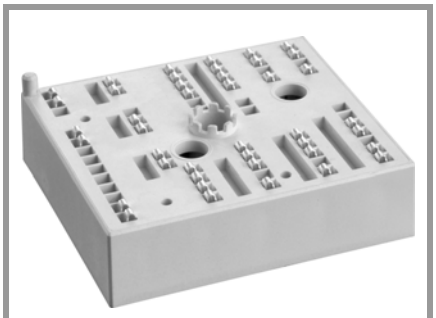
SKiiP 24NAB176V1



MiniSKiiP® 2

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

SKiiP 24NAB176V1

Features*

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

Remarks

- Max. case temperature limited to T_C=125°C
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- $I_{t(RMS)}$ limited to 20A for +B, B, -B, -DC/U, -DC/V, -DC/W power connectors
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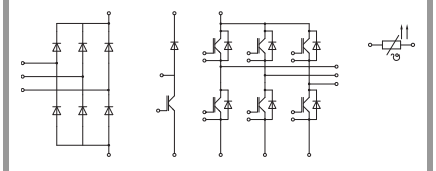
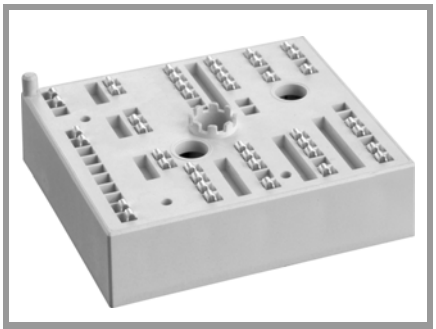


NAB

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V_{CES}	T_j = 25 °C		1700	V
I_C	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	38	A
	T_j = 150 °C	T_s = 70 °C	29	A
I_C	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	43	A
	T_j = 150 °C	T_s = 70 °C	33	A
I_{Cnom}			29	A
I_{CRM}			58	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 1200 V V_{GE} ≤ 20 V V_{CES} ≤ 1700 V	T_j = 125 °C	10	µs
T_j			-55 ... 150	°C
Chopper - IGBT				
V_{CES}	T_j = 25 °C		1700	V
I_C	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	38	A
	T_j = 150 °C	T_s = 70 °C	29	A
I_C	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	43	A
	T_j = 150 °C	T_s = 70 °C	33	A
I_{Cnom}			29	A
I_{CRM}			58	A
V_{GES}			-20 ... 20	V
t_{psc}	V_{CC} = 1200 V V_{GE} ≤ 20 V V_{CES} ≤ 1700 V	T_j = 125 °C	10	µs
T_j			-55 ... 150	°C
Inverse - Diode				
V_{RRM}	T_j = 25 °C		1700	V
I_F	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	48	A
	T_j = 175 °C	T_s = 70 °C	38	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	54	A
	T_j = 175 °C	T_s = 70 °C	43	A
I_{FRM}			80	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		280	A
T_j			-40 ... 175	°C
Freewheeling - Diode				
V_{RRM}	T_j = 25 °C		1700	V
I_F	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	48	A
	T_j = 175 °C	T_s = 70 °C	38	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	54	A
	T_j = 175 °C	T_s = 70 °C	43	A
I_{FRM}			80	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		280	A
T_j			-40 ... 175	°C

SKiiP 24NAB176V1



MiniSKiiP® 2

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

SKiiP 24NAB176V1

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Remarks

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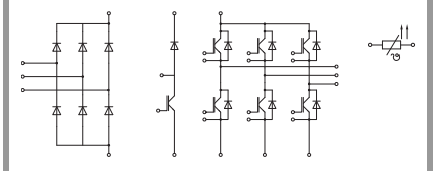
- The distance between terminals of +rect, +B and +DC not sufficient for basic insulation
- The distance between terminals of -B, -DC/U, DC/V and –DC/W not sufficient for basic insulation

