

IGBT Modules



V_{CES} 1200V
 I_C 50A

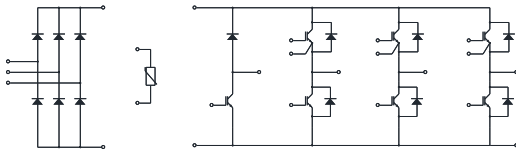
Applications

- Motor Drivers
- AC and DC servo drive amplifier
- UPS (Uninterruptible Power Supplies)

Features

- Low switching losses
- Low $V_{CE(sat)}$ with positive temperature coefficient
- Including fast & soft recovery anti-parallel FWD
- Low inductance case
- High short circuit capability(10us)
- Maximum junction temperature 175°C

Circuit



● IGBT- inverter

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Collector-Emitter Voltage	V_{CES}	$V_{GE}=0V, I_C=1mA, T_{vj}=25^{\circ}C$	1200	V
Continuous Collector Current	I_C	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	50	A
Repetitive Peak Collector Current	I_{CRM}	$t_p=1ms$	100	A
Gate-Emitter Voltage	V_{GES}	$T_{vj}=25^{\circ}C$	± 20	V
Total Power Dissipation	P_{tot}	$T_C=25^{\circ}C$ $T_{vjmax}=175^{\circ}C$	288	W



● IGBT- inverter
Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$, $I_C=1.7mA$, $T_{vj}=25^{\circ}C$	5.2	5.8	6.4	V
Collector-Emitter Cut-off Current	I_{CES}	$V_{CE}=1200V$, $V_{GE}=0V$, $T_{vj}=25^{\circ}C$			1.0	mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=50A$, $V_{GE}=15V$, $T_{vj}=25^{\circ}C$		1.90		V
		$I_C=50A$, $V_{GE}=15V$, $T_{vj}=125^{\circ}C$		2.20		
		$I_C=50A$, $V_{GE}=15V$, $T_{vj}=150^{\circ}C$		2.32		
Gate Charge	Q_G			0.35		uC
Input Capacitance	C_{ies}	$V_{CE}=25V$, $V_{GE}=0V$, $f=1MHz$, $T_{vj}=25^{\circ}C$		2.60		nF
Reverse Transfer Capacitance	C_{res}			0.10		nF
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0V$, $V_{GE}=20V$, $T_{vj}=25^{\circ}C$			400	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C=50A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=20\Omega$ $T_{vj}=25^{\circ}C$		41		ns
Rise Time	t_r			48		ns
Turn-off Delay Time	$t_{d(off)}$			160		ns
Fall Time	t_f			244		ns
Energy Dissipation During Turn-on Time	E_{on}			5.92		mJ
Energy Dissipation During Turn-off Time	E_{off}			3.39		mJ
Turn-on Delay Time	$t_{d(on)}$	$I_C=50A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=20\Omega$ $T_{vj}=150^{\circ}C$		45		ns
Rise Time	t_r			50		ns
Turn-off Delay Time	$t_{d(off)}$			169		ns
Fall Time	t_f			302		ns
Energy Dissipation During Turn-on Time	E_{on}			6.87		mJ
Energy Dissipation During Turn-off Time	E_{off}			3.73		mJ
SC Data	I_{sc}	$t_p \leq 10\mu s$, $V_{GE}=15V$, $T_{vj}=150^{\circ}C$, $V_{CC}=900V$, $V_{CEM} \leq 1200V$		200		A



● Diode-inverter

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	$T_{vj}=25^{\circ}\text{C}$	1200	V
Continuous DC Forward Current	I_F		50	A
Repetitive Peak Forward Current	I_{FRM}	$t_p=1\text{ms}$	100	A
I^2t -value	I^2t	$V_R=0\text{V}, t_p=10\text{ms}, T_{vj}=125^{\circ}\text{C}$	560	A^2s
		$V_R=0\text{V}, t_p=10\text{ms}, T_{vj}=150^{\circ}\text{C}$	480	

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	$I_F=50\text{A}, T_{vj}=25^{\circ}\text{C}$		1.85		V
		$I_F=50\text{A}, T_{vj}=125^{\circ}\text{C}$		1.70		
		$I_F=50\text{A}, T_{vj}=150^{\circ}\text{C}$		1.62		
Recovered Charge	Q_{rr}	$I_F=50\text{A}$		4.39		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{V}$ $-di_F/dt = 1000\text{A}/\mu\text{s}$		31		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=25^{\circ}\text{C}$		1.35		mJ
Recovered Charge	Q_{rr}	$I_F=50\text{A}$		6.65		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{V}$ $-di_F/dt = 1000\text{A}/\mu\text{s}$		33		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=150^{\circ}\text{C}$		2.10		mJ



