# NTLJD3183CZTAG-VB Datasheet

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

| PRODUCT SUMMARY | | | | |
|---|---|---|---|---|
| | $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (A) | $Q_g$ (Typ.) |
| N-Channel | 20 | 0.020 at $V_{GS}$ = 4.5 V | 5[a] | 6.7 nC |
| | | 0.032 at $V_{GS}$ = 2.5 V | 5[a] | |
| P-Channel | - 20 | 0.024 at $V_{GS}$ = - 4.5 V | - 5 [a] | 17 nC |
| | | 0.040 at $V_{GS}$ = - 2.5 V | - 5 [a] | |

### FEATURES

- **Halogen-free**
- Trench Power MOSFETs

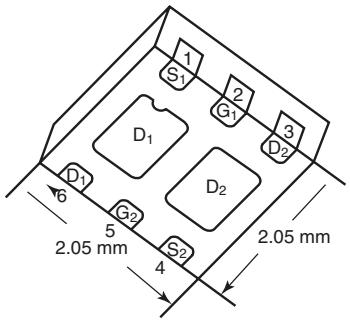
Pb-free

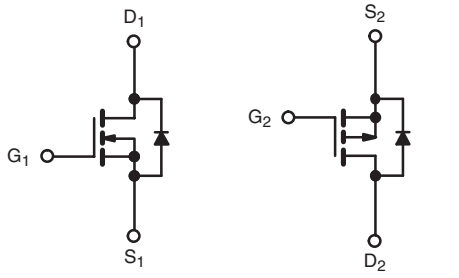
RoHS COMPLIANT

### APPLICATIONS

- Load Switch
- DC/DC Converter

DFN 2x2




| 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 | | $V_{GS}$ | ± 12 | | |
| Continuous Drain Current ($T_J$ = 150 °C) | $T_C$ = 25 °C | $I_D$ | 5.0 | - 5 .0 | A |
| | $T_C$ = 70 °C | | 3.5 | - 3 .0 | |
| | $T_A$ = 25 °C | | 4.0[b, c] | - 3 .5[b, c] | |
| | $T_A$ = 70 °C | | 2.5[b, c] | - 2 .0[b, c] | |
| Pulsed Drain Current | | $I_{DM}$ | 20 | - 2 0 | |
| Source Drain Current Diode Current | $T_C$ = 25 °C | $I_S$ | 1.3 | - 1.4 | |
| | $T_A$ = 25 °C | | 0.9[b, c] | - 1.0[b, c] | |
| Maximum Power Dissipation | $T_C$ = 25 °C | $P_D$ | 2.7 | 2.9 | W |
| | $T_C$ = 70 °C | | 1.78 | 1.86 | |
| | $T_A$ = 25 °C | | 1.9[b, c] | 1.9[b, c] | |
| | $T_A$ = 70 °C | | 1.2[b, c] | 1.2[b, c] | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 150 | | °C |

| THERMAL RESISTANCE RATINGS | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | N-Channel | | P-Channel | | |
| **Parameter** | | **Symbol** | **Typ.** | **Max.** | **Typ.** | **Max.** | **Unit** |
| Maximum Junction-to-Case[b, d] | t ≤ 10 s | $R_{thJC}$ | 25 | 45 | 25 | 43 | °C/W |
| Maximum Junction-to-Ambient | Steady State | $R_{thJA}$ | 66 | - | 66 | - | |

Notes:
a. $T_C$ = 25 °C.
b. Surface Mounted on 1" x 1" FR4 board.
c. t = 10 s.
d. Maximum under Steady State conditions is 145 °C/W.

| **SPECIFICATIONS** $T_J$ = 25 °C, unless otherwise noted | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | | **Min.** | **Typ.** | **Max.** | **Unit** |
| **Static** | | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 µA | N-Ch | 20 | | | V |
| | | $V_{GS}$ = 0 V, $I_D$ = - 250 µA | P-Ch | - 20 | | | |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS}/T_J$ | $I_D$ = 250 µA | N-Ch | | 22 | | mV/°C |
| | | $I_D$ = - 250 µA | P-Ch | | - 21 | | |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | $I_D$ = 250 µA | N-Ch | | - 3.5 | | |
| | | $I_D$ = - 250 µA | P-Ch | | 3.5 | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | N-Ch | | 0.7 | | V |
| | | $V_{DS}$ = $V_{GS}$, $I_D$ = - 250 µA | P-Ch | | -0.6 | | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 12 V | N-Ch | | | ± 100 | nA |
| | | | P-Ch | | | ± 100 | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V | N-Ch | | | 1 | µA |
| | | $V_{DS}$ = - 20 V, $V_{GS}$ = 0 V | P-Ch | | | - 1 | |
| | | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V, $T_J$ = 55 °C | N-Ch | | | 10 | |
| | | $V_{DS}$ = - 20 V, $V_{GS}$ = 0 V, $T_J$ = 55 °C | P-Ch | | | - 10 | |
| On-State Drain Current[b] | $I_{D(on)}$ | $V_{DS} \geq$ 5 V, $V_{GS}$ = 4.5 V | N-Ch | 20 | | | A |
| | | $V_{DS} \leq$ - 5 V, $V_{GS}$ = - 4.5 V | P-Ch | - 2 0 | | | |
| Drain-Source On-State Resistance[b] | $R_{DS(on)}$ | $V_{GS}$ = 4.5 V, $I_D$ = 2.5 A | N-Ch | | 0.020 | | Ω |
| | | $V_{GS}$ = - 4.5 V, $I_D$ = - 2.0 A | P-Ch | | 0.032 | | |
| | | $V_{GS}$ = 2.5 V, $I_D$ = 2.0 A | N-Ch | | 0.024 | | |
| | | $V_{GS}$ = - 2.5 V, $I_D$ = - 1.8 A | P-Ch | | 0.040 | | |
| Forward Transconductance[b] | $g_{fs}$ | $V_{DS}$ = 10 V, $I_D$ = 2.5 A | N-Ch | | 17 | | S |
| | | $V_{DS}$ = - 10 V, $I_D$ = -2.5 A | P-Ch | | 22 | | |
| **Dynamic**[a] | | | | | | | |
| Input Capacitance | $C_{iss}$ | N-Channel $V_{DS}$ = 10 V, $V_{GS}$ = 0 V, f = 1 MHz<br>P-Channel $V_{DS}$ = - 10 V, $V_{GS}$ = 0 V, f = 1 MHz | N-Ch | | 600 | | pF |
| | | | P-Ch | | 700 | | |
| Output Capacitance | $C_{oss}$ | | N-Ch | | 150 | | |
| | | | P-Ch | | 260 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | N-Ch | | 70 | | |
| | | | P-Ch | | 45 | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = 10 V, $V_{GS}$ = 10 V, $I_D$ = 2.5 A | N-Ch | | 15 | 23 | nC |
| | | $V_{DS}$ = - 10 V, $V_{GS}$ = - 10 V, $I_D$ = - 2.5 A | P-Ch | | 34 | 51 | |
| | | N-Channel $V_{DS}$ = 10 V, $V_{GS}$ = 4.5 V, $I_D$ = 2.5 A<br>P-Channel $V_{DS}$ = - 10 V, $V_{GS}$ = - 4.5 V, $I_D$ = - 2.5 A | N-Ch | | 6.7 | 11 | |
| | | | P-Ch | | 17 | 30 | |
| Gate-Source Charge | $Q_{gs}$ | | N-Ch | | 1.8 | | |
| | | | P-Ch | | 3 | | |
| Gate-Drain Charge | $Q_{gd}$ | | N-Ch | | 0.9 | | |
| | | | P-Ch | | 5.5 | | |
| Gate Resistance | $R_g$ | f = 1 MHz | N-Ch | | 2 | | Ω |
| | | | P-Ch | | 6 | | |

