

N & P-Channel 60-V (D-S) MOSFET

Key Features:

- Low $r_{DS(on)}$ trench technology
- Low thermal impedance
- Fast switching speed

Typical Applications:

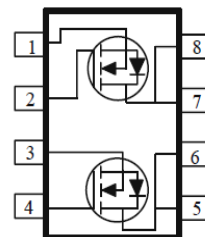
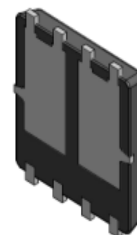
- Automotive Systems
- DC/DC Conversion Circuits
- Motor Drives

| PRODUCT SUMMARY | | |
|-----------------|----------------------------|-----------------|
| V_{DS} (V) | $r_{DS(on)}$ (m Ω) | I_D (A) |
| 60 | 22 @ $V_{GS} = 10V$ | 33 ^c |
| | 26 @ $V_{GS} = 4.5V$ | 30 ^c |
| -60 | 42 @ $V_{GS} = 10V$ | 24 ^c |
| | 52 @ $V_{GS} = 4.5V$ | 21 ^c |

DFN5X6-8L



RoHS
COMPLIANT
HALOGEN
FREE



ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)

| Parameter | | Symbol | Nch Limit | Pch Limit | Units |
|-----------------------------------------------------------|--------------------------|----------------|------------------|-------------------|------------------|
| Drain-Source Voltage | | V_{DS} | 60 | -60 | V |
| Gate-Source Voltage | | V_{GS} | ± 20 | ± 20 | |
| Continuous Drain Current | $T_A = 25^\circ\text{C}$ | I_D | 8.7 ^a | 6.3 ^a | A |
| | $T_A = 70^\circ\text{C}$ | | 7.0 ^a | -5.0 ^a | |
| | $T_C = 25^\circ\text{C}$ | | 33 ^c | 24 ^c | |
| | $T_C = 70^\circ\text{C}$ | | 26 ^c | 19 ^c | |
| Pulsed Drain Current ^b | | I_{DM} | 35 | -25 | |
| Continuous Source Current (Diode Conduction) ^a | | I_S | 3.3 | -3.1 | |
| Power Dissipation | $T_A = 25^\circ\text{C}$ | P_D | 2.5 ^a | 2.5 ^a | W |
| | $T_A = 70^\circ\text{C}$ | | 1.6 ^a | 1.6 ^a | |
| | $T_C = 25^\circ\text{C}$ | | 36 | 36 | |
| | $T_C = 70^\circ\text{C}$ | | 23 | 23 | |
| Operating Junction and Storage Temperature Range | | T_J, T_{stg} | -55 to 150 | | $^\circ\text{C}$ |

THERMAL RESISTANCE RATINGS

| Parameter | | Symbol | Maximum | Units |
|------------------------------------------|-----------------|-----------------|---------|---------------------------|
| Maximum Junction-to-Ambient ^a | $t \leq 10$ sec | $R_{\theta JA}$ | 50 | $^\circ\text{C}/\text{W}$ |
| | Steady State | | 70 | |
| Maximum Junction-to-Case | Steady State | $R_{\theta JC}$ | 3.5 | |

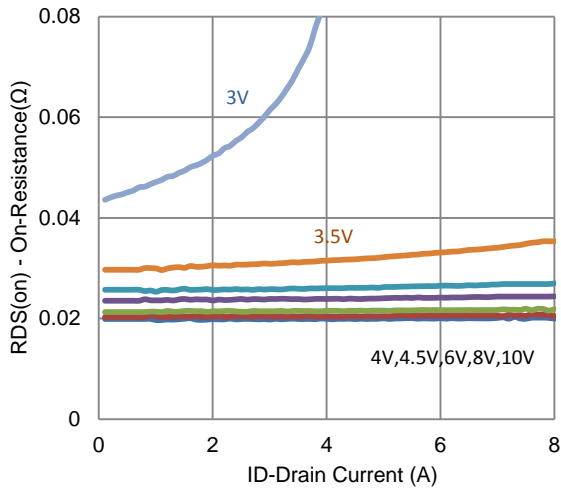
Notes

- Surface Mounted on 1" x 1" FR4 Board
- Pulse width limited by maximum junction temperature
- Package limited

