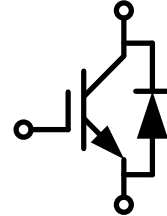


IGBT Discrete with Anti-Parallel Diode

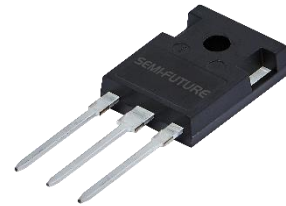
电气特性/ Features And Benefits:

- 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:

- 充电桩
Charging station
- 不间断电源
Uninterruptible power supplies
- 逆变器
Inverters



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

Type	V _{CE}	I _C	V _{CEsat} , T _{vj} =25°C	T _{vjmax}	Package
SD40R12A6HS	1200V	40A	1.90V	175°C	TO-247-3L

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	40	A
集电极重复峰值电流 Repetitive peak collector current	t _p =1 ms	I _{CRM}	120	A
总功率损耗 Total power dissipation	T _C =25°C, T _{vj max} =175°C T _C =100°C, T _{vj max} =175°C	P _{tot}	900 500	W

栅极-发射极电压 Gate emitter voltage		V_{GE}	± 20	V
瞬变栅极-发射极电压 Transient Gate-emitter voltage	$t_p \leq 10\mu s, D < 0.010$	V_{GE}	± 25	V
在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	$-40 \dots +175$	$^{\circ}C$
储存温度 Storage temperature		T_{stg}	$-40 \dots +150$	$^{\circ}C$

热特性 / Thermal Characteristics

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
IGBT 热阻, 结-壳 IGBT thermal resistance, junction - case		$R_{th(j-c)}$		0.138		K/W
二极管热阻, 结-壳 Diode thermal resistance, junction - case		$R_{th(j-c)}$		0.393		K/W

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
击穿电压 Collector-emitter breakdown voltage	$V_{GE}=0V, I_c=0.25mA$	$V_{(BR)CES}$	1200			V
集电极-发射极饱和电压 Collector-Emitter saturation Voltage	$V_{GE}=15V, I_c=40A$ $V_{GE}=15V, I_c=40A$ $V_{GE}=15V, I_c=40A$	$T_{vj}=25^{\circ}C$ $T_{vj}=125^{\circ}C$ $T_{vj}=150^{\circ}C$		1.90 2.47 2.57	2.40	
栅极-发射极阈值电压 Gate-Emitter threshold Voltage	$I_c=0.4mA, V_{GE}=V_{CE}$	$T_{vj}=25^{\circ}C$	$V_{GE(th)}$	4.9	5.5	
跨导 Transconductance	$V_{CE}=20V, I_c=40A$		G_{fs}		28	S
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}C$		R_{Gint}		2.3	Ω
输入电容 Input capacitance	$f=1\ 00KHZ, V_{CE}=25V, V_{GE}=0V$	$T_{vj}=25^{\circ}C$	C_{ies}		3.12	nF
输出电容 Output capacitance			C_{oes}		0.24	
反向传输电容 Reverse transfer capacitance			C_{res}		0.12	
门极电荷 Gate charge	$I_c = 40A, V_{GE} = 15V,$ $V_{CE} = 960V$	$T_{vj}=25^{\circ}C$	Q_G		255	μC
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE}=1200V, V_{GE}=0V$	$T_{vj}=25^{\circ}C$ $T_{vj}=175^{\circ}C$	I_{CES}		3000	10 μA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{CE}=0V, V_{GE}=20V$	$T_{vj}=25^{\circ}C$	I_{GES}			100 nA

开通延迟时间 Turn-on delay time	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$t_{d\ on}$		49 50		ns
上升时间 Rise time	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	t_r		74 69		
关断延迟时间 Turn-off delay time	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$t_{d\ off}$		162 237		
下降时间 Fall time	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	t_f		136 160		
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	E_{on}		3.51 6.78		mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ $di/dt = 450 A/\mu s$ ($T_{vj} = 175^\circ C$)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	E_{off}		1.61 2.66		mJ
开关损耗能量 (每脉冲) Total switching energy	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=10\Omega$ $dv/dt = 5500 V/\mu s$ ($T_{vj} = 175^\circ C$)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	E_{ts}		5.12 9.44		

