

General Description

The Sanrise SRT045N012HS 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 SRT045N012HS break down voltage is 45V and it has a high rugged avalanche characteristics. The SRT045N012HS is available in PDFN5*6 and TO-220C and TO-263-2 packages.

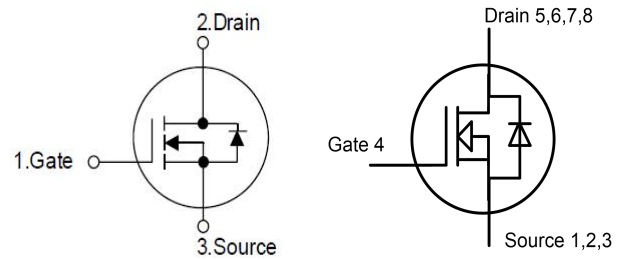
Features

- Ultra Low
 $R_{DS(ON_TYP)} = 1.07m\Omega$, PDFN5*6@ $V_{GS} = 10V$.
 $R_{DS(ON_TYP)} = 1.8m\Omega$, TO-220C @ $V_{GS} = 10V$.
 $R_{DS(ON_TYP)} = 1.6m\Omega$, TO-263-2@ $V_{GS} = 10V$.
- 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

Symbol



TO-220C, TO-263-2

PDFN5*6

Figure 1 Symbol of SRT045N012HS

Package Type

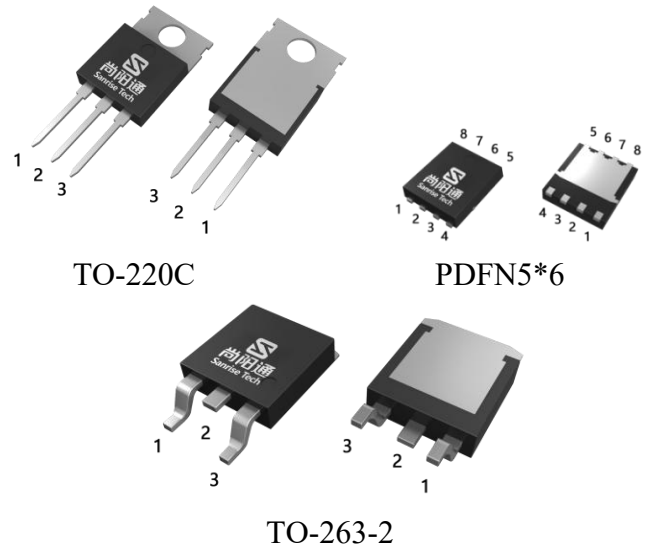


Figure 2 Package Type of SRT045N012HS

1.2mΩ, 45V, N-Channel Power MOSFET

SRT045N012HS

Ordering Information

SRT045N012H□□-□

Circuit Type _____ E: Lead Free
GS: Green

Package _____ Blank: Tube
D56: PDFN5*6
TC: TO-220C
S2: TO-263-2
TR: Tape & Reel

Package	Part Number	Marking ID	Packing Type
PDFN5*6	SRT045N012HD56TR-GS	SRT045N012HD56GS	Tape & Reel
TO-220C	SRT045N012HTC-GS	SRT045N012HTCGS	Tube
TO-263-2	SRT045N012HS2TR-GS	SRT045N012HS2GS	Tape & Reel

1.2mΩ, 45V, N-Channel Power MOSFET
SRT045N012HS
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	PDFN56	228	A
			TO-220C	188	
			TO-263-2	188	
	T _C =100°C		PDFN56	144	
			TO-220C	119	
			TO-263-2	119	
Pulsed Drain Current (Note 3)		I _{DM}	PDFN56	912	A
			TO-220C	752	
			TO-263-2	752	
Power Dissipation (T _C = 25°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		°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. 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

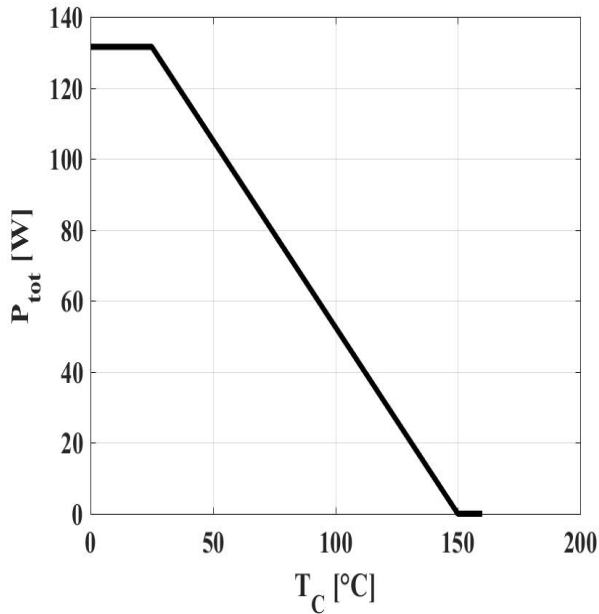
Parameter		Symbol	Min	Typ	Max	Unit
Thermal Resistance, Junction-to-Case	PDFN5*6	R_{thJC}			0.95	$^\circ\text{C/W}$
	TO-220C				0.70	
	TO-263-2				0.70	
Thermal Resistance, Junction-to-Ambient	PDFN5*6	R_{thJA}			50	
	TO-220C				62	
	TO-263-2				62	

1.2m Ω , 45V, N-Channel Power MOSFET
SRT045N012HS
Electrical Characteristics
 $T_J = 25^\circ\text{C}$, unless otherwise specified.

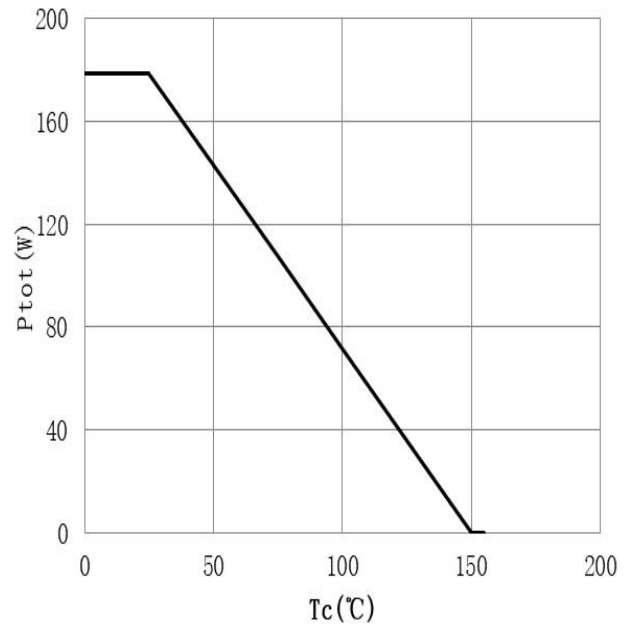
Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250uA	45			V
Zero Gate Voltage Drain Current		I _{DSS}	V _{DS} =45V, V _{GS} =0V			1	uA
Gate-Body Leakage Current	Forward	I _{GSSF}	V _{GS} =20V, V _{DS} =0V			2	uA
	Reverse	I _{GSSR}	V _{GS} =-20V, V _{DS} =0V			-2	
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 =60A		1.07	1.2	mΩ
	TO-220C				1.8	2.5	
	TO-263-2				1.6	2.5	
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 _{tr}			130		nC
Peak Reverse Recovery Current		I _{rrm}			4.3		A

