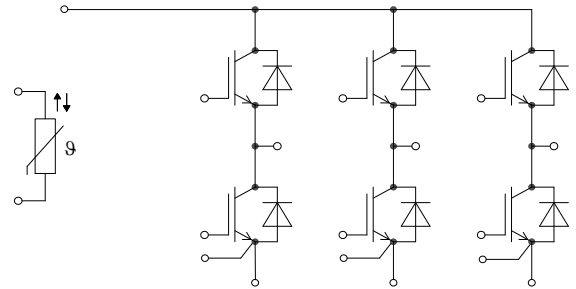
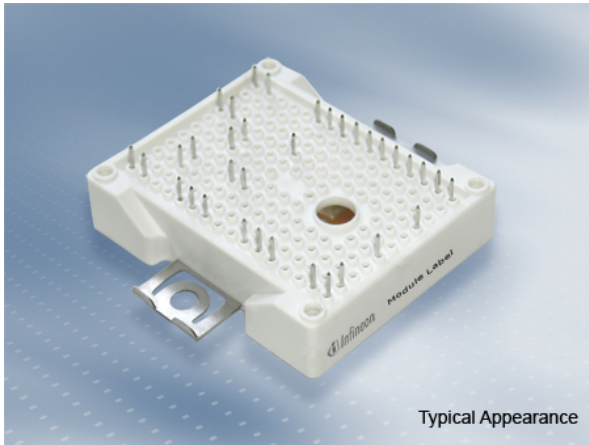


EasyPACK™ 模块 采用第七代沟槽栅/场终止IGBT7和第七代发射极控制二极管 带有温度检测NTC  
 EasyPACK™ module with TRENCHSTOP™ IGBT7 and Emitter Controlled 7 diode and NTC

初步数据 / Preliminary Data



$V_{CES} = 1200V$   
 $I_{C\ nom} = 50A / I_{CRM} = 100A$

### 潜在应用

- UPS系统
- 伺服驱动器
- 电机传动
- 空调
- 辅助逆变器

### Potential Applications

- UPS systems
- Servo drives
- Motor drives
- Air conditioning
- Auxiliary inverters

### 电气特性

- 低  $V_{CEsat}$
- 沟槽栅IGBT7
- 过载操作达175°C

### Electrical Features

- LOW  $V_{CEsat}$
- Trenchstop™ IGBT7
- Overload operation up to 175°C

### 机械特性

- 2.5 kV 交流 1分钟 绝缘
- 低热阻的三氧化二铝  $Al_2O_3$  衬底
- 焊接技术
- 紧凑型设计
- 高功率密度

### Mechanical Features

- 2.5 kV AC 1min insulation
- $Al_2O_3$  substrate with low thermal resistance
- Solder contact technology
- Compact design
- High power density

## Module Label Code

Barcode Code 128



DMX - Code



### Content of the Code

Content of the Code	Digit
Module Serial Number	1 - 5
Module Material Number	6 - 11
Production Order Number	12 - 19
Datecode (Production Year)	20 - 21
Datecode (Production Week)	22 - 23

IGBT, 逆变器 / IGBT, Inverter  
最大额定值 / Maximum Rated Values

集电极 - 发射极电压 Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1200	V
连续集电极直流电流 Continuous DC collector current	$T_H = 65^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{CDC}$	50	A
集电极重复峰值电流 Repetitive peak collector current	$t_P = 1\text{ ms}$	$I_{CRM}$	100	A
栅极 - 发射极峰值电压 Gate-emitter peak voltage		$V_{GES}$	+/-20	V

特征值 / Characteristic Values

			min.	typ.	max.	
集电极 - 发射极饱和电压 Collector-emitter saturation voltage	$I_C = 50\text{ A}$ $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$V_{CE\text{ sat}}$	1,50 1,64 1,72	t.b.d.	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 1,28\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GEth}$	5,15	5,80	6,45 V
栅极电荷 Gate charge	$V_{GE} = -15 / 15\text{ V}, V_{CE} = 600\text{ V}$		$Q_G$	0,92		$\mu\text{C}$
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	0,0		$\Omega$
输入电容 Input capacitance	$f = 100\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{ies}$	11,1		nF
反向传输电容 Reverse transfer capacitance	$f = 100\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{res}$	0,039		nF
集电极-发射极截止电流 Collector-emitter cut-off current	$V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	$I_{CES}$		0,0079	mA
栅极-发射极漏电流 Gate-emitter leakage current	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}, T_{vj} = 25^{\circ}\text{C}$		$I_{GES}$		100	nA
开通延迟时间(电感负载) Turn-on delay time, inductive load	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 5,1\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_{don}$	0,0183 0,0298 0,035		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
上升时间(电感负载) Rise time, inductive load	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 5,1\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_r$	0,0213 0,024 0,025		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 5,1\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_{doff}$	0,27 0,325 0,36		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
下降时间(电感负载) Fall time, inductive load	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 5,1\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_f$	0,12 0,187 0,264		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 35\text{ nH}$ $di/dt = 1650\text{ A}/\mu\text{s} (T_{vj} = 175^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Gon} = 5,1\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$E_{on}$	2,41 4,30 5,45		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 50\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 35\text{ nH}$ $du/dt = 2900\text{ V}/\mu\text{s} (T_{vj} = 175^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Goff} = 5,1\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$E_{off}$	1,90 4,72 6,12		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$ $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$	$t_P \leq 8\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ $t_P \leq 7\ \mu\text{s}, T_{vj} = 175^{\circ}\text{C}$	$I_{SC}$	190 180		A A
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个 IGBT / per IGBT		$R_{thJH}$	0,955		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	175	$^{\circ}\text{C}$

