# NTGD4167CT1G-VB Datasheet

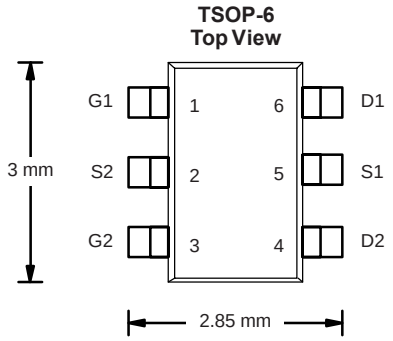
# N- and P-Channel 20V (D-S) MOSFET

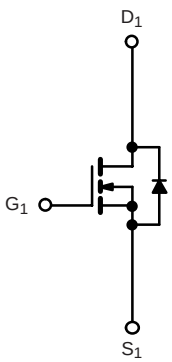
| PRODUCT SUMMARY | | | |
|---|---|---|---|
| | $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (A) |
| N-Channel | 20 | 0.022 at $V_{GS}$ = 10 V | 5.5 |
| | | 0.030at $V_{GS}$ = 4.5 V | 4.2 |
| P-Channel | - 20 | 0.055 at $V_{GS}$ = - 10 V | - 3.4 |
| | | 0.079 at $V_{GS}$ = - 4.5 V | - 2.5 |

## FEATURES

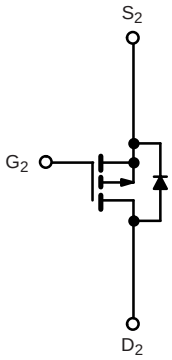
- **Halogen-free According to IEC 61249-2-21 Definition**
- Trench Power MOSFET
- 100 % $R_g$ Tested
- Compliant to RoHS Directive 2002/95/EC

Pb-free
RoHS COMPLIANT
HALOGEN FREE Available




N-Channel MOSFET




P-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS $T_A$ = 25 °C, unless otherwise noted | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **N-Channel** | **P-Channel** | **Unit** |
| Drain-Source Voltage | | $V_{DS}$ | 20 | - 20 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | ± 20 | |
| Continuous Drain Current ($T_J$ = 150 °C)[a, b] | $T_A$ = 25 °C | $I_D$ | 5.5 | - 3.4 | A |
| | $T_A$ = 70 °C | | 4.0 | - 2.3 | |
| Pulsed Drain Current | | $I_{DM}$ | 15 | 10 | |
| Continuous Source Current (Diode Conduction)[a, b] | | $I_S$ | 1.05 | - 1.05 | |
| Maximum Power Dissipation[a, b] | $T_A$ = 25 °C | $P_D$ | 1.15 | | W |
| | $T_A$ = 70 °C | | 0.73 | | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 150 | | °C |

| THERMAL RESISTANCE RATINGS | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Typical** | **Maximum** | **Unit** |
| Maximum Junction-to-Ambient[a] | t ≤ 5 s | $R_{thJA}$ | 93 | 110 | °C/W |
| | Steady State | | 130 | 150 | |
| Maximum Junction-to-Lead | Steady State | $R_{thJL}$ | 75 | 90 | |

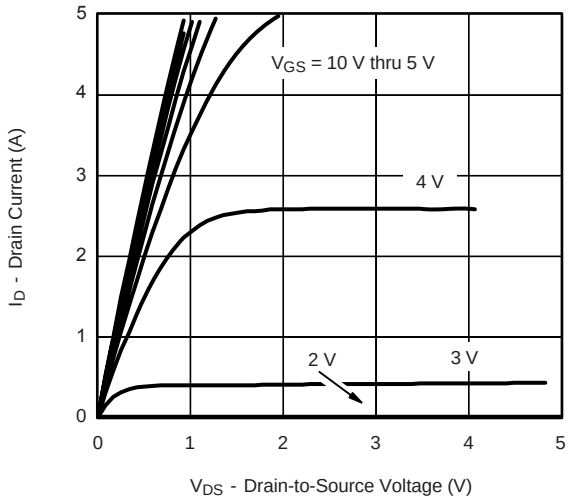
Notes:
a. Surface Mounted on FR4 board.
b. t ≤ 5 s.

