

General Description

The Sanrise SRC65R040BT-GA 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 SRC65R040BT-GA break down voltage is 650V and it has a high rugged avalanche characteristics.

The SRC65R040BT-GA is available in TO-247 package.

Features

- Ultra Low $R_{DS(ON)} = 40m\Omega @ V_{GS} = 10V$.
- Ultra Low Gate Charge, $Q_g = 275nC$ typ.
- Fast switching capability
- Robust design with better EAS performance
- EMI Improved
- Qualified according to AEC Q101
- Green Product (RoHS compliant)
- Ultra-fast body diode

Application

- On-Board charger
- DC/DC Converter
- Auxiliary Inverter

Symbol

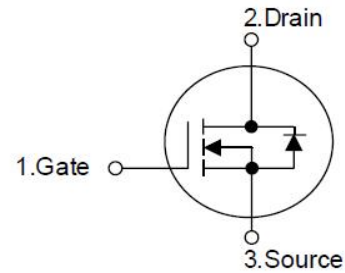
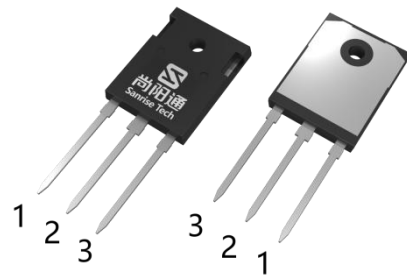


Figure 1 Symbol of SRC65R040BT-GA

Package Type



TO-247

Figure 2 Package Type of SRC65R040BT-GA

Ordering Information

SRC65R040B□□-□		
Circuit Type	_____	A: Automotive
Package	_____	G: Green
T: TO-247		Blank: Tube
		TR: Tape & Reel

Package	Part Number	Marking ID	Packing Type
TO-247	SRC65R040BT-GA	SRC65R040BTGA	Tube

Absolute Maximum Ratings^{Note 1}

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DSS}	650	V
Drain-Source Voltage($T_J=150^{\circ}\text{C}$)		V_{DSS}	700	V
Gate-Source Voltage (static)		V_{GSS}	± 20	V
Gate-Source Voltage (dynamic), AC ($f>1\text{ Hz}$)		V_{GSS}	± 30	V
Power Dissipation($T_C=25^{\circ}\text{C}$, TO-247)		P_{tot}	462	W
Continuous Drain Current	$T_C=25^{\circ}\text{C}$	I_D	64	A
	$T_C=100^{\circ}\text{C}$		40	
	$T_C=125^{\circ}\text{C}$		28	
Pulsed Drain Current (Note 2)		I_{DM}	192	A
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	264	mJ
Avalanche Energy, Single Pulse (Note 4)		E_{AS}	4083	mJ
Avalanche Energy, Repetitive (Note 2)		E_{AR}	0.2	mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	2.8	A
Continuous Diode Forward Current		I_S	64	A
Diode Pulse Current		$I_{S,PULSE}$	192	A
Maximum diode commutation speed(Note 4)		di_F/dt	900	A/us
MOSFET dv/dt Ruggedness, $V_{DS}\leq 480\text{V}$		dv/dt	80	V/ns
Reverse Diode dv/dt , $V_{DS}\leq 480\text{V}$, $I_{SD}\leq I_D$		dv/dt	50	V/ns
Operating Junction Temperature		T_J	150	$^{\circ}\text{C}$
Storage Temperature		T_{STG}	-55 to 150	$^{\circ}\text{C}$
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	$^{\circ}\text{C}$

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. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $I_{AS}=2.8\text{A}$, $V_{DD}=60\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$. Finish goods test condition.
4. $I_{AS}=11\text{A}$, $V_{DD}=60\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$. Typical Eas.
5. $V_{DS}=0\sim 400\text{V}$, $I_{SD}\leq 34\text{A}$, $T_J=25^{\circ}\text{C}$.

Thermal characteristics

Parameter (TO247-package)	Symbol	Min	Typ	Max	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	-		0.27	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	-		62	

Electrical Characteristics

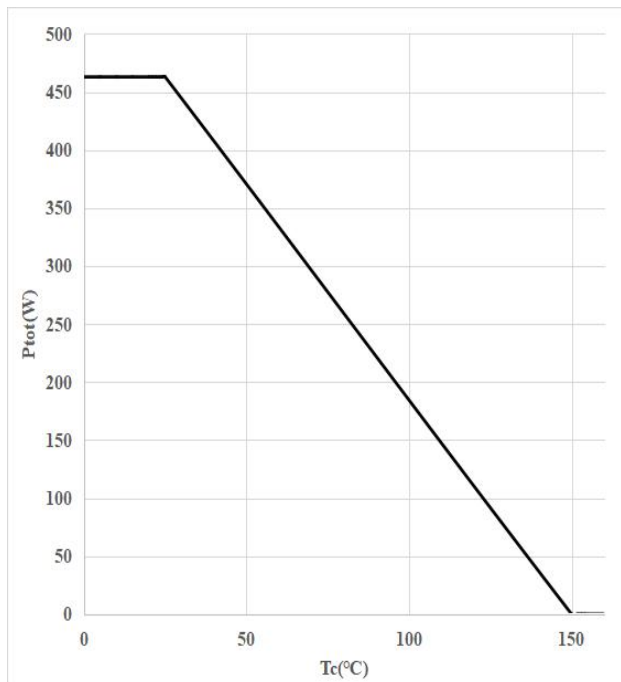
$T_J = 25^{\circ}\text{C}$, unless otherwise specified.

