

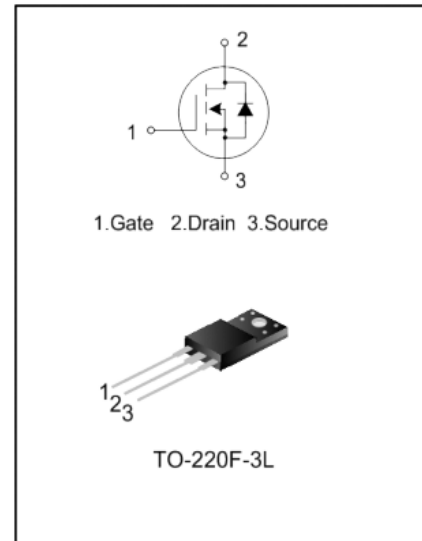
## 650V N-Channel MOSFET

### GENERAL DESCRIPTION

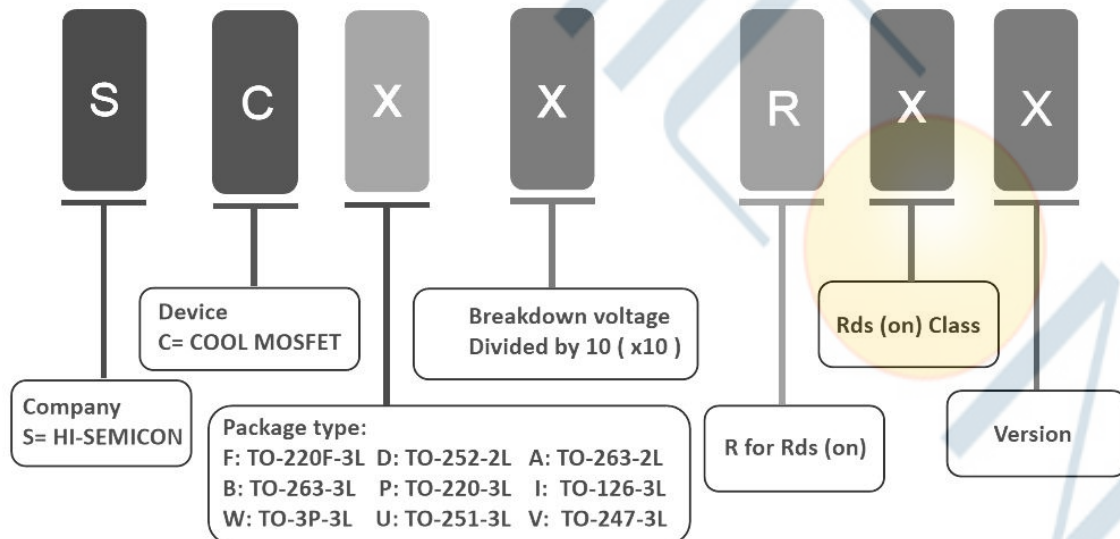
SJ-FET is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance. This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. SJ-FET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency.

### FEATURES

- ◆ New revolutionary high voltage technology
- ◆ Typ. RDS(on) = 0.26Ω
- ◆ Ultra Low Gate Charge (typ. Qg = 24nC)
- ◆ 100% avalanche tested



### NOMENCLATURE



## ORDERING INFORMATION

Part No.	Package	Marking	Material	Packing
SCF65R310C	TO-220F-3L	SCF65R310C	Pb free	Tube

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	SCF65R310C	Unit
VDSS	Drain-Source Voltage	650	V
ID	Drain Current-Continuous (TC = 25°C)	14	A
	-Continuous (TC = 100°C)	8.8	
IDM	Drain Current - Pulsed	56	A
VGSS	Gate-Source voltage	±30	V
EAS	Single Pulsed Avalanche Energy (Note1)	593	mJ
dv/dt	Reverse diode dv/dt (Note2)	15	V/ns
dv/dt	MOSFET dv/dt ruggedness (Note3)	50	V/ns
PD	Power Dissipation (TC = 25°C)	35.7	W
TJ	Operation Junction Temperature Range	-55 to +150	°C
TSTG	Storage Temperature Range	-55 to +150	°C
TL	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	°C

