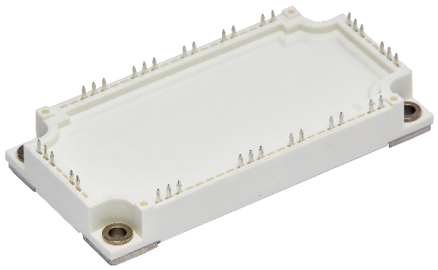
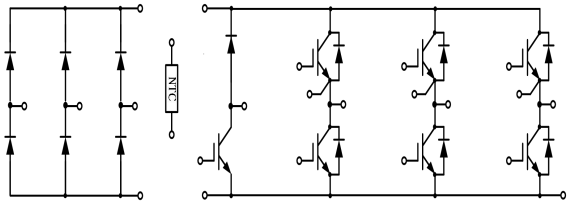
PIM IGBT Module

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



F3



Equivalent Circuit

Features：

- 1200V Trench /Field Stop process
- Low switching losses
- Vcesat 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°C	V_{CES}	1200	V
Continuous DC collector current	T_C=100°C, $T_{vj\,max}$=175°C	$I_{C\,nom}$	75	A
Repetitive peak collector current	t_P=1 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 V_{GE}=15V, I_C=75A V_{GE}=15V, I_C=75A	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°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°C	$V_{GE(th)}$	5.10	5.60	6.20	
Gate charge	V_{GE}=-15V…+15V		Q_G		0.58		μC

Internal gate resistor		R_{Gint}		6.24		Ω
Input capacitance	f=1MHz, V_{CE}=25 V, V_{GE}=0 V T_{vj}=25°C	C_{ies}		5.24		nF
Reverse transfer capacitance		C_{res}		0.24		
Collector-emitter cut-off current	V_{CE}=1200V , V_{GE}= 0 V T_{vj}=25°C	I_{CES}			1.0	mA
Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V T_{vj}=25°C	I_{GES}			100	nA
Turn-on delay time	I_C=75A, V_{CE}=600 V, V_{GE}=±15 V, R_G=1Ω (inductive load) T_{vj}=25°C / T_{vj}=125°C / T_{vj}=150°C	$t_{d\,on}$		85 95 96		ns
Rise time	I_C=75A, V_{CE}=600 V, V_{GE}=±15 V, R_G=1Ω (inductive load) T_{vj}=25°C / T_{vj}=125°C / T_{vj}=150°C	t_r		31 34 37		
Turn-off delay time	I_C=75A, V_{CE}=600 V, V_{GE}=±15 V, R_G=1Ω (inductive load) T_{vj}=25°C / T_{vj}=125°C / T_{vj}=150°C	$t_{d\,off}$		256 309 323		
Fall time	I_C=75A, V_{CE}=600 V, V_{GE}=±15 V, R_G=1Ω (inductive load) T_{vj}=25°C / T_{vj}=125°C / T_{vj}=150°C	t_f		186 178 167		
Turn-on energy loss per pulse	I_C=75A, V_{CE}=600 V, V_{GE}=±15 V, R_G=1Ω, di/dt =1600 A/μs (Tvj = 150°C) (inductive load) T_{vj}=25°C / T_{vj}=125°C / T_{vj}=150°C	E_{on}		4.34 7.86 8.90		mJ
Turn-off energy loss per pulse	I_C=75A, V_{CE}=600 V, V_{GE}=±15 V, R_G=1Ω, dv/dt = 4100V/μs (Tvj = 150°C) (inductive load) T_{vj}=25°C / T_{vj}=125°C / T_{vj}=150°C	E_{off}		5.58 6.87 7.06		
SC data	V_{GE}≤15V, Vcc=800V, V_{CEmax}=V_{CES}-L_{sCE}·di/dt t_P≤10us, T_{vj}=150°C	I_{SC}		398		A
Temperature under switching conditions		$T_{vj\,op}$	-40		150	°C

