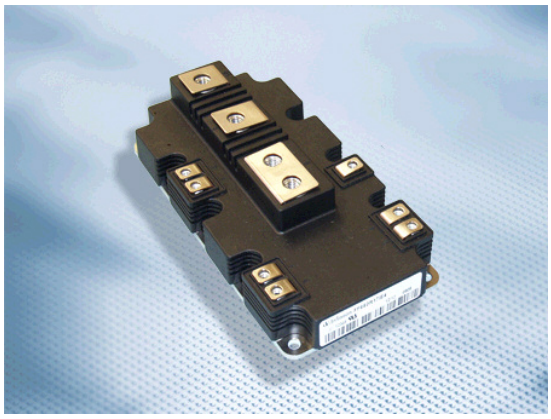
Technische Information / technical information

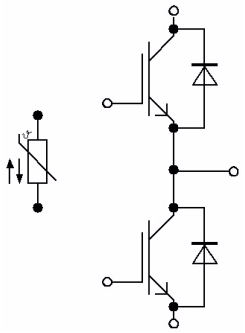
IGBT-Module
IGBT-modules

FF600R12IP4

PrimePACK™2 Modul mit Trench/Fieldstopp IGBT4 und Emitter Controlled 4 Diode und NTC
PrimePACK™2 module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode and NTC

Vorläufige Daten / preliminary data





V_{CES} = 1200V
$I_{C\ nom}$ = 600A / I_{CRM} = 1200A

Typische Anwendungen

- Hilfsumrichter
- Hochleistungsumrichter
- Motorantriebe
- Traktionsumrichter
- USV-Systeme
- Windgeneratoren

Typical Applications

- Auxiliary Inverters
- High Power Converters
- Motor Drives
- Traction Drives
- UPS Systems
- Wind Turbines

Elektrische Eigenschaften

- Erweiterte Sperrschichttemperatur $T_{vj\ op}$
- Große DC-Festigkeit
- Hohe Kurzschlussrobustheit, selbstlimitierender Kurzschlussstrom
- Sehr große Robustheit
- V_{CEsat} mit positivem Temperaturkoeffizienten
- niedriges V_{CEsat}

Electrical Features

- Extended Operation Temperature $T_{vj\ op}$
- High DC Stability
- High Short Circuit Capability, Self Limiting Short Circuit Current
- Unbeatable Robustness
- V_{CEsat} with positive Temperature Coefficient
- Low V_{CEsat}

Mechanische Eigenschaften

- 4kV AC 1min Isolationsfestigkeit
- Gehäuse mit CTI > 400
- Große Luft- und Kriechstrecken
- Hohe Last- und thermische Wechselfestigkeit
- Hohe Leistungsdichte
- Substrat für kleinen thermischen Widerstand

Mechanical Features

- 4kV AC 1min Insulation
- Package with CTI > 400
- High Creepage and Clearance Distances
- High Power and Thermal Cycling Capability
- High Power Density
- Substrate for Low Thermal Resistance

Module Label Code

Barcode Code 128

Sample
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

prepared by: AC	date of publication: 2009-08-13	material no: 32928
approved by: MS	revision: 2.4	

Vorläufige Daten
preliminary data

IGBT-Wechselrichter / IGBT-inverter

Höchstzulässige Werte / maximum rated values

Kollektor-Emitter-Sperrspannung collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
Kollektor-Dauergleichstrom DC-collector current	T_C = 100°C, T_{vj} = 175°C	$I_{C\ nom}$	600	A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms	I_{CRM}	1200	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C, T_{vj} = 175°C	P_{tot}	3,35	kW
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/-20	V

