

IGBT module with Trench/Fieldstop IGBT and Emitter Controlled diode and NTC

Features

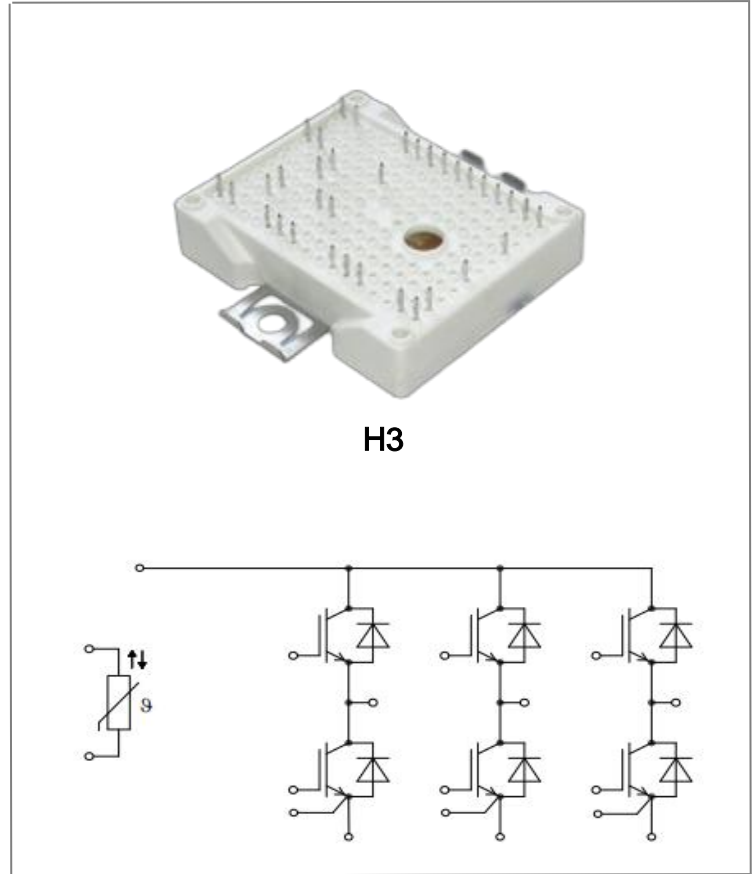
- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 μ s short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Isolated heatsink using DBC technology

Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

Product validation

- Qualified for industrial applications according to the relevant tests of IEC 60747, 60749 and 60068



Package Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f=50Hz, t=60s	2.5	kV
Internal isolation		basic insulation(class 1, IEC 61140)	Al ₂ O ₃	
Creepage distance	d_{creep}	terminal to heatsink	11.5	mm
Creepage distance	d_{creep}	terminal to terminal	6.3	mm
Clearance	d_{clear}	terminal to heatsink	10	mm
Clearance	d_{clear}	terminal to terminal	5	mm
Comparative tracking index (electrical)	CTI		>200	

Package Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Mounting torque for module mounting	M	-Mounting according to valid application note	M5, Screw	40		80	Nm
Weight	G				41.2		g

Absolute Maximum Ratings (T_C = 25°C unless otherwise noted)

IGBT

Symbol	Description	Value	Unit
V _{CES}	Collector-Emitter Voltage	1200	V
V _{GES}	Gate-Emitter Voltage	±25	V
I _C	Collector Current @ T _C =25°C	100	A
	Collector Current @ T _C =100°C	50	A
I _{CM}	Pulsed Collector Current, t _p limited by T _{vj max}	100	A
T _{Jmax}	Maximum Junction Temperature	175	°C
P _D	Power Dissipation @ T _C = 25°C	307	W
	Power Dissipation @T _C = 100 °C	153	W

Diode

Symbol	Description	Value	Unit
V _{RRM}	Repetitive Peak Reverse Voltage	1200	V
I _F	Diode Continuous Forward Current	50	A
I _{FM}	Diode Maximum Forward Current t _p =1ms	100	A

Module

Symbol	Description	Value	Unit
T _{vj op}	Temperature under switching conditions	-40 to 150	°C
T _{STG}	Storage Temperature Range	-40 to 125	°C
V _{ISO}	Isolation Voltage RMS, f=50Hz, t=1min	2500	V

