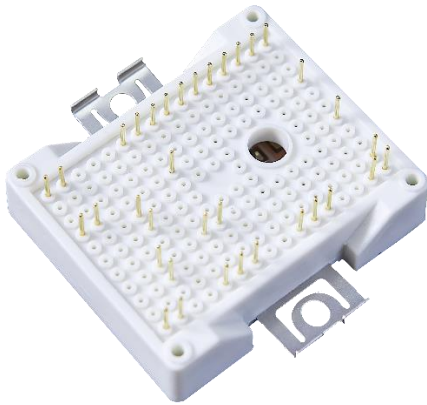


IGBT Modules

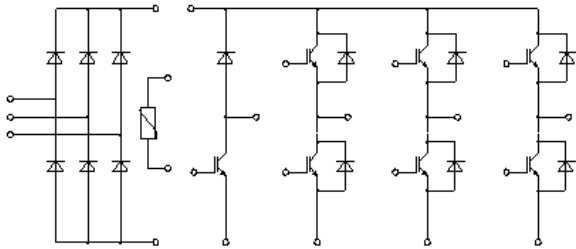


V_{CES}	1200V
I_c	25A

Applications

- Motor Drivers
- AC and DC Servo Drive Amplifier
- UPS (Uninterruptible Power Supplies)

Circuit



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)
- Isolated heatsink using DBC technology
- Maximum junction temperature 175°C

● 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	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	25	A
Repetitive Peak Collector Current	I_{CRM}	$t_p=1ms$	50	A
Gate-Emitter Voltage	V_{GES}	$T_{vj}=25^{\circ}C$	± 20	V
Total Power Dissipation	P_{tot}	$T_C=25^{\circ}C$ $T_{vjmax}=175^{\circ}C$	175	W



● IGBT- inverter

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.2mA, T_{vj}=25^{\circ}C$	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	$V_{CE(sat)}$	$I_C=25A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.85	2.25	V
		$I_C=25A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15		
		$I_C=25A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.25		
Gate Charge	Q_G			0.20		uC
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V,$ $f=1MHz, T_{vj}=25^{\circ}C$		1.90		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	$t_{d(on)}$	$I_C=25A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=20\Omega$ $T_{vj}=25^{\circ}C$		26		ns
Rise Time	t_r			17		ns
Turn-off Delay Time	$t_{d(off)}$			194		ns
Fall Time	t_f			181		ns
Energy Dissipation During Turn-on Time	E_{on}			1.62		mJ
Energy Dissipation During Turn-off Time	E_{off}			1.44		mJ
Turn-on Delay Time	$t_{d(on)}$	$I_C=25A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=20\Omega$ $T_{vj}=125^{\circ}C$		28		ns
Rise Time	t_r			21		ns
Turn-off Delay Time	$t_{d(off)}$			284		ns
Fall Time	t_f			212		ns
Energy Dissipation During Turn-on Time	E_{on}			2.4		mJ
Energy Dissipation During Turn-off Time	E_{off}			2.18		mJ
SC Data	I_{SC}	$t_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C,$ $V_{CC}=900V, V_{CEM} \leq 1200V$		120		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		25	A
Repetitive Peak Forward Current	I_{FRM}	$t_p=1\text{ms}$	50	A
I^2t -value	I^2t	$V_R=0\text{V}, t_p=10\text{ms}, T_{vj}=125^{\circ}\text{C}$	90	A^2s
		$V_R=0\text{V}, t_p=10\text{ms}, T_{vj}=150^{\circ}\text{C}$	75	

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	$I_F=25\text{A}, T_{vj}=25^{\circ}\text{C}$		2.01	2.50	V
		$I_F=25\text{A}, T_{vj}=125^{\circ}\text{C}$		1.72		
		$I_F=25\text{A}, T_{vj}=150^{\circ}\text{C}$		1.67		
Recovered Charge	Q_{rr}	$I_F=25\text{A}$		2.52		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{V}$ $-di_F/dt=1700\text{A}/\mu\text{s}$		28.5		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=25^{\circ}\text{C}$		0.94		mJ
Recovered Charge	Q_{rr}	$I_F=25\text{A}$		5.08		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{V}$ $-di_F/dt=1700\text{A}/\mu\text{s}$		30.5		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=125^{\circ}\text{C}$		1.75		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	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	25	A
Repetitive Peak Collector Current	I_{CRM}	$t_p=1ms$	50	A
Gate-Emitter Voltage	V_{GES}	$T_{vj}=25^{\circ}C$	± 20	V
Total Power Dissipation	P_{tot}	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	175	W

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.2mA, T_{vj}=25^{\circ}C$	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	$V_{CE(sat)}$	$I_C=25A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.85	2.25	V
		$I_C=25A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15		
		$I_C=25A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.25		
Gate Charge	Q_G			0.20		uC
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$		1.90		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	$t_{d(on)}$	$I_C=25A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=20\Omega$ $T_{vj}=25^{\circ}C$		26		ns
Rise Time	t_r			17		ns
Turn-off Delay Time	$t_{d(off)}$			194		ns
Fall Time	t_f			181		ns
Energy Dissipation During Turn-on Time	E_{on}			1.62		mJ
Energy Dissipation During Turn-off Time	E_{off}			1.44		mJ



