

MiniSKiiP® 2

3-Level NPC IGBT-Module

SKiiP 28MLI07E3V1

Features*

- 650V Trench IGBTs
- Robust and soft diodes in CAL technology
- Highly reliable spring contacts for electrical connections
- UL recognised: File no. E63532
- NTC T-Sensor

Typical Applications

- Uninterruptible power supplies (UPS)
- Solar inverters

Remarks

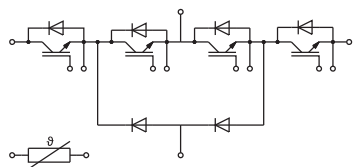
- Case temperature limited to $T_C=125^\circ\text{C}$ max.; $T_C=T_S$ (valid for baseplate-less modules)
- Product reliability results are valid for $T_{jop}=150^\circ\text{C}$

Footnotes

¹⁾ Please find further technical information on the SEMIKRON website.

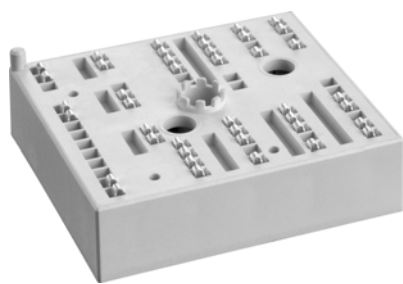
Absolute Maximum Ratings				
Symbol	Conditions		Values	Unit
IGBT				
V _{CES}			650	V
I _C	λ _{paste} =0.8 W/(mK) T _j = 175 °C	T _s = 25 °C	135	A
		T _s = 70 °C	107	A
I _C	λ _{paste} =2.5 W/(mK) T _j = 175 °C	T _s = 25 °C	163	A
		T _s = 70 °C	130	A
I _{Cnom}			150	A
I _{CRM}			450	A
V _{GES}			-20 ... 20	V
t _{psc}	V _{CC} = 360 V V _{GE} ≤ 15 V V _{CES} ≤ 650 V	T _j = 150 °C	6	μs
T _j			-40 ... 175	°C
Inverse diode				
I _F	λ _{paste} =0.8 W/(mK) T _j = 175 °C	T _s = 25 °C	126	A
		T _s = 70 °C	97	A
I _F	λ _{paste} =2.5 W/(mK) T _j = 175 °C	T _s = 25 °C	151	A
		T _s = 70 °C	118	A
I _{FRM}			300	A
I _{FSM}	t _p = 10 ms, sin 180°, T _j = 25 °C		1200	A
T _j			-40 ... 175	°C
Clamping diode				
I _F	λ _{paste} =0.8 W/(mK) T _j = 175 °C	T _s = 25 °C	126	A
		T _s = 70 °C	97	A
I _F	λ _{paste} =2.5 W/(mK) T _j = 175 °C	T _s = 25 °C	151	A
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I _{FRM}			300	A
I _{FSM}	10 ms, sin 180°, T _j = 25 °C		1200	A
T _j			-40 ... 175	°C
Module				
I _{t(RMS)}	T _{terminal} = 80°C, 20A per spring		120	A
T _{stg}			-40 ... 125	°C
V _{isol}	AC sinus 50 Hz, t = 1 min		2500	V

Characteristics						
Symbol	Conditions		min.	typ.	max.	Unit
IGBT						
V _{CE(sat)}	I _C = 150 A	T _j = 25 °C		1.45	1.90	V
	V _{GE} = 15 V chipelevel	T _j = 150 °C		1.70	2.10	V
V _{CE0}	chipelevel	T _j = 25 °C		0.90	1.00	V
		T _j = 150 °C		0.82	0.90	V
r _{CE}	V _{GE} = 15 V	T _j = 25 °C		3.7	6.0	mΩ
	chipelevel	T _j = 150 °C		5.9	8.0	mΩ
V _{GE(th)}	V _{GE} = V _{CE} , I _C = 2.4 mA		5.1	5.8	6.4	V
I _{CES}	V _{GE} = 0 V	T _j = 25 °C			1.5	mA
	V _{CE} = 650 V			-		mA
C _{ies}	V _{CE} = 25 V V _{GE} = 0 V	f = 1 MHz		9.24		nF
C _{oes}		f = 1 MHz		0.58		nF
C _{res}		f = 1 MHz		0.27		nF



