

1.2mΩ, 45V, N-Channel Power MOSFET
SRT045N012H
General Description

The Sanrise SRT045N012H 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 SRT045N012H break down voltage is 45V and it has a high rugged avalanche characteristics. The SRT045N012H is available in PDFN5*6 package.

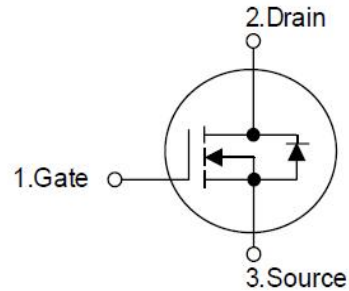
Symbol


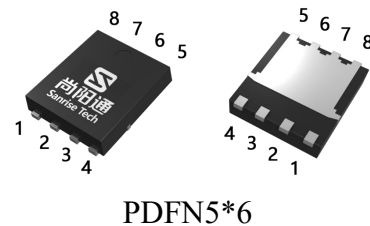
Figure 1 Symbol of SRT045N012H

Features

- Ultra Low $R_{DS(ON)}$ _TYP = 1.07mΩ @V_{GS} = 10V.
- Ultra Low Gate Charge, Q_g=73nC typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved
- Non-automotive Qualified

Application

- Server/Telecom
- DC/DC Converter
- High Power Supply
- E-Tools
- BMS

Package Type


PDFN5*6

Figure 2 Package Type of SRT045N012H

Ordering Information

SRT045N012H□□-□	
Circuit Type	E: Lead Free
Package	G: Green
D56: PDFN5*6	Blank: Tube
	TR: Tape & Reel

Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
PDFN5*6	SRT045N012HD56TR-E	SRT045N012HD56TR-G	SRT045N012HD56E	SRT045N012HD56G	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	$T_C=25^{\circ}\text{C}$	I_D	228	A
	$T_C=100^{\circ}\text{C}$		144	
Pulsed Drain Current (Note 3)		I_{DM}	912	A
Power Dissipation ($T_C = 25^{\circ}\text{C}$)		P_D	131	W
Avalanche Destructive Energy, Single Pulse (Note 5)		E_{AS_Limit}	625	mJ
Avalanche Energy, Single Pulse (Note 4)		E_{AS}	121	mJ
Avalanche Energy, Repetitive (Note 3)		E_{AR}	0.3	mJ
Avalanche Current, Repetitive (Note 3)		I_{AR}	50.0	A
Continuous Diode Forward Current		I_S	228	A
Diode Pulse Current		$I_{S,PULSE}$	912	A
Operating Junction Temperature		T_J	150	$^{\circ}\text{C}$
Storage Temperature		T_{STG}	-55 to 150	$^{\circ}\text{C}$
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	$^{\circ}\text{C}$

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. Current Limited by Package.
3. Repetitive Rating: Pulse width limited by maximum junction temperature
4. $I_{AS}=22\text{A}$, $V_{DD}=20\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$
5. $I_{AS_Limit}=50.0\text{A}$, $V_{DD}=20\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$

Thermal Resistance

Parameter		Symbol	Min	Typ	Max	Unit
Thermal Resistance, Junction-to-Case	PDFN5*6	R_{thJC}			0.95	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	PDFN5*6	R_{thJA}			50	

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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		R _{DS(ON)}	V _{GS} =10V, I _D =60A		1.07	1.2	mΩ
Gate Resistance		R _G	f=1MHz, Open Drain		1.1		Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =20V, V _{GS} =0V, f=1MHz		5.2		nF
Output Capacitance		C _{OSS}			2.0		nF
Reverse Transfer Capacitance		C _{RSS}			125		pF
Effective output capacitance, energy related ^{NOTE5}		C _{O(er)}	V _{GS} =0V, V _{DS} =0...20V		3.1		nF
Effective output capacitance, time related ^{NOTE6}		C _{O(tr)}			3.8		
Turn-on Delay Time		t _{d(on)}	V _{DD} =20V, I _D =50A R _G =1.6Ω, V _{GS} =10V		18		ns
Rise Time		t _r			50		
Turn-off Delay Time		t _{d(off)}			54		
Fall Time		t _f			12		
Gate Charge Characteristics							
Gate to Source Charge		Q _{gs}	V _{DD} =20V, I _D =50A V _{GS} =0 to 10V		24		nC
Gate to Drain Charge		Q _{gd}			13		
Gate Charge Total		Q _g			73		
Gate Plateau Voltage		V _{plateau}			4.9		V
Gate Charge Total, sync FET		Q _g	V _{DD} =0.1V, V _{GS} =0 to 10V		69		nC
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _{SD} =50A		0.84	1.0	V
Reverse Recovery Time		t _{rr}	V _R =20V, I _F =50A dI _F /dt=100A/us		62		ns
Reverse Recovery Charge		Q _{rr}			130		nC
Peak Reverse Recovery Current		I _{rrm}			4.3		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 20V
- $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 20V