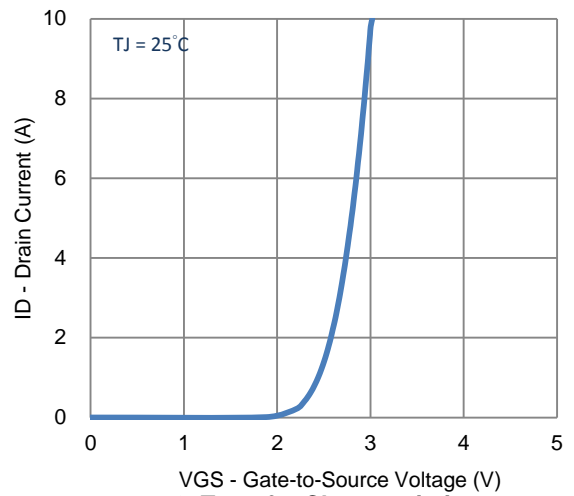
Electrical Characteristics

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-----------------------------------------|--------------|------------------------------------------------------------------------------------------------------------|------|-------|-----------|------|
| Static | | | | | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250 \mu A$ (Nch) | 1 | | | V |
| | | $V_{DS} = V_{GS}, I_D = -250 \mu A$ (Pch) | -1 | | | V |
| Gate-Body Leakage | I_{GSS} | $V_{DS} = 0 V, V_{GS} = \pm 20 V$ | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 48 V, V_{GS} = 0 V$ (Nch) | | | 1 | uA |
| | | $V_{DS} = -48 V, V_{GS} = 0 V$ (Pch) | | | -1 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} = 5 V, V_{GS} = 10 V$ (Nch) | 10 | | | A |
| | | $V_{DS} = -5 V, V_{GS} = 10 V$ (Pch) | -7.5 | | | A |
| Drain-Source On-Resistance ^a | $r_{DS(on)}$ | $V_{GS} = 10 V, I_D = 7 A$ (Nch) | | | 22 | mΩ |
| | | $V_{GS} = 4.5 V, I_D = 5.6 A$ (Nch) | | | 26 | |
| | | $V_{GS} = -10 V, I_D = -5 A$ (Pch) | | | 42 | mΩ |
| | | $V_{GS} = -4.5 V, I_D = -4 A$ (Pch) | | | 52 | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 15 V, I_D = 7 A$ (Nch) | | 8 | | S |
| | | $V_{DS} = -15 V, I_D = -5 A$ (Pch) | | 7 | | S |
| Diode Forward Voltage ^a | V_{SD} | $I_S = 1.7 A, V_{GS} = 0 V$ (Nch) | | 0.72 | | V |
| | | $I_S = -1.6 A, V_{GS} = 0 V$ (Pch) | | -0.76 | | V |
| Dynamic ^b | | | | | | |
| Total Gate Charge | Q_g | N - Channel $V_{DS} = 30 V, V_{GS} = 4.5 V,$ $I_D = 7 A$ | | 16 | | nC |
| Gate-Source Charge | Q_{gs} | | | 4 | | |
| Gate-Drain Charge | Q_{gd} | | | 8 | | |
| Turn-On Delay Time | $t_{d(on)}$ | N - Channel $V_{DS} = 30 V, R_L = 4.3 \Omega,$ $I_D = 7 A,$ $V_{GEN} = 10 V, R_{GEN} = 6 \Omega$ | | 8 | | ns |
| Rise Time | t_r | | | 11 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 48 | | |
| Fall Time | t_f | | | 14 | | |
| Input Capacitance | C_{iss} | N - Channel $V_{DS} = 15 V, V_{GS} = 0 V, f = 1 Mhz$ | | 1465 | | pF |
| Output Capacitance | C_{oss} | | | 126 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 114 | | |
| Total Gate Charge | Q_g | P - Channel $V_{DS} = -30 V, V_{GS} = -4.5 V,$ $I_D = -5 A$ | | 20 | | nC |
| Gate-Source Charge | Q_{gs} | | | 6 | | |
| Gate-Drain Charge | Q_{gd} | | | 8 | | |
| Turn-On Delay Time | $t_{d(on)}$ | P - Channel $V_{DS} = -30 V, R_L = 6 \Omega,$ $I_D = -5 A,$ $V_{GEN} = -10 V, R_{GEN} = 6 \Omega$ | | 6 | | ns |
| Rise Time | t_r | | | 14 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 73 | | |
| Fall Time | t_f | | | 27 | | |
| Input Capacitance | C_{iss} | P - Channel $V_{DS} = -15 V, V_{GS} = 0 V, f = 1 Mhz$ | | 1817 | | pF |
| Output Capacitance | C_{oss} | | | 129 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 111 | | |

