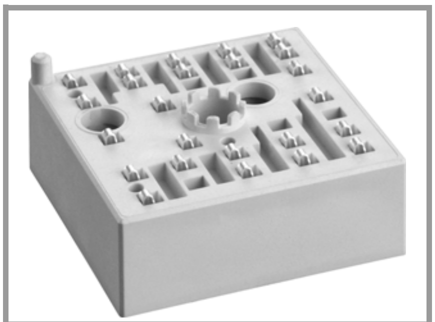
SKiiP 11NAB12T7V1



MiniSKiiP® 1

3-phase Converter-Inverter-Brake (CIB)

SKiiP 11NAB12T7V1

Features*

- 1200V Generation 7 IGBTs (T7)
- Robust and soft switching freewheeling diodes in CAL technology
- New SKR PEP diode technology for enhanced power and environmental robustness
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

Remarks

- Max. case temperature limited to TC=TS=125 °C
- Product reliability results valid for Tj≤150 °C; Tj,op >150°C during overload (Details see AN19-002)
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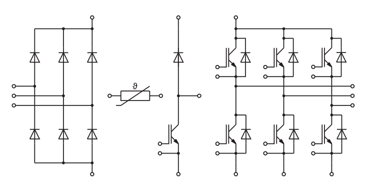
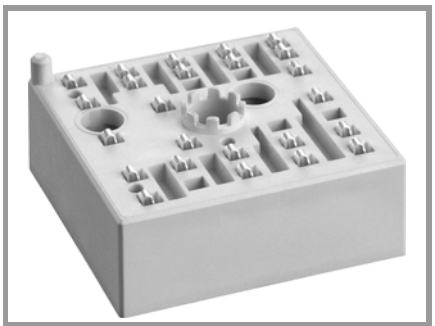


NAB

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 = 70 °C	20	A
	T_j = 175 °C	T_s = 100 °C	16	A
I_C	λ_{paste}=2.5 W/(mK)	T_s = 70 °C	20	A
	T_j = 175 °C	T_s = 100 °C	18	A
I_{Cnom}			10	A
I_{CRM}			20	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V V_{GE} ≤ 15 V V_{CES} ≤ 1200 V	T_j = 175 °C	7	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 = 70 °C	20	A
	T_j = 175 °C	T_s = 100 °C	16	A
I_C	λ_{paste}=2.5 W/(mK)	T_s = 70 °C	20	A
	T_j = 175 °C	T_s = 100 °C	18	A
I_{Cnom}			10	A
I_{CRM}			20	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 800 V V_{GE} ≤ 15 V V_{CES} ≤ 1200 V	T_j = 175 °C	7	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 = 70 °C	13	A
	T_j = 175 °C	T_s = 100 °C	10	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 70 °C	14	A
	T_j = 175 °C	T_s = 100 °C	11	A
I_{FRM}			16	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		36	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 = 70 °C	13	A
	T_j = 175 °C	T_s = 100 °C	10	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 70 °C	14	A
	T_j = 175 °C	T_s = 100 °C	11	A
I_{FRM}			16	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		36	A
T_j			-40 ... 175	°C



MiniSKiiP® 1

3-phase
Converter-Inverter-Brake
(CIB)

SKiiP 11NAB12T7V1

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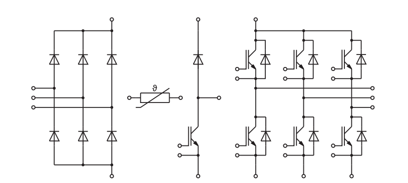


