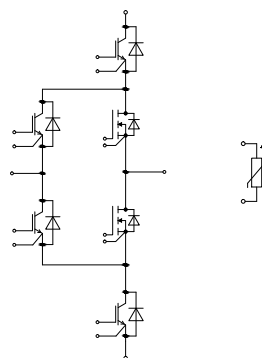
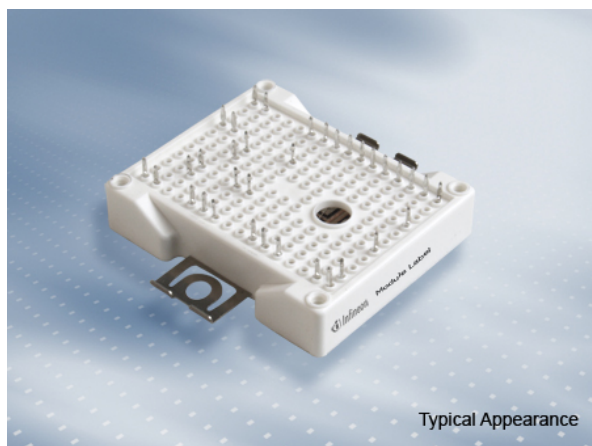


EasyPACK™ 模块 采用 CoolSiC™ Trench MOSFET 带有pressfit压接管脚和温度检测NTC
 EasyPACK™ module with CoolSiC™ Trench MOSFET and PressFIT / NTC

初步数据 / Preliminary Data



$V_{DSS} = 1200V$
 $I_{D\ nom} = 100A / I_{DRM} = 200A$

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



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

初步数据
 Preliminary Data

MOSFET / MOSFET

最大额定值 / Maximum Rated Values

漏源极电压 Drain-source voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{DSS}	1200	V
直流漏极电流 DC drain current	$T_{vj} = 175^{\circ}\text{C}, V_{GS} = 15\text{ V}$	$T_H = 5^{\circ}\text{C}$	$I_{D\text{ nom}}$	100 A
脉冲漏极电流 Pulsed drain current	经设计验证, t_p 由 $T_{vj\text{ max}}$ 限定 verified by design, t_p limited by $T_{vj\text{ max}}$		$I_{D\text{ pulse}}$	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	$I_D = 100\text{ A}$ $V_{GS} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$R_{DS\text{ on}}$	11,3 14,8 16,5		m Ω
栅极阈值电压 Gate threshold voltage	$I_D = 40,0\text{ mA}, V_{DS} = V_{GS}, T_{vj} = 25^{\circ}\text{C}$ (tested after 1ms pulse at $V_{GS} = +20\text{ V}$)		$V_{GS(th)}$	3,45	4,50	5,55 V
总的栅极电荷 Total gate charge	$V_{GS} = -5\text{ V} / 15\text{ V}, V_{DS} = 800\text{ V}$		Q_G	0,248		μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	1,0		Ω
输入电容 Input capacitance	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}$ $V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, V_{AC} = 25\text{ mV}$		C_{iss}	7,36		nF
输出电容 Output capacitance	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}$ $V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, V_{AC} = 25\text{ mV}$		C_{oss}	0,44		nF
反向传输电容 Reverse transfer capacitance	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}$ $V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, V_{AC} = 25\text{ mV}$		C_{rss}	0,056		nF
C_{oss} stored energy	$T_{vj} = 25^{\circ}\text{C}$ $V_{DS} = 800\text{ V}, V_{GS} = -5\text{ V} / 15\text{ V}$		E_{oss}	176		μJ
零栅电压漏极电流 Zero gate voltage drain current	$V_{DS} = 1200\text{ V}, V_{GS} = -5\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	I_{DSS}	0,40	380	μA
栅极漏电流 Gate-source leakage current	$V_{DS} = 0\text{ V}$ $T_{vj} = 25^{\circ}\text{C}$	$V_{GS} = 20\text{ V}$ $V_{GS} = -10\text{ V}$	I_{GSS}		400	nA
开通延迟时间(电感负载) Turn on delay time, inductive load	$I_D = 100\text{ A}, V_{DS} = 600\text{ V}$ $V_{GS} = -5\text{ V} / 15\text{ V}$ $R_{Gon} = 4,70\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{ on}}$	26,7 25,0 23,8		ns
上升时间(电感负载) Rise time, inductive load	$I_D = 100\text{ A}, V_{DS} = 600\text{ V}$ $V_{GS} = -5\text{ V} / 15\text{ V}$ $R_{Gon} = 4,70\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	23,4 22,9 21,9		ns
关断延迟时间(电感负载) Turn off delay time, inductive load	$I_D = 100\text{ A}, V_{DS} = 600\text{ V}$ $V_{GS} = -5\text{ V} / 15\text{ V}$ $R_{Goff} = 4,70\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{ off}}$	82,9 85,7 86,3		ns
下降时间(电感负载) Fall time, inductive load	$I_D = 100\text{ A}, V_{DS} = 600\text{ V}$ $V_{GS} = -5\text{ V} / 15\text{ V}$ $R_{Goff} = 4,70\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	18,5 20,8 21,7		ns
开通损耗(每脉冲) Turn-on energy loss per pulse	$I_D = 100\text{ A}, V_{DS} = 600\text{ V}, L_{\sigma} = 35\text{ nH}$ $di/dt = 5,00\text{ kA}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) $V_{GS} = -5\text{ V} / 15\text{ V}, R_{Gon} = 4,70\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	1,57 1,59 1,62		mJ
关断损耗(每脉冲) Turn-off energy loss per pulse	$I_D = 100\text{ A}, V_{DS} = 600\text{ V}, L_{\sigma} = 35\text{ nH}$ $du/dt = 23,0\text{ kV}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) $V_{GS} = -5\text{ V} / 15\text{ V}, R_{Goff} = 4,70\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	1,33 1,42 1,44		mJ
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个MOSFET / per MOSFET		R_{thJH}	0,660		K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