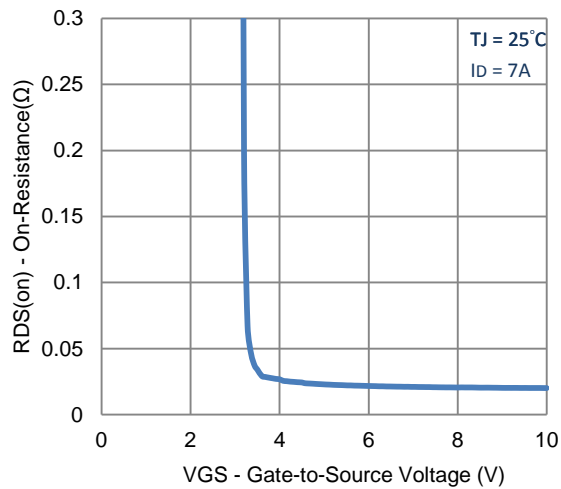
Typical Electrical Characteristics - N-channel



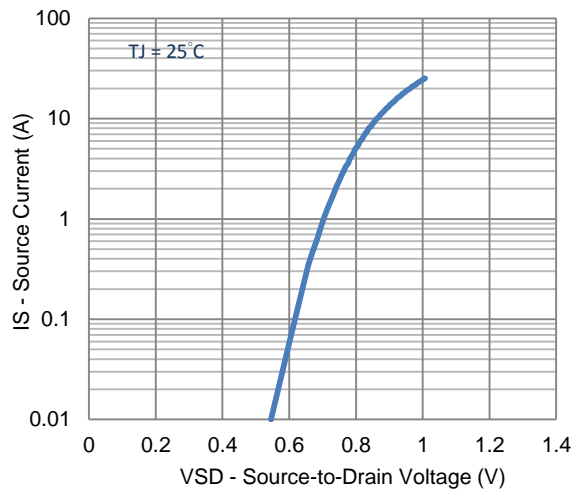
1. On-Resistance vs. Drain Current



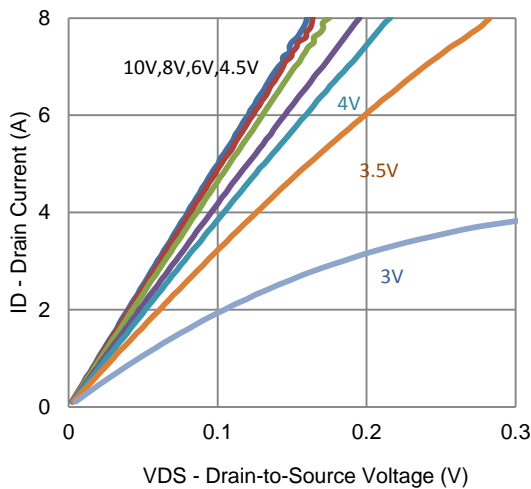
2. Transfer Characteristics



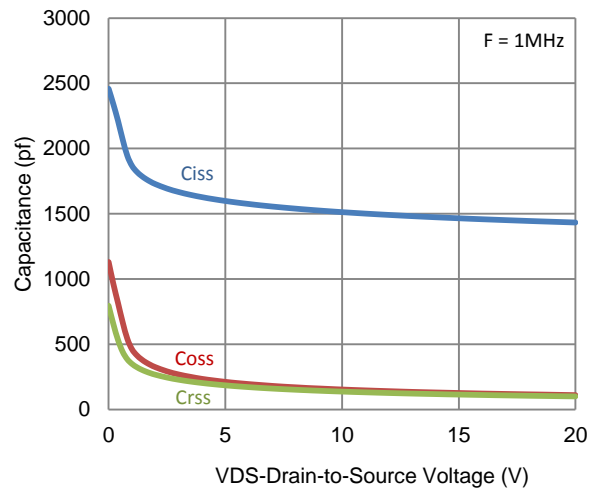
3. On-Resistance vs. Gate-to-Source Voltage



