Sanrise Tech

160A 650V Trench Fieldstop IGBT with FRD SRE160N065FSUD8

General Description

The SRE160N065FSUD8 is a Field Stop Trench IGBT with anti-parallel diode, which offers ultra low conduction loss, high energy efficiency for switching applications such as Inverter, Driver, Converter, etc.

The SRE160N065FSUD8 package is TO-247Plus.

Features

- High Breakdown Voltage to 650V
- Advanced Trench Fieldstop technology
  - Short circuit ruggedness>8us @ 25°C
  - High Ruggedness, Temperature Stability
  - Easy Parallel Switching Capability due to Positive Temperature Coefficient in $V_{CE(SAT)}$
- Low $V_{CE(SAT)}$
- Enhanced Avalanche Capability
- Qualified according to AEC Q101

Application

- Motor Drives
- Inverter & Solar
- Converter with high switching frequency

Symbol

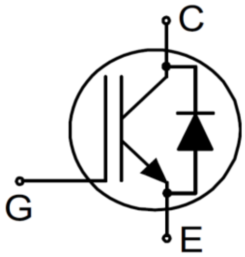
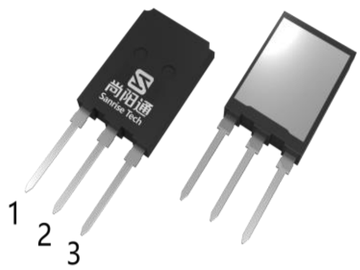


Figure 1 Symbol of SRE160N065FSUD8

Package Type



TO-247Plus

Pin 1- Gate

Pin 2&backside- Collector

Pin 3-Emitter

Figure 2 Package Type of SRE160N065FSUD8

Ordering Information

SRE160N065FSUD8□□–□

Circuit Type

Package

TP: TO-247Plus

G: Green

Blank: Tube

TR: Tape & Reel

Package	Part Number	Marking ID	Packing Type
TO-247Plus	SRE160N065FSUD8TP-G1A	SRE160N065FSUD8TPG1A	Tube

Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Collector-emitter voltage		V_{CES}	650	V
Gate-emitter Voltage		V_{GES}	±20	V
Transient Gate-emitter Voltage			±30	V
Continuous Collector Current	T_C=25°C	I_C	240[1]	A
	T_C=100°C		160	
Pulsed Collector Current, Limited by T_{Jmax}		I_{CM}	480	A
Diode Continuous Collector Current	T_C=25°C	I_F	200	A
	T_C=100°C		160	A
Diode Pulsed Current, Limited by T_{Jmax}		I_{FM}	420	A
Power Dissipation	T_C=25°C	P_{tot}	882	W
	T_C=100°C		441	
Short Circuit withstand time: V_{GE}=15V,Vcc≤400V,Tj_start=25℃; Allow number of short circuits<1000; Time between short circuits:1.0S;		tsc	8	us
Operating Junction Temperature Range		T_J	-40 ~ 175[2]	°C
Storage Temperature		T_{STG}	-55 ~ 150	°C
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	°C

Note:
1. Limited to bondwire.
2. Reliability testing conducted at T_{Jmax}=175℃

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
IGBT thermal Resistance， Junction-to-Case	R_{thJC}	-	-	0.17	°C/W
Diode thermal Resistance， Junction-to-Case	R_{thJC}	-	-	0.3	
Thermal Resistance， Junction-to-Ambient	R_{thJA}	-	-	40	

Electrical Characteristics

T_J = 25ºC, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics						
Collector-emitter Breakdown Voltage	BV_{CES}	V_{GE}=0V, I_C=250uA	650			V
Gate Threshold Voltage	$V_{GE(th)}$	V_{CE}=V_{GE}, I_C=1.6mA	4.2	4.8	5.4	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE}=15V, I_C=160A, T_J=25ºC		1.46	1.60	V
		T_J=125ºC		1.72		V
		T_J=175ºC		1.89		V
Zero Gate Voltage Collector Current	I_{CES}	V_{CE}=650V,V_{GE}=0V T_J=25ºC		0.1	10	uA
		T_J=175ºC			1	mA
Gate-emitter Leakage Current Forward	I_{GESF}	V_{GE}=20V, V_{CE}=0V			100	nA
Gate-emitter Leakage Current Reverse	I_{GESR}	V_{GE}=-20V, V_{CE}=0V			-100	nA
Dynamic Characteristics						
Input Capacitance	C_{IES}	V_{CE}=25V, V_{GE}=0V, f=100KHz		8446		pF
Output Capacitance	C_{OES}			585		
Reverse Transfer Capacitance	C_{RES}			113		
Gate Resistance	R_G	f=1MHz,Open Drain		0.5		Ω
Turn-on Delay Time	$t_{d(on)}$	T_J=25ºC V_{CC}=400V, I_C=160A R_G=20Ω, V_{GE}=0/15V Energy losses include "tail" and diode reverse recovery		98		ns
Rise Time	t_r			132		ns
Turn-off Delay Time	$t_{d(off)}$			560		ns
Fall Time	t_f			96		ns
Turn-on energy	E_{on}			9.0		mJ
Turn-off energy	E_{off}			5.0		mJ
Total switching energy	E_{ts}			14.0		mJ
Turn-on Delay Time	$t_{d(on)}$	T_J=150ºC V_{CC}=400V,I_C=160A R_G=20Ω,V_{GE}=0/15V Energy losses include "tail" and diode reverse recovery		92		ns
Rise Time	t_r			137		ns
Turn-off Delay Time	$t_{d(off)}$			665		ns
Fall Time	t_f			125		ns
Turn-on energy	E_{on}			10.4		mJ
Turn-off energy	E_{off}			6		mJ
Total switching energy	E_{ts}			16.4		mJ
Gate to Emitter Charge	Q_{GE}	V_{CC}=400V,I_C=160A V_{GE}=0 to 15V		87		nC
Gate to Collector Charge	Q_{GC}			124		
Gate Charge Total	Q_G			356		