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250uA	650			V
Zero Gate Voltage Drain Current		I _{DSS}	V _{DS} =650V, V _{GS} =0V			20	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 =1.85mA	3.5	4.5	5.5	V
Static Drain-Source On-Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =34A		35	40	mΩ
Gate Resistance		R _G	f=1MHz, Open Drain		1.2		Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =400V, V _{GS} =0V, f=100KHz		6186		nF
Output Capacitance		C _{OSS}			137		nF
Effective output capacitance, energy related ^{NOTE6}		C _{O(er)}	V _{GS} =0V, V _{DS} =0...480V		185		pF
Effective output capacitance, time related ^{NOTE7}		C _{O(tr)}			1264		
Turn-on Delay Time		t _{d(on)}	V _{DD} =400V, I _D =34A R _G =3.3Ω, V _{GS} =10V		63		ns
Rise Time		t _r			15.6		
Turn-off Delay Time		t _{d(off)}			136		
Fall Time		t _f			7.6		
Gate Charge Characteristics							
Gate to Source Charge		Q _{gs}	V _{DD} =400V, I _D =34A V _{GS} =0 to 10V		63		nC
Gate to Drain Charge		Q _{gd}			145		
Gate Charge Total		Q _g			275		
Gate Plateau Voltage		V _{plateau}			7.5		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _{SD} =34A		0.86	1.1	V
Reverse Recovery Time		t _{rr}	V _R =400V, I _F =34A dI _F /dt=100A/us		157		ns
Reverse Recovery Charge		Q _{rr}			1.5		uC
Peak Reverse Recovery Current		I _{rrm}			15.6		A

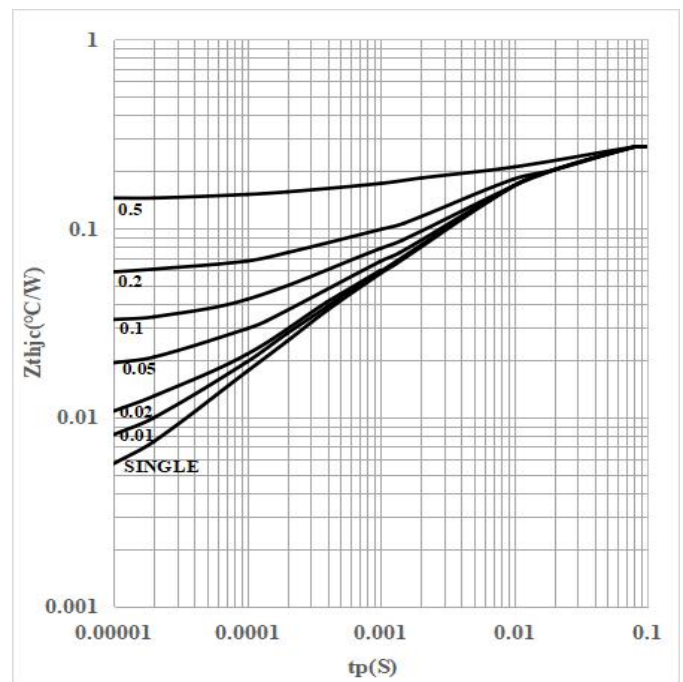
Note:

6. $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 480V

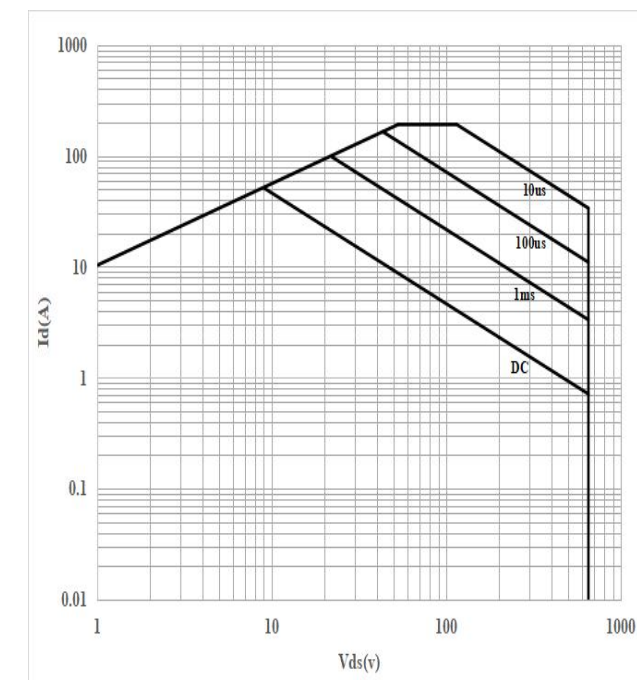
7. $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 480 V