## 初步数据 Preliminary Data

### 二极管, 逆变器 / Diode, Inverter 最大额定值 / Maximum Rated Values

反向重复峰值电压 Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	1200	V
连续正向直流电流 Continuous DC forward current		$I_F$	50	A
正向重复峰值电流 Repetitive peak forward current	$t_p = 1 \text{ ms}$	$I_{FRM}$	100	A
I <sup>2</sup> t-值 I <sup>2</sup> t - value	$V_R = 0 \text{ V}, t_p = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0 \text{ V}, t_p = 10 \text{ ms}, T_{vj} = 175^{\circ}\text{C}$		300	A <sup>2</sup> s
			250	A <sup>2</sup> s

### 特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_F = 50 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		1,72	t.b.d.	V
	$I_F = 50 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 125^{\circ}\text{C}$	$V_F$	1,59		V
	$I_F = 50 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 175^{\circ}\text{C}$		1,52		V
反向恢复峰值电流 Peak reverse recovery current	$I_F = 50 \text{ A}, -di_F/dt = 1650 \text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 600 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	$I_{RM}$	42,5		A
		$T_{vj} = 125^{\circ}\text{C}$		53,0		A
		$T_{vj} = 175^{\circ}\text{C}$		60,5		A
恢复电荷 Recovered charge	$I_F = 50 \text{ A}, -di_F/dt = 1650 \text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 600 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	$Q_r$	3,74		$\mu\text{C}$
		$T_{vj} = 125^{\circ}\text{C}$		8,19		$\mu\text{C}$
		$T_{vj} = 175^{\circ}\text{C}$		10,4		$\mu\text{C}$
反向恢复损耗 (每脉冲) Reverse recovery energy	$I_F = 50 \text{ A}, -di_F/dt = 1650 \text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 600 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	$E_{rec}$	1,72		mJ
		$T_{vj} = 125^{\circ}\text{C}$		3,06		mJ
		$T_{vj} = 175^{\circ}\text{C}$		3,73		mJ
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个二极管 / per diode	$R_{thJH}$		1,22		K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj op}$	-40		175	$^{\circ}\text{C}$

### 负温度系数热敏电阻 / NTC-Thermistor

#### 特征值 / Characteristic Values

			min.	typ.	max.	
额定电阻值 Rated resistance	$T_{NTC} = 25^{\circ}\text{C}$	$R_{25}$		5,00		k $\Omega$
R100 偏差 Deviation of R100	$T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493 \Omega$	$\Delta R/R$	-5		5	%
耗散功率 Power dissipation	$T_{NTC} = 25^{\circ}\text{C}$	$P_{25}$			20,0	mW
B-值 B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	$B_{25/50}$		3375		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$	$B_{25/80}$		3411		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$	$B_{25/100}$		3433		K

根据应用手册标定

Specification according to the valid application note.

## 初步数据 Preliminary Data

### 模块 / Module

绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V <sub>ISOL</sub>	2,5		kV
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) basic insulation (class 1, IEC 61140)		Al <sub>2</sub> O <sub>3</sub>		
爬电距离 Creepage distance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		11,5 6,3		mm
电气间隙 Clearance	端子至散热器 / terminal to heatsink 端子至端子 / terminal to terminal		10,0 5,0		mm
相对电痕指数 Comperative tracking index		CTI	> 200		
相对温度指数 (电) RTI Elec.	住房 housing	RTI	140		°C
			min.	typ.	max.
杂散电感, 模块 Stray inductance module		L <sub>sCE</sub>		40	nH
模块引线电阻, 端子-芯片 Module lead resistance, terminals - chip	T <sub>H</sub> = 25°C, 每个开关 / per switch	R <sub>CC'+EE'</sub>		4,00	mΩ
储存温度 Storage temperature		T <sub>stg</sub>	-40		125 °C
Anpresskraft für mech. Bef. pro Feder mounting force per clamp		F	40	-	80 N
重量 Weight		G		39	g

Der Strom im Dauerbetrieb ist auf 30 A effektiv pro Anschlusspin begrenzt.

