

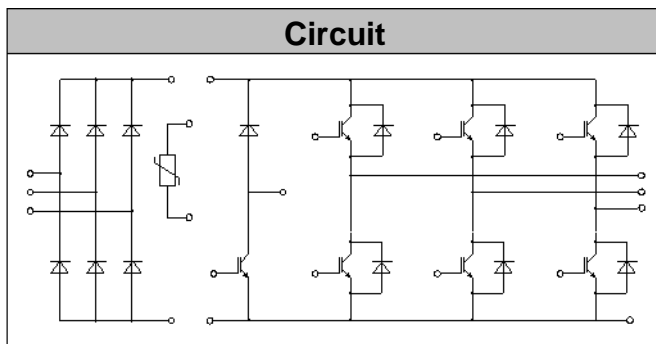


## IGBT Modules

$V_{CES}$	1200V
$I_c$	15A

## 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	$I_c$	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	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	$P_{tot}$	$T_C=25^{\circ}C$ $T_{vjmax}=175^{\circ}C$	130	W



## ● IGBT- inverter

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Gate-emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=0.5mA, T_{vj}=25^{\circ}C$	5.2	5.9	6.8	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	$V_{CE(sat)}$	$I_C=15A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.9		V
		$I_C=15A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.1		
		$I_C=15A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.2		
Gate Charge	$Q_G$			0.15		uC
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$		0.98		nF
Reverse Transfer Capacitance	$C_{res}$			0.034		nF
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C=15A, V_{CE}=600V, V_{GE}=\pm 15V, R_G=39\Omega, T_{vj}=25^{\circ}C$		61		ns
Rise Time	$t_r$			29		ns
Turn-off Delay Time	$t_{d(off)}$			89		ns
Fall Time	$t_f$			311		ns
Energy Dissipation During Turn-on Time	$E_{on}$			1.98		mJ
Energy Dissipation During Turn-off Time	$E_{off}$			0.99		mJ
Turn-on Delay Time	$t_{d(on)}$	$I_C=15A, V_{CE}=600V, V_{GE}=\pm 15V, R_G=39\Omega, T_{vj}=150^{\circ}C$		60		ns
Rise Time	$t_r$			32		ns
Turn-off Delay Time	$t_{d(off)}$			89		ns
Fall Time	$t_f$			319		ns
Energy Dissipation During Turn-on Time	$E_{on}$			2.15		mJ
Energy Dissipation During Turn-off Time	$E_{off}$			1.13		mJ
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-inverter

### Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	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	$I^2t$	$V_R=0V, t_p=10ms, T_{vj}=125^{\circ}C$	16.0	A <sup>2</sup> s
		$V_R=0V, t_p=10ms, T_{vj}=150^{\circ}C$	14.0	

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	$V_F$	$I_F=15A, T_{vj}=25^{\circ}C$		2.00	2.6	V
		$I_F=15A, T_{vj}=125^{\circ}C$		1.80		
		$I_F=15A, T_{vj}=150^{\circ}C$		1.75		
Recovered Charge	$Q_{rr}$	$I_F=15A$		0.45		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt = 600A/\mu s$		13		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=25^{\circ}C$		0.49		mJ
Recovered Charge	$Q_{rr}$	$I_F=15A$		0.54		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt = 600A/\mu s$		14		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=150^{\circ}C$		0.68		mJ



## ● IGBT-brake-chopper

### 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	$I_C$	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	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	$P_{tot}$	$T_C=25^{\circ}C, T_{vjmax}=175^{\circ}C$	130	W

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit	
			Min.	Typ.	Max.		
Gate-emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=0.5mA, T_{vj}=25^{\circ}C$	5.2	5.9	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	$V_{CE(sat)}$	$I_C=15A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.9	2.25	V	
		$I_C=15A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.1			
		$I_C=15A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.2			
Gate Charge	$Q_G$			0.09		$\mu C$	
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$		0.98		nF	
Reverse Transfer Capacitance	$C_{res}$			0.034		nF	
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA	
Turn-on Delay Time	$t_{d(on)}$	$I_C=15A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=39\Omega$ $T_{vj}=25^{\circ}C$		61		ns	
Rise Time	$t_r$			29		ns	
Turn-off Delay Time	$t_{d(off)}$			89		ns	
Fall Time	$t_f$			311		ns	
Energy Dissipation During Turn-on Time	$E_{on}$				1.98		mJ
Energy Dissipation During Turn-off Time	$E_{off}$				0.99		mJ



Turn-on Delay Time	$t_{d(on)}$	$I_C=15A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=39\Omega$ $T_{vj}=150^\circ C$	60	ns
Rise Time	$t_r$		32	ns
Turn-off Delay Time	$t_{d(off)}$		89	ns
Fall Time	$t_f$		319	ns
Energy Dissipation During Turn-on Time	$E_{on}$		2.15	mJ
Energy Dissipation During Turn-off Time	$E_{off}$		1.13	mJ
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

