MG40P12E1

RoHS COMPLIANT

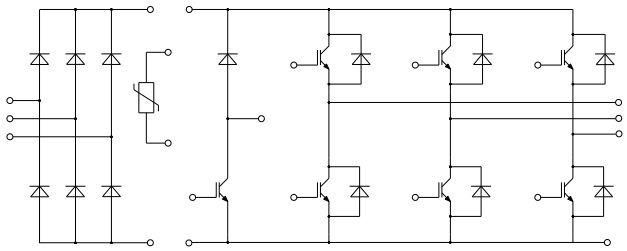
IGBT Modules

VCES	1200V
IC	40A

Applications

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

Circuit



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℃

● IGBT- inverter

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Collector-Emitter Voltage	V_{CES}	V_{GE}=0V, I_C =1mA, T_{vj}=25℃	1200	V
Continuous Collector Current	I_C	T_c=100℃, T_{vjmax}=175℃	40	A
Repetitive Peak Collector Current	I_{CRM}	tp=1ms	80	A
Gate-Emitter Voltage	V_{GES}	T_{vj}=25℃	±20	V
Total Power Dissipation	P_{tot}	T_c=25℃ T_{vjmax}=175℃	227	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 =1.2mA,T_{vj}=25℃	5.2	6.0	6.8	V
Collector-Emitter Cut-off Current	I_{CES}	V_{CE}=1200V,V_{GE}=0V, T_{vj}=25℃			1.0	mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	Ic=40A,V_{GE}=15V, T_{vj}=25℃		1.90	2.30	V
		Ic=40A,V_{GE}=15V, T_{vj}=125℃		2.20		
		Ic=40A,V_{GE}=15V, T_{vj}=150℃		2.40		
Gate Charge	Q_G			0.35		uC
Input Capacitance	C_{ies}	V_{CE}=25V, V_{GE} =0V, f=1MHz, T_{vj}=25℃		2.25		nF
Reverse Transfer Capacitance	C_{res}			0.10		nF
Gate-Emitter leakage current	I_{GES}	V_{CE}=0 V, V_{GE}=20V,T_{vj} = 25℃			400	nA
Turn-on Delay Time	$t_{d(on)}$	I_C =40 A V_{CE} = 600 V V_{GE} = ±15V R_G = 13Ω T_{vj}=25℃		198		ns
Rise Time	t_r			24		ns
Turn-off Delay Time	$t_{d(off)}$			360		ns
Fall Time	t_f			72		ns
Energy Dissipation During Turn-on Time	E_{on}			4.25		mJ
Energy Dissipation During Turn-off Time	E_{off}			2.00		mJ
Turn-on Delay Time	$t_{d(on)}$	I_C =40 A V_{CE} = 600 V V_{GE} = ±15V R_G = 13Ω T_{vj}=125℃		210		ns
Rise Time	t_r			28		ns
Turn-off Delay Time	$t_{d(off)}$			470		ns
Fall Time	t_f			90		ns
Energy Dissipation During Turn-on Time	E_{on}			6.04		mJ
Energy Dissipation During Turn-off Time	E_{off}			3.05		mJ
SC Data	I_{sc}	T_p≤10us,V_{GE}=15V,T_{vj}=150℃, V_{cc}=900V,V_{CEM}≤1200V		200		A

Diode-inverter

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	T_{vj}=25℃	1200	V
Continuous DC Forward Current	I_F		40	A
Repetitive Peak Forward Current	I_{FRM}	t_p=1ms	80	A
I^2t-value	I^2t	V_R=0,t_p=10ms,T_{vj}=125℃	240	A^2s
		V_R=0,t_p=10ms,T_{vj}=150℃	220	

