

General Description

The Sanrise SRC60R230B 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 SRC60R230B break down voltage is 600V and it has a high rugged avalanche characteristics. The SRC60R230B is available in TO-252, TO-263-2, TO-220F and TO-220C packages.

Features

- Ultra Low $R_{DS(ON)} = 230m\Omega @ V_{GS} = 10V$.
- Ultra Low Gate Charge, $Q_g = 25.6nC$ 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

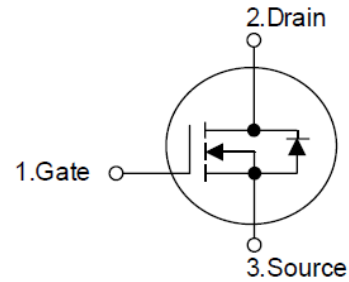


Figure 1 Symbol of SRC60R230B

Package Type

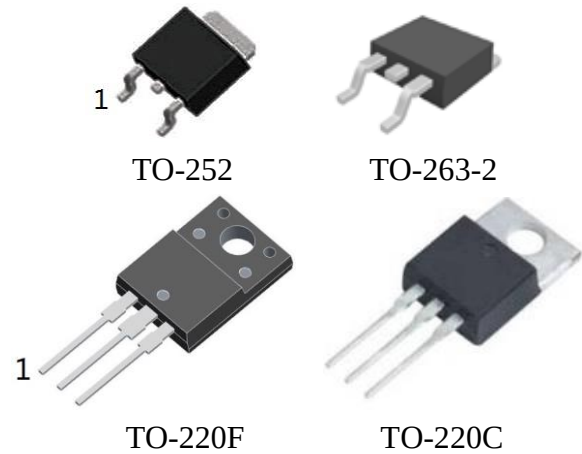


Figure 2 Package Types of SRC60R230B

Ordering Information

SRC60R230B□□-□		
Circuit Type	_____	E: Lead Free
Package	_____	G: Green
D: TO-252		Blank: Tube
TF: TO-220F		TR: Tape & Reel
TC: TO-220C		

Package	Part Number		Marking ID		Packing Type
	Lead Free	Green	Lead Free	Green	
TO-252	SRC60R230BDTR-E	SRC60R230BDTR-G	SRC60R230BDE	SRC60R230BDG	Tape & Reel
TO-263-2	SRC60R230BS2TR-E	SRC60R230BS2TR-G	SRC60R230BS2E	SRC60R230BS2G	Tape & Reel
TO-220F	SRC60R230BTF-E	SRC60R230BTF-G	SRC60R230BTFE	SRC60R230BTFG	Tube
TO-220C	SRC60R230BTC-E	SRC60R230BTC-G	SRC60R230BTCE	SRC60R230BTCG	Tube

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Drain-Source Voltage (Note2)		V_{DS}	630	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current	$T_C=25^{\circ}\text{C}$	I_D	13.7	A
	$T_C=125^{\circ}\text{C}$		6.5	
Pulsed Drain Current (Note 3)		I_{DM}	41.1	A
Avalanche Energy, Single Pulse (Note 4)		E_{AS}	190	mJ
Avalanche Energy, Repetitive (Note 3)		E_{AR}	0.2	mJ
Avalanche Current, Repetitive (Note 3)		I_{AR}	4.0	A
Continuous Diode Forward Current		I_S	13.7	A
Diode Pulse Current		$I_{S,PULSE}$	41.1	A
MOSFET dv/dt Ruggedness, $V_{DS} \leq 480\text{V}$		dv/dt	50	V/ns
Reverse Diode dv/dt, $V_{DS} \leq 480\text{V}$, $I_{SD} \leq I_D$		dv/dt	15	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. For Transient Voltage Spike.
3. Repetitive Rating: Pulse width limited by maximum junction temperature
4. $I_{AS} = 4.0\text{A}$, $V_{DD} = 60\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^{\circ}\text{C}$

Thermal characteristics

Parameter		Symbol	Min	Typ	Max	Unit
Thermal resistance, Junction-to-Case	TO-220F	RthJC			4.0	$^{\circ}\text{C} / \text{W}$
	TO-247				1.44	
	TO-220C				1.44	
	TO-263-2				1.44	
	TO-262				1.44	
	TO-252				1.44	
Thermal resistance, Junction-to-Ambient	TO-220F	RthJA			80	$^{\circ}\text{C} / \text{W}$
	TO-247				80	
	TO-220C				80	
	TO-263-2				80	
	TO-262				80	
	TO-252				80	

Electrical Characteristics

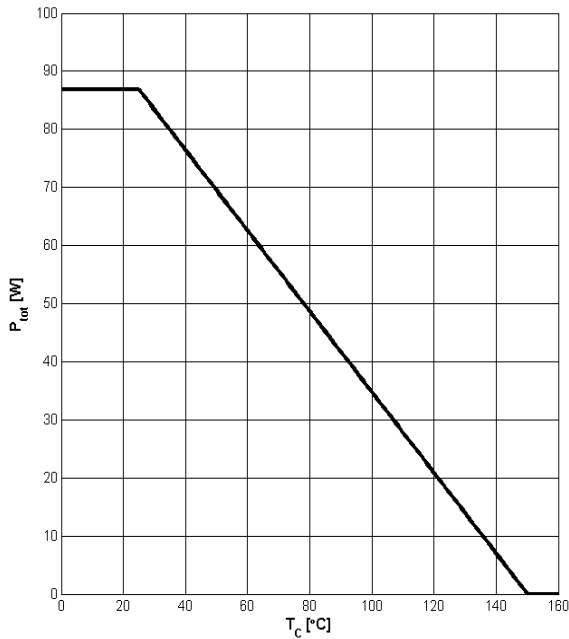
$T_J = 25^{\circ}\text{C}$, unless otherwise specified.

