30V N+P Dual Channel MOSFETs

# PDQ3716

## General Description

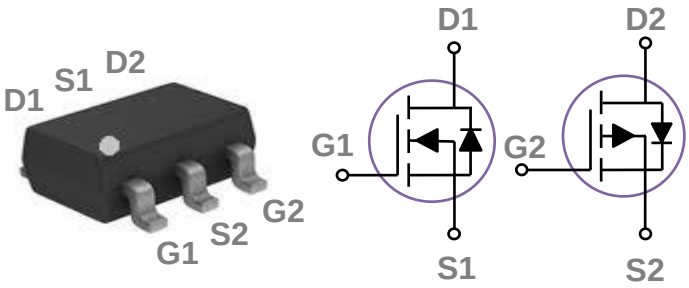
*These N+P dual Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.*

| BVDSS | RDSON | ID |
|---|---|---|
| 30V | 34mΩ | 4.5A |
| -30V | 86mΩ | -3A |

## Features

- *Fast switching*
- *Green Device Available*
- *Suit for 4.5V Gate Drive Applications*

## SOT23-6 Dual Pin Configuration




## Applications

- *DC Fan*
- *Motor Drive Applications*
- *Networking*
- *Half / Full Bridge Topology*

## Absolute Maximum Ratings Tc=25℃ unless otherwise noted

| Symbol | Parameter | Rating | | Units |
|---|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 30 | -30 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | ±20 | V |
| $I_D$ | Drain Current – Continuous ($T_A$=25℃) | 4.5 | -3 | A |
| | Drain Current – Continuous ($T_A$=70℃) | 3.6 | -2.4 | A |
| $I_{DM}$ | Drain Current – Pulsed[1,4] | 18 | -12 | A |
| $P_D$ | Power Dissipation ($T_A$=25℃) | 1.25 | | W |
| | Power Dissipation – Derate above 25℃ | 0.01 | | W/℃ |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | | ℃ |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | --- | 100 | ℃/W |

## N-CH Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

### Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 30 | --- | --- | V |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=30V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
| | | $V_{DS}$=24V , $V_{GS}$=0V , $T_J$=125℃ | --- | --- | 10 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |

### On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V , $I_D$=2A | --- | 28 | 34 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=1.5A | --- | 44 | 57 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.2 | 1.6 | 2.5 | V |
| gfs | Forward Transconductance | $V_{DS}$=10V , $I_D$=1.5A | --- | 2.3 | --- | S |

### Dynamic and switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge[2,3] | $V_{DS}$=15V , $V_{GS}$=10V , $I_D$=2.5A | --- | 7.7 | 15 | nC |
| $Q_{gs}$ | Gate-Source Charge[2,3] | | --- | 0.3 | 2 | |
| $Q_{gd}$ | Gate-Drain Charge[2,3] | | --- | 0.7 | 3 | |
| $T_{d(on)}$ | Turn-On Delay Time[2,3] | $V_{DD}$=15V , $V_{GS}$=10V , $R_G$=6Ω , $I_D$=2.5A | --- | 2 | 5 | ns |
| $T_r$ | Rise Time[2,3] | | --- | 3 | 5 | |
| $T_{d(off)}$ | Turn-Off Delay Time[2,3] | | --- | 9 | 15 | |
| $T_f$ | Fall Time[2,3] | | --- | 6 | 10 | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , F=1MHz | --- | 245 | 370 | pF |
| $C_{oss}$ | Output Capacitance | | --- | 33 | 50 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 28 | 45 | |

### Drain-Source Diode Characteristics and Maximum Ratings

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | $V_G$=$V_D$=0V , Force Current | --- | --- | 4.5 | A |
| $I_{SM}$ | Pulsed Source Current | | --- | --- | 9 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=1A , $T_J$=25℃ | --- | --- | 1 | V |

Note :
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%.
3. Essentially independent of operating temperature.