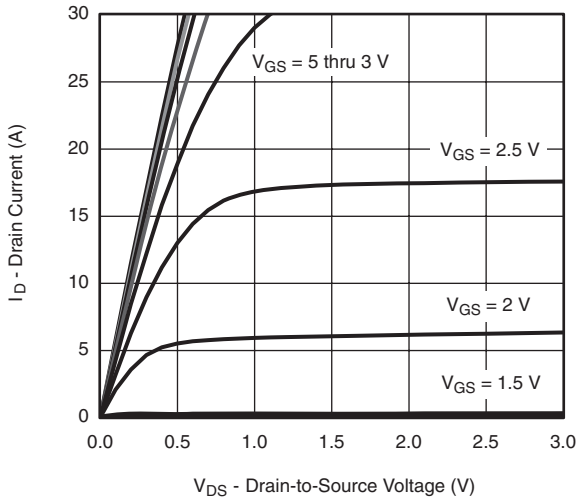
Notes:
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

| **SPECIFICATIONS** $T_J$ = 25 °C, unless otherwise noted | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | | **Min.** | **Typ.** | **Max.** | **Unit** |
| **Dynamic**[a] | | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | N-Channel $V_{DD}$ = 10 V, $R_L$ = 2.2 Ω $I_D \cong$ 2.5A, $V_{GEN}$ = 4.5 V, $R_g$ = 1 Ω | N-Ch | | 12 | 20 | ns |
| | | | P-Ch | | 30 | 45 | |
| Rise Time | $t_r$ | | N-Ch | | 10 | 15 | |
| | | | P-Ch | | 25 | 40 | |
| Turn-Off Delay Time | $t_{d(off)}$ | P-Channel $V_{DD}$ = - 10 V, $R_L$ = 2.4 Ω $I_D \cong$ - 2.5 A, $V_{GEN}$ = - 4.5 V, $R_g$ = 1 Ω | N-Ch | | 25 | 40 | |
| | | | P-Ch | | 45 | 70 | |
| Fall Time | $t_f$ | | N-Ch | | 10 | 15 | |
| | | | P-Ch | | 15 | 25 | |
| Turn-On Delay Time | $t_{d(on)}$ | N-Channel $V_{DD}$ = 10 V, $R_L$ = 2.2 Ω $I_D \cong$ 2.5 A, $V_{GEN}$ = 10 V, $R_g$ = 1 Ω | N-Ch | | 10 | 15 | ns |
| | | | P-Ch | | 10 | 15 | |
| Rise Time | $t_r$ | | N-Ch | | 10 | 15 | |
| | | | P-Ch | | 10 | 15 | |
| Turn-Off Delay Time | $t_{d(off)}$ | P-Channel $V_{DD}$ = - 10 V, $R_L$ = 2.4 Ω $I_D \cong$ - 2.5 A, $V_{GEN}$ = - 10 V, $R_g$ = 1 Ω | N-Ch | | 20 | 30 | |
| | | | P-Ch | | 45 | 70 | |
| Fall Time | $t_f$ | | N-Ch | | 8 | 15 | |
| | | | P-Ch | | 15 | 25 | |
| **Drain-Source Body Diode Characteristics** | | | | | | | |
| Continuous Source-Drain Diode Current | $I_S$ | $T_C$ = 25 °C | N-Ch | | | 1.3 | A |
| | | | P-Ch | | | - 1.4 | |
| Pulse Diode Forward Current[a] | $I_{SM}$ | | N-Ch | | | 30 | |
| | | | P-Ch | | | - 30 | |
| Body Diode Voltage | $V_{SD}$ | $I_S$ = 1.2 A, $V_{GS}$ = 0 V | N-Ch | | 0.8 | 1.2 | V |
| | | $I_S$ = - 1.1 A, $V_{GS}$ = 0 V | P-Ch | | - 0.8 | - 1.2 | |
| Body Diode Reverse Recovery Time | $t_{rr}$ | N-Channel $I_F$ = 4.5 A, dI/dt = 100 A/µs, $T_J$ = 25 °C P-Channel $I_F$ = - 4.1 A, dI/dt = - 100 A/µs, $T_J$ = 25 °C | N-Ch | | 15 | 30 | ns |
| | | | P-Ch | | 35 | 55 | |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | N-Ch | | 6 | 12 | nC |
| | | | P-Ch | | 21 | 35 | |
| Reverse Recovery Fall Time | $t_a$ | | N-Ch | | 7.6 | | ns |
| | | | P-Ch | | 18 | | |
| Reverse Recovery Rise Time | $t_b$ | | N-Ch | | 7.4 | | |
| | | | P-Ch | | 17 | | |

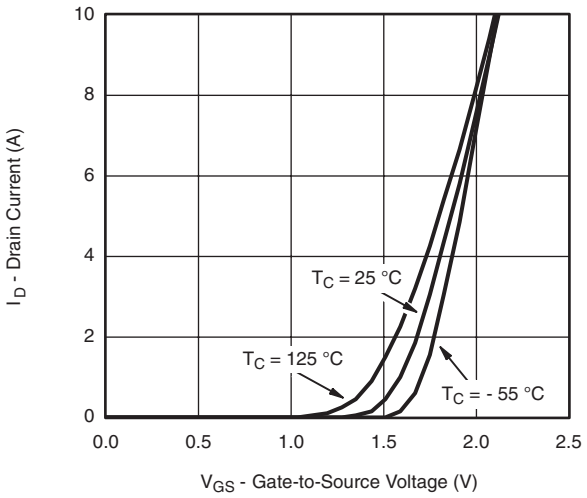
Notes:
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

