



E502650

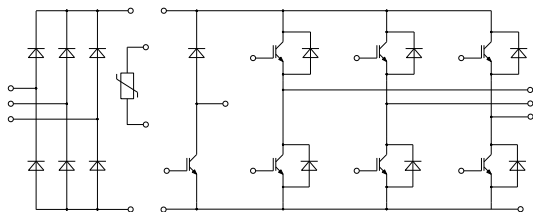
**Features**

- 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 $\mu$ 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**

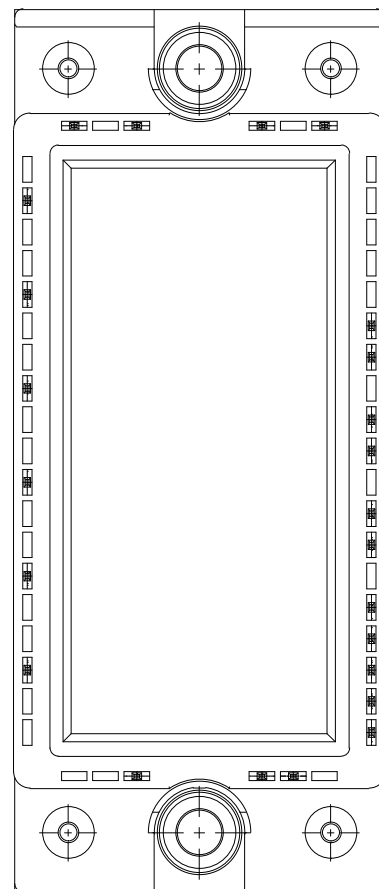
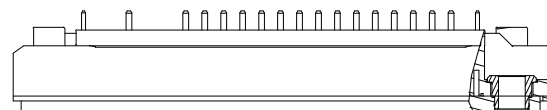
- Motor Drivers
- AC and DC Servo Drive Amplifier
- UPS (Uninterruptible Power Supplies)

**Circuit Diagram**



**IGBT Modules  
1200V 25A**

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	$I_C$	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	25	A
Repetitive Peak Collector Current	$I_{CRM}$	$t_p=1ms$	50	A
Gate-Emitter Voltage	$V_{GES}$	$T_{vj}=25^{\circ}C$	$\pm 20$	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	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=0.8mA, T_{vj}=25^{\circ}C$	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	$V_{CE(sat)}$	$I_C=25A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.85	2.25	V	
		$I_C=25A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15		V	
		$I_C=25A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.25		V	
Gate Charge	$Q_g$			0.2		$\mu C$	
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		1.45		nF	
Reverse Transfer Capacitance	$C_{res}$			0.05			
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=25A, V_{GE}=\pm 15V, R_G=18\Omega, T_{vj}=25^{\circ}C$		158		ns	
Rise Time	$t_r$			32			
Turn-Off Delay Time	$t_{d(off)}$			331			
Fall Time	$t_f$			83			
Turn-On Energy	$E_{on}$			1.8			mJ
Turn-Off Energy	$E_{off}$			1.4			
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=25A, V_{GE}=\pm 15V, R_G=18\Omega, T_{vj}=125^{\circ}C$		172		ns	
Rise Time	$t_r$			435			
Turn-Off Delay Time	$t_{d(off)}$			154			
Fall Time	$t_f$			212			
Turn-On Energy	$E_{on}$			2.4			mJ
Turn-Off Energy	$E_{off}$			2.18			
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

### 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	$I_F$		25	A
Repetitive Peak Forward Current	$I_{FRM}$	$t_p=1ms$	50	A
$I^2t$ -value	$I^2t$	$V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$	90	$A^2s$
		$V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$	75	

### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Forward Voltage	$V_F$	$I_F=25A, T_{vj}=25^{\circ}C$		2.1	2.5	V
		$I_F=25A, T_{vj}=125^{\circ}C$		2.2		V
		$I_F=25A, T_{vj}=150^{\circ}C$		2.2		V
Recovered Charge	$Q_{rr}$	$I_F=25A, V_R=600V,$ $-di_F/dt=680A/\mu s, T_{vj}=25^{\circ}C$		2.52		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			28.5		A
Reverse Recovery Energy	$E_{rec}$			0.94		mJ
Recovered Charge	$Q_{rr}$	$I_F=25A, V_R=600V,$ $-di_F/dt=680A/\mu s, T_{vj}=125^{\circ}C$		50.8		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			30.5		A
Reverse Recovery Energy	$E_{rec}$			1.75		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	$I_C$	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	15	A
Repetitive Peak Collector Current	$I_{CRM}$	$t_p=1ms$	30	A
Gate-Emitter Voltage	$V_{GES}$	$T_{vj}=25^{\circ}C$	$\pm 20$	V
Total Power Dissipation	$P_{tot}$	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	155	W

### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
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	mA	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=15A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.85	2.25	V	
		$I_C=15A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15		V	
		$I_C=15A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.25		V	
Gate Charge	$Q_g$			0.09		$\mu C$	
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		1.35		nF	
Reverse Transfer Capacitance	$C_{res}$			0.08			
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=15A, V_{GE}=\pm 15V, R_G=39\Omega, T_{vj}=25^{\circ}C$		46		ns	
Rise Time	$t_r$			45			
Turn-Off Delay Time	$t_{d(off)}$			182			
Fall Time	$t_f$			168			
Turn-On Energy	$E_{on}$			0.92			mJ
Turn-Off Energy	$E_{off}$			0.56			
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=15A, V_{GE}=\pm 15V, R_G=39\Omega, T_{vj}=125^{\circ}C$		46		ns	
Rise Time	$t_r$			63			
Turn-Off Delay Time	$t_{d(off)}$			248			
Fall Time	$t_f$			220			
Turn-On Energy	$E_{on}$			1.37			mJ
Turn-Off Energy	$E_{off}$			0.81			
SC Data	$I_{SC}$	$T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$		55		A	

## ● 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	$I^2t$	$V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$	40	$A^2s$
		$V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$	34	

### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Forward Voltage	$V_F$	$I_F=15A, T_{vj}=25^{\circ}C$		2.0	2.65	V
		$I_F=15A, T_{vj}=125^{\circ}C$		2.1		V
		$I_F=15A, T_{vj}=150^{\circ}C$		2.1		V
Recovered Charge	$Q_{rr}$	$I_F=15A, V_R=600V,$ $-di_F/dt=600A/\mu s, T_{vj}=25^{\circ}C$		1.2		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			13.0		A
Reverse Recovery Energy	$E_{rec}$			0.37		mJ
Recovered Charge	$Q_{rr}$	$I_F=15A, V_R=600V,$ $-di_F/dt=550A/\mu s, T_{vj}=125^{\circ}C$		2.4		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			19.4		A
Reverse Recovery Energy	$E_{rec}$			0.86		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	$I_{F(AV)}$	$T_C=100^{\circ}\text{C}$	35	A
Maximum RMS Current at Rectifier Output	$I_{RMSM}$	$T_C=100^{\circ}\text{C}$	60	A
Surge Forward Current	$I_{FSM}$	$V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	320	A
$I^2t$ -value	$I^2t$	$V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	510	$\text{A}^2\text{s}$

### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	$V_F$	$I_F=25\text{A}, T_j=150^{\circ}\text{C}$		1.02		V
Reverse Current	$I_r$	$T_j=125^{\circ}\text{C}, V_R=1600\text{V}$			2	mA