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250uA	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			-100	
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} , I _D =250uA	3.0	4.0	5.0	V
Static Drain-Source On-Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =8.0A		190	230	mΩ
Gate Resistance		R _G	f=1MHz, Open Drain		2.0		Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =50V, V _{GS} =0V, f=1MHz		1130		pF
Output Capacitance		C _{OSS}			86.4		
Reverse Transfer Capacitance		C _{RSS}			10		
Effective output capacitance, energy related ^{NOTE5}		C _{O(er)}	V _{GS} =0V, V _{DS} =0...480V		51.2		pF
Effective output capacitance, time related ^{NOTE6}		C _{O(tr)}			187.3		
Turn-on Delay Time		t _{d(on)}	V _{DD} =400V, I _D =8.0A R _G =10Ω, V _{GS} =10V		12		ns
Rise Time		t _r			20		
Turn-off Delay Time		t _{d(off)}			24		
Fall Time		t _f			50		
Gate Charge Characteristics							
Gate to Source Charge		Q _{gs}	V _{DD} =480V, I _D =8.0A V _{GS} =0 to 10V		8.0		nC
Gate to Drain Charge		Q _{gd}			8.2		
Gate Charge Total		Q _g			25.6		
Gate Plateau Voltage		V _{plateau}			5.8		V
Reverse Diode Characteristics							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V, I _{SD} =8.0A		0.89	1.1	V
Reverse Recovery Time		t _{rr}	V _R =400V, I _F =8.0A dI _F /dt=100A/us		105		ns
Reverse Recovery Charge		Q _{rr}			0.42		uC
Peak Reverse Recovery Current		I _{rrm}			8.0		A

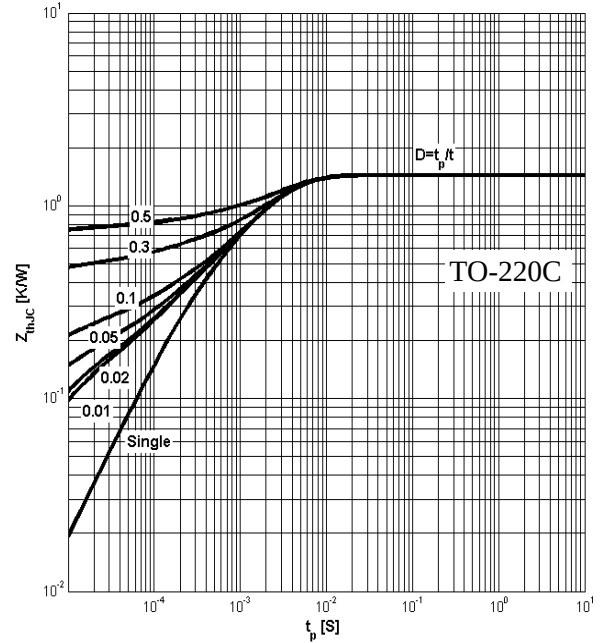
Note:

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

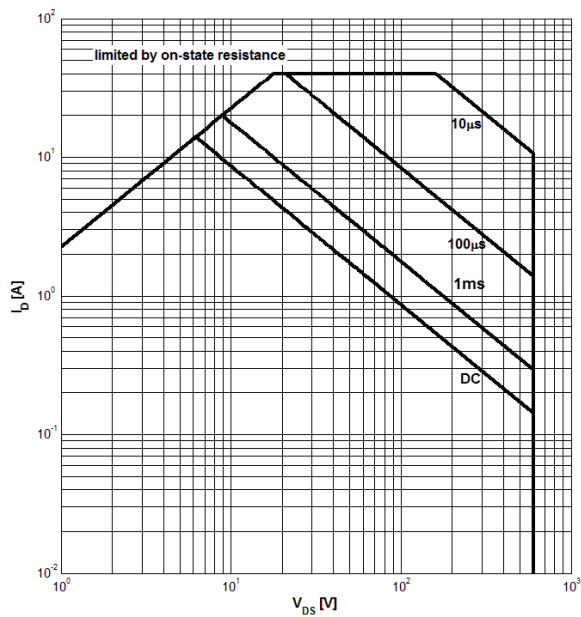
6. $C_{O(tr)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 480 V

