

■ PRODUCT CHARACTERISTICS

| N-Channel | P-Channel |
|--|--|
| $BV_{DSS} = 40V$ | $BV_{DSS} = -40V$ |
| $R_{DS(on)} (Typ@VGS= 10V) < 17m\Omega$ | $R_{DS(on)}(Typ@VGS= -10V) < 29m\Omega$ |
| $R_{DS(on)} (Typ@VGS= 4.5V) < 22m\Omega$ | $R_{DS(on)}(Typ@VGS= -4.5V) < 34m\Omega$ |

■ APPLICATIONS

- Motor Drive
- DC-DC Converter

■ FEATURES

- Advanced trench cell design
- Super trench
- Low thermal resistance

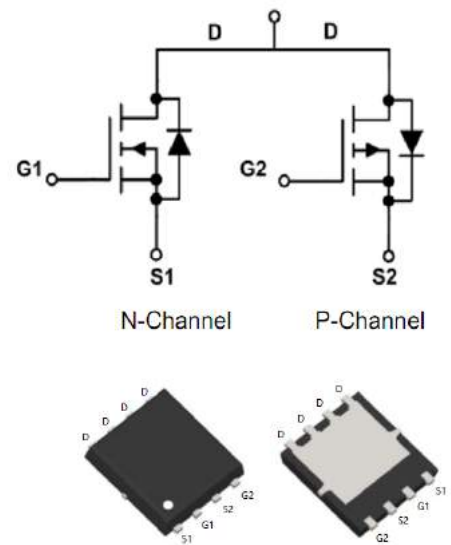
■ Absolute Maximum Ratings ($T_C=25^\circ C$ unless otherwise specified)

| Parameter | Symbol | N-Channel | P-Channel | Unit | |
|--|----------------|-------------------|-----------|------------|---|
| Drain-Source Voltage | V_{DS} | 40 | -40 | V | |
| Gate-Source Voltage | V_{GS} | ± 20 | ± 20 | V | |
| Continuous Drain Current | I_D | $T_C=25^\circ C$ | 28 | -15 | A |
| | | $T_C=100^\circ C$ | 19.8 | -10.6 | A |
| Pulsed Drain Current ^(Note 1) | I_{DM} | 70 | -60 | A | |
| Maximum Power Dissipation | P_D | 35 | | W | |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 150 | | $^\circ C$ | |

■ THERMAL DATA

| | | | |
|--|-----------------|-----|--------------|
| Thermal Resistance, Junction-to-Case ^(Note 2) | $R_{\theta JC}$ | 3.6 | $^\circ C/W$ |
|--|-----------------|-----|--------------|

Symbol



■ N-Channel Electrical Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|--------------|--|-----|------|-----------|------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=250\mu A$ | 40 | - | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=40V, V_{GS}=0V$ | - | - | 1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1.0 | 1.4 | 2.0 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=15A$ | - | 17 | 22 | m Ω |
| | | $V_{GS}=4.5V, I_D=10A$ | - | 22 | 30 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=5V, I_D=15A$ | - | 7 | - | S |
| Dynamic Characteristics (Note 4) | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS}=20V, V_{GS}=0V,$ $F=1.0MHz$ | - | 964 | - | PF |
| Output Capacitance | C_{oss} | | - | 109 | - | PF |
| Reverse Transfer Capacitance | C_{rss} | | - | 96 | - | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=20V, R_L=2.5\Omega$ $V_{GS}=10V, R_G=3\Omega$ | - | 5.5 | - | nS |
| Turn-on Rise Time | t_r | | - | 14 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 24 | - | nS |
| Turn-Off Fall Time | t_f | | - | 5 | - | nS |
| Total Gate Charge | Q_g | $V_{DS}=20V, I_D=15A,$ $V_{GS}=10V$ | - | 22.9 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 3.5 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 5.3 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage (Note 3) | V_{SD} | $V_{GS}=0V, I_S=15A$ | - | - | 1.2 | V |
| Diode Forward Current (Note 2) | I_S | | - | - | 28 | A |

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production
5. EAS condition: $T_j=25^\circ\text{C}, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25\Omega$

