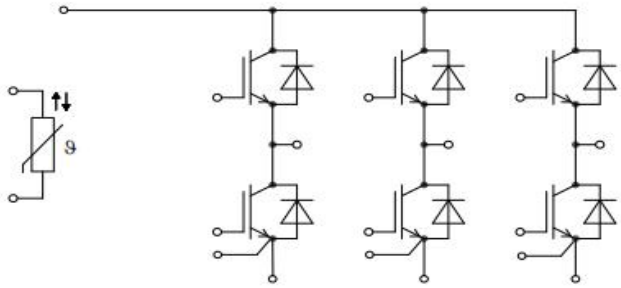
IGBT module with Trench/Fieldstop IGBT and Emitter Controlled diode and NTC

Features

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

H3



Equivalent Circuit

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_2O_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 (Tc = 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℃	100	A
	Collector Current @ T_C=100℃	50	A
I_{CM}	Pulsed Collector Current，t_p limited by $T_{vj\ max}$	100	A
T_{jmax}	Maximum Junction Temperature	175	℃
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	℃
T_{STG}	Storage Temperature Range	-40 to 125	℃
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V

IGBT Characteristics (Tc = 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
RGint	Internal Gate Resistance		--	1.27	--	Ω
Cies	Input Capacitance	V_{CE}=25V,f=1MHz,	--	5.07	--	nF
Cres	Reverse Transfer	V_{GE}=0V	--	0.13	--	nF
Q_G	Gate Charge	V_{GE}=0...+15V	--	0.19	--	μC
td(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
tr	Rise Time		--	30	--	
td(off)	Turn−off Delay Time		--	180	--	
tf	Fall Time		--	190	--	
Eon	Turn−On Switching Loss per Pulse		--	2.83	--	mJ
Eoff	Turn Off Switching Loss per Pulse		--	4.42	--	
td(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
tr	Rise Time		--	30	--	
td(off)	Turn−off Delay Time		--	230	--	
tf	Fall Time		--	340	--	
Eon	Turn−on Switching Loss per Pulse		--	4.16	--	mJ
Eoff	Turn Off Switching Loss per Pulse		--	5.24	--	

$t_{d(on)}$	Turn−On Delay Time	V_{CC} = 600 V, I_C = 50 A R_G = 10Ω, V_{GE} =±15V Inductive Load T_{vj} = 150°C	--	110	--	ns
t_r	Rise Time		--	40	--	
$t_{d(off)}$	Turn−off Delay Time		--	240	--	
t_f	Fall Time		--	330	--	
E_{on}	Turn−on Switching Loss per Pulse		--	4.87	--	mJ
E_{off}	Turn Off Switching Loss per Pulse		--	5.49	--	
I_{SC}	SC Data	t_P≤10μs, V_{GE} ≤15V, T_{vj} =150℃, V_{CC}=800V, V_{CEmax}=V_{CES} -L_{sCE}*di/dt	--	130	--	A
R_{thJC}	Thermal resistance	Junction-to-Case (per IGBT)	--	0.435	0.489	K/W
R_{thCH}	Thermal resistance, case to heat sink	Case-to-Heatsink (per IGBT) λ_{Paste}=1W/(m·K)/λ_{grease}=1W/(m·K)	--	0.573	--	K/W

Diode Characteristics （Tc=25℃ unless otherwise noted）

V_F	Diode Forward Voltage	I_F = 50A, V_{GE}=0V， T_{vj} = 25°C	--	2.5	3.3	V
		I_F = 50A, V_{GE}=0V， T_{vj} = 125°C	--	2.4	--	
		I_F = 50A, V_{GE}=0V， T_{vj} = 150°C	--	2.3	--	
Q_r	Recovered Charge	V_R=600V, I_F=50A, -di/dt=1100A/μs, V_{GE}=-15V T_{vj} =25℃	--	0.48	--	μC
I_{RM}	Peak Reverse Recovery Current		--	40	--	A
T_{rr}	Reverse Recovery Time		--	16.5	--	ns
Erec	Reverse Recovery Energy		--	0.65	--	mJ
Q_r	Recovered Charge	V_R=600V, I_F=50A, -di/dt=1100A/μs, V_{GE}=-15V T_{vj} =125℃	--	0.67	--	μC
I_{RM}	Peak Reverse Recovery Current		--	25	--	A
T_{rr}	Reverse Recovery Time		--	36.5	--	ns
Erec	Reverse Recovery Energy		--	0.96	--	mJ
Q_r	Recovered Charge	V_R=600V, I_F=50A, -di/dt=1100A/μs, V_{GE}=-15V T_{vj} =150℃	--	1.72	--	μC
I_{RM}	Peak Reverse Recovery Current		--	27	--	A
T_{rr}	Reverse Recovery Time		--	42.9	--	ns
Erec	Reverse Recovery Energy		--	1.01	--	mJ
R_{thJC}	Thermal resistance	Junction-to-Case (per diode)	--	0.714	0.824	K/W
R_{thCH}	Thermal resistance,case to heat sink	Case-to-Heatsink (per diode) λ_{Paste}=1W/(m·K)/λ_{grease}=1W/(m·K)	--	0.866	--	K/W

