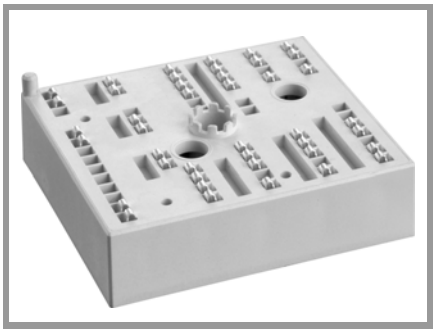
SKiiP 24NAB12T7V1



MiniSKiiP® 2

3-phase
Converter-Inverter-Brake
(CIB)

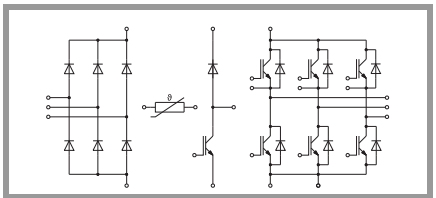
SKiiP 24NAB12T7V1

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

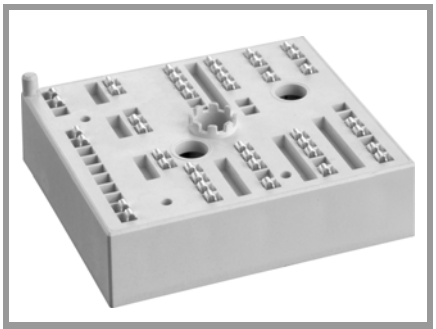
Remarks

- 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)
- 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



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_j = 175 °C	T_s = 70 °C	43	A
		T_s = 100 °C	35	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	48	A
		T_s = 100 °C	39	A
I_{Cnom}			35	A
I_{CRM}			70	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_j = 175 °C	T_s = 70 °C	43	A
		T_s = 100 °C	35	A
I_C	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	48	A
		T_s = 100 °C	39	A
I_{Cnom}			35	A
I_{CRM}			70	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_j = 175 °C	T_s = 70 °C	33	A
		T_s = 100 °C	27	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	37	A
		T_s = 100 °C	30	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 = 70 °C	33	A
		T_s = 100 °C	27	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	37	A
		T_s = 100 °C	30	A
I_{FRM}			70	A
I_{FSM}	t_p = 10 ms, sin 180°, T_j = 150 °C		170	A
T_j			-40 ... 175	°C



MiniSKiiP® 2

3-phase
Converter-Inverter-Brake
(CIB)

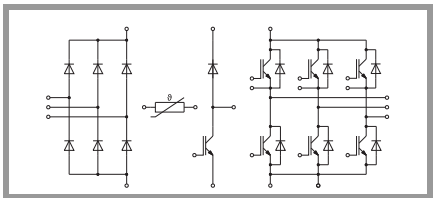
SKiiP 24NAB12T7V1

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)
- 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



