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## IGBT Modules

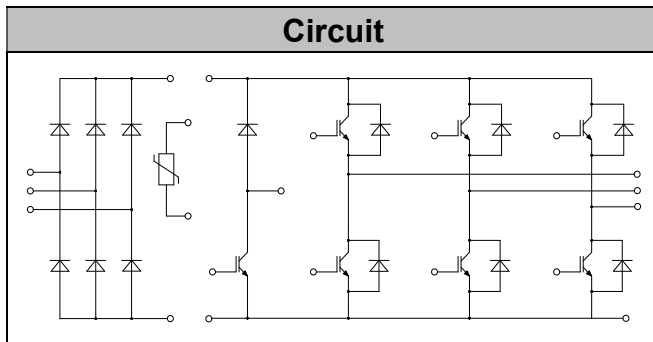
V <sub>CES</sub>	1200V
I <sub>C</sub>	15A

## Applications

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

## Features

- Low switching losses
- Low V<sub>ce(sat)</sub> 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 <sub>CES</sub>	V <sub>GE</sub> =0V, I <sub>C</sub> =1mA, T <sub>vj</sub> =25°C	1200	V
Continuous Collector Current	I <sub>C</sub>	T <sub>c</sub> =100°C, T <sub>vjmax</sub> =175°C	15	A
Repetitive Peak Collector Current	I <sub>CRM</sub>	t <sub>p</sub> =1ms	30	A
Gate-Emitter Voltage	V <sub>GES</sub>	T <sub>vj</sub> =25°C	± 20	V
Total Power Dissipation	P <sub>tot</sub>	T <sub>c</sub> =25°C T <sub>vjmax</sub> =175°C	142	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	6.0	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	$V_{CE(sat)}$	$I_C=15A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.85	2.20	V	
		$I_C=15A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15			
		$I_C=15A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.25			
Gate Charge	$Q_G$			0.15		uC	
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$		1.1		nF	
Reverse Transfer Capacitance	$C_{res}$			0.04		nF	
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA	
Turn-on Delay Time	$t_{d(on)}$	$I_C=15A, V_{CE}=600V, V_{GE}=\pm 15V, R_G=39\Omega, T_{vj}=25^{\circ}C$		90		ns	
Rise Time	$t_r$			64		ns	
Turn-off Delay Time	$t_{d(off)}$			180		ns	
Fall Time	$t_f$			135		ns	
Energy Dissipation During Turn-on Time	$E_{on}$			1.42		mJ	
Energy Dissipation During Turn-off Time	$E_{off}$			0.78		mJ	
Turn-on Delay Time	$t_{d(on)}$		$I_C=15A, V_{CE}=600V, V_{GE}=\pm 15V, R_G=39\Omega, T_{vj}=125^{\circ}C$		95		ns
Rise Time	$t_r$				70		ns
Turn-off Delay Time	$t_{d(off)}$			260		ns	
Fall Time	$t_f$			180		ns	
Energy Dissipation During Turn-on Time	$E_{on}$			1.85		mJ	
Energy Dissipation During Turn-off Time	$E_{off}$			1.13		mJ	
SC Data	$I_{sc}$	$T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C, V_{cc}=900V, V_{CEM} \leq 1200V$			90		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	$I^2t$	$V_R=0, t_p=10ms, T_{vj}=125^{\circ}C$	16.0	A <sup>2</sup> s
		$V_R=0, t_p=10ms, T_{vj}=150^{\circ}C$	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	2.65	V
		$I_F=15A, T_{vj}=125^{\circ}C$		2.10		
		$I_F=15A, T_{vj}=150^{\circ}C$		2.10		
Recovered Charge	$Q_{rr}$	$I_F=15A$		1.20		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt=600A/\mu s$		13.0		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=25^{\circ}C$		0.37		mJ
Recovered Charge	$Q_{rr}$	$I_F=15A$		2.05		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt=600A/\mu s$		12.0		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=125^{\circ}C$		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	$P_{tot}$	$T_C=25^\circ C, T_{vjmax}=175^\circ C$	155	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	6.0	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	$V_{CE(sat)}$	$I_C=15A, V_{GE}=15V, T_{vj}=25^\circ C$		1.85	2.25	V
		$I_C=15A, V_{GE}=15V, T_{vj}=125^\circ C$		2.15		
		$I_C=15A, V_{GE}=15V, T_{vj}=150^\circ C$		2.25		
Gate Charge	$Q_G$			0.09		uC
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V,$		1.35		nF
Reverse Transfer Capacitance	$C_{res}$	$f=1MHz, T_{vj}=25^\circ C$		0.08		nF
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^\circ C$			400	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C=15A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=39\Omega$ $T_{vj}=25^\circ C$		46		ns
Rise Time	$t_r$			45		ns
Turn-off Delay Time	$t_{d(off)}$			182		ns
Fall Time	$t_f$			168		ns
Energy Dissipation During Turn-on Time	$E_{on}$			0.92		mJ
Energy Dissipation During Turn-off Time	$E_{off}$			0.56		mJ