Note:

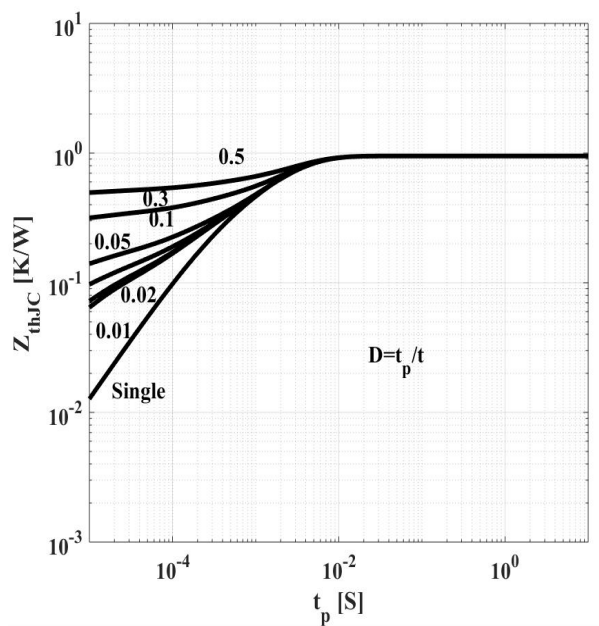
- $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 20V
- $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 20V

Typical Performance Characteristics
Figure 3A: Power Dissipation
 (PDFN5*6)


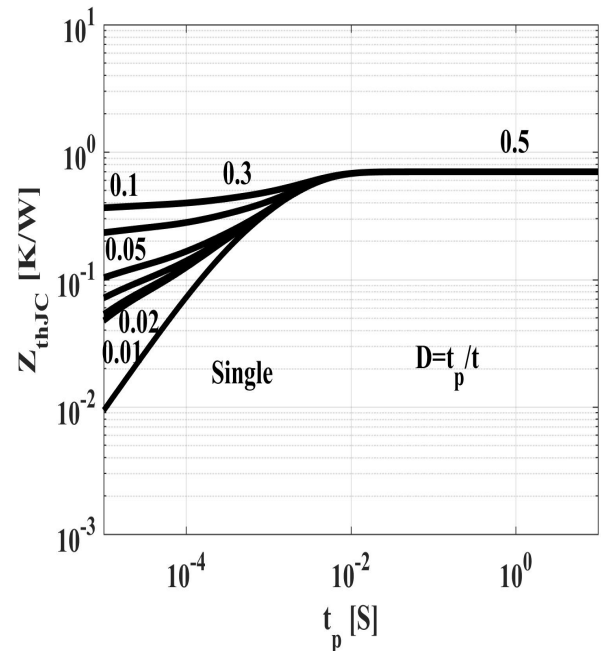
$$P_{tot}=f(T_c)$$

Figure 3B: Power Dissipation
 (TO-220C&TO-263)


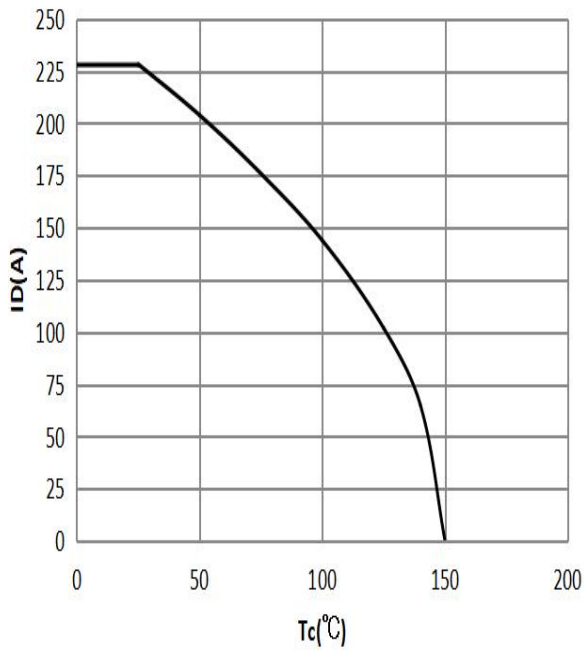
$$P_{tot}=f(T_c)$$

Figure 4A: Max. Transient Thermal Impedance
 (PDFN5*6)


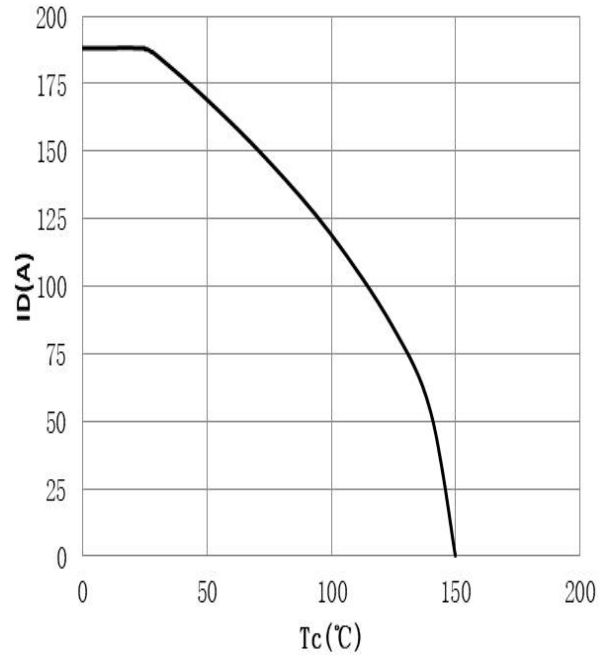
$$Z_{(th)JC}=f(t_p); \text{ parameter: } D=t_p/T$$

Figure 4B: Max. Transient Thermal Impedance
 (TO-220C&TO-263)


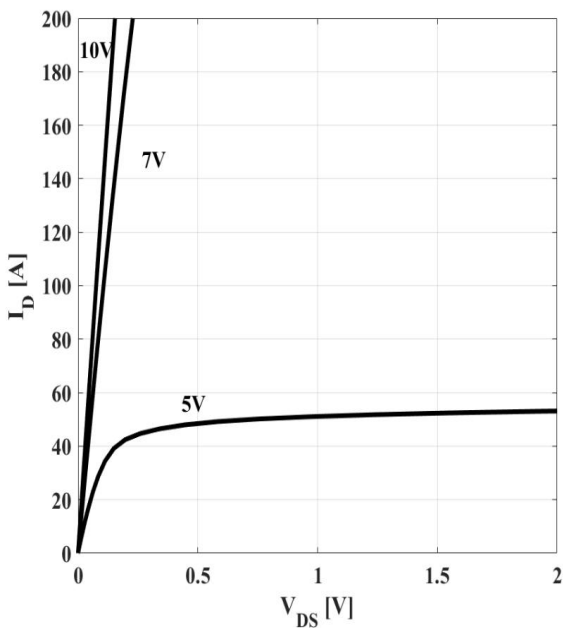
$$Z_{(th)JC}=f(t_p); \text{ parameter: } D=t_p/T$$

1.2mΩ, 45V, N-Channel Power MOSFET
SRT045N012HS
Figure5A: Drain Current (PDFN5*6)