Typical Performance Characteristics
Figure 3: Power Dissipation


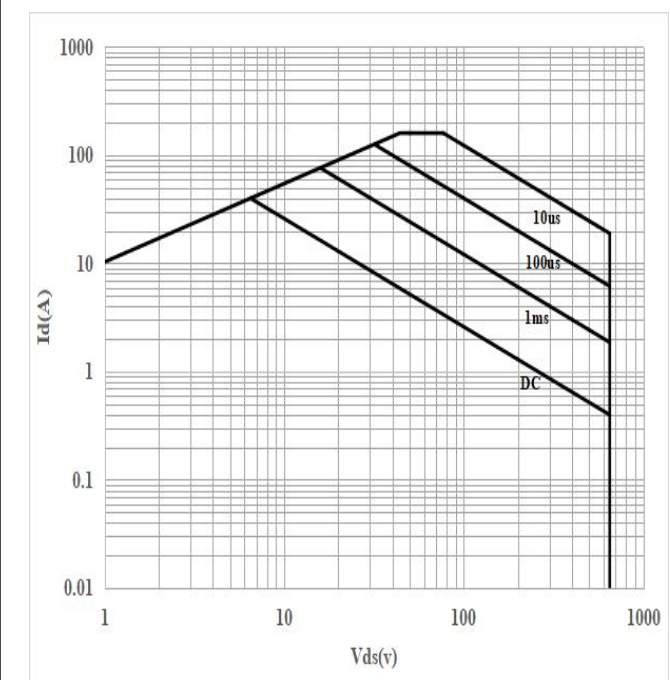
$$P_{tot} = f(T_c)$$

Figure 4: Max. Transient Thermal Impedance


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

Figure 5: Safe Operating Area


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

Figure 6: Safe Operating Area


$$I_D = f(V_{DS}); T_c = 80^\circ\text{C}; V_{GS} > 7\text{V}; \text{ parameter } t_p$$

