

60V N-Channel MOSFETs

General Description

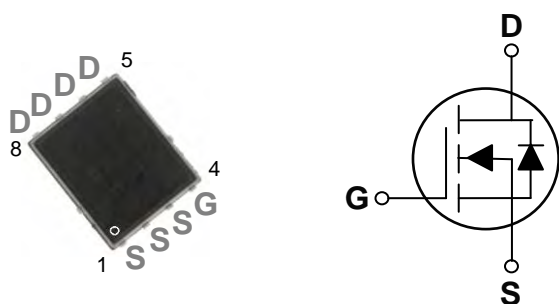
These N-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These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

| | | |
|-------|---------------------|----------------|
| BVDSS | R _{DS(ON)} | I _D |
| 60V | 12mΩ | 50A |

Features

- 60V,50A, R_{DS(ON)} = 12mΩ @V_{GS} = 10V
- Improved dv/dt capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

PPAK5X6 Pin Configuration



Applications

- Motor Drive
- Power Tools
- LED Lighting

Absolute Maximum Ratings (T_c=25°C unless otherwise noted)

| Symbol | Parameter | Rating | Units |
|------------------|--|------------|-------|
| V _{DS} | Drain-Source Voltage | 60 | V |
| V _{GS} | Gate-Source Voltage | ± 20 | V |
| I _D | Drain Current – Continuous (T _c =25°C) | 50 | A |
| | Drain Current – Continuous (T _c =100°C) | 31 | A |
| I _{DM} | Drain Current – Pulsed ¹ | 200 | A |
| EAS | Single Pulse Avalanche Energy ² | 61 | mJ |
| IAS | Single Pulse Avalanche Current ² | 35 | A |
| P _D | Power Dissipation (T _c =25°C) | 96 | W |
| | Power Dissipation – Derate above 25°C | 0.77 | W/°C |
| T _{STG} | Storage Temperature Range | -55 to 150 | °C |
| T _J | Operating Junction Temperature Range | -55 to 150 | °C |

Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|------------------|--|------|------|------|
| R _{θJA} | Thermal Resistance Junction to ambient | --- | 62 | °C/W |
| R _{θJC} | Thermal Resistance Junction to Case | --- | 1.3 | °C/W |



FTK6904DFN56

60V N-Channel MOSFETs

Electrical Characteristics ($T_J=25^\circ\text{C}$, unless otherwise noted)

Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------------------------|------------------------------------|--|------|------|-----------|---------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$ | 60 | --- | --- | V |
| $\Delta BV_{DSS}/\Delta T_J$ | BV_{DSS} Temperature Coefficient | Reference to 25°C , $I_D=1\text{mA}$ | --- | 0.03 | --- | V/ $^\circ\text{C}$ |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=60V, V_{GS}=0V, T_J=25^\circ\text{C}$ | --- | --- | 1 | μA |
| | | $V_{DS}=48V, V_{GS}=0V, T_J=125^\circ\text{C}$ | --- | --- | 10 | μA |
| I_{GSS} | Gate-Source Leakage Current | $V_{GS}=\pm 20V, V_{DS}=0V$ | --- | --- | ± 100 | nA |

On Characteristics

| | | | | | | |
|---------------------|--|-------------------------------|-----|------|-----|----------------------|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance ³ | $V_{GS}=10V, I_D=10A$ | --- | 10 | 12 | m Ω |
| | | $V_{GS}=4.5V, I_D=8A$ | --- | 12 | 15 | m Ω |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}=V_{DS}, I_D=250\mu A$ | 1.2 | 1.6 | 2.5 | V |
| $\Delta V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | -4 | --- | mV/ $^\circ\text{C}$ |
| g_{fs} | Forward Transconductance | $V_{DS}=10V, I_D=6A$ | --- | 11.7 | --- | S |