Body diode

最大额定值 / Maximum Rated Values

DC body diode forward current	$T_{vj} = 175^{\circ}\text{C}, V_{GS} = -5\text{ V}$	$T_H = 5^{\circ}\text{C}$	I_{SD}	32	A
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特征值 / Characteristic Values

			min.	typ.	max.	
正向电压 Forward voltage	$I_{SD} = 100\text{ A}, V_{GS} = -5\text{ V}$ $I_{SD} = 100\text{ A}, V_{GS} = -5\text{ V}$ $I_{SD} = 100\text{ A}, V_{GS} = -5\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_{SD}	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	$T_{vj} = 25^{\circ}\text{C}$	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	$T_H = 65^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	I_{CDC}	65	A
集电极重复峰值电流 Repetitive peak collector current	$t_p = 1\text{ ms}$	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	$I_C = 100\text{ A}$ $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{ sat}}$	1,75 2,05 2,10	2,10	V V V
栅极阈值电压 Gate threshold voltage	$I_C = 4,00\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{Geth}	5,05	5,80	6,45 V
栅极电荷 Gate charge	$V_{GE} = -15\text{ V} / 15\text{ V}$		Q_G	0,80		μC
内部栅极电阻 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	0,0		Ω
输入电容 Input capacitance	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		C_{ies}	6,30		nF
反向传输电容 Reverse transfer capacitance	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		C_{res}	0,27		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}		0,04	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	$I_C = 100\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15\text{ V} / 15\text{ V}$ $R_{Gon} = 1,6\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,013 0,014 0,014		μs μs μs
上升时间(电感负载) Rise time, inductive load	$I_C = 100\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15\text{ V} / 15\text{ V}$ $R_{Gon} = 1,6\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,009 0,01 0,01		μs μs μs
关断延迟时间(电感负载) Turn-off delay time, inductive load	$I_C = 100\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15\text{ V} / 15\text{ V}$ $R_{Goff} = 1,6\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	0,196 0,287 0,306		μs μs μs
下降时间(电感负载) Fall time, inductive load	$I_C = 100\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15\text{ V} / 15\text{ V}$ $R_{Goff} = 1,6\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,138 0,212 0,253		μs μs μs
开通损耗能量(每脉冲) Turn-on energy loss per pulse	$I_C = 100\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 35\text{ nH}$ $di/dt = 7800\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15\text{ V} / 15\text{ V}, R_{Gon} = 1,6\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	1,94 3,05 3,34		mJ mJ mJ
关断损耗能量(每脉冲) Turn-off energy loss per pulse	$I_C = 100\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 35\text{ nH}$ $du/dt = 3200\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15\text{ V} / 15\text{ V}, R_{Goff} = 1,6\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	5,47 9,12 10,4		mJ mJ mJ
短路数据 SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$ $V_{CE\max} = V_{CES} - L_{SCE} \cdot di/dt$ $t_p \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		I_{SC}	400		A
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个 IGBT / per IGBT		R_{thJH}	0,655		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	150	$^{\circ}\text{C}$

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	$T_{vj} = 25^{\circ}\text{C}$	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^2t -值 I^2t - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	I^2t	370 340	A^2s A^2s

特征值 / Characteristic Values

			min.	typ.	max.		
正向电压 Forward voltage	$I_F = 50\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 50\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 50\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F		1,75 1,75 1,75	2,15	V V V
结 - 散热器热阻 Thermal resistance, junction to heatsink	每个二极管 / per diode		R_{thJH}		1,17		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

模块 / Module

绝缘测试电压 Isolation test voltage	RMS, $f = 50\text{ Hz}, t = 1\text{ min.}$	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						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			$^{\circ}\text{C}$
				min.	typ.	max.	
杂散电感, 模块 Stray inductance module		L_{sCE}		12			nH
储存温度 Storage temperature		T_{stg}	-40			125	$^{\circ}\text{C}$
Anpresskraft für mech. Bef. pro Feder mounting 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.

