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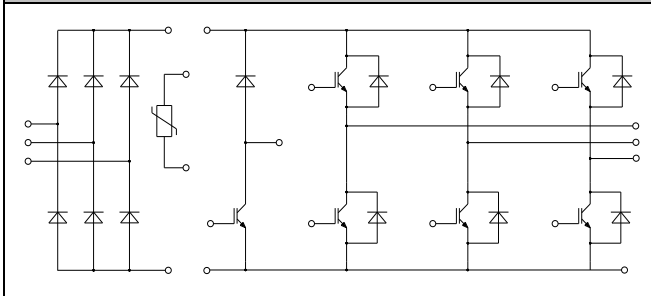
IGBT Modules

V _{CES}	1200V
I _C	10A

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)
- 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°C	1200	V
Continuous Collector Current	I _C	T _c =100°C, T _{vjmax} =175°C	10	A
Repetitive Peak Collector Current	I _{CRM}	t _p =1ms	20	A
Gate-Emitter Voltage	V _{GES}	T _{vj} =25°C	± 20	V
Total Power Dissipation	P _{tot}	T _c =25°C T _{vjmax} =175°C	120	W



● IGBT- inverter

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}$, $I_C=0.5mA$, $T_{vj}=25^{\circ}C$	5.2	6.0	6.8	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	$V_{CE(sat)}$	$I_C=10A$, $V_{GE}=15V$, $T_{vj}=25^{\circ}C$		1.85	2.50	V
		$I_C=10A$, $V_{GE}=15V$, $T_{vj}=150^{\circ}C$		2.25		
Gate Charge	Q_G			0.12		uC
Input Capacitance	C_{ies}	$V_{CE}=25V$, $V_{GE}=0V$, $f=1MHz$, $T_{vj}=25^{\circ}C$		0.9		nF
Reverse Transfer Capacitance	C_{res}			0.03		nF
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0V$, $V_{GE}=20V$, $T_{vj}=25^{\circ}C$			400	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C=10A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=47\Omega$ $T_{vj}=25^{\circ}C$		84		ns
Rise Time	t_r			80		ns
Turn-off Delay Time	$t_{d(off)}$			150		ns
Fall Time	t_f			145		ns
Energy Dissipation During Turn-on Time	E_{on}			1.20		mJ
Energy Dissipation During Turn-off Time	E_{off}			0.60		mJ
Turn-on Delay Time	$t_{d(on)}$	$I_C=10A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=47\Omega$ $T_{vj}=125^{\circ}C$		85		ns
Rise Time	t_r			62		ns
Turn-off Delay Time	$t_{d(off)}$			270		ns
Fall Time	t_f			170		ns
Energy Dissipation During Turn-on Time	E_{on}			1.50		mJ
Energy Dissipation During Turn-off Time	E_{off}			0.8		mJ
SC Data	I_{sc}	$T_p \leq 10\mu s$, $V_{GE}=15V$, $T_{vj}=150^{\circ}C$, $V_{cc}=900V$, $V_{CEM} \leq 1200V$		70		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		10	A
Repetitive Peak Forward Current	I_{FRM}	$t_p=1\text{ms}$	20	A
I^2t -value	I^2t	$V_R=0, t_p=10\text{ms}, T_{vj}=150^{\circ}\text{C}$	16.0	A^2s

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	$I_F=10\text{A}, T_{vj}=25^{\circ}\text{C}$		2.00	2.80	V
		$I_F=10\text{A}, T_{vj}=125^{\circ}\text{C}$		2.00		
Recovered Charge	Q_{rr}	$I_F=10\text{A}$		1.0		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{V}$ $-di_F/dt=600\text{A}/\mu\text{s}$		12.5		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=25^{\circ}\text{C}$		0.30		mJ
Recovered Charge	Q_{rr}	$I_F=10\text{A}$		1.75		μC
Peak Reverse Recovery Current	I_{rr}	$V_R=600\text{V}$ $-di_F/dt=600\text{A}/\mu\text{s}$		10.0		A
Reverse Recovery Energy	E_{rec}	$T_{vj}=125^{\circ}\text{C}$		0.52		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	$T_c=100^{\circ}C, T_{vjmax}=175^{\circ}C$	10	A
Repetitive Peak Collector Current	I_{CRM}	$tp=1ms$	20	A
Gate-Emitter Voltage	V_{GES}	$T_{vj}=25^{\circ}C$	± 20	V
Total Power Dissipation	P_{tot}	$T_c=25^{\circ}C, T_{vjmax}=175^{\circ}C$	92	W

