

PIM IGBT Module

$V_{CES}=1200V$, $I_{C\text{nom}}=75A$ /
 $I_{CRM}=150A$

Electrical characteristics :

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

Applications:

- Variable Frequency Drive
- Servo drive
- Inverter

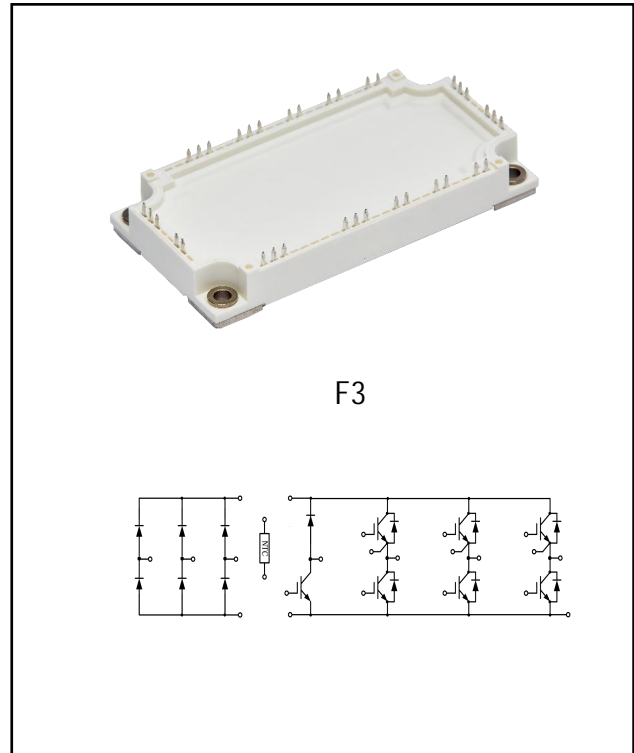
IGBT, Inverter

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	$T_{vj}=25^{\circ}C$	V_{CES}	1200	V
Continuous DC collector current	$T_C=100^{\circ}C$, $T_{vj\text{max}}=175^{\circ}C$	$I_{C\text{nom}}$	75	A
Repetitive peak collector current	$t_p=1\text{ ms}$	I_{CRM}	150	A
Gate emitter voltage		V_{GE}	± 20	V

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter saturation voltage	$V_{GE}=15V$, $I_C=75A$ $T_{vj}=25^{\circ}C$ $V_{GE}=15V$, $I_C=75A$ $T_{vj}=125^{\circ}C$ $V_{GE}=15V$, $I_C=75A$ $T_{vj}=150^{\circ}C$	V_{CEsat}		1.72 2.04 2.12	2.10	V
Gate-Emitter threshold voltage	$I_C=2.4mA$, $V_{GE}=V_{CE}$ $T_{vj}=25^{\circ}C$	$V_{GE(th)}$	5.10	5.60	6.20	
Gate charge	$V_{GE}=-15V\dots+15V$	Q_G		0.58		μC



