



E502650

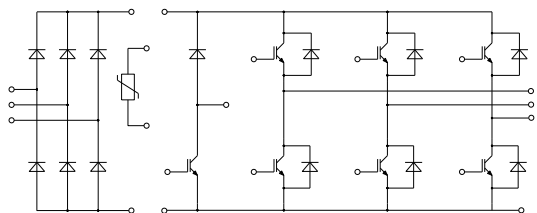
### Features

- 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

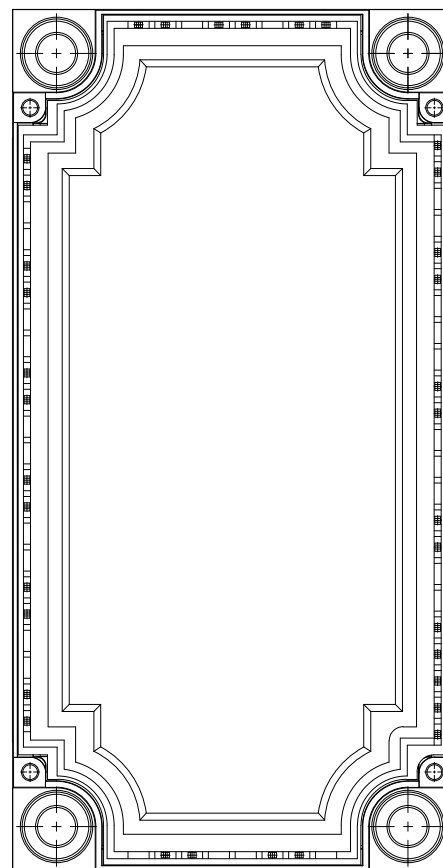
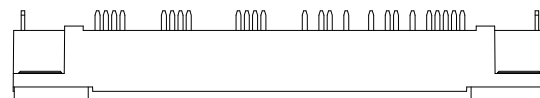
- Motor Drivers
- AC and DC Servo Drive Amplifier
- UPS (Uninterruptible Power Supplies)

### Circuit Diagram



## IGBT Modules 1200V 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	$I_C$	$T_C=80^{\circ}C, T_{vjmax}=175^{\circ}C$	50	A
Repetitive Peak Collector Current	$I_{CRM}$	$t_p=1ms$	100	A
Gate-Emitter Voltage	$V_{GES}$	$T_{vj}=25^{\circ}C$	$\pm 20$	V
Total Power Dissipation	$P_{tot}$	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	288	W

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.7mA, T_{vj}=25^{\circ}C$	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	mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=50A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.9	2.3	V
		$I_C=50A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.2		V
		$I_C=50A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.3		V
Gate Charge	$Q_g$			0.35		$\mu C$
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		2.6		nF
Reverse Transfer Capacitance	$C_{res}$			0.1		
Internal Gate Resistance	$R_{gint}$			4		$\Omega$
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=50A, V_{GE}=\pm 15V, R_G=15\Omega, T_{vj}=25^{\circ}C$		168		ns
Rise Time	$t_r$			34		
Turn-Off Delay Time	$t_{d(off)}$			320		
Fall Time	$t_f$			78		
Turn-On Energy	$E_{on}$			5.42		
Turn-Off Energy	$E_{off}$		4.15			
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=50A, V_{GE}=\pm 15V, R_G=15\Omega, T_{vj}=125^{\circ}C$		175		ns
Rise Time	$t_r$			42		
Turn-Off Delay Time	$t_{d(off)}$			426		
Fall Time	$t_f$			148		
Turn-On Energy	$E_{on}$			7.26		
Turn-Off Energy	$E_{off}$		5.8			
SC Data	$I_{SC}$	$T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$		220		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
I <sup>2</sup> t-value	I <sup>2</sup> t	$V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$	560	A <sup>2</sup> s
		$V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$	480	A <sup>2</sup> s

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Forward Voltage	$V_F$	$I_F=50A, T_{vj}=25^{\circ}C$		1.9	2.4	V
		$I_F=50A, T_{vj}=125^{\circ}C$		1.9		V
		$I_F=50A, T_{vj}=150^{\circ}C$		1.95		V
Recovered Charge	$Q_{rr}$	$I_F=50A, V_R=600V, -di_F/dt=1500A/\mu s, T_{vj}=25^{\circ}C$		5.8		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			56		A
Reverse Recovery Energy	$E_{rec}$			1.85		mJ
Recovered Charge	$Q_{rr}$	$I_F=50A, V_R=600V, -di_F/dt=1500A/\mu s, T_{vj}=125^{\circ}C$		9.1		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			58		A
Reverse Recovery Energy	$E_{rec}$			3.3		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	$I_C$	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	35	A
Repetitive Peak Collector Current	$I_{CRM}$	$t_p=1ms$	70	A
Gate-Emitter Voltage	$V_{GES}$	$T_{vj}=25^{\circ}C$	$\pm 20$	V
Total Power Dissipation	$P_{tot}$	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	227	W

Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.4mA, T_{vj}=25^{\circ}C$	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	mA	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=35A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.85	2.25	V	
		$I_C=35A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15		V	
		$I_C=35A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.25		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	$t_{d(on)}$	$V_{CE}=600V, I_C=35A, V_{GE}=\pm 15V, R_G=12\Omega, T_{vj}=25^{\circ}C$		25		ns	
Rise Time	$t_r$			13			
Turn-Off Delay Time	$t_{d(off)}$			24			
Fall Time	$t_f$			115			
Turn-On Energy	$E_{on}$				1.9		mJ
Turn-Off Energy	$E_{off}$			2.0			
Turn-On Delay Time	$t_{d(on)}$	$V_{CE}=600V, I_C=35A, V_{GE}=\pm 15V, R_G=12\Omega, T_{vj}=125^{\circ}C$		25		ns	
Rise Time	$t_r$			16			
Turn-Off Delay Time	$t_{d(off)}$			295			
Fall Time	$t_f$			170			
Turn-On Energy	$E_{on}$				2.9		mJ
Turn-Off Energy	$E_{off}$				2.9		
SC Data	$I_{SC}$	$T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{CC}=900V, V_{CEM} \leq 1200V$		150		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	$I^2t$	$V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$	16	$A^2s$
		$V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$	14	

### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Forward Voltage	$V_F$	$I_F=15A, T_{vj}=25^{\circ}C$		2.0	2.4	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	$Q_{rr}$	$I_F=15A, V_R=600V,$ $-di_F/dt=550A/\mu s, T_{vj}=25^{\circ}C$		1.1		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			12		A
Reverse Recovery Energy	$E_{rec}$			0.3		mJ
Recovered Charge	$Q_{rr}$	$I_F=15A, V_R=600V,$ $-di_F/dt=550A/\mu s, T_{vj}=125^{\circ}C$		1.9		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$			14		A
Reverse Recovery Energy	$E_{rec}$			0.6		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