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=0.5mA, T_{vj}=25^{\circ}C$	5.2	6.0	6.8	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	$V_{CE(sat)}$	$I_C=10A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.85	2.25	V
		$I_C=10A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15		
Gate Charge	Q_G			0.09		uC
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$		1.35		nF
Reverse Transfer Capacitance	C_{res}			0.08		nF
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C=10A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=47\Omega$ $T_{vj}=25^{\circ}C$		80		ns
Rise Time	t_r			78		ns
Turn-off Delay Time	$t_{d(off)}$			150		ns
Fall Time	t_f			148		ns
Energy Dissipation During Turn-on Time	E_{on}			1.10		mJ
Energy Dissipation During Turn-off Time	E_{off}			0.83		mJ



Turn-on Delay Time	$t_{d(on)}$	$I_C = 10A$ $V_{CE} = 600V$ $V_{GE} = \pm 15V$ $R_G = 47\Omega$ $T_{vj} = 125^\circ C$		82		ns
Rise Time	t_r			63		ns
Turn-off Delay Time	$t_{d(off)}$			258		ns
Fall Time	t_f			180		ns
Energy Dissipation During Turn-on Time	E_{on}			1.47		mJ
Energy Dissipation During Turn-off Time	E_{off}			0.81		mJ
SC Data	I_{sc}	$T_p \leq 10\mu s, V_{GE} = 15V, T_{vj} = 150^\circ C,$ $V_{cc} = 900V, V_{CEM} \leq 1200V$		70		A

● Diode-Brake-Chopper

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	$T_j = 25^\circ C$	1200	V
Continuous DC Forward Current	I_F		10	A
Repetitive Peak Forward Current	I_{FRM}	$t_p = 1ms$	20	A
I^2t -value	I^2t	$V_R = 0, t_p = 10ms, T_j = 125^\circ C$	16.0	A ² s

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	$I_F = 10A, T_{vj} = 25^\circ C$		2.0	2.80	V
		$I_F = 10A, T_{vj} = 125^\circ C$		2.10		
Recovered Charge	Q_{rr}	$I_F = 10A$		0.90		μC
Peak Reverse Recovery Current	I_{rr}	$V_R = 600V$ $-di_F/dt = 500A/\mu s$		12.5		A
Reverse Recovery Energy	E_{rec}	$T_{vj} = 25^\circ C$		0.25		mJ
Recovered Charge	Q_{rr}	$I_F = 10A$		1.70		μC
Peak Reverse Recovery Current	I_{rr}	$V_R = 600V$ $-di_F/dt = 500A/\mu s$		10.4		A
Reverse Recovery Energy	E_{rec}	$T_{vj} = 125^\circ C$		0.50		mJ



● Diode-Rectifier

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	$T_j=25^{\circ}\text{C}$	1600	V
Average output Current 50/60Hz, sine wave	$I_{F(AV)}$	$T_c=100^{\circ}\text{C}$	10	A
Maximum RMS Current at Rectifier Output	I_{RMSM}	$T_c=100^{\circ}\text{C}$	20	A
Surge Forward Current	I_{FSM}	$V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	100	A
I^2t -value	I^2t	$V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	360	A^2s

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_F	$I_F=10\text{A}, T_j=150^{\circ}\text{C}$		0.90		V
Reverse Current	I_R	$T_j=125^{\circ}\text{C}, V_R=1600\text{V}$			1.0	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		150	$^{\circ}\text{C}$
Stray-inductance-module	L_{SCE}			60		nH
Module lead resistance, terminals-chip	$R_{\text{cc'+EE'}}$	$T_C=25^{\circ}\text{C}$, per switch		4.0		m Ω
	$R_{\text{AA'+CC'}}$			3.0		
Thermal Resistance Junction-to Case	$R_{\theta \text{ JC}}$	per IGBT-inverter			1.25	K/W
		per Diode-inverter			1.64	
		per IGBT-brake-copper			1.30	
		per Diode-chopper			2.39	
		per Diode-rectifier			1.17	
Thermal Resistance Case-to Sink	$R_{\theta \text{ CS}}$	per IGBT-inverter		0.40		K/W
		per Diode-inverter		0.72		
		per IGBT-brake-copper		0.53		
		per Diode-chopper		0.77		
		per Diode-rectifier		1.10		
		per Module		0.02		
Mounting Force Per Clamp	F		3.0		6.0	N
Weight of Module	G			180		g

