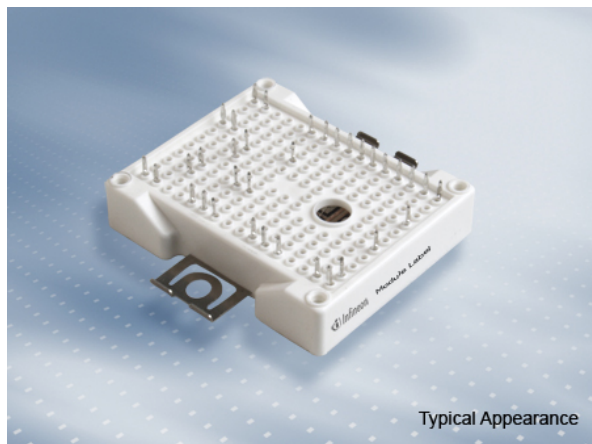


EasyPACK モジュール and PressFIT / NTCサーミスタ  
EasyPACK module and PressFIT / NTC



#### 一般応用

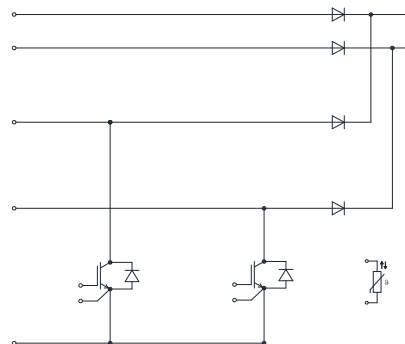
- ソーラーアプリケーション

#### 電気的特性

- 
- 高速IGBT H3
- 低スイッチング損失

#### 機械的特性

- 3 kV AC 1分 絶縁耐圧
- 低熱インピーダンスの Al<sub>2</sub>O<sub>3</sub> DCB
- 内蔵されたNTCサーミスタ
- コンパクトデザイン
- PressFIT 接合 技術



$$V_{CES} = 1200V$$

$$I_{C\text{ nom}} = 80A / I_{CRM} = 160A$$

#### Typical Applications

- Solar applications

#### Electrical Features

- CoolSiC (TM) Schottky diode gen 5
- High speed IGBT H3
- Low switching losses

#### Mechanical Features

- 3 kV AC 1min insulation
- Al<sub>2</sub>O<sub>3</sub> substrate with low thermal resistance
- Integrated NTC temperature sensor
- Compact design
- PressFIT contact technology

### 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

## バイパスダイオード / Bypass-Diode

## 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
最大実効順電流/chip Maximum RMS forward current per chip	$T_H = 60^{\circ}\text{C}$	$I_{FRMSM}$	50	A
整流出力の最大実効電流 Maximum RMS current at rectifier output	$T_H = 60^{\circ}\text{C}$	$I_{RMSM}$	60	A
サージ順電流 Surge forward current	$t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I_{FSM}$	450 360	A A
電流二乗時間積 $I^2t$ - value	$t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	1000 650	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$

## 電気的特性 / Characteristic Values

		min. typ. max.			
順電圧 Forward voltage	$T_{vj} = 150^{\circ}\text{C}, I_F = 30\text{ A}$	$V_F$		0,95	V
逆電流 Reverse current	$T_{vj} = 150^{\circ}\text{C}, V_R = 1200\text{ V}$	$I_R$		0,10	mA
ジャンクション・ヒートシンク間熱抵抗 Thermal resistance, junction to heatsink	/Diode ( 1 素子当り ) / per diode	$R_{thJH}$		1,60	K/W
動作温度 Temperature under switching conditions		$T_{vj\text{ op}}$	-40		150 $^{\circ}\text{C}$

## 逆極性保護diodeA / Inverse-polarity protection diode A

## 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
最大実効順電流/chip Maximum RMS forward current per chip	$T_H = 75^{\circ}\text{C}$	$I_{FRMSM}$	30	A
整流出力の最大実効電流 Maximum RMS current at rectifier output	$T_H = 75^{\circ}\text{C}$	$I_{RMSM}$	60	A
サージ順電流 Surge forward current	$t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I_{FSM}$	290 245	A A
電流二乗時間積 $I^2t$ - value	$t_p = 10\text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	420 300	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$

## 電気的特性 / Characteristic Values

		min. typ. max.			
順電圧 Forward voltage	$T_{vj} = 150^{\circ}\text{C}, I_F = 20\text{ A}$	$V_F$		1,00	V
逆電流 Reverse current	$T_{vj} = 150^{\circ}\text{C}, V_R = 1200\text{ V}$	$I_R$		0,10	mA
ジャンクション・ヒートシンク間熱抵抗 Thermal resistance, junction to heatsink	/Diode ( 1 素子当り ) / per diode	$R_{thJH}$		2,35	K/W
動作温度 Temperature under switching conditions		$T_{vj\text{ op}}$	-40		150 $^{\circ}\text{C}$

