

**Key Parameters**

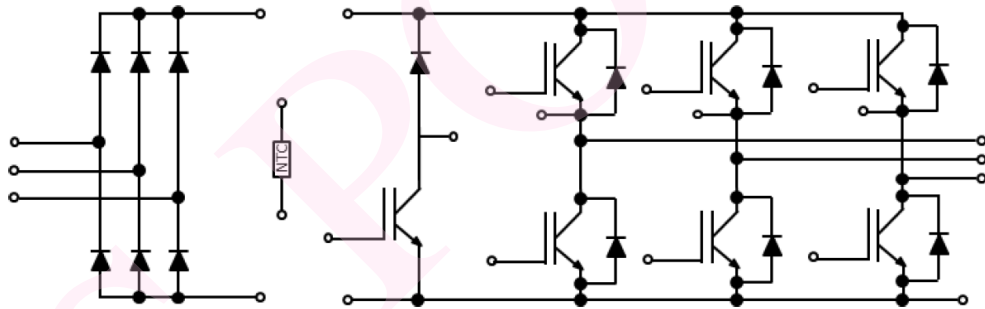
$V_{CES}$  = 1200V  
 $I_c$  = 40A

**Features**

- Low  $V_{ce(sat)}$
- Fast switching
- High ruggedness
- High short circuit capability

**Applications**

- Inverter for motor drive
- Frequency converters
- Servos
- General purpose Inverters



