22mΩ, 600V, Super Junction N-Channel Power MOSFET SRC60R022FBS

General Description

The Sanrise SRC60R022FBS is a high voltage power MOSFET, fabricated using advanced super junction 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 outstanding efficiency.

The SRC60R022FBS break down voltage is 600V and it has a high rugged avalanche characteristics.

The SRC60R022FBS is available in TO-247-4 package.

Symbol

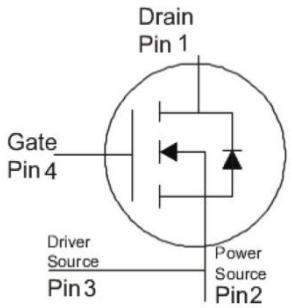


Figure 1 Symbol of SRC60R022FBS

Features

- Ultra Low $R_{DS(ON)}$ = 22mΩ @ V_{GS} = 10V.
- Vds@Tjmax=650v.
- Ultra Low Gate Charge, Qg=168nC typ.
- Intrinsic Fast-Recovery Body Diode
- Fast switching capability
- Robust design with better EAS performance
- Non-automotive Qualified
- Ultra-fast body diode

Application

- EV Charger
- Server / Telecom

Package Type

TO-247-4

Figure 2 Package Type of SRC60R022FBS

Ordering Information

SRC60R022FBS□□–□

Circuit Type

Package
T4: TO-247-4

E: Lead Free
G: Green

Blank: Tube
TR: Tape & Reel

Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
TO-247-4	SRC60R022FBST4-E	SRC60R022FBST4-G	SRC60R022FBST4E	SRC60R022FBST4G	Tube

22mΩ, 600V, Super Junction N-Channel Power MOSFET SRC60R022FBS

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DSS}	600	V
Gate-Source Voltage		V_{GSS}	±30	V
Gate-Source Voltage (dynamic), AC (f>1 Hz)		V_{GSS}	±30	V
Power Dissipation(T_C=25ºC,TO-247-4)		P_{tot}	657.8	W
Continuous Drain Current	T_C=25ºC	I_D	115	A
	T_C=100ºC		72.7	
	T_C=125ºC		51.4	
Pulsed Drain Current (Note 2)		I_{DM}	345	A
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	600	mJ
Avalanche Energy, Single Pulse (Note 4)		E_{AS}	3802	mJ
Avalanche Energy, Repetitive (Note 2)		E_{AR}	1.6	mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	8.5	A
Continuous Diode Forward Current		I_S	115	A
Diode Pulse Current		$I_{S.PULSE}$	345	A
MOSFET dv/dt Ruggedness, V_{DS}<=480V		dv/dt	80	V/ns
Reverse Diode dv/dt, V_{DS}<=480V, I_{SD}<=I_D		dv/dt	50	V/ns
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} = 7.8A, V_{DD} = 60V, R_G = 25Ω, Starting T_J = 25°C. Finish goods test condition.
4. I_{AS} = 19.5A, V_{DD} = 60V, R_G = 25Ω, Starting T_J = 25°C. Typical Eas.

Thermal characteristics

Parameter	Symbol	Package	Value (Max.)	Unit
Thermal resistance, junction - case	R_{thJC}	TO-247-4	0.21	ºC /W
Thermal resistance, junction – ambient	R_{thJA}	TO-247-4	62	ºC /W

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	600			V
Zero Gate Voltage Drain Current		I_{DSS}	V_{DS}=600V, V_{GS}=0V			10	uA
Gate-Body Leakage Current	Forward	I_{GSSF}	V_{GS}=30V, V_{DS}=0V			200	nA
	Reverse	I_{GSSR}	V_{GS}=-30V, V_{DS}=0V			-200	
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=3.0mA	3.0	4.0	5.0	V
Static Drain-Source On-Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=57A		18.6	22	mΩ
Gate Resistance		R_G	f=1MHz, Open Drain		1.6		Ω
Dynamic Characteristics							
Input Capacitance		C_{ISS}	V_{DS}=400V, V_{GS}=0V, f=100KHz		10.3		nF
Output Capacitance		C_{OSS}			206		pF
Effective output capacitance, energy related NOTE5		$C_{O(er)}$	V_{GS}=0V, V_{DS}=0…400V		301.4		pF
Effective output capacitance, time related NOTE6		$C_{O(tr)}$			1835.7		
Turn-on Delay Time		$t_{d(on)}$	V_{DD}=400V, I_D=57A R_G=1.8Ω, V_{GS}=10V		29		ns
Rise Time		t_r			26		
Turn-off Delay Time		$t_{d(off)}$			74		
Fall Time		t_f			6		
Gate Charge Characteristics							
Gate to Source Charge		Q_{gs}	V_{DD}=480V, I_D=57A V_{GS}=0 to 10V		78		nC
Gate to Drain Charge		Q_{gd}			46.5		
Gate Charge Total		Q_g			168		
Gate Plateau Voltage		$V_{plateau}$			6.5		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V, I_{SD}=57A		0.9	1.1	V
Reverse Recovery Time		t_{rr}	V_R=100V, I_F=57A dI_F/dt=100A/us		182		ns
Reverse Recovery Charge		Q_{rr}			1.43		uC
Peak Reverse Recovery Current		I_{rrm}			15.7		A

