50A 1200V Trench Fieldstop IGBT with anti-parallel diode SRE50N120FSUDA

General Description

The SRE50N120FSUDA is a Field Stop Trench IGBT with anti-parallel diode, which offers low switching losses, high energy efficiency and high avalanche ruggedness for soft switching applications such as UPS, solar inverters, etc.
The SRE50N120FSUDA is available in TO-247-4.

Features

- High Breakdown Voltage to 1200V
- Advanced Trench Fieldstop technology
  - Low $V_{CE(sat)}$
  - High Ruggedness, Temperature Stability
  - Easy Parallel Switching Capability due to Positive Temperature Coefficient in $V_{CE(SAT)}$
- Soft Current Turn-off Waveforms
- Non-Automotive Qualified

Application

- Solar Inverters
- Uninterrupted Power Supply
- Industrial Power Supplies
- Grid Inverter

Symbol

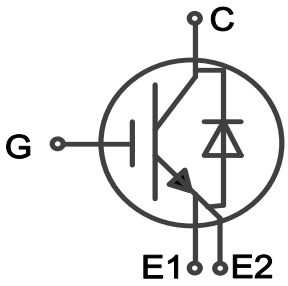
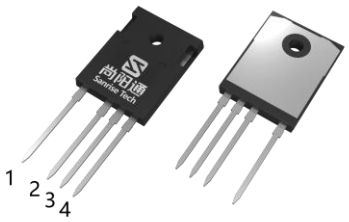


Figure 1 Symbol of SRE50N120FSUDA

Package Type



TO-247-4

Pin 1- &backside-Collector； Pin 2-Emitter2
Pin 3- Kelvin Emitter1； Pin 4- Gate

Figure 2 Package Type of SRE50N120FSUDA

Ordering Information

SRE50N120FSUDA□□–□

Circuit Type
Package
T4: TO-247-4

G: Green
Blank: Tube
TR: Tape & Reel

Package	Part Number	Marking ID	Packing Type
TO-247-4	SRE50N120FSUDAT4-G	SRE50N120FSUDAT4G	Tube

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Absolute Maximum Ratings

Parameter		Symbol	Rating	Unit
Collector-emitter voltage		V_{CES}	1200	V
Gate-emitter Voltage		V_{GES}	±20	V
Transient Gate-emitter Voltage			±30	V
Continuous Collector Current	T_C=25ºC	I_C	100	A
	T_C=100ºC		50	
Pulsed Collector Current, Limited by T_{Jmax}		I_{CM}	300	A
Diode Continuous Collector Current (T_C=100ºC)		I_F	50	A
Diode Pulsed Current, Limited by T_{Jmax}		I_{FM}	300	A
Power dissipation (TO-247)	T_C=25ºC	P_{tot}	500	W
	T_C=100ºC		250	W
Power dissipation (TO-247Plus)	T_C=25ºC	P_{tot}	650	W
	T_C=100ºC		325	W
Maximum Operating Junction Temperature		T_{Jmax}	175(1)	ºC
Storage Temperature		T_{STG}	-55 ~ 150	ºC
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	ºC

Note:
1. Reliability testing conducted at Tj=175℃.

Thermal Resistance

Parameter	Package	Symbol	Min	Typ	Max	Unit
IGBT thermal Resistance，Junction-to-Case	TO-247-4	R_{thJC}	-	-	0.3	ºC/W
Diode thermal Resistance，Junction-to-Case	TO-247-4	R_{thJC}	-	-	0.6	
Thermal Resistance，Junction-to-Ambient	TO-247-4	R_{thJA}	-	-	40	

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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=500uA	1200			V
Gate Threshold Voltage		$V_{GE(th)}$	VCE=VGE, IC=1.6mA	4.6	5.4	6.2	V
Collector-emitter saturation voltage		V_{CEsat}	V_{GE}=15V, I_C=50A, T_J=25ºC		1.6	2.0	V
			T_J=125ºC		2.0		V
			T_J=175ºC		2.43		V
Zero Gate Voltage Collector Current		I_{CES}	V_{CE}=1200V, V_{GE}=0V T_J=25ºC			100	uA
			T_J=175ºC			1	mA
Gate-emitter Leakage Current	Forward	I_{GESF}	V_{GE}=20V, V_{CE}=0V			100	nA
	Reverse	I_{GESR}	V_{GE}=-20V, V_{CE}=0V			-100	nA
Dynamic Characteristics							
Input Capacitance		C_{IES}	V_{CE}=25V, V_{GE}=0V, f=1MHz		4450		pF
Output Capacitance		C_{OES}			215		
Reverse Transfer Capacitance		C_{RES}			26		
Gate Resistance		R_G	f=1MHz, Open Drain		1.2		Ω
Turn-on Delay Time		$t_{d(on)}$	Tj=25℃ V_{CC}=600V, I_C=25A R_G=20Ω, V_{GE}=0/15V Energy losses include "tail" and diode reverse recovery		95		ns
Rise Time		t_r			25		ns
Turn-off Delay Time		$t_{d(off)}$			406		ns
Fall Time		t_f			116		ns
Turn-on energy		E_{on}			1.5		mJ
Turn-off energy		E_{off}			0.8		mJ
Total switching energy		E_{ts}			2.3		mJ
Turn-on Delay Time		$t_{d(on)}$	Tj=25℃ V_{CC}=600V, I_C=50A R_G=20Ω,V_{GE}=0/15V Energy losses include "tail" and diode reverse recovery		96		ns
Rise Time		t_r			47		ns
Turn-off Delay Time		$t_{d(off)}$			396		ns
Fall Time		t_f			135		ns
Turn-on energy		E_{on}			3.0		mJ
Turn-off energy		E_{off}			1.8		mJ
Total switching energy		E_{ts}			4.8		mJ
Gate to Emitter Charge		Q_{GE}	V_{CC}=600V, I_C=50A V_{GE}=0 to 15V		57		nC
Gate to Collector Charge		Q_{GC}			66		
Gate Charge Total		Q_G			139		

