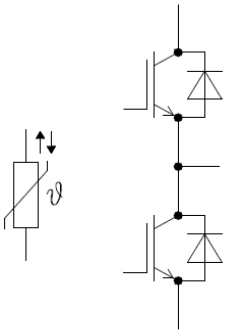
M series package: 1200V 450A IGBT module



等效电路图
Equivalent Circuit Schematic

Features:

- 1200V 450A, $V_{CE(sat)}$ =1.65 V@25℃
- High RBSOA capability
- Trench/FS Technology
- Low reverse-recovery losses
- High SC capability

产品特性:

- 1200V 450A, $V_{CE(sat)}$ = 1.65V@25℃
- 高 RBSOA 能力
- 沟槽栅/场终止技术
- 低反向恢复损耗
- 高短路能力

Typical Applications：

- Motor Drives
- Solar Applications
- UPS Systems
- Commercial Agriculture Vehicles

典型应用：

- 电机驱动
- 光伏应用
- UPS 系统
- 商用车

IGBT, Inverter / IGBT，逆变部分

Maximum Rated Values / 最大标称参数

Collector-emitter Voltage 集电极-发射极电压	T_{vj}=25℃	V_{CES}	1200	V
Continuous DC collector current 集电极连续直流电流		$I_{C\ nom}$	450	A
	T_C=100℃, T_{vjmax}=175℃	I_C	460	A
Repetitive Peak collector current 集电极可重复峰值电流	I_{CRM}=2×$I_{C\ nom}$	I_{CRM}	900	A
Gate-emitter peak voltage 门极-发射极峰值电压		V_{GES}	±20	V

Characteristic Values / 性能参数

			min.	typ.	max.	
Collector-emitter saturation Voltage[1)] 集电极-发射极饱和压降	I_C=450A, V_{GE}=15V T_{vj}=25℃ I_C=450A, V_{GE}=15V T_{vj}=125℃ I_C=450A, V_{GE}=15V T_{vj}=150℃	V_{CEsat}		1.65 1.85 1.90	1.95	V
Gate Threshold Voltage 门极阈值电压	V_{CE}=10V, I_C=17.1mA, T_{vj}=25℃	V_{GEth}	5.0	6.0	7.0	V
Gate Charge 门极电荷	V_{GE}=-15V/15V	Q_G		2.79		μC
Internal Gate Resistor 内置门极电阻	T_{vj}=25℃	R_{Gint}		1.50		Ω
Input Capacitance 输入电容	V_{CE}=25V, V_{GE}=0V, f=100KHz	C_{ies}		160		nF
Reverse Transfer Capacitance 反向传输电容	V_{CE}=25V, V_{GE}=0V, f=100KHz	C_{res}		1.35		nF
Collector-emitter Cutoff Current 集电极-发射极关断漏电流	V_{CE}=1200V, V_{GE}=0V, T_{vj}=25℃	I_{CES}			3	mA
Gate-emitter Leakage Current 门极-发射极漏电流	V_{CE}=0V, V_{GE}=20V, T_{vj}=25℃	I_{GES}			500	nA
Turn-on Delay Time, Inductive Load 开通延迟时间，感性负载	I_C=450A, V_{CE}=600V T_{vj}=25℃ V_{GE}= -8V/15V T_{vj}=125℃ R_{Gon}=0.5Ω T_{vj}=150℃	t_{don}		285 288 290		ns
Rise Time, Inductive Load 上升时间，感性负载	I_C=450A, V_{CE}=600V T_{vj}=25℃ V_{GE}= -8V/15V T_{vj}=125℃ R_{Gon}=0.5Ω T_{vj}=150℃	t_r		65 67 68		ns
Turn-off Delay Time, Inductive Load 关断延迟时间，感性负载	I_C=450A, V_{CE}=600V T_{vj}=25℃ V_{GE}= -8V/15V T_{vj}=125℃ R_{Goff}=0.5Ω T_{vj}=150℃	t_{doff}		485 510 515		ns
Fall Time, Inductive Load 下降时间，感性负载	I_C=450A, V_{CE}=600V T_{vj}=25℃ V_{GE}= -8V/15V T_{vj}=125℃ R_{Goff}=0.5Ω T_{vj}=150℃	t_f		130 160 175		ns
Turn-on energy loss per pulse 开通损耗	I_C=450A, V_{CE}=600V T_{vj}=25℃ V_{GE}= -8V/15V T_{vj}=125℃ R_{Gon}=0.5Ω,Lσ=35nH T_{vj}=150℃	E_{on}		37.0 62.0 70.0		mJ
Turn-off energy loss per pulse 关断损耗	I_C=450A, V_{CE}=600V, T_{vj}=25℃ V_{GE}=-8V / 15V, T_{vj}=125℃ R_{Goff}=2.4Ω, L_σ=35nH T_{vj}=150℃	E_{off}		42.0 75.0 85.0		mJ
SC Data	V_{CE}=600V, V_{GE}=15V/-8V, T_{vj}=150℃	t_{psc}	10			μs

