

## PIM IGBT Module

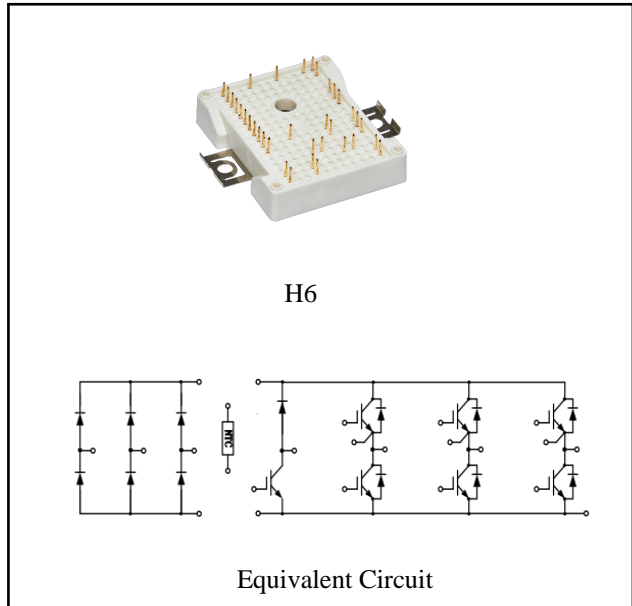
$V_{CES} = 1200V$ ,  $I_{C\ nom} = 40A / I_{CRM} = 80A$

### Features :

- 1200V Trench /Field Stop process
- Low switching losses
- $V_{cesat}$  has a positive temperature coefficient

### Applications:

- Variable Frequency Drive
- Servo drive
- Inverter



## IGBT, Inverter

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	$T_{vj} = 25^{\circ}C$	$V_{CES}$	1200	V
Continuous DC collector current	$T_C = 100^{\circ}C$ , $T_{vj\ max} = 175^{\circ}C$	$I_{C\ nom}$	40	A
Repetitive peak collector current	$t_p = 1\ ms$	$I_{CRM}$	80	A
Gate emitter voltage		$V_{GE}$	$\pm 20$	V

### Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter saturation voltage	$V_{GE} = 15V, I_C = 40A$ $T_{vj} = 25^{\circ}C$ $V_{GE} = 15V, I_C = 40A$ $T_{vj} = 125^{\circ}C$ $V_{GE} = 15V, I_C = 40A$ $T_{vj} = 150^{\circ}C$	$V_{CESat}$		1.73 2.02 2.04	2.15	V
Gate-Emitter threshold voltage	$I_C = 1.5mA, V_{GE} = V_{CE}$ $T_{vj} = 25^{\circ}C$	$V_{GE(th)}$	5.00	5.60	6.20	
Gate charge	$V_{GE} = -15V \dots +15V$	$Q_G$		0.33		$\mu C$
Internal gate resistor		$R_{Gint}$		None		$\Omega$

Input capacitance	f=1MHz, V <sub>CE</sub> =25 V, V <sub>GE</sub> =0 V    T <sub>vj</sub> =25°C	C <sub>ies</sub>	2.72	nF
Reverse transfer capacitance		C <sub>res</sub>	0.14	
Collector-emitter cut-off current	V <sub>CE</sub> =1200V, V <sub>GE</sub> = 0 V    T <sub>vj</sub> =25°C	I <sub>CES</sub>	1	mA
Gate-emitter leakage current	V <sub>CE</sub> =0 V, V <sub>GE</sub> = 20 V    T <sub>vj</sub> =25°C	I <sub>GES</sub>	100	nA
Turn-on delay time	I <sub>C</sub> =40A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =20Ω (inductive load)	T <sub>vj</sub> =25°C	49	ns
		T <sub>vj</sub> =125°C	42	
		T <sub>vj</sub> =150°C	44	
Rise time	I <sub>C</sub> =40A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =20Ω (inductive load)	T <sub>vj</sub> =25°C	55	
		T <sub>vj</sub> =125°C	57	
		T <sub>vj</sub> =150°C	57	
Turn-off delay time	I <sub>C</sub> =40A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =20Ω (inductive load)	T <sub>vj</sub> =25°C	267	
		T <sub>vj</sub> =125°C	320	
		T <sub>vj</sub> =150°C	336	
Fall time	I <sub>C</sub> =40A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =20Ω (inductive load)	T <sub>vj</sub> =25°C	148	
		T <sub>vj</sub> =125°C	226	
		T <sub>vj</sub> =150°C	245	
Turn-on energy loss per pulse	I <sub>C</sub> =40A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =20Ω (inductive load)	T <sub>vj</sub> =25°C	3.47	mJ
		T <sub>vj</sub> =125°C	4.94	
		T <sub>vj</sub> =150°C	5.65	
Turn-off energy loss per pulse	I <sub>C</sub> =40A, V <sub>CE</sub> =600 V V <sub>GE</sub> =±15 V, R <sub>G</sub> =20Ω (inductive load)	T <sub>vj</sub> =25°C	2.07	
		T <sub>vj</sub> =125°C	2.92	
		T <sub>vj</sub> =150°C	3.17	
SC data	V <sub>GE</sub> ≤15V, V <sub>CC</sub> =800V V <sub>CEmax</sub> =V <sub>CES</sub> -L <sub>sCE</sub> ·di/dt    t <sub>p</sub> ≤8us, T <sub>vj</sub> =150°C	I <sub>sc</sub>	196	A
Temperature under switching conditions		T <sub>vj op</sub>	-40	150 °C