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	I_F=40A,T_{vj}=25℃		1.90	2.25	V
		I_F=40A,T_{vj}=125℃		1.90		
		I_F=40A,T_{vj}=150℃		1.85		
Recovered Charge	Q_{rr}	I_F =40 A V_R=600V -di$_F$/dt =1600A/us T_{vj}=25℃		4.15		uC
Peak Reverse Recovery Current	I_{rr}			42		A
Reverse Recovery Energy	E_{rec}			1.30		mJ
Recovered Charge	Q_{rr}	I_F =40 A V_R=600V -di$_F$/dt =1600A/us T_{vj}=125℃		8.00		uC
Peak Reverse Recovery Current	I_{rr}			46		A
Reverse Recovery Energy	E_{rec}			2.38		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℃	1200	V
Continuous Collector Current	I_C	T_c=100℃, T_{vjmax}=175℃	25	A
Repetitive Peak Collector Current	I_{CRM}	tp=1ms	50	A
Gate-Emitter Voltage	V_{GES}	T_{vj}=25℃	±20	V
Total Power Dissipation	P_{tot}	T_c=25℃ T_{vjmax}=175℃	166	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℃	5.2	6.0	6.8	V
Collector-Emitter Cut-off Current	I_{CES}	V_{CE}=1200V,V_{GE}=0V, T_{vj}=25℃			1.0	mA
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	Ic=25A,V_{GE}=15V, T_{vj}=25℃		1.90	2.30	V
		Ic=25A,V_{GE}=15V, T_{vj}=125℃		2.20		
		Ic=25A,V_{GE}=15V, T_{vj}=150℃		2.30		
Gate Charge	Q_G			0.24		uC
Input Capacitance	C_{ies}	V_{CE}=25V, V_{GE} =0V, f=1MHz, T_{vj}=25℃		1.60		nF
Reverse Transfer Capacitance	C_{res}			0.07		nF
Gate-Emitter leakage current	I_{GES}	V_{CE}=0 V, V_{GE}=20 V,T_{vj} = 25℃			100	nA
Turn-on Delay Time	$t_{d(on)}$	I_C =25 A V_{CE} = 600 V V_{GE} = ±15V R_G = 18Ω T_{vj}=25℃		175		ns
Rise Time	t_r			38		ns
Turn-off Delay Time	$t_{d(off)}$			420		ns
Fall Time	t_f			65		ns
Energy Dissipation During Turn-on Time	E_{on}			1.95		mJ
Energy Dissipation During Turn-off Time	E_{off}			1.20		mJ

Turn-on Delay Time	$t_{d(on)}$	I_C =25 A V_{CE} = 600 V V_{GE} = ±15V R_G = 18Ω T_{vj}=125℃		185		ns
Rise Time	t_r			43		ns
Turn-off Delay Time	$t_{d(off)}$			510		ns
Fall Time	t_f			120		ns
Energy Dissipation During Turn-on Time	E_{on}			2.60		mJ
Energy Dissipation During Turn-off Time	E_{off}			2.00		mJ
SC Data	I_{sc}	T_p≤10us,V_{GE}=15V,T_{vj}=150℃, V_{cc}=900V,V_{CEM}≤1200V		135		A

● Diode-Brake-Chopper

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	T_j=25℃	1200	V
Continuous DC Forward Current	I_F		15	A
Repetitive Peak Forward Current	I_{FRM}	tp=1ms	30	A
I^2t-value	I^2t	V_R=0,t_p=10ms,T_j=125℃	48.0	A^2s
		V_R=0,t_p=10ms,T_j=150℃	42.0	

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Forward Voltage	V_F	I_F=15A,T_{vj}=25℃		2.00	2.40	V
		I_F=15A,T_{vj}=125℃		2.10		
		I_F=15A,T_{vj}=150℃		2.10		
Recovered Charge	Q_{rr}	I_F =15 A V_R=600V -di$_F$/dt =550A/us T_{vj}=25℃		1.10		uC
Peak Reverse Recovery Current	I_{rr}			12.0		A
Reverse Recovery Energy	E_{rec}			0.30		mJ
Recovered Charge	Q_{rr}	I_F =15 A V_R=600V -di$_F$/dt =550A/us		1.90		uC
Peak Reverse Recovery Current	I_{rr}			14.0		A

Reverse Recovery Energy	E_{rec}	T_{vj}=125℃		0.60		mJ

Diode-Rectifier

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Value	Unit
Repetitive Peak Reverse Voltage	V_{RRM}	T_j=25℃	1600	V
Average output Current 50/60Hz, sine wave	$I_{F(AV)}$	T_c=100℃	50	A
Maximum RMS Current at Rectifier Output	I_{RMSM}	T_c=100℃	60	A
Surge Forward Current	I_{FSM}	V_R=0,t_p=10ms,T_j=45℃	320	A
I^2t-value	I^2t	V_R=0,t_p=10ms,T_j=45℃	510	A^2s

Characteristic values

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Diode Forward Voltage	V_F	I_F=40A,T_j=125℃		1.12		V
Reverse Current	I_R	T_j=125℃,V_R=1600V			2.0	mA

NTC-Thermistor

Characteristic values

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

Module Characteristics

T_C=25°C unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			Min.	Typ.	Max.	
Isolation voltage	V_{isol}	t=1min,f=50Hz	2500			V
Maximum Junction Temperature	T_{jmax}				175	℃
Operating Junction Temperature	$T_{vj\ op}$		-40		150	℃
Storage Temperature	T_{stg}		-40		125	℃
Stray-inductance-module	L_{SCE}			60		nH
Module lead resistance, terminals-chip	$R_{cc'+EE'}$	T_C=25℃, per switch		4.0		mΩ
	$R_{AA'+CC'}$			3.0		
Thermal Resistance Junction-to Case	$R_{\theta JC}$	per IGBT-inverter			0.66	K/W
		per Diode-inverter			1.00	
		per IGBT-brake-copper			0.90	
		per Diode-chopper			1.50	
		per Diode-rectifier			0.75	
Thermal Resistance Case-to Sink	$R_{\theta CS}$	per IGBT-inverter		0.31		K/W
		per Diode-inverter		0.48		
		per IGBT-brake-copper		0.33		
		per Diode-chopper		0.70		
		per Diode-rectifier		0.36		
		per Module		0.02		
Mounting Force Per Clamp	F		3.0		6.0	N
Weight of Module	G			180		g

