

## IGBT Modules

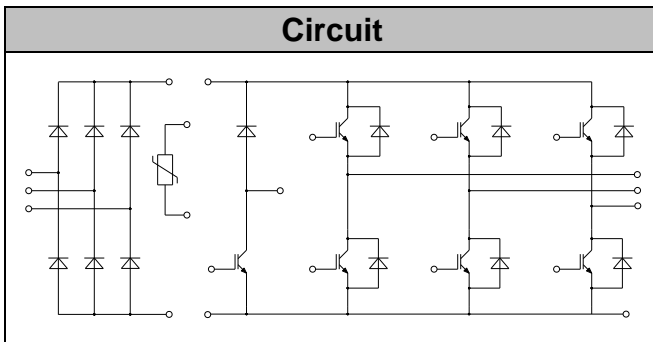
**V<sub>CEs</sub>**            1200V  
**I<sub>C</sub>**                50A

## Applications

- Motor Drivers
- AC and DC servo drive amplifier
- UPS (Uninterruptible Power Supplies)

## 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	$V_{CES}$	$V_{GE}=0V, I_C=1mA, T_{vj}=25^{\circ}C$	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	$P_{tot}$	$T_c=25^{\circ}C,$ $T_{vjmax}=175^{\circ}C$	280	W



## Characteristic values

Parameter	Symbol	Conditions	Value			Unit	
			Min.	Typ.	Max.		
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=1.7mA, T_{vj}=25^{\circ}C$	5.0	5.7	6.5	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	$V_{CE(sat)}$	$I_C=50A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.65	2.05	V	
		$I_C=50A, V_{GE}=15V, T_{vj}=125^{\circ}C$		1.95			
		$I_C=50A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.05			
Gate Charge	$Q_G$			0.35		uC	
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V,$ $f=1MHz, T_{vj}=25^{\circ}C$		2.60		nF	
Reverse Transfer Capacitance	$C_{res}$			0.10		nF	
Internal Gate Resistance	$R_{gint}$			5.0		$\Omega$	
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA	
Turn-on Delay Time	$t_{d(on)}$	$I_C=50A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=15\Omega$ $T_{vj}=25^{\circ}C$		168		ns	
Rise Time	$t_r$			34		ns	
Turn-off Delay Time	$t_{d(off)}$			320		ns	
Fall Time	$t_f$			78		ns	
Energy Dissipation During Turn-on Time	$E_{on}$			5.42		mJ	
Energy Dissipation During Turn-off Time	$E_{off}$			4.15		mJ	
Turn-on Delay Time	$t_{d(on)}$		$I_C=50A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=15\Omega$ $T_{vj}=125^{\circ}C$		175		ns
Rise Time	$t_r$				42		ns
Turn-off Delay Time	$t_{d(off)}$				426		ns
Fall Time	$t_f$				148		ns
Energy Dissipation During Turn-on Time	$E_{on}$			7.26		mJ	
Energy Dissipation During Turn-off Time	$E_{off}$			5.80		mJ	



Turn-on Delay Time	$t_{d(on)}$	$I_C = 50\text{ A}$ $V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_G = 15\Omega$ $T_{vj} = 150^\circ\text{C}$	180	ns
Rise Time	$t_r$		46	ns
Turn-off Delay Time	$t_{d(off)}$		454	ns
Fall Time	$t_f$		174	ns
Energy Dissipation During Turn-on Time	$E_{on}$		8.05	mJ
Energy Dissipation During Turn-off Time	$E_{off}$		6.33	mJ
SC Data	$I_{sc}$	$T_p \leq 10\mu\text{s}, V_{GE} = 15\text{ V}, T_{vj} = 150^\circ\text{C},$ $V_{cc} = 900\text{ V}, V_{CEM} \leq 1200\text{ V}$	260	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	$I_F$		50	A
Repetitive Peak Forward Current	$I_{FRM}$	$t_p = 1\text{ ms}$	100	A
$I^2t$ -value	$I^2t$	$V_R = 0, t_p = 10\text{ ms}, T_{vj} = 125^\circ\text{C}$	560	A <sup>2</sup> s
		$V_R = 0, t_p = 10\text{ ms}, T_{vj} = 150^\circ\text{C}$	480	