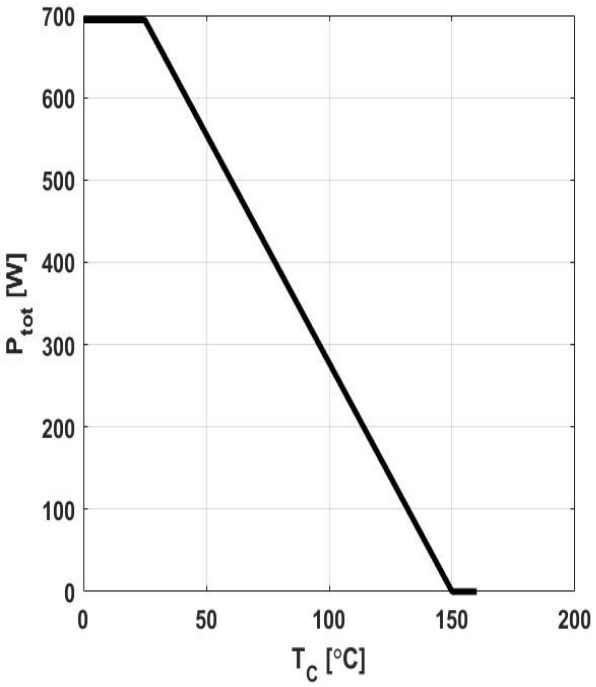
Note:

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 400V

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 400 V

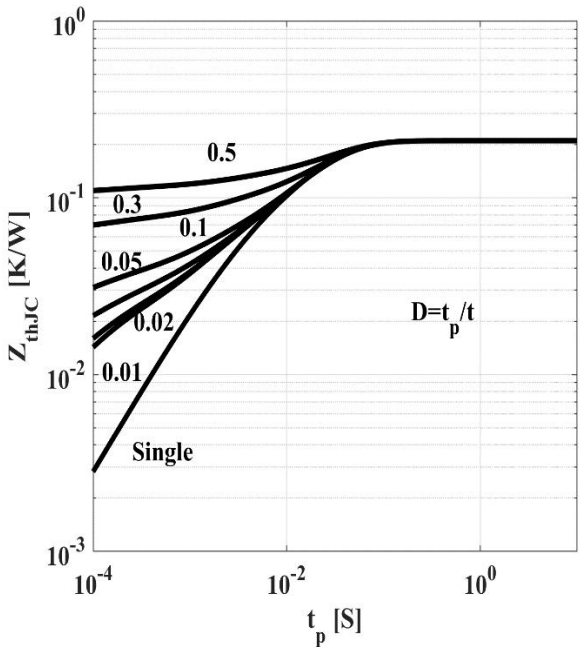
Typical Performance Characteristics

Figure 3: Power Dissipation



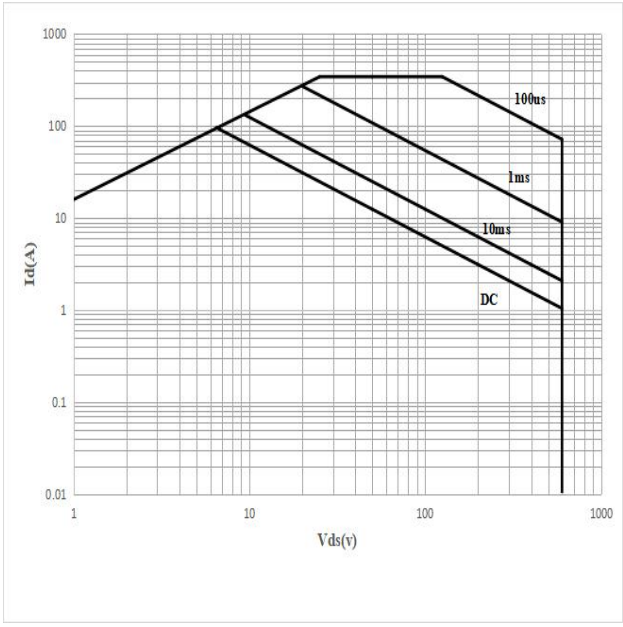
$P_{tot} = f(T_c)$

Figure 4: Max. Transient Thermal Impedance



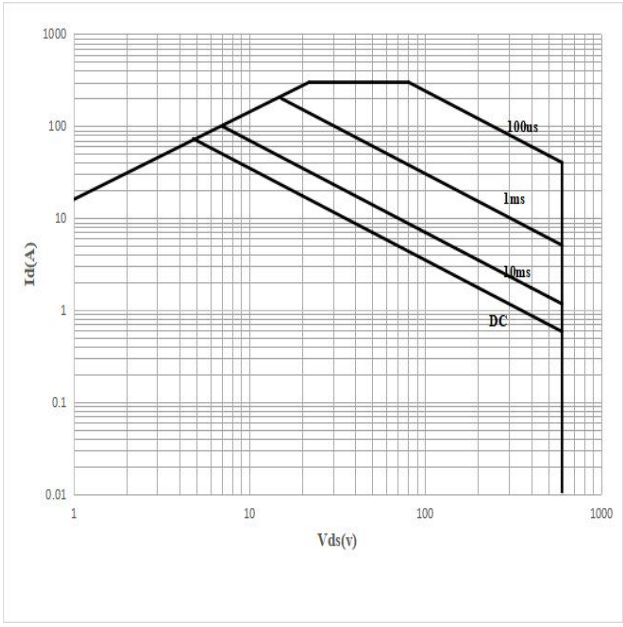
$Z_{(thJC)} = f(t_p)$; parameter: $D = t_p/T$

