

# SKiiP 24ACC12T4V10



MiniSKiiP® 2

## Twin 6-pack

### SKiiP 24ACC12T4V10

#### Features

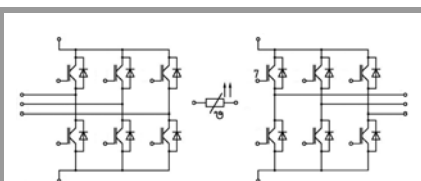
- Trench 4 IGBTs
- Robust and soft freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532

#### Typical Applications\*

- 4Q inverters

#### 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  $T_{j,op} = -40 \dots +150^\circ\text{C}$ )
- Terminal distances sufficient for basic insulation in 3-phase 480VAC TN systems
- DC-link voltage  $V_{DC} \leq 800\text{V}$
- Temperature sensor: no basic insulation to main circuit, signal processing with reference to -DC potential
- Please refer to MiniSKiiP "Technical Explanations" and "Mounting Instructions" for further information



ACC

Absolute Maximum Ratings				
Symbol	Conditions	Values	Unit	
<b>IGBT 1 - 6</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$	1200	V	
$I_C$	$\lambda_{paste}=0.8\text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	41	A
	$T_j = 175^\circ\text{C}$	$T_s = 70^\circ\text{C}$	34	A
$I_C$	$\lambda_{paste}=2.5\text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	45	A
	$T_j = 175^\circ\text{C}$	$T_s = 70^\circ\text{C}$	37	A
$I_{Cnom}$		25	A	
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$	75	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>IGBT 7 - 12</b>				
$V_{CES}$	$T_j = 25^\circ\text{C}$	1200	V	
$I_C$	$\lambda_{paste}=0.8\text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	52	A
	$T_j = 175^\circ\text{C}$	$T_s = 70^\circ\text{C}$	43	A
$I_C$	$\lambda_{paste}=2.5\text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	58	A
	$T_j = 175^\circ\text{C}$	$T_s = 70^\circ\text{C}$	48	A
$I_{Cnom}$		35	A	
$I_{CRM}$	$I_{CRM} = 3 \times I_{Cnom}$	105	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>Diode 1 - 6</b>				
$V_{RRM}$	$T_j = 25^\circ\text{C}$	1200	V	
$I_F$	$\lambda_{paste}=0.8\text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	32	A
	$T_j = 175^\circ\text{C}$	$T_s = 70^\circ\text{C}$	26	A
$I_F$	$\lambda_{paste}=2.5\text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	35	A
	$T_j = 175^\circ\text{C}$	$T_s = 70^\circ\text{C}$	28	A
$I_{Fnom}$		25	A	
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$	75	A	
$I_{FSM}$	10 ms, sin 180°, $T_j = 150^\circ\text{C}$	100	A	
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Diode 7 - 12</b>				
$V_{RRM}$	$T_j = 25^\circ\text{C}$	1200	V	
$I_F$	$\lambda_{paste}=0.8\text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	44	A
	$T_j = 175^\circ\text{C}$	$T_s = 70^\circ\text{C}$	35	A
$I_F$	$\lambda_{paste}=2.5\text{ W/(mK)}$	$T_s = 25^\circ\text{C}$	49	A
	$T_j = 175^\circ\text{C}$	$T_s = 70^\circ\text{C}$	40	A
$I_{Fnom}$		35	A	
$I_{FRM}$	$I_{FRM} = 3 \times I_{Fnom}$	105	A	
$I_{FSM}$	10 ms, sin 180°, $T_j = 150^\circ\text{C}$	170	A	
$T_j$		-40 ... 175	$^\circ\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$	20 A per spring	40	A	
$T_{stg}$		-40 ... 125	$^\circ\text{C}$	
$V_{isol}$	AC sinus 50 Hz, 1 min	2500	V	

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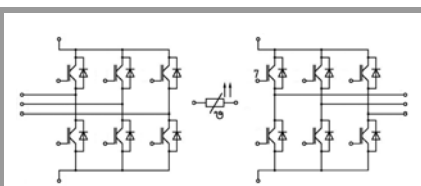
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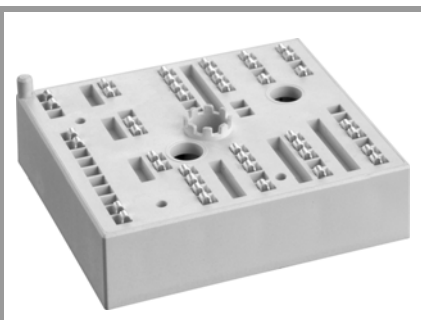
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- Product reliability results valid for  $T_j \leq 150^\circ\text{C}$  (recommended  $T_{j,op} = -40 \dots +150^\circ\text{C}$ )
- Terminal distances sufficient for basic insulation in 3-phase 480VAC TN systems
- DC-link voltage  $V_{DC} \leq 800\text{V}$
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ACC