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	$V_F$	$I_F = 50\text{ A}, T_{vj} = 25^\circ\text{C}$		1.70	2.15	V
		$I_F = 50\text{ A}, T_{vj} = 125^\circ\text{C}$		1.65		
		$I_F = 50\text{ A}, T_{vj} = 150^\circ\text{C}$		1.65		
Recovered Charge	$Q_{rr}$	$I_F = 50\text{ A}$		5.8		$\mu\text{C}$
Peak Reverse Recovery Current	$I_{rr}$	$V_R = 600\text{ V}$ $-di_F/dt = 1500\text{ A}/\mu\text{s}$		56		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj} = 25^\circ\text{C}$		1.85		mJ
Recovered Charge	$Q_{rr}$	$I_F = 50\text{ A}$		9.1		$\mu\text{C}$
Peak Reverse Recovery Current	$I_{rr}$	$V_R = 600\text{ V}$ $-di_F/dt = 1500\text{ A}/\mu\text{s}$		58		A



Reverse Recovery Energy	$E_{rec}$	$T_{vj}=125^{\circ}C$		3.30		mJ
Recovered Charge	$Q_{rr}$	$I_F=50\text{ A}$ $V_R=600\text{ V}$ $-di_f/dt=1500\text{ A/us}$		10.4		$\mu\text{C}$
Peak Reverse Recovery Current	$I_{rr}$			60		A
Reverse Recovery Energy	$E_{rec}$		$T_{vj}=150^{\circ}C$		4.05	

## ● IGBT-brake-chopper

### Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Collector-Emitter Voltage	$V_{CES}$	$V_{GE}=0\text{ V}, I_c=1\text{ mA}, T_{vj}=25^{\circ}C$	1200	V
Continuous Collector Current	$I_c$	$T_c=100^{\circ}C, T_{vjmax}=175^{\circ}C$	25	A
Repetitive Peak Collector Current	$I_{CRM}$	$t_p=1\text{ ms}$	50	A
Gate-Emitter Voltage	$V_{GES}$	$T_{vj}=25^{\circ}C$	$\pm 20$	V
Total Power Dissipation	$P_{tot}$	$T_c=25^{\circ}C, T_{vjmax}=175^{\circ}C$	158	W

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_c=0.8\text{ mA}, T_{vj}=25^{\circ}C$	5.2	5.8	6.4	V
Collector-Emitter Cut-off Current	$I_{CES}$	$V_{CE}=1200\text{ V}, V_{GE}=0\text{ V}, T_{vj}=25^{\circ}C$			1.0	mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_c=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=25^{\circ}C$		1.85	2.25	V
		$I_c=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=125^{\circ}C$		2.15		
		$I_c=25\text{ A}, V_{GE}=15\text{ V}, T_{vj}=150^{\circ}C$		2.25		
Gate Charge	$Q_G$			0.20		$\mu\text{C}$
Input Capacitance	$C_{ies}$	$V_{CE}=25\text{ V}, V_{GE}=0\text{ V},$ $f=1\text{ MHz}, T_{vj}=25^{\circ}C$		1.45		nF
Reverse Transfer Capacitance	$C_{res}$			0.05		nF
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0\text{ V}, V_{GE}=20\text{ V}, T_{vj}=25^{\circ}C$			100	nA