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Reverse Diode Characteristics						
Diode Forward Voltage	V_F	I_F=80A T_J=25°C	1.10	1.50	1.90	V
		I_F=80A T_J=125°C		1.36		
		I_F=80A T_J=175°C		1.27		
		I_F=160A T_J=25°C	1.30	1.78	2.20	V
		I_F=160A T_J=125°C		1.71		
		I_F=160A T_J=175°C		1.66		
Reverse Recovery Time	t_{rr}	T_J=25°C V_R=400V, I_F=80A R_G=20Ω dI_F/dt=730A/μs		182		ns
Reverse Recovery Charge	Q_{rr}			1.65		uC
Peak Reverse Recovery Current	I_{rrm}			26		A
Diode peak rate of fall off reverse recovery current	dirr/dt			-200		A/μs
Reverse recovery energy	Erec			0.81		mJ
Reverse Recovery Time	t_{rr}	T_J=175°C V_R=400V, I_F=80A R_G=20Ω dI_F/dt=710A/μs		404		ns
Reverse Recovery Charge	Q_{rr}			11.1		uC
Peak Reverse Recovery Current	I_{rrm}			59		A
Diode peak rate of fall off reverse recovery current	dirr/dt			-180		A/μs
Reverse recovery energy	Erec			5.94		mJ
Reverse Recovery Time	t_{rr}	T_J=25°C V_R=400V, I_F=160A R_G=20Ω dI_F/dt=650A/μs		197		ns
Reverse Recovery Charge	Q_{rr}			1.71		uC
Peak Reverse Recovery Current	I_{rrm}			26		A
Diode peak rate of fall off reverse recovery current	dirr/dt			-160		A/μs
Reverse recovery energy	Erec			0.85		mJ
Reverse Recovery Time	t_{rr}	T_J=175°C V_R=400V, I_F=160A R_G=20Ω dI_F/dt=670A/μs		463		ns
Reverse Recovery Charge	Q_{rr}			14.6		uC
Peak Reverse Recovery Current	I_{rrm}			69		A
Diode peak rate of fall off reverse recovery current	dirr/dt			-190		A/μs
Reverse recovery energy	Erec			8.11		mJ

Typical Performance Characteristics

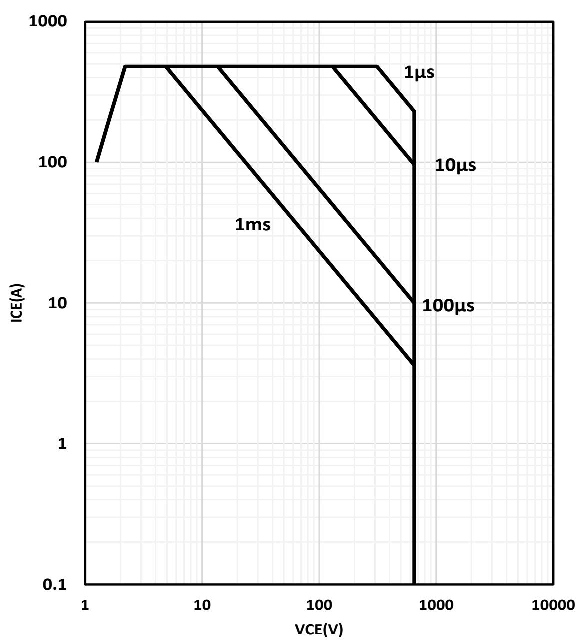
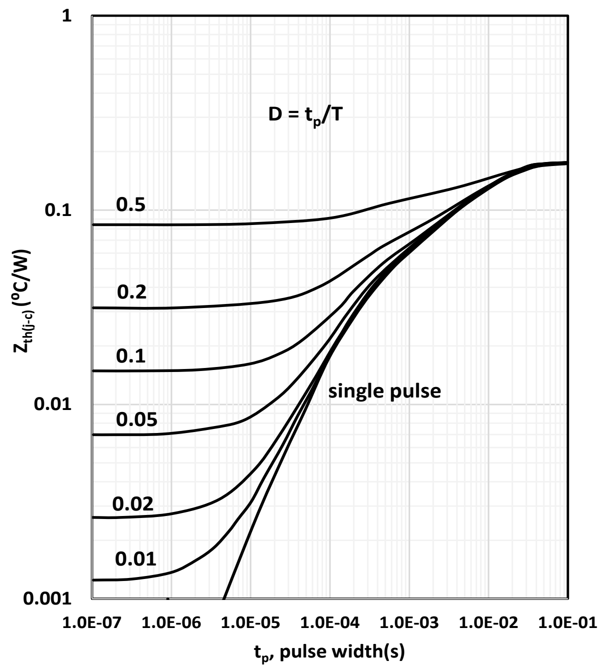
Figure 3: IGBT forward bias safe operating area (FBSOA)	Figure 4: IGBT transient thermal impedance
	
$I_C = f(V_{CE})$; $V_{GE} \geq 15/0V$; $Tj \leq 175°C$	$R_{th(J\text{-}C)} = f(t_p)$; duty cycle: $D = t_p/T$

