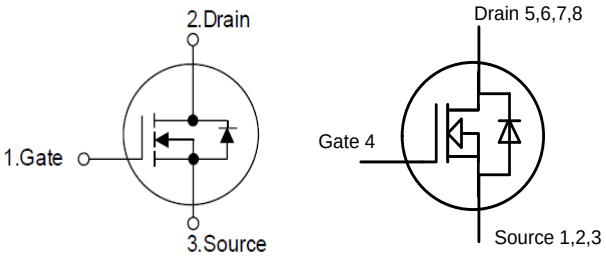
1.2mΩ, 45V, N-Channel Power MOSFET SRT045N012HS

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.

Symbol



TO-220C,TO-263-2 PDFN5*6

Figure 1 Symbol of SRT045N012HS

Features

- Ultra Low

$R_{DS(ON)\_TYP}$ = 1.07mΩ ,PDFN5*6@V_{GS} = 10V.

$R_{DS(ON)\_TYP}$ = 1.8mΩ, TO-220C @V_{GS} = 10V.

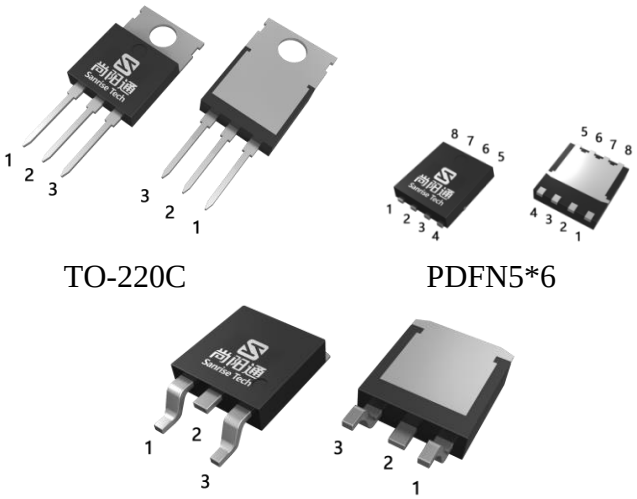
$R_{DS(ON)\_TYP}$ = 1.6mΩ, TO-263-2@V_{GS} = 10V.

- Ultra Low Gate Charge, Qg=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



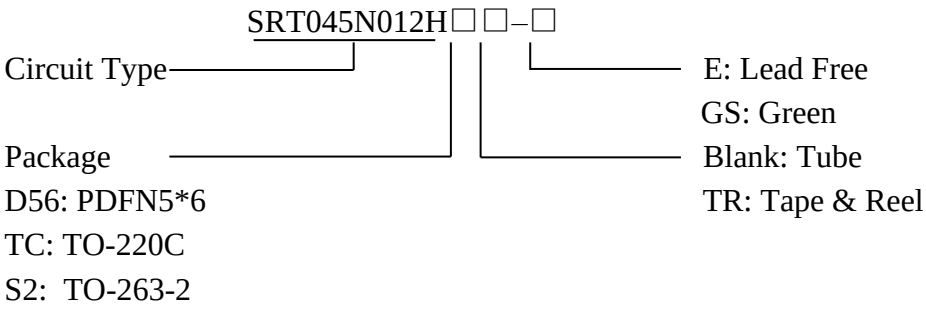
TO-220C PDFN5*6

TO-263-2

Figure 2 Package Type of SRT045N012HS

1.2mΩ, 45V, N-Channel Power MOSFET SRT045N012HS

Ordering Information



Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
PDFN5*6	SRT045N012HD56TR-ES	SRT045N012HD56TR-GS	SRT045N012HD56ES	SRT045N012HD56GS	Tape & Reel
TO-220C	SRT045N012HTC-ES	SRT045N012HTC-GS	SRT045N012HTCES	SRT045N012HTCGS	Tube
TO-263-2	SRT045N012HS2TR-ES	SRT045N012HS2TR-GS	SRT045N012HS2ES	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=25ºC	I_D	PDFN56	228	A
			TO-220C	188	
			TO-263-2	188	
	T_C=100ºC		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		ºC
Storage Temperature		T_{STG}	-55 to 150		ºC
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260		ºC

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}= 22A, V_{DD}= 20V, R_G= 25Ω, Starting T_J= 25°C
5. I_{AS_Limit}= 50.0A, V_{DD}= 20V, R_G= 25Ω, Starting T_J= 25°C

Thermal Resistance

Parameter		Symbol	Min	Typ	Max	Unit
Thermal Resistance，Junction-to-Case	PDFN5*6	R_{thJC}			0.95	ºC/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	

1.2mΩ, 45V, N-Channel Power MOSFET SRT045N012HS

Electrical Characteristics

T_J = 25℃, 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_{rr}			130		nC
Peak Reverse Recovery Current		I_{rrm}			4.3		A

Note:

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

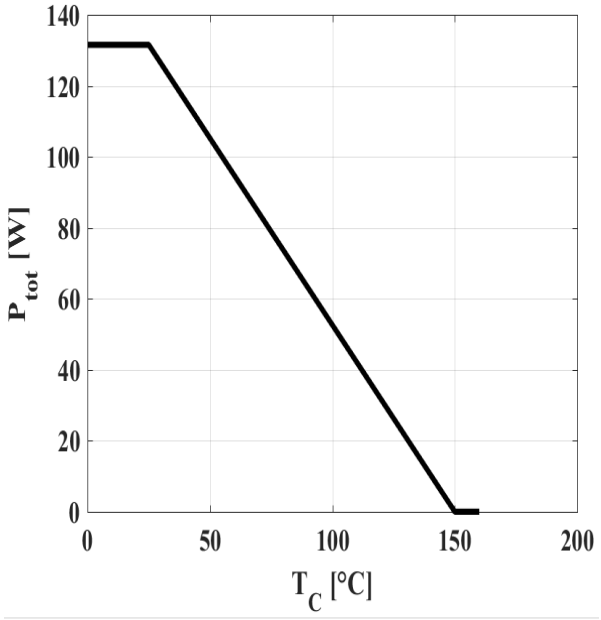
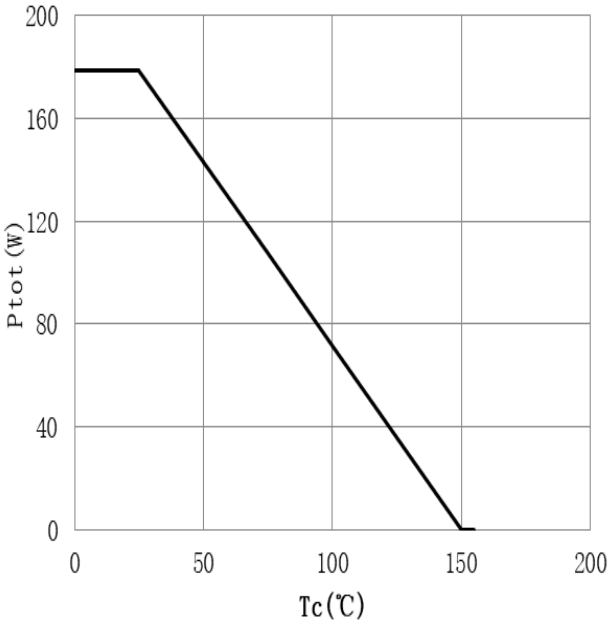
Figure 3A: Power Dissipation (PDFN5*6)	Figure 3B: Power Dissipation (TO-220C&TO-263)
	