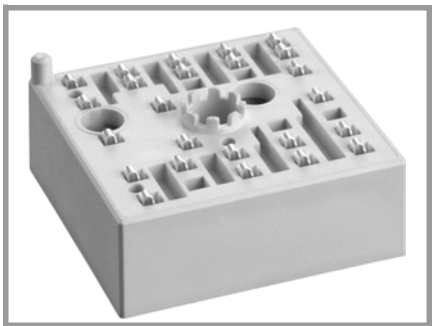
NAB

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_j = 175 °C	T_s = 70 °C	41	A
		T_s = 100 °C	33	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	46	A
		T_s = 100 °C	37	A
I_{FSM}	t_p = 10 ms sin 180°	T_j = 25 °C	220	A
		T_j = 150 °C	200	A
i^2t	t_p = 10 ms sin 180°	T_j = 25 °C	242	A^2s
		T_j = 150 °C	200	A^2s
T_j			-40 ... 175	°C
Module				
$I_{t(RMS)}$	$T_{terminal}$ = 80 °C, 20 A per spring		20	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 = 10 A V_{GE} = 15 V chiplevel	T_j = 25 °C		1.60	1.75	V
		T_j = 150 °C		1.78	1.93	V
		T_j = 175 °C		1.82	1.97	V
V_{CE0}	chiplevel	T_j = 25 °C		1.00	1.05	V
		T_j = 150 °C		0.80	0.85	V
		T_j = 175 °C		0.75	0.80	V
r_{CE}	V_{GE} = 15 V chiplevel	T_j = 25 °C		60	70	mΩ
		T_j = 150 °C		98	108	mΩ
		T_j = 175 °C		107	117	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 0.22 mA		5.15	5.8	6.45	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		1.90		nF
C_{oes}		f = 1 MHz		0.02		nF
C_{res}		f = 1 MHz		0.01		nF
Q_G	V_{GE} = - 8V ... + 15 V			140		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CC} = 600 V I_C = 10 A $R_{G\,on}$ = 32 Ω $R_{G\,off}$ = 32 Ω V_{GE} = +15/-15 V	T_j = 25 °C		44		ns
		T_j = 150 °C		46		ns
		T_j = 175 °C		47		ns
t_r		T_j = 25 °C		39		ns
		T_j = 150 °C		44		ns
		T_j = 175 °C		47		ns
E_{on}	@ T_j = 150 °C: di/dt_{on} = 190 A/µs di/dt_{off} = 130 A/µs dv/dt = 3580 V/µs	T_j = 25 °C		0.8		mJ
		T_j = 150 °C		1.1		mJ
		T_j = 175 °C		1.2		mJ



MiniSKiiP® 1

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SKiiP 11NAB12T7V1

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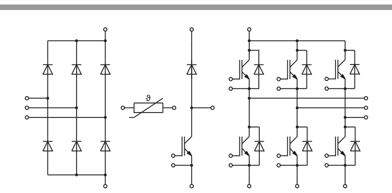