MLI

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Typical Applications

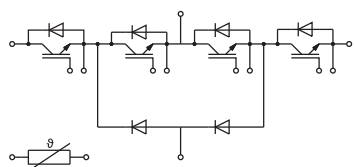
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Characteristics					
Symbol	Conditions	min.	typ.	max.	Unit
IGBT					
Q_G	$V_{GE} = -8 \text{ V} \dots +15 \text{ V}$		1200		nC
R_{Gint}	$T_j = 25^\circ\text{C}$		2.0		Ω
T1 / T4					
$t_{d(on)}$	$V_{CE} = 300 \text{ V}$ $I_C = 150 \text{ A}$	$T_j = 150^\circ\text{C}$	108		ns
t_r	$V_{GE} = +15/-15 \text{ V}$ $R_{G on} = 3 \Omega$	$T_j = 150^\circ\text{C}$	73		ns
E_{on}	$R_{G off} = 1.6 \Omega$	$T_j = 150^\circ\text{C}$	5.5		mJ
$t_{d(off)}$	$di/dt_{on} = 2100 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	268		ns
t_f	$di/dt_{off} = 1700 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	76		ns
E_{off}		$T_j = 150^\circ\text{C}$	5.6		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 \text{ W}/(\text{mK})$		0.55		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 \text{ W}/(\text{mK})$		0.41		K/W
T2 / T3					
$t_{d(on)}$	$V_{CE} = 300 \text{ V}$ $I_C = 150 \text{ A}$	$T_j = 150^\circ\text{C}$	106		ns
t_r	$V_{GE} = +15/-15 \text{ V}$ $R_{G on} = 3 \Omega$	$T_j = 150^\circ\text{C}$	64		ns
E_{on}	$R_{G off} = 1.6 \Omega$	$T_j = 150^\circ\text{C}$	2		mJ
$t_{d(off)}$	$di/dt_{on} = 2520 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	268		ns
t_f	$di/dt_{off} = 1750 \text{ A}/\mu\text{s}$	$T_j = 150^\circ\text{C}$	77		ns
E_{off}		$T_j = 150^\circ\text{C}$	5.2		mJ
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=0.8 \text{ W}/(\text{mK})$		0.55		K/W
$R_{th(j-s)}$	per IGBT, $\lambda_{paste}=2.5 \text{ W}/(\text{mK})$		0.41		K/W
Inverse diode					
$V_F = V_{EC}$	$I_F = 150 \text{ A}$ $V_{GE} = 0 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.40	1.76	V
		$T_j = 150^\circ\text{C}$	1.39	1.77	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$	1.04	1.24	V
		$T_j = 150^\circ\text{C}$	0.85	0.99	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$	2.4	3.5	m Ω
		$T_j = 150^\circ\text{C}$	3.6	5.2	m Ω
I_{RRM}	$I_F = 150 \text{ A}$	$T_j = 150^\circ\text{C}$	121		A
Q_{rr}	$di/dt_{off} = 2450 \text{ A}/\mu\text{s}$ $V_{GE} = -15 \text{ V}$	$T_j = 150^\circ\text{C}$	20		μC
E_{rr}	$V_R = 300 \text{ V}$	$T_j = 150^\circ\text{C}$	5.5		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8 \text{ W}/(\text{mK})$		0.75		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5 \text{ W}/(\text{mK})$		0.58		K/W
Clamping diode					
$V_F = V_{EC}$	$I_F = 150 \text{ A}$ $V_{GE} = 0 \text{ V}$ chipelevel	$T_j = 25^\circ\text{C}$	1.40	1.76	V
		$T_j = 150^\circ\text{C}$	1.39	1.77	V
V_{F0}	chipelevel	$T_j = 25^\circ\text{C}$	1.04	1.24	V
		$T_j = 150^\circ\text{C}$	0.85	0.99	V
r_F	chipelevel	$T_j = 25^\circ\text{C}$	2.4	3.5	m Ω
		$T_j = 150^\circ\text{C}$	3.6	5.2	m Ω
I_{RRM}	$I_F = 150 \text{ A}$	$T_j = 150^\circ\text{C}$	116		A
Q_{rr}	$di/dt_{off} = 2210 \text{ A}/\mu\text{s}$ $V_{GE} = -15 \text{ V}$	$T_j = 150^\circ\text{C}$	13.2		μC
E_{rr} ¹⁾	$V_R = 300 \text{ V}$	$T_j = 150^\circ\text{C}$	2.6		mJ
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=0.8 \text{ W}/(\text{mK})$		0.75		K/W
$R_{th(j-s)}$	per Diode, $\lambda_{paste}=2.5 \text{ W}/(\text{mK})$		0.58		K/W
Module					
M_s	to heat sink	2		2.5	Nm
w	weight		55		g
Temperature Sensor					
R_{25}	NTC, $T_r = 25^\circ\text{C}$ ¹⁾		5.0 $\pm$ 5%		k Ω