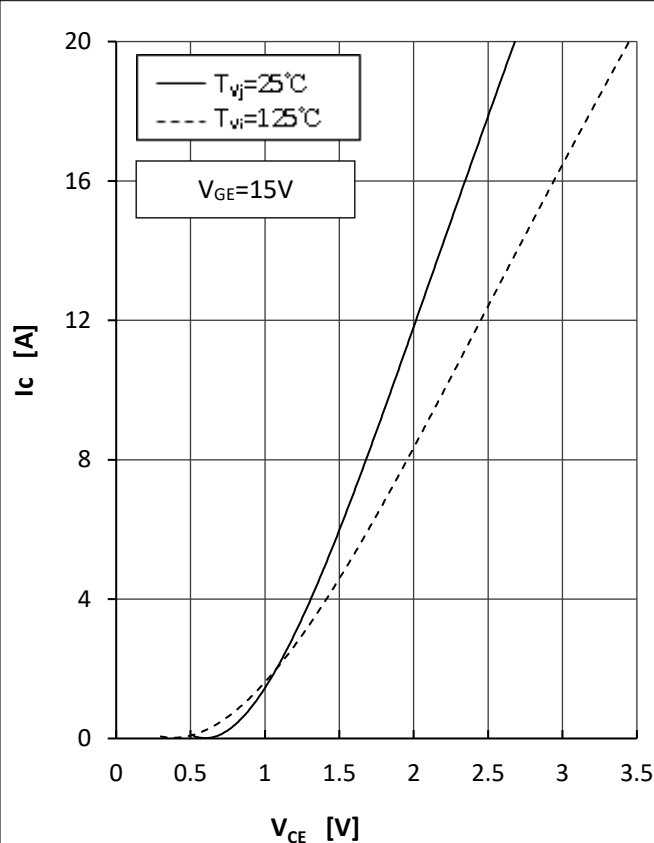


Fig1.IGBT Output Characteristics

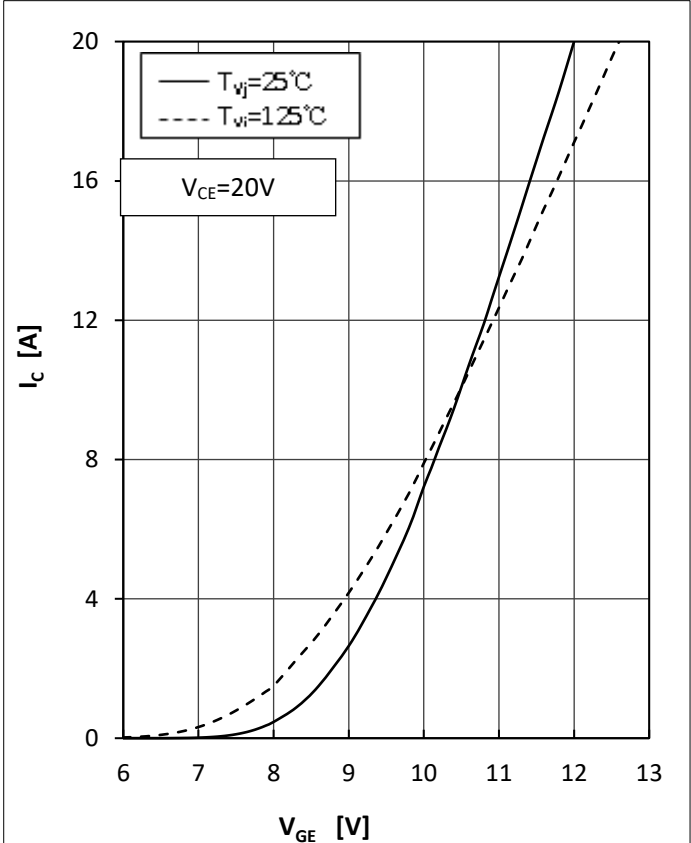


Fig2.IGBT Transfer Characteristics

