

General Description

The SRE100N120FSUDA 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 SRE100N120FSUDA is TO-247Plus package.

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 $V_{CE(sat)}$
- High Speed Switching
- Enhanced Avalanche Capability
- Non-Automotive Qualified

Application

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

Ordering Information

SRE100N120FSUDA□□-□

Circuit Type		G: Green
Package		Blank: Tube
TP:TO-247Plus		TR: Tape & Reel

Symbol

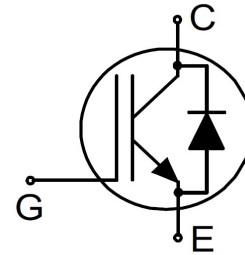
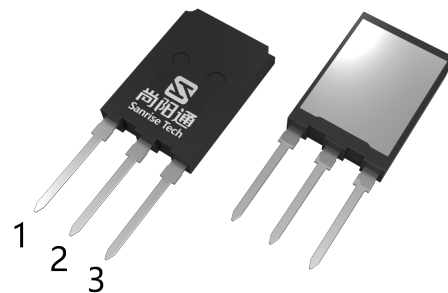


Figure 1 Symbol of SRE100N120FSUDA

Package Type



TO-247Plus

- Pin 1- Gate
- Pin 2&backside- Collector
- Pin 3-Emitter

Figure 2 Package Type of SRE100N120FSUDA

Package	Part Number	Marking ID	Packing Type
	Green	Green	
TO-247Plus	SRE100N120FSUDATP-G7	SRE100N120FSUDATPG7	Tube

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	I_C	$T_C=25^\circ\text{C}$	160 ⁽¹⁾
		$T_C=100^\circ\text{C}$	100
Pulsed Collector Current, Limited by T_{Jmax}		I_{CM}	400
Diode Continuous Collector Current	I_F	$T_C=25^\circ\text{C}$	120
		$T_C=100^\circ\text{C}$	100 ⁽²⁾
Diode Pulsed Current, Limited by T_{Jmax}		I_{FM}	320
Power dissipation	P_{tot}	$T_C=25^\circ\text{C}$	880
		$T_C=100^\circ\text{C}$	440
Operating Junction Temperature		T_J	$-40\sim 175^{(3)}$
Storage Temperature		T_{STG}	$-55 \sim 150$
Lead Temperature (Soldering, 10 sec)		T_{LEAD}	260

Note:

1. Limited to bond wire.
2. Current level is limited by T_{j_max} .
3. Reliability testing conducted at $T_j=175^\circ\text{C}$.

Thermal Resistance

Parameter	Package	Symbol	Min	Typ	Max	Unit
IGBT thermal Resistance, Junction-to-Case	TO-247Plus	R_{thJC}	-	-	0.17	°C/W
Diode thermal Resistance, Junction-to-Case	TO-247Plus	R_{thJC}	-	-	0.4	
Thermal Resistance, Junction-to-Ambient	TO-247Plus	R_{thJA}	-	-	40	

Electrical Characteristics
 $T_J = 25^\circ\text{C}$, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Statistic Characteristics							
Collector-emitter Breakdown Voltage	BV_{CES}	$V_{GE}=0V, I_C=500\mu A$	1200			V	
Gate Threshold Voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}, I_C=1.6mA$	4.6	5.6	6.6	V	
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE}=15V, I_C=100A,$ $T_J=25^\circ\text{C}$		1.8	2.2	V	
		$T_J=125^\circ\text{C}$		2.46		V	
		$T_J=175^\circ\text{C}$		2.86		V	
Zero Gate Voltage Collector Current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$ $T_J=25^\circ\text{C}$			100	μA	
		$T_J=175^\circ\text{C}$			1.3	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}	$V_{CE}=25V, V_{GE}=0V,$ $f=100KHz$		6965		pF	
Output Capacitance	C_{OES}			399			
Reverse Transfer Capacitance	C_{RES}			70			
Gate Resistance	R_G	$f=1MHz, \text{Open Drain}$		0.83		Ω	
Turn-on Delay Time	$t_{d(on)}$	$T_J=25^\circ\text{C},$ $V_{CC}=600V,$ $I_C=100A$ $R_G=10\Omega, V_{GE}=0/15V$ (Ets includes tail current and FRD reverse recovery energy.)		55		ns	
Rise Time	t_r			66		ns	
Turn-off Delay Time	$t_{d(off)}$			276		ns	
Fall Time	t_f			100		ns	
Turn-on energy	E_{on}			7		mJ	
Turn-off energy	E_{off}			2.6		mJ	
Total switching energy	E_{ts}			9.6		mJ	
Turn-on Delay Time	$t_{d(on)}$		$T_J=150^\circ\text{C}$ $V_{CC}=600V,$ $I_C=100A; R_G=10\Omega,$ $V_{GE}=0/15V$ (Ets includes tail current and FRD reverse recovery energy.)		47		ns
Rise Time	t_r				66		ns
Turn-off Delay Time	$t_{d(off)}$				288		ns
Fall Time	t_f			111		ns	
Turn-on energy	E_{on}			8.2		mJ	
Turn-off energy	E_{off}			3.4		mJ	
Total switching energy	E_{ts}			11.6		mJ	
Gate to Emitter Charge	Q_{GE}	$V_{CC}=600V, I_C=100A$ $V_{GE}=0 \text{ to } 15V$			46		nC
Gate to Collector Charge	Q_{GC}				97		
Gate Charge Total	Q_G			168			

