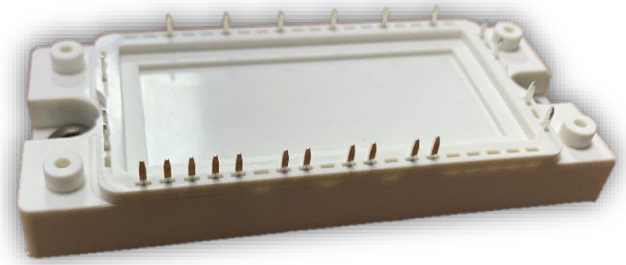


Features

- Trench/Fieldstop IGBT
- Half-bridge
- Low inductance
- Standard package
- High short circuit capability
- Including anti-parallel FWD



Typical Applications

- Motor Drives
- Servo Drives
- Auxiliary Inverters

IGBT, Inverter

Maximum Rated Values						
Symbol	Item	Conditions	Rating			Unit
IGBT						
V_{CES}	Collector-emitter voltage	$T_{vj}=25^{\circ}\text{C}$	1200			V
V_{GES}	Gate-emitter voltage	-	± 20			V
I_C	Collector current,DC	$T_C=100^{\circ}\text{C}, T_{vj}=175^{\circ}\text{C}$	40			A
I_{CRM}	Repetitive peak collector current	$t_p=1\text{ms}$	80			A
P_{tot}	Total power dissipation	$T_C=25^{\circ}\text{C}, T_{vj}=175^{\circ}\text{C}$	250			W
Characteristics Values						
Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	
I_{CES}	Collector-emitter cut-off current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$	-	-	1	mA
I_{GES}	Gate leakage current	$V_{CE}=0\text{V}, V_{GE}=20\text{V}, T_{vj}=25^{\circ}\text{C}$	-	-	100	nA
$V_{GE(th)}$	Gate-emitter threshold voltage	$I_C=1.5\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.2	5.58	6.6	V
V_{CEsat}	Collector-emitter saturation voltage	$I_C=40\text{A}$ $V_{GE}=15\text{V}$ $T_{vj}=25^{\circ}\text{C}$	-	1.98	-	
		$T_{vj}=125^{\circ}\text{C}$	-	2.31	-	
		$T_{vj}=150^{\circ}\text{C}$	-	2.37	-	
C_{ies}	Input capacitance	$V_{CE}=25\text{V}, V_{GE}=0\text{V}$ $f=1\text{MHz}, T_{vj}=25^{\circ}\text{C}$	-	3.13	-	nF
C_{oes}	Output capacitance		-	0.17	-	
C_{res}	Reverse transfer capacitance		-	0.09	-	
Q_G	Gate charge	$V_{CC}=600\text{V}, I_C=40\text{A}$ $V_{GE}=-15\dots+15\text{V}, T_{vj}=25^{\circ}\text{C}$	-	0.24	-	μC
R_g	Internal gate resistance	$T_{vj}=25^{\circ}\text{C}$	-	-	-	Ω

$t_{d(on)}$	Turn-on delay time	$V_{CC}=600V$ $I_C=40A$ $V_{GE}=\pm 15V$ $R_{G(on)}=30\Omega$ $R_{G(off)}=30\Omega$	$T_{vj}=25^\circ C$	-	136	-	ns
			$T_{vj}=125^\circ C$	-	116	-	
			$T_{vj}=150^\circ C$	-	99	-	
t_r	Rise time		$T_{vj}=25^\circ C$	-	55	-	
			$T_{vj}=125^\circ C$	-	58	-	
			$T_{vj}=150^\circ C$	-	61	-	
$t_{d(off)}$	Turn-off delay time		$T_{vj}=25^\circ C$	-	294	-	
			$T_{vj}=125^\circ C$	-	328	-	
			$T_{vj}=150^\circ C$	-	371	-	
t_f	Fall time		$T_{vj}=25^\circ C$	-	273	-	
			$T_{vj}=125^\circ C$	-	408	-	
			$T_{vj}=150^\circ C$	-	521	-	
E_{on}	Turn-on energy (per pulse)	$T_{vj}=25^\circ C$	-	6.4	-	mJ	
		$T_{vj}=125^\circ C$	-	8.2	-		
		$T_{vj}=150^\circ C$	-	10.9	-		
E_{off}	Turn-off energy (per pulse)	$T_{vj}=25^\circ C$	-	2.8	-		
		$T_{vj}=125^\circ C$	-	3.6	-		
		$T_{vj}=150^\circ C$	-	4.1	-		
SC data	Short-circuit current	$V_{CC}=600V, V_{GE}\leq 15V, T_{vj}=125^\circ C$ $V_{CES}\leq 1200V, t_p\leq 10\mu s$	-	180	-	A	
R_{thJC}	Thermal resistance, junction to case	Per IGBT	-	-	0.6	K/W	
R_{thCH}	Thermal resistance, case to heatsink	Per IGBT $\lambda_{grease}=1W/(m\cdot K)$	-	-	-	K/W	
T_{vjop}	Temperature under switching conditions		-40		150	$^\circ C$	