Turn-on Delay Time	$t_{d(on)}$	$I_C = 15A$ $V_{CE} = 600V$ $V_{GE} = \pm 15V$ $R_G = 39\Omega$ $T_{vj} = 125^\circ C$	46		ns
Rise Time	$t_r$		63		ns
Turn-off Delay Time	$t_{d(off)}$		248		ns
Fall Time	$t_f$		220		ns
Energy Dissipation During Turn-on Time	$E_{on}$		1.37		mJ
Energy Dissipation During Turn-off Time	$E_{off}$		0.81		mJ
SC Data	$I_{sc}$	$T_p \leq 10\mu s, V_{GE} = 15V, T_{vj} = 150^\circ C,$ $V_{cc} = 900V, V_{CEM} \leq 1200V$	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	$I_F$		10	A
Repetitive Peak Forward Current	$I_{FRM}$	$t_p = 1ms$	20	A
I <sup>2</sup> t-value	$I^2t$	$V_R = 0, t_p = 10ms, T_j = 125^\circ C$	16.0	A <sup>2</sup> s
		$V_R = 0, t_p = 10ms, T_j = 150^\circ C$	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
		$I_F = 10A, T_{vj} = 125^\circ C$		2.10		
		$I_F = 10A, T_{vj} = 150^\circ C$		2.10		
Recovered Charge	$Q_{rr}$	$I_F = 10A$		0.90		uC
Peak Reverse Recovery Current	$I_{rr}$	$V_R = 600V$ $-di_F/dt = 500A/\mu s$		12.5		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj} = 25^\circ C$		0.25		mJ
Recovered Charge	$Q_{rr}$	$I_F = 10A$		1.70		uC
Peak Reverse Recovery Current	$I_{rr}$	$V_R = 600V$ $-di_F/dt = 500A/\mu s$		10.4		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj} = 125^\circ C$		0.50		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 output Current 50/60Hz, sine wave	$I_{F(AV)}$	$T_c=100^\circ\text{C}$	20	A
Maximum RMS Current at Rectifier Output	$I_{RMSM}$	$T_c=100^\circ\text{C}$	40	A
Surge Forward Current	$I_{FSM}$	$V_R=0, t_p=10\text{ms}, T_j=45^\circ\text{C}$	270	A
$I^2t$ -value	$I^2t$	$V_R=0, t_p=10\text{ms}, T_j=45^\circ\text{C}$	360	$\text{A}^2\text{s}$

