

TSG15N60

IGBT trench process

Features

- ◆ 600V,15A
- ◆ $V_{CE(sat)}(typ.)=1.65V@V_{GE}=15V, I_C=15A$
- ◆ High speed switching
- ◆ Higher system efficiency
- ◆ built-in FRD

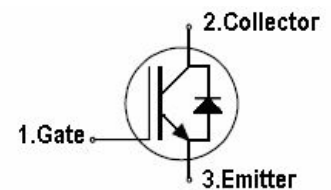
General Description

- ◆ Package: ITO-220AB DG
- ◆ 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.

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Absolute Maximum Ratings

Symbol	Parameter		Spec	Units
V_{CES}	Collector-Emitter Voltage		600	V
V_{GES}	Gate-Emitter Voltage		± 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	
I_{FM}	Diode Maximum Forward Current (Note 1)		45	A
t_{sc}	Short Circuit Withstand Time		5	us
P_D	Maximum Power Dissipation	(TC=25 °C)	130	W
	Maximum Power Dissipation	(TC=100°C)	65	
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
$R_{th\ j-c}$	Thermal Resistance, Junction to case for IGBT	1.15	K/W
$R_{th\ j-c}$	Thermal Resistance, Junction to case for Diode	1.9	
$R_{th\ j-a}$	Thermal Resistance, Junction to Ambient	62	

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	600			V
I _{CES}	Collector-Emitter Leakage Current	V _{CE} = 600V, V _{GE} = 0V			40	uA
		T _J =25 ℃				
		T _J =150 ℃			1000	
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	4.4	5.2	6.0	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} =15V, I _C = 15A		1.6	1.9	V
		T _J =25 ℃				
		T _J =150 ℃		1.93		
V _F	Diode Forward Voltage	V _{GE} = 0V, I _F =15A		2.1		V
		T _J =25 ℃				
		T _J =150 ℃		1.50		
g _{FS}	transconductance	V _{CE} = 20V, I _C = 15A		8.6		S
Dynamic characteristics						
C _{iss}	Input Capacitance	V _{CE} =25V		1020		pF
C _{oss}	Output Capacitance	V _{GE} =0V		74		
C _{rss}	Reverse Transfer Capacitance	f = 1MHz		35		
Q _G	Gate Charge	V _{CC} =480V, I _C =15A, V _{GE} =15V		76		nc
IGBT switching characteristic(Inductive Load)						
t _{d(on)}	Turn-on Delay Time	V _{CC} =400V I _C =15A V _{GE} =15V/0V R _G =15 Ω L _{Load} =500 μ H T _J =25 ℃		23		ns
t _r	Turn-on Rise Time			20		
t _{d(off)}	Turn-off Delay Time			139		
t _f	Turn-off Fall Time			42		
E _{on}	Turn-on Switching Loss			0.36		mJ
E _{off}	Turn-off Switching Loss	V _{CC} =400V V _{GE} =15V/0V I _C =15A R _G =15 Ω L _{Load} =500 μ H T _J =150 ℃		0.32		
E _{ts}	Total Switching Loss			0.68		
t _{d(on)}	Turn-on Delay Time			27		ns
t _r	Turn-on Rise Time			25		
t _{d(off)}	Turn-off Delay Time			155		
t _f	Turn-off Fall Time			108		
E _{on}	Turn-on Switching Loss			0.37		mJ
E _{off}	Turn-off Switching Loss			0.46		
E _{ts}	Total Switching Loss			0.83		

Electrical Characteristics of Diode

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
t_{rr}	Diode Reverse Recovery Time	$V_R = 400V$		45		ns
I_{rrm}	Diode peak Reverse Recovery Current	$I_F = 10A$		4		A
Q_{rr}	Diode Reverse Recovery Charge	$dI_F/dt = 200A/us$ $T_J = 25^\circ C$		73		nC
t_{rr}	Diode Reverse Recovery Time	$V_R = 400V$		92		ns
I_{rrm}	Diode peak Reverse Recovery Current	$I_F = 10A$		8		A
Q_{rr}	Diode Reverse Recovery Charge	$dI_F/dt = 200A/us$ $T_J = 150^\circ C$		371		nC