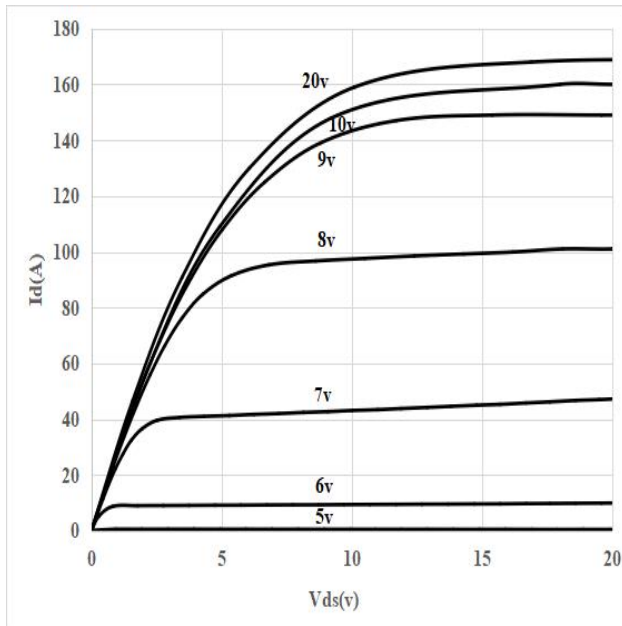
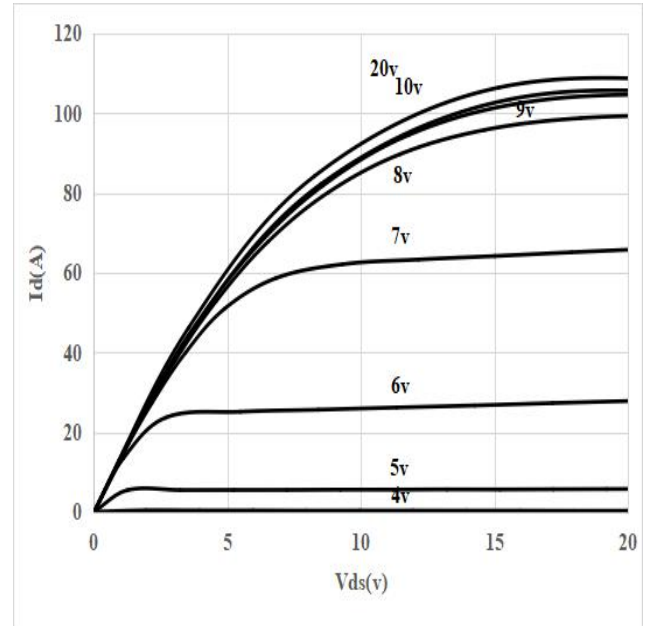
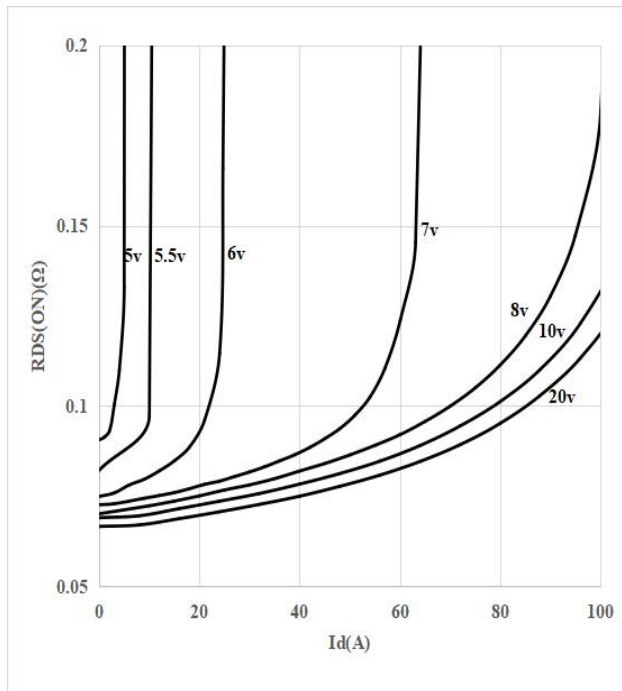
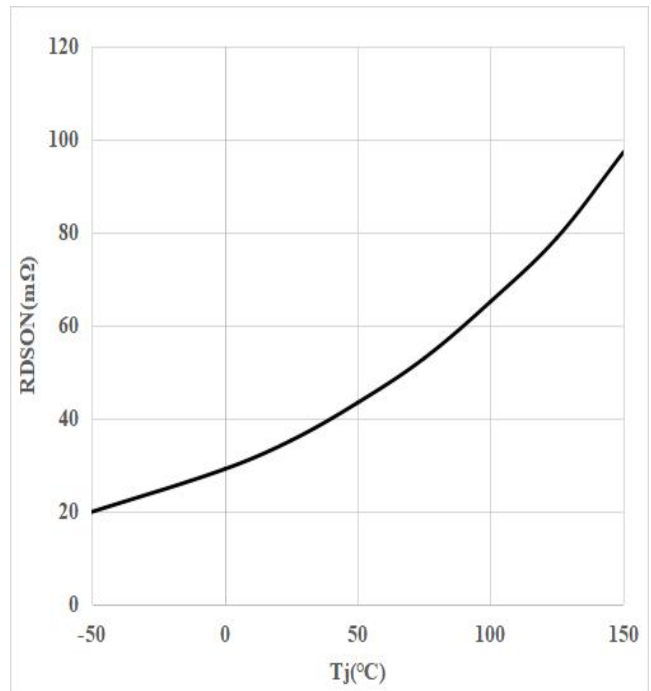
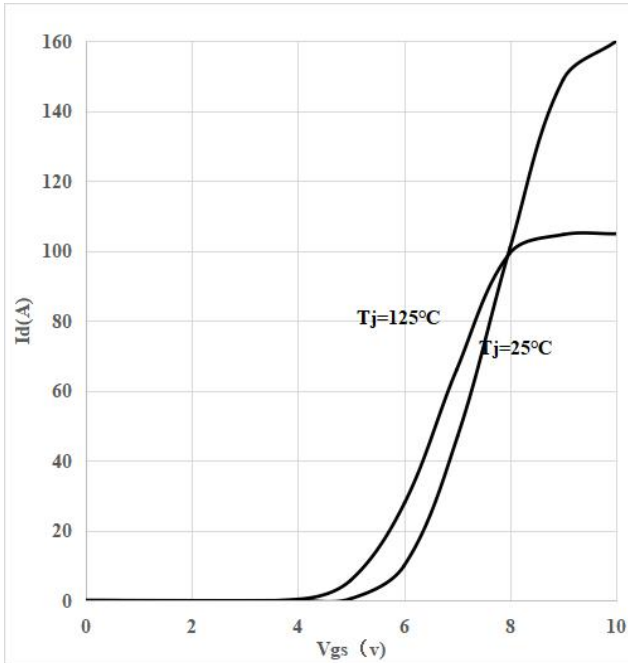
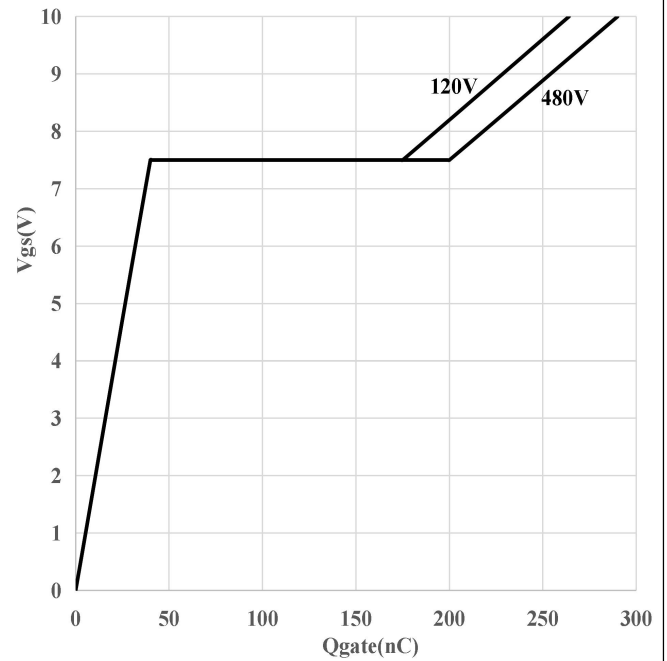
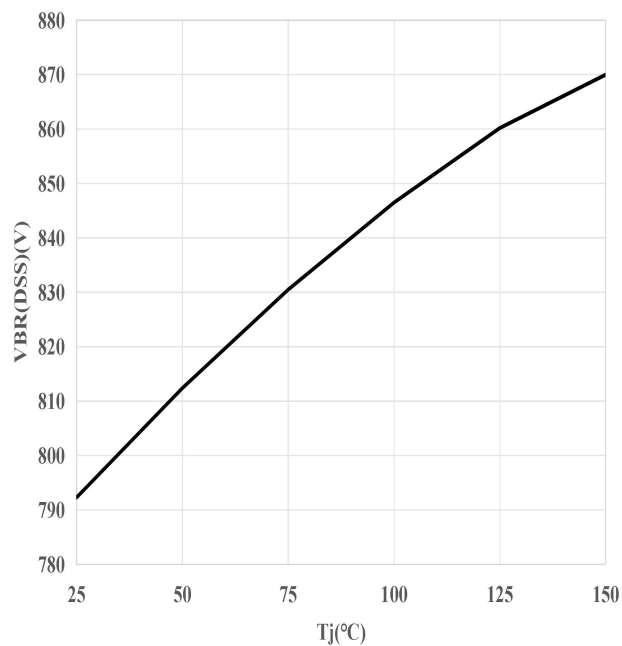
Figure 7: Typ. Output Characteristics

