SKiiP 25NABI066V3

MiniSKiiP® CIB IPM

3-phase bridge rectifier + brake chopper + 3-phase bridge inverter

intelligent power module

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Features

- Contact springs for solder-free and quick assembly
- Trench-Field-Stop IGBT
- Freewheeling diodes in CAL technology
- HVIC gate driver in SOI technology with advanced level shifter
- Matched propagation delay
- Over-current and under-voltage detection
- Interlock logic for cross conduction protection
- Multi-purpose error input
- Integrated temperature sensor (NTC)
- RoHs compliant
- UL recognised file no. E63532

Typical Applications*

- Industrial & consumer drives
- Power supplies (SMPS & UPS)

Remarks

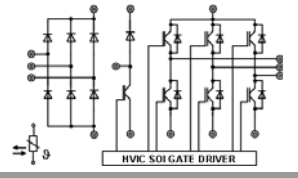
- Product reliability results valid for $T_j \leq 150°C$
- Case temp. limited to $T_c = 125°C$ max. (for baseplateless modules $T_c = T_s$

Footnotes

[1)] Please refer to Technical Explanations

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V_{CES}	T_j = 25 °C		600	V
I_C	T_j = 150 °C	T_s = 25 °C	37	A
		T_s = 70 °C	28	A
I_C	T_j = 175 °C	T_s = 25 °C	41	A
		T_s = 70 °C	33	A
I_{Cnom}			30	A
I_{CRM}	I_{CRM} = 2 x I_{Cnom}		60	A
t_{psc}	V_{CC} = 360 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 600 V	T_j = 150 °C	6	µs
T_j			-40 ... 175	°C
Chopper - IGBT				
V_{CES}	T_j = 25 °C		600	V
I_C	T_j = 150 °C	T_s = 25 °C	37	A
		T_s = 70 °C	28	A
I_C	T_j = 175 °C	T_s = 25 °C	41	A
		T_s = 70 °C	33	A
I_{Cnom}			30	A
I_{CRM}	I_{CRM} = 2 x I_{Cnom}		60	A
t_{psc}	V_{CC} = 360 V $V_{GE} \leq$ 15 V $V_{CES} \leq$ 600 V	T_j = 150 °C	6	µs
T_j			-40 ... 175	°C
Inverse - Diode				
V_{RRM}	T_j = 25 °C		600	V
I_F	T_j = 150 °C	T_s = 25 °C	33	A
		T_s = 70 °C	25	A
I_F	T_j = 175 °C	T_s = 25 °C	37	A
		T_s = 70 °C	29	A
I_{Fnom}			30	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		60	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		160	A
T_j			-40 ... 175	°C
Freewheeling - Diode				
V_{RRM}	T_j = 25 °C		600	V
I_F	T_j = 150 °C	T_s = 25 °C	33	A
		T_s = 70 °C	25	A
I_F	T_j = 175 °C	T_s = 25 °C	37	A
		T_s = 70 °C	29	A
I_{Fnom}			30	A
I_{FRM}	I_{FRM} = 2 x I_{Fnom}		60	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		160	A
T_j			-40 ... 175	°C



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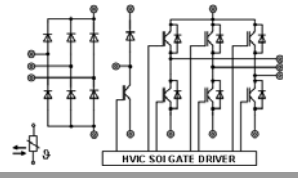