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Rectifier - Diode				
V_{RRM}	T_j = 25 °C		1800	V
I_F	λ_{paste}=0.8 W/(mK)	T_s = 25 °C	59	A
	T_j = 150 °C	T_s = 70 °C	42	A
I_F	λ_{paste}=2.5 W/(mK)	T_s = 25 °C	66	A
	T_j = 150 °C	T_s = 70 °C	48	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 = 29 A	T_j = 25 °C		2.00	2.45	V
	V_{GE} = 15 V chiplevel	T_j = 125 °C		2.45	2.90	V
V_{CE0}	chiplevel	T_j = 25 °C		1.00	1.20	V
		T_j = 125 °C		0.90	1.10	V
r_{CE}	V_{GE} = 15 V	T_j = 25 °C		34	43	mΩ
	chiplevel	T_j = 125 °C		53	62	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 1.2 mA		5.2	5.8	6.4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1700 V, T_j = 25 °C				1	mA
C_{ies}	V_{CE} = 25 V	f = 1 MHz		2.50		nF
C_{oes}	V_{GE} = 0 V	f = 1 MHz		0.11		nF
C_{res}		f = 1 MHz		0.08		nF
Q_G	V_{GE} = - 8 V...+ 15 V			240		nC
R_{Gint}	T_j = 25 °C			32		Ω
$t_{d(on)}$	V_{CC} = 900 V	T_j = 125 °C		290		ns
t_r	I_C = 20 A	T_j = 125 °C		40		ns
E_{on}	$R_{G\ on}$ = 1 Ω	T_j = 125 °C		5.1		mJ
$t_{d(off)}$	$R_{G\ off}$ = 1 Ω di/dt_{on} = 580 A/µs	T_j = 125 °C		690		ns
t_f	di/dt_{off} = 120 A/µs	T_j = 125 °C		120		ns
E_{off}	dv/dt = 4000 V/µs V_{GE} = +15/-15 V L_s = 47 nH	T_j = 125 °C		6.3		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.91		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.73		K/W



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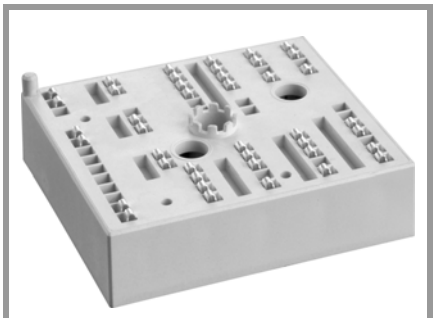

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SKiiP 24NAB176V1

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- $I_{t(RMS)}$ limited to 20A for +B, B, -B, -DC/U, -DC/V, -DC/W power connectors
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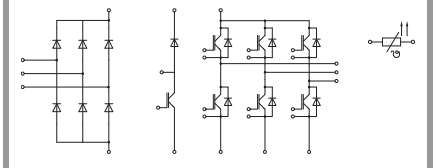
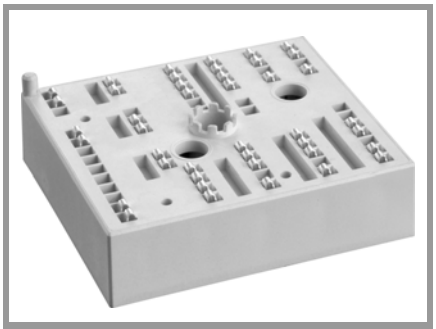


