

6.0mΩ, 45V, N-Channel Power MOSFET
SRT045N060H
General Description

The Sanrise SRT045N060H is a low voltage power MOSFET, fabricated using advanced split gate trench technology. The resulting device has extremely low on resistance, low gate charge and fast switching time, making it especially suitable for applications which require superior power density and synchronous rectification.

The SRT045N060H break down voltage is 45V and it has a high rugged avalanche characteristics. The SRT045N060H is available in PDFN5*6 and PDFN3.3*3.3 packages.

Features

- Ultra Low
 $R_{DS(ON_TYP)} = 5.1m\Omega, PDFN5*6 @ V_{GS} = 10V$.
 $R_{DS(ON_TYP)} = 5.6m\Omega, PDFN3.3*3.3 @ V_{GS} = 10V$.
- Ultra Low Gate Charge, $Q_g = 13nC$ typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved
- Non-automotive Qualified

Application

- High Power Supply
- E-Tools
- Motor Driver
- BMS

Ordering Information

SRT045N060H□□-□		
Circuit Type		E: Lead Free
Package		G: Green
D56: PDFN5*6		Blank: Tube
D33: PDFN3.3*3.3		TR: Tape & Reel

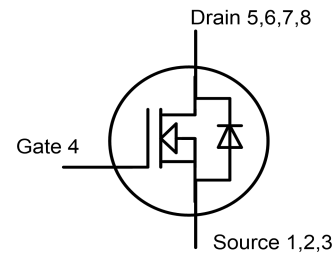
Symbol


Figure 1 Symbol of SRT045N060H

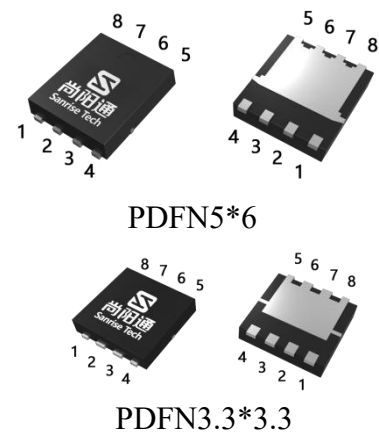
Package Type


Figure 2 Package Type of SRT045N060H

PDFN5*6	SRT045N060HD56TR-G	SRT045N060HD56G	Tape & Reel
PDFN3.3*3.3	SRT045N060HD33TR-G	045N060HD33G	Tape & Reel

Absolute Maximum Ratings

Parameter		Symbol	Rating		Unit
Drain-Source Voltage		V _{DSS}	45		V
Gate-Source Voltage		V _{GSS}	±20		V
Continuous Drain Current, Silicon	T _C =25°C	I _D	PDFN5*6	52	A
	T _C =125°C		PDFN3.3*3.3	48	
			PDFN5*6	23	
			PDFN3.3*3.3	21.5	
Pulsed Drain Current (Note 2)		I _{DM}	160		A
Power Dissipation (T _C = 25°C)		P _D	32.9		W
Avalanche Destructive Energy, Single Pulse (Note 4)		E _{AS_Limit}	56		mJ
Avalanche Energy, Single Pulse (Note 3)		E _{AS}	9		mJ
Avalanche Energy, Repetitive (Note 2)		E _{AR}	0.01		mJ
Avalanche Current, Repetitive (Note 2)		I _{AR}	6.0		A
Continuous Diode Forward Current		I _S	52		A
Diode Pulse Current		I _{S.PULSE}	160		A
Operating Junction Temperature		T _J	150		°C
Storage Temperature		T _{STG}	-55 to 150		°C
Lead Temperature (Soldering, 10 sec)		T _{LEAD}	260		°C

Note:

1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $I_{AS} = 6.0\text{A}$, $V_{DD} = 20\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
4. $I_{AS_Limit} = 15\text{A}$, $V_{DD} = 20\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

Thermal Resistance

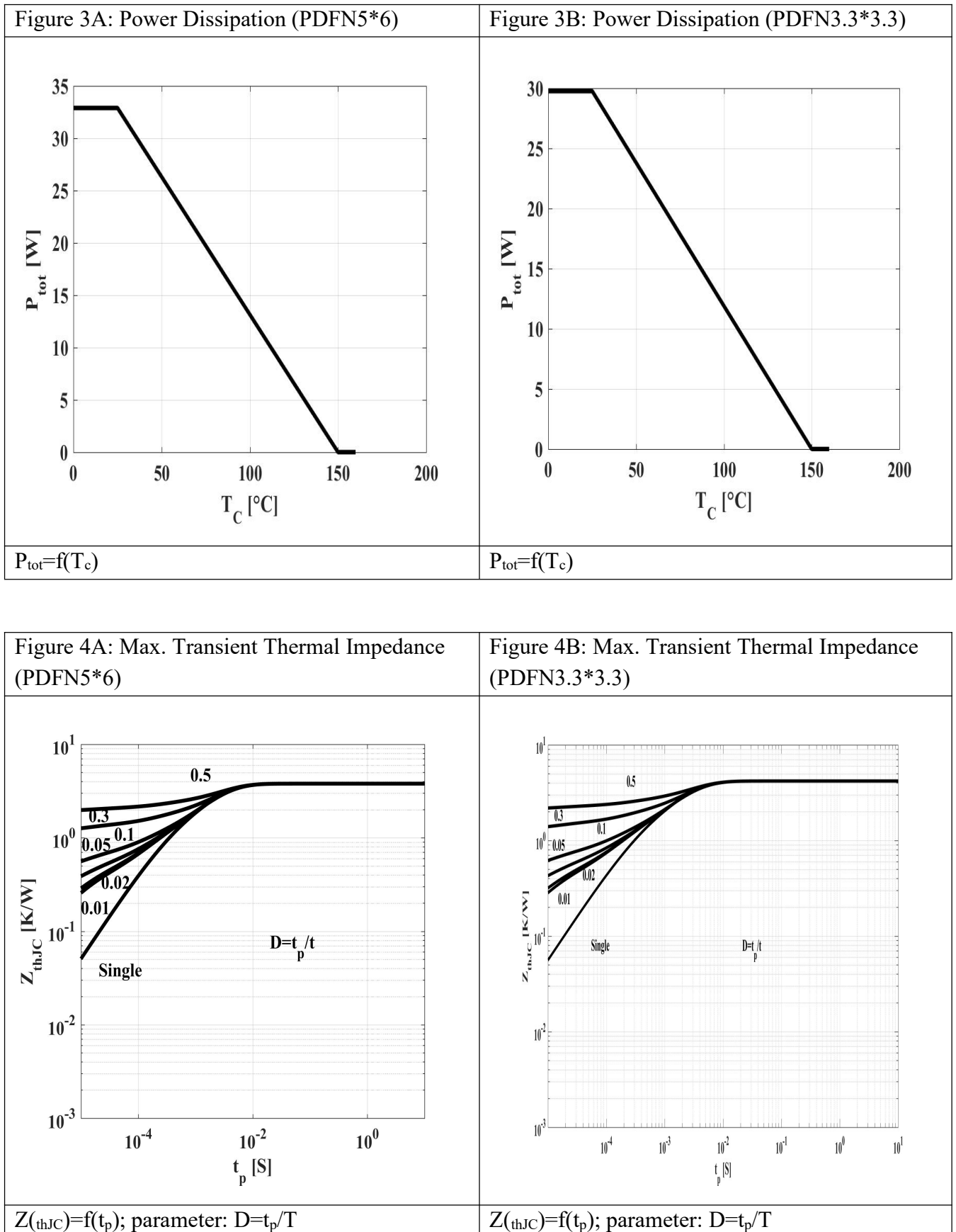
Parameter		Symbol	Min	Typ	Max	Unit
Thermal Resistance, Junction-to-Case	PDFN5*6	R_{thJC}			3.8	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient		R_{thJA}			50	
Thermal Resistance, Junction-to-Case	PDFN3.3*3.3	R_{thJC}			4.2	
Thermal Resistance, Junction-to-Ambient		R_{thJA}			56	

