

1. Product Features

1.1 Electrical features

- $V_{CES}=750V$
- $I_c=820A / I_{CRM}=1640A$
- Low switching losses
- Low inductance
- Fast switching and short tail current
- Integrated NTC temperature sensor
- High power and thermal cycling capability

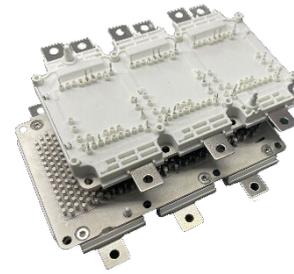


Figure 1 IGBT Module

1.2 Mechanical features

- Integrated NTC temperature sensor
- High power and thermal cycling capability
- Al₂O₃ substrate with low thermal resistance
- Copper base plate with Pin Fin
- PressFIT Contact Technology

2. Typical Applications

- Automotive Applications
- Hybrid Electrical Vehicles (H)EV
- Motor Drives
- Commercial Agriculture Vehicles

3. Description

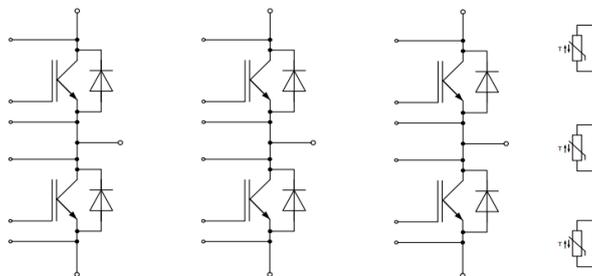


Figure 2 Six Pack

4. IGBT, Inverter

4.1 Maximum rated values

Parameter	Note or test condition	Symbol	Values	Unit
Collector-emitter voltage 集电极—发射极间电压	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	750	V
Continuous DC collector current 连续集电极电流	$T_F = 130^{\circ}\text{C}, T_{vj, \max} = 175^{\circ}\text{C}$	$I_{C \text{ nom}}$	450	A
Repetitive peak collector current 集电极峰值电流	$t_P = 1 \text{ ms}$	I_{CRM}	1640	A
Total power dissipation 总功率损耗	$T_F = 75^{\circ}\text{C}, T_{vj, \max} = 175^{\circ}\text{C}$	P_{tot}	1000	W
Gate-emitter peak voltage 栅极—发射极峰值电压		V_{GES}	+/- 20	V

4.2 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage 集电极—发射极饱和电压	$I_C = 450 \text{ A}, V_{GE} = 15 \text{ V}$	$V_{CE, \text{sat}}$		$T_{vj} = 25^{\circ}\text{C}$	1.03	V
				$T_{vj} = 150^{\circ}\text{C}$	0.99	V
				$T_{vj} = 175^{\circ}\text{C}$	0.98	V
	$I_C = 820 \text{ A}, V_{GE} = 15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	1.20	V		
		$T_{vj} = 175^{\circ}\text{C}$	1.27	V		
Gate threshold voltage 栅极阈值电压	$I_C = 9.6 \text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE, \text{th}}$	5	5.8	6.5	V
Collector-emitter cut-off current 集电极-发射极截止电流	$V_{CE} = 750 \text{ V}, V_{GE} = 0 \text{ V}, T_{vj} = 25^{\circ}\text{C}$	I_{CES}			50	mA
Gate-emitter leakage current 栅极-发射极漏电流	$V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}, T_{vj} = 25^{\circ}\text{C}$	I_{GES}			500	nA
Turn-on delay time, inductive load 开通延迟时间	$I_C = 450 \text{ A}, V_{CE} = 400 \text{ V}$ $V_{GE} = +15/-15 \text{ V}$ $R_{G, \text{on}} = 3.9 \Omega$	$t_{d, \text{on}}$		$T_{vj} = 25^{\circ}\text{C}$	0.30	us
				$T_{vj} = 150^{\circ}\text{C}$	0.30	us
				$T_{vj} = 175^{\circ}\text{C}$	0.30	us
Rise time, inductive load 上升时间	$I_C = 450 \text{ A}, V_{CE} = 400 \text{ V}$ $V_{GE} = +15/-15 \text{ V}$ $R_{G, \text{on}} = 3.9 \Omega$	t_r		$T_{vj} = 25^{\circ}\text{C}$	0.10	us
				$T_{vj} = 150^{\circ}\text{C}$	0.11	us
				$T_{vj} = 175^{\circ}\text{C}$	0.11	us