Equivalent Circuit Schematic

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Absolute Maximum Ratings: IGBT, Inverter							
Symbol	Characteristic	Value	Unit				
V <sub>CEs</sub>	Collector-Emitter Voltage	1200	V				
I <sub>CDC</sub>	Continuous DC Collector Current (T <sub>C</sub> =100°C, T <sub>J</sub> =175°C)	40	A				
I <sub>CRM</sub>	Peak Collector Current (tp=1ms)	80	A				
V <sub>GES</sub>	Gate-Emitter Voltage	±20	V				
IGBT Characteristics							
Symbol	Characteristic	Conditions	Value			Unit	
			Min.	Typ.	Max.		
BV <sub>CEs</sub>	Collector-Emitter breakdown Voltage	V <sub>GE</sub> =0V, I <sub>C</sub> =250μA, T <sub>vj</sub> =25°C	1200			V	
I <sub>CEs</sub>	Collector-Emitter leakage Current	V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>vj</sub> =25°C			1.0	mA	
I <sub>GES</sub>	Gate-Emitter leakage Current	V <sub>CE</sub> =0V, V <sub>GE</sub> =±20V, T <sub>vj</sub> =25°C			100	ηA	
V <sub>GE(th)</sub>	Gate-emitter Threshold Voltage	V <sub>GE</sub> =V <sub>CE</sub> , I <sub>C</sub> =1.5mA, T <sub>vj</sub> =25°C	5.5	6.5	7.5	V	
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	I <sub>C</sub> =40A, V <sub>GE</sub> =15V, T <sub>vj</sub> =25°C		1.75	2.1	V	
		I <sub>C</sub> =40A, V <sub>GE</sub> =15V, T <sub>vj</sub> =125°C		2.0		V	
		I <sub>C</sub> =40A, V <sub>GE</sub> =15V, T <sub>vj</sub> =150°C		2.3		V	
Q <sub>G</sub>	Gate Charge	V <sub>CC</sub> =600V, V <sub>GE</sub> =15V, I <sub>C</sub> =40A T <sub>vj</sub> =25°C		148		ηC	
C <sub>iss</sub>	Input Capacitance	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f=1MHz, T <sub>vj</sub> =25°C		3460		pF	
C <sub>oss</sub>	Output Capacitance			154		pF	
C <sub>rss</sub>	Reverse Transfer Capacitance			41		pF	
t <sub>d(on)</sub>	Turn-on Delay Time	I <sub>C</sub> =40A V <sub>CE</sub> = 600 V V <sub>GE</sub> =±15V R <sub>G</sub> = 10Ω T <sub>vj</sub> =25°C , L <sub>load</sub> =0.82mH Energy loss include tail and diode reverse recovery		40		ηs	
t <sub>r</sub>	Rise Time			30		ηs	
t <sub>d(off)</sub>	Turn-off Delay Time			153		ηs	
t <sub>f</sub>	Fall Time			112		ηs	
E <sub>on</sub>	Energy Dissipation During Turn-on Time			2.21		mJ	
E <sub>off</sub>	Energy Dissipation During Turn-off Time			1.73		mJ	
t <sub>d(on)</sub>	Turn-on Delay Time		I <sub>C</sub> =40A V <sub>CE</sub> = 600 V V <sub>GE</sub> =±15V R <sub>G</sub> = 10Ω T <sub>vj</sub> =150°C , L <sub>load</sub> =0.82mH Energy loss include tail and diode reverse recovery		45		ηs
t <sub>r</sub>	Rise Time				32		ηs
t <sub>d(off)</sub>	Turn-off Delay Time			169		ηs	
t <sub>f</sub>	Fall Time			157		ηs	
E <sub>on</sub>	Energy Dissipation During Turn-on Time			5.23		mJ	
E <sub>off</sub>	Energy Dissipation During Turn-off Time			2.54		mJ	
I <sub>C(SC)</sub>	SC Data	t <sub>sc</sub> ≤10μs, V <sub>GE</sub> =15V, T <sub>vj</sub> =25°C, V <sub>CC</sub> ≤600V,			160		A
Absolute Maximum Ratings: Diode, Inverter							
Symbol	Characteristic	Value	Unit				
V <sub>RRM</sub>	Repetitive peak reverse voltage	1200	V				