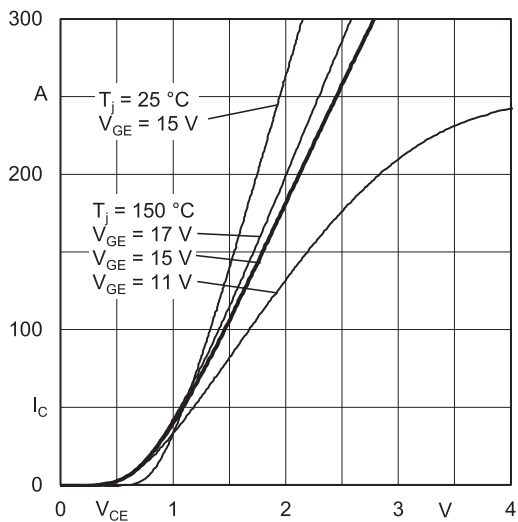


Fig. 1: Typ. IGBT1 output characteristic, incl. $R_{CC'+EE'}$

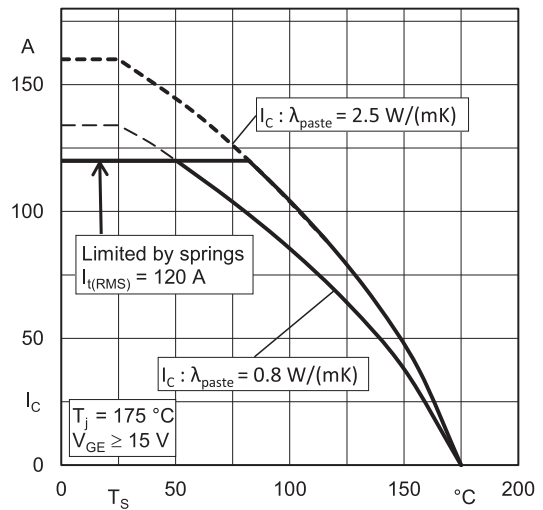


Fig. 2: Rated current vs. temperature $I_C = f(T_s)$

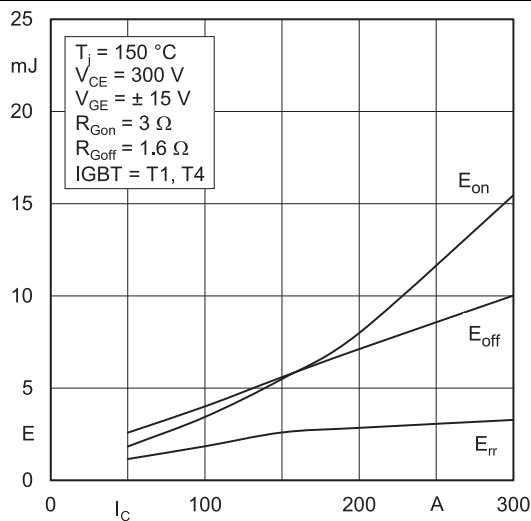


Fig. 3: Typ. IGBT1 & Diode5 turn-on /-off energy = $f(I_C)$

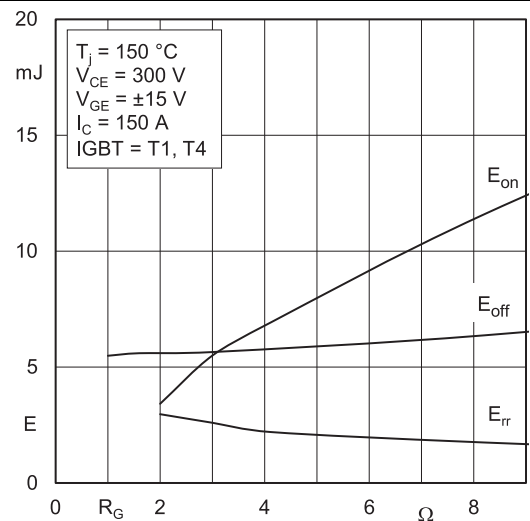