Turn-on Delay Time	$t_{d(on)}$	$I_C = 25\text{ A}$ $V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_G = 18\Omega$ $T_{vj} = 25^\circ\text{C}$		158		ns
Rise Time	$t_r$			32		ns
Turn-off Delay Time	$t_{d(off)}$			331		ns
Fall Time	$t_f$			83		ns
Energy Dissipation During Turn-on Time	$E_{on}$			1.80		mJ
Energy Dissipation During Turn-off Time	$E_{off}$			1.40		mJ
Turn-on Delay Time	$t_{d(on)}$	$I_C = 25\text{ A}$ $V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_G = 18\Omega$ $T_{vj} = 125^\circ\text{C}$		172		ns
Rise Time	$t_r$			435		ns
Turn-off Delay Time	$t_{d(off)}$			154		ns
Fall Time	$t_f$			212		ns
Energy Dissipation During Turn-on Time	$E_{on}$			2.4		mJ
Energy Dissipation During Turn-off Time	$E_{off}$			2.18		mJ
Turn-on Delay Time	$t_{d(on)}$	$I_C = 25\text{ A}$ $V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_G = 18\Omega$ $T_{vj} = 150^\circ\text{C}$		174		ns
Rise Time	$t_r$			43		ns
Turn-off Delay Time	$t_{d(off)}$			452		ns
Fall Time	$t_f$			174		ns
Energy Dissipation During Turn-on Time	$E_{on}$			2.65		mJ
Energy Dissipation During Turn-off Time	$E_{off}$			2.40		mJ
SC Data	$I_{sc}$	$T_p \leq 10\mu\text{s}, V_{GE} = 15\text{ V}, T_{vj} = 150^\circ\text{C},$ $V_{cc} = 900\text{ V}, V_{CEM} \leq 1200\text{ V}$		90		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	$I_F$		20	A
Repetitive Peak Forward Current	$I_{FRM}$	$t_p=1ms$	40	A
$I^2t$ -value	$I^2t$	$V_R=0, t_p=10ms, T_J=125^{\circ}C$	48.0	A <sup>2</sup> s
		$V_R=0, t_p=10ms, T_J=150^{\circ}C$	42.0	

**Characteristic values**

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	$V_F$	$I_F=20A, T_{vj}=25^{\circ}C$		2.00	2.45	V
		$I_F=20A, T_{vj}=125^{\circ}C$		1.95		
		$I_F=20A, T_{vj}=150^{\circ}C$		1.95		
Recovered Charge	$Q_{rr}$	$I_F=20A$		1.85		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt=900A/\mu s$		24		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=25^{\circ}C$		0.65		mJ
Recovered Charge	$Q_{rr}$	$I_F=20A$		2.30		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt=900A/\mu s$		28		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=125^{\circ}C$		1.15		mJ
Recovered Charge	$Q_{rr}$	$I_F=20A$		2.65		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt=900A/\mu s$		30		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=150^{\circ}C$		1.35		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 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	$\text{A}^2\text{s}$

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	$V_F$	$I_F=50\text{A}, T_j=150^{\circ}\text{C}$		1.00		V
Reverse Current	$I_R$	$T_j=125^{\circ}\text{C}, V_R=1600\text{V}$			1.5	mA

