

N- and P-Channel 30-V (D-S) MOSFET

| PRODUCT SUMMARY | | | |
|-----------------|---------------------|------------------------------------|--------------------|
| | V _{DS} (V) | R _{DS(on)} (Ω) | I _D (A) |
| N-Channel | 30 | 0.077 at V _{GS} = 4.5 V | 3 |
| | | 0.120 at V _{GS} = 2.5 V | 2 |
| P-Channel | - 30 | 0.170 at V _{GS} = - 4.5 V | - 2 |
| | | 0.300 at V _{GS} = - 2.5 V | - 1.2 |

FEATURES

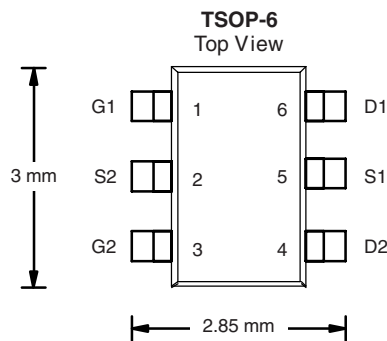
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET[®] Power MOSFET
- Ultra Low R_{DS(on)} N- and P-Channel for High Efficiency
- Optimized for High-Side/Low-Side
- Minimized Conduction Losses
- Compliant to RoHS Directive 2002/95/EC



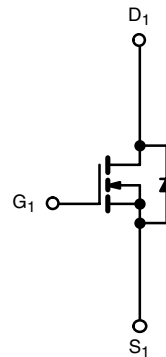
RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

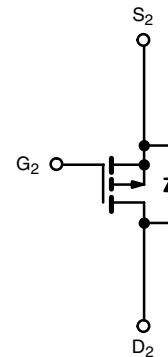
- Portable Devices Including PDAs, Cellular Phones and Pagers



Ordering Information: Si3590DV-T1-E3 (Lead (Pb)-free)
Si3590DV-T1-GE3 (Lead (Pb)-free and Halogen-free)



N-Channel MOSFET



P-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS T _A = 25 °C, unless otherwise noted | | | | | | | |
|---|-----------------------------------|------------------------|--------------|-----------|--------------|-------|---|
| Parameter | Symbol | N-Channel | | P-Channel | | Unit | |
| | | 10 s | Steady State | 10 s | Steady State | | |
| Drain-Source Voltage | V _{DS} | 30 | | - 30 | | V | |
| Gate-Source Voltage | V _{GS} | ± 12 | | ± 12 | | | |
| Continuous Drain Current (T _J = 150 °C) ^a | I _D | T _A = 25 °C | 3 | 2.5 | - 2 | - 1.7 | A |
| | | T _A = 70 °C | 2.3 | 2.0 | - 1.6 | - 1.3 | |
| Pulsed Drain Current | I _{DM} | 8 | | - 8 | | A | |
| Continuous Source Current (Diode Conduction) ^a | I _S | 1.05 | 0.75 | - 1.05 | - 0.75 | | |
| Maximum Power Dissipation ^a | P _D | T _A = 25 °C | 1.15 | 0.83 | 1.15 | 0.83 | W |
| | | T _A = 70 °C | 0.70 | 0.53 | 0.70 | 0.53 | |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to 150 | | | | °C | |

| THERMAL RESISTANCE RATINGS | | | | | | | |
|--|-------------------|--------------|------|-----------|------|------|------|
| Parameter | Symbol | N-Channel | | P-Channel | | Unit | |
| | | Typ. | Max. | Typ. | Max. | | |
| Maximum Junction-to-Ambient ^a | R _{thJA} | t ≤ 10 s | 93 | 110 | 93 | 110 | °C/W |
| | | Steady State | 130 | 150 | 130 | 150 | |
| Maximum Junction-to-Foot (Drain) | R _{thJF} | 75 | 90 | 75 | 90 | | |

Notes:

a. Surface Mounted on 1" x 1" FR4 board.