Figure 5: Safe Operating Area



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

Figure 6: Safe Operating Area



$I_D = f(V_{DS})$; T_c= 80ºC; V_{GS}>7V; parameter t_p

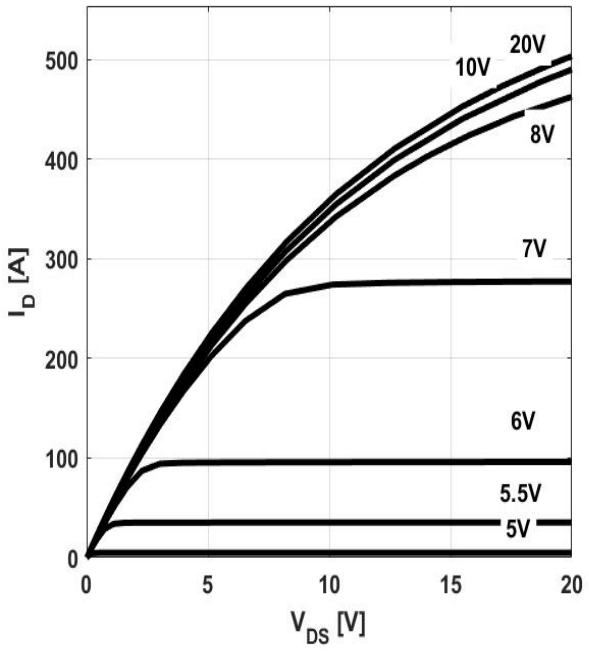
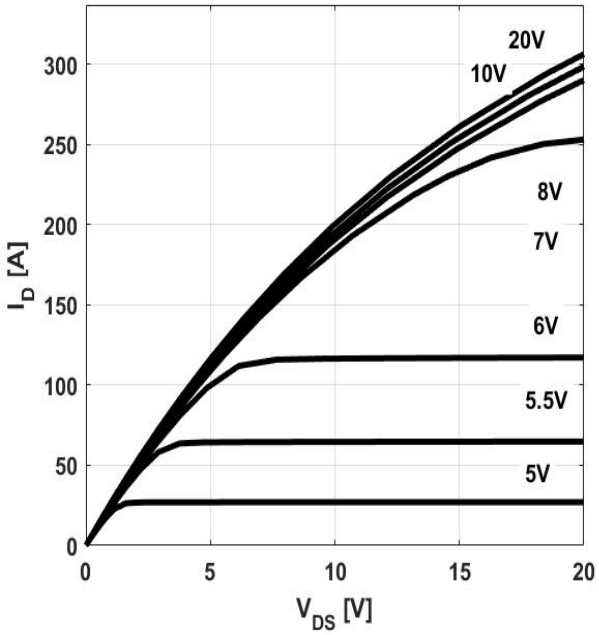
Figure 7: Typ. Output Characteristics	Figure 8: Typ. Output Characteristics
	
$I_D = f(V_{DS})$; Tj= 25ºC; parameter: V_{GS}	$I_D = f(V_{DS})$; T_j= 125ºC; parameter: V_{GS}