■ N-CHANNEL TEST CIRCUITS AND WAVEFORMS

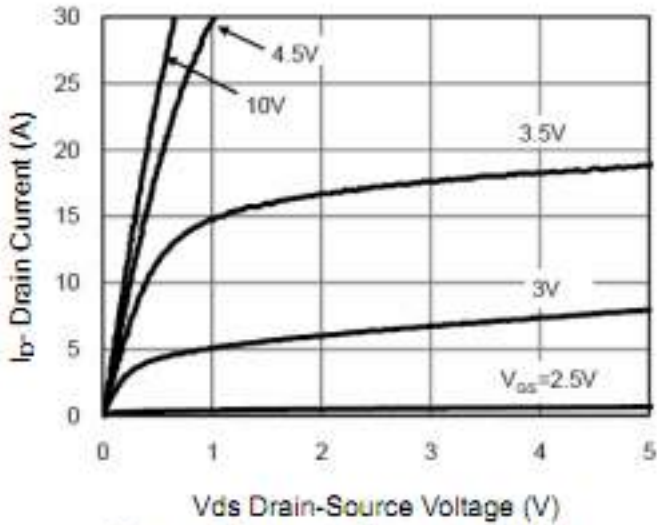


Figure 1 Output Characteristics

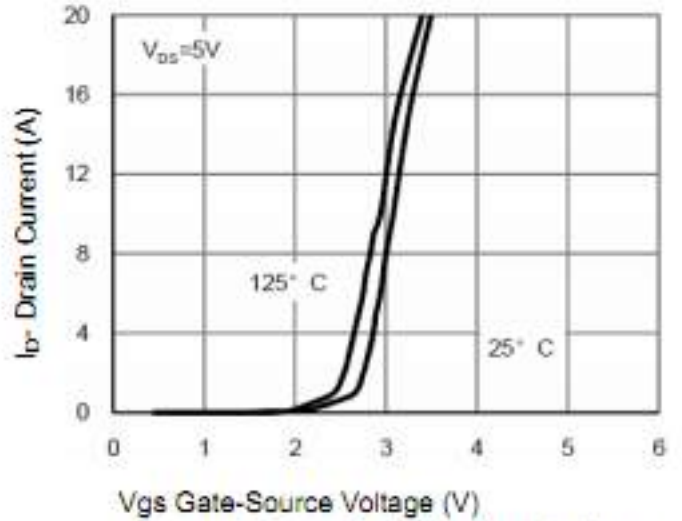


Figure 2 Transfer Characteristics

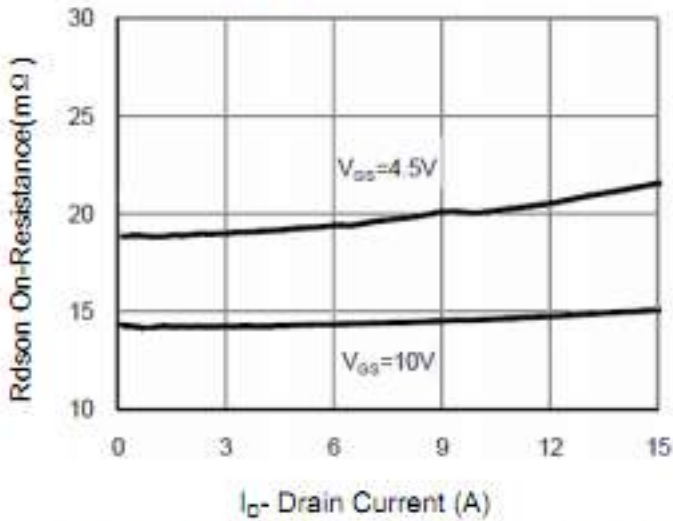


Figure 3 Drain-Source On-Resistance

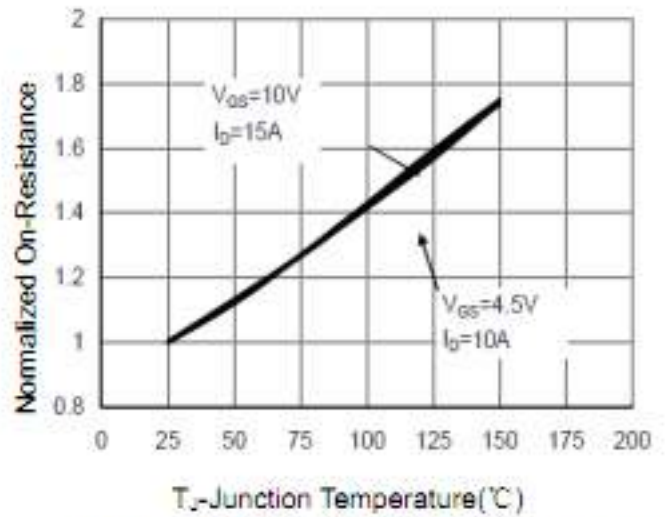


Figure 4 Drain-Source On-Resistance

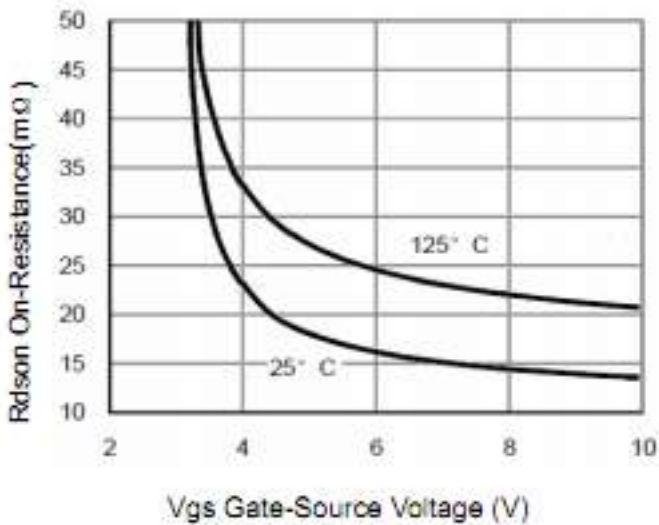


Figure 5 Rdson vs Vgs

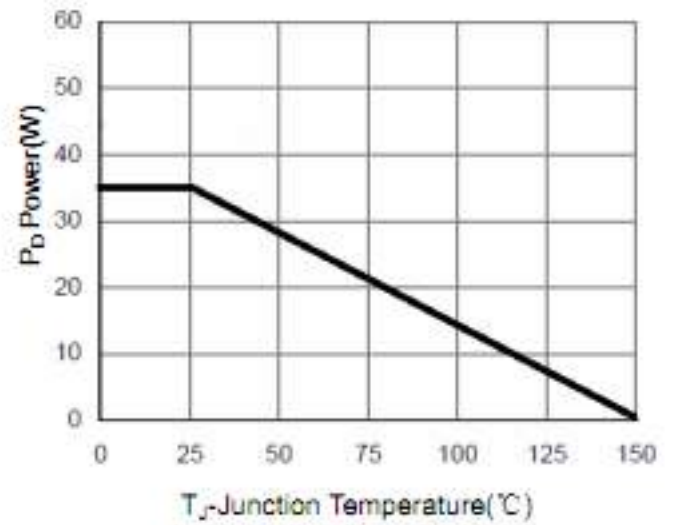


Figure 6 Power Dissipation

■ N-CHANNEL TEST CIRCUITS AND WAVEFORMS(Cont.)