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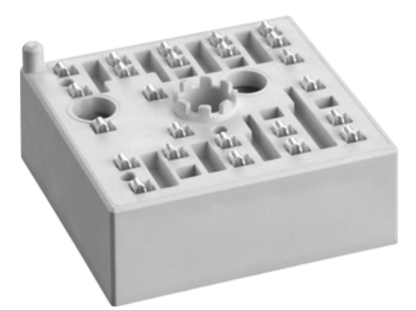
Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
$t_{d(off)}$	V_{CC} = 600 V	T_j = 25 °C		198		ns
	I_C = 10 A	T_j = 150 °C		288		ns
	$R_{G\,on}$ = 32 Ω	T_j = 175 °C		313		ns
t_f	$R_{G\,off}$ = 32 Ω	T_j = 25 °C		42		ns
	V_{GE} = +15/-15 V	T_j = 150 °C		63		ns
		T_j = 175 °C		85		ns
E_{off}	@ T_j = 150 °C:	T_j = 25 °C		0.65		mJ
	di/dt_{on} = 190 A/µs	T_j = 150 °C		1.1		mJ
	di/dt_{off} = 130 A/µs dv/dt = 3580 V/µs	T_j = 175 °C		1.2		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1.67		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			1.44		K/W
Chopper - IGBT						
$V_{CE(sat)}$	I_C = 10 A	T_j = 25 °C		1.60	1.75	V
	V_{GE} = 15 V	T_j = 150 °C		1.78	1.93	V
	chiplevel	T_j = 175 °C		1.82	1.97	V
V_{CE0}		T_j = 25 °C		1.00	1.05	V
	chiplevel	T_j = 150 °C		0.80	0.85	V
		T_j = 175 °C		0.75	0.80	V
r_{CE}		T_j = 25 °C		60	70	mΩ
	V_{GE} = 15 V chiplevel	T_j = 150 °C		98	108	mΩ
		T_j = 175 °C		107	117	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 0.22 mA		5.15	5.8	6.45	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1200 V, T_j = 25 °C				1	mA
C_{ies}		f = 1 MHz		1.90		nF
C_{oes}	V_{CE} = 25 V V_{GE} = 0 V	f = 1 MHz		0.02		nF
C_{res}		f = 1 MHz		0.01		nF
Q_G	V_{GE} = - 8V ... + 15 V			140		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$		T_j = 25 °C		44		ns
		T_j = 150 °C		46		ns
		T_j = 175 °C		47		ns
t_r		T_j = 25 °C		39		ns
	V_{CC} = 600 V	T_j = 150 °C		44		ns
	I_C = 10 A	T_j = 175 °C		47		ns
E_{on}	$R_{G\,on}$ = 32 Ω	T_j = 25 °C		0.8		mJ
	$R_{G\,off}$ = 32 Ω	T_j = 150 °C		1.1		mJ
	V_{GE} = +15/-15 V	T_j = 175 °C		1.2		mJ
$t_{d(off)}$		T_j = 25 °C		198		ns
	@ T_j = 150 °C:	T_j = 150 °C		288		ns
	di/dt_{on} = 190 A/µs	T_j = 175 °C		313		ns
t_f	di/dt_{off} = 130 A/µs	T_j = 25 °C		42		ns
	dv/dt = 3580 V/µs	T_j = 150 °C		63		ns
		T_j = 175 °C		85		ns
E_{off}		T_j = 25 °C		0.65		mJ
		T_j = 150 °C		1.1		mJ
		T_j = 175 °C		1.2		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1.67		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			1.44		K/W



MiniSKiiP® 1

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SKiiP 11NAB12T7V1

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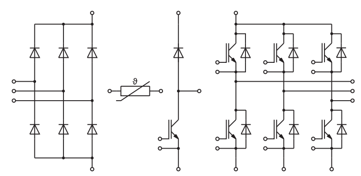
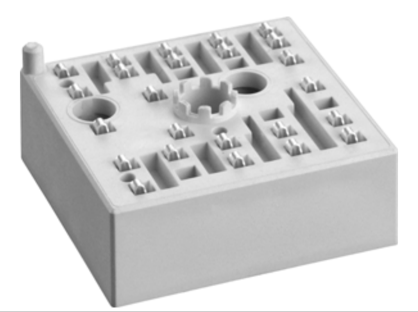


