

SKiiP 10NAB12T4V1



MiniSKiiP® 1

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Features

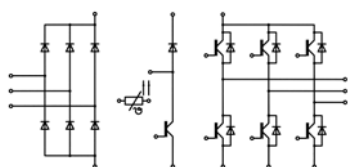
- Trench 4 IGBT's
- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised file no. E63532

Remarks

- V_{CEsat} , V_F = chip level value
- Case temp. limited to $T_C = 125^\circ\text{C}$ max. (for baseplateless modules $T_C = T_S$)
- product rel. results valid for $T_j \leq 150$ (recomm. Top = $-40 \dots +150^\circ\text{C}$)

Absolute Maximum Ratings

Symbol	Conditions		Values	Unit
Inverter - IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	T _j = 150 °C	T _s = 25 °C	6	A
		T _s = 70 °C	6	A
I _C	T _j = 175 °C	T _s = 25 °C	6	A
		T _s = 70 °C	6	A
I _{Cnom}			4	A
I _{CRM}	I _{CRM} = 3 x I _{Cnom}		12	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 150 °C	10	μs
T _j			-40 ... 175	°C
Chopper - IGBT				
V _{CES}	T _j = 25 °C		1200	V
I _C	T _j = 150 °C	T _s = 25 °C	6	A
		T _s = 70 °C	6	A
I _C	T _j = 175 °C	T _s = 25 °C	6	A
		T _s = 70 °C	6	A
I _{Cnom}			4	A
I _{CRM}	I _{CRM} = 3 x I _{Cnom}		12	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 800 V V _{GE} ≤ 15 V V _{CES} ≤ 1200 V	T _j = 150 °C	10	μs
T _j			-40 ... 175	°C
Inverse - Diode				
V _{RRM}	T _j = 25 °C		1200	V
I _F	T _j = 150 °C	T _s = 25 °C	7.5	A
		T _s = 70 °C	7.5	A
I _F	T _j = 175 °C	T _s = 25 °C	7.5	A
		T _s = 70 °C	7.5	A
I _{Fnom}			4	A
I _{FRM}	I _{FRM} = 3 x I _{Fnom}		12	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	T _j = 150 °C	T _s = 25 °C	7.5	A
		T _s = 70 °C	7.5	A
I _F	T _j = 175 °C	T _s = 25 °C	7.5	A
		T _s = 70 °C	7.5	A
I _{Fnom}			4	A
I _{FRM}	I _{FRM} = 3 x I _{Fnom}		12	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 150 °C		36	A
T _i			-40 ... 175	°C



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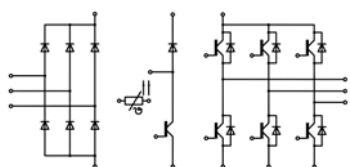
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- Case temp. limited to $T_C = 125^\circ\text{C}$ max. (for baseplateless modules $T_C = T_S$)
- product rel. results valid for $T_j \leq 150$ (recomm. Top = $-40 \dots +150^\circ\text{C}$)



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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	$T_s = 25^\circ\text{C}$, $T_j = 150^\circ\text{C}$	39	A
I_{Fnom}		8	A
I_{FSM}	10 ms	$T_j = 25^\circ\text{C}$	A
	sin 180°	$T_j = 150^\circ\text{C}$	A
I^2t	10 ms	$T_j = 25^\circ\text{C}$	A^2s
	sin 180°	$T_j = 150^\circ\text{C}$	A^2s
T_j		$-40 \dots 150$	$^\circ\text{C}$
Module			
$I_{t(RMS)}$	$T_{terminal} = 80^\circ\text{C}$, 20A per spring	20	A
T_{stg}		$-40 \dots 125$	$^\circ\text{C}$
V_{isol}	AC sinus 50Hz, 1 min	2500	V

