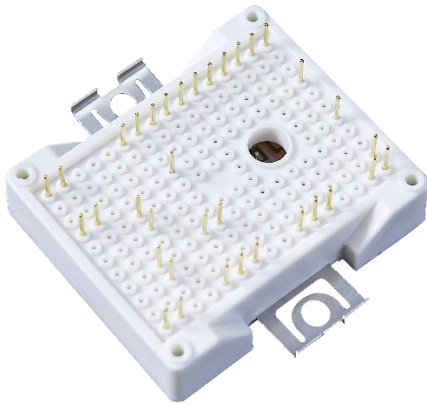


IGBT Modules

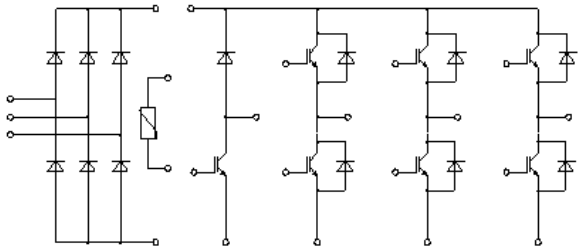


V_{CES}	1200V
I_C	50A

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(8us)
- 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	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	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}	$T_C=25^{\circ}C$ $T_{vjmax}=175^{\circ}C$	200	W



● IGBT- inverter

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.5mA, T_{vj}=25^{\circ}C$	5.0	5.8	6.5	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	$V_{CE(sat)}$	$I_C=50A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.70		V
		$I_C=50A, V_{GE}=15V, T_{vj}=125^{\circ}C$		1.95		
		$I_C=50A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.05		
Gate Charge	Q_G			0.57		uC
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V,$ $f=1MHz, T_{vj}=25^{\circ}C$		7.29		nF
Reverse Transfer Capacitance	C_{res}			0.09		nF
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C=50A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=5.6\Omega$ $T_{vj}=25^{\circ}C$		29		ns
Rise Time	t_r			59		ns
Turn-off Delay Time	$t_{d(off)}$			173		ns
Fall Time	t_f			198		ns
Energy Dissipation During Turn-on Time	E_{on}			3.39		mJ
Energy Dissipation During Turn-off Time	E_{off}			3.13		mJ
Turn-on Delay Time	$t_{d(on)}$	$I_C=50A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=5.6\Omega$ $T_{vj}=150^{\circ}C$		28		ns
Rise Time	t_r			54		ns
Turn-off Delay Time	$t_{d(off)}$			208		ns
Fall Time	t_f			324		ns
Energy Dissipation During Turn-on Time	E_{on}			4.98		mJ
Energy Dissipation During Turn-off Time	E_{off}			4.4		mJ
SC Data	I_{SC}	$t_p \leq 8\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C,$ $V_{CC}=600V, V_{CEM} \leq 1200V$		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

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	$I_F=50\text{A}, T_{vj}=25^{\circ}\text{C}$		1.90		V
		$I_F=50\text{A}, T_{vj}=125^{\circ}\text{C}$		1.83		
		$I_F=50\text{A}, T_{vj}=150^{\circ}\text{C}$		1.80		
Recovered Charge	Q_{rr}	$I_F=50\text{A}$		3.57		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{V}$ $-di_F/dt = 650\text{A}/\mu\text{s}$		26		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=25^{\circ}\text{C}$		1.35		mJ
Recovered Charge	Q_{rr}	$I_F=50\text{A}$		6.53		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{V}$ $-di_F/dt = 650\text{A}/\mu\text{s}$		34		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=150^{\circ}\text{C}$		2.42		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	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	40	A
Repetitive Peak Collector Current	I_{CRM}	$t_p=1ms$	80	A
Gate-Emitter Voltage	V_{GES}	$T_{vj}=25^{\circ}C$	± 20	V
Total Power Dissipation	P_{tot}	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	161	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	$V_{CE(sat)}$	$I_C=40A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.65		V
		$I_C=40A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.00		
		$I_C=40A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.10		
Gate Charge	Q_G			0.29		uC
Internal Gate Resistance	R_{Gint}			1.68		Ω
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$		4.28		nF
Reverse Transfer Capacitance	C_{res}			0.043		nF
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C=40A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=10\Omega$ $T_{vj}=25^{\circ}C$		51		ns
Rise Time	t_r			64		ns
Turn-off Delay Time	$t_{d(off)}$			129		ns
Fall Time	t_f			161		ns
Energy Dissipation During Turn-on Time	E_{on}			3.05		mJ
Energy Dissipation During Turn-off Time	E_{off}			1.68		mJ



