9.0mΩ, 200V, N-Channel Power MOSFET SRT20N090H

General Description

The Sanrise SRT20N090H 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 SRT20N090H break down voltage is 200V and it has a high rugged avalanche characteristics. The SRT20N090H is available in TO-220C and TO-263-2 packages.

Features

- Ultra Low

$R_{DS(ON)\_TYP}$ = 7.0mΩ, TO-220C @V_{GS} = 10V.

$R_{DS(ON)\_TYP}$ = 6.9mΩ, TO-263-2@V_{GS} = 10V.

- Ultra Low Gate Charge, Qg=52.6nC typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved
- Non-automotive Qualified

Application

- Server/Telecom
- High Power Supply
- Synchronous Rectifier
- BMS

Symbol

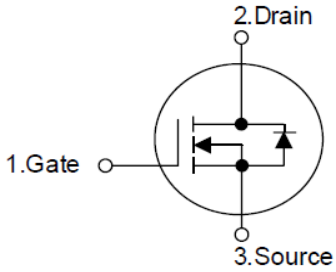
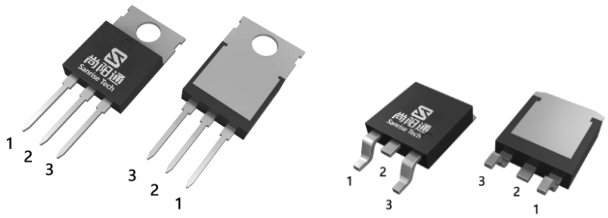


Figure 1 Symbol of SRT20N090H

Package Type



TO-220C TO-263-2

Figure 2 Package Type of SRT20N090H

Ordering Information

SRT20N090H□□–□

Circuit Type

Package

TC: TO-220C

S2: TO-263-2

E: Lead Free

G: Green

Blank: Tube

TR: Tape & Reel

Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
TO-220C	SRT20N090HTC-E	SRT20N090HTC-G	SRT20N090HTCE	SRT20N090HTCG	Tube
TO-263-2	SRT20N090HS2TR-E	SRT20N090HS2TR-E	SRT20N090HS2E	SRT20N090HS2E	Tape &Reel

9.0mΩ, 200V, N-Channel Power MOSFET SRT20N090H

Absolute Maximum Ratings

Parameter		Symbol	Rating		Unit
Drain-Source Voltage		V_{DSS}	200		V
Gate-Source Voltage		V_{GSS}	±20		V
Continuous Drain Current, Package limited	T_C=25ºC	I_D	TO-220C	120	A
			TO-263-2	120	
	T_C=100ºC		TO-220C	77	
			TO-263-2	77	
Continuous Drain Current, Silicon	T_C=25ºC		TO-220C	121	
			TO-263-2	121	
Pulsed Drain Current (Note 2)		I_{DM}	TO-220C	480	A
			TO-263-2	480	
Max Power Dissipation		P_D	265		W
Avalanche Destructive Energy, Single Pulse (Note 4)		E_{AS_Limit}	441		mJ
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	36		mJ
Avalanche Energy, Repetitive (Note 2)		E_{AR}	0.04		mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	12.0		A
Continuous Diode Forward Current		I_S	120		A
Diode Pulse Current		$I_{S.PULSE}$	480		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. Repetitive Rating: Pulse width limited by maximum junction temperature
3. I_{AS}= 12A, V_{DD}= 75V, R_G= 25Ω, Starting T_J= 25°C
4. I_{AS_Limit}= 42A, V_{DD} = 75V, R_G = 25Ω, Starting T_J = 25°C

Thermal Resistance

Parameter		Symbol	Min	Typ	Max	Unit
Thermal Resistance，Junction-to-Case	TO-220C	R_{thJC}			0.47	ºC/W
	TO-263-2				0.47	
Thermal Resistance，Junction-to-Ambient		R_{thJA}			62	

9.0mΩ, 200V, N-Channel Power MOSFET SRT20N090H

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=1mA	200			V
Zero Gate Voltage Drain Current		I_{DSS}	V_{DS}=160V, V_{GS}=0V			1	uA
Gate-Body Leakage Current	Forward	I_{GSSF}	V_{GS}=20V, V_{DS}=0V			100	nA
	Reverse	I_{GSSR}	V_{GS}=-20V, V_{DS}=0V			-100	
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	TO-220C	$R_{DS(ON)}$	V_{GS}=10V, I_D=60A		7.0	9.0	mΩ
	TO-263-2				6.9	9.0	mΩ
Gate Resistance		R_G	f=1MHz, Open Drain		1.5		Ω
Dynamic Characteristics							
Input Capacitance		C_{ISS}	V_{DS}=100V, V_{GS}=0V, f=1MHz		3.7		nF
Output Capacitance		C_{OSS}			1.2		nF
Reverse Transfer Capacitance		C_{RSS}			6		pF
Effective output capacitance, energy related NOTE5		$C_{O(er)}$	V_{GS}=0V, V_{DS}=0…160V		1.2		nF
Effective output capacitance, time related NOTE6		$C_{O(tr)}$			1.9		
Turn-on Delay Time		$t_{d(on)}$	V_{DD}=100V, I_D=60A R_G=1.6Ω, V_{GS}=10V		12		ns
Rise Time		t_r			9		
Turn-off Delay Time		$t_{d(off)}$			25		
Fall Time		t_f			7		
Gate Charge Characteristics							
Gate to Source Charge		Q_{gs}	V_{DD}=100V, I_D=60A V_{GS}=0 to 10V		19.1		nC
Gate to Drain Charge		Q_{gd}			10.9		
Gate Charge Total		Q_g			52.6		
Gate Plateau Voltage		$V_{plateau}$			5.1		V
Gate Charge Total, sync FET		Q_g	V_{DD}=0.1V, V_{GS}=0 to 10V		44.8		nC
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V, I_{SD}=60A		0.87	1.1	V
Reverse Recovery Time		t_{rr}	V_R=100V, I_F=60A dI$_F$/dt=100A/us		180		ns
Reverse Recovery Charge		Q_{rr}			500		nC
Peak Reverse Recovery Current		I_{rrm}			5.5		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 160V
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 160 V

