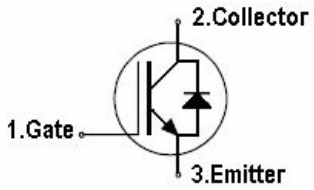
TSG40N60

600 V, 40 A Field Stop IGBT

DRAWING

G C E



Features

- High Current Capability
- Low Saturation Voltage: V_{CE}(sat) = 1.8 V @ IC = 40 A
- High Input Impedance
- Fast Switching
- RoHS Compliant

General Description

- Package:TO-247
- Using novel field stop IGBT technology, TS's field stop IGBTs offer the optimum performance for solar inverter, UPS, welder, microwave oven, telecom, ESS and PFC applications where low conduction and switching losses are essential.

Applications

Solar Inverter, UPS, Welder, PFC, Microwave Oven, Telecom, ESS

Absolute Maximum Ratings

Symbol	Parameter		Spec	Units
V_{CES}	Collector-Emitter Voltage		1200	V
V_{GES}	Gate-Emitter Voltage		±20	V
	Transient Gate-to-Emitter Voltage		±30	V
I_C	Collector Current	(T_C=25℃)	80	A
	Collector Current	(T_C=100℃)	40	A
I_{CM}	Pulsed Collector Current (Note 1)	(T_C=25℃)	120	A
P_D	Maximum Power Dissipation	(T_C=25℃)	290	W
	Maximum Power Dissipation	(T_C=100℃)	116	W
T_J	Operating Junction Temperature		-55 to +150	℃
T_{STG}	Storage Temperature Range		-55 to +150	℃
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds		300	℃

Note1： Repetitive rating: Pulse width limited by max. junction temperature

Thermal Characteristics

Symbol	Parameter	Spec	Units
R_{θ}j-c	Thermal Resistance, Junction to case for IGBT	0.43	℃/W
R_{θ}j-c	Thermal Resistance, Junction to case for Diode	1.45	
R_{θ}j-a	Thermal Resistance, Junction to Ambient	40	

Electrical Characteristics (T_C=25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
Off Characteristics							
BV_{CES}	Collector-Emitter Breakdown Voltage	V_{GE}= 0V, I_C= 250uA		600			V
BV_{DSS}/T_J	Temperature Coefficient of Breakdown Voltage	I_D=250uA,Referenced to 25℃		_	0.6	_	V/℃
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES}, V_{GE}= 0V				250	uA
I_{GES}	G-E Leakage Current	V_{GE}=V_{GES}, V_{CE}= 0V				±400	nA
On Characteristics							
VGE(th)	G-E Threshold Voltage	I_C= 250uA, V_{CE}=V_{GE}		4.5	5.8	6.5	V
VCE(sat)	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C= 40A	Tj=25℃		1.8	2.4	V
			Tj=150℃		2.0		
Dynamic characteristics							
Cies	Input Capacitance	V_{CE}=30V			2110		pF
Coes	Output Capacitance	V_{GE}=0V			200		
Cres	Reverse Transfer Capacitance	f = 1MHz			60		
IGBT switching characteristic(Inductive Load)							
t d(on)	Turn-on Delay Time	V_{CC}=400V I_C=40A V_{GE}=15V R_G=10 Ω Inductive Load T_C=25℃			24		ns
t r	Turn-on Rise Time				44		
t d(off)	Turn-off Delay Time				112		
t f	Turn-off Fall Time				30	60	
Eon	Turn-on Switching Loss				1.19		mJ
Eoff	Turn-off Switching Loss				0.46		
Ets	Total Switching Loss				1.65		
t d(on)	Turn-on Delay Time	V_{CC}=400V V_{GE}=15V I_C=40A R_G=10 Ω Inductive Load T_C=125℃			24		ns
t r	Turn-on Rise Time				45		
t d(off)	Turn-off Delay Time				120		
t f	Turn-off Fall Time				40		
Eon	Turn-on Switching Loss				1.2		mJ
Eoff	Turn-off Switching Loss				0.69		
Ets	Total Switching Loss				1.89		
Qg	Total Gate Charge	V_{CE}=400V V_{GE}=15V I_C=40A			120		nC
Qge	Gate to Emitter Charge				14		nC
Qgc	Gate to Collector Charge				58		nC

Electrical Characteristics of the Diode T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Unit
V_{FM}	Diode Forward Voltage	I_F = 20 A	T_C=25℃		1.95	2.6	V
			T_C=125℃		1.85		
t_{rr}	Diode Reverse Recovery Time	I_F =20 A, diF/dt = 200 A/us	T_C=25℃		45		ns
			T_C=125℃		140		
Q_{rr}	Diode Reverse Recovery Charge		T_C=25℃		75		nC
			T_C=125℃		375		

