

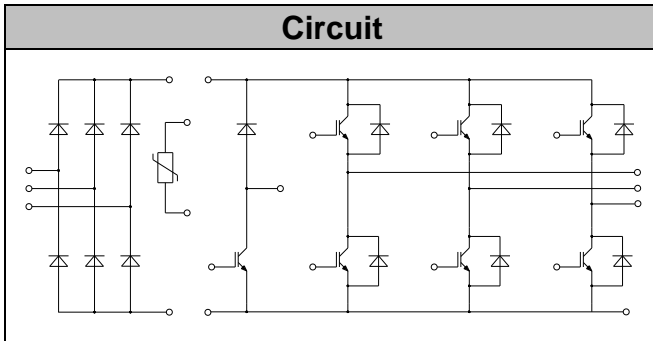


## IGBT Modules

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

## Applications

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## Features

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### ● 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> =80°C, T <sub>vjmax</sub> =150°C	50	A
Repetitive Peak Collector Current	I <sub>CRM</sub>	tp=1ms	100	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> =150°C	368	W



## Characteristic values

Parameter	Symbol	Conditions	Value			Unit	
			Min.	Typ.	Max.		
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{GE}=V_{CE}, I_C=2mA, T_{vj}=25^{\circ}C$	5.0	5.8	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	$V_{CE(sat)}$	$I_C=50A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.95	2.25	V	
		$I_C=50A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.15			
		$I_C=50A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.20			
Gate Charge	$Q_G$			0.60		uC	
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V,$ $f=1MHz, T_{vj}=25^{\circ}C$		3.80		nF	
Reverse Transfer Capacitance	$C_{res}$			0.26		nF	
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	$t_{d(on)}$	$I_C=50A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=15\Omega$ $T_{vj}=25^{\circ}C$		40		ns	
Rise Time	$t_r$			65		ns	
Turn-off Delay Time	$t_{d(off)}$			390		ns	
Fall Time	$t_f$			36		ns	
Energy Dissipation During Turn-on Time	$E_{on}$			6.05		mJ	
Energy Dissipation During Turn-off Time	$E_{off}$			3.30		mJ	
Turn-on Delay Time	$t_{d(on)}$		$I_C=50A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=15\Omega$ $T_{vj}=125^{\circ}C$		45		ns
Rise Time	$t_r$				70		ns
Turn-off Delay Time	$t_{d(off)}$				440		ns
Fall Time	$t_f$				41		ns
Energy Dissipation During Turn-on Time	$E_{on}$			8.0		mJ	
Energy Dissipation During Turn-off Time	$E_{off}$			5.50		mJ	
SC Data	$I_{sc}$	$T_p \leq 10\mu s, V_{GE}=15V, T_{vj}=150^{\circ}C,$ $V_{cc}=900V, V_{CEM} \leq 1200V$			320		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	$I_F$		50	A
Repetitive Peak Forward Current	$I_{FRM}$	$t_p=1ms$	100	A

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
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		
		$I_F=50A, T_{vj}=150^{\circ}C$		2.10		
Recovered Charge	$Q_{rr}$	$I_F=50A$		3.5		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt=900A/\mu s$		40		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=25^{\circ}C$		1.35		mJ
Recovered Charge	$Q_{rr}$	$I_F=50A$		6.5		$\mu C$
Peak Reverse Recovery Current	$I_{rr}$	$V_R=600V$ $-di_F/dt=900A/\mu s$		50		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj}=125^{\circ}C$		2.00		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	$I_C$	$T_C=100^{\circ}C, T_{vjmax}=175^{\circ}C$	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