| **SPECIFICATIONS** $T_J$ = 25 °C, unless otherwise noted | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | | **Min.** | **Typ.** | **Max.** | **Unit** |
| **Static** | | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D$ = 250 µA | N-Ch | 0.5 | 0.8 | 1.5 | V |
| | | $V_{DS} = V_{GS}$, $I_D$ = - 250 µA | P-Ch | - 0.5 | -0.8 | -1.5 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 8 V | N-Ch | | | ± 100 | nA |
| | | | P-Ch | | | ± 100 | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 16 V, $V_{GS}$ = 0 V | N-Ch | | | 1 | µA |
| | | $V_{DS}$ = - 16 V, $V_{GS}$ = 0 V | P-Ch | | | - 1 | |
| | | $V_{DS}$ = 16 V, $V_{GS}$ = 0 V, $T_J$ = 55 °C | N-Ch | | | 5 | |
| | | $V_{DS}$ = - 16 V, $V_{GS}$ = 0 V, $T_J$ = 55 °C | P-Ch | | | - 5 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS}$ = 5 V, $V_{GS}$ = 10 V | N-Ch | 3.7 | | | A |
| | | $V_{DS}$ = - 5 V, $V_{GS}$ = - 10 V | P-Ch | - 3 | | | |
| Drain-Source On-State Resistance[a] | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 2.5 A | N-Ch | | 0.022 | | Ω |
| | | $V_{GS}$ = - 10 V, $I_D$ = - 1.8 A | P-Ch | | 0.055 | | |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 2.0 A | N-Ch | | 0.030 | | |
| | | $V_{GS}$ = - 4.5 V, $I_D$ = - 1.2 A | P-Ch | | 0.079 | | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = 10 V, $I_D$ = 2.5 A | N-Ch | | 4.3 | | S |
| | | $V_{DS}$ = - 15 V, $I_D$ = - 1.8 A | P-Ch | | 2.4 | | |
| Diode Forward Voltage[a] | $V_{SD}$ | $I_S$ = 1.05 A, $V_{GS}$ = 0 V | N-Ch | | 0.81 | 1.10 | V |
| | | $I_S$ = - 1.05 A, $V_{GS}$ = 0 V | P-Ch | | - 0.83 | - 1.10 | |
| **Dynamic[b]** | | | | | | | |
| Total Gate Charge | $Q_g$ | N-Channel $V_{DS}$ = 15 V, $V_{GS}$ = 5 V, $I_D$ = 1.8 A; P-Channel $V_{DS}$ = - 15 V, $V_{GS}$ = - 5 V, $I_D$ = - 1.8 A | N-Ch | | 2.1 | 3.2 | nC |
| | | | P-Ch | | 2.4 | 3.6 | |
| Gate-Source Charge | $Q_{gs}$ | | N-Ch | | 0.7 | | |
| | | | P-Ch | | 0.9 | | |
| Gate-Drain Charge | $Q_{gd}$ | | N-Ch | | 0.7 | | |
| | | | P-Ch | | 0.8 | | |
| Gate Resistance | $R_g$ | | N-Ch | 0.5 | | 2.4 | Ω |
| | | | P-Ch | 3 | | 11 | |
| Turn-On Delay Time | $t_{d(on)}$ | N-Channel $V_{DD}$ = 15 V, $R_L$ = 15 Ω, $I_D \cong$ 1 A, $V_{GEN}$ = 10 V, $R_g$ = 6 Ω; P-Channel $V_{DD}$ = - 15 V, $R_L$ = 15 Ω, $I_D \cong$ - 1 A, $V_{GEN}$ = - 10 V, $R_g$ = 6 Ω | N-Ch | | 7 | 11 | ns |
| | | | P-Ch | | 8 | 12 | |
| Rise Time | $t_r$ | | N-Ch | | 9 | 14 | |
| | | | P-Ch | | 12 | 18 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | N-Ch | | 13 | 20 | |
| | | | P-Ch | | 12 | 18 | |
| Fall Time | $t_f$ | | N-Ch | | 5 | 8 | |
| | | | P-Ch | | 7 | 11 | |
| Source-Drain Reverse Recovery Time | $t_{rr}$ | $I_F$ = 1.05 A, dI/dt = 100 A/µs | N-Ch | | 35 | 60 | |
| | | $I_F$ = - 1.05 A, dI/dt = 100 A/µs | P-Ch | | 30 | 60 | |

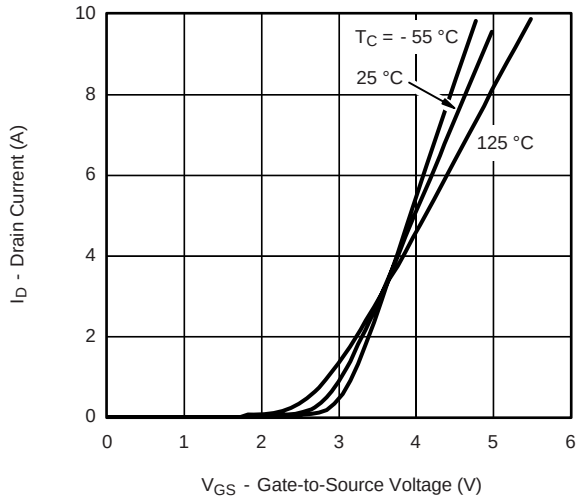
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

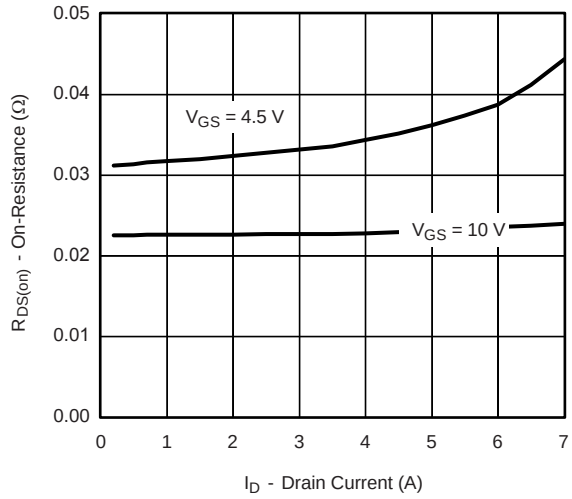
## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



