



SKiiP® 3

2-pack-integrated intelligent Power System

SKiiP 2413 GB123-4DFL V3

Features

- SKiiP technology inside
- Trench IGBTs
- CAL HD diode technology
- Integrated current sensor
- Integrated temperature sensor
- Integrated heat sink
- Fiber optic interface
- UL recognized File no. E63532

Typical Applications*

- Renewable energies
- Traction
- Elevators
- Industrial drives

Footnotes

¹⁾ With assembly of suitable MKP capacitor per terminal

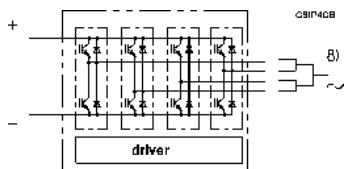
Absolute Maximum Ratings		$T_s = 25^\circ\text{C}$ unless otherwise specified	
Symbol	Conditions	Values	Unit
System			
$V_{CC}^{1)}$	Operating DC link voltage	900	V
V_{isol}	DC, $t = 1\text{ s}$, main terminals to heat sink	4300	V
$I_{t(RMS)}$	per AC terminal, $T_{terminal} < 115^\circ\text{C}$	400	A
I_{FSM}	$T_j = 150^\circ\text{C}$, $t_p = 10\text{ ms}$, sin 180°	13500	A
I^2t	$T_j = 150^\circ\text{C}$, $t_p = 10\text{ ms}$, diode	911	kA^2s
f_{out}	fundamental output frequency	1	kHz
T_{stg}	storage temperature	-40 ... 85	$^\circ\text{C}$

IGBT			
V_{CES}	$T_j = 25^\circ\text{C}$	1200	V
I_C	$T_j = 150^\circ\text{C}$	$T_s = 25^\circ\text{C}$	2280
		$T_s = 70^\circ\text{C}$	1756
I_{Cnom}		2400	A
T_j	junction temperature	-40 ... 150	$^\circ\text{C}$

Diode			
V_{RRM}	$T_j = 25^\circ\text{C}$	1200	V
I_F	$T_j = 150^\circ\text{C}$	$T_s = 25^\circ\text{C}$	1807
		$T_s = 70^\circ\text{C}$	1370
I_{Fnom}		1860	A
T_j	junction temperature	-40 ... 150	$^\circ\text{C}$

Driver			
V_s	power supply	13 ... 30	V
V_{iH}	input signal voltage (high)	15 + 0.3	V
$V_{isolIPD}$	QPD $\leq 10\text{ pC}$, PRIM to POWER	1170	V
dv/dt	secondary to primary side	75	$\text{kV}/\mu\text{s}$
f_{sw}	switching frequency	8	kHz

Characteristics		$T_s = 25^\circ\text{C}$ unless otherwise specified			
Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
$V_{CE(sat)}$	$I_C = 1200\text{ A}$ at terminal	$T_j = 25^\circ\text{C}$	1.7	2.1	V
		$T_j = 125^\circ\text{C}$	1.9		V
V_{CE0}		$T_j = 25^\circ\text{C}$	0.90	1.10	V
		$T_j = 125^\circ\text{C}$	0.80	1.00	V
r_{CE}	at terminal	$T_j = 25^\circ\text{C}$	0.7	0.8	$\text{m}\Omega$
		$T_j = 125^\circ\text{C}$	0.9	1.1	$\text{m}\Omega$
$E_{on} + E_{off}$	$I_C = 1200\text{ A}$ $T_j = 125^\circ\text{C}$	$V_{CC} = 600\text{ V}$	442		mJ
		$V_{CC} = 900\text{ V}$	780		mJ
$R_{th(j-s)}$	per IGBT switch			0.015	K/W
$R_{th(j-r)}$	per IGBT switch			0.015	K/W



S43

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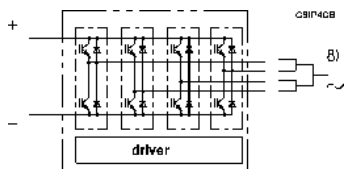
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Footnotes

