ACF-2 I型3-电平NPC 逆变模块
ACF-2 I Type 3-Level NPC Inverter Module

特性/Features:

- I型NPC三电平逆变模块
  I type NPC Three−Level Inverter Module
- 650V 沟槽栅/场截止工艺
  650V Trench Gate/Field-Stop Process
- 内置直流电容
  Integrated DC capacitor
- 低V_{CEsat}/低开关损耗
  Low V_{CEsat} / Low Switching Losses
- V_{CEsat} 正温度系数
  V_{CEsat} with Positive Temperature Coefficient
- 低热阻三氧化二铝（Al_2O_3）衬底
  Al_2O_3 Substrate with Low Thermal Resistance
- 紧凑型&低电感设计
  Compact and low inductance Design
- 采用DBC技术的隔离散热器
  Isolated Heatsink using DBC technology

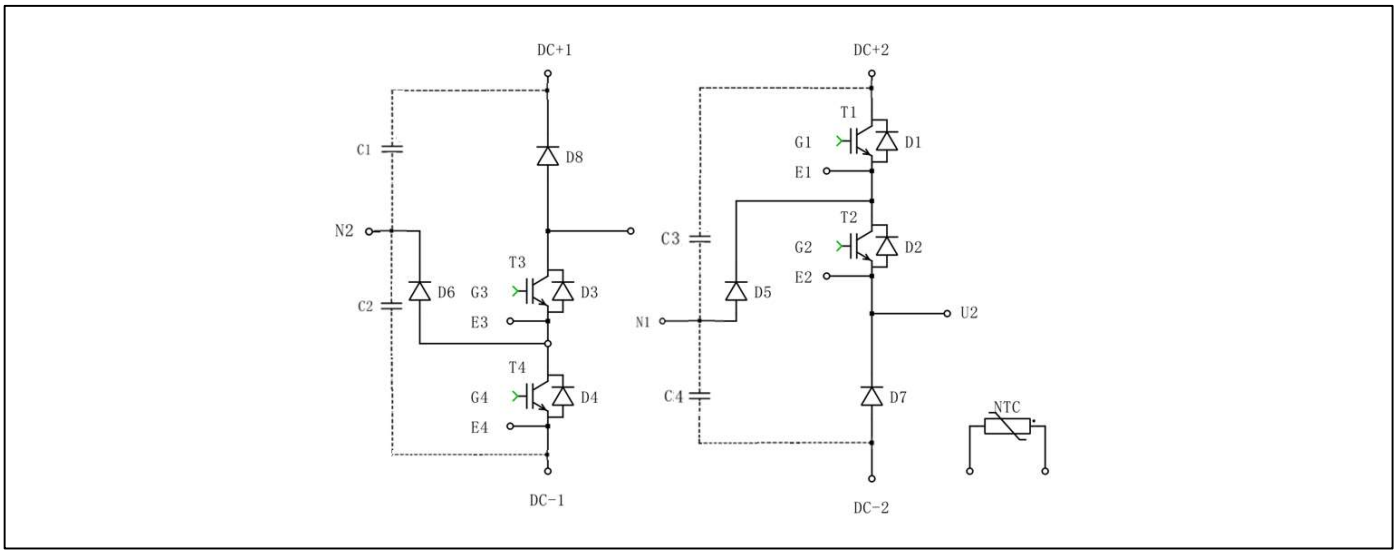
应用/Application:S

- 不间断电源/UPS Systems
- 太阳能系统/Solar Applications
- 工业驱动器/Industrial Drives

12mm or 13mm Housing

Marking Diagram
AMG300L65F2S5RA = Specific Device
F2CQ22420010001= Lot Traceability
ACF-2 = Package Type

RoHS



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1 封装/Package

表 1 绝缘参数/Insulation coordination

Parameter	Conditions	Symbol	Value	Unit
绝缘测试电压 Isolation test voltage	RMS, f = 50Hz, t = 3s	V_{ISO}	3.0	kV
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) Basic insulation (class 1, IEC 61140)		Al_2O_3	
爬电距离 Creepage distance	端子至散热器 Terminal to heatsink	d_{Creep}	>12.7	mm
电气间隙 Clearance	端子至散热器 Terminal to heatsink	d_{Clear}	>12.7	mm
相对电痕指数 Comparative tracking index		CTI	≥600	