NAB

Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Chopper - IGBT						
$V_{CE(sat)}$	I_C = 29 A, V_{GE} = 15 V, chiplevel	T_j = 25 °C		2.00	2.45	V
		T_j = 125 °C		2.45	2.90	V
V_{CE0}	chiplevel	T_j = 25 °C		1.00	1.20	V
		T_j = 125 °C		0.90	1.10	V
r_{CE}	V_{GE} = 15 V, chiplevel	T_j = 25 °C		34	43	mΩ
		T_j = 125 °C		53	62	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 1.2 mA		5.2	5.8	6.4	V
I_{CES}	V_{GE} = 0 V, V_{CE} = 1700 V, T_j = 25 °C				1	mA
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V	f = 1 MHz		2.50		nF
C_{oes}		f = 1 MHz		0.11		nF
C_{res}		f = 1 MHz		0.08		nF
Q_G	V_{GE} = - 8 V...+ 15 V			240		nC
R_{Gint}	T_j = 25 °C			32		Ω
$t_{d(on)}$	V_{CC} = 900 V, I_C = 20 A, $R_{G\,on}$ = 1 Ω, $R_{G\,off}$ = 1 Ω, di/dt$_{on}$ = 580 A/µs, di/dt$_{off}$ = 120 A/µs, dv/dt = 4000 V/µs, V_{GE} = +15/-15 V, L_s = 47 nH	T_j = 125 °C		290		ns
t_r		T_j = 125 °C		40		ns
E_{on}		T_j = 125 °C		5.1		mJ
$t_{d(off)}$		T_j = 125 °C		690		ns
t_f		T_j = 125 °C		120		ns
E_{off}		T_j = 125 °C		6.3		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			0.91		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.73		K/W
Inverse - Diode						
$V_F = V_{EC}$	I_F = 40 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		2.00	2.38	V
		T_j = 150 °C		2.14	2.56	V
V_{F0}	chiplevel	T_j = 25 °C		1.32	1.56	V
		T_j = 150 °C		1.08	1.22	V
r_F	chiplevel	T_j = 25 °C		17	20	mΩ
		T_j = 150 °C		27	33	mΩ
I_{RRM}	I_F = 20 A, di/dt$_{off}$ = 620 A/µs, V_{GE} = -15 V, V_{CC} = 900 V	T_j = 125 °C		32.7		A
Q_{rr}		T_j = 125 °C		8.7		µC
E_{rr}		T_j = 125 °C		4.9		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.14		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.95		K/W
Freewheeling - Diode						
$V_F = V_{EC}$	I_F = 40 A, V_{GE} = 0 V, chiplevel	T_j = 25 °C		2.00	2.38	V
		T_j = 150 °C		2.14	2.56	V
V_{F0}	chiplevel	T_j = 25 °C		1.32	1.56	V
		T_j = 150 °C		1.08	1.22	V
r_F	chiplevel	T_j = 25 °C		17	20	mΩ
		T_j = 150 °C		27	33	mΩ
I_{RRM}	I_F = 20 A, di/dt$_{off}$ = 620 A/µs, V_{GE} = -15 V, V_{CC} = 900 V	T_j = 125 °C		32.7		A
Q_{rr}		T_j = 125 °C		8.7		µC
E_{rr}		T_j = 125 °C		4.9		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.14		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			0.95		K/W



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SKiiP 24NAB176V1

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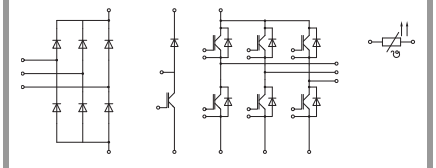

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Characteristics

Symbol	Conditions		min.	typ.	max.	Unit
Rectifier - Diode						
$V_F = V_{EC}$	I_F = 41 A chiplevel	T_j = 25 °C		1.19	1.45	V
		T_j = 125 °C		1.17	1.42	V
V_{F0}	chiplevel	T_j = 25 °C	0.6	0.87	1.10	V
		T_j = 125 °C		0.75	0.97	V
r_F	chiplevel	T_j = 25 °C		7.9	8.7	mΩ
		T_j = 125 °C		10	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)			1.32		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.12		K/W
Module						
M_s	to heat sink		2		2.5	Nm
w				55		g
L_{CE}				31		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}					