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
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	$I_{CES}$	$V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$			1.0	mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=40A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.95	2.35	V
		$I_C=40A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.30		
		$I_C=40A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.40		
Gate Charge	$Q_G$			0.27		$\mu C$
Input Capacitance	$C_{ies}$	$V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$		2.00		nF
Reverse Transfer Capacitance	$C_{res}$			0.07		nF
Gate-Emitter leakage current	$I_{GES}$	$V_{CE}=0V, V_{GE}=20V, T_{vj}=25^{\circ}C$			400	nA
Turn-on Delay Time	$t_{d(on)}$	$I_C=40A$ $V_{CE}=600V$ $V_{GE}=\pm 15V$ $R_G=12\Omega$ $T_{vj}=25^{\circ}C$		28		ns
Rise Time	$t_r$			16		ns
Turn-off Delay Time	$t_{d(off)}$			26		ns
Fall Time	$t_f$			125		ns
Energy Dissipation During Turn-on Time	$E_{on}$			2.40		mJ
Energy Dissipation During Turn-off Time	$E_{off}$			2.25		mJ



Turn-on Delay Time	$t_{d(on)}$	$I_C = 40\text{ A}$ $V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_G = 12\Omega$ $T_{vj} = 125^\circ\text{C}$		28		ns
Rise Time	$t_r$			18		ns
Turn-off Delay Time	$t_{d(off)}$			310		ns
Fall Time	$t_f$			190		ns
Energy Dissipation During Turn-on Time	$E_{on}$			3.60		mJ
Energy Dissipation During Turn-off Time	$E_{off}$			3.20		mJ
SC Data	$I_{sc}$		$T_p \leq 10\mu\text{s}, V_{GE} = 15\text{ V}, T_{vj} = 150^\circ\text{C},$ $V_{cc} = 900\text{ V}, V_{CEM} \leq 1200\text{ V}$		130	

## ● Diode-Brake-Chopper

### Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	$V_{RRM}$	$T_j = 25^\circ\text{C}$	1200	V
Continuous DC Forward Current	$I_F$		40	A
Repetitive Peak Forward Current	$I_{FRM}$	$t_p = 1\text{ ms}$	80	A
$I^2t$ -value	$I^2t$	$V_R = 0, t_p = 10\text{ ms}, T_j = 125^\circ\text{C}$	240	A <sup>2</sup> s
		$V_R = 0, t_p = 10\text{ ms}, T_j = 150^\circ\text{C}$	220	

### Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	$V_F$	$I_F = 40\text{ A}, T_{vj} = 25^\circ\text{C}$		1.75	2.25	V
		$I_F = 40\text{ A}, T_{vj} = 125^\circ\text{C}$		1.75		
		$I_F = 40\text{ A}, T_{vj} = 150^\circ\text{C}$		1.75		
Recovered Charge	$Q_{rr}$	$I_F = 40\text{ A}$		4.15		uC
Peak Reverse Recovery Current	$I_{rr}$	$V_R = 600\text{ V}$ $-di_F/dt = 1600\text{ A/us}$		42		A
Reverse Recovery Energy	$E_{rec}$	$T_{vj} = 25^\circ\text{C}$		1.30		mJ



Recovered Charge	$Q_{rr}$	$I_F = 40\text{ A}$ $V_R = 600\text{ V}$ $-di_F/dt = 1600\text{ A/us}$ $T_{vj} = 125^\circ\text{C}$	8.00	uC
Peak Reverse Recovery Current	$I_{rr}$		46	A
Reverse Recovery Energy	$E_{rec}$		2.38	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

