

**Description**

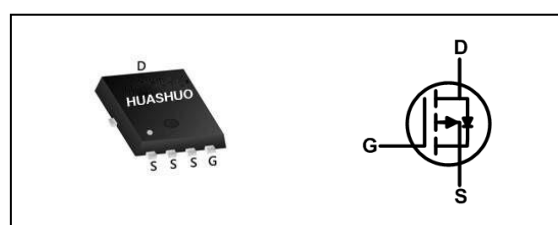
The HSBB4113 is the high cell density trenched P-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The HSBB4113 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 <sub>DS</sub>	-40	V
R <sub>DS(ON),max</sub>	40	mΩ
I <sub>D</sub>	-15	A

**PRPAK3\*3 Pin Configuration**

**Absolute Maximum Ratings**

Symbol	Parameter	Rating	Units
V <sub>DS</sub>	Drain-Source Voltage	-40	V
V <sub>GS</sub>	Gate-Source Voltage	±20	V
I <sub>D</sub> @T <sub>C</sub> =25°C	Continuous Drain Current, -V <sub>GS</sub> @ -10V <sup>1</sup>	-15	A
I <sub>D</sub> @T <sub>C</sub> =100°C	Continuous Drain Current, -V <sub>GS</sub> @ -10V <sup>1</sup>	-10	A
I <sub>DM</sub>	Pulsed Drain Current <sup>2</sup>	-46	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	37	mJ
I <sub>AS</sub>	Avalanche Current	-27.2	A
P <sub>D</sub> @T <sub>C</sub> =25°C	Total Power Dissipation <sup>4</sup>	32	W
T <sub>STG</sub>	Storage Temperature Range	-55 to 150	°C
T <sub>J</sub>	Operating Junction Temperature Range	-55 to 150	°C

**Thermal Data**

Symbol	Parameter	Typ.	Max.	Unit
R <sub>θJA</sub>	Thermal Resistance Junction-Ambient <sup>1</sup>	---	62	°C/W
R <sub>θJC</sub>	Thermal Resistance Junction-Case <sup>1</sup>	---	4	°C/W

**P-Channel Electrical Characteristics ( $T_J=25\text{ }^\circ\text{C}$ , 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
$\Delta BV_{DSS}/\Delta T_J$	$BV_{DSS}$ Temperature Coefficient	Reference to $25^\circ\text{C}$ , $I_D=-1\text{mA}$	---	-0.012	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=-10V, I_D=-12A$	---	---	40	m $\Omega$
		$V_{GS}=-4.5V, I_D=-10A$	---	---	65	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1.0	---	-2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	4.32	---	$\text{mV}/^\circ\text{C}$
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=-32V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	$\mu\text{A}$
		$V_{DS}=-32V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
$g_{fs}$	Forward Transconductance	$V_{DS}=-5V, I_D=-12A$	---	15	---	S
$R_g$	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	13	---	$\Omega$
$Q_g$	Total Gate Charge (-4.5V)	$V_{DS}=-20V, V_{GS}=-4.5V, I_D=-6A$	---	9	---	nC
$Q_{gs}$	Gate-Source Charge		---	2.54	---	
$Q_{gd}$	Gate-Drain Charge		---	3.1	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-15V, V_{GS}=-10V, R_G=3.3\Omega, I_D=-1A$	---	19.2	---	ns
$T_r$	Rise Time		---	12.8	---	
$T_{d(off)}$	Turn-Off Delay Time		---	48.6	---	
$T_f$	Fall Time		---	4.6	---	
$C_{iss}$	Input Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$	---	1004	---	pF
$C_{oss}$	Output Capacitance		---	108	---	
$C_{rss}$	Reverse Transfer Capacitance		---	80	---	

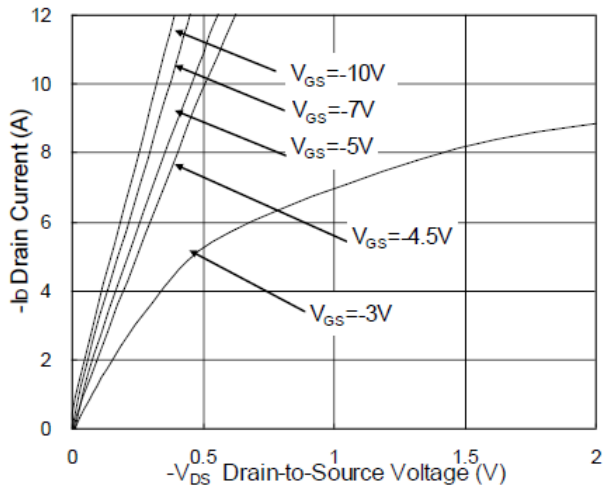
**Diode Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Source Current <sup>1,5</sup>	$V_G=V_D=0V$ , Force Current	---	---	-10	A
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$	---	---	-1	V