Typical Characteristics

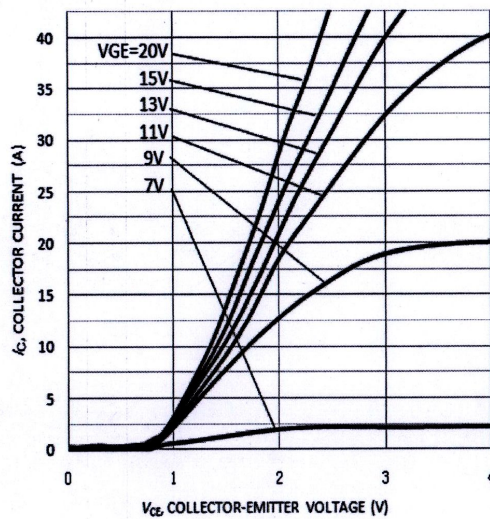


Figure 1. Typical output characteristic
($T_J = 25^\circ C$)

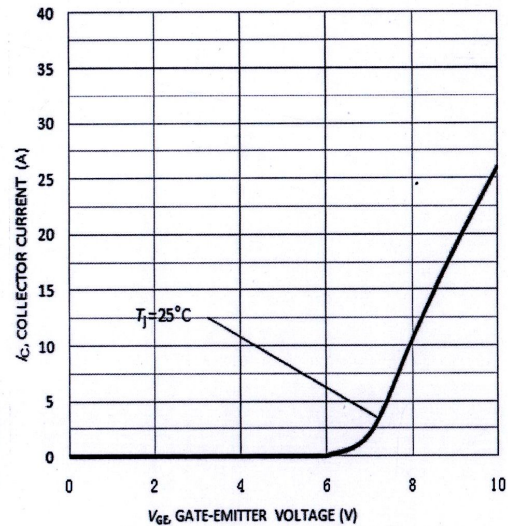


Figure 2. Typical transfer characteristic
($V_{CE} = 20V$)

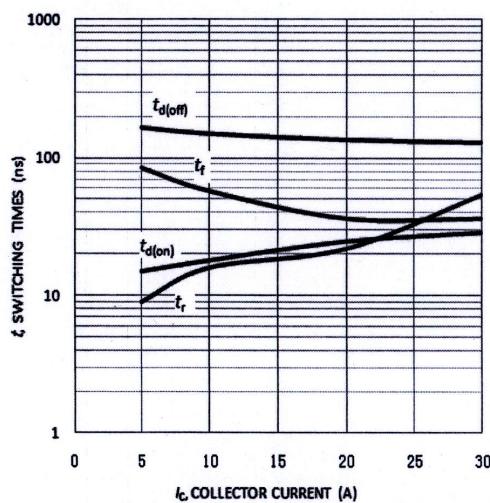


Figure 3. Typical switching times as a function of collector current
(inductive load, $T_J = 25^\circ C$, $V_{CE} = 400V$, $V_{GE} = 0/15V$, $R_G = 15\Omega$, Dynamic test circuit in Figure E)

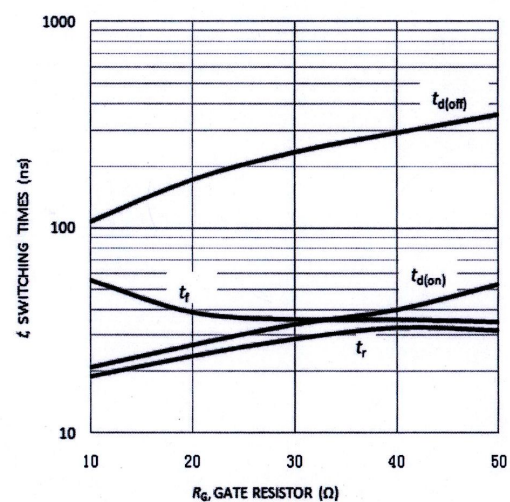


Figure 4. Typical switching times as a function of gate resistor
(inductive load, $T_J = 25^\circ C$, $V_{CE} = 400V$, $V_{GE} = 0/15V$, $I_C = 15A$, Dynamic test circuit in Figure E)

