Technical datasheet

1. Product Features

1.1 Electrical features

- V_{CES}=650V
- $I_{C\ nom}$=400A / I_{CRM}=800A
- Low switching losses
- Low inductance
- Fast switching and short tail current
- High power and thermal cycling capability

Figure1 IGBT Module

1.2 Mechanical features

- High power and thermal cycling capability
- Al_2O_3 substrate with low thermal resistance
- Copper base plate

2. Typical Applications

- Switching mode power supply
- Drive inverters with brake system
- Uninterruptible power supply
- AC and DC servo drive amplifier

3. Description

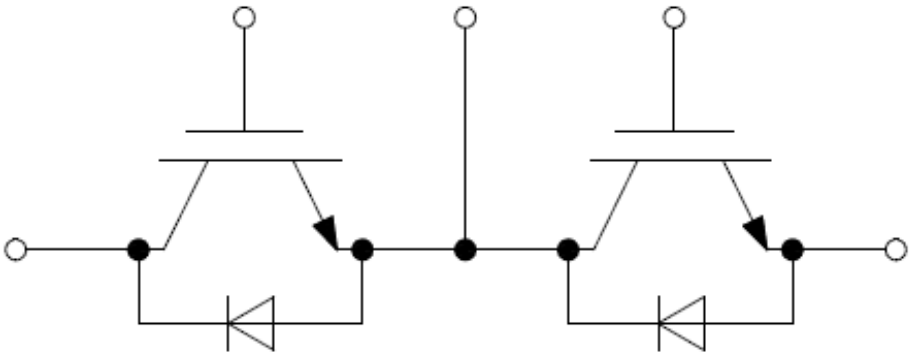


Figure 2 Half Bridge

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°C	V_{CES}	650	V
Continuous DC collector current 连续集电极电流	T_C = 100°C, $T_{vj,max}$ = 150°C	$I_{C\ nom}$	400	A
Repetitive peak collector current 集电极峰值电流	t_P = 1 ms	I_{CRM}	800	A
Total power dissipation 总功率损耗	T_C = 25°C, $T_{vj,max}$ = 175 °C	P_{tot}	1165	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 = 400 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE,sat}$		1.40 1.50 1.51	1.75	V V V
Gate threshold voltage 栅极阈值电压	I_C = 6.4mA, V_{CE} = V_{GE}, T_{vj} = 25°C		$V_{GE,th}$	5.0	5.8	6.5	V
Gate charge 栅极电荷	V_{GE} = -15 V ... +15 V		Q_G		3.0		µC
Internal gate resistor 内部栅极电阻	T_{vj} = 25°C		R_{Gint}		1.45		Ω
Input capacitance 输入电容	f=1MHz, T_{vj}=25°C, V_{CE}=25V, V_{GE}=0V		C_{ies}		64.7		nF
Reverse transfer capacitance 反向传输电容	f=1MHz, T_{vj}=25°C, V_{CE}=25V, V_{GE}=0V		C_{res}		0.27		nF
Collector-emitter cut-off current 集电极-发射极截止电流	V_{CE} = 650 V, V_{GE} = 0 V, T_{vj} = 25°C		I_{CES}			2	mA
Gate-emitter leakage current 栅极-发射极漏电流	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C		I_{GES}			400	nA
Turn-on delay time, inductive load 开通延迟时间	I_C = 400A, V_{CE} = 300V V_{GE} = +15/-15V $R_{G,on}$ = 3.3Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d,on}$		0.104 0.112 0.106		us us us
Rise time, inductive load 上升时间	I_C = 400A, V_{CE} = 300V V_{GE} = +15/-15V $R_{G,on}$ = 3.3Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0.068 0.071 0.073		us us us

