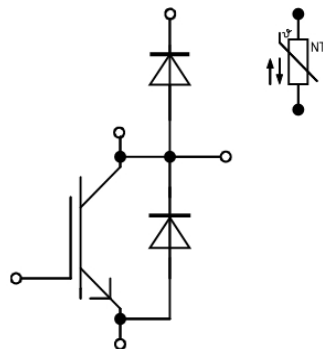
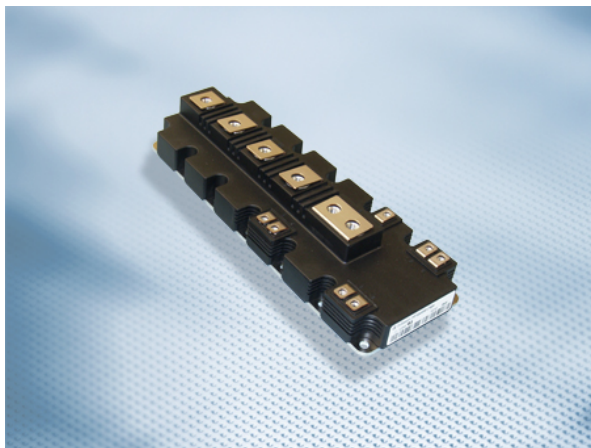


PrimePACK™3 モジュール and NTCサーミスタ  
PrimePACK™3 module and NTC

**暫定データ / Preliminary Data**



$V_{CES} = 1700V$   
 $I_{C\ nom} = 1000A / I_{CRM} = 2000A$

**一般応用**

- 3レベル アプリケーション
- チョッパアプリケーション
- スタティックインバーター
- ハイパワーコンバータ
- モーター駆動
- 電鉄駆動
- 風力タービン

**Typical Applications**

- 3-Level-Applications
- Chopper Applications
- Auxiliary Inverters
- High Power Converters
- Motor Drives
- Traction Drives
- Wind Turbines

**電気的特性**

- 拡張された動作温度  $T_{vj\ op}$
- 高いDC電圧での安定性
- 高い電流密度
- 低スイッチング損失
- 低  $V_{CEsat}$  飽和電圧
- $T_{vj\ op} = 150^{\circ}C$
- 回制動作用大容量diode

**Electrical Features**

- Extended Operation Temperature  $T_{vj\ op}$
- High DC Stability
- High Current Density
- Low Switching Losses
- Low  $V_{CEsat}$
- $T_{vj\ op} = 150^{\circ}C$
- Enlarged Diode for regenerative operation

**機械的特性**

- CTI(比較トラッキング指数) >400のモジュールパッケージ
- 長い縁面/空間距離
- 高いパワー/サーマルサイクル耐量
- 高いパワー密度

**Mechanical Features**

- Package with CTI > 400
- High Creepage and Clearance Distances
- High Power and Thermal Cycling Capability
- High Power Density