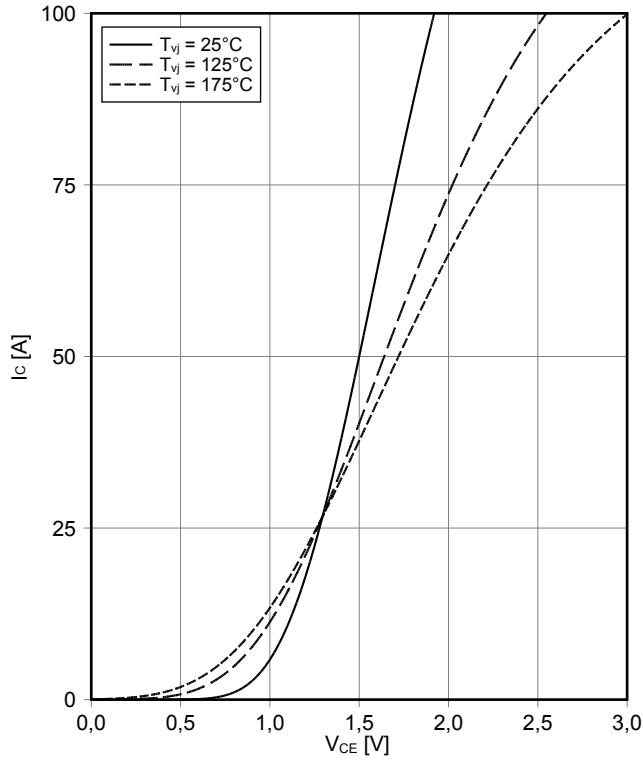
The current under continuous operation is limited to 30 A rms per connector pin.

T<sub>vj op</sub> > 150°C ist im Überlastbetrieb zulässig. Detaillierte Angaben sind AN 2018-14 zu entnehmen.

T<sub>vj op</sub> > 150°C is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

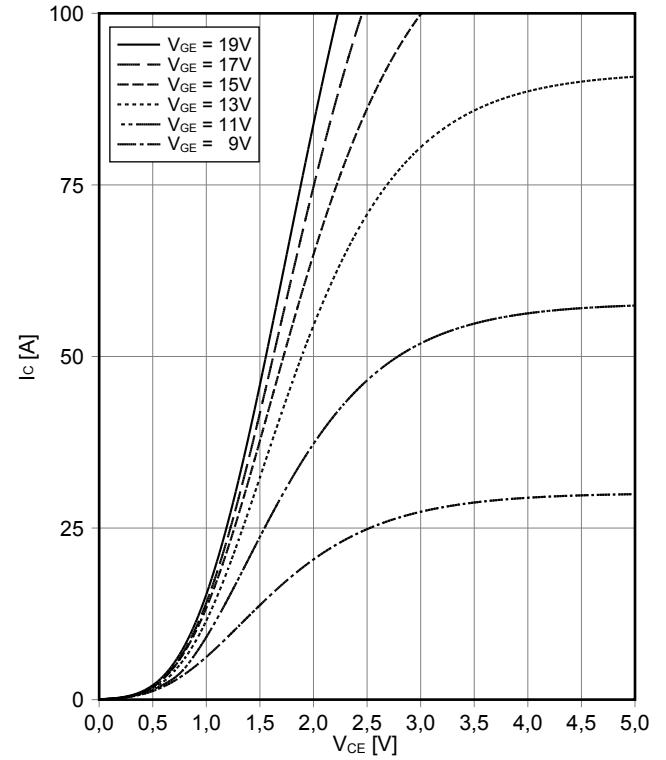
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$



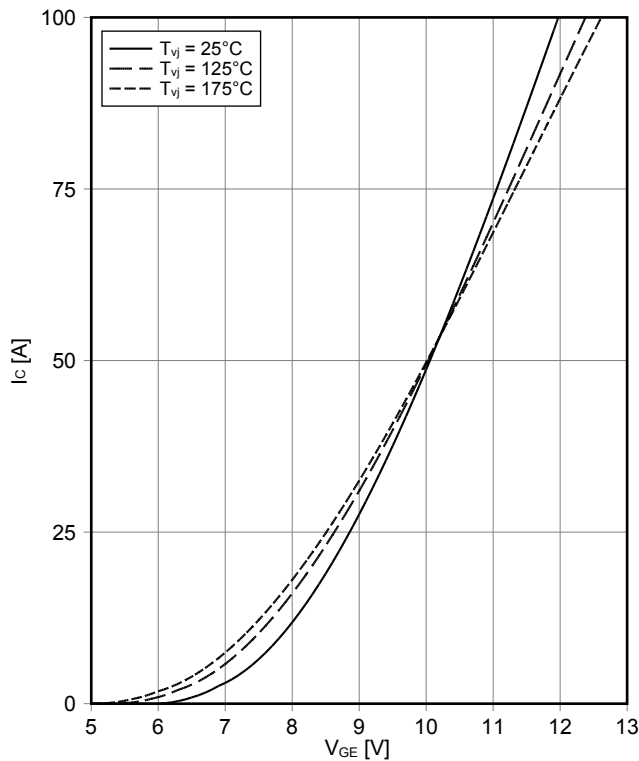
输出特性 IGBT, 逆变器 (典型)  
output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$   
 $T_{vj} = 175^\circ\text{C}$



