

PIM IGBT Module

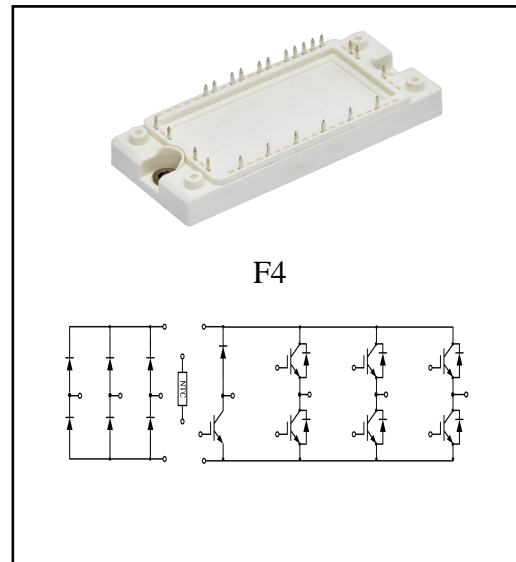
$V_{CES}=1200V$, $I_{C\ nom}=50A / I_{CRM}=100A$

Electrical characteristics :

- 1200V trench gate/field termination 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	$T_C=100^{\circ}C, T_{vj\ max}=175^{\circ}C$	$I_{C\ nom}$	50	A
Repetitive peak collector current	$t_p=1\ ms$	I_{CRM}	100	A
Total power dissipation	$T_C = 25^{\circ}C, T_{vj\ max} = 175^{\circ}C$	P_{tot}	280	W
Gate emitter voltage		V_{GE}	± 20	V

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter saturation voltage	$V_{GE}=15V, I_C=50A$	$T_{vj}=25^{\circ}C$	V_{CESat}	2.15	2.59	V
	$V_{GE}=15V, I_C=50A$	$T_{vj}=125^{\circ}C$		2.55		
	$V_{GE}=15V, I_C=50A$	$T_{vj}=150^{\circ}C$		2.64		
Gate-Emitter threshold voltage	$I_C=1.7mA, V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}C$	$V_{GE(th)}$	5.20	5.90	6.40

Internal gate resistor		R_{Gint}		2.82		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}		2.96		nF
Reverse transfer capacitance		C_{res}		0.12		
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	$I_C=50\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=15\Omega$ (inductive load)	$T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	t_{don}		54	
					52	
					52	
Rise time	$I_C=50\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=15\Omega$ (inductive load)	$T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	t_r		29	ns
					30	
					31	
Turn-off delay time	$I_C=50\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=15\Omega$ (inductive load)	$T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	t_{doff}		190	
					229	
					239	
Fall time	$I_C=50\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=15\Omega$ (inductive load)	$T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	t_f		146	
					187	
					206	
Turn-on energy loss per pulse	$I_C=50\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=15\Omega,$ $di/dt=1250\text{A}/\mu\text{s} (T_{vj}=150^\circ\text{C})$ (inductive load)	$T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	E_{on}		3.51	mJ
					5.50	
					6.06	
Turn-off energy loss per pulse	$I_C=50\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=15\Omega,$ $du/dt=5600\text{V}/\mu\text{s} (T_{vj}=150^\circ\text{C})$ (inductive load)	$T_{vj}=25^\circ\text{C}$ $T_{vj}=125^\circ\text{C}$ $T_{vj}=150^\circ\text{C}$	E_{off}		2.48	
					3.28	
					3.50	
SC data	$V_{GE}\leq 15\text{V}, V_{CC}=800\text{V}$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt \quad t_p\leq 10\mu\text{s}, T_{vj}=150^\circ\text{C}$	I_{SC}		190		A
Temperature under switching conditions		T_{vjop}	-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	50	A
Repetitive peak forward current	$t_p=1\text{ms}$	I_{FRM}	100	A