100A 1200V Trench Fieldstop IGBT with FRD
SRE100N120FSUDA

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Reverse Diode Characteristics						
Drain-Source Diode Forward Voltage	V_F	$V_{GE}=0V, I_F=100A$ $T_j=25^\circ C$		2.5	2.9	V
		$V_{GE}=0V, I_F=100A$ $T_j=125^\circ C$		2.45		
		$V_{GE}=0V, I_F=100A$ $T_j=175^\circ C$		2.26		
Reverse Recovery Time	t_{rr}	$T_j=25^\circ C$		316		ns
Reverse Recovery Charge	Q_{rr}			2.0		μC
Peak Reverse Recovery Current	I_{rrm}	$V_R=600V, I_F=100A$ $dI_F/dt=1200A/\mu s$		31		A
Diode peak rate of fall of reverse Recovery current during t_b	di_{rr}/dt			-485		A/ μs
Reverse Recovery Time	t_{rr}	$T_j=150^\circ C$ $V_R=600V, I_F=100A$ $dI_F/dt=1200A/\mu s$		468		ns
Reverse Recovery Charge	Q_{rr}			6.7		μC
Peak Reverse Recovery Current	I_{rrm}			59		A
Diode peak rate of fall of reverse Recovery current during t_b	di_{rr}/dt			-435		A/ μs

Typical Performance Characteristics

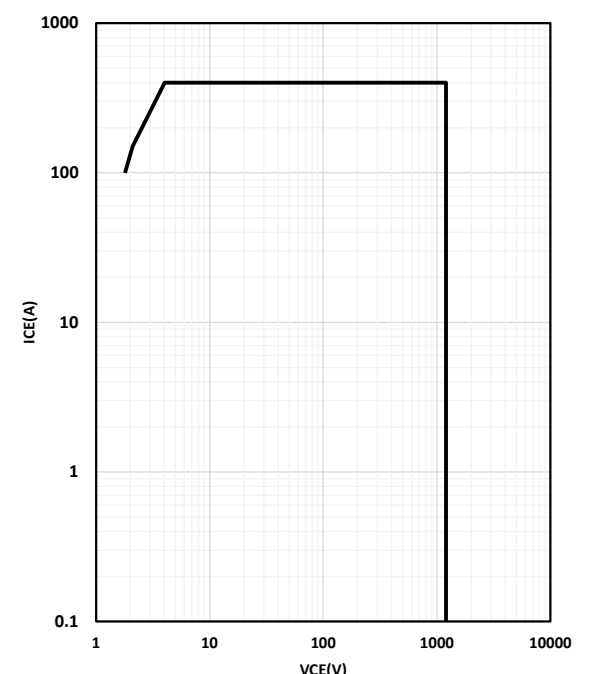
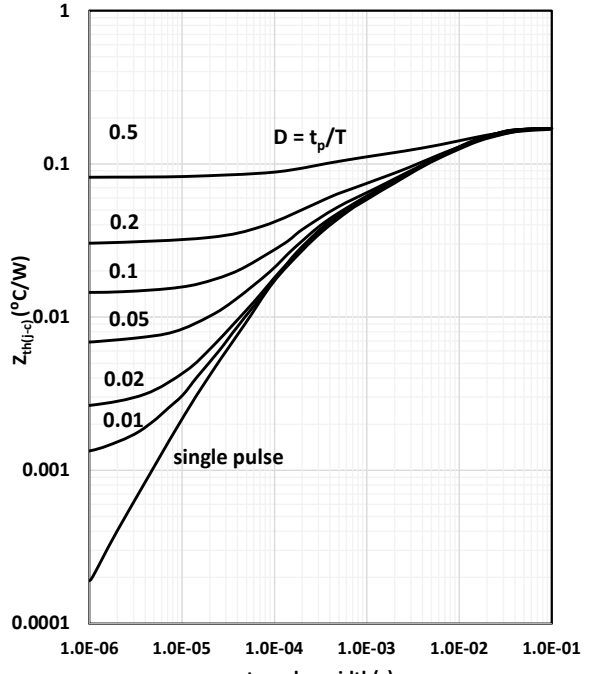
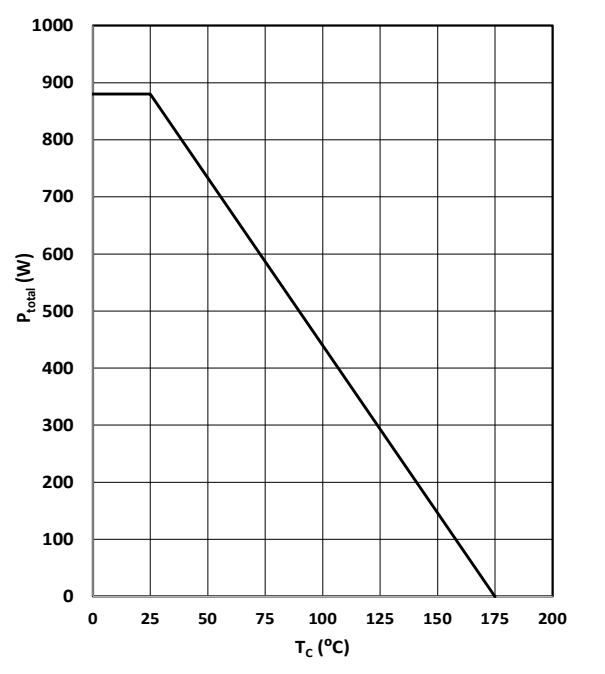
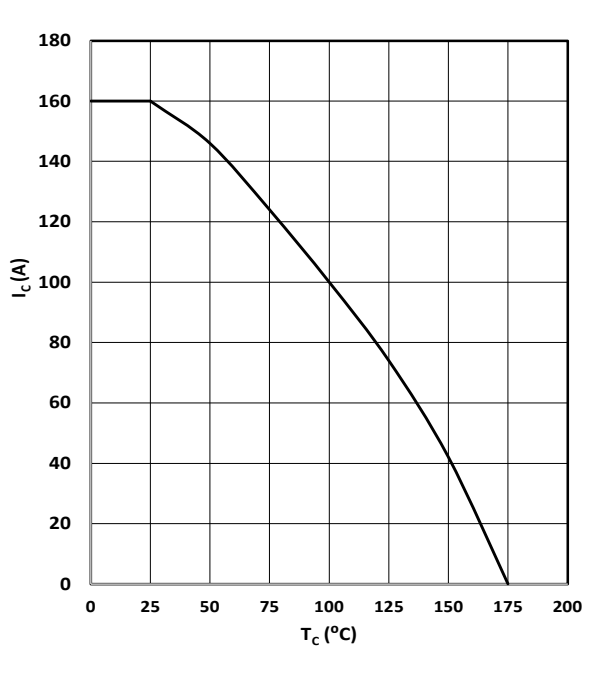
<p>Figure 3: IGBT FBSOA</p>  <p>$I_C = f(V_{CE}); V_{GE} \geq 15/0V; T_j \leq 175\text{ }^\circ\text{C}$</p>	<p>Figure 4: IGBT Transient Thermal Impedance</p>  <p>$R_{th(j-c)} = f(t_p); \text{ parameter: } D = t_p/T$</p>
<p>Figure 5: Power Dissipation</p>  <p>$P_{tot} = f(T_c)$</p>	<p>Figure 6: Collector Current vs. Temperature</p>  <p>$I_C = f(T_j); V_{GE} \geq 15V; T_j \leq 175\text{ }^\circ\text{C}$</p>