Characteristics

Symbol	Conditions	min.	typ.	max.	Unit
Inverter - IGBT					
$V_{CE(sat)}$	$I_C = 4\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.85	2.10	V
		$T_j = 150^\circ\text{C}$	2.25	2.45	V
V_{CE0}		$T_j = 25^\circ\text{C}$	0.8	0.9	V
		$T_j = 150^\circ\text{C}$	0.7	0.8	V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	263	300	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	388	413	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}\text{ V}$, $I_C = 1\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = V_{CES}\text{ V}$	$T_j = 25^\circ\text{C}$	0.1	0.3	mA
					mA
C_{ies}	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	0.25		nF
C_{oes}		$f = 1\text{ MHz}$	0.03		nF
C_{res}		$f = 1\text{ MHz}$	0.01		nF
Q_G	$-8\text{ V} \dots +15\text{ V}$		23		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0.00		Ω
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$	65		ns
t_r	$I_C = 4\text{ A}$	$T_j = 150^\circ\text{C}$	45		ns
E_{on}	$R_{G on} = 150\ \Omega$	$T_j = 150^\circ\text{C}$	0.66		mJ
$t_{d(off)}$	$R_{G off} = 150\ \Omega$	$T_j = 150^\circ\text{C}$	300		ns
t_f		$T_j = 150^\circ\text{C}$	110		ns
E_{off}	$V_{GE} = +15/-15\text{ V}$	$T_j = 150^\circ\text{C}$	0.37		mJ
$R_{th(j-s)}$	per IGBT		2.49		K/W
Chopper - IGBT					
$V_{CE(sat)}$	$I_C = 4\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.85	2.10	V
		$T_j = 150^\circ\text{C}$	2.25	2.45	V
V_{CE0}		$T_j = 25^\circ\text{C}$	0.8	0.9	V
		$T_j = 150^\circ\text{C}$	0.7	0.8	V
r_{CE}	$V_{GE} = 15\text{ V}$	$T_j = 25^\circ\text{C}$	263	300	$\text{m}\Omega$
		$T_j = 150^\circ\text{C}$	388	413	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}\text{ V}$, $I_C = 1\text{ mA}$	5	5.8	6.5	V
I_{CES}	$V_{GE} = 0\text{ V}$ $V_{CE} = 1200\text{ V}$	$T_j = 25^\circ\text{C}$	0.1	0.3	mA
		$T_j = 150^\circ\text{C}$			mA
Q_G	$-8\text{ V} \dots +15\text{ V}$		23		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		0.00		Ω