## IGBT、チヨッパー / IGBT-Chopper 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
コレクタ電流 Implemented collector current		$I_{CN}$	40	A
連続DCコレクタ電流 Continuous DC collector current	$T_H = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$	20	A
繰り返しピークコレクタ電流 Repetitive peak collector current	$t_p = 1\text{ms}$	$I_{CRM}$	80	A
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	$I_C = 20\text{A}, V_{GE} = 15\text{V}$ $I_C = 20\text{A}, V_{GE} = 15\text{V}$ $I_C = 20\text{A}, V_{GE} = 15\text{V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,55 1,70 1,75	1,70	V V V
ゲート・エミッタ間しきい値電圧 Gate threshold voltage	$I_C = 1,00\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{G\text{eth}}$	5,00	5,80	6,50 V
ゲート電荷量 Gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$		$Q_G$	0,32		$\mu\text{C}$
内蔵ゲート抵抗 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{G\text{int}}$	0,0		$\Omega$
入力容量 Input capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{\text{ies}}$	2,35		nF
帰還容量 Reverse transfer capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{\text{res}}$	0,13		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	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^{\circ}\text{C}$		$I_{GES}$		100	nA
ターンオン遅れ時間 (誘導負荷) Turn-on delay time, inductive load	$I_C = 20\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{G\text{on}} = 12\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{on}}$	0,025 0,025 0,028		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオン上昇時間 (誘導負荷) Rise time, inductive load	$I_C = 20\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{G\text{on}} = 12\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	0,01 0,012 0,012		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオフ遅れ時間 (誘導負荷) Turn-off delay time, inductive load	$I_C = 20\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{G\text{off}} = 12\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{off}}$	0,25 0,32 0,35		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオフ下降時間 (誘導負荷) Fall time, inductive load	$I_C = 20\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{G\text{off}} = 12\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	0,016 0,023 0,025		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオンスイッチング損失 Turn-on energy loss per pulse	$I_C = 20\text{A}, V_{CE} = 600\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, di/dt = 1800\text{A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{G\text{on}} = 12\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{\text{on}}$	0,26 0,32 0,35		mJ mJ mJ
ターンオフスイッチング損失 Turn-off energy loss per pulse	$I_C = 20\text{A}, V_{CE} = 600\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, du/dt = 3000\text{V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{G\text{off}} = 12\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{\text{off}}$	0,80 1,20 1,40		mJ mJ mJ
短絡電流 SC data	$V_{GE} \leq 15\text{V}, V_{CC} = 800\text{V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_p \leq 10\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		$I_{SC}$	130		A
ジャンクション・ヒートシンク間熱抵抗 Thermal resistance, junction to heatsink	IGBT部 ( 1素子当り ) / per IGBT		$R_{th\text{JH}}$	1,10		K/W
動作温度 Temperature under switching conditions			$T_{vj\text{op}}$	-40	150	$^{\circ}\text{C}$

## Diode-、チヨツパー / Diode-Chopper

### 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		$I_F$	15	A
ピーク繰返し順電流 Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	30	A
電流二乗時間積 $I^2t$ - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$	$I^2t$	40,0	$\text{A}^2\text{s}$

### 電気的特性 / Characteristic Values

			min.	typ.	max.	
順電圧 Forward voltage	$I_F = 15\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		1,45	1,75	V
	$I_F = 15\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 125^{\circ}\text{C}$	$V_F$	1,75		V
	$I_F = 15\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 150^{\circ}\text{C}$		1,85		V
ピーク逆回復電流 Peak reverse recovery current	$I_F = 15\text{ A}, -di_F/dt = 1800\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		5,00		A
		$T_{vj} = 125^{\circ}\text{C}$	$I_{RM}$	5,00		A
		$T_{vj} = 150^{\circ}\text{C}$		5,00		A
逆回復電荷量 Recovered charge	$I_F = 15\text{ A}, -di_F/dt = 1800\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		0,15		$\mu\text{C}$
		$T_{vj} = 125^{\circ}\text{C}$	$Q_r$	0,25		$\mu\text{C}$
		$T_{vj} = 150^{\circ}\text{C}$		0,25		$\mu\text{C}$
逆回復損失 Reverse recovery energy	$I_F = 15\text{ A}, -di_F/dt = 1800\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		0,03		mJ
		$T_{vj} = 125^{\circ}\text{C}$	$E_{rec}$	0,03		mJ
		$T_{vj} = 150^{\circ}\text{C}$		0,03		mJ
ジャンクション・ヒートシンク間熱抵抗 Thermal resistance, junction to heatsink	/Diode ( 1 素子当り ) / per diode	$R_{thJH}$		1,57		K/W
動作温度 Temperature under switching conditions		$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

