

PIM IGBT Module

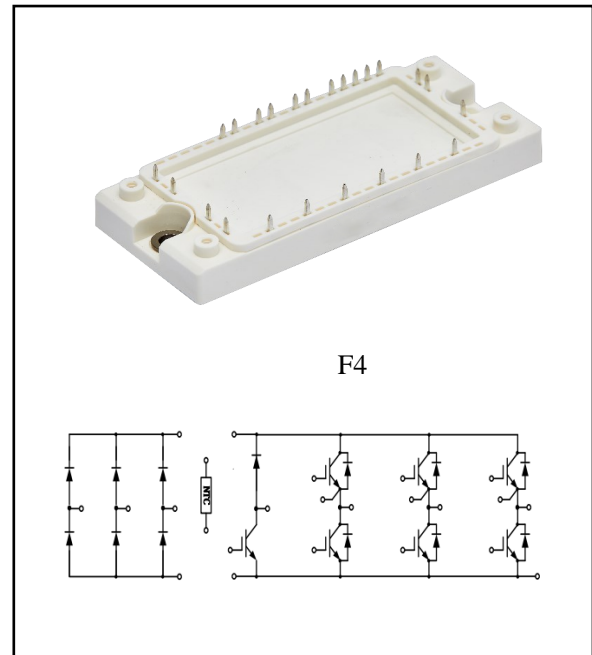
$V_{CES}=1200V$, $I_{C\ nom}=40A$ / $I_{CRM}=80A$

Electrical characteristics :

- 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
Total power dissipation	$T_C = 25^{\circ}C$, $T_{vj\ max} = 175^{\circ}C$	P_{tot}	250	W
Gate emitter voltage		V_{GE}	± 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_{CEsat}	1.71	2.0	V	
	$V_{GE}=15V$, $I_C=40A$	$T_{vj}=125^{\circ}C$		2.02			
	$V_{GE}=15V$, $I_C=40A$	$T_{vj}=150^{\circ}C$		2.09			
Gate-Emitter threshold voltage	$I_C=1.5mA$, $V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}C$	$V_{GE(th)}$	5.0	5.6	6.2	

Internal gate resistor		R_{Gint}		None		Ω
Input capacitance	$f=1\text{MHz}, V_{CE}=25\text{V}, V_{GE}=0\text{V}$ $T_{vj}=25^{\circ}\text{C}$	C_{ies}		2.71		nF
Reverse transfer capacitance		C_{res}		0.13		
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	$I_C=40\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=30\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_{don}		72	
					68	
					61	
Rise time	$I_C=40\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=30\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_r		58	ns
					60	
					67	
Turn-off delay time	$I_C=40\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=30\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_{doff}		356	
					397	
					404	
Fall time	$I_C=40\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=30\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_f		196	
					245	
					252	
Turn-on energy loss per pulse	$I_C=40\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=30\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	E_{on}		4.33	mJ
					5.97	
					6.27	
Turn-off energy loss per pulse	$I_C=40\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=30\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	E_{off}		2.65	
					3.67	
					3.71	
SC data	$V_{GE}\leq 15\text{V}, V_{cc}=800\text{V}$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$ $t_p\leq 8\mu\text{s}, T_{vj}=150^{\circ}\text{C}$	I_{SC}		208		A
Thermal resistance, junction to case	per IGBT	R_{thJC}			0.60	K/W
Temperature under switching conditions		$T_{vj\text{op}}$	-40		150	$^{\circ}\text{C}$

