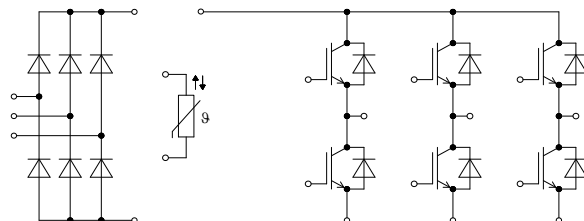
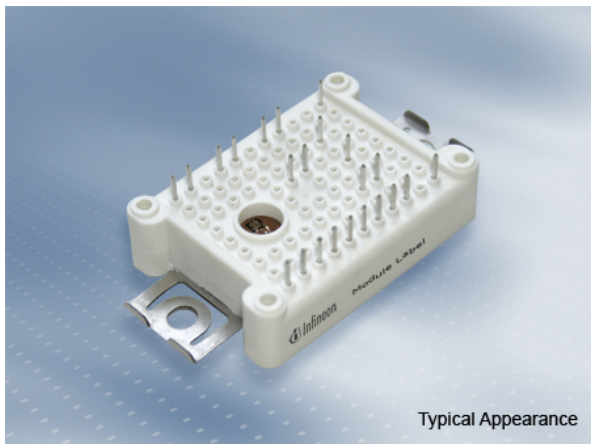


EasyPIM™ モジュール トレンチ/フィールドストップ IGBT4 and エミッターコントロール4 diode内蔵 and NTCサーミスタ

EasyPIM™ module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode and NTC

### 暫定データ / Preliminary Data



$V_{CES} = 1200V$   
 $I_{C\ nom} = 6A / I_{CRM} = 12A$

#### 一般応用

- スタティックインバーター
- 空冷
- モーター駆動

#### Typical Applications

- Auxiliary Inverters
- Air Conditioning
- Motor Drives

#### 電気的特性

- 低スイッチング損失
- トレンチ IGBT 4
- 正温度特性を持った  $V_{CESat}$  飽和電圧
- 低  $V_{CESat}$  飽和電圧

#### Electrical Features

- Low Switching Losses
- Trench IGBT 4
- $V_{CESat}$  with positive Temperature Coefficient
- Low  $V_{CESat}$

#### 機械的特性

- 低熱インピーダンスの  $Al_2O_3$  DCB
- コンパクトデザイン
- 半田接合技術
- 固定用クランプによる強固なマウンティング

#### Mechanical Features

- $Al_2O_3$  Substrate with Low Thermal Resistance
- Compact design
- Solder Contact Technology
- 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

prepared by: DK	date of publication: 2013-10-03	
approved by: MB	revision: 2.3	UL approved (E83335)



暫定データ  
Preliminary Data

IGBT- インバータ / IGBT, Inverter  
最大定格 / Maximum Rated Values

コレクタ・エミッタ間電圧 Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1200	V
連続DCコレクタ電流 Continuous DC collector current	$T_C = 100^{\circ}\text{C}, T_{vj\text{max}} = 175^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj\text{max}} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$ $I_C$	6 12	A A
繰り返しピークコレクタ電流 Repetitive peak collector current	$t_P = 1\text{ms}$	$I_{CRM}$	12	A
トータル損失 Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\text{max}} = 175$	$P_{tot}$	94,0	W
ゲート・エミッタ間ピーク電圧 Gate-emitter peak voltage		$V_{GES}$	+/-20	V