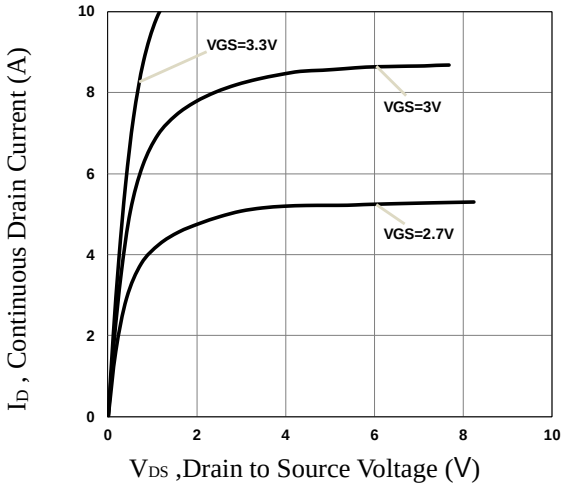



**Fig.1 Typical Output Characteristics**

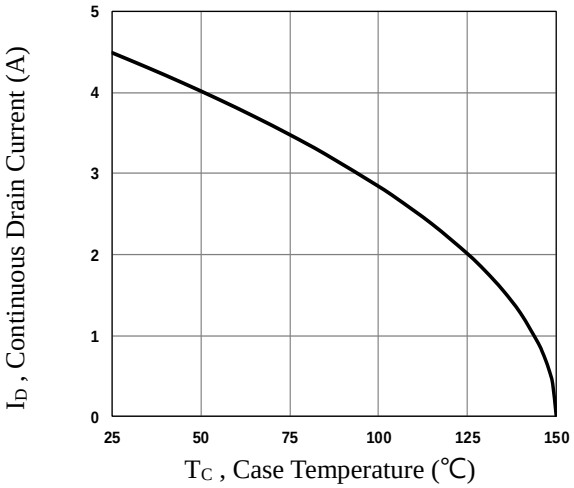



**Fig.2 Continuous Drain Current vs. $T_C$**

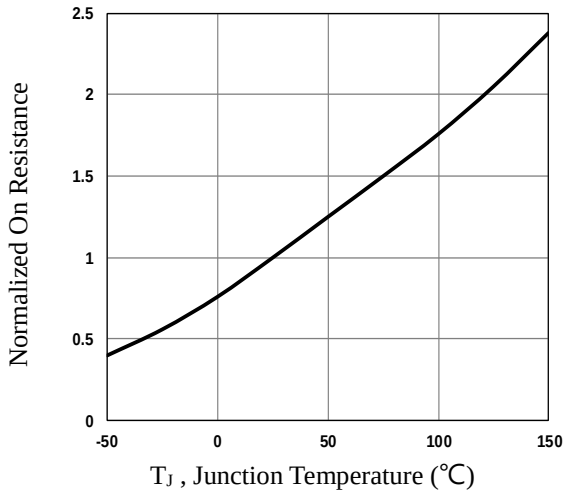



**Fig.3 Normalized RDSON vs. $T_J$**

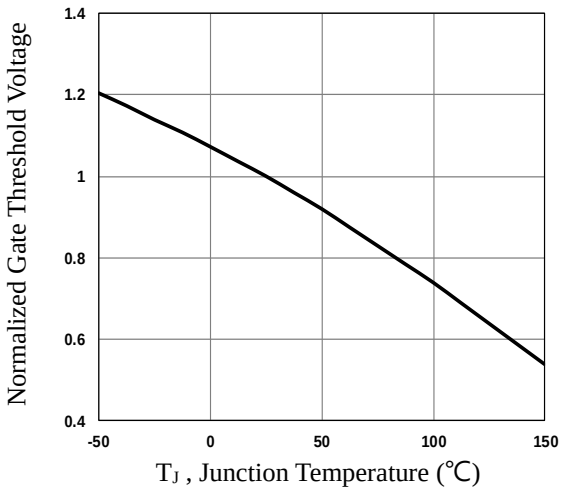



**Fig.4 Normalized $V_{th}$ vs. $T_J$**

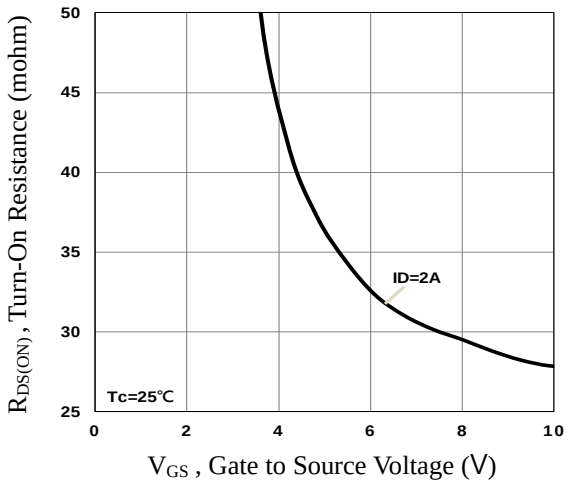



**Fig.5 Turn-On Resistance vs. $V_{GS}$**

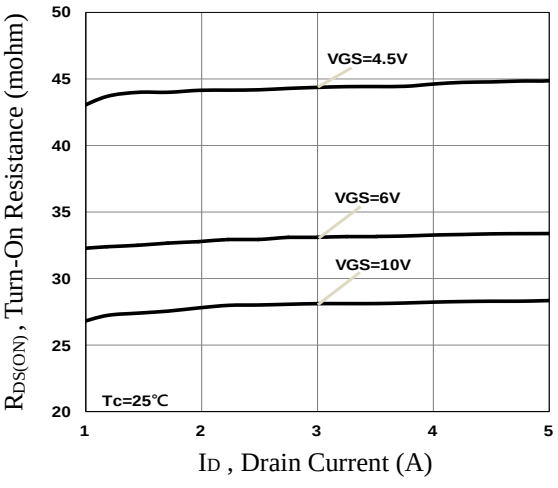



**Fig.6 Turn-On Resistance vs. $I_D$**

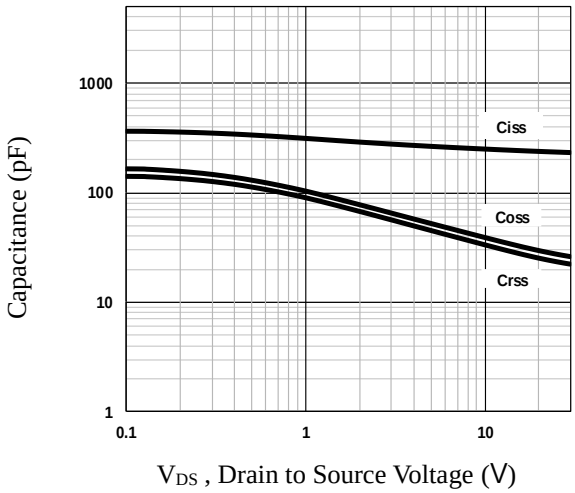



**Fig.7 Capacitance Characteristics**

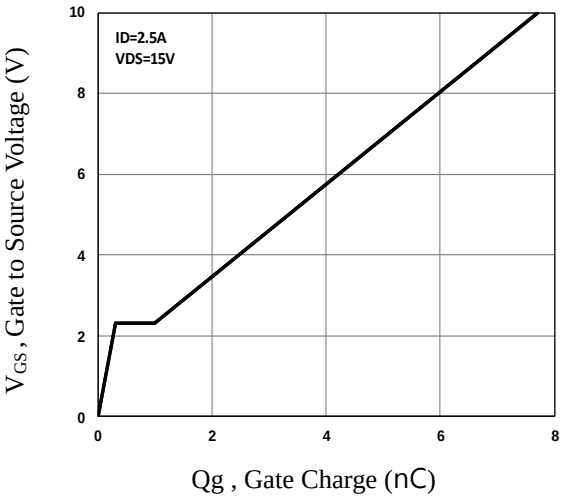



**Fig.8 Gate Charge Characteristics**

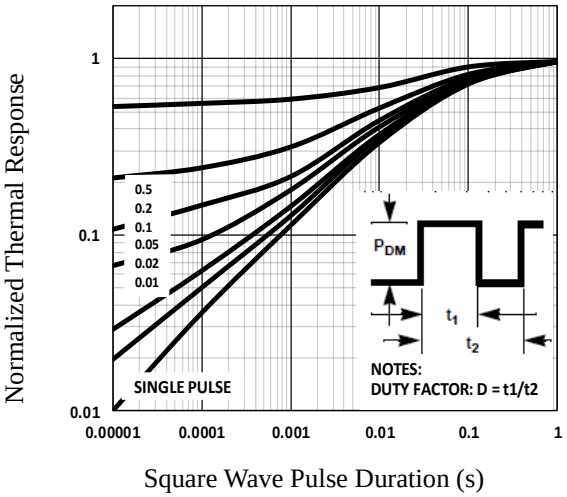



**Fig.9 Normalized Transient Impedance**

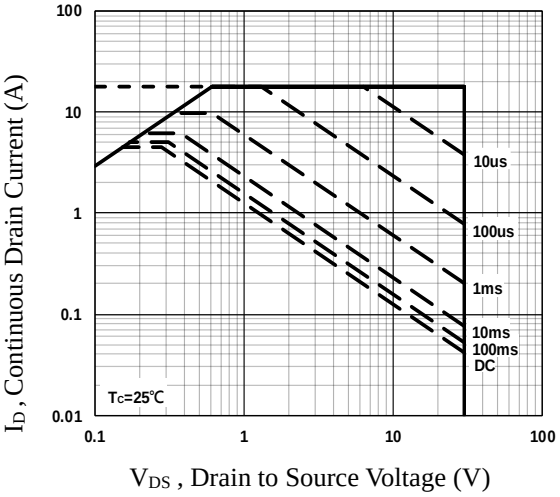