(table continues...) 待续

Technical datasheet

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 = 400A, V_{CE} = 300V V_{GE} = +15/-15V $R_{G,off}$ = 3.3Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d,off}$		0.222 0.252 0.260		us us us
Fall time, inductive load 下降时间	I_C = 400A, V_{CE} = 300V V_{GE} = +15/-15V $R_{G,off}$ = 3.3Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0.113 0.194 0.222		us us us
Turn-on energy loss per pulse 开通损耗能量	I_C = 400A, V_{CE} = 300V, L_s=20nH V_{GE} = +15/-15V, di/dt =4400A/μs $R_{G,on}$ = 3.3Ω (T_{vj} = 150°C)	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		2.78 3.85 4.38		mJ mJ mJ
Turn-off energy loss per pulse 关断损耗能量	I_C = 400A, V_{CE} = 300V, L_s=20nH V_{GE} = +15/-15V, dv/dt =3700V/μs $R_{G,off}$ = 3.3Ω (T_{vj} = 150°C)	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		13.67 17.54 19.54		mJ mJ mJ
SC data 短路数据	V_{GE} ≤15V, V_{CC} =300 V, t_P ≤ 8 μs, T_{vj} = 150°C , C_{GE} = 0.0uF , V_{CEmax} = V_{CES} -L_{sCE} · di/dt		I_{SC}		2100		A
Thermal resistance, junction to case 结－外壳热阻	Per IGBT		$R_{th,JC}$			0.13	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°C	V_{RRM}	650	V
Continuous DC forward current 连续正向直流电流		I_F	400	A
Repetitive peak forward current 正向重复峰值电流	t_P = 1 ms	I_{FRM}	800	A

5.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	I_F = 400 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1.22 1.19 1.17		V V V

(table continues...) 待续

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 = 400A, V_R = 300V V_{GE} = -15V , - di_F/dt = 3670 A/μs (T_{vj}=150°C)	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		300 330 340		A A A
Recovered charge 恢复电荷	I_F = 400A, V_R = 300V V_{GE} = -15V , - di_F/dt = 3670 A/μs (T_{vj}=150°C)	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		29.3 43.8 50.2		μC μC μC
Reverse recovery energy 反向恢复损耗（每脉冲）	I_F = 400A, V_R = 300V V_{GE} = -15V , - di_F/dt = 3670 A/μs (T_{vj}=150°C)	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		4.2 8.0 9.5		mJ mJ mJ
Thermal resistance, junction to case 结－外壳热阻	Per diode		$R_{th,JC}$			0.29	K/W

6. Module

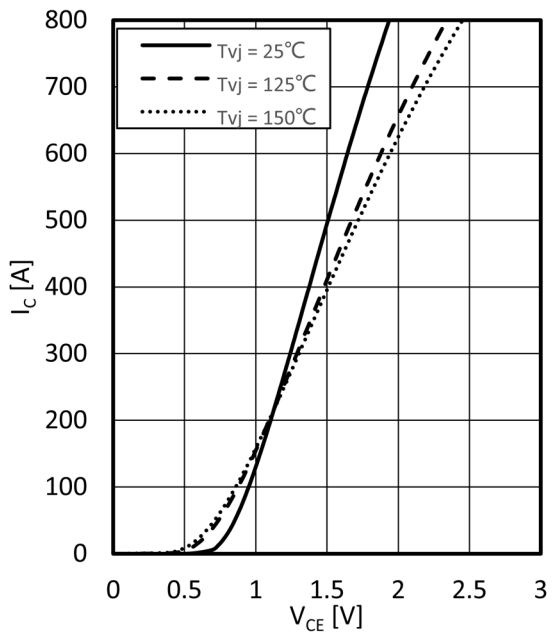
6.1 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation Voltage 隔离电压	RMS, f=50HZ,1min	V_{ISOL}			2500	V
Stray inductance module 杂散电感		L_{sCE}		20		nH

(table continues...) 待续

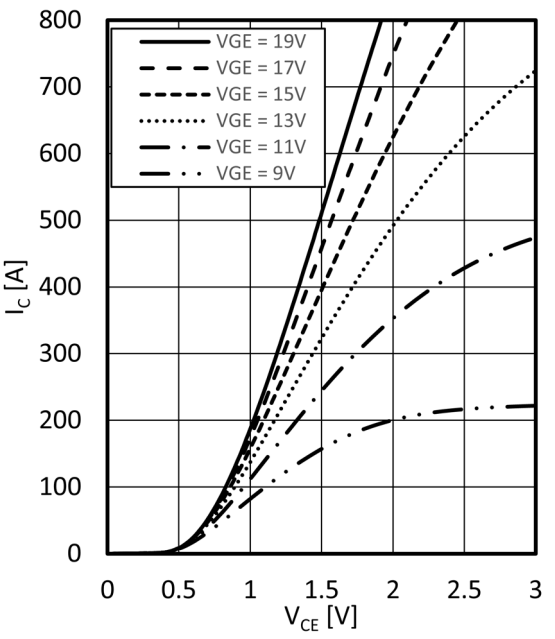
Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Operation Junction Temperature 结温		T_{jop}	-40		150	˚C
Storage Temperature Range 存储温度范围		T_{stg}	-40		125	˚C
Mounting Torque 安装扭矩	Screw M6	M	3		6	N.m
Terminal Connection Torque 端子連接扭矩	Screw M6	M	2.5		5	N.m
Weight of Module 重量		G		340		g