● IGBT-brake-chopper

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Collector-Emitter Voltage	V_{CES}	$V_{GE}=0V, I_C=1mA, T_{vj}=25^{\circ}C$	1200	V
Continuous Collector Current	I_C	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	35	A
Repetitive Peak Collector Current	I_{CRM}	$t_p=1ms$	70	A
Gate-Emitter Voltage	V_{GES}	$T_{vj}=25^{\circ}C$	± 20	V
Total Power Dissipation	P_{tot}	$T_C=25^{\circ}C$ $T_{vjmax}=175^{\circ}C$	227	W

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.4mA, T_{vj}=25^{\circ}C$	5.2	5.8	6.4	V
Collector-Emitter Cut-off Current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$			1.0	mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=35A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.95		V
		$I_C=35A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15		
		$I_C=35A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.25		
Gate Charge	Q_G			0.27		uC
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V,$ $f=1MHz, T_{vj}=25^{\circ}C$		2.00		nF
Reverse Transfer Capacitance	C_{res}			0.07		nF
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C=35A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=27\Omega$ $T_{vj}=25^{\circ}C$		30		ns
Rise Time	t_r			40		ns
Turn-off Delay Time	$t_{d(off)}$			151		ns
Fall Time	t_f			257		ns
Energy Dissipation During Turn-on Time	E_{on}			3.50		mJ
Energy Dissipation During Turn-off Time	E_{off}			2.43		mJ



Turn-on Delay Time	$t_{d(on)}$	$I_C=35A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=27\Omega$ $T_{vj}=150^\circ C$		33		ns
Rise Time	t_r			44		ns
Turn-off Delay Time	$t_{d(off)}$			158		ns
Fall Time	t_f			274		ns
Energy Dissipation During Turn-on Time	E_{on}			4.13		mJ
Energy Dissipation During Turn-off Time	E_{off}			2.75		mJ
SC Data	I_{sc}	$t_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^\circ C,$ $V_{CC}=900V, V_{CEM} \leq 1200V$		150		A

● Diode-Brake-Chopper

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	$T_{vj}=25^\circ C$	1200	V
Continuous DC Forward Current	I_F		15	A
Repetitive Peak Forward Current	I_{FRM}	$t_p=1ms$	30	A
I^2t -value	I^2t	$V_R=0V, t_p=10ms, T_{vj}=125^\circ C$	16.0	A^2s
		$V_R=0V, t_p=10ms, T_{vj}=150^\circ C$	14.0	

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	$I_F=15A, T_{vj}=25^\circ C$		2.00		V
		$I_F=15A, T_{vj}=125^\circ C$		1.80		
		$I_F=15A, T_{vj}=150^\circ C$		1.70		
Recovered Charge	Q_{rr}	$I_F=15A$		1.20		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600V$ $-di_F/dt = 550A/\mu s$		10		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=25^\circ C$		0.35		mJ
Recovered Charge	Q_{rr}	$I_F=15A$		1.60		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600V$ $-di_F/dt = 550A/\mu s$		15		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=150^\circ C$		1.20		mJ



● Diode-Rectifier

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	$T_{vj}=25^{\circ}\text{C}$	1600	V
Average output Current 50/60Hz, sine wave	$I_{F(AV)}$	$T_C=100^{\circ}\text{C}$	65	A
Maximum RMS Current at Rectifier Output	I_{RMSM}	$T_C=100^{\circ}\text{C}$	110	A
Surge Forward Current	I_{FSM}	$V_R=0V, t_p=10\text{ms}, T_{vj}=45^{\circ}\text{C}$	850	A
I^2t -value	I^2t	$V_R=0V, t_p=10\text{ms}, T_{vj}=45^{\circ}\text{C}$	3610	A^2s

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_F	$I_F=50\text{A}, T_{vj}=125^{\circ}\text{C}$		1.0		V
Reverse Current	I_R	$T_{vj}=125^{\circ}\text{C}, V_R=1600\text{V}$			1.5	mA

● NTC-Thermistor

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Rated Resistance	R_{25}			5.0		k Ω
Deviation of R_{100}	$\Delta R/R$	$T_C=100, R_{100}=493.3\Omega$	-5		5	%
Power Dissipation	P_{25}				20.0	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K



● **Module Characteristics** $T_C=25^{\circ}\text{C}$ unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Isolation voltage	V_{isol}	$t=1\text{min}, f=50\text{Hz}$	2500			V
Maximum Junction Temperature	T_{jmax}				175	$^{\circ}\text{C}$
Operating Junction Temperature	$T_{\text{vj op}}$		-40		150	$^{\circ}\text{C}$
Storage Temperature	T_{stg}		-40		125	$^{\circ}\text{C}$
Stray-inductance-module	L_{SCE}			60		nH
Module lead resistance, terminals-chip	$R_{\text{CC}'+\text{EE}'}$	$T_C=25^{\circ}\text{C}$, per switch		4.0		m Ω
	$R_{\text{AA}'+\text{CC}'}$			3.0		
Thermal Resistance Junction to Case	$R_{\theta\text{JC}}$	per IGBT-inverter		0.52		K/W
		per Diode-inverter		0.81		
		per IGBT-brake-chopper		0.66		
		per Diode-chopper		1.50		
		per Diode-rectifier		0.64		
Thermal Resistance Case to Sink	$R_{\theta\text{CS}}$	per IGBT-inverter		0.29		K/W
		per Diode-inverter		0.44		
		per IGBT-brake-chopper		0.32		
		per Diode-chopper		0.33		
		per Diode-rectifier		0.70		
		per Module		0.009		
Module-to-Sink Torque	M_s		3.0		6.0	N·m
Weight of Module	G			300		g

