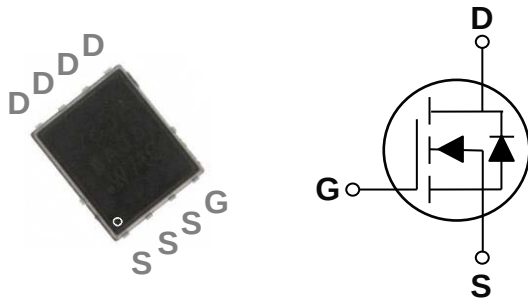


## 60V N-Channel MOSFETs

### 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.

### PPAK5X6 Pin Configuration



| BVDSS | RDS(ON) | ID   |
|-------|---------|------|
| 60V   | 2mΩ     | 140A |

### Features

- 60V,140A,  $R_{DS(ON)} = 2m\Omega @ V_{GS} = 10V$
- Improved  $dv/dt$  capability
- Fast switching
- 100% EAS Guaranteed
- Green Device Available

### Applications

- Networking
- Load Switch
- LED applications

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

| Symbol    | Parameter                                              | Rating     | Units               |
|-----------|--------------------------------------------------------|------------|---------------------|
| $V_{DS}$  | Drain-Source Voltage                                   | 60         | V                   |
| $V_{GS}$  | Gate-Source Voltage                                    | $\pm 20$   | V                   |
| $I_D$     | Drain Current – Continuous ( $T_c=25^\circ\text{C}$ )  | 140        | A                   |
|           | Drain Current – Continuous ( $T_c=100^\circ\text{C}$ ) | 88         | A                   |
| $I_{DM}$  | Drain Current – Pulsed <sup>1</sup>                    | 560        | A                   |
| EAS       | Single Pulse Avalanche Energy <sup>2</sup>             | 423        | mJ                  |
| IAS       | Single Pulse Avalanche Current <sup>2</sup>            | 92         | A                   |
| $P_D$     | Power Dissipation ( $T_c=25^\circ\text{C}$ )           | 110        | W                   |
|           | Power Dissipation – Derate above $25^\circ\text{C}$    | 0.89       | W/ $^\circ\text{C}$ |
| $T_{STG}$ | Storage Temperature Range                              | -50 to 150 | $^\circ\text{C}$    |
| $T_J$     | Operating Junction Temperature Range                   | -50 to 150 | $^\circ\text{C}$    |

### Thermal Characteristics

| Symbol          | Parameter                              | Typ. | Max. | Unit               |
|-----------------|----------------------------------------|------|------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | ---  | 62   | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case    | ---  | 1.12 | $^\circ\text{C/W}$ |



# FTK6990DFN56

## 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       |
| $I_{DSS}$  | Drain-Source Leakage Current   | $V_{DS}=60V$ , $V_{GS}=0V$ , $T_J=25^{\circ}\text{C}$  | ---  | ---  | 1         | $\mu A$ |
|            |                                | $V_{DS}=48V$ , $V_{GS}=0V$ , $T_J=125^{\circ}\text{C}$ | ---  | ---  | 10        | $\mu A$ |
| $I_{GSS}$  | Gate-Source Leakage Current    | $V_{GS}=\pm 20V$ , $V_{DS}=0V$                         | ---  | ---  | $\pm 100$ | nA      |

### On Characteristics

|              |                                   |                                  |     |     |     |            |
|--------------|-----------------------------------|----------------------------------|-----|-----|-----|------------|
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=10V$ , $I_D=20A$         | --- | 1.7 | 2   | m $\Omega$ |
|              |                                   | $V_{GS}=4.5V$ , $I_D=10A$        | --- | 2.5 | 3.2 | m $\Omega$ |
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{GS}=V_{DS}$ , $I_D=250\mu A$ | 1.2 | 1.7 | 2.5 | V          |
| $g_{fs}$     | Forward Transconductance          | $V_{DS}=10V$ , $I_D=3A$          | --- | 15  | --- | S          |