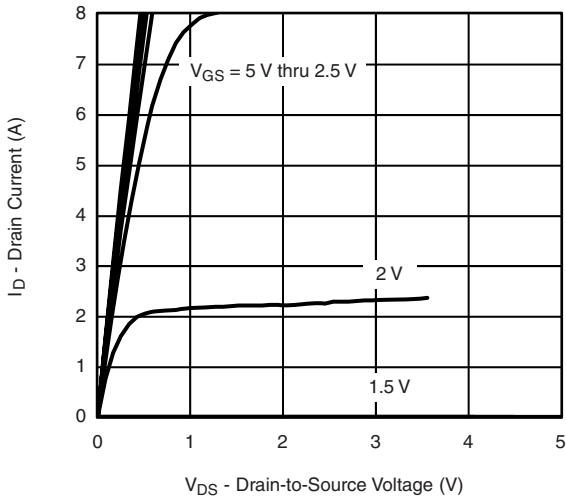
| SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted | | | | | | | |
|---|--------------|---|---|------|-------|------------------------|---------------|
| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit | |
| Static | | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250 \mu\text{A}$ | N-Ch | 0.6 | | 1.5 | V |
| | | $V_{DS} = V_{GS}, I_D = -250 \mu\text{A}$ | P-Ch | -0.6 | | -1.5 | |
| Gate-Body Leakage | I_{GSS} | $V_{DS} = 0 \text{ V}, V_{GS} = \pm 12 \text{ V}$ | N-Ch P-Ch | | | ± 100 ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$ | N-Ch | | | 1 | μA |
| | | $V_{DS} = -30 \text{ V}, V_{GS} = 0 \text{ V}$ | P-Ch | | | -1 | |
| | | $V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ\text{C}$ | N-Ch | | | 5 | |
| | | $V_{DS} = -30 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 55^\circ\text{C}$ | P-Ch | | | -5 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \geq 5 \text{ V}, V_{GS} = 4.5 \text{ V}$ | N-Ch | 5 | | | A |
| | | $V_{DS} \leq -5 \text{ V}, V_{GS} = -4.5 \text{ V}$ | P-Ch | -5 | | | |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = 4.5 \text{ V}, I_D = 3 \text{ A}$ | N-Ch | | 0.062 | 0.077 | Ω |
| | | $V_{GS} = -4.5 \text{ V}, I_D = -2 \text{ A}$ | P-Ch | | 0.135 | 0.170 | |
| | | $V_{GS} = 2.5 \text{ V}, I_D = 2 \text{ A}$ | N-Ch | | 0.095 | 0.120 | |
| | | $V_{GS} = -2.5 \text{ V}, I_D = -1.2 \text{ A}$ | P-Ch | | 0.235 | 0.300 | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 5 \text{ V}, I_D = 3 \text{ A}$ | N-Ch | | 10 | | S |
| | | $V_{DS} = -5 \text{ V}, I_D = -2 \text{ A}$ | P-Ch | | 5 | | |
| Diode Forward Voltage ^a | V_{SD} | $I_S = 1.05 \text{ A}, V_{GS} = 0 \text{ V}$ | N-Ch | | 0.80 | 1.10 | V |
| | | $I_S = -1.05 \text{ A}, V_{GS} = 0 \text{ V}$ | P-Ch | | -0.83 | -1.10 | |
| Dynamic^b | | | | | | | |
| Total Gate Charge | Q_g | N-Channel $V_{DS} = 15 \text{ V}, V_{GS} = 4.5 \text{ V}, I_D = 2 \text{ A}$ P-Channel $V_{DS} = -15 \text{ V}, V_{GS} = -4.5 \text{ V}, I_D = -2 \text{ A}$ | N-Ch | | 3 | 4.5 | nC |
| Gate-Source Charge | Q_{gs} | | P-Ch | | 3.8 | 6 | |
| Gate-Drain Charge | Q_{gd} | | N-Ch | | 0.6 | | |
| | | | P-Ch | | 0.6 | | |
| Turn-On Delay Time | $t_{d(on)}$ | N-Channel $V_{DD} = 15 \text{ V}, R_L = 15 \Omega$ $I_D \cong 1 \text{ A}, V_{GEN} = 10 \text{ V}, R_g = 6 \Omega$ P-Channel $V_{DD} = -15 \text{ V}, R_L = 15 \Omega$ $I_D \cong -1 \text{ A}, V_{GEN} = -10 \text{ V}, R_g = 6 \Omega$ | N-Ch | | 5 | 8 | ns |
| Rise Time | t_r | | P-Ch | | 5 | 8 | |
| | | | N-Ch | | 12 | 23 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | P-Ch | | 15 | 23 | |
| | | | N-Ch | | 13 | 23 | |
| Fall Time | t_f | | P-Ch | | 20 | 30 | |
| | | | N-Ch | | 7 | 12 | |
| Source-Drain Reverse Recovery Time | t_{rr} | | $I_F = 1.05 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ | N-Ch | | 15 | |
| | | $I_F = -1.05 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ | P-Ch | | 18 | 30 | |

Notes:

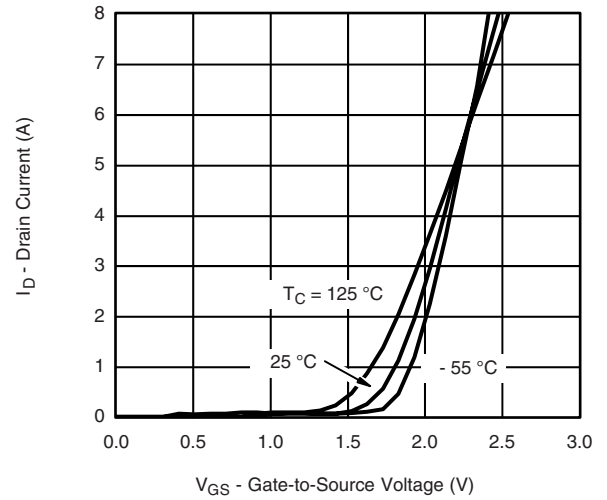
- a. Pulse test; pulse width $\leq 300 \mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.

