

# SKiiP 11AC12T7V1



MiniSKiiP® 1

## Sixpack

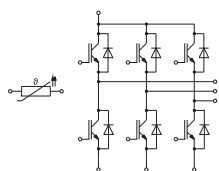
### SKiiP 11AC12T7V1

#### Features\*

- 1200V Generation 7 IGBTs (T7)
- Robust and soft switching freewheeling diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognized: File no. E63532

#### Remarks

- Max. case temperature limited to  $T_C = T_S = 125\text{ °C}$
- Product reliability results valid for  $T_j \leq 150\text{ °C}$ ;  $T_{j,op} > 150\text{ °C}$  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.
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#### Absolute Maximum Ratings

Symbol	Conditions	Values	Unit	
<b>Inverter - IGBT</b>				
$V_{CES}$	$T_j = 25\text{ °C}$	1200	V	
$I_C$	$\lambda_{paste}=0.8\text{ W/(mK)}$	$T_s = 70\text{ °C}$	20	A
	$T_j = 175\text{ °C}$	$T_s = 100\text{ °C}$	16	A
$I_C$	$\lambda_{paste}=2.5\text{ W/(mK)}$	$T_s = 70\text{ °C}$	22	A
	$T_j = 175\text{ °C}$	$T_s = 100\text{ °C}$	18	A
$I_{Chom}$		10	A	
$I_{CRM}$		20	A	
$V_{GES}$		-20 ... 20	V	
$t_{psc}$	$V_{CC} = 800\text{ V}$ $V_{GE} \leq 15\text{ V}$ $V_{CES} \leq 1200\text{ V}$	$T_j = 175\text{ °C}$	7	$\mu\text{s}$
$T_j$		-40 ... 175	$^{\circ}\text{C}$	
<b>Inverse - Diode</b>				
$V_{RRM}$	$T_j = 25\text{ °C}$	1200	V	
$I_F$	$\lambda_{paste}=0.8\text{ W/(mK)}$	$T_s = 70\text{ °C}$	13	A
	$T_j = 175\text{ °C}$	$T_s = 100\text{ °C}$	11	A
$I_F$	$\lambda_{paste}=2.5\text{ W/(mK)}$	$T_s = 70\text{ °C}$	14	A
	$T_j = 175\text{ °C}$	$T_s = 100\text{ °C}$	12	A
$I_{FRM}$		16	A	
$I_{FSM}$	$t_p = 10\text{ ms, sin } 180^{\circ}, T_j = 150\text{ °C}$	36	A	
$T_j$		-40 ... 175	$^{\circ}\text{C}$	
<b>Module</b>				
$I_{t(RMS)}$	$T_{terminal} = 80\text{ °C}, 20\text{ A per spring}$	40	A	
$T_{stg}$	module without TIM	-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>					
$V_{CE(sat)}$	$I_C = 10\text{ A}$ $V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25\text{ °C}$	1.60	1.75	V
		$T_j = 150\text{ °C}$	1.78	1.93	V
		$T_j = 175\text{ °C}$	1.82	1.97	V
$V_{CE0}$	chiplevel	$T_j = 25\text{ °C}$	1.00	1.05	V
		$T_j = 150\text{ °C}$	0.80	0.85	V
		$T_j = 175\text{ °C}$	0.75	0.80	V
$r_{CE}$	$V_{GE} = 15\text{ V}$ chiplevel	$T_j = 25\text{ °C}$	60	70	$\text{m}\Omega$
		$T_j = 150\text{ °C}$	98	108	$\text{m}\Omega$
		$T_j = 175\text{ °C}$	107	117	$\text{m}\Omega$
$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 0.22\text{ mA}$	5.15	5.8	6.45	V
$I_{CES}$	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}, T_j = 25\text{ °C}$			1	mA
$C_{ies}$	$V_{CE} = 25\text{ V}$		1.90		nF
$C_{oes}$	$V_{GE} = 0\text{ V}$		0.02		nF
$C_{res}$			0.01		nF
$Q_G$	$V_{GE} = -8\text{ V} \dots +15\text{ V}$		140		nC
$R_{Gint}$	$T_j = 25\text{ °C}$		0		$\Omega$

