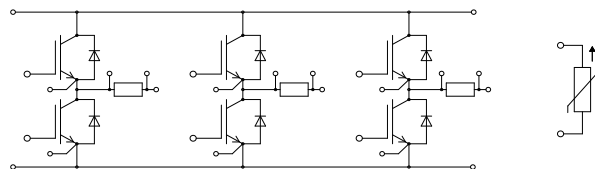
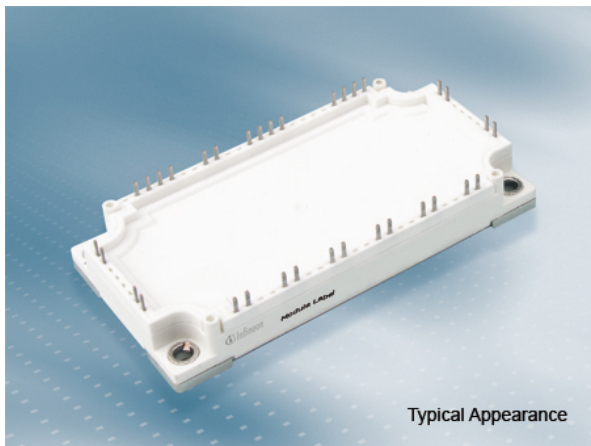


MIPAQ™base モジュール トレンチ/フィールドストップ IGBT4 and エミッターコントロールHE diode内蔵 and NTC サーミスタ/ 電流センス用シャント抵抗

MIPAQ™base module with Trench/Fieldstop IGBT4 and Emitter Controlled HE diode and NTC / shunt



$V_{CES} = 1200V$

$I_{C\ nom} = 200A / I_{CRM} = 400A$

一般応用

- モーター駆動
- サーボ駆動

電気的特性

- 低スイッチング損失
- 低 V_{CEsat} 飽和電圧
- $T_{vj\ op} = 150^{\circ}C$

機械的特性

- 高いパワー/サーマルサイクル耐量
- 絶縁されたベースプレート
- 銅ベースプレート
- 半田接合技術
- 標準ハウジング

Typical Applications

- Motor drives
- Servo drives

Electrical Features

- Low switching losses
- Low V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$

Mechanical Features

- High power and thermal cycling capability
- Isolated base plate
- Copper base plate
- Solder contact technology
- Standard housing

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: SH	date of publication: 2015-12-01	
approved by: RS	revision: V3.0	UL approved (E83335)



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	$T_C = 90^{\circ}\text{C}, T_{vj\text{max}} = 175^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj\text{max}} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$ I_C	200 280	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}	400	A
トータル損失 Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\text{max}} = 175^{\circ}\text{C}$	P_{tot}	940	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	$I_C = 200\text{A}, V_{GE} = 15\text{V}$ $I_C = 200\text{A}, V_{GE} = 15\text{V}$ $I_C = 200\text{A}, V_{GE} = 15\text{V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,75 2,00 2,05	2,10	V V V	
ゲート・エミッタ間しきい値電圧 Gate threshold voltage	$I_C = 7,60\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		V_{GEth}	5,25	5,80	6,35	V
ゲート電荷量 Gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$		Q_G	1,65			μC
内蔵ゲート抵抗 Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	3,5			Ω
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}	14,0			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}	0,50			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	$I_C = 200\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 1,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,14 0,15 0,15			μs μs μs
ターンオン上昇時間 (誘導負荷) Rise time, inductive load	$I_C = 200\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Gon} = 1,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,028 0,034 0,035			μs μs μs
ターンオフ遅れ時間 (誘導負荷) Turn-off delay time, inductive load	$I_C = 200\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 1,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	0,32 0,41 0,44			μs μs μs
ターンオフ下降時間 (誘導負荷) Fall time, inductive load	$I_C = 200\text{A}, V_{CE} = 600\text{V}$ $V_{GE} = \pm 15\text{V}$ $R_{Goff} = 1,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,043 0,079 0,088			μs μs μs
ターンオンスイッチング損失 Turn-on energy loss per pulse	$I_C = 200\text{A}, V_{CE} = 600\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, di/dt = 5500\text{A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 1,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	13,0 21,0 23,5			mJ mJ mJ
ターンオフスイッチング損失 Turn-off energy loss per pulse	$I_C = 200\text{A}, V_{CE} = 600\text{V}, L_S = 30\text{nH}$ $V_{GE} = \pm 15\text{V}, du/dt = 3300\text{V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 1,0\Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	15,5 24,0 26,5			mJ mJ mJ
短絡電流 SC data	$V_{GE} \leq 15\text{V}, V_{CE} = 800\text{V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		I_{SC}	800			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}			0,160	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}	0,0540			K/W
動作温度 Temperature under switching conditions			$T_{vj\text{op}}$	-40		150	$^{\circ}\text{C}$