IGBT Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} = 15 V, I _C = 50 A, T _{vj} = 25°C	--	1.80	2.00	V
		V _{GE} = 15 V, I _C = 50 A, T _{vj} = 125°C	--	2.15	--	
		V _{GE} = 15 V, I _C = 50 A, T _{vj} = 150°C	--	2.30	--	
V _{GE(TH)}	Gate-Emitter Threshold Voltage	V _{GE} = V _{CE} , I _C = 1 mA, T _{vj} = 25°C	5.6	6.0	6.4	V
I _{CES}	Collector-Emitter Cutoff Current	V _{GE} = 0 V, V _{CE} = V _{CES} , T _{vj} = 25°C	--	--	200	µA
I _{GES}	Gate-Emitter Leakage Current	V _{GE} = V _{GES} , V _{CE} = 0 V, T _{vj} = 25°C	--	--	200	nA
R _{Gint}	Internal Gate Resistance		--	1.27	--	Ω
C _{ies}	Input Capacitance	V _{CE} =25V, f=1MHz,	--	5.07	--	nF
C _{res}	Reverse Transfer	V _{GE} =0V	--	0.13	--	nF
Q _G	Gate Charge	V _{GE} =0...+15V	--	0.19	--	µC
t _{d(on)}	Turn-On Delay Time	V _{CC} = 600 V, I _C = 50 A R _G = 10Ω, V _{GE} = ±15V Inductive Load T _{vj} = 25°C	--	110	--	ns
t _r	Rise Time		--	30	--	
t _{d(off)}	Turn-off Delay Time		--	180	--	
t _f	Fall Time		--	190	--	
E _{on}	Turn-On Switching Loss per Pulse		--	2.83	--	
E _{off}	Turn Off Switching Loss per Pulse	--	4.42	--		
t _{d(on)}	Turn-On Delay Time	V _{CC} = 600 V, I _C = 50 A R _G = 10Ω, V _{GE} = ±15V Inductive Load T _{vj} = 125°C	--	120	--	ns
t _r	Rise Time		--	30	--	
t _{d(off)}	Turn-off Delay Time		--	230	--	
t _f	Fall Time		--	340	--	
E _{on}	Turn-on Switching Loss per Pulse		--	4.16	--	
E _{off}	Turn Off Switching Loss per Pulse	--	5.24	--		

td(on)	Turn-On Delay Time	$V_{CC} = 600\text{ V}, I_C = 50\text{ A}$ $R_G = 10\Omega, V_{GE} = \pm 15\text{ V}$ Inductive Load $T_{vj} = 150^\circ\text{C}$	--	110	--	ns
tr	Rise Time		--	40	--	
td(off)	Turn-off Delay Time		--	240	--	
tf	Fall Time		--	330	--	
Eon	Turn-on Switching Loss per Pulse		--	4.87	--	mJ
Eoff	Turn Off Switching Loss per Pulse		--	5.49	--	
ISC	SC Data	$t_p \leq 10\mu\text{s}, V_{GE} \leq 15\text{ V},$ $T_{vj} = 150^\circ\text{C}, V_{CC} = 800\text{ V},$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	--	130	--	A
RthJC	Thermal resistance	Junction-to-Case (per IGBT)	--	0.435	0.489	K/W
RthCH	Thermal resistance, case to heat sink	Case-to-Heatsink (per IGBT) $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})/\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$	--	0.573	--	K/W

Diode Characteristics (Tc=25°C unless otherwise noted)

VF	Diode Forward Voltage	$I_F = 50\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 25^\circ\text{C}$	--	2.5	3.3	V
		$I_F = 50\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 125^\circ\text{C}$	--	2.4	--	
		$I_F = 50\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 150^\circ\text{C}$	--	2.3	--	
Qr	Recovered Charge	$V_R = 600\text{ V}, I_F = 50\text{ A},$ $-di/dt = 1100\text{ A}/\mu\text{s}, V_{GE} = -15\text{ V}$ $T_{vj} = 25^\circ\text{C}$	--	0.48	--	μC
IRM	Peak Reverse Recovery Current		--	40	--	A
Trr	Reverse Recovery Time		--	16.5	--	ns
Erec	Reverse Recovery Energy		--	0.65	--	mJ
Qr	Recovered Charge	$V_R = 600\text{ V}, I_F = 50\text{ A},$ $-di/dt = 1100\text{ A}/\mu\text{s}, V_{GE} = -15\text{ V}$ $T_{vj} = 125^\circ\text{C}$	--	0.67	--	μC
IRM	Peak Reverse Recovery Current		--	25	--	A
Trr	Reverse Recovery Time		--	36.5	--	ns
Erec	Reverse Recovery Energy		--	0.96	--	mJ
Qr	Recovered Charge	$V_R = 600\text{ V}, I_F = 50\text{ A},$ $-di/dt = 1100\text{ A}/\mu\text{s}, V_{GE} = -15\text{ V}$ $T_{vj} = 150^\circ\text{C}$	--	1.72	--	μC
IRM	Peak Reverse Recovery Current		--	27	--	A
Trr	Reverse Recovery Time		--	42.9	--	ns
Erec	Reverse Recovery Energy		--	1.01	--	mJ
RthJC	Thermal resistance	Junction-to-Case (per diode)	--	0.714	0.824	K/W
RthCH	Thermal resistance, case to heat sink	Case-to-Heatsink (per diode) $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})/\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$	--	0.866	--	K/W

NTC Characteristics (Tc = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
R25	Rated Resistance		--	5.0	--	kΩ
ΔR/R	Deviation of R100	Tc=100 °C, R100=493.3Ω	-5	--	5	%
P25	Power Dissipation		--	--	20.0	mW
B25/50	B-value	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15\text{K}))]$	--	3375	--	K
B25/80	B-value	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15\text{K}))]$	--	3411	--	K
B25/100	B-value	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298.15\text{K}))]$	--	3433	--	K

