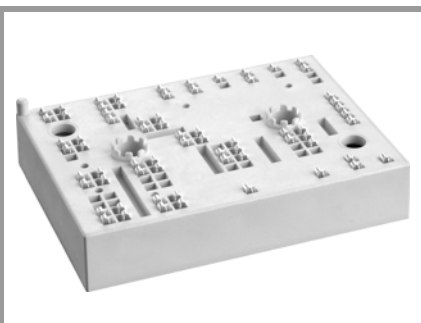


# SKiiP 39AC12T4V1



MiniSKiiP® 3

## SKiiP 39AC12T4V1

### Features

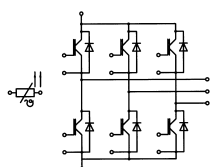
- Trench 4 IGBTs
- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532

### Typical Applications\*

- Inverter up to 50 kVA
- Typical motor power 30 kW

### Remarks

- Max. case temperature limited to  $T_C=125^\circ\text{C}$
- Product reliability results valid for  $T_j \leq 150^\circ\text{C}$  (recommended  $T_{j,op} = -40 \dots +150^\circ\text{C}$ )
- For short circuit: Soft  $R_{Goff}$  recommended
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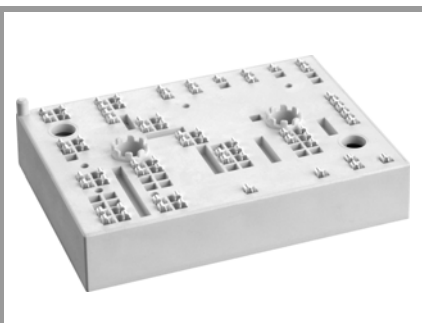


AC

Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
<b>Inverter - IGBT</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$		1200	V
$I_C$	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	167	A
		$T_j = 175^\circ\text{C}$	135	A
$I_C$	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	217	A
		$T_j = 175^\circ\text{C}$	177	A
$I_{Cnom}$			150	A
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$		450	A
$V_{GES}$			-20 ... 20	V
$t_{psc}$	$V_{CC} = 800 \text{ V}$	$T_j = 150^\circ\text{C}$	10	$\mu\text{s}$
	$V_{GE} \leq 15 \text{ V}$			
	$V_{CES} \leq 1200 \text{ V}$			
$T_j$			-40 ... 175	$^\circ\text{C}$
<b>Inverse - Diode</b>				
$I_F$	$\lambda_{paste}=0.8 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	136	A
		$T_j = 175^\circ\text{C}$	107	A
$I_F$	$\lambda_{paste}=2.5 \text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	163	A
		$T_j = 175^\circ\text{C}$	130	A
$I_{Fnom}$			150	A
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$		450	A
$I_{FSM}$	10 ms, sin 180°, $T_j = 150^\circ\text{C}$		900	A
$T_j$			-40 ... 175	$^\circ\text{C}$
<b>Module</b>				
$I_t(\text{RMS})$	$T_{terminal} = 80^\circ\text{C}$ , 20 A per spring		160	A
$T_{stg}$			-40 ... 125	$^\circ\text{C}$
$V_{isol}$	AC sinus 50 Hz, $t = 1 \text{ min}$		2500	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverter - IGBT</b>						
$V_{CE(sat)}$	$I_C = 150 \text{ A}$ $V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.85	2.10		V
		$T_j = 150^\circ\text{C}$	2.25	2.45		V
$V_{CE0}$	chipelevel	$T_j = 25^\circ\text{C}$	0.80	0.90		V
		$T_j = 150^\circ\text{C}$	0.70	0.80		V
$r_{CE}$	$V_{GE} = 15 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	7.0	8.0		m $\Omega$
		$T_j = 150^\circ\text{C}$	10	11		m $\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}$ , $I_C = 6 \text{ mA}$		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
$C_{ies}$	$V_{CE} = 25 \text{ V}$ $V_{GE} = 0 \text{ V}$	$f = 1 \text{ MHz}$	8.80			nF
$C_{oes}$		$f = 1 \text{ MHz}$	0.58			nF
$C_{res}$		$f = 1 \text{ MHz}$	0.47			nF
$Q_G$	- 8 V...+ 15 V			850		nC
$R_{Gint}$	$T_j = 25^\circ\text{C}$			5.0		$\Omega$
$t_{d(on)}$	$V_{CC} = 600 \text{ V}$	$T_j = 150^\circ\text{C}$		165		ns
$t_r$	$I_C = 150 \text{ A}$ $R_{Gon} = 1 \Omega$	$T_j = 150^\circ\text{C}$		50		ns
		$T_j = 150^\circ\text{C}$		22.5		mJ
$E_{on}$	$R_{Goff} = 1 \Omega$	$T_j = 150^\circ\text{C}$		22.5		mJ
$t_{d(off)}$	$di/dt_{on} = 2840 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		390		ns
$t_f$	$di/dt_{off} = 1880 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		80		ns
$E_{off}$	$V_{GE} = +15/-15 \text{ V}$	$T_j = 150^\circ\text{C}$		14		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 \text{ W/(mK)}$			0.33		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 \text{ W/(mK)}$			0.21		K/W

