

Dual N-Channel Enhancement Mode MOSFET

TDM3412

DESCRIPTION

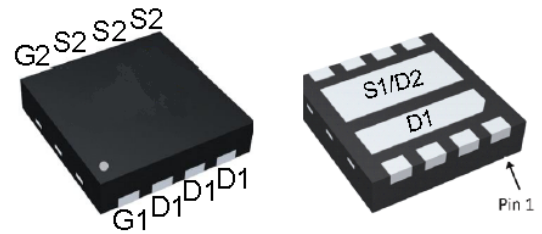
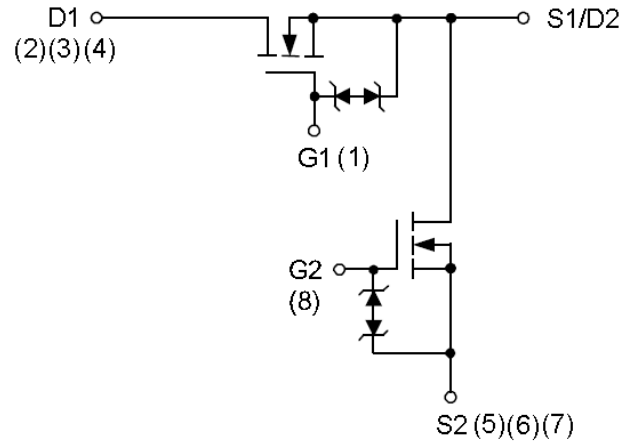
The TDM3412 uses advanced trench technology to provide excellent RDS(ON) and low gate charge. This device is suitable for use as a load switch or in PWM applications.

GENERAL FEATURES

- Channel 1
RDS(ON) < 17.5mΩ @ VGS=4.5V
RDS(ON) < 10.8mΩ @ VGS=10V
- Channel 2
RDS(ON) < 16mΩ @ VGS=4.5V
RDS(ON) < 10mΩ @ VGS=10V
- High Power and current handling capability
- ESD protection
- Lead free product is available
- Surface Mount Package

Application

- PWM applications
- Load switch
- Power management



DFN3x3E-8_EP2

ABSOLUTE MAXIMUM RATINGS(TA=25°C unless otherwise noted)

| Parameter | Symbol | Channel 1 | Channel 2 | Unit |
|--|--|------------|-----------|------|
| Drain-Source Voltage | V _{DS} | 30 | 30 | V |
| Gate-Source Voltage | V _{GS} | +20 | +20 | V |
| Diode Continuous Forward Current | I _S (T _C =25°C) | 5 | 5 | A |
| Continuous Drain Current ^(note1) | I _D (T _C =25°C) | 18 | 18 | A |
| Pulse Drain Current Tested ^(note4) | I _{DP} (T _C =25°C) | 45 | 45 | A |
| Maximum Power Dissipation | P _D (T _C =25°C) | 20 | 20 | W |
| Continuous Drain Current | I _D (T _A =25°C) | 8.4 | 9.1 | A |
| | I _D (T _A =70°C) | 6.7 | 7.3 | |
| Pulse Drain Current Tested | I _{DP} (T _A =25°C) | 33.5 | 36 | A |
| Maximum Power Dissipation | P _D (T _A =25°C) | 1.14 | 1.13 | W |
| Thermal Resistance-Junction to Ambient ^(note 5) | R _{θJA} (t≤10s) | 66 | 60 | °C/W |
| | R _{θJA} (Steady State) | 110 | 100 | |
| Thermal Resistance-Junction to Case | R _{θJC} (Steady State) | 6 | 6 | °C/W |
| Maximum Operating Junction Temperature | T _J | 150 | | °C |
| Storage Temperature Range | T _{STG} | -55 To 150 | | °C |

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

| Parameter | Symbol | Condition | Channel1 | | | Unit |
|---|--------------|--|----------|------|----------|------------|
| | | | Min | Typ | Max | |
| OFF CHARACTERISTICS | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 30 | - | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=24V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 10 | μA |
| ON CHARACTERISTICS (Note 2) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1.4 | 1.8 | 2.5 | V |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=10A$ | - | 9 | 10.8 | m Ω |
| | | $V_{GS}=4.5V, I_D=8A$ | - | 13.5 | 17.5 | m Ω |
| DYNAMIC CHARACTERISTICS (Note3) | | | | | | |
| Gate Resistance | R_G | $V_{GS}=0V, V_{DS}=0V, F=1MHz$ | - | 1.35 | 2.5 | Ω |
| Input Capacitance | C_{iss} | $V_{DS}=15V, V_{GS}=0V, F=1.0MHz$ | - | 450 | 600 | PF |
| Output Capacitance | C_{oss} | | - | 318 | - | PF |
| Reverse Transfer Capacitance | C_{rss} | | - | 22 | - | PF |
| SWITCHING CHARACTERISTICS (Note 3) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DS}=15V, R_L=15\Omega, V_{GEN}=10V, R_G=6\Omega, I_D=1A$ | - | 8.5 | 16 | nS |
| Turn-on Rise Time | t_r | | - | 10 | 18 | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 14 | 26 | nS |
| Turn-Off Fall Time | t_f | | - | 10.6 | 19 | nS |
| Total Gate Charge | Q_g | $V_{DS}=15V, I_D=10A, V_{GS}=10V$ | - | 8 | 12 | nC |
| Gate-Source Charge | Q_{gs} | | - | 1.6 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 1.2 | - | nC |
| Body Diode Reverse Recovery Time | T_{rr} | $I_{DS}=10A, di/dt=100A/\mu s$ | - | 20.5 | - | nS |
| Body Diode Reverse Recovery Charge | Q_{rr} | | - | 7.2 | - | nC |
| DRAIN-SOURCE DIODE CHARACTERISTICS | | | | | | |
| Diode Forward Voltage (Note 2) | V_{SD} | $V_{GS}=0V, I_S=5A$ | - | 0.8 | 1.1 | V |

NOTES:

1. Max continuous current is limited by bonding wire.
2. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
3. Guaranteed by design, not subject to production testing.
4. Pulse width is limited by max. junction temperature.
5. $R_{\theta JA}$ steady state $t=999s$