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	I_C = 600 A, V_{GE} = 15 V I_C = 600 A, V_{GE} = 15 V I_C = 600 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE\ sat}$	1,70 2,00 2,10	2,05	V V V
Gate-Schwellenspannung gate threshold voltage	I_C = 23,0 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		V_{GEth}	5,0	5,8	6,5	V
Gateladung gate charge	V_{GE} = -15 V ... +15 V		Q_G		4,40		µC
Interner Gatewiderstand internal gate resistor	T_{vj} = 25°C		R_{Gint}		1,8		Ω
Eingangskapazität input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		37,0		nF
Rückwirkungskapazität reverse transfer capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{res}		2,05		nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V_{CE} = 1200 V, V_{GE} = 0 V, T_{vj} = 25°C		I_{CES}			5,0	mA
Gate-Emitter Reststrom gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C		I_{GES}			400	nA
Einschaltverzögerungszeit (ind. Last) turn-on delay time (inductive load)	I_C = 600 A, V_{CE} = 600 V V_{GE} = ±15 V R_{Gon} = 2,2 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\ on}$		0,21 0,24 0,24		µs µs µs
Anstiegszeit (induktive Last) rise time (inductive load)	I_C = 600 A, V_{CE} = 600 V V_{GE} = ±15 V R_{Gon} = 2,2 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0,12 0,12 0,13		µs µs µs
Abschaltverzögerungszeit (ind. Last) turn-off delay time (inductive load)	I_C = 600 A, V_{CE} = 600 V V_{GE} = ±15 V R_{Goff} = 2,2 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\ off}$		0,70 0,80 0,85		µs µs µs
Fallzeit (induktive Last) fall time (inductive load)	I_C = 600 A, V_{CE} = 600 V V_{GE} = ±15 V R_{Goff} = 2,2 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0,15 0,20 0,20		µs µs µs
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	I_C = 600 A, V_{CE} = 600 V, L_S = 45 nH V_{GE} = ±15 V, di/dt = 3800 A/µs (T_{vj}=150°C) R_{Gon} = 2,2 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		52,0 77,0 83,0		mJ mJ mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	I_C = 600 A, V_{CE} = 600 V, L_S = 45 nH V_{GE} = ±15 V, du/dt = 3100 V/µs (T_{vj}=150°C) R_{Goff} = 2,2 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		81,0 105 115		mJ mJ mJ
Kurzschlussverhalten 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}		2400		A
Innerer Wärmewiderstand thermal resistance, junction to case	pro IGBT / per IGBT		R_{thJC}			45,0	K/kW
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro IGBT / per IGBT λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		14,0		K/kW

Vorläufige Daten
preliminary data

Diode-Wechselrichter / diode-inverter

Höchstzulässige Werte / maximum rated values

Periodische Spitzensperrspannung repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
Dauergleichstrom DC forward current		I_F	600	A
Periodischer Spitzenstrom repetitive peak forward current	t_P = 1 ms	I_{FRM}	1200	A
Grenzlastintegral 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	I²t	51,0 49,0	kA²s kA²s

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Durchlassspannung forward voltage	I_F = 600 A, V_{GE} = 0 V I_F = 600 A, V_{GE} = 0 V I_F = 600 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1,80 1,75 1,70	2,20	V V V
Rückstromspitze peak reverse recovery current	I_F = 600 A, - di_F/dt = 3800 A/µs (T_{vj}=150°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		350 430 440		A A A
Sperrverzögerungsladung recovered charge	I_F = 600 A, - di_F/dt = 3800 A/µs (T_{vj}=150°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		60,0 110 120		µC µC µC
Abschaltenergie pro Puls reverse recovery energy	I_F = 600 A, - di_F/dt = 3800 A/µs (T_{vj}=150°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		25,0 42,0 50,0		mJ mJ mJ
Innerer Wärmewiderstand thermal resistance, junction to case	pro Diode / per diode		R_{thJC}			75,0	K/kW
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Diode / per diode λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		24,0		K/kW

NTC-Widerstand / NTC-thermistor

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Nennwiderstand rated resistance	T_C = 25°C	R_{25}		5,00		kΩ
Abweichung von R_{100} deviation of R_{100}	T_C = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
Verlustleistung power dissipation	T_C = 25°C	P_{25}			20,0	mW
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/50}$		3375		K
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/80}$		3411		K
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/100}$		3433		K

Angaben gemäß gültiger Application Note.
Specification according to the valid application note.