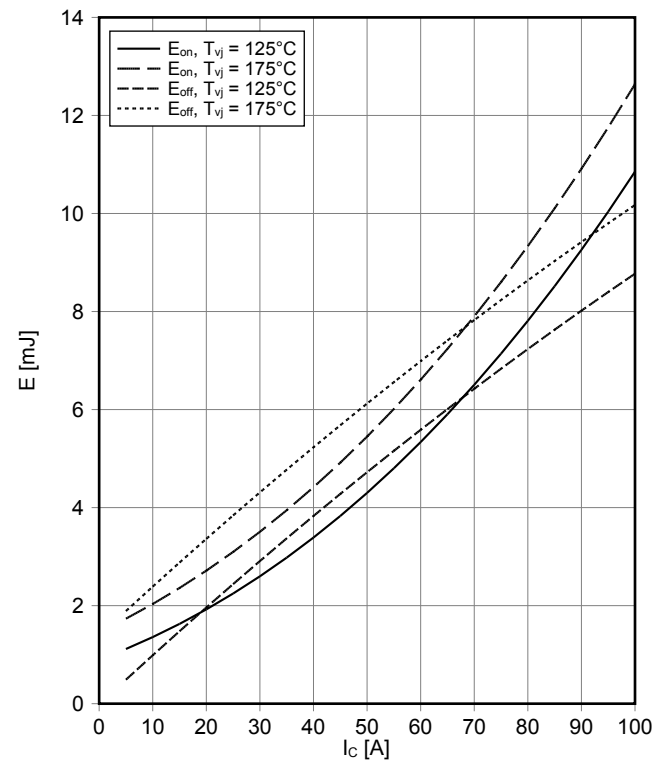
传输特性 IGBT, 逆变器 (典型)  
transfer characteristic IGBT, Inverter (typical)

$I_C = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$



开关损耗 IGBT, 逆变器 (典型)  
switching losses IGBT, Inverter (typical)

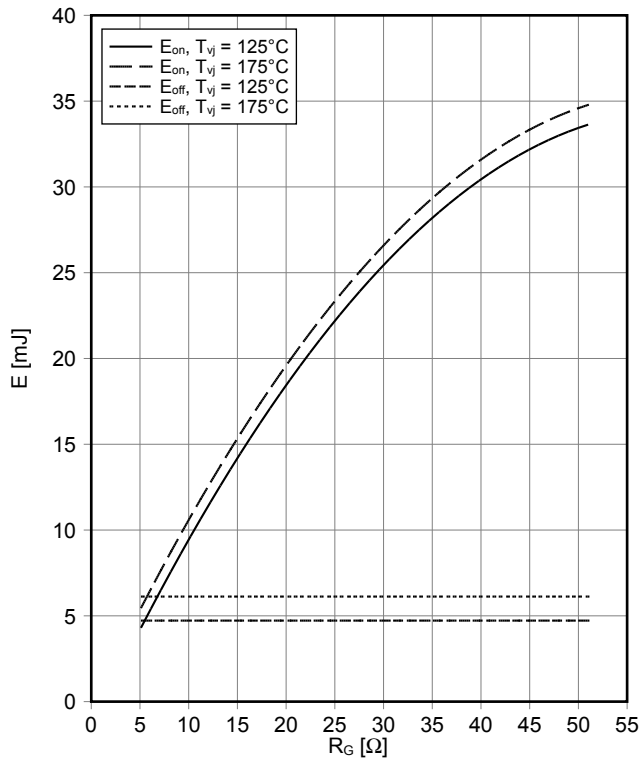
$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 5.1\ \Omega$ ,  $R_{Goff} = 5.1\ \Omega$ ,  $V_{CE} = 600\text{ V}$



## 初步数据 Preliminary Data

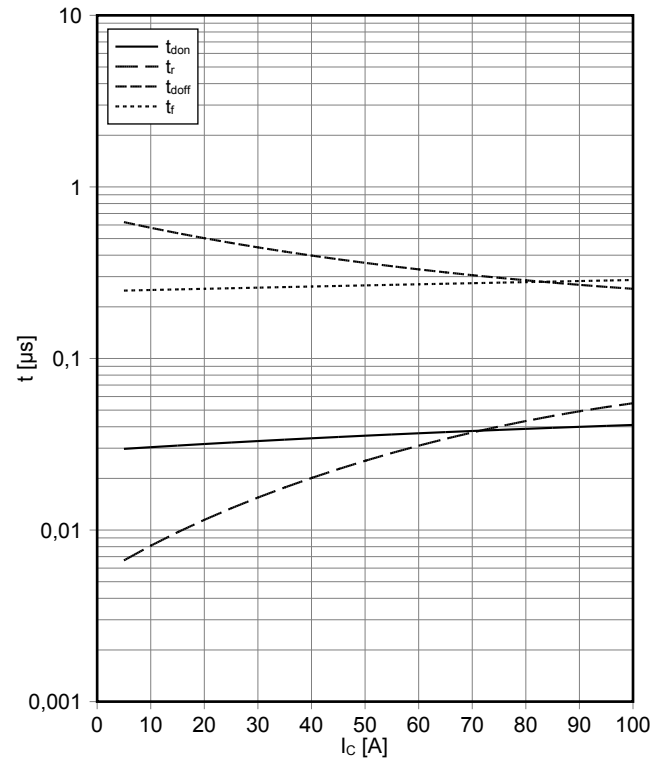
### 开关损耗 IGBT, 逆变器 (典型) switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 50\text{ A}, V_{CE} = 600\text{ V}$