4. Drain-to-Source Forward Voltage

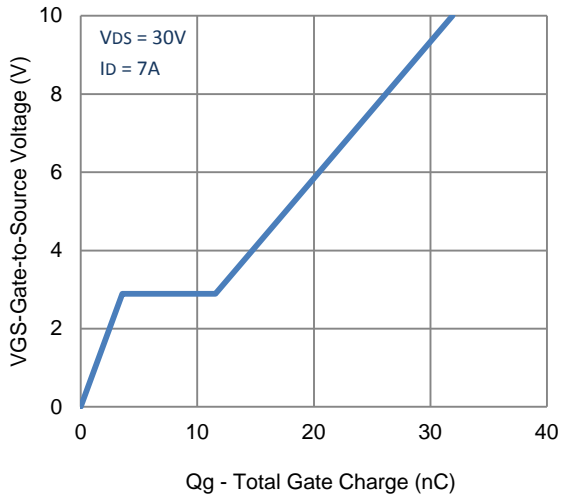


5. Output Characteristics

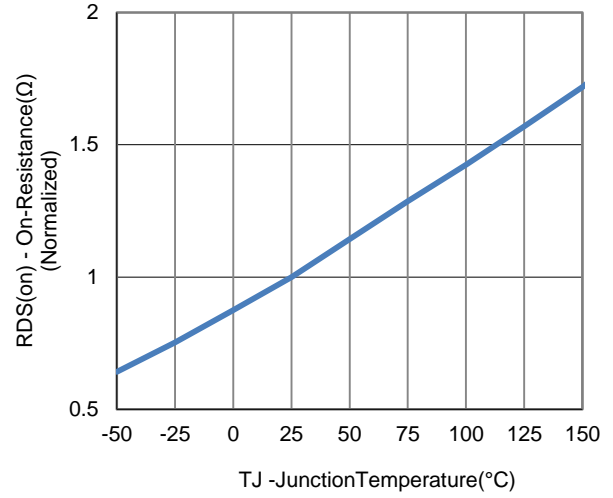


6. Capacitance

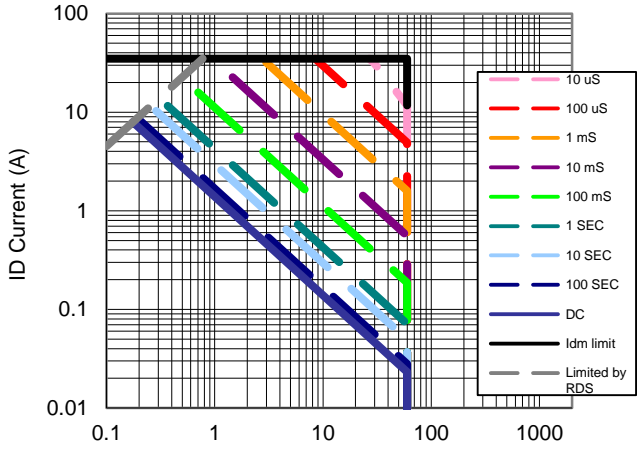
Typical Electrical Characteristics - N-channel



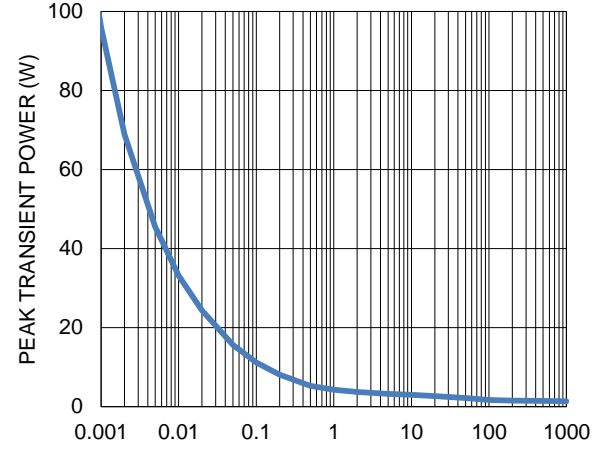
7. Gate Charge



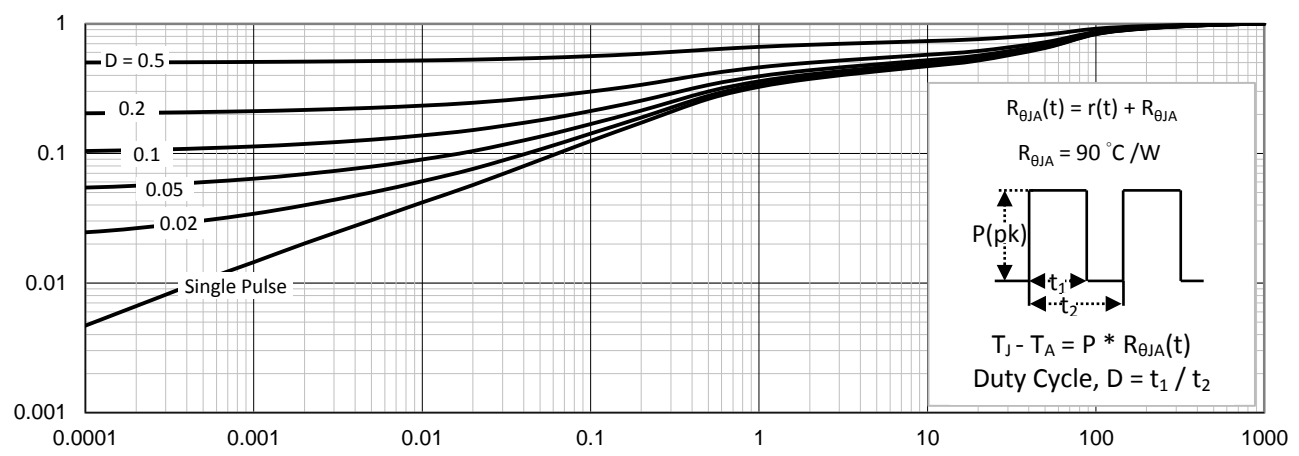
8. Normalized On-Resistance Vs Junction Temperature