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Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Reverse Diode Characteristics						
Diode Forward Voltage	V_F	I_F=25A Tj=25℃		1.71	2.1	V
		I_F=25A Tj=100℃		1.54		
		I_F=25A Tj=175℃		1.39		
		I_F=50A Tj=25℃		2.05	2.45	
		I_F=50A Tj=100℃		1.87		
		I_F=50A Tj=175℃		1.72		
Reverse Recovery Time	t_{rr}	Tj=25℃ V_R=600V, I_F=50A dI_F/dt=1200A/us		130		ns
Reverse Recovery Charge	Q_{rr}			2.47		uC
Peak Reverse Recovery Current	I_{rrm}			38		A
Diode peak rate of fall of reverse Recovery current during tb	dirr/dt			-622		A/us
Reverse Recovery Time	t_{rr}	Tj=100℃ V_R=600V, I_F=50A dI_F/dt=1200A/us		204		ns
Reverse Recovery Charge	Q_{rr}			5.18		uC
Peak Reverse Recovery Current	I_{rrm}			56		A
Diode peak rate of fall of reverse Recovery current during tb	dirr/dt			-648		A/us
Reverse Recovery Time	t_{rr}	Tj=150℃ V_R=600V, I_F=50A dI_F/dt=1200A/us		258		ns
Reverse Recovery Charge	Q_{rr}			7.88		uC
Peak Reverse Recovery Current	I_{rrm}			69		A
Diode peak rate of fall of reverse Recovery current during tb	dirr/dt			-704		A/us

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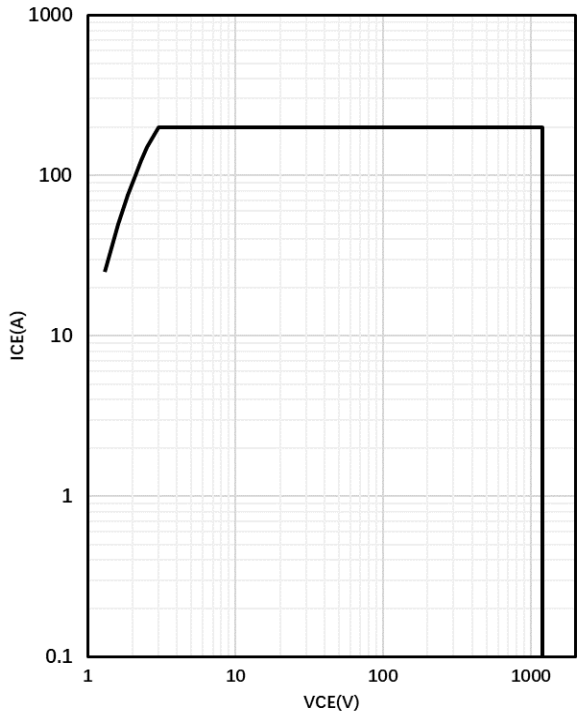
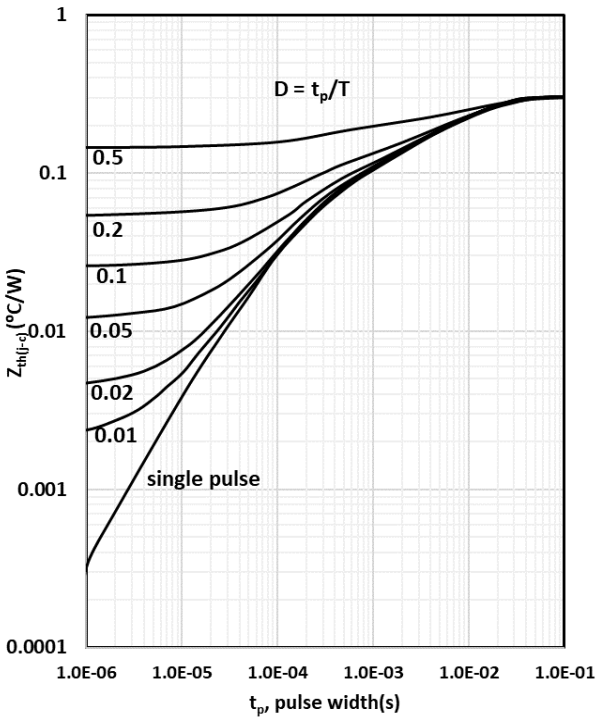
Typical Performance Characteristics