Typical Performance Characteristics

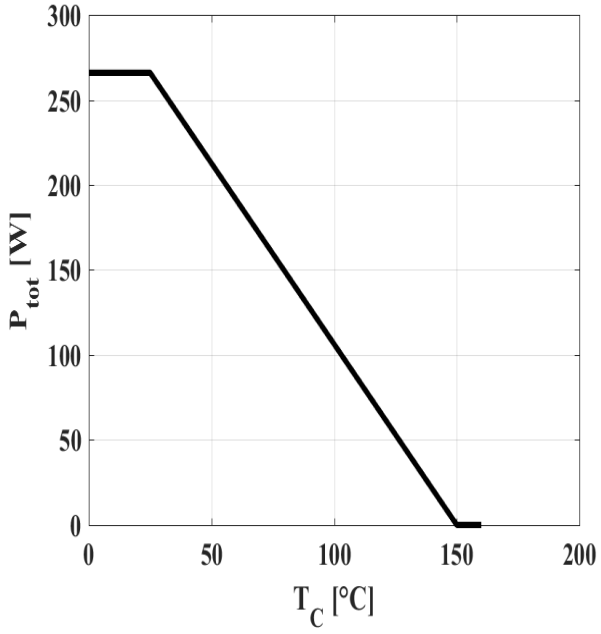
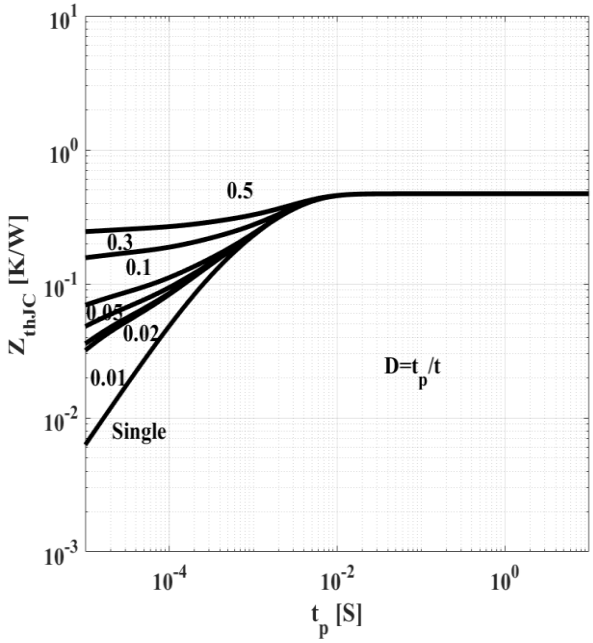
Figure 3: Power Dissipation	Figure 4: Max. Transient Thermal Impedance
	
$P_{tot}=f(T_C)$	$Z(_{thJC})=f(t_p)$;parameter:$D=t_p/T$

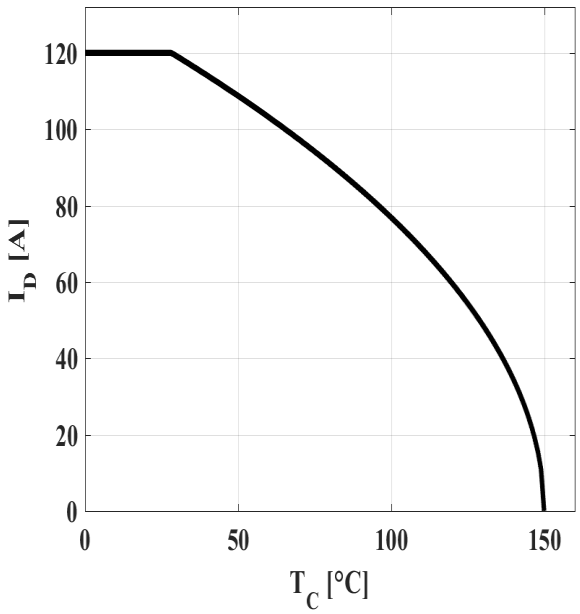
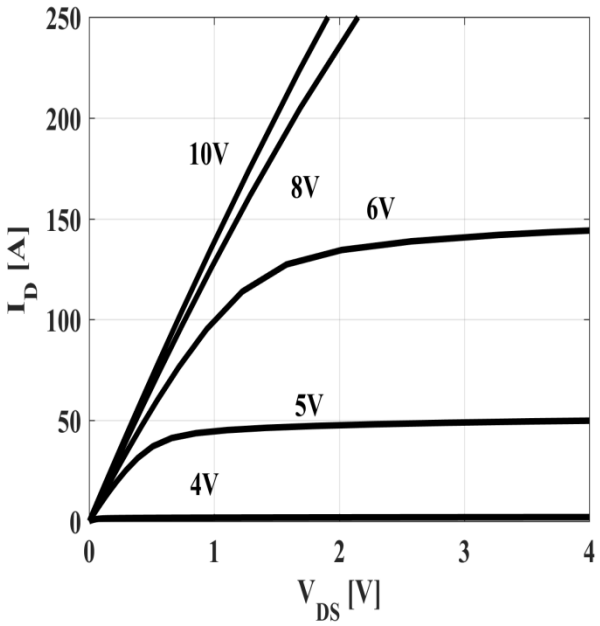
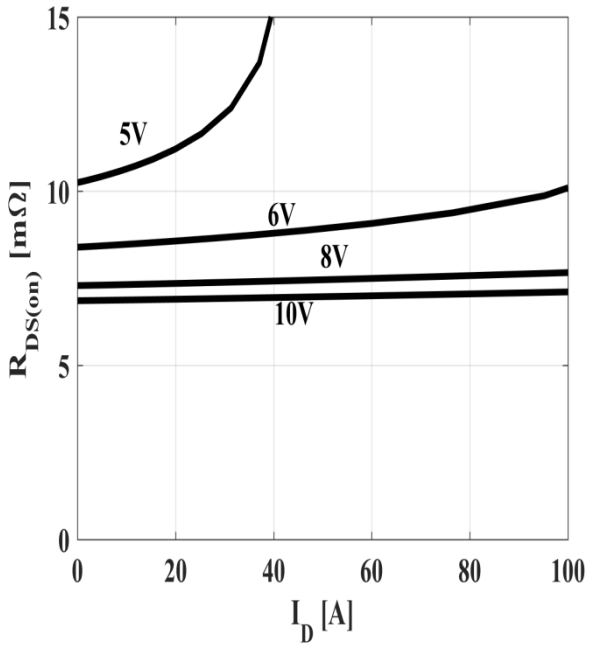
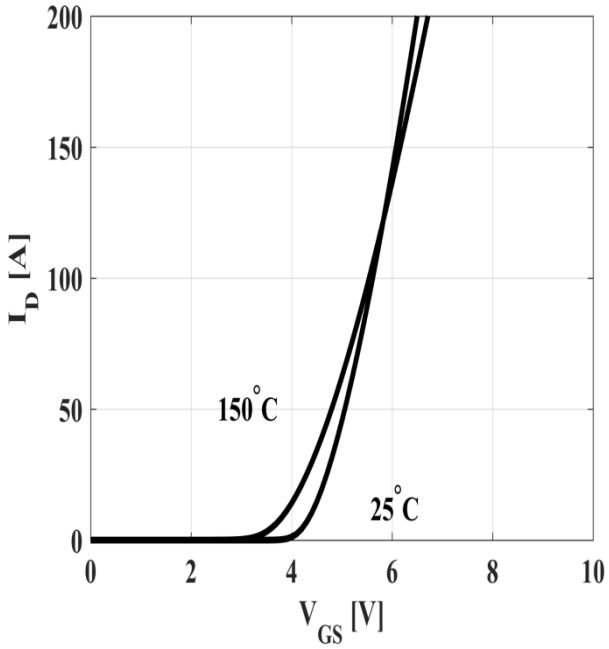
Figure5: Drain Current	Figure6: Typ. Output Characteristics
	