## ● NTC-Thermistor

### Characteristic values

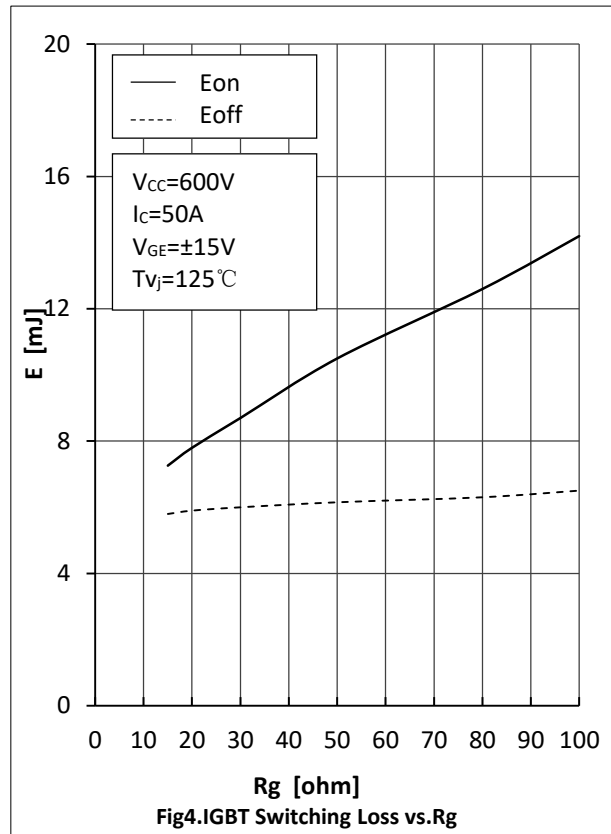
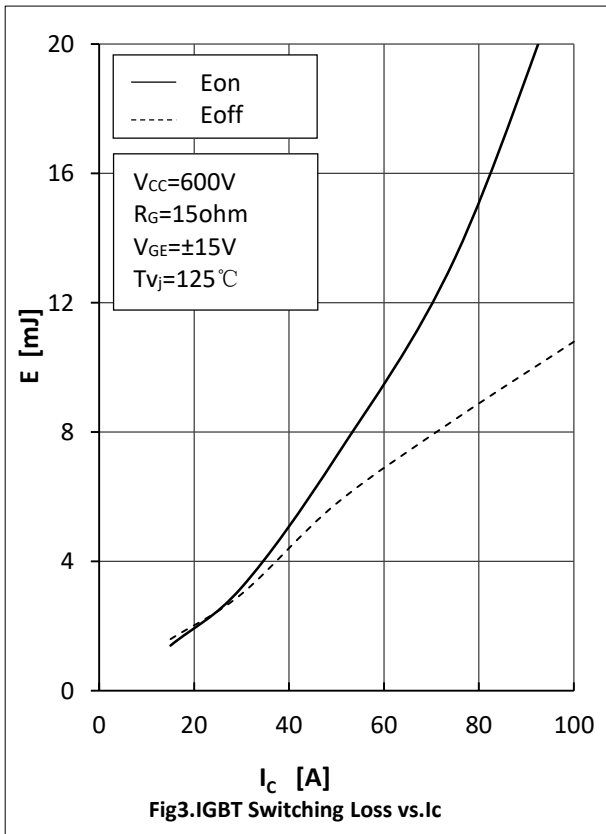
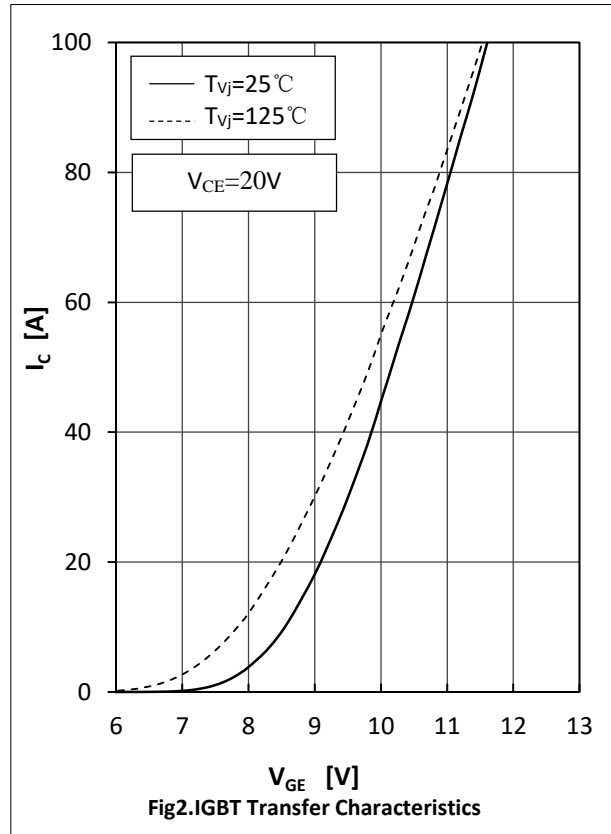
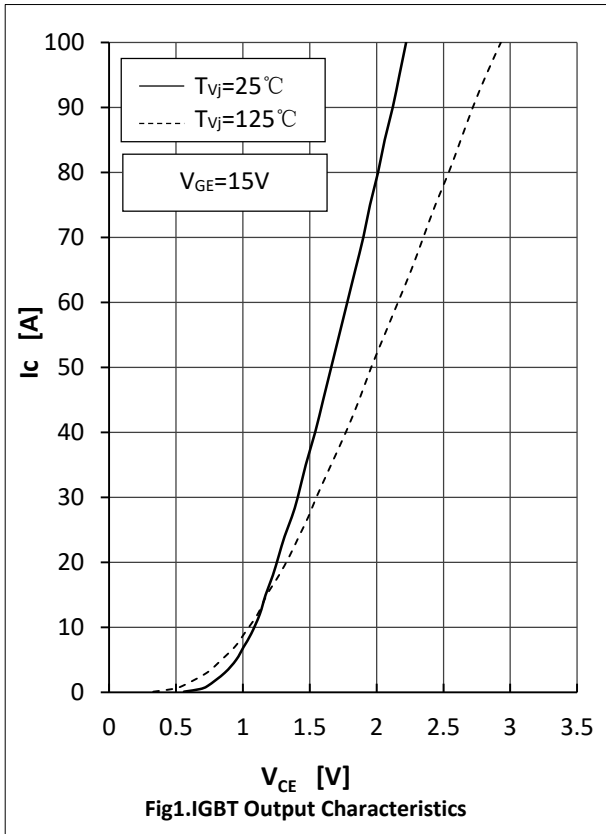
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Rated Resistance	$R_{25}$			5.0		$\text{k}\Omega$
Deviation of $R_{100}$	$\Delta R/R$	$T_C=100, R_{100}=493.3\Omega$	-5		5	%
Power Dissipation	$P_{25}$			20.0		mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K

