

## Features

- Advanced Trench MOS Technology
- 100% EAS Guaranteed
- Green Device Available

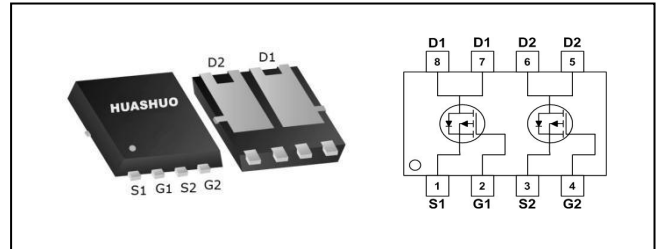
## Product Summary

|                  |     |            |
|------------------|-----|------------|
| $V_{DS}$         | -30 | V          |
| $R_{DS(ON),max}$ | 40  | m $\Omega$ |
| $I_D$            | -19 | A          |

## Application

- Battery Powered Systems.
- Portable Equipment.

## PRPAK3\*3 Pin Configuration



## Absolute Maximum Ratings

| Symbol                     | Parameter                                               | Rating     | Units            |
|----------------------------|---------------------------------------------------------|------------|------------------|
| $V_{DS}$                   | Drain-Source Voltage                                    | -30        | V                |
| $V_{GS}$                   | Gate-Source Voltage                                     | $\pm 20$   | V                |
| $I_D@T_C=25^\circ\text{C}$ | Continuous Drain Current, $-V_{GS}$ @ -10V <sup>1</sup> | -19        | A                |
| $I_D@T_C=70^\circ\text{C}$ | Continuous Drain Current, $-V_{GS}$ @ -10V <sup>1</sup> | -12        | A                |
| $I_D@T_A=25^\circ\text{C}$ | Continuous Drain Current, $-V_{GS}$ @ -10V <sup>1</sup> | -5.5       | A                |
| $I_D@T_A=70^\circ\text{C}$ | Continuous Drain Current, $-V_{GS}$ @ -10V <sup>1</sup> | -3.4       | A                |
| $I_{DM}$                   | Pulsed Drain Current <sup>2</sup>                       | -38        | A                |
| EAS                        | Single Pulse Avalanche Energy <sup>3</sup>              | 45         | mJ               |
| $I_{AS}$                   | Avalanche Current                                       | -30        | A                |
| $P_D@T_C=25^\circ\text{C}$ | Total Power Dissipation <sup>4</sup>                    | 21         | W                |
| $P_D@T_A=25^\circ\text{C}$ | Total Power Dissipation <sup>4</sup>                    | 1.67       | W                |
| $T_{STG}$                  | Storage Temperature Range                               | -55 to 150 | $^\circ\text{C}$ |
| $T_J$                      | Operating Junction Temperature Range                    | -55 to 150 | $^\circ\text{C}$ |

## Thermal Data

| Symbol          | Parameter                                        | Typ. | Max. | Unit               |
|-----------------|--------------------------------------------------|------|------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup> | ---  | 75   | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case <sup>1</sup>    | ---  | 6    | $^\circ\text{C/W}$ |