*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.*

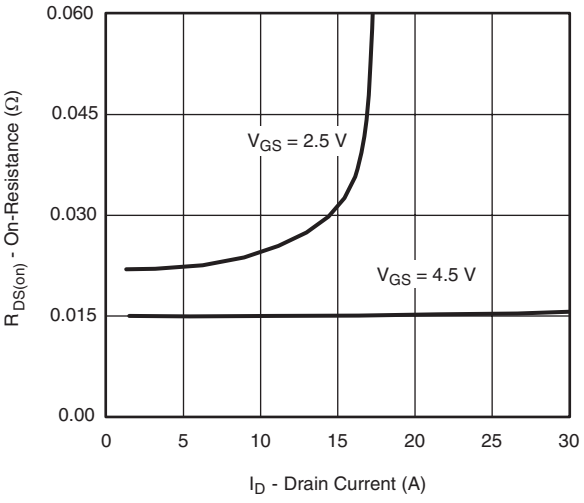
## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



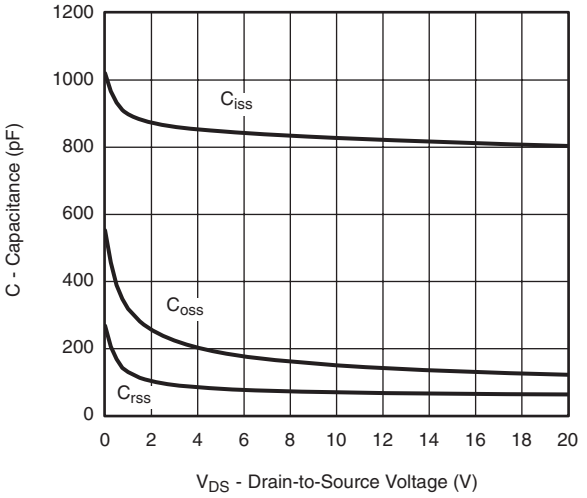

**Output Characteristics**



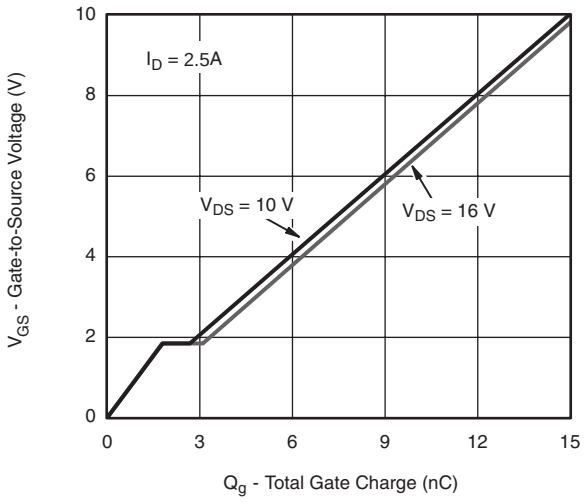

**Transfer Characteristics**



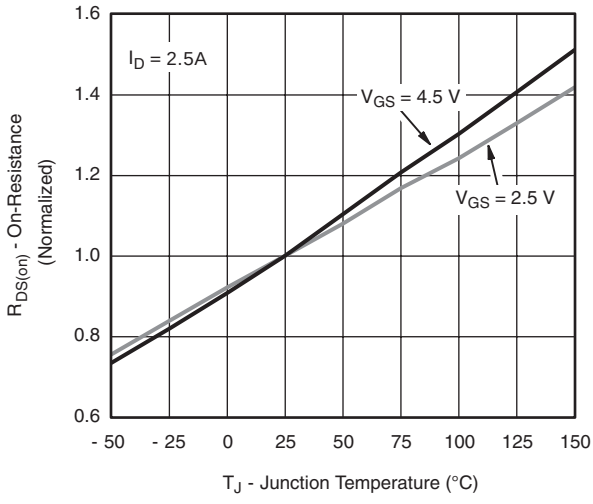

**On-Resistance vs. Drain Current**




**Capacitance**

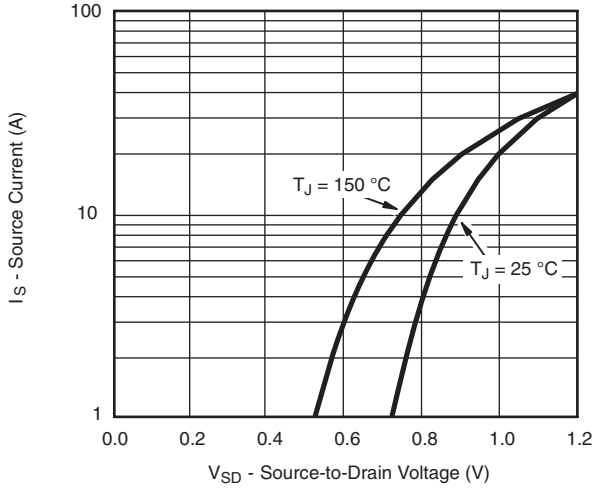



**Gate Charge**

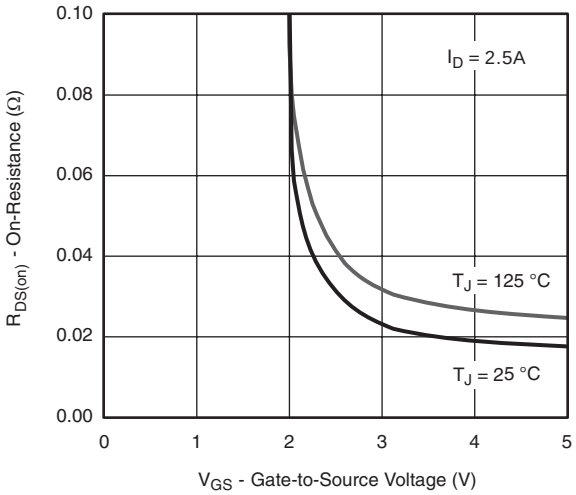



**On-Resistance vs. Junction Temperature**

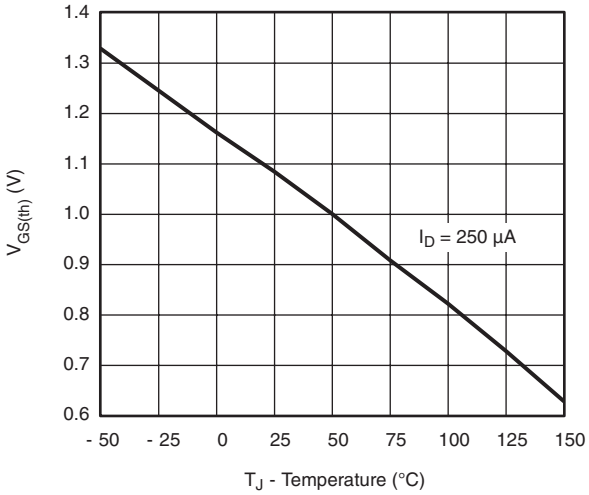
## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



