

N and P-Channel Enhancement Mode Power MOSFET

Description

The HMI Î I €Ö uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

General Features

● N-Channel

$$V_{DS} = 10V, I_D = 1A$$

$$R_{DS(ON)} < 41m\Omega @ V_{GS}=4.5V$$

$$R_{DS(ON)} < 68m\Omega @ V_{GS}=2.5V$$

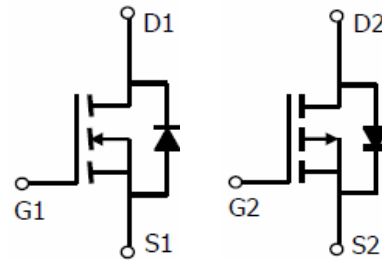
● P-Channel

$$V_{DS} = -10V, I_D = -1A$$

$$R_{DS(ON)} < 80m\Omega @ V_{GS}=-4.5V$$

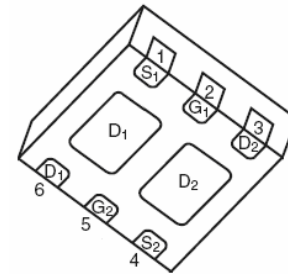
$$R_{DS(ON)} < 135m\Omega @ V_{GS}=-2.5V$$

- High power and current handling capability
- Lead free product is acquired
- Surface mount package



N-channel

P-channel



Pin assignment

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|----------------|------------|----------------|-----------|------------|-------------|
| 20** | HMI Î I €Ö | ÖÖP GÝ GË Š | Ø180mm | ÁÁÁ { { | ÁÁ000 units |

Absolute Maximum Ratings ($T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | N-Channel | P-Channel | Unit |
|--|----------------|------------|------------|------------------|
| Drain-Source Voltage | V_{DS} | 10 | -10 | V |
| Gate-Source Voltage | V_{GS} | ± 12 | ± 12 | V |
| Continuous Drain Current | I_D | 1 | -1 | A |
| | | H_1 | $-H_1$ | |
| Pulsed Drain Current ^(Note 1) | I_{DM} | 11 | -11 | A |
| Maximum Power Dissipation | P_D | 0.8 | 0.8 | W |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 150 | -55 To 150 | $^\circ\text{C}$ |

Thermal Characteristic

| | | | | |
|--|-----------------|------|-----|--------------------|
| Thermal Resistance, Junction-to-Ambient ^(Note2) | $R_{\theta JA}$ | N-Ch | 156 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient ^(Note2) | $R_{\theta JA}$ | P-Ch | 156 | $^\circ\text{C/W}$ |

N-CH Electrical Characteristics (T_A=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---------------------|---|------|-----|------|------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | V _{GS} =0V, I _D =250μA | 20 | 22 | - | V |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} =40V, V _{GS} =0V | - | - | 1 | μA |
| Gate-Body Leakage Current | I _{GSS} | V _{GS} =±12V, V _{DS} =0V | - | - | ±100 | nA |
| On Characteristics (Note 3) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | V _{DS} =V _{GS} , I _D =250μA | F. € | 10 | 10 | V |
| Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} =2.5V, I _D =2.8A | - | 33 | 41 | mΩ |
| | | V _{GS} =4.5V, I _D =1A | - | 46 | 68 | mΩ |
| Forward Transconductance | g _{FS} | V _{DS} =5V, I _D =1A | - | 8 | - | S |
| Dynamic Characteristics (Note4) | | | | | | |
| Input Capacitance | C _{ISS} | V _{DS} =10V, V _{GS} =0V, F=1.0MHz | - | 260 | - | PF |
| Output Capacitance | C _{OSS} | | - | 48 | - | PF |
| Reverse Transfer Capacitance | C _{RSS} | | - | 27 | - | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | t _{d(on)} | V _{DD} =10V, R _L =3.3Ω V _{GS} =4.5V, R _{GEN} =6Ω | - | 2.5 | - | nS |
| Turn-on Rise Time | t _r | | - | 3.2 | - | nS |
| Turn-Off Delay Time | t _{d(off)} | | - | 21 | - | nS |
| Turn-Off Fall Time | t _f | | - | 3 | - | nS |
| Total Gate Charge | Q _g | V _{DS} =10V, I _D =1A, V _{GS} =4.5V | - | 2.9 | 5 | nC |
| Gate-Source Charge | Q _{gs} | | - | 0.4 | - | nC |
| Gate-Drain Charge | Q _{gd} | | - | 0.6 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage (Note 3) | V _{SD} | V _{GS} =0V, I _S =1A | - | - | 1.2 | V |
| Diode Forward Current (Note 2) | I _S | | - | - | 5 | A |

