

**TSG15N120**

**IGBT trench process**

DRAWING

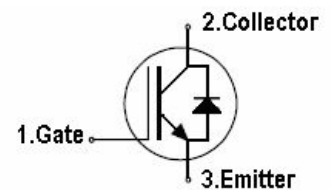
**Features**

- ◆ 1200V,15A
- ◆  $V_{CE(sat)}(typ.)=2.4V@V_{GE}=15V, I_C=15A$
- ◆ 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	$\pm 20$	V
$I_C$	Continuous Collector Current (TC=25 °C)	30	A
	Continuous Collector Current (TC=100 °C)	15	A
$I_{CM}$	Pulsed Collector Current (Note 1)	45	A
$I_F$	Diode Continuous Forward Current (TC=25 °C)	30	A
	Diode Continuous Forward Current (TC=100 °C)	15	A
$I_{FM}$	Diode Maximum Forward Current (Note 1)	45	A
$t_{sc}$	Short Circuit Withstand Time	10	us
$P_D$	Maximum Power Dissipation (TC=25 °C)	208	W
	Maximum Power Dissipation (TC=100 °C)	83	W
$T_J$	Operating Junction Temperature Range	-55 to +150	°C
$T_{STG}$	Storage Temperature Range	-55 to +150	°C

**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°C unless otherwise noted )**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units	
<b>Static characteristics</b>							
BV <sub>CES</sub>	Collector-Emitter Breakdown Voltage	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250uA	1200			V	
I <sub>CES</sub>	Collector-Emitter Leakage Current	V <sub>CE</sub> = 1200V, V <sub>GE</sub> = 0V			0.1	mA	
					2.0		
I <sub>GES</sub>	Gate Leakage Current, Forward	V <sub>GE</sub> =20V, V <sub>CE</sub> = 0V			100	nA	
	Gate Leakage Current, Reverse	V <sub>GE</sub> = -20V, V <sub>CE</sub> = 0V			-100	nA	
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 250uA	5.0	5.8	6.5	V	
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> =15V, I <sub>C</sub> = 15A	T <sub>j</sub> =25 °C	2.4	2.7	V	
			T <sub>j</sub> =150 °C	2.85			
V <sub>F</sub>	Diode Forward Voltage	V <sub>GE</sub> = 0V, I <sub>F</sub> =15A	T <sub>j</sub> =25 °C	1.2		V	
			T <sub>j</sub> =150 °C	1.15			
g <sub>FS</sub>	transconductance	V <sub>CE</sub> = 20V, I <sub>C</sub> = 15A		4.5		S	
<b>Dynamic characteristics</b>							
C <sub>iss</sub>	Input Capacitance	V <sub>CE</sub> =25V		1678		pF	
C <sub>oss</sub>	Output Capacitance	V <sub>GE</sub> =0V		57			
C <sub>rss</sub>	Reverse Transfer Capacitance	f = 1MHz		27			
Q <sub>G</sub>	Gate Charge	V <sub>CC</sub> =900V, I <sub>C</sub> =15A, V <sub>GE</sub> =15V		64		nc	
<b>IGBT switching characteristic(Inductive Load)</b>							
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>CC</sub> =600V I <sub>C</sub> =15A V <sub>GE</sub> =15V/0V R <sub>G</sub> =15 Ω L <sub>Load</sub> =500 μ H TC=25 °C		23		ns	
t <sub>r</sub>	Turn-on Rise Time			41			
t <sub>d(off)</sub>	Turn-off Delay Time			95			
t <sub>f</sub>	Turn-off Fall Time			103			
E <sub>on</sub>	Turn-on Switching Loss	L <sub>Load</sub> =500 μ H TC=25 °C		0.75		mJ	
E <sub>off</sub>	Turn-off Switching Loss			0.38			
E <sub>ts</sub>	Total Switching Loss			1.12			
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>CC</sub> =600V V <sub>GE</sub> =15V/0V I <sub>C</sub> =15A R <sub>G</sub> =15 Ω L <sub>Load</sub> =500 μ H TC=150 °C		18		ns	
t <sub>r</sub>	Turn-on Rise Time			25			
t <sub>d(off)</sub>	Turn-off Delay Time			123			
t <sub>f</sub>	Turn-off Fall Time			238			
E <sub>on</sub>	Turn-on Switching Loss		L <sub>Load</sub> =500 μ H TC=150 °C		0.73		mJ
E <sub>off</sub>	Turn-off Switching Loss				0.77		
E <sub>ts</sub>	Total Switching Loss				1.50		

