

40V P-Channel MOSFETs

General Description

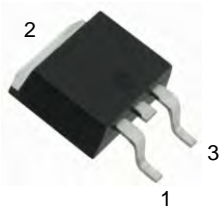
These P-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These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

| | | |
|-------|-------|------|
| BVDSS | RDSON | ID |
| -40V | 17mΩ | -45A |

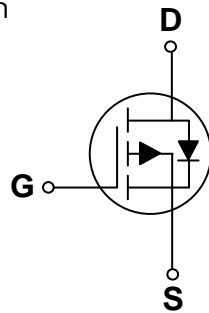
Features

- -40V, -45A, $R_{DS(ON)} = 17m\Omega @ V_{GS} = -10V$
- Improved dv/dt capability
- Fast switching
- Green Device Available

TO-252 Pin Configuration



1. Gate
2. Drain
3. Source



Applications

- Motor Drive
- Power Tools
- LED Lighting

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

| Symbol | Parameter | Rating | Units |
|-----------|--|------------|---------------------|
| V_{DS} | Drain-Source Voltage | -40 | V |
| V_{GS} | Gate-Source Voltage | ± 20 | V |
| I_D | Drain Current – Continuous ($T_c=25^\circ\text{C}$) | -45 | A |
| | Drain Current – Continuous ($T_c=100^\circ\text{C}$) | -28 | A |
| I_{DM} | Drain Current – Pulsed ¹ | -180 | A |
| EAS | Single Pulse Avalanche Energy ² | 100 | mJ |
| IAS | Single Pulse Avalanche Current ² | -45 | A |
| P_D | Power Dissipation ($T_c=25^\circ\text{C}$) | 62.5 | W |
| | Power Dissipation – Derate above 25°C | 0.5 | W/ $^\circ\text{C}$ |
| T_{STG} | Storage Temperature Range | -55 to 150 | $^\circ\text{C}$ |
| T_J | Operating Junction Temperature Range | -55 to 150 | $^\circ\text{C}$ |

Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|-----------------|--|------|------|---------------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | --- | 62 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | --- | 2.0 | $^\circ\text{C}/\text{W}$ |



FTK4963D

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

Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|------------------------------|------------------------------------|---|------|-------|-----------|---------------------|
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=-250\mu A$ | -40 | --- | --- | V |
| $\Delta BV_{DSS}/\Delta T_J$ | BV_{DSS} Temperature Coefficient | Reference to $25\text{ }^\circ\text{C}$, $I_D=-1mA$ | --- | -0.05 | --- | V/ $^\circ\text{C}$ |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=-40V, V_{GS}=0V, T_J=25\text{ }^\circ\text{C}$ | --- | --- | -1 | μA |
| | | $V_{DS}=-32V, V_{GS}=0V, T_J=125\text{ }^\circ\text{C}$ | --- | --- | -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 | $V_{GS}=-10V, I_D=-15A$ | --- | 15 | 17 | m Ω |
| | | $V_{GS}=-4.5V, I_D=-10A$ | --- | 22 | 25 | m Ω |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}=V_{DS}, I_D=-250\mu A$ | -1.2 | -1.6 | -2.5 | V |
| gfs | Forward Transconductance | $V_{DS}=-10V, I_D=-3A$ | --- | 13 | --- | S |