### Characteristic values

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

## ● NTC-Thermistor

### Characteristic values

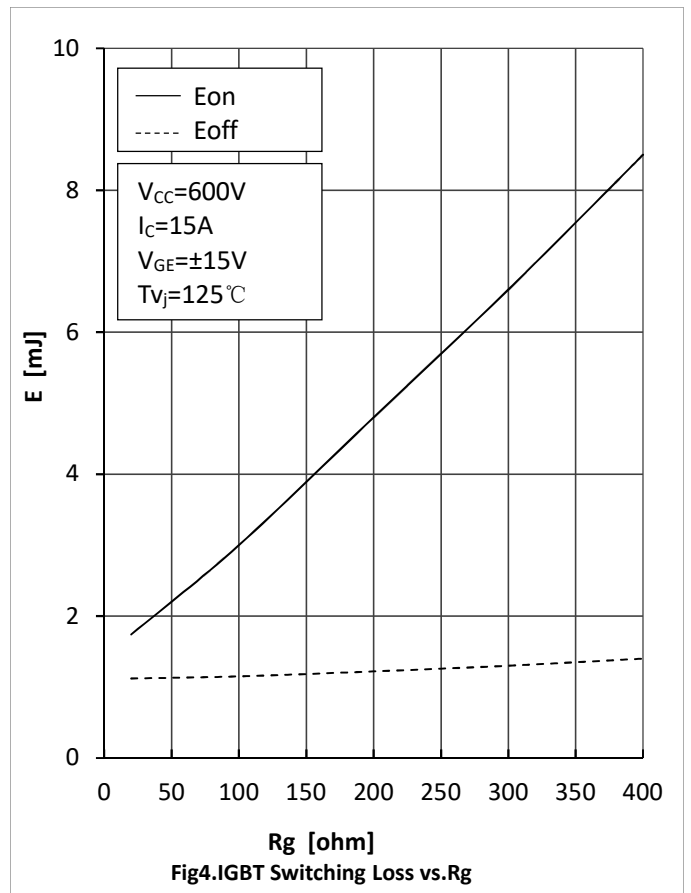
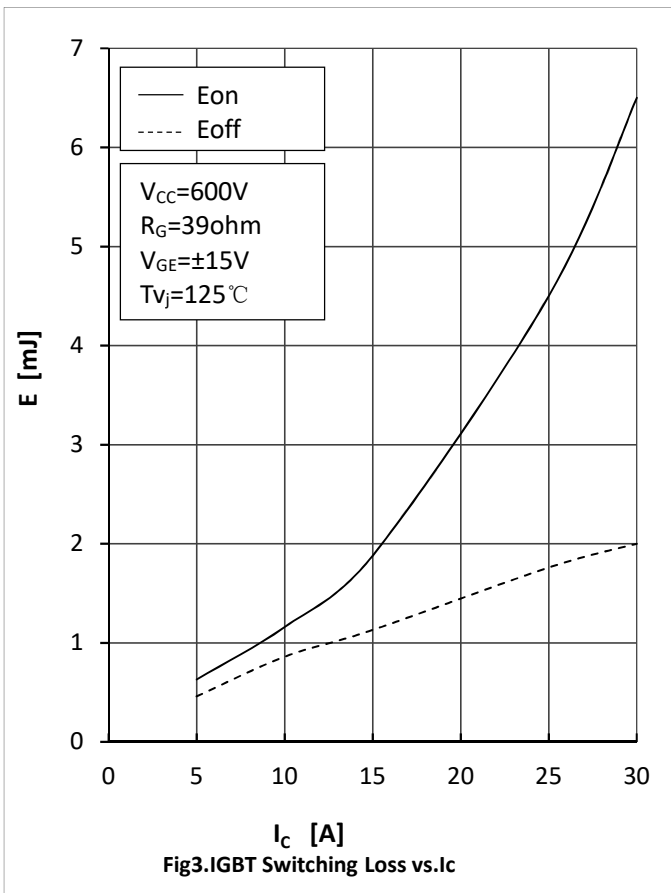
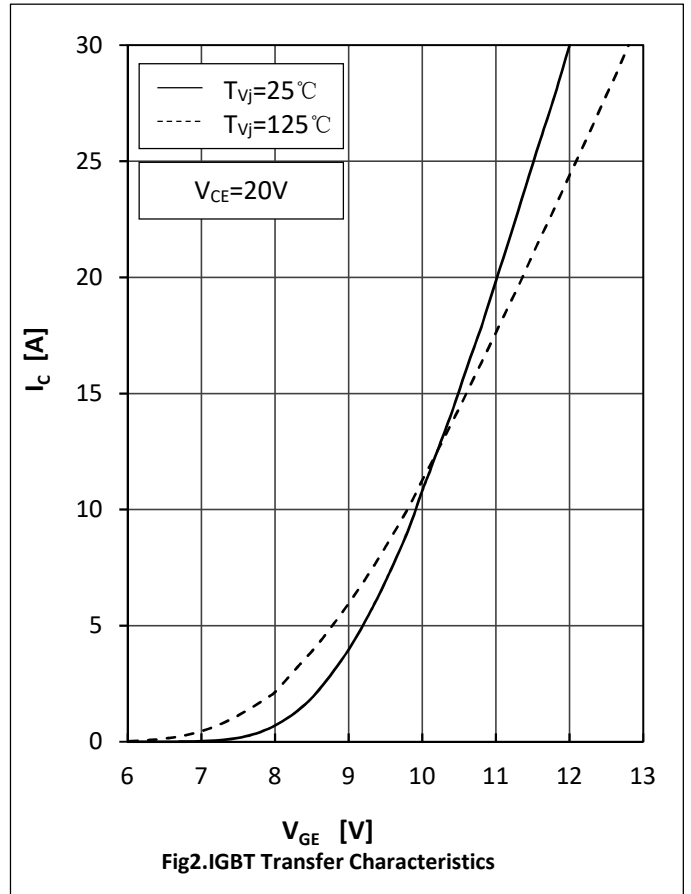
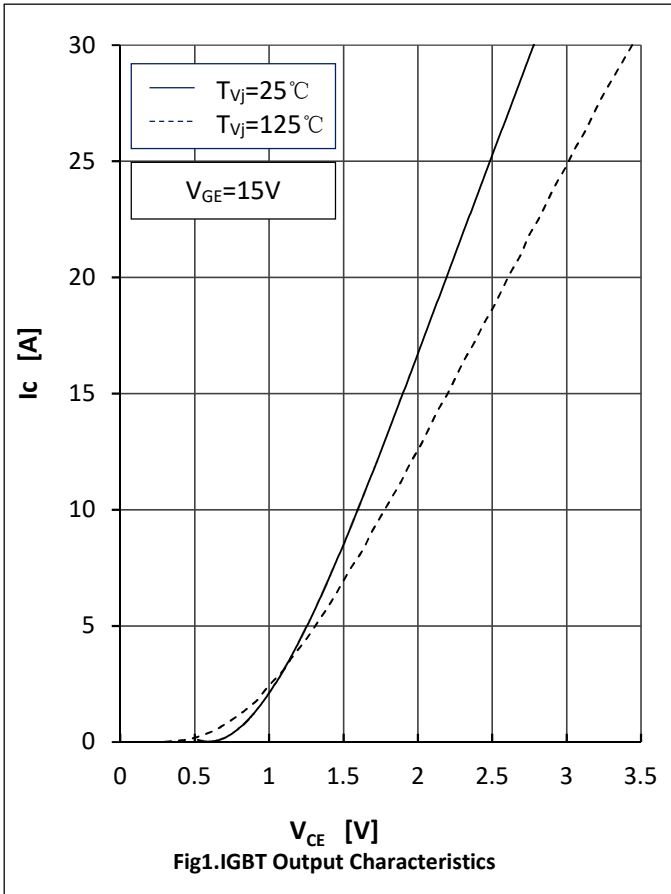
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Rated Resistance	$R_{25}$			5.0		$\text{k}\Omega$
Deviation of $R_{100}$	$\Delta R/R$	$T_c=100, R_{100}=493.3\Omega$	-5		5	%
Power Dissipation	$P_{25}$				20.0	mW
B-value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375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