$I_D=f(T_C)$;$V_{GS}\geq 10V$	$I_D=f(V_{DS})$;Tj=25ºC; parameter:V_{GS}

Figure7: Typ. Drain-Source On-State Resistance



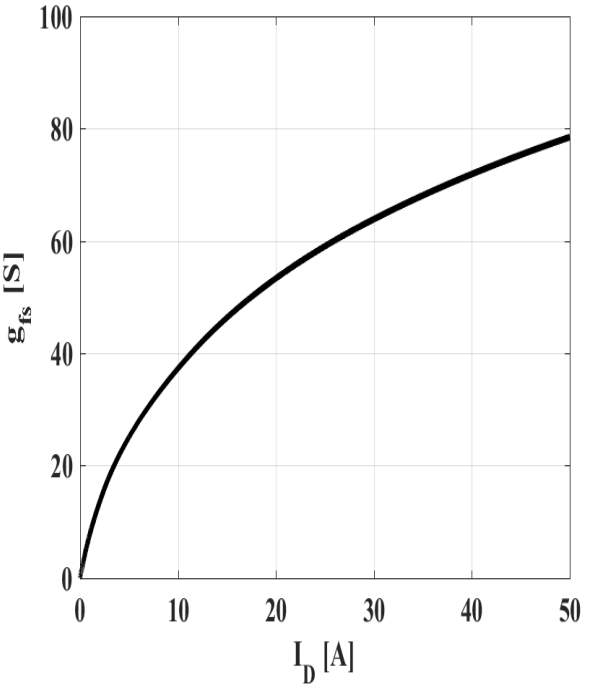
$R_{DS(ON)}=f(I_D)$;T_j=25ºC; parameter:V_{GS}

Figure8: Typ. Transfer Characteristics



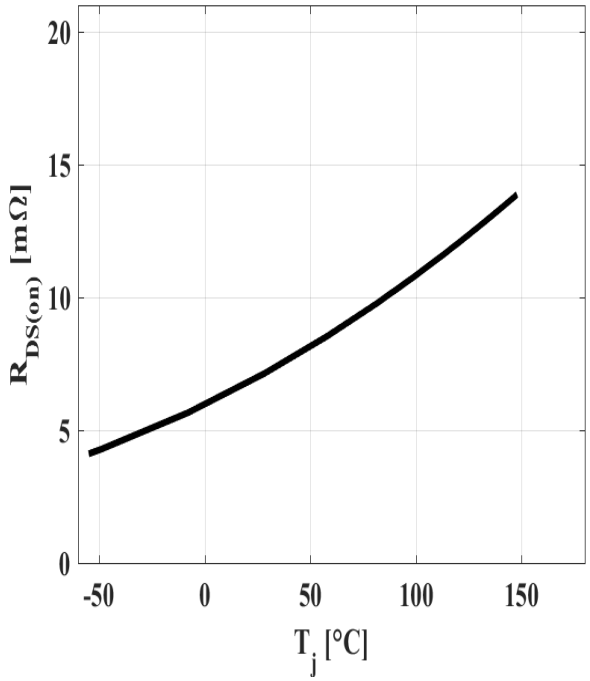
$I_D=f(V_{GS})$; $|V_{DS}|>2|I_D|R_{DS(on)max}$; parameter: T_j