NAB

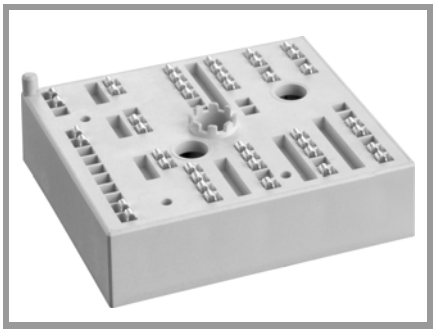
Absolute Maximum Ratings

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	49	A
		T_s = 100 °C	39	A
I_F	λ_{paste}=2.5 W/(mK) T_j = 175 °C	T_s = 70 °C	55	A
		T_s = 100 °C	43	A
I_{FSM}	t_p = 10 ms sin 180°	T_j = 25 °C	370	A
		T_j = 150 °C	270	A
i^2t	t_p = 10 ms sin 180°	T_j = 25 °C	685	A^2s
		T_j = 150 °C	365	A^2s
T_j			-40 ... 175	°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 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		17	20	mΩ
		T_j = 150 °C		28	31	mΩ
		T_j = 175 °C		31	33	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 0.75 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		6.60		nF
C_{oes}		f = 1 MHz		0.09		nF
C_{res}		f = 1 MHz		0.02		nF
Q_G	V_{GE} = - 8V ... + 15 V			490		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CC} = 600 V I_C = 35 A $R_{G\ on}$ = 9.1 Ω $R_{G\ off}$ = 9.1 Ω V_{GE} = +15/-15 V	T_j = 25 °C		37		ns
		T_j = 150 °C		39		ns
		T_j = 175 °C		40		ns
t_r		T_j = 25 °C		37		ns
		T_j = 150 °C		43		ns
		T_j = 175 °C		46		ns
E_{on}	@ T_j = 150 °C: di/dt_{on} = 860 A/µs di/dt_{off} = 380 A/µs dv/dt = 3610 V/µs	T_j = 25 °C		2.8		mJ
		T_j = 150 °C		4		mJ
		T_j = 175 °C		4.2		mJ

 © by SEMIKRON



MiniSKiiP® 2

3-phase
Converter-Inverter-Brake
(CIB)

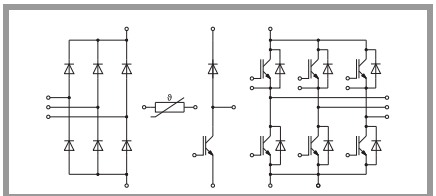
SKiiP 24NAB12T7V1

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

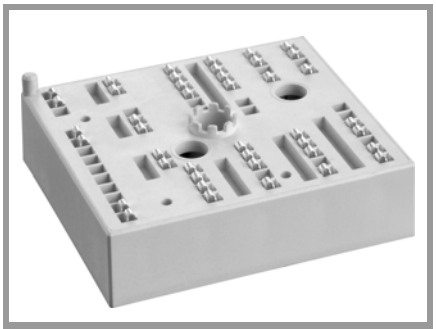
Remarks

- 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)
- 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



NAB

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverter - IGBT						
$t_{d(off)}$	V_{CC} = 600 V I_C = 35 A $R_{G\ on}$ = 9.1 Ω $R_{G\ off}$ = 9.1 Ω V_{GE} = +15/-15 V @ T_j = 150 °C: di/dt_{on} = 860 A/µs di/dt_{off} = 380 A/µs dv/dt = 3610 V/µs	T_j = 25 °C		231		ns
		T_j = 150 °C		321		ns
		T_j = 175 °C		346		ns
t_f		T_j = 25 °C		48		ns
		T_j = 150 °C		74		ns
		T_j = 175 °C		90		ns
E_{off}		T_j = 25 °C		2.3		mJ
		T_j = 150 °C		3.9		mJ
		T_j = 175 °C		4.2		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1.12		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.93		K/W
Chopper - IGBT						
$V_{CE(sat)}$	I_C = 35 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		17	20	mΩ
		T_j = 150 °C		28	31	mΩ
		T_j = 175 °C		31	33	mΩ
$V_{GE(th)}$	V_{GE} = V_{CE}, I_C = 0.75 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		6.60		nF
C_{oes}		f = 1 MHz		0.09		nF
C_{res}		f = 1 MHz		0.02		nF
Q_G	V_{GE} = - 8V ... + 15 V			490		nC
R_{Gint}	T_j = 25 °C			0		Ω
$t_{d(on)}$	V_{CC} = 600 V I_C = 35 A $R_{G\ on}$ = 9.1 Ω $R_{G\ off}$ = 9.1 Ω V_{GE} = +15/-15 V @ T_j = 150 °C: di/dt_{on} = 860 A/µs di/dt_{off} = 380 A/µs dv/dt = 3610 V/µs	T_j = 25 °C		37		ns
		T_j = 150 °C		39		ns
		T_j = 175 °C		40		ns
t_r		T_j = 25 °C		37		ns
		T_j = 150 °C		43		ns
		T_j = 175 °C		46		ns
E_{on}		T_j = 25 °C		2.8		mJ
		T_j = 150 °C		4		mJ
		T_j = 175 °C		4.2		mJ
$t_{d(off)}$		T_j = 25 °C		231		ns
		T_j = 150 °C		321		ns
		T_j = 175 °C		346		ns
t_f		T_j = 25 °C		48		ns
		T_j = 150 °C		74		ns
		T_j = 175 °C		90		ns
E_{off}		T_j = 25 °C		2.3		mJ
		T_j = 150 °C		3.9		mJ
		T_j = 175 °C		4.2		mJ
$R_{th(j-s)}$	per IGBT, λ_{paste}=0.8 W/(mK)			1.12		K/W
$R_{th(j-s)}$	per IGBT, λ_{paste}=2.5 W/(mK)			0.93		K/W



