

## MRI15.12-PIM

### IGBT POWER MODULE

#### Features:

- 10us short circuit capability
- Low switching losses
- VCE(sat) with Positive temperature coefficient
- Fast & soft reverse recovery anti-parallel FWD

#### Typical Applications:

- Inverter for motor drive(VFD)
- AC and DC servo drive amplifier
- Uninterruptible power supply

IGBT, Inverter

SYMBOL	CHARACTERISTIC	TEST CONDITIONS	VALUE			UNIT
			Min	Type	Max	
V <sub>CES</sub>	Collector-Emitter voltage	T <sub>j</sub> =25°C			1200	V
V <sub>GES</sub>	Gate-Emitter voltage	T <sub>j</sub> =25°C			±20	V
I <sub>C</sub>	Collector current	Continuous@ T <sub>c</sub> =100°C			15	A
I <sub>CRM</sub>		t <sub>p</sub> =1ms			30	A
P <sub>tot</sub>	Total power dissipation	T <sub>c</sub> = 25°C, T <sub>vjmax</sub> =175°C			130	W
V <sub>GE(th)</sub>	Gate-Emitter threshold voltage	T <sub>j</sub> =25°C, V <sub>CE</sub> =20V, I <sub>C</sub> =1.20mA	5.2	5.8	6.4	V
V <sub>CE(sat)</sub>	Collector-Emitter saturation voltage	T <sub>j</sub> =25°C, V <sub>GE</sub> =15V, I <sub>C</sub> =15A		1.85	2.25	V
		T <sub>j</sub> =25°C, V <sub>GE</sub> =15V, I <sub>C</sub> =15A		2.15		V
		T <sub>j</sub> =25°C, V <sub>GE</sub> =15V, I <sub>C</sub> =15A		2.25		V
Q <sub>g</sub>	Gate Charge	V <sub>GE</sub> =±15V		0.12		μC
R <sub>Gint</sub>	Integrated gate resistor	T <sub>j</sub> =25°C		0		Ω
C <sub>ies</sub>	Input capacitance	T <sub>j</sub> =25°C, V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f=1MHz		0.89		nF
C <sub>res</sub>	Reverse transfer capacitance			0.03		nF
I <sub>CES</sub>	Zero gate voltage collector current	T <sub>j</sub> =25°C, V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V			1.0	mA
I <sub>GES</sub>	Gate-Emitter leakage current	T <sub>j</sub> =25°C, V <sub>CE</sub> =0V, V <sub>GE</sub> =±20V	-0.4		0.4	μA
t <sub>(d)on</sub>	Turn-on time	V <sub>CC</sub> =600V, I <sub>C</sub> =15A, V <sub>GE</sub> =±15V, R <sub>Gon</sub> =39Ω, Inductive load	T <sub>j</sub> =25°C		55	ns
			T <sub>j</sub> =125°C		55	ns
			T <sub>j</sub> =150°C		55	ns
T <sub>j</sub> =25°C				59	ns	
T <sub>j</sub> =125°C				65	ns	
T <sub>j</sub> =150°C				65	ns	
t <sub>(d)off</sub>	Turn-off time	V <sub>CC</sub> =600V, I <sub>C</sub> =15A, V <sub>GE</sub> =±15V, R <sub>Goff</sub> =39Ω, Inductive load	T <sub>j</sub> =25°C		195	ns
			T <sub>j</sub> =125°C		275	ns
			T <sub>j</sub> =150°C		280	ns
T <sub>j</sub> =25°C				145	ns	
T <sub>j</sub> =125°C				190	ns	
T <sub>j</sub> =150°C				215	ns	
E <sub>on</sub>		I <sub>C</sub> =15 A, V <sub>CE</sub> =600V, L <sub>S</sub> =50nH, V <sub>GE</sub> =±15 V, di/dt=550A/μs (T <sub>vj</sub> = 150°C), R <sub>Gon</sub> =39 Ω	T <sub>j</sub> =25°C		1.30	mJ
			T <sub>j</sub> =125°C		1.75	mJ
			T <sub>j</sub> =150°C		1.95	mJ
E <sub>off</sub>		I <sub>C</sub> =15 A, V <sub>CE</sub> =600V, L <sub>S</sub> =50nH, V <sub>GE</sub> =±15 V, di/dt=550A/μs (T <sub>vj</sub> = 150°C), R <sub>Goff</sub> =39 Ω	T <sub>j</sub> =25°C		0.83	mJ
			T <sub>j</sub> =125°C		1.20	mJ
			T <sub>j</sub> =150°C		1.35	mJ

$I_{sc}$	Short circuit withstand current	$V_{GE}=15V, V_{CC}=800V, V_{CEmax}=V_{CES} - L_{sCE} \cdot di/dt,$ $t_p \leq 10\mu s, T_{vj}=150^\circ C$		55		A
$R_{th(j-c)}$	Thermal resistance, junction to case	per IGBT		1.05	1.15	$^\circ C/W$
$R_{th(c-h)}$	Thermal resistance, case to heatsink			1.05		$^\circ C/W$
$T_{Vjop}$	Junction temperature	/	-40		150	$^\circ C$
$T_{stg}$	Storage temperature		-40		125	$^\circ C$
F	mounting force per clamp		20		50	N
$W_t$	Weight			24		g