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 8: Typ. Output Characteristics

 $I_D = f(V_{DS}); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 9: Typ. Drain-Source On-State Resistance

 $R_{DS(ON)} = f(I_D); T_j = 125^\circ\text{C}; \text{parameter: } V_{GS}$
Figure 10: Typ. Drain-Source On-State Resistance

 $R_{DS(ON)} = f(T_j); I_D = 34\text{A}; V_{GS} = 10\text{V}$

Figure 11: Typ. Transfer Characteristics


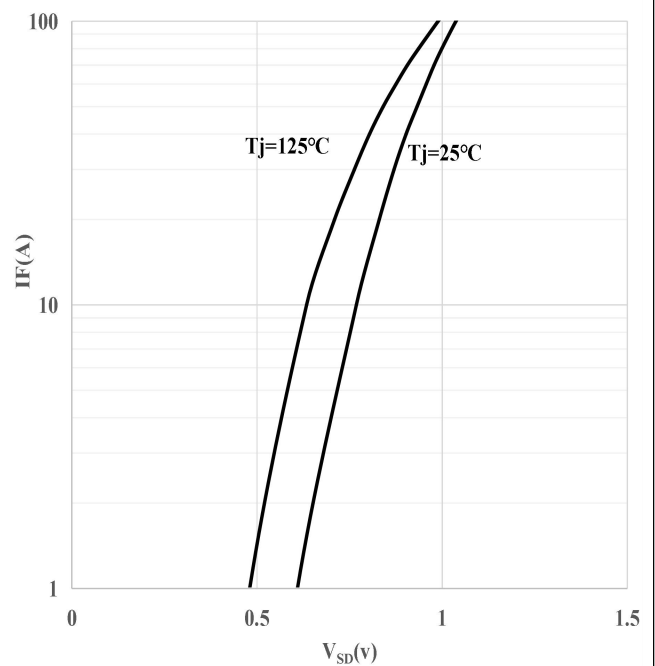
$$I_D = f(V_{GS}); V_{DS} = 20V$$

Figure 12: Typ. Gate Charge


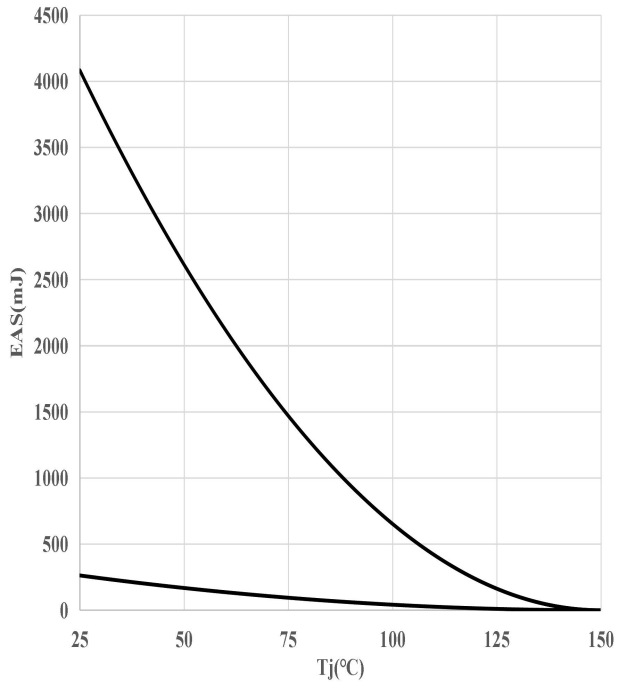
$$V_{GS} = f(Q_{gate}), I_D = 34A \text{ pulsed}$$

