

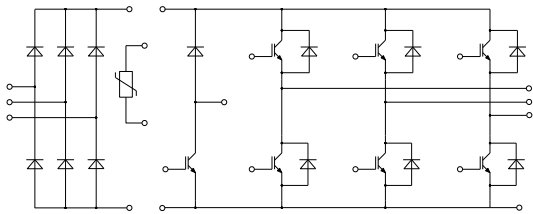
## Features

- 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

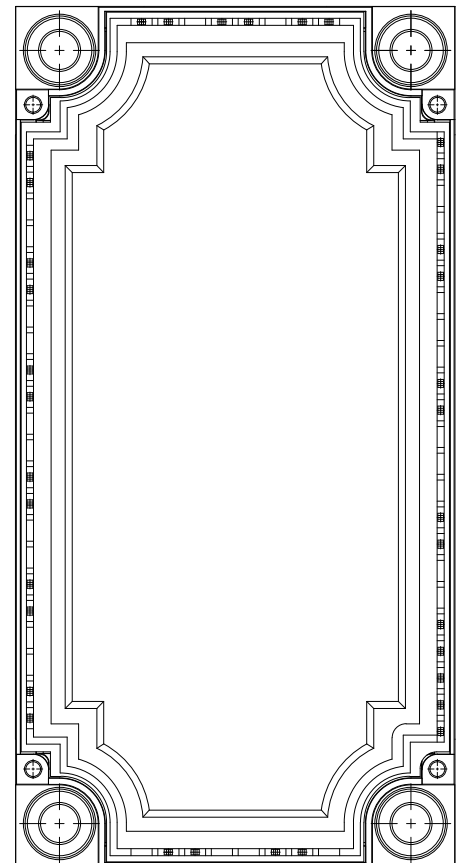
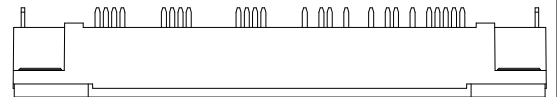
- Motor Drivers
- AC and DC Servo Drive Amplifier
- UPS (Uninterruptible Power Supplies)

## Circuit Diagram



# IGBT Modules 1200V 50A

E2A



● 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	$I_C$	$T_C=80^{\circ}C, T_{vjmax}=150^{\circ}C$	50	A
Repetitive Peak Collector Current	$I_{CRM}$	$t_p=1ms$	100	A
Gate-Emitter Voltage	$V_{GES}$	$T_{vj}=25^{\circ}C$	$\pm 20$	V
Total Power Dissipation	$P_{tot}$	$T_C=25^{\circ}C, T_{vjmax}=150^{\circ}C$	368	W

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=2mA, T_{vj}=25^{\circ}C$	5	5.8	6.5	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	$V_{CE(sat)}$	$I_C=50A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.95	2.25	V
		$I_C=50A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15		V
		$I_C=50A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.2		V
Gate Charge	$Q_g$			0.6		$\mu C$
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		3.8		nF
Reverse Transfer Capacitance	$C_{res}$			0.26		
Internal Gate Resistance	$R_{gint}$			2.5		$\Omega$
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=50A, V_{GE}=\pm 15V, R_G=15\Omega, T_{vj}=25^{\circ}C$		40		ns
Rise Time	$t_r$			65		
Turn-Off Delay Time	$t_{d(off)}$			390		
Fall Time	$t_f$			36		
Turn-On Energy	$E_{on}$			6.05		
Turn-Off Energy	$E_{off}$		3.3			
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=50A, V_{GE}=\pm 15V, R_G=15\Omega, T_{vj}=125^{\circ}C$		45		ns
Rise Time	$t_r$			70		
Turn-Off Delay Time	$t_{d(off)}$			440		
Fall Time	$t_f$			41		
Turn-On Energy	$E_{on}$			8		
Turn-Off Energy	$E_{off}$		5.5			
SC Data	$I_{SC}$	$T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$		320		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	$I_F$		50	A
Repetitive Peak Forward Current	$I_{FRM}$	$t_p=1ms$	100	A

### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Forward Voltage	$V_F$	$I_F=50A, T_{vj}=25^{\circ}C$		1.95	2.25	V
		$I_F=50A, T_{vj}=125^{\circ}C$		2.05		V
		$I_F=50A, T_{vj}=150^{\circ}C$		2.1		V
Recovered Charge	$Q_{rr}$	$I_F=50A, V_R=600V,$ $-di_F/dt=900A/\mu s, T_{vj}=25^{\circ}C$		3.5		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			40		A
Reverse Recovery Energy	$E_{rec}$			1.35		mJ
Recovered Charge	$Q_{rr}$	$I_F=50A, V_R=600V,$ $-di_F/dt=900A/\mu s, T_{vj}=125^{\circ}C$		6.5		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			50		A
Reverse Recovery Energy	$E_{rec}$			2		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	$I_C$	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	40	A
Repetitive Peak Collector Current	$I_{CRM}$	$t_p=1ms$	80	A
Gate-Emitter Voltage	$V_{GES}$	$T_{vj}=25^{\circ}C$	$\pm 20$	V
Total Power Dissipation	$P_{tot}$	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	300	W

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.2mA, T_{vj}=25^{\circ}C$	5.8	6.7	7.2	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	$V_{CE(sat)}$	$I_C=40A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.95	2.35	V	
		$I_C=40A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.3		V	
		$I_C=40A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.4		V	
Gate Charge	$Q_g$			0.27		$\mu C$	
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		2		nF	
Reverse Transfer Capacitance	$C_{res}$			0.07			
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA	
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=40A, V_{GE}=\pm 15V, R_G=12\Omega, T_{vj}=25^{\circ}C$		28		ns	
Rise Time	$t_r$			16			
Turn-Off Delay Time	$t_{d(off)}$			26			
Fall Time	$t_f$			125			
Turn-On Energy	$E_{on}$				2.4		mJ
Turn-Off Energy	$E_{off}$			2.25			
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=40A, V_{GE}=\pm 15V, R_G=12\Omega, T_{vj}=125^{\circ}C$		28		ns	
Rise Time	$t_r$			18			
Turn-Off Delay Time	$t_{d(off)}$			310			
Fall Time	$t_f$			190			
Turn-On Energy	$E_{on}$				3.6		mJ
Turn-Off Energy	$E_{off}$				3.2		
SC Data	$I_{SC}$	$T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$		130		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	$I_F$		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	$V_F$	$I_F=40A, T_{vj}=25^{\circ}C$		1.75	2.25	V
		$I_F=40A, T_{vj}=125^{\circ}C$		1.75		V
		$I_F=40A, T_{vj}=150^{\circ}C$		1.75		V
Recovered Charge	$Q_{rr}$	$I_F=40A, V_R=600V,$ $-di_F/dt=1600A/\mu s, T_{vj}=25^{\circ}C$		4.15		$\mu C$
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		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			46		A
Reverse Recovery Energy	$E_{rec}$			2.38		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	$I_{F(AV)}$	$T_C=100^{\circ}\text{C}$	65	A
Maximum RMS Current at Rectifier Output	$I_{RMSM}$	$T_C=100^{\circ}\text{C}$	110	A
Surge Forward Current	$I_{FSM}$	$V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	850	A
$I^2t$ -value	$I^2t$	$V_R=0, t_p=10\text{ms}, T_j=45^{\circ}\text{C}$	3610	$\text{A}^2\text{s}$

### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Diode Forward Voltage	$V_F$	$I_F=50\text{A}, T_j=150^{\circ}\text{C}$		1		V
Reverse Current	$I_r$	$T_j=125^{\circ}\text{C}, V_R=1600\text{V}$			1.5	mA