**Diode, Inverter**

SYMBOL	CHARACTERISTIC	TEST CONDITIONS	VALUE			UNIT
			Min	Type	Max	
$V_{RRM}$	Repetitive peak reverse voltage	$T_{vj}=25^\circ C$			1200	V
$I_F$	Continuous DC forward current				15	A
$I_{FRM}$	Repetitive peak forward current				30	A
$I^2t$	$I^2t$ - value	$V_R=0V, t_p=10ms, T_{vj}=150^\circ C$			14	$A^2s$
$V_F$	Forward on voltage	$I_F=15A$	$T_j=25^\circ C$	2.00	2.65	V
			$T_j=125^\circ C$	2.10		V
			$T_j=150^\circ C$	2.10		V
$I_{RRM}$	Max. reverse recovery current	$I_F=15A, -di_F/dt=550A/\mu s,$ $V_R=600V$	$T_j=25^\circ C$	13		A
			$T_j=125^\circ C$	12		A
			$T_j=150^\circ C$	12		A
$Q_r$	Recovered charge	$I_F=15A, -di_F/dt=550A/\mu s,$ $V_R=600V$	$T_j=25^\circ C$	1.20		$\mu C$
			$T_j=125^\circ C$	2.05		$\mu C$
			$T_j=150^\circ C$	2.40		$\mu C$
$E_{rec}$	Reverse recovery energy	$I_F=15A, -di_F/dt=550A/\mu s,$ $V_R=600V$	$T_j=25^\circ C$	0.37		mJ
			$T_j=125^\circ C$	0.68		mJ
			$T_j=150^\circ C$	0.80		mJ
$R_{th(j-c)}$	Thermal resistance, junction to case	per diode		1.75	1.90	$^\circ C/W$
$R_{th(c-h)}$	Thermal resistance, case to heatsink			1.30		$^\circ C/W$
$T_{Vjop}$	Junction temperature	/	-40		150	$^\circ C$

**Diode, Rectifier**

SYMBOL	CHARACTERISTIC	TEST CONDITIONS	VALUE			UNIT
			Min	Type	Max	
$V_{RRM}$	Repetitive peak reverse voltage	$T_{vj}=25^\circ C$			1600	V
$I_{FRMSM}$	Maximum RMS forward current per chip	$T_C=80^\circ C$			30	A
$I_{RMSM}$	Maximum RMS current at rectifier output	$T_C=80^\circ C$			30	A
$I_{FSM}$	Surge forward current	$t_p=10ms, T_{vj}=150^\circ C$			245	A
$I^2t$	$I^2t$ - value	$V_R=0V, t_p=10ms, T_{vj}=150^\circ C$			300	$A^2s$
$V_F$	Forward on voltage	$I_F=15A, T_j=150^\circ C$		0.85		V
$I_R$	reverse current	$V_R=1600V, T_j=150^\circ C$		1.0		mA
$R_{th(j-c)}$	Thermal resistance, junction to case	per diode		1.20	1.35	$^\circ C/W$
$R_{th(c-h)}$	Thermal resistance, case to heatsink			1.15		$^\circ C/W$
$T_{Vjop}$	Junction temperature	/	-40		150	$^\circ C$

