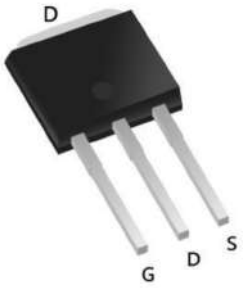
# N-Ch 60V Fast Switching MOSFETs

- ★ 100% EAS Guaranteed
- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology

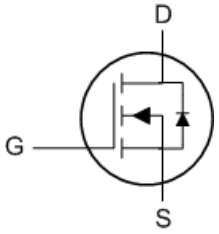



**TO251 Pin Configuration**

## Description:

The KWR6016 is the high cell density trenched N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The KWR6016 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.




| BVDSS | RDSON | ID |
|---|---|---|
| 60V | 12mΩ | 47A |

### Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 60 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_C$=25°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 47 | A |
| $I_D$@$T_C$=100°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 30 | A |
| $I_D$@$T_A$=25°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 9.2 | A |
| $I_D$@$T_A$=70°C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 7.5 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 100 | A |
| EAS | Single Pulse Avalanche Energy[3] | 72.2 | mJ |
| $I_{AS}$ | Avalanche Current | 38 | A |
| $P_D$@$T_C$=25°C | Total Power Dissipation[4] | 52 | W |
| $P_D$@$T_A$=25°C | Total Power Dissipation[4] | 2 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | °C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | °C |

### Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient [1] | --- | 62 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case[1] | --- | 2.4 | °C/W |

## Electrical Characteristics ($T_J$=25 ˚C, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 60 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25˚C , $I_D$=1mA | --- | 0.052 | --- | V/˚C |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V , $I_D$=30A | --- | --- | 12 | mΩ |
| | | $V_{GS}$=4.5V , $I_D$=15A | --- | --- | 15 | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.2 | --- | 2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -5.76 | --- | mV/˚C |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=48V , $V_{GS}$=0V , $T_J$=25˚C | --- | --- | 1 | uA |
| | | $V_{DS}$=48V , $V_{GS}$=0V , $T_J$=55˚C | --- | --- | 5 | |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=5V , $I_D$=30A | --- | 42 | --- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 1.5 | --- | Ω |
| $Q_g$ | Total Gate Charge (4.5V) | $V_{DS}$=48V , $V_{GS}$=4.5V , $I_D$=15A | --- | 28.7 | --- | nC |
| $Q_{gs}$ | Gate-Source Charge | | --- | 10.5 | --- | |
| $Q_{gd}$ | Gate-Drain Charge | | --- | 9.9 | --- | |
| $T_{d(on)}$ | Turn-On Delay Time | $V_{DD}$=30V , $V_{GS}$=10V , $R_G$=3.3Ω, $I_D$=15A | --- | 10.4 | --- | ns |
| $T_r$ | Rise Time | | --- | 9.2 | --- | |
| $T_{d(off)}$ | Turn-Off Delay Time | | --- | 63 | --- | |
| $T_f$ | Fall Time | | --- | 4.8 | --- | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , f=1MHz | --- | 3240 | --- | pF |
| $C_{oss}$ | Output Capacitance | | --- | 210 | --- | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 146 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_S$ | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | 47 | A |
| $I_{SM}$ | Pulsed Source Current[2,5] | | --- | --- | 100 | A |
| $V_{SD}$ | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=A , $T_J$=25˚C | --- | --- | 1.2 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$=15A , dI/dt=100A/μs , $T_J$=25˚C | --- | 18 | --- | nS |
| $Q_{rr}$ | Reverse Recovery Charge | | --- | 14 | --- | nC |

Note :

1.The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.
2.The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%
3.The EAS data shows Max. rating . The test condition is $V_{DD}$=25V,$V_{GS}$=10V,L=0.1mH,$I_{AS}$=38A
4.The power dissipation is limited by 150˚C junction temperature
5.The data is theoretically the same as $I_D$ and $I_{DM}$ , in real applications , should be limited by total power dissipation.