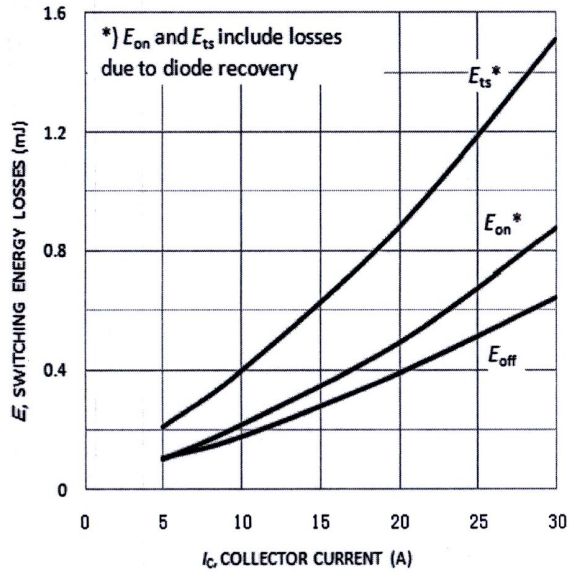


Figure 5. Typical switching energy losses as a function of collector current
(inductive load, $T_J=25^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=15\Omega$, Dynamic test circuit in Figure E)

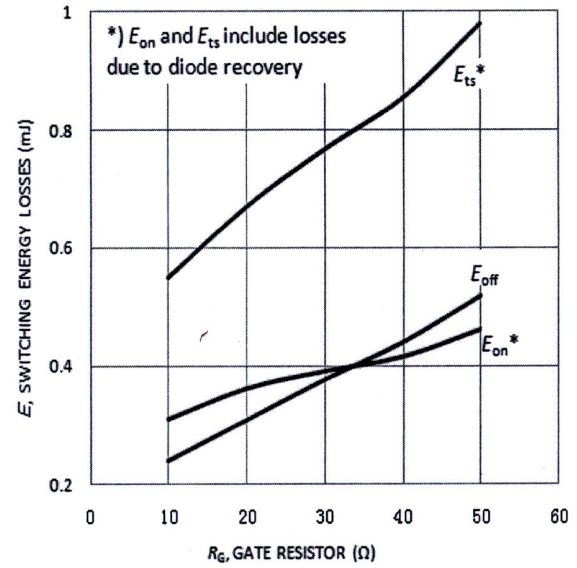


Figure 6. Typical switching energy losses as a function of gate resistor
(inductive load, $T_J=25^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=15\text{A}$, Dynamic test circuit in Figure E)

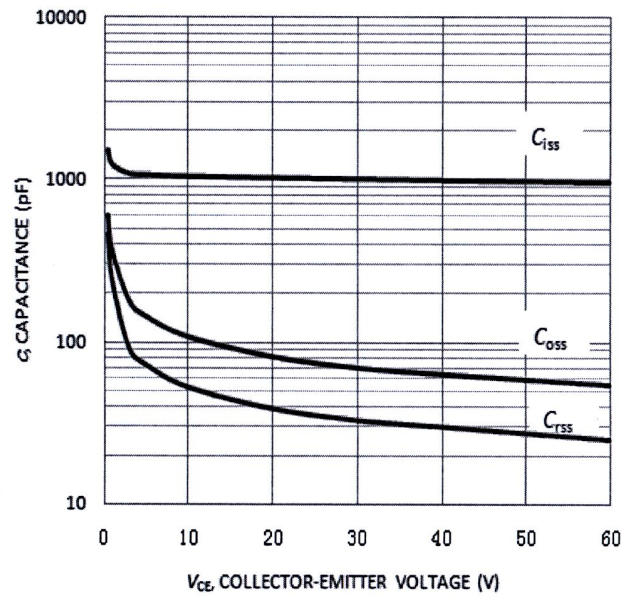


Figure 7. Typical capacitance as a function of collector-emitter voltage
($V_{GE}=0\text{V}$, $f=1\text{MHz}$)

