

## P-Ch 40V Fast Switching MOSFETs

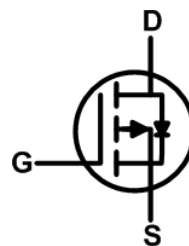
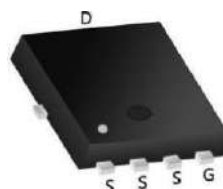
### Features

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

### Description

The KPRA4115 is the high cell density trench P-ch MOSFETs, which provide excellent  $R_{DS(on)}$  and gate charge for most of the synchronous buck converter applications. The KPRA4115 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

### PRPAK5X6 Pin Configuration



### Product Summary

| BVDSS | $R_{DS(on)}$ | $I_D$ |
|-------|--------------|-------|
| -40V  | 13m $\Omega$ | -52A  |

### Absolute Maximum Ratings

| Symbol                | Parameter                                   | Rating     | Units      |
|-----------------------|---------------------------------------------|------------|------------|
| $V_{DS}$              | Drain-Source Voltage                        | -40        | V          |
| $V_{GS}$              | Gate-Source Voltage                         | $\pm 20$   | V          |
| $I_D@T_C=25^\circ C$  | Continuous Drain Current, $V_{GS} @ -10V^1$ | -52        | A          |
| $I_D@T_C=100^\circ C$ | Continuous Drain Current, $V_{GS} @ -10V^1$ | -32        | A          |
| $I_{DM}$              | Pulsed Drain Current <sup>2</sup>           | -105       | A          |
| EAS                   | Single Pulse Avalanche Energy <sup>3</sup>  | 146        | mJ         |
| $I_{AS}$              | Avalanche Current                           | -54        | A          |
| $P_D@T_C=25^\circ C$  | Total Power Dissipation <sup>4</sup>        | 52.1       | W          |
| $T_{STG}$             | Storage Temperature Range                   | -55 to 150 | $^\circ C$ |
| $T_J$                 | Operating Junction Temperature Range        | -55 to 150 | $^\circ C$ |

### Thermal Data

| Symbol          | Parameter                                        | Typ. | Max. | Unit         |
|-----------------|--------------------------------------------------|------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup> | ---  | 62   | $^\circ C/W$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 2.4  | $^\circ C/W$ |

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

| Symbol       | Parameter                                      | Conditions                                                     | Min. | Typ. | Max.      | Unit      |
|--------------|------------------------------------------------|----------------------------------------------------------------|------|------|-----------|-----------|
| $BV_{DSS}$   | Drain-Source Breakdown Voltage                 | $V_{GS}=0V$ , $I_D=-250\mu A$                                  | -40  | ---  | ---       | V         |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance <sup>2</sup> | $V_{GS}=-10V$ , $I_D=-18A$                                     | ---  | 10.5 | 13        | $m\Omega$ |
|              |                                                | $V_{GS}=-4.5V$ , $I_D=-12A$                                    | ---  | 15   | 20        |           |
| $V_{GS(th)}$ | Gate Threshold Voltage                         | $V_{GS}=V_{DS}$ , $I_D=-250\mu A$                              | -1.0 | -1.6 | -2.5      | V         |
| $I_{DSS}$    | Drain-Source Leakage Current                   | $V_{DS}=-32V$ , $V_{GS}=0V$ , $T_J=25^\circ\text{C}$           | ---  | ---  | 1         | $\mu A$   |
|              |                                                | $V_{DS}=-32V$ , $V_{GS}=0V$ , $T_J=55^\circ\text{C}$           | ---  | ---  | 5         |           |
| $I_{GSS}$    | Gate-Source Leakage Current                    | $V_{GS}=\pm 20V$ , $V_{DS}=0V$                                 | ---  | ---  | $\pm 100$ | nA        |
| $g_{fs}$     | Forward Transconductance                       | $V_{DS}=-5V$ , $I_D=-18A$                                      | ---  | 24   | ---       | S         |
| $Q_g$        | Total Gate Charge (-4.5V)                      | $V_{DS}=-20V$ , $V_{GS}=-4.5V$ , $I_D=-12A$                    | ---  | 27.9 | ---       | nC        |
| $Q_{gs}$     | Gate-Source Charge                             |                                                                | ---  | 7.7  | ---       |           |
| $Q_{gd}$     | Gate-Drain Charge                              |                                                                | ---  | 7.5  | ---       |           |
| $T_{d(on)}$  | Turn-On Delay Time                             | $V_{DD}=-15V$ , $V_{GS}=-10V$ , $R_G=3.3\Omega$ ,<br>$I_D=-1A$ | ---  | 40   | ---       | ns        |
| $T_r$        | Rise Time                                      |                                                                | ---  | 35.2 | ---       |           |
| $T_{d(off)}$ | Turn-Off Delay Time                            |                                                                | ---  | 100  | ---       |           |
| $T_f$        | Fall Time                                      |                                                                | ---  | 9.6  | ---       |           |
| $C_{iss}$    | Input Capacitance                              | $V_{DS}=-15V$ , $V_{GS}=0V$ , $f=1\text{MHz}$                  | ---  | 3500 | ---       | pF        |
| $C_{oss}$    | Output Capacitance                             |                                                                | ---  | 323  | ---       |           |
| $C_{rss}$    | Reverse Transfer Capacitance                   |                                                                | ---  | 222  | ---       |           |