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>IGBT 1 - 6</b>						
$V_{CE(sat)}$	$I_C = 25\text{ A}$ $V_{GE} = 15\text{ V}$ 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	$T_j = 25^\circ\text{C}$	42	48		m $\Omega$
		$T_j = 150^\circ\text{C}$	62	66		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
						mA
$C_{ies}$	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	1.43			nF
$C_{oes}$		$f = 1\text{ MHz}$	0.12			nF
$C_{res}$		$f = 1\text{ MHz}$	0.09			nF
$Q_G$	$V_{GE} = -8\text{ V} \dots +15\text{ V}$			142		nC
$R_{Gint}$	$T_j = 25^\circ\text{C}$			0.0		$\Omega$
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		96		ns
$t_r$	$I_C = 25\text{ A}$	$T_j = 150^\circ\text{C}$		80		ns
$E_{on}$	$R_{G\ on} = 39\ \Omega$ $R_{G\ off} = 39\ \Omega$	$T_j = 150^\circ\text{C}$		4.2		mJ
$t_{d(off)}$	$di/dt_{on} = 250\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		400		ns
$t_f$	$di/dt_{off} = 400\text{ A}/\mu\text{s}$ $du/dt = 3600\text{ V}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		51		ns
$E_{off}$	$V_{GE} = +15/-15\text{ V}$ $L_s = 22\text{ nH}$	$T_j = 150^\circ\text{C}$		2.6		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			1		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			0.84		K/W
<b>IGBT 7 - 12</b>						
$V_{CE(sat)}$	$I_C = 35\text{ A}$ $V_{GE} = 15\text{ V}$ 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	$T_j = 25^\circ\text{C}$	30	34		m $\Omega$
		$T_j = 150^\circ\text{C}$	44	47		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
			-			mA
$C_{ies}$	$V_{CE} = 25\text{ V}$ $V_{GE} = 0\text{ V}$	$f = 1\text{ MHz}$	1.95			nF
$C_{oes}$		$f = 1\text{ MHz}$	0.16			nF
$C_{res}$		$f = 1\text{ MHz}$	0.12			nF
$Q_G$	$V_{GE} = -8\text{ V} \dots +15\text{ V}$			200		nC
$R_{Gint}$	$T_j = 25^\circ\text{C}$			0		$\Omega$
$t_{d(on)}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		52		ns
$t_r$	$I_C = 35\text{ A}$	$T_j = 150^\circ\text{C}$		34		ns
$E_{on}$	$R_{G\ on} = 16\ \Omega$ $R_{G\ off} = 16\ \Omega$	$T_j = 150^\circ\text{C}$		3.9		mJ
$t_{d(off)}$	$di/dt_{on} = 680\text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		337		ns
$t_f$	$di/dt_{off} = 560\text{ A}/\mu\text{s}$ $du/dt = 4000\text{ V}/\mu\text{s}$	$T_j = 150^\circ\text{C}$		53		ns
$E_{off}$	$V_{GE} = +15/-15\text{ V}$ $L_s = 22\text{ nH}$	$T_j = 150^\circ\text{C}$		3.5		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			0.85		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			0.7		K/W

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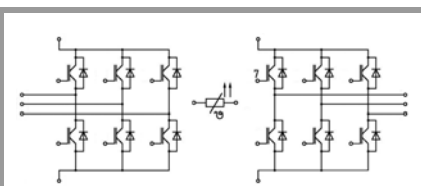
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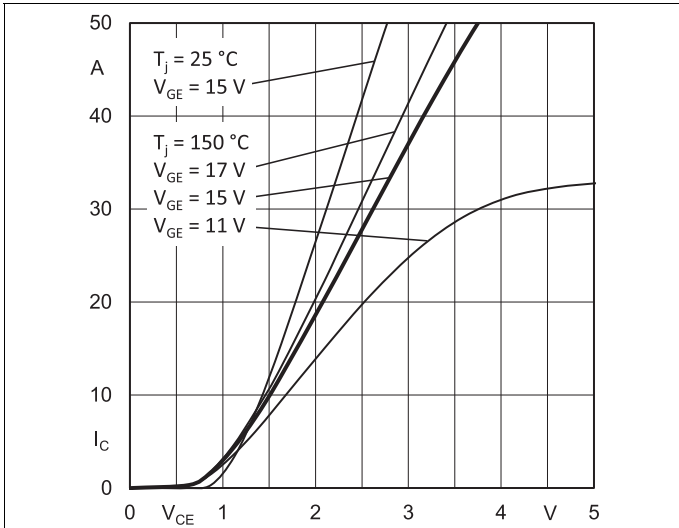
#### Remarks

