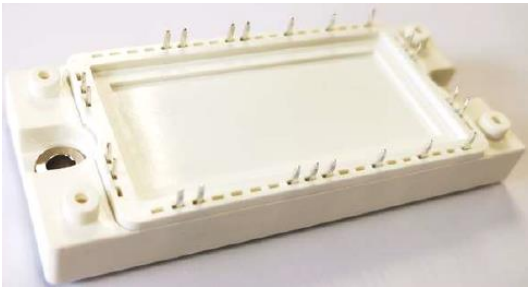
MS KM50NAB12D
Technical Information
IGBT Power Module

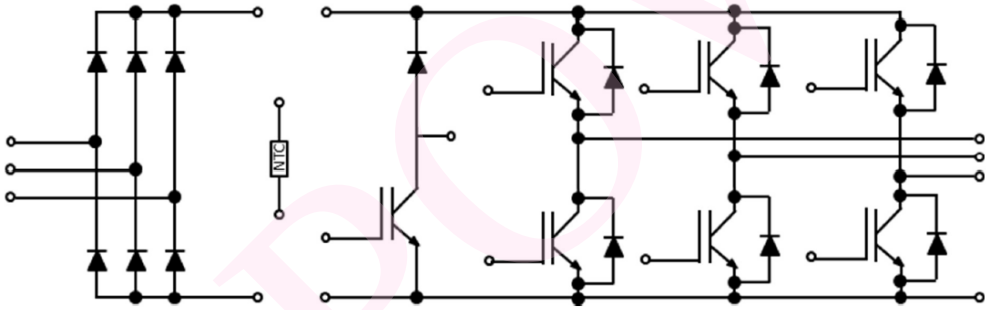


Key Parameters

V_{CES}	= 1200V
I_C	= 50A

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

Applications
- Inverter for motor drive
- Frequency converters
- UPS
- General purpose Inverters



Equivalent Circuit Schematic

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Absolute Maximum Ratings: IGBT, Inverter

Symbol	Characteristic	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
I_{CDC}	Continuous DC Collector Current (T_C=100°C, Tj=175°C)	50	A
I_{CRM}	Peak Collector Current (tp=1ms)	100	A
V_{GES}	Gate-Emitter Voltage	±20	V

IGBT Characteristics

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-Emitter breakdown Voltage	V_{GE}=0V, I_C =250μA,T_{vj}=25°C	1200			V
I_{CES}	Collector-Emitter leakage Current	V_{CE}=1200V,V_{GE}=0V, T_{vj}=25°C			1.0	mA
I_{GES}	Gate-Emitter leakage Current	V_{CE}=0V,V_{GE}=±20V, T_{vj}=25°C			100	ηA
$V_{GE(th)}$	Gate-emitter Threshold Voltage	V_{GE}=V_{CE}, I_C =1.5mA,T_{vj}=25°C	5.5	6.5	7.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	Ic=50A,V_{GE}=15V, T_{vj}=25°C		1.55	2.0	V
		Ic=50A,V_{GE}=15V, T_{vj}=125°C		1.9		V
		Ic=50A,V_{GE}=15V, T_{vj}=150°C		2.0		V
Q_G	Gate Charge	V_{CC}=600V, V_{GE}=15V, I_C=50A T_{vj} =25°C		220		ηC
C_{iss}	Input Capacitance	V_{CE}=25V, V_{GE} =0V, f=1MHz, T_{vj}=25°C		4150		pF
C_{oss}	Output Capacitance			230		pF
C_{rss}	Reverse Transfer Capacitance			54		pF
$t_{d(on)}$	Turn-on Delay Time	I_C =50A V_{CE} = 600 V V_{GE} =0/15V R_G = 10Ω T_{vj}=25°C , L_{load} =0.82mH Energy loss include tail and diode reverse recovery		65		ηs
t_r	Rise Time			63		ηs
$t_{d(off)}$	Turn-off Delay Time			333		ηs
t_f	Fall Time			221		ηs
E_{on}	Energy Dissipation During Turn-on Time			4.9		mJ
E_{off}	Energy Dissipation During Turn-off Time			3.7		mJ
$t_{d(on)}$	Turn-on Delay Time	I_C =50A V_{CE} = 600 V V_{GE} =0/15V R_G = 10Ω T_{vj}=150°C , L_{load} =0.82mH Energy loss include tail and diode reverse recovery		73		ηs
t_r	Rise Time			65		ηs
$t_{d(off)}$	Turn-off Delay Time			396		ηs
t_f	Fall Time			294		ηs
E_{on}	Energy Dissipation During Turn-on Time			8.0		mJ
E_{off}	Energy Dissipation During Turn-off Time			5.6		mJ
$I_{C(SC)}$	SC Data	t_{sc}≤10μs,V_{GE}=15V, Tv_j=25°C,V_{cc}≤600V,		175		A

