

SKiiP 13NAB12T7V1



MiniSKiiP® 1

3-phase Converter-Inverter-Brake (CIB)

SKiiP 13NAB12T7V1

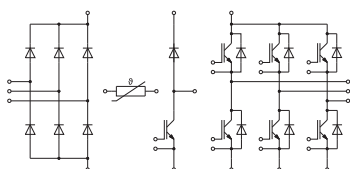
Features*

- 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 $T_{j \leq 150^\circ\text{C}}$; $T_{j, \text{op}} > 150^\circ\text{C}$ 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	38	A
	T _j = 175 °C	T _s = 100 °C	31	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	42	A
	T _j = 175 °C	T _s = 100 °C	34	A
I _{Cnom}			25	A
I _{CRM}			50	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	38	A
	T _j = 175 °C	T _s = 100 °C	31	A
I _C	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	42	A
	T _j = 175 °C	T _s = 100 °C	34	A
I _{Cnom}			25	A
I _{CRM}			50	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	27	A
	T _j = 175 °C	T _s = 100 °C	22	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	30	A
	T _j = 175 °C	T _s = 100 °C	24	A
I _{FRM}			50	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		100	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	27	A
	T _j = 175 °C	T _s = 100 °C	22	A
I _F	λ _{paste} =2.5 W/(mK)	T _s = 70 °C	30	A
	T _j = 175 °C	T _s = 100 °C	24	A
I _{FRM}			50	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		100	A
T _j			-40 ... 175	°C



NAB

SKiiP 13NAB12T7V1



MiniSKiiP® 1

3-phase Converter-Inverter-Brake (CIB)

SKiiP 13NAB12T7V1

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

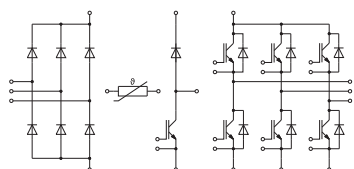
- Max. case temperature limited to $T_C = T_S = 125^\circ\text{C}$
- Product reliability results valid for $T_j \leq 150^\circ\text{C}$; $T_{j,op} > 150^\circ\text{C}$ during overload (Details see AN19-002)
- MiniSKiiP "Technical Explanations" and "Mounting Instructions" are part of the data sheet Please 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
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					
$V_{CE(sat)}$	$I_C = 25 \text{ A}$ $V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.60	1.75	V
		$T_j = 150^\circ\text{C}$	1.78	1.93	V
		$T_j = 175^\circ\text{C}$	1.82	1.97	V
V_{CE0}	chipelevel	$T_j = 25^\circ\text{C}$	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}	$V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	24	28	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	39	43	$\text{m}\Omega$
		$T_j = 175^\circ\text{C}$	43	47	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}$, $I_C = 0.53 \text{ mA}$	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}	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	4.80		nF
C_{oes}		$f = 1 \text{ MHz}$	0.06		nF
C_{res}		$f = 1 \text{ MHz}$	0.02		nF
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$		350		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0		Ω
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$ $I_C = 25 \text{ A}$ $R_{G on} = 12.8 \Omega$ $R_{G off} = 12.8 \Omega$	$T_j = 25^\circ\text{C}$	40		ns
		$T_j = 150^\circ\text{C}$	42		ns
		$T_j = 175^\circ\text{C}$	43		ns
t_r	$V_{GE} = +15/-15 \text{ V}$	$T_j = 25^\circ\text{C}$	38		ns
		$T_j = 150^\circ\text{C}$	44		ns
		$T_j = 175^\circ\text{C}$	47		ns
E_{on}	@ $T_j = 150^\circ\text{C}$: $di/dt_{on} = 590 \text{ A}/\mu\text{s}$ $di/dt_{off} = 280 \text{ A}/\mu\text{s}$ $dv/dt = 3600 \text{ V}/\mu\text{s}$	$T_j = 25^\circ\text{C}$	2		mJ
		$T_j = 150^\circ\text{C}$	2.8		mJ
		$T_j = 175^\circ\text{C}$	3		mJ



NAB

SKiiP 13NAB12T7V1



MiniSKiiP® 1

3-phase Converter-Inverter-Brake (CIB)