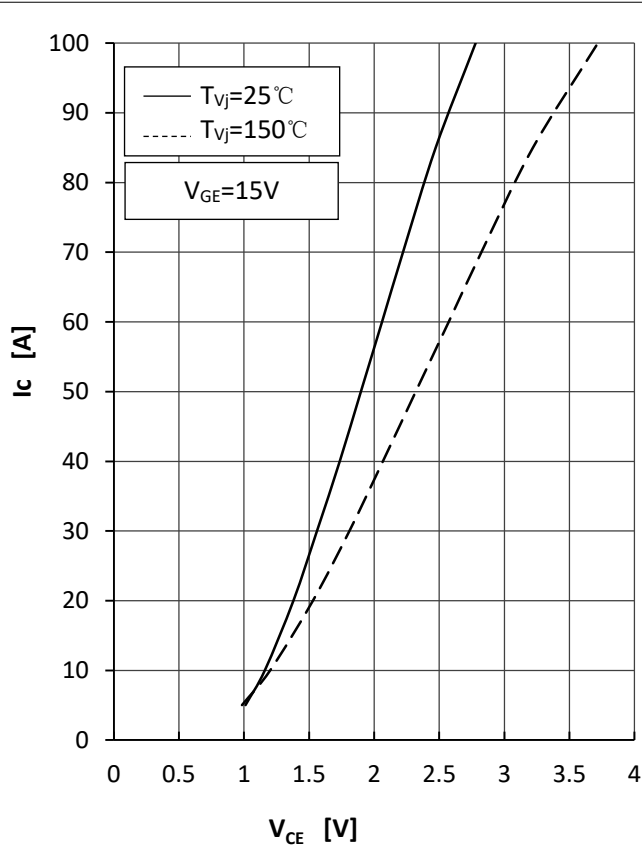


Fig1.IGBT Output Characteristics

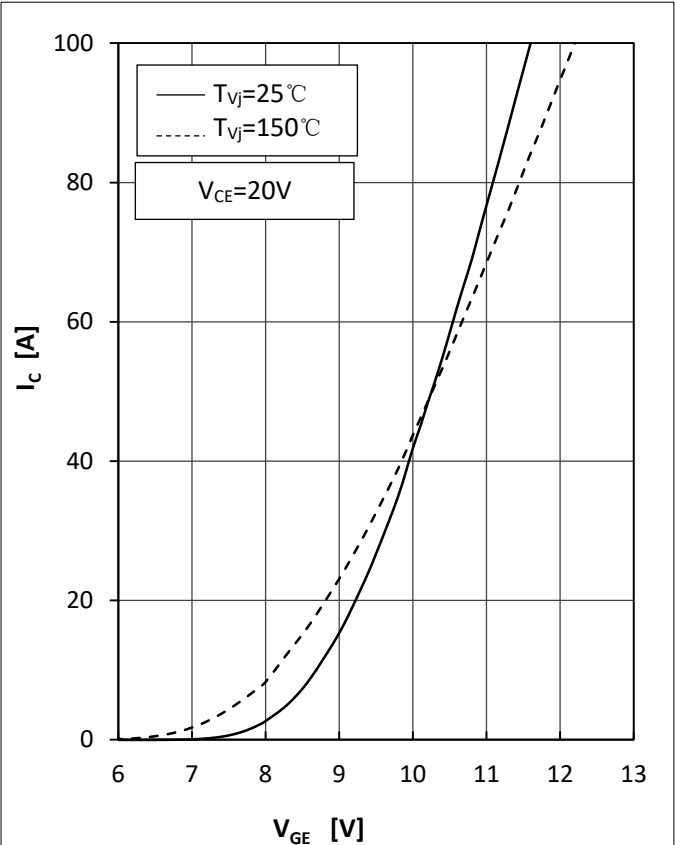


