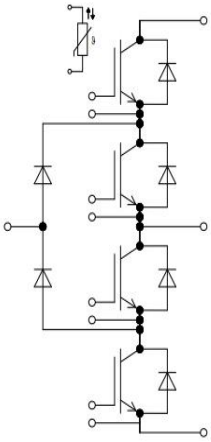
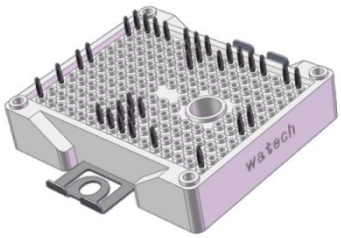
NPCI 3-LEVEL IGBT Power Transistor Module

H3L150R07W2G4





1. Product Features:

- Low switching losses
- Low $V_{CE(sat)}$ losses
- Low stray inductance design
- Maximum junction temperature 175℃
- RoHS compliant

2. Product Applications

- 3-Level-application
- Solar String Inverter
- Energy Storage Inverter
- UPS

3. Typical Performance Parameters

Type	V_{CE}	I_C	I_F	T_{vjmax}	Marking	Package
H3L150R07W2G4	650V	150A	150A	175℃	H3L150R07W2G4	W2

4. IGBT Maximum Rated Values

Symbol	Parameters	Value	Unit	Test Conditions
V_{CES}	Collector-emitter voltage	650	V	V_{GS} = 0V, I_{CE} = 1mA
$I_{C\ nom}$	Continuous DC collector current	150	A	T_C = 60°C, $T_{vj\ max}$ = 175°C
I_C		180	A	T_C = 25°C, $T_{vj\ max}$ = 175°C
I_{CRM}	Pulsed Drain Current	300	A	t_P = 1 ms
P_{tot}	Power dissipation	330	W	T_C = 25°C, $T_{vj\ max}$ = 175°C
V_{GES}	Gate-emitter peak voltage	+/-20	V	V_{CE} = 0V, I_{GS} = 100μA

5. IGBT Characteristic Values (T_{vj} = 25°C, unless otherwise specified)

Symbol	Parameters	Min.	Typ.	Max.	Unit	Test Conditions
$V_{CE(sat)}$	Collector-emitter saturation voltage		1.37 1.53	1.8	V	I_{CE}=150A ,V_{GE} = 15V T_{vj}=25℃ I_{CE}=150A ,V_{GE} = 15V T_{vj}=150℃
V_{GEth}	Gate Threshold Voltage	5.0	5.7	6.4	V	V_{GE}=V_{CE} , I_{CE}=1mA
Q_G	Gate-charge		1.86		uC	V_{GE}=-15V...+15V
R_{Gint}	Internal gate resistor		0.3		Ω	
C_{ies}	Input capacitance		17.0		nF	f = 1 MHz, V_{CE} = 25 V, V_{GE} = 0 V
C_{res}	Reverse transfer capacitance		0.8		nF	f = 1 MHz, V_{CE} = 25 V, V_{GE} = 0 V
I_{CES}	Collector-emitter cut-off current			1.0	mA	V_{CE}= 650V, V_{GE}= 0V
I_{GES}	Gate-emitter leakage current			500	nA	V_{GE}=V_{CE} , V_{GE}=20V