MiniSKiiP® 2

3-phase
Converter-Inverter-Brake
(CIB)

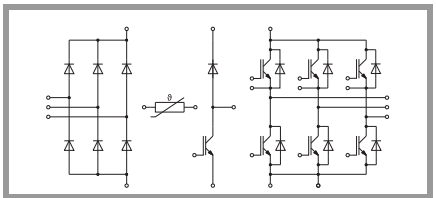
SKiiP 24NAB12T7V1

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

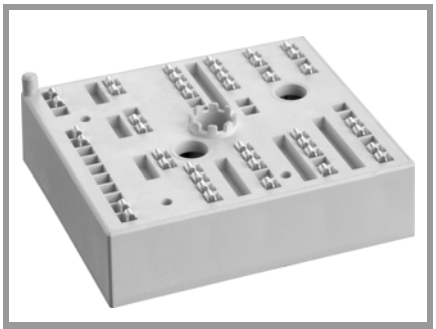
- Max. case temperature limited to TC=TS=125 °C
- Product reliability results valid for Tj≤150 °C; Tj,op >150°C during overload (Details see AN19-002)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet Please refer to both documents for further information
- For 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



NAB

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Inverse - Diode						
$V_F = V_{EC}$	I_F = 35 A	T_j = 25 °C		2.30	2.62	V
	V_{GE} = 0 V	T_j = 150 °C		2.29	2.62	V
	chiplevel	T_j = 175 °C		2.14	2.46	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		29	32	mΩ
	chiplevel	T_j = 150 °C		40	43	mΩ
		T_j = 175 °C		38	42	mΩ
I_{RRM}		T_j = 25 °C		22		A
		T_j = 150 °C		28		A
	V_{CC} = 600 V	T_j = 175 °C		33		A
Q_{rr}	I_F = 35 A	T_j = 25 °C		2		µC
	V_{GE} = -15 V	T_j = 150 °C		5.2		µC
	@ T_j = 150 °C:	T_j = 175 °C		5.7		µC
E_{rr}	di/dt_{off} = 870 A/µs	T_j = 25 °C		0.65		mJ
		T_j = 150 °C		2.1		mJ
		T_j = 175 °C		2.7		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.34		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.13		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	T_j = 150 °C		2.29	2.62	V
	chiplevel	T_j = 175 °C		2.14	2.46	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		29	32	mΩ
	chiplevel	T_j = 150 °C		40	43	mΩ
		T_j = 175 °C		38	42	mΩ
I_{RRM}		T_j = 25 °C		22		A
		T_j = 150 °C		28		A
	V_{CC} = 600 V	T_j = 175 °C		33		A
Q_{rr}	I_F = 35 A	T_j = 25 °C		2		µC
	V_{GE} = -15 V	T_j = 150 °C		5.2		µC
	@ T_j = 150 °C:	T_j = 175 °C		5.7		µC
E_{rr}	di/dt_{off} = 870 A/µs	T_j = 25 °C		0.65		mJ
		T_j = 150 °C		2.1		mJ
		T_j = 175 °C		2.7		mJ
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.34		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.13		K/W