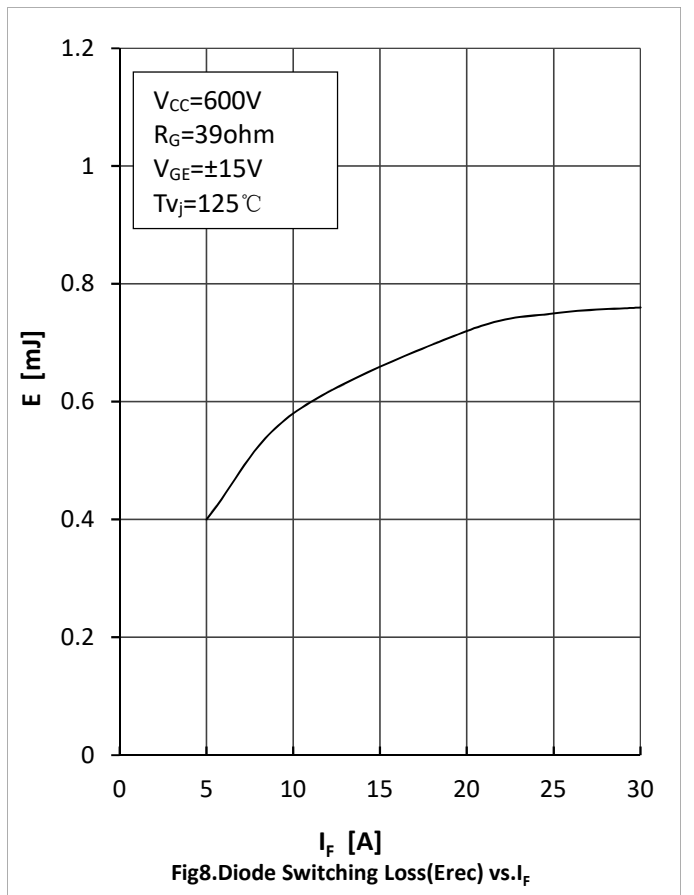
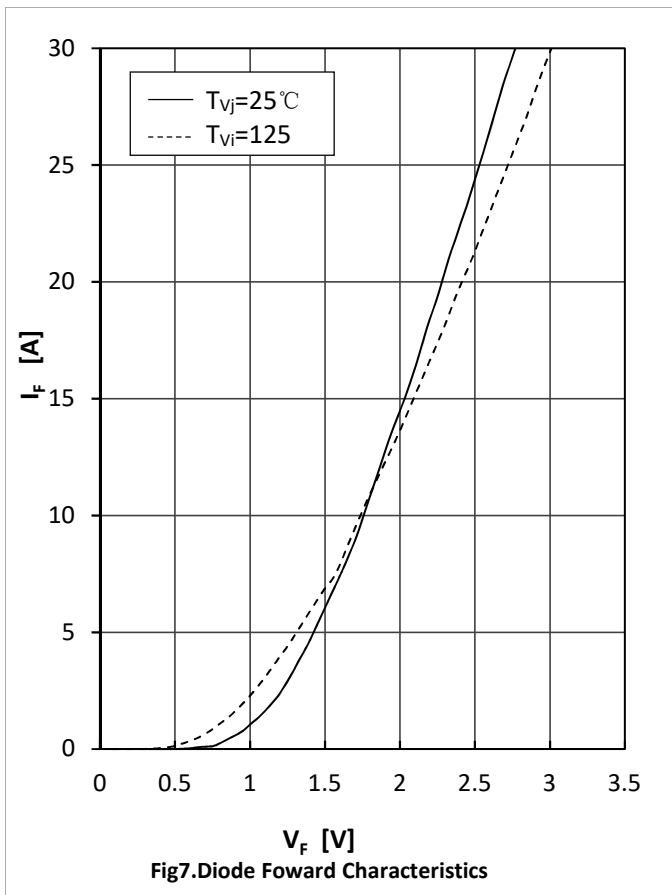
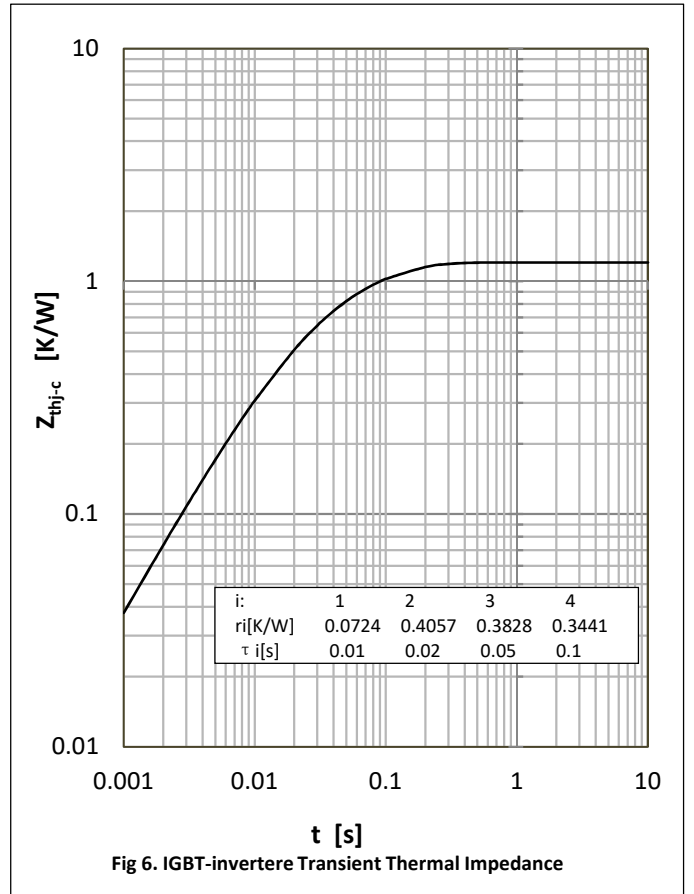
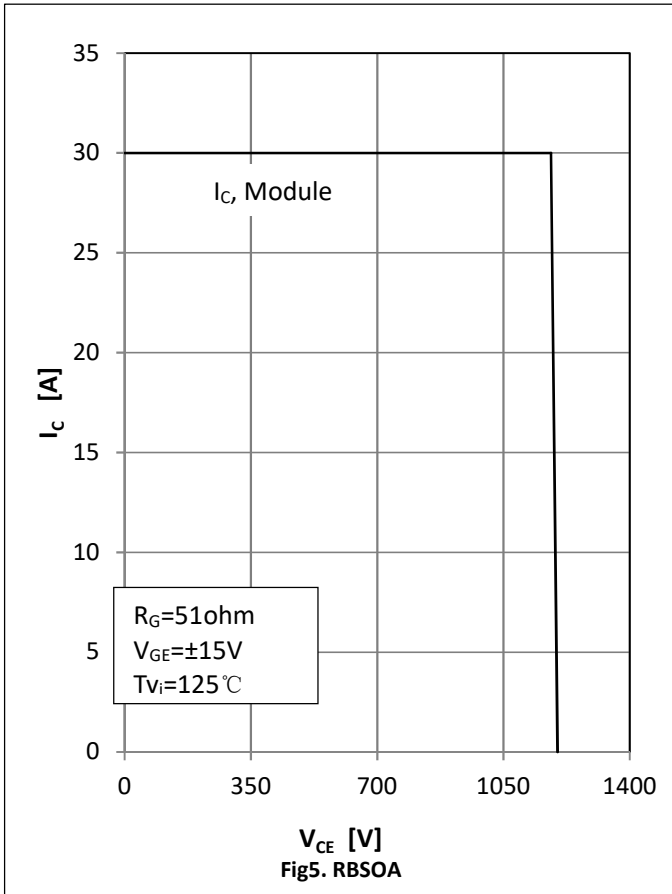
## ● Module Characteristics

