

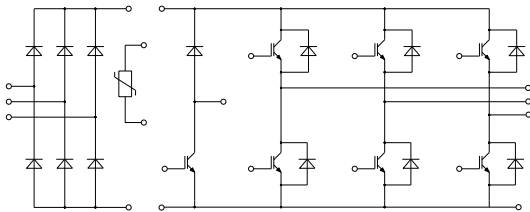
Features

- 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(10 μ s)
- Maximum Junction Temperature 175°C
- Epoxy Meets UL 94 V-0 Flammability Rating
- Lead Free Finish/RoHS Compliant ("P" Suffix Designates RoHS Compliant. See Ordering Information)

Applications

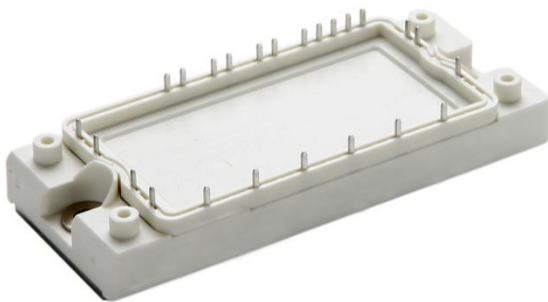
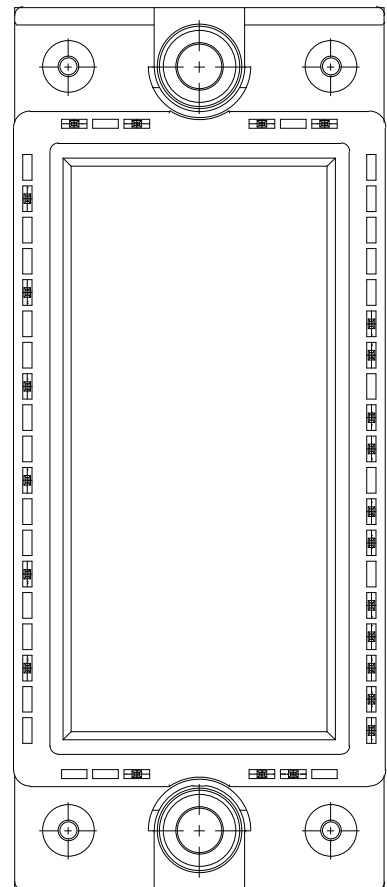
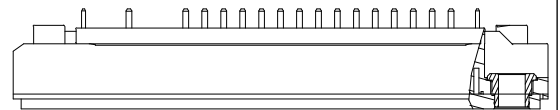
- Motor Drivers
- AC and DC Servo Drive Amplifier
- UPS (Uninterruptible Power Supplies)

Circuit Diagram



IGBT Modules 1200V 40A

E1



● IGBT- Inverter

Maximum Ratings

Parameter	Symbol	Test Conditions	Rating	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}	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	227	W

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.2mA, T_{vj}=25^{\circ}C$	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	mA	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=40A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.90	2.30	V	
		$I_C=40A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.20		V	
		$I_C=40A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.40		V	
Gate Charge	Q_g			0.35		μC	
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		2.25		nF	
Reverse Transfer Capacitance	C_{res}			0.10			
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=40A, V_{GE}=\pm 15V, R_G=13\Omega, T_{vj}=25^{\circ}C$		198		ns	
Rise Time	t_r			24			
Turn-Off Delay Time	$t_{d(off)}$			360			
Fall Time	t_f			72			
Turn-On Energy	E_{on}			4.25			mJ
Turn-Off Energy	E_{off}			2.0			
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=40A, V_{GE}=\pm 15V, R_G=13\Omega, T_{vj}=125^{\circ}C$		210		ns	
Rise Time	t_r			28			
Turn-Off Delay Time	$t_{d(off)}$			470			
Fall Time	t_f			90			
Turn-On Energy	E_{on}			6.04			mJ
Turn-Off Energy	E_{off}			3.05			
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

Maximum Ratings

Parameter	Symbol	Test Conditions	Rating	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	$T_{vj}=25^{\circ}C$	1200	V
Continuous DC Forward Current	I_F		40	A
Repetitive Peak Forward Current	I_{FRM}	$t_p=1ms$	80	A
I^2t -value	I^2t	$V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$	240	A^2s
		$V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$	220	

