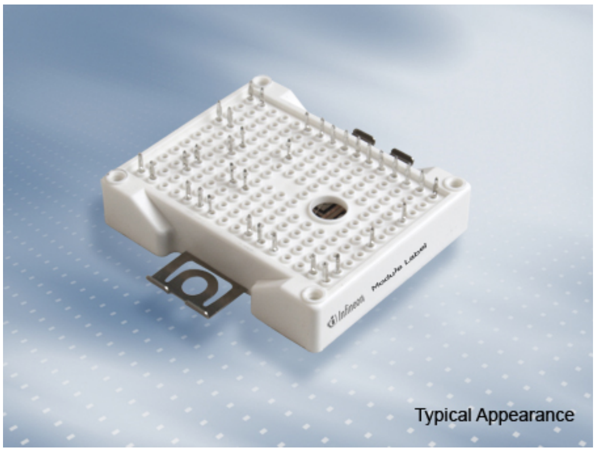
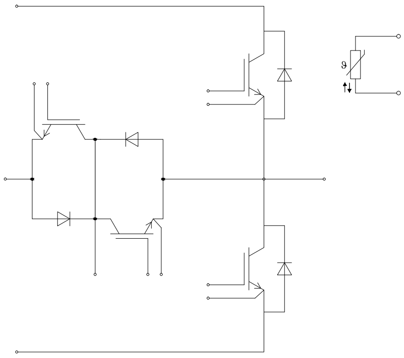
IGBT-模块
IGBT-Module

F3L150R12W2H3_B11

EasyPACK 模块 采用第二类中点钳位拓扑 (NPC2) 带有pressfit压接管脚和温度检测NTC
EasyPACK module with active "Neutral Point Clamp 2" topology and PressFIT / NTC





V_{CES} = 1200V
$I_{C\ nom}$ = 75A / I_{CRM} = 150A

典型应用
- 三电平应用
- 太阳能应用

Typical Applications
- 3-Level-Applications
- Solar Applications

电气特性
- 高速IGBT H3
- 低开关损耗
- $T_{vj\ op}$ = 150°C

Electrical Features
- High Speed IGBT H3
- Low Switching Losses
- $T_{vj\ op}$ = 150°C

机械特性
- PressFIT 压接技术
- 符合RoHS

Mechanical Features
- PressFIT Contact Technology
- RoHS compliant

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

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IGBT, T1 / T4 / IGBT, T1 / T4

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}	150	A
连续集电极直流电流 Continuous DC collector current	T_C = 100°C, $T_{vj\,max}$ = 175°C	$I_{C\,nom}$	75	A
集电极重复峰值电流 Repetitive peak collector current	t_P = 1 ms	I_{CRM}	300	A
总功率损耗 Total power dissipation	T_C = 25°C, $T_{vj\,max}$ = 175°C	P_{tot}	500	W
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 = 75 A, V_{GE} = 15 V I_C = 75 A, V_{GE} = 15 V I_C = 75 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE\,sat}$		1,55 1,70 1,75	1,75	V V V
栅极阈值电压 Gate threshold voltage	I_C = 5,20 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		V_{GEth}	5,25	5,80	6,35	V
栅极电荷 Gate charge	V_{GE} = -15 V ... +15 V		Q_G		1,15		µC
内部栅极电阻 Internal gate resistor	T_{vj} = 25°C		R_{Gint}		5,0		Ω
输入电容 Input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		8,70		nF
反向传输电容 Reverse transfer capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{res}		0,48		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}			1,0	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 = 75 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Gon} = 3,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,on}$		0,16 0,17 0,175		µs µs µs
上升时间(电感负载) Rise time, inductive load	I_C = 75 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Gon} = 3,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0,03 0,035 0,035		µs µs µs
关断延迟时间(电感负载) Turn-off delay time, inductive load	I_C = 75 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Goff} = 3,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,off}$		0,33 0,42 0,44		µs µs µs
下降时间(电感负载) Fall time, inductive load	I_C = 75 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Goff} = 3,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0,035 0,06 0,07		µs µs µs
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	I_C = 75 A, V_{CE} = 400 V, L_S = 25 nH V_{GE} = ±15 V, di/dt = 2600 A/µs (T_{vj} = 150°C) R_{Gon} = 3,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		1,55 2,45 2,70		mJ mJ mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	I_C = 75 A, V_{CE} = 400 V, L_S = 25 nH V_{GE} = ±15 V, du/dt = 2400 V/µs (T_{vj} = 150°C) R_{Goff} = 3,0 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		2,60 4,40 5,00		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 ≤ 10 µs, T_{vj} = 150°C	I_{SC}		600		A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}		0,25	0,30	K/W

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外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个 IGBT / per IGBT λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)	R_{thCH}		0,30		K/W
在开关状态下温度 Temperature under switching conditions		$T_{vj\ op}$	-40		150	°C

二极管, D2 / D3 / Diode, D2 / D3

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}	650	V
正向电流 Implemented forward current		I_{FN}	125	A
连续正向直流电流 Continuous DC forward current		I_F	75	A
正向重复峰值电流 Repetitive peak forward current	t_P = 1 ms	I_{FRM}	250	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} = 150°C	I^2t	1450 1400	A^2s A^2s

特征值 / Characteristic Values

				min.	typ.	max.	
正向电压 Forward voltage	I_F = 75 A, V_{GE} = 0 V I_F = 75 A, V_{GE} = 0 V I_F = 75 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1,45 1,30 1,35	1,70	V V V
反向恢复峰值电流 Peak reverse recovery current	I_F = 75 A, - di_F/dt = 2600 A/µs (T_{vj}=150°C) V_R = 400 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		62,0 72,0 75,0		A A A
恢复电荷 Recovered charge	I_F = 75 A, - di_F/dt = 2600 A/µs (T_{vj}=150°C) V_R = 400 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		3,40 5,00 5,60		µC µC µC
反向恢复损耗（每脉冲） Reverse recovery energy	I_F = 75 A, - di_F/dt = 2600 A/µs (T_{vj}=150°C) V_R = 400 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		0,60 0,95 1,10		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}		0,55	0,65	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个二极管 / per diode λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		0,60		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\ op}$	-40		150	°C

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IGBT, T2 / T3 / IGBT, T2 / T3

