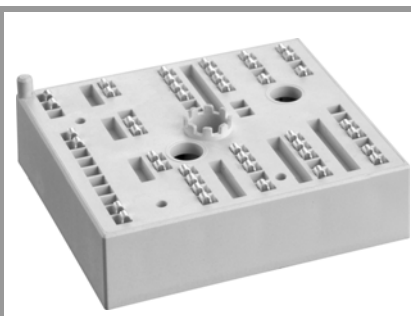


SKiiP 24NAB12T4V10



MiniSKiiP® 2

Converter-Inverter-Brake (CIB)

SKiiP 24NAB12T4V10

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

Typical Applications

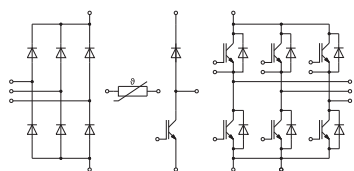
- Inverter up to 22 kVA
- Typical motor power 11 kW

Remarks

- Max. case temperature limited to $T_C=125^\circ\text{C}$
- Product reliability results valid for $T_J \leq 150^\circ\text{C}$ (recommended $T_{J,op} = -40 \dots +150^\circ\text{C}$)
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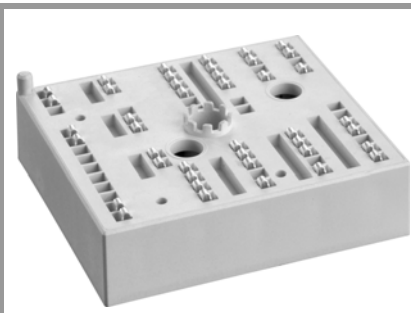
Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	48	A
	T _j = 175 °C	T _s = 70 °C	39	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	t.b.d.	A
	T _j = 175 °C	T _s = 70 °C	t.b.d.	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 _s = 25 °C	48	A
	T _j = 175 °C	T _s = 70 °C	39	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	t.b.d.	A
	T _j = 175 °C	T _s = 70 °C	t.b.d.	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
Inverse - Diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	λ _{paste} =0.8 W/(mK)	T _s = 25 °C	44	A
	T _j = 175 °C	T _s = 70 °C	35	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	t.b.d.	A
	T _j = 175 °C	T _s = 70 °C	t.b.d.	A
I _{FRM}			105	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 _s = 25 °C	44	A
	T _j = 175 °C	T _s = 70 °C	35	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 25 °C	t.b.d.	A
	T _j = 175 °C	T _s = 70 °C	t.b.d.	A
I _{FRM}			105	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		170	A
T _j			-40 ... 175	°C



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Remarks

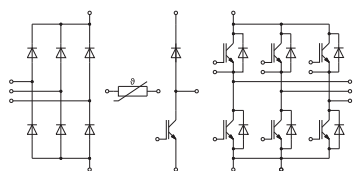
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Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
Rectifier - Diode			
V_{RRM}	$T_J = 25^\circ\text{C}$	1600	V
I_F	$\lambda_{paste}=0.8 \text{ W/(mK)}$ $T_J = 150^\circ\text{C}$	81	A
	$T_s = 25^\circ\text{C}$ $T_s = 70^\circ\text{C}$	60	A
I_F	$\lambda_{paste}=2.5 \text{ W/(mK)}$ $T_J = 150^\circ\text{C}$		A
	$T_s = 25^\circ\text{C}$ $T_s = 70^\circ\text{C}$		A
I_{FSM}	$t_p = 10 \text{ ms}$ $\sin 180^\circ$	700	A
	$T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$	490	A
i^2t	$t_p = 10 \text{ ms}$ $\sin 180^\circ$	2450	A^2s
	$T_J = 25^\circ\text{C}$ $T_J = 150^\circ\text{C}$	1200	A^2s
T_J		-40 ... 150	$^\circ\text{C}$
Module			
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$, 20 A per spring	40	A
T_{stg}	module without TIM	-40 ... 125	$^\circ\text{C}$
V_{isol}	AC sinus 50 Hz, 1 min	2500	V