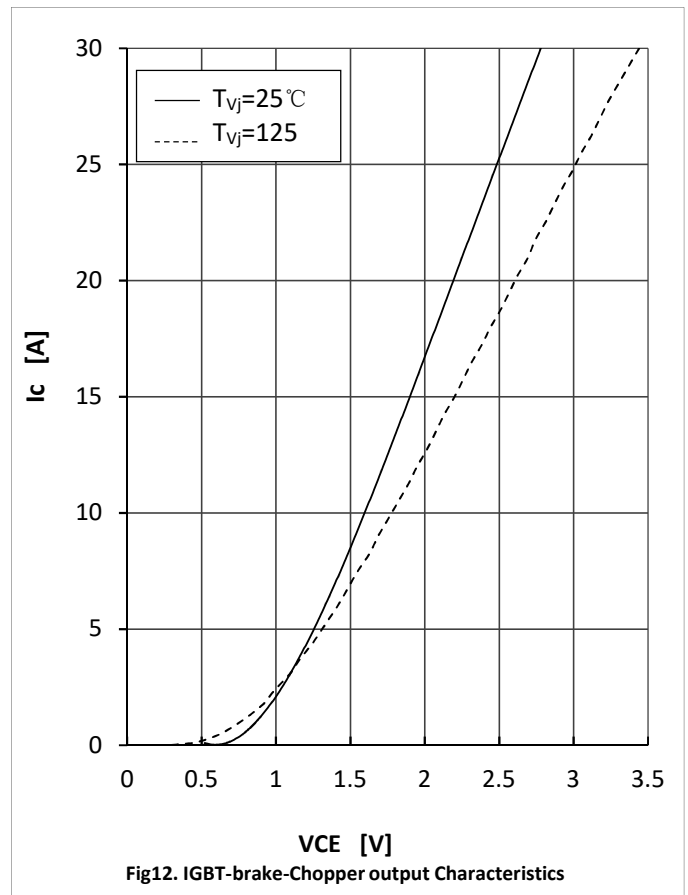
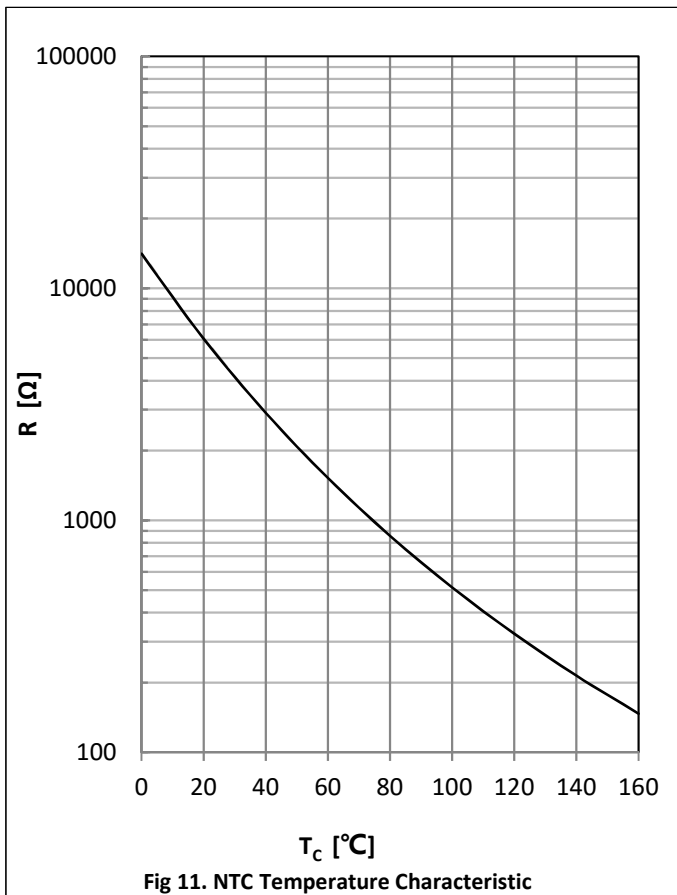
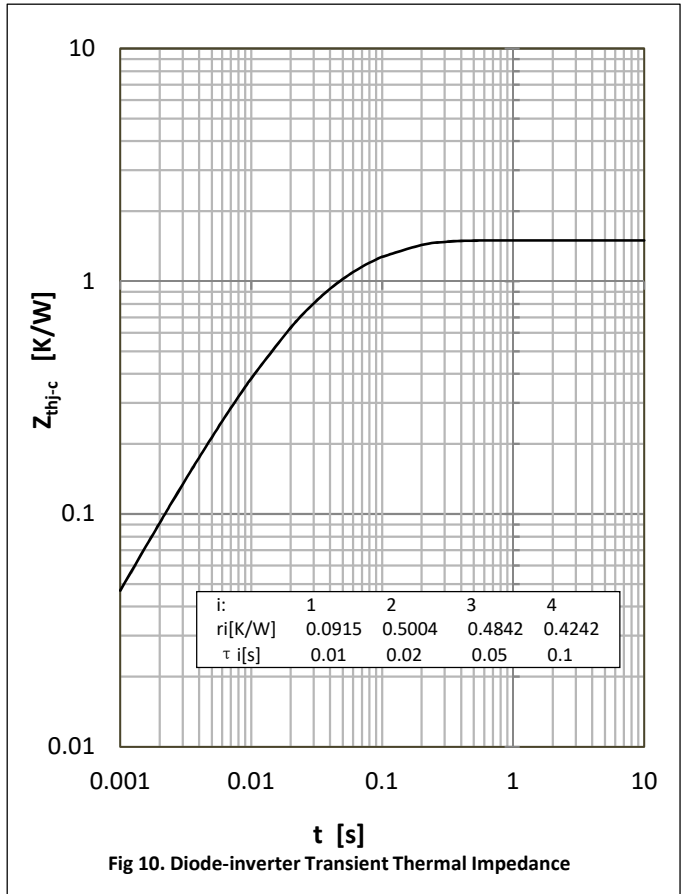
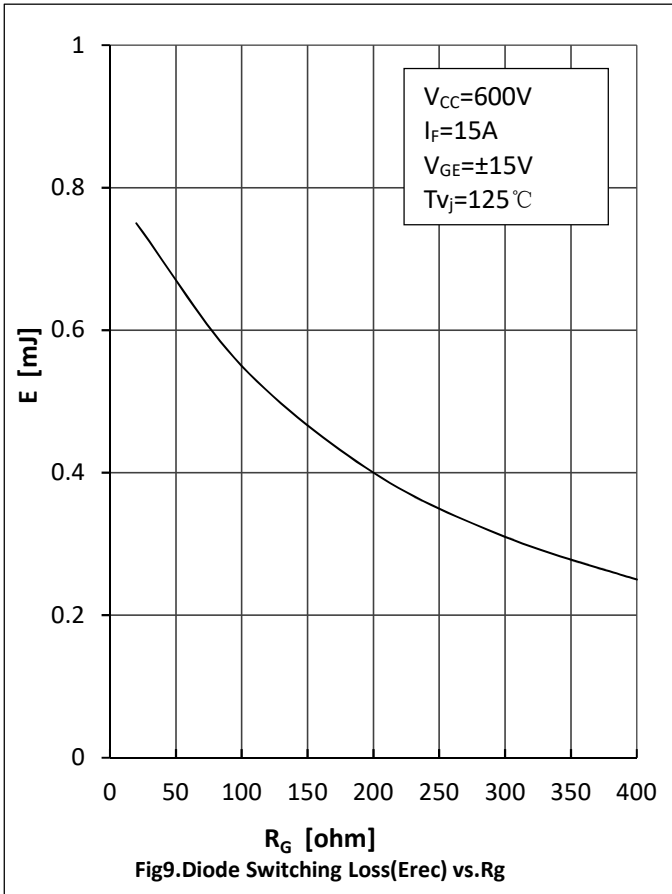
$T_C=25^\circ\text{C}$  unless otherwise specified