 © by SEMIKRON



MiniSKiiP® 2

3-phase
Converter-Inverter-Brake
(CIB)

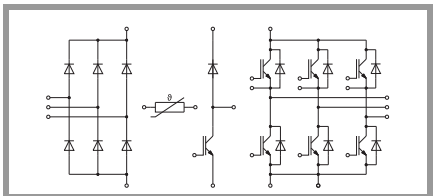
SKiiP 24NAB12T7V1

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)
- 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



NAB

Characteristics						
Symbol	**Conditions**		**min.**	**typ.**	**max.**	**Unit**
Rectifier - Diode						
V_F	I_F = 13 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		6.2	8.5	mΩ
		T_j = 150 °C		8.8	12	mΩ
		T_j = 175 °C		10.0	13	mΩ
I_R	T_j = 150 °C, V_{RRM}				1.7	mA
$R_{th(j-s)}$	per Diode, λ_{paste}=0.8 W/(mK)			1.39		K/W
$R_{th(j-s)}$	per Diode, λ_{paste}=2.5 W/(mK)			1.2		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}					

Creepage distance (spring to spring) between temperature sensor and phase DC- = 3.2mm (CTI 600)

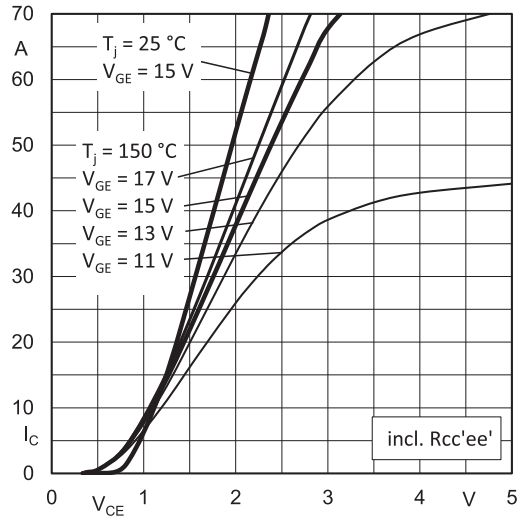


Fig. 1: Typ. output characteristic

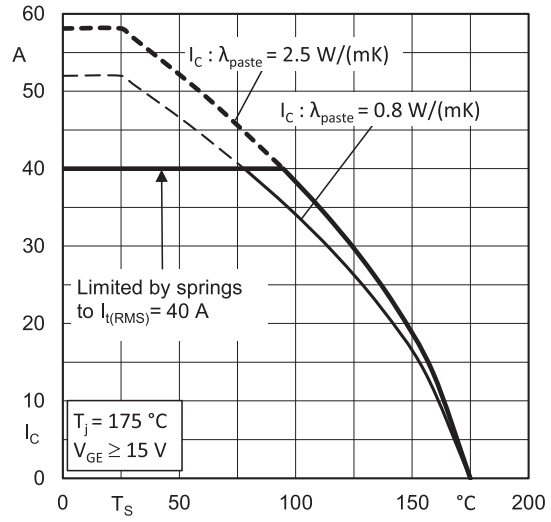


Fig. 2: Typ. rated current vs. temperature $I_C = f(T_S)$

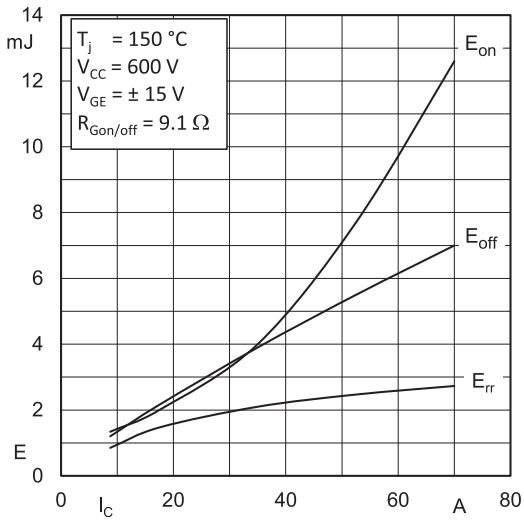


Fig. 3: Typ. turn-on /-off energy = f (I_C)