Diode, Inverter

Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
V_{RRM}	Repetitive peak reverse voltage	$T_{vj}=25^\circ C$	1200	V
I_F	Forward current, DC		40	A
I_{FRM}	Repetitive peak forward current	$t_p=1ms$	80	A
I^2t	I^2t -value	$V_R=0V, t_p=10ms, T_{vj}=125^\circ C$	320	A^2s

Characteristic Values

			Min.	Typ.	Max.		
V_F	Continuous forward voltage	$I_F=40A$ $V_{GE}=0V$	$T_{vj}=25^\circ C$	-	2.22	2.4	V
			$T_{vj}=125^\circ C$	-	1.86	2.2	
			$T_{vj}=150^\circ C$	-	1.78	-	
I_{RM}	Peak reverse recovery current	$V_R=600V$ $I_F=40A$ $V_{GE}=-15V$	$T_{vj}=25^\circ C$	-	29	-	A
			$T_{vj}=125^\circ C$	-	36	-	
			$T_{vj}=150^\circ C$	-	34	-	
t_{rr}	Reverse recovery time		$T_{vj}=25^\circ C$	-	125	-	ns
			$T_{vj}=125^\circ C$	-	526	-	
			$T_{vj}=150^\circ C$	-	591	-	
Q_r	Recovered charge	$T_{vj}=25^\circ C$	-	2.51	-	μC	
		$T_{vj}=125^\circ C$	-	7.08	-		
		$T_{vj}=150^\circ C$	-	7.5	-		

E _{rec}	Reverse recovery energy		T _{vj} =25°C	-	0.56	-	mJ
			T _{vj} =125°C	-	1.99	-	
			T _{vj} =150°C	-	2.9	-	
R _{thJC}	Thermal resistance, junction to case	Per IGBT		-	-	0.95	K/W
T _{vjop}	Temperature under switching conditions			-40		150	°C

Diode, Rectifier

Maximum Rated Values							
Symbol	Item	Conditions		Rating			Unit
V _{RRM}	Repetitive peak reverse voltage	T _{vj} =25°C		1800			V
I _F	Forward current, DC	T _C =100°C		50			A
I _{FRM}	Repetitive peak forward current	t _p =1ms		60			A
I ² t	I ² t-value	V _R =0V, t _p =10ms, T _{vj} =150°C		340			A ² s
Characteristic Values							
Symbol	Item	Conditions	Values			Unit	
			Min.	Typ.	Max.		
V _F	Continuous forward voltage	I _F =40A V _{GE} =0V	T _{vj} =25°C	-	1.21	2.3	V
			T _{vj} =125°C	-	1.69	-	
			T _{vj} =150°C	-	1.68	-	
I _R	Reverse current	V _R =1800V	T _{vj} =25°C	-	-	10	uA
			T _{vj} =125°C	-	-	-	
			T _{vj} =150°C	-	-	-	
R _{thJC}	Thermal resistance, junction to case	Per diode		-	-	1	K/W
T _{vjop}	Temperature under switching conditions			-40		150	°C

IGBT, Brake-Chopper

Maximum Rated Values							
Symbol	Item	Conditions		Values			Unit
V _{CES}	Collector-emitter voltage	T _{vj} =25°C		1200			V
V _{GES}	Gate-emitter voltage	-		±20			V
I _C	Collector current, DC	T _C =100°C, T _{vj} =175°C		15			A
I _{CRM}	Repetitive peak collector current	t _p =1ms		30			A
P _{tot}	Total power dissipation	T _C =25°C, T _{vj} =175°C		125			W
Characteristic Values							
Symbol	Item	Conditions	Values			Unit	
			Min.	Typ.	Max.		
IGBT							
I _{CES}	Collector-emitter cut-off current	V _{CE} =1200V, V _{GE} =0V, T _{vj} =25°C		-	-	1	mA
I _{GES}	Gate leakage current	V _{CE} =0V, V _{GE} =20V, T _{vj} =25°C		-	-	100	nA
V _{GE(th)}	Gate-emitter threshold voltage	I _C =0.5mA, V _{CE} =V _{GE} , T _{vj} =25°C		5.2	5.87	6.6	V
V _{CEsat}	Collector-emitter saturation voltage	I _C =15A V _{GE} =15V	T _{vj} =25°C	-	1.94	2.25	
			T _{vj} =125°C	-	2.1	-	
			T _{vj} =150°C	-	2.4	-	
C _{ies}	Input capacitance	V _{CE} =25V, V _{GE} =0V f=1MHz, T _{vj} =25°C		-	1.12	-	nF
C _{oes}	Output capacitance			-	0.081	-	
C _{res}	Reverse transfer capacitance			-	0.035	-	