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Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Rectifier - Diode				
V_{RRM}	T_j = 25 °C, chiplevel		1600	V
I_F	T_s = 25 °C, T_j = 150 °C		43	A
I_{FSM}	10 ms sin 180°	T_j = 25 °C	370	A
		T_j = 150 °C	270	A
I^2t	10 ms sin 180°	T_j = 25 °C	685	A^2s
		T_j = 150 °C	365	A^2s
T_j			-40 ... 150	°C
Driver				
VCC	VCC-VSS, VCCL-VSSL		17	V
VBx	VB1-U, VB2-V, VB3-W		17	V
VSx	Voltage to VSS		-25 ... 600	V
V_{in}	HINx-VSS, LINx-VSS, /ERRIN-VSS		VSS-0.3 ... VCC+0.3	V
V_{oErr}	/ERROUT-VSS		VSS-0.3 ... VCC+0.3	V
$I_{max(EO)}$	/ERROUT-VSS		10	mA
V_{ITRIP}	ITRIP-VSS		VSS-0.3 ... VCC+0.3	V
Module				
T_c			-40 ... 125	°C
T_{stg}			-40 ... 125	°C
V_{isol}	AC sinus 50Hz, all pins to heat sink, 1 min		2500	V
$I_{t(RMS)}$	$T_{terminal}$ = 80 °C, 20A per spring		60	A

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
$V_{CE(sat)}$	I_C = 30 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		1.50	1.90	V
		T_j = 150 °C		1.65	2.10	V
V_{CE0}	chiplevel	T_j = 25 °C		0.9	1	V
		T_j = 150 °C		0.85	0.9	V
r_{CE}	V_{GE} = 15 V, chiplevel	T_j = 25 °C		20	30	mΩ
		T_j = 150 °C		27	40	mΩ
I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V	T_j = 25 °C		0.1	0.3	mA
						mA
Q_G	0 V ... +15 V			165		nC
$t_{d(on)}$	V_{CC} = 300 V, I_C = 30 A, V_{GE} = +15/0 V [1]	T_j = 150 °C		855		ns
t_r		T_j = 150 °C		34		ns
E_{on}		T_j = 150 °C		1.1		mJ
$t_{d(off)}$		T_j = 150 °C		1273		ns
t_f		T_j = 150 °C		34		ns
E_{off}		T_j = 150 °C		1		mJ
$R_{th(j-s)}$	per IGBT			1.4		K/W

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- Power supplies (SMPS & UPS)

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- Product reliability results valid for $T_j \leq 150°C$
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Footnotes

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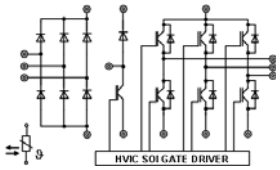

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Chopper - IGBT						
$V_{CE(sat)}$	I_C = 30 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		1.50	1.90	V
		T_j = 150 °C		1.65	2.10	V
V_{CE0}	chiplevel	T_j = 25 °C		0.9	1	V
		T_j = 150 °C		0.85	0.9	V
r_{CE}	V_{GE} = 15 V, chiplevel	T_j = 25 °C		20	30	mΩ
		T_j = 150 °C		27	40	mΩ
I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V	T_j = 25 °C		0.1	0.3	mA
						mA
$t_{d(on)}$	V_{CC} = 300 V, I_C = 30 A, V_{GE} = +15/0 V [1]	T_j = 150 °C		855		ns
t_r		T_j = 150 °C		34		ns
E_{on}		T_j = 150 °C		1.1		mJ
$t_{d(off)}$		T_j = 150 °C		1273		ns
t_f		T_j = 150 °C		34		ns
E_{off}		T_j = 150 °C		1		mJ
$R_{th(j-s)}$	per IGBT			1.4		K/W
Inverse diode						
$V_F = V_{EC}$	I_F = 30 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		1.6	1.9	V
		T_j = 150 °C		1.7	2.0	V
V_{F0}	chiplevel	T_j = 25 °C		1	1.1	V
		T_j = 150 °C		0.85	0.95	V
r_F	chiplevel	T_j = 25 °C		21	26	mΩ
		T_j = 150 °C		29	34	mΩ
I_{RRM}	I_F = 30 A, V_{GE} = 0 V, V_{CC} = 300 V	T_j = 150 °C		43		A
Q_{rr}		T_j = 150 °C		3.4		µC
E_{rr}		T_j = 150 °C		0.7		mJ
$R_{th(j-s)}$	per Diode			1.8		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	I_F = 30 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		1.6	1.9	V
		T_j = 150 °C		1.7	2.0	V
V_{F0}	chiplevel	T_j = 25 °C		1	1.1	V
		T_j = 150 °C		0.85	0.95	V
r_F	chiplevel	T_j = 25 °C		21	26	mΩ
		T_j = 150 °C		29	34	mΩ
I_{RRM}	I_F = 30 A, V_{GE} = 0 V, V_{CC} = 300 V	T_j = 150 °C		43		A
Q_{rr}		T_j = 150 °C		3.4		µC
E_{rr}		T_j = 150 °C		0.7		mJ
$R_{th(j-s)}$	per Diode			1.8		K/W
Rectifier diode						
$V_F = V_{EC}$	I_F = 13 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		1	1.21	V
		T_j = 125 °C			1.1	V
V_{F0}	chiplevel	T_j = 25 °C			1.0	V
		T_j = 125 °C			0.8	V
r_F	chiplevel	T_j = 25 °C		9.2	18	mΩ
		T_j = 125 °C			21	mΩ
$R_{th(j-s)}$	per Diode			1.7		K/W

