

SKiiP 12NAB12T7V1



MiniSKiiP® 1

3-phase Converter-Inverter-Brake (CIB)

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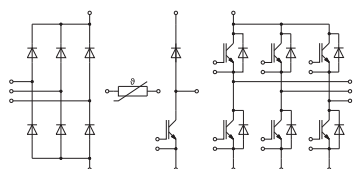
Features*

- 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 $T_C = T_S = 125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$; $T_{j,op} > 150^\circ\text{C}$ during overload (Details see AN19-002)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet Please refer to both documents for further information
- For storage and case temperature with TIM see document "Technical Explanations Thermal Interface Materials"
- Inverter IGBT: T1 – T6
- Chopper IGBT: T14
- Inverse Diode: D1 – D6
- Freewheeling Diode: D13
- Rectifier Diode: D7 – D12

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	26	A
	T _j = 175 °C	T _s = 100 °C	22	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	29	A
	T _j = 175 °C	T _s = 100 °C	24	A
I _{Cnom}			15	A
I _{CRM}			30	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	26	A
	T _j = 175 °C	T _s = 100 °C	22	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	29	A
	T _j = 175 °C	T _s = 100 °C	24	A
I _{Cnom}			15	A
I _{CRM}			30	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	19	A
	T _j = 175 °C	T _s = 100 °C	16	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	21	A
	T _j = 175 °C	T _s = 100 °C	17	A
I _{FRM}			30	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		65	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	19	A
	T _j = 175 °C	T _s = 100 °C	16	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	21	A
	T _j = 175 °C	T _s = 100 °C	17	A
I _{FRM}			30	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		65	A
T _j			-40 ... 175	°C



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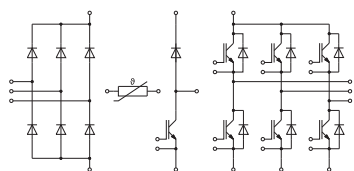
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Absolute Maximum Ratings

Symbol	Conditions	Values	Unit
Rectifier - Diode			
V_{RRM}	$T_j = 25^\circ\text{C}$	1600	V
I_F	$\lambda_{paste} = 0.8 \text{ W/(mK)}$	$T_s = 70^\circ\text{C}$	A
	$T_j = 175^\circ\text{C}$	$T_s = 100^\circ\text{C}$	A
I_F	$\lambda_{paste} = 2.5 \text{ W/(mK)}$	$T_s = 70^\circ\text{C}$	A
	$T_j = 175^\circ\text{C}$	$T_s = 100^\circ\text{C}$	A
I_{FSM}	$t_p = 10 \text{ ms}$	$T_j = 25^\circ\text{C}$	A
	$\sin 180^\circ$	$T_j = 150^\circ\text{C}$	A
i^2t	$t_p = 10 \text{ ms}$	$T_j = 25^\circ\text{C}$	A^2s
	$\sin 180^\circ$	$T_j = 150^\circ\text{C}$	A^2s
T_j		-40 ... 175	$^\circ\text{C}$
Module			
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$, 20 A per spring	20	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					
$V_{CE(sat)}$	$I_C = 15 \text{ A}$	$T_j = 25^\circ\text{C}$	1.60	1.75	V
	$V_{GE} = 15 \text{ V}$	$T_j = 150^\circ\text{C}$	1.78	1.93	V
	chipelevel	$T_j = 175^\circ\text{C}$	1.82	1.97	V
V_{CE0}	$T_j = 25^\circ\text{C}$		1.00	1.05	V
	$T_j = 150^\circ\text{C}$		0.80	0.85	V
	$T_j = 175^\circ\text{C}$		0.75	0.80	V
r_{CE}	$V_{GE} = 15 \text{ V}$	$T_j = 25^\circ\text{C}$	40	47	$\text{m}\Omega$
	chipelevel	$T_j = 150^\circ\text{C}$	65	72	$\text{m}\Omega$
	$T_j = 175^\circ\text{C}$		71	78	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 0.33 \text{ mA}$	5.15	5.8	6.45	V
I_{CES}	$V_{GE} = 0 \text{ V}$, $V_{CE} = 1200 \text{ V}$, $T_j = 25^\circ\text{C}$			1	mA
C_{ies}	$V_{CE} = 25 \text{ V}$	$f = 1 \text{ MHz}$	2.80		nF
C_{oes}	$V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	0.04		nF
C_{res}		$f = 1 \text{ MHz}$	0.01		nF
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$		210		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0		Ω
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$	$T_j = 25^\circ\text{C}$	43		ns
	$I_C = 15 \text{ A}$	$T_j = 150^\circ\text{C}$	44		ns
	$R_{G on} = 21.3 \Omega$	$T_j = 175^\circ\text{C}$	46		ns
t_r	$R_{G off} = 21.3 \Omega$	$T_j = 25^\circ\text{C}$	38		ns
	$V_{GE} = +15/-15 \text{ V}$	$T_j = 150^\circ\text{C}$	44		ns
		$T_j = 175^\circ\text{C}$	47		ns
E_{on}	@ $T_j = 150^\circ\text{C}$:	$T_j = 25^\circ\text{C}$	1.2		mJ
	$di/dt_{on} = 320 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	1.7		mJ
	$dv/dt = 3590 \text{ V}/\mu\text{s}$	$T_j = 175^\circ\text{C}$	1.8		mJ