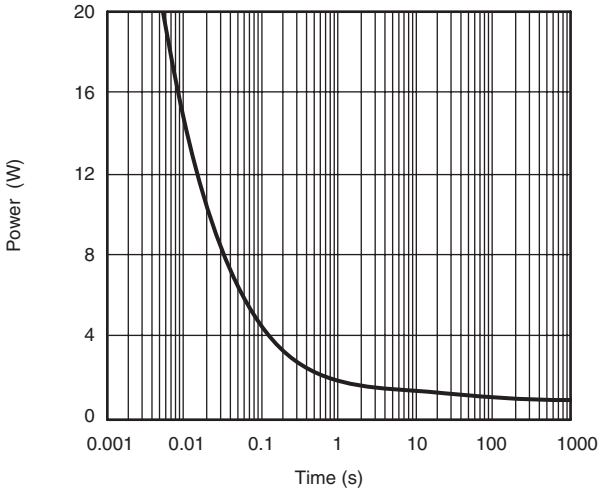

**Source-Drain Diode Forward Voltage**



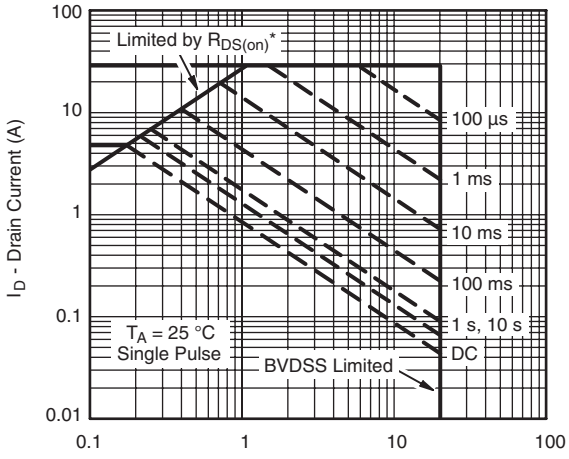

**On-Resistance vs. Gate-to-Source Voltage**




**Threshold Voltage**



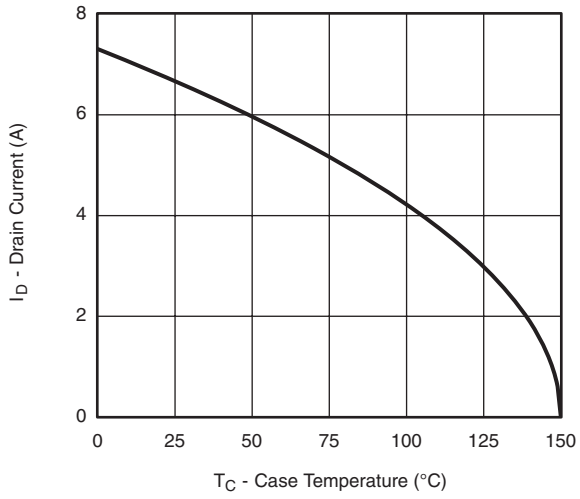

**Single Pulse Power**



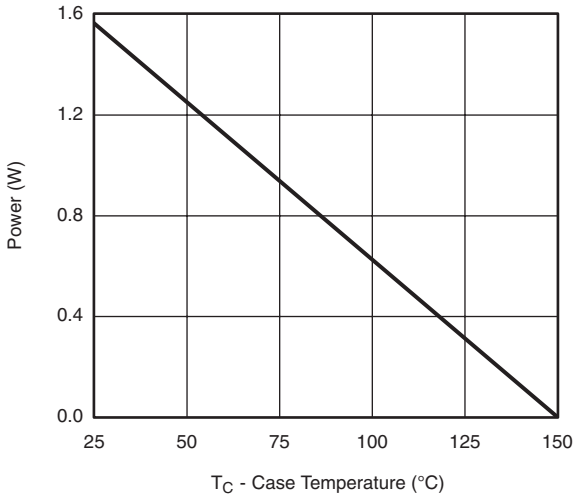

* $V_{GS}$ > minimum $V_{GS}$ at which $R_{DS(on)}$ is specified

**Safe Operating Area, Junction-to-Ambient**

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



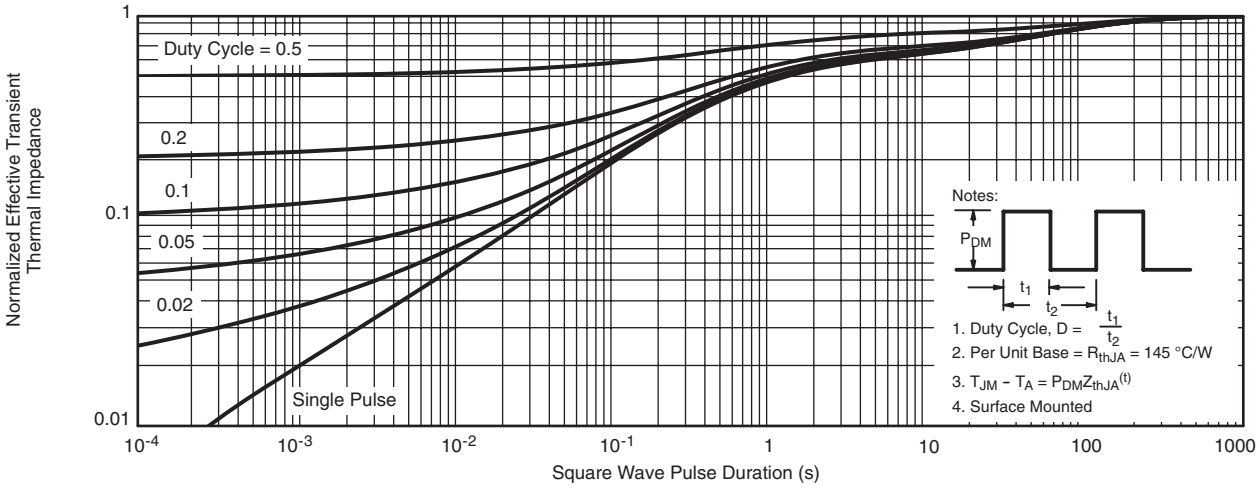

