140mΩ, 600V, Super Junction N-Channel Power MOSFET SRC60R140B

General Description

The Sanrise SRC60R140B 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 SRC60R140B break down voltage is 600V and it has a high rugged avalanche characteristics.

The SRC60R140B is available in TO-220F, TO-220C, TO-263-2 and TO-247 packages.

Features

- Ultra Low $R_{DS(ON)}$ = 140mΩ @ V_{GS} = 10V.
- Ultra Low Gate Charge, Qg=40.4nC typ.
- Intrinsic Fast-Recovery Body Diode
- Fast switching capability
- Robust design with better EAS performance

Application

- AC/DC Power Supply
- PC Power
- Sever / Telecom
- Solar Inverter

Symbol

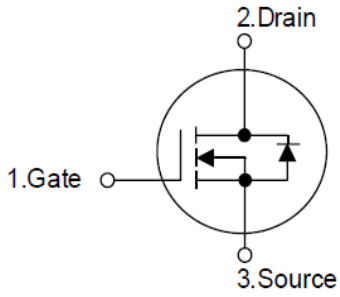
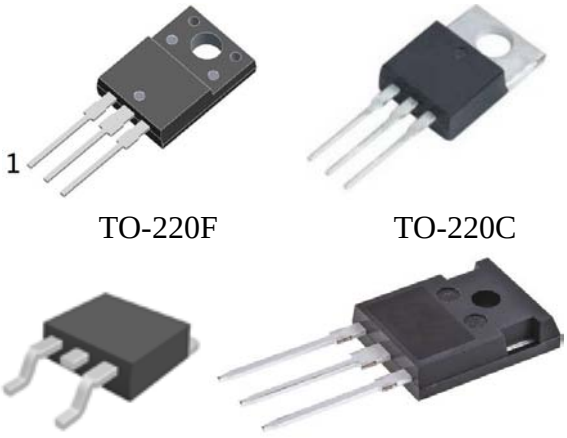


Figure 1 Symbol of SRC60R140B

Package Type



TO-220F TO-220C

TO-263-2 TO-247

Figure 2 Package Types of SRC60R140B

Ordering Information

SRC60R140B□□–□

Circuit Type

Package
TF: TO-220F
TC: TO-220C
S2: TO-263-2
T: TO-247

E: Lead Free
G: Green
Blank: Tube
TR: Tape & Reel

Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
TO-220F	SRC60R140BTF-E	SRC60R140BTF-G	SRC60R140BTFE	SRC60R140BTFG	Tube
TO-220C	SRC60R140BTC-E	SRC60R140BTC-G	SRC60R140BTCE	SRC60R140BTCG	Tube
TO-263-2	SRC60R140BS2TR-E	SRC60R140BS2TR-G	SRC60R140BS2E	SRC60R140BS2G	Tape & Reel
TO-247	SRC60R140BT-E	SRC60R140BT-G	SRC60R140BTE	SRC60R140BTG	Tube

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Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DSS}	600	V
Gate-Source Voltage		V_{GSS}	±30	V
Continuous Drain Current	T_C=25ºC	I_D	25.0	A
	T_C=125ºC		11.2	
Pulsed Drain Current (Note 2)		I_{DM}	76	A
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	510	mJ
Avalanche Energy, Repetitive (Note 2)		E_{AR}	0.7	mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	3.6	A
Continuous Diode Forward Current		I_S	25.0	A
Diode Pulse Current		$I_{S.PULSE}$	76	A
MOSFET dv/dt Ruggedness, V_{DS}<=480V		dv/dt	50	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} = 3.6A, V_{DD} = 60V, R_G = 25Ω, Starting T_J = 25°C

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Electrical Characteristics

T_J = 25 ºC, unless otherwise specified.

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
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			100	nA
	Reverse	I_{GSSR}	V_{GS}=-30V, V_{DS}=0V			-1.0	uA
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250uA	2.3	3.3	4.3	V
Static Drain-Source On-Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=13.0A		126	140	mΩ
Gate Resistance		R_G	f=1MHz, Open Drain		1.7		Ω
Dynamic Characteristics							
Input Capacitance		C_{ISS}	V_{DS}=50V, V_{GS}=0V, f=1MHz		1650		pF
Output Capacitance		C_{OSS}			129.6		
Reverse Transfer Capacitance		C_{RSS}			10.1		
Effective output capacitance, energy related NOTE5		$C_{O(er)}$	V_{GS}=0V, V_{DS}=0…480V		76.8		pF
Effective output capacitance, time related NOTE6		$C_{O(tr)}$			281		
Turn-on Delay Time		$t_{d(on)}$	V_{DD}=400V, I_D=13.0A R_G=3.4Ω, V_{GS}=10V		11		ns
Rise Time		t_r			10		
Turn-off Delay Time		$t_{d(off)}$			76		
Fall Time		t_f			8		
Gate Charge Characteristics							
Gate to Source Charge		Q_{gs}	V_{DD}=480V, I_D=13.0A V_{GS}=0 to 10V		10.8		nC
Gate to Drain Charge		Q_{gd}			13.9		
Gate Charge Total		Q_g			40.4		
Gate Plateau Voltage		$V_{plateau}$			5.4		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS}=0V, I_{SD}=13.0A		0.90	1.1	V
Reverse Recovery Time		t_{rr}	V_R=400V, I_F=13.0A dI$_F$/dt=100.0A/us		124		ns
Reverse Recovery Charge		Q_{rr}			0.59		uC
Peak Reverse Recovery Current		I_{rrm}			9.5		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 480V

