

# TSG40N120A

IGBT

DRAWING

Features

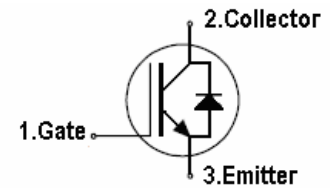
- 1200V,40A
- $V_{CE(sat)(typ.)}=2.5V@V_{GE}=15V, I_c=40A$
- High speed switching
- Higher system efficiency
- Soft current turn-off waveforms
- Square RBSOA using NPT technology



G C E

General Description

TS NPT IGBTs 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	$\pm 30$	V
$I_c$	Continuous Collector Current ( $T_C=25\text{ }^\circ\text{C}$ )	80	A
	Continuous Collector Current ( $T_C=100\text{ }^\circ\text{C}$ )	40	A
$I_{CM}$	Pulsed Collector Current (Note 1)	110	A
$I_F$	Diode Continuous Forward Current ( $T_C=100\text{ }^\circ\text{C}$ )	40	A
$I_{FM}$	Diode Maximum Forward Current (Note 1)	75	A
tsc	Short Circuit Withstand Time	10	us
$P_D$	Maximum Power Dissipation ( $T_C=25\text{ }^\circ\text{C}$ )	300	W
	Maximum Power Dissipation ( $T_C=100\text{ }^\circ\text{C}$ )	120	W
$T_J$	Operating Junction Temperature Range	-55 to +150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to +150	$^\circ\text{C}$

Notes:

1. 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	0.42	$^\circ\text{C}/\text{W}$
Rth j-c	Thermal Resistance, Junction to case for Diode	0.83	$^\circ\text{C}/\text{W}$
Rth j-a	Thermal Resistance, Junction to Ambient	40	$^\circ\text{C}/\text{W}$

Electrical Characteristics (TC=25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$BV_{CES}$	Collector-Emitter Breakdown Voltage	$V_{GE}=0V, I_C=250\mu A$	1200			V
$I_{CES}$	Collector-Emitter Leakage Current	$V_{CE}=1200V, V_{GE}=0V$			250	$\mu A$
$I_{GES}$	Gate Leakage Current, Forward	$V_{GE}=30V, V_{CE}=0V$			100	nA
	Gate Leakage Current, Reverse	$V_{GE}=-30V, V_{CE}=0V$			-100	nA
$V_{GE(th)}$	Gate Threshold Voltage	$V_{GE}=V_{CE}, I_C=250\mu A$	4		6	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=40A$		2.5		V
Qg	Total Gate Charge	$V_{CC}=960V$		200		nC
Qge	Gate-Emitter Charge	$V_{GE}=15V$		54		nC
Qgc	Gate-Collector Charge	$I_C=40A$		90		nC
t <sub>d(on)</sub>	Turn-on Delay Time	$V_{CC}=600V$ $V_{GE}=15V, I_C=40A$ $R_G=28\Omega$ Inductive Load TC=25 °C		67		ns
t <sub>r</sub>	Turn-on Rise Time			95		ns
t <sub>d(off)</sub>	Turn-off Delay Time			728		ns
t <sub>f</sub>	Turn-off Fall Time			45		ns
E <sub>on</sub>	Turn-on Switching Loss			4.6		mJ
E <sub>off</sub>	Turn-off Switching Loss			2.8		mJ
E <sub>ts</sub>	Total Switching Loss			7.4		mJ
C <sub>ies</sub>	Input Capacitance	$V_{CE}=25V$		930		pF
C <sub>oes</sub>	Output Capacitance	$V_{GE}=0V$		225		pF
C <sub>res</sub>	Reverse Transfer Capacitance	f = 100kHz		118		pF
R <sub>Gint</sub>	Integrated gate resistor			3.8		$\Omega$

