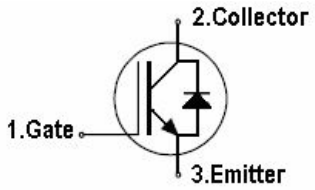
TSG20N120

IGBT trench process

DRAWING

G C E



Features

- 1200V,20A
- VCE(sat)(typ.)=2.3V@VGE=15V，IC=20A
- High speed switching
- Higher system efficiency
- built-in FRD

General Description

- Package:TO-3PN
- TS IGBTs with trench process offer lower losses and higher energy efficiency for application such as IH (induction heating),UPS, general inverter and other soft switching applications.

Absolute Maximum Ratings

Symbol	Parameter		Spec	Units
V_{CES}	Collector-Emitter Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		±20	V
I_C	Continuous Collector Current	(TC=25 ℃)	30	A
	Continuous Collector Current	(TC=100℃)	20	A
I_{CM}	Pulsed Collector Current (Note 1)		45	A
I_F	Diode Continuous Forward Current	(TC=25 ℃)	30	A
	Diode Continuous Forward Current	(TC=100℃)	20	
I_{FM}	Diode Maximum Forward Current (Note 1)		45	A
tsc	Short Circuit Withstand Time		10	us
P_D	Maximum Power Dissipation	(TC=25 ℃)	208	W
	Maximum Power Dissipation	(TC=100℃)	83	W
T_J	Operating Junction Temperature Range		-55 to +150	℃
T_{STG}	Storage Temperature Range		-55 to +150	℃

Note1： Repetitive Rating: Pulse width limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	Spec	Units
Rth j-c	Thermal Resistance, Junction to case for IGBT	0.6	KW
Rth j-c	Thermal Resistance, Junction to case for Diode	2	
Rth j-a	Thermal Resistance, Junction to Ambient	40	

Electrical Characteristics (TC=25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Static characteristics							
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE}= 0V, I_C= 250uA		1200			V
I_{CES}	Collector-Emitter Leakage Current	V_{CE}= 1200V, V_{GE}= 0V	Tj=25 ℃			0.1	mA
			Tj=150 ℃			2.0	
I_{GES}	Gate Leakage Current, Forward	V_{GE}=20V, V_{CE}= 0V				100	nA
	Gate Leakage Current, Reverse	V_{GE}= -20V, V_{CE}= 0V				-100	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}= V_{CE}, I_C= 250uA		5.0	5.5	6.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C= 20A	Tj=25 ℃		2.1	2.3	V
			Tj=150 ℃		2.3		
V_F	Diode Forward Voltage	V_{GE}= 0V, I_F=20A	Tj=25 ℃		1.25		V
			Tj=150 ℃		1.15		
g_{FS}	transconductance	V_{CE}= 20V, I_C= 20A			8.5		S
Dynamic characteristics							
Ciss	Input Capacitance	V_{CE}=25V			2750		pF
Coss	Output Capacitance	V_{GE}=0V			85		
Crss	Reverse Transfer Capacitance	f = 1MHz			48		
Q_G	Gate Charge	Vcc=900V, I_C=20A, V_{GE}=15V			tbd		nc
IGBT switching characteristic(Inductive Load)							
t d(on)	Turn-on Delay Time	V_{CC}=600V I_C=20A V_{GE}=15V/0V R_G=15Ω L_{Load}=500μH TC=25 ℃			25		ns
t r	Turn-on Rise Time				48		
t d(off)	Turn-off Delay Time				155		
t f	Turn-off Fall Time				115		
Eon	Turn-on Switching Loss				0.67		mJ
Eoff	Turn-off Switching Loss				0.45		
Ets	Total Switching Loss				1.12		
t d(on)	Turn-on Delay Time	V_{CC}=600V V_{GE}=15V/0V I_C=20A R_G=15Ω L_{Load}=500μH TC=150 ℃			23		ns
t r	Turn-on Rise Time				46		
t d(off)	Turn-off Delay Time				182		
t f	Turn-off Fall Time				240		
Eon	Turn-on Switching Loss				0.75		mJ
Eoff	Turn-off Switching Loss				0.92		
Ets	Total Switching Loss				1.67		

