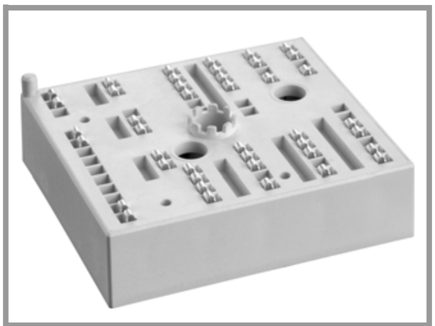

MiniSKiiP® 2

Converter-Inverter-Brake (CIB)

SKiiP 24NAB12T4V4

Features*

- Trench 4 IGBTs
- Robust and soft switching freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

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- Inverter up to 22 kVA
- Typical motor power 11 kW

Remarks

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- Please refer to MiniSKiiP “Technical Explanations” and “Mounting Instructions” for further information
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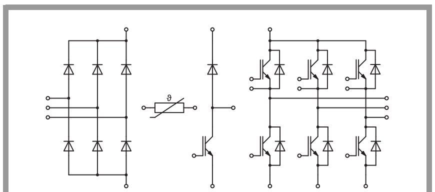
- Chopper is limited to $I_{t(RMS)}$ =20A (one spring only)
- All graphs are referring to inverter/ rectifier part

Absolute Maximum Ratings				
Symbol	**Conditions**		**Values**	**Unit**
Inverter - IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	48	A
		T_s = 70 °C	39	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	53	A
		T_s = 70 °C	43	A
I_{Cnom}			35	A
I_{CRM}			105	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V V_{GE} ≤ 15 V V_{CES} ≤ 1200 V	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C
Chopper - IGBT				
V_{CES}	T_j = 25 °C		1200	V
I_C	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	39	A
		T_s = 70 °C	32	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	43	A
		T_s = 70 °C	35	A
I_{Cnom}			25	A
I_{CRM}			75	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V V_{GE} ≤ 15 V V_{CES} ≤ 1200 V	T_j = 150 °C	10	µs
T_j			-40 ... 175	°C
Inverse - Diode				
V_{RRM}	T_j = 25 °C		1200	V
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	40	A
		T_s = 70 °C	32	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	44	A
		T_s = 70 °C	35	A
I_{FRM}			70	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		170	A
T_j			-40 ... 175	°C
Freewheeling - Diode				
V_{RRM}	T_j = 25 °C		1200	V
I_F	λ_{paste}=0.8 W/(mK) T_j = 175 °C	T_s = 25 °C	33	A
		T_s = 70 °C	27	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 25 °C	36	A
		T_s = 70 °C	29	A
I_{FRM}			50	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		100	A
T_j			-40 ... 175	°C



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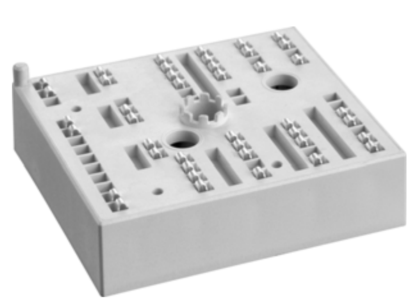

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SKiiP 24NAB12T4V4

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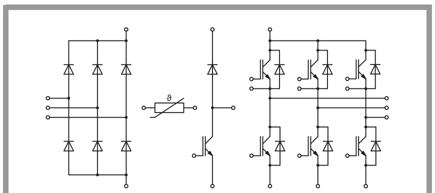