## IGBT, Brake-Chopper

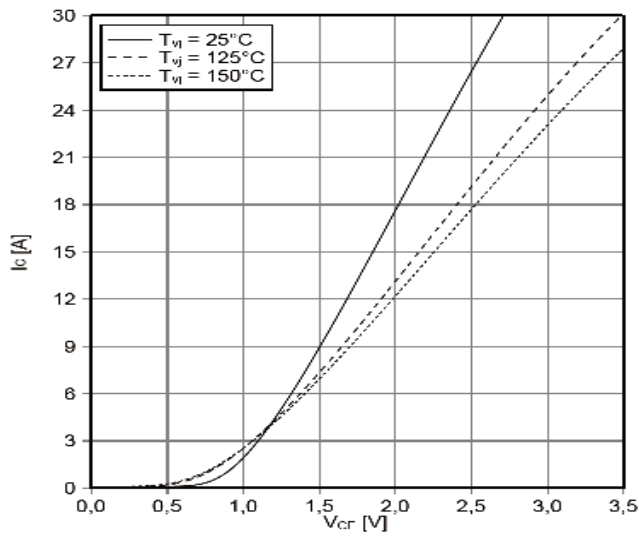
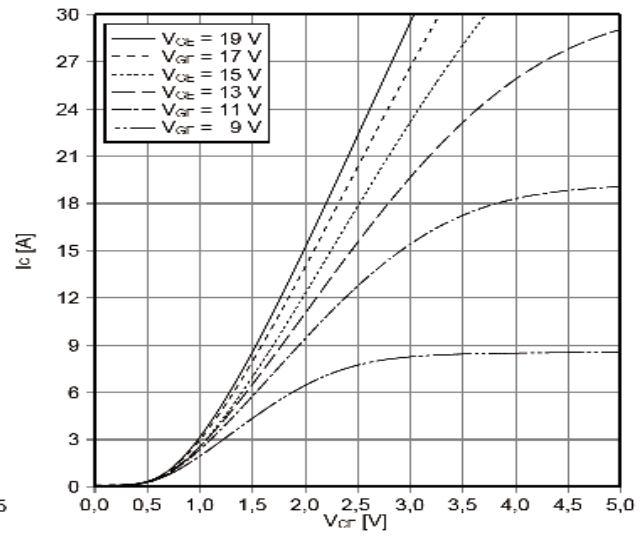
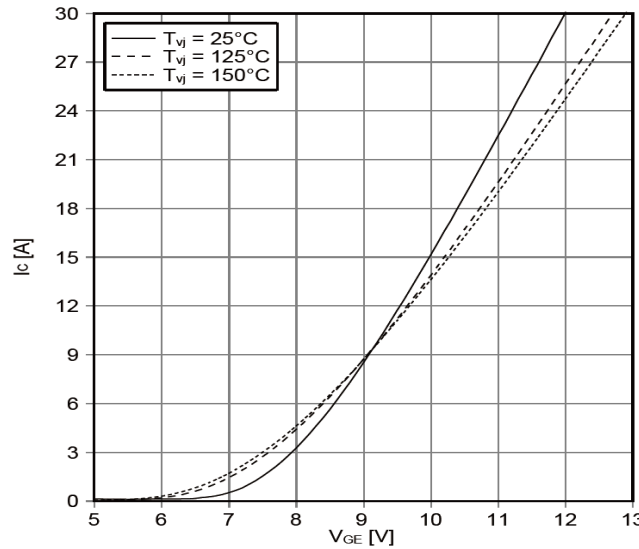
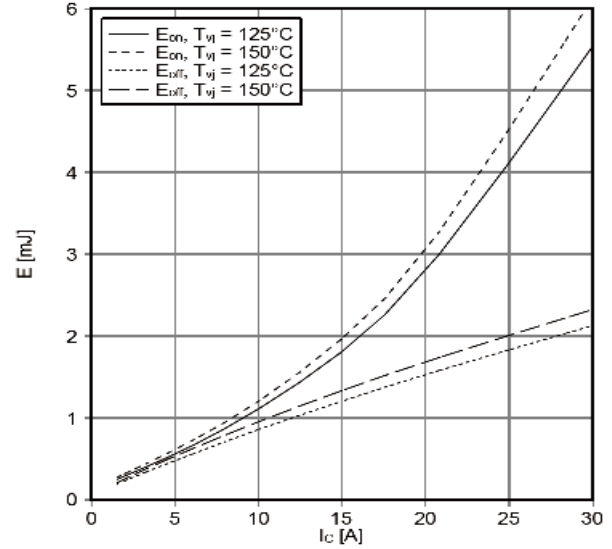
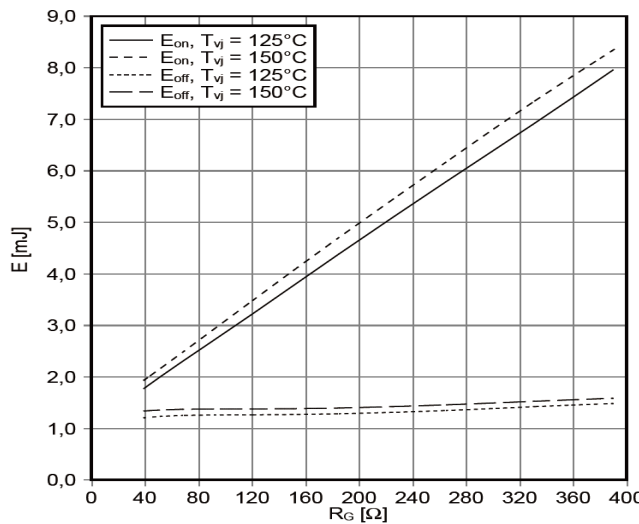
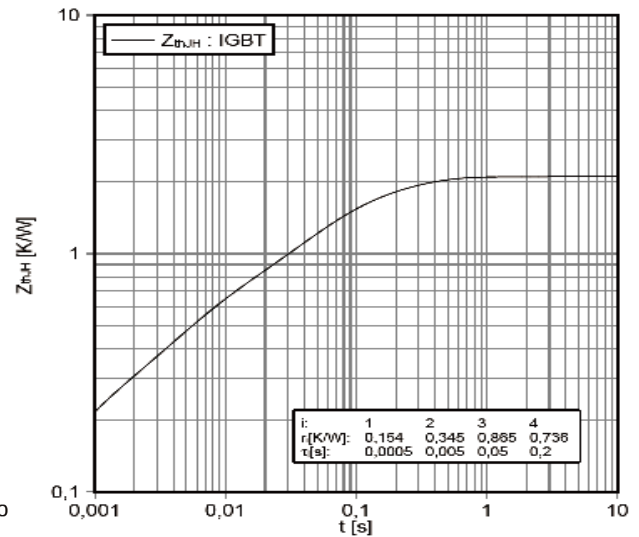
SYMBOL	CHARACTERISTIC	TEST CONDITIONS	VALUE			UNIT
			Min	Type	Max	
$V_{CES}$	Collector-Emitter voltage	$T_j=25^\circ\text{C}$			1200	V
$V_{GES}$	Gate-Emitter voltage	$T_j=25^\circ\text{C}$			$\pm 20$	V
$I_C$	Collector current	Continuous@ $T_C=100^\circ\text{C}$			15	A
$I_{CRM}$		$t_p=1\text{ms}$			30	A
$P_{tot}$	Total power dissipation	$T_C=25^\circ\text{C}, T_{vjmax}=175^\circ\text{C}$			130	W
$V_{GE(th)}$	Gate-Emitter threshold voltage	$T_j=25^\circ\text{C}, V_{CE}=20\text{V}, I_C=1.20\text{mA}$	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector-Emitter saturation voltage	$T_j=25^\circ\text{C}, V_{GE}=15\text{V}, I_C=35\text{A}$		1.85	2.25	V
		$T_j=25^\circ\text{C}, V_{GE}=15\text{V}, I_C=35\text{A}$		2.15		V
		$T_j=25^\circ\text{C}, V_{GE}=15\text{V}, I_C=35\text{A}$		2.25		V
$Q_g$	Gate Charge	$V_{GE}=\pm 15\text{V}$		0.12		$\mu\text{C}$
$R_{Gint}$	Integrated gate resistor	$T_j=25^\circ\text{C}$		0		$\Omega$
$C_{ies}$	Input capacitance	$T_j=25^\circ\text{C}, V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		0.89		nF
$C_{res}$	Reverse transfer capacitance			0.03		nF
$I_{CES}$	Zero gate voltage collector current	$T_j=25^\circ\text{C}, V_{CE}=1200\text{V}, V_{GE}=0\text{V}$			1.0	mA
$I_{GES}$	Gate-Emitter leakage current	$T_j=25^\circ\text{C}, V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-0.4		0.4	$\mu\text{A}$
$t_{(d)on}$	Turn-on time	$V_{CC}=600\text{V}, I_C=15\text{A}, V_{GE}=\pm 15\text{V}, R_{gon}=43\Omega, \text{ Inductive load}$	$T_j=25^\circ\text{C}$		65	ns
			$T_j=125^\circ\text{C}$		65	ns
			$T_j=150^\circ\text{C}$		65	ns
$t_r$			$T_j=25^\circ\text{C}$		60	ns
			$T_j=125^\circ\text{C}$		65	ns
			$T_j=150^\circ\text{C}$		65	ns
$t_{(d)off}$	Turn-off time	$V_{CC}=600\text{V}, I_C=15\text{A}, V_{GE}=\pm 15\text{V}, R_{goff}=43\Omega, \text{ Inductive load}$	$T_j=25^\circ\text{C}$		210	ns
			$T_j=125^\circ\text{C}$		280	ns
			$T_j=150^\circ\text{C}$		285	ns
$t_f$			$T_j=25^\circ\text{C}$		170	ns
			$T_j=125^\circ\text{C}$		200	ns
			$T_j=150^\circ\text{C}$		225	ns
$E_{on}$		$I_C=15\text{A}, V_{CE}=600\text{V}, L_S=50\text{nH}, V_{GE}=\pm 15\text{V}, R_{gon}=43\Omega$	$T_j=25^\circ\text{C}$		1.35	mJ
			$T_j=125^\circ\text{C}$		1.80	mJ
			$T_j=150^\circ\text{C}$		2.00	mJ
$E_{off}$		$I_C=15\text{A}, V_{CE}=600\text{V}, L_S=50\text{nH}, V_{GE}=\pm 15\text{V}, R_{goff}=43\Omega$	$T_j=25^\circ\text{C}$		0.85	mJ
			$T_j=125^\circ\text{C}$		1.20	mJ
			$T_j=150^\circ\text{C}$		1.35	mJ
$I_{sc}$	Short circuit withstand current	$V_{GE}=15\text{V}, V_{CC}=800\text{V}, V_{CEmax}=V_{CES}-L_{sCE} \cdot di/dt, t_p \leq 10\mu\text{s}, T_{vj}=150^\circ\text{C}$		55		A
$R_{th(j-c)}$	Thermal resistance, junction to case	per IGBT		1.05	1.15	$^\circ\text{C/W}$
$R_{th(c-h)}$	Thermal resistance, case to heatsink			1.05		$^\circ\text{C/W}$
$T_{Vjop}$	Junction temperature	/	-40		150	$^\circ\text{C}$