Typical Characteristics

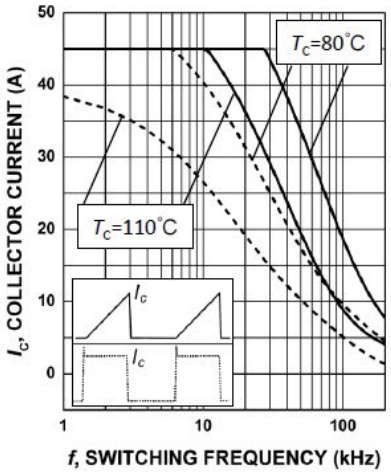


Figure 1. Collector current as a function of switching frequency
(T_j≤150°C, D = 0.5, V_{CE} = 600V, V_{GE} = 0/+15V, R_G = 15Ω)

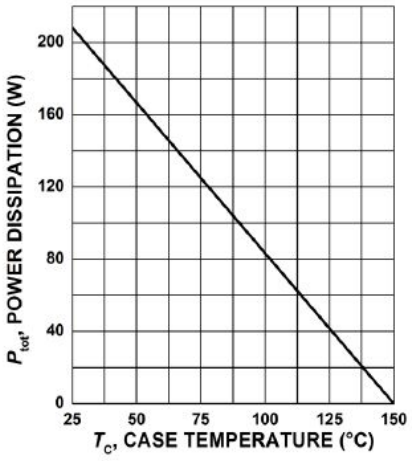


Figure 2. Maximum power dissipation as a function of case temperature
(T_j ≤ 150°C)

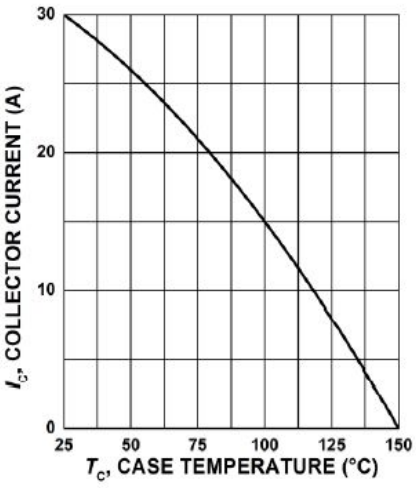


Figure 3. Maximum collector current as a function of case temperature
(V_{GE} ≥ 15V, T_j ≤ 150°C)

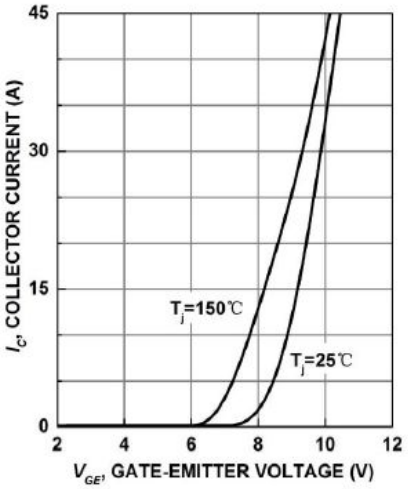


Figure 4. Typical transfer characteristic
(V_{CE}=15V)

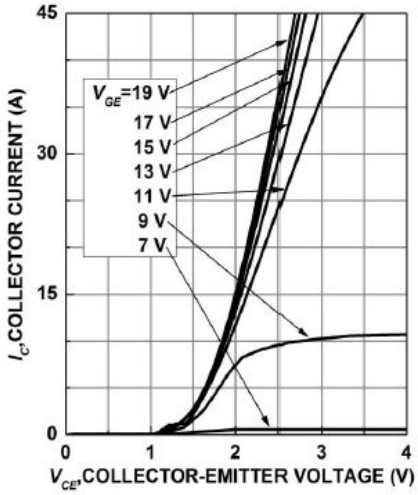


Figure 5. Typical output characteristic
(T_j = 25°C)

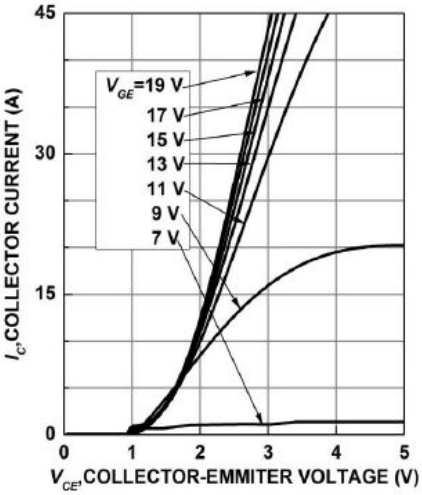


Figure 6. Typical output characteristic
(T_j = 150°C)