Electrical Characteristics of Diode (TC=25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_F$	Diode Forward Voltage	$I_F=40A$		2.5	3.5	V
t <sub>rr</sub>	Diode Reverse Recovery Time	$V_{CE}=600V$ $I_F=40A$ dI <sub>F</sub> /dt = 200A/us		160		ns
I <sub>rr</sub>	Diode peak Reverse Recovery Current			12		A
Q <sub>rr</sub>	Diode Reverse Recovery Charge			1040		nC

Typical Characteristics

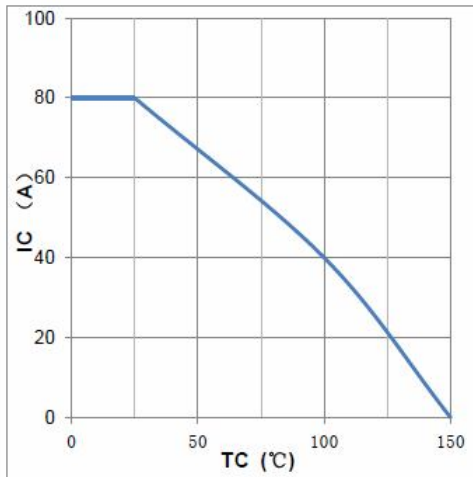


Figure1: maximum DC collector current VS. case temperature