Turn-on Delay Time	$t_{d(on)}$	$I_C=25\text{ A}$ $V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ $R_G=20\Omega$ $T_{vj}=125^\circ\text{C}$		28		ns
Rise Time	t_r			21		ns
Turn-off Delay Time	$t_{d(off)}$			284		ns
Fall Time	t_f			212		ns
Energy Dissipation During Turn-on Time	E_{on}			2.4		mJ
Energy Dissipation During Turn-off Time	E_{off}			2.18		mJ
SC Data	I_{SC}	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{ V}, T_{vj}=150^\circ\text{C},$ $V_{CC}=900\text{ V}, V_{CEM} \leq 1200\text{ V}$		120		A

● Diode-brake-chopper

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		15	A
Repetitive Peak Forward Current	I_{FRM}	$t_p=1\text{ ms}$	30	A
I^2t -value	I^2t	$V_R=0\text{ V}, t_p=10\text{ ms}, T_{vj}=125^\circ\text{C}$	16	A^2s
		$V_R=0\text{ V}, t_p=10\text{ ms}, T_{vj}=150^\circ\text{C}$	14	

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	$I_F=15\text{ A}, T_{vj}=25^\circ\text{C}$		2.00	2.65	V
		$I_F=15\text{ A}, T_{vj}=125^\circ\text{C}$		1.74		
		$I_F=15\text{ A}, T_{vj}=150^\circ\text{C}$		1.70		
Recovered Charge	Q_{rr}	$I_F=15\text{ A}$		1.20		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{ V}$ $-di_F/dt=600\text{ A}/\mu\text{s}$		13.0		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=25^\circ\text{C}$		0.37		mJ
Recovered Charge	Q_{rr}	$I_F=15\text{ A}$		2.05		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{ V}$ $-di_F/dt=600\text{ A}/\mu\text{s}$		12.0		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=125^\circ\text{C}$		0.68		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	$I_{F(AV)}$	$T_C=100^{\circ}\text{C}$	35	A
Maximum RMS Current at Rectifier Output	I_{RMSM}	$T_C=100^{\circ}\text{C}$	60	A
Surge Forward Current	I_{FSM}	$V_R=0V, t_p=10\text{ms}, T_{vj}=45^{\circ}\text{C}$	320	A
I^2t -value	I^2t	$V_R=0V, t_p=10\text{ms}, T_{vj}=45^{\circ}\text{C}$	510	A^2s

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_F	$I_F=10\text{A}, T_{vj}=150^{\circ}\text{C}$		1.02		V
Reverse Current	I_R	$T_{vj}=150^{\circ}\text{C}, V_R=1600\text{V}$			2	mA