初步数据
 Preliminary Data

 负温度系数热敏电阻 / NTC-Thermistor
 特征值 / Characteristic Values

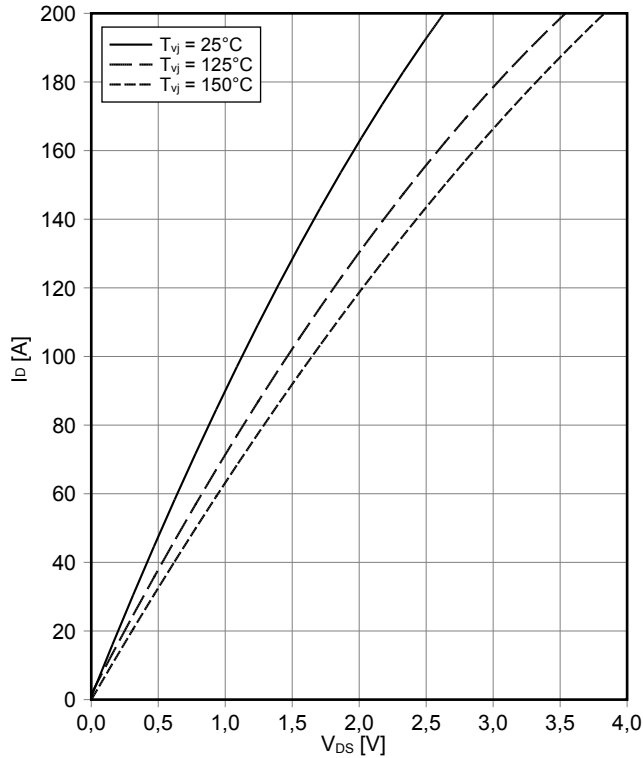
			min.	typ.	max.	
额定电阻值 Rated resistance	$T_{NTC} = 25^{\circ}\text{C}$	R_{25}		5,00		k Ω
R100 偏差 Deviation of R100	$T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493 \Omega$	$\Delta R/R$	-5		5	%
耗散功率 Power dissipation	$T_{NTC} = 25^{\circ}\text{C}$	P_{25}			20,0	mW
B-值 B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2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

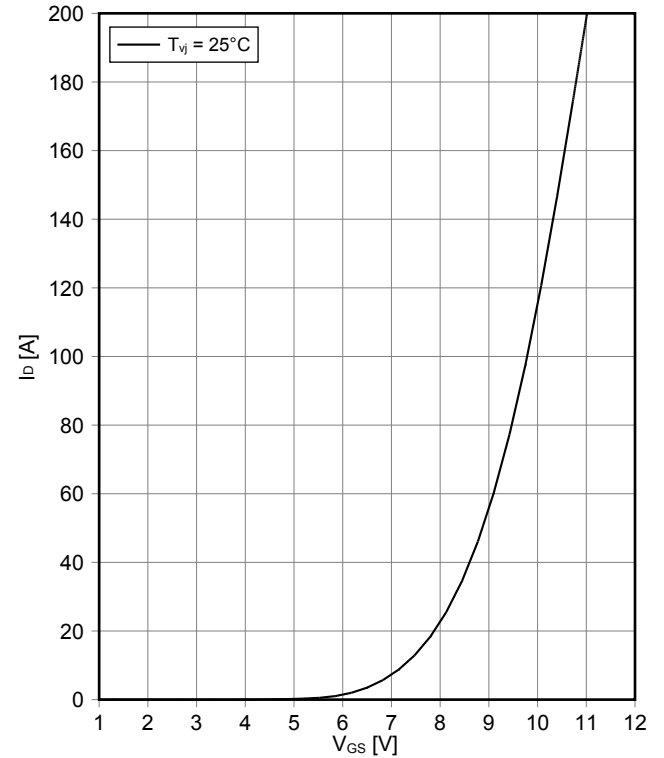
输出特性 MOSFET (典型)
output characteristic MOSFET (typical)