**Electrical Characteristics (T<sub>J</sub>=25 °C, unless otherwise noted)**

| Symbol               | Parameter                                      | Conditions                                                                              | Min. | Typ. | Max. | Unit  |
|----------------------|------------------------------------------------|-----------------------------------------------------------------------------------------|------|------|------|-------|
| BV <sub>DSS</sub>    | Drain-Source Breakdown Voltage                 | V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA                                             | -30  | ---  | ---  | V     |
| R <sub>DS(ON)</sub>  | Static Drain-Source On-Resistance <sup>2</sup> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-10A                                             | ---  | ---  | 40   | mΩ    |
|                      |                                                | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-6A                                             | ---  | ---  | 62   |       |
| V <sub>GS(th)</sub>  | Gate Threshold Voltage                         | V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA                               | -1.0 | -1.7 | -2.5 | V     |
| ΔV <sub>GS(th)</sub> | V <sub>GS(th)</sub> Temperature Coefficient    |                                                                                         | ---  | 4.6  | ---  | mV/°C |
| I <sub>DSS</sub>     | Drain-Source Leakage Current                   | V <sub>DS</sub> =-24V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C                        | ---  | ---  | -1   | uA    |
|                      |                                                | V <sub>DS</sub> =-24V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C                        | ---  | ---  | -5   |       |
| I <sub>GSS</sub>     | Gate-Source Leakage Current                    | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                              | ---  | ---  | ±100 | nA    |
| R <sub>g</sub>       | Gate Resistance                                | V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz                                        | ---  | 15   | ---  | Ω     |
| Q <sub>g</sub>       | Total Gate Charge (-4.5V)                      | V <sub>DS</sub> =-20V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-10A                     | ---  | 9.6  | ---  | nC    |
| Q <sub>gs</sub>      | Gate-Source Charge                             |                                                                                         | ---  | 2.8  | ---  |       |
| Q <sub>gd</sub>      | Gate-Drain Charge                              |                                                                                         | ---  | 3.8  | ---  |       |
| T <sub>d(on)</sub>   | Turn-On Delay Time                             | V <sub>DD</sub> =-24V, V <sub>GS</sub> =-10V, R <sub>G</sub> =3.3Ω, I <sub>D</sub> =-1A | ---  | 14.6 | ---  | ns    |
| T <sub>r</sub>       | Rise Time                                      |                                                                                         | ---  | 24.8 | ---  |       |
| T <sub>d(off)</sub>  | Turn-Off Delay Time                            |                                                                                         | ---  | 51   | ---  |       |
| T <sub>f</sub>       | Fall Time                                      |                                                                                         | ---  | 10   | ---  |       |
| C <sub>iss</sub>     | Input Capacitance                              | V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHz                                      | ---  | 945  | ---  | pF    |
| C <sub>oss</sub>     | Output Capacitance                             |                                                                                         | ---  | 140  | ---  |       |
| C <sub>rss</sub>     | Reverse Transfer Capacitance                   |                                                                                         | ---  | 118  | ---  |       |

**Diode Characteristics**

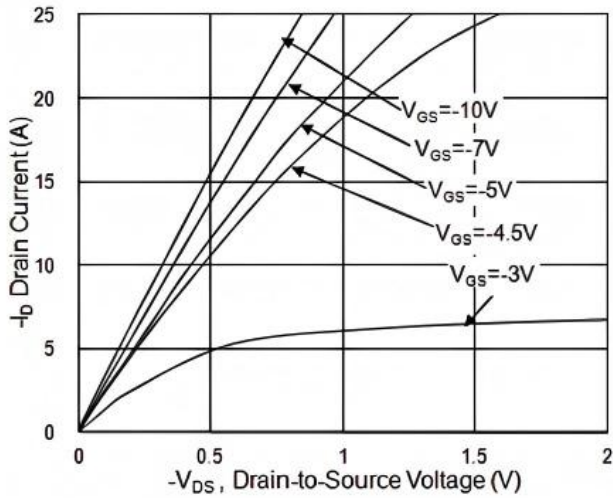
| Symbol          | Parameter                                | Conditions                                                     | Min. | Typ. | Max. | Unit |
|-----------------|------------------------------------------|----------------------------------------------------------------|------|------|------|------|
| I <sub>S</sub>  | Continuous Source Current <sup>1,5</sup> | V <sub>G</sub> =V <sub>D</sub> =0V, Force Current              | ---  | ---  | -19  | A    |
| V <sub>SD</sub> | Diode Forward Voltage <sup>2</sup>       | V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C | ---  | ---  | -1.2 | V    |

Note :

