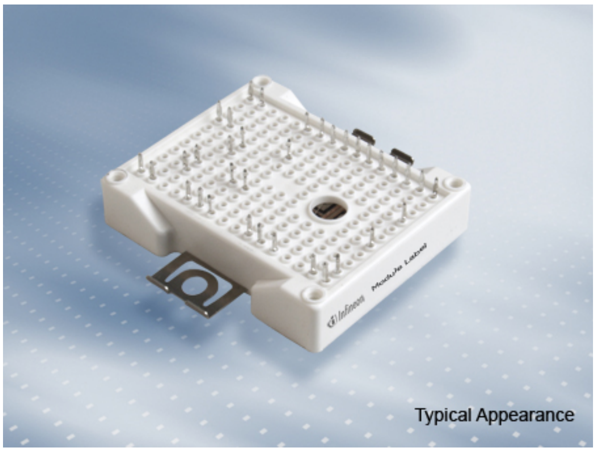
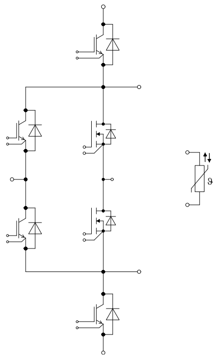
F3L11MR12W2M1_B74

EasyPACK™ 模块 采用 CoolSiC™ Trench MOSFET 带有pressfit压接管脚和温度检测NTC
EasyPACK™ module with CoolSiC™ Trench MOSFET and PressFIT / NTC

初步数据 / Preliminary Data





V_{CES} = 1200V
$I_{C\ nom}$ = 100A / I_{CRM} = 200A

潜在应用
- 三电平应用
- 太阳能应用
- 高频开关应用

Potential Applications
- 3-level-applications
- Solar applications
- High Frequency Switching application

电气特性
- 低开关损耗
- 增加直流母线电压
- 高电流密度

Electrical Features
- Low switching losses
- Increased DC-link voltage
- High current density

机械特性
- PressFIT 压接技术
- 集成NTC温度传感器
- 集成的安装夹使安装坚固

Mechanical Features
- PressFIT contact technology
- Integrated NTC temperature sensor
- Rugged mounting due to integrated mounting clamps

Module Label Code

Barcode Code 128

00000123456000000000000

DMX - 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

初步数据
Preliminary Data

MOSFET / MOSFET

最大额定值 / Maximum Rated Values

漏源极电压 Drain-source voltage		T_{vj} = 25°C	V_{DSS}	1200	V
直流漏极电流 DC drain current	T_{vj} = 175°C V_{GS} = 15 V	T_H = 20°C	$I_{D\ nom}$	100	A
脉冲漏极电流 Pulsed drain current	经设计验证，tp由Tvjmax限定 verified by design, t_p limited by T_{vjmax}		$I_{D\ pulse}$	200	A
栅源峰值电压 Gate-source voltage			V_{GSS}	-10 / 20	V

特征值 / Characteristic Values

				min.	typ.	max.	
漏源通态电阻 Drain-source on resistance	$I_{D\ nom}$ = 100 A V_{GS} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$R_{DS\ on}$		11,3 14,8 16,5		mΩ
栅极阈值电压 Gate threshold voltage	I_D = 40,0 mA, V_{DS} = V_{GS} (tested after 1ms pulse at V_{GS} = +20 V)	T_{vj} = 25°C	$V_{GS(th)}$	3,45	4,50	5,15	V
总的栅极电荷 Total gate charge	V_{GS} = -5 V / 15 V V_{DS} = 800 V		Q_G		0,248		µC
内部栅极电阻 Internal gate resistor		T_{vj} = 25°C	R_{Gint}		2,0		Ω
输入电容 Input capacitance	f = 1 MHz, V_{GS} = 0 V V_{DS} = 800 V	T_{vj} = 25°C	C_{iss}		7,36		nF
输出电容 Output capacitance	f = 1 MHz, V_{GS} = 0 V V_{DS} = 800 V	T_{vj} = 25°C	C_{oss}		0,44		nF
反向传输电容 Reverse transfer capacitance	f = 1 MHz, V_{GS} = 0 V V_{DS} = 800 V	T_{vj} = 25°C	C_{rss}		0,056		nF
C_{OSS} 存储能量 C_{OSS} stored energy	V_{DS} = 800 V V_{GS} = -5 V / 15 V	T_{vj} = 25°C	E_{OSS}		176		µJ
漏源泄漏电流 Drain-source leakage current	V_{DSS} = 1200 V V_{GS} = -5 V	T_{vj} = 25°C	I_{DSX}		0,40	380	µA
栅极漏电流 Gate-source leakage current	V_{DS} = 0 V T_{vj} = 25°C	V_{GS} = 20 V	I_{GSS}			400	nA
开通延迟时间(电感负载) Turn on delay time, inductive load	$I_{D\ nom}$ = 100 A, R_{Gon} = 3,90 Ω V_{DS} = 600 V V_{GS} = -5 V / 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\ on}$		45,1 43,9 42,0		ns
上升时间(电感负载) Rise time, inductive load	$I_{D\ nom}$ = 100 A, R_{Gon} = 3,90 Ω V_{DS} = 600 V V_{GS} = -5 V / 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		25,5 25,3 24,4		ns
关断延迟时间(电感负载) Turn off delay time, inductive load	$I_{D\ nom}$ = 100 A, R_{Goff} = 3,90 Ω V_{DS} = 600 V V_{GS} = -5 V / 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\ off}$		84,2 86,7 87,5		ns
下降时间(电感负载) Fall time, inductive load	$I_{D\ nom}$ = 100 A, R_{Goff} = 3,90 Ω V_{DS} = 600 V V_{GS} = -5 V / 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		32,2 35,5 37,3		ns
开通损耗 (每脉冲) Turn-on energy loss per pulse	$I_{D\ nom}$ = 100 A, V_{GS} = -5 V / 15 V V_{DS} = 600 V, R_{Gon} = 3,90 Ω L_S = 35 nH di/dt = 4,50 kA/µs ($T_{vj\ op}$ = 150°C)	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		1,00 1,15 1,24		mJ
关断损耗 (每脉冲) Turn-off energy loss per pulse	$I_{D\ nom}$ = 100 A, V_{GS} = -5 V / 15 V V_{DS} = 600 V, R_{Goff} = 3,90 Ω L_S = 35 nH du/dt = 21,0 kV/µs ($T_{vj\ op}$ = 150°C)	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		1,62 1,85 1,93		mJ

初步数据
Preliminary Data

特征值 / Characteristic Values

			min.	typ.	max.	
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个MOSFET / per MOSFET	R_{thJH}		0,580		K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C

体二极管 / Body diode

最大额定值 / Maximum Rated Values

直流体二极管正向电流 DC body diode forward current	T_{vj} = 175°C V_{GS} = -5 V	T_H = 20°C	I_{SD}	32	A

特征值 / Characteristic Values

				min.	typ.	max.	
正向电压 Forward voltage	I_{SD} = 100 A V_{GS} = -5 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_{DSR}		4,60 4,35 4,30	5,65	V