**Current Derating***



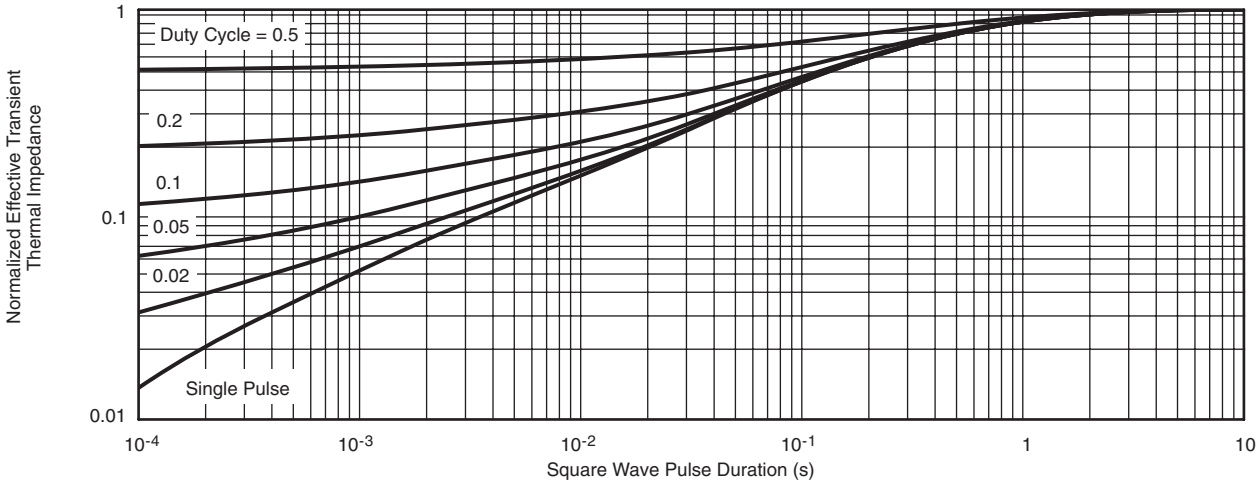

**Power Derating**

* The power dissipation $P_D$ is based on $T_{J(max)}$ = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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

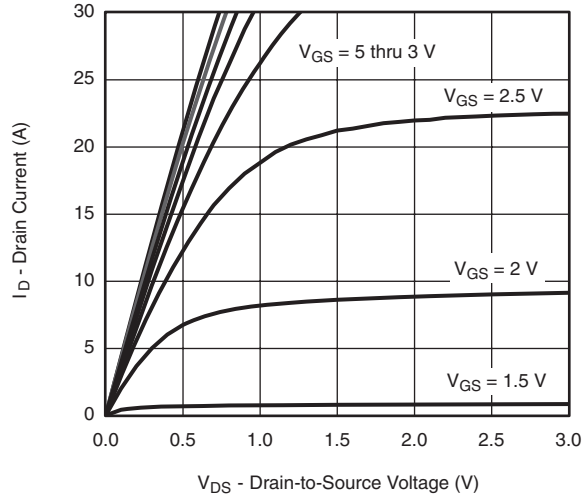



**Normalized Thermal Transient Impedance, Junction-to-Case**

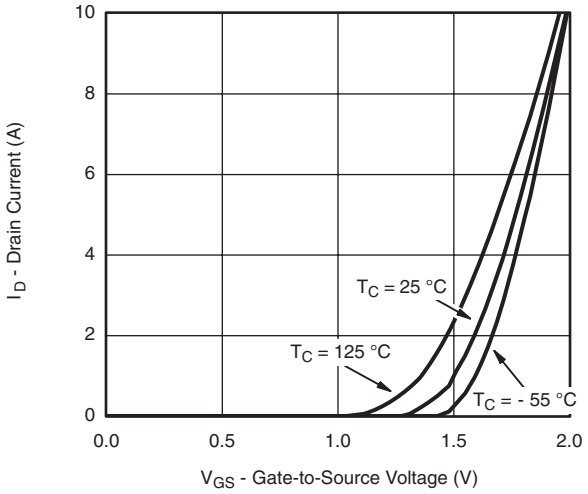



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

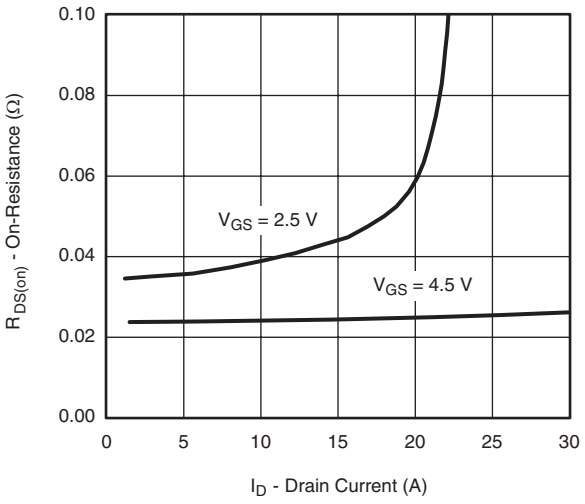
## P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