Absolute Maximum Ratings: Diode, Inverter

Symbol	Characteristic	Value	Unit
V_{RRM}	Repetitive peak reverse voltage	1200	V
I_F	Continuous DC forward current (T_C=100°C, T_j=150°C)	50	A
I_{FRM}	Repetitive peak forward current (tp=1ms)	100	A

Diode Characteristics

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	I_F=50A,T_{vj}=25°C		2.0	2.45	V
		I_F=50A,T_{vj}=125°C		1.75		V
		I_F=50A,T_{vj}=150°C		1.70		V
Q_{rr}	Recovered Charge	I_F =50A V_R=600V -di_F/dt =460A/μs T_{vj}=25°C		1.7		μC
I_{rrm}	Peak Reverse Recovery Current			15		A
E_{rr}	Reverse Recovery Energy			0.5		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°C, Tj=175°C)	35	A
I_{CRM}	Peak Collector Current (tp=1ms)	70	A
V_{GES}	Gate-Emitter Voltage	±20	V

IGBT Characteristics

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
BV_{CES}	Collector-Emitter breakdown Voltage	V_{GE}=0V, I_C =250μA,T_{vj}=25°C	1200			V
I_{CES}	Collector-Emitter leakage Current	V_{CE}=1200V,V_{GE}=0V, T_{vj}=25°C			1.0	mA
I_{GES}	Gate-Emitter leakage Current	V_{CE}=0V,V_{GE}=±20V, T_{vj}=25°C			100	ηA
$V_{GE(th)}$	Gate-emitter Threshold Voltage	V_{GE}=V_{CE}, I_C =1.5mA,T_{vj}=25°C	5.5	6.5	7.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	Ic=35A,V_{GE}=15V, T_{vj}=25°C		1.65	2.0	V
		Ic=35A,V_{GE}=15V, T_{vj}=125°C		2.0		V
		Ic=35A,V_{GE}=15V, T_{vj}=150°C		2.1		V
Q_G	Gate Charge	V_{CC}=600V, V_{GE}=15V, I_C=35A T_{vj} =25°C		148		ηC
C_{iss}	Input Capacitance	V_{CE}=25V, V_{GE} =0V, f=1MHz, T_{vj}=25°C		3460		pF
C_{oss}	Output Capacitance			154		pF
C_{rss}	Reverse Transfer Capacitance			41		pF
$t_{d(on)}$	Turn-on Delay Time	I_C =35A V_{CE} = 600 V V_{GE} =0/15V R_G = 10Ω T_{vj}=25°C , L_{load} =0.82mH Energy loss include tail and diode reverse recovery		51		ηs
t_r	Rise Time			75		ηs
$t_{d(off)}$	Turn-off Delay Time			196		ηs
t_f	Fall Time			110		ηs
E_{on}	Energy Dissipation During Turn-on Time			3.1		mJ
E_{off}	Energy Dissipation During Turn-off Time			1.5		mJ
$t_{d(on)}$	Turn-on Delay Time	I_C =35A V_{CE} = 600 V V_{GE} =0/15V R_G = 10Ω T_{vj}=150°C , L_{load} =0.82mH Energy loss include tail and diode reverse recovery		60		ηs
t_r	Rise Time			72		ηs
$t_{d(off)}$	Turn-off Delay Time			235		ηs
t_f	Fall Time			134		ηs
E_{on}	Energy Dissipation During Turn-on Time			5.2		mJ
E_{off}	Energy Dissipation During Turn-off Time			2.1		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 (T_C=100°C, T_j=150°C)	25	A
I_{FRM}	Repetitive peak forward current (tp=1ms)	50	A