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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	200	A
ピーク繰返し順電流 Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	400	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	7800 7400	A^2s A^2s

電気的特性 / Characteristic Values

			min.	typ.	max.	
順電圧 Forward voltage	$I_F = 200\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 200\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 200\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F	1,70 1,65 1,65	2,15	V V V
ピーク逆回復電流 Peak reverse recovery current	$I_F = 200\text{ A}, -di_F/dt = 5500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}	195 215 220		A A A
逆回復電荷量 Recovered charge	$I_F = 200\text{ A}, -di_F/dt = 5500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r	18,0 33,0 37,0		μC μC μC
逆回復損失 Reverse recovery energy	$I_F = 200\text{ A}, -di_F/dt = 5500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}	8,85 17,5 20,0		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}		0,250	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}	0,0720		K/W
動作温度 Temperature under switching conditions			$T_{vj\text{ op}}$	-40	150	$^{\circ}\text{C}$

シャント抵抗 / Shunt

			min.	typ.	max.	
定格抵抗値 Rated resistance	$T_c = 20^{\circ}\text{C}$		R_{20}	1,50		m Ω
温度係数 Temperature coefficient (tcr)	$20^{\circ}\text{C} - 60^{\circ}\text{C}$			< 30		ppm/K
シャント抵抗の動作温度 Operation temperature shunt-resistor			$T_{tvj\text{ op}}$		200	$^{\circ}\text{C}$
ジャンクション・ケース間熱抵抗 Thermal resistance; junction to case			R_{thJC}		8,7	K/W

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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 Ω
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
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_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		10,0		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		7,5		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}	20		nH
パワーターミナル・チップ間抵抗 Module lead resistance, terminals - chip	$T_C = 25^\circ\text{C}, / \text{スイッチ} / \text{per switch}$	$R_{CC'+EE'}$	1,80		m Ω
保存温度 Storage temperature		T_{stg}	-40	125	$^\circ\text{C}$
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
質量 Weight		G	300		g

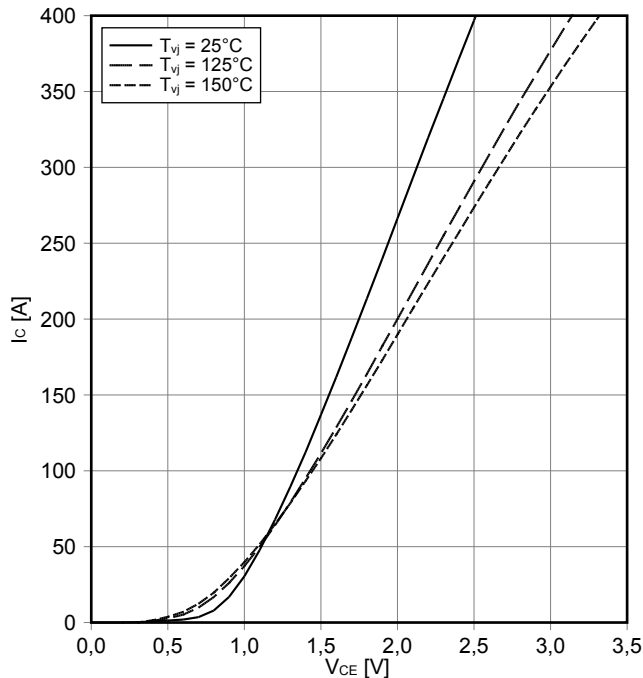
Der Strom im Dauerbetrieb ist auf 50 A effektiv pro Anschlusspin begrenzt.
The current under continuous operation is limited to 50 A rms per connector pin.
Der Shuntwert ist nicht im $R_{cc'+ee'}$ enthalten.
The shunt value is not a part of the $R_{cc'+ee'}$ resistance.