NAB

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Inverse - Diode						
$V_F = V_{EC}$	I_F = 10 A	T_j = 25 °C		2.59	2.94	V
	V_{GE} = 0 V	T_j = 150 °C		2.71	3.08	V
	chiplevel	T_j = 175 °C		2.53	2.89	V
V_{F0}		T_j = 25 °C		1.30	1.50	V
	chiplevel	T_j = 150 °C		0.90	1.10	V
		T_j = 175 °C		0.82	0.98	V
r_F		T_j = 25 °C		129	144	mΩ
	chiplevel	T_j = 150 °C		181	198	mΩ
		T_j = 175 °C		171	191	mΩ
I_{RRM}		T_j = 25 °C		6		A
		T_j = 150 °C		7		A
	V_{CC} = 600 V	T_j = 175 °C		8		A
Q_{rr}	I_F = 10 A	T_j = 25 °C		0.7		µC
	V_{GE} = -15 V	T_j = 150 °C		1.4		µC
	@ T_j = 150 °C:	T_j = 175 °C		1.6		µC
E_{rr}	di/dt_{off} = 210 A/µs	T_j = 25 °C		0.2		mJ
		T_j = 150 °C		0.56		mJ
		T_j = 175 °C		0.73		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			2.4		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			2.1		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	I_F = 10 A	T_j = 25 °C		2.59	2.94	V
	V_{GE} = 0 V	T_j = 150 °C		2.71	3.08	V
	chiplevel	T_j = 175 °C		2.53	2.89	V
V_{F0}		T_j = 25 °C		1.30	1.50	V
	chiplevel	T_j = 150 °C		0.90	1.10	V
		T_j = 175 °C		0.82	0.98	V
r_F		T_j = 25 °C		129	144	mΩ
	chiplevel	T_j = 150 °C		181	198	mΩ
		T_j = 175 °C		171	191	mΩ
I_{RRM}		T_j = 25 °C		6		A
		T_j = 150 °C		7		A
	V_{CC} = 600 V	T_j = 175 °C		8		A
Q_{rr}	I_F = 10 A	T_j = 25 °C		0.7		µC
	V_{GE} = -15 V	T_j = 150 °C		1.4		µC
	@ T_j = 150 °C:	T_j = 175 °C		1.6		µC
E_{rr}	di/dt_{off} = 210 A/µs	T_j = 25 °C		0.2		mJ
		T_j = 150 °C		0.56		mJ
		T_j = 175 °C		0.73		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			2.4		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			2.1		K/W



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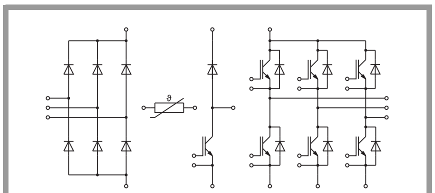


NAB

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Rectifier - Diode						
V_F	I_F = 8 A chiplevel	T_j = 25 °C		0.97	1.20	V
		T_j = 150 °C		0.84	1.07	V
		T_j = 175 °C		0.82	1.05	V
V_{F0}	chiplevel	T_j = 25 °C		0.89	1.09	V
		T_j = 150 °C		0.73	0.92	V
		T_j = 175 °C		0.69	0.88	V
r_F	chiplevel	T_j = 25 °C		10	14	mΩ
		T_j = 150 °C		14	19	mΩ
		T_j = 175 °C		16	21	mΩ
I_R	T_j = 150 °C, V_{RRM}				1.7	mA
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.44		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.23		K/W
Module						
M_s	to heat sink		2		2.5	Nm
w				30		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}					