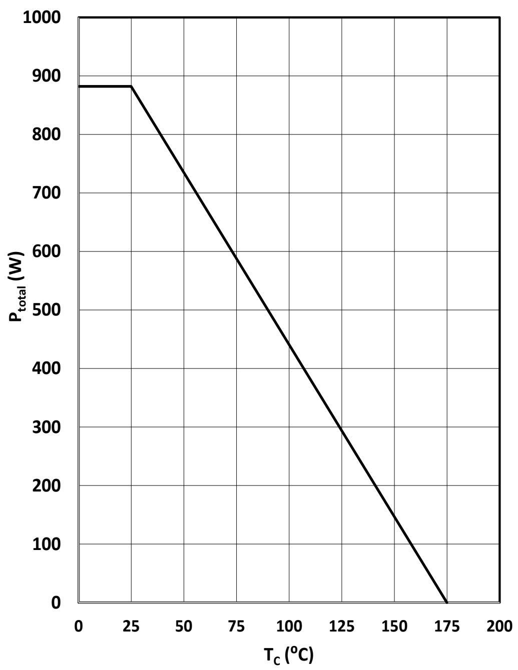
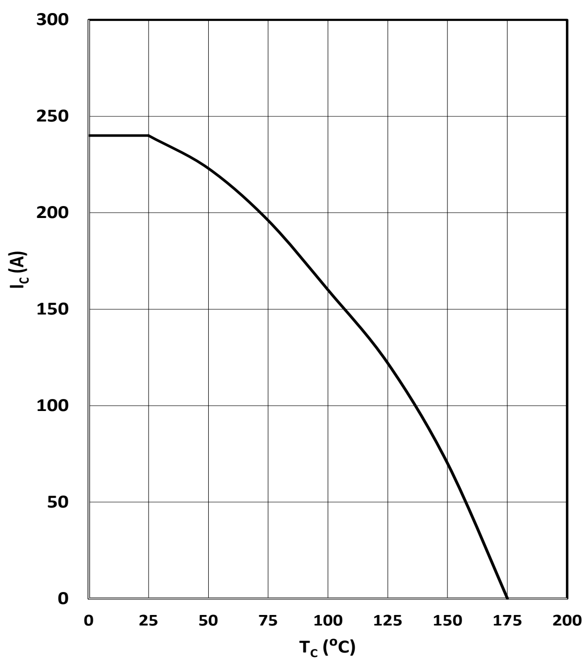
Figure 5: Power Dissipation	Figure 6: Collector current vs. temperature
	
Ptot= f(Tc)	$Ic = f(Tj)$; $V_{GE} \geq 15/0V$; $Tj \leq 175°C$

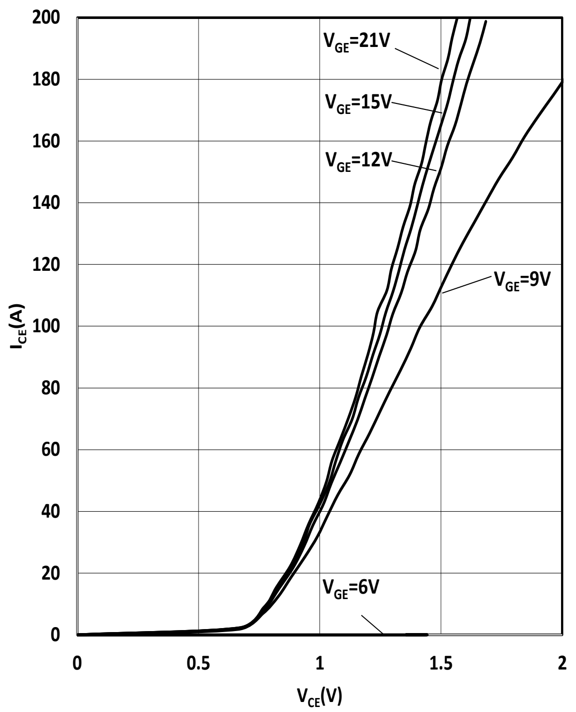
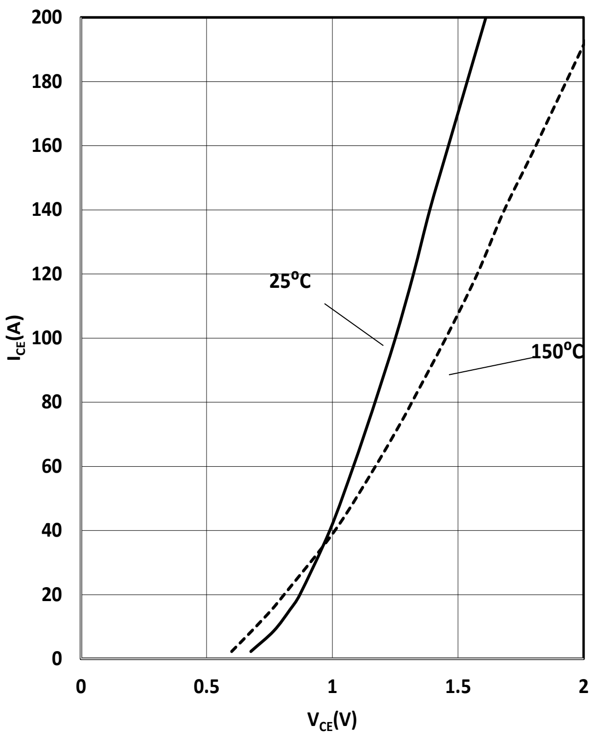
Figure 7: Typical Output Characteristics	Figure 8: Typical transfer characteristic
	