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production

P-CH Electrical Characteristics (TA=25°C unless otherwise noted)

| 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} | $V_{GS}=\pm 12V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\mu A$ | -1.0 | -2.0 | -3.0 | V |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS}=-4.5V, I_D=-2.5 A$ | - | 72 | 80 | m Ω |
| | | $V_{GS}=-2.5V, I_D=-2A$ | - | 110 | 135 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=-5V, I_D=-2.5A$ | - | 9.5 | - | S |
| Dynamic Characteristics (Note 4) | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS}=-10V, V_{GS}=0V,$ $F=1.0MHz$ | - | 325 | - | PF |
| Output Capacitance | C_{oss} | | - | 63 | - | PF |
| Reverse Transfer Capacitance | C_{rss} | | - | 37 | - | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=-10V, R_L=5\Omega$ $V_{GS}=-4.5V, R_{GEN}=3\Omega$ | - | 11 | - | nS |
| Turn-on Rise Time | t_r | | - | 5.5 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 22 | - | nS |
| Turn-Off Fall Time | t_f | | - | 8 | - | nS |
| Total Gate Charge | Q_g | $V_{DS}=-10V, I_D=-2A,$ $V_{GS}=-4.5V$ | - | 3.2 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 0.6 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 0.9 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage | V_{SD} | $V_{GS}=0V, I_S=-5A$ | - | - | -1.2 | V |
| Diode Forward Current | I_S | | - | - | -5 | 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

N- Channel Typical Electrical and Thermal Characteristics (Curves)