## ● Diode-Brake-Chopper

### Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	$V_{RRM}$	$T_{vj}=25^\circ C$	1200	V
Continuous DC Forward Current	$I_F$		10	A
Repetitive Peak Forward Current	$I_{FRM}$	$t_p=1ms$	20	A
$I^2t$ -value	$I^2t$	$V_R=0V, t_p=10ms, T_{vj}=125^\circ C$	16.0	A <sup>2</sup> s
		$V_R=0V, t_p=10ms, T_{vj}=150^\circ C$	14.0	

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	$V_F$	$I_F=10A, T_{vj}=25^\circ C$		2.00	2.50	V
		$I_F=10A, T_{vj}=125^\circ C$		1.85		
		$I_F=10A, T_{vj}=150^\circ C$		1.80		
Recovered Charge	$Q_{rr}$	$I_F=10A$		0.26		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt = 500A/\mu s$		11		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=25^\circ C$		0.25		mJ
Recovered Charge	$Q_{rr}$	$I_F=10A$		0.49		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt = 500A/\mu s$		13		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=150^\circ C$		0.50		mJ



## ● Diode-Rectifier

### Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	$V_{RRM}$	$T_{vj}=25^{\circ}C$	1600	V
Average output Current 50/60Hz, sine wave	$I_{F(AV)}$	$T_C=100^{\circ}C$	20	A
Maximum RMS Current at Rectifier Output	$I_{RMSM}$	$T_C=100^{\circ}C$	40	A
Surge Forward Current	$I_{FSM}$	$V_R=0V, t_p=10ms, T_{vj}=25^{\circ}C$	330	A
		$V_R=0V, t_p=10ms, T_{vj}=150^{\circ}C$	280	A
$I^2t$ -value	$I^2t$	$V_R=0V, t_p=10ms, T_{vj}=25^{\circ}C$	520	$A^2s$
		$V_R=0V, t_p=10ms, T_{vj}=150^{\circ}C$	390	$A^2s$

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	$V_F$	$I_F=15A, T_{vj}=150^{\circ}C$		0.96		V
Reverse Current	$I_R$	$T_{vj}=150^{\circ}C, V_R=1600V$			1.0	mA