Typical Performance Characteristics

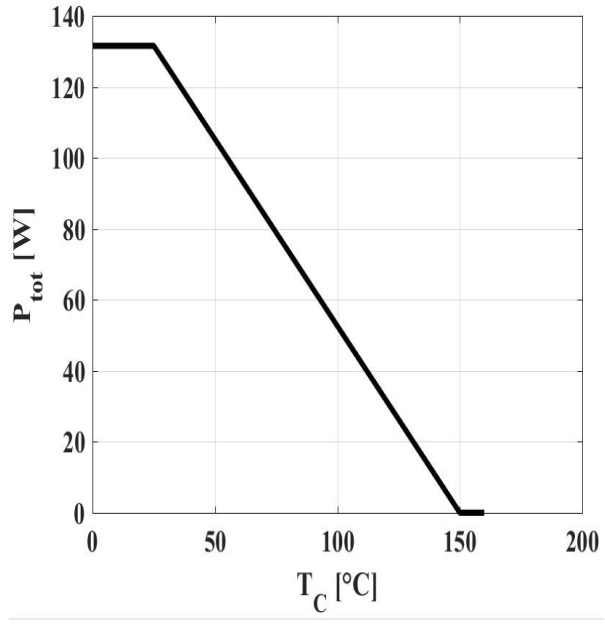
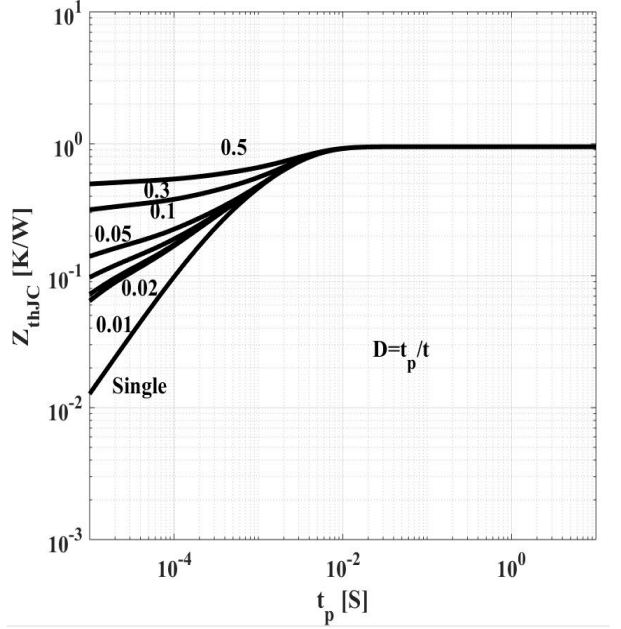
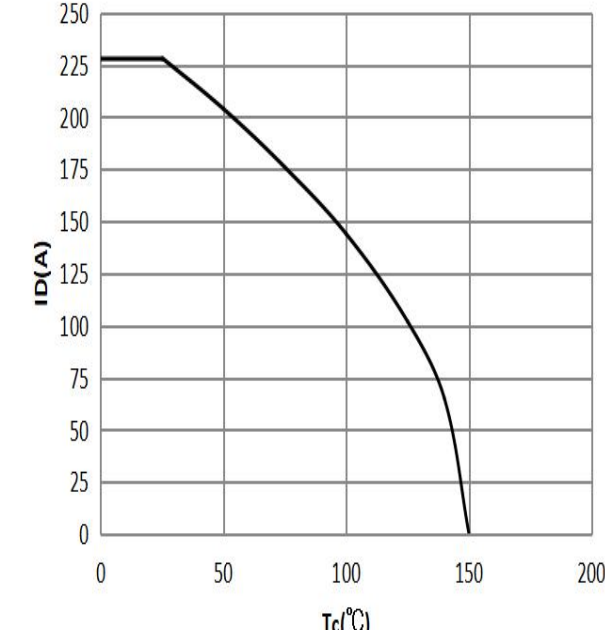
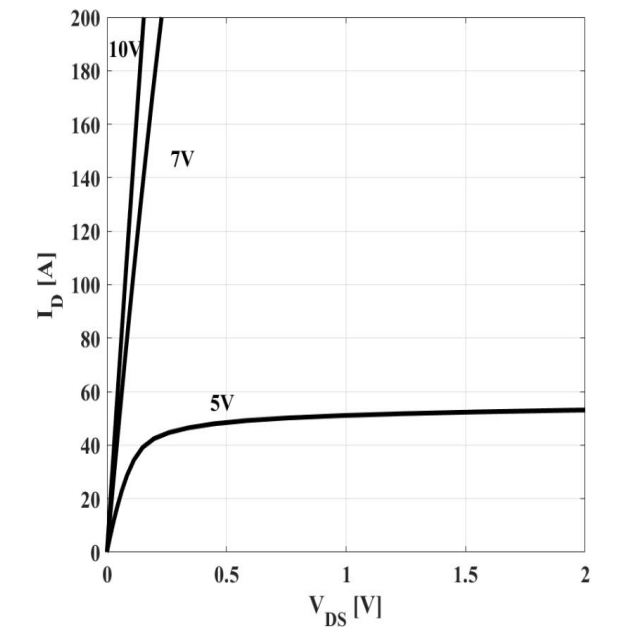
Figure 3: Power Dissipation  $P_{tot}=f(T_c)$	Figure 4: Max. Transient Thermal Impedance  $Z_{(th)JC}=f(t_p)$; parameter: $D=t_p/T$
Figure5: Drain Current  $I_D=f(T_c); V_{GS} \geq 10V$	Figure6: Typ. Output Characteristics  $I_D=f(V_{DS}); T_j=25^{\circ}C$; parameter: V_{GS}