I ² t-value	t _p =10ms, sin180° , T _{vj} =125°C	I ² t	1100	A ² s
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Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	I _F =50A, V _{GE} =0V	T _{vj} =25°C		2.17	2.60	V
	I _F =50A, V _{GE} =0V	T _{vj} =125°C		1.80		
	I _F =50A, V _{GE} =0V	T _{vj} =150°C		1.72		
Peak reverse recovery current	I _F =50A,	T _{vj} =25°C		27		A
	-di _F /dt=1300A/μs(T _{vj} =150°C)	T _{vj} =125°C		45		
	V _R =600V, V _{GE} =-15V	T _{vj} =150°C		50		
Recovered charge	I _F =50A,	T _{vj} =25°C		2.16		μC
	-di _F /dt=1300A/μs(T _{vj} =150°C)	T _{vj} =125°C		5.83		
	V _R =600V, V _{GE} =-15V	T _{vj} =150°C		7.31		
Reverse recovered energy	I _F =50A,	T _{vj} =25°C		0.59		mJ
	-di _F /dt=1300A/μs(T _{vj} =150°C)	T _{vj} =125°C		1.64		
	V _R =600V, V _{GE} =-15V	T _{vj} =150°C		2.12		
Temperature under switching conditions		T _{vj op}	-40		150	°C

Diode, Rectifier

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T _{vj} =25°C, I _{RRM} =0.05mA	V _{RRM}	1600	V
Non-Repetitive peak reverse voltage	T _{vj} =25°C, I _{RRM} =0.05mA	V _{RSM}	2000	V
Maximum Average Forward Current	T _S =80°C, T _{vj} =25°C	I _{F(AV)}	25	A
Surge forward current	t _p =10ms, sin180° , T _{vj} =25°C	I _{FSM}	320	A
I ² t-value	t _p =10ms, sin180° , T _{vj} =25°C	I ² t	512	A ² s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	I _F =25A, T _{vj} =25°C	V _F		1.00	1.20	V
Reverse current	V _R =V _{RRM} T _{vj} =25°C	I _R			50	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
Gate emitter voltage		V_{GE}	± 20	V

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter saturation voltage	$V_{GE}=15\text{V}$, $I_C=25\text{A}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=15\text{V}$, $I_C=25\text{A}$ $T_{vj}=125^{\circ}\text{C}$ $V_{GE}=15\text{V}$, $I_C=25\text{A}$ $T_{vj}=150^{\circ}\text{C}$	V_{CEsat}		1.81 2.11 2.20	2.20	V
Gate-Emitter threshold voltage	$I_C=0.85\text{mA}$, $V_{GE}=V_{CE}$ $T_{vj}=25^{\circ}\text{C}$	$V_{GE(th)}$	5.30	5.85	6.40	
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	$I_C=25\text{A}$, $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	t_{don}		72 60 58		ns
Rise time	$I_C=25\text{A}$, $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	t_r		57 62 63		
Turn-off delay time	$I_C=25\text{A}$, $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	t_{doff}		283 324 335		
Fall time	$I_C=25\text{A}$, $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	t_f		171 238 250		

Turn-on energy loss per pulse	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ $di/dt=370A/\mu s (T_{vj}=150^\circ C)$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{on}		2.66 3.55 3.89		mJ
Turn-off energy loss per pulse	$I_C=25A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ $du/dt=4800V/\mu s (T_{vj}=150^\circ C)$ (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{off}		1.37 1.87 2.02		
SC data	$V_{GE}\leq 15V, V_{CC}=800V$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$	$t_p\leq 10\mu s, T_{vj}=150^\circ C$	I_{sc}		116		A
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	50	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit	
			Min.	Typ.	Max.		
Forward voltage	$I_F=15A, V_{GE}=0V$ $I_F=15A, V_{GE}=0V$ $I_F=15A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	V_F		2.05 1.67 1.60	2.70	V
Peak reverse recovery current	$I_F=15A,$ $-di_F/dt=360A/\mu s (T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	I_{RM}		4 10 13		A
Recovered charge	$I_F=15A,$ $-di_F/dt=360A/\mu s (T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	Q_r		0.26 1.02 1.31		μC
Reverse recovered energy	$I_F=15A,$ $-di_F/dt=360A/\mu s (T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{rec}		0.05 0.25 0.35		mJ
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	$T_c=25^{\circ}\text{C}$, $\pm 5\%$	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	$^{\circ}\text{C}$
Mounting torque for modul mounting		M	3.0		6.0	Nm
Weight		W		170		g