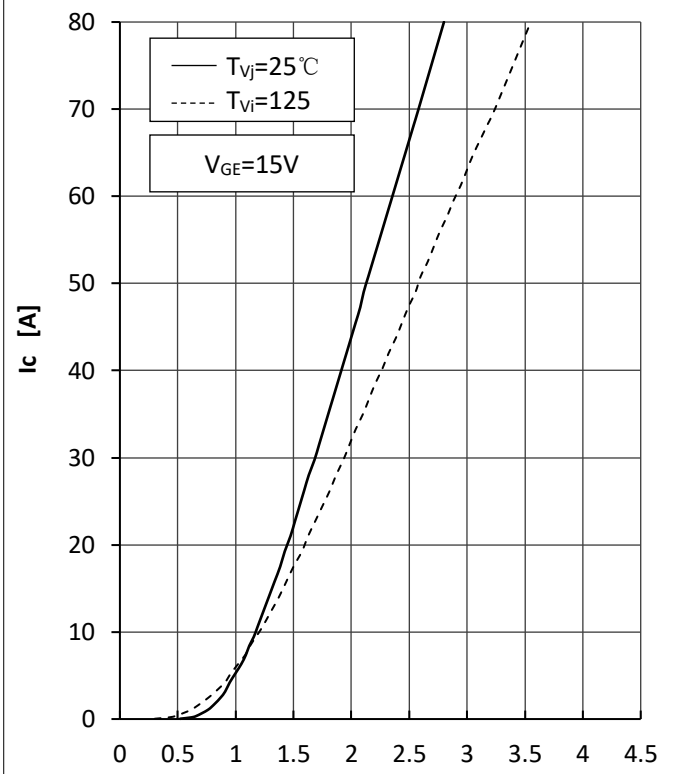


Fig12.IGBT Output Characteristics

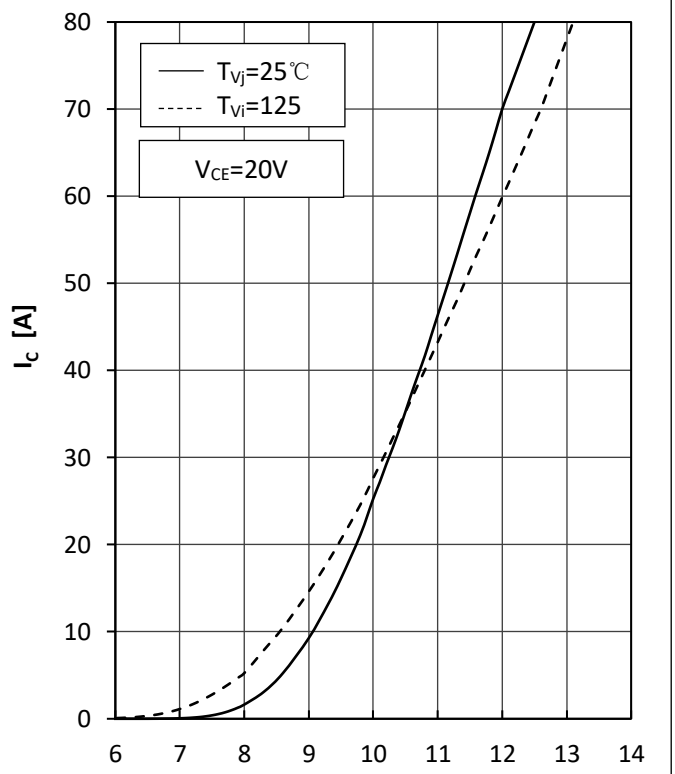


Fig2.IGBT Transfer Characteristics

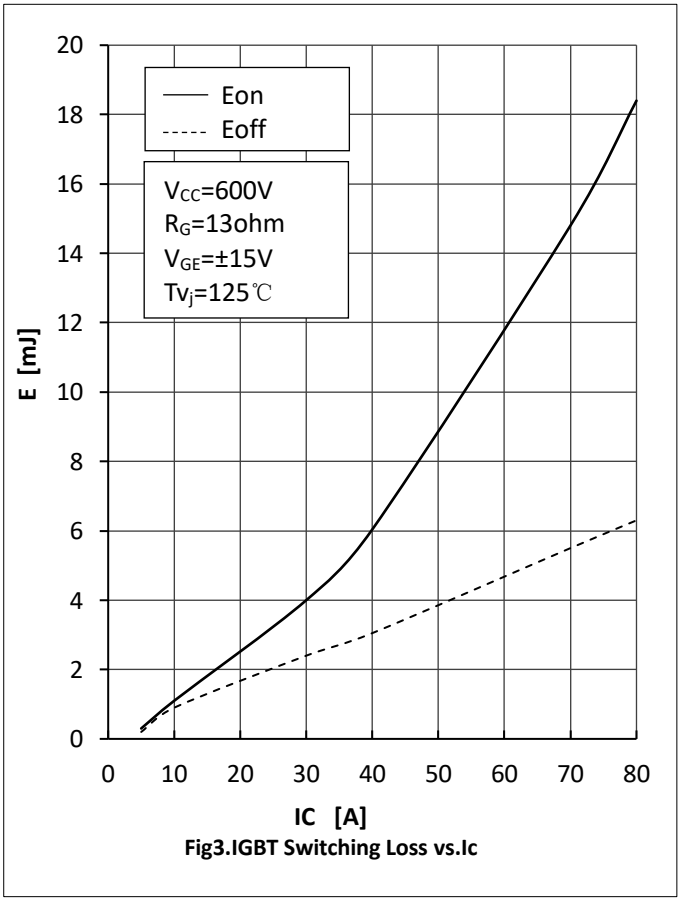


