100A 650V Trench Fieldstop IGBT with anti-parallel diode SRE100N065FSU2DB

General Description

The SRE100N065FSU2DB 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, PFC, Converter, etc.

The SRE100N065FSU2DB package is TO-247-4.

Features

- High Breakdown Voltage to 650V
- Advanced Trench Fieldstop technology
  - Smooth Switching Off with Lower Spike
  - High Ruggedness, Temperature Stability
  - Easy Parallel Switching Capability due to Positive Temperature Coefficient in $V_{CE(SAT)}$
- Low $V_{CE(SAT)}$
- Enhanced Avalanche Capability
- Non-Automotive Qualified

Application

- PFC application
- Inverter & Solar
- Converter with high switching frequency

Symbol

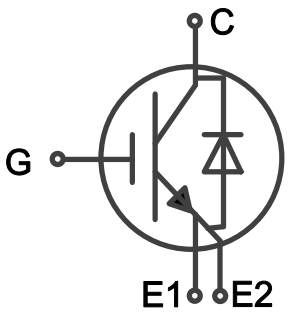
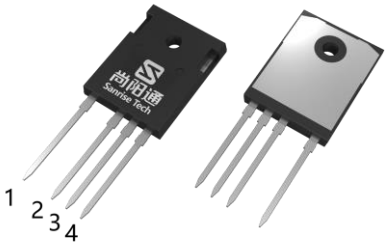


Figure 1 Symbol of SRE100N065FSU2DB

Package Type



TO-247-4

Pin 1- &backside-Collector； Pin 2-Emitter2

Pin 3- Kelvin Emitter1； Pin 4- Gate

Figure 2 Package Type of SRE100N065FSU2DB

Ordering Information

SRE100N065FSU2DB□□–□

Circuit Type

Package

T4: TO-247-4

G: Green

Blank: Tube

TR: Tape & Reel

Package	Part Number	Marking ID	Packing Type
TO-247-4	SRE100N065FSU2DBT4-G2	SRE100N065FSU2DBT4G2	Tube

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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=25ºC	I_C	150	A
	T_C=100ºC		100	
Pulsed Collector Current, Limited by T_{Jmax}		I_{CM}	400	A
Diode Continuous Collector Current	T_C=25ºC	I_F	120	A
	T_C=100ºC		100	A
Diode Pulsed Current, Limited by T_{Jmax}		I_{FM}	320	A
Power Dissipation	T_C=25ºC	P_{tot}	394	W
	T_C=100ºC		197	
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	6	us
Operating Junction Temperature Range		T_J	-40 ~ 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 T_{Jmax}=175℃.

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
IGBT thermal Resistance，Junction-to-Case	R_{thJC}	-	-	0.38	ºC/W
Diode thermal Resistance，Junction-to-Case	R_{thJC}	-	-	0.45	
Thermal Resistance，Junction-to-Ambient	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=250uA	650			V
Gate Threshold Voltage		$V_{GE(th)}$	V_{CE}=V_{GE}, I_C=250uA	3.8	4.5	5.4	V
Collector-emitter saturation voltage		V_{CEsat}	V_{GE}=15V, I_C=100A, T_J=25ºC		1.57	1.9	V
			T_J=125ºC		1.89		V
			T_J=175ºC		2.08		V
Zero Gate Voltage Collector Current		I_{CES}	V_{CE}=650V,V_{GE}=0V T_J=25ºC		0.1	40	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=1 MHz		3750		pF
Output Capacitance		C_{OES}			350		
Reverse Transfer Capacitance		C_{RES}			40		
Gate Resistance		R_G	f=1MHz,Open Drain		1.7		Ω
Turn-on Delay Time		$t_{d(on)}$	T_J=25ºC V_{CC}=400V, I_C=100A R_G=10Ω, V_{GE}=0/15V Energy losses include "tail" and diode reverse recovery		66		ns
Rise Time		t_r			92		ns
Turn-off Delay Time		$t_{d(off)}$			255		ns
Fall Time		t_f			145		ns
Turn-on energy		E_{on}			3.9		mJ
Turn-off energy		E_{off}			1.2		mJ
Total switching energy		E_{ts}			5.1		mJ
Turn-on Delay Time		$t_{d(on)}$	T_J=150ºC V_{CC}=400V,I_C=100A R_G=10Ω,V_{GE}=0/15V Energy losses include "tail" and diode reverse recovery		60		ns
Rise Time		t_r			105		ns
Turn-off Delay Time		$t_{d(off)}$			280		ns
Fall Time		t_f			160		ns
Turn-on energy		E_{on}			4.4		mJ
Turn-off energy		E_{off}			1.5		mJ
Total switching energy		E_{ts}			5.9		mJ
Gate to Emitter Charge		Q_{GE}	V_{CC}=400V, $_C$=100A V_{GE}=0 to 15V		42		nC
Gate to Collector Charge		Q_{GC}			72		
Gate Charge Total		Q_G			162		

