NTP6N50

Preferred Devices

Product Preview

Power MOSFET 6 Amps, 500 Volts

N−Channel TO−220

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}	500	Vdc
Drain−Gate Voltage (R_{GS} = 1.0 MΩ)	V_{DGR}	500	Vdc
Gate−Source Voltage − Continuous − Non−Repetitive ($t_p \leq 10$ ms)	 V_{GS} V_{GS}	 ±20 ±40	Vdc
Drain − Continuous @ T_A 25°C − Continuous @ T_A 100°C − Single Pulse ($t_p \leq 10$ µs)	I_D I_D I_{DM}	6.0 5.0 18	Adc Apk
Total Power Dissipation @ T_A 25°C Derate above 25°C Total Power Dissipation @ T_A 25°C (Note 1.)	P_D	104 0.83 1.75	Watts W/°C Watts
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(pk) = 6 A, L = 10 mH, V_{DS} = 500 Vdc, R_G = 25 Ω)	E_{AS}	180	mJ
Thermal Resistance − Junction−to−Case − Junction−to−Ambient	 $R_{\theta JC}$ $R_{\theta JA}$	 1.2 62.5	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 10 seconds	T_L	260	°C

1. Repetitive rating; pulse width limited by maximum junction temperature.

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

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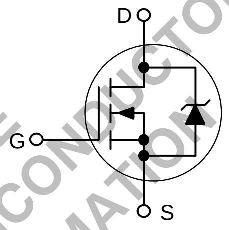
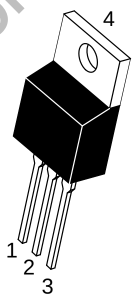
6 AMPERES
500 VOLTS
$R_{DS(on)}$ = 1700 mΩ

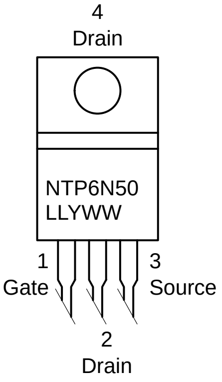
N−Channel



MARKING DIAGRAM & PIN ASSIGNMENT



TO−220AB
CASE 221A
STYLE 5



NTP6N50 = Device Code
LL = Location Code
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
NTP6N50	TO−220AB	50 Units/Rail

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

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

OFF CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Drain−to−Source Breakdown Voltage (Note 2.) (V_{GS} = 0 Vdc, I_D = 250 μAdc)	$V_{(BR)DSS}$	500	−	−	Vdc
Temperature Coefficient (Positive)		−	590	−	mV/°C
Zero Gate Voltage Drain Current (V_{DS} = 500 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	−	−	10	μAdc
(V_{DS} = 500 Vdc, V_{GS} = 0 Vdc, T_J =125°C)		−	−	100	
Gate−Body Leakage Current (V_{GS} = ±20 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	−	−	±100	nAdc

ON CHARACTERISTICS (Note 2.)

Characteristic	Symbol	Min	Typ	Max	Unit
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 250 μAdc)	$V_{GS(th)}$	2.0	3.1	4.0	Vdc
Temperature Coefficient (Negative)		−	6.4	−	mV/°C
Static Drain−to−Source On−Resistance (V_{GS} = 10 Vdc, I_D = 3 Adc)	$R_{DS(on)}$	−	1300	1700	mΩ
Static Drain−to−Source On−Resistance (V_{GS} = 10 Vdc, I_D = 6 Adc)	$V_{DS(on)}$	−	−	12.2	V
(V_{GS} = 10 Vdc, I_D = 3 Adc, T_J = 125°C)		−	−	11.0	
Forward Transconductance (V_{DS} = 15 Vdc, I_D = 3 Adc)	g_{FS}	−	6.7	−	mhos

DYNAMIC CHARACTERISTICS

Characteristic		Symbol	Min	Typ	Max	Unit
Input Capacitance	(V_{DS} = 25 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	−	520	730	pF
Output Capacitance		C_{oss}	−	170	240	
Transfer Capacitance		C_{rss}	−	5.0	20	

SWITCHING CHARACTERISTICS (Note 3.)

