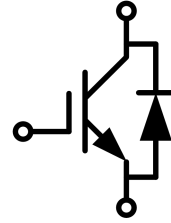


IGBT Discrete with Anti-Parallel Diode

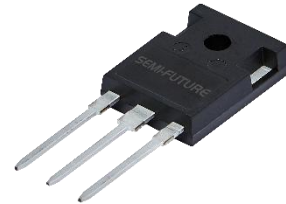
电气特性:

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



典型应用:

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



$V_{CES} = 1200V$, $I_{C\ nom} = 40A$ / $I_{CRM} = 160A$

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

Type	V_{CE}	I_C	$V_{CESat}, T_{vj}=25^\circ C$	T_{vjmax}	Package
SD40R12A6H	1200V	40A	1.91V	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	$T_{vj}=25^\circ C$	V_{CES}	1200	V
连续集电极直流电流 Continuous DC collector current	$T_C=25^\circ C, T_{vj\ max}=175^\circ C$ $T_C=100^\circ C, T_{vj\ max}=175^\circ C$	$I_{C\ nom}$	80 40	A
集电极重复峰值电流 Repetitive peak collector current	$t_p=1\ ms$	I_{CRM}	160	A
栅极-发射极电压 Gate emitter voltage		V_{GE}	± 20	V
总功率损耗 Power dissipation	$T_C=25^\circ C$ $T_C=100^\circ C$	P_{tot}	575 290	W
在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-40...+175	°C

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Edited by Semi-Future Technologies, Edition 1.2

储存温度 Storage temperature	T_{stg}	-40...+150	°C
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热特性 / Thermal Characteristics

Parameter	Conditions	Symbol	Value	Unit
IGBT 热阻, 结-壳 IGBT thermal resistance, junction - case		$R_{th(j-c)}$	0.26	K/W
二极管热阻, 结-壳 Diode thermal resistance, junction - case		$R_{th(j-c)}$	0.54	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	$V_{GE}=15V, I_C=40A$ $V_{GE}=15V, I_C=40A$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	V_{CEsat}	1.91 2.36	2.30	V
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_C=1.5mA, V_{GE}=V_{CE}$	$T_{vj}=25^\circ C$	$V_{GE(th)}$	4.5	5.1	5.7
跨导 Transconductance	$V_{CE}=20V, I_C=15A$		G_{fs}	27		S
输入电容 Input capacitance			C_{ies}	2.51		nF
输出电容 Output capacitance	$f=100KHz, V_{CE}=25V, V_{GE}=0V$	$T_{vj}=25^\circ C$	C_{oes}	0.21		
反向传输电容 Reverse transfer capacitance			C_{res}	0.11		
门极电荷 Gate charge	$I_C = 40.0 A, V_{GE} = 15 V,$ $V_{CE} = 960 V$	$T_{vj}=25^\circ C$	Q_G	0.12		μC
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE}=1200V, V_{GE}=0V$	$T_{vj}=25^\circ C$	I_{CES}		250	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}		600	nA
开通延迟时间 Turn-on delay time	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=12\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	t_{don}	17 16		ns
上升时间 Rise time	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=12\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	t_r	71 68		
关断延迟时间 Turn-off delay time	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=12\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	t_{doff}	150 222		
下降时间 Fall time	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=12\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	t_f	85 177		
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=12\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	E_{on}	3.48 5.74		mJ

关断损耗能量（每脉冲） Turn-off energy loss per pulse	$I_C=40A, V_{CE}=600V$ $V_{GE}=\pm 15V, R_G=12\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	E_{off}		1.47 2.54		
在开关状态下温度 Temperature under switching conditions			$T_{vj\ op}$	-40		175	$^\circ C$

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	$T_C=25^\circ C, T_{vj\ max}=175^\circ C$	I_F	40	A
正向重复峰值电流 Repetitive peak forward current	$t_p=1ms$	I_{FRM}	80	A

特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=40A, V_{GE}=0V$ $I_F=40A, V_{GE}=0V$	V_F		2.00 1.74	2.50	V
反向恢复峰值电流 Peak reverse recovery current	$I_F=40A,$ $di_F/dt=400A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	I_{RM}		13 27		A
反向恢复电荷 Reverse Recovered charge	$I_F=40A,$ $di_F/dt=400A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	Q_{rr}		2.57 7.64		μC
反向恢复时间 Reverse Recovery Time	$I_F=40A,$ $di_F/dt=400A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	t_{rr}		450 707		ns
反向恢复损耗（每脉冲） Reverse recovered energy	$I_F=40A,$ $di_F/dt=400A/\mu s(T_{vj}=175^\circ C)$ $V_R=600V, V_{GE}=-15V$	E_{rec}		1.04 3.08		mJ
在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-40		175	$^\circ C$