$P_{tot}=f(T_c)$	$P_{tot}=f(T_c)$

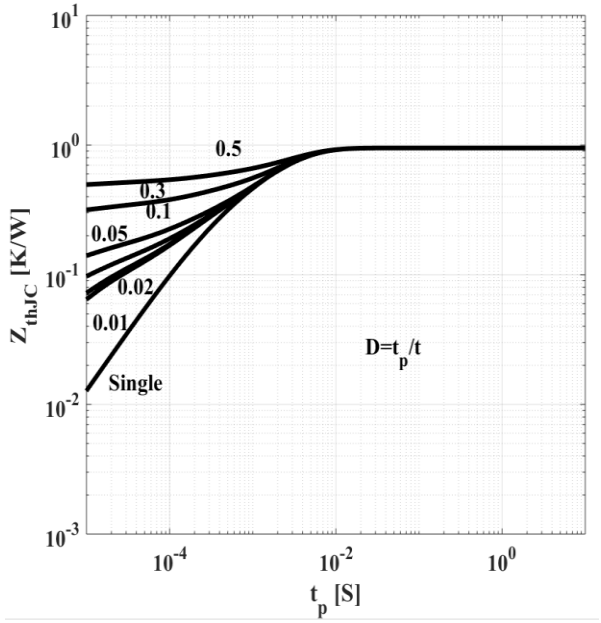
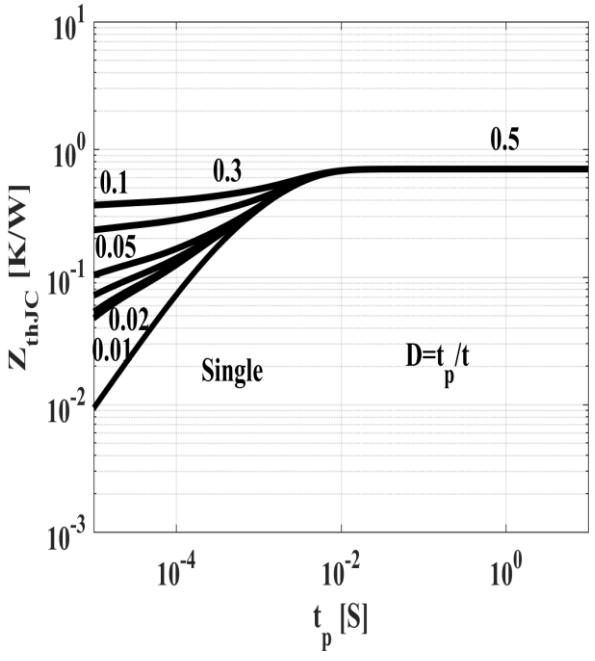
Figure 4A: Max. Transient Thermal Impedance (PDFN5*6)	Figure 4B: Max. Transient Thermal Impedance (TO-220C&TO-263)
	
$Z_{(thJC)}=f(t_p)$; parameter: $D=t_p/T$	$Z_{(thJC)}=f(t_p)$; parameter: $D=t_p/T$

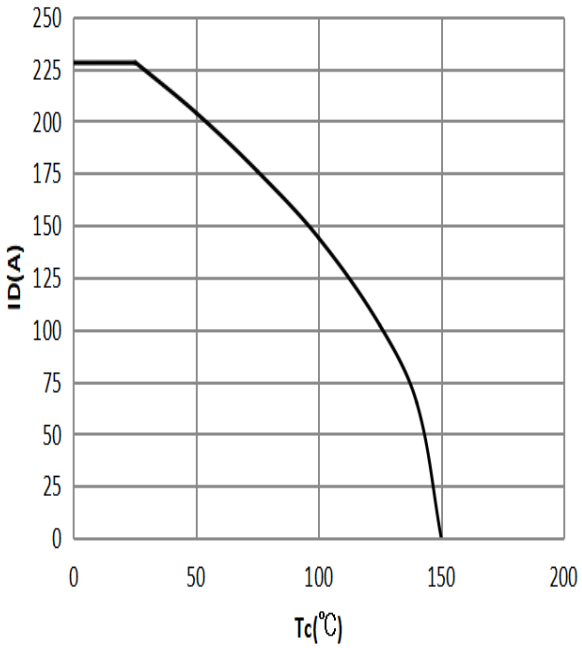
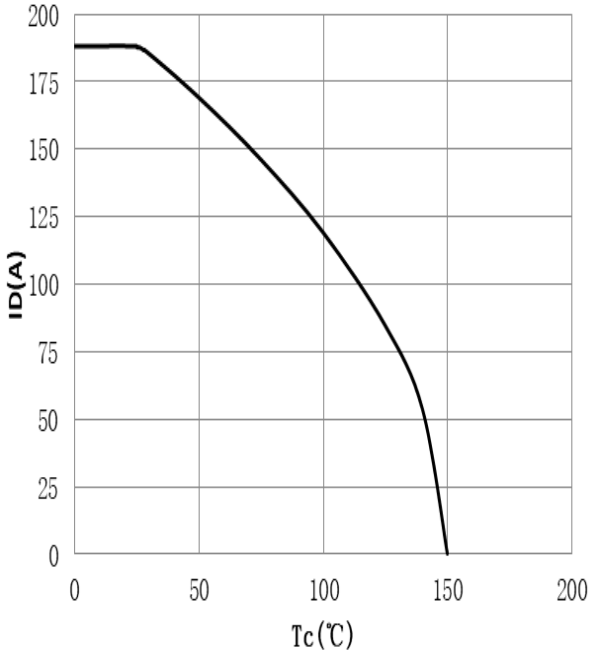
Figure5A: Drain Current (PDFN5*6)	Figure5B: Drain Current(PDFN5*6)
	
$I_D=f(T_C);V_{GS}\geq 10V$	$I_D=f(T_C);V_{GS}\geq 10V$

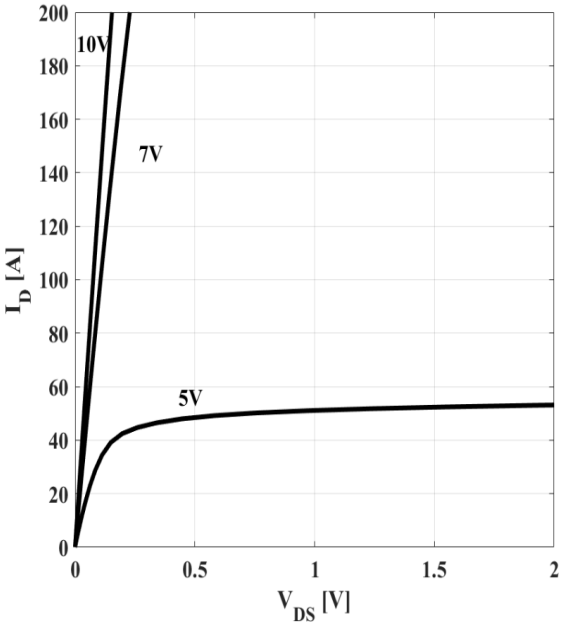
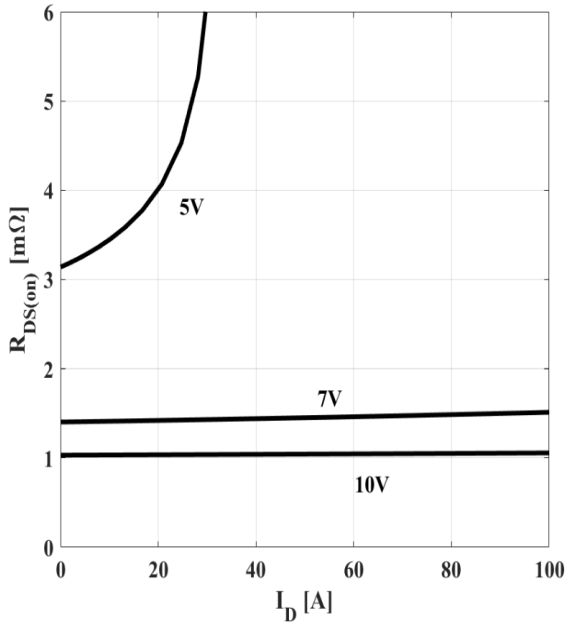
Figure6: Typ. Output Characteristics	Figure7: Typ. Drain-Source On-State Resistance
	