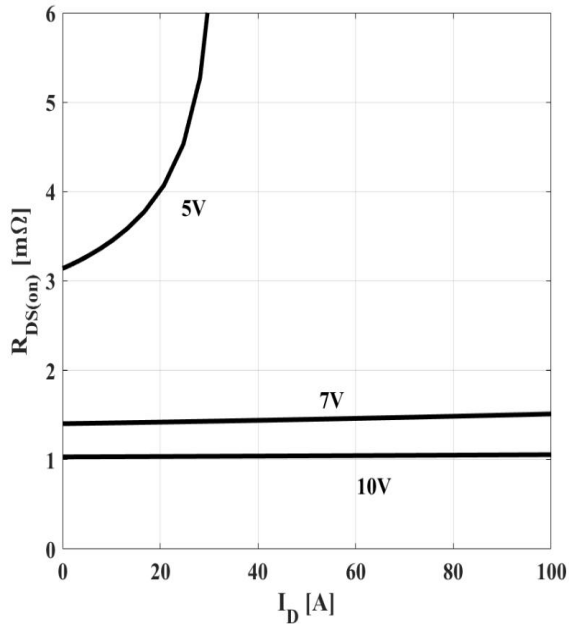
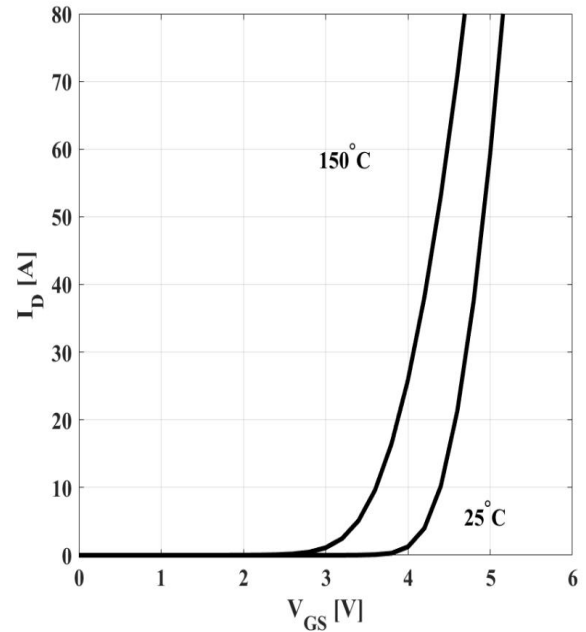
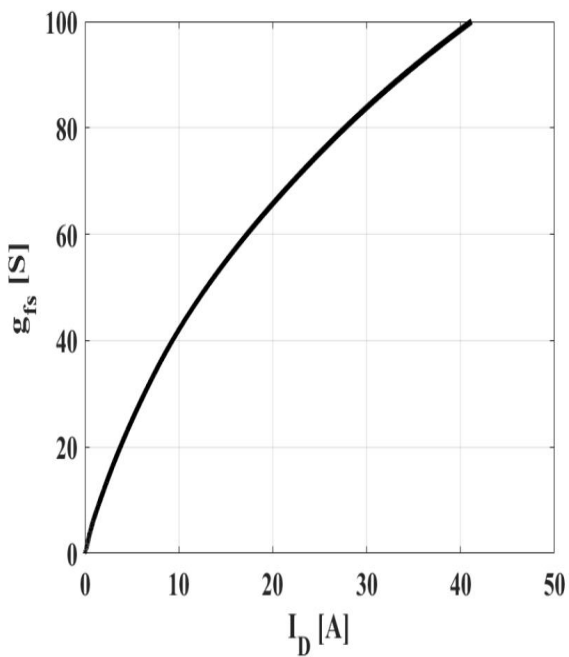
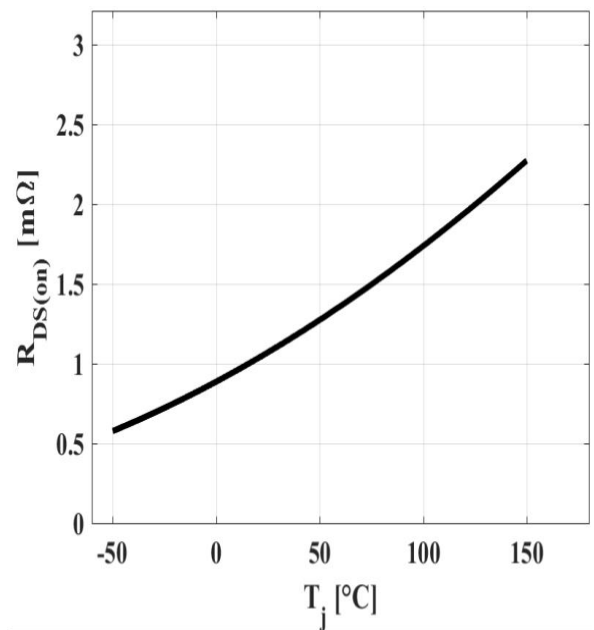