初步数据
Preliminary Data

IGBT, 三电平 / IGBT,3-Level

最大额定值 / Maximum Rated Values

集电极 - 发射极电压 Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
集电极电流 Implemented collector current		I_{CN}	100	A
连续集电极直流电流 Continuous DC collector current	T_H = 65°C, $T_{vj\,max}$ = 175°C	I_{CDC}	60	A
集电极重复峰值电流 Repetitive peak collector current	t_P = 1 ms	I_{CRM}	200	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 = 100 A V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	$V_{CE\,sat}$		1,50 1,64 1,72	t.b.d.	V V V
栅极阈值电压 Gate threshold voltage	I_C = 2,50 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		V_{GEth}	5,15	5,80	6,45	V
栅极电荷 Gate charge	V_{GE} = -15 / 15 V, V_{CE} = 600 V		Q_G		1,80		µC
内部栅极电阻 Internal gate resistor	T_{vj} = 25°C		R_{Gint}		1,5		Ω
输入电容 Input capacitance	f = 100 kHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		21,7		nF
反向传输电容 Reverse transfer capacitance	f = 100 kHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{res}		0,076		nF
集电极-发射极截止电流 Collector-emitter cut-off current	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25°C	I_{CES}			0,009	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}			100	nA
开通延迟时间(电感负载) Turn-on delay time, inductive load	I_C = 100 A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_{Gon} = 1,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	$t_{d\,on}$		0,153 0,166 0,174		µs µs µs
上升时间(电感负载) Rise time, inductive load	I_C = 100 A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_{Gon} = 1,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	t_r		0,033 0,037 0,04		µs µs µs
关断延迟时间(电感负载) Turn-off delay time, inductive load	I_C = 100 A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_{Goff} = 1,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	$t_{d\,off}$		0,283 0,368 0,421		µs µs µs
下降时间(电感负载) Fall time, inductive load	I_C = 100 A, V_{CE} = 600 V V_{GE} = -15 / 15 V R_{Goff} = 1,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	t_f		0,149 0,221 0,273		µs µs µs
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	I_C = 100 A, V_{CE} = 600 V, Lσ = 35 nH di/dt = 2400 A/µs (T_{vj} = 175°C) V_{GE} = -15 / 15 V, R_{Gon} = 1,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	E_{on}		6,75 9,80 11,5		mJ mJ mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	I_C = 100 A, V_{CE} = 600 V, Lσ = 35 nH du/dt = 2700 V/µs (T_{vj} = 175°C) V_{GE} = -15 / 15 V, R_{Goff} = 1,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	E_{off}		6,60 10,2 12,7		mJ mJ mJ
短路数据 SC data	V_{GE} ≤ 15 V, V_{CC} = 800 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt	t_P ≤ 8 µs, T_{vj} = 150°C t_P ≤ 7 µs, T_{vj} = 175°C	I_{SC}		370 350		A A
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个 IGBT / per IGBT		R_{thJH}		0,920		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		175	°C

初步数据
Preliminary Data

二极管, 三电平 / Diode, 3-Level

最大额定值 / Maximum Rated Values

反向重复峰值电压 Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
连续正向直流电流 Continuous DC forward current		I_F	100	A
正向重复峰值电流 Repetitive peak forward current	t_P = 1 ms	I_{FRM}	200	A
I2t-值 I^2t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 125°C V_R = 0 V, t_P = 10 ms, T_{vj} = 175°C	I^2t	970 860	A^2s A^2s

特征值 / Characteristic Values

				min.	typ.	max.	
正向电压 Forward voltage	I_F = 100 A, V_{GE} = 0 V I_F = 100 A, V_{GE} = 0 V I_F = 100 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	V_F		1,72 1,59 1,52	t.b.d.	V V V
反向恢复峰值电流 Peak reverse recovery current	I_F = 100 A, - di_F/dt = 2400 A/µs (T_{vj}=175°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	I_{RM}		95,5 119 134		A A A
恢复电荷 Recovered charge	I_F = 100 A, - di_F/dt = 2400 A/µs (T_{vj}=175°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	Q_r		8,64 15,1 20,0		µC µC µC
反向恢复损耗（每脉冲） Reverse recovery energy	I_F = 100 A, - di_F/dt = 2400 A/µs (T_{vj}=175°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	E_{rec}		3,13 5,83 7,58		mJ mJ mJ
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个二极管 / per diode		R_{thJH}		1,03		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\ op}$	-40		175	°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°C	R_{25}		5,00		kΩ
R100 偏差 Deviation of R100	T_{NTC} = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
耗散功率 Power dissipation	T_{NTC} = 25°C	P_{25}			20,0	mW
B-值 B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15\ K))]$	$B_{25/50}$		3375		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15\ K))]$	$B_{25/80}$		3411		K
B-值 B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\ K))]$	$B_{25/100}$		3433		K

根据应用手册标定
Specification according to the valid application note.

初步数据
Preliminary Data

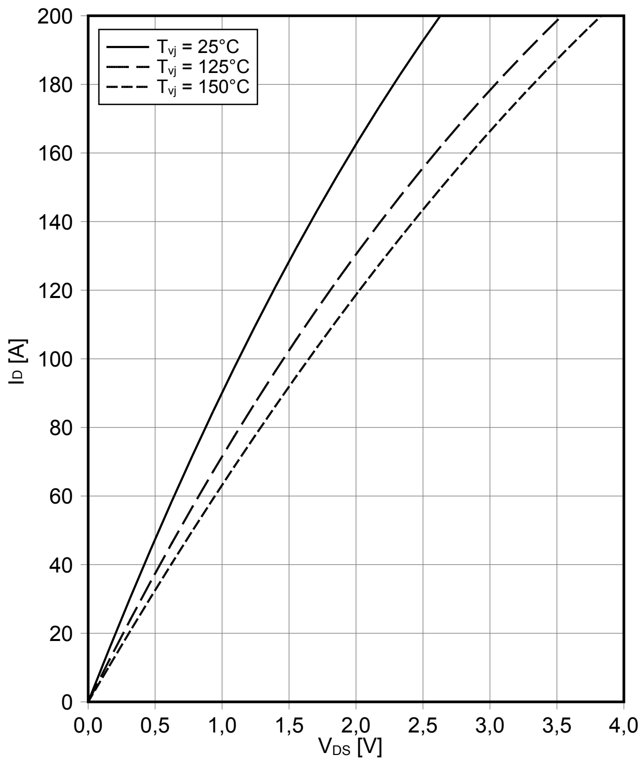
模块 / Module

绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}		3,0		kV
内部绝缘 Internal isolation	基本绝缘 (class 1, IEC 61140) basic insulation (class 1, IEC 61140)			Al_2O_3		
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_{sCE}		15		nH
储存温度 Storage temperature		T_{stg}	-40		125	°C
Anpresskraft für mech. Bef. pro Feder mountig force per clamp		F	40	-	80	N
重量 Weight		G		39		g

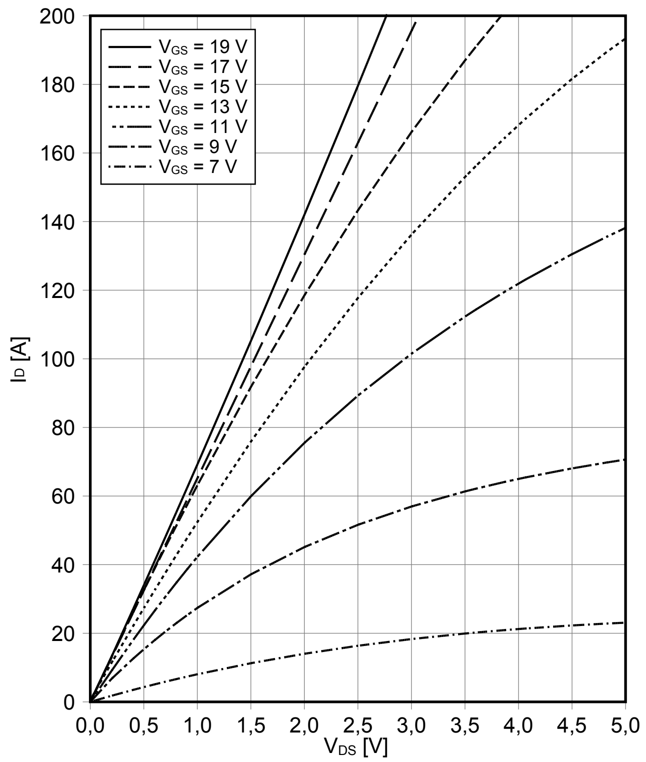
The current under continuous operation is limited to 25 A rms per connector pin.
Important note: The selection of positive and negative gate-source voltages impacts the long-term behavior of the device. The design guidelines described in Application Note AN 2018-09 must be considered to ensure sound operation of the device over the planned lifetime.
Tvj op > 150°C is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