Q_G	Gate charge	$V_{CC}=600V, I_C=15A$ $V_{GE}=-15...+15V, T_{vj}=25^\circ C$	-	0.094	-	μC	
R_g	Internal gate resistance	$T_{vj}=25^\circ C$	-	-	-	Ω	
$t_{d(on)}$	Turn-on delay time	$V_{CC}=600V$ $I_C=15A$ $V_{GE}=\pm 15V$ $R_{G(on)}=30\Omega$ $R_{G(off)}=30\Omega$	$T_{vj}=25^\circ C$	-	105	-	ns
t_r	Rise time		$T_{vj}=125^\circ C$	-	86	-	
			$T_{vj}=150^\circ C$	-	78	-	
$t_{d(off)}$	Turn-off delay time		$T_{vj}=25^\circ C$	-	28	-	
			$T_{vj}=125^\circ C$	-	33	-	
			$T_{vj}=150^\circ C$	-	41	-	
t_f	Fall time		$T_{vj}=25^\circ C$	-	223	-	
			$T_{vj}=125^\circ C$	-	245	-	
E_{on}	Turn-on energy (per pulse)		$T_{vj}=150^\circ C$	-	312	-	
			$T_{vj}=25^\circ C$	-	396	-	
			$T_{vj}=125^\circ C$	-	540	-	
E_{off}	Turn-off energy (per pulse)		$T_{vj}=150^\circ C$	-	681	-	
		$T_{vj}=25^\circ C$	-	1.9	-		
		$T_{vj}=125^\circ C$	-	2.6	-		
E_{off}	Turn-off energy (per pulse)	$T_{vj}=150^\circ C$	-	3.8	-		
		$T_{vj}=25^\circ C$	-	1.4	-		
		$T_{vj}=125^\circ C$	-	1.7	-		
E_{off}	Turn-off energy (per pulse)	$T_{vj}=150^\circ C$	-	1.9	-		
		$T_{vj}=125^\circ C$	-	1.9	-		
SC data	Short-circuit current	$V_{CC}=600V, V_{GE}\leq 15V, T_{vj}=125^\circ C$ $V_{CES}\leq 1200V, t_p\leq 10\mu s$	-	60	-	A	
R_{thJC}	Thermal resistance, junction to case	Per IGBT	-	-	1.2	K/W	
T_{vjop}	Temperature under switching conditions		-40		150	$^\circ C$	

Diode, Brake-Chopper
Maximum Rated Values

Symbol	Item	Conditions	Rating	Unit
V_{RRM}	Repetitive peak reverse voltage	$T_{vj}=25^\circ C$	1200	V
I_F	Forward current, DC		10	A
I_{FRM}	Repetitive peak forward current	$t_p=1ms$	20	A
I^2t	I^2t -value	$V_R=0V, t_p=10ms, T_{vj}=125^\circ C$	20	A^2s

Characteristic Values

			Min.	Typ.	Max.		
V_F	Continuous forward voltage	$I_F=10A$ $V_{GE}=0V$	$T_{vj}=25^\circ C$	-	2.2	2.3	V
			$T_{vj}=125^\circ C$	-	1.9	-	
			$T_{vj}=150^\circ C$	-	1.7	-	
I_{RM}	Peak reverse recovery current	$V_R=600V$ $I_F=10A$	$T_{vj}=25^\circ C$	-	28	-	A
			$T_{vj}=125^\circ C$	-	36	-	
			$T_{vj}=150^\circ C$	-	33	-	
T_{rr}	Reverse recovery time	$V_{GE}=-15V$	$T_{vj}=25^\circ C$	-	82	-	ns
			$T_{vj}=125^\circ C$	-	282	-	
			$T_{vj}=150^\circ C$	-	381	-	

Q _r	Recovered charge	V _R =600V I _F =10A V _{GE} =-15V	T _{vj} =25°C	-	1.03	-	μC
			T _{vj} =125°C	-	3.33	-	
			T _{vj} =150°C	-	4.21	-	
E _{rec}	Reverse recovery energy	V _R =600V I _F =10A V _{GE} =-15V	T _{vj} =25°C	-	0.12	-	mJ
			T _{vj} =125°C	-	0.89	-	
			T _{vj} =150°C	-	1.51	-	
R _{thJC}	Thermal resistance, junction to case	per diode	-	-	2.3	K/W	
T _{vjop}	Temperature under switching conditions			-40		150	°C

Note:

IGBT electrical characteristics according to IEC 60747 – 9

Diode electrical characteristics according to IEC 60747 – 2

NTC Thermistor Characteristics

Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	
R ₂₅	Rated resistance	T _C =25°C	-	5	-	kΩ
ΔR/R	Deviation of resistance	T _C =100°C, R ₁₀₀ =493Ω	-5	-	5	%
P ₂₅	Power dissipation	T _C =25°C	-	-	20	mW
B _{25/50}	B-constant	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$	-	3375	-	K
B _{25/80}	B-constant	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$	-	3411	-	
B _{25/100}	B-constant	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$	-	3433	-	

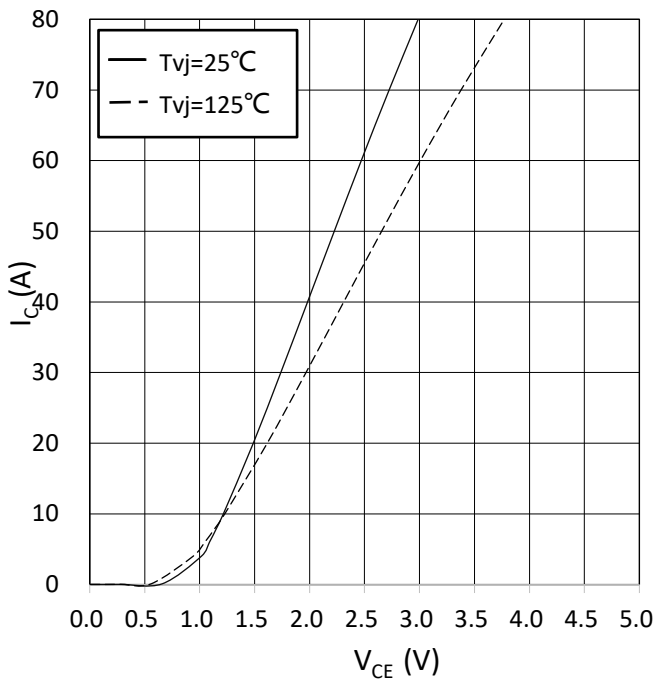
Module

Symbol	Item	Conditions	Rating			Unit
V _{ISOL}	Isolation voltage	Terminals to baseplate, RMS, f=50Hz, t=1min	2500			V
T _{vj max}	Maximum junction temperature	-	175			°C
T _{vj op}	Operating junction temperature	Continuous operationg(under switching)	-40~150			°C
T _{stg}	Storage temperature	-	-40~125			°C
Symbol	Item	Conditions	Values			Unit
			Min.	Typ.	Max.	
Ms	Mounting torque	Mounting to heat sink, M5 screw	3	-	6	Nm
ds	Creepage distance	Terminal to terminal	-	-	-	mm
		Terminal to base plate	-	10	-	
da	Clearance	Terminal to terminal	-	-	-	mm
		Terminal to base plate	-	7.5	-	
m	Weight	-	-	175	-	g