## 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	$T_{NTC} = 25^{\circ}\text{C}$	$R_{25}$		5,00		k $\Omega$
R100の偏差 Deviation of R100	$T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493\ \Omega$	$\Delta R/R$	-5		5	%
損失 Power dissipation	$T_{NTC} = 25^{\circ}\text{C}$	$P_{25}$			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

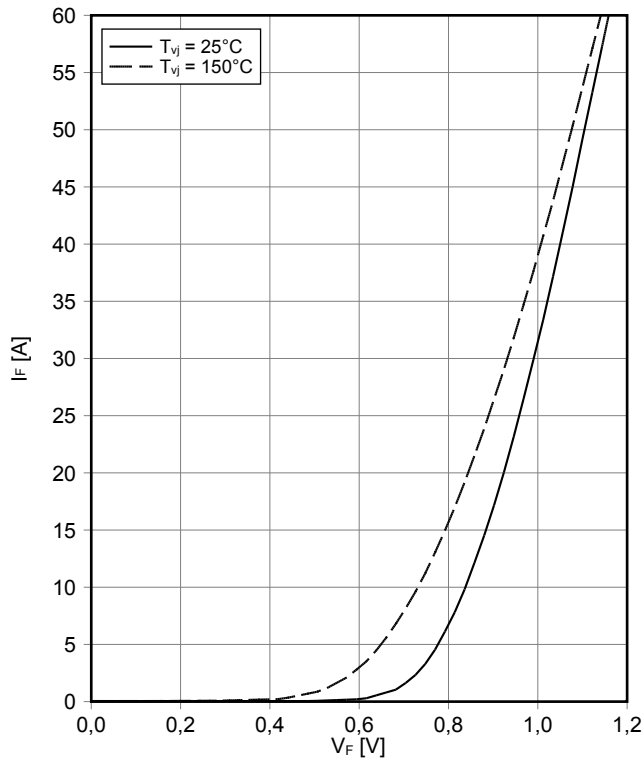
Specification according to the valid application note.

## モジュール / Module

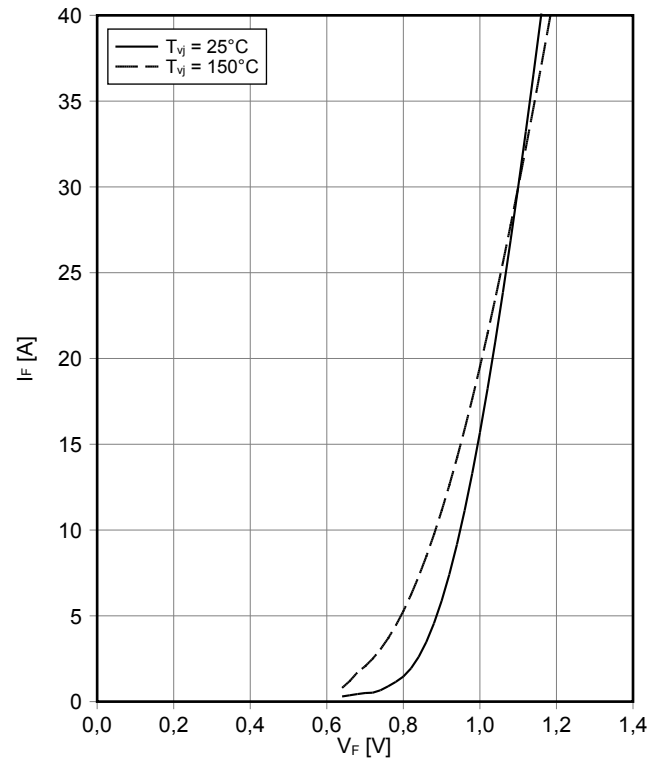
絶縁耐圧 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V <sub>ISOL</sub>	3,0			kV
内部絶縁 Internal isolation	基礎絶縁 (クラス1, IEC 61140) basic insulation (class 1, IEC 61140)		Al <sub>2</sub> O <sub>3</sub>			
沿面距離 Creepage distance	連絡方法 - ヒートシンク / terminal to heatsink 連絡方法 - 連絡方法 / terminal to terminal		11,5 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 <sub>sCE</sub>		20		nH
保存温度 Storage temperature		T <sub>stg</sub>	-40		125	°C
Anpresskraft für mech. Bef. pro Feder mounting force per clamp		F	40	-	80	N
質量 Weight		G		36		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.