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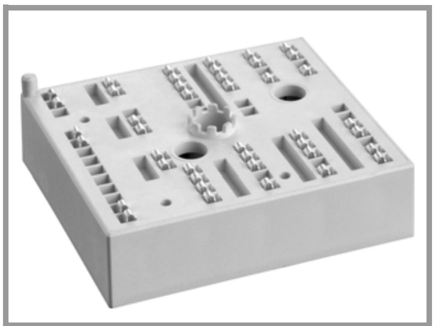
Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Rectifier - Diode				
V_{RRM}	T_j = 25 °C		1600	V
I_F	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	52	A
	T_j = 150 °C	T_s = 70 °C	39	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	57	A
	T_j = 150 °C	T_s = 70 °C	43	A
I_{FSM}	t_p = 10 ms	T_j = 25 °C	370	A
	sin 180°	T_j = 150 °C	270	A
i^2t	t_p = 10 ms	T_j = 25 °C	685	A^2s
	sin 180°	T_j = 150 °C	365	A^2s
T_j			-40 ... 150	°C
Module				
$I_{t(RMS)}$	$T_{terminal}$ = 80 °C, 20 A per spring		40	A
T_{stg}	module without TIM		-40 ... 125	°C
V_{isol}	AC sinus 50 Hz, 1 min		2500	V

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
$V_{CE(sat)}$	I_C = 35 A	T_j = 25 °C		1.85	2.10	V
	V_{GE} = 15 V chiplevel	T_j = 150 °C		2.25	2.45	V
V_{CE0}	chiplevel	T_j = 25 °C		0.80	0.90	V
		T_j = 150 °C		0.70	0.80	V
r_{CE}	V_{GE} = 15 V	T_j = 25 °C		30	34	mΩ
	chiplevel	T_j = 150 °C		44	47	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 1.2 mA		5	5.8	6.5	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				1	mA
C_{ies}	V_{CE} = 25 V	f = 1 MHz		1.95		nF
C_{oes}	V_{GE} = 0 V	f = 1 MHz		0.16		nF
C_{res}		f = 1 MHz		0.12		nF
Q_G	V_{GE} = - 8 V...+ 15 V			200		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CC} = 600 V	T_j = 150 °C		30		ns
t_r	I_C = 35 A	T_j = 150 °C		35		ns
E_{on}	$R_{G\,on}$ = 18 Ω	T_j = 150 °C		4.3		mJ
$t_{d(off)}$	$R_{G\,off}$ = 18 Ω	T_j = 150 °C		300		ns
t_f	di/dt_{on} = 830 A/µs	T_j = 150 °C		55		ns
E_{off}	di/dt_{off} = 600 A/µs V_{GE} = +15/-15 V	T_j = 150 °C		3.25		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.82		K/W



MiniSKiiP® 2

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SKiiP 24NAB12T4V4

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- Typical motor power 11 kW

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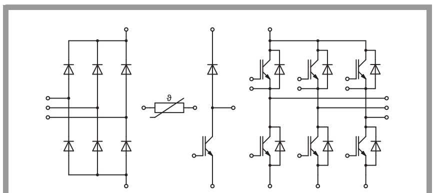
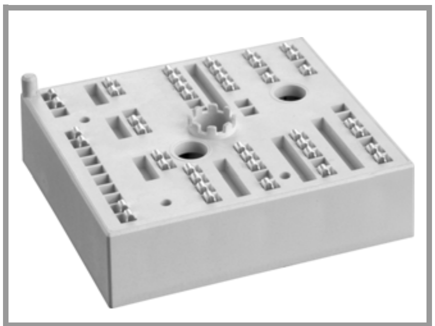