Internal gate resistor		R_{Gint}		6.24		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}		5.24		nF
Reverse transfer capacitance		C_{res}		0.24		
Collector-emitter cut-off current	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$ $T_{vj}=25^{\circ}\text{C}$	I_{CES}			1.0	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	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_{don}		85	
					95	
					96	
Rise time	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_r		31	ns
					34	
					37	
Turn-off delay time	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_{doff}		256	
					309	
					323	
Fall time	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	t_f		186	
					178	
					167	
Turn-on energy loss per pulse	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ $di/dt = 1600\text{A}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	E_{on}		4.34	mJ
					7.86	
					8.90	
Turn-off energy loss per pulse	$I_C=75\text{A}, V_{CE}=600\text{V}$ $V_{GE}=\pm 15\text{V}, R_G=1\Omega$ $dv/dt = 4100\text{V}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) (inductive load)	$T_{vj}=25^{\circ}\text{C}$ $T_{vj}=125^{\circ}\text{C}$ $T_{vj}=150^{\circ}\text{C}$	E_{off}		5.58	
					6.87	
					7.06	
SC data	$V_{GE} \leq 15\text{V}, V_{CC}=800\text{V}$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ $t_p \leq 10\mu\text{s}, T_{vj}=150^{\circ}\text{C}$	I_{SC}		398		A
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	60	A
Repetitive peak forward current	$t_p=1\text{ms}$	I_{FRM}	120	A
I^2t -value	$t_p=10\text{ms}, \sin 180^{\circ}, T_j=125^{\circ}\text{C}$	I^2t	960	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=60A, V_{GE}=0V$ $T_{vj}=25^{\circ}C$	V_F		2.12	2.50	V
	$I_F=60A, V_{GE}=0V$ $T_{vj}=125^{\circ}C$			1.72		
	$I_F=60A, V_{GE}=0V$ $T_{vj}=150^{\circ}C$			1.64		
Peak reverse recovery current	$I_F=60A,$ $-di_F/dt=1700A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	I_{RM}		64		A
	$T_{vj}=125^{\circ}C$			98		
	$T_{vj}=150^{\circ}C$			107		
Recovered charge	$I_F=60A,$ $-di_F/dt=1700A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	Q_r		4.74		μC
	$T_{vj}=125^{\circ}C$			10.79		
	$T_{vj}=150^{\circ}C$			12.65		
Reverse recovered energy	$I_F=60A,$ $-di_F/dt=1700A/\mu s(T_{vj}=150^{\circ}C)$ $V_R=600V, V_{GE}=-15V$	E_{rec}		1.75		mJ
	$T_{vj}=125^{\circ}C$			3.87		
	$T_{vj}=150^{\circ}C$			4.86		
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}	1800	V
Non-Repetitive peak reverse voltage	$T_{vj}=25^{\circ}C, I_{RRM}=10\mu A$	V_{RSM}	2000	V
Maximum Average Forward Current		$I_{F(AV)}$	70	A
Surge forward current	$t_p=10ms, \sin 180^{\circ}, T_{vj}=25^{\circ}C$	I_{FSM}	840	A
I^2t -value	$t_p=10ms, \sin 180^{\circ}, T_{vj}=25^{\circ}C$	I^2t	3528	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=70A, T_{vj}=25^{\circ}C$	V_F		1.10	1.20	V
Reverse current	$V_R=V_{RRM}$ $T_{vj}=25^{\circ}C$	I_R			10	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 curren	$T_C=100^{\circ}\text{C}$, $T_{vj\text{ max}}=175^{\circ}\text{C}$	$I_{C\text{ nom}}$	50	A
Repetitive peak collector current	$t_p=1\text{ ms}$	I_{CRM}	100	A
Total power dissipation	$T_C = 25^{\circ}\text{C}$, $T_{vj\text{ max}} = 175^{\circ}\text{C}$	P_{tot}	270	W
Gate emitter voltage		V_{GE}	± 20	V

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Collector-Emitter saturation voltage	$V_{GE}=15\text{V}$, $I_C=50\text{A}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=15\text{V}$, $I_C=50\text{A}$ $T_{vj}=125^{\circ}\text{C}$ $V_{GE}=15\text{V}$, $I_C=50\text{A}$ $T_{vj}=150^{\circ}\text{C}$	$V_{CE\text{ sat}}$		2.27 2.78 2.91	2.60	V
Gate-Emitter threshold voltage	$I_C=1.6\text{mA}$, $V_{GE}=V_{CE}$ $T_{vj}=25^{\circ}\text{C}$	$V_{GE(\text{th})}$	5.20	5.90	6.40	
Gate charge	$V_{GE}=-15\text{V}\dots+15\text{V}$	Q_G		0.26		μC
Internal gate resistor		$R_{G\text{int}}$		2.66		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}		3.03		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	$I_C=50\text{A}$, $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	$t_{d\text{ on}}$		127 110 108		ns
Rise time	$I_C=50\text{A}$, $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	t_r		55 67 68		
Turn-off delay time	$I_C=50\text{A}$, $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	$t_{d\text{ off}}$		347 383 391		
Fall time	$I_C=50\text{A}$, $V_{CE}=600\text{V}$ $T_{vj}=25^{\circ}\text{C}$ $V_{GE}=\pm 15\text{V}$, $R_G=40\Omega$ $T_{vj}=125^{\circ}\text{C}$ (inductive load) $T_{vj}=150^{\circ}\text{C}$	t_f		94 125 134		