電気的特性 / Characteristic Values

			min.	typ.	max.	
コレクタ・エミッタ間飽和電圧 Collector-emitter saturation voltage	$I_C = 6\text{A}, V_{GE} = 15\text{V}$ $I_C = 6\text{A}, V_{GE} = 15\text{V}$ $I_C = 6\text{A}, V_{GE} = 15\text{V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,50 1,65 1,70	2,25	V V V
ゲート・エミッタ間しきい値電圧 Gate threshold voltage	$I_C = 0,30\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GEth}$	5,2 5,8	6,4	V
ゲート電荷量 Gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$		$Q_G$	0,09		$\mu\text{C}$
内蔵ゲート抵抗 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	0,0		$\Omega$
入力容量 Input capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{ies}$	0,60		nF
帰還容量 Reverse transfer capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{res}$	0,024		nF
コレクタ・エミッタ間遮断電流 Collector-emitter cut-off current	$V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$		$I_{CES}$		1,0	mA
ゲート・エミッタ間漏れ電流 Gate-emitter leakage current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^{\circ}\text{C}$		$I_{GES}$		400	nA
ターンオン遅れ時間 (誘導負荷) Turn-on delay time, inductive load	$I_C = 6\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 47\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{don}$	0,045 0,045 0,045		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオン上昇時間 (誘導負荷) Rise time, inductive load	$I_C = 6\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 47\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	0,045 0,05 0,05		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオフ遅れ時間 (誘導負荷) Turn-off delay time, inductive load	$I_C = 6\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 47\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{doff}$	0,155 0,235 0,275		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオフ下降時間 (誘導負荷) Fall time, inductive load	$I_C = 6\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 47\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	0,17 0,28 0,29		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオンスイッチング損失 Turn-on energy loss per pulse	$I_C = 6\text{A}, V_{CE} = 600\text{V}, L_S = 50\text{nH}$ $V_{GE} = \pm 15\text{V}, di/dt = 500\text{A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 47\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{on}$	0,55 0,85 0,95		mJ mJ mJ
ターンオフスイッチング損失 Turn-off energy loss per pulse	$I_C = 6\text{A}, V_{CE} = 600\text{V}, L_S = 50\text{nH}$ $V_{GE} = \pm 15\text{V}, du/dt = 3500\text{V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 47\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{off}$	0,35 0,50 0,55		mJ mJ mJ
短絡電流 SC data	$V_{GE} \leq 15\text{V}, V_{CC} = 800\text{V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		$I_{SC}$	35		A
ジャンクション・ケース間熱抵抗 Thermal resistance, junction to case	IGBT部 ( 1素子当り ) / per IGBT		$R_{thJC}$	1,45	1,60	K/W
ケース・ヒートシンク間熱抵抗 Thermal resistance, case to heatsink	IGBT部 ( 1素子当り ) / per IGBT $\lambda_{\text{Paste}} = 1\text{W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	1,25		K/W
動作温度 Temperature under switching conditions			$T_{vj\text{op}}$	-40	150	$^{\circ}\text{C}$

prepared by: DK	date of publication: 2013-10-03
approved by: MB	revision: 2.3



暫定データ  
Preliminary Data

Diode、インバータ / Diode, Inverter  
最大定格 / Maximum Rated Values

ピーク繰返し逆電圧 Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	1200	V
連続DC電流 Continuous DC forward current		$I_F$	6	A
ピーク繰返し順電流 Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	12	A
電流二乗時間積 $I^2t$ - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	16,0 14,0	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$

電気的特性 / Characteristic Values

			min.	typ.	max.	
順電圧 Forward voltage	$I_F = 6\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 6\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 6\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_F$	1,45 1,40 1,40	2,25	V V V
ピーク逆回復電流 Peak reverse recovery current	$I_F = 6\text{ A}, -di_F/dt = 500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$I_{RM}$	12,0 10,0 10,0		A A A
逆回復電荷量 Recovered charge	$I_F = 6\text{ A}, -di_F/dt = 500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$Q_r$	0,80 1,40 1,60		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
逆回復損失 Reverse recovery energy	$I_F = 6\text{ A}, -di_F/dt = 500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{rec}$	0,21 0,41 0,48		mJ mJ mJ
ジャンクション・ケース間熱抵抗 Thermal resistance, junction to case	/Diode ( 1 素子当り ) / per diode		$R_{thJC}$	2,00	2,20	K/W
ケース・ヒートシンク間熱抵抗 Thermal resistance, case to heatsink	/Diode ( 1 素子当り ) / per diode $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	1,35		K/W
動作温度 Temperature under switching conditions			$T_{vj op}$	-40	150	$^{\circ}\text{C}$

Diode、整流器 / Diode, Rectifier  
最大定格 / Maximum Rated Values

ピーク繰返し逆電圧 Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	1600	V
最大実効順電流/chip Maximum RMS forward current per chip	$T_C = 80^{\circ}\text{C}$	$I_{FRMSM}$	30	A
整流出力の最大実効電流 Maximum RMS current at rectifier output	$T_C = 80^{\circ}\text{C}$	$I_{RMSM}$	30	A
サージ順電流 Surge forward current	$t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I_{FSM}$	300 245	A A
電流二乗時間積 $I^2t$ - value	$t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	450 300	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$

電気的特性 / Characteristic Values

			min.	typ.	max.	
順電圧 Forward voltage	$T_{vj} = 150^{\circ}\text{C}, I_F = 6\text{ A}$	$V_F$		0,75		V
逆電流 Reverse current	$T_{vj} = 150^{\circ}\text{C}, V_R = 1600\text{ V}$	$I_R$		1,00		mA
ジャンクション・ケース間熱抵抗 Thermal resistance, junction to case	/Diode ( 1 素子当り ) / per diode		$R_{thJC}$	1,20	1,35	K/W
ケース・ヒートシンク間熱抵抗 Thermal resistance, case to heatsink	/Diode ( 1 素子当り ) / per diode $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	1,15		K/W
動作温度 Temperature under switching conditions			$T_{vj op}$	-40	150	$^{\circ}\text{C}$

