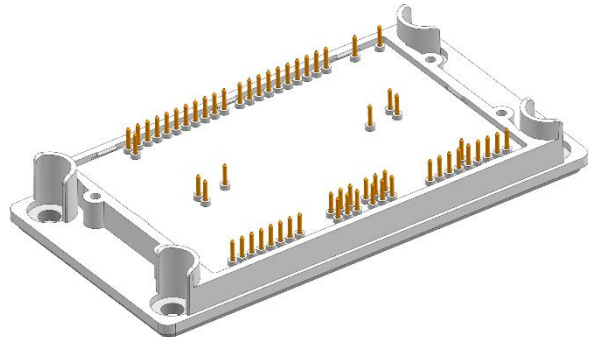


NI450TN12A3F5

1200V 450A IGBT 模块, A3 封装
1200V 450A IGBT Module, A3 Package

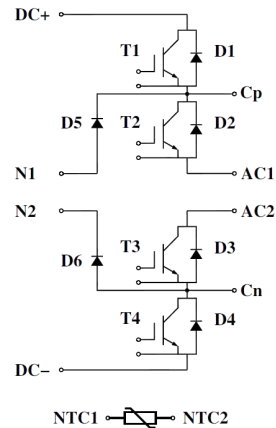
特点 Features

- 低开关损耗
Low switching losses
- 高功率密度
High power density
- 正温度系数
Positive temperature coefficient



应用 Applications

- 储能系统
Energy storage systems
- 太阳能应用
Solar applications
- 三电平应用
Three-level applications



最大额定值/ Maximum Rated Values

参数 Parameter	符号 Symbol	条件 Condition	数值 Value	单位 Unit
最高结温 Maximum Junction Temperature	$T_{vj, max}$		175	°C
工作结温 Operating Junction Temperature	$T_{vj, op}$		-40~150	°C
存储温度范围 Storage Temperature Range	T_{stg}		-40~125	°C

IGBT, T1/T2/T3/T4

参数 Parameter	符号 Symbol	条件 Condition	数值 Value	单位 Unit
集电极-发射极电压 Collector-Emitter Voltage	V_{CES}	$V_{GE}=0V, T_{vj}=25^{\circ}C$	1200	V
集电极电流 DC Collector Current	I_C	$T_c=100^{\circ}C, T_{vj, max}=175^{\circ}C$	450	A
集电极峰值电流 Peak Collector Current	I_{CM}	$t_p=1ms$	900	A
栅极-发射极电压 Gate-Emitter Voltage	V_{GES}		±20	V

Diode, D1/D4/D5/D6

参数 Parameter	符号 Symbol	条件 Condition	数值 Value	单位 Unit
反向重复峰值电压 Repetitive Peak Reverse Voltage	V_{RRM}	$T_{vj}=25^{\circ}C$	1200	V
连续正向直流电流 Continuous DC Forward Current	I_F		450	A
正向重复峰值电流 Repetitive Peak Forward Current	I_{FRM}	$t_p=1ms$	900	A

Diode, D2 / D3

参数 Parameter	符号 Symbol	条件 Condition	数值 Value	单位 Unit
反向重复峰值电压 Repetitive Peak Reverse Voltage	V_{RRM}	$T_{vj}=25^{\circ}\text{C}$	1200	V
连续正向直流电流 Continuous DC Forward Current	I_F		450	A
正向重复峰值电流 Repetitive Peak Forward Current	I_{FRM}	$t_p=1\text{ms}$	900	A

IGBT特征值 IGBT Characteristics Values ($T_{vj}=25^{\circ}\text{C}$ unless otherwise noted) IGBT, T1 / T4

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit	
			Min.	Typ.	Max.		
集电极-发射极饱和电压 Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=450\text{A}, V_{GE}=15\text{V}$	$T_{vj}=25^{\circ}\text{C}$		1.90	V	
			$T_{vj}=150^{\circ}\text{C}$		2.45		
栅极-发射极阈值电压 Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C=16\text{mA}, V_{CE}=V_{GE}$		5.8		V	
集电极-发射极截止电流 Collector-Emitter Cut-off Current	I_{CES}	$V_{CE}=1200\text{V}, V_{GE}=0\text{V}$			1	mA	
栅极-发射极漏电流 Gate-Emitter Leakage Current	I_{GES}	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-100		100	nA	
开通延迟时间 Turn-on Delay Time	$t_{d(on)}$	$I_C=450\text{A},$ $V_{CE}=600\text{V},$ $V_{GE}=-8/15\text{V}$ $R_{Gon}=1.65\Omega$ $R_{Goff}=1.65\Omega$ Inductive Load	$T_{vj}=25^{\circ}\text{C}$		125	ns	
			$T_{vj}=150^{\circ}\text{C}$		130		
上升时间 Rise Time	t_r		$T_{vj}=25^{\circ}\text{C}$		35	ns	
			$T_{vj}=150^{\circ}\text{C}$		42		
关断延迟时间 Turn-off Delay Time	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$		215	ns	
			$T_{vj}=150^{\circ}\text{C}$		253		
下降时间 Fall Time	t_f		$T_{vj}=25^{\circ}\text{C}$		130	ns	
			$T_{vj}=150^{\circ}\text{C}$		150		
开通损耗 Turn-on Energy Loss	E_{on}		$T_{vj}=25^{\circ}\text{C}$		16.0	mJ	
			$T_{vj}=150^{\circ}\text{C}$		25.2		
关断损耗 Turn-off Energy Loss	E_{off}		$T_{vj}=25^{\circ}\text{C}$		19.0	mJ	
			$T_{vj}=150^{\circ}\text{C}$		25.6		
内置栅极电阻 Internal Gate Resistance	R_{Gint}				1		Ω
栅极电荷 Gate Charge	Q_G		$I_C=450\text{A}, V_{CC}=600\text{V}, V_{GE}=-8/15\text{V}$		1.9		μC
输入电容 Input Capacitance	C_{ies}	$V_{CE}=25\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$		68		nF	
输出电容 Output Capacitance	C_{oes}			1.7		nF	
反向传输电容 Reverse Transfer Capacitance	C_{res}			1.1		nF	

