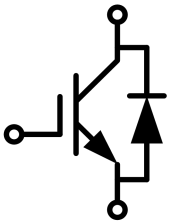
IGBT Discrete with Anti-Parallel Diode

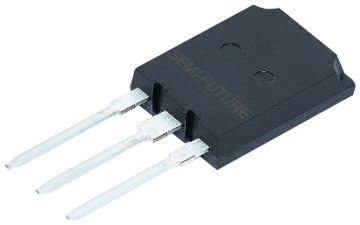
电气特性/ Features and Benefits:

- 1200V 沟槽栅/场终止工艺
  1200V trench gate/field termination process
- 低开关损耗
  Low switching losses
- Vcesat 正温度系数
  Vcesat has a positive temperature coefficient



典型应用/ Applications:

- 储能逆变器
  Energy storage inverter
- 不间断电源
  Uninterruptible power supplies
- 光伏逆变器
  Solar inverters



V_{CES} =1200V，$I_{C\ nom}$ =120A / I_{CRM} =360A

关键性能和程序参数 / Key Performance and Package Parameters

Type	V_{CE}	I_C	VCEsat, T_{vj}=25°C	T_{vjmax}	Package
SD120R12I7HQ	1200V	120A	1.85V	175°C	TO-247PLUS-3L

双极晶体管/IGBT

最大额定值 / Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
集电极-发射极电压 Collector-Emitter voltage	T_{vj}=25°C	V_{CES}	1200	V
连续集电极直流电流 Continuous DC collector current	T_C=100°C, $T_{vj\ max}$=175°C	$I_{C\ nom}$	120	A
集电极重复峰值电流 Repetitive peak collector current	t_P=1 ms	I_{CRM}	360	A
栅极-发射极电压 Gate emitter voltage	t_p ≤0.5μs, D<0.001	V_{GE}	±20 ±25	V
总功率损耗 Power dissipation	T_C=25℃ T_C=100℃	P_{tot}	1010 505	W

在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-40…+175	℃
储存温度 Storage temperature		T_{stg}	-40…+150	℃

热特性 / Thermal Characteristics

Parameter	Conditions	Symbol	Value	Unit
IGBT 热阻，结-壳 IGBT thermal resistance, junction - case		$R_{th(j-C)}$	0.12	K/W
二极管热阻，结-壳 Diode thermal resistance, junction - case		$R_{th(j-C)}$	0.20	K/W

特征值 / Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
集电极-发射极饱和电压 Collector-Emitter saturation voltage	V_{GE}=15V, I_C=120A V_{GE}=15V, I_C=120A V_{GE}=15V, I_C=120A	T_{vj}=25°C T_{vj}=150°C T_{vj}=175°C	V_{CEsat}		1.85 2.34 2.49	2.20	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	I_C=2.34mA, V_{GE}= V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	5.2	5.8	6.4	V
跨导 Transconductance	V_{CE}=20V，I_C=120A		G_{fs}		94		S
输入电容 Input capacitance	f=100kHz, V_{CE}=25 V, V_{GE}=0 V	T_{vj}=25°C	C_{ies}		17.16		nF
输出电容 Output capacitance			C_{oes}		0.44		nF
反向传输电容 Reverse transfer capacitance			C_{res}		0.12		nF
门极电荷 Gate charge	I_C = 120 A, V_{GE} = 15 V, V_{CE} =960 V	T_{vj}=25°C	Q_G		1.06		μC
集电极-发射极截止电流 Collector-emitter cut-off current	V_{CE}=1200V , V_{GE}= 0 V	T_{vj}=25°C	I_{CES}			40	μA
栅极-发射极漏电流 Gate-emitter leakage current	V_{CE}=0 V, V_{GE}= 20 V	T_{vj}=25°C	I_{GES}			100	nA
开通延迟时间 Turn-on delay time	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	$t_{d(on)}$		32 31		ns
上升时间 Rise time	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_r		203 165		ns
关断延迟时间 Turn-off delay time	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	$t_{d(off)}$		154 186		ns