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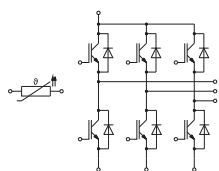
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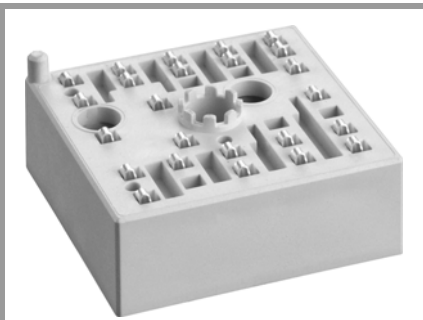


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Characteristics						
Symbol	Conditions	min.	typ.	max.	Unit	
<b>Inverter - IGBT</b>						
$t_{d(on)}$		$T_j = 25\text{ °C}$	44		ns	
		$T_j = 150\text{ °C}$	46		ns	
		$T_j = 175\text{ °C}$	47		ns	
$t_r$	$V_{CC} = 600\text{ V}$ $I_C = 10\text{ A}$	$T_j = 25\text{ °C}$	39		ns	
		$T_j = 150\text{ °C}$	44		ns	
		$T_j = 175\text{ °C}$	47		ns	
$E_{on}$	$R_{G, on} = 32\text{ }\Omega$ $R_{G, off} = 32\text{ }\Omega$ $V_{GE} = +15/-15\text{ V}$	$T_j = 25\text{ °C}$	0.88		mJ	
		$T_j = 150\text{ °C}$	1.2		mJ	
		$T_j = 175\text{ °C}$	1.3		mJ	
$t_{d(off)}$		$T_j = 25\text{ °C}$	198		ns	
		@ $T_j = 150\text{ °C}$ : $dI/dt_{on} = 190\text{ A}/\mu\text{s}$	$T_j = 150\text{ °C}$	288		ns
		$T_j = 175\text{ °C}$	313		ns	
$t_f$	$dI/dt_{off} = 130\text{ A}/\mu\text{s}$ $dV/dt = 3580\text{ V}/\mu\text{s}$	$T_j = 25\text{ °C}$	42		ns	
		$T_j = 150\text{ °C}$	63		ns	
		$T_j = 175\text{ °C}$	85		ns	
$E_{off}$		$T_j = 25\text{ °C}$	0.65		mJ	
		$T_j = 150\text{ °C}$	1.1		mJ	
		$T_j = 175\text{ °C}$	1.2		mJ	
$R_{th(j-s)}$	per IGBT, $\lambda_{paste} = 0.8\text{ W}/(\text{mK})$		1.7		K/W	
$R_{th(j-s)}$	per IGBT, $\lambda_{paste} = 2.5\text{ W}/(\text{mK})$		1.46		K/W	

Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>Inverse - Diode</b>					
$V_F = V_{EC}$	$I_F = 10\text{ A}$ $V_{GE} = 0\text{ V}$ chiplevel	$T_j = 25\text{ °C}$	2.59	2.94	V
		$T_j = 150\text{ °C}$	2.71	3.08	V
		$T_j = 175\text{ °C}$	2.53	2.89	V
$V_{F0}$	chiplevel	$T_j = 25\text{ °C}$	1.30	1.50	V
		$T_j = 150\text{ °C}$	0.90	1.10	V
		$T_j = 175\text{ °C}$	0.82	0.98	V
$r_F$	chiplevel	$T_j = 25\text{ °C}$	129	144	m $\Omega$
		$T_j = 150\text{ °C}$	181	198	m $\Omega$
		$T_j = 175\text{ °C}$	171	191	m $\Omega$
$I_{RRM}$		$T_j = 25\text{ °C}$	6		A
		$T_j = 150\text{ °C}$	7		A
		$T_j = 175\text{ °C}$	8		A
$Q_{rr}$	$I_F = 10\text{ A}$ $V_{GE} = +15/-15\text{ V}$ $V_{CC} = 600\text{ V}$	$T_j = 25\text{ °C}$	0.7		$\mu\text{C}$
		$T_j = 150\text{ °C}$	1.4		$\mu\text{C}$
		@ $T_j = 150\text{ °C}$ : $dI/dt_{off} = 210\text{ A}/\mu\text{s}$	$T_j = 175\text{ °C}$	1.6	
$E_{rr}$		$T_j = 25\text{ °C}$	0.19		mJ
		$T_j = 150\text{ °C}$	0.53		mJ
		$T_j = 175\text{ °C}$	0.69		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 0.8\text{ W}/(\text{mK})$		2.33		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste} = 2.5\text{ W}/(\text{mK})$		2		K/W
<b>Module</b>					
$L_{CE}$			-		nH
$M_s$	to heat sink	2		2.5	Nm
w			30		g

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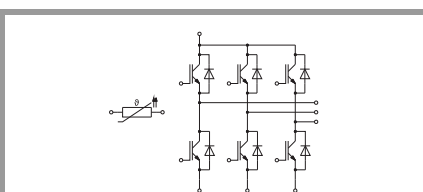
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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
<b>Temperature Sensor</b>					
$R_{100}$	$T_r=100\text{ °C}$ ( $R_{25}=1000\Omega$ )		$1670 \pm 3\%$		$\Omega$
$R_{(T)}$	$R_{(T)}=1000\Omega[1+A(T-25\text{ °C})+B(T-25\text{ °C})^2]$ $A = 7.635 \cdot 10^{-3}\text{ °C}^{-1}$ , $B = 1.731 \cdot 10^{-5}\text{ °C}^{-2}$				

Creepage distance (spring to spring) between temperature sensor and phase W = 2.9mm (CTI 600)



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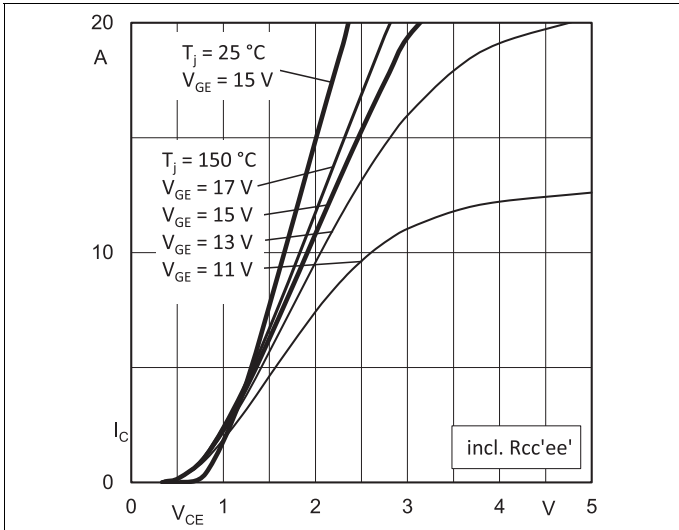