初步数据
Preliminary Data

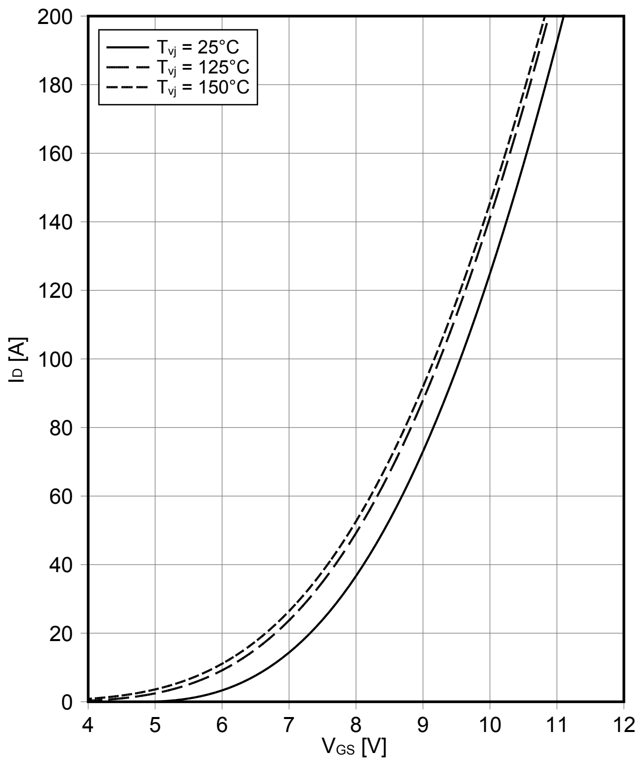
输出特性 MOSFET （典型)
output characteristic MOSFET (typical)
$I_D = f(V_{DS})$
$V_{GS} = 15$ V



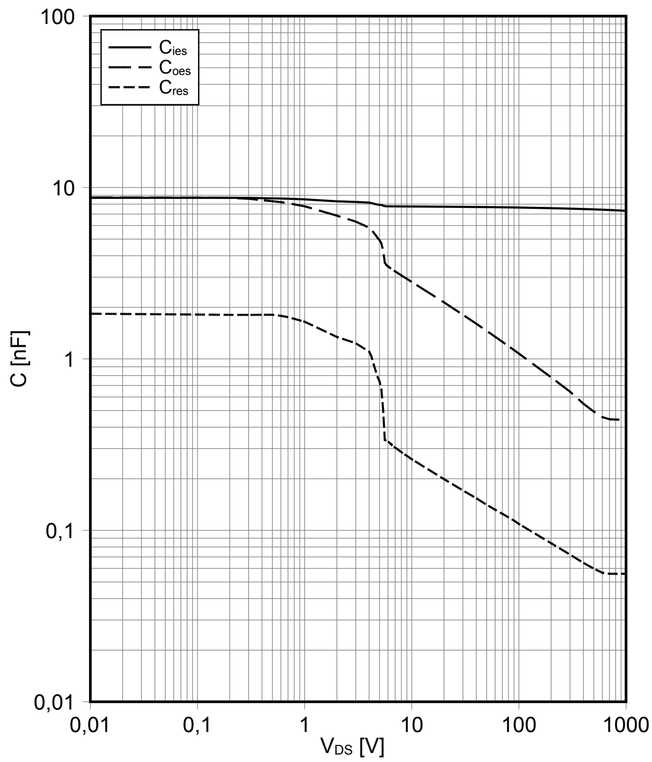
输出特性 MOSFET （典型)
output characteristic MOSFET (typical)
$I_D = f(V_{DS})$
$T_{vj} = 150°C$



传输特性 MOSFET （典型)
transfer characteristic MOSFET (typical)
$I_D = f(V_{GS})$
$V_{DS} = 20$ V

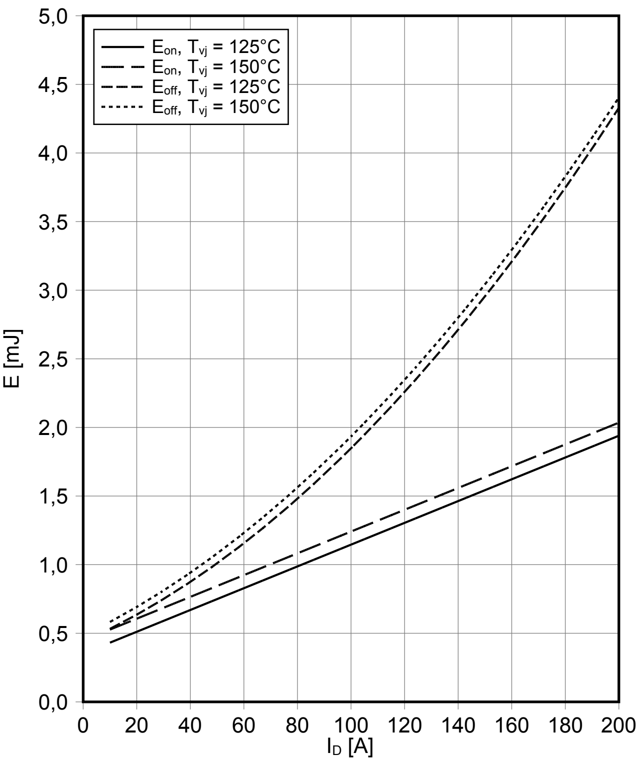


电容特性 MOSFET （典型)
capacity characteristic MOSFET (typical)
$C = f(V_{DS})$
$V_{GS} = 0$ V, $T_{vj} = 25°C$, f = 1MHz