## ● NTC-Thermistor

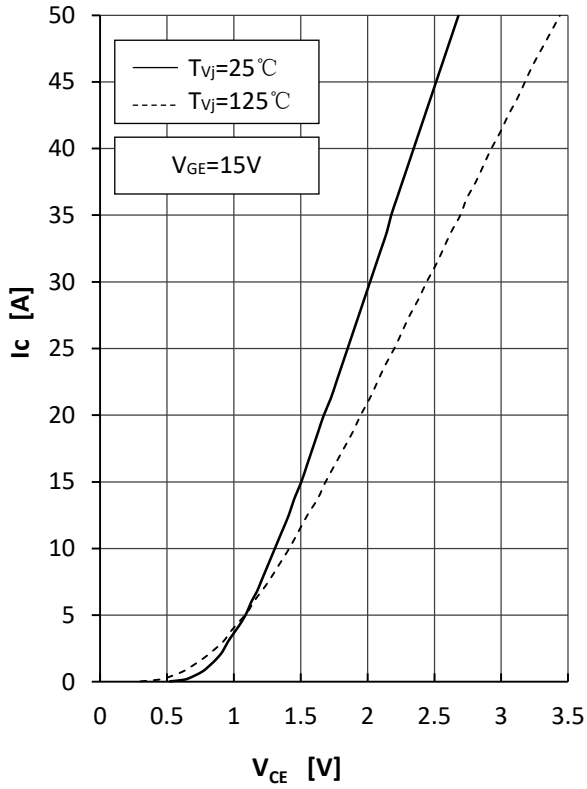
### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Rated Resistance	$R_{25}$			5		k $\Omega$
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

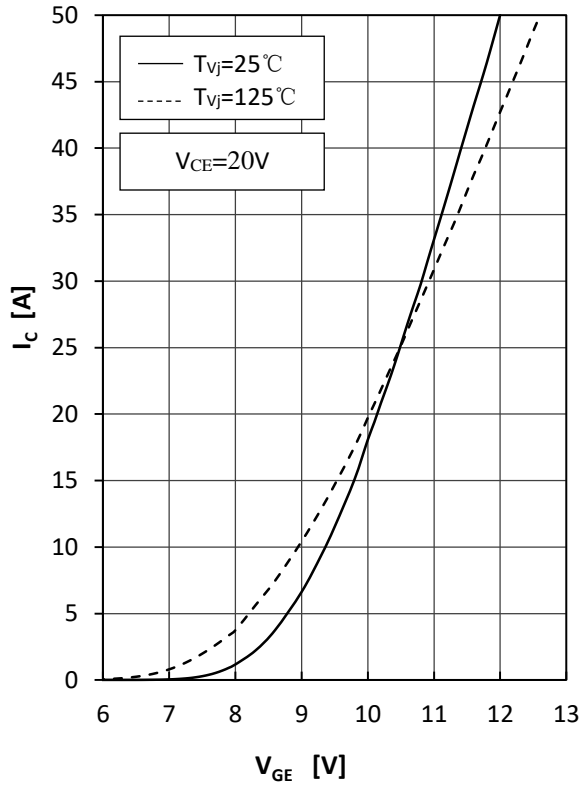
**● Module Characteristics( $T_C=25^\circ\text{C}$  unless otherwise specified)**

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Isolation voltage	$V_{\text{isol}}$	$t=1\text{ min}, f=50\text{ Hz}$	2500			V
Maximum Junction Temperature	$T_{\text{jmax}}$	Inverter, brake			175	$^\circ\text{C}$
		rectifier			150	
Operating Junction Temperature	$T_{\text{vj op}}$		-40		150	$^\circ\text{C}$
Operating Junction Temperature	$T_{\text{stg}}$		-40		125	$^\circ\text{C}$
Stray Inductance	$L_{\text{CE}}$			60		nH
Module Lead Resistance , Terminal to Chip	$R_{\text{cc'+EE'}}$	TC=25 $^\circ\text{C}$ , per switch		4		m $\Omega$
	$R_{\text{AA'+CC'}}$			3		
Thermal Resistance Junction to Case	$R_{\theta\text{j c}}$	per IGBT-inverter			0.90	K/W
		per Diode-inverter			1.2	
		per IGBT-brake-chopper			1.2	
		per Diode-chopper			1.5	
		per Diode-rectifier			1.15	
Thermal Resistance Case to Sink	$R_{\theta\text{c s}}$	per IGBT-inverter		0.33		K/W
		per Diode-inverter		0.46		
		per IGBT-brake-chopper		0.46		
		per Diode-chopper		0.70		
		per Diode-rectifier		0.49		
		per Module		0.02		
Module-to-Sink Torque	$M_{\text{S}}$		3		6	N·m
Weight of Module	G			180		g

