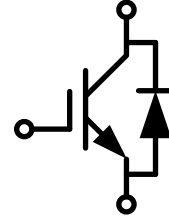




## NJ40R07A6U IGBT Discrete with Anti-Parallel Diode

### 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	$V_{CE}$	$I_C$	$V_{CESat}, T_{vj}=25^{\circ}C$	$T_{vjmax}$	Package
NJ40R07A6U	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	$T_{vj}=25^{\circ}C$	$V_{CES}$	700	V
连续集电极直流电流 Continuous DC collector current	$T_C=100^{\circ}C, T_{vj\ max}=175^{\circ}C$	$I_{C\ nom}$	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	$t_p \leq 0.5\mu s, D < 0.001$	$V_{GE}$	$\pm 20$ $\pm 30$	V

## Typical Characteristics

总功率损耗 Power dissipation	$T_C=25^{\circ}\text{C}$ $T_C=100^{\circ}\text{C}$	$P_{\text{tot}}$	294 147	W
在开关状态下温度 Temperature under switching conditions		$T_{\text{vj op}}$	-40...+175	$^{\circ}\text{C}$
储存温度 Storage temperature		$T_{\text{stg}}$	-40...+150	$^{\circ}\text{C}$

### 热特性 / Thermal Characteristics

Parameter	Conditions	Symbol	Value	Unit
IGBT 热阻, 结-壳 IGBT thermal resistance, junction - case		$R_{\text{th(j-C)}}$	0.51	K/W
二极管热阻, 结-壳 Diode thermal resistance, junction - case		$R_{\text{th(j-C)}}$	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	$V_{\text{GE}}=15\text{V}, I_{\text{C}}=40\text{A}$ $V_{\text{GE}}=15\text{V}, I_{\text{C}}=40\text{A}$ $V_{\text{GE}}=15\text{V}, I_{\text{C}}=40\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$ $T_{\text{vj}}=150^{\circ}\text{C}$ $T_{\text{vj}}=175^{\circ}\text{C}$	$V_{\text{CEsat}}$	1.42 1.70 1.73	1.80	V	
栅极-发射极阈值电压 Gate-Emitter threshold voltage	$I_{\text{C}}=0.4\text{mA}, V_{\text{GE}}=V_{\text{CE}}$	$T_{\text{vj}}=25^{\circ}\text{C}$	$V_{\text{GE(th)}}$	4.3	4.9	5.5	V
跨导 Transconductance	$V_{\text{CE}}=20\text{V}, I_{\text{C}}=40\text{A}$		$G_{\text{fs}}$		67		S
输入电容 Input capacitance			$C_{\text{ies}}$		5514		pF
输出电容 Output capacitance	$f=100\text{kHz}, V_{\text{CE}}=25\text{V}, V_{\text{GE}}=0\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	$C_{\text{oes}}$		202		pF
反向传输电容 Reverse transfer capacitance			$C_{\text{res}}$		93		pF
门极电荷 Gate charge	$I_{\text{C}}=40\text{A}, V_{\text{GE}}=15\text{V},$ $V_{\text{CE}}=560\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	$Q_{\text{G}}$		533		nC
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{\text{CE}}=700\text{V}, V_{\text{GE}}=0\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	$I_{\text{CES}}$			1	mA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{\text{CE}}=0\text{V}, V_{\text{GE}}=20\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	$I_{\text{GES}}$			200	nA
开通延迟时间 Turn-on delay time	$I_{\text{C}}=40\text{A}, V_{\text{CE}}=400\text{V}$ $V_{\text{GE}}=\pm 15\text{V}, R_{\text{G}}=8\Omega$ (电感负载) / (inductive load)	$T_{\text{vj}}=25^{\circ}\text{C}$ $T_{\text{vj}}=175^{\circ}\text{C}$	$t_{\text{d(on)}}$		24 20		ns
上升时间 Rise time	$I_{\text{C}}=40\text{A}, V_{\text{CE}}=400\text{V}$ $V_{\text{GE}}=\pm 15\text{V}, R_{\text{G}}=8\Omega$ (电感负载) / (inductive load)	$T_{\text{vj}}=25^{\circ}\text{C}$ $T_{\text{vj}}=175^{\circ}\text{C}$	$t_{\text{r}}$		61 56		ns