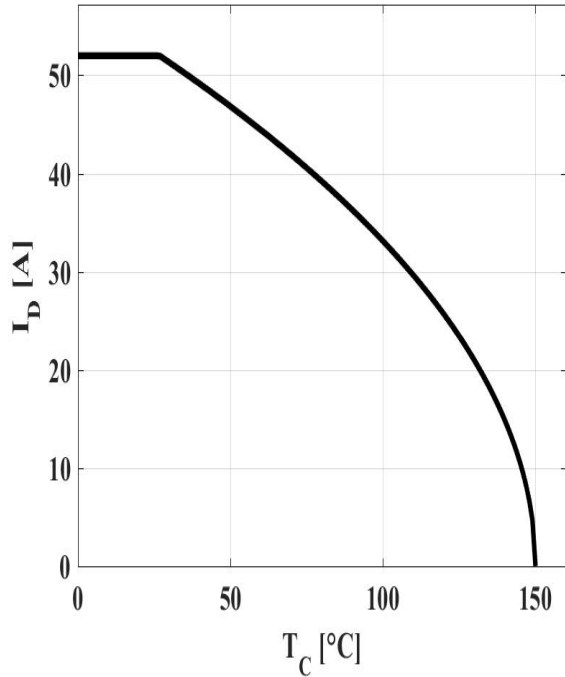
6.0mΩ, 45V, N-Channel Power MOSFET
SRT045N060H
Electrical Characteristics
 $T_J = 25^\circ\text{C}$, unless otherwise specified.

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250uA	45			V
Zero Gate Voltage Drain Current		I _{DSS}	V _{DS} =45V, V _{GS} =0V			1	uA
Gate-Body Leakage Current	Forward	I _{GSSF}	V _{GS} =20V, V _{DS} =0V			200	nA
	Reverse	I _{GSSR}	V _{GS} =-20V, V _{DS} =0V			-200	
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} , I _D =0.25mA	2.0	3.0	4.0	V
Static Drain-Source On-Resistance	PDFN5*6	R _{DS(ON)}	V _{GS} =10V, I _D =20A		5.1	6.0	mΩ
	PDFN3.3*3.3	R _{DS(ON)}	V _{GS} =10V, I _D =20A		5.6	6.5	mΩ
Gate Resistance		R _G	f=1MHz, Open Drain		2.3		Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =20V, V _{GS} =0V, f=1MHz		870		pF
Output Capacitance		C _{OSS}			290		pF
Reverse Transfer Capacitance		C _{RSS}			18		pF
Effective output capacitance, energy related ^{NOTE5}		C _{O(er)}	V _{GS} =0V, V _{DS} =0...20V		310		pF
Effective output capacitance, time related ^{NOTE6}		C _{O(tr)}			430		
Turn-on Delay Time		t _{d(on)}	V _{DD} =20V, I _D =10A R _G =1.6Ω, V _{GS} =10V		6		ns
Rise Time		t _r			3		
Turn-off Delay Time		t _{d(off)}			25		
Fall Time		t _f			4		
Gate Charge Characteristics							
Gate to Source Charge		Q _{gs}	V _{DD} =20V, I _D =10A V _{GS} =0 to 10V		4.2		nC
Gate to Drain Charge		Q _{gd}			2.1		
Gate Charge Total		Q _g			13		
Gate Plateau Voltage		V _{plateau}			5.0		V
Gate Charge Total, sync FET		Q _g	V _{DD} =0.1V, V _{GS} =0 to 10V		11.9		nC
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _{SD} =10A		0.82	1.0	V
Reverse Recovery Time		t _{rr}	V _R =20V, I _F =10A dI _F /dt=100A/us		18		ns
Reverse Recovery Charge		Q _{rr}			12		nC
Peak Reverse Recovery Current		I _{rrm}			1.3		A