Fig2.IGBT Transfer Characteristics

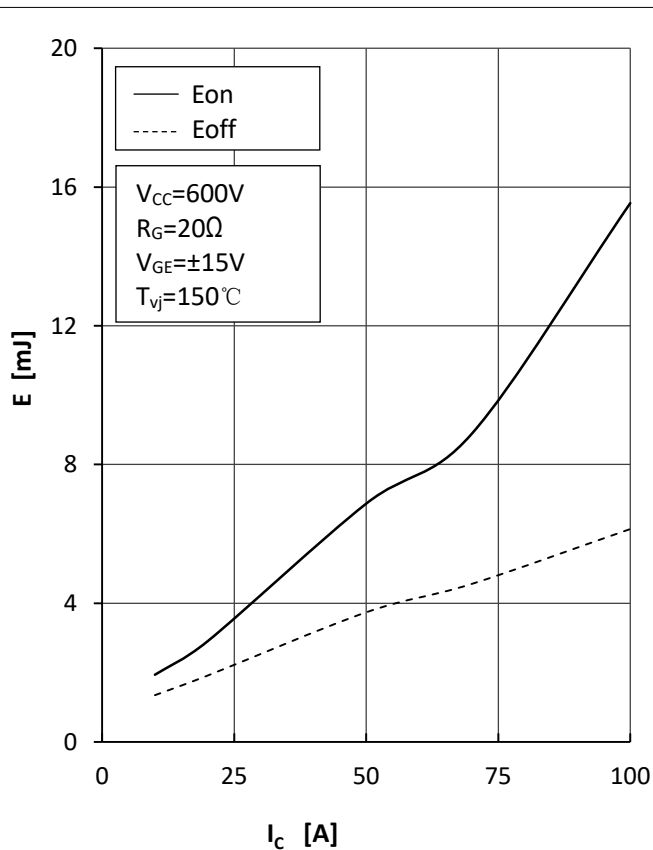


Fig3.IGBT Switching Loss vs. I_c