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	$T_{vj}=25^\circ C$	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current	$T_C=100^\circ C, T_{vj\ max}=175^\circ C$	I_F	40	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1ms$	I_{FRM}	120	A
I_{2t} 值 I_{2t} -value	$t_p=10ms, \sin 180^\circ, T_j=125^\circ C$	I_{2t}	310	A

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward Voltage	$I_F=40A, V_{GE}=0V$ $I_F=40A, V_{GE}=0V$ $I_F=40A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	V_F		1.82 1.60 1.54	2.40 V

反向恢复峰值电流 Peak reverse recovery current	$I_F=40A$, $-di_F/dt=350A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	I_{RM}		12 29		A
反向恢复电荷 Reverse Recovered charge	$I_F=40A$, $-di_F/dt=350A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	Q_{rr}		3.29 10.5		μC
反向恢复时间 Reverse Recovery Time	$I_F=40A$, $-di_F/dt=350A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	t_{rr}		558 870		ns
反向恢复损耗（每脉冲） Reverse recovered energy	$I_F=40A$, $-di_F/dt=350A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=125^\circ C$ $T_{vj}=150^\circ C$	E_{rec}		1.40 4.21		mJ

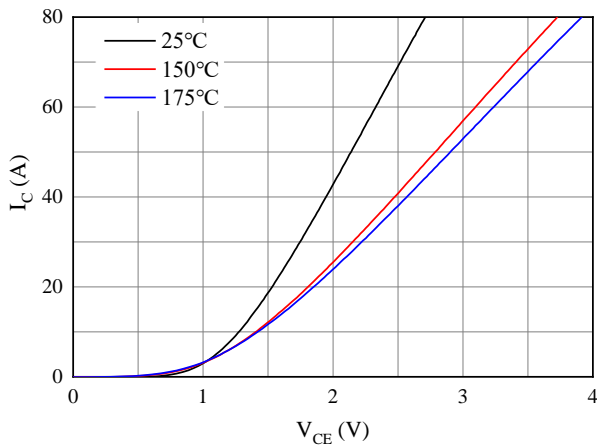


图 1. 典型输出特性 ($V_{GE}=15V$)

Figure 1. Typical output characteristics ($V_{GE}=15V$)

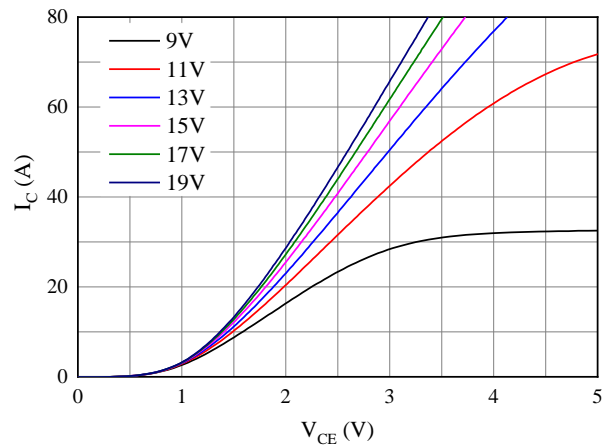


图 2. 典型输出特性 ($T_{vj}=150^{\circ}C$)

Figure 2. Typical output characteristics ($T_{vj}=150^{\circ}C$)

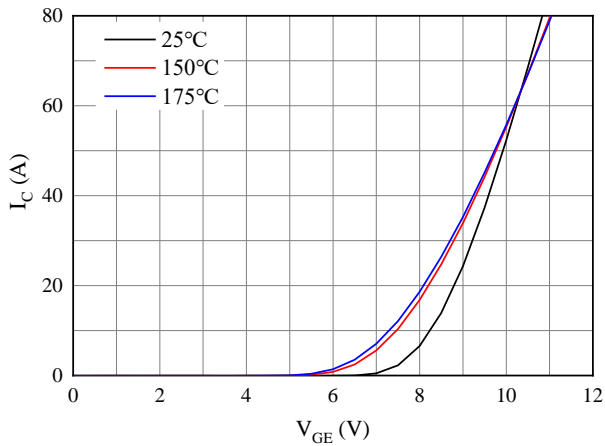


图 3. 典型传输特性 ($V_{CE}=20V$)