下降时间 Fall time	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_f		68 138		ns
开通损耗能量（每脉冲） Turn-on energy loss per pulse	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω di/dt=500A/us(T_{vj}=175°C) (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	E_{on}		19.51 23.30		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	I_C=120A, V_{CE}=600V V_{GE}=±15 V, R_G=3.3Ω dv/dt=8300V/us(T_{vj}=175°C) (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	E_{off}		4.74 7.28		mJ

二极管/Diode

最大额定值 / Maximum Ratings

Parameter	Conditions	Symbol	Value	Unit
反向重复峰值电压 Repetitive peak reverse voltage	T_{vj}=25°C	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current	T_C=100°C, $T_{vj\ max}$=175°C	I_F	120	A
正向重复峰值电流 Repetitive peak forward current	t_p=1ms	I_{FRM}	360	A

特征值 / Characteristic Values

Parameter	Conditions		Symbol	Value			Unit
				Min.	Typ.	Max.	
正向电压 Forward voltage	I_F=120A, V_{GE}=0V I_F=120A, V_{GE}=0V I_F=120A, V_{GE}=0V	T_{vj}=25°C T_{vj}=150°C T_{vj}=175°C	V_F		1.77 2.00 1.97	2.30	V
反向恢复峰值电流 Peak reverse recovery current	I_F=120A, -di$_F$/dt=500A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	I_{RM}		36 58		A
反向恢复电荷 Reverse Recovered charge	I_F=120A, -di$_F$/dt=500A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	Q_{rr}		8.08 19.03		μC
反向恢复时间 Reverse Recovery Time	I_F=120A, -di$_F$/dt=500A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	t_{rr}		409 682		ns
反向恢复损耗（每脉冲） Reverse recovered energy	I_F=120A, -di$_F$/dt=500A/μs(T_{vj}=175°C) V_R=600V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	E_{rec}		2.91 7.60		mJ

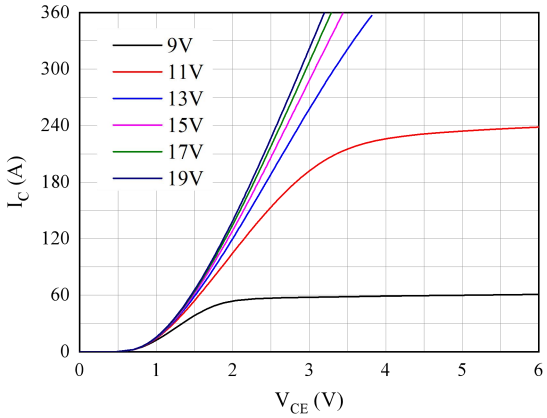


图 1. 典型输出特性 (T_{vj}=25℃)
Figure 1. Typical output characteristics (T_{vj}=25℃)

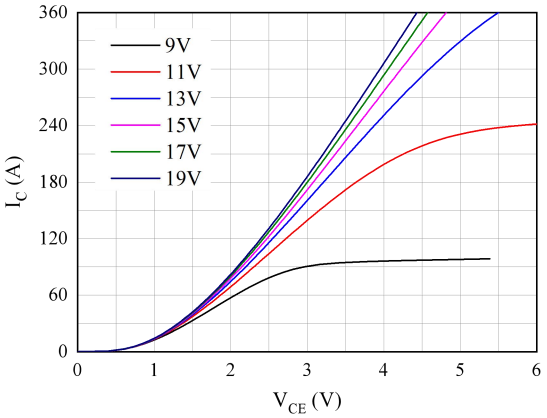


图 2. 典型输出特性 (T_{vj}=175℃)
Figure 2. Typical output characteristics (T_{vj}=175℃)

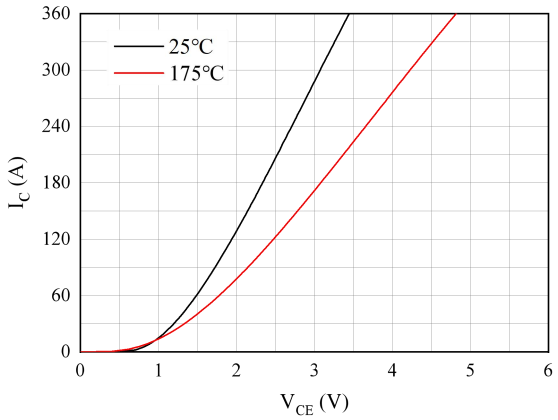


图 3. 典型输出特性 (V_{GE}=15V)
Figure 3. Typical output characteristics (V_{GE}=15V)