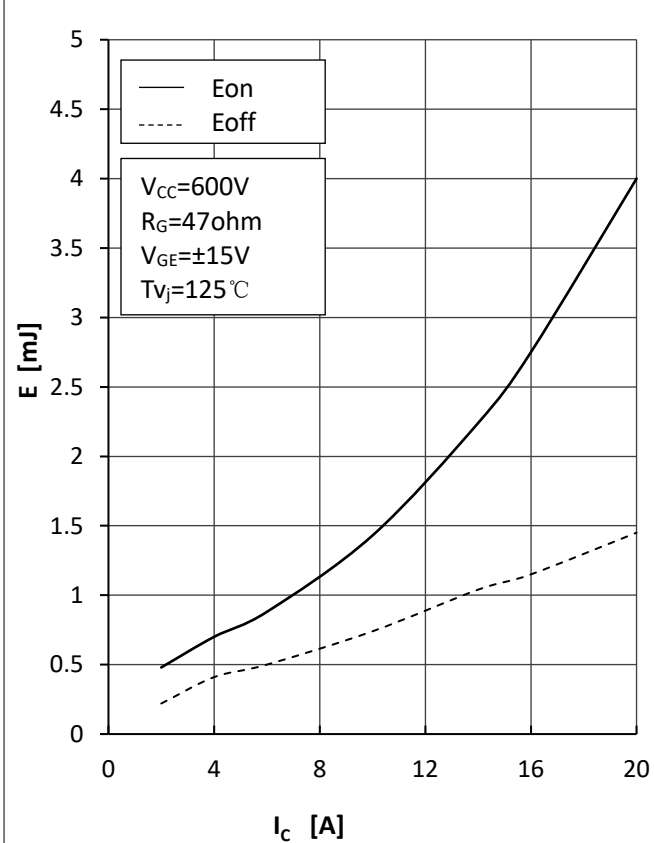


Fig3.IGBT Switching Loss vs.Ic

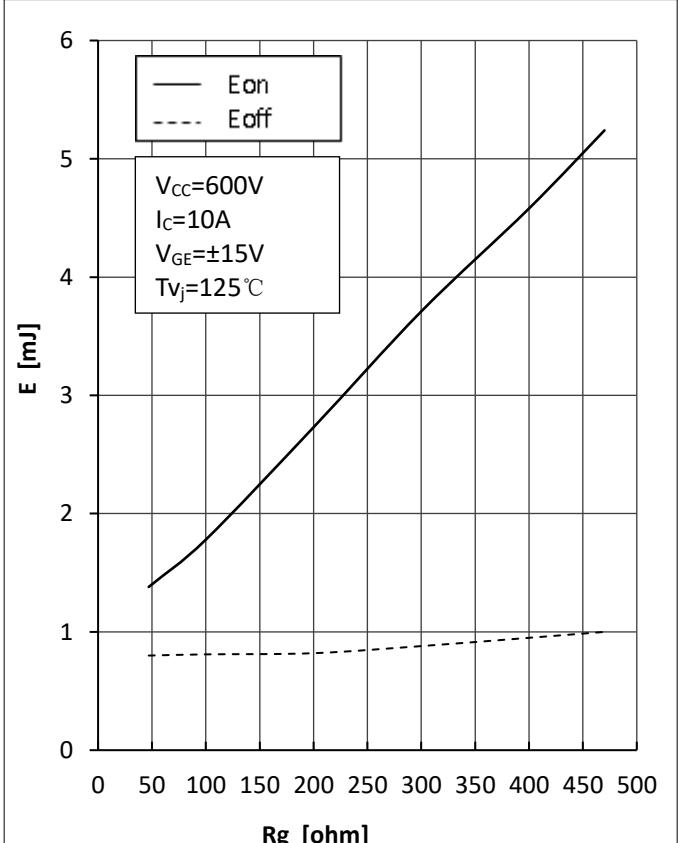


Fig4.IGBT Switching Loss vs.Rg