Turn-on energy loss per pulse	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ $di/dt=570A/\mu s$ ($T_{vj}=150^\circ C$) (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{on}		7.09 9.49 10.22		mJ
Turn-off energy loss per pulse	$I_C=50A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=40\Omega$ $dv/dt=5200V/\mu s$ ($T_{vj}=150^\circ C$) (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{off}		2.58 3.35 3.61		
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}		190		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	30	A
Repetitive peak forward current	$t_p=1ms$	I_{FRM}	60	A
I^2t -value	$t_p=10ms, \sin 180^\circ, T_{vj}=125^\circ C$	I^2t	90	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	$I_F=30A, V_{GE}=0V$ $I_F=30A, V_{GE}=0V$ $I_F=30A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	V_F	1.94 1.60 1.53	2.40	V
Peak reverse recovery current	$I_F=30A,$ $-di_F/dt=600A/\mu s$ ($T_{vj}=150^\circ C$) $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	I_{RM}	18 26 28		A
Recovered charge	$I_F=30A,$ $-di_F/dt=600A/\mu s$ ($T_{vj}=150^\circ C$) $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	Q_r	2.44 5.65 7.17		μC
Reverse recovered energy	$I_F=30A,$ $-di_F/dt=600A/\mu s$ ($T_{vj}=150^\circ C$) $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{rec}	0.77 1.85 2.43		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	$\pm 2\%$	$B_{25/50}$		3375		K

Module

Parameter	Conditions	Symbol	Value			Unit
Isolation test voltage	RMS, $f=50\text{Hz}, t=1\text{min}$	V_{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		300		g

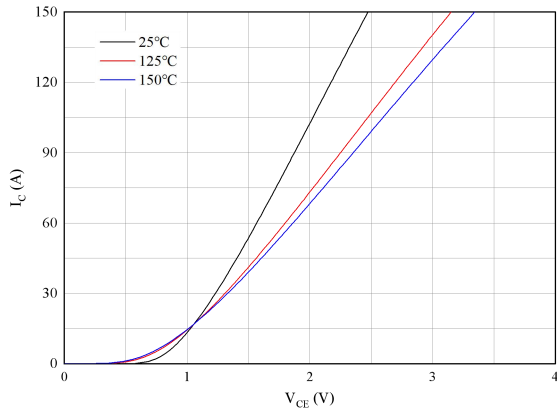


Fig 1. Typical output characteristics ($V_{GE}=15V$)

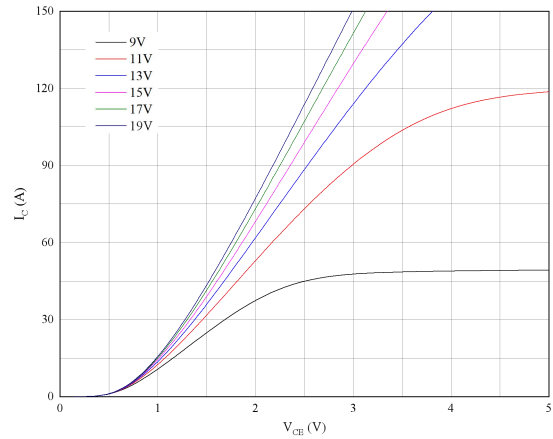


Fig 2. Typical output characteristics ($T_{vj}=150^{\circ}C$)

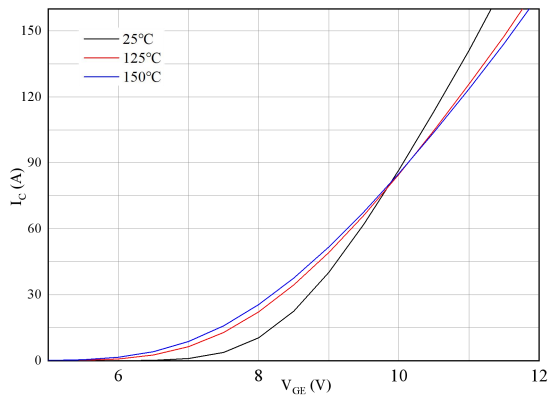


Fig 3. Typical transfer characteristic ($V_{CE}=20V$)