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
R_{25}	Rated Resistance		--	5.0	--	kΩ
ΔR/R	Deviation of R100	Tc=100 ℃, R_{100}=493.3Ω	-5	--	5	%
P_{25}	Power Dissipation		--	--	20.0	mW
$B_{25/50}$	B-value	R_2=R_{25}exp[$B_{25/50}$(1/T2- 1/(298.15K))]	--	3375	--	K
$B_{25/80}$	B-value	R_2=R_{25}exp[$B_{25/80}$(1/T2- 1/(298.15K))]	--	3411	--	K
$B_{25/100}$	B-value	R_2=R_{25}exp[$B_{25/100}$(1/T2- 1/(298.15K))]	--	3433	--	K

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

Symbol	Parameter	Min	Typ	Max	Unit
L_{CE}	Stray Inductance	--	40	--	nH
$R_{CC'+EE'}$	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

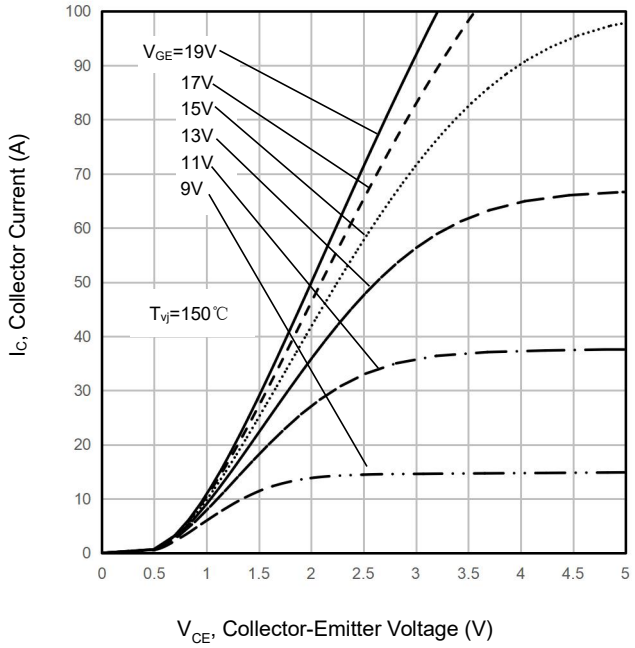


Figure 2.Typical Transfer Characteristics

