SKiiP 3614 GB17E4-6DUL

SKiiP® 4

2-pack-integrated intelligent Power System

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Features

- Intelligent Power Module
- Integrated current and temperature measurement
- Integrated DC-link measurement
- Solder free power section
- IGBT4 and CAL4F technology
- Safety isolated switching and sensor signals
- Digital signal transmission
- CAN Interface
- 100% tested IPM
- RoHS compliant
- UL recognition in progress, file no. E242581

Typical Applications*

- Renewable energies
- Traction
- Elevators
- Industrial drives

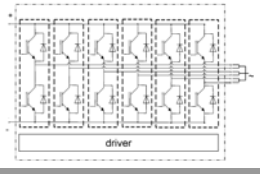
Remarks

For further information please refer to SKiiP®4 Technical Explanation

Footnote

[1] With assembly of suitable MKP capacitor per terminal

[2] The specified maximum operation junction temperature T_{vjop} can be >150°C for a maximum of 1000 cum. operation hours



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Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
System				
V_{CC} [1]	Operating DC link voltage		1300	V
V_{isol}	DC, t = 1 s, each polarity		5600	V
$I_{t(RMS)}$	per AC terminal, rms, sinusoidal current		500	A
$I_{max\ (peak)}$	max. peak current of power section		5400	A
I_{FSM}	T_j = 175 °C, t_p = 10 ms, sin 180°		16547	A
I^2t	T_j = 175 °C, t_p = 10 ms, diode		1369	kA^2s
f_{out}	fundamental output frequency (sinusoidal)		1	kHz
T_{stg}	storage temperature		-40 ... 85	°C
IGBT				
V_{CES}	T_j = 25 °C		1700	V
I_C	T_j = 175 °C	T_s = 25 °C	5078	A
		T_s = 70 °C	4085	A
I_{Cnom}			3600	A
T_j [2]	junction temperature		-40 ... 175	°C
Diode				
V_{RRM}	T_j = 25 °C		1700	V
I_F	T_j = 175 °C	T_s = 25 °C	3547	A
		T_s = 70 °C	2807	A
I_{Fnom}			3600	A
T_j [2]	junction temperature		-40 ... 175	°C
Driver				
V_s	power supply		19.2 ... 28.8	V
V_{iH}	input signal voltage (high)		V_s + 0.3	V
dv/dt	secondary to primary side		75	kV/µs
f_{sw}	switching frequency		5	kHz

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
IGBT						
$V_{CE(sat)}$	I_C = 3600 A at terminal	T_j = 25 °C		2.12	2.43	V
		T_j = 150 °C		2.53	2.79	V
V_{CE0}		T_j = 25 °C		1.10	1.20	V
		T_j = 150 °C		1.00	1.10	V
r_{CE}	at terminal	T_j = 25 °C		0.28	0.34	mΩ
		T_j = 150 °C		0.42	0.47	mΩ
$E_{on} + E_{off}$	I_C = 3600 A	V_{CC} = 900 V		4288		mJ
	T_j = 150 °C	V_{CC} = 1300 V		6840		mJ
$R_{th(j-s)}$	per IGBT switch				0.0092	K/W
$R_{th(j-r)}$	per IGBT switch				0.0035	K/W

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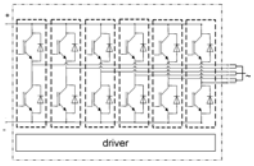

