



**Description**

The HSBA6040 is the high cell density trench N-ch MOSFETs, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

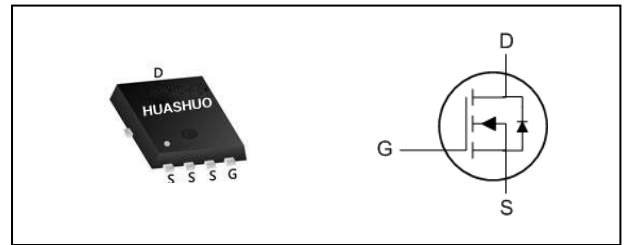
The HSBA6040 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

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

**Product Summary**

V <sub>DS</sub>	60	V
R <sub>DS(ON),max</sub>	5.2	mΩ
I <sub>D</sub>	116	A

**PRPAK5X6 Pin Configuration**



**Absolute Maximum Ratings**

Symbol	Parameter	Rating	Units
V <sub>DS</sub>	Drain-Source Voltage	60	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 <sub>1</sub>	116	A
I <sub>D</sub> @T <sub>C</sub> =100°C	Continuous Drain Current, V <sub>GS</sub> @ 10V <sub>1</sub>	74	A
I <sub>DM</sub>	Pulsed Drain Current <sub>2</sub>	250	A
EAS	Single Pulse Avalanche Energy <sub>3</sub>	125	mJ
I <sub>AS</sub>	Avalanche Current	50	A
P <sub>D</sub> @T <sub>C</sub> =25°C	Total Power Dissipation <sub>4</sub>	113	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 <sub>1</sub>	---	62	°C/W
R <sub>θJC</sub>	Thermal Resistance Junction-Case <sub>1</sub>	---	1.1	°C/W

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
B <sub>VDS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	60	---	---	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =30A	---	4.3	5.2	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =20A	---	6	7	mΩ
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =250uA	1.2	---	2.5	V
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =48V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	1	uA
		V <sub>DS</sub> =48V, 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
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =10V, I <sub>D</sub> =30A	---	75	---	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	---	0.7	---	Ω
Q <sub>g</sub>	Total Gate Charge (10V)	V <sub>DS</sub> =48V, V <sub>GS</sub> =10V, I <sub>D</sub> =25A	---	75	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	15.5	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	20.3	---	
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =30V, V <sub>GS</sub> =10V, R <sub>G</sub> =3.3Ω, I <sub>D</sub> =30A	---	18.5	---	ns
T <sub>r</sub>	Rise Time		---	8.8	---	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	58.8	---	
T <sub>f</sub>	Fall Time		---	15.8	---	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1MHz	---	4706	---	pF
C <sub>oss</sub>	Output Capacitance		---	325	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	245	---	

**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	---	---	116	A
I <sub>SM</sub>	Pulsed Source Current <sup>2,5</sup>		---	---	250	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
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> =30A, di/dt=100A/μs, T <sub>J</sub> =25°C	---	22.9	---	nS
Q <sub>rr</sub>	Reverse Recovery Charge		---	11.6	---	nC

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%

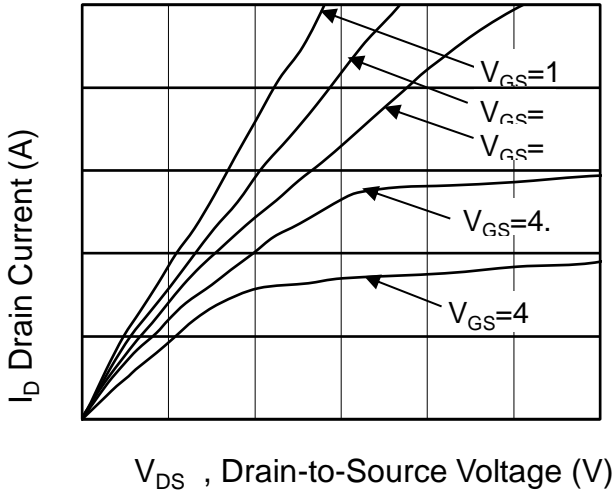
3.The EAS data shows Max. rating. The test condition is V<sub>DD</sub>=50V, V<sub>GS</sub>=10V, L=0.1mH, I<sub>AS</sub>=50A

4.The power dissipation is limited by 150°C junction temperature

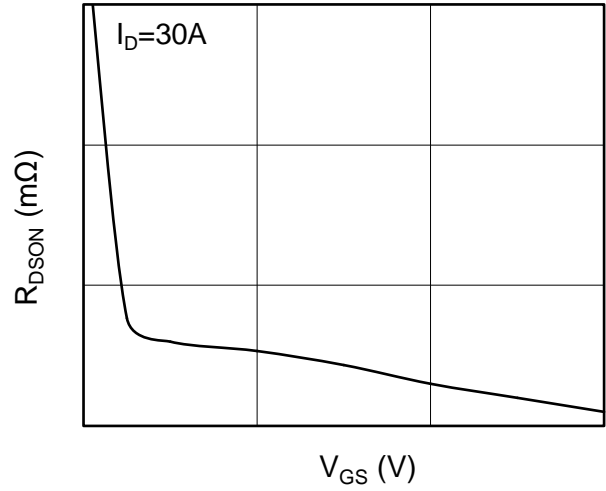
5.The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub>, in real applications, should be limited by total power dissipation.