NAB

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Chopper - IGBT						
$V_{CE(sat)}$	I_C = 25 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		1.85	2.10	V
		T_j = 150 °C		2.25	2.45	V
V_{CE0}	chiplevel	T_j = 25 °C		0.80	0.90	V
		T_j = 150 °C		0.70	0.80	V
r_{CE}	V_{GE} = 15 V, chiplevel	T_j = 25 °C		42	48	mΩ
		T_j = 150 °C		62	66	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 0.85 mA		5.3	5.8	6.3	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				1	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		1.45		nF
C_{oes}		f = 1 MHz		0.12		nF
C_{res}		f = 1 MHz		0.05		nF
Q_G	V_{GE} = - 8 V...+ 15 V			142		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CC} = 600 V, I_C = 35 A, $R_{G\,on}$ = 18 Ω, $R_{G\,off}$ = 18 Ω, di/dt_{on} = 710 A/µs, di/dt_{off} = 400 A/µs, V_{GE} = +15/-15 V	T_j = 150 °C		12		ns
t_r		T_j = 150 °C		55		ns
E_{on}		T_j = 150 °C		4.5		mJ
$t_{d(off)}$		T_j = 150 °C		300		ns
t_f		T_j = 150 °C		72		ns
E_{off}		T_j = 150 °C		3.9		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1.1		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.92		K/W
Inverse - Diode						
$V_F = V_{EC}$	I_F = 35 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		2.30	2.62	V
		T_j = 150 °C		2.29	2.62	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		29	32	mΩ
		T_j = 150 °C		40	43	mΩ
I_{RRM}	I_F = 35 A, di/dt_{off} = 1250 A/µs, V_{GE} = -15 V, V_{CC} = 600 V	T_j = 150 °C		34		A
Q_{rr}		T_j = 150 °C		5.6		µC
E_{rr}		T_j = 150 °C		2.4		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.4		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.2		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	I_F = 25 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		2.41	2.74	V
		T_j = 150 °C		2.45	2.79	V
V_{F0}	chiplevel	T_j = 25 °C		1.30	1.50	V
		T_j = 150 °C		0.90	1.10	V
r_F	chiplevel	T_j = 25 °C		44	50	mΩ
		T_j = 150 °C		62	68	mΩ
I_{RRM}	I_F = 25 A, di/dt_{off} = 1160 A/µs, V_{GE} = -15 V, V_{CC} = 600 V	T_j = 150 °C		30		A
Q_{rr}		T_j = 150 °C		5		µC
E_{rr}		T_j = 150 °C		2		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.44		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.22		K/W



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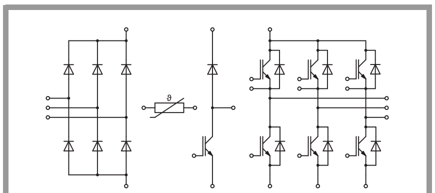


NAB

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Rectifier - Diode						
$V_F = V_{EC}$	I_F = 13 A chiplevel	T_j = 25 °C		1.00	1.21	V
		T_j = 125 °C		0.90	1.10	V
V_{F0}	chiplevel	T_j = 25 °C		0.88	0.98	V
		T_j = 125 °C		0.73	0.83	V
r_F	chiplevel	T_j = 25 °C		9.2	18	mΩ
		T_j = 125 °C		13	21	mΩ
I_R	T_j = 145 °C, V_{RRM}				1.1	mA
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.25		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.1		K/W
Module						
M_s	to heat sink		2		2.5	Nm
w				55		g
L_{CE}				-		nH
Temperature Sensor						
R_{100}	T_r=100°C (R_{25}=1000Ω)			1670 ± 3%		Ω
$R_{(T)}$	$R_{(T)}$=1000Ω[1+A(T-25°C)+B(T-25°C)^2], A = 7.635*10^{-3}°C^{-1}, B = 1.731*10^{-5}°C^{-2}					