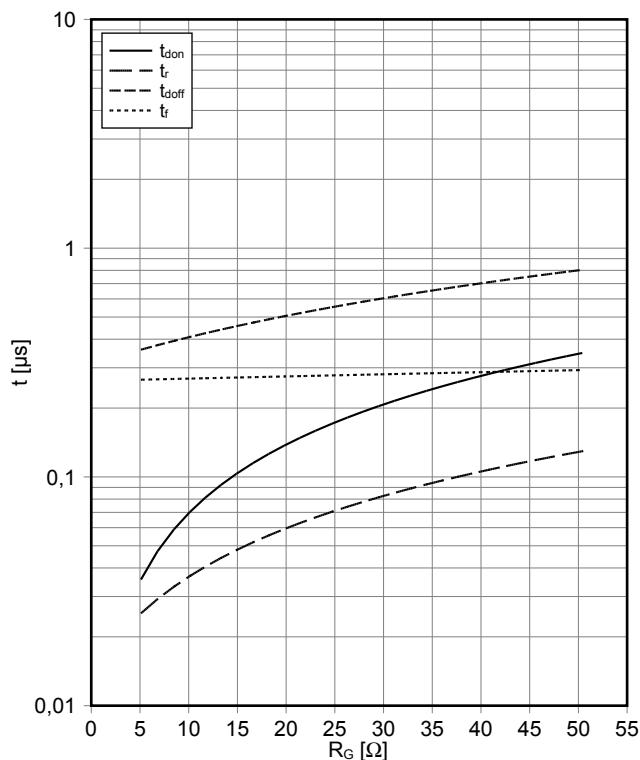
### ??? IGBT, 逆变器 (典型) switching times IGBT, Inverter (typical)

$t_{don} = f(I_C), t_r = f(I_C), t_{doff} = f(I_C), t_f = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 5.1\ \Omega, R_{Goff} = 5.1\ \Omega, V_{CE} = 600\text{ V}, T_{vj} = 175^\circ\text{C}$



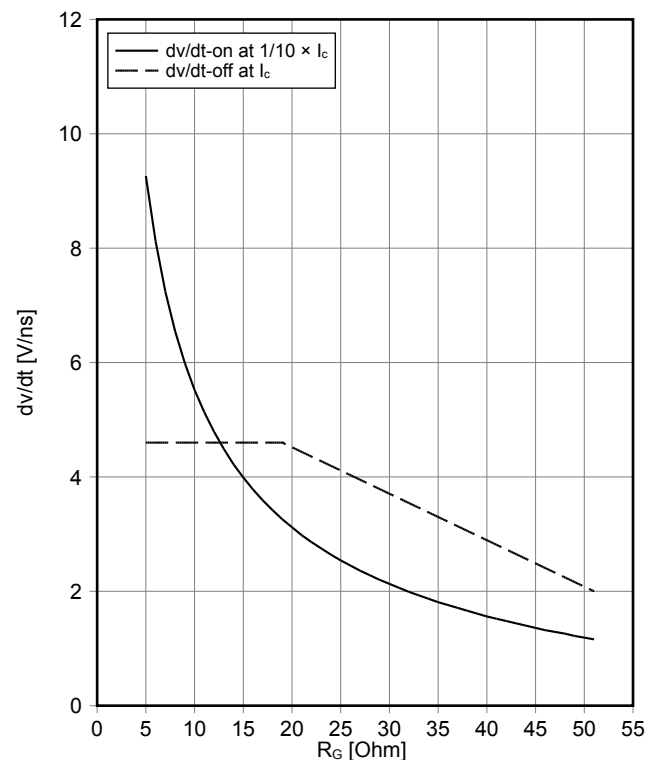
### ??? IGBT, 逆变器 (典型) switching times IGBT, Inverter (typical)

$t_{don} = f(R_G), t_r = f(R_G), t_{doff} = f(R_G), t_f = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 50\text{ A}, V_{CE} = 600\text{ V}, T_{vj} = 175^\circ\text{C}$



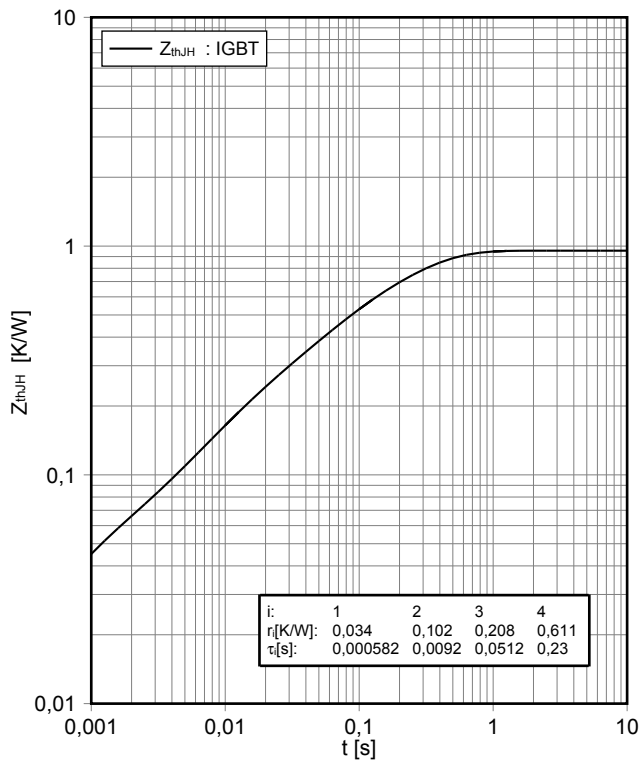
### dv/dt IGBT, 逆变器 (典型) dv/dt IGBT, Inverter (typical)