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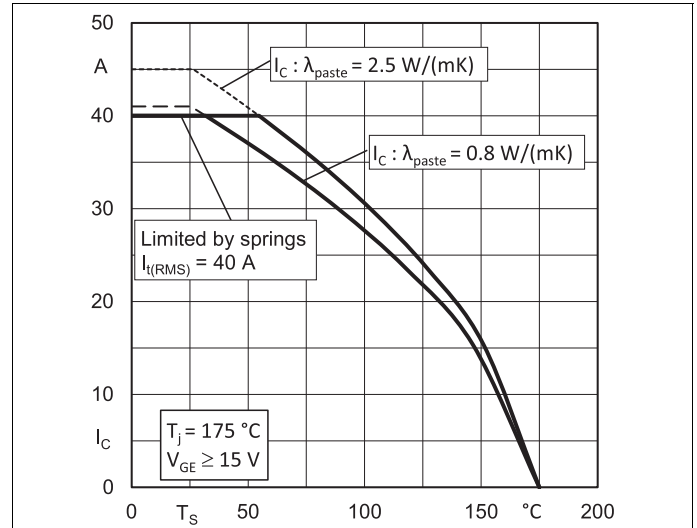
Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
<b>Diode 1 - 6</b>						
$V_F = V_{EC}$	$I_F = 25\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.41	2.74	V
		$T_j = 150^\circ\text{C}$		2.45	2.79	V
$V_{F0}$	chipelevel	$T_j = 25^\circ\text{C}$		1.30	1.50	V
		$T_j = 150^\circ\text{C}$		0.90	1.10	V
$r_F$	chipelevel	$T_j = 25^\circ\text{C}$		44	50	m $\Omega$
		$T_j = 150^\circ\text{C}$		62	68	m $\Omega$
$I_{RRM}$	$I_F = 25\text{ A}$	$T_j = 150^\circ\text{C}$		17		A
$Q_{rr}$	$di/dt_{off} = 380\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$		4		$\mu\text{C}$
$E_{rr}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		1.4		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			1.52		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			1.31		K/W
<b>Diode 7 - 12</b>						
$V_F = V_{EC}$	$I_F = 35\text{ A}$ $V_{GE} = 0\text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$		2.30	2.62	V
		$T_j = 150^\circ\text{C}$		2.29	2.62	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	$T_j = 25^\circ\text{C}$		29	32	m $\Omega$
		$T_j = 150^\circ\text{C}$		40	43	m $\Omega$
$I_{RRM}$	$I_F = 35\text{ A}$	$T_j = 150^\circ\text{C}$		28		A
$Q_{rr}$	$di/dt_{off} = 720\text{ A}/\mu\text{s}$ $V_{GE} = -15\text{ V}$	$T_j = 150^\circ\text{C}$		5.8		$\mu\text{C}$
$E_{rr}$	$V_{CC} = 600\text{ V}$	$T_j = 150^\circ\text{C}$		2.3		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8\text{ W}/(\text{mK})$			1.2		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5\text{ W}/(\text{mK})$			1		K/W
<b>Module</b>						
$L_{CE}$				30		nH
$M_s$	to heat sink		2		2.5	Nm
w				55		g
<b>Temperature Sensor</b>						
$R_{100}$	$T_r=100^\circ\text{C}$ ( $R_{25}=1000\Omega$ )			$1670 \pm 3\%$		$\Omega$
$R(T)$	$R(T)=1000\Omega[1+A(T-25^\circ\text{C})+B(T-25^\circ\text{C})^2]$ $A = 7.635 \cdot 10^{-3} \text{ }^\circ\text{C}^{-1}$ , $B = 1.731 \cdot 10^{-5} \text{ }^\circ\text{C}^{-2}$					



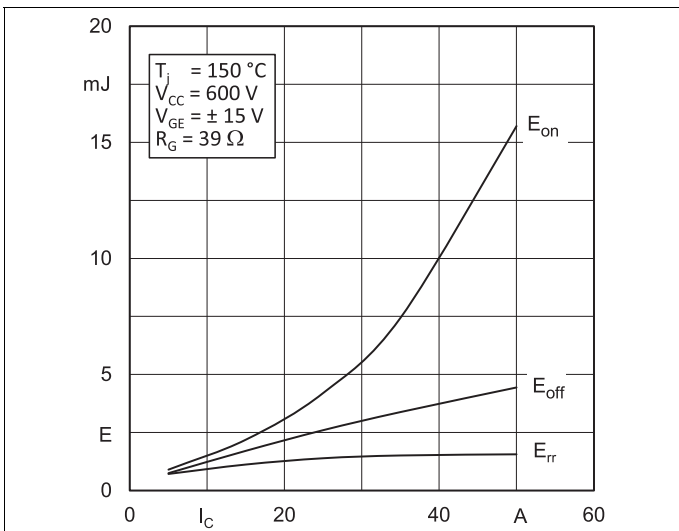
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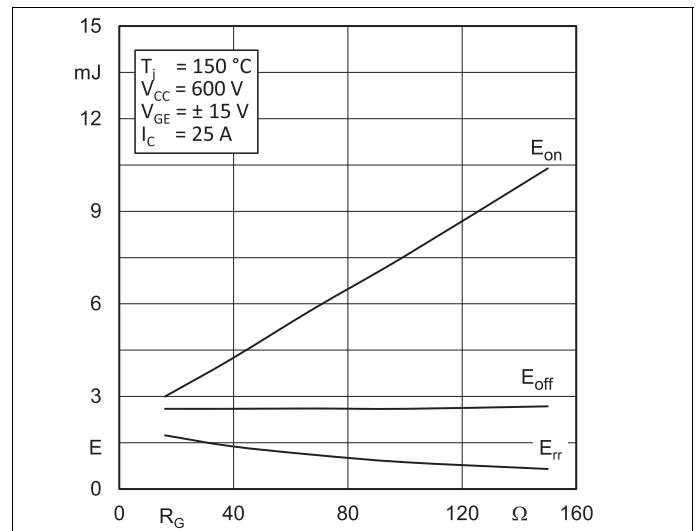
IGBT 1-6 - Fig. 1:  
Typ. output characteristic



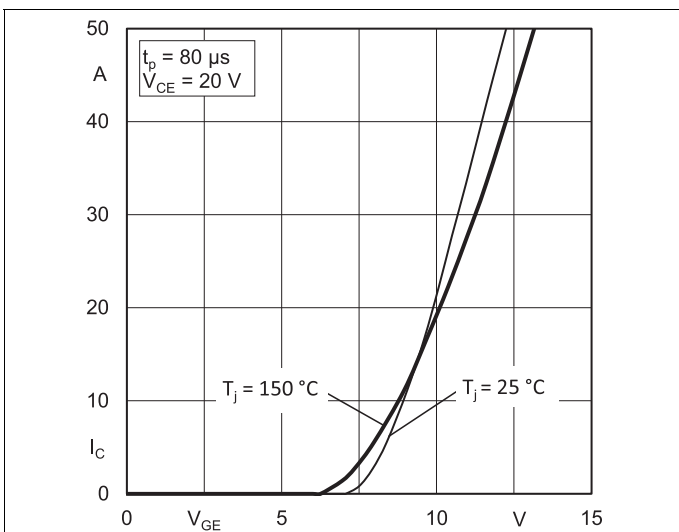
IGBT 1-6 - Fig. 2:  
Typ. rated current vs. temperature  $I_C = f(T_S)$