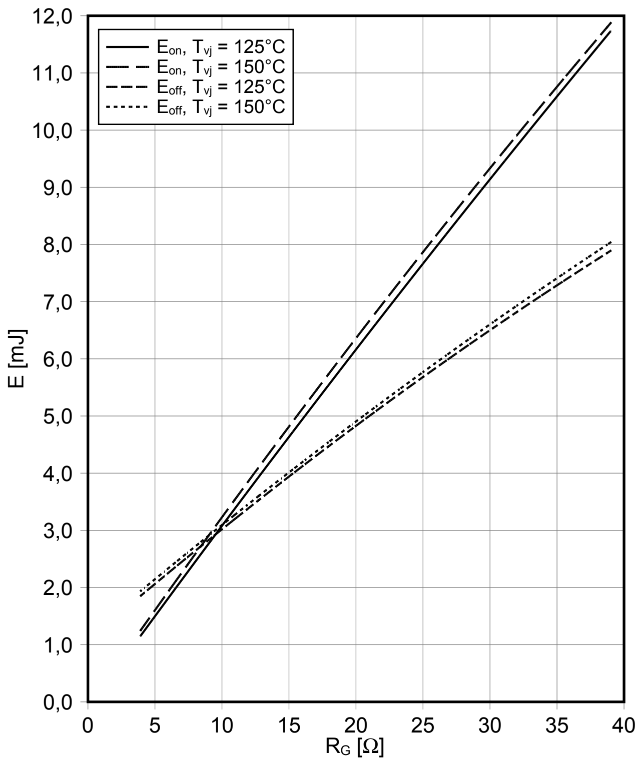


初步数据
Preliminary Data

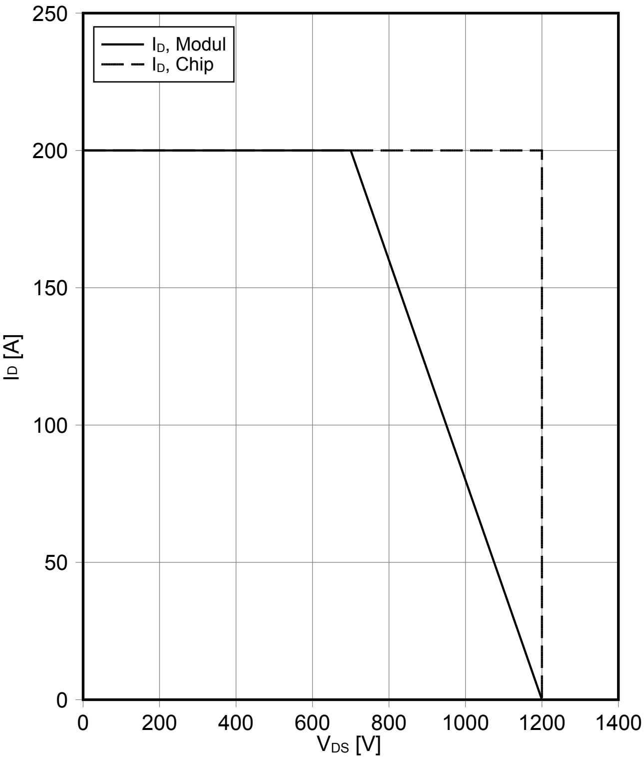
开关损耗 MOSFET （典型)
switching losses MOSFET (typical)
$E_{on} = f(I_D)$, $E_{off} = f(I_D)$
V_{GS} = -5 V / 15 V , R_{Gon} = 3,9 Ω, R_{Goff} = 3,9 Ω, V_{DS} = 600 V



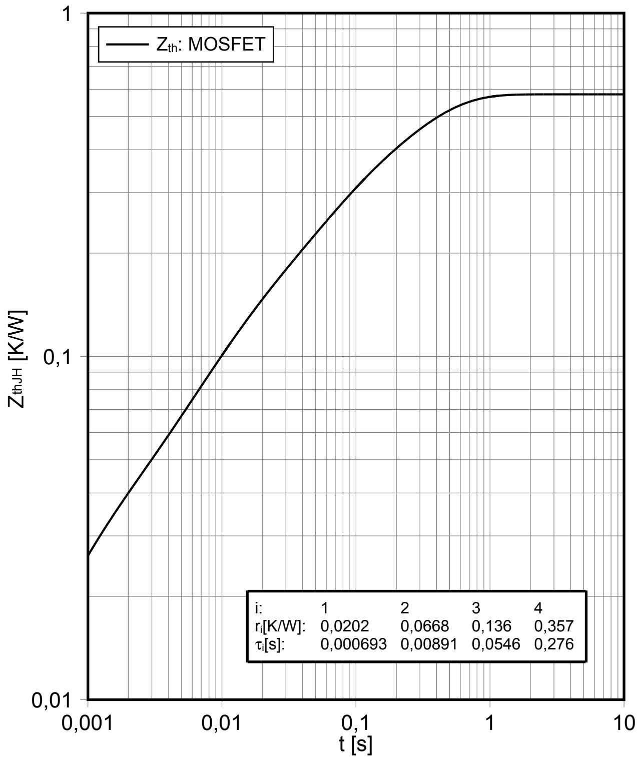
开关损耗 MOSFET （典型)
switching losses MOSFET (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
V_{GS} = -5 V / 15 V , I_D = 100 A, V_{DS} = 600 V



反偏安全工作区 MOSFET (RBSOA)
reverse bias safe operating area MOSFET (RBSOA)
$I_D = f(V_{DS})$
V_{GS} = -5 V / 15 V , T_{vj} = 150°C , R_G = 3,9 Ω

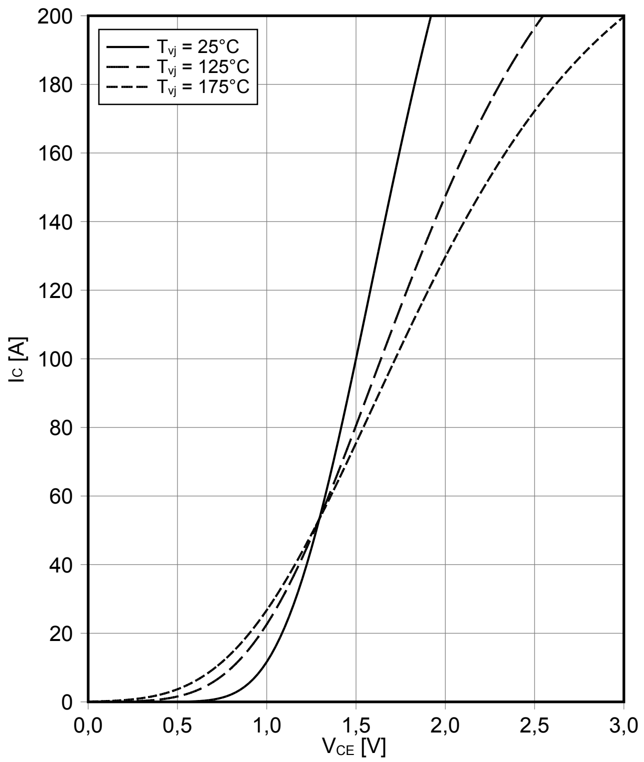


瞬态热阻抗 MOSFET
transient thermal impedance MOSFET
$Z_{thJH} = f(t)$

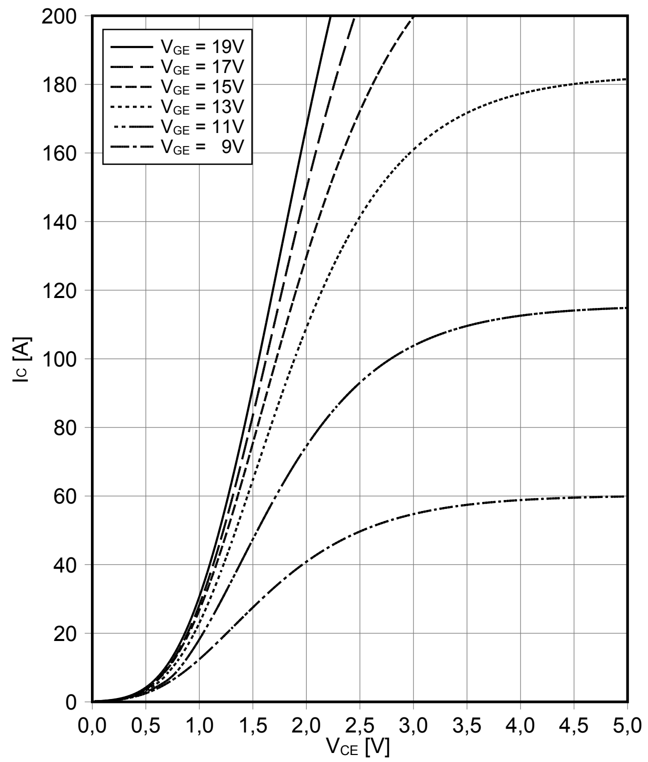


初步数据
Preliminary Data

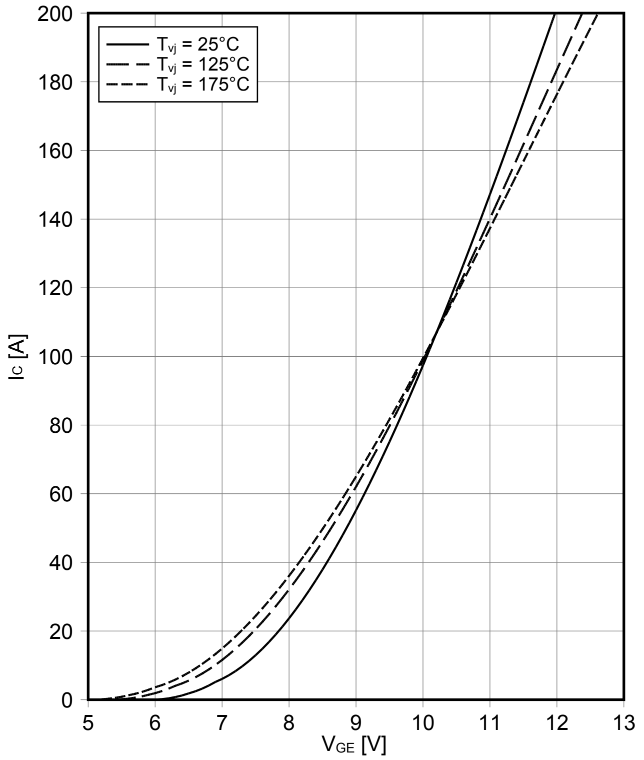
输出特性 IGBT, 三电平 （典型)
output characteristic IGBT,3-Level (typical)
$I_C = f (V_{CE})$
$V_{GE} = 15$ V