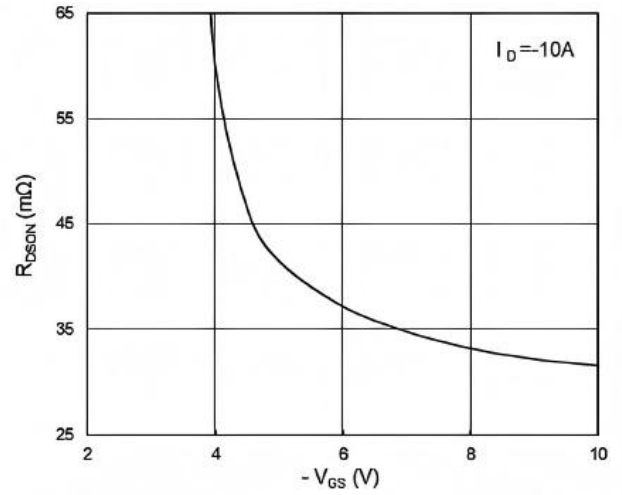
- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%
- 3.The EAS data shows Max. rating . The test condition is V<sub>DD</sub>=-25V, V<sub>GS</sub>=-10V, L=0.1mH, I<sub>AS</sub>=-30A
- 4.The power dissipation is limited by 150°C junction temperature
- 5.The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub> , in real applications , should be limited by total power dissipation.



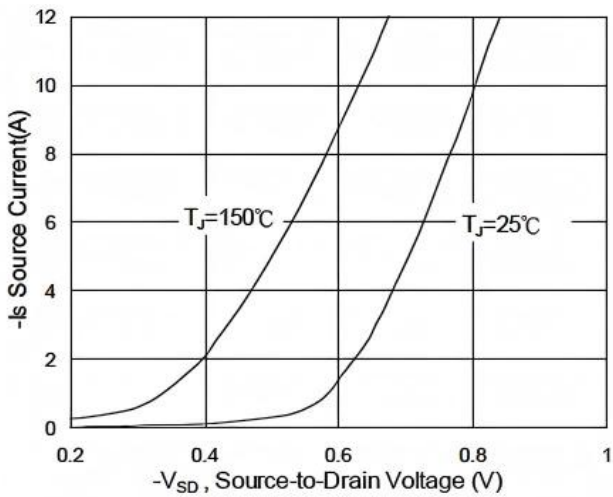
## Typical Characteristics



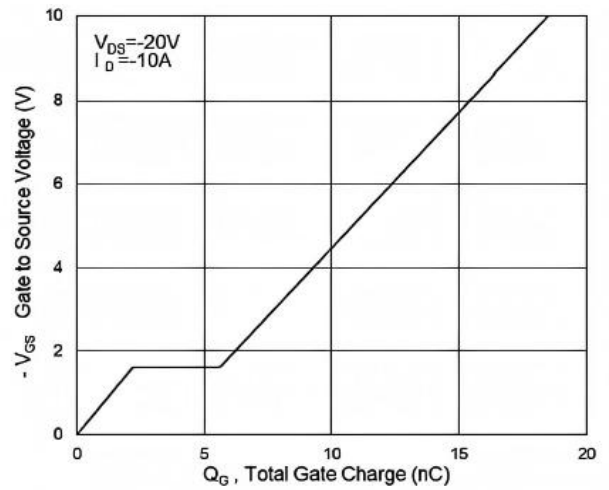
**Fig.1 Typical Output Characteristics**