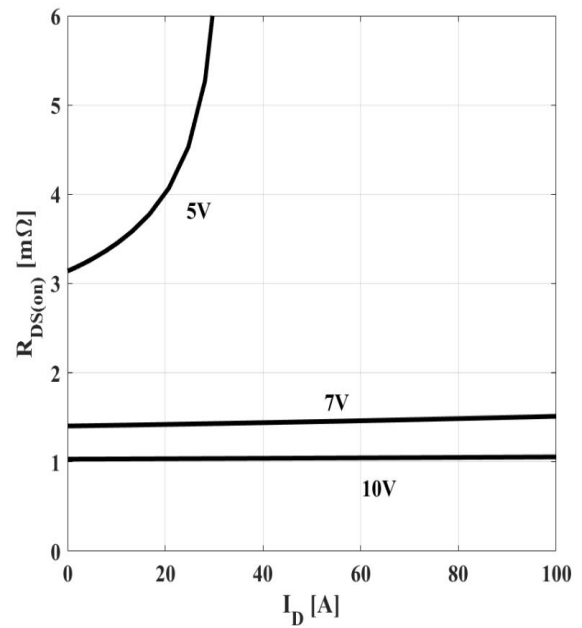
$$I_D = f(T_C); V_{GS} \geq 10V$$

Figure5B: Drain Current(PDFN5*6)


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

Figure6: Typ. Output Characteristics


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

Figure7: Typ. Drain-Source On-State Resistance


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

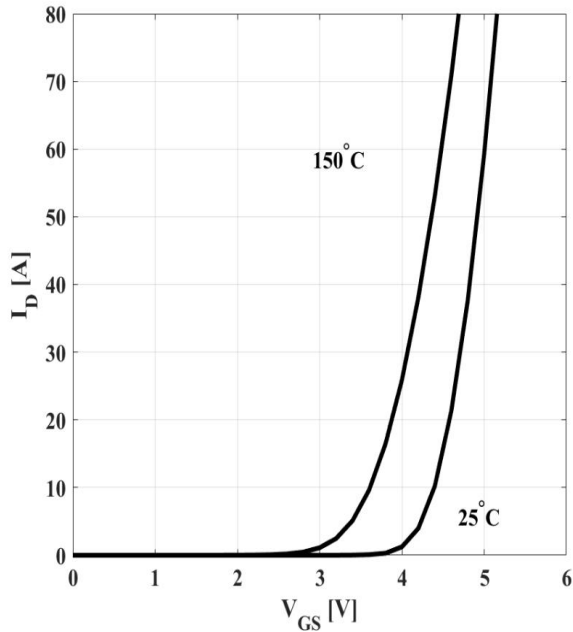
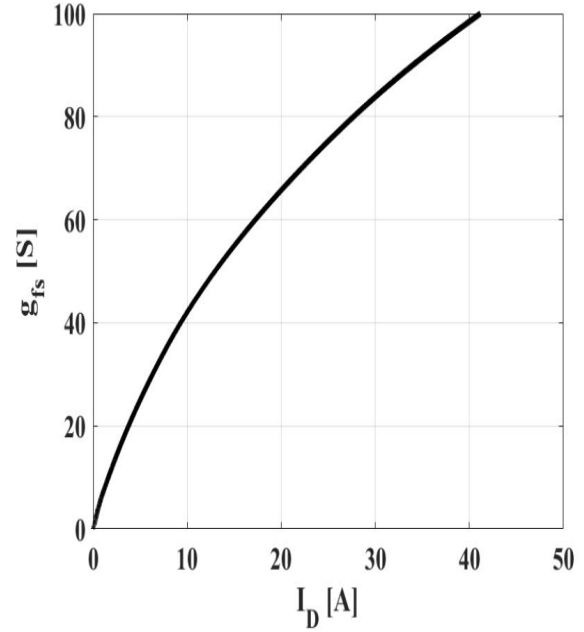
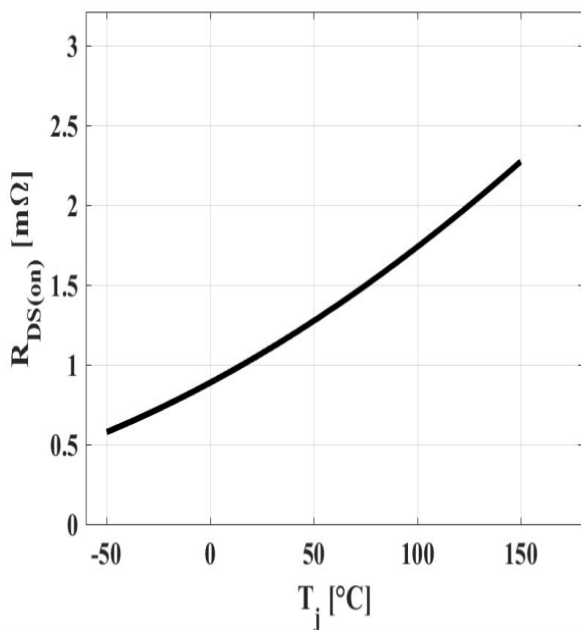
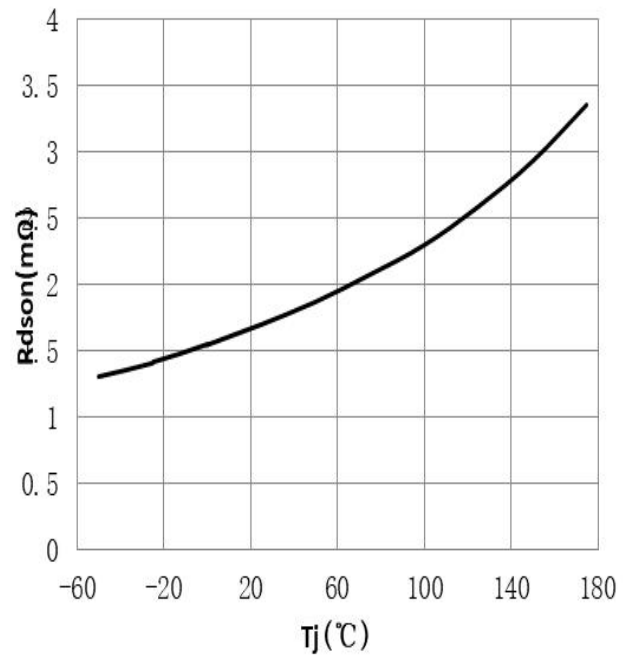
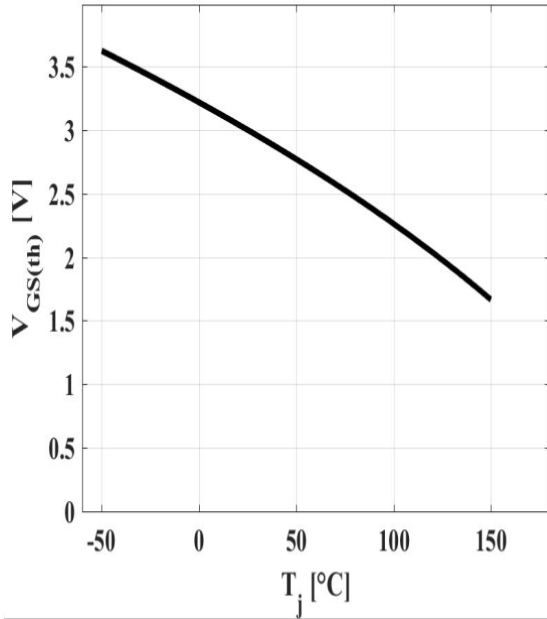
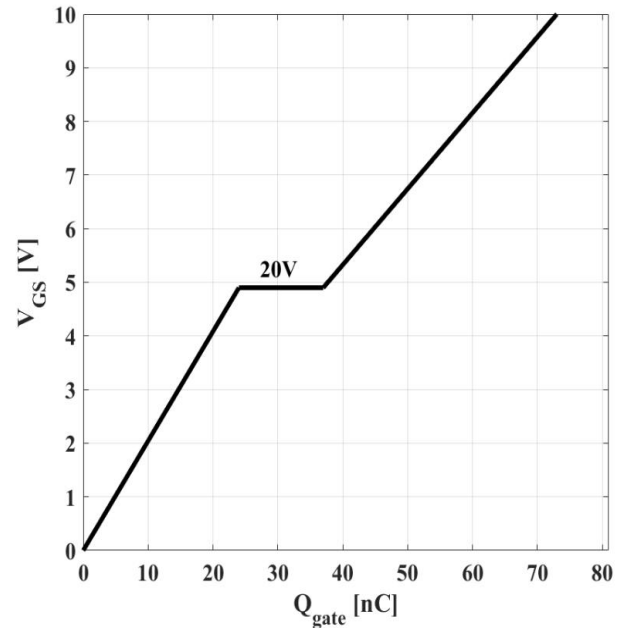
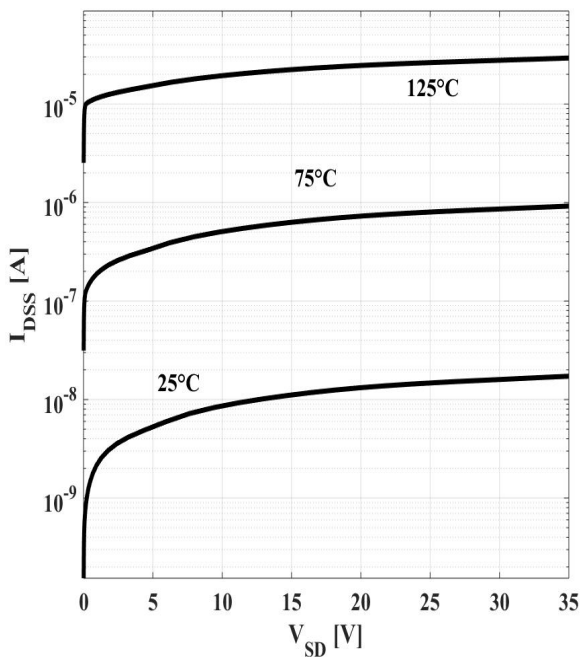
Figure8: Typ. Transfer Characteristics