## ● NTC-Thermistor

### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Rated Resistance	$R_{25}$			5		$\text{k}\Omega$
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	$V_{isol}$	$t=1\text{ min}, f=50\text{ Hz}$	2500			V
Maximum Junction Temperature	$T_{jmax}$	Inverter, brake			175	$^\circ\text{C}$
		rectifier			150	
Operating Junction Temperature	$T_{vj\text{ op}}$		-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	$R_{cc'+EE'}$	TC= $25^\circ\text{C}$ , per switch		4		m $\Omega$
	$R_{AA'+CC'}$			2		
Thermal Resistance Junction to Case	$R_{\theta jc}$	per IGBT-inverter			0.339	K/W
		per Diode-inverter			0.619	
		per IGBT-brake-chopper			0.5	
		per Diode-chopper			1.266	
		per Diode-rectifier			0.635	
Thermal Resistance Case to Sink	$R_{\theta cs}$	per IGBT-inverter		0.121		K/W
		per Diode-inverter		0.221		
		per IGBT-brake-chopper		0.18		
		per Diode-chopper		0.452		
		per Diode-rectifier		0.227		
		per Module		0.02		
Module-to-Sink Torque	$M_S$		3		6	N·m
Weight of Module	G			300		g

### Curve Characteristics

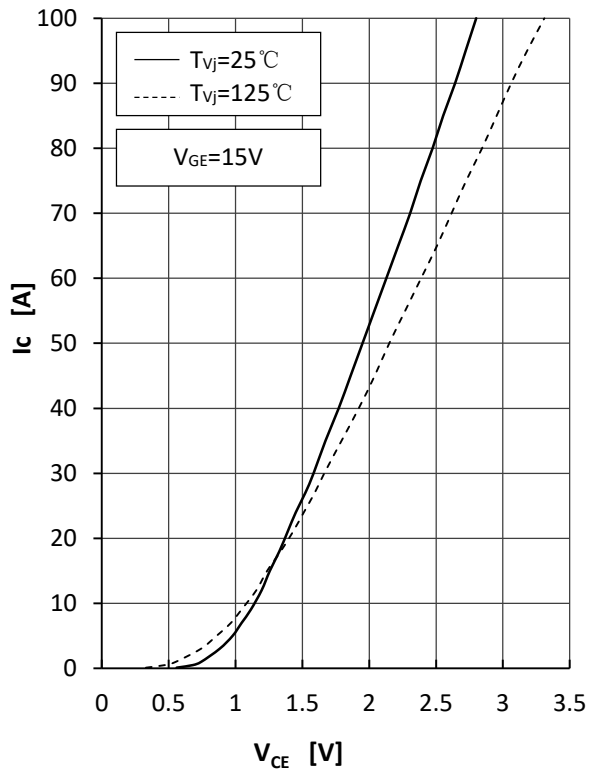


Fig1.IGBT Output Characteristics

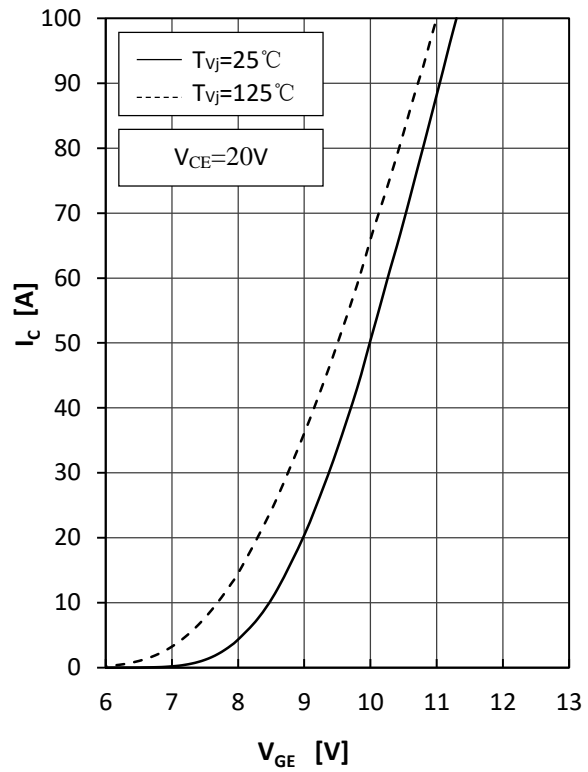


Fig2.IGBT Transfer Characteristics

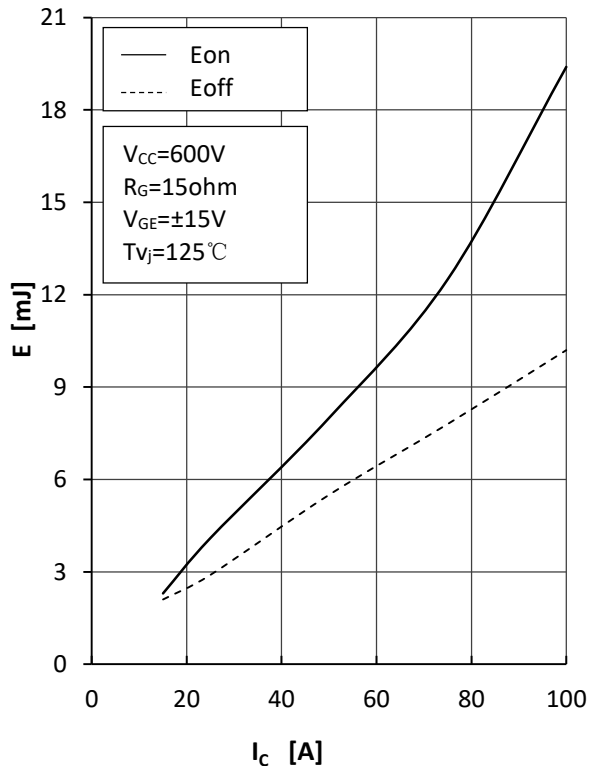


Fig3.IGBT Switching Loss vs.Ic

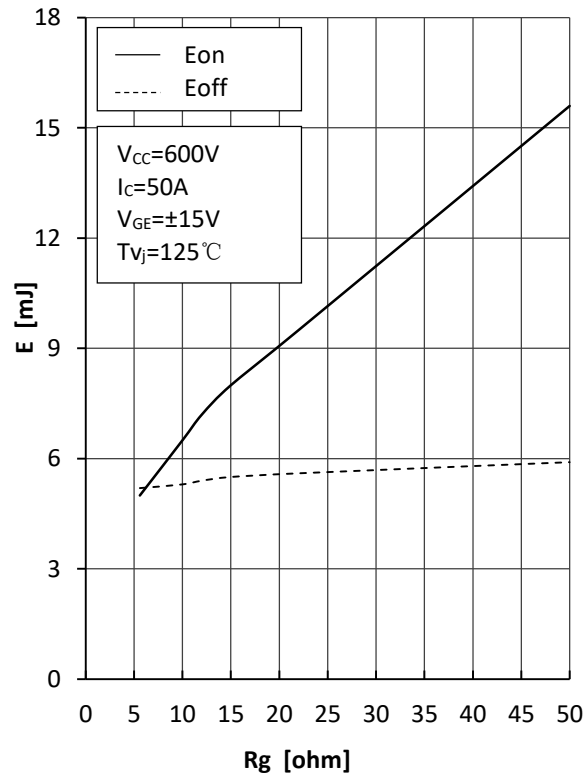
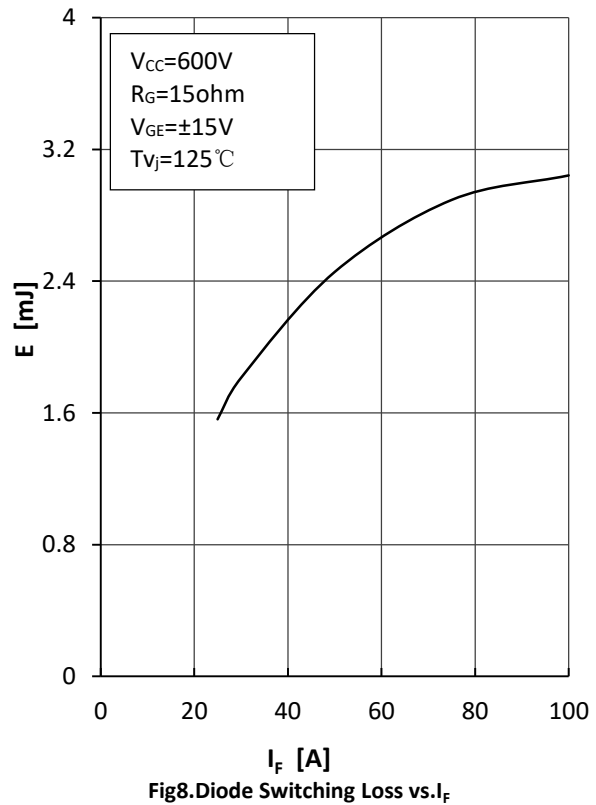
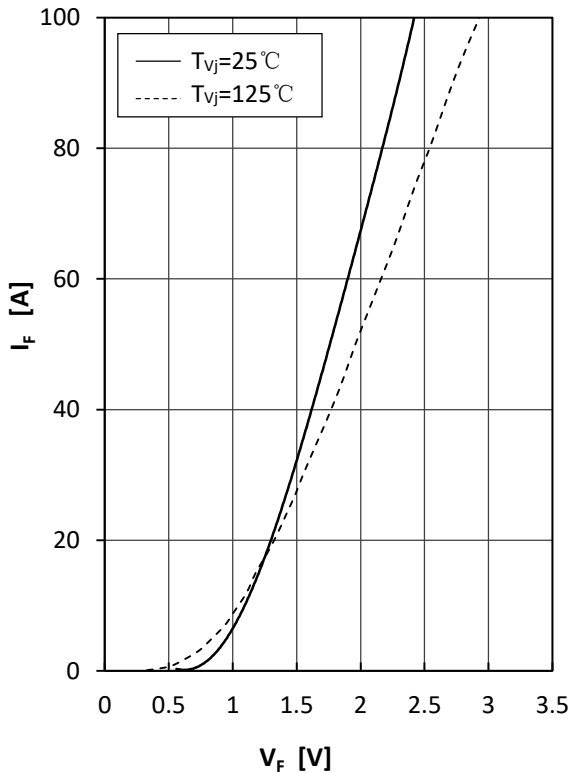
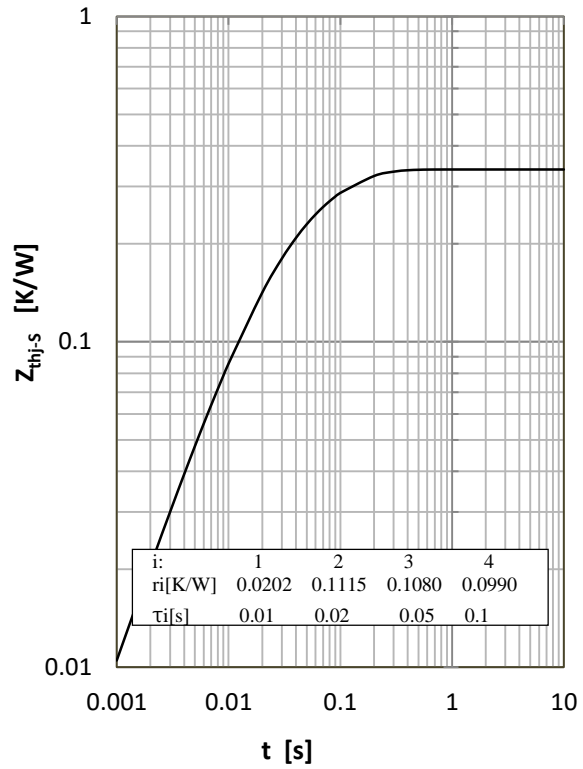
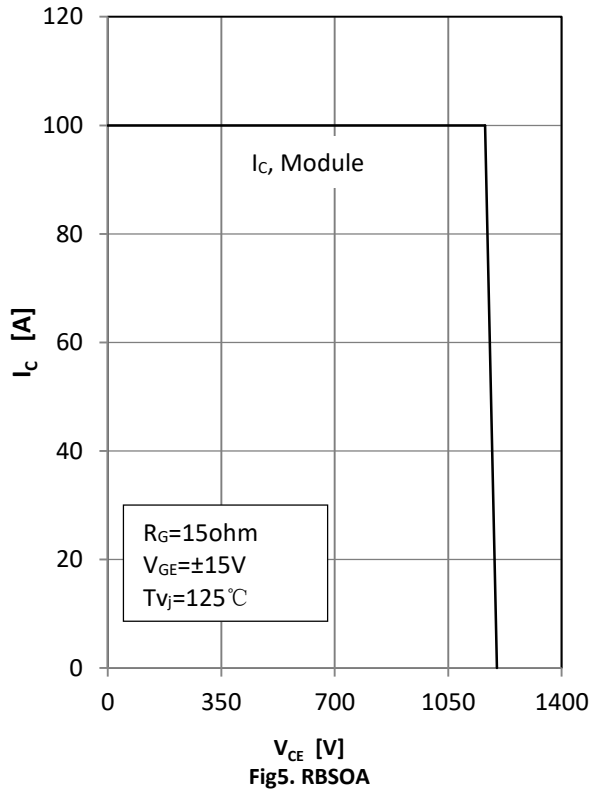