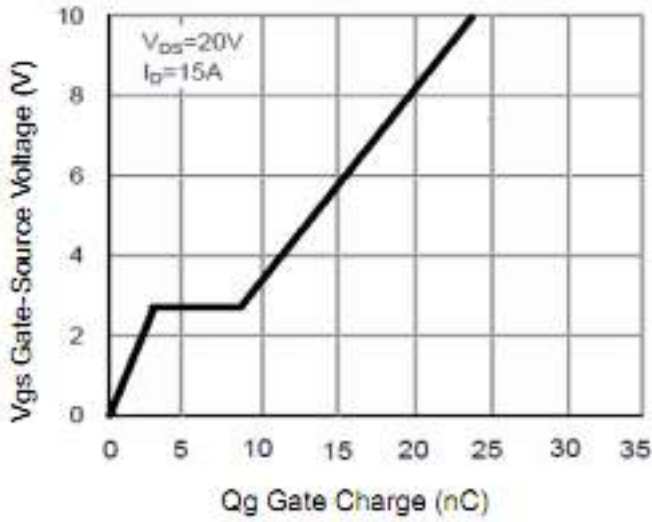


Figure 7 Gate Charge

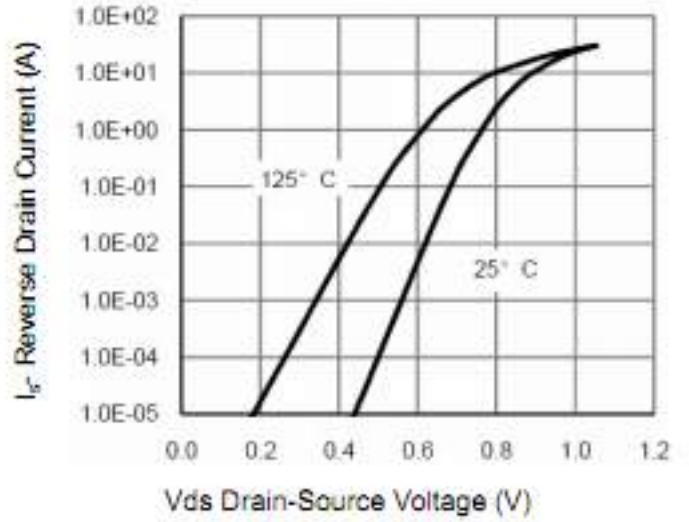


Figure 8 Source- Drain Diode Forward

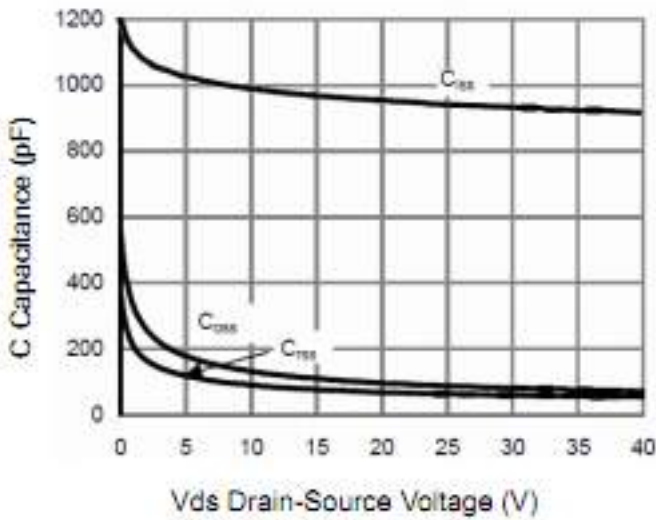


Figure 9 Capacitance vs Vds

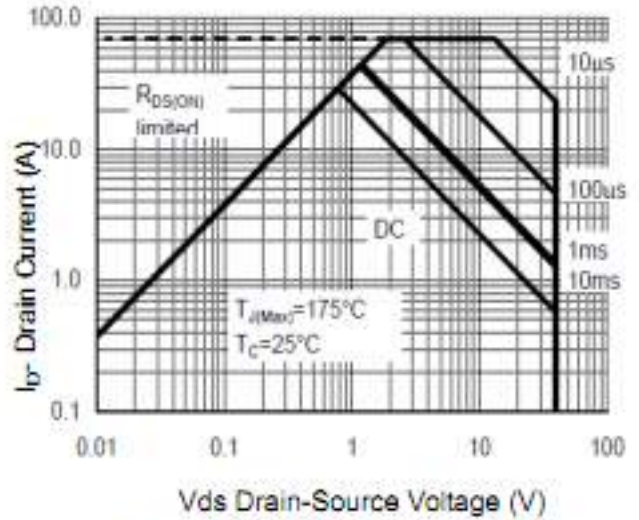


Figure 10 Safe Operation Area

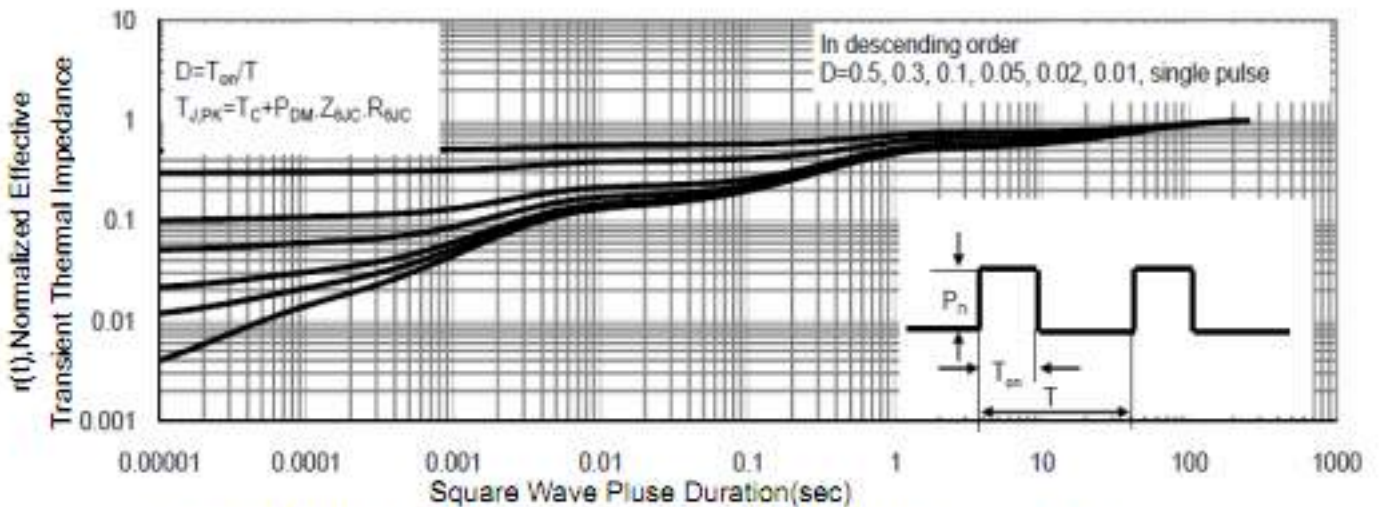


Figure 11 Normalized Maximum Transient Thermal Impedance

■ P-Channel Electrical Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|--------------|--|------|------|-----------|------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=-250\mu A$ | -40 | - | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=-40V, V_{GS}=0V$ | - | - | -1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics ^(Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\mu A$ | -1.0 | -1.5 | -2.0 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=-10V, I_D=-7A$ | - | 29 | 35 | m Ω |
| | | $V_{GS}=-4.5V, I_D=-4A$ | - | 34 | 45 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=-5V, I_D=-7A$ | 20 | - | - | S |
| Dynamic Characteristics ^(Note 4) | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS}=-20V, V_{GS}=0V,$ $F=1.0MHz$ | - | 964 | - | PF |
| Output Capacitance | C_{OSS} | | - | 109 | - | PF |
| Reverse Transfer Capacitance | C_{RSS} | | - | 96 | - | PF |
| Switching Characteristics ^(Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=-20V, R_L=2.3\Omega$ $V_{GS}=-10V, R_{GEN}=6\Omega$ | - | 5.5 | - | nS |
| Turn-on Rise Time | t_r | | - | 14 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 24 | - | nS |
| Turn-Off Fall Time | t_f | | - | 12 | - | nS |
| Total Gate Charge | Q_g | $V_{DS}=-20V, I_D=-7A$ $V_{GS}=-10V$ | - | 22.9 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 3.5 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 5.3 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage ^(Note 3) | V_{SD} | $V_{GS}=0V, I_S=-10A$ | - | - | 1.2 | V |