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.

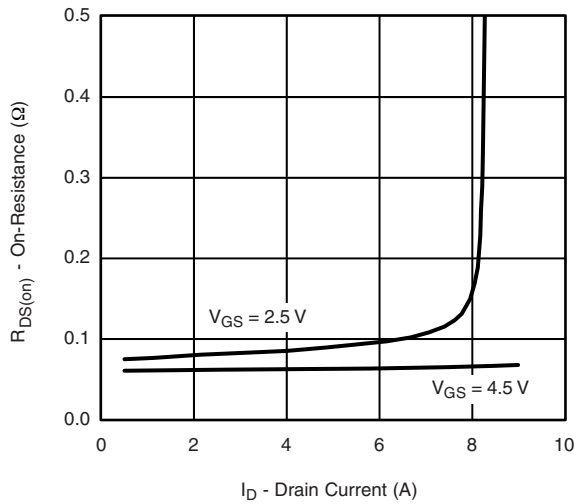
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C unless noted



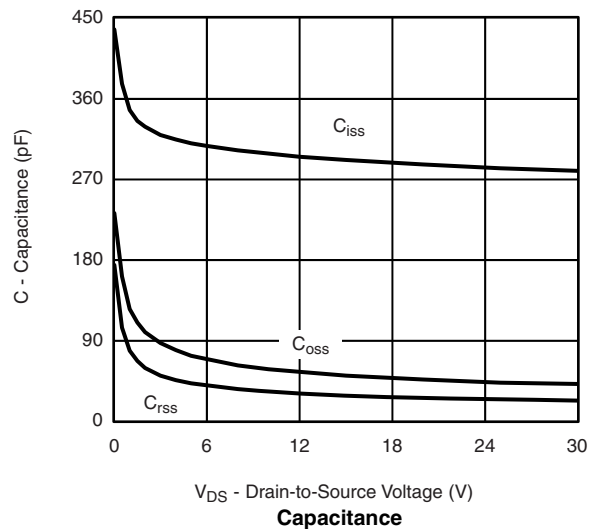
Output Characteristics



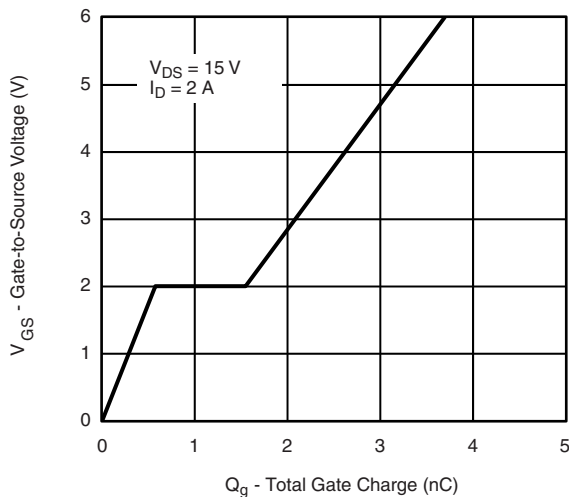
Transfer Characteristics



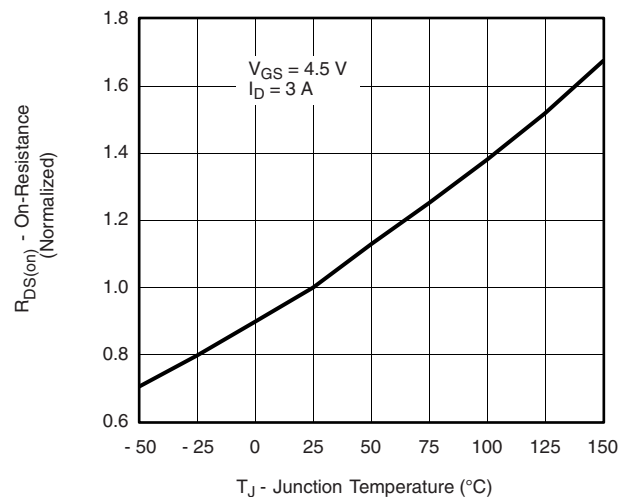
On-Resistance vs. Drain Current



Capacitance