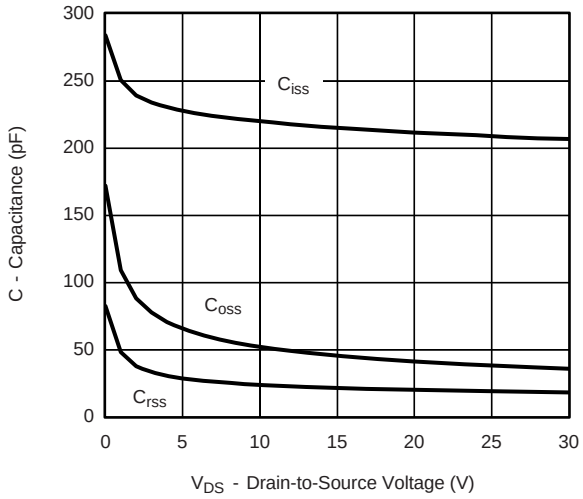

**Output Characteristics**



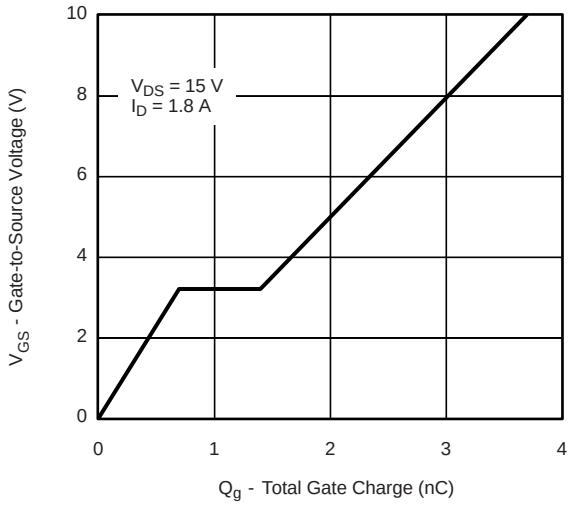

**Transfer Characteristics**



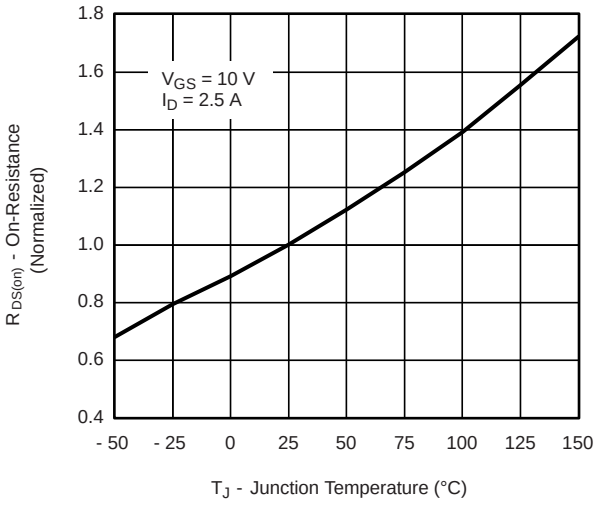

**On-Resistance vs. Drain Current**




**Capacitance**

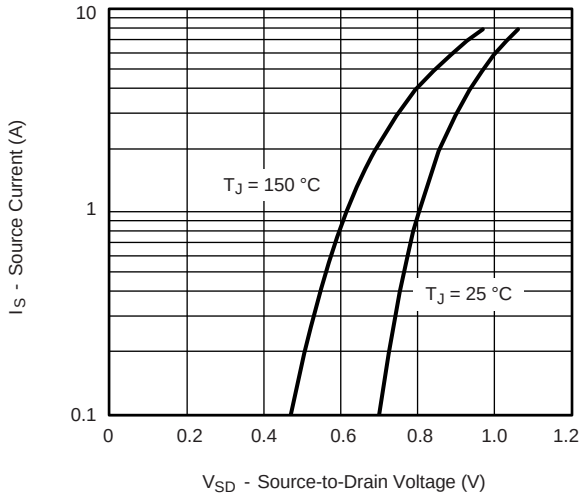



**Gate Charge**

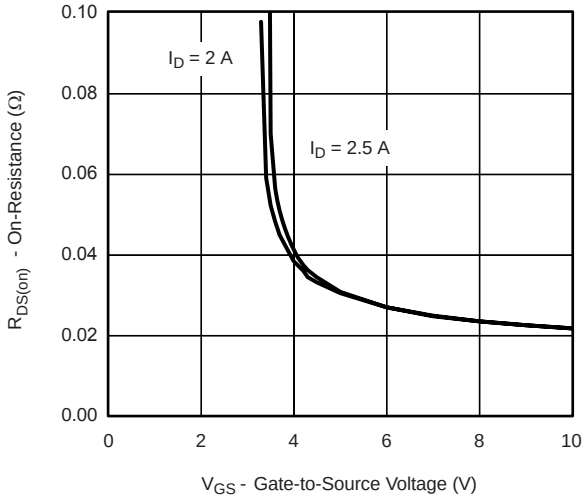



**On-Resistance vs. Junction Temperature**

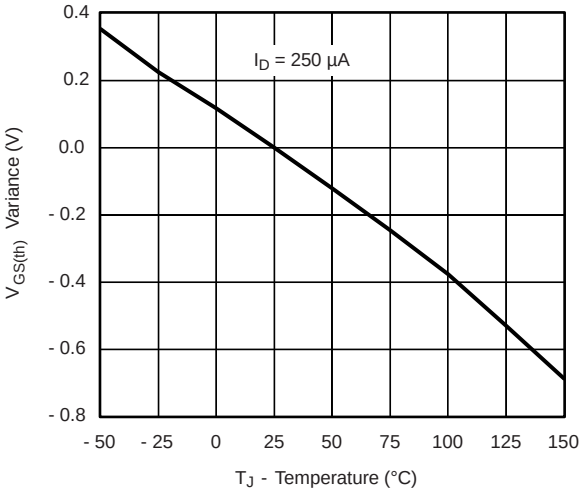
## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