Fig4.IGBT Switching Loss vs.Rg



Curve Characteristics



Curve Characteristics

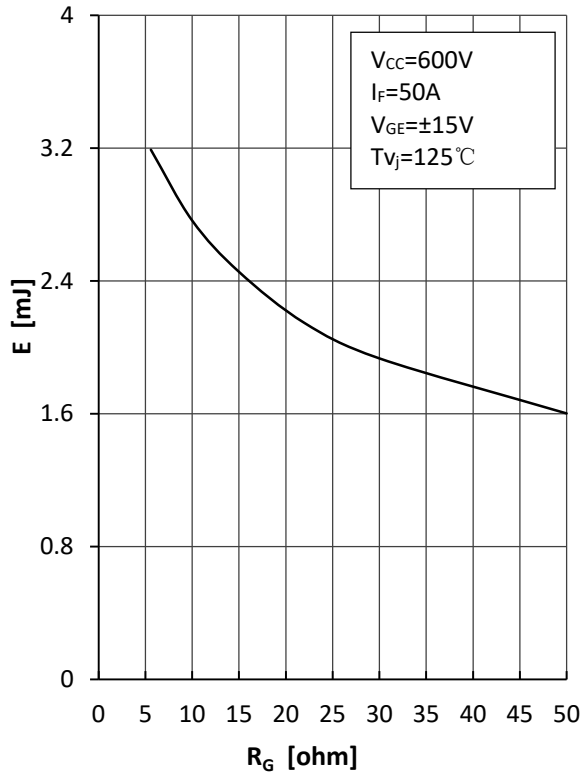


Fig9.Diode Switching Loss vs.Rg