■ P-CHANNEL TEST CIRCUITS AND WAVEFORMS

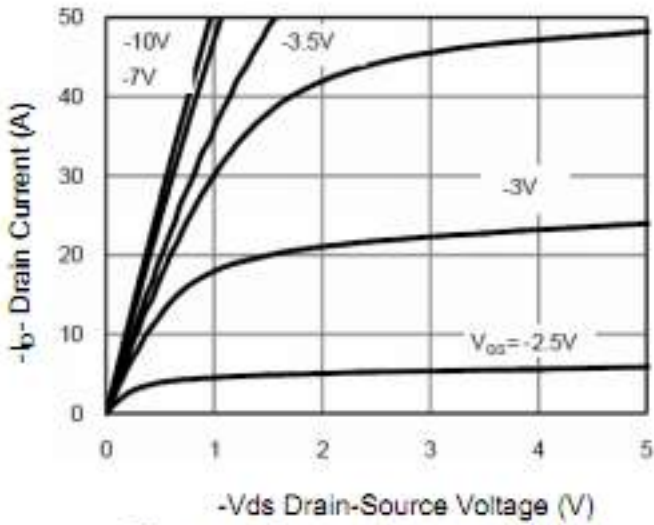


Figure 1 Output Characteristics

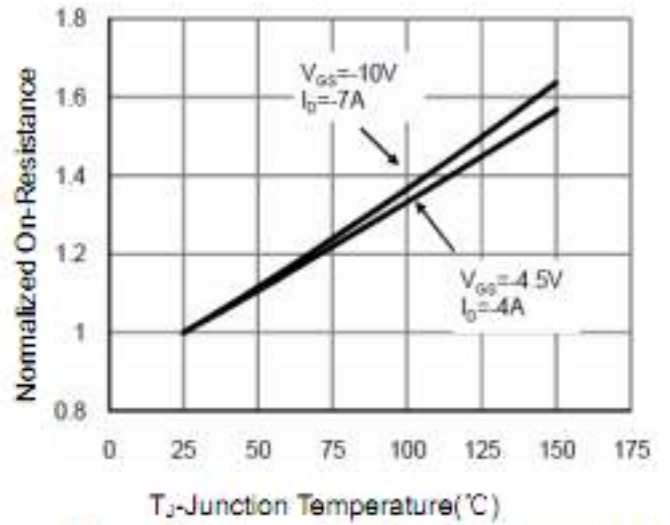


Figure 4 R_{DS(on)}-Junction Temperature

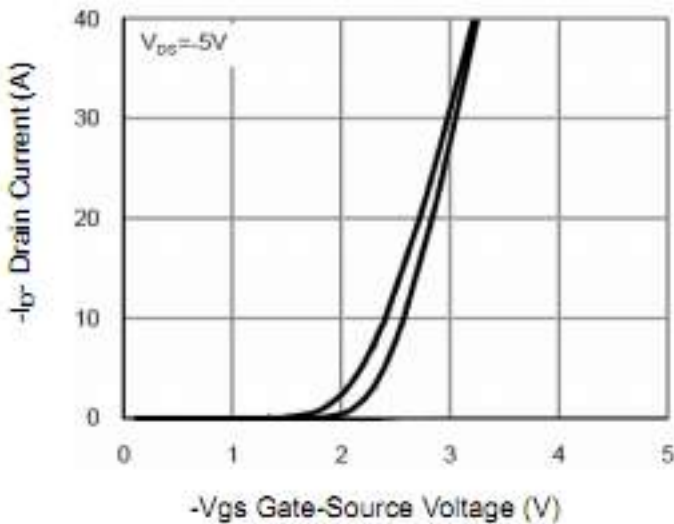


Figure 2 Transfer Characteristics