IGBT, T2 / T3

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
集电极-发射极饱和电压 Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C=450A, V_{GE}=15V$	$T_{vj}=25^{\circ}C$	1.90		V
			$T_{vj}=150^{\circ}C$	2.45		
栅极-发射极阈值电压 Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$I_C=16mA, V_{CE}=V_{GE}$		5.8		V
集电极-发射极截止电流 Collector-Emitter Cut-off Current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$			1	mA
栅极-发射极漏电流 Gate-Emitter Leakage Current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$	-100		100	nA
开通延迟时间 Turn-on Delay Time	$t_{d(on)}$	$I_C=450A,$ $V_{CE}=600V,$ $V_{GE}=-8/15V$ $R_{Gon}=1.65\Omega$ $R_{Goff}=1.65\Omega$ Inductive Load	$T_{vj}=25^{\circ}C$		117	ns
			$T_{vj}=150^{\circ}C$		122	
上升时间 Rise Time	t_r		$T_{vj}=25^{\circ}C$		41	ns
			$T_{vj}=150^{\circ}C$		46	
关断延迟时间 Turn-off Delay Time	$t_{d(off)}$		$T_{vj}=25^{\circ}C$		211	ns
			$T_{vj}=150^{\circ}C$		256	
下降时间 Fall Time	t_f		$T_{vj}=25^{\circ}C$		207	ns
			$T_{vj}=150^{\circ}C$		188	
开通损耗 Turn-on Energy Loss	E_{on}		$T_{vj}=25^{\circ}C$		8.8	mJ
			$T_{vj}=150^{\circ}C$		13.8	
关断损耗 Turn-off Energy Loss	E_{off}		$T_{vj}=25^{\circ}C$		34.2	mJ
			$T_{vj}=150^{\circ}C$		35.1	
内置栅极电阻 Internal Gate Resistance	R_{Gint}			1		Ω
栅极电荷 Gate Charge	Q_G	$I_C=450A, V_{CE}=1200V, V_{GE}=-8/15V$		1.9		μC
输入电容 Input Capacitance	C_{ies}	$V_{CE}=25V, V_{GE}=0V, f=1MHz$		68		nF
输出电容 Output Capacitance	C_{oes}			1.7		nF
反向传输电容 Reverse Transfer Capacitance	C_{res}			1.1		nF

二极管特征值 Diode Characteristics Values Diode, D1 / D4

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
正向电压 Forward Voltage	V_F	$I_F=450A$	$T_{vj}=25^{\circ}C$		2.40	V
			$T_{vj}=150^{\circ}C$		2.55	

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
反向恢复峰值电流 Peak Reverse Recovery Current	I_{RM}	$I_F=450A,$ $V_R=600V,$ $di_F/dt=-9150A/\mu s$ ($T_{vj}=150^\circ C$) $V_{GE}=-8V$ Inductive Load	$T_{vj}=25^\circ C$	425		A
			$T_{vj}=150^\circ C$		475	
反向恢复电荷 Reverse Recovery Charge	Q_{rr}		$T_{vj}=25^\circ C$	24.5		uC
			$T_{vj}=150^\circ C$	42.8		
反向恢复损耗 Reverse Recovery Energy Loss	E_{rec}		$T_{vj}=25^\circ C$	10.8		mJ
			$T_{vj}=150^\circ C$	17.5		

Diode, D2 / D3

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
正向电压 Forward Voltage	V_F	$I_F=450A$	$T_{vj}=25^\circ C$	1.60		V
			$T_{vj}=150^\circ C$	1.70		

Diode, D5 / D6

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
正向电压 Forward Voltage	V_F	$I_F=450A$	$T_{vj}=25^\circ C$	2.40		V
			$T_{vj}=150^\circ C$	2.55		
反向恢复峰值电流 Peak Reverse Recovery Current	I_{RM}	$I_F=450A,$ $V_R=600V,$ $di_F/dt=-11600A/\mu s$ ($T_{vj}=150^\circ C$) $V_{GE}=-8V$ Inductive Load	$T_{vj}=25^\circ C$	390		A
			$T_{vj}=150^\circ C$	450		
反向恢复电荷 Reverse Recovery Charge	Q_{rr}		$T_{vj}=25^\circ C$	20.0		uC
			$T_{vj}=150^\circ C$	40.0		
反向恢复损耗 Reverse Recovery Energy Loss	E_{rec}		$T_{vj}=25^\circ C$	6.8		mJ
			$T_{vj}=150^\circ C$	16.0		

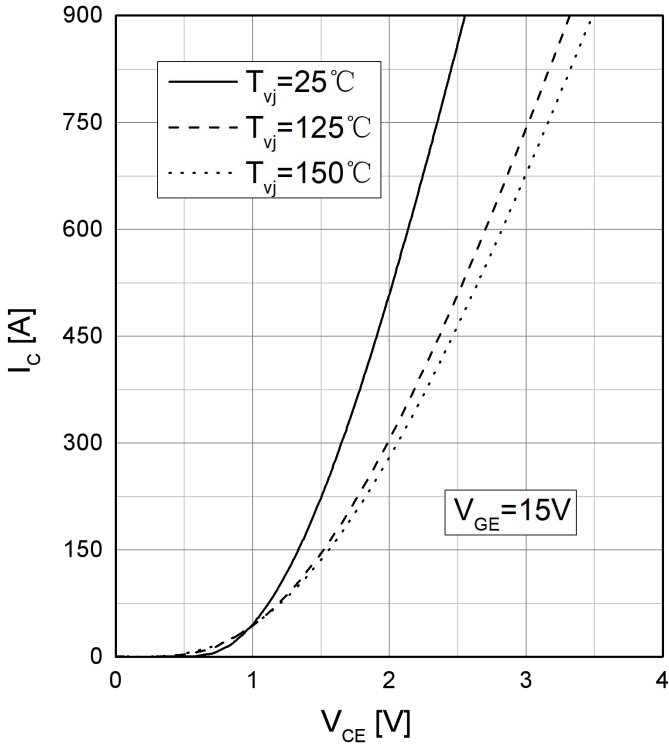
负温度系数热敏电阻 NTC-Thermistor

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
额定电阻 Rated Resistance	R_{25}	$T_C=25^\circ C$		22		k Ω
B-值 B-Value	$B_{25/50}$	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298,15K))]$		3950		K