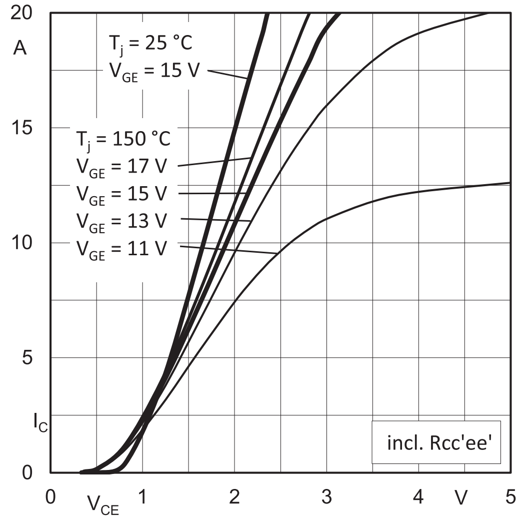


Fig. 1: Typ. output characteristic

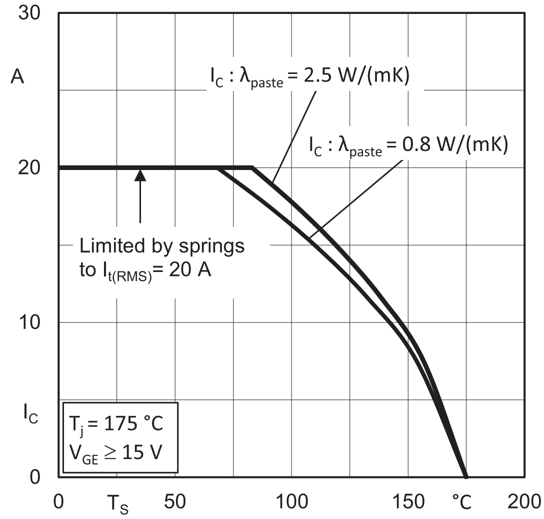


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

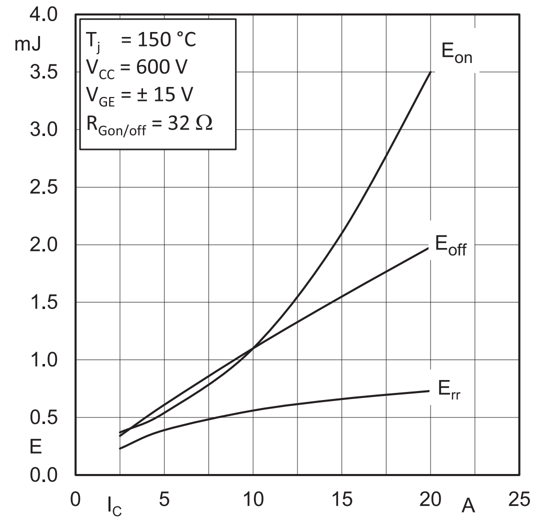


Fig. 3: Typ. turn-on /-off energy = f (I_C)

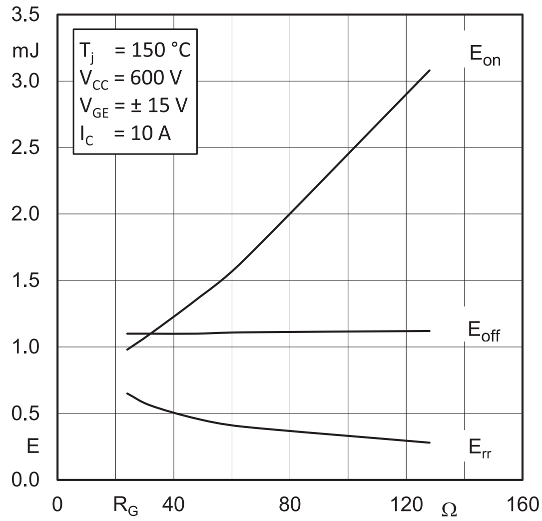


Fig. 4: Typ. turn-on /-off energy = f (R_G)