Figure 3. Typical transfer characteristic ($V_{CE}=20V$)

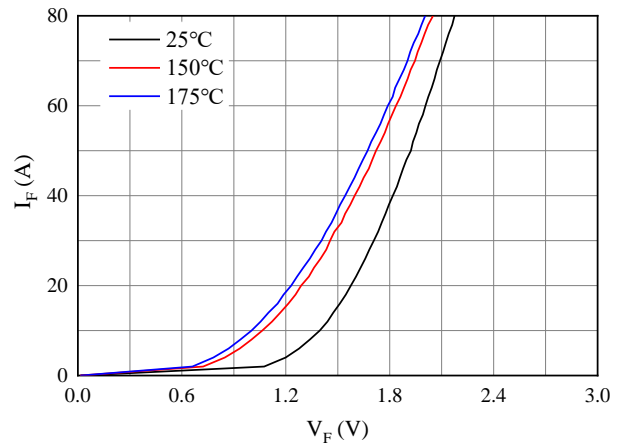


图 4. 正向偏压特性 二极管

Figure 4. Forward characteristic of Diode

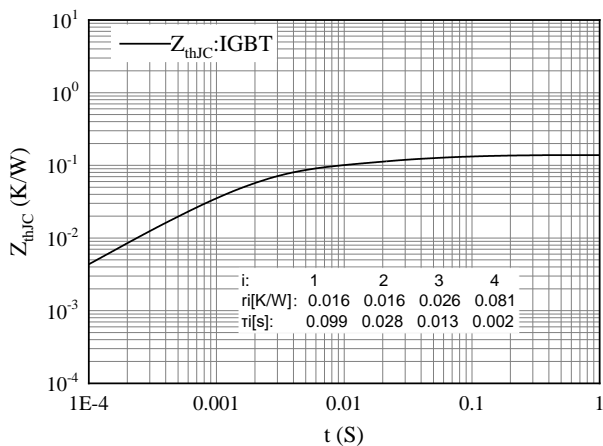


图 5. 瞬态热阻抗 IGBT

Figure 5. Transient thermal impedance IGBT,
 $Z_{thJC}=f(t)$

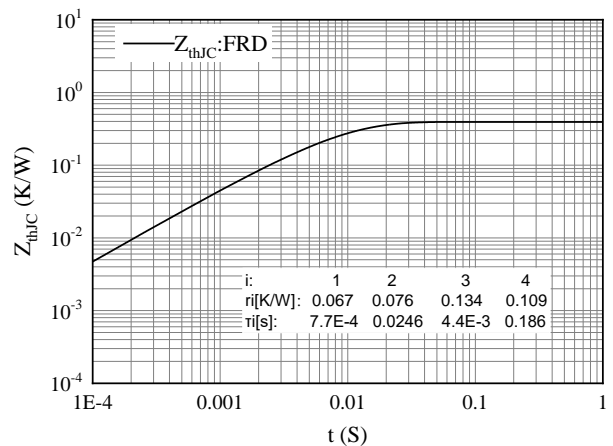


图 6. 瞬态热阻抗 FRD

Figure 6. Transient thermal impedance FRD,
 $Z_{thJC}=f(t)$

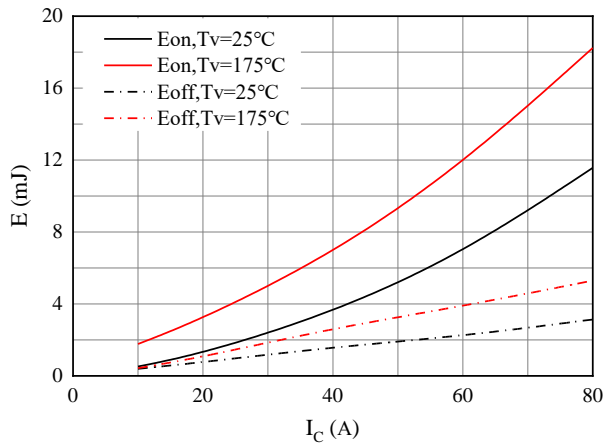


图 7. 开关损耗

Figure 7. Switching losses of IGBT