Turn-on Delay Time	$t_{d(on)}$	$I_C=40A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=10\Omega$ $T_{vj}=150^\circ C$		48		ns
Rise Time	t_r			70		ns
Turn-off Delay Time	$t_{d(off)}$			144		ns
Fall Time	t_f			229		ns
Energy Dissipation During Turn-on Time	E_{on}			4.85		mJ
Energy Dissipation During Turn-off Time	E_{off}			2.03		mJ
SC Data	I_{SC}	$t_p \leq 8\mu s, V_{GE}=15V, T_{vj}=150^\circ C,$ $V_{CC}=600V, V_{CEM} \leq 1200V$		140		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

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	$I_F=15A, T_{vj}=25^\circ C$		2.00	2.80	V
		$I_F=15A, T_{vj}=125^\circ C$		1.80		
		$I_F=15A, T_{vj}=150^\circ C$		1.75		
Recovered Charge	Q_{rr}	$I_F=15A$		0.45		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600V$ $-di_F/dt = 600A/\mu s$		13		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=25^\circ C$		0.49		mJ
Recovered Charge	Q_{rr}	$I_F=15A$		0.54		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600V$ $-di_F/dt = 600A/\mu s$		14		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=150^\circ C$		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	$I_{F(AV)}$	$T_C=100^{\circ}\text{C}$	50	A
Maximum RMS Current at Rectifier Output	I_{RMSM}	$T_C=100^{\circ}\text{C}$	50	A
Surge Forward Current	I_{FSM}	$V_R=0V, t_p=10\text{ms}, T_{vj}=25^{\circ}\text{C}$	420	A
		$V_R=0V, t_p=10\text{ms}, T_{vj}=150^{\circ}\text{C}$	350	A
I^2t -value	I^2t	$V_R=0V, t_p=10\text{ms}, T_{vj}=25^{\circ}\text{C}$	880	A^2s
	I^2t	$V_R=0V, t_p=10\text{ms}, T_{vj}=150^{\circ}\text{C}$	610	A^2s

Characteristic Values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_F	$I_F=50\text{A}, T_{vj}=150^{\circ}\text{C}$		1.1		V
Reverse Current	I_R	$T_{vj}=150^{\circ}\text{C}, V_R=1600\text{V}$			2	mA