Figure 7: Typ. Output Characteristics

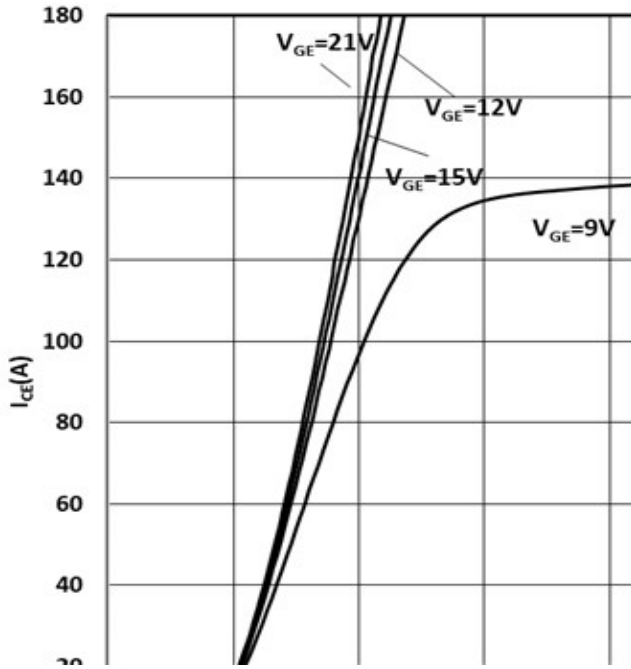

 $I_C = f(V_{CE}); T_j = 25^\circ\text{C}; \text{parameter: } V_{GE}$

Figure 8: Typ. Output Characteristics

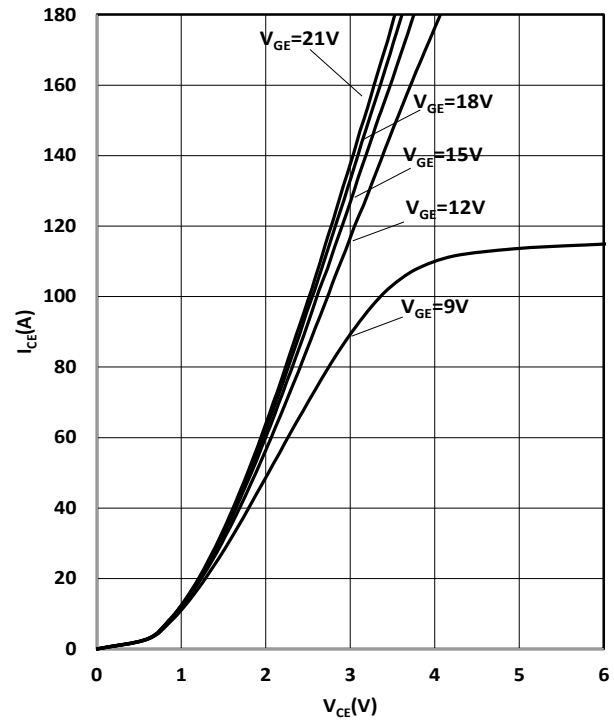

 $I_C = f(V_{CE}); T_j = 175^\circ\text{C}; \text{parameter: } V_{GE}$