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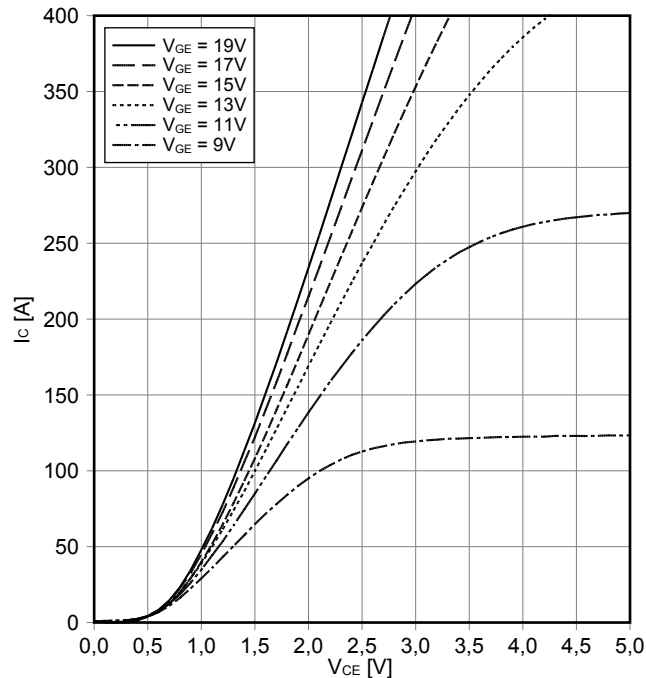
出力特性 IGBT- インバータ (Typical)
output characteristic IGBT, Inverter (typical)

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



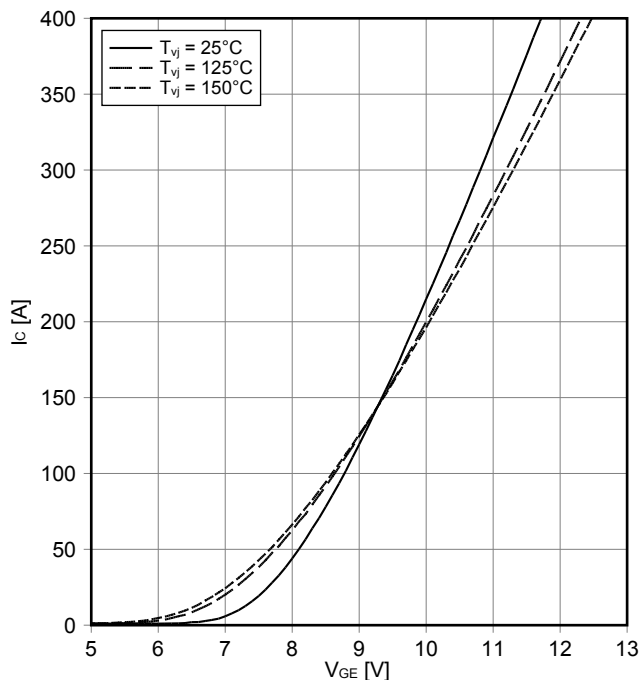
出力特性 IGBT- インバータ (Typical)
output characteristic IGBT, Inverter (typical)