● NTC-Thermistor

Characteristic Values

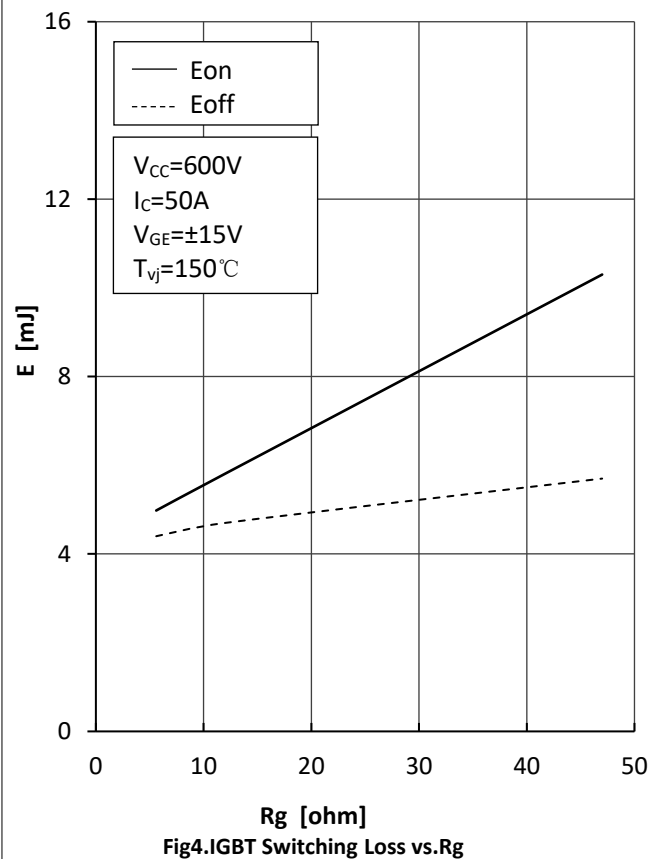
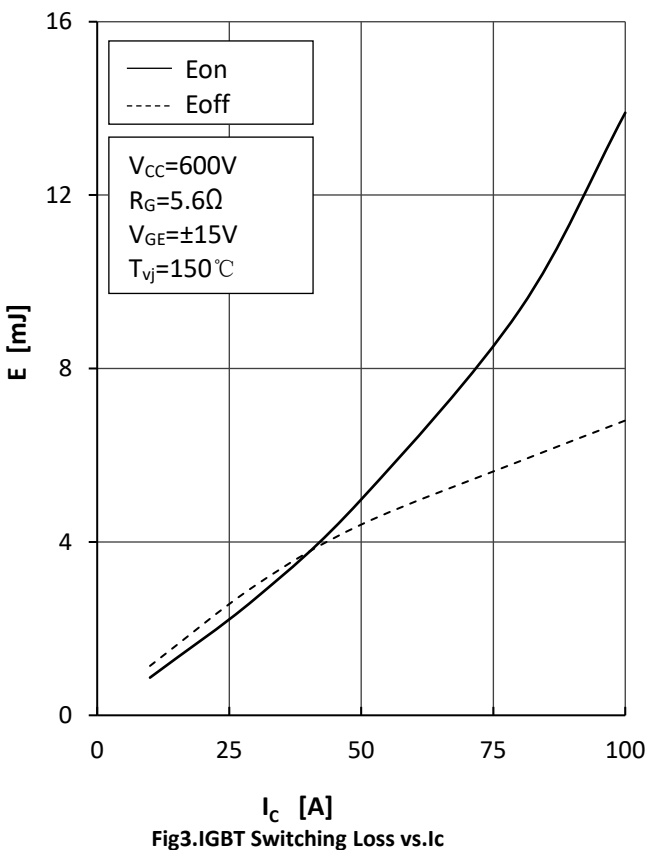
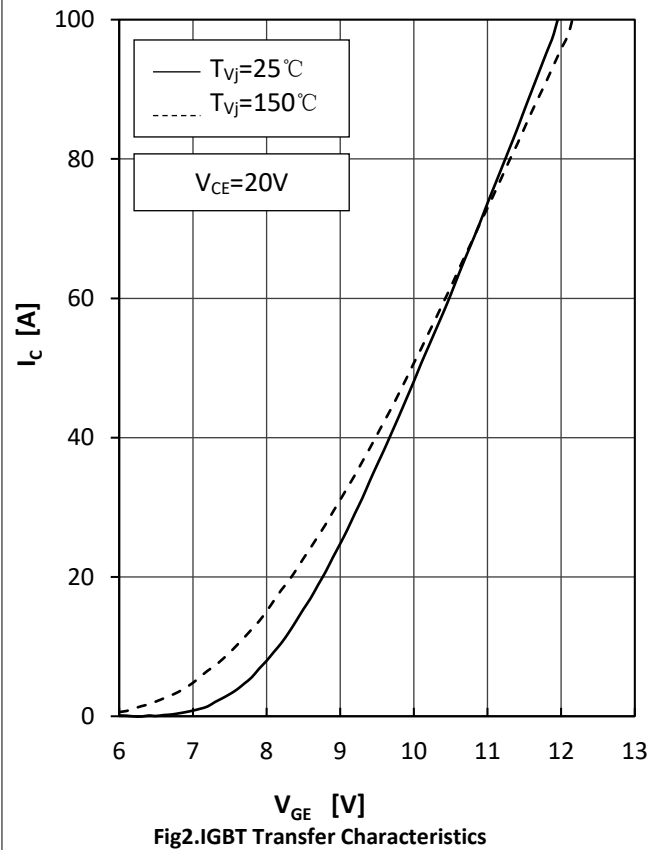
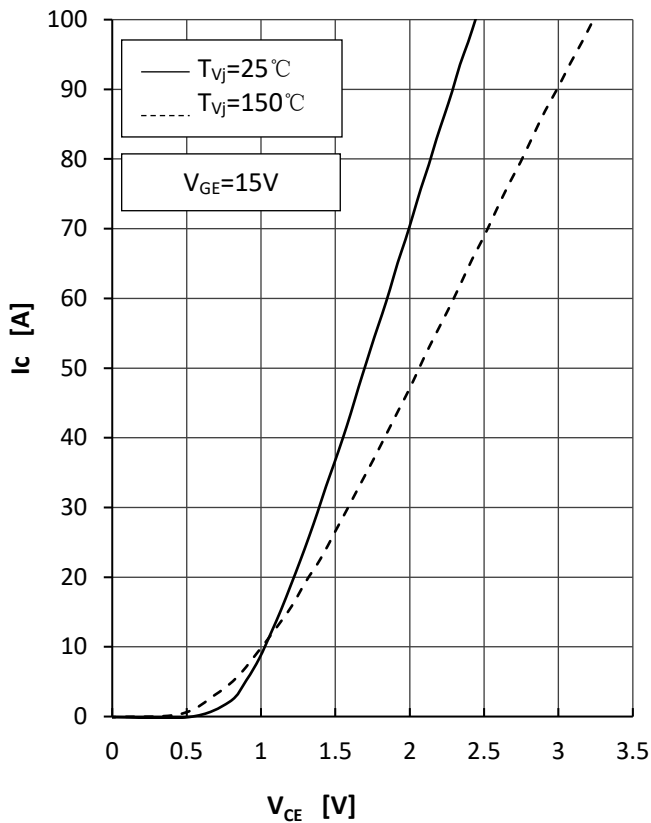
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Rated Resistance	R_{25}			5.0		k Ω
Deviation of R100	$\Delta R/R$	$T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$	-5		5	%
Power Dissipation	P_{25}				20.0	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K