Symbol	Parameters	Min.	Typ.	Max.	Unit	Test Conditions
E_{on}	Turn-On Switching Energy		2.5 4.3		mJ	V_{CE} = 300V, Ic= 150A T_{vj}=25℃ Rg=12Ω V_{GE} = ±15V T_{vj}=150℃
E_{off}	Turn Off Switching Energy		3.3 4.0			V_{CE} = 300V, Ic= 150A T_{vj}=25℃ Rg=12Ω V_{GE} = ±15V T_{vj}=150℃
$t_{d(on)}$	Turn-On Delay Time		345 330		ns	V_{CE} = 300V, Ic= 150A T_{vj}=25℃ Rg=12Ω V_{GE} = ±15V T_{vj}=150℃
t_r	Rise Time		46 54			V_{CE} = 300V, Ic= 150A T_{vj}=25℃ Rg=12Ω V_{GE} = ±15V T_{vj}=150℃
$t_{d(off)}$	Turn-Off Delay Time		238 252			V_{CE} = 300V, Ic= 150A T_{vj}=25℃ Rg=12Ω V_{GE} = ±15V T_{vj}=150℃
t_f	Fall Time		104 160			V_{CE} = 300V, Ic= 150A T_{vj}=25℃ Rg=12Ω V_{GE} = ±15V T_{vj}=150℃
$R_{th(j-c)}$	Thermal Resistance from Junction to Case		0.22	0.25	°C/W	Per IGBT
$T_{vj,op}$	Temperature under switching conditions	-40		150		

6. Reverse Diode(D1-D4) Maximum Rated Values

Symbol	Parameters	Value	Unit	Test Conditions
V_{RRM}	Repetitive peak reverse voltage	650	V	
I_F	Continuous DC forward current	150	A	
I_{FRM}	Repetitive peak forward current	300	A	t_P = 1 ms

7. Reverse Diode(D1-D4) Characteristic Values

Symbol	Parameters	Min.	Typ.	Max.	Unit	Test Conditions
V_F	Forward voltage		1.5 1.22	2.1	V	I_F= 150A, V_{GE}= 0V, Tvj = 25ºC I_F= 150A, V_{GE}= 0V, Tvj = 150ºC
I_{RM}	Peak reverse recovery current		91 162		A	V_R = 300V,I_F= 150A Tvj=25℃ V_{GE} =-15V Tvj=150℃ -diF/dt=3200A/us
Q_{rr}	Reverse Recovery Charge		2.67 12.89		uC	V_R = 300V,I_F= 150A Tvj=25℃ V_{GE} =-15V Tvj=150℃ -diF/dt=3200A/us
E_{rec}	Reverse recovery energy		0.4 2.18		mJ	V_R = 300V,I_F= 150A Tvj=25℃ V_{GE} =-15V Tvj=150℃ -diF/dt=3200A/us
$R_{th(j-c)}$	Thermal Resistance from Junction to Case		0.35	0.40	°C/W	
$T_{vj,op}$	Temperature under switching condition	-40		150		

8. Clamping Diode(D5-D6) Maximum Rated Values

Symbol	Parameters	Value	Unit	Test Conditions
V_{RRM}	Repetitive peak reverse voltage	650	V	
I_F	Continuous DC forward current	150	A	
I_{FRM}	Repetitive peak forward current	300	A	t_P = 1 ms

9. Clamping Diode（D5-D6) Characteristic Values

Symbol	Parameters	Min.	Typ.	Max.	Unit	Test Conditions
V_F	Forward voltage		2.0 1.6	2.35	V	I_F= 150A, V_{GE}= 0V, Tvj = 25℃ I_F= 150A, V_{GE}= 0V, Tvj = 150℃
I_{RM}	Peak reverse recovery current		39 98		A	V_R = 300V,I_F= 150A Tvj=25℃ V_{GE} =-15V Tvj=150℃ -diF/dt=2600A/us
Q_{rr}	Reverse recovery charge		0.63 3.74		uC	V_R = 300V,I_F= 150A Tvj=25℃ V_{GE} =-15V Tvj=150℃ -diF/dt=2600A/us
E_{rec}	Reverse recovery energy		0.06 0.38		mJ	V_R = 300V,I_F= 150A Tvj=25℃ V_{GE} =-15V Tvj=150℃ -diF/dt=2600A/us
$R_{th(j-c)}$	Thermal Resistance from Junction to Case		0.37	0.43	°C/W	
$T_{vj,op}$	Temperature under switching conditions	-40		150		