I <sub>F</sub>	Continuous DC forward current (T <sub>C</sub> =100°C, T <sub>J</sub> =150°C)	40	A				
I <sub>FRM</sub>	Repetitive peak forward current (tp=1ms)	80	A				
Diode Characteristics							
Symbol	Characteristic	Conditions	Value			Unit	
			Min.	Typ.	Max.		
V <sub>F</sub>	Forward Voltage	I <sub>F</sub> =40A, T <sub>vj</sub> =25°C		2.0	2.4	V	
		I <sub>F</sub> =40A, T <sub>vj</sub> =125°C		1.8		V	
		I <sub>F</sub> =40A, T <sub>vj</sub> =150°C		1.7		V	
Q <sub>rr</sub>	Recovered Charge	I <sub>F</sub> =40A		2.32		μC	
I <sub>rrm</sub>	Peak Reverse Recovery Current	V <sub>R</sub> =600V		35.8		A	
E <sub>rr</sub>	Reverse Recovery Energy	-di <sub>F</sub> /dt =1100A/μs T <sub>vj</sub> =25°C		0.77		mJ	
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Absolute Maximum Ratings: IGBT, Break-Chopper							
Symbol	Characteristic	Value	Unit				
$V_{CES}$	Collector-Emitter Voltage	1200	V				
$I_{CDC}$	Continuous DC Collector Current ( $T_C=100^{\circ}C, T_J=175^{\circ}C$ )	25	A				
$I_{CRM}$	Peak Collector Current ( $t_p=1ms$ )	50	A				
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V				
IGBT Characteristics							
Symbol	Characteristic	Conditions	Value			Unit	
			Min.	Typ.	Max.		
$BV_{CES}$	Collector-Emitter breakdown Voltage	$V_{GE}=0V, I_C=250\mu A, T_{vj}=25^{\circ}C$	1200			V	
$I_{CES}$	Collector-Emitter leakage Current	$V_{CE}=1200V, V_{GE}=0V, T_{vj}=25^{\circ}C$			1.0	mA	
$I_{GES}$	Gate-Emitter leakage Current	$V_{CE}=0V, V_{GE}=\pm 20V, T_{vj}=25^{\circ}C$			100	$\eta A$	
$V_{GE(th)}$	Gate-emitter Threshold Voltage	$V_{GE}=V_{CE}, I_C=600\mu A, T_{vj}=25^{\circ}C$	5.5	6.5	7.5	V	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C=25A, V_{GE}=15V, T_{vj}=25^{\circ}C$		1.85	2.2	V	
		$I_C=25A, V_{GE}=15V, T_{vj}=125^{\circ}C$		2.3		V	
		$I_C=25A, V_{GE}=15V, T_{vj}=150^{\circ}C$		2.4		V	
$Q_G$	Gate Charge	$V_{CC}=600V, V_{GE}=15V, I_C=25A, T_{vj}=25^{\circ}C$		105		$\eta C$	
$C_{iss}$	Input Capacitance	$V_{CE}=25V, V_{GE}=0V, f=1MHz, T_{vj}=25^{\circ}C$		1980		pF	
$C_{oss}$	Output Capacitance			110		pF	
$C_{rss}$	Reverse Transfer Capacitance			20		pF	
$t_{d(on)}$	Turn-on Delay Time	$I_C=25A, V_{CE}=600V, V_{GE}=\pm 15V, R_G=15\Omega, T_{vj}=25^{\circ}C, L_{load}=0.82mH$ Energy loss include tail and diode reverse recovery		48		$\eta s$	
$t_r$	Rise Time			39		$\eta s$	
$t_{d(off)}$	Turn-off Delay Time			296		$\eta s$	
$t_f$	Fall Time			89		$\eta s$	
$E_{on}$	Energy Dissipation During Turn-on Time			1.52		mJ	
$E_{off}$	Energy Dissipation During Turn-off Time			1.18		mJ	
$t_{d(on)}$	Turn-on Delay Time		$I_C=25A, V_{CE}=600V, V_{GE}=\pm 15V, R_G=15\Omega, T_{vj}=150^{\circ}C, L_{load}=0.82mH$ Energy loss include tail and diode reverse recovery		53		$\eta s$
$t_r$	Rise Time				42		$\eta s$
$t_{d(off)}$	Turn-off Delay Time			370		$\eta s$	
$t_f$	Fall Time			125		$\eta s$	
$E_{on}$	Energy Dissipation During Turn-on Time			2.12		mJ	
$E_{off}$	Energy Dissipation During Turn-off Time			1.61		mJ	
Absolute Maximum Ratings: Diode, Break-Chopper							
Symbol	Characteristic	Value		Unit			