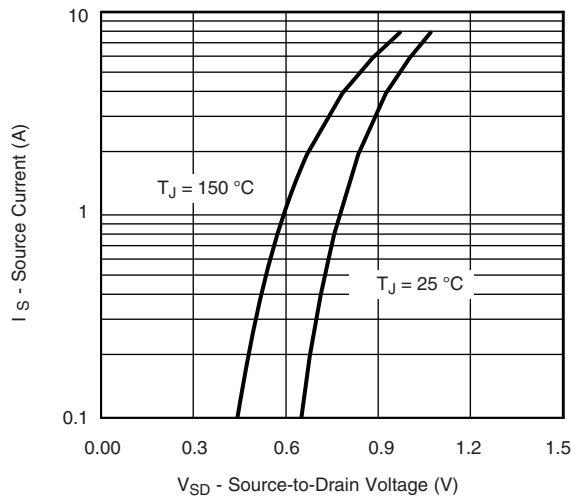


Gate Charge

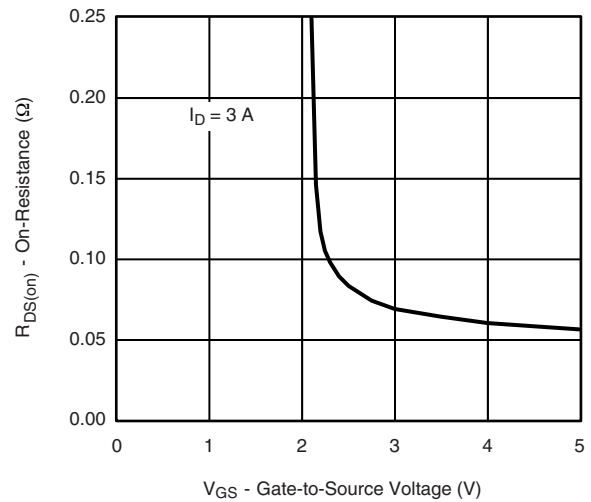


On-Resistance vs. Junction Temperature

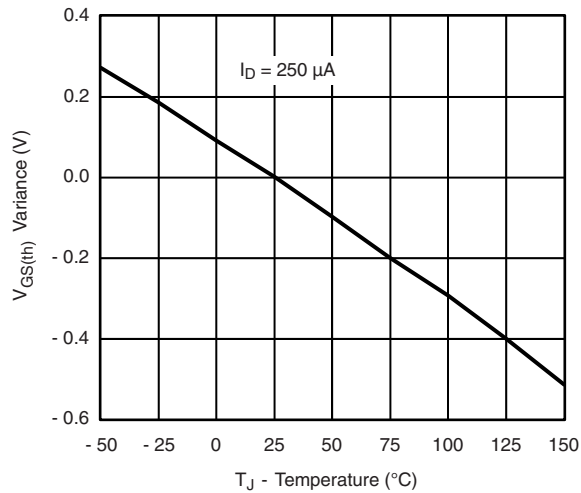
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C unless noted



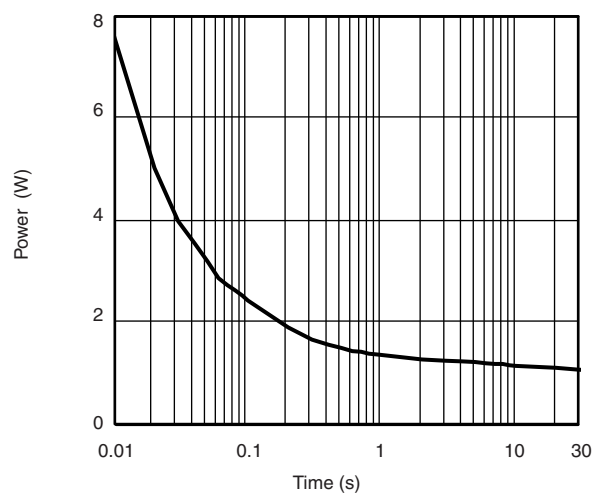
Source-Drain Diode Forward Voltage



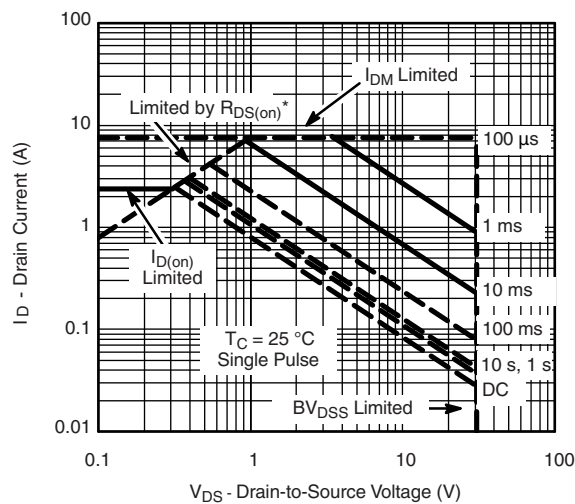
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