¹⁾ With assembly of suitable MKP capacitor per terminal

Characteristics			T _s = 25°C unless otherwise specified			
Symbol	Conditions		min.	typ.	max.	Unit
Diode						
V _F = V _{EC}	I _F = 1200 A at terminal	T _j = 25 °C		1.50	1.80	V
		T _j = 125 °C		1.50		V
V _{F0}	at terminal	T _j = 25 °C		0.9	1.10	V
		T _j = 125 °C		0.7	0.90	V
r _F		T _j = 25 °C		0.5	0.6	mΩ
		T _j = 125 °C		0.7	0.8	mΩ
E _{rr}	I _F = 1200 A T _j = 125 °C	V _R = 600 V		84		mJ
		V _R = 900 V		112		mJ
R _{th(j-s)}	per diode switch				0.029	K/W
R _{th(j-r)}	per diode switch				0.048	K/W
Driver						
V _s	supply voltage non stabilized		13	24	30	V
I _{S0}	bias current @V _s =24V, f _{sw} = 0, I _{AC} = 0			330		mA
I _s	k ₁ = 55 mA/kHz, k ₂ = 0.00035 mA/A ²		= 330	+ k ₁ * f _{sw} + k ₂ * I _{AC} ²		mA
V _{IT+}	input threshold voltage (HIGH)		12.3			V
V _{IT-}	Input threshold voltage (LOW)				4.6	V
R _{IN}	input resistance			10		kΩ
C _{IN}	input capacitance			1		nF
t _{pRESET}	error memory reset time			0.0122		ms
t _{TD}	top / bottom switch interlock time			3		μs
t _{jitter}	jitter clock time			125		ns
t _{SIS}	short pulse suppression time			0.625	0.7	μs
I _{TRIPSC}	over current trip level		2940	3000	3060	A _{PEAK}
T _{trip}	over temperature trip level		110	115	120	°C
V _{DCtrip}	over voltage trip level,			not impl.		V
t _{d(on)IO}	V _{CC} = 900 V I _C = 1200 A T _j = 25 °C	input-output turn-on propagation time		1.4		μs
t _{d(off)IO}		input-output turn-off propagation time		1.4		μs
System						
R _{th(r-a)}	flow rate=390m ³ /h, T _a =25°C, 500m above sea level				0.0255	K/W
R _{CC'+EE'}	measured per switch, T _s = 25 °C			0.13		mΩ
L _{CE}	commutation inductance			3		nH
C _{CHC}	per phase, AC-side			6.8		nF
I _{CES} + I _{RD}	V _{GE} = 0 V, V _{CE} = 1200 V, T _j = 25 °C			4.8		mA
M _{dc}	DC terminals, SI Units		6		8	Nm
M _{ac}	AC terminals, SI Units		13		15	Nm
w	SKiiP System w/o heat sink			3.1		kg
w _h	heat sink			8		kg



S43

SKiiP 2413 GB123-4DFL V3**Isolation coordination acc. to EN 50178 and IEC 61800-5-1**

Maximum grid RMS voltage, line-to-line, grounded delta mains	480V+20%
Installation altitude for maximum grid RMS voltage, line-to-line, grounded delta mains	2000m
Maximum grid RMS voltage, line-to-line, star point grounded mains	480V+20%
Installation altitude for maximum grid RMS voltage, line-to-line, star point grounded mains	5000m
Maximum transient peak voltage between low voltage circuit and mains	1600V
Pollution degree acc. to IEC 60664-1 outside the moulded power section	2
Overvoltage cat. acc. to IEC 60664-1 for mains	III
Basic isolation	between heat sink and mains; between low voltage circuit and mains
Protection level acc. to IEC 60529	IP00

Environmental conditions acc.to IEC 60721

	Storage	Transportation	Operation stationary use at weather protected locations	Operating ground vehicle installations	Operating ship environment
Climatic conditions	1K2 ₍₁₎	2K2 ₍₁₎	3K3 ₍₁₎	5K1 ₍₁₎	---
Biological conditions	1B1	2B1	3B1	5B1	6B1
Chemically active substances (excluded: salt spray)	1C2	2C1	3C2	5C2	6C2
Mechanically active substances	1S1	2S1	3S1	5S1	6S1
Mechanical conditions	1M3	(4)	3M6 ₍₂₎	5M3 ₍₃₎	6M3
Contaminating fluids	---	---	---	5F1	---

(1) expanded temperature range: -40°C / +85°C. Please note: by operation near 85°C the life time of product is reduced.

