75A 650V Trench Fieldstop IGBT with anti-parallel diode SRE75N065FSU2D6

General Description

The SRE75N065FSU2D6 is a Field Stop Trench IGBT with anti-parallel diode, which offers ultra-low switching losses, high energy efficiency for switching applications such as PFC, Power Supply, Inverter, etc.

The SRE75N065FSU2D6 package is TO-247.

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

- Inverter
- Uninterruptible power supplies
- PFC application
- Converter with high switching frequency

Symbol

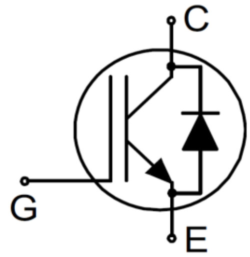
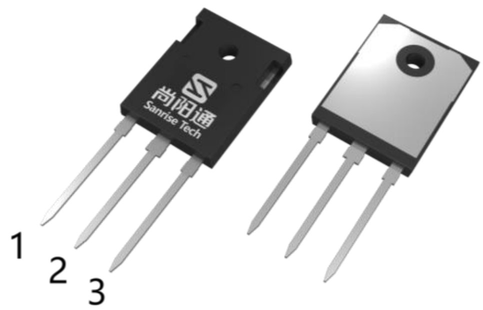


Figure 1 Symbol of SRE75N065FSU2D6

Package Type



TO-247

Pin 1- gate

Pin 2&backside-collector

Pin 3-emitter

Figure 2 Package Type of SRE75N065FSU2D6

Ordering Information

SRE75N065FSU2D6□□–□

Circuit Type

Package

T: TO-247

G: Green

Blank: Tube

TR: Tape & Reel

Package	Part Number	Marking ID	Packing Type
TO-247	SRE75N065FSU2D6T-GC	SRE75N065FSU2D6TGC	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=25ºC	I_C	100	A
	T_C=100ºC		75	
Pulsed Collector Current,Limited by T_{Jmax}		I_{CM}	300	A
Diode Continuous Collector Current	T_C=25ºC	I_F	100	A
	T_C=100ºC		75	
Diode Pulsed Current, Limited by T_{Jmax}		I_{FM}	200	A
Power Dissipation	T_C=25ºC	P_{tot}	306	W
	T_C=100ºC		153	
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	4	us
Operating Junction Temperature Range		T_J	-40 ~ 175	ºC
Storage Temperature Range		T_{STG}	-55 ~ 150	ºC
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260	ºC

Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
IGBT Thermal Resistance， Junction-to-Case	R_{thJC}	-	-	0.49	ºC/W
Diode Thermal Resistance， Junction-to-Case	R_{thJC}	-	-	0.6	
Thermal Resistance， Junction-to-Ambient	R_{thJA}	-	-	40	

Electrical Characteristics

T_J = 25°C, unless otherwise specified.

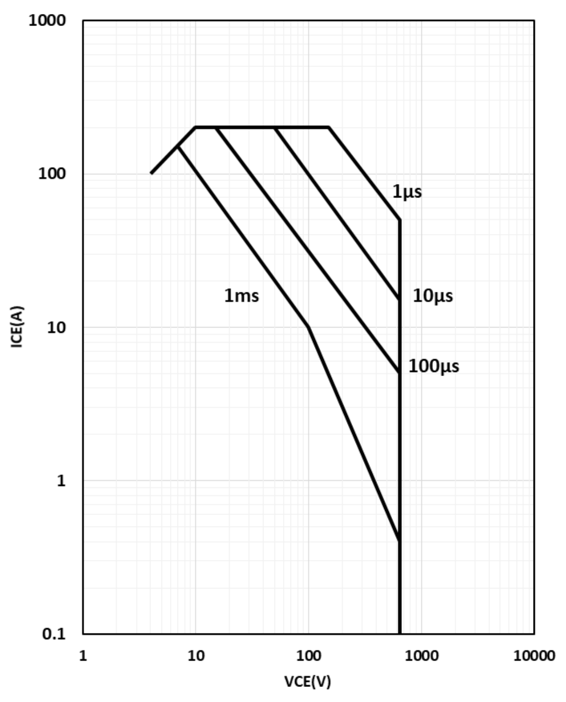
Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Statistic Characteristics							
Collector-emitter Breakdown Voltage		BV_{CES}	V_{GE}=0V, I_C=250uA	650			V
Gate Threshold Voltage		$V_{GE(th)}$	V_{CE}=V_{GE}, I_C=250uA	4.2	4.8	5.4	V
Collector-emitter saturation voltage		V_{CEsat}	V_{GE}=15V, I_C=75A, T_J=25°C		1.67	2.2	V
			T_J=125°C		2.03		V
			T_J=175°C		2.27		V
Zero Gate Voltage Collector Current		I_{CES}	V_{CE}=650V,V_{GE}=0V T_J=25°C		0.1	40	µA
			T_J=150°C			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=100KHz		2460		pF
Output Capacitance		C_{OES}			247		
Reverse Transfer Capacitance		C_{RES}			48		
Gate Resistance		R_G	f=1 MHz, Open Drain		1.53		Ω
Turn-on Delay Time		$t_{d(on)}$	T_J=25°C V_{CC}=400V, I_C=75A R_G=10Ω, V_{GE}=0/15V Energy losses include “tail” and diode reverse recovery		21		ns
Rise Time		t_r			58		ns
Turn-off Delay Time		$t_{d(off)}$			95		ns
Fall Time		t_f			47		ns
Turn-on energy		E_{on}			3.0		mJ
Turn-off energy		E_{off}			0.7		mJ
Total switching energy		E_{ts}			3.7		mJ
Turn-on Delay Time		$t_{d(on)}$	T_J=150°C V_{CC}=400V, I_C=75A R_G=10Ω,V_{GE}=0/15V Energy losses include “tail” and diode reverse recovery		19		ns
Rise Time		t_r			55		ns
Turn-off Delay Time		$t_{d(off)}$			104		ns
Fall Time		t_f			79		ns
Turn-on energy		E_{on}			3.5		mJ
Turn-off energy		E_{off}			1.0		mJ
Total switching energy		E_{ts}			4.5		mJ
Gate to Emitter Charge		Q_{GE}	V_{CC}=400V, I_C=75A V_{GE}=0 to 15V		25		nC
Gate to Collector Charge		Q_{GC}			37		
Gate Charge Total		Q_G			113		