Fig. 1: Typ. output characteristic

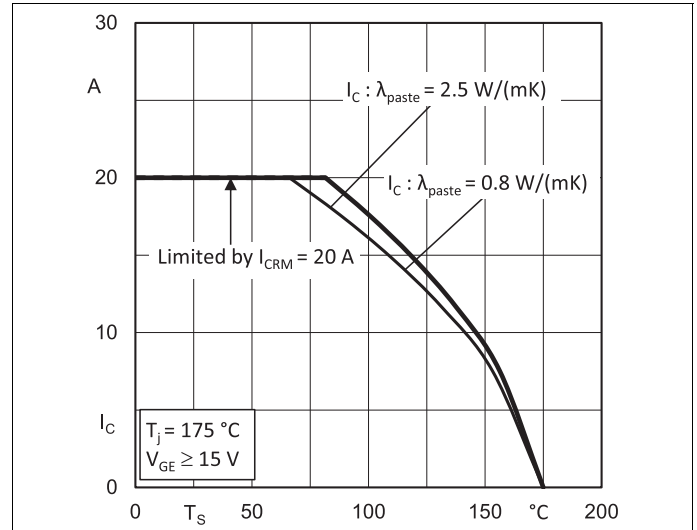


Fig. 2: Rated current vs. temperature  $I_C = f(T_s)$

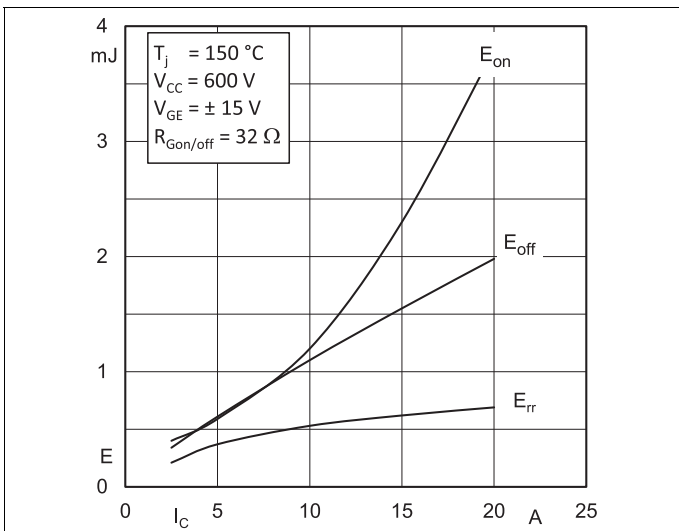


Fig. 3: Typ. turn-on /-off energy =  $f(I_C)$

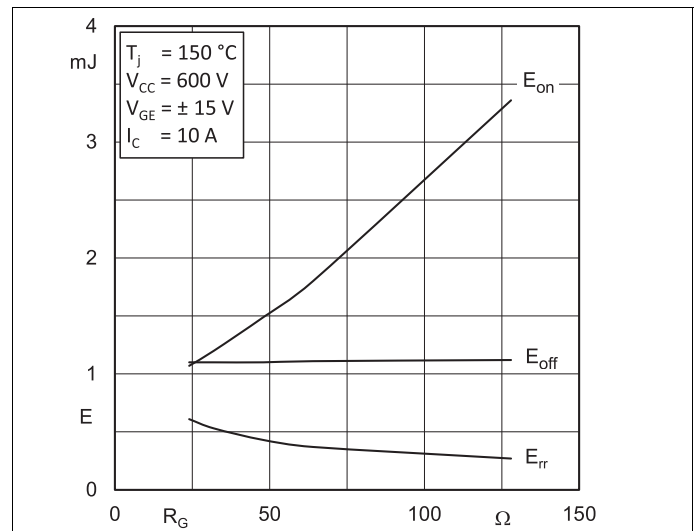


Fig. 4: Typ. turn-on /-off energy =  $f(R_G)$

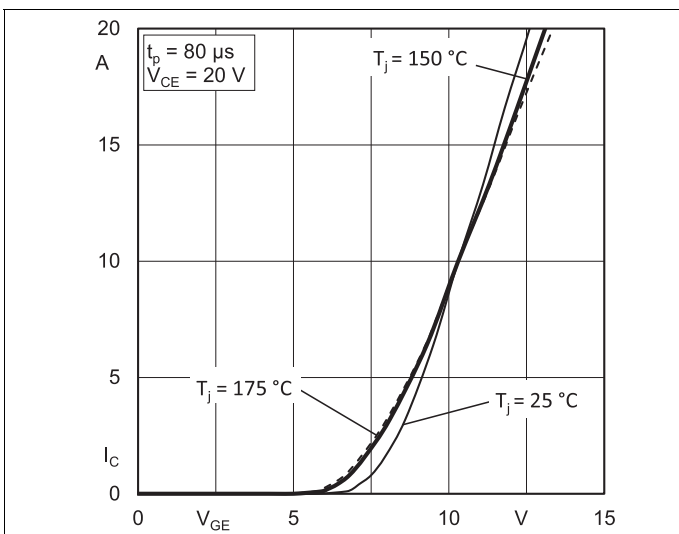


Fig. 5: Typ. transfer characteristic

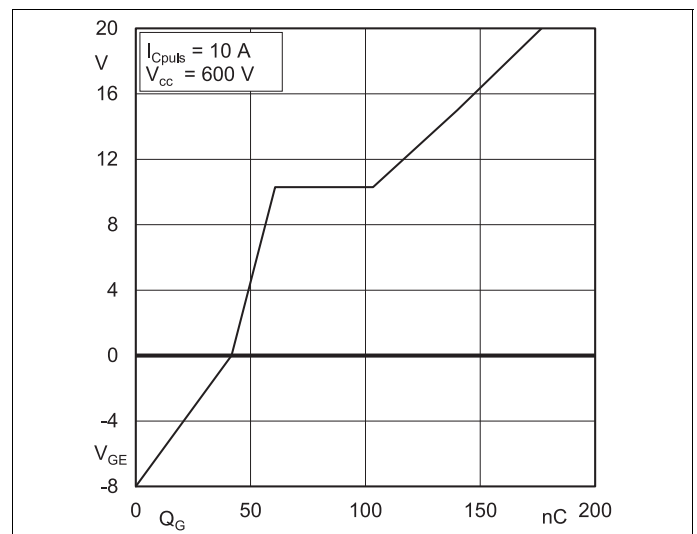