## ● NTC-Thermistor

### Characteristic values

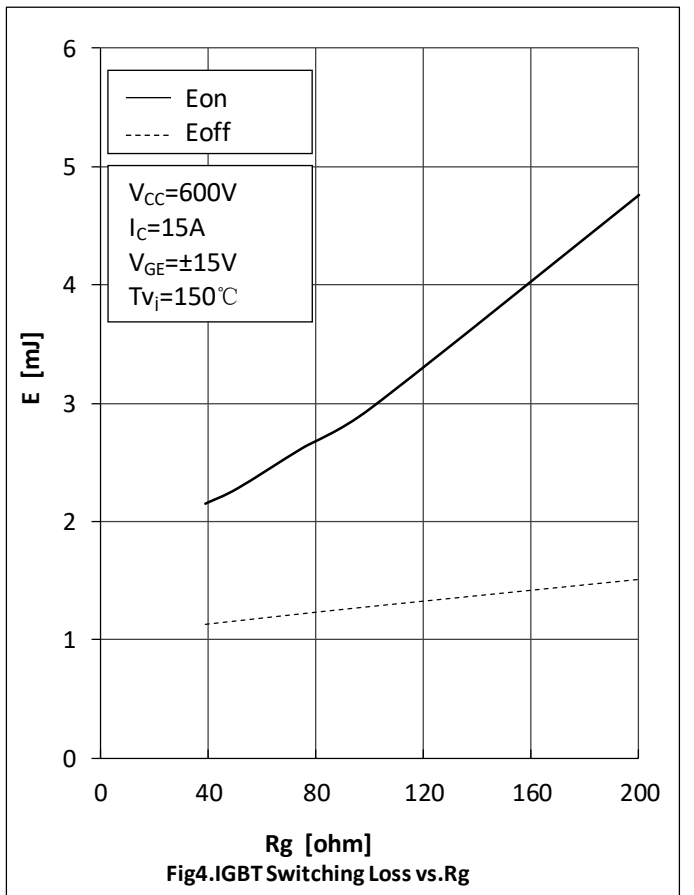
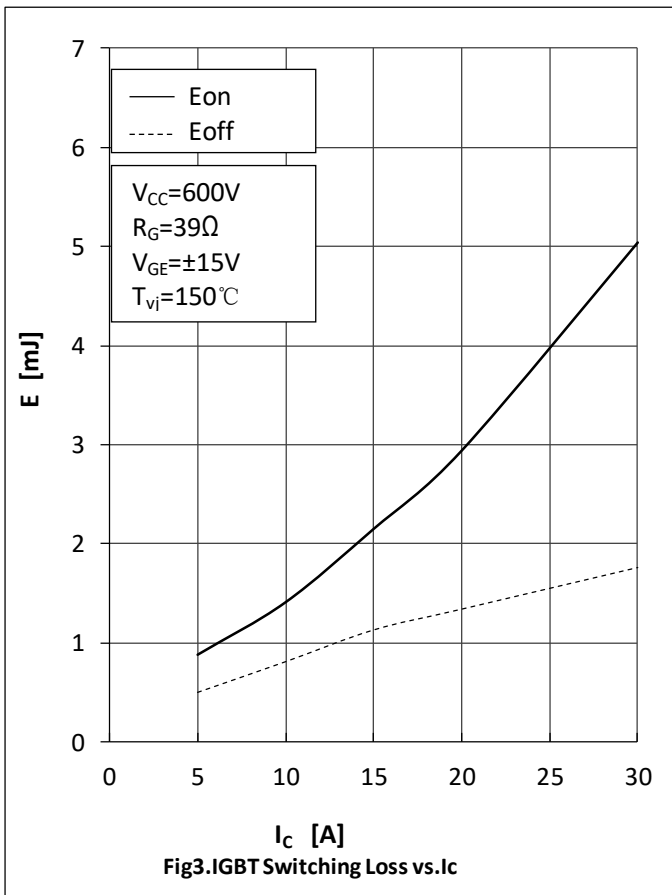
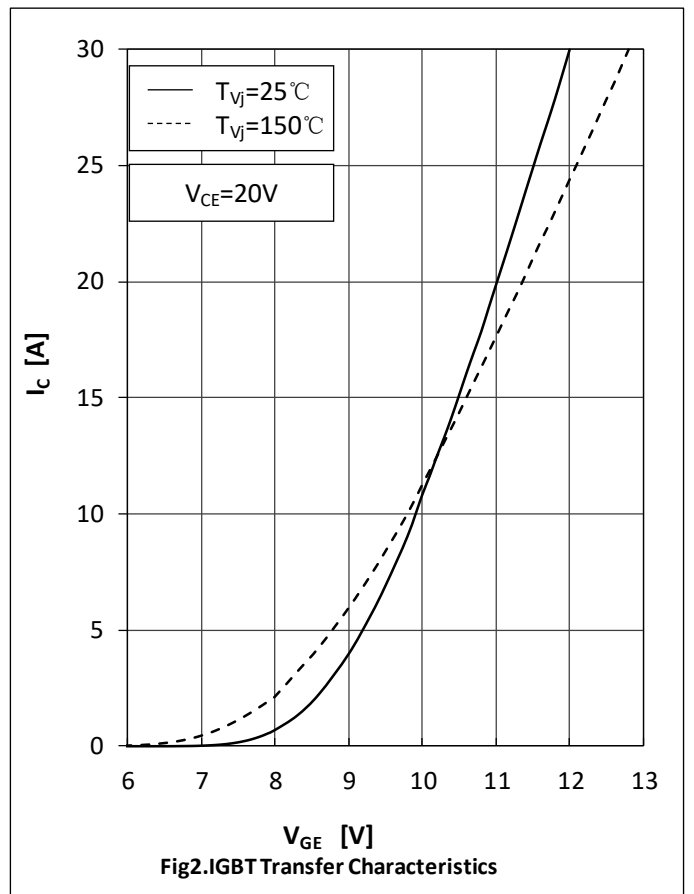
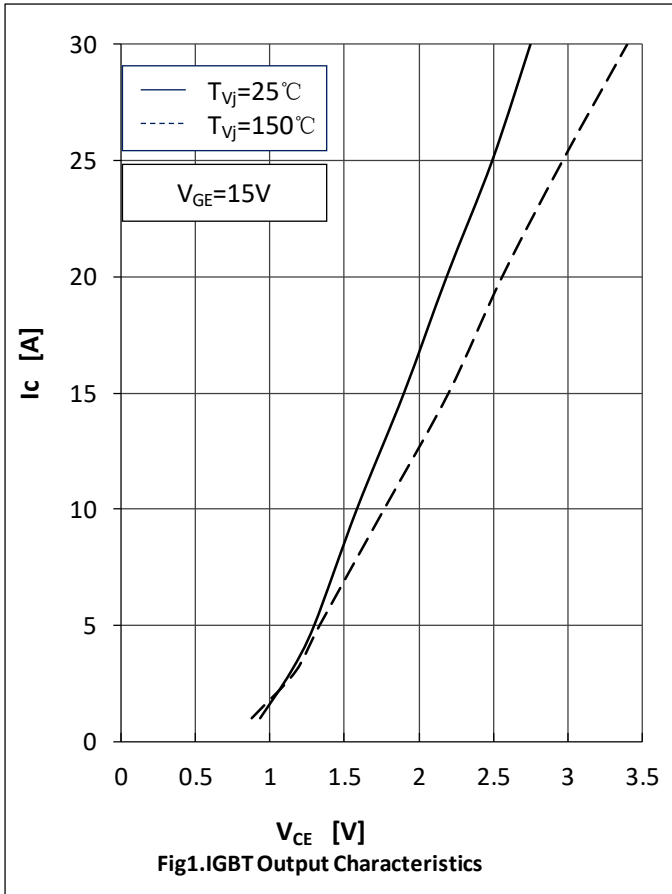
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Rated Resistance	$R_{25}$			5.0		k $\Omega$
Deviation of R100	$\Delta R/R$	$T_C=100, R_{100}=493.3\Omega$	-5		5	%
Power Dissipation	$P_{25}$				20.0	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{ K}))]$		3375		K