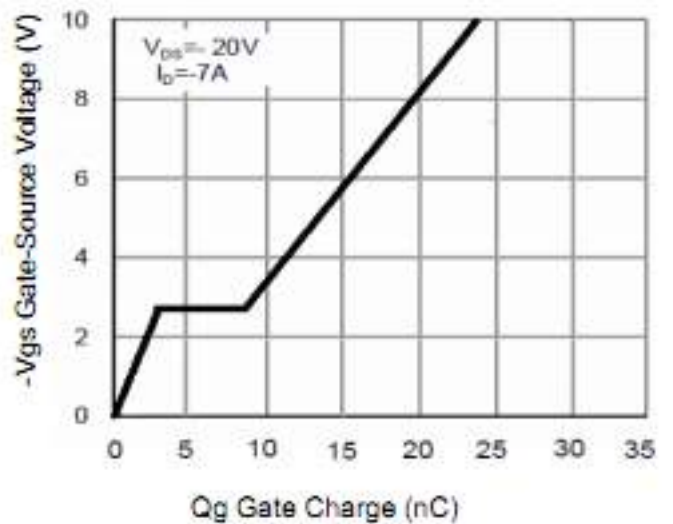


Figure 5 Gate Charge

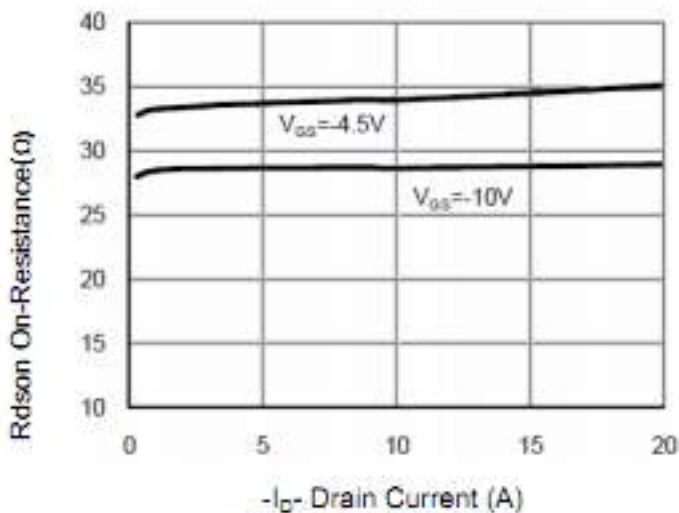


Figure 3 R_{DS(on)}-Drain Current

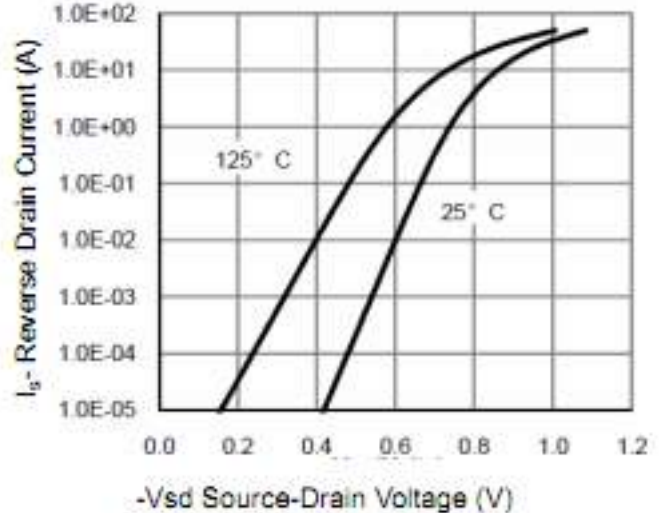


Figure 6 Source-Drain Diode Forward

■ P-CHANNEL TEST CIRCUITS AND WAVEFORMS(Cont.)