Module Characteristics (Tc = 25°C unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Unit
LCE	Stray Inductance	--	40	--	nH
RCC+EE'	Module Lead Resistance, Terminal to Chip	--	4.00	--	mΩ
F	Mounting Force Per Clamp	40	--	80	N
G	Weight of Module	--	41.2	--	g

Figure 1. Typical Output Characteristics

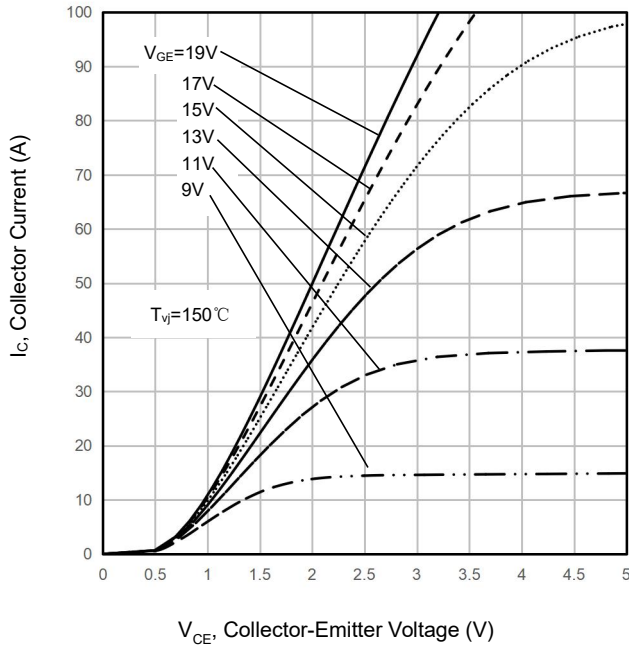


Figure 2. Typical Transfer Characteristics

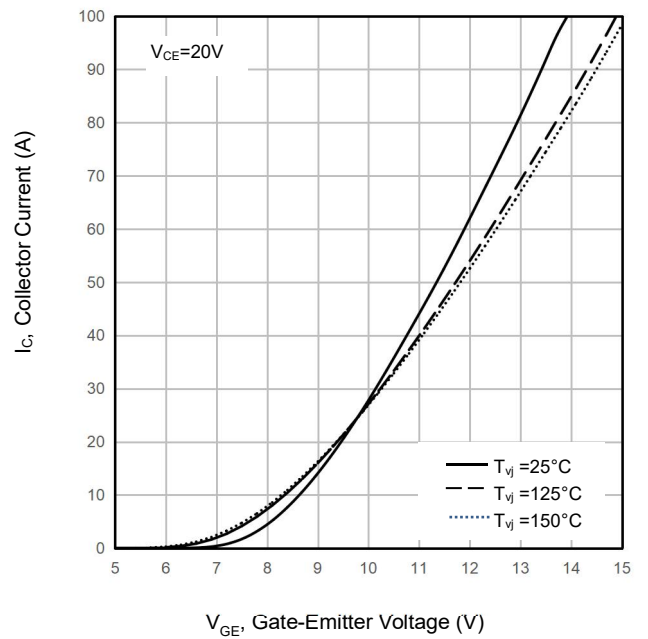


Figure 3. Switching Loss vs. Collector Current

$V_{CE}=600\text{V}, V_{GE}=\pm 15\text{V}, R_G=10\Omega$

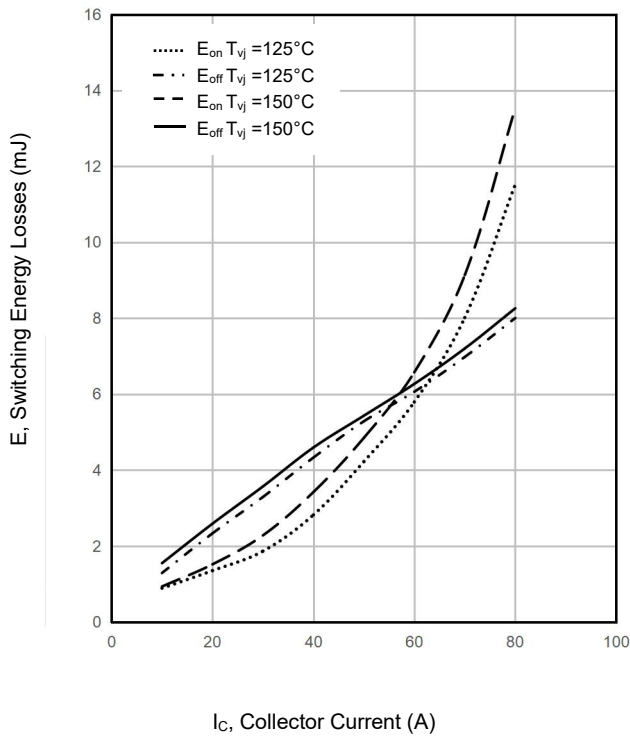


Figure 4. Switching Loss vs. R_G

$V_{CE}=600\text{V}, V_{GE}=\pm 15\text{V}, I_C=50\text{A}$

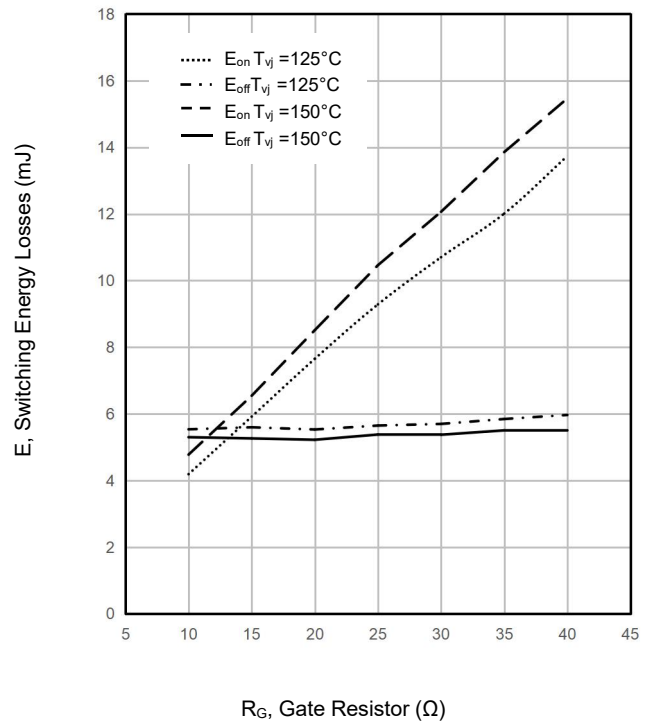


Figure 5. Switching Time IGBT
 $V_{CE}=600V, V_{GE}=\pm 15V, R_G=10\Omega, T_V=150^\circ C$

