

## PIM IGBT Module

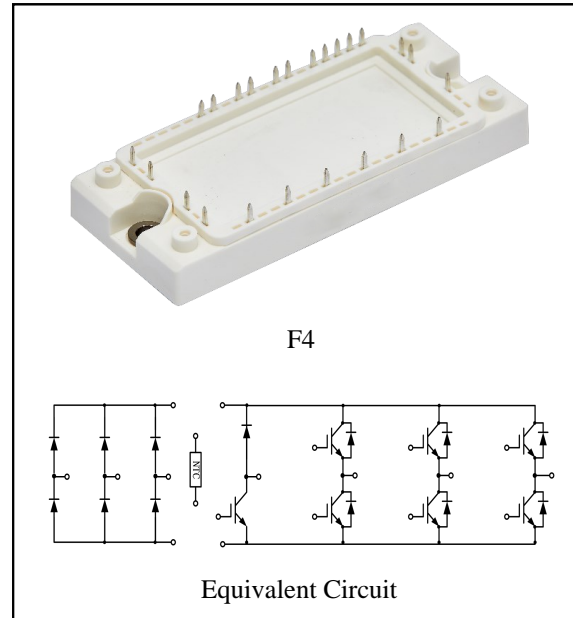
$V_{CES} = 1200V$ ,  $I_{C\ nom} = 40A / I_{CRM} = 80A$

### 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	$V_{GE} = 15V$ , $I_C = 40A$	$V_{CESat}$		1.78	2.3	V	
	$V_{GE} = 15V$ , $I_C = 40A$			2.11			
	$V_{GE} = 15V$ , $I_C = 40A$			2.17			
Gate-Emitter threshold voltage	$I_C = 1.5mA$ , $V_{GE} = V_{CE}$	$T_{vj} = 25^{\circ}C$	$V_{GE(th)}$	5.3	5.8	6.4	
Internal gate resistor			$R_{Gint}$		None		$\Omega$

Input capacitance	$f=100\text{KHz}, V_{CE}=25\text{ V}, V_{GE}=0\text{ V}$ $T_{vj}=25^\circ\text{C}$	$C_{ies}$	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)	$T_{vj}=25^\circ\text{C}$	67	ns	
		$T_{vj}=125^\circ\text{C}$	60		
		$T_{vj}=150^\circ\text{C}$	56		
Rise time	$I_C=40\text{A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}, R_G=30\Omega$ (inductive load)	$T_{vj}=25^\circ\text{C}$	52	ns	
		$T_{vj}=125^\circ\text{C}$	53		
		$T_{vj}=150^\circ\text{C}$	55		
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)	$T_{vj}=25^\circ\text{C}$	326	ns	
		$T_{vj}=125^\circ\text{C}$	370		
		$T_{vj}=150^\circ\text{C}$	379		
Fall time	$I_C=40\text{A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}, R_G=30\Omega$ (inductive load)	$T_{vj}=25^\circ\text{C}$	127	ns	
		$T_{vj}=125^\circ\text{C}$	219		
		$T_{vj}=150^\circ\text{C}$	258		
Turn-on energy loss per pulse	$I_C=40\text{A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}, R_G=30\Omega$ $di/dt=550\text{A}/\mu\text{s}(T_{vj}=150^\circ\text{C})$ (inductive load)	$T_{vj}=25^\circ\text{C}$	4.39	mJ	
		$T_{vj}=125^\circ\text{C}$	6.28		
		$T_{vj}=150^\circ\text{C}$	6.89		
Turn-off energy loss per pulse	$I_C=40\text{A}, V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}, R_G=30\Omega$ $du/dt=4700\text{V}/\mu\text{s}(T_{vj}=150^\circ\text{C})$ (inductive load)	$T_{vj}=25^\circ\text{C}$	2.00	mJ	
		$T_{vj}=125^\circ\text{C}$	3.01		
		$T_{vj}=150^\circ\text{C}$	3.30		
SC data	$V_{GE}\leq 15\text{V}, V_{CC}=650\text{V}$ $V_{CEmax}=V_{CES}-L_{sCE}\cdot di/dt$ $t_p\leq 10\mu\text{s}, T_{vj}=150^\circ\text{C}$	$I_{SC}$	190	A	
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		$I_F$	40	A
Repetitive peak forward current	$t_p=1\text{ms}$	$I_{FRM}$	80	A
$I^2t$ -value	$t_p=10\text{ms}, \sin 180^\circ, T_j=125^\circ\text{C}$	$I^2t$	680	$\text{A}^2\text{s}$

## Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=40A, V_{GE}=0V$ $T_{vj}=25^{\circ}C$	$V_F$		2.11	2.55	V
	$I_F=40A, V_{GE}=0V$ $T_{vj}=125^{\circ}C$			1.77		
	$I_F=40A, V_{GE}=0V$ $T_{vj}=150^{\circ}C$			1.70		
Peak reverse recovery current	$I_F=40A,$ $-di_F/dt=550A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	$I_{RM}$		24		A
	$T_{vj}=25^{\circ}C$			40		
	$T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$			43		
Recovered charge	$I_F=40A,$ $-di_F/dt=550A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	$Q_r$		0.97		$\mu C$
	$T_{vj}=25^{\circ}C$			6.37		
	$T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$			7.70		
Reverse recovered energy	$I_F=40A,$ $-di_F/dt=550A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	$E_{rec}$		0.08		mJ
	$T_{vj}=25^{\circ}C$			1.89		
	$T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$			2.35		
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	$t_p=10ms, \sin 180^{\circ}, T_{vj}=125^{\circ}C$	$I_{FSM}$	530	A
$I^2t$ -value	$t_p=10ms, \sin 180^{\circ}, T_{vj}=125^{\circ}C$	$I^2t$	1400	$A^2s$

## Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=40A, T_{vj}=25^{\circ}C$	$V_F$		1.16	1.40	V
Reverse current	$V_R=V_{RRM}$ $T_{vj}=25^{\circ}C$	$I_R$			100	$\mu A$
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	$V_{GE}=15\text{V}$ , $I_C=25\text{A}$ $V_{GE}=15\text{V}$ , $I_C=25\text{A}$ $V_{GE}=15\text{V}$ , $I_C=25\text{A}$	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$V_{CESat}$	1.81 2.11 2.20	2.50	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	5.8	6.4
Internal gate resistor			$R_{Gint}$	None		$\Omega$
Input capacitance	$f=100\text{KHz}$ , $V_{CE}=25\text{ V}$ , $V_{GE}=0\text{ V}$ $T_{vj}=25^{\circ}\text{C}$		$C_{ies}$	1.46		nF
Reverse transfer capacitance		$C_{res}$	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	$I_C=25\text{A}$ , $V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ , $R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{don}$	72 60 58		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)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_r$	57 62 63		
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)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_{doff}$	283 324 335		
Fall time	$I_C=25\text{A}$ , $V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{ V}$ , $R_G=40\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$t_f$	171 238 250		
Turn-on energy loss per pulse	$I_C=25\text{A}$ , $V_{CE}=600\text{ V}$ $V_{GE}=\pm 15\text{V}$ , $R_G=40\ \Omega$ $di/dt=370\text{A}/\mu\text{s}$ ( $T_{vj}=150^{\circ}\text{C}$ ) (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	$E_{on}$	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		
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	$V_R=0V, t_p=10ms, T_{vj}=125^\circ C$	$I^2t$	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	$I_F=15A,$ $-di_F/dt=370A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$I_{RM}$	4 10 13		A
Recovered charge	$I_F=15A,$ $-di_F/dt=370A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$Q_r$	0.26 1.02 1.31		$\mu C$
Reverse recovered energy	$I_F=15A,$ $-di_F/dt=370A/\mu s(T_{vj}=150^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	$E_{rec}$	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, $f=50\text{Hz}, t=1\text{min}$	$V_{\text{ISOL}}$	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		170		g