Fig. 6: Typ. gate charge characteristic

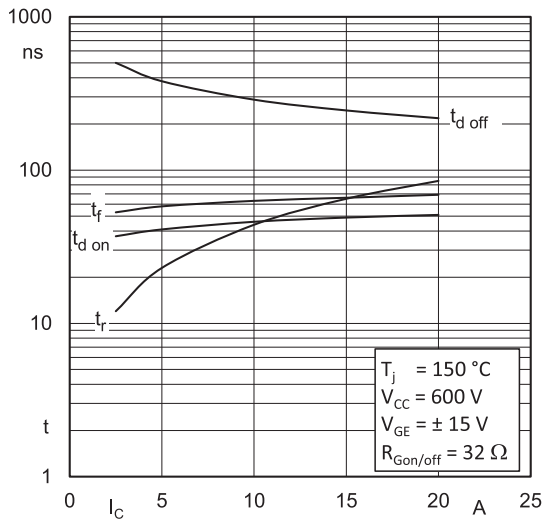


Fig. 7: Typ. switching times vs.  $I_C$

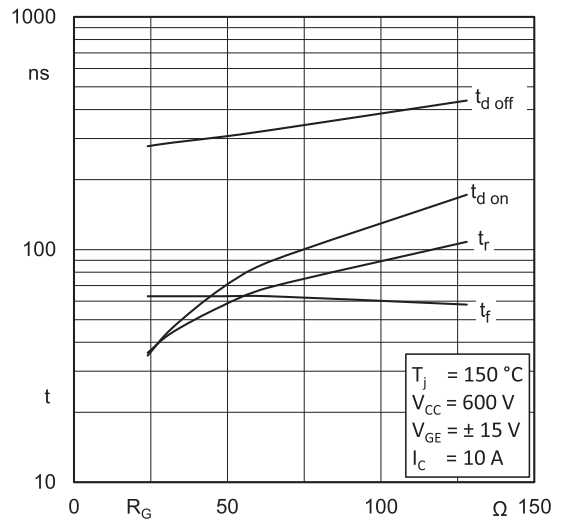


Fig. 8: Typ. switching times vs. gate resistor  $R_G$

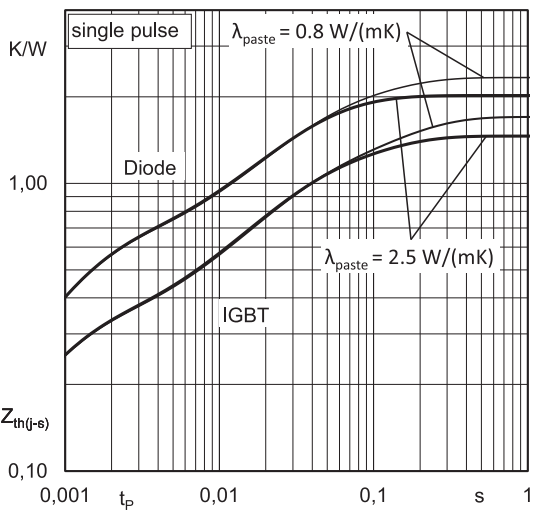


Fig. 9: Typ. transient thermal impedance

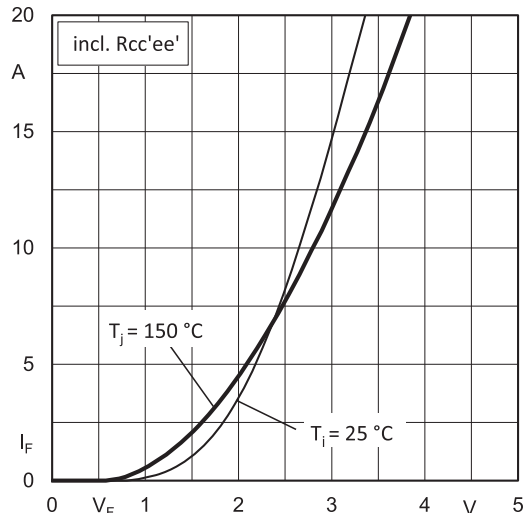


Fig. 10: Typ. CAL diode forward characteristic

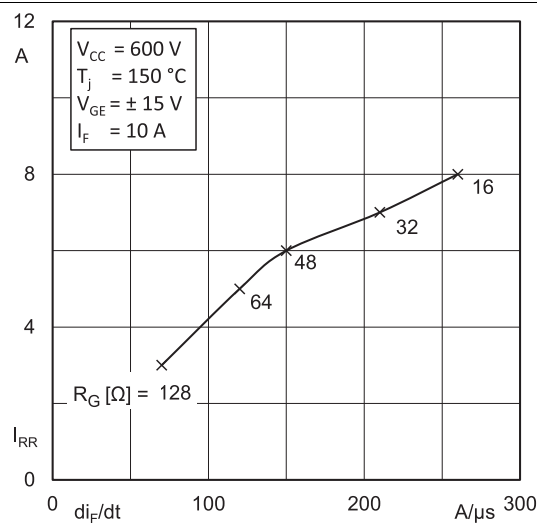