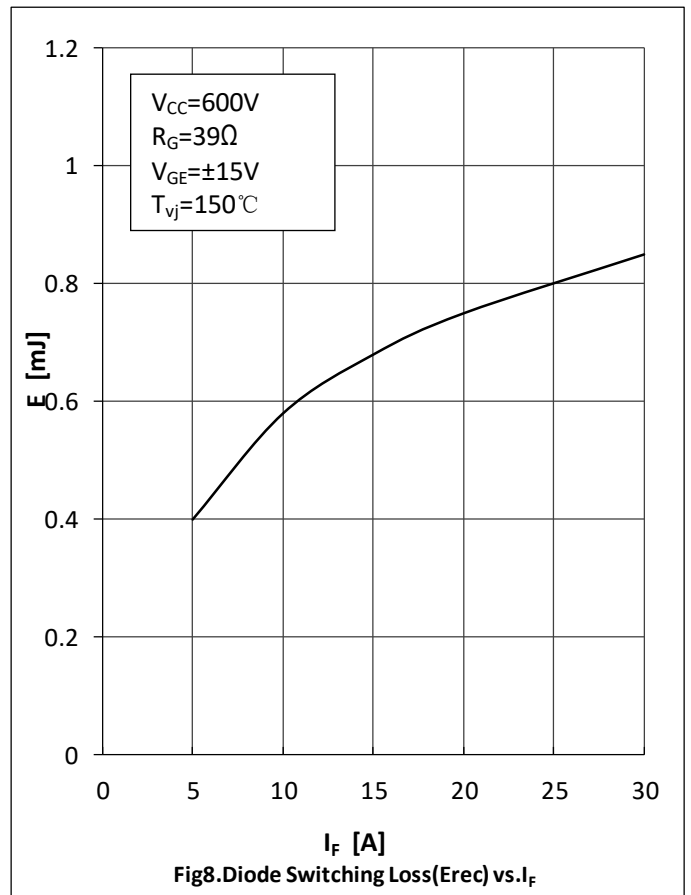
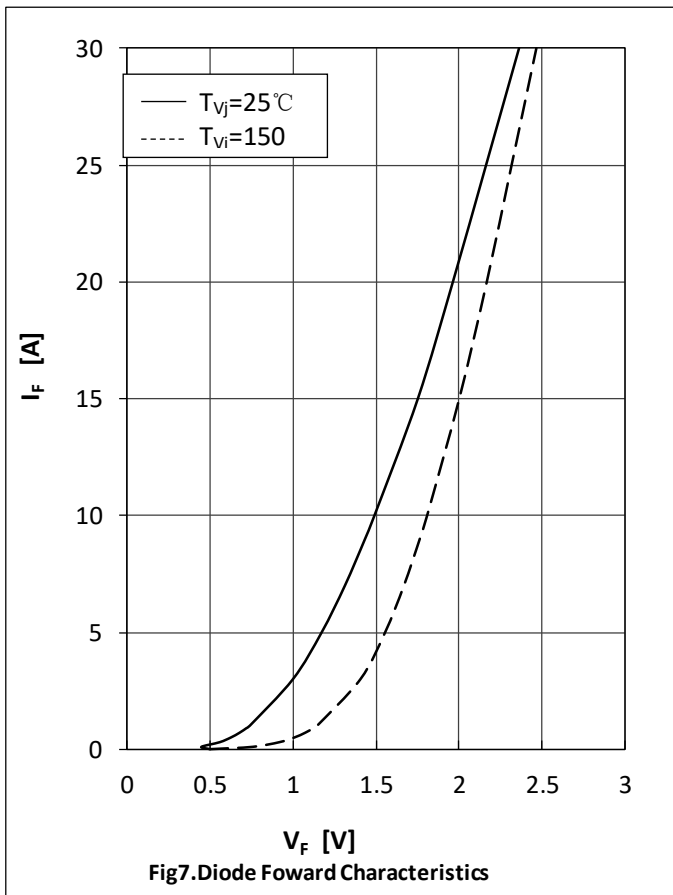
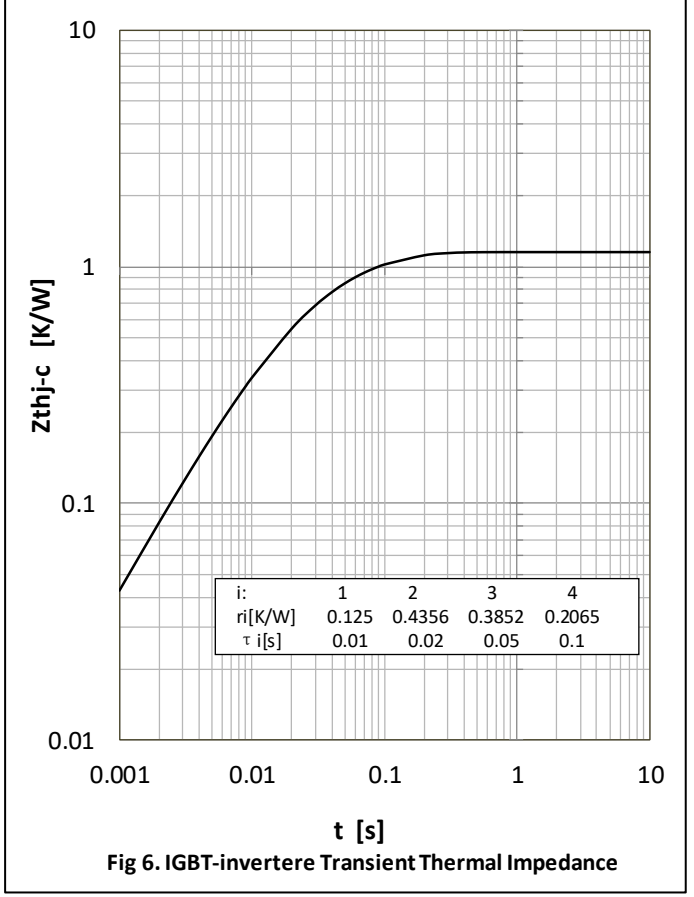
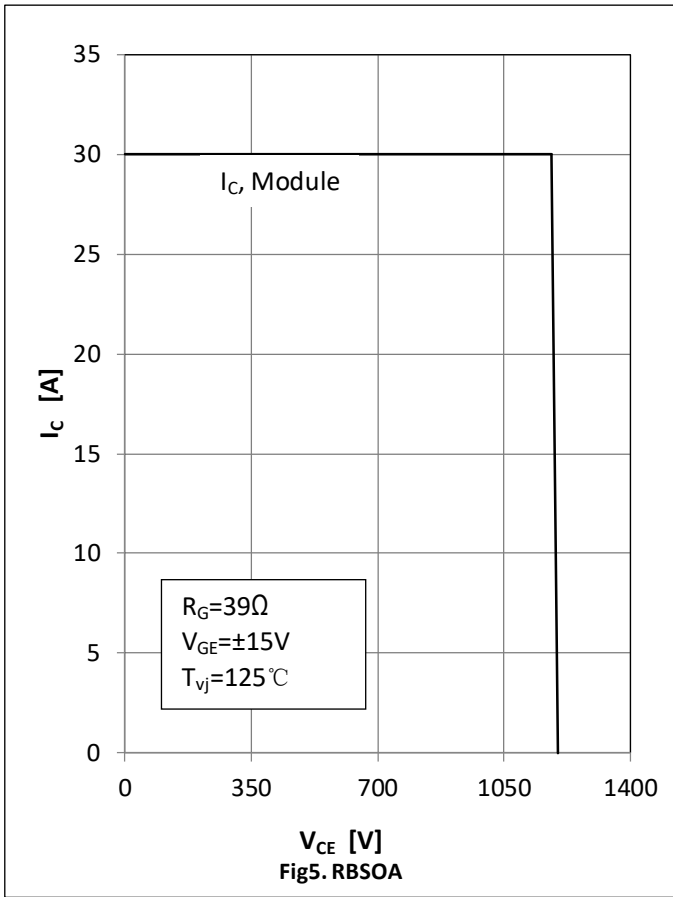
## ● Module Characteristics