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

 $g_{fs} = f(I_D); T_j = 25^\circ\text{C}$
Figure10A: Typ. Drain-Source On-State Resistance (PDFN5*6)

 $R_{DS(ON)} = f(T_j); I_D = 50\text{A}; V_{GS} = 10\text{V}$
Figure10B: Typ. Drain-Source On-State Resistance (TO-220C&TO-263)

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

Figure 11: Typ. Gate Threshold Voltage


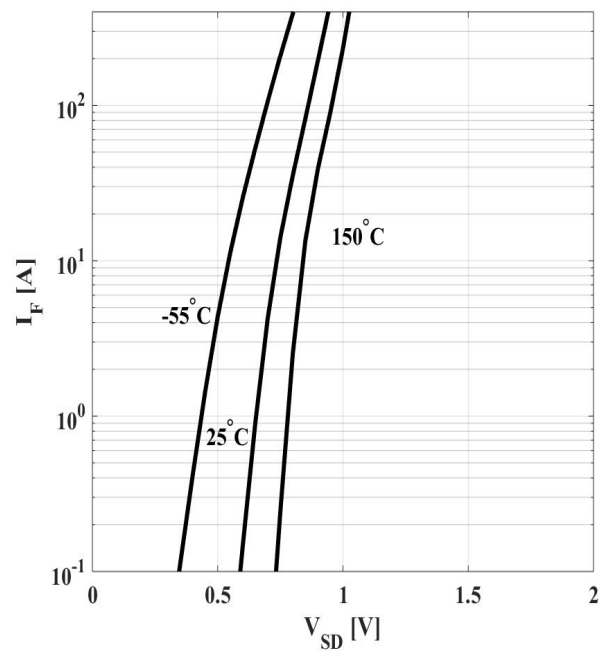
$$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}; I_{DS} = 250\mu A$$

Figure 12: Typ. Gate Charge


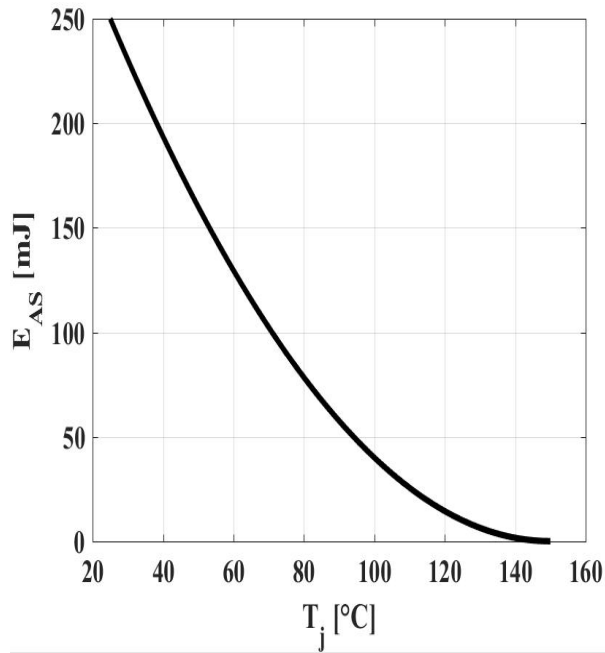
$$V_{GS} = f(Q_{gate}), I_D = 50A \text{ pulsed}$$

Figure 13: Drain-Source Leakage Current


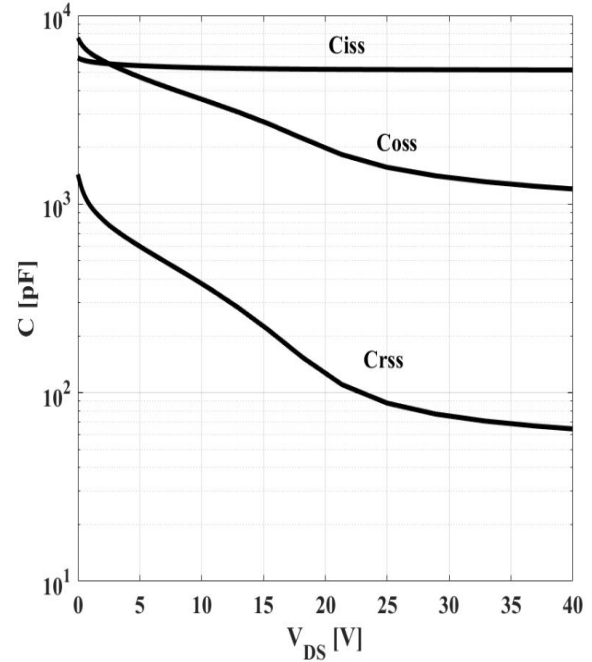
$$I_{DSS} = f(V_{DS}); V_{GS} = 0V; \text{parameter: } T_j$$