Dynamic and switching Characteristics

| | | | | | | |
|--------------|------------------------------------|---|-----|------|------|----------|
| Q_g | Total Gate Charge ^{3,4} | $V_{DS}=30V, V_{GS}=10V, I_D=10A$ | --- | 39.2 | 59 | nC |
| Q_{gs} | Gate-Source Charge ^{3,4} | | --- | 5.9 | 9 | |
| Q_{gd} | Gate-Drain Charge ^{3,4} | | --- | 8.8 | 14 | |
| $T_{d(on)}$ | Turn-On Delay Time ^{3,4} | $V_{DD}=15V, V_{GS}=10V, R_G=6\Omega$ $I_D=1A$ | --- | 9.6 | 18 | ns |
| T_r | Rise Time ^{3,4} | | --- | 28.2 | 54 | |
| $T_{d(off)}$ | Turn-Off Delay Time ^{3,4} | | --- | 45.3 | 86 | |
| T_f | Fall Time ^{3,4} | | --- | 10.9 | 21 | |
| C_{iss} | Input Capacitance | $V_{DS}=25V, V_{GS}=0V, F=1\text{MHz}$ | --- | 2100 | 3050 | pF |
| C_{oss} | Output Capacitance | | --- | 165 | 240 | |
| C_{riss} | Reverse Transfer Capacitance | | --- | 80 | 120 | |
| R_g | Gate resistance | $V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$ | --- | 1.6 | 3.2 | Ω |

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 | --- | --- | 55 | A |
| I_{SM} | Pulsed Source Current ³ | | --- | --- | 220 | A |
| V_{SD} | Diode Forward Voltage ³ | $V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$ | --- | --- | 1 | V |
| t_{rr} | Reverse Recovery Time | $V_{GS}=0V, I_S=1A, di/dt=100A/\mu s$ | --- | --- | --- | ns |
| Q_{rr} | Reverse Recovery Charge | $T_J=25^\circ\text{C}$ | --- | --- | --- | nC |

Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. $V_{DD}=25V, V_{GS}=10V, L=0.1\text{mH}, I_{AS}=35A, R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$.
3. The data tested by pulsed, pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.
4. Essentially independent of operating temperature.