$I_D = f(V_{DS})$
 $V_{GS} = 15\text{ V}$



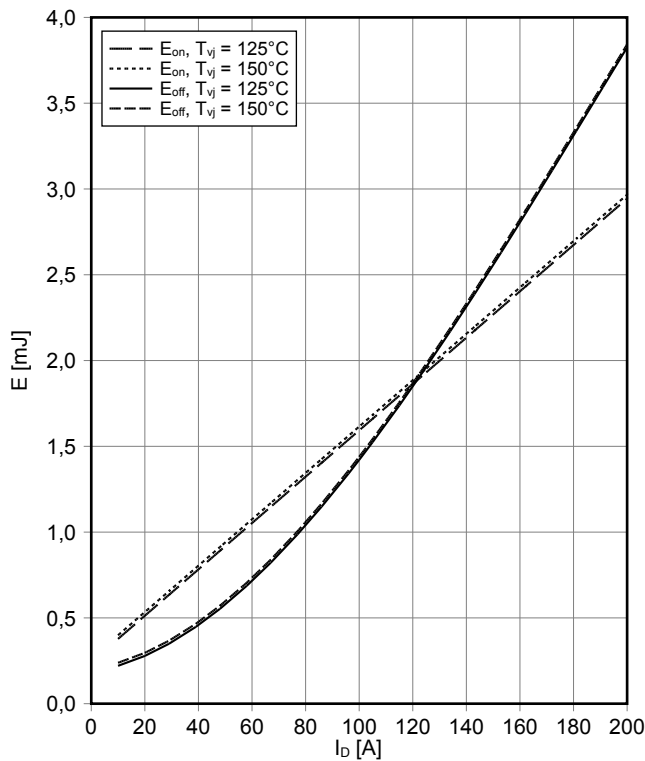
传输特性 MOSFET (典型)
transfer characteristic MOSFET (typical)

$I_D = f(V_{GS})$
 $V_{DS} = 20\text{ V}$



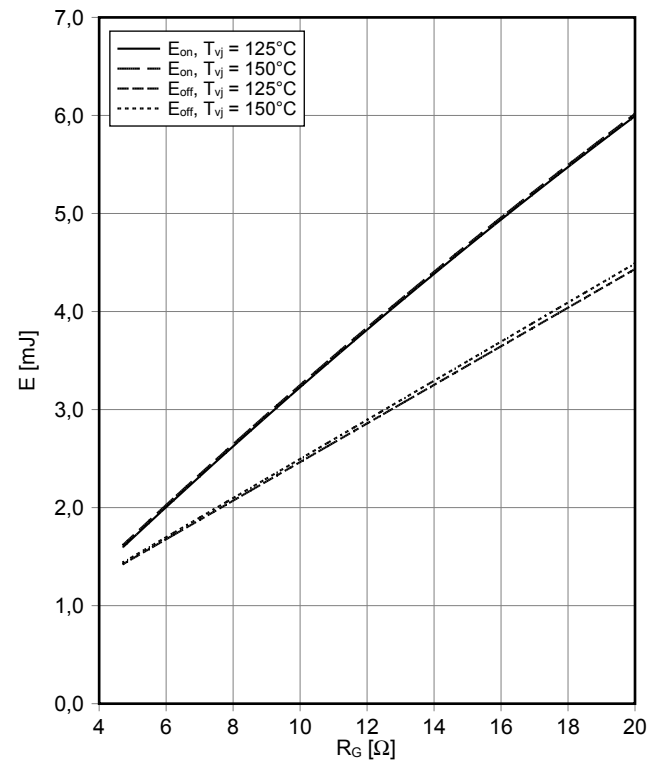
开关损耗 MOSFET (典型)
switching losses MOSFET (typical)

$E_{on} = f(I_D), E_{off} = f(I_D)$
 $V_{GS} = -5\text{ V} / 15\text{ V}, R_{Gon} = 4,7\ \Omega, R_{Goff} = 4,7\ \Omega, V_{DS} = 600\text{ V}$



开关损耗 MOSFET (典型)
switching losses MOSFET (typical)

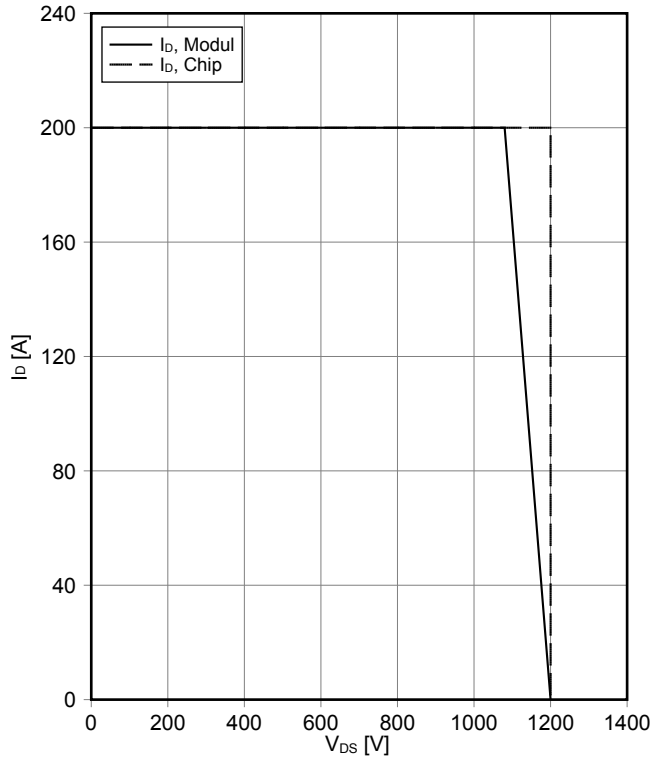
$E_{on} = f(R_G), E_{off} = f(R_G)$
 $V_{GS} = -5\text{ V} / 15\text{ V}, I_D = 100\text{ A}, V_{DS} = 600\text{ V}$