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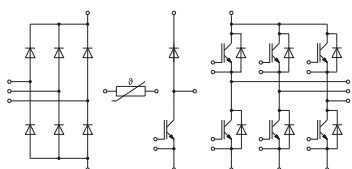
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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
t _{d(off)}	V _{CC} = 600 V	T _j = 25 °C		205		ns
	I _C = 15 A	T _j = 150 °C		295		ns
	R _{G on} = 21.3 Ω	T _j = 175 °C		320		ns
t _f	R _{G off} = 21.3 Ω	T _j = 25 °C		44		ns
	V _{GE} = +15/-15 V	T _j = 150 °C		66		ns
		T _j = 175 °C		85		ns
E _{off}	@ T _j = 150 °C:	T _j = 25 °C		0.98		mJ
	di/dt _{on} = 320 A/μs	T _j = 150 °C		1.7		mJ
	di/dt _{off} = 180 A/μs	T _j = 175 °C		1.8		mJ
	dv/dt = 3590 V/μs					
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			1.4		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			1.2		K/W
Chopper - IGBT						
V _{CE(sat)}	I _C = 15 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		40	47	mΩ
	V _{GE} = 15 V	T _j = 150 °C		65	72	mΩ
	chiplevel	T _j = 175 °C		71	78	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 0.33 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		2.80		nF
C _{oes}	V _{CE} = 25 V	f = 1 MHz		0.04		nF
C _{res}	V _{GE} = 0 V	f = 1 MHz		0.01		nF
Q _G	V _{GE} = - 8V ... + 15 V			210		nC
R _{Gint}	T _j = 25 °C			0		Ω
t _{d(on)}		T _j = 25 °C		43		ns
		T _j = 150 °C		44		ns
		T _j = 175 °C		46		ns
t _r		T _j = 25 °C		38		ns
		T _j = 150 °C		44		ns
		T _j = 175 °C		47		ns
E _{on}	V _{CC} = 600 V	T _j = 25 °C		1.2		mJ
	I _C = 15 A	T _j = 150 °C		1.7		mJ
	R _{G on} = 21.3 Ω	T _j = 175 °C		1.8		mJ
	R _{G off} = 21.3 Ω	T _j = 25 °C		205		ns
	V _{GE} = +15/-15 V	T _j = 150 °C		295		ns
t _{d(off)}		T _j = 175 °C		320		ns
		T _j = 25 °C		44		ns
		T _j = 150 °C		66		ns
		T _j = 175 °C		85		ns
E _{off}	@ T _j = 150 °C:	T _j = 25 °C		0.98		mJ
	di/dt _{on} = 320 A/μs	T _j = 150 °C		1.7		mJ
	di/dt _{off} = 180 A/μs	T _j = 175 °C		1.8		mJ
	dv/dt = 3590 V/μs					
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			1.4		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			1.2		K/W