Typical Characteristics

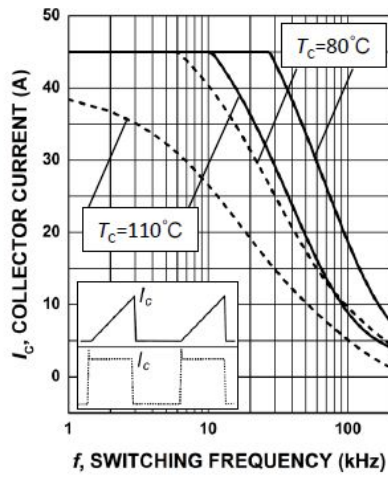


Figure 1. Collector current as a function of switching frequency  
 ( $T_j \leq 150^\circ\text{C}$ ,  $D = 0.5$ ,  $V_{CE} = 600\text{V}$ ,  
 $V_{GE} = 0/+15\text{V}$ ,  $R_G = 15\Omega$ )

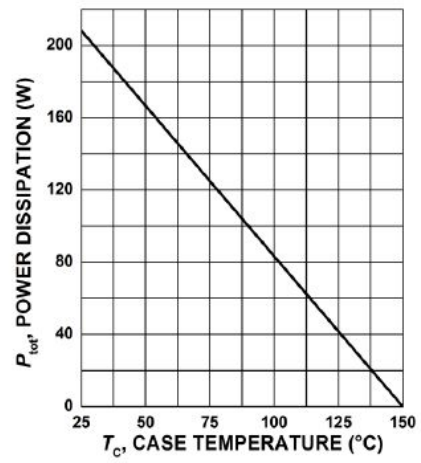


Figure 2. Maximum power dissipation as a function of case temperature  
 ( $T_j \leq 150^\circ\text{C}$ )

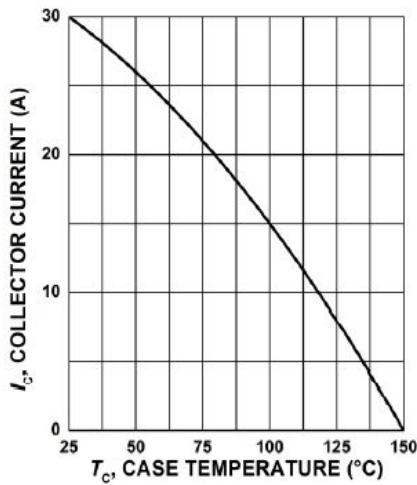


Figure 3. Maximum collector current as a function of case temperature  
 ( $V_{GE} \geq 15\text{V}$ ,  $T_j \leq 150^\circ\text{C}$ )

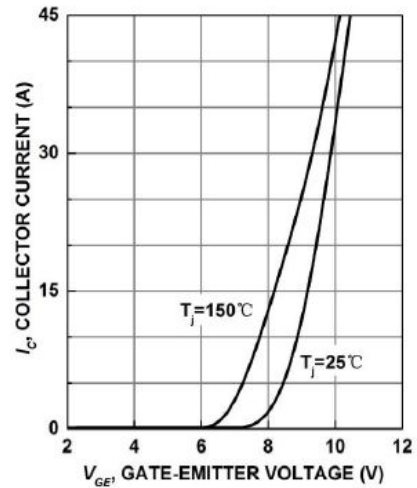


Figure 4. Typical transfer characteristic  
 ( $V_{CE} = 15\text{V}$ )

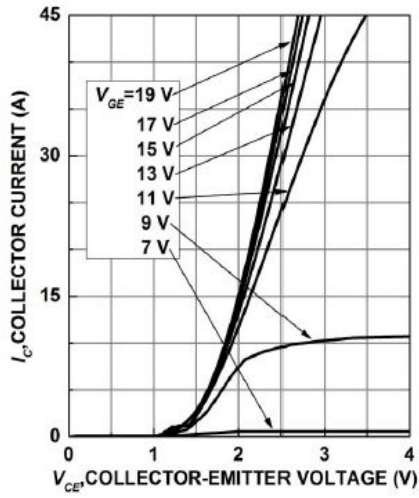


Figure 5. Typical output characteristic ( $T_j = 25^\circ\text{C}$ )

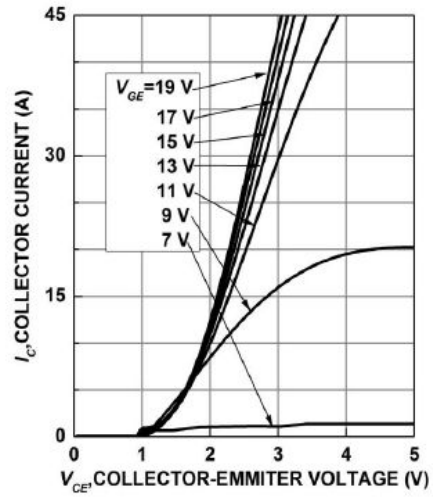


Figure 6. Typical output characteristic ( $T_j = 150^\circ\text{C}$ )