# SKiiP 39AC12T4V1



MiniSKiiP® 3

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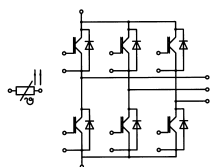
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### Remarks

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Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Inverse - Diode</b>						
$V_F = V_{EC}$	$I_F = 150\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.14	2.46	V
		$T_j = 150^\circ\text{C}$		2.07	2.38	V
$V_{F0}$	chipelevel	$T_j = 25^\circ\text{C}$		1.30	1.50	V
		$T_j = 150^\circ\text{C}$		0.90	1.10	V
$r_F$	chipelevel	$T_j = 25^\circ\text{C}$		5.6	6.4	m $\Omega$
		$T_j = 150^\circ\text{C}$		7.8	8.5	m $\Omega$
$I_{RRM}$	$I_F = 150\text{ A}$	$T_j = 150^\circ\text{C}$		188		A
$Q_{rr}$	$di/dt_{off} = 4020\text{ A}/\mu\text{s}$ +15/-15	$T_j = 150^\circ\text{C}$		27		$\mu\text{C}$
$E_{rr}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		11.4		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			0.52		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			0.39		K/W
<b>Module</b>						
$L_{CE}$						nH
$M_s$	to heat sink		2		2.5	Nm
$w$				82		g
<b>Temperature Sensor</b>						
$R_{100}$	$T_r=100^\circ\text{C}$ ( $R_{25}=1000\Omega$ )			1670 $\pm$ 3%		$\Omega$
$R(T)$	$R(T)=1000\Omega[1+A(T-25^\circ\text{C})+B(T-25^\circ\text{C})^2]$ ], $A = 7.635 \cdot 10^{-3} \text{ }^\circ\text{C}^{-1}$ , $B = 1.731 \cdot 10^{-5} \text{ }^\circ\text{C}^{-2}$					