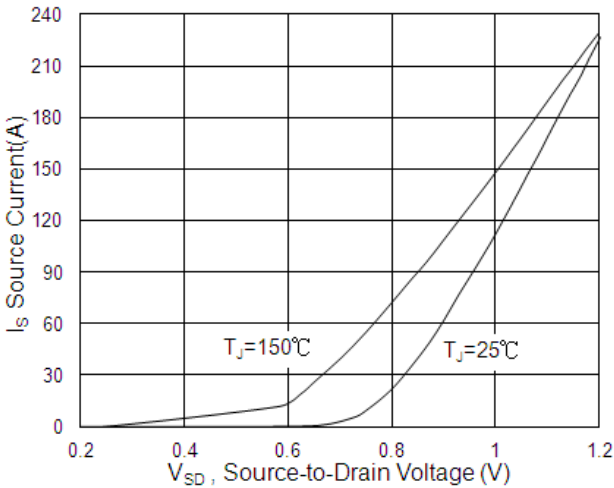
**Typical Characteristics**



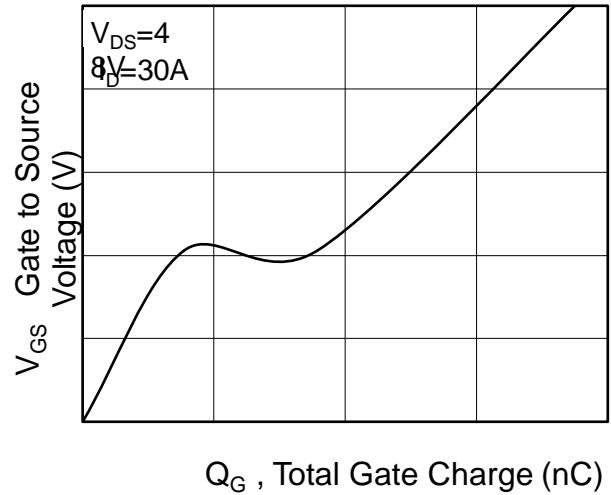
**Fig.1 Typical Output Characteristics**



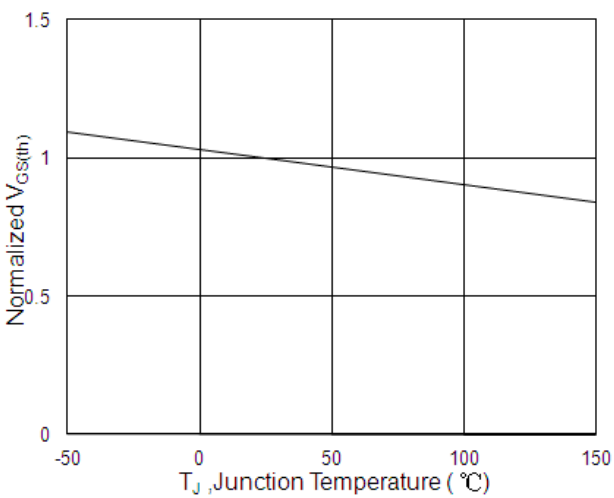
**Fig.2 On-Resistance v.s Gate-Source**



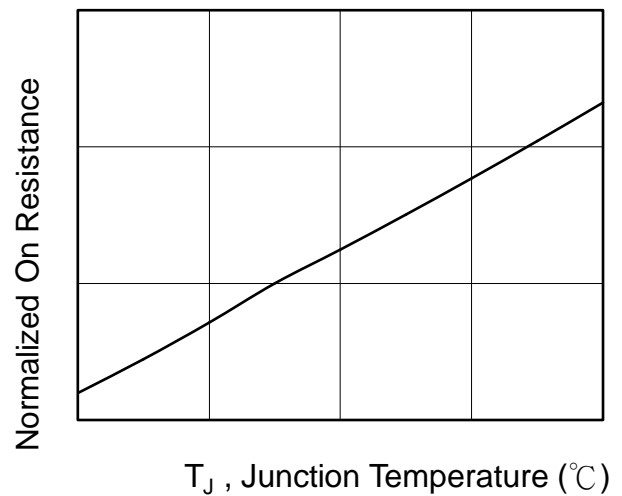
**Fig.3 Forward Characteristics of Reverse**