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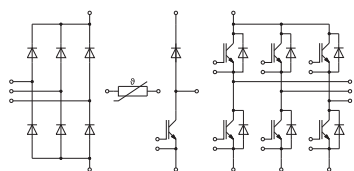
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- Rectifier Diode: D7 – D12

Characteristics					
Symbol	Conditions		min.	typ.	max. Unit
Inverse - Diode					
$V_F = V_{EC}$	$I_F = 15\text{ A}$	$T_j = 25^\circ\text{C}$		2.38	2.71 V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.44	2.77 V
	chipelevel	$T_j = 175^\circ\text{C}$		2.26	2.58 V
V_{F0}		$T_j = 25^\circ\text{C}$		1.30	1.50 V
	chipelevel	$T_j = 150^\circ\text{C}$		0.90	1.10 V
		$T_j = 175^\circ\text{C}$		0.82	0.98 V
r_F		$T_j = 25^\circ\text{C}$		72	81 mΩ
	chipelevel	$T_j = 150^\circ\text{C}$		103	111 mΩ
		$T_j = 175^\circ\text{C}$		96	107 mΩ
I_{RRM}		$T_j = 25^\circ\text{C}$		9	A
		$T_j = 150^\circ\text{C}$		11	A
	$V_{CC} = 600\text{ V}$	$T_j = 175^\circ\text{C}$		13	A
Q_{rr}	$I_F = 15\text{ A}$	$T_j = 25^\circ\text{C}$		0.9	μC
	$V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$		2.1	μC
		$T_j = 175^\circ\text{C}$		2.4	μC
E_{rr}	@ $T_j = 150^\circ\text{C}$:	$T_j = 25^\circ\text{C}$		0.29	mJ
	$di/dt_{off} = 350\text{ A/μs}$	$T_j = 150^\circ\text{C}$		0.86	mJ
		$T_j = 175^\circ\text{C}$		1.1	mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 0.8\text{ W/(mK)}$			1.78	K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 2.5\text{ W/(mK)}$			1.53	K/W
Freewheeling - Diode					
$V_F = V_{EC}$	$I_F = 15\text{ A}$	$T_j = 25^\circ\text{C}$		2.38	2.71 V
	$V_{GE} = 0\text{ V}$	$T_j = 150^\circ\text{C}$		2.44	2.77 V
	chipelevel	$T_j = 175^\circ\text{C}$		2.26	2.58 V
V_{F0}		$T_j = 25^\circ\text{C}$		1.30	1.50 V
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$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 0.8\text{ W/(mK)}$			1.78	K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 2.5\text{ W/(mK)}$			1.53	K/W



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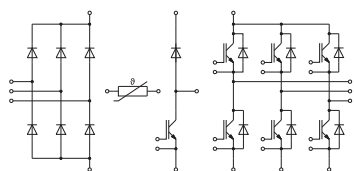
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Characteristics						
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Rectifier - Diode						
V _F	I _F = 8 A chiplevel	T _j = 25 °C		0.97	1.20	V
		T _j = 150 °C		0.84	1.07	V
		T _j = 175 °C		0.82	1.05	V
V _{F0}	chiplevel	T _j = 25 °C		0.89	1.09	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					



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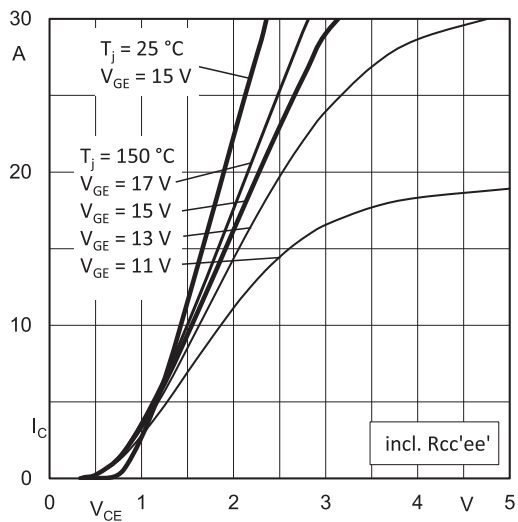