**Fig.10 Maximum Safe Operation Area**

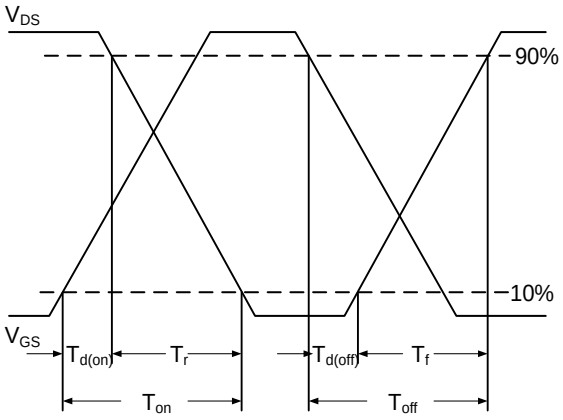



**Fig.11 Switching Time Waveform**

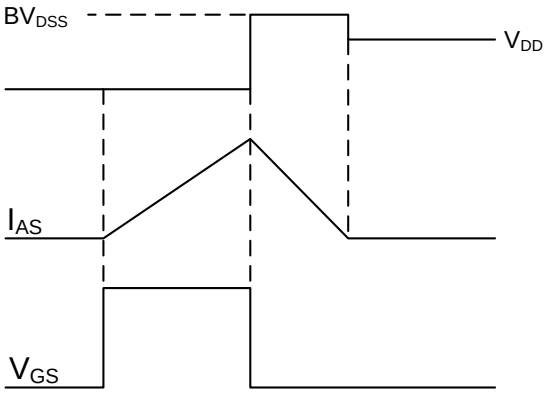



**Fig.12 EAS Waveform**

## P-CH Electrical Characteristics ($T_J$=25 ℃, unless otherwise noted)

### Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=-250uA | -30 | --- | --- | V |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-30V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | -1 | uA |
| | | $V_{DS}$=-24V , $V_{GS}$=0V , $T_J$=125℃ | --- | --- | -10 | uA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |

### On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=-10V , $I_D$=-1.5A | --- | 72 | 86 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-1A | --- | 106 | 138 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =-250uA | -1.2 | -1.6 | -2.5 | V |
| gfs | Forward Transconductance | $V_{DS}$=-10V , $I_D$=-1A | --- | 2 | --- | S |

### Dynamic and switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge[5,6] | $V_{DS}$=-10V , $V_{GS}$=-10V , $I_D$=-1.5A | --- | 7.3 | 11 | nC |
| $Q_{gs}$ | Gate-Source Charge[5,6] | | --- | 2.1 | 5 | |
| $Q_{gd}$ | Gate-Drain Charge[5,6] | | --- | 1.3 | 3 | |
| $T_{d(on)}$ | Turn-On Delay Time[5,6] | $V_{DD}$=-10V , $V_{GS}$=-10V , $R_G$=6Ω , $I_D$=-1.5A | --- | 4 | 6 | ns |
| $T_r$ | Rise Time[5,6] | | --- | 6 | 10 | |
| $T_{d(off)}$ | Turn-Off Delay Time[5,6] | | --- | 12 | 18 | |
| $T_f$ | Fall Time[5,6] | | --- | 8 | 12 | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-15V , $V_{GS}$=0V , F=1MHz | --- | 250 | 380 | pF |
| $C_{oss}$ | Output Capacitance | | --- | 37 | 60 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 30 | 45 | |