● NTC-Thermistor

Characteristic Values

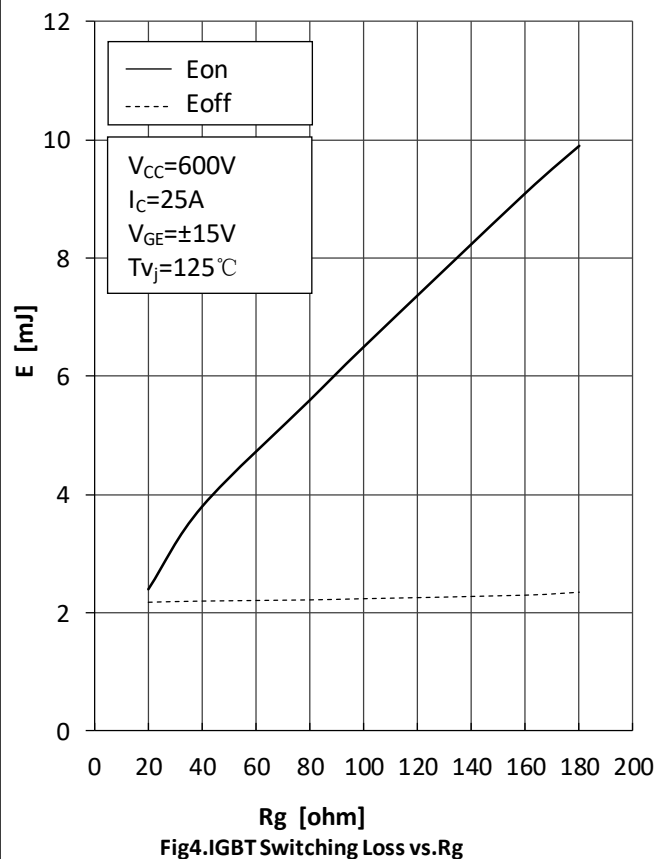
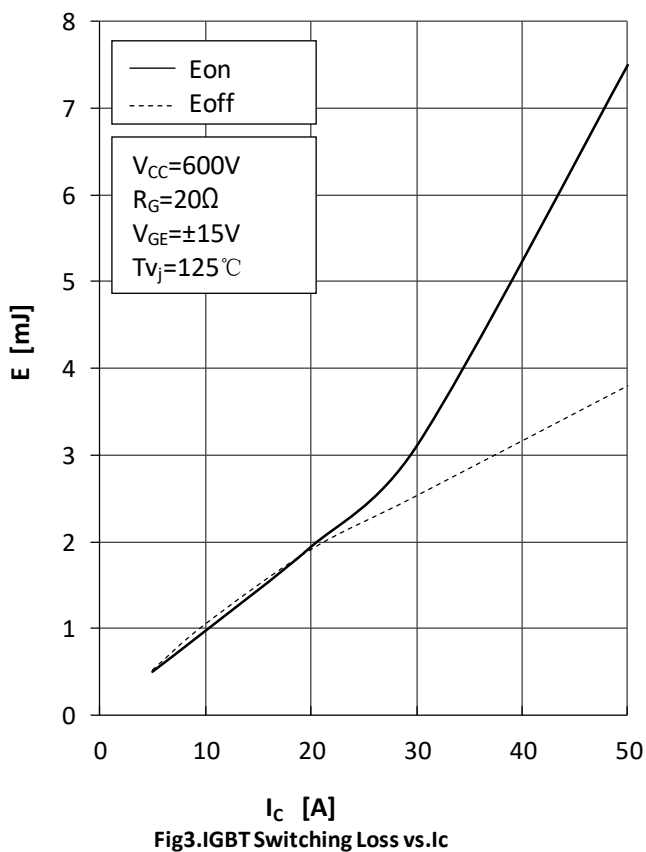
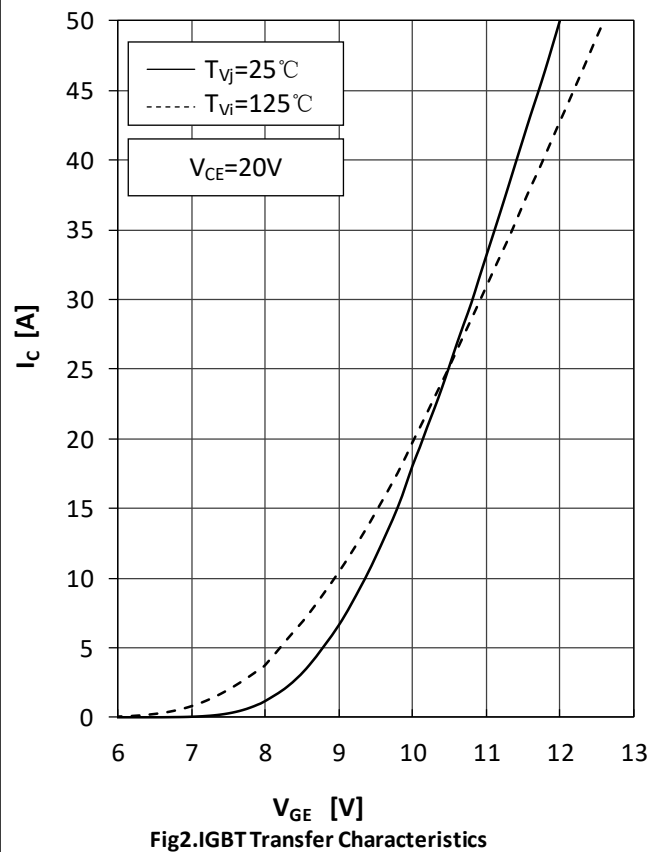
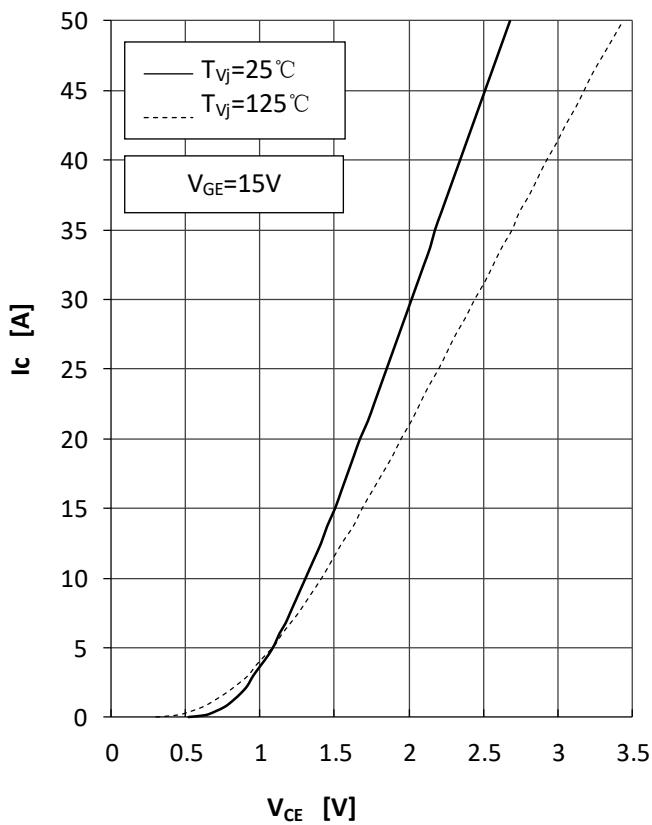
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Rated Resistance	R_{25}			5.0		$\text{k}\Omega$
Deviation of R_{100}	$\Delta R/R$	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-5		5	%
Power Dissipation	P_{25}				20.0	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$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