Fig. 11: Typ. CAL diode peak reverse recovery current

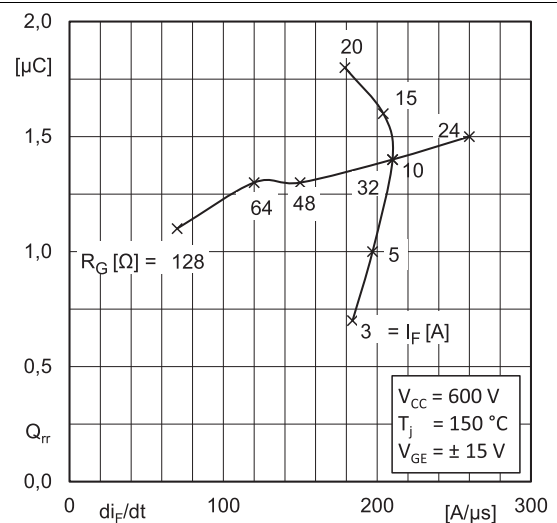
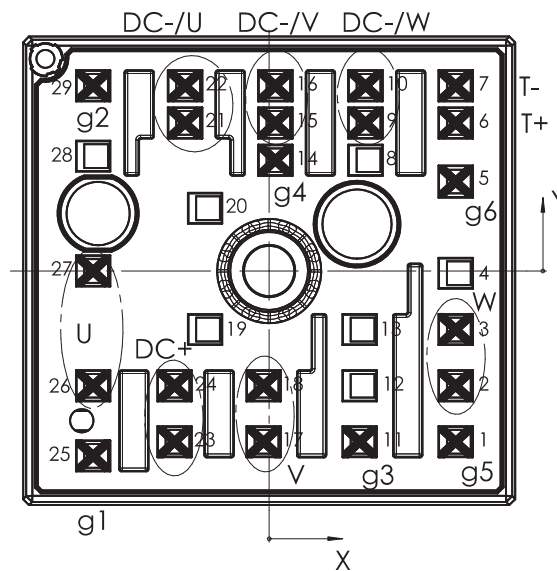


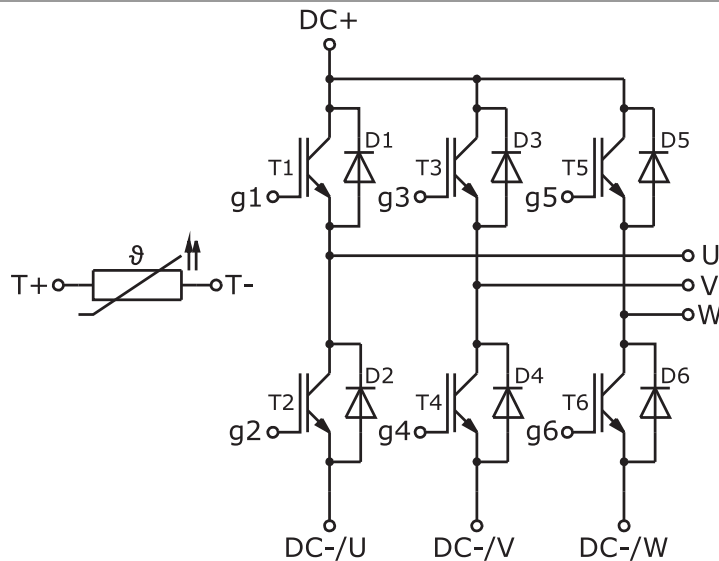
Fig. 12: Typ. CAL diode recovery charge

Pin out							
Pin	X	Y	Function	Pin	X	Y	Function
1	15,93	-14,6	g5	16	0,53	15,8	DC-/V
2	15,93	-9,8	W	17	-0,48	-14,6	V
3	15,93	-5	W	18	-0,48	-9,8	V
4				19			
5	15,93	7,63	g6	20			
6	15,93	12,63	T+	21	-7,18	12,63	DC-/U
7	15,93	15,8	T-	22	-7,18	15,8	DC-/U
8				23	-8,08	-14,6	DC+
9	8,23	12,63	DC-/W	24	-8,08	-9,8	DC+
10	8,23	15,8	DC-/W	25	-15,03	-15,8	g1
11	7,73	-14,6	g3	26	-15,03	-9,8	U
12	7,73	-9,8		27	-15,03	0	U
13				28			
14	0,53	9,45	g4	29	-15,03	15,8	g2
15	0,53	12,63	DC-/V				

all values in mm



Pinout and Dimensions



Pinout

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

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

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