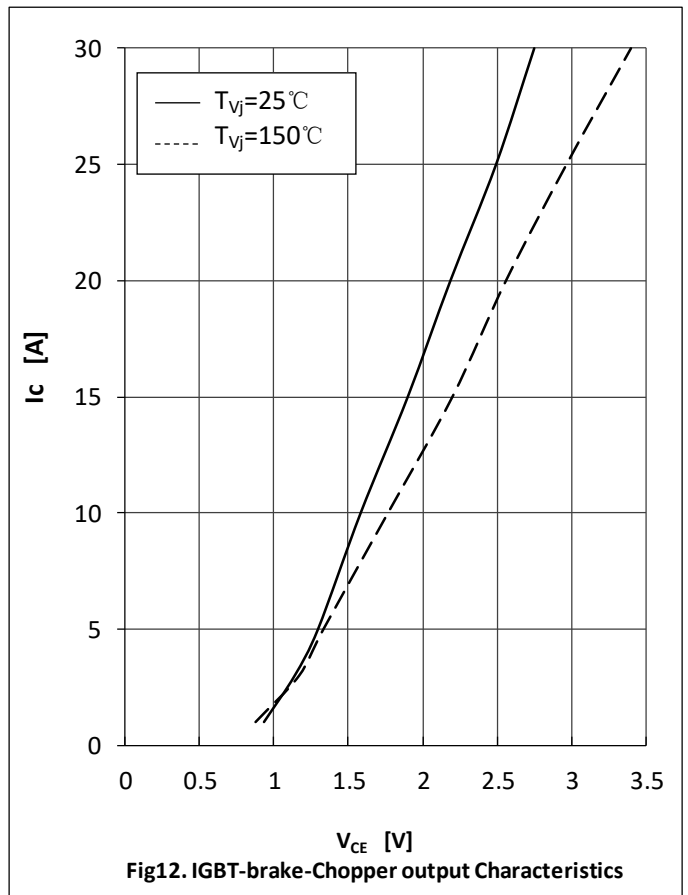
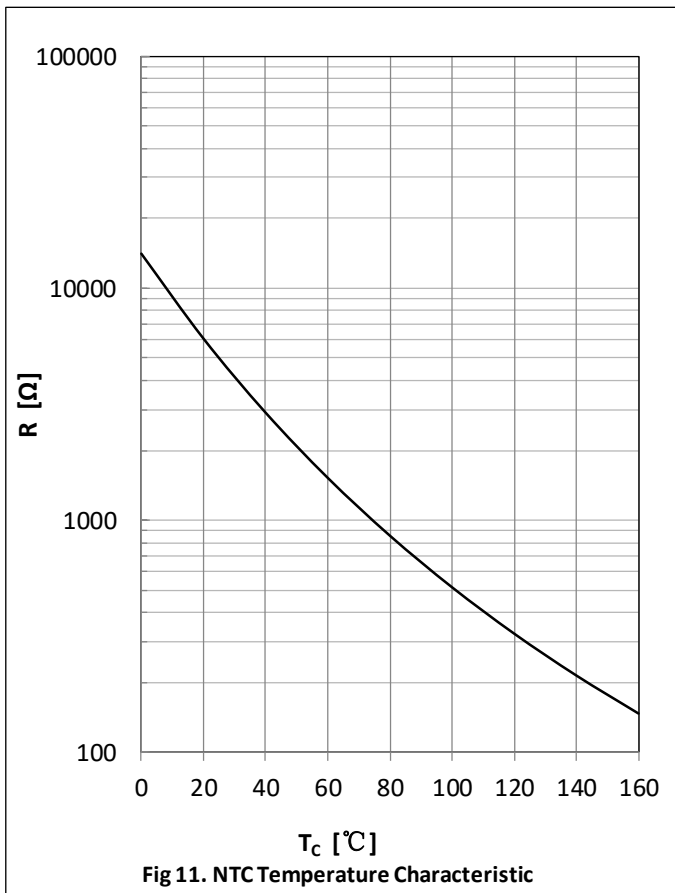
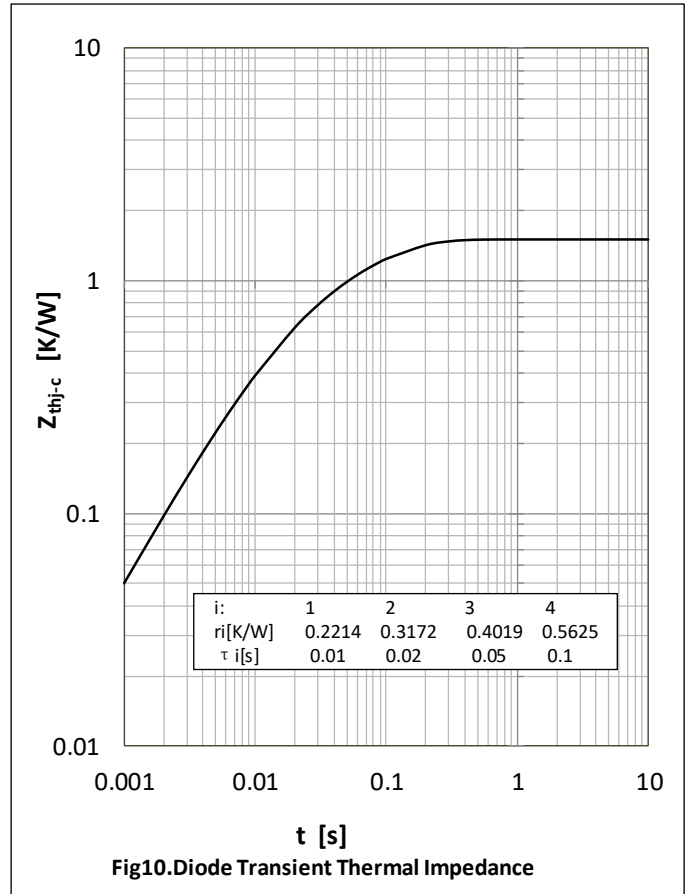
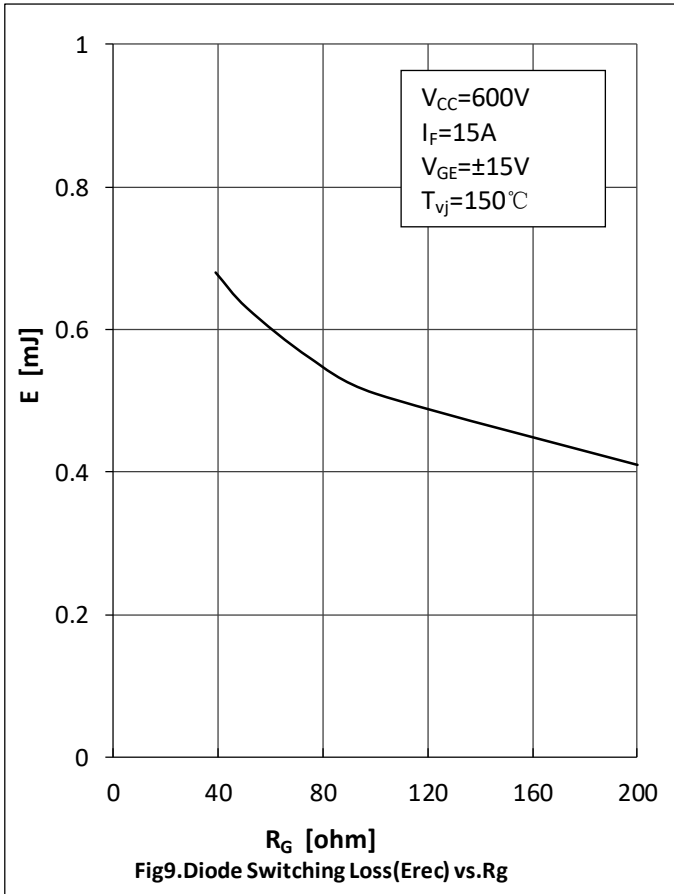
$T_C=25^{\circ}\text{C}$  unless otherwise specified