Figure 9: Typ. Transfer Characteristics

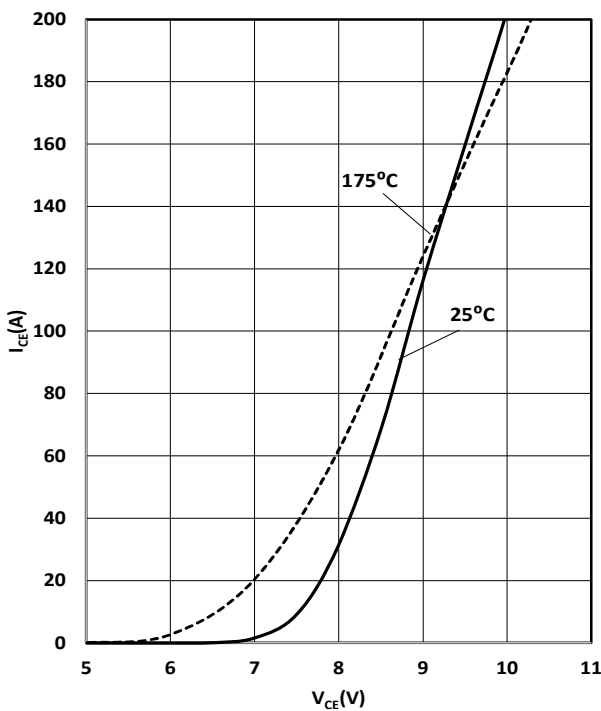

 $I_C = f(V_{GE}); V_{CE} = 20\text{V}$

Figure 10: Typ. Collector Voltage vs. Temperature

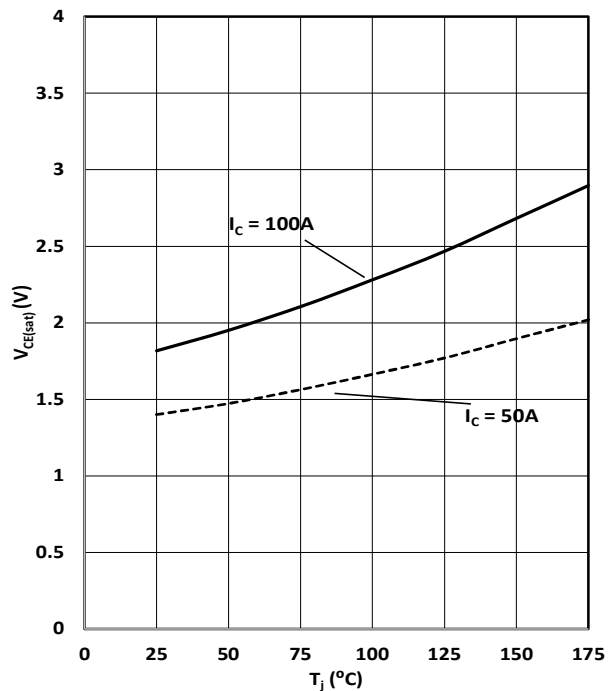
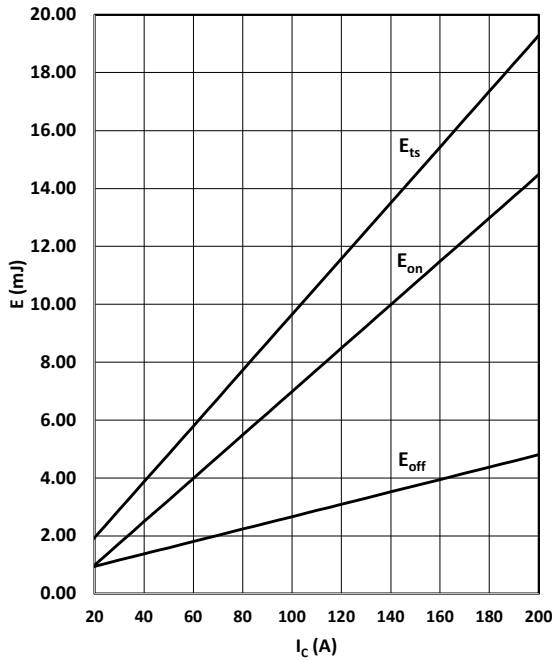
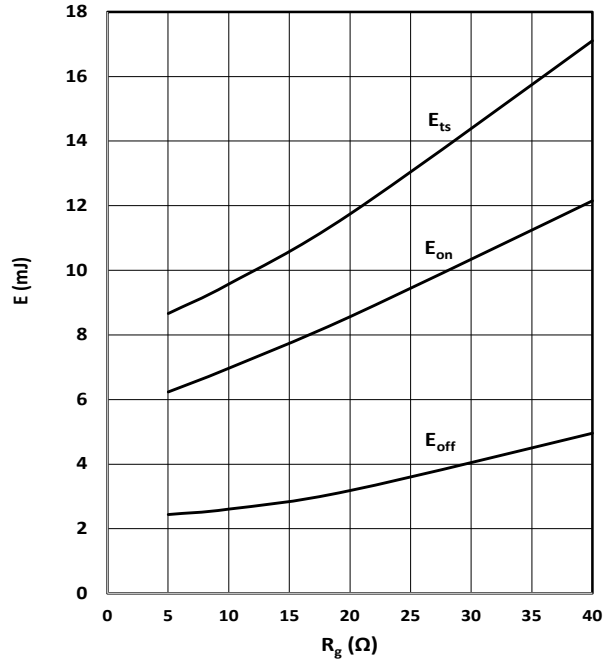
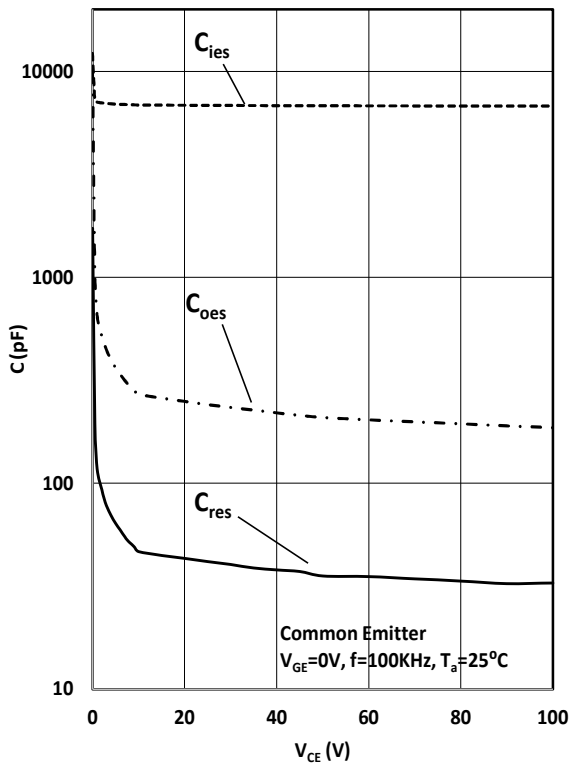