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Diode						
$V_F = V_{EC}$	I_F = 3600 A at terminal	T_j = 25 °C		2.02	2.34	V
		T_j = 150 °C		2.27	2.62	V
V_{F0}		T_j = 25 °C		1.21	1.36	V
		T_j = 150 °C		0.99	1.12	V
r_F	at terminal	T_j = 25 °C		0.23	0.27	mΩ
		T_j = 150 °C		0.36	0.42	mΩ
E_{rr}	I_F = 3600 A, T_j = 150 °C	V_R = 900 V		618		mJ
		V_R = 1300 V		996		mJ
$R_{th(j-s)}$	per diode switch				0.0187	K/W
$R_{th(j-r)}$	per diode switch				0.011	K/W
Driver						
V_s	supply voltage non stabilized		19.2	24	28.8	V
I_{S0}	bias current @V_s= 24V, f_{sw} = 0, I_{AC} = 0			430		mA
I_s	k_1 = 66 mA/kHz, k_2 = 0.286 mA/A, f_{out} =50Hz, sinusoidal current		= 430	+ k_1* f_{sw}	+ k_2 * I_{AC}	mA
V_{IT+}	input threshold voltage (HIGH)		0,7*V_s			V
V_{IT-}	input threshold voltage (LOW)				0,3*V_s	V
R_{IN}	input resistance			13		kΩ
C_{IN}	input capacitance			1		nF
t_{pRESET}	error memory reset time		1300		2900	ms
$t_{pReset(OCP)}$	Over current reset time, FRT-function can be activated via CAN interface					µs
t_{TD}	top / bottom switch interlock time			3		µs
t_{jitter}	jitter clock time			52	58	ns
t_{SIS}	short pulse suppression time			0.6		µs
t_{POR}	Power-On-Reset completed			3.5		s
$I_{digiout}$	digital output sink current (HALT-signal)				16	mA
$V_{it+\ HALT}$	input threshold voltage HIGH HALT (Low -->High)		0,6*V_s			V
$V_{it-HALT}$	input threshold voltage LOW HALT (High --> Low)				0.4*V_s	V
$t_{d(err)}$	Error delay time (from detection to HALT), (depends on kind of error)		1.8		170	µs
I_{TRIPSC}	over current trip level		5290	5400	5510	A_{PEAK}
I_{LL}				n.a.		A_{PEAK}
T_{trip}	over temperature trip level		128	135	142	°C
$T_{DriverTrip}$	over temperature PCB trip level		113	120	124	°C
V_{DCtrip}	over voltage trip level, can be deactivated via CAN interface,		1300	1340	1380	V
$V_{DCtripLL}$				n.a.		V

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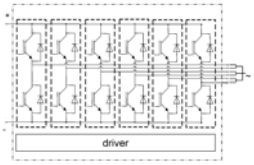
Symbol	Conditions		min.	typ.	max.	Unit
System						
$t_{d(on)IO}$	V_{CC} = 1300 V I_C = 3600 A T_j = 25 °C	turn on propagation delay time		2.8		µs
$t_{d(off)IO}$		turn off propagation delay time		2.6		µs
dV_{CE}/dt_{on}	T_j = 25 °C V_{CC} = 1300 V	I_C = 0 A		10		kV/µs
		I_C = 3600 A		3		kV/µs
dV_{CE}/dt_{off}		I_C = 3600 A		4		kV/µs
$R_{th(s-a)}$	flow rate = 500 m^3/h, T_a=25°C, 500m above sea level				0.017	K/W
$R_{CC'+EE'}$	terminals to chip, T_s = 25 °C			0.045		mΩ
L_{CE}	commutation inductance			3		nH
C_{CHC}	coupling capacitance secondary to heat sink			8.4		nF
C_{ps}	coupling capacitance primary to secondary			0.102		nF
$I_{CES} + I_{RD}$	V_{GE} = 0 V, V_{CE} = 1700 V, T_j = 25 °C			0.226		mA
M_{dc}	DC terminals		6		8	Nm
M_{ac}	AC terminals		13		15	Nm
w	SKiiP System w/o heat sink			4.84		kg
w_h	heat sink			9.9		kg



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Isolation coordination acc. to EN 50178 and IEC 61800-5-1	
Maximum grid RMS voltage, line-to-line, grounded delta mains	690V+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	690V+20%
Installation altitude for maximum grid RMS voltage, line-to-line, star point grounded mains	4000m
Maximum transient peak voltage between low voltage circuit and mains	1900V
Pollution degree acc. to IEC 60664-1 outside the moulded power section	2
Overvoltage cat. acc. to IEC 60664-1 for mains	III
Overvoltage cat. acc. to UL 840 within mains	I
Overvoltage cat. acc. to UL 840 between mains and ground	III
Overvoltage cat. acc. to UL 840 between mains and low voltage circuit	III
Basic isolation	between heat sink and mains
Reinforced isolation	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)	6K1(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

