

PIM IGBT Module

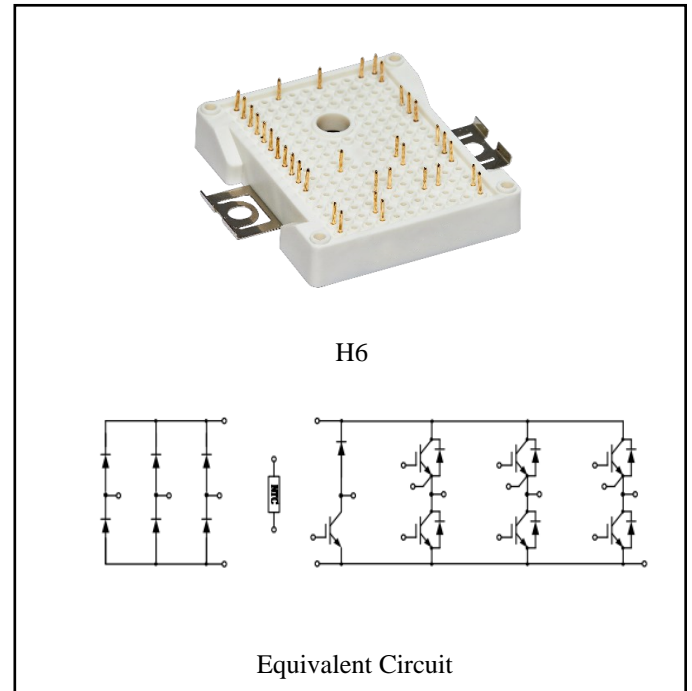
$V_{CES} = 1200V$, $I_{C\ nom} = 25A / I_{CRM} = 50A$

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	$T_C = 100^{\circ}C, T_{vj\ max} = 175^{\circ}C$	$I_{C\ nom}$	25	A
Repetitive peak collector current	$t_p = 1\ ms$	I_{CRM}	50	A
Total power dissipation	$T_C = 25^{\circ}C, T_{vj\ max} = 175^{\circ}C$	P_{tot}	175	W
Gate emitter voltage		V_{GE}	± 20	V

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter saturation voltage	$V_{GE} = 15V, I_C = 25A$	V_{CEsat}		1.65	2.00	V
	$V_{GE} = 15V, I_C = 25A$			1.95		
	$V_{GE} = 15V, I_C = 25A$			2.00		
Gate-Emitter threshold voltage	$I_C = 0.8mA, V_{GE} = V_{CE}$	$V_{GE(th)}$	5.2	5.85	6.4	

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}		1.67		nF
Reverse transfer capacitance		C_{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	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_{don}		63	
					58	
					54	
Rise time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_r		48	ns
					55	
					56	
Turn-off delay time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_{doff}		314	
					351	
					362	
Fall time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_f		191	
					301	
					313	
Turn-on energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	E_{on}		2.88	mJ
					4.44	
					4.74	
Turn-off energy loss per pulse	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	E_{off}		1.66	
					2.14	
					2.31	
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}		117		A
Thermal resistance, junction to case	per IGBT	R_{thJC}			0.85	K/W
Temperature under switching conditions		$T_{vj op}$	-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	25	A
Repetitive peak forward current	$t_p=1\text{ms}$	I_{FRM}	50	A
I^2t -value	$t_p=10\text{ms}, \sin 180^{\circ}, T_j=125^{\circ}\text{C}$	I^2t	500	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=25A, V_{GE}=0V$ $T_{vj}=25^{\circ}C$	V_F		1.77	2.3	V
	$I_F=25A, V_{GE}=0V$ $T_{vj}=125^{\circ}C$			1.48		
	$I_F=25A, V_{GE}=0V$ $T_{vj}=150^{\circ}C$			1.41		
Peak reverse recovery current	$I_F=25A,$ $-di_F/dt=333A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$	I_{RM}		15		A
	$T_{vj}=125^{\circ}C$			24		
	$T_{vj}=150^{\circ}C$			26		
Recovered charge	$I_F=25A,$ $-di_F/dt=333A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$	Q_F		1.97		μC
	$T_{vj}=125^{\circ}C$			5.28		
	$T_{vj}=150^{\circ}C$			6.32		
Reverse recovered energy	$I_F=25A,$ $-di_F/dt=333A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$ $T_{vj}=25^{\circ}C$	E_{rec}		0.64		mJ
	$T_{vj}=125^{\circ}C$			1.75		
	$T_{vj}=150^{\circ}C$			2.12		
Thermal resistance, junction to case	per diode	R_{thJC}			1.20	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	$T_{vj}=25^{\circ}C$	V_{RRM}	1600	V
Non-Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C$	V_{RSM}	1800	V
Maximum Average Forward Current		$I_{F(AV)}$	25	A
Surge forward current	$t_p=10ms, \sin 180^{\circ}, T_{vj}=25^{\circ}C$	I_{FSM}	320	A
I^2t -value	$t_p=10ms, \sin 180^{\circ}, T_{vj}=125^{\circ}C$	I^2t	850	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=25A, T_{vj}=25^{\circ}C$	V_F			1.1	V
Reverse current	$V_R=V_{RRM}$ $T_{vj}=25^{\circ}C$	I_R			5	μA

Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C
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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	$T_C=100^{\circ}\text{C}, T_{vj\ max}=175^{\circ}\text{C}$	$I_{C\ nom}$	25	A
Repetitive peak collector current	$t_p=1\ ms$	I_{CRM}	50	A
Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\ max} = 175^{\circ}\text{C}$	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_{CESat}	1.80 2.08 2.15	2.20	V
Gate-Emitter threshold voltage	$I_C=1\text{mA}, V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}\text{C}$	$V_{GE(th)}$	5.2	5.85 6.4	
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}	1.66		nF
Reverse transfer capacitance			C_{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	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{d\ on}$	65 60 56		ns
Rise time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_r	87 90 92		
Turn-off delay time	$I_C=25\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{d\ off}$	301 350 355		

Fall time	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	t_f		231 302 290		
Turn-on energy loss per pulse	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{on}		2.34 2.73 2.90		mJ
Turn-off energy loss per pulse	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{off}		1.66 2.16 2.30		
Thermal resistance, junction to case	per IGBT		R_{thJC}			1.2	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	30	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		2.03 1.70 1.63	2.50 V
Peak reverse recovery current	$I_F=8A,$ $-di_F/dt=217A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	I_{RM}		8 10 11	A
Recovered charge	$I_F=8A,$ $-di_F/dt=217A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	Q_f		0.74 1.33 1.61	μC
Reverse recovered energy	$I_F=8A,$ $-di_F/dt=217A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{rec}		0.27 0.45 0.56	mJ

Thermal resistance, junction to case	per diode	R_{thJC}			1.90	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		K Ω
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

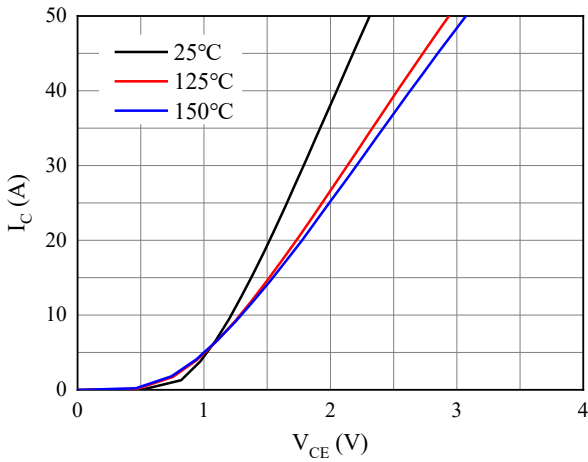


Fig 1. Typical output characteristics ($V_{GE}=15V$)

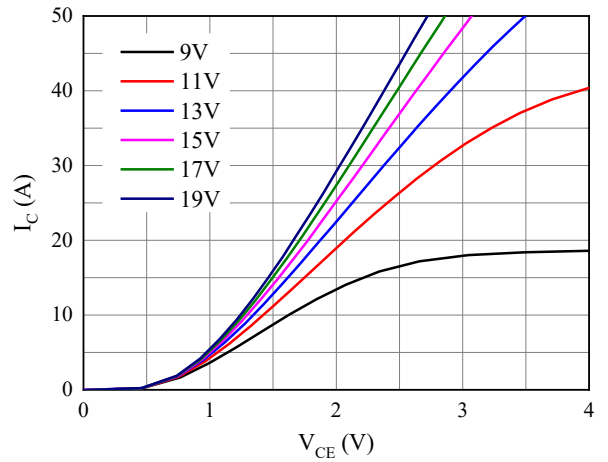


Fig 2. Typical output characteristics ($T_{vj}=150^{\circ}C$)