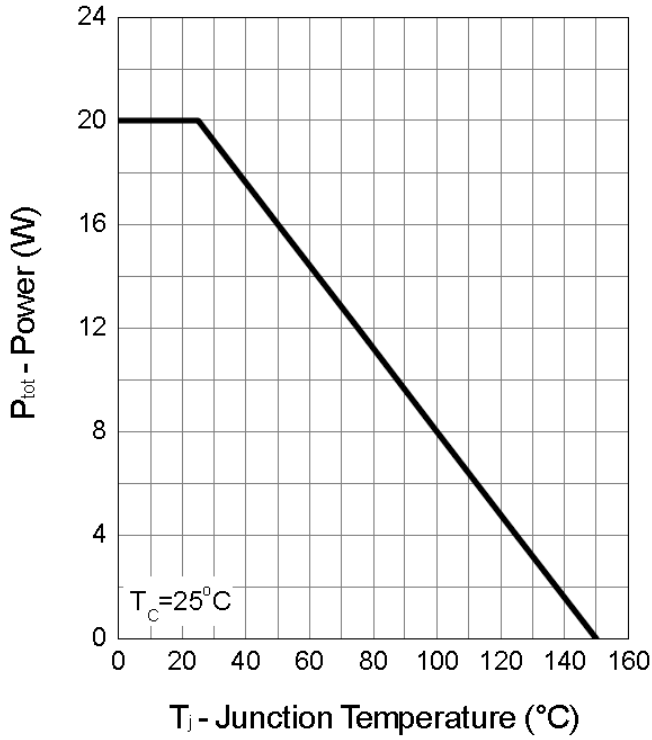
ELECTRICAL CHARACTERISTICS Cont. ($T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Condition | Channel2 | | | Unit |
|---|--------------|--|----------|------|----------|------------|
| | | | Min | Typ | Max | |
| OFF CHARACTERISTICS | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 30 | - | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=24V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 10 | μA |
| ON CHARACTERISTICS (Note 2) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1.4 | 1.8 | 2.5 | V |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=10A$ | - | 8.2 | 10 | m Ω |
| | | $V_{GS}=4.5V, I_D=8A$ | - | 12.3 | 16 | m Ω |
| DYNAMIC CHARACTERISTICS (Note3) | | | | | | |
| Gate Resistance | R_G | $V_{GS}=0V, V_{DS}=0V, F=1MHz$ | - | 1.35 | 2.5 | Ω |
| Input Capacitance | C_{iss} | $V_{DS}=15V, V_{GS}=0V, F=1.0MHz$ | - | 450 | 600 | PF |
| Output Capacitance | C_{oss} | | - | 318 | - | PF |
| Reverse Transfer Capacitance | C_{rss} | | - | 22 | - | PF |
| SWITCHING CHARACTERISTICS (Note 3) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DS}=15V, R_L=15\Omega, V_{GEN}=10V, R_G=6\Omega, I_D=1A$ | - | 8.5 | 16 | nS |
| Turn-on Rise Time | t_r | | - | 10 | 18 | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 14 | 26 | nS |
| Turn-Off Fall Time | t_f | | - | 10.6 | 19 | nS |
| Total Gate Charge | Q_g | $V_{DS}=15V, I_D=10A, V_{GS}=10V$ | - | 8 | 12 | nC |
| Gate-Source Charge | Q_{gs} | | - | 1.6 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 1.2 | - | nC |
| Body Diode Reverse Recovery Time | T_{rr} | $I_{DS}=10A, di/dt=100A/\mu s$ | - | 20.5 | - | nS |
| Body Diode Reverse Recovery Charge | Q_{rr} | | - | 7.2 | - | nC |
| DRAIN-SOURCE DIODE CHARACTERISTICS | | | | | | |
| Diode Forward Voltage (Note 2) | V_{SD} | $V_{GS}=0V, I_S=5A$ | - | 0.8 | 1.1 | V |

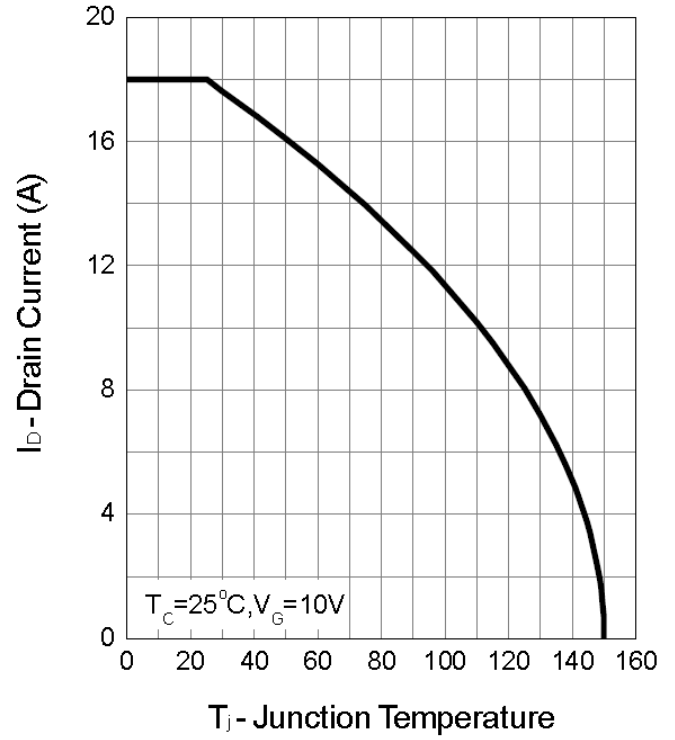
Dual N-Channel Enhancement Mode MOSFET TDM3412