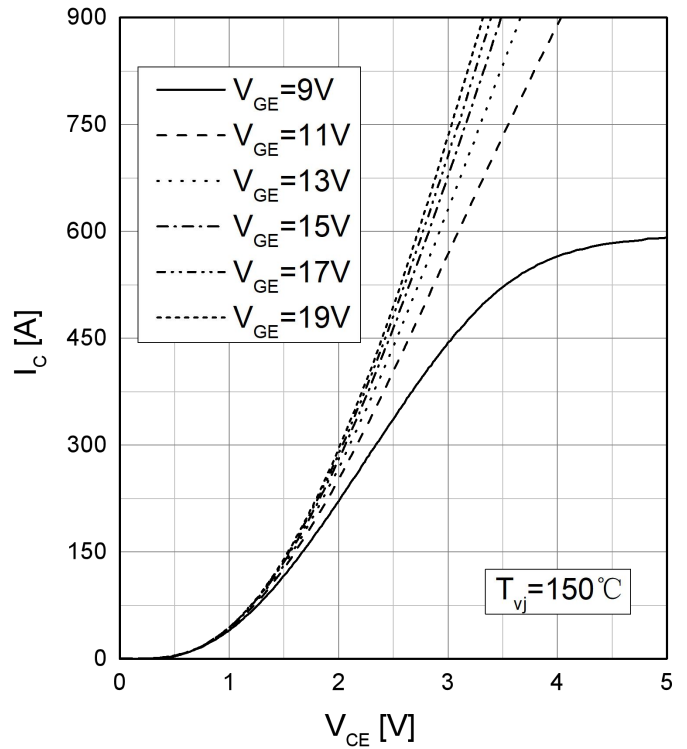
封装特性 Package Properties

参数 Parameter	符号 Symbol	条件 Condition	数值 Value			单位 Unit
			Min.	Typ.	Max.	
IGBT 结-壳热阻, T1/T4 IGBT Thermal Resistance: Junction to Case, T1/T4	$R_{th(J-C)}$	每个IGBT/per IGBT		0.061		K/W
IGBT 结-壳热阻, T2/T3 IGBT Thermal Resistance: Junction to Case, T2/T3	$R_{th(J-C)}$	每个IGBT/per IGBT		0.055		K/W
二极管 结-壳热阻, D1/D4 Diode Thermal Resistance: Junction to Case, D1/D4	$R_{th(J-C)}$	每个二极管/per Diode		0.085		K/W
二极管 结-壳热阻, D2/D3 Diode Thermal Resistance: Junction to Case, D2/D3	$R_{th(J-C)}$	每个二极管/per Diode		0.090		K/W
二极管 结-壳热阻, D5/D6 Diode Thermal Resistance: Junction to Case, D5/D6	$R_{th(J-C)}$	每个二极管/per Diode		0.117		K/W
绝缘耐压 Isolation Voltage	V_{isol}	RMS, f=50Hz, t=60s	4.0			kV
爬电距离 Creepage Distance	d_{cr}	端子到散热器 Terminal to Heatsink	18			mm
		端子到端子 Terminal to Terminal	11.4			mm
电气间隙 Clearance Distance	d_{cl}	端子到散热器 Terminal to Heatsink	15			mm
		端子到端子 Terminal to Terminal	9.8			mm
相对漏电起痕指数 Comparative Tracking Index	CTI		400			
模块寄生电感 Module Stray Inductance	$L_{s, CE}$	每个桥臂/per Switch		20		nH
模块引线内阻 Module lead Resistance, Terminal to Chip	R_{CC+EE}	每个桥臂/per Switch, $T_c=25^\circ\text{C}$		1.2		m Ω
安装扭矩 Mounting Torques	M	基板至散热器, Baseplate to Heatsink, M5	3.0		6.0	Nm
模块重量 Module Weight	G			290		g

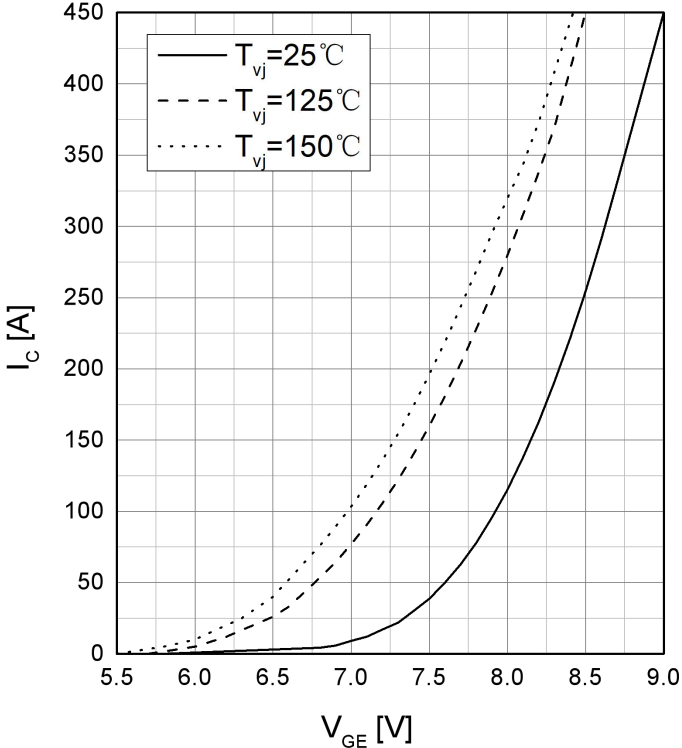
输出特性 IGBT, T1/T4
Output characteristic IGBT, T1/T4
 $I_c=f(V_{ce}), V_{ge}=15V$