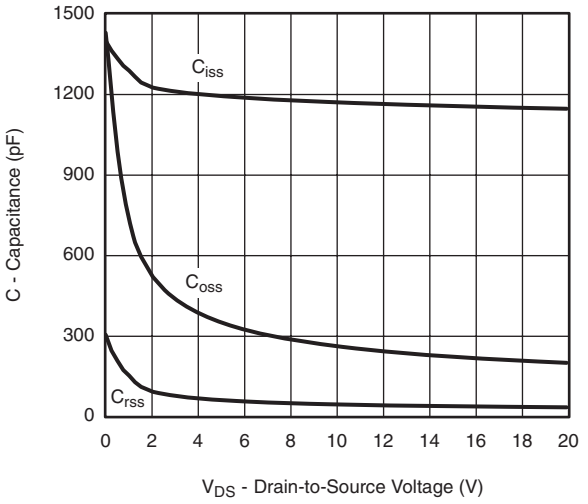

**Output Characteristics**



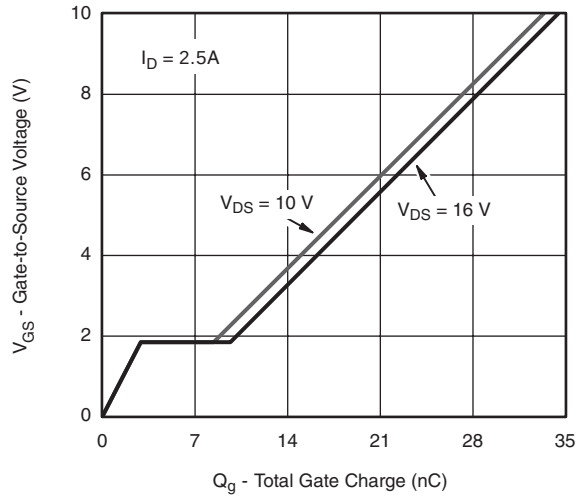

**Transfer Characteristics**



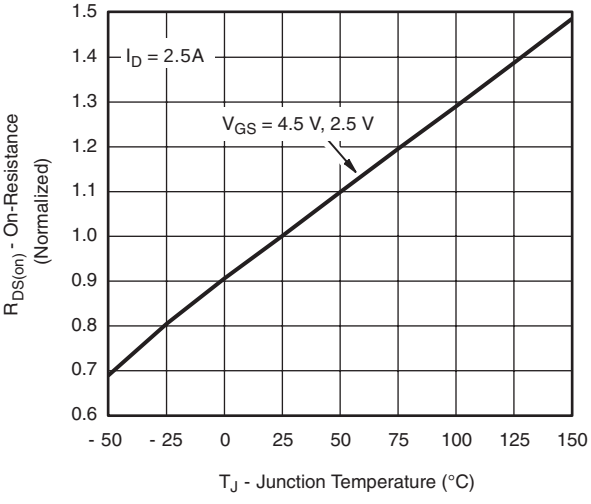

**On-Resistance vs. Drain Current**




**Capacitance**

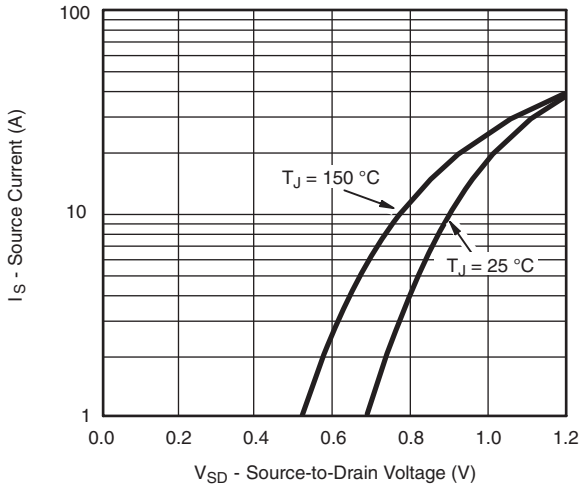



**Gate Charge**

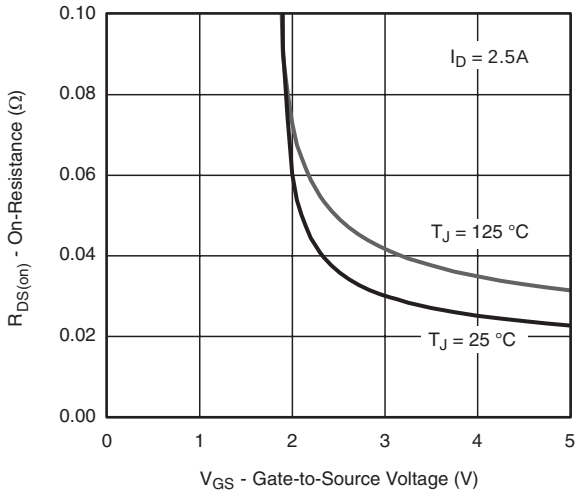



**On-Resistance vs. Junction Temperature**

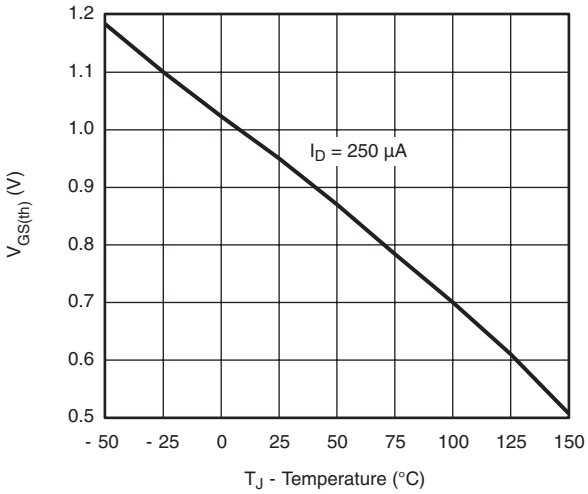
## P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