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Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Reverse Diode Characteristics						
Diode Forward Voltage	V_F	I_F=50A T_J=25ºC		1.39	1.7	V
		I_F=50A T_J=125ºC		1.23		
		I_F=50A T_J=175ºC		1,13		
		I_F=100A T_J=25ºC		1.71	2.0	
		I_F=100A T_J=125ºC		1.62		
		I_F=100A T_J=175ºC		1.55		
Reverse Recovery Time	t_{rr}	T_J=25ºC V_R=400V, I_F=50A dI_F/dt=840A/μs		190		ns
Reverse Recovery Charge	Q_{rr}			1150		nC
Peak Reverse Recovery Current	I_{rrm}			18		A
Reverse Recovery Time	t_{rr}	T_J=25ºC V_R=400V, I_F=100A dI_F/dt=660A/μs		174		ns
Reverse Recovery Charge	Q_{rr}			760		nC
Peak Reverse Recovery Current	I_{rrm}			14		A

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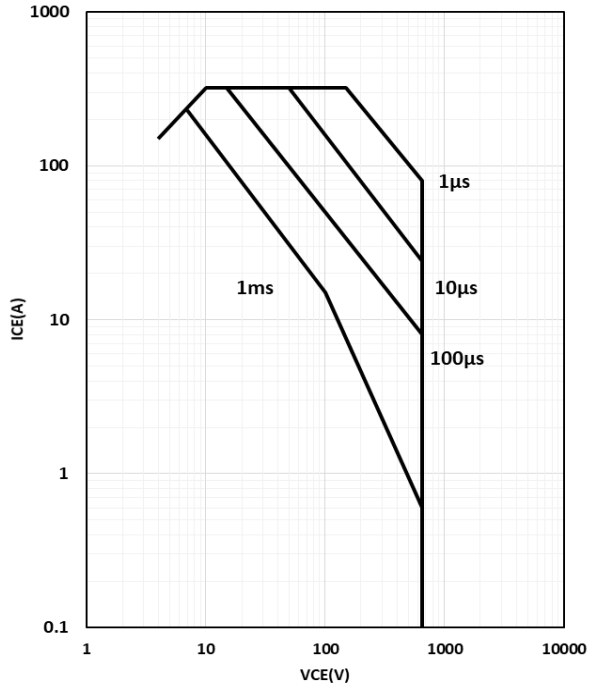
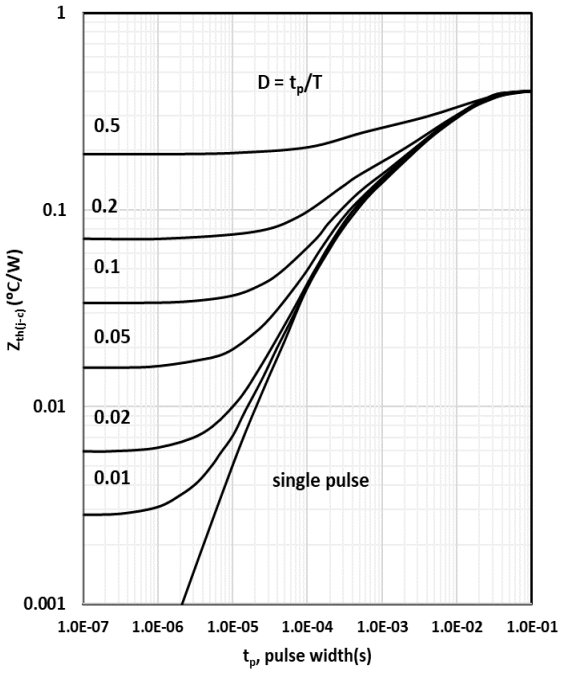
Typical Performance Characteristics

Figure 3: IGBT forward bias safe operating area (FBSOA)



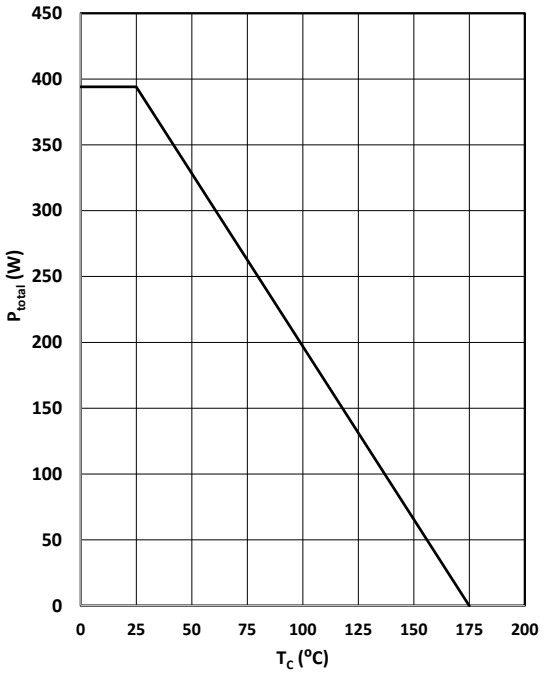
$I_C = f(V_{CE})$; $V_{GE} \geq 15/0V$; Tj ≤175ºC