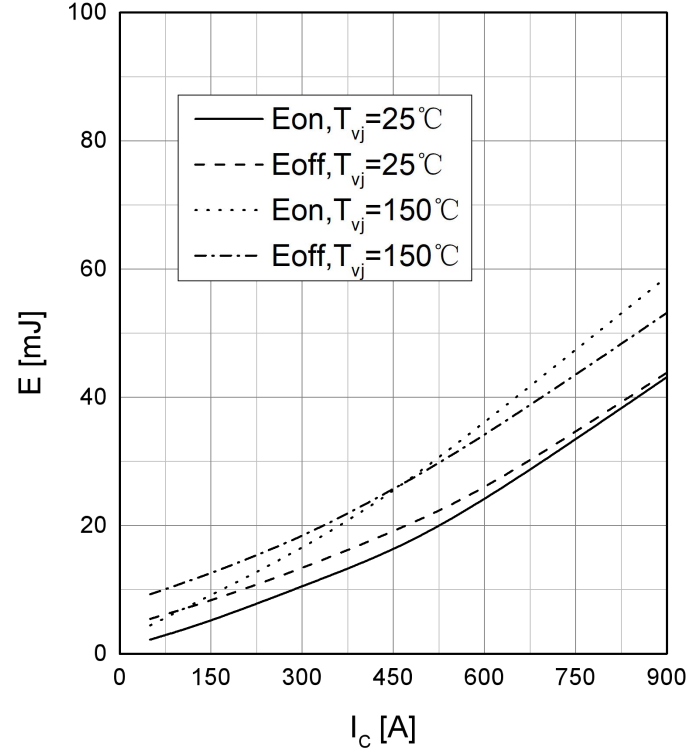
输出特性 IGBT, T1/T4
Output characteristic IGBT, T1/T4
 $I_c=f(V_{ce}), T_{vj}=150^\circ C$



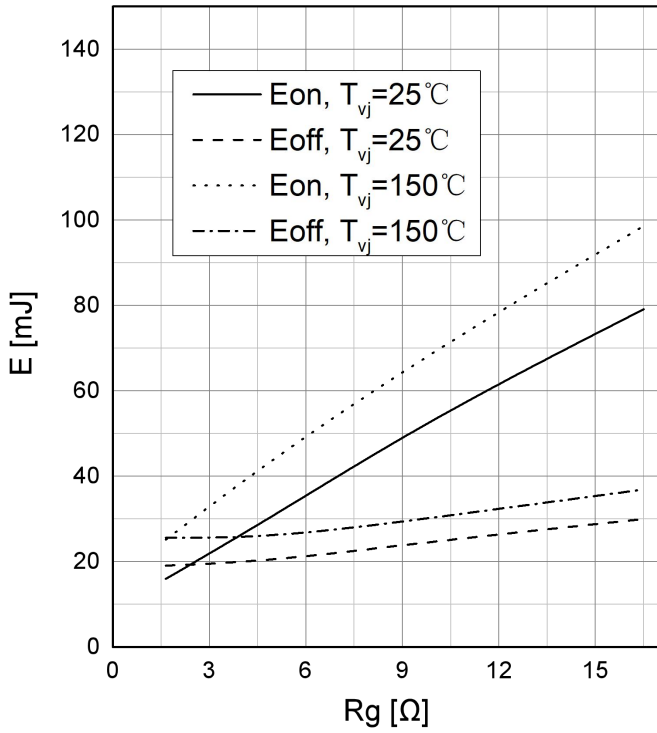
传输特性 IGBT, T1/T4
Transfer characteristic IGBT, T1/T4
 $I_c=f(V_{ge}), V_{ce}=10V$



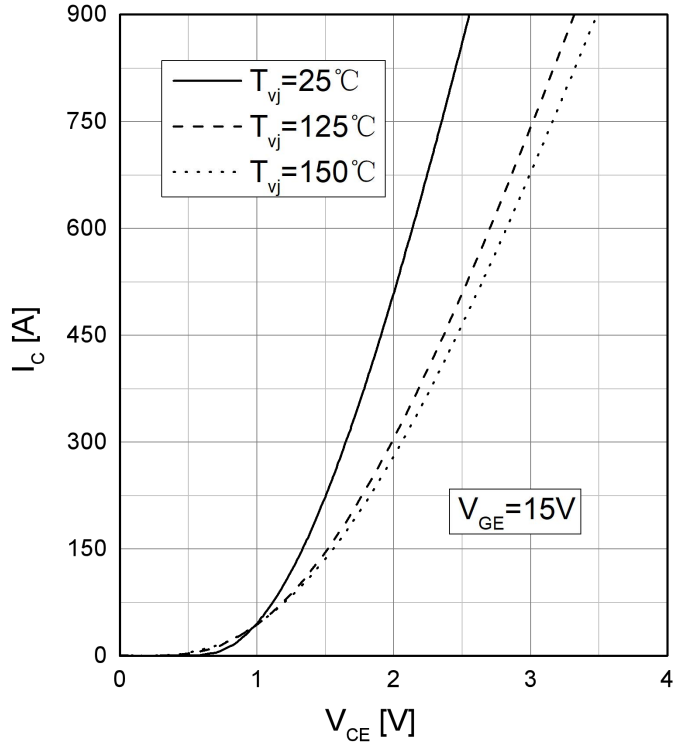
开关损耗 IGBT, T1/T4
Switching losses IGBT, T1/T4
 $E=f(I_c), V_{ge}=\pm 15V, R_{gon}=R_{goff}=1.65\Omega, V_{ce}=600V$



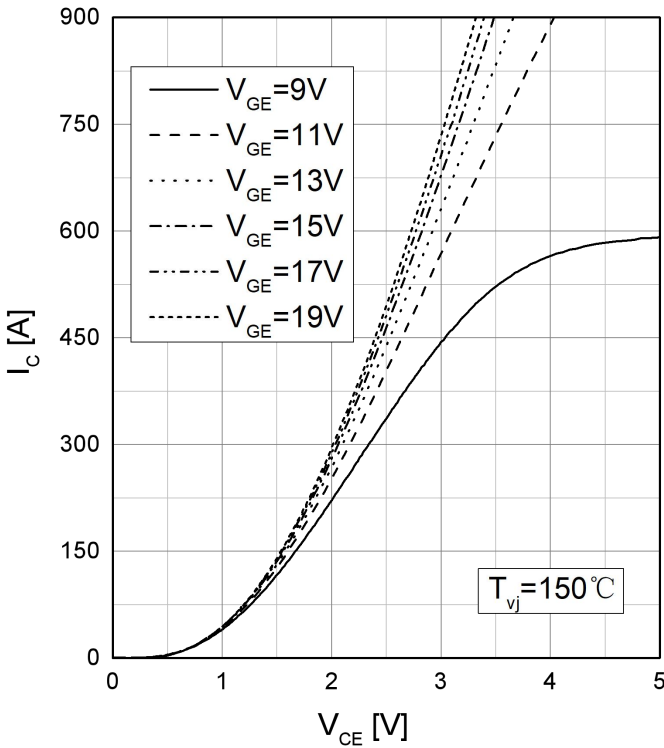
开关损耗IGBT, T1/T4
Switching losses IGBT, T1/T4
 $V_{GE}=\pm 15V, I_c=450A, V_{CE}=600V$