Fig3.IGBT Switching Loss vs.Ic

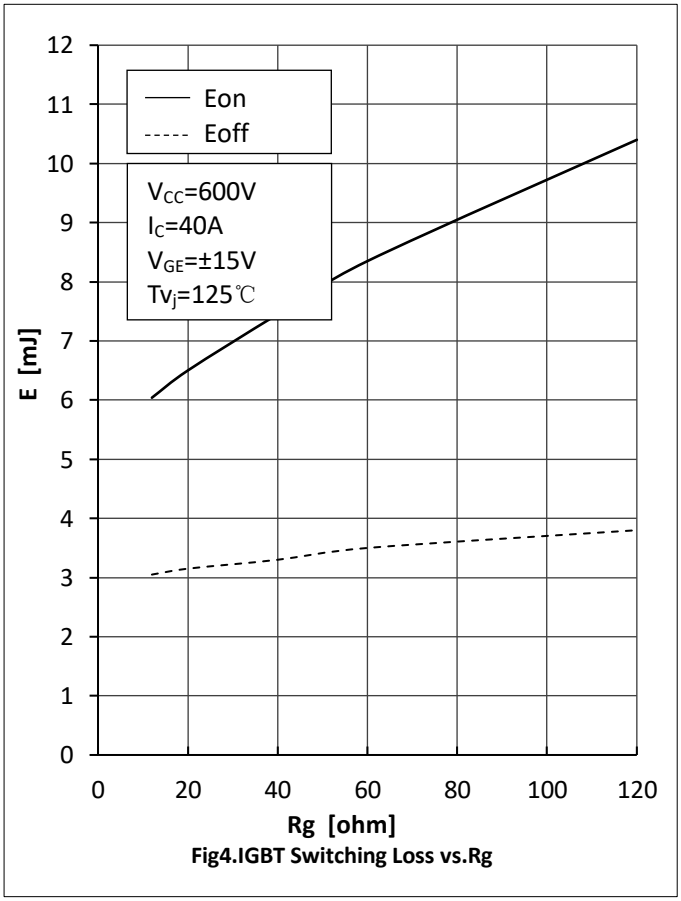


Fig4.IGBT Switching Loss vs.Rg

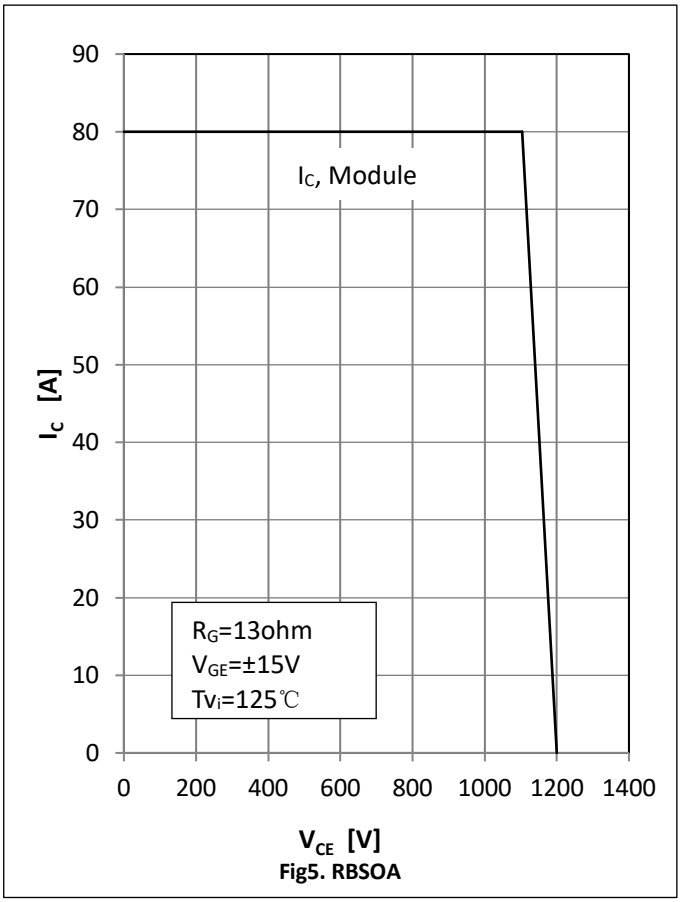


Fig5. RBSOA

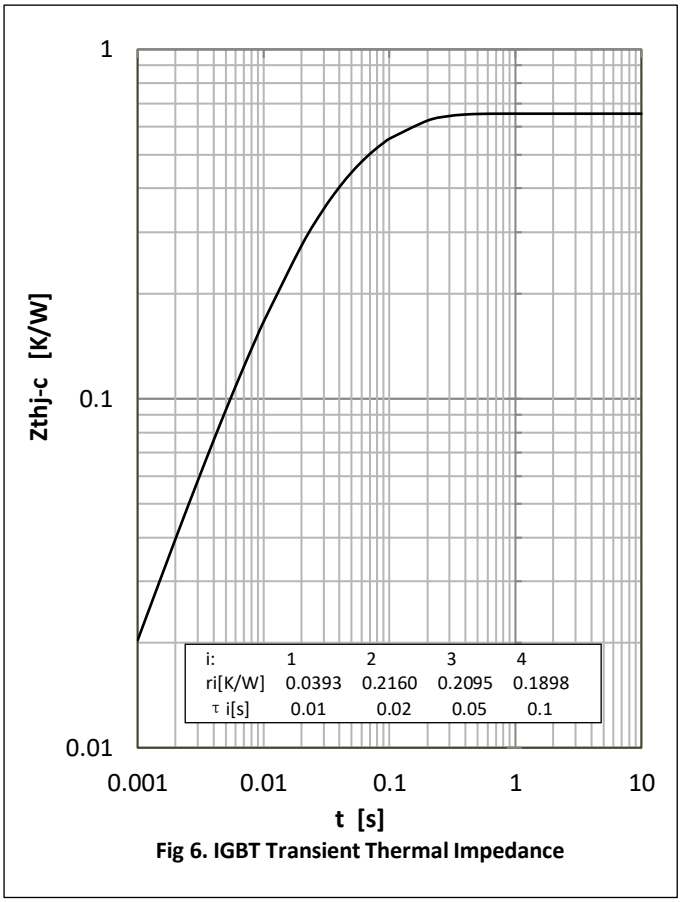