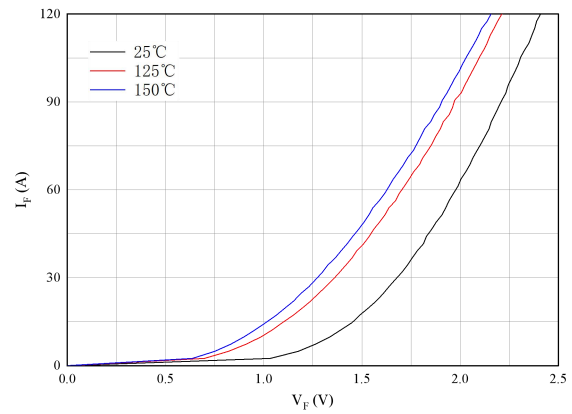


Fig 4. Forward characteristic of Diode

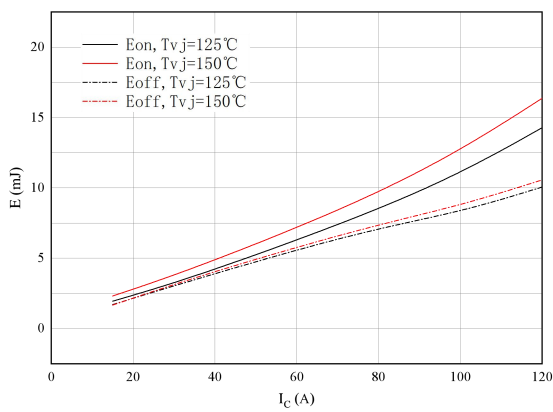


Fig 5. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $R_{gon}=1\Omega$, $R_{goff}=1\Omega$, $V_{CE}=600V$

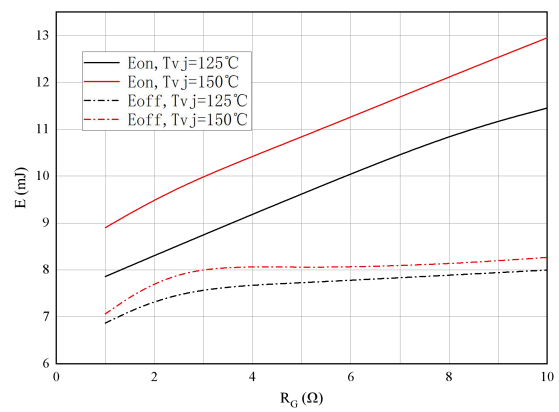


Fig 6. Switching losses of IGBT
 $V_{GE}=\pm 15V$, $I_C=75A$, $V_{CE}=600V$

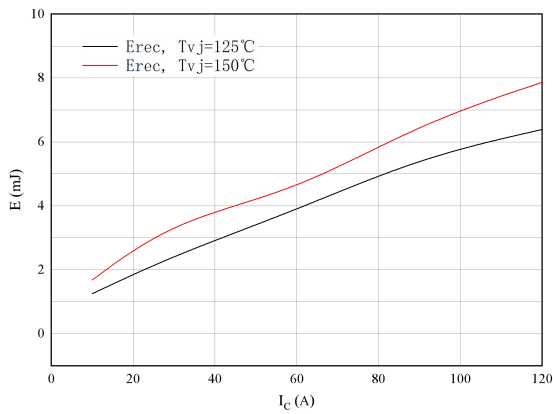


Fig 7. Switching losses of Diode
Rgon=1Ω, VCE=600V

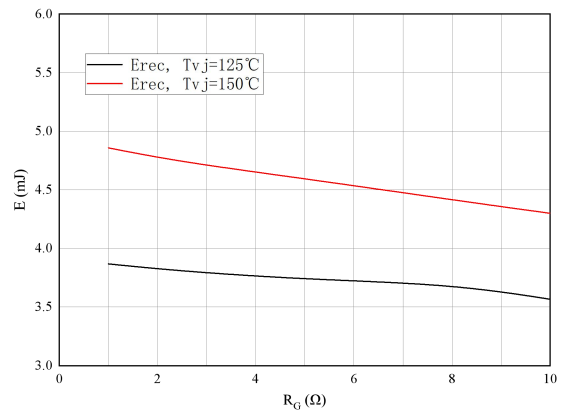


Fig 8. Switching losses of Diode
IF=60A, VCE=600V

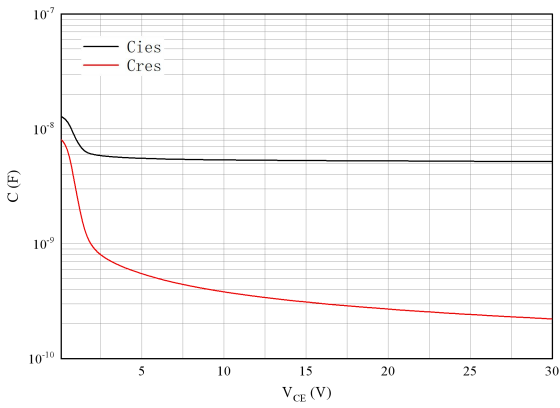


Fig 9. Capacitance characteristic

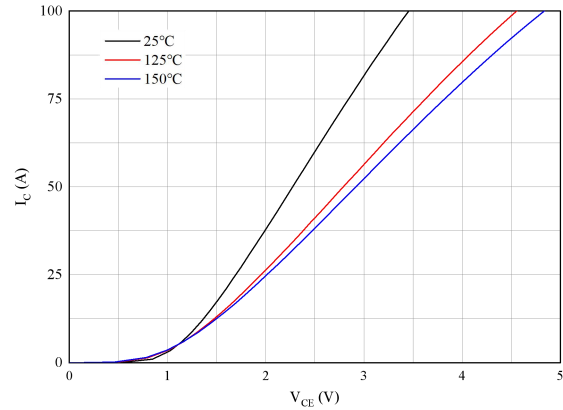


Fig 10. Typical output characteristics (VGE=15V)