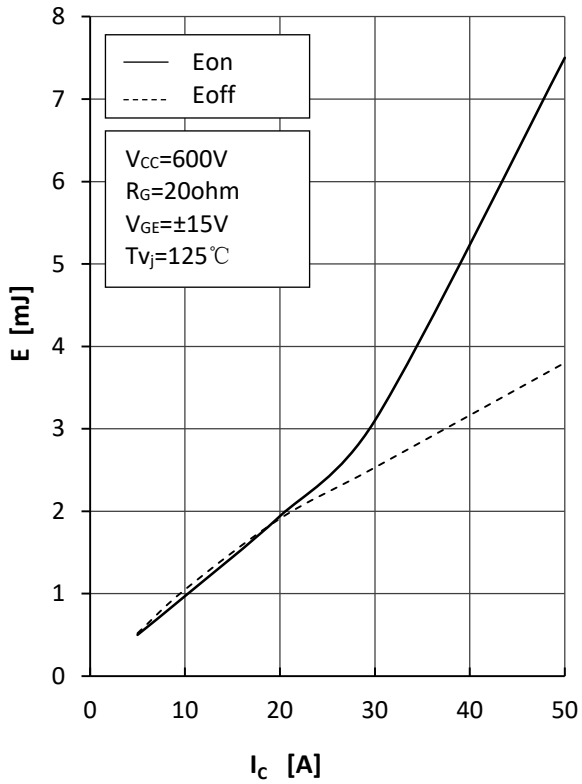
**Curve Characteristics**



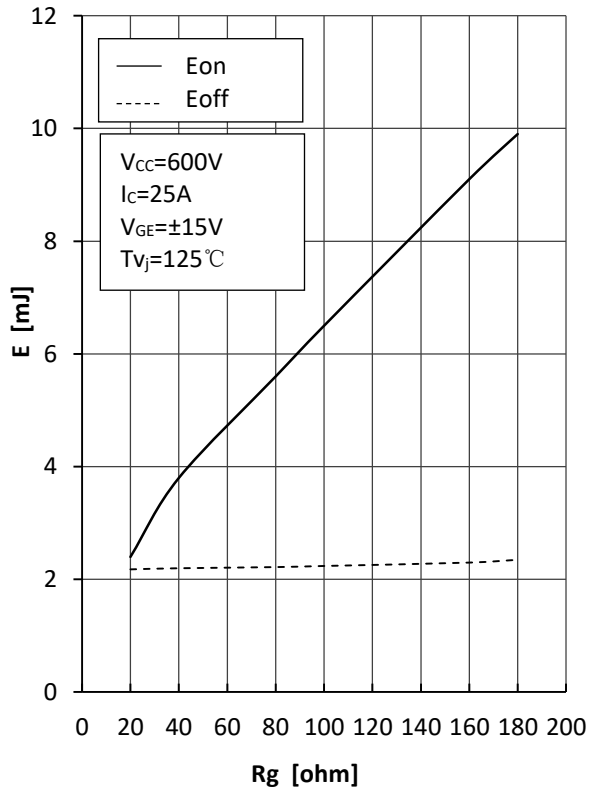
**Fig1.IGBT Output Characteristics**



**Fig2.IGBT Transfer Characteristics**