## Thermal Characteristics

Symbol	Parameter	SCF65R310C	Unit
RθJC	Thermal Resistance, Junction-to-Case	3.50	°C/W
RθJA	Thermal Resistance, Junction-to-Ambient	62.5	°C/W

**Electrical Characteristics TC = 25°C** unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA,	650	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V	-	-	1.0	μA
I <sub>GSS</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = ±30V, V <sub>DS</sub> = 0V	-	-	±100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.0	-	4.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 7 A	-	0.26	0.31	Ω
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 100V, V <sub>GS</sub> = 0V,	-	802	-	pF
C <sub>oss</sub>	Output Capacitance	f = 1.0MHz	-	45	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	2.2	-	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 325V, I <sub>D</sub> =14A, V <sub>GS</sub> = 10V R <sub>G</sub> =25Ω (Note 4,5)	-	13	-	ns
t <sub>r</sub>	Turn-On Rise Time		-	37	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	59	-	ns
t <sub>f</sub>	Turn-Off Fall Time		-	32	-	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 520V, I <sub>D</sub> =14.0A, V <sub>GS</sub> =10V	-	24	-	nC
Q <sub>gs</sub>	Gate-Source Charge	(Note 4,5)	-	6.5	-	nC
Q <sub>gd</sub>	Gate-Drain Charge		-	11	-	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		-	-	14	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		-	-	56	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 14.0A	-	-	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0V, I <sub>S</sub> = 14.0A, dI <sub>F</sub> /dt=100A/ s μ	-	367	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	4.7	-	μC

**Notes:**

- 1.L=79mH, I<sub>AS</sub>=3.6A, V<sub>DD</sub>=100V, R<sub>G</sub>=25Ω, starting temperature T<sub>J</sub>=25°C;
- 2.V<sub>DS</sub>=0~400V, I<sub>SD</sub><=14A, T<sub>J</sub>=25°C;
- 3.V<sub>DS</sub>=0~480V;
4. Pulse Test: Pulse width ≤300μs, Duty cycle≤2%;
5. Essentially independent of operating temperature.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