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Forward Voltage	V_F	$I_F=40A, T_{vj}=25^{\circ}C$		1.90	2.25	V
		$I_F=40A, T_{vj}=125^{\circ}C$		1.90		V
		$I_F=40A, T_{vj}=150^{\circ}C$		1.85		V
Recovered Charge	Q_{rr}	$I_F=40A, V_R=600V,$ $-di_F/dt=1600A/\mu s, T_{vj}=25^{\circ}C$		4.15		μC
Peak Reverse Recovery Current	I_{rr}			42		A
Reverse Recovery Energy	E_{rec}			1.3		mJ
Recovered Charge	Q_{rr}	$I_F=40A, V_R=600V,$ $-di_F/dt=1600A/\mu s, T_{vj}=125^{\circ}C$		8		μC
Peak Reverse Recovery Current	I_{rr}			46		A
Reverse Recovery Energy	E_{rec}			2.38		mJ

● IGBT- Brake-chopper

Maximum Ratings

Parameter	Symbol	Test Conditions	Rating	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}	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	166	W

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.2mA, T_{vj}=25^{\circ}C$	5.3	6.0	6.8	V	
Collector-Emitter Cut-off Current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$			1	mA	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=25A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.90	2.30	V	
		$I_C=25A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.20		V	
		$I_C=25A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.30		V	
Gate Charge	Q_g			0.24		μC	
Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		1.60		nF	
Reverse Transfer Capacitance	C_{res}			0.07			
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			100	nA	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=25A, V_{GE}=\pm 15V, R_G=18\Omega, T_{vj}=25^{\circ}C$		175		ns	
Rise Time	t_r			38			
Turn-Off Delay Time	$t_{d(off)}$			420			
Fall Time	t_f			65			
Turn-On Energy	E_{on}			1.95			mJ
Turn-Off Energy	E_{off}		1.2				
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=25A, V_{GE}=\pm 15V, R_G=18\Omega, T_{vj}=125^{\circ}C$		185		ns	
Rise Time	t_r			43			
Turn-Off Delay Time	$t_{d(off)}$			510			
Fall Time	t_f			120			
Turn-On Energy	E_{on}			2.60			mJ
Turn-Off Energy	E_{off}			2.0			
SC Data	I_{SC}		$T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$		135		

● Diode- Brake-chopper

Maximum Ratings

Parameter	Symbol	Test Conditions	Rating	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	$V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$	48	A^2s
		$V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$	42	

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Forward Voltage	V_F	$I_F=15A, T_{vj}=25^{\circ}C$		2.0	2.40	V
		$I_F=15A, T_{vj}=125^{\circ}C$		2.10		V
		$I_F=15A, T_{vj}=150^{\circ}C$		2.10		V
Recovered Charge	Q_{rr}	$I_F=15A, V_R=600V,$ $-di_F/dt=550A/\mu s, T_{vj}=25^{\circ}C$		1.1		μC
Peak Reverse Recovery Current	I_{rr}			12		A
Reverse Recovery Energy	E_{rec}			0.30		mJ
Recovered Charge	Q_{rr}	$I_F=15A, V_R=600V,$ $-di_F/dt=550A/\mu s, T_{vj}=125^{\circ}C$		1.90		μC
Peak Reverse Recovery Current	I_{rr}			14.0		A
Reverse Recovery Energy	E_{rec}			0.60		mJ

● Diode- Rectifier

Maximum Ratings

Parameter	Symbol	Test Conditions	Rating	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	$T_j=25^{\circ}\text{C}$	1600	V
Average On-state Current 50/60Hz, sine wave	$I_{F(AV)}$	$T_C=100^{\circ}\text{C}$	50	A
Maximum RMS Current at Rectifier Output	I_{RMSM}	$T_C=100^{\circ}\text{C}$	60	A
Surge Forward Current	I_{FSM}	$V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	320	A
I^2t -value	I^2t	$V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	510	A^2s

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	V_F	$I_F=40\text{A}, T_j=125^{\circ}\text{C}$		1.12		V
Reverse Current	I_r	$T_j=125^{\circ}\text{C}, V_R=1600\text{V}$			2	mA