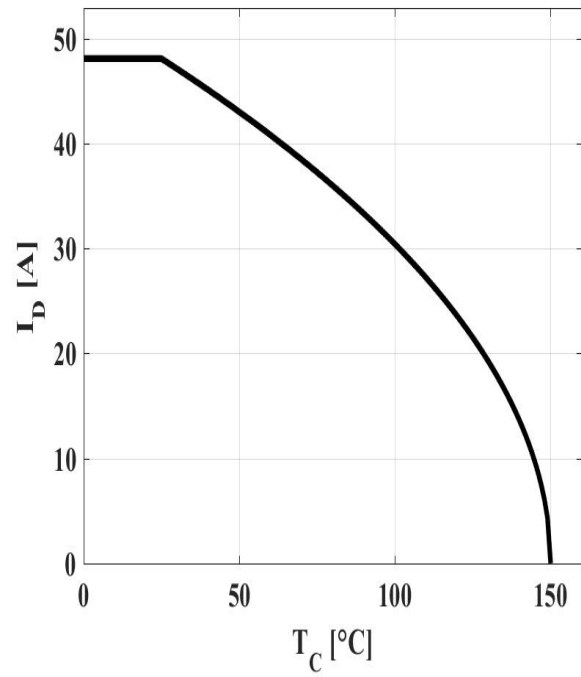
Note:

- $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 32V
- $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 32 V

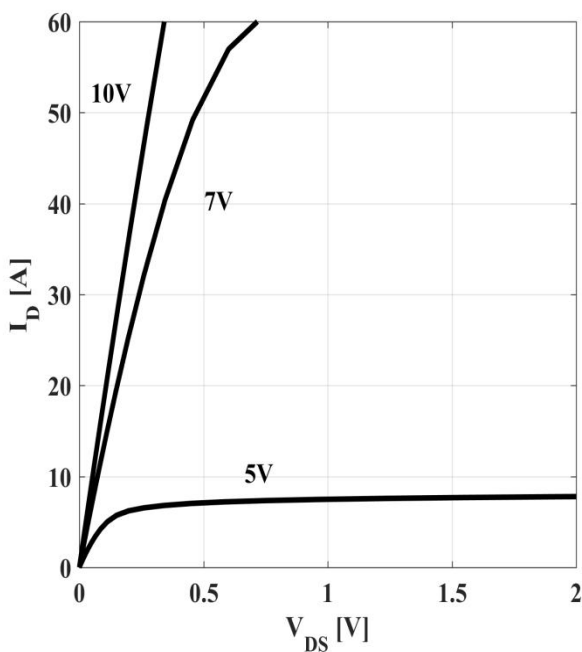
Typical Performance Characteristics


6.0mΩ, 45V, N-Channel Power MOSFET
SRT045N060H
Figure5A: Drain Current(PDFN5*6)


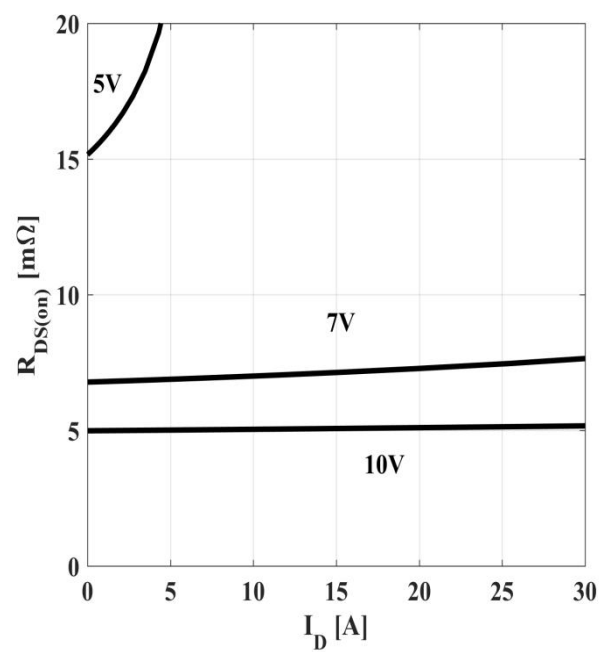
$$I_D = f(T_C); V_{GS} \geq 10V$$

Figure5B: Drain Current(PDFN3.3*3.3)