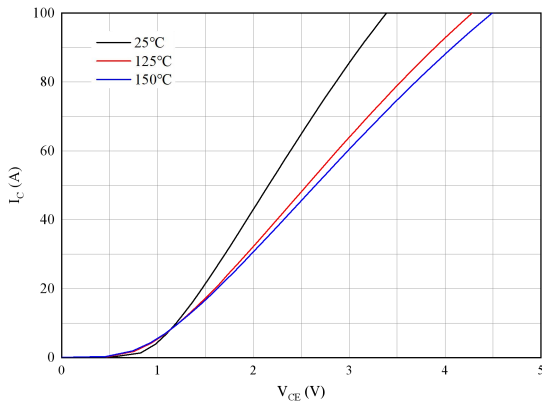


Fig 1. Typical output characteristics ($V_{GE}=15V$)

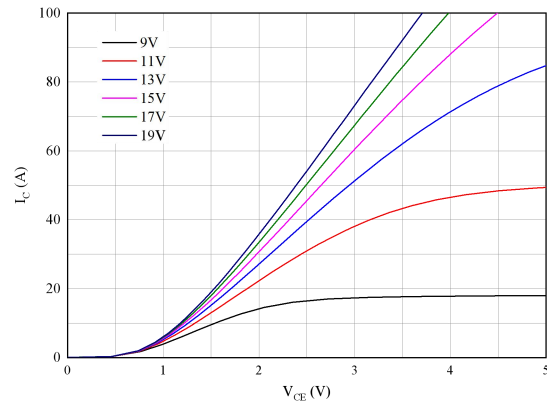


Fig 2. Typical output characteristics ($T_{vj}=150^{\circ}C$)

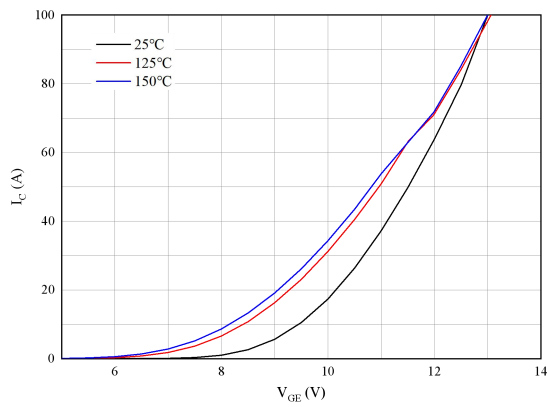


Fig 3. Typical transfer characteristic ($V_{CE}=20V$)

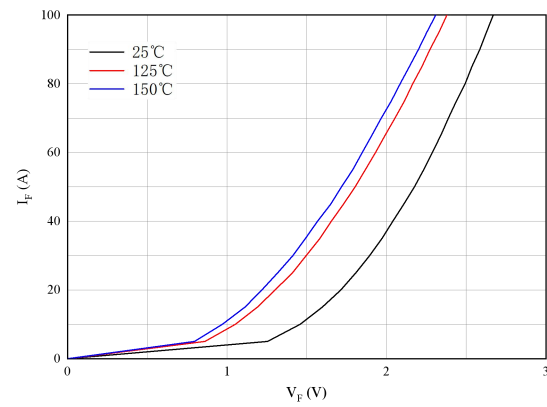


Fig 4. Forward characteristic of Diode

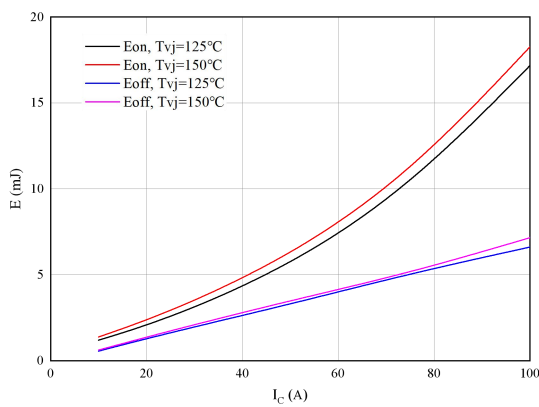


Fig 5. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $R_{gon}=15\Omega$, $R_{goff}=15\Omega$, $V_{CE}=600V$