Figure 4: IGBT transient thermal impedance



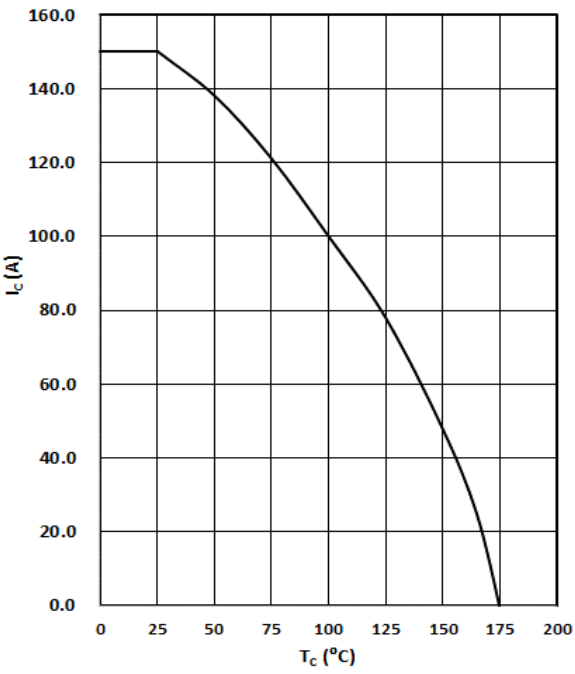
$R_{th(J-C)} = f(t_p)$; duty cycle: $D = t_p/T$

Figure 5: Power Dissipation



Ptot= f(Tc)

Figure 6: Collector current vs. temperature



Ic= f(Tj); $V_{GE} \geq 15/0V$; Tj≤175ºC

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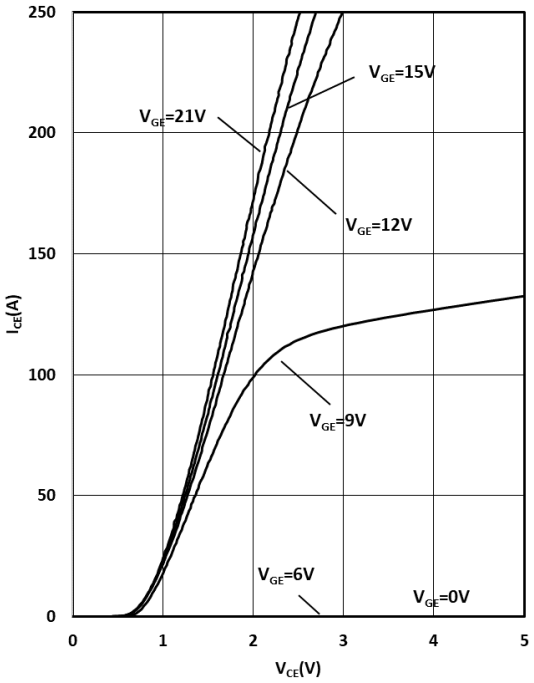
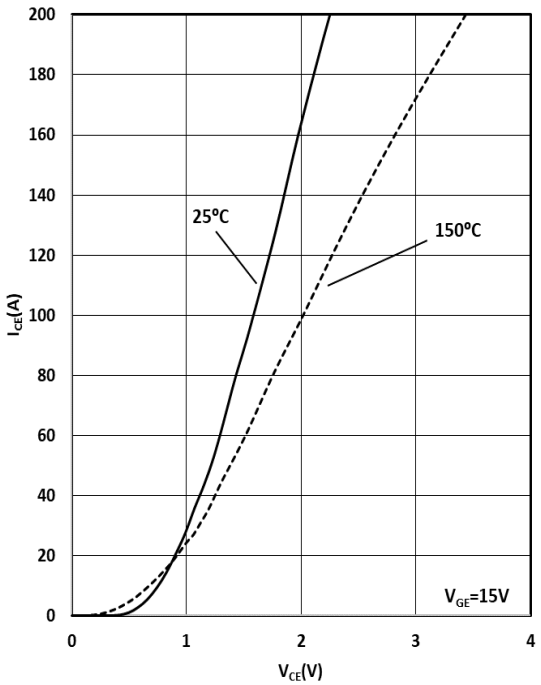
Figure 7: Typical Output Characteristics