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



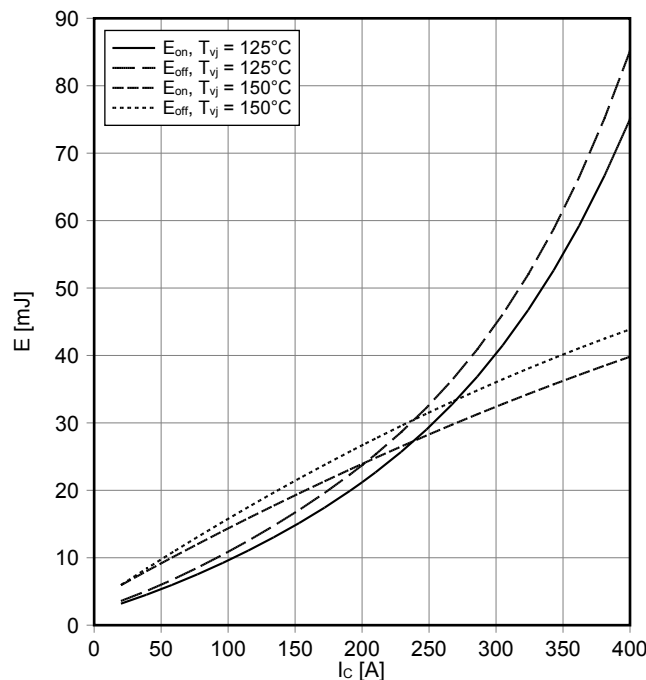
伝達特性 IGBT- インバータ (Typical)
transfer characteristic IGBT, Inverter (typical)

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



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

$E_{on} = f(I_C), E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 1\ \Omega, R_{Goff} = 1\ \Omega, V_{CE} = 600\text{ V}$

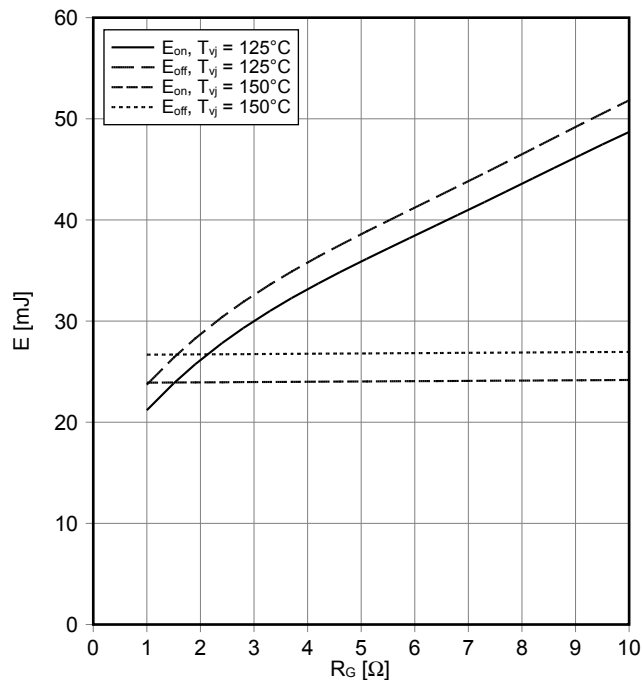


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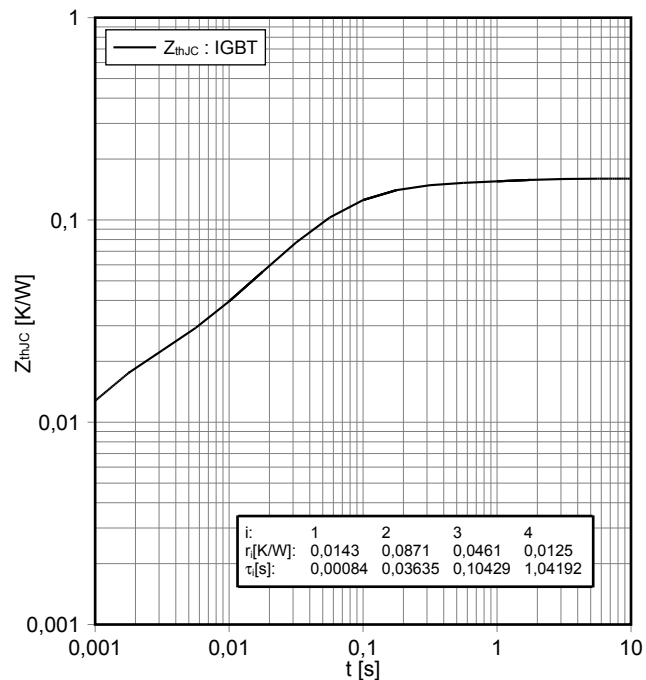
スイッチング損失 IGBT- インバータ (Typical)
switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}$, $I_C = 200\text{ A}$, $V_{CE} = 600\text{ V}$



