

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 ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Rating | Symbol | Value | Unit |
|--|-----------------|-------------|---------------------|
| Drain-Source Voltage | V_{DSS} | 500 | Vdc |
| Drain-Gate Voltage ($R_{GS} = 1.0\text{ M}\Omega$) | V_{DGR} | 500 | Vdc |
| Gate-Source Voltage | V_{GS} | ± 20 | Vdc |
| - Continuous | V_{GS} | ± 40 | |
| - Non-Repetitive ($t_p \leq 10\text{ ms}$) | | | |
| Drain-Continuous @ $T_A 25^\circ\text{C}$ | I_D | 6.0 | Adc |
| - Continuous @ $T_A 100^\circ\text{C}$ | I_D | 5.0 | |
| - Single Pulse ($t_p \leq 10\ \mu\text{s}$) | I_{DM} | 18 | Apk |
| Total Power Dissipation @ $T_A 25^\circ\text{C}$ | P_D | 104 | Watts |
| Derate above 25°C | | 0.83 | W/ $^\circ\text{C}$ |
| Total Power Dissipation @ $T_A 25^\circ\text{C}$ (Note 1.) | | 1.75 | Watts |
| Operating and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |
| Single Drain-to-Source Avalanche Energy - Starting $T_J = 25^\circ\text{C}$ ($V_{DD} = 100\text{ V}$, $V_{GS} = 10\text{ Vdc}$, $I_L(pk) = 6\text{ A}$, $L = 10\text{ mH}$, $V_{DS} = 500\text{ Vdc}$, $R_G = 25\ \Omega$) | E_{AS} | 180 | mJ |
| Thermal Resistance | $R_{\theta JC}$ | 1.2 | $^\circ\text{C/W}$ |
| - Junction-to-Case | $R_{\theta JA}$ | 62.5 | |
| - Junction-to-Ambient | | | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | T_L | 260 | $^\circ\text{C}$ |

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

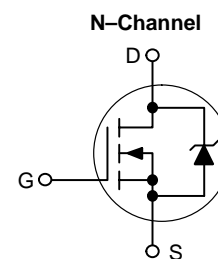
This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.



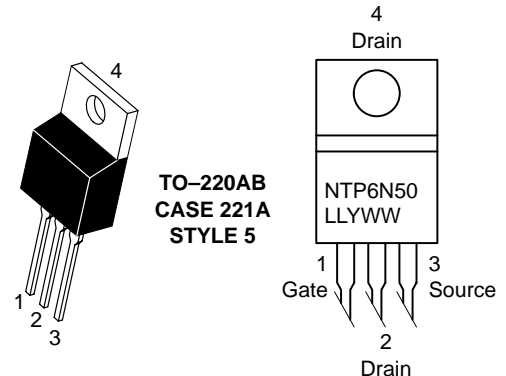
ON Semiconductor™

<http://onsemi.com>

6 AMPERES
500 VOLTS
 $R_{DS(on)} = 1700\text{ m}\Omega$



MARKING DIAGRAM & PIN ASSIGNMENT



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.

NTP6N50

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|---|----------------------|----------|----------|-----------|--------------|
| Drain-to-Source Breakdown Voltage (Note 2.) (V _{GS} = 0 Vdc, I _D = 250 μAdc) Temperature Coefficient (Positive) | V _{(BR)DSS} | 500 – | – 590 | – – | Vdc mV/°C |
| Zero Gate Voltage Drain Current (V _{DS} = 500 Vdc, V _{GS} = 0 Vdc) (V _{DS} = 500 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 Vdc) | I _{GSS} | – | – | ±100 | nAdc |

ON CHARACTERISTICS (Note 2.)