output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$

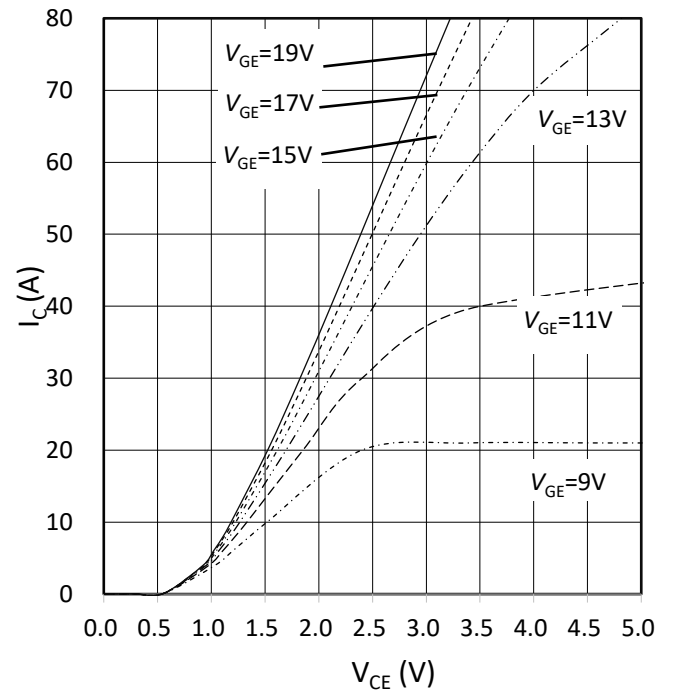
$V_{GE} = 15V$



output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$

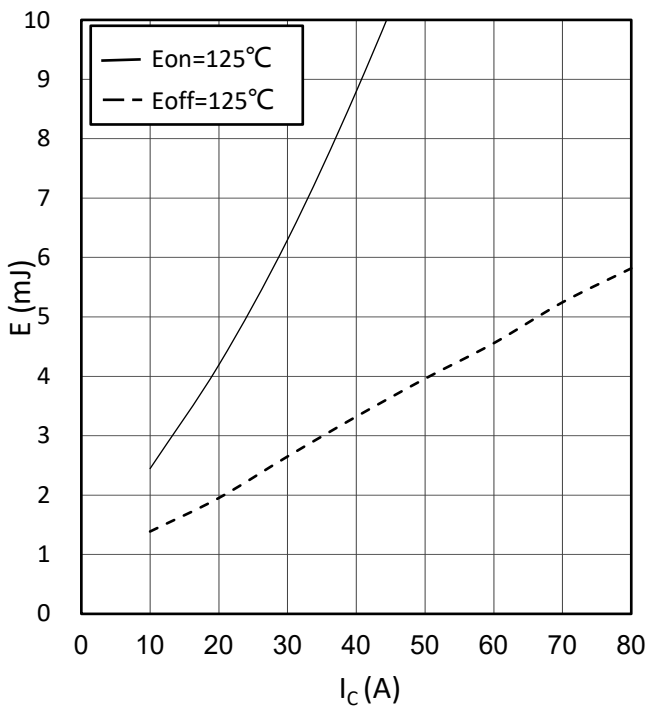
$T_{vj} = 125^\circ C$



switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C), E_{off} = f(I_C)$

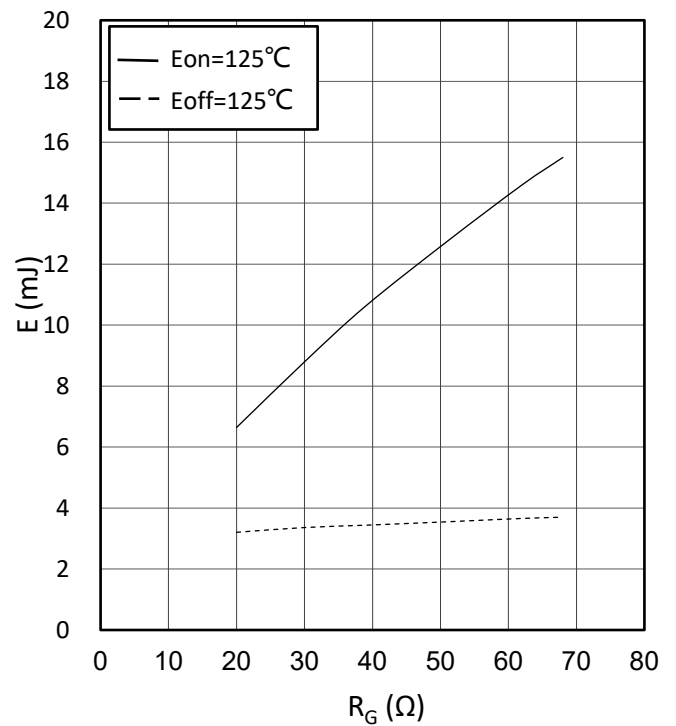
$V_{GE} = \pm 15V, R_{Gon} = 30\Omega, R_{Goff} = 30\Omega, V_{CE} = 600V$



switching losses IGBT, Inverter (typical)

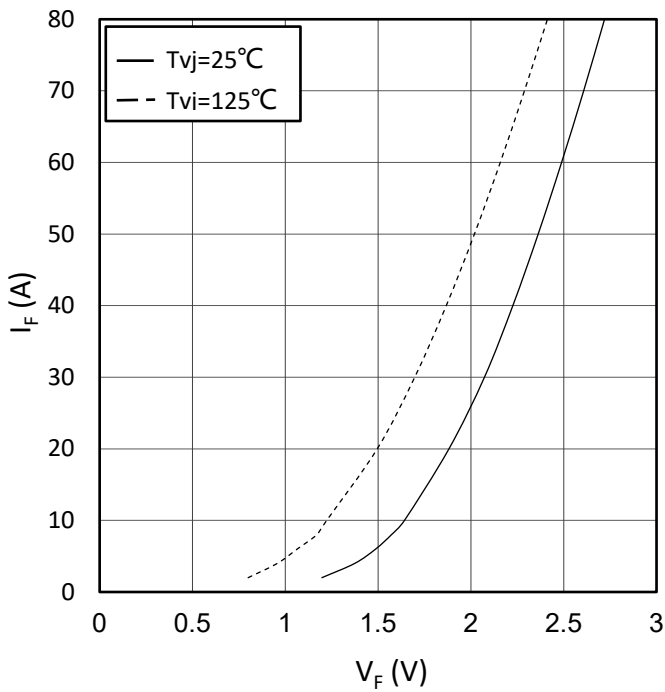
$E_{on} = f(R_G), E_{off} = f(R_G)$

$V_{GE} = \pm 15V, I_C = 40A, V_{CE} = 600V$



forward characteristic of Diode, Inverter (typical)