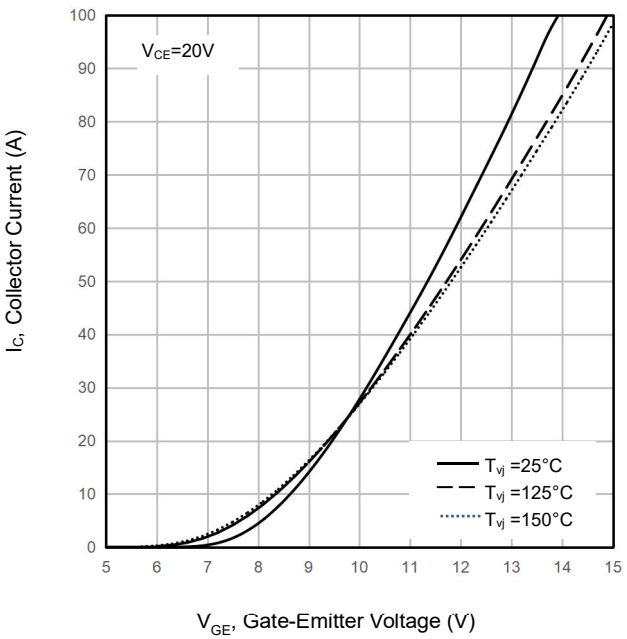


Figure 3.Switching Loss vs. Collector Current

V_{CE}=600V,V_{GE}=±15V,R_G=10Ω

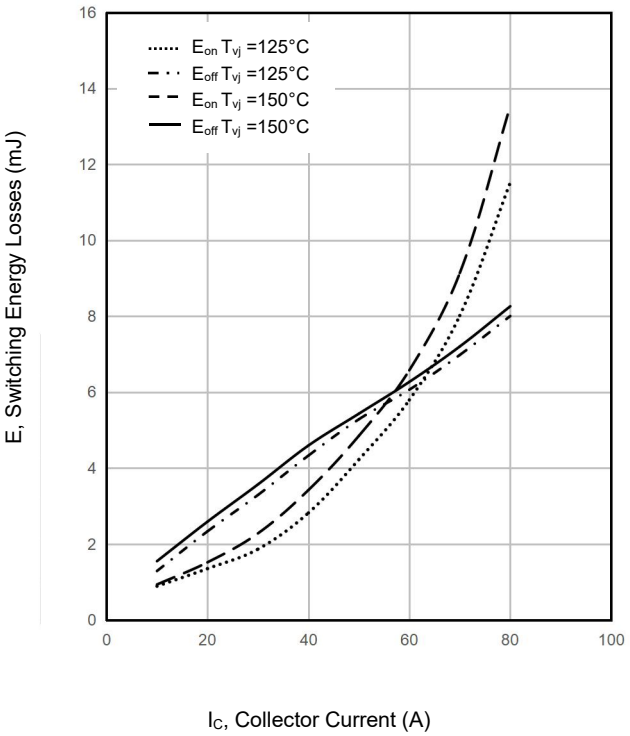


Figure 4.Switching Loss vs. R_G

V_{CE}=600V,V_{GE}=±15V,I_C=50A

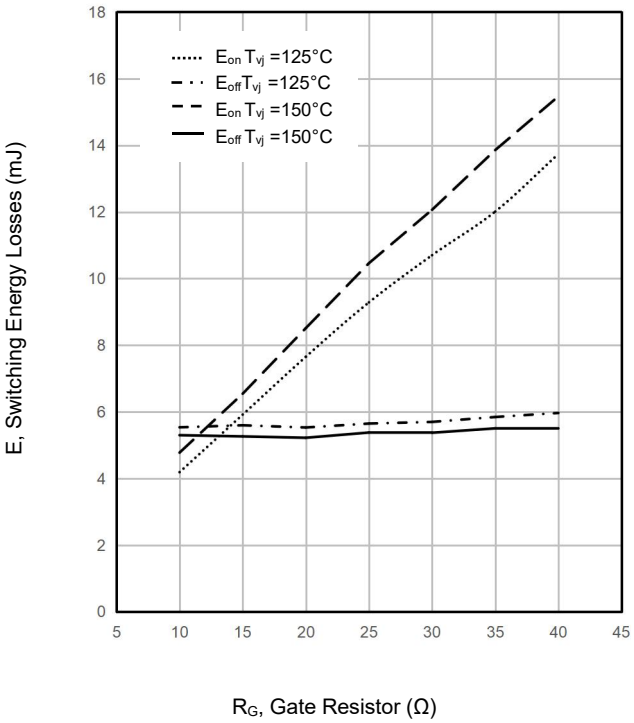


Figure 5.Switching Time IGBT
V_{CE}=600V,V_{GE}=±15V,R_G=10Ω,T_{vj}= 150℃