$V_{RRM}$	Repetitive peak reverse voltage	1200	V				
$I_F$	Continuous DC forward current	15	A				
$I_{FRM}$	Repetitive peak forward current ( $t_p=1ms$ )	30	A				
Diode Characteristics							
Symbol	Characteristic	Conditions	Value			Unit	
			Min.	Typ.	Max.		
$V_F$	Forward Voltage	$I_F=15A, T_{vj}=25^{\circ}C$		2.0	2.40	V	
		$I_F=15A, T_{vj}=125^{\circ}C$		1.75		V	
		$I_F=15A, T_{vj}=150^{\circ}C$		1.65		V	
$Q_{rr}$	Recovered Charge	$I_F=25A, V_R=600V$		1.14		$\mu C$	
$I_{rrm}$	Peak Reverse Recovery Current	$-di_F/dt=520A/\mu s, T_{vj}=25^{\circ}C$		15.4		A	
$E_{rr}$	Reverse Recovery Energy			0.36		mJ	
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Absolute Maximum Ratings: Diode, Rectifier						
Symbol	Characteristic	Value				Unit
$V_{RRM}$	Repetitive peak reverse voltage	1600				V
$I_{F(AV)}$	Average output current 50/60Hz, sine wave ( $T_C=100^\circ\text{C}$ )	40				A
$I_{RMSM}$	Maximum RMS current at rectifier output ( $T_C=100^\circ\text{C}$ )	80				A
$I_{FSM}$	Surge forward current ( $V_R=0V$ , $t_p=10\text{msec}$ )	320				A
$I^2t$	$I^2t$ value ( $V_R=0V$ , $t_p=10\text{msec}$ )	512				$\text{A}^2\text{s}$
Diode Characteristics						
Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_F$	Forward Voltage	$I_F=40A, T_{vj}=150^\circ\text{C}$		1.3		V
$I_R$	Diode reverse current	$V_R=1600V, T_j=150^\circ\text{C}$			2.0	mA
Module Characteristics						
Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{isol}$	Isolation voltage	$t=1\text{min}, f=50\text{Hz}$	2500			V
$T_{jmax}$	Maximum Junction Temperature				175	$^\circ\text{C}$
$T_{vjop}$	Operating Junction Temperature		-40		150	$^\circ\text{C}$
$T_{stg}$	Storage Temperature		-40		150	$^\circ\text{C}$
$R_{CC'+EE'}$	Module lead resistance terminal to chip			4.0		m $\Omega$
$R_{AA'+CC'}$	Module lead resistance terminal to chip			3.0		m $\Omega$
$L_{SCE}$	Stray Inductance, Module			35		nH
$R_{\theta jc}$	Junction-to Case	per IGBT-inverter		0.55		$^\circ\text{C}/\text{W}$
		per Diode-inverter		0.76		$^\circ\text{C}/\text{W}$
		per IGBT-Break Chopper		0.85		$^\circ\text{C}/\text{W}$
		per Diode- Break Chopper		1.24		$^\circ\text{C}/\text{W}$
		per Diode- Rectifier		0.86		$^\circ\text{C}/\text{W}$
$R_{\theta cs}$	Case to Sink	per IGBT-inverter		0.33		$^\circ\text{C}/\text{W}$
		per Diode-inverter		0.46		$^\circ\text{C}/\text{W}$
		per IGBT-Break Chopper		0.40		$^\circ\text{C}/\text{W}$
		per Diode- Break Chopper		1.05		$^\circ\text{C}/\text{W}$
		per Diode- Rectifier		0.38		$^\circ\text{C}/\text{W}$
		per Module		0.02		$^\circ\text{C}/\text{W}$
$M_t$	Module to heatsink torque		3.0		6.0	Nm
$G$	Weight of Module			180		g
NTC thermistors Characteristics						
Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Unit
$R_{25}$	Rated resistance			5.0		k $\Omega$
$\Delta R/R$	Deviation of R100	$T_C=100^\circ\text{C}, R_{100}=493.3\Omega$	-5		5	%
$P_{25}$	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
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• Typical Electrical Characteristics