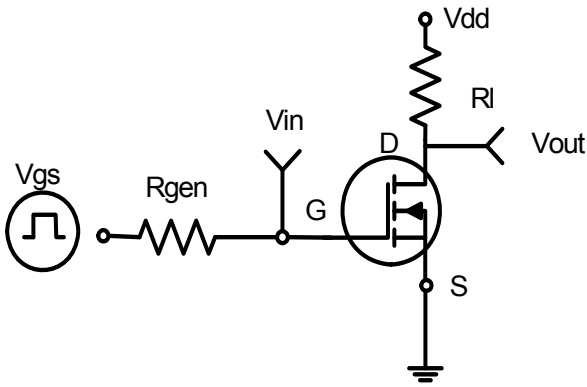


Figure 1: Switching Test Circuit

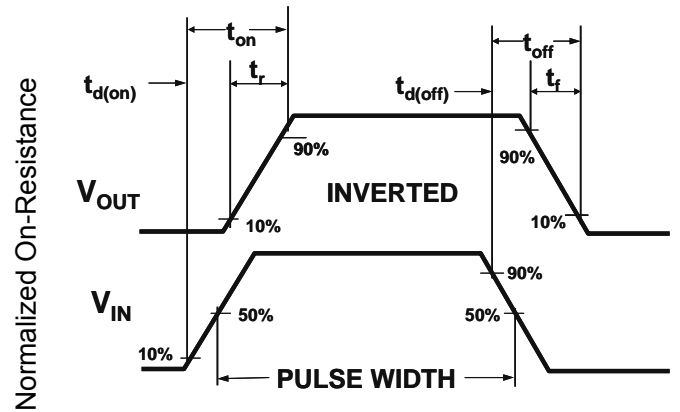


Figure 2: Switching Waveforms

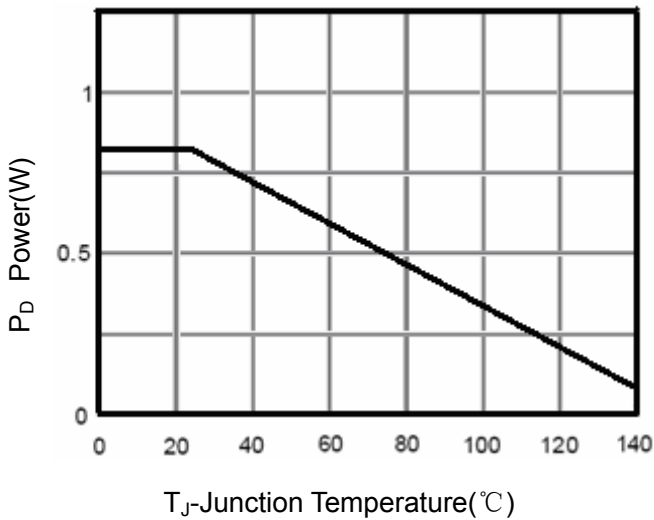


Figure 3 Power Dissipation

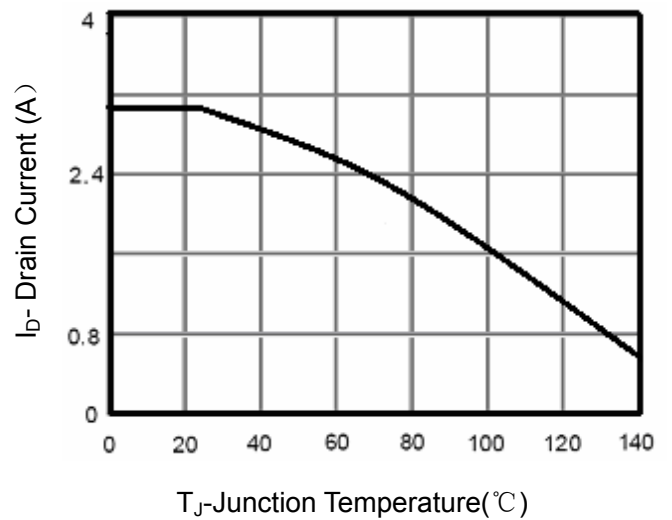


Figure 4 Drain Current

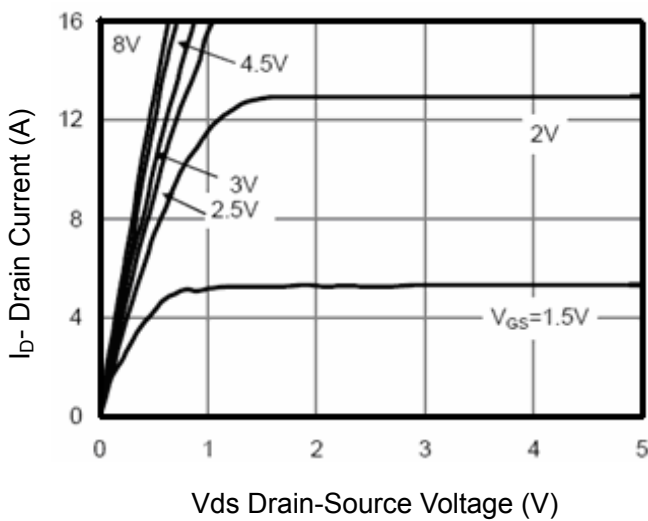


Figure 5 Output Characteristics

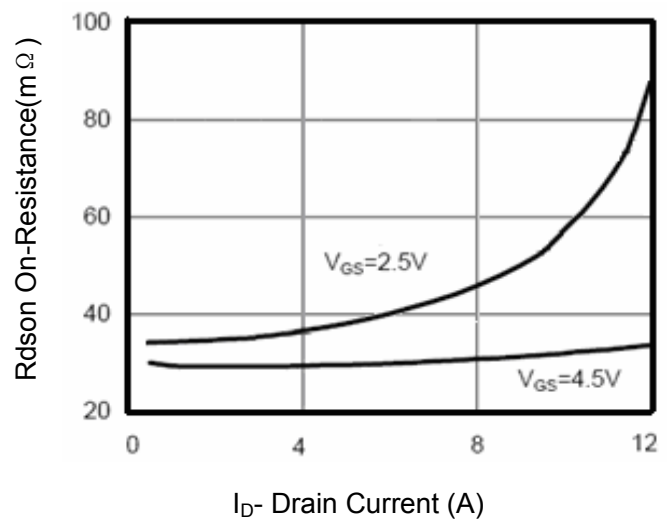


Figure 6 Drain-Source On-Resistance

