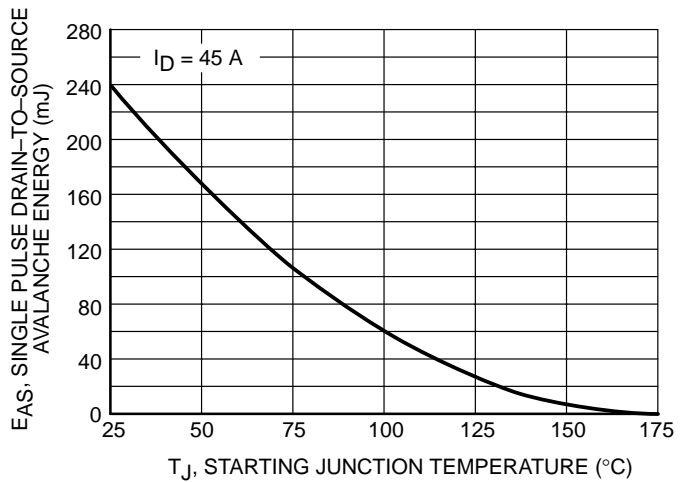


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

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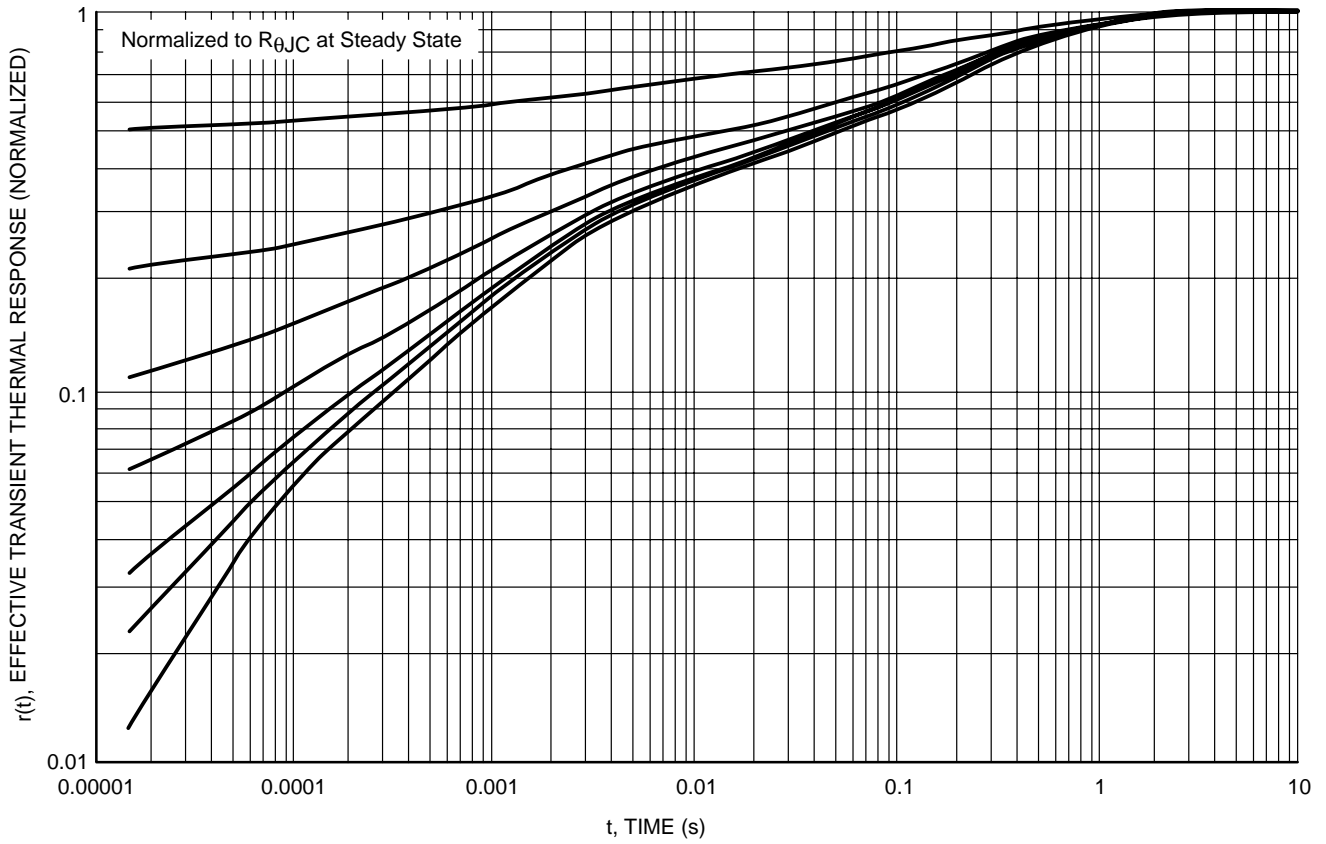