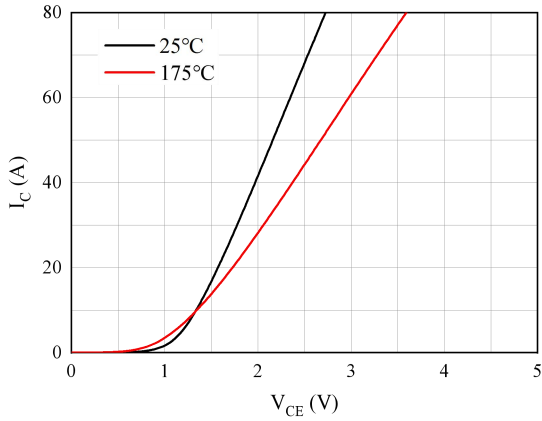


图 1. 典型输出特性 ($V_{GE}=15V$)
Figure 1. Typical output characteristics ($V_{GE}=15V$)

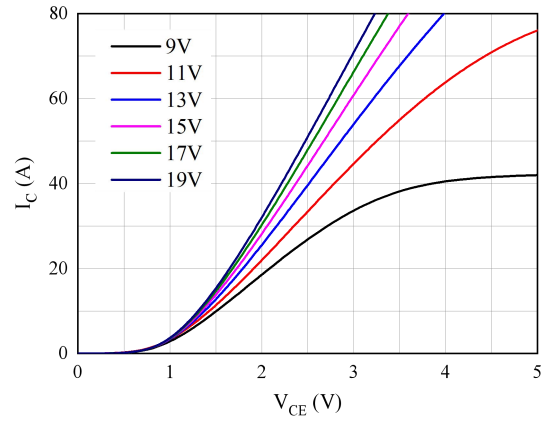


图 2. 典型输出特性 ($T_{vj}=175^{\circ}C$)
Figure 2. Typical output characteristics ($T_{vj}=175^{\circ}C$)

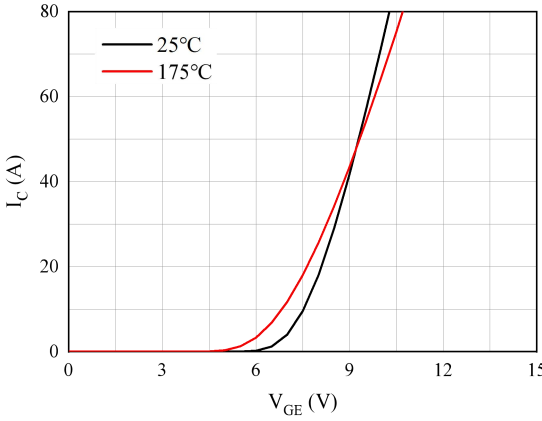


图 3. 典型传输特性 ($V_{CE}=20V$)
Figure 3. Typical transfer characteristic ($V_{CE}=20V$)