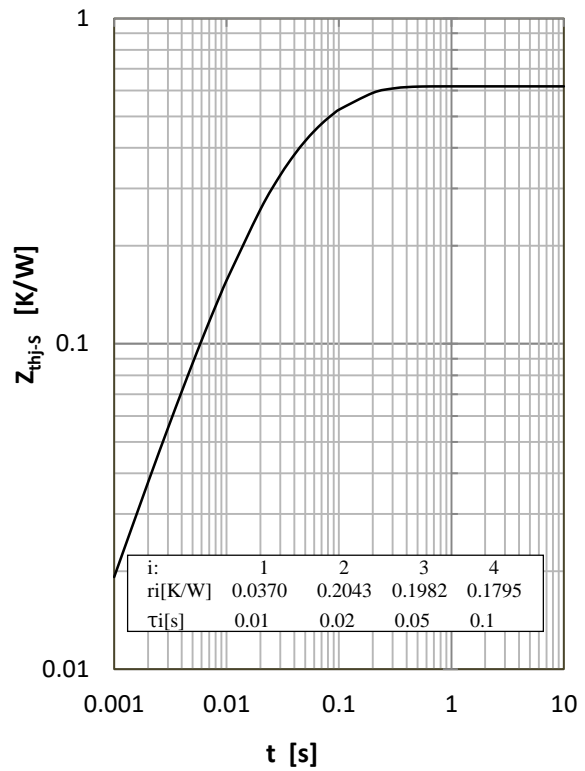


Fig10.Diode Transient Thermal Impedance

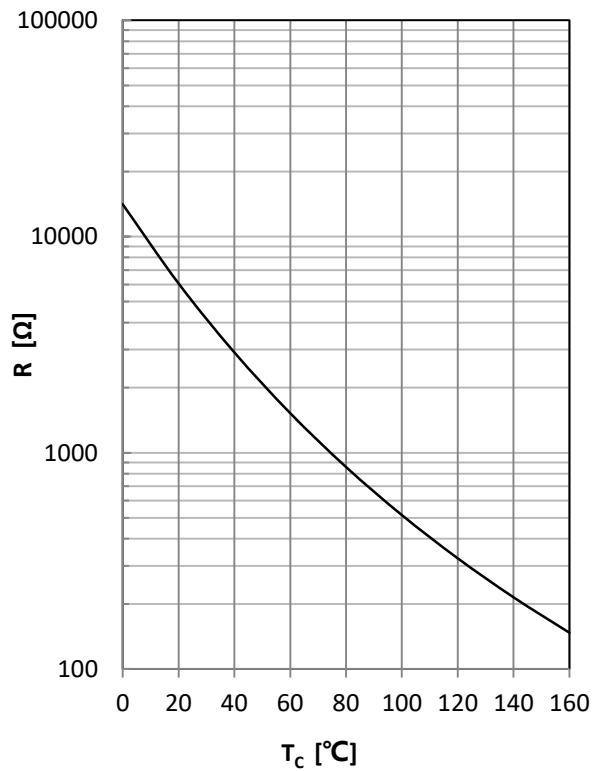
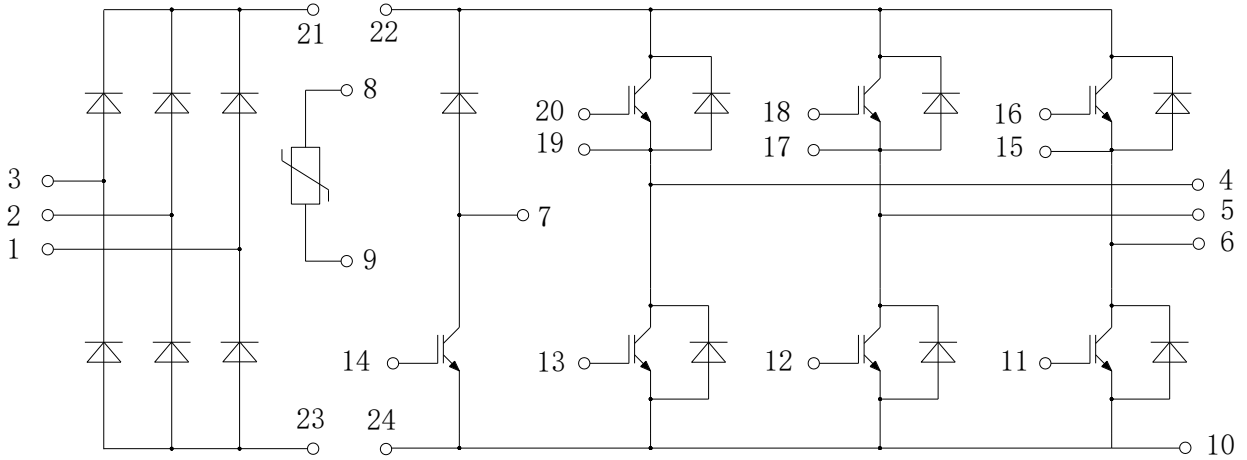