Diode Characteristics

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	I_F=25A,T_{vj}=25°C		2.1	2.5	V
		I_F=25A,T_{vj}=125°C		1.8		V
		I_F=25A,T_{vj}=150°C		1.7		V
Q_{rr}	Recovered Charge	I_F =25A V_R=600V -di_F/dt =427A/μs T_{vj}=25°C		1.4		μC
I_{rrm}	Peak Reverse Recovery Current			14		A
E_{rr}	Reverse Recovery Energy			0.44		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°C)	50	A
I_{RMSM}	Maximum RMS current at rectifier output (T_C=100°C)	100	A
I_{FSM}	Surge forward current (V_R=0V, t_p=10msec)	500	A
I^2t	I^2t value (V_R=0V, t_p=10msec)	1250	A^2s

Diode Characteristics

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
V_F	Forward Voltage	I_F=50A,T_{vj}=150°C		1.09		V
I_R	Diode reverse current	V_R=1600V, T_j=150°C			2.0	mA

Module Characteristics

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{isol}	Isolation voltage	t=1min,f=50Hz	2500			V
T_{jmax}	Maximum Junction Temperature				175	°C
$T_{vj\ op}$	Operating Junction Temperature		-40		150	°C
T_{stg}	Storage Temperature		-40		150	°C
$R_{CC'+EE'}$	Module lead resistance terminal to chip			4.0		mΩ
$R_{AA'+CC'}$	Module lead resistance terminal to chip			3.0		mΩ
L_{SCE}	Stray Inductance, Module			35		nH
$R_{\theta jc}$	Junction-to Case	per IGBT-inverter		0.45		°C/W
		per Diode-inverter		0.62		°C/W
		per IGBT-Break Chopper		0.60		°C/W
		per Diode- Break Chopper		1.05		°C/W
		per Diode- Rectifier		0.55		°C/W
$R_{\theta cs}$	Case to Sink	per IGBT-inverter		0.32		°C/W
		per Diode-inverter		0.46		°C/W
		per IGBT-Break Chopper		0.54		°C/W
		per Diode- Break Chopper		0.86		°C/W
		per Diode- Rectifier		0.48		°C/W
		per Module		0.02		°C/W
M_t	Module to sink 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		kΩ
ΔR/R	Deviation of R100	T_C=100°C, R_{100}=493Ω	-9.22		9.89	%
P_{25}	Power Dissipation			1.4		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