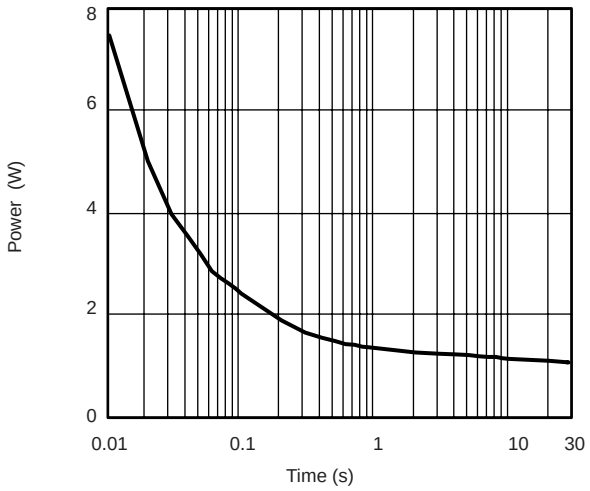

**Source-Drain Diode Forward Voltage**



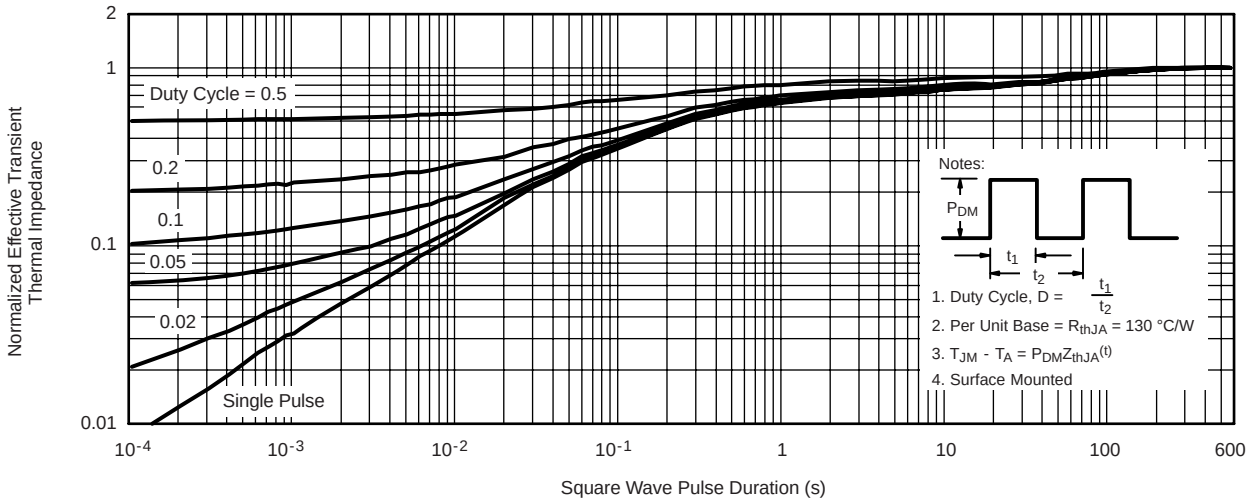

**On-Resistance vs. Gate-to-Source Voltage**




**Threshold Voltage**

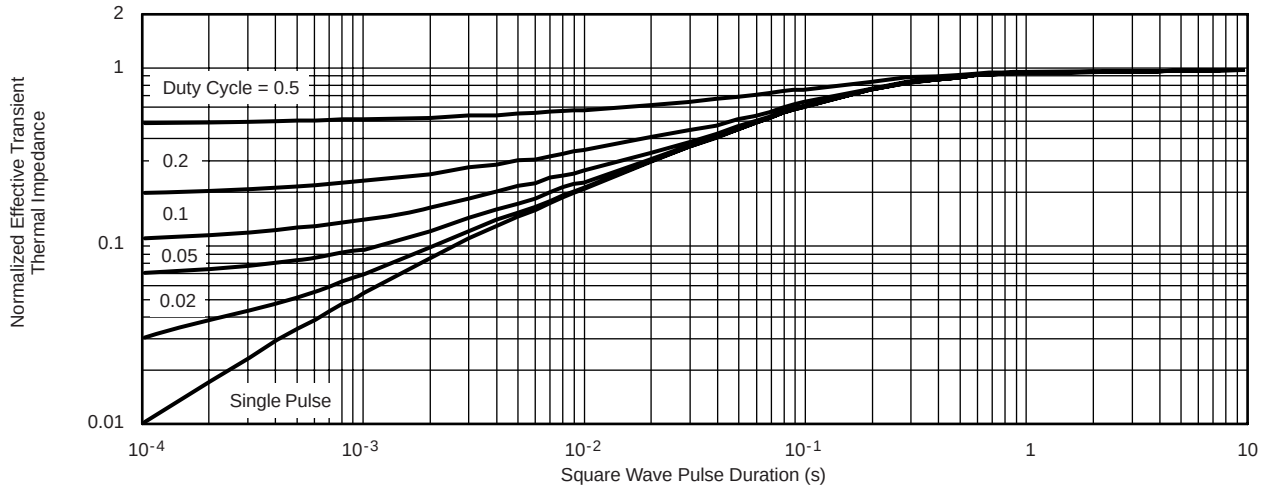



**Single Pulse Power (Junction-to-Ambient)**



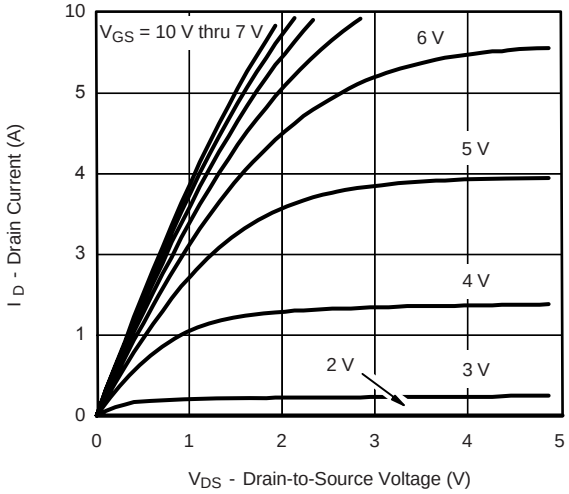

**Normalized Thermal Transient Impedance, Junction-to-Ambient**

## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

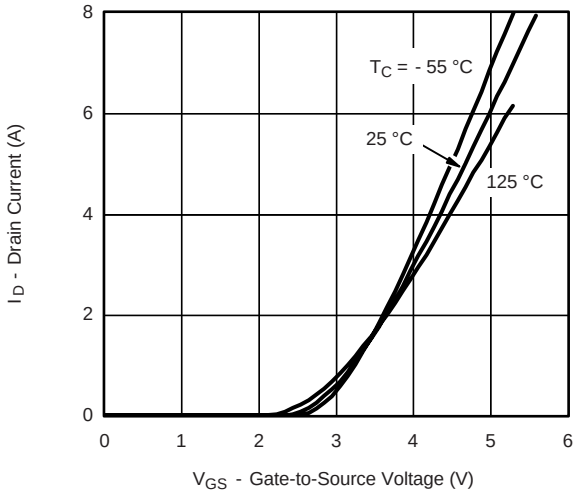



**Normalized Thermal Transient Impedance, Junction-to-Foot**

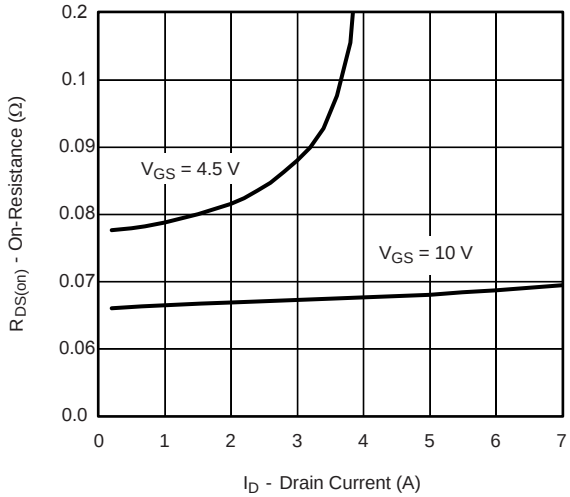
## P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