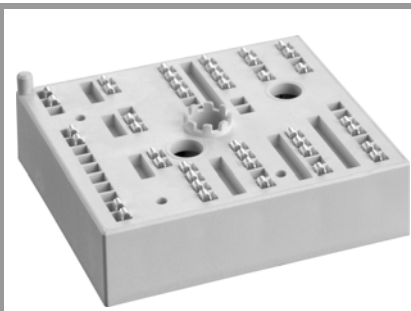
Characteristics

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



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Features*

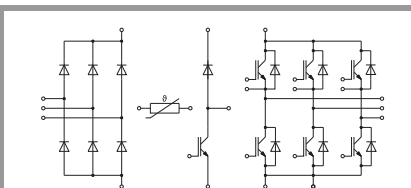
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- Typical motor power 11 kW

Remarks

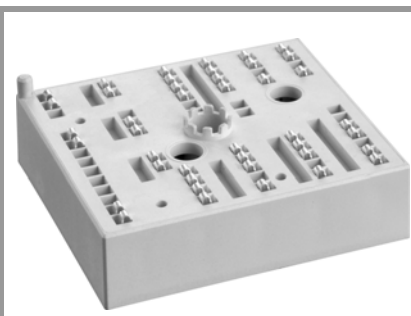
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Chopper - IGBT						
V _{CE(sat)}	I _C = 35 A	T _J = 25 °C		1.85	2.10	V
	V _{GE} = 15 V chipelevel	T _J = 150 °C		2.25	2.45	V
V _{CE0}	chipelevel	T _J = 25 °C		0.80	0.90	V
		T _J = 150 °C		0.70	0.80	V
r _{CE}	V _{GE} = 15 V chipelevel	T _J = 25 °C		30	34	mΩ
		T _J = 150 °C		44	47	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 1 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 V _{GE} = 0 V	f = 1 MHz		1.95		nF
C _{oes}		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		T _J = 150 °C		55		ns
E _{off}		V _{GE} = +15/-15 V	T _J = 150 °C		3.25	
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)			t.b.d.		K/W
Inverse - Diode						
V _F = V _{EC}	I _F = 35 A	T _J = 25 °C		2.30	2.62	V
	V _{GE} = 0 V chipelevel	T _J = 150 °C		2.29	2.62	V
V _{F0}	chipelevel	T _J = 25 °C		1.30	1.50	V
		T _J = 150 °C		0.90	1.10	V
r _F	chipelevel	T _J = 25 °C		29	32	mΩ
		T _J = 150 °C		40	43	mΩ
I _{RRM}	I _F = 35 A	T _J = 150 °C		34		A
Q _{rr}	di/dt _{off} = 1250 A/μs	T _J = 150 °C		5.6		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _J = 150 °C		2.4		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			1.2		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			t.b.d.		K/W
Freewheeling - Diode						
V _F = V _{EC}	I _F = 35 A	T _J = 25 °C		2.30	2.62	V
	V _{GE} = 0 V chipelevel	T _J = 150 °C		2.29	2.62	V
V _{F0}	chipelevel	T _J = 25 °C		1.30	1.50	V
		T _J = 150 °C		0.90	1.10	V
r _F	chipelevel	T _J = 25 °C		29	32	mΩ
		T _J = 150 °C		40	43	mΩ
I _{RRM}	I _F = 35 A	T _J = 150 °C		34		A
Q _{rr}	di/dt _{off} = 1250 A/μs	T _J = 150 °C		5.6		μC
E _{rr}	V _{GE} = -15 V V _{CC} = 600 V	T _J = 150 °C		2.4		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			1.2		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			t.b.d.		K/W

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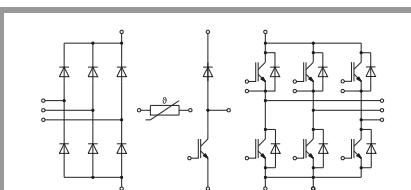
Typical Applications

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Rectifier - Diode						
V _F = V _{EC}	I _F = 25 A	T _j = 25 °C		1.00	1.21	V
	chiplevel	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		4.8	9.2	mΩ
		T _j = 125 °C		6.8	11	mΩ
I _R	T _j = 145 °C, V _{RRM}				1.1	mA
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			0.9		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)					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					