## Typical Characteristics

关断延迟时间 Turn-off delay time	$I_C=40A, V_{CE}=400V$ $V_{GE}=\pm 15V, R_G=8\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$t_{d(off)}$	148 172	ns
下降时间 Fall time	$I_C=40A, V_{CE}=400V$ $V_{GE}=\pm 15V, R_G=8\Omega$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$t_f$	41 77	ns
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	$I_C=40A, V_{CE}=400V$ $V_{GE}=\pm 15V, R_G=8\Omega$ $di/dt=600A/\mu s(T_{vj}=175^\circ C)$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$E_{on}$	1.31 2.83	mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	$I_C=40A, V_{CE}=400V$ $V_{GE}=\pm 15V, R_G=8\Omega$ $dv/dt=9000V/\mu s(T_{vj}=175^\circ C)$ (电感负载) / (inductive load)	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$E_{off}$	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	$T_{vj}=25^\circ C$	$V_{RRM}$	700	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

### 特征值 / Characteristic Values

Parameter	Conditions	Symbol	Value			Unit
			Min.	Typ.	Max.	
正向电压 Forward voltage	$I_F=40A, V_{GE}=0V$ $I_F=40A, V_{GE}=0V$ $I_F=40A, V_{GE}=0V$	$T_{vj}=25^\circ C$ $T_{vj}=150^\circ C$ $T_{vj}=175^\circ C$	$V_F$	1.52 1.23 1.19	2.00	V
反向恢复峰值电流 Peak reverse recovery current	$I_F=40A,$ $-di_F/dt=600A/\mu s(T_{vj}=175^\circ C)$ $V_R=400V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$I_{RM}$	15.36 41.28		A
反向恢复电荷 Reverse Recovered charge	$I_F=40A,$ $-di_F/dt=600A/\mu s(T_{vj}=175^\circ C)$ $V_R=400V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$Q_{rr}$	0.96 5.39		$\mu C$
反向恢复时间 Reverse Recovery Time	$I_F=40A,$ $-di_F/dt=600A/\mu s(T_{vj}=175^\circ C)$ $V_R=400V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$t_{rr}$	119 200		ns
反向恢复损耗 (每脉冲) Reverse recovered energy	$I_F=40A,$ $-di_F/dt=600A/\mu s(T_{vj}=175^\circ C)$ $V_R=400V, V_{GE}=-15V$	$T_{vj}=25^\circ C$ $T_{vj}=175^\circ C$	$E_{rec}$	0.22 1.13		mJ

# Typical Characteristics

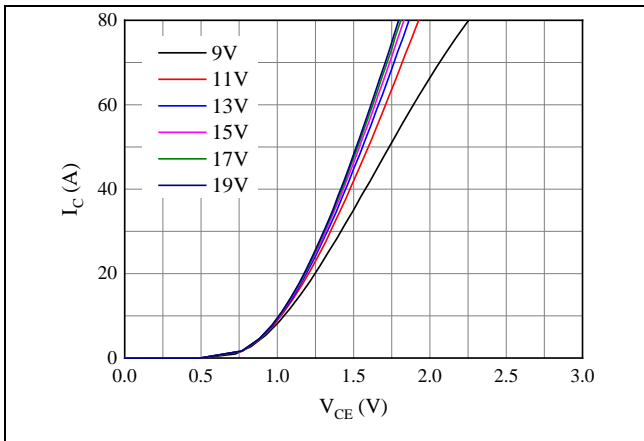


图 1. 典型输出特性 ( $T_{vj}=25^{\circ}\text{C}$ )  
Figure 1. Typical output characteristics ( $T_{vj}=25^{\circ}\text{C}$ )