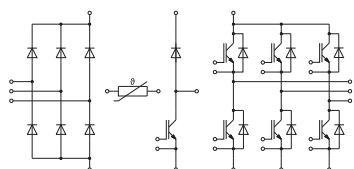
SKiiP 13NAB12T7V1

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



NAB

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverter - IGBT						
t _{d(off)}	V _{CC} = 600 V	T _j = 25 °C		218		ns
	I _C = 25 A	T _j = 150 °C		308		ns
	R _{G on} = 12.8 Ω	T _j = 175 °C		333		ns
t _f	R _{G off} = 12.8 Ω	T _j = 25 °C		46		ns
	V _{GE} = +15/-15 V	T _j = 150 °C		71		ns
		T _j = 175 °C		87		ns
E _{off}	@ T _j = 150 °C:	T _j = 25 °C		1.6		mJ
	di/dt _{on} = 590 A/μs	T _j = 150 °C		2.8		mJ
	di/dt _{off} = 280 A/μs	T _j = 175 °C		3		mJ
	dv/dt = 3600 V/μs					
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			1.08		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			0.91		K/W
Chopper - IGBT						
V _{CE(sat)}	I _C = 25 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		24	28	mΩ
	V _{GE} = 15 V	T _j = 150 °C		39	43	mΩ
	chiplevel	T _j = 175 °C		43	47	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 0.53 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		4.80		nF
C _{oes}	V _{CE} = 25 V	f = 1 MHz		0.06		nF
C _{res}	V _{GE} = 0 V	f = 1 MHz		0.02		nF
Q _G	V _{GE} = - 8V ... + 15 V			350		nC
R _{Gint}	T _j = 25 °C			0		Ω
t _{d(on)}		T _j = 25 °C		40		ns
		T _j = 150 °C		42		ns
		T _j = 175 °C		43		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		2		mJ
	I _C = 25 A	T _j = 150 °C		2.8		mJ
	R _{G on} = 12.8 Ω	T _j = 175 °C		3		mJ
	R _{G off} = 12.8 Ω					
	V _{GE} = +15/-15 V					
t _{d(off)}		T _j = 25 °C		218		ns
		T _j = 150 °C		308		ns
	@ T _j = 150 °C:	T _j = 175 °C		333		ns
t _f	di/dt _{on} = 590 A/μs	T _j = 25 °C		46		ns
	di/dt _{off} = 280 A/μs	T _j = 150 °C		71		ns
	dv/dt = 3600 V/μs	T _j = 175 °C		87		ns
		T _j = 25 °C		1.6		mJ
E _{off}		T _j = 150 °C		2.8		mJ
		T _j = 175 °C		3		mJ
R _{th(j-s)}	per IGBT, λ _{paste} =0.8 W/(mK)			1.08		K/W
R _{th(j-s)}	per IGBT, λ _{paste} =2.5 W/(mK)			0.91		K/W

SKiiP 13NAB12T7V1



MiniSKiiP® 1

3-phase Converter-Inverter-Brake (CIB)

SKiiP 13NAB12T7V1

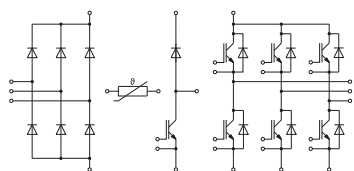
Features*

- 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

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
Inverse - Diode						
V _F = V _{EC}	I _F = 25 A	T _j = 25 °C		2.41	2.74	V
	V _{GE} = 0 V	T _j = 150 °C		2.45	2.79	V
	chiplevel	T _j = 175 °C		2.30	2.62	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		44	50	mΩ
	chiplevel	T _j = 150 °C		62	68	mΩ
		T _j = 175 °C		59	66	mΩ
I _{RRM}		T _j = 25 °C		15		A
		T _j = 150 °C		20		A
	V _{CC} = 600 V	T _j = 175 °C		23		A
Q _{rr}	I _F = 25 A	T _j = 25 °C		1.5		μC
	V _{GE} = -15 V	T _j = 150 °C		3.7		μC
	@ T _j = 150 °C:	T _j = 175 °C		4.1		μC
E _{rr}	di/dt _{off} = 610 A/μs	T _j = 25 °C		0.48		mJ
		T _j = 150 °C		1.4		mJ
		T _j = 175 °C		1.9		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			1.38		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			1.18		K/W
Freewheeling - Diode						
V _F = V _{EC}	I _F = 25 A	T _j = 25 °C		2.41	2.74	V
	V _{GE} = 0 V	T _j = 150 °C		2.45	2.79	V
	chiplevel	T _j = 175 °C		2.30	2.62	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		44	50	mΩ
	chiplevel	T _j = 150 °C		62	68	mΩ
		T _j = 175 °C		59	66	mΩ
I _{RRM}		T _j = 25 °C		15		A
		T _j = 150 °C		20		A
	V _{CC} = 600 V	T _j = 175 °C		23		A
Q _{rr}	I _F = 25 A	T _j = 25 °C		1.5		μC
	V _{GE} = -15 V	T _j = 150 °C		3.7		μC
	@ T _j = 150 °C:	T _j = 175 °C		4.1		μC
E _{rr}	di/dt _{off} = 610 A/μs	T _j = 25 °C		0.48		mJ
		T _j = 150 °C		1.4		mJ
		T _j = 175 °C		1.9		mJ
R _{th(j-s)}	per Diode, λ _{paste} =0.8 W/(mK)			1.38		K/W
R _{th(j-s)}	per Diode, λ _{paste} =2.5 W/(mK)			1.18		K/W