Figure 3: IGBT FBSOA



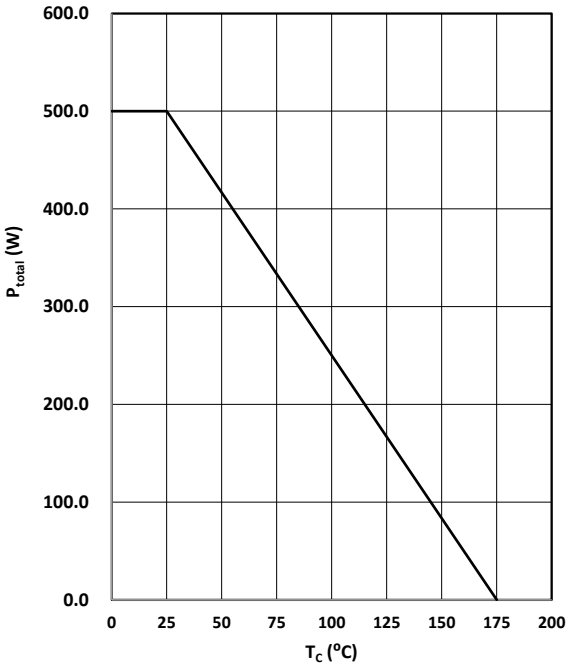
I_C=f(V_{CE});V_{GE}>=15/0V;Tj≤ 175 ºC

Figure 4: IGBT Transient Thermal Impedance



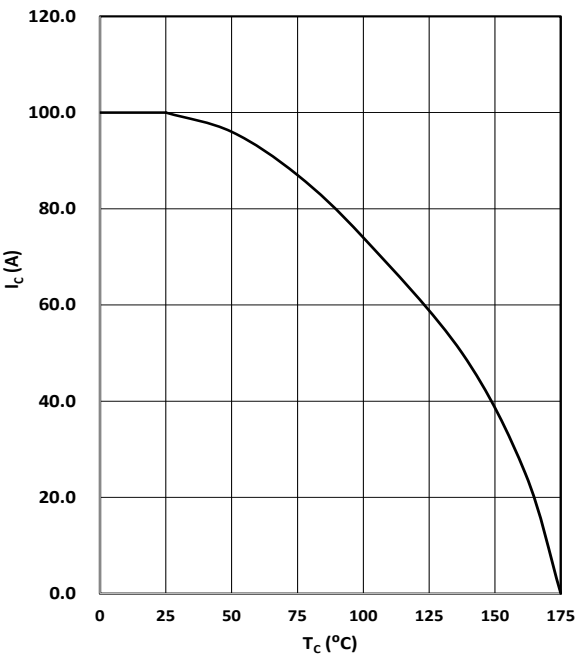
R($_{thJC}$) = f(tp); parameter: D = tp/T

Figure 5: Power Dissipation



Ptot=f(T_C)