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Reverse Diode Characteristics						
Diode Forward Voltage	V_F	I_F=37A T_J=25°C		1.3	1.6	V
		I_F=37A T_J=125°C		1.24		
		I_F=37A T_J=175°C		1.1		
		I_F=75A T_J=25°C	1.40	1.65	1.90	
		I_F=75A T_J=125°C		1.55		
		I_F=75A T_J=175°C		1.51		
Reverse Recovery Time	t_{rr}	T_J=25°C V_R=400V, I_F=75A dI_F/dt=920A/us		177		ns
Reverse Recovery Charge	Q_{rr}			1.8		uC
Peak Reverse Recovery Current	I_{rrm}			30		A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt			-540		A/µs
Reverse Recovery Time	t_{rr}	T_J=175°C V_R=400V, I_F=75A dI_F/dt=940A/us		404		ns
Reverse Recovery Charge	Q_{rr}			8.1		uC
Peak Reverse Recovery Current	I_{rrm}			64		A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt			-240		A/µs

75A 650V Trench Fieldstop IGBT with anti-parallel diode SRE75N065FSU2D6

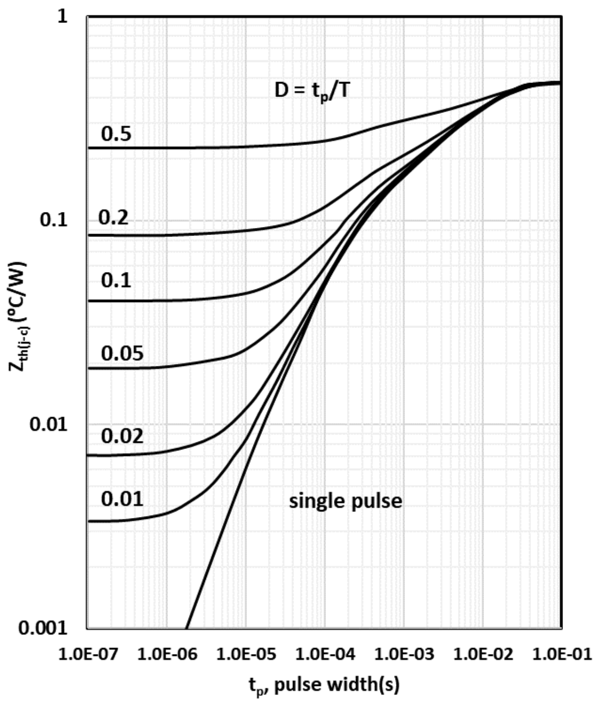
Typical Performance Characteristics

Figure 3: IGBT FBSOA



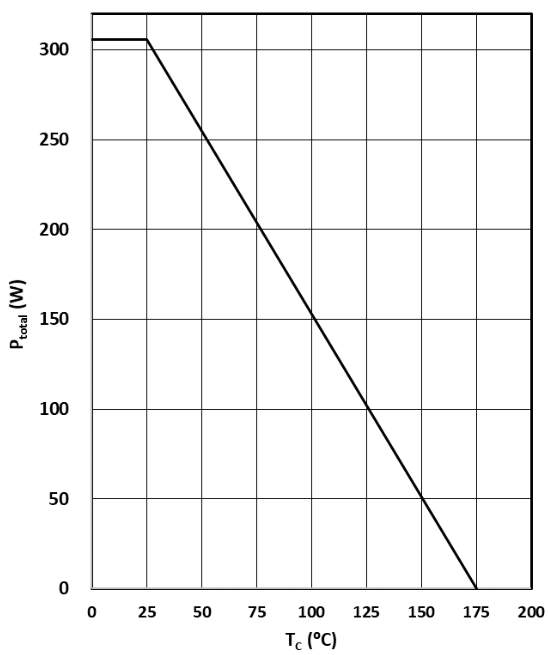
$I_C = f(V_{CE})$; $V_{GE} \geq 15/0V$; $Tj \leq 175°C$

Figure 4: IGBT transient thermal impedance



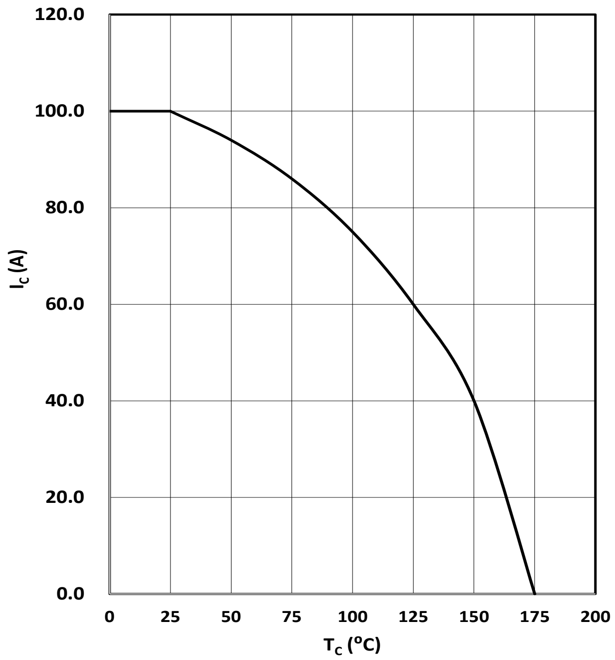
$R_{th(J-C)} = f(t_p)$; duty cycle: $D = t_p/T$