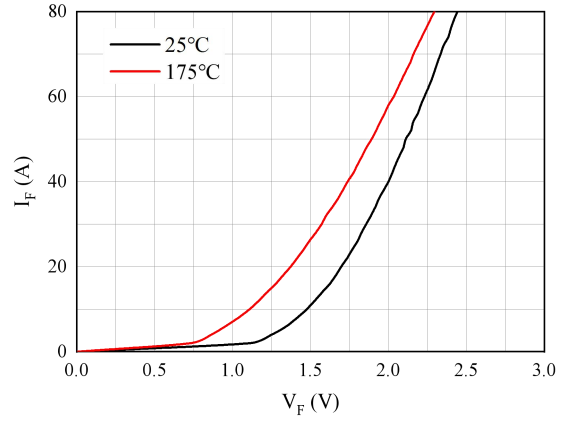


图 4. 正向偏压特性 二极管
Figure 4. Forward characteristic of Diode

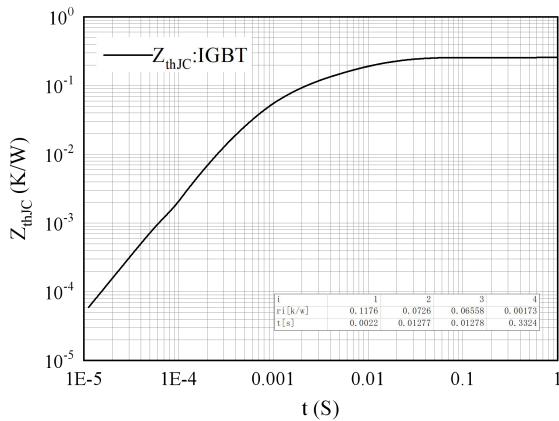


图 5. 瞬态热阻抗 IGBT
Figure 5. Transient thermal impedance IGBT,
 $Z_{thJC}=f(t)$

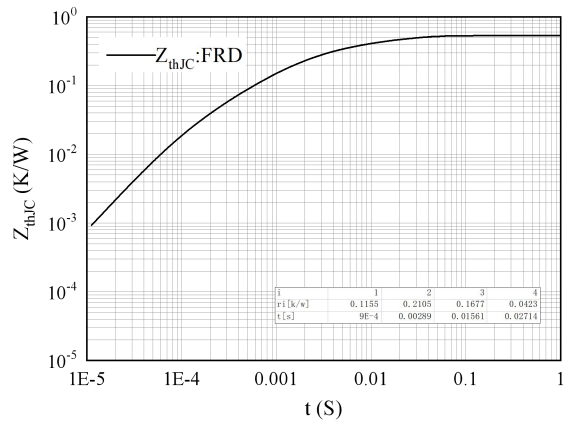


图 6. 瞬态热阻抗 FRD
Figure 6. Transient thermal impedance FRD,
 $Z_{thJC}=f(t)$

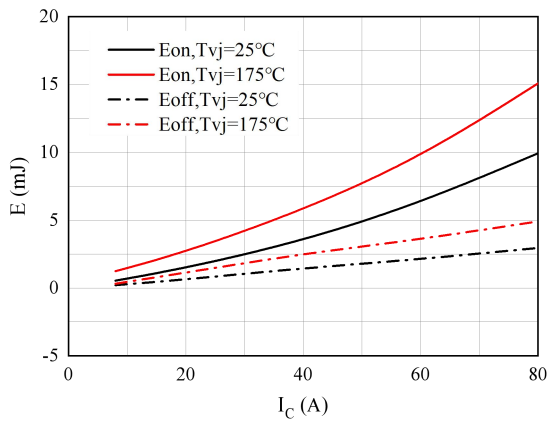


图 7. 开关损耗

Figure 7. Switching losses of IGBT
VGE=±15V, Rgon=12Ω, Rgoff=12Ω, VCE=600V

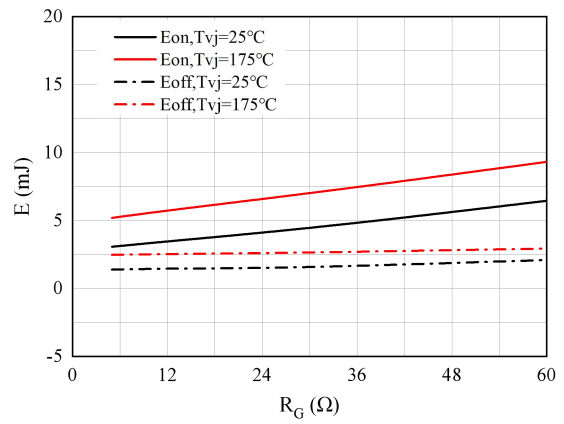


图 8. 开关损耗

Figure 8. Switching losses of IGBT
VGE=±15V, IC=40A, VCE=600V

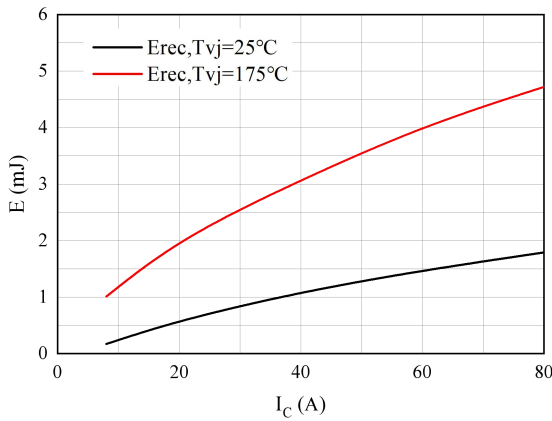


图 9. 开关损耗 二极管

Figure 9. Switching losses of Diode
Rgon=12Ω, VCE=600V