Typical Performance Characteristics
Figure 3: Power Dissipation


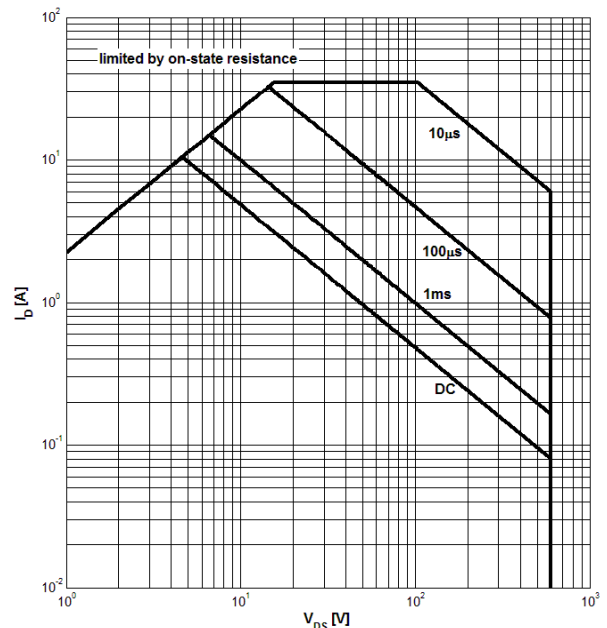
$$P_{tot} = f(T_c)$$

Figure 4: Max. Transient Thermal Impedance


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

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


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