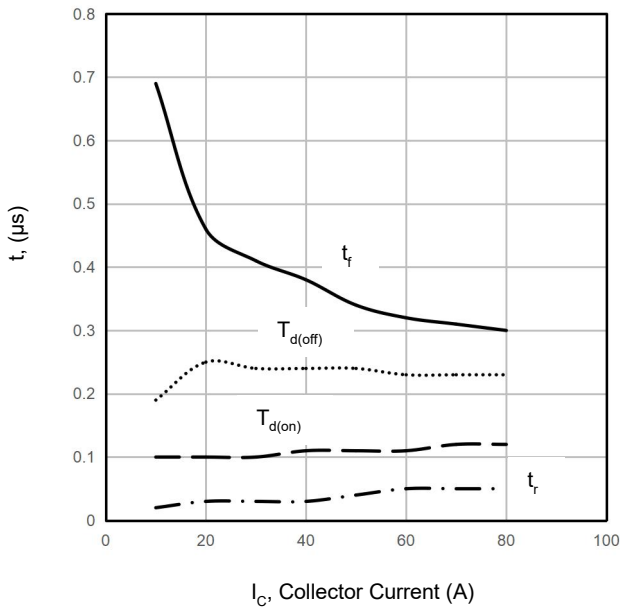


Figure 6. Capacitance IGBT
 $f=100KHz, V_{GE}=0V$

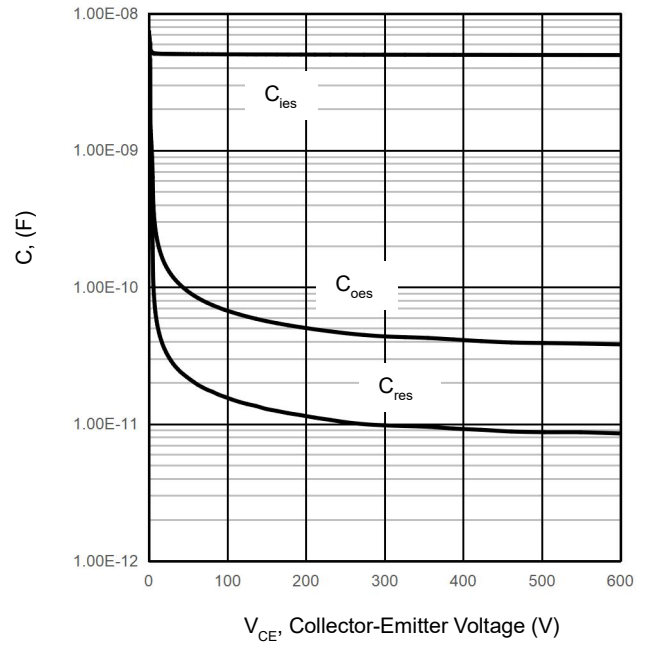


Figure 7. Gate Voltage
 $V_{CE}=600V, V_{GE}=15V, I_C=50A$

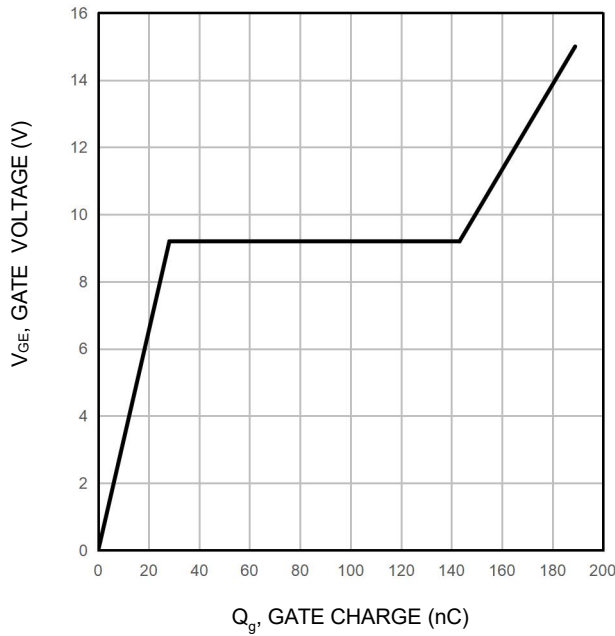


Figure 8. IGBT Transient Thermal Impedance

