

NTR4171P

MOSFET – Power, Single, P-Channel, SOT-23

-30 V, -3.5 A



ON Semiconductor®

www.onsemi.com

Features

- Low $R_{DS(on)}$ at Low Gate Voltage
- Low Threshold Voltage
- High Power and Current Handling Capability
- This is a Pb-Free Device

Applications

- Load Switch
- Optimized for Battery and Load Management Applications in Portable Equipment like Cell Phones, PDA's, Media Players, etc.

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

| Parameter | Symbol | Value | Unit |
|---|------------------------|---|------------------|
| Drain-to-Source Voltage | V_{DS} | -30 | V |
| Gate-to-Source Voltage | V_{GS} | ± 12 | V |
| Continuous Drain Current (Note 1) | Steady State | $T_A = 25^\circ\text{C}$ | -2.2 |
| | | $T_A = 85^\circ\text{C}$ | -1.5 |
| | | $t \leq 5 \text{ s}$, $T_A = 25^\circ\text{C}$ | -3.5 |
| Power Dissipation (Note 1) | Steady State | $T_A = 25^\circ\text{C}$ | 0.48 |
| | | $t \leq 5 \text{ s}$ | 1.25 |
| Pulsed Drain Current | $t_p = 10 \mu\text{s}$ | I_{DM} | -15.0 |
| Operating Junction and Storage Temperature | T_J , T_{stg} | -55 to 150 | $^\circ\text{C}$ |
| Source Current (Body Diode) | I_S | -1.0 | A |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | T_L | 260 | $^\circ\text{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

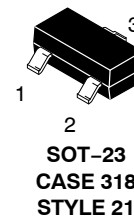
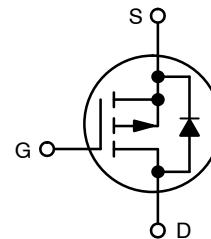
THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Unit |
|--|-----------------|-----|---------------------------|
| Junction-to-Ambient – Steady State (Note 1) | $R_{\theta JA}$ | 260 | $^\circ\text{C}/\text{W}$ |
| Junction-to-Ambient – $t \leq 10 \text{ s}$ (Note 1) | $R_{\theta JA}$ | 100 | |

1. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces)

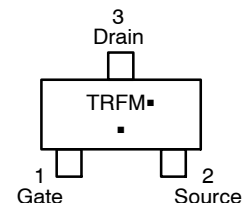
| $V_{(BR)DSS}$ | $R_{DS(on)}$ MAX | I_D MAX |
|---------------|-------------------------|-----------|
| -30 V | 75 m Ω @ -10 V | -2.2 A |
| | 110 m Ω @ -4.5 V | -1.8 A |
| | 150 m Ω @ -2.5 V | -1.0 A |

P-CHANNEL MOSFET



**SOT-23
CASE 318
STYLE 21**

MARKING DIAGRAM/ PIN ASSIGNMENT



TRF = Specific Device Code
M = Date Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

| Device | Package | Shipping† |
|-------------|------------------|-------------------|
| NTR4171PT1G | SOT-23 (Pb-Free) | 3000/Tape & Reel |
| NTR4171PT3G | SOT-23 (Pb-Free) | 10000/Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

NTR4171P

MOSFET ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Units |
|-----------|--------|----------------|-----|-----|-----|-------|
|-----------|--------|----------------|-----|-----|-----|-------|

OFF CHARACTERISTICS

| | | | | | | |
|---|-------------------|--|-----|----|--------------|----------------------------|
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$ | -30 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D = -250\ \mu\text{A}$, Reference to 25°C | | 24 | | $\text{mV}/^\circ\text{C}$ |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = -24\text{ V}, T_J = 25^\circ\text{C}$ $V_{GS} = 0\text{ V}, V_{DS} = -24\text{ V}, T_J = 85^\circ\text{C}$ | | | -1.0 -5.0 | μA |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$ | | | ± 0.1 | μA |