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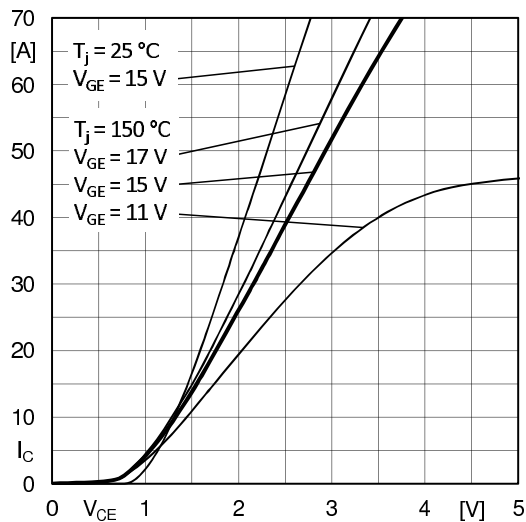


Fig. 1: Typ. output characteristic

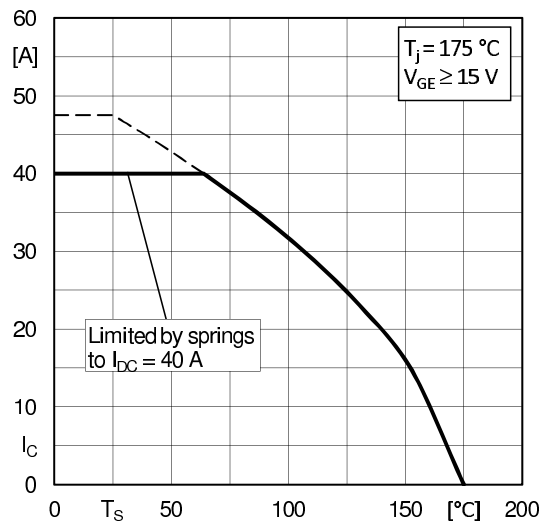


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_s)$

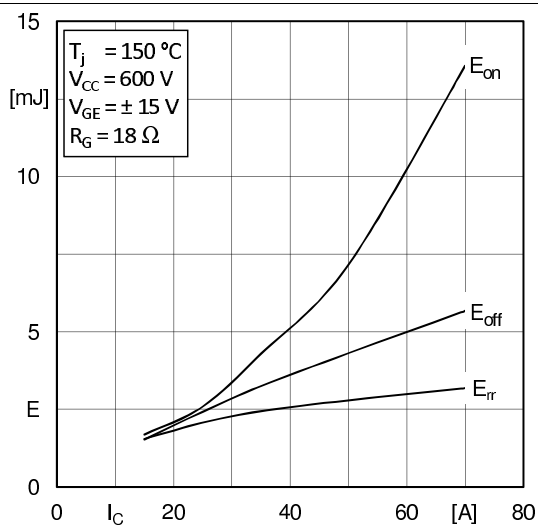


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

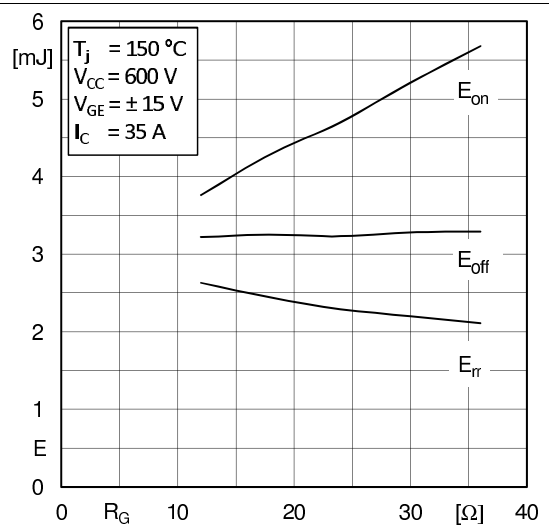


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

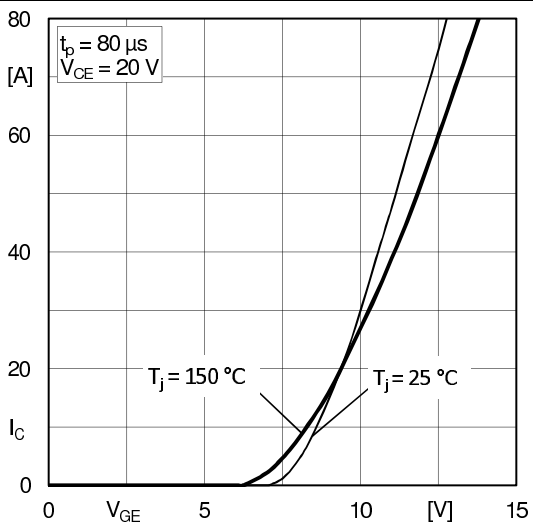