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}	650	V
连续集电极直流电流 Continuous DC collector current	T_C = 100°C, $T_{vj\,max}$ = 175°C	$I_{C\,nom}$	75	A
集电极重复峰值电流 Repetitive peak collector current	t_P = 1 ms	I_{CRM}	150	A
总功率损耗 Total power dissipation	T_C = 25°C, $T_{vj\,max}$ = 175°C	P_{tot}	215	W
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 = 75 A, V_{GE} = 15 V I_C = 75 A, V_{GE} = 15 V I_C = 75 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE\,sat}$		1,45 1,60 1,70	1,90	V V V
栅极阈值电压 Gate threshold voltage	I_C = 1,20 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		V_{GEth}	4,95	5,80	6,45	V
栅极电荷 Gate charge	V_{GE} = -15 V ... +15 V		Q_G		0,80		µC
内部栅极电阻 Internal gate resistor	T_{vj} = 25°C		R_{Gint}		0,0		Ω
输入电容 Input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		4,60		nF
反向传输电容 Reverse transfer capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{res}		0,145		nF
集电极-发射极截止电流 Collector-emitter cut-off current	V_{CE} = 650 V, V_{GE} = 0 V, T_{vj} = 25°C		I_{CES}			1,0	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 = 75 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Gon} = 5,1 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,on}$		0,025 0,025 0,025		µs µs µs
上升时间(电感负载) Rise time, inductive load	I_C = 75 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Gon} = 5,1 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0,02 0,02 0,02		µs µs µs
关断延迟时间(电感负载) Turn-off delay time, inductive load	I_C = 75 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Goff} = 5,1 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,off}$		0,19 0,21 0,22		µs µs µs
下降时间(电感负载) Fall time, inductive load	I_C = 75 A, V_{CE} = 400 V V_{GE} = ±15 V R_{Goff} = 5,1 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0,02 0,035 0,04		µs µs µs
开通损耗能量 (每脉冲) Turn-on energy loss per pulse	I_C = 75 A, V_{CE} = 400 V, L_S = 25 nH V_{GE} = ±15 V, di/dt = 3600 A/µs (T_{vj} = 150°C) R_{Gon} = 5,1 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		1,30 2,10 2,30		mJ mJ mJ
关断损耗能量 (每脉冲) Turn-off energy loss per pulse	I_C = 75 A, V_{CE} = 400 V, L_S = 25 nH V_{GE} = ±15 V, du/dt = 5400 V/µs (T_{vj} = 150°C) R_{Goff} = 5,1 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		1,70 2,40 2,60		mJ mJ mJ
短路数据 SC data	V_{GE} ≤ 15 V, V_{CC} = 360 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt	t_P ≤ 8 µs, T_{vj} = 25°C t_P ≤ 6 µs, T_{vj} = 150°C	I_{SC}		530 380		A A
结 - 外壳热阻 Thermal resistance, junction to case	每个 IGBT / per IGBT		R_{thJC}		0,60	0,70	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个 IGBT / per IGBT λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		0,60		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		150	°C

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二极管, D1 / D4 / Diode, D1 / D4

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	50	A
正向重复峰值电流 Repetitive peak forward current	t_P = 1 ms	I_{FRM}	150	A
I2t-值 I²t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 125°C V_R = 0 V, t_P = 10 ms, T_{vj} = 150°C	I^2t	1050 985	A²s A²s

特征值 / Characteristic Values

				min.	typ.	max.	
正向电压 Forward voltage	I_F = 50 A, V_{GE} = 0 V I_F = 50 A, V_{GE} = 0 V I_F = 50 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		2,00 1,70 1,65	2,55	V V V
反向恢复峰值电流 Peak reverse recovery current	I_F = 50 A, - di_F/dt = 3200 A/µs (T_{vj}=150°C) V_R = 400 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		100 120 130		A A A
恢复电荷 Recovered charge	I_F = 50 A, - di_F/dt = 3200 A/µs (T_{vj}=150°C) V_R = 400 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		3,50 7,80 10,0		µC µC µC
反向恢复损耗（每脉冲） Reverse recovery energy	I_F = 50 A, - di_F/dt = 3200 A/µs (T_{vj}=150°C) V_R = 400 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		1,10 2,50 3,30		mJ mJ mJ
结 - 外壳热阻 Thermal resistance, junction to case	每个二极管 / per diode		R_{thJC}		0,55	0,60	K/W
外壳 - 散热器热阻 Thermal resistance, case to heatsink	每个二极管 / per diode λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		0,50		K/W
在开关状态下温度 Temperature under switching conditions			$T_{vj\,op}$	-40		150	°C

模块 / Module

绝缘测试电压 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}		2,5		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		
			min.	typ.	max.	
杂散电感,模块 Stray inductance module		L_{sCE}		14		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

Der Strom im Dauerbetrieb ist auf 25A effektiv pro Anschlusspin begrenzt.
The current under continuous operation is limited to 25A rms per connector pin.

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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_C = 25°C	R_{25}		5,00		kΩ
R100 偏差 Deviation of R100	T_C = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
耗散功率 Power dissipation	T_C = 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.