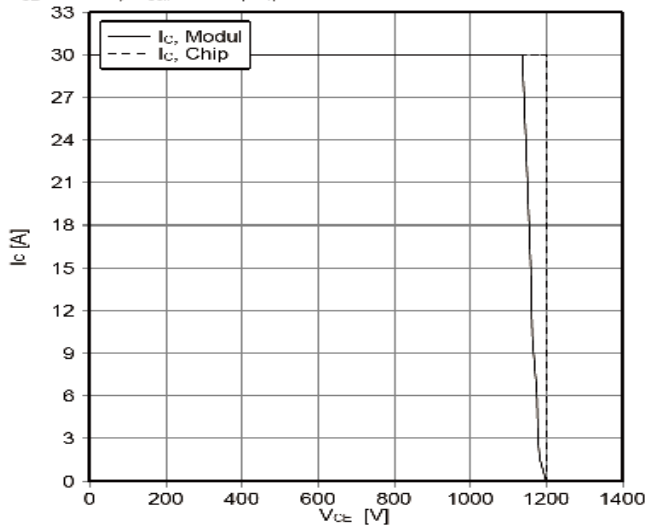
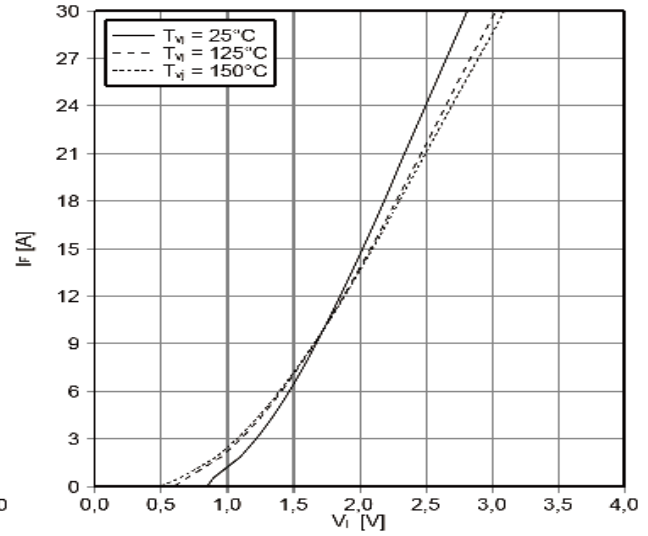
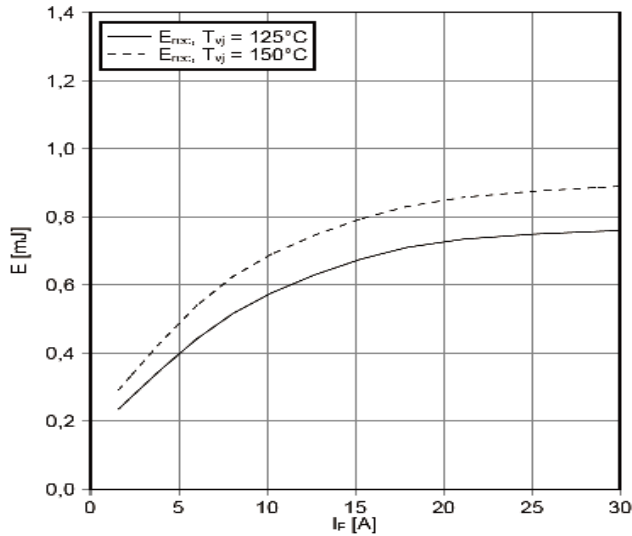
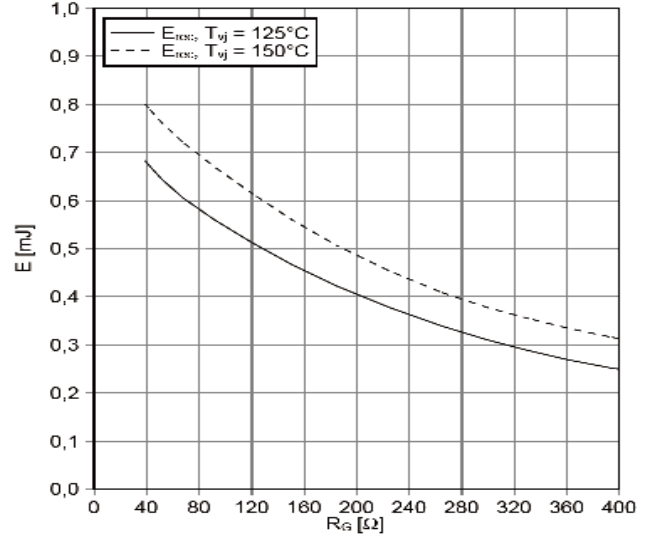
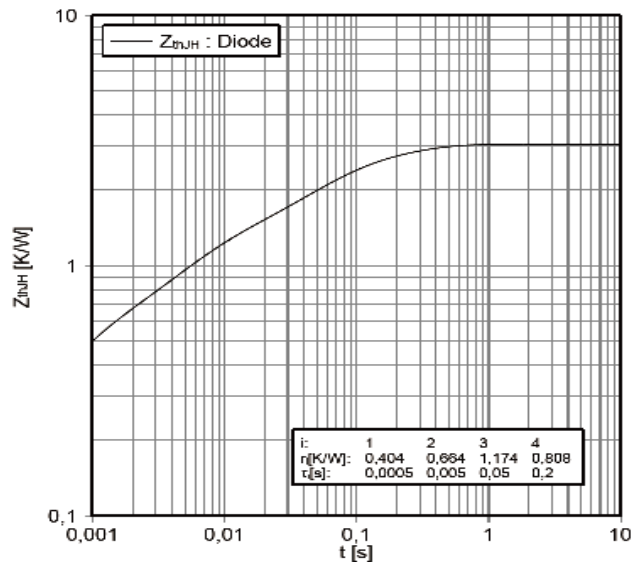
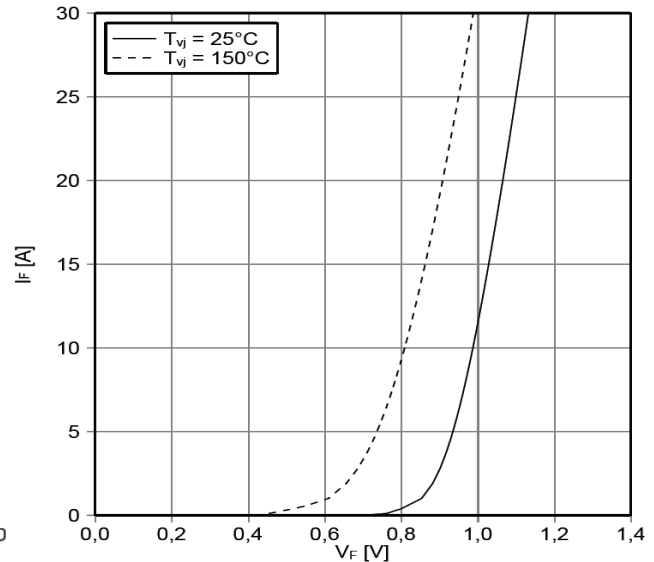
## Diode, Brake-Chopper

