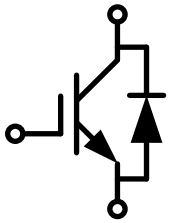
IGBT Discrete with Anti-Parallel Diode

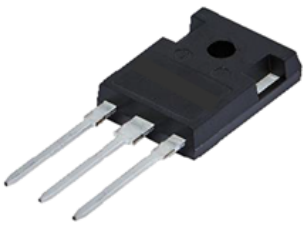
电气特性/ Features and Benefits:



- 700V 沟槽栅/场终止工艺
  700V 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
- OBC
  On board charger
- 不间断电源
  Uninterruptible power supplies
- 逆变器
  Inverters



V_{CES} =700V，$I_{C\ nom}$ =40A / I_{CRM} =120A

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
SD40R07A6U	700V	40A	1.42V	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}	700	V
连续集电极直流电流 Continuous DC collector current	T_C=100°C, $T_{vj\ max}$=175°C	$I_{C\ nom}$	40	A
集电极重复峰值电流 Repetitive peak collector current	t_P=1 ms	I_{CRM}	120	A
栅极-发射极电压 Gate emitter voltage	t_p ≤0.5μs, D<0.001	V_{GE}	±20 ±30	V

总功率损耗 Power dissipation	T_C=25℃ T_C=100℃	P_{tot}	294 147	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		$R_{th(j-C)}$	0.51	K/W
二极管热阻，结-壳 Diode thermal resistance, junction - case		$R_{th(j-C)}$	0.42	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=40A V_{GE}=15V, I_C=40A V_{GE}=15V, I_C=40A	T_{vj}=25°C T_{vj}=150°C T_{vj}=175°C	V_{CEsat}		1.42 1.70 1.73	1.80	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	I_C=0.4mA, V_{GE}= V_{CE}	T_{vj}=25°C	$V_{GE(th)}$	4.3	4.9	5.5	V
跨导 Transconductance	V_{CE}=20V，I_C=40A		G_{fs}		67		S
输入电容 Input capacitance	f=100kHz, V_{CE}=25 V, V_{GE}=0 V	T_{vj}=25°C	C_{ies}		5514		pF
输出电容 Output capacitance			C_{oes}		202		pF
反向传输电容 Reverse transfer capacitance			C_{res}		93		pF
门极电荷 Gate charge	I_C = 40A, V_{GE} = 15 V, V_{CE} =560V	T_{vj}=25°C	Q_G		533		nC
集电极-发射极截止电流 Collector-emitter cut-off current	V_{CE}=700V , V_{GE}= 0 V	T_{vj}=25°C	I_{CES}			1	mA
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}			200	nA
开通延迟时间 Turn-on delay time	I_C=40A, V_{CE}=400V V_{GE}=±15 V, R_G=8Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	$t_{d(on)}$		24 20		ns
上升时间 Rise time	I_C=40A, V_{CE}=400V V_{GE}=±15 V, R_G=8Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_r		61 56		ns