● NTC-Thermistor

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Rated Resistance	R_{25}			5		k Ω
Deviation of R100	$\Delta R/R$	$T_C=100, R_{100}=493.3\Omega$	-5		5	%
Power Dissipation	P_{25}				20	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	Test Conditions	Min	Typ	Max	Unit
Isolation voltage	V_{isol}	$t=1\text{min}, f=50\text{Hz}$	2500			V
Maximum Junction Temperature	T_{jmax}	Inverter, brake			175	$^\circ\text{C}$
		rectifier			150	
Operating Junction Temperature	$T_{\text{vj op}}$		-40		150	$^\circ\text{C}$
Operating Junction Temperature	T_{stg}		-40		125	$^\circ\text{C}$
Stray Inductance	L_{CE}			60		nH
Module Lead Resistance , Terminal to Chip	$R_{\text{cc'+EE'}}$	TC=25 $^\circ\text{C}$, per switch		4		m Ω
	$R_{\text{AA'+CC'}}$			3		
Thermal Resistance Junction to Case	$R_{\theta\text{j c}}$	per IGBT-inverter			0.66	K/W
		per Diode-inverter			1	
		per IGBT-brake-chopper			0.9	
		per Diode-chopper			1.5	
		per Diode-rectifier			0.75	
Thermal Resistance Case to Sink	$R_{\theta\text{CS}}$	per IGBT-inverter		0.31		K/W
		per Diode-inverter		0.48		
		per IGBT-brake-chopper		0.33		
		per Diode-chopper		0.7		
		per Diode-rectifier		0.36		
		per Module		0.02		
Module-to-Sink Torque	M_{S}		3		6	N·m
Weight of Module	G			180		g