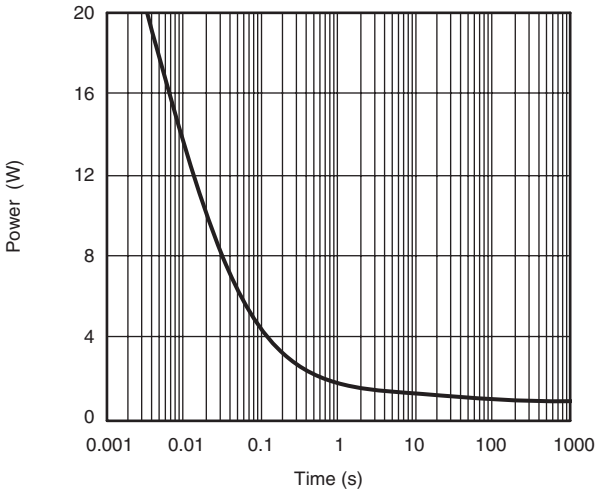

**Source-Drain Diode Forward Voltage**



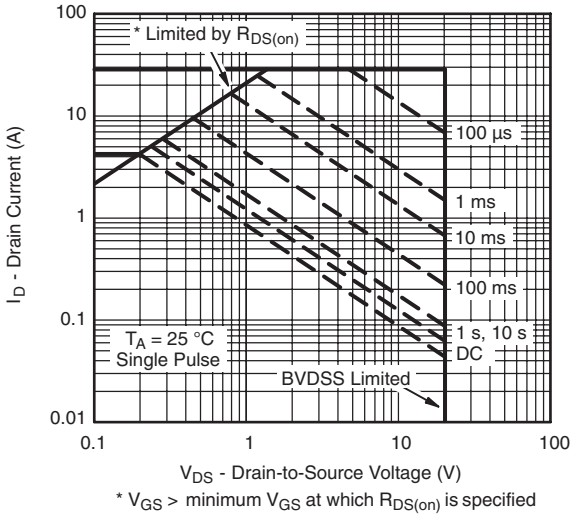

**On-Resistance vs. Gate-to-Source**




**Threshold Voltage**



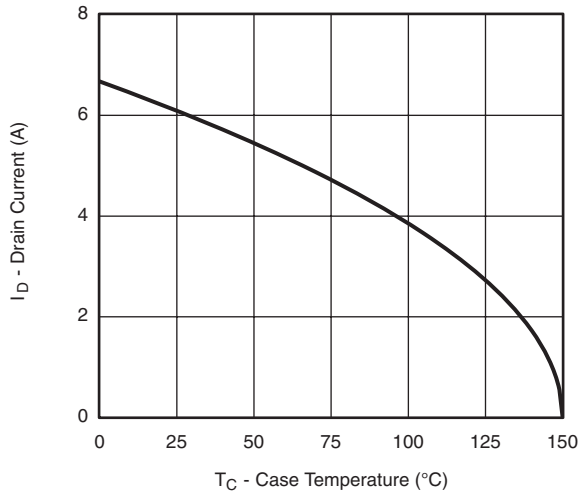

**Single Pulse Power**



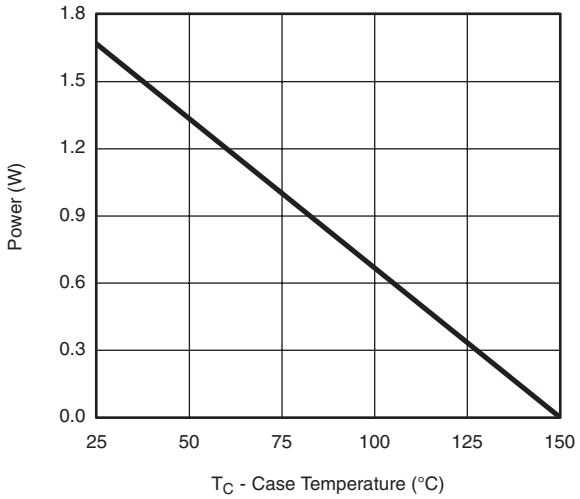

* $V_{GS}$ > minimum $V_{GS}$ at which $R_{DS(on)}$ is specified

**Safe Operating Area, Junction-to-Ambient**

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



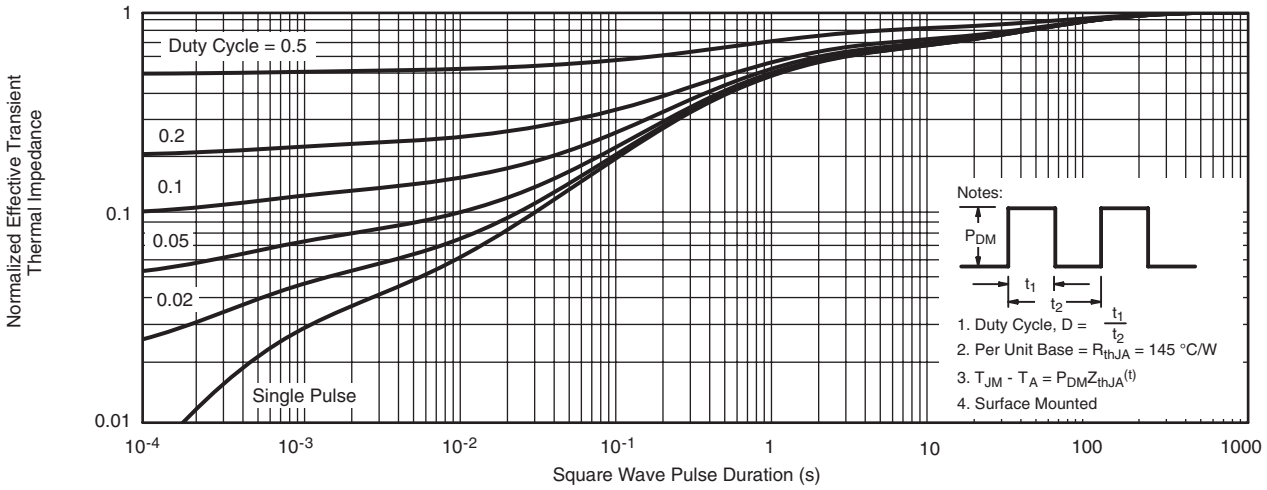

**Current Derating***



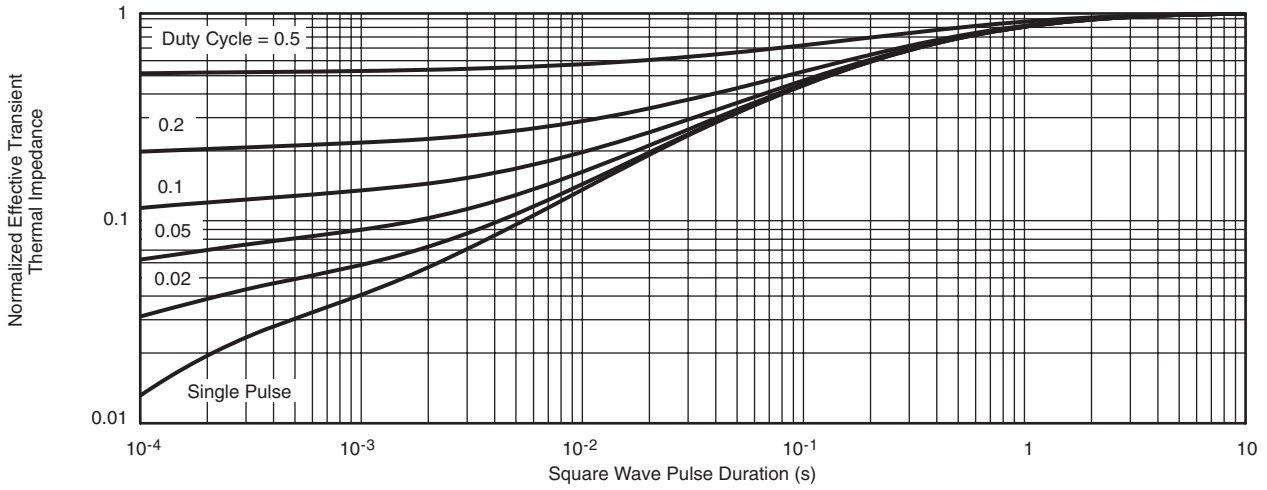

**Power Derating**

* The power dissipation $P_D$ is based on $T_{J(max)}$ = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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