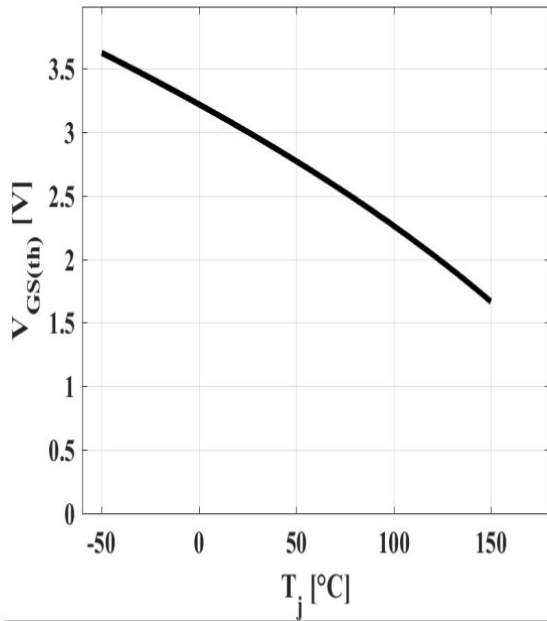
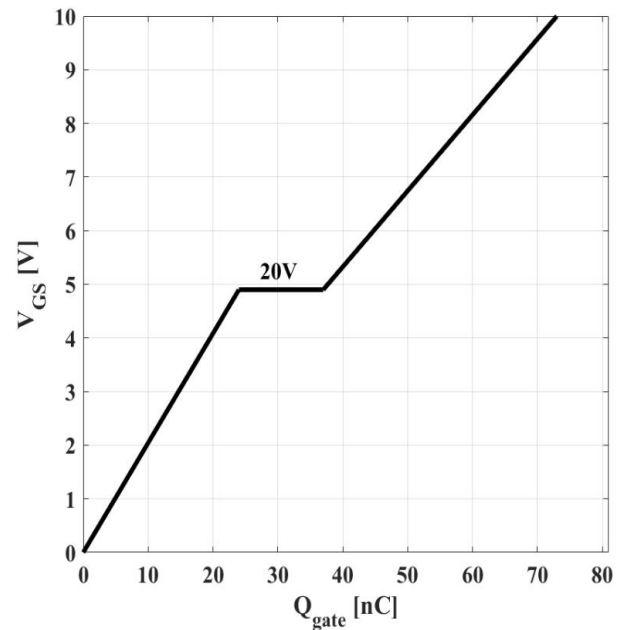
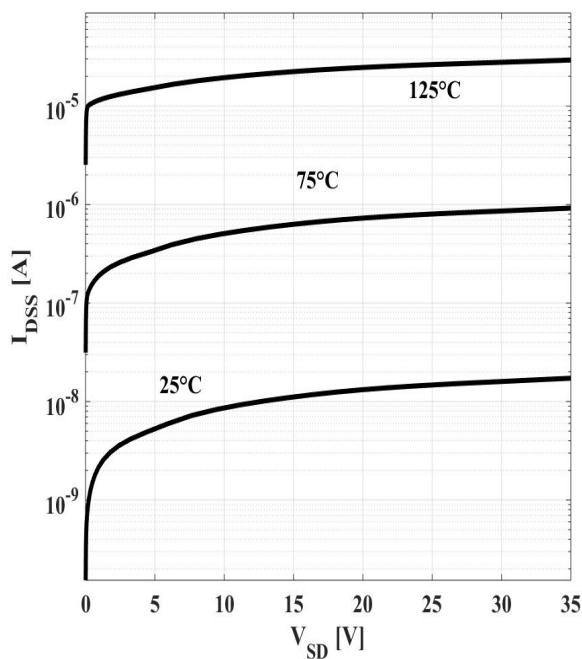
Figure7: Typ. Drain-Source On-State Resistance