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 480 V

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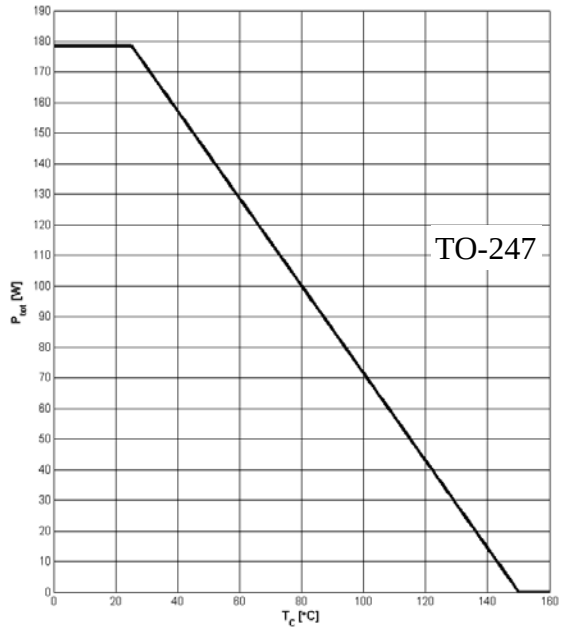
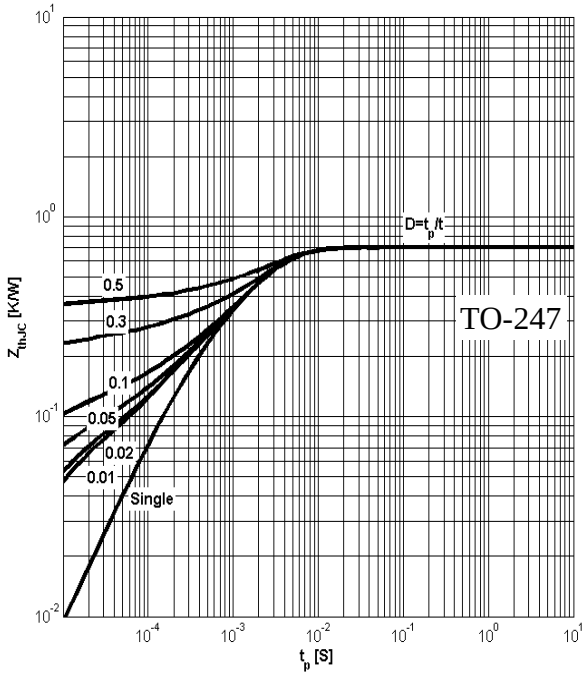
Typical Performance Characteristics

Figure 3: Power Dissipation



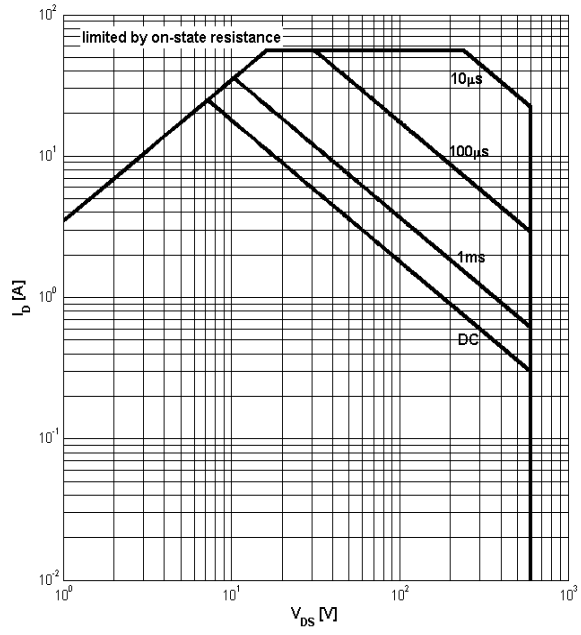
$P_{tot} = f(T_c)$

Figure 4: Max. Transient Thermal Impedance



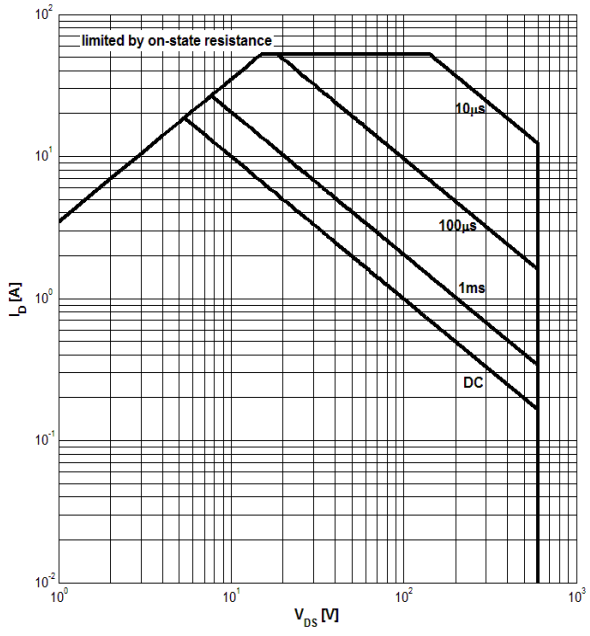
$Z_{(thJC)} = f(t_p)$; parameter: $D = t_p/T$