NAB

SKiiP 13NAB12T7V1



MiniSKiiP® 1

3-phase Converter-Inverter-Brake (CIB)

SKiiP 13NAB12T7V1

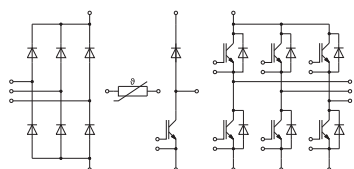
Features*

- 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

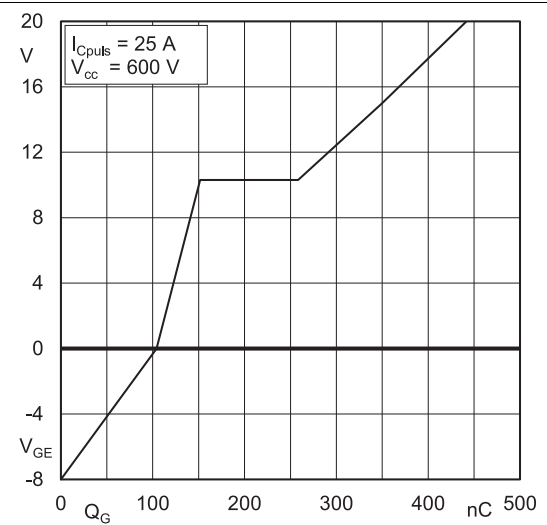
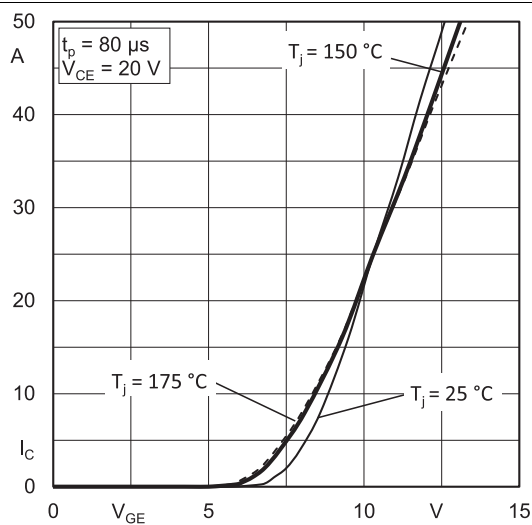
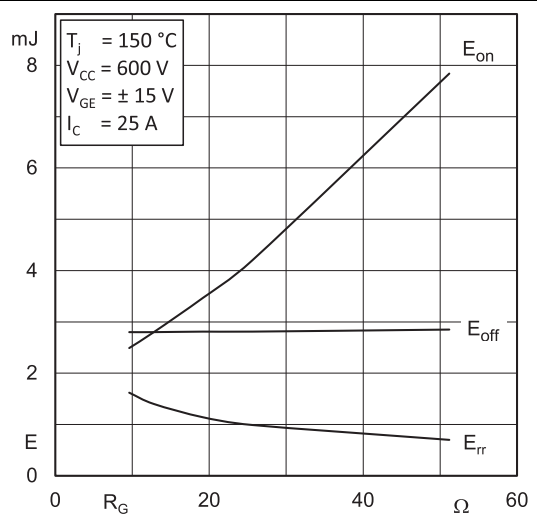
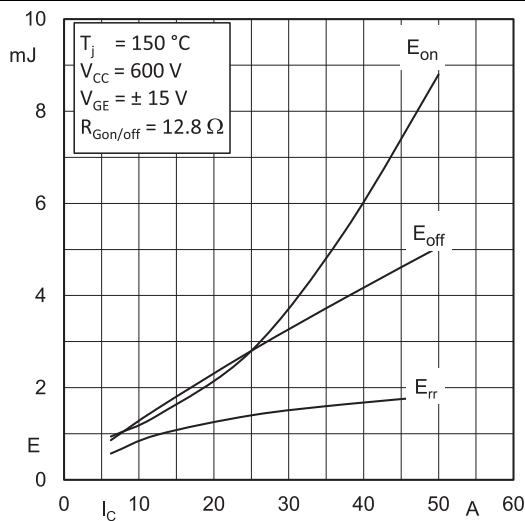
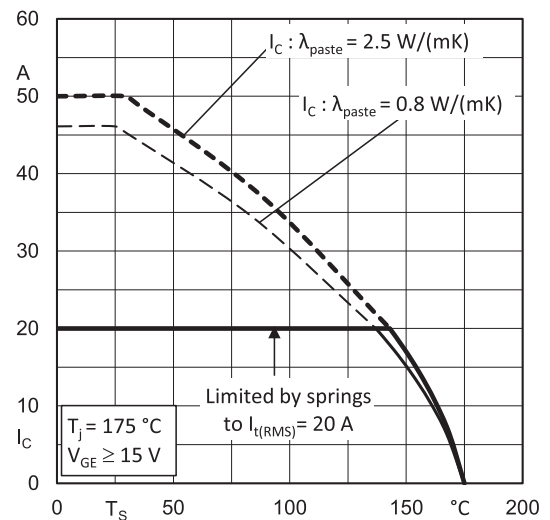
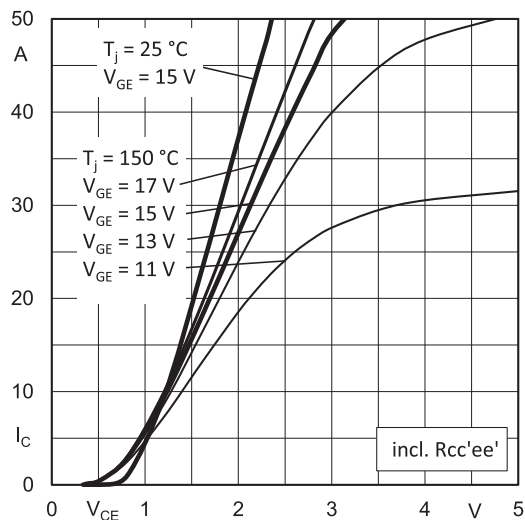
Remarks