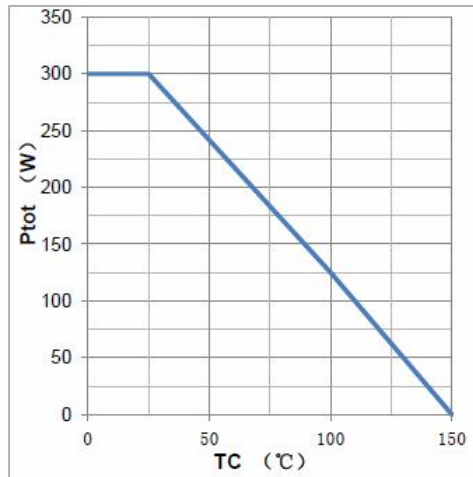


Figure2: power dissipation VS. case temperature

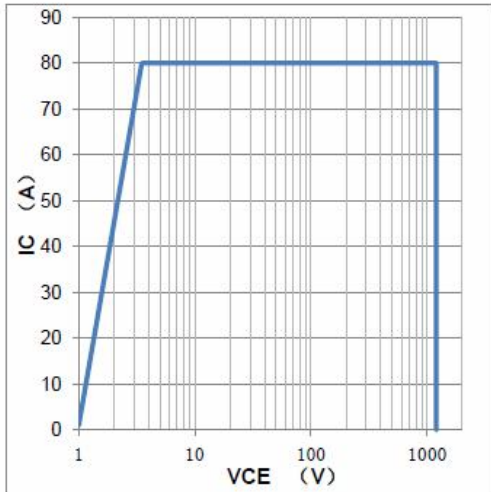


Figure3: reverse bias SOA, TJ=150°C, VGE=15V

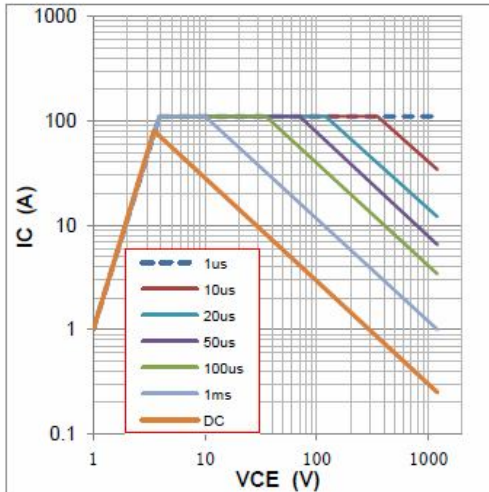


Figure4: forward SOA, TC=25°C, TJ ≤ 150°C

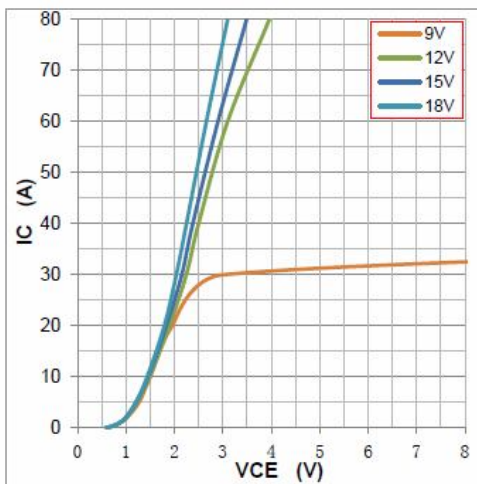


Figure5: typical IGBT output characteristics, TJ=25°C; tp=300us

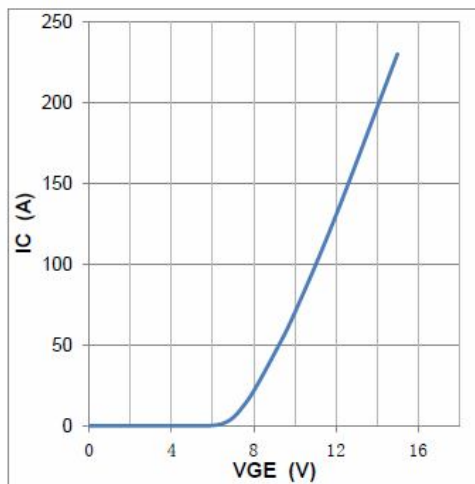


Figure6: typical trans characteristics, VCE=20V, tp=20us