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

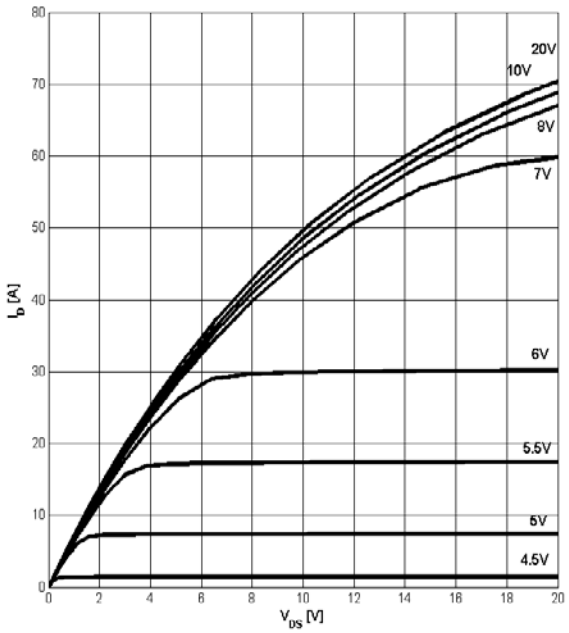
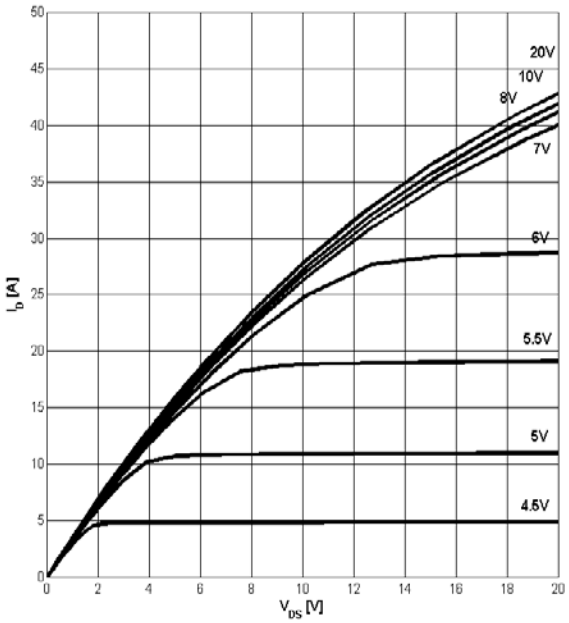
Figure 7: Typ. Output Characteristics	Figure 8: Typ. Output Characteristics
	
$I_D = f(V_{DS})$; Tj= 25ºC; parameter: V_{GS}	$I_D = f(V_{DS})$; T_j= 125ºC; parameter: V_{GS}

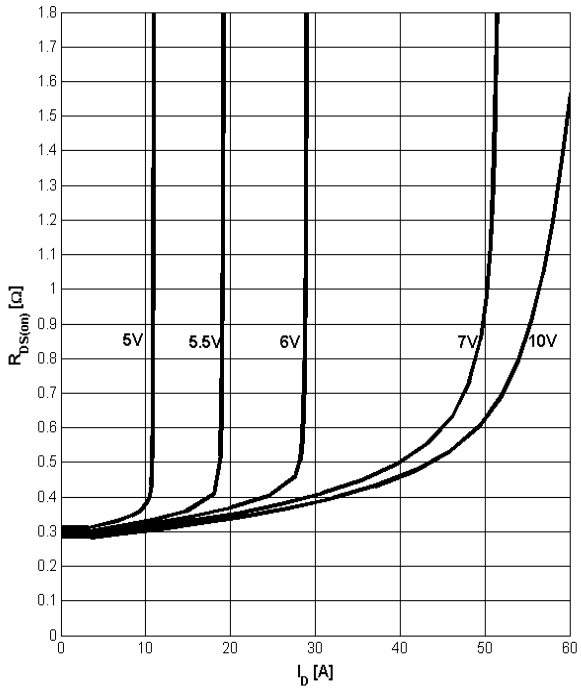
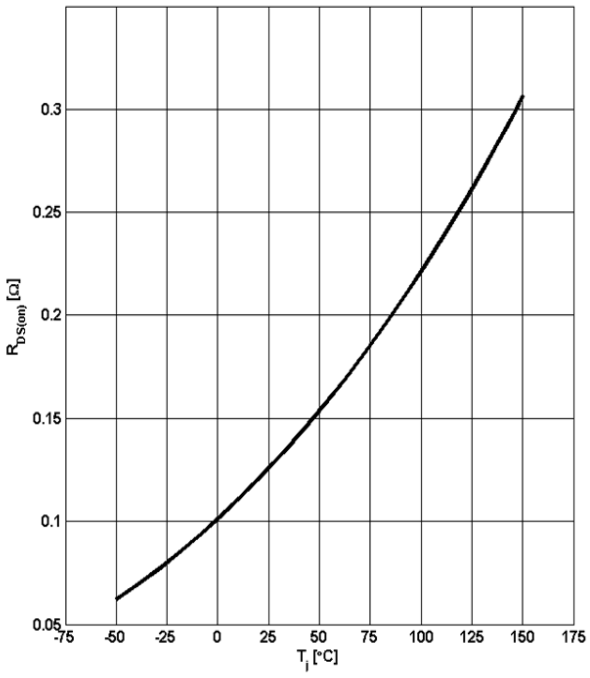
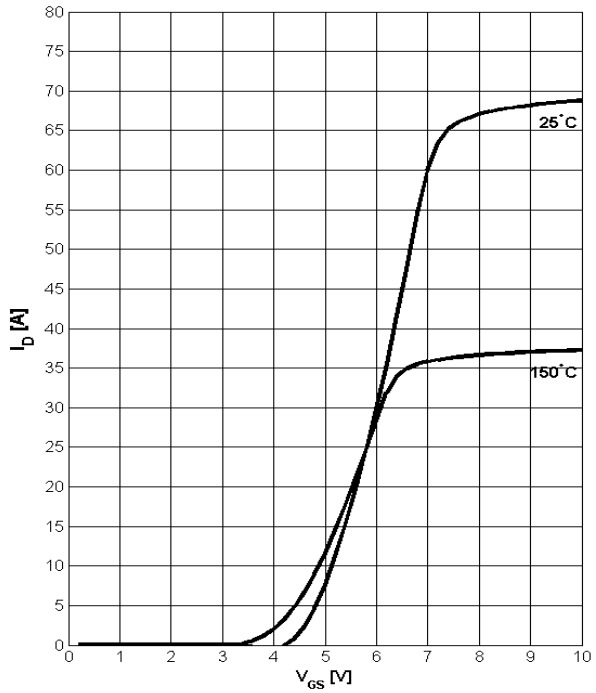
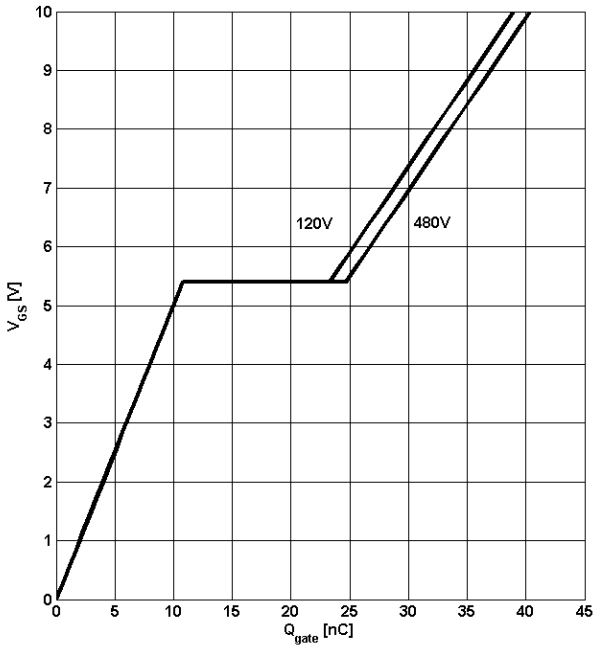
Figure 9: Typ. Drain-Source On-State Resistance	Figure 10: Typ. Drain-Source On-State Resistance
	