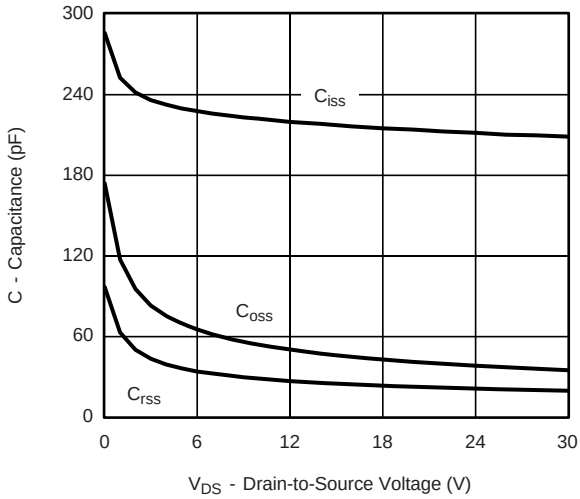

**Output Characteristics**




**Transfer Characteristics**

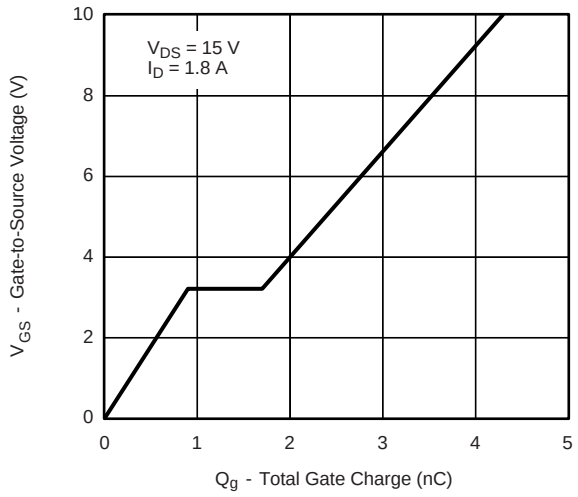



**On-Resistance vs. Drain Current**

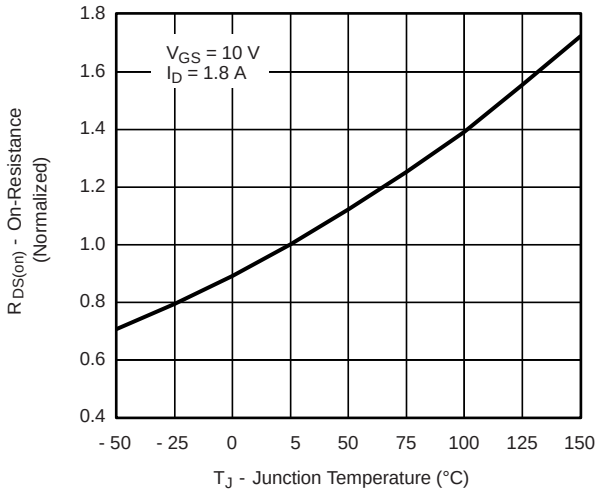



**Capacitance**

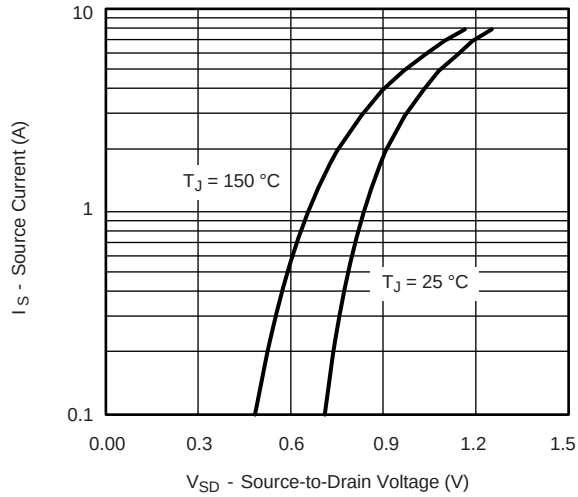
## P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