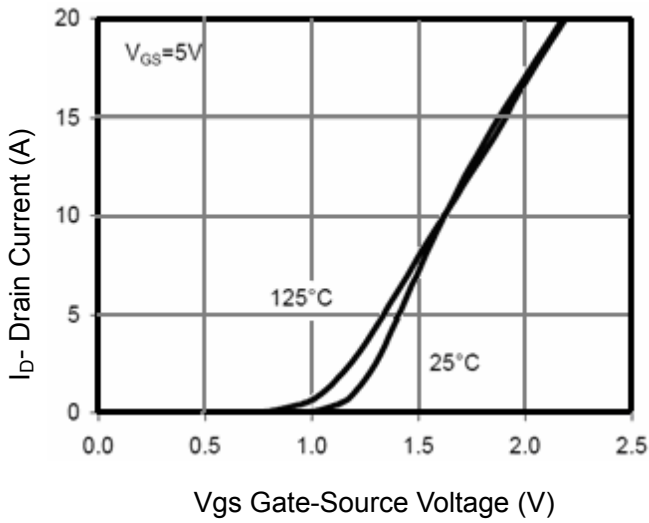


Figure 7 Transfer Characteristics

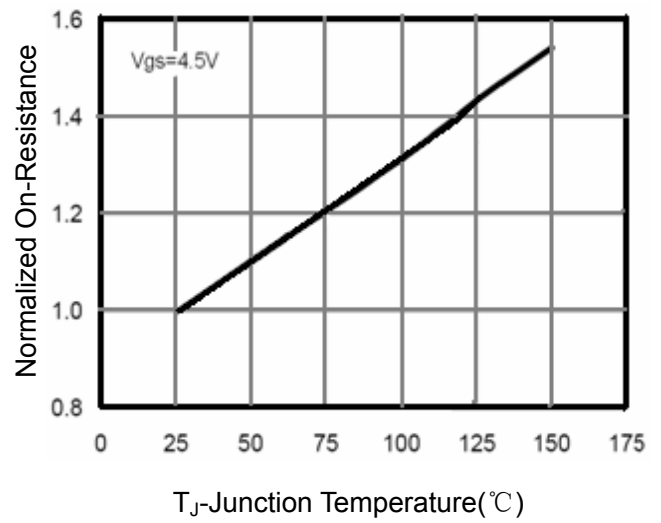


Figure 8 Drain-Source On-Resistance

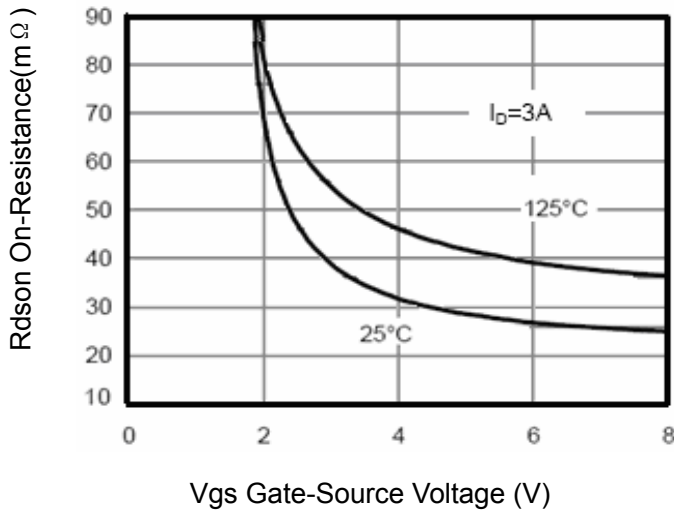


Figure 9 Rdson vs Vgs

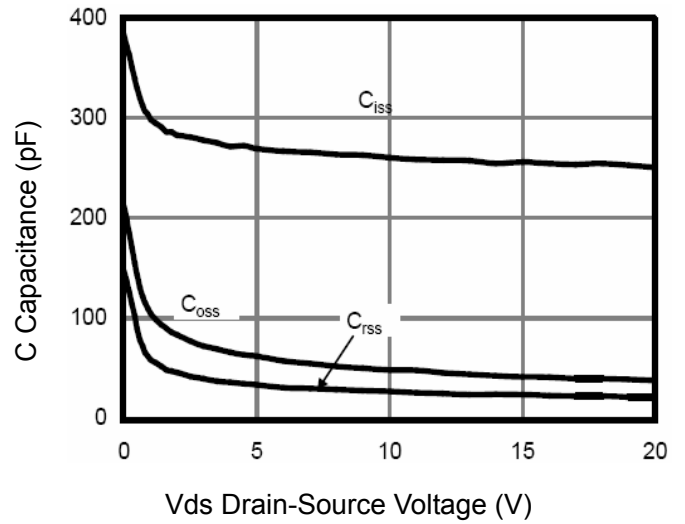


Figure 10 Capacitance vs Vds

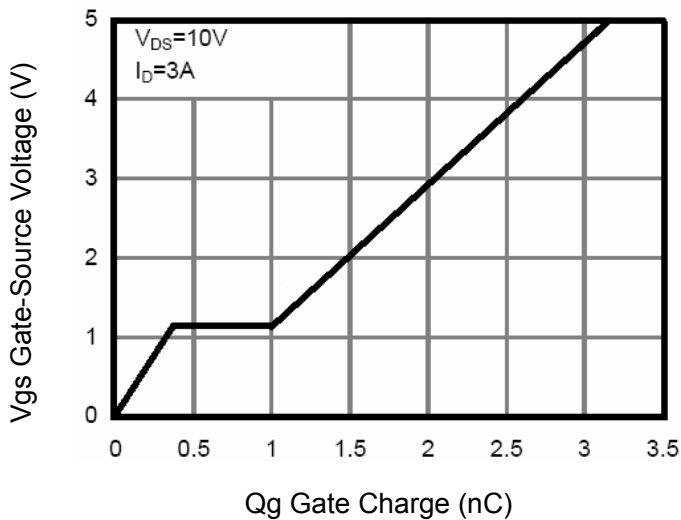


Figure 11 Gate Charge

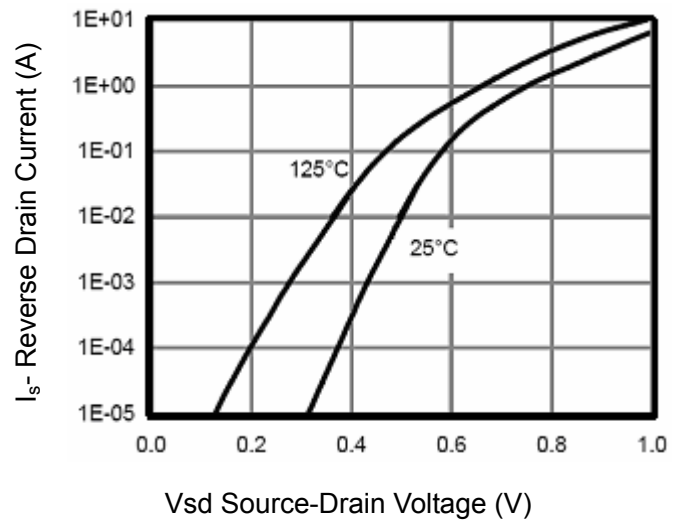


Figure 12 Source- Drain Diode Forward