Curve Characteristics

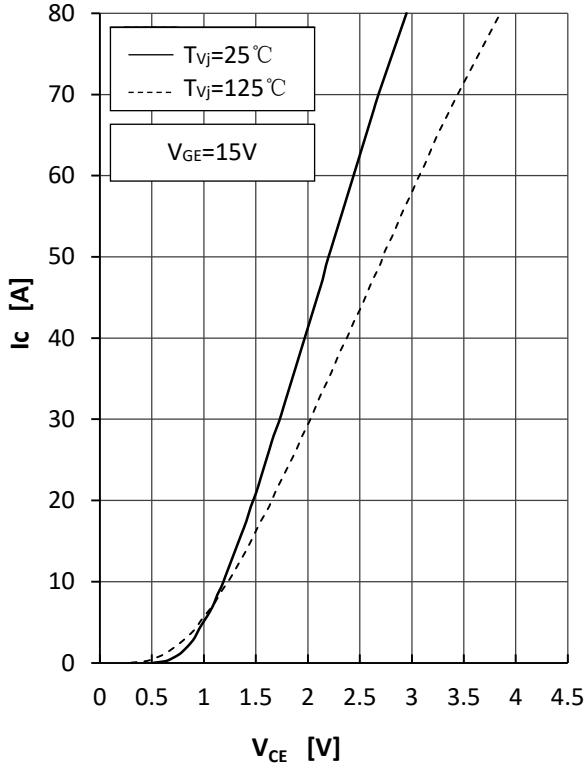


Fig1.IGBT Output Characteristics

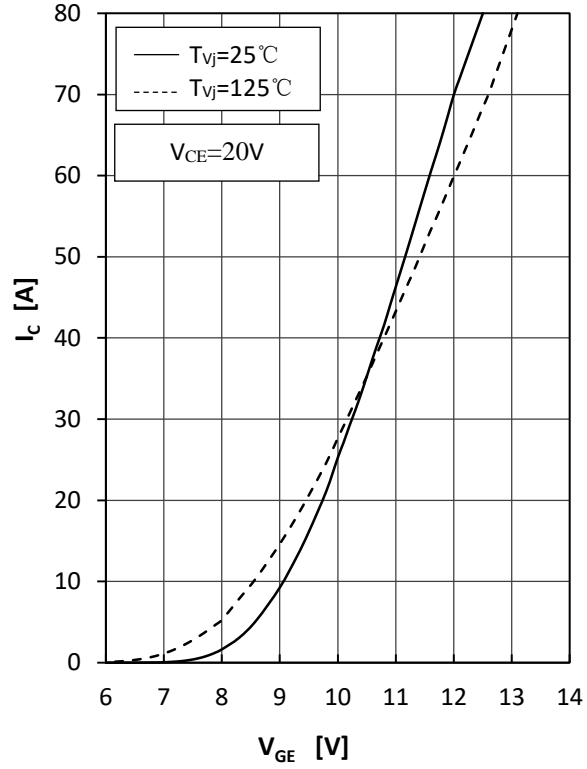


Fig2.IGBT Transfer Characteristics

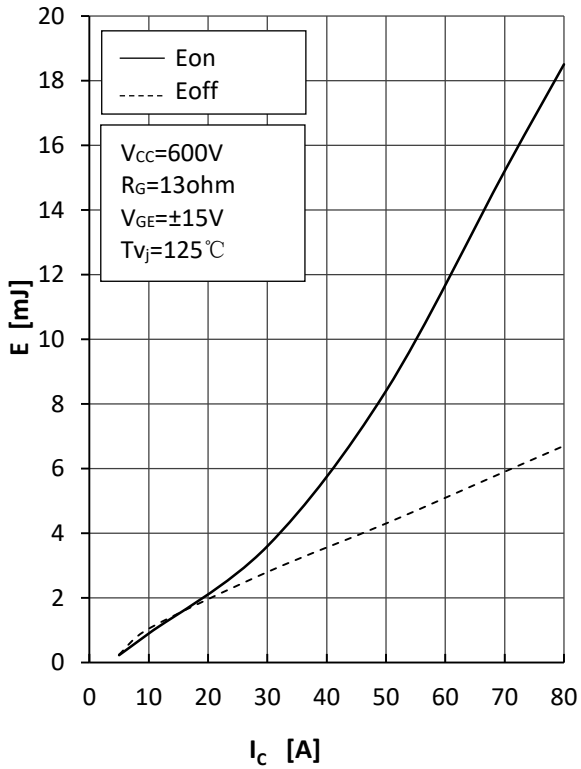