prepared by: DK	date of publication: 2013-10-03
approved by: MB	revision: 2.3



暫定データ  
Preliminary Data

NTC-サーミスタ / NTC-Thermistor  
電気的特性 / Characteristic Values

			min.	typ.	max.	
定格抵抗値 Rated resistance	$T_C = 25^\circ\text{C}$	$R_{25}$		5,00		k $\Omega$
R100の偏差 Deviation of R100	$T_C = 100^\circ\text{C}, R_{100} = 493 \Omega$	$\Delta R/R$	-5		5	%
損失 Power dissipation	$T_C = 25^\circ\text{C}$	$P_{25}$			20,0	mW
B-定数 B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	$B_{25/50}$		3375		K
B-定数 B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$	$B_{25/80}$		3411		K
B-定数 B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$	$B_{25/100}$		3433		K

適切なアプリケーションノートによる仕様  
Specification according to the valid application note.

モジュール / Module

絶縁耐圧 Isolation test voltage	RMS, f = 50 Hz, t = 1 min	$V_{ISOL}$		2,5		kV
内部絶縁 Internal isolation	基礎絶縁 (クラス1, IEC 61140) basic insulation (class 1, IEC 61140)			$Al_2O_3$		
沿面距離 Creepage distance	連絡方法 - ヒートシンク / terminal to heatsink 連絡方法 - 連絡方法 / terminal to terminal			11,5 6,3		mm
空間距離 Clearance	連絡方法 - ヒートシンク / terminal to heatsink 連絡方法 - 連絡方法 / terminal to terminal			10,0 5,0		mm
相対トラッキング指数 Comperative tracking index		CTI		> 200		
			min.	typ.	max.	
内部インダクタンス Stray inductance module		$L_{sCE}$		30		nH
パワーターミナル・チップ間抵抗 Module lead resistance, terminals - chip	$T_C = 25^\circ\text{C}$ , /スイッチ / per switch	$R_{CC+EE}$ $R_{AA+CC}$		8,00 6,00		m $\Omega$
最大ジャンクション温度 Maximum junction temperature	インバータ、ブレーキチョッパー / inverter, brake-chopper 整流器 / rectifier	$T_{vj \max}$			175 150	$^\circ\text{C}$ $^\circ\text{C}$
動作温度 Temperature under switching conditions	インバータ、ブレーキチョッパー / inverter, brake-chopper 整流器 / rectifier	$T_{vj \text{ op}}$	-40 -40		150 150	$^\circ\text{C}$ $^\circ\text{C}$
保存温度 Storage temperature		$T_{stg}$	-40		125	$^\circ\text{C}$
Anpresskraft für mech. Bef. pro Feder mountig force per clamp		F	20	-	50	N
質量 Weight		G		24		g

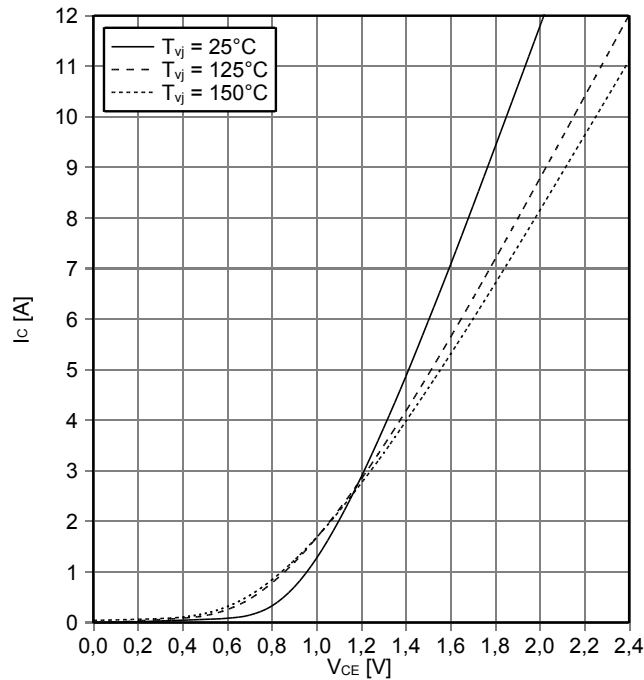
Der Strom im Dauerbetrieb ist auf 30A effektiv pro Anschlusspin begrenzt.  
The current under continuous operation is limited to 30A rms per connector pin.