7. Characteristics diagrams



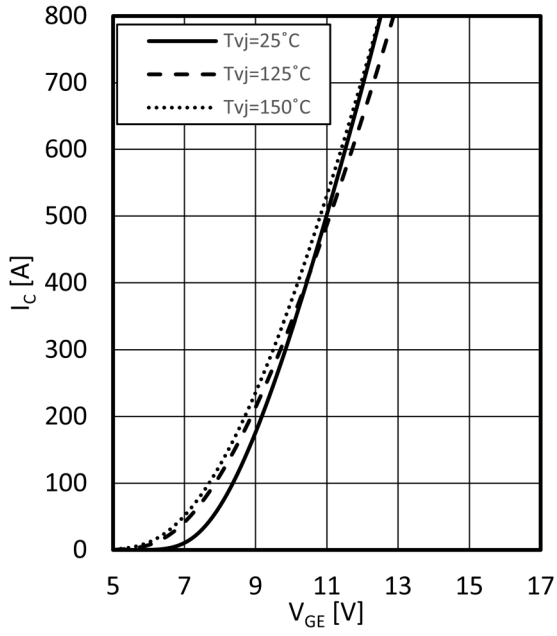
Output characteristic IGBT, Inverter (typical)

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



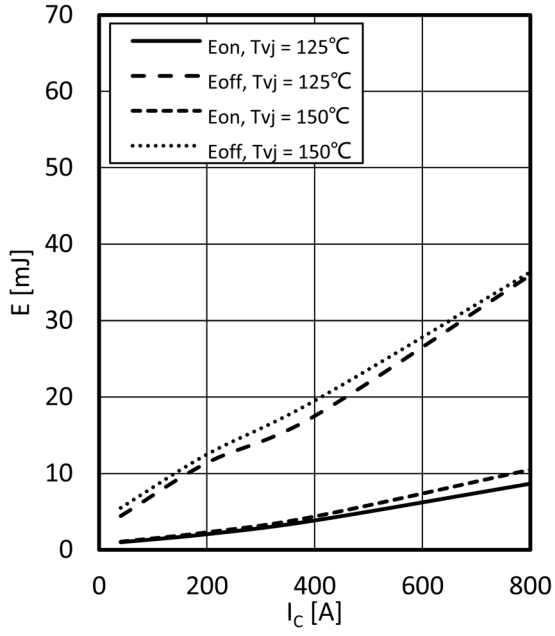
Output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$ $T_{vj} = 150°C$



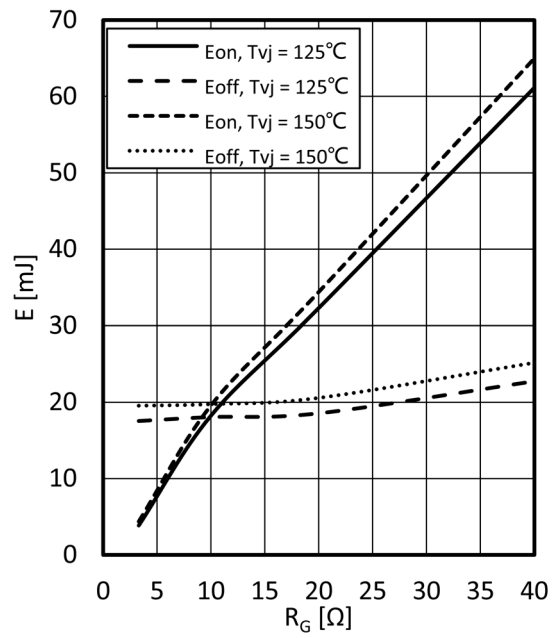
Transfer characteristic IGBT, Inverter (typical)