### Drain-Source Diode Characteristics and Maximum Ratings

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current | $V_G$=$V_D$=0V , Force Current | --- | --- | -3 | A |
| $I_{SM}$ | Pulsed Source Current | | --- | --- | -6 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$=0V , $I_S$=-1A , $T_J$=25℃ | --- | --- | -1 | V |

Note :
4. Repetitive Rating : Pulsed width limited by maximum junction temperature.
5. The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%.
6. Essentially independent of operating temperature.

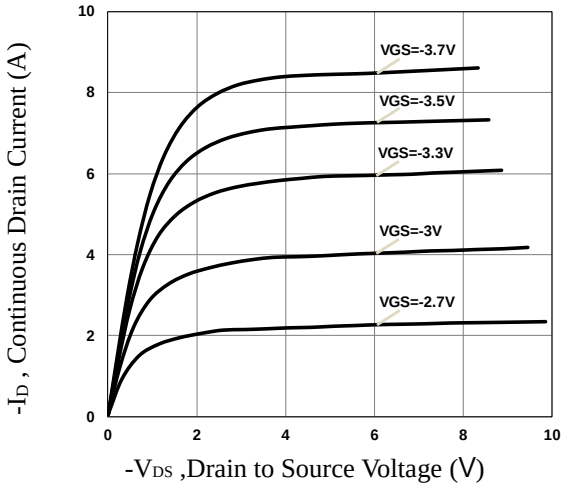



**Fig.13 Typical Output Characteristics**

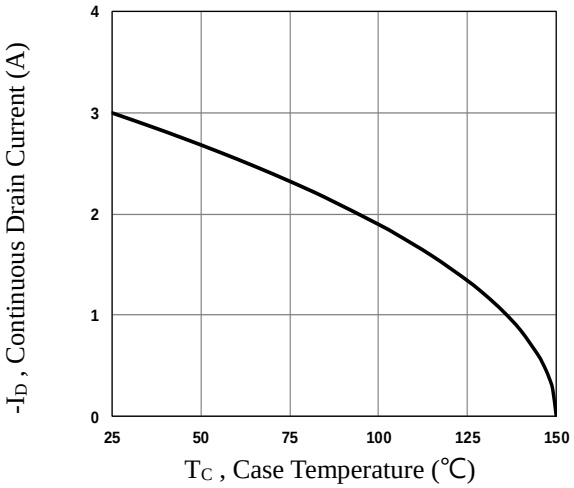



**Fig.14 Continuous Drain Current vs. $T_C$**

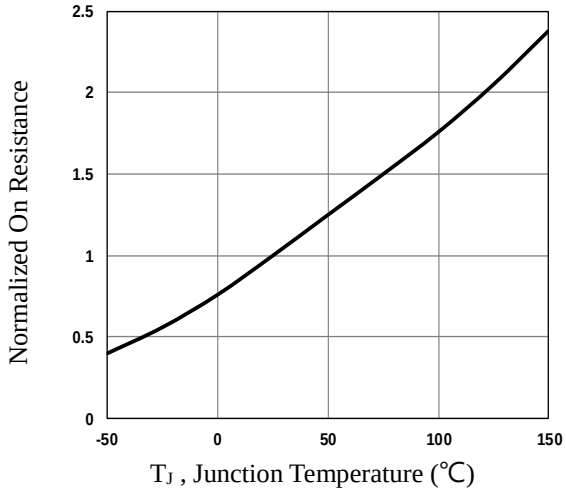



**Fig.15 Normalized RDSON vs. $T_J$**

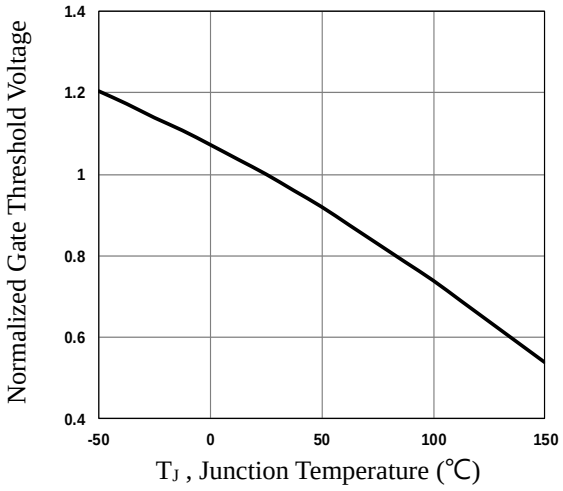



**Fig.16 Normalized $V_{th}$ vs. $T_J$**

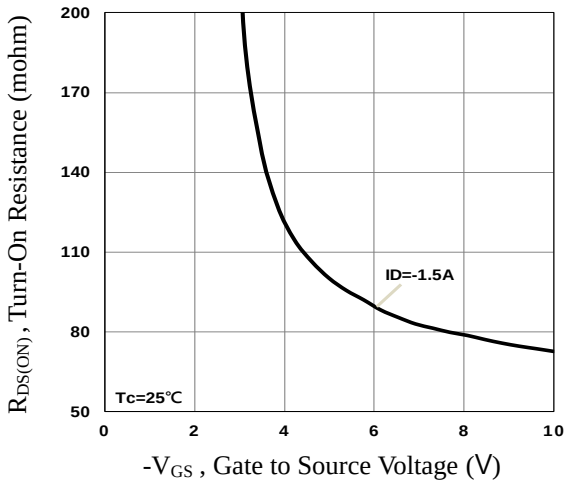



**Fig.17 Turn-On Resistance vs. $V_{GS}$**

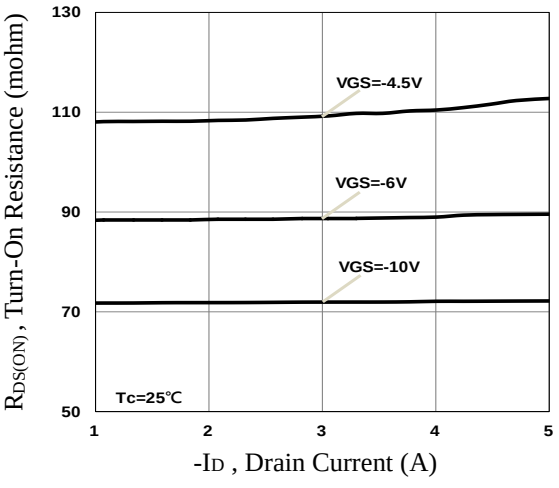