Figure9: Typ. Forward Transconductance



$g_{fs}=f(I_D)$; T_j=25℃

Figure10: Typ. Drain-Source On-State Resistance



$R_{DS(ON)}=f(T_j)$;I_D=60A;V_{GS}=10V

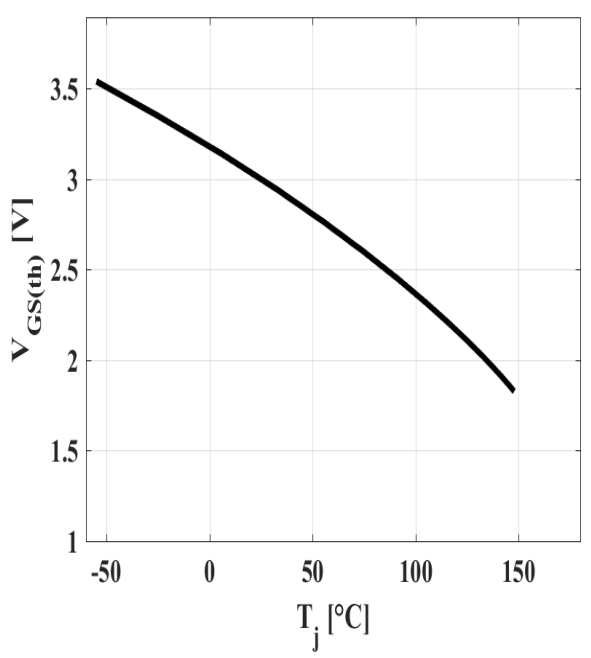
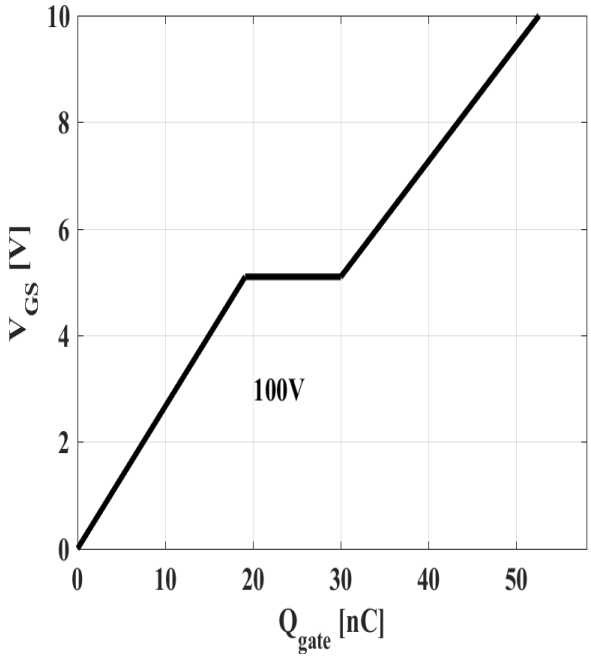
Figure11: Typ.Gate Threshold Voltage	Figure 12: Typ. Gate Charge
	
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; I_{DS}=250μA	V_{GS}= f(Q_{gate}), I_D=60A pulsed

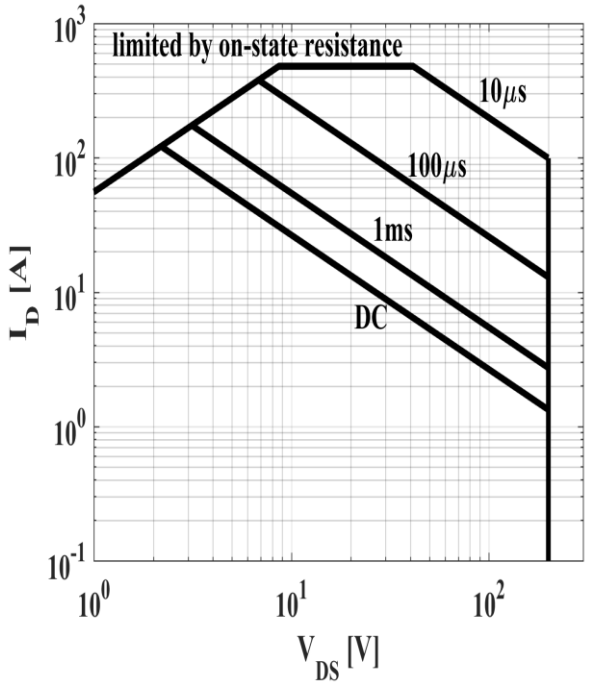
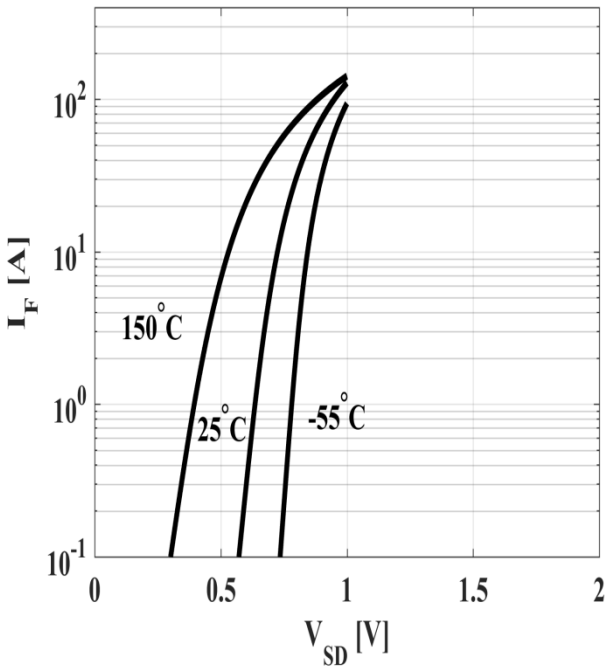
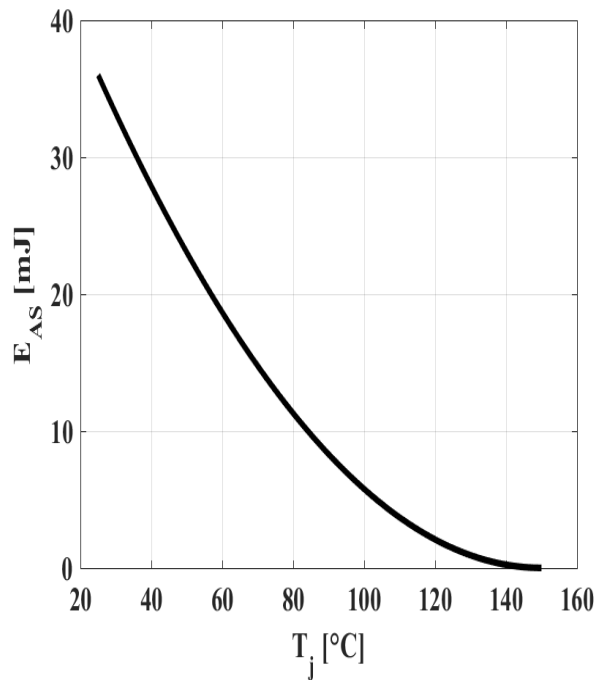
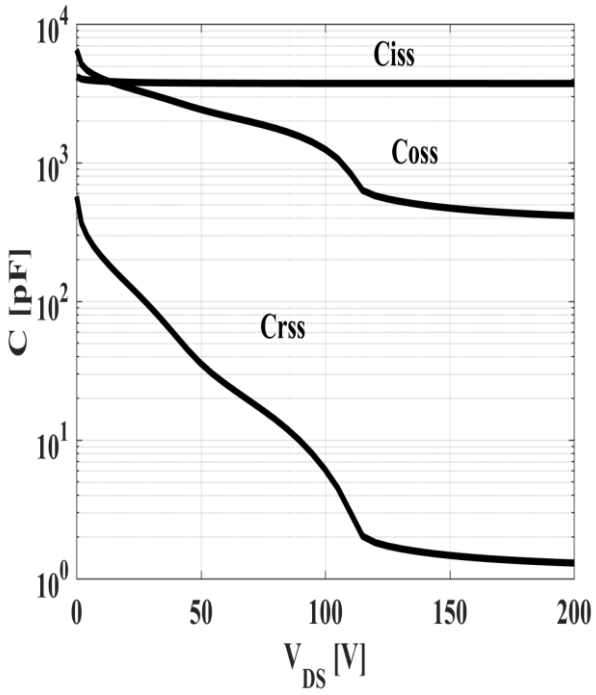
Figure 13: Safe Operating Area	Figure 14: Forward Characteristics of Reverse Diode
	