表 2 特征值/Characteristic values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
杂散电感, 模块 Stray inductance module		L_{sCE}		20		nH
储存温度 Storage temperature		T_{stg}	-40		125	℃
工作温度 Operation temperature under switching condition		T_{vjop}	-40		Tjmax-25	℃
端子安装扭距（参考安装指导说明） Terminal connection torque	根据相应的应用手册进行安装 Mounting according to valid application note	M5, 螺丝 M5, Screw	1.5		6.0	N.m
重量 Weight		G		175		g

2 IGBT (T1/T4)

表 3 最大标定值/Maximum rated values

Parameter	Conditions		Symbol	Value	Unit
集电极－发射极电压 Collector-emitter voltage		Tj = 25℃	V_{CES}	650	V
连续集电极直流电流 Continuous DC collector current	$T_{j\,max}$ = 175℃	T_h = 80℃	I_{CDC}	270	A
集电极重复峰值电流 Repetitive peak collector current	t_p limited by $T_{j\,max}$		I_{CRM}	900	A
总耗散功率 Total Power dissipation	Tj=Tjmax, Th=80℃		P_{tot}	432	W
栅极－发射极电压 Gate-emitter peak voltage			V_{GES}	±20	V

表 4 特征值/Characteristic values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
集电极-发射极饱和电压（端对端） Collector-emitter saturation voltage（pin to pin）	I_C = 300A, V_{GE} = 15V	Tj = 25℃	$V_{CE\,sat}$		1.47		V
		Tj = 125℃			1.58		
栅极阈值电压 Gate threshold voltage	I_C = 3 mA, V_{GE} = V_{CE}, Tj = 25℃		V_{GEth}		4.0		V
栅极电荷 Gate charge	V_{GE} = ±15 V, V_{CE} = 400V， I_C = 300A		Q_G		780		nC
输入电容 Input capacitance	f = 1MHz, Tj = 25℃, V_{CE} = 20V, V_{GE} = 0V		C_{ies}		32000		pF
输出电容 Output capacitance			C_{oes}		920		pF
反向传输电容 Reverse transfer capacitance			C_{res}		24		pF
集电极－发射极截止电流 Collector-emitter cut-off current	V_{CE} = 650V, V_{GE} = 0V, T_j = 25℃		I_{CES}			100	uA
栅极－发射极漏电流 Gate-emitter leakage current	V_{CE} = 0V, V_{GE} = 20V, T_j = 25℃		I_{GES}			200	nA
开通延迟时间（感性负载） Turn-on delay time (inductive load)	VCC = 400 V, IC = 150A VGE = +15/-5 V, Rgon= Rgoff= 12Ω	Tj = 25℃	tdon		154		ns
		Tj = 125℃			144		
上升时间（感性负载） Rise time (inductive load)		Tj = 25℃	tr		68		ns
		Tj = 125℃			75		
关断延迟时间（感性负载） Turn-off delay time (inductive load)		Tj = 25℃	tdoff		847		nS
		Tj = 125℃			916		
下降时间（感性负载） Fall time (inductive load)		Tj = 25℃	tf		87		nS
		Tj = 125℃			72		
开通耗损能量（每脉冲） Turn-on energy loss per pulse		Tj = 25℃	Eon		5.64		mJ
		Tj = 125℃			7.77		
关断损耗能量（每脉冲） Turn-off energy loss per pulse		Tj = 25℃	Eoff		4.61		mJ
		Tj = 125℃			5.54		
结－散热器热阻 Thermal resistance, junction to heatsink	每个IGBT, λ_{grease} = 3.4W/(m*K) Per IGBT, λ_{grease} = 3.4W/(m*K)		R_{thJH}		0.22		K/W
最高结温 Maximum junction temperature			T_{jop}		175		℃

3 Diode (D5/D6)

表 5 最大标定值/Maximum rated values

Parameter	Conditions		Symbol	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage		Tj = 25℃	V_{RRM}	650	V
连续正向直流电流 Continuous DC forward current	$T_{j\,max}$ = 175℃	T_h = 80℃	I_F	255	A
正向重复峰值电流 Repetitive peak forward current	t_p limited by $T_{j\,max}$		I_{FRM}	600	A
总耗散功率 Total Power dissipation	Tj=Tjmax, Th=80℃		P_{tot}	317	W