Fig 6. IGBT Transient Thermal Impedance

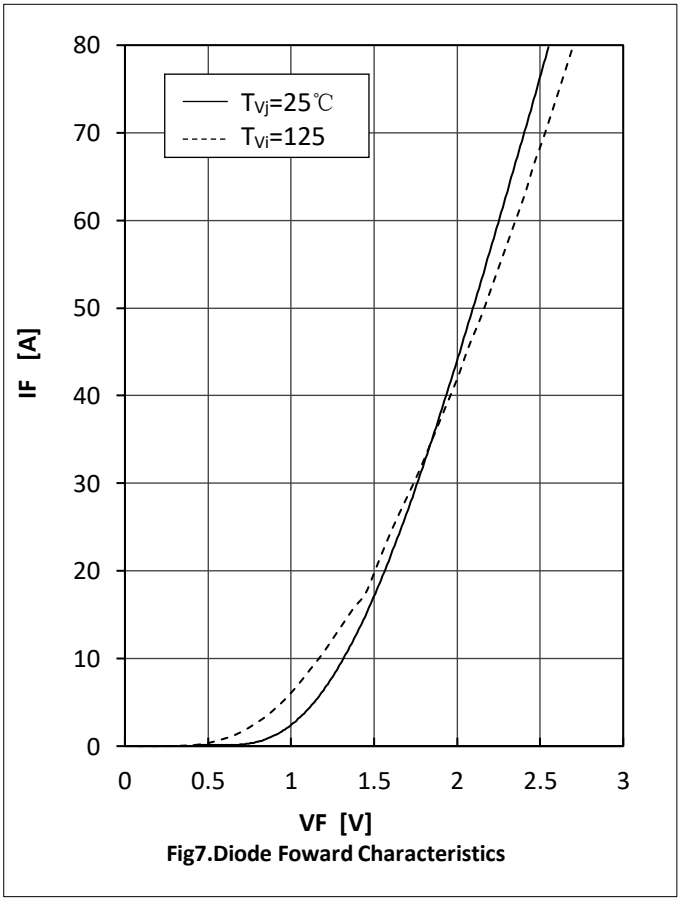


Fig7.Diode Foward Characteristics

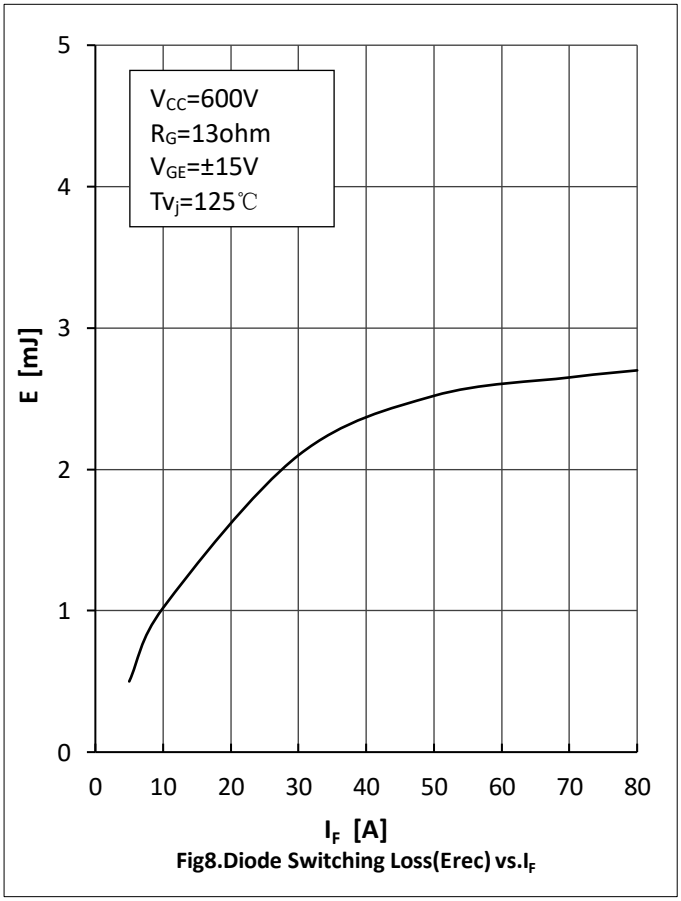