 $V_{CE} = f(T_j); V_{GE} = 15\text{V}$

Figure 11: IGBT switching energy losses


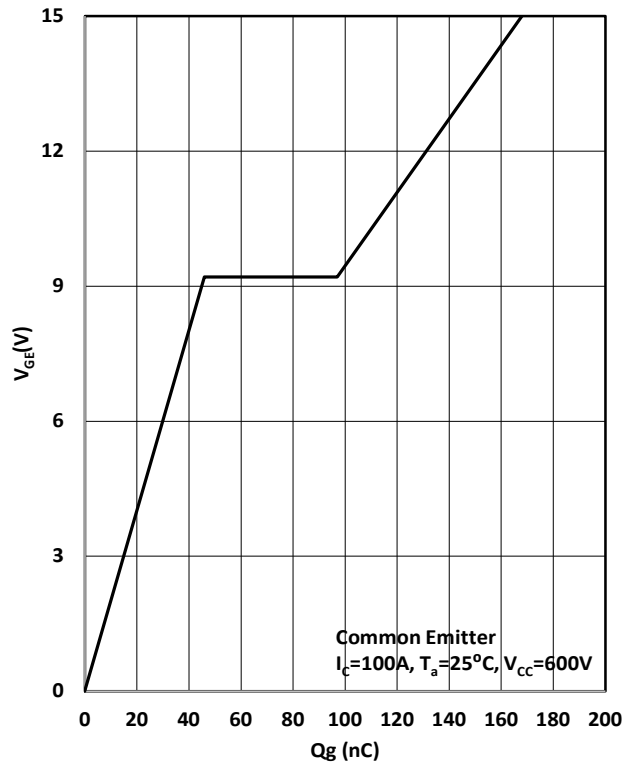
$$E=f(I_C) ; V_{CE}=600V; T_j=25^{\circ}C; R_G=10\Omega$$