10. NTC-Thermistor Characteristic Values

Symbol	Parameters	Min.	Typ.	Max.	Unit	Test Conditions
R_{25}	Rated resistance		5		kΩ	Tc=25°C
R/R	Deviation of R100	-5		5	%	T_C = 100°C, R100 = 493
P_{25}	Power Dissipation			20	mW	Tc=25°C
$B_{25/50}$	B-value		3375		K	R2 = R25 exp [B25/50(1/T2 - 1/(298,15 K))]
$B_{25/80}$	B-value		3411		K	R2 = R25 exp [B25/80(1/T2 - 1/(298,15 K))]
$B_{25/100}$	B-value		3433		K	R2 = R25 exp [B25/100(1/T2 - 1/(298,15 K))]

11. Module

Symbol	Parameters	Value	Unit	Test Conditions
V_{ISOL}	Isolation test voltage	2.5	kV	RMS, f = 50 Hz, t = 1 min.
	Internal isolation	Al_2O_3		Basic insulation (class 1, IEC 61140)
	Creepage distance	11.5 6.3	mm	terminal to heatsink terminal to terminal
	Clearance	10.0 5.0	mm	terminal to heatsink terminal to terminal
CTI	Comperative tracking index	>200		

Symbol	Parameters	Min.	Typ.	Max.	Unit	Test Conditions
L_{sCE}	Stray inductance module		15		nH	
$R_{CC'+EE'}$	Module lead resistance, terminals - chip		2.00		mΩ	
Tstg	Storage temperature	-40		125	℃	
F	Mounting force per clamp	40		80	N	

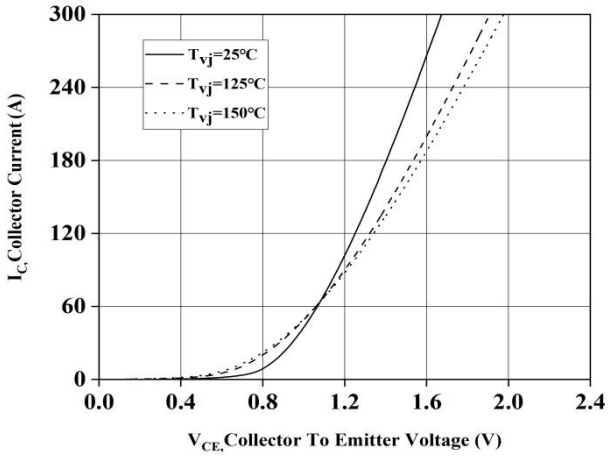


Fig.1.output characteristic IGBT,Inverter(typical)

$I_C=f(V_{CE})$, V_{GE}=15V

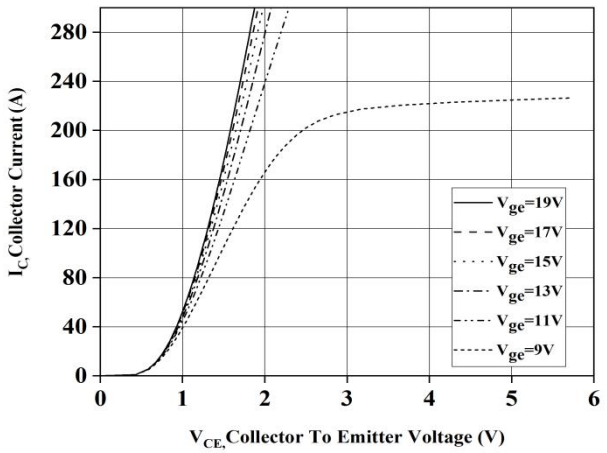


Fig.2.output characteristic IGBT,Inverter(typical)