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暫定データ  
Preliminary Data

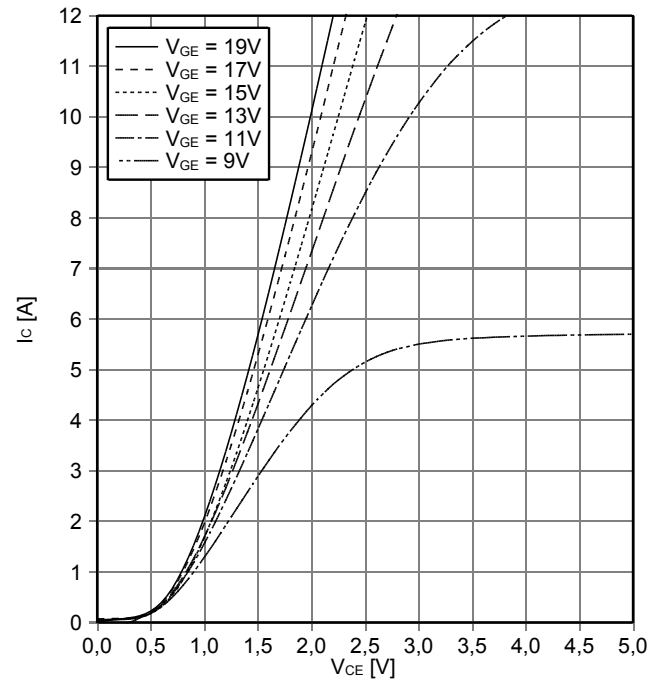
出力特性 IGBT- インバータ (Typical)  
output characteristic IGBT, Inverter (typical)

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



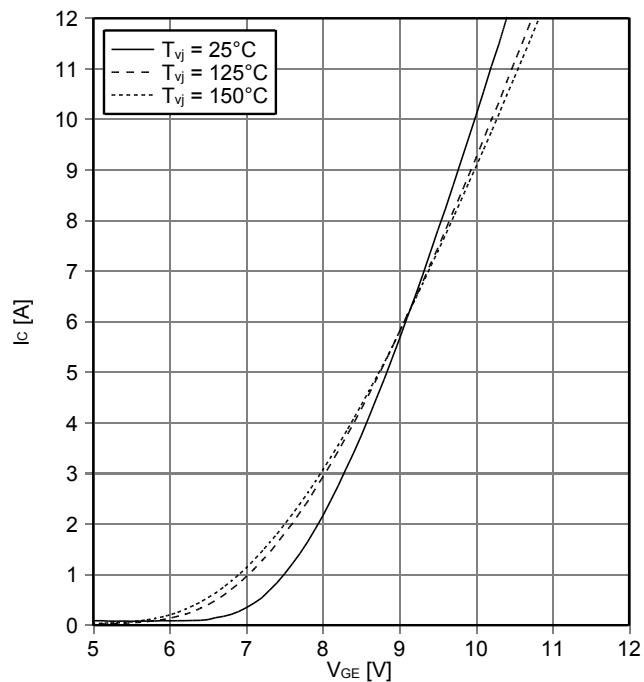
出力特性 IGBT- インバータ (Typical)  
output characteristic IGBT, Inverter (typical)

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



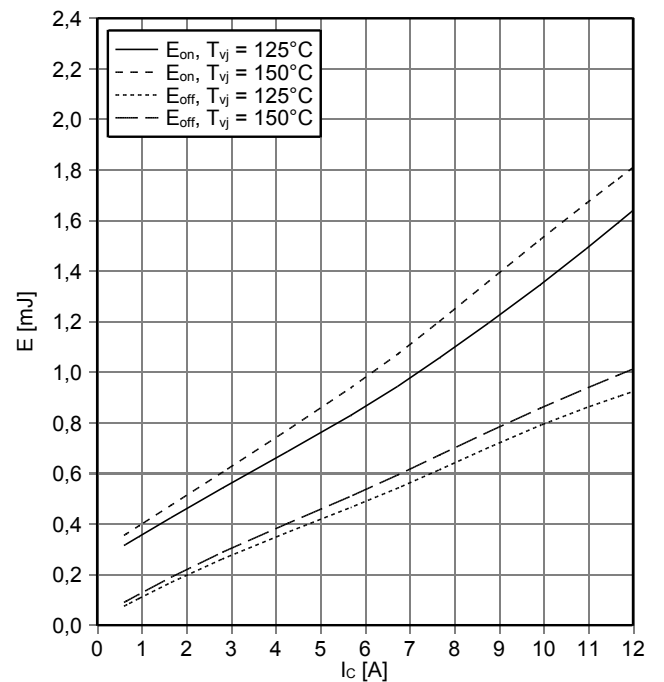
伝達特性 IGBT- インバータ (Typical)  
transfer characteristic IGBT, Inverter (typical)

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



スイッチング損失 IGBT- インバータ (Typical)  
switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C), E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 47\ \Omega, R_{Goff} = 47\ \Omega, V_{CE} = 600\text{ V}$