### Dynamic and switching Characteristics

|              |                                     |                                                           |     |      |      |          |
|--------------|-------------------------------------|-----------------------------------------------------------|-----|------|------|----------|
| $Q_g$        | Total Gate Charge <sup>3, 4</sup>   | $V_{DS}=30V$ , $V_{GS}=10V$ , $I_D=50A$                   | --- | 98   | 140  | nC       |
| $Q_{gs}$     | Gate-Source Charge <sup>3, 4</sup>  |                                                           | --- | 24   | 36   |          |
| $Q_{gd}$     | Gate-Drain Charge <sup>3, 4</sup>   |                                                           | --- | 27   | 40   |          |
| $T_{d(on)}$  | Turn-On Delay Time <sup>3, 4</sup>  | $V_{DD}=30V$ , $V_{GS}=10V$ , $R_G=3.3\Omega$<br>$I_D=1A$ | --- | 19   | 38   | ns       |
| $T_r$        | Rise Time <sup>3, 4</sup>           |                                                           | --- | 12   | 24   |          |
| $T_{d(off)}$ | Turn-Off Delay Time <sup>3, 4</sup> |                                                           | --- | 62   | 124  |          |
| $T_f$        | Fall Time <sup>3, 4</sup>           |                                                           | --- | 130  | 260  |          |
| $C_{iss}$    | Input Capacitance                   | $V_{DS}=30V$ , $V_{GS}=0V$ , $F=1\text{MHz}$              | --- | 4947 | 7400 | pF       |
| $C_{oss}$    | Output Capacitance                  |                                                           | --- | 2850 | 4200 |          |
| $C_{rss}$    | Reverse Transfer Capacitance        |                                                           | --- | 26   | 40   |          |
| $R_g$        | Gate resistance                     | $V_{GS}=0V$ , $V_{DS}=0V$ , $F=1\text{MHz}$               | --- | 1.1  | ---  | $\Omega$ |

### 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                      | ---  | ---  | 140  | A    |
| $I_{SM}$ | Pulsed Source Current     |                                                   | ---  | ---  | 280  | A    |
| $V_{SD}$ | Diode Forward Voltage     | $V_{GS}=0V$ , $I_S=1A$ , $T_J=25^{\circ}\text{C}$ | ---  | ---  | 1    | V    |
| $T_{rr}$ | Reverse Recovery Time     | $V_{GS}=10V, I_S=10A$ ,                           | ---  | 88   | ---  | ns   |
| $Q_{rr}$ | Reverse Recovery Charge   | $di/dt=100A/\mu s$ $T_J=25^{\circ}\text{C}$       | ---  | 175  | ---  | nC   |

Note :

1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2.  $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=92A, R_G=25\Omega$ , 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