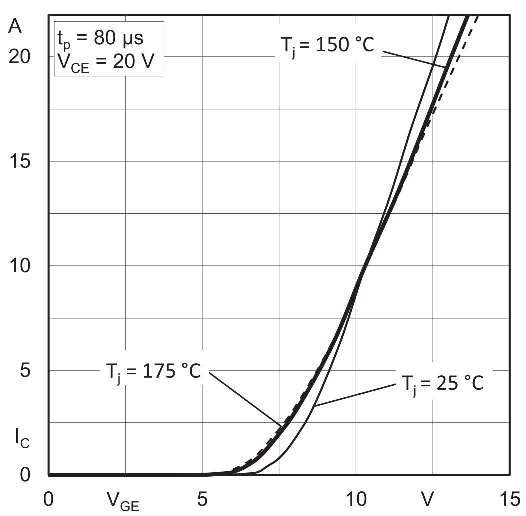


Fig. 5: Typ. transfer characteristic

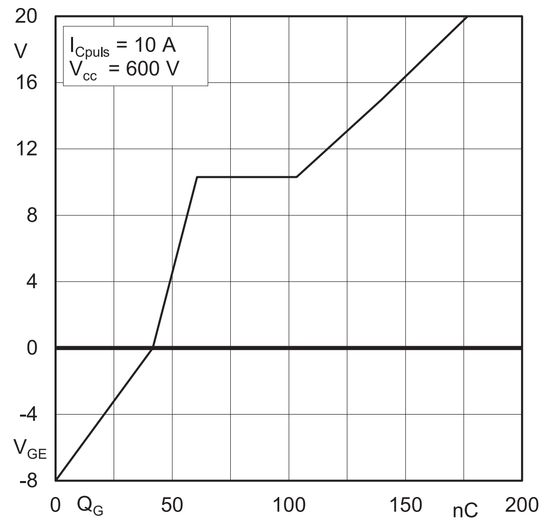


Fig. 6: Typ. gate charge characteristic

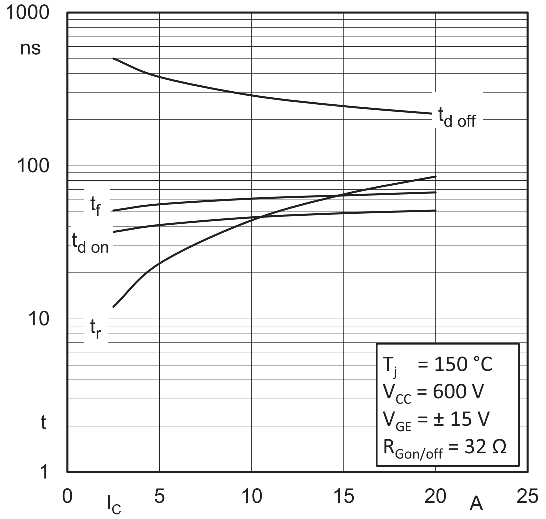


Fig. 7: Typ. switching times vs. I_C

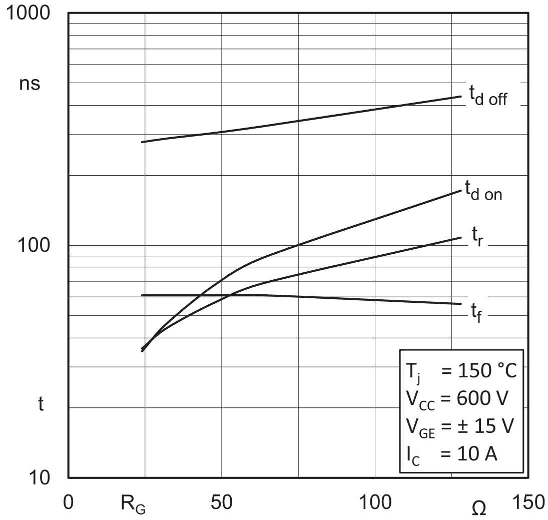


Fig. 8: Typ. switching times vs. gate resistor R_G