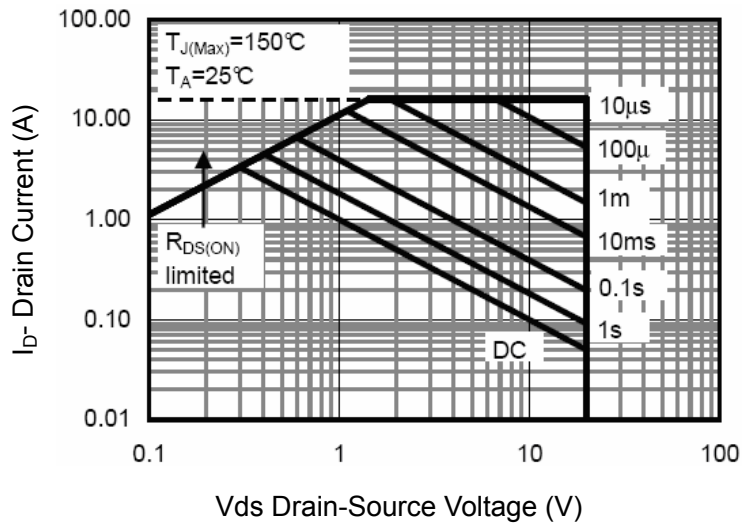


Figure 13 Safe Operation Area

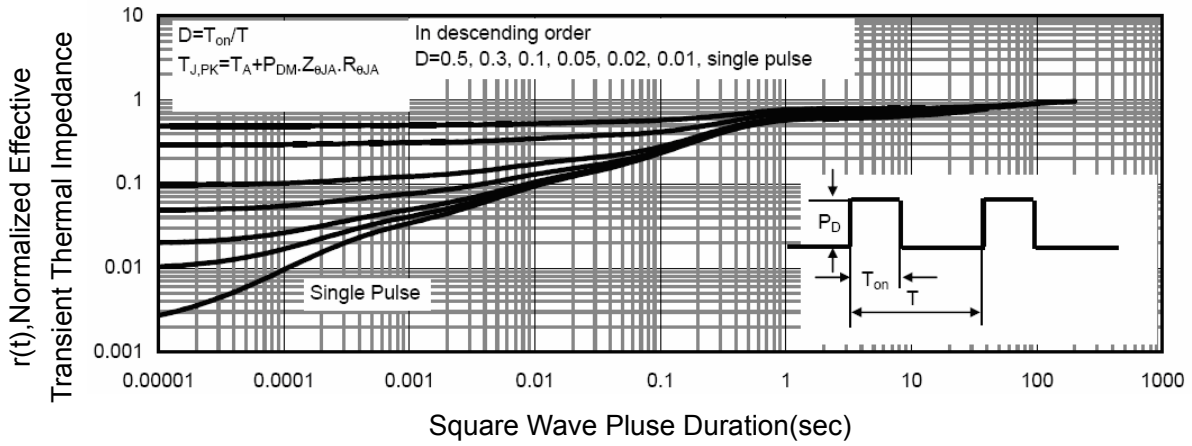


Figure 14 Normalized Maximum Transient Thermal Impedance

P- Channel Typical Electrical and Thermal Characteristics (Curves)

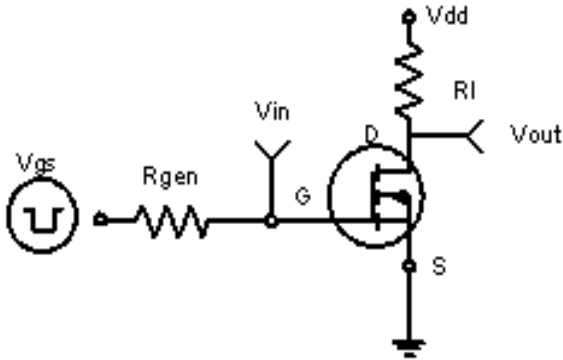


Figure 1: Switching Test Circuit

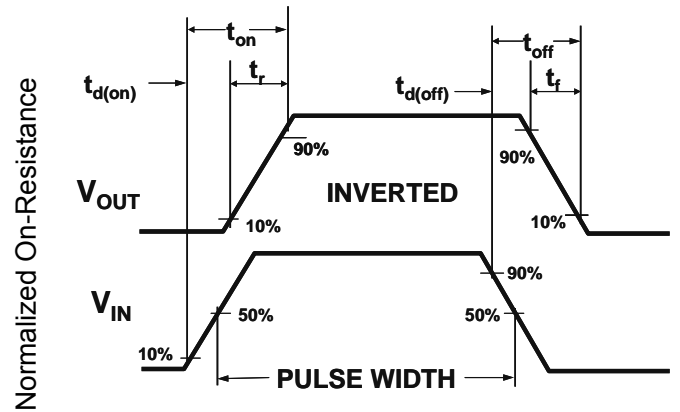
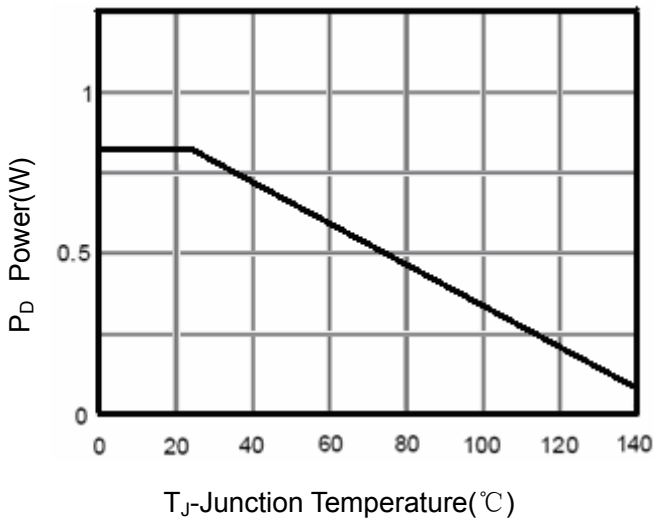
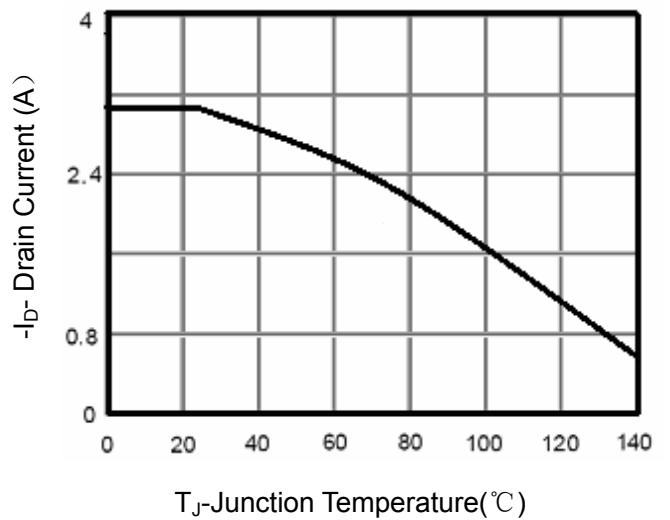