$dv/dt = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 50\text{ A}, V_{CE} = 600\text{ V}, T_{vj} = 25^\circ\text{C}$

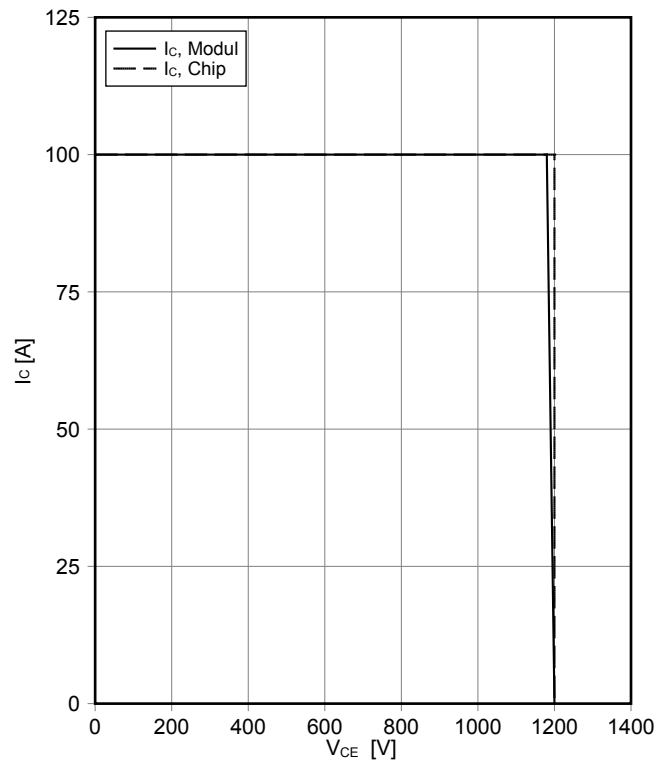


## 初步数据 Preliminary Data

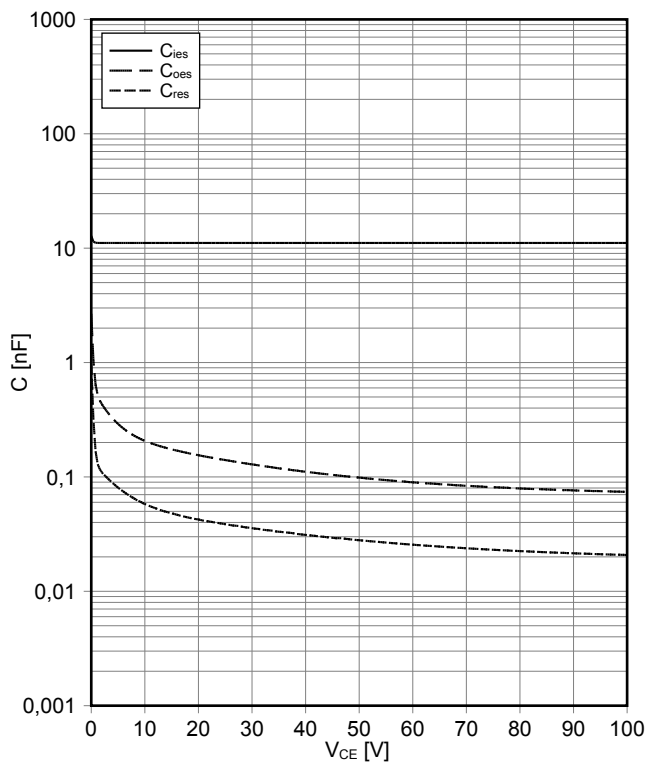
瞬态热阻抗 IGBT, 逆变器  
**transient thermal impedance IGBT, Inverter**  
 $Z_{thJH} = f(t)$



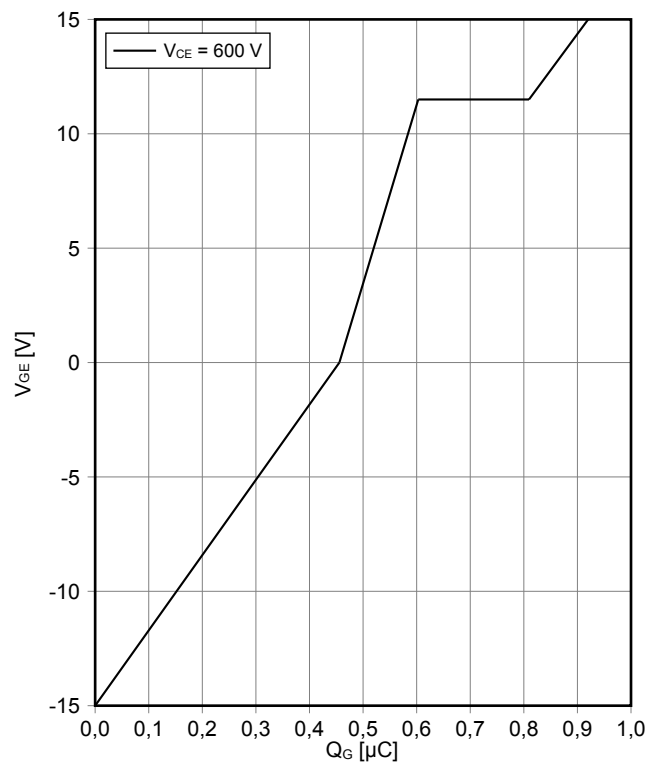
反偏安全工作区 IGBT, 逆变器 (RBSOA)  
**reverse bias safe operating area IGBT, Inverter (RBSOA)**  
 $I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Goff} = 5.1\ \Omega$ ,  $T_{vj} = 175^\circ\text{C}$