表 6 特征值/Characteristic values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	I_F = 300A, V_{GE} = 0V	Tj = 25℃	V_F		1.62		V
		Tj = 125℃			1.53		
反向恢复峰值电流 Peak reverse recovery current	V_R = 400V, I_F = 150A,	Tj = 25℃	I_{rm}		35		A
		Tj = 125℃			72		
反向恢复时间 Reverse recovery time		Tj = 25℃	Trr		142		nS
		Tj = 125℃			190		
反向恢复电荷 Recovered charge		Tj = 25℃	Qr		2.3		μC
		Tj = 125℃			7.6		
反向恢复损耗（每脉冲） Reverse recovery energy		Tj = 25℃	$Erec$		0.41		mJ
		Tj = 125℃			1.72		
结一散热器热阻 Thermal resistance, junction to heatsink	每个二极管,λgrease = 3.4 W/(m*K) Per diode,λgrease = 3.4 W/(m*K)		R_{thCH}		0.3		K/W
最高结温 Maximum junction temperature			Tj_{op}		175		℃

4 Diode (D1/D2/D3/D4)

表 7 最大标定值/Maximum rated values

Parameter	Conditions		Symbol	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage		Tj = 25℃	V_{RRM}	650	V
连续正向直流电流 Continuous DC forward current	$T_{j\,max}$ = 175℃	T_h = 80℃	I_F	50	A
正向重复峰值电流 Repetitive peak forward current	t_p limited by $T_{j\,max}$		I_{FRM}	150	A
总耗散功率 Total Power dissipation	Tj=Tjmax, Th=80℃		P_{tot}	79	W

表 8 特征值/Characteristic values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	I_F = 50A, V_{GE} = 0V	Tj = 25℃	V_F		1.75		V
		Tj = 125℃			1.61		
结一散热器热阻 Thermal resistance, junction to heatsink	每个二极管,λgrease = 3.4 W/(m*K) Per diode,λgrease = 3.4 W/(m*K)		R_{thCH}		1.2		K/W
最高结温 Maximum junction temperatur			Tj_{op}		175		℃

5 IGBT (T2/T3)

表 9 最大标定值/Maximum rated values

Parameter	Conditions		Symbol	Value	Unit
集电极－发射极电压 Collector-emitter voltage		Tj = 25℃	V_{CES}	650	V
连续集电极直流电流 Continuous DC collector current	$T_{j\,max}$ = 175℃	T_h = 80℃	I_{CDC}	270	A
集电极重复峰值电流 Repetitive peak collector current	t_p limited by $T_{j\,max}$		I_{CRM}	900	A
总耗散功率 Total Power dissipation	Tj=Tjmax, Th=80℃		P_{tot}	432	W
栅极－发射极电压 Gate-emitter peak voltage			V_{GES}	±20	V

表 10 特征值/Characteristic values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
集电极-发射极饱和电压（端对端） Collector-emitter saturation voltage（pin to pin）	I_C = 300A, V_{GE} = 15V	Tj = 25℃	$V_{CE\,sat}$		1.47		V
		Tj = 125℃			1.52		
栅极阈值电压 Gate threshold voltage	I_C = 3 mA, V_{GE} = V_{CE}, Tj = 25℃		V_{GEth}		4.0		V
栅极电荷 Gate charge	V_{GE} = ±15 V, V_{CE} = 400V		Q_G		780		nC
输入电容 Input capacitance	f = 1MHz, Tj = 25℃, V_{CE} = 20V, V_{GE} = 0V		C_{ies}		32000		pF
输出电容 Output capacitance			C_{oes}		920		pF
反向传输电容 Reverse transfer capacitance			C_{res}		24		pF
集电极－发射极截止电流 Collector-emitter cut-off current	V_{CE} = 650V, V_{GE} = 0V, T_j = 25℃		I_{CES}			100	uA
栅极－发射极漏电流 Gate-emitter leakage current	V_{CE} = 0V, V_{GE} = 20V, T_j = 25℃		I_{GES}			200	nA
开通延迟时间（感性负载） Turn-on delay time (inductive load)	VCC = 400 V, IC = 150A VGE = +15/-5 V, Rgon= Rgoff= 12Ω	Tj = 25℃	tdon		121		ns
		Tj = 125℃			115		
上升时间（感性负载） Rise time (inductive load)		Tj = 25℃	tr		69		ns
		Tj = 125℃			74		
关断延迟时间（感性负载） Turn-off delay time (inductive load)		Tj = 25℃	tdoff		865		nS
		Tj = 125℃			951		
下降时间（感性负载） Fall time (inductive load)		Tj = 25℃	tf		92		nS
		Tj = 125℃			75		
开通耗损能量（每脉冲） Turn-on energy loss per pulse		Tj = 25℃	Eon		5.01		mJ
		Tj = 125℃			7.62		
关断损耗能量（每脉冲） Turn-off energy loss per pulse		Tj = 25℃	Eoff		5.16		mJ
		Tj = 125℃			6.10		
结－散热器热阻 Thermal resistance, junction to heatsink	每个IGBT, λ_{grease} = 3.4W/(m*K) Per IGBT, λ_{grease} = 3.4W/(m*K)		R_{thJH}		0.22		K/W
最高结温 Maximum junction temperature			T_{jop}		175		℃