Characteristic		Symbol	Min	Typ	Max	Unit
Turn−On Delay Time	(V_{DD} = 250 Vdc, I_D = 6 Adc, V_{GS} = 10 Vdc, R_G = 9.1 Ω)	$t_{d(on)}$	−	9.0	20	ns
Rise Time		t_r	−	12	20	
Turn−Off Delay Time		$t_{d(off)}$	−	17	40	
Fall Time		t_f	−	12	30	
Gate Charge	(V_{DS} = 400 Vdc, I_D = 6 Adc, V_{GS} = 10 Vdc)	Q_T	−	10	20	nC
		Q_1	−	3.0	−	
		Q_2	−	6.0	−	

SOURCE−DRAIN DIODE CHARACTERISTICS

Characteristic		Symbol	Min	Typ	Max	Unit
Forward On−Voltage (Note 2.)	(I_S = 6 Adc, V_{GS} = 0 Vdc)	V_{SD}	−	0.9	1.0	Vdc
	(I_S = 6 Adc, V_{GS} = 0 Vdc, T_J = 125°C)		−	0.8	−	
Reverse Recovery Time	(I_S = 6 Adc, V_{GS} = 0 Vdc, dI_S/dt = 100 A/μs)	t_{rr}	−	251	−	ns
		t_a	−	168	−	
		t_b	−	83	−	
Reverse Recovery Stored Charge		Q_{RR}	−	2.3	−	μC