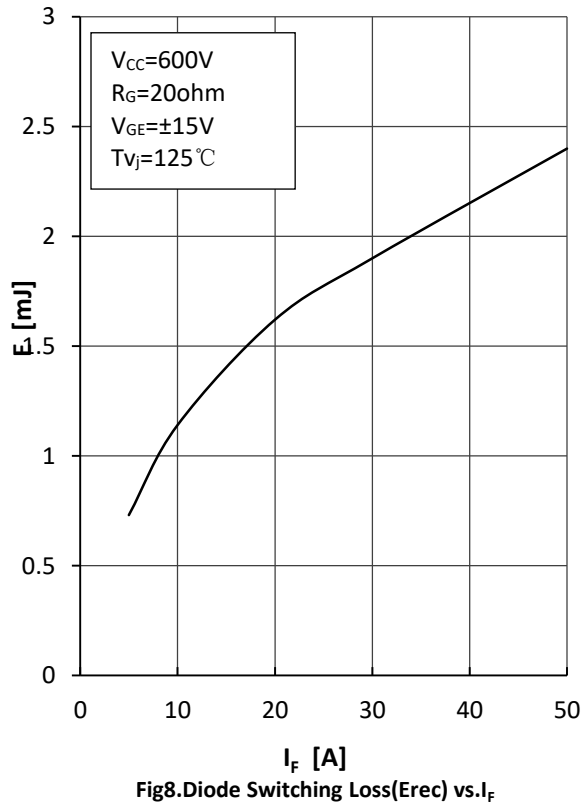
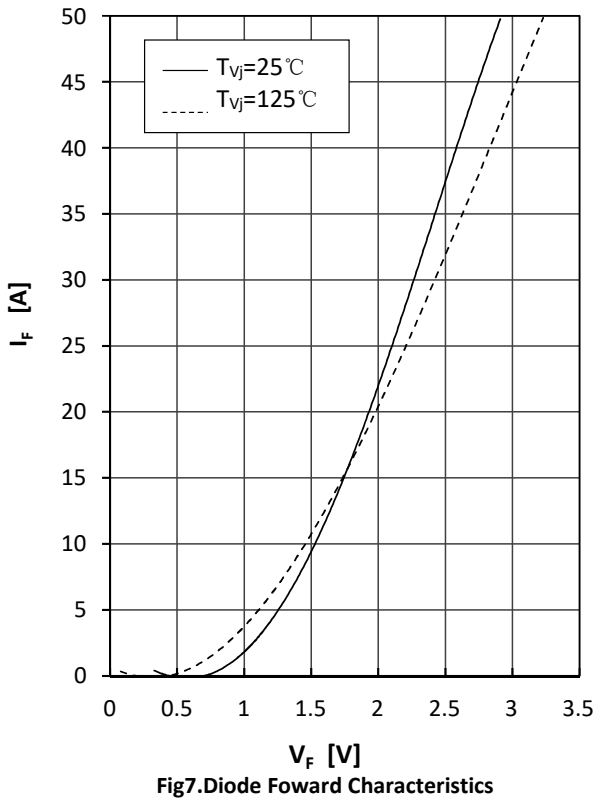
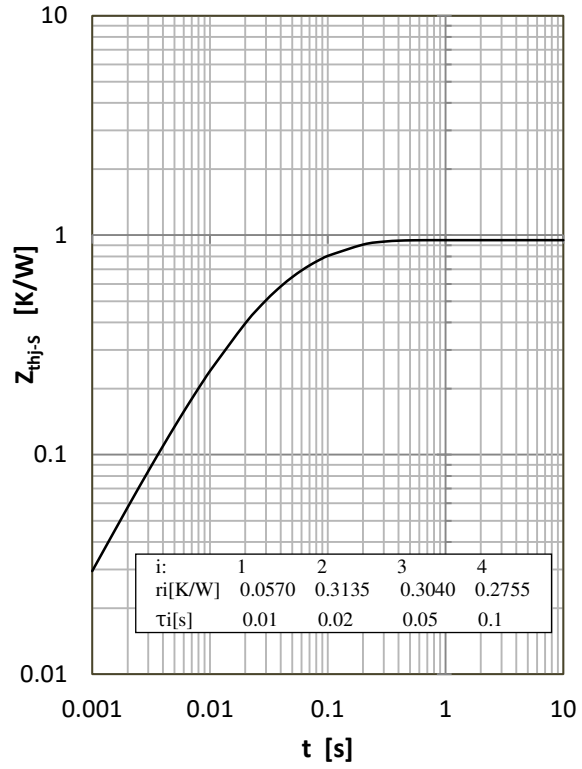
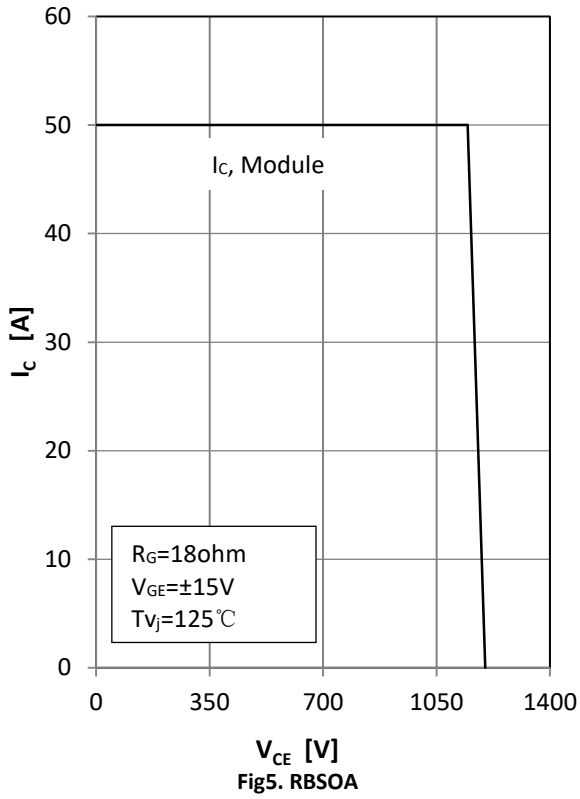
**Fig3.IGBT Switching Loss vs.Ic**