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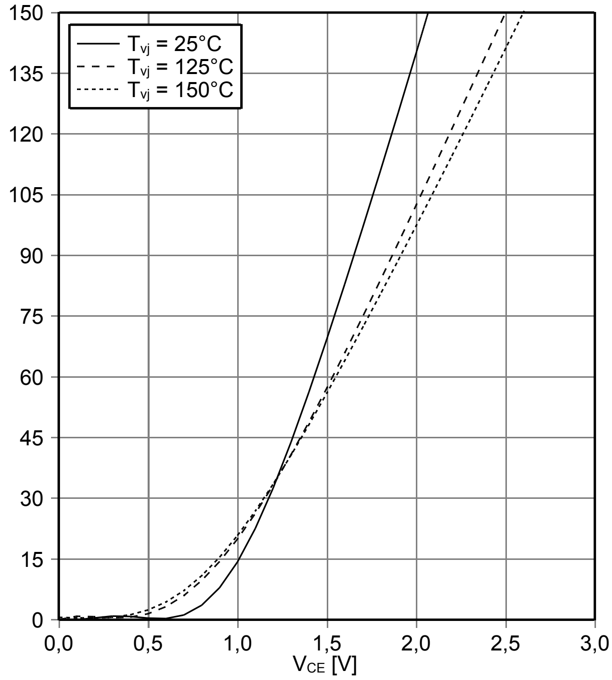
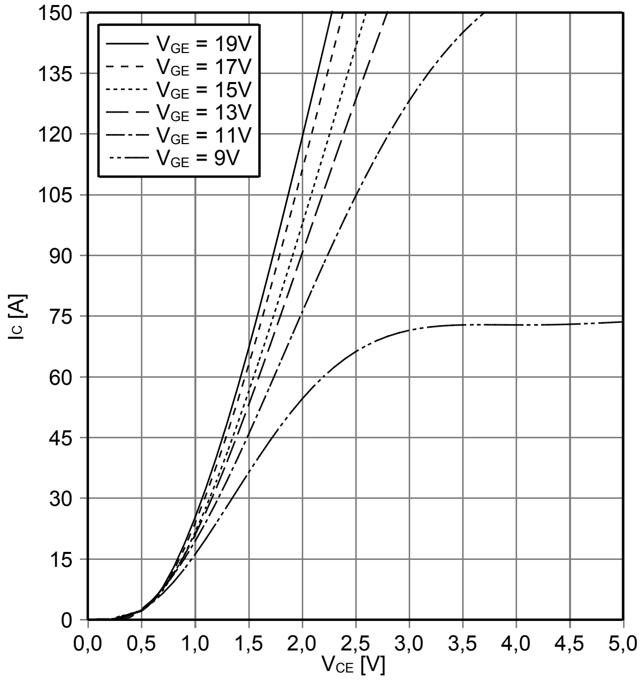
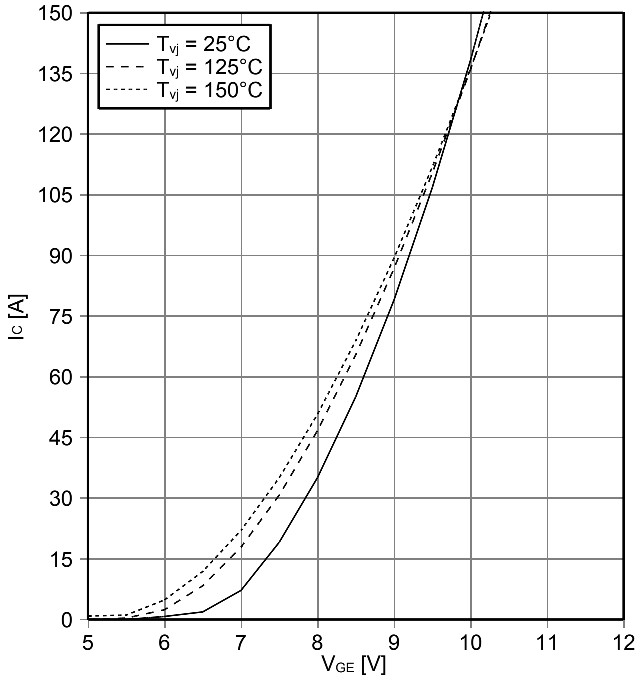
输出特性 IGBT, T1 / T4 （典型)
output characteristic IGBT, T1 / T4 (typical)
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



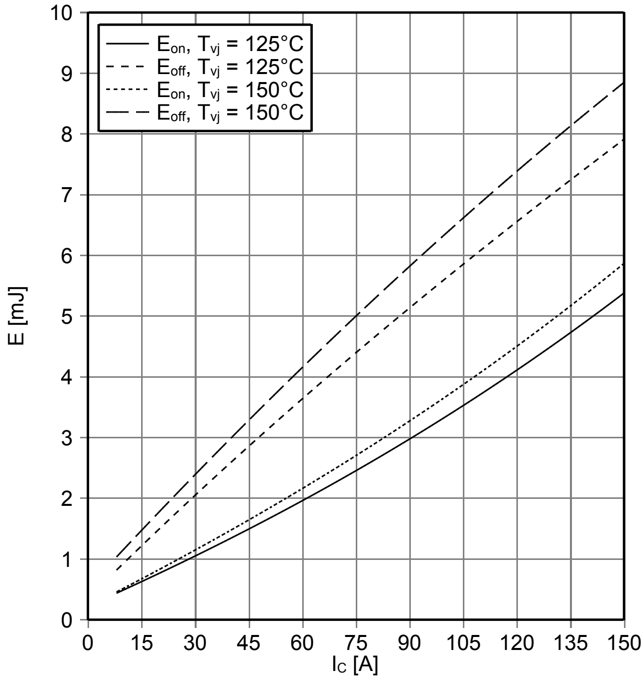
输出特性 IGBT, T1 / T4 （典型)
output characteristic IGBT, T1 / T4 (typical)
$I_C = f(V_{CE})$
$T_{vj} = 150°C$



传输特性 IGBT, T1 / T4 (典型)
transfer characteristic IGBT, T1 / T4 (typical)
$I_C = f(V_{GE})$
$V_{CE} = 20$ V



开关损耗 IGBT, T1 / T4 （典型)
switching losses IGBT, T1 / T4 (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE} = \pm15$ V, $R_{Gon} = 3\ \Omega$, $R_{Goff} = 3\ \Omega$, $V_{CE} = 400$ V