$I_C = f(V_{CE})$; Tj= 25°C; parameter: V_{GE}	$I_C = f(V_{CE})$; Tj= 25°C vs 150°C V_{GE} =15V;

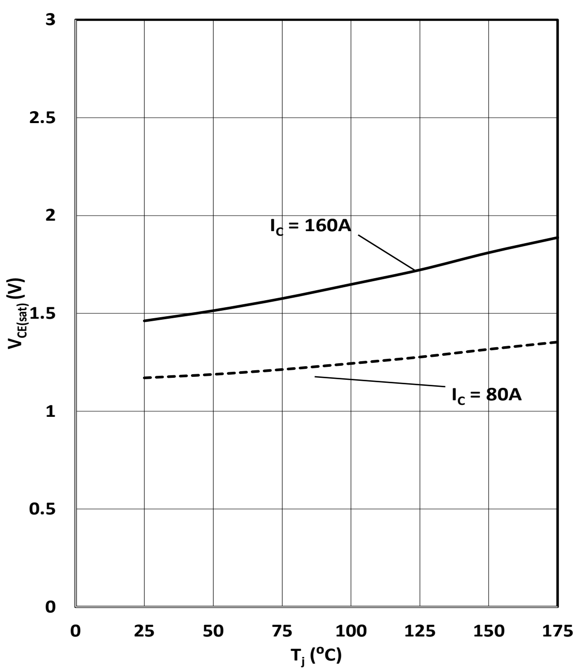
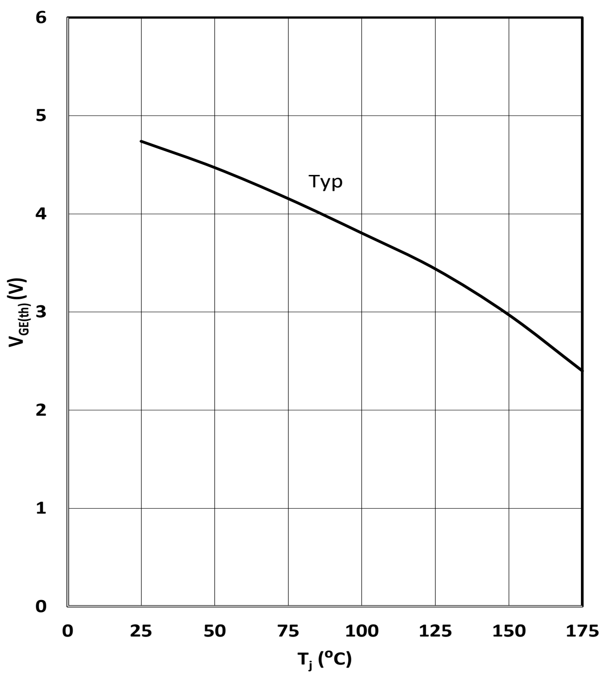
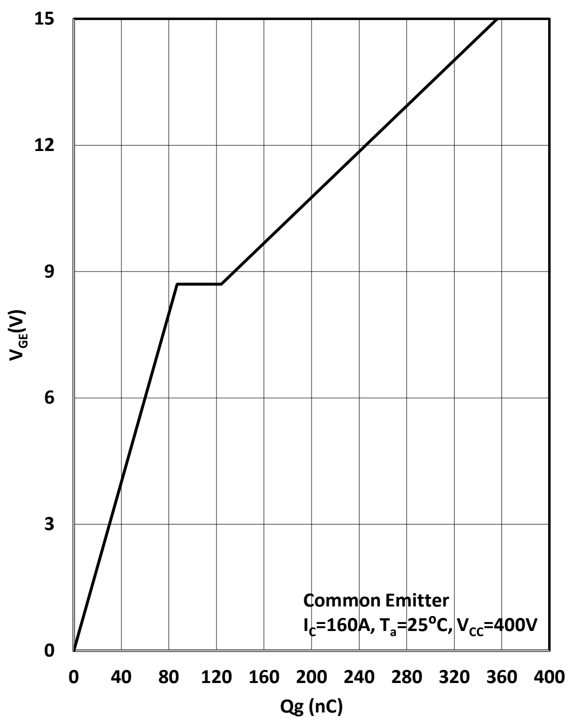
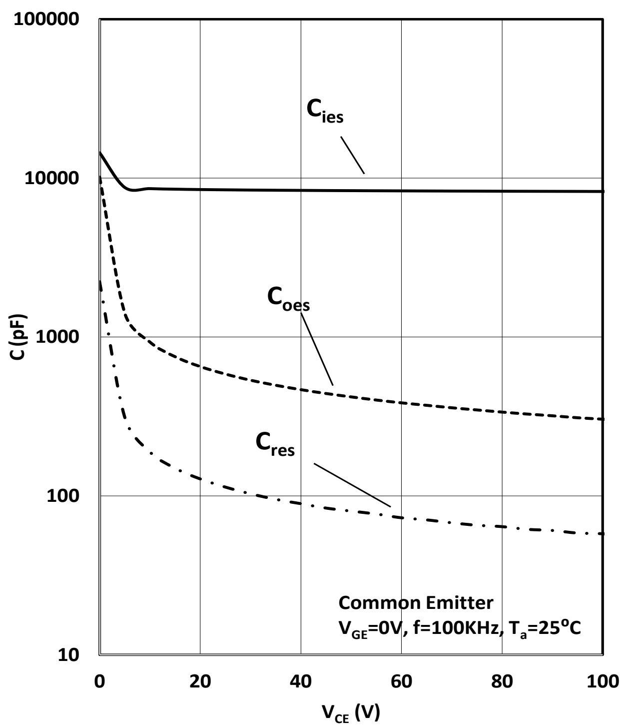
Figure 9: Typical collector-emitter saturation voltage as a function of junction temperature	Figure 10: Gate-emitter threshold voltage as a function of junction temperature
	