Figure 5: Power dissipation



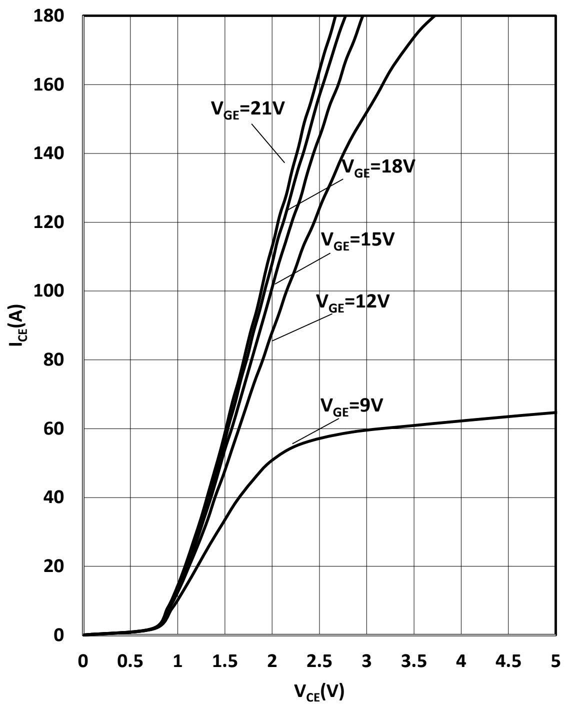
$Ptot = f(Tc)$;

Figure 6: Collector current vs. temperature



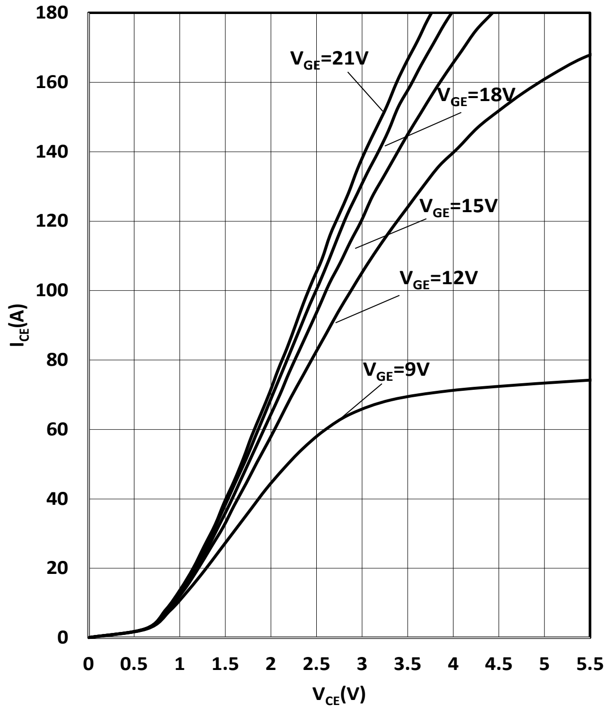
$Ic = f(Tj)$; $V_{GE} \geq 15V$; $Tj \leq 175°C$

Figure 7: Typical Output Characteristics



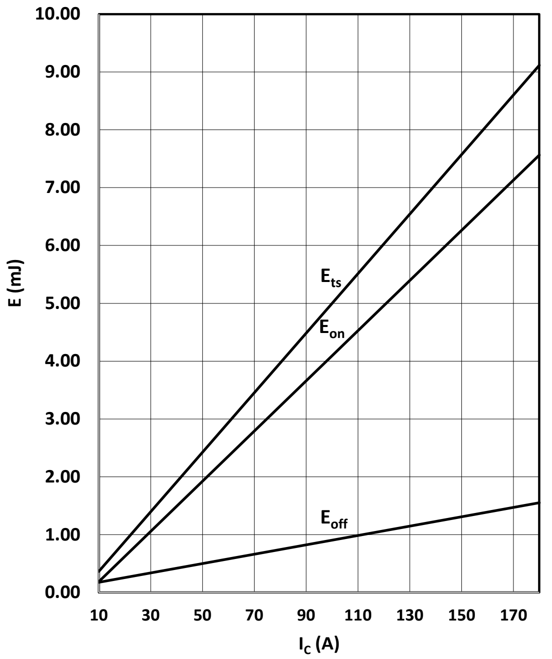
$I_C = f(V_{CE})$; Tj= 25ºC; parameter: V_{GE}

Figure 8: Typical Output Characteristics



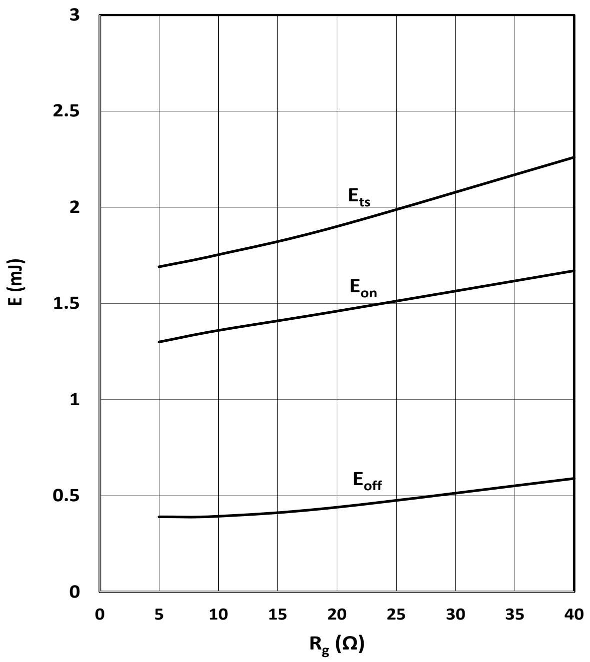
$I_C = f(V_{CE})$; Tj= 150ºC; parameter: V_{GE}