$R_{DS(ON)} = f(I_D)$; T_j=125ºC; parameter: V_{GS}	$R_{DS(ON)} = f(T_j)$; I_D=13A; V_{GS}=10V

Figure 11: Typ. Transfer Characteristics



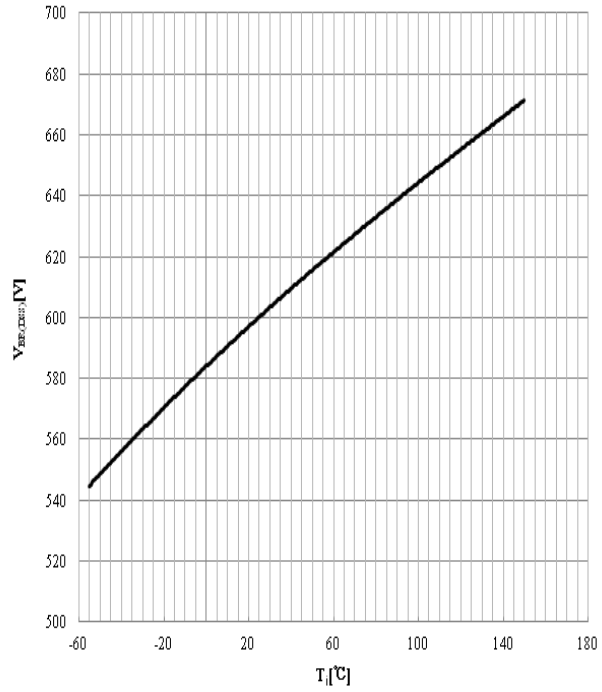
$I_D = f(V_{GS})$; V_{DS} = 20V

Figure 12: Typ. Gate Charge



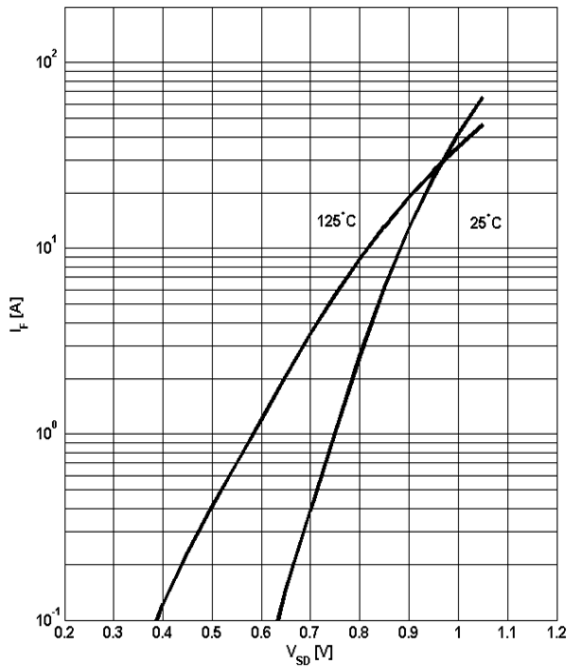
$V_{GS}= f(Q_{gate})$, I_D= 13A pulsed

Figure 13: Drain-Source Breakdown Voltage



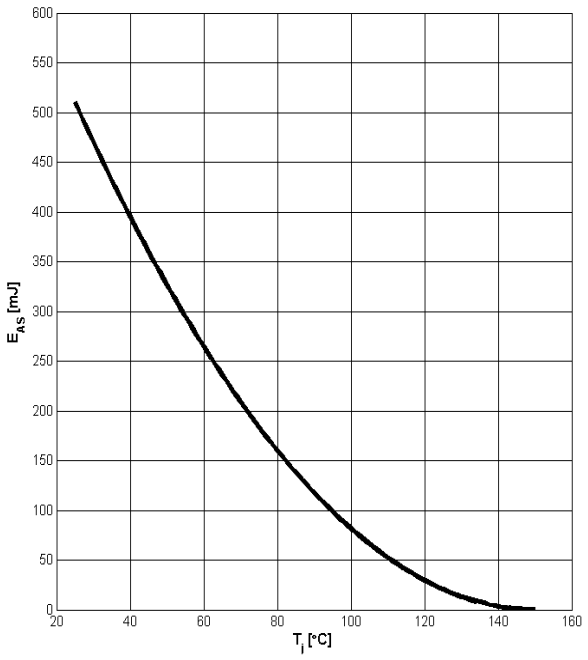
$V_{BR(DSS)}=f(T_j)$; I_D=1mA

Figure 14: Forward Characteristics of Reverse Diode



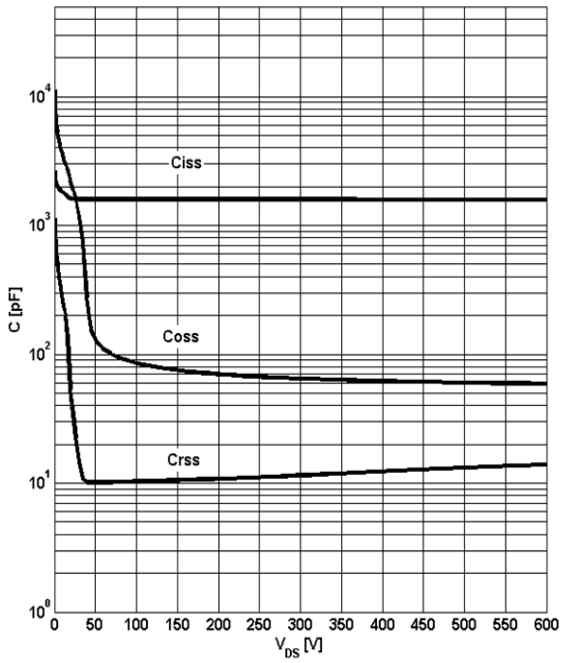