Fig8.Diode Switching Loss(Erec) vs.I_F

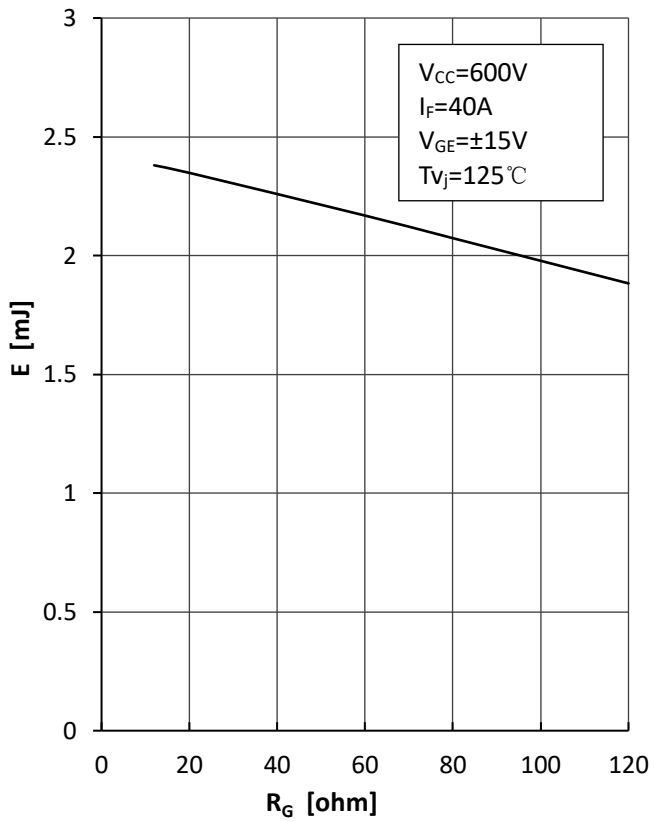


Fig9.Diode Switching Loss(Erec) vs.Rg

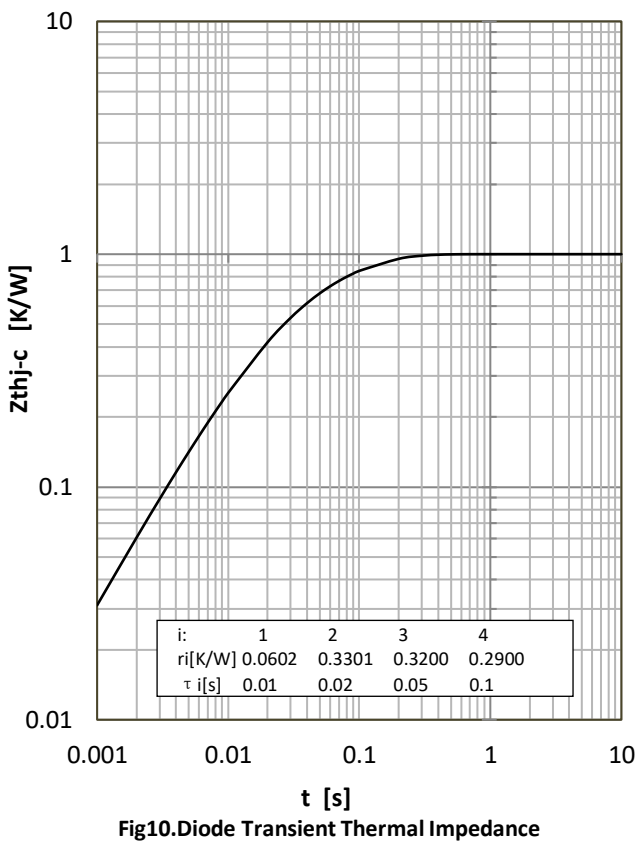


Fig10.Diode Transient Thermal Impedance