Fig. 4: Typ. IGBT1 & Diode5 turn-on /-off energy = $f(R_G)$

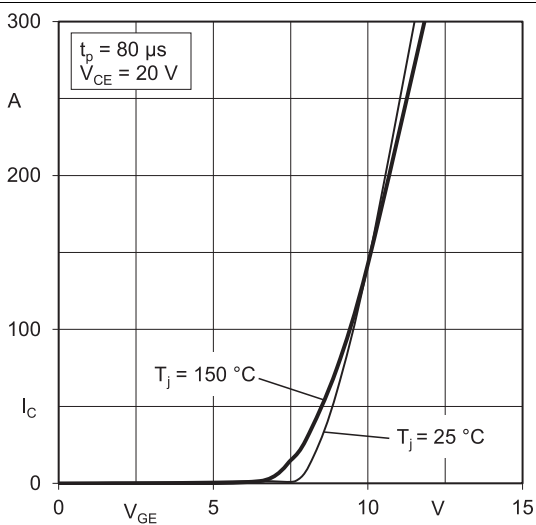


Fig. 5: Typ. IGBT1 transfer characteristic

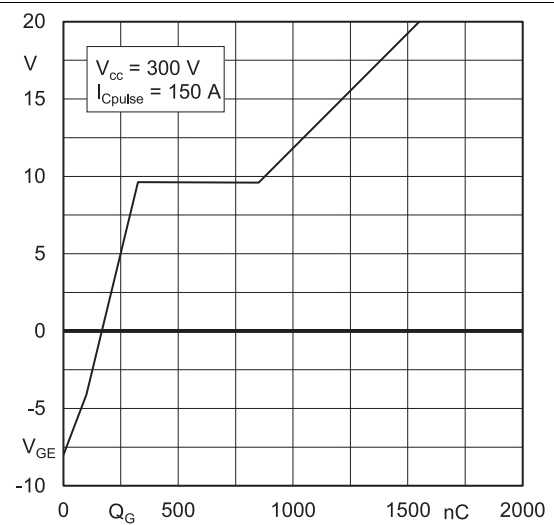


Fig. 6: Typ. IGBT1 gate charge characteristic

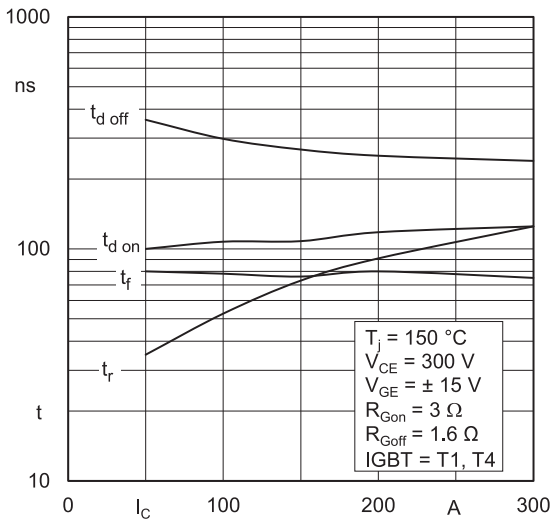


Fig. 7: Typ. IGBT1 switching times vs. I_C

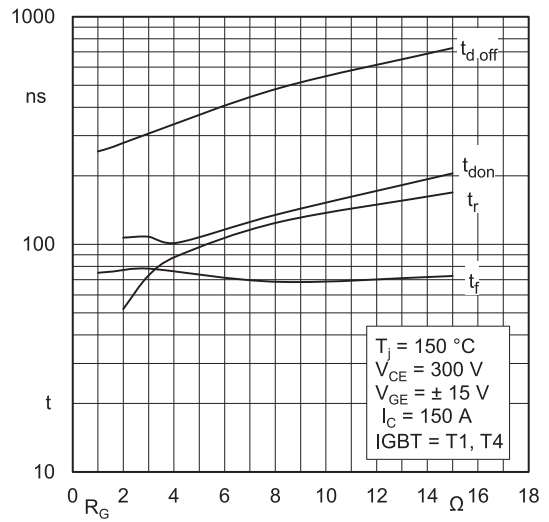


Fig. 8: Typ. IGBT1 switching times vs. gate resistor R_G