SYMBOL	CHARACTERISTIC	TEST CONDITIONS	VALUE			UNIT
			Min	Type	Max	
$V_{RRM}$	Repetitive peak reverse voltage	$T_{vj}=25^{\circ}\text{C}$			1200	V
$I_F$	Continuous DC forward current				10	A
$I_{FRM}$	Repetitive peak forward current				20	A
$I^2t$	$I^2t$ - value	$V_R=0\text{V}, t_p=10\text{ms}, T_{vj}=125^{\circ}\text{C}$			16	$\text{A}^2\text{s}$
$V_F$	Forward on voltage	$I_F=10\text{A}, V_{GE}=0\text{V}$	$T_j=25^{\circ}\text{C}$	1.75	2.25	V
			$T_j=125^{\circ}\text{C}$	1.75		V
			$T_j=150^{\circ}\text{C}$	1.75		V
$I_{RRM}$	Max. reverse recovery current	$I_F=10\text{A},$ $-di_F/dt=500\text{A}/\mu\text{s}, (T_{vj}=150^{\circ}\text{C}),$ $V_R=600\text{V}$	$T_j=25^{\circ}\text{C}$	12		A
			$T_j=125^{\circ}\text{C}$	10		A
			$T_j=150^{\circ}\text{C}$	8		A
$Q_r$	Recovered charge	$I_F=10\text{A}, -di_F/dt=500\text{A}/\mu\text{s},$ $V_R=600\text{V}$	$T_j=25^{\circ}\text{C}$	0.90		$\mu\text{C}$
			$T_j=125^{\circ}\text{C}$	1.70		$\mu\text{C}$
			$T_j=150^{\circ}\text{C}$	1.90		$\mu\text{C}$
$E_{rec}$	Reverse recovery energy	$I_F=10\text{A}, -di_F/dt=500\text{A}/\mu\text{s},$ $V_R=600\text{V}$	$T_j=25^{\circ}\text{C}$	0.24		mJ
			$T_j=125^{\circ}\text{C}$	0.52		mJ
			$T_j=150^{\circ}\text{C}$	0.59		mJ
$R_{th(j-c)}$	Thermal resistance, junction to case	per diode		1.75	1.90	$^{\circ}\text{C}/\text{W}$
$R_{th(c-h)}$	Thermal resistance, case to heatsink			1.30		$^{\circ}\text{C}/\text{W}$
$T_{vjop}$	Junction temperature	/	-40		150	$^{\circ}\text{C}$