关断延迟时间 Turn-off delay time	I_C=40A, V_{CE}=400V V_{GE}=±15 V, R_G=8Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	$t_{d(off)}$		148 172		ns
下降时间 Fall time	I_C=40A, V_{CE}=400V V_{GE}=±15 V, R_G=8Ω (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	t_f		41 77		ns
开通损耗能量（每脉冲） Turn-on energy loss per pulse	I_C=40A, V_{CE}=400V V_{GE}=±15 V, R_G=8Ω di/dt=600A/us(T_{vj}=175°C) (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	E_{on}		1.31 2.83		mJ
关断损耗能量（每脉冲） Turn-off energy loss per pulse	I_C=40A, V_{CE}=400V V_{GE}=±15 V, R_G=8Ω dv/dt=9000V/us(T_{vj}=175°C) (电感负载) / (inductive load)	T_{vj}=25°C T_{vj}=175°C	E_{off}		0.51 0.74		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}=25ºC	V_{RRM}	700	V
连续正向直流电流 Continuous DC forward current	T_C=100°C, $T_{vj\ max}$=175°C	I_F	40	A
正向重复峰值电流 Repetitive peak forward current	t_p=1ms	I_{FRM}	120	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°C T_{vj}=150°C T_{vj}=175°C	V_F		1.52 1.23 1.19	2.00	V
反向恢复峰值电流 Peak reverse recovery current	I_F=40A, -di$_F$/dt=600A/μs(T_{vj}=175°C) V_R=400V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	I_{RM}		15.36 41.28		A
反向恢复电荷 Reverse Recovered charge	I_F=40A, -di$_F$/dt=600A/μs(T_{vj}=175°C) V_R=400V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	Q_{rr}		0.96 5.39		μC
反向恢复时间 Reverse Recovery Time	I_F=40A, -di$_F$/dt=600A/μs(T_{vj}=175°C) V_R=400V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	t_{rr}		119 200		ns
反向恢复损耗（每脉冲） Reverse recovered energy	I_F=40A, -di$_F$/dt=600A/μs(T_{vj}=175°C) V_R=400V, V_{GE}=-15V	T_{vj}=25°C T_{vj}=175°C	E_{rec}		0.22 1.13		mJ

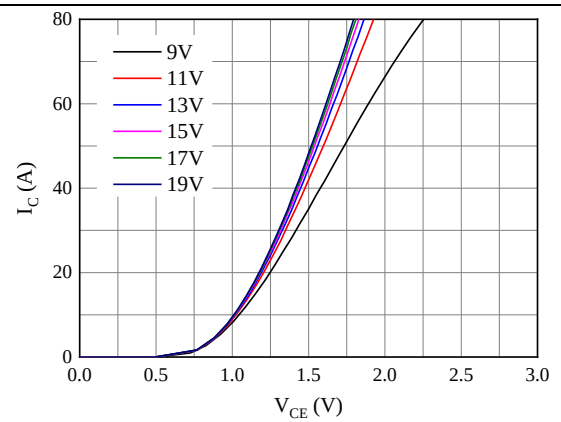


图 1. 典型输出特性 (T_{vj}=25℃)
Figure 1. Typical output characteristics (T_{vj}=25℃)

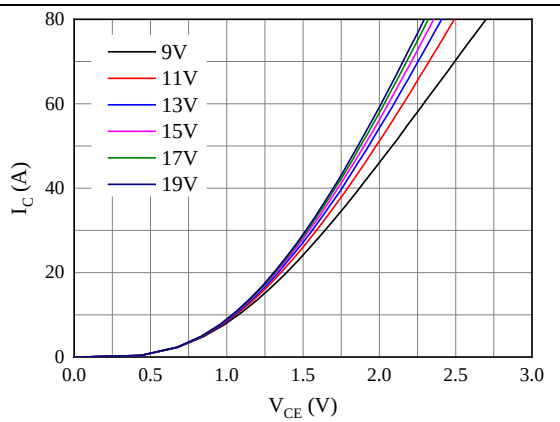


图 2. 典型输出特性 (T_{vj}=175℃)
Figure 2. Typical output characteristics (T_{vj}=175℃)

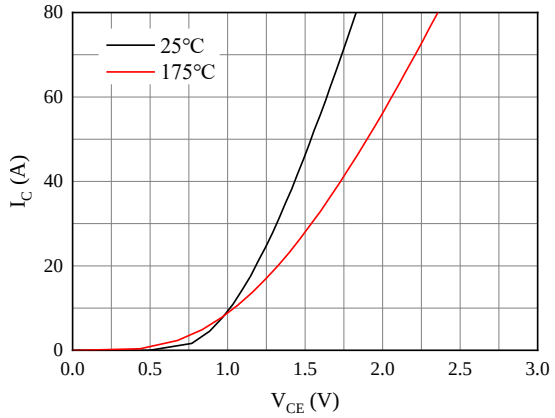


图 3. 典型输出特性 (V_{GE}=15V)
Figure 3. Typical output characteristics (V_{GE}=15V)