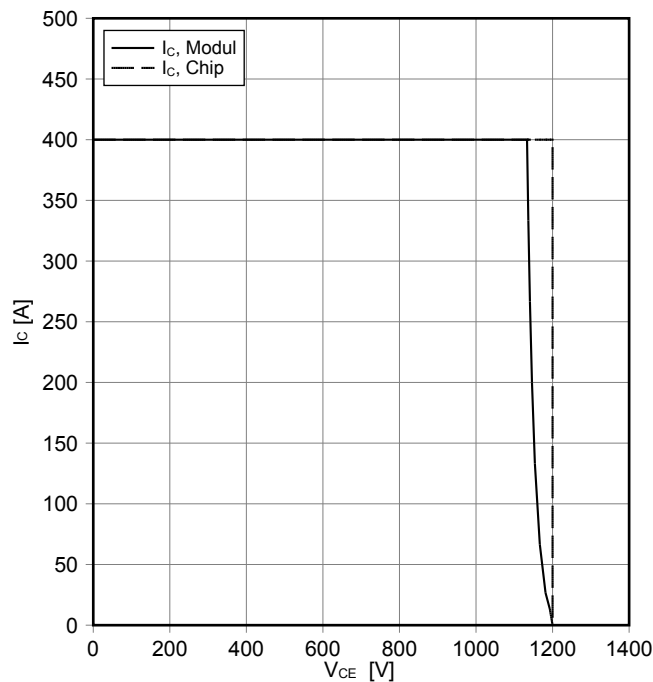
過渡熱インピーダンス IGBT- インバータ
transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



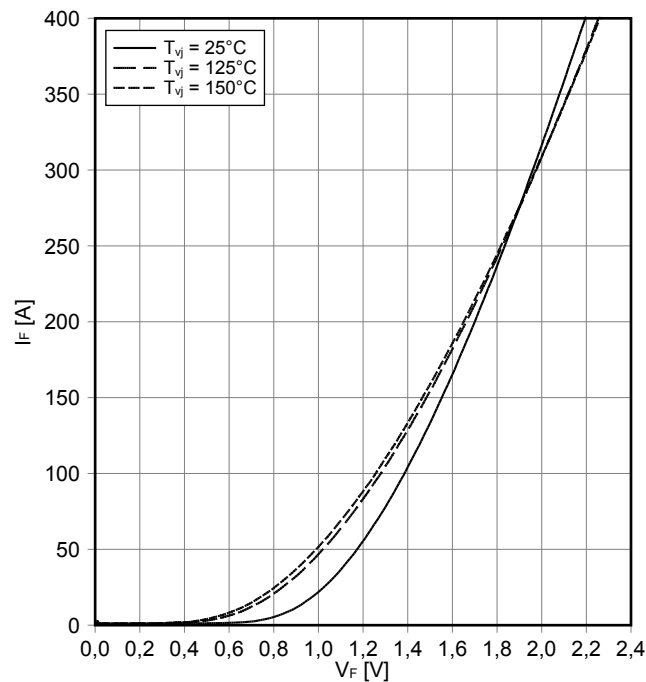
逆バイアス安全動作領域 IGBT- インバータ (RBSOA)
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 1\ \Omega$, $T_{vj} = 150^\circ\text{C}$