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Footnotes

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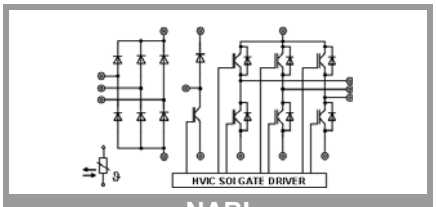
Characteristics					
Symbol	**Conditions**	**min.**	**typ.**	**max.**	**Unit**
Driver					
VCC	VCC-VSS, VCCL-VSSL [1]		15		V
ICCo	Quiescent current, VCC=15V [1]			6.5	mA
VBx	VB1-U, VB2-V, VB2-W [1]		15		V
IBx	Quiescent high side driver supply current per channel, VBx=15V [1]		380	450	µA
V_{IT+}	Input threshold voltage (HIGH) [1]		1.9	2.4	V
V_{IT-}	Input threshold voltage (LOW) [1]	0.8	1.1		V
V_{ITRIP+}	ITRIP set threshold voltage [1]		0.51	0.6	V
V_{ITRIP-}	ITRIP reset threshold voltage [1]	0.35	0.41		V
V_{oErr}	Error output, open drain [1]			15	V
V_{UV}	Supply under-voltage protection set [1]	10.5	11.1		V
V_{UVr}	Supply under-voltage protection reset [1]		11.5	12.3	V
$t_{d,ITRIP}$	ITRIP to LOUTx/HOUTx shutdown propagation delay		700		ns
t_{SIS}	PWM short pulse suppression		0.47		µs
t_{TD}	Interlock dead time		0.48		µs
f_{SW}	Switching frequency			25	kHz
Temperatur Sensor					
R_{25}	$T_r = 25 °C$ [1]		5.0 ± 5%		kΩ
Module					
M_s	to heat sink	2		2.5	Nm
w	weight		60		g



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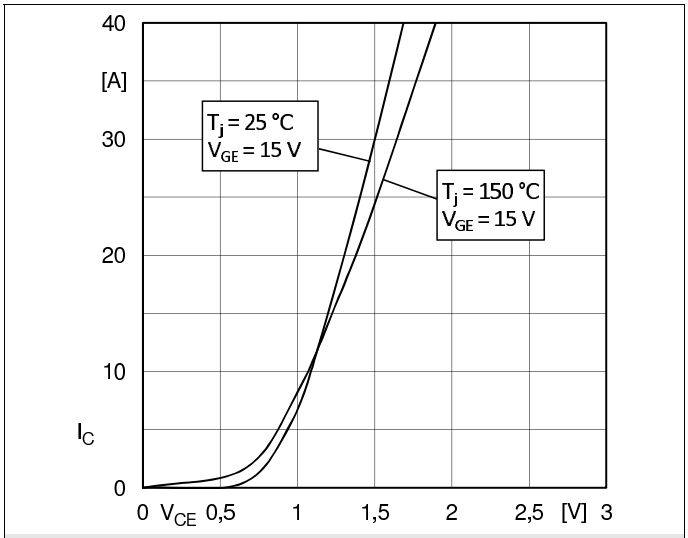