电容特性 IGBT, 逆变器 (典型)  
**capacity characteristic IGBT, Inverter (typical)**  
 $C = f(V_{CE})$   
 $V_{GE} = 0\text{ V}$ ,  $T_{vj} = 25^\circ\text{C}$ ,  $f = 100\text{ kHz}$

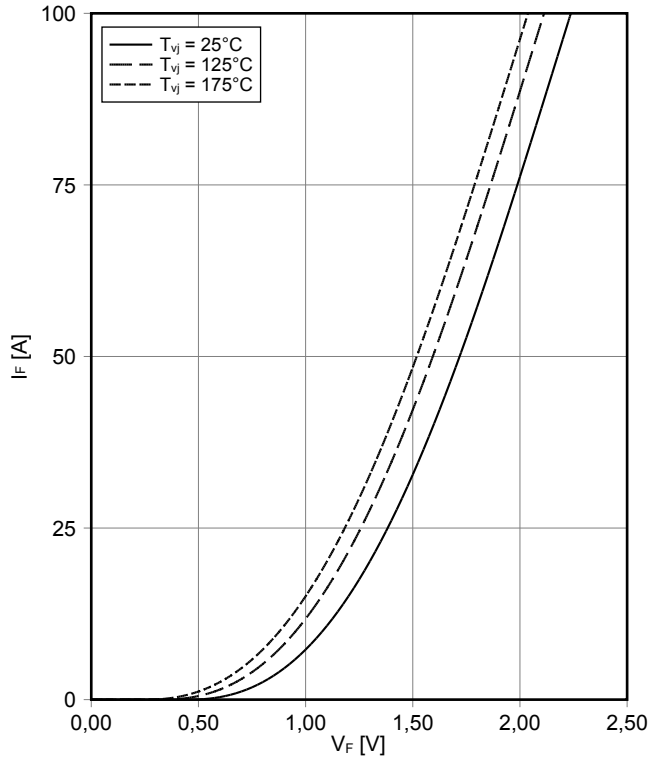


栅极电荷特性 IGBT, 逆变器 (典型)  
**gate charge characteristic IGBT, Inverter (typical)**  
 $V_{GE} = f(Q_G)$   
 $I_C = 50\text{ A}$ ,  $T_{vj} = 25^\circ\text{C}$