Figure 9: Typical switching energy losses as a function of collector current



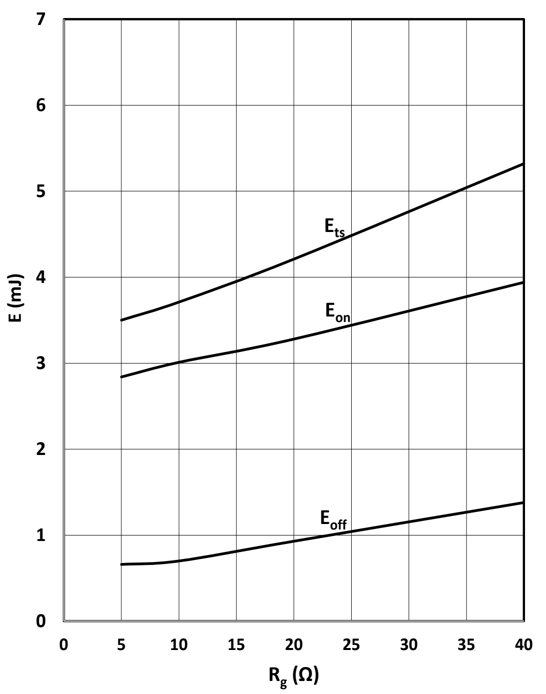
E=f(Ic); V_{CE}=400V; Tj=25ºC; R_G=10Ω

Figure10: Typical switching energy losses as a function of gate resistor



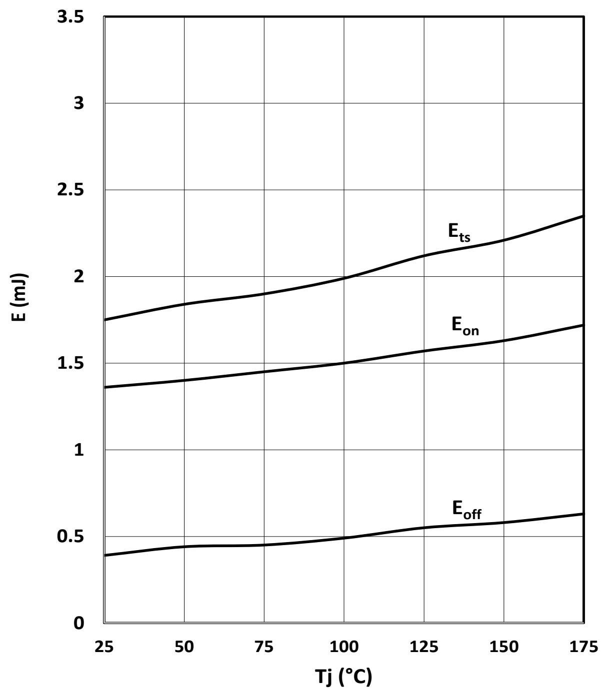
E=f(R_G); V_{CE}=400V; Tj=25ºC; Ic=37A

Figure 11: Typical switching energy losses as a function of gate resistor



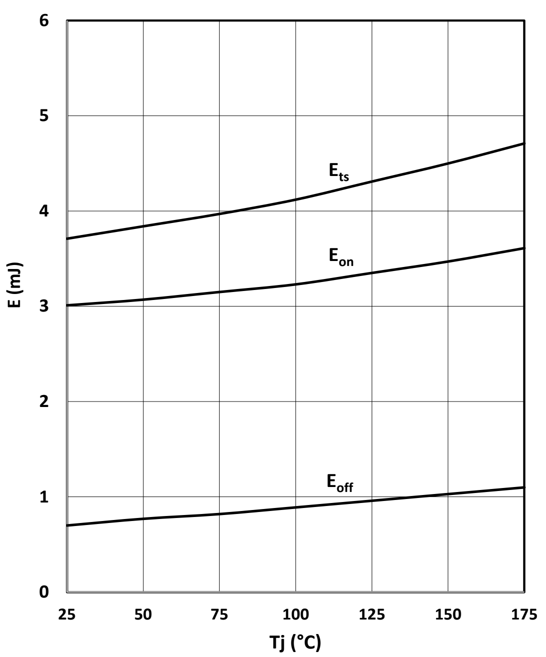
E=f(R_G); V_{CE}=400V; Tj=25ºC; Ic=75A

Figure12: Typical switching energy losses as a function of junction temperature



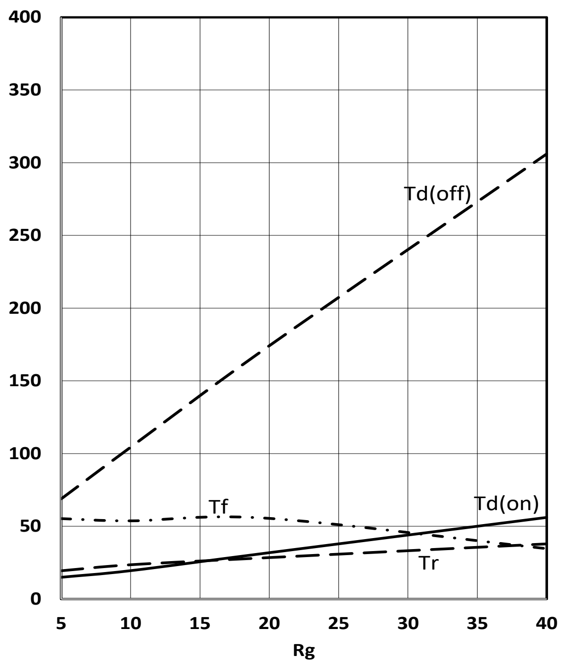
E=f(Tj); V_{CE}=400V; R_G =10 Ω; Ic=37A

Figure 13: Typical switching energy losses as a function of junction temperature