短路耐量						
Thermal Resistance, Junction to Case 结-壳热阻	Per IGBT/单个 IGBT	R_{thJC}		0.057		K/W
Temperature under switching conditions 工作温度		$T_{vj\ op}$	-40		150	℃

Diode, Inverter / 二极管，逆变部分

Maximum Rated Values / 最大标称参数

Repetitive peak reverse voltage 可重复反向峰值电压	T_{vj}=25℃	V_{RRM}	1200	V
Continuous DC Forward Current 可连续正向直流电流		I_{Fnom}	450	A
Repetitive Peak Forward Current 可重复正向峰值电流	I_{FRM}=2×I_F	I_{FRM}	900	A

Characteristic Values / 性能参数

			min.	typ.	max.	
Forward Voltage [1)] 正向通态压降	I_F=450A, V_{GE}=0V T_{vj}=25℃ I_F=450A, V_{GE}=0V T_{vj}=125℃ I_F=450A, V_{GE}=0V T_{vj}=150℃	V_F		1.87 1.85 1.84	2.40	V
Peak Reverse Recovery Current 反向恢复峰值电流	I_F=450A, V_R=600V T_{vj}=25℃ -di$_F$/dt=5000A/us(T_{vj}=150℃) T_{vj}=125℃ V_{GE}=-8V T_{vj}=150℃	I_{RM}		300 332 345		A
Recovery Charge 反向恢复电荷	I_F=450A, V_R=600V T_{vj}=25℃ -di$_F$/dt=5000A/us(T_{vj}=150℃) T_{vj}=125℃ V_{GE}=-8V T_{vj}=150℃	Q_R		19.5 40.5 53.0		μC
Reverse Recovery Energy 反向恢复损耗	I_F=450A, V_R=600V T_{vj}=25℃ -di$_F$/dt=5000A/us(T_{vj}=150℃) T_{vj}=125℃ V_{GE}=-8V T_{vj}=150℃	E_{rec}		10.0 18.7 23.0		mJ
Thermal Resistance, Junction to Case 结-壳热阻	Per FRD/单个 FRD	R_{thJC}		0.094		K/W
Temperature under switching conditions 工作温度		$T_{vj\ op}$	-40		150	℃

NTC-Thermistor/ NTC-热敏电阻

Characteristic Values / 性能参数

			min.	typ.	max.	
Rated Resistance 标称电阻	T_{NTC}=25℃	R_{25}		5		KΩ
Deviation of R100 R100 偏移值	T_{NTC}=100℃，R_{100}=465Ω	△R/R	-7.3		7.3	%
Power Dissipation 功率耗散	T_{NTC}=25℃	P_{25}			10	mW
B-Value B 值	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$	$B_{25/50}$		3380		K
	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$	$B_{25/80}$		3470		K
	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$	$B_{25/100}$		3520		K