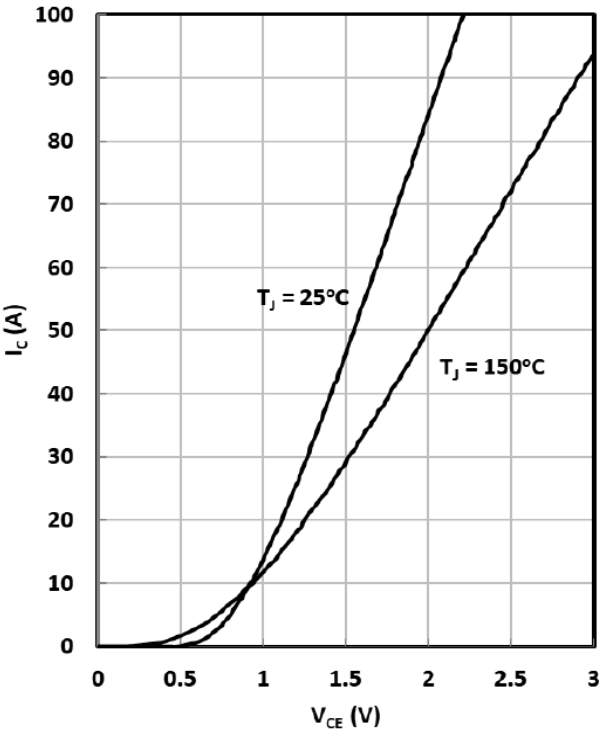

Fig. 1 IGBT (Inverter) Output Characteristics

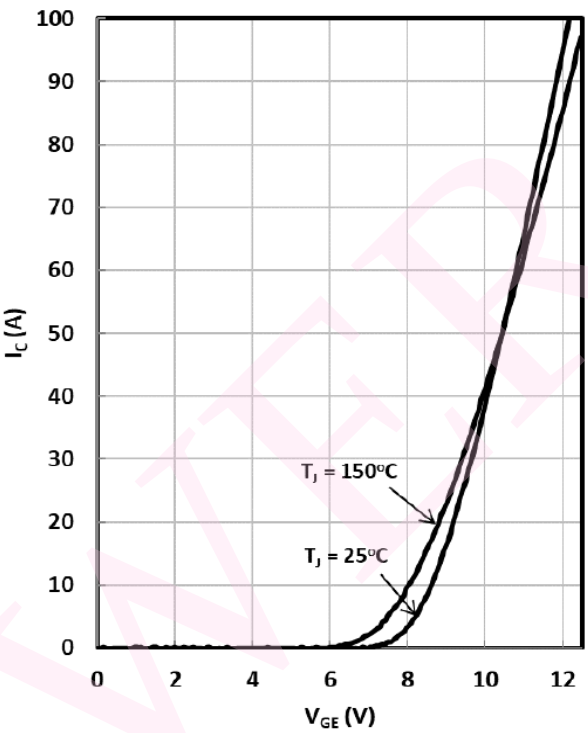

Fig. 2 IGBT (Inverter) Transfer Characteristics

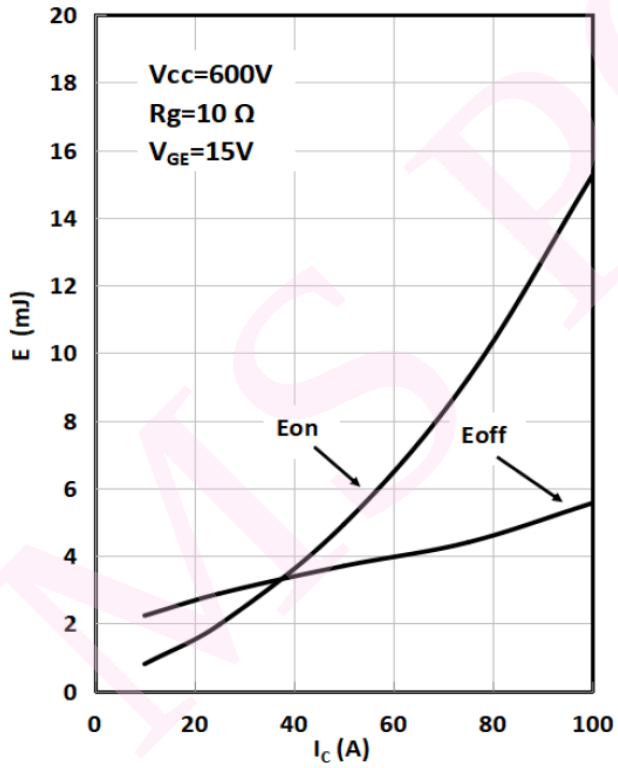