| | | | | | |
|--|---------------------|----------|------------|--------------|--------------|
| Gate Threshold Voltage (V _{DS} = V _{GS} , I _D = 250 μAdc) Temperature Coefficient (Negative) | V _{GS(th)} | 2.0 – | 3.1 6.4 | 4.0 – | Vdc 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 _{GS} = 10 Vdc, I _D = 3 Adc, T _J = 125°C) | V _{DS(on)} | – – | – – | 12.2 11.0 | V |
| Forward Transconductance (V _{DS} = 15 Vdc, I _D = 3 Adc) | g _{FS} | – | 6.7 | – | mhos |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|----------------------|---|------------------|---|-----|-----|----|
| 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.)

| | | | | | | |
|---------------------|---|---------------------|---|-----|----|----|
| 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

| | | | | | | |
|--------------------------------|--|-----------------|--------|------------|----------|-----|
| Forward On-Voltage (Note 2.) | (I _S = 6 Adc, V _{GS} = 0 Vdc) (I _S = 6 Adc, V _{GS} = 0 Vdc, T _J = 125°C) | V _{SD} | – – | 0.9 0.8 | 1.0 – | Vdc |
| 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.

NTP6N50

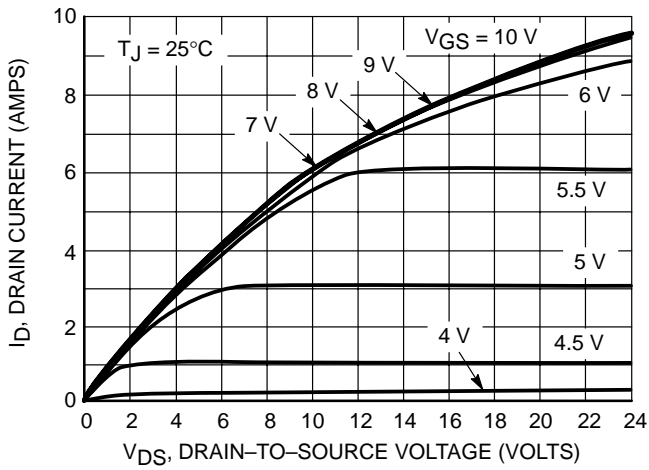


Figure 1. On-Region Characteristics