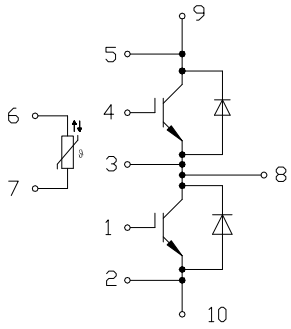
Vorläufige Daten
preliminary data

Modul / module

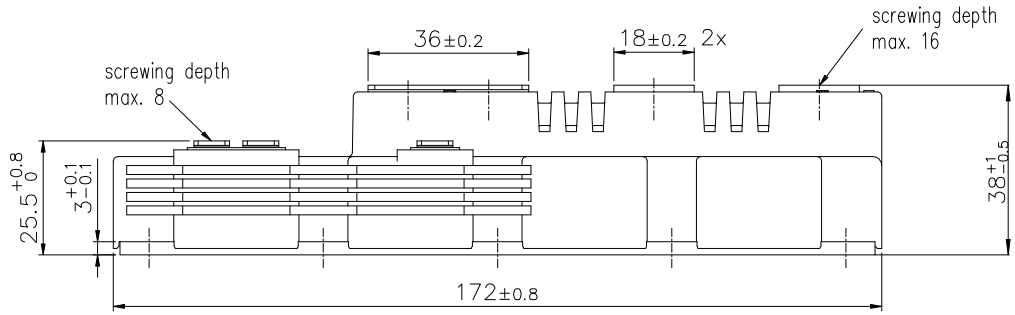
Isolations-Prüfspannung insulation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}		4,0		kV
Material Modulgrundplatte material of module baseplate				Cu		
Material für innere Isolation material for internal insulation				Al_2O_3		
Kriechstrecke creepage distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal			33,0 33,0		mm
Luftstrecke clearance distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal			19,0 19,0		mm
Vergleichszahl der Kriechwegbildung comparative tracking index		CTI		> 400		
			min.	typ.	max.	
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per module λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)	R_{thCH}		4,50		K/kW
Modulinduktivität stray inductance module		L_{sCE}		18		nH
Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip	T_C = 25°C, pro Schalter / per switch	$R_{CC'+EE'}$		0,30		mΩ
Höchstzulässige Sperrschichttemperatur maximum junction temperature	Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper	$T_{vj\ max}$			175	°C
Temperatur im Schaltbetrieb temperature under switching conditions	Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper	$T_{vj\ op}$	-40		150	°C
Lagertemperatur storage temperature		T_{stg}	-40		150	°C
Anzugsdrehmoment f. mech. Befestigung mounting torque	Schraube M5 - Montage gem. gültiger Applikation Note screw M5 - mounting according to valid application note	M	3,00	-	6,00	Nm
Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque	Schraube M4 - Montage gem. gültiger Applikation Note screw M4 - mounting according to valid application note Schraube M8 - Montage gem. gültiger Applikation Note screw M8 - mounting according to valid application note	M	1,8 8,0	- -	2,1 10	Nm Nm
Gewicht weight		G		825		g

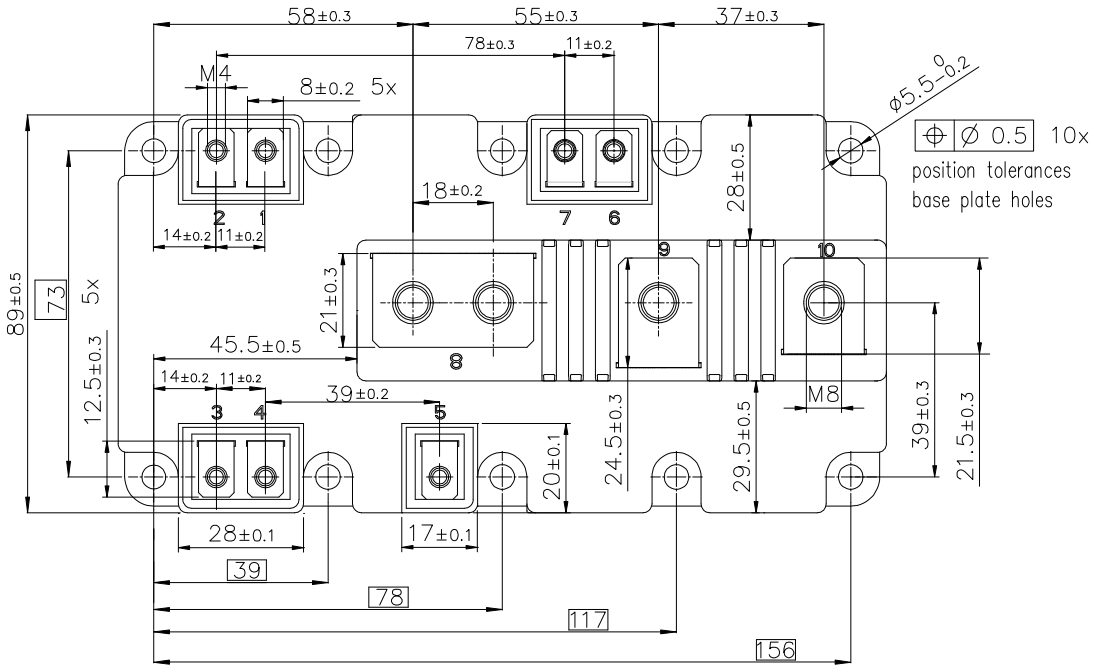
Vorläufige Daten
preliminary data

Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines





prepared by: AC	date of publication: 2009-08-13
approved by: MS	revision: 2.4