Diode, Inverter

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	$T_{vj}=25^{\circ}\text{C}$	V_{RRM}	1200	V
Continuous DC forward current		I_F	30	A
Repetitive peak forward current	$t_p=1\text{ms}$	I_{FRM}	60	A
I^2t -value	$t_p=10\text{ms}, \sin 180^{\circ}, T_j=125^{\circ}\text{C}$	I^2t	365	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=30A, V_{GE}=0V$ $T_{vj}=25^{\circ}C$	V_F		2.03	2.55	V
	$I_F=30A, V_{GE}=0V$ $T_{vj}=125^{\circ}C$			1.67		
	$I_F=30A, V_{GE}=0V$ $T_{vj}=150^{\circ}C$			1.59		
Peak reverse recovery current	$I_F=30A,$ $-di_F/dt=480A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	I_{RM}		18		A
	$T_{vj}=25^{\circ}C$			29		
	$T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$			31		
Recovered charge	$I_F=30A,$ $-di_F/dt=480A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	Q_r		2.25		μC
	$T_{vj}=25^{\circ}C$			5.43		
	$T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$			6.34		
Reverse recovered energy	$I_F=30A,$ $-di_F/dt=480A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	E_{rec}		0.68		mJ
	$T_{vj}=25^{\circ}C$			1.69		
	$T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$			2.00		
Thermal resistance, junction to case	per diode	R_{thJC}			0.95	K/W
Temperature under switching conditions		$T_{vj op}$	-40		150	$^{\circ}C$

Diode, Rectifier

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C, I_{RRM}=0.05mA$	V_{RRM}	1600	V
Non-Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C, I_{RRM}=0.05mA$	V_{RSM}	1800	V
Maximum Average Forward Current	$T_S=80^{\circ}C, T_{vj}=25^{\circ}C$	$I_{F(AV)}$	35	A
Surge forward current	$t_p=10ms, \sin 180^{\circ}, T_{vj}=25^{\circ}C$	I_{FSM}	420	A
I^2t -value	$t_p=10ms, \sin 180^{\circ}, T_{vj}=25^{\circ}C$	I^2t	880	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=5A, T_{vj}=25^{\circ}C$	V_F		0.9	1	V
Reverse current	$V_R=V_{RRM}$ $T_{vj}=25^{\circ}C$	I_R			50	μA
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
Total power dissipation	$T_C = 25^{\circ}\text{C}$, $T_{vj\text{ max}} = 175^{\circ}\text{C}$	P_{tot}	125	W
Gate emitter voltage		V_{GE}	± 20	V

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter saturation voltage	$V_{GE}=15\text{V}$, $I_C=25\text{A}$ $V_{GE}=15\text{V}$, $I_C=25\text{A}$ $V_{GE}=15\text{V}$, $I_C=25\text{A}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$V_{CE\text{ sat}}$	2.16 2.69 2.82	2.5	V
Gate-Emitter threshold voltage	$I_C=1\text{mA}$, $V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}\text{C}$	$V_{GE(\text{th})}$	5.2	5.75	6.4
Internal gate resistor			$R_{G\text{ int}}$	None		Ω
Input capacitance	$f=1\text{ MHz}$, $V_{CE}=25\text{ V}$, $V_{GE}=0\text{ V}$	$T_{vj}=25^{\circ}\text{C}$	$C_{\text{ ies}}$	1.46		nF
Reverse transfer capacitance			$C_{\text{ res}}$	0.06		
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	$I_C=25\text{A}$, $V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$, $R_G=75\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{d\text{ on}}$	106 95 93		ns
Rise time	$I_C=25\text{A}$, $V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$, $R_G=75\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_r	54 54 53		
Turn-off delay time	$I_C=25\text{A}$, $V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$, $R_G=75\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{d\text{ off}}$	285 325 328		
Fall time	$I_C=25\text{A}$, $V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$, $R_G=75\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_f	214 281 272		

Turn-on energy loss per pulse	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=75\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{on}		2.26 3.02 3.37		mJ
Turn-off energy loss per pulse	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=75\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{off}		1.56 2.02 2.19		
Thermal resistance, junction to case	per IGBT		R_{thJC}			1.20	K/W
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	8	A
Repetitive peak forward current	$t_p=1ms$	I_{FRM}	16	A
I^2t -value	$V_R=0V, t_p=10ms, T_{vj}=125^\circ C$	I^2t	32	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=8A, V_{GE}=0V$ $I_F=8A, V_{GE}=0V$ $I_F=8A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	V_F	1.98 1.68 1.61	2.6	V
Peak reverse recovery current	$I_F=8A,$ $-di_F/dt=322A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	I_{RM}	7 9 10		A
Recovered charge	$I_F=8A,$ $-di_F/dt=322A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	Q_r	0.67 1.42 1.73		μC
Reverse recovered energy	$I_F=8A,$ $-di_F/dt=322A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{rec}	0.20 0.44 0.57		mJ
Thermal resistance, junction to case	per diode		R_{thJC}		2.30	K/W

Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C
--	--	--------------	-----	--	-----	----

NTC-Thermistor

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Rated resistances	$T_c=25^\circ\text{C}, \pm 5\%$	R_{25}		5.0		$\text{K}\Omega$
B-value	$\pm 1\%$	$B_{25/50}$		3380		K

Module

Parameter	Conditions	Symbol	Value			Unit
Isolation test voltage	RMS, $f=50\text{Hz}$, $t=1\text{min}$	V_{ISOL}	2500			V
Internal isolation			Al_2O_3			
Storage temperature		T_{stg}	-40		125	°C
Mounting torque for modul mounting		M	3.0		6.0	Nm
Weight		W		170		g

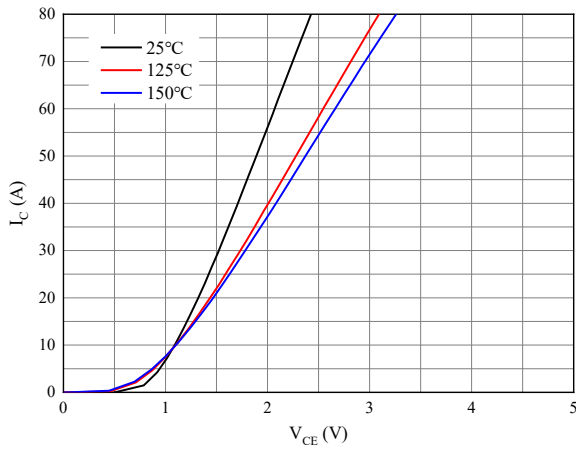


Fig 1. Typical output characteristics ($V_{GE}=15V$)

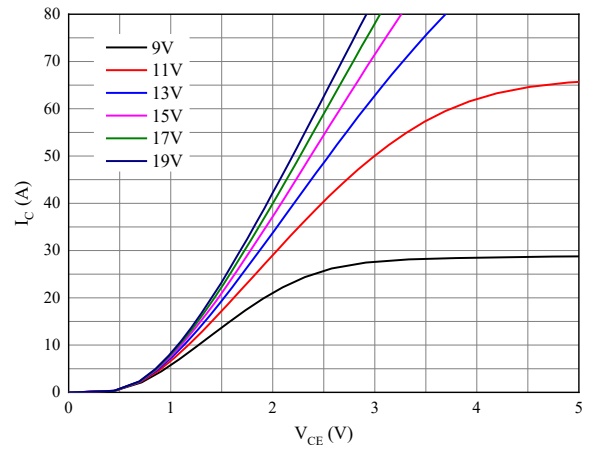


Fig 2. Typical output characteristics ($T_{vj}=150^{\circ}C$)

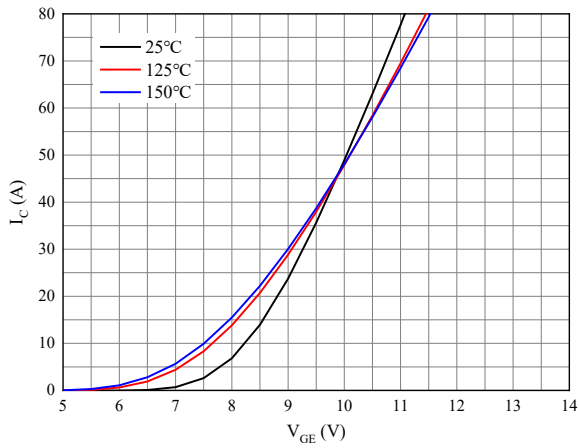


Fig 3. Typical transfer characteristic ($V_{CE}=20V$)