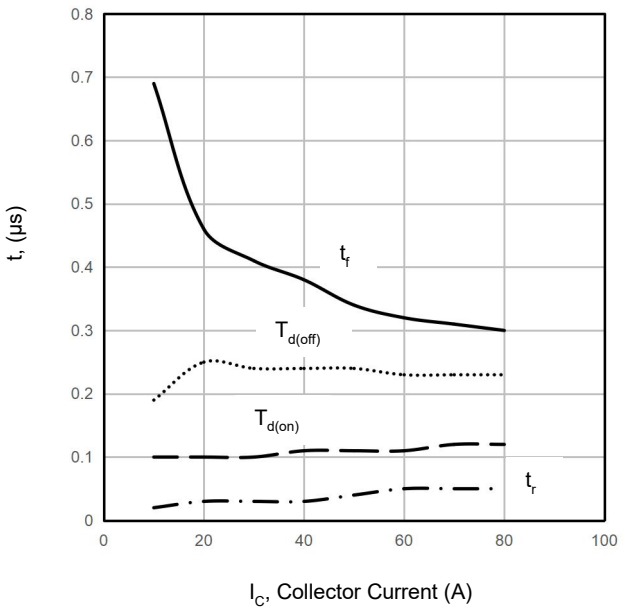


Figure 6.Capacitance IGBT
f=100KHz,V_{GE}=0V

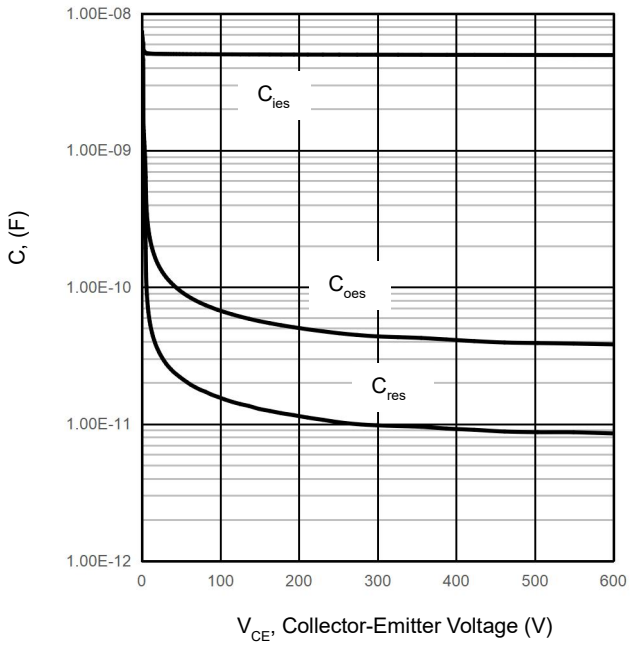


Figure 7.Gate Voltage
V_{CE}=600V,V_{GE}=15V,I_C=50A

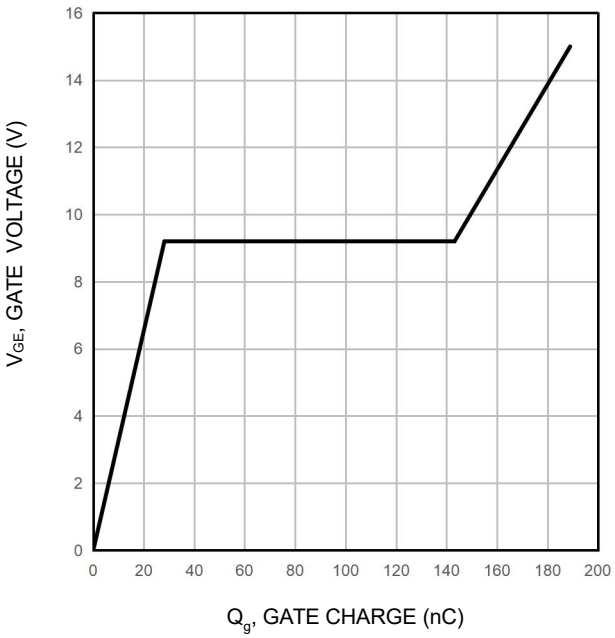


Figure 8.IGBT Transient Thermal Impedance

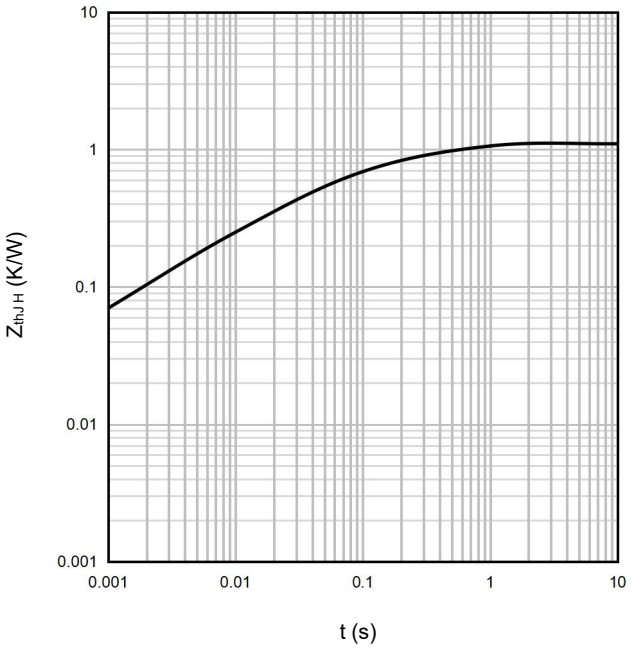


Figure 9.RBSOA IGBT

V_{GE}=±15V,R_G=10Ω,T_{vj}= 150℃