## Typical Characteristics

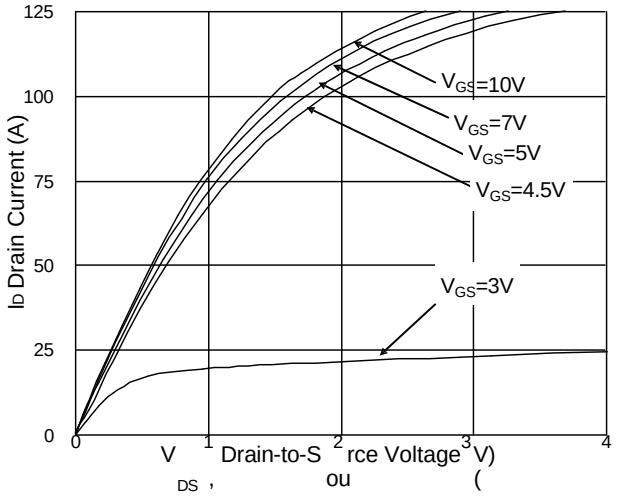



**Fig.1 Typical Output Characteristics**

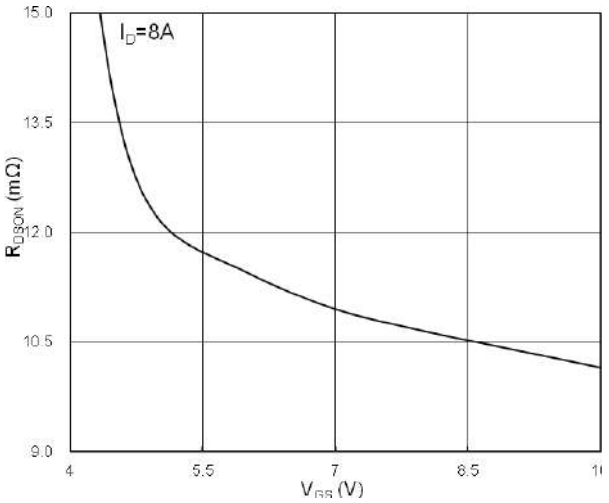



**Fig.2 On-Resistance v.s Gate-Source**

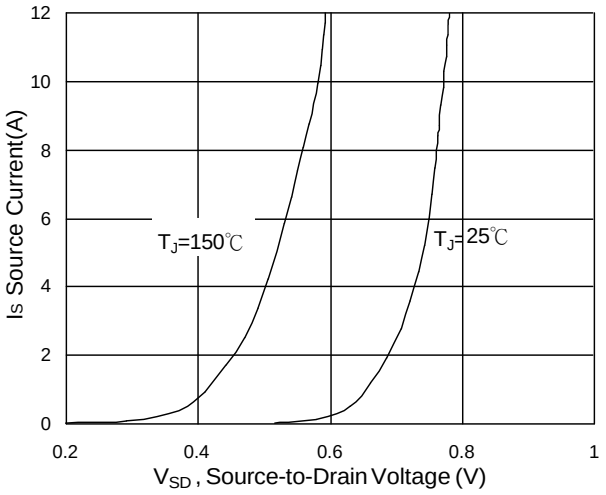



**Fig.3 Forward Characteristics of Reverse**

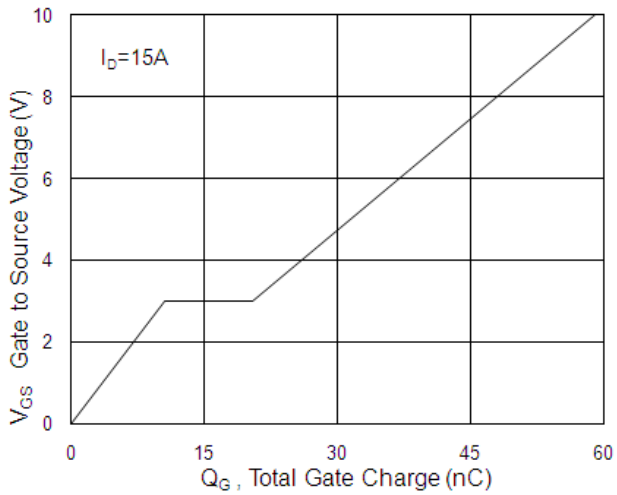