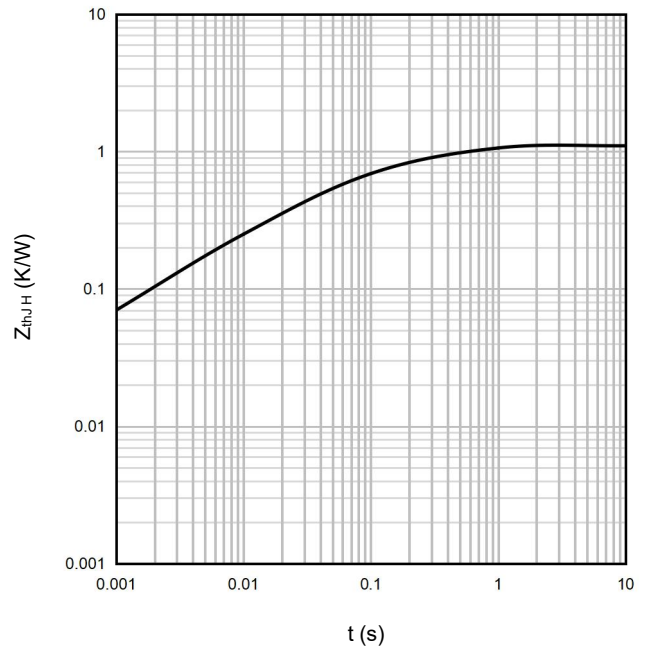


Figure 9.RBSOA IGBT

$V_{GE} = \pm 15V, R_G = 10\Omega, T_{vj} = 150^\circ C$

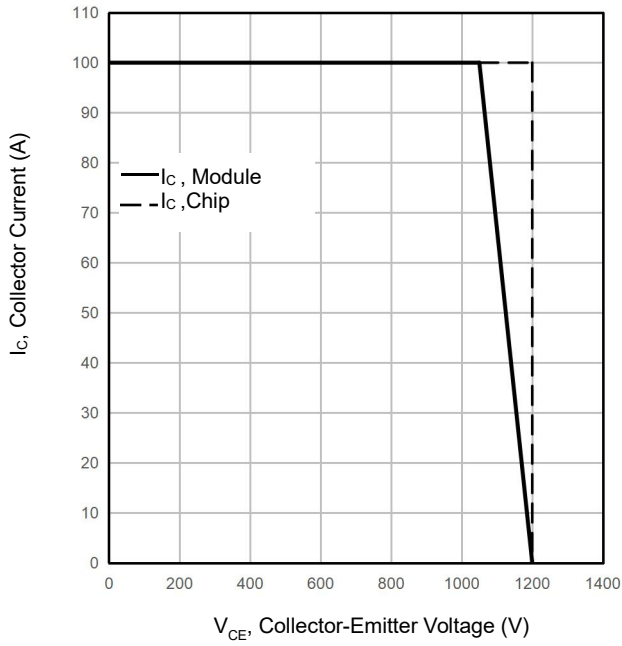


Figure 10.FBSOA IGBT

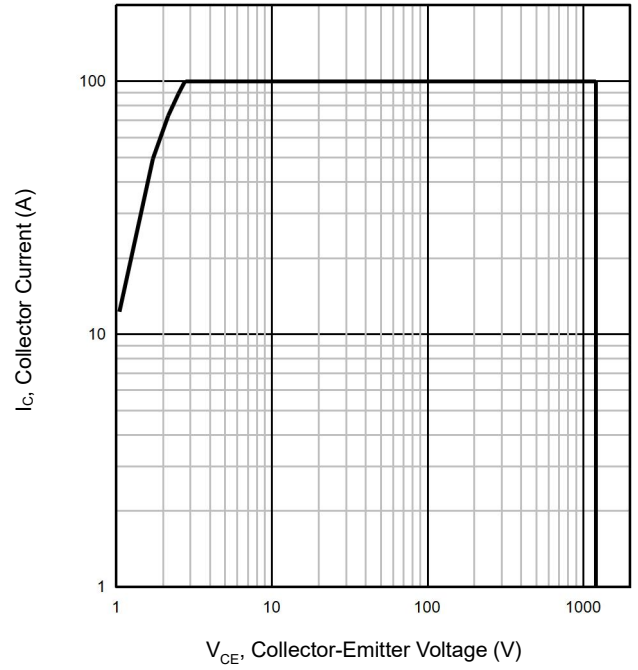


Figure 11.SCSOA IGBT

$V_{GE} = \pm 15V, R_G = 15\Omega, t_p \leq 10\mu s, T_{vj} = 150^\circ C$