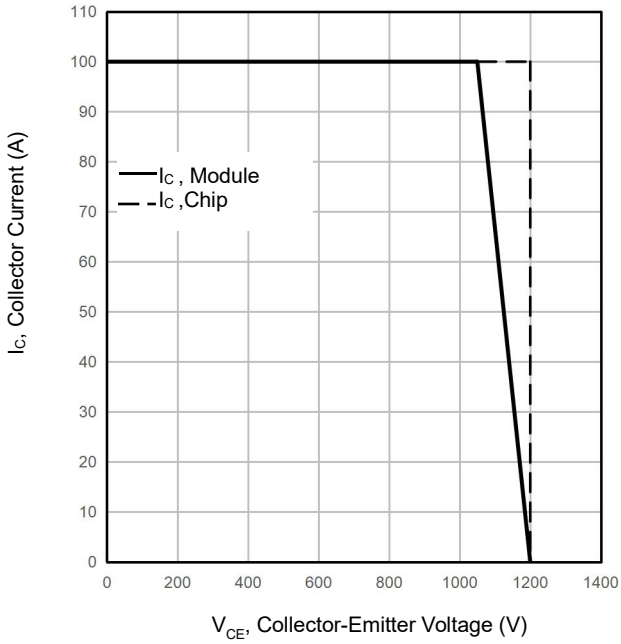


Figure 10.FBSOA IGBT

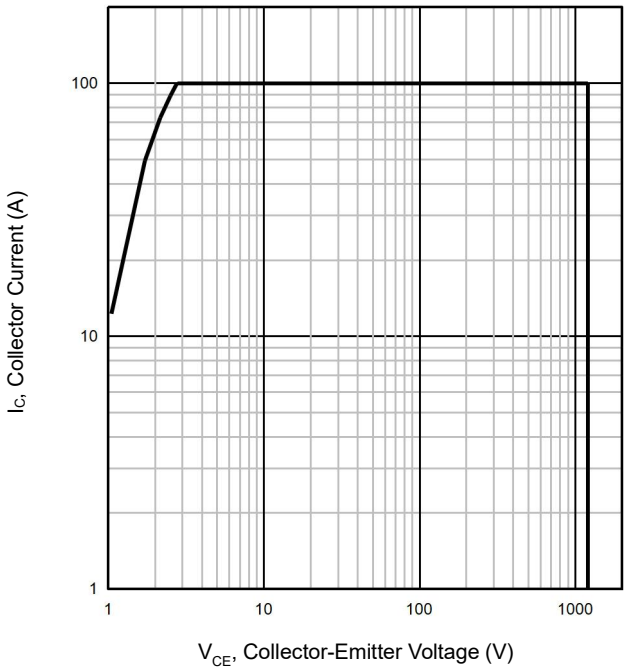


Figure 11.SCSOA IGBT

V_{GE}=±15V,R_G=15Ω,t_P≤10μs,T_{vj}= 150℃

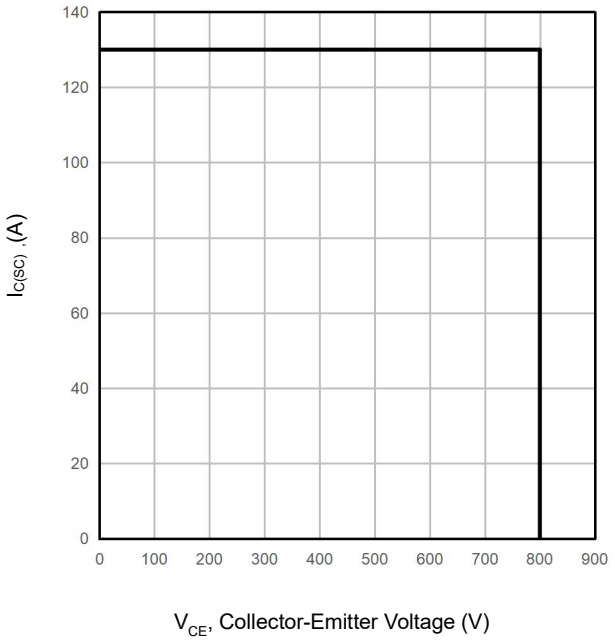


Figure 12.Reverse Recovery Energy Loss vs. IC

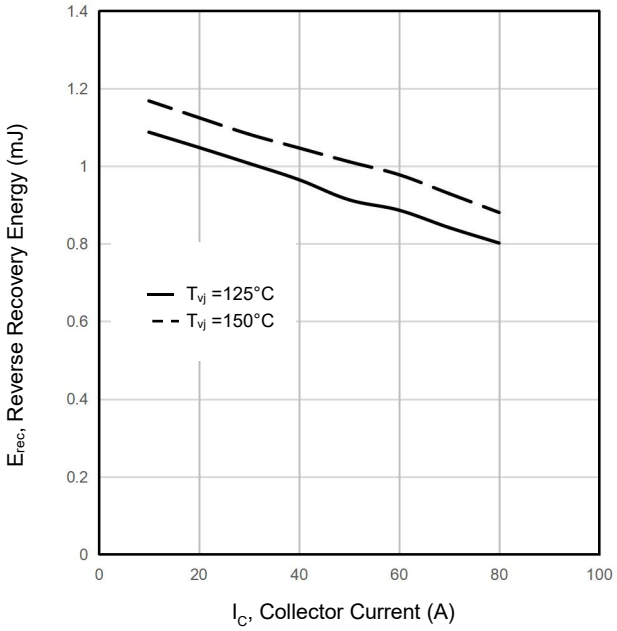


Figure 13.Reverse Recovery Energy Loss vs. R_G