Diode, Inverter

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T_{vj}=25°C	V_{RRM}	1200	V
Continuous DC forward current		I_F	60	A
Repetitive peak forward current	t_p=1ms	I_{FRM}	120	A
I^2t-value	t_p=10ms，sin180° ，T_j=125°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°C I_F=60A, V_{GE}=0V T_{vj}=125°C I_F=60A, V_{GE}=0V T_{vj}=150°C	V_F		2.12 1.72 1.64	2.50	V
Peak reverse recovery current	I_F=60A, T_{vj}=25°C $-di_F/dt$=1700A/μs(T_{vj}=150°C) T_{vj}=125°C V_R=600V, V_{GE}=-15V T_{vj}=150°C	I_{RM}		64 98 107		A
Recovered charge	I_F=60A, T_{vj}=25°C $-di_F/dt$=1700A/μs(T_{vj}=150°C) T_{vj}=125°C V_R=600V, V_{GE}=-15V T_{vj}=150°C	Q_r		4.74 10.79 12.65		μC
Reverse recovered energy	I_F=60A, T_{vj}=25°C $-di_F/dt$=1700A/μs(T_{vj}=150°C) T_{vj}=125°C V_R=600V, V_{GE}=-15V T_{vj}=150°C	E_{rec}		1.75 3.87 4.86		mJ
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	V_{RRM}	1800	V
Non-Repetitive peak reverse voltage	T_{vj}=25°C，I_{RRM}=10μA	V_{RSM}	2000	V
Maximum Average Forward Current		$I_{F(AV)}$	70	A
Surge forward current	t_p=10ms，sin180°，T_{vj}=25°C	I_{FSM}	840	A
I^2t-value	t_p=10ms，sin180°，T_{vj}=25°C	I^2t	3528	A^2s

Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
Forward voltage	I_F=70A, T_{vj}=25°C	V_F		1.10	1.20	V
Reverse current	V_R=V_{RRM} T_{vj}=25°C	I_R			10	μA
Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C

IGBT, Brake-Chopper

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Collector-Emitter voltage	T_{vj}=25°C	V_{CES}	1200	V
Continuous DC collector curren	T_C=100°C, $T_{vj\ max}$=175°C	$I_{C\ nom}$	50	A
Repetitive peak collector current	t_P=1 ms	I_{CRM}	100	A
Total power dissipation	T_C = 25°C, $T_{vj\ max}$ = 175°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}=15V, I_C=50A V_{GE}=15V, I_C=50A V_{GE}=15V, I_C=50A	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	V_{CEsat}		2.27 2.78 2.91	2.60	V
Gate-Emitter threshold voltage	I_C=1.6mA, V_{GE}= V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	5.20	5.90	6.40	
Gate charge	V_{GE}=-15V…+15V		Q_G		0.26		µC
Internal gate resistor			R_{Gint}		2.66		Ω
Input capacitance	f=1MHz, V_{CE}=25 V, V_{GE}=0 V	T_{vj}=25°C	C_{ies}		3.03		nF
Reverse transfer capacitance			C_{res}		0.13		
Collector-emitter cut-off current	V_{CE}=1200V , V_{GE}= 0 V	T_{vj}=25°C	I_{CES}			1	mA
Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V	T_{vj}=25°C	I_{GES}			100	nA
Turn-on delay time	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	$t_{d\ on}$		127 110 108		ns
Rise time	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_r		55 67 68		
Turn-off delay time	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	$t_{d\ off}$		347 383 391		
Fall time	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	t_f		94 125 134		

Turn-on energy loss per pulse	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω di/dt =570A/μs (Tvj = 150°C) (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{on}	7.09 9.49 10.22		mJ
Turn-off energy loss per pulse	I_C=50A, V_{CE}=600 V V_{GE}=±15 V, R_G=40Ω dv/dt =5200V/μs (Tvj = 150°C) (inductive load)	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{off}	2.58 3.35 3.61		
SC data	V_{GE}≤15V, Vcc=800V V_{CEmax}=V_{CES}-L_{sCE}·di/dt t_P≤10us, T_{vj}=150°C		I_{SC}	190		A
Temperature under switching conditions			$T_{vj\ op}$	-40	150	°C

Diode, Brake-Chopper

Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
Repetitive peak reverse voltage	T_{vj}=25°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, sin180°， T_{vj}=125°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°C T_{vj}=125°C T_{vj}=150°C	V_F		1.94 1.60 1.53	2.40	V
Peak reverse recovery current	I_F=30A, -di_F/dt=600A/μs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	I_{RM}		18 26 28		A
Recovered charge	I_F=30A, -di_F/dt=600A/μs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	Q_r		2.44 5.65 7.17		μC
Reverse recovered energy	I_F=30A, -di_F/dt=600A/μs(T_{vj}=150°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=125°C T_{vj}=150°C	E_{rec}		0.77 1.85 2.43		mJ
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°C， ±5%	R_{25}		5.0		KΩ
B-value	±2%	$B_{25/50}$		3375		K