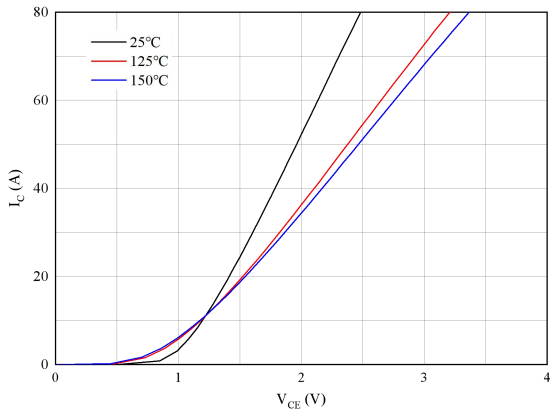


Fig 1. Typical output characteristics ( $V_{GE}=15V$ )

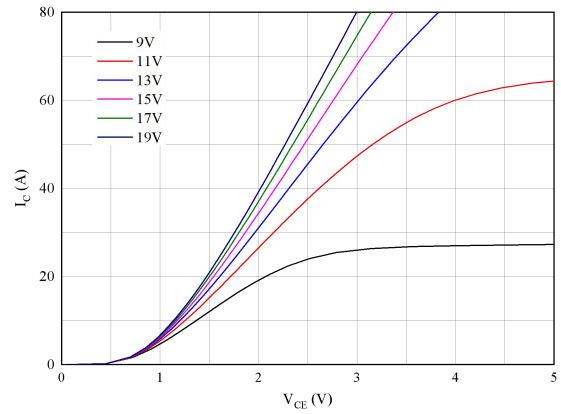


Fig 2. Typical output characteristics ( $T_{vj}=150^{\circ}C$ )

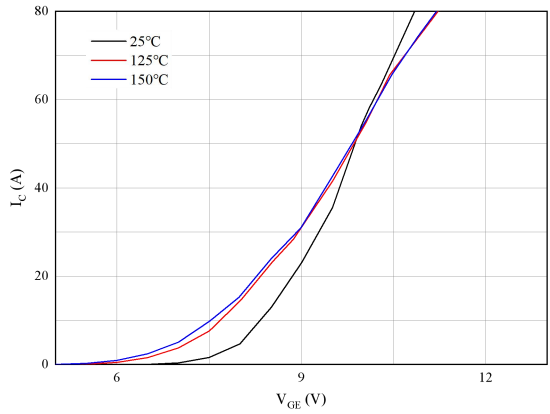


Fig 3. Typical transfer characteristic ( $V_{CE}=20V$ )

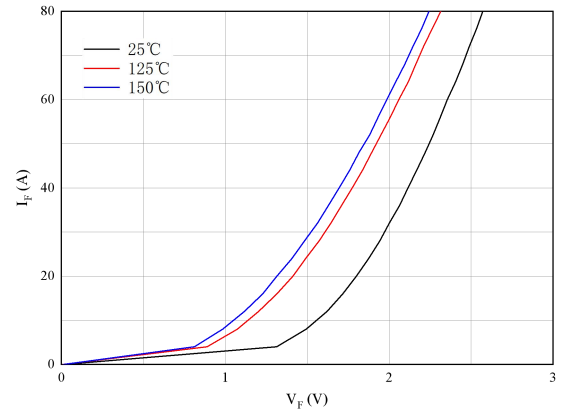


Fig 4. Forward characteristic of Diode

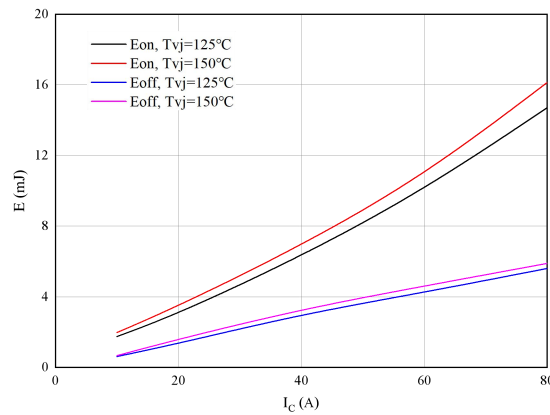


Fig 5. Switching losses of IGBT  
 $V_{GE}=\pm 15V, R_{gon}=30\Omega, R_{goff}=30\Omega, V_{CE}=600V$