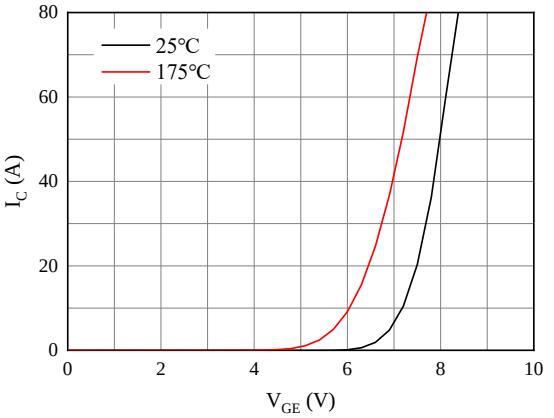


图 4. 典型传输特性(V_{CE}=20V)
Figure 4. Typical transfer characteristic(V_{CE}=20V)

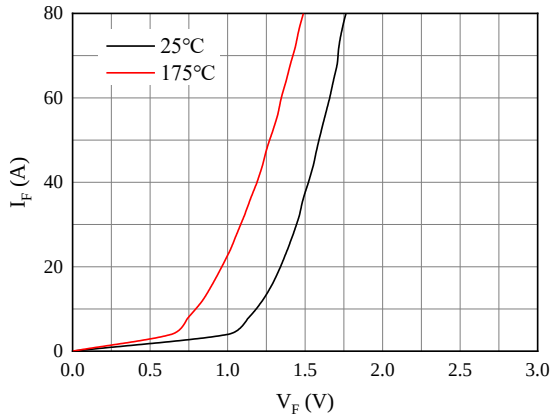


图 5. 正向偏压特性 二极管
Figure 5. Forward characteristic of Diode

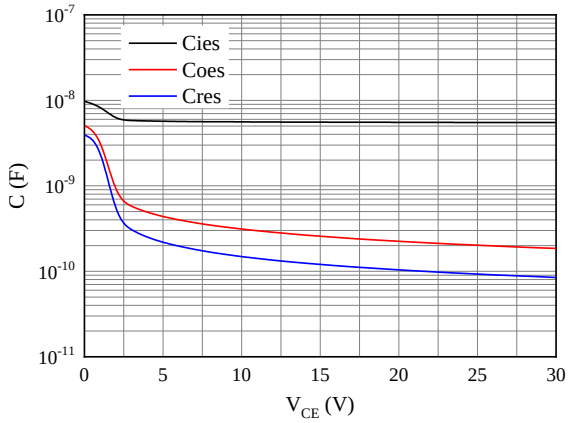


图 6. 电容特性
Figure 6. Capacitance characteristic

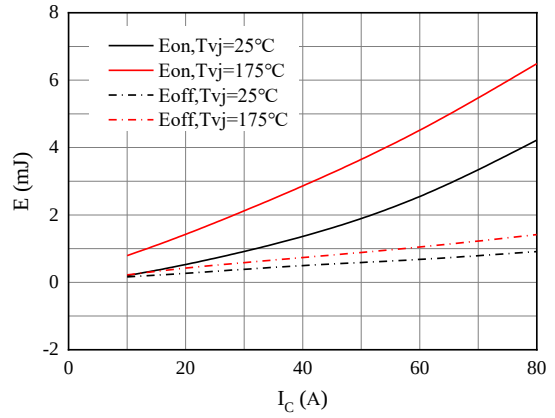


图 7. 开关损耗
Figure 7. Switching losses of IGBT
V_{GE}=±15V, Rgon=8Ω, Rgoff=8Ω, V_{CE}=400V