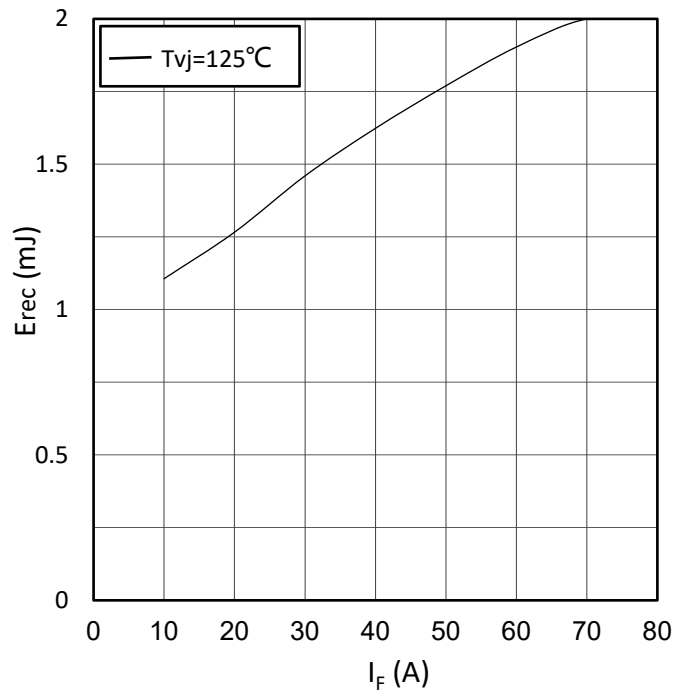
$I_F = f(V_F)$



switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$

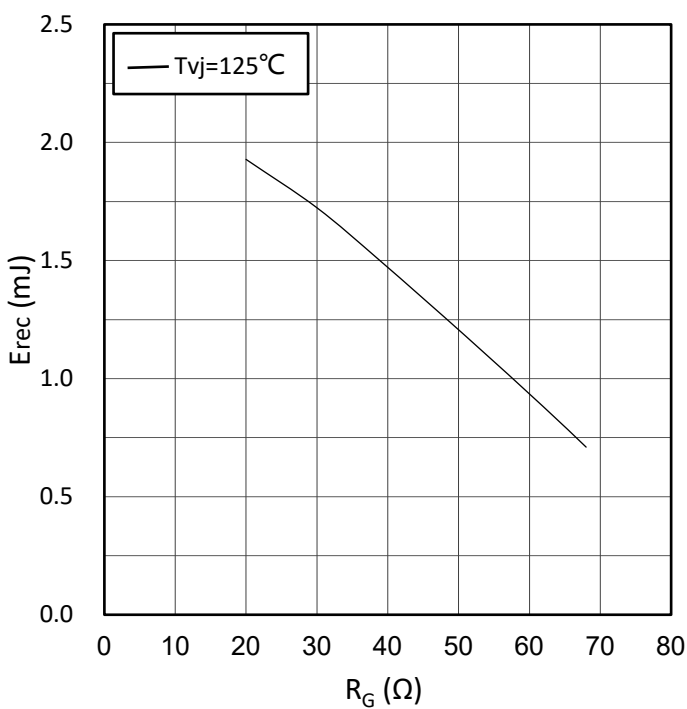
$R_{Gon} = 30\Omega, V_{CE} = 600\text{ V}$



switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$

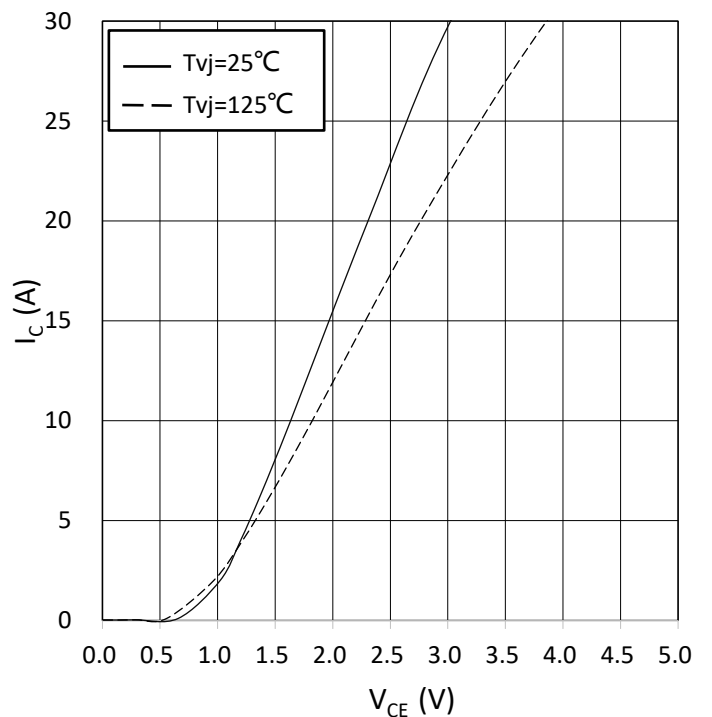
$I_F = 40\text{A}, V_{CE} = 600\text{V}$