- 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

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					



NAB



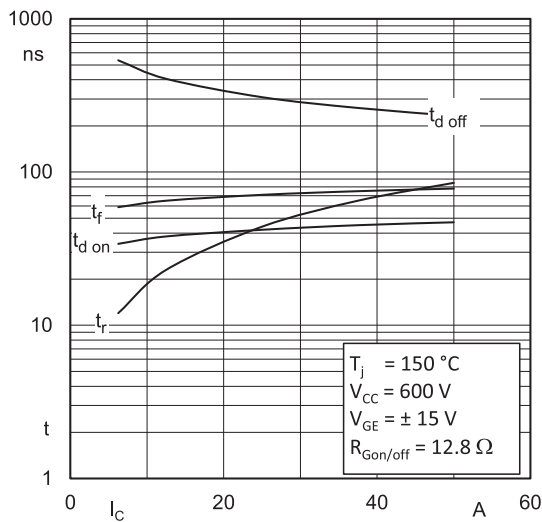


Fig. 7: Typ. switching times vs. I_C

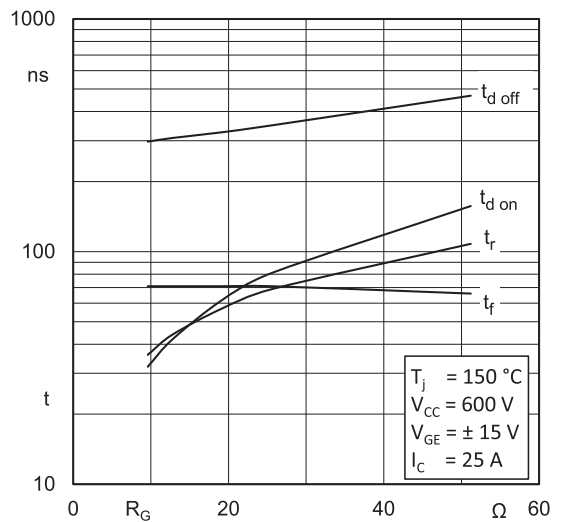


Fig. 8: Typ. switching times vs. gate resistor R_G

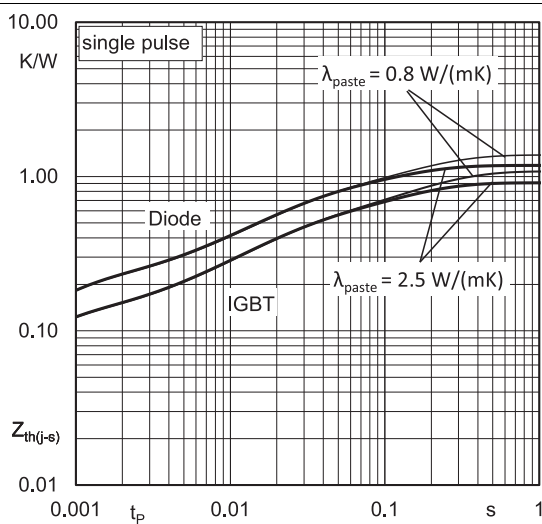


Fig. 9: Typ. transient thermal impedance