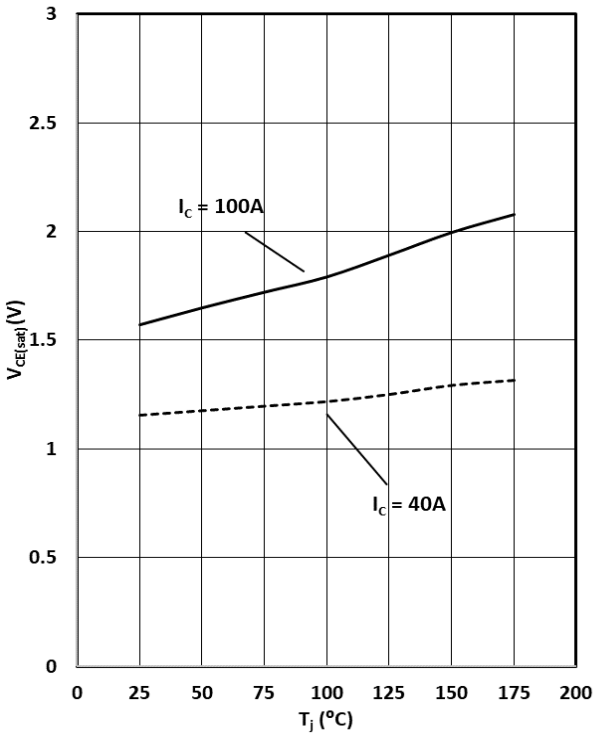
$I_C = f(V_{CE})$; Tj= 25ºC; parameter: V_{GE}

Figure 8: Typical transfer characteristic



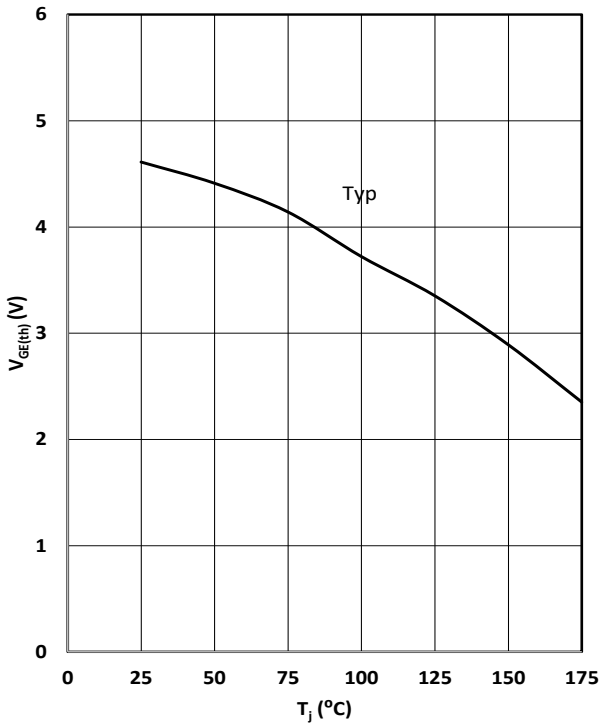
$I_C = f(V_{CE})$; Tj= 25ºC vs 150ºC;

Figure 9: Typical collector-emitter saturation voltage as a function of junction temperature