**Fig.18 Turn-On Resistance vs. $I_D$**

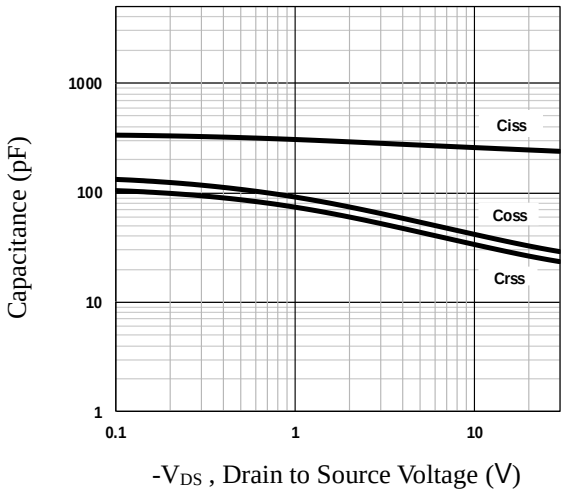



**Fig.19 Capacitance Characteristics**

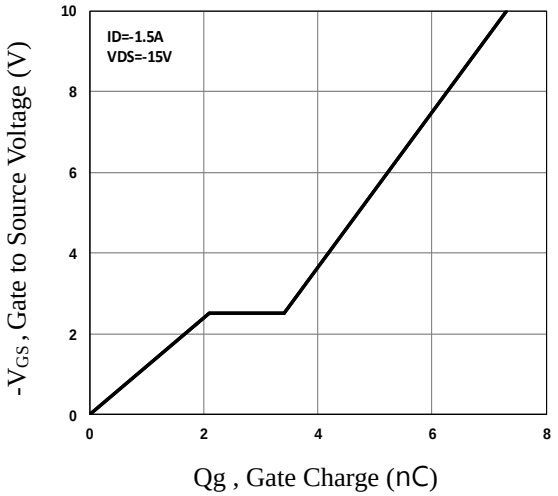



**Fig.20 Gate Charge Characteristics**

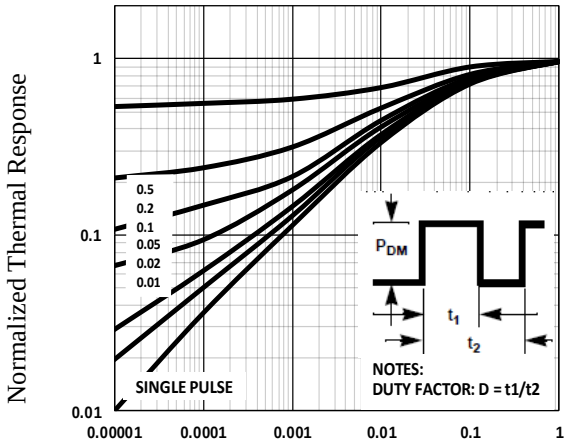



**Fig.21 Normalized Transient**

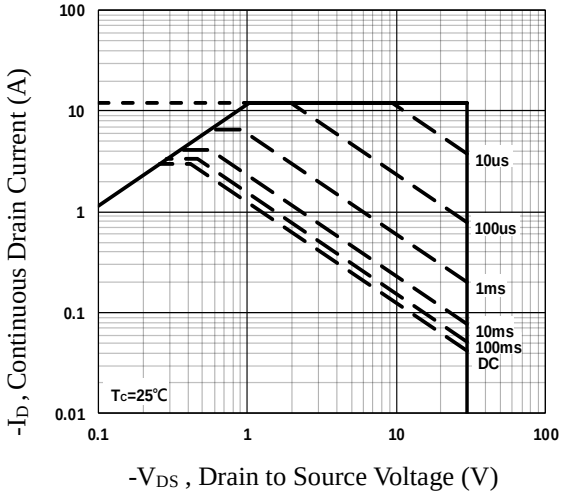



**Fig.22 Maximum Safe Operation Area**

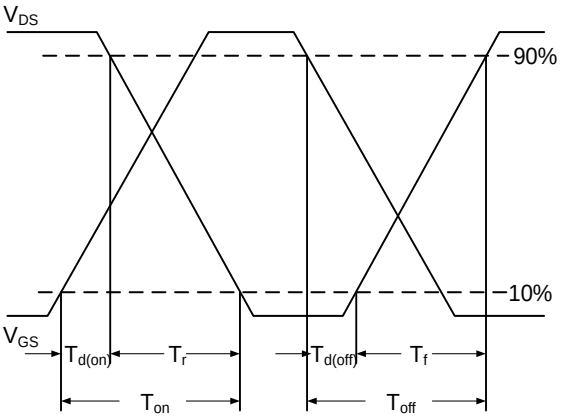



**Fig.23 Switching Time Waveform**

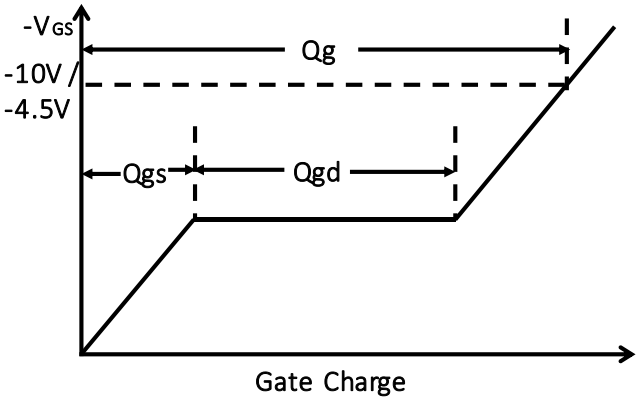
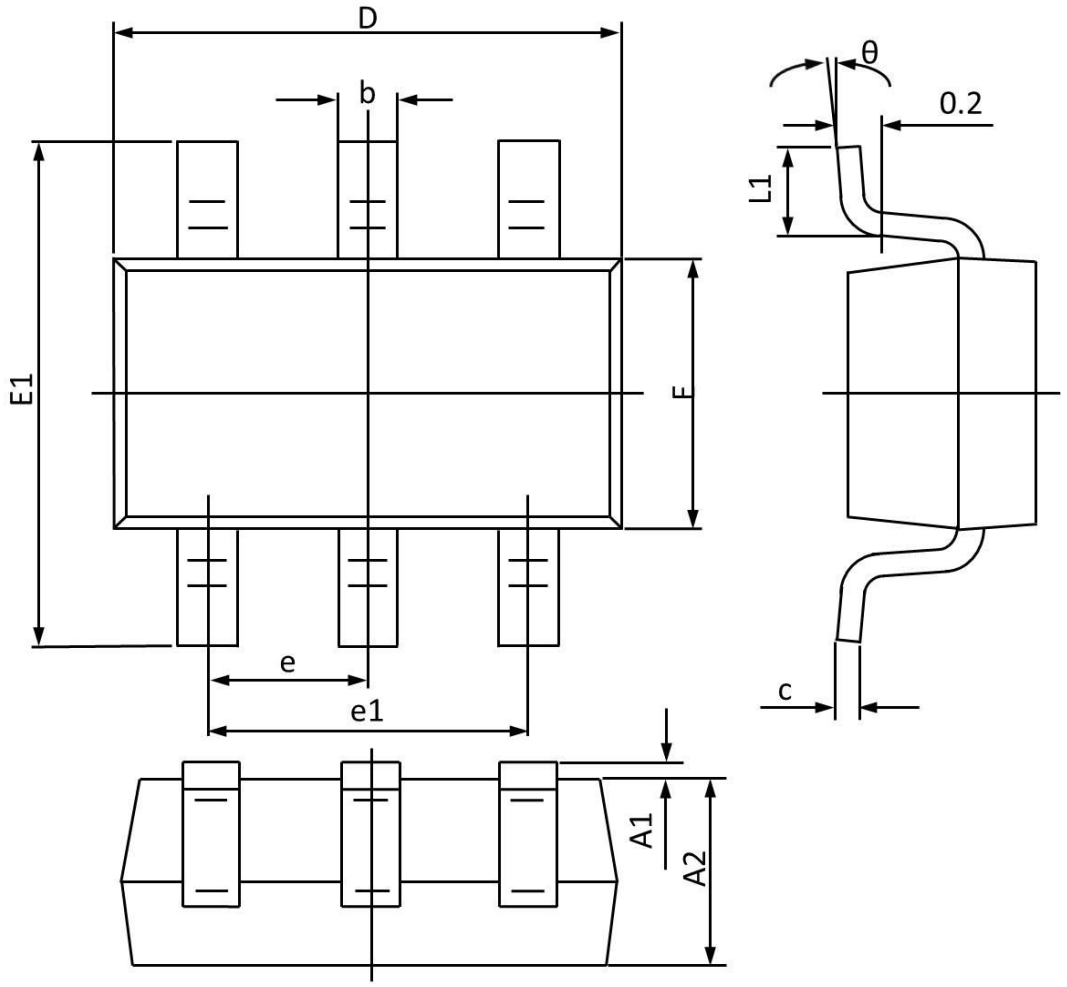



**Fig.24 Gate Charge Waveform**

# SOT23-6 PACKAGE INFORMATION




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A1 | --- | 0.150 | --- | 0.006 |
| A2 | 0.900 | 1.300 | 0.035 | 0.051 |
| b | 0.300 | 0.500 | 0.012 | 0.019 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.800 | 3.050 | 0.110 | 0.120 |
| E1 | 2.600 | 3.000 | 0.103 | 0.118 |
| F | 1.500 | 1.800 | 0.059 | 0.071 |
| e | 0.950 TYP | | 0.037 TYP | |
| e1 | 1.900 TYP | | 0.075 TYP | |
| L1 | 0.250 | 0.600 | 0.010 | 0.024 |
| θ | 0° | 8° | 0° | 8° |