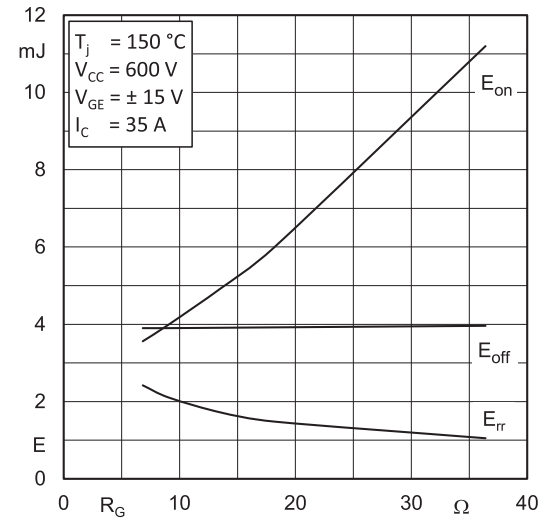


Fig. 4: Typ. turn-on /-off energy = f (R_G)

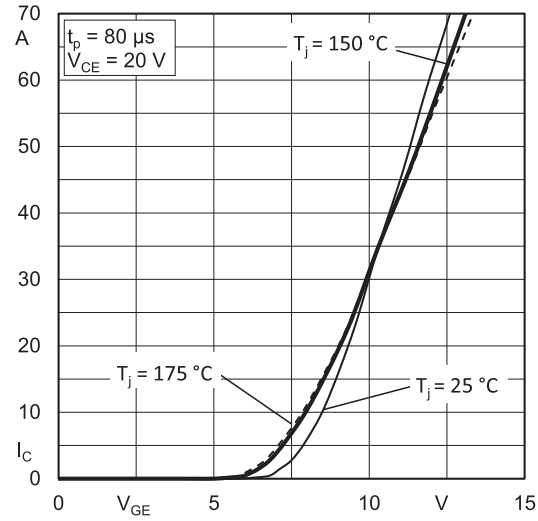


Fig. 5: Typ. transfer characteristic

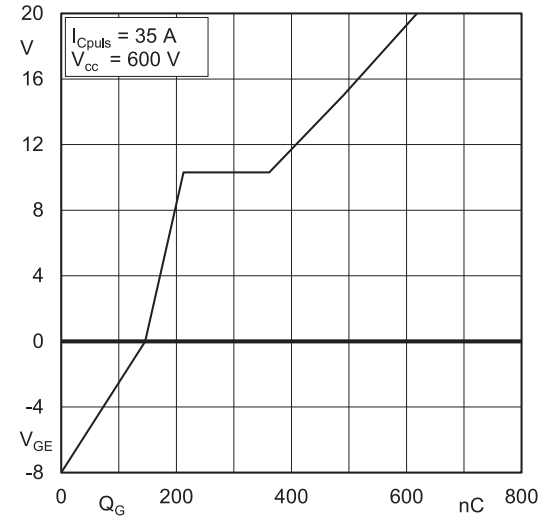


Fig. 6: Typ. gate charge characteristic

 © by SEMIKRON