Typical Characteristics

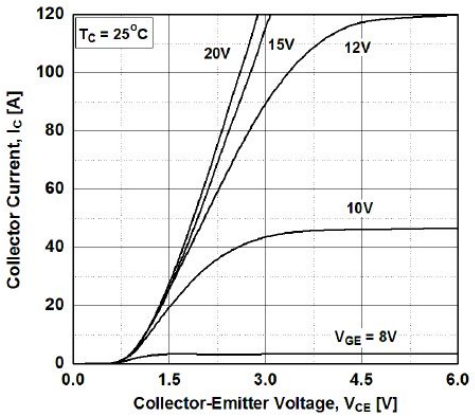


Figure 1. Typical Output Characteristics

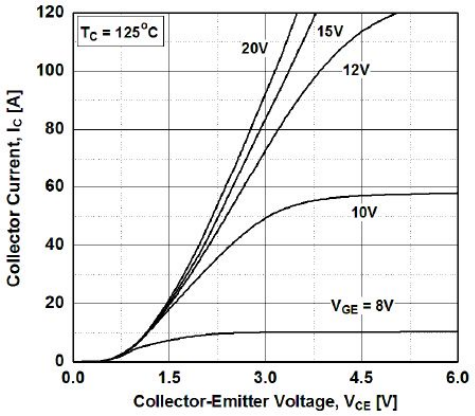


Figure 2. Typical Output Characteristics

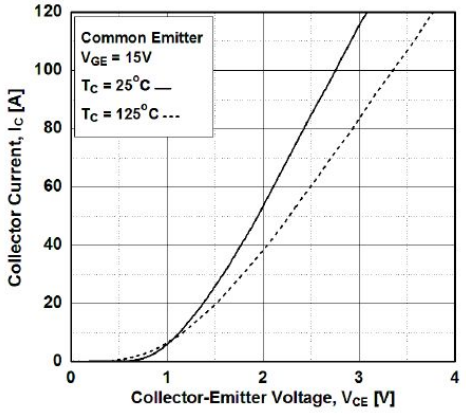


Figure 3. Typical Saturation Voltage Characteristics

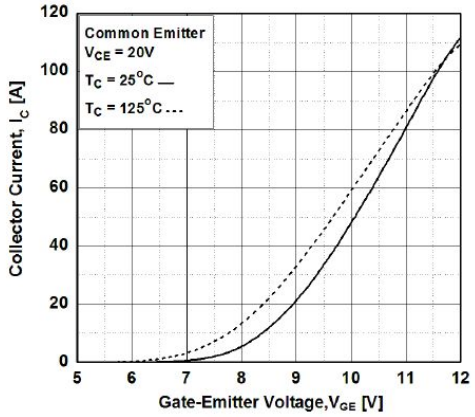


Figure 4. Transfer Characteristics

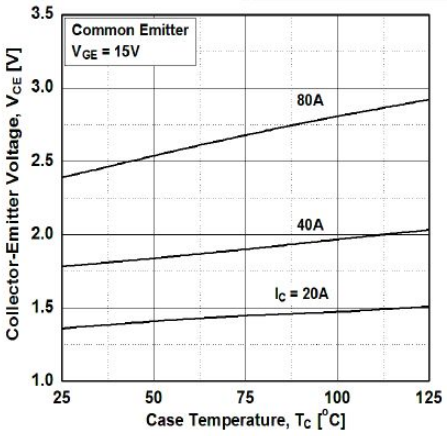


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

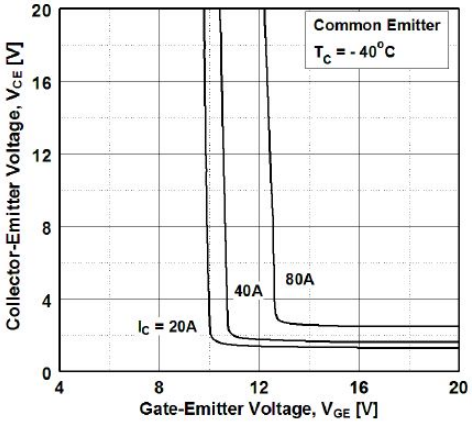