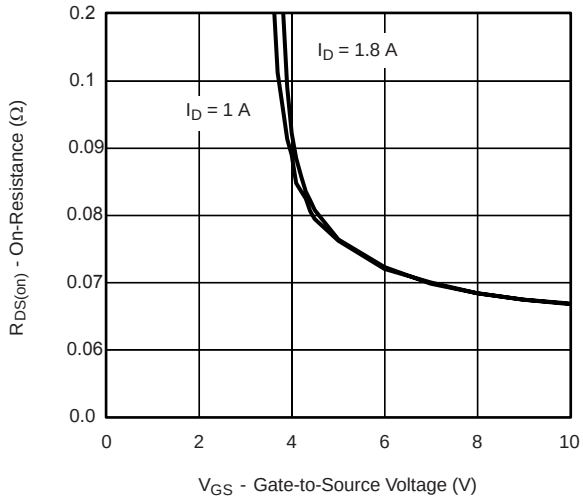

**Gate Charge**



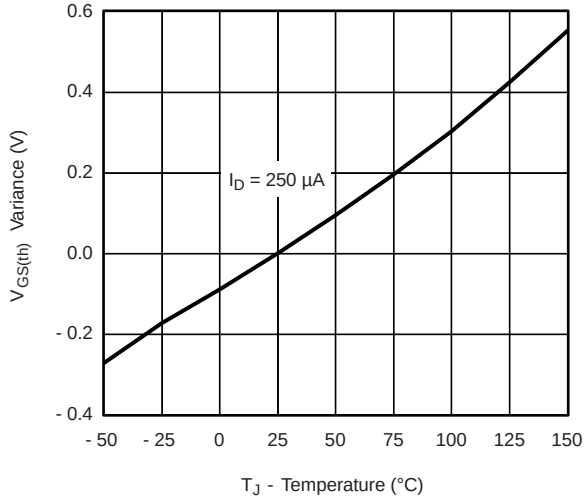

**On-Resistance vs. Junction Temperature**



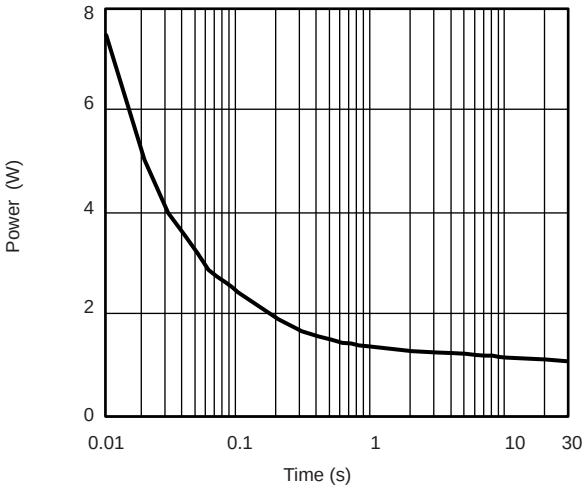

**Source-Drain Diode Forward Voltage**




**On-Resistance vs. Gate-to-Source Voltage**

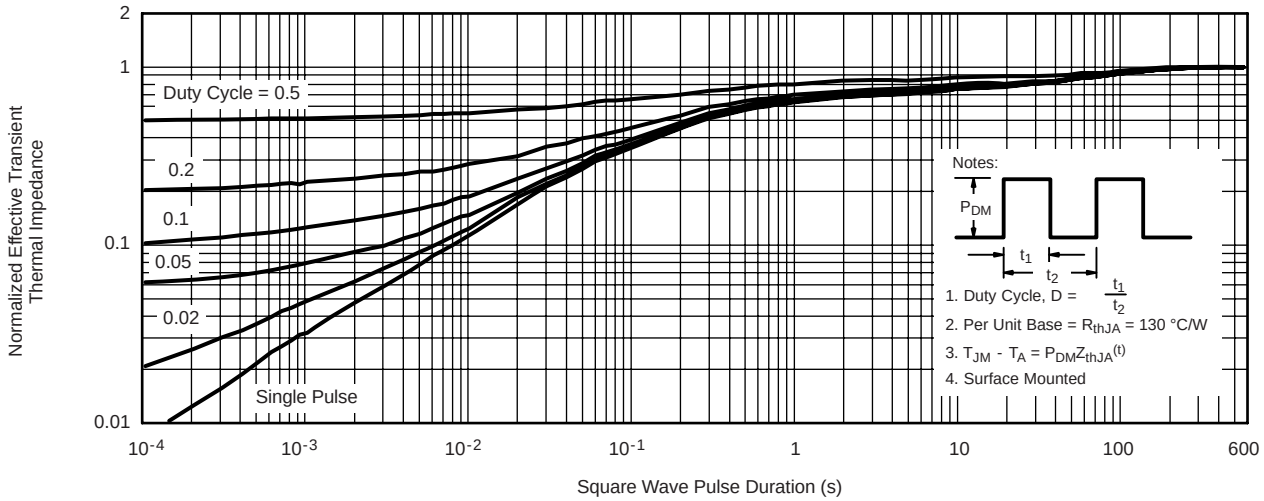



**Threshold Voltage**

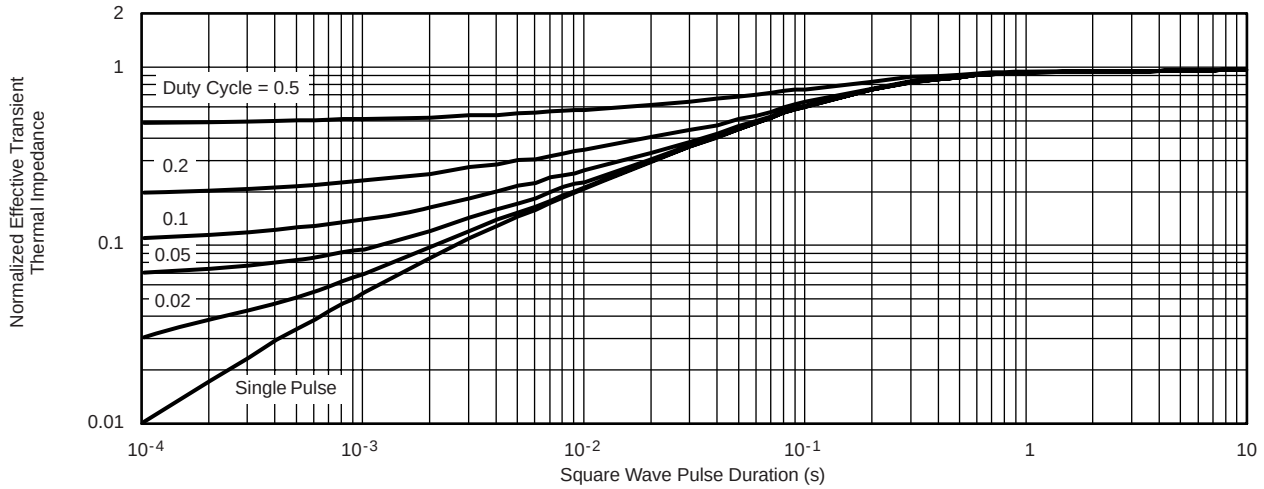