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Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Turn-off delay time, inductive load 关断延迟时间	$I_C = 450A, V_{CE} = 400V$ $V_{GE} = +15/-15V$ $R_{G,off} = 8.2\Omega$	$T_{vj} = 25^\circ C$	$t_{d,off}$		1.40		us
		$T_{vj} = 150^\circ C$			1.70		us
		$T_{vj} = 175^\circ C$			1.75		us
Fall time, inductive load 下降时间	$I_C = 450A, V_{CE} = 400V$ $V_{GE} = +15/-15V$ $R_{G,off} = 8.2\Omega$	$T_{vj} = 25^\circ C$	t_f		0.16		us
		$T_{vj} = 150^\circ C$			0.16		us
		$T_{vj} = 175^\circ C$			0.19		us
Turn-on energy loss per pulse 开通损耗能量	$I_C = 450A, V_{CE} = 400V, L_s=35nH$ $V_{GE} = +15/-15V, di/dt = 3770A/\mu s$ $R_{G,on} = 3.9\Omega (T_{vj} = 175^\circ C)$	$T_{vj} = 25^\circ C$	E_{on}		19.1		mJ
		$T_{vj} = 150^\circ C$			27.0		mJ
		$T_{vj} = 175^\circ C$			29.2		mJ
Turn-off energy loss per pulse 关断损耗能量	$I_C = 450A, V_{CE} = 400V, L_s=35nH$ $V_{GE} = +15/-15V, dv/dt = 1480A/\mu s$ $R_{G,off} = 8.2\Omega (T_{vj} = 175^\circ C)$	$T_{vj} = 25^\circ C$	E_{off}		33.6		mJ
		$T_{vj} = 150^\circ C$			41.6		mJ
		$T_{vj} = 175^\circ C$			43.4		mJ
SC data 短路数据	$V_{GE} \leq 15V, V_{CC}=400V, t_p \leq 6\mu s, T_{vj} = 25^\circ C,$ $C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$		I_{sc}		6095		A
		$V_{GE} \leq 15V, V_{CC}=400V, t_p \leq 3\mu s, T_{vj} = 175^\circ C,$ $C_{GE} = 0.0\mu F, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$				4940	
Thermal resistance, junction to -Cooling Fluid 结-热阻	Per IGBT		$R_{th,JF}$		0.10		K/W

5. Diode, Inverter

5.1 Maximum rated values

Parameter	Note or test condition	Symbol	Values	Unit
Repetitive peak reverse voltage 反向重复峰值电压	$T_{vj} = 25^\circ C$	V_{RRM}	750	V
Continuous DC forward current 连续正向直流电流		I_F	450	A
Repetitive peak forward current 正向重复峰值电流	$t_p = 1ms$	I_{FRM}	1640	A

5.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	$I_F = 450A, V_{GE} = 0V$	$T_{vj} = 25^\circ C$	V_F		1.17		V
		$T_{vj} = 150^\circ C$			1.12		V
		$T_{vj} = 175^\circ C$			1.10		V
	$I_F = 820A, V_{GE} = 0V$	$T_{vj} = 150^\circ C$			1.34		V
		$T_{vj} = 175^\circ C$			1.35		V

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current 反向恢复峰值电流	$I_F = 450A, V_R = 400V$ $V_{GE} = -15V, -di_F/dt = 7400 A/\mu s$ $(T_{vj}=175^\circ C)$	$T_{vj} = 25^\circ C$	I_{RM}		475		A
		$T_{vj} = 150^\circ C$			541		A
		$T_{vj} = 175^\circ C$			557		A
Recovered charge 恢复电荷	$I_F = 450A, V_R = 400V$ $V_{GE} = -15V, -di_F/dt = 7400 A/\mu s$ $(T_{vj}=175^\circ C)$	$T_{vj} = 25^\circ C$	Q_r		11.5		μC
		$T_{vj} = 150^\circ C$			29.4		μC
		$T_{vj} = 175^\circ C$			39.5		μC
Reverse recovery energy 反向恢复损耗 (每脉冲)	$I_F = 450A, V_R = 400V$ $V_{GE} = -15V, -di_F/dt = 7400 A/\mu s$ $(T_{vj}=175^\circ C)$	$T_{vj} = 25^\circ C$	E_{rec}		6.98		mJ
		$T_{vj} = 150^\circ C$			12.4		mJ
		$T_{vj} = 175^\circ C$			15.4		mJ
Thermal resistance, junction to -Cooling Fluid 结-热阻	Per diode		$R_{th,jF}$		0.17		K/W