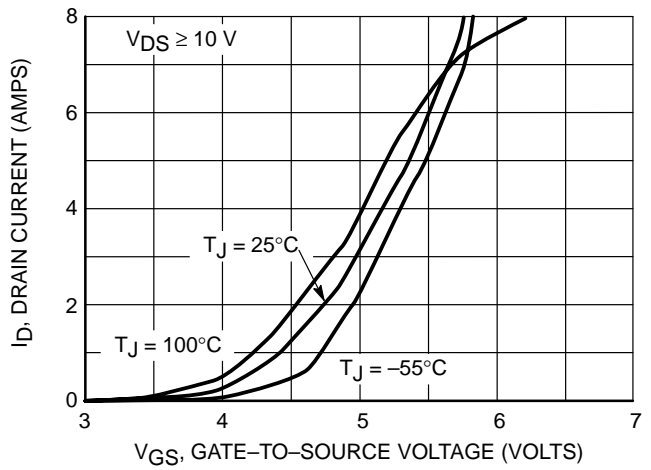


Figure 2. Transfer Characteristics

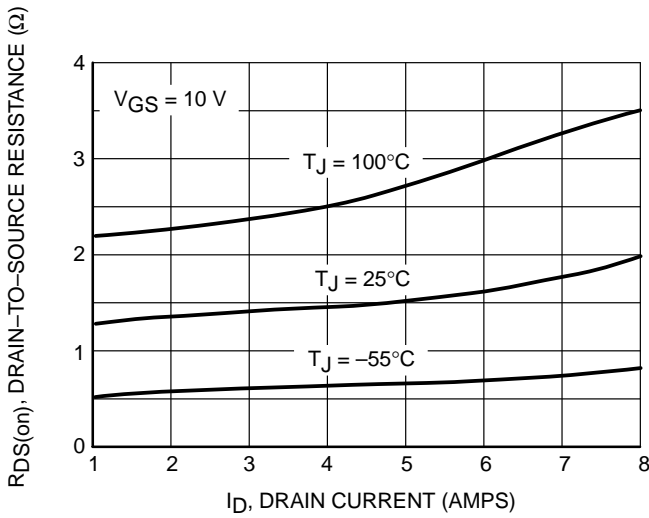


Figure 3. On-Resistance versus Drain Current and Temperature

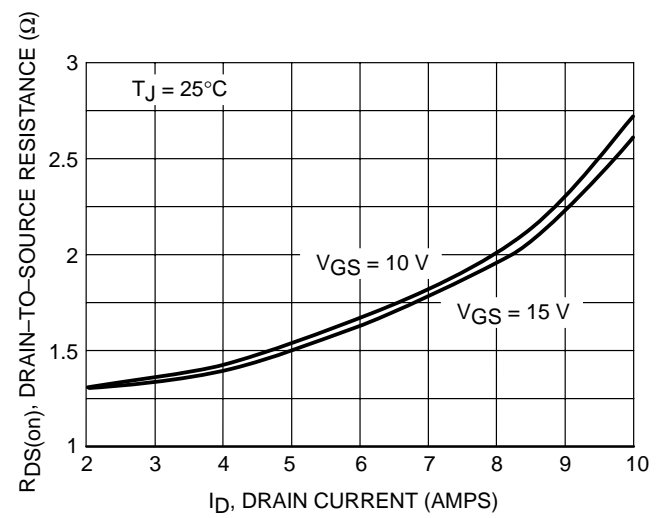


Figure 4. On-Resistance versus Drain Current and Gate Voltage

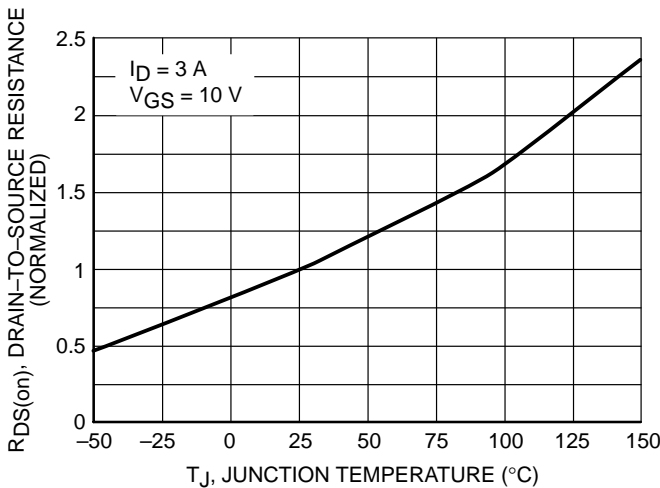


Figure 5. On-Resistance Variation with Temperature

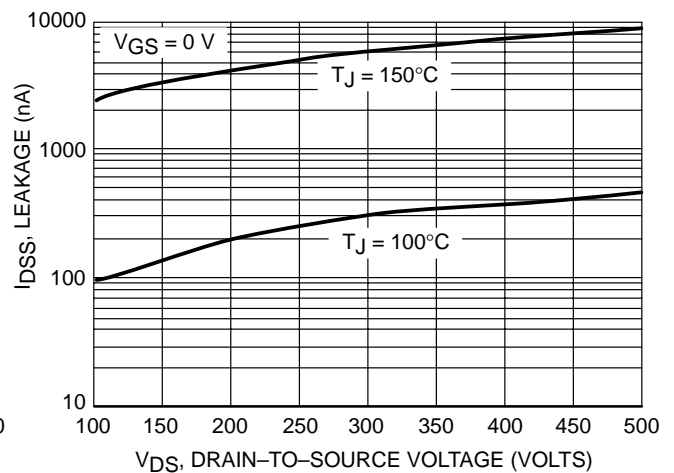


Figure 6. Drain-to-Source Leakage Current versus Voltage

NTP6N50

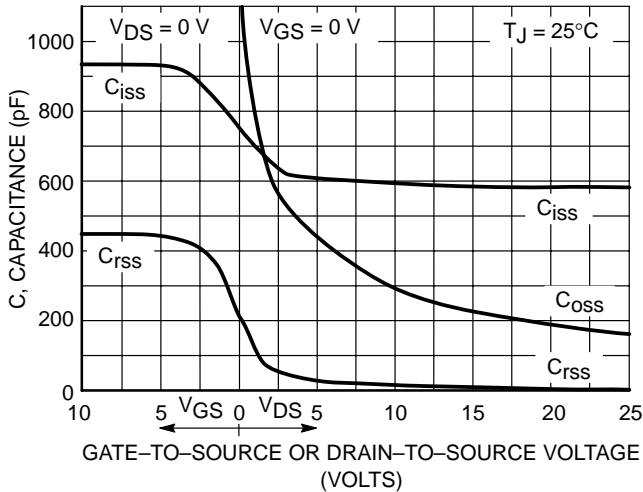


Figure 7. Capacitance Variation

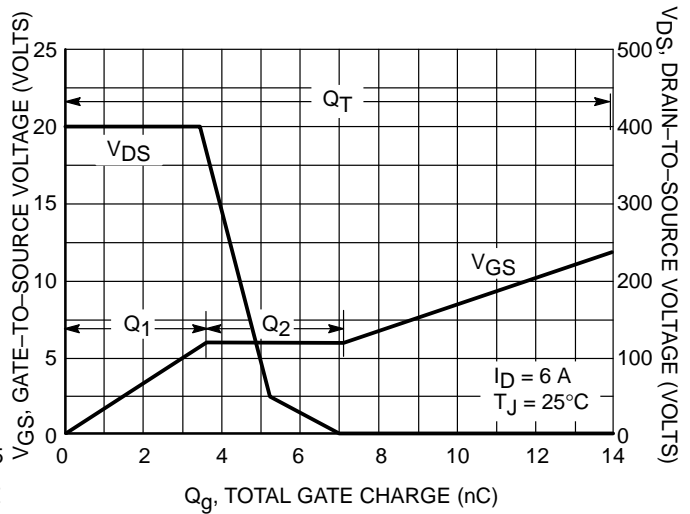