Fig. 1: Typ. output characteristic

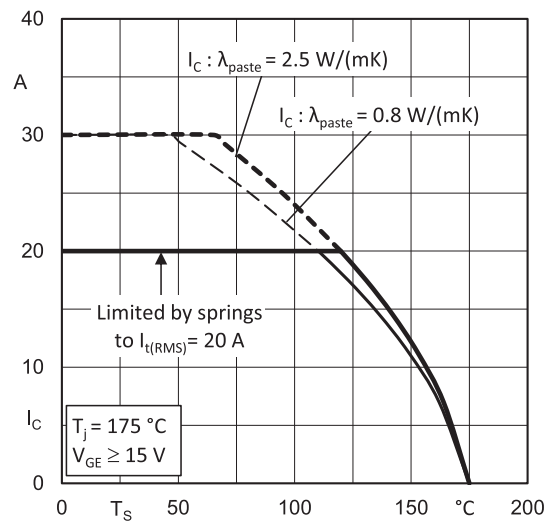


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_s)$

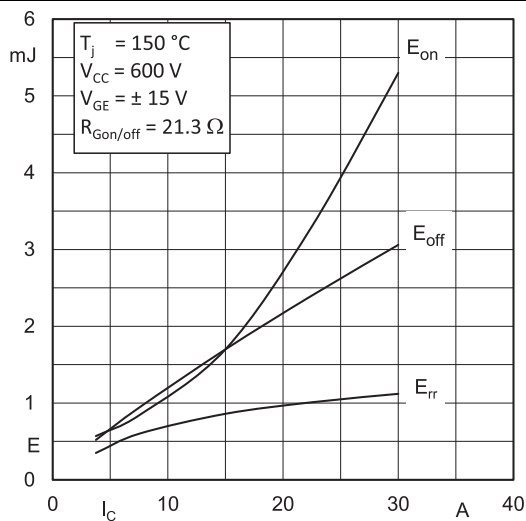


Fig. 3: Typ. turn-on /-off energy = $f(I_C)$

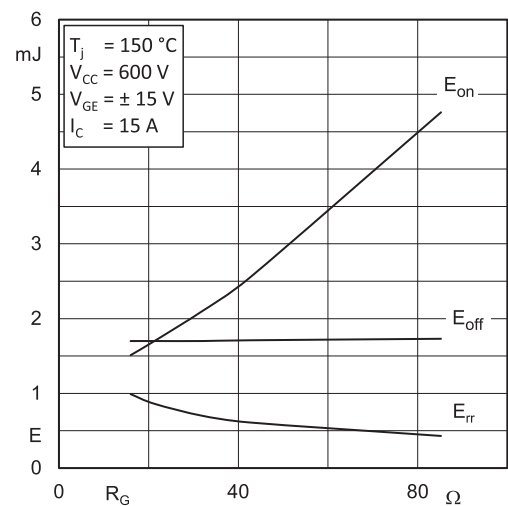


Fig. 4: Typ. turn-on /-off energy = $f(R_G)$

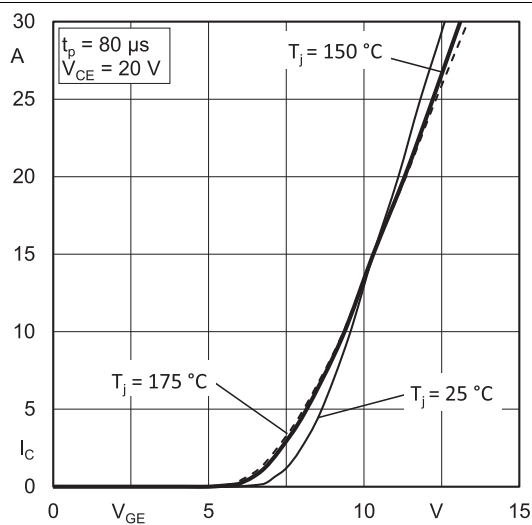


Fig. 5: Typ. transfer characteristic