初步数据 Preliminary Data

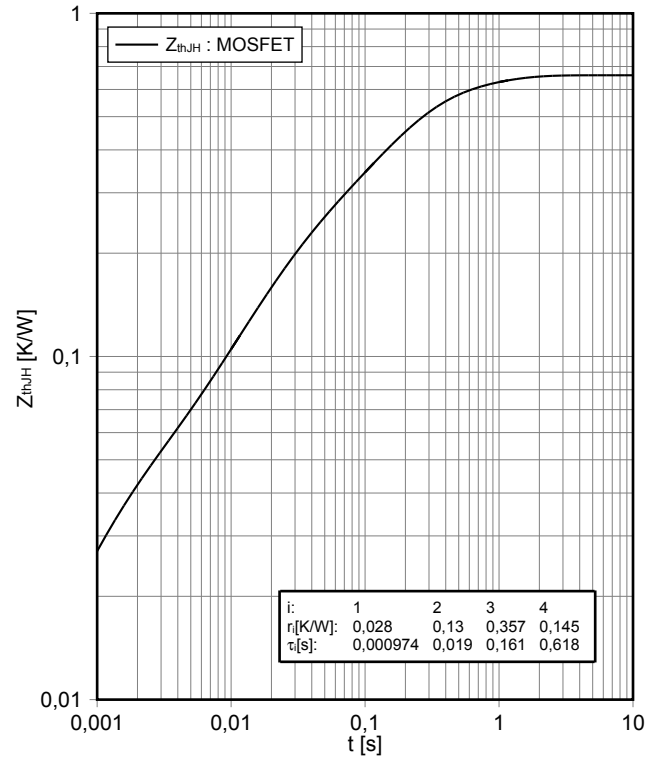
反偏安全工作区 MOSFET (RBSOA) reverse bias safe operating area MOSFET (RBSOA)

$I_D = f(V_{DS})$
 $V_{GS} = -5 \text{ V} / 15 \text{ V}$, $T_{vj} = 150^\circ\text{C}$, $R_G = 4,7 \Omega$



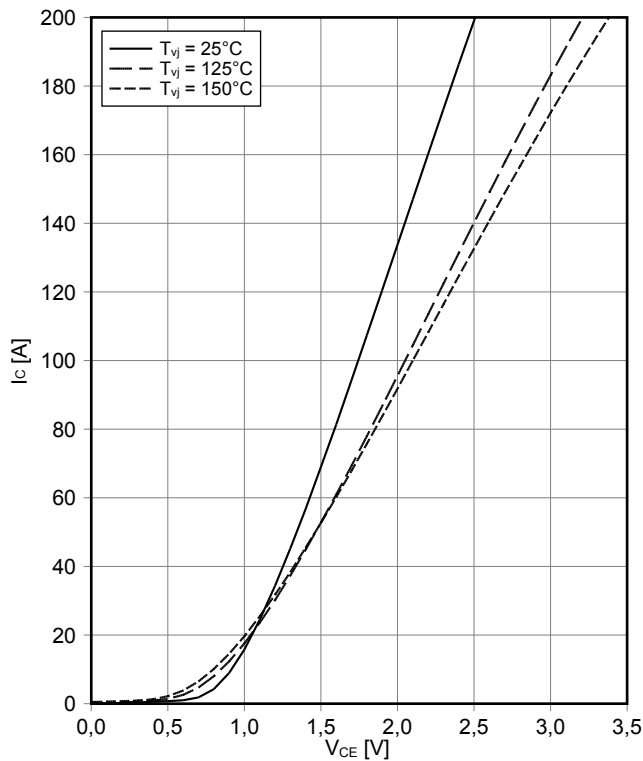
瞬态热阻抗 MOSFET transient thermal impedance MOSFET