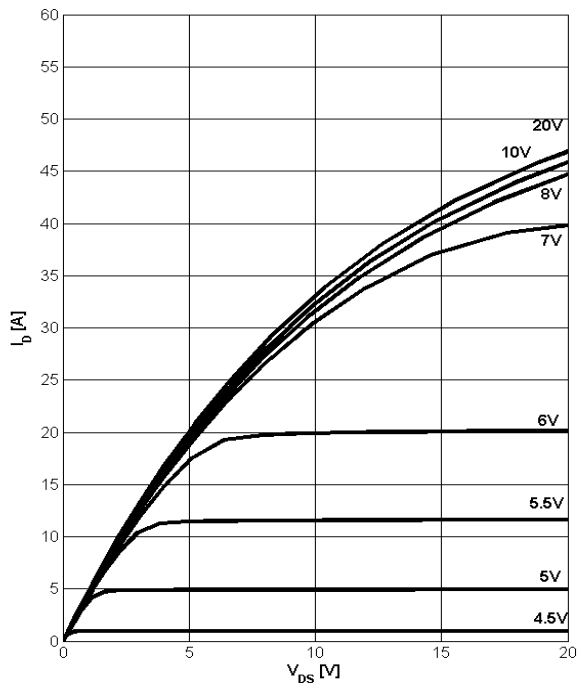
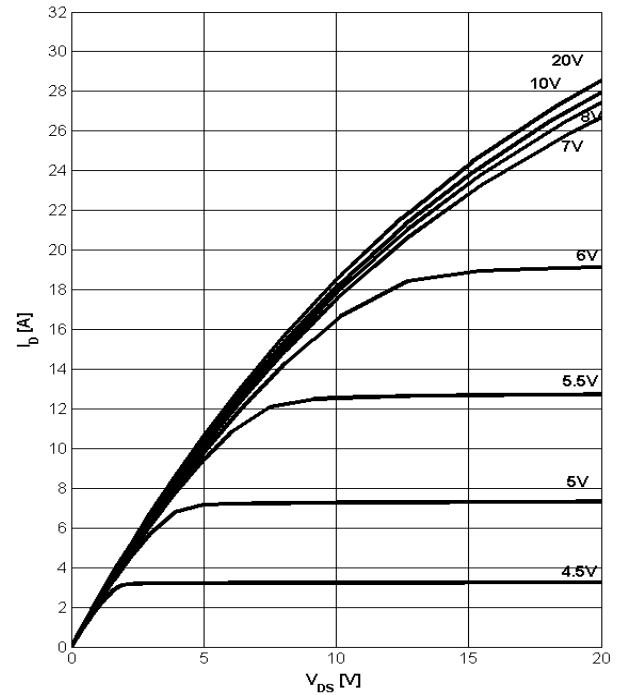
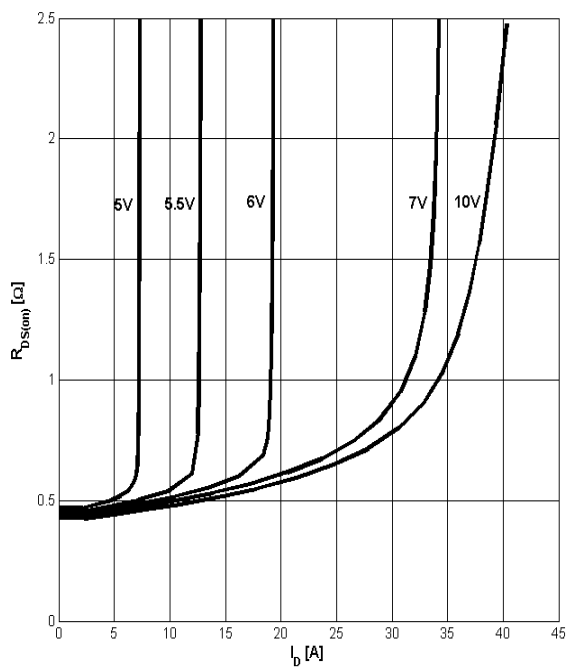
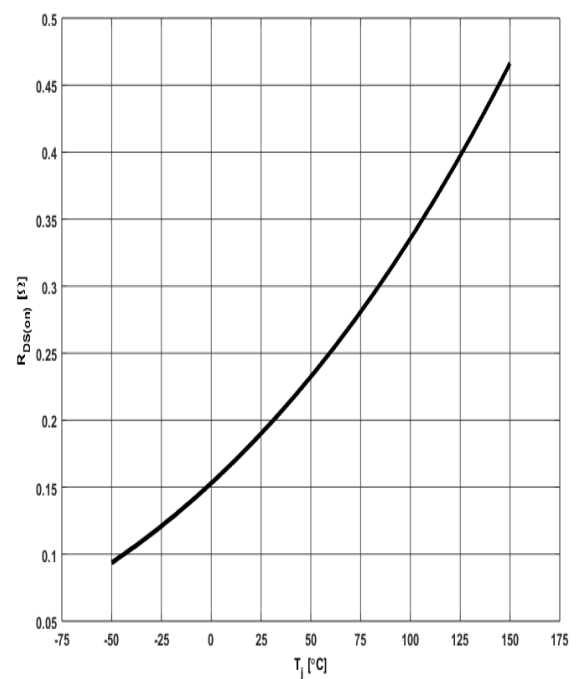
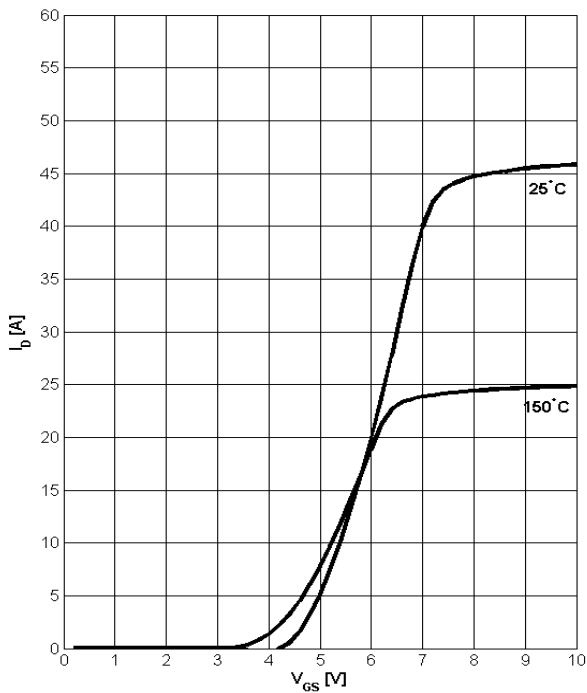
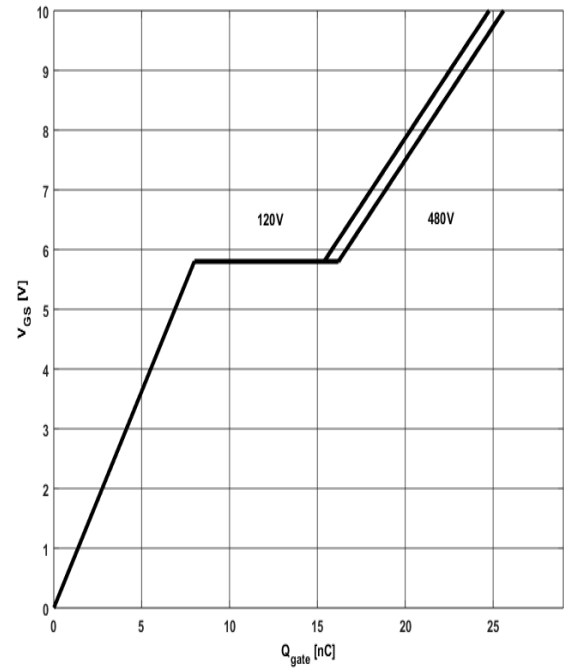
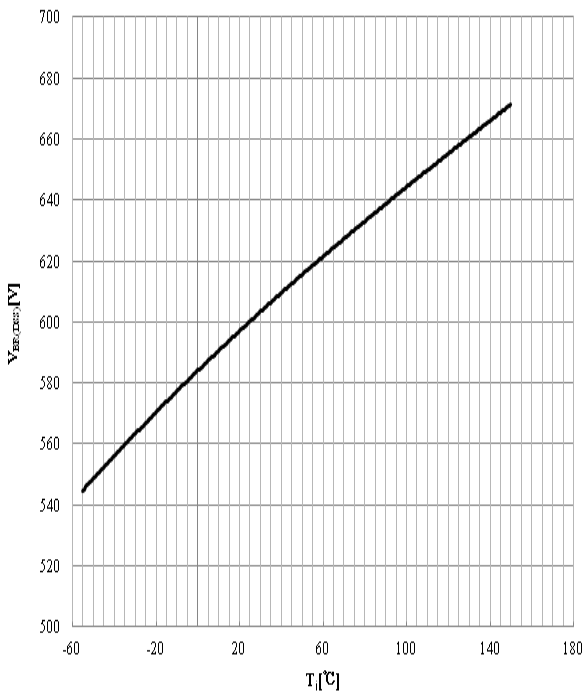
Figure 7: Typ. Output Characteristics