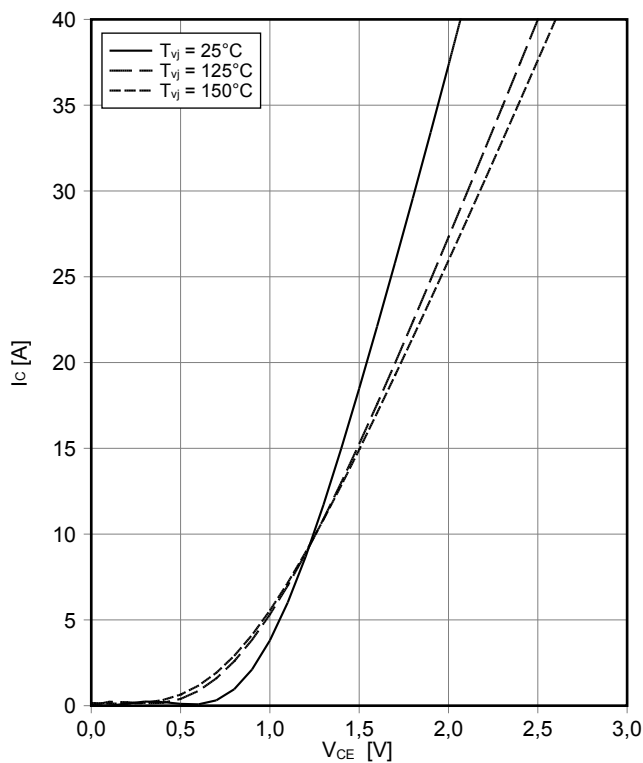
順方向特性 バイパスダイオード ( 典型 )  
 forward characteristic of Bypass-Diode (typical)  
 $I_F = f(V_F)$



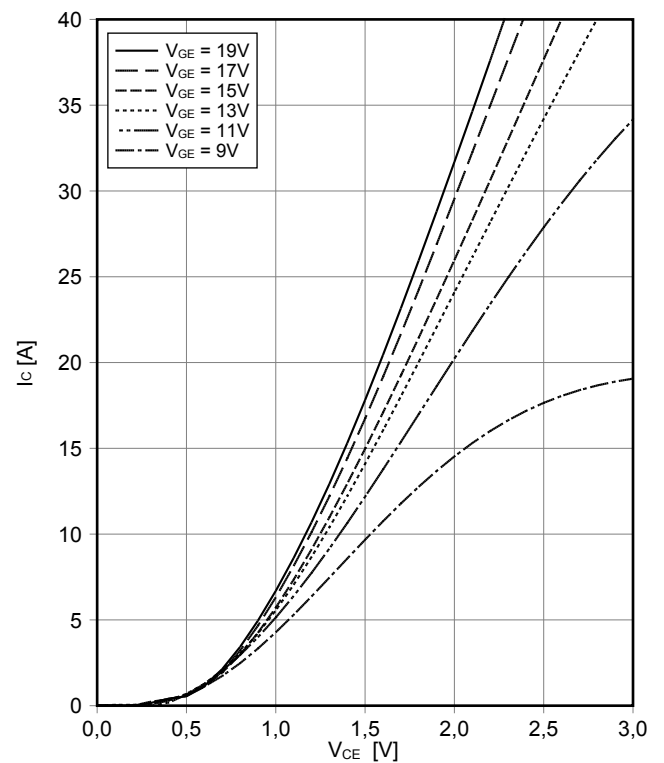
順方向特性 逆極性保護diodeA ( 典型 )  
 forward characteristic of Inverse-polarity protection diode A (typical)  
 $I_F = f(V_F)$



出力特性 IGBT、チヨツパー (Typical)  
 output characteristic IGBT-Chopper (typical)  
 $I_C = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$