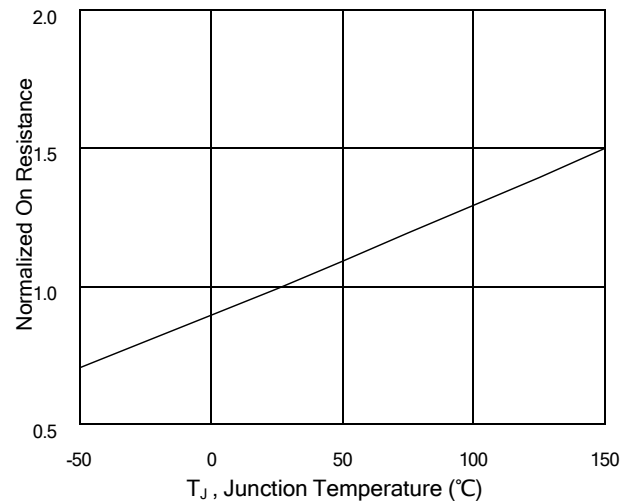
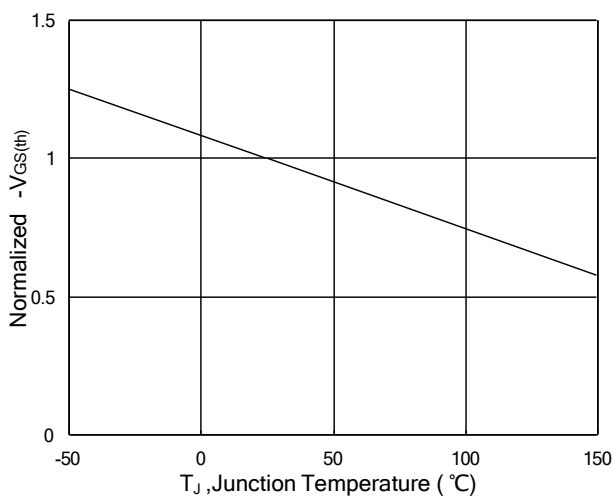
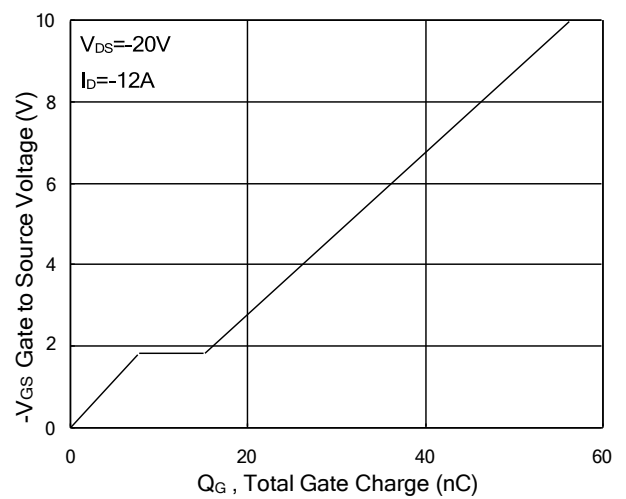
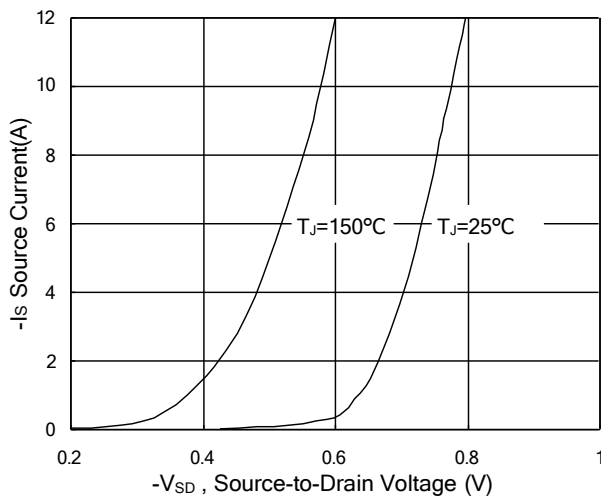
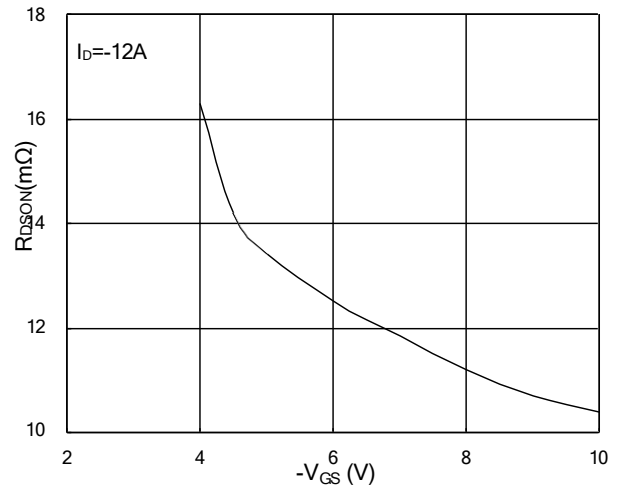
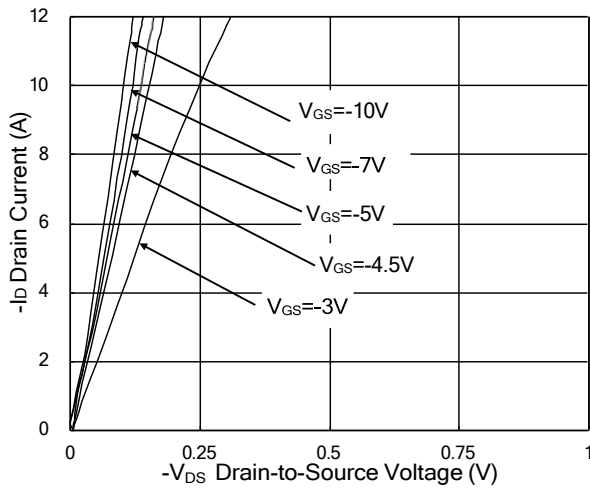
## Diode Characteristics