I_D = f(V_{DS}); T_c= 25ºC; V_{GS}>7V; parameter t_p	I_F=f(V_{SD}); parameter: T_j

Figure 15: Avalanche Energy



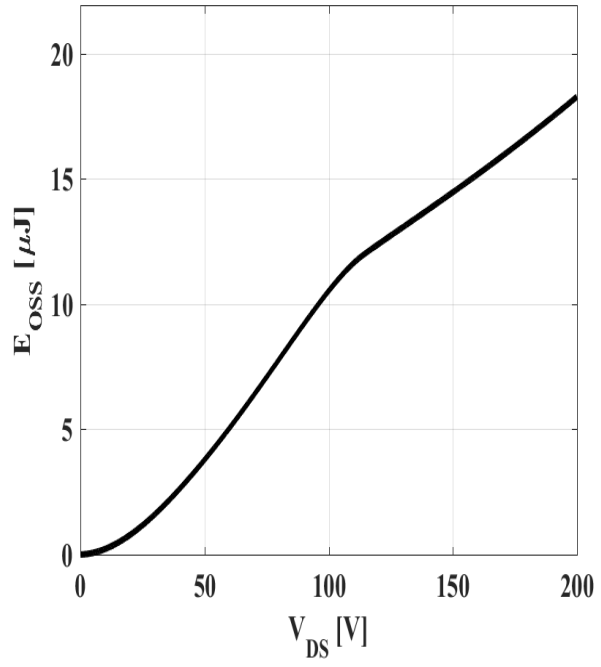
$E_{AS}=f(T_j)$;I_D=40.0A; V_{DD}=75V

Figure 16: Typ. Capacitances



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

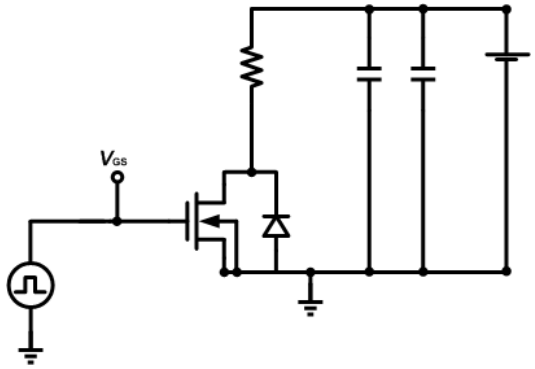
Figure 17: C_{OSS} Stored Energy

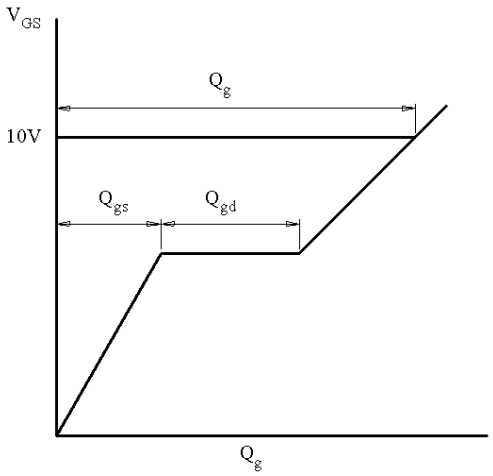


$E_{OSS}=f(V_{DS})$

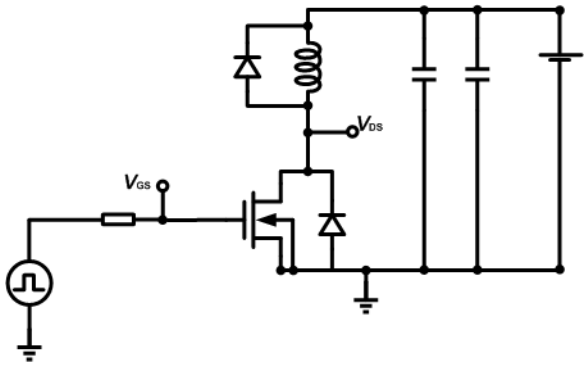
Test Circuits

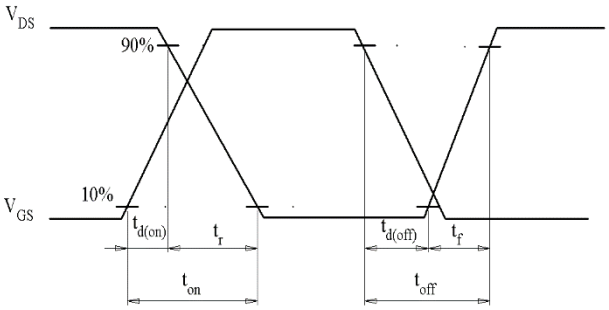