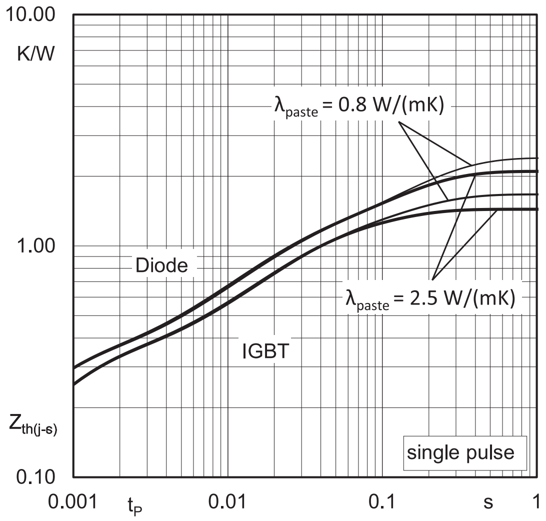


Fig. 9: Typ. transient thermal impedance

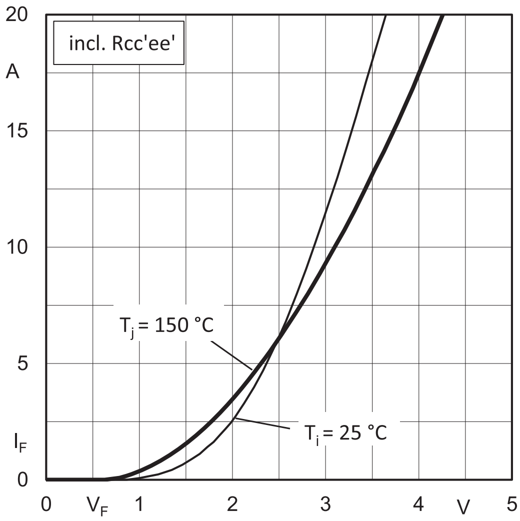


Fig. 10: Typ. CAL diode forward characteristic

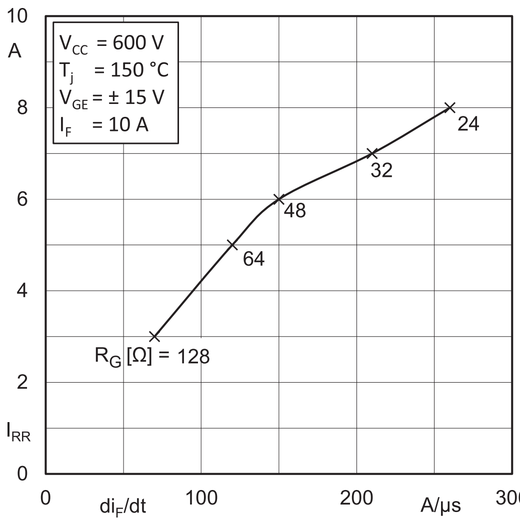


Fig. 11: Typ. CAL diode peak reverse recovery current

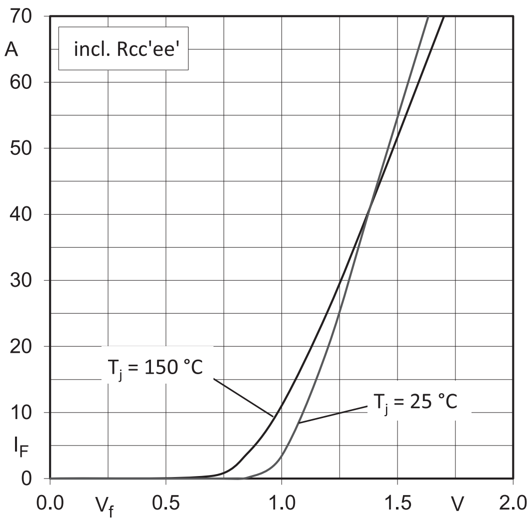
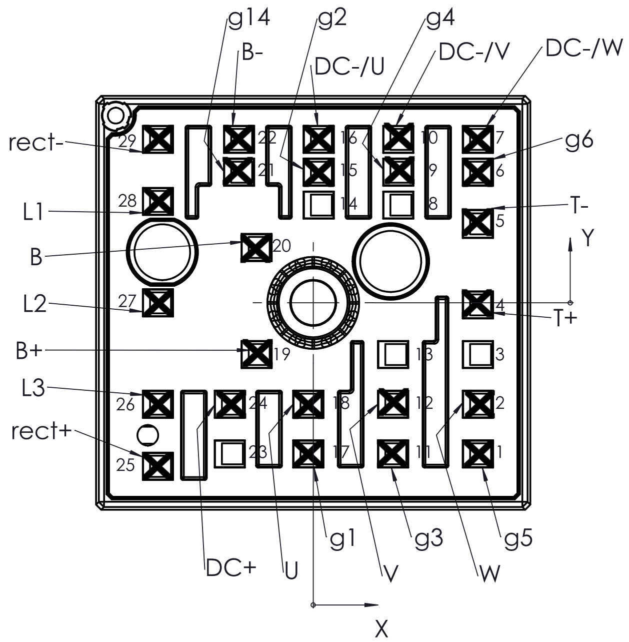