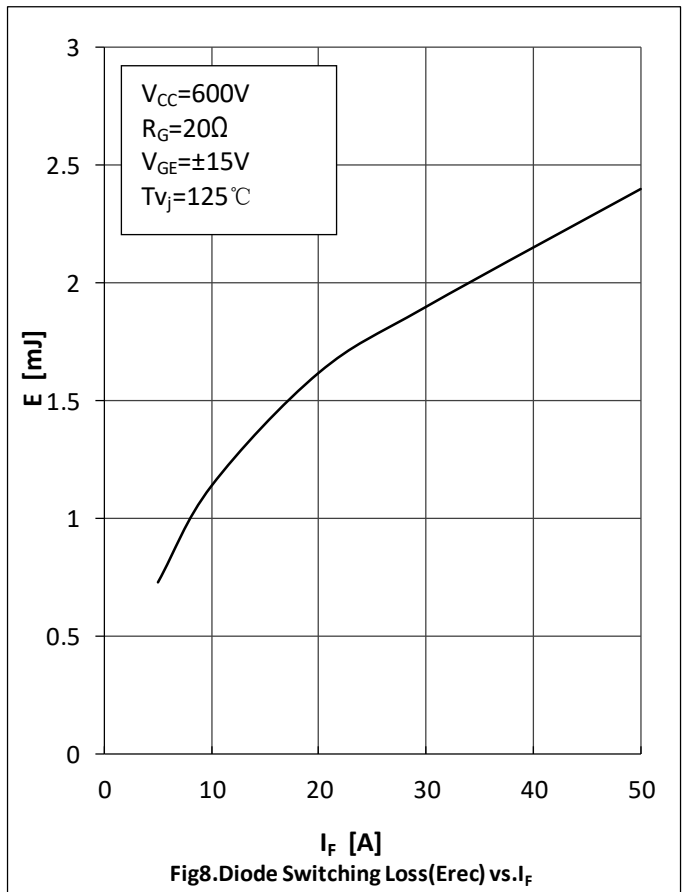
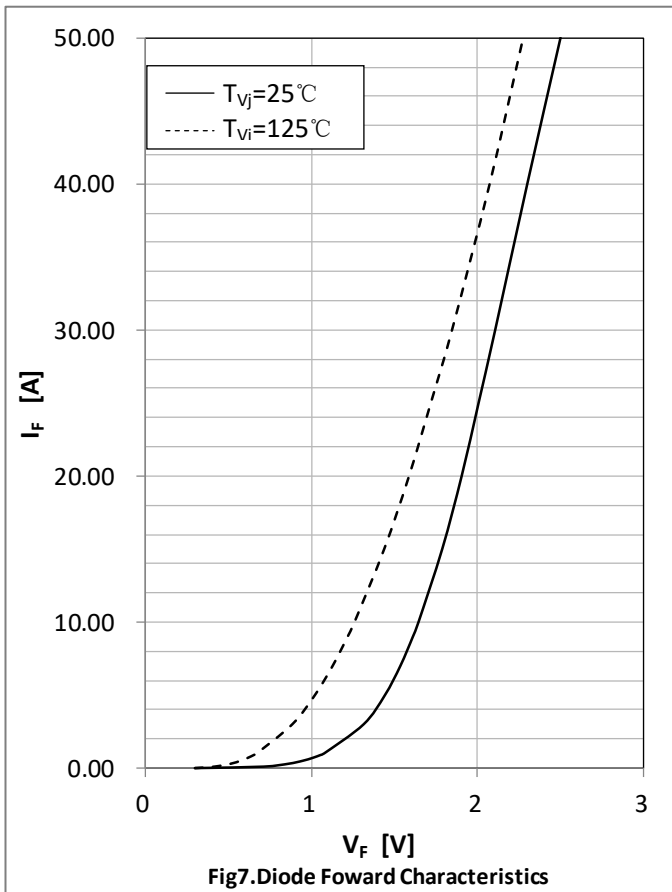
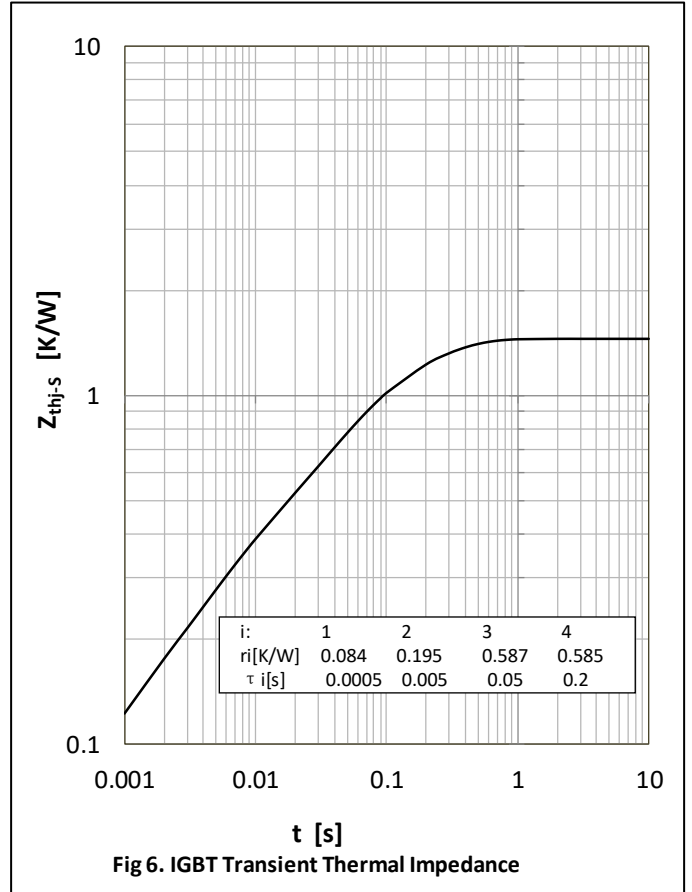
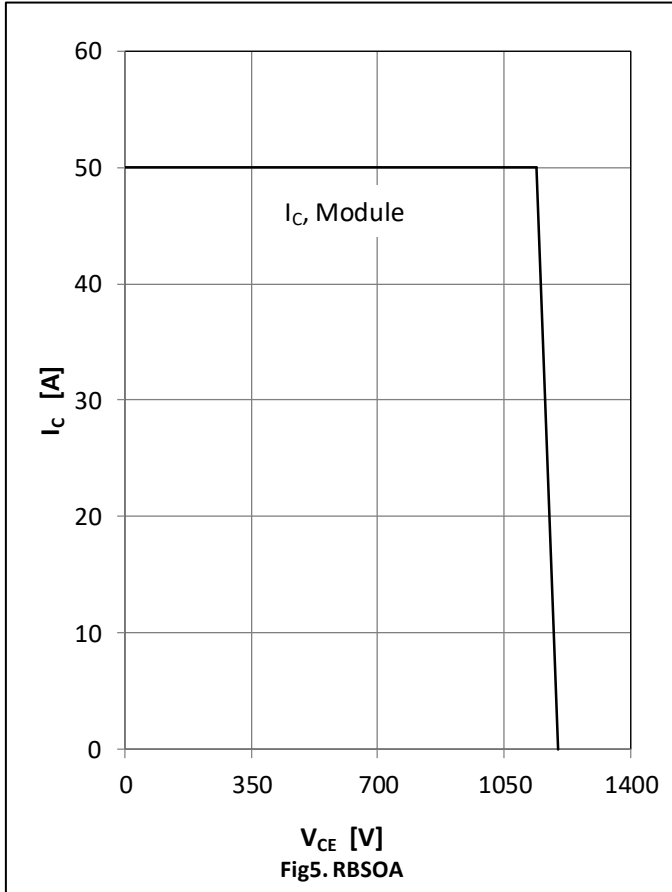