**Module Label Code**

Barcode Code 128



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

prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



暫定データ  
Preliminary Data

IGBT、チョッパー / IGBT-Chopper  
最大定格 / Maximum Rated Values

コレクタ・エミッタ間電圧 Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1700	V
連続DCコレクタ電流 Continuous DC collector current	$T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$ $I_C$	1000 1390	A A
繰り返しピークコレクタ電流 Repetitive peak collector current	$t_P = 1\text{ms}$	$I_{CRM}$	2000	A
トータル損失 Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$P_{\text{tot}}$	6,25	kW
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	$I_C = 1000\text{A}, V_{GE} = 15\text{V}$ $I_C = 1000\text{A}, V_{GE} = 15\text{V}$ $I_C = 1000\text{A}, V_{GE} = 15\text{V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	2,00 2,35 2,45	2,45 2,80	V V V	
ゲート・エミッタ間しきい値電圧 Gate threshold voltage	$I_C = 36,0\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GEth}$	5,2	5,8	6,4	V
ゲート電荷量 Gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$		$Q_G$	10,0			$\mu\text{C}$
内蔵ゲート抵抗 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	1,8			$\Omega$
入力容量 Input capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{ies}$	81,0			nF
帰還容量 Reverse transfer capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$		$C_{res}$	2,60			nF
コレクタ・エミッタ間遮断電流 Collector-emitter cut-off current	$V_{CE} = 1700\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$		$I_{CES}$			5,0	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	$I_C = 1000\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 0,3\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{don}$	0,66 0,70 0,71			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオン上昇時間 (誘導負荷) Rise time, inductive load	$I_C = 1000\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 0,3\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	0,10 0,11 0,12			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオフ遅れ時間 (誘導負荷) Turn-off delay time, inductive load	$I_C = 1000\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 1,2\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{doff}$	1,15 1,30 1,35			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオフ下降時間 (誘導負荷) Fall time, inductive load	$I_C = 1000\text{A}, V_{CE} = 900\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 1,2\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	0,25 0,48 0,56			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
ターンオンスイッチング損失 Turn-on energy loss per pulse	$I_C = 1000\text{A}, V_{CE} = 900\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, di/dt = 8900\text{A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 0,3\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{on}$	260 365 415			mJ mJ mJ
ターンオフスイッチング損失 Turn-off energy loss per pulse	$I_C = 1000\text{A}, V_{CE} = 900\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, du/dt = 2800\text{V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 1,2\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{off}$	210 315 345			mJ mJ mJ
短絡電流 SC data	$V_{GE} \leq 15\text{V}, V_{CC} = 1000\text{V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		$I_{SC}$	4000			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		$R_{thJC}$			24,0	K/kW
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 $\lambda_{\text{Paste}} = 1\text{W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	10,0			K/kW
動作温度 Temperature under switching conditions			$T_{vj\text{op}}$	-40		150	$^{\circ}\text{C}$

prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



暫定データ  
Preliminary Data

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	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	1700	V
連続DC電流 Continuous DC forward current		$I_F$	1000	A
ピーク繰返し順電流 Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	2000	A
電流二乗時間積 $I^2t$ - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	185 175	kA <sup>2</sup> s kA <sup>2</sup> s

電気的特性 / Characteristic Values

			min.	typ.	max.	
順電圧 Forward voltage	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_F$	1,70 1,70 1,70	2,15	V V V
ピーク逆回復電流 Peak reverse recovery current	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$I_{RM}$	1300 1400 1450		A A A
逆回復電荷量 Recovered charge	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$Q_r$	285 460 520		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
逆回復損失 Reverse recovery energy	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{rec}$	145 260 295		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		$R_{thJC}$		35,0	K/kW
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 $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	15,0		K/kW
動作温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	150	$^{\circ}\text{C}$

prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



暫定データ  
Preliminary Data

Diode、リバーズ / Diode, Reverse  
最大定格 / Maximum Rated Values

ピーク繰返し逆電圧 Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	1700	V
連続DC電流 Continuous DC forward current		$I_F$	1000	A
ピーク繰返し順電流 Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	2000	A
電流二乗時間積 $I^2t$ - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$	$I^2t$	185	$\text{kA}^2\text{s}$
	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$		175	$\text{kA}^2\text{s}$

電気的特性 / Characteristic Values

			min.	typ.	max.	
順電圧 Forward voltage	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		1,70	2,15	V
	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 125^{\circ}\text{C}$		1,70		V
	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 150^{\circ}\text{C}$		1,70		V
ピーク逆回復電流 Peak reverse recovery current	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		1300		A
		$T_{vj} = 125^{\circ}\text{C}$		1400		A
		$T_{vj} = 150^{\circ}\text{C}$		1450		A
逆回復電荷量 Recovered charge	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		285		$\mu\text{C}$
		$T_{vj} = 125^{\circ}\text{C}$		460		$\mu\text{C}$
		$T_{vj} = 150^{\circ}\text{C}$		520		$\mu\text{C}$
逆回復損失 Reverse recovery energy	$I_F = 1000\text{ A}, -di_F/dt = 8900\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$		145		mJ
		$T_{vj} = 125^{\circ}\text{C}$		260		mJ
		$T_{vj} = 150^{\circ}\text{C}$		295		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	$R_{thJC}$			35,0	K/kW
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 $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$	$R_{thCH}$		15,0		K/kW
動作温度 Temperature under switching conditions		$T_{vj op}$	-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	$T_C = 25^{\circ}\text{C}$	$R_{25}$		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.

prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



暫定データ  
Preliminary Data

モジュール / Module

絶縁耐圧 Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V <sub>ISOL</sub>	4,0		kV
ベースプレート材質 Material of module baseplate			Cu		
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		33,0 33,0		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		19,0 19,0		mm
相対トラッキング指数 Comperative tracking index		CTI	> 400		
			min.	typ.	max.
内部インダクタンス Stray inductance module		L <sub>sCE</sub>		10	nH
パワーターミナル・チップ間抵抗 Module lead resistance, terminals - chip	T <sub>c</sub> = 25°C, /スイッチ / per switch	R <sub>CC+EE'</sub>		0,20	mΩ
保存温度 Storage temperature		T <sub>stg</sub>	-40		150 °C
取り付けネジ締め付けトルク Mounting torque for modul mounting	取り付けネジ M5 適切なアプリケーションノートによるマウンティング Screw M5 - Mounting according to valid application note	M	3,00	-	6,00 Nm
主端子ネジ締め付けトルク Terminal connection torque	取り付けネジ M4 適切なアプリケーションノートによるマウンティング Screw M4 - Mounting according to valid application note	M	1,8	-	2,1 Nm
	取り付けネジ M8 適切なアプリケーションノートによるマウンティング Screw M8 - Mounting according to valid application note		8,0	-	10 Nm
質量 Weight		G		1200	g

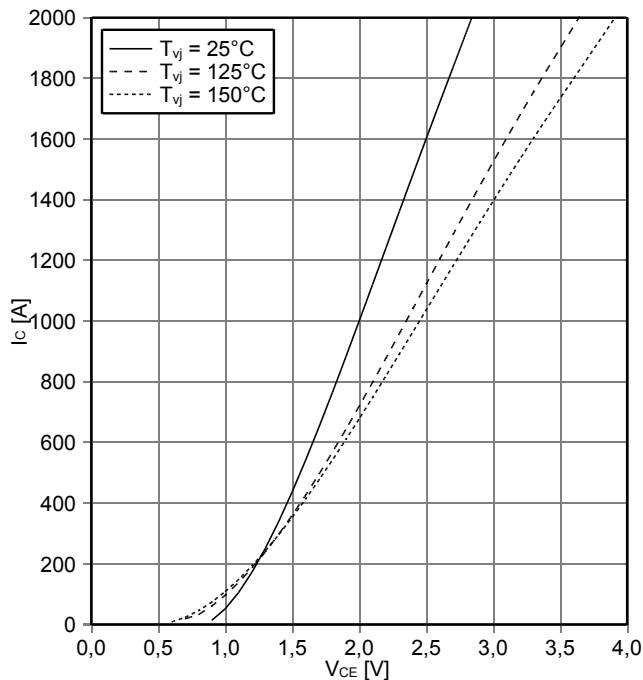
prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



暫定データ  
Preliminary Data

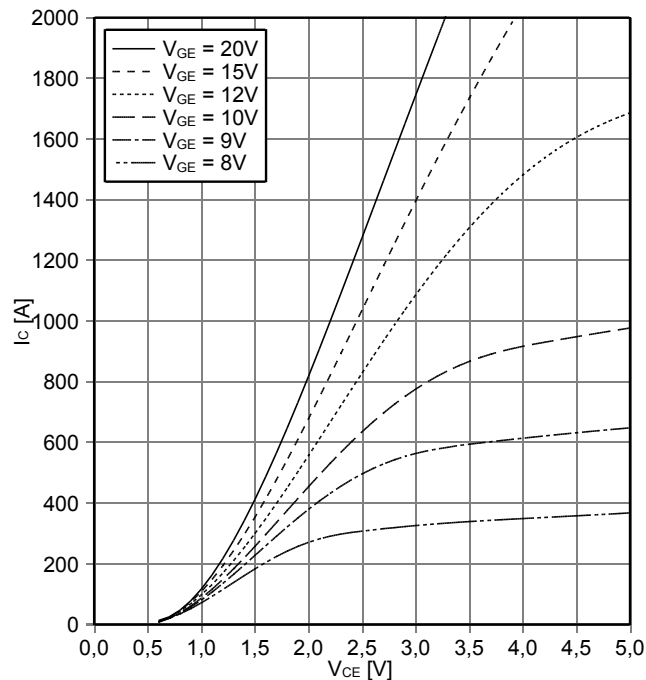
出力特性 IGBT、チヨッパー (Typical)  
output characteristic IGBT-Chopper (typical)