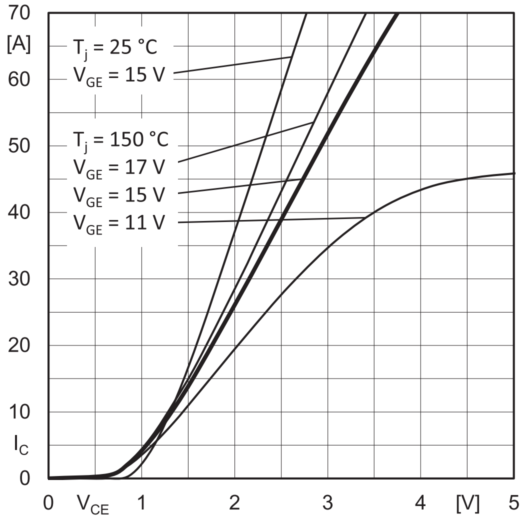


Fig. 1: Typ. output characteristic

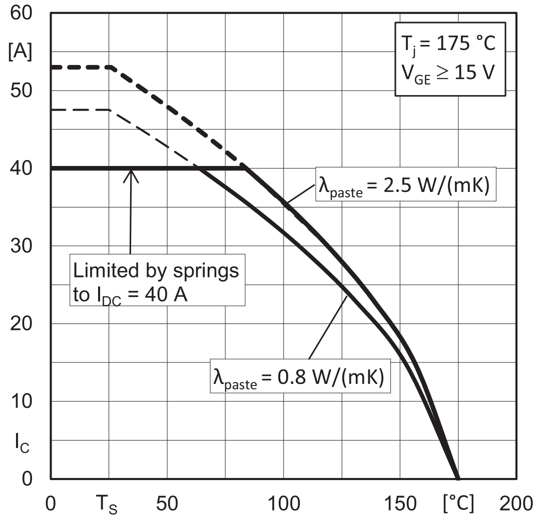


Fig. 2: Typ. rated current vs. temperature Ic = f(Ts)

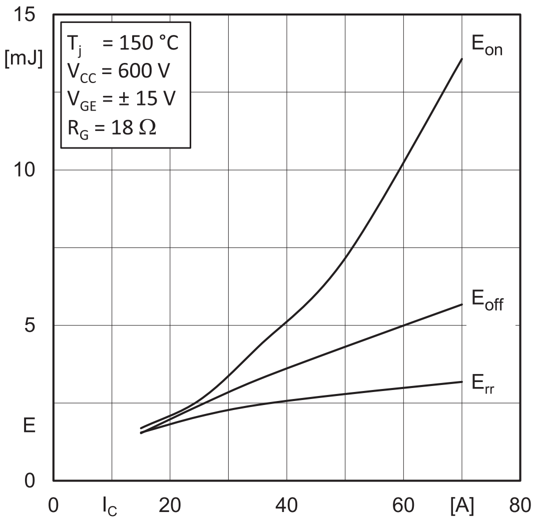


Fig. 3: Typ. turn-on /-off energy = f (I_C)

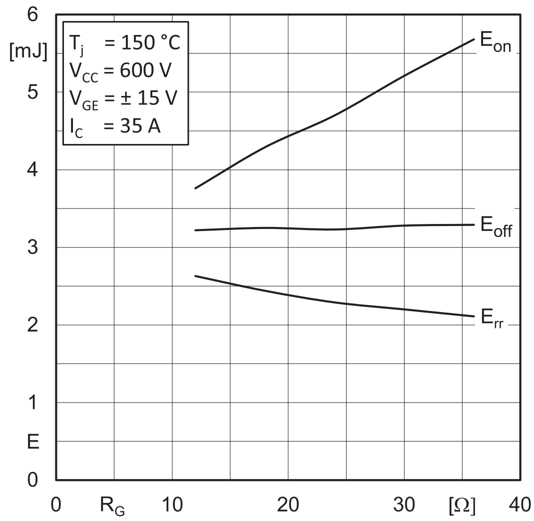


Fig. 4: Typ. turn-on /-off energy = f (R_G)