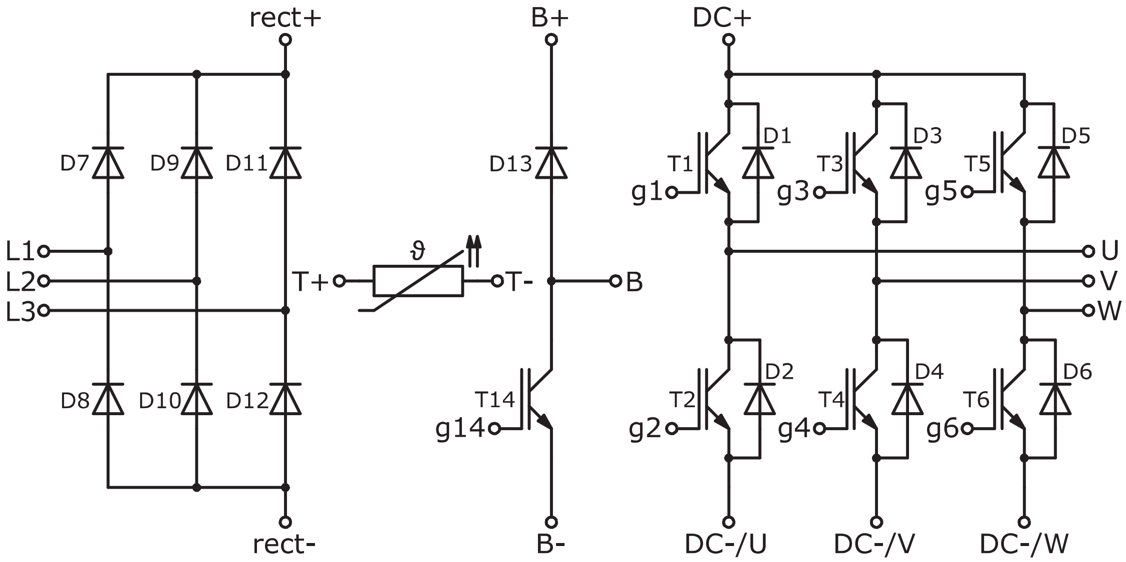
Fig. 12: Typ. input bridge forward characteristic

Pin out							
Pin	X	Y	*Function*	*Pin*	X	Y	*Function*
1	15,93	-14,60	g5	16	0,53	15,80	DC-/U
2	15,93	-9,80	W	17	-0,48	-14,60	g1
3				18	-0,48	-9,80	U
4	15,93	-0,20	T+	19	-5,48	-5	B+
5	15,93	7,63	T-	20	-5,48	5,35	B
6	15,93	12,63	g6	21	-7,18	12,63	g14
7	15,93	15,80	DC-/W	22	-7,18	15,80	B-
8				23			
9	8,23	12,63	g4	24	-8,08	-9,80	DC+
10	8,23	15,80	DC-/V	25	-15,03	-15,8	rect+
11	7,73	-14,60	g3	26	-15,03	-9,8	L3
12	7,73	-9,80	V	27	-15,03	0	L2
13				28	-15,03	9,8	L1
14				29	-15,03	15,8	rect-
15	0,53	12,63	g2				

all values in mm



Pinout



Pinout

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

***IMPORTANT INFORMATION AND WARNINGS**

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