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

$I_F = f(V_F)$

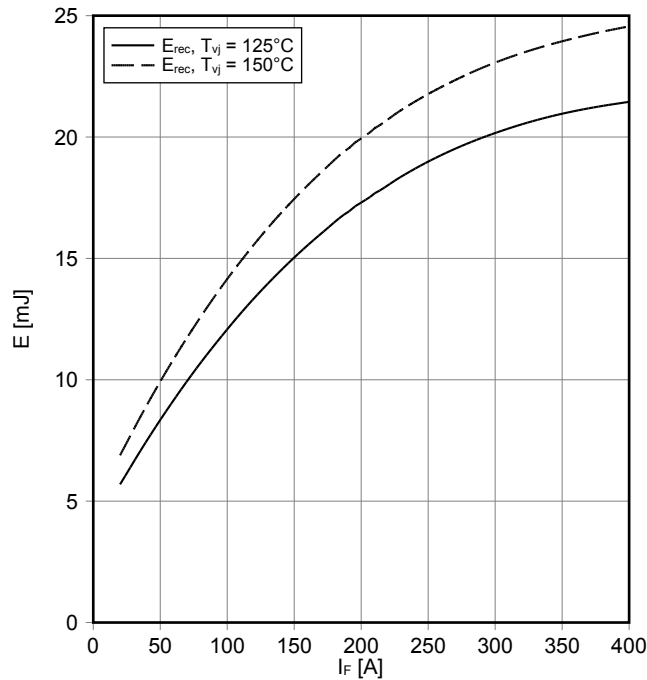


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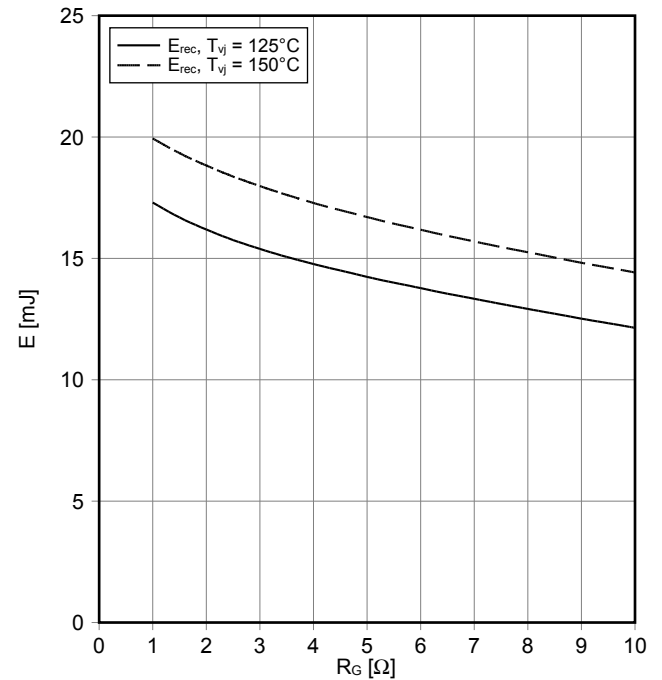
スイッチング損失 Diode、インバータ (Typical)
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 1 \Omega, V_{CE} = 600 V$



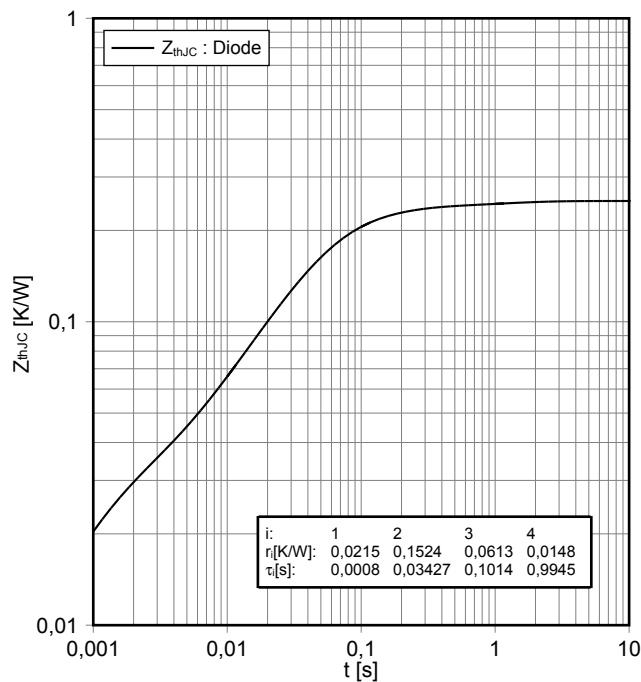
スイッチング損失 Diode、インバータ (Typical)
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 200 A, V_{CE} = 600 V$