VGE=±15V, Rgon=10Ω, Rgoff=10Ω, VCE=600V

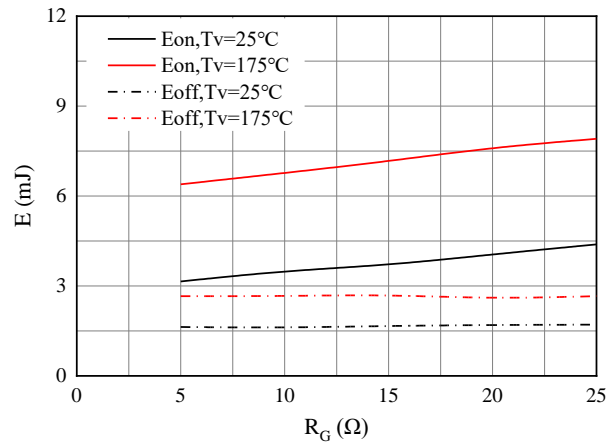


图 8. 开关损耗

Figure 8. Switching losses of IGBT

VGE=±15V, IC=40A, VCE=600V

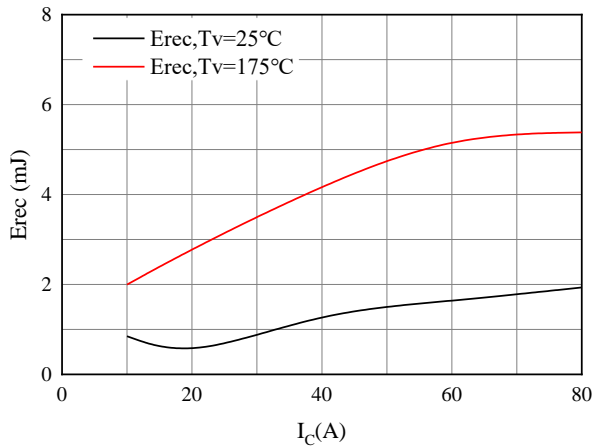


图 9. 开关损耗 二极管

Figure 9. Switching losses of Diode

Rgon=10Ω, VCE=600V

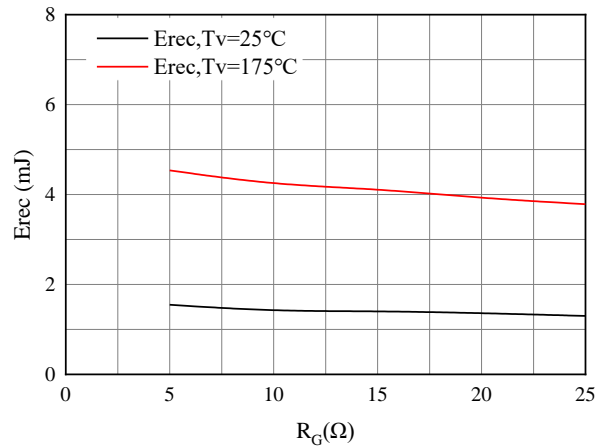


图 10. 开关损耗 二极管

Figure 10. Switching losses of Diode

IF=40A, VCE=600V

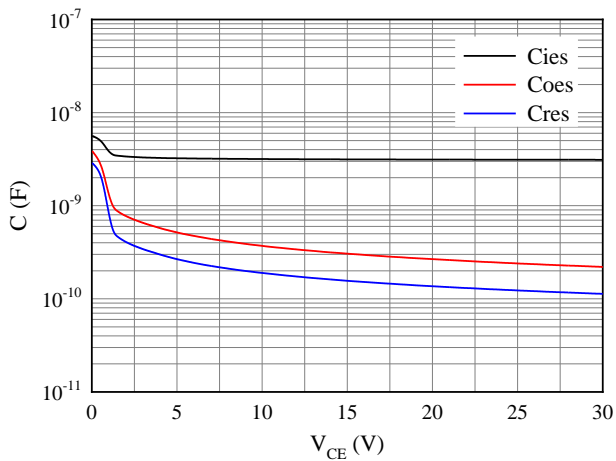
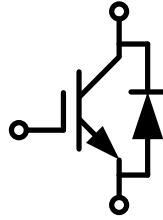