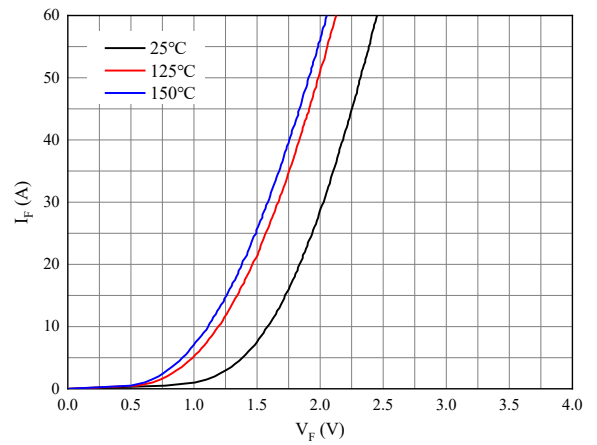


Fig 4. Forward characteristic of Diode

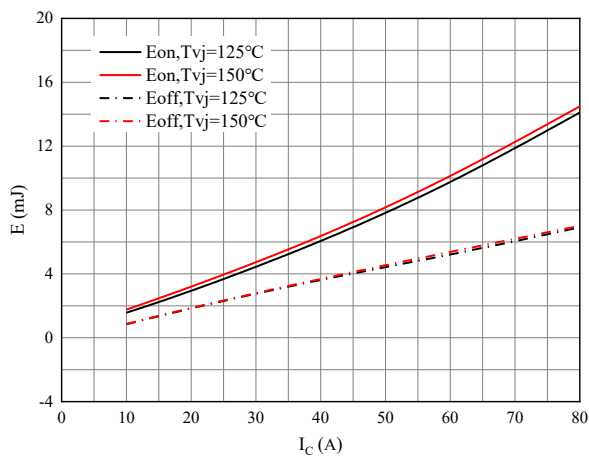


Fig 5. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $R_{Gon}=30\Omega$, $R_{Goff}=30\Omega$, $V_{CE}=600V$

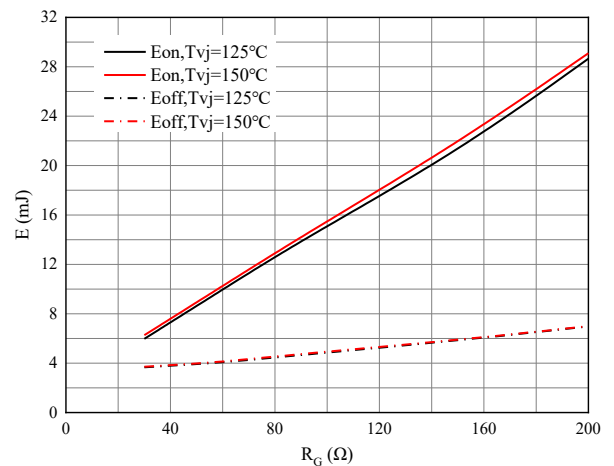


Fig 6. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $I_C=40A$, $V_{CE}=600V$