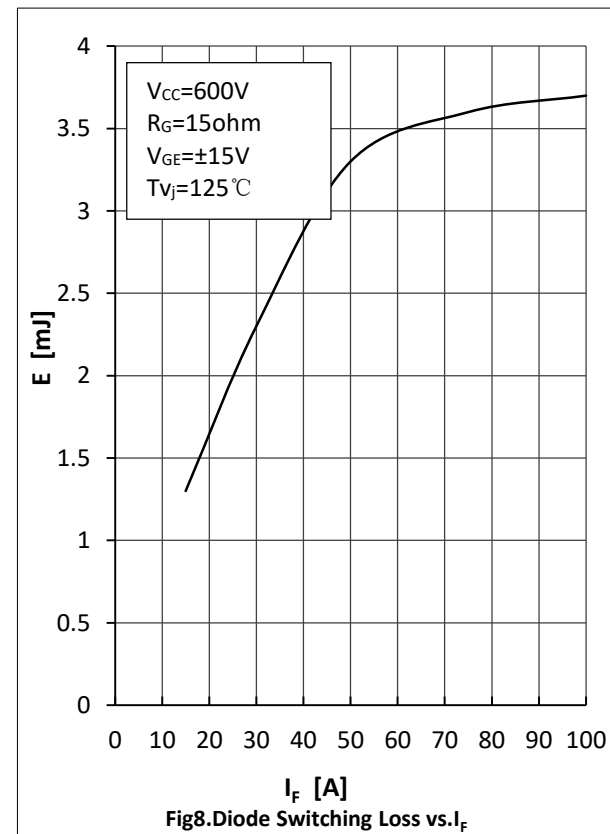
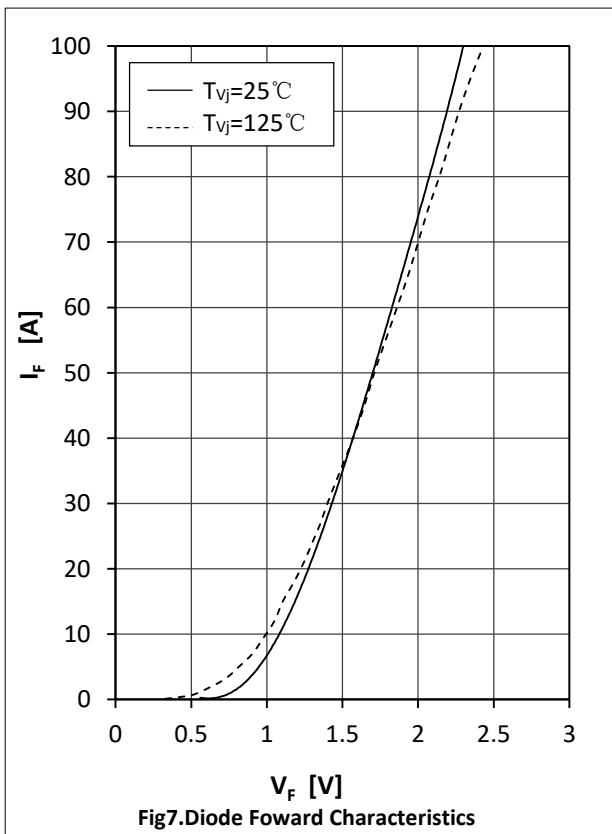
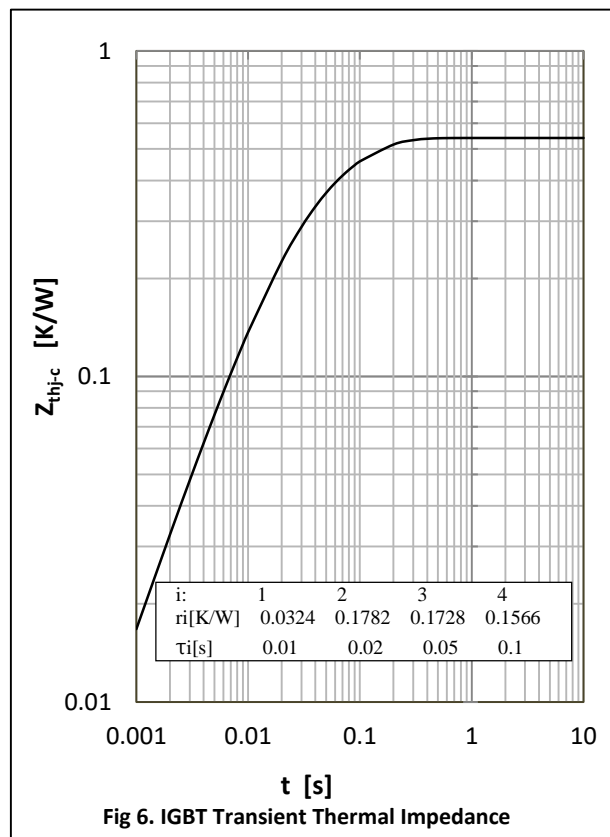
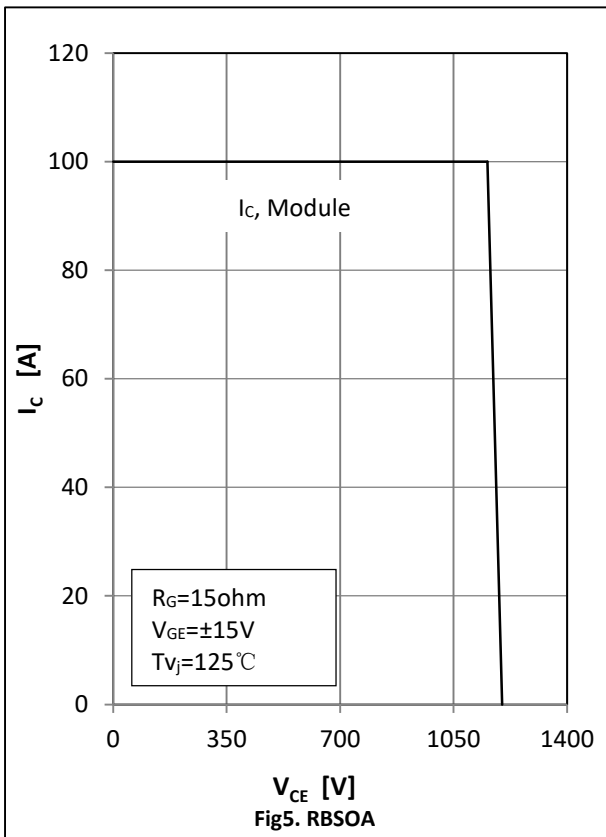