Dynamic and switching Characteristics

| | | | | | | |
|--------------|------------------------------------|--|-----|------|------|----------|
| Q_g | Total Gate Charge ^{3,4} | $V_{DS}=-20V, V_{GS}=-4.5V, I_D=-5A$ | --- | 19 | 38 | nC |
| Q_{gs} | Gate-Source Charge ^{3,4} | | --- | 6.2 | 12 | |
| Q_{gd} | Gate-Drain Charge ^{3,4} | | --- | 5.2 | 10 | |
| $T_{d(on)}$ | Turn-On Delay Time ^{3,4} | $V_{DD}=-20V, V_{GS}=-10V, R_G=6\Omega$ $I_D=-1A$ | --- | 18.2 | 36 | ns |
| T_r | Rise Time ^{3,4} | | --- | 4.2 | 8.5 | |
| $T_{d(off)}$ | Turn-Off Delay Time ^{3,4} | | --- | 72 | 140 | |
| T_f | Fall Time ^{3,4} | | --- | 9.8 | 20 | |
| C_{iss} | Input Capacitance | $V_{DS}=-25V, V_{GS}=0V, F=1MHz$ | --- | 2260 | 3300 | pF |
| C_{oss} | Output Capacitance | | --- | 170 | 250 | |
| C_{rss} | Reverse Transfer Capacitance | | --- | 130 | 190 | |
| R_g | Gate resistance | $V_{GS}=0V, V_{DS}=0V, F=1MHz$ | --- | 7.5 | 15 | 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 | --- | --- | -45 | A |
| I_{SM} | Pulsed Source Current | | --- | --- | -90 | A |
| V_{SD} | Diode Forward Voltage | $V_{GS}=0V, I_S=-1A, T_J=25\text{ }^\circ\text{C}$ | --- | --- | -1 | V |
| t_{rr} | Reverse Recovery Time ³ | $V_{GS}=0V, I_S=-1A, di/dt=100A/\mu s$ | --- | --- | --- | ns |
| Q_{rr} | Reverse Recovery Charge ³ | $T_J=25\text{ }^\circ\text{C}$ | --- | --- | --- | nC |

Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. $V_{DD}=-25V, V_{GS}=-10V, L=0.1mH, I_{AS}=-45A, R_G=25\Omega$, Starting $T_J=25\text{ }^\circ\text{C}$
3. The data tested by pulsed, pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.
4. Essentially independent of operating temperature.