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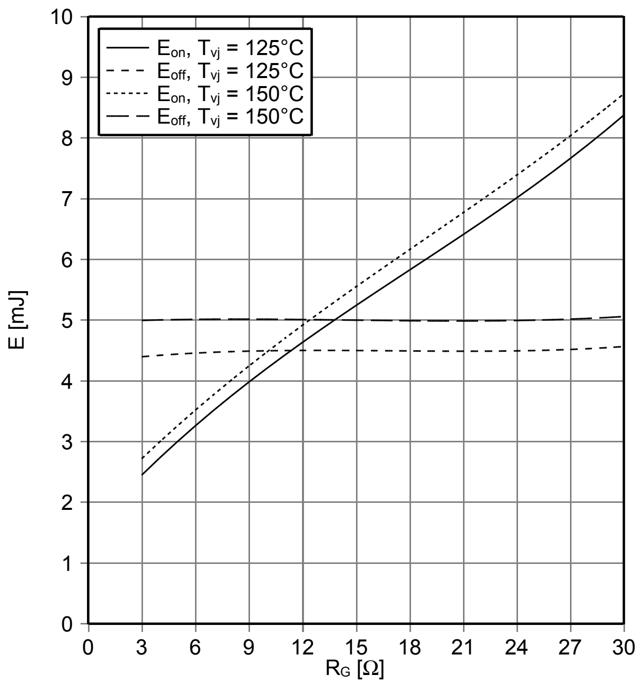
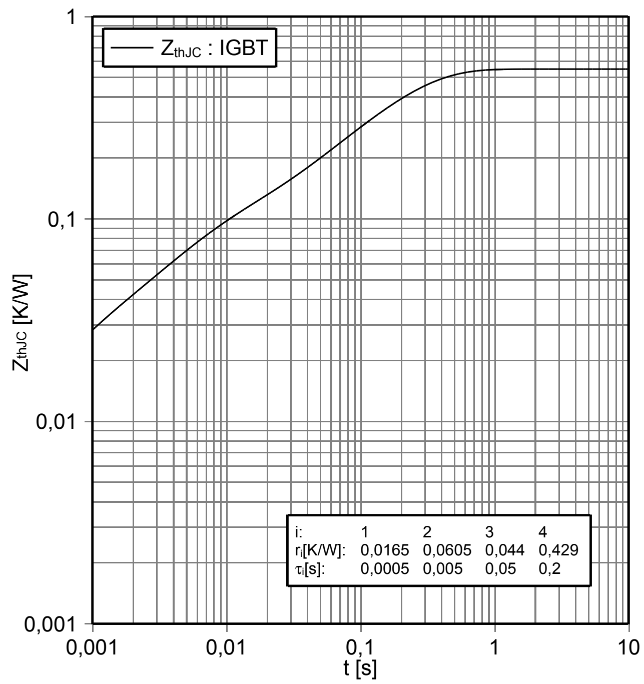
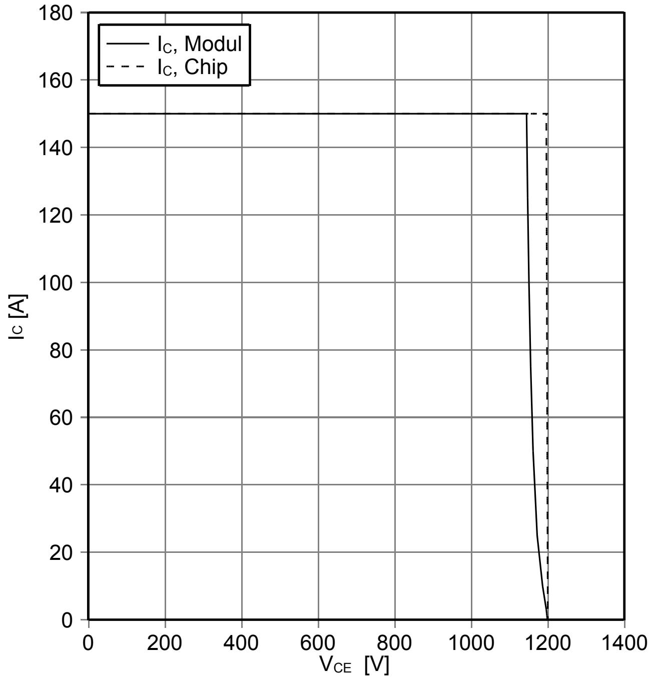
开关损耗 IGBT, T1 / T4 （典型)
switching losses IGBT, T1 / T4 (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
$V_{GE} = \pm 15$ V, $I_C = 75$ A, $V_{CE} = 400$ V



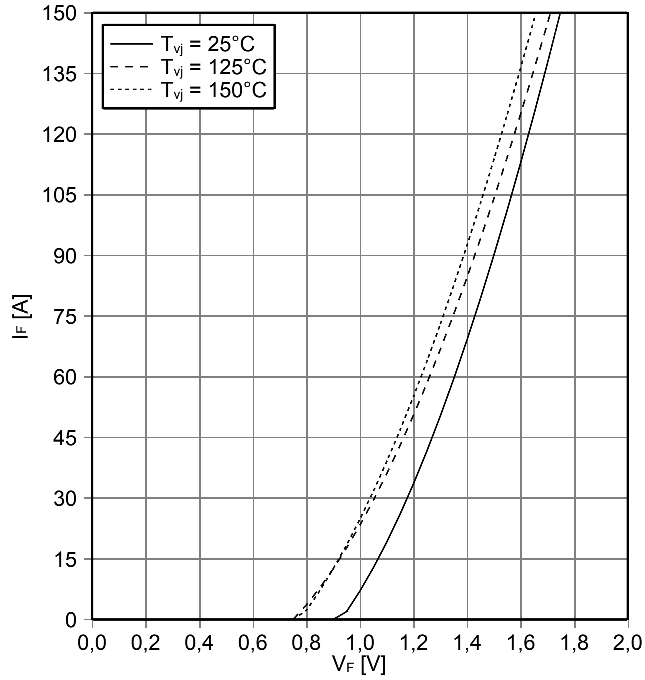
瞬态热阻抗 IGBT, T1 / T4
transient thermal impedance IGBT, T1 / T4
$Z_{thJC} = f(t)$



反偏安全工作区 IGBT, T1 / T4 （RBSOA）
reverse bias safe operating area IGBT, T1 / T4 (RBSOA)
$I_C = f(V_{CE})$
$V_{GE} = \pm 15$ V, $R_{Goff} = 3$ Ω, $T_{vj} = 150$°C



正向偏压特性 二极管, D2 / D3 （典型)
forward characteristic of Diode, D2 / D3 (typical)
$I_F = f(V_F)$



