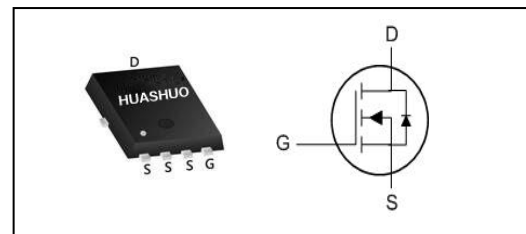


Description

- Advanced Trench Technology
 - Low Gate Charge
 - 100% UIS Tested
 - Low Gate Charge
-
- SMPS Synchronous Rectification
 - DC/DC Converters
 - Or-ing

Product Summary

V_{DS}	40	V
$R_{DS(ON),typ}$	3.9	m Ω
I_D	60	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
$I_D@T_C=25^\circ\text{C}$	Continuous Drain Current ¹	60	A
$I_D@T_C=100^\circ\text{C}$	Continuous Drain Current ¹	39	A
I_{DM}	Pulsed Drain Current ²	240	A
EAS	Single Pulse Avalanche Energy ³	78	mJ
I_{AS}	Avalanche Current	39	A
$P_D@T_C=25^\circ\text{C}$	Total Power Dissipation ⁴	30	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 (Steady State) ¹	---	60	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	---	3.3	$^\circ\text{C/W}$

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
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=10V, I_D=15A$	---	3.9	5	m Ω
		$V_{GS}=4.5V, I_D=15A$	---	5.7	7	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.2	1.8	2.2	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=32V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=32V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
R_g	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	1.9	---	Ω
Q_g	Total Gate Charge	$V_{DS}=20V, V_{GS}=4.5V, I_D=20A$	---	13	---	nC
Q_{gs}	Gate-Source Charge		---	4.1	---	
Q_{gd}	Gate-Drain Charge		---	5.2	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=20V, V_{GS}=10V, R_G=3.3\Omega, I_D=20A$	---	7	---	ns
T_r	Rise Time		---	36	---	
$T_{d(off)}$	Turn-Off Delay Time		---	21	---	
T_f	Fall Time		---	9	---	
C_{iss}	Input Capacitance	$V_{DS}=20V, V_{GS}=0V, f=1\text{MHz}$	---	1350	---	pF
C_{oss}	Output Capacitance		---	513	---	
C_{rss}	Reverse Transfer Capacitance		---	46	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,5}	$V_G=V_D=0V$, Force Current	---	---	70	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1.2	V
t_{rr}	Reverse Recovery Time	$I_F=20A, di/dt=100A/\mu s, T_J=25^\circ\text{C}$	---	36	---	nS
Q_{rr}	Reverse Recovery Charge		---	20	---	nC

Note :

- 1.The data tested by surface mounted on a 1 inch² 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 $V_{DD}=25V, V_{GS}=10V, L=0.1mH, I_{AS}=39A$
- 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