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

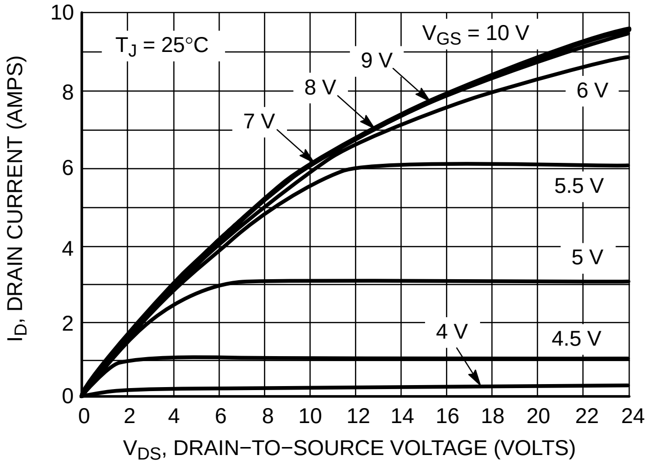


Figure 1. On−Region Characteristics

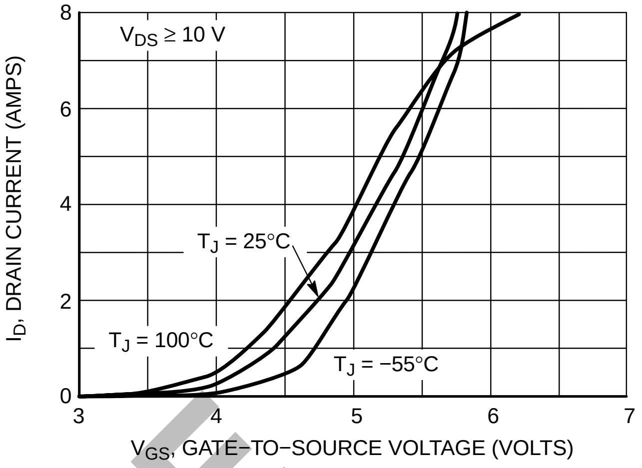


Figure 2. Transfer Characteristics

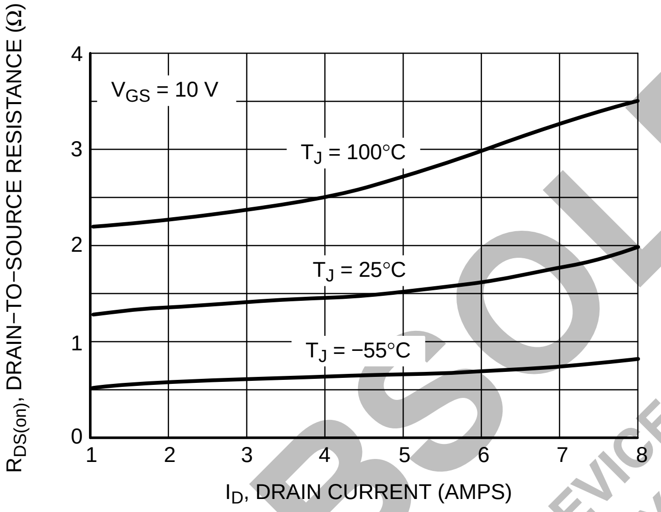


Figure 3. On−Resistance versus Drain Current and Temperature

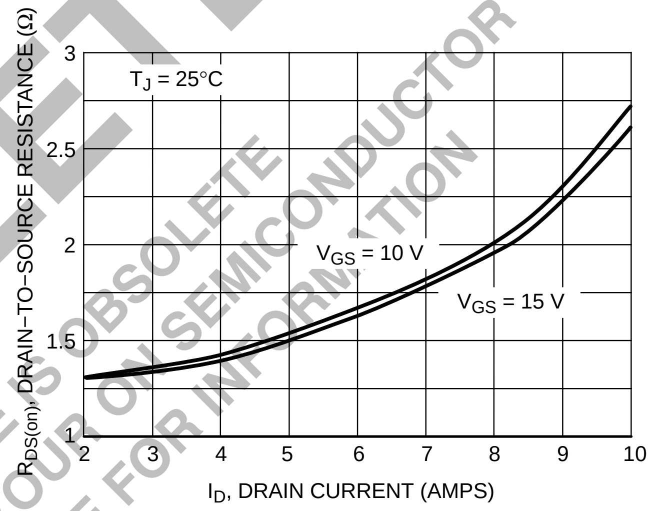