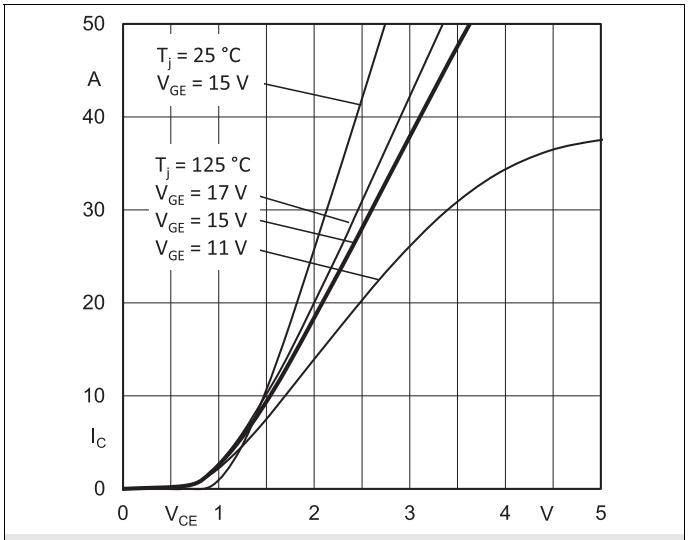


Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

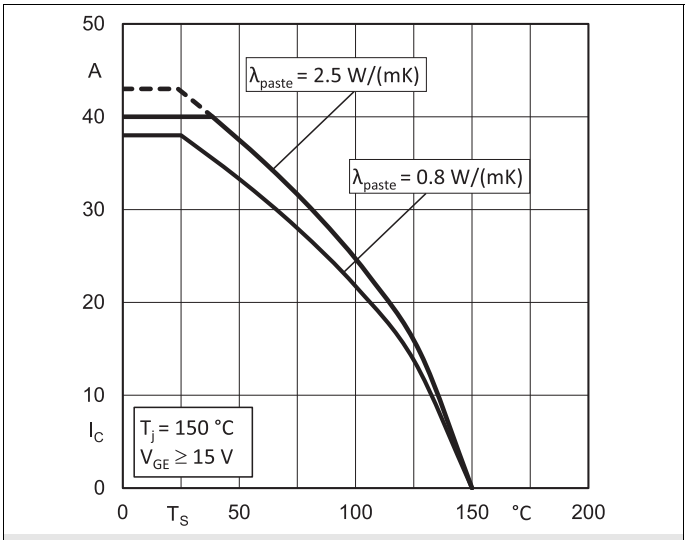


Fig. 2: Typ. rated current vs. temperature Ic = f(Ts)

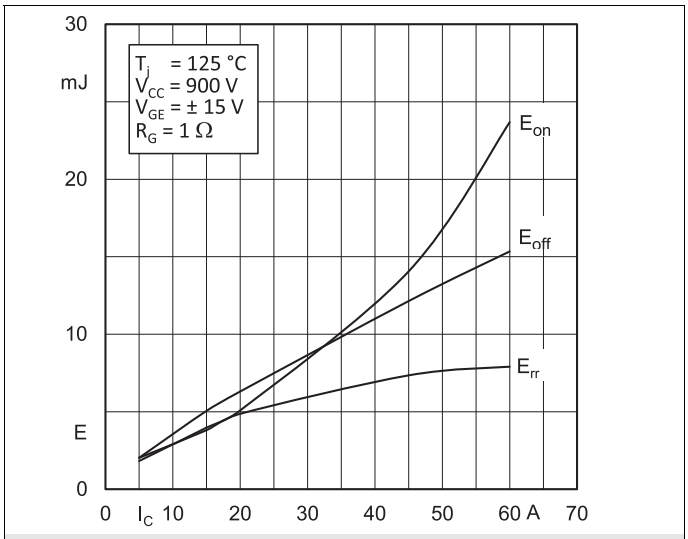


Fig. 3: Typ. turn-on /-off energy = f (I_C)