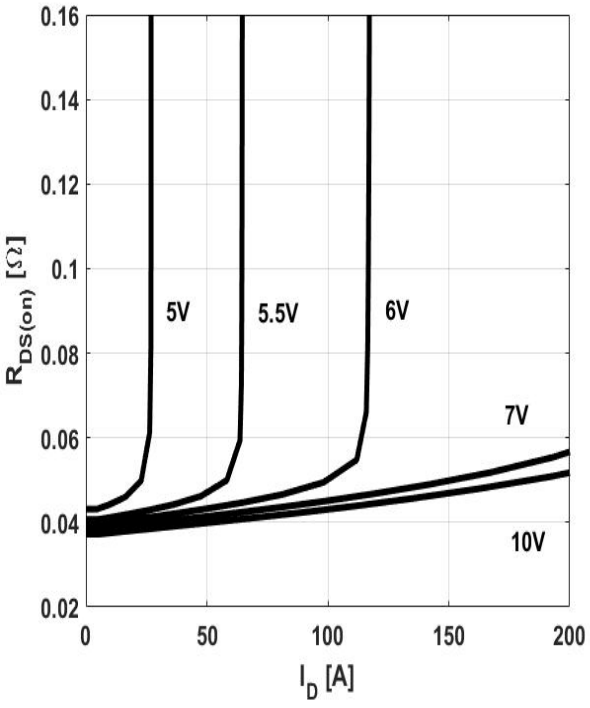
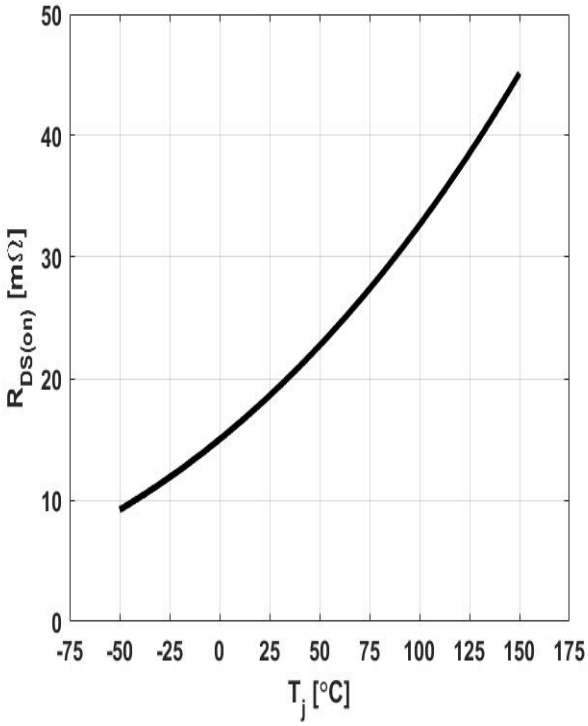
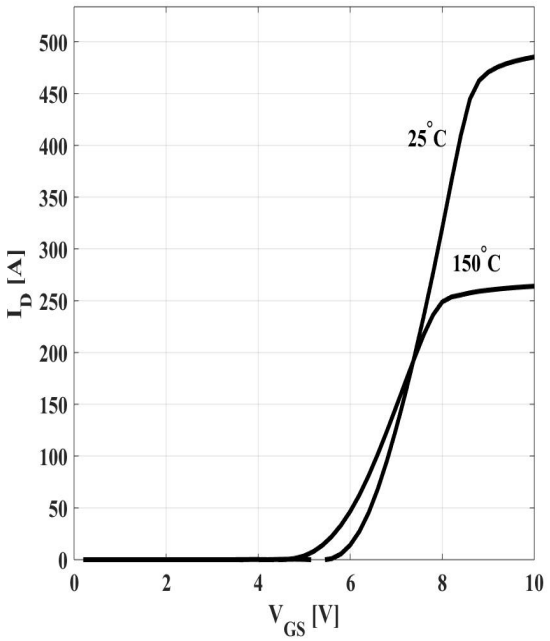
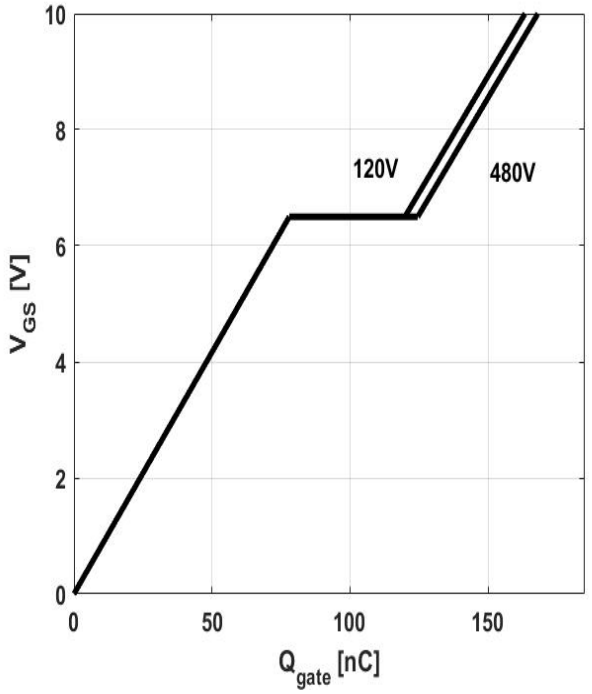
Figure 9: Typ. Drain-Source On-State Resistance	Figure 10: Typ. Drain-Source On-State Resistance
	
$R_{DS(ON)} = f(I_D)$; T_j=125ºC; parameter: V_{GS}	$R_{DS(ON)} = f(T_j)$; I_D=57A; V_{GS}=10V