Channel 1 Typical Operating Characteristics

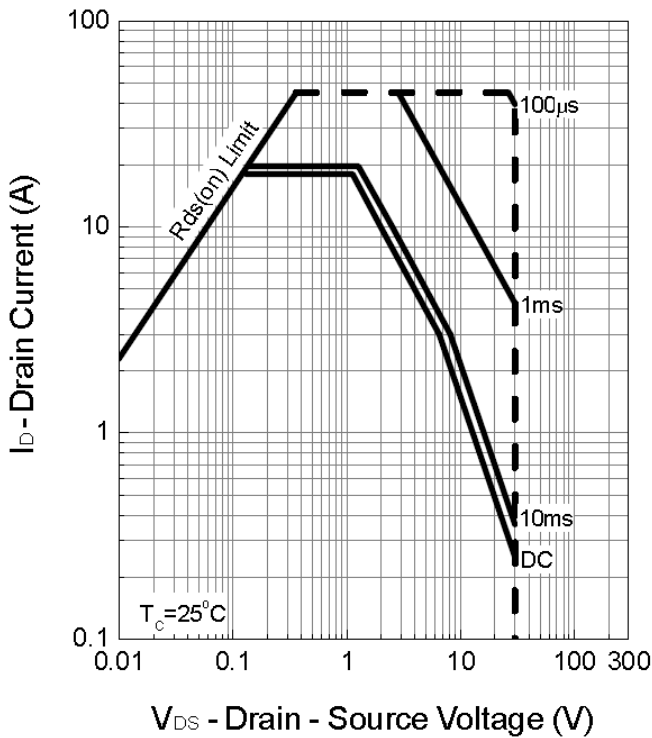
Power Dissipation



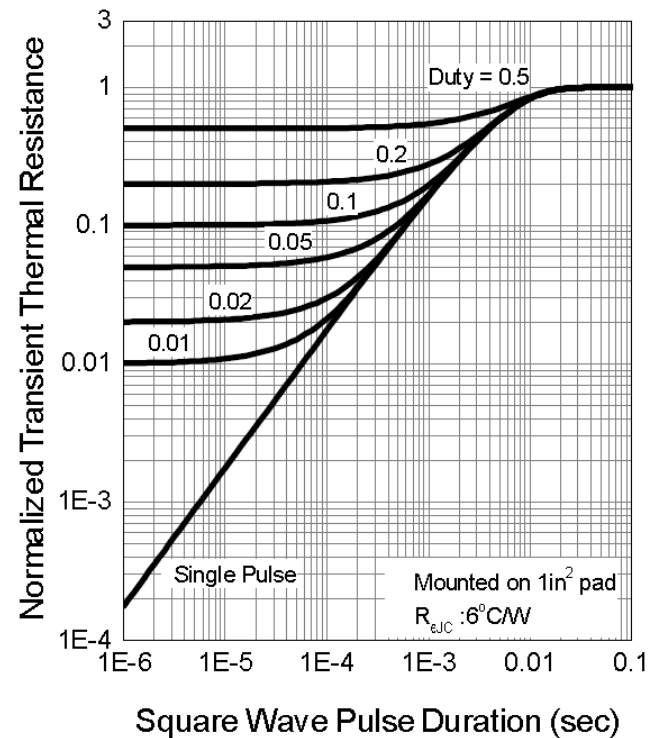
Drain Current



Safe Operation Area



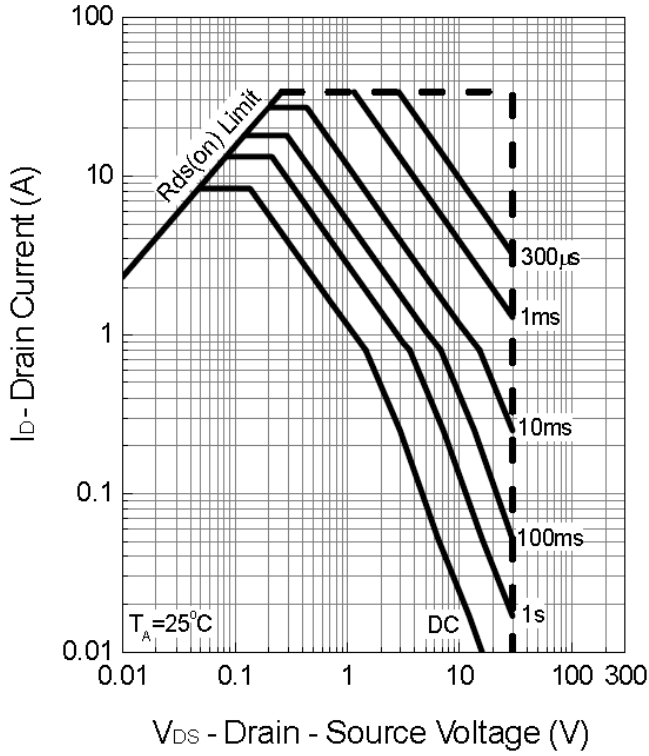
Thermal Transient Impedance



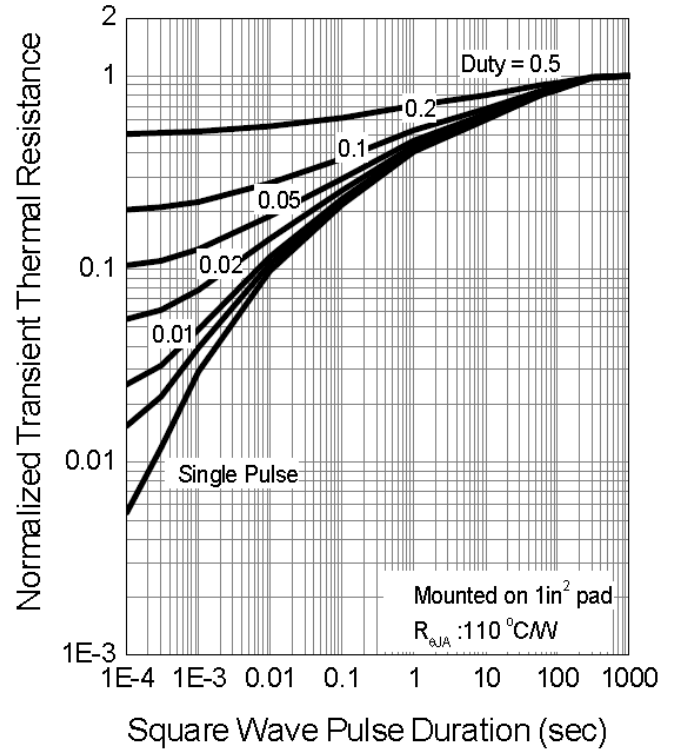
Dual N-Channel Enhancement Mode MOSFET TDM3412

Channel 1 Typical Operating Characteristics(Cont.)