$I_D=f(V_{DS});Tj=25^oC$; parameter: V_{GS}	$R_{DS(ON)}=f(I_D);T_j=25^oC$; parameter: V_{GS}

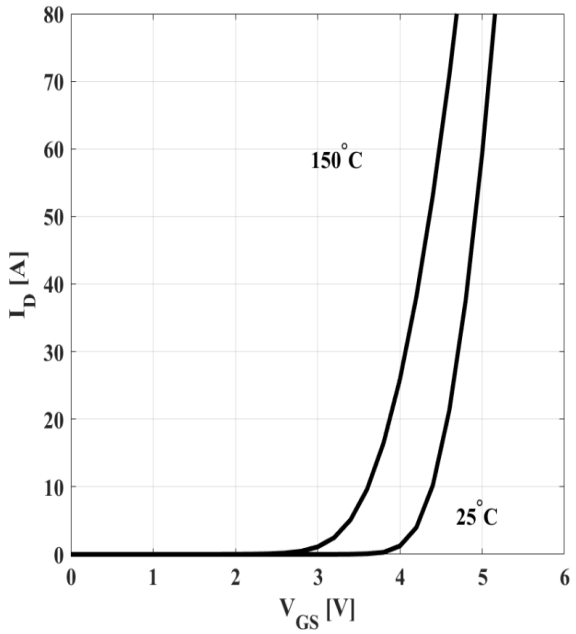
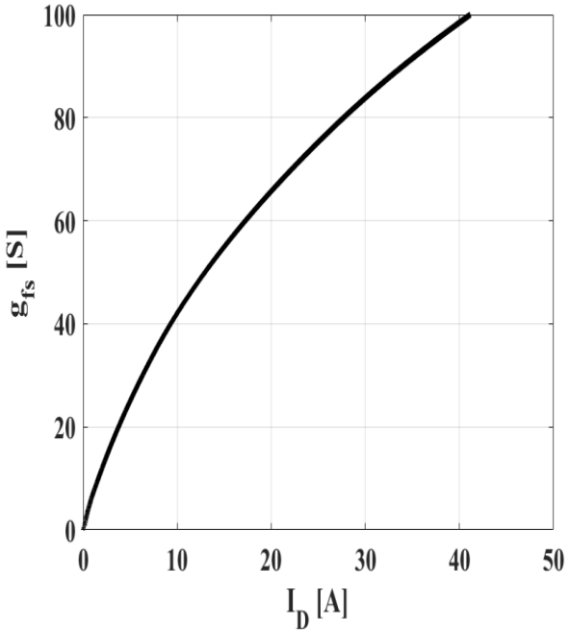
Figure8: Typ. Transfer Characteristics	Figure9: Typ. Forward Transconductance
	
$I_D=f(V_{GS})$; $\lvert V_{DS}\rvert>2\lvert I_D\rvert R_{DS(on)max}$; parameter: T_j	$g_{fs}=f(I_D)$; T_j=25℃

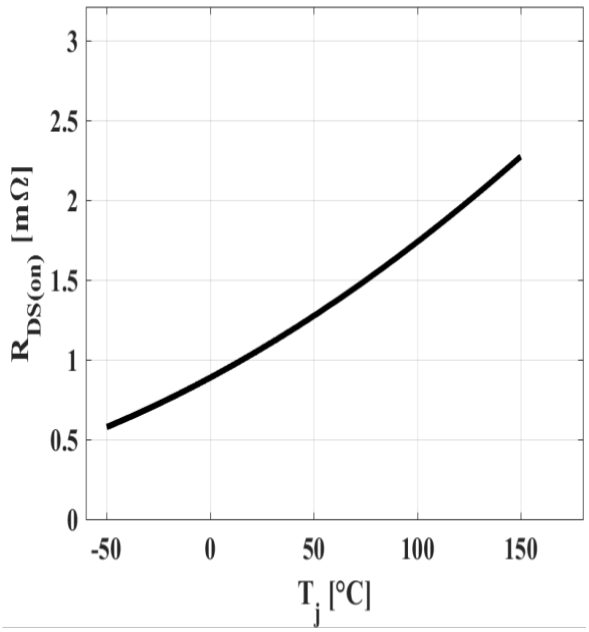
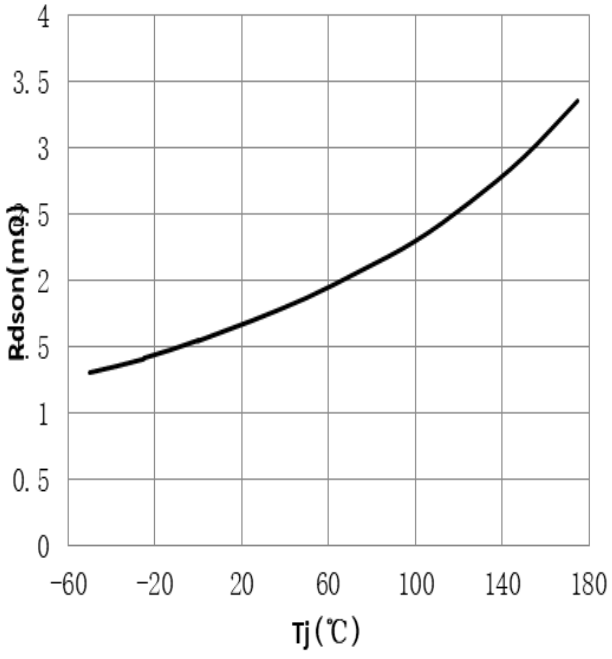
Figure10A: Typ. Drain-Source On-State Resistance (PDFN5*6)	Figure10B: Typ. Drain-Source On-State Resistance (TO-220C&TO-263)
	
