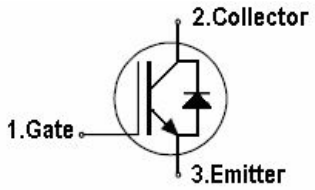
TSG40N120

IGBT trench process

DRAWING

G C E



Features

- 1200V,40A
- VCE(sat)(typ.)=2.24V@VGE=15V，IC=40A
- 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 ℃)	60	A
		(TC=100℃)	40	
I_{CM}	Pulsed Collector Current (Note 1)		120	A
IF	Diode Continuous Forward Current	(TC=25 ℃)	30	A
		(TC=100℃)	30	
IFM	Diode Maximum Forward Current (Note 1)		80	A
tsc	Short Circuit Withstand Time VGE=15V, VCC=600V，Tj=25 ℃		3	μs
P_D	Maximum Power Dissipation	(TC=25 ℃)	297	W
		(TC=100℃)	119	
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 ℃			0.4	mA
			Tj=150 ℃			4.0	
I_{GES}	Gate Leakage Current, Forward	V_{GE}=20V, V_{CE}= 0V				200	nA
	Gate Leakage Current, Reverse	V_{GE}= -20V, V_{CE}= 0V				-200	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{GE}= V_{CE}, I_C= 250uA		5.0	6.0	7.0	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C= 40A	Tj=25 ℃		2.24	2.4	V
			Tj=150 ℃		2.5		
V_F	Diode Forward Voltage	V_{GE}= 0V, I_F=40A	Tj=25 ℃		3.0		V
			Tj=150 ℃		3.3		
g_{FS}	transconductance	V_{CE}= 20V, I_C= 40A			18.5		S
Dynamic characteristics							
Ciss	Input Capacitance	V_{CE}=25V V_{GE}=0V f = 1MHz			8450		pF
Coss	Output Capacitance				160		
Crss	Reverse Transfer Capacitance				120		
Q_G	Gate Charge	Vcc=750V, I_C=40A, V_{GE}=15V					nc
IGBT switching characteristic(Inductive Load)							
t d(on)	Turn-on Delay Time	V_{CC}=600V I_C=40A V_{GE}=15V/0V R_G=12Ω L_{Load}=500μH TC=25 ℃			45		ns
t r	Turn-on Rise Time				50		
t d(off)	Turn-off Delay Time				165		
t f	Turn-off Fall Time				98		
Eon	Turn-on Switching Loss				1.33		mJ
Eoff	Turn-off Switching Loss				0.82		
Ets	Total Switching Loss				2.15		
t d(on)	Turn-on Delay Time	V_{CC}=600V I_C=40A V_{GE}=15V R_G=12Ω L_{Load}=500μH TC=150 ℃			35		ns
t r	Turn-on Rise Time				52		
t d(off)	Turn-off Delay Time				200		
t f	Turn-off Fall Time				225		
Eon	Turn-on Switching Loss				1.35		mJ
Eoff	Turn-off Switching Loss				1.60		
Ets	Total Switching Loss				2.95		

Typical Characteristics

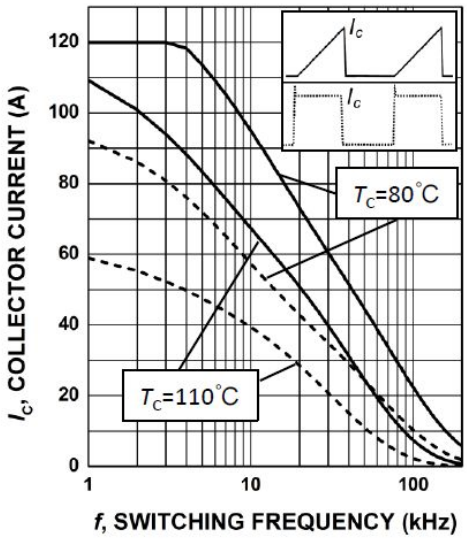


Figure 1. Collector current as a function of switching frequency
(T_j≤150°C, D = 0.5, V_{CE} = 600V, V_{GE} = 0/+15V, R_G = 12Ω)