Figure 13. Thermal Response

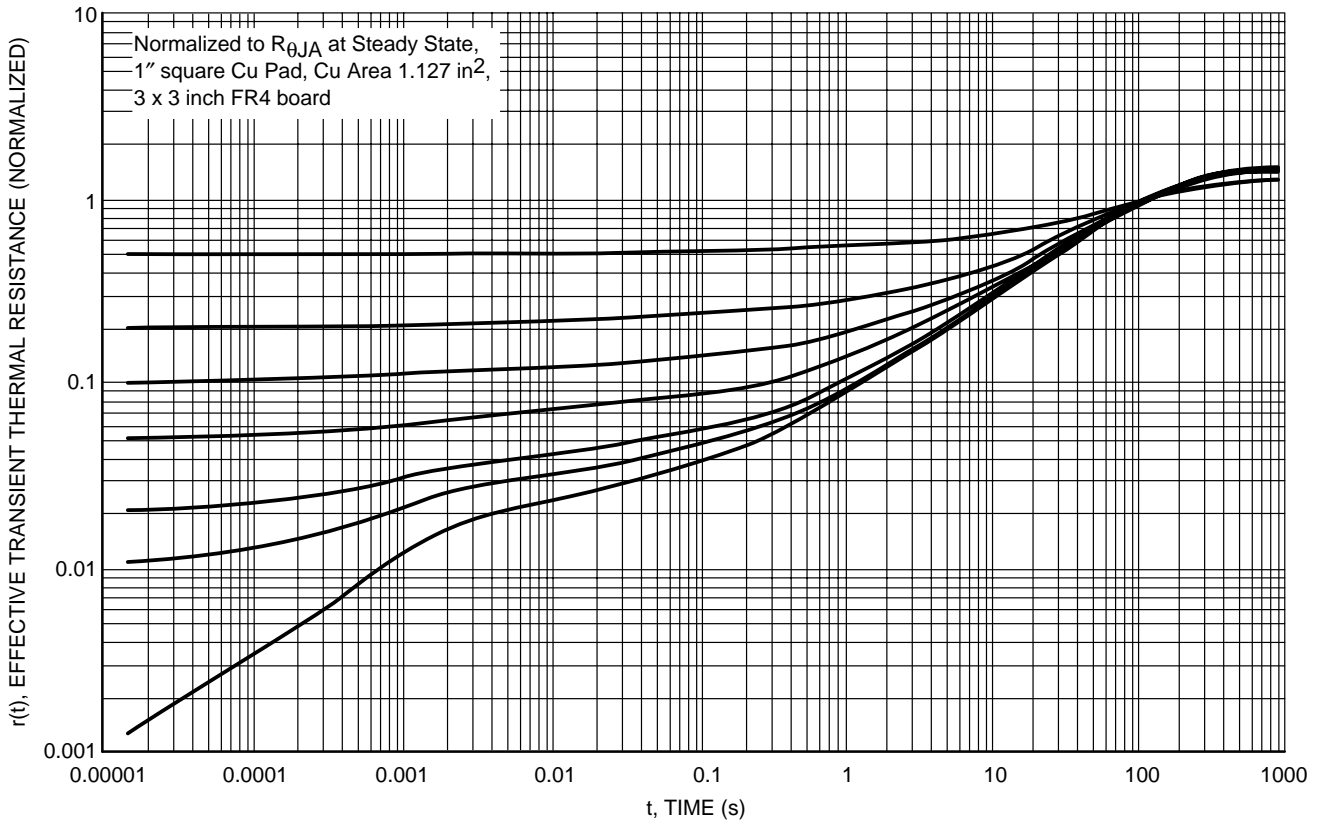


Figure 14. Thermal Response

# NTP45N06, NTB45N06

## 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.

DIM	INCHES		MILLIMETERS	
	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

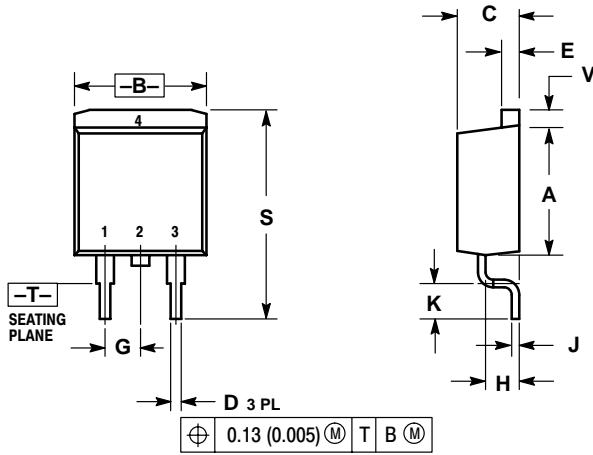
STYLE 5:

- PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

# NTP45N06, NTB45N06

## PACKAGE DIMENSIONS

**D2PAK**  
CASE 418B-03  
ISSUE D



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

DIM	INCHES		MILLIMETERS	
	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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