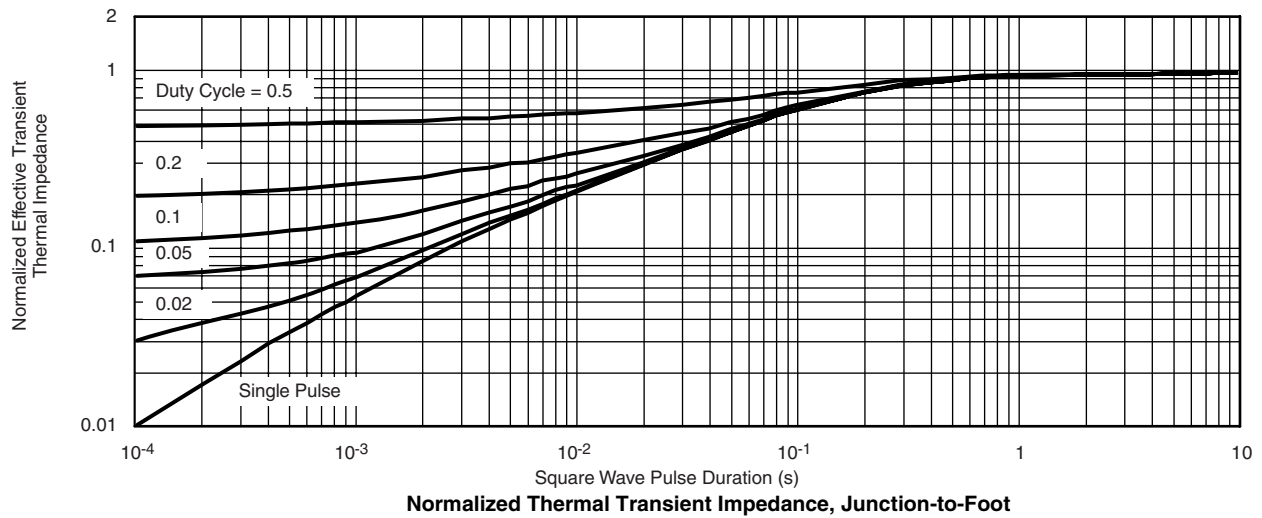
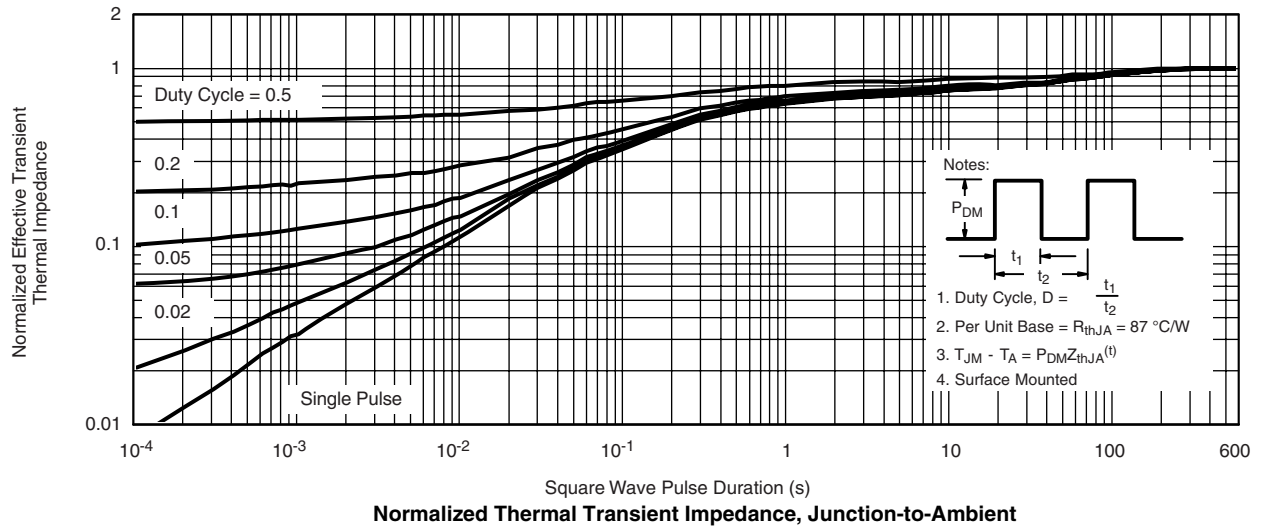
Single Pulse Power, Junction-to-Ambient