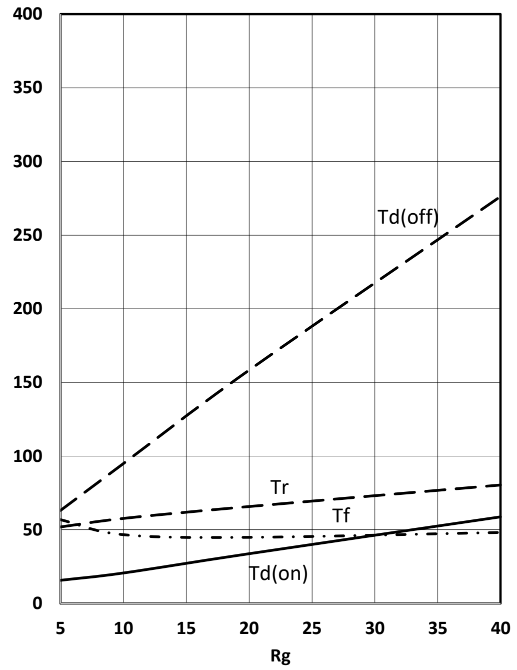
E=f(Tj); V_{CE}=400V; R_G =10 Ω; Ic=75A

Figure14: Typical Switching time as a function of gate resistor



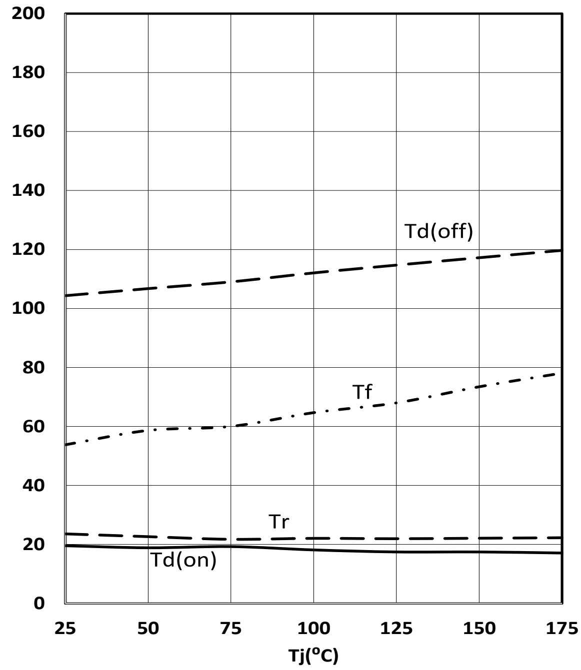
V_{CE}=400V; Tj=25ºC; Ic=37A

Figure 15: Typical Switching time as a function of gate resistor



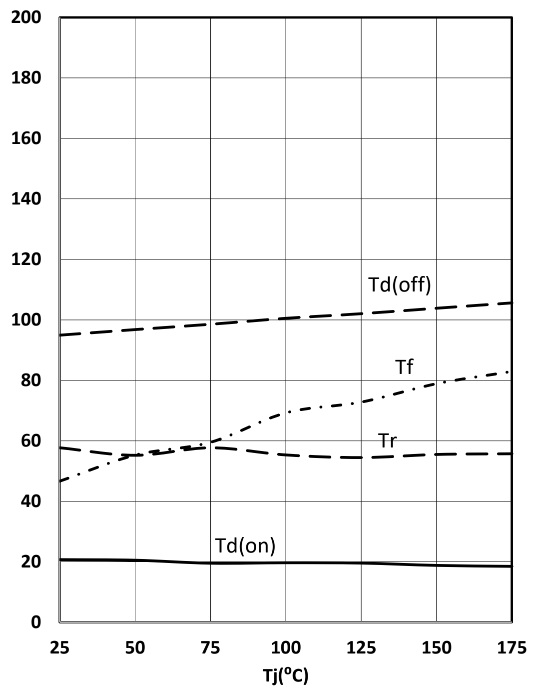
V_{CE}=400V; Tj=25ºC; Ic=75A

Figure16: Typical Switching time as a function of junction temperature



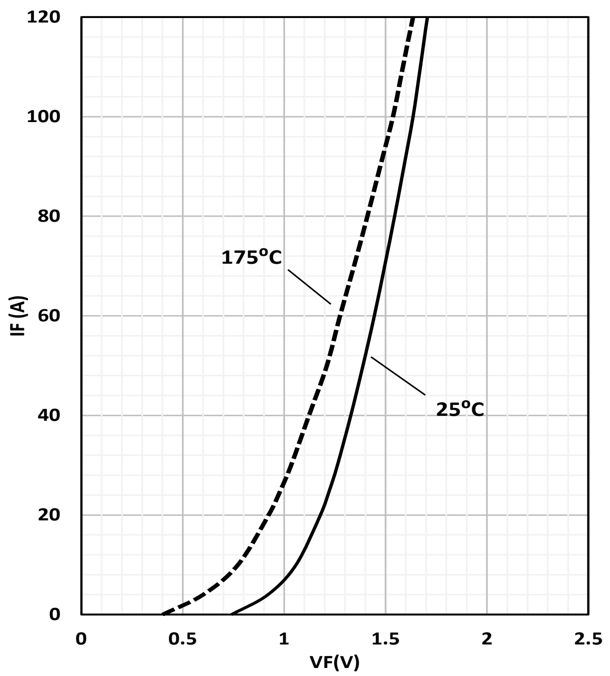
V_{CE}=400V; R_G=10Ω ; Ic=37A

Figure 17: Typical Switching time as a function of junction temperature



V_{CE}=400V; R_G=10Ω ; Ic=75A

Figure 18: Typical diode forward current as a function of forward voltage



I_F= f(V_F);