Figure6. Saturation Voltage vs. VGE

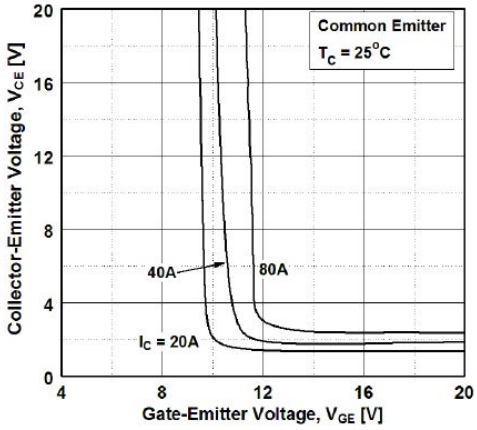


Figure 7. Saturation Voltage vs. VGE

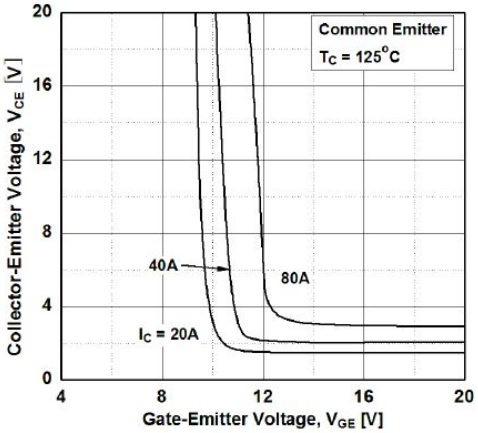


Figure 8. Saturation Voltage vs. VGE

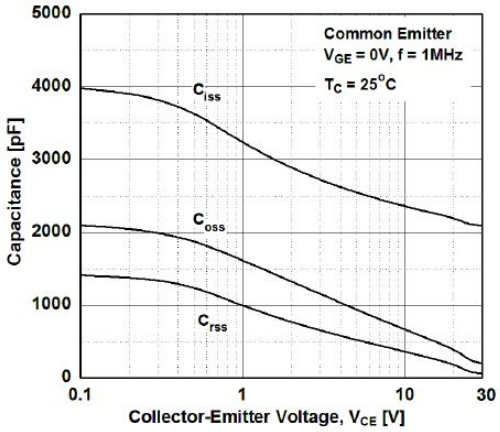


Figure 9. Capacitance Characteristics

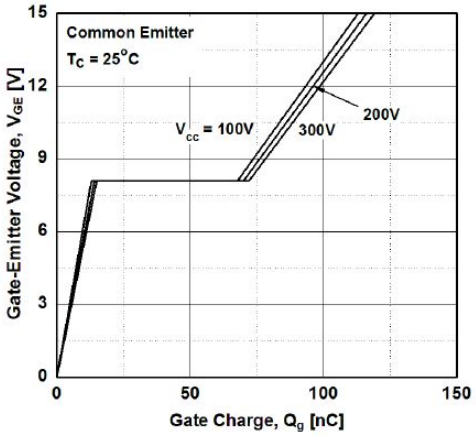


Figure10. Gate charge Characteristics

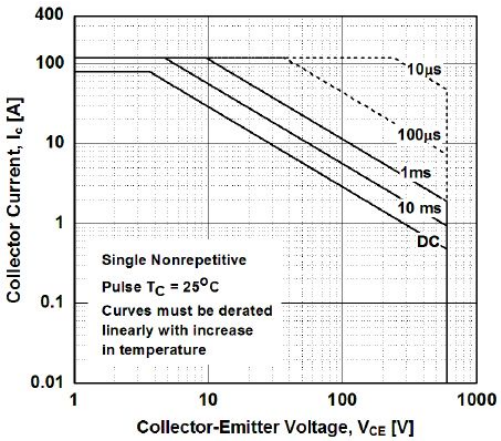


Figure 11. SOA Characteristics

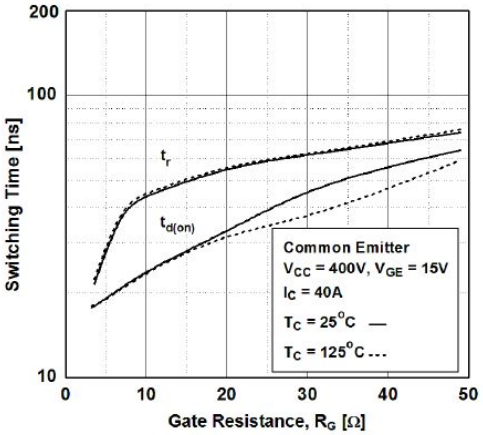