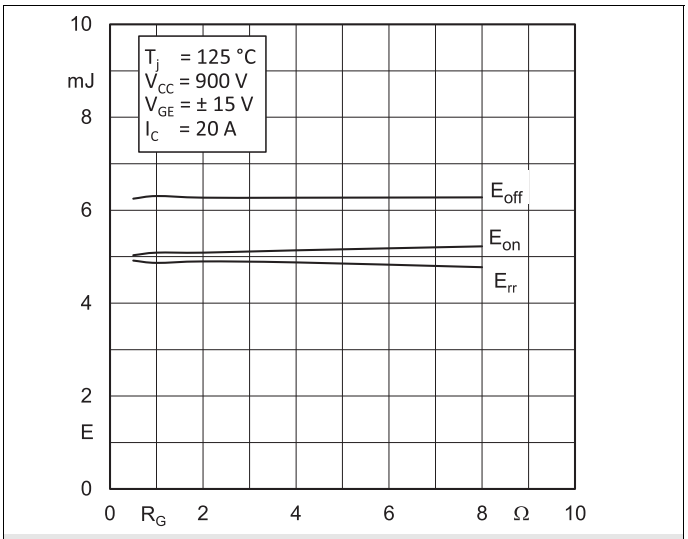


Fig. 4: Typ. turn-on /-off energy = f (R_G)