Figure 14: Forward Characteristics of Reverse Diode


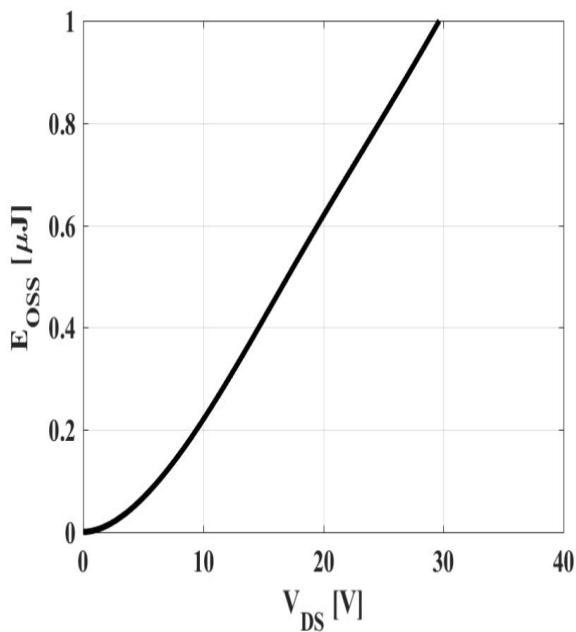
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

1.2mΩ, 45V, N-Channel Power MOSFET
SRT045N012HS
Figure 15: Avalanche Energy


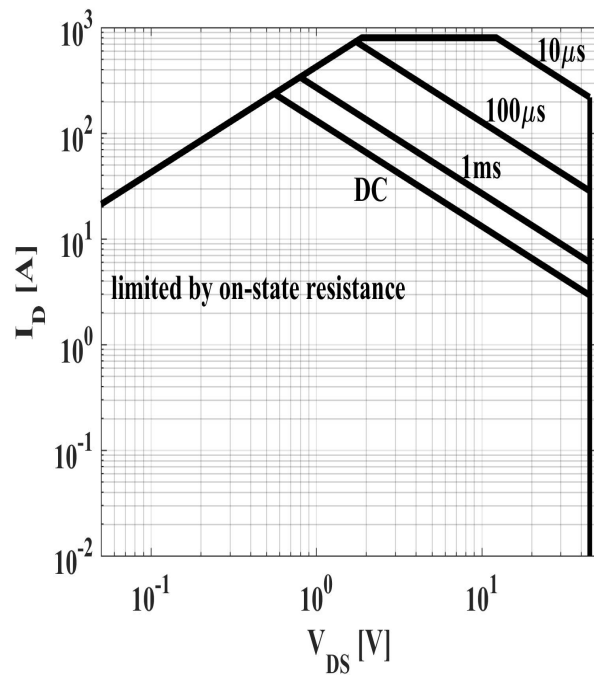
$$E_{AS}=f(T_j); I_D=50.0A; V_{DD}=20V$$

Figure 16: Typ. Capacitances


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

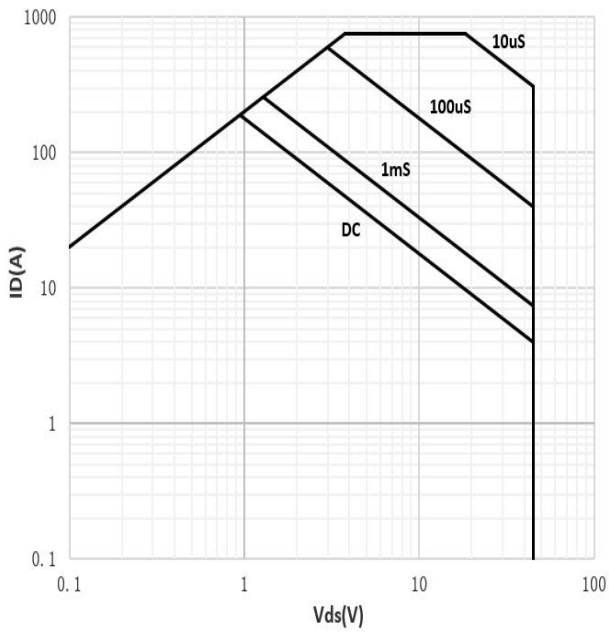
Figure 17: Coss Stored Energy


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

Figure 18A: Safe Operating Area (PDFN5*6)


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

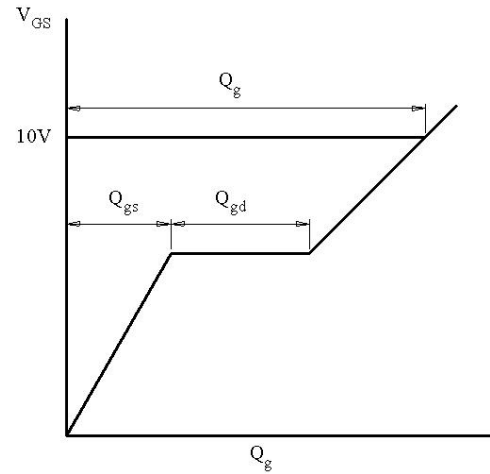
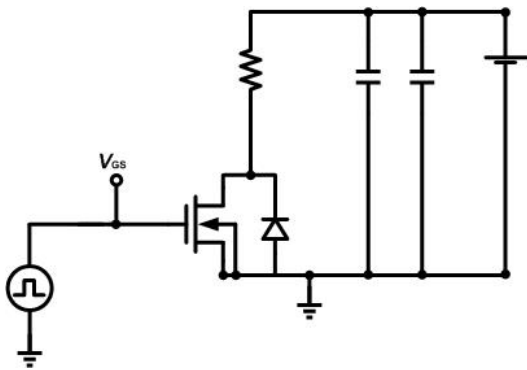
Figure 18B: Safe Operating Area
(TO-220C&TO-263)



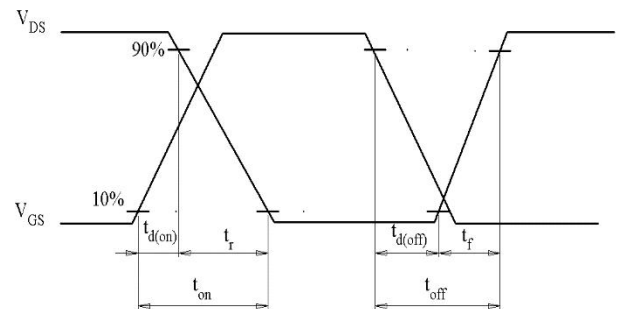
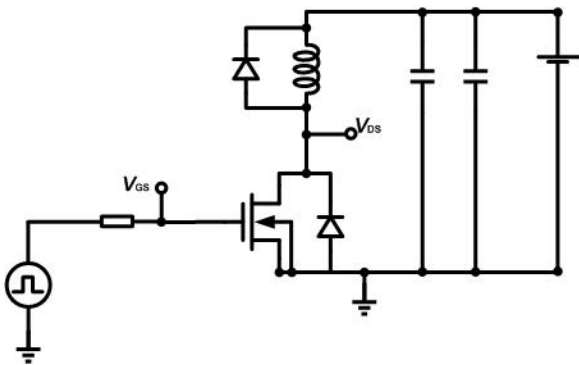
$I_D = f(V_{DS})$; $T_c = 25^\circ\text{C}$; $V_{GS} > 7\text{V}$; parameter t_p