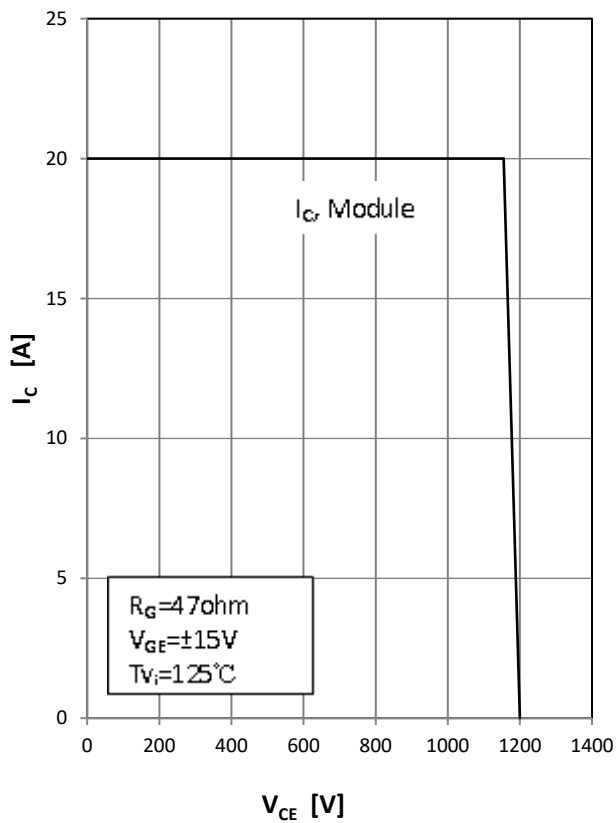


Fig5. RBSOA

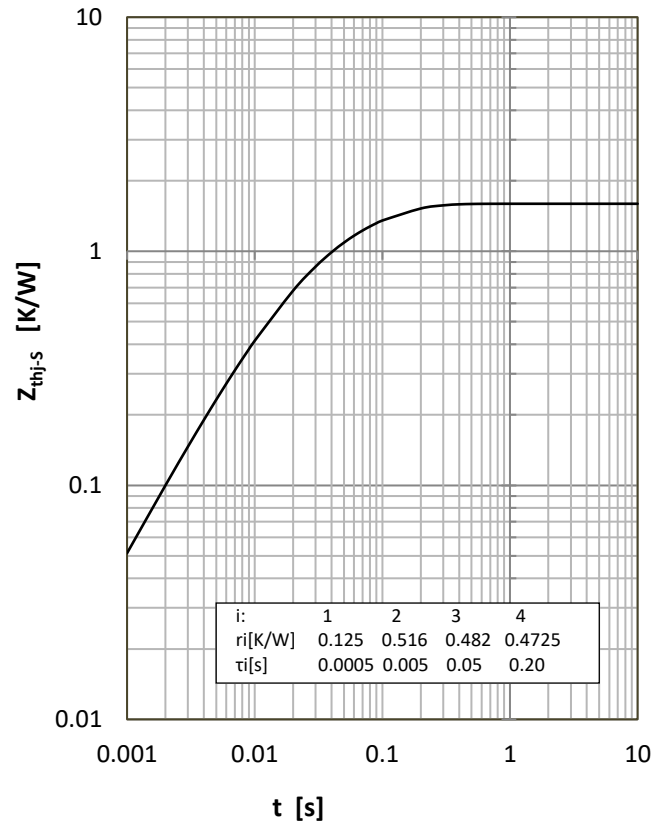


Fig 6. IGBT Transient Thermal Impedance