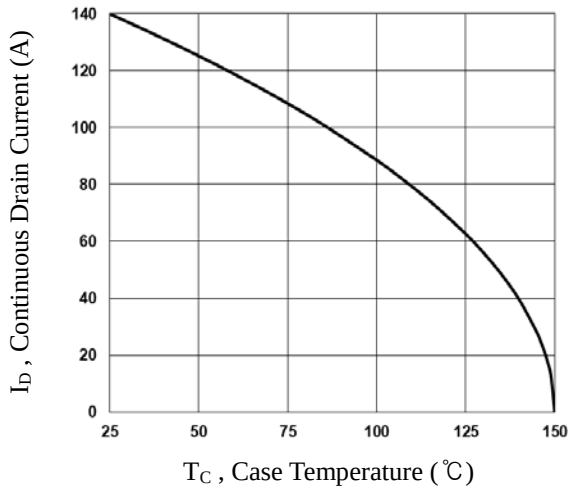


Fig.1 Continuous Drain Current vs. TC

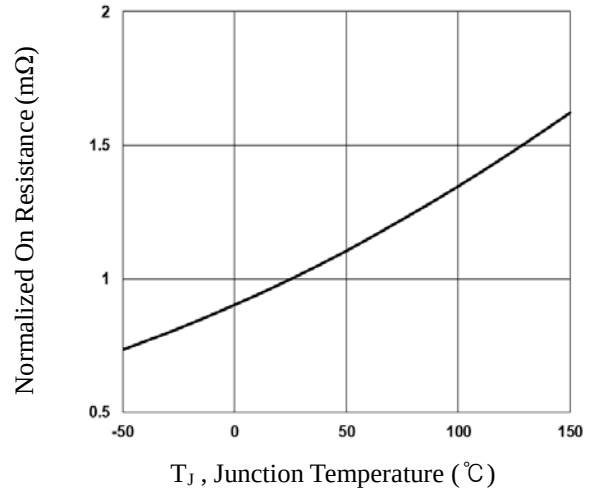


Fig.2 Normalized  $R_{DS(on)}$  vs.  $T_J$

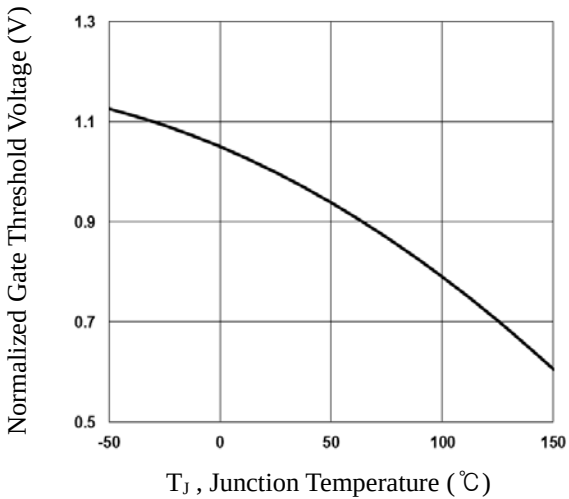


Fig.3 Normalized  $V_{th}$  vs.  $T_J$

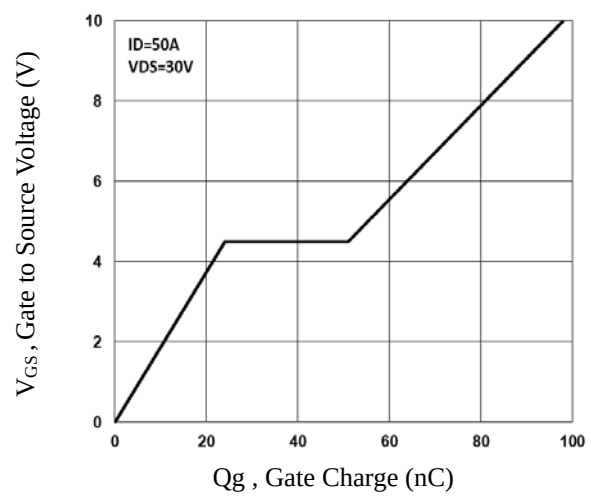


Fig.4 Gate Charge Characteristics

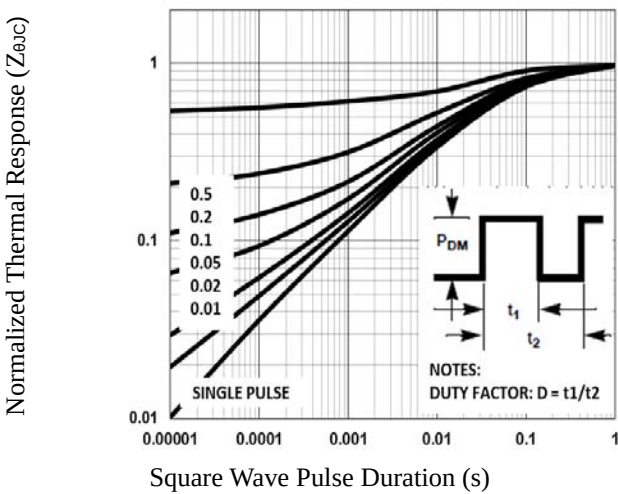


Fig.5 Normalized Transient Impedance