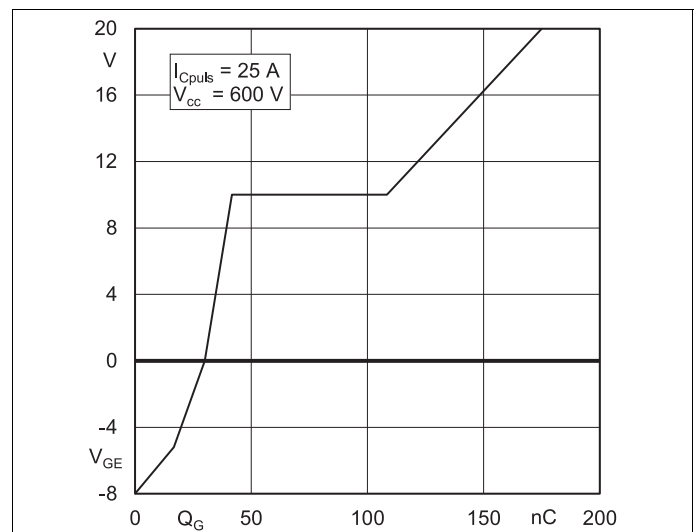
IGBT 1-6 - Fig. 3:  
Typ. turn-on /-off energy =  $f(I_C)$



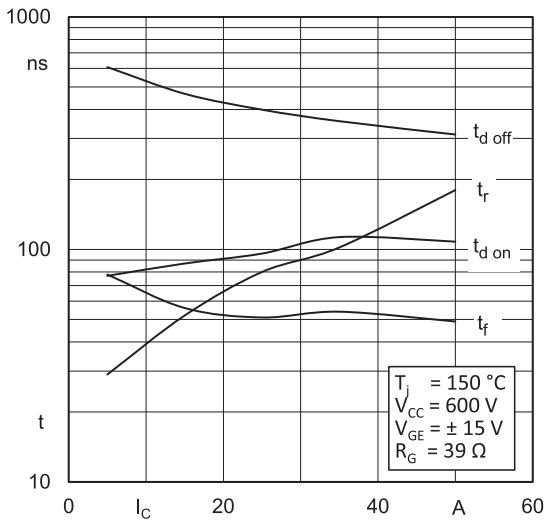
IGBT 1-6 - Fig. 4:  
Typ. turn-on /-off energy =  $f(R_G)$



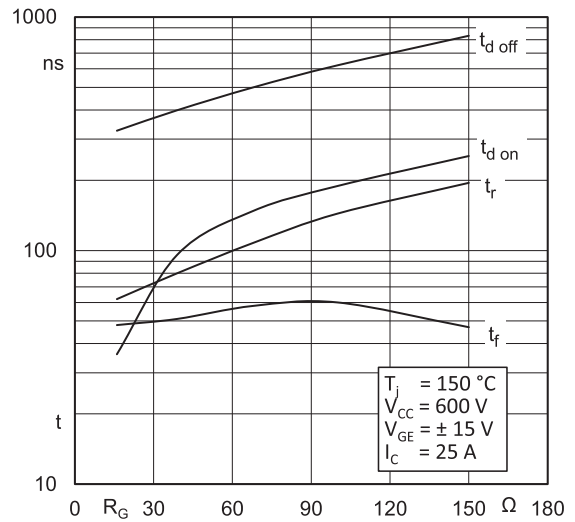
IGBT 1-6 - Fig. 5:  
Typ. transfer characteristic



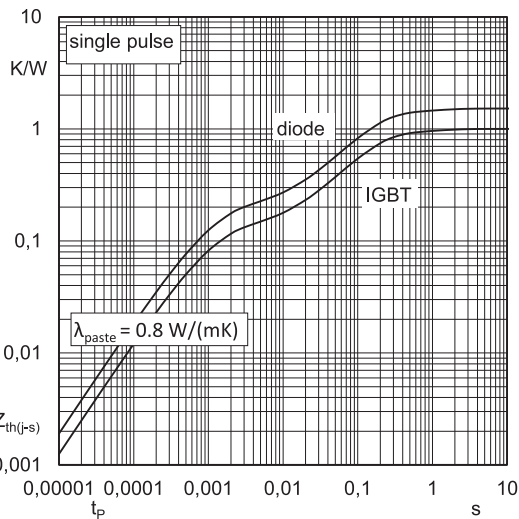
IGBT 1-6 - Fig. 6:  
Typ. gate charge characteristic



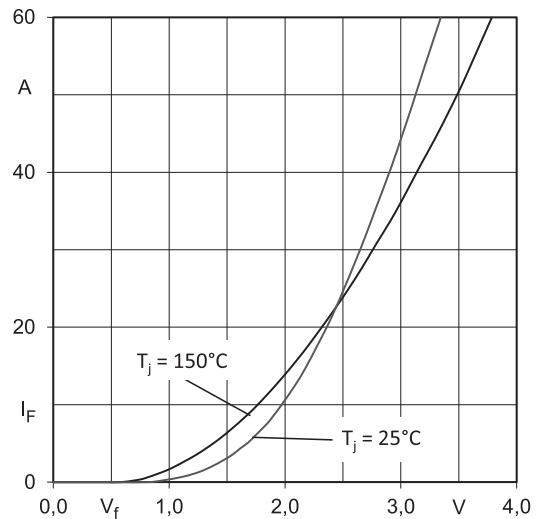
IGBT 1-6 - Fig. 7:  
Typ. switching times vs.  $I_C$