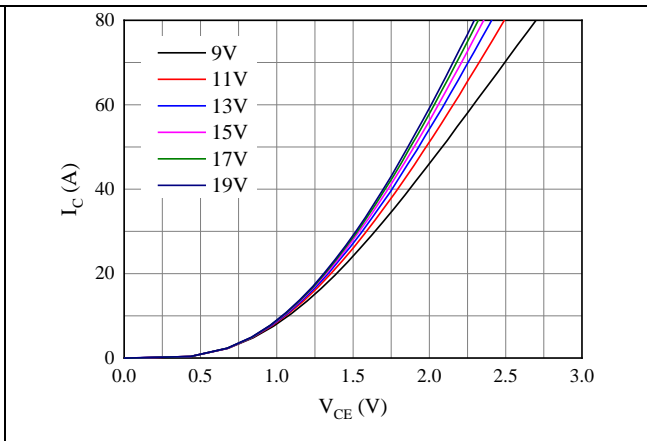


图 2. 典型输出特性 ( $T_{vj}=175^{\circ}\text{C}$ )  
Figure 2. Typical output characteristics ( $T_{vj}=175^{\circ}\text{C}$ )

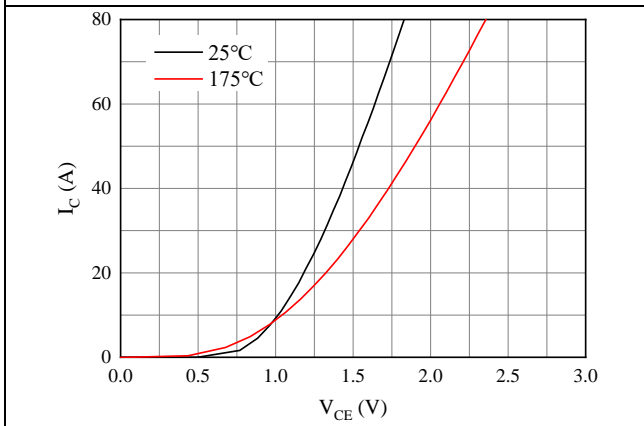


图 3. 典型输出特性 ( $V_{GE}=15\text{V}$ )  
Figure 3. Typical output characteristics ( $V_{GE}=15\text{V}$ )

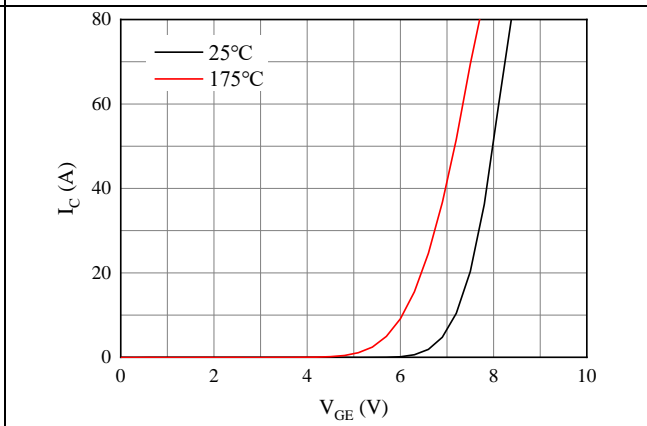


图 4. 典型传输特性 ( $V_{CE}=20\text{V}$ )  
Figure 4. Typical transfer characteristic ( $V_{CE}=20\text{V}$ )