Figure 6: Collector Current vs. Temperature



I_C = f(Tj); V_{GE}>=15V;Tj≤ 175 ºC

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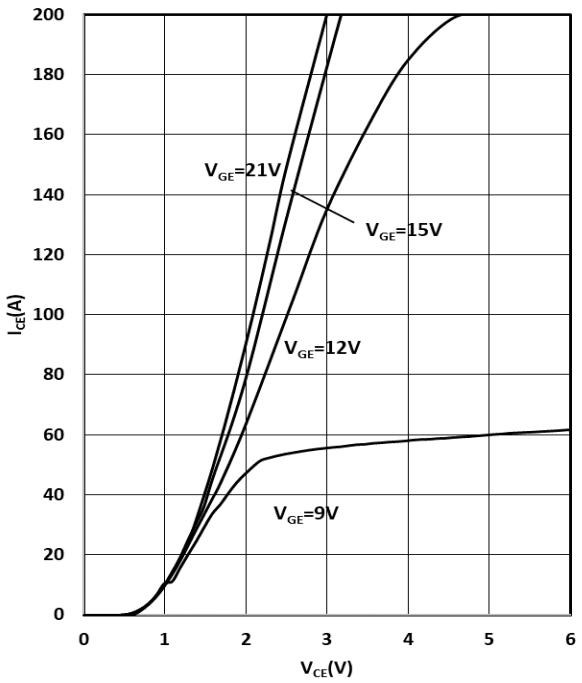
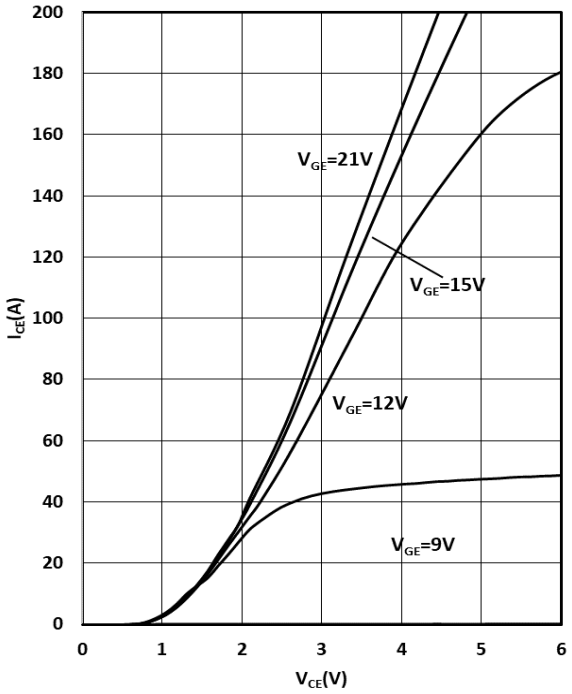
Figure 7: Typical Output Characteristics



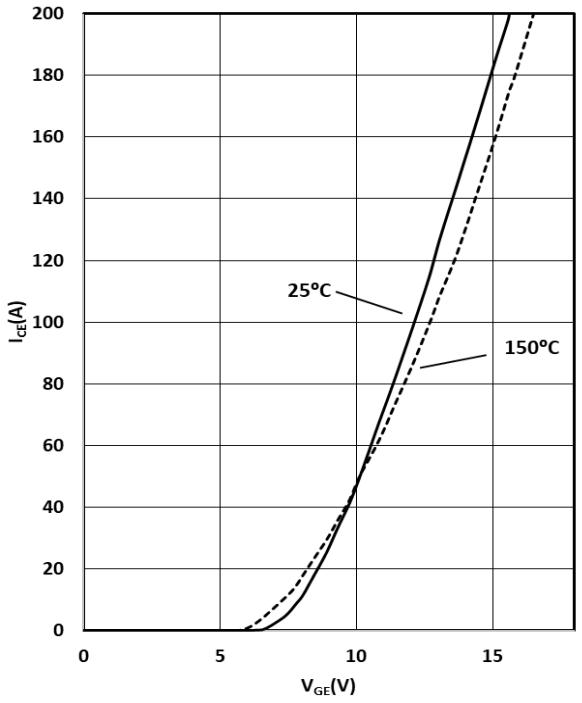
$I_C = f(V_{CE})$; Tj= 25ºC; parameter: V_{GE}

Figure 8: Typical Output Characteristics



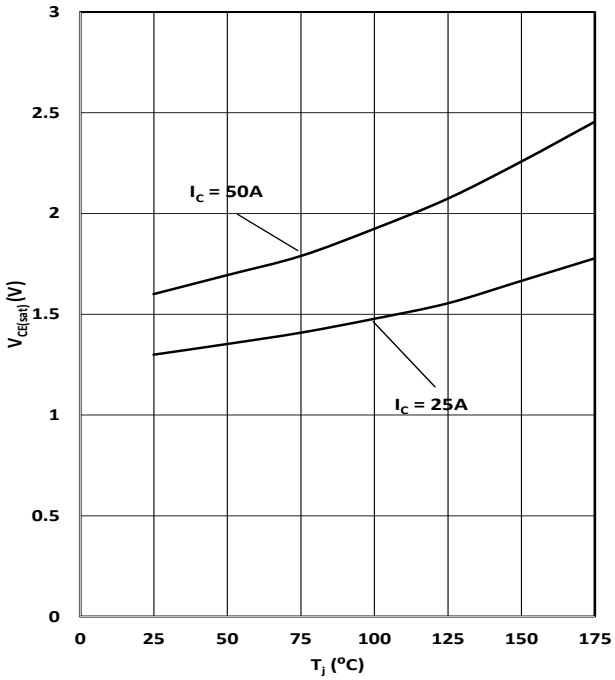
$I_C = f(V_{CE})$; Tj= 175ºC; parameter: V_{GE}