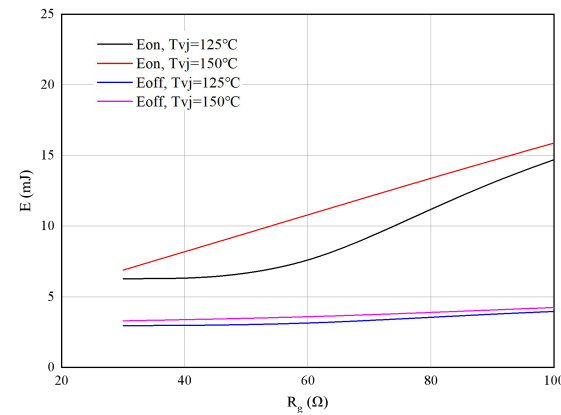


Fig 6. Switching losses of IGBT  
 $V_{GE}=\pm 15V, I_C=40A, V_{CE}=600V$

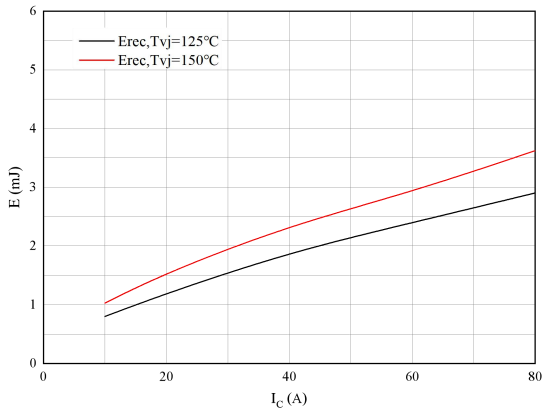


Fig 7 . Switching losses of Diode

Rgon=30Ω, VCE=600V

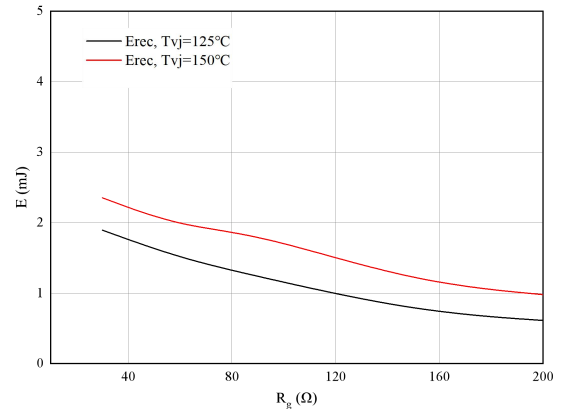


Fig 8. Switching losses of Diode

IF=40A, VCE=600V

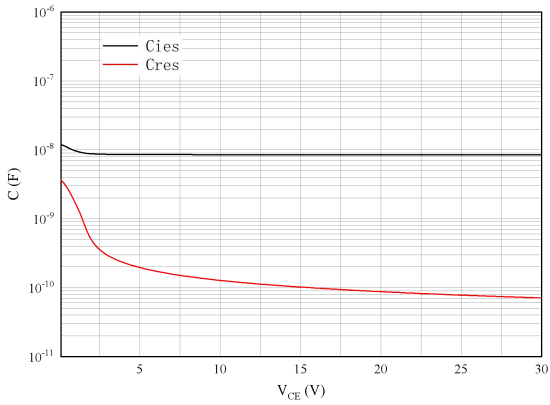


Fig 9. Capacitance characteristic

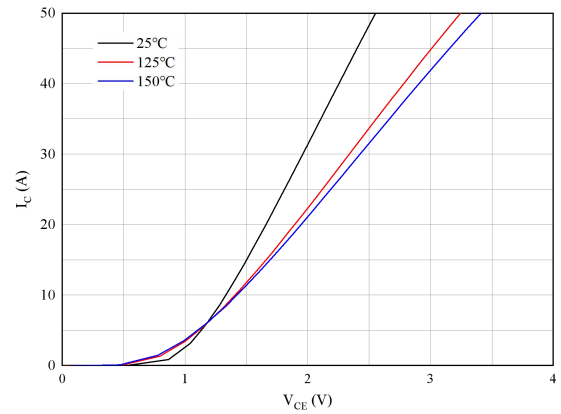


Fig 10. Typical output characteristics (VGE=15V)