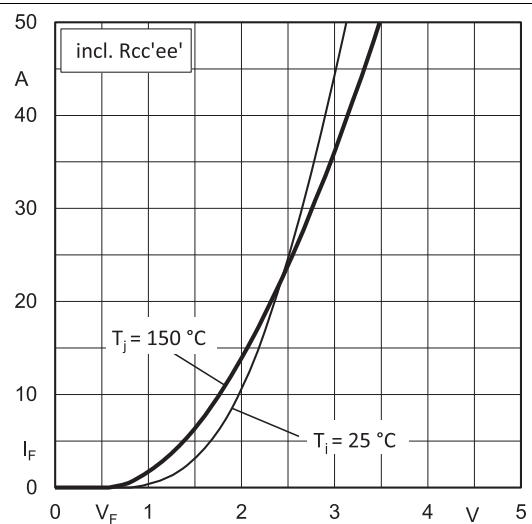


Fig. 10: Typ. CAL diode forward characteristic

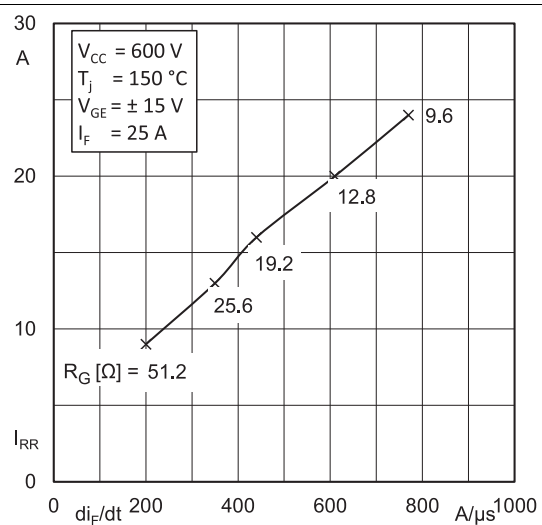


Fig. 11: Typ. CAL diode peak reverse recovery current

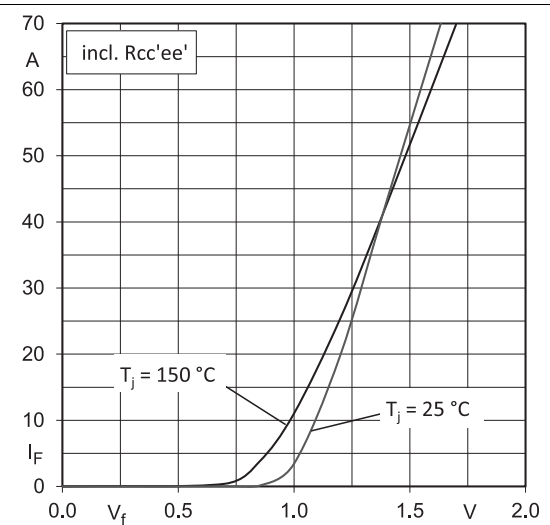


Fig. 12: Typ. input bridge forward characteristic

all values in mm



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.