Figure 9: Typical transfer characteristic



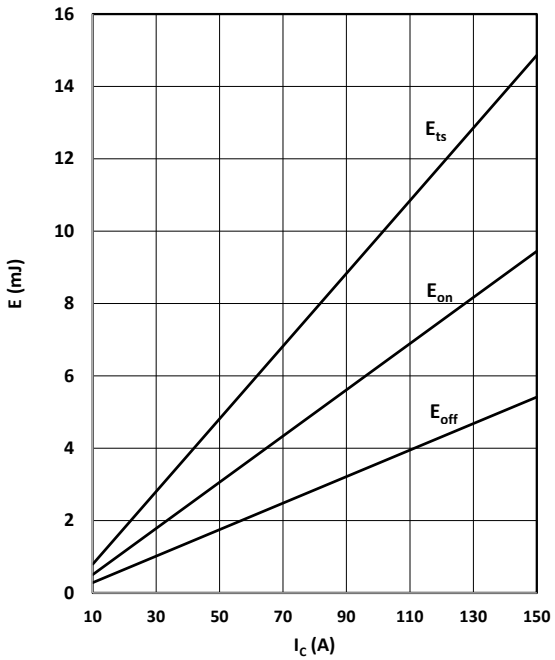
$I_C = f(V_{GE})$; V_{CE}=20V

Figure 10: Typical collector-emitter saturation voltage as a function of junction temperature



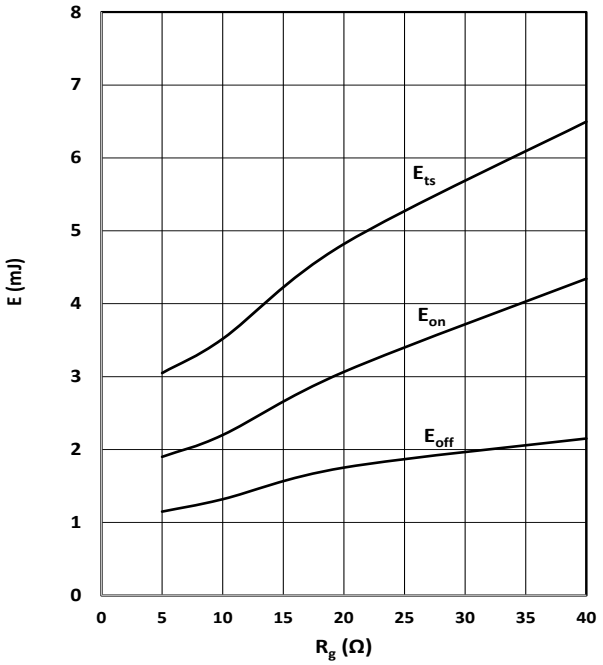
V_{CE} =f(Tj); V_{GE}=15V

Figure 11: Typical switching energy losses as a function of collector current



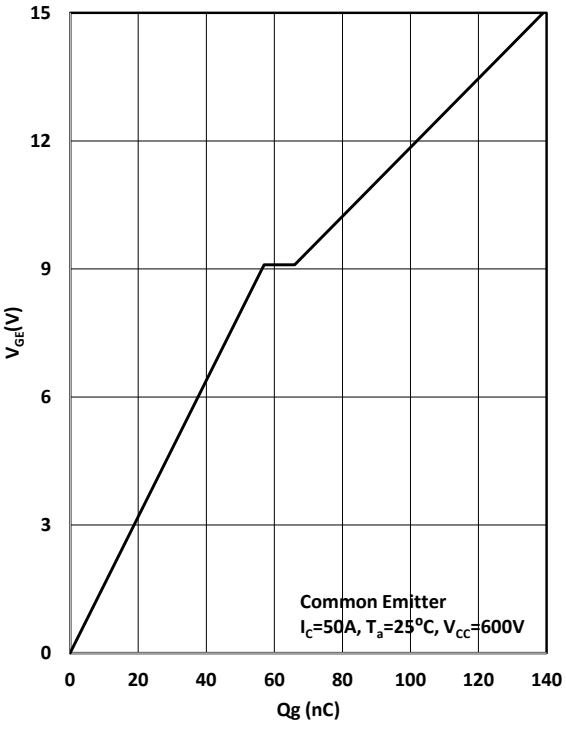
$E=f(I_C)$; V_{CE}=600V;Tj=25°C; R_G=20Ω

Figure 12: Typical switching energy losses as a function of gate resistor



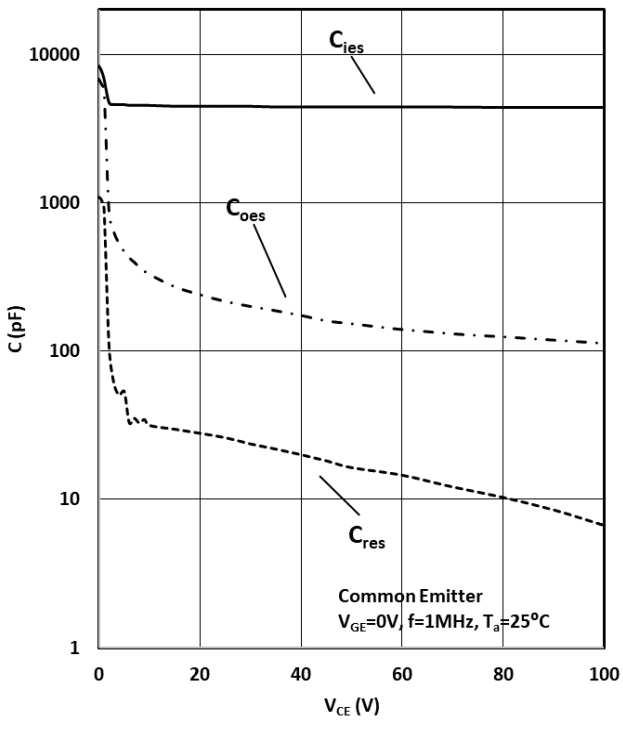
$E=f(R_G)$; V_{CE}=600V;Tj=25°C; I_C=50A