6. NTC-Thermistor

6.1 Characteristic value

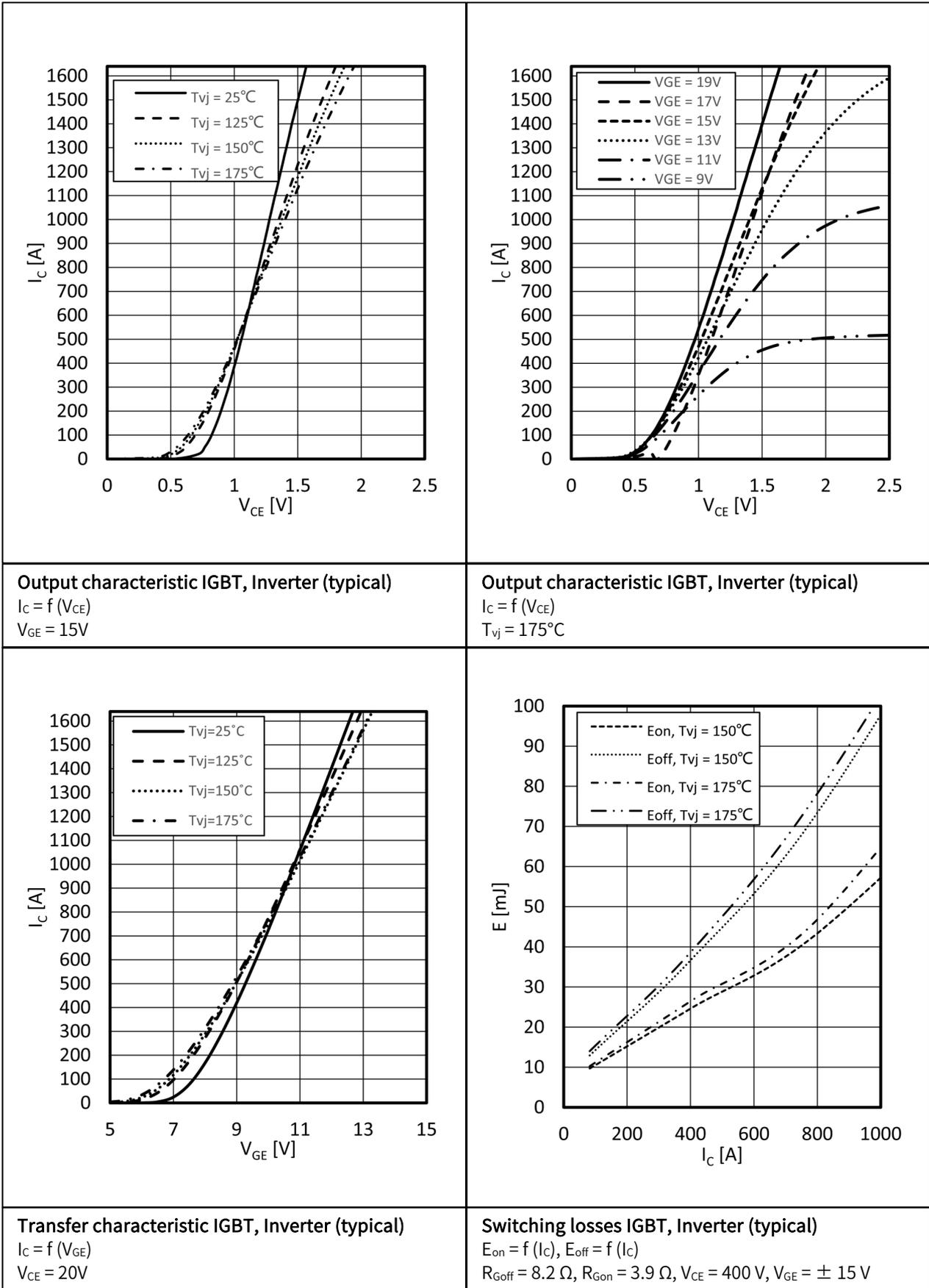
Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance 额定电阻值	$T_C = 25^\circ C$	R_{25}		5.00		K Ω
Power dissipation 耗散功耗	$T_C = 25^\circ C$	P_{25}			20	mW
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298, 15K))]$	B_{25}/B_{50}		3375		K
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/75}(1/T_2 - 1/(298, 15K))]$	B_{25}/B_{75}		3408		K
B-value B-Z 值	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298, 15K))]$	B_{25}/B_{100}		3436		K