$R_{DS(ON)}=f(T_j)$;I_D=50A;V_{GS}=10V	$R_{DS(ON)}=f(T_j)$;I_D=50A;V_{GS}=10V

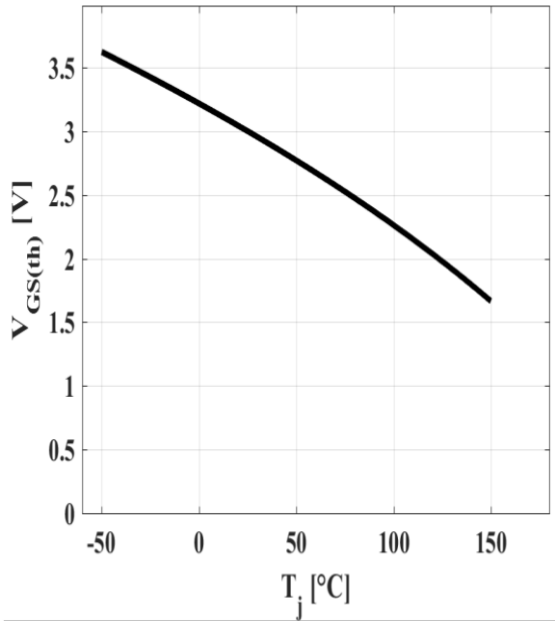
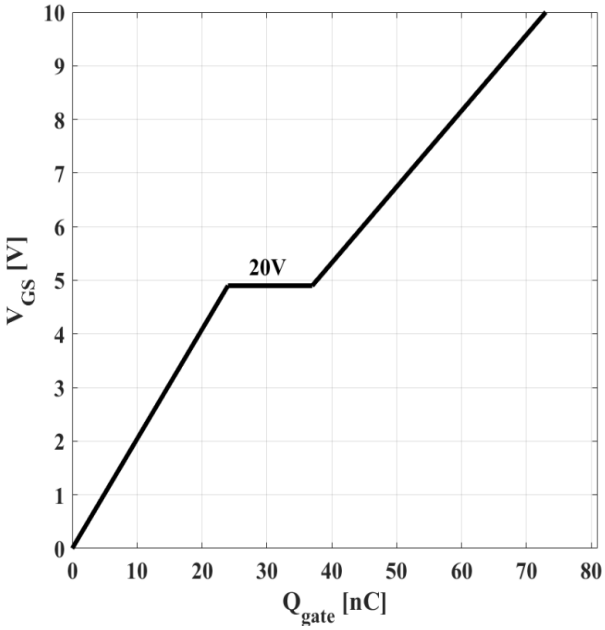
Figure11: Typ. Gate Threshold Voltage	Figure 12: Typ. Gate Charge
	
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; I_{DS}=250μA	V_{GS}= f(Q_{gate}), I_D=50A pulsed

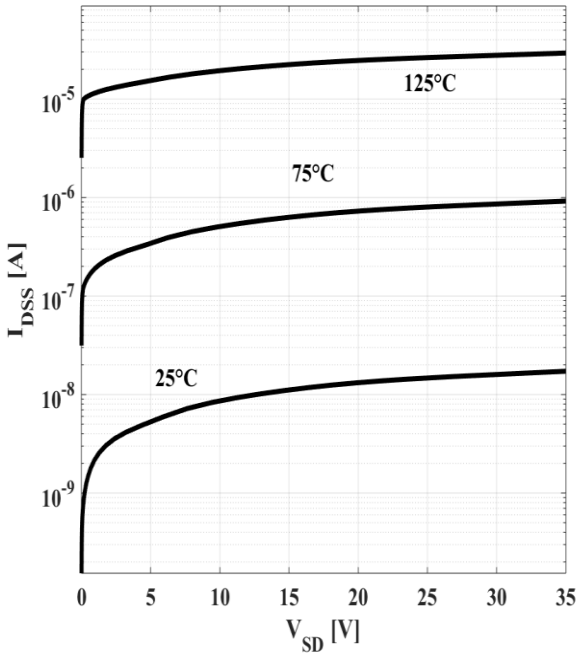
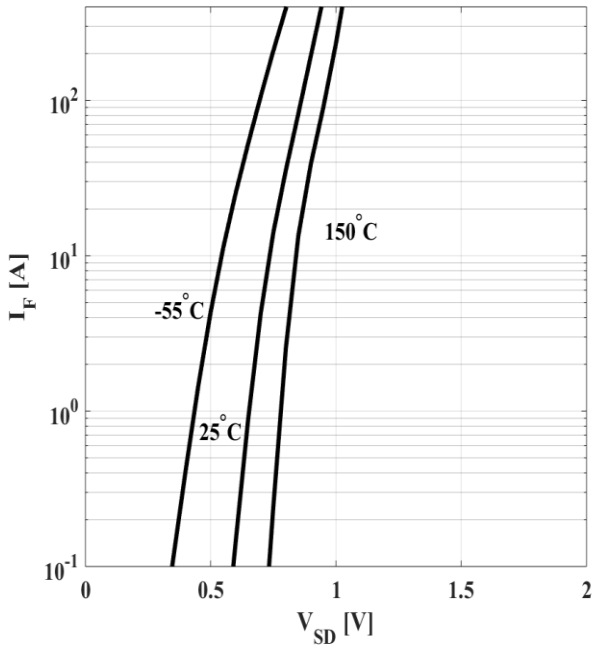
Figure 13: Drain-Source Leakage Current	Figure 14: Forward Characteristics of Reverse Diode
	
I_{DSS}=f(V_{DS}); V_{GS}=0V; parameter: T_j	I_F=f(V_{SD}); parameter: T_j

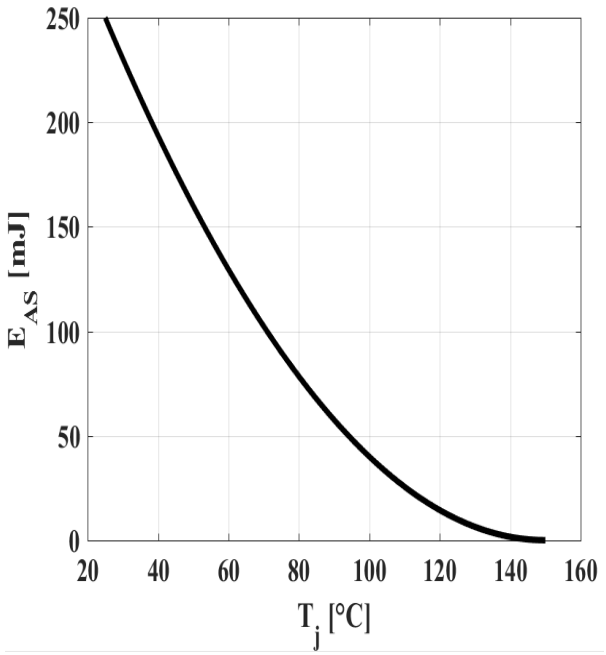
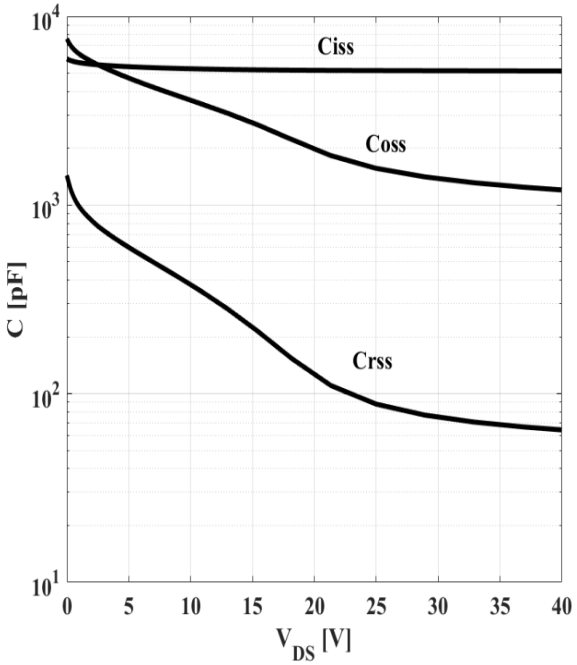
Figure 15: Avalanche Energy	Figure 16: Typ. Capacitances
	