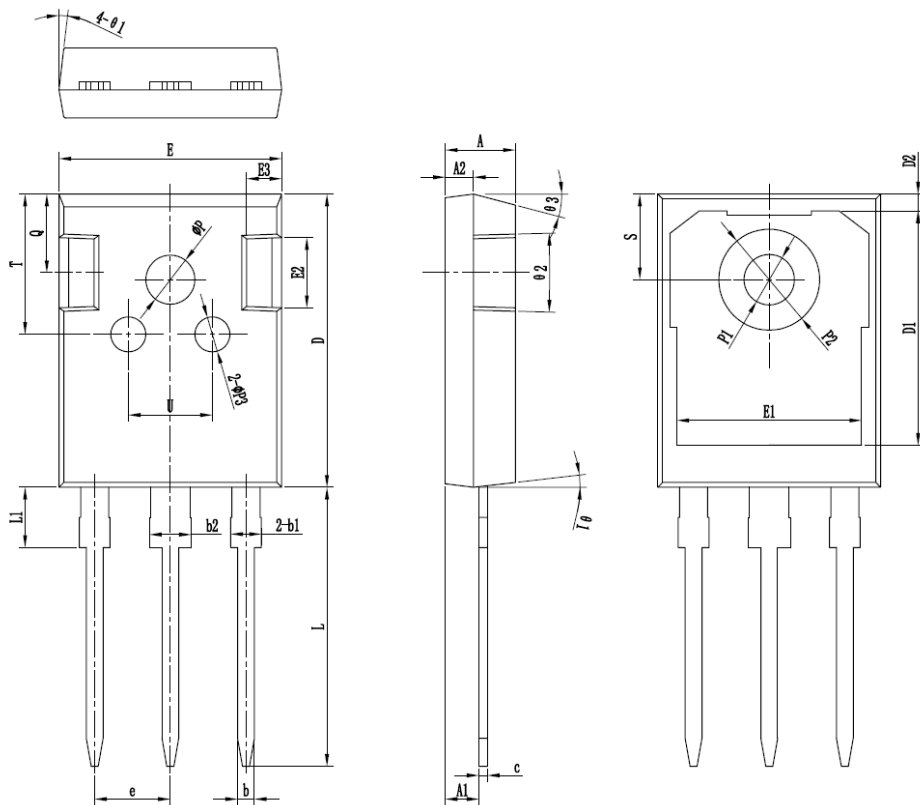
图 11. 电容特性

Figure 11. Capacitance characteristic

接线图 / Circuit diagram



封装尺寸 / Package outlines



符号	单位: mm		
	MIN	NOM	MAX
EA	4.90	5.00	5.10
EA1	2.31	2.41	2.51
A2	1.90	2.00	2.10
EB	1.15	1.20	1.25
EA1	1.95	2.10	2.25
EA2	2.95	3.10	3.25
EC	0.65	0.60	0.65
ED	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35
ED	15.70	15.80	15.90
E1	13.10	13.25	13.40
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
EE	5.40	5.44	5.48
EL	19.80	19.92	20.10
EA1	-	-	4.30
EA2	3.70	3.80	3.90
EA3	3.50	3.60	3.70
EA4	7.00	7.20	7.40
EA5	2.40	2.50	2.60
Q	5.60	5.80	6.00
ES	6.05	6.15	6.25
T	9.80	10.00	10.20
U	6.00	6.20	6.40
Ø1	5°	7°	9°
Ø2	1°	3°	5°
Ø3	13°	15°	17°

*为关键管控尺寸