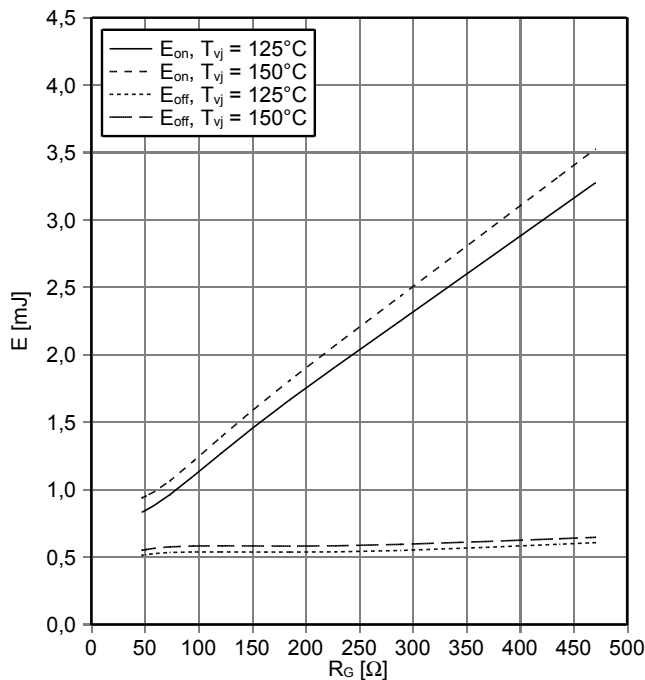
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暫定データ  
Preliminary Data

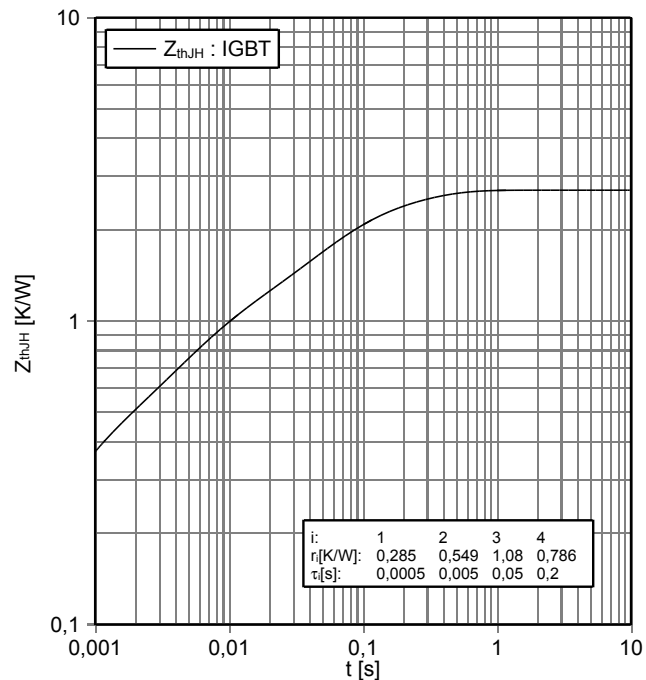
スイッチング損失 IGBT- インバータ (Typical)  
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15 V, I_C = 6 A, V_{CE} = 600 V$



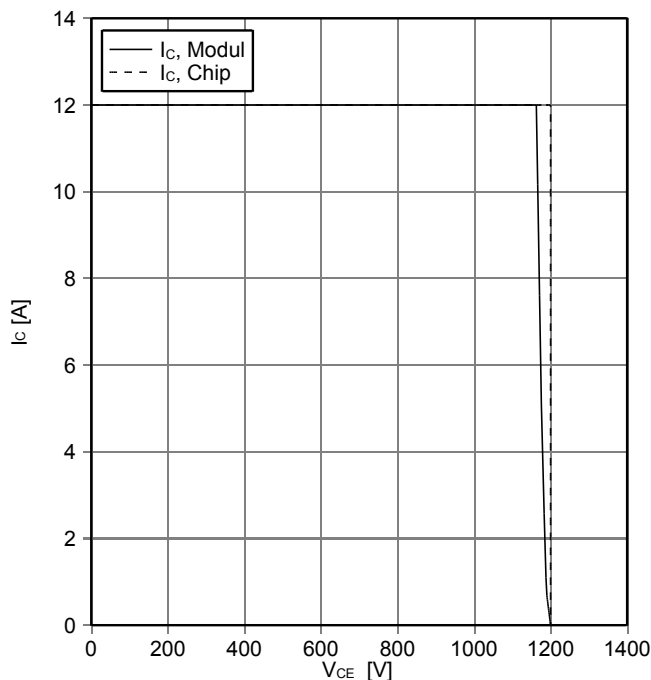
過渡熱インピーダンス IGBT- インバータ  
transient thermal impedance IGBT, Inverter