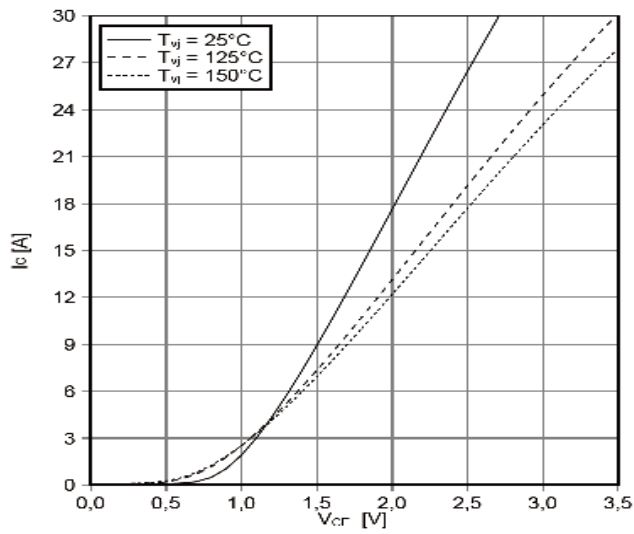
## NTC-Thermistor

SYMBOL	CHARACTERISTIC	TEST CONDITIONS	VALUE			UNIT
			Min	Type	Max	
$R_{25}$	Rated resistance	$T_c=25^{\circ}\text{C}$		5.00		$\text{k}\Omega$
$\Delta R/R$	Deviation of $R_{100}$	$T_c=100^{\circ}\text{C}, R_{100}=493\text{W}$	-5		5	%
$P_{25}$	Power dissipation	$T_c=25^{\circ}\text{C}$			20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25} \exp [B_{25/50}(1/T_2-1/(298,15\text{K}))]$		3375		K
$B_{25/80}$		$R_2=R_{25} \exp [B_{25/80}(1/T_2-1/(298,15\text{K}))]$		3411		K
$B_{25/100}$		$R_2=R_{25} \exp [B_{25/100}(1/T_2-1/(298,15\text{K}))]$		3433		K