Fig. 3 IGBT (Inverter) Switching Loss vs. I_C

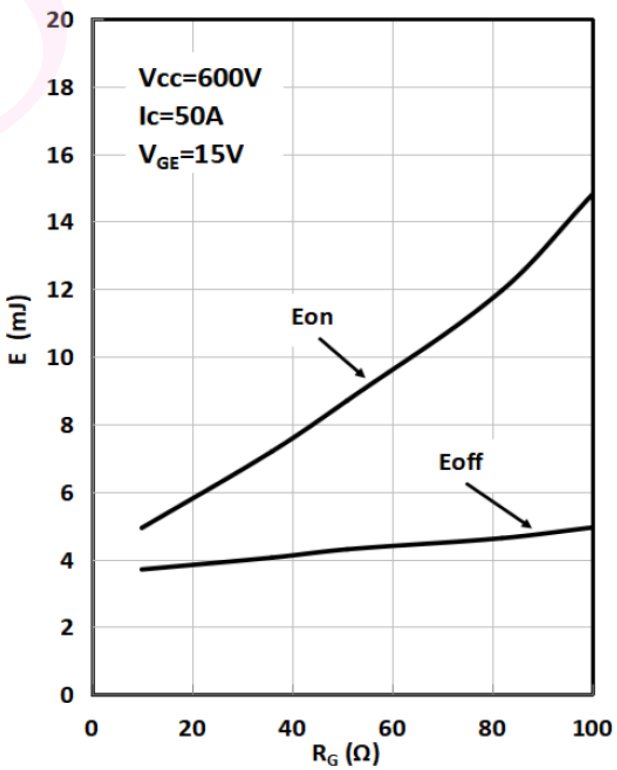

Fig. 4 IGBT (Inverter) Switching Loss vs. R_G

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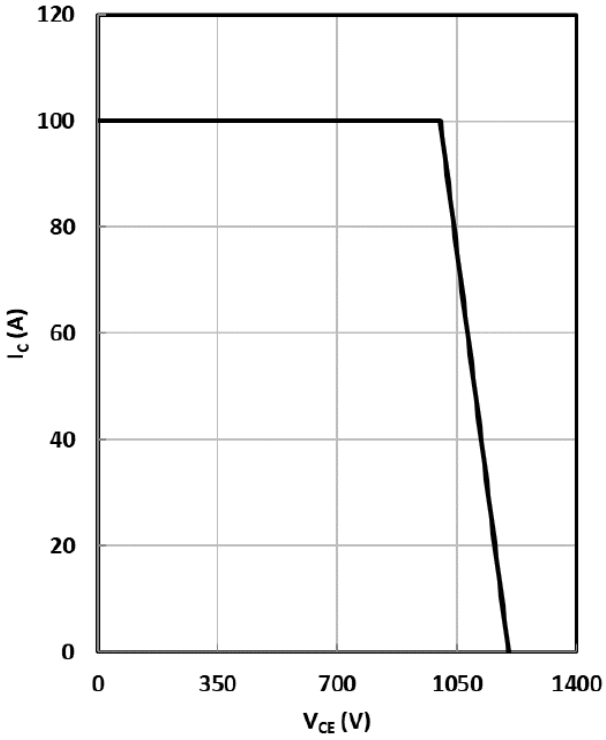