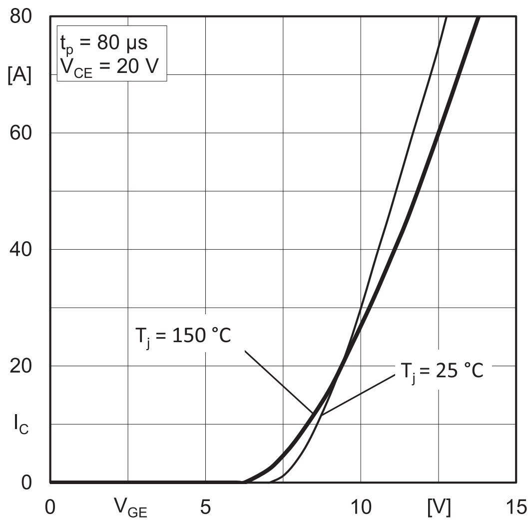


Fig. 5: Typ. transfer characteristic

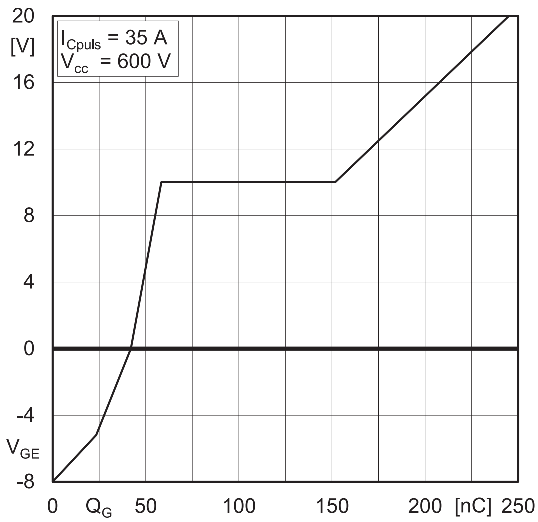


Fig. 6: Typ. gate charge characteristic

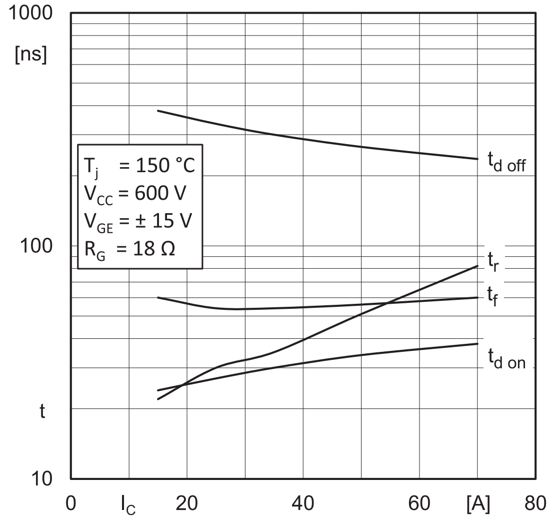


Fig. 7: Typ. switching times vs. I_C

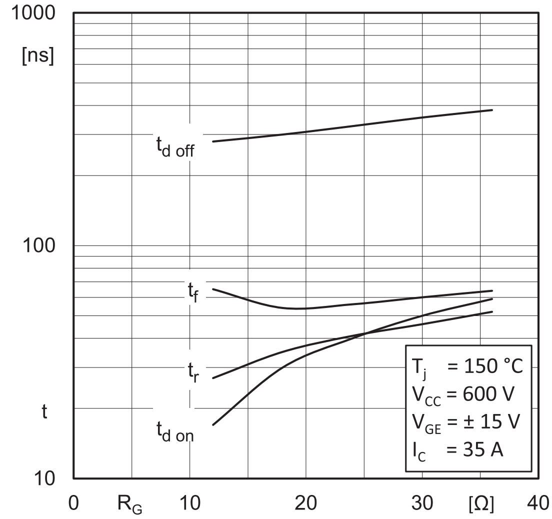


Fig. 8: Typ. switching times vs. gate resistor R_G