E_{AS}=f(T_j);I_D=50.0A; V_{DD}=20V	C=f(V_{DS}); V_{GS}=0; f=1MHz

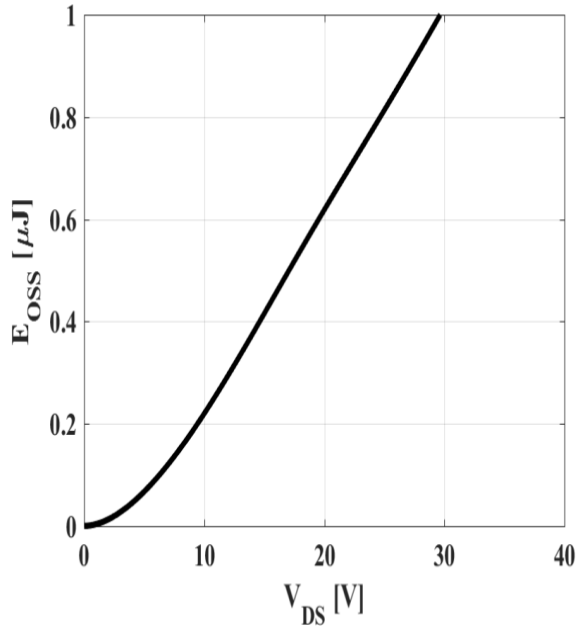
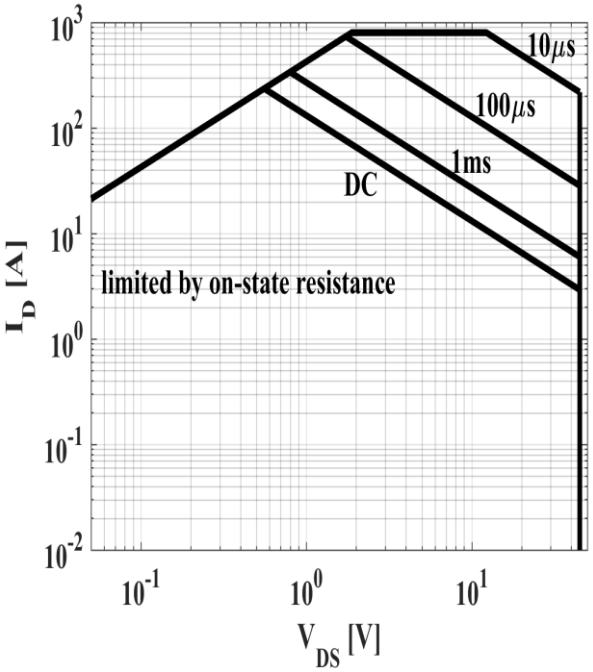
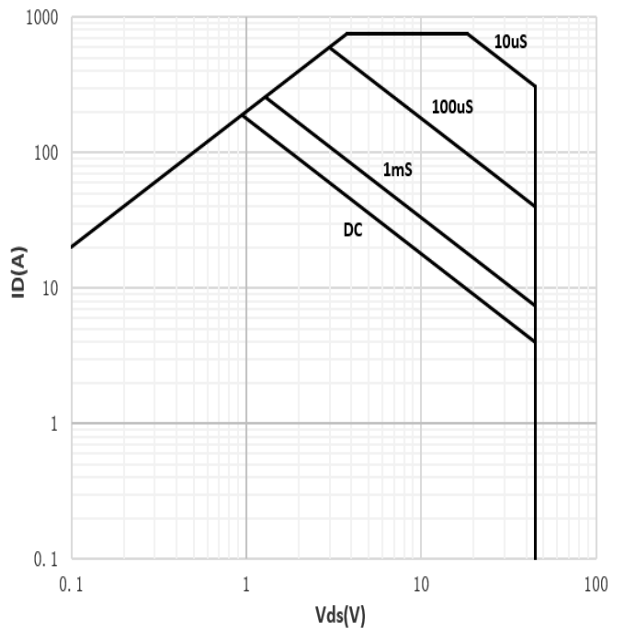
Figure 17: C_{OSS} Stored Energy	Figure 18A: Safe Operating Area (PDFN5*6)
	
E_{OSS}=f(V_{DS})	I_D = f(V_{DS}); T_c= 25ºC; V_{GS}>7V; parameter t_p

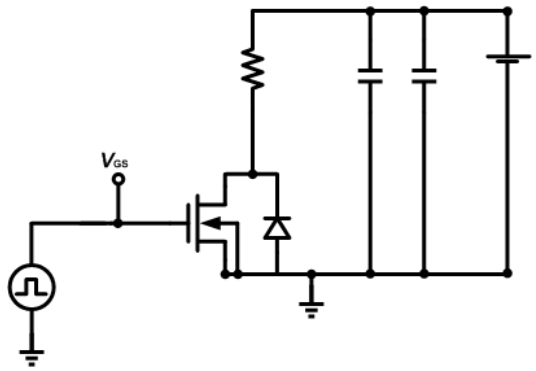
Figure 18B: Safe Operating Area
(TO-220C&TO-263)