ON CHARACTERISTICS (Note 3)

| | | | | | | |
|--|------------------|---|------|-------|------|----------------------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$ | -0.7 | -1.15 | -1.4 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | 3.5 | | $\text{mV}/^\circ\text{C}$ |
| Drain-to-Source On-Resistance | $R_{DS(on)}$ | $V_{GS} = -10\text{ V}, I_D = -2.2\text{ A}$ | | 50 | 75 | $\text{m}\Omega$ |
| | | $V_{GS} = -4.5\text{ V}, I_D = -1.8\text{ A}$ | | 60 | 110 | |
| | | $V_{GS} = -2.5\text{ V}, I_D = -1.0\text{ A}$ | | 90 | 150 | |
| Forward Transconductance | g_{FS} | $V_{DS} = -5.0\text{ V}, I_D = -2.2\text{ A}$ | | 7.0 | | S |

CHARGES, CAPACITANCES AND GATE RESISTANCE

| | | | | | | |
|------------------------------|--------------|---|--|------|--|-------------|
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz},$ $V_{DS} = -15\text{ V}$ | | 720 | | pF |
| Output Capacitance | C_{oss} | | | 95 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 65 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = -10\text{ V}, V_{DS} = -15\text{ V},$ $I_D = -3.5\text{ A}$ | | 15.6 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 0.7 | | |
| Gate-to-Source Charge | Q_{GS} | | | 1.6 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 2.6 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = -4.5\text{ V}, V_{DS} = -15\text{ V},$ $I_D = -3.5\text{ A}$ | | 7.4 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | 0.7 | | |
| Gate-to-Source Charge | Q_{GS} | | | 1.6 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 2.6 | | |
| Gate Resistance | R_G | | | 6.1 | | Ω |

SWITCHING CHARACTERISTICS, $V_{GS} = 4.5\text{ V}$ (Note 4)

| | | | | | | |
|---------------------|--------------|--|--|-----|--|----|
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS} = -10\text{ V}, V_{DS} = -15\text{ V},$ $I_D = -3.5\text{ A}, R_G = 6\ \Omega$ | | 8.0 | | ns |
| Rise Time | t_r | | | 11 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 32 | | |
| Fall Time | t_f | | | 14 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS} = -4.5\text{ V}, V_{DS} = -15\text{ V},$ $I_D = -3.5\text{ A}, R_G = 6\ \Omega$ | | 9.0 | | ns |
| Rise Time | t_r | | | 16 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 25 | | |
| Fall Time | t_f | | | 22 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | |
|-------------------------|----------|--|--|------|------|-------------|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V}, I_S = -1.0\text{ A}, T_J = 25^\circ\text{C}$ | | -0.8 | -1.2 | V |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, I_S = -1.0\text{ A},$ $dI_{SD}/dt = 100\text{ A}/\mu\text{s}$ | | 14 | | ns |
| Charge Time | t_a | | | 10 | | |
| Discharge Time | t_b | | | 4.0 | | |
| Reverse Recovery Charge | Q_{RR} | | | 8.0 | | nC |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [2 oz] including traces)

3. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$

4. Switching characteristics are independent of operating junction temperatures

TYPICAL CHARACTERISTICS

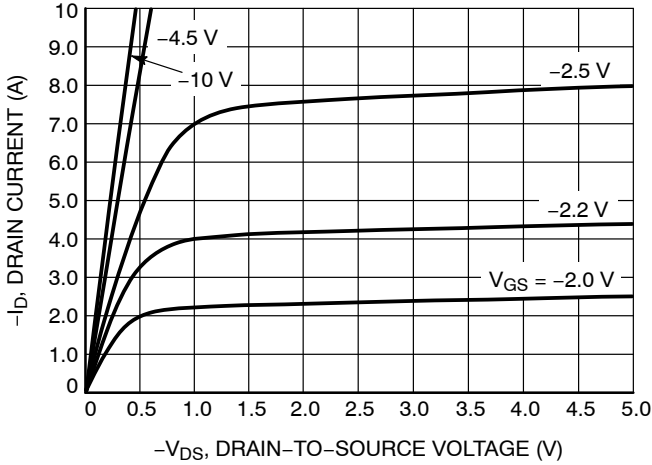


Figure 1. On-Region Characteristics

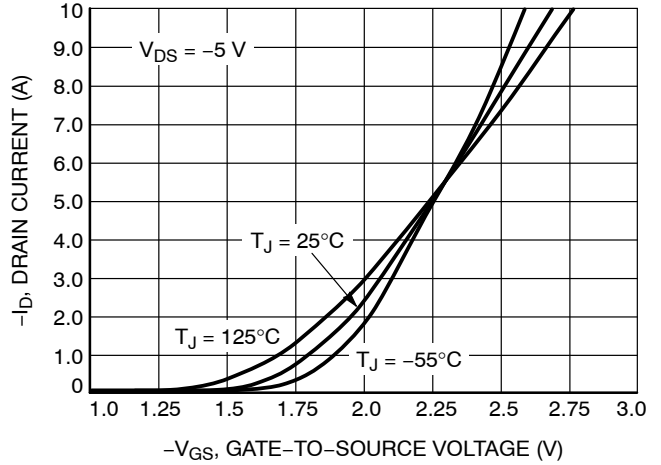


Figure 2. Transfer Characteristics

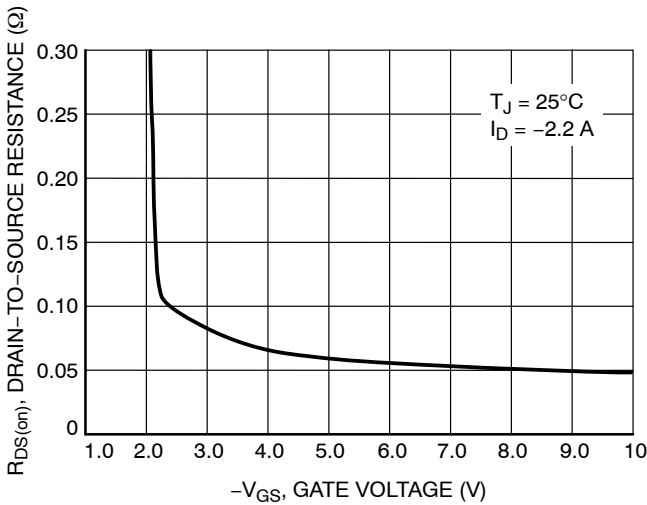


Figure 3. On-Resistance vs. Gate-to-Source Voltage

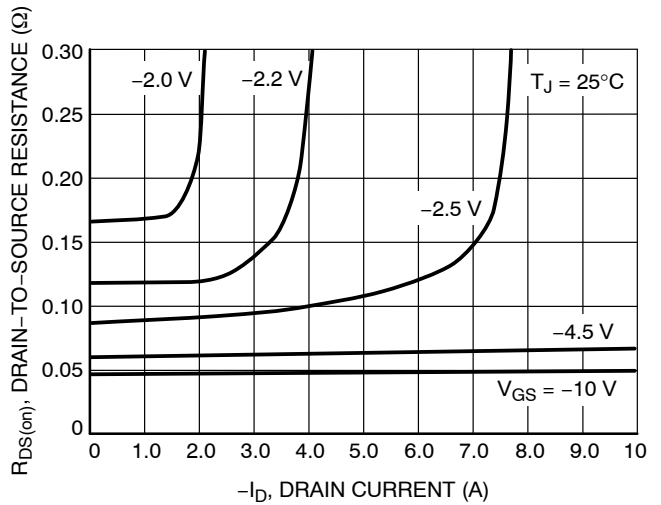


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

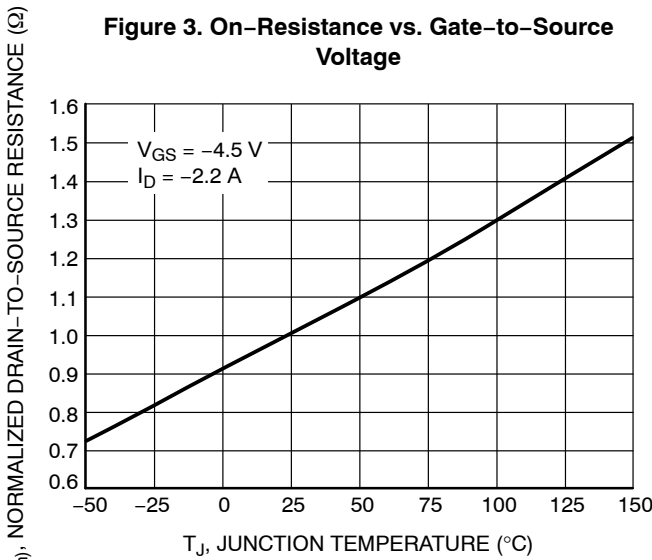


Figure 5. On-Resistance Variation with Temperature