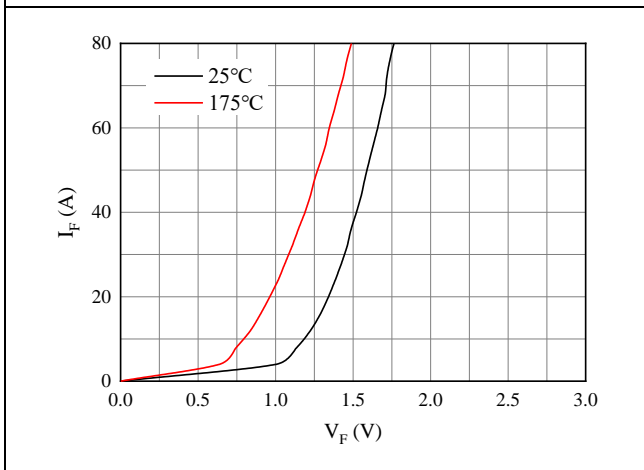


图 5. 正向偏压特性 二极管  
Figure 5. Forward characteristic of Diode

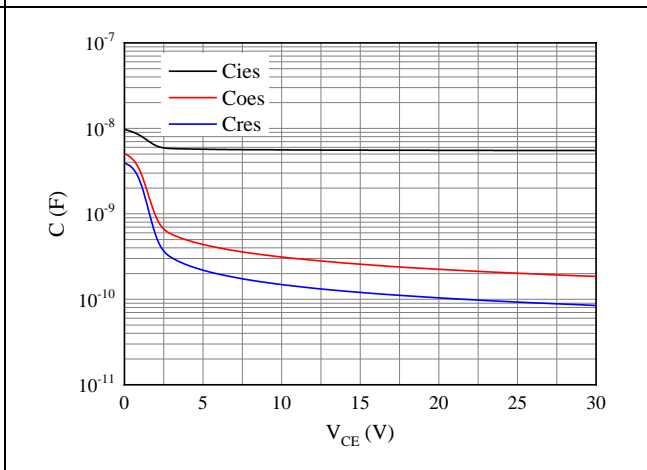


图 6. 电容特性  
Figure 6. Capacitance characteristic

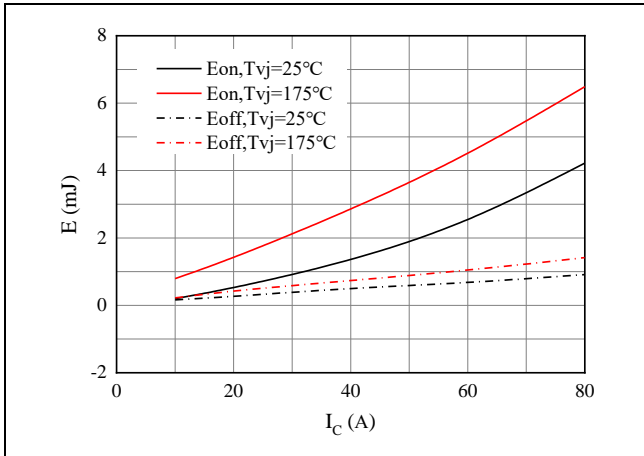


图 7. 开关损耗  
Figure 7. Switching losses of IGBT  
 $V_{GE} = \pm 15V, R_{gon} = 8\Omega, R_{goff} = 8\Omega, V_{CE} = 400V$

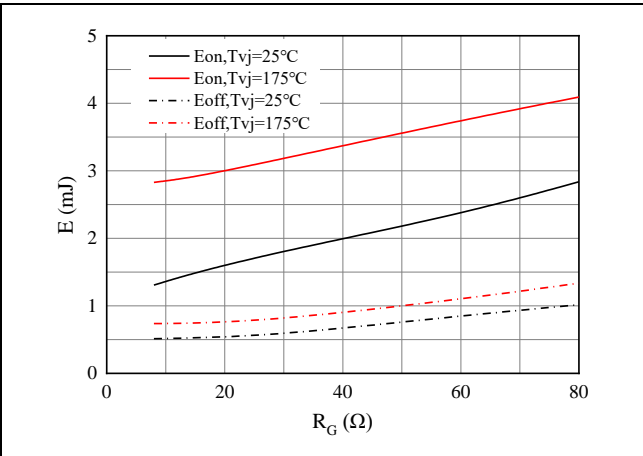


图 8. 开关损耗  
Figure 8. Switching losses of IGBT  
 $V_{GE} = \pm 15V, I_C = 40A, V_{CE} = 400V$