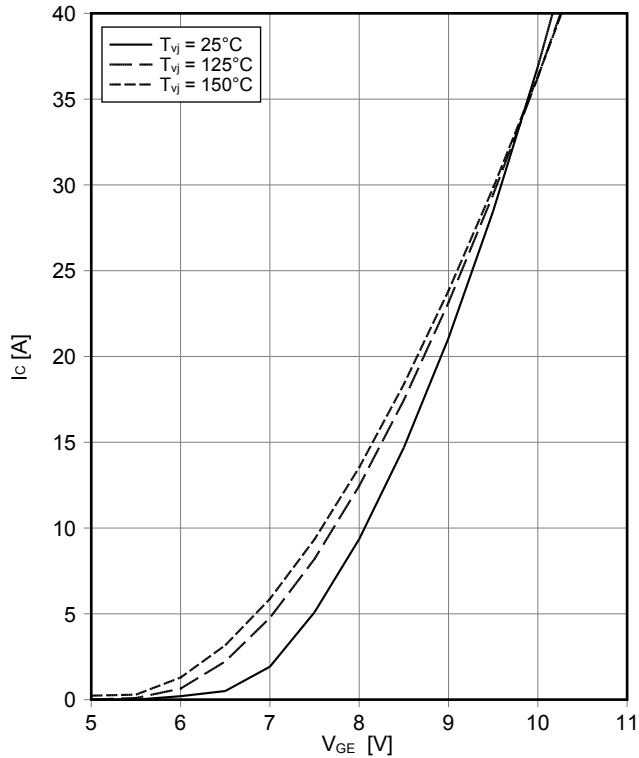


出力特性 IGBT、チヨツパー (Typical)  
 output characteristic IGBT-Chopper (typical)  
 $I_C = f(V_{CE})$   
 $T_{vj} = 150^\circ\text{C}$



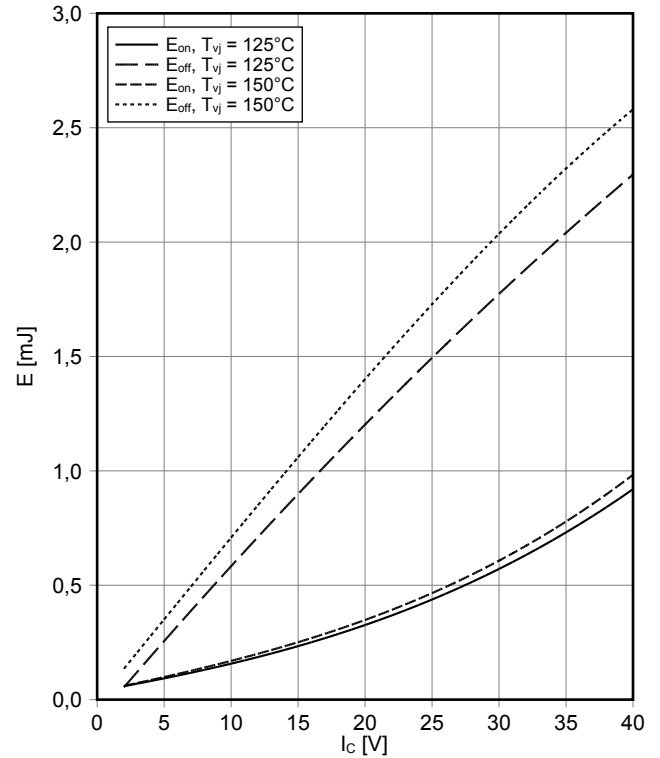
**伝達特性 IGBT、チョッパー (Typical)**  
**transfer characteristic IGBT-Chopper (typical)**

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



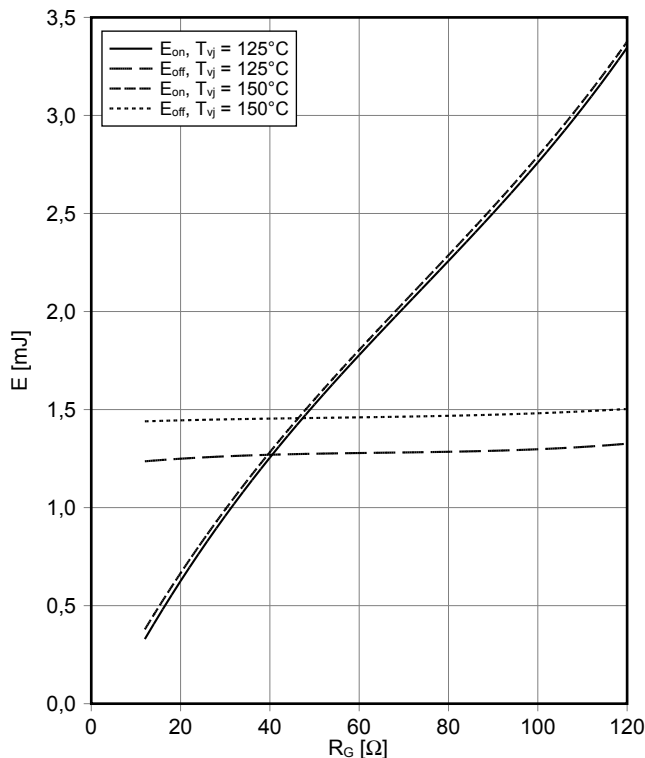
**スイッチング損失 IGBT、チョッパー (Typical)**  
**switching losses IGBT-Chopper (typical)**