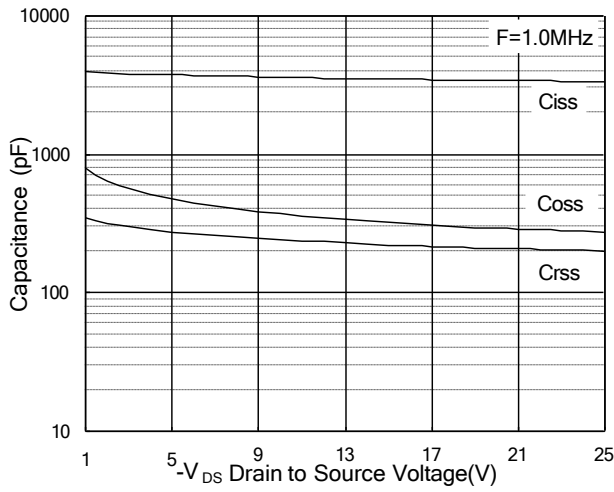
| Symbol   | Parameter                                | Conditions                                       | Min. | Typ. | Max. | Unit |
|----------|------------------------------------------|--------------------------------------------------|------|------|------|------|
| $I_S$    | Continuous Source Current <sup>1,5</sup> | $V_G=V_D=0V$ , Force Current                     | ---  | ---  | -30  | A    |
| $V_{SD}$ | Diode Forward Voltage <sup>2</sup>       | $V_{GS}=0V$ , $I_S=-1A$ , $T_J=25^\circ\text{C}$ | ---  | ---  | -1   | V    |

Note :

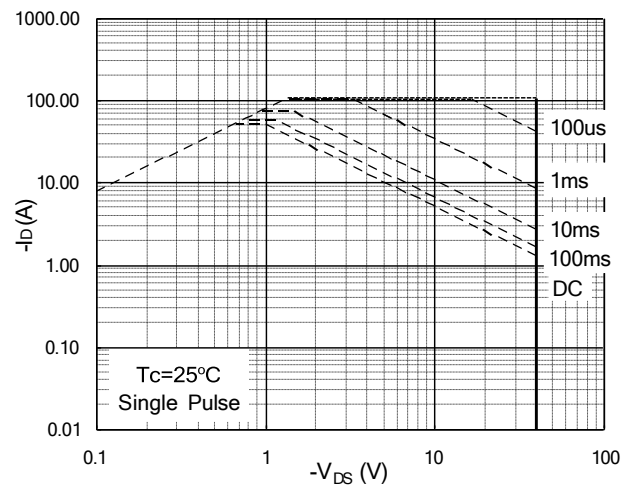
1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.
2. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$
3. The EAS data shows Max. rating . The test condition is  $V_{DD}=-25V$ ,  $V_{GS}=-10V$ ,  $L=0.1mH$ ,  $I_{AS}=-54A$
4. The power dissipation is limited by  $150^\circ\text{C}$  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