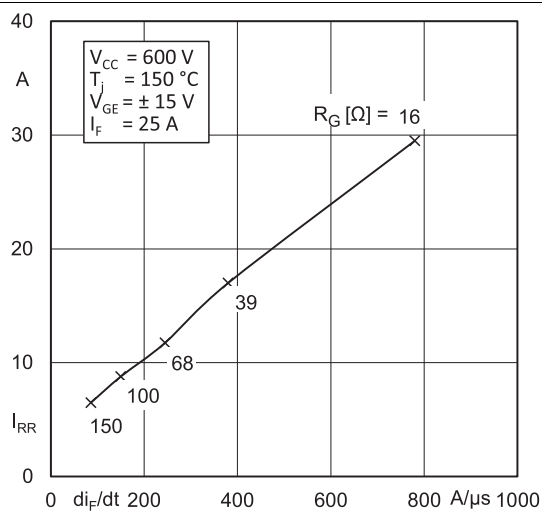
IGBT 1-6 - Fig. 8:  
Typ. switching times vs. gate resistor  $R_G$



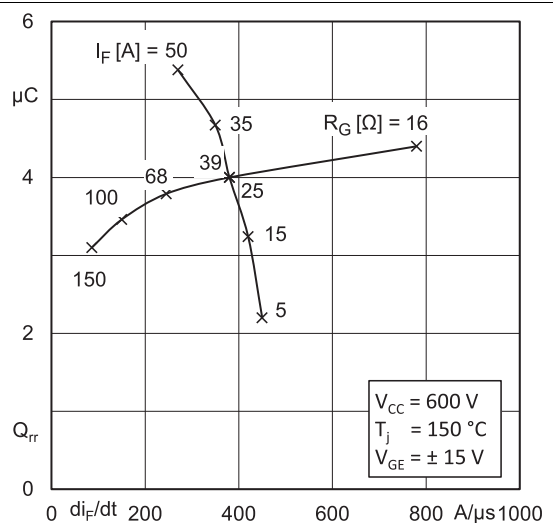
IGBT 1-6 - Fig. 9:  
Transient thermal impedance of IGBT and Diode



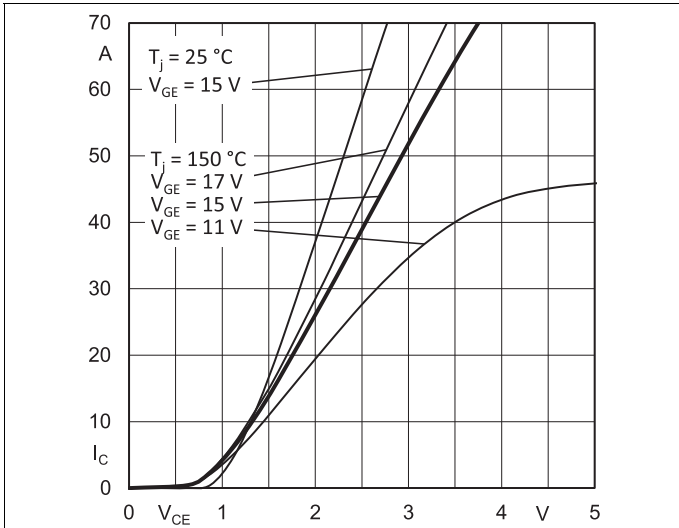
IGBT 1-6 - Fig. 10:  
CAL diode forward characteristic



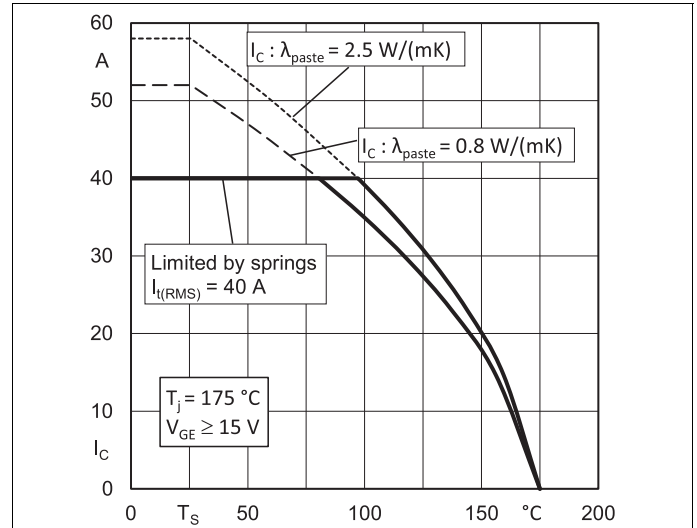
IGBT 1-6 - Fig. 11:  
Typ. CAL diode peak reverse recovery current