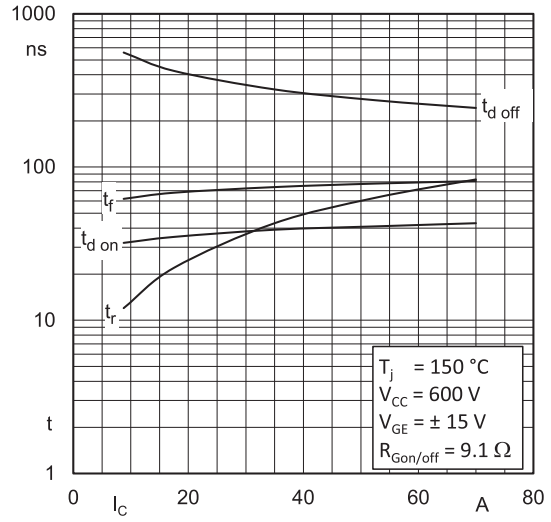


Fig. 7: Typ. switching times vs. I_C

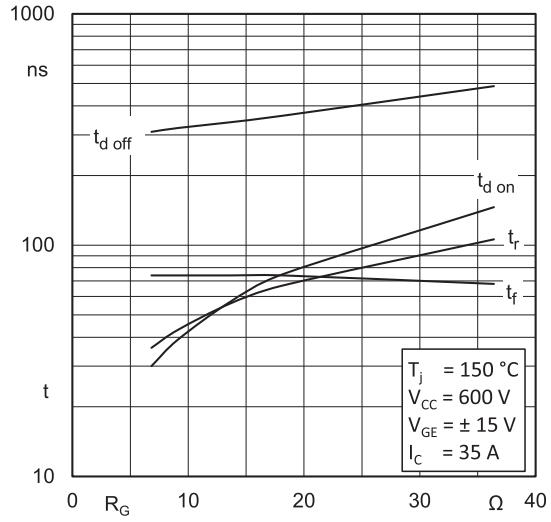


Fig. 8: Typ. switching times vs. gate resistor R_G

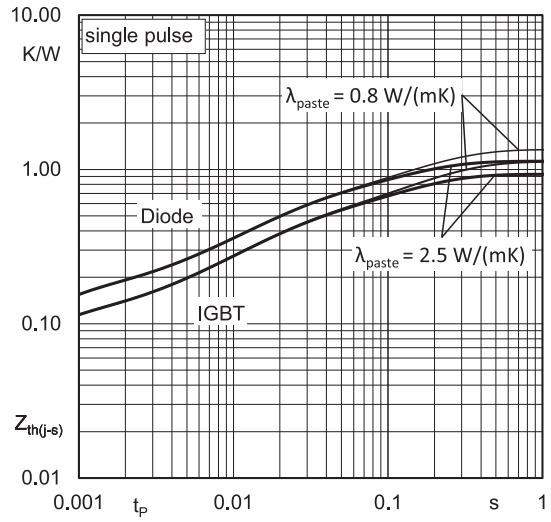


Fig. 9: Typ. transient thermal impedance

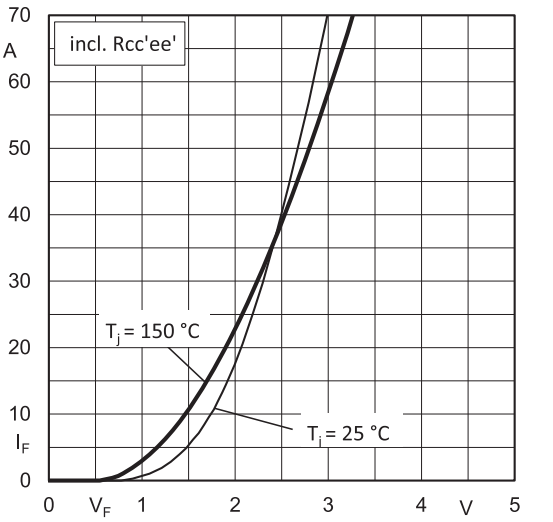