Figure 13: Typical Gate Charge

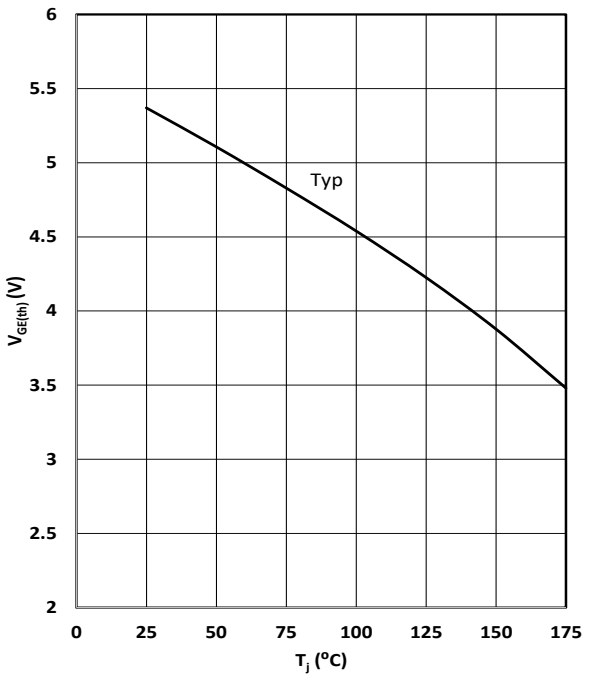
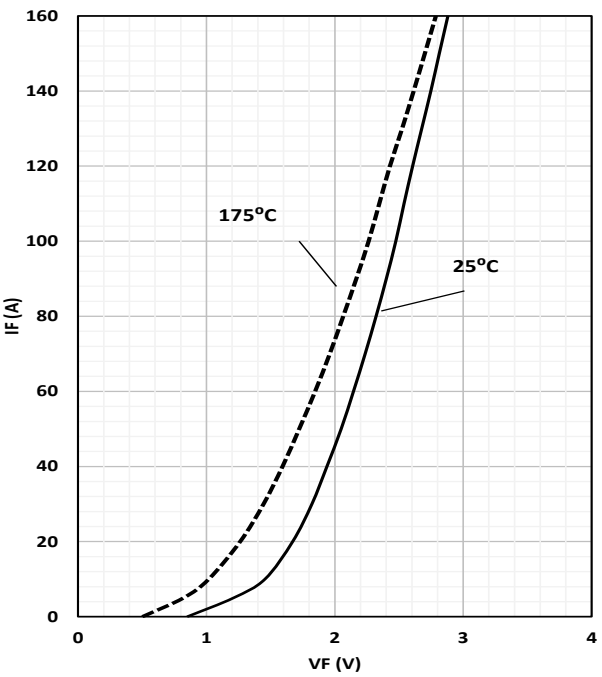