Fig. 5: Typ. transfer characteristic

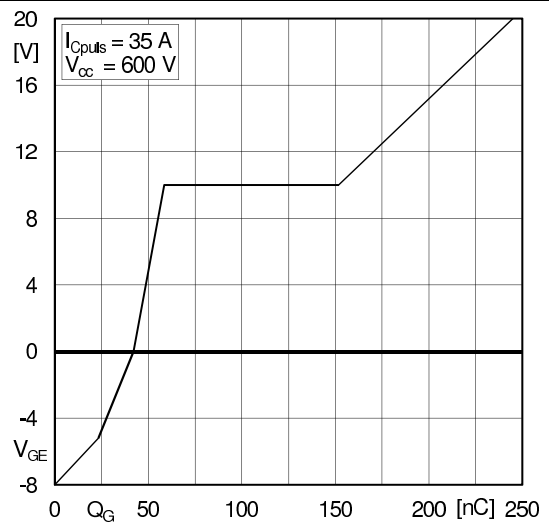


Fig. 6: Typ. gate charge characteristic

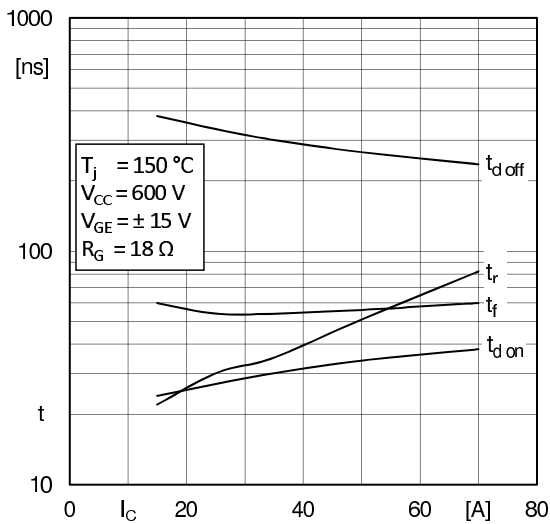


Fig. 7: Typ. switching times vs. I_C

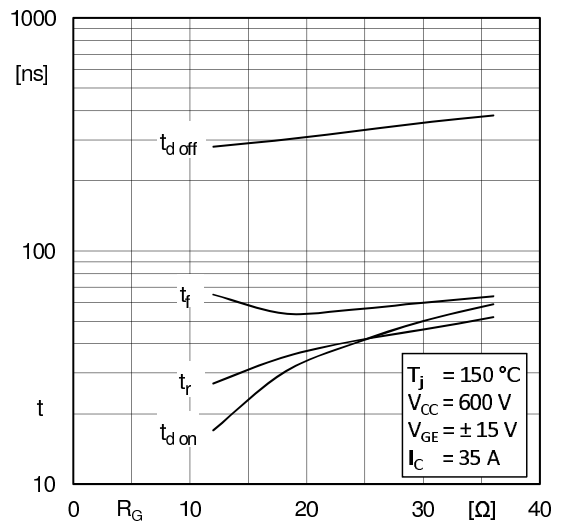


Fig. 8: Typ. switching times vs. gate resistor R_G

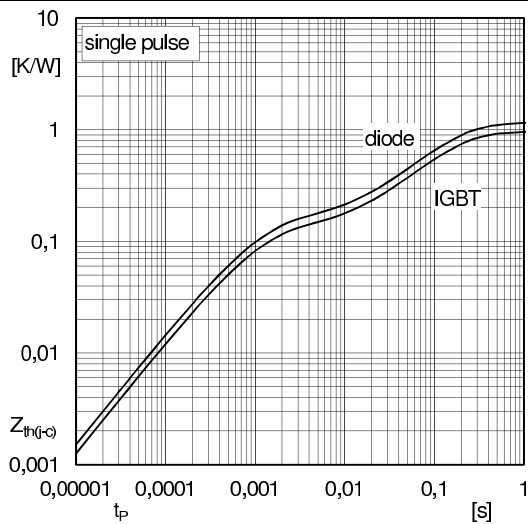


Fig. 9: Typ. transient thermal impedance

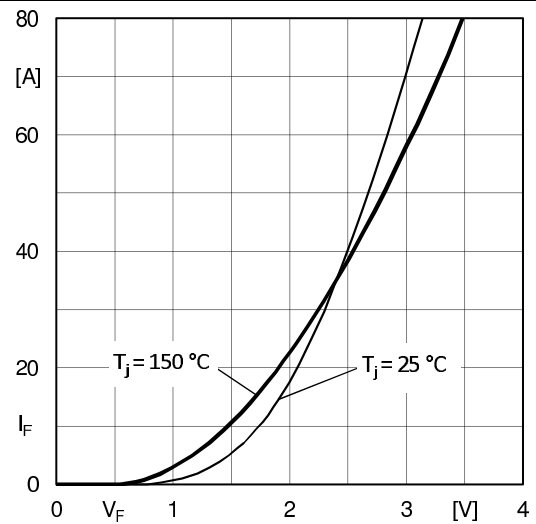


Fig. 10: Typ. CAL diode forward characteristic