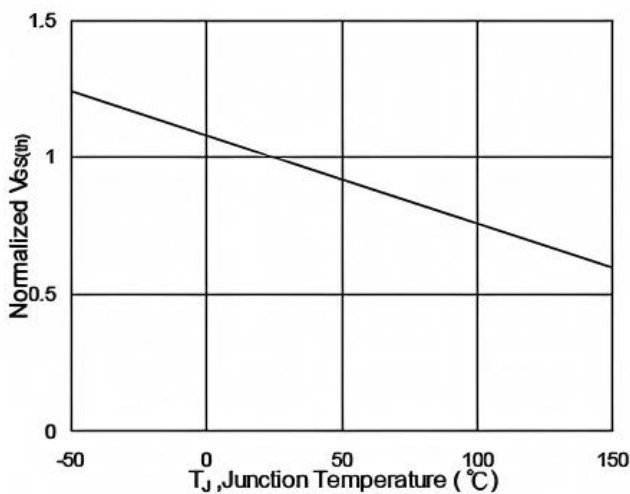
**Fig.2 On-Resistance v.s Gate-Source**



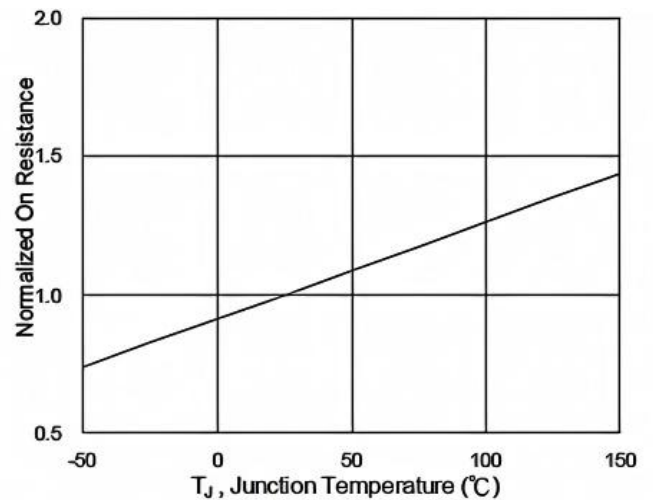
**Fig.3 Forward Characteristics of Reverse**



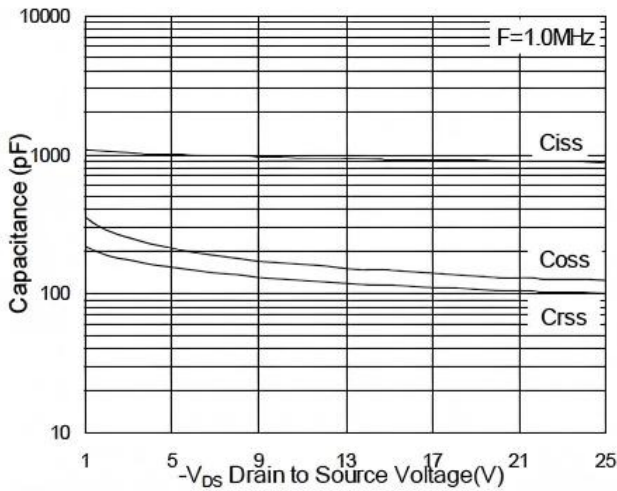
**Fig.4 Gate-Charge Characteristics**



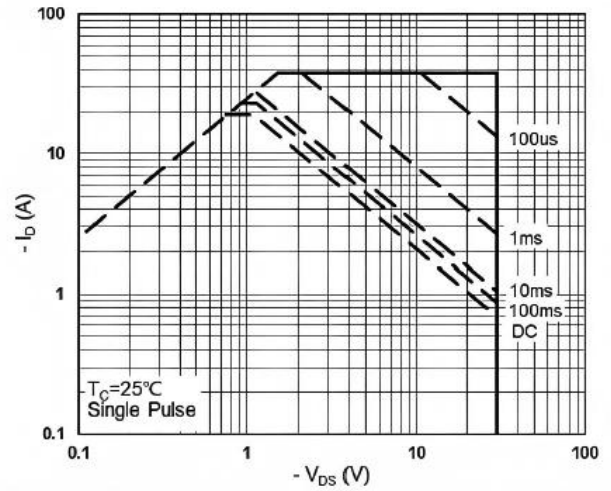
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