Figure 12: IGBT switching energy losses


$$E=f(R_G) ; V_{CE}=600V; T_j=25^{\circ}C; I_C=100A$$

Figure 13: Typ. Capacitances


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

Figure 14: Typ. Gate Charge


$$V_{GE}=f(Q_g), I_C=100A$$

Figure 15: Typ. Switching time as a function of gate resistance

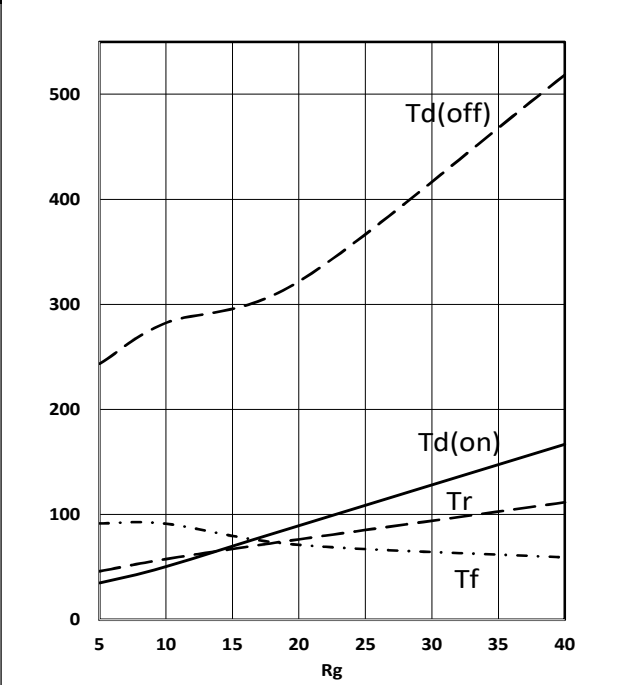

 $V_{CE}=600V; I_C=100A; T_j=25^{\circ}C$

Figure 16: Typ. Switching time as a function of junction temperature

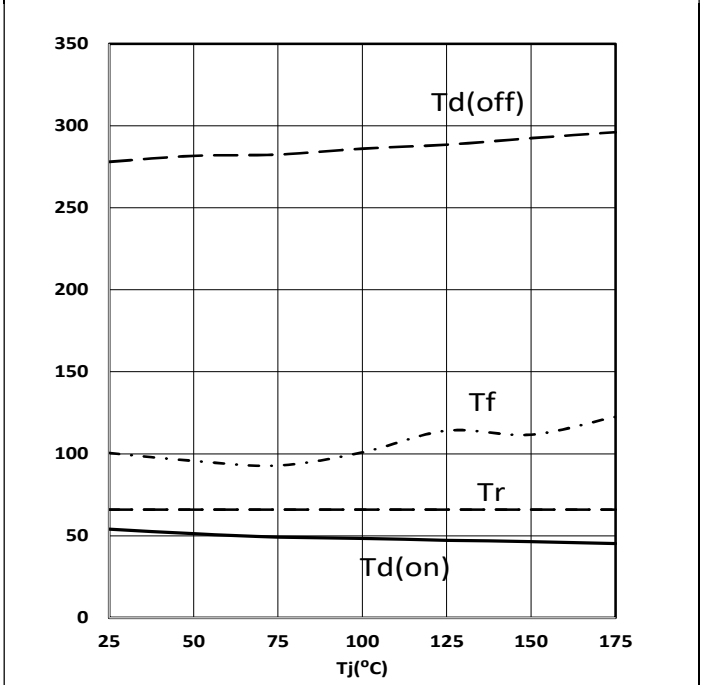

 $V_{CE}=600V; I_C=100A; R_G=10\Omega$

Figure 17: Typical switching energy losses as a function of junction temperature

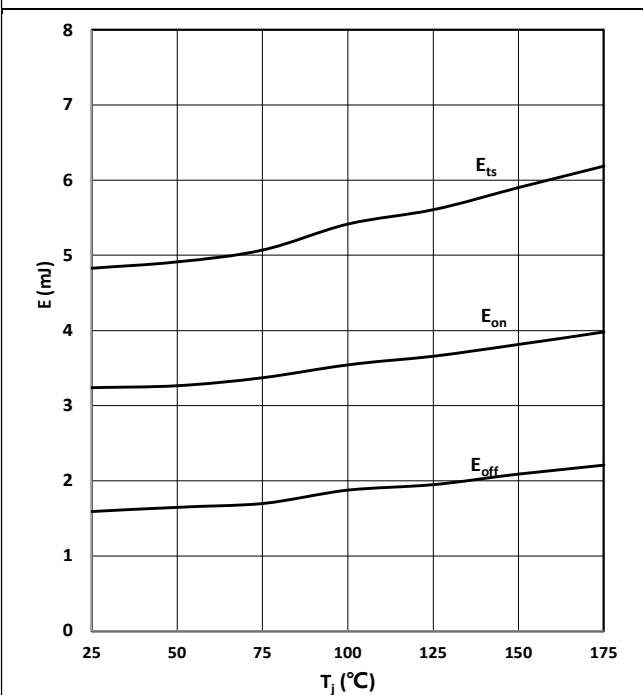

 $E=f(T_j); V_{CE}=600V; I_C=50A; R_G=10\Omega$

Figure 18: Typical switching energy losses as a function of junction temperature

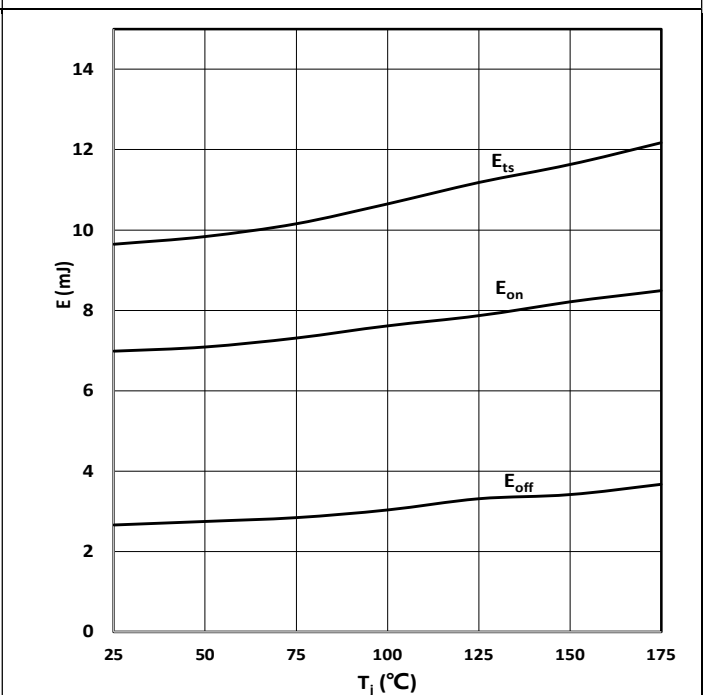
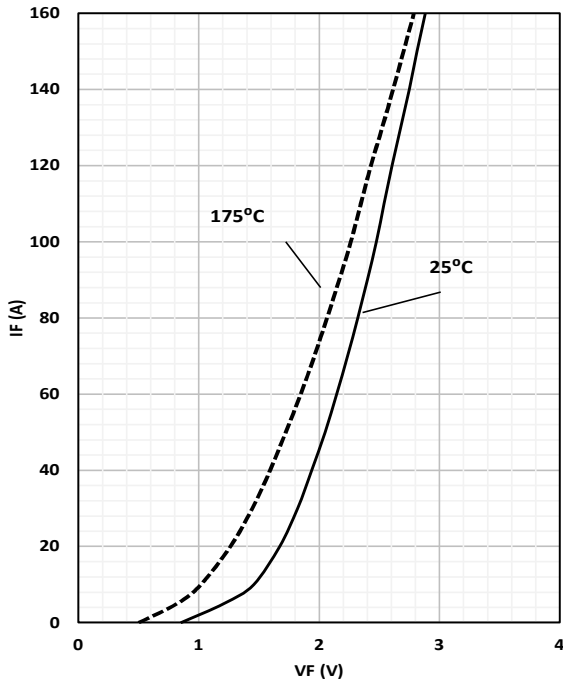
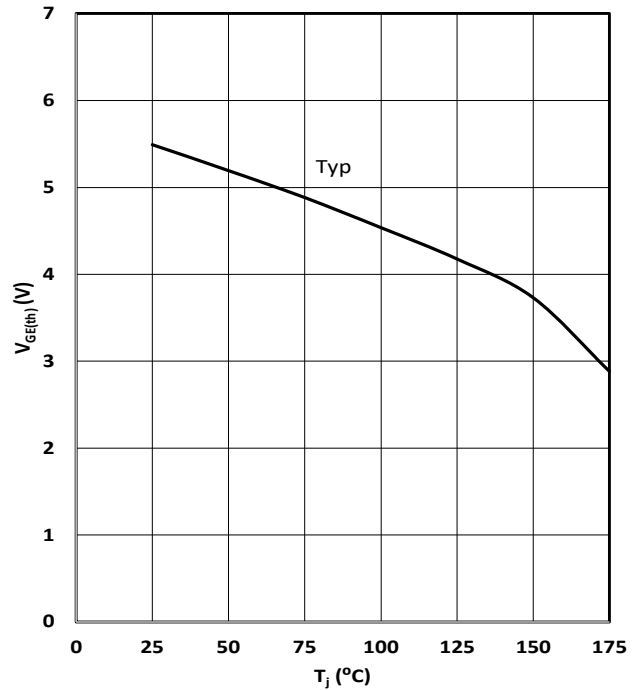