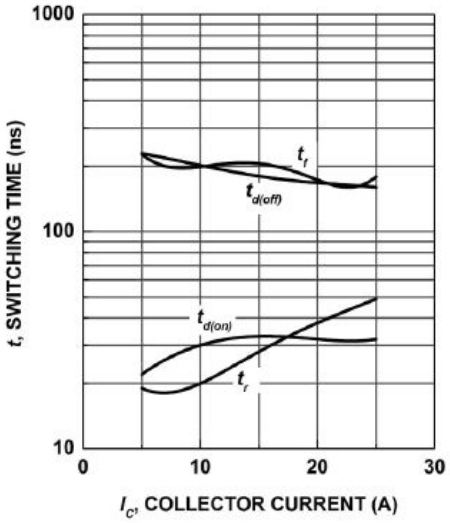


Figure 7. Typical switching times as a function of collector current
(inductive load, T_j=150°C, V_{CE}=600V, V_{GE}=0/15V, R_G=15Ω,
Dynamic test circuit in Figure D)

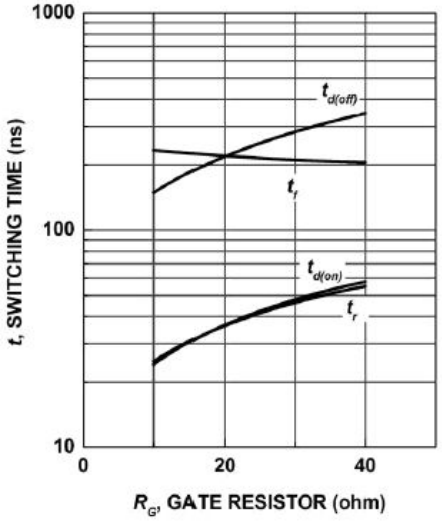


Figure 8. Typical switching times as a function of gate resistor
(inductive load, T_j=150°C, V_{CE}=600V, V_{GE}=0/15V, I_C=20A, Dynamic test circuit in Figure D)

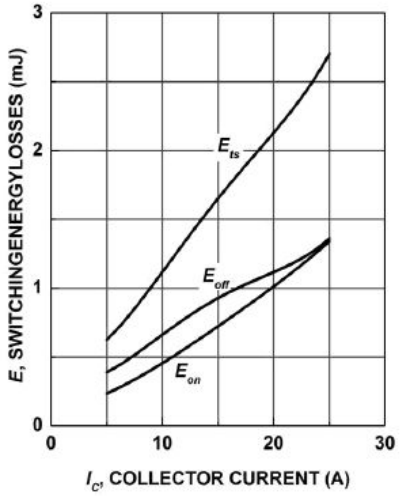


Figure 9. Typical switching energy losses as a function of collector current
(inductive load, T_j=150°C, V_{CE}=600V,
V_{GE}=0/15V, R_G=15Ω,
Dynamic test circuit in Figure D)

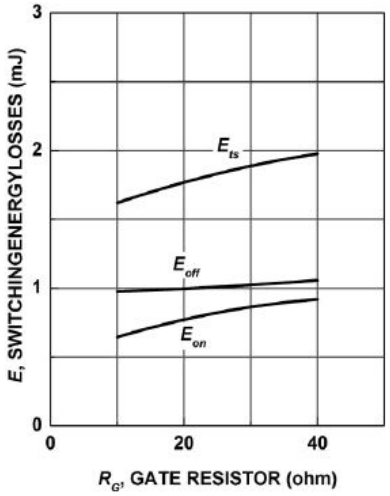


Figure 10. Typical switching energy losses as a function of gate resistor
(inductive load, T_j=150°C, V_{CE}=600V,
V_{GE}=0/15V, I_C=20A,
Dynamic test circuit in Figure D)

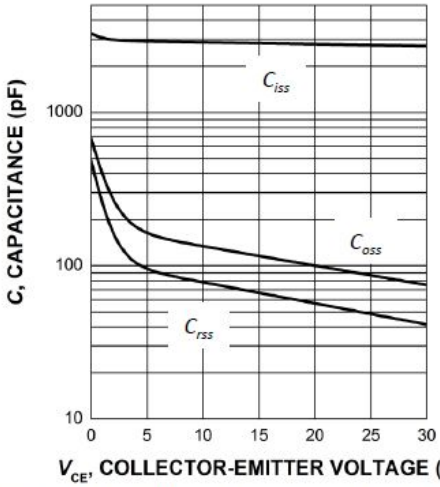


Figure 11. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f = 1 MHz)