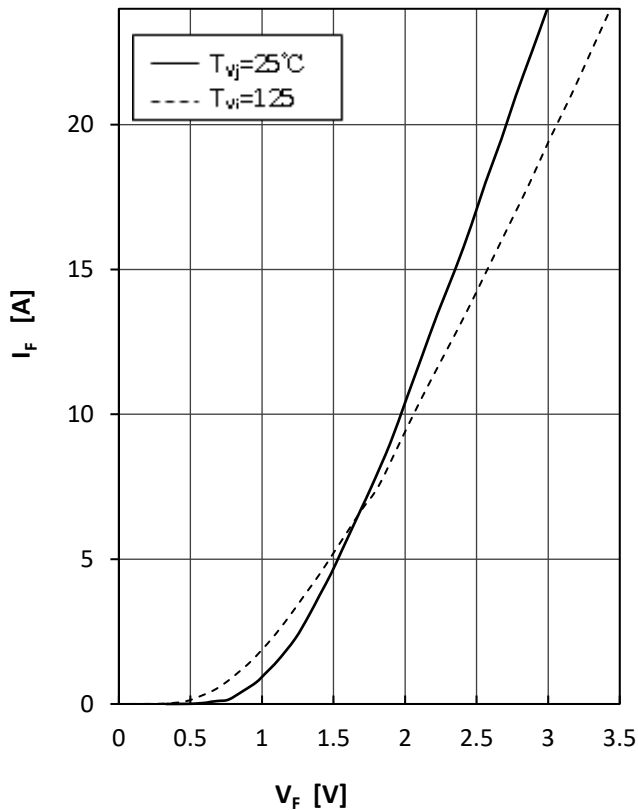


Fig7. Diode Forward Characteristics

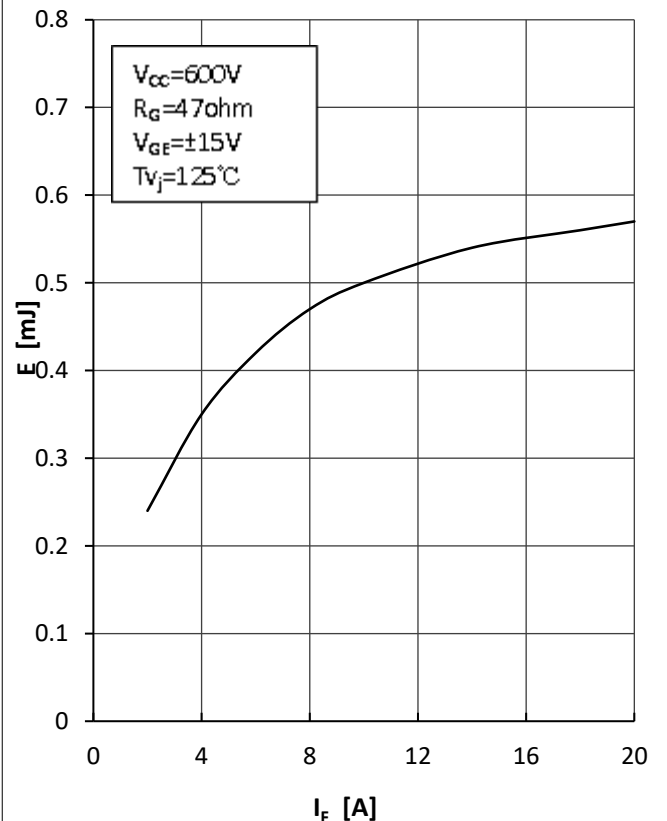
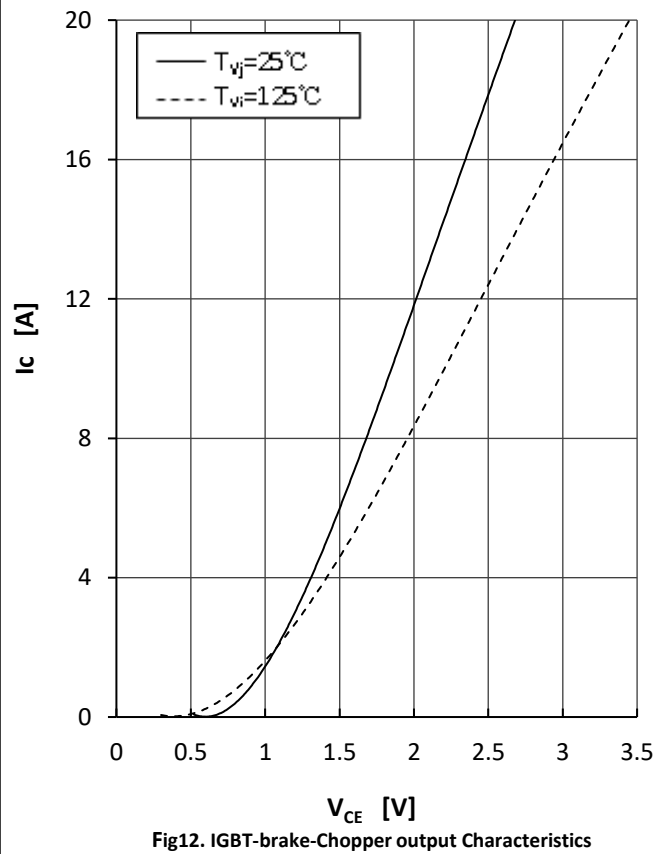