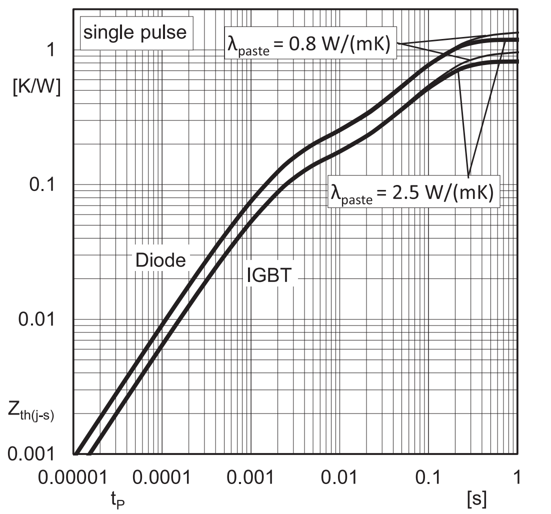


Fig. 9: Typ. transient thermal impedance

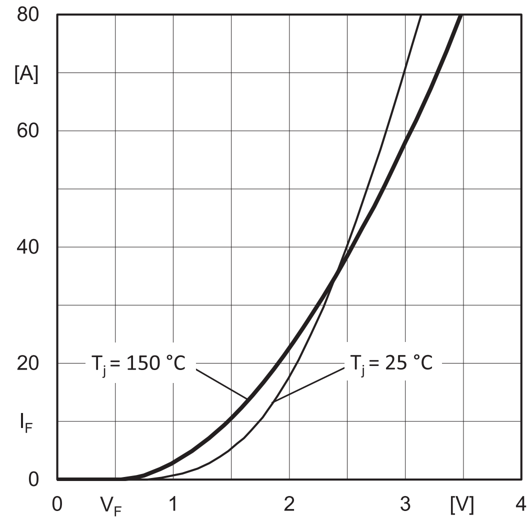


Fig. 10: Typ. CAL diode forward characteristic

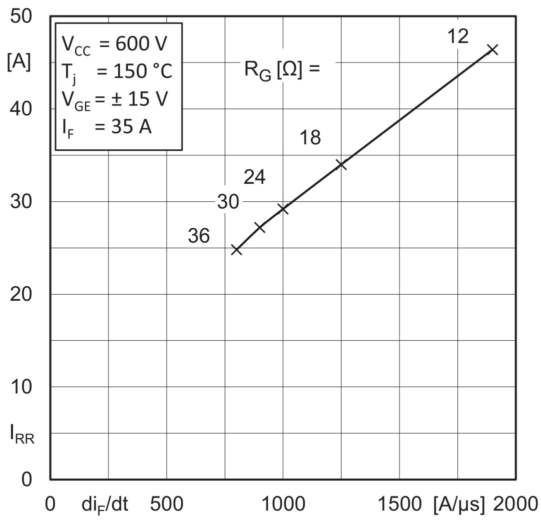


Fig. 11: Typ. CAL diode peak reverse recovery current

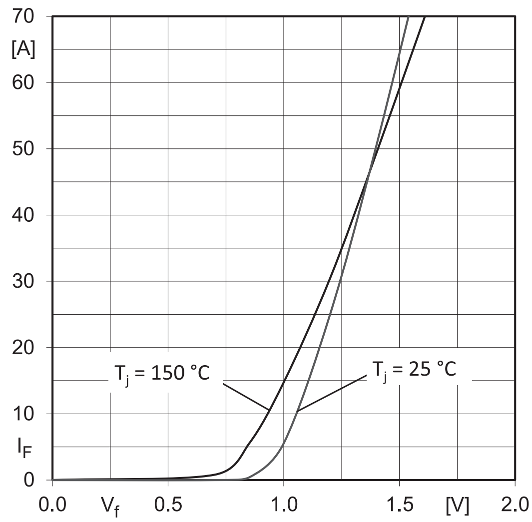
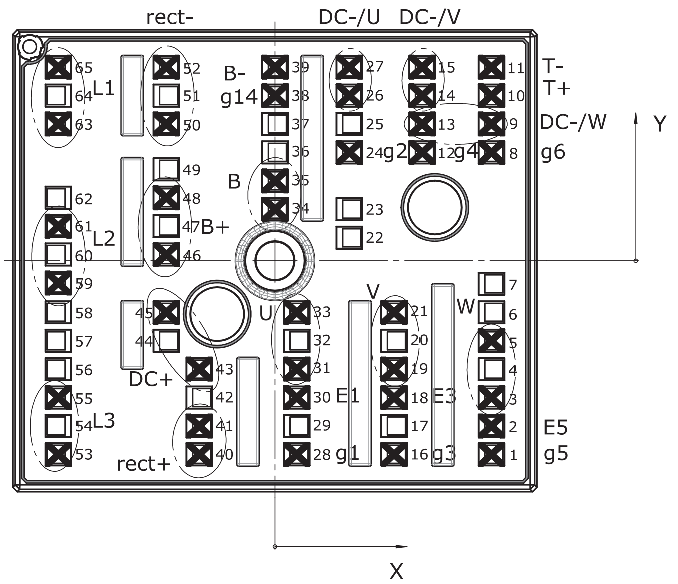