$Z_{thJH} = f(t)$



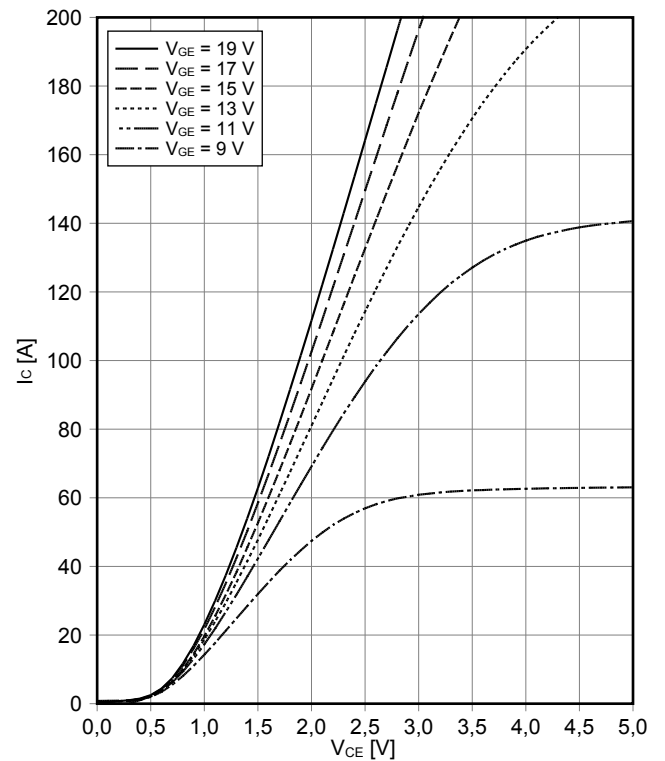
输出特性 IGBT, 三电平 (典型) output characteristic IGBT, 3-Level (typical)

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



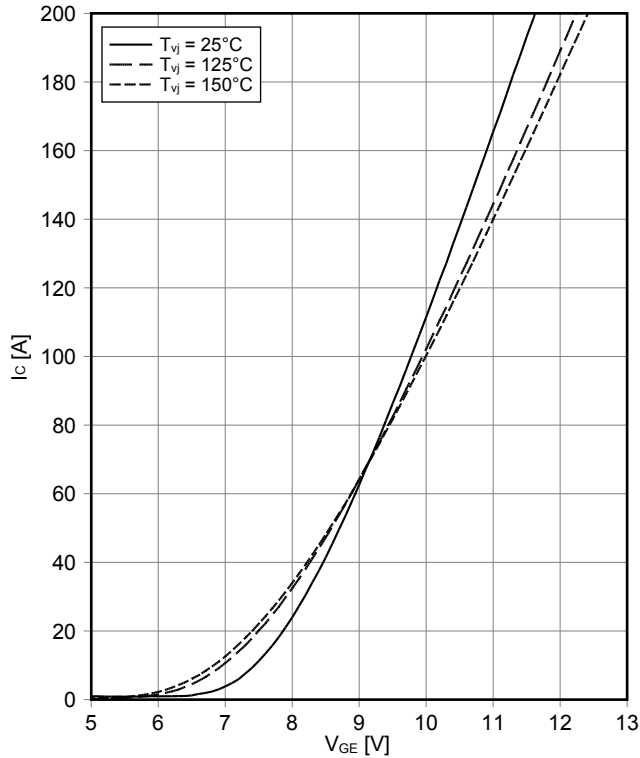
输出特性 IGBT, 三电平 (典型) output characteristic IGBT, 3-Level (typical)