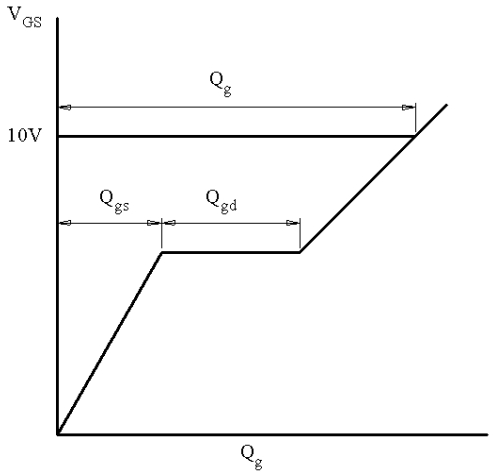


$I_D = f(V_{DS})$; T_c= 25ºC; V_{GS}>7V; parameter t_p

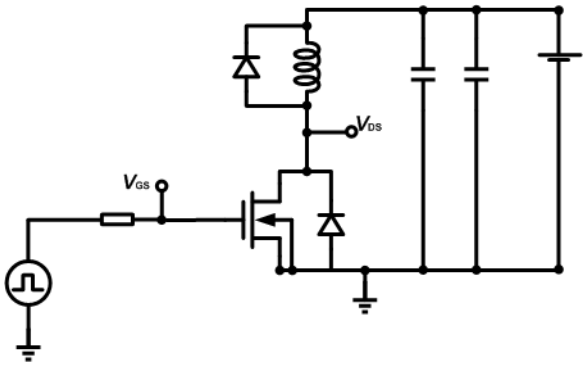
Test Circuits

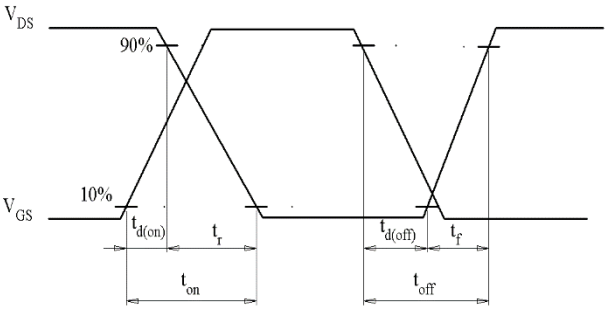
1. Gate Charge Test Circuit & Waveform



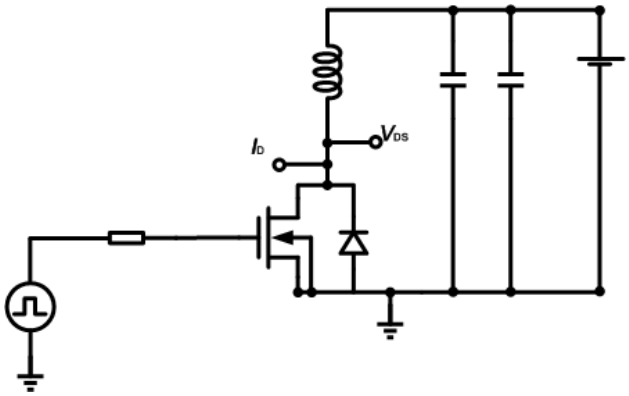


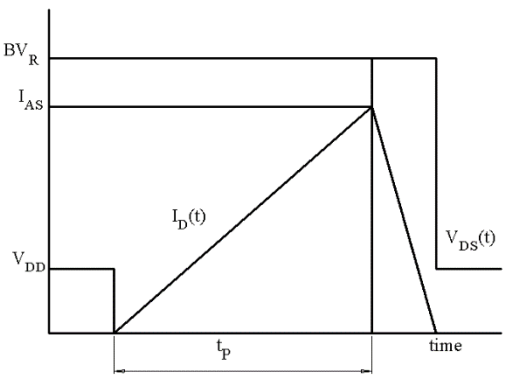
2. Switch Time Test Circuit



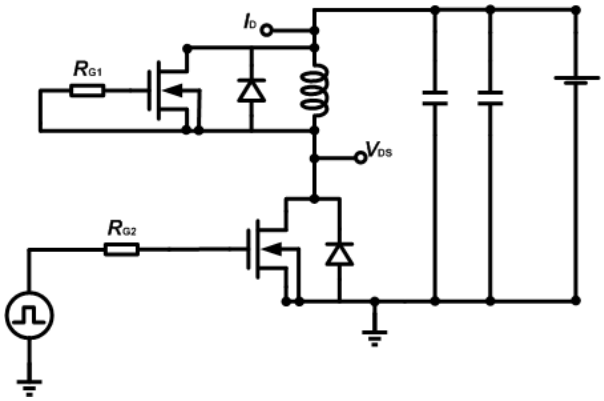


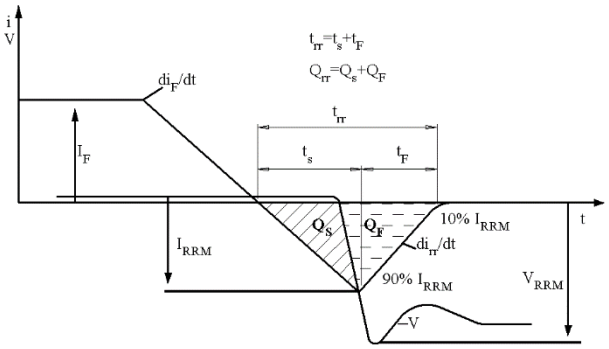
3. Unclamped Inductive Switching Test Circuit & Waveforms