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



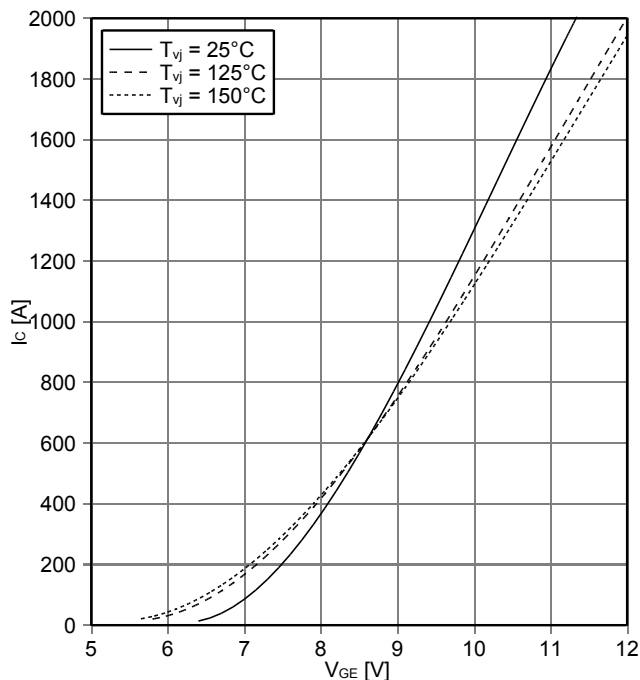
出力特性 IGBT、チヨッパー (Typical)  
output characteristic IGBT-Chopper (typical)

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



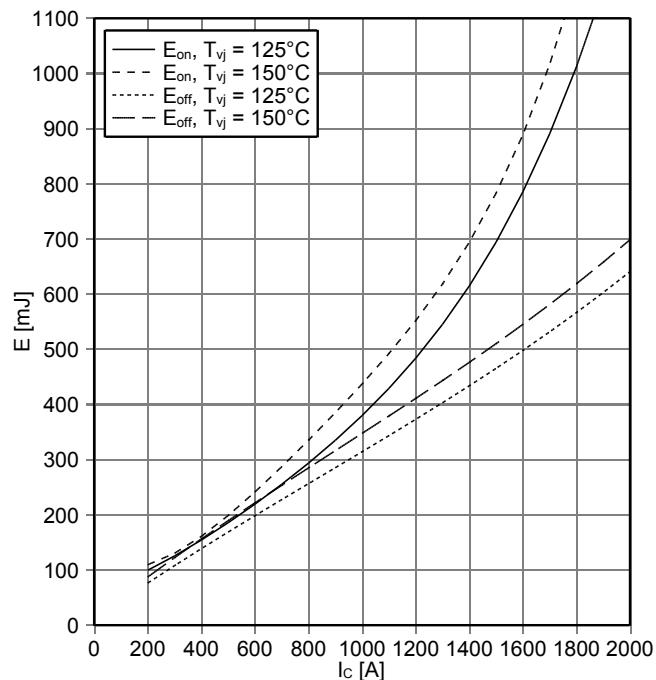
伝達特性 IGBT、チヨッパー (Typical)  
transfer characteristic IGBT-Chopper (typical)

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



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

$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 0.3\ \Omega$ ,  $R_{Goff} = 1.2\ \Omega$ ,  $V_{CE} = 900\text{ V}$



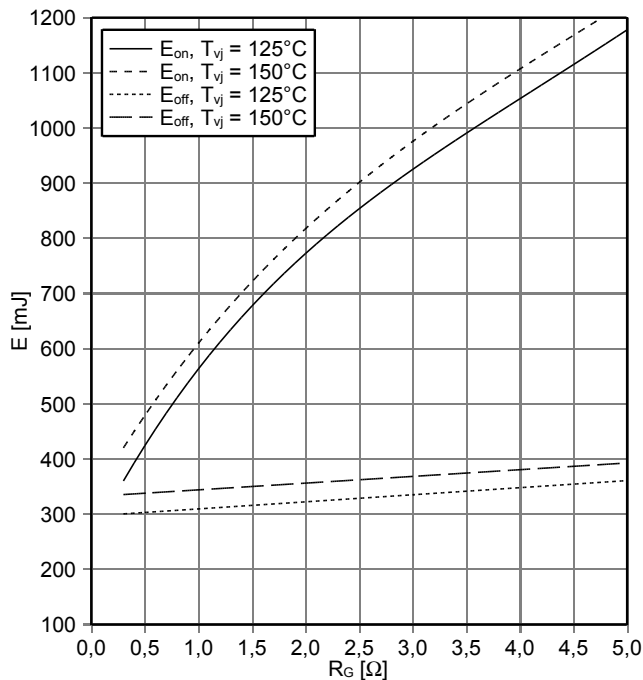
prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