$I_C=f(V_{CE})$, T_{vj}=150℃

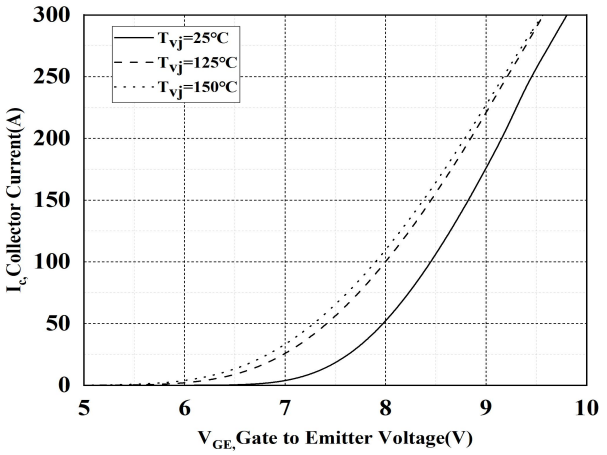


Fig.3.transfer characteristic IGBT,Inverter(typical)

$I_C=f(V_{GE})$,V_{CE}=20V

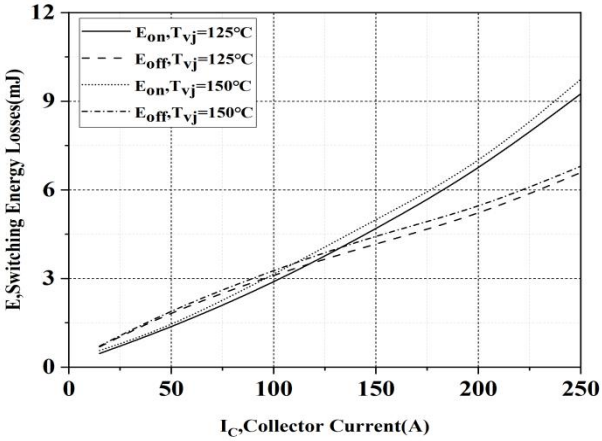


Fig.4.switching losses IGBT,Inverter (typical)

$E_{on}=f(I_C)$, $E_{off}=f(I_C)$, $V_{GE}=\pm15V$, R_{Gon}=12 Ω , R_{Goff}=12 Ω , V_{CE}=300V

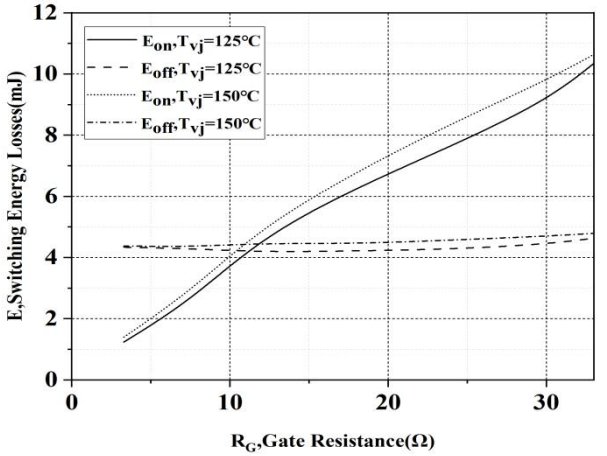


Fig.5.switching losses IGBT,Inverter (typical)