$Z_{thJH} = f(t)$



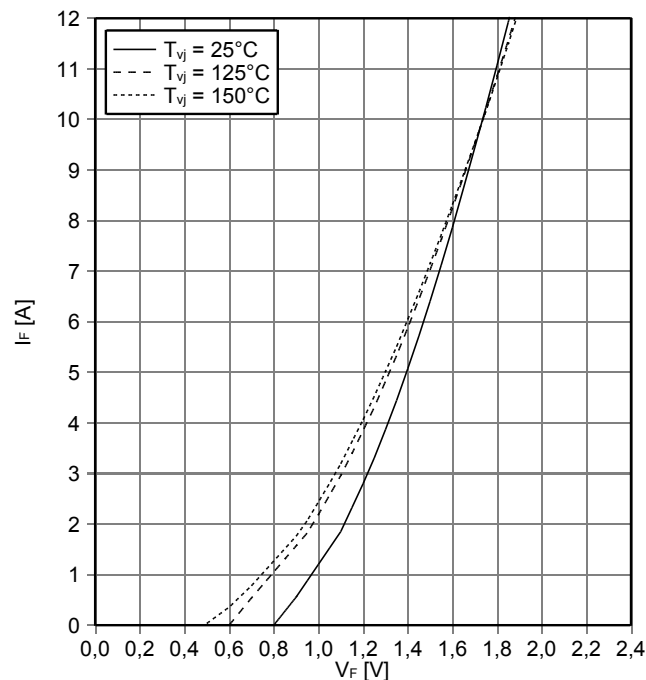
逆バイアス安全動作領域 IGBT- インバータ (RBSOA)  
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15 V, R_{Goff} = 47 \Omega, T_{vj} = 150^\circ C$



順電圧特性 Diode、インバータ (typical)  
forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$



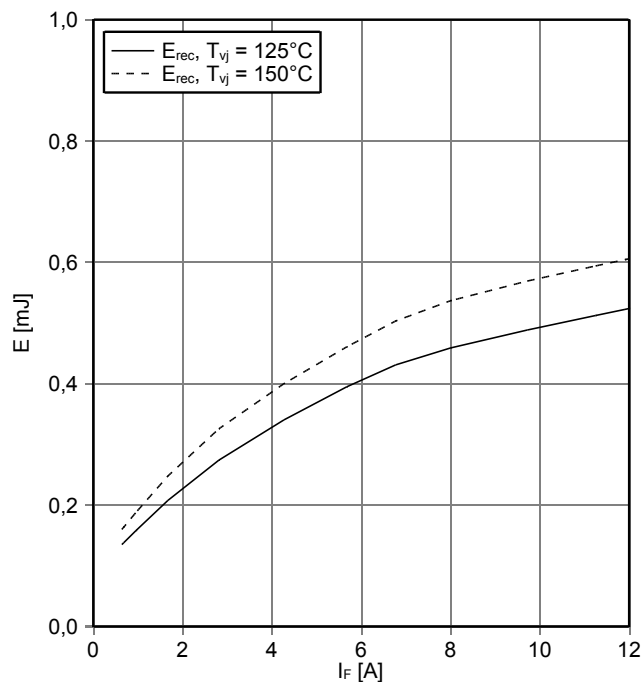
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暫定データ  
Preliminary Data

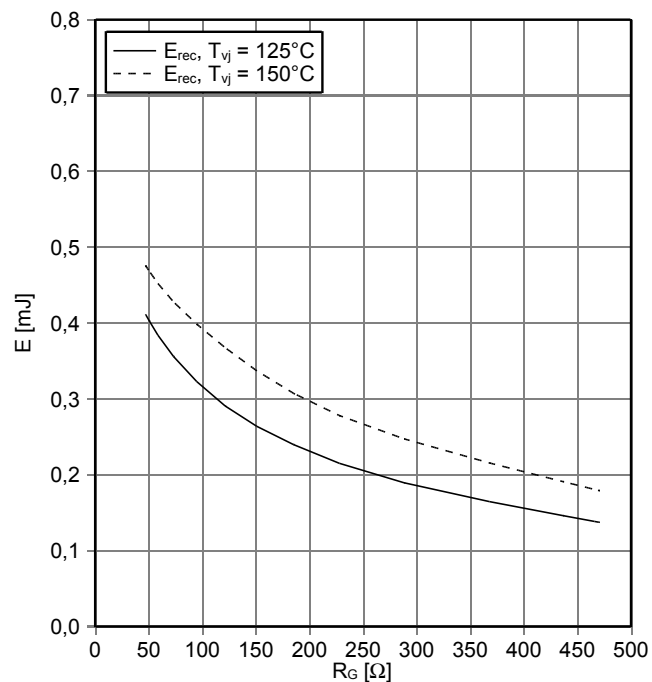
スイッチング損失 Diode、インバータ (Typical)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 47 \Omega, V_{CE} = 600 V$