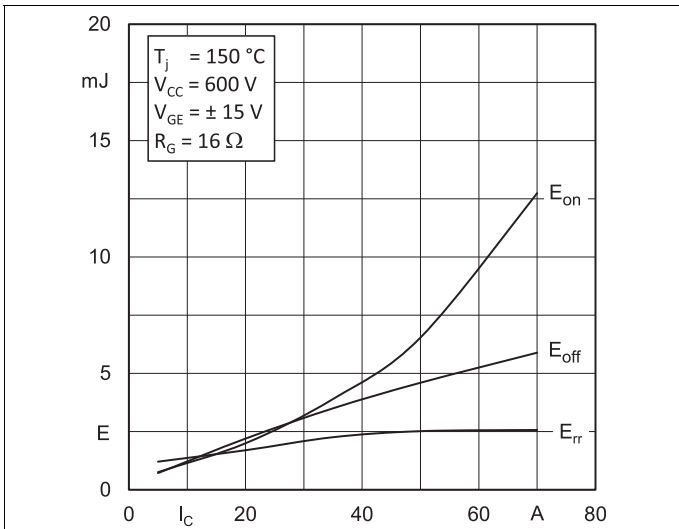
IGBT 1-6 - Fig. 12:  
Typ. CAL diode recovery charge



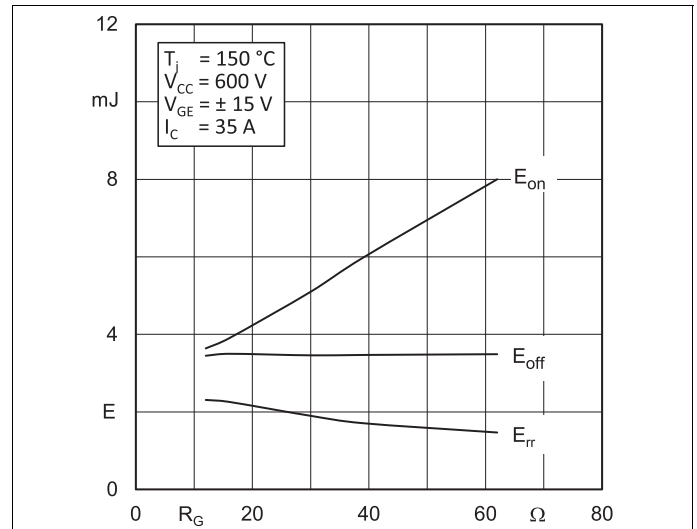
IGBT 7-12 - Fig. 1:  
Typ. output characteristic



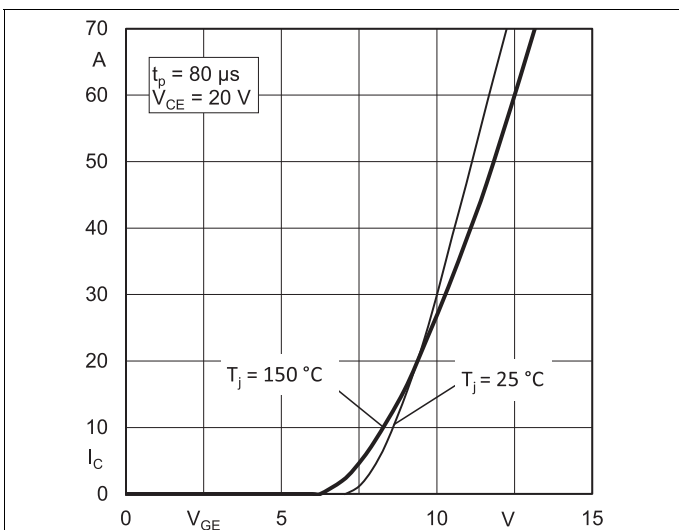
IGBT 7-12 - Fig. 2:  
Typ. rated current vs. temperature  $I_C = f(T_S)$



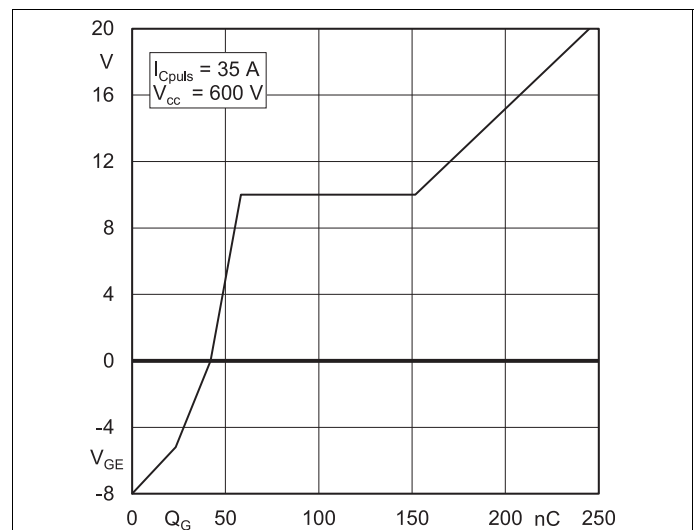
IGBT 7-12 - Fig. 3:  
Typ. turn-on /-off energy =  $f(I_C)$



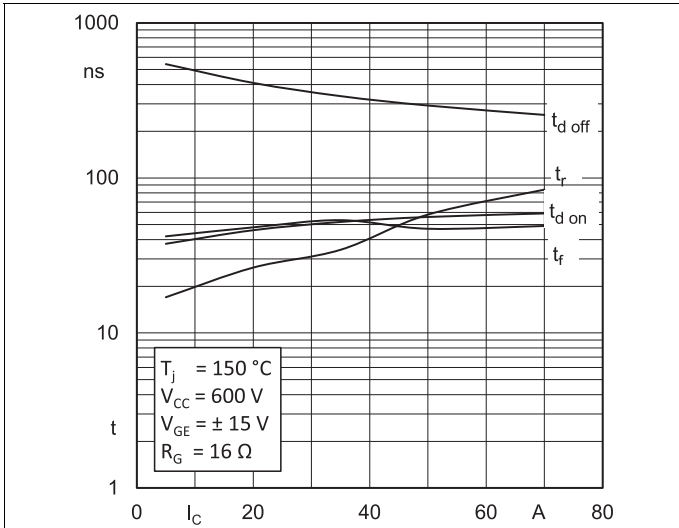
IGBT 7-12 - Fig. 4:  
Typ. turn-on /-off energy =  $f(R_G)$