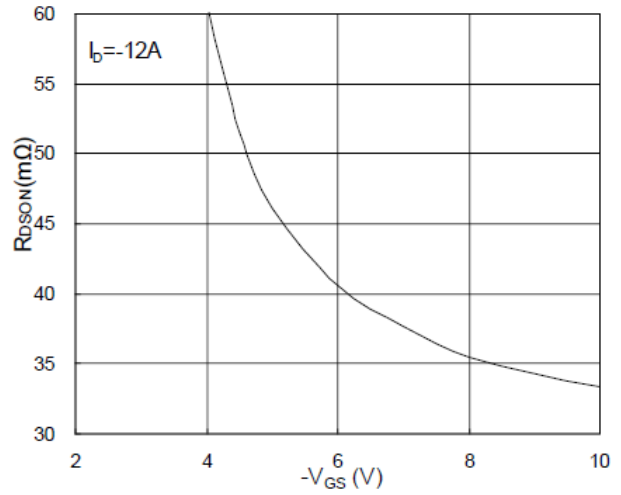
Note :

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width  $\leq 300\mu\text{s}$  , duty cycle  $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is  $V_{DD}=-25V, V_{GS}=-10V, L=0.1\text{mH}, I_{AS}=-27.2A$
- 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.

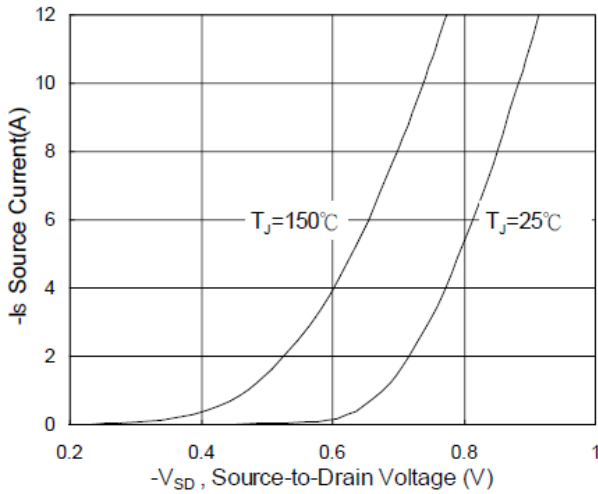
**P-Channel Typical Characteristics**



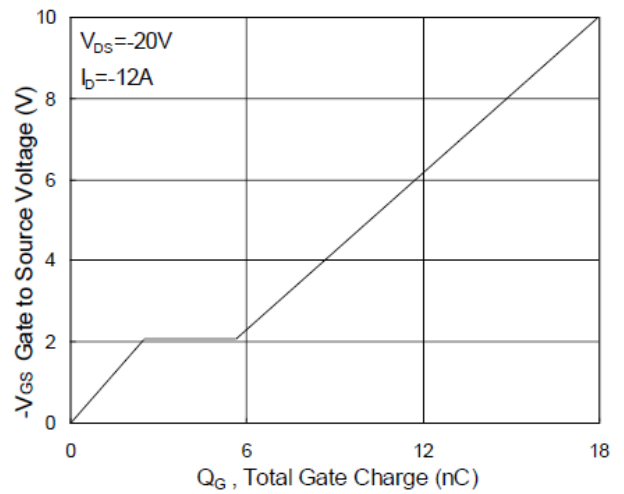
**Fig.1 Typical Output Characteristics**