暫定データ  
Preliminary Data

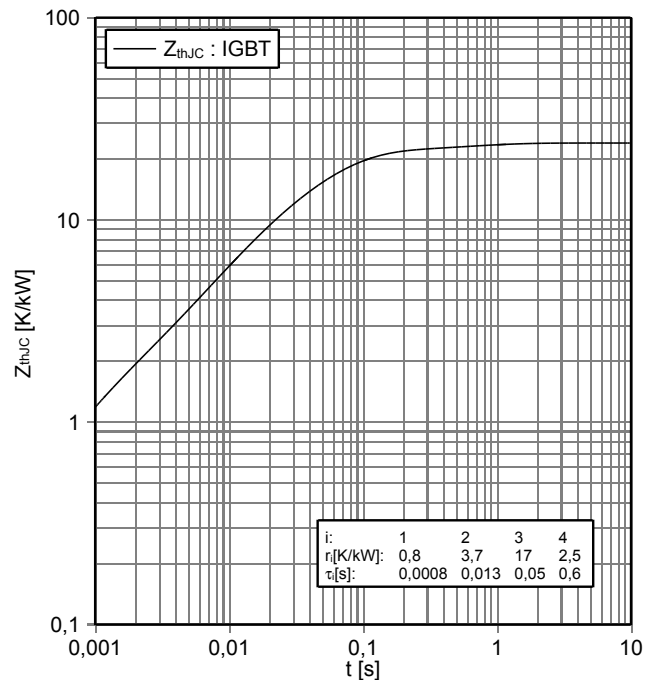
スイッチング損失 IGBT、チョッパー (Typical)  
switching losses IGBT-Chopper (typical)

$E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 1000\text{ A}$ ,  $V_{CE} = 900\text{ V}$



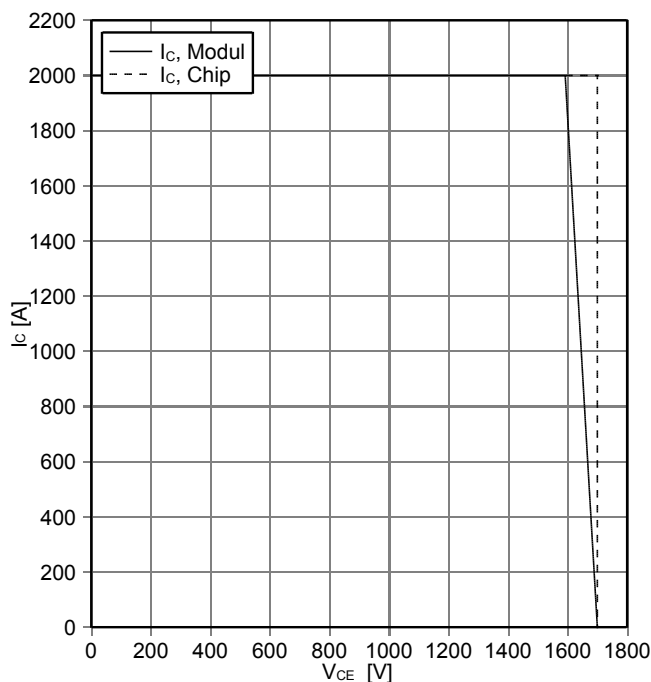
過渡熱インピーダンス IGBT、チョッパー  
transient thermal impedance IGBT-Chopper