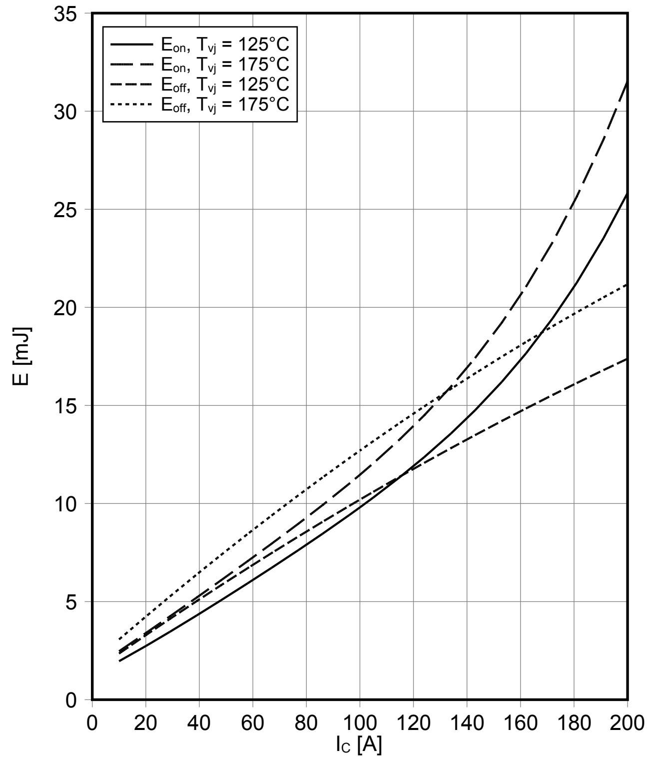
输出特性 IGBT, 三电平 （典型)
output characteristic IGBT,3-Level (typical)
$I_C = f (V_{CE})$
$T_{vj} = 175$°C



传输特性 IGBT, 三电平 (典型)
transfer characteristic IGBT,3-Level (typical)
$I_C = f (V_{GE})$
$V_{CE} = 20$ V

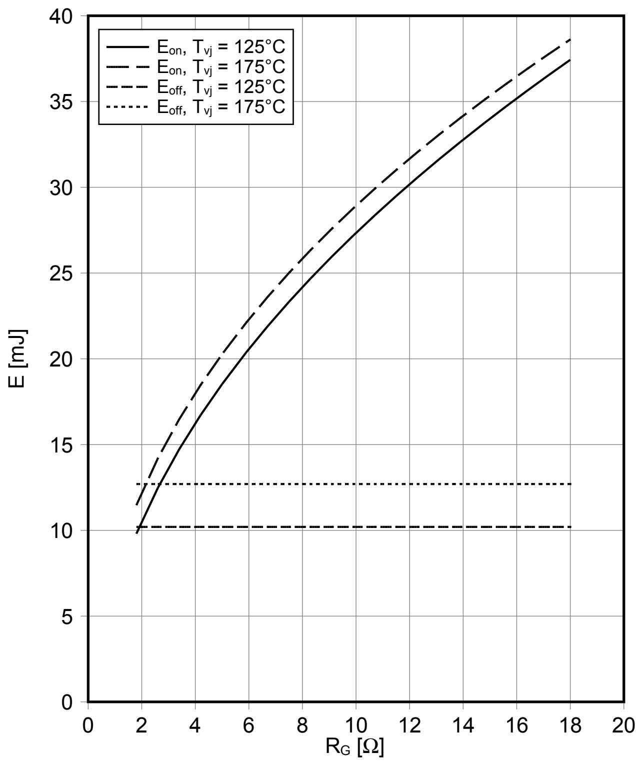


开关损耗 IGBT, 三电平 （典型)
switching losses IGBT,3-Level (typical)
$E_{on} = f (I_C)$, $E_{off} = f (I_C)$
$V_{GE} = \pm 15$ V, $R_{Gon} = 1{,}8\ \Omega$, $R_{Goff} = 1{,}8\ \Omega$, $V_{CE} = 600$ V

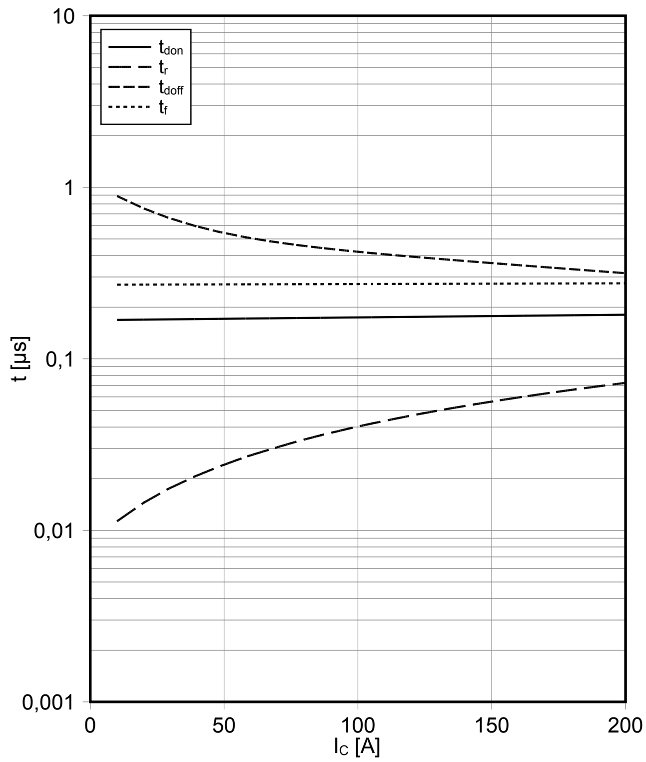


初步数据
Preliminary Data

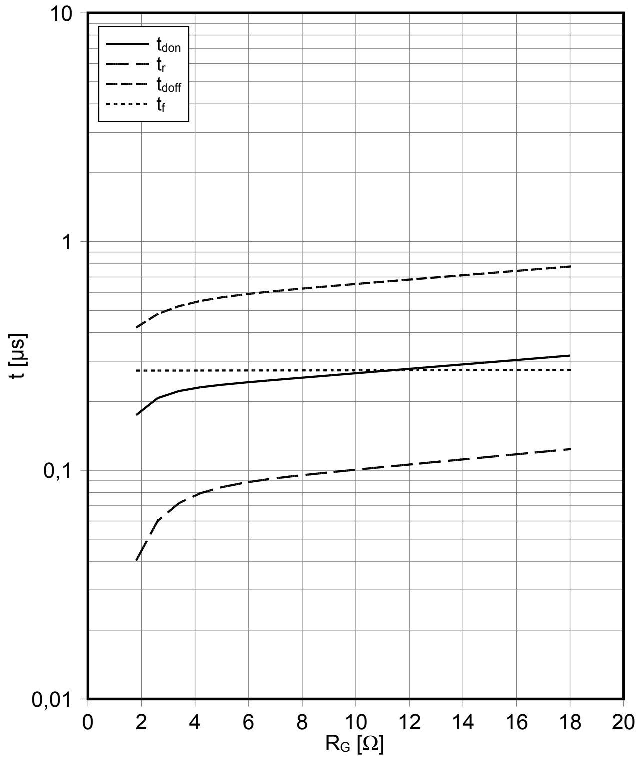
开关损耗 IGBT, 三电平 （典型)
switching losses IGBT,3-Level (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
$V_{GE} = \pm15$ V, $I_C = 100$ A, $V_{CE} = 600$ V