Module / 模块

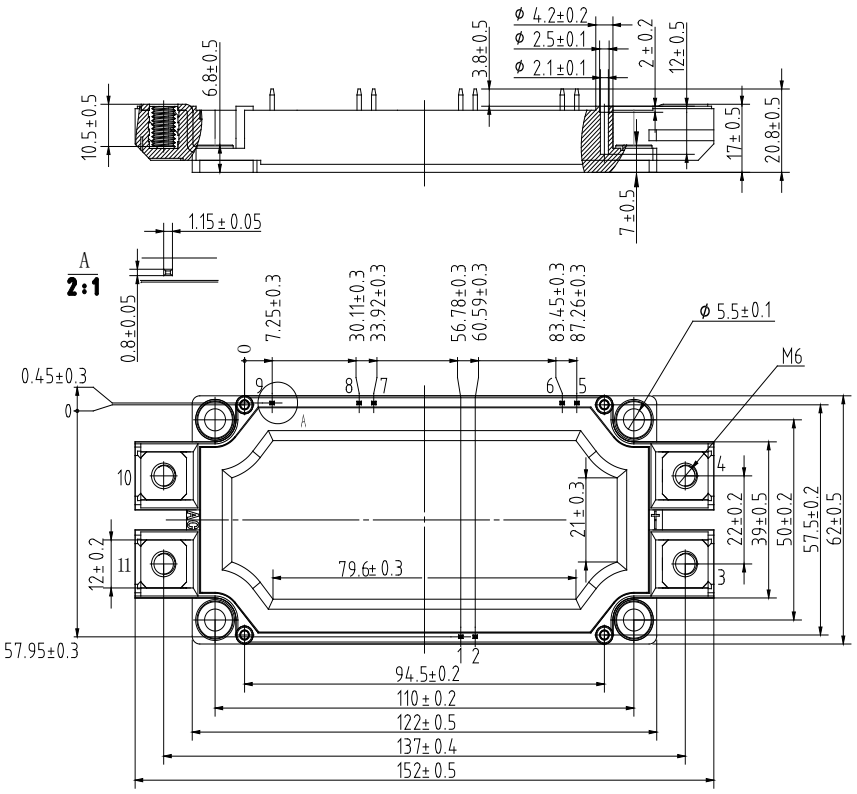
Isolation Test Voltage 绝缘测试电压	RMS, f=50Hz, t=1min	V_{ISOL}	2.5		KV
Material of Module Baseplate 模块底板材料			Cu		
Internal Isolation 内部绝缘			Al_2O_3		
Creepage Distance 爬电距离	Terminal to heatsink Terminal to terminal		14.5 13		mm
Clearance 电气间隙	Terminal to heatsink Terminal to terminal		12.5 10		mm
Comparative Tracking Index 相对漏电起痕指数		CTI	200 [2]		

			min.	typ.	max.	
Stray Inductance Module 模块杂散电感		L_{sCE}		20		nH
Module Lead Resistance, Terminals-Chip 模块引脚电阻，端子-芯片	T_C=25℃，Per Switch	$R_{CC'+EE'}$		1.10		mΩ
Storage Temperature 贮存温度		T_{stg}	-40		125	℃
Mounting Torque for Module Mounting 模块安装力矩	Screw M5 / M5 螺丝	M	3.0		6.0	Nm
Weight 重量		G		345		g

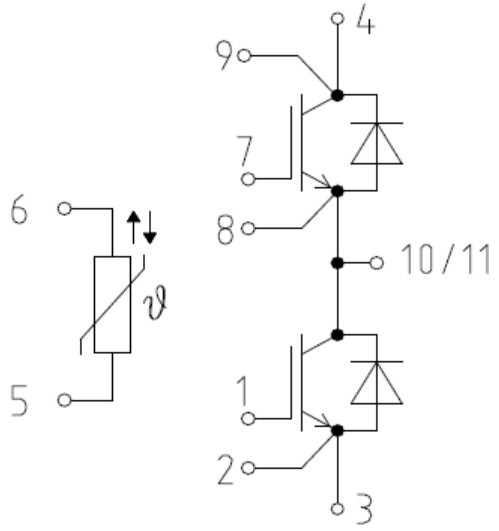
1) Terminal impedance is not included.
不包含端子阻抗。
2) CTI is about 200.
CTI 约等于 200。