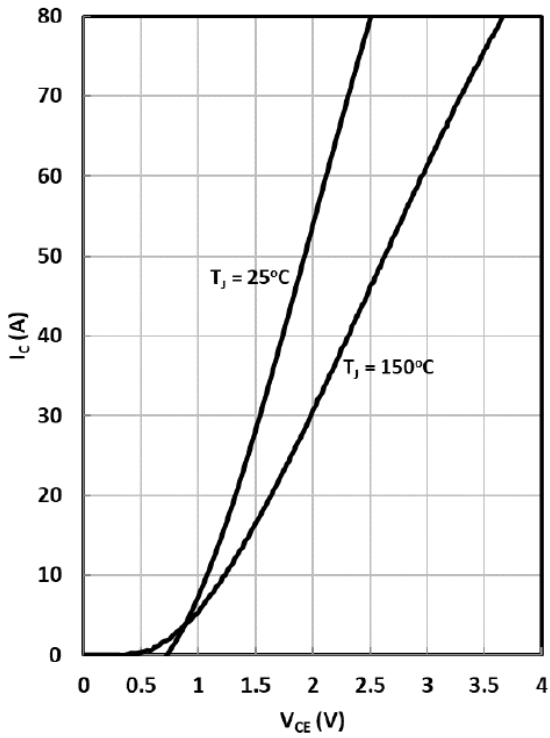


Fig. 1 IGBT (Inverter) Output Characteristics

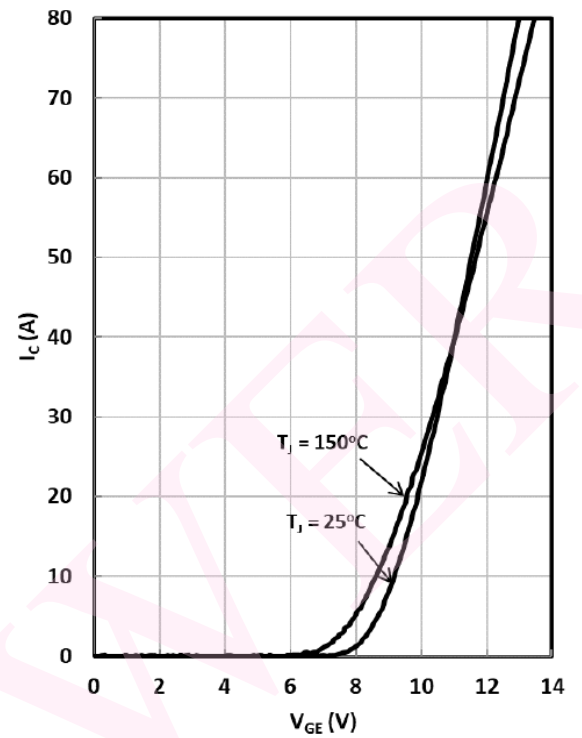


Fig. 2 IGBT (Inverter) Transfer Characteristics