V_{GE}= f(Qg), I_C= 50A

Figure 14: Typical Capacitances

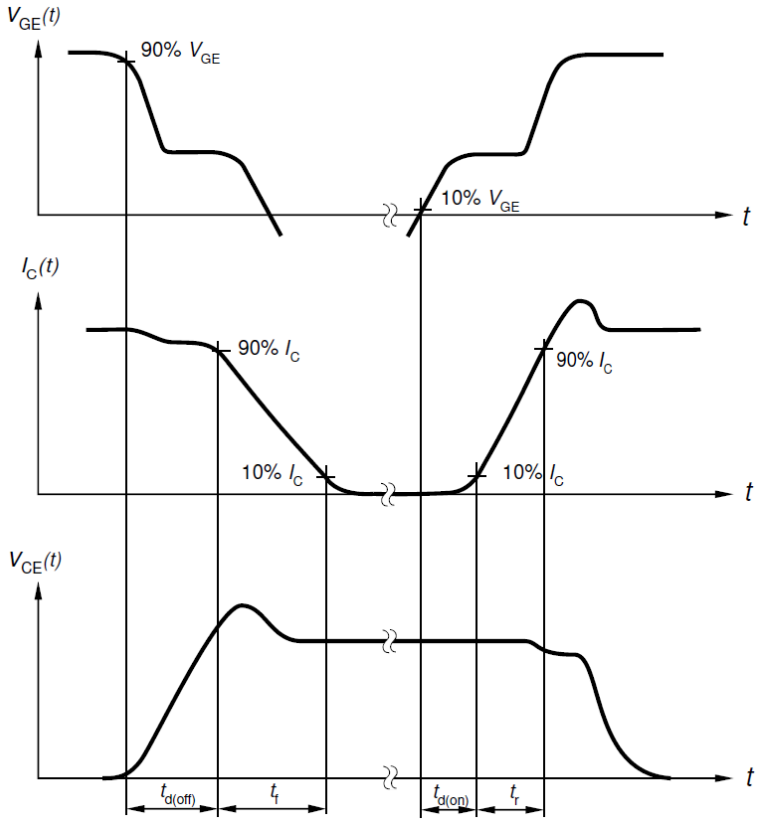


$C=f(V_{CE})$; V_{GE}=0; f=1MHz

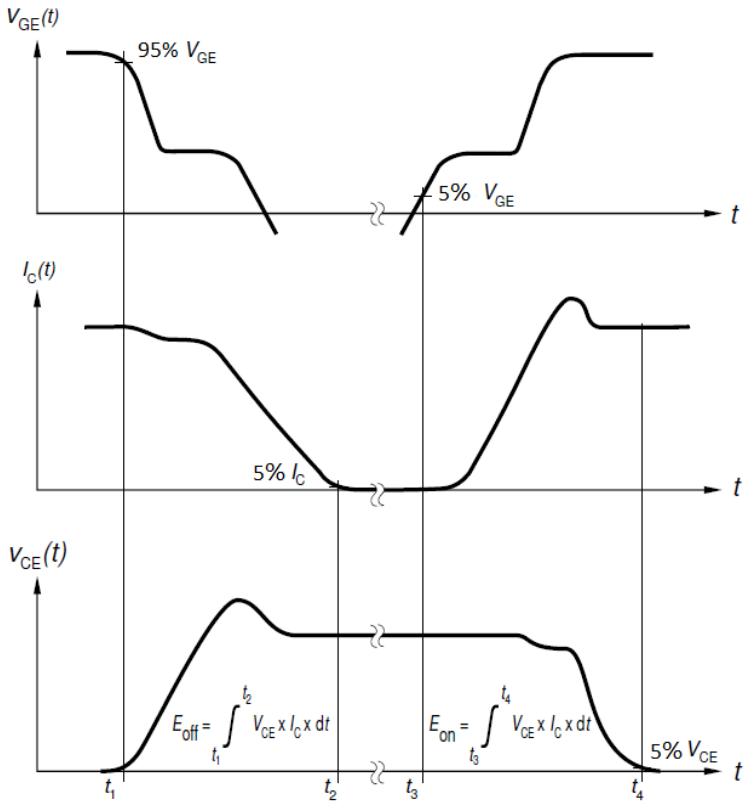
Figure 15: Typ. emitter threshold voltage as a function of junction temperature	Figure 16: Typical diode forward current as a function of forward voltage
	
V_{GE} =f(Tj); I_{CE} = 1. 6mA	V_F= f(I_F);