Package Dimension / 封装尺寸

Dimensions in Millimeters / 毫米为单位

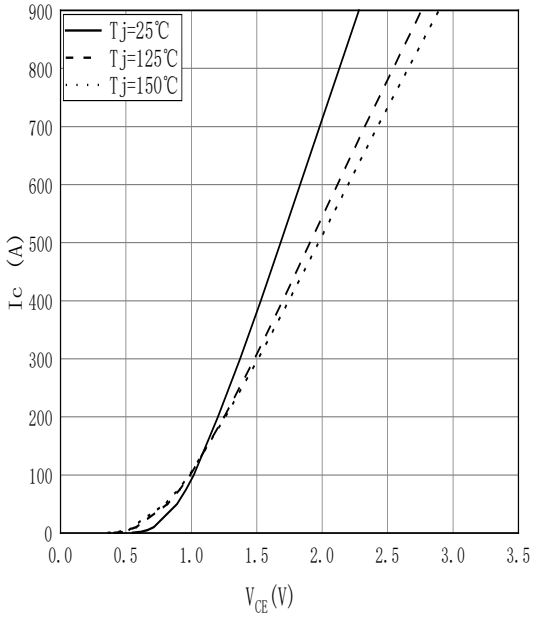


Internal Circuit / 内部电路

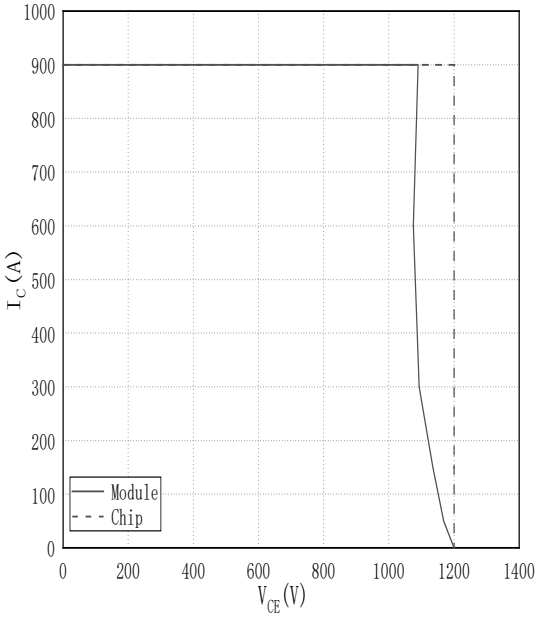


Circuit Diagram / 曲线图

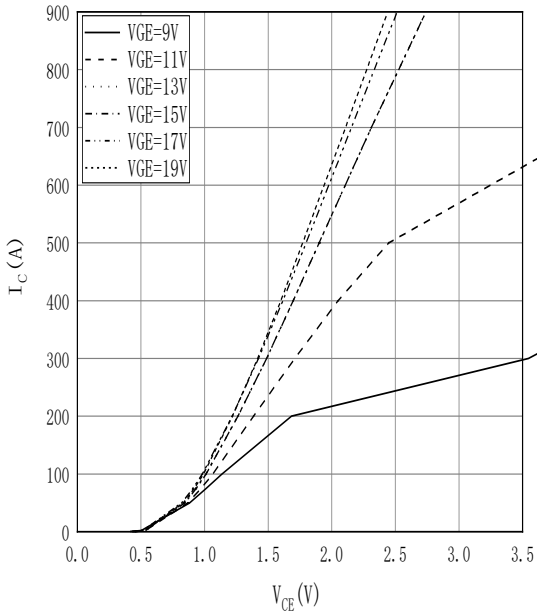
Output chanracteristic IGBT, Inverter(typical), Inclusive $R_{CC'+EE'}$.
IGBT 输出特性，逆变（典型值），包含 $R_{CC'+EE'}$.
Ic=f(V_{CE}), V_{GE}=15V



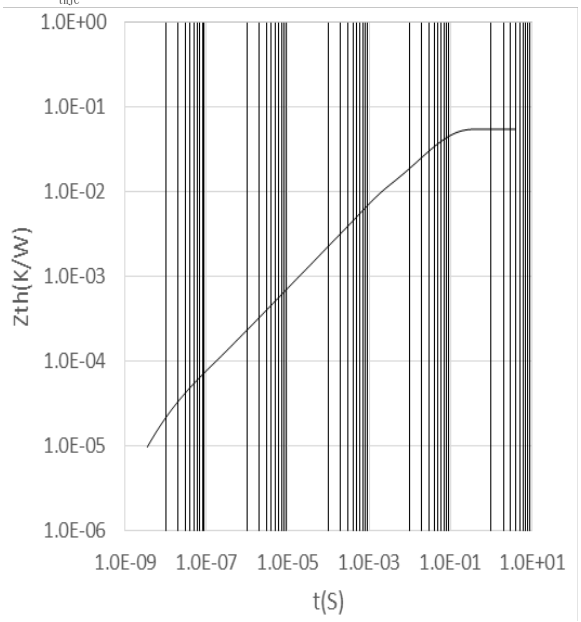
Reverse bias safe operating area IGBT, Inverter(RBSOA)
IGBT 反向安全工作区，逆变(RBSOA)
I_C=f(V_{CE}), V_{GE}=+15V/-8V, R_{goff}=1.5Ω, Tvj=150℃