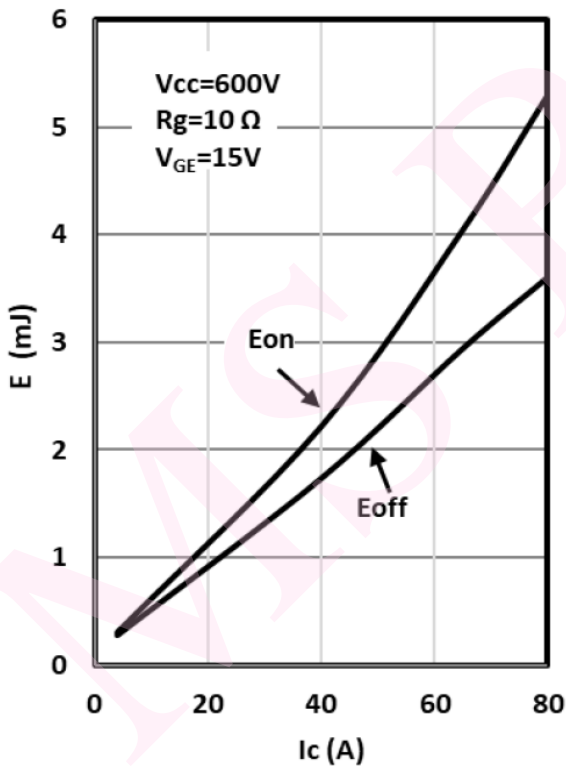


Fig. 3 IGBT (Inverter) Switching Loss vs. Ic

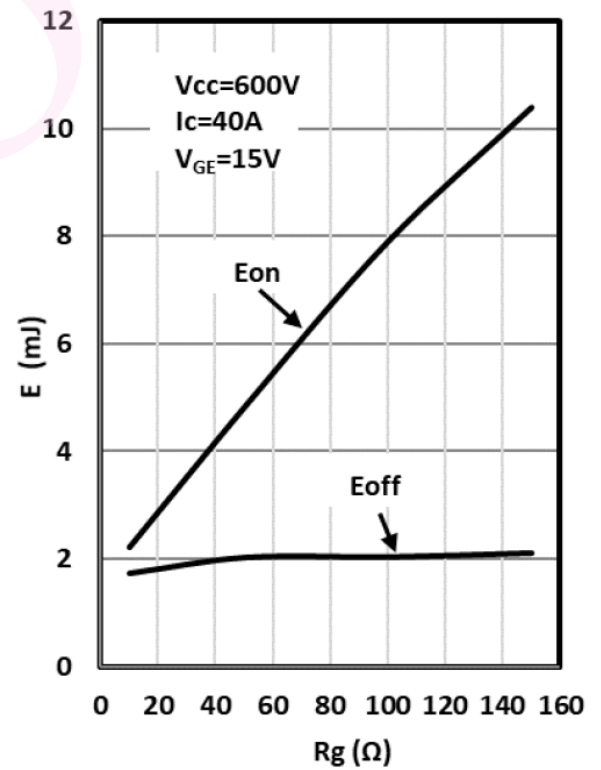
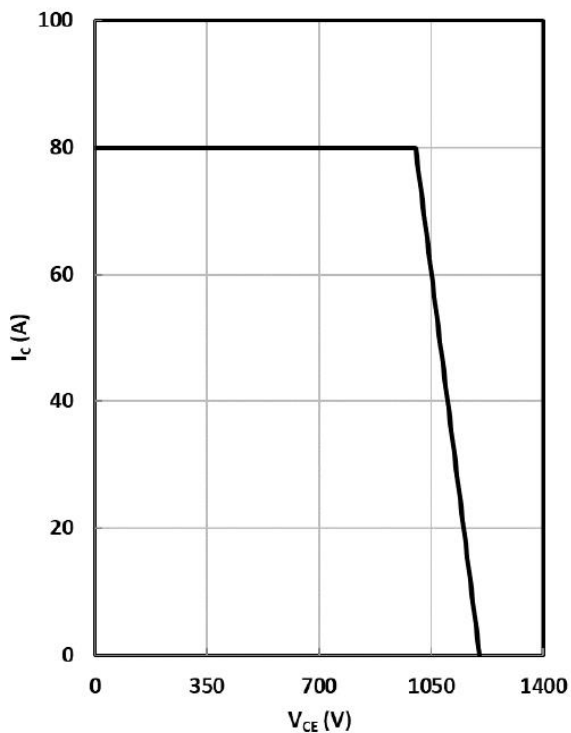
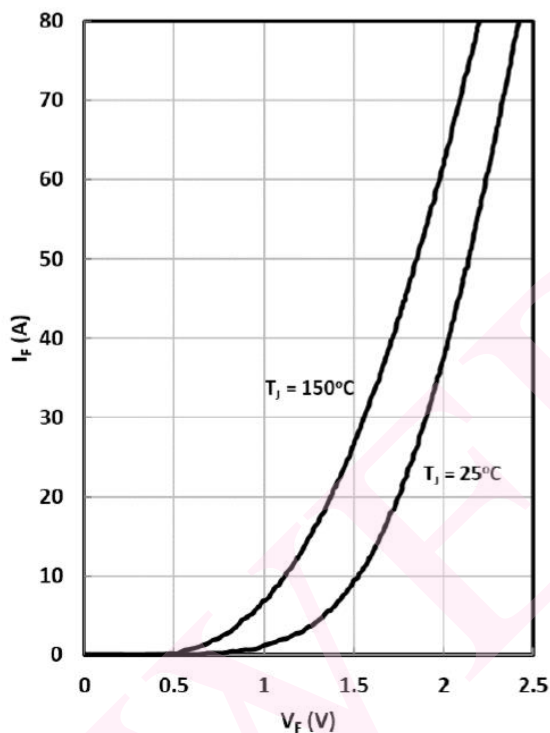