V_{CE}=600V,R_G=10Ω

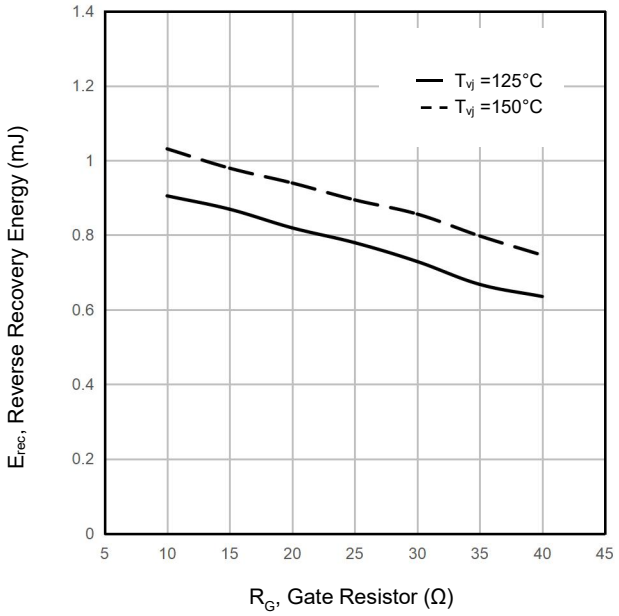


Figure 14.Diode Forward Characteristics

f=100KHz,V_{GE}=0V,T_{vj}= 25℃

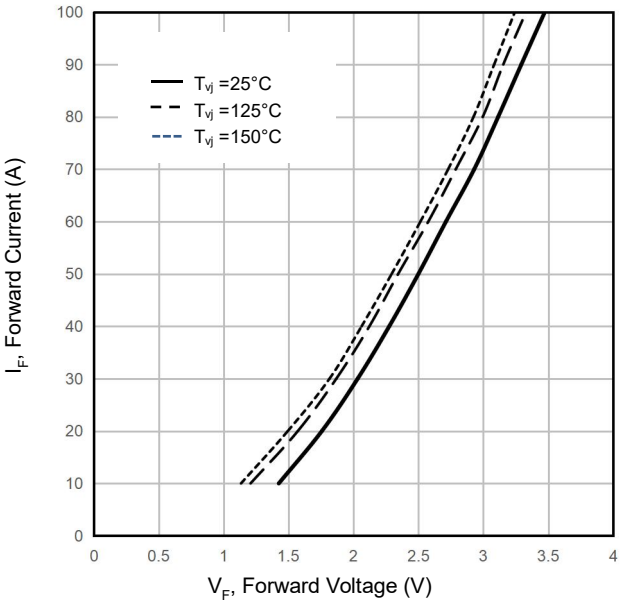


Figure 15.Diode Transient Thermal Impedance

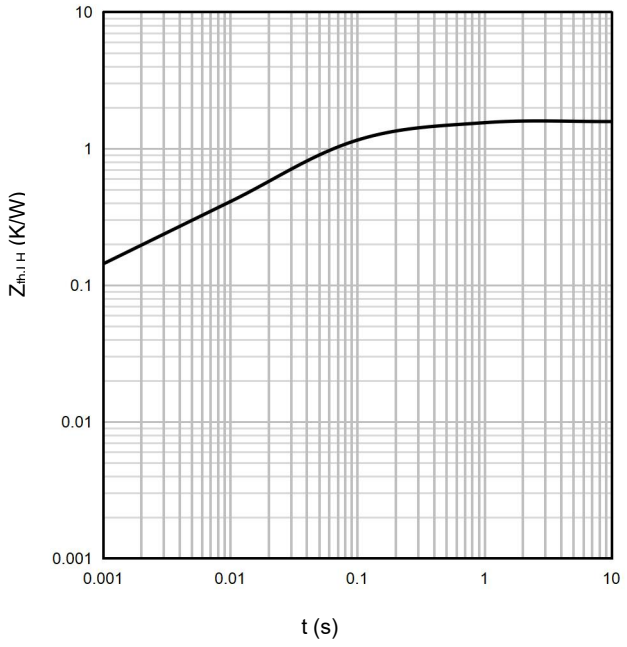
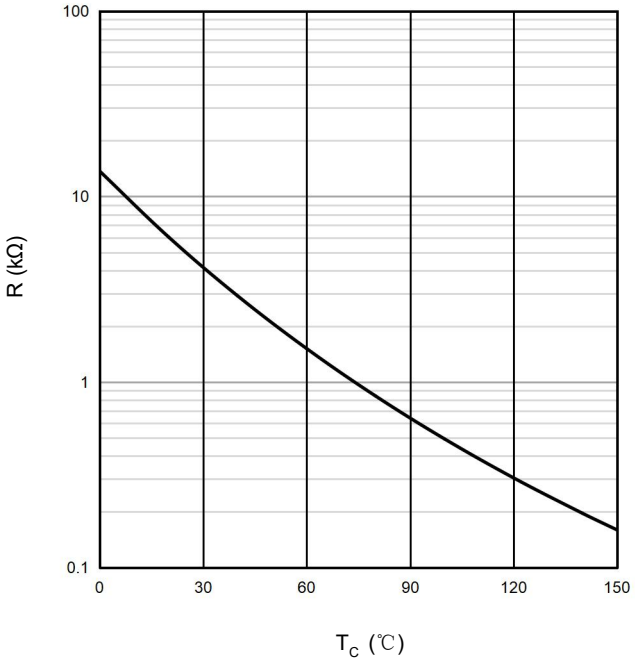
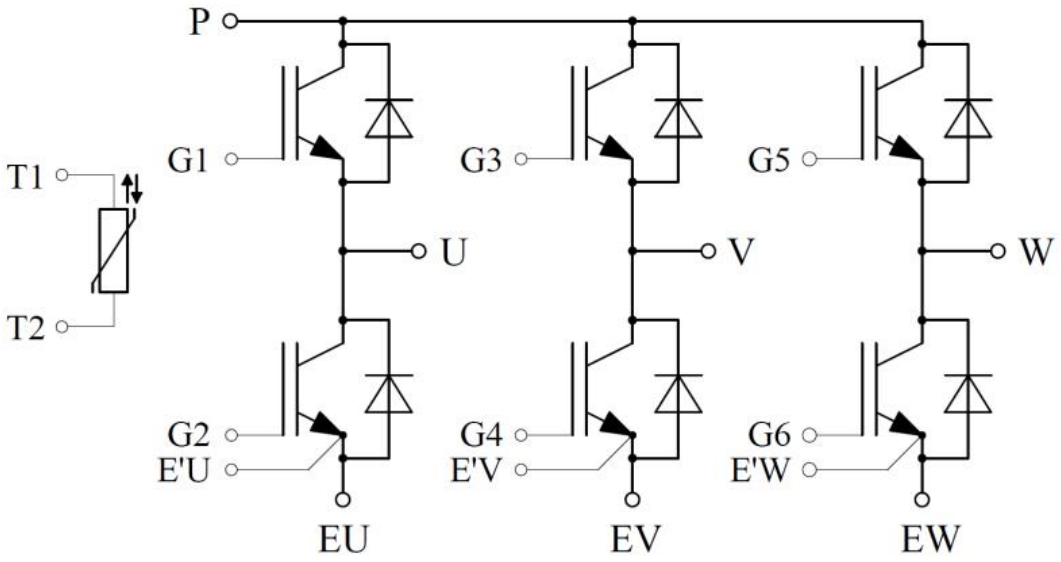