Fig. 1: Typ. output characteristic

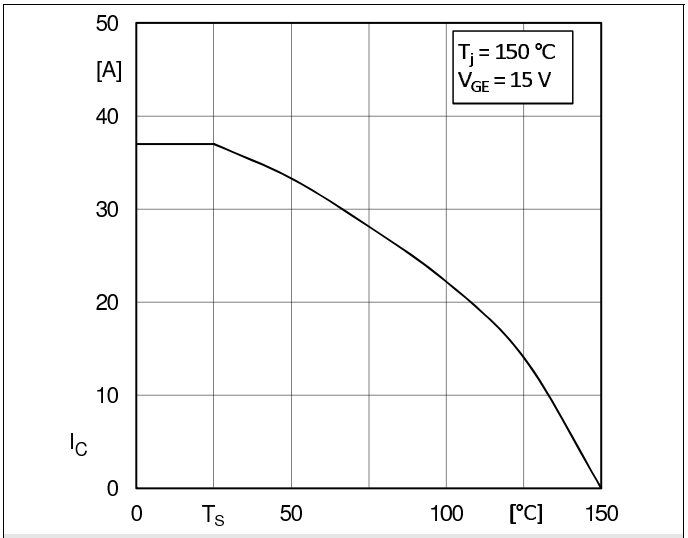


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

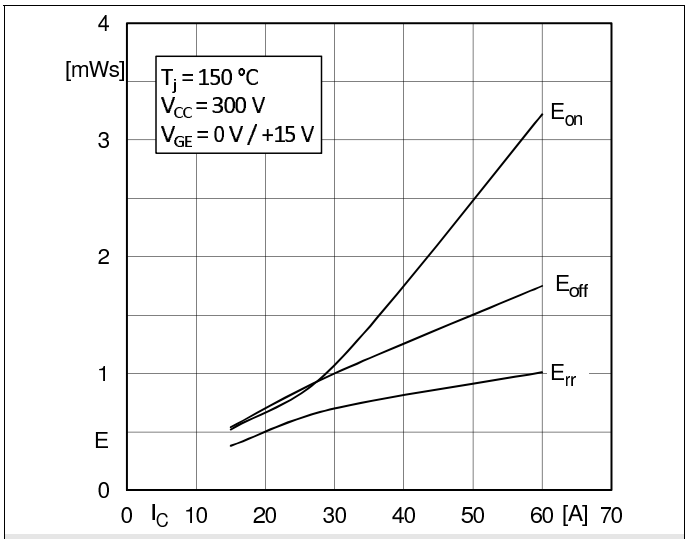


Fig. 3: Typ. turn-on /-off energy = f (I_C)