$V_{CE} = f(T_j)$; V_{GE}=15V	$V_{GE} = f(T_j)$; I_{CE} = 1.6mA

Figure 11: Typical Gate Charge



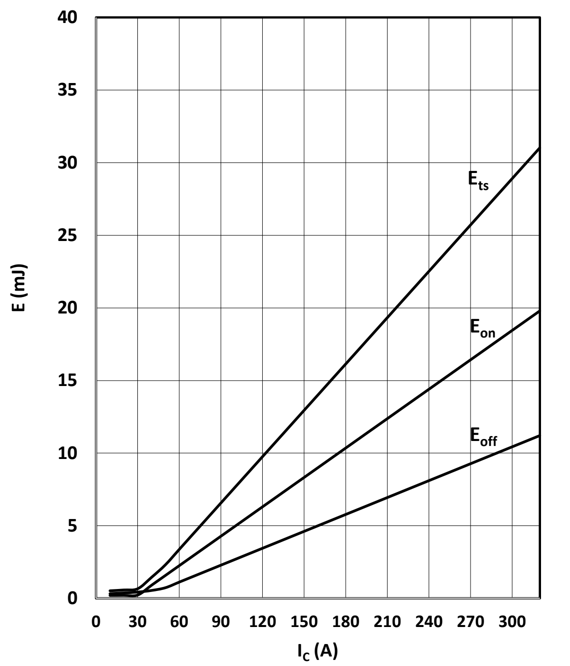
V_{GE}= f(Q_{gate}), I_C= 160A

Figure 12: Typical Capacitances



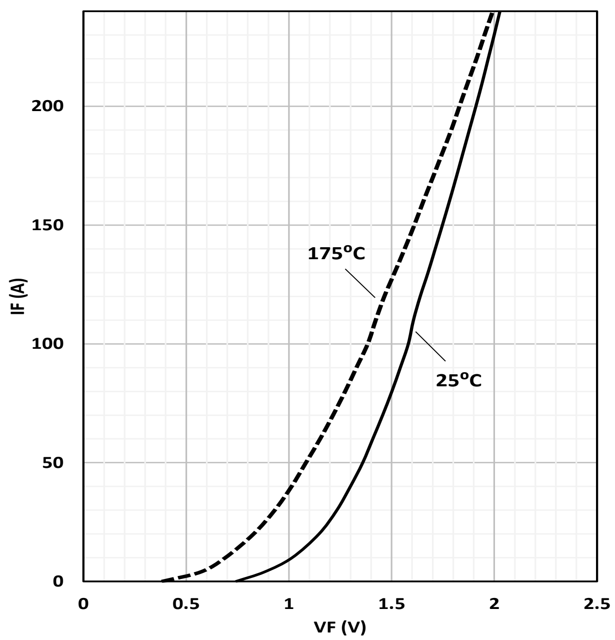
C=f(V_{CE}); V_{GE}=0; f=100KHz

Figure13: Typical switching energy losses as a function of collector current



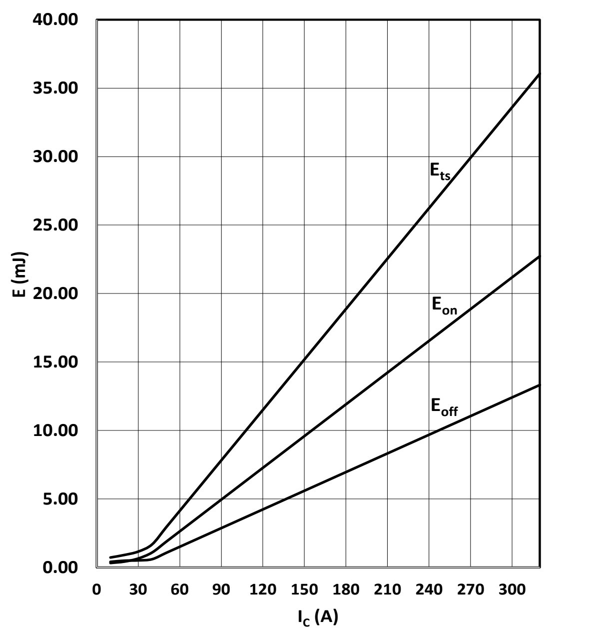
E=f(I_C); V_{CE}=400V; Tc=25°C; R_G=20Ω

Figure 14: Typical diode forward current as a function of forward voltage



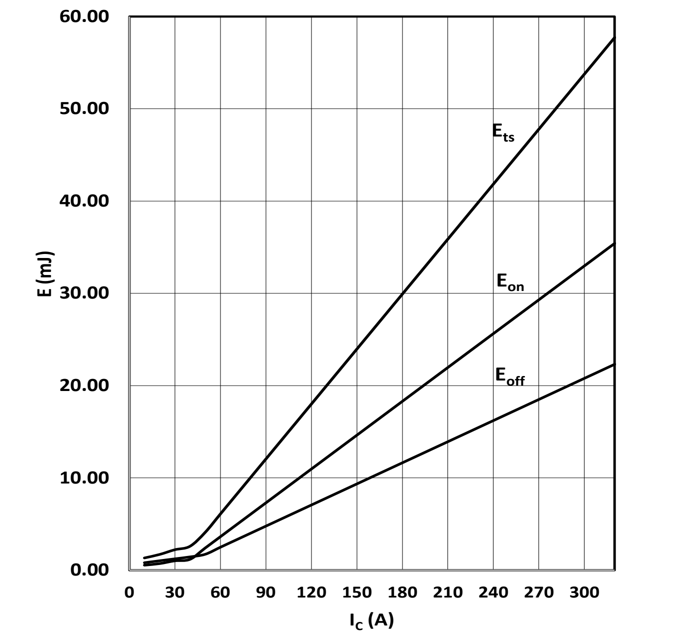
I_F= f(V_F);