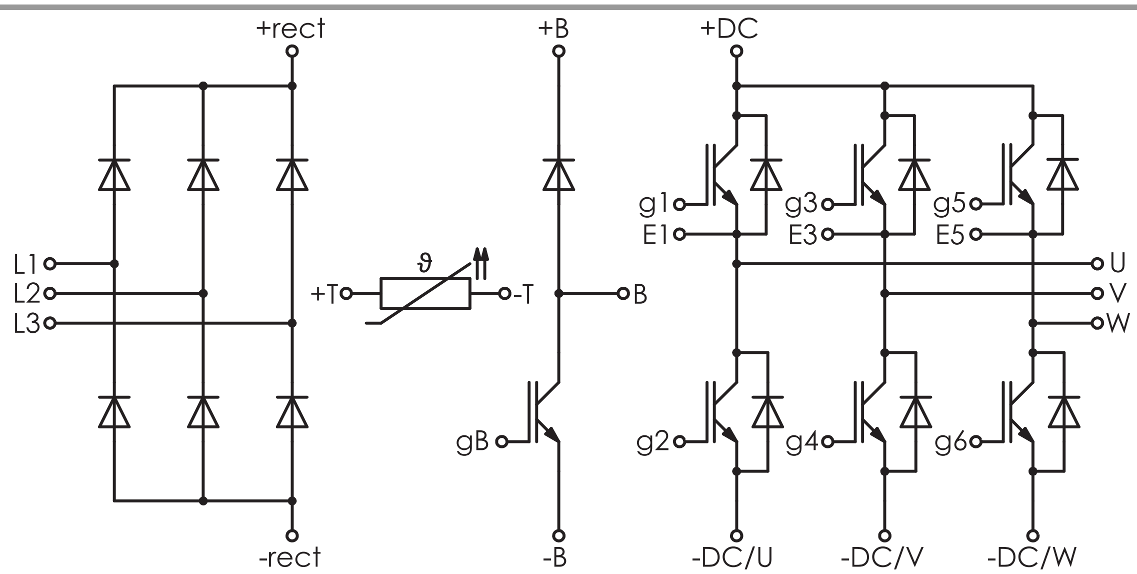
Fig. 12: Typ. input bridge forward characteristic

Pin out											
Pin	*X*	*Y*	*Function*	*Pin*	*X*	*Y*	*Function*	*Pin*	*X*	*Y*	*Function*
1	24,38	-21,80	g5	23	8,38	5,80		45	-12,23	-5,80	DC+
2	24,38	-18,60	E5	24	8,38	12,20	g2	46	-12,23	0,70	B+
3	24,38	-15,40	W	25	8,38	15,40		47	-12,23	3,90	
4	24,38	-12,20		26	8,38	18,60	DC-/U	48	-12,23	7,10	B+
5	24,38	-9,00	W	27	8,38	21,80	DC-/U	49	-12,23	10,30	
6	24,38	-5,80		28	2,46	-21,80	g1	50	-12,23	15,40	rect-
7	24,38	-2,60		29	2,46	-18,60		51	-12,23	18,60	
8	24,38	12,20	g6	30	2,46	-15,40	E1	52	-12,23	21,80	rect-
9	24,38	15,40	DC-/W	31	2,46	-12,20	U	53	-24,38	-21,80	L3
10	24,38	18,60	T+	32	2,46	-9,00		54	-24,38	-18,60	
11	24,38	21,80	T-	33	2,46	-5,80	U	55	-24,38	-15,40	L3
12	16,58	12,20	g4	34	0,03	5,80	B	56	-24,38	-12,20	
13	16,58	15,40	DC-/W	35	0,03	9,00	B	57	-24,38	-9,00	
14	16,58	18,60	DC-/V	36	0,03	12,20		58	-24,38	-5,80	
15	16,58	21,80	DC-/V	37	0,03	15,40		59	-24,38	-2,50	L2
16	13,42	-21,80	g3	38	0,03	18,60	g14	60	-24,38	0,70	
17	13,42	-18,60		39	0,03	21,80	B-	61	-24,38	3,90	L2
18	13,42	-15,40	E3	40	-8,51	-21,80	rect+	62	-24,38	7,10	
19	13,42	-12,20	V	41	-8,51	-18,60	rect+	63	-24,38	15,40	L1
20	13,42	-9,00		42	-8,51	-15,40		64	-24,38	18,60	
21	13,42	-5,80	V	43	-8,51	-12,20	DC+	65	-24,38	21,80	L1
22	8,38	2,60		44	-12,23	-9,00					