 $I_D = f(V_{DS}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GS}$
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

 $R_{DS(ON)} = f(T_j); I_D = 8.0\text{A}; V_{GS} = 10\text{V}$

Figure 11: Typ. Transfer Characteristics


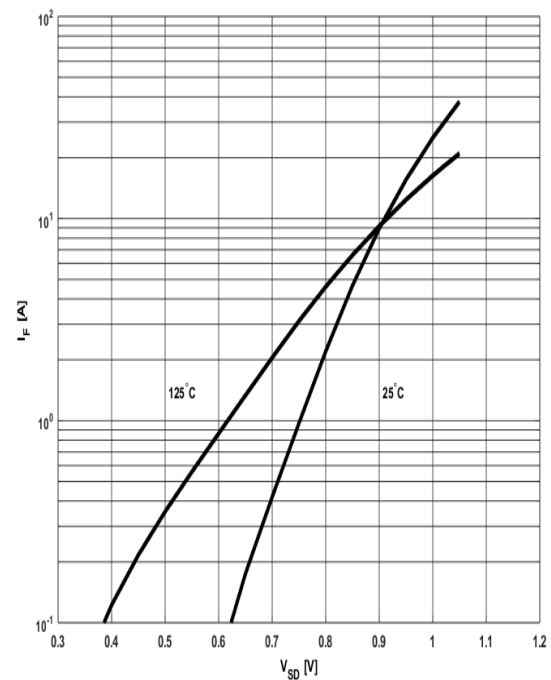
$$I_D = f(V_{GS}); V_{DS} = 20V$$

Figure 12: Typ. Gate Charge


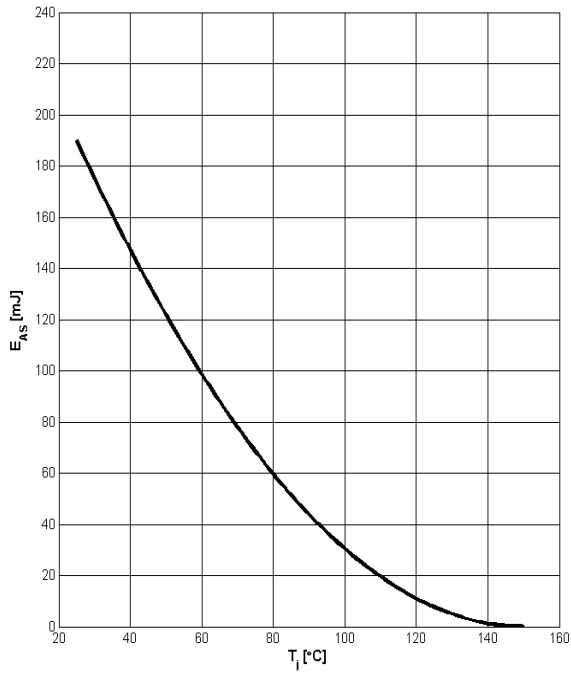
$$V_{GS} = f(Q_{gate}), I_D = 8A \text{ pulsed}$$

Figure 13: Drain-Source Breakdown Voltage


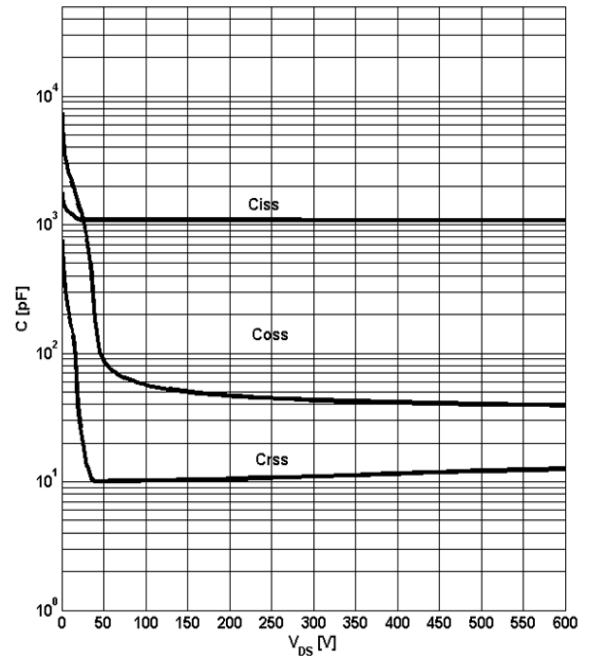
$$V_{BR(DSS)} = f(T_j); I_D = 10mA$$

Figure 14: Forward Characteristics of Reverse Diode


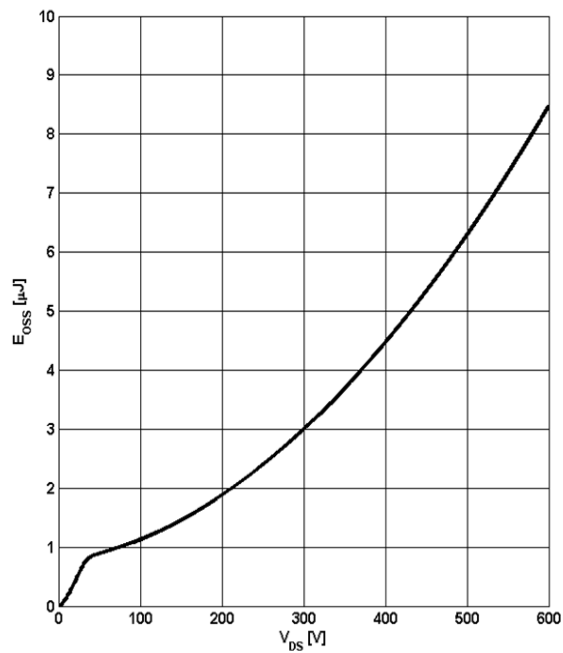
$$I_F = f(V_{SD}); \text{parameter: } T_j$$

