中国中车 CRRC

产品数据手册 Product Datasheet 版本 Ver.1610

TIM1600FSM17-PSA011

单管型IGBT模块

Single Switch IGBT

关键参数 Key Parameters

V_{CES}		1700	V
$V_{CE(sat)}$	(typ)	2.30	V
I_C	(max)	1600	A
$I_{C(RM)}$	(max)	3200	A

典型应用 Typical Applications

- 牵引传动 Traction drives
- 电机控制 Motor Controllers
- 风力发电 Wind Power
- 高可靠性逆变器 High Reliability Inverter

特点 Features

- AlSiC基板 AlSiC Base
- AlN衬板 AlN Substrates
- 高热循环能力 High Thermal Cycling Capability
- 10μs短路承受能力 10μs Short Circuit Withstand
- 低$V_{ce(sat)}$型器件 Low $V_{ce(sat)}$ device
- 高电流密度 High current density

电路结构 Circuit Configuration

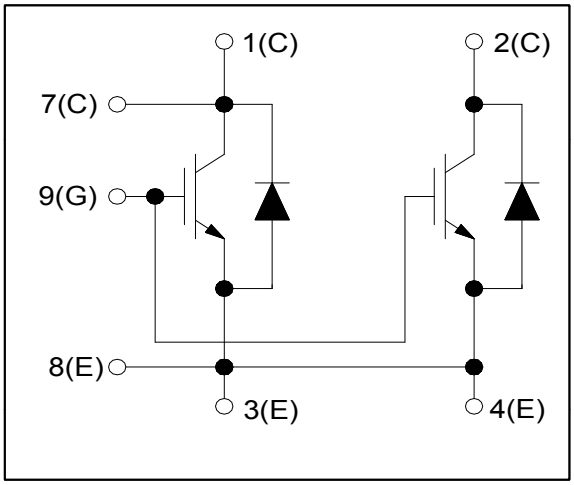


图1. 电路结构
Fig. 1 Circuit configuration

图2. 模块外形
Fig. 2 Module appearance

模块标签说明 Module Label code instruction

ab1234567890/123456781234

数据位置 Data position	数据内容 Content of data
1--12	模块产品编码 Module product code
13	分隔符 virgule
14--21	模块批次号 Module batch number
22--25	模块序列号 Module serial number

Caution: This device is sensitive to electrostatic discharge. Users should follow ESD handling procedures.
注意: 该器件对静电敏感，用户须采取ESD防护措施。

最大额定值 Absolute Maximum Rating

符号 (Symbol)	参数名称 (Parameter)	测试条件 (Test Conditions)	数值 (value)	单 位 (Unit)
V_{CES}	集电极-发射极电压 Collector-emitter voltage	V_{GE} = 0V, T_C = 25 °C	1700	V
V_{GES}	栅极-发射极电压 Gate-emitter voltage	T_C = 25 °C	± 20	V
I_C	集电极电流 Collector-emitter current	T_C = 80 °C	1600	A
$I_{C(PK)}$	集电极峰值电流 Peak collector current	t_P=1ms	3200	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	T_{vj} = 150°C, T_C = 25 °C	13.8	kW
I^2t	二极管I^2t值 Diode I^2t	V_R =0V, t_P = 10ms, T_{vj} = 125 °C	480	kA^2s
V_{Isol}	绝缘电压(模块) Isolation voltage – per module	短接所有端子，端子与基板间施加电压 (Commoned terminals to base plate), AC RMS,1 min, 50Hz,T_C= 25 °C	4000	V
Q_{PD}	局部放电电荷(模块) Partial discharge – per module	IEC1287. V_1 = 1800V, V_2 = 1300V, 50Hz RMS, T_C= 25 °C	10	pC

热和机械数据 Thermal & Mechanical Data

爬电距离	Creepage distance	20mm
绝缘间隙	Clearance	10mm
耐漏电起痕指数	CTI (Critical Tracking Index)	>350