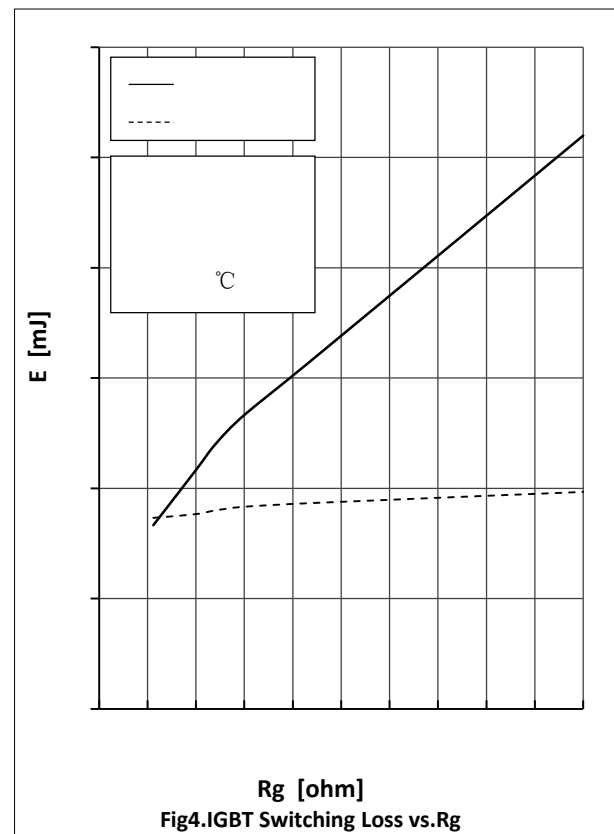
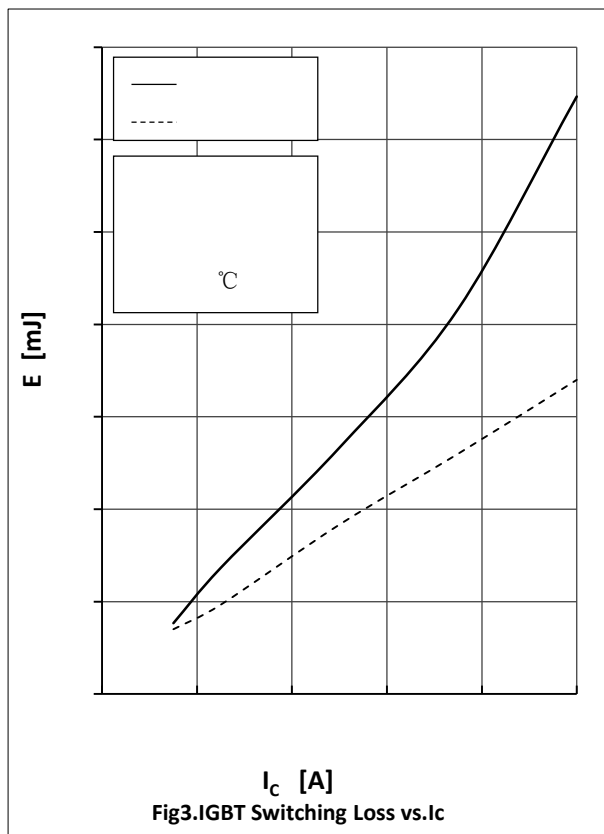