**Fig4.IGBT Switching Loss vs.Rg**



Curve Characteristics



Curve Characteristics

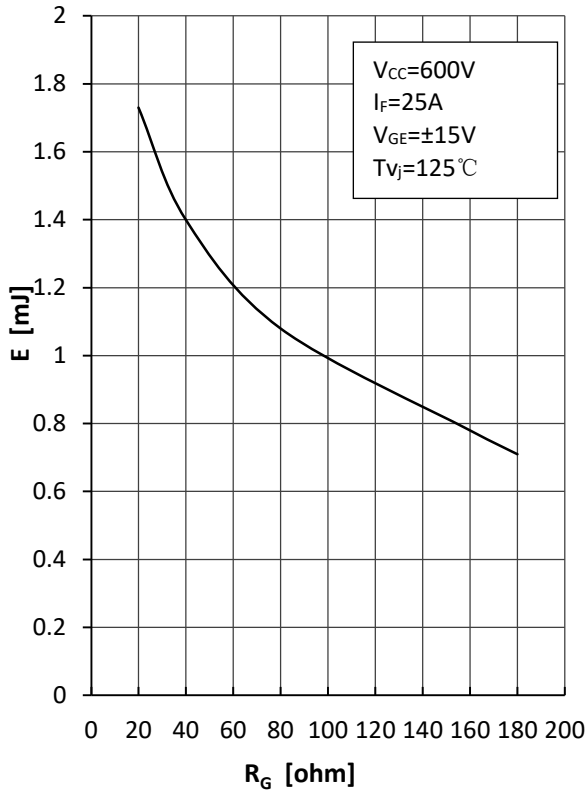


Fig9.Diode Switching Loss(Erec) vs.Rg