符号 (Symbol)	参数名称 (Parameter)	测试条件 (Test Conditions)	最 小 (Min)	最 大 (Max)	单 位 (Unit)
$R_{th(J-C)\ IGBT}$	IGBT结壳热阻 Thermal resistance – IGBT	结壳恒定功耗 Continuous dissipation - junction to case		9	K/ kW
$R_{th(J-C)\ Diode}$	二极管结壳热阻 Thermal resistance – diode	结壳恒定功耗 Continuous dissipation - junction to case		20	K/ kW
$R_{th(C-H)}$	接触热阻(模块) Thermal resistance – case to heatsink (per module)	安装力矩5Nm (加导热脂) Mounting torque 5Nm (with mounting grease)		8	K/ kW
T_{vj}	结温 Junction temperature	IGBT部分 (IGBT)		150	°C
		二极管部分(Diode)		125	°C
T_{stg}	存储温度 Storage temperature range		-40	125	°C
M	安装力矩 Screw torque	安装紧固用 - M6 Mounting – M6		5	Nm
		电路互连用 - M4 Electrical connections – M4		2	Nm
		电路互连用 - M8 Electrical connections – M8		10	Nm

电特性值 Electrical Characristics

除非特别声明，否则T_C= 25 °C

T_C= 25 °C unless stated otherwise

符号 (Symbol)	参数名称 (Parameter)	条件 (Test Conditions)	最小 (Min)	典型 (Typ)	最大 (Max)	单位 (Unit)
I_{CES}	集电极截止电流 Collector cut-off current	V_{GE} = 0V,V_{CE} = V_{CES}			2	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C=125 ° C			50	mA
I_{GES}	栅极漏电流 Gate leakage current	V_{GE} = ±20V, V_{CE} = 0V			8	μA
$V_{GE\ (TH)}$	栅极-发射极阈值电压 Gate threshold voltage	I_C = 80mA, V_{GE} = V_{CE}	5.60	5.90	6.20	V
$V_{CE\ (sat)}$(*1)	集电极-发射极饱和电压 Collector-emitter saturation voltage	V_{GE} =15V, I_C = 1600A		2.30	2.60	V
		V_{GE} =15V, I_C = 1600A,T_{vj} = 125 ° C		2.80	3.10	V
I_F	二极管正向直流电流 Diode forward current	直流 DC			1600	A
I_{FRM}	二极管正向重复峰值电流 Diode maximum forward current	t_P = 1ms			3200	A
V_F(*1)	二极管正向电压 Diode forward voltage	I_F = 1600A		1.70	2.00	V
		I_F = 1600A, T_{vj} = 125 ° C		1.80	2.10	V
C_{ies}	输入电容 Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		120		nF
Q_g	栅极电荷 Gate charge	±15V		18		μC
C_{res}	反向传输电容 Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		-		nF
L_M	模块电感 Module inductance			15		nH
R_{INT}	内阻 Internal transistor resistance			140		μΩ
I_{SC}	短路电流 Short circuit current, I_{SC}	T_{vj} = 125° C, V_{CC} = 1000V, V_{GE}≤15V, t_p≤10μs, $V_{CE(max)}$ = V_{CES} – L (*2)×di/dt, IEC 6074-9		6400		A

注意： 1.(*1) 表示该参数的测试点为辅助母排端子((*1) indicates it is measured at the auxiliary busbar terminal);

2.(*2) 表示L是电路杂散电感加上L_M((*2) indicates L is the circuit stray inductance plus L_M).