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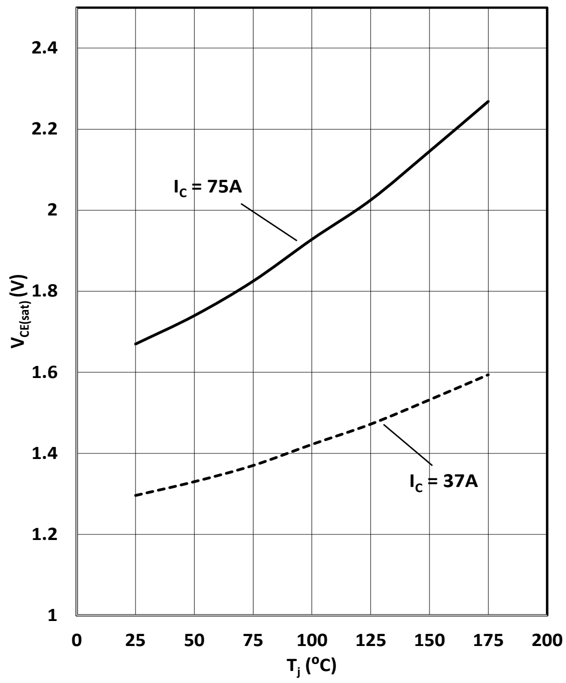
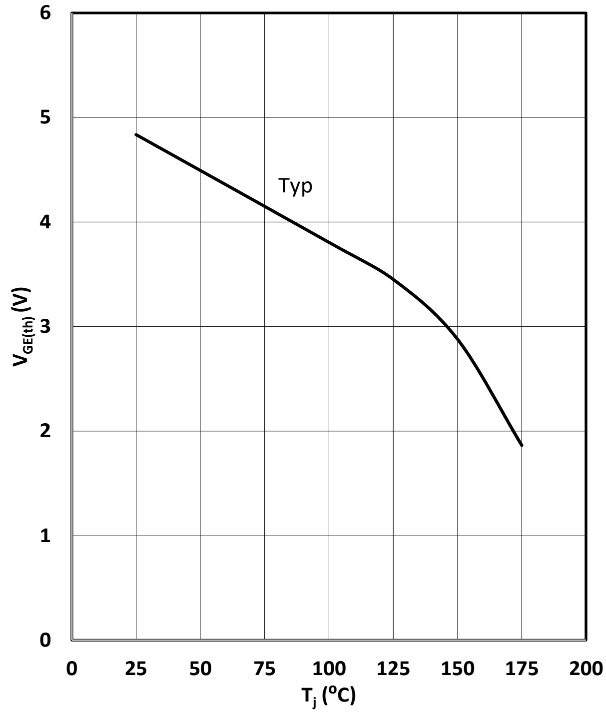
Figure 19: Typical collector-emitter saturation voltage as a function of junction temperature	Figure 20: Gate-emitter threshold voltage as a function of junction temperature
	
V_{CE} =f(T_j); V_{GE}=15V	V_{GE} =f(T_j); I_{CE} = 250µA

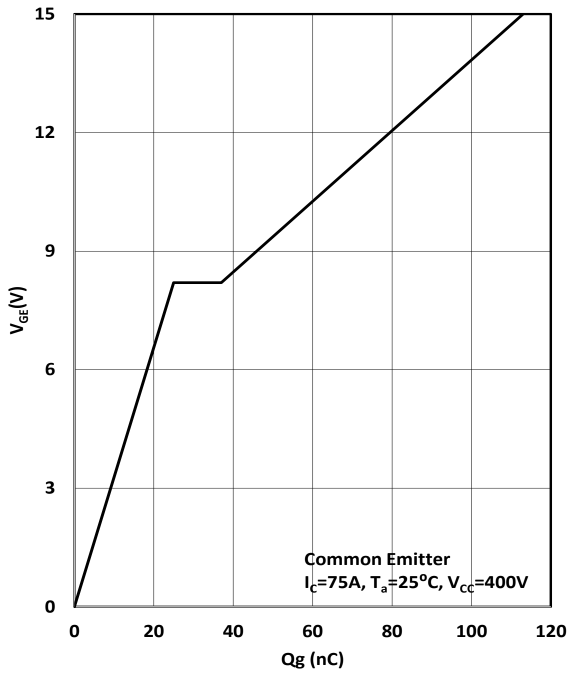
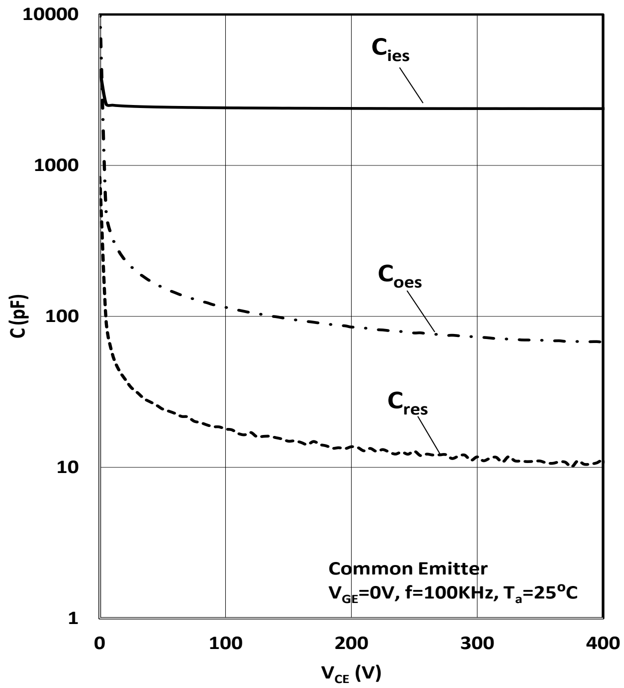
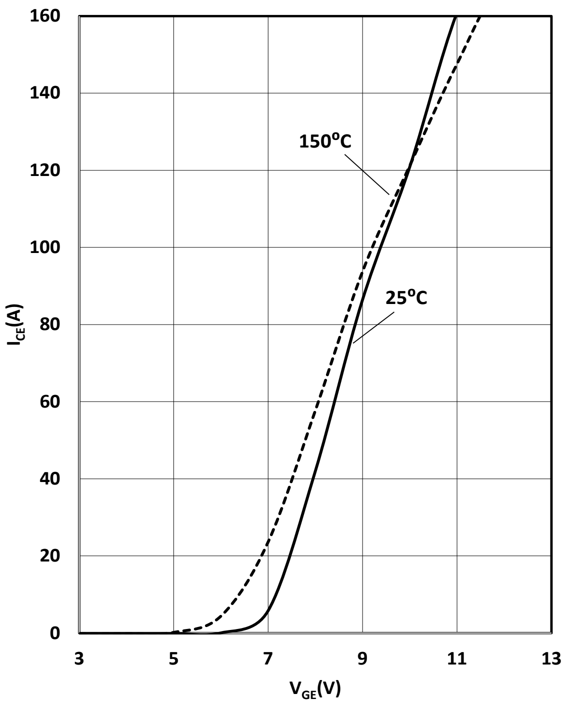
Figure 21: Typical Gate Charge	Figure 22: Typical Capacitances
	