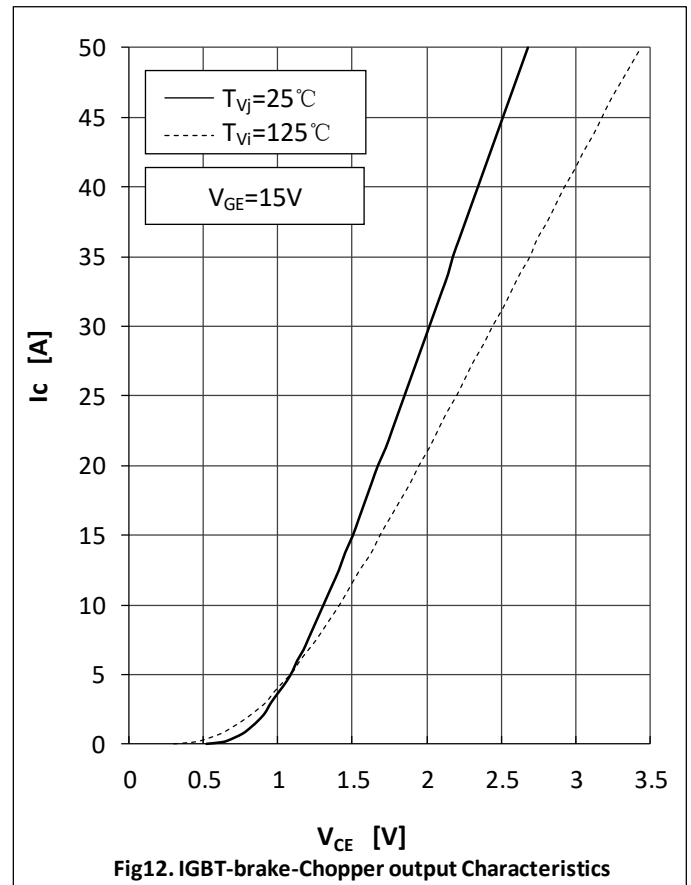
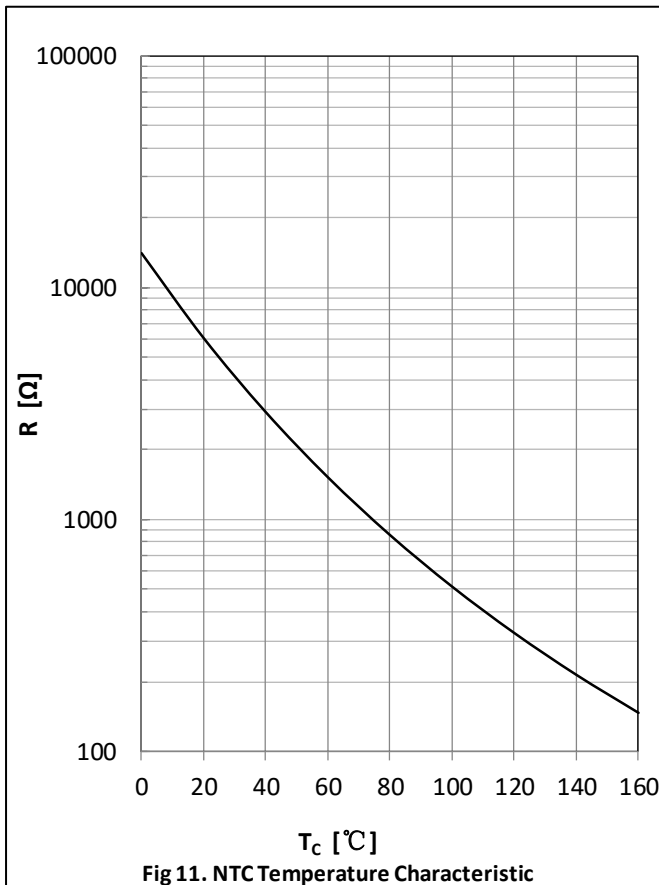
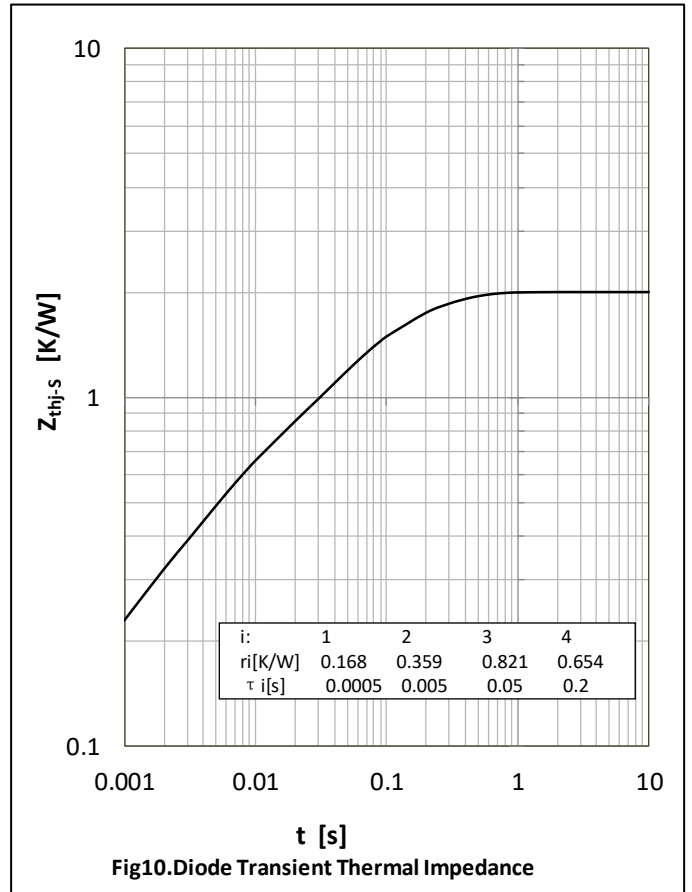
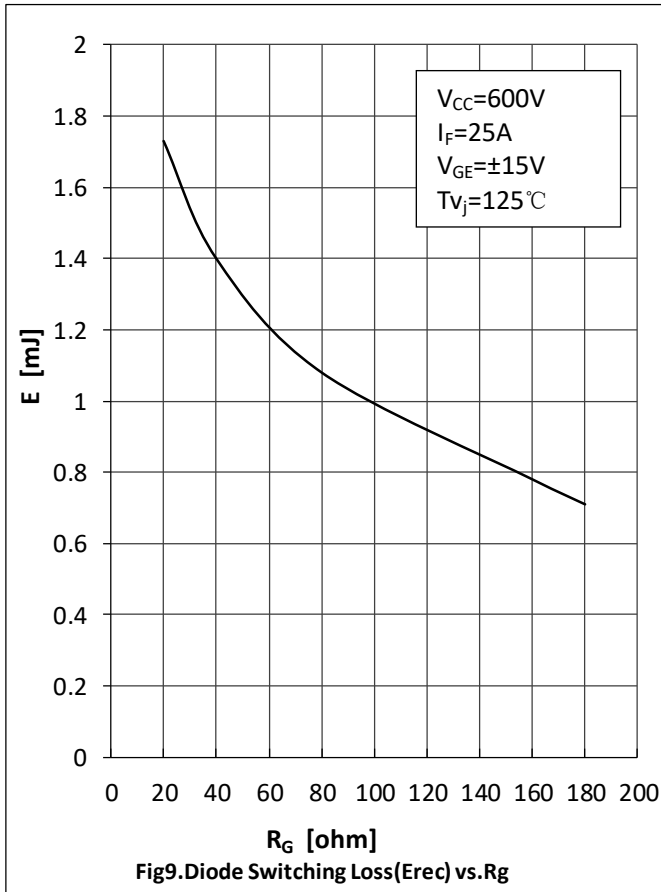
● Module Characteristics