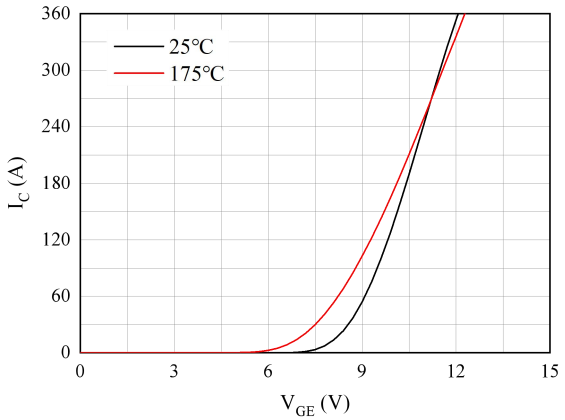


图 4. 典型传输特性(V_{CE}=20V)
Figure 4. Typical transfer characteristic(V_{CE}=20V)

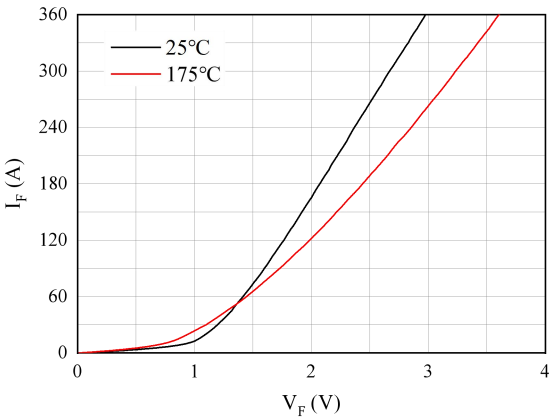


图 5. 正向偏压特性 二极管
Figure 5. Forward characteristic of Diode

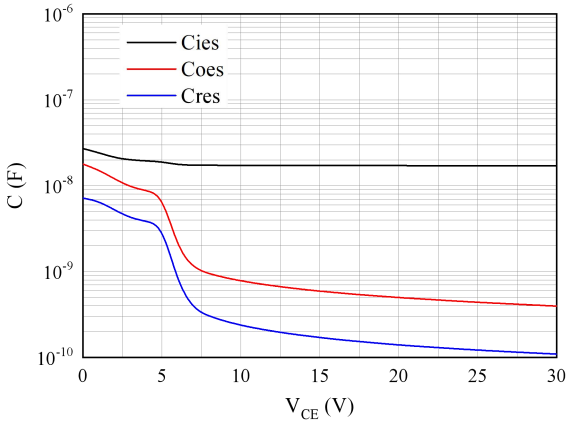


图 6. 电容特性
Figure 6. Capacitance characteristic

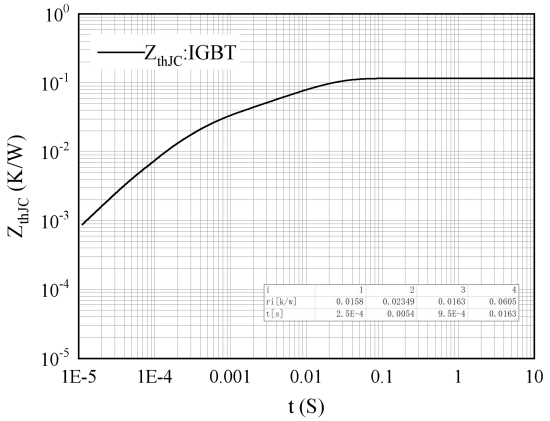


图 7. 瞬态热阻抗 IGBT
Figure 7. Transient thermal impedance IGBT, $Z_{thJC}=f(t)$