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



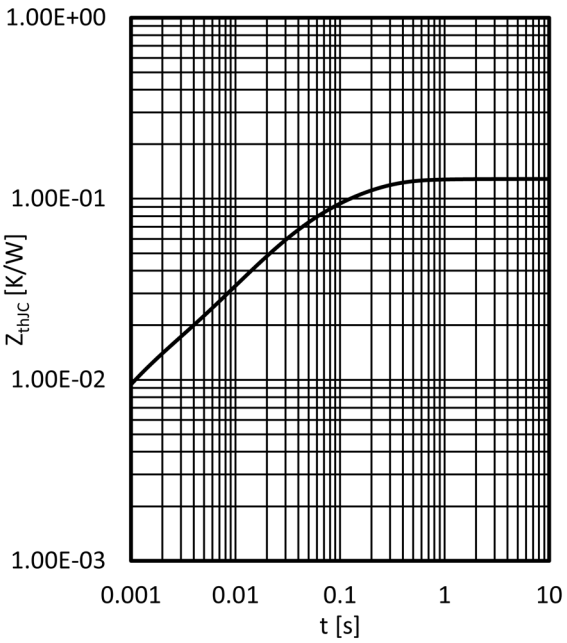
Switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C)$, $E_{off} = f(I_C)$ $V_{GE} = \pm 15V$, $R_{Gon} = 3.3\ \Omega$ $R_{Goff} = 3.3\ \Omega$, $V_{CE} = 300V$



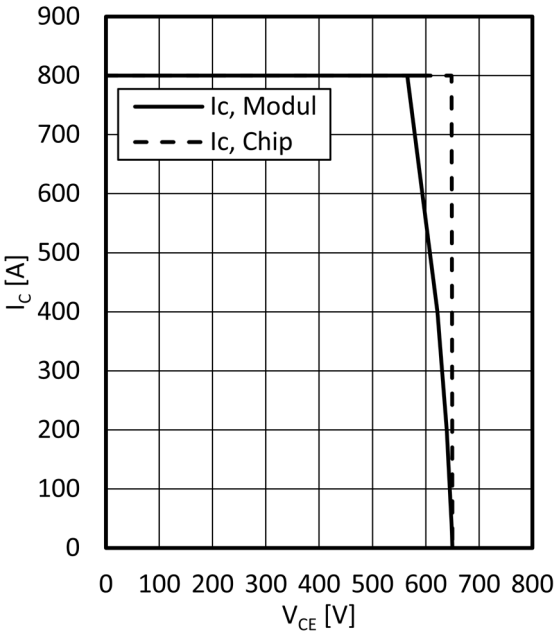
Switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$ $V_{GE} = \pm 15V$, $I_C = 400A$, $V_{CE} = 300V$



Transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



Reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$ $V_{GE} = \pm 15V$ $R_{Goff} = 3.3\ \Omega$, $T_{vj} = 150°C$

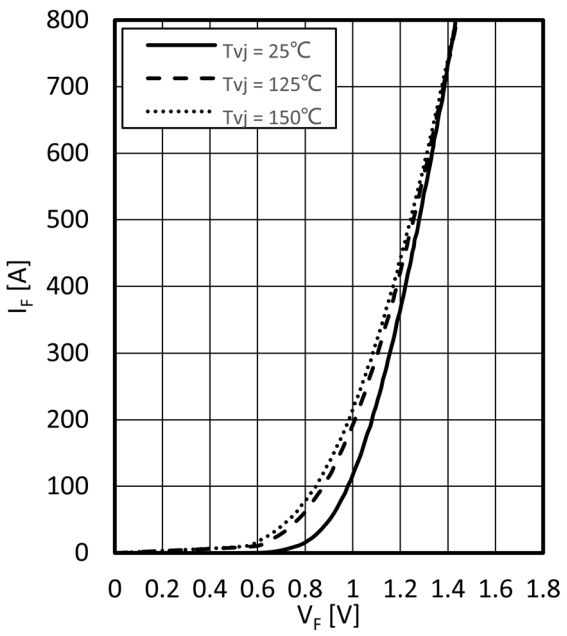
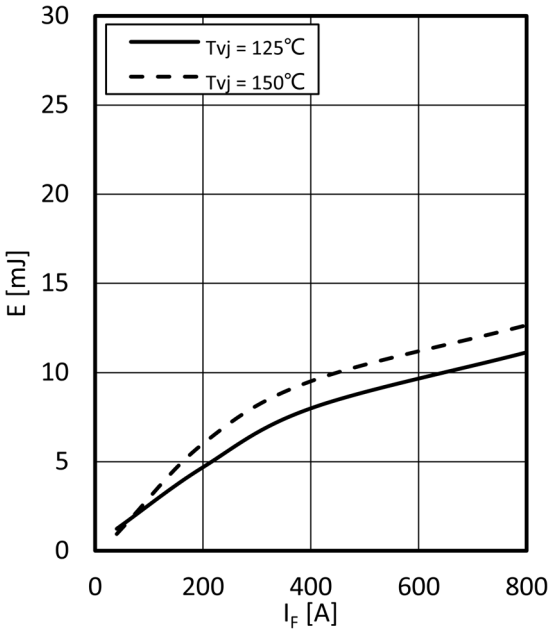