Figure 15: Avalanche Energy


$$E_{AS}=f(T_J); I_D=4.0A; V_{DD}=60V$$

Figure 16: Typ. Capacitances


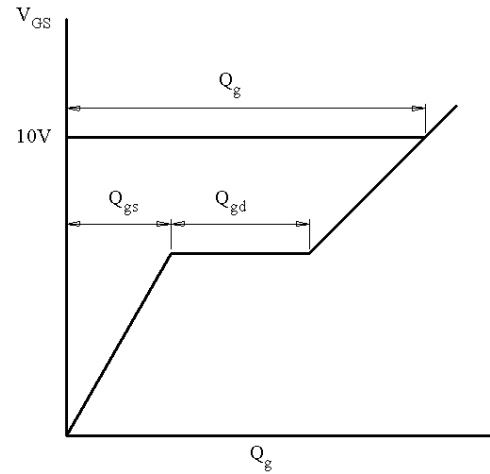
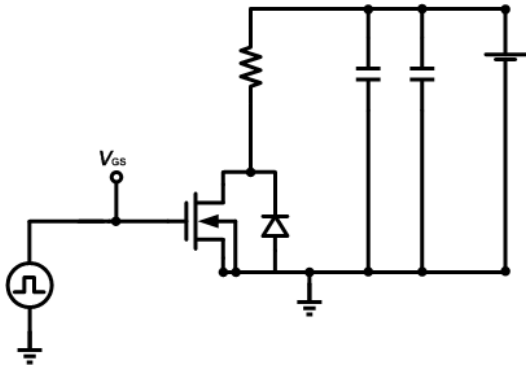
$$C=f(V_{DS}); V_{GS}=0; f=1MHz$$

Figure 17: Coss Stored Energy


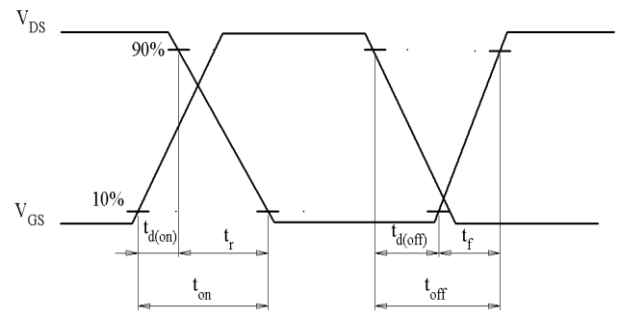
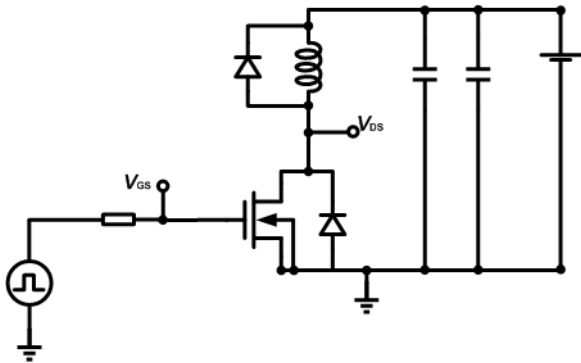
$$E_{OSS}=f(V_{DS})$$

Test Circuits

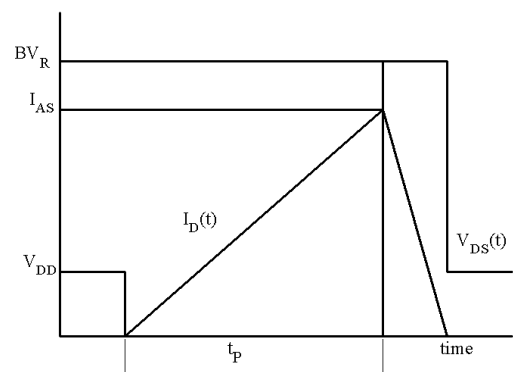
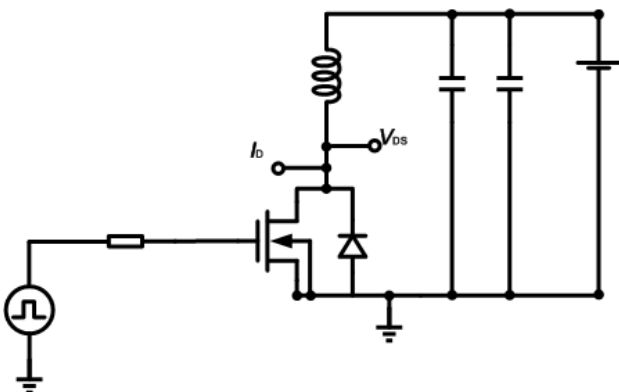
1. Gate Charge Test Circuit & Waveform



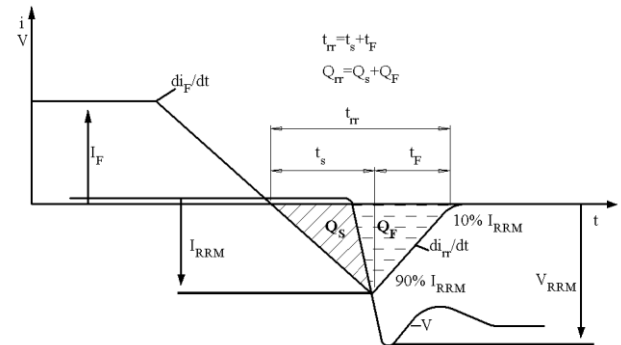
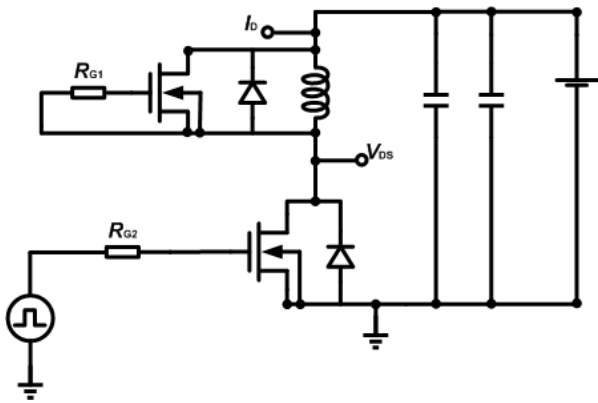
2. Switch Time Test Circuit