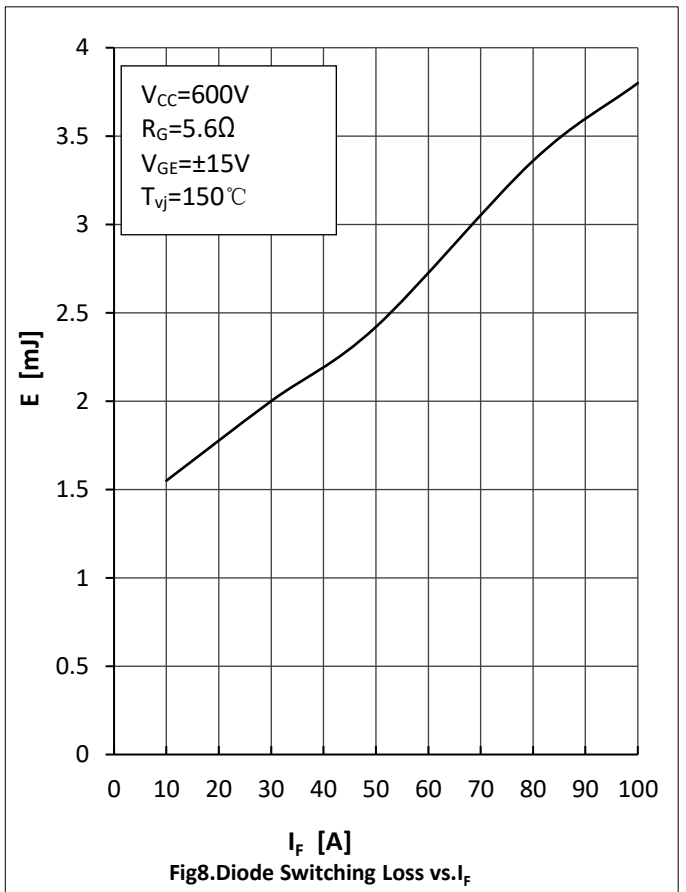
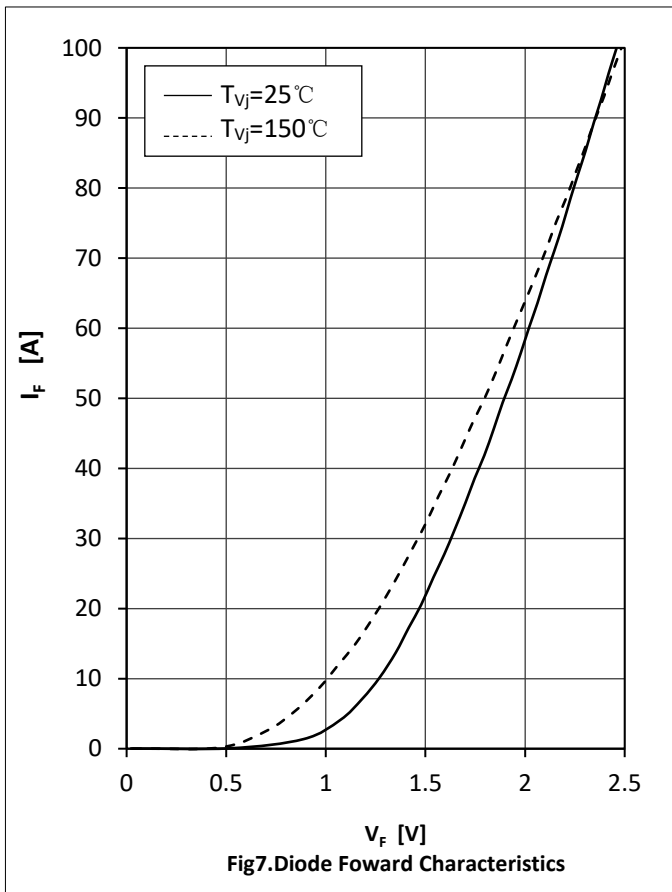