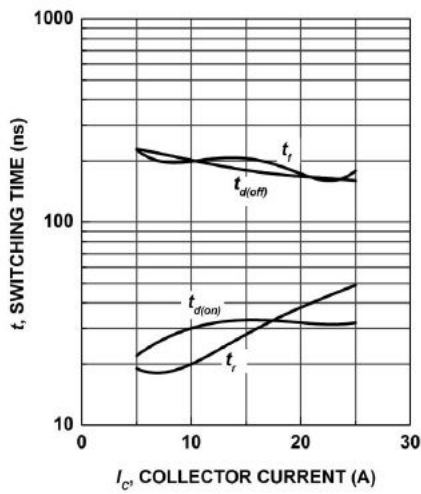


Figure 7. Typical switching times as a function of collector current (inductive load,  $T_j = 150^\circ\text{C}$ ,  $V_{CE} = 600\text{V}$ ,  $V_{GE} = 0/15\text{V}$ ,  $R_G = 15\Omega$ , Dynamic test circuit in Figure D)

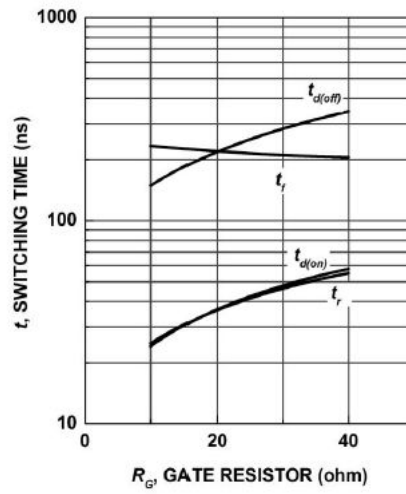


Figure 8. Typical switching times as a function of gate resistor (inductive load,  $T_j = 150^\circ\text{C}$ ,  $V_{CE} = 600\text{V}$ ,  $V_{GE} = 0/15\text{V}$ ,  $I_C = 15\text{A}$ , Dynamic test circuit in Figure D)

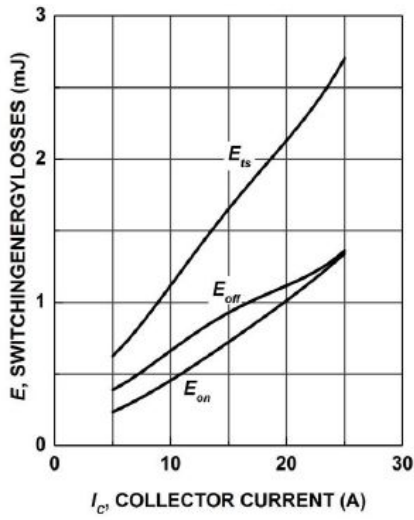


Figure 9. Typical switching energy losses as a function of collector current (inductive load,  $T_j=150^{\circ}\text{C}$ ,  $V_{\text{CE}}=600\text{V}$ ,  $V_{\text{GE}}=0/15\text{V}$ ,  $R_{\text{G}}=15\Omega$ , Dynamic test circuit in Figure D)

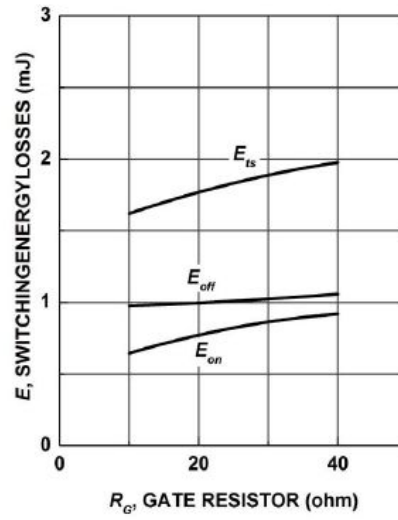


Figure 10. Typical switching energy losses as a function of gate resistor (inductive load,  $T_j=150^{\circ}\text{C}$ ,  $V_{\text{CE}}=600\text{V}$ ,  $V_{\text{GE}}=0/15\text{V}$ ,  $I_{\text{C}}=15\text{A}$ , Dynamic test circuit in Figure D)

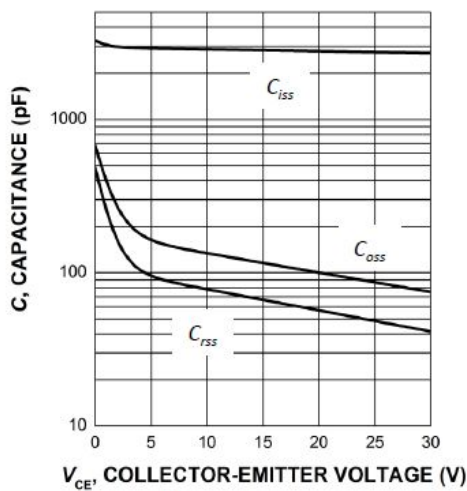


Figure 11. Typical capacitance as a function of collector-emitter voltage ( $V_{\text{GE}}=0\text{V}$ ,  $f = 1\text{ MHz}$ )