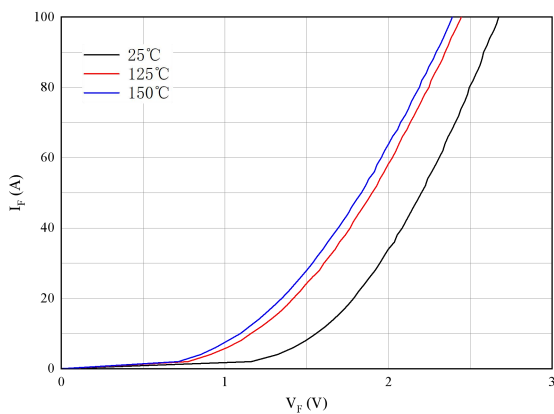


Fig 11. Forward characteristic of Diode

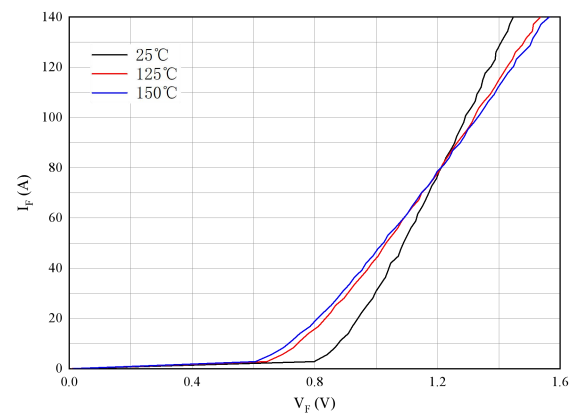


Fig 12. Forward characteristic of Diode

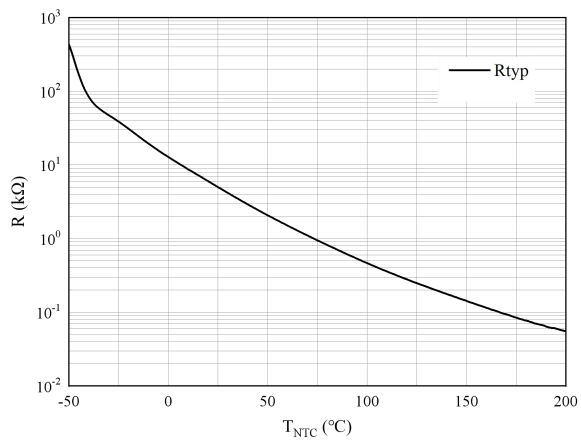
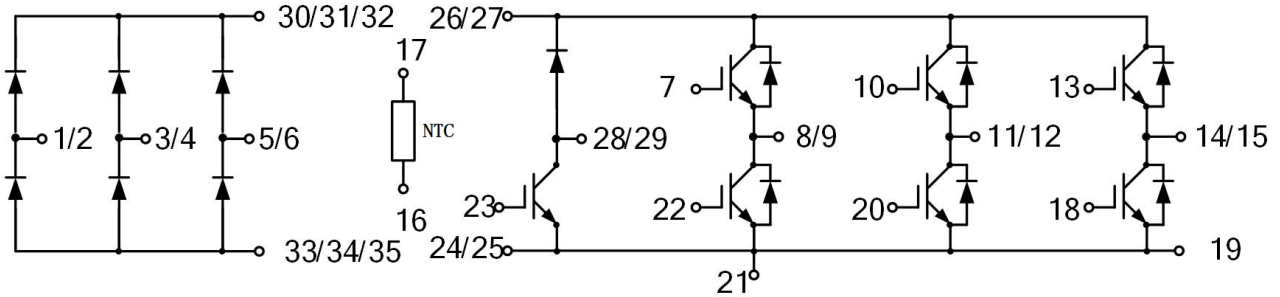


Fig 13.NTC-Themistor-temperature characteristic

Circuit diagram



Package outlines