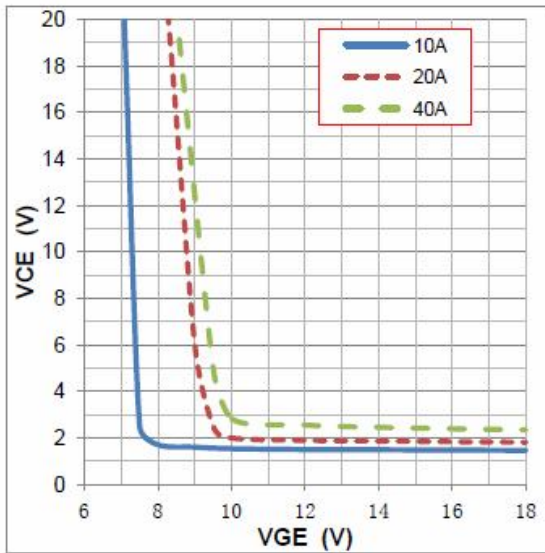


Figure7: typical VCE VS. VGE, TJ=25°C

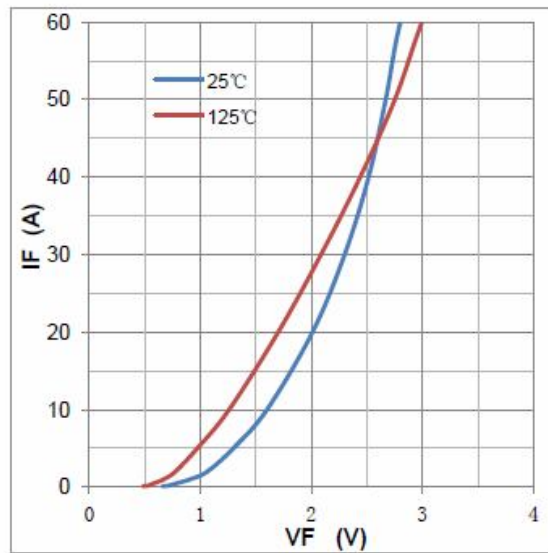


Figure8: typical diode forward characteristic, tp=300us

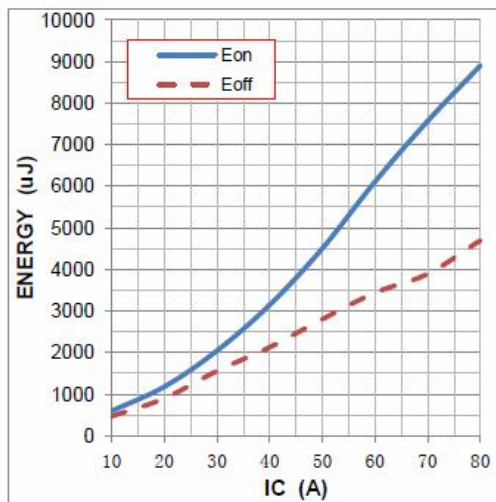


Figure9: typical energy loss VS. IC, TC=25°C,

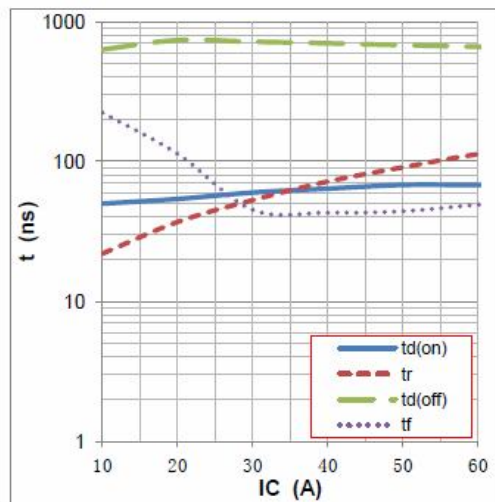


Figure10: typical switching time VS. IC, TC=25°C,

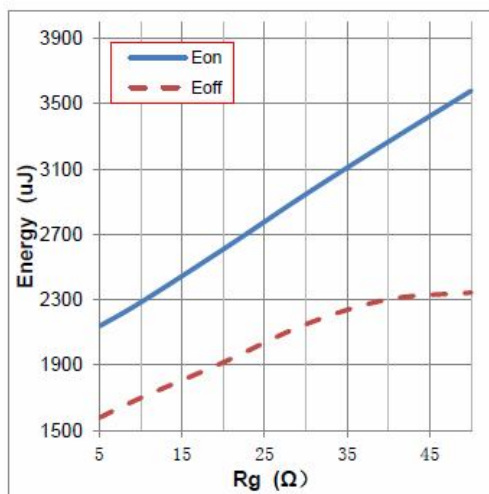


Figure11: typical energy loss VS. Rg, TC=25°C,

L=500uH, VCE=600V, VGE=15V, IC=20A