V_{GE}= f(Q_{gate}); I_C= 75A	C=f(V_{CE}); V_{GE}=0; f=100KHz

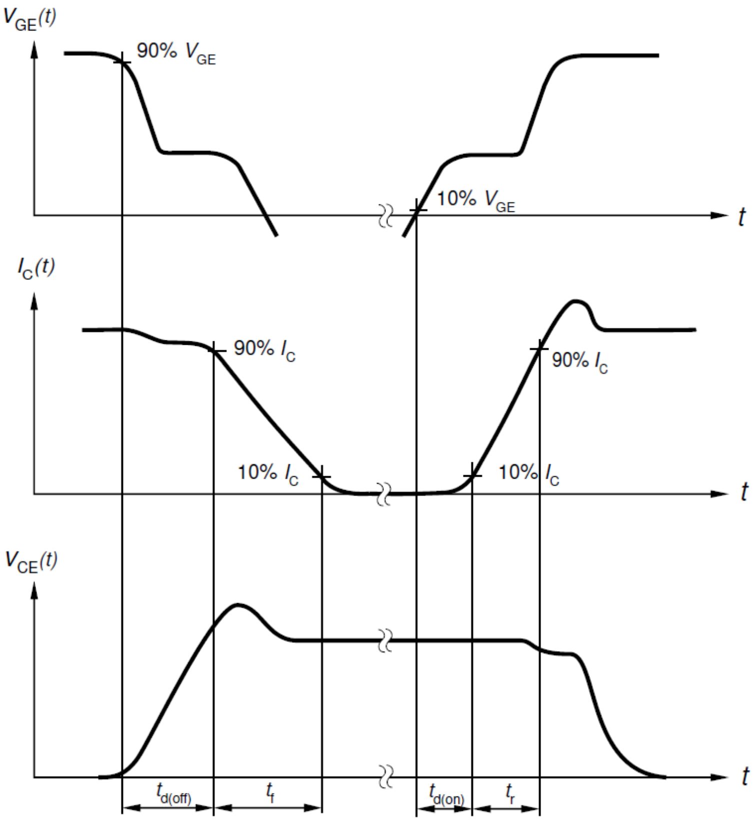
Figure 23: Typical transfer characteristic



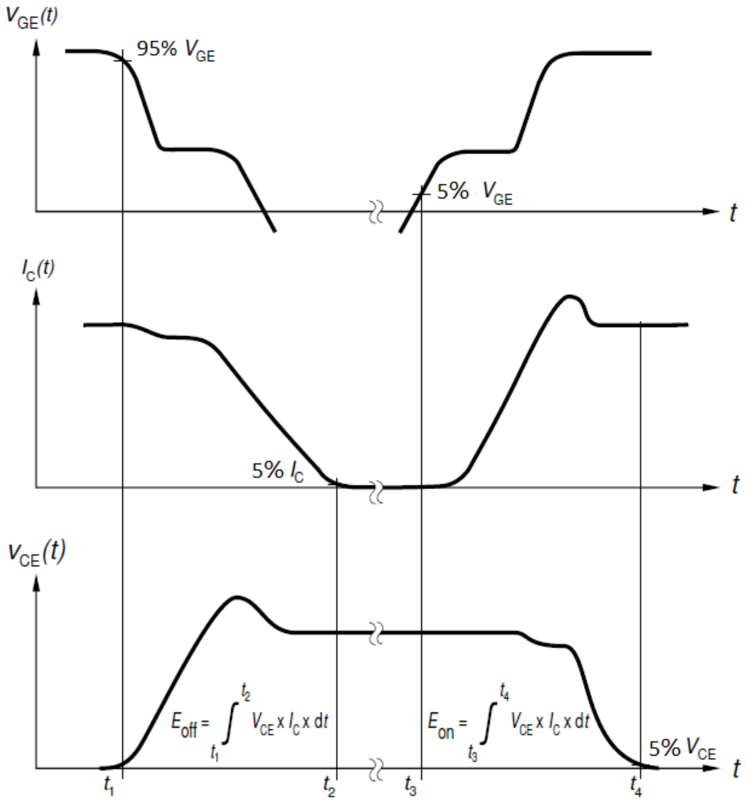
$I_C = f(V_{GE})$; Tj= 25°C vs 150°C; (V_{CE}=20V)