Fig3.IGBT Switching Loss vs.Ic

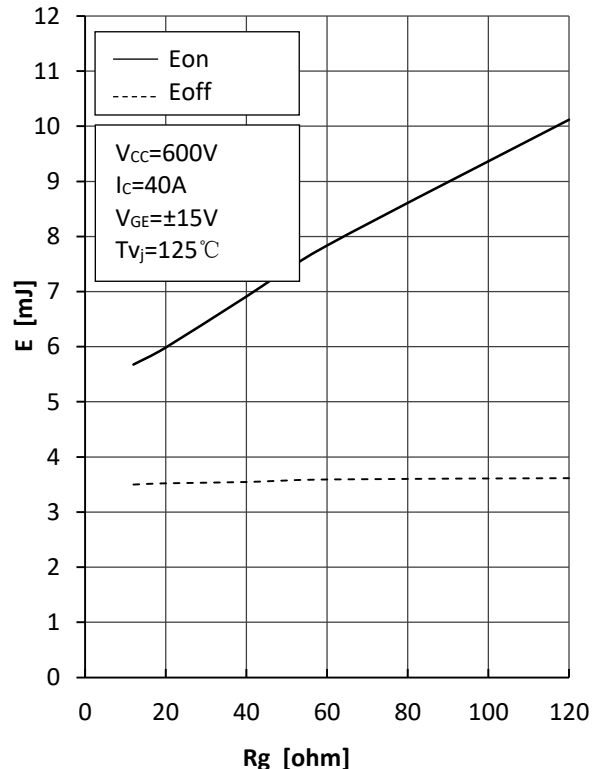
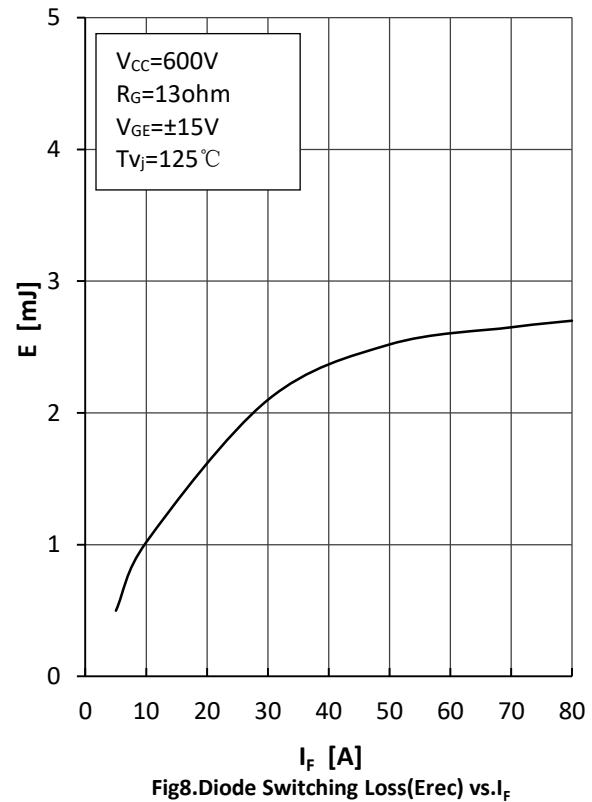
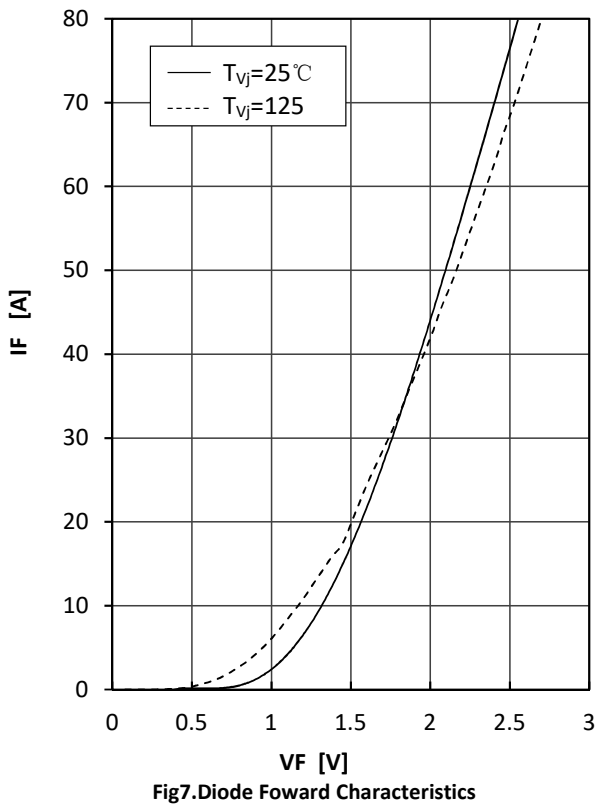
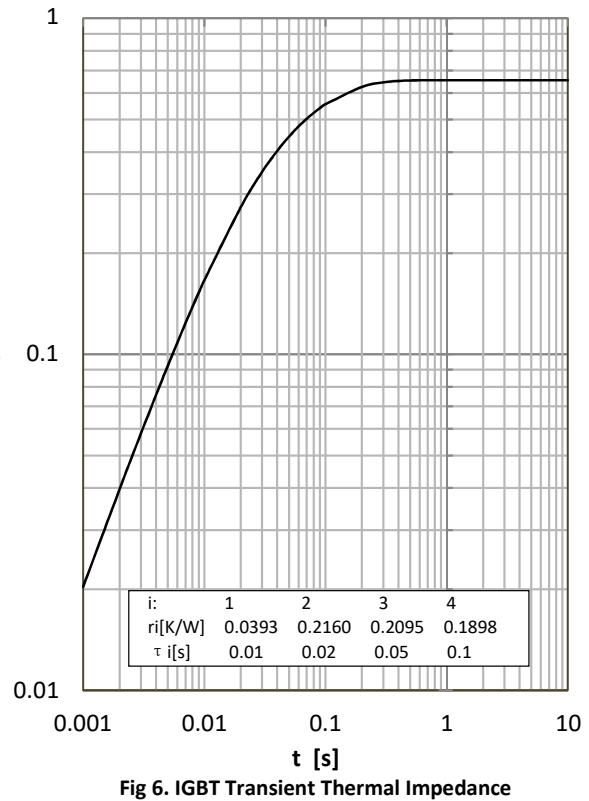
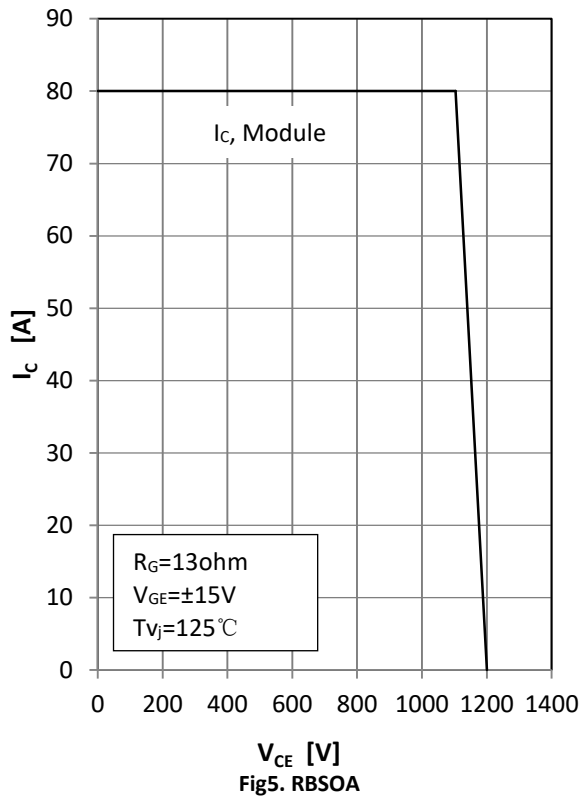