Figure 11: Typ. Transfer Characteristics



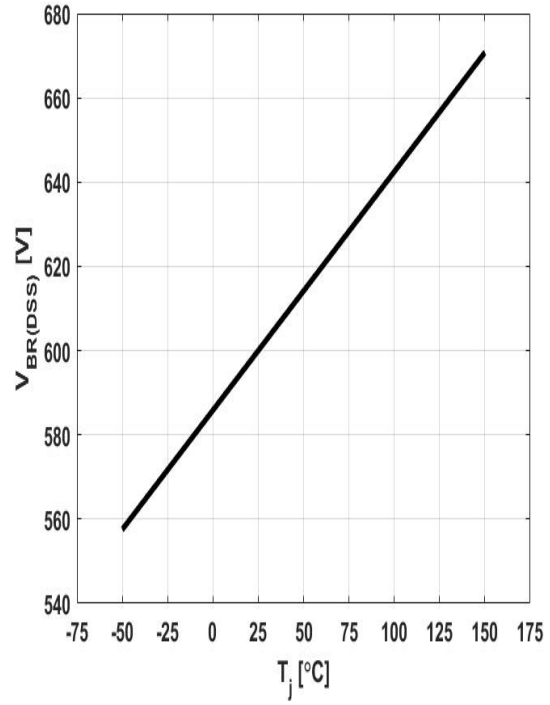
$I_D = f(V_{GS})$; $V_{DS} = 20V$

Figure 12: Typ. Gate Charge



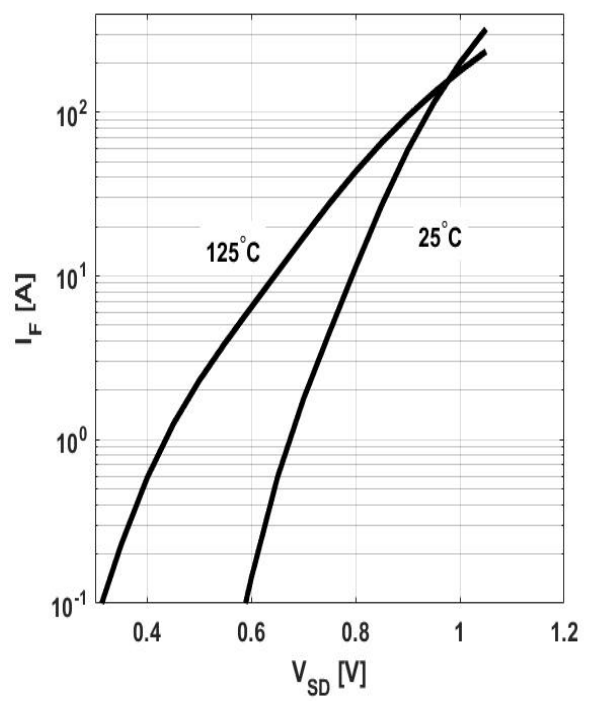
$V_{GS} = f(Q_{gate})$, $I_D = 57A$ pulsed

Figure 13: Drain-Source Breakdown Voltage



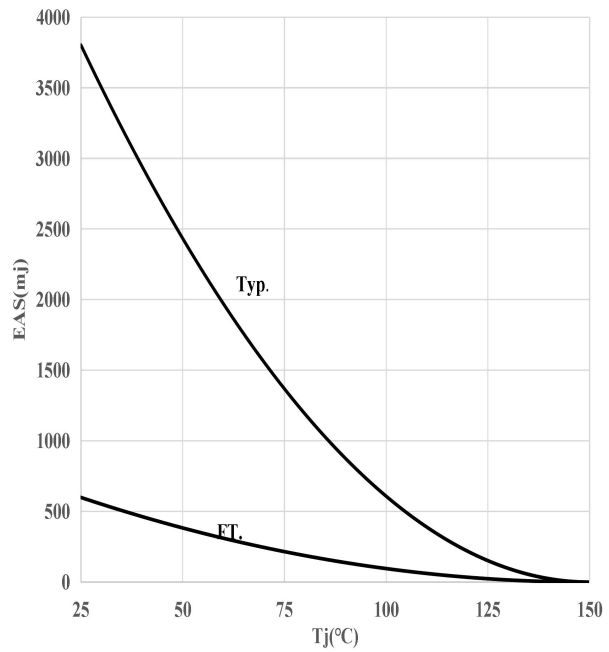
Minimum $V_{BR(DSS)} = f(T_j)$; $I_D = 10mA$