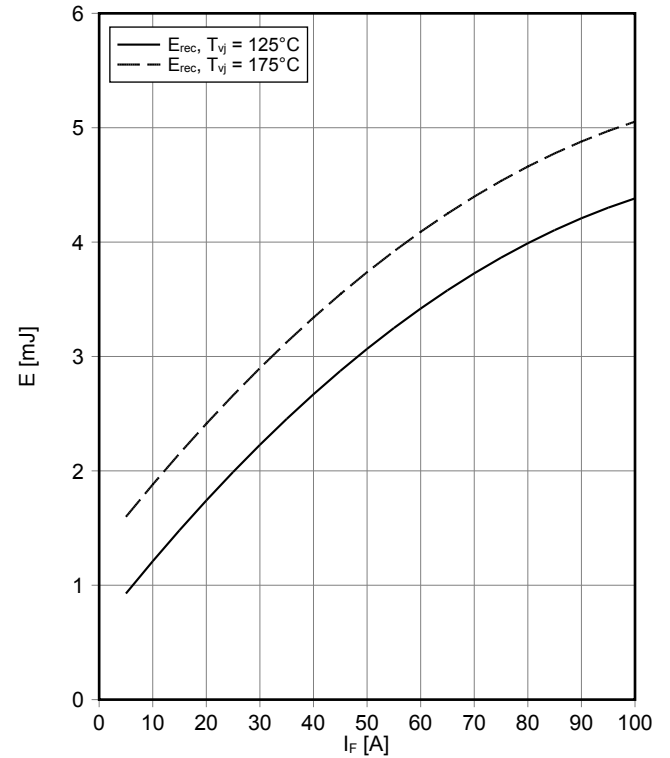


## 初步数据 Preliminary Data

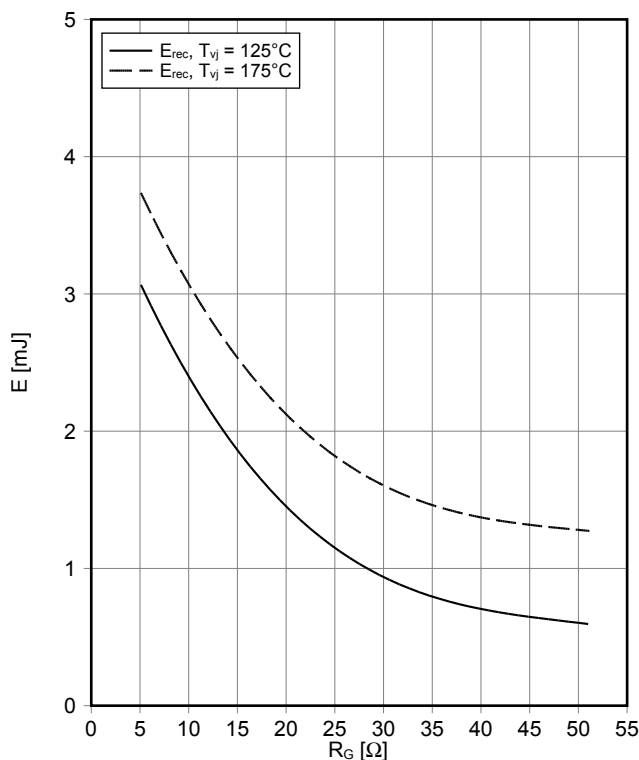
正向偏压特性 二极管,逆变器 (典型)  
forward characteristic of Diode, Inverter (typical)  
 $I_F = f(V_F)$



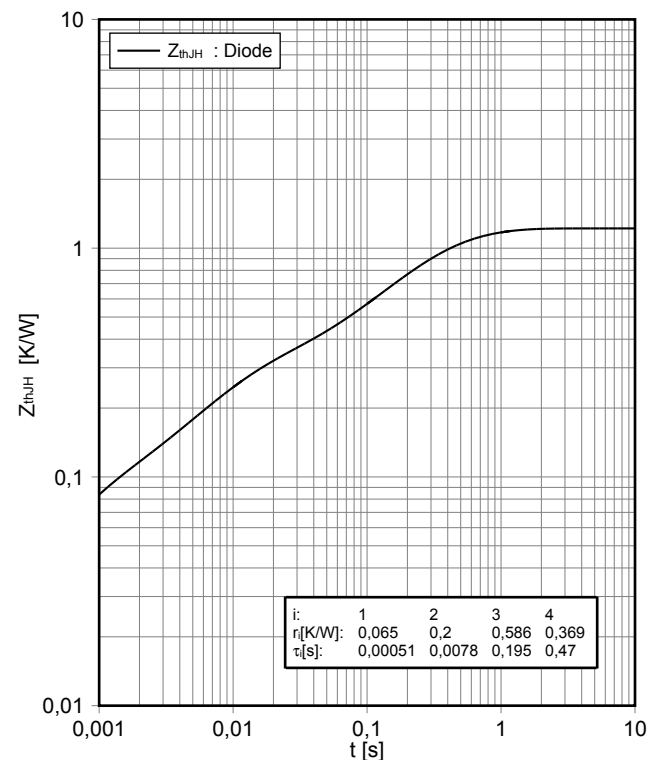
开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)  
 $E_{rec} = f(I_F)$   
 $R_{Gon} = 5.1 \Omega, V_{CE} = 600 \text{ V}$



开关损耗 二极管,逆变器 (典型)  
switching losses Diode, Inverter (typical)  
 $E_{rec} = f(R_G)$   
 $I_F = 50 \text{ A}, V_{CE} = 600 \text{ V}$

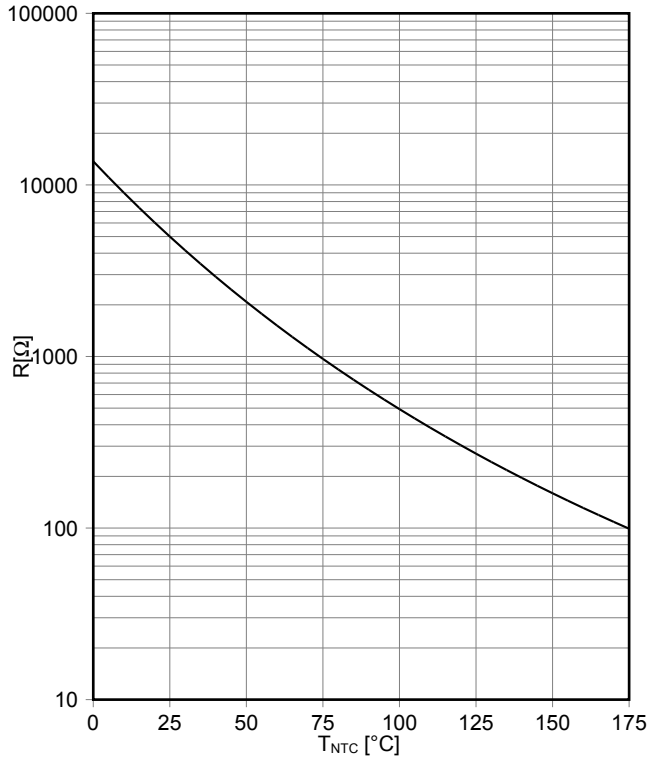


瞬态热阻抗 二极管,逆变器  
transient thermal impedance Diode, Inverter  
 $Z_{thJH} = f(t)$





负温度系数热敏电阻 温度特性  
NTC-Thermistor-temperature characteristic (typical)  
 $R = f(T_{NTC})$





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