$I_C = f(V_{CE})$
 $T_{vj} = 150^\circ\text{C}$

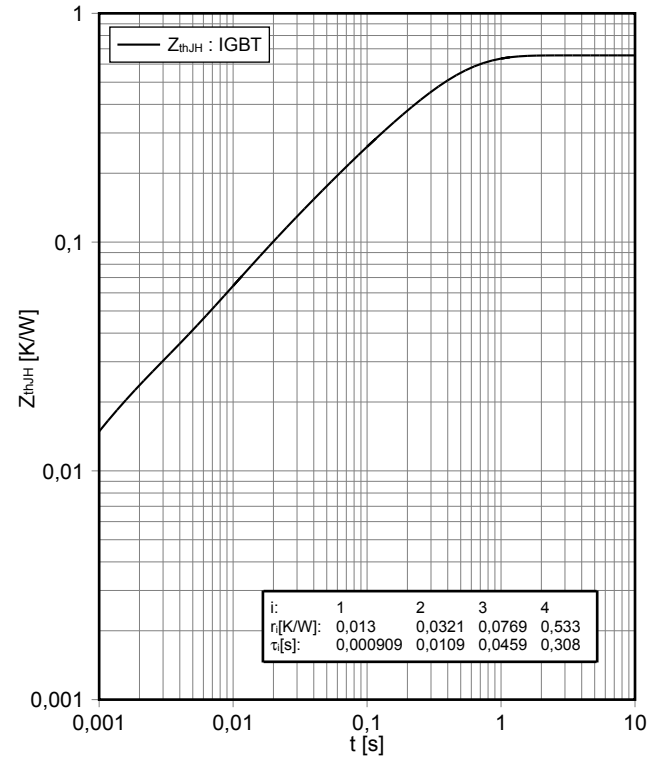


初步数据 Preliminary Data

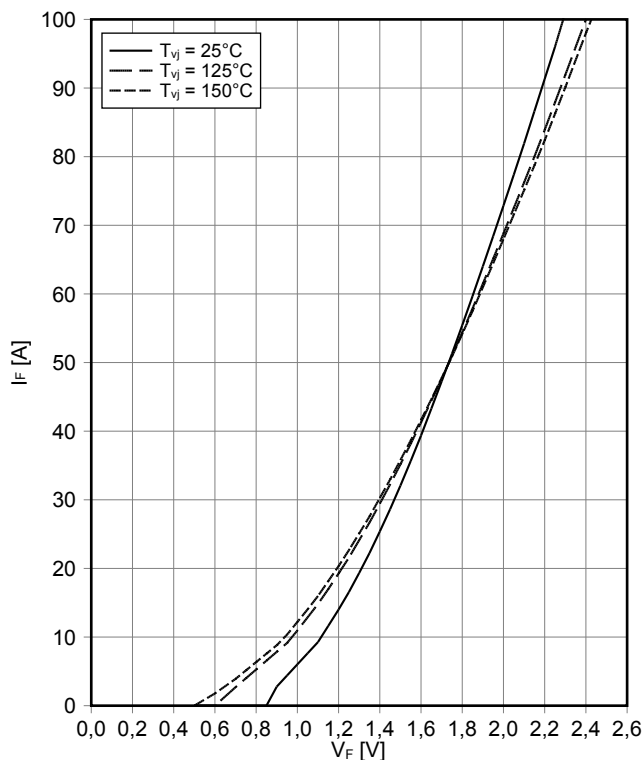
传输特性 IGBT, 三电平 (典型)
transfer characteristic IGBT, 3-Level (typical)
 $I_C = f(V_{GE})$
 $V_{CE} = 20\text{ V}$



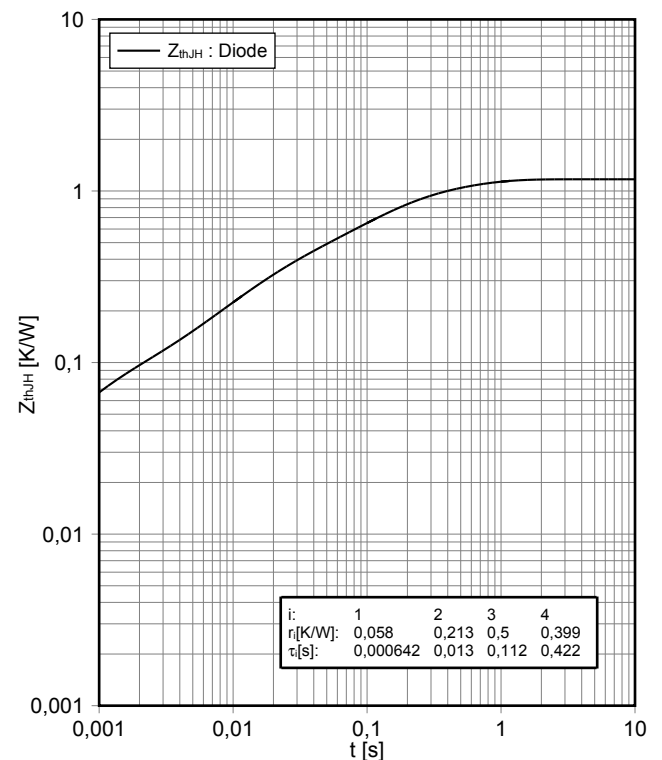
瞬态热阻抗 IGBT, 三电平
transient thermal impedance IGBT, 3-Level
 $Z_{thJH} = f(t)$



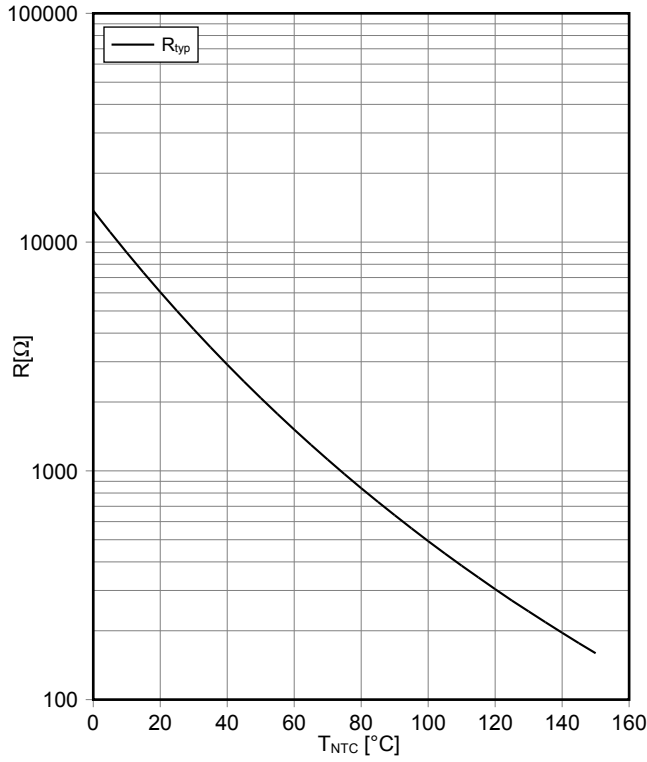
正向偏压特性 二极管, 三电平 (典型)
forward characteristic of Diode, 3-Level (typical)
 $I_F = f(V_F)$