## Diode, Inverter

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T <sub>vj</sub> =25°C	V <sub>RRM</sub>	1200	V
Continuous DC forward current		I <sub>F</sub>	30	A
Repetitive peak forward current	t <sub>p</sub> =1ms	I <sub>FRM</sub>	60	A
I <sup>2</sup> t-value	t <sub>p</sub> =10ms, sin180° , T <sub>vj</sub> =125°C	I <sup>2</sup> t	1560	A <sup>2</sup> s

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=30A, V_{GE}=0V$ $T_{vj}=25^{\circ}C$	$V_F$		2.05	2.60	V
	$I_F=30A, V_{GE}=0V$ $T_{vj}=125^{\circ}C$			1.71		
	$I_F=30A, V_{GE}=0V$ $T_{vj}=150^{\circ}C$			1.61		
Peak reverse recovery current	$I_F=30A,$ $-di_F/dt=632A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$	$I_{RM}$		28		A
	$T_{vj}=125^{\circ}C$			43		
	$T_{vj}=150^{\circ}C$			47		
Recovered charge	$I_F=30A,$ $-di_F/dt=632A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$	$Q_F$		2.39		$\mu C$
	$T_{vj}=125^{\circ}C$			5.90		
	$T_{vj}=150^{\circ}C$			7.21		
Reverse recovered energy	$I_F=30A,$ $-di_F/dt=632A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$	$E_{rec}$		0.81		mJ
	$T_{vj}=125^{\circ}C$			1.99		
	$T_{vj}=150^{\circ}C$			2.42		
Temperature under switching conditions		$T_{vj\ op}$	-40		150	$^{\circ}C$

## Diode, Rectifier

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C$	$V_{RRM}$	1600	V
Non-Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C, I_{RRM}=5\mu A$	$V_{RSM}$	2000	V
Maximum Average Forward Current		$I_{F(AV)}$	30	A
Surge forward current	$t_p=10ms, \sin 180^{\circ}, T_{vj}=25^{\circ}C$	$I_{FSM}$	360	A
$I^2t$ -value	$t_p=10ms, \sin 180^{\circ}, T_{vj}=125^{\circ}C$	$I^2t$	648	$A^2s$

### Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=30A, T_j=25^{\circ}C$	$V_F$			1.2	V
Reverse current	$V_R=V_{RRM}$ $T_{vj}=25^{\circ}C$	$I_R$			5	$\mu A$
Temperature under switching conditions		$T_{vj\ op}$	-40		150	$^{\circ}C$

## IGBT, Brake-Chopper

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	$T_{vj}=25^{\circ}\text{C}$	$V_{CES}$	1200	V
Continuous DC collector current	$T_C=100^{\circ}\text{C}$ , $T_{vj\text{ max}}=175^{\circ}\text{C}$	$I_{C\text{ nom}}$	25	A
Repetitive peak collector current	$t_p=1\text{ ms}$	$I_{CRM}$	50	A
Gate emitter voltage		$V_{GE}$	$\pm 20$	V

### Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter saturation voltage	$V_{GE}=15\text{V}$ , $I_C=25\text{A}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=15\text{V}$ , $I_C=25\text{A}$ $T_{vj}=125^{\circ}\text{C}$ $V_{GE}=15\text{V}$ , $I_C=25\text{A}$ $T_{vj}=150^{\circ}\text{C}$	$V_{CE\text{ sat}}$		1.97 2.20 2.26	2.40	V
Gate-Emitter threshold voltage	$I_C=1\text{mA}$ , $V_{GE}=V_{CE}$ $T_{vj}=25^{\circ}\text{C}$	$V_{GE(\text{th})}$	5.10	5.70	6.30	
Gate charge	$V_{GE}=-15\text{V}\dots+15\text{V}$	$Q_G$		0.18		$\mu\text{C}$
Internal gate resistor		$R_{G\text{int}}$		None		$\Omega$
Input capacitance	$f=1\text{MHz}$ , $V_{CE}=25\text{V}$ , $V_{GE}=0\text{V}$ $T_{vj}=25^{\circ}\text{C}$	$C_{\text{ies}}$		1.65		nF
Reverse transfer capacitance		$C_{\text{res}}$		0.08		
Collector-emitter cut-off current	$V_{CE}=1200\text{V}$ , $V_{GE}=0\text{V}$ $T_{vj}=25^{\circ}\text{C}$	$I_{CES}$			1	mA
Gate-emitter leakage current	$V_{CE}=0\text{V}$ , $V_{GE}=20\text{V}$ $T_{vj}=25^{\circ}\text{C}$	$I_{GES}$			100	nA
Turn-on delay time	$I_C=25\text{A}$ , $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$ , $R_G=68\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	$t_{d\text{ on}}$		112 97 96		ns
Rise time	$I_C=25\text{A}$ , $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$ , $R_G=68\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	$t_r$		96 102 105		
Turn-off delay time	$I_C=25\text{A}$ , $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$ , $R_G=68\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	$t_{d\text{ off}}$		422 460 470		
Fall time	$I_C=25\text{A}$ , $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$ , $R_G=68\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	$t_f$		187 262 282		
Turn-on energy loss per pulse	$I_C=25\text{A}$ , $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$ , $R_G=68\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	$E_{\text{on}}$		3.75 4.67 5.02		mJ

Turn-off energy loss per pulse	$I_C=25A, V_{CE}=600V$	$T_{vj}=25^{\circ}C$	$E_{off}$		1.83		
	$V_{GE}=\pm 15V, R_G=68\Omega$	$T_{vj}=125^{\circ}C$			2.28		
	(inductive load)	$T_{vj}=150^{\circ}C$			2.45		
Temperature under switching conditions			$T_{vj op}$	-40		150	$^{\circ}C$

## Diode, Brake-Chopper

### Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C$	$V_{RRM}$	1200	V
Continuous DC forward current		$I_F$	15	A
Repetitive peak forward current	$t_p=1ms$	$I_{FRM}$	30	A
$I^2t$ -value	$t_p=10ms, \sin 180^{\circ}, T_{vj}=125^{\circ}C$	$I^2t$	120	$A^2s$

### Characteristic Values

Parameter	Conditions	Symbol	Value			Unit	
			Min.	Typ.	Max.		
Forward voltage	$I_F=15A, V_{GE}=0V$	$T_{vj}=25^{\circ}C$	$V_F$		2.32	2.70	V
	$I_F=15A, V_{GE}=0V$	$T_{vj}=125^{\circ}C$			1.80		
	$I_F=15A, V_{GE}=0V$	$T_{vj}=150^{\circ}C$			1.69		
Peak reverse recovery current	$I_F=15A,$	$T_{vj}=25^{\circ}C$	$I_{RM}$		8		A
	$-di_F/dt=189A/\mu s(T_{vj}=150^{\circ}C)$	$T_{vj}=125^{\circ}C$			12		
	$V_R=600V, V_{GE}=-15V$	$T_{vj}=150^{\circ}C$			14		
Recovered charge	$I_F=15A,$	$T_{vj}=25^{\circ}C$	$Q_F$		1.25		$\mu C$
	$-di_F/dt=189A/\mu s(T_{vj}=150^{\circ}C)$	$T_{vj}=125^{\circ}C$			2.75		
	$V_R=600V, V_{GE}=-15V$	$T_{vj}=150^{\circ}C$			3.58		
Reverse recovered energy	$I_F=15A,$	$T_{vj}=25^{\circ}C$	$E_{rec}$		0.40		mJ
	$-di_F/dt=189A/\mu s(T_{vj}=150^{\circ}C)$	$T_{vj}=125^{\circ}C$			0.90		
	$V_R=600V, V_{GE}=-15V$	$T_{vj}=150^{\circ}C$			1.21		
Temperature under switching conditions			$T_{vj op}$	-40		150	$^{\circ}C$

