STEIFPOWER TECHNOLOGY

40V P-Channel MOSFETs

# SPC4959X

## General Description

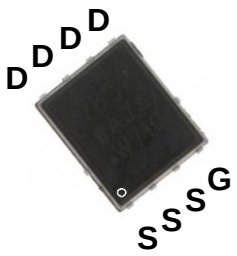
*These P-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These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

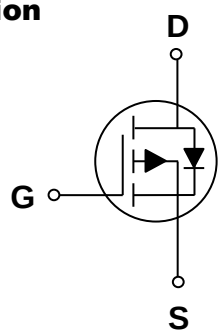
| BVDSS | RDSON | ID |
|---|---|---|
| -40V | 5.8mΩ | -85A |

## Features

- *-40V, -85A, RDS(ON) =5.8mΩ@VGS = -10V*
- *Improved dv/dt capability*
- *Fast switching*
- *100% EAS Guaranteed*
- *Green Device Available*

## PPAK5X6 Pin Configuration




## Applications

- *Motor Drive*
- *Power Tools*
- *LED Lighting*

RoHS COMPLIANT

## Absolute Maximum Ratings Tc=25℃ 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˚C) | -85 | A |
| | Drain Current – Continuous ($T_C$=100˚C) | -53.7 | A |
| $I_{DM}$ | Drain Current – Pulsed[1] | -340 | A |
| EAS | Single Pulse Avalanche Energy[2] | 245 | mJ |
| IAS | Single Pulse Avalanche Current[2] | -70 | A |
| $P_D$ | Power Dissipation ($T_C$=25˚C) | 135 | W |
| | Power Dissipation – Derate above 25˚C | 1.09 | W/˚C |
| $T_{STG}$ | Storage Temperature Range | -50 to 150 | ˚C |
| $T_J$ | Operating Junction Temperature Range | -50 to 150 | ˚C |

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | --- | 62 | ˚C/W |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | --- | 0.92 | ˚C/W |

## 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 | -40 | --- | --- | V |
| $\triangle BV_{DSS}/\triangle T_J$ | $BV_{DSS}$ Temperature Coefficient | Reference to 25℃ , $I_D$=-1mA | --- | -0.03 | --- | V/℃ |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=-40V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | -1 | uA |
| | | $V_{DS}$=-32V , $V_{GS}$=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 , $I_D$=-25A | --- | 4.7 | 5.8 | mΩ |
| | | $V_{GS}$=-4.5V , $I_D$=-12A | --- | 6.4 | 8.5 | mΩ |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$=-250uA | -1.2 | -1.6 | -2.5 | V |
| $\triangle V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient | | --- | 5.38 | --- | mV/℃ |
| gfs | Forward Transconductance | $V_{DS}$=-10V , $I_D$=-3A | --- | 15 | --- | S |

### Dynamic and switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge[3,4] | $V_{DS}$=-32V , $V_{GS}$=-10V , $I_D$=-10A | --- | 106 | 160 | nC |
| $Q_{gs}$ | Gate-Source Charge[3,4] | | --- | 13.1 | 20 | |
| $Q_{gd}$ | Gate-Drain Charge[3,4] | | --- | 24.9 | 38 | |
| $T_{d(on)}$ | Turn-On Delay Time[3,4] | $V_{DD}$=-32V , $V_{GS}$=-10V , $R_G$=6Ω , $I_D$=-1A | --- | 41.6 | 82 | ns |
| $T_r$ | Rise Time[3,4] | | --- | 12.7 | 26 | |
| $T_{d(off)}$ | Turn-Off Delay Time[3,4] | | --- | 308 | 600 | |
| $T_f$ | Fall Time[3,4] | | --- | 70 | 140 | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$=-25V , $V_{GS}$=0V , F=1MHz | --- | 5720 | 8580 | pF |
| $C_{oss}$ | Output Capacitance | | --- | 527 | 790 | |
| $C_{rss}$ | Reverse Transfer Capacitance | | --- | 352 | 528 | |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, F=1MHz | --- | 4.2 | 6.3 | 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 | --- | --- | -85 | A |
| $I_{SM}$ | Pulsed Source Current | | --- | --- | -170 | 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. $V_{DD}$=-25V,$V_{GS}$=-10V,L=0.1mH,$I_{AS}$=-70A.,$R_G$=25Ω, Starting $T_J$=25℃
3. The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%.
4. Essentially independent of operating temperature.