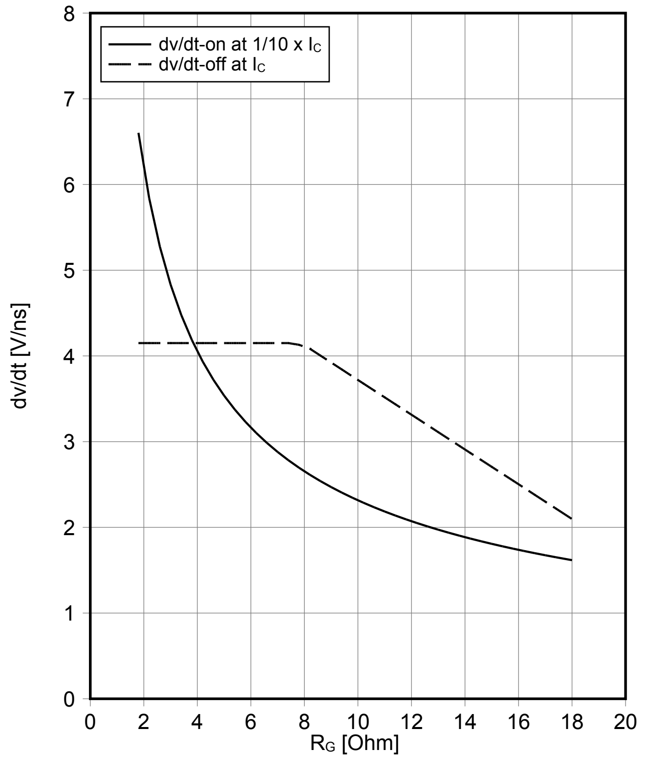
??? IGBT, 三电平 （典型)
switching times IGBT,3-Level (typical)
$t_{don} = f(I_C)$, $t_r = f(I_C)$, $t_{doff} = f(I_C)$, $t_f = f(I_C)$
$V_{GE} = \pm15$ V, $R_{Gon} = 1.8$ Ω, $R_{Goff} = 1.8$ Ω, $V_{CE} = 600$ V, $T_{vj} = 175$°C



??? IGBT, 三电平 （典型)
switching times IGBT,3-Level (typical)
$t_{don} = f(R_G)$, $t_r = f(R_G)$, $t_{doff} = f(R_G)$, $t_f = f(R_G)$
$V_{GE} = \pm15$ V, $I_C = 100$ A, $V_{CE} = 600$ V, $T_{vj} = 175$°C

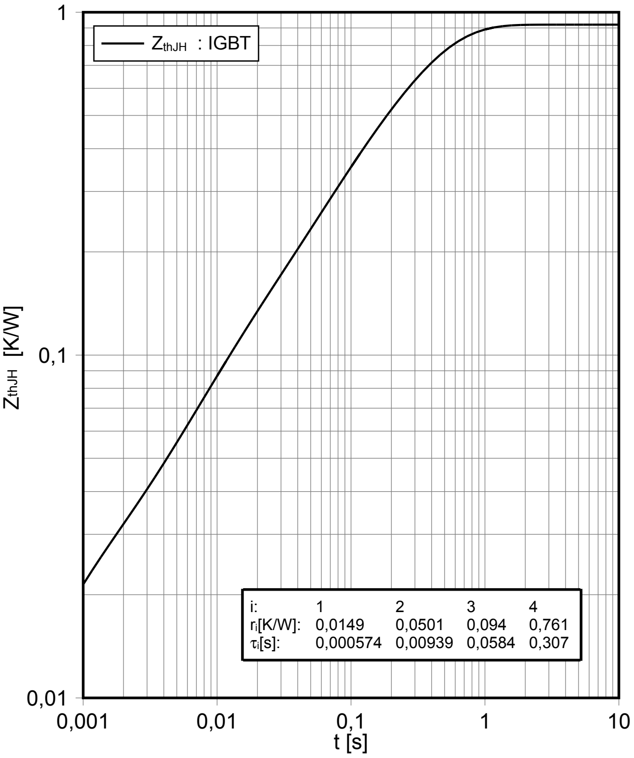


dv/dt IGBT, 三电平 （典型)
dv/dt IGBT,3-Level (typical)
$dv/dt = f(R_G)$
$V_{GE} = \pm15$ V, $I_C = 100$ A, $V_{CE} = 600$ V, $T_{vj} = 25$°C

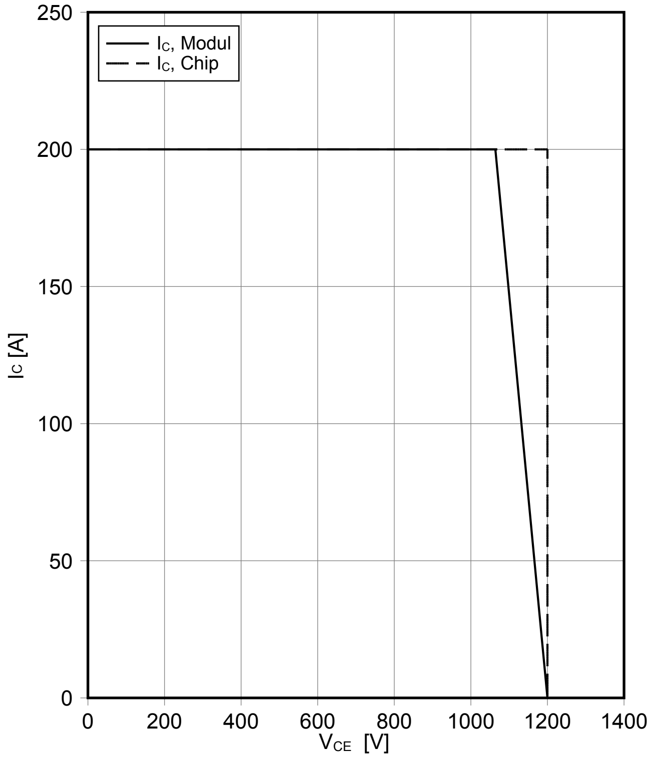


初步数据
Preliminary Data

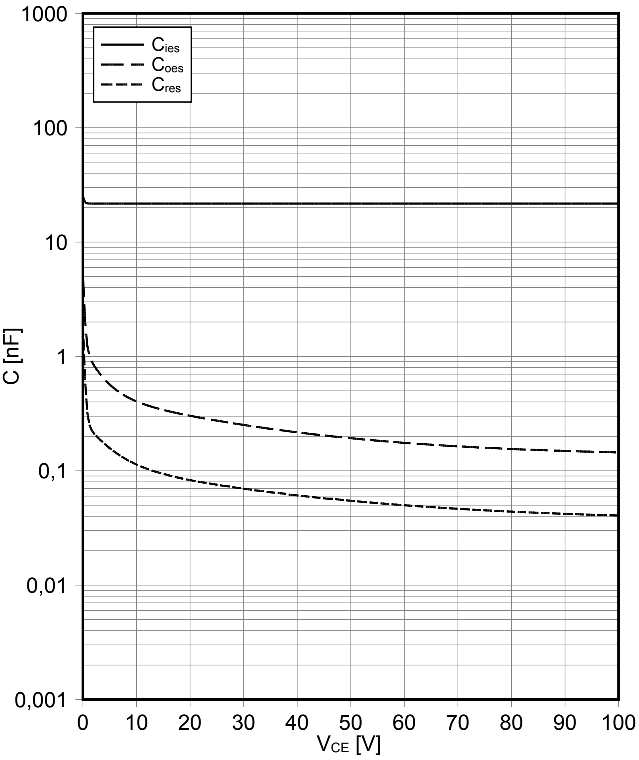
瞬态热阻抗 IGBT, 三电平
transient thermal impedance IGBT,3-Level
Z_{thJH} = f (t)