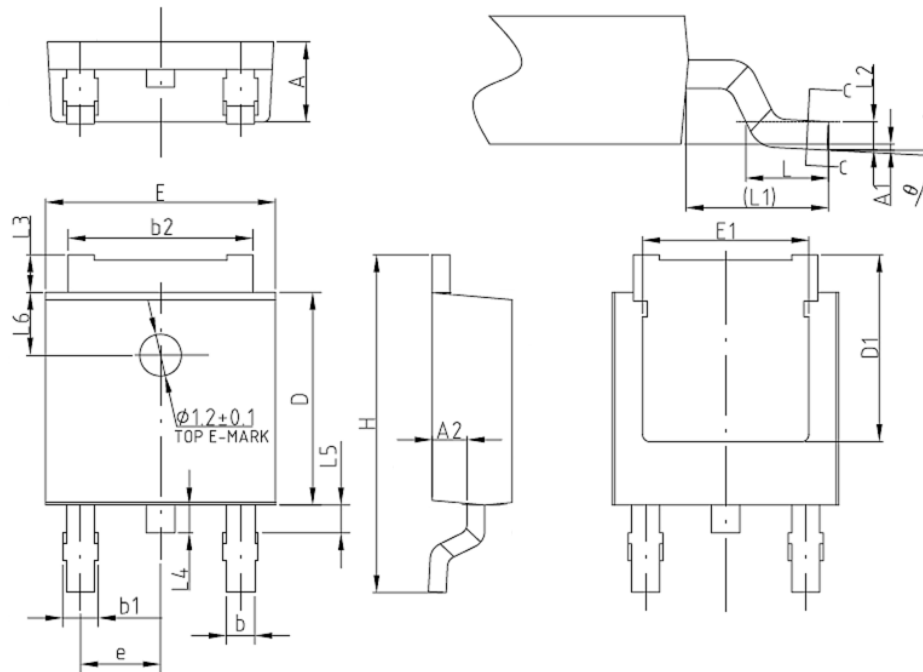


3. Unclaimed Inductive Switching Test Circuit & Waveforms

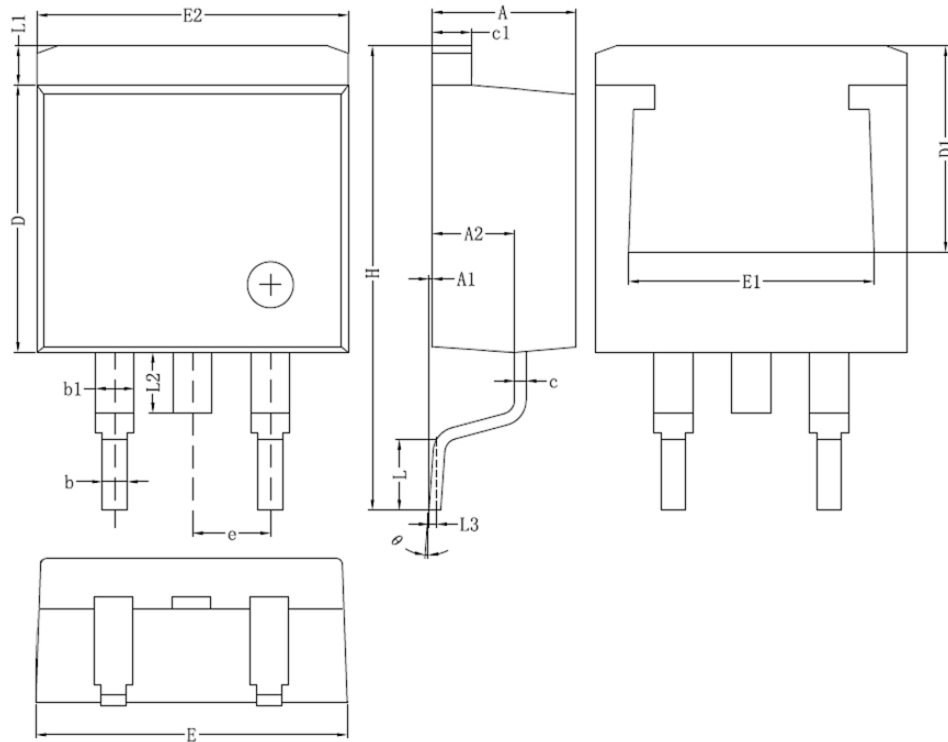


4. Test Circuit and Waveform for Diode Characteristics

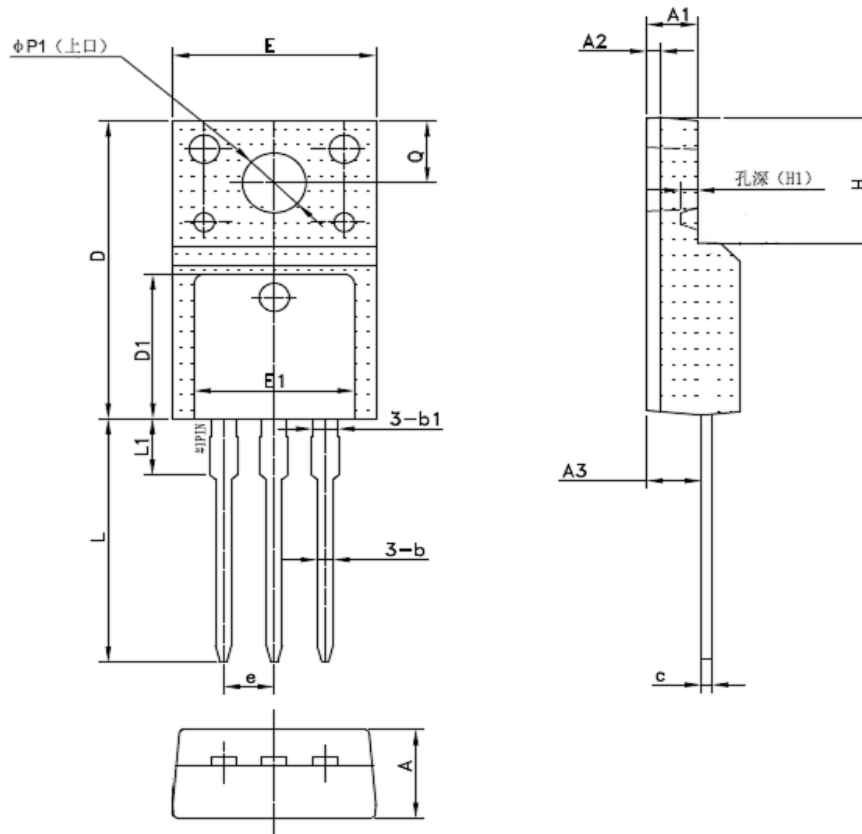


Mechanical Dimensions
TO-252
Unit: mm


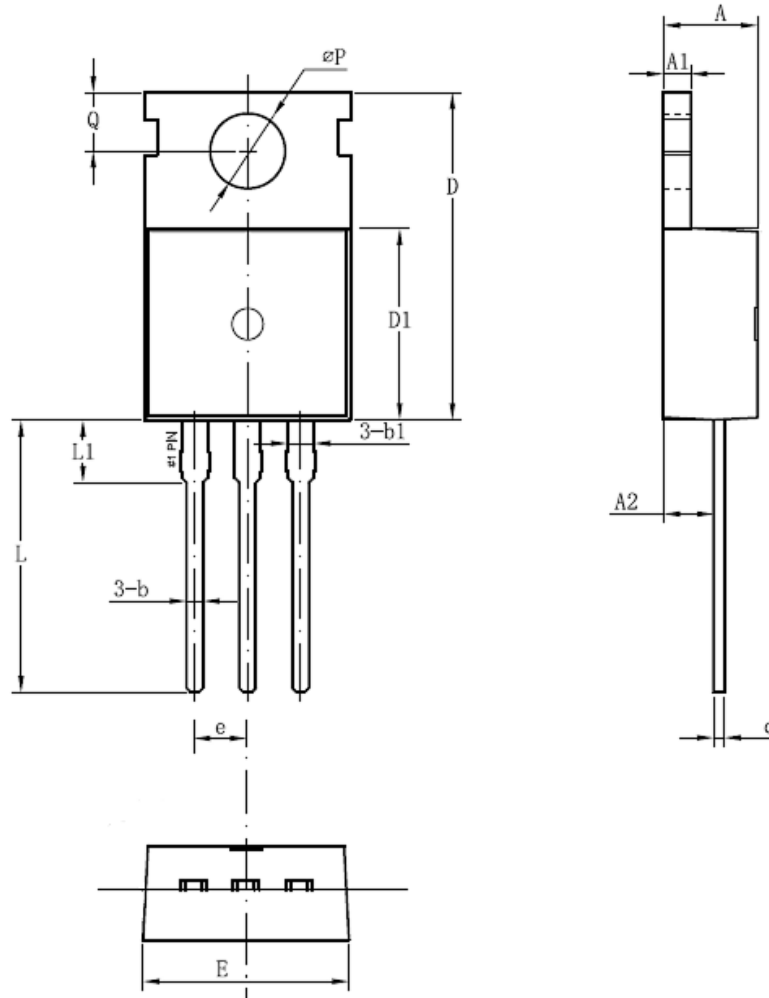
Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	2.20	2.30	2.40
A1	0	-	0.10
A2	0.90	1.00	1.17
b	0.70	0.76	0.90
b1	0.77	-	1.10
b2	5.13	5.33	5.46
c	0.45	-	0.60
D	5.95	6.10	6.25
D1	-	5.30	-
E	6.45	6.60	6.75
E1	-	4.80	-
e	2.286(BSC)		
H	9.70	10.10	10.40
L	1.25	1.50	1.75
L1	-	2.90	-
L2	-	0.51	-
L3	0.90	-	1.25
L4	-	0.80	-
L5	-	1.00	-
L6	-	1.80	-
θ	0°	-	8°

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°

Mechanical Dimensions (Continued)
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



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