AC

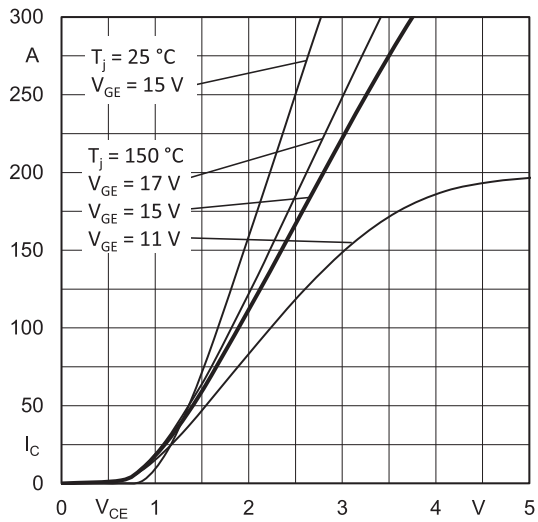


Fig. 1: Typ. output characteristic, inclusive  $R_{CC+EE}$

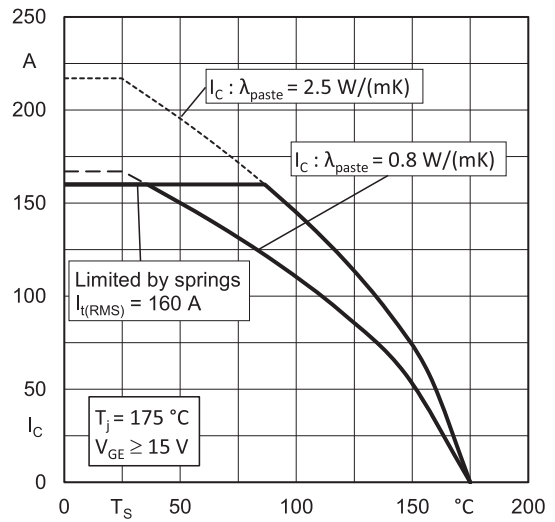


Fig. 2: Rated current vs. temperature  $I_C = f(T_S)$

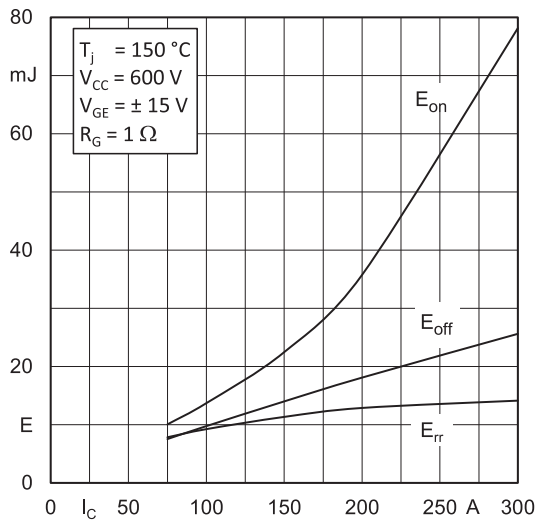


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

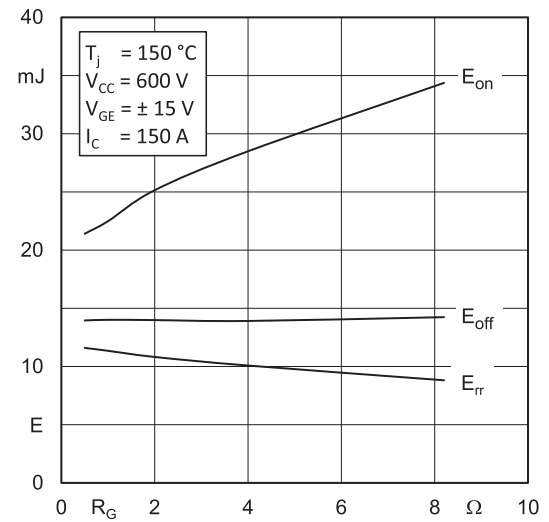


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