 $R_{DS(ON)}=f(I_D); T_j=25^{\circ}C$; parameter: V_{GS}
Figure8: Typ. Transfer Characteristics

 $I_D=f(V_{GS}); |V_{DS}|>2I_D R_{DS(on)max}$; parameter: T_j
Figure9: Typ. Forward Transconductance

 $g_{fs}=f(I_D); T_j=25^{\circ}C$
Figure10: Typ. Drain-Source On-State Resistance

 $R_{DS(ON)}=f(T_j); I_D=50A; V_{GS}=10V$

Figure 11: Typ. Gate Threshold Voltage


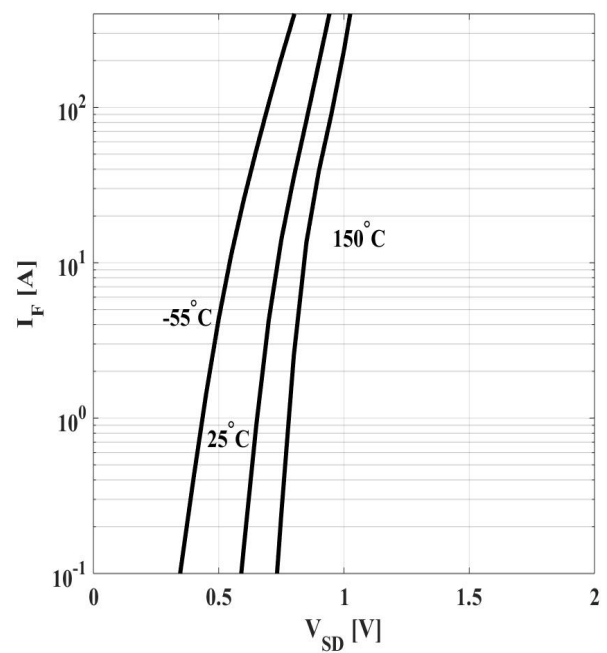
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_{DS} = 250\mu A$$

Figure 12: Typ. Gate Charge


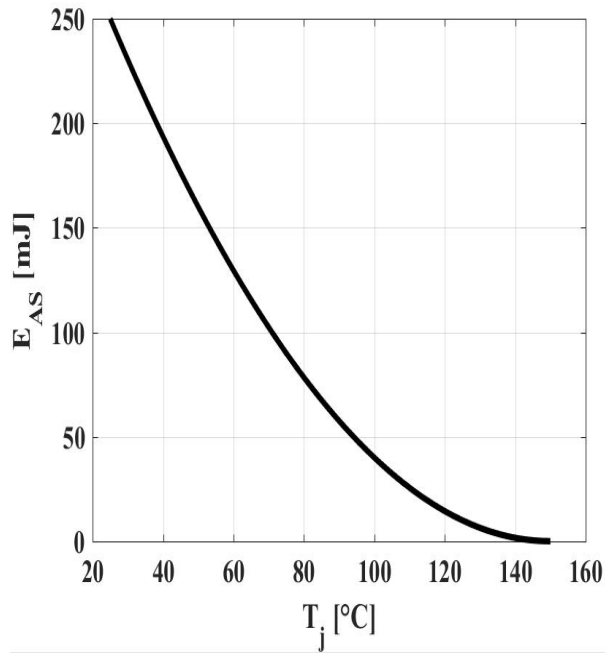
$$V_{GS} = f(Q_{gate}), I_D = 50A \text{ pulsed}$$