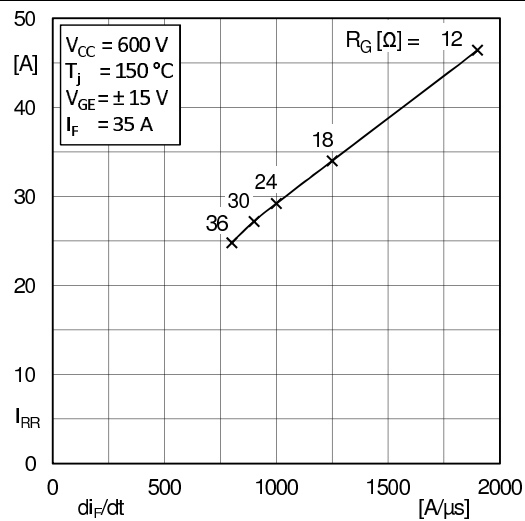


Fig. 11: Typ. CAL diode peak reverse recovery current

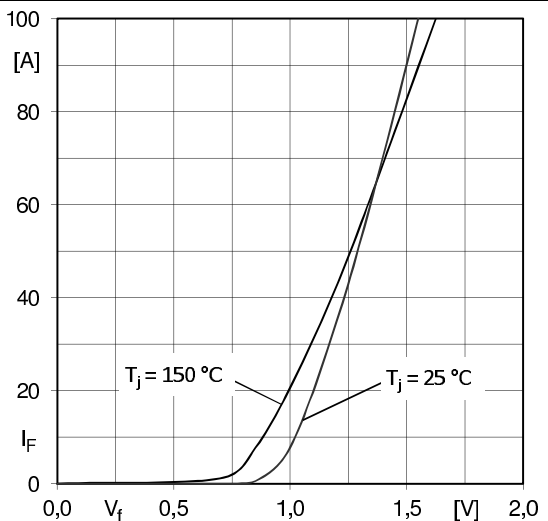
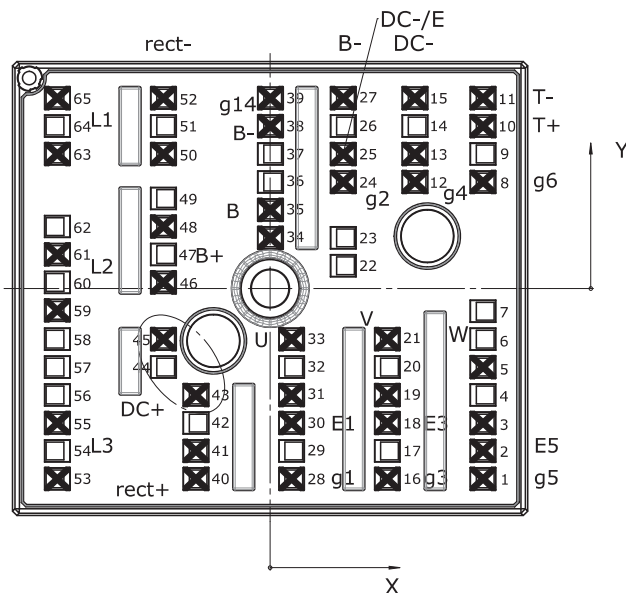


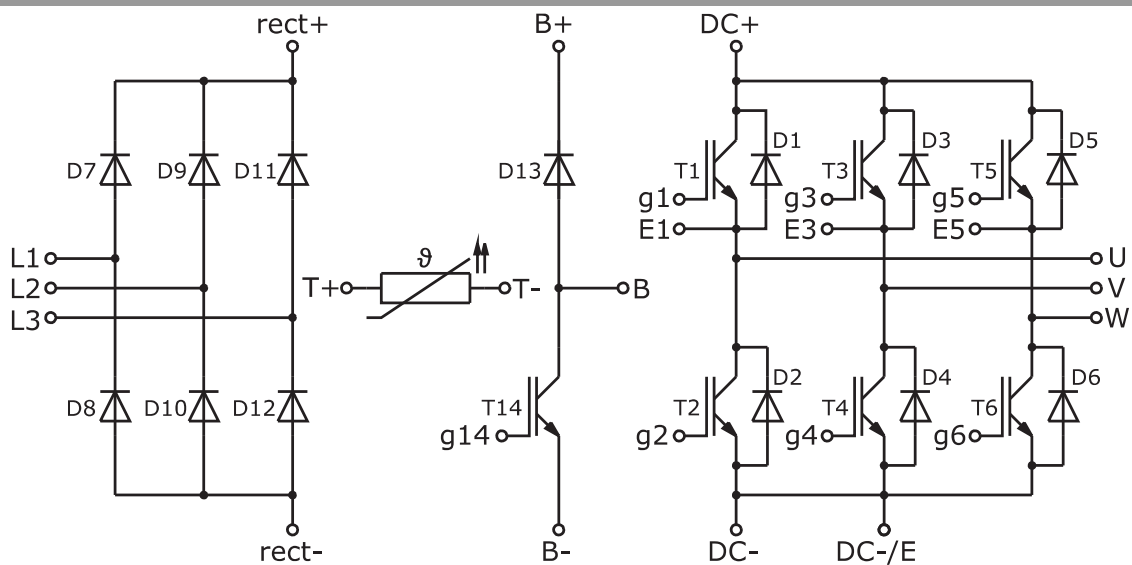
Fig. 12: Typ. input bridge forward characteristic

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	DC-/E	47	-12,23	3,90	
4	24,38	-12,20		26	8,38	18,60		48	-12,23	7,10	B+
5	24,38	-9,00	W	27	8,38	21,80	B-	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		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-	35	0,03	9,00	B	57	-24,38	-9,00	
14	16,58	18,60		36	0,03	12,20		58	-24,38	-5,80	
15	16,58	21,80	DC-	37	0,03	15,40		59	-24,38	-2,50	L2
16	13,42	-21,80	g3	38	0,03	18,60	B-	60	-24,38	0,70	
17	13,42	-18,60		39	0,03	21,80	g14	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

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

***IMPORTANT INFORMATION AND WARNINGS**

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