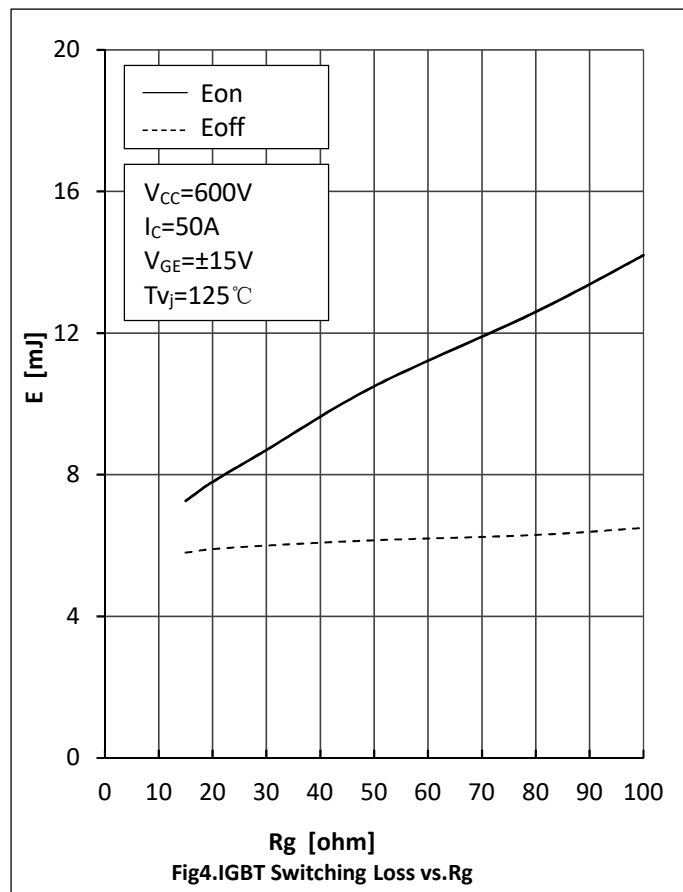
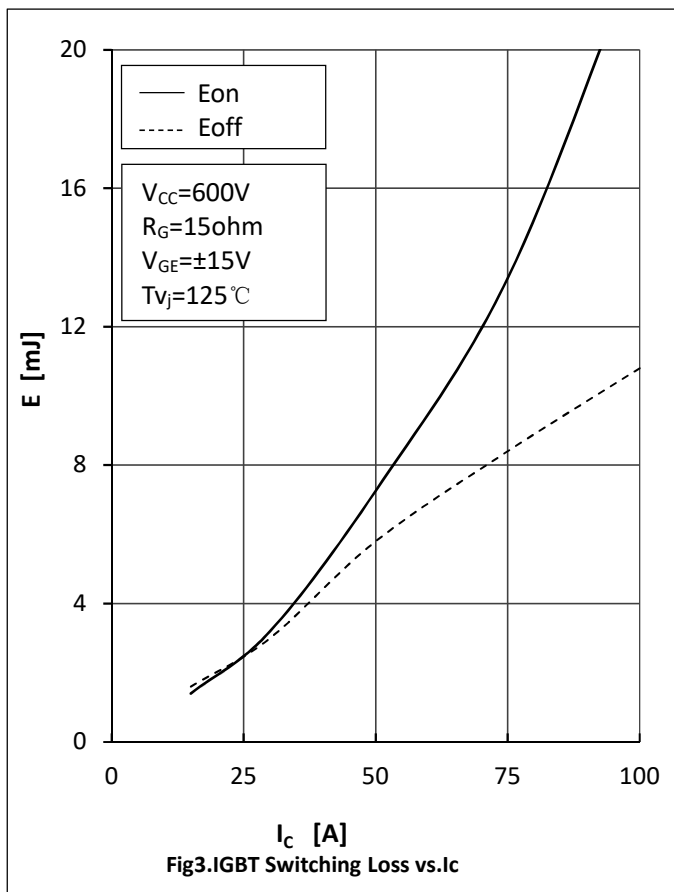
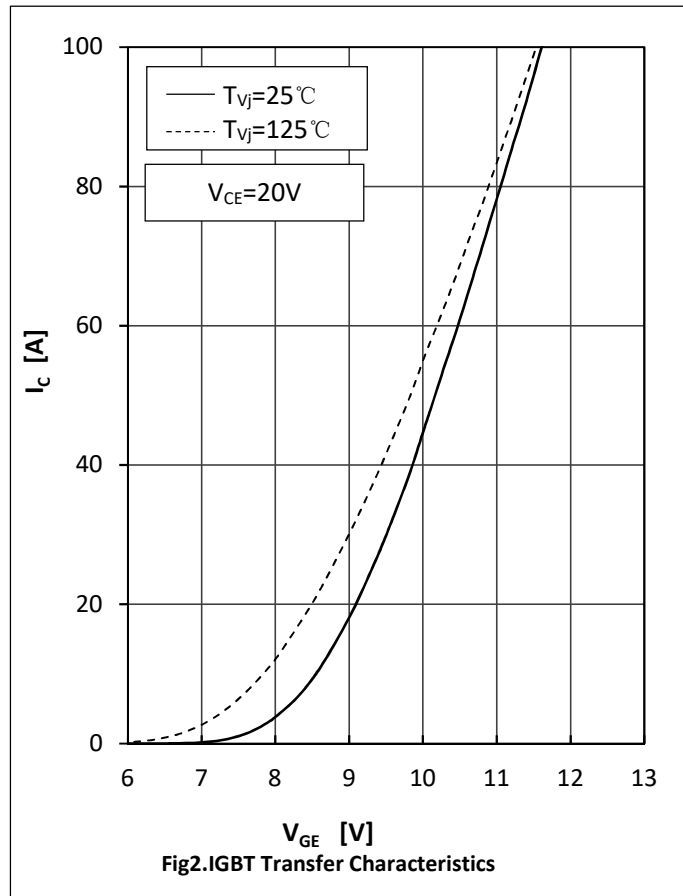
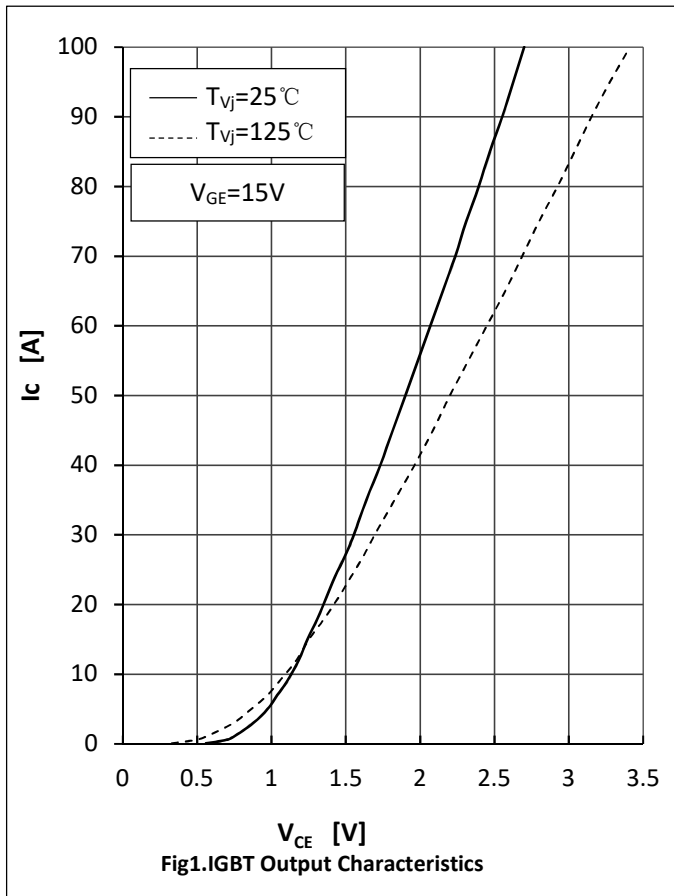
### Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Rated Resistance	$R_{25}$			5		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)**