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

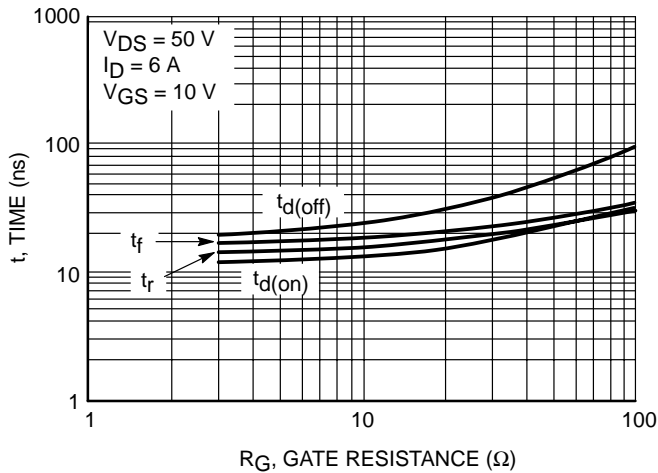


Figure 9. Resistive Switching Time Variation versus Gate Resistance

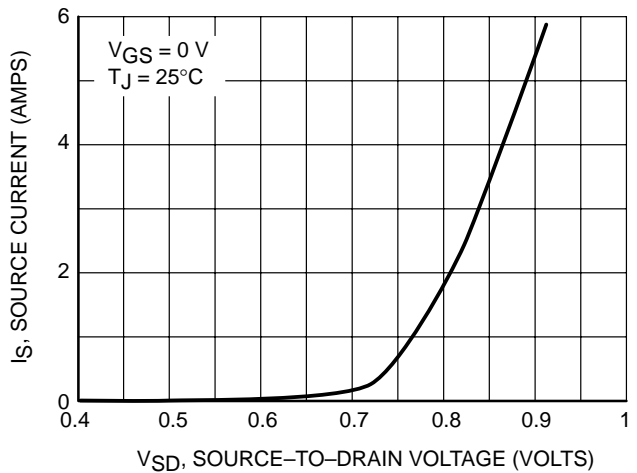


Figure 10. Diode Forward Voltage versus Current

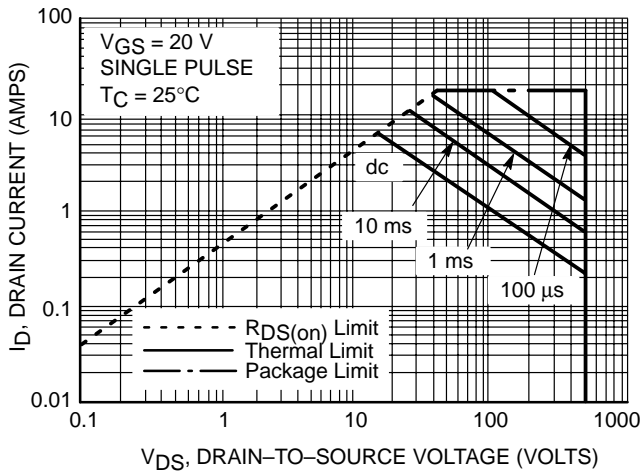


Figure 11. Maximum Rated Forward Biased Safe Operating Area

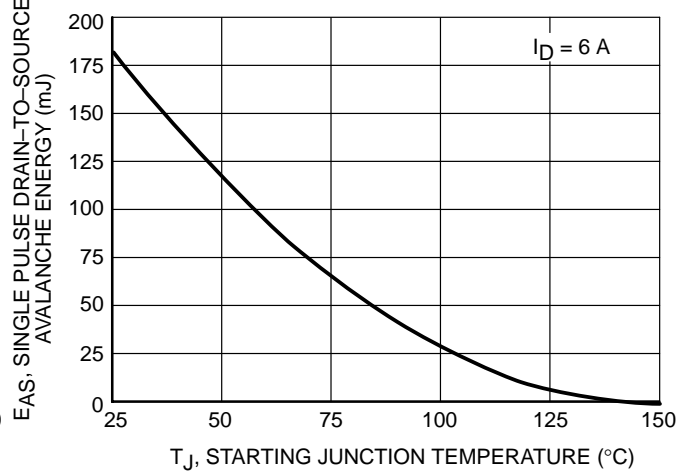


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

NTP6N50

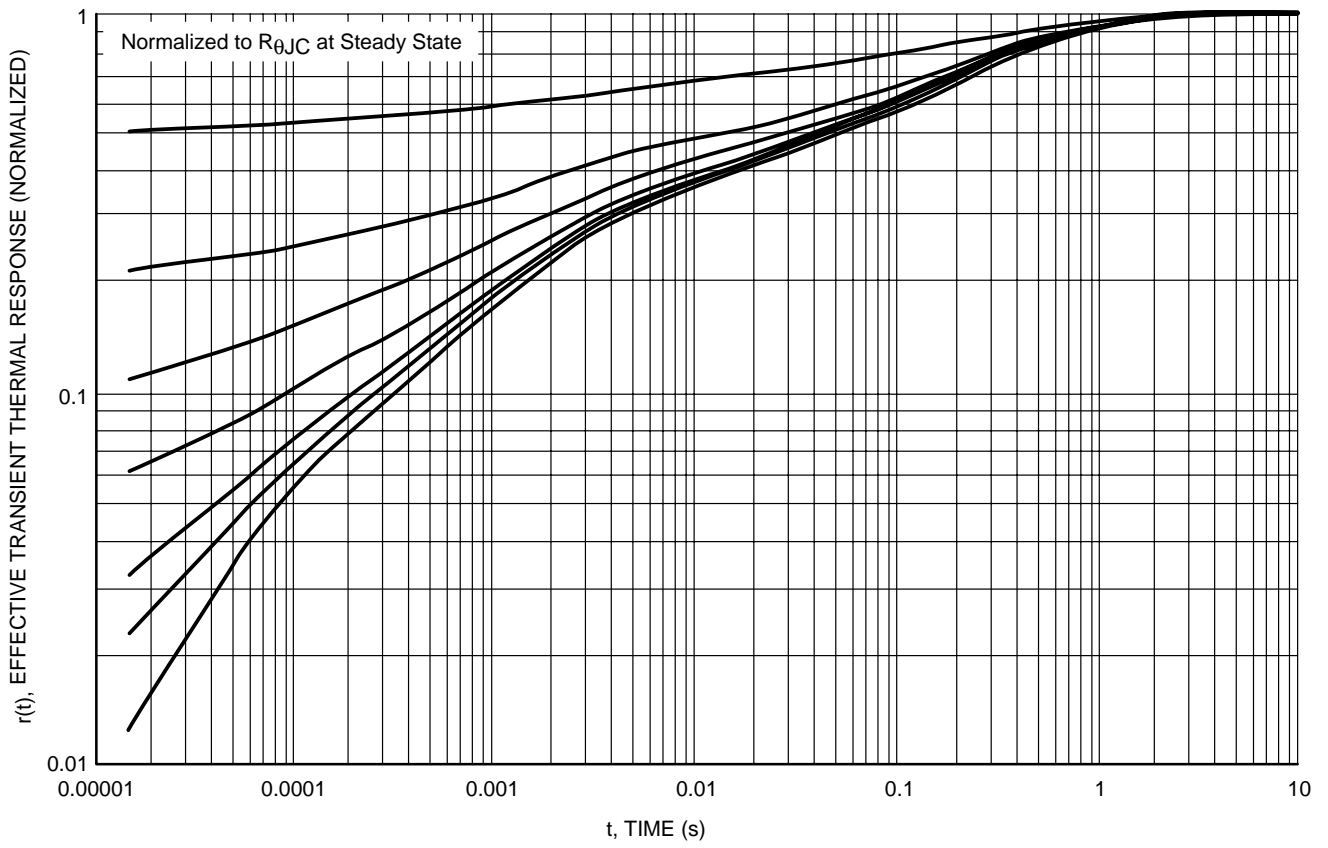
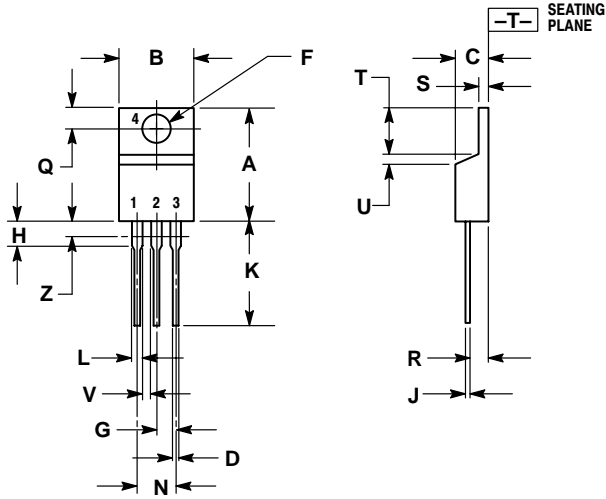


Figure 13. Thermal Response

NTP6N50

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
- DRAIN

Notes

NTP6N50

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

PUBLICATION ORDERING INFORMATION

Literature Fulfillment:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com

N. American Technical Support: 800-282-9855 Toll Free USA/Canada

JAPAN: ON Semiconductor, Japan Customer Focus Center
4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031
Phone: 81-3-5740-2700
Email: r14525@onsemi.com

ON Semiconductor Website: <http://onsemi.com>

For additional information, please contact your local Sales Representative.