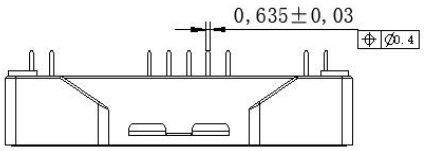
Figure 16.NTC Temperature Characteristic



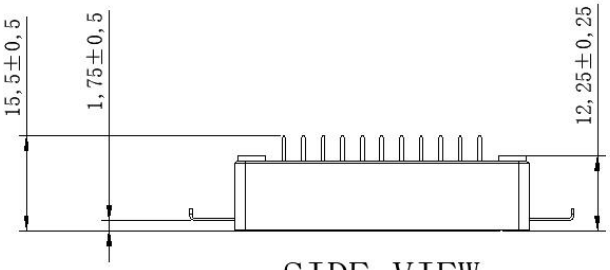
CIRCUIT DIAGRAM



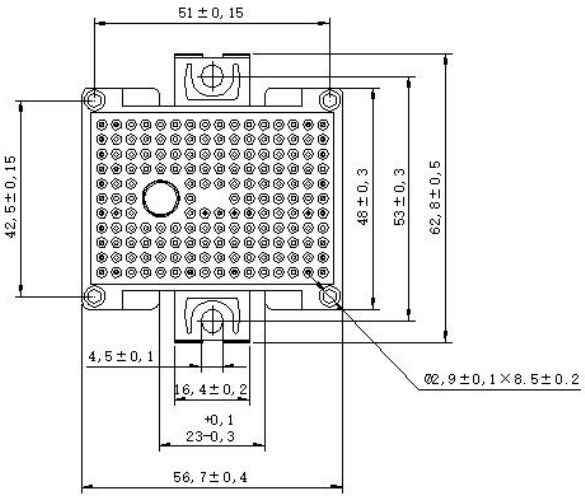
PACKAGE DIMENSION



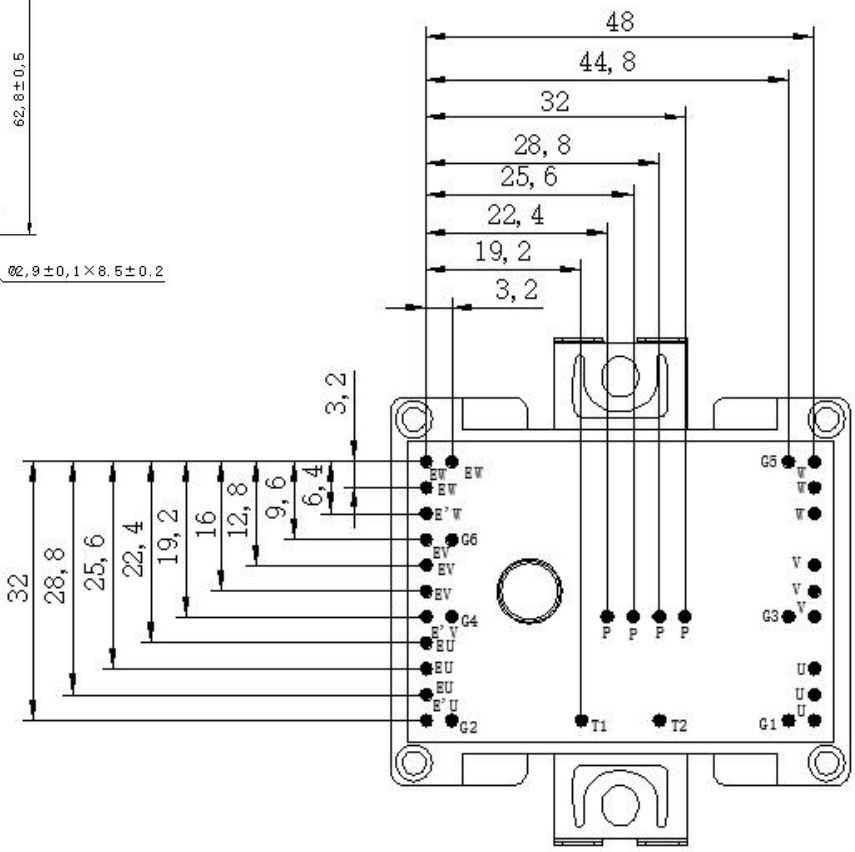
SIDE VIEW



SIDE VIEW



TOP VIEW



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