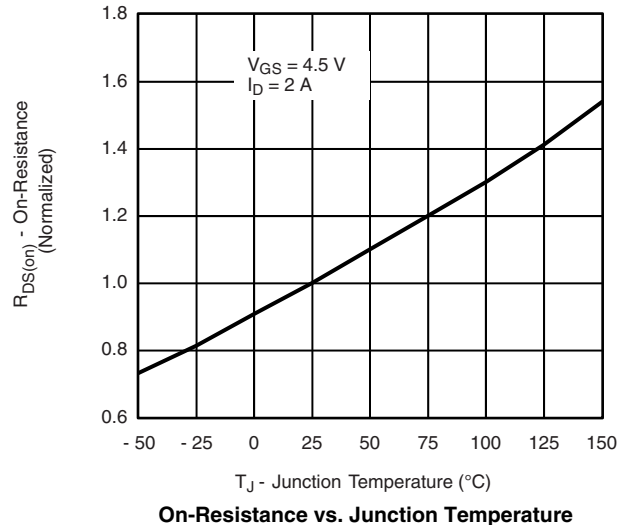
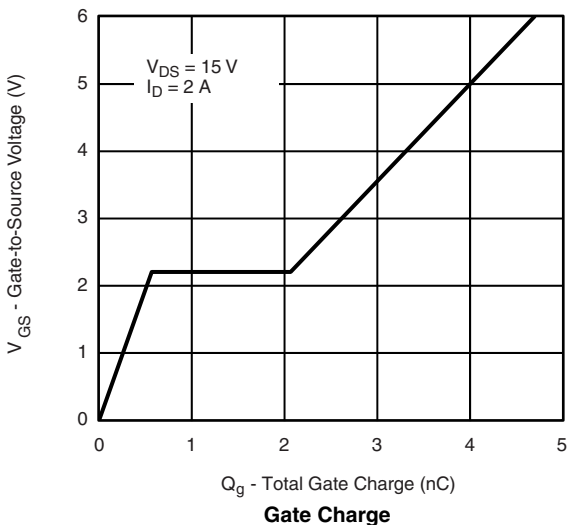
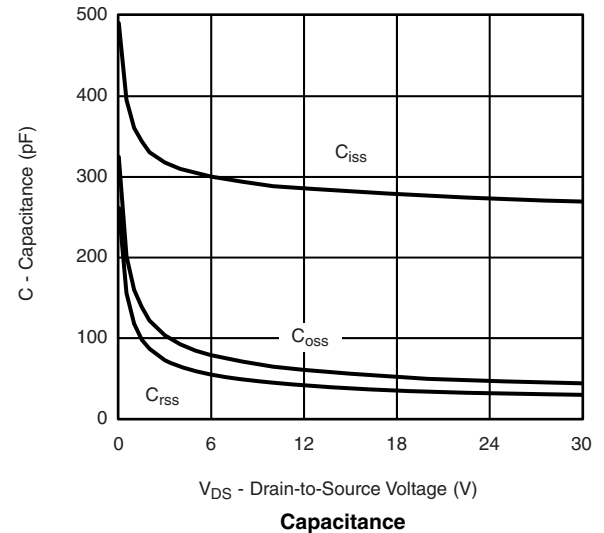
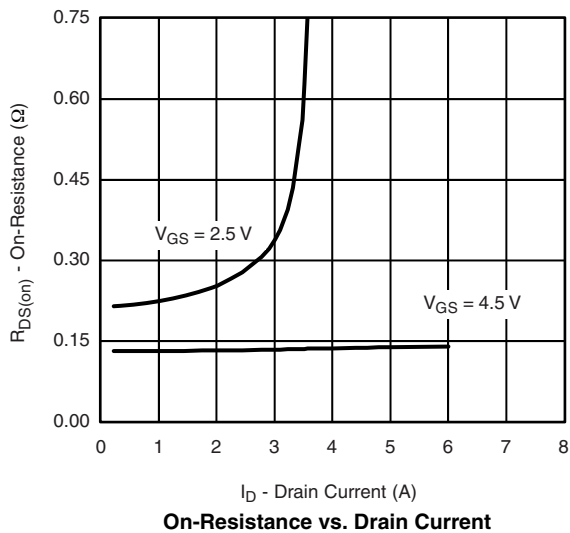
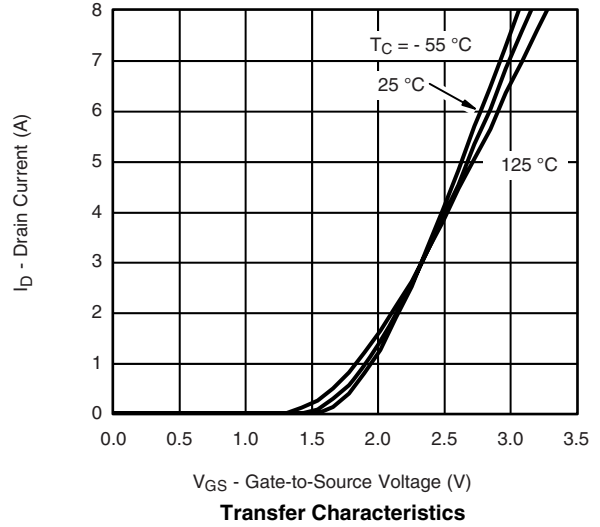
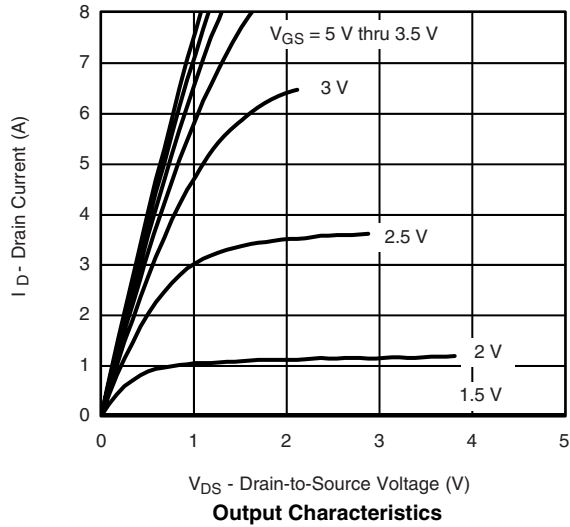
* $V_{GS} > \text{minimum } V_{GS} \text{ at which } R_{DS(on)} \text{ is specified}$