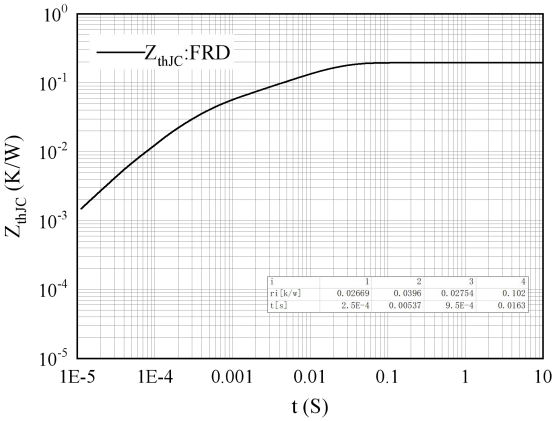


图 8. 瞬态热阻抗 FRD
Figure 8. Transient thermal impedance FRD, $Z_{thJC}=f(t)$

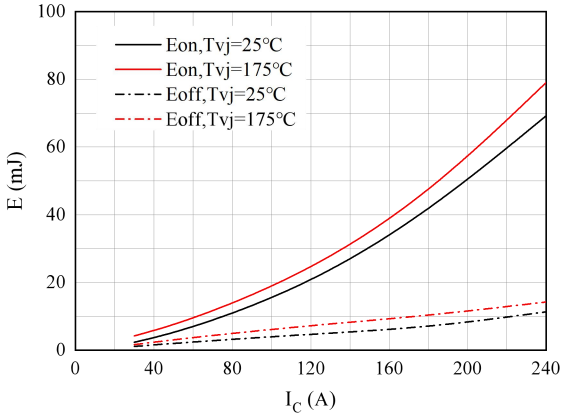


图 9. 开关损耗
Figure 9. Switching losses of IGBT
$V_{GE}=\pm15V$, Rgon=3.3Ω, Rgoff=3.3Ω, $V_{CE}=600V$

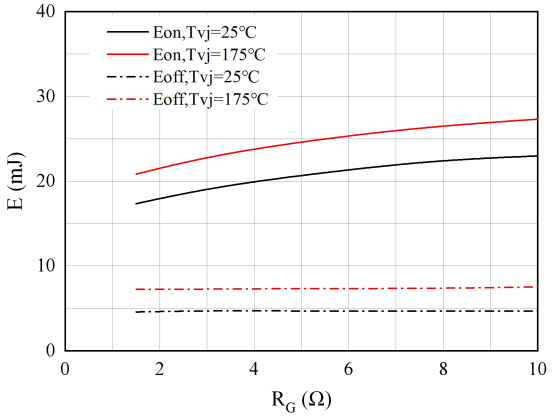


图 10. 开关损耗
Figure 10. Switching losses of IGBT
$V_{GE}=\pm15V$, $I_C=120A$, $V_{CE}=600V$