output characteristic IGBT, Brake-Chopper (typical)

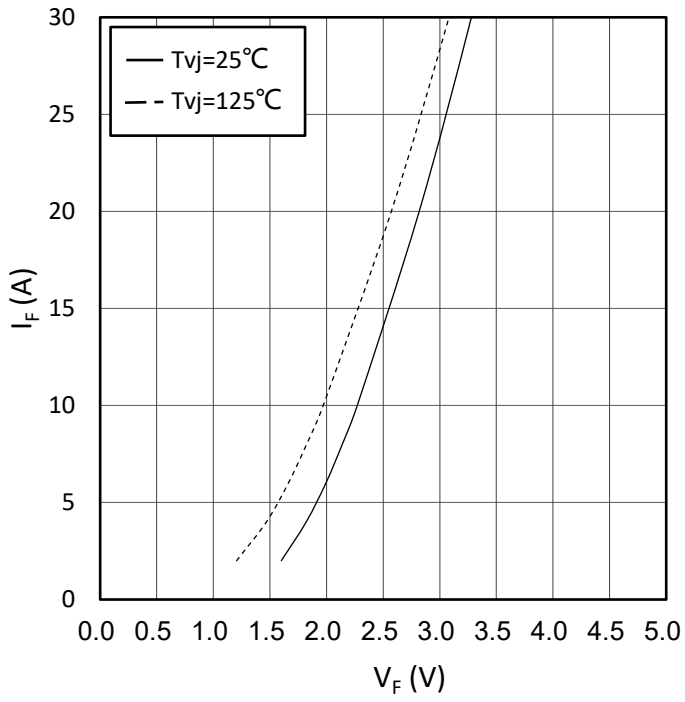
$I_C = f(V_{CE})$

$V_{GE} = 15\text{V}$



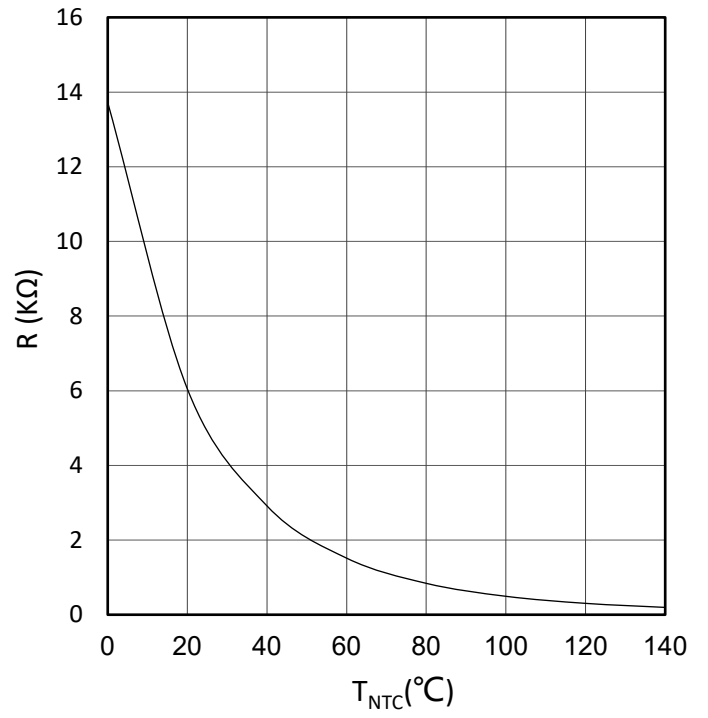
forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$