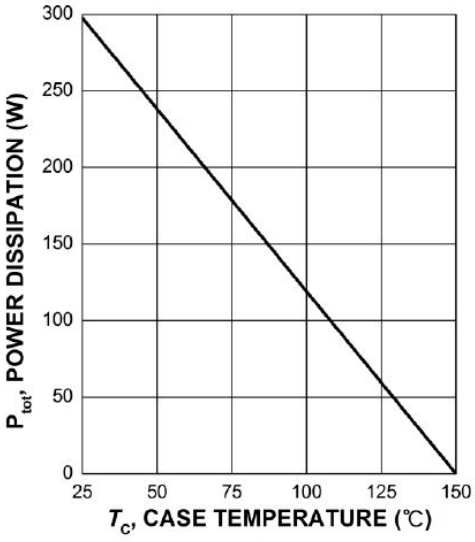


Figure 2. Maximum power dissipation as a function of case temperature
(T_j ≤ 150°C)

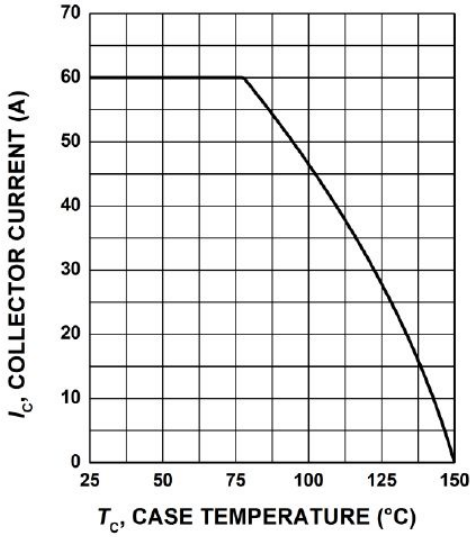


Figure 3. Maximum collector current as a function of case temperature
(V_{GE} ≥ 15V, T_j ≤ 150°C)

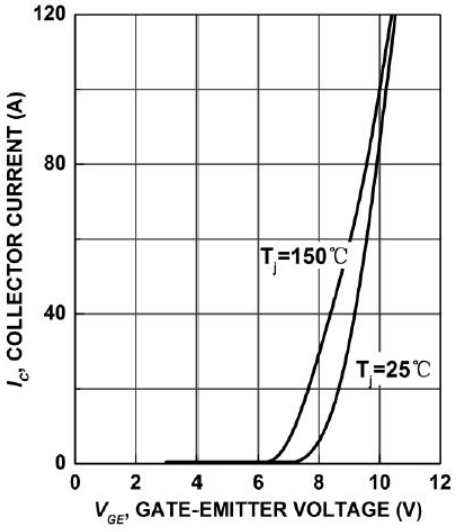


Figure 4. Typical transfer characteristic
(V_{CE}=15V)

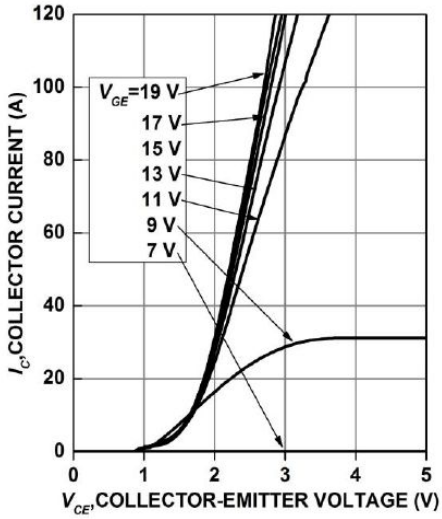


Figure 5. Typical output characteristic
(T_j = 25°C)

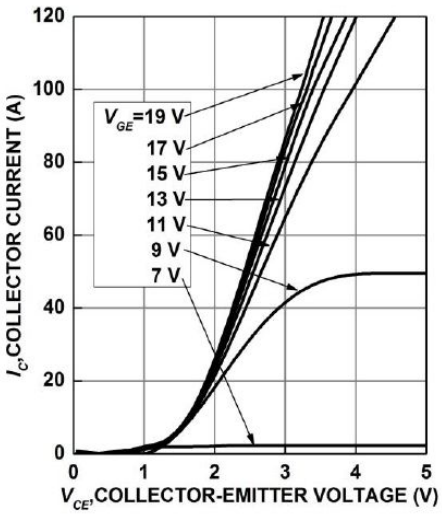


Figure 6. Typical output characteristic
(T_j = 150°C)