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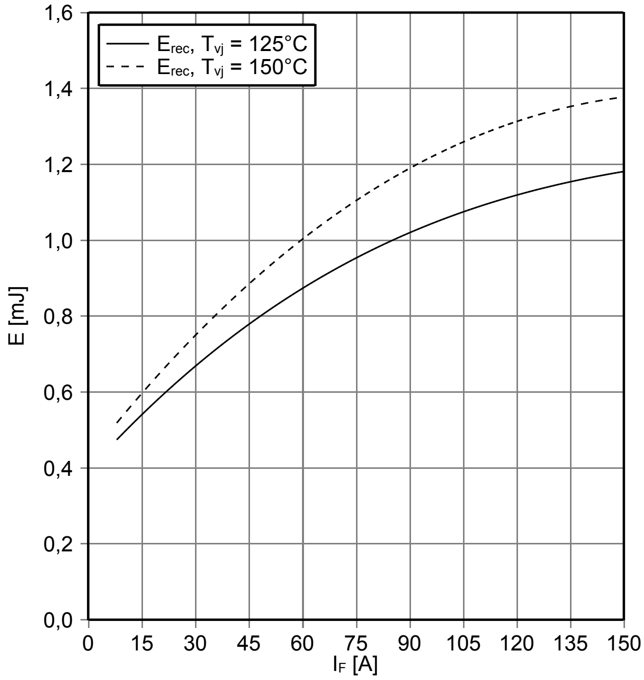
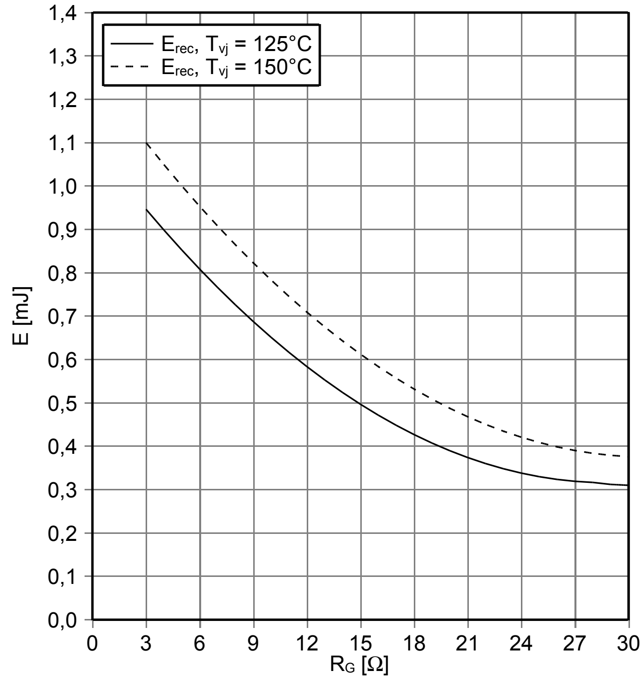
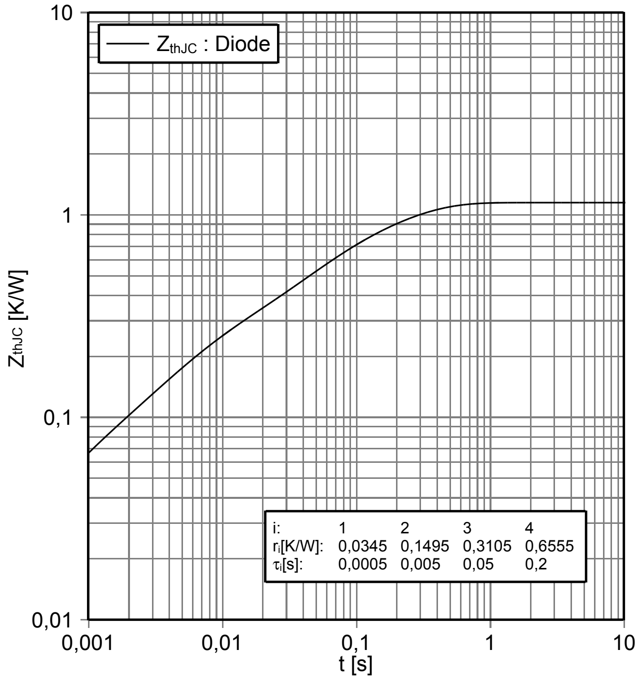
开关损耗 二极管, D2 / D3 （典型)
switching losses Diode, D2 / D3 (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 3\ \Omega$, $V_{CE} = 400$ V



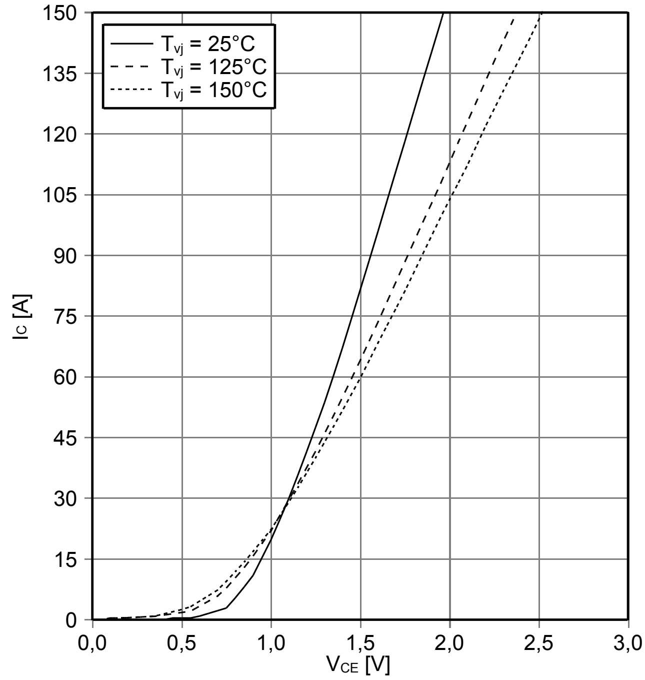
开关损耗 二极管, D2 / D3 （典型)
switching losses Diode, D2 / D3 (typical)
$E_{rec} = f(R_G)$
$I_F = 75$ A, $V_{CE} = 400$ V



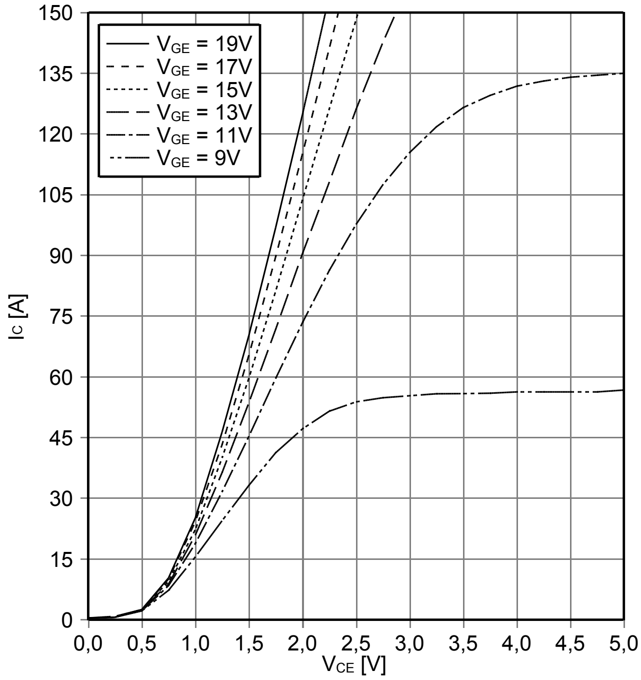
瞬态热阻抗 二极管, D2 / D3
transient thermal impedance Diode, D2 / D3
$Z_{thJC} = f(t)$



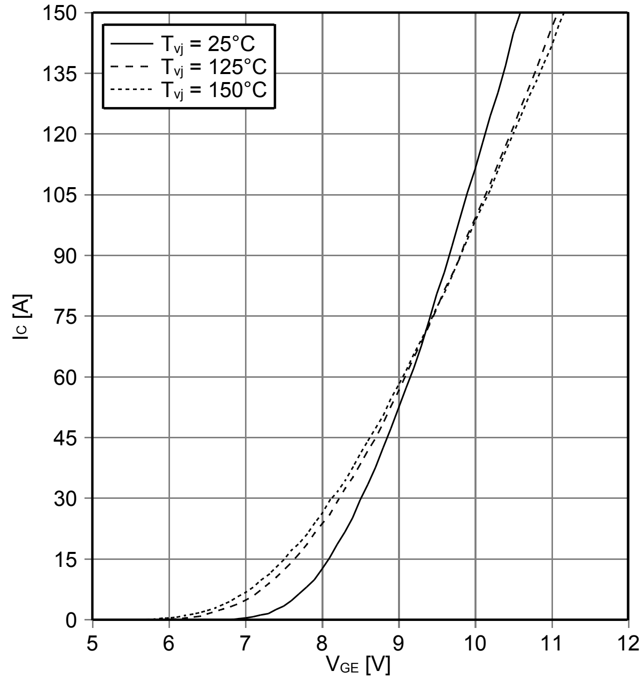
输出特性 IGBT, T2 / T3 （典型)
output characteristic IGBT, T2 / T3 (typical)
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