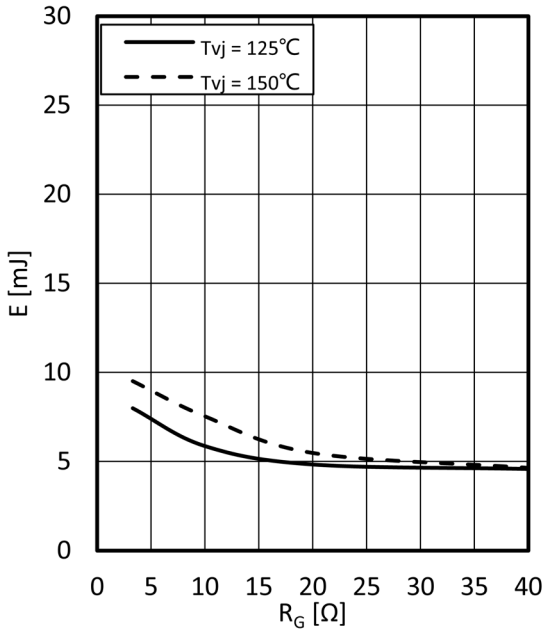
Figure 10 Forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$



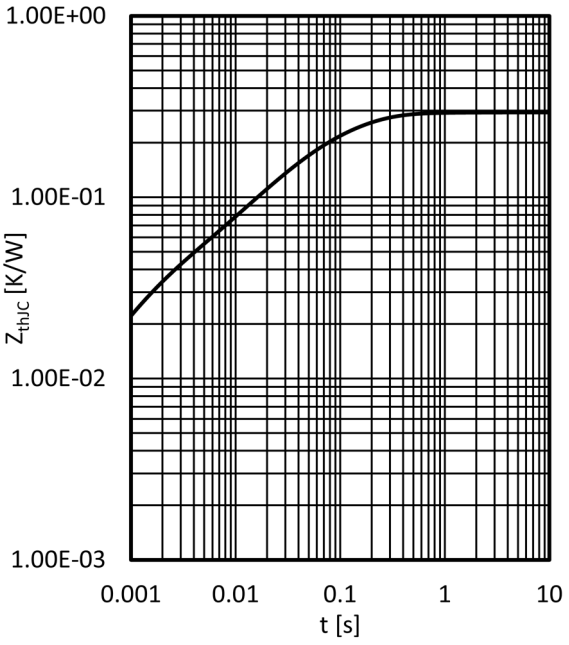
Switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$ $R_{Gon} = 3.3\ \Omega$, $V_{CC} = 300V$



Switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$ $I_F = 400\ A$, $V_{CC} = 300V$