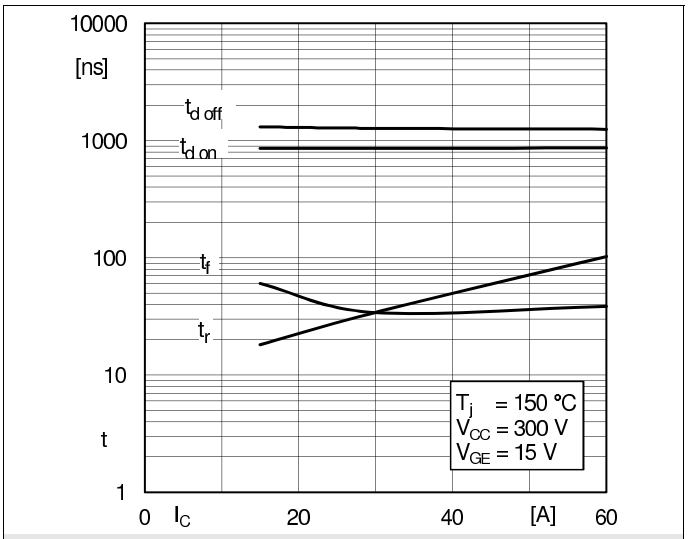


Fig. 4: Typ. switching times vs. I_c

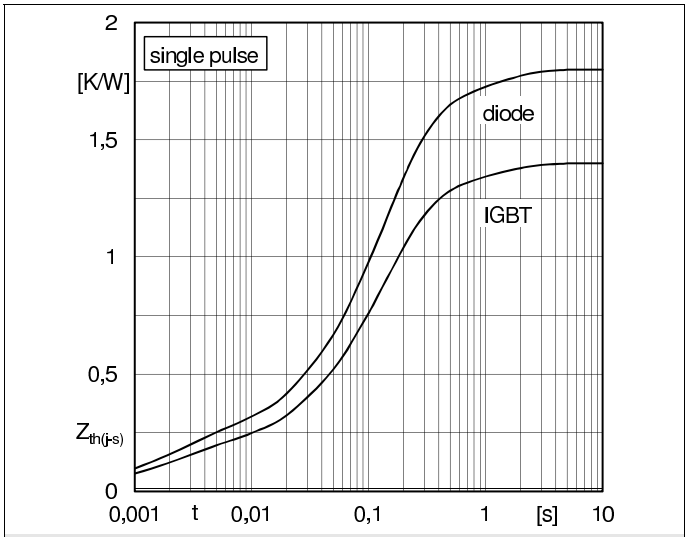


Fig. 5: Transient thermal impedance of IGBT and diode

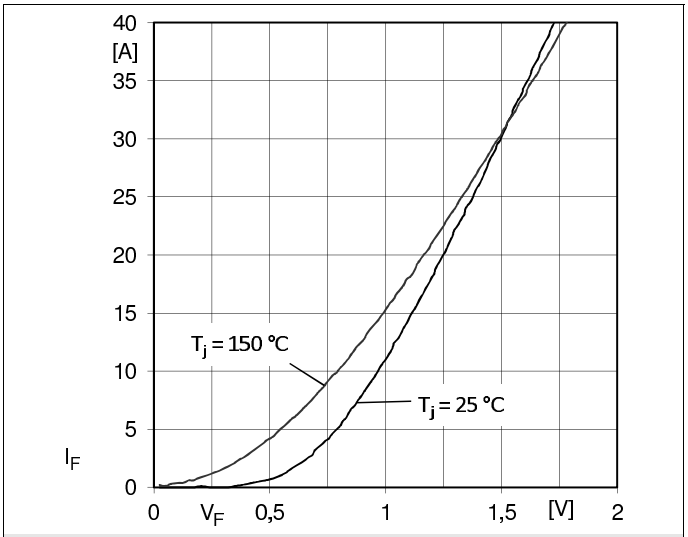