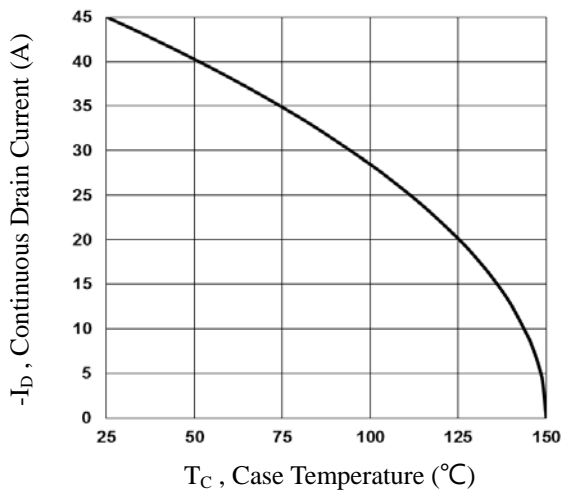


Fig.1 Continuous Drain Current vs. T_c

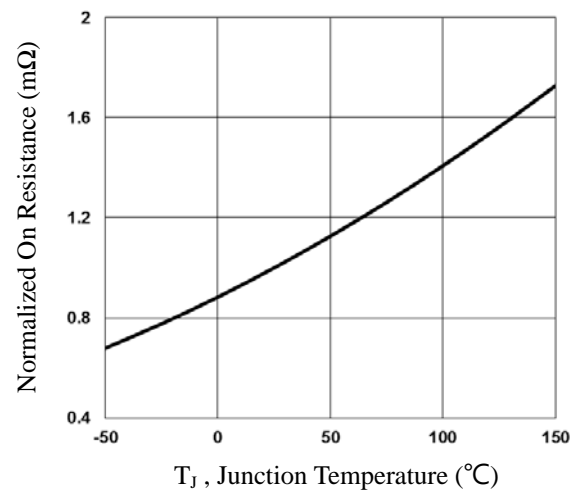


Fig.2 Normalized $R_{DS(on)}$ vs. T_j

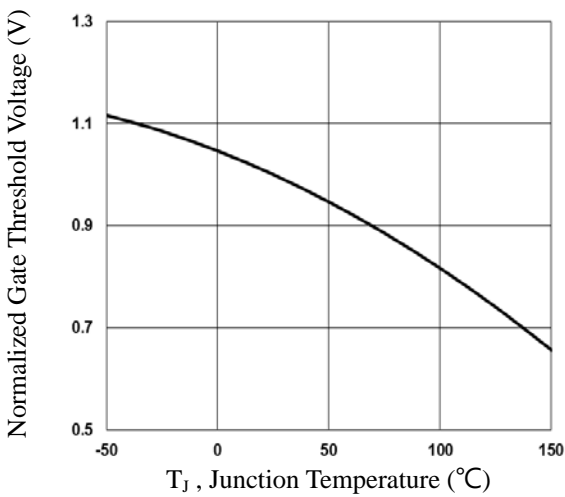


Fig.3 Normalized V_{th} vs. T_j

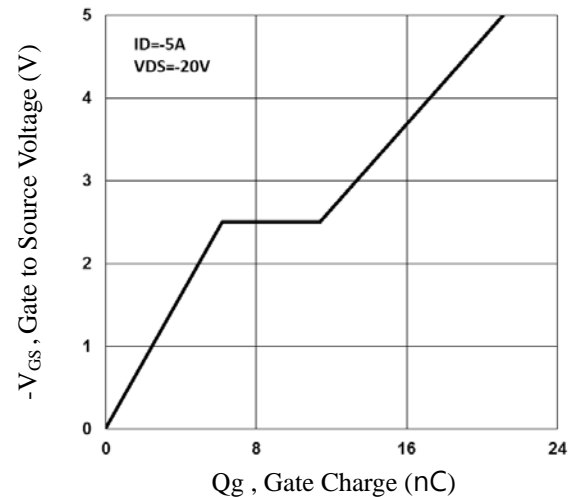


Fig.4 Gate Charge Waveform

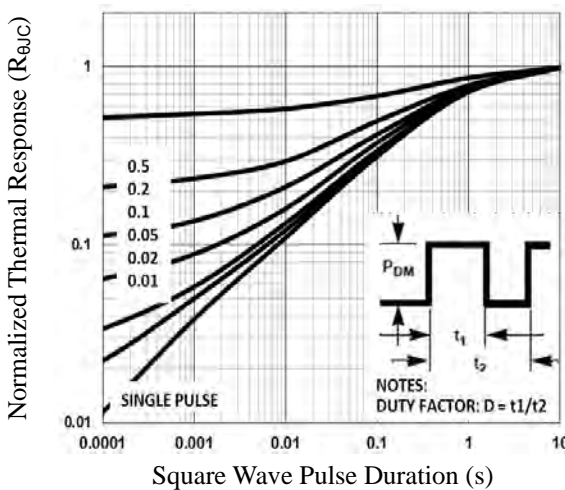


Fig.5 Normalized Transient Impedance

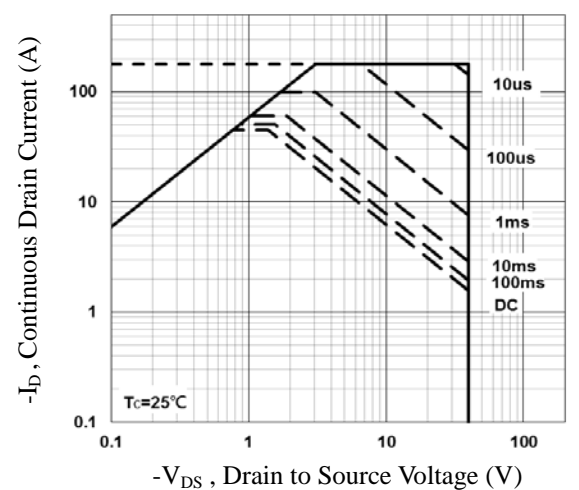


Fig.6 Maximum Safe Operation Area

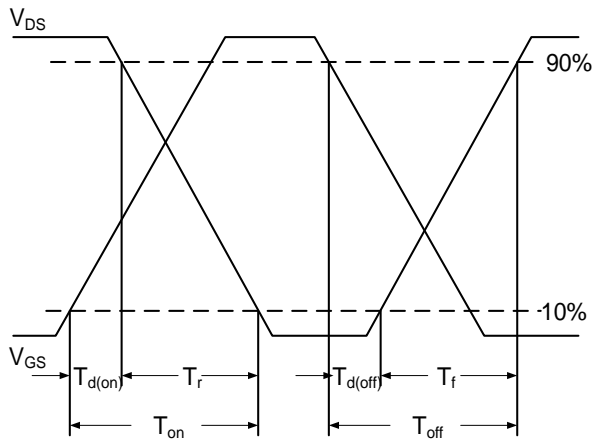


Fig.7 Switching Time Waveform

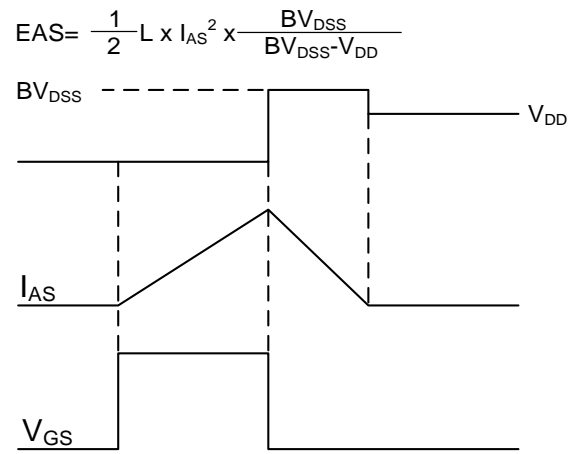
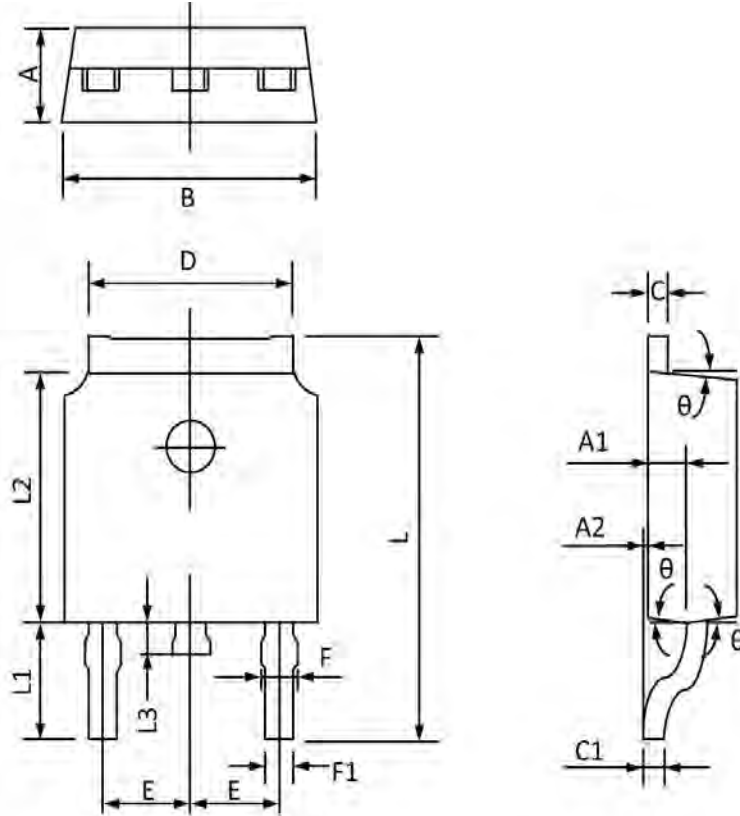


Fig.8 EAS Waveform

TO-252 PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | MAX | MIN | MAX | MIN |
| A | 2.400 | 2.200 | 0.094 | 0.087 |
| A1 | 1.110 | 0.910 | 0.044 | 0.036 |
| A2 | 0.150 | 0.000 | 0.006 | 0.000 |
| B | 6.800 | 6.400 | 0.268 | 0.252 |
| C | 0.580 | 0.450 | 0.023 | 0.018 |
| C1 | 0.580 | 0.460 | 0.023 | 0.018 |
| D | 5.500 | 5.100 | 0.217 | 0.201 |
| E | 2.386 | 2.186 | 0.094 | 0.086 |
| F | 0.940 | 0.600 | 0.037 | 0.024 |
| F1 | 0.860 | 0.500 | 0.034 | 0.020 |
| L | 10.400 | 9.400 | 0.409 | 0.370 |
| L1 | 3.000 | 2.400 | 0.118 | 0.094 |
| L2 | 6.200 | 5.400 | 0.244 | 0.213 |
| L3 | 1.200 | 0.600 | 0.047 | 0.024 |
| θ | 9° | 3° | 9° | 3° |