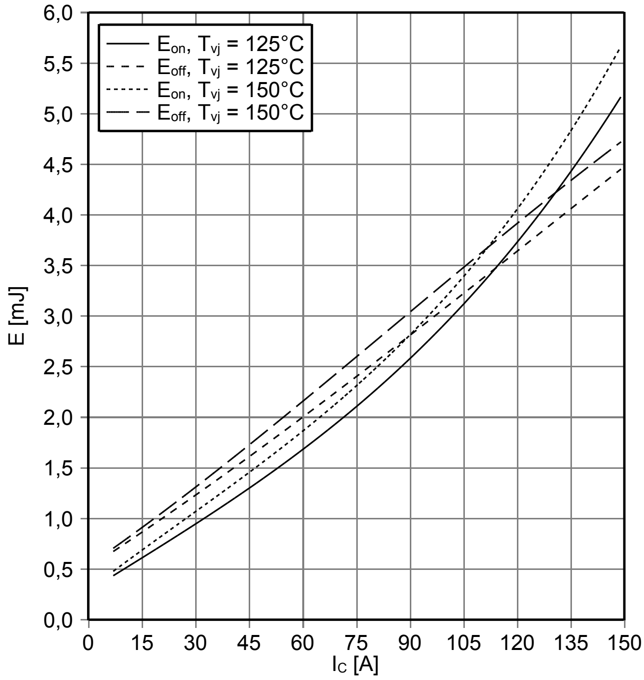
输出特性 IGBT, T2 / T3 （典型)
output characteristic IGBT, T2 / T3 (typical)
$I_C = f(V_{CE})$
$T_{vj} = 150°C$



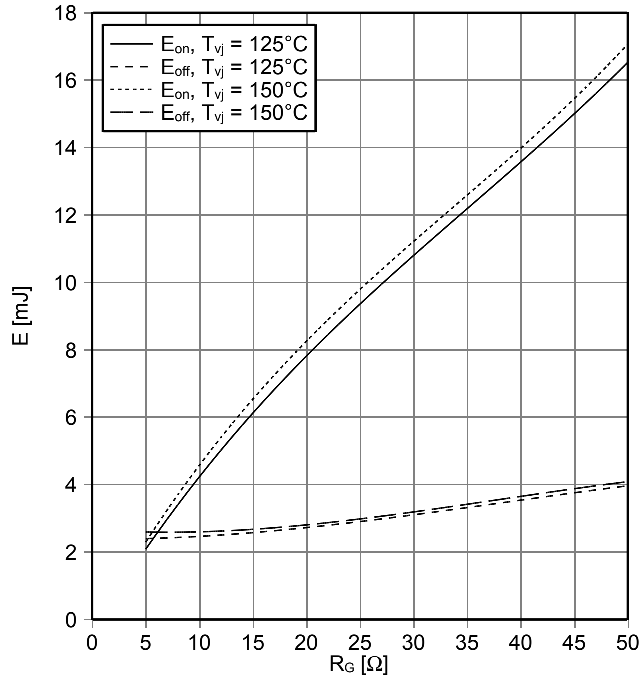
传输特性 IGBT, T2 / T3 (典型)
transfer characteristic IGBT, T2 / T3 (typical)
$I_C = f(V_{GE})$
$V_{CE} = 20\ V$



开关损耗 IGBT, T2 / T3 （典型)
switching losses IGBT, T2 / T3 (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE} = \pm 15\ V$, $R_{Gon} = 5.1\ \Omega$, $R_{Goff} = 5.1\ \Omega$, $V_{CE} = 400\ V$



开关损耗 IGBT, T2 / T3 （典型)
switching losses IGBT, T2 / T3 (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
$V_{GE} = \pm 15\ V$, $I_C = 75\ A$, $V_{CE} = 400\ V$