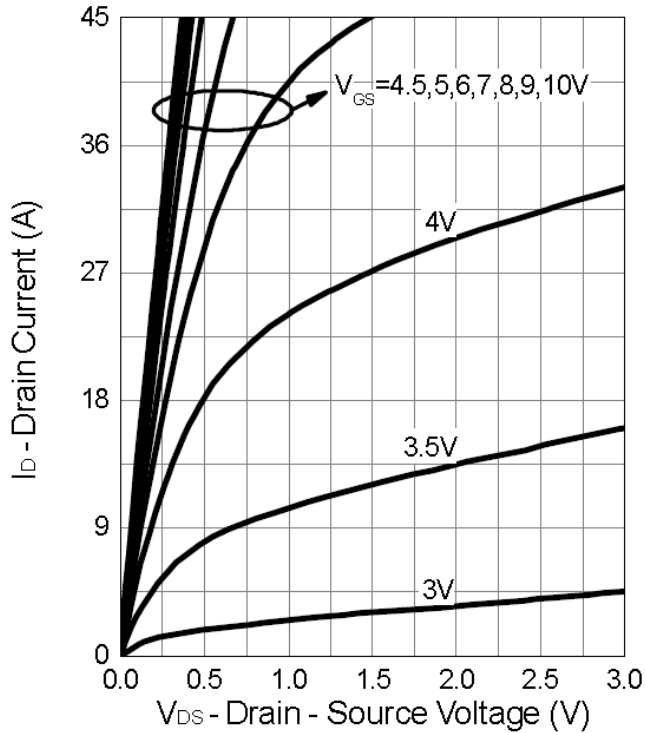
Safe Operation Area



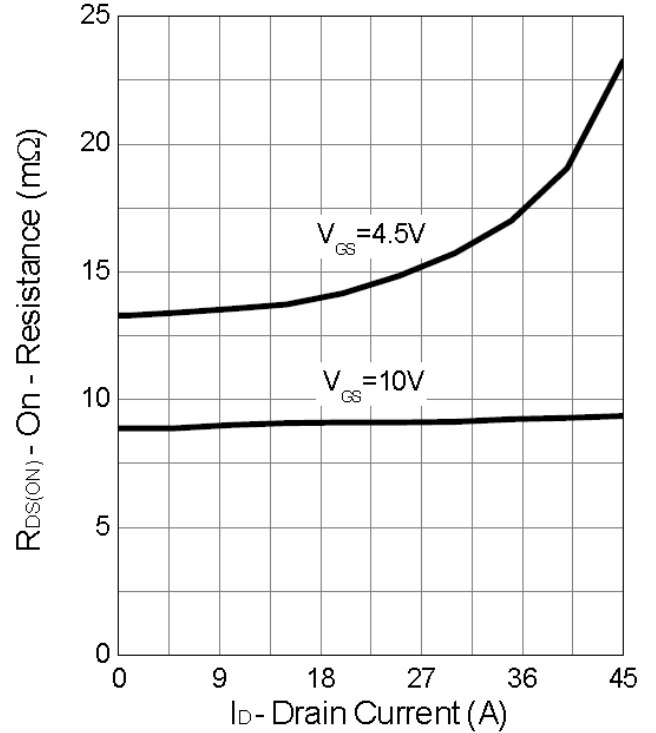
Thermal Transient Impedance



Output Characteristics



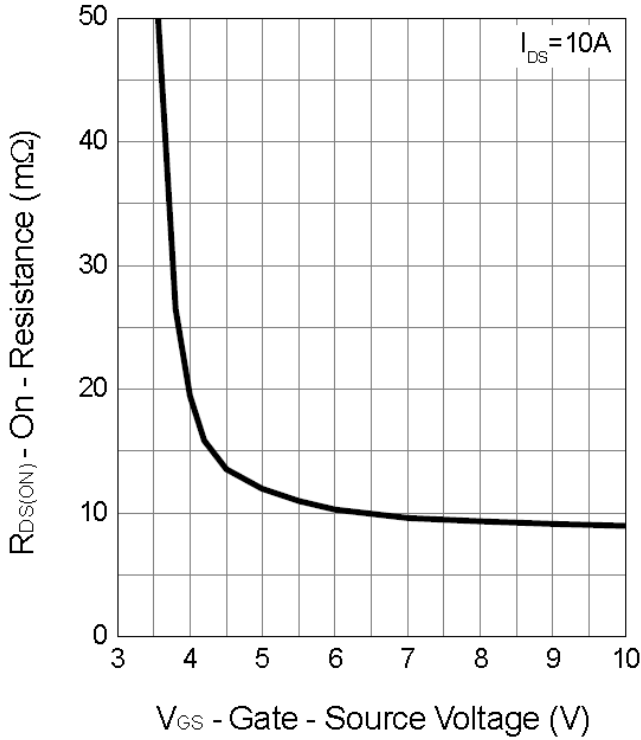
Drain-Source On Resistance



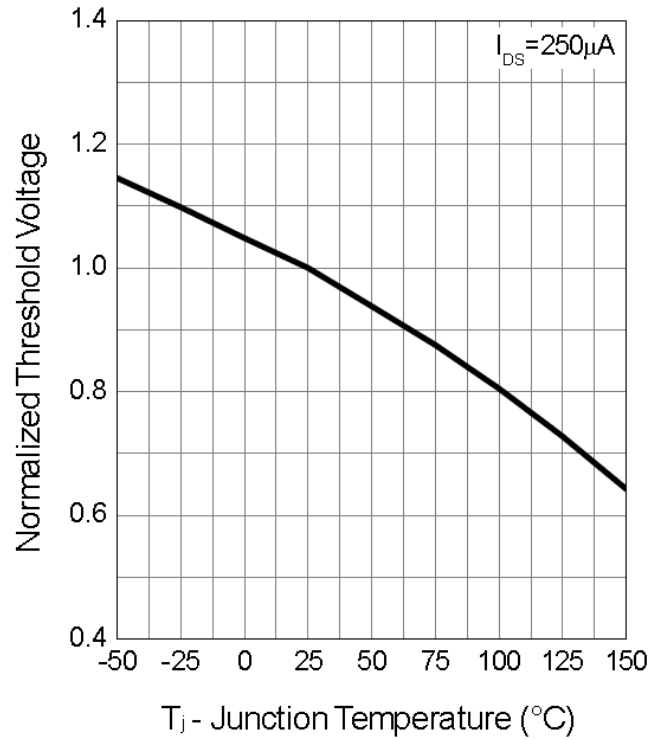
Dual N-Channel Enhancement Mode MOSFET TDM3412

Channel 1 Typical Operating Characteristics (Cont.)