$Z_{thJC} = f(t)$



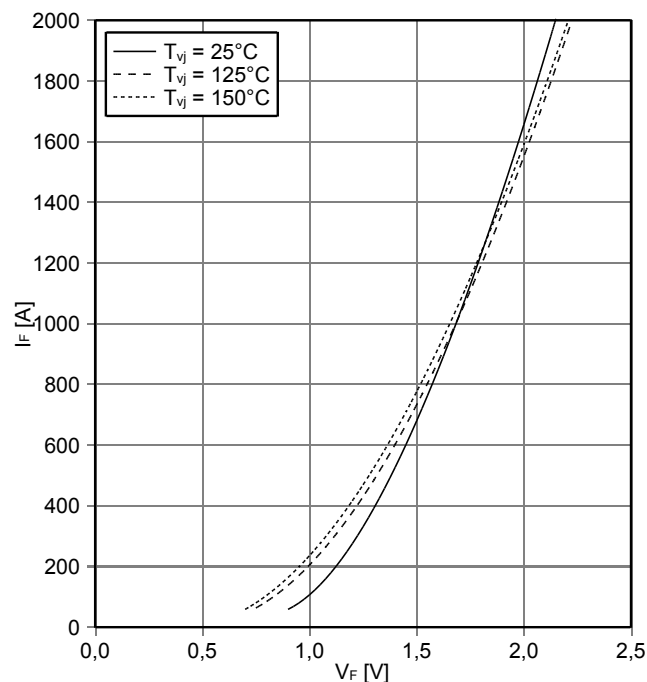
逆バイアス安全動作領域 IGBT、チョッパー (RBSOA)  
reverse bias safe operating area IGBT-Chopper (RBSOA)

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Goff} = 1.2\ \Omega$ ,  $T_{vj} = 150^\circ\text{C}$



順電圧特性 Diode-, チョッパー (typical)  
forward characteristic of Diode-Chopper (typical)

$I_F = f(V_F)$



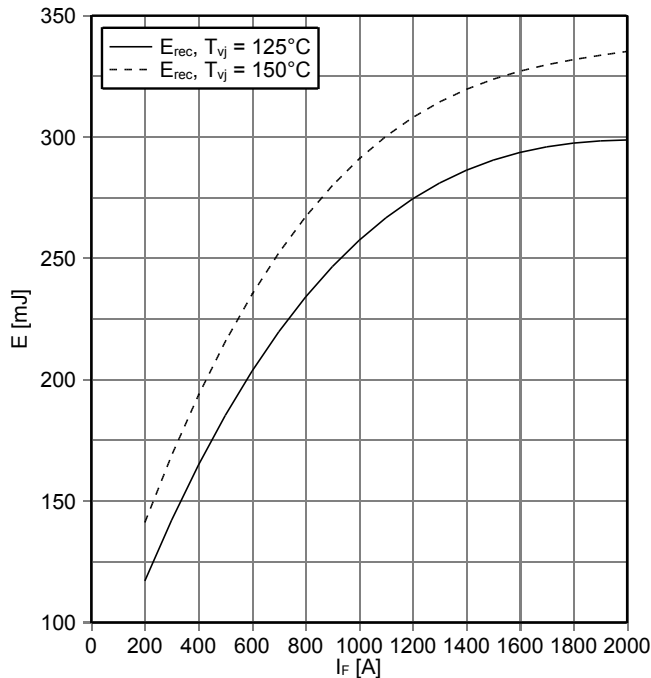
prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



暫定データ  
Preliminary Data

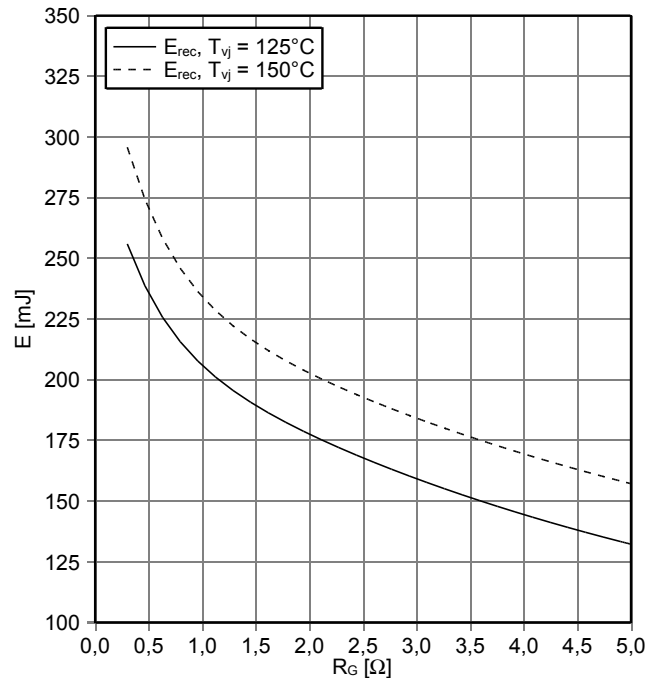
スイッチング損失 Diode-, チョッパー (Typical)  
switching losses Diode-Chopper (typical)