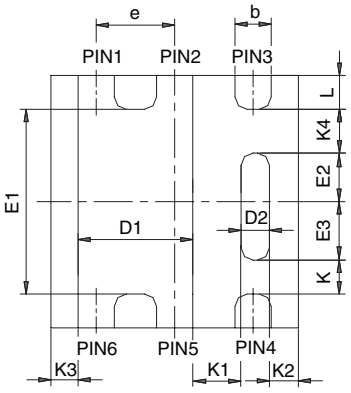



**Normalized Thermal Transient Impedance, Junction-to-Case**

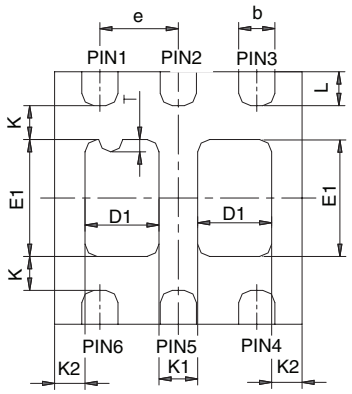



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

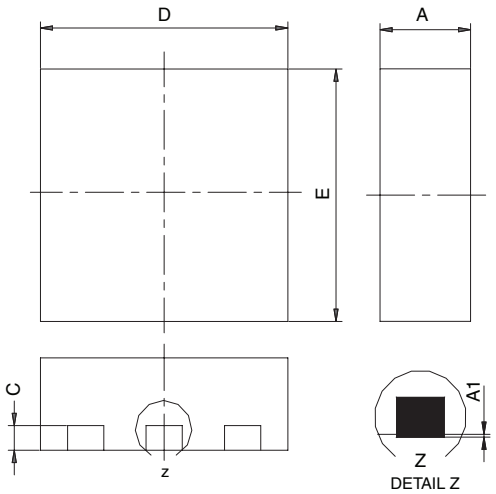
# DFN2x2




BACKSIDE VIEW OF SINGLE




BACKSIDE VIEW OF DUAL

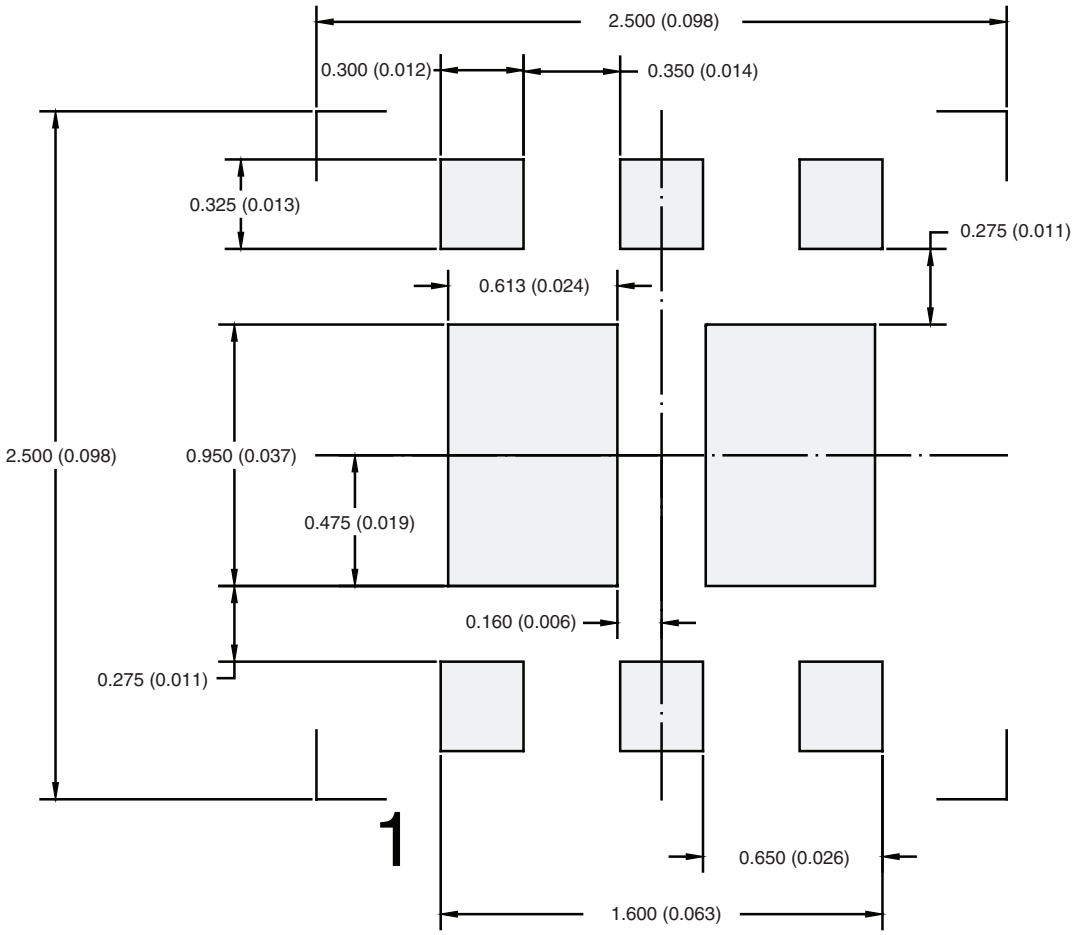



DETAIL Z

Notes:
1. All dimensions are in millimeters
2. Package outline exclusive of mold flash and metal burr
3. Package outline inclusive of plating

| DIM | SINGLE PAD | | | | | | DUAL PAD | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MILLIMETERS | | | INCHES | | | MILLIMETERS | | | INCHES | | |
| | Min | Nom | Max | Min | Nom | Max | Min | Nom | Max | Min | Nom | Max |
| A | 0.675 | 0.75 | 0.80 | 0.027 | 0.030 | 0.032 | 0.675 | 0.75 | 0.80 | 0.027 | 0.030 | 0.032 |
| A1 | 0 | - | 0.05 | 0 | - | 0.002 | 0 | - | 0.05 | 0 | - | 0.002 |
| b | 0.23 | 0.30 | 0.38 | 0.009 | 0.012 | 0.015 | 0.23 | 0.30 | 0.38 | 0.009 | 0.012 | 0.015 |
| C | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 1.98 | 2.05 | 2.15 | 0.078 | 0.081 | 0.085 | 1.98 | 2.05 | 2.15 | 0.078 | 0.081 | 0.085 |
| D1 | 0.85 | 0.95 | 1.05 | 0.033 | 0.037 | 0.041 | 0.513 | 0.613 | 0.713 | 0.020 | 0.024 | 0.028 |
| D2 | 0.135 | 0.235 | 0.335 | 0.005 | 0.009 | 0.013 | | | | | | |
| E | 1.98 | 2.05 | 2.15 | 0.078 | 0.081 | 0.085 | 1.98 | 2.05 | 2.15 | 0.078 | 0.081 | 0.085 |
| E1 | 1.40 | 1.50 | 1.60 | 0.055 | 0.059 | 0.063 | 0.85 | 0.95 | 1.05 | 0.033 | 0.037 | 0.041 |
| E2 | 0.345 | 0.395 | 0.445 | 0.014 | 0.016 | 0.018 | | | | | | |
| E3 | 0.425 | 0.475 | 0.525 | 0.017 | 0.019 | 0.021 | | | | | | |
| e | 0.65 BSC | | | 0.026 BSC | | | 0.65 BSC | | | 0.026 BSC | | |
| K | 0.275 TYP | | | 0.011 TYP | | | 0.275 TYP | | | 0.011 TYP | | |
| K1 | 0.400 TYP | | | 0.016 TYP | | | 0.320 TYP | | | 0.013 TYP | | |
| K2 | 0.240 TYP | | | 0.009 TYP | | | 0.252 TYP | | | 0.010 TYP | | |
| K3 | 0.225 TYP | | | 0.009 TYP | | | | | | | | |
| K4 | 0.355 TYP | | | 0.014 TYP | | | | | | | | |
| L | 0.175 | 0.275 | 0.375 | 0.007 | 0.011 | 0.015 | 0.175 | 0.275 | 0.375 | 0.007 | 0.011 | 0.015 |
| T | | | | | | | 0.05 | 0.10 | 0.15 | 0.002 | 0.004 | 0.006 |

## XRECOMMENDED PAD LAYOUT FOR DFN2x2




Dimensions in mm (inches)

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