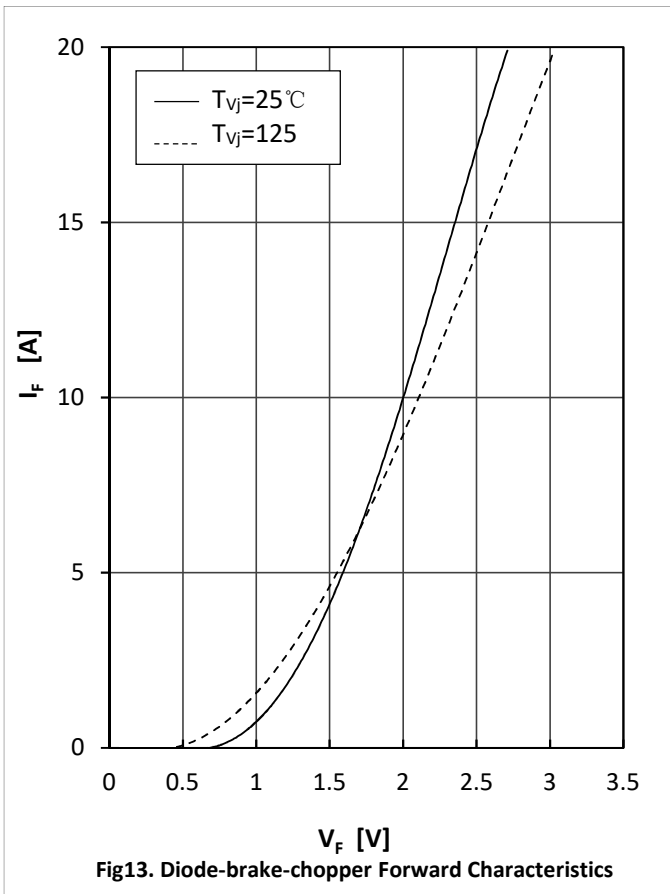
Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Isolation voltage	$V_{\text{isol}}$	$t=1\text{min}, f=50\text{Hz}$	2500			V
Maximum Junction Temperature	$T_{\text{jmax}}$				175	$^\circ\text{C}$
Operating Junction Temperature	$T_{\text{vj op}}$		-40		150	$^\circ\text{C}$
Storage Temperature	$T_{\text{stg}}$		-40		125	$^\circ\text{C}$
Stray-inductance-module	$L_{\text{SCE}}$			60		nH
Module lead resistance, terminals-chip	$R_{\text{CC'+EE'}}$	$T_C=25^\circ\text{C}$ , per switch		4.0		m $\Omega$
	$R_{\text{AA'+CC'}}$			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