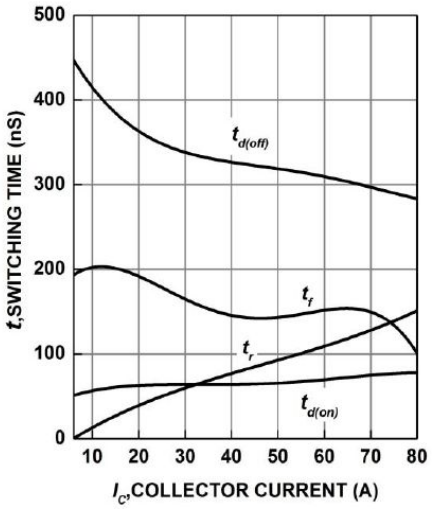


Figure 7. Typical switching times as a function of collector current
(inductive load, T_j=150°C, V_{CE}=600V, V_{GE}=0/15V, R_G=12Ω,
Dynamic test circuit in Figure D)

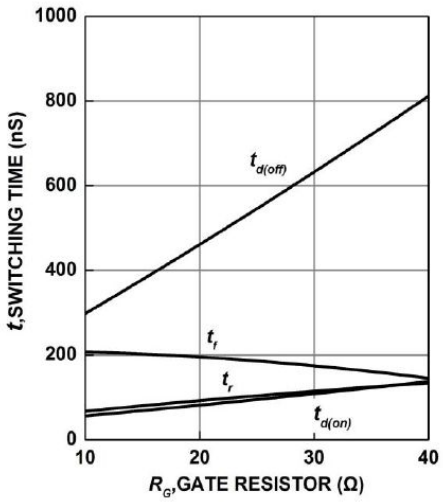


Figure 8. Typical switching times as a function of gate resistor
(inductive load, T_j=150°C, V_{CE}=600V, V_{GE}=0/15V, I_C=40A, Dynamic test circuit in Figure D)

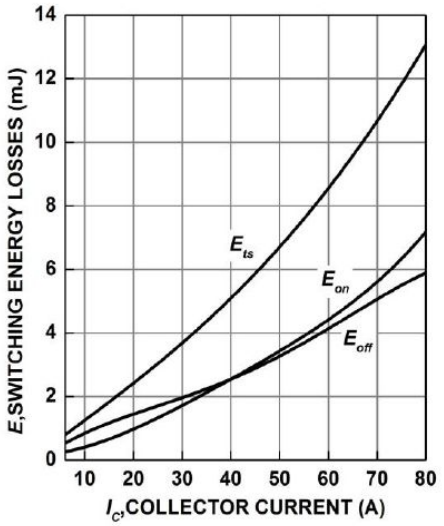


Figure 9. Typical switching energy losses as a function of collector current
(inductive load, T_j=150°C, V_{CE}=600V,
V_{GE}=0/15V, R_G=12Ω,
Dynamic test circuit in Figure D)

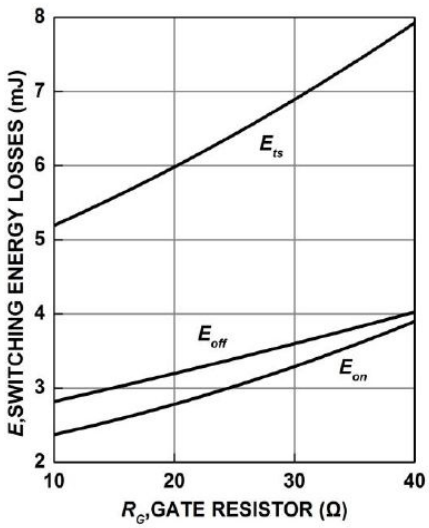


Figure 10. Typical switching energy losses as a function of gate resistor
(inductive load, T_j=150°C, V_{CE}=600V,
V_{GE}=0/15V, I_C=40A,
Dynamic test circuit in Figure D)