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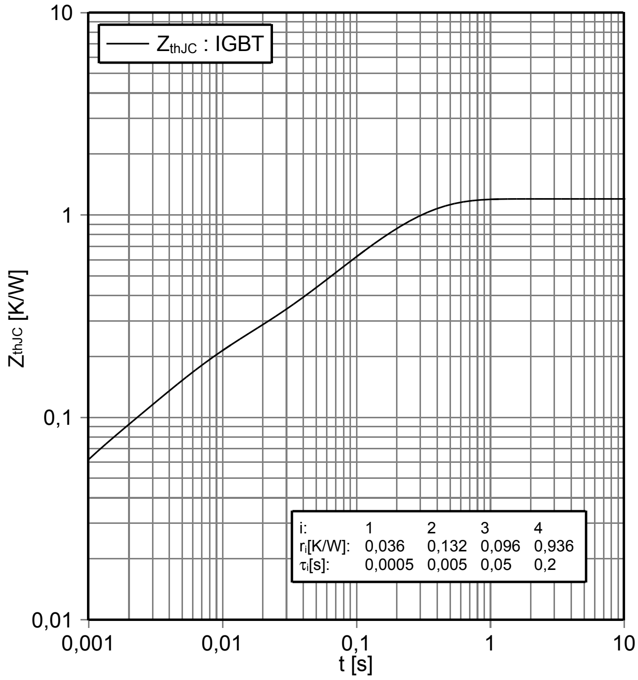
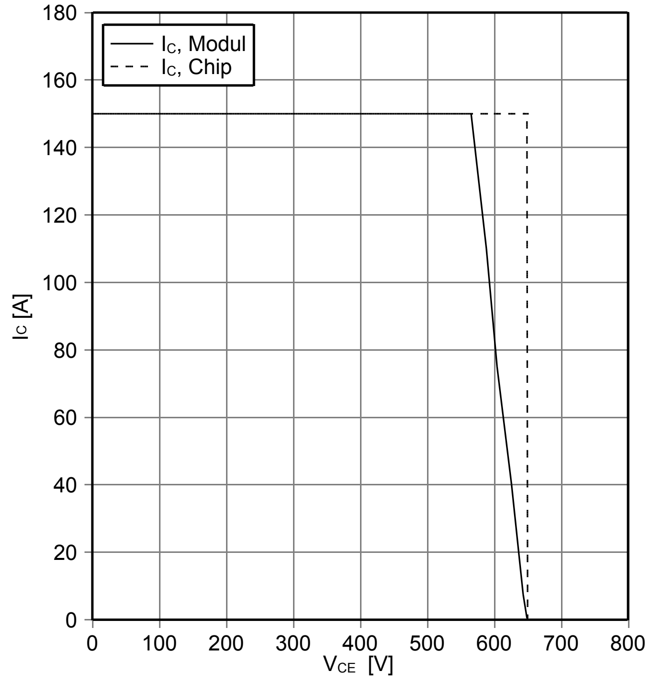
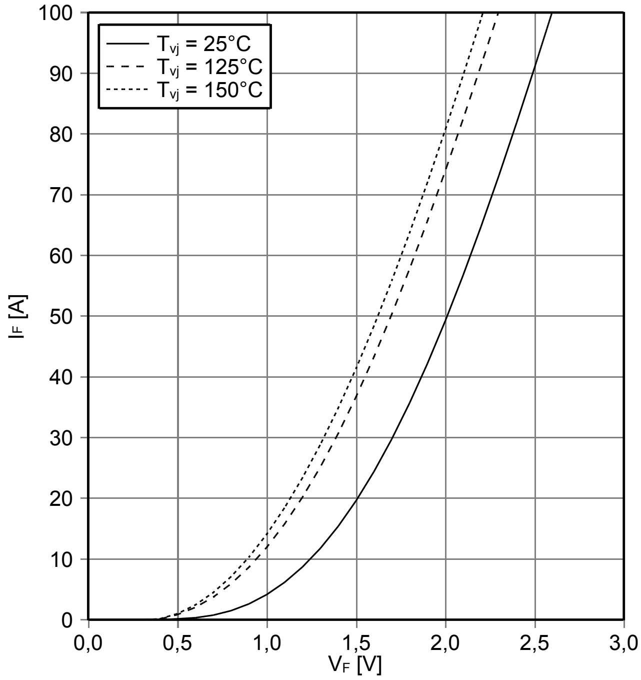
瞬态热阻抗 IGBT, T2 / T3
transient thermal impedance IGBT, T2 / T3
$Z_{thJC} = f(t)$



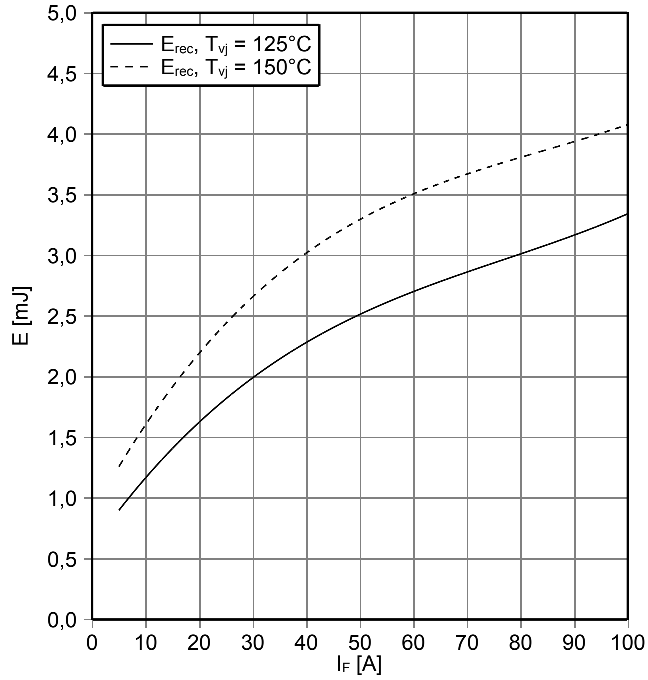
反偏安全工作区 IGBT, T2 / T3 （RBSOA）
reverse bias safe operating area IGBT, T2 / T3 (RBSOA)
$I_C = f(V_{CE})$
$V_{GE} = \pm 15$ V, $R_{Goff} = 5.1\ \Omega$, $T_{vj} = 150°C$



正向偏压特性 二极管, D1 / D4 （典型)
forward characteristic of Diode, D1 / D4 (typical)
$I_F = f(V_F)$



开关损耗 二极管, D1 / D4 （典型)
switching losses Diode, D1 / D4 (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 5.1\ \Omega$, $V_{CE} = 400$ V