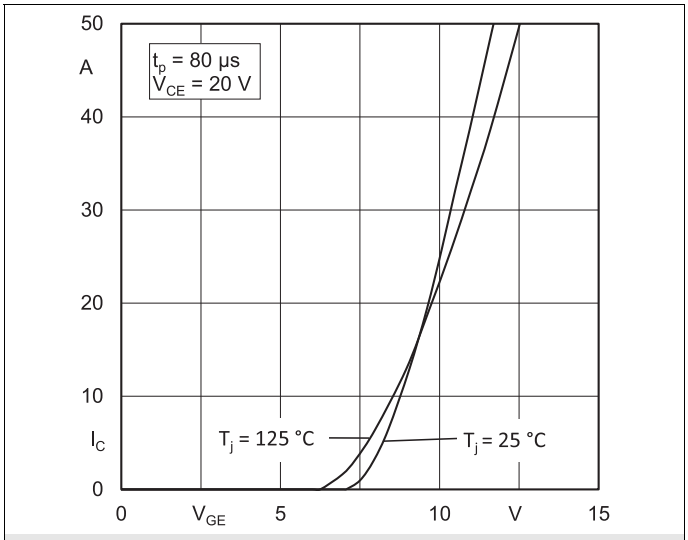


Fig. 5: Typ. transfer characteristic

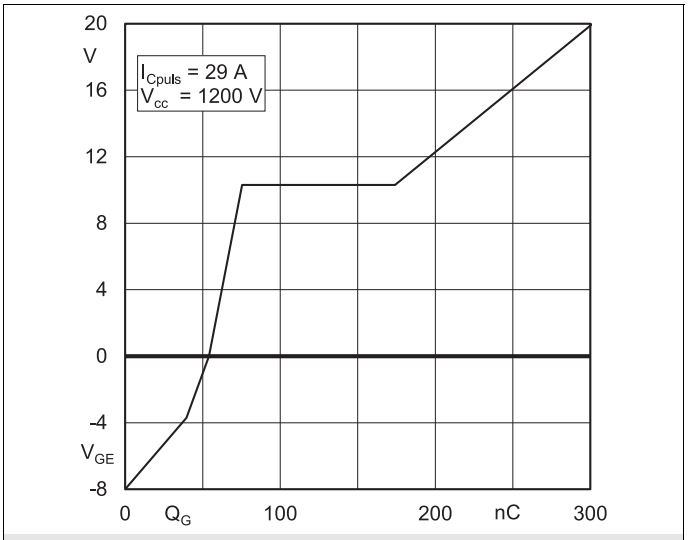


Fig. 6: Typ. gate charge characteristic

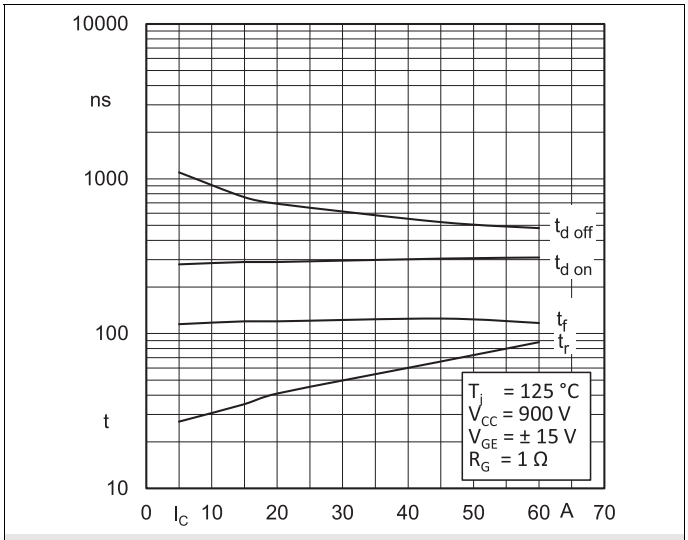


Fig. 7: Typ. switching times vs. I_C

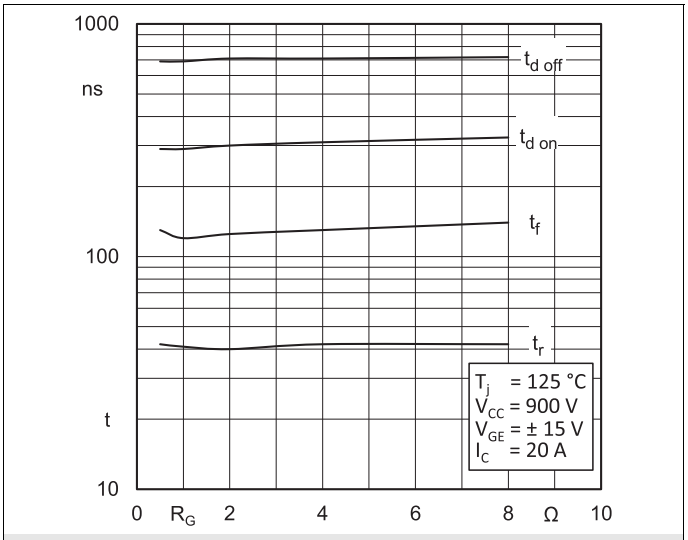


Fig. 8: Typ. switching times vs. gate resistor R_G