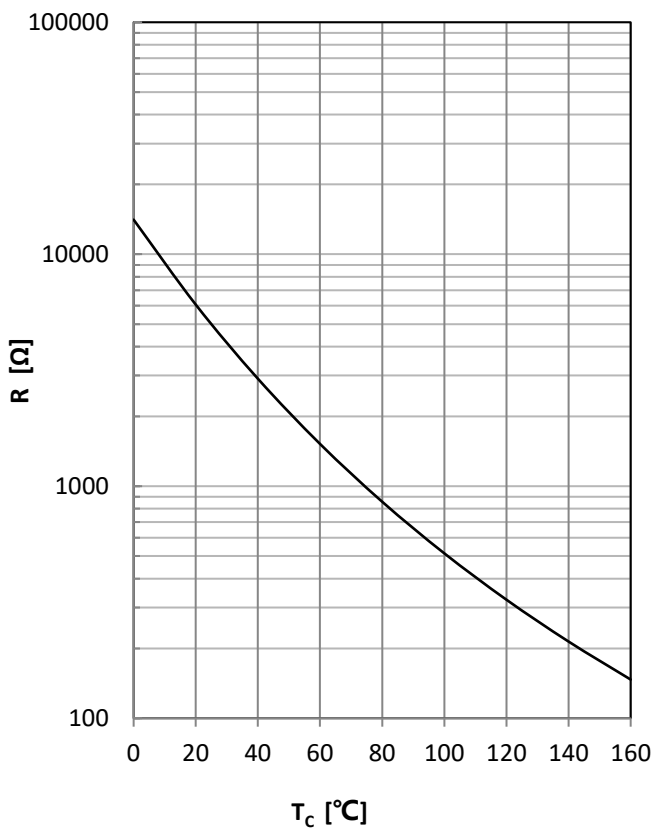
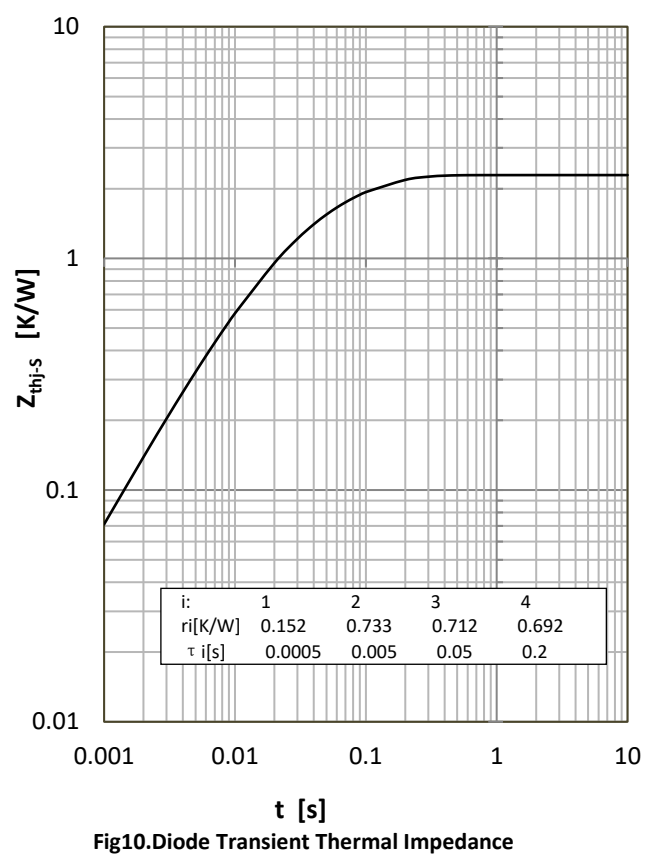
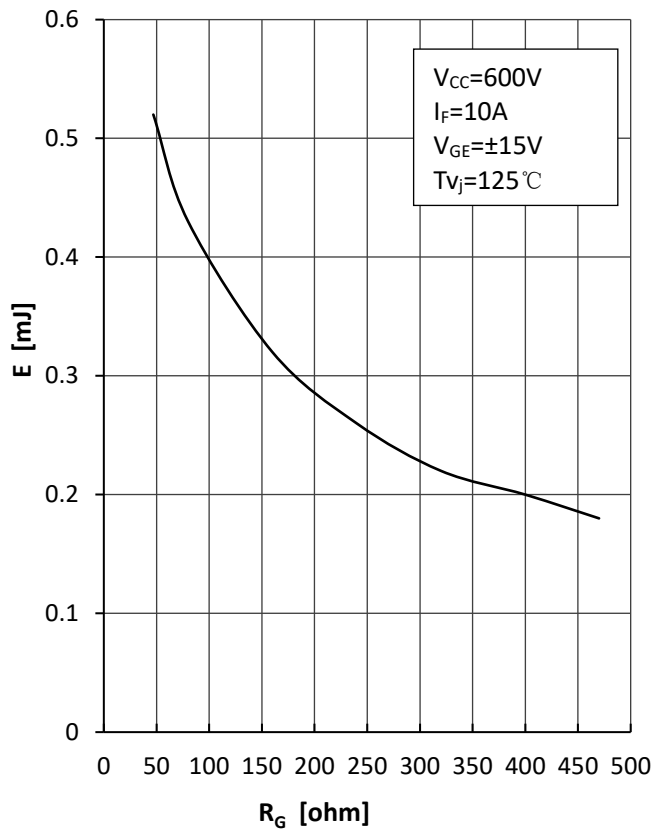
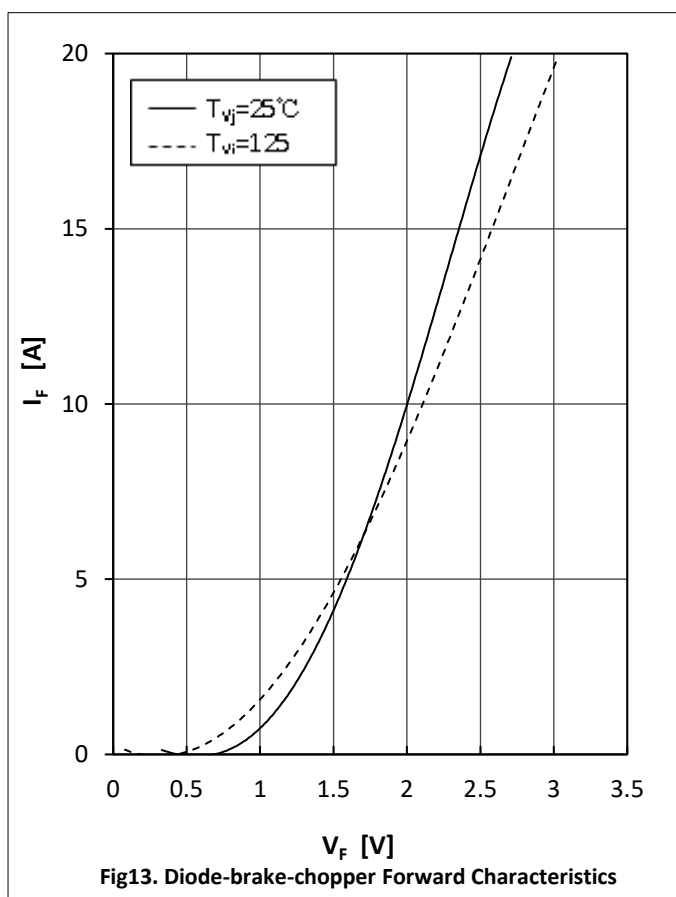