$E_{on}=f(R_G)$, $E_{off}=f(R_G)$, $V_{GE}=\pm15V$, I_C=150A,V_{CE}=300V

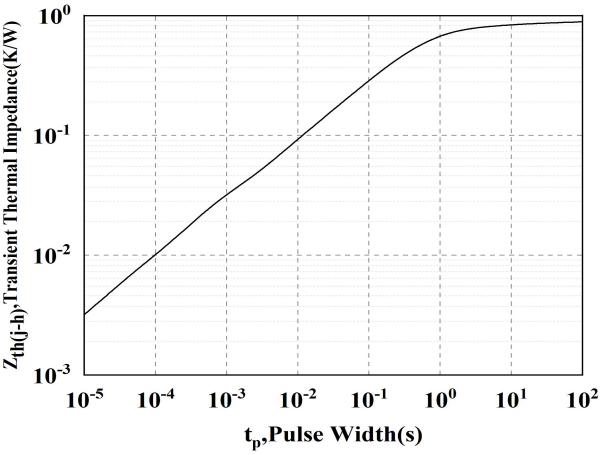


Fig.6.transient thermal impedance IGBT,Inverter

$Z_{thJH}=f(t)$

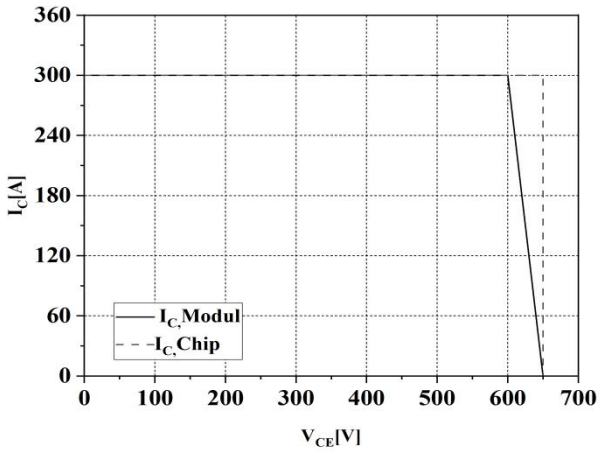


Fig.7. reverse bias safe operating area IGBT,Inverter(RBSOA)

$I_C=f(V_{CE})$,$V_{GE}=\pm 15V$, $R_{Goff}=12\,\Omega$, $T_{vj}=150℃$

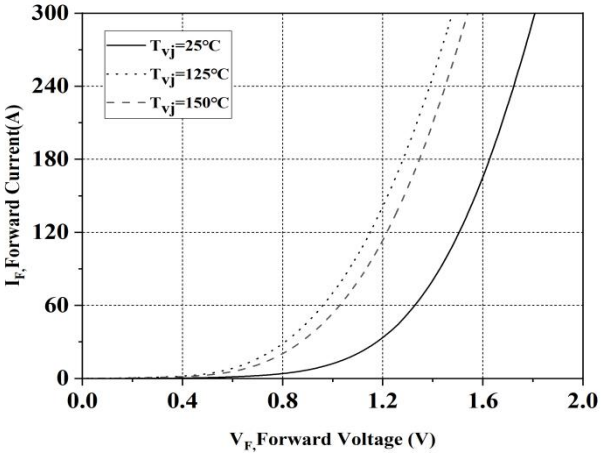


Fig.8.forward characteristic of Diode,Inverter(typical)

$I_F=f(V_F)$

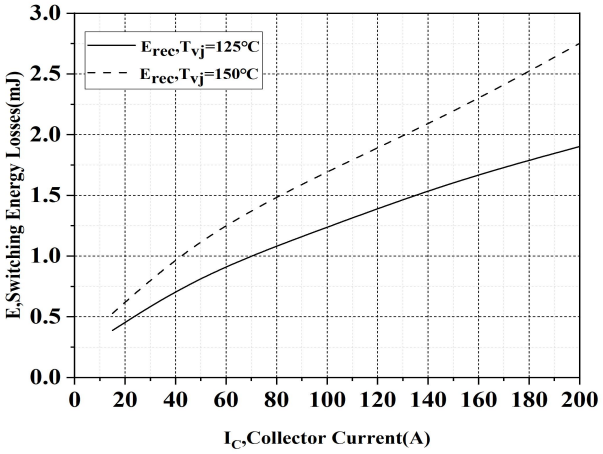


Fig.9. switching losses Diode, Inverter(typical)