1. Gate Charge Test Circuit & Waveform



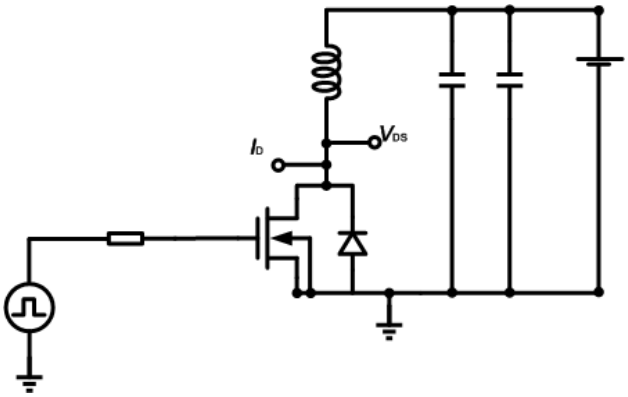


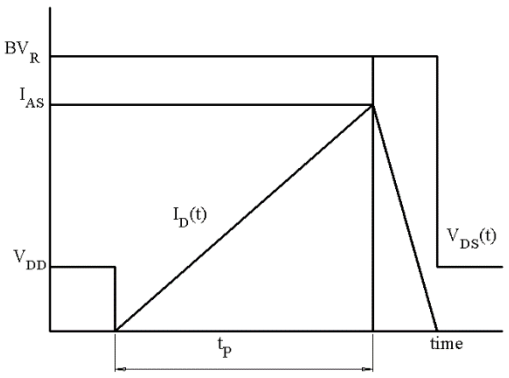
2. Switch Time Test Circuit



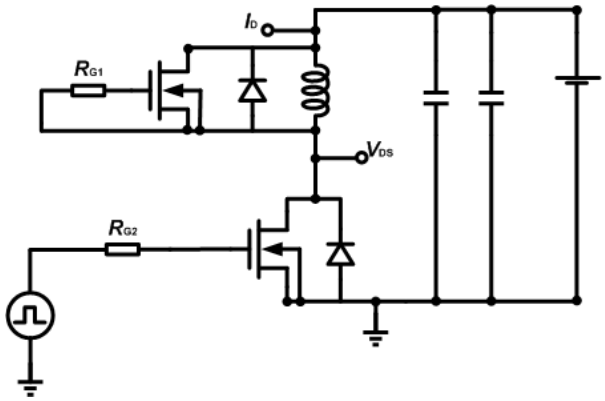


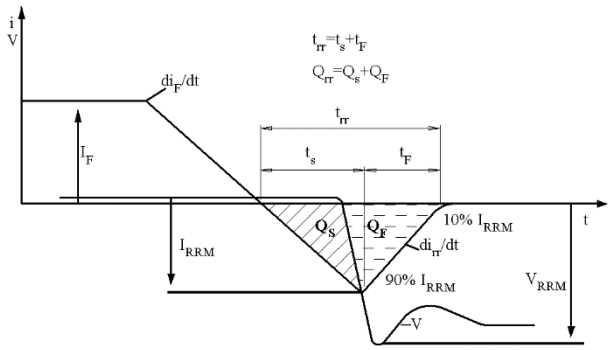
3. Unclamped Inductive Switching Test Circuit & Waveforms





4. Test Circuit and Waveform for Diode Characteristics



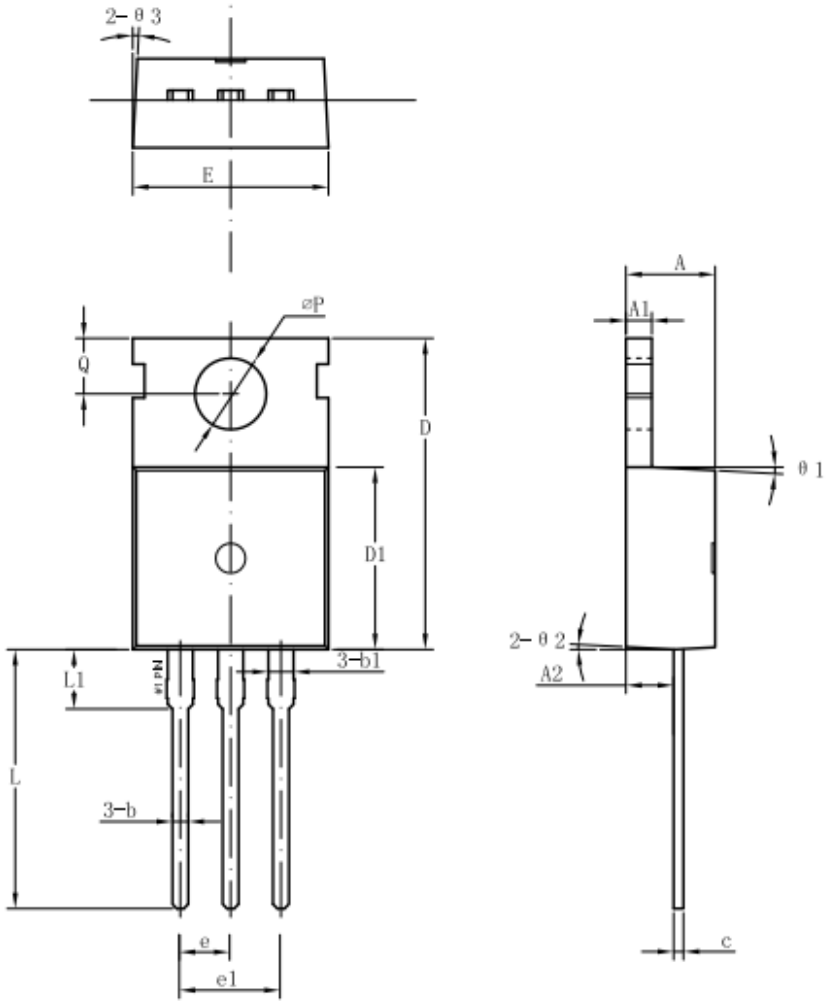


9.0mΩ, 200V, N-Channel Power MOSFET SRT20N090H

Mechanical Dimensions

TO-220C(Package1)