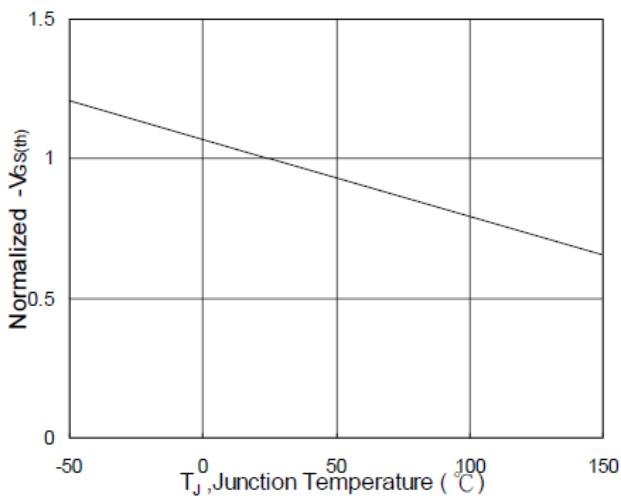
**Fig.2 On-Resistance v.s Gate-Source**



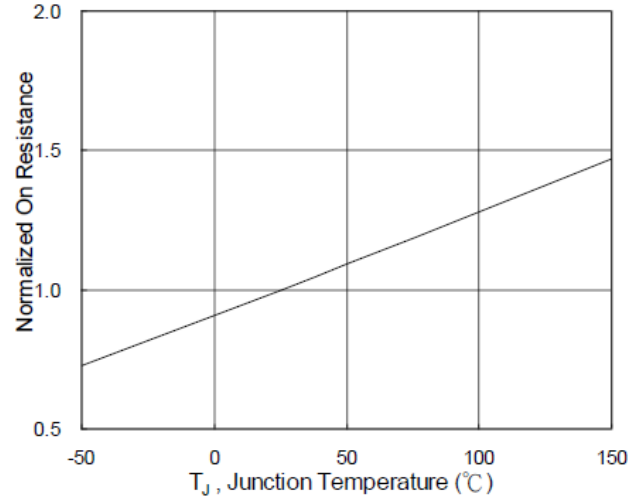
**Fig.3 Forward Characteristics of Reverse**



**Fig.4 Gate-Charge Characteristics**



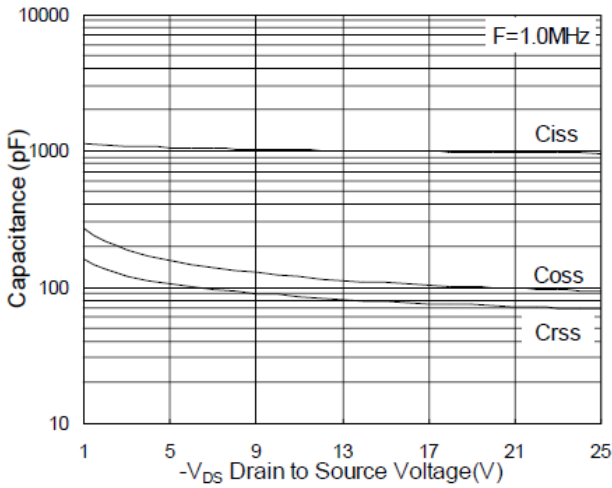
**Fig.5 Normalized V<sub>GS(th)</sub> v.s T<sub>J</sub>**



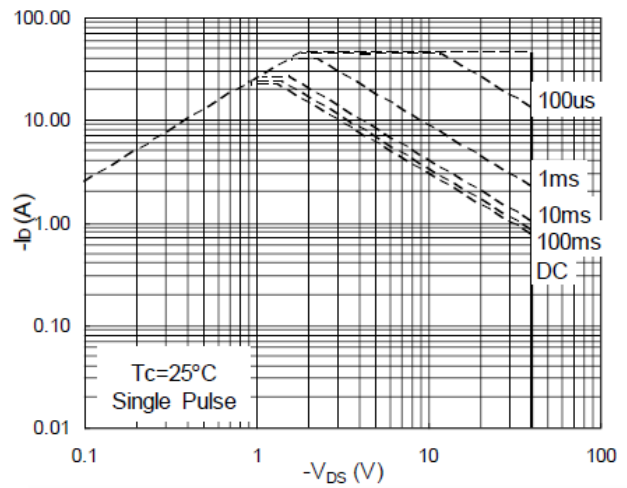
**Fig.6 Normalized R<sub>DS(on)</sub> v.s T<sub>J</sub>**