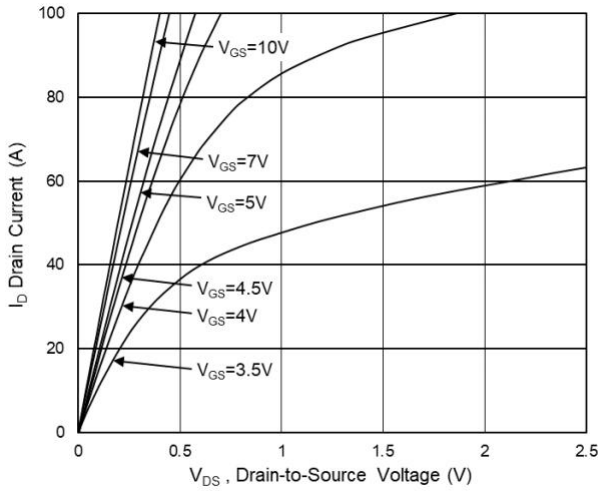


Fig.1 Typical Output Characteristics

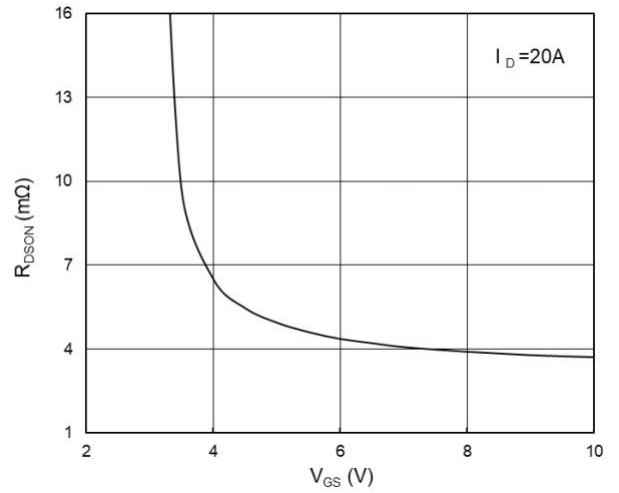


Fig.2 On-Resistance vs. G-S Voltage

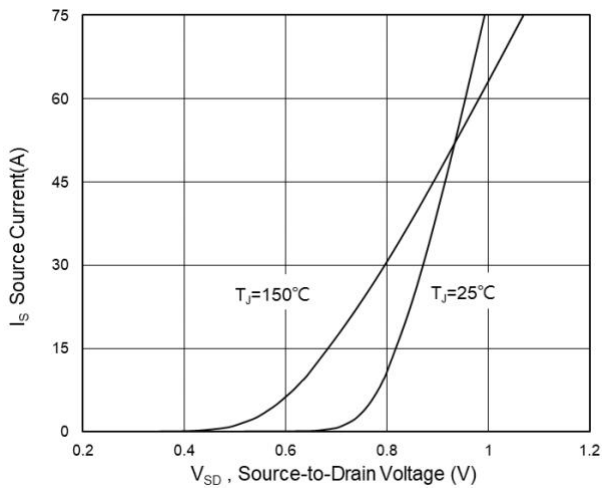


Fig.3 Source Drain Forward Characteristics

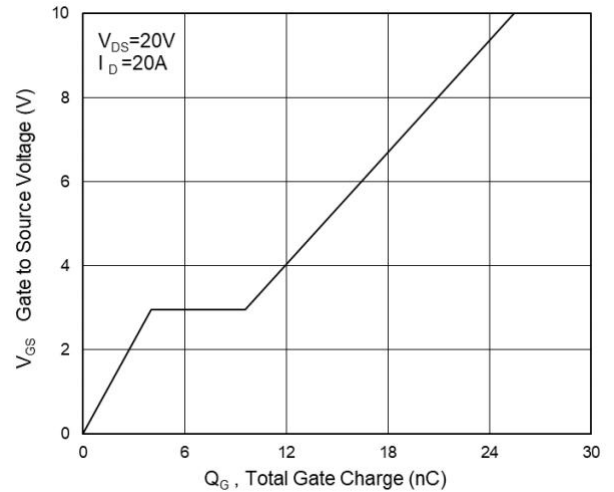


Fig.4 Gate-Charge Characteristics

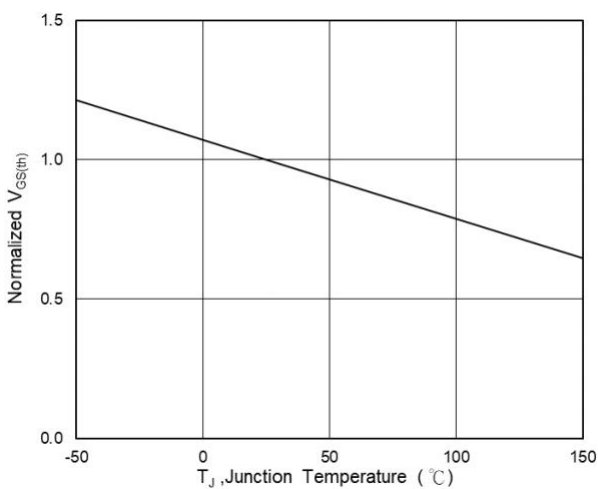


Fig.5 Normalized V_{GS(th)} vs. T_J