Safe Operating Area, Junction-to-Case

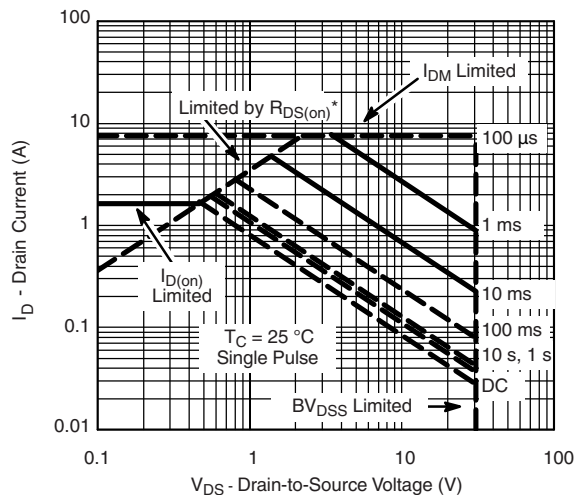
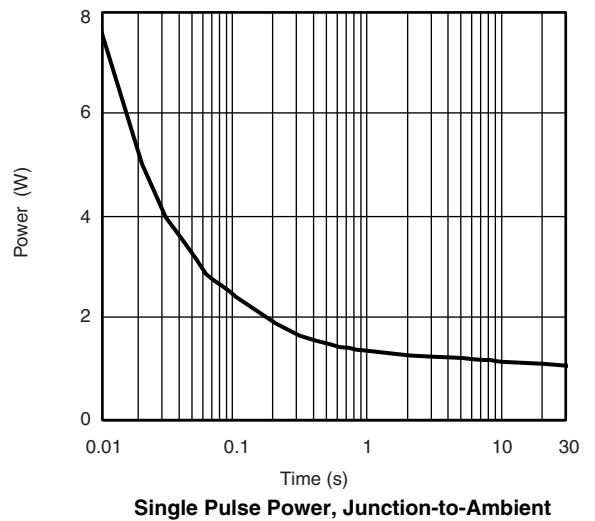
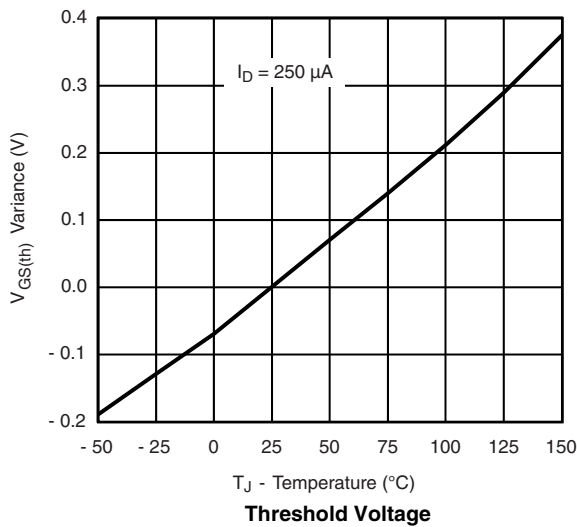
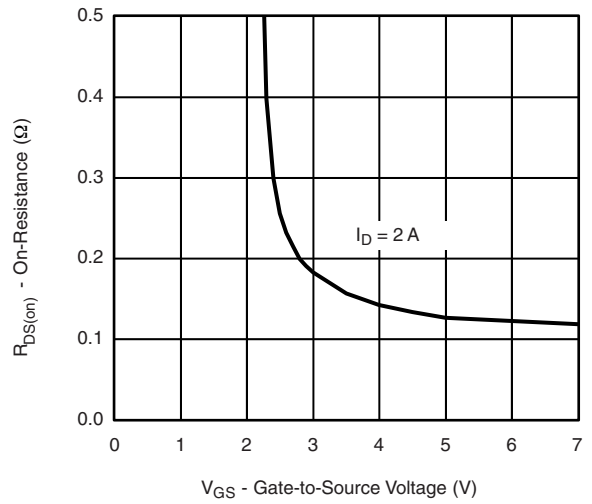
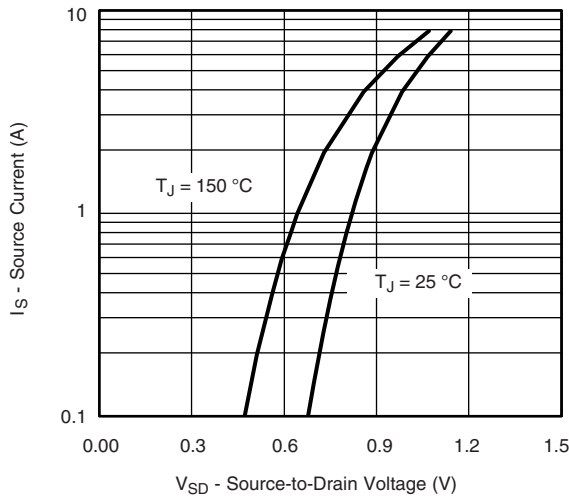
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C unless noted