4. Test Circuit and Waveform for Diode Characteristics

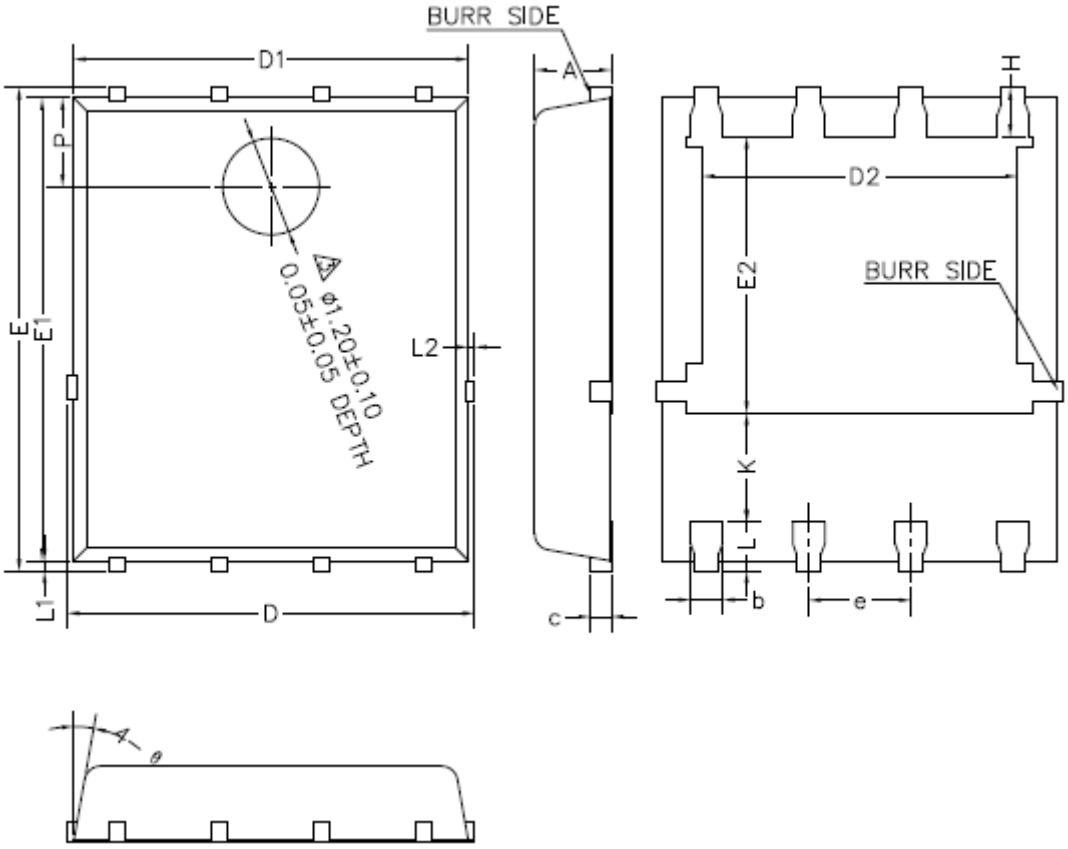




1.2mΩ, 45V, N-Channel Power MOSFET **SRT045N012HS**

Mechanical Dimension

PDFN5*6-8 **Unit: mm**

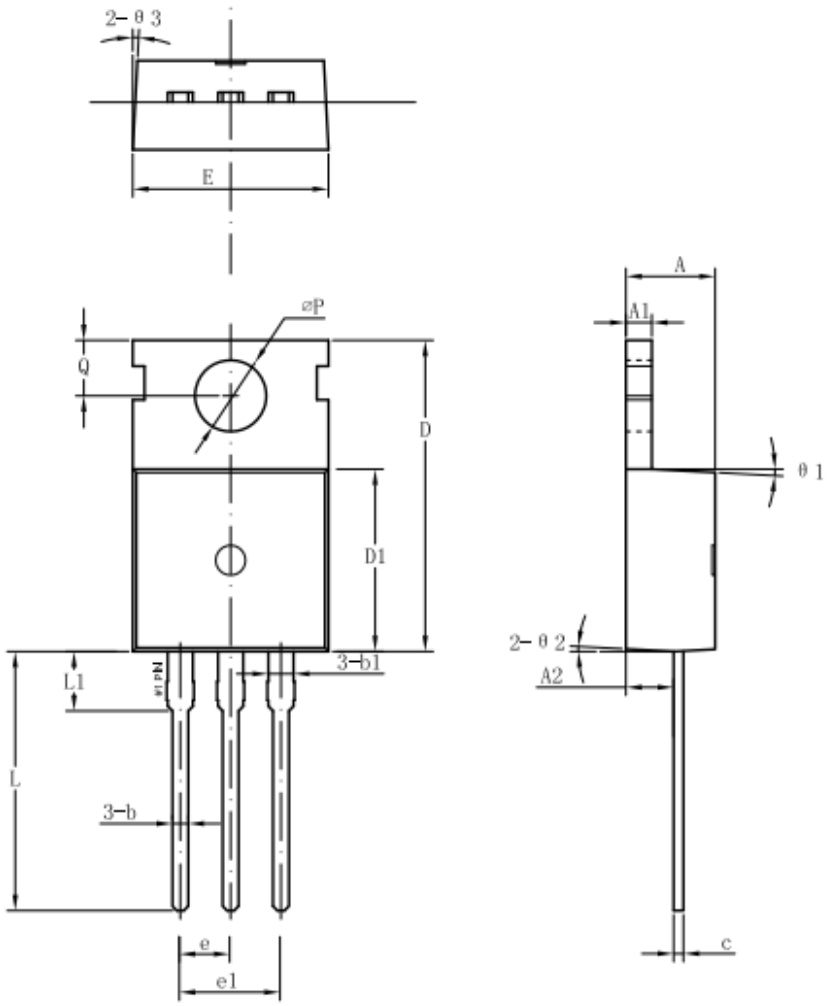


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	0.90	1.10	1.20
b	0.35	0.40	0.45
c	0.21	0.25	0.34
D			5.10
D1	4,80	4.90	5.00
D2	3.91	4.01	4.11
e	1.17	1.27	1.37
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.34	3.44	3.54
H	0.51	0.61	0.71
K	1.10		
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
L2			0.10
P	1.00	1.10	1.20
θ	8°	10°	12°

1.2mΩ, 45V, N-Channel Power MOSFET SRT045N012HS

Mechanical Dimensions

TO-220C(Package1) **Unit: mm**

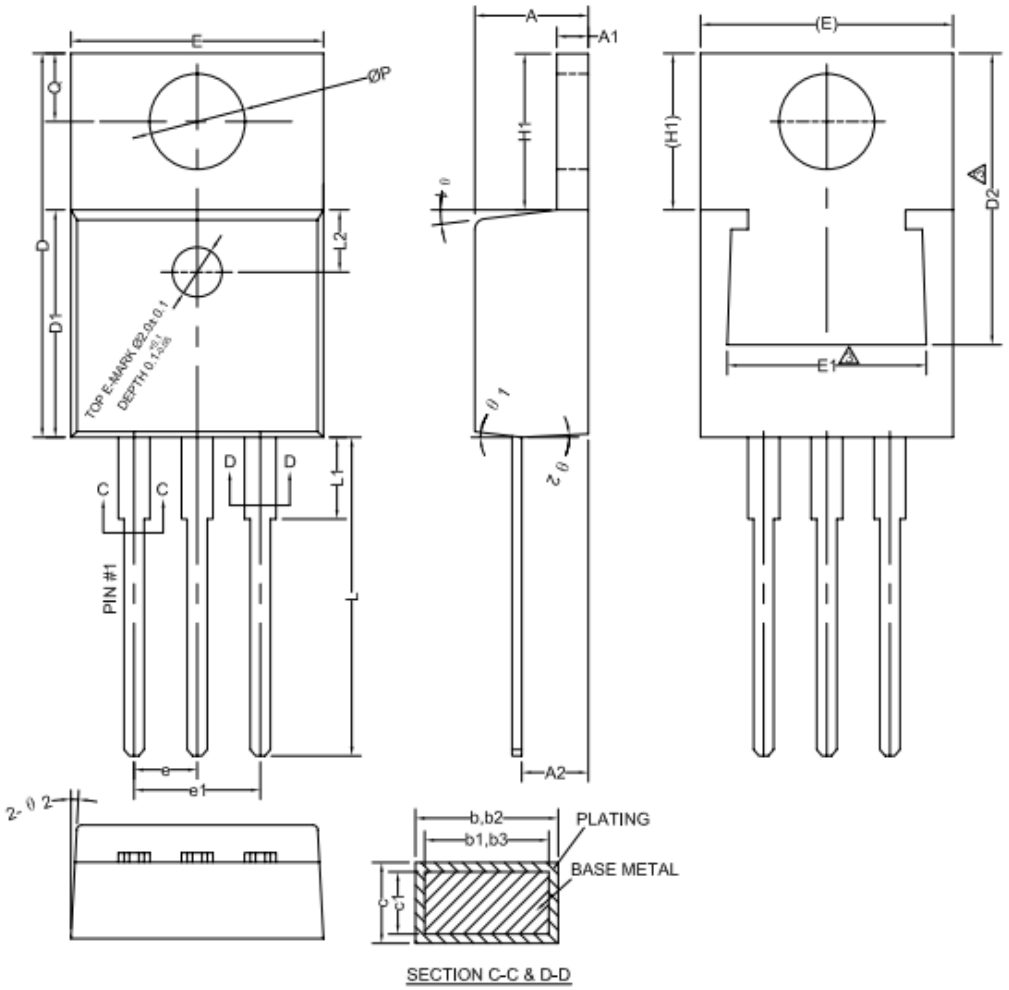


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.30	4.50	4.70	e	-	2.54	-
A1	1.25	1.30	1.40	e1	-	5.08	-
A2	2.20	2.40	2.60	L	12.60	13.08	13.60
b	0.70	0.80	0.95	L1	-	3.00	-
b1	-	1.27	-	ΦP	3.50	3.60	3.80
c	0.40	0.50	0.65	Q	2.60	2.80	3.00
D	15.20	15.70	16.20	Θ1	-	3°	-
D1	9.00	9.20	9.40	Θ2	-	3°	-
E	9.70	10.00	10.10	Θ3	-	3°	-