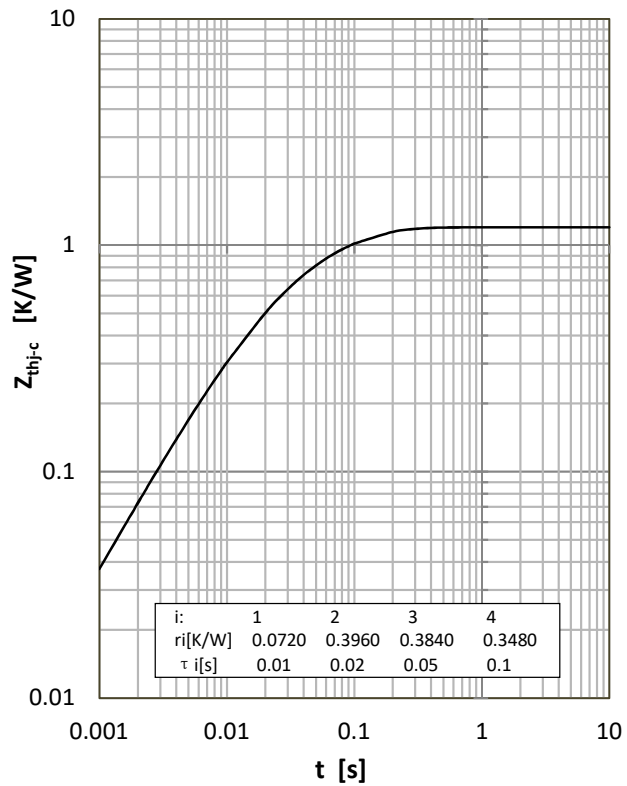


Fig10.Diode Transient Thermal Impedance

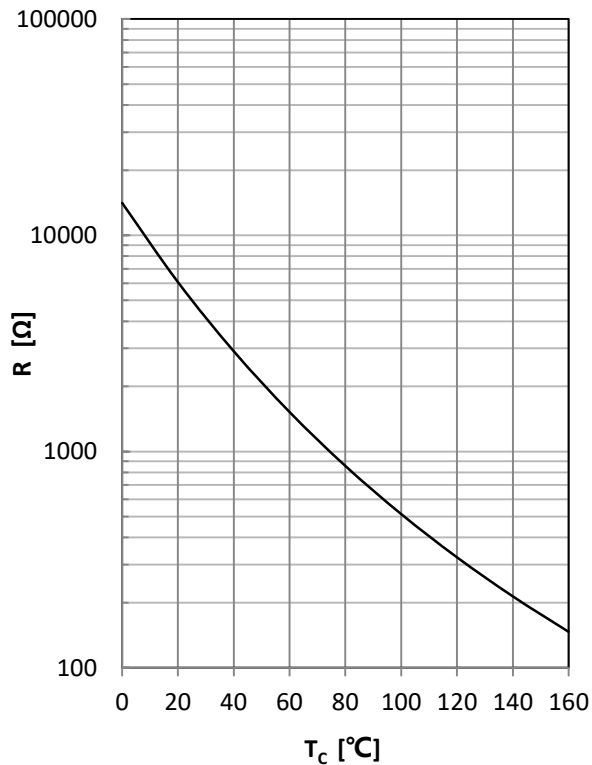
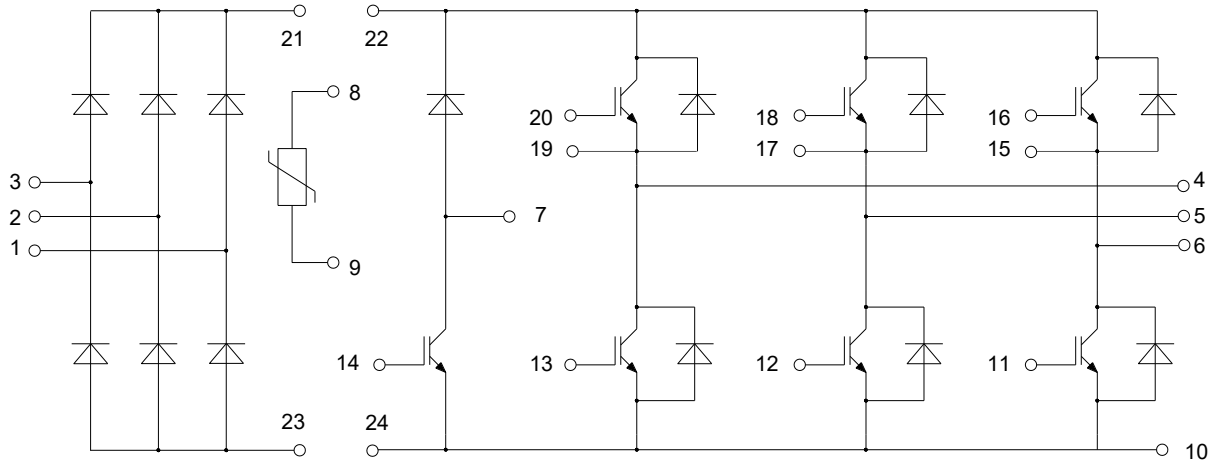