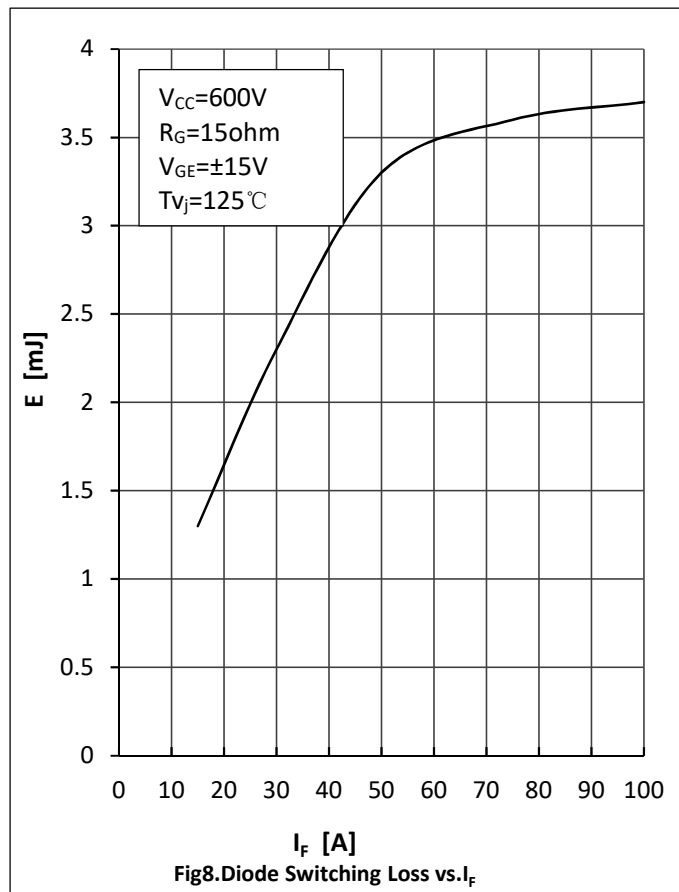
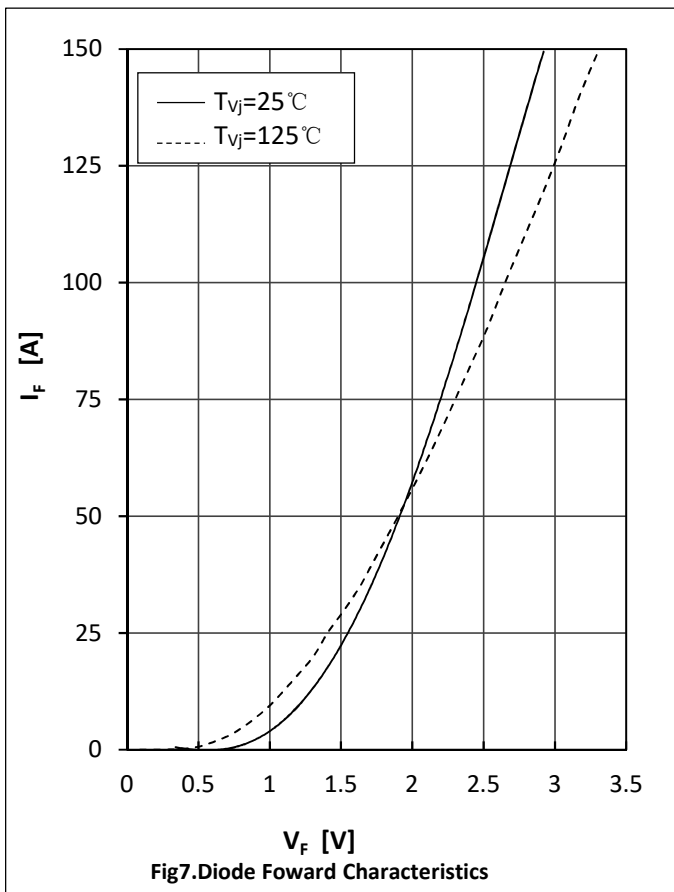
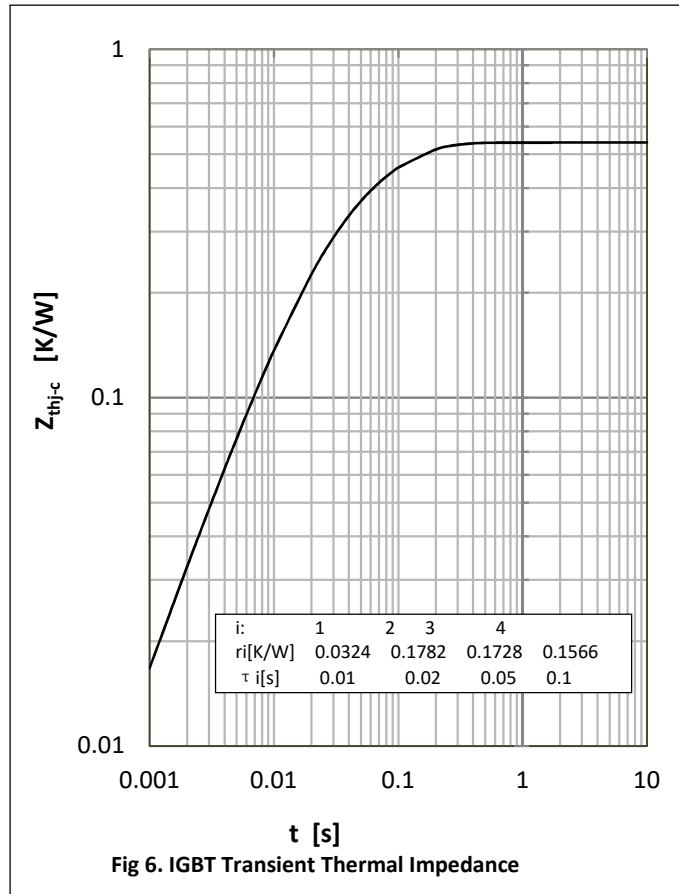
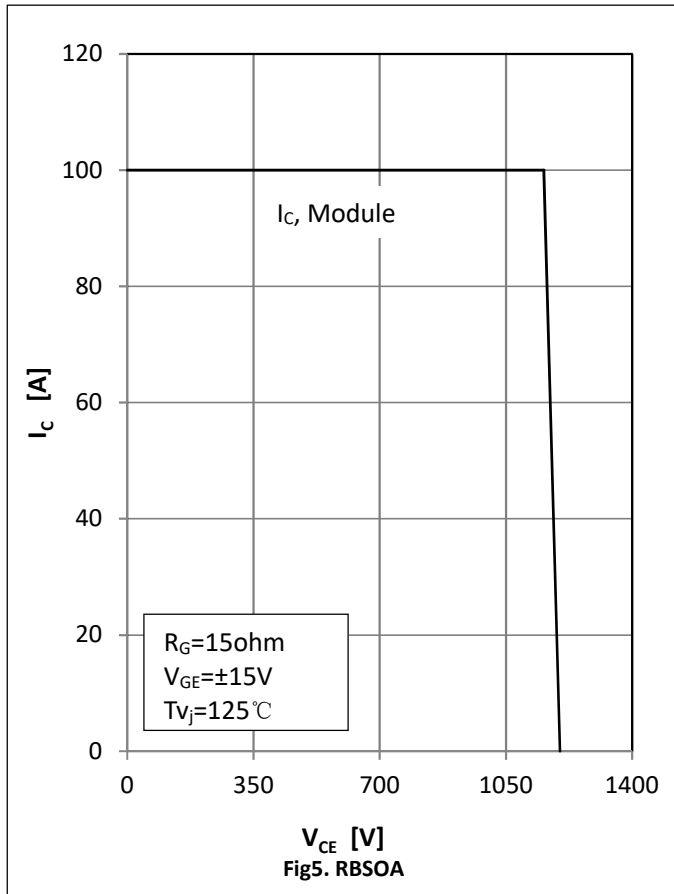
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Isolation voltage	$V_{\text{isol}}$	$t=1\text{ min}, f=50\text{Hz}$	2500			V
Maximum Junction Temperature	$T_{\text{jmax}}$				175	$^{\circ}\text{C}$
Operating Junction Temperature	$T_{\text{vj op}}$		-40		150	$^{\circ}\text{C}$
Operating Junction Temperature	$T_{\text{stg}}$		-40		125	$^{\circ}\text{C}$
Stray Inductance	$L_{\text{CE}}$			60		nH
Module Lead Resistance , Terminal to Chip	$R_{\text{CC'+EE'}}$	$T_C=25^{\circ}\text{C}$ , per switch		4		m $\Omega$
	$R_{\text{AA'+CC'}}$			3		
Thermal Resistance Junction to Case	$R_{\theta\text{jc}}$	per IGBT-inverter			0.52	K/W
		per Diode-inverter			0.81	
		per IGBT-brake-chopper			0.66	
		per Diode-chopper			1.5	
		per Diode-rectifier			0.64	
Thermal Resistance Case to Sink	$R_{\theta\text{cs}}$	per IGBT-inverter		0.29		K/W
		per Diode-inverter		0.44		
		per IGBT-brake-chopper		0.36		
		per Diode-chopper		0.33		
		per Diode-rectifier		0.70		
		per Module		0.009		
Module-to-Sink Torque	$M_{\text{S}}$		3		6	N·m
Weight of Module	G			300		g