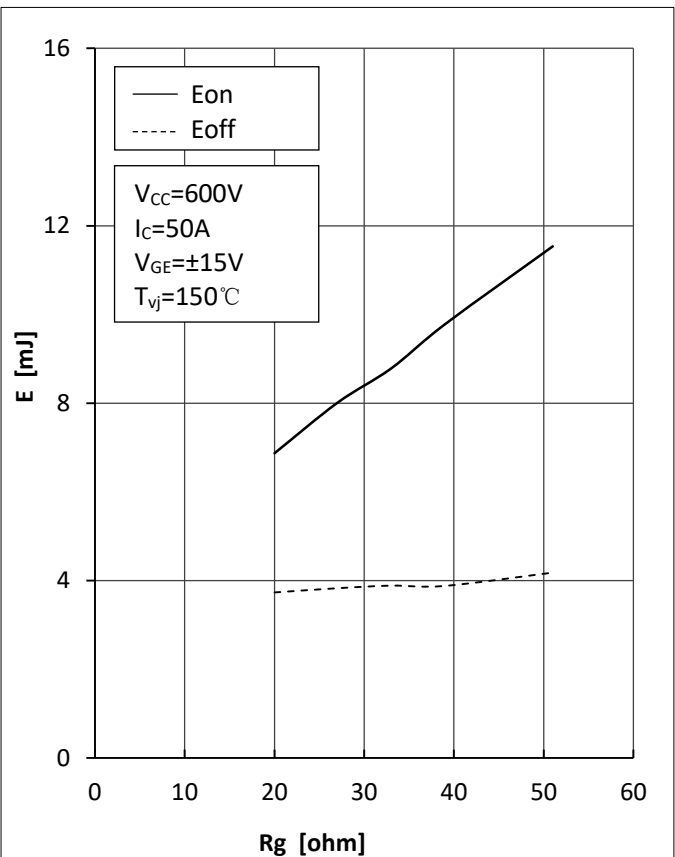
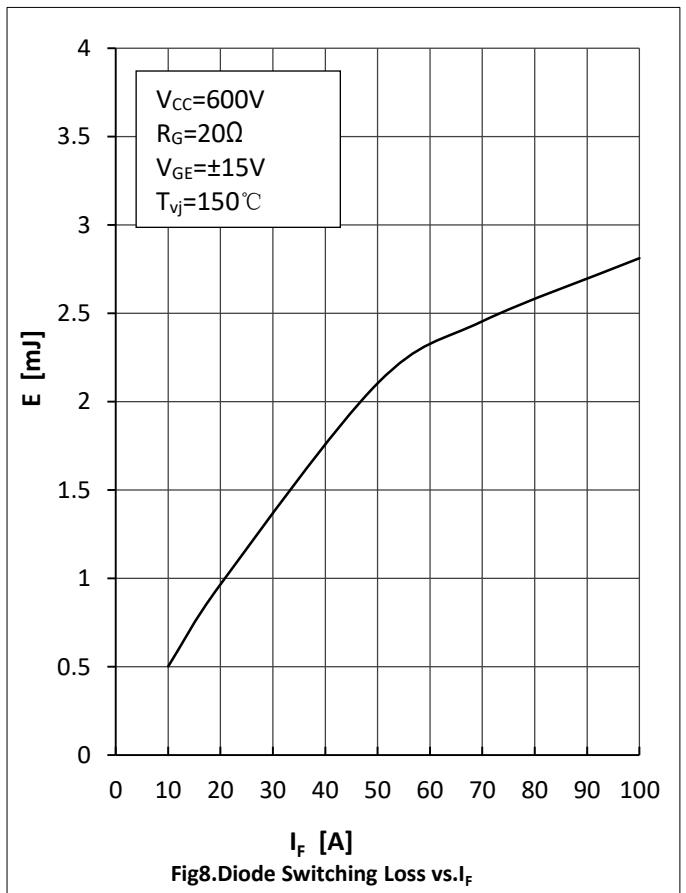
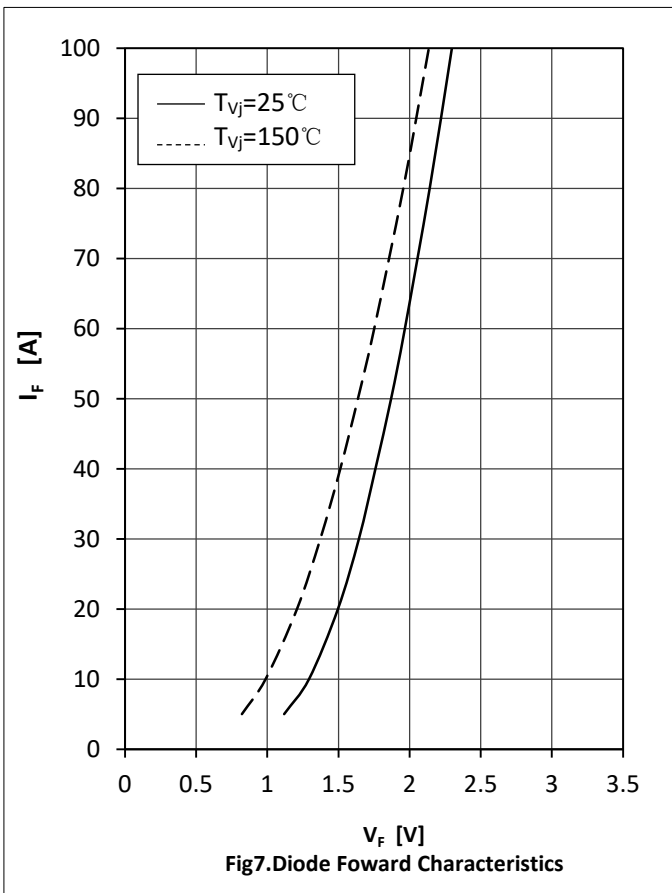