Test circuits and waveforms

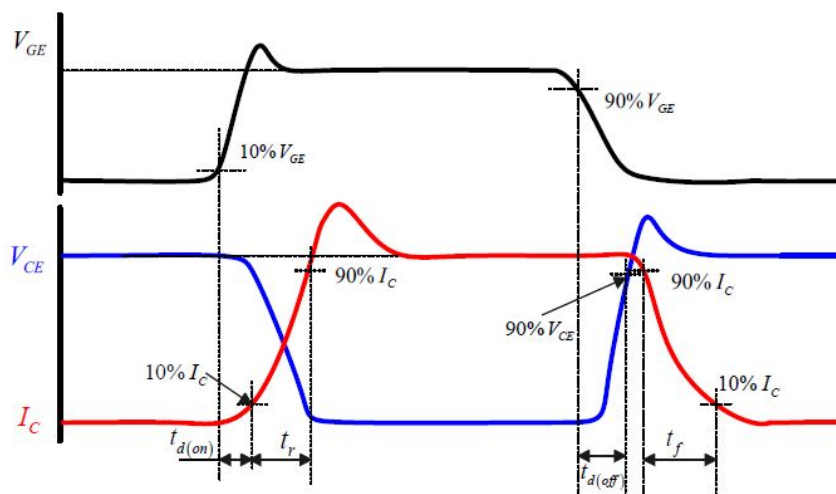


Figure A. Definition of switching times

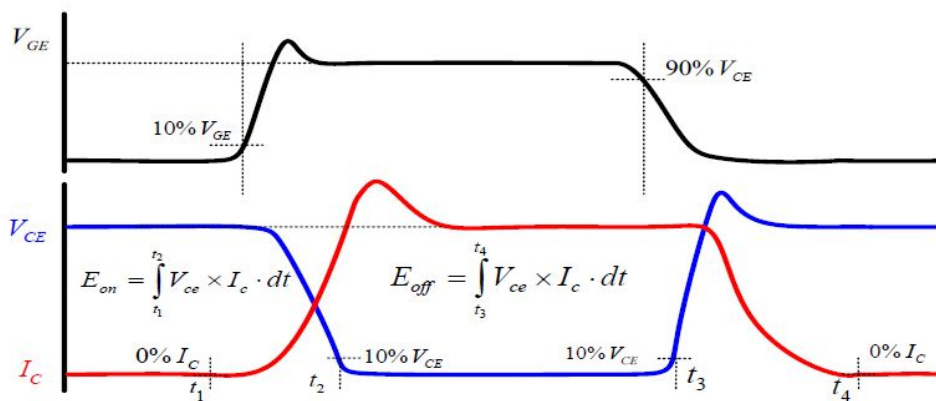


Figure B. Definition of switching losses

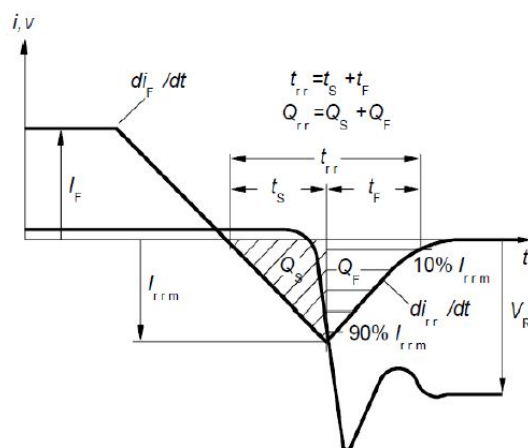


Figure C. Definition of diodes switching characteristics

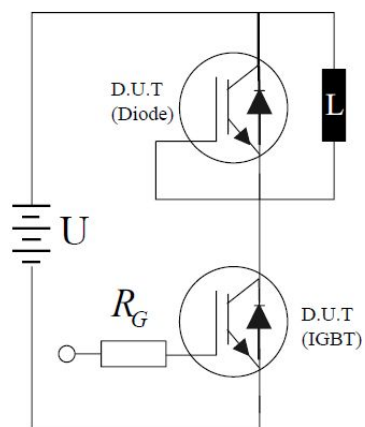


Figure D. Dynamic test circuit

Mechanical Dimensions