Fig. 5 RBSOA

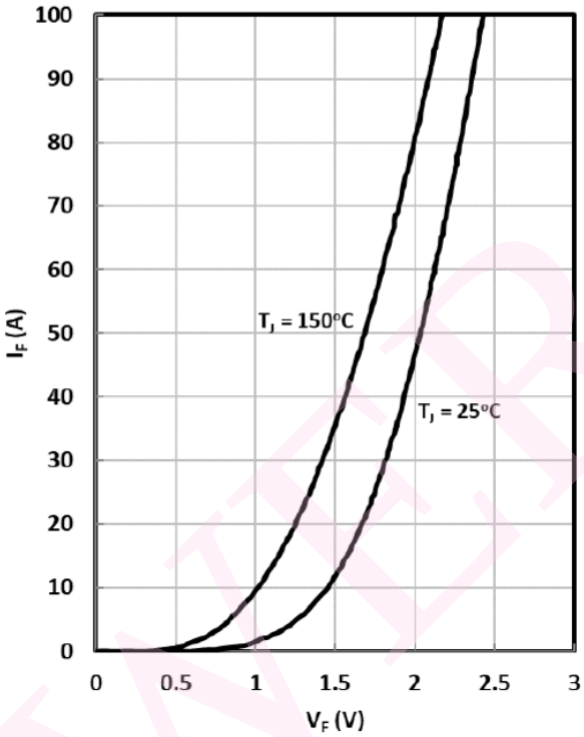

Fig. 6 Diode (Inverter) Forward Characteristics

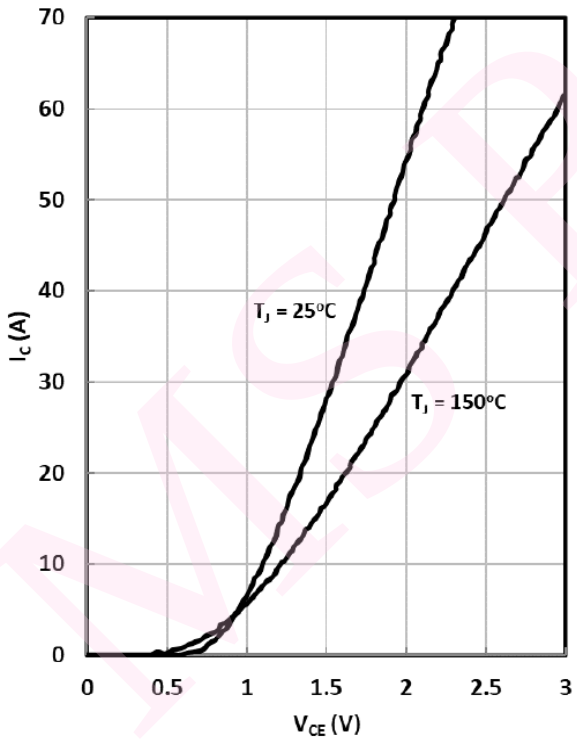

Fig. 7 IGBT (Brake-Chopper) Output Characteristics

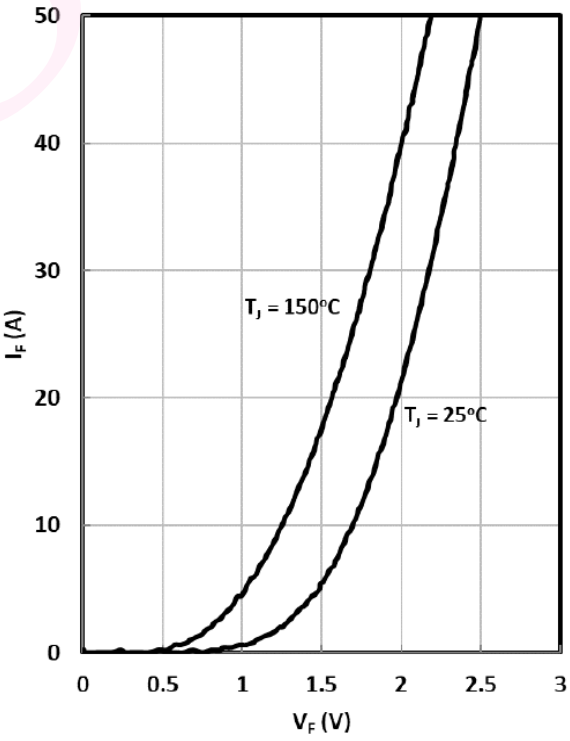

Fig. 8 Diode (Brake-Chopper) Output Characteristics

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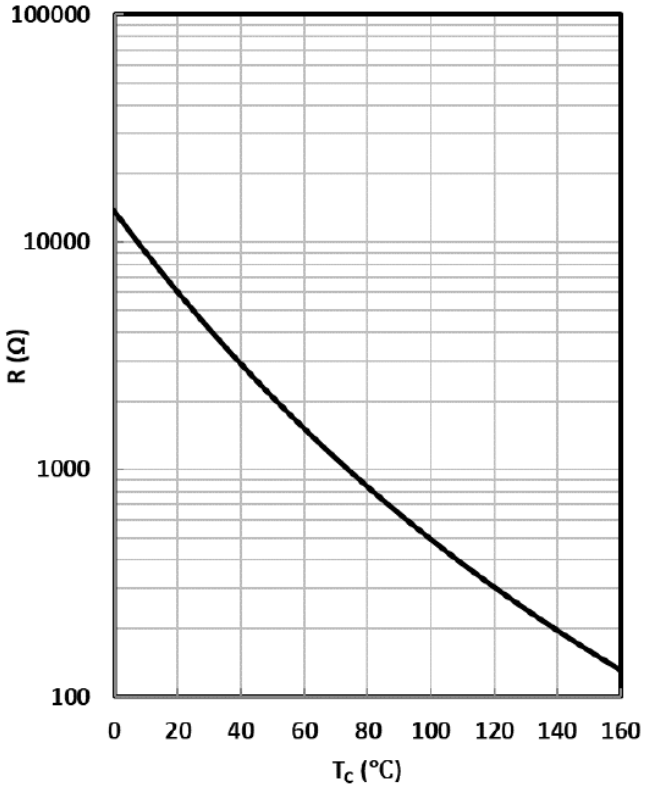