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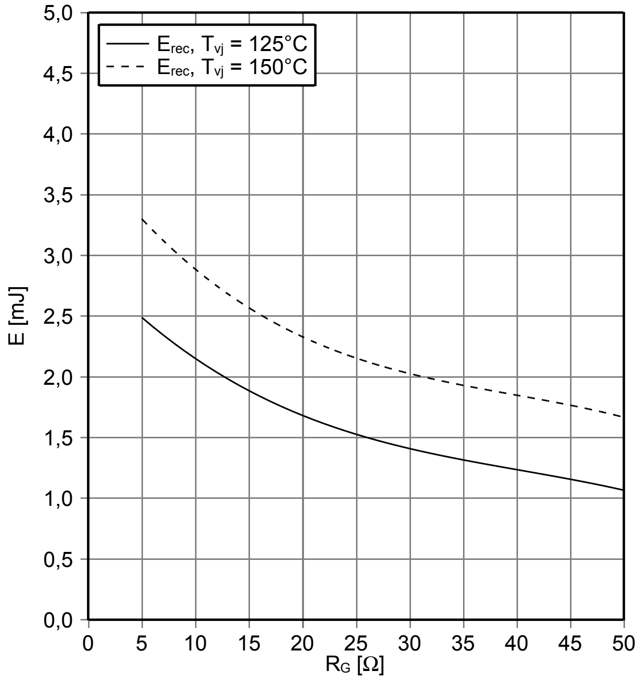
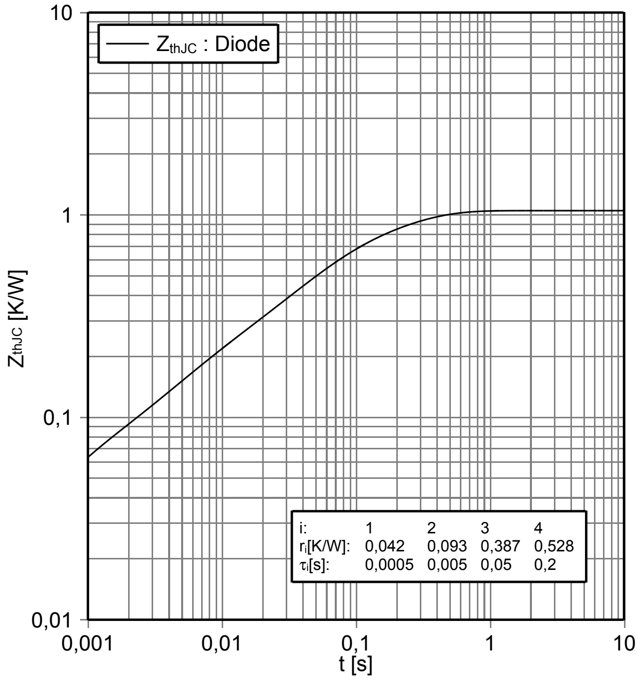
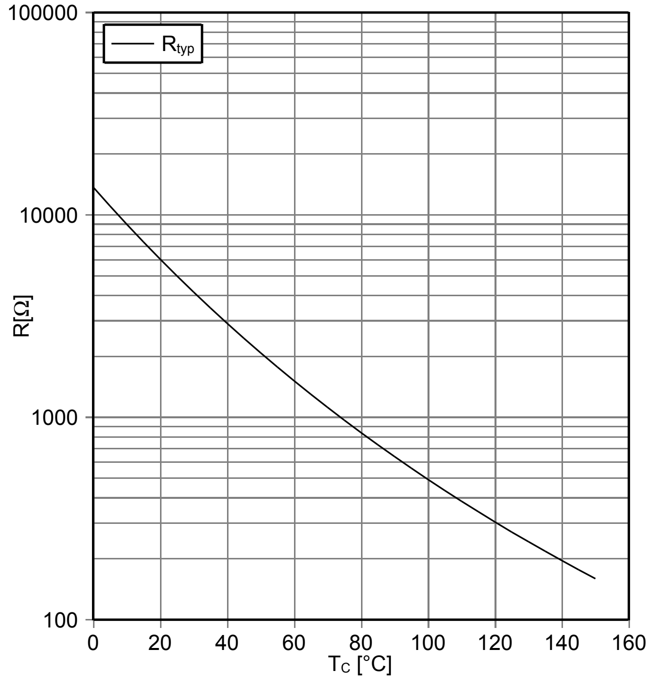
开关损耗 二极管, D1 / D4 （典型)
switching losses Diode, D1 / D4 (typical)
$E_{rec} = f(R_G)$
$I_F = 50\ A$, $V_{CE} = 400\ V$



瞬态热阻抗 二极管, D1 / D4
transient thermal impedance Diode, D1 / D4
$Z_{thJC} = f(t)$



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



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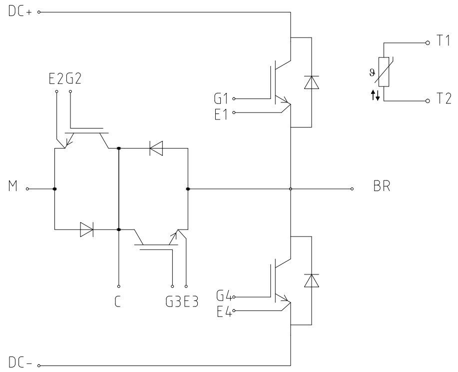
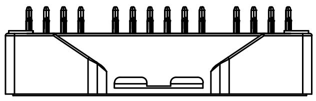
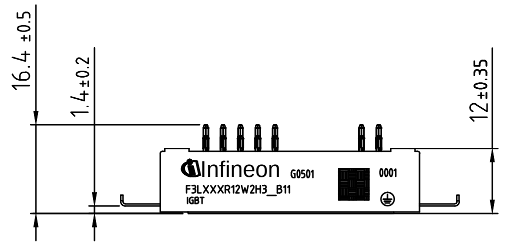
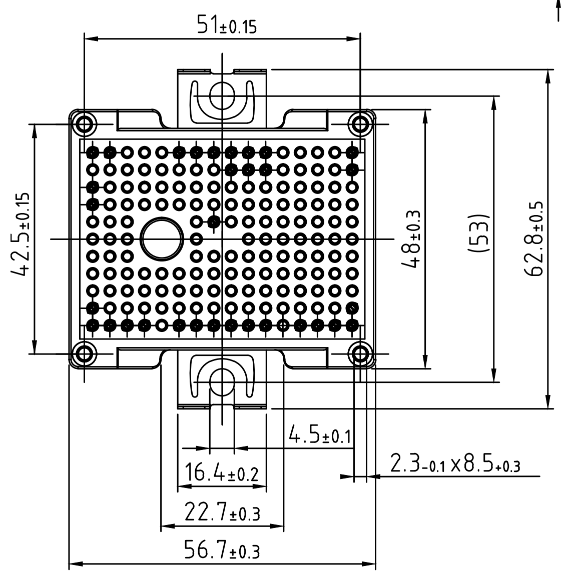
接线图 / circuit_diagram_headline



封装尺寸 / package outlines



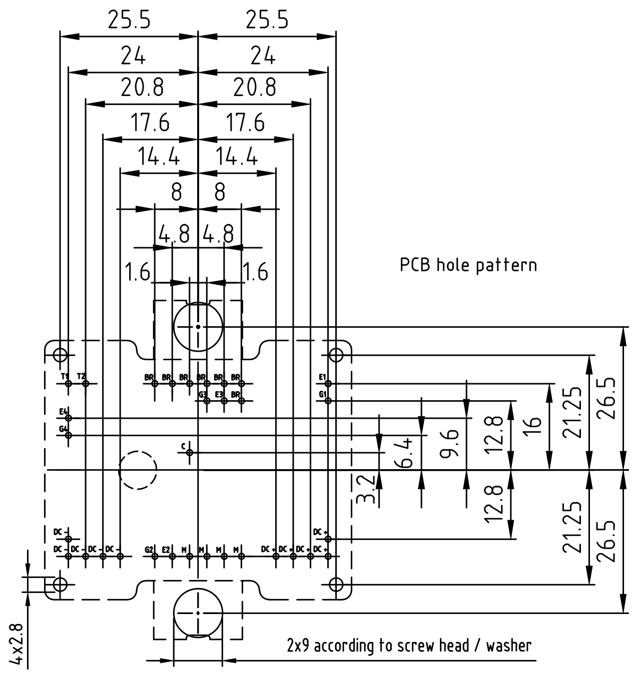




- Pin-Grid 3.2mm
- Tolerance of PCB hole pattern ∅0.1
- Hole specification for contacts see AN 2009-01:

  Diameters of drill Ø 1.15mm

  and copper thickness in hole 25-50µm



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使用条件和条款

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- the conclusion of Quality Agreements;
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