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

Figure 10: Gate-emitter threshold voltage as a function of junction temperature



$V_{GE} = f(T_j)$; I_{CE} = 250uA

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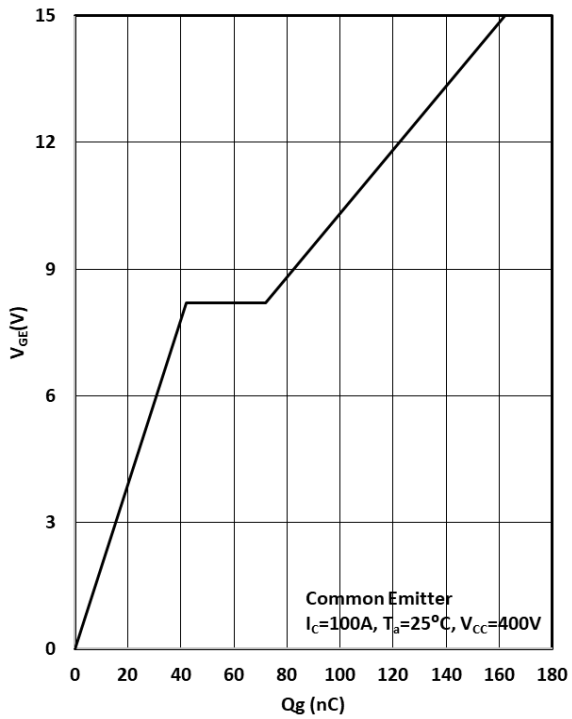
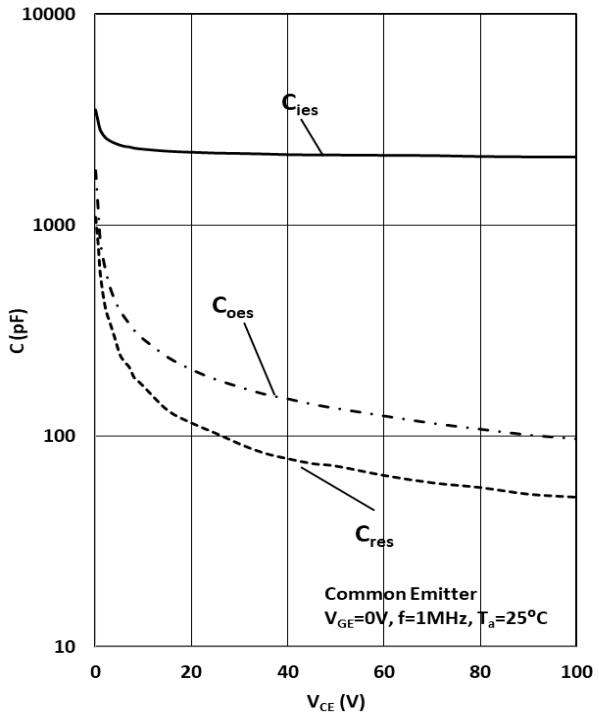
Figure 11: Typical Gate Charge	Figure 12: Typical Capacitances
	
V_{GE}= f(Q_{gate}), I_C= 100A	C=f(V_{CE}); V_{GE}=0; f=1MHz

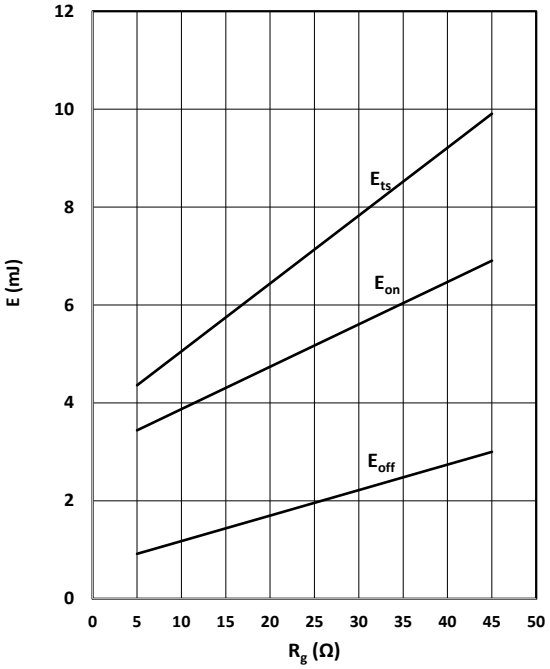
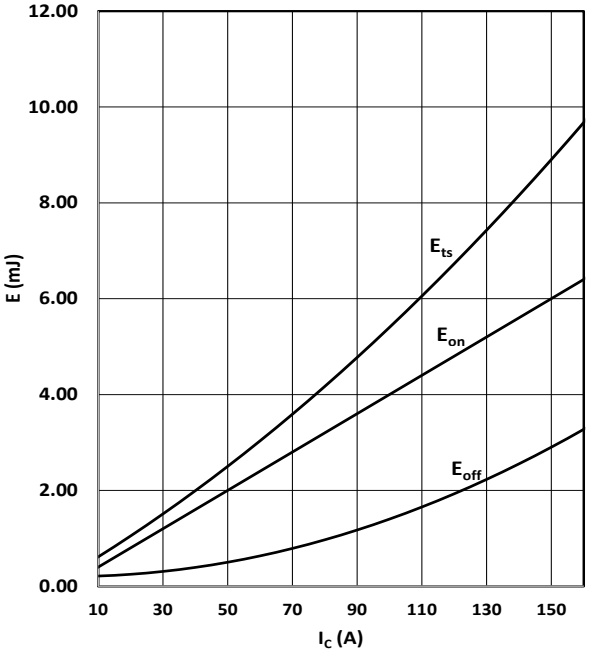
Figure13: Typical switching energy losses as a function of gate resistor	Figure 14: Typical switching energy losses as a function of collector current
	