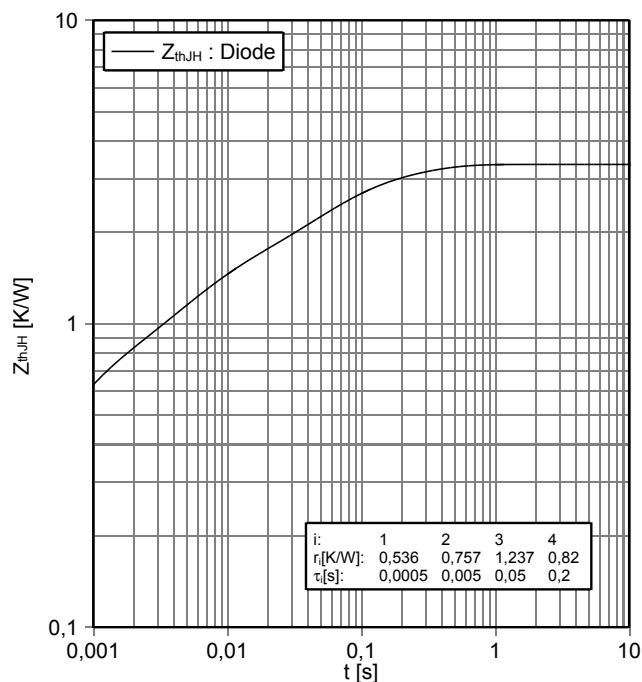
スイッチング損失 Diode、インバータ (Typical)  
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$   
 $I_F = 6 A, V_{CE} = 600 V$



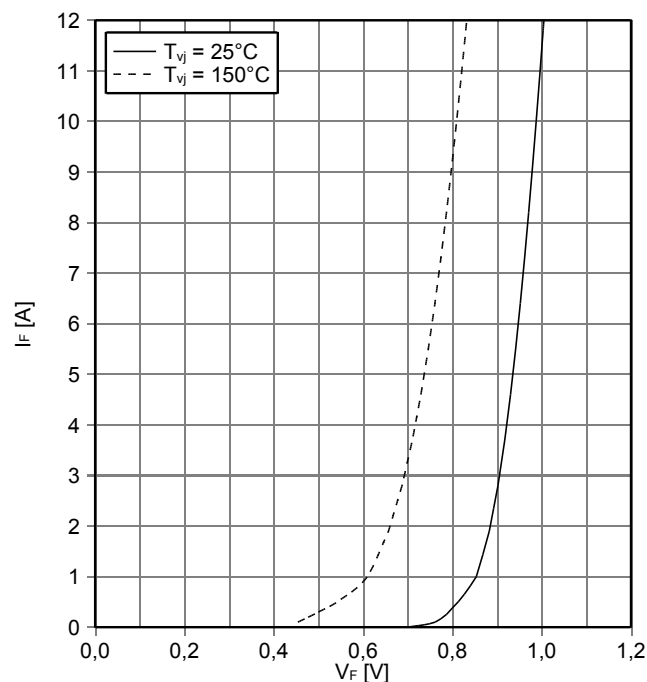
過渡熱インピーダンス Diode、インバータ  
transient thermal impedance Diode, Inverter

$Z_{thJH} = f(t)$



順方向特性 Diode、整流器 (典型)  
forward characteristic of Diode, Rectifier (typical)

$I_F = f(V_F)$

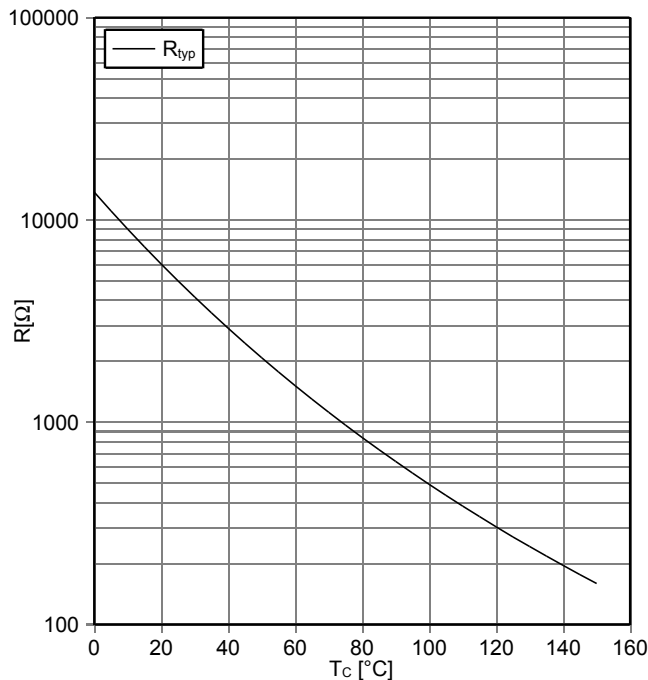


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approved by: MB	revision: 2.3