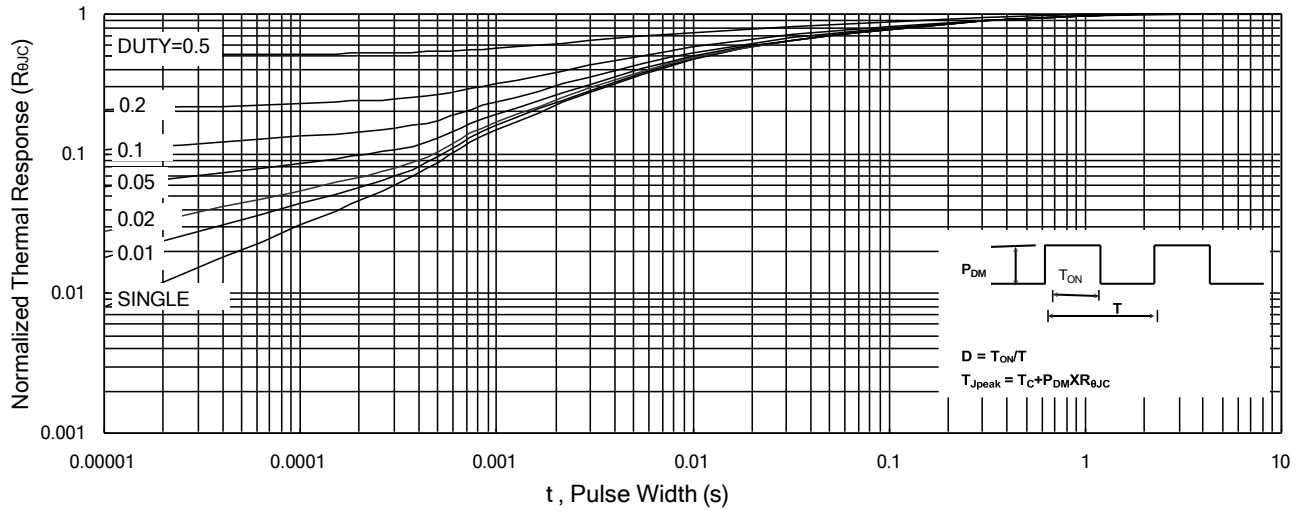




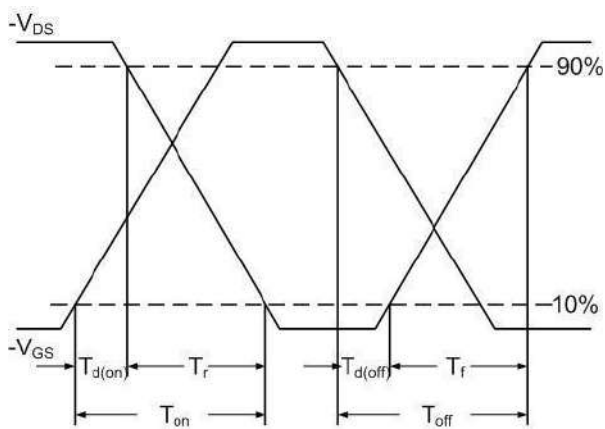
**Fig.7 Capacitance**



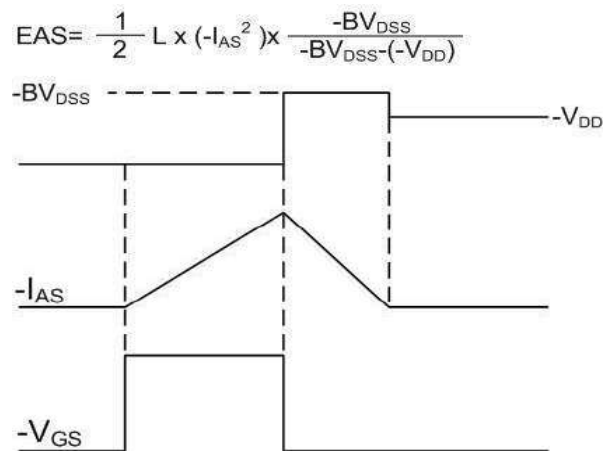
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Waveform**