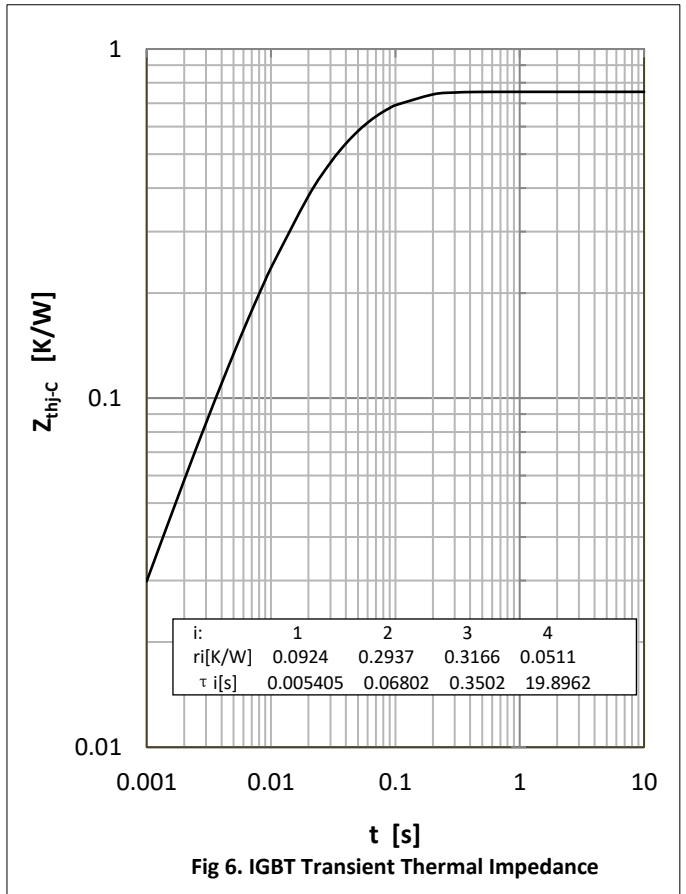
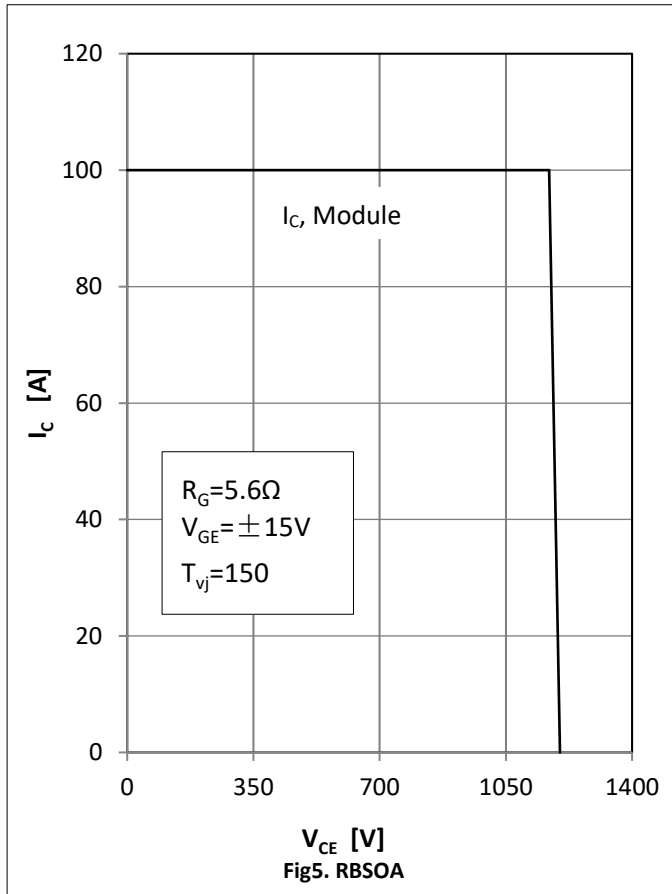