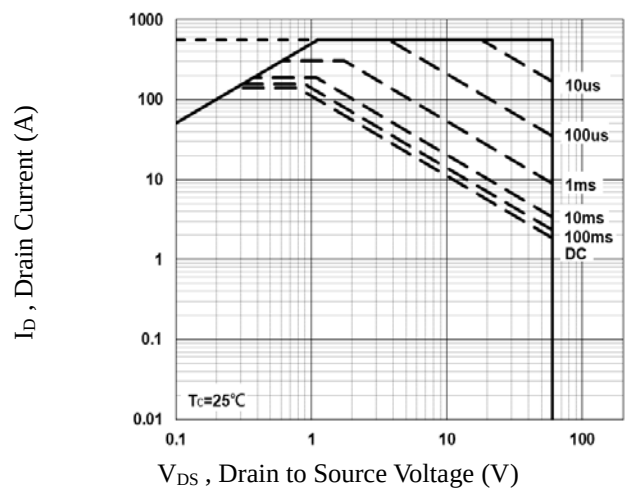


Fig.6 Maximum Safe Operation Area

## 60V N-Channel MOSFETs

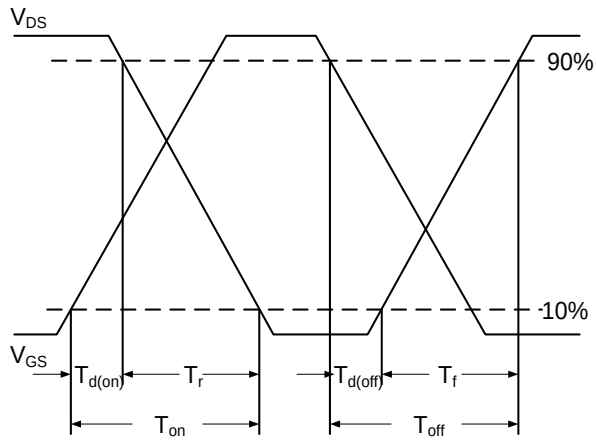


Fig.7 Switching Time Waveform

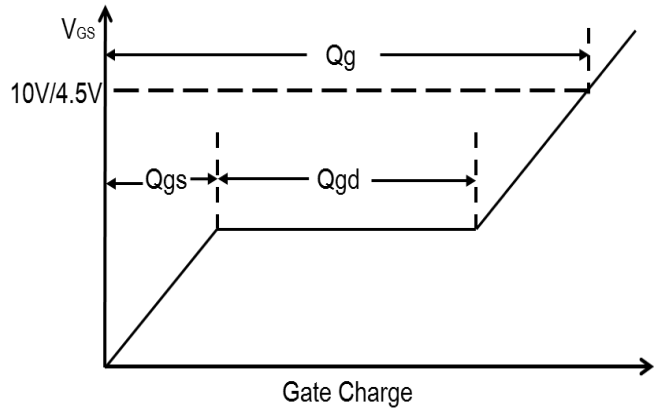
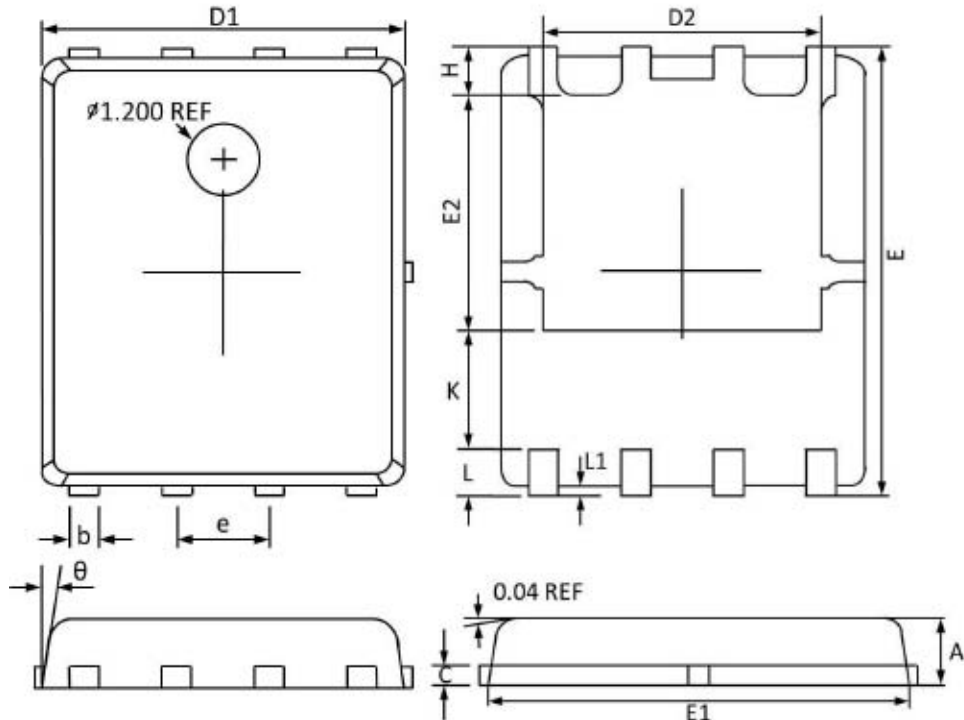


Fig.8 Gate Charge Waveform

## 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 |
| θ      | 12°                       | 0°    | 12°                  | 0°    |