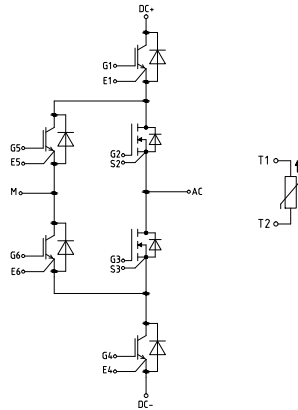
瞬态热阻抗 二极管, 三电平
transient thermal impedance Diode, 3-Level
 $Z_{thJH} = f(t)$



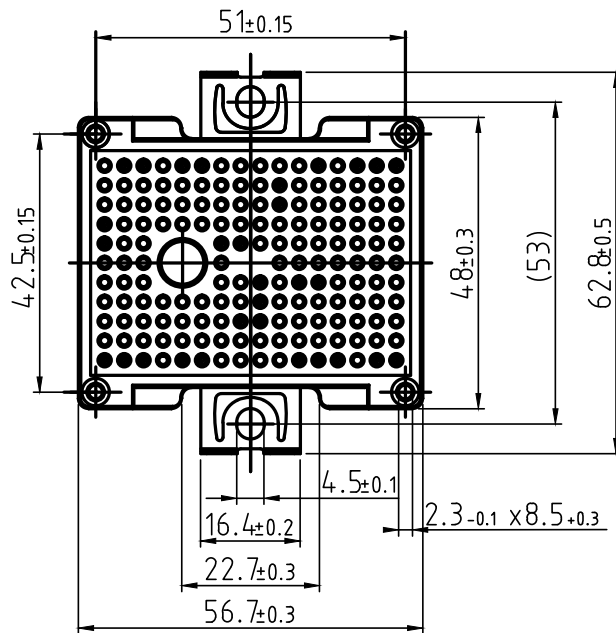
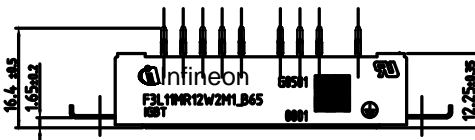
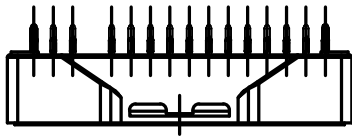
负温度系数热敏电阻 温度特性
NTC-Thermistor-temperature characteristic (typical)
 $R = f(T)$



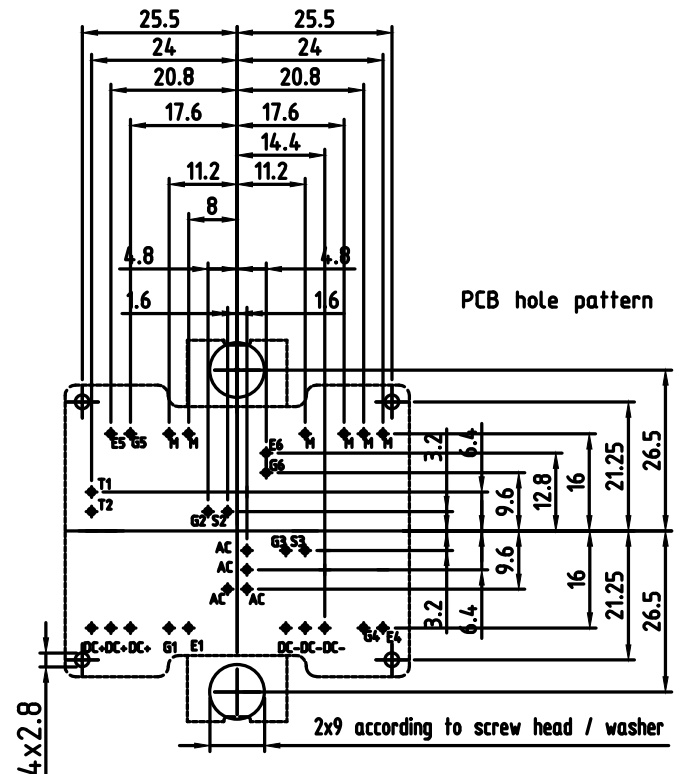
接线图 / Circuit diagram



封装尺寸 / Package outlines



- Pin-Grid 3.2mm
- Tolerance of PCB hole pattern $\varnothing 0.1$
- Hole specification for contacts see AN 2009-01:
Diameters of drill $\varnothing 1.15\text{mm}$
and copper thickness in hole 25-50 μm



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