$E_{rec} = f(I_F)$   
 $R_{Gon} = 0.3 \Omega, V_{CE} = 900 V$



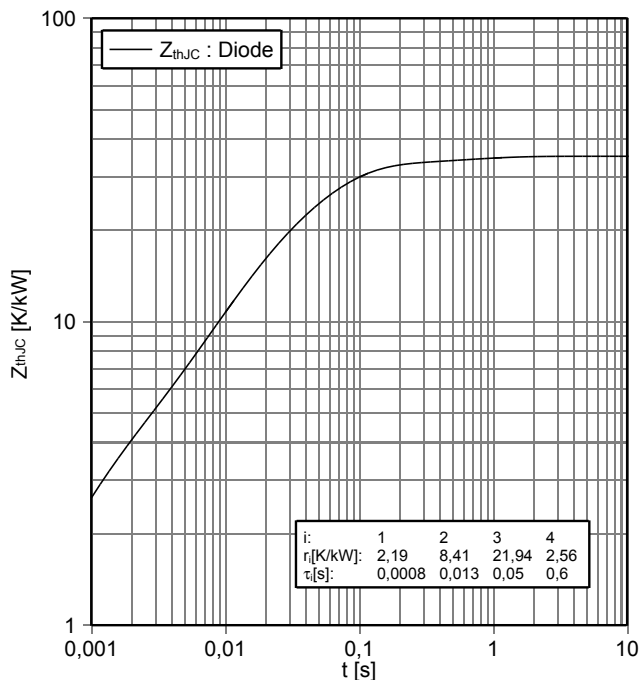
スイッチング損失 Diode-, チョッパー (Typical)  
switching losses Diode-Chopper (typical)

$E_{rec} = f(R_G)$   
 $I_F = 1000 A, V_{CE} = 900 V$



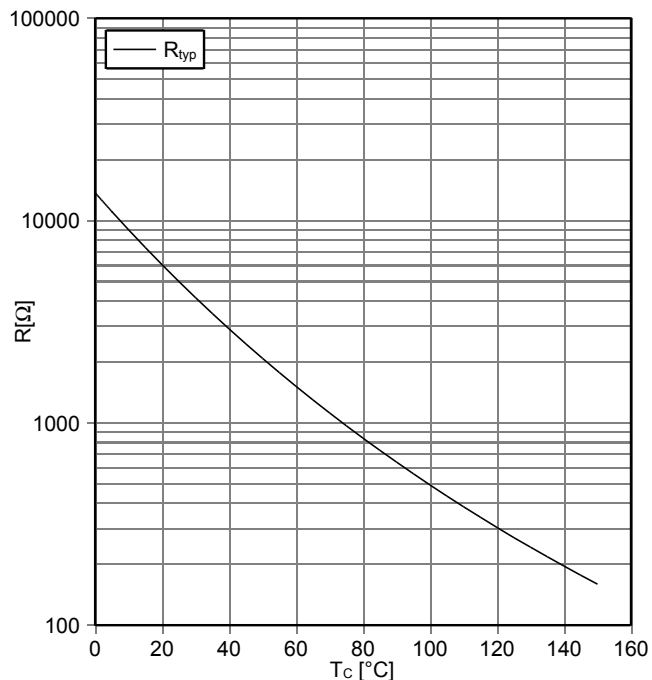
過渡熱インピーダンス Diode-, チョッパー  
transient thermal impedance Diode-Chopper

$Z_{thJC} = f(t)$



NTC-サーミスタ サーミスタの温度特性  
NTC-Thermistor-temperature characteristic (typical)

$R = f(T)$



prepared by: TA	date of publication: 2013-11-05
approved by: MS	revision: 2.1