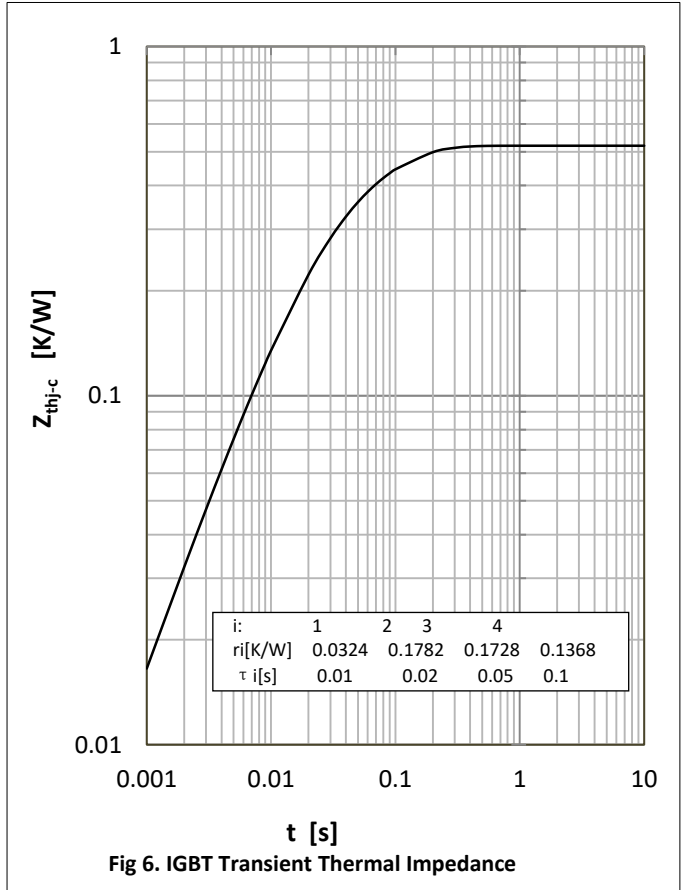
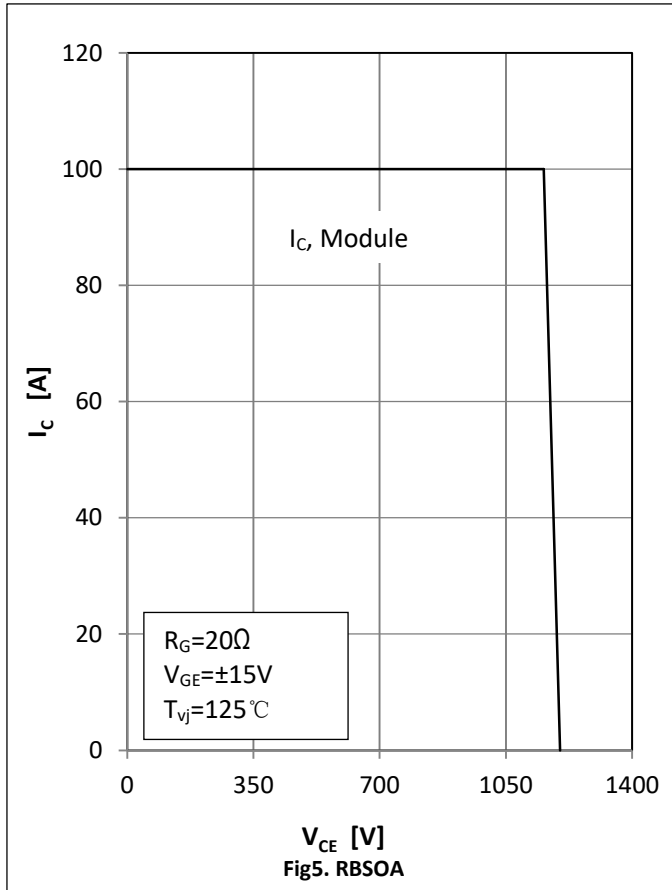
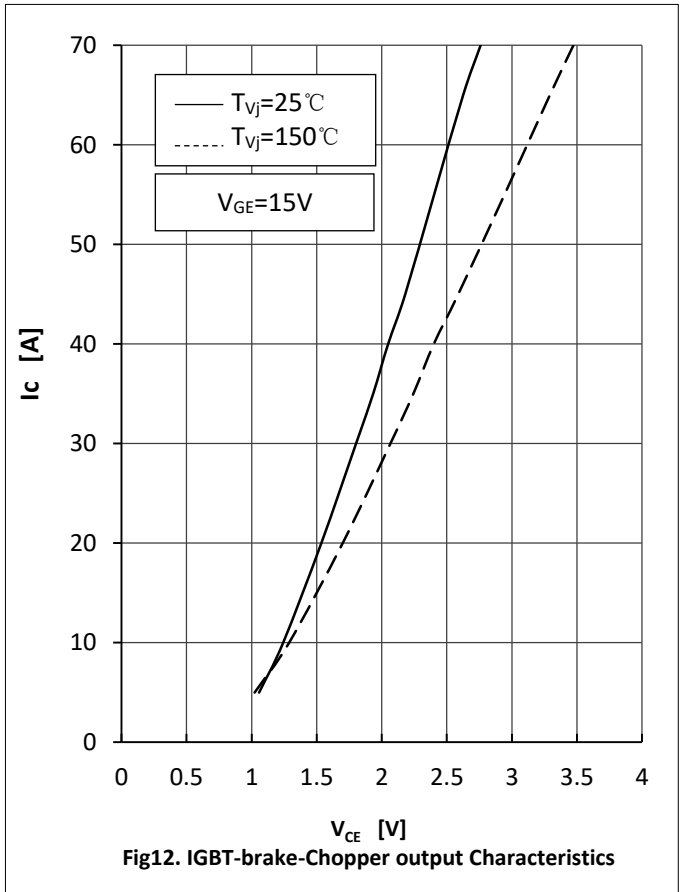