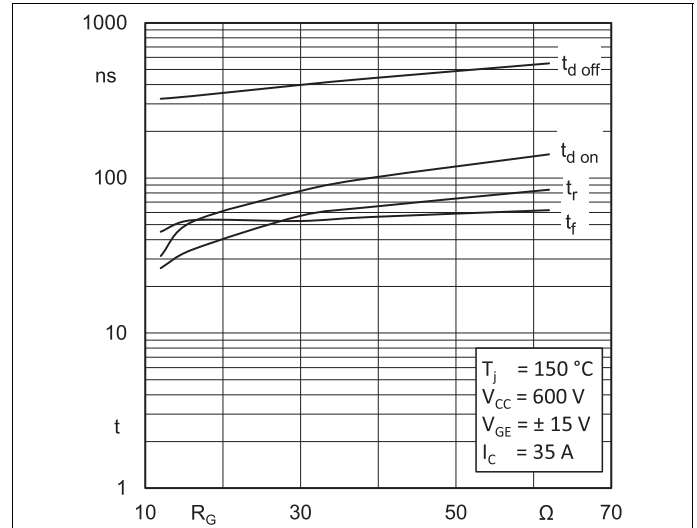
IGBT 7-12 - Fig. 5:  
Typ. transfer characteristic



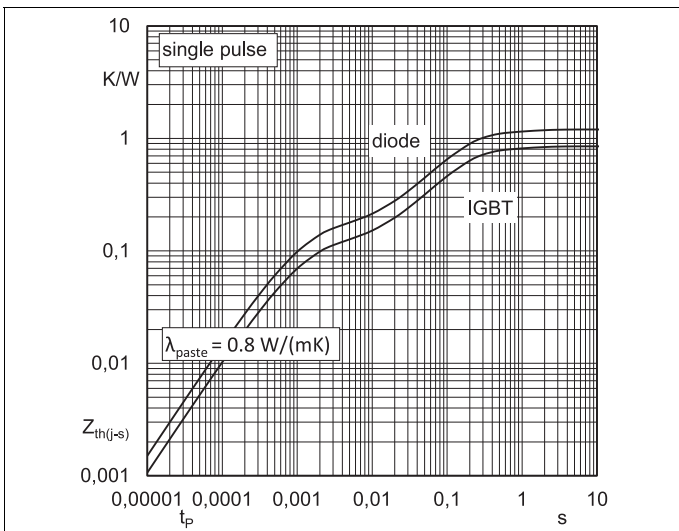
IGBT 7-12 - Fig. 6:  
Typ. gate charge characteristic



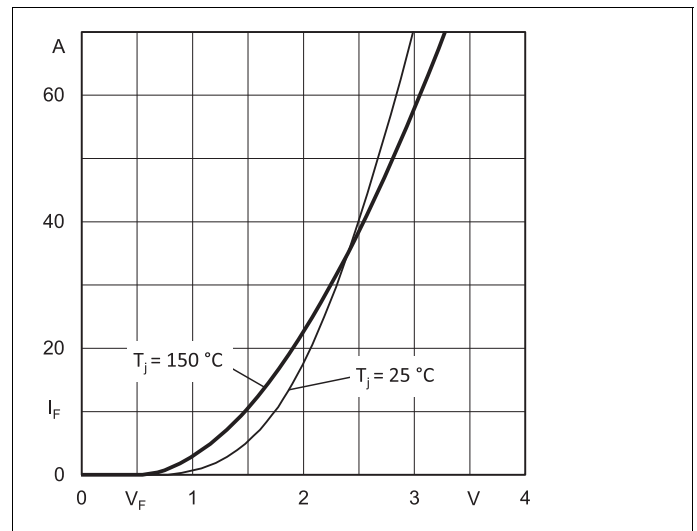
IGBT 7-12 - Fig. 7:  
Typ. switching times vs.  $I_C$



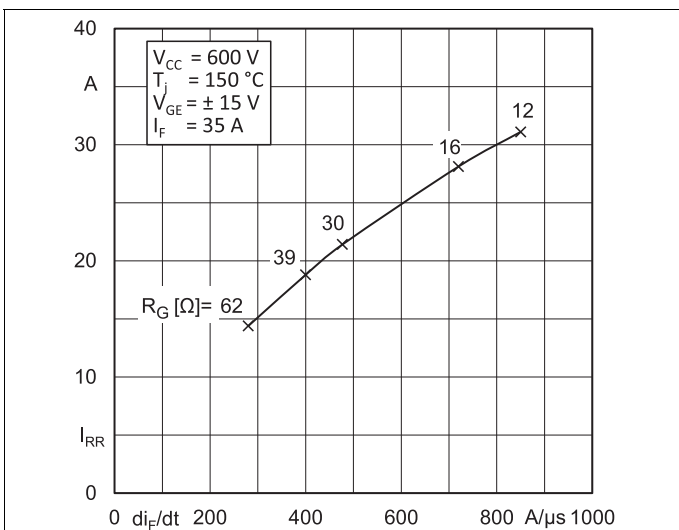
IGBT 7-12 - Fig. 8:  
Typ. switching times vs. gate resistor  $R_G$