E=f(R_G); V_{CE}=400V; Tc=25ºC; Ic=100A	E=f(Ic); V_{CE}=400V; Tc=25ºC; R_G=10Ω

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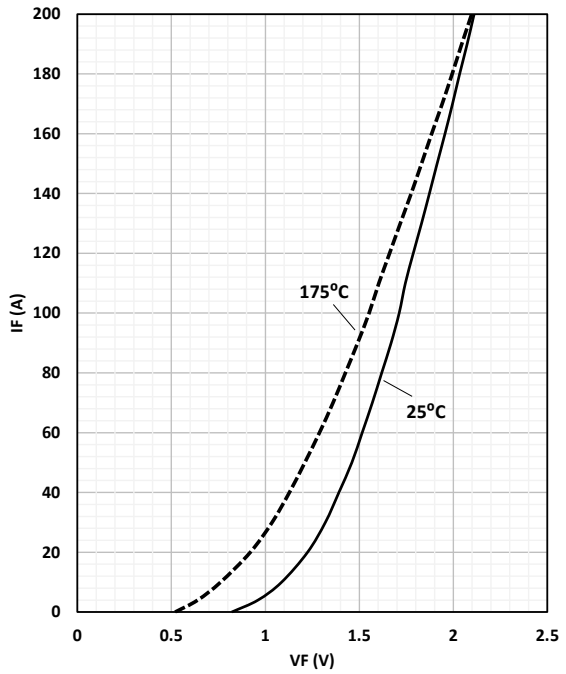
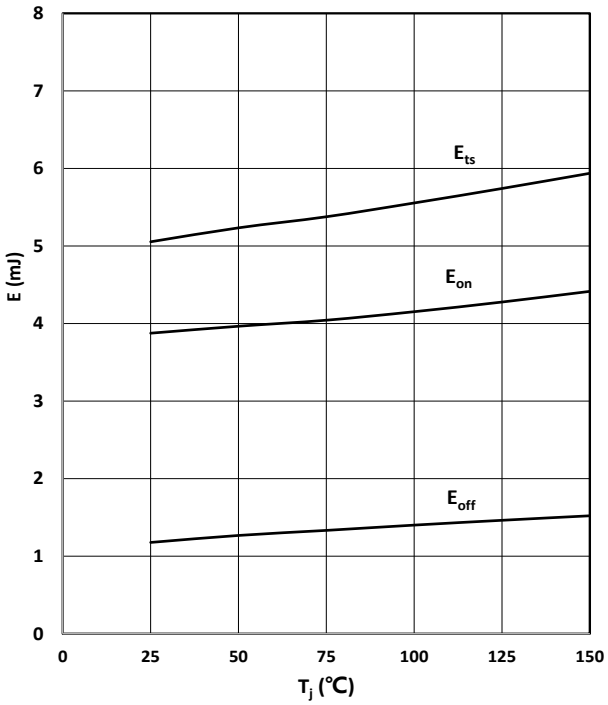
Figure 15: Typical diode forward current as a function of forward voltage	Figure 16: Typical switching energy losses as a function of junction temperature
	