**Single Pulse Power (Junction-to-Ambient)**

**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

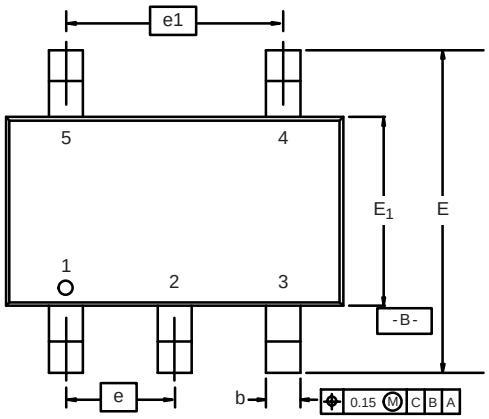



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

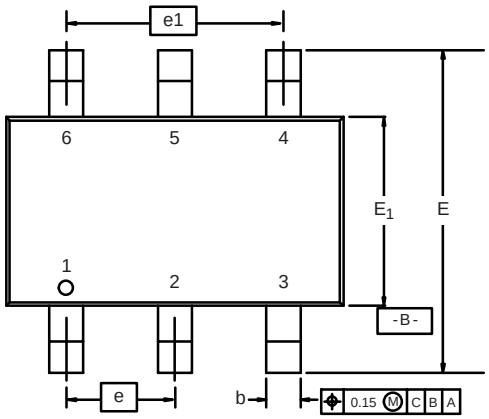



**Normalized Thermal Transient Impedance, Junction-to-Foot**

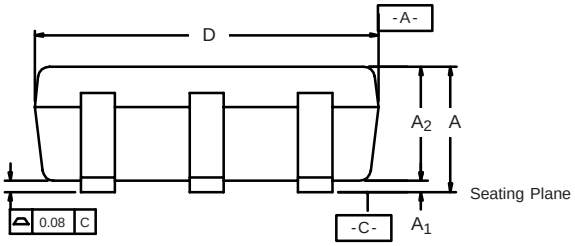
**TSOP: 5/6−LEAD**
**JEDEC Part Number: MO-193C**