Figure 13: Drain-Source Breakdown Voltage


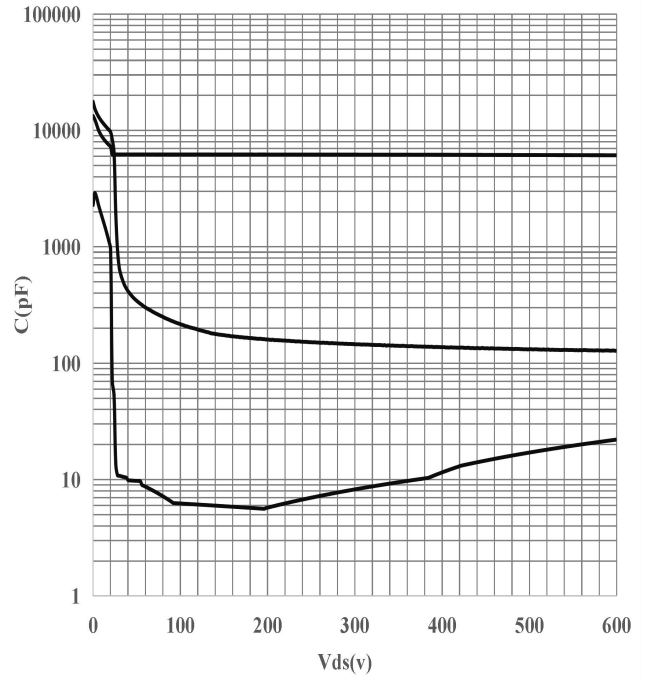
$$V_{BR(DSS)} = f(T_j); I_D = 15mA$$

Figure 14: Forward Characteristics of Reverse Diode


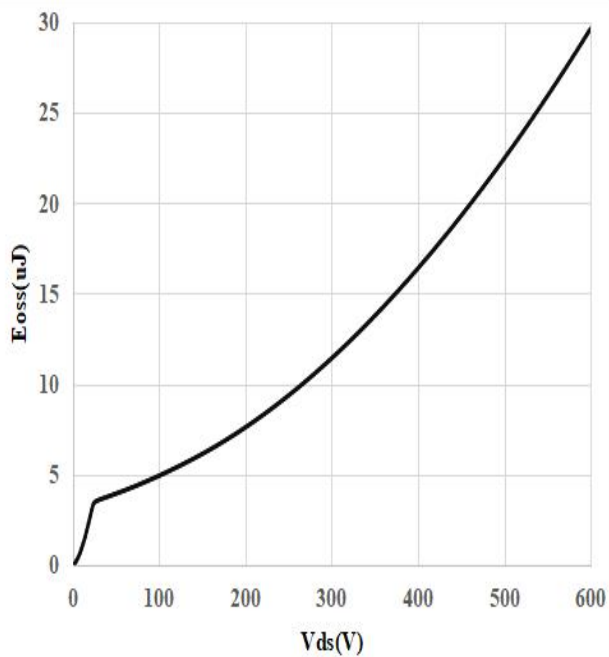
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

40mΩ, 650V, Super Junction N-Channel Power MOSFET
SRC65R040BT-GA
Figure 15: Avalanche Energy


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

Figure 16: Typ. Capacitances


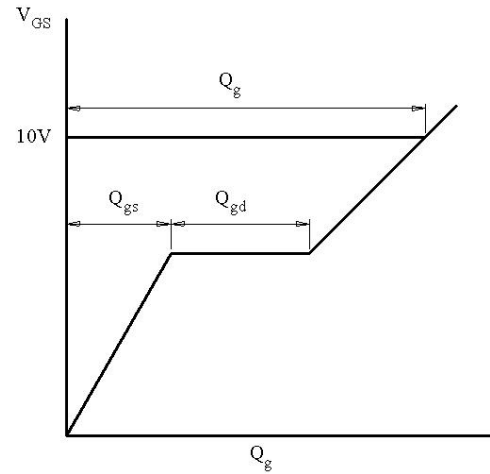
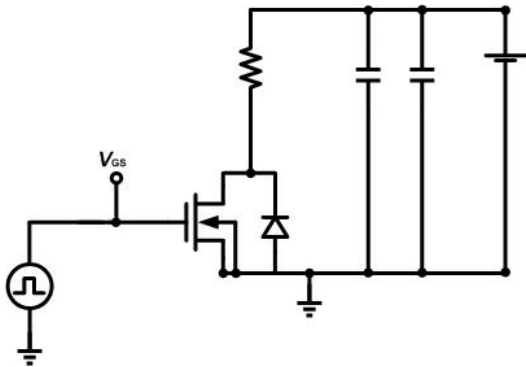
$$C=f(V_{DS}); V_{GS}=0; f=100kHz$$

Figure 17: Coss Stored Energy


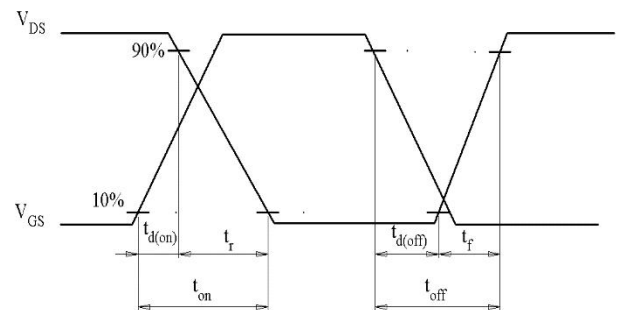
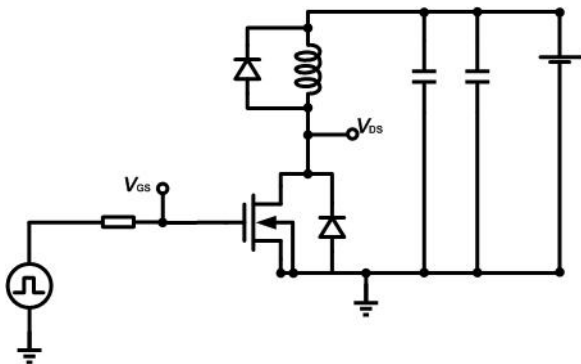
$$E_{oss}=f(V_{DS})$$