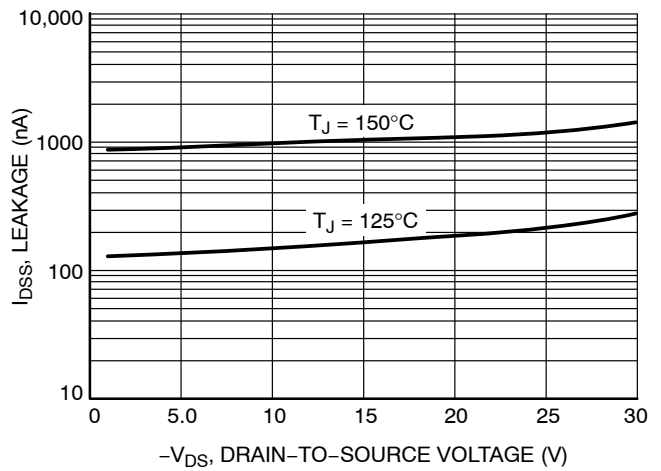


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

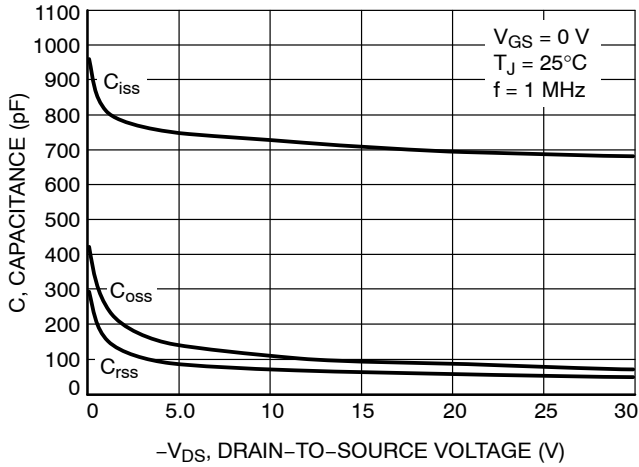


Figure 7. Capacitance Variation

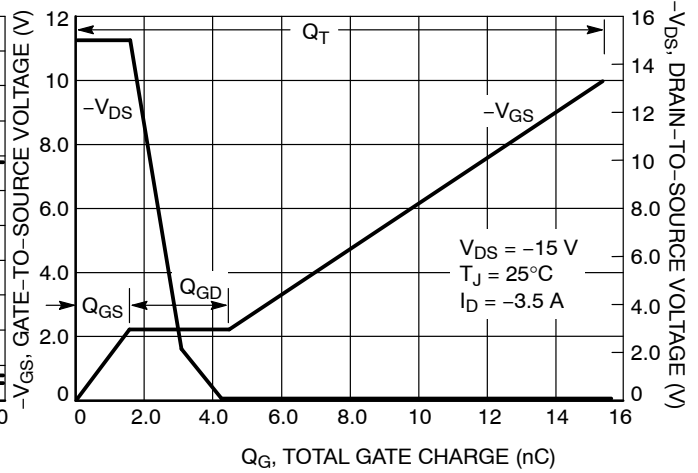


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

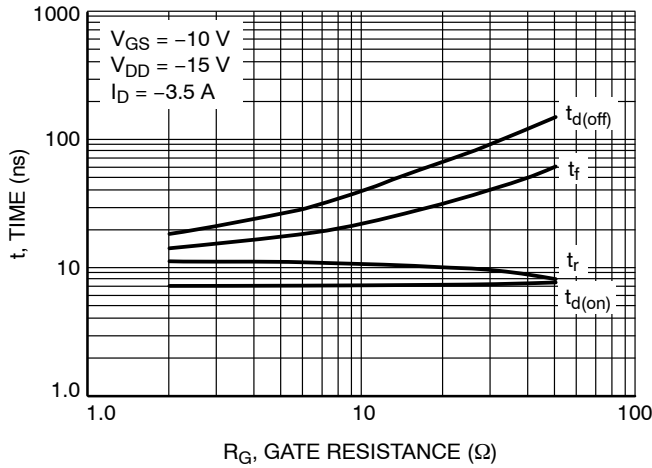


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

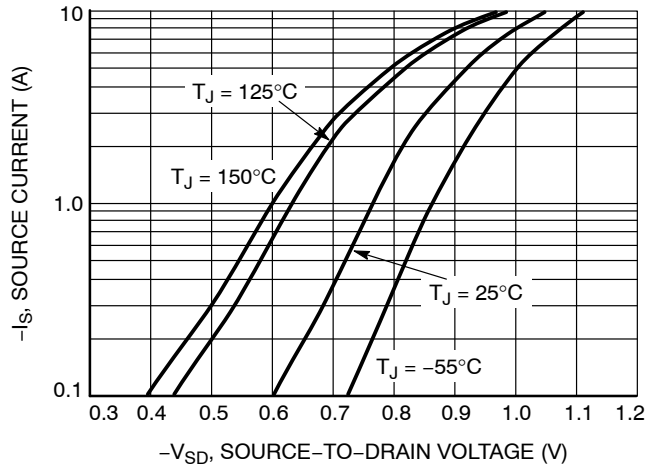


Figure 10. Diode Forward Voltage vs. Current

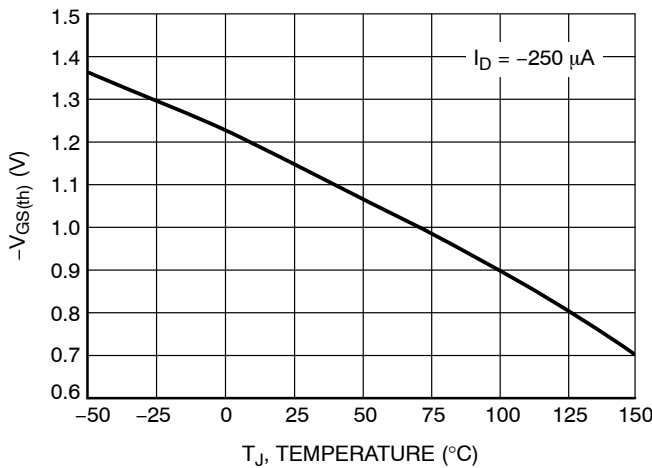


Figure 11. Threshold Voltage

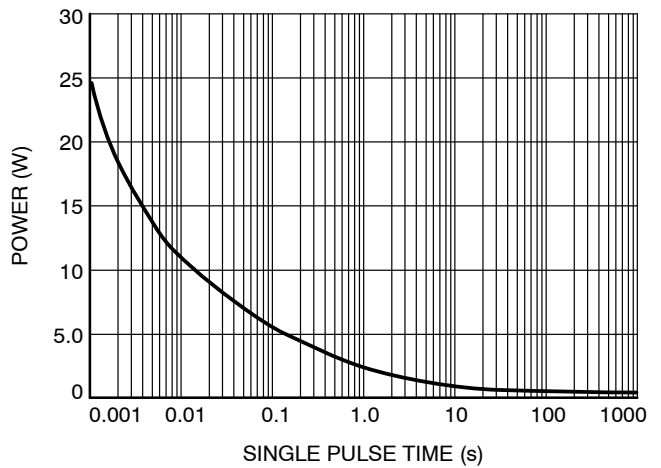


Figure 12. Single Pulse Maximum Power Dissipation

NTR4171P