Figure 4. On−Resistance versus Drain Current and Gate Voltage

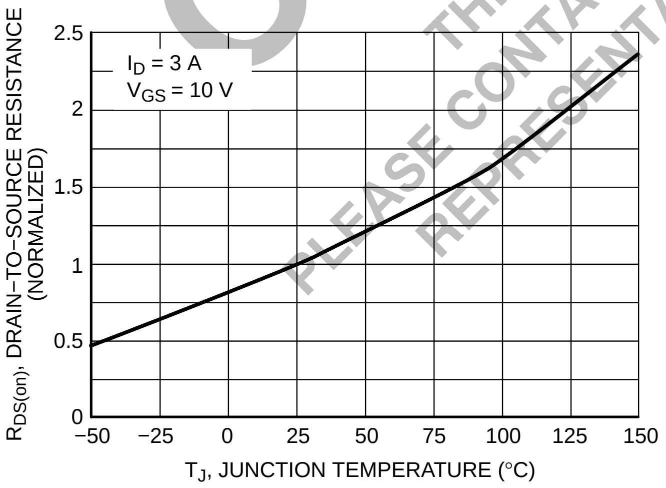


Figure 5. On−Resistance Variation with Temperature

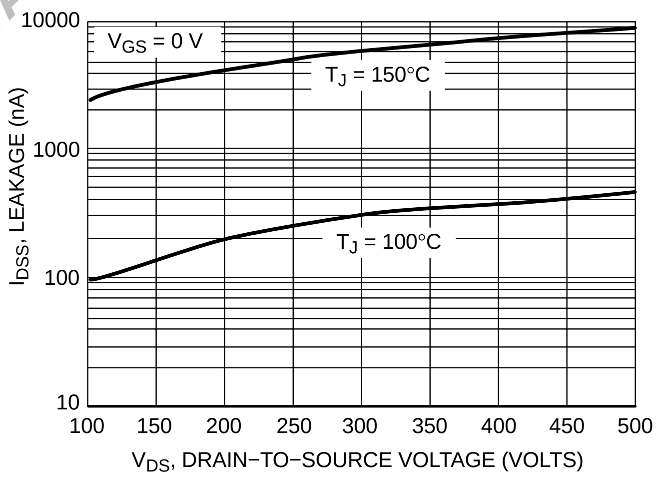


Figure 6. Drain−to−Source Leakage Current versus Voltage

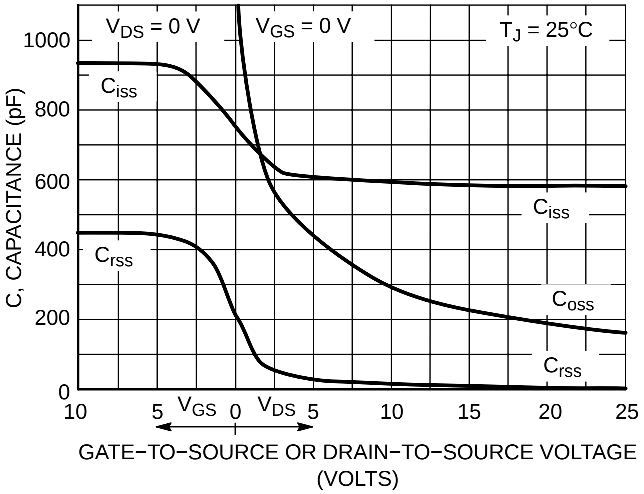


Figure 7. Capacitance Variation

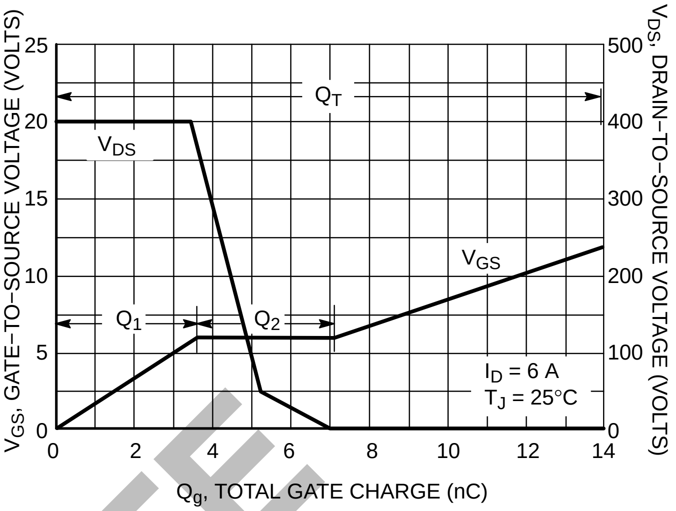