$I_F=f(V_{SD})$; parameter: T_j

Figure 15: Avalanche Energy



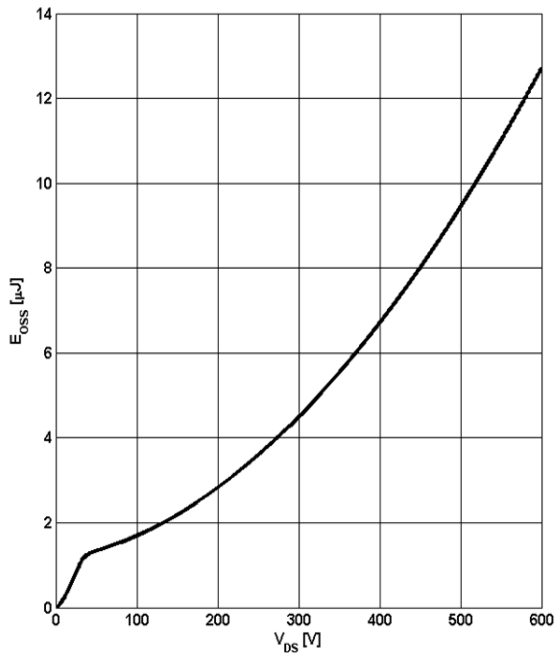
$E_{AS}=f(T_j)$; $I_D=3.6A$; $V_{DD}=60V$

Figure 16: Typ. Capacitances



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

Figure 17: C_{OSS} Stored Energy



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

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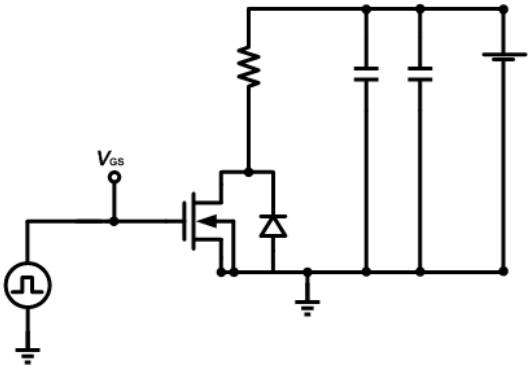
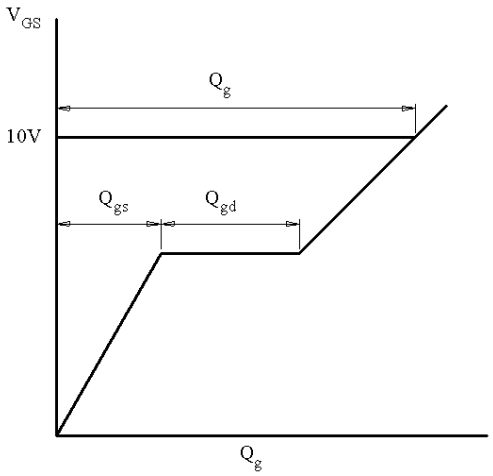
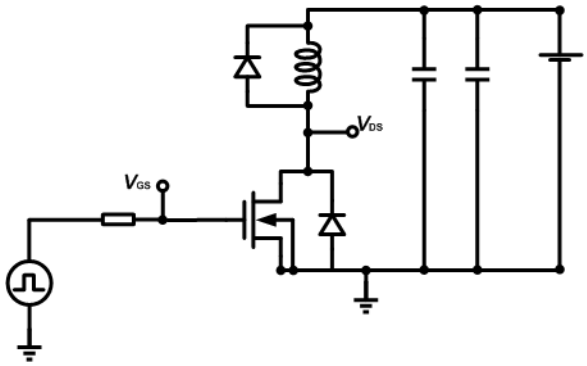
Test Circuits