(2) 3M7 possible, but due to the mechanic load capacity of external components like DC-Link capacitors limited to 3M6

(3) 5M3 without impact of foreign bodies, stones

(4) no declaration due to customer-specific packing

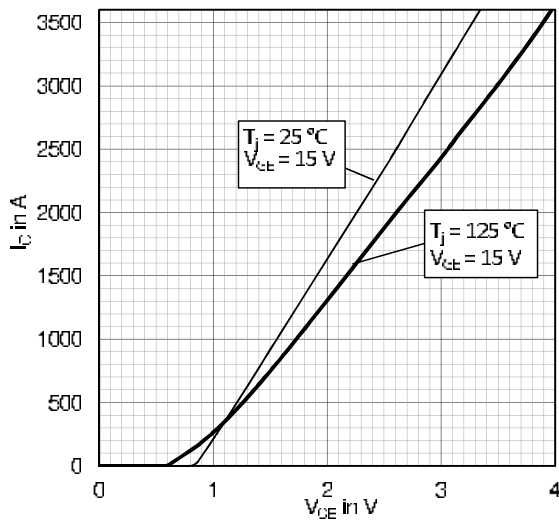


Fig. 1: Typical IGBT output characteristic

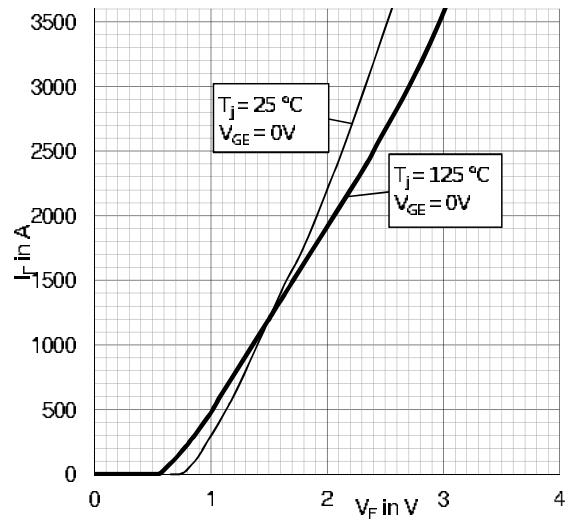


Fig. 2: Typical diode output characteristics

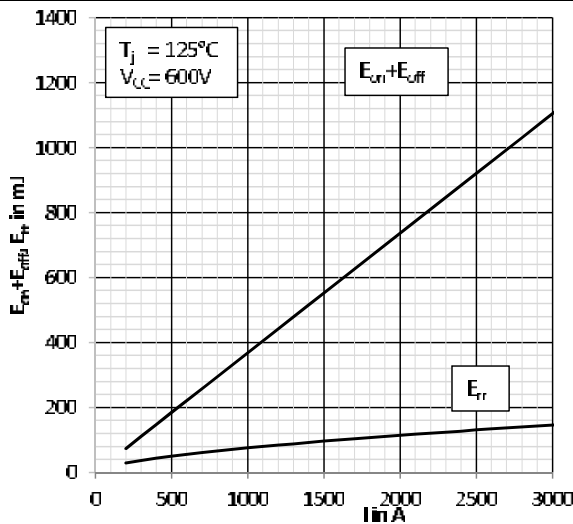


Fig. 3: Typical energy losses $E = f(I_C, V_{CC})$

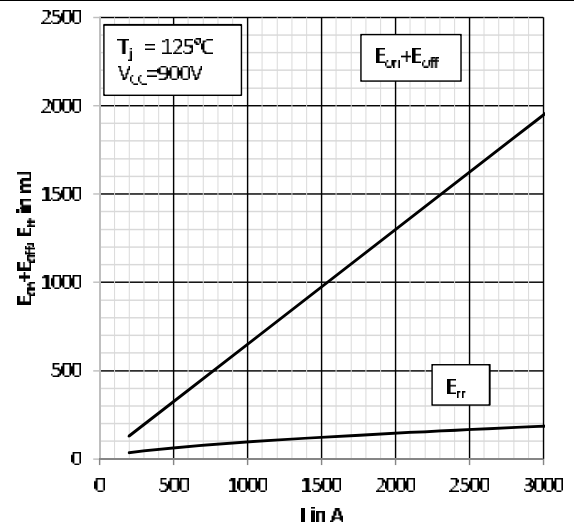


Fig. 4: Typical energy losses $E = f(I_C, V_{CC})$

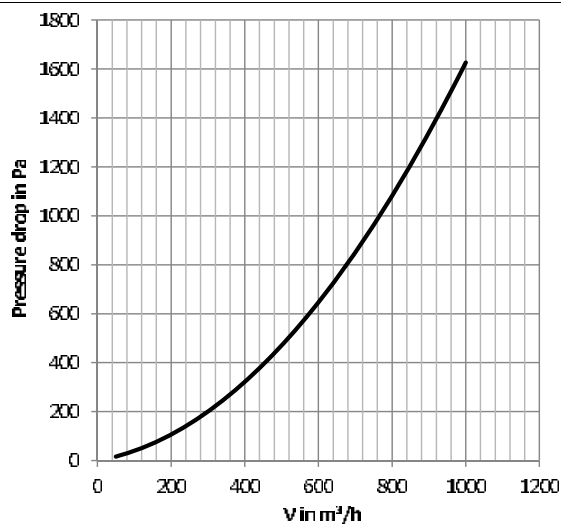