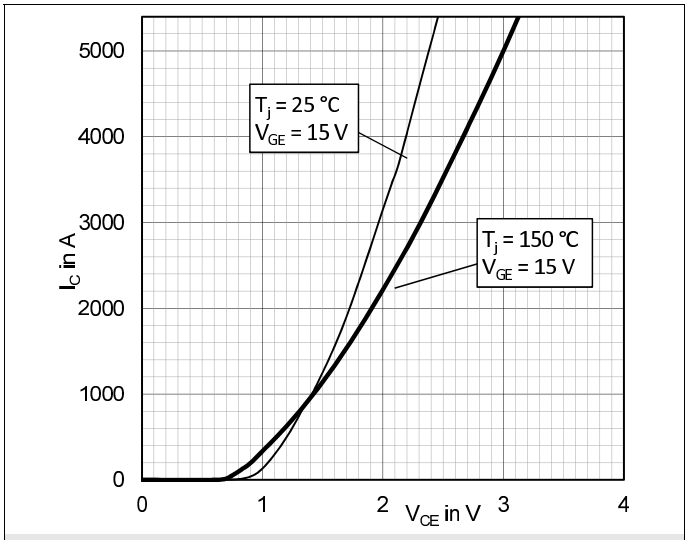


Fig. 1: Typical IGBT output characteristics

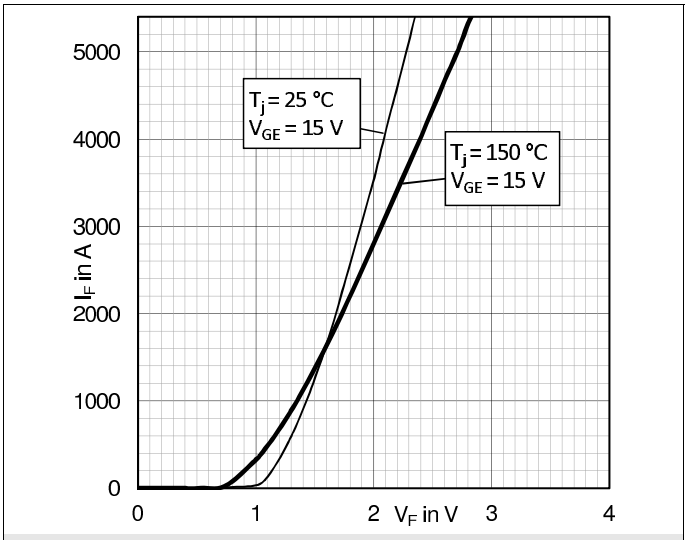


Fig. 2: Typical diode output characteristics

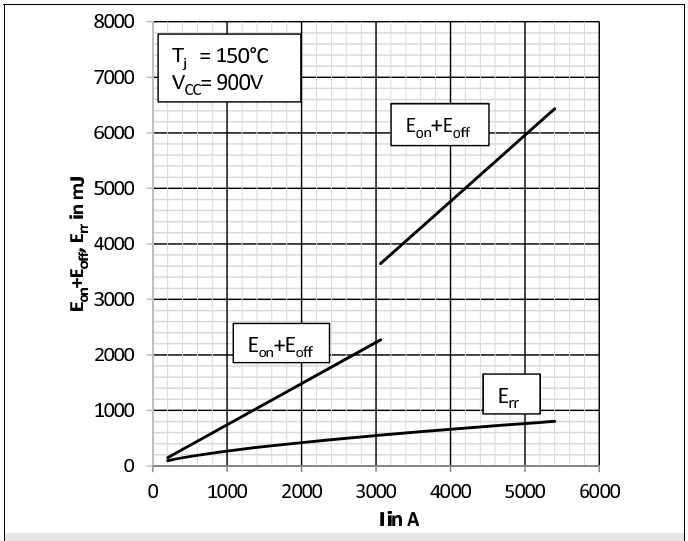


Fig. 3: Typical switching energy E = f(I_c)