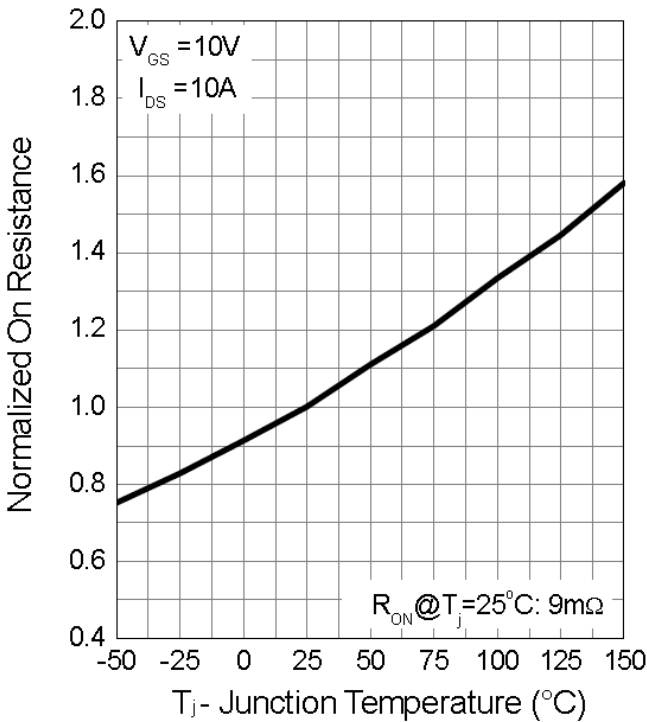
Gate-Source On Resistance



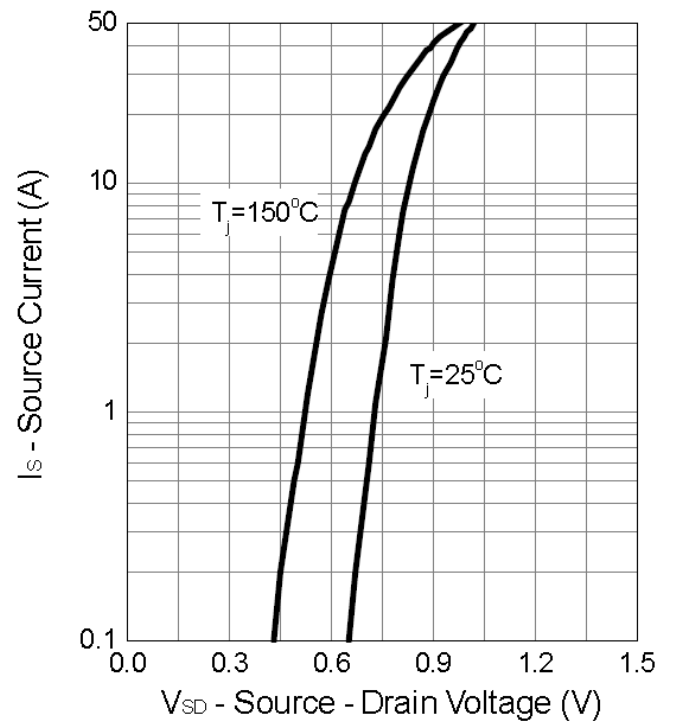
Gate Threshold Voltage



Drain-Source On Resistance



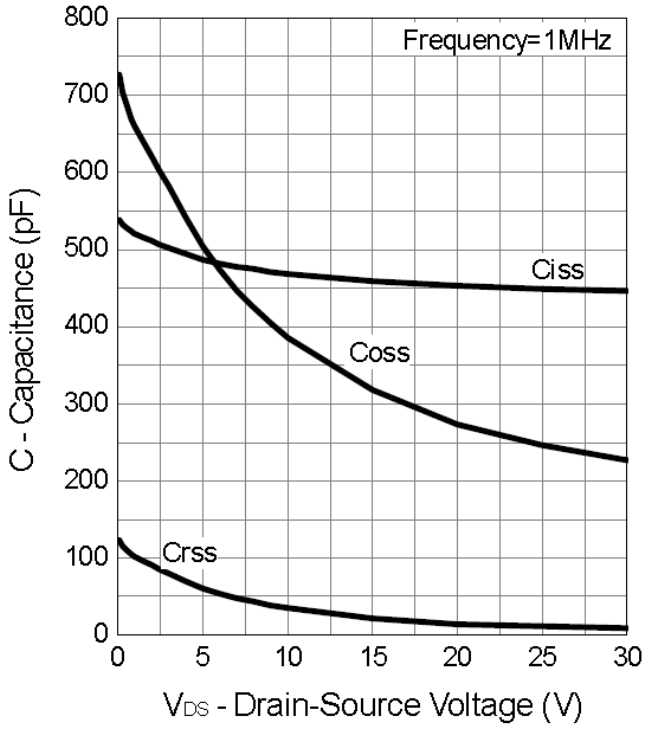
Source-Drain Diode Forward



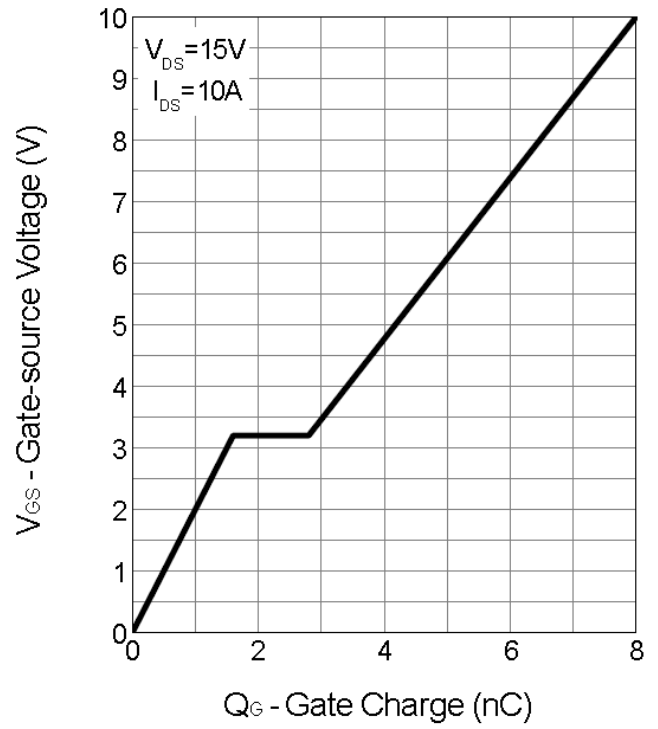
Dual N-Channel Enhancement Mode MOSFET TDM3412

Channel 1 Typical Operating Characteristics (Cont.)

Capacitance



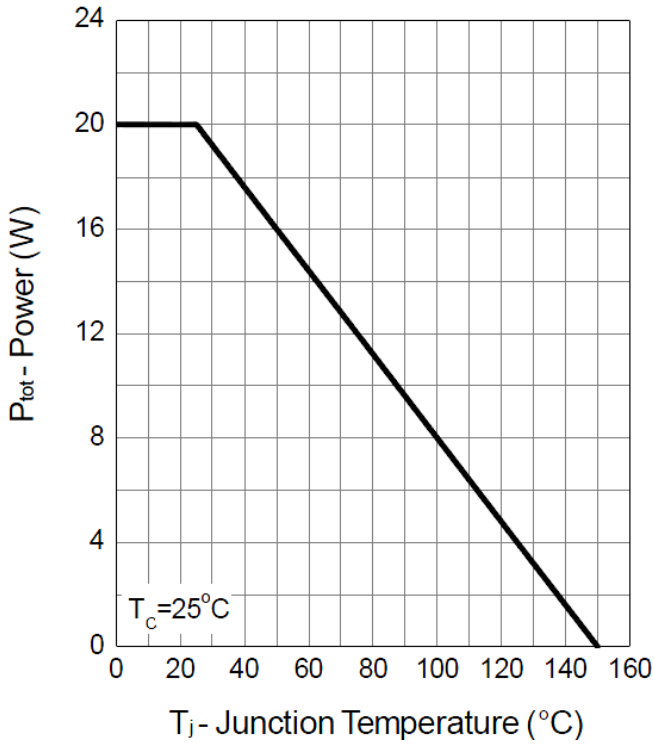
Gate Charge



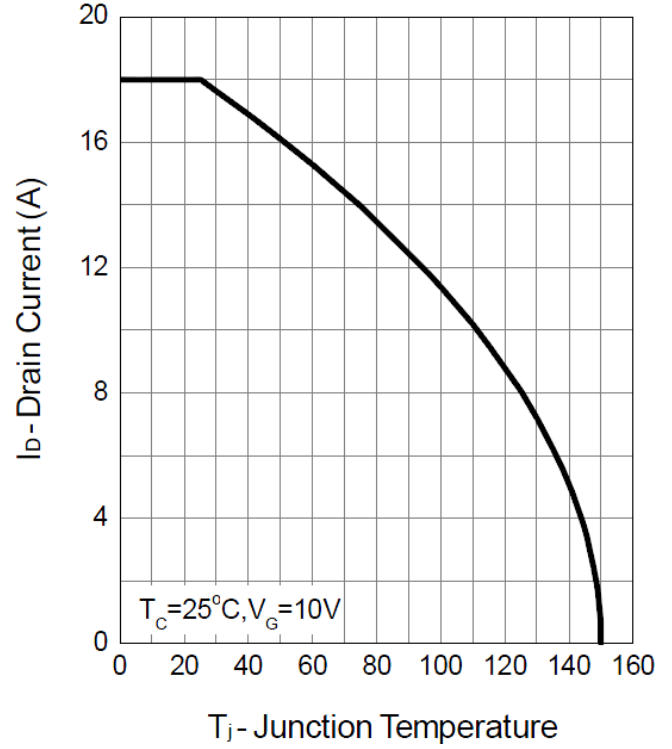
Dual N-Channel Enhancement Mode MOSFET TDM3412