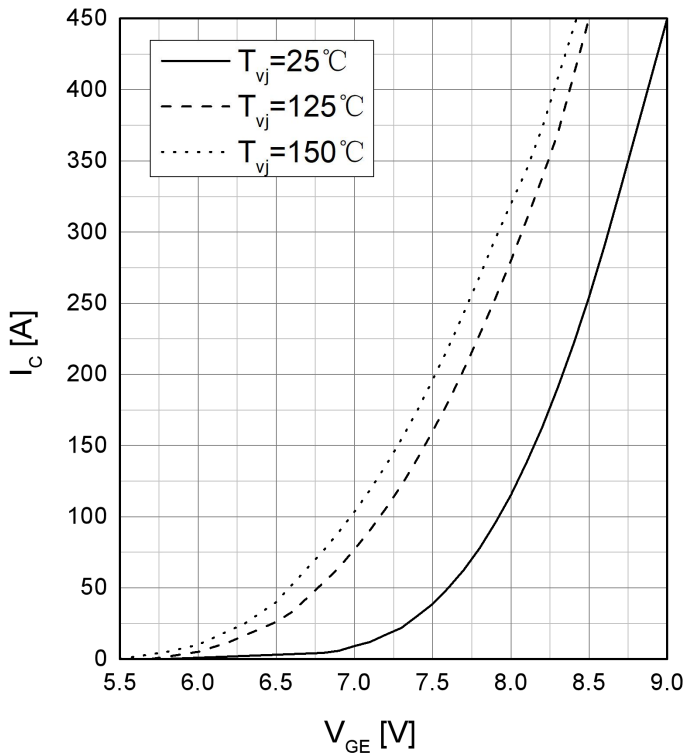
输出特性IGBT, T2/T3
Output characteristic IGBT, T2/T3
 $I_c=f(V_{CE}), V_{GE}=15V$



输出特性IGBT, T2/T3
Output characteristic IGBT, T2/T3
 $I_c=f(V_{CE}), T_{vj}=150^\circ C$



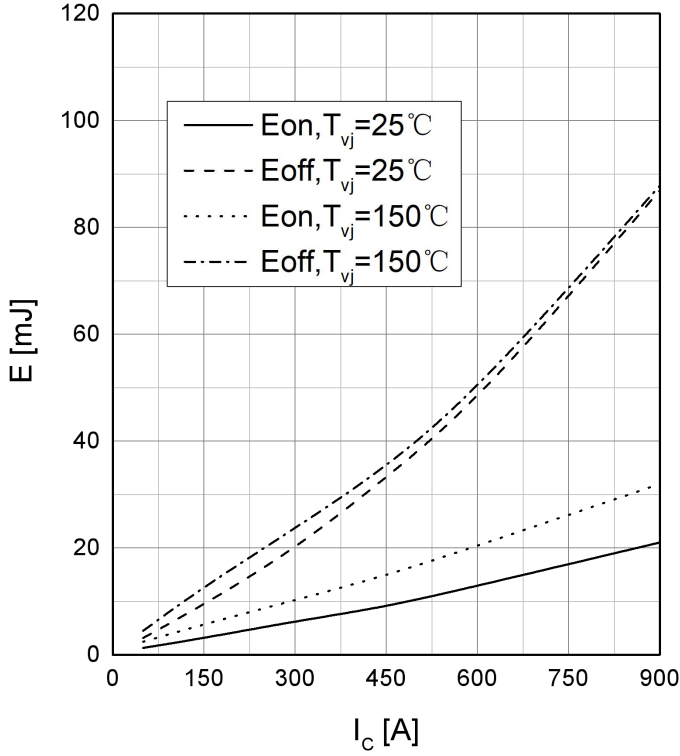
传输特性 IGBT, T2/T3
Transfer characteristic IGBT, T2/T3
 $I_c=f(V_{GE}), V_{CE}=10V$



开关损耗 IGBT, T2/T3

Switching losses IGBT, T2/T3

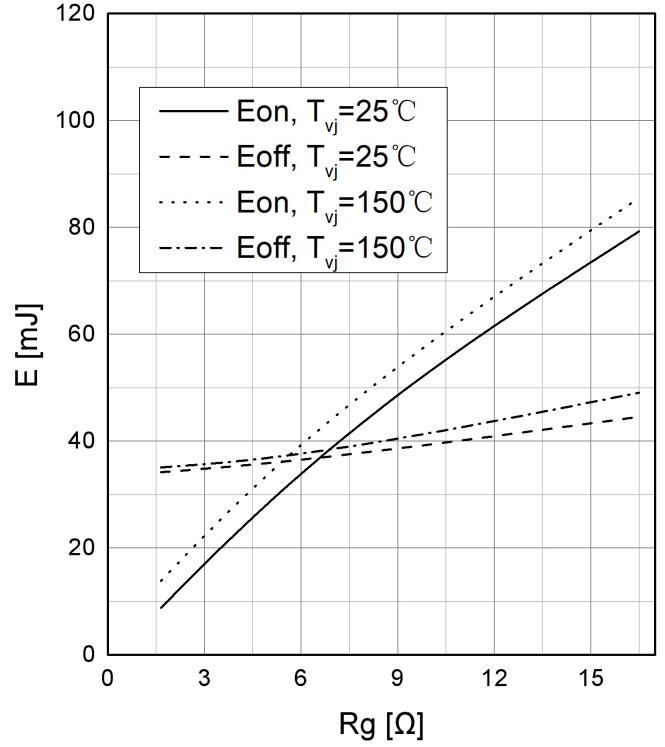
$E=f(I_c)$, $V_{GE}=\pm 15V$, $R_{Gon}=R_{Goff}=1.65\Omega$, $V_{CE}=600V$