9. Safe Operating Area

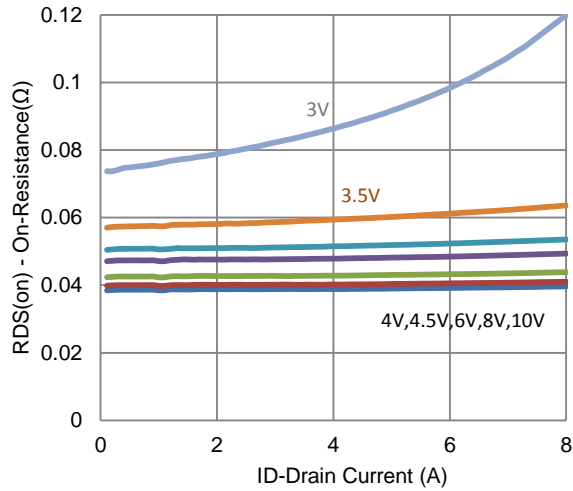


10. Single Pulse Maximum Power Dissipation

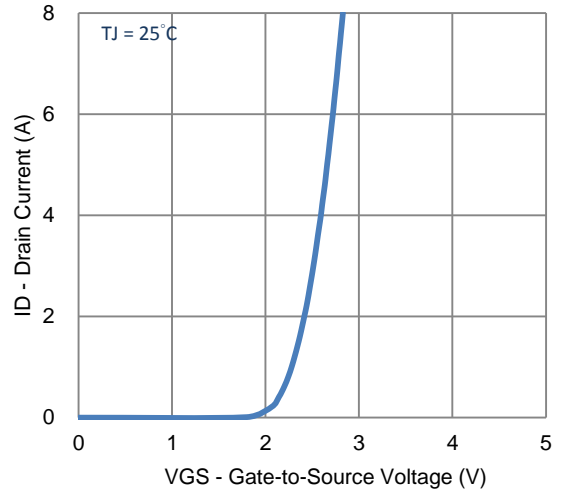


11. Normalized Thermal Transient Junction to Ambient

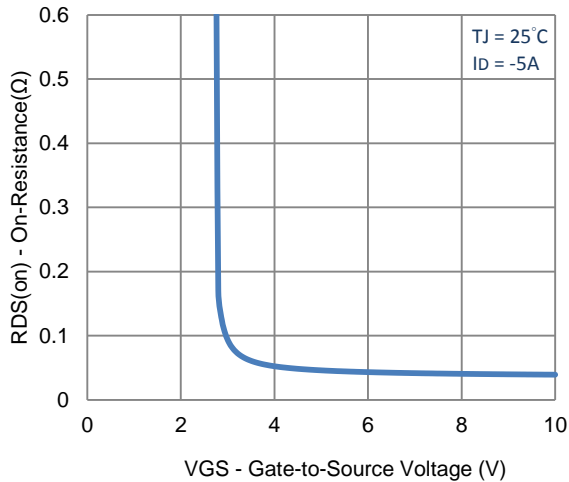
Typical Electrical Characteristics - P-channel