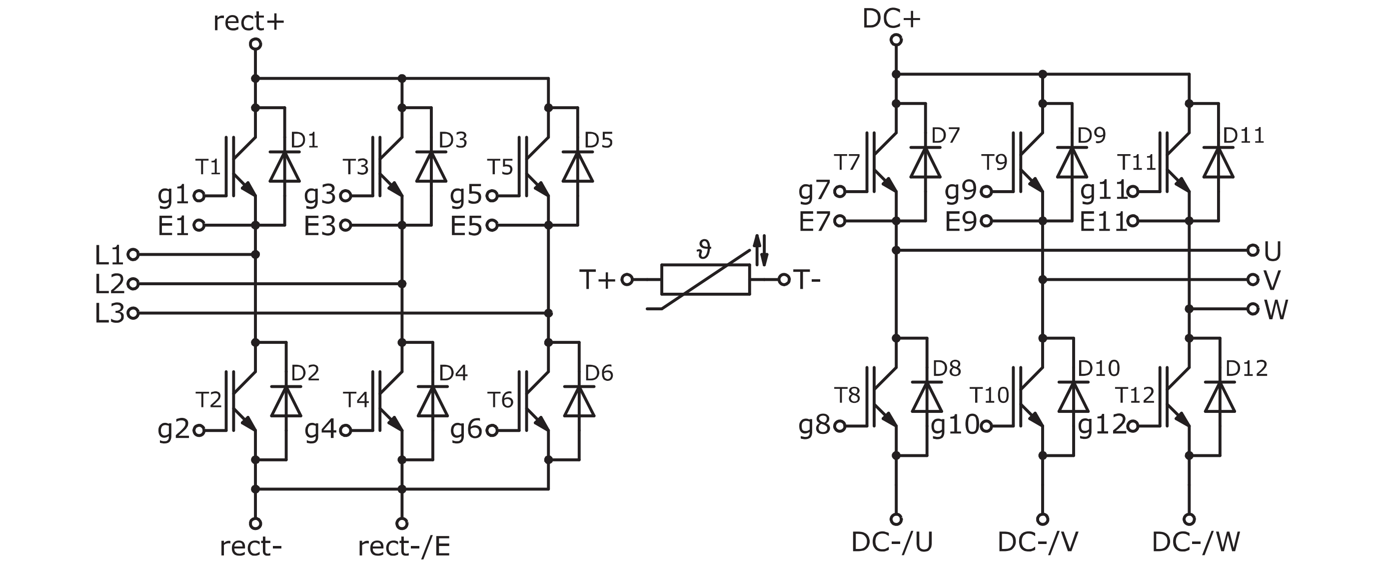
all values in mm



Pinout and Dimensions



Pinout



Pinout

This is an electrostatic discharge sensitive device (ESDS) due to international standard IEC 61340.

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