Fig. 4 IGBT (Inverter) Switching Loss vs. Rg

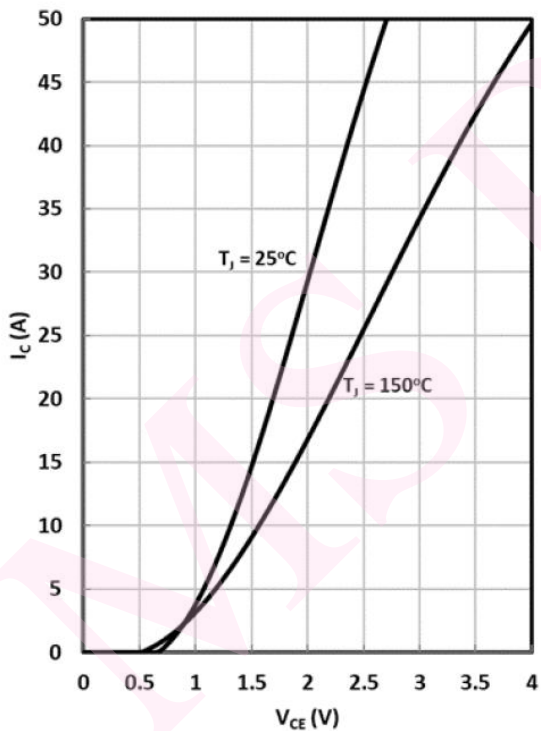
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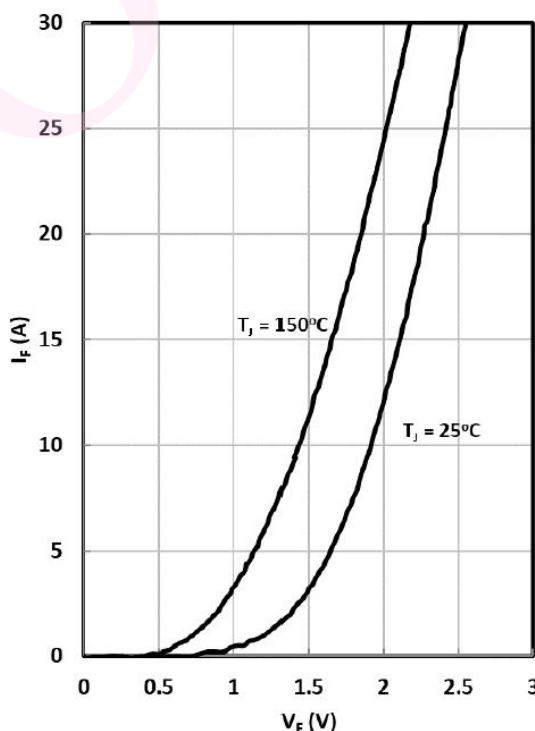
**Fig. 5 RBSOA**