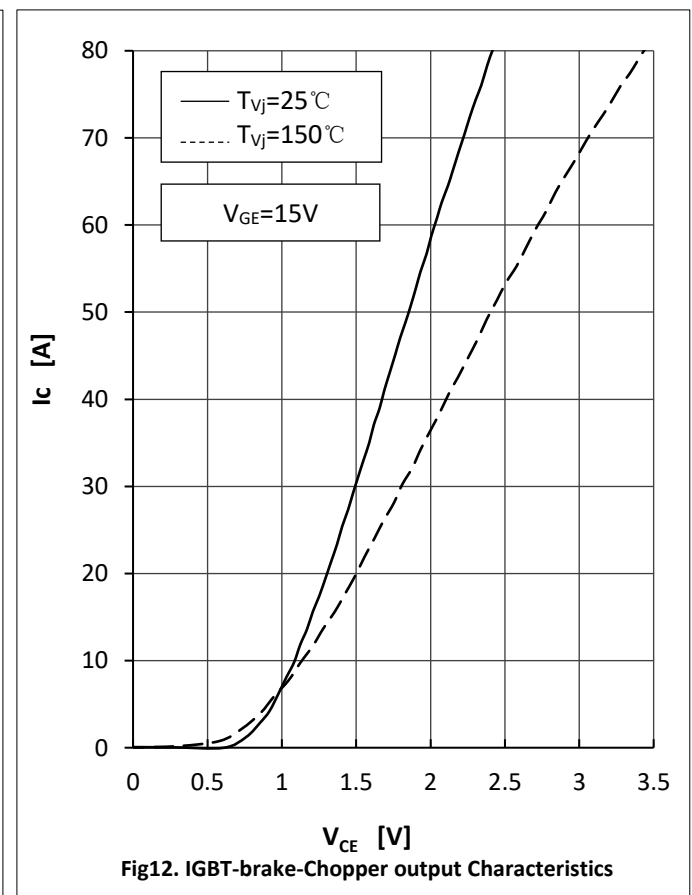
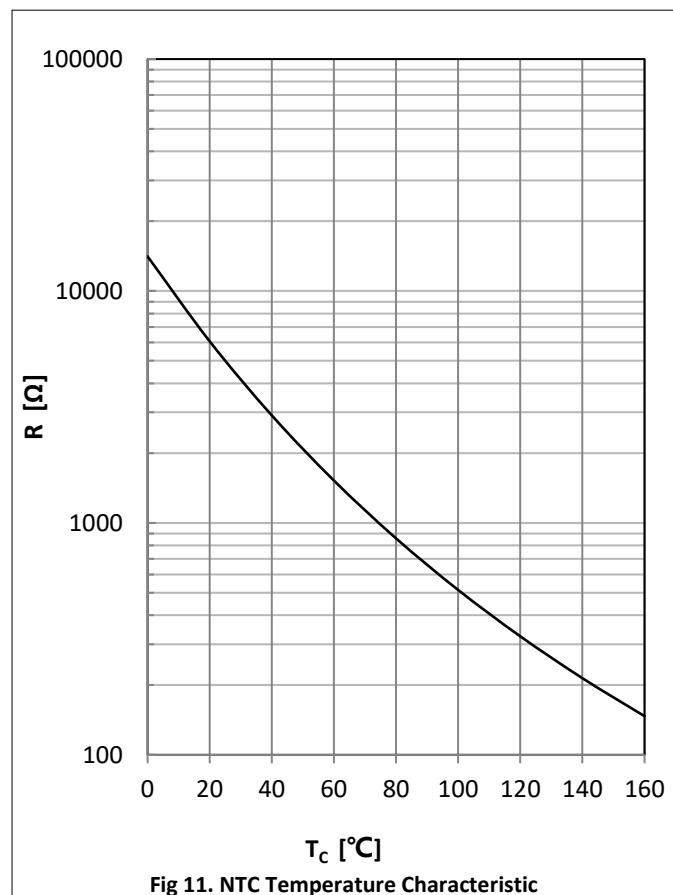