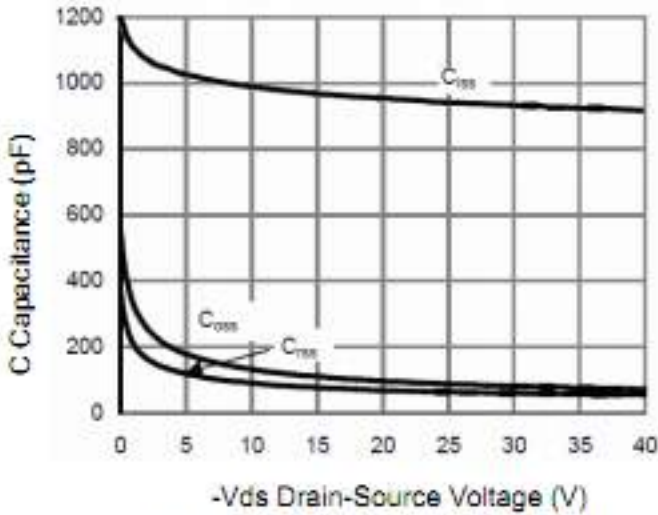


Figure 7 Capacitance vs Vds

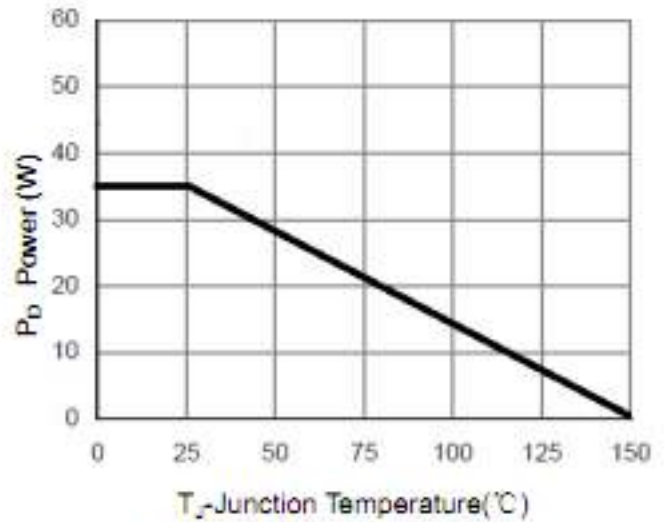


Figure 9 Power Dissipation

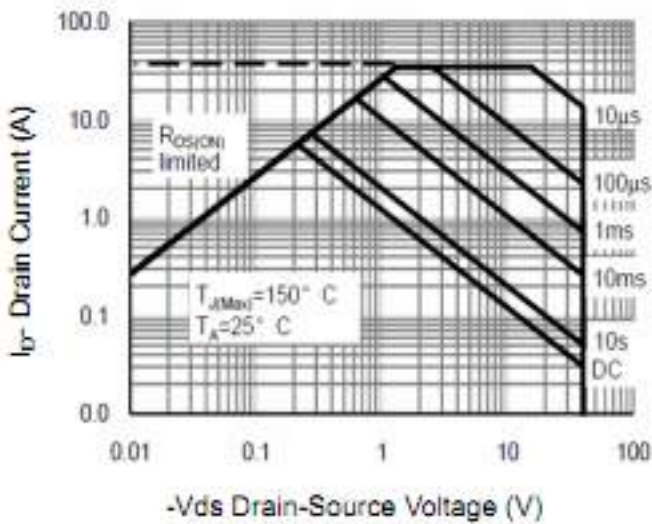


Figure 8 Safe Operation Area

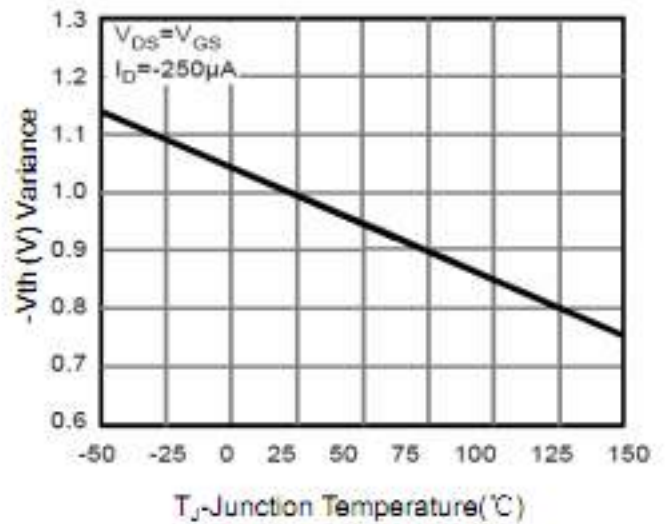


Figure 10 $V_{GS(th)}$ vs Junction Temperature

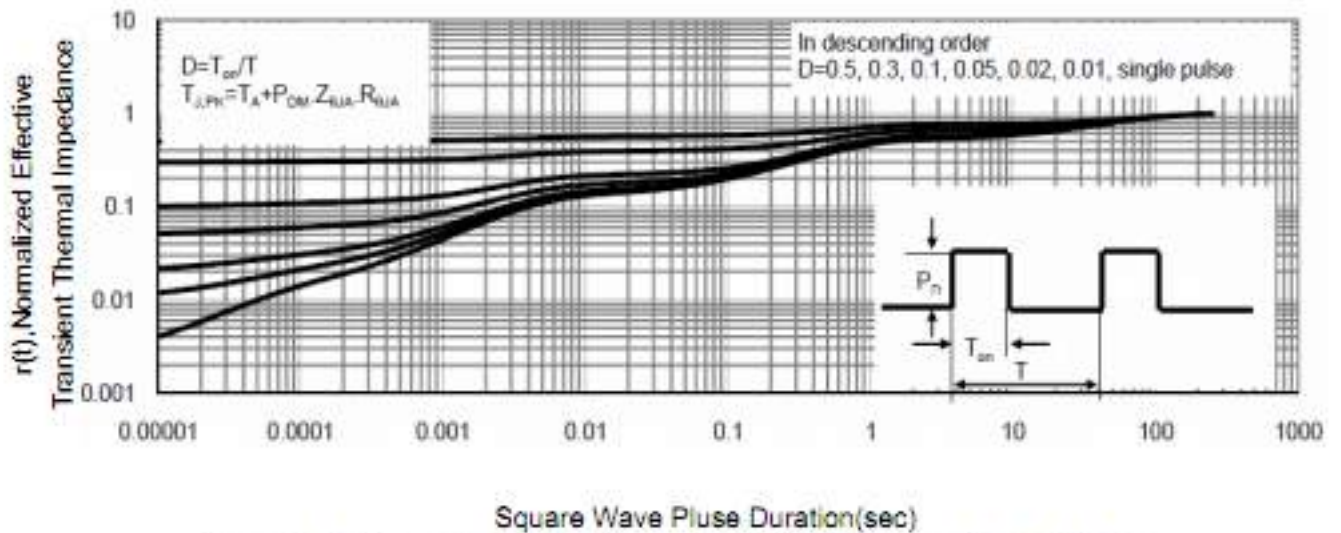
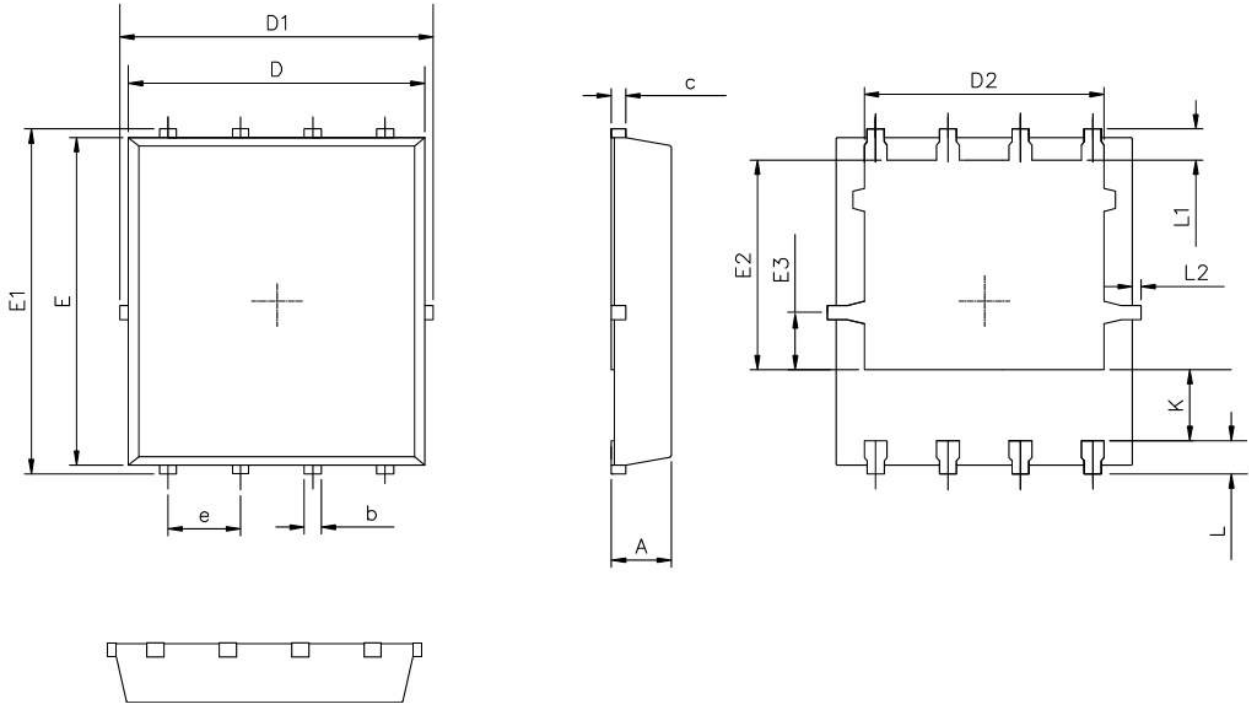
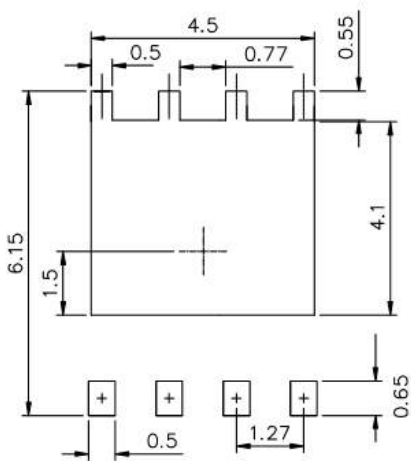


Figure 11 Normalized Maximum Transient Thermal Impedance

■ PDFN5060-8L Package Mechanical Data



RECOMMENDED LAND PATTERN



UNIT:mm

| | MIN | NOM | MAX |
|----|-------|-------|-------|
| A | 0.90 | 1.00 | 1.10 |
| b | 0.25 | 0.35 | 0.50 |
| c | 0.10 | 0.20 | 0.30 |
| D | 4.80 | 5.00 | 5.30 |
| D1 | 4.90 | 5.10 | 5.50 |
| D2 | 3.92 | 4.02 | 4.20 |
| E | 5.65 | 5.75 | 5.85 |
| E1 | 5.90 | 6.05 | 6.20 |
| E2 | 3.325 | 3.525 | 3.775 |
| E3 | 0.80 | 0.90 | 1.00 |
| e | | 1.27 | |
| L | 0.40 | 0.55 | 0.70 |
| L1 | | 0.65 | |
| L2 | 0.00 | | 0.15 |
| K | 1.00 | 1.30 | 1.50 |