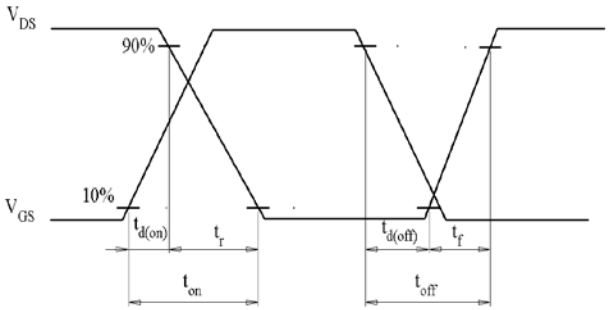
1. Gate Charge Test Circuit & Waveform



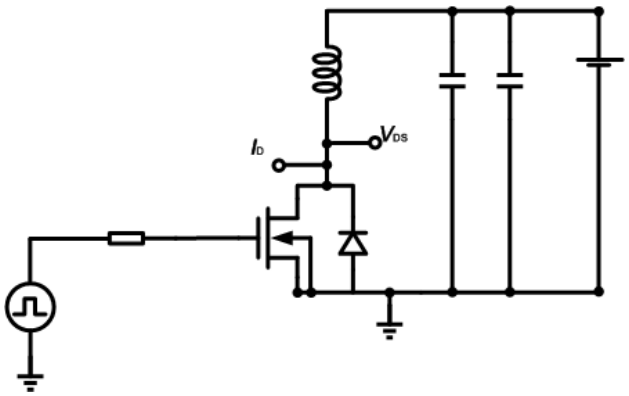


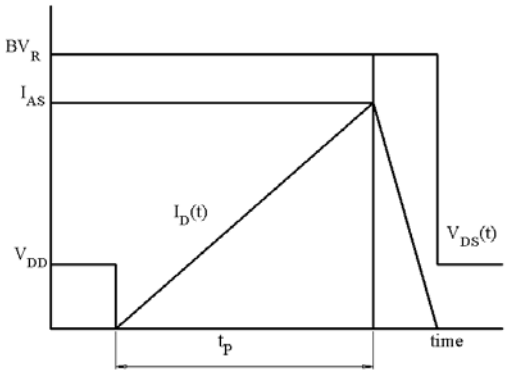
2. Switch Time Test Circuit



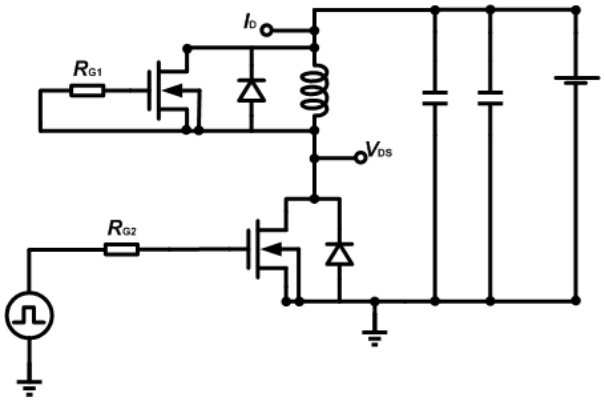


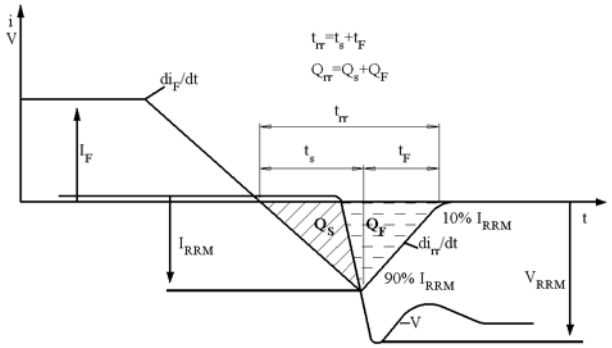
3. Unclaimed Inductive Switching Test Circuit & Waveforms