Fig. 5: Pressure drop Δp versus flow rate V

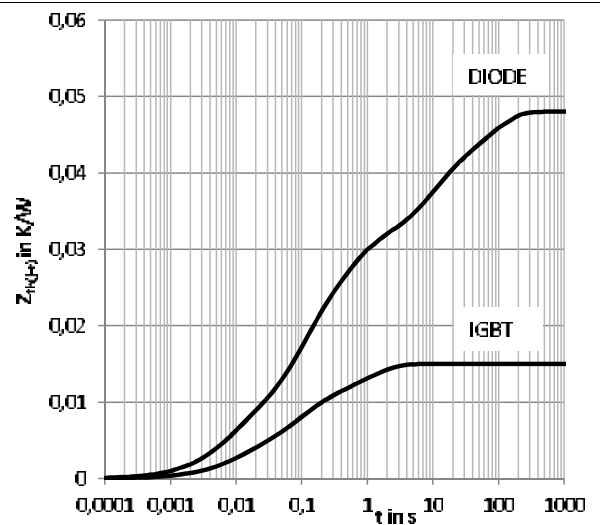


Fig. 6: Transient thermal impedance $Z_{th}(j-r)$

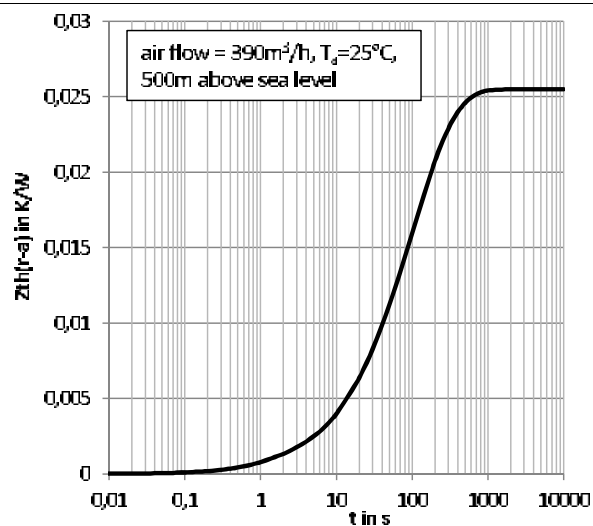


Fig. 7: Transient thermal impedance $Z_{th}(r-a)$

	$R_{th} [K/W]$					
	1	2	3	4	5	6
$Z_{th}(r-a) I$	0,0027	0,0055	0,0022	0,0046	0,0000	0,0000
$Z_{th}(r-a) D$	0,0061	0,0126	0,0113	0,0076	0,0019	0,0085
$Z_{th}(r-a)$	0,0008	0,0030	0,0120	0,0097	0,0000	0,0000

	$\tau [s]$					
	1	2	3	4	5	6
$Z_{th}(r-a) I$	0,0090	0,0700	0,2200	1,1000	1,0000	1,0000
$Z_{th}(r-a) D$	0,0070	0,0850	0,4400	8,3000	12,000	72,000
$Z_{th}(r-a)$	1,3800	17,000	82,000	209,00	1,0000	1,0000