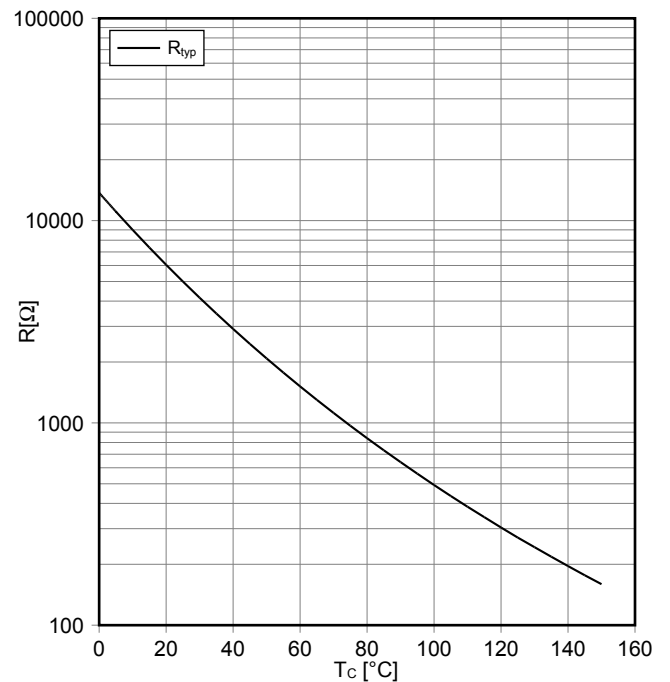
過渡熱インピーダンス Diode、インバータ
transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$



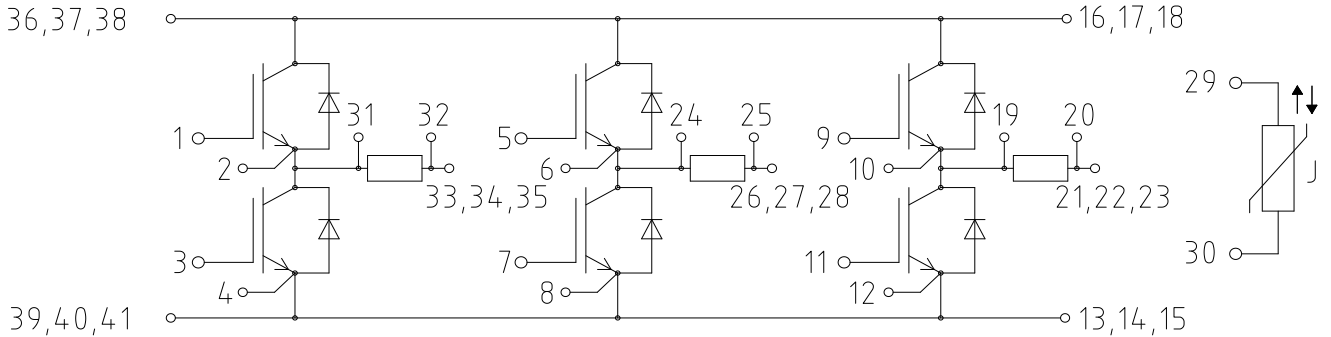
NTC-サーミスタ サーミスタの温度特性
NTC-Thermistor-temperature characteristic (typical)