Module

Parameter	Conditions	Symbol	Value			Unit
Isolation test voltage	RMS, f=50Hz, t=1min	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		300		g

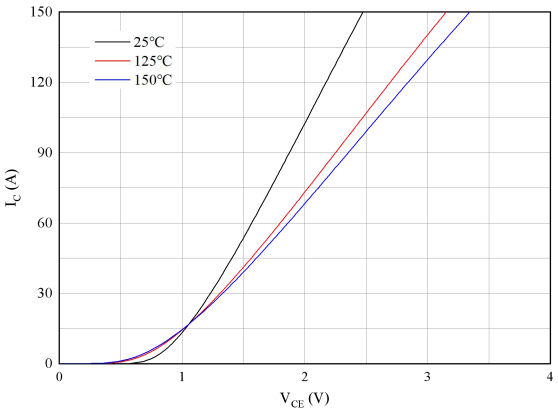


Fig 1. Typical output characteristics (V_{GE}=15V)

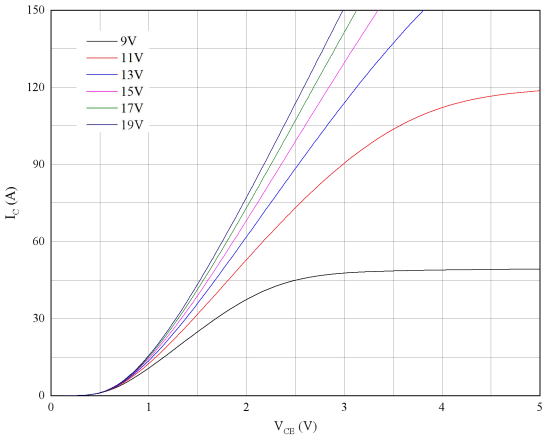


Fig 2. Typical output characteristics (T_{vj}=150℃)

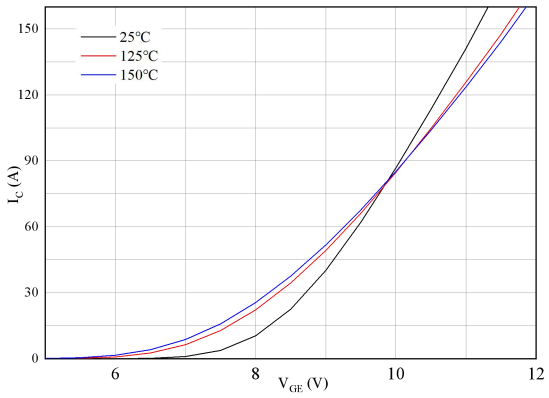


Fig 3. Typical transfer characteristic(V_{CE}=20V)