Test Circuits

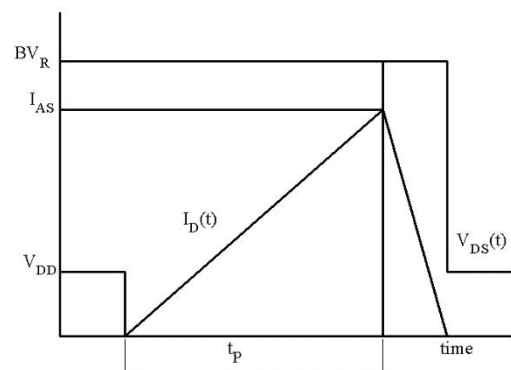
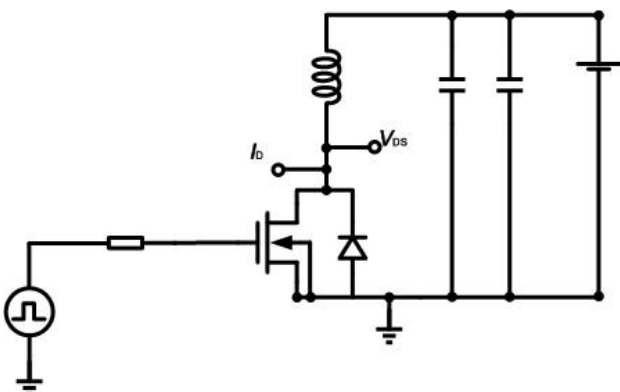
1. Gate Charge Test Circuit & Waveform



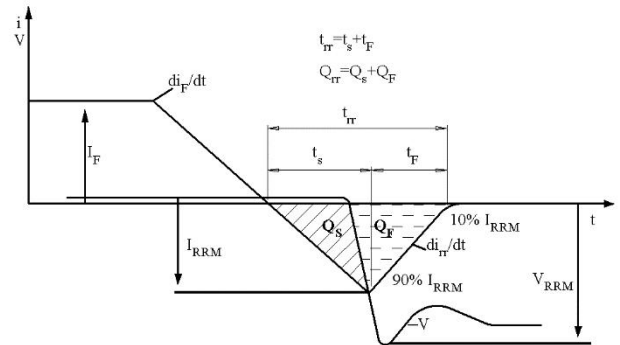
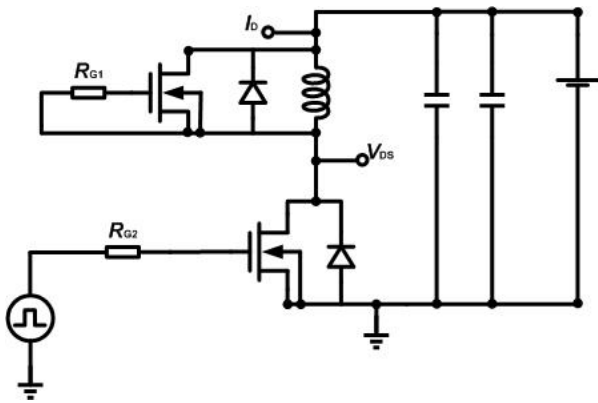
2. Switch Time Test Circuit