Channel 2 Typical Operating Characteristics

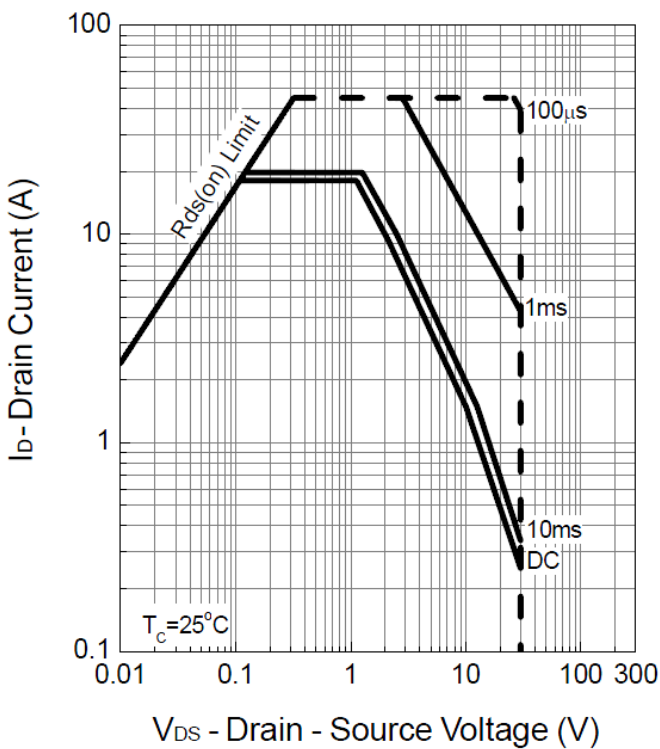
Power Dissipation



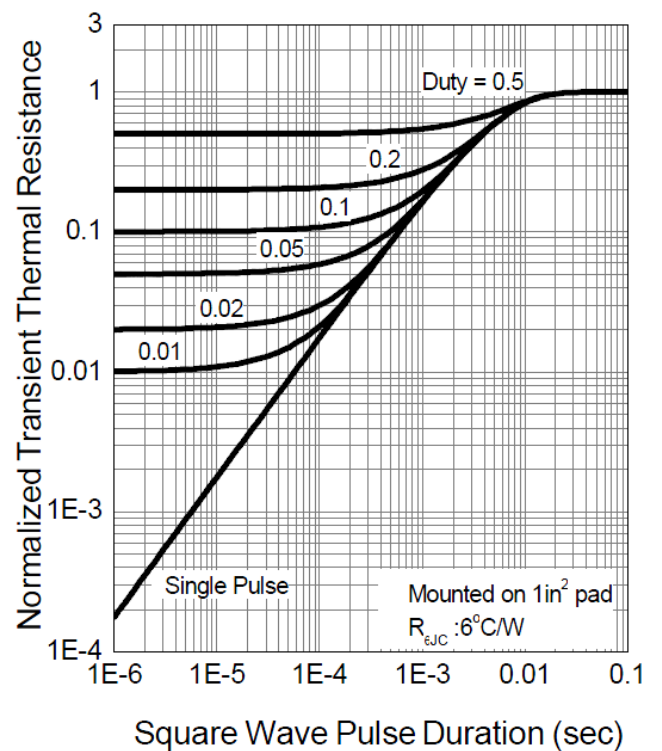
Drain Current



Safe Operation Area



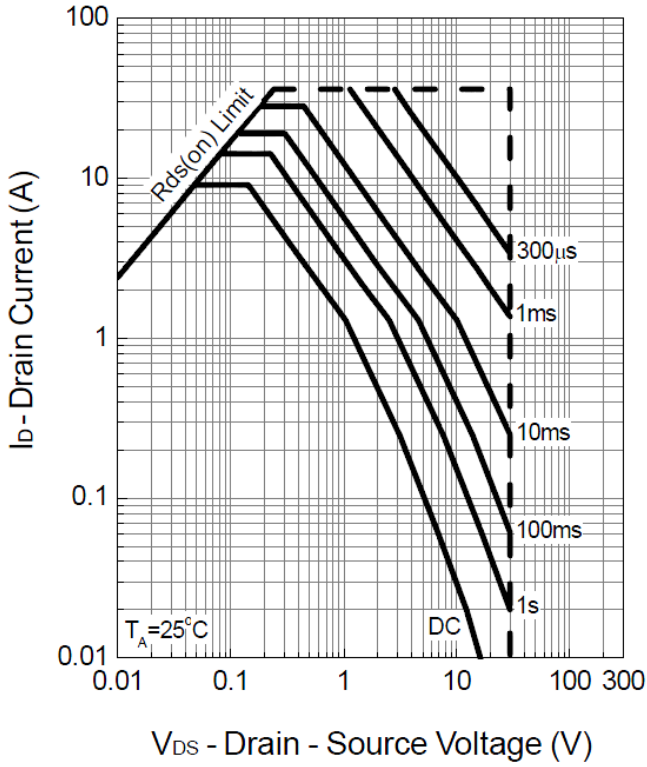
Thermal Transient Impedance



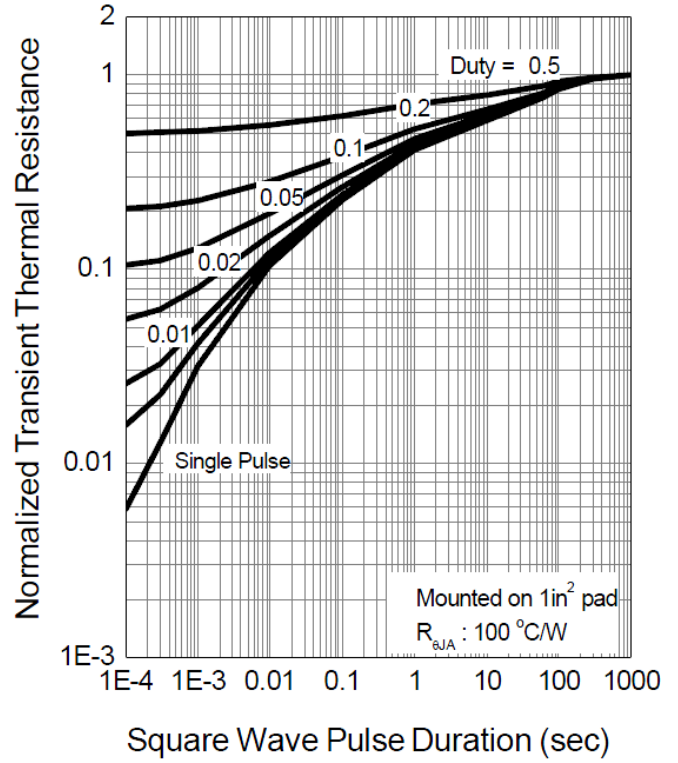
Dual N-Channel Enhancement Mode MOSFET TDM3412

Channel 2 Typical Operating Characteristics (Cont.)