Test circuits and waveforms

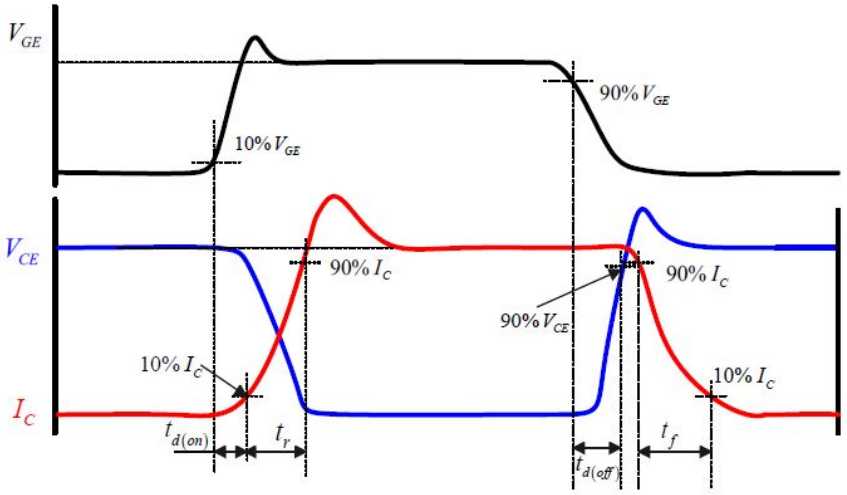


Figure A. Definition of switching times

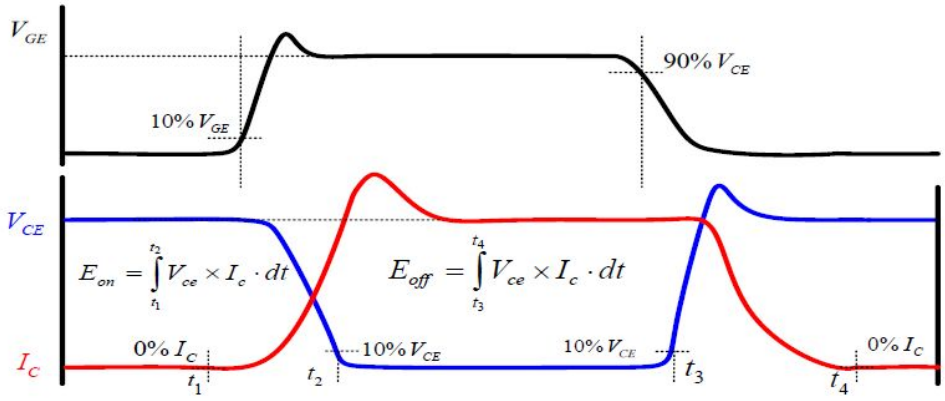


Figure B. Definition of switching losses

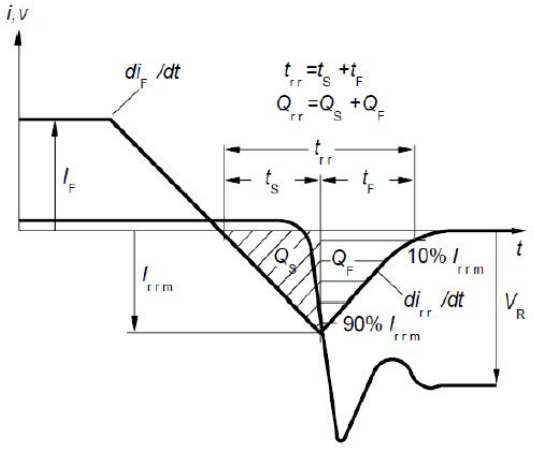


Figure C. Definition of diodes switching characteristics

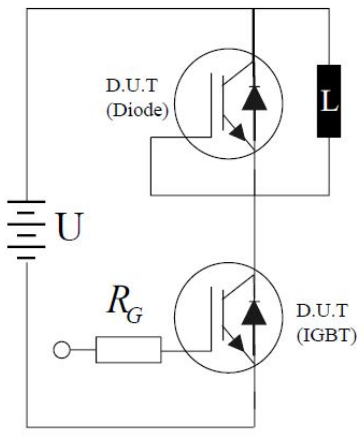


Figure D. Dynamic test circuit

Mechanical Dimensions