 $E=f(T_j); V_{CE}=600V; I_C=100A; R_G=10\Omega$

Figure 19: Typ. diode forward current as a function of forward voltage



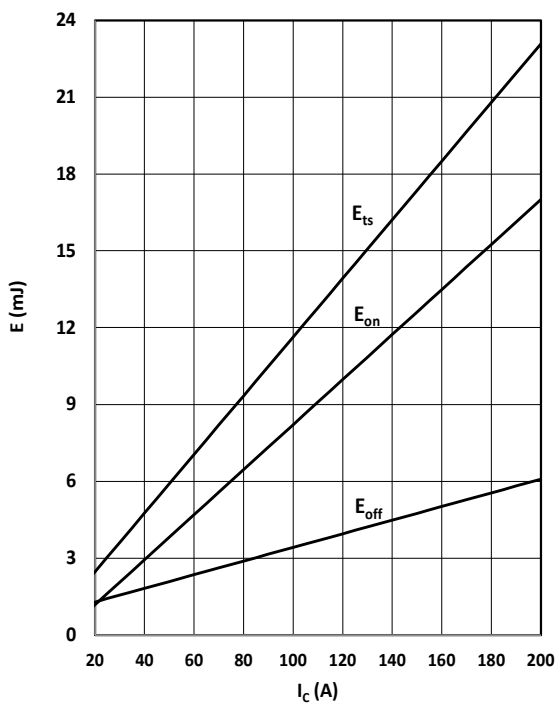
$$I_F = f(V_F);$$

Figure 20: Typ. emitter threshold voltage as a function of junction temperature

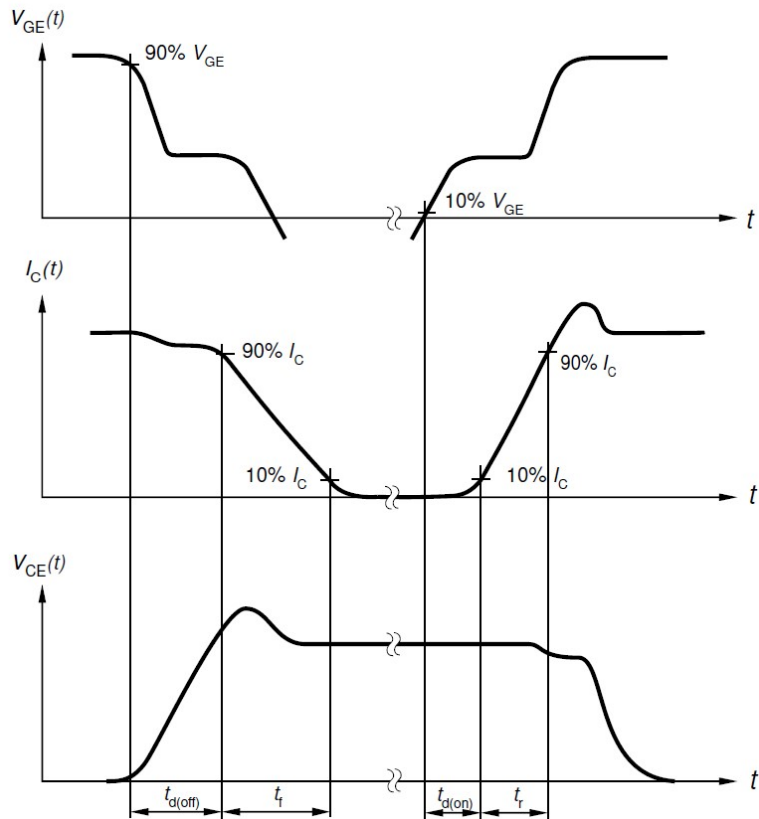
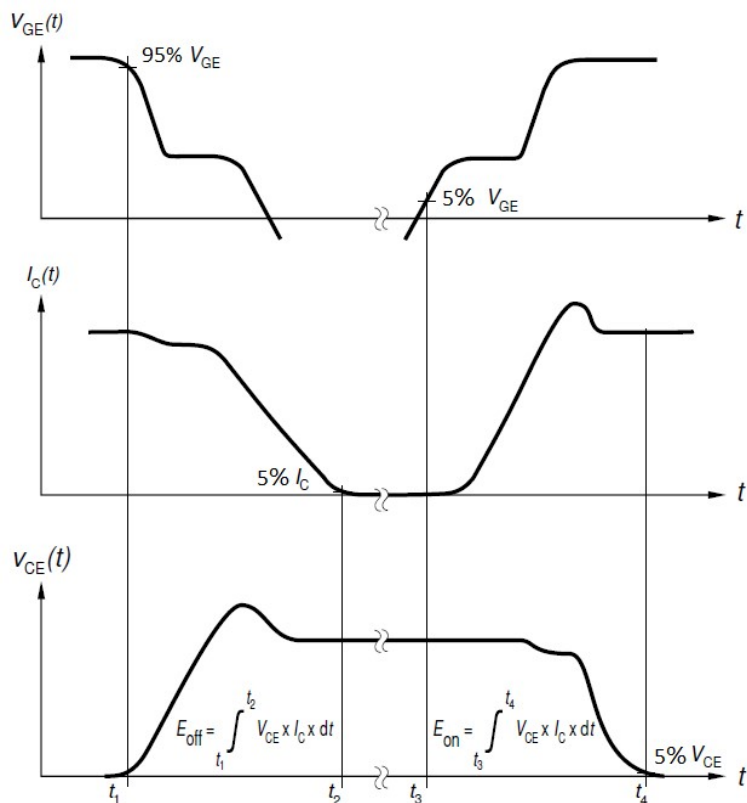