Figure 8. Gate−to−Source and Drain−to−Source Voltage versus Total Charge

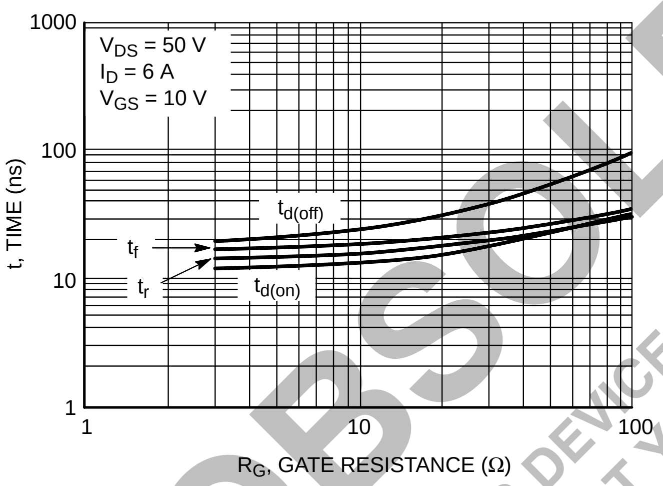


Figure 9. Resistive Switching Time Variation versus Gate Resistance

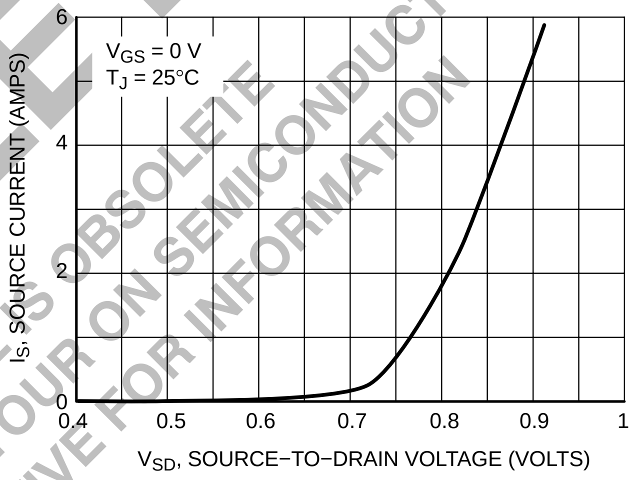


Figure 10. Diode Forward Voltage versus Current

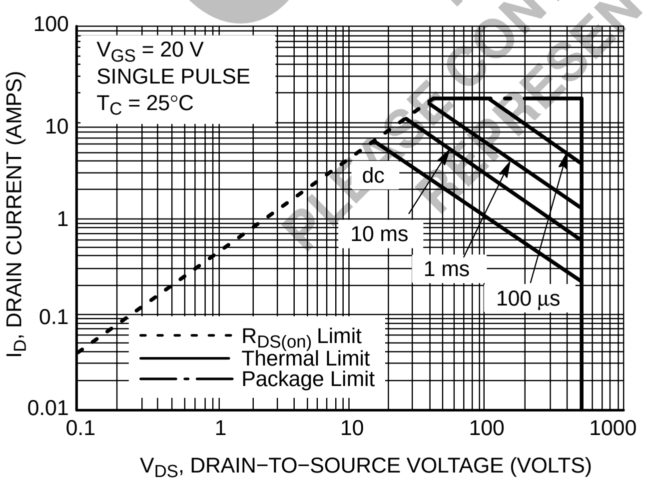


Figure 11. Maximum Rated Forward Biased Safe Operating Area