Fig4.IGBT Switching Loss vs.Rg

Curve Characteristics



Curve Characteristics

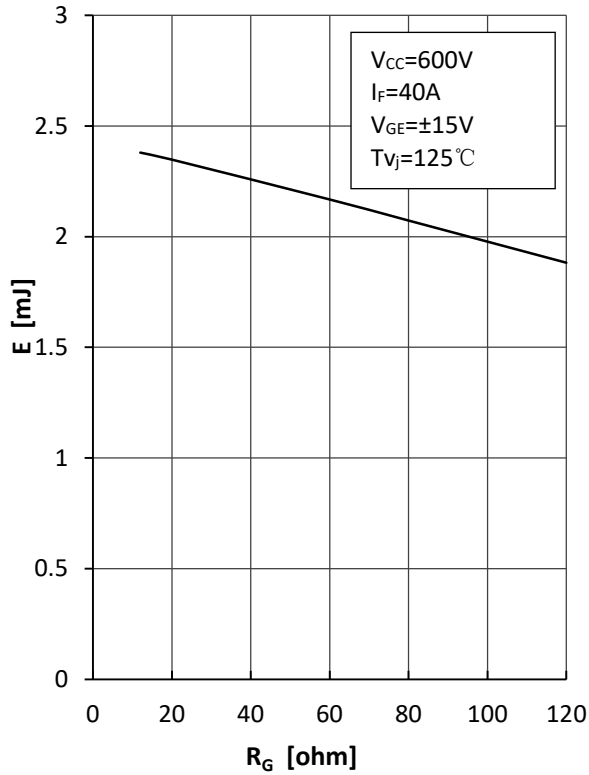


Fig9.Diode Switching Loss(Erec) vs.Rg

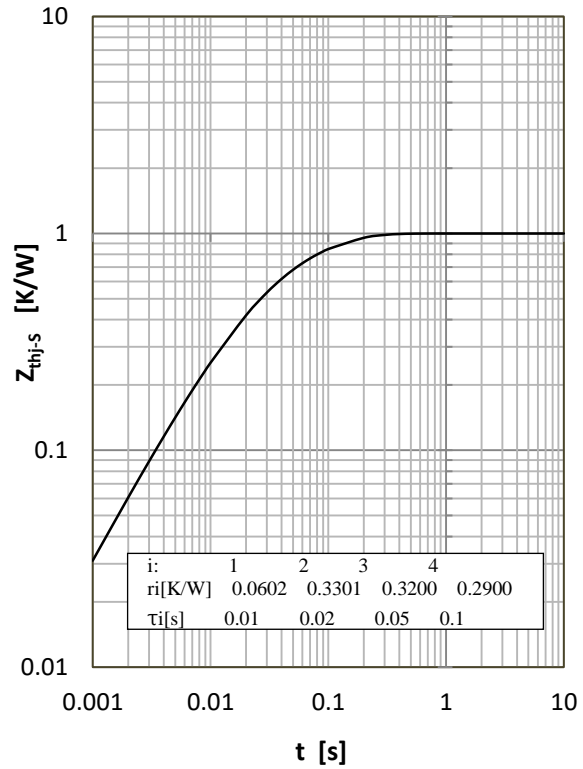


Fig10.Diode Transient Thermal Impedance