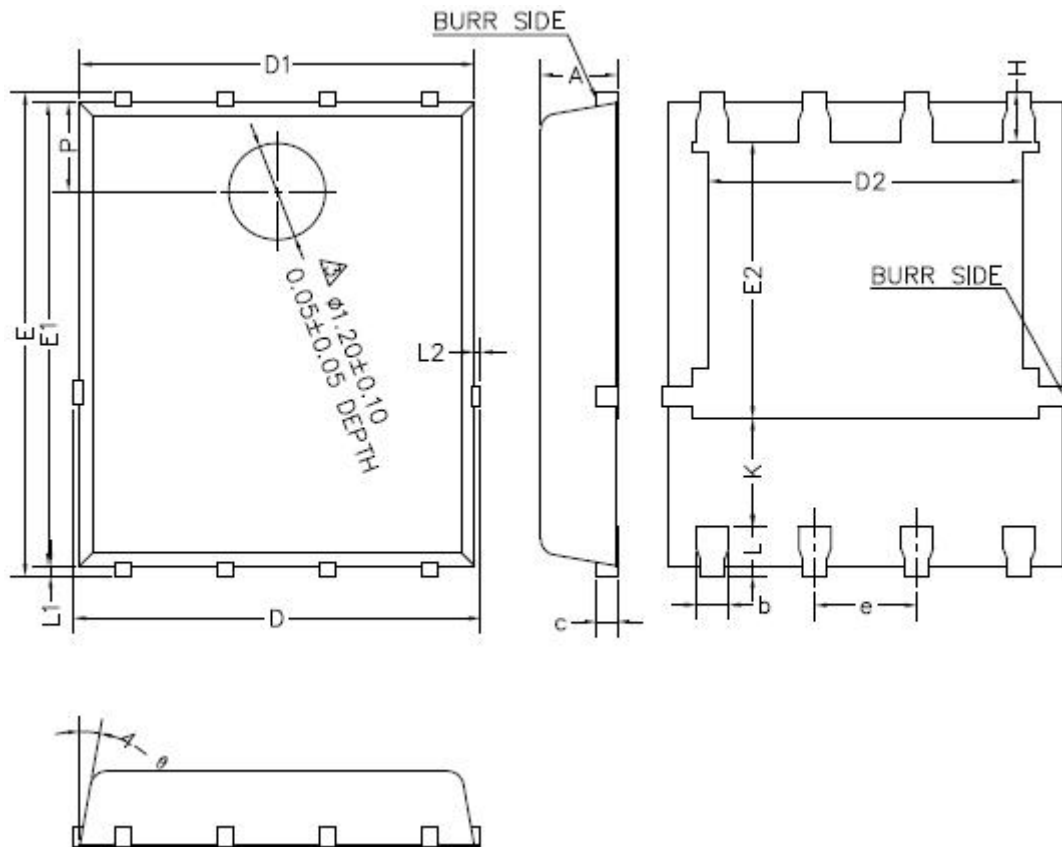


3. Unclamped Inductive Switching Test Circuit & Waveforms



4. Test Circuit and Waveform for Diode Characteristics



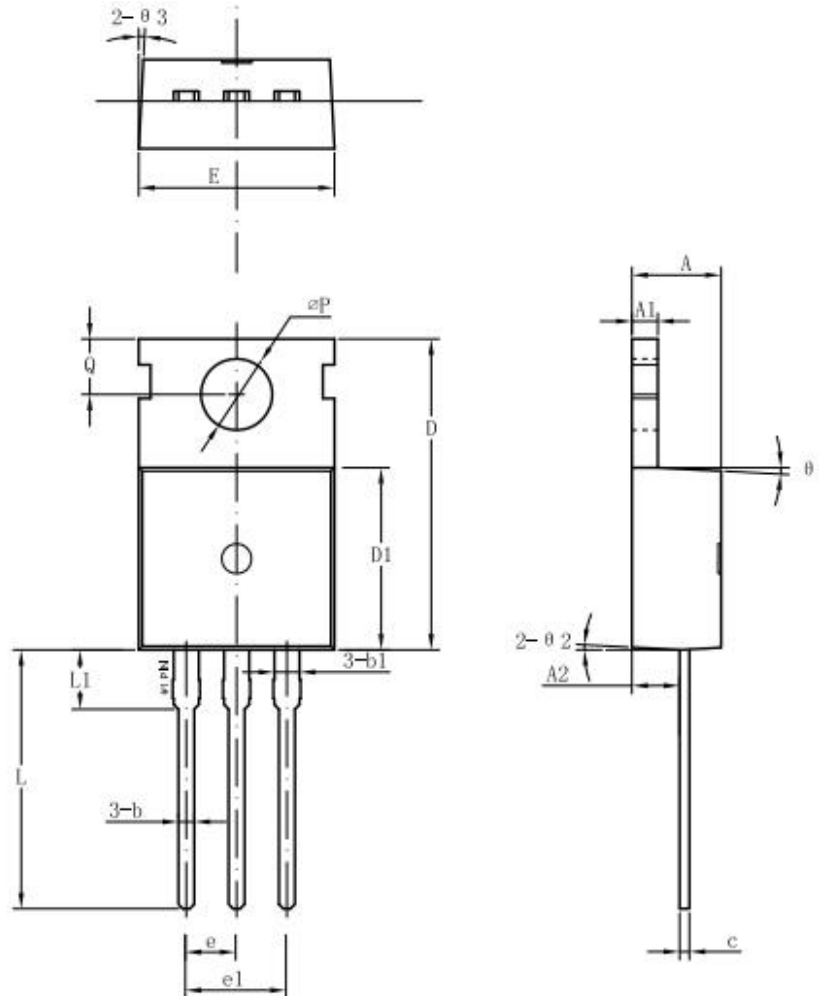
Mechanical Dimension
PDFN5*6-8 Unit: mm


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	0.90	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°

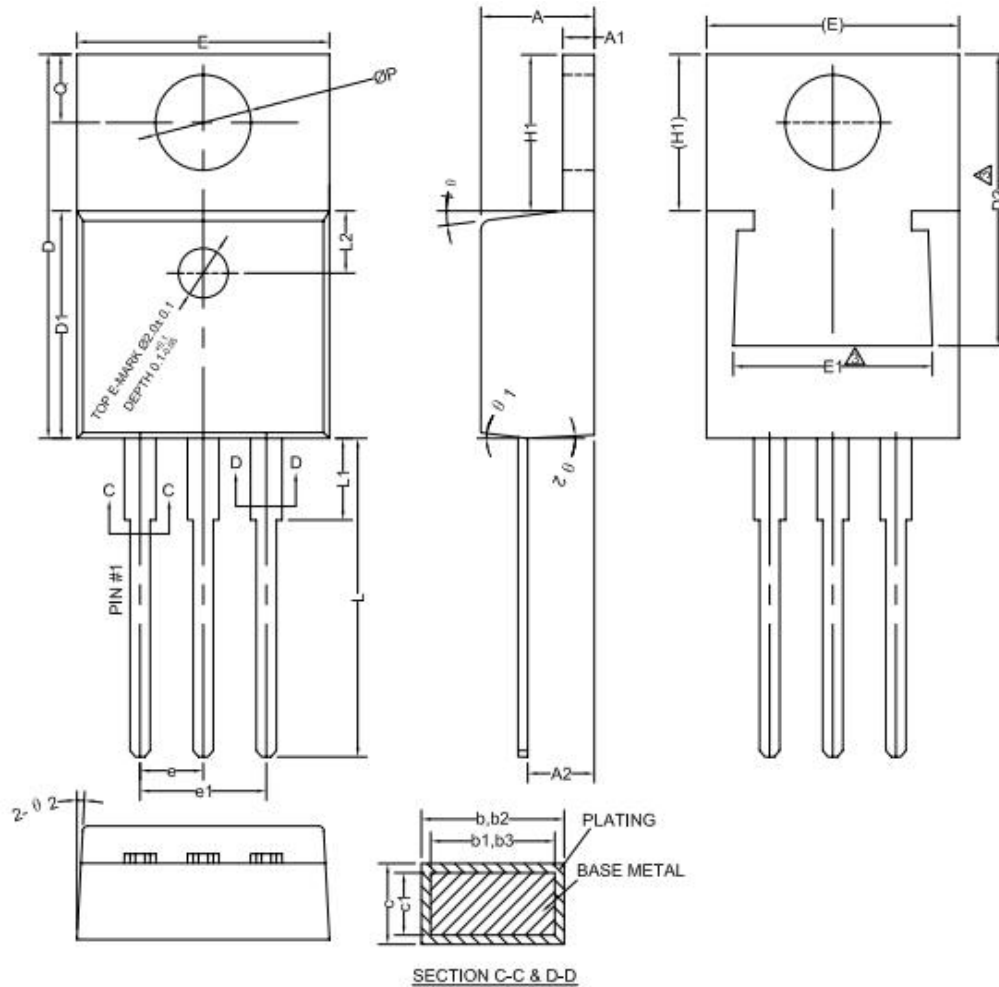
Mechanical Dimensions

TO-220C(Package1)