6 Diode (D7/D8)

表 11 最大标定值/Maximum rated values

Parameter	Conditions		Symbol	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage		Tj = 25℃	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current	$T_{j\,max}$ = 175℃	T_h = 80℃	I_F	240	A
正向重复峰值电流 Repetitive peak forward current	t_p limited by $T_{j\,max}$		I_{FRM}	600	A
总耗散功率 Total Power dissipation	Tj=Tjmax, Th=80℃		P_{tot}	475	W

表 12 特征值/Characteristic values

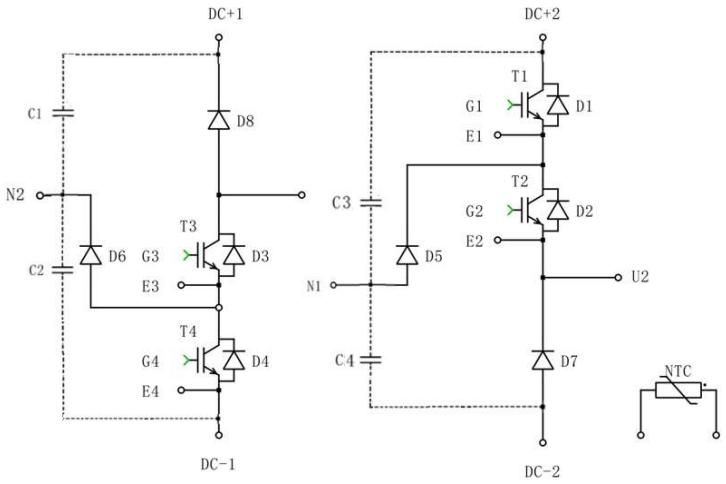
Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	I_F = 300A, V_{GE} = 0V	Tj = 25℃	V_F		2.3		V
		Tj = 125℃			2.2		
反向恢复峰值电流 Peak reverse recovery current	V_R = 400V, I_F = 150A,	Tj = 25℃	I_{RM}		29		A
		Tj = 125℃			60		
反向恢复时间 Reverse recovery time		Tj = 25℃	Trr		105		nS
		Tj = 125℃			128		
反向恢复电荷 Recovered charge		Tj = 25℃	Qr		2.1		μC
		Tj = 125℃			6.4		
反向恢复损耗（每脉冲） Reverse recovery energy		Tj = 25℃	$Erec$		1.15		mJ
		Tj = 125℃			2.23		
结一散热器热阻 Thermal resistance, junction to heatsink	每个二极管,λgrease = 3.4 W/(m*K) Per diode,λgrease = 3.4 W/(m*K)		R_{thCH}		0.2		K/W
最高结温 Maximum junction temperature			Tj_{op}		175		℃