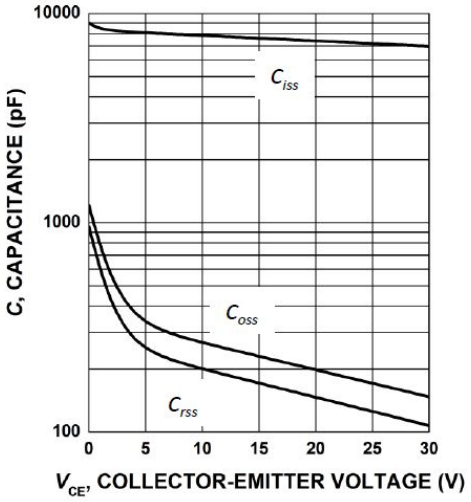


Figure 11. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f = 1 MHz)

Test circuits and waveforms

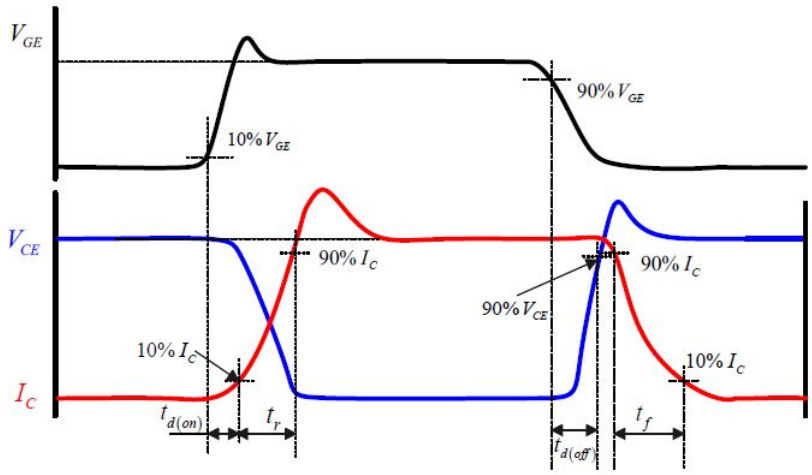


Figure A. Definition of switching times

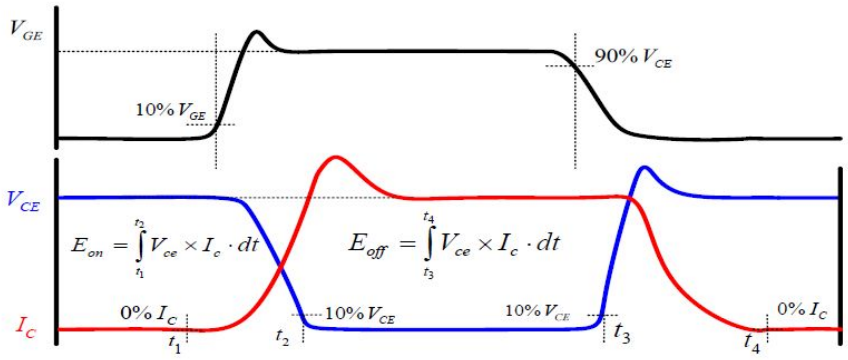


Figure B. Definition of switching losses

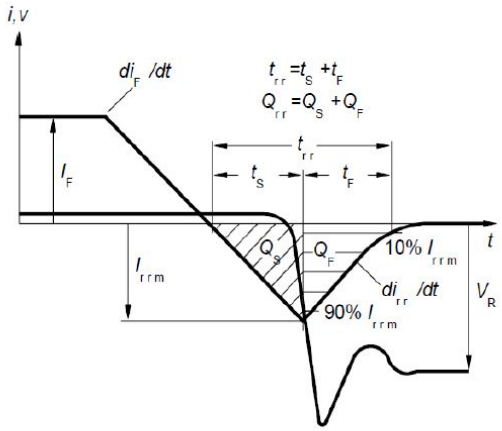


Figure C. Definition of diodes switching characteristics

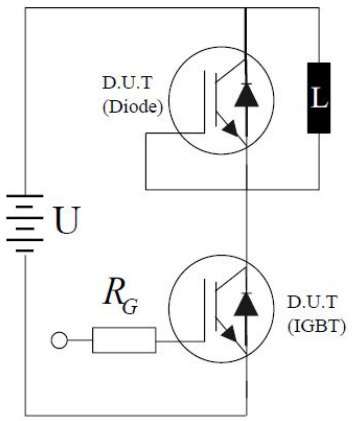


Figure D. Dynamic test circuit

Mechanical Dimensions