$E_{on} = f(I_C), E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 12\ \Omega, R_{Goff} = 12\ \Omega, V_{CE} = 600\text{ V}$



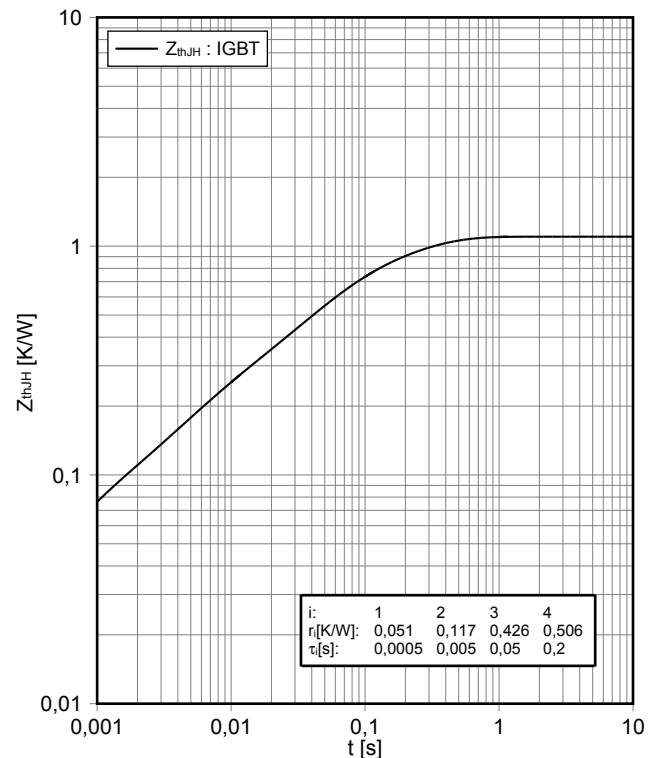
**スイッチング損失 IGBT、チョッパー (Typical)**  
**switching losses IGBT-Chopper (typical)**

$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 20\text{ A}, V_{CE} = 600\text{ V}$



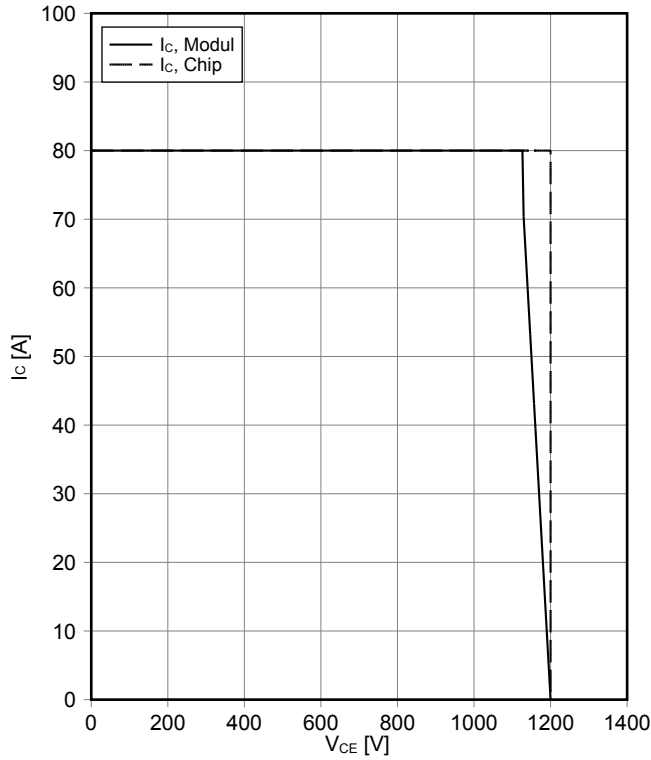
**過渡熱インピーダンス IGBT、チョッパー**  
**transient thermal impedance IGBT-Chopper**