**Curve Characteristics**

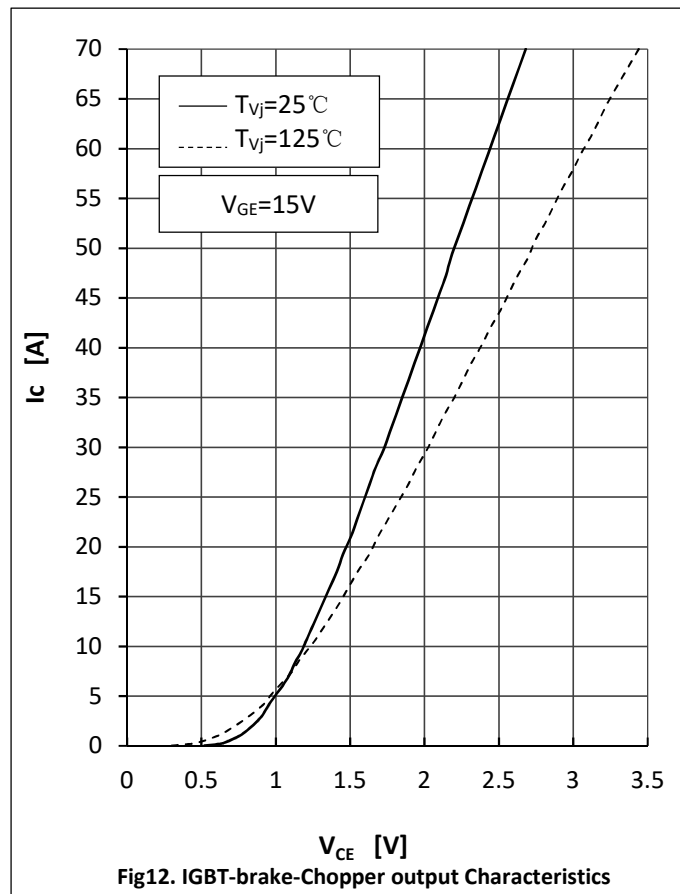
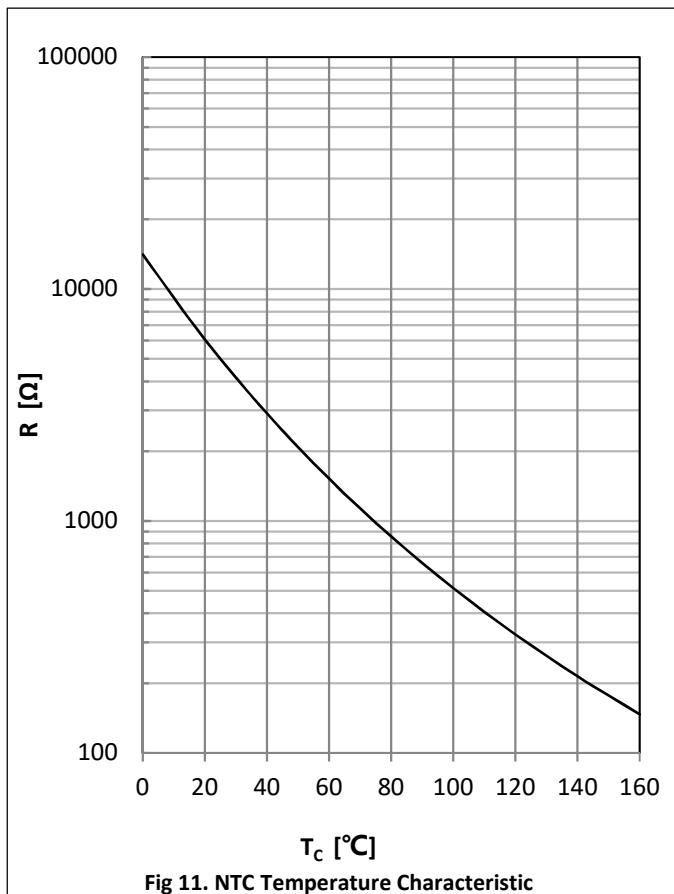
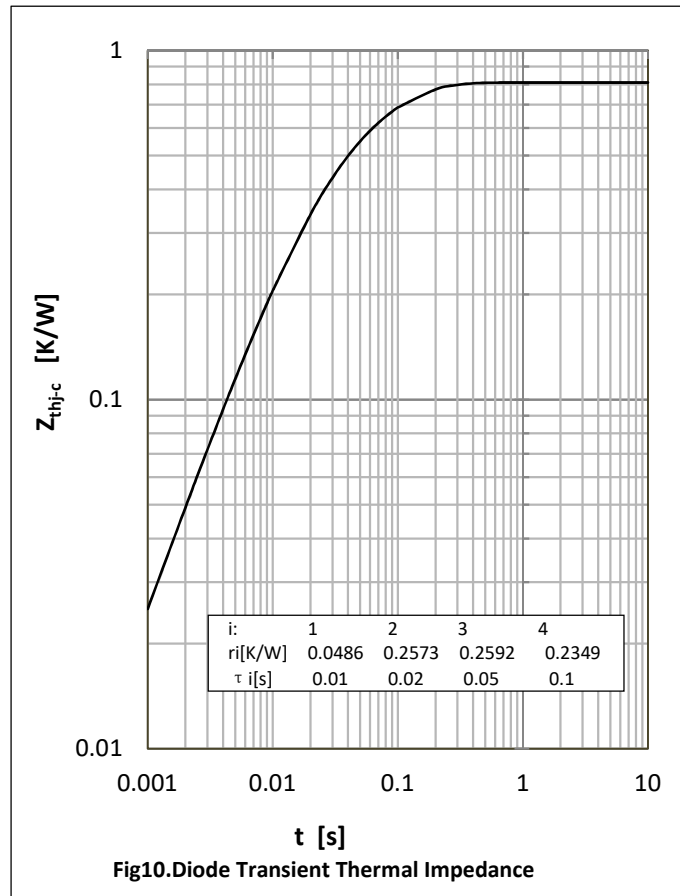
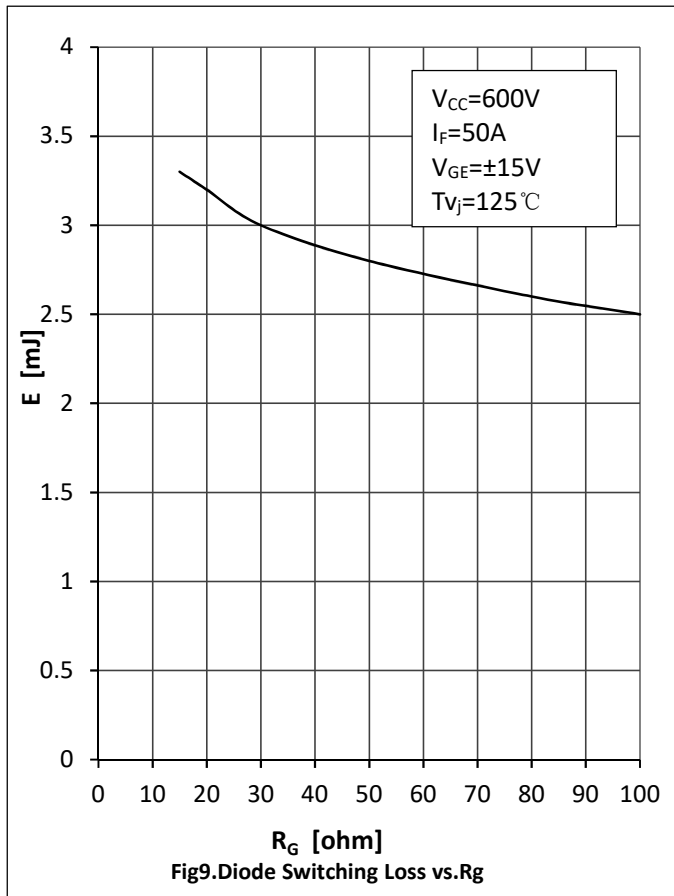