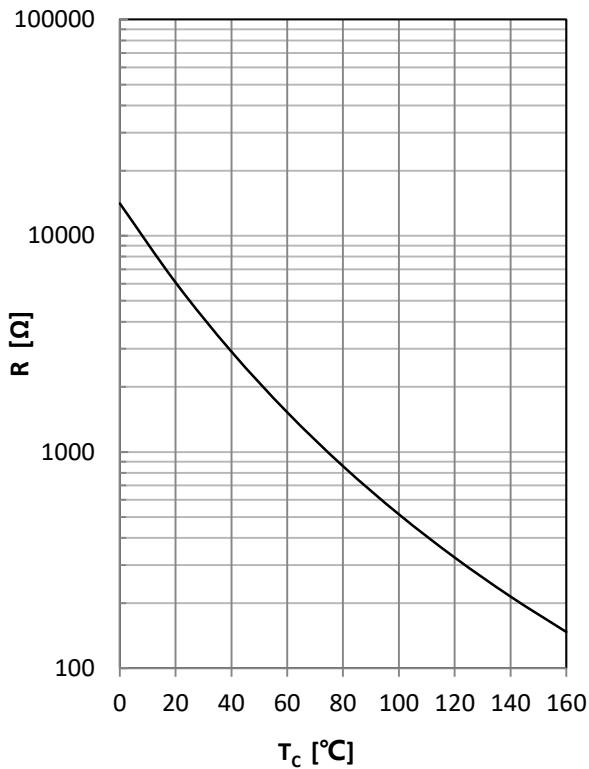


Fig 11. NTC Temperature Characteristic

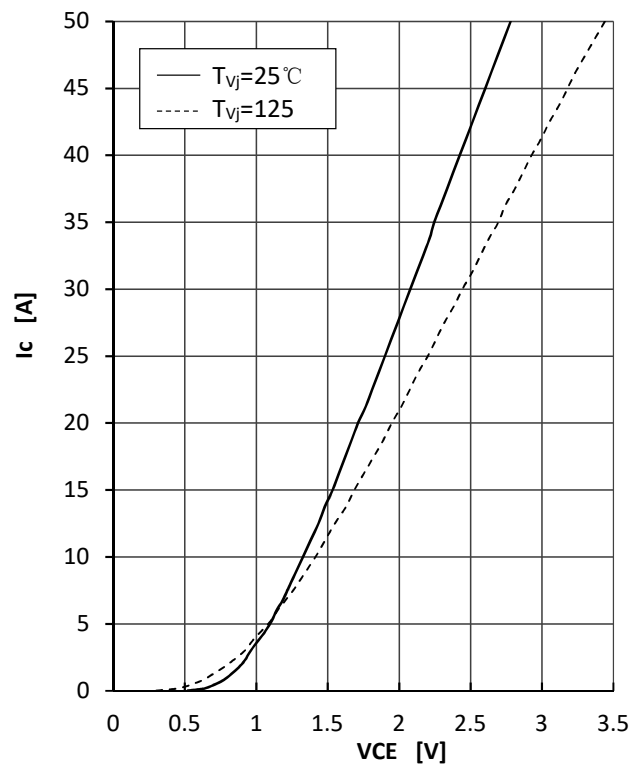


Fig12. IGBT-brake-Chopper Output Characteristics

Curve Characteristics

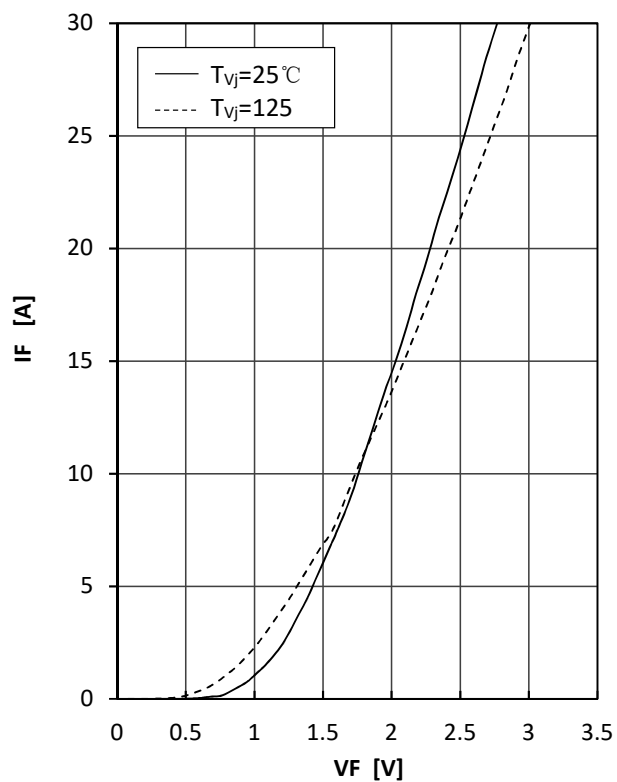
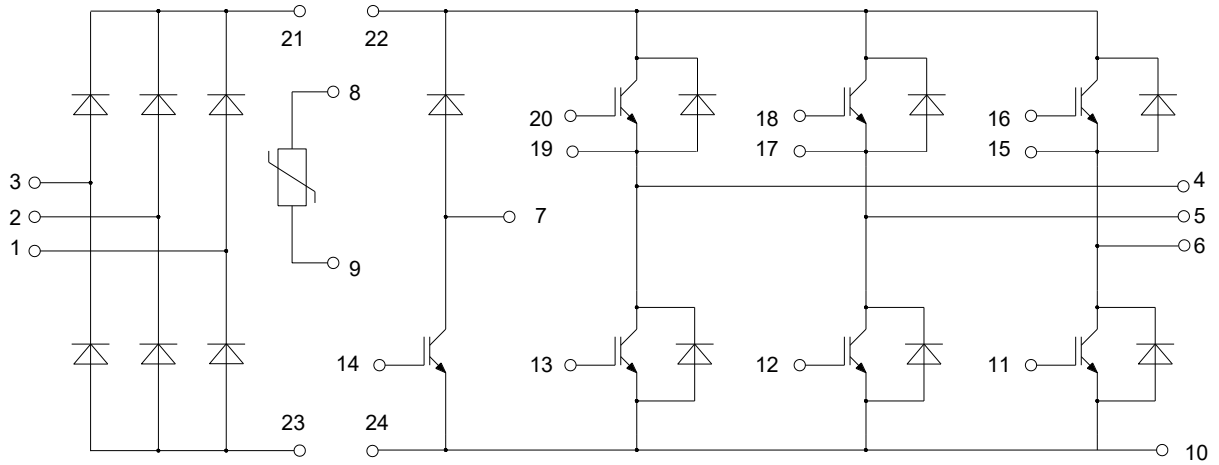