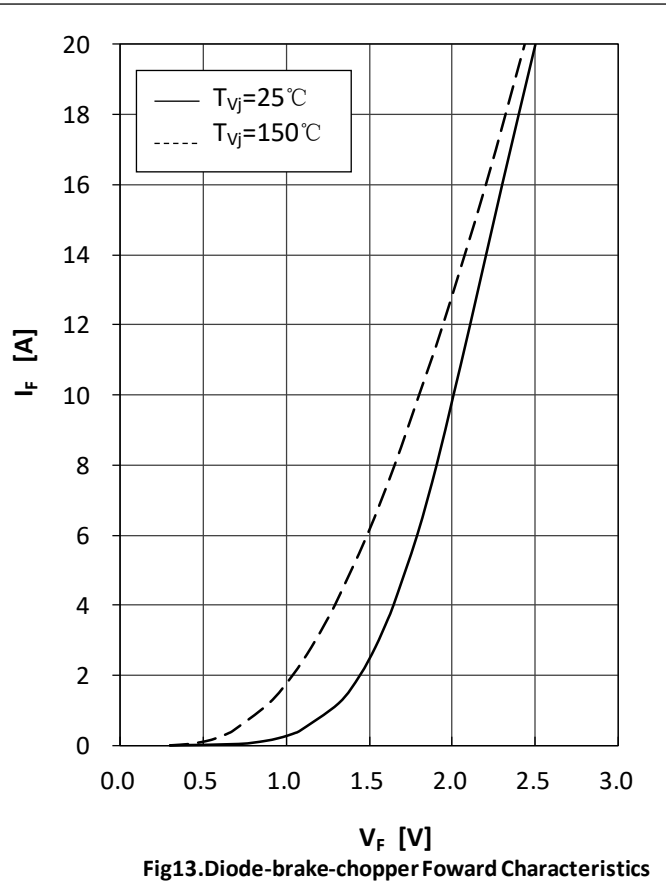
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Isolation voltage	$V_{\text{isol}}$	$t=1\text{min}, f=50\text{Hz}$	2500			V
Maximum Junction Temperature	$T_{\text{jmax}}$				175	$^{\circ}\text{C}$
Operating Junction Temperature	$T_{\text{vj op}}$		-40		150	$^{\circ}\text{C}$
Storage Temperature	$T_{\text{stg}}$		-40		125	$^{\circ}\text{C}$
Stray-inductance-module	$L_{\text{SCE}}$			60		nH
Module lead resistance, terminals-chip	$R_{\text{CC}'+\text{EE}}$	$T_C=25^{\circ}\text{C}$ , per switch		4.0		m $\Omega$
	$R_{\text{AA}'+\text{CC}'}$			3.0		
Thermal Resistance Junction-to Case	$R_{\theta\text{JC}}$	per IGBT-inverter		1.15		K/W
		per Diode-inverter		1.50		
		per IGBT-brake-copper		1.15		
		per Diode-chopper		2.39		
		per Diode-rectifier		1.13		
Thermal Resistance Case-to Sink	$R_{\theta\text{CS}}$	per IGBT-inverter		0.41		K/W
		per Diode-inverter		0.51		
		per IGBT-brake-copper		0.51		
		per Diode-chopper		0.77		
		per Diode-rectifier		1.02		
		per Module		0.02		
Mounting Force Per Clamp	F		3.0		6.0	N
Weight of Module	G			180		g