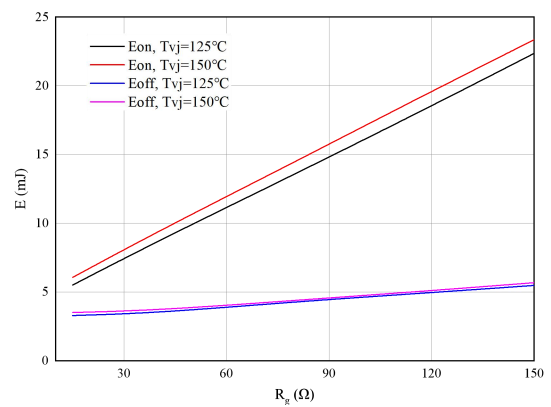


Fig 6. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $I_C=50A$, $V_{CE}=600V$

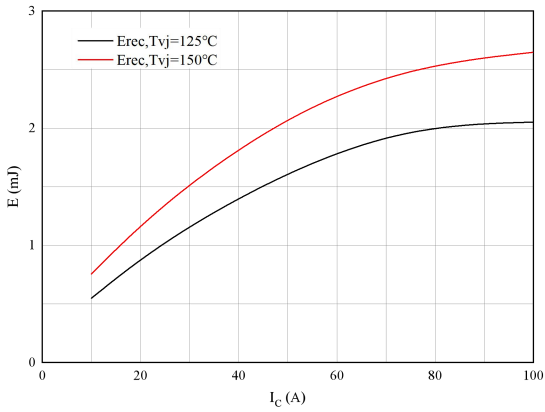


Fig 7. Switching losses of Diode

$R_{gon}=15\ \Omega, V_{CE}=600V$

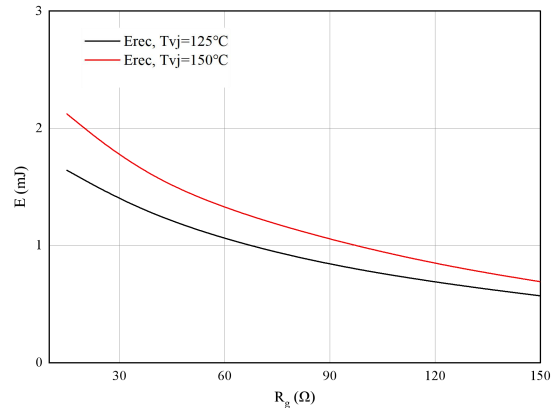


Fig 8. Switching losses of Diode

$I_F=50A, V_{CE}=600V$

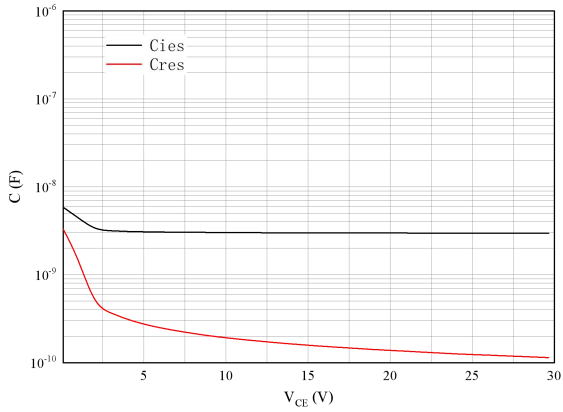


Fig 9. Capacitance characteristic

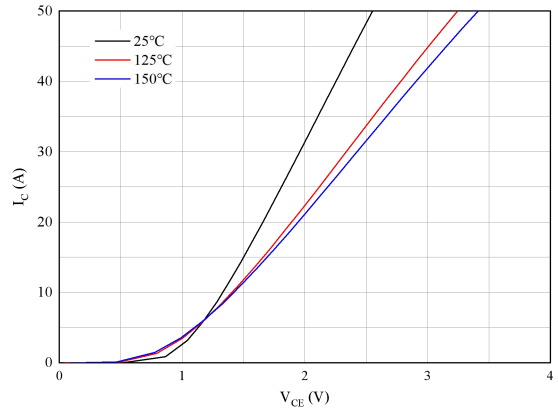


Fig 10. Typical output characteristics ($V_{GE}=15V$)