电特性值 Electrical Characristics

除非特别声明，否则T_C= 25 °C

T_C= 25 °C unless stated otherwise

符号 (Symbol)	参数名称 (Parameter)	测试条件 (Test Conditions)	最小 (Min)	典型 (Typ)	最大 (Max)	单位 (Unit)
$t_{d(off)}$	关断延迟时间 Turn-off delay time	I_C = 1600A V_{CE} = 900V L ~ 100nH V_{GE} = ±15V $R_{G(ON)}$ = 1.5 Ω $R_{G(OFF)}$= 1.5 Ω		1360		ns
t_f	下降时间 Fall time			275		ns
E_{OFF}	关断损耗 Turn-off energy loss			600		mJ
$t_{d(on)}$	开通延迟时间 Turn-on delay time			440		ns
t_r	上升时间 Rise time			390		ns
E_{ON}	开通损耗 Turn-on energy loss			330		mJ
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	I_F =1600A V_{CE} =900V di_F/dt =7000A/us		550		μC
I_{rr}	二极管反向恢复电流 Diode reverse recovery current			980		A
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy			380		mJ

除非特别声明，否则T_C= 125 °C

T_C= 125 °C unless stated otherwise

符号 (Symbol)	参数名称 (Parameter)	测试条件 (Test Conditions)	最小 (Min)	典型 (Typ)	最大 (Max)	单位 (Unit)
$t_{d(off)}$	关断延迟时间 Turn-off delay time	I_C = 1600A V_{CE} = 900V L ~ 100nH V_{GE} = ±15V $R_{G(ON)}$ = 1.5 Ω $R_{G(OFF)}$= 1.5 Ω		1450		ns
t_f	下降时间 Fall time			330		ns
E_{OFF}	关断损耗 Turn-off energy loss			710		mJ
$t_{d(on)}$	开通延迟时间 Turn-on delay time			440		ns
t_r	上升时间 Rise time			390		ns
E_{ON}	开通损耗 Turn-on energy loss			500		mJ
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	I_F =1600A V_{CE} =900V di_F/dt =7000A/us		870		μC
I_{rr}	二极管反向恢复电流 Diode reverse recovery current			1150		A
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy			590		mJ