4. Test Circuit and Waveform for Diode Characteristics

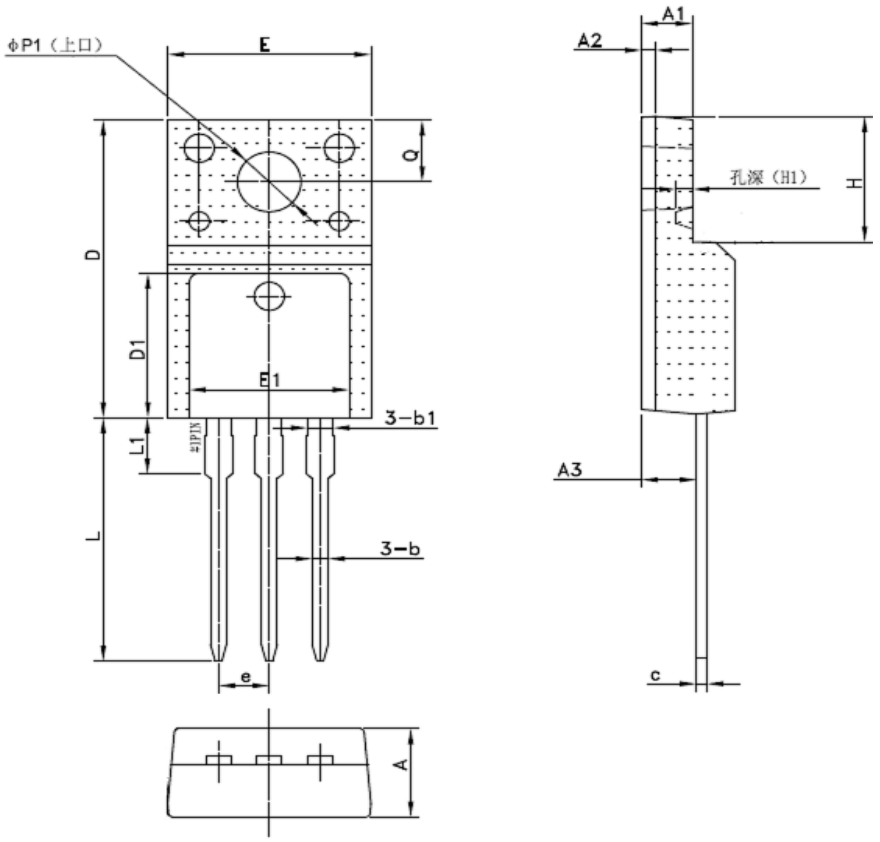




140mΩ, 600V, Super Junction N-Channel Power MOSFET SRC60R140B

Mechanical Dimensions

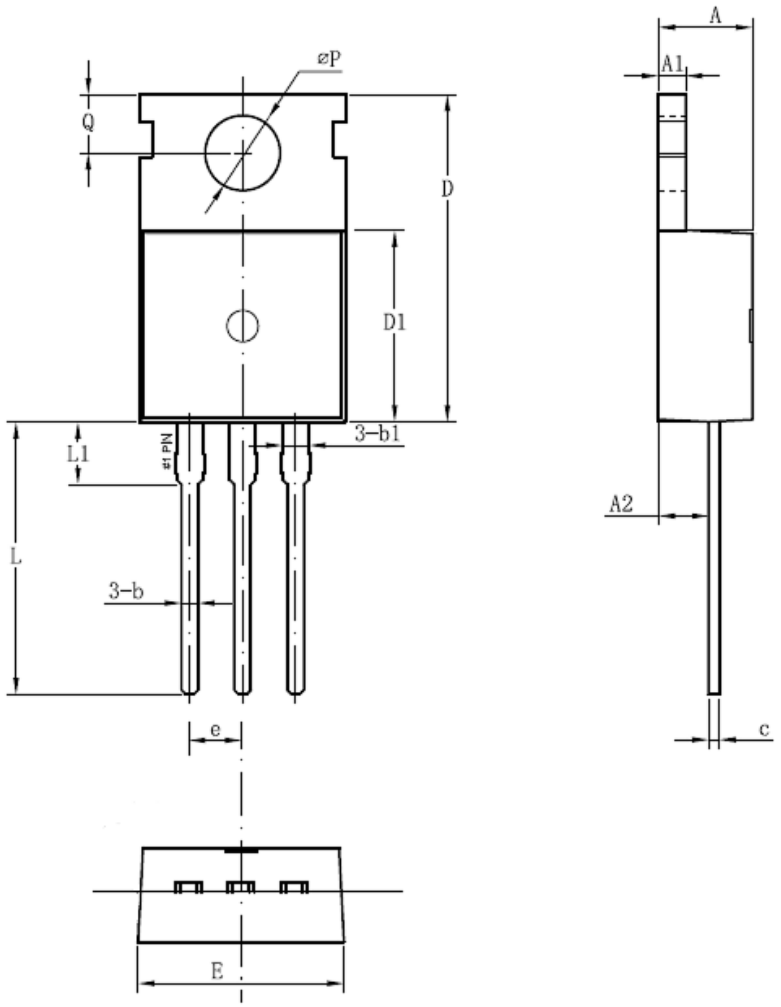
TO-220F **Unit: mm**



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.70	4.90
A1	2.34	2.54	2.90
A2	-	0.70	-
A3	2.56	2.76	2.96
b	0.55	-	0.95
b1	-	1.28	-
c	0.42	0.50	0.70
D	14.70	-	16.07
D1	-	7.70	-
E	9.96	10.16	10.36
E1	-	8.00	-
e	2.54(BSC)		
H	-	6.70	-
(H1)	-	(0.81)	-
L	12.48	12.98	13.50
L1	-	2.93	-
ΦP1	-	3.18	-
Q	2.90	3.30	3.50

Mechanical Dimensions (Continued)

TO-220C **Unit: mm**

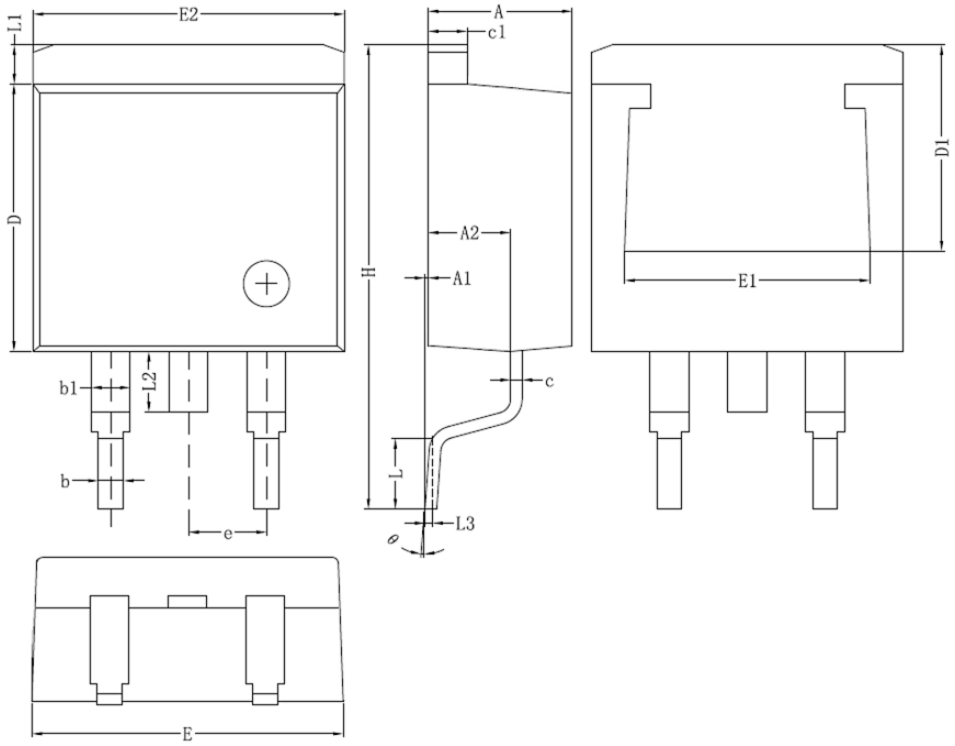


Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.50	4.70
A1	1.20	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b1	-	1.27	-
c	0.40	0.50	0.65
D	15.20	15.70	16.20
D1	9.00	9.20	9.40
E	9.70	10.00	10.20
e	2.54(BSC)		
L	12.60	13.08	13.60
L1	-	3.00	-
ΦP	3.50	3.60	3.80
Q	2.60	2.80	3.00