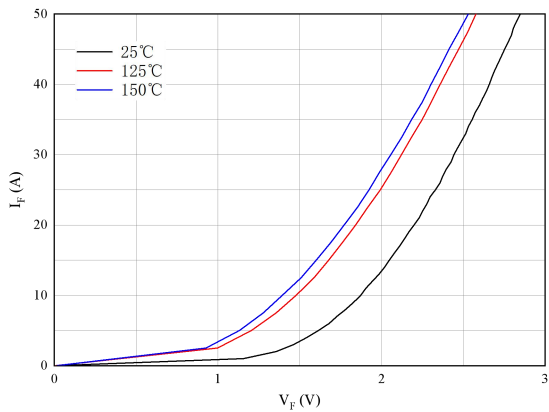


Fig 11. Forward characteristic of Diode

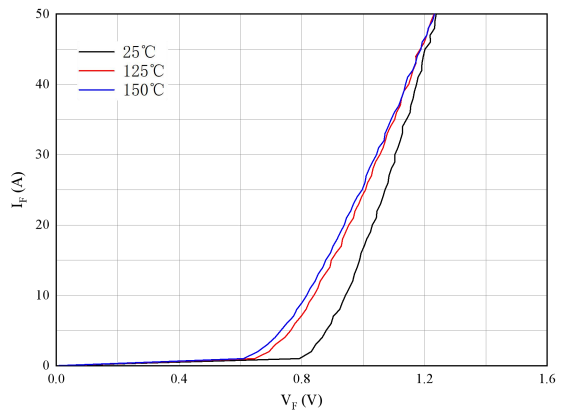


Fig 12. Forward characteristic of Diode

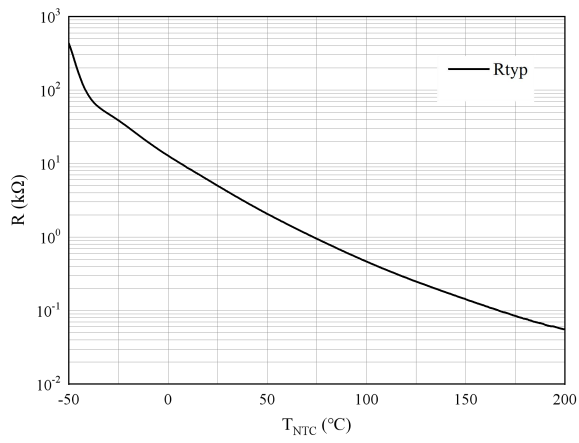
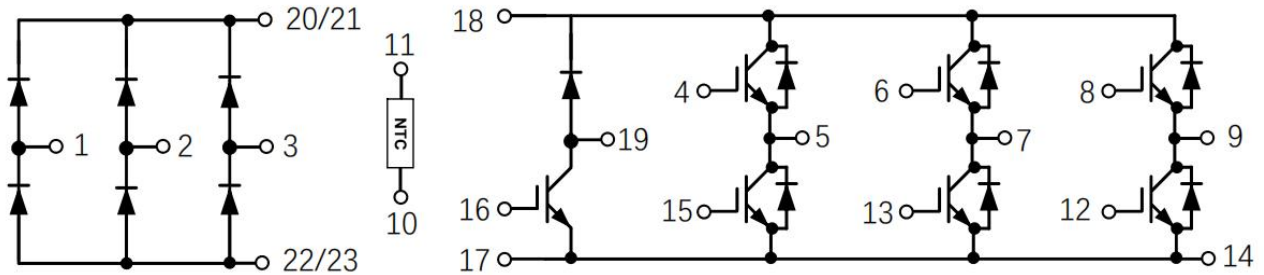


Fig 13. NTC-Themistor-temperature characteristic

Circuit diagram



Package outlines