1.2mΩ, 45V, N-Channel Power MOSFET SRT045N012HS

Mechanical Dimensions

TO-220C(Package2) **Unit: mm**

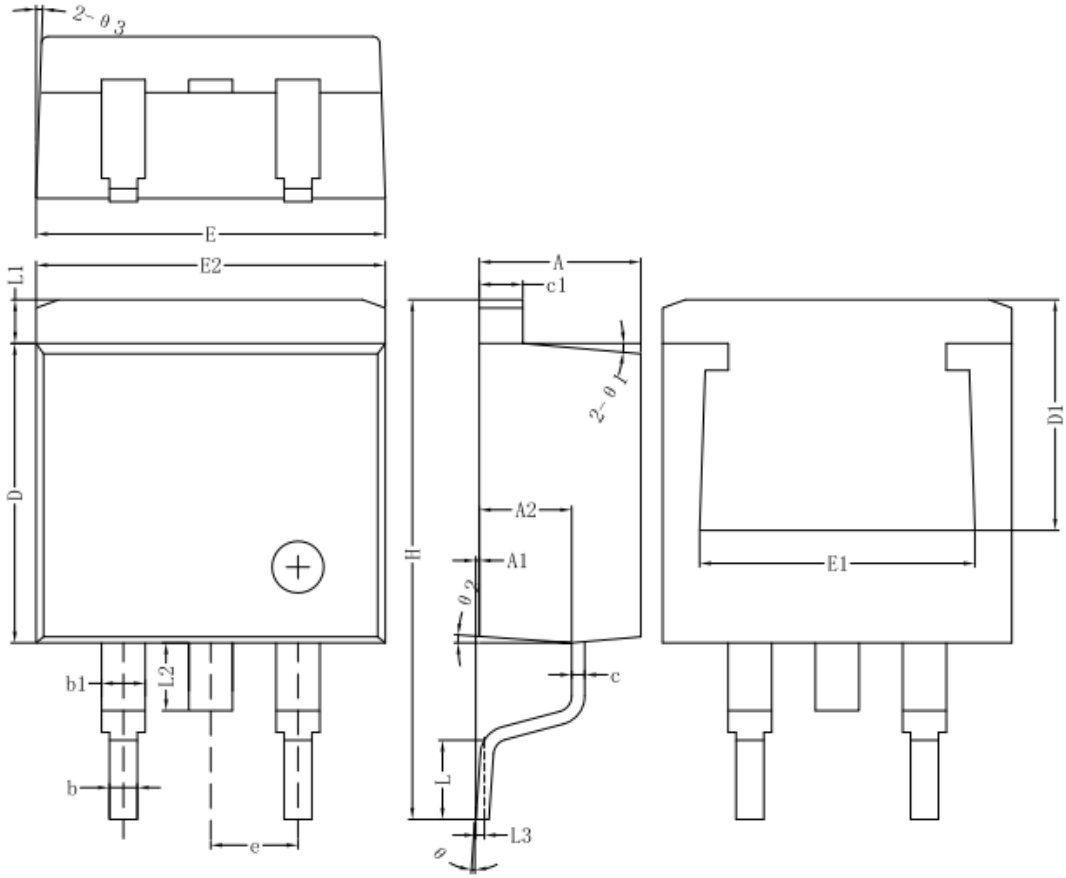


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.40	4.57	4.70	E	9.96	10.16	10.36
A1	1.22	-	1.32	E1	6.86	-	8.89
A2	2.59	2.69	2.79	e	2.44	2.54	2.64
b	0.77	-	0.90	e1	4.98	5.08	5.18
b1	0.76	0.81	0.86	H1	6.10	6.30	6.50
b2	1.23	-	1.36	L	12.70	-	13.12
b3	1.22	1.27	1.32	L1	-	-	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	θ1	5°	7°	9°
D2	11.40	-	12.88	θ2	1°	3°	5°

Mechanical Dimensions (Continued)

TO-263-2(Package1)

Unit: mm

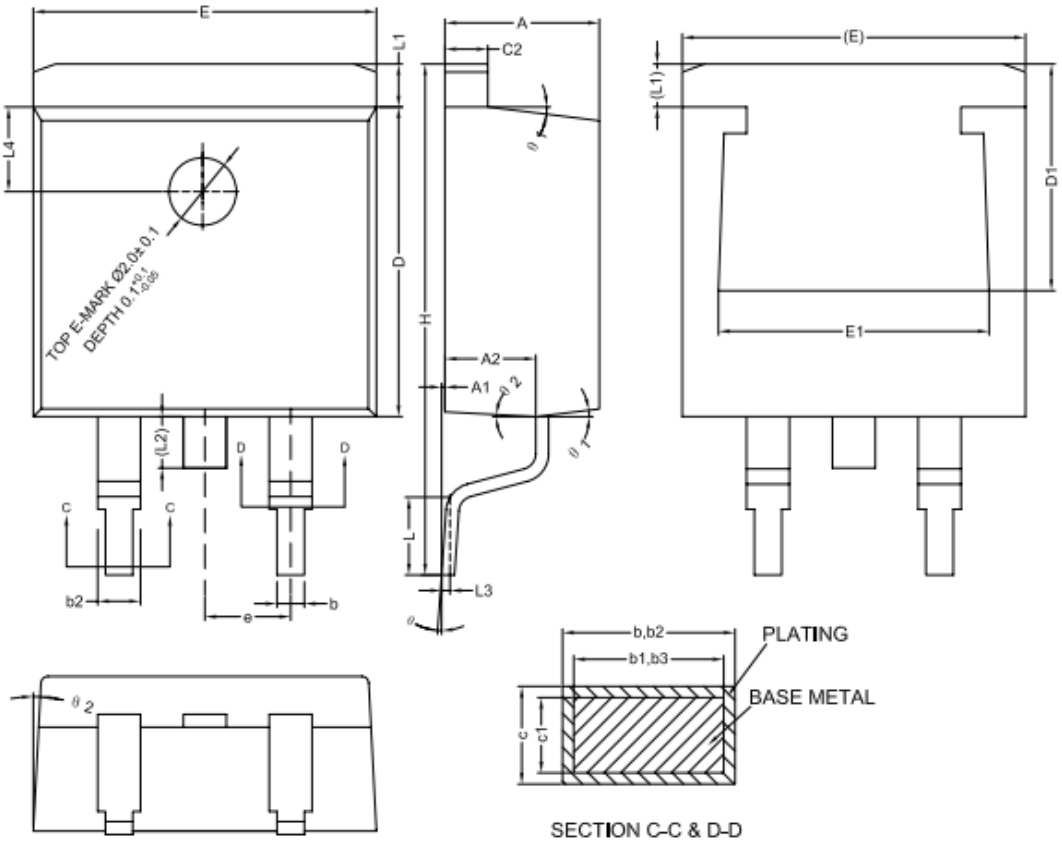


Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.55	4.70	4.85	E2	9.98	10.08	10.18
A1	0.00	0.10	0.25	e	-	2.54	-
A2	2.59	2.69	2.89	H	14.70	15.10	15.50
b	0.71	0.81	0.96	L	2.00	2.30	2.70
b1	-	1.27	-	L1	1.17	1.27	1.40
c	0.36	0.38	0.61	L2	-	-	2.20
c1	1.17	1.27	1.37	L3	-	0.25BSC	-
D	8.55	8.70	8.85	Θ	0°	-	8°
D1	-	7.20	-	Θ1	-	5°	-
E	10.01	10.16	10.31	Θ2	-	4°	-
E1	-	7.8	-	Θ3	-	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	Θ	0°	-	8°
D	9.05	9.15	9.25	Θ1	5°	7°	9°
D1	6.60	-	-	Θ2	1°	3°	5°

1.2mΩ, 45V, N-Channel Power MOSFET SRT045N012HS

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