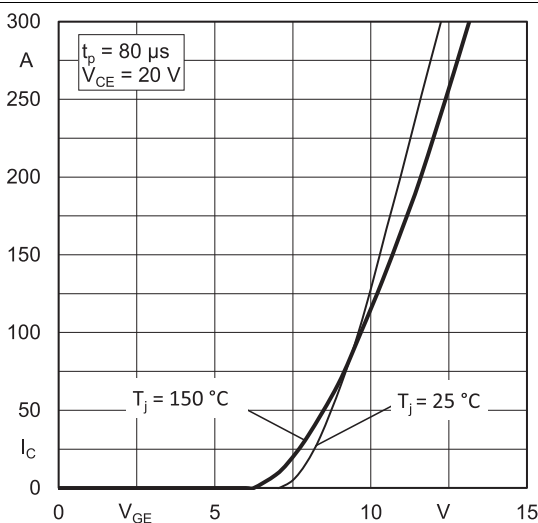


Fig. 5: Typ. transfer characteristic

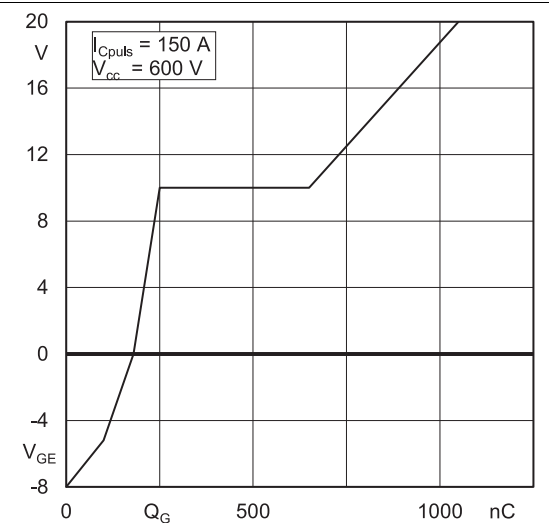


Fig. 6: Typ. gate charge characteristic

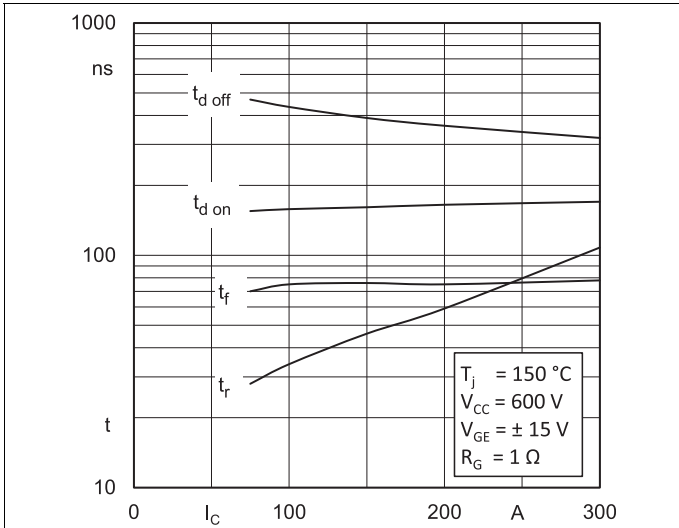


Fig. 7: Typ. switching times vs.  $I_C$

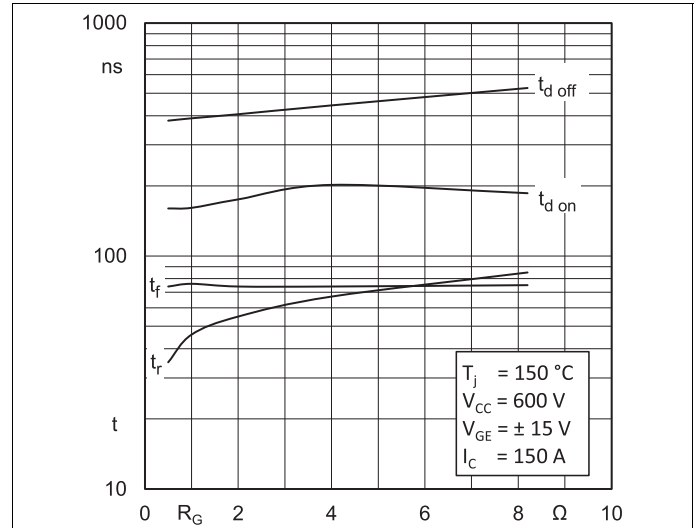


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

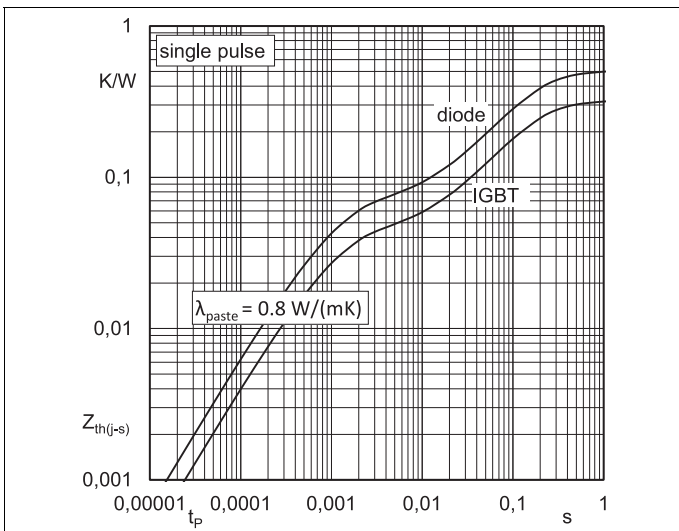