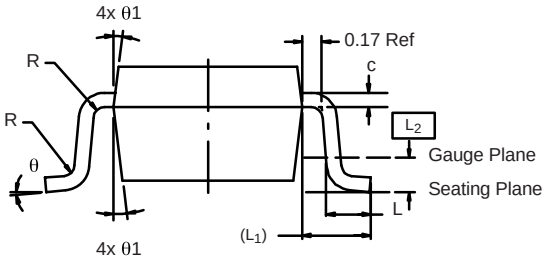



**5-LEAD TSOP**



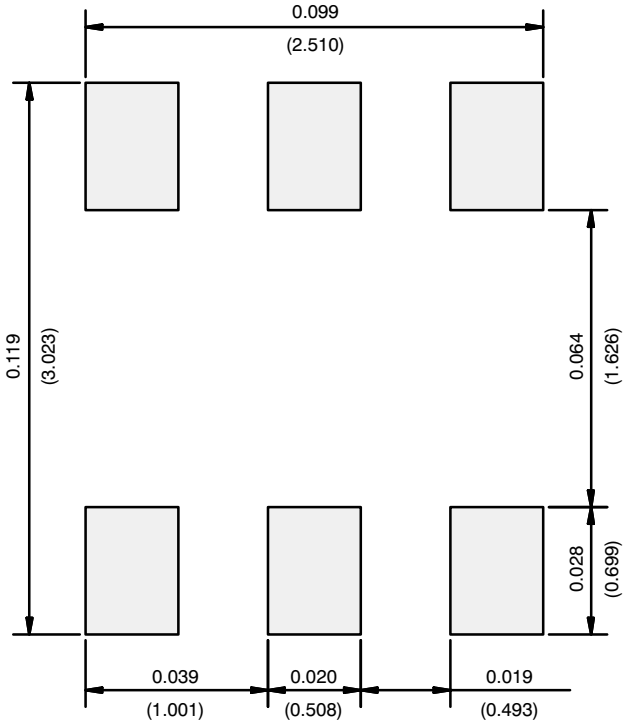

**6-LEAD TSOP**




| Dim | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | 0.91 | - | 1.10 | 0.036 | - | 0.043 |
| $A_1$ | 0.01 | - | 0.10 | 0.0004 | - | 0.004 |
| $A_2$ | 0.90 | - | 1.00 | 0.035 | 0.038 | 0.039 |
| b | 0.30 | 0.32 | 0.45 | 0.012 | 0.013 | 0.018 |
| c | 0.10 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| D | 2.95 | 3.05 | 3.10 | 0.116 | 0.120 | 0.122 |
| E | 2.70 | 2.85 | 2.98 | 0.106 | 0.112 | 0.117 |
| $E_1$ | 1.55 | 1.65 | 1.70 | 0.061 | 0.065 | 0.067 |
| e | 0.95 BSC | | | 0.0374 BSC | | |
| $e_1$ | 1.80 | 1.90 | 2.00 | 0.071 | 0.075 | 0.079 |
| L | 0.32 | - | 0.50 | 0.012 | - | 0.020 |
| $L_1$ | 0.60 Ref | | | 0.024 Ref | | |
| $L_2$ | 0.25 BSC | | | 0.010 BSC | | |
| R | 0.10 | - | - | 0.004 | - | - |
| θ | 0° | 4° | 8° | 0° | 4° | 8° |
| $θ_1$ | 7° Nom | | | 7° Nom | | |
| ECN: C-06593-Rev. I, 18-Dec-06<br>DWG: 5540 | | | | | | |

**RECOMMENDED MINIMUM PADS FOR TSOP-6**




Recommended Minimum Pads
Dimensions in Inches/(mm)

# Disclaimer

All products due to improve reliability, function or design or for other reasons, product specifications and data are subject to change without notice.

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# Material Category Policy

**Taiwan VBsemi Electronics Co., Ltd., hereby certify that all of the products are determined to be RoHS compliant and meets the definition of restrictions under Directive of the European Parliament 2011/65 / EU, 2011 Nian. 6. 8 Ri Yue restrict the use of certain hazardous substances in electrical and electronic equipment (EEE) - modification, unless otherwise specified as inconsistent.(www.VBsemi.com)**

**Please note that some documents may still refer to Taiwan VBsemi RoHS Directive 2002/95 / EC. We confirm that all products identified as consistent with the Directive 2002/95 / EC European Directive 2011/65 /.**

**Taiwan VBsemi Electronics Co., Ltd. hereby certify that all of its products comply identified as halogen-free halogen-free standards required by the JEDEC JS709A. Please note that some Taiwanese VBsemi documents still refer to the definition of IEC 61249-2-21, and we are sure that all products conform to confirm compliance with IEC 61249-2-21 standard level JS709A.**