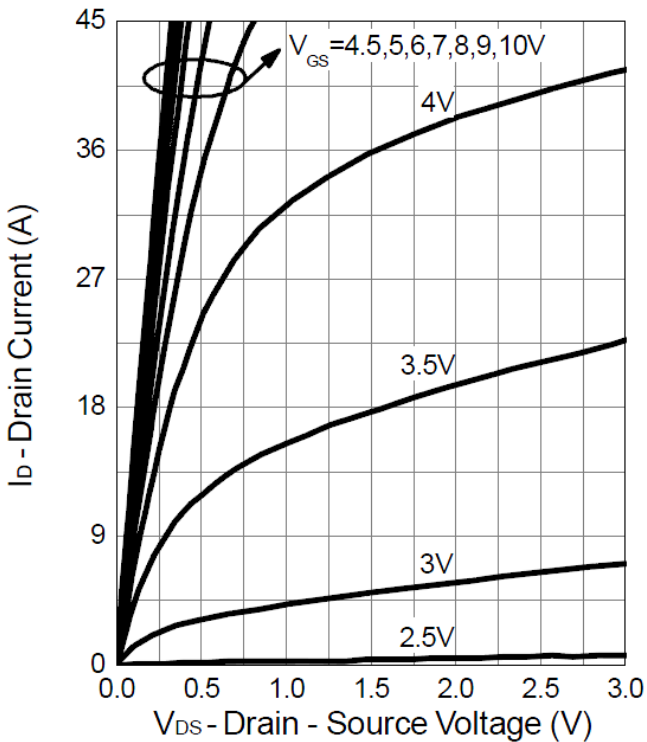
Safe Operation Area



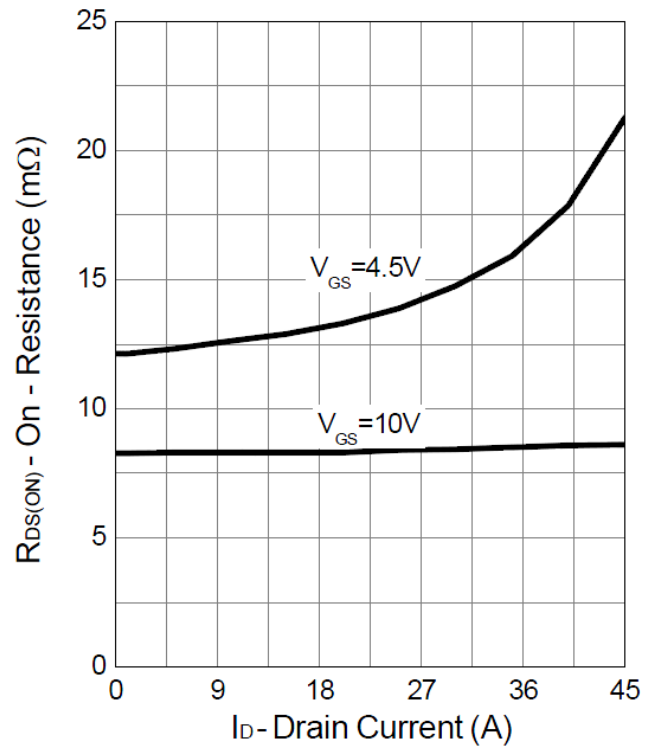
Thermal Transient Impedance



Output Characteristics



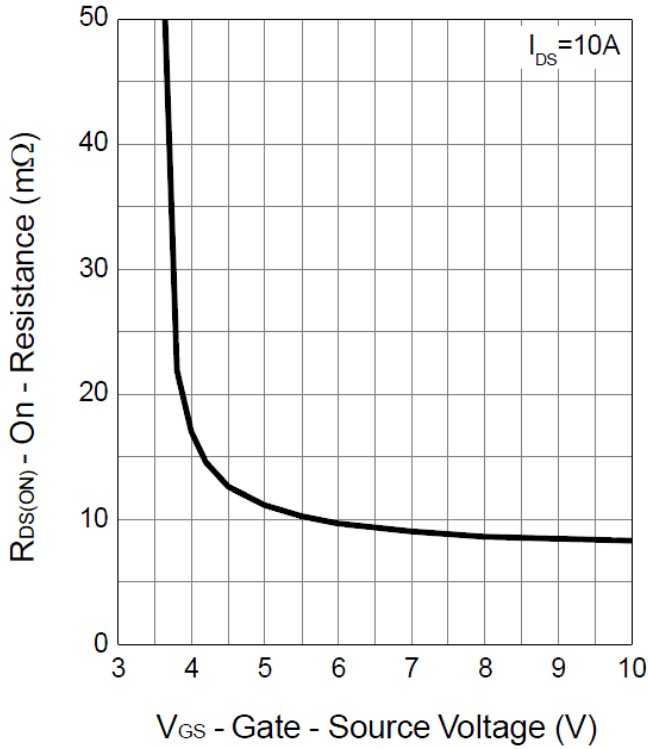
Drain-Source On Resistance



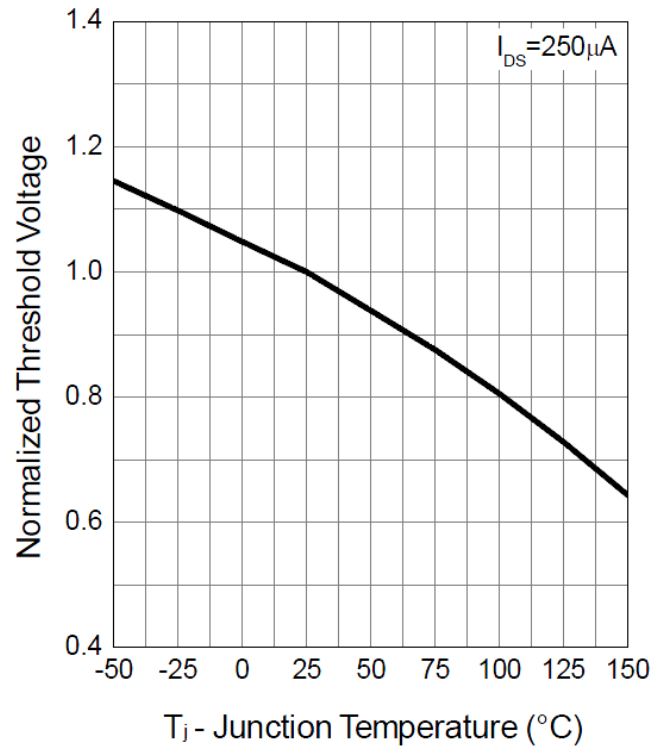
Dual N-Channel Enhancement Mode MOSFET TDM3412

Channel 2 Typical Operating Characteristics (Cont.)