Fig. 10: Typ. CAL diode forward characteristic

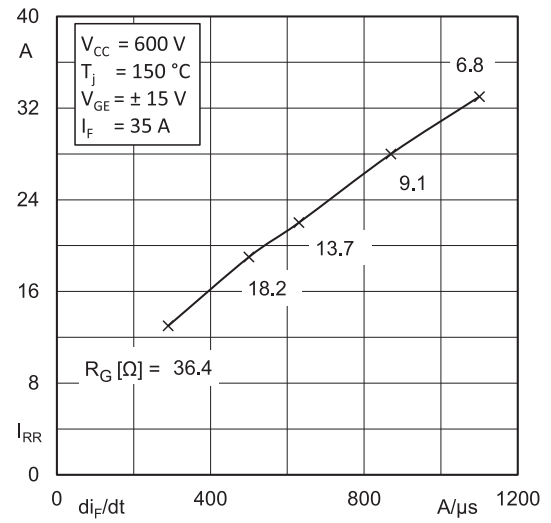


Fig. 11: Typ. CAL diode peak reverse recovery current

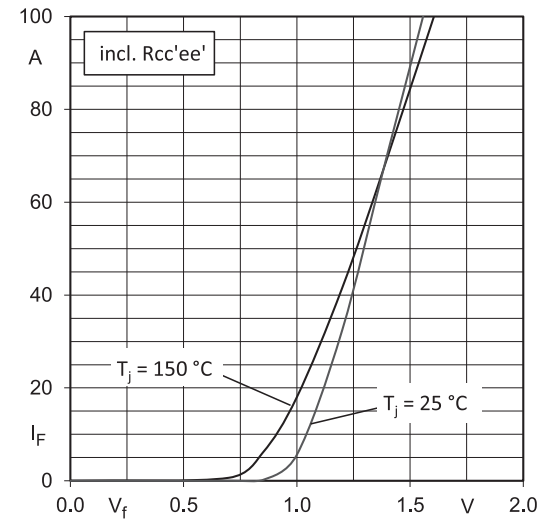
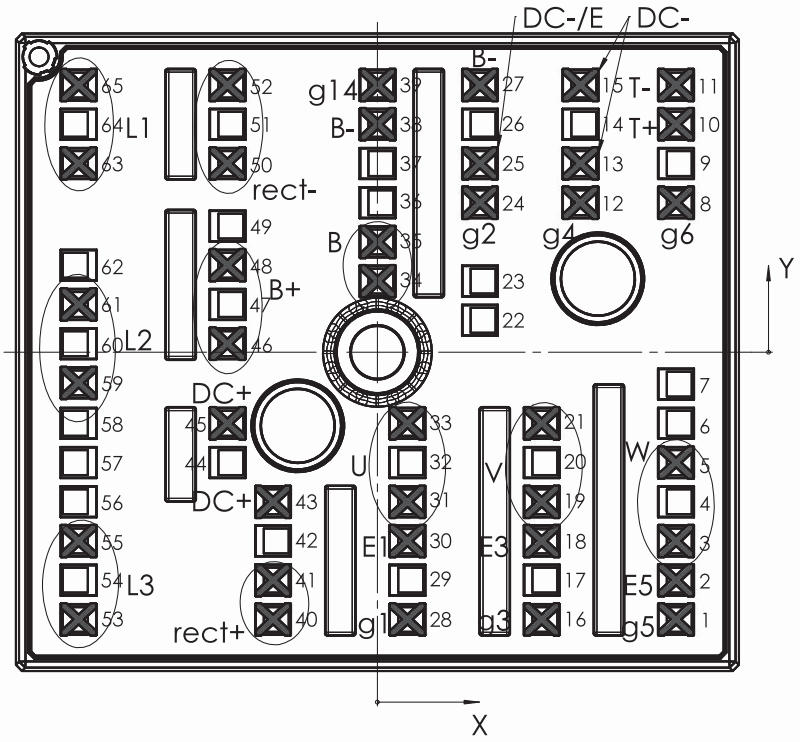
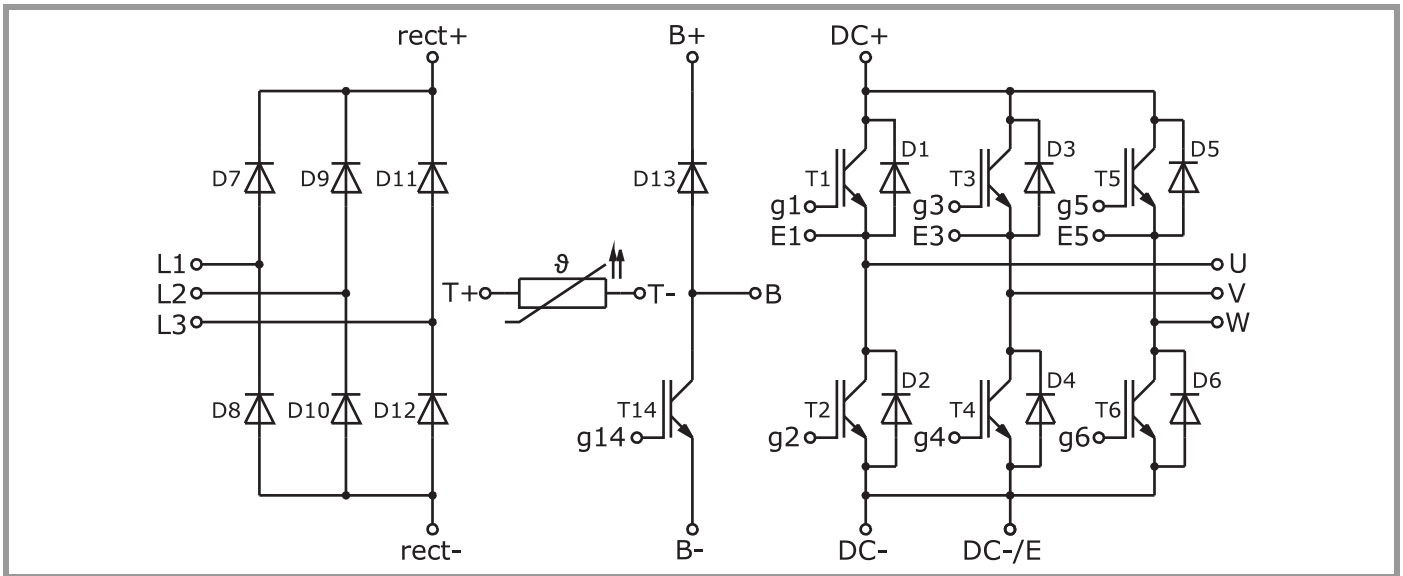