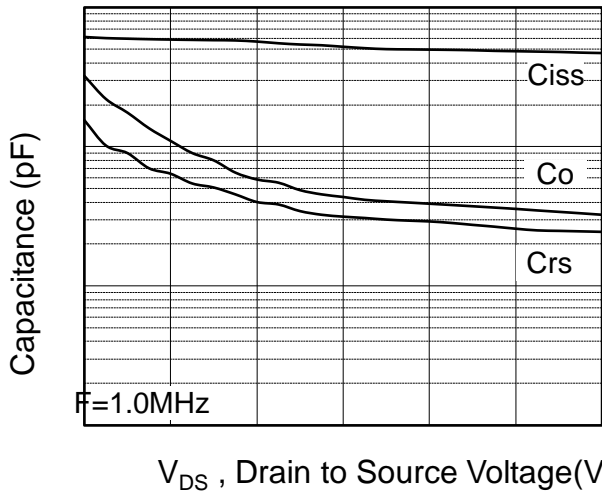
**Fig.4 Gate-Charge Characteristics**



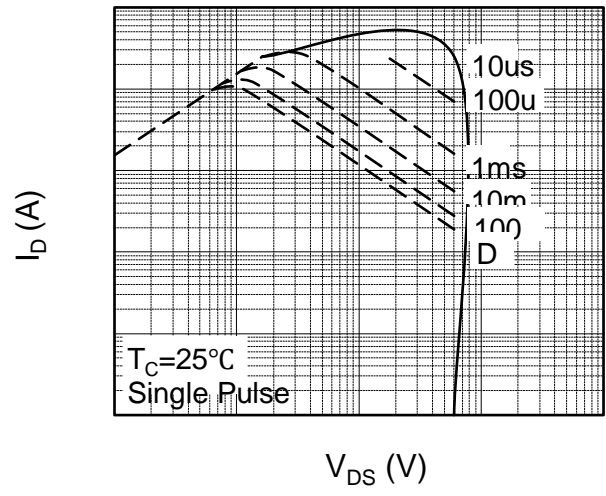
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



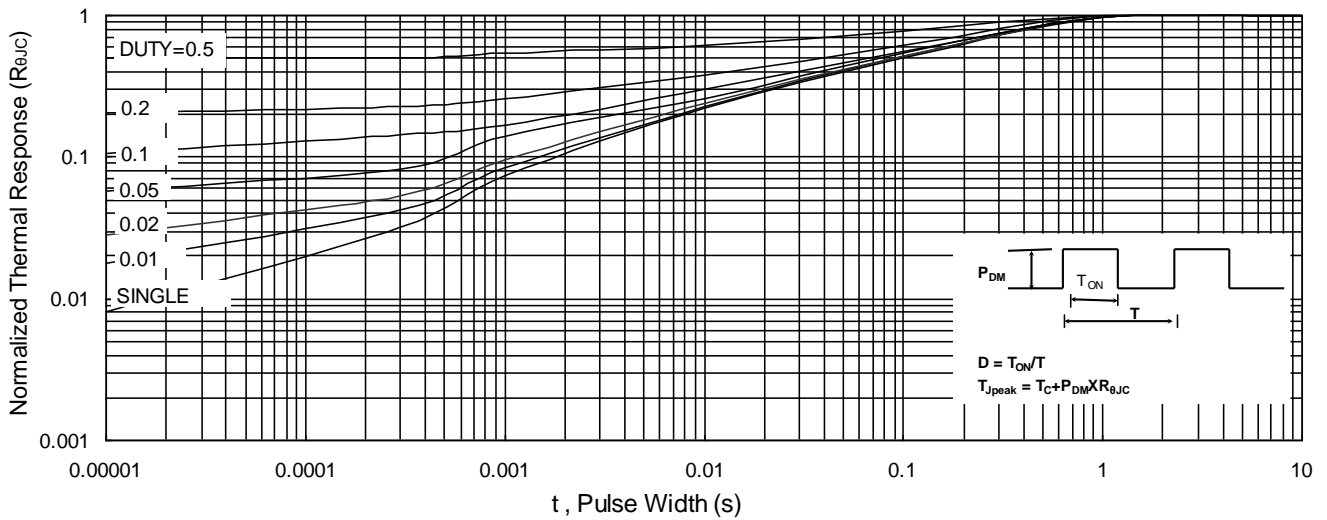
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