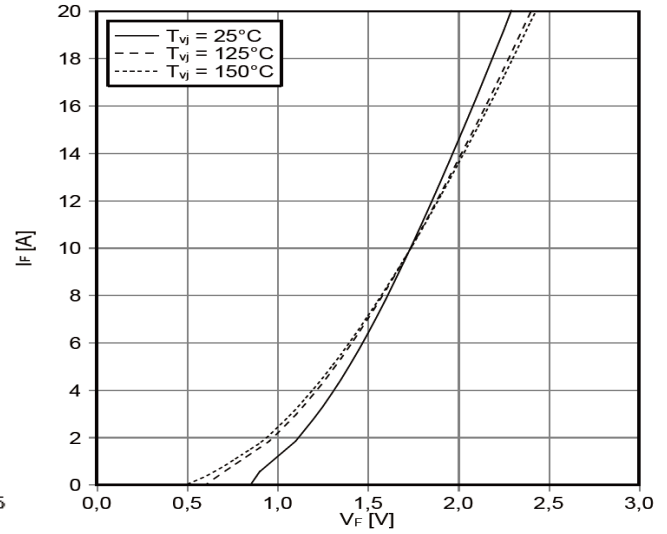
**output characteristic IGBT, Inverter (typical)**
 $I_c = f(V_{CE})$   
 $V_{CE} = 15\text{ V}$ 

**output characteristic IGBT, Inverter (typical)**
 $I_c = f(V_{CE})$   
 $T_{vj} = 150^\circ\text{C}$ 

**transfer characteristic IGBT, Inverter (typical)**
 $I_c = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$ 

**switching losses IGBT, Inverter (typical)**
 $E_{on} = f(I_c), E_{off} = f(I_c)$   
 $V_{CE} = \pm 15\text{ V}, R_{D(on)} = 39\ \Omega, R_{D(off)} = 39\ \Omega, V_{CE} = 600\text{ V}$ 

**switching losses IGBT, Inverter (typical)**
 $E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_c = 15\text{ A}, V_{CE} = 600\text{ V}$ 

**transient thermal impedance IGBT, Inverter**
 $Z_{th(j-t)} = f(t)$ 


**reverse bias safe operating area IGBT, Inverter (RBSOA)**
 $I_C = f(V_{CE})$   
 $V_{CE} = \pm 15 \text{ V}, R_{\text{Dtot}} = 39 \text{ } \Omega, T_{vj} = 150^\circ\text{C}$ 

**forward characteristic of Diode, Inverter (typical)**
 $I_i = f(V_i)$ 

**switching losses Diode, Inverter (typical)**
 $E_{\text{rec}} = f(I_F)$   
 $R_{\text{Dtot}} = 39 \text{ } \Omega, V_{\text{Cr}} = 600 \text{ V}$ 

**switching losses Diode, Inverter (typical)**
 $E_{\text{rec}} = f(R_G)$   
 $I_F = 15 \text{ A}, V_{\text{Cr}} = 600 \text{ V}$ 

**transient thermal impedance Diode, Inverter**
 $Z_{\text{thJH}} = f(t)$ 

**forward characteristic of Diode, Rectifier (typical)**
 $I_F = f(V_F)$ 


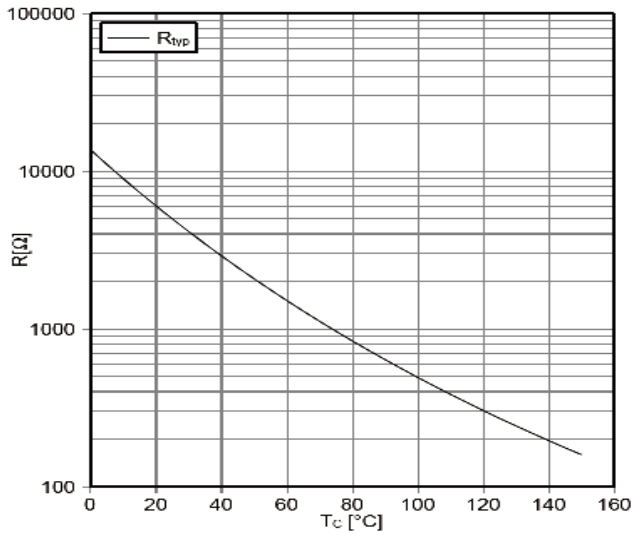
**output characteristic IGBT, Brake-Chopper (typical)**  
 $I_c = f(V_{ce})$   
 $V_{er} = 15 V$