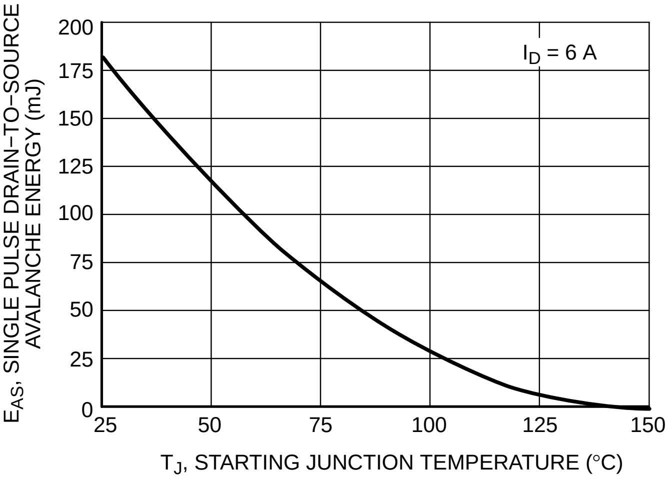


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

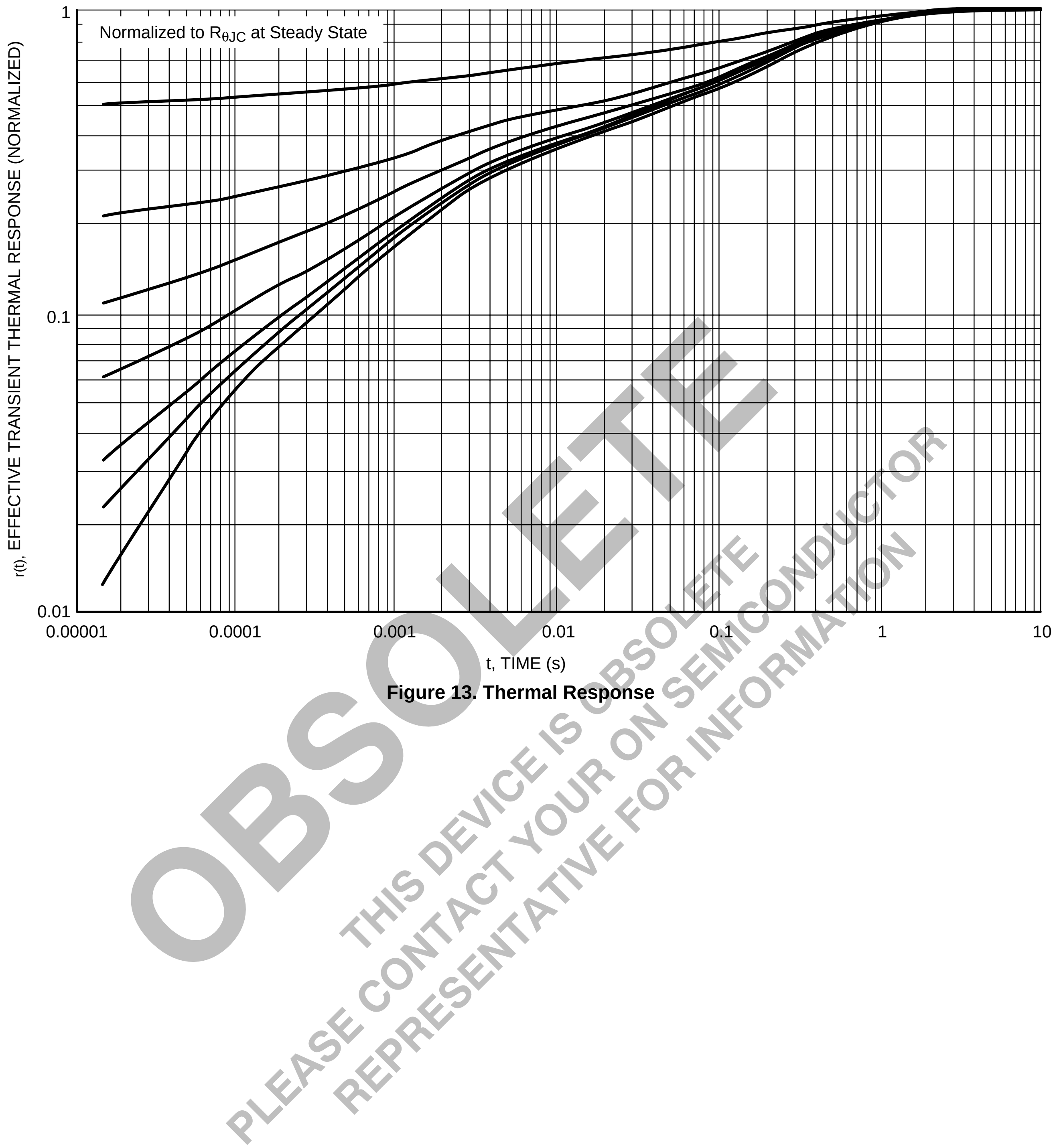
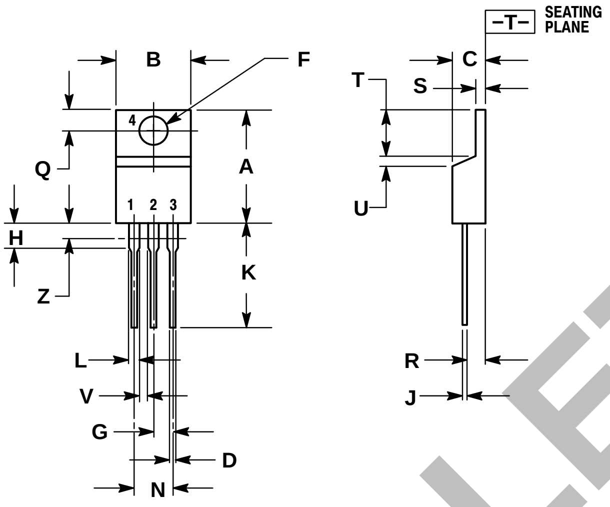


Figure 13. Thermal Response

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

Notes

OBSOLETE

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