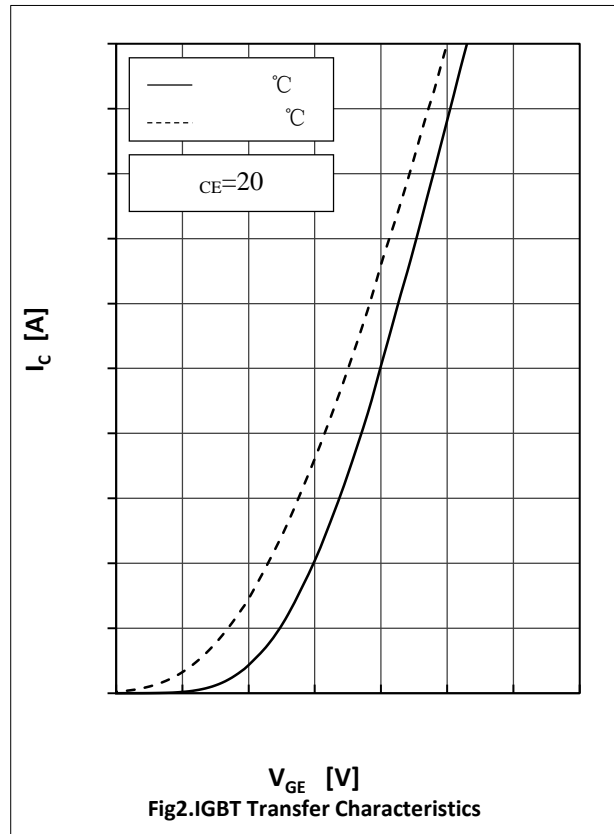
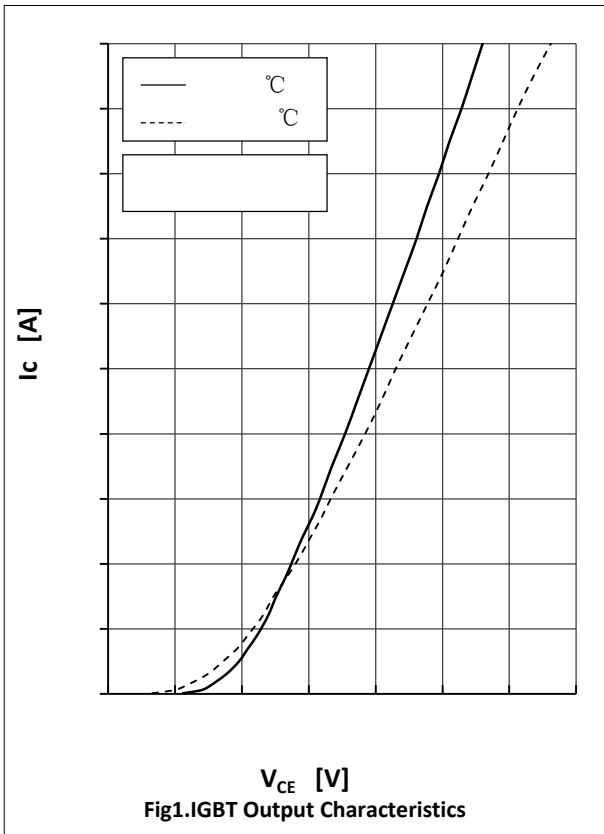
### Characteristic values