Test Circuits

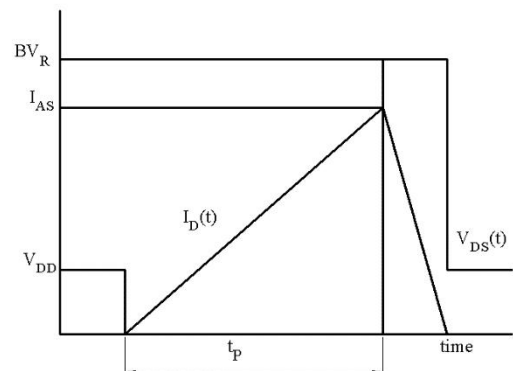
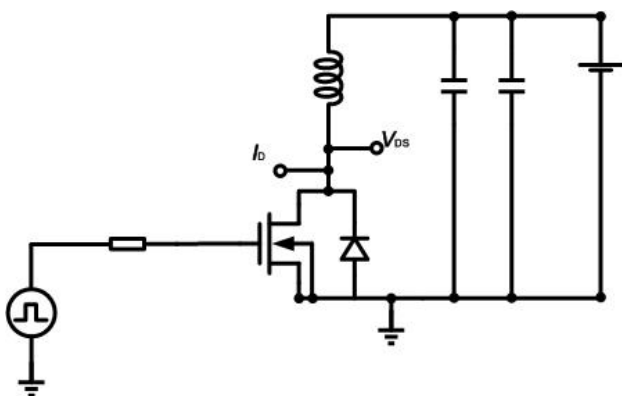
1. Gate Charge Test Circuit & Waveform



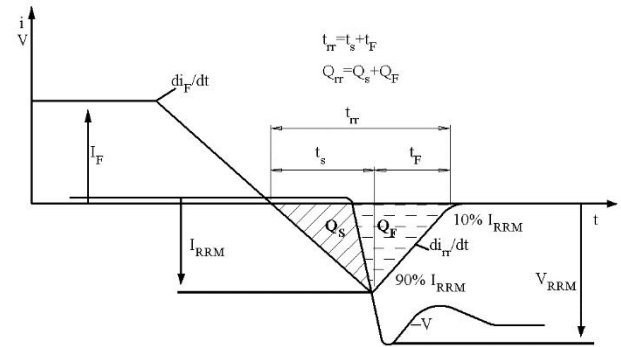
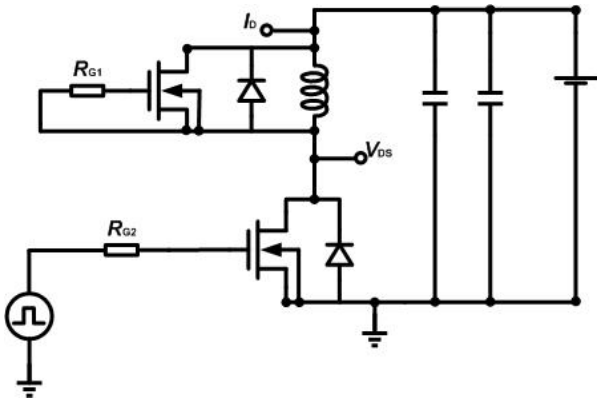
2. Switch Time Test Circuit