Transient thermal impedance Diode Inverter

$Z_{thJC} = f(t)$

8. Circuit Diagram

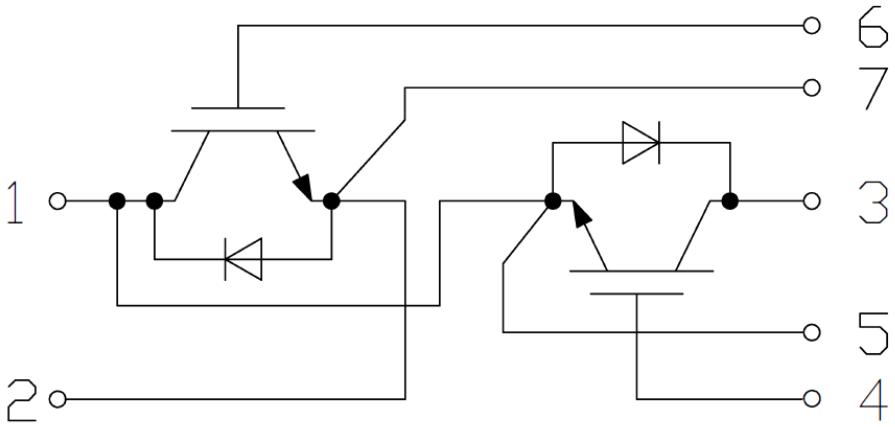


Figure 3

9. Package Outlines

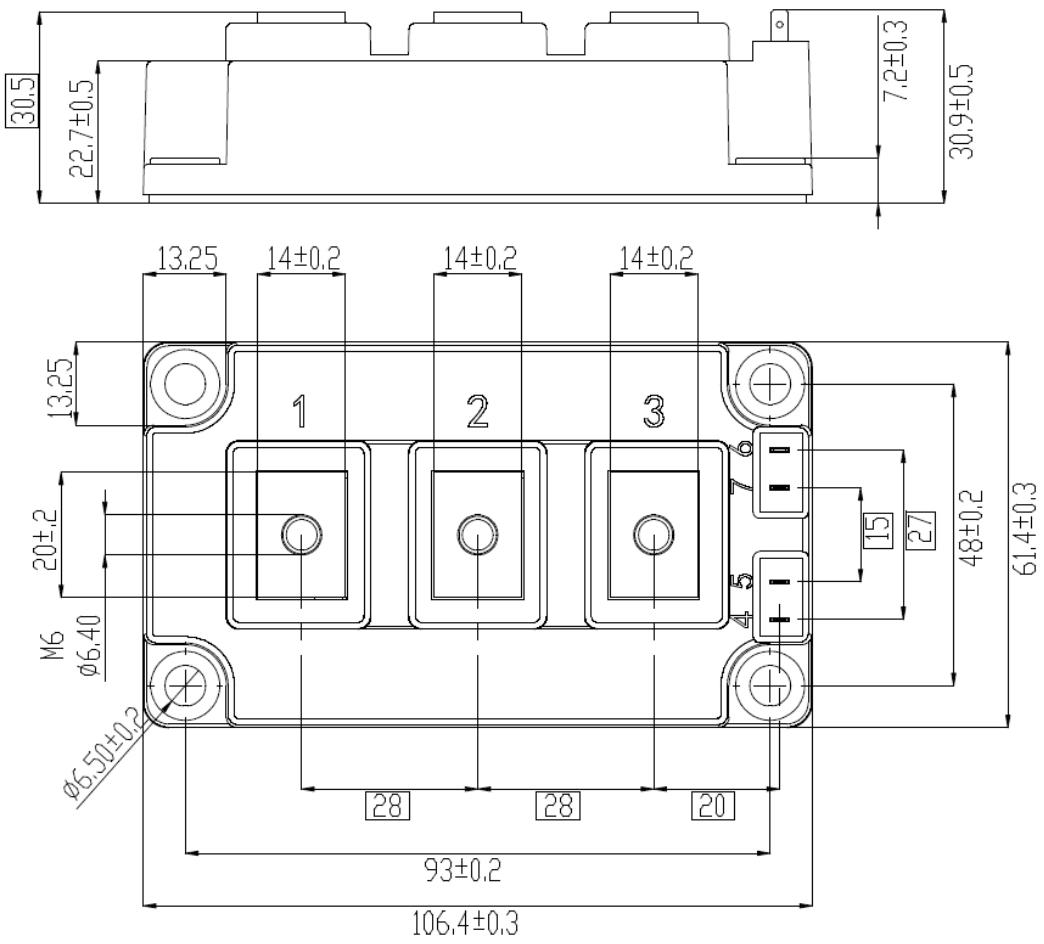


Figure 4

Technical datasheet