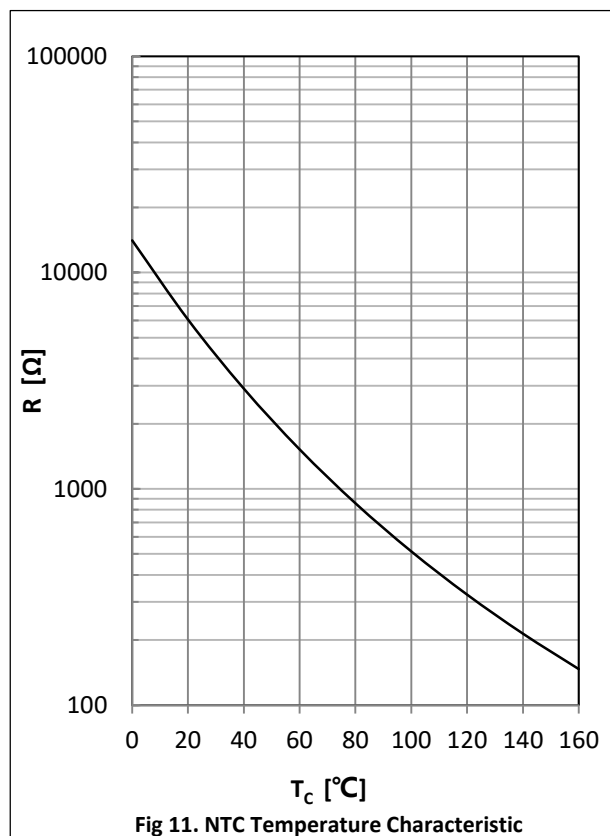
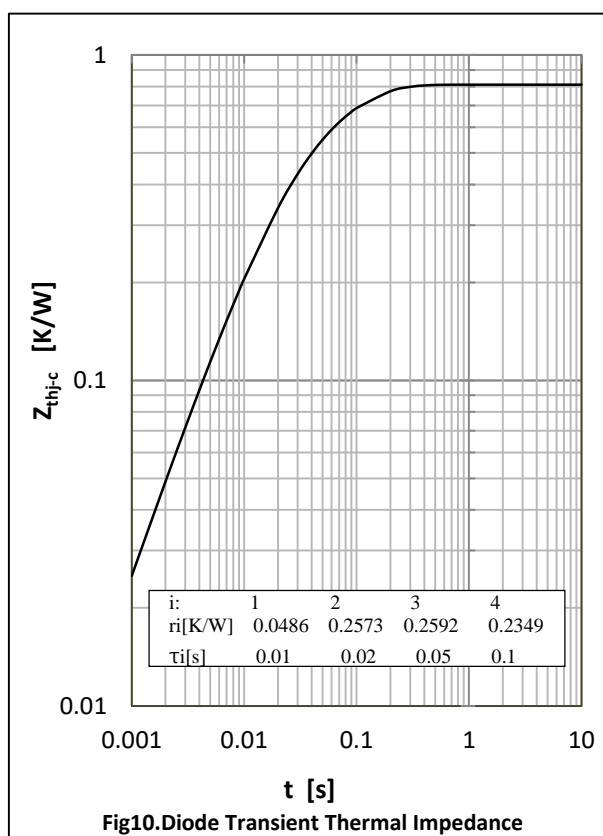
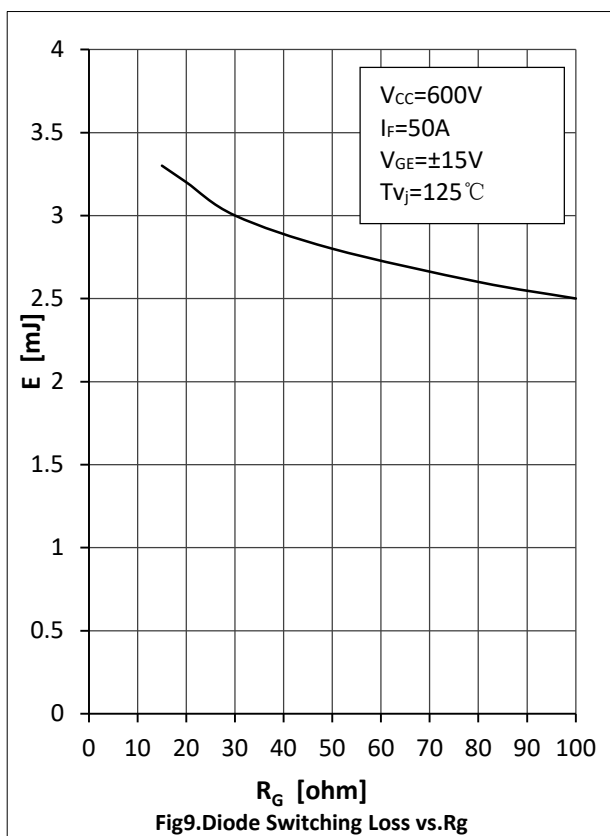
● **Module Characteristics**  $T_C=25^\circ\text{C}$  unless otherwise specified