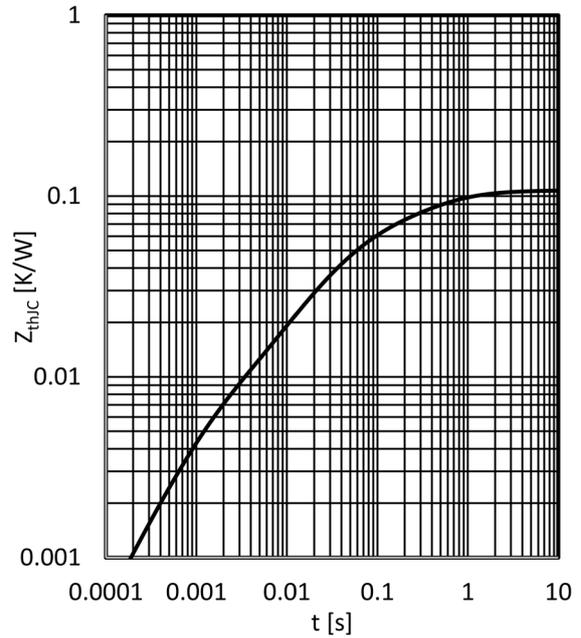
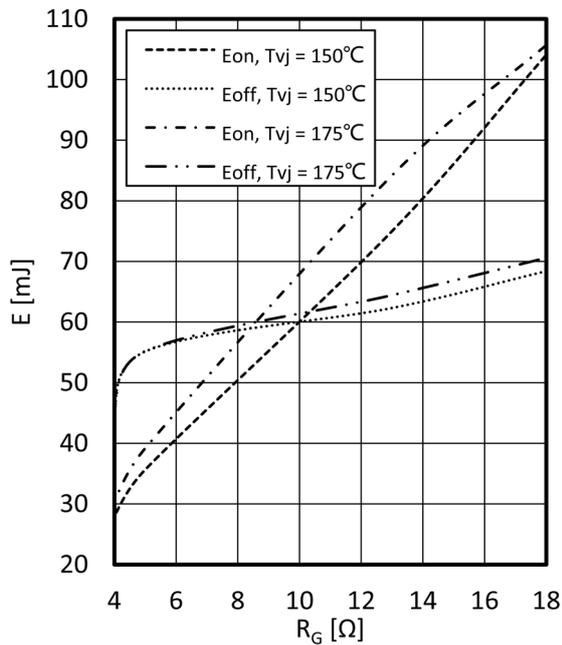
7. Module

7.1 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation Voltage 隔离电压	RMS, f=50HZ,1min	V_{ISOL}			4200	V
Stray inductance module 杂散电感		L_{SCE}		8		nH
Operation Junction Temperature 结温		T_{jop}	-40		175	°C
Storage Temperature Range 存储温度范围		T_{stg}	-40		125	°C
Mounting Torque 安装扭矩	Screw M4 baseplate to heatsink	M	1.80	2.00	2.20	N.m
Weight of Module 重量		G		720		g