**Fig.4 Gate-Charge Characteristics**

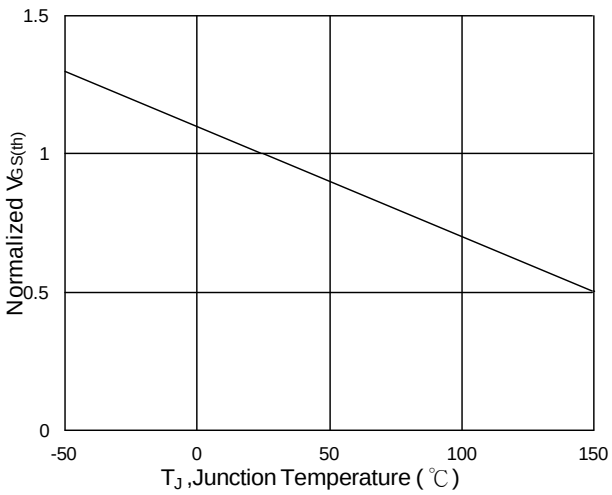



**Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$**

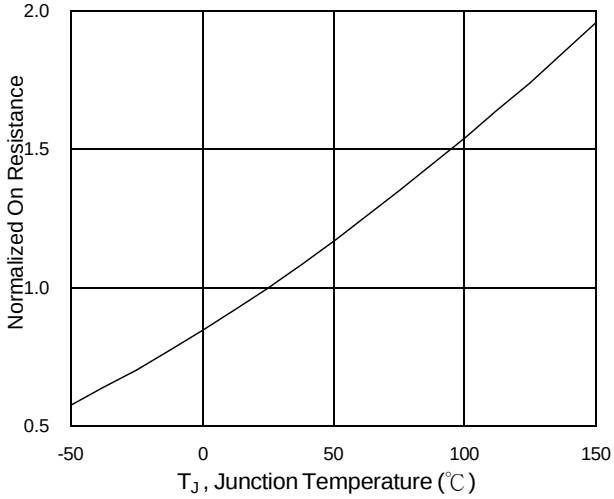



**Fig.6 Normalized $R_{DSON}$ vs. $T_J$**

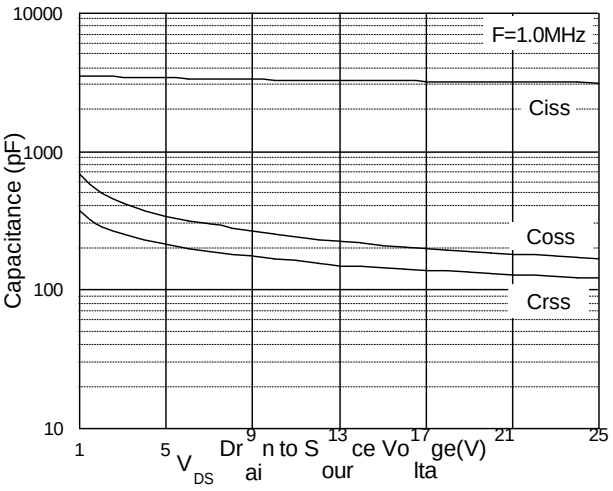



Fig.7 Capacitance