$R = f(T)$

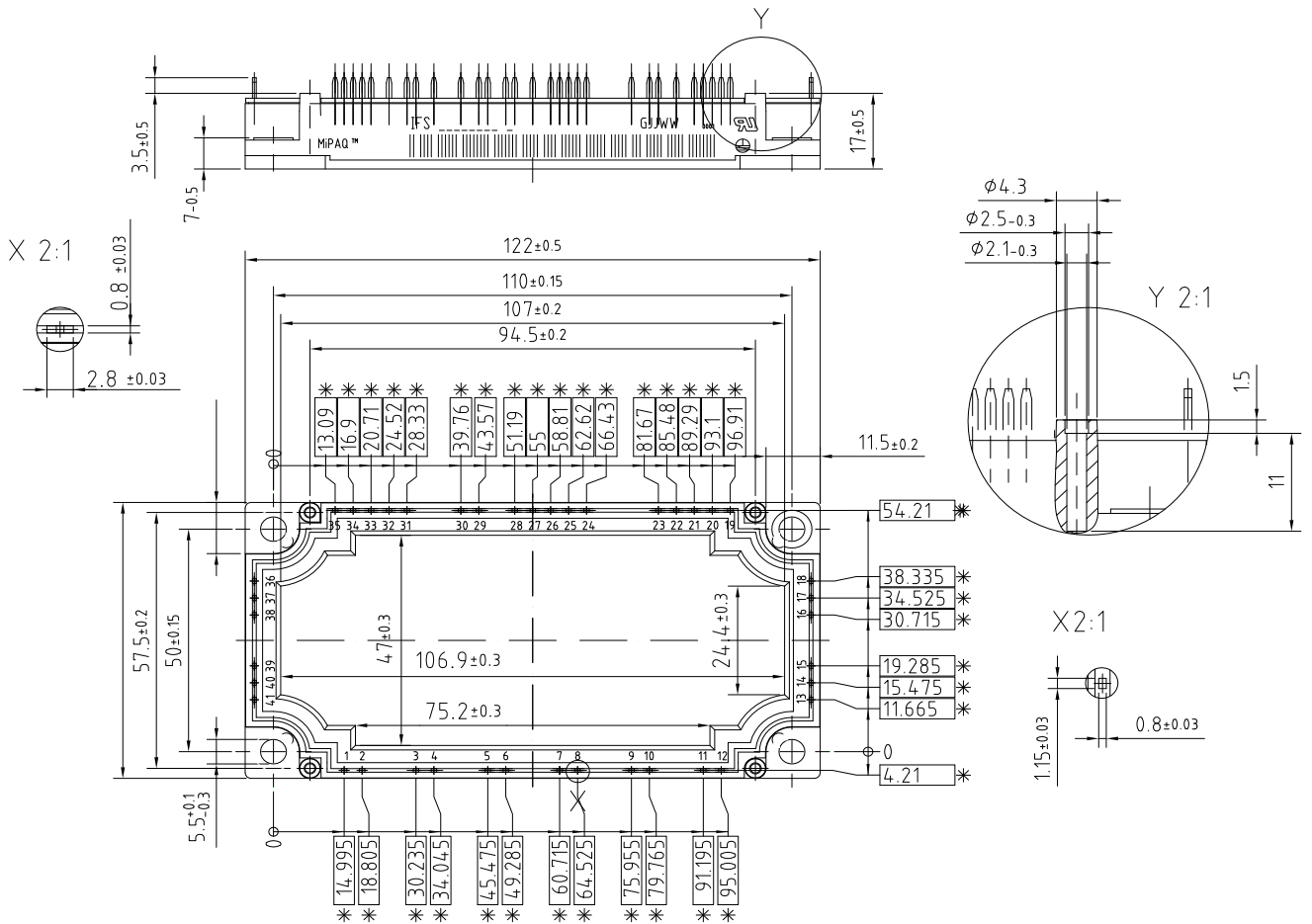


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回路図 / Circuit diagram



パッケージ概要 / Package outlines



* = alle Maße mit einer Toleranz von

* = all dimensions with tolerance of

± 0.5

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revision: V3.0