8. Characteristics diagrams





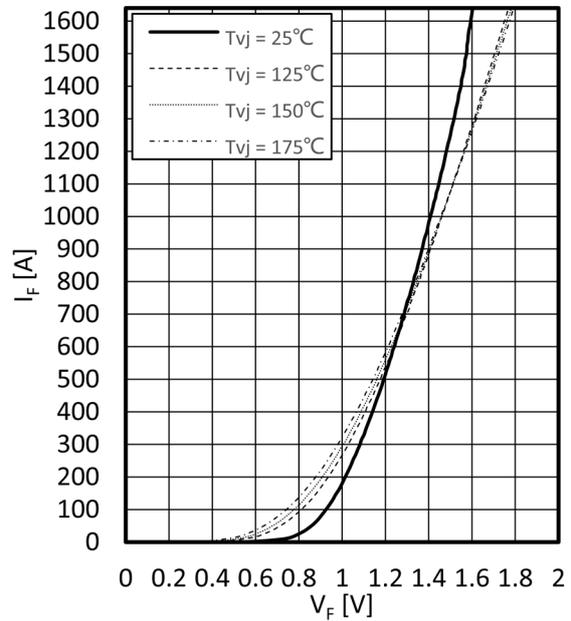
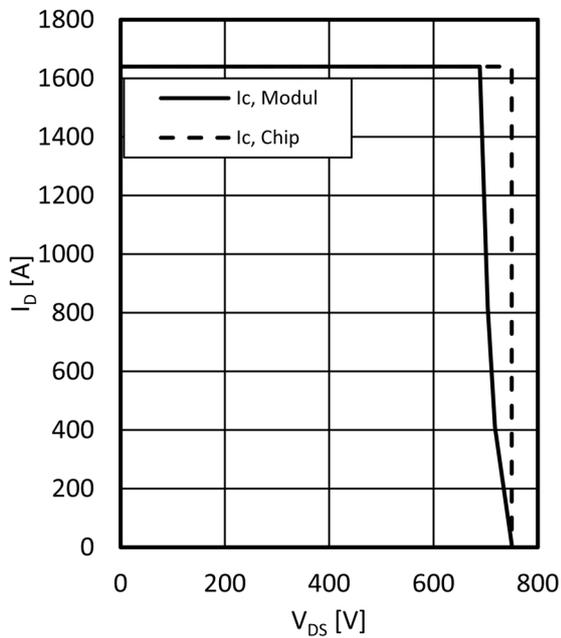
Switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$

$I_C = 450 \text{ A}, V_{CE} = 400 \text{ V}, V_{GE} = \pm 15 \text{ V}$

Transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



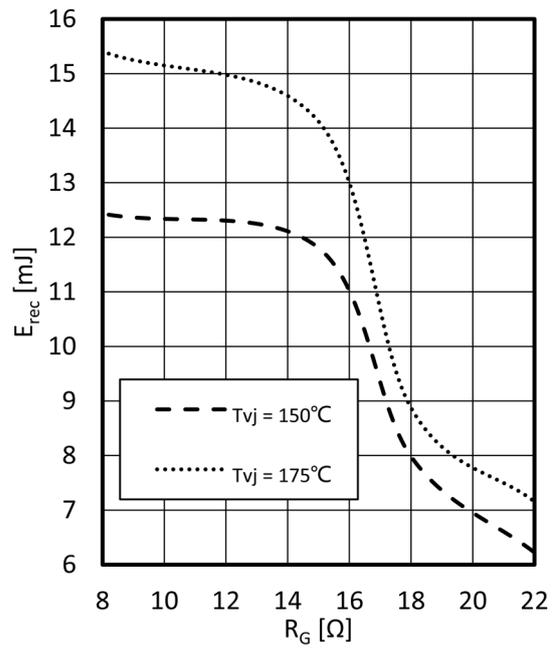
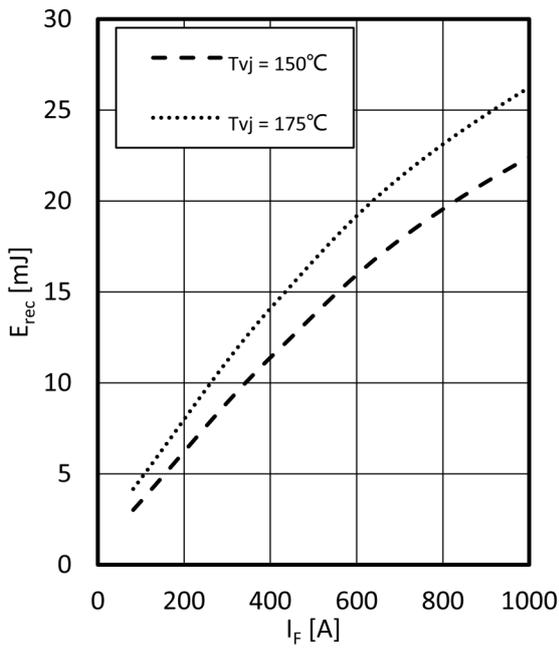
Reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$