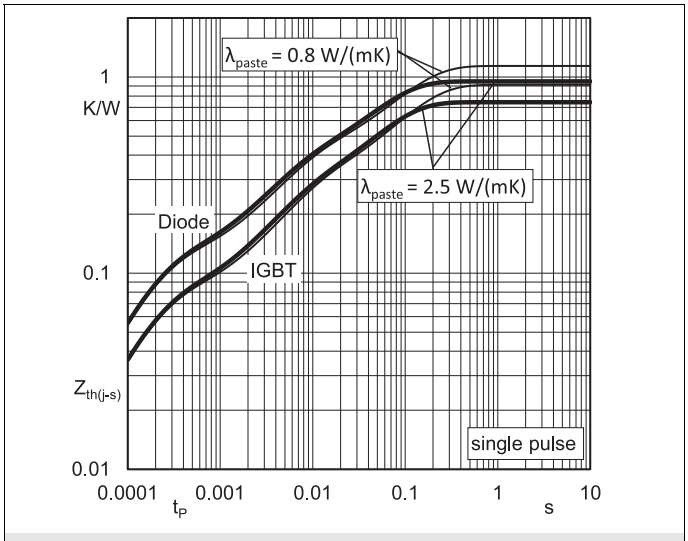


Fig. 9: Typ. transient thermal impedance

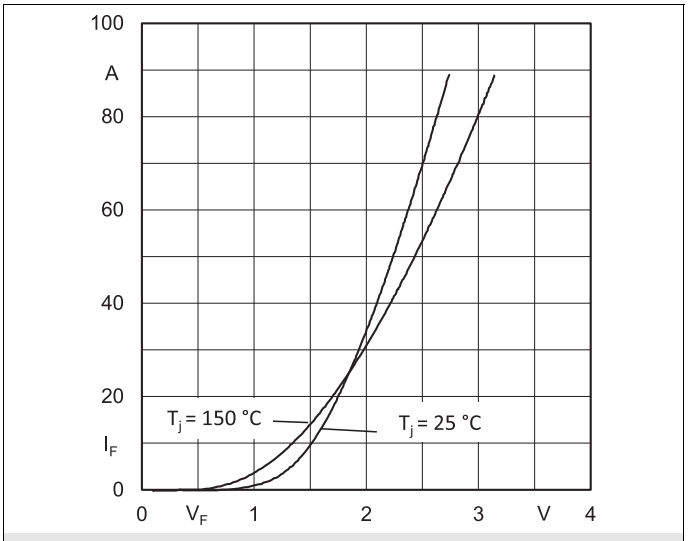


Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

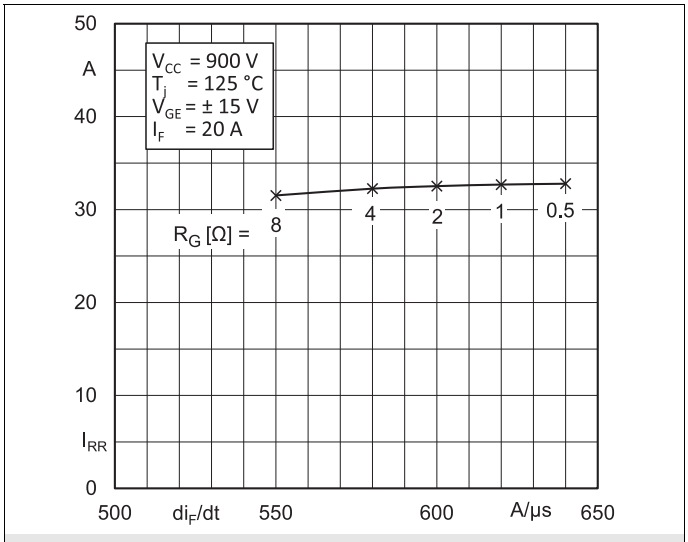


Fig. 11: Typ. CAL diode peak reverse recovery current

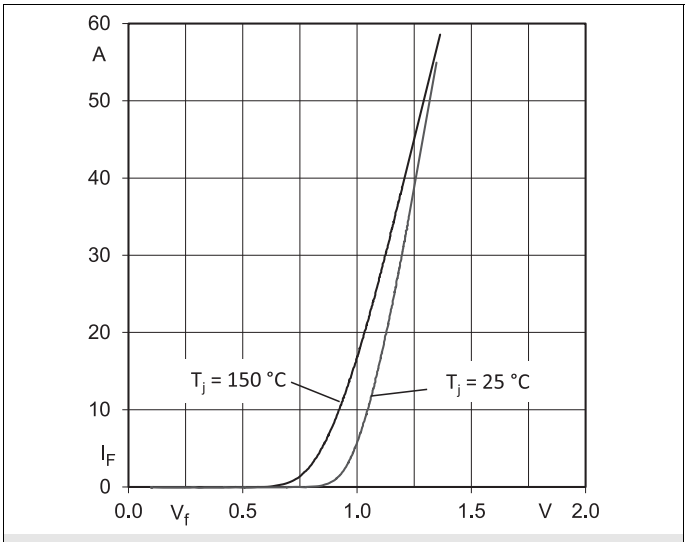
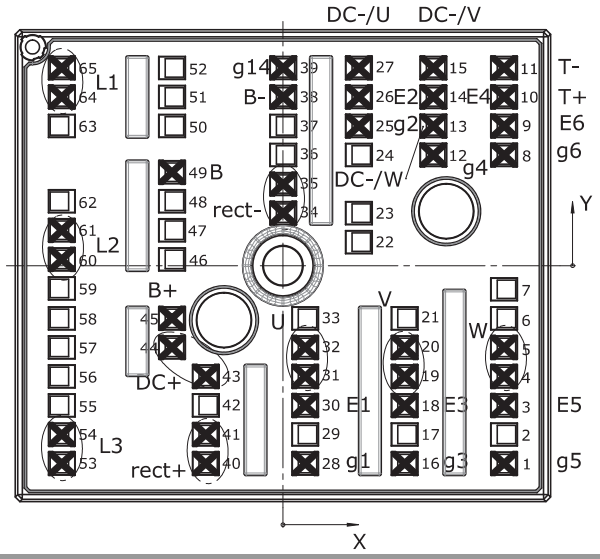