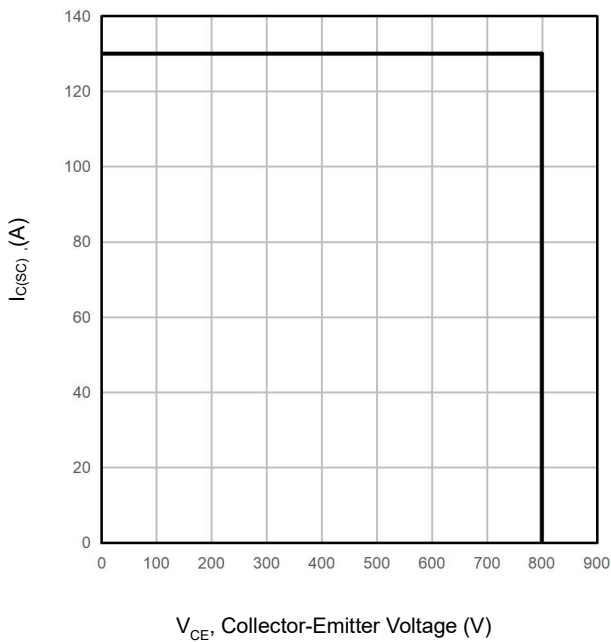


Figure 12.Reverse Recovery Energy Loss vs. IC

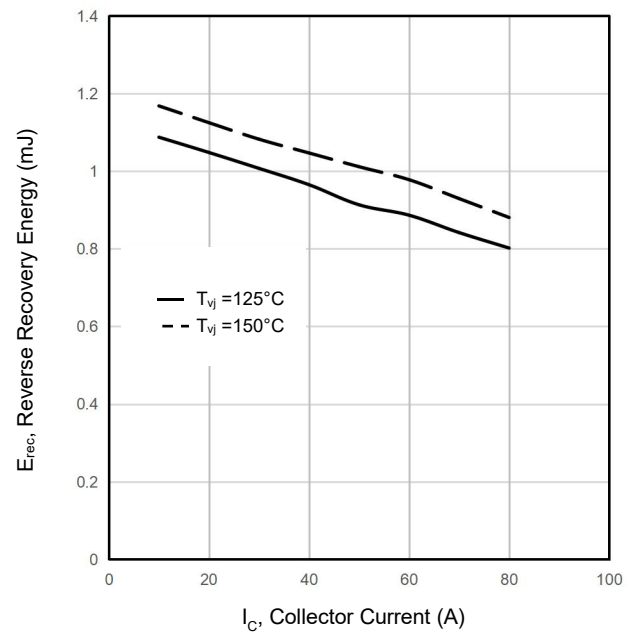


Figure 13. Reverse Recovery Energy Loss vs. R_G

$V_{CE}=600V, R_G=10\Omega$

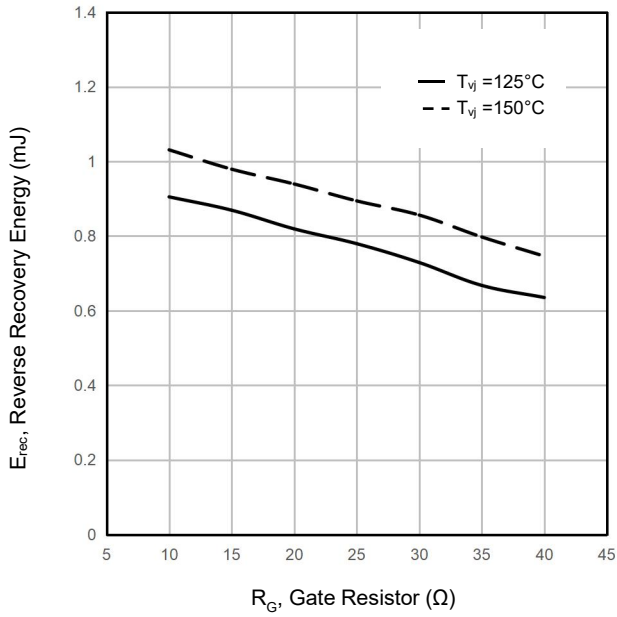