Figure 14: Forward Characteristics of Reverse Diode



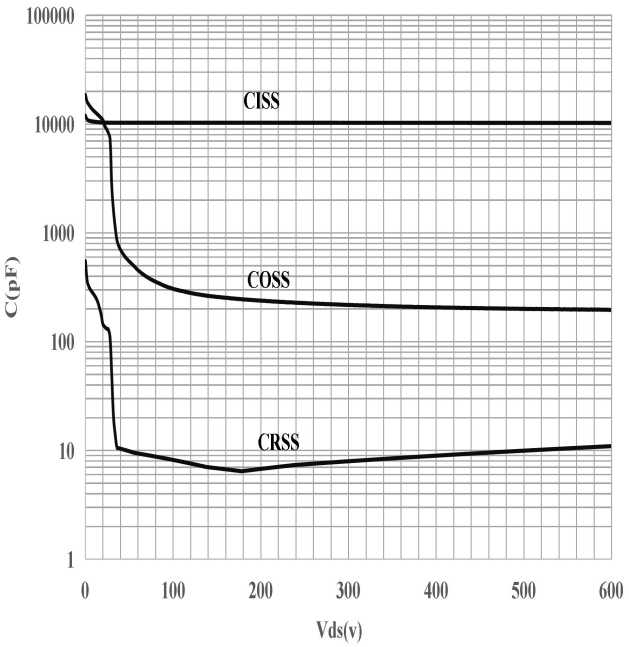
$I_F = f(V_{SD})$; parameter: T_j

Figure 15: Avalanche Energy



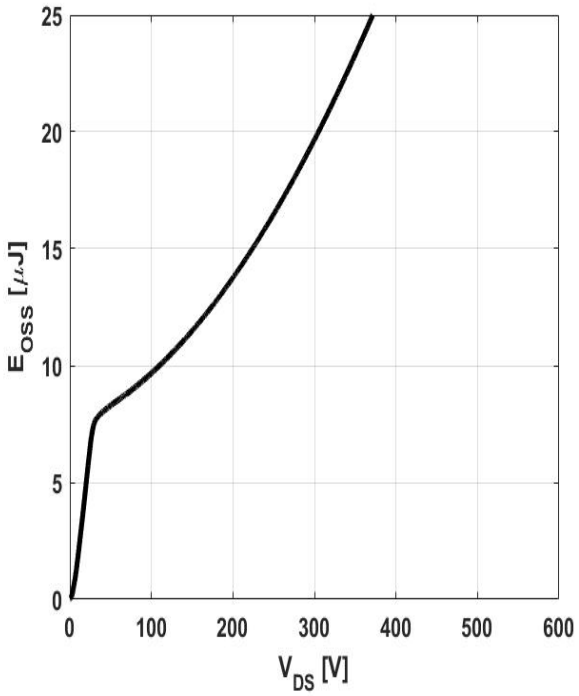
$E_{AS}=f(T_j)$; $V_{DD}=60V$

Figure 16: Typ. Capacitances



$C=f(V_{DS})$; $V_{GS}=0$; f=100KHz

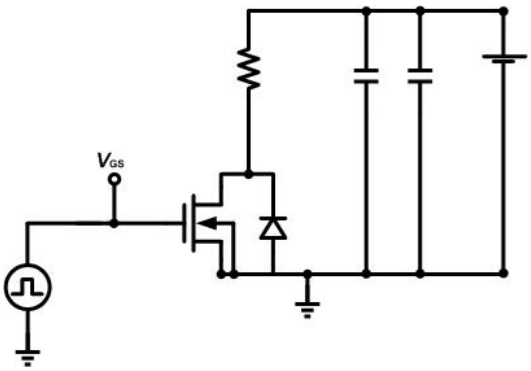
Figure 17: C_{OSS} Stored Energy

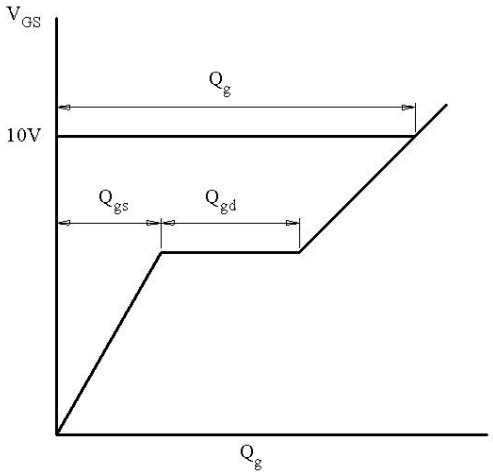


$E_{OSS}=f(V_{DS})$

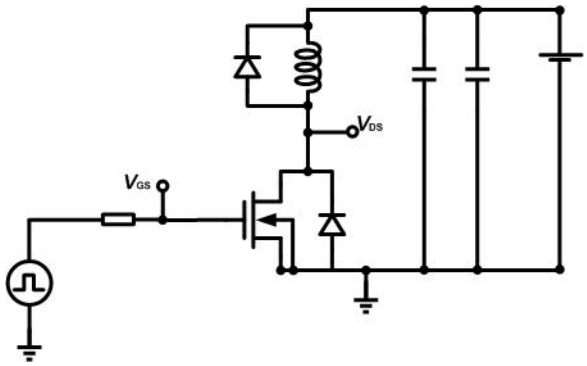
Test Circuits

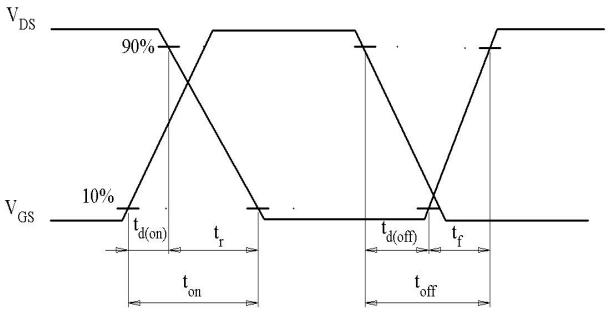