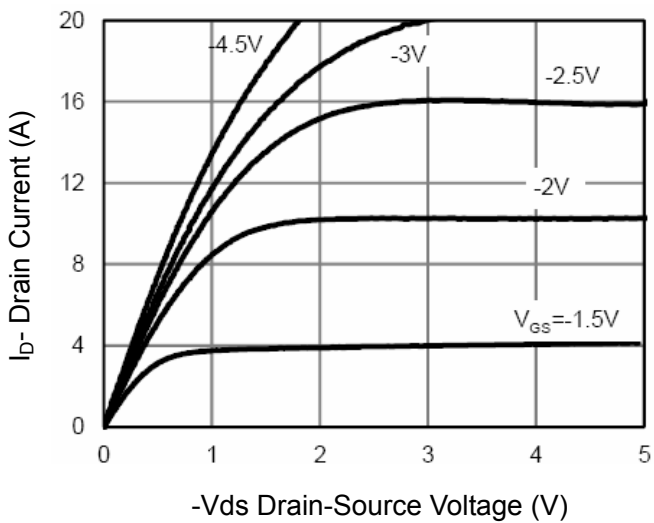
Figure 2: Switching Waveforms



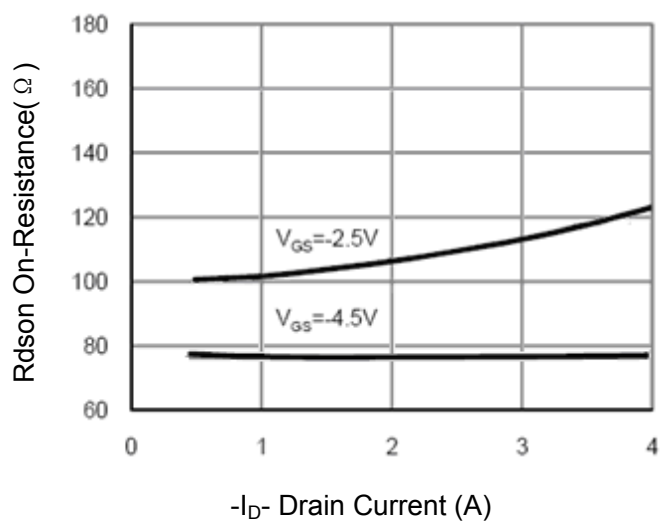
T_J-Junction Temperature(°C)
Figure 3 Power Dissipation