Fig. 9 NTC Temperature Characteristics

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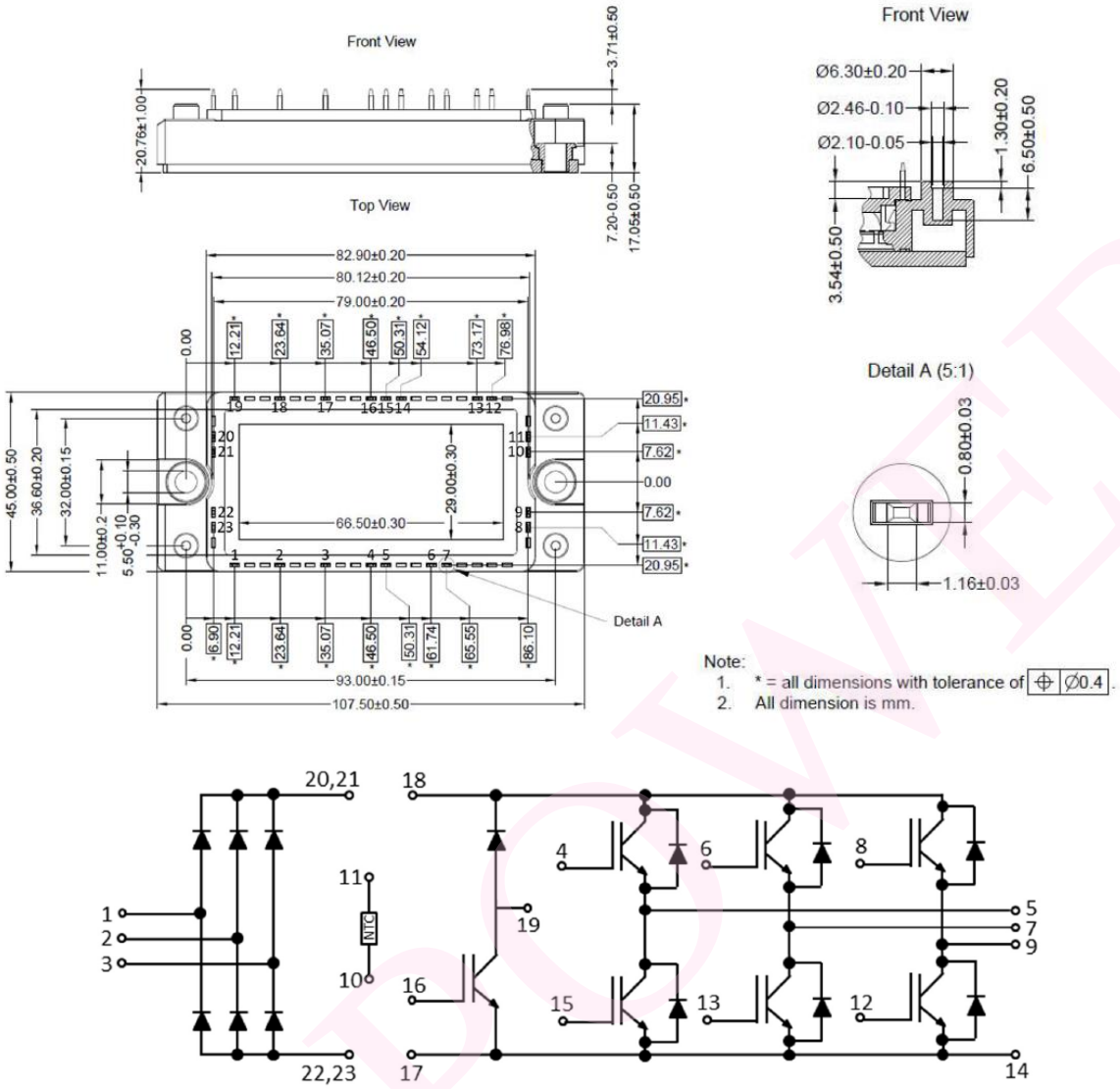

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