$$V_{GE} = f(T_j); I_{CE} = 1.6\text{mA}$$

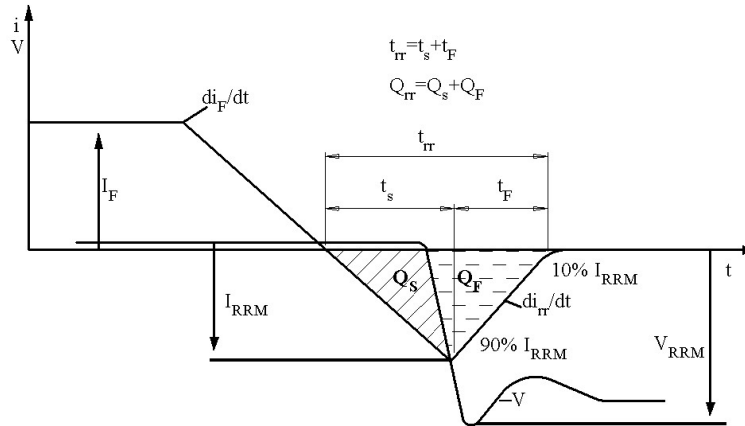
Figure 21: IGBT switching energy losses



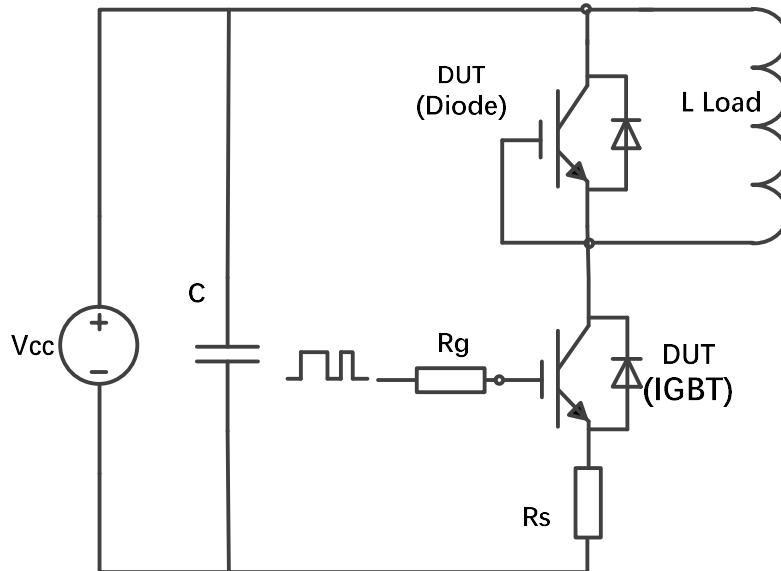
$$E = f(I_C); V_{CE} = 600\text{V}; T_j = 150^\circ\text{C}; R_G = 10\Omega$$

Test Circuits
1. Definition Switching times

2. Definition Switching losses


3. Definition Diode Switching Characteristics



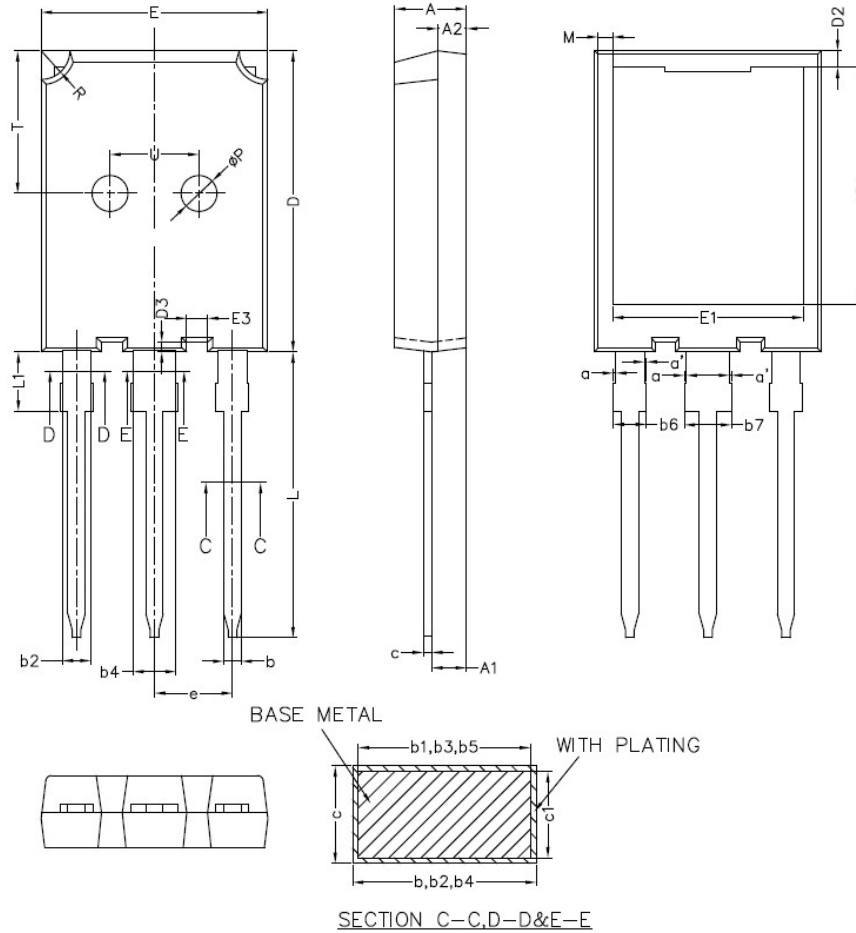
4. Dynamic test circuit



Mechanical Dimensions

TO-247Plus

Unit: mm



100A 1200V Trench Fieldstop IGBT with FRD
SRE100N120FSUDA

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
α	0	-	0.15
α'	0	-	0.15
b	1.16	-	1.26
b1	1.15	1.2	1.22
b2	1.96	-	2.06
b3	1.95	2.00	2.02
b4	2.96	-	3.06
b5	2.95	3.00	3.02
b6	-	-	2.25
b7	-	-	3.25
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	1.17	1.35
D3	0.58	0.68	0.78
E	15.70	15.80	15.90
E1	13.10	13.26	13.50
E3	1.35	1.45	1.55
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1	3.90	-	4.30
M	0.70	-	1.30
P	2.40	2.50	2.60
R	1.90	2.00	2.10
T	9.80	-	10.20
U	6.00	-	6.40



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