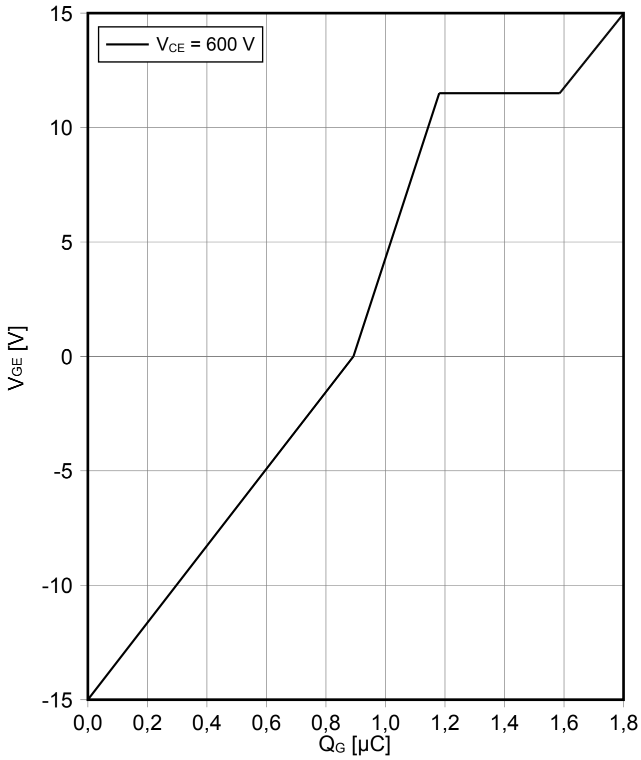
反偏安全工作区 IGBT, 三电平 （RBSOA）
reverse bias safe operating area IGBT,3-Level (RBSOA)
I_C = f (V_{CE})
V_{GE} = ±15 V, R_{Goff} = 1.8 Ω, T_{vj} = 175°C



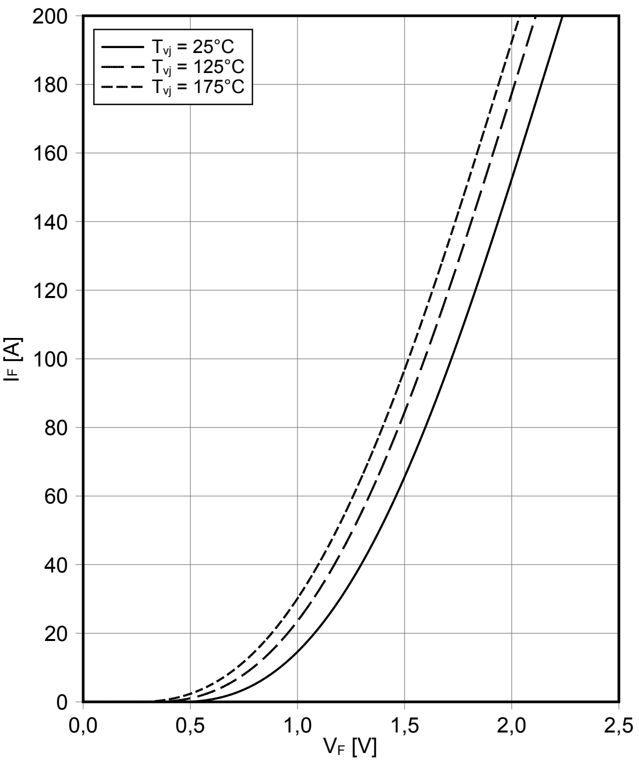
电容特性 IGBT, 三电平 （典型)
capacity characteristic IGBT,3-Level (typical)
C = f(V_{CE})
V_{GE} = 0 V, T_{vj} = 25°C, f = 100kHz



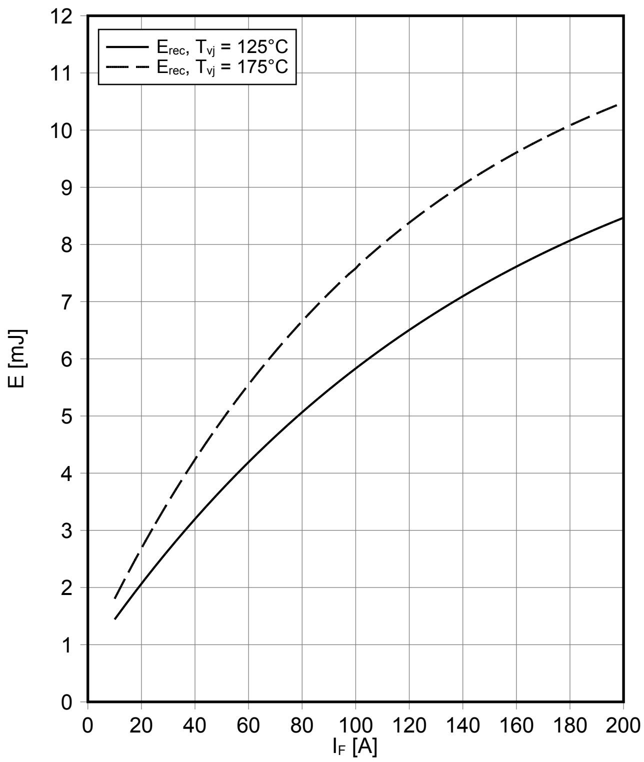
栅极电荷特性 IGBT, 三电平 （典型)
gate charge characteristic IGBT,3-Level (typical)
V_{GE} = f(Q_G)
I_C = 100 A, T_{vj} = 25°C



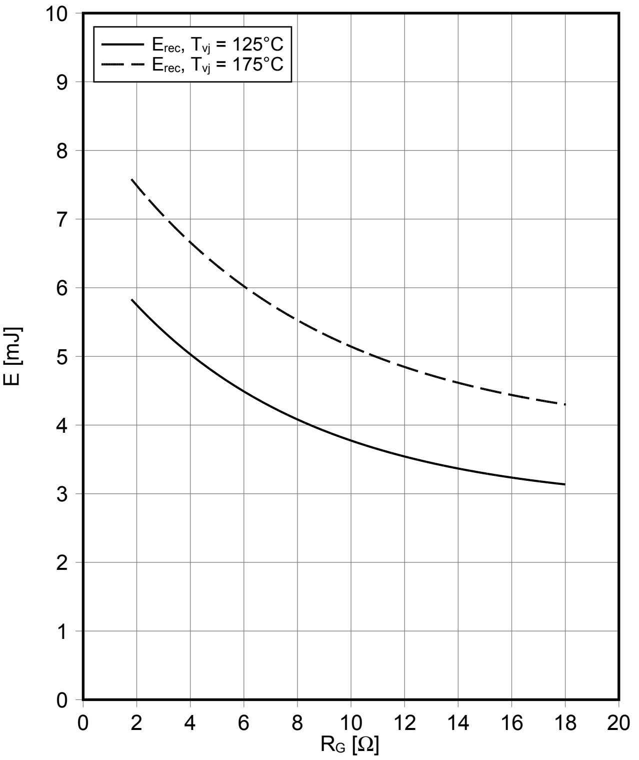
正向偏压特性 二极管, 三电平 （典型)
forward characteristic of Diode, 3-Level (typical)
$I_F = f (V_F)$