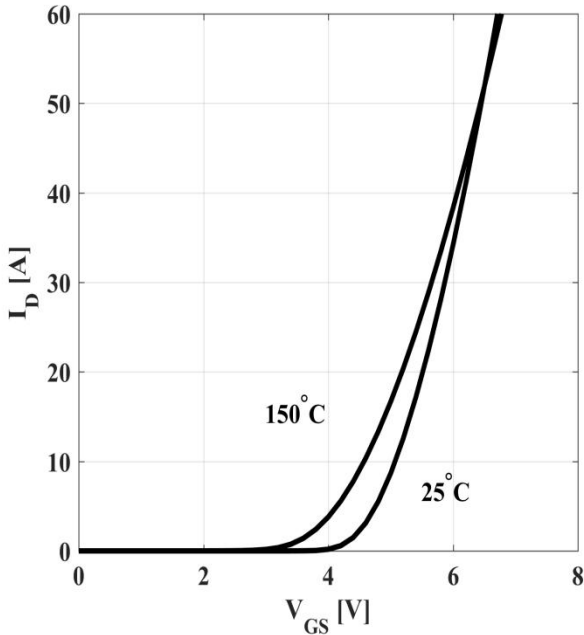
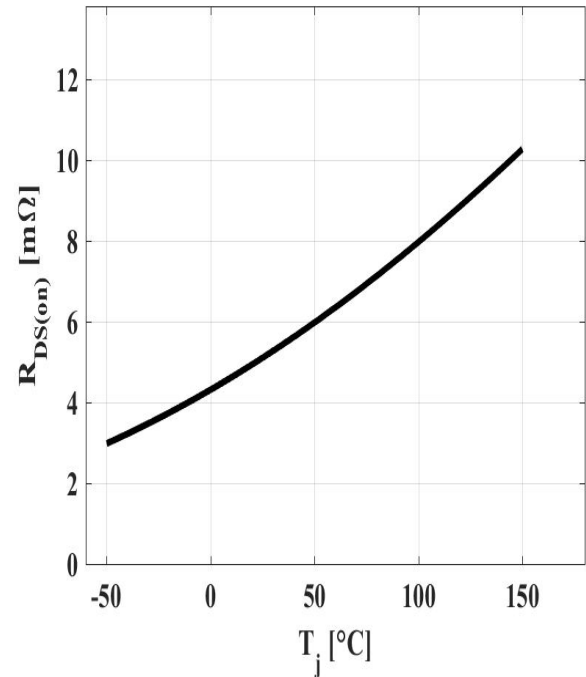
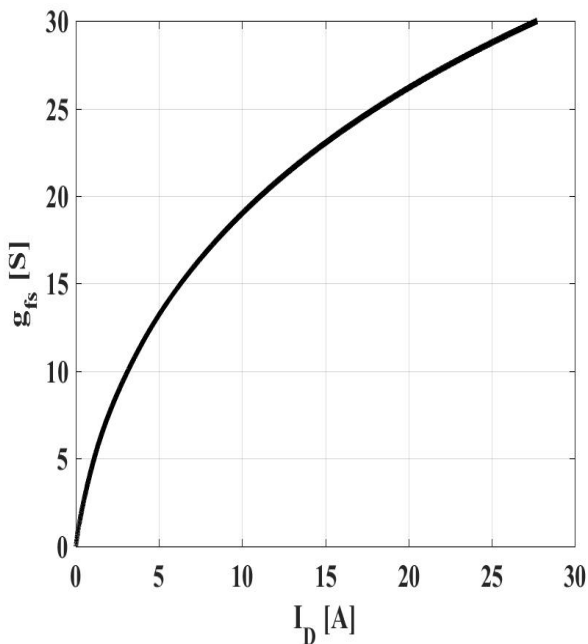
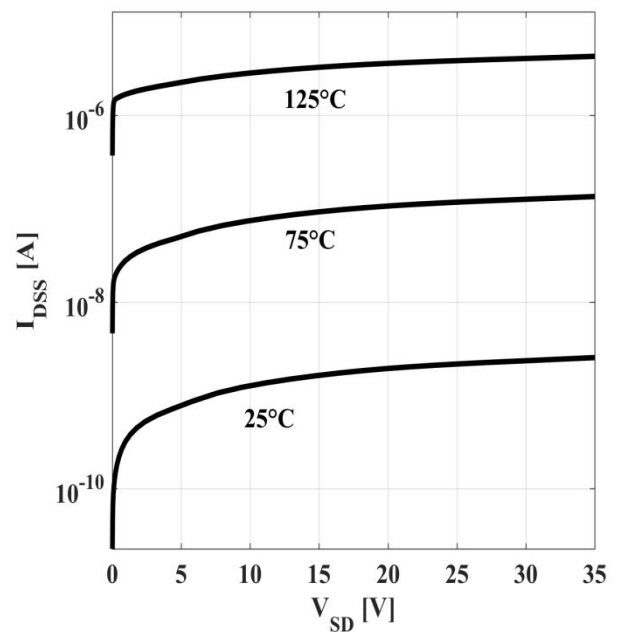
$$I_D = f(T_C); V_{GS} \geq 10V$$

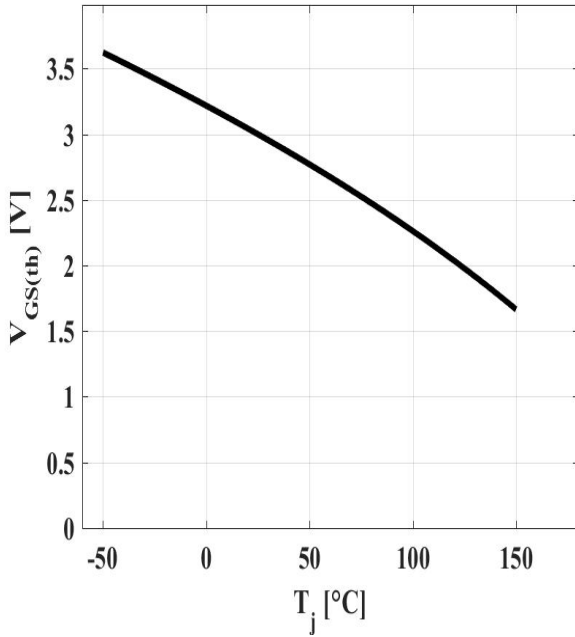
Figure6: Typ. Output Characteristics (PDFN5*6)


$$I_D = f(V_{DS}); T_J = 25^\circ C; \text{parameter: } V_{GS}$$

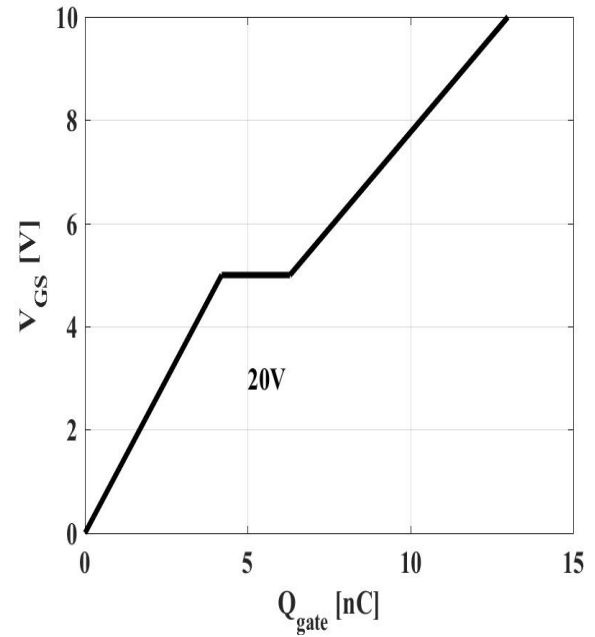
Figure7: Typ. Drain-Source On-State Resistance (PDFN5*6)