60V N-Channel MOSFETs

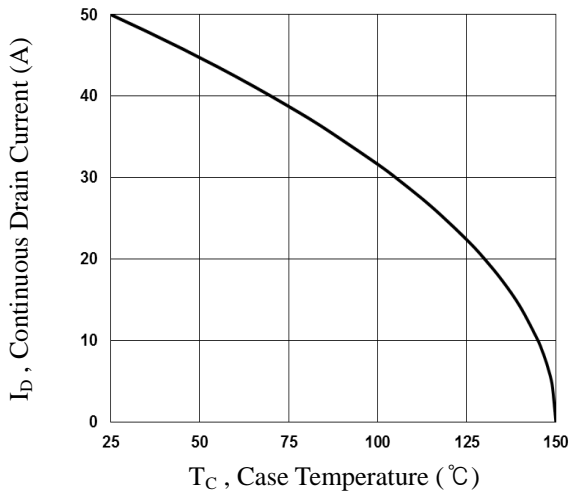


Fig.1 Continuous Drain Current vs. T_C

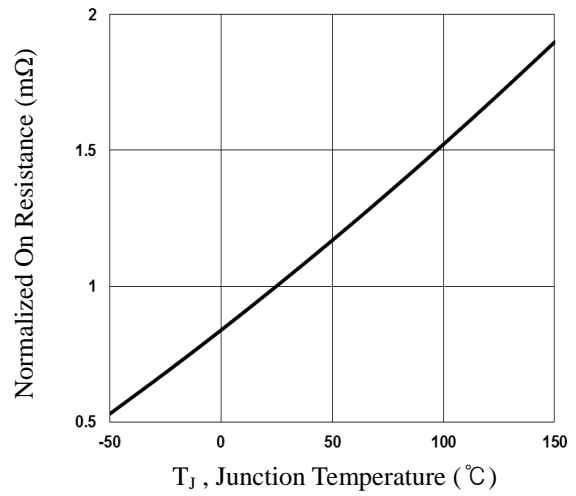


Fig.2 Normalized $R_{DS(on)}$ vs. T_J

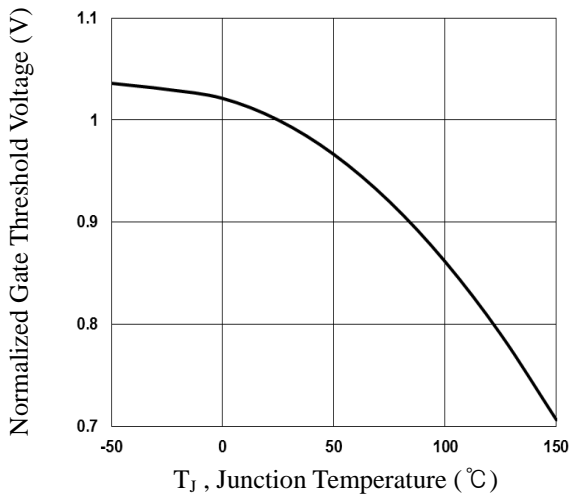


Fig.3 Normalized V_{th} vs. T_J

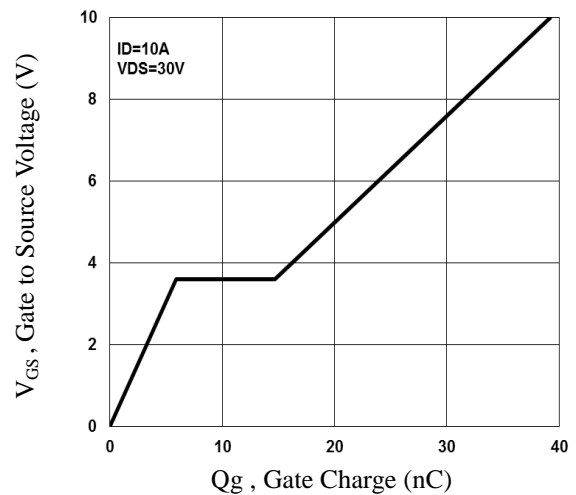


Fig.4 Gate Charge Waveform

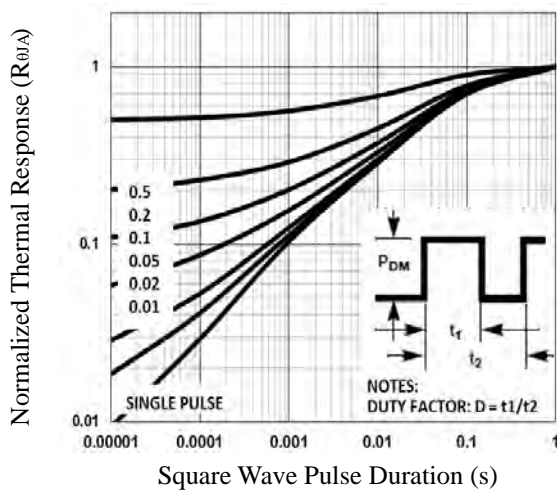


Fig.5 Normalized Transient Response

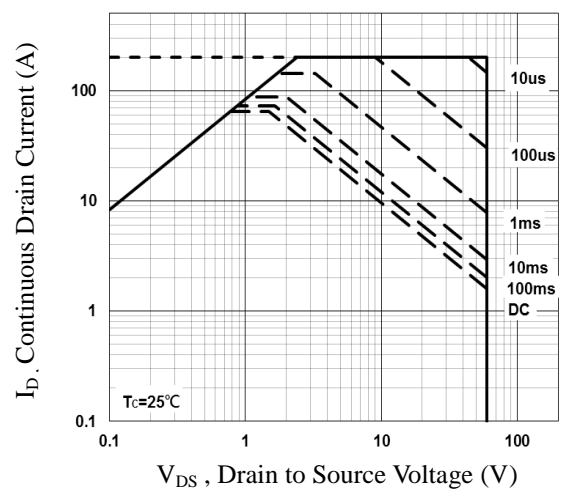


Fig.6 Maximum Safe Operation Area

60V N-Channel MOSFETs

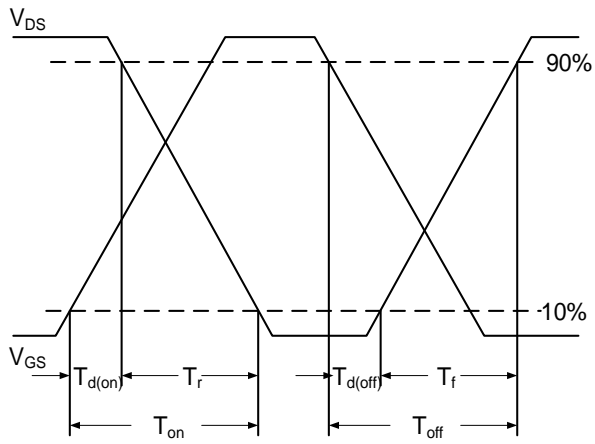


Fig.7 Switching Time Waveform

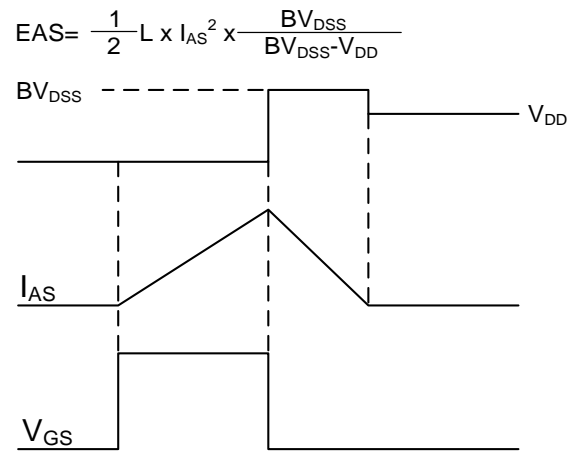
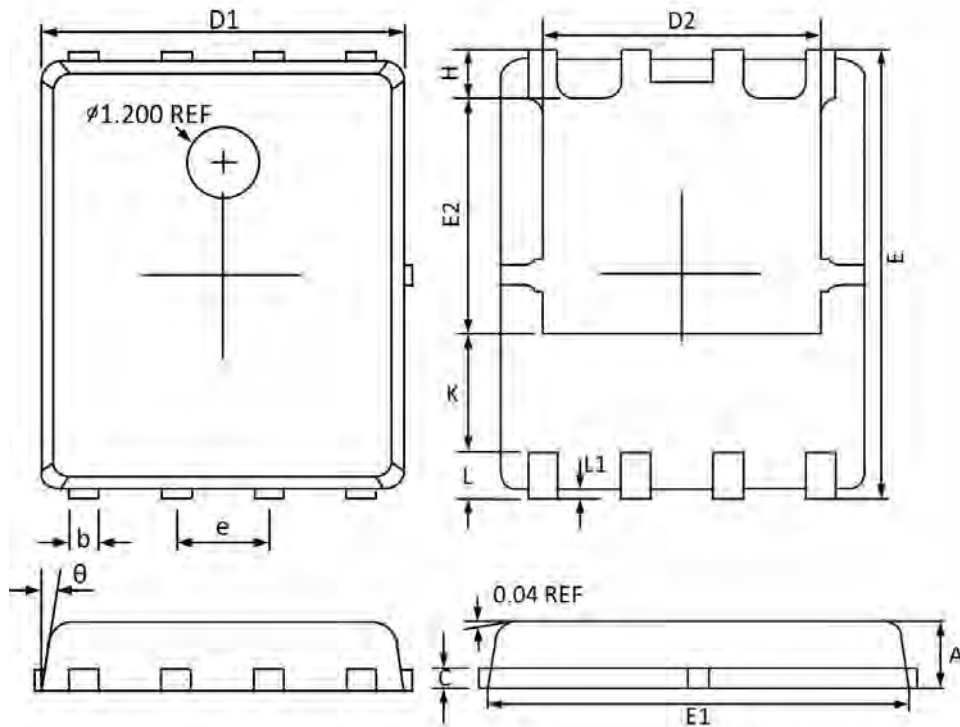


Fig.8 EAS Waveform

60V N-Channel MOSFETs

PPAK5x6 PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | MAX | MIN | MAX | MIN |
| A | 1.100 | 0.800 | 0.043 | 0.031 |
| b | 0.510 | 0.330 | 0.020 | 0.013 |
| C | 0.300 | 0.200 | 0.012 | 0.008 |
| D1 | 5.100 | 4.800 | 0.201 | 0.189 |
| D2 | 4.100 | 3.610 | 0.161 | 0.142 |
| E | 6.200 | 5.900 | 0.244 | 0.232 |
| E1 | 5.900 | 5.700 | 0.232 | 0.224 |
| E2 | 3.780 | 3.350 | 0.149 | 0.132 |
| e | 1.27BSC | | 0.05BSC | |
| H | 0.700 | 0.410 | 0.028 | 0.016 |
| K | 1.500 | 1.100 | 0.059 | 0.043 |
| L | 0.710 | 0.510 | 0.028 | 0.020 |
| L1 | 0.200 | 0.060 | 0.008 | 0.002 |
| theta | 12° | 0° | 12° | 0° |