I_F= f(V_F);	E= f(T_j); V_{CE}=400V;I_C= 100A;R_G=10Ω

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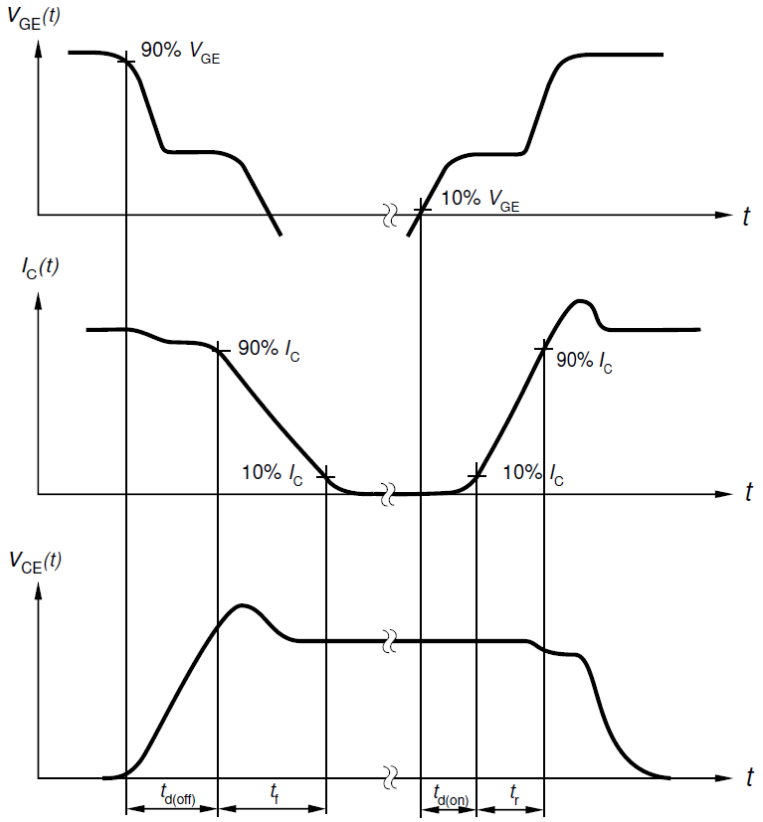
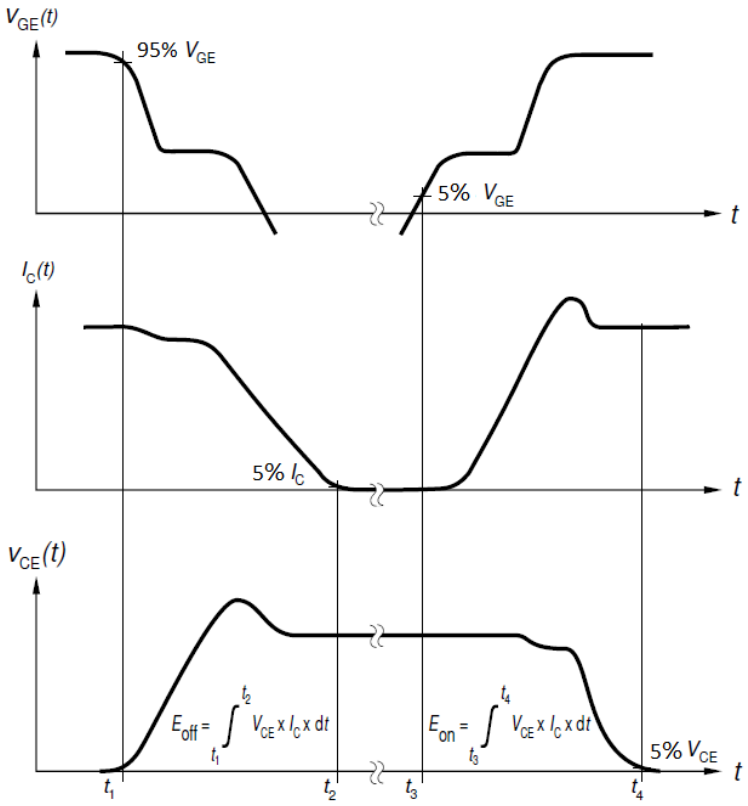
Test Circuits