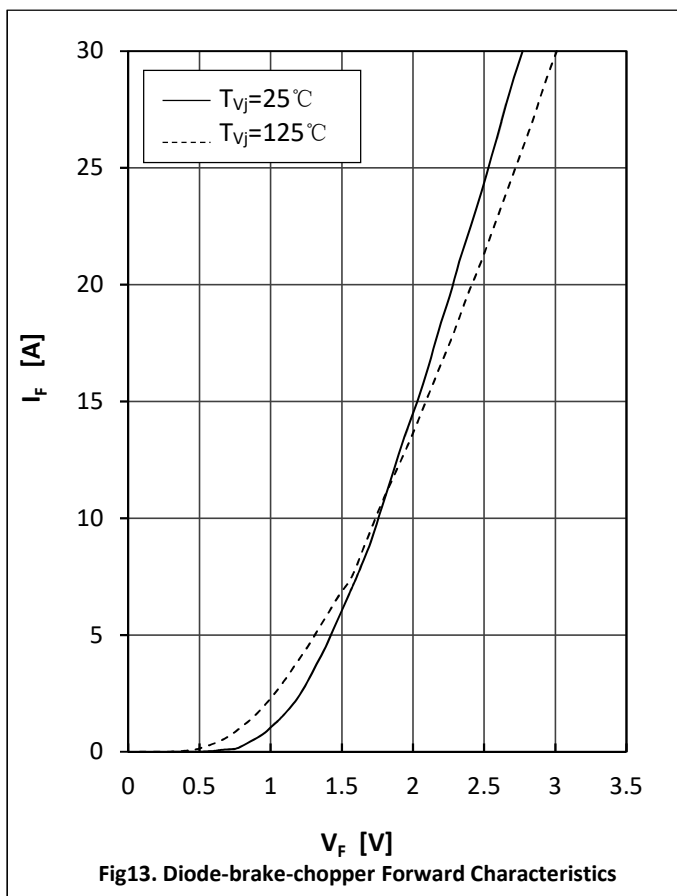
**Curve Characteristics**



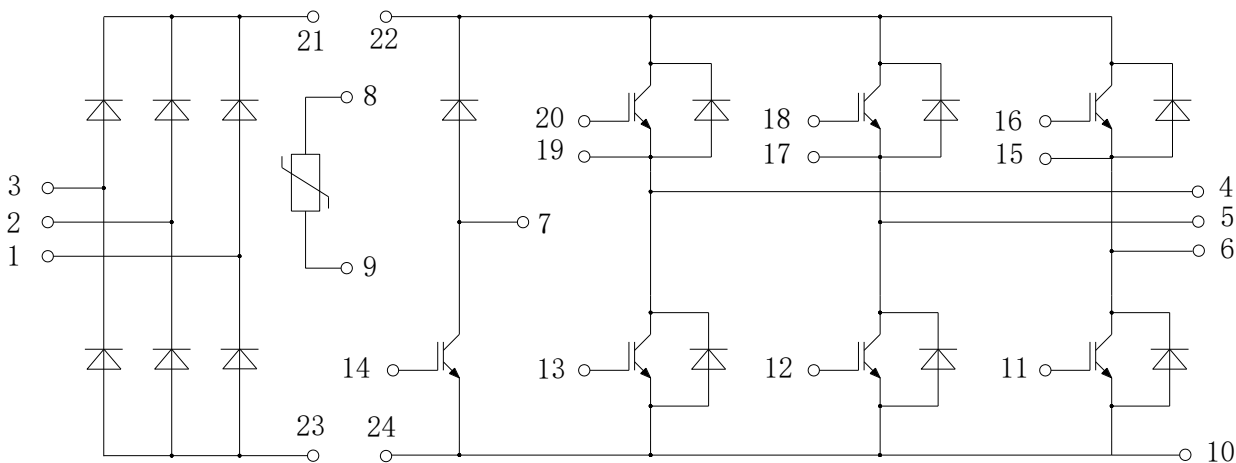
Curve Characteristics



### Curve Characteristics



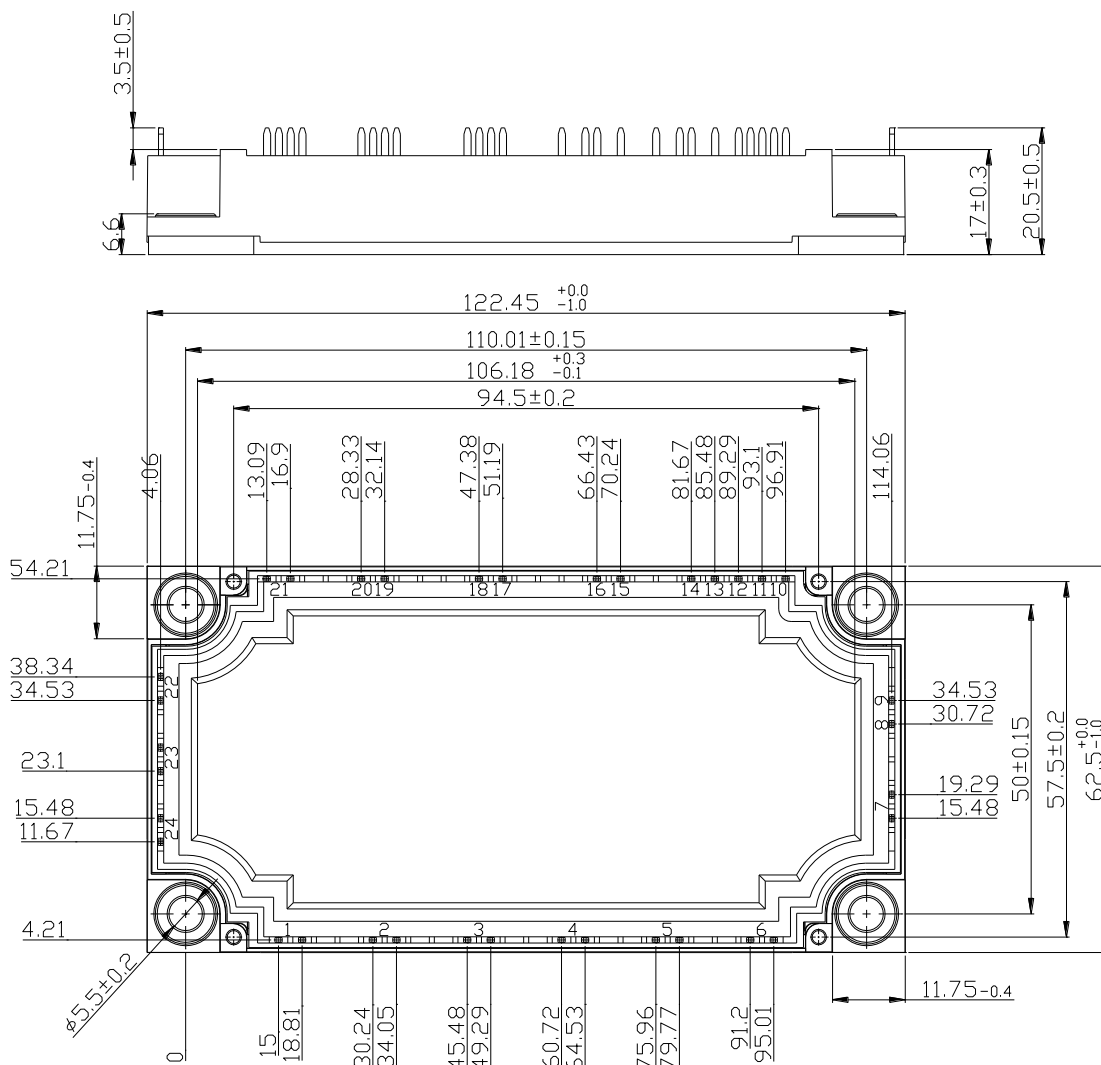
### Circuit Diagram



### Package Dimensions

Dimensions in mm

# E2A



## Ordering Information

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

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