Figure 14. Diode Forward Characteristics

$f=100KHz, V_{GE}=0V, T_{vj}= 25^\circ C$

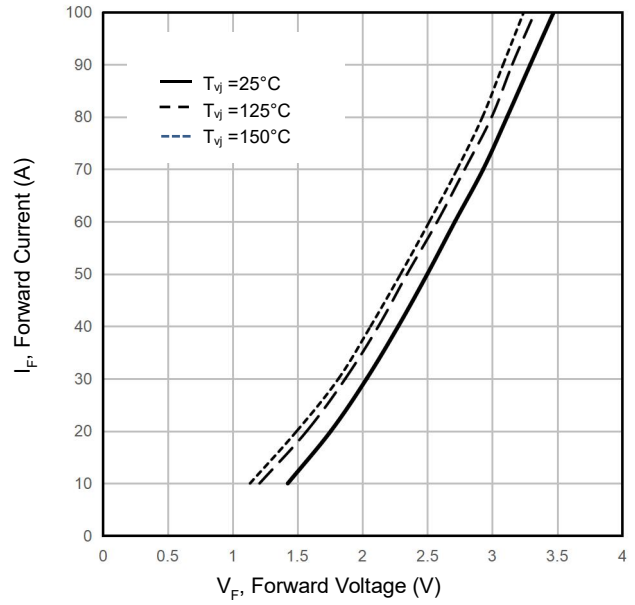


Figure 15. Diode Transient Thermal Impedance

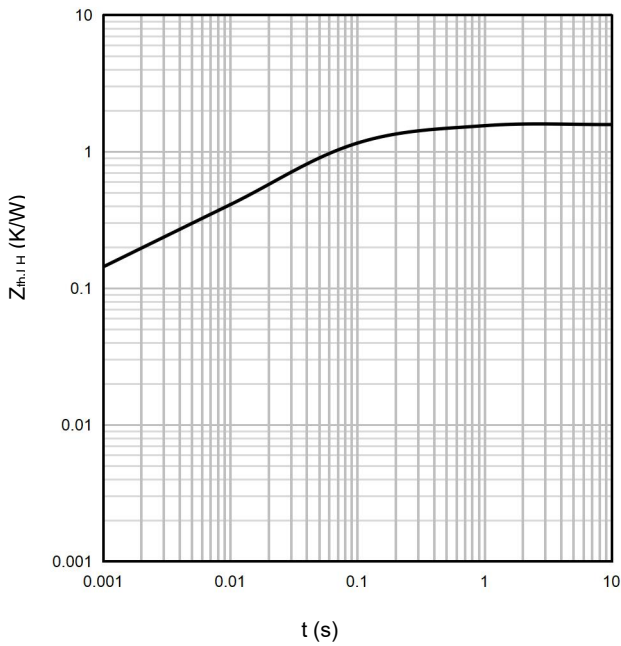
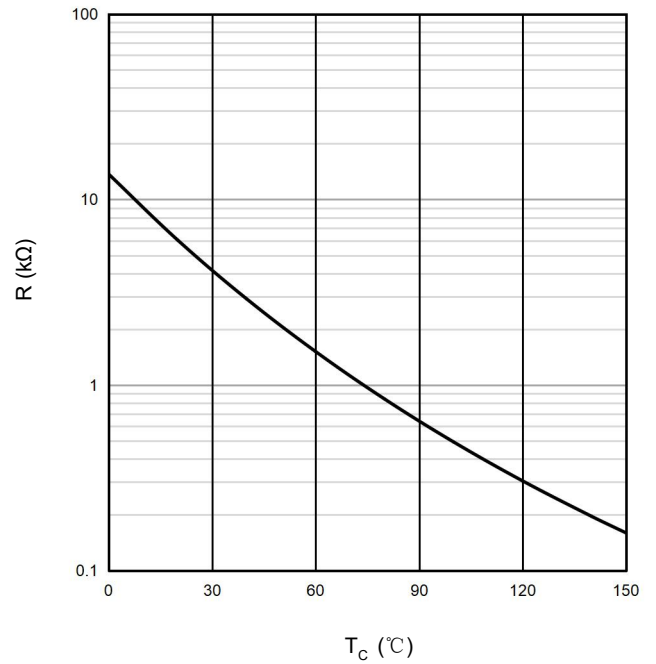
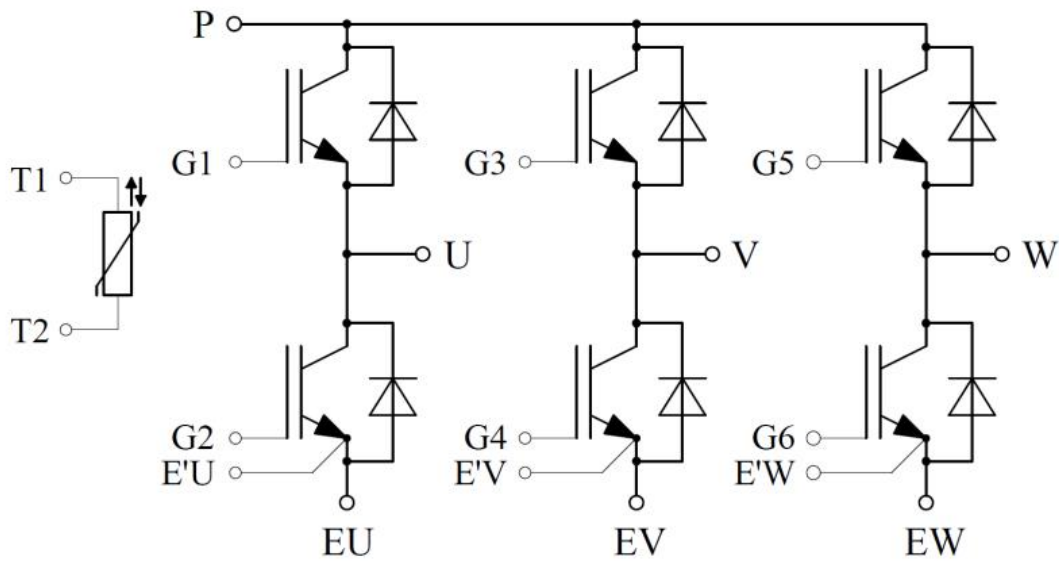