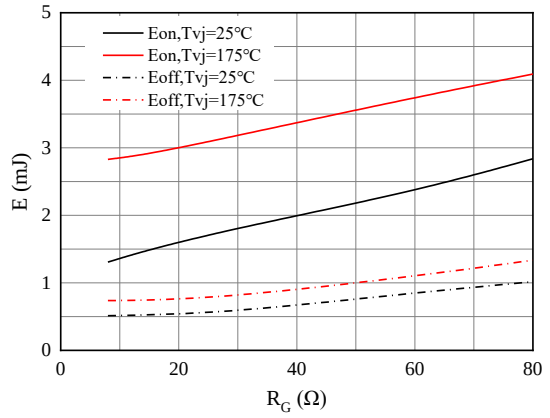


图 8. 开关损耗
Figure 8. Switching losses of IGBT
V_{GE}=±15V, I_C=40A, V_{CE}=400V

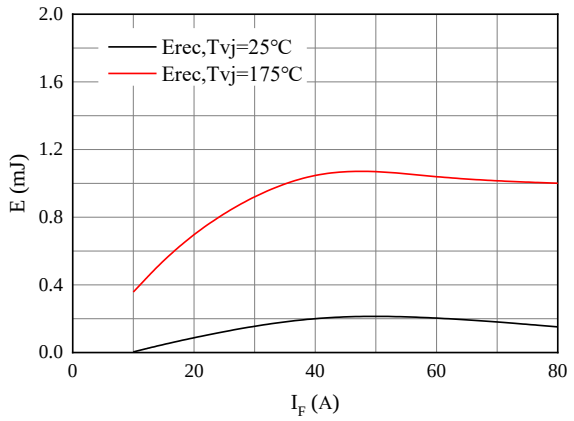


图 9. 开关损耗 二极管
Figure 9. Switching losses of Diode
Rgon=8Ω, V_{CE}=400V

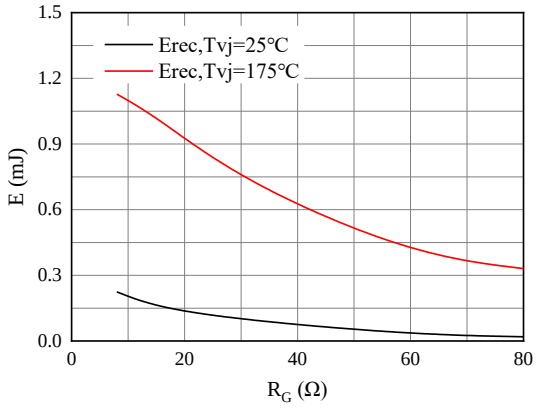


图 10. 开关损耗 二极管
Figure 10. Switching losses of Diode
I_F=40A, V_{CE}=400V

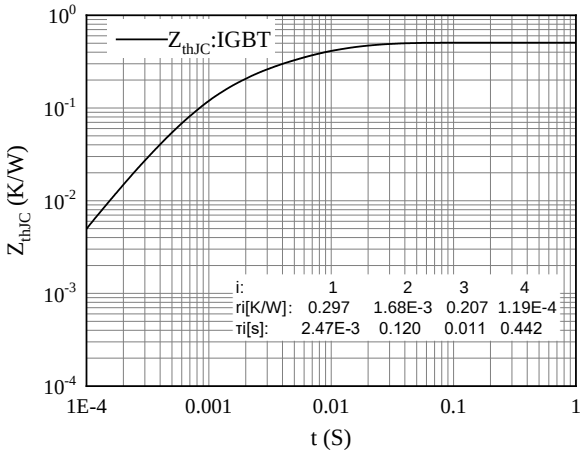


图 11. 瞬态热阻抗 IGBT
Figure 11. Transient thermal impedance IGBT, Z_{thJC}=f(t)