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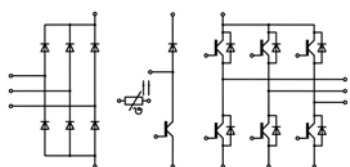
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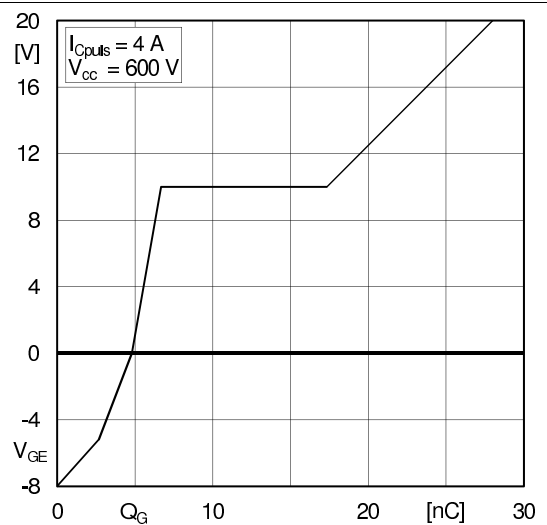
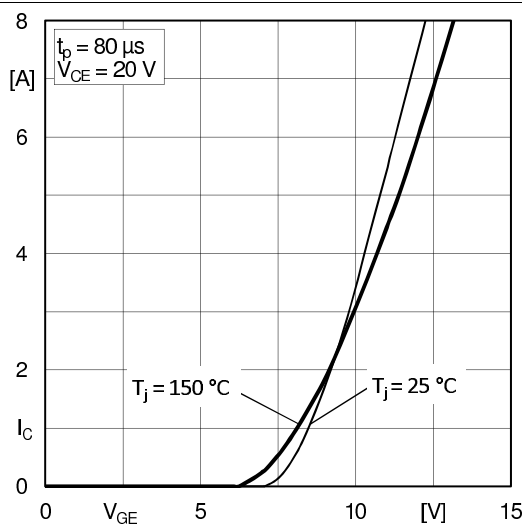
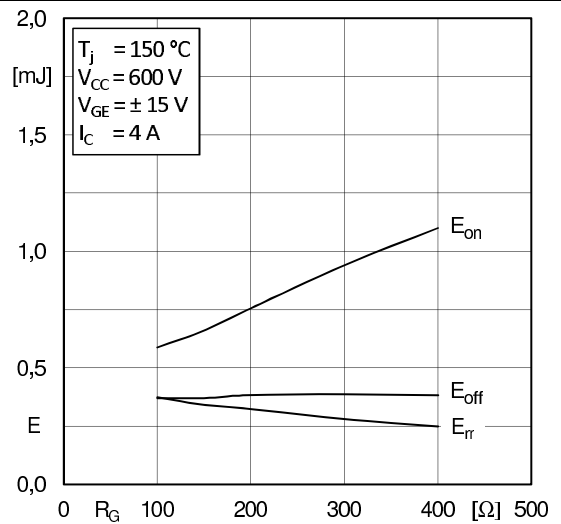
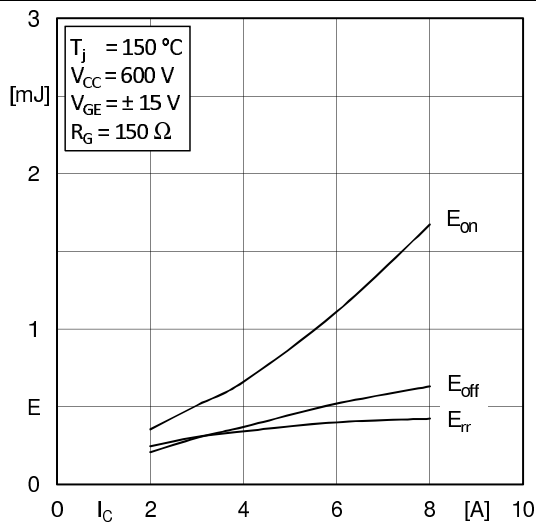
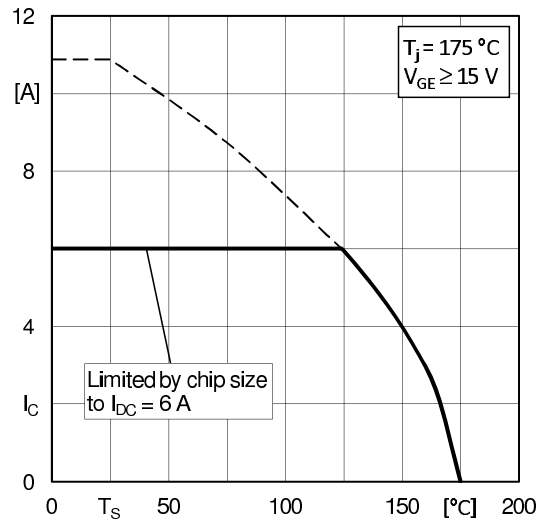
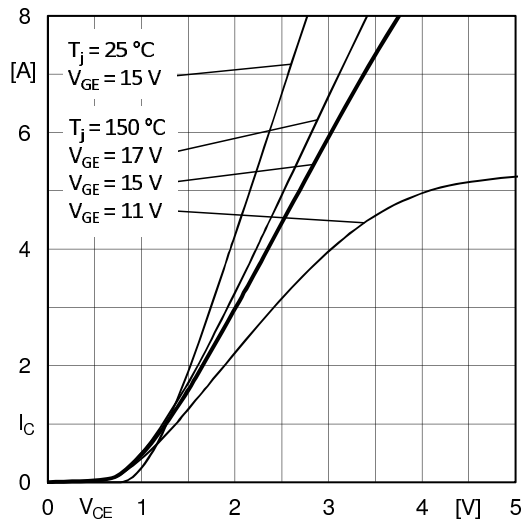
Remarks

- V_{CEsat} , V_F = chip level value
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- product rel. results valid for $T_j \leq 150$ (recomm. Top = $-40 \dots +150^\circ\text{C}$)