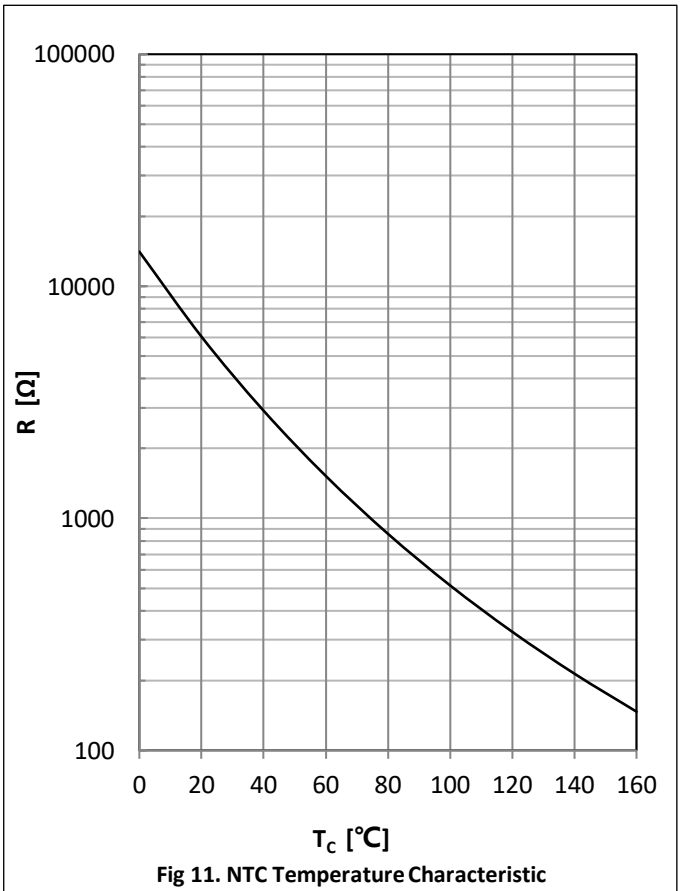


Fig 11. NTC Temperature Characteristic

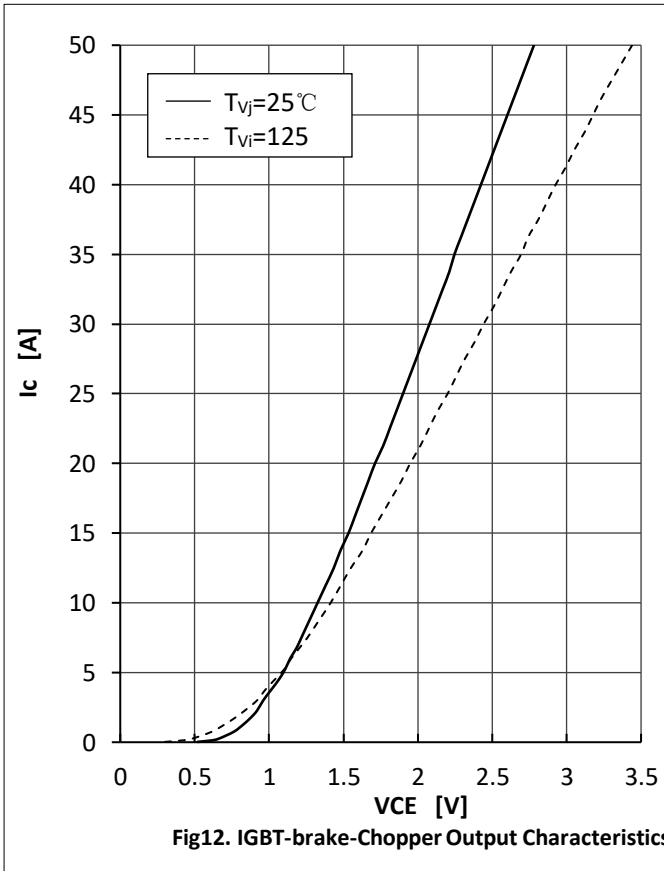


Fig12. IGBT-brake-Chopper Output Characteristics