Figure 13: Drain-Source Leakage Current


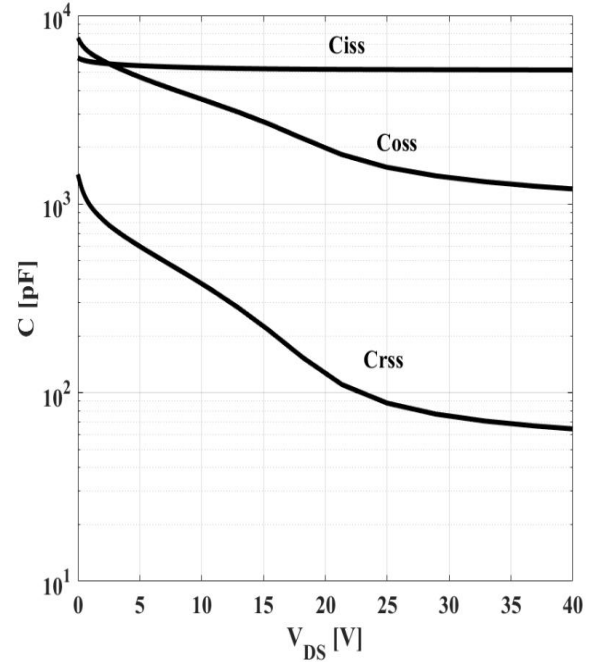
$$I_{DSS} = f(V_{DS}); V_{GS} = 0V; \text{parameter: } T_j$$

Figure 14: Forward Characteristics of Reverse Diode


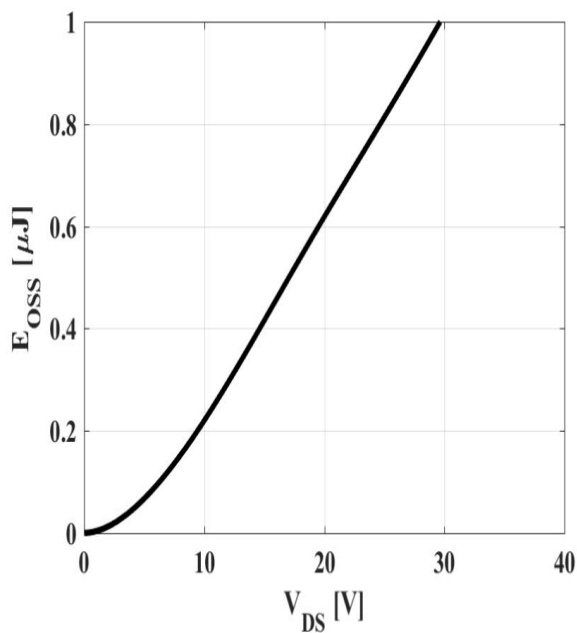
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

Figure 15: Avalanche Energy


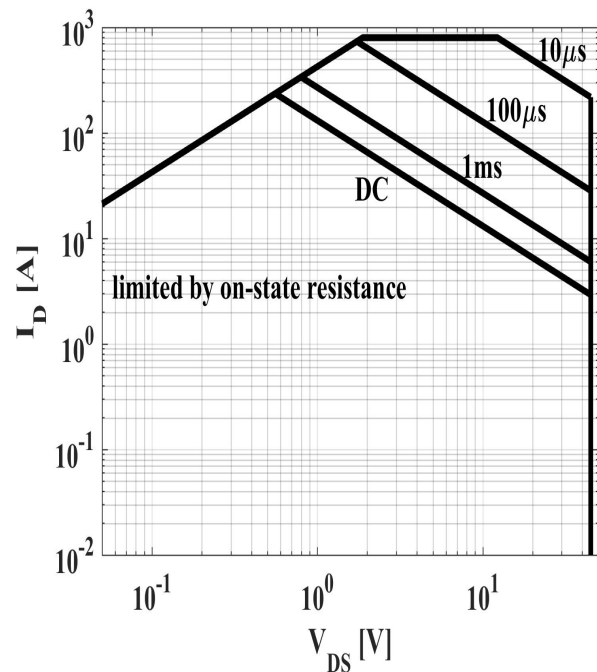
$$E_{AS}=f(T_j); I_D=50.0A; V_{DD}=20V$$