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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
Chopper - IGBT					
$t_{d(on)}$	$V_{CC} = 600\text{ V}$ $I_C = 4\text{ A}$		65		ns
t_r	$T_j = 150^\circ\text{C}$		45		ns
E_{on}	$R_{G\ on} = 150\ \Omega$ $R_{G\ off} = 150\ \Omega$		0.66		mJ
$t_{d(off)}$	$T_j = 150^\circ\text{C}$		300		ns
t_f	$T_j = 150^\circ\text{C}$		110		ns
E_{off}	$V_{GE} = +15/-15\text{ V}$ $T_j = 150^\circ\text{C}$		0.37		mJ
$R_{th(j-s)}$	per IGBT		2.49		K/W
Inverse - Diode					
$V_F = V_{EC}$	$I_F = 4\text{ A}$ $V_{GE} = 0\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.8	2.1	V
		$T_j = 150^\circ\text{C}$	1.6	1.9	V
V_{F0}		$T_j = 25^\circ\text{C}$	1.3	1.5	V
		$T_j = 150^\circ\text{C}$	0.9	1.1	V
r_F		$T_j = 25^\circ\text{C}$	129	144	m Ω
		$T_j = 150^\circ\text{C}$	181	198	m Ω
I_{RRM}	$I_F = 4\text{ A}$	$T_j = 150^\circ\text{C}$	3.4		A
Q_{rr}	$di/dt_{off} = 110\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$	0.95		μC
E_{rr}	$V_{CC} = 600\text{ V}$ $T_j = 150^\circ\text{C}$		0.34		mJ
$R_{th(j-s)}$	per Diode		2.53		K/W
Freewheeling - Diode					
$V_F = V_{EC}$	$I_F = 4\text{ A}$ $V_{GE} = 0\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1.8	2.1	V
		$T_j = 150^\circ\text{C}$	1.6	1.9	V
V_{F0}		$T_j = 25^\circ\text{C}$	1.3	1.5	V
		$T_j = 150^\circ\text{C}$	0.9	1.1	V
r_F		$T_j = 25^\circ\text{C}$	129	144	m Ω
		$T_j = 150^\circ\text{C}$	181	198	m Ω
I_{RRM}	$I_F = 4\text{ A}$	$T_j = 150^\circ\text{C}$	3.4		A
Q_{rr}	$di/dt_{off} = 110\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$	0.95		μC
E_{rr}	$V_{CC} = 600\text{ V}$ $T_j = 150^\circ\text{C}$		0.34		mJ
$R_{th(j-s)}$	per Diode		2.53		K/W
Rectifier - Diode					
$V_F = V_{EC}$	$I_F = 8\text{ A}$ $V_{GE} = 0\text{ V}$ chiplevel	$T_j = 25^\circ\text{C}$	1	1.21	V
		$T_j = 125^\circ\text{C}$		1.1	V
V_{F0}		$T_j = 25^\circ\text{C}$		1.0	V
		$T_j = 125^\circ\text{C}$		0.8	V
r_F		$T_j = 25^\circ\text{C}$	15	29	m Ω
		$T_j = 125^\circ\text{C}$		34	m Ω
$R_{th(j-s)}$	per Diode		1.5		K/W
Module					
M_s	to heat sink	2		2.5	Nm
w			35		g
Temperatur Sensor					
R_{100}	$T_r = 100^\circ\text{C}$, tolerance = 3 %		1670 $\pm$ 3%		Ω
$R(T)$	$R(T) = 1000\ \Omega [1 + A(T - 25^\circ\text{C}) + B(T - 25^\circ\text{C})^2]$], $A = 7.635 \cdot 10^{-3} \text{ }^\circ\text{C}^{-1}$, $B = 1.731 \cdot 10^{-5} \text{ }^\circ\text{C}^{-2}$				