TYPICAL CHARACTERISTICS

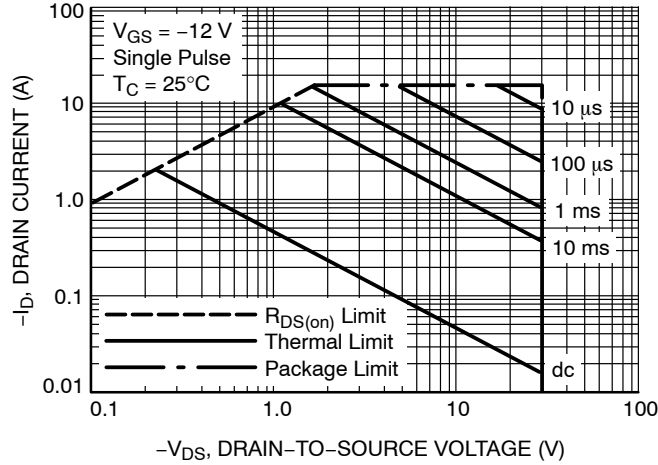


Figure 13. Maximum Rated Forward Biased Safe Operating Area

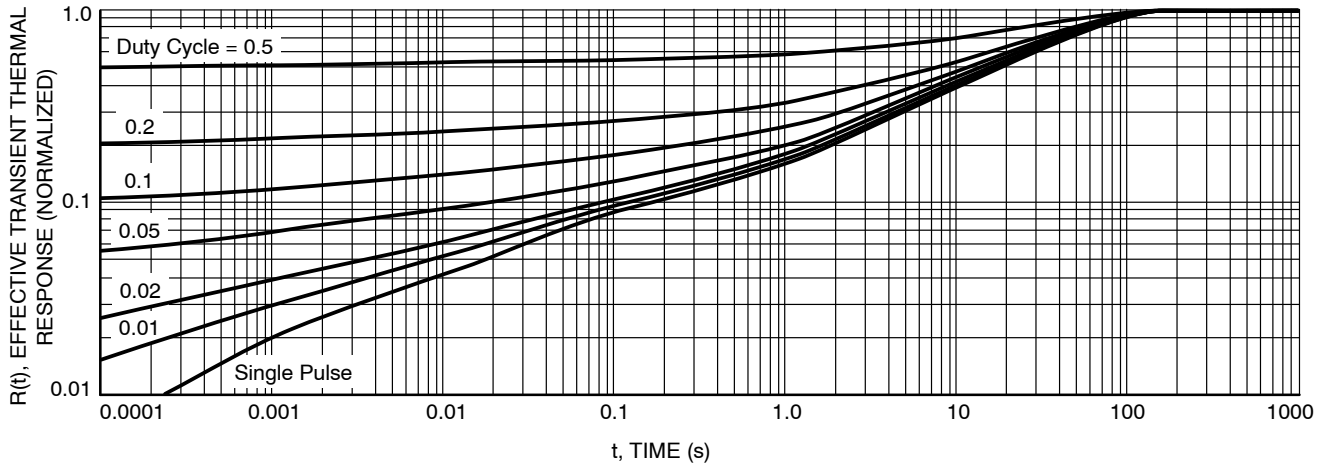


Figure 14. FET Thermal Response



SCALE 4:1

SOT-23 (TO-236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

DATE 14 AUG 2024



| MILLIMETERS | | | |
|-------------|------|------|------|
| DIM | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 |
| A1 | 0.01 | 0.06 | 0.10 |
| b | 0.37 | 0.44 | 0.50 |
| c | 0.08 | 0.14 | 0.20 |
| D | 2.80 | 2.90 | 3.04 |
| E | 1.20 | 1.30 | 1.40 |
| e | 1.78 | 1.90 | 2.04 |
| L | 0.30 | 0.43 | 0.55 |
| L1 | 0.35 | 0.54 | 0.69 |
| HE | 2.10 | 2.40 | 2.64 |
| T | 0° | --- | 10° |

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

GENERIC MARKING DIAGRAM*



XXX = Specific Device Code
M = Date Code
▪ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



* For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

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CASE 318
ISSUE AU

DATE 14 AUG 2024

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE-ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE-ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

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