开关损耗 IGBT, T2/T3

Switching losses IGBT, T2/T3

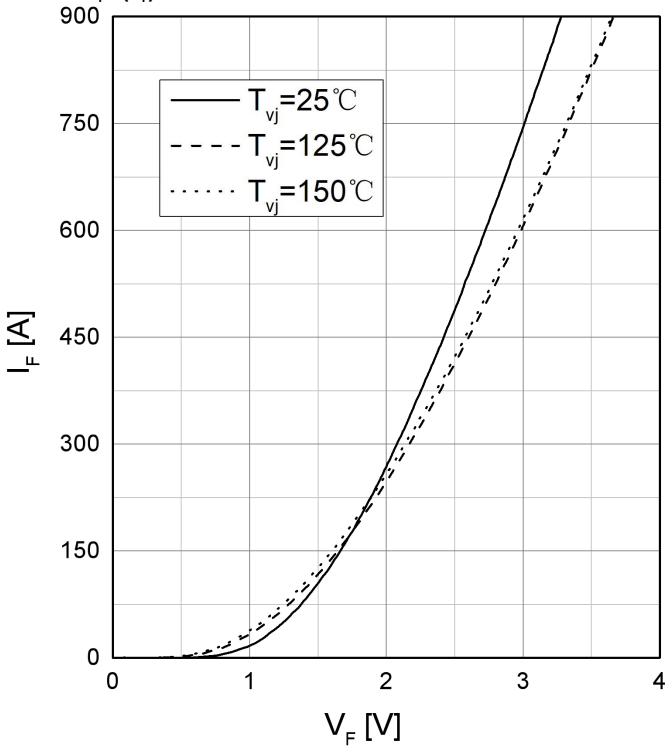
$V_{GE}=\pm 15V$, $I_c=450A$, $V_{CE}=600V$