Figure12. Turn-on Characteristics vs. Gate Resistance

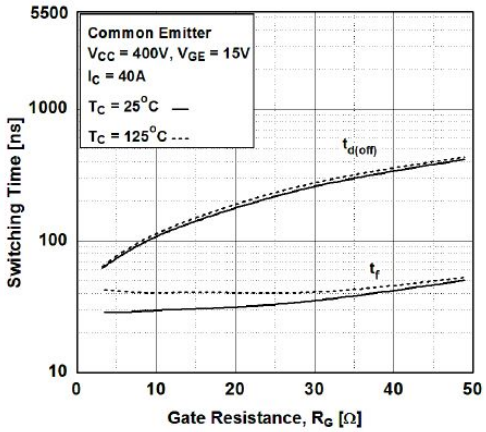


Figure 13. Turn-off Characteristics vs. Gate Resistance

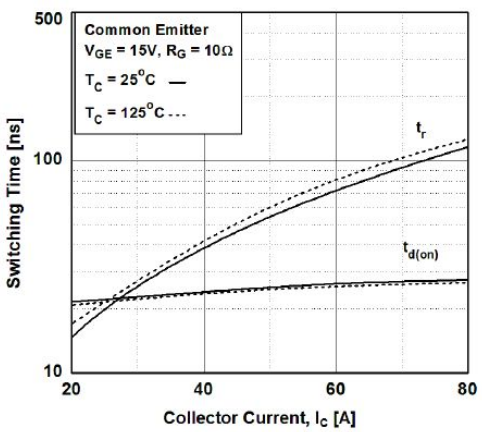


Figure14. Turn-on Characteristics vs. Collector Current

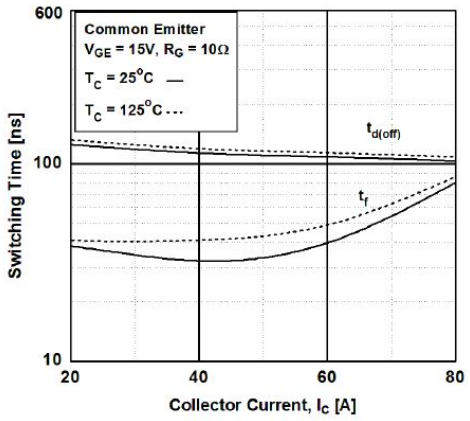


Figure 15. Turn-off Characteristics vs. Collector Current

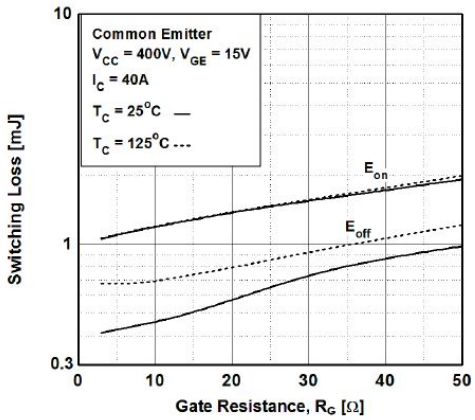


Figure16. Switching Loss vs. Gate Resistance

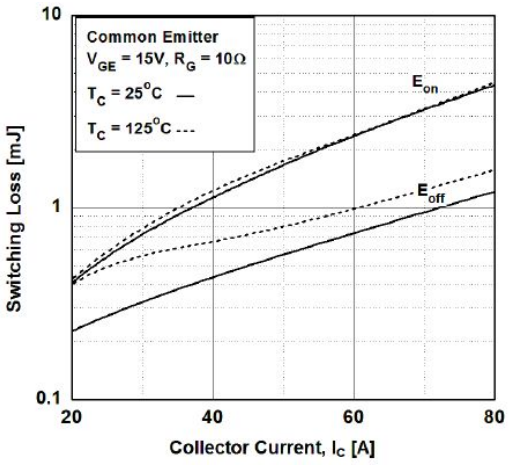


Figure 17. Switching Loss vs. Collector Current