Figure15: Typical switching energy losses as a function of collector current



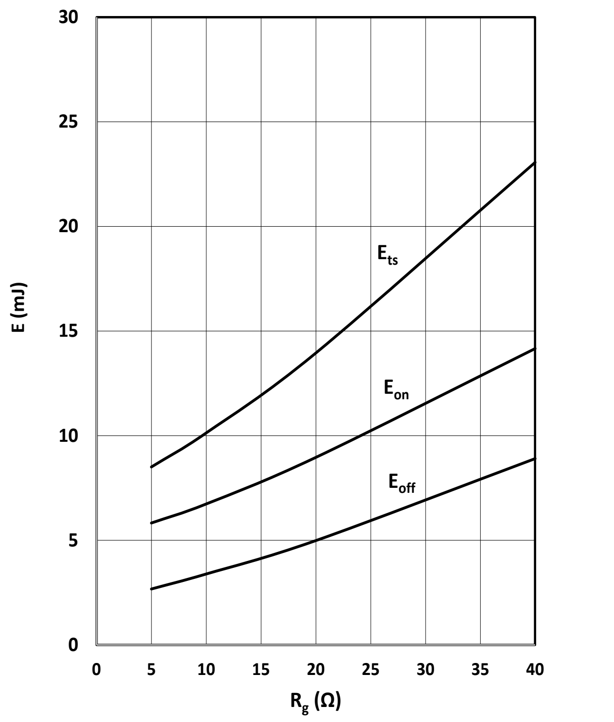
E=f(Ic); V_{CE}=400V; Tc=150℃; Rg=20Ω

Figure 16: Typical switching energy losses as a function of collector current



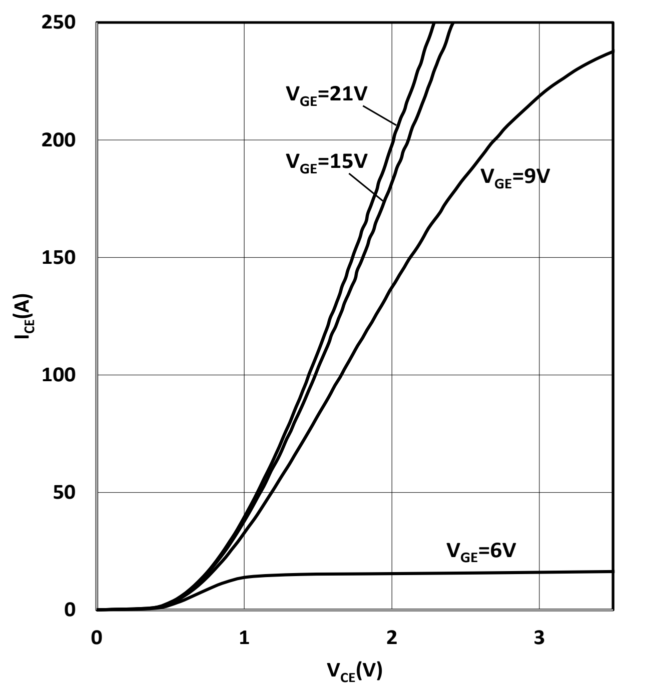
E=f(Ic); V_{CE}=400V; Tc=150℃; Rg=40Ω

Figure17: Typical switching energy losses as a function of gate resistor