## NTC-Thermistor

### Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Rated resistances	$T_e=25^{\circ}\text{C}, \pm 5\%$	$R_{25}$		5.0		$\text{K}\Omega$
B-value	$\pm 2\%$	$B_{25/50}$		3375		K

## Module

Parameter	Conditions	Symbol	Value			Unit
Isolation test voltage	RMS, $f=50\text{Hz}, t=1\text{min}$	$V_{\text{ISOL}}$	2500			V
Internal isolation			$\text{Al}_2\text{O}_3$			
Storage temperature		$T_{\text{stg}}$	-40		125	$^{\circ}\text{C}$
Mounting torque for modul mounting		M	3.0		6.0	Nm
Weight		W		42		g

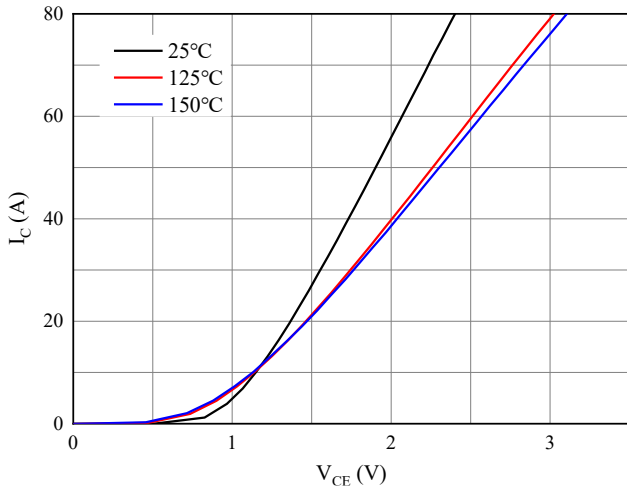


Fig 1. Typical output characteristics ( $V_{GE}=15V$ )

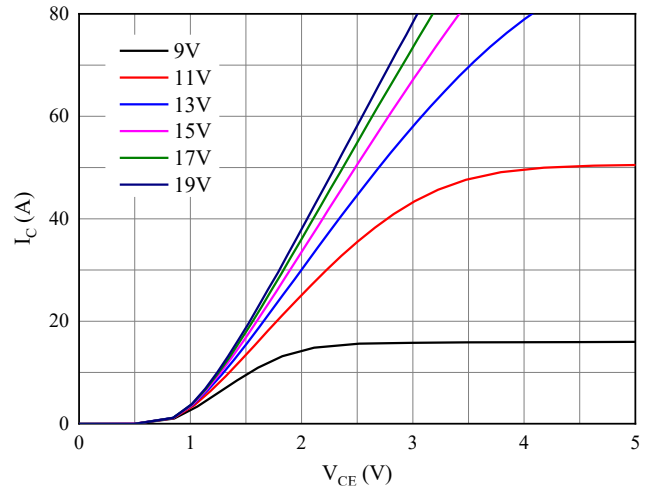


Fig 2. Typical output characteristics ( $T_{vj}=150^{\circ}C$ )

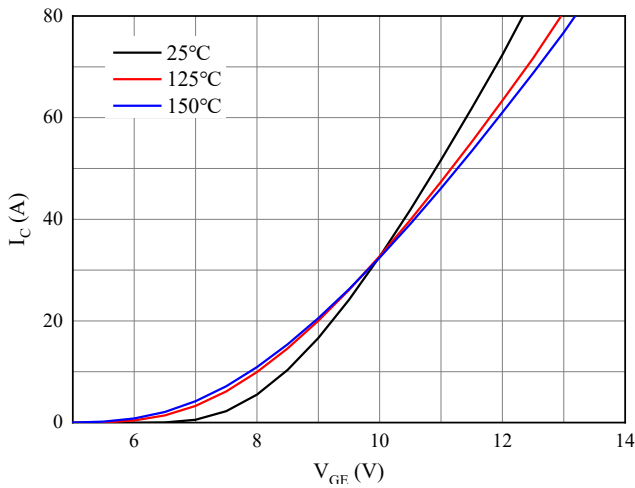


Fig 3. Typical transfer characteristic ( $V_{CE}=20V$ )