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

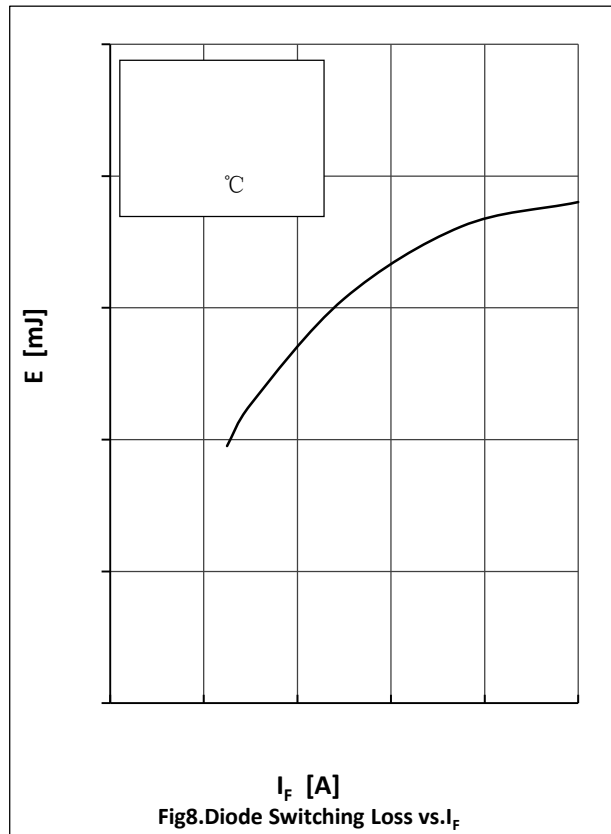
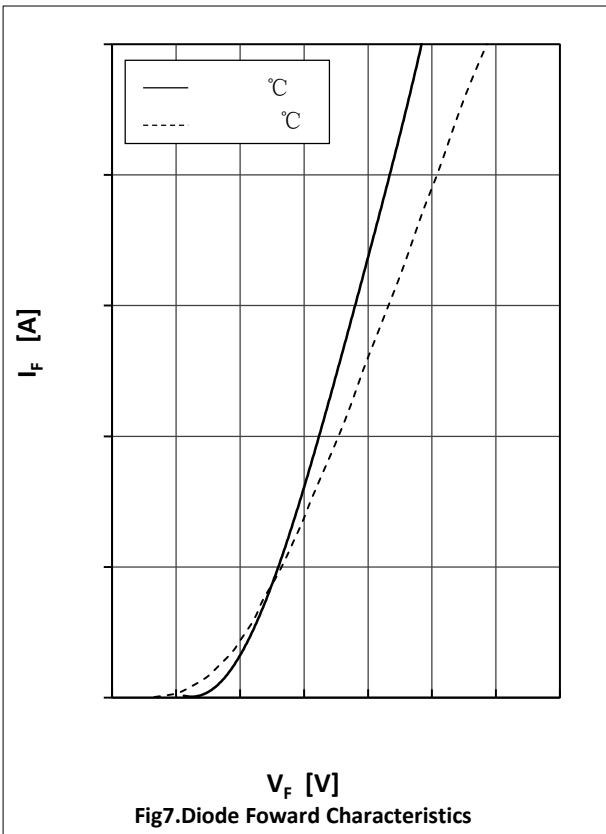
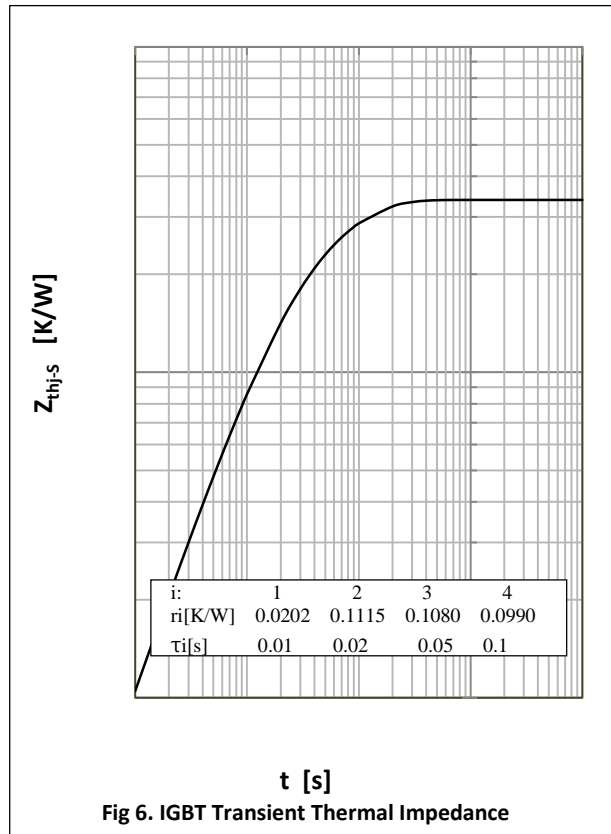
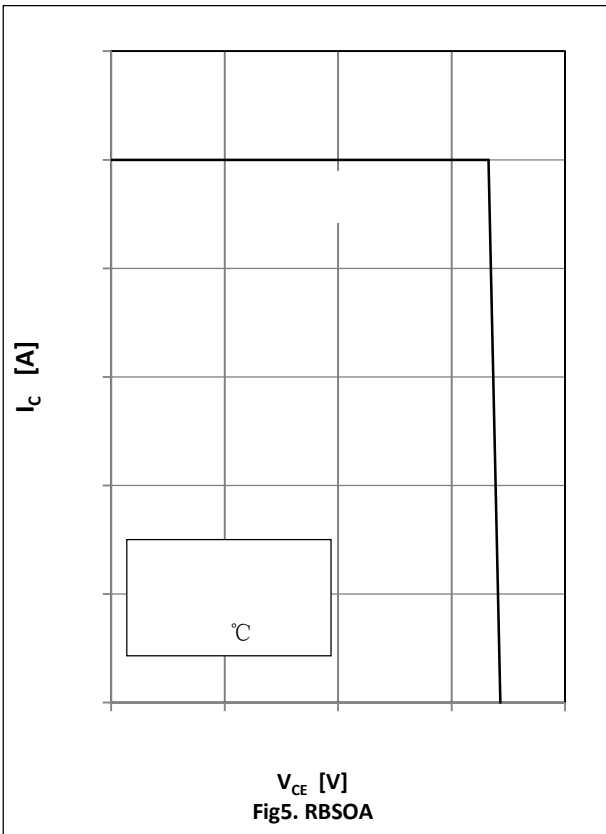