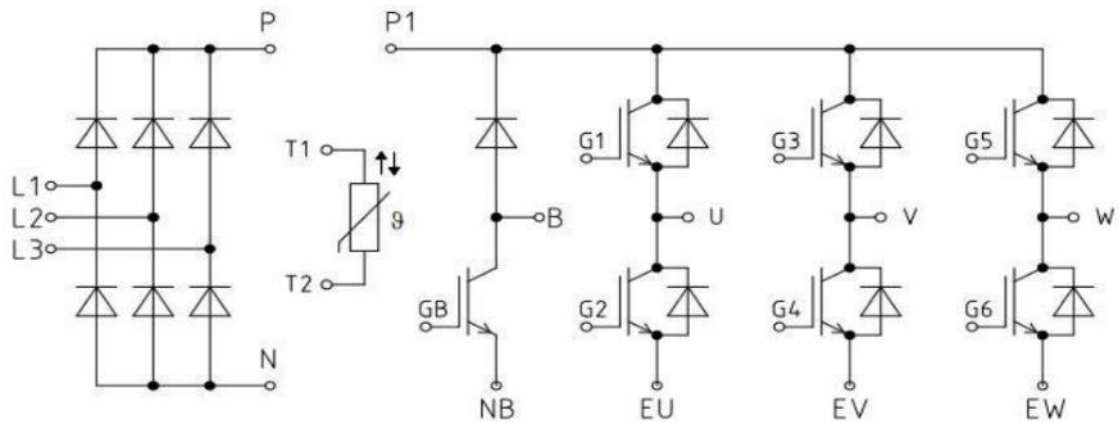
**forward characteristic of Diode, Brake-Chopper (typical)**  
 $I_F = f(V_F)$

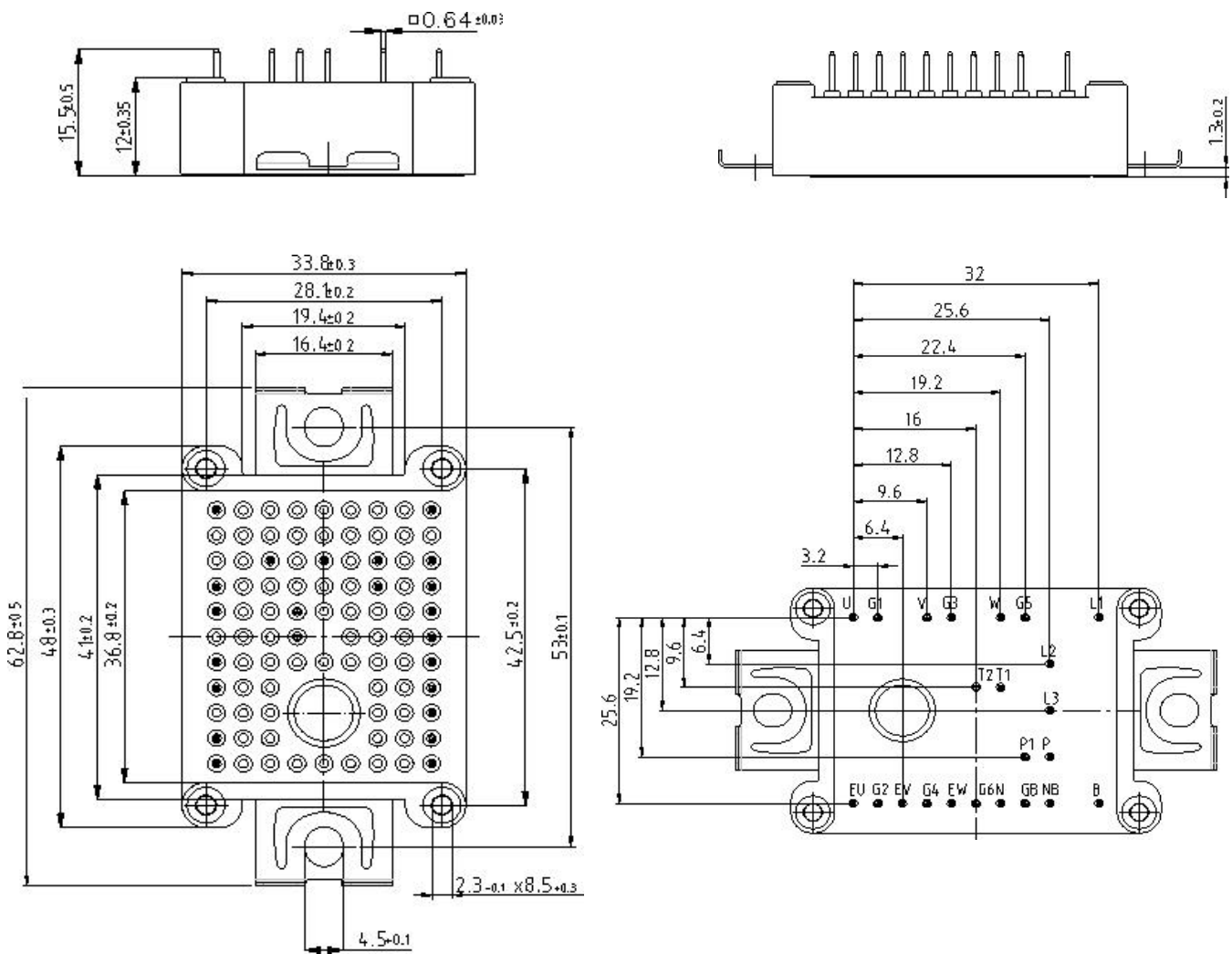


**NTC-Thermistor-temperature characteristic (typical)**  
 $R = f(T)$



**Outline:**





TECHSEM reserves the right to change specifications without notice.

Outline:258H5P