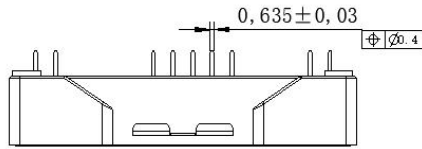
Figure 16. NTC Temperature Characteristic



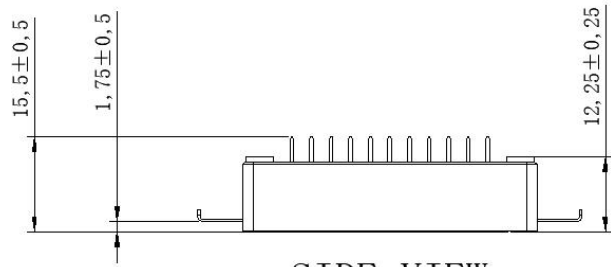
CIRCUIT DIAGRAM



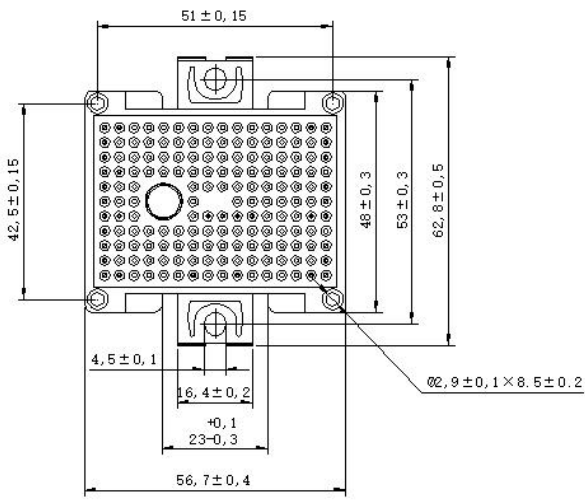
PACKAGE DIMENSION



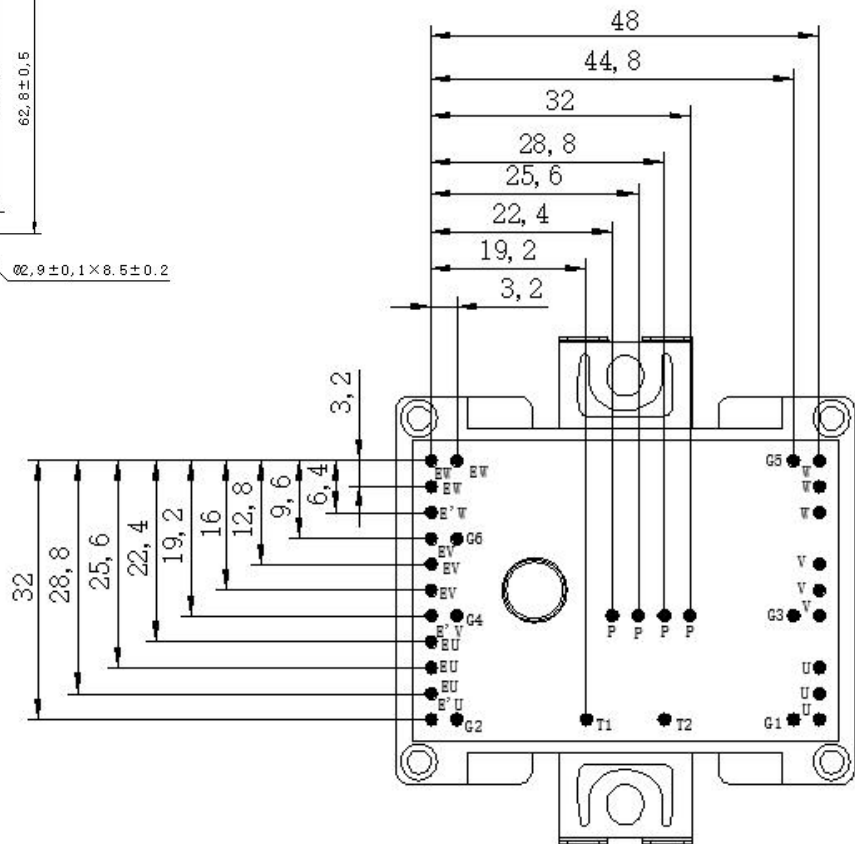
SIDE VIEW



SIDE VIEW



TOP VIEW



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME 7 14.5M,2009.
2. CONTROLLING DIMENSION:MILLIMETERS