$$R_{DS(ON)} = f(I_D); T_J = 25^\circ C; \text{parameter: } V_{GS}$$

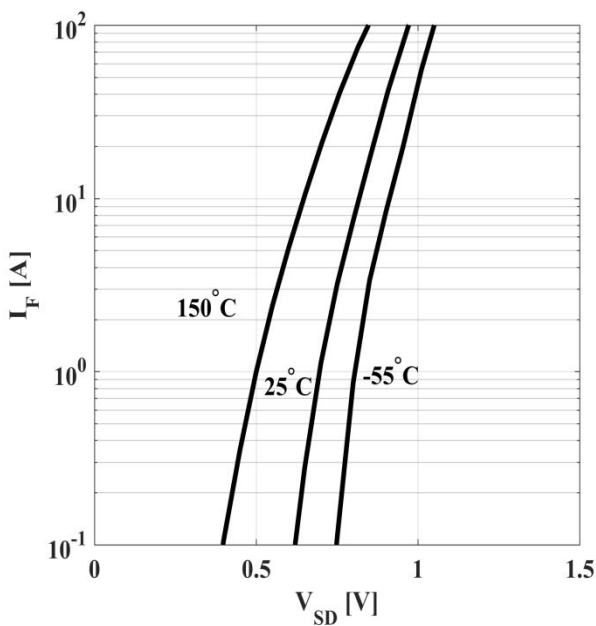
Figure8: Typ. Transfer Characteristics
 (PDFN5*6)

 $I_D = f(V_{GS}); |V_{DS}| > 2|I_D|R_{DS(on)max}; \text{parameter: } T_j$
Figure9: Typ. Drain-Source On-State Resistance
 (PDFN5*6)

 $R_{DS(ON)} = f(T_j); I_D = 20A; V_{GS} = 10V$
Figure10: Typ. Forward Transconductance

 $g_{fs} = f(I_D); T_j = 25^\circ C$
Figure 11: Drain-Source Leakage Current

 $I_{DSS} = f(V_{DS}); V_{GS} = 0V; \text{parameter: } T_j$

6.0mΩ, 45V, N-Channel Power MOSFET
SRT045N060H
Figure12: Typ. Gate Threshold Voltage
 (PDFN5*6)


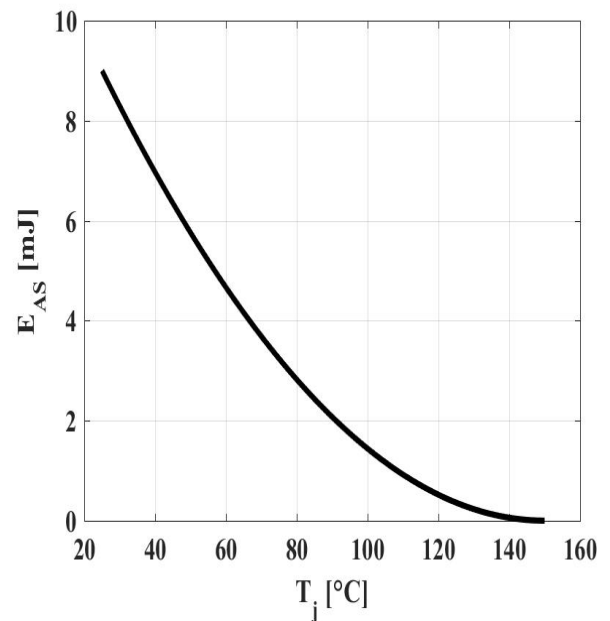
$$V_{GS(th)}=f(T_j); V_{GS}=V_{DS}; I_{DS}=250\mu A$$

Figure 13: Typ. Gate Charge
 (PDFN5*6)


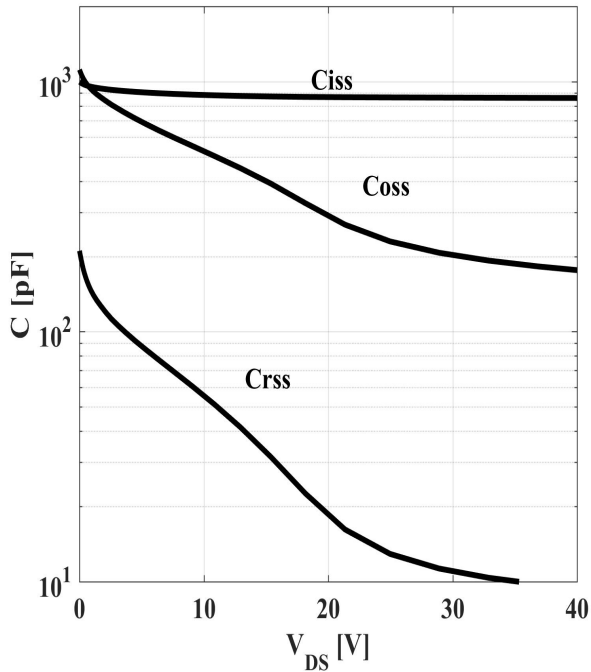
$$V_{GS}=f(Q_{gate}), I_D=10A \text{ pulsed}$$

Figure 14: Forward Characteristics of Reverse Diode
 (PDFN5*6)


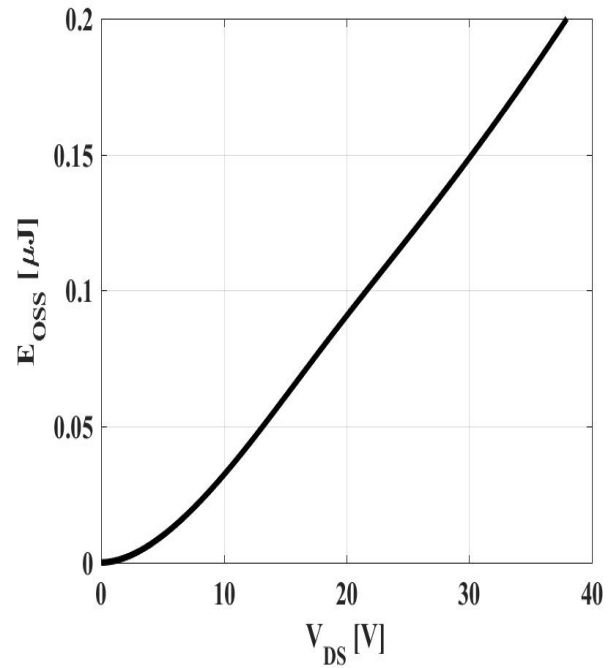
$$I_F=f(V_{SD}); \text{parameter: } T_j$$