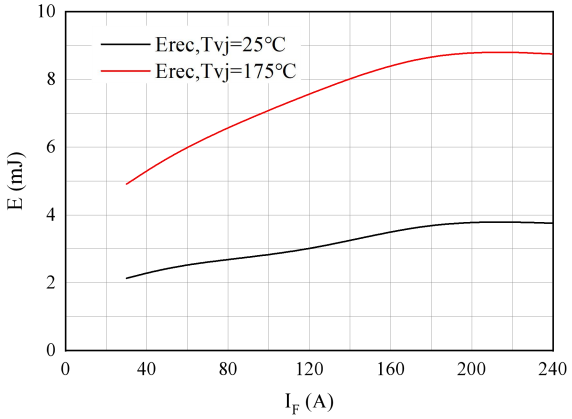


图 11. 开关损耗 二极管
Figure 11. Switching losses of Diode
Rgon=3.3Ω, $V_{CE}=600V$

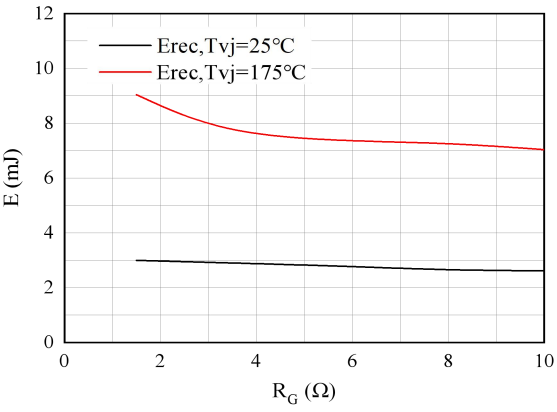
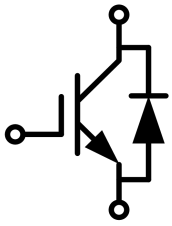
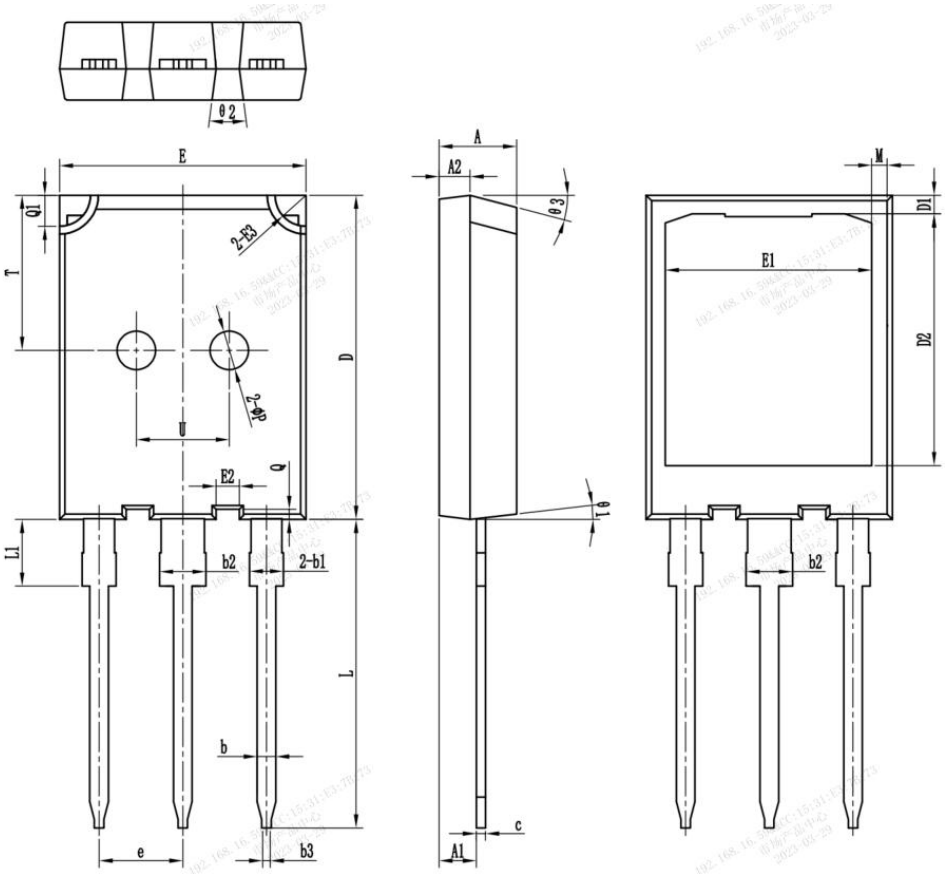


图 12. 开关损耗 二极管
Figure 12. Switching losses of Diode
$I_F=120A$, $V_{CE}=600V$

接线图 / Circuit diagram



封装尺寸 / Package outlines



符号	单位:mm		
	MIN	NOM	MAX
*A	4.90	5.00	5.10
*A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
*b	1.15	1.20	1.25
*b1	1.95	2.10	2.25
*b2	2.95	3.10	3.25
b3	0.45	0.60	0.75
*c	0.55	0.60	0.68
*D	20.90	21.00	21.10
D1	1.00	1.20	1.40
D2	16.05	16.35	16.65
*E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	1.25	1.45	1.65
E3	1.80	2.00	2.20
*e	5.40	5.44	5.48
*L	19.80	19.92	20.10
*L1	-	-	4.30
M	0.5	0.7	0.9
ΦP	2.30	2.50	2.70
Q	0.50	0.68	0.80
Q1	1.8	2.0	2.2
T	9.80	10.00	10.20
U	5.80	6.00	6.20
θ1	5°	7°	9°
θ2	13°	16°	19°
θ3	13°	15°	17°

*为关键管控尺寸