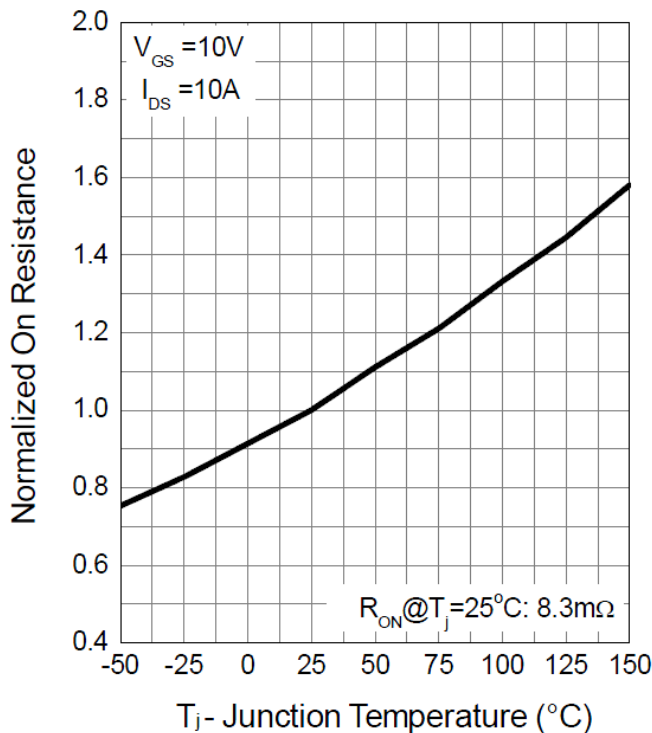
Gate-Source On Resistance



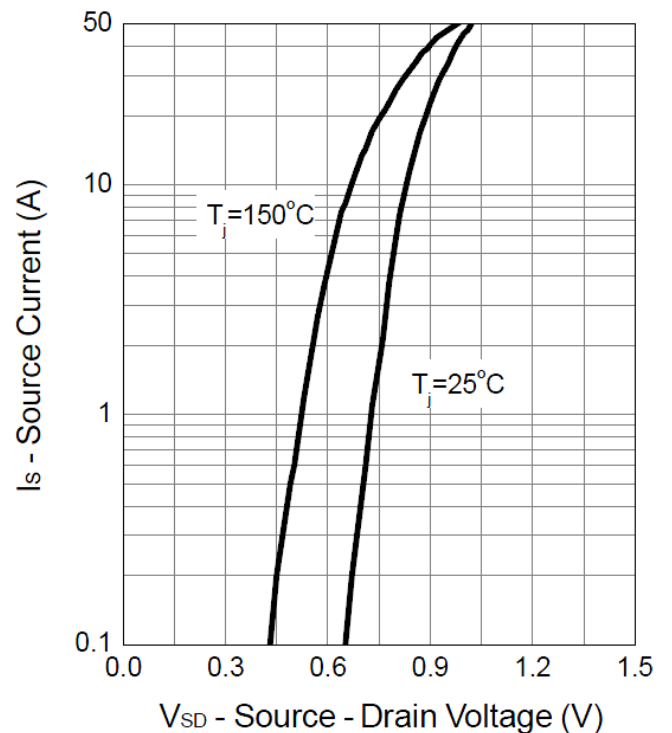
Gate Threshold Voltage



Drain-Source On Resistance

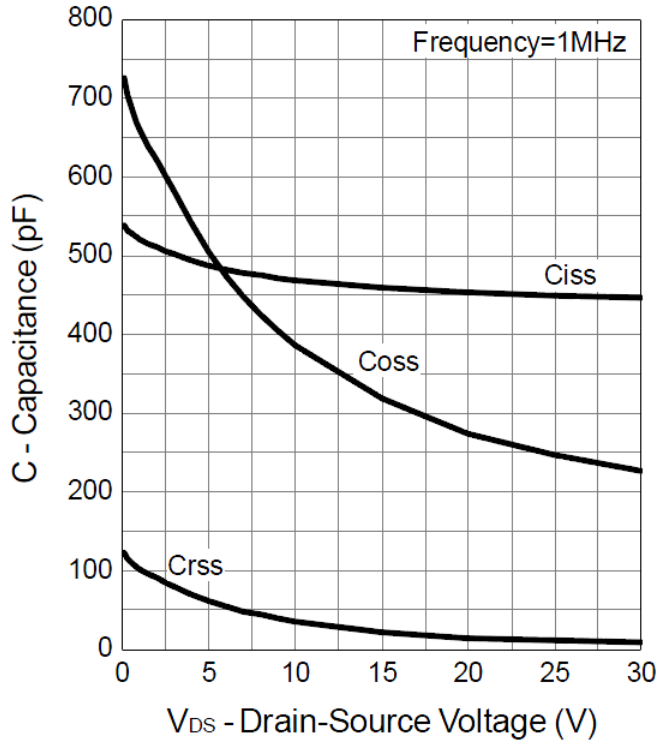


Source-Drain Diode Forward

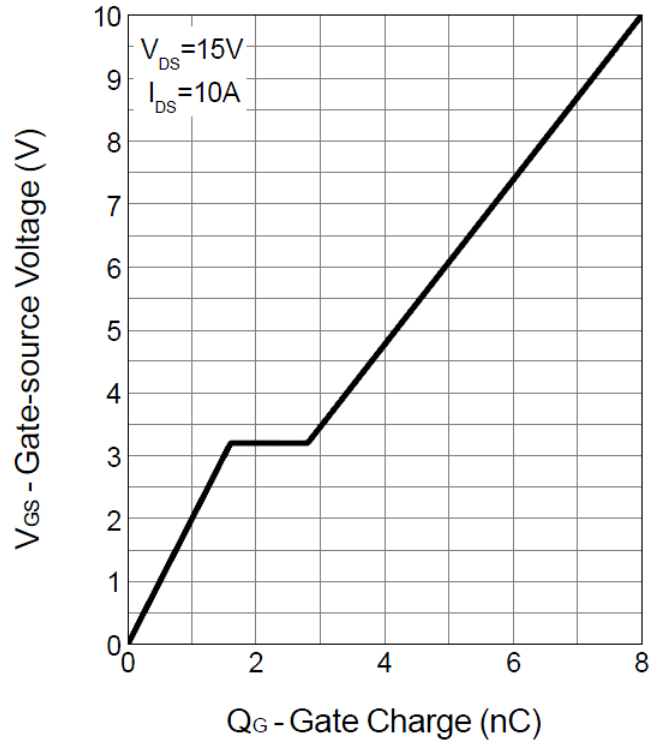


Channel 2 Typical Operating Characteristics (Cont.)

Capacitance

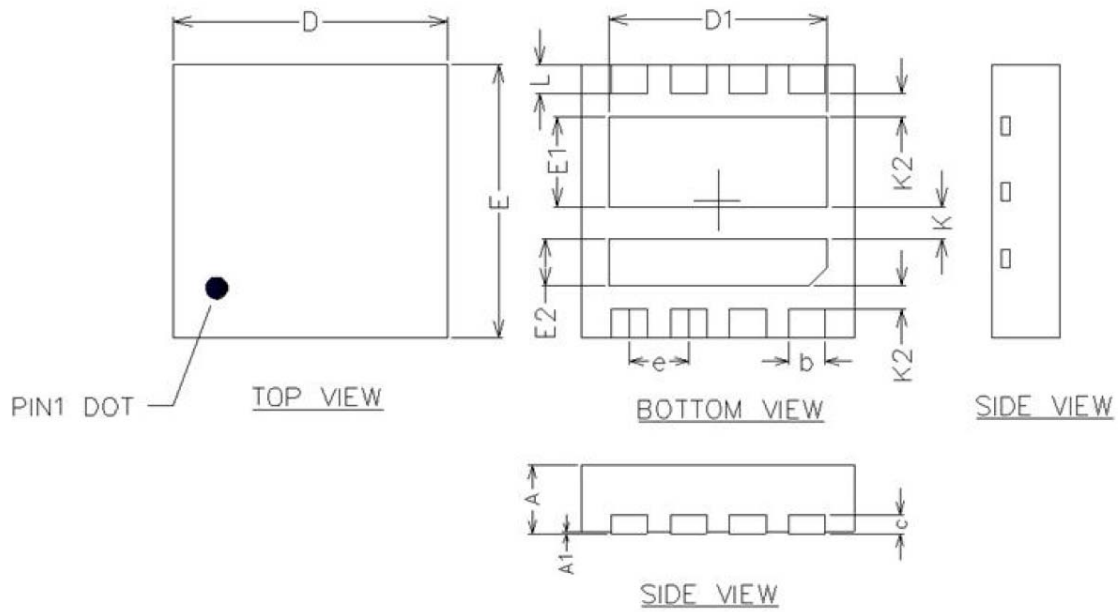


Gate Charge



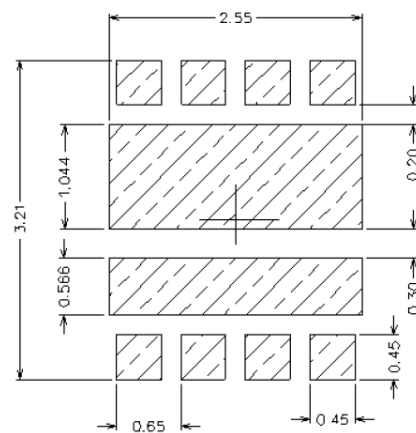
Package Information

DFN3*3E-8 Package



| SYMBOLS | DFN3x3E-8_EP2_S | | | |
|---------|-----------------|------|------------|-------|
| | MILLIMETERS | | INCHES | |
| | MIN. | MAX. | MIN. | MAX. |
| A | 0.7 | 0.8 | 0.028 | 0.032 |
| A1 | 0 | 0.05 | 0 | 0.002 |
| c | 0.203 REF. | | 0.008 REF. | |
| b | 0.35 | 0.45 | 0.014 | 0.018 |
| D | 2.9 | 3.1 | 0.114 | 0.122 |
| D1 | 2.3 | 2.5 | 0.09 | 0.098 |
| E | 2.9 | 3.1 | 0.114 | 0.122 |
| E1 | 0.89 | 1.09 | 0.035 | 0.043 |
| E2 | 0.42 | 0.62 | 0.016 | 0.024 |
| e | 0.65 BSC | | 0.026 BSC | |
| L | 0.27 | 0.37 | 0.011 | 0.015 |
| K | 0.35 REF. | | 0.014 REF. | |
| K1 | 0.06 REF. | | 0.002 REF. | |
| K2 | 0.25 REF. | | 0.010 REF. | |

RECOMMENDED LAND PATTERN



Design Notes