Figure 15: Avalanche Energy
 (PDFN5*6)


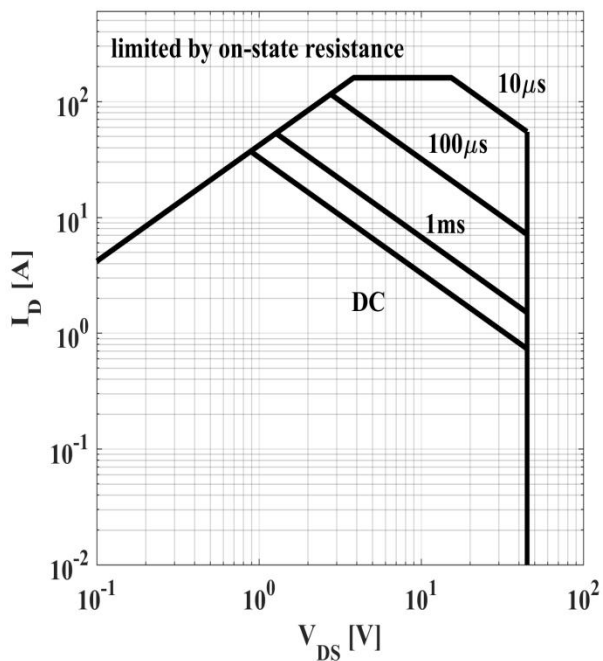
$$E_{AS}=f(T_j); I_D=6.0A; V_{DD}=20V$$

Figure 16: Typ. Capacitances (PDFN5*6)


$$C=f(V_{DS}); V_{GS}=0; f=1\text{MHz}$$

Figure 17: Coss Stored Energy(PDFN5*6)


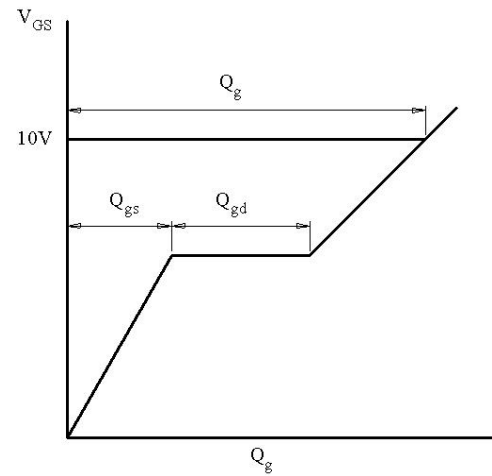
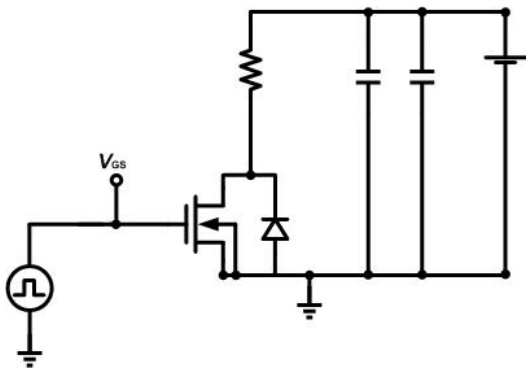
$$E_{OSS}=f(V_{DS})$$

Figure 18: Safe Operating Area (PDFN5*6)


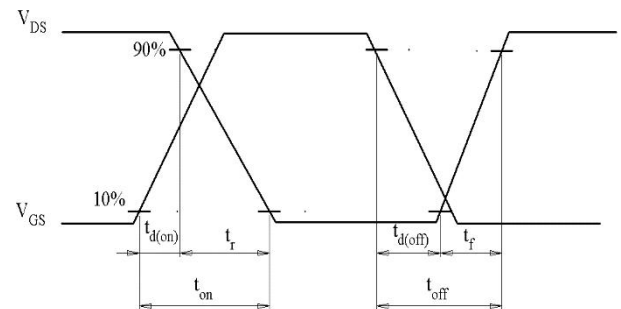
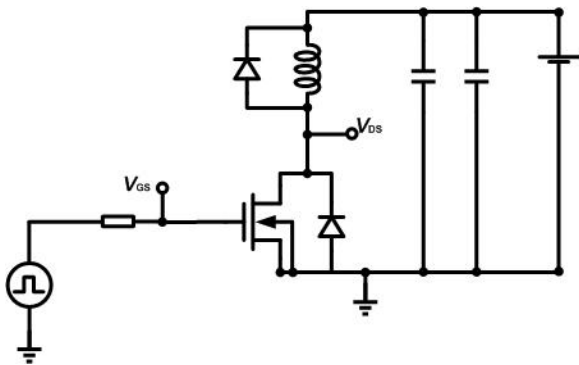
$$I_D = f(V_{DS}); T_c = 25^\circ\text{C}; V_{GS} > 7\text{V}; \text{parameter } t_p$$