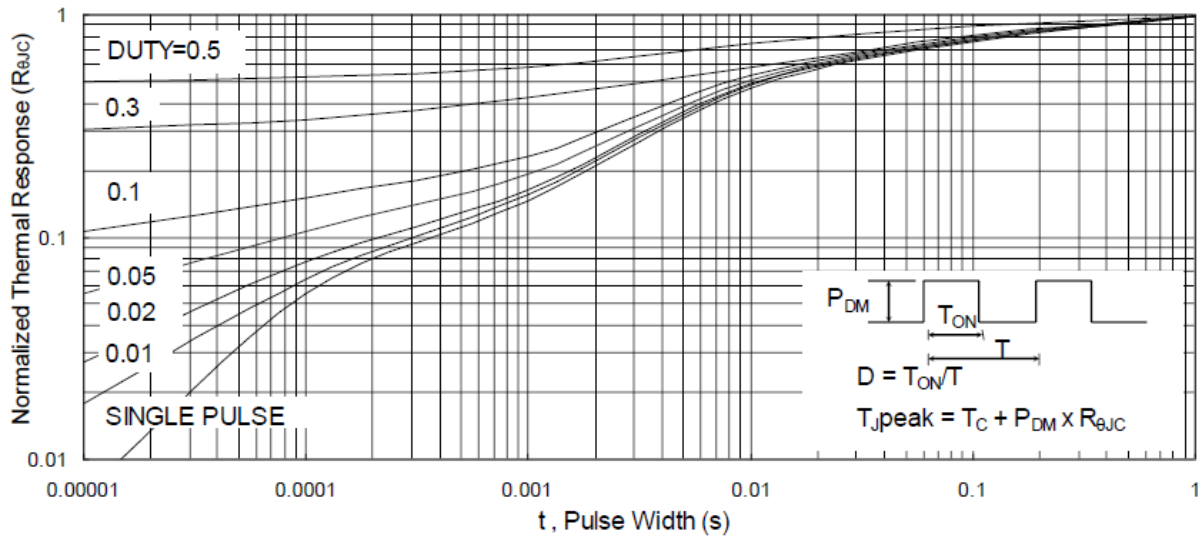
**P-Ch 40V Fast Switching MOSFETs**



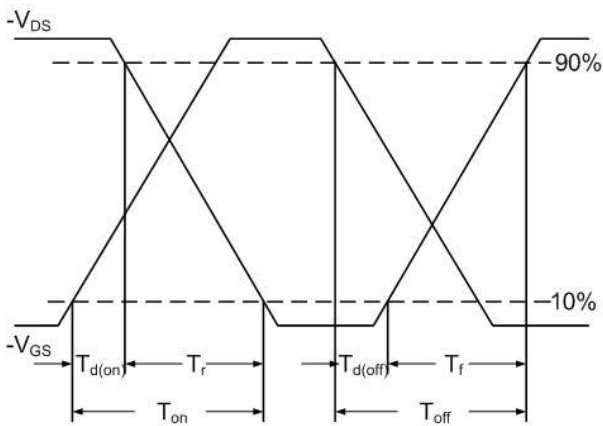
**Fig.7 Capacitance**



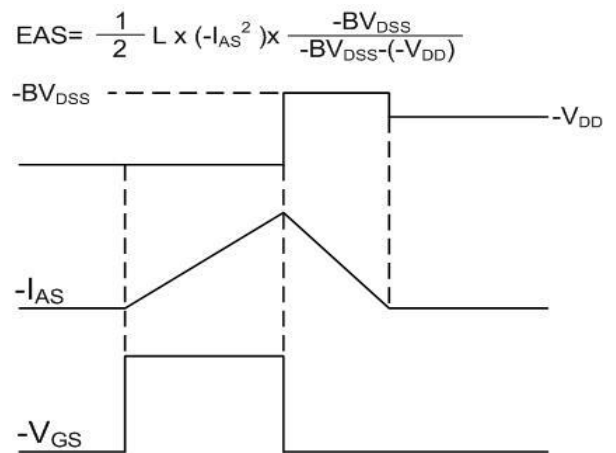
**Fig.8 Safe Operating Area**



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



**Fig.10 Switching Time Waveform**

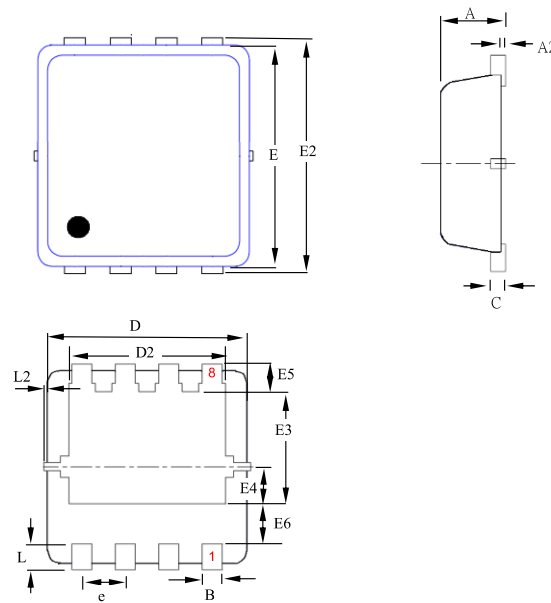


**Fig.11 Unclamped Inductive Waveform**

## Ordering Information

Part Number	Package code	Packaging
HSBB4113	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	—

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