Fig. 6: Typ. freewheeling diode forward characteristic

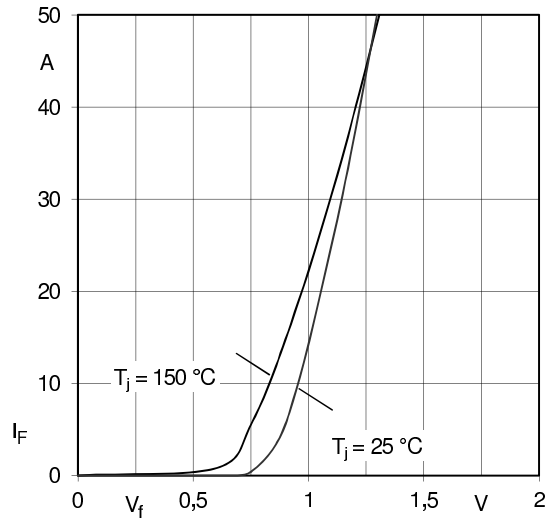
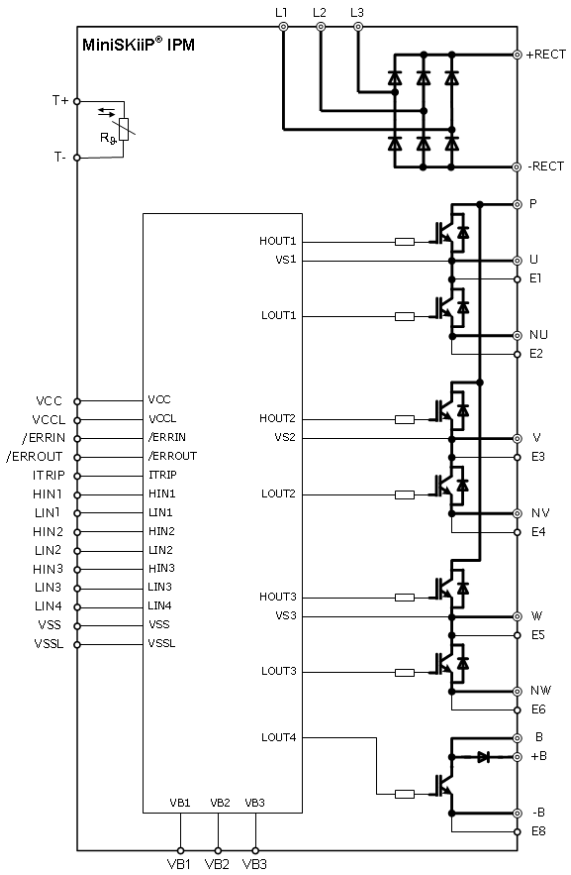


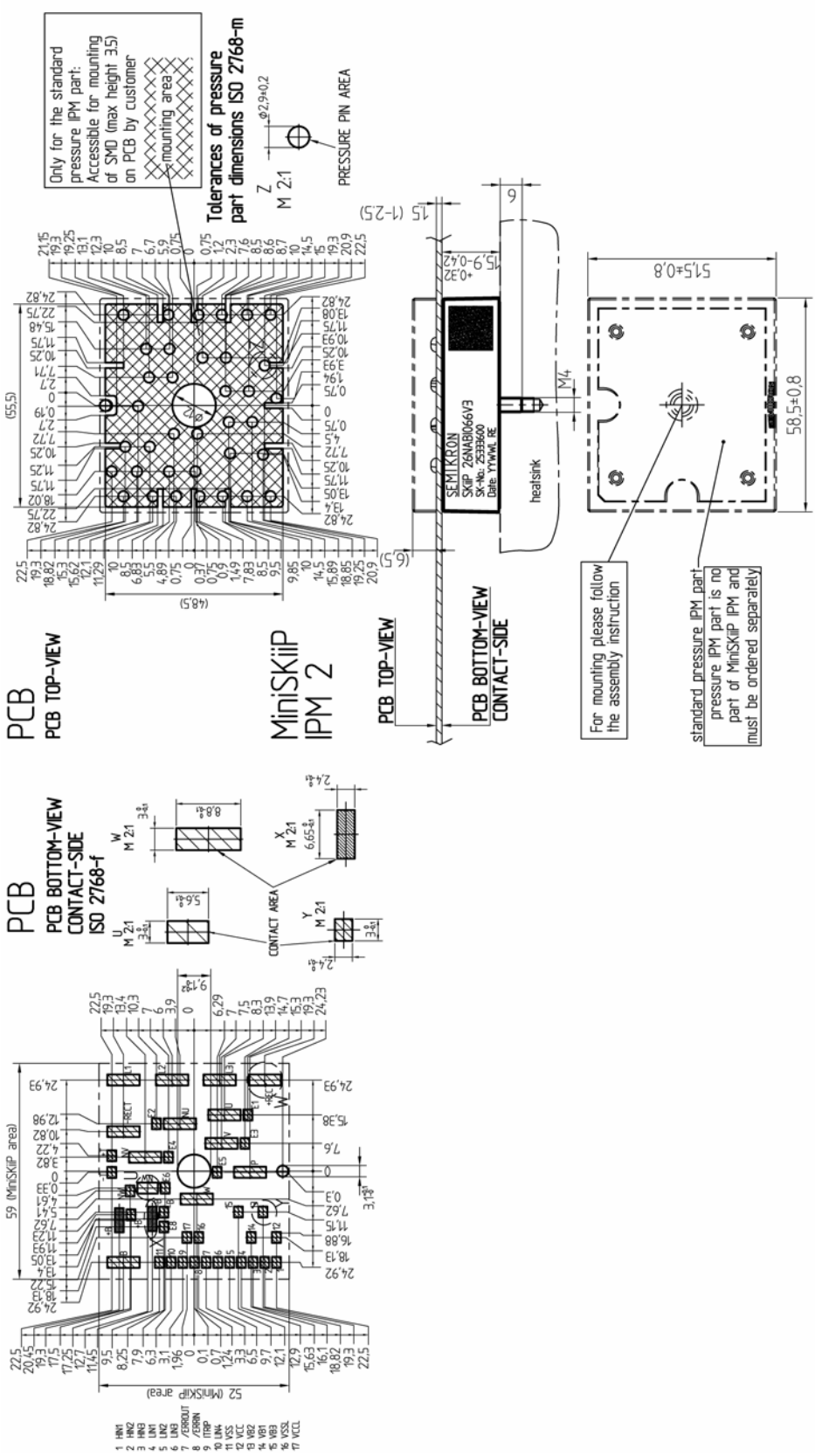
Fig. 7: Typ. input bridge forward characteristic