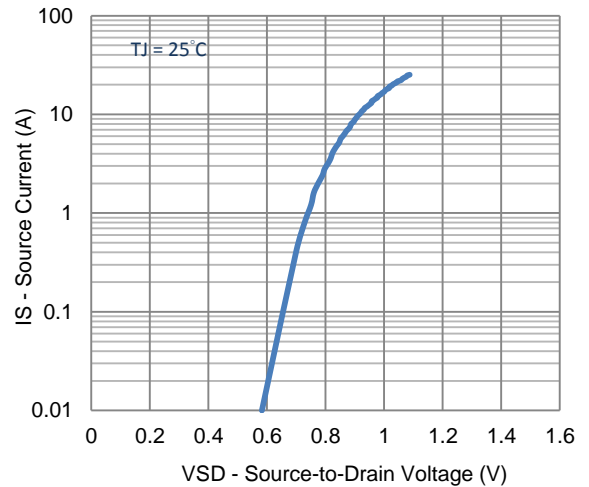
1. On-Resistance vs. Drain Current



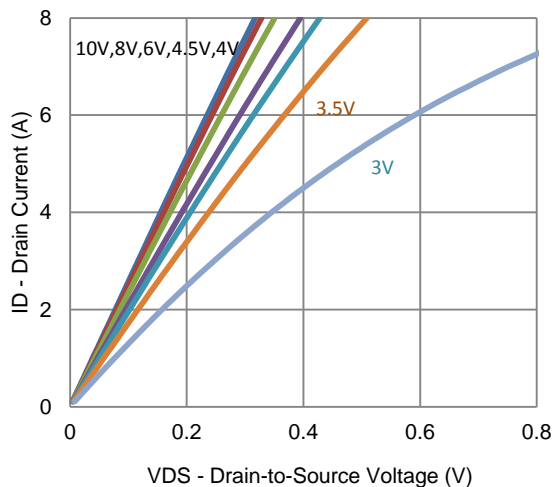
2. Transfer Characteristics



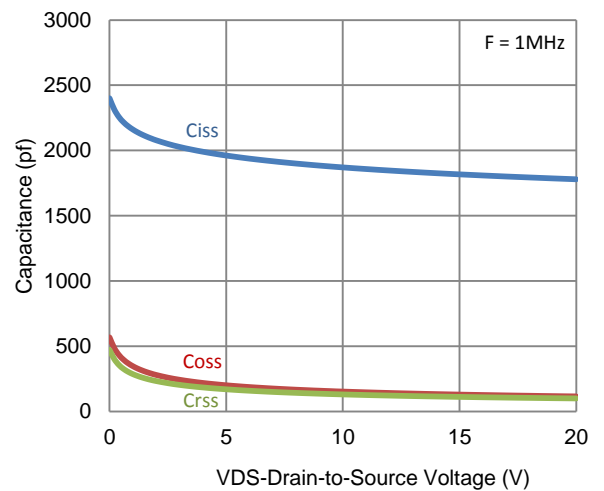
3. On-Resistance vs. Gate-to-Source Voltage