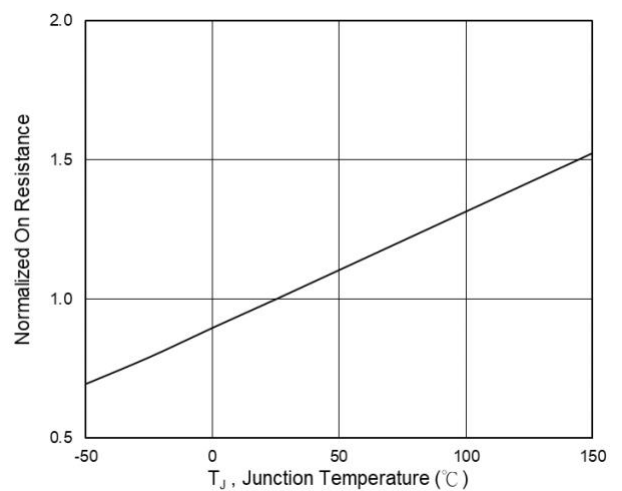


Fig.6 Normalized R_{DS(on)} vs. T_J



N-Ch 40V Fast Switching MOSFETs

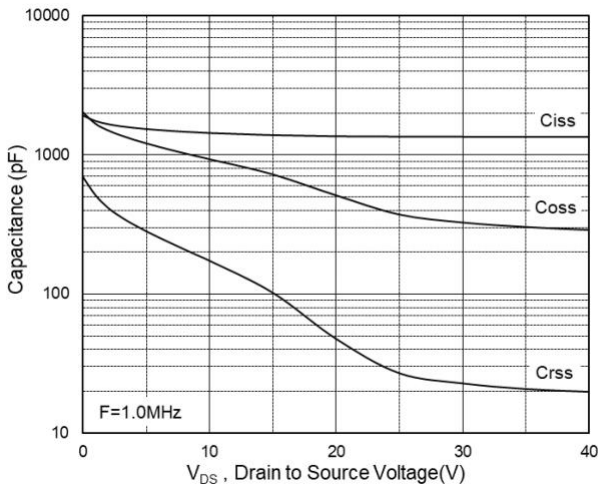


Fig.7 Capacitance

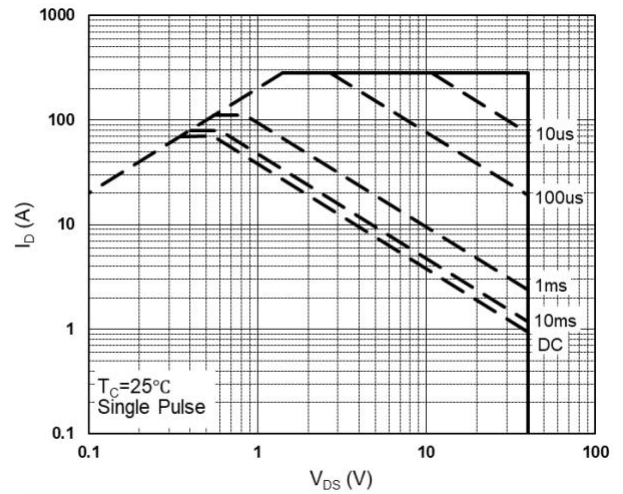


Fig.8 Safe Operating Area

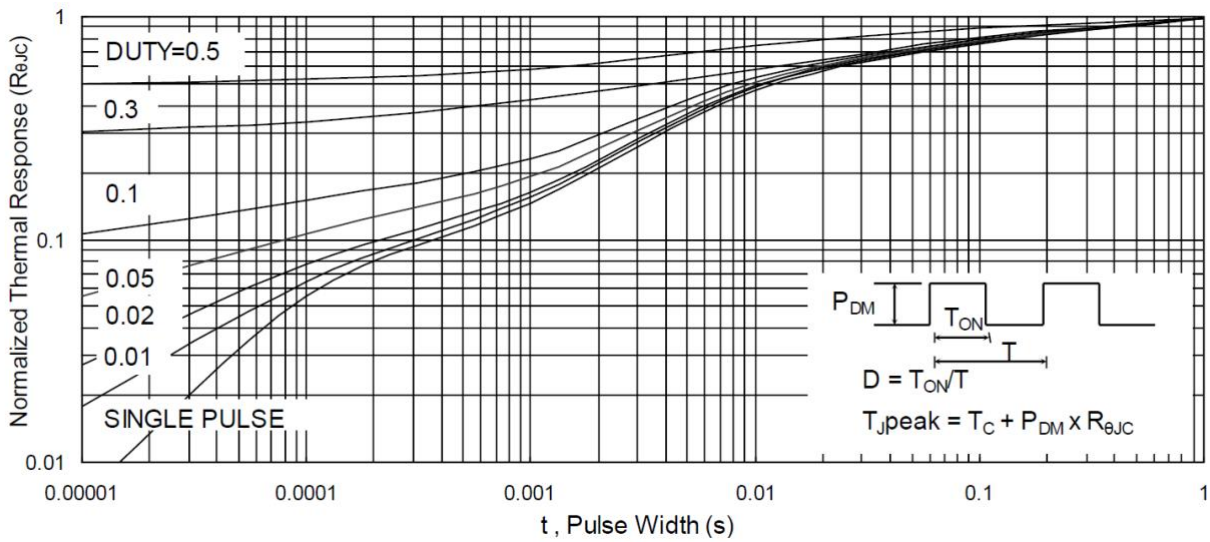


Fig.9 Normalized Maximum Transient Thermal Impedance

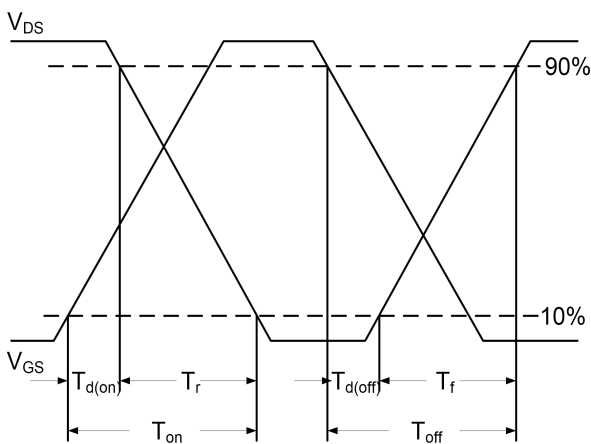


Fig.10 Switching Time Waveform