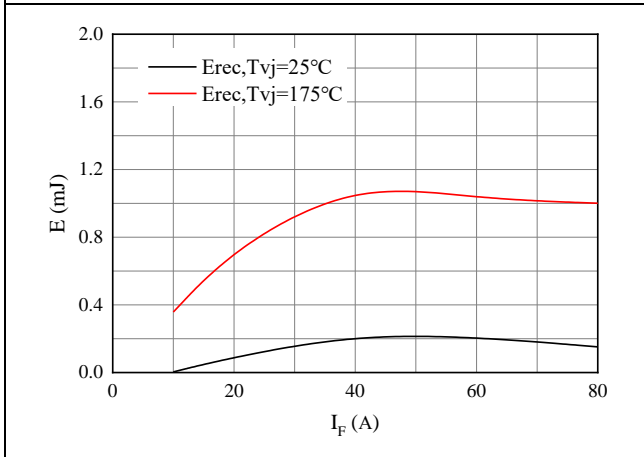


图 9. 开关损耗 二极管  
Figure 9. Switching losses of Diode  
 $R_{gon} = 8\Omega, V_{CE} = 400V$

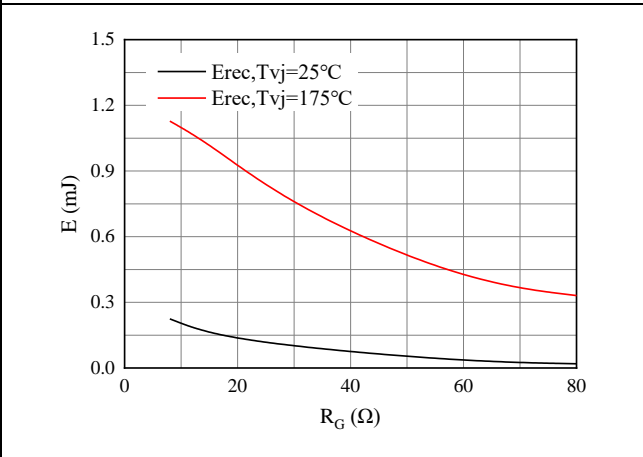


图 10. 开关损耗 二极管  
Figure 10. Switching losses of Diode  
 $I_F = 40A, V_{CE} = 400V$

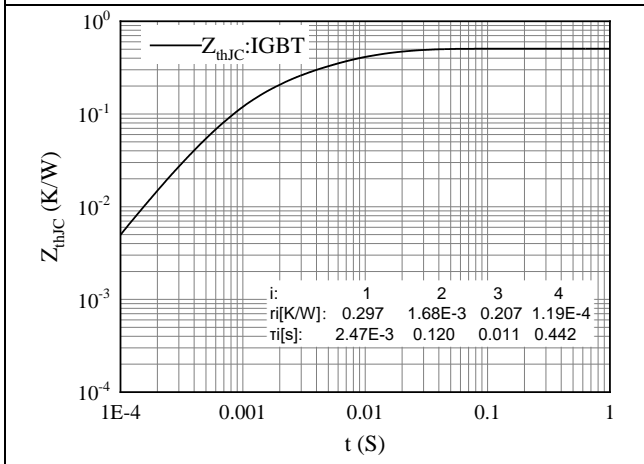


图 11. 瞬态热阻抗 IGBT  
Figure 11. Transient thermal impedance IGBT,  
 $Z_{thJC} = f(t)$

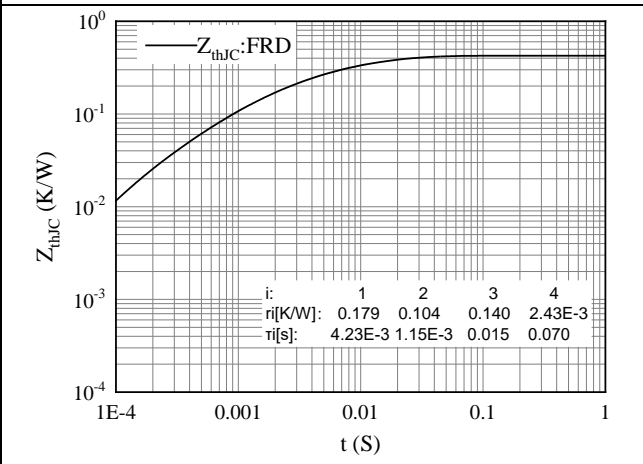
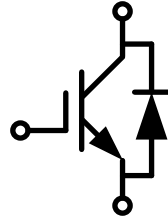