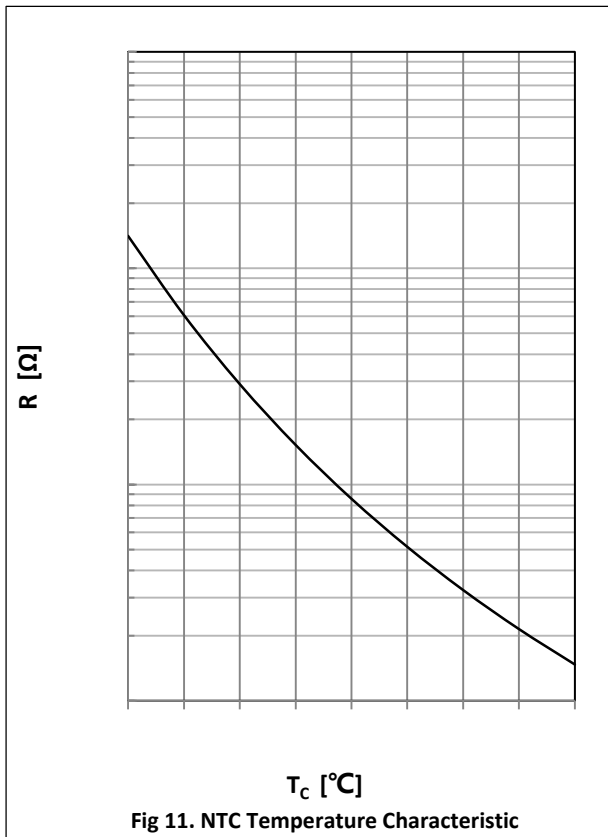
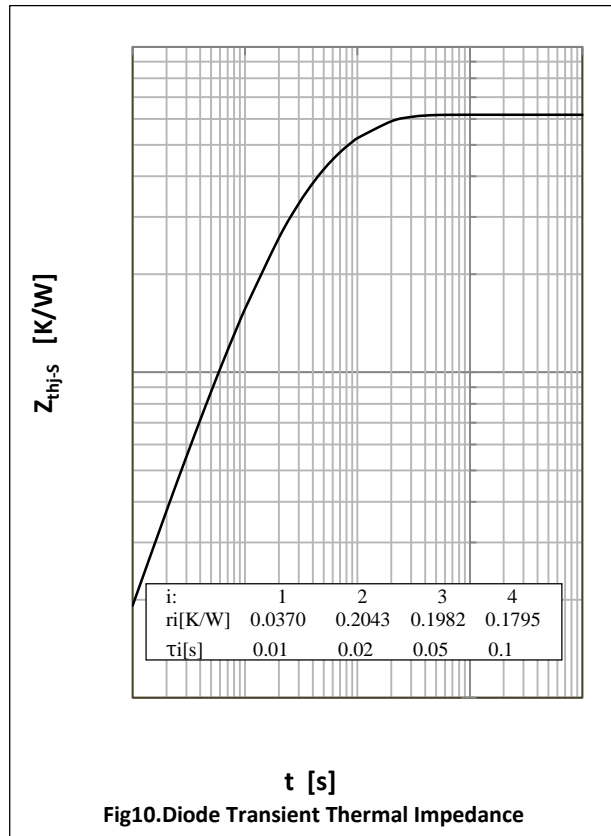
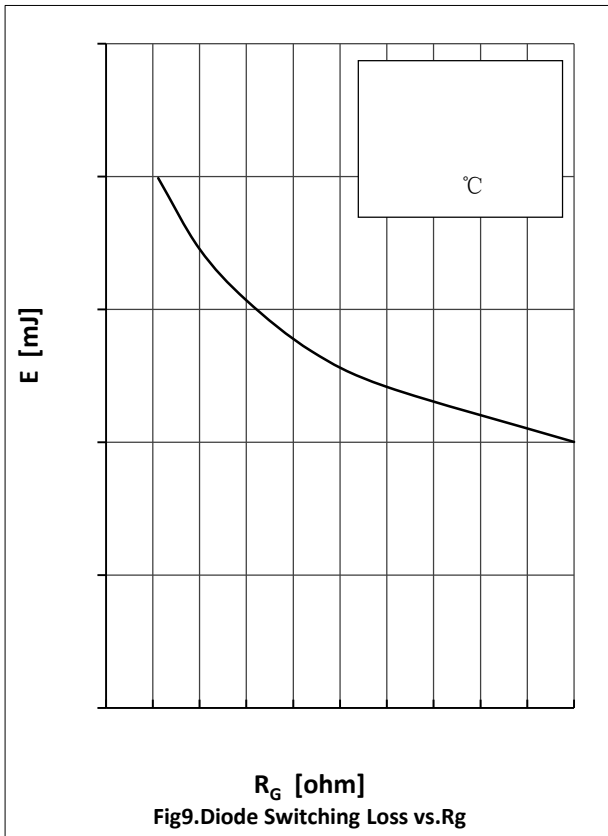
● **Module Characteristics**  $T_C=25^{\circ}\text{C}$  unless otherwise specified