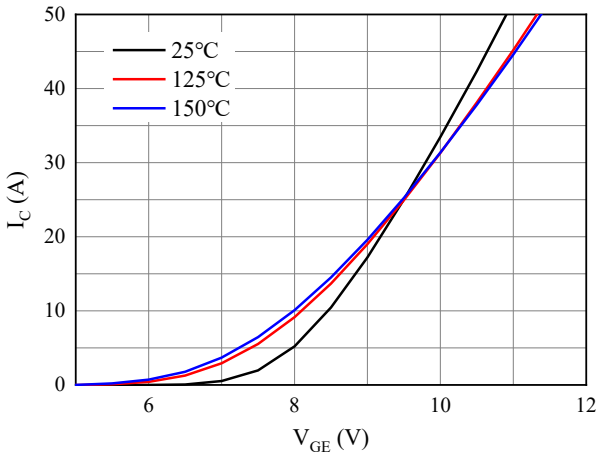


Fig 3. Typical transfer characteristic($V_{CE}=20V$)

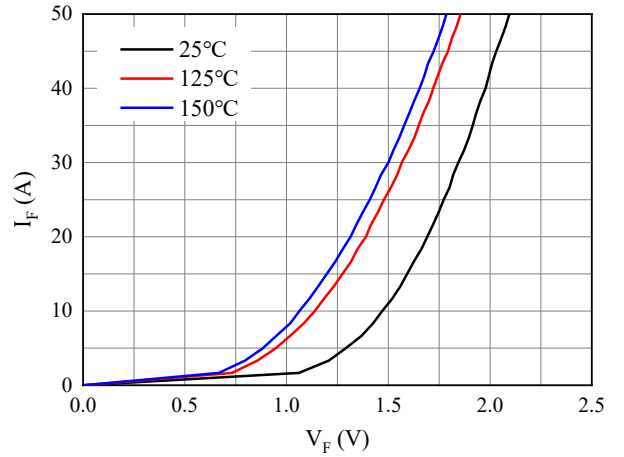


Fig 4. Forward characteristic of Diode

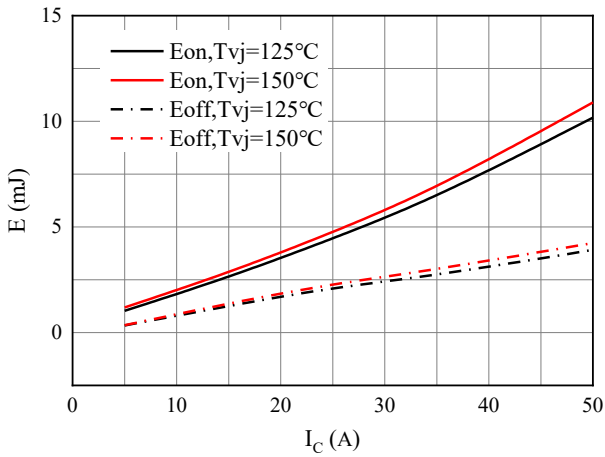


Fig 5. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $R_{Gon}=40\Omega$, $R_{Goff}=40\Omega$, $V_{CE}=600V$

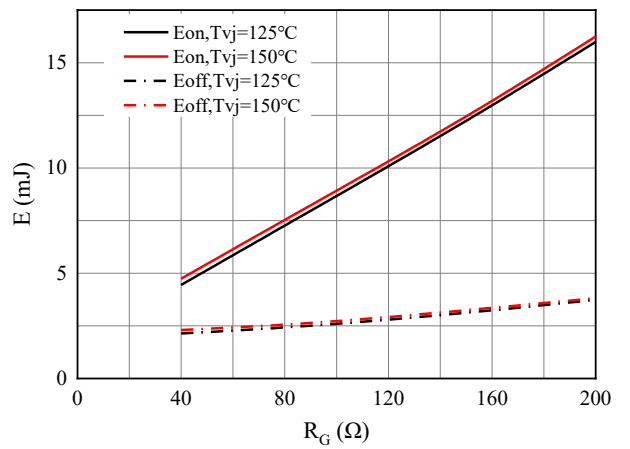


Fig 6. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $I_C=25A$, $V_{CE}=600V$