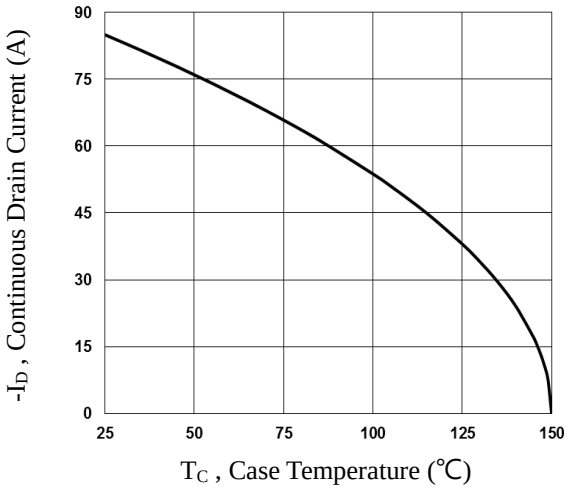



**Fig.1 Continuous Drain Current vs. $T_C$**

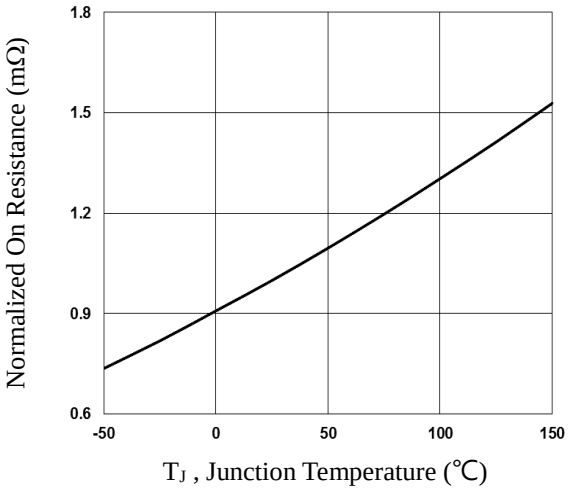



**Fig.2 Normalized RDSON vs. $T_J$**

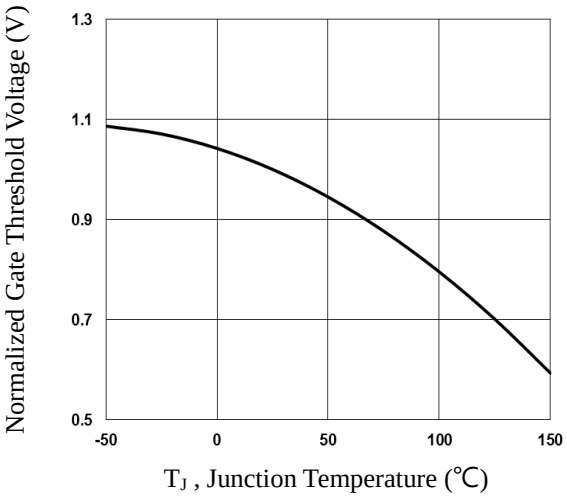



**Fig.3 Normalized $V_{th}$ vs. $T_J$**

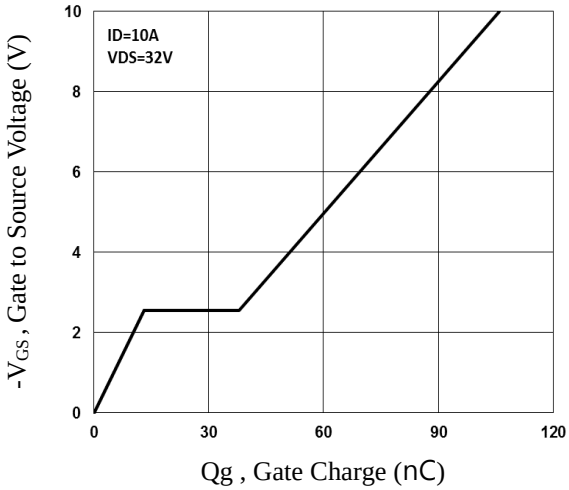



**Fig.4 Gate Charge Waveform**

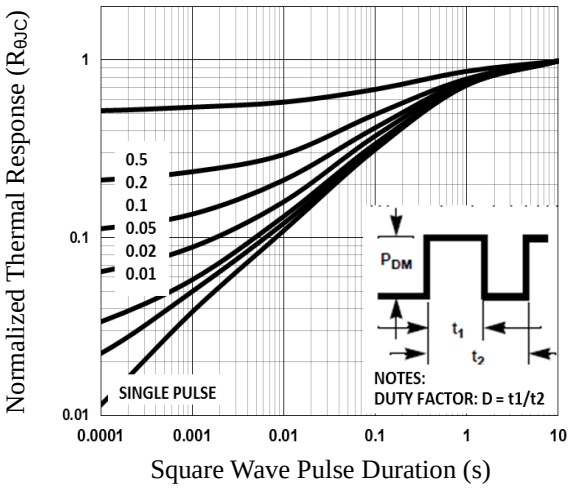