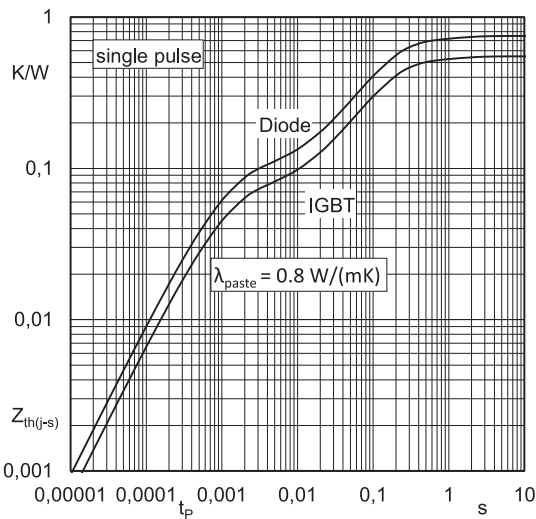


Fig. 9: Typ. transient thermal impedance of IGBT1 & Diode5

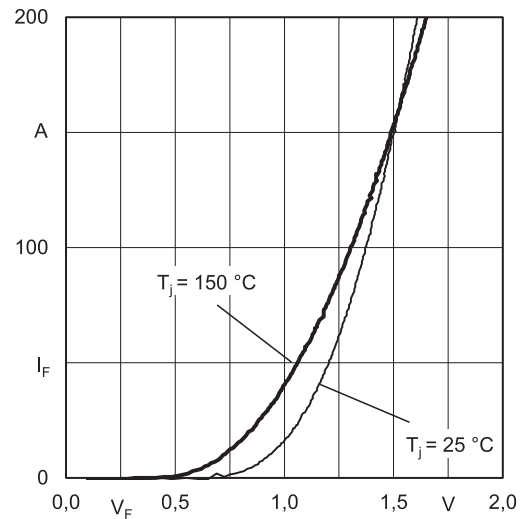


Fig. 10: Typ. Diode5 forward characteristic, incl. $R_{CC'+EE'}$

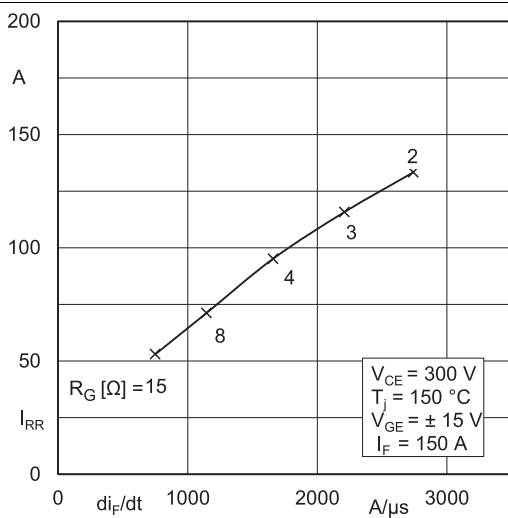


Fig. 11: Typ. Diode5 peak reverse recovery current

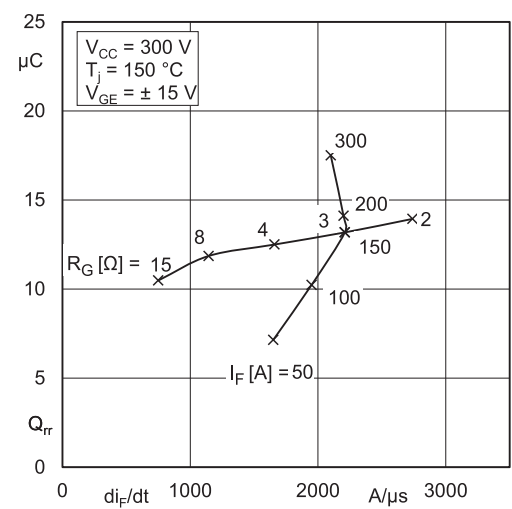