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	$T_{vj op}$		-40		150	$^{\circ}\text{C}$
Storage Temperature	$T_{stg}$		-40		125	$^{\circ}\text{C}$
Stray Inductance	$L_{CE}$			60		nH
Module Lead Resistance ,Terminal to Chip	$R_{cc'+EE'}$	$T_C=25^{\circ}\text{C}$ , per switch		4.0		m $\Omega$
	$R_{AA'+CC'}$			2.0		
Thermal Resistance Junction-to Case	$R_{\theta jc}$	per IGBT-inverter			0.339	K/W
		per Diode-inverter			0.619	
		per IGBT-brake-copper			0.500	
		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-copper		0.180		
		per Diode-chopper		0.452		
		per Diode-rectifier		0.227		
		per Module		0.009		
Module-to-Sink Torque	$M_s$		3.0		6.0	N·m
Weight of Module	G			300		g



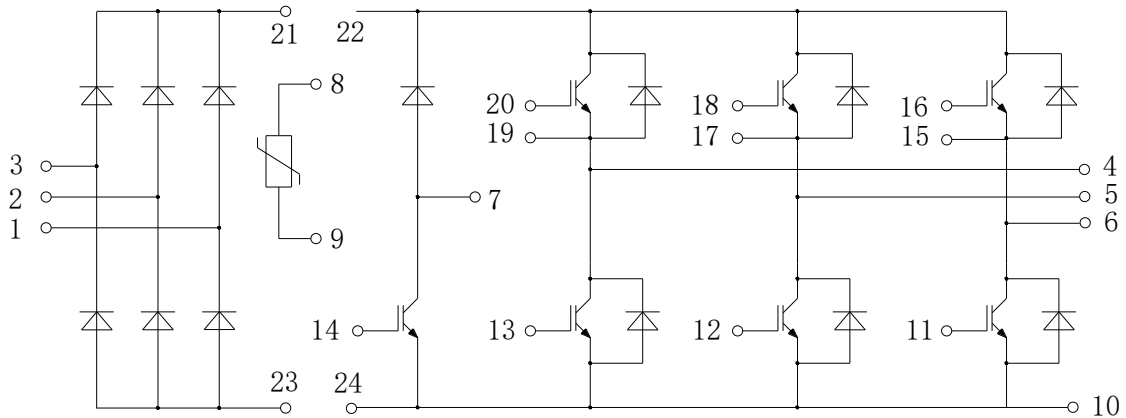








## ● Circuit Diagram



## ● Package Dimensions