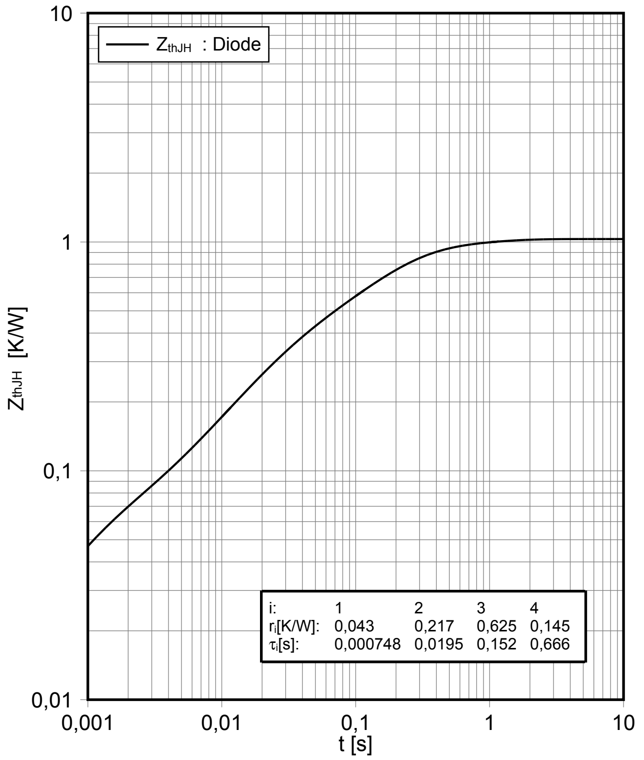
开关损耗 二极管, 三电平 （典型)
switching losses Diode, 3-Level (typical)
$E_{rec} = f (I_F)$
R_{Gon} = 1,8 Ω, V_{CE} = 600 V



开关损耗 二极管, 三电平 （典型)
switching losses Diode, 3-Level (typical)
$E_{rec} = f (R_G)$
I_F = 100 A, V_{CE} = 600 V

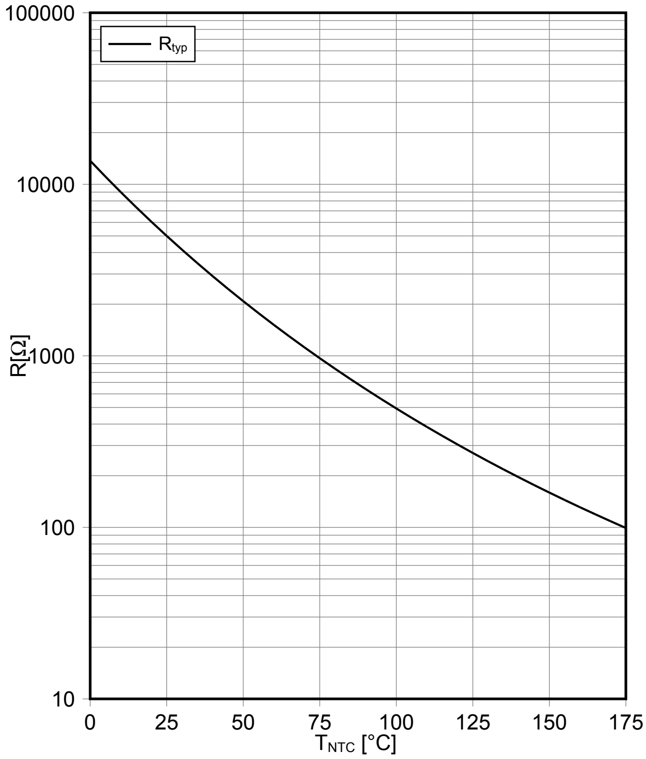


瞬态热阻抗 二极管, 三电平
transient thermal impedance Diode, 3-Level
$Z_{thJH} = f (t)$



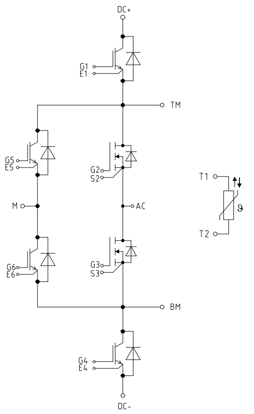
i:	1	2	3	4
r_i[K/W]:	0,043	0,217	0,625	0,145
τ_i[s]:	0,000748	0,0195	0,152	0,666

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

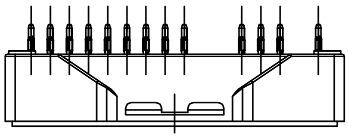


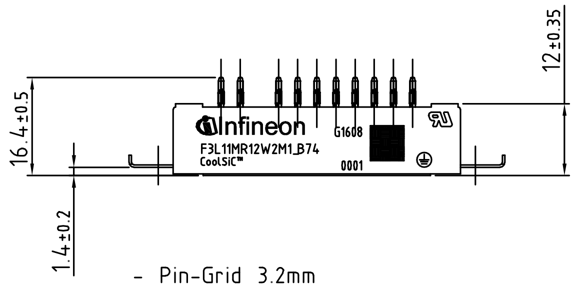
初步数据
Preliminary Data

接线图 / Circuit diagram

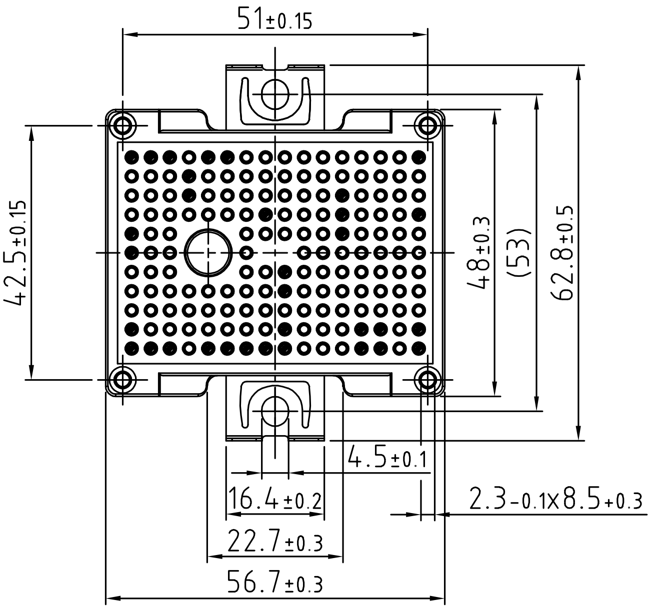


封装尺寸 / Package outlines

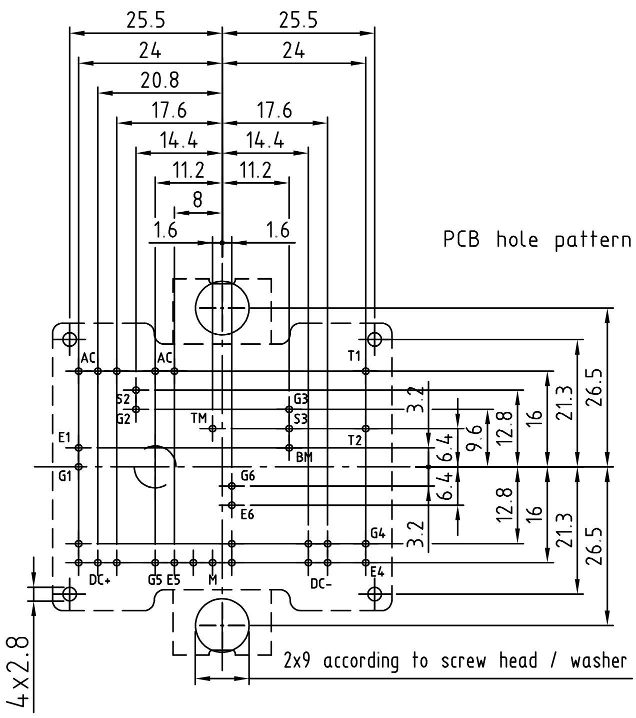




- Pin-Grid 3.2mm
- Tolerance of PCB hole pattern ⌖ ⌀0.1
- Hole specification for contacts see AN 2009-01:
  Diameters of drill ⌀ 1.15mm
  and copper thickness in hole 25-50μm



PCB hole pattern



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