 $T_C=25^{\circ}\text{C}$ 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	$T_{j\text{max}}$				175	$^{\circ}\text{C}$
Operating Junction Temperature	$T_{vj\text{op}}$		-40		150	$^{\circ}\text{C}$
Storage Temperature	T_{stg}		-40		125	$^{\circ}\text{C}$
Stray-inductance-module	L_{SCE}			30		nH
Module lead resistance, terminals-chip	$R_{\text{CC}'+\text{EE}}$	$T_C=25^{\circ}\text{C}$, per switch		5.00		m Ω
	$R_{\text{AA}'+\text{CC}'}$			6.00		
Thermal Resistance Junction-to Case	$R_{\theta\text{JC}}$	per IGBT-inverter		0.75	0.85	K/W
		per Diode-inverter		1.10	1.20	
		per IGBT-brake-chopper		0.75	0.85	
		per Diode-chopper		1.30	1.45	
		per Diode-rectifier		0.90	1.25	
Thermal Resistance Case-to Sink	$R_{\theta\text{CS}}$	per IGBT-inverter		0.70		K/W
		per Diode-inverter		0.90		
		per IGBT-brake-chopper		0.70		
		per Diode-chopper		1.05		
		per Diode-rectifier		0.95		
		per Module		0.037		
Mounting Force Per Clamp	F		30		80	N
Weight of Module	G			45		g