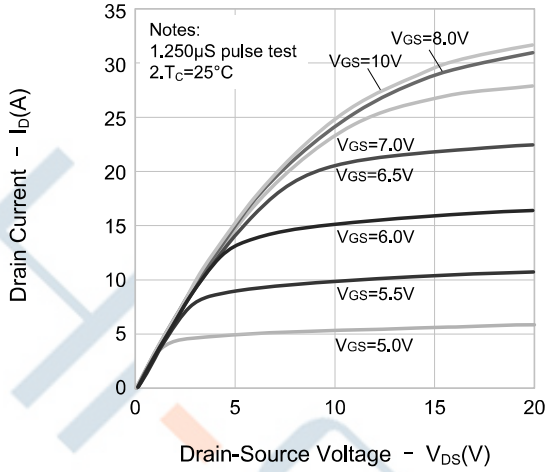


Figure 2. Transfer Characteristics

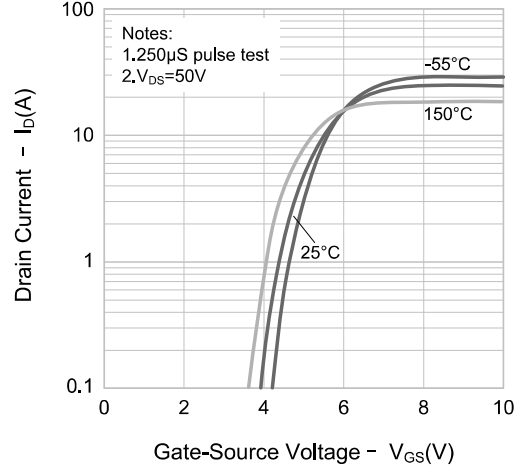


Figure 3. On-Resistance Variation vs. Drain Current

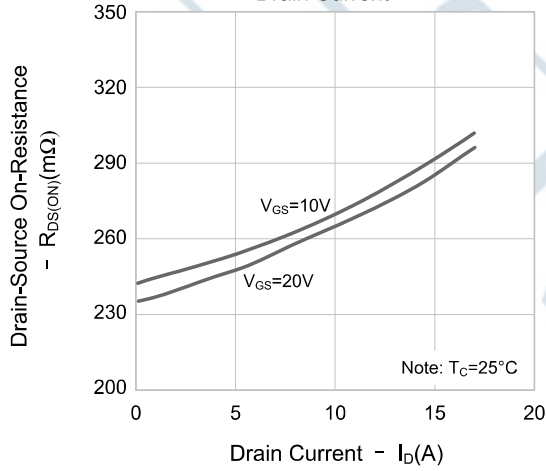


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

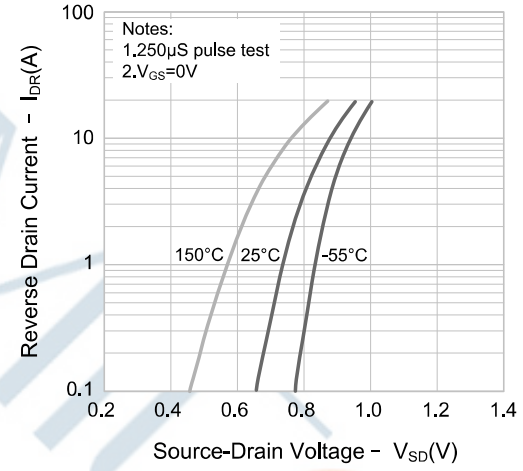


Figure 5. Capacitance Characteristics

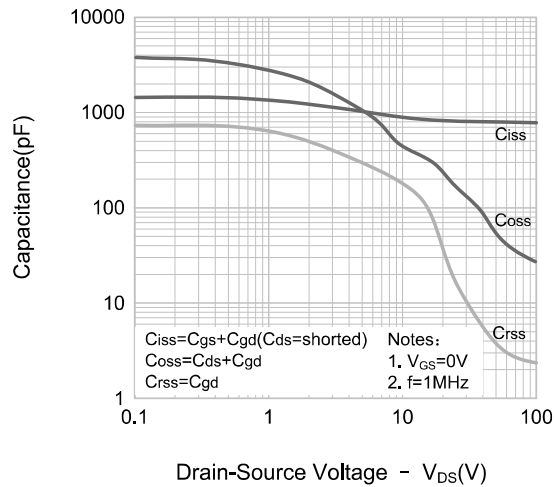
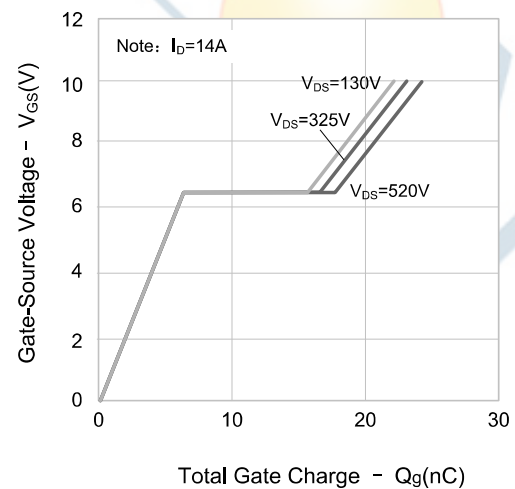