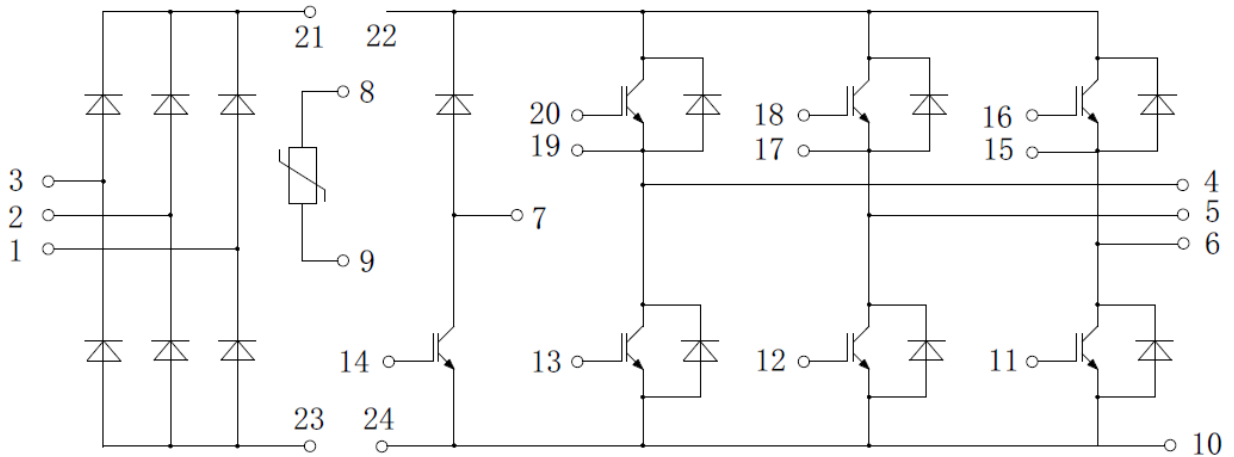




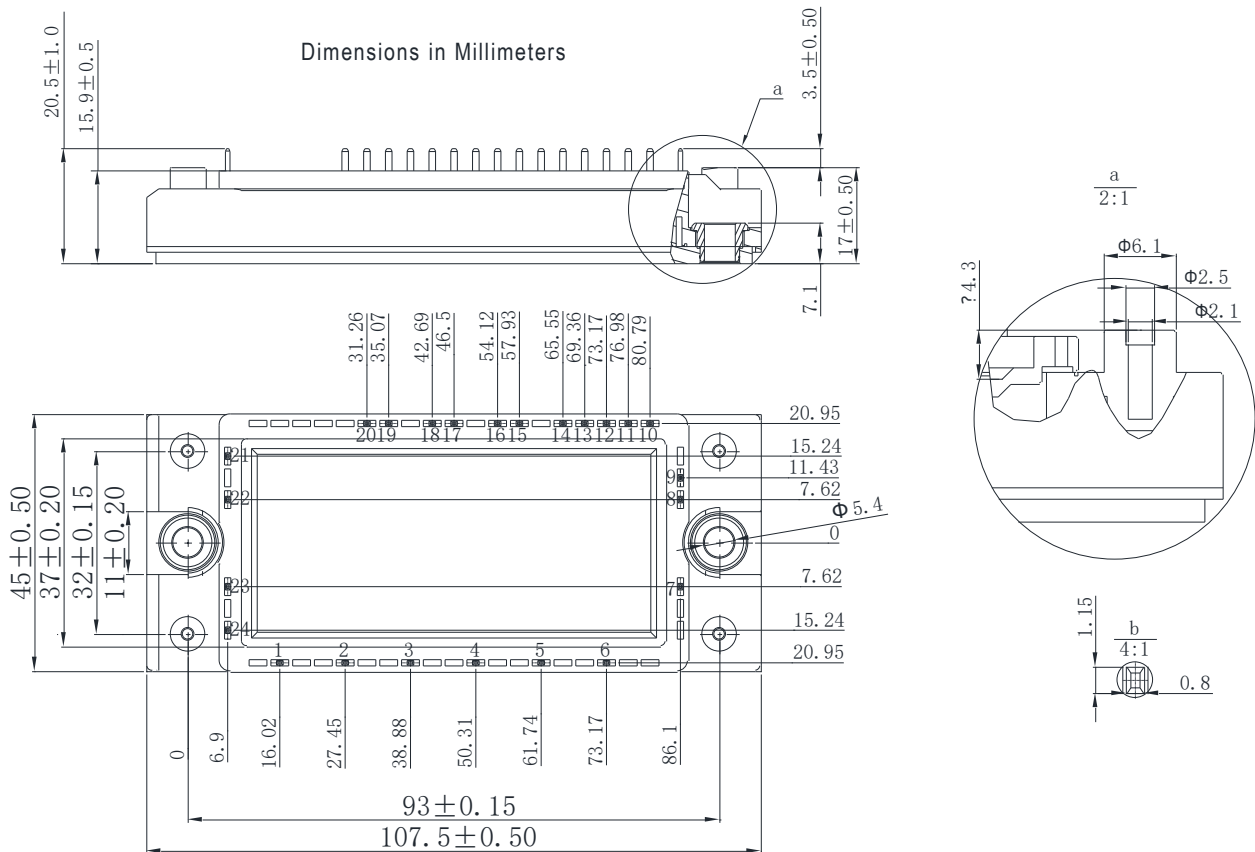




## ● Circuit Diagram



## ● Package Dimensions





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