Test Circuits

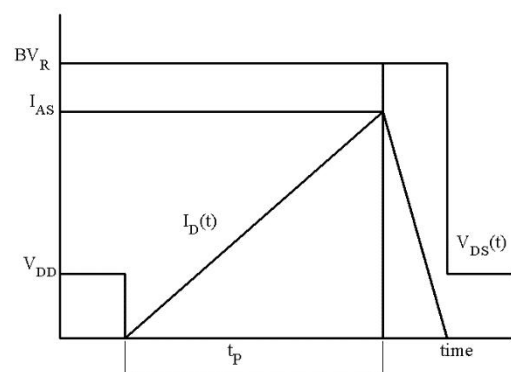
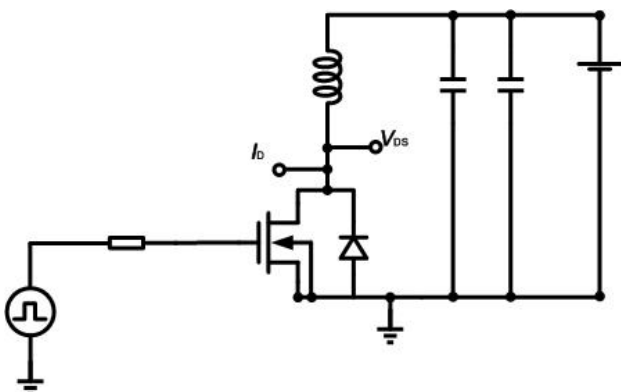
1. Gate Charge Test Circuit & Waveform



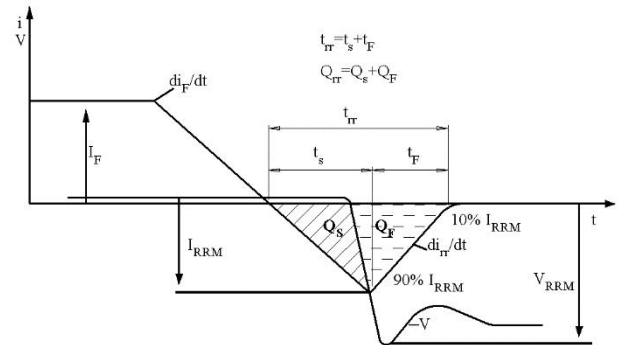
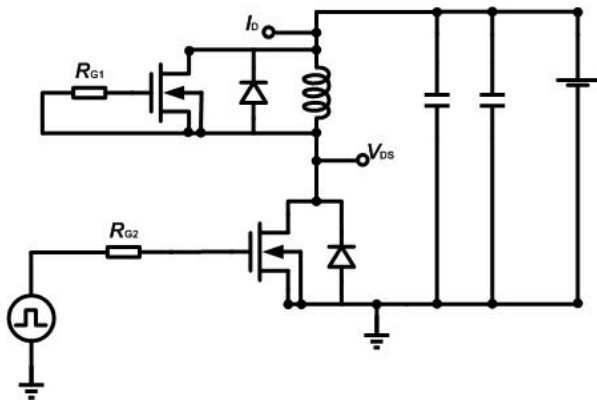
2. Switch Time Test Circuit