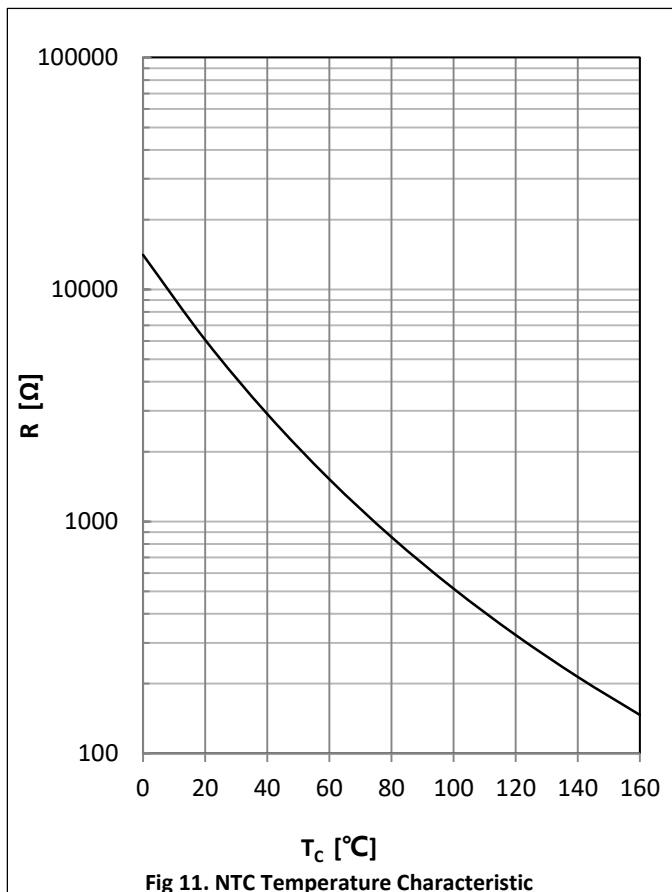
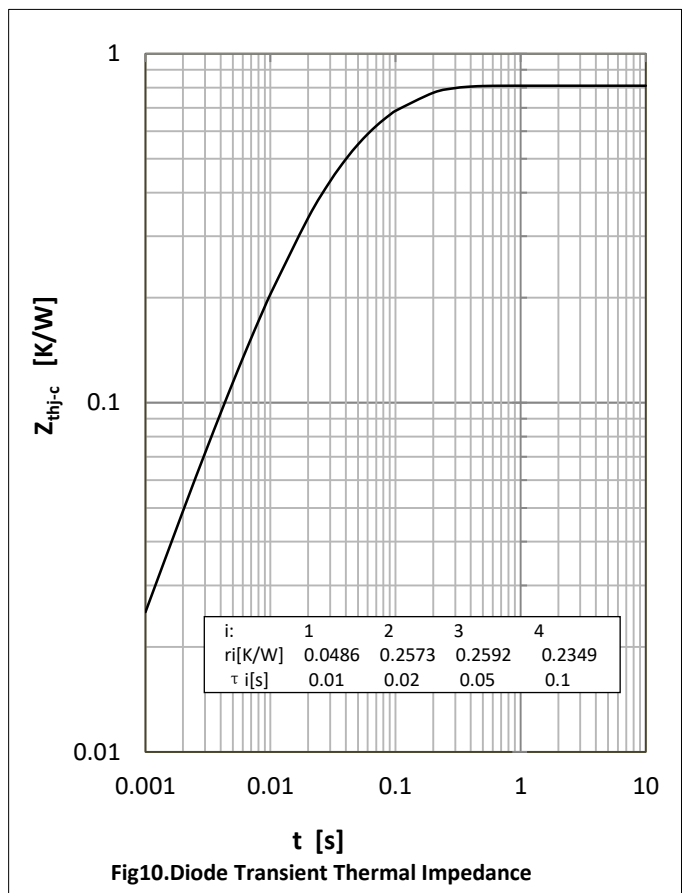
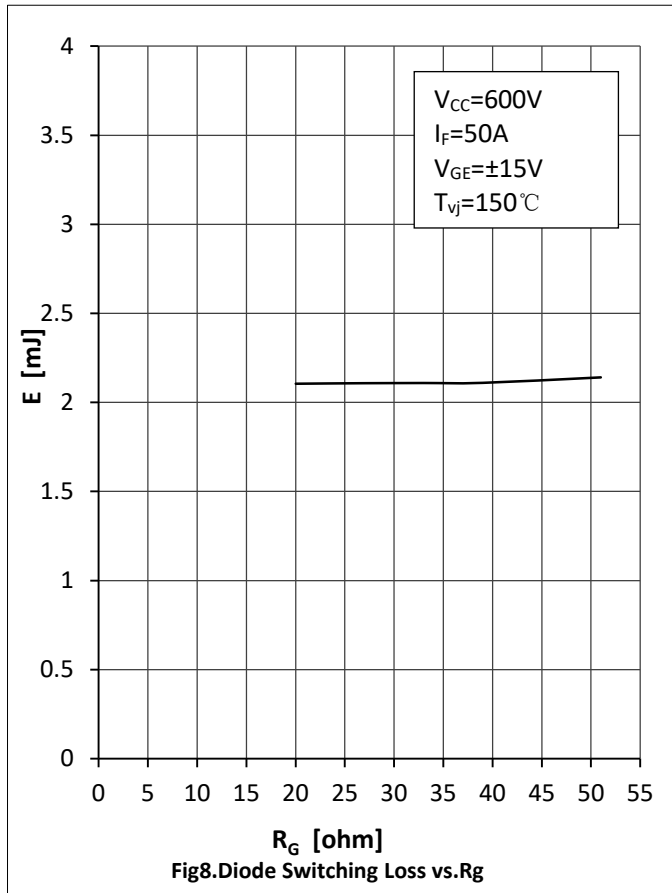