T_J-Junction Temperature(°C)
Figure 4 Drain Current



-V_{ds} Drain-Source Voltage (V)
Figure 5 Output Characteristics



-I_D Drain Current (A)
Figure 6 Drain-Source On-Resistance

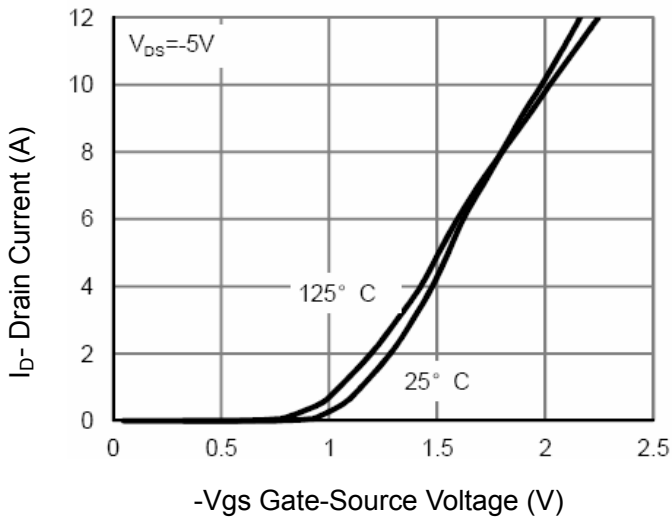


Figure 7 Transfer Characteristics

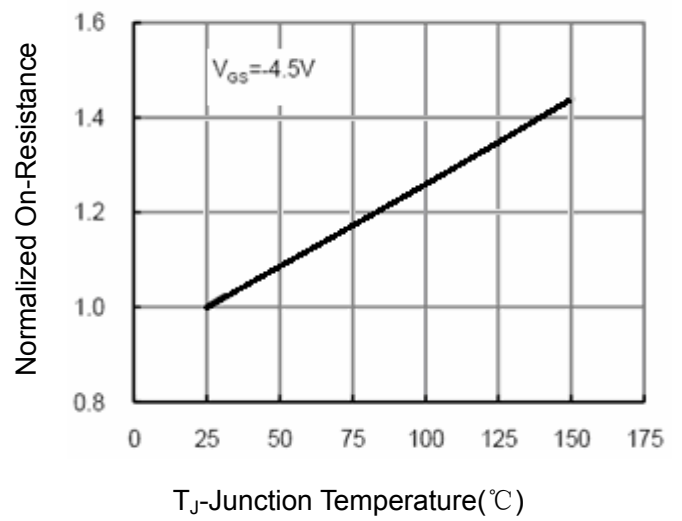


Figure 8 Drain-Source On-Resistance

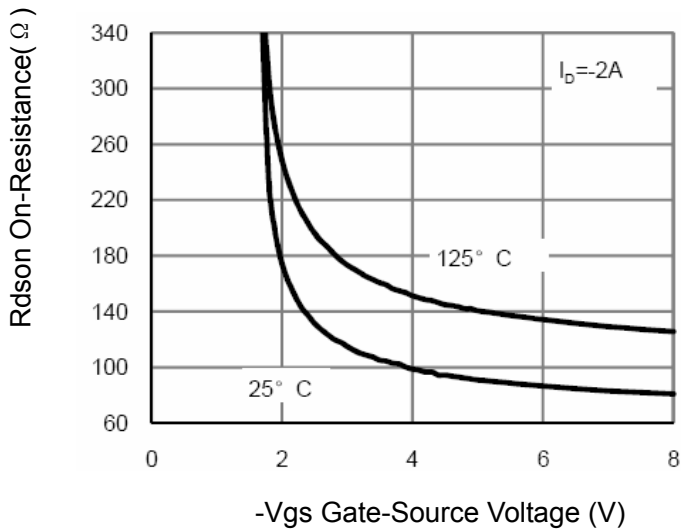


Figure 9 Rdson vs Vgs

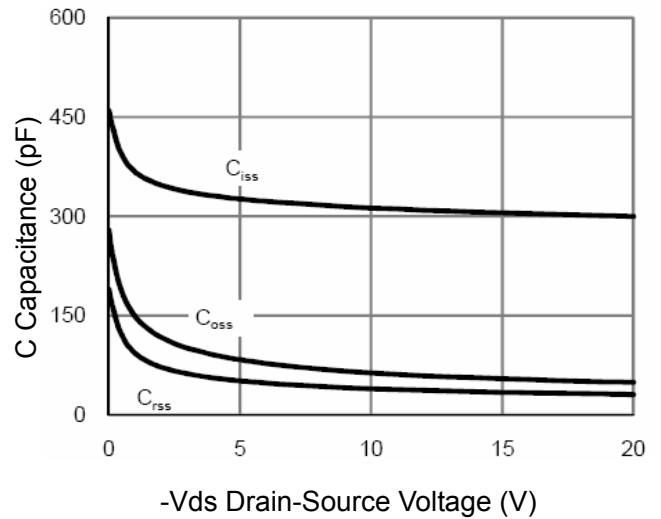


Figure 10 Capacitance vs Vds

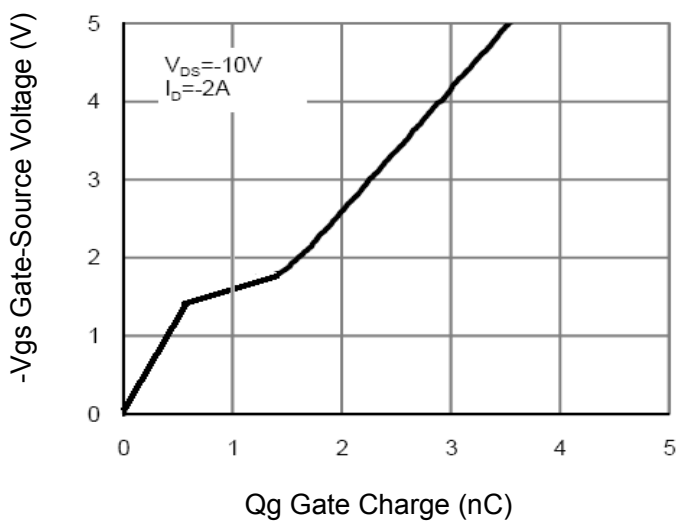


Figure 11 Gate Charge

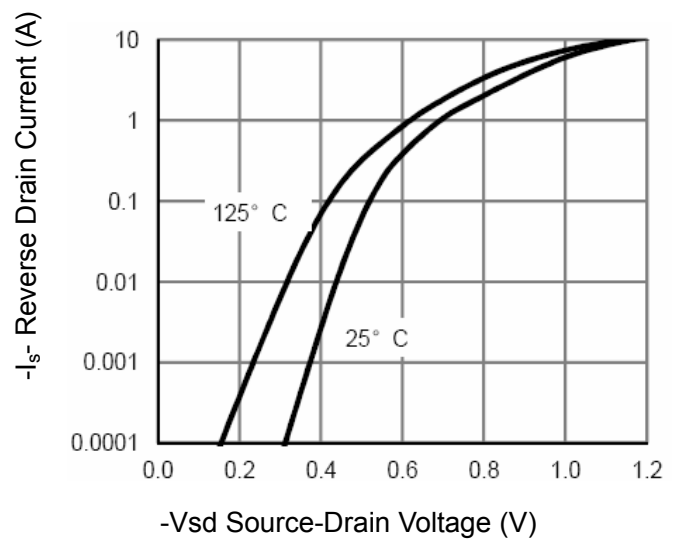


Figure 12 Source- Drain Diode Forward

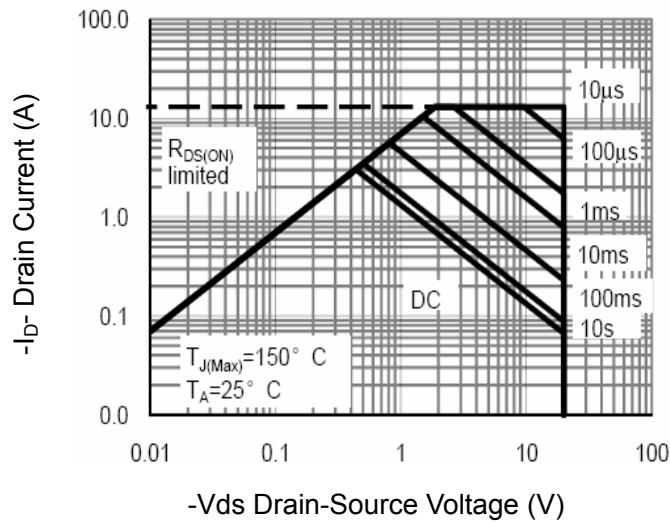


Figure 13 Safe Operation Area

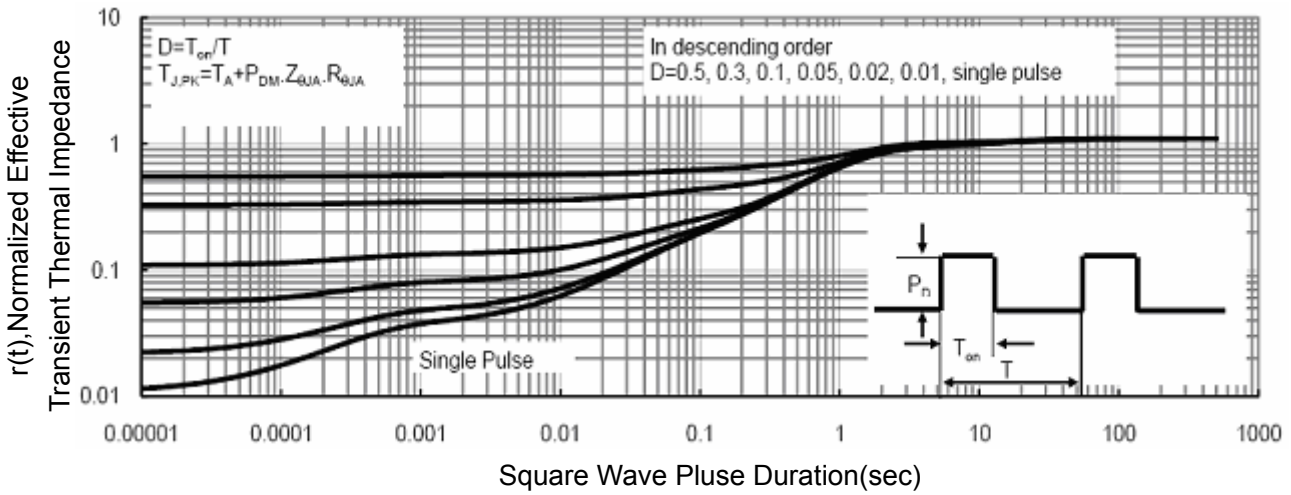
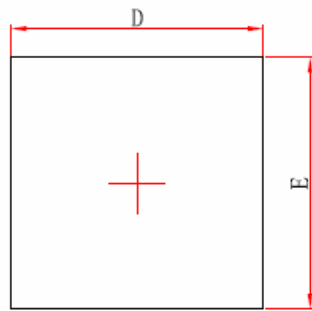