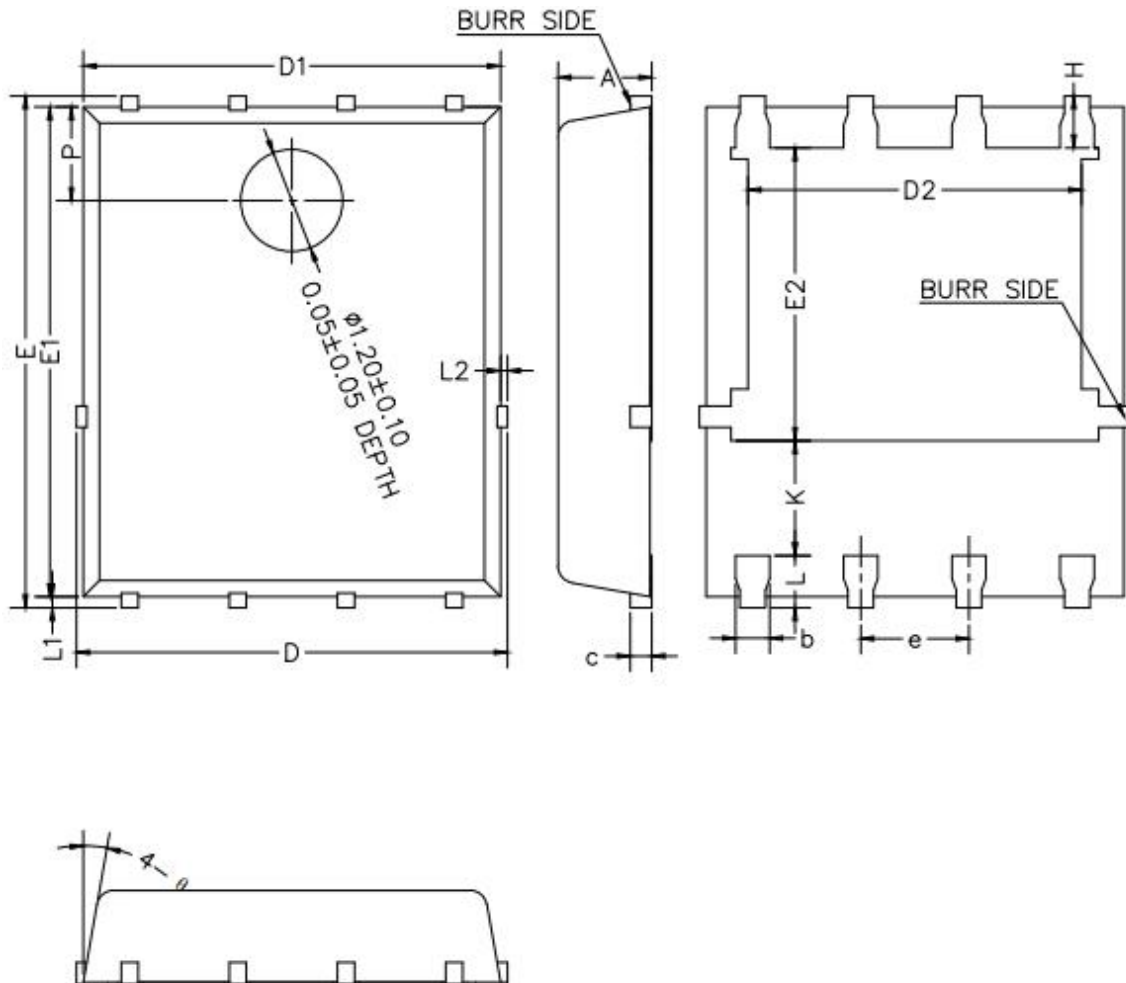


3. Unclamped Inductive Switching Test Circuit & Waveforms



4. Test Circuit and Waveform for Diode Characteristics



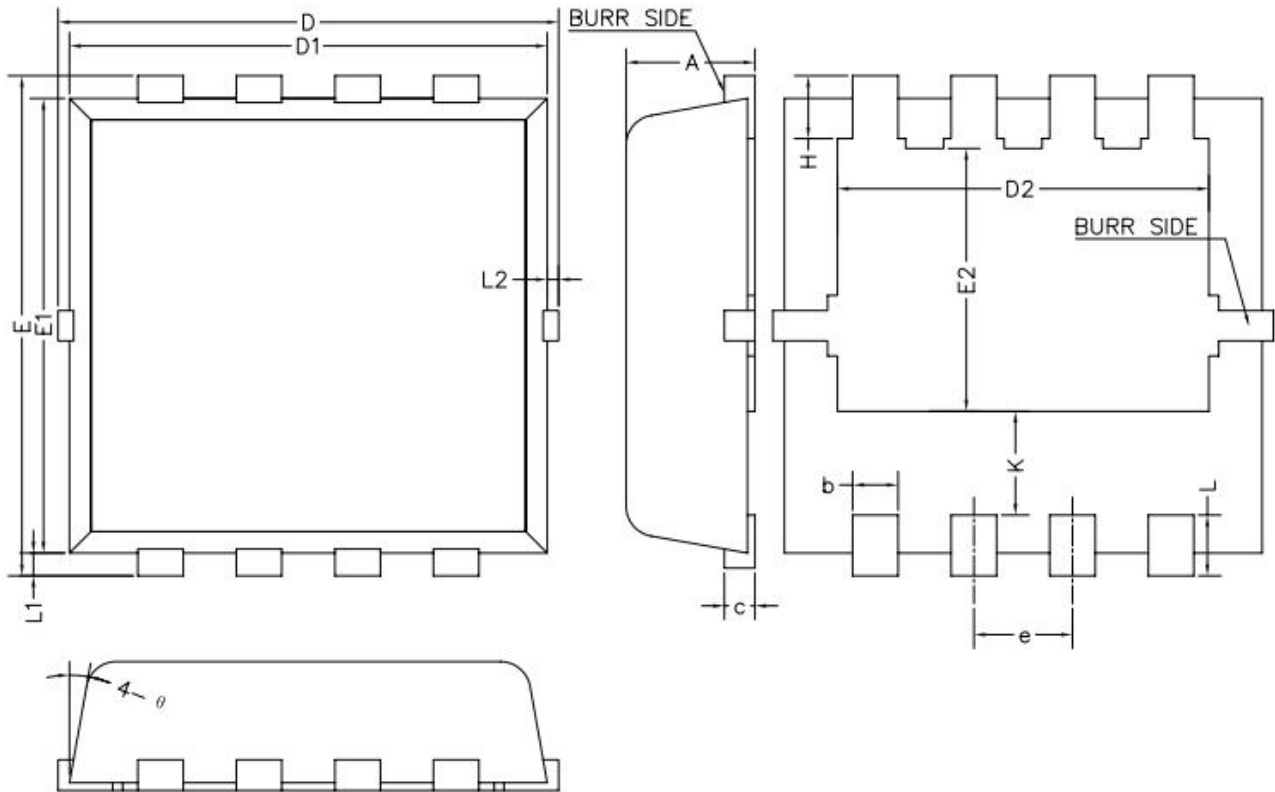
Mechanical Dimensions
DFN5*6-8 Unit: mm


Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	0.90	1.10	1.20	E2	3.18	—	3.54
b	0.35	0.40	0.45	H	0.51	0.61	0.71
c	0.21	0.25	0.34	K	1.10	—	—
D	—	—	5.10	L	0.51	0.61	0.71
D1	4.80	4.90	5.00	L1	0.06	0.13	0.20
D2	3.82	—	4.11	L2	—	—	0.10
e	1.17	1.27	1.37	P	1.00	1.10	1.20
E	5.90	6.00	6.10	θ	8°	10°	12°
E1	5.70	5.75	5.80				

Mechanical Dimensions (Continued)

PDFN3.3*3.3-8

Unit: mm



Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	0.70	0.80	0.90	E1	2.90	3.00	3.10
b	0.25	0.30	0.35	E2	1.64	1.74	1.84
c	0.14	0.15	0.20	H	0.32	0.42	0.52
D	3.10	3.30	3.50	K	0.59	0.69	0.79
D1	3.05	3.15	3.25	L	0.25	0.40	0.55
D2	2.35	2.45	2.55	L1	0.10	0.15	0.20
e	0.55	0.65	0.75	L2	—	—	0.15
E	3.10	3.30	3.50	θ	8°	10°	12°



Sanrise Technology Limited Company

<http://www.sanrise-tech.com>

IMPORTANT NOTICE

Shenzhen Sanrise Technology Co., LTD. reserves the right to make changes without further notice to any products or specifications herein. Shenzhen Sanrise Technology Co., LTD. does not assume any responsibility for use of any its products for any particular purpose, nor does Shenzhen Sanrise Technology Co., LTD. assume any liability arising out of the application or use of any its products or circuits. Shenzhen Sanrise Technology Co., LTD. does not convey any license under its patent rights or other rights nor the rights of others.

Main Site:

- Headquarter

Shenzhen Sanrise Technology Co., LTD.

A1206, Skyworth building, No. 008, gaoxinnan 1st Road,
Gaoxin District, Yuehai street,, Nanshan District, ShenZhen,
P.R.China

Tel: +86-755-22953335

Fax: +86-755-22916878

- Shanghai Office

Sanrise Technology Limited Company

Rm.401, Building B, No. 666, Zhangheng Road,
Zhangjiang Hi-Tech Park, Shanghai, P.R.China

Tel: +86-21-68825918