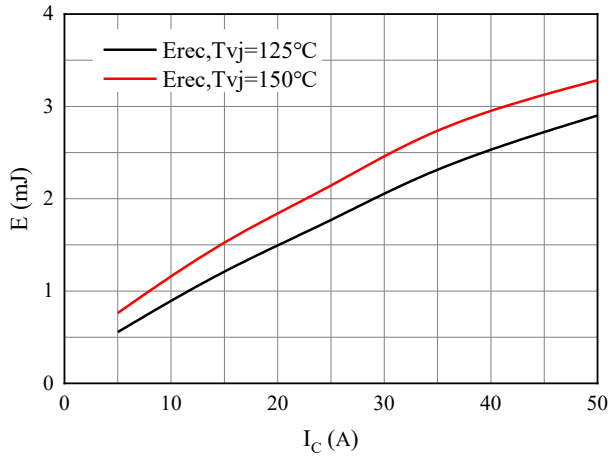


Fig 7. Switching losses of Diode
 $R_{Gon}=40\Omega$, $V_{CE}=600\text{V}$

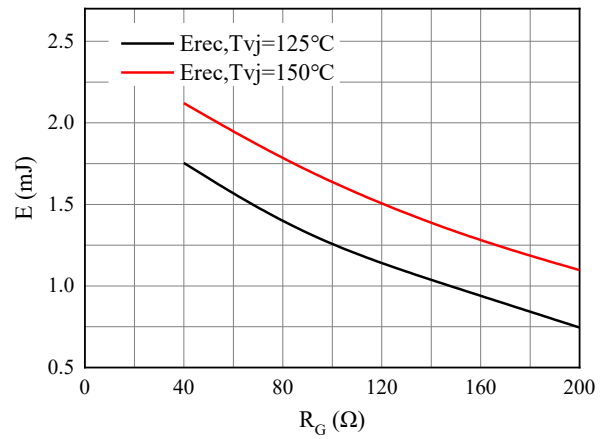


Fig 8. Switching losses of Diode
 $I_F=25\text{A}$, $V_{CE}=600\text{V}$

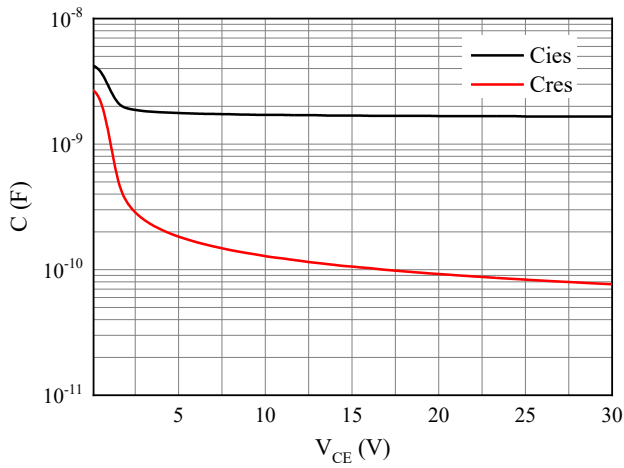


Fig 9. Capacitance characteristic

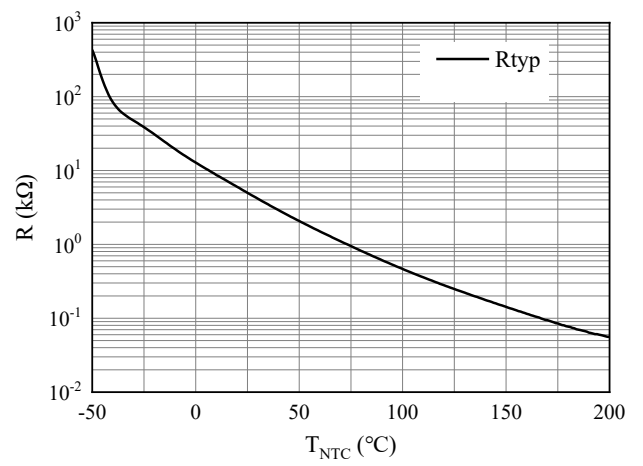
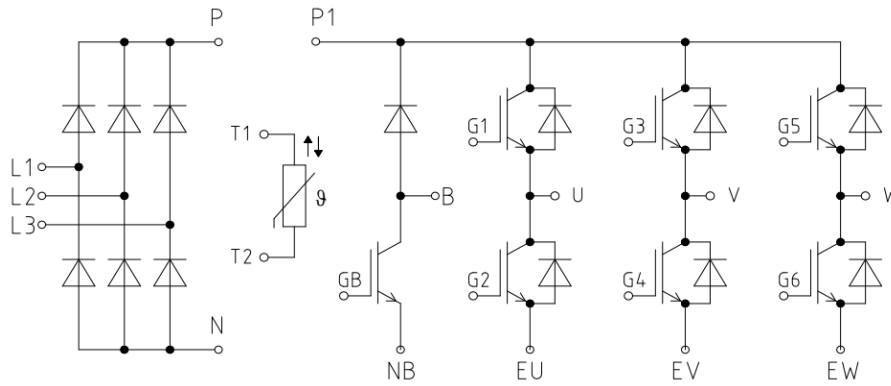


Fig 10. NTC-Themistor-temperature characteristic

Circuit diagram



Package outlines