4. Drain-to-Source Forward Voltage

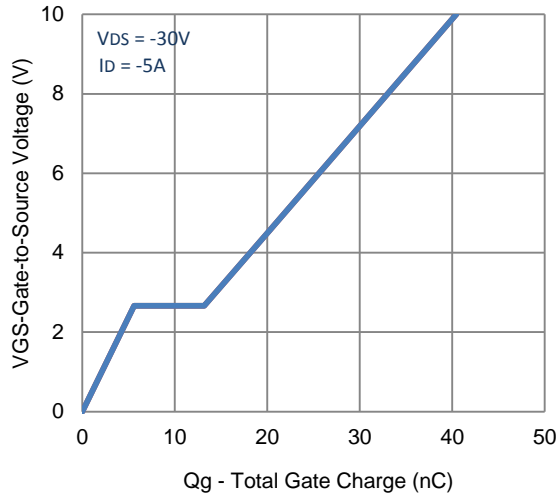


5. Output Characteristics

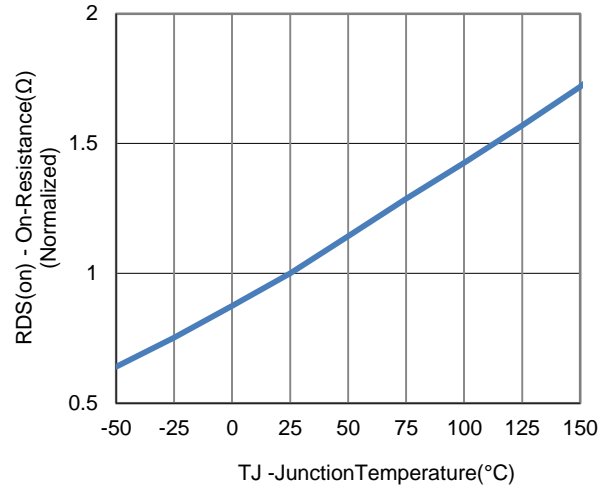


6. Capacitance

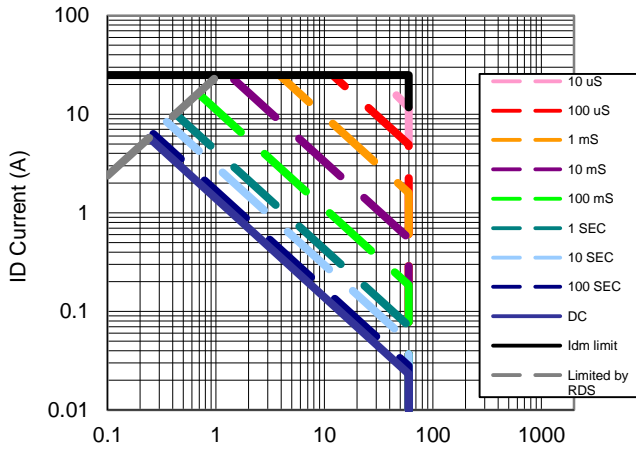
Typical Electrical Characteristics - P-channel



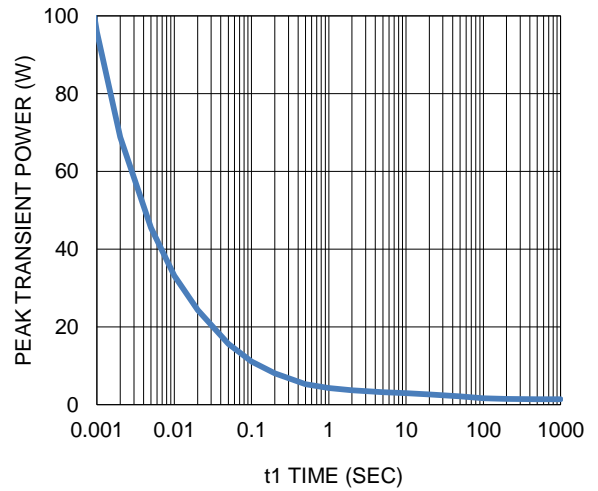
7. Gate Charge



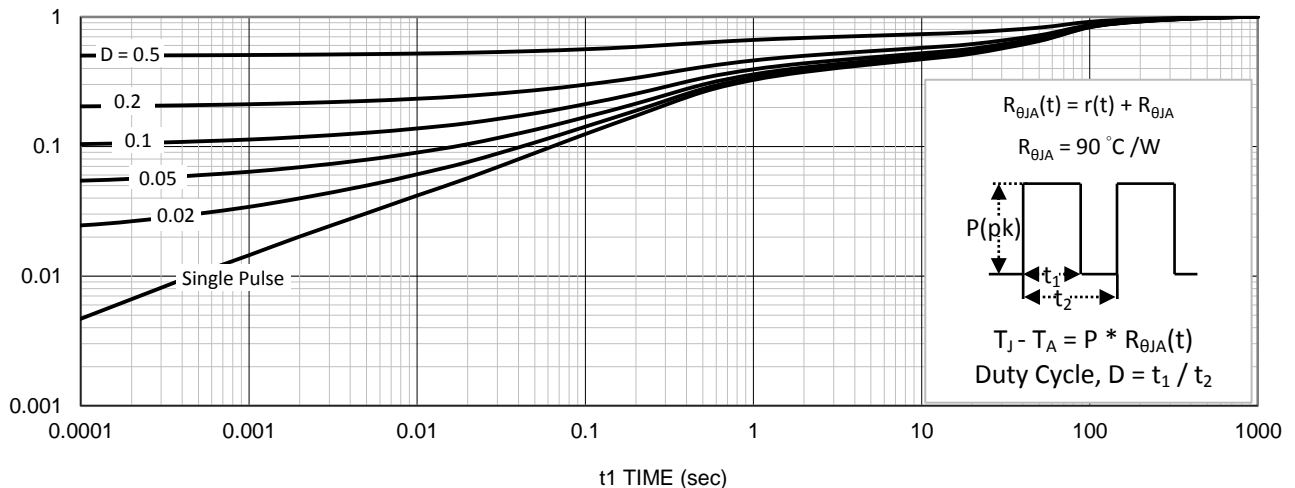
8. Normalized On-Resistance Vs Junction Temperature