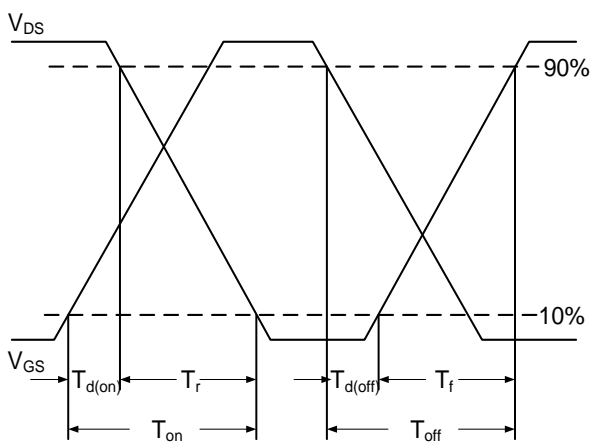
**Fig.7 Capacitance**



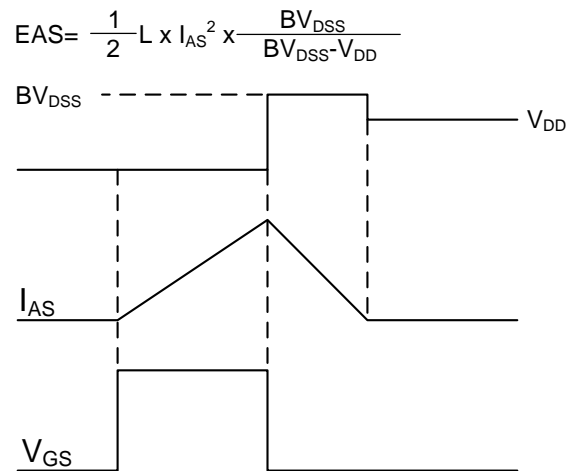
**Fig.8 Safe Operating Area**



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



**Fig.10 Switching Time Waveform**

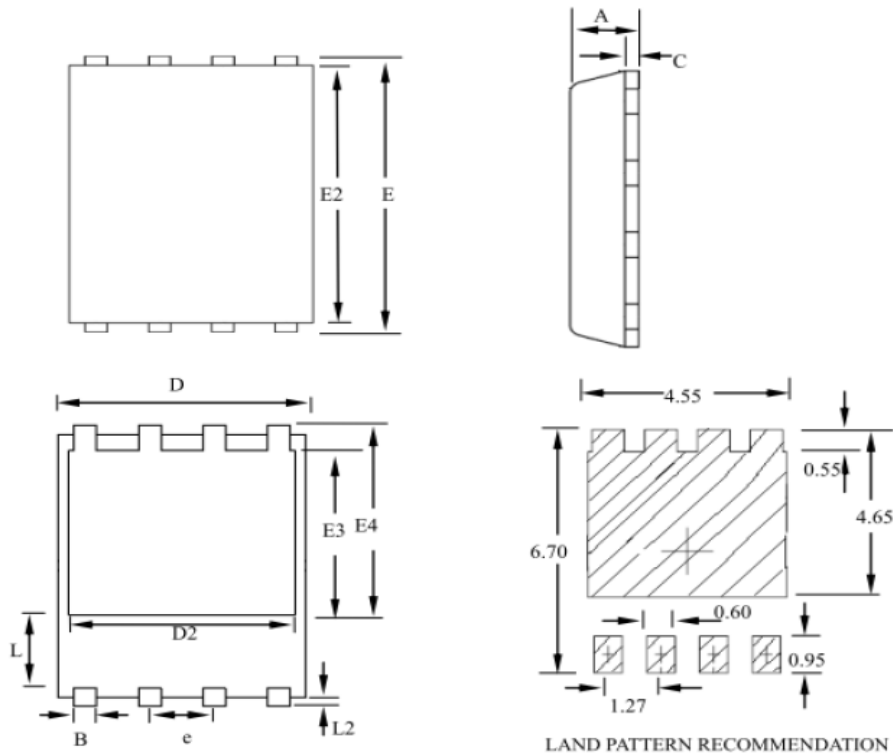


**Fig.11 Unclamped Inductive Switching**

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

## Ordering Information

Part Number	Package code	Packaging
HSBA6040	PRPAK5*6	3000/Tape&Reel



SYMBOLS	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	--	1.20	0.031	--	0.047
B	0.30	--	0.51	0.012	--	0.020
C	0.15	--	0.35	0.006	--	0.014
D	4.80	--	5.30	0.189	--	0.209
D2	3.61	--	4.35	0.142	--	0.171
E	5.90	--	6.35	0.232	--	0.250
E2	5.42	--	5.90	0.213	--	0.232
E3	3.23	--	3.90	0.127	--	0.154
E4	3.69	--	4.55	0.145	--	0.179
L	0.61	--	1.80	0.024	--	0.071
L2	0.05	--	0.36	0.002	--	0.014
e	--	1.27	--	--	0.050	--