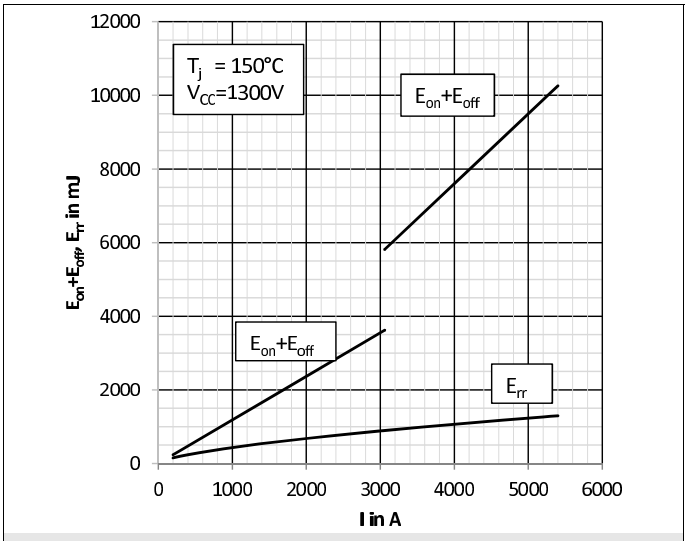


Fig. 4: Typical switching energy E = f(I_c)

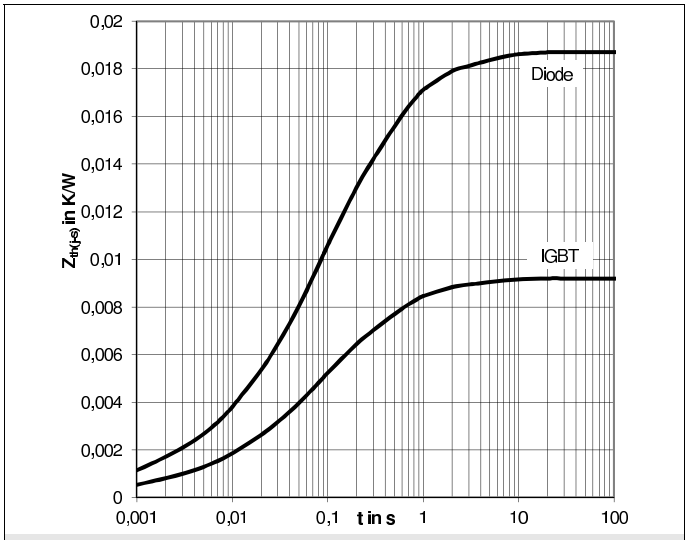


Fig. 5: Transient thermal impedance Zth(j-s)

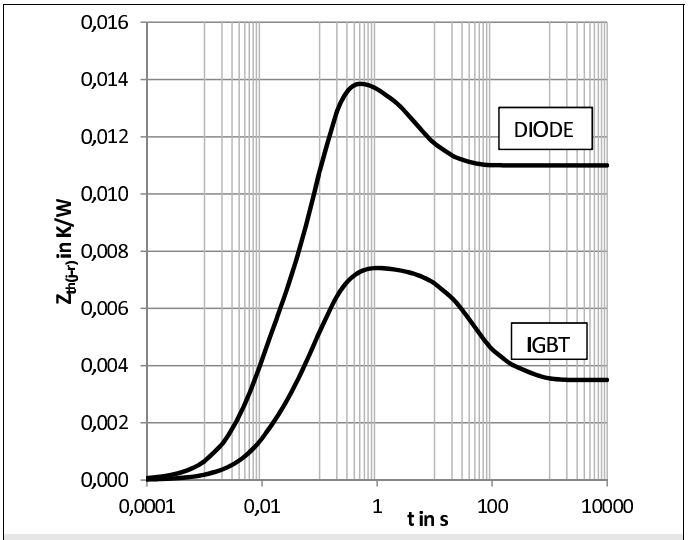


Fig. 6: Transient thermal impedance Zth(j-r)