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	$T_{jmax}$	Inverter, brake			175	$^\circ\text{C}$
		rectifier			150	
Operating Junction Temperature	$T_{vjop}$		-40		150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$		-40		125	$^\circ\text{C}$
Stray Inductance	$L_{CE}$			35		nH
Module Lead Resistance ,Terminal to Chip	$R_{CC'+EE'}$	$T_C=25^\circ\text{C}$ , per switch		4.0		m $\Omega$
	$R_{AA'+CC'}$			3.0		
Thermal Resistance Junction-to Case	$R_{\theta jc}$	per IGBT-inverter			0.54	K/W
		per Diode-inverter			0.81	
		per IGBT-brake-chopper			0.95	
		per Diode-chopper			1.13	
		per Diode-rectifier			0.64	
Thermal Resistance Case-to Sink	$R_{\theta cs}$	per IGBT-inverter		0.29		K/W
		per Diode-inverter		0.44		
		per IGBT-brake-chopper		0.36		
		per Diode-chopper		0.50		
		per Diode-rectifier		0.23		
		per Module		0.02		
Module-to-Sink Torque	$M_s$		3.0		6.0	N·m
Weight of Module	G			180		g

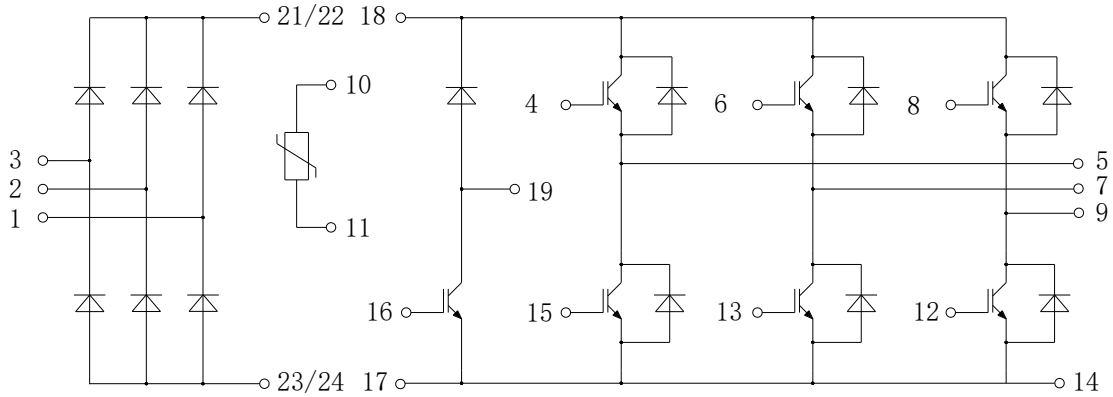








## ● Circuit Diagram



## ● Package Dimensions

Dimensions in Millimeters