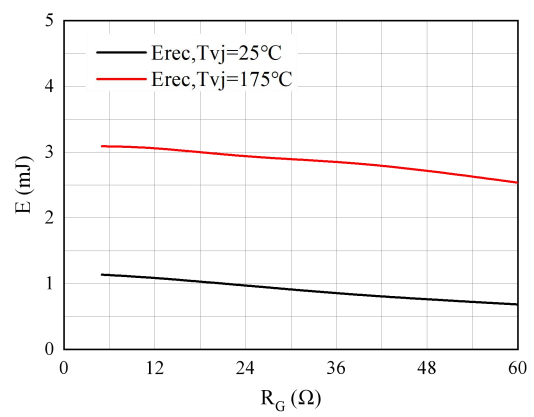


图 10. 开关损耗 二极管

Figure 10. Switching losses of Diode
IF=40A, VCE=600V

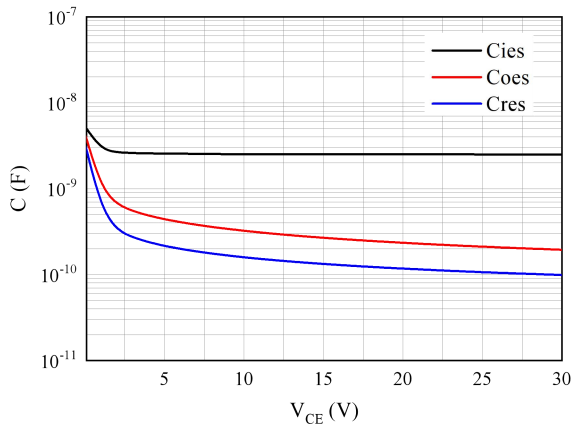
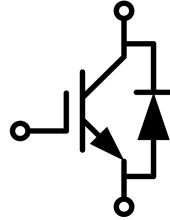


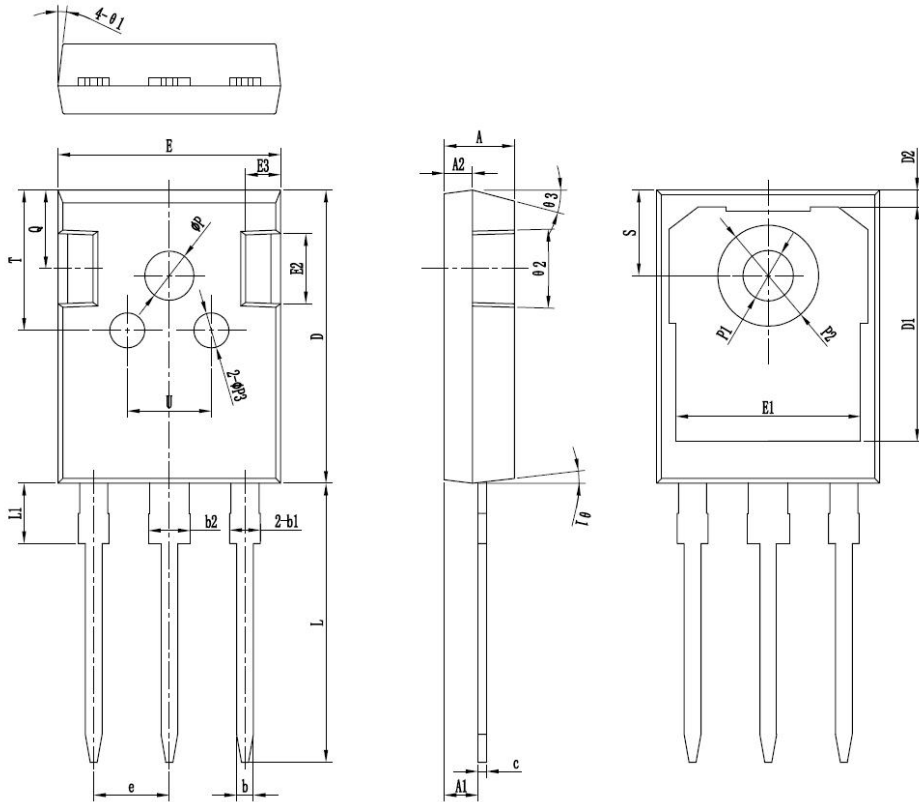
图 11. 电容特性

Figure 11. Capacitance characteristic

接线图 / Circuit diagram



封装尺寸 / Package outlines



符号	单位:mm		
	MIN	NOM	MAX
±h	4.90	5.00	5.10
±h1	2.31	2.41	2.51
A2	1.90	2.00	2.10
±h	1.15	1.20	1.25
±h1	1.95	2.10	2.25
±h2	2.95	3.10	3.25
±c	0.65	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
±f	19.80	19.92	20.10
±f1	-	-	4.30
±g	3.70	3.80	3.90
±g1	3.50	3.60	3.70
±g2	7.00	7.20	7.40
±g3	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