Fig4.IGBT Switching Loss vs. R_g





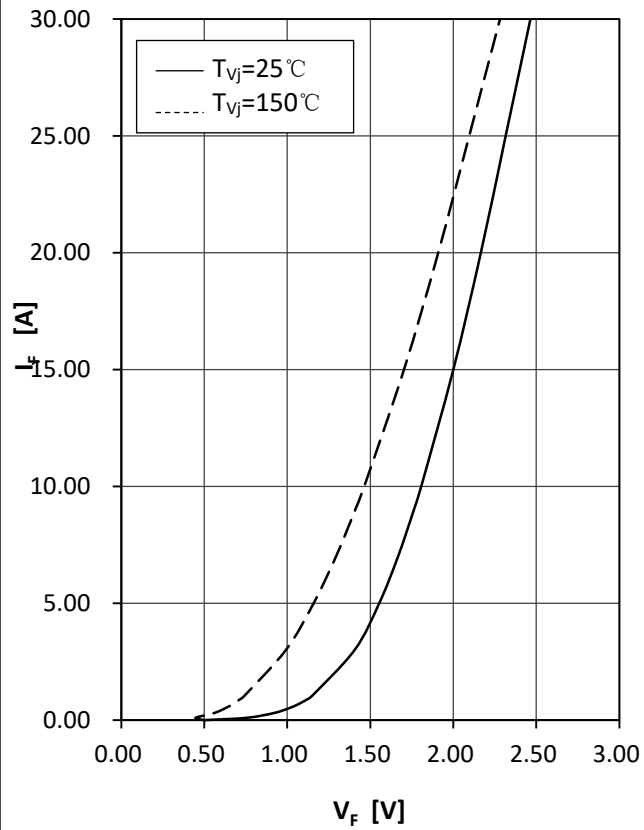
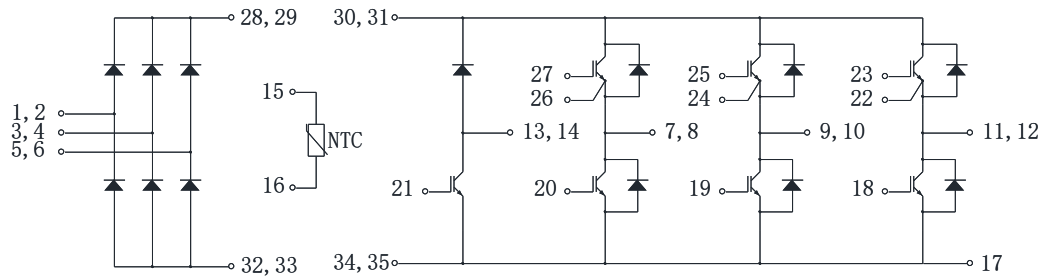
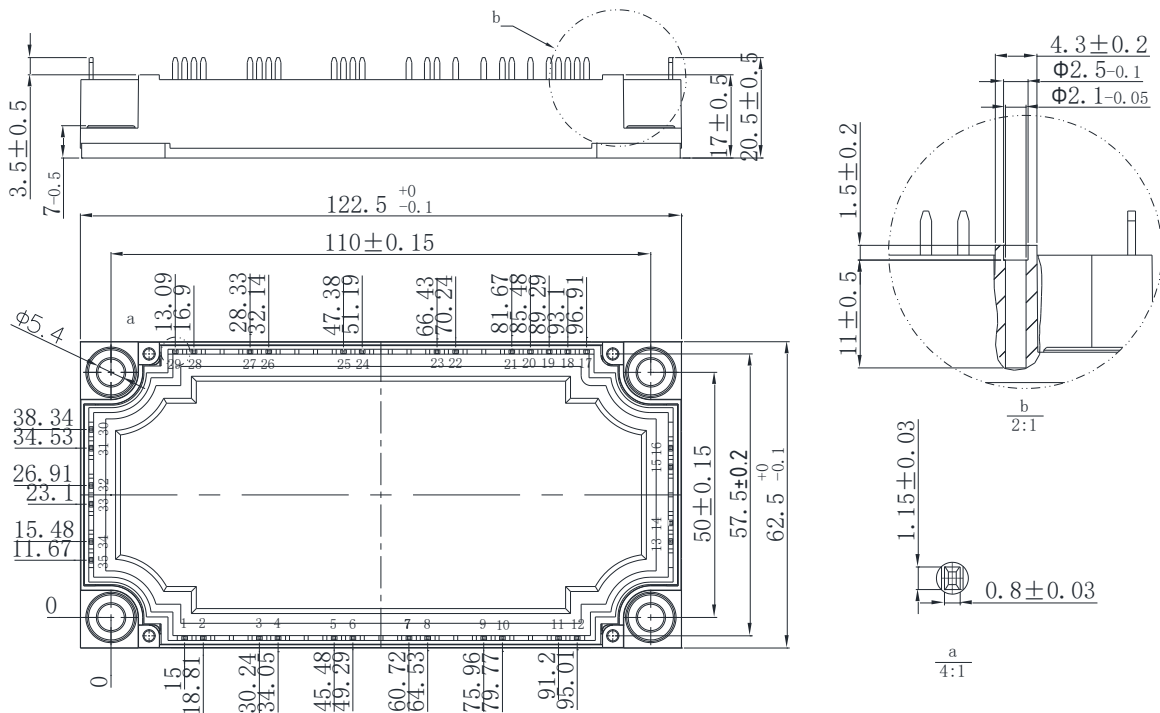


Fig13.Diode-brake-chopper Forward Characteristics

- **Circuit Diagram**



● Package Outline Information





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IGBTs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.

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