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics

Figure 7. Breakdown Voltage Variation vs. Temperature

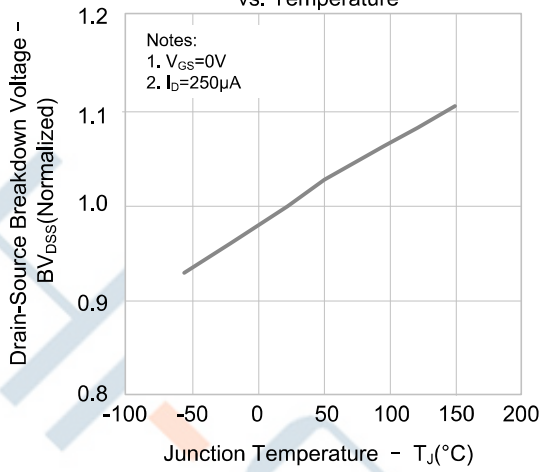


Figure 8. On-resistance Variation vs. Temperature

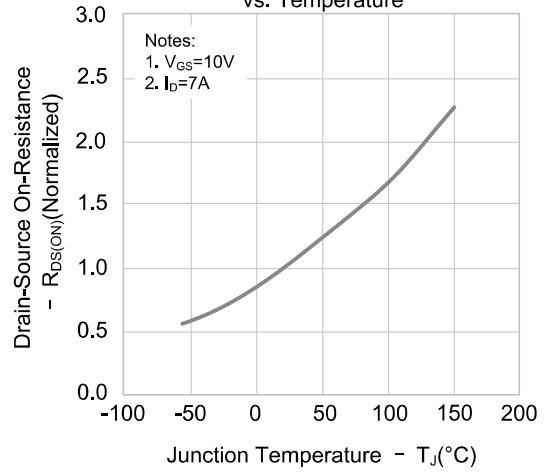
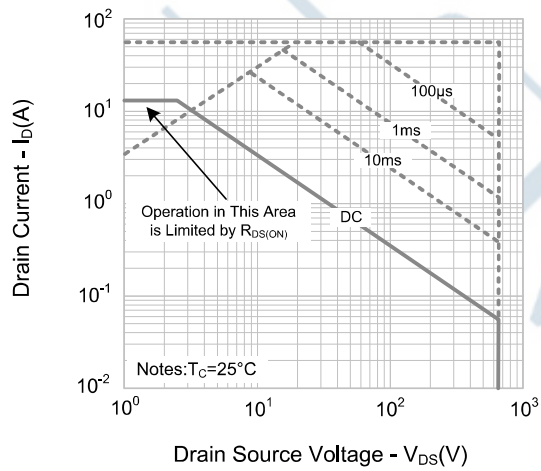
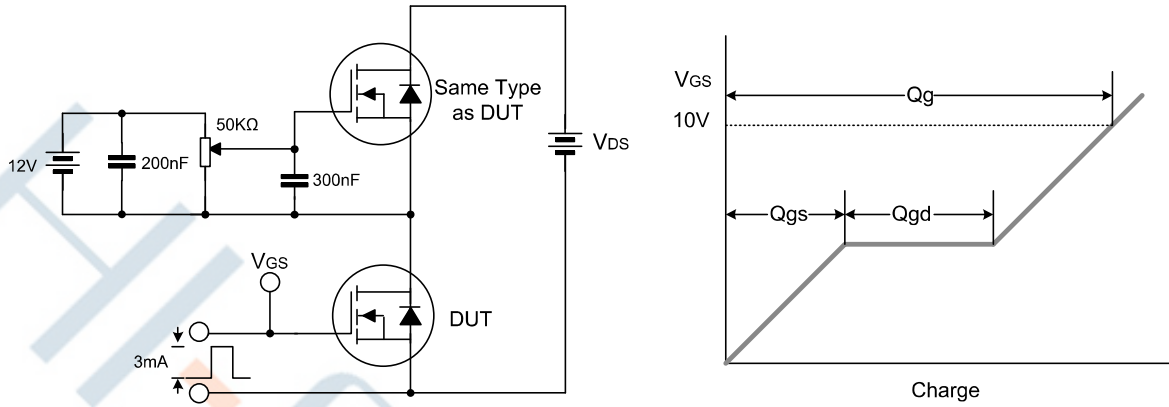