$V_{GE} = 15 \text{ V}, R_{Goff} = 8.2 \Omega, T_{vj} = 175^\circ\text{C}$

Forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$

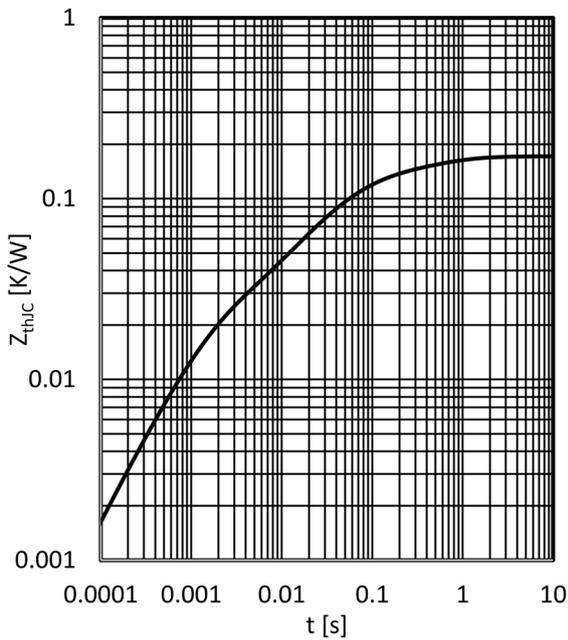


Switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 3.9 \Omega, V_{CE} = 600 \text{ V}$

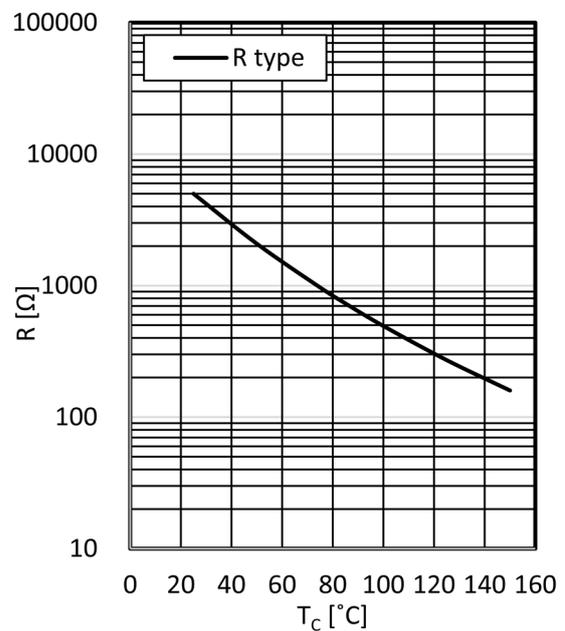
Switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 450 \text{ A}, V_{CE} = 400 \text{ V}$



Transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$



NTC-Thermistor-temperature characteristic (typical)