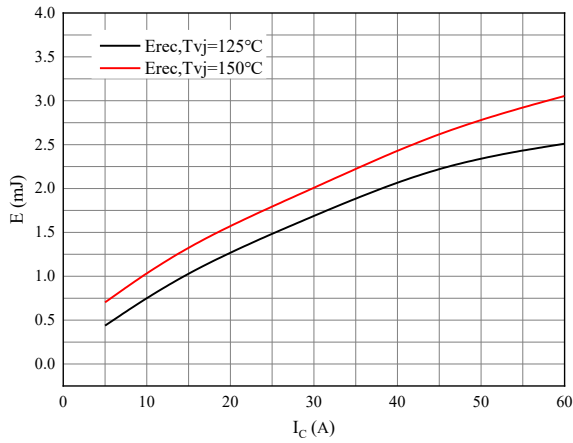


Fig 7. Switching losses of Diode
 $R_{Gon}=30\Omega, V_{CE}=600V$

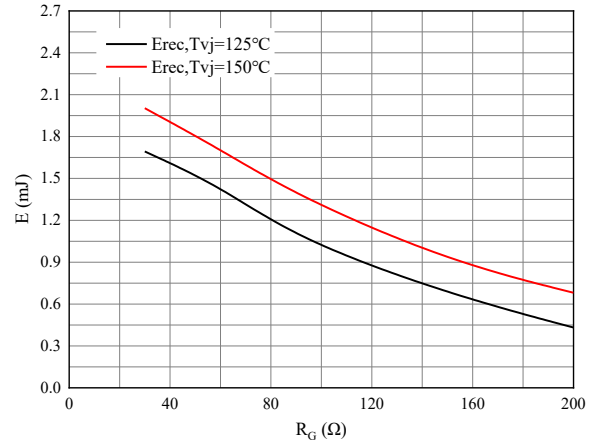


Fig 8. Switching losses of Diode
 $IF=30A, V_{CE}=600V$

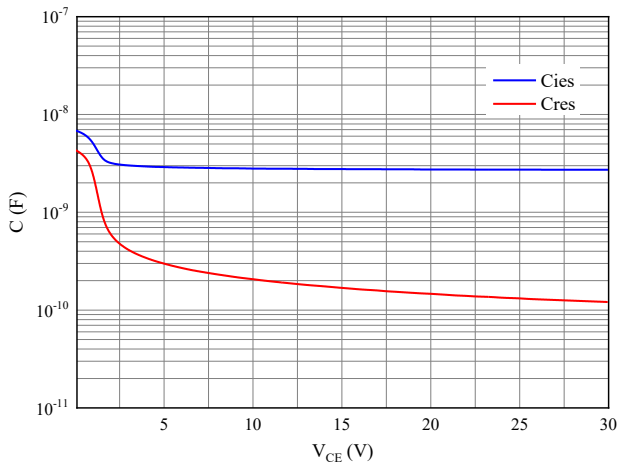


Fig 9. Capacitance characteristic

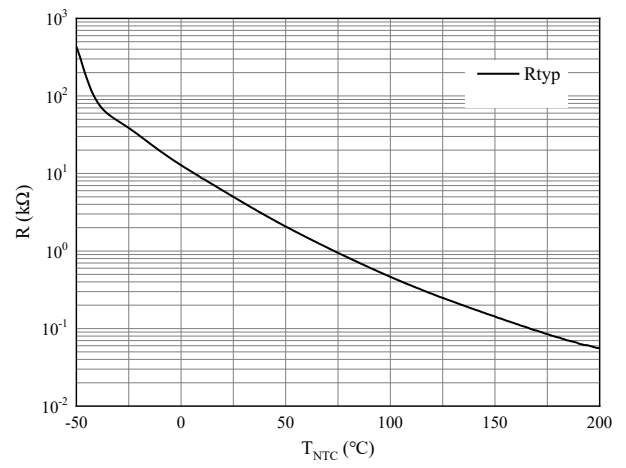
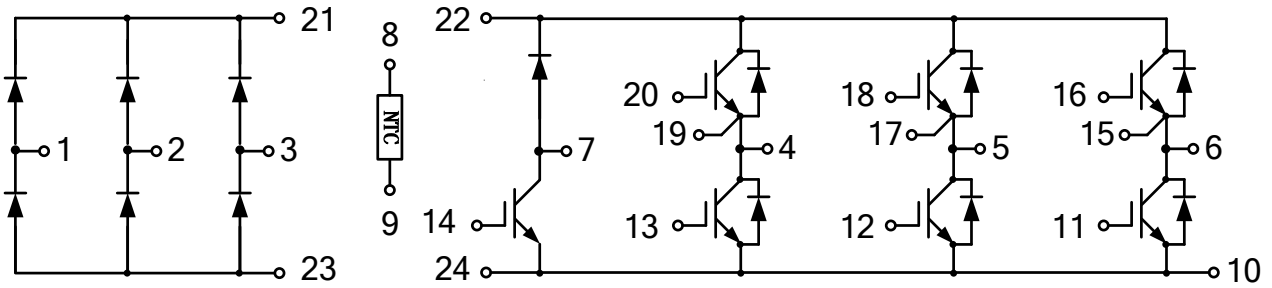


Fig 10. NTC-Themistor-temperature characteristic

Circuit diagram



Package outlines