P-CHANNEL TYPICAL CHARACTERISTICS 25 °C unless noted

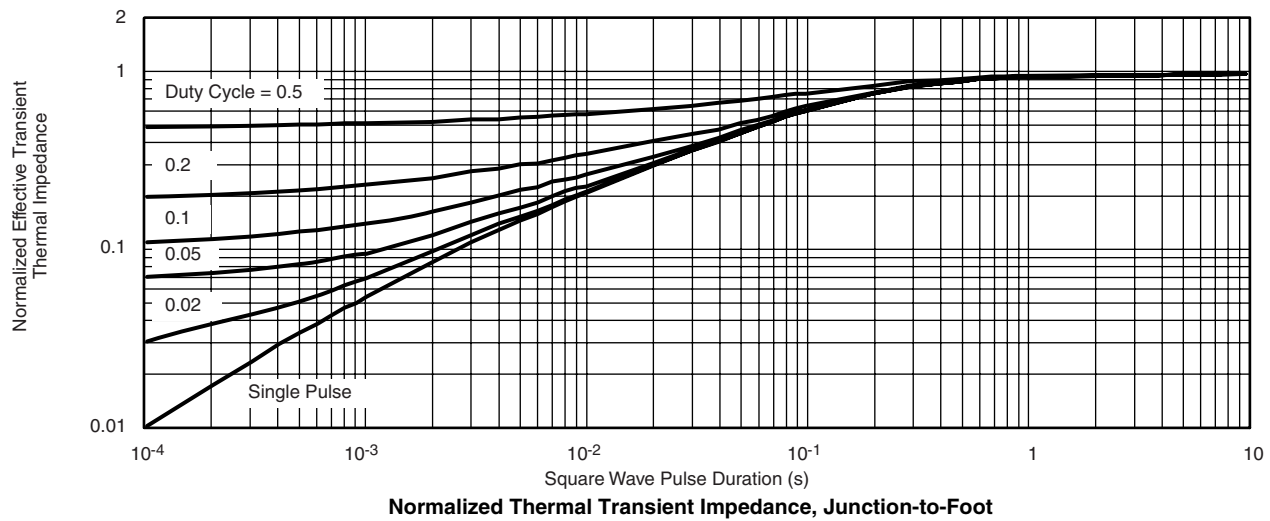
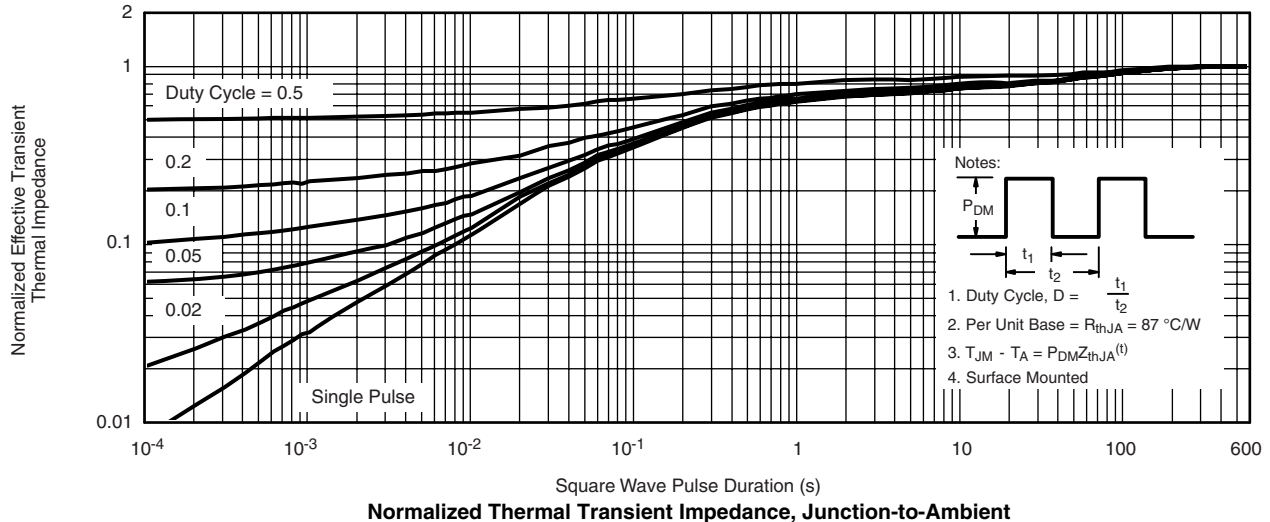


P-CHANNEL TYPICAL CHARACTERISTICS 25 °C unless noted



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

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C unless noted



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