**Fig. 6 Diode (Inverter) Forward Characteristics**

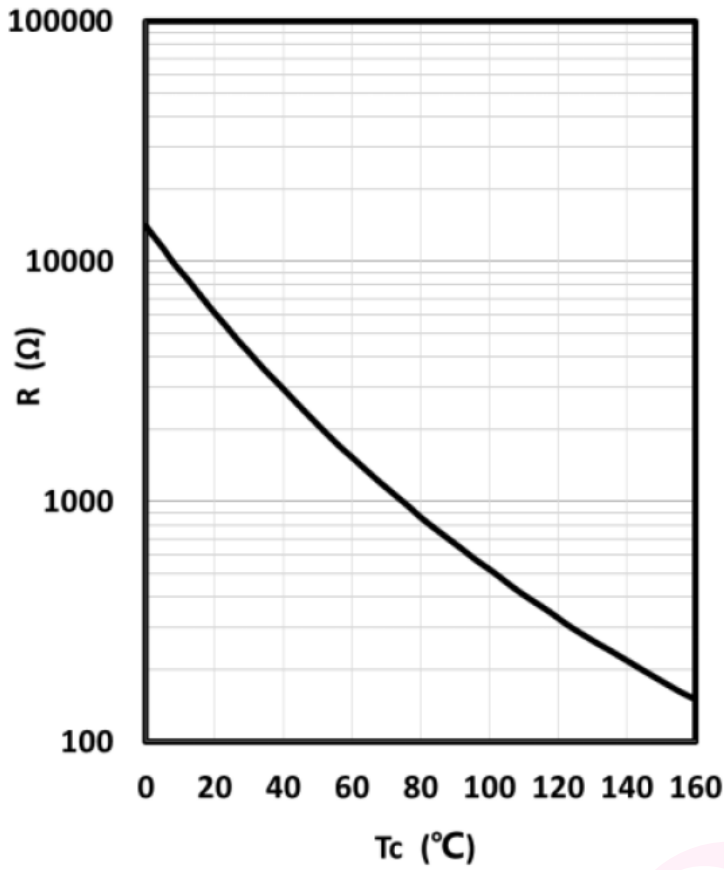


**Fig. 7 IGBT (Brake-Chopper) Output Characteristics**



**Fig. 8 Diode (Brake-Chopper) Output Characteristics**

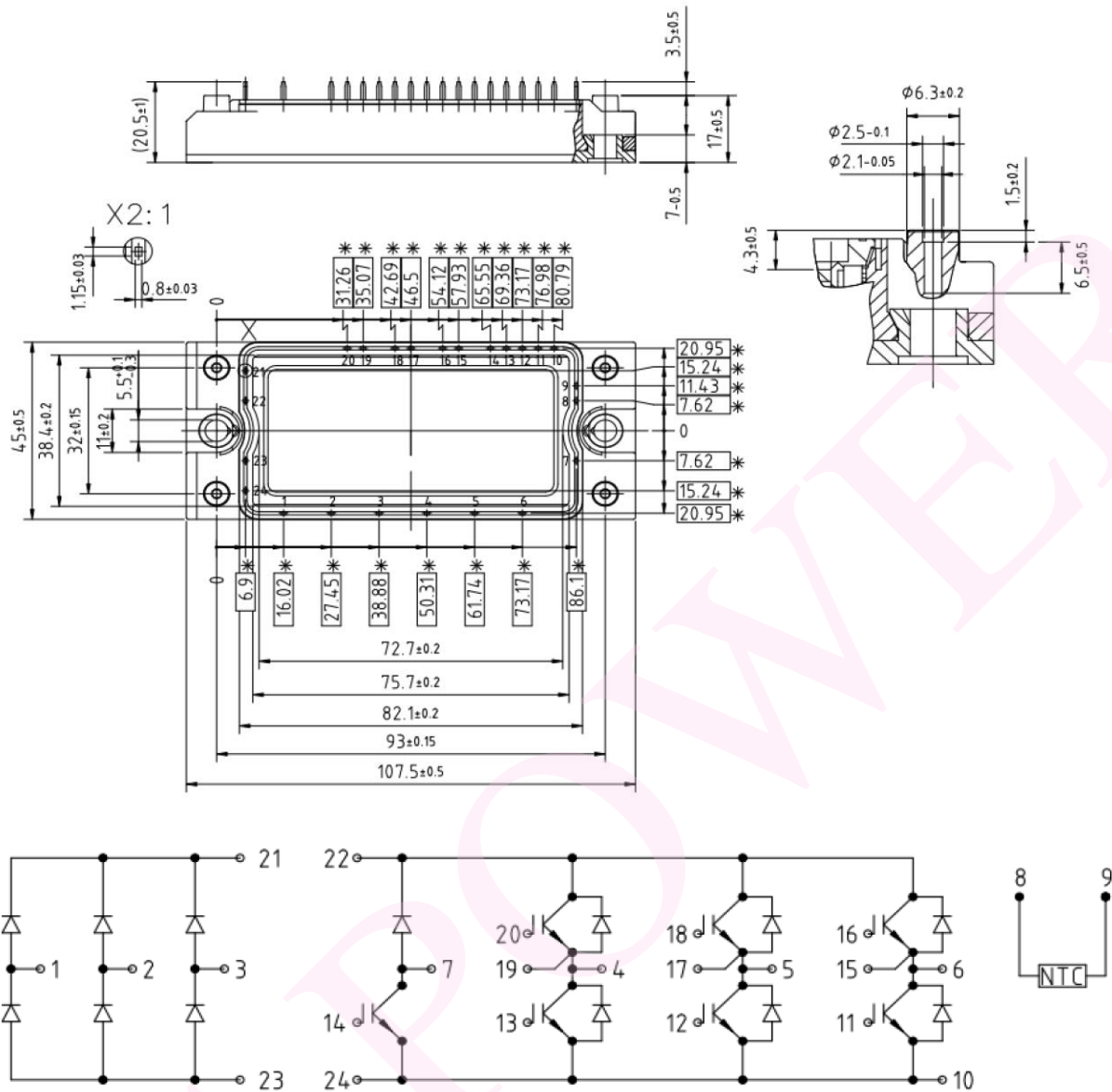
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**Fig. 9 NTC Temperature Characteristics**

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