$E_{rec}=f(I_F)$, $R_{Gon}=12\,\Omega$, $V_{CE}=300V$

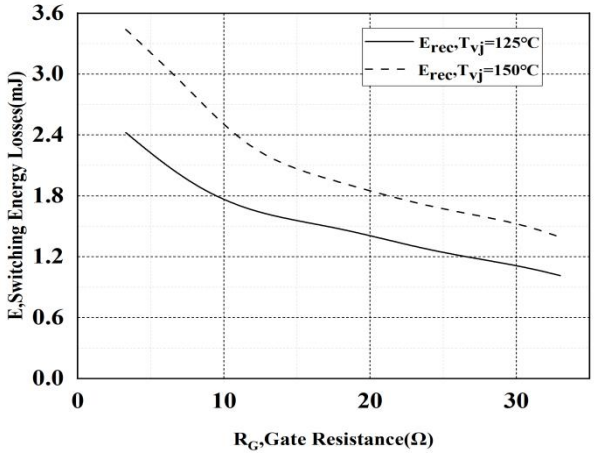


Fig.10. switching losses Diode, Inverter(typical)

$E_{rec}=f(R_G)$, $I_F=150A$,$V_{CE}=300V$

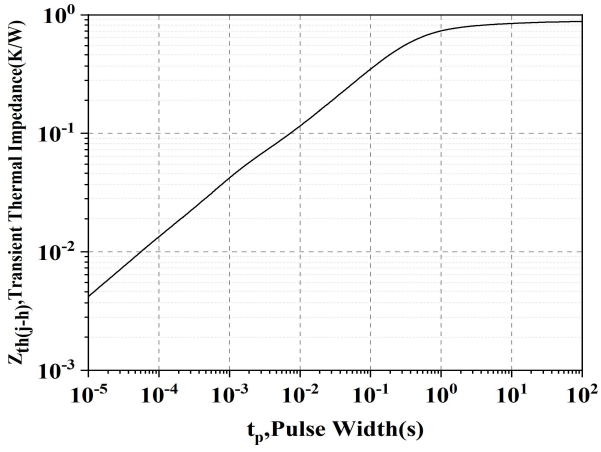


Fig.11. transient thermal impedance Diode,Inverter

$Z_{thJH}=f(t)$

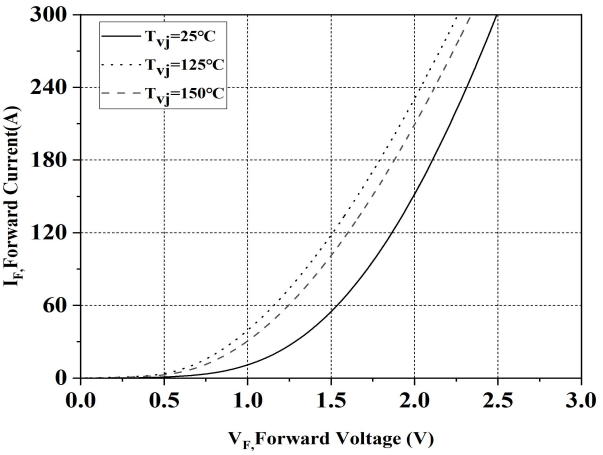


Fig.12.forward characteristic of Diode,D5-D6(typical)

$I_F=f(V_F)$

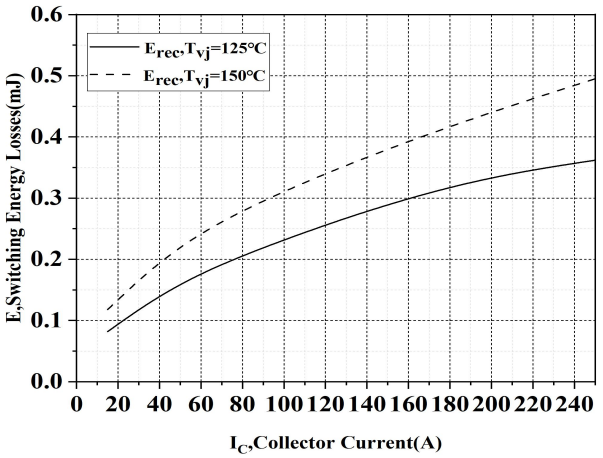


Fig.13.switching losses Diode, D5-D6(typical)