$Z_{thJH} = f(t)$



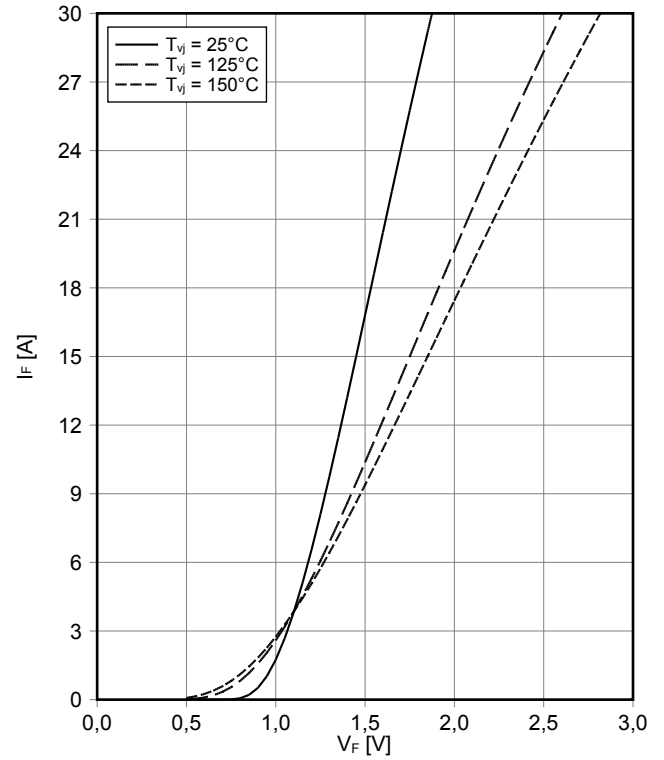
**逆バイアス安全動作領域 IGBT、チヨッパ- ( RBSOA )  
reverse bias safe operating area IGBT-Chopper (RBSOA)**

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Goff} = 12\ \Omega$ ,  $T_{vj} = 150^\circ\text{C}$



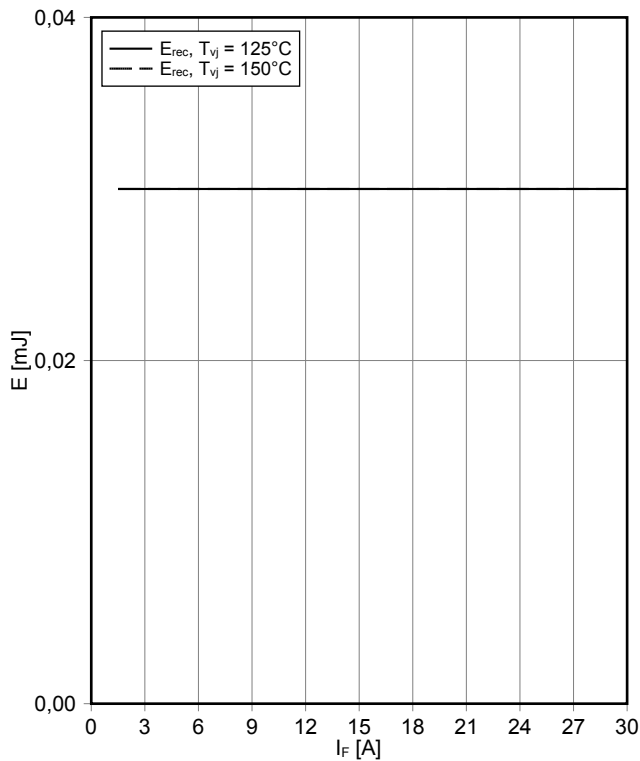
**順電圧特性 Diode-、チヨッパ- ( typical )  
forward characteristic of Diode-Chopper ( typical)**

$I_F = f(V_F)$



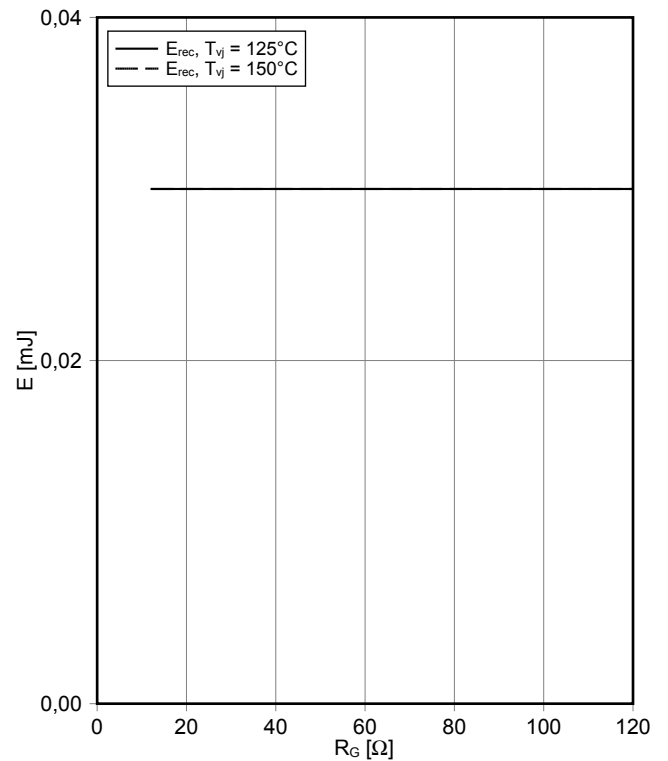
**スイッチング損失 Diode-、チヨッパ- (Typical)  
switching losses Diode-Chopper (typical)**