Internal circuit

Pin	Signal	Description
1	HIN1	PWM signal input for phase U high side switch
2	HIN2	PWM signal input for phase V high side switch
3	HIN3	PWM signal input for phase W high side switch
4	LIN1	PWM signal input for phase U low side switch
5	LIN2	PWM signal input for phase V low side switch
6	LIN3	PWM signal input for phase W low side switch
7	/ERROUT	Error logic output (low active)
8	/ERRIN	Multi-purpose error input for common shut-down (low active)
9	ITRIP	Comparator input / current sense input for overcurrent shut-down
10	LIN4	PWM signal input for brake chopper switch
11	VSS	Driver IC supply voltage ground
12	VCC	Driver IC main supply voltage
13	VB2	Floating supply voltage for phase V high side IGBT
14	VB1	Floating supply voltage for phase U high side IGBT
15	VB3	Floating supply voltage for phase W high side IGBT
16	VSSL	Low side supply voltage ground
17	VCCL	Low side supply voltage
L1	L1	Bridge rectifier input for phase 1
L2	L2	Bridge rectifier input for phase 2
L3	L3	Bridge rectifier input for phase 3
U	U	Phase U AC terminal
E1	E1	Auxiliary emitter terminal of phase U high side IGBT
V	V	Phase V AC terminal
E3	E3	Auxiliary emitter terminal of phase V high side IGBT
W	W	Phase W AC terminal
E5	E5	Auxiliary emitter terminal of phase W high side IGBT
NU	NU	Phase U -DC terminal
E2	E2	Auxiliary emitter terminal of phase U low side IGBT
NV	NV	Phase V -DC terminal
E4	E4	Auxiliary emitter terminal of phase V low side IGBT
NW	NW	Phase W -DC terminal
E6	E6	Auxiliary emitter terminal of phase W low side IGBT
B	B	Brake chopper B terminal
+B	+B	Brake chopper +B terminal
-B	-B	Brake chopper -B terminal
E8	E8	Auxiliary emitter terminal of brake chopper IGBT
P	P	+DC terminal
+RECT	+RECT	Bridge rectifier positive voltage output terminal
-RECT	-RECT	Bridge rectifier negative voltage output terminal
+T	+T	Temperature sensor terminal (+)
-T	-T	Temperature sensor terminal (-)

Pin and signal description



pinout, dimensions

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.