$E_{rec}=f(I_F)$, $R_{Gon}=12\ \Omega$,$V_{CE}=300V$

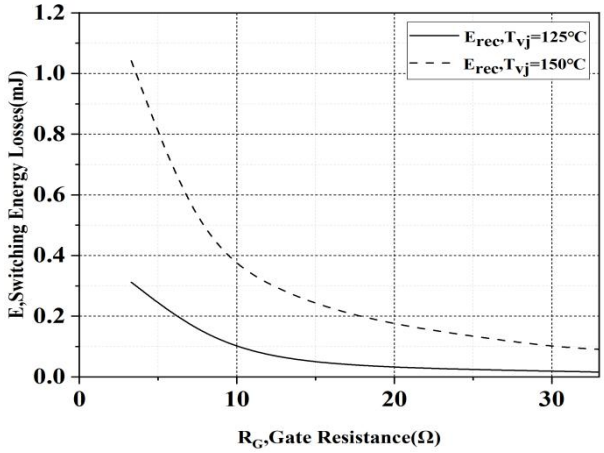


Fig.14.switching losses Diode, D5-D6(typical)

$E_{rec}=f(R_G)$, $I_F=150A$,$V_{CE}=300V$

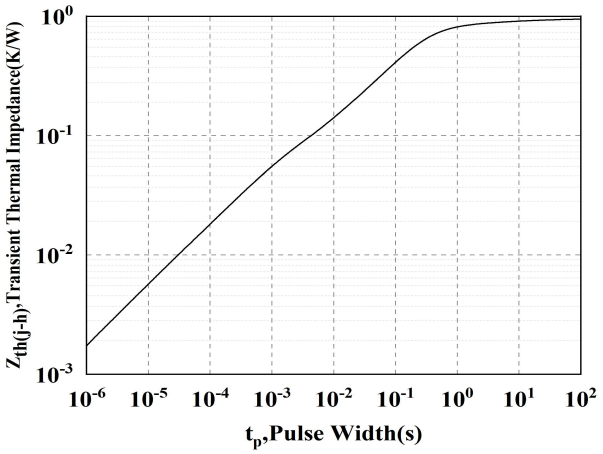


Fig.15. transient thermal impedance Diode,Inverter

ZthJH=f(t)

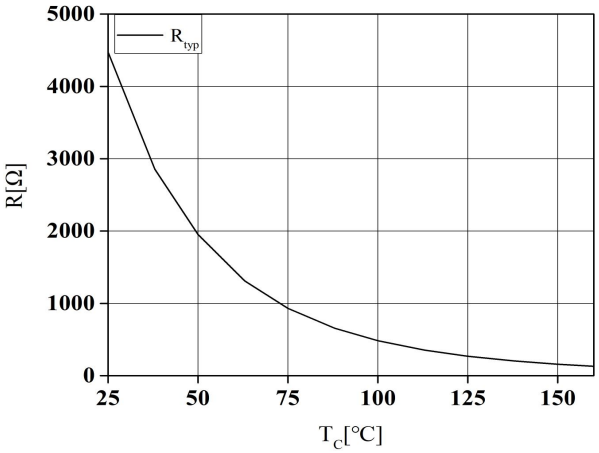
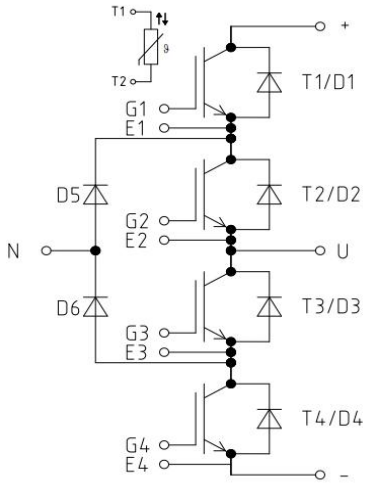