Test circuits and waveforms

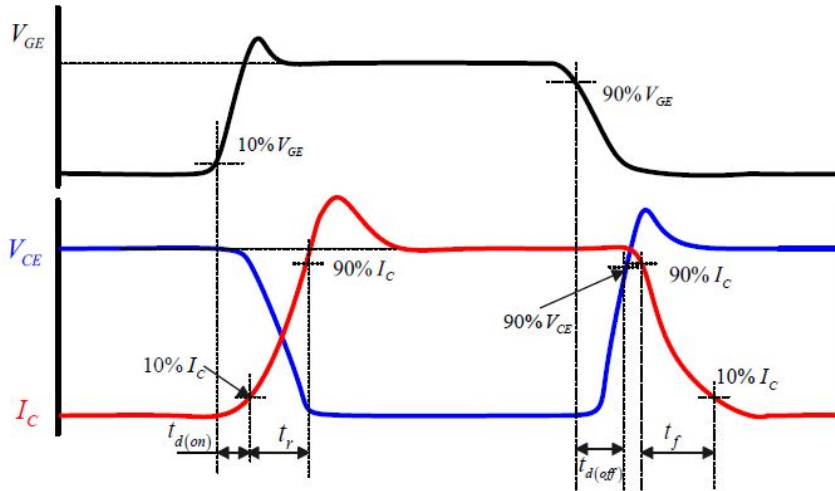


Figure A. Definition of switching times

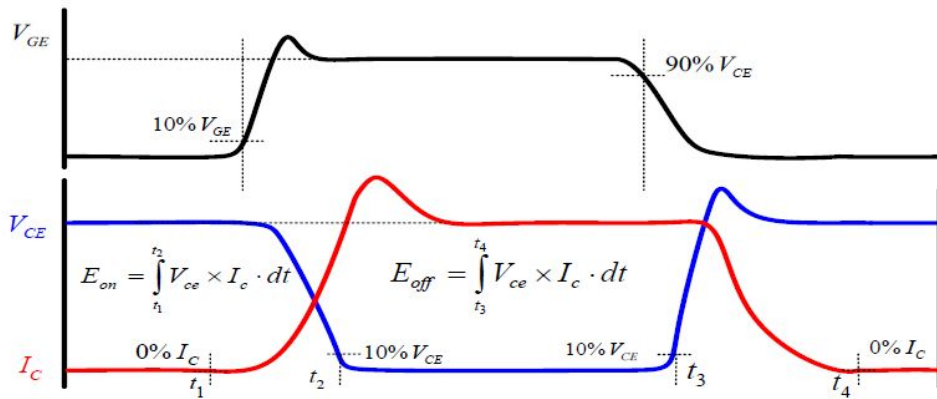


Figure B. Definition of switching losses

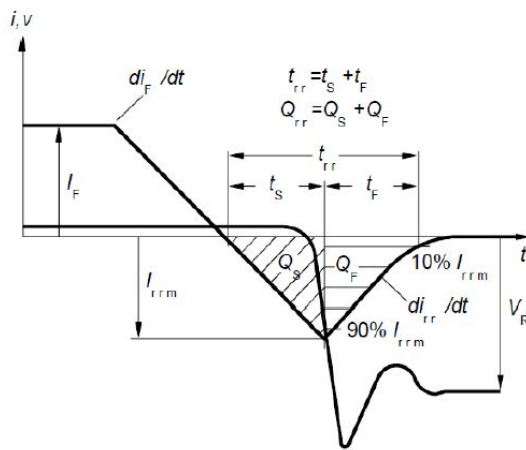


Figure C. Definition of diodes switching characteristics

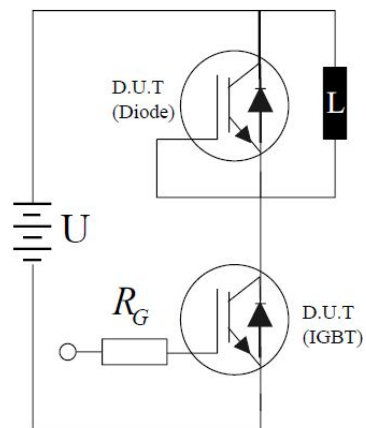


Figure D. Dynamic test circuit

Mechanical Dimensions