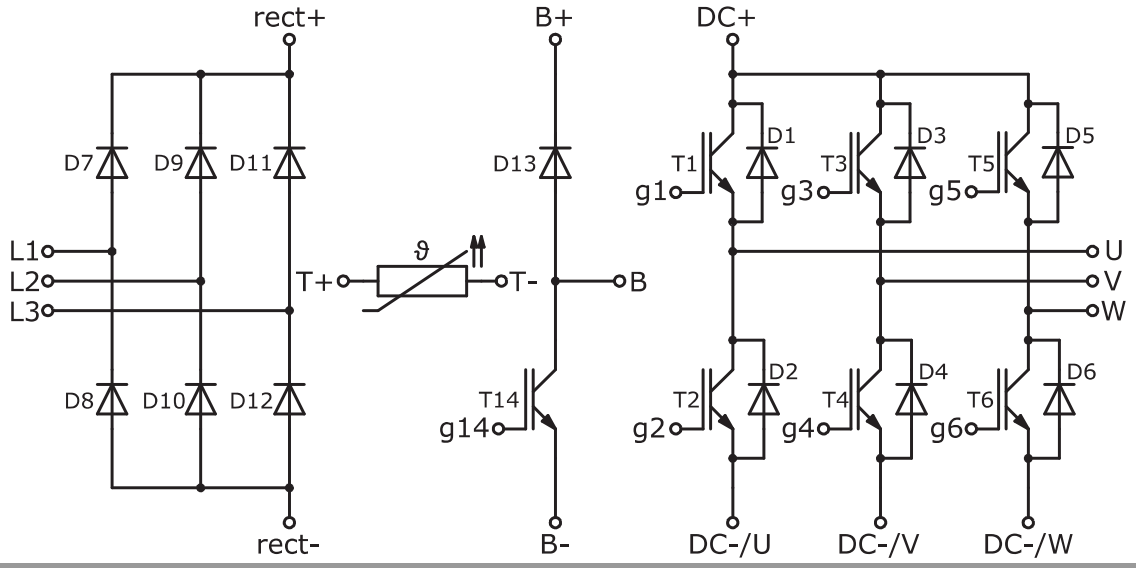
Fig. 12: Typ. input bridge forward characteristic incl. $R_{CC'+EE'}$

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	B+
2	24,38	-18,60		24	8,38	12,20		46	-12,23	0,70	
3	24,38	-15,40	E5	25	8,38	15,40	g2	47	-12,23	3,90	
4	24,38	-12,20	W	26	8,38	18,60	E2	48	-12,23	7,10	
5	24,38	-9,00	W	27	8,38	21,80	DC-/U	49	-12,23	10,30	B
6	24,38	-5,80		28	2,46	-21,80	g1	50	-12,23	15,40	
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	
9	24,38	15,40	E6	31	2,46	-12,20	U	53	-24,38	-21,80	L3
10	24,38	18,60	T+	32	2,46	-9,00	U	54	-24,38	-18,60	L3
11	24,38	21,80	T-	33	2,46	-5,80		55	-24,38	-15,40	
12	16,58	12,20	g4	34	0,03	5,80	rect-	56	-24,38	-12,20	
13	16,58	15,40	DC-/W	35	0,03	9,00	rect-	57	-24,38	-9,00	
14	16,58	18,60	E4	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	
16	13,42	-21,80	g3	38	0,03	18,60	B-	60	-24,38	0,70	L2
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	
20	13,42	-9,00	V	42	-8,51	-15,40		64	-24,38	18,60	L1
21	13,42	-5,80		43	-8,51	-12,20	DC+	65	-24,38	21,80	L1
22	8,38	2,60		44	-12,23	-9,00	DC+				

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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