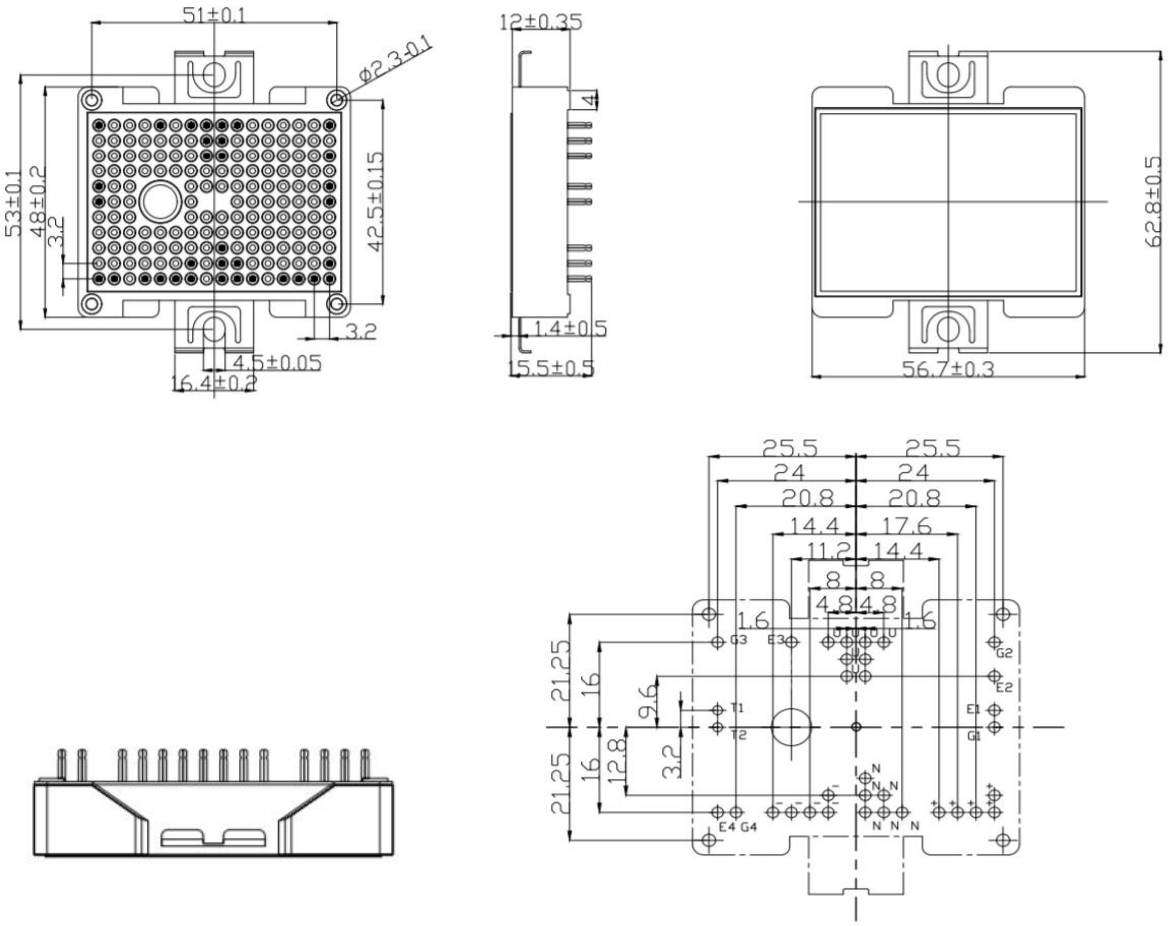
Fig.16.NTC-Thermistor-temperature characteristic(typical)

$R=f(T_C)$

12.Circuit Diagram



13.Product Outline



14.Version Information

Version No.	Status	Date changed	Version revision record
V1.0	Preliminary version	2022/06	New build
V1.1	Final version	2023/11	Updated