Unit: mm

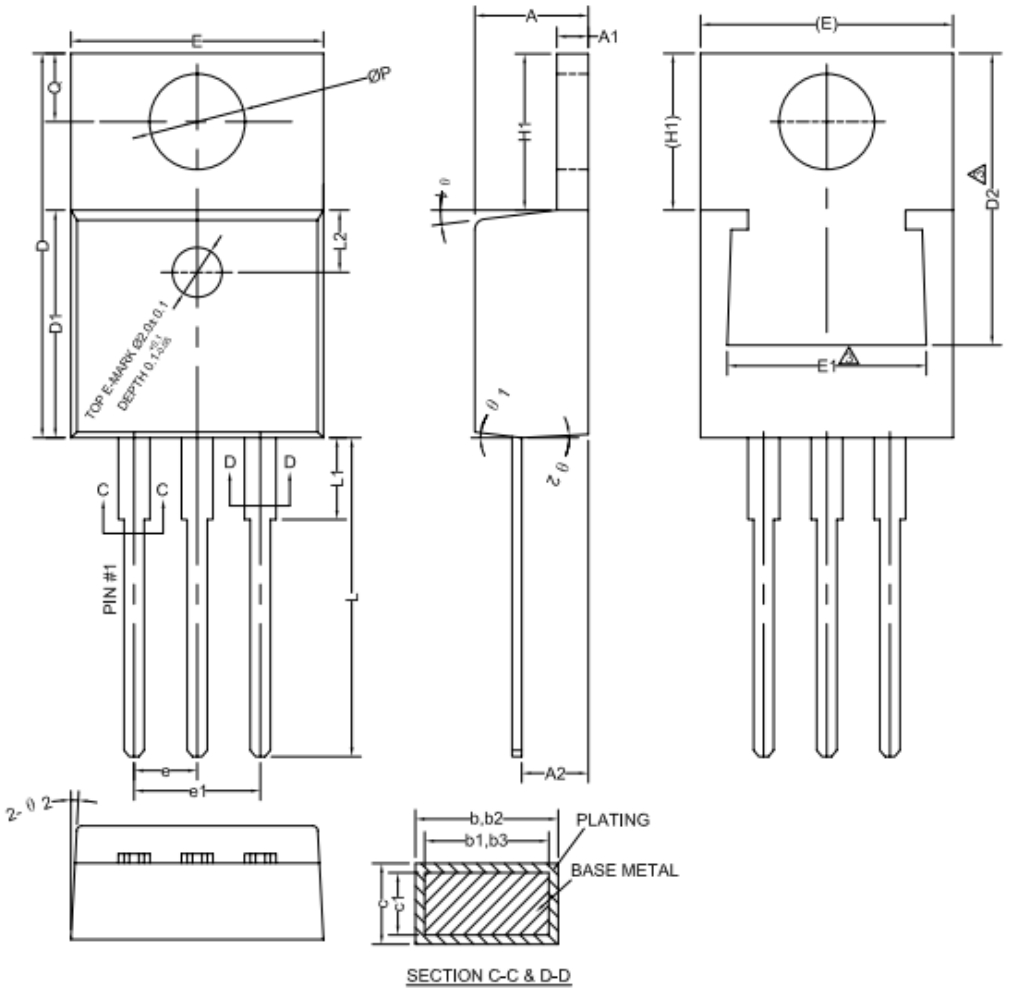


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.30	4.50	4.70	e	-	2.54	-
A1	1.25	1.30	1.40	e1	-	5.08	-
A2	2.20	2.40	2.60	L	12.60	13.08	13.60
b	0.70	0.80	0.95	L1	-	3.00	-
b1	-	1.27	-	ΦP	3.50	3.60	3.80
c	0.40	0.50	0.65	Q	2.60	2.80	3.00
D	15.20	15.70	16.20	Θ1	-	3°	-
D1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