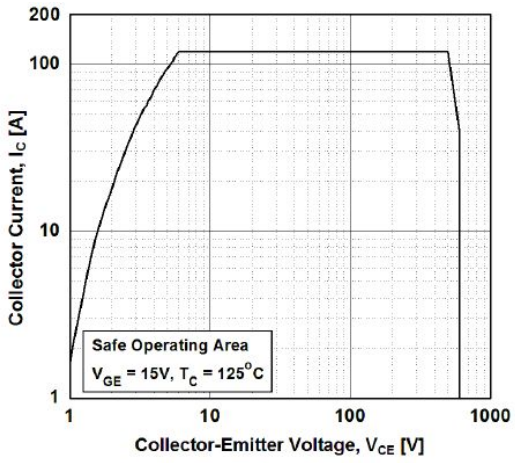


Figure 18. Turn off Switching SOA Characteristics

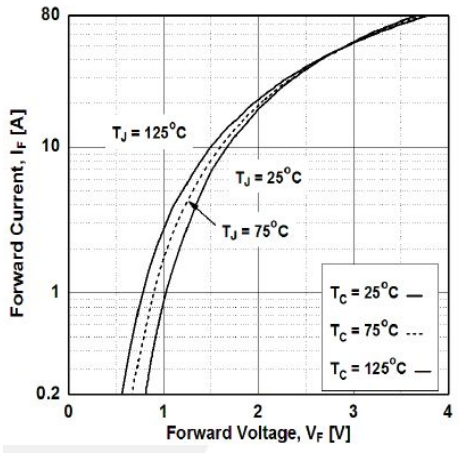


Figure 19. Forward Characteristics

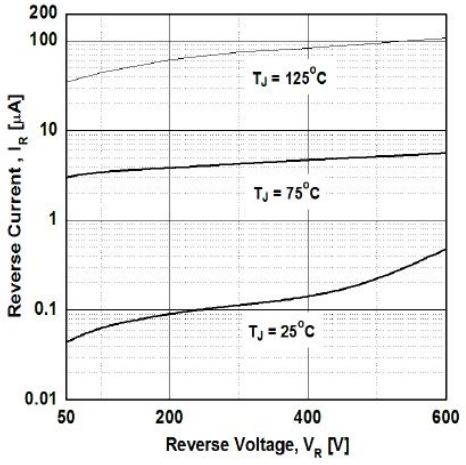


Figure 20. Reverse Current

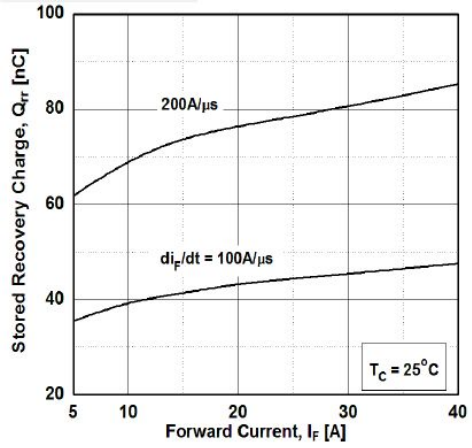


Figure 21. Stored Charge

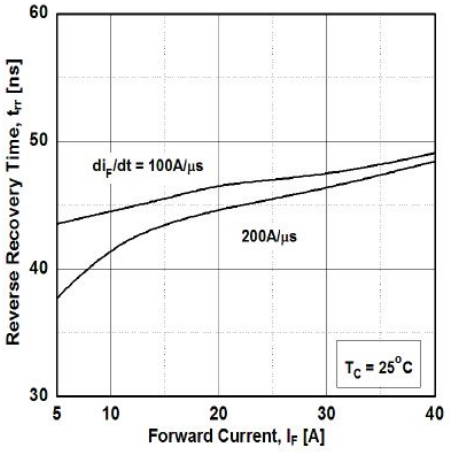


Figure 22. Reverse Recovery Time

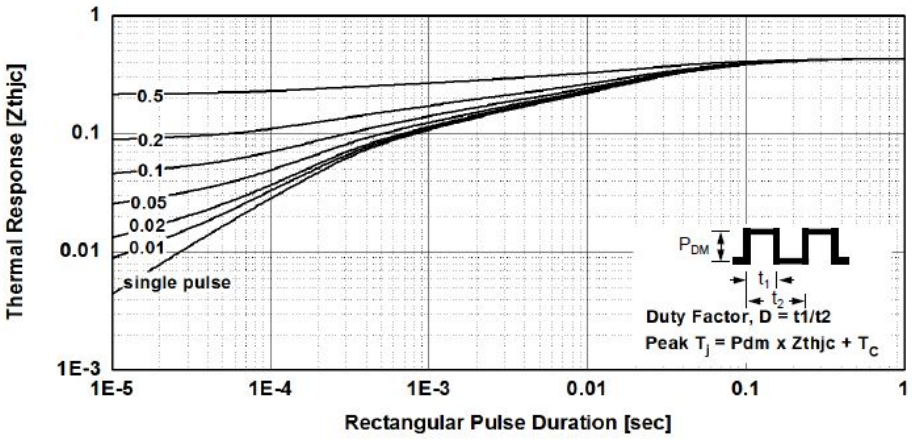


Figure 23.Transient Thermal Impedance of IGBT

Mechanical Dimensions