7 负温度系数热敏电阻/NTC-Thermistor

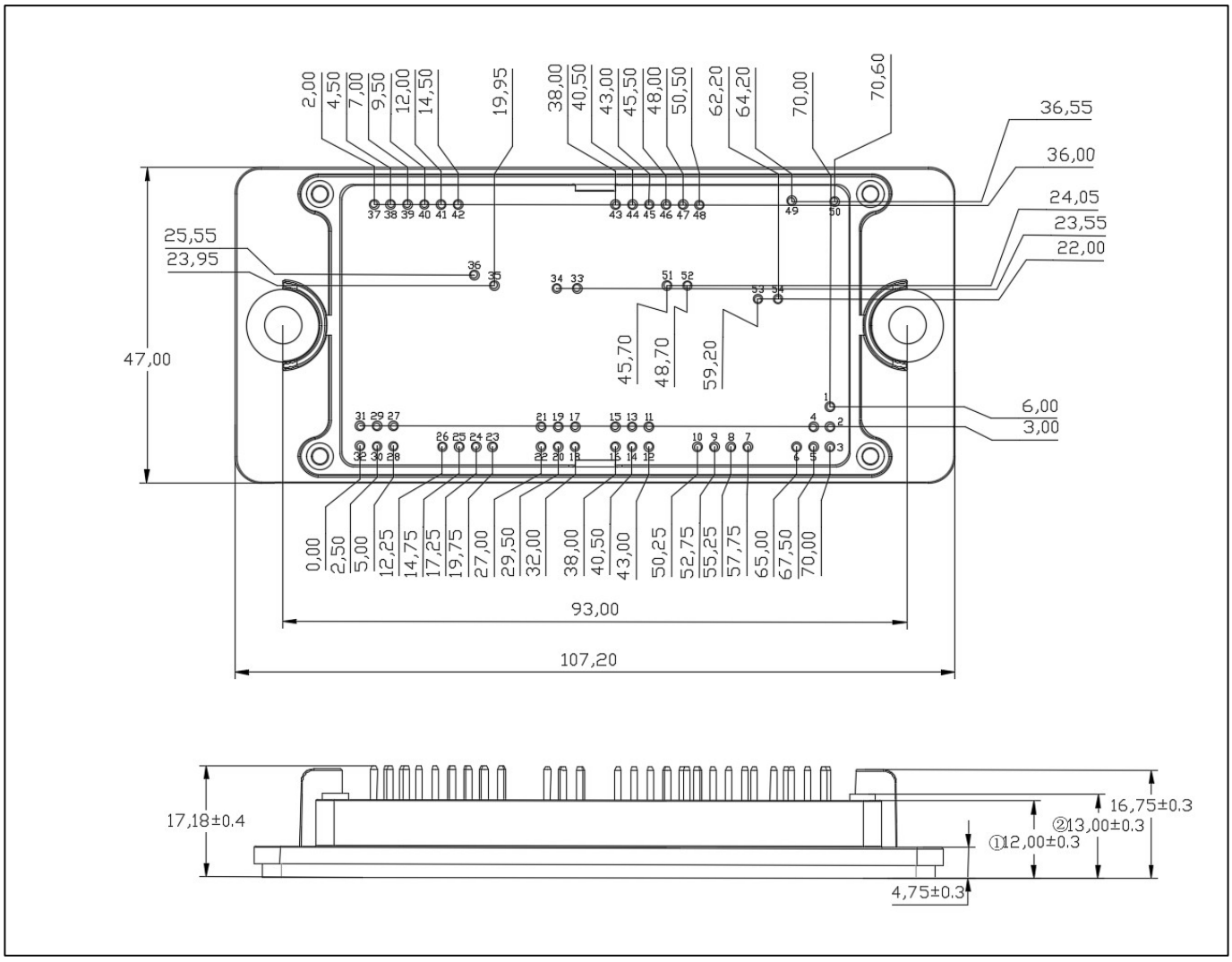
表 13 特征值/Characteristic values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
额定电阻值 Rated resistance	T_{NTC} = 25°C	R_{25}		22		kΩ
R_{100}偏差 Deviation of R_{100}	T_{NTC} = 100°C, R_{100} = 1486 Ω	ΔR/R	-5		5	%
耗散功率 Power dissipation	T_{NTC} = 25°C	P_{25}			200	mW
B-值 B-value	$R_2 = R_{25}\exp[B_{25/50}(1/T_2-1/(298{,}15\ K))]$	$B_{25/50}$		3950		K

8 电路拓扑图 / Circuit diagram



9 封装尺寸 / Package outlines



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