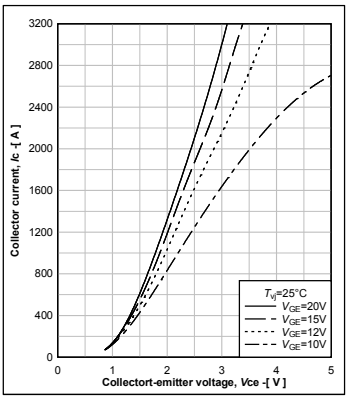


图3. 输出特性典型曲线
Fig.3 Typical output characteristics

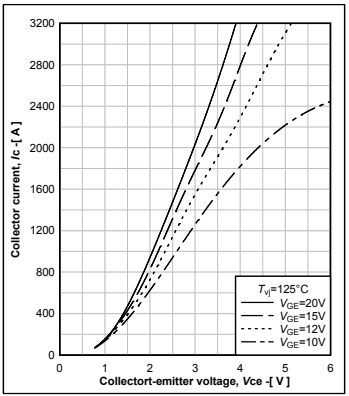


图4. 输出特性典型曲线
Fig.4 Typical output characteristics

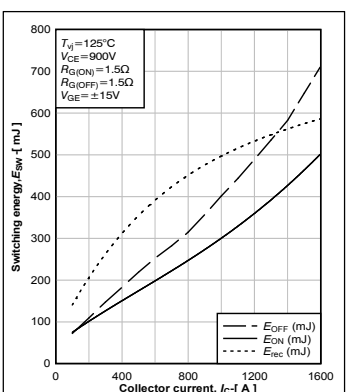


图5. 开关能耗与集电极电流关系曲线
Fig.5 Typical switching energy vs collector current

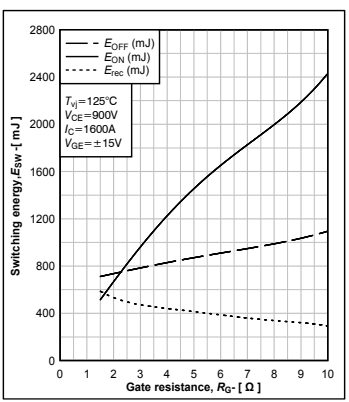


图6. 开关能耗与栅极电阻的关系曲线
Fig. 6 Typical switching energy vs gate resistance

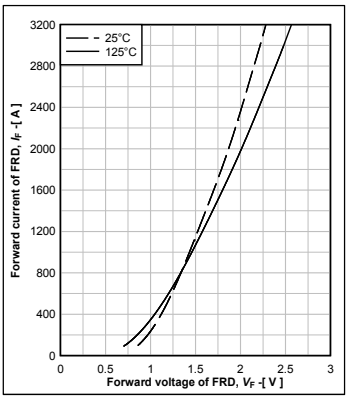


图7. 二极管正向特性典型曲线
Fig.7 Diode typical forward characteristics

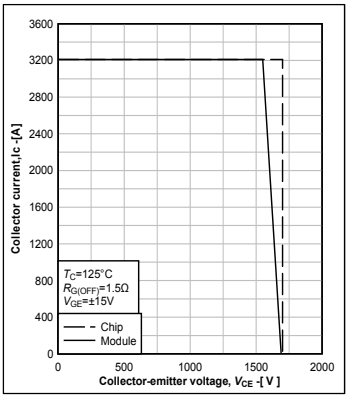


图8. 反偏安全工作区
Fig.8 Reverse bias safe operating area

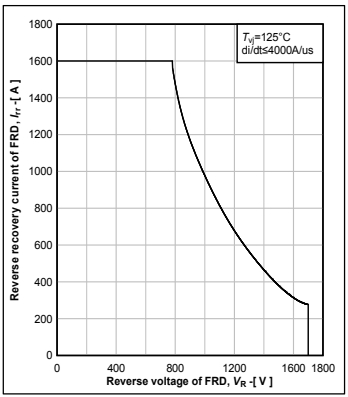


图9. 二极管反偏安全工作区
Fig.9 Diode reverse bias safe operating area

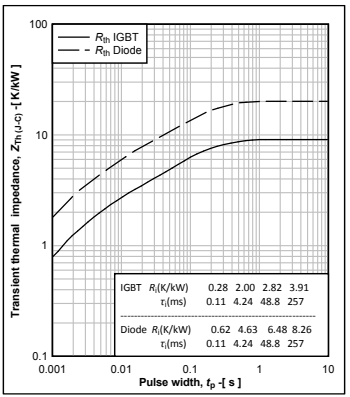
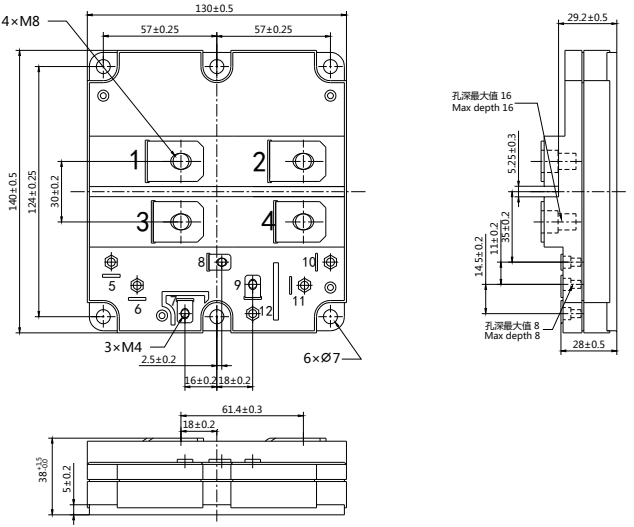


图10. 瞬态热阻抗曲线
Fig. 10 Transient thermal impedance



重量 Weight：900g　　模块外观类型 Module outline code：F

图11. 模块外观尺寸

Fig. 11 Module outline drawing

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