Fig. 9: Transient thermal impedance of IGBT and Diode

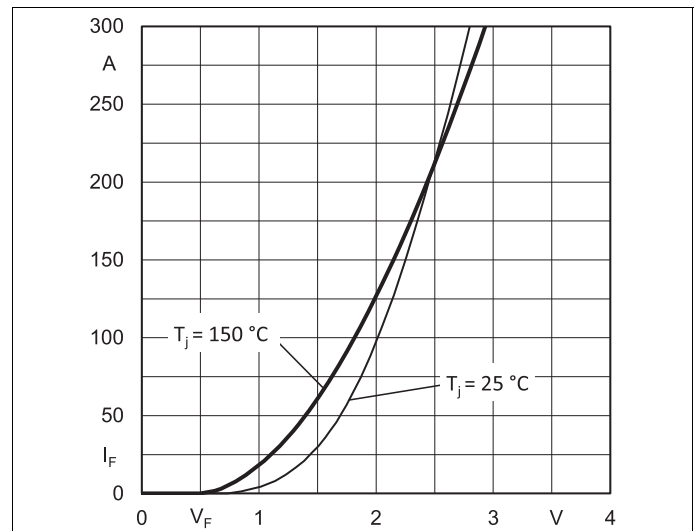


Fig. 10: CAL diode forward characteristic

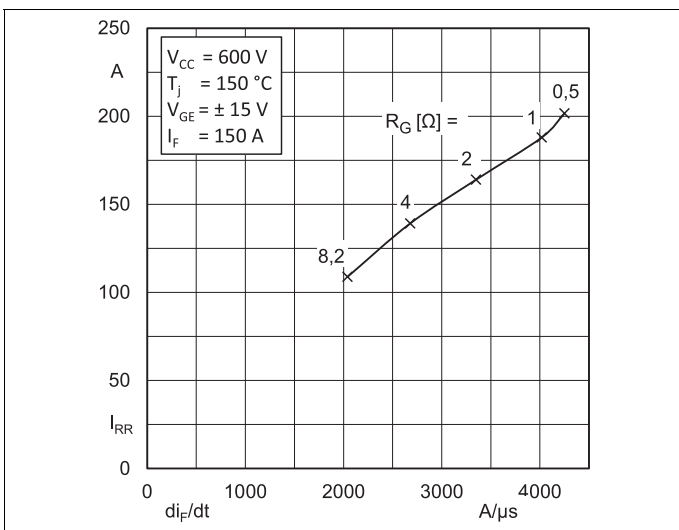


Fig. 11: Typ. CAL diode peak reverse recovery current

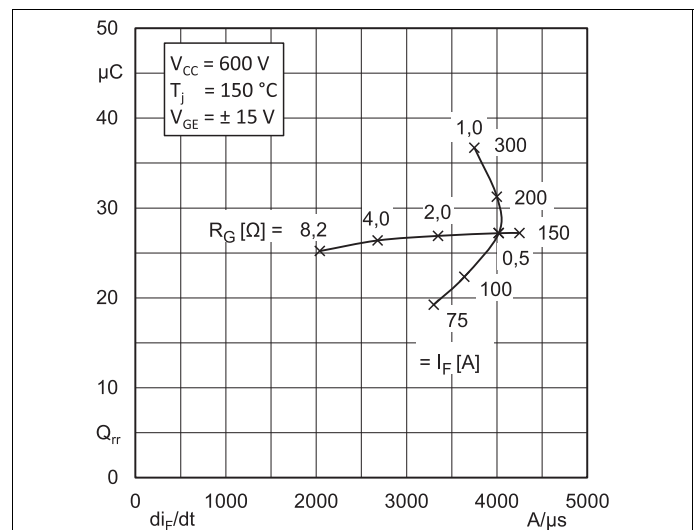


Fig. 12: Typ. CAL diode recovery charge



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