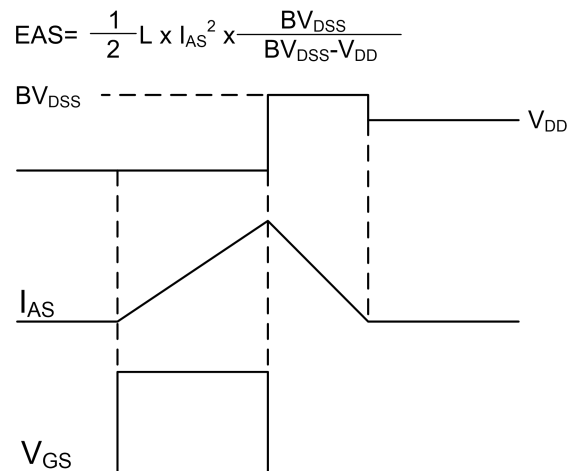
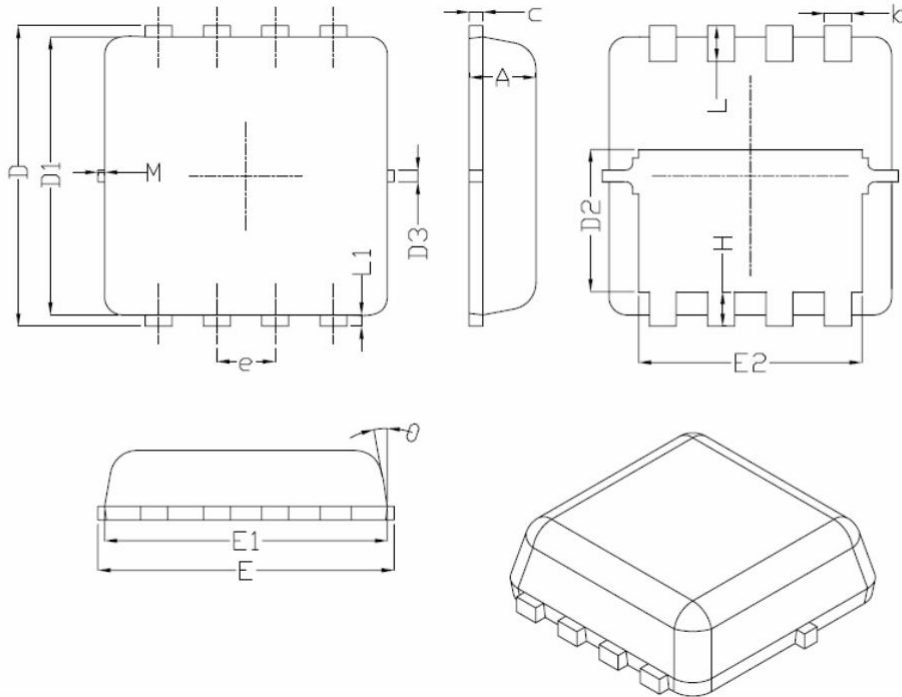


Fig.11 Unclamped Inductive Waveform



Ordering Information

Part Number	Package code	Packaging
HSBB4056	PRPAK3*3	3000/Tape&Reel



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	1.48	1.58	1.68
D3	-	0.13	-
E	3.15	3.30	3.45
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	-
M	*	*	0.15
θ		10°	12°