Figure 9. Max. Safe Operating Area

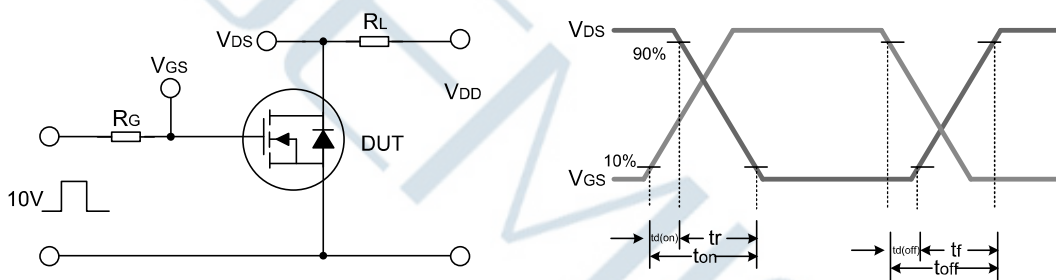


Test circuits

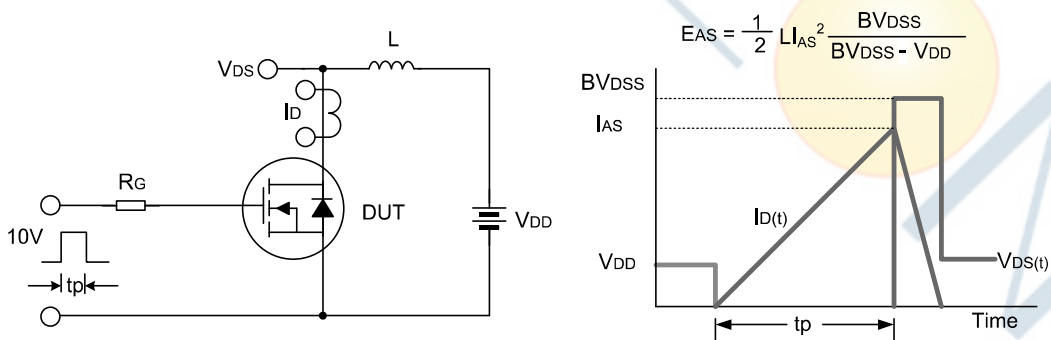
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform

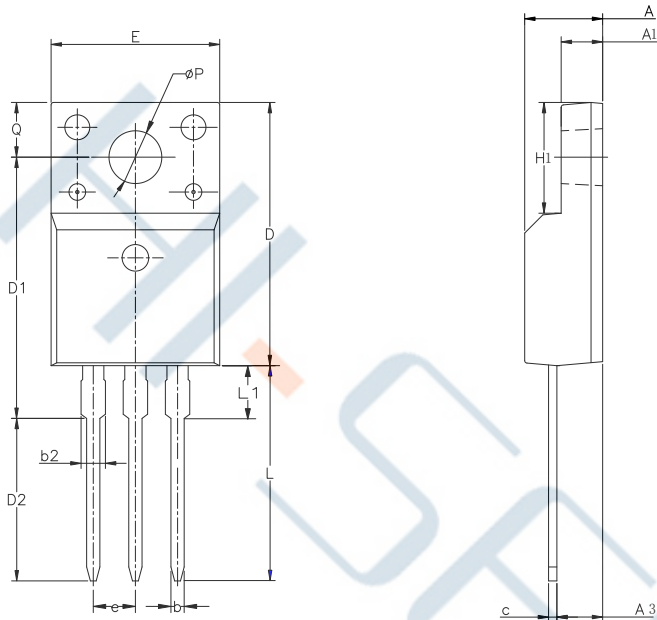


Unclamped Inductive Switching Test Circuit & Waveform



TO-220F-3L

UNIT: mm



SYMBOL	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.55	0.70	0.85
b2	—	—	1.29
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	13.97	14.47	14.97
D2	10.58	11.08	11.58
E	9.73	10.16	10.36
e	2.54BCS		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	—	—	2.00
ØP	3.00	3.18	3.40
Q	3.05	3.30	3.55