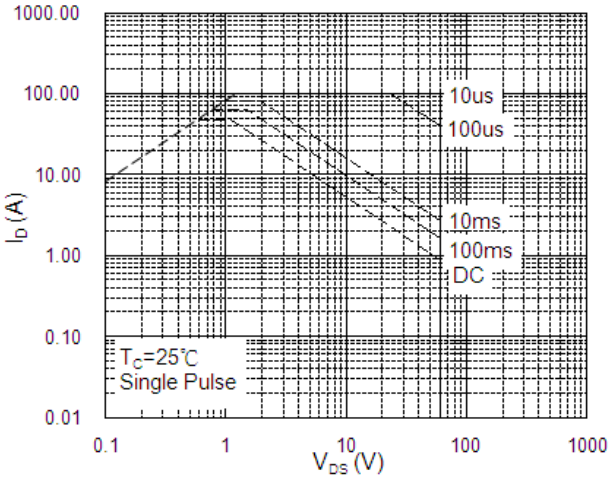



Fig.8 Safe Operating Area

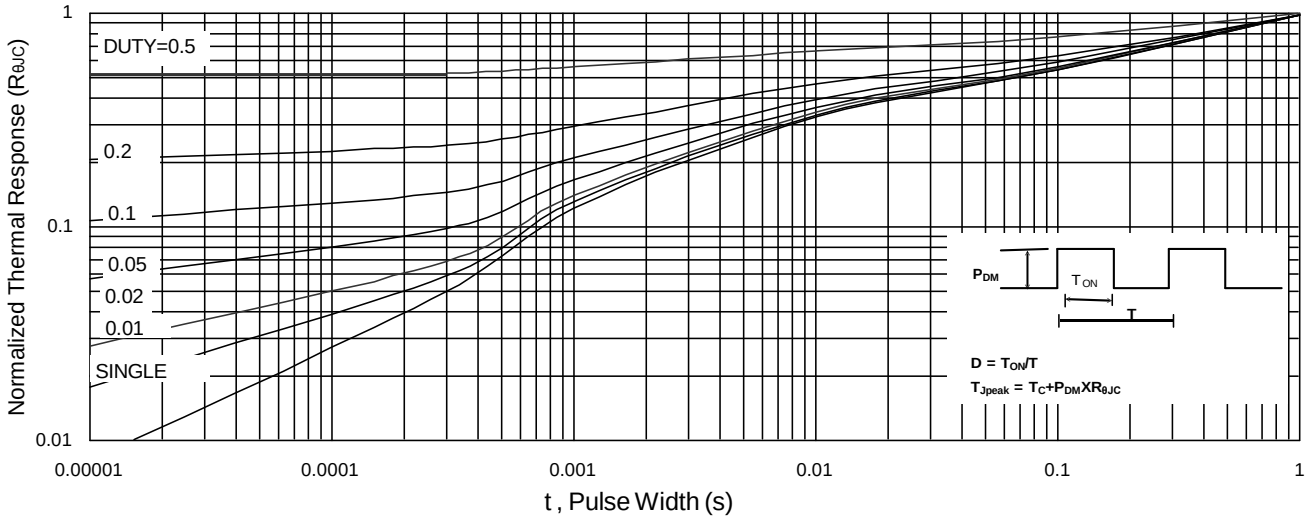



Fig.9 Normalized Maximum Transient Thermal Impedance

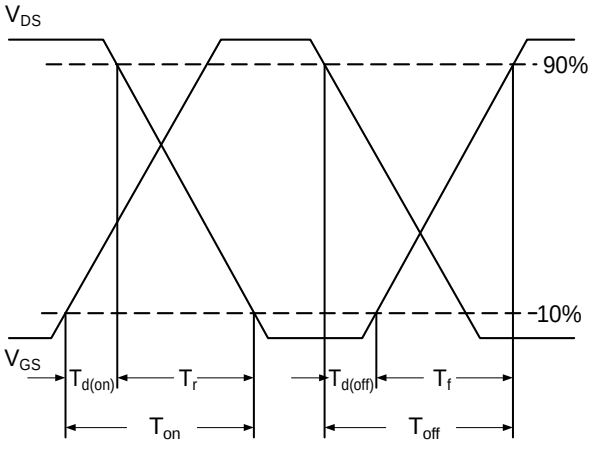



Fig.10 Switching Time Waveform

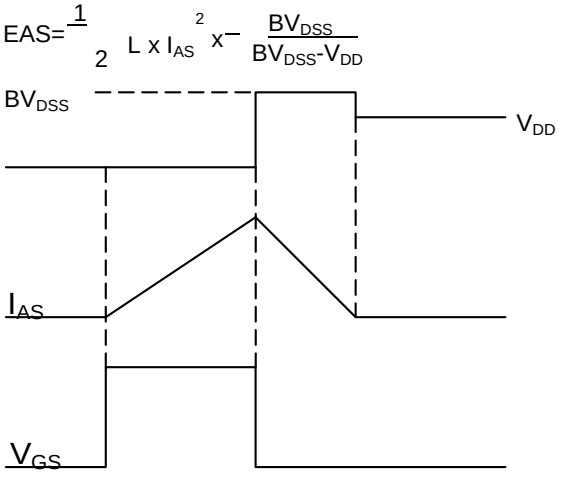



Fig.11 Unclamped Inductive Switching Waveform