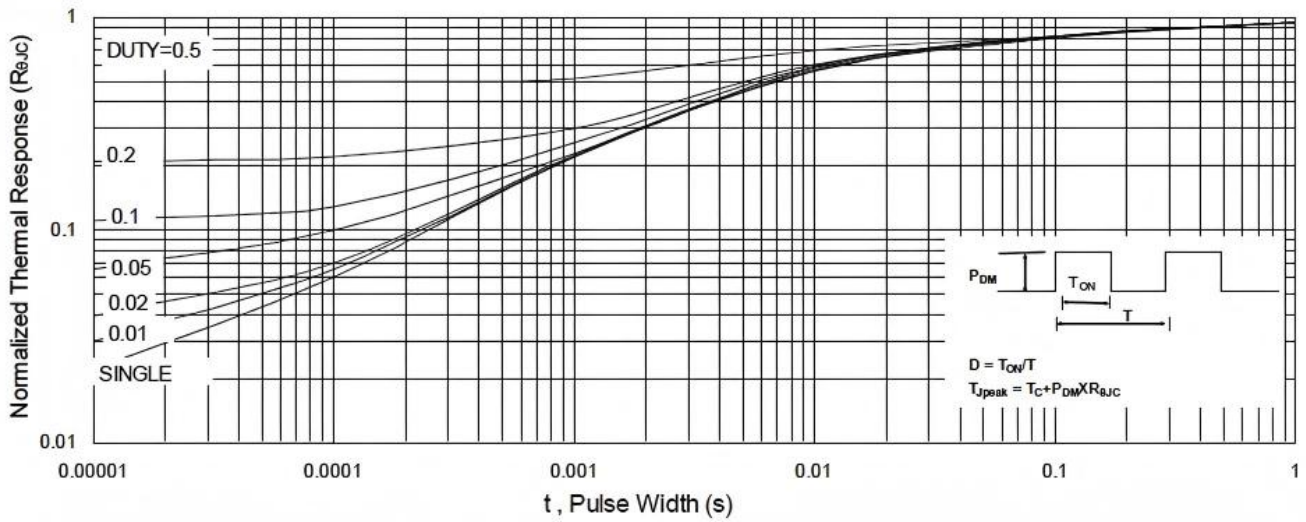
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