1. Gate Charge Test Circuit & Waveform



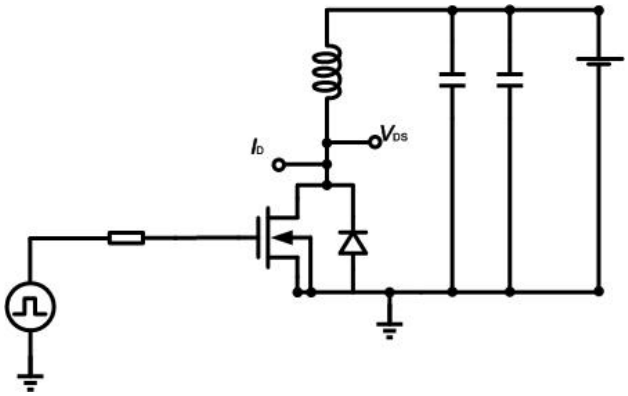


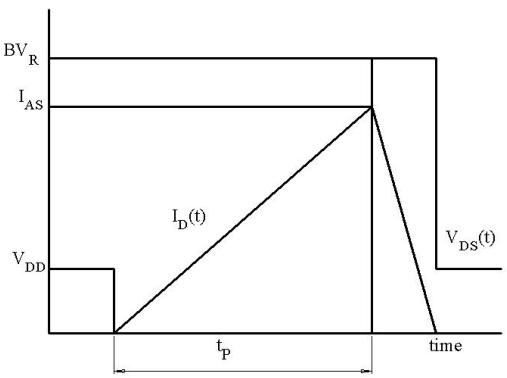
2. Switch Time Test Circuit



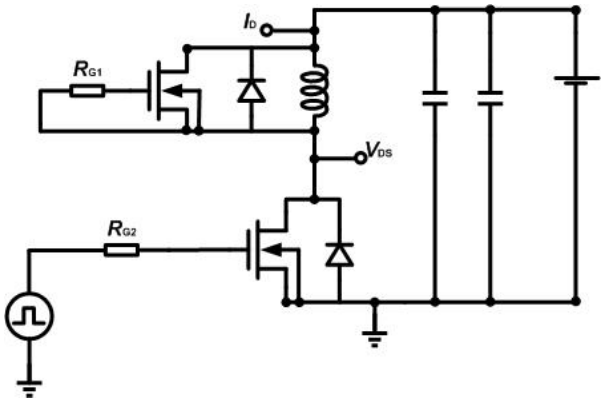


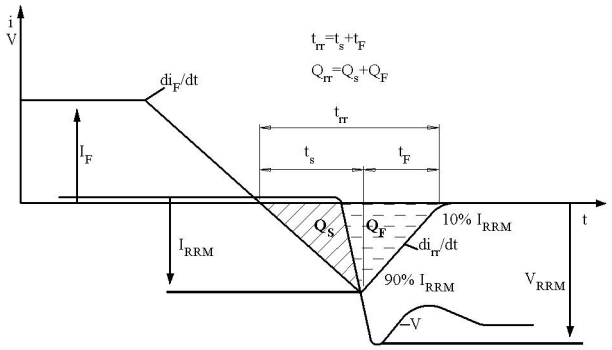
3. Unclaimed Inductive Switching Test Circuit & Waveforms





4. Test Circuit and Waveform for Diode Characteristics



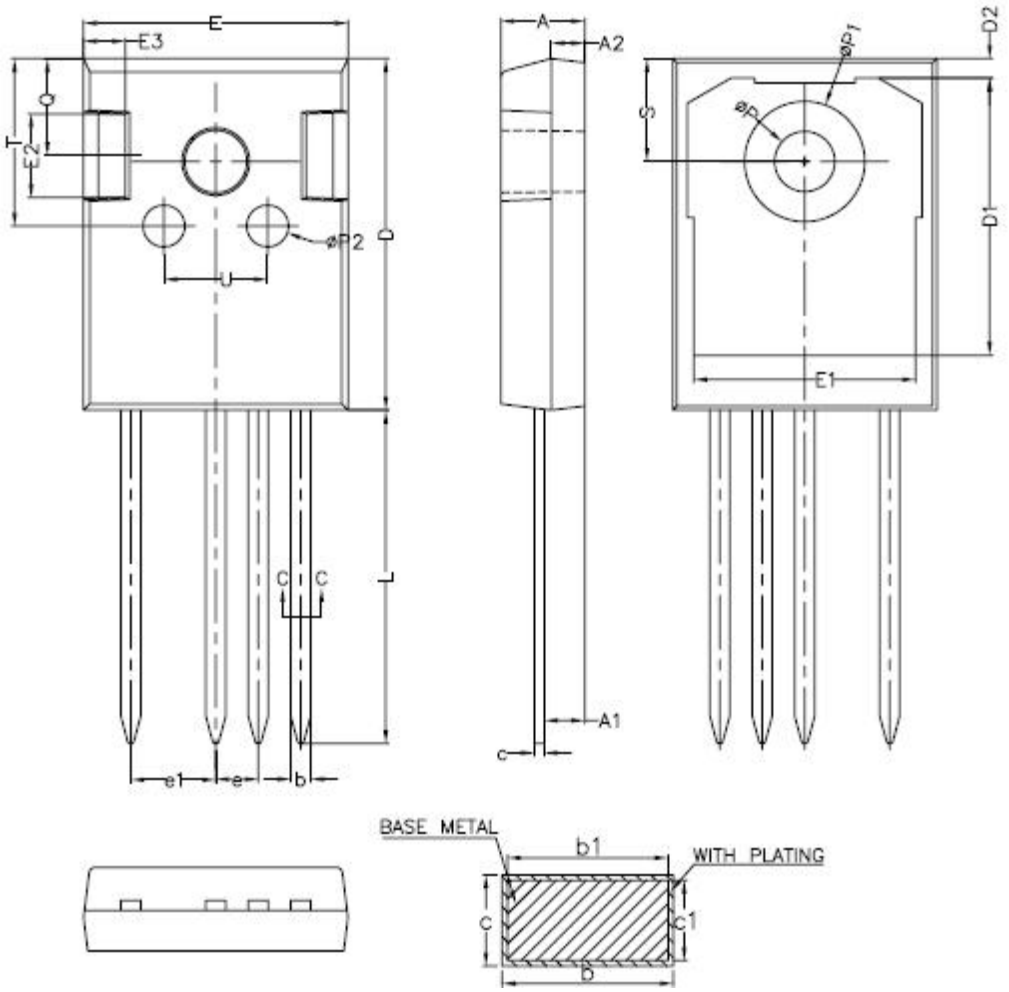


22mΩ, 600V, Super Junction N-Channel Power MOSFET **SRC60R022FBS**

Mechanical Dimensions

TO-247-4(Package 1)