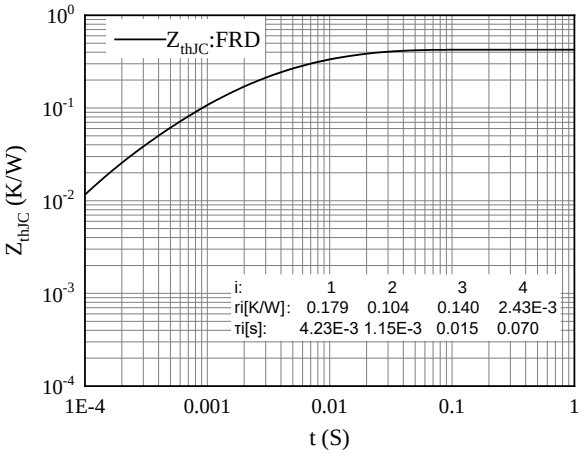
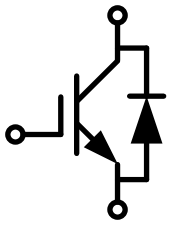
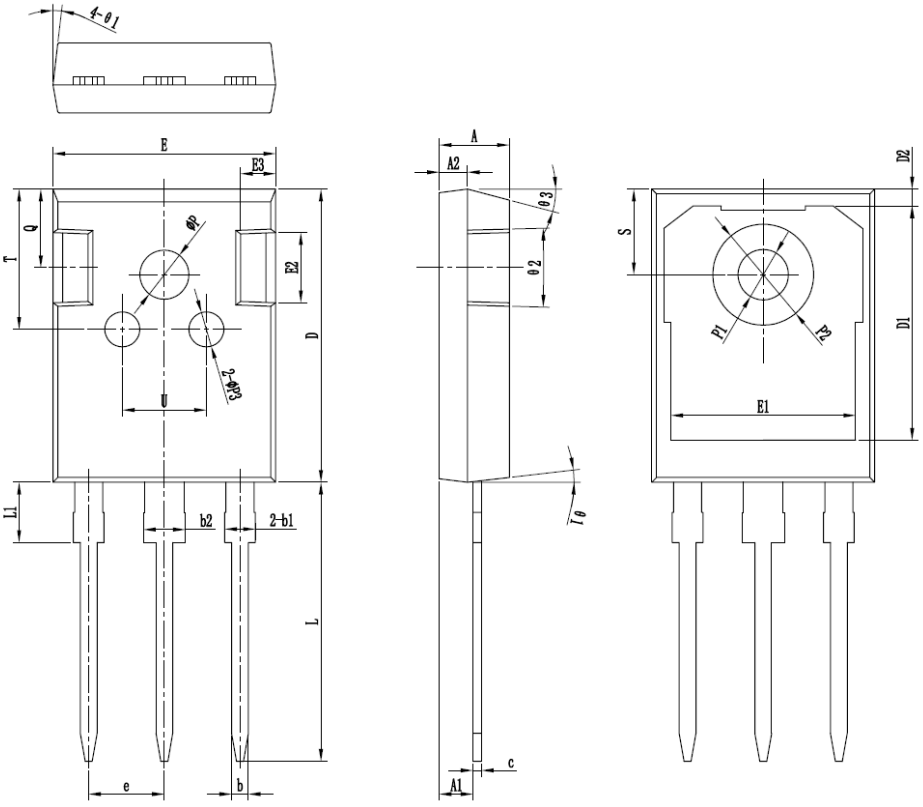


图 12. 瞬态热阻抗 FRD
Figure 12. Transient thermal impedance FRD, Z_{thJC}=f(t)

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
*c	0.55	0.60	0.65
*D	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35
*E	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
*e	5.40	5.44	5.48
*L	19.80	19.92	20.10
*L1	-	-	4.30
*ΦP	3.70	3.80	3.90
*ΦP1	3.50	3.60	3.70
ΦP2	7.00	7.20	7.40
ΦP3	2.40	2.50	2.60
Q	5.60	5.80	6.00
*S	6.05	6.15	6.25
T	9.80	10.00	10.20
U	6.00	6.20	6.40
θ1	5°	7°	9°
θ2	1°	3°	5°
θ3	13°	15°	17°

*为关键管控尺寸

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