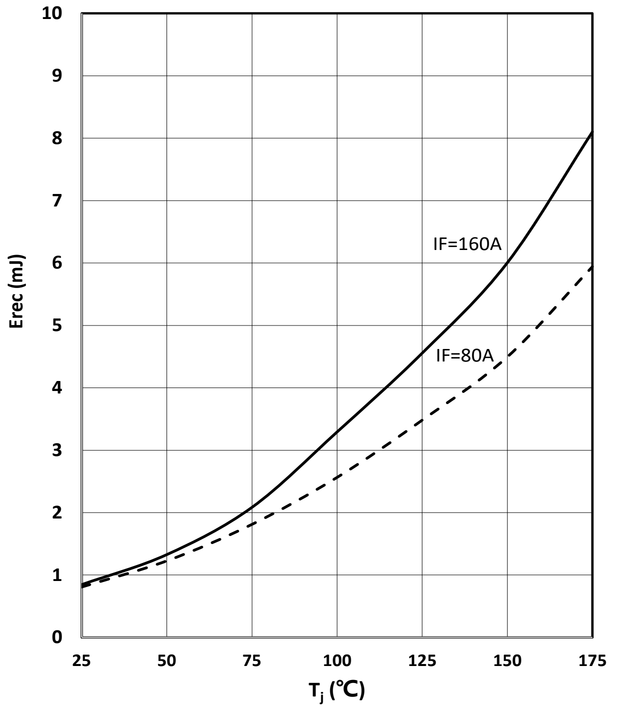
E=f(Ic); V_{CE}=400V; Tc=25℃; Ic=160A

Figure18: Typical Output Characteristics



I_C = f(V_{CE}); Tj= 150℃; parameter: V_{GE}

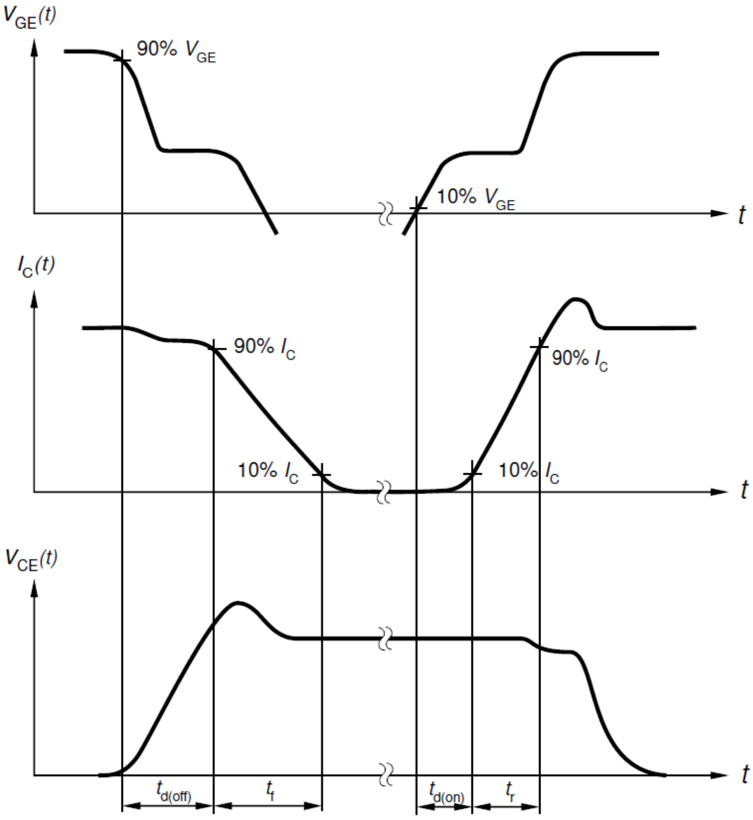
Figure19: Typical reverse energy losses as a function of junction temperature



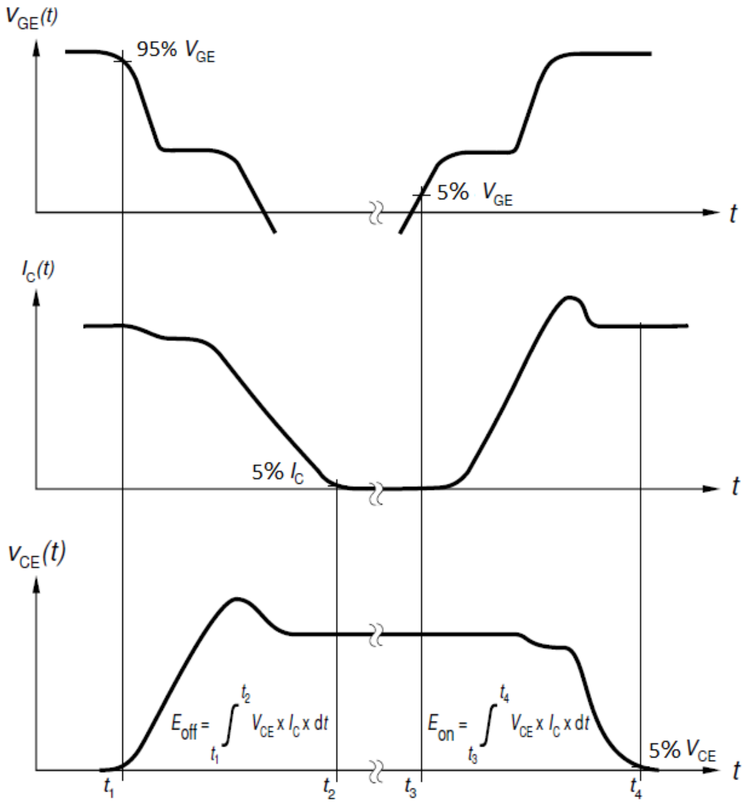
Erec= f(Tj); V_{CE}=400V; I_F=80A 160A; R_G=20Ω