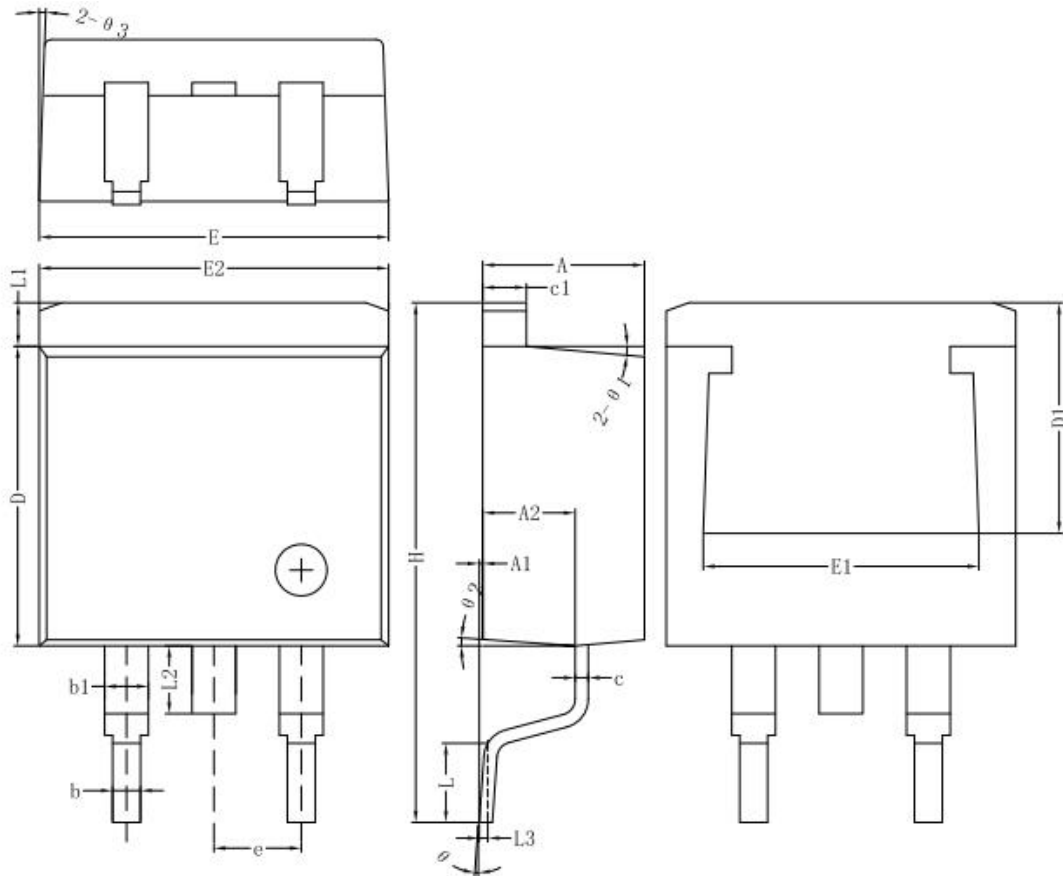
Unit: mm



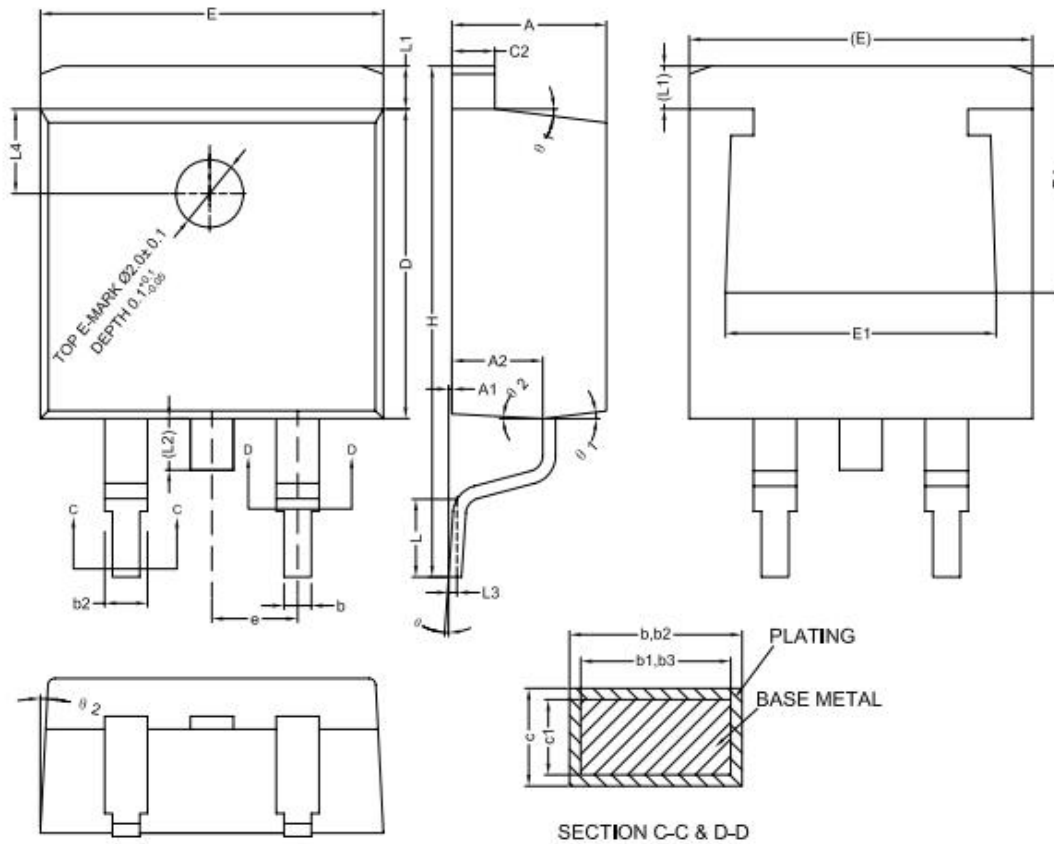
Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.30	4.50	4.70	e	—	2.54	—
A1	1.25	1.30	1.40	e1	—	5.08	—
A2	2.20	2.40	2.60	L	12.60	13.08	13.60
b	0.70	0.80	0.95	L1	—	3.00	—
b1	—	1.27	—	Φ P	3.50	3.60	3.80
c	0.40	0.50	0.65	Q	2.60	2.80	3.00
D	15.20	15.70	16.20	θ 1	—	3°	—
D1	9.00	9.20	9.40	θ 2	—	3°	—
E	9.70	10.00	10.10	θ 3	—	3°	—

Mechanical Dimensions
TO-220C(Package2)
Unit: mm


Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.40	4.57	4.70	E	9.96	10.16	10.36
A1	1.22	—	1.32	E1	6.86	—	8.89
A2	2.59	2.69	2.79	e	2.44	2.54	2.64
b	0.77	—	0.90	e1	4.98	5.08	5.18
b1	0.76	0.81	0.86	H1	6.10	6.30	6.50
b2	1.23	—	1.36	L	12.70	—	13.12
b3	1.22	1.27	1.32	L1	—	—	3.90
c	0.34	—	0.47	L2	—	2.50REF	—
c1	0.33	0.38	0.43	ΦP	3.80	3.84	3.88
D	15.15	15.45	15.75	Q	2.60	—	2.90
D1	9.05	9.15	9.25	θ 1	5°	7°	9°
D2	11.40	—	12.88	θ 2	1°	3°	5°

Mechanical Dimensions (Continued)
TO-263-2(Package1)
Unit: mm


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.55	4.70	4.85	E2	9.98	10.08	10.18
A1	0.00	0.10	0.25	e	—	2.54	—
A2	2.59	2.69	2.89	H	14.70	15.10	15.50
b	0.71	0.81	0.96	L	2.00	2.30	2.70
b1	—	1.27	—	L1	1.17	1.27	1.40
c	0.36	0.38	0.61	L2	—	—	2.20
c1	1.17	1.27	1.37	L3	—	0.25BSC	—
D	8.55	8.70	8.85	⊙	0°	—	8°
D1	—	7.20	—	⊙1	—	5°	—
E	10.01	10.16	10.31	⊙2	—	4°	—
E1	—	7.8	—	⊙3	—	4°	—

Mechanical Dimensions (Continued)
TO-263-2(Package2)
Unit: mm


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.40	4.57	4.70	E	10.06	10.16	10.26
A1	0.00	0.10	0.25	E1	7.80	—	8.20
A2	2.59	2.69	2.79	e	—	2.54BSC	—
b	0.77	—	0.90	H	14.70	15.10	15.50
b1	0.76	0.81	0.86	L	2.00	2.30	2.60
b2	1.23	—	1.36	L1	1.17	1.27	1.40
b3	1.22	1.27	1.32	L2	—	—	1.75
c	0.34	—	0.47	L3	—	0.25BSC	—
c1	0.33	0.38	0.43	L4	—	2.00REF	—
c2	1.22	—	1.32	⊙	0°	—	8°
D	9.05	9.15	9.25	⊙1	5°	7°	9°
D1	6.60	—	—	⊙2	1°	3°	5°



Sanrise Technology Limited Company

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