正向特性 Diode, D1/D4

Forward characteristic Diode, D1/D4

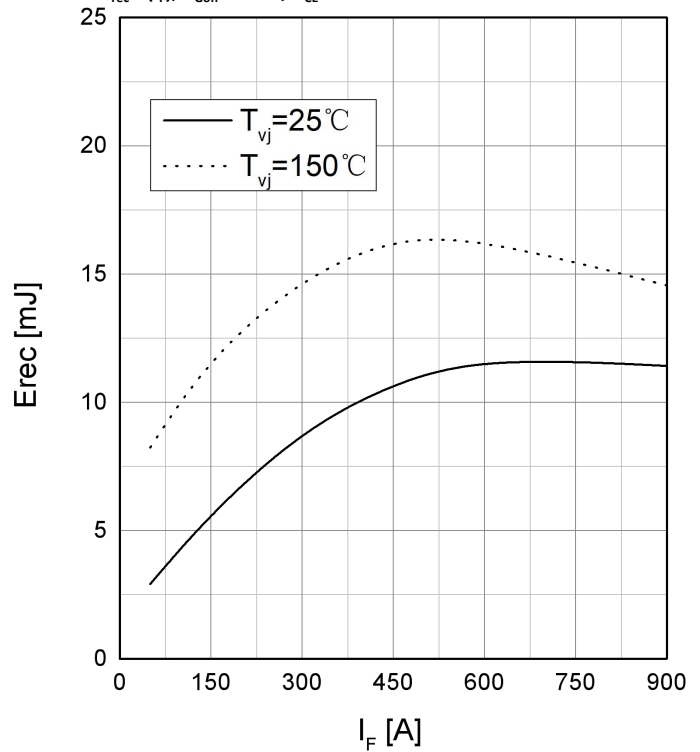
$I_f=f(V_f)$



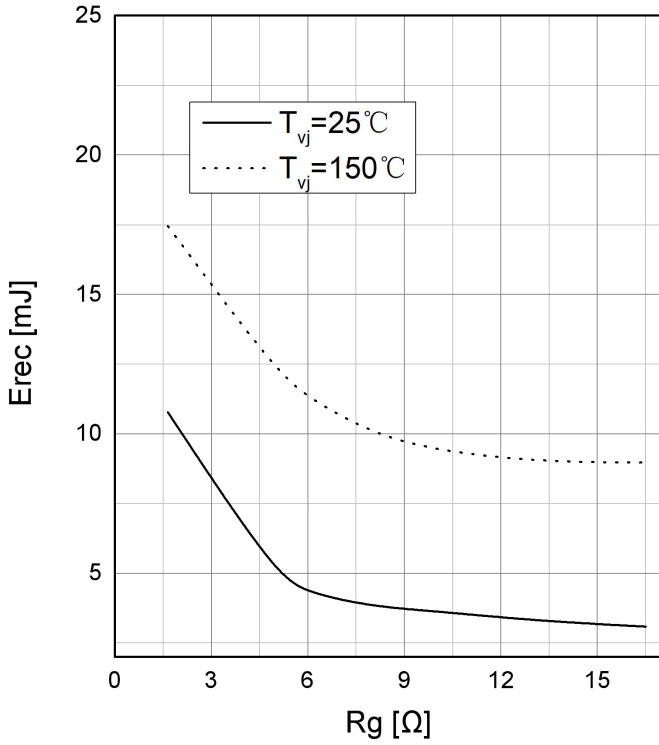
开关损耗 Diode, D1/D4

Switching losses Diode, D1/D4

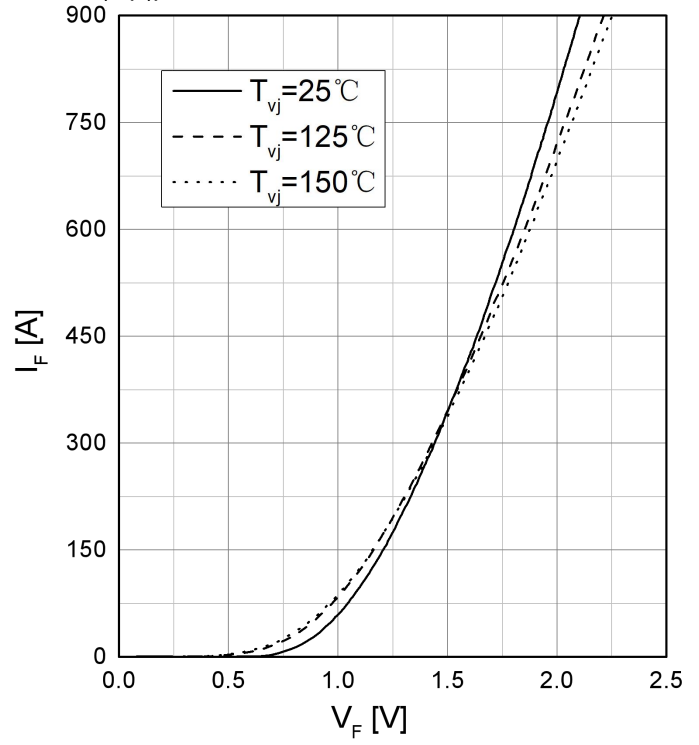
$E_{rec}=f(I_f)$, $R_{Gon}=1.65\Omega$, $V_{CE}=600V$



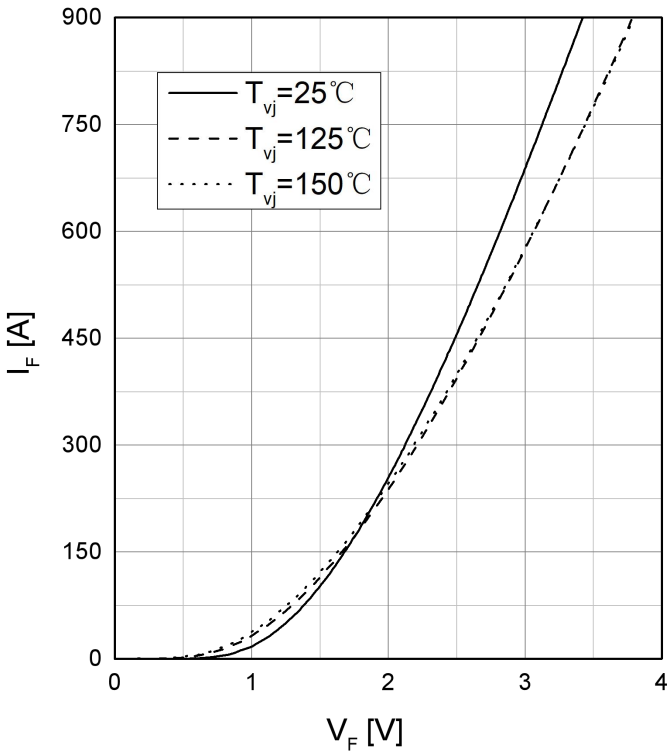
开关损耗Diode, D1/D4
switching losses Diode, D1/D4
 $E_{rec}=f(R_g), V_{CE}=600V$



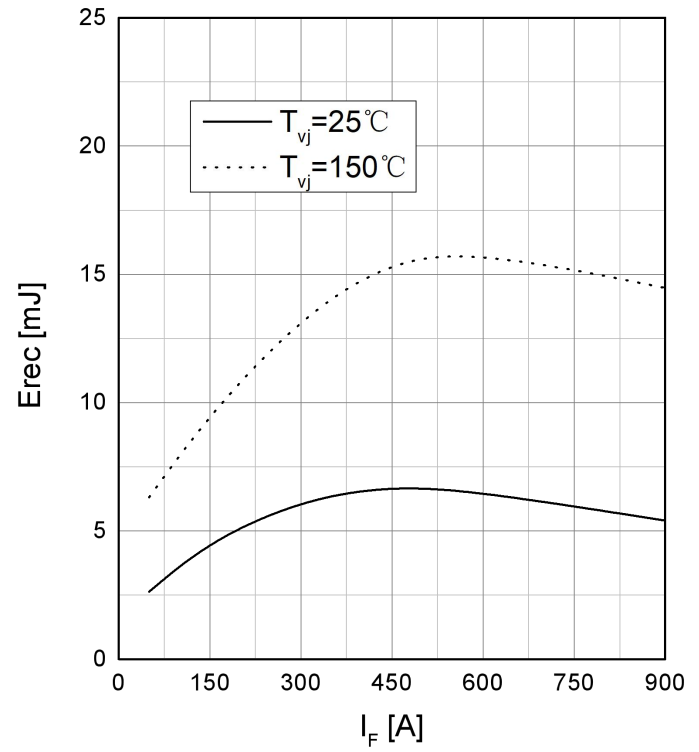
正向特性Diode, D2/D3
Forward characteristic Diode, D2/D3
 $I_F=f(V_F)$



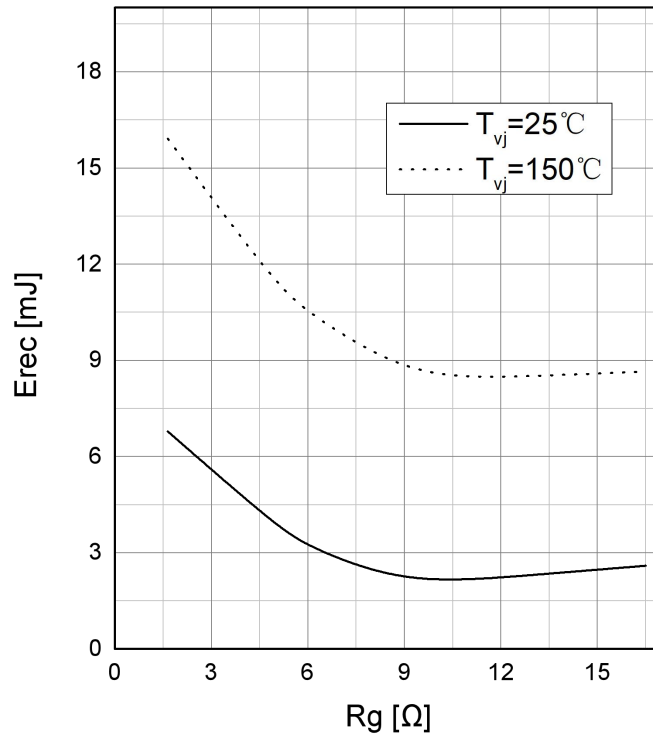
正向特性Diode, D5/D6
Forward characteristic Diode, D5/D6
 $I_F=f(V_F)$