Test Circuits

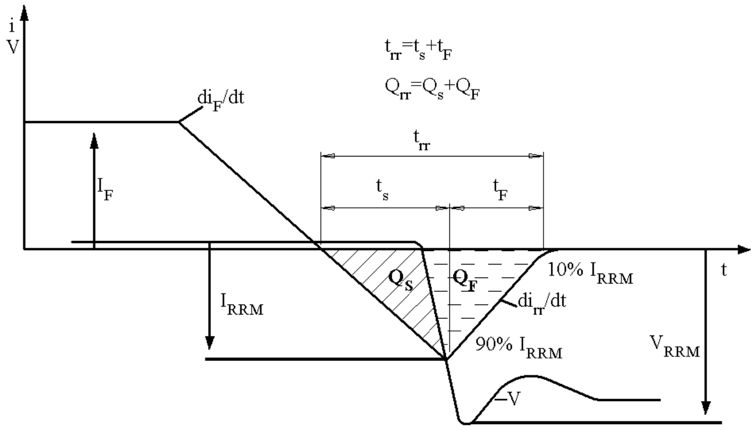
1. Definition Switching times



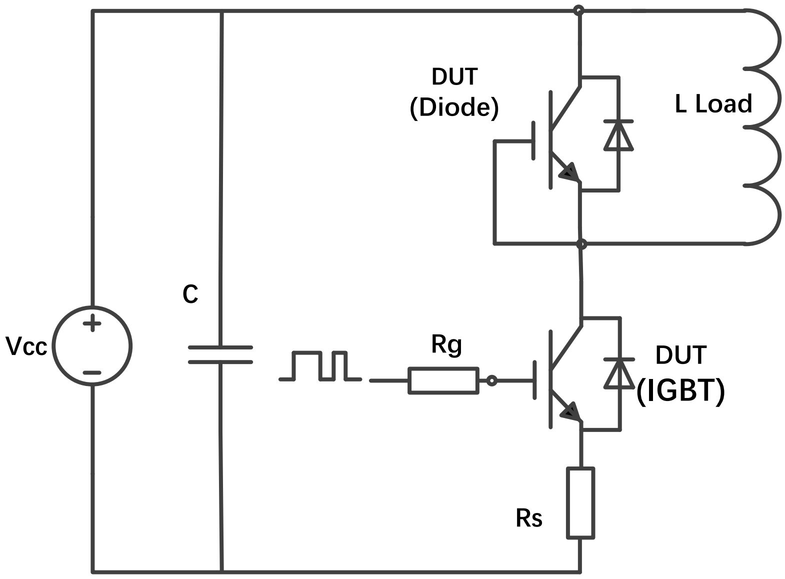
2. Definition Switching losses



3. Definition Diode Switching Characteristics

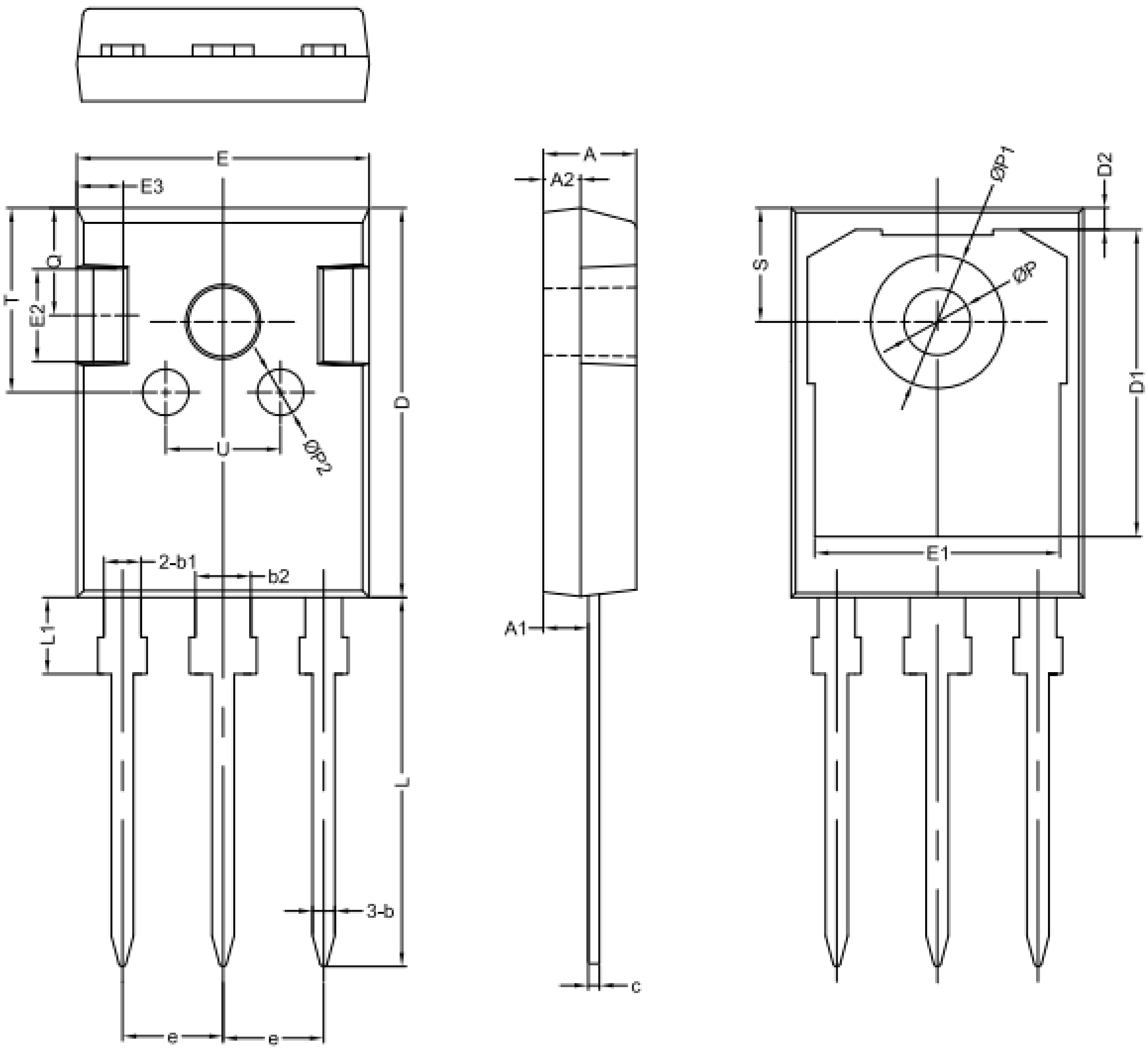


4. Dynamic test circuit



Mechanical Dimensions

TO-247 **Unit: mm**



Mechanical Dimensions

Symbol	Dimensions (mm)			Symbol	Dimensions (mm)		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.80	5.00	5.20	E2	–	5.00	–
A1	2.21	2.41	2.61	E3	–	2.50	–
A2	1.90	2.00	2.10	e	–	5.44	–
b	1.10	1.20	1.35	L	19.42	19.92	20.42
b1	–	2.00	–	L1	–	4.13	–
b2	–	3.00	–	P	3.50	3.60	3.70
c	0.55	0.60	0.75	P1	–	7.19	–
D	20.80	21.00	21.20	P2	–	2.50	–
D1	–	16.55	–	Q	–	5.80	–
D2	–	1.20	–	S	6.05	6.15	6.25
E	15.60	15.80	16.00	T	–	10.00	–
E1	–	13.30	–	U	–	6.20	–

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