**Fig.5 Normalized Transient Impedance**

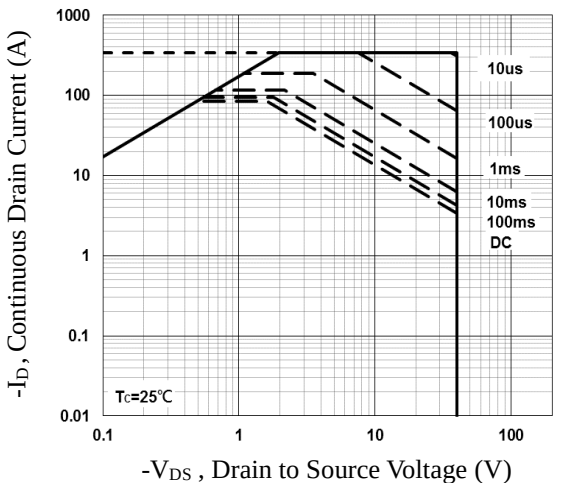



**Fig.6 Maximum Safe Operation Area**

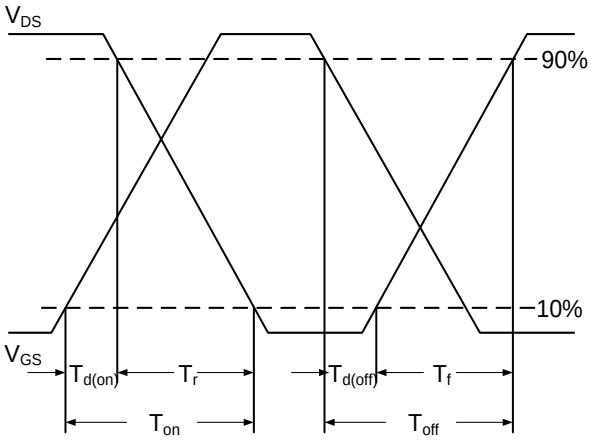



**Fig.7 Switching Time Waveform**

$$EAS = \frac{1}{2} L \times (-I_{AS})^2 \times \frac{-BVDSS}{-BVDSS-(-VDD)}$$

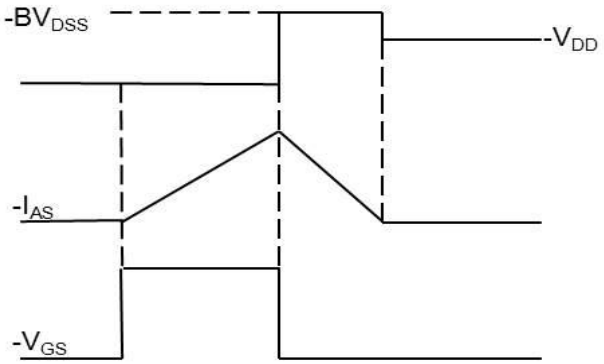
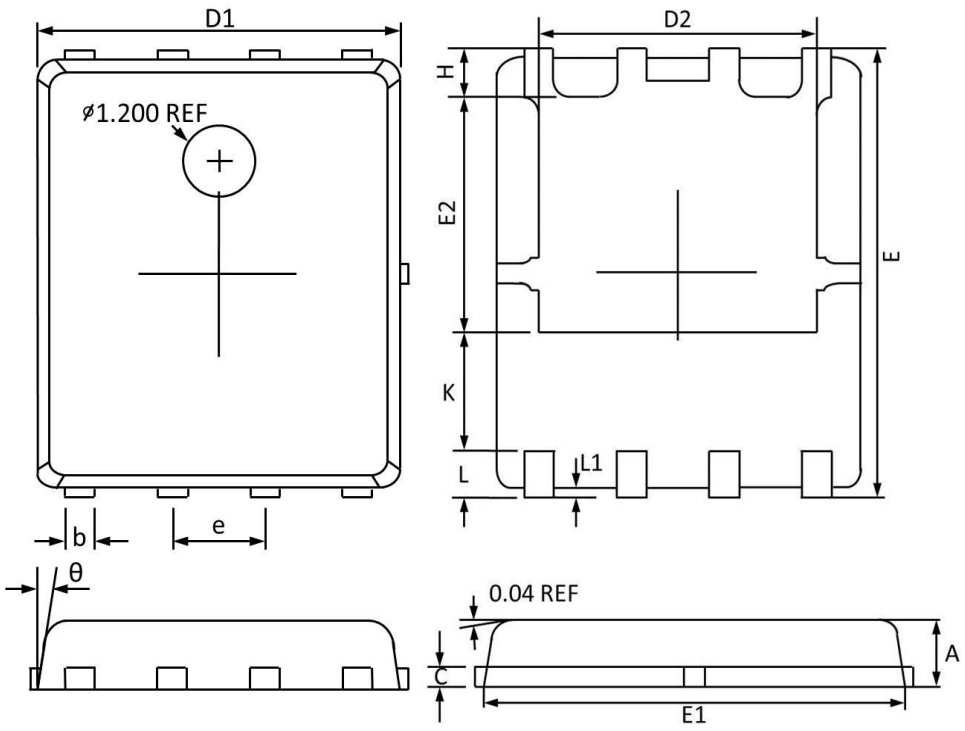



**Fig.8 EAS Waveform**

# 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° |