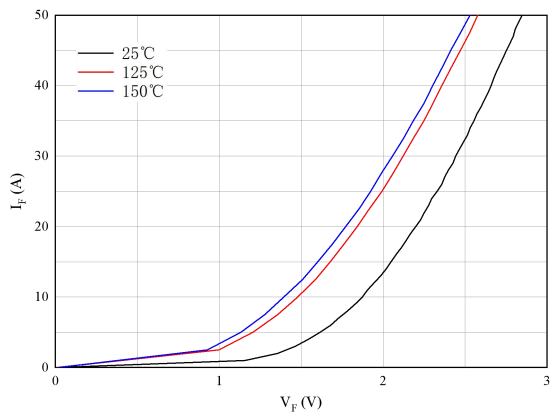


Fig11.Forward characteristic of Diode

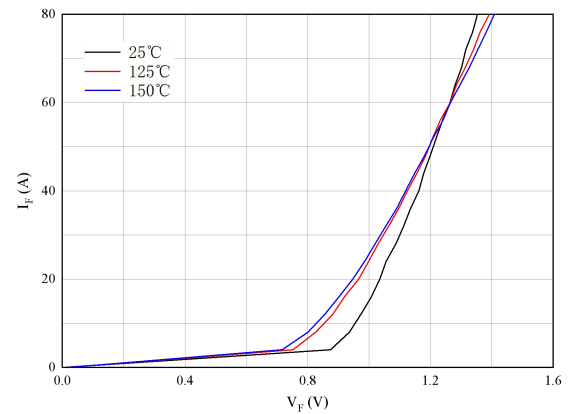


Fig 12.Forward characteristic of Diode



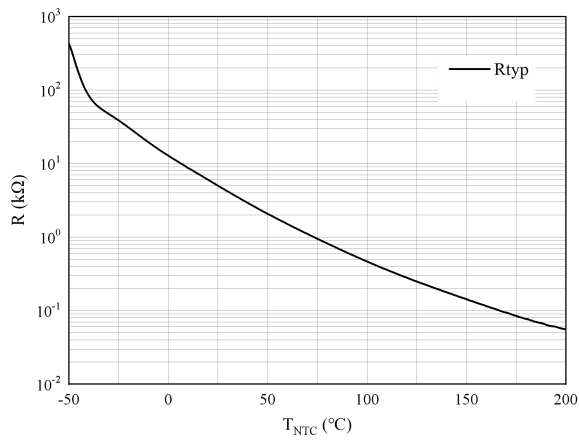
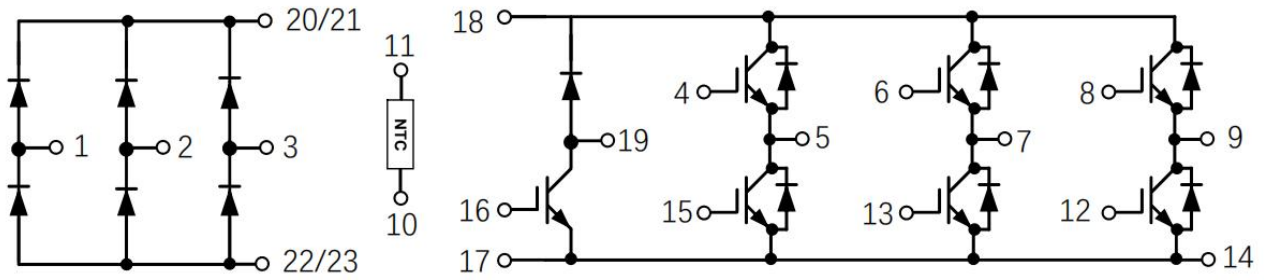


Fig 13.NTC-Themistor-temperature characteristic

**Circuit diagram**



**Package outlines**