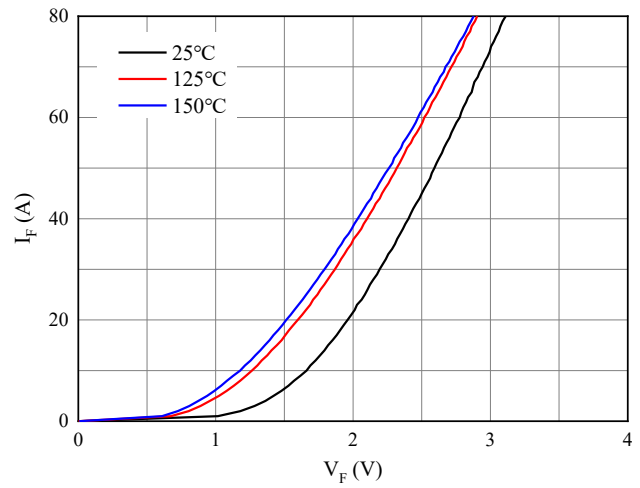


Fig 4. Forward characteristic of Diode

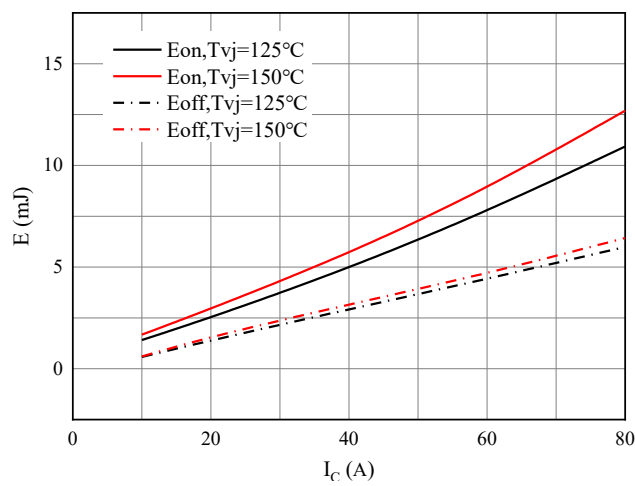


Fig 5. Switching losses of IGBT  
 $V_{GE}=\pm 15V, R_{Gon}=20\Omega, R_{Goff}=20\Omega, V_{CE}=600V$