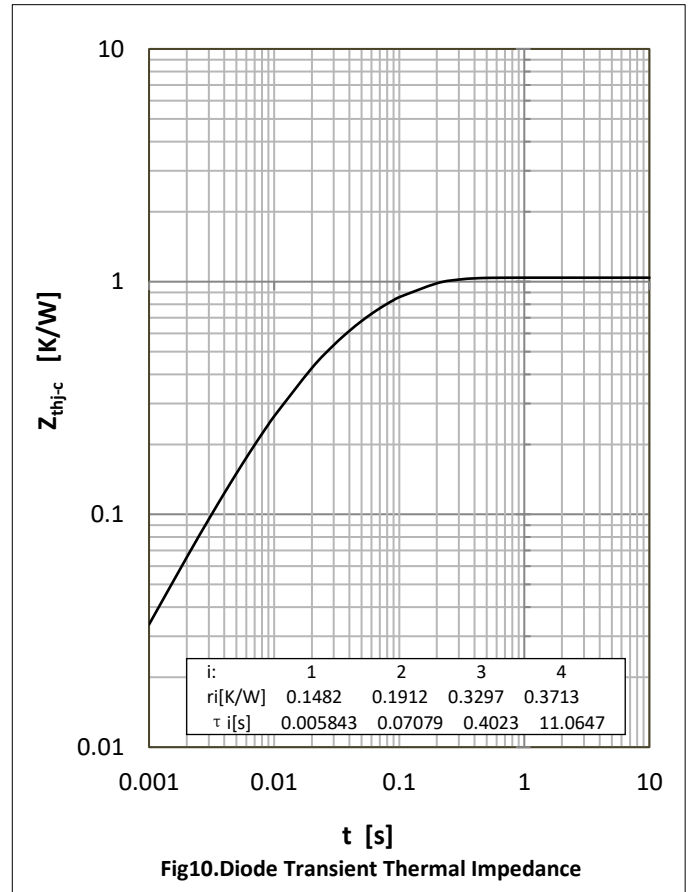
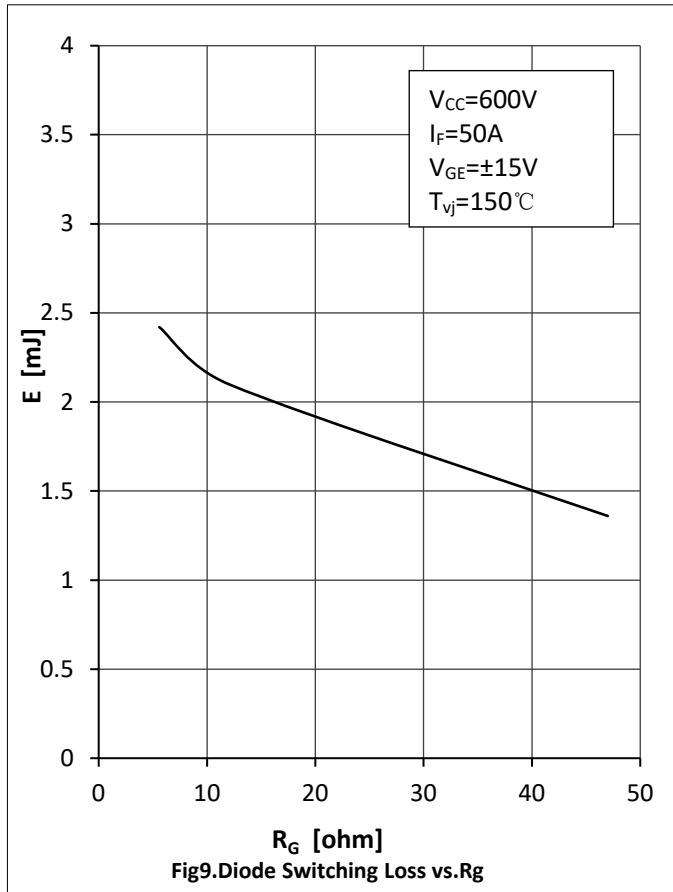
● Module Characteristics