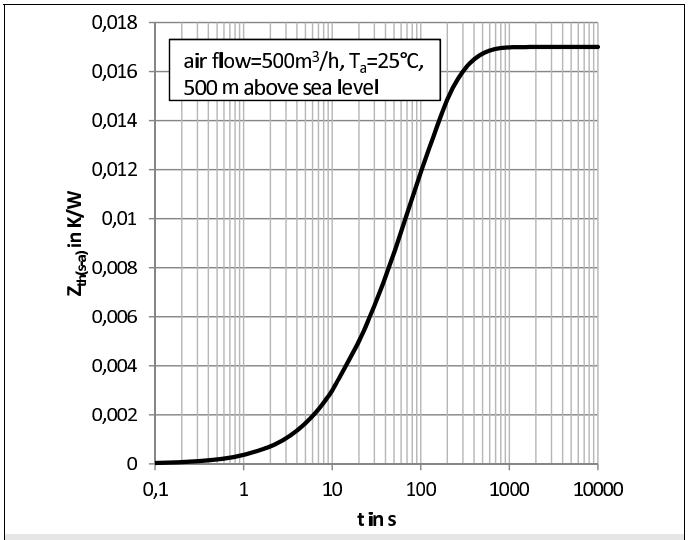


Fig. 7: Transient thermal impedance Zth(s-a)

	R_{th} [K/W]				
	1	2	3	4	5
$Z_{th(j-s)}$ I	0,0006	0,0033	0,0037	0,0011	0,0005
$Z_{th(j-s)}$ D	0,0013	0,0067	0,0074	0,0022	0,0011
$Z_{th(j-r)}$ I	0,0014	0,0038	0,0023	-0,0030	-0,0010
$Z_{th(j-r)}$ D	0,0041	0,0035	0,0066	-0,0023	-0,0009
$Z_{th(s-a)}$	0,0029	0,0090	0,0051	0,0000	0,0000
	tau [s]				
	1	2	3	4	5
$Z_{th(j-s)}$ I	3,6500	0,4100	0,0650	0,0090	0,0008
$Z_{th(j-s)}$ D	3,6500	0,4100	0,0650	0,0090	0,0008
$Z_{th(j-r)}$ I	0,0110	0,0700	0,2000	44,900	337,00
$Z_{th(j-r)}$ D	0,0070	0,0620	0,1100	4,2000	20,000
$Z_{th(s-a)}$	13,100	73,000	168,00	1,0000	1,0000