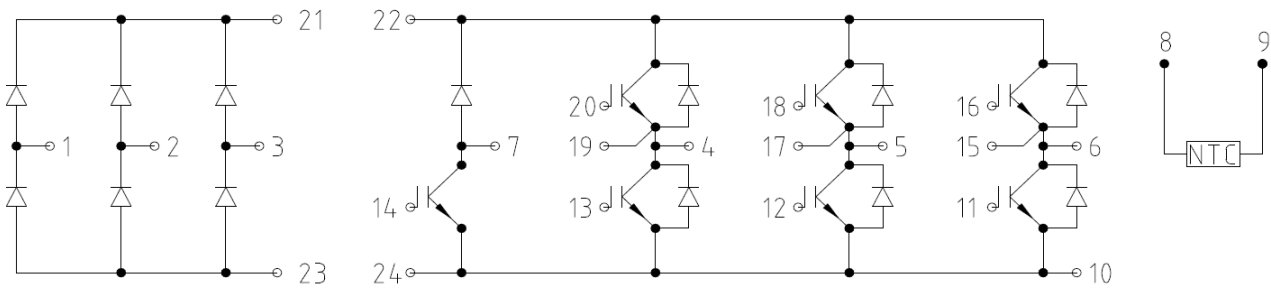


NTC-Thermistor-temperature characteristic(typical)

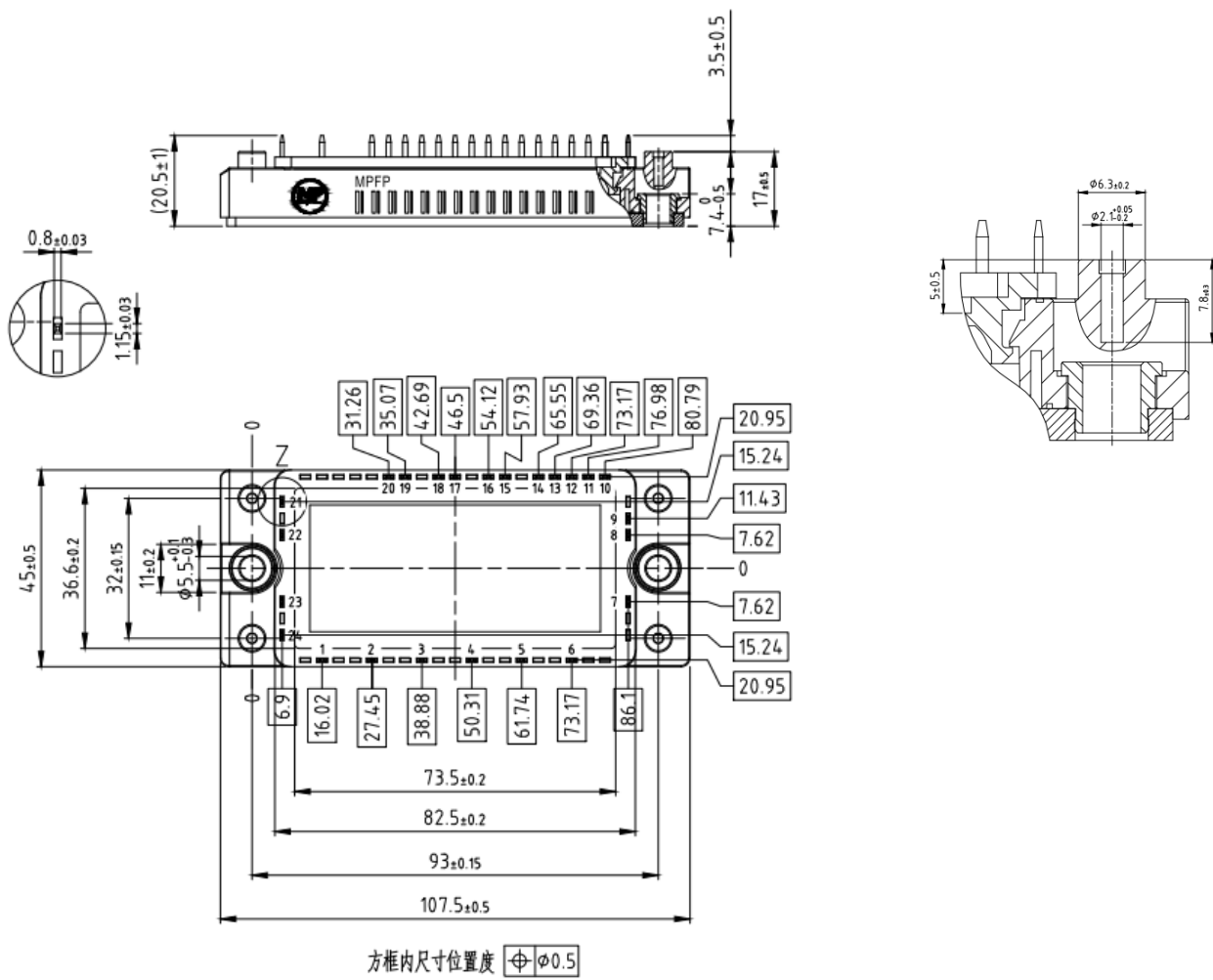
$R=f(T)$



Circuit Diagram



Package Outlines



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