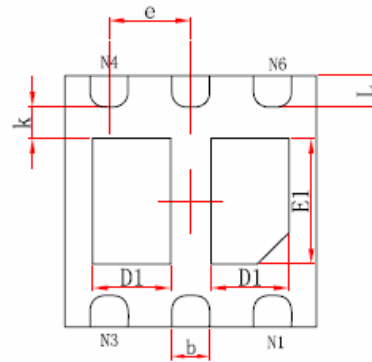


Figure 14 Normalized Maximum Transient Thermal Impedance

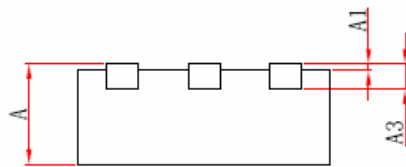
DFN2X2-6L Package Information



Top View



Bottom View



Side View

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------------|----------------------|-------------|
| | Min. | Max. | Min. | Max. |
| A | 0.700/0.800 | 0.800/0.900 | 0.028/0.031 | 0.031/0.035 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A3 | 0.203REF. | | 0.008REF. | |
| D | 1.924 | 2.076 | 0.076 | 0.082 |
| E | 1.924 | 2.076 | 0.076 | 0.082 |
| D1 | 0.520 | 0.720 | 0.020 | 0.028 |
| E1 | 0.900 | 1.100 | 0.035 | 0.043 |
| k | 0.200MIN. | | 0.008MIN. | |
| b | 0.250 | 0.350 | 0.010 | 0.014 |
| e | 0.650TYP. | | 0.026TYP. | |
| L | 0.174 | 0.326 | 0.007 | 0.013 |