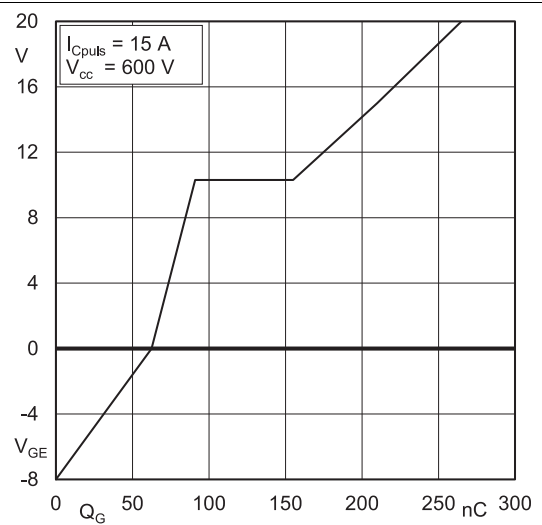


Fig. 6: Typ. gate charge characteristic

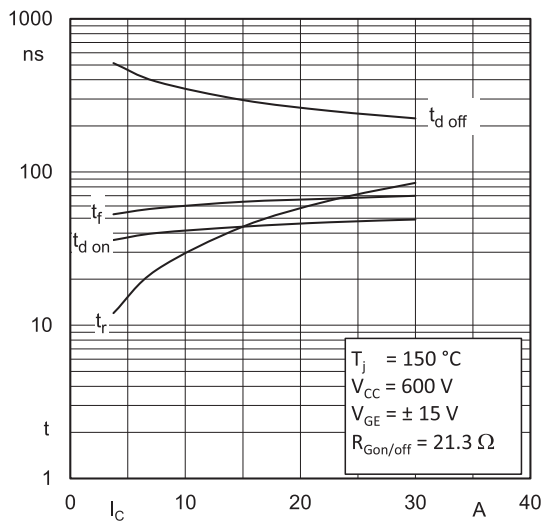


Fig. 7: Typ. switching times vs. I_C

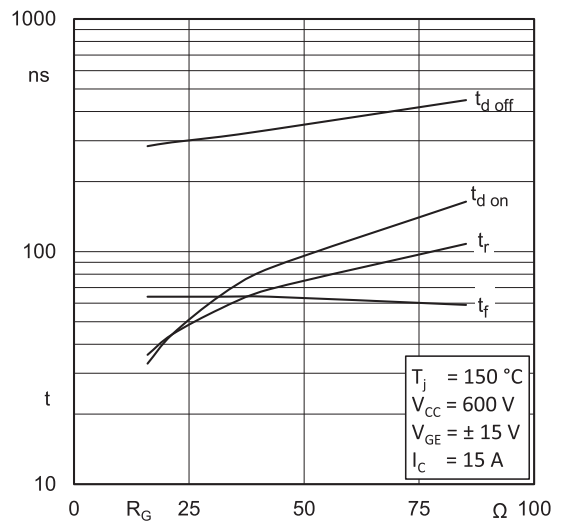


Fig. 8: Typ. switching times vs. gate resistor R_G

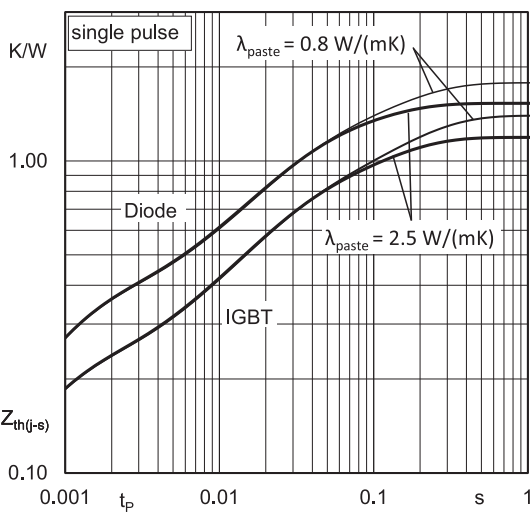


Fig. 9: Typ. transient thermal impedance

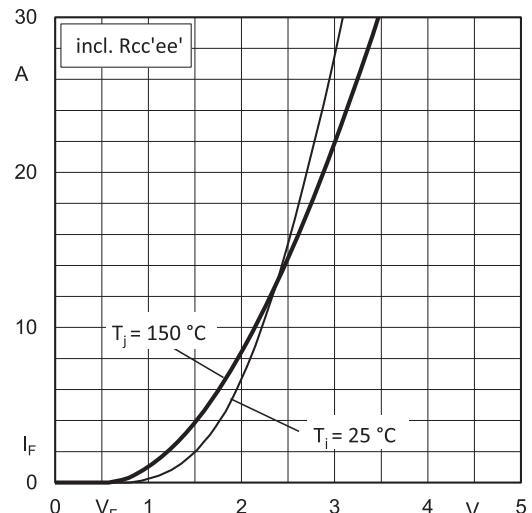