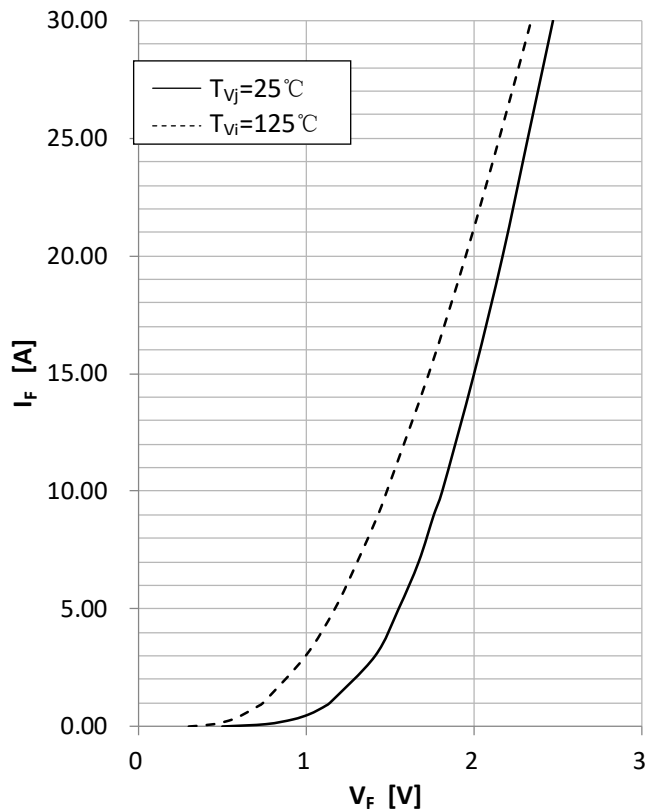
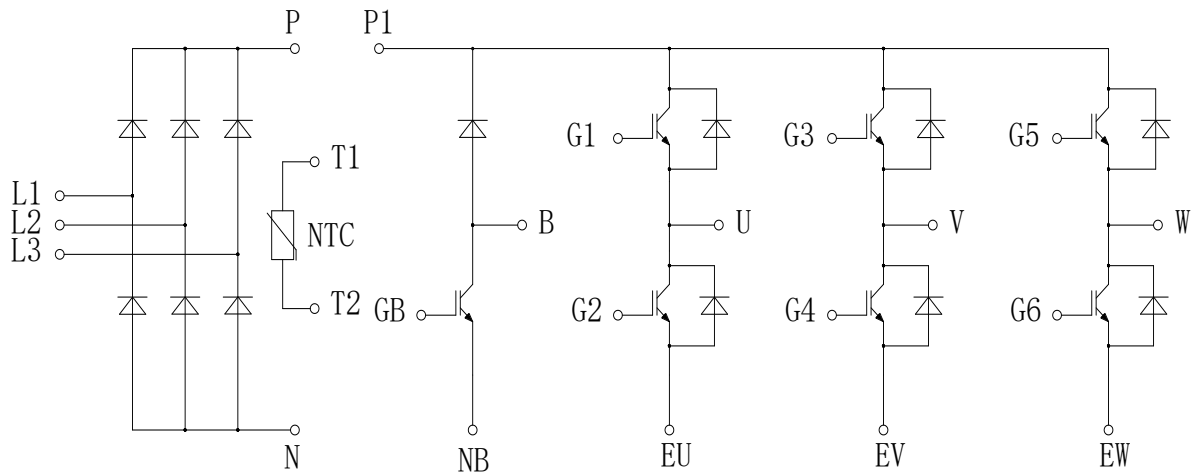