Figure 16: Typ. Capacitances


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

Figure 17: Coss Stored Energy


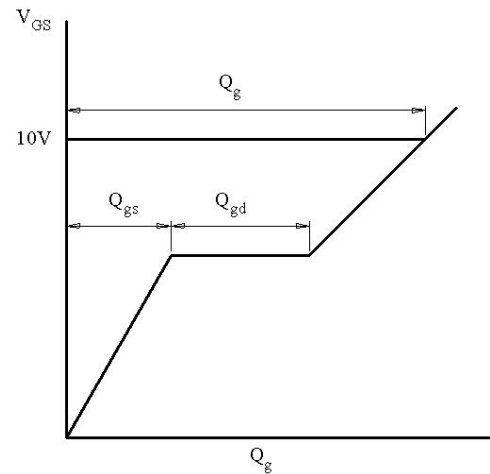
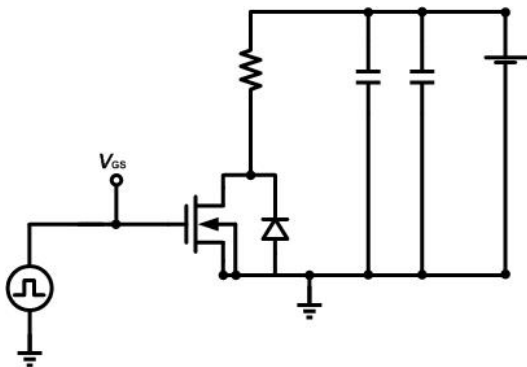
$$E_{OSS}=f(V_{DS})$$

Figure 18: Safe Operating Area


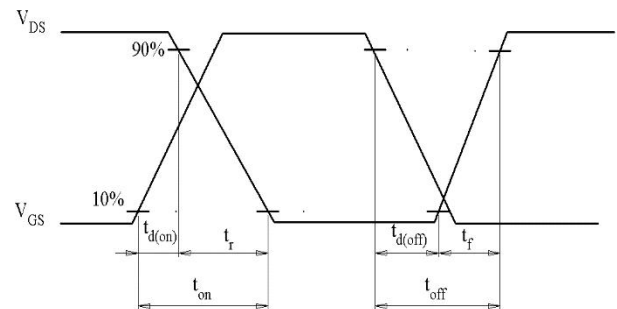
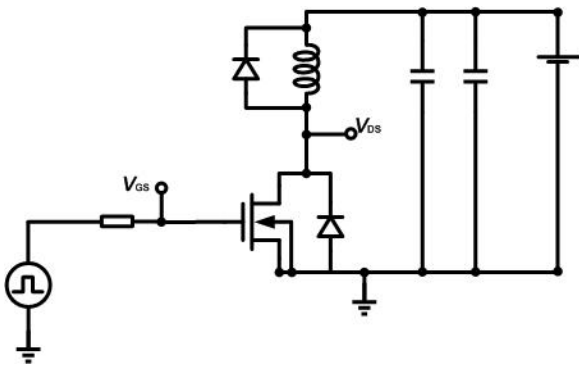
$$I_D = f(V_{DS}); T_c = 25^\circ C; V_{GS} > 7V; \text{parameter } t_p$$

Test Circuits

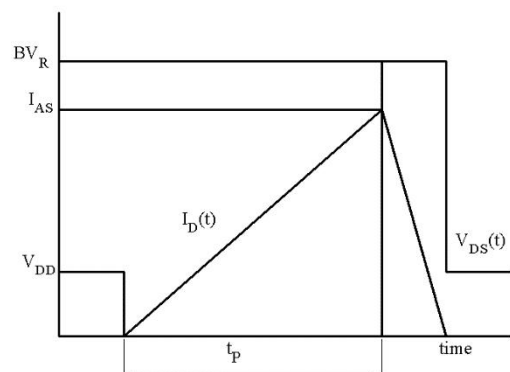
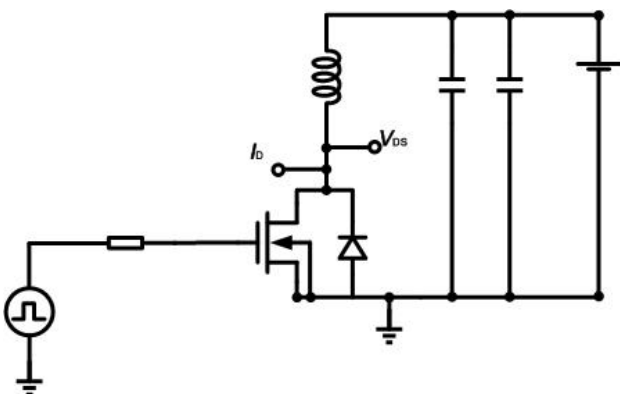
1. Gate Charge Test Circuit & Waveform