$R = f(T_{NTC})$

9. Circuit Diagram

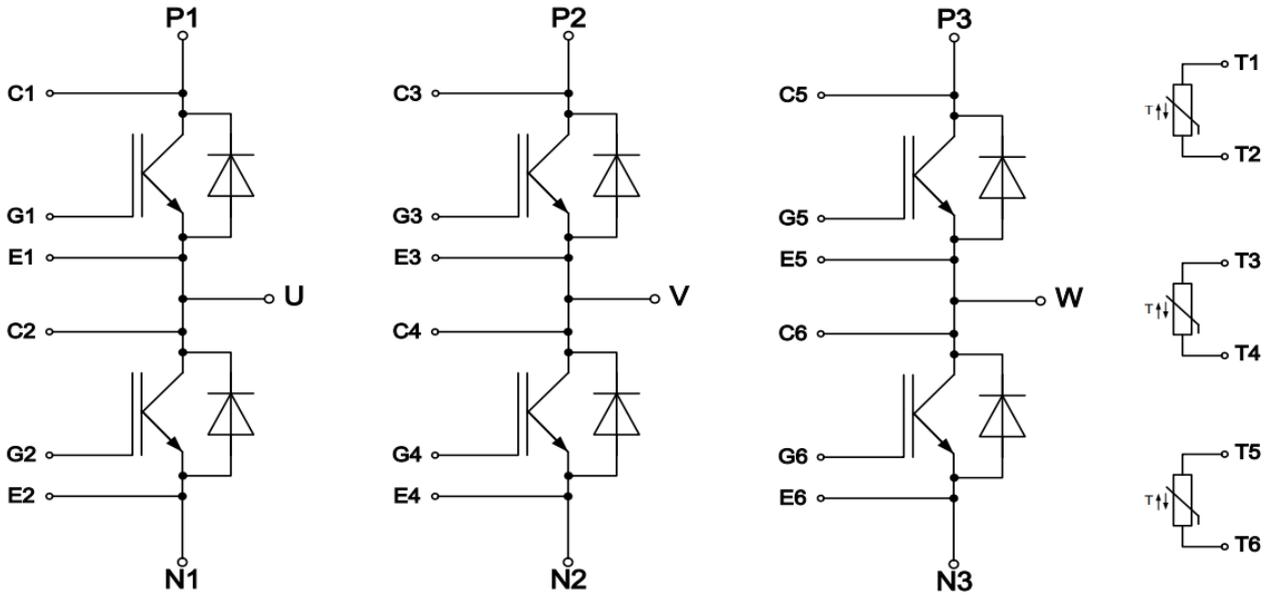


Figure 3

10. Package Outlines

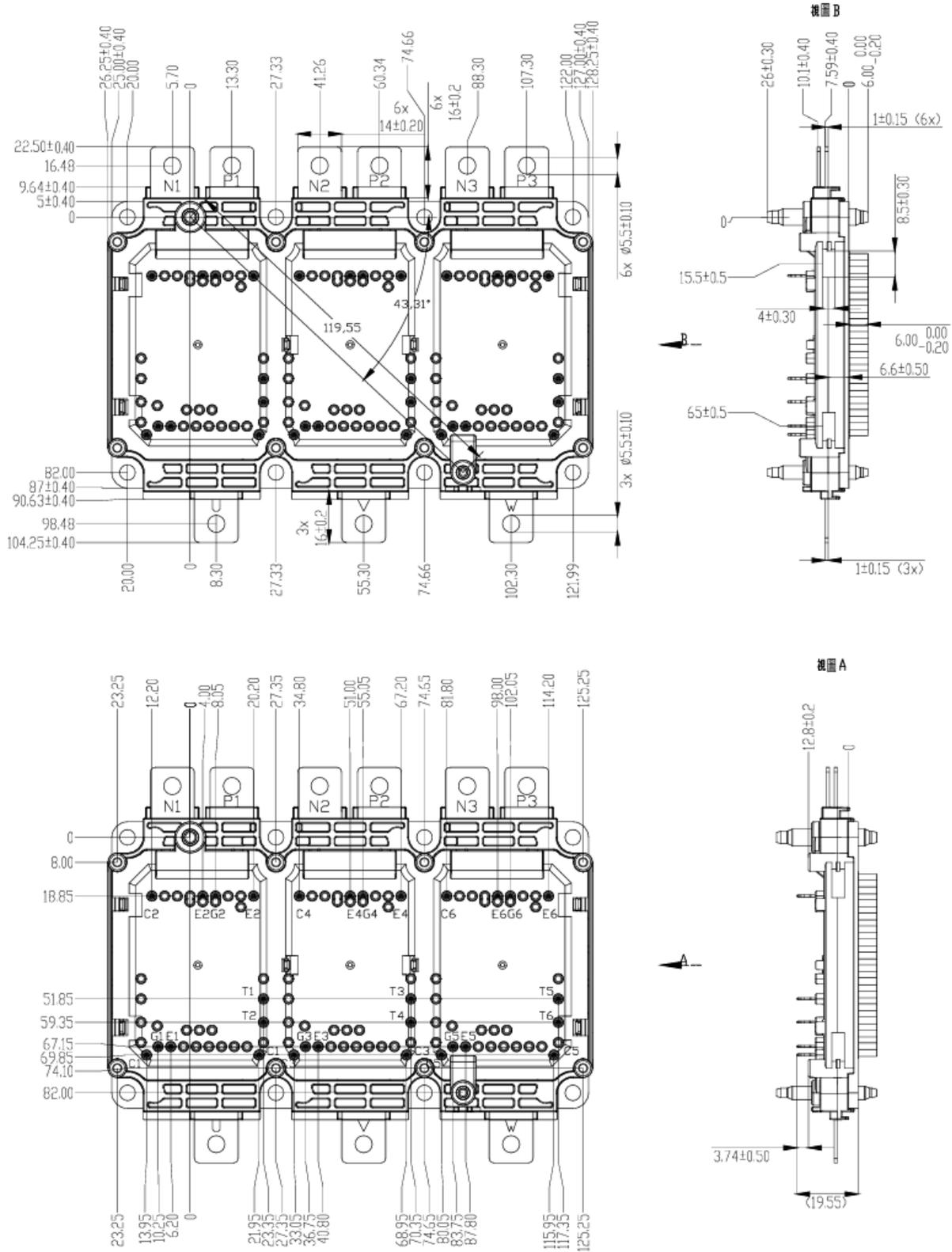


Figure 4