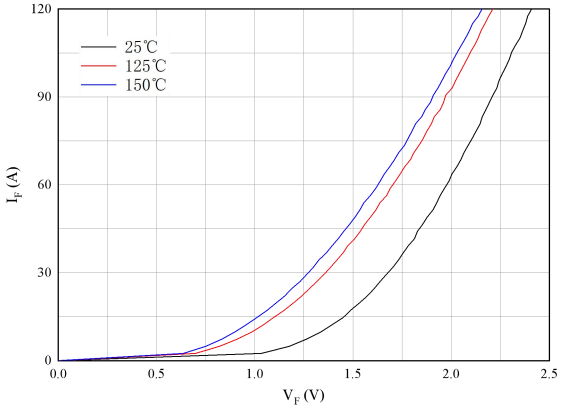


Fig 4. Forward characteristic of Diode

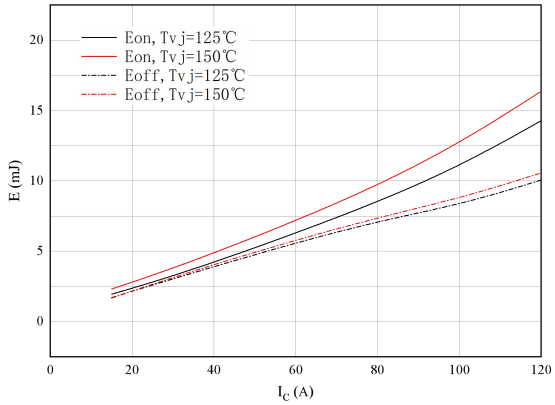


Fig 5. Switching losses of IGBT
VGE=±15V, Rgon=1Ω, Rgoff=1Ω, VCE=600V

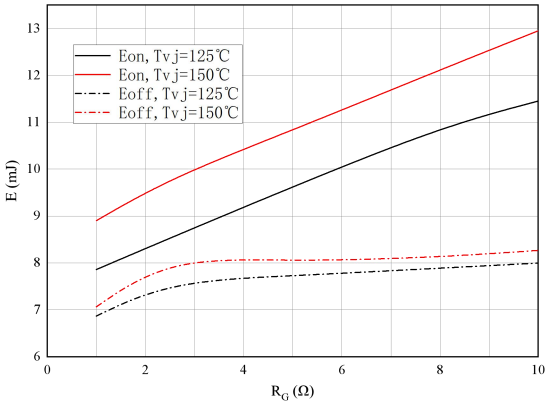


Fig 6. Switching losses of IGBT
VGE=±15V, IC=75A, VCE=600V

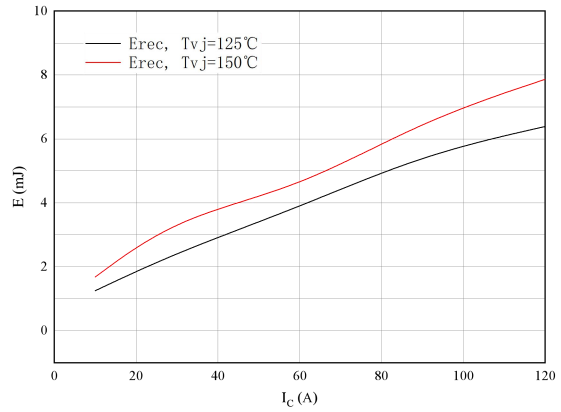


Fig 7. Switching losses of Diode
Rgon=1Ω, VCE=600V

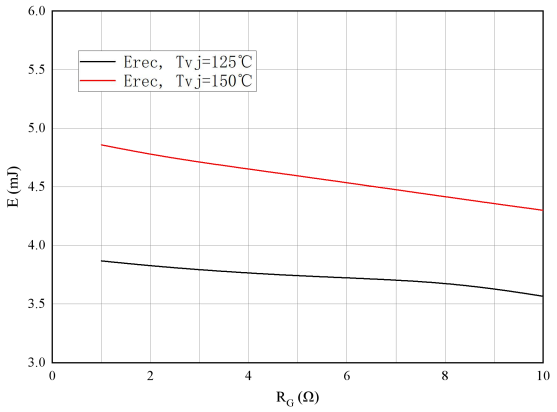


Fig 8. Switching losses of Diode
IF=60A, VCE=600V

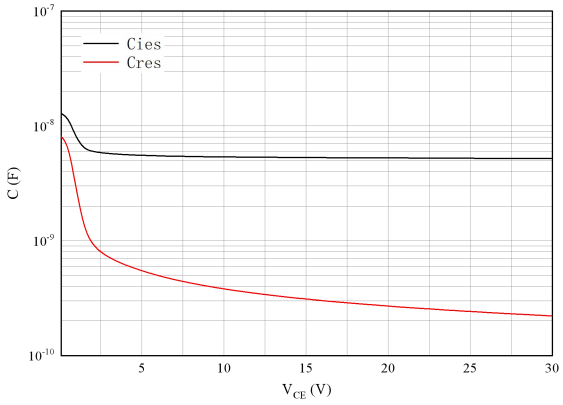


Fig 9. Capacitance characteristic

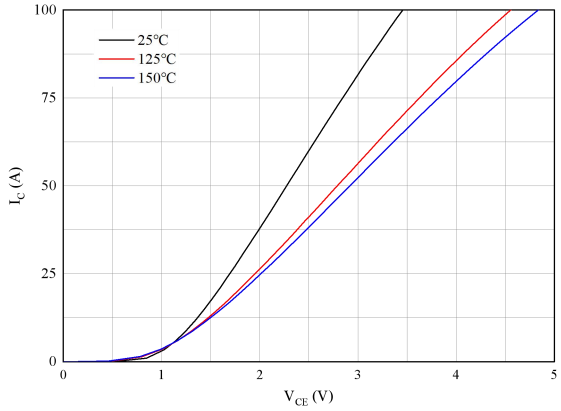


Fig 10. Typical output characteristics (V_{GE}=15V)