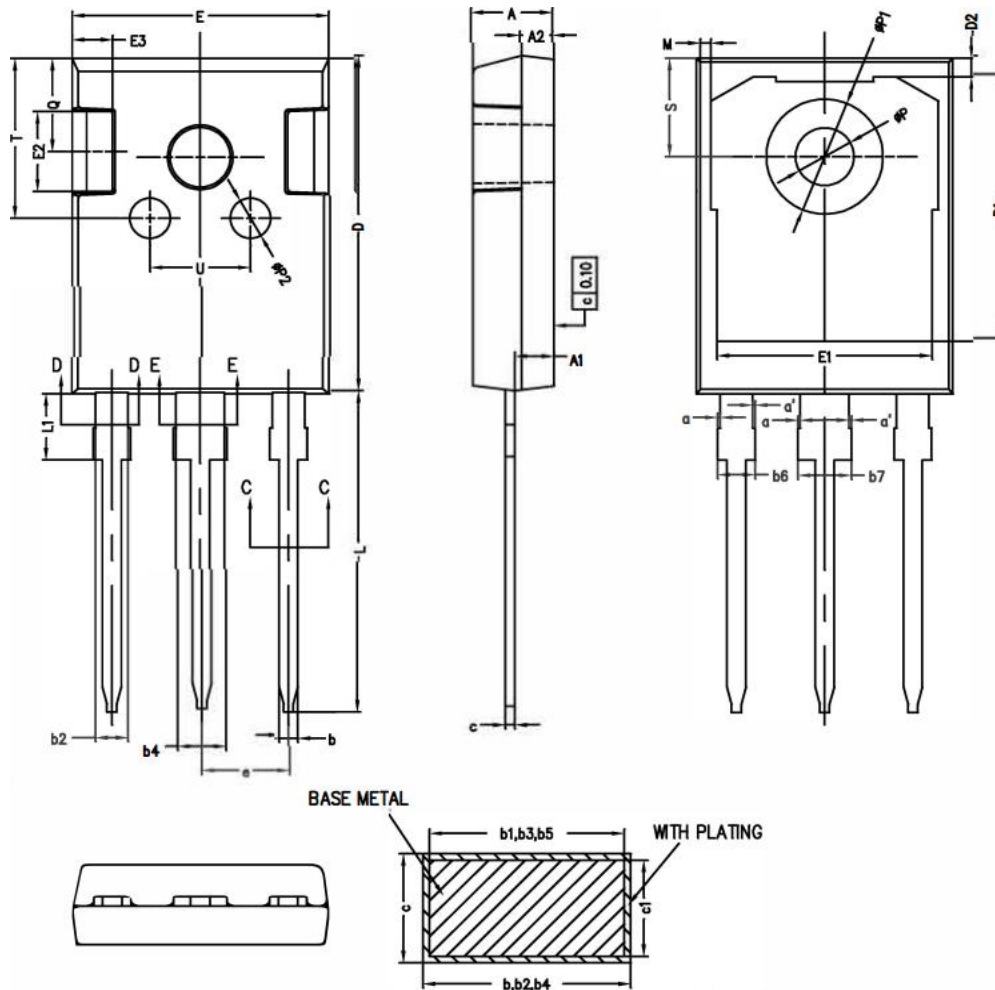


3. Unclaimed Inductive Switching Test Circuit & Waveforms

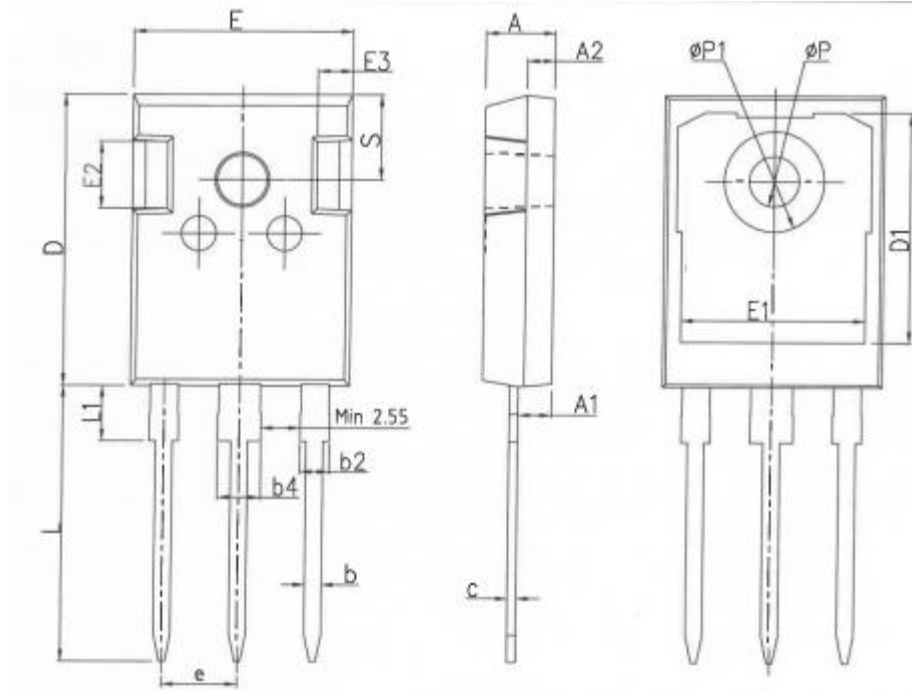


4. Test Circuit and Waveform for Diode Characteristics



Mechanical Dimensions
TO-247(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	5.34	5.44	5.54
b	1.12	-	1.22	L	19.80	19.92	20.10
b1	1.11	1.16	1.18	L1	3.95	4.13	4.30
b2	1.96	-	2.06	P	3.50	3.60	3.70
c	0.59	-	0.66	P1	7.00	-	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	6.05	6.15	6.25
E	15.70	15.80	15.90	T	9.80	-	10.20
E1	13.10	13.30	13.50	U	6.00	-	6.40

Mechanical Dimensions**TO-247(Package 2)****Unit: mm**

Symbol	Dimensions(mm)			Symbol	Dimensions(mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.80	5.00	5.20	E2	4.80	5.00	5.20
A1	2.21	2.41	2.59	E3	2.30	2.50	2.70
A2	1.85	2.00	2.15	e	5.44BSC		
b	1.11	1.21	1.36	L	19.62	19.92	20.22
b2	1.91	2.01	2.21	L1	-	-	4.30
b4	2.91	3.01	3.21	P	3.40	3.60	3.80
c	0.51	0.61	0.75	P1	-	-	7.30
D	20.70	21.00	21.30	S	6.15BSC		
D1	16.25	16.55	16.85	E1	13.00	13.30	13.60
E	15.50	15.80	16.10				



Shenzhen Sanrise Technology Co., LTD

<http://www.sanrise-tech.com>

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