暫定データ  
Preliminary Data

NTC-サーミスタ サーミスタの温度特性  
NTC-Thermistor-temperature characteristic (typical)  
 $R = f(T)$

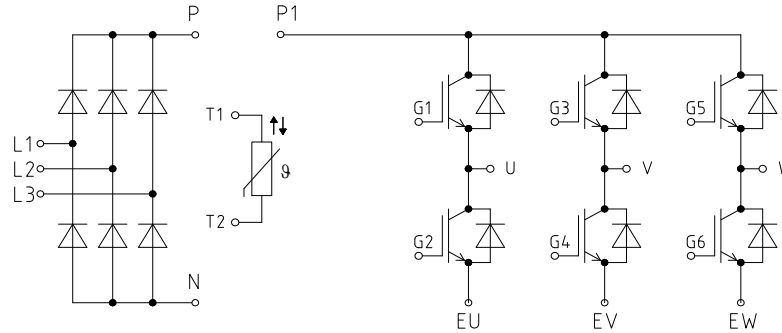


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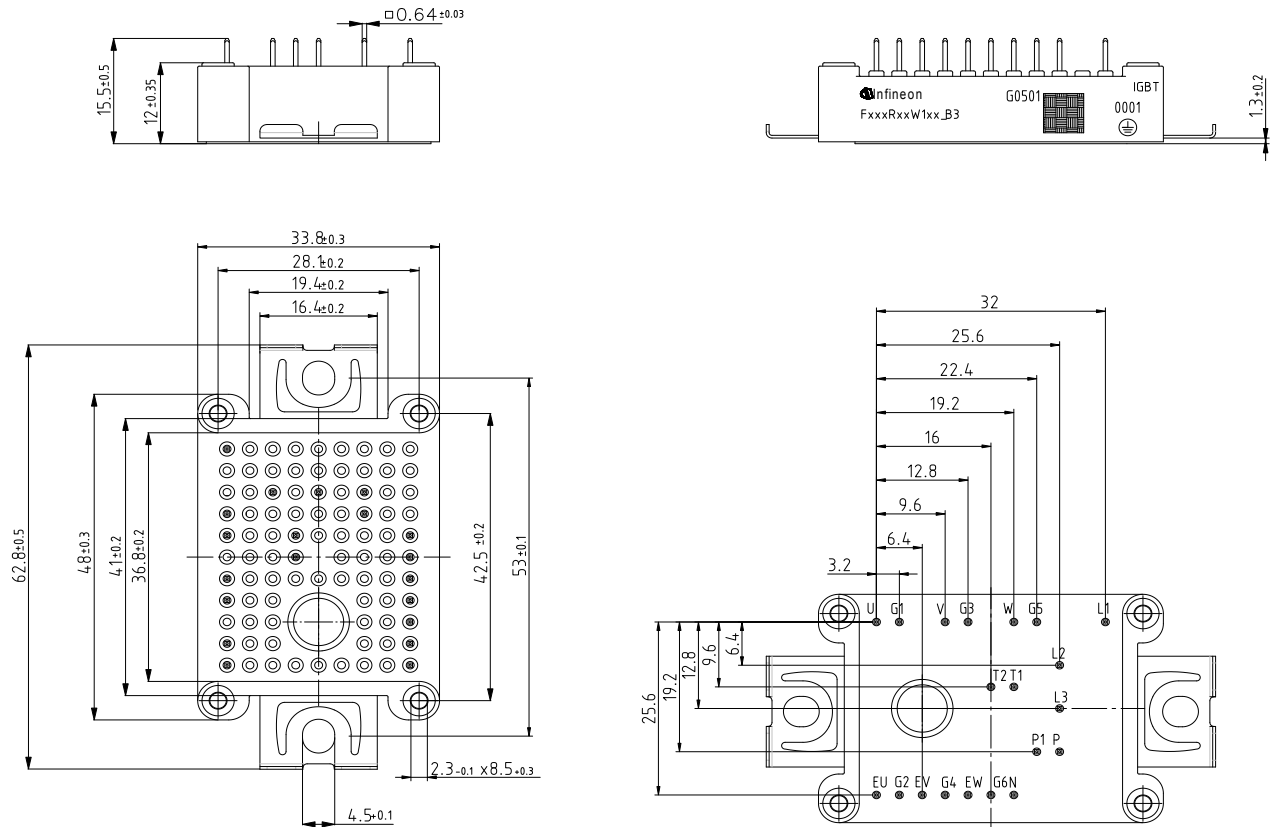


暫定データ  
Preliminary Data

回路図 / circuit\_diagram\_headline



パッケージ概要 / package outlines



Pinpositions with tolerance  $\pm 0.4$

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