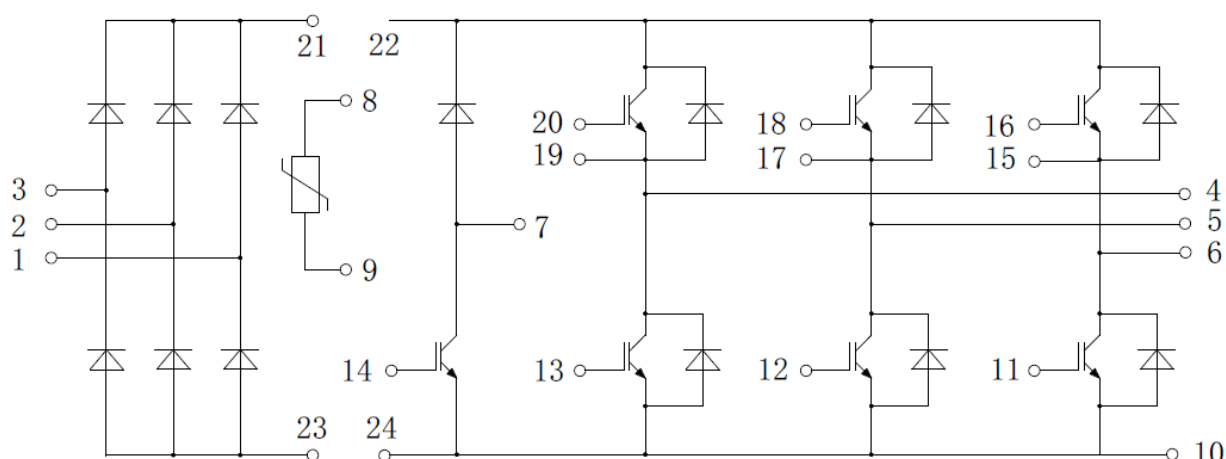


Fig8. Diode Switching Loss(Erec) vs. I_F





● Circuit Diagram



● Package Dimensions