140mΩ, 600V, Super Junction N-Channel Power MOSFET SRC60R140B

Mechanical Dimensions (Continued)

TO-263-2 **Unit: mm**



Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.30	4.60	4.85
A1	0.00	0.10	0.25
A2	2.59	2.69	2.89
b	0.70	0.81	0.96
b1	-	1.27	-
c	0.36	0.40	0.61
c1	1.15	1.27	1.40
D	8.55	-	9.40
D1	6.40	-	-
E	9.80	10.10	10.31
E1	7.60	-	-
E2	9.80	10.00	10.20
e	2.54(BSC)		
H	14.70	15.20	16.00
L	2.00	2.30	2.84
L1	1.00	1.27	1.40
L2	-	-	2.20
L3	-	0.25	-
θ	0°	-	8°

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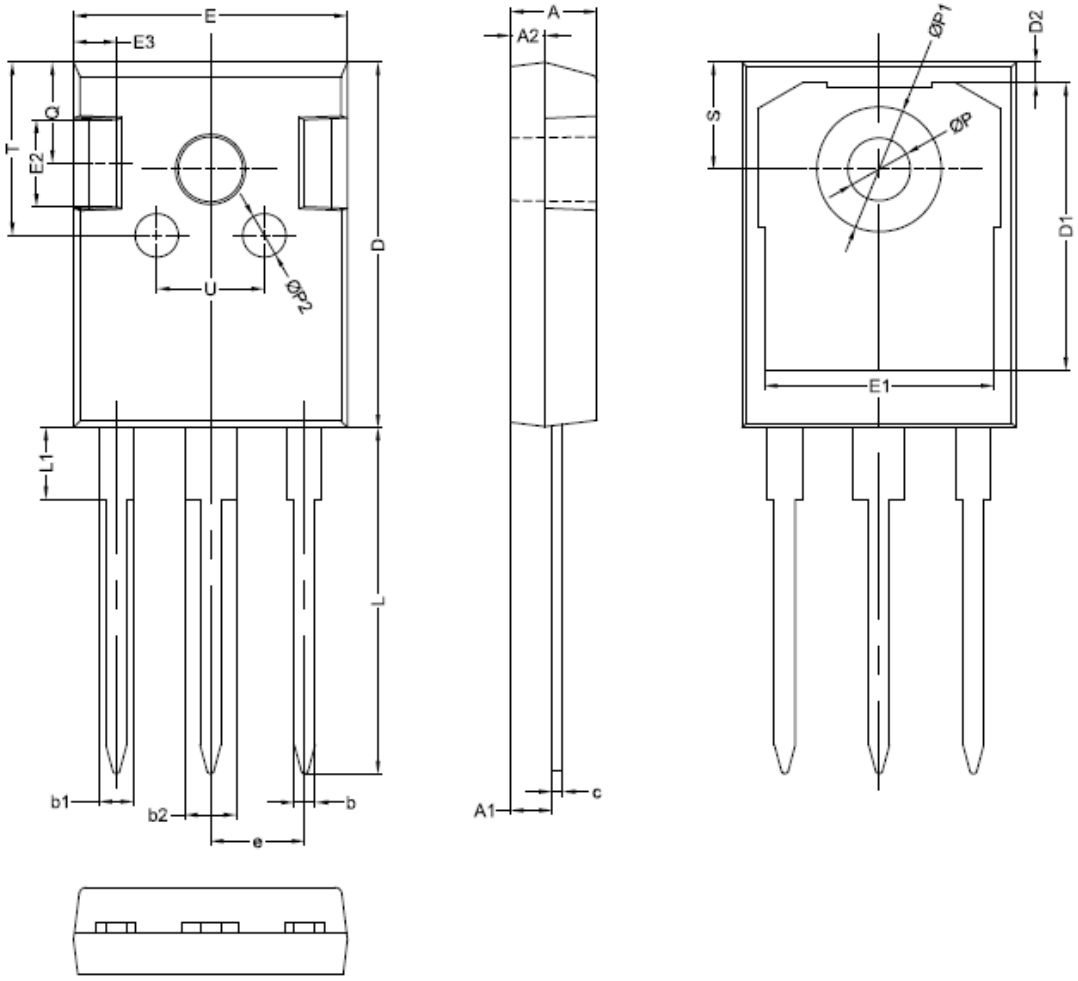
Mechanical Dimensions (Continued)

TO-247 **Unit: mm**



Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.80	5.00	5.20	E2	-	5.00	-
A1	2.21	2.41	2.61	E3	-	2.50	-
A2	1.90	2.00	2.10	e	5.44(BSC)		
b	1.10	1.20	1.35	L	19.42	19.92	20.42
b1	-	2.00	-	L1	-	4.13	-
b2	-	3.00	-	P	3.50	3.60	3.70
c	0.55	0.60	0.75	P1	-	-	7.40
D	20.80	21.00	21.20	P2	-	2.50	-
D1	-	16.55	-	Q	-	5.80	-
D2	-	1.20	-	S	6.05	6.15	6.25
E	15.60	15.80	16.00	T	-	10.00	-
E1	-	13.30	-	U	-	6.20	-

140mΩ, 600V, Super Junction N-Channel Power MOSFET SRC60R140B

Sanrise Technology Limited Company

http://www.sanrise-tech.com

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