Fig 11. NTC Temperature Characteristic

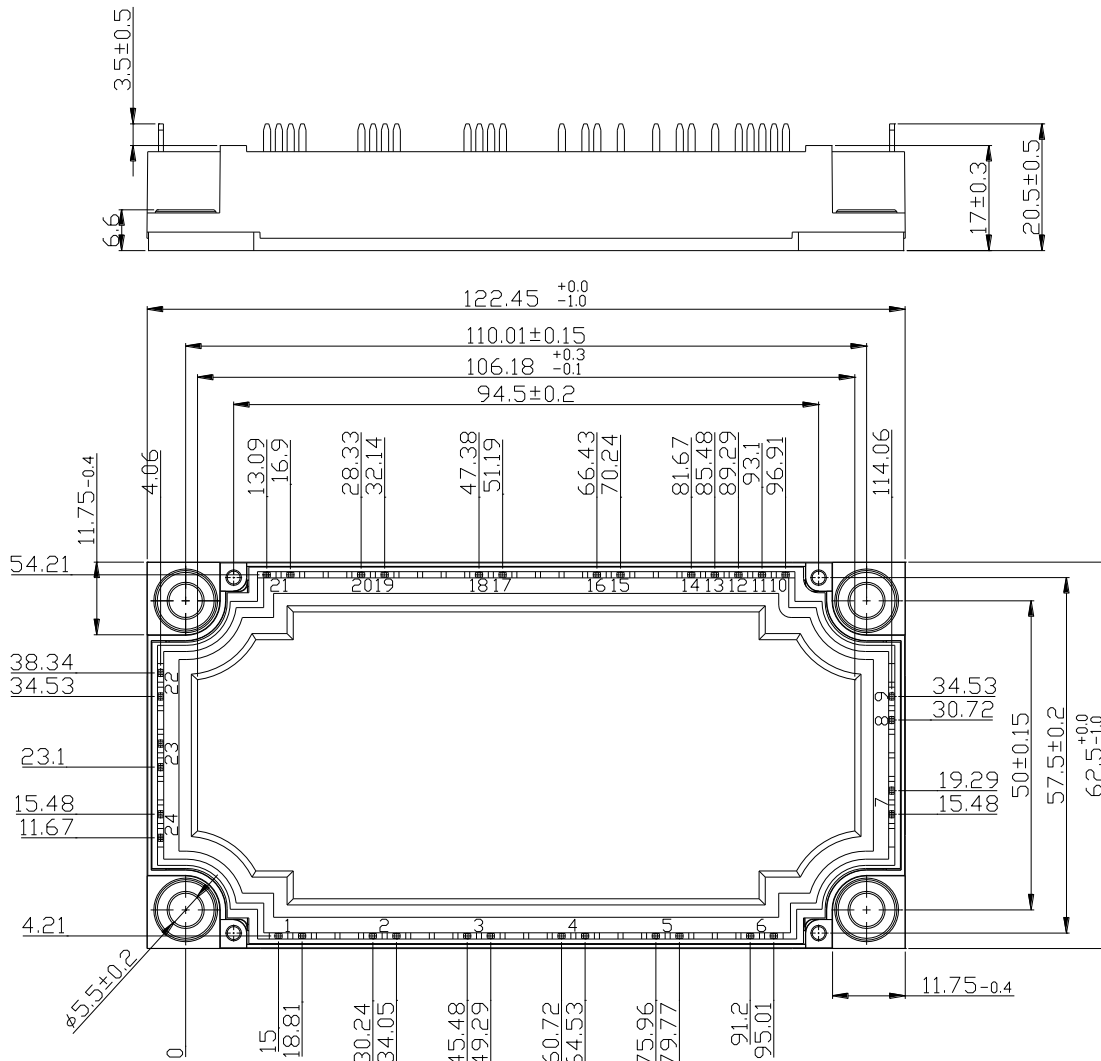
### Circuit Diagram



### Package Dimensions

Dimensions in mm

# E2A



## Ordering Information

Device	Packing
Part Number-BP	Bulk: 6pcs/Box ; 42pcs/Ctn

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