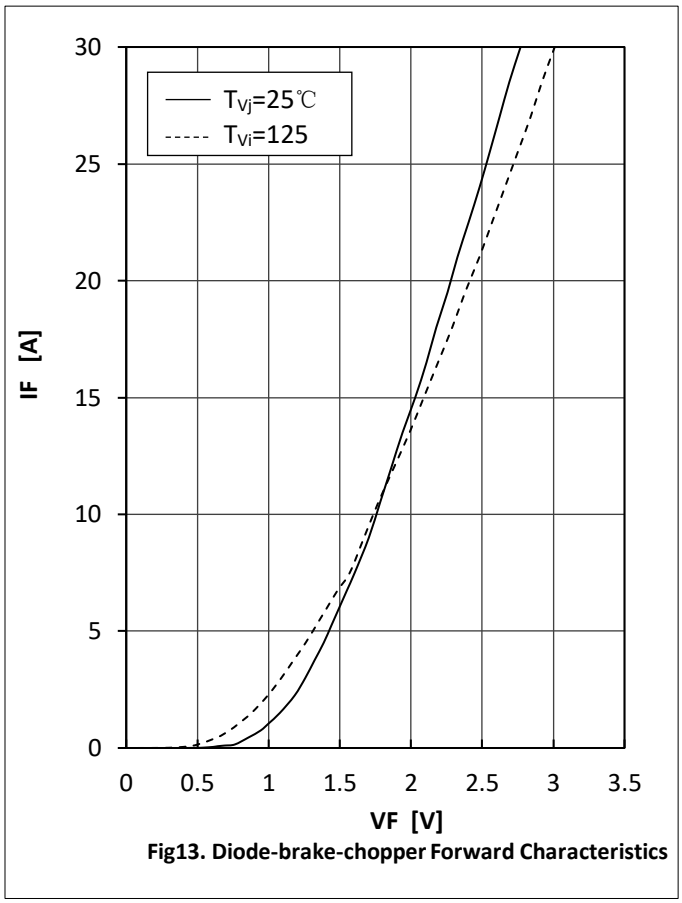
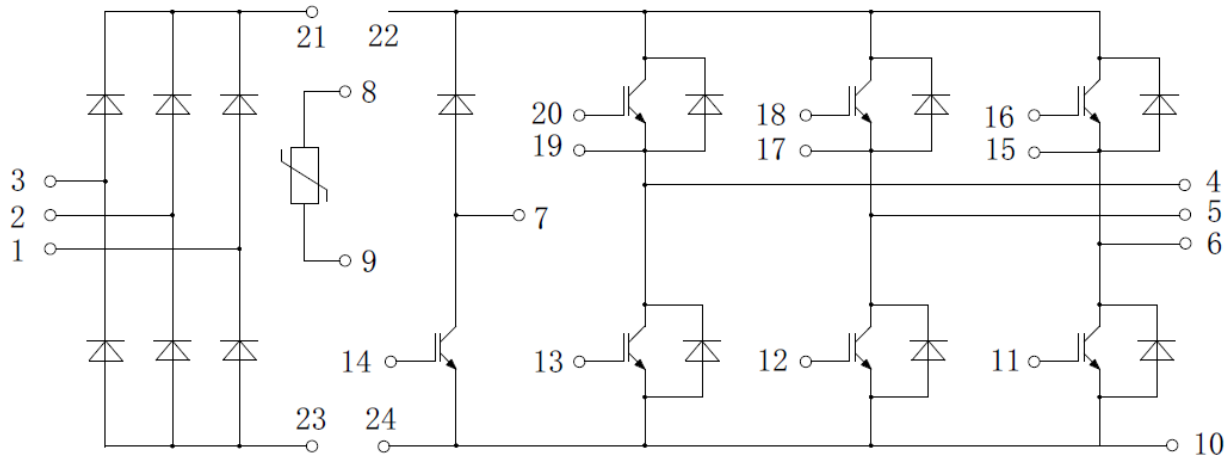


Fig13. Diode-brake-chopper Forward Characteristics

Circuit Diagram



Package Outline Information

Dimensions in Millimeters