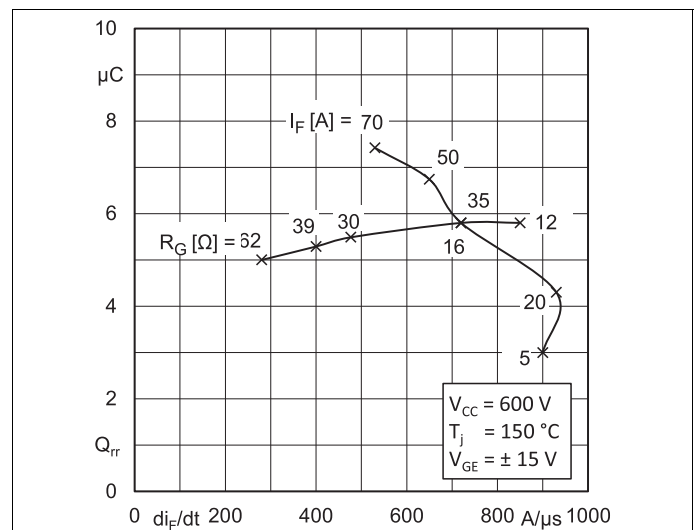
IGBT 7-12 - Fig. 9:  
Transient thermal impedance of IGBT and Diode



IGBT 7-12 - Fig. 10:  
CAL diode forward characteristic



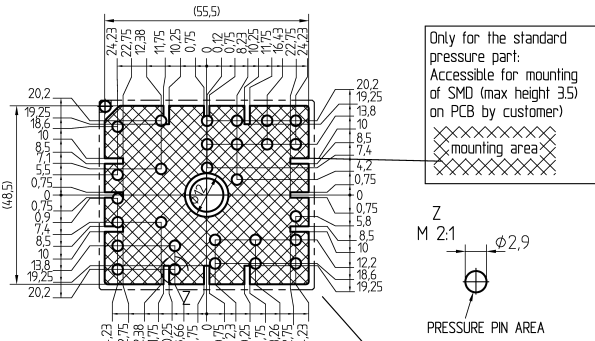
IGBT 7-12 - Fig. 11:  
Typ. CAL diode peak reverse recovery current



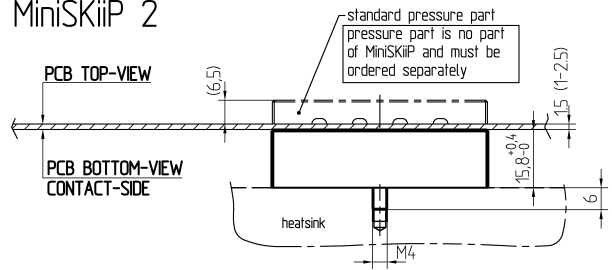
IGBT 7-12 - Fig. 12:  
Typ. CAL diode recovery charge

# SKiiP 24ACC12T4V10

## PCB PCB TOP-VIEW

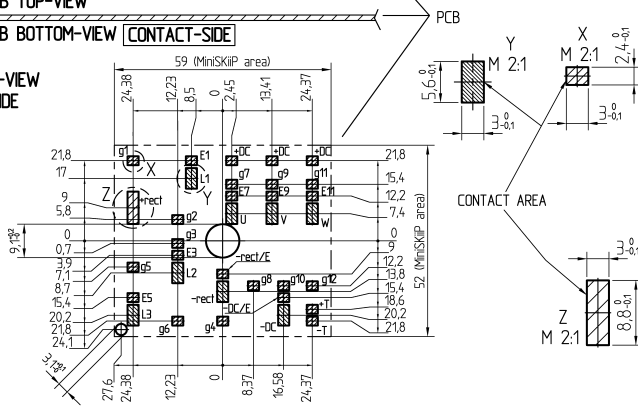


## MiniSKiiP 2

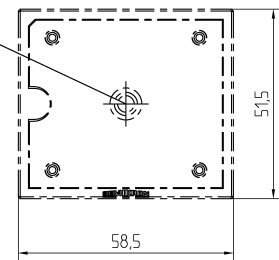


## PCB TOP-VIEW PCB BOTTOM-VIEW CONTACT-SIDE

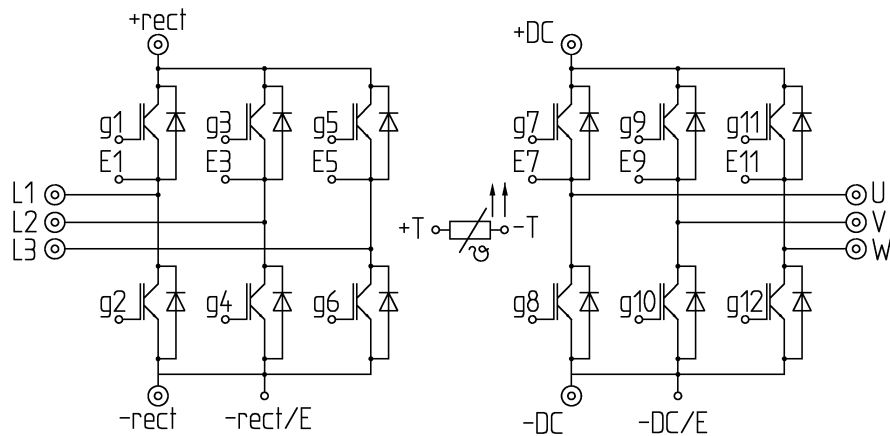
## PCB BOTTOM-VIEW CONTACT-SIDE



For mounting please follow the assembly instruction



## pinout, dimensions



- ⊙ power connector
- control connector

## pinout



This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

## **\*IMPORTANT INFORMATION AND WARNINGS**

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