Fig. 8: Coefficients of thermal impedances

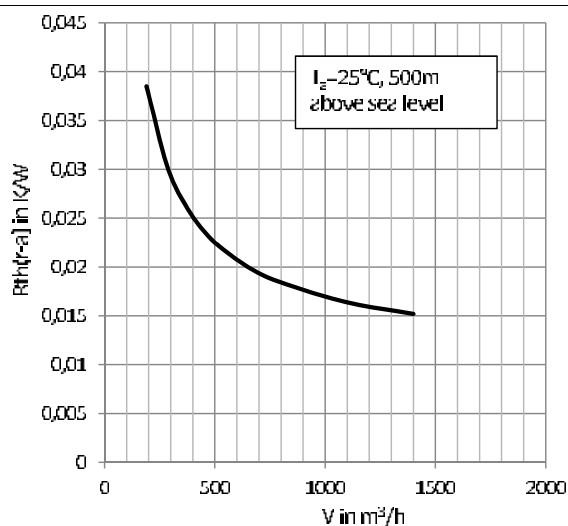
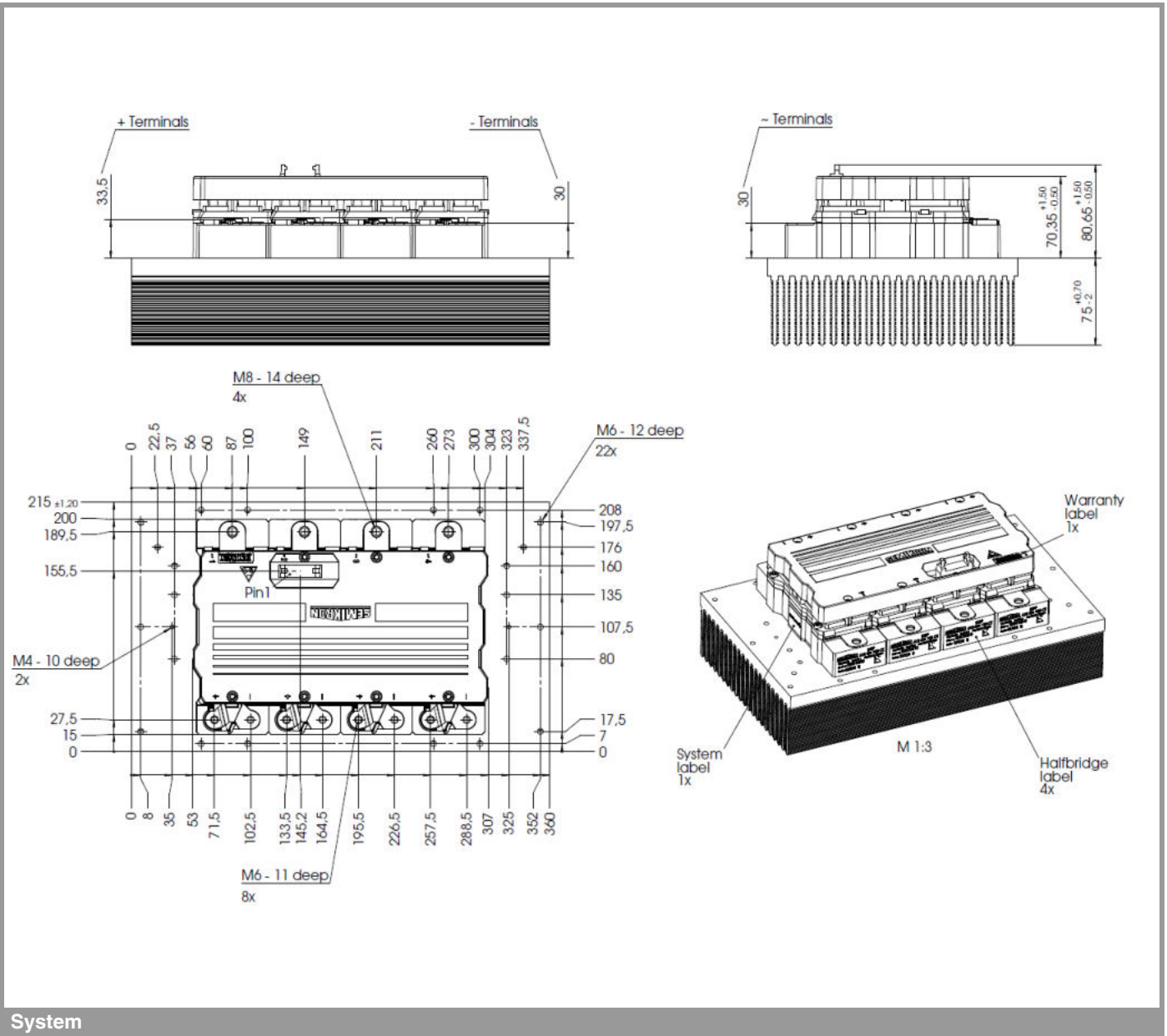


Fig. 9: Thermal resistance $R_{th}(r-a)$ versus flow rate V



System

This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

*IMPORTANT INFORMATION AND WARNINGS

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