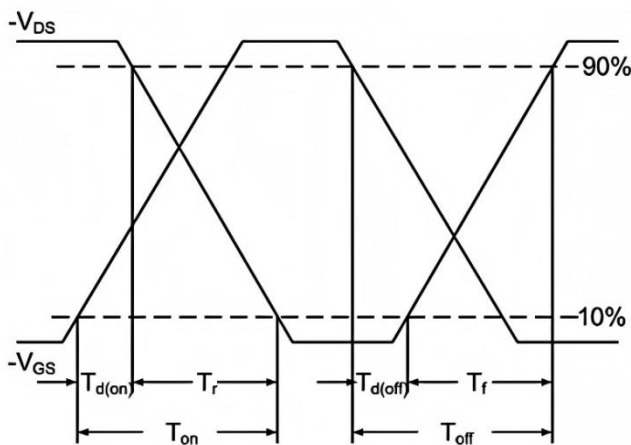
**Fig.7 Capacitance**



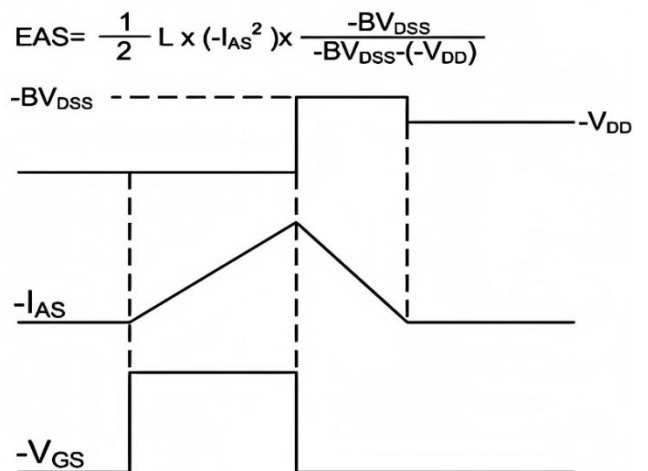
**Fig.8 Safe Operating Area**



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



**Fig.10 Switching Time Waveform**



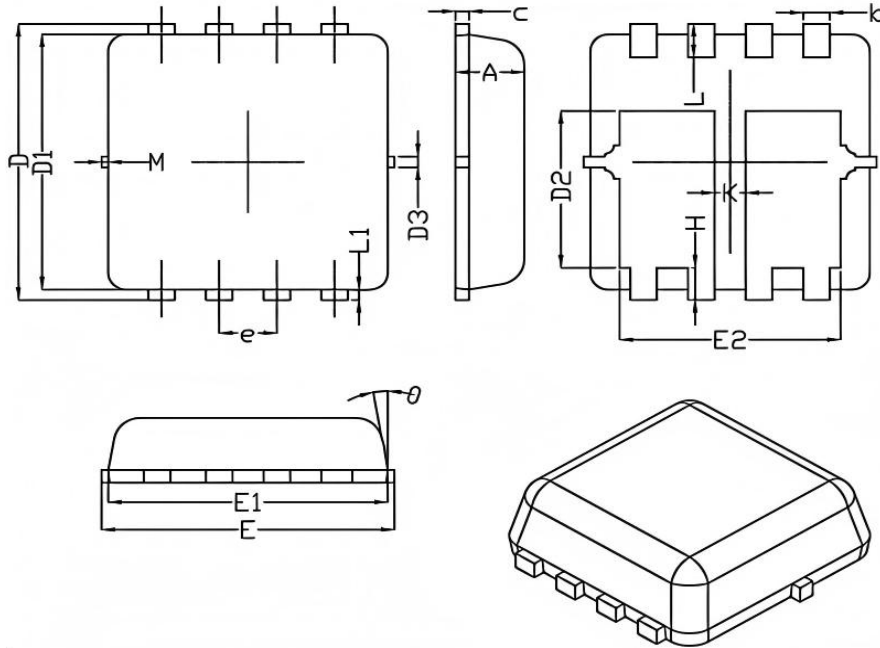
**Fig.11 Unclamped Inductive Switching Waveform**



## Ordering Information

| Part Number     | Package code    | Packaging                 |
|-----------------|-----------------|---------------------------|
| <b>HSBB3313</b> | <b>PRPAK3*3</b> | <b>3000/Tape&amp;Reel</b> |

**PRPAK3\*3 Dual Package Outline**



| SYMBOL         | Dimensions In Millimeters |      |      |
|----------------|---------------------------|------|------|
|                | MIN                       | NOM  | MAX  |
| A              | 0.70                      | 0.75 | 0.80 |
| b              | 0.25                      | 0.30 | 0.35 |
| C              | 0.10                      | 0.15 | 0.25 |
| D              | 3.25                      | 3.35 | 3.45 |
| D1             | 3.00                      | 3.10 | 3.20 |
| D2             | 1.78                      | 1.88 | 1.98 |
| D3             | ---                       | 0.13 | ---  |
| E              | 3.20                      | 3.30 | 3.40 |
| E1             | 3.00                      | 3.15 | 3.20 |
| E2             | 2.39                      | 2.49 | 2.59 |
| e              | 0.65BSC                   |      |      |
| H              | 0.30                      | 0.39 | 0.50 |
| L              | 0.30                      | 0.40 | 0.50 |
| L1             | ---                       | 0.13 | ---  |
| K              | 0.30                      | ---  | ---  |
| θ              | ---                       | 10°  | 12°  |
| M              | *                         | *    | 0.15 |
| *Not specified |                           |      |      |



## HSBB3313 Marking:

