# HSBB4052

## N-Ch 40V Fast Switching MOSFETs

## Description

The HSBB4052 is the high cell density trenched N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The HSBB4052 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

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

## Product Summary

| | | |
|---|---|---|
| $V_{DS}$ | 40 | V |
| $R_{DS(ON),typ}$ | 6.9 | mΩ |
| $I_D$ | 43 | A |

## PRPAK3X3 Pin Configuration
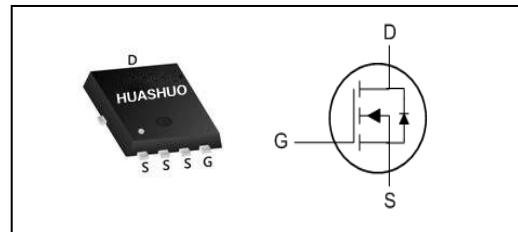


## Absolute Maximum Ratings

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 40 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_C$=25°C | Continuous Drain Current1 | 43 | A |
| $I_D$@$T_C$=100°C | Continuous Drain Current1 | 28 | A |
| $I_{DM}$ | Pulsed Drain Current2 | 60 | A |
| EAS | Single Pulse Avalanche Energy3 | 48 | mJ |
| $I_{AS}$ | Avalanche Current | 31 | A |
| $P_D$@$T_C$=25°C | Total Power Dissipation4 | 27.8 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | °C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | °C |

## Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|---|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance Junction-ambient (Steady State)1 | --- | 60 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance Junction-Case1 | --- | 4.5 | °C/W |

## Electrical Characteristics (T$_J$=25 ℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BV$_{DSS}$ | Drain-Source Breakdown Voltage | V$_{GS}$=0V , I$_D$=250uA | 40 | --- | --- | V |
| R$_{DS(ON)}$ | Static Drain-Source On-Resistance2 | V$_{GS}$=10V , I$_D$=12A | --- | 6.9 | 8.5 | mΩ |
| | | V$_{GS}$=4.5V , I$_D$=10A | --- | 10.5 | 15 | |
| V$_{GS(th)}$ | Gate Threshold Voltage | V$_{GS}$=V$_{DS}$ , I$_D$ =250uA | 1.0 | 1.5 | 2.5 | V |
| I$_{DSS}$ | Drain-Source Leakage Current | V$_{DS}$=32V , V$_{GS}$=0V , T$_J$=25°C | --- | --- | 1 | uA |
| | | V$_{DS}$=32V , V$_{GS}$=0V , T$_J$=55°C | --- | --- | 5 | |
| I$_{GSS}$ | Gate-Source Leakage Current | V$_{GS}$=±20V , V$_{DS}$=0V | --- | --- | ±100 | nA |
| R$_g$ | Gate Resistance | V$_{DS}$=0V , V$_{GS}$=0V , f=1MHz | --- | 1.7 | --- | Ω |
| Q$_g$ | Total Gate Charge (4.5V) | V$_{DS}$=20V , V$_{GS}$=4.5V , I$_D$=12A | --- | 5.8 | --- | nC |
| Q$_{gs}$ | Gate-Source Charge | | --- | 3 | --- | |
| Q$_{gd}$ | Gate-Drain Charge | | --- | 1.2 | --- | |
| T$_{d(on)}$ | Turn-On Delay Time | V$_{DD}$=15V , V$_{GS}$=10V , R$_G$=3.3Ω I$_D$=1A | --- | 14.3 | --- | ns |
| T$_r$ | Rise Time | | --- | 5.6 | --- | |
| T$_{d(off)}$ | Turn-Off Delay Time | | --- | 20 | --- | |
| T$_f$ | Fall Time | | --- | 11 | --- | |
| C$_{iss}$ | Input Capacitance | V$_{DS}$=15V , V$_{GS}$=0V , f=1MHz | --- | 690 | --- | pF |
| C$_{oss}$ | Output Capacitance | | --- | 193 | --- | |
| C$_{rss}$ | Reverse Transfer Capacitance | | --- | 38 | --- | |

## Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| I$_S$ | Continuous Source Current1,5 | V$_G$=V$_D$=0V , Force Current | --- | --- | 20 | A |
| V$_{SD}$ | Diode Forward Voltage2 | V$_{GS}$=0V , I$_S$=1A , T$_J$=25°C | --- | --- | 1 | V |

Note :
1.The data tested by surface mounted on a 1 inch2 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$_{DD}$=25V,V$_{GS}$=10V,L=0.1mH,I$_{AS}$=31A
4.The power dissipation is limited by 150°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
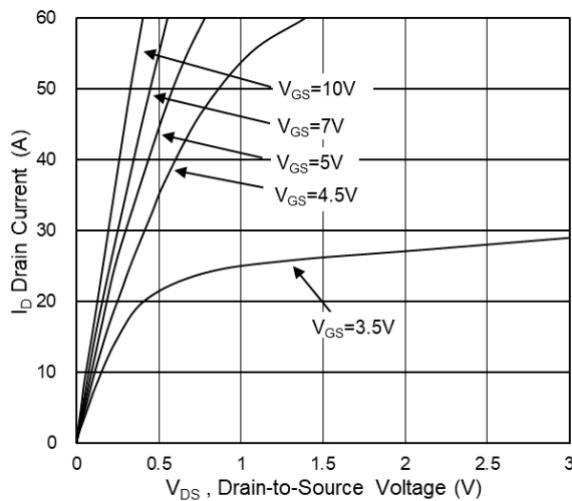
Fig.1 Typical Output Characteristics
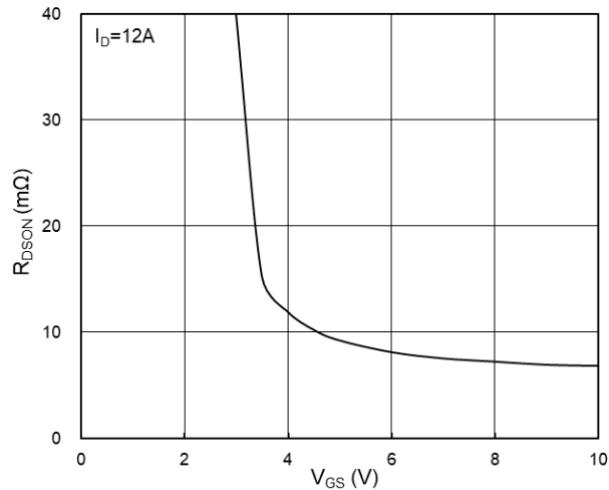
Fig.2 On-Resistance vs. G-S Voltage
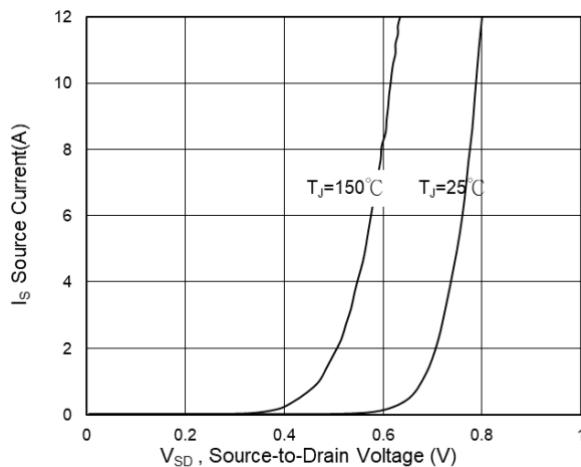
Fig.3 Source Drain Forward Characteristics
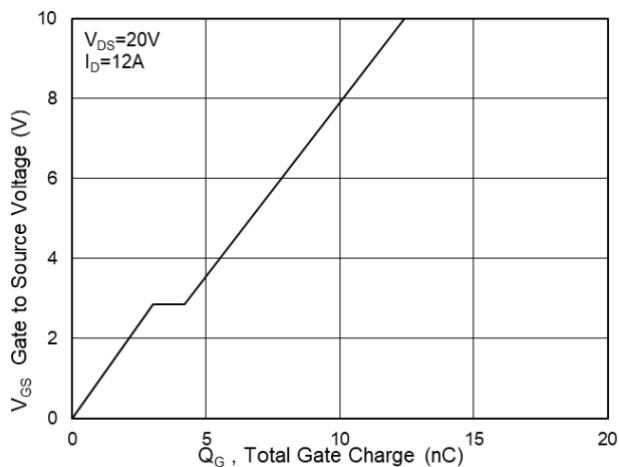
Fig.4 Gate-Charge Characteristics
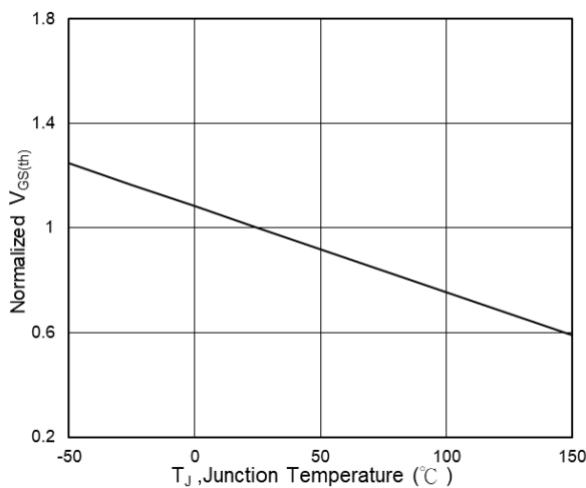
Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$
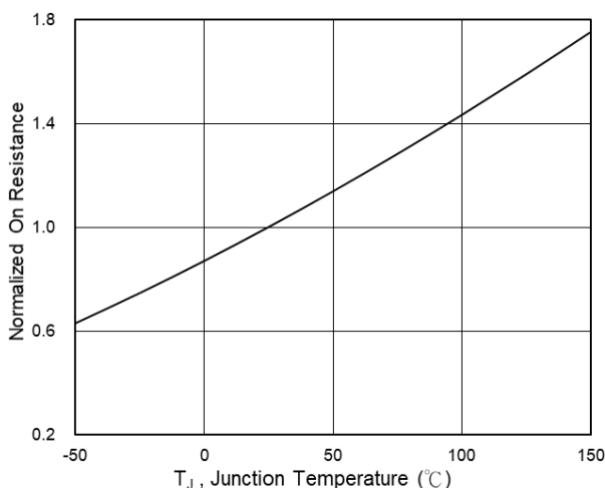
Fig.6 Normalized $R_{DSON}$ vs. $T_J$
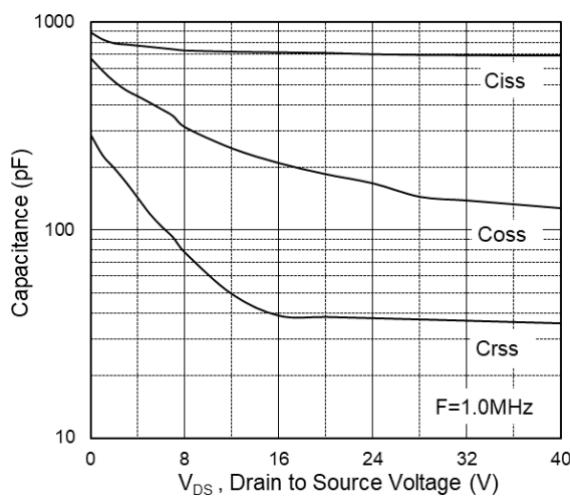
**Fig.7 Capacitance**
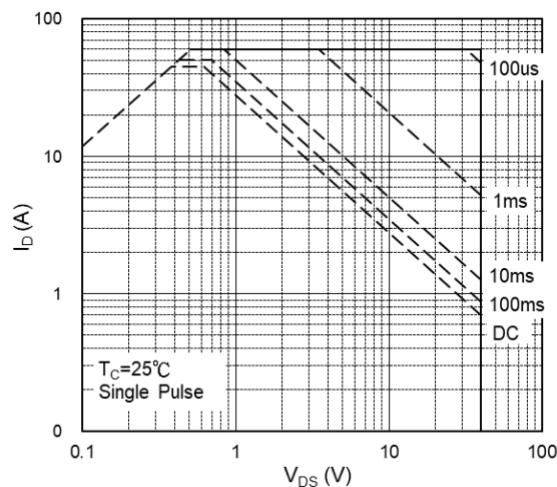


**Fig.8 Safe Operating Area**



$$D = T_{ON}/T$$

$$T_{J}peak = T_C + P_{DM} \times R_{\theta JC}$$
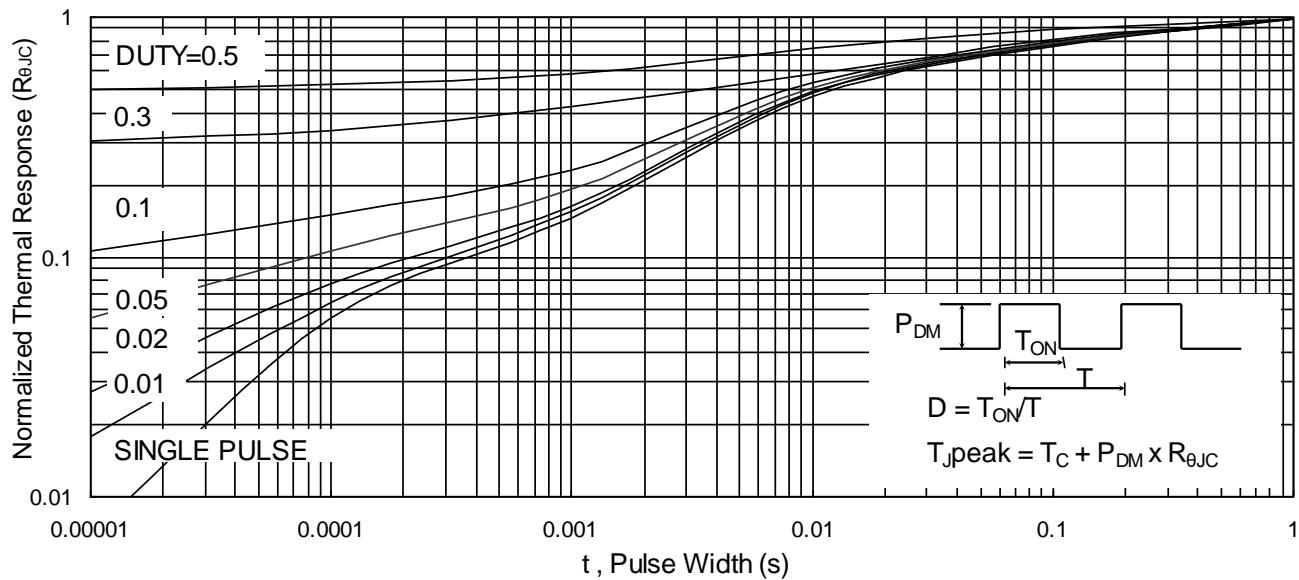
**Fig.9 Normalized Maximum Transient Thermal Impedance**
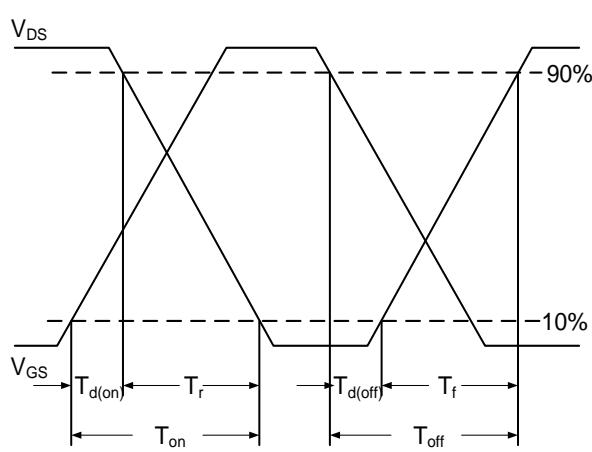