Test Circuits

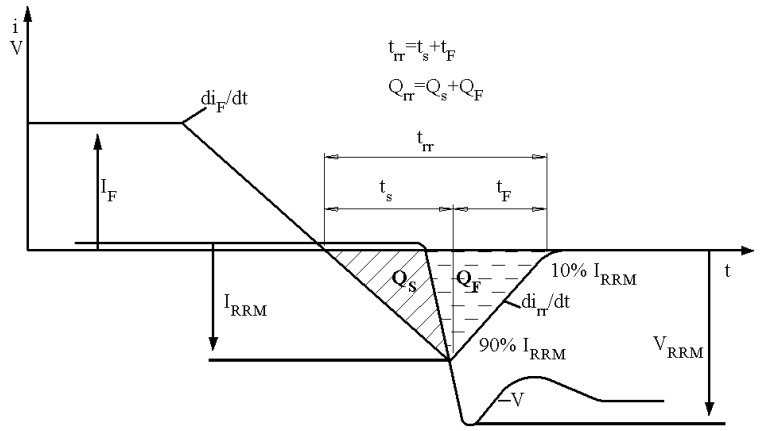
1. Definition Switching times



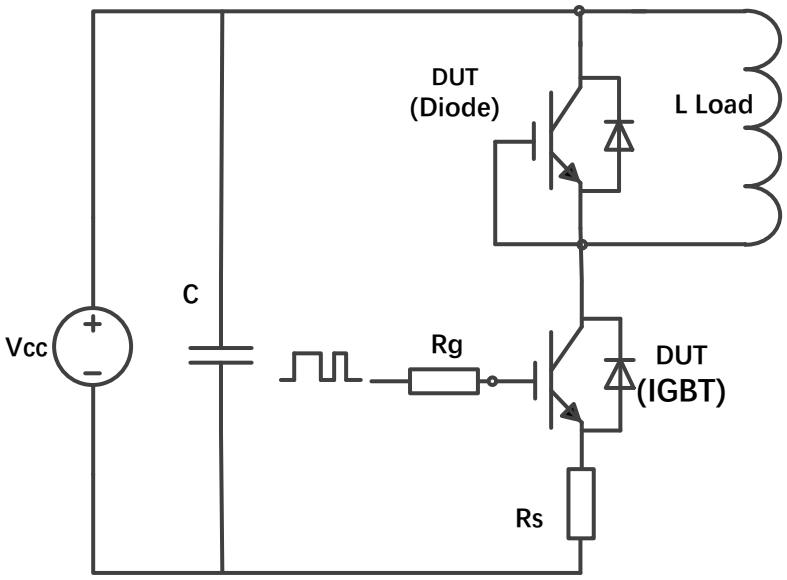
2. Definition Switching losses



3. Definition Diode Switching Characteristics



4. Dynamic test circuit



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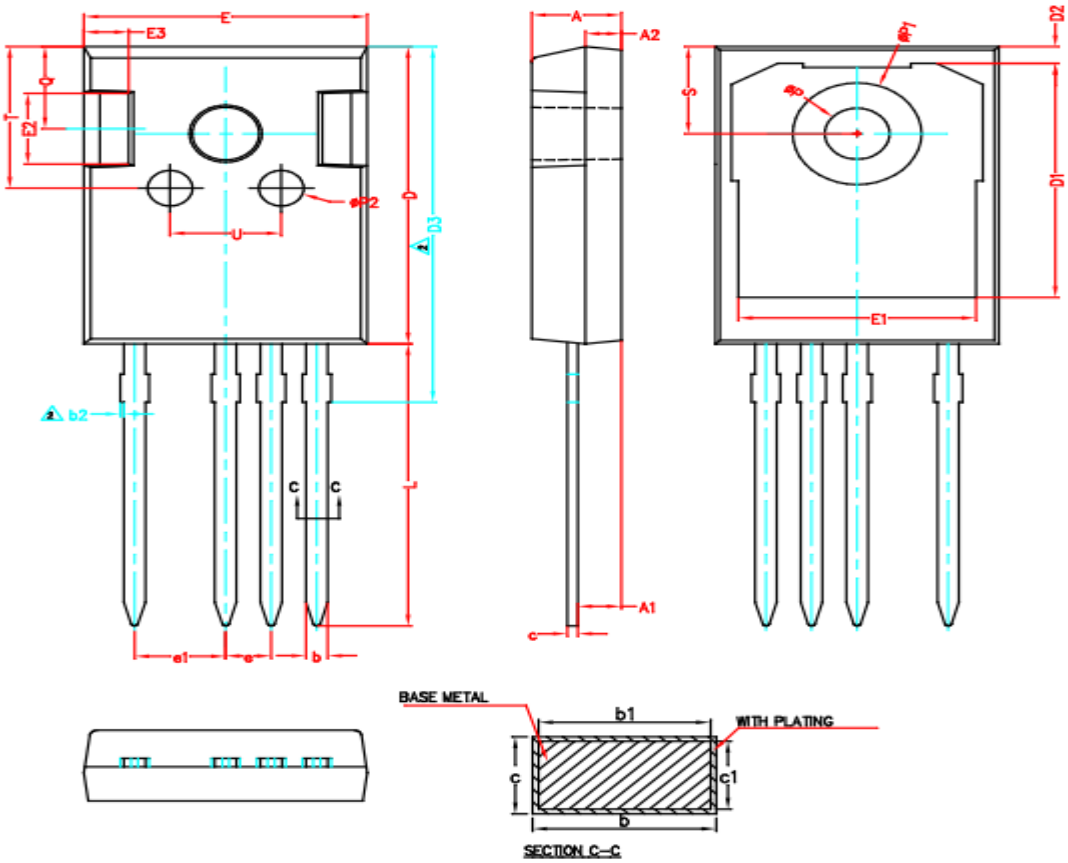
Mechanical Dimensions

TO-247-4 **Unit: mm**



Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.90	5.00	5.10	E1	13.10	13.30	13.50
A1	2.31	2.41	2.51	E2	4.90	5.00	5.10
A2	1.90	2.00	2.10	E3	2.40	2.50	2.60
b	1.16	-	1.29	e	2.44	2.54	2.64
b1	1.15	1.2	1.25	e1	4.98	5.08	5.18
b2	0.00	-	0.20	L	19.80	19.92	20.10
c	0.59	-	0.66	P	3.50	3.60	3.70
c1	0.58	0.60	0.62	P1	-	-	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	-	6.15BSC	-
D3	24.97	25.12	25.27	T	9.80	-	10.20
E	15.70	15.80	15.90	U	6.00	-	6.40

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Shenzhen Sanrise Technology Co., LTD

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