9. Safe Operating Area

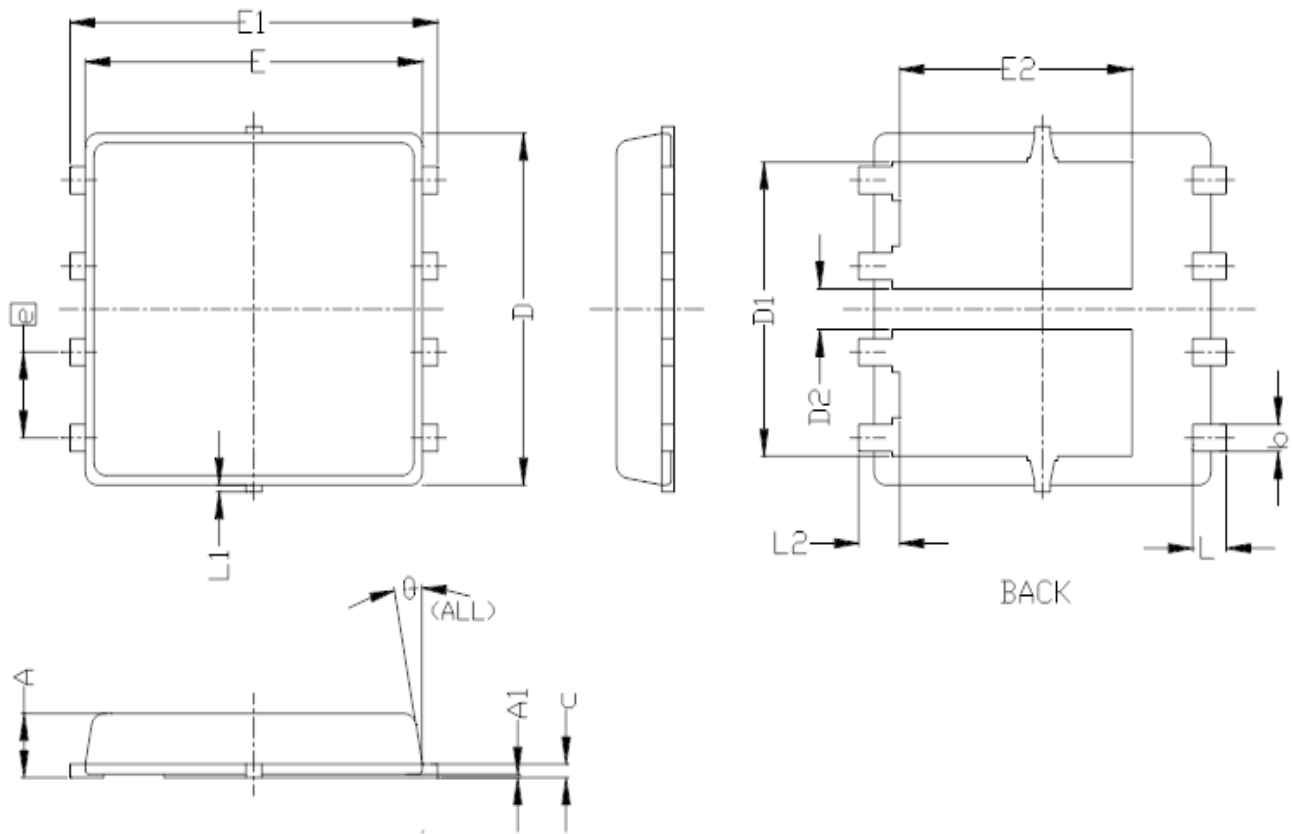


10. Single Pulse Maximum Power Dissipation



11. Normalized Thermal Transient Junction to Ambient

Package Information



| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---------|---------------------------|------|------|----------------------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.85 | 0.95 | 1.00 | 0.033 | 0.037 | 0.039 |
| A1 | 0.00 | --- | 0.05 | 0.000 | --- | 0.002 |
| b | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| c | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 5.20 BSC | | | 0.205 BSC | | |
| D1 | 4.35 BSC | | | 0.171 BSC | | |
| E | 5.55 BSC | | | 0.219 BSC | | |
| E1 | 6.05 BSC | | | 0.238 BSC | | |
| E2 | 3.62 BSC | | | 0.143 BSC | | |
| e | 1.27 BSC | | | 0.050 BSC | | |
| L | 0.45 | 0.55 | 0.65 | 0.018 | 0.022 | 0.026 |
| L1 | 0 | --- | 0.15 | 0 | --- | 0.006 |
| L2 | 0.68 REF | | | 0.027 REF | | |
| θ | 0° | --- | 10° | 0° | --- | 10° |