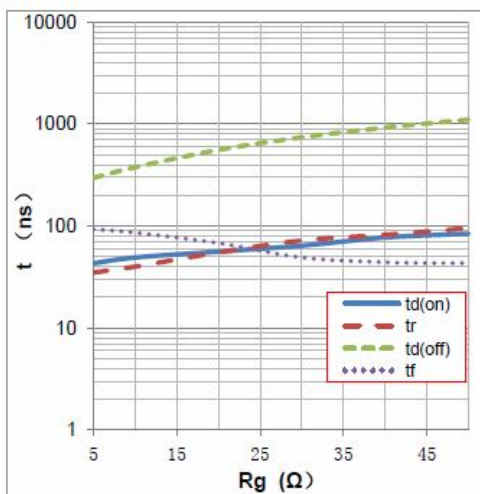


Figure12: typical switching time VS. Rg, TC=25°C,

L=500uH, VCE=600V, VGE=15V, IC=20A

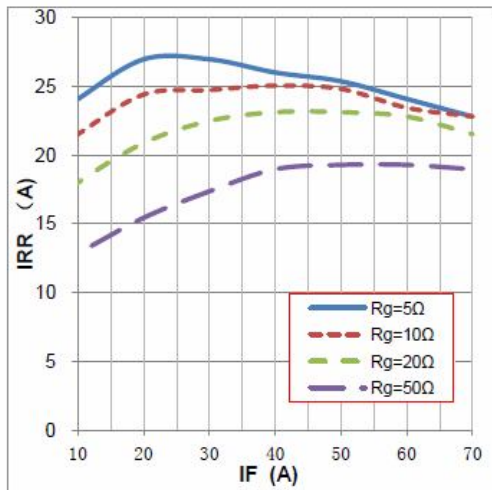


Figure13: typical diode IRR VS. IF, TC=25°C

VCC=600V, VGE=15V

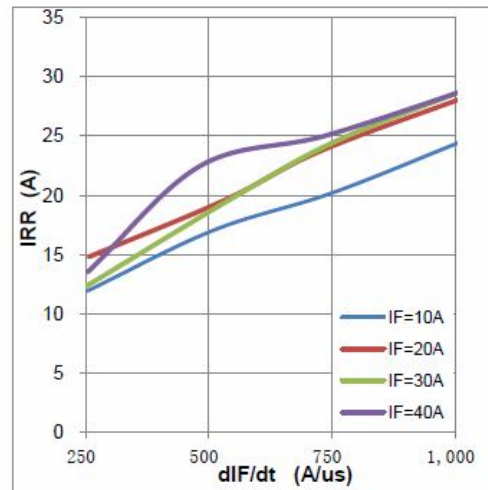


Figure14: typical diode IRR VS. dIF/dt

VCC=600V, VGE=15V

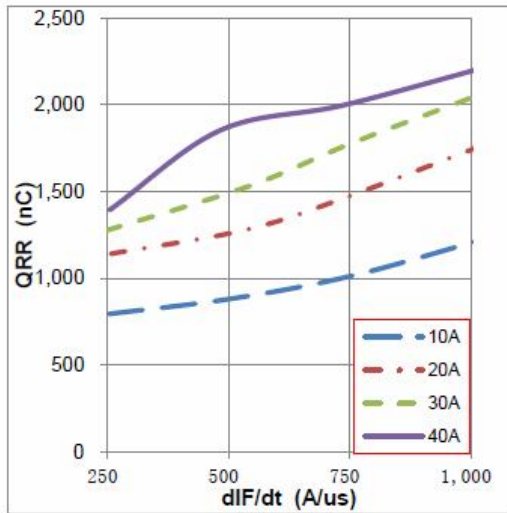


Figure15: typical diode QRR VS. dIF/dt

VCC=600V, VGE=15V

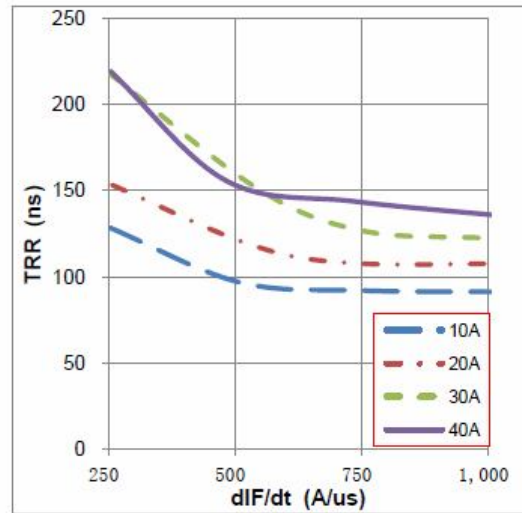