Test Circuits

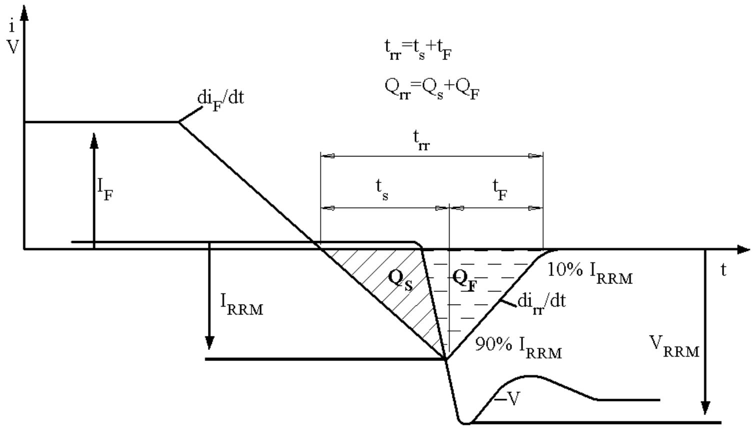
1. Definition Switching times



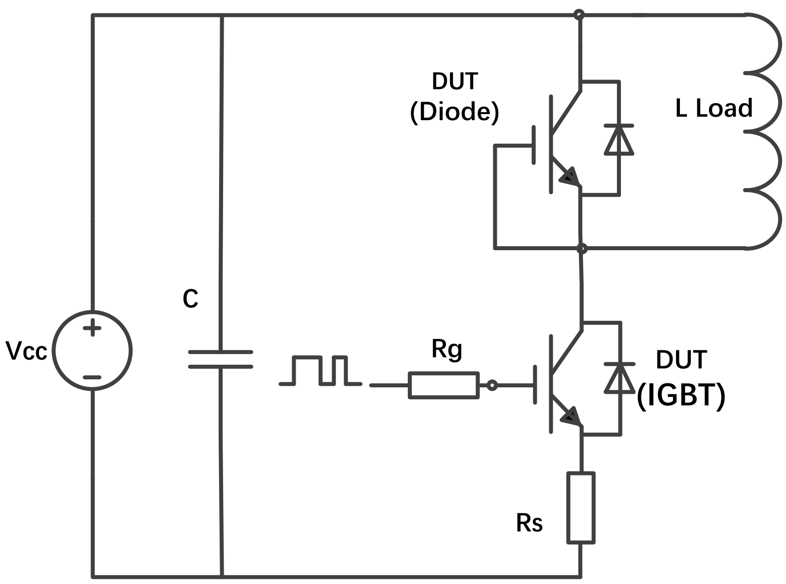
2. Definition Switching losses



3. Definition Diode Switching Characteristics

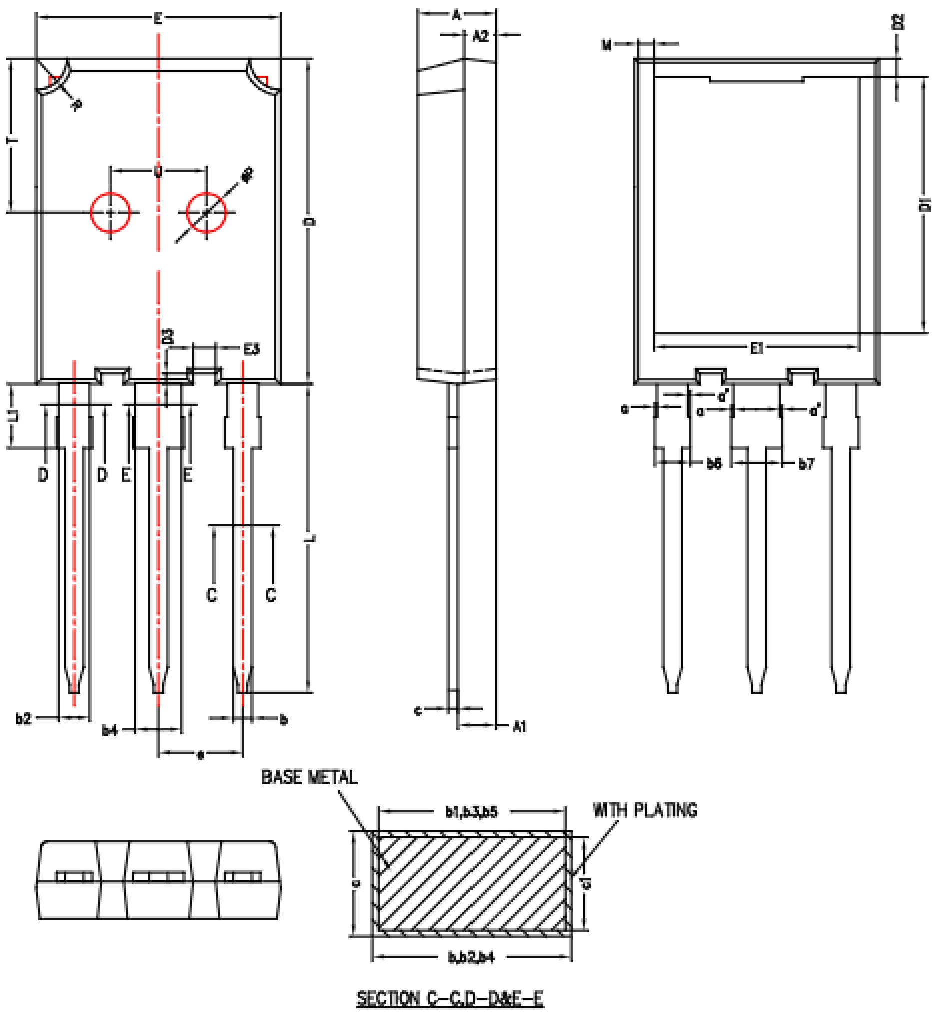


4. Dynamic test circuit



Mechanical Dimensions

TO-247 Plus **Unit: mm**



Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	D	20.90	21.00	21.10
A1	2.31	2.41	2.51	D1	16.25	16.55	16.85
A2	1.90	2.00	2.10	D2	1.05	1.17	1.35
a	0	-	0.15	D3	0.58	0.68	0.78
a′	0	-	0.15	E	15.70	15.80	15.90
b	1.16	-	1.26	E1	13.10	13.26	13.50
b1	1.15	1.20	1.22	E3	1.35	1.45	1.55
b2	1.96	-	2.06	e	5.34	5.44	5.54
b3	1.95	2.00	2.02	L	19.80	19.92	20.10
b4	2.96	-	3.06	L1	3.90	-	4.30
b5	2.95	3.00	3.02	M	0.70	-	1.30
b6	-	-	2.25	P	2.40	2.50	2.60
b7	-	-	3.25	R	1.90	2.00	2.10
c	0.59	-	0.66	T	9.80	-	10.20
c1	0.58	0.60	0.62	U	6.00	-	6.40

Sanrise Tech
尚阳通

Shenzhen Sanrise Technology Co., LTD.

http://www.sanrise-tech.com

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