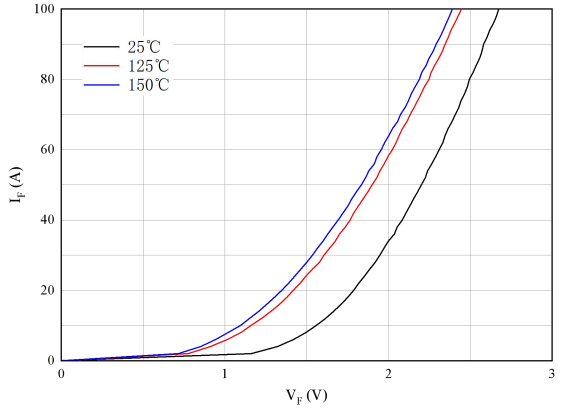


Fig 11.Forward characteristic of Diode

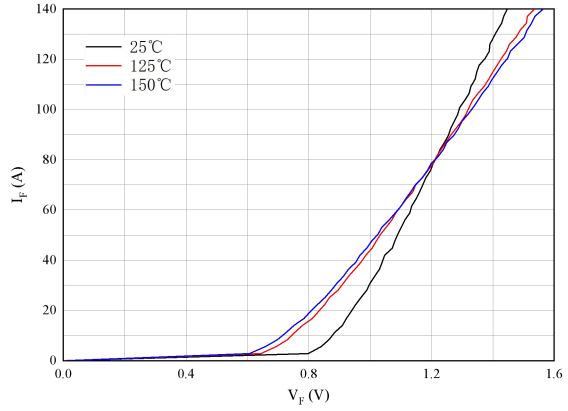


Fig 12.Forward characteristic of Diode

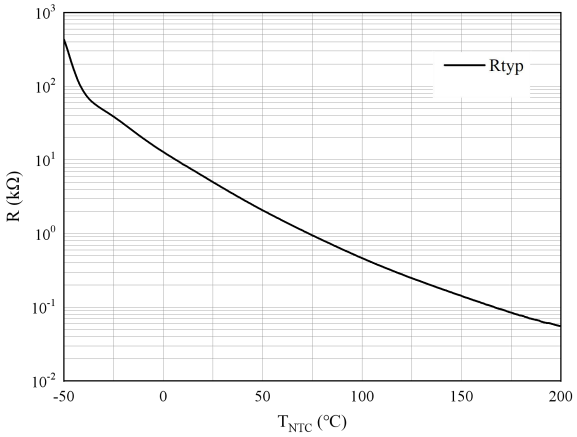
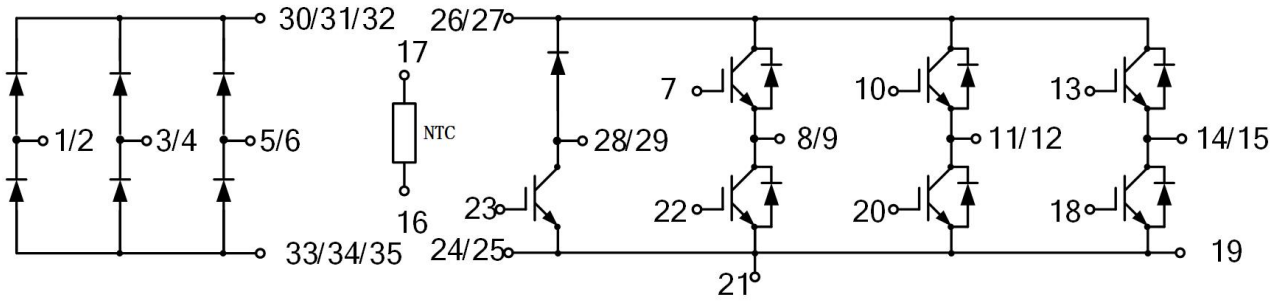


Fig 13.NTC-Themistor-temperature characteristic

Circuit diagram



Package outlines