Fig. 12: Typ. input bridge forward characteristic

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

all values in mm





Pinout

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

***IMPORTANT INFORMATION AND WARNINGS**

The specifications of SEMIKRON products may not be considered as guarantee or assurance of product characteristics ("Beschaffenheitsgarantie"). The specifications of SEMIKRON products describe only the usual characteristics of products to be expected in typical applications, which may still vary depending on the specific application. Therefore, products must be tested for the respective application in advance. Application adjustments may be necessary. The user of SEMIKRON products is responsible for the safety of their applications embedding SEMIKRON products and must take adequate safety measures to prevent the applications from causing a physical injury, fire or other problem if any of SEMIKRON products become faulty. The user is responsible to make sure that the application design is compliant with all applicable laws, regulations, norms and standards. Except as otherwise explicitly approved by SEMIKRON in a written document signed by authorized representatives of SEMIKRON, SEMIKRON products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury. No representation or warranty is given and no liability is assumed with respect to the accuracy, completeness and/or use of any information herein, including without limitation, warranties of non-infringement of intellectual property rights of any third party. SEMIKRON does not assume any liability arising out of the applications or use of any product; neither does it convey any license under its patent rights, copyrights, trade secrets or other intellectual property rights, nor the rights of others. SEMIKRON makes no representation or warranty of non-infringement or alleged non-infringement of intellectual property rights of any third party which may arise from applications. Due to technical requirements our products may contain dangerous substances. For information on the types in question please contact the nearest SEMIKRON sales office. This document supersedes and replaces all information previously supplied and may be superseded by updates. SEMIKRON reserves the right to make changes.