Fig. 8: Coefficients of thermal impedances

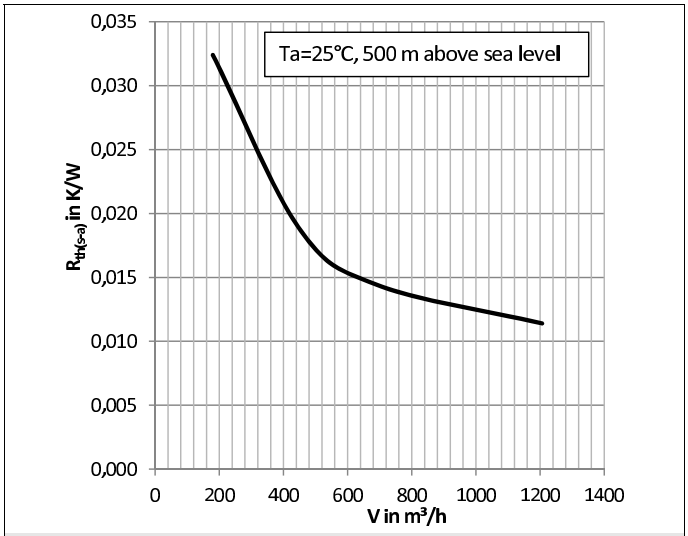


Fig. 9: Thermal resistance Rth(s-a) versus flow rate V

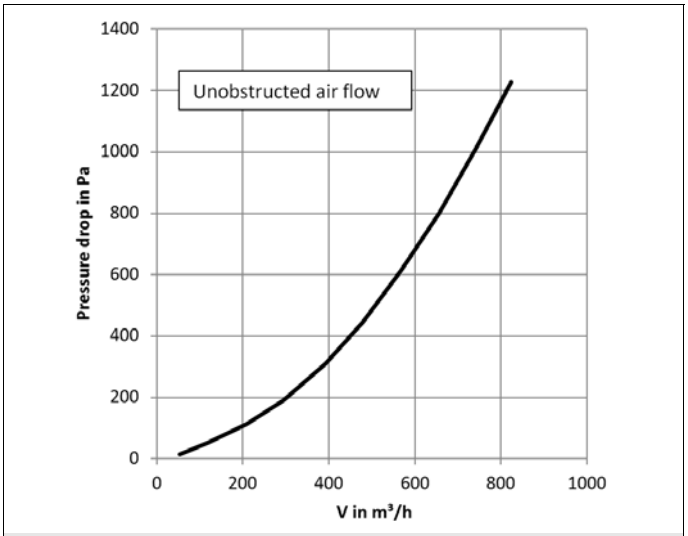
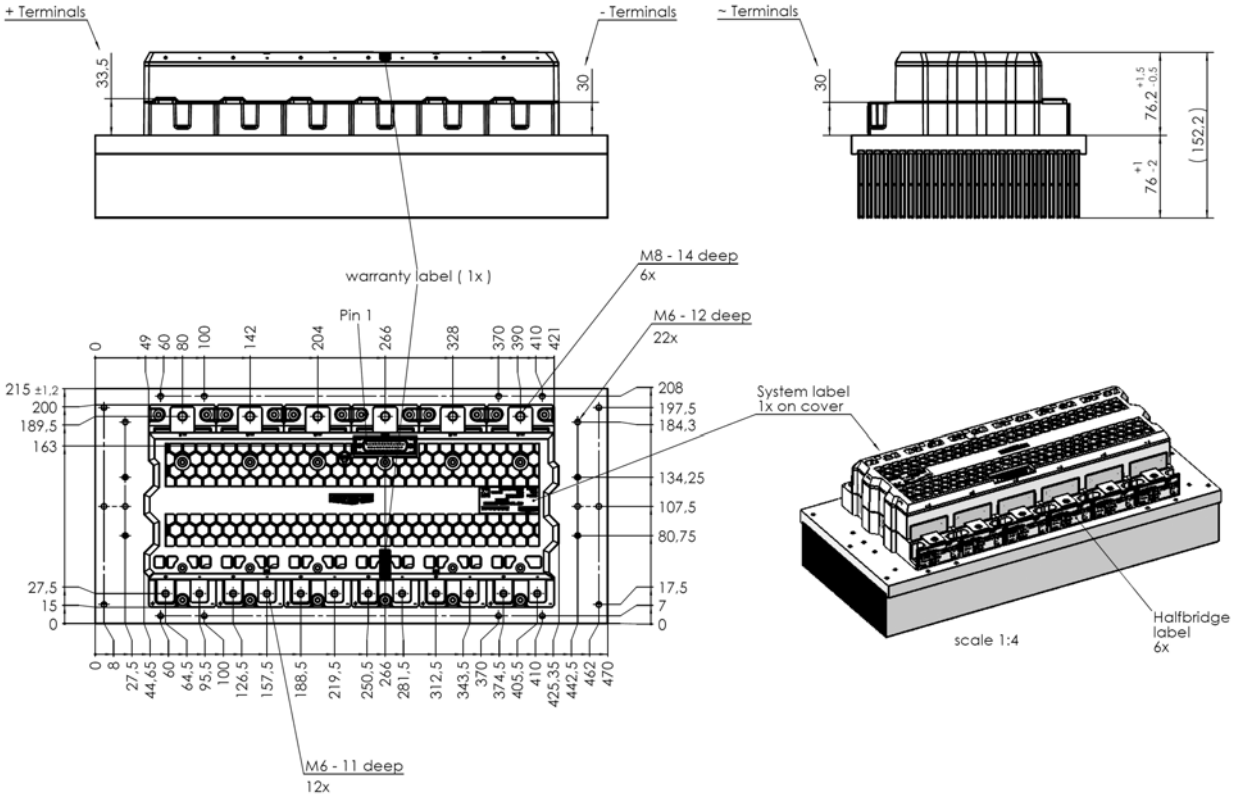


Fig. 10: Pressure drop Δp versus flow rate V



System

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

* The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our staff.