 $T_C=25^{\circ}\text{C}$ 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	K/W
		per Diode-inverter			1.04	
		per IGBT-brake-chopper			0.93	
		per Diode-chopper			1.49	
		per Diode-rectifier			0.95	
Thermal Resistance Case to Sink	$R_{\theta\text{CS}}$	per Module		0.037		K/W
Mounting Force Per Clamp	F		30		80	N
Weight of Module	G			45		g







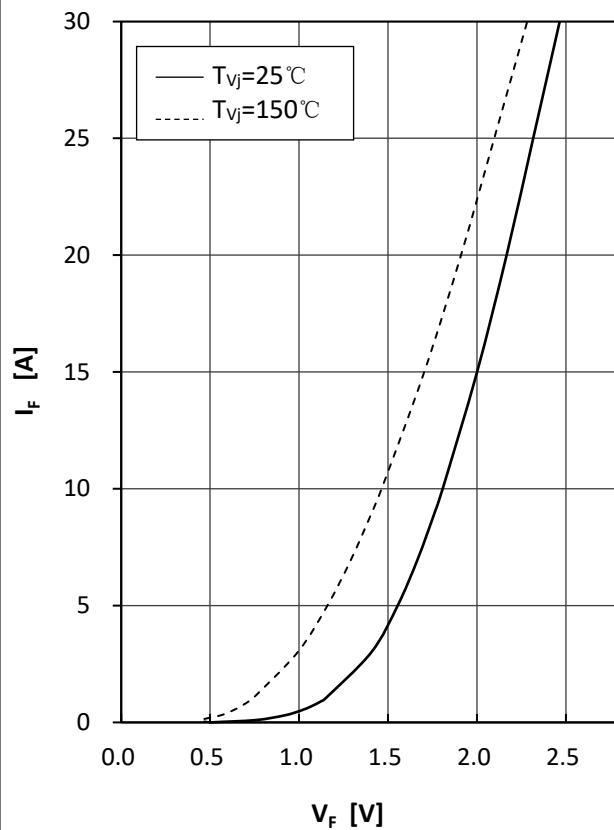


Fig13. Diode-brake-chopper Forward Characteristics





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