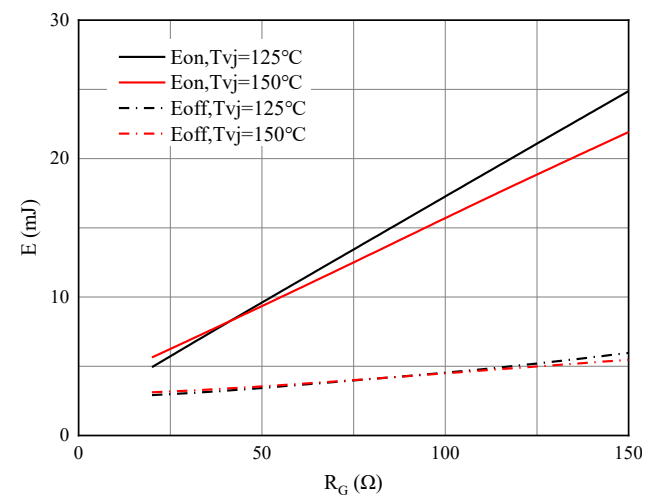


Fig 6. Switching losses of IGBT  
 $V_{GE}=\pm 15V, I_C=40A, V_{CE}=600V$

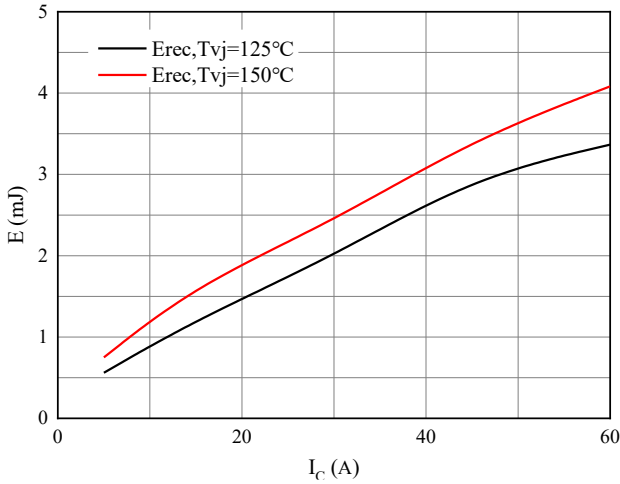


Fig 7. Switching losses of Diode

$R_{Gon}=68\Omega, V_{CE}=600V$

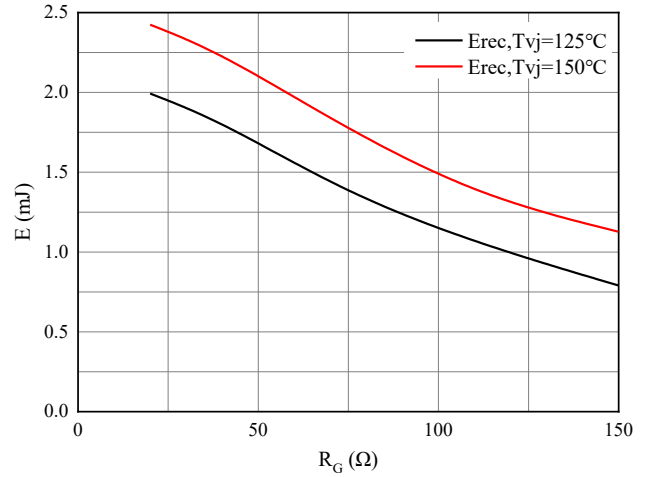


Fig 8. Switching losses of Diode

$I_F=30A, V_{CE}=600V$

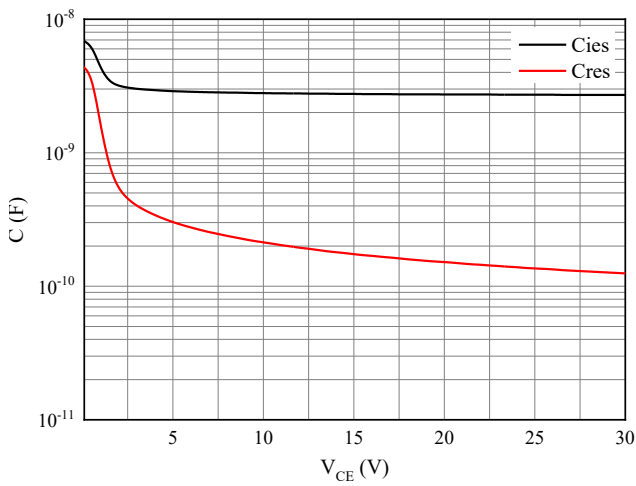


Fig 9. Capacitance characteristic

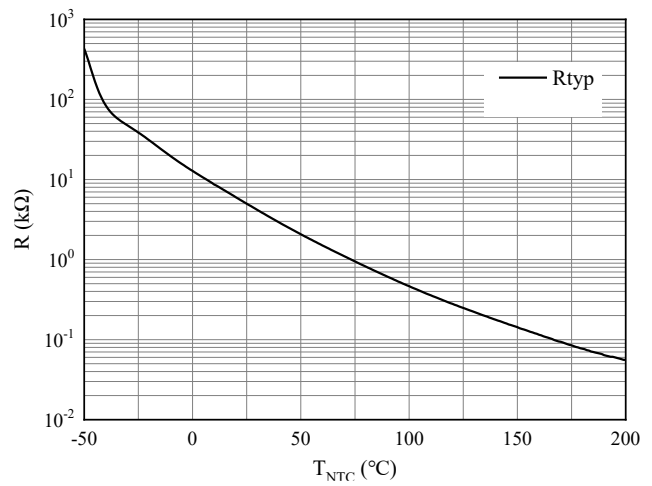
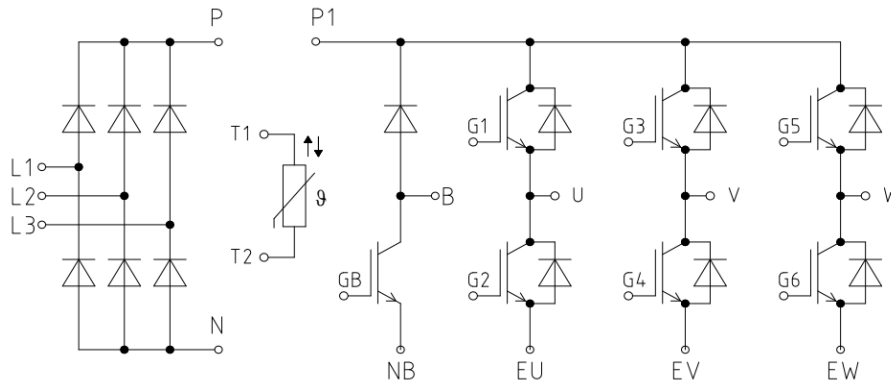


Fig 10. NTC-Themistor-temperature characteristic



**Circuit diagram**



**Package outlines**