**Fig.10 Switching Time Waveform**

$$EAS = \frac{1}{2}L \times I_{AS}^2 \times \frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$
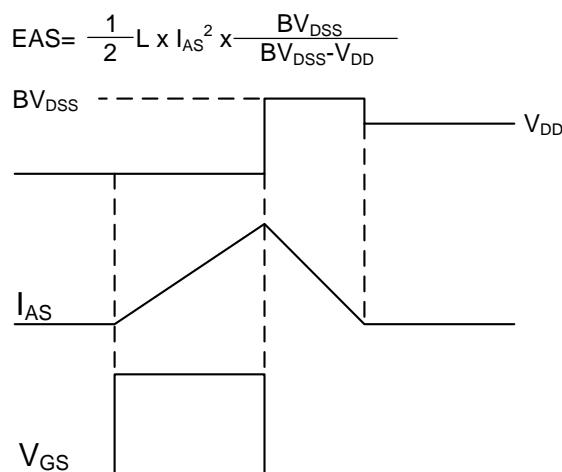


**Fig.11 Unclamped Inductive Waveform**

**N-Ch 40V Fast Switching MOSFETs**

# Ordering Information

| Part Number | Package code | Packaging |
|---|---|---|
| HSBB4052 | PRPAK3*3 | 3000/Tape&Reel |

**PRPAK 3*3(E) Single Outline**
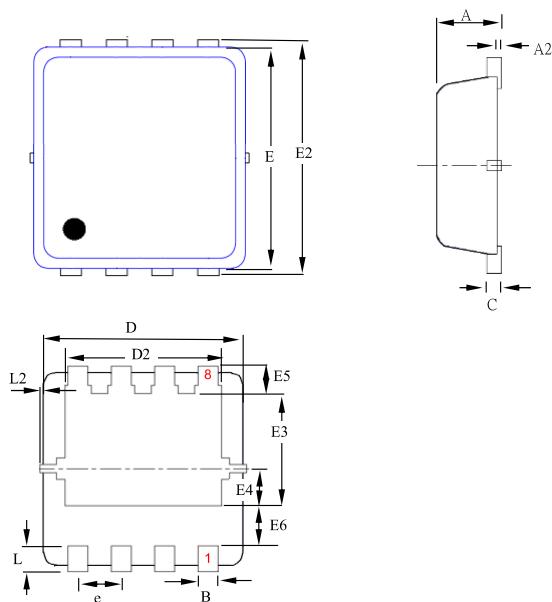


| SYMBOLS | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.70 | 0.80 | 0.90 | 0.028 | 0.031 | 0.035 |
| A2 | 0.00 | -- | 0.05 | 0.000 | -- | 0.002 |
| B | 0.24 | 0.30 | 0.35 | 0.009 | 0.012 | 0.014 |
| C | 0.10 | 0.15 | 0.25 | 0.004 | 0.006 | 0.010 |
| D | 2.90 | 3.00 | 3.20 | 0.114 | 0.118 | 0.126 |
| D2 | 2.15 | 2.35 | 2.59 | 0.085 | 0.093 | 0.102 |
| E | 2.90 | 3.00 | 3.12 | 0.114 | 0.118 | 0.123 |
| E2 | 3.05 | 3.20 | 3.45 | 0.120 | 0.126 | 0.136 |
| E3 | 1.55 | 1.75 | 1.95 | 0.061 | 0.069 | 0.077 |
| E4 | 0.48 | 0.58 | 0.68 | 0.019 | 0.023 | 0.027 |
| E5 | 0.28 | 0.43 | 0.58 | 0.011 | 0.017 | 0.023 |
| E6 | 0.43 | 0.63 | 0.87 | 0.017 | 0.025 | 0.034 |
| L | 0.30 | 0.40 | 0.50 | 0.012 | 0.016 | 0.020 |
| L2 | 0.00 | -- | 0.10 | 0.000 | -- | 0.004 |
| e | -- | 0.65 | -- | -- | 0.026 | -- |