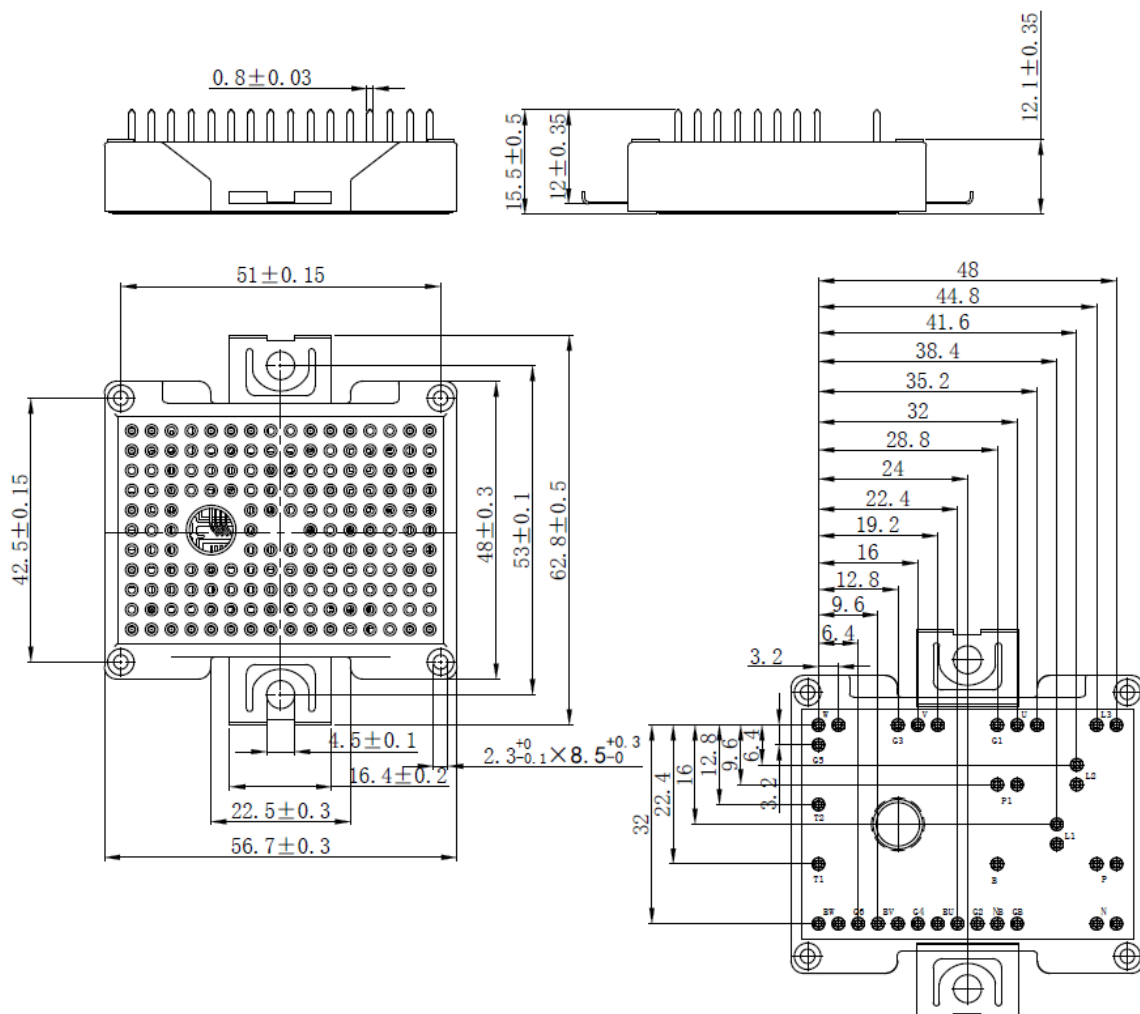
Fig13. Diode-brake-chopper Forward Characteristics



Circuit Diagram



Package Dimensions





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