Unit: mm

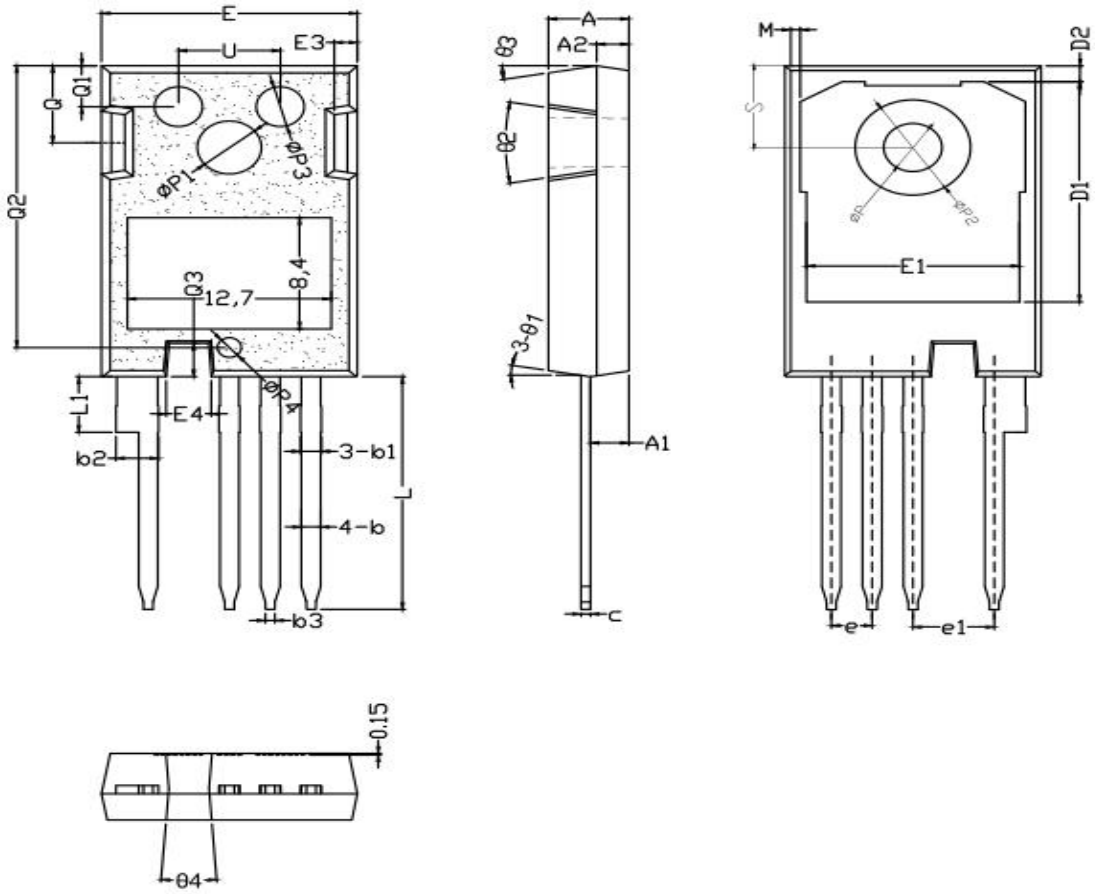


Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	E2	4.90	5.00	5.10
A1	2.31	2.41	2.51	E3	2.40	2.50	2.60
A2	1.90	2.00	2.10	e	2.44	2.54	2.64
b	1.16	1.20	1.29	L	19.80	19.92	20.10
b2	0	-	0.20	P	3.50	3.60	3.70
c	0.59	-	0.66	P1	-	-	7.40
D	20.90	21.00	21.10	P2	2.40	2.50	2.60
D1	16.25	16.55	16.85	Q	5.60	-	6.00
D2	1.05	1.20	1.35	S	6.15BSC		
E	15.70	15.80	15.90	T	9.80	-	10.20
E1	13.10	13.30	13.50	U	6.00	-	6.40
e1	4.98	5.08	5.18	D3	24.97	25.12	25.27
c1	0.58	0.60	0.62	b1	1.15	1.20	1.25

Mechanical Dimensions

TO-247-4(Package 2)

Unit: mm



Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.83	5.02	5.21	E2	4.20	4.60	5.00
A1	2.29	2.42	2.54	E3	1.00	1.45	1.90
A2	1.91	2.00	2.16	e	2.50	2.54	2.58
b	1.07	1.20	1.33	e1	5.03	5.08	5.13
b2	2.39	2.67	2.94	L	17.27	17.57	17.82
b3	0.45	0.60	0.75	L1	-	-	4.37
c	0.55	0.60	0.68	ΦP	3.51	3.61	3.71
D	23.30	23.45	23.60	ΦP1	3.80	4.00	4.20
D1	16.35	16.65	16.95	ΦP2	7.03	7.18	7.33
D2	0.95	1.19	1.25	ΦP3	2.80	3.00	3.20
E	15.75	15.94	16.13	ΦP4	1.30	1.50	1.70
E1	13.00	13.25	13.45	S	6.04	6.17	6.30
M	0.40	0.60	0.80	U	6.05	6.35	6.55
b1	1.07	1.20	1.33	E4	2.40	2.80	3.20
Q	5.49	5.79	6.00	Θ1	6°	10°	13°
Q1	2.80	3.10	3.40	Θ2	16°	20°	24°
Q2	19.95	21.25	21.55	Θ3	6°	10°	13°
Q3	2.35	2.50	2.65	Θ4	5°	8°	11°

22mΩ, 600V, Super Junction N-Channel Power MOSFET SRC60R022FBS

Shenzhen Sanrise Technology Co., LTD

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

Shenzhen Sanrise Technology Co., LTD

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

Tel: +86-21-68825918