Figure16: typical diode TRR VS. dIF/dt,

VCC=600V, VGE=15V

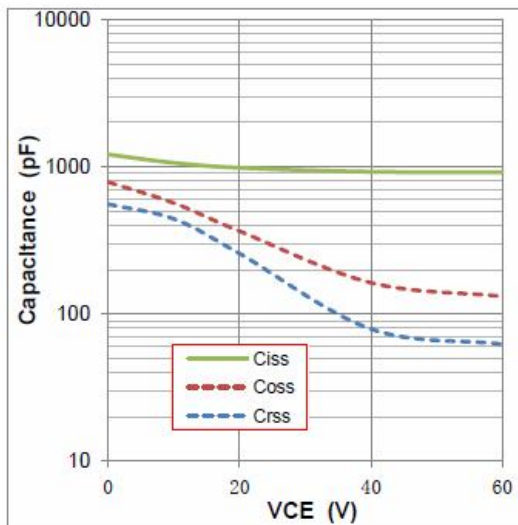


Figure17: typical capacitance VS. VCE, VGE=0V, f=100kHz

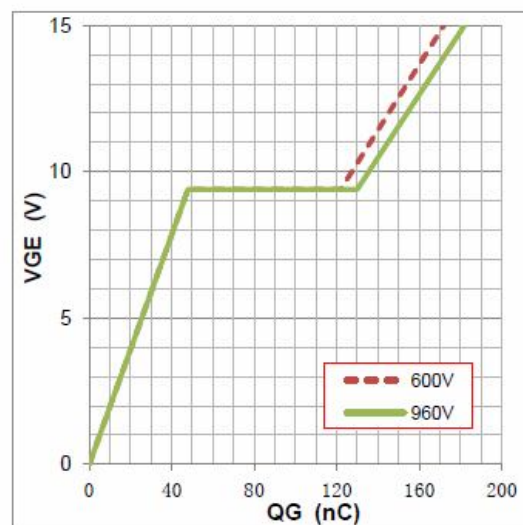


Figure18: typical gate charge VS. VGE, IC=20A



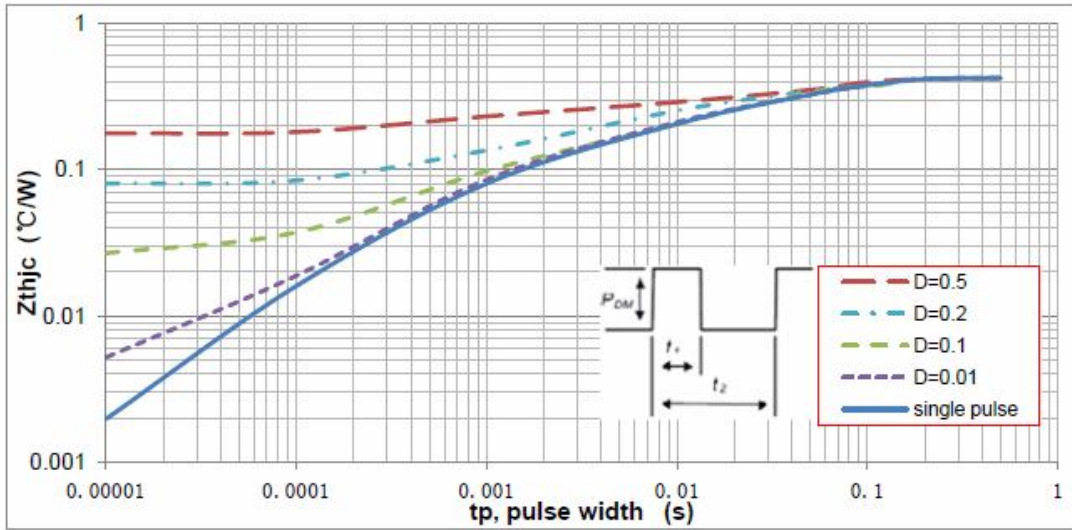


Figure19:normalized transient thermal impedance, junction-to-case

Note1.Duty factor  $D=t_1/t_2$ ; Note2:peak  $T_J=P_{DM} \times Z_{thjc}+T_C$

Mechanical Dimensions