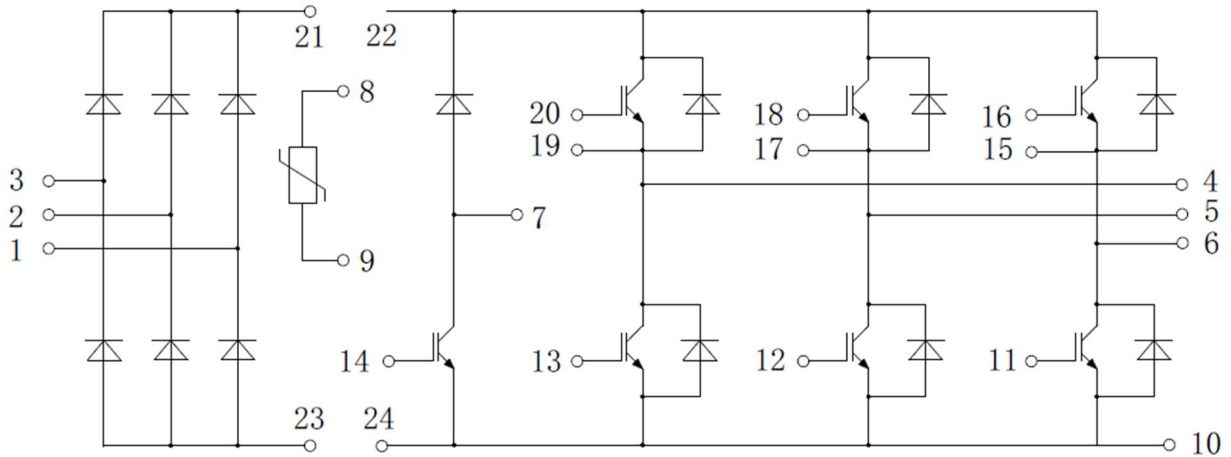








## ● Circuit Diagram



## ● Package Dimensions