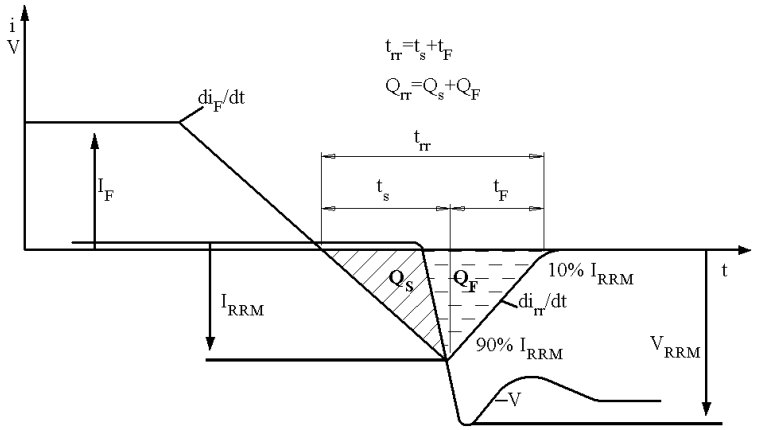
1. Definition Switching times



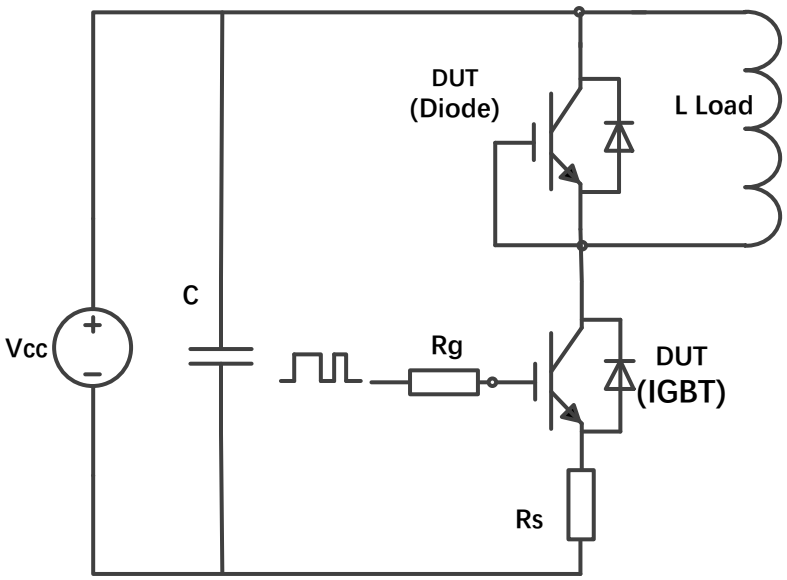
2. Definition Switching losses



3. Definition Diode Switching Characteristics



4. Dynamic test circuit



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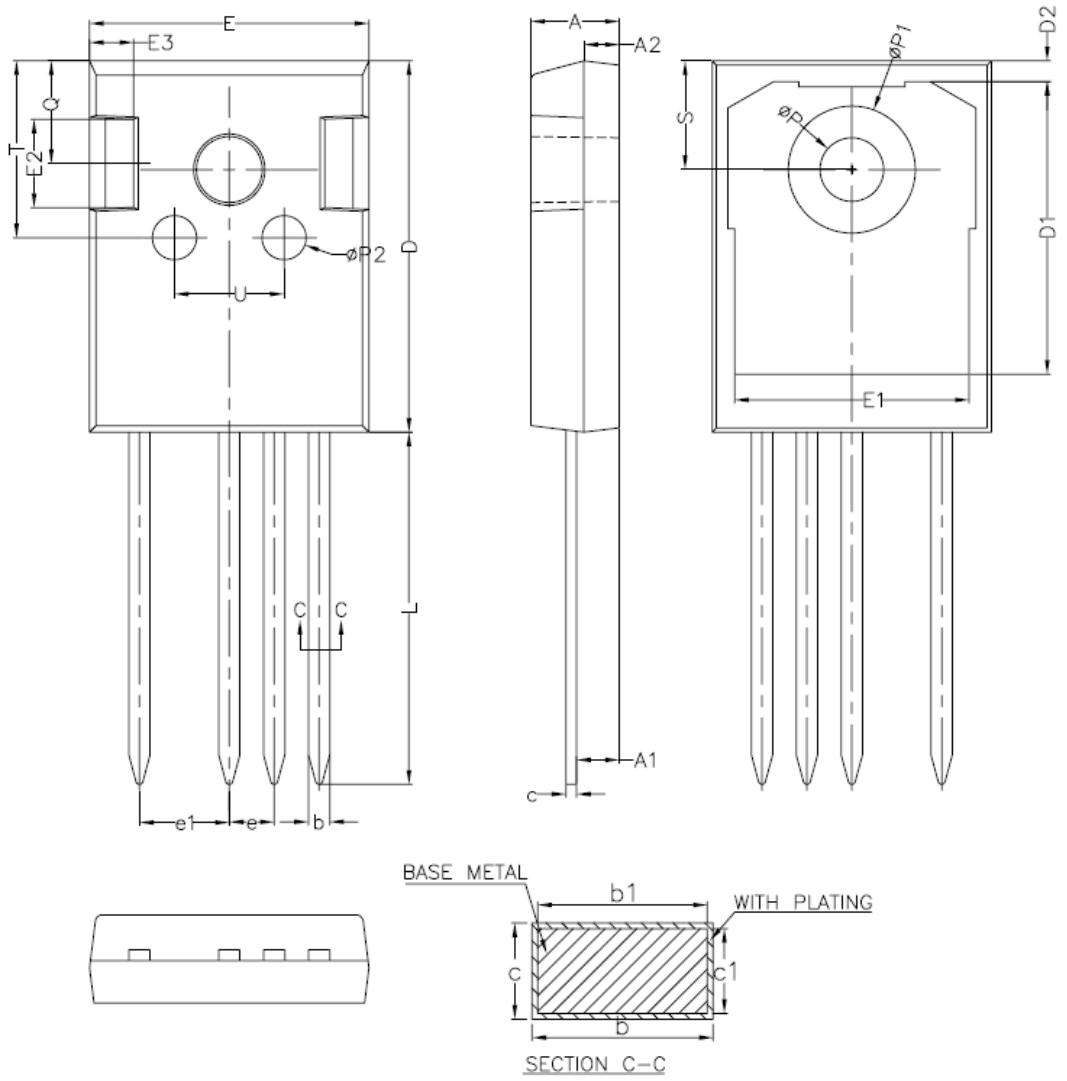
Mechanical Dimensions

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



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Mechanical Dimensions

Symbol	Dimensions(mm)		
	Min.	Typ.	Max.
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16	-	1.29
b1	1.15	1.2	1.25
c	0.59	-	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
L	19.80	19.92	20.10
P	3.50	3.60	3.70
P1	-	-	7.40
P2	2.40	2.50	2.60
Q	5.60	-	6.00
S	6.15 BSC		
T	9.80	-	10.20
U	6.00	-	6.40

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