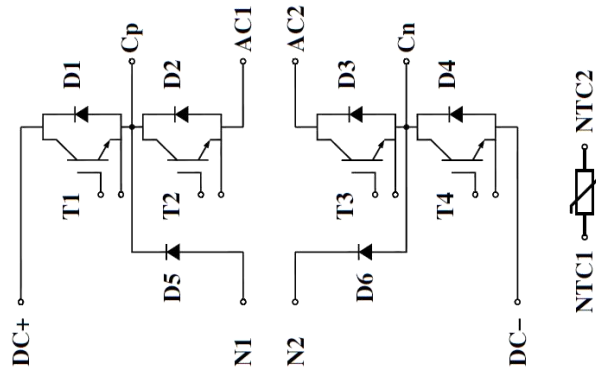
开关损耗 Diode, D5/D6
Switching losses Diode, D5/D6
 $E_{rec}=f(I_F), R_{Gon}=1.65\Omega, V_{CE}=600V$



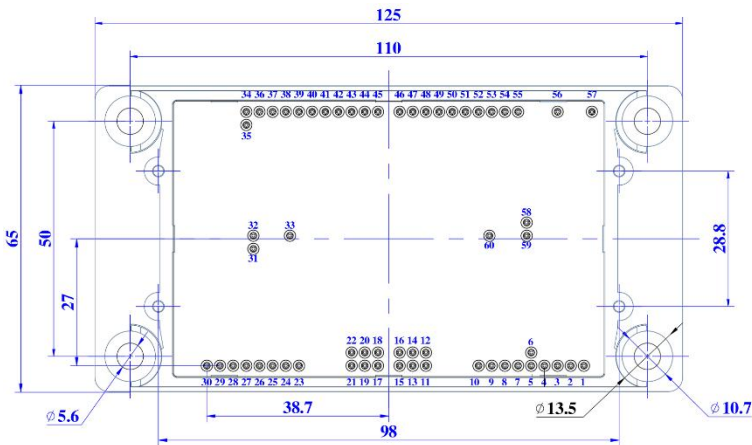
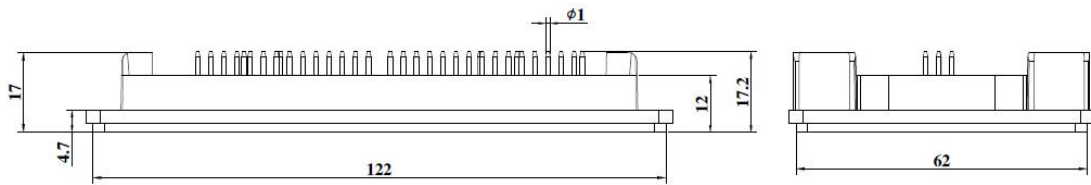
开关损耗Diode, D5/D6
switching losses Diode, D5/D6
 $E_{rec}=f(R_g), V_{CE}=600V$



电路图 Circuit Diagram



外形尺寸 Outline Drawing



端子号	符号	端子功能	坐标 (X,Y) /mm	端子号	符号	端子功能	坐标 (X,Y) /mm
1	DC-	直流负	80.2, 0	31	G1	T1管驱动G	9.9, 24.85
2	DC-	直流负	77.4, 0	32	E1	T1管驱动E	9.9, 27.65
3	DC-	直流负	74.6, 0	33	Cp	吸收电容正	17.7, 27.65
4	DC-	直流负	71.8, 0	34	E2	T2管驱动E	8.4, 54
5	E4	T4管驱动E	69, 0	35	G2	T2管驱动G	8.4, 51.2
6	G4	T4管驱动G	69, 2.8	36	AC1	交流输出1	11.2, 54
7	DC-	直流负	66.2, 0	37	AC1	交流输出1	14, 54
8	DC-	直流负	63.4, 0	38	AC1	交流输出1	16.8, 54
9	DC-	直流负	60.6, 0	39	AC1	交流输出1	19.6, 54
10	DC-	直流负	57.8, 0	40	AC1	交流输出1	22.4, 54
11	N2	直流中点	46.6, 0	41	AC1	交流输出1	25.2, 54
12	N2	直流中点	46.6, 2.8	42	AC1	交流输出1	28, 54
13	N2	直流中点	43.8, 0	43	AC1	交流输出1	30.8, 54
14	N2	直流中点	43.8, 2.8	44	AC1	交流输出1	33.6, 54
15	N2	直流中点	41, 0	45	AC1	交流输出1	36.4, 54
16	N2	直流中点	41, 2.8	46	AC2	交流输出2	41, 54
17	N1	直流中点	36.4, 0	47	AC2	交流输出2	43.8, 54
18	N1	直流中点	36.4, 2.8	48	AC2	交流输出2	46.6, 54
19	N1	直流中点	33.6, 0	49	AC2	交流输出2	49.4, 54
20	N1	直流中点	33.6, 2.8	50	AC2	交流输出2	52.2, 54
21	N1	直流中点	30.8, 0	51	AC2	交流输出2	55, 54
22	N1	直流中点	30.8, 2.8	52	AC2	交流输出2	57.8, 54
23	DC+	直流正	19.6, 0	53	AC2	交流输出2	60.6, 54
24	DC+	直流正	16.8, 0	54	AC2	交流输出2	63.4, 54
25	DC+	直流正	14, 0	55	AC2	交流输出2	66.2, 54
26	DC+	直流正	11.2, 0	56	NTC1	NTC端子	74.6, 54
27	DC+	直流正	8.4, 0	57	NTC2	NTC端子	81.9, 54
28	DC+	直流正	5.6, 0	58	G3	T3管驱动G	68, 30.45
29	DC+	直流正	2.8, 0	59	E3	T3管驱动E	68, 27.65
30	DC+	直流正	0, 0	60	Cn	吸收电容负	60.1, 27.65

端子位置度: ±0.4mm