Fig 11. NTC Temperature Characteristic

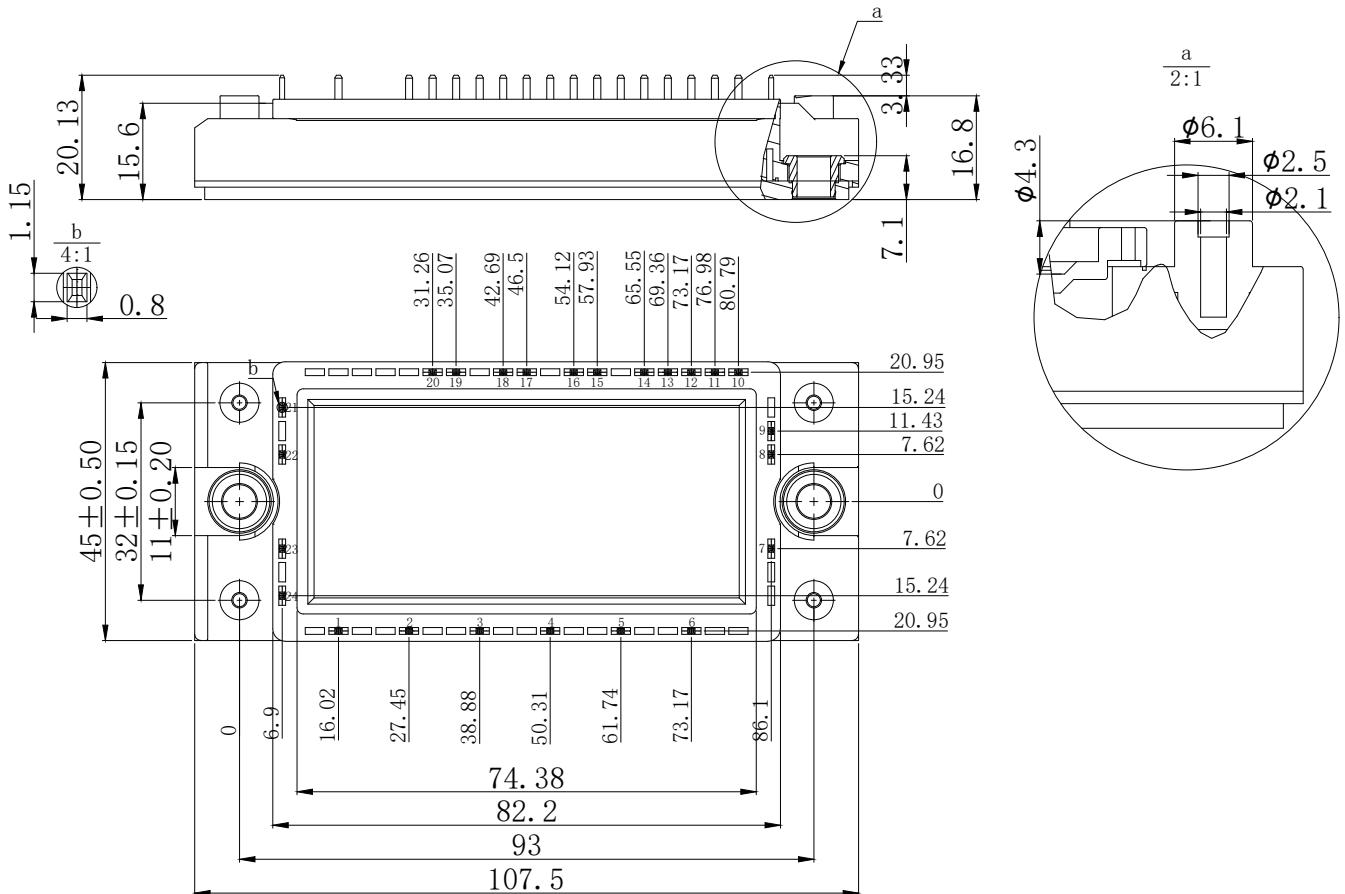
### Circuit Diagram



### Package Dimensions

**E1**

Dimensions in mm



## Ordering Information

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

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