Fig13. Diode-brake-chopper Forward Characteristics

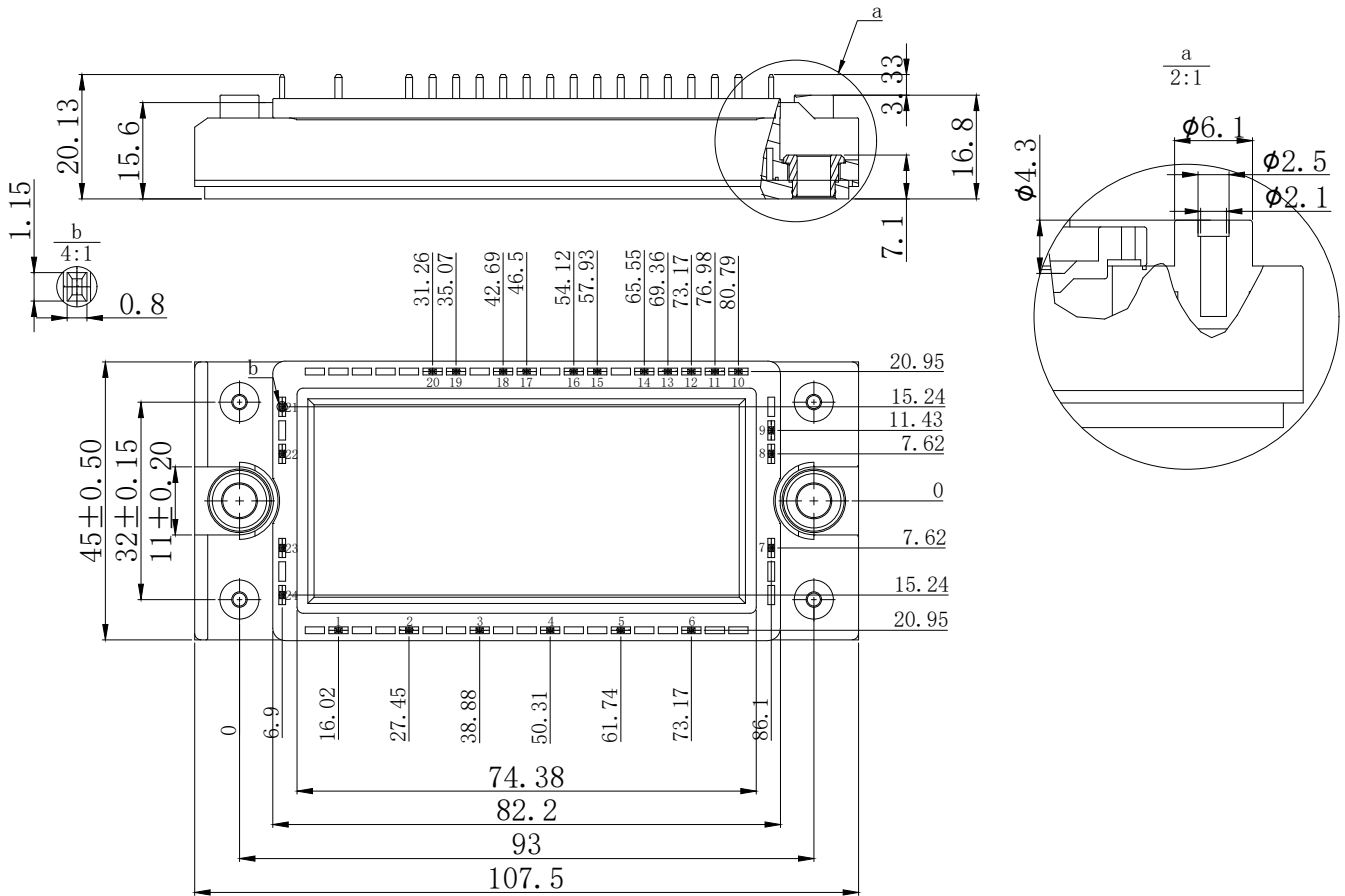
Circuit Diagram



Package Dimensions

E1

Dimensions in mm



Ordering Information

Device	Packing
Part Number-BP	Bulk: 10pcs/Box ; 70pcs/Ctn

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