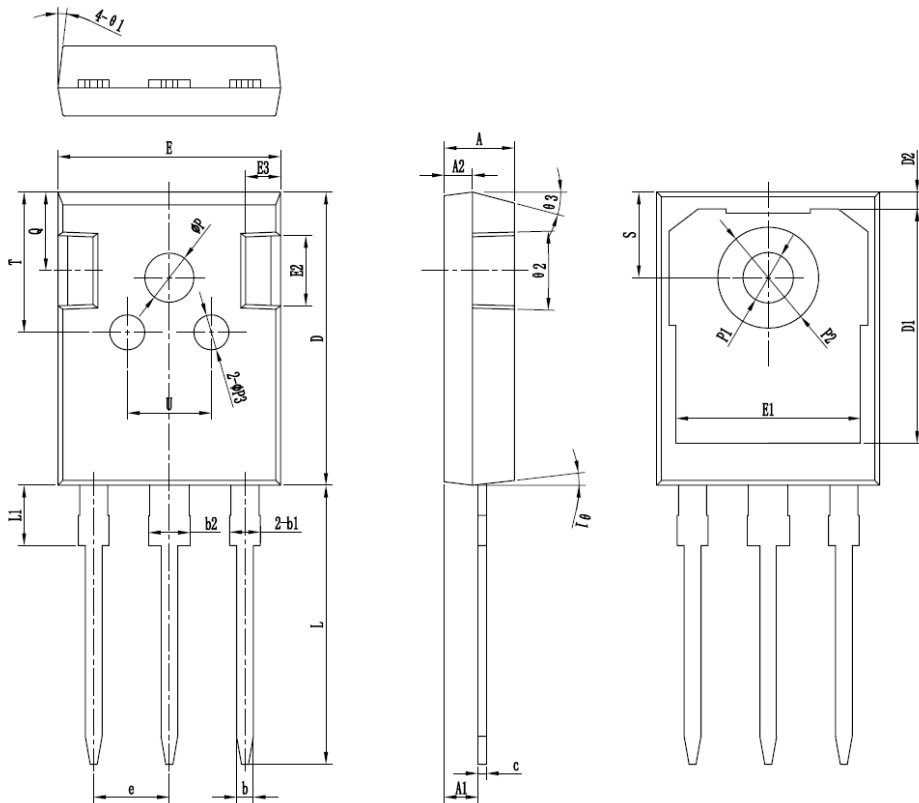
图 12. 瞬态热阻抗 FRD  
Figure 12. Transient thermal impedance FRD,  
 $Z_{thJC} = f(t)$

# Package Outline Dimensions

接线图 / Circuit diagram



封装尺寸 / Package outlines



符号	单位:mm		
	MIN	NOM	MAX
hA	4.90	5.00	5.10
hA1	2.31	2.41	2.51
A2	1.90	2.00	2.10
hB	1.15	1.20	1.25
hB1	1.95	2.10	2.25
hB2	2.95	3.10	3.25
hC	0.55	0.60	0.65
hD	20.90	21.00	21.10
D1	16.35	16.55	16.75
D2	1.05	1.20	1.35
hE	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
hE	5.40	5.44	5.48
hL	19.80	19.92	20.10
hL1	-	-	4.30
hP	3.70	3.80	3.90
hP1	3.50	3.60	3.70
hP2	7.00	7.20	7.40
hP3	2.40	2.50	2.60
Q	5.60	5.80	6.00
hS	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