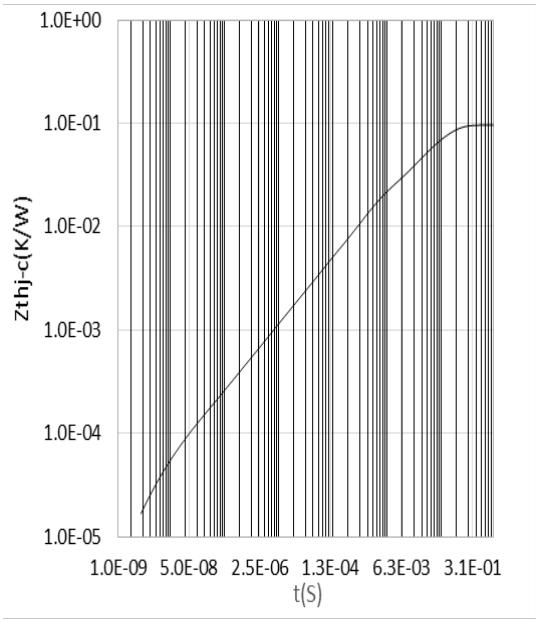
Output characteristic IGBT, Inverter(typical) (Tj=150℃), Inclusive $R_{CC'+EE'}$
IGBT 输出特性，逆变（Tj=150℃），包含 $R_{CC'+EE'}$



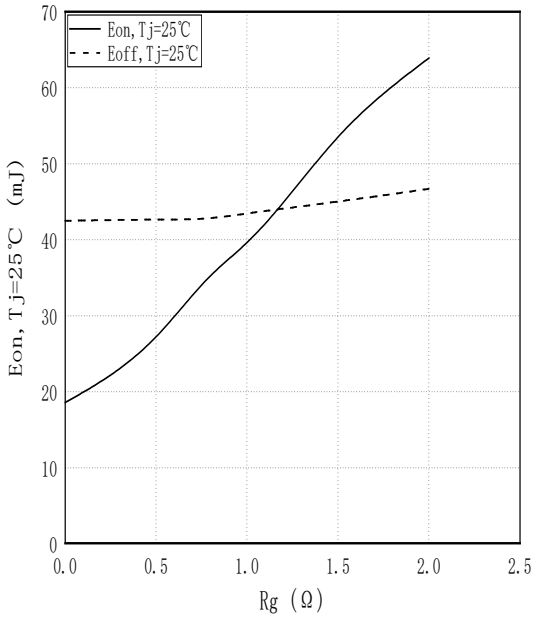
transient thermal impedance IGBT, Inerter
IGBT 瞬态热阻，逆变
Z_{thJC}=f(t)



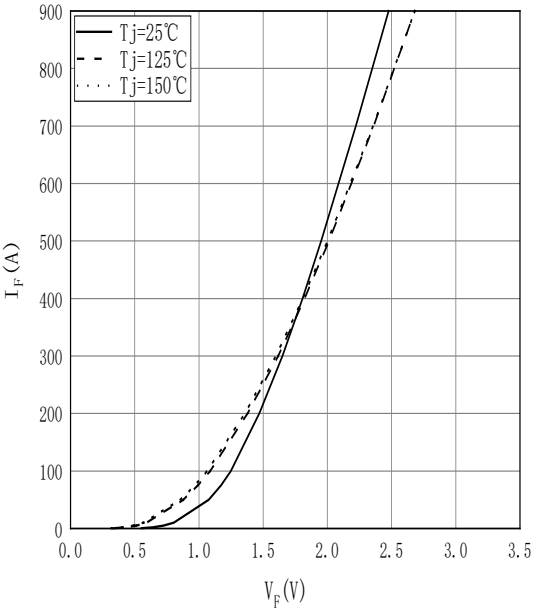
transient thermal impedance FRD, Inerter
FRD 瞬态热阻，逆变
$Z_{thJC}=f(t)$



Switching loss IGBT, Inverter (Typical)
IGBT 关断损耗，逆变（典型值）
$E_{off}=F(Ic), V_{GE}=+15V/-8V, R_{goff}=1.5\Omega, V_{CE}=600V$



Output characteristic FRD, Inverter (typical)
Inclusive $R_{CC'+EE'}$
FRD 输出特性，逆变（典型值），包含 $R_{CC'+EE'}$
$I_F=f(V_F)$



NTC Thermistor
NTC 热敏电阻
R=f（T）