9.0mΩ, 200V, N-Channel Power MOSFET SRT20N090H

Mechanical Dimensions

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



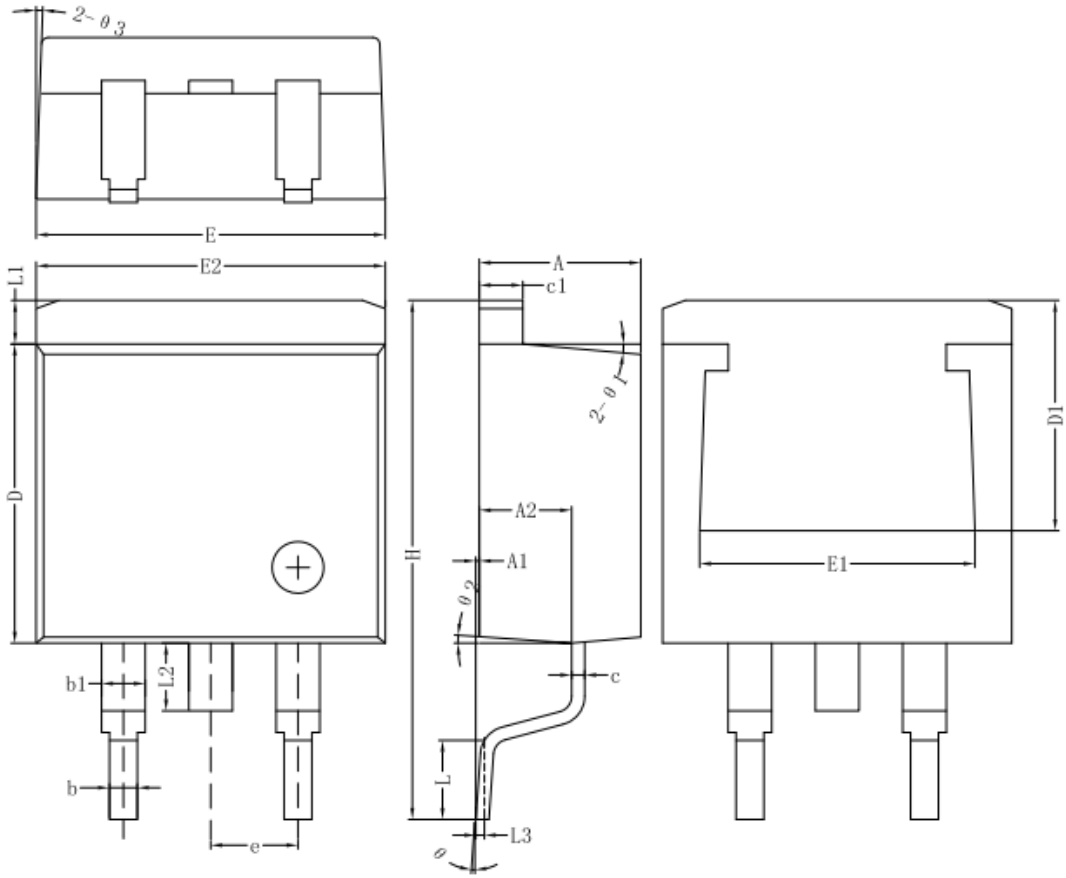
Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.40	4.57	4.70	E	9.96	10.16	10.36
A1	1.22	-	1.32	E1	6.86	-	8.89
A2	2.59	2.69	2.79	e	2.44	2.54	2.64
b	0.77	-	0.90	e1	4.98	5.08	5.18
b1	0.76	0.81	0.86	H1	6.10	6.30	6.50
b2	1.23	-	1.36	L	12.70	-	13.12
b3	1.22	1.27	1.32	L1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

9.0mΩ, 200V, N-Channel Power MOSFET **SRT20N090H**

Mechanical Dimensions (Continued)

TO-263-2(Package1)

Unit: mm



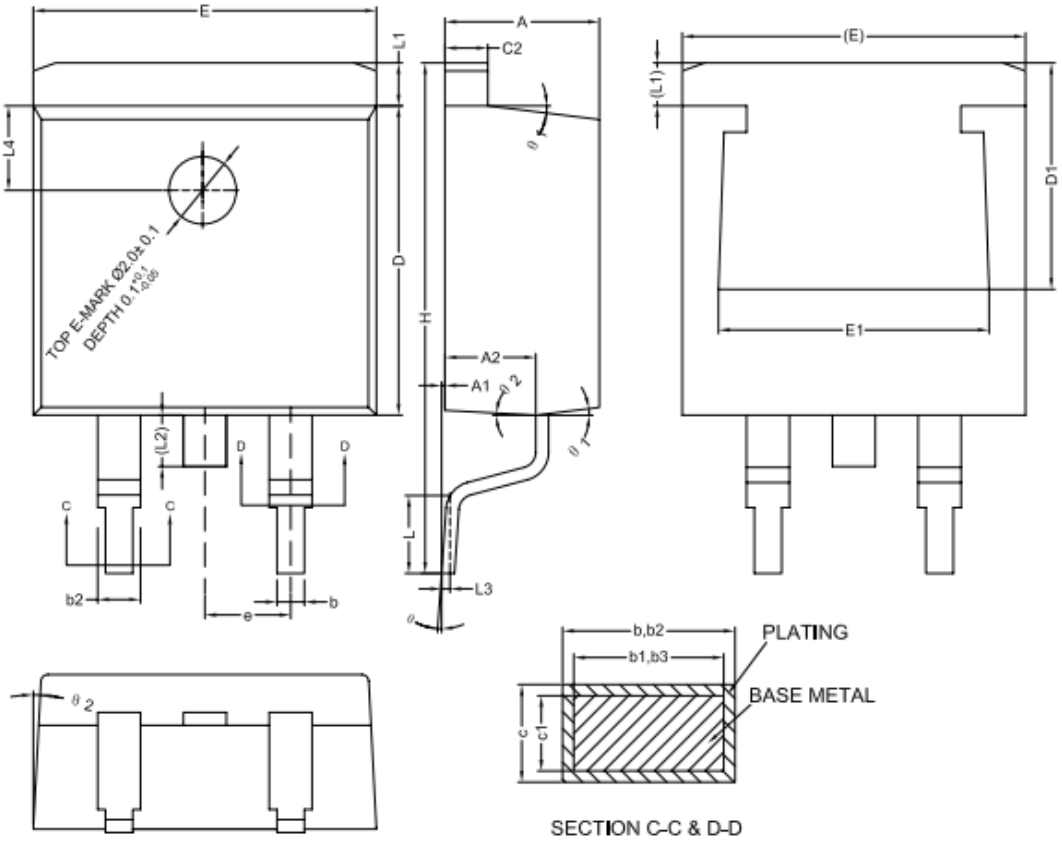
Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.55	4.70	4.85	E2	9.98	10.08	10.18
A1	0.00	0.10	0.25	e	-	2.54	-
A2	2.59	2.69	2.89	H	14.70	15.10	15.50
b	0.71	0.81	0.96	L	2.00	2.30	2.70
b1	-	1.27	-	L1	1.17	1.27	1.40
c	0.36	0.38	0.61	L2	-	-	2.20
c1	1.17	1.27	1.37	L3	-	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°	-

9.0mΩ, 200V, N-Channel Power MOSFET **SRT20N090H**

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°

9.0mΩ, 200V, N-Channel Power MOSFET SRT20N090H

Sanrise Technology Limited Company

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