$E_{rec} = f(I_F)$   
 $R_{Gon} = 12\ \Omega$ ,  $V_{CE} = 600\text{ V}$



**スイッチング損失 Diode-、チヨッパ- (Typical)  
switching losses Diode-Chopper (typical)**

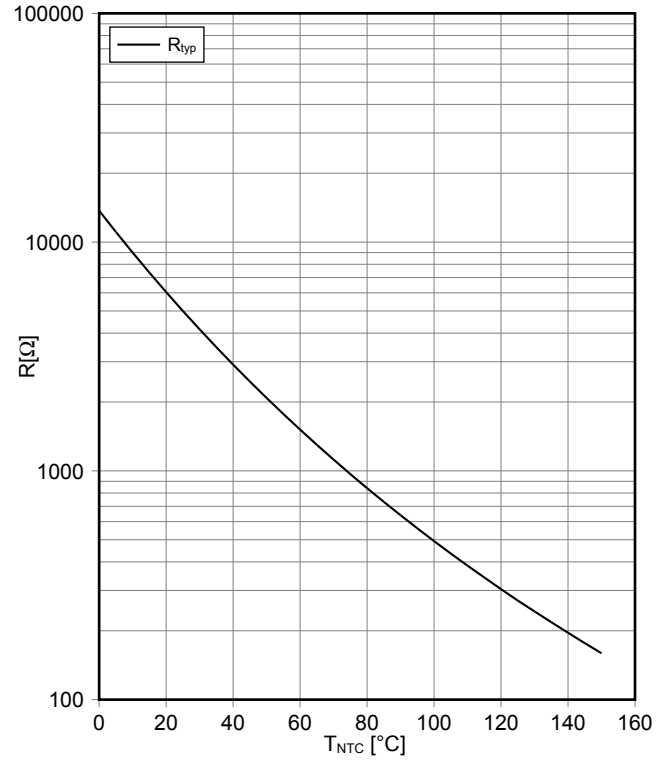
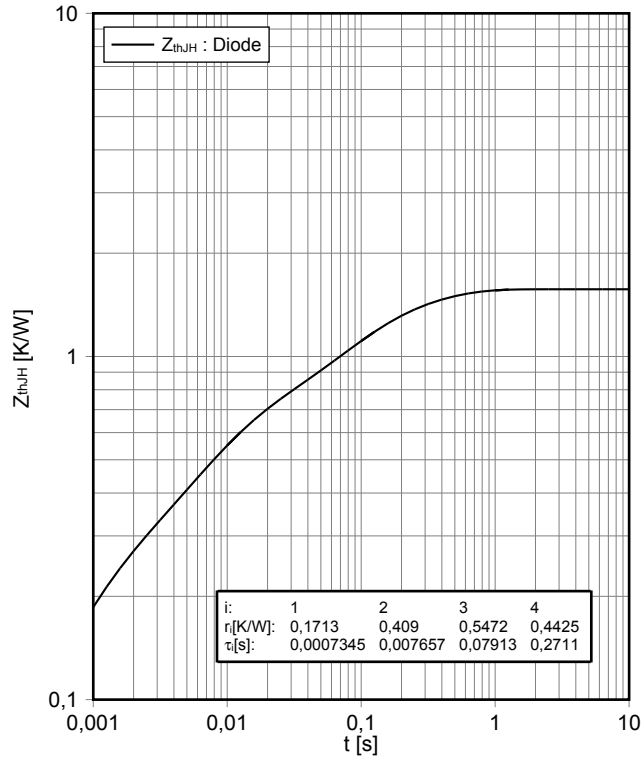
$E_{rec} = f(R_G)$   
 $I_F = 15\text{ A}$ ,  $V_{CE} = 600\text{ V}$



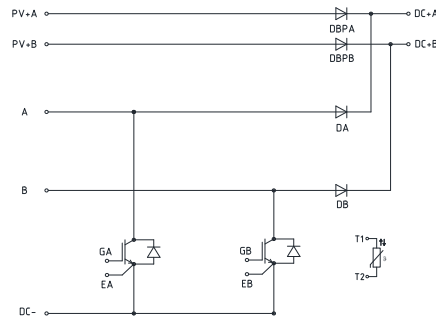


過渡熱インピーダンス Diode-、チョッパ  
 transient thermal impedance Diode-Chopper  
 $Z_{thJH} = f(t)$

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



## 回路図 / Circuit diagram



## パッケージ概要 / Package outlines