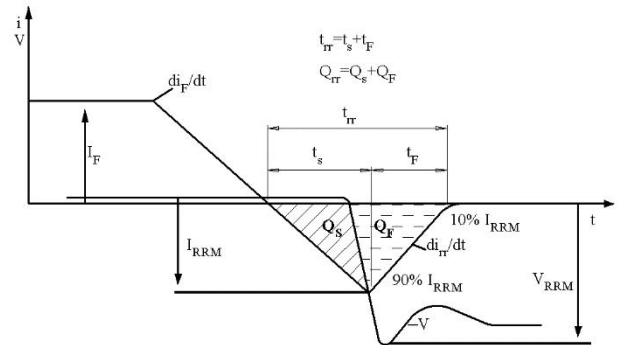
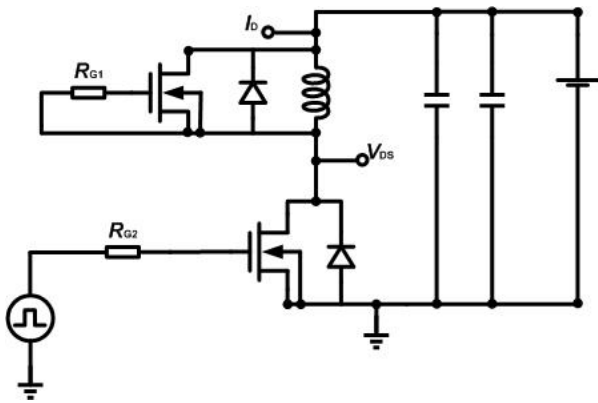
2. Switch Time Test Circuit

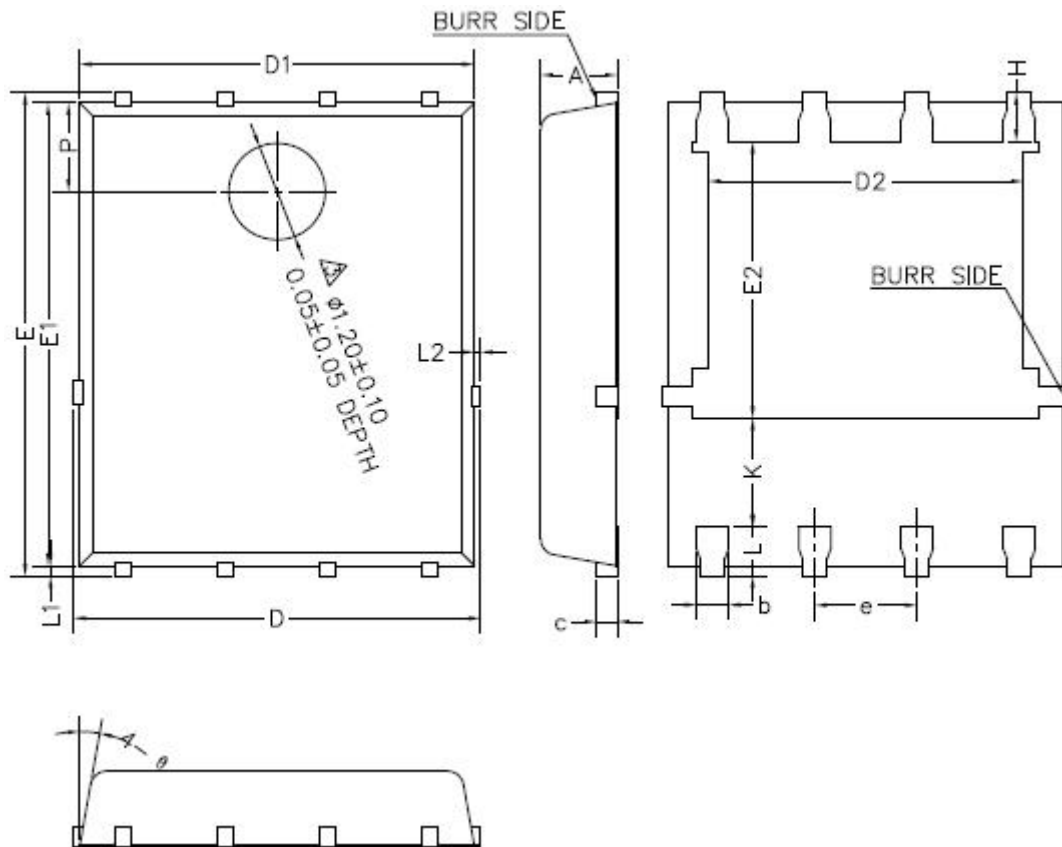


3. Unclamped Inductive Switching Test Circuit & Waveforms



4. Test Circuit and Waveform for Diode Characteristics



Mechanical Dimension
PDFN5*6-8 Unit: mm


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	1.0	1.10	1.20
b	0.35	0.40	0.45
c	0.21	0.25	0.34
D			5.10
D1	4.80	4.90	5.00
D2	3.91	4.01	4.11
e	1.17	1.27	1.37
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.34	3.44	3.54
H	0.51	0.61	0.71
K	1.10		
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
L2			0.10
P	1.00	1.10	1.20
θ	8°	10°	12°



Sanrise Technology Limited Company

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