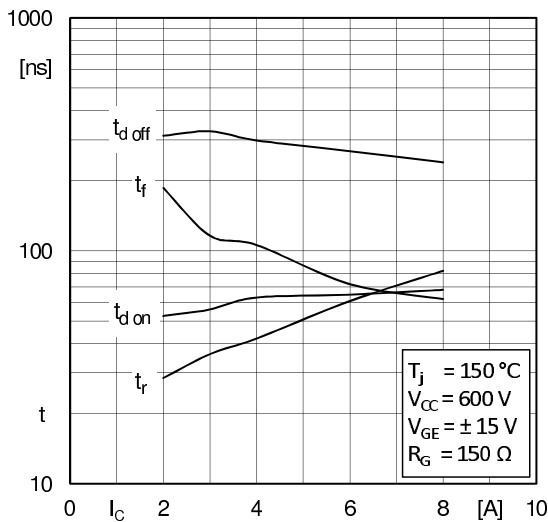


Fig. 7: Typ. switching times vs. I_C

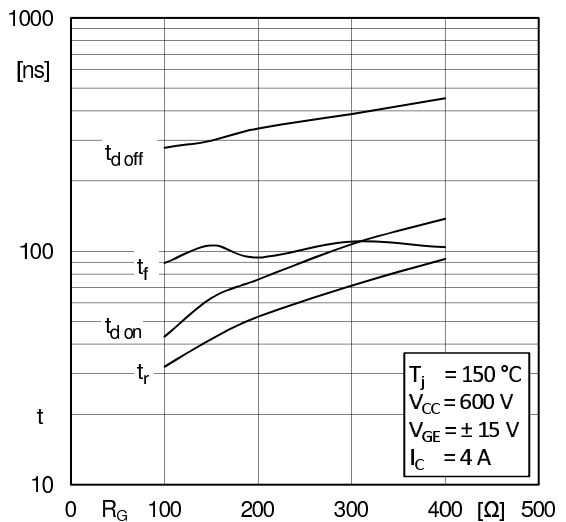


Fig. 8: Typ. switching times vs. gate resistor R_G

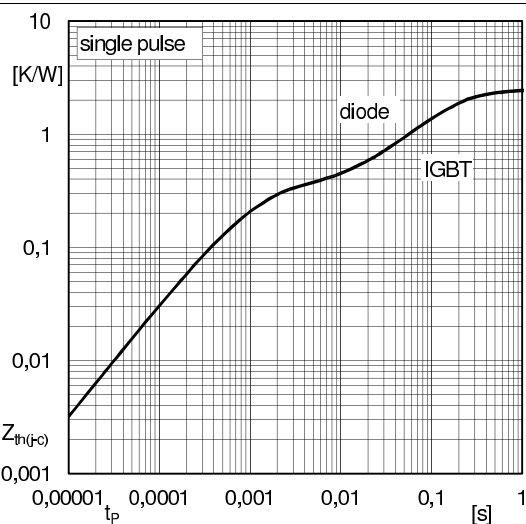


Fig. 9: Transient thermal impedance of IGBT and Diode

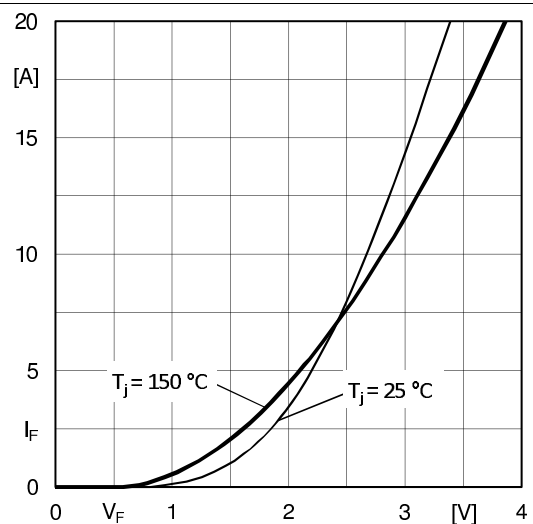


Fig. 10: CAL diode forward characteristic

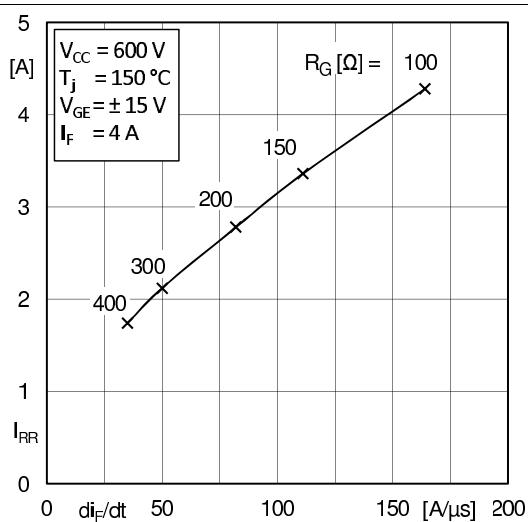


Fig. 11: Typ. CAL diode peak reverse recovery current

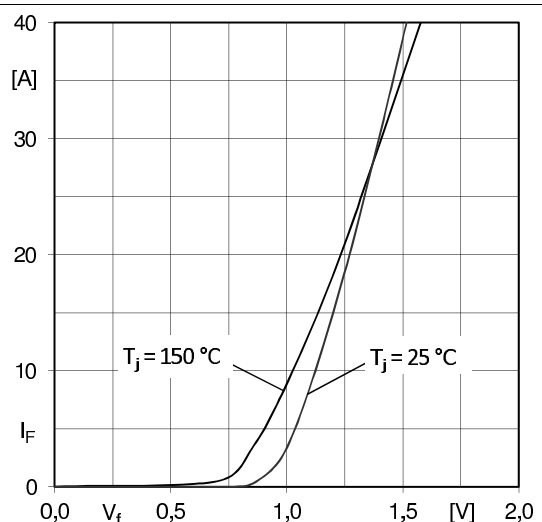


Fig. 12: Typ. input bridge forward characteristic