Fig. 10: Typ. CAL diode forward characteristic

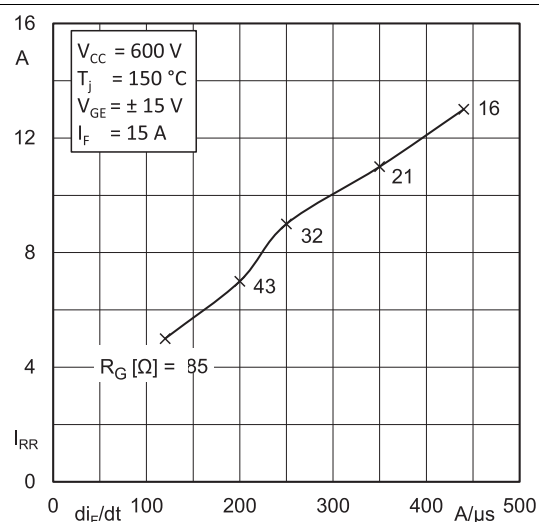


Fig. 11: Typ. CAL diode peak reverse recovery current

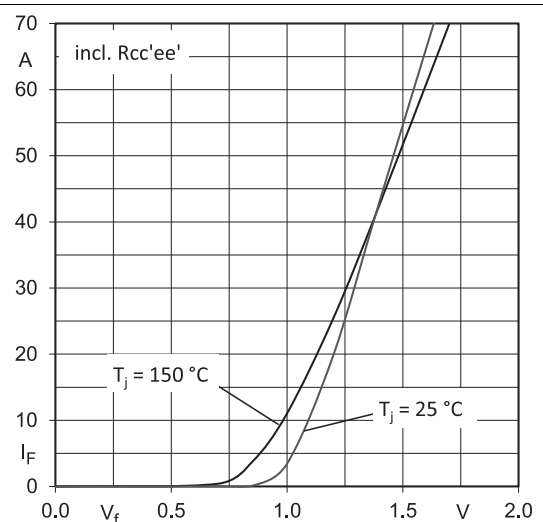
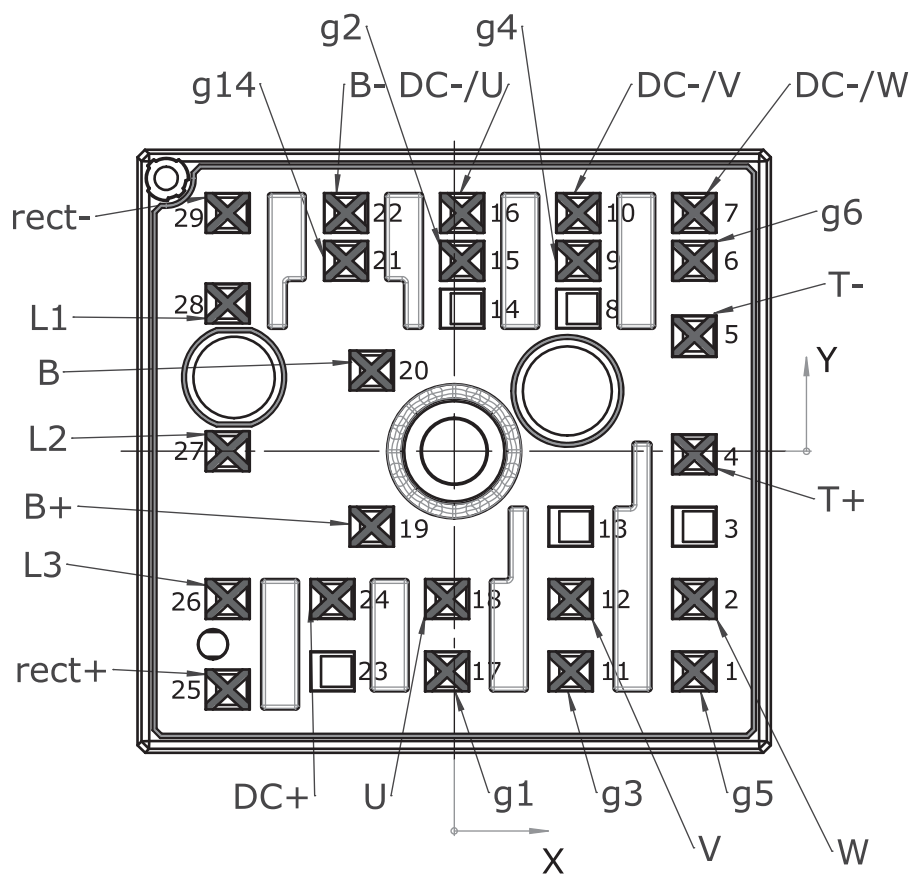
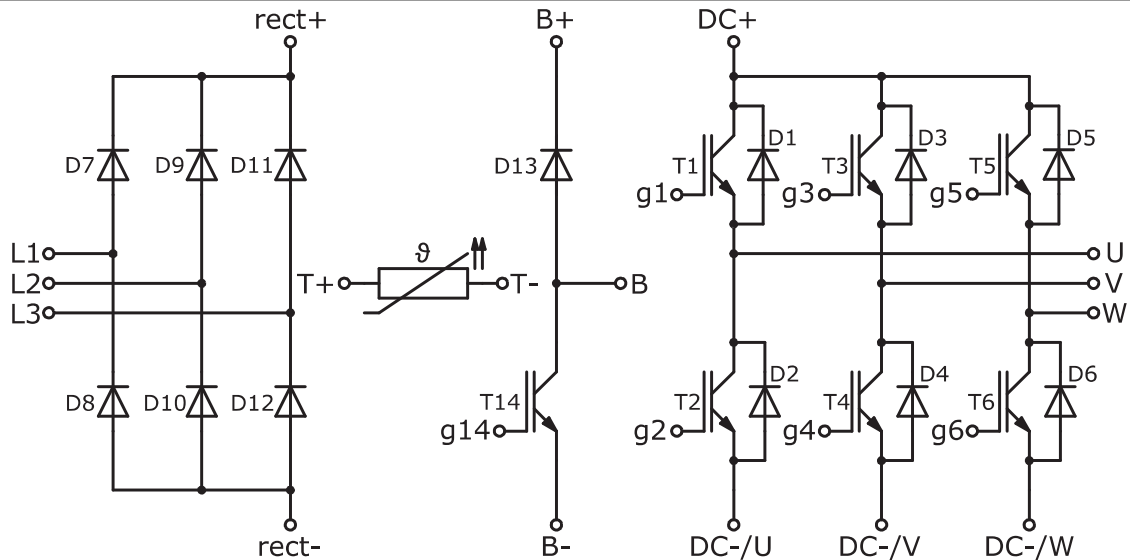


Fig. 12: Typ. input bridge forward characteristic

Pin out							
Pin	X	Y	Function	Pin	X	Y	Function
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	-5,0	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	-15,80	rect+
11	7,73	-14,60	g3	26	-15,03	-9,80	L3
12	7,73	-9,80	V	27	-15,03	0	L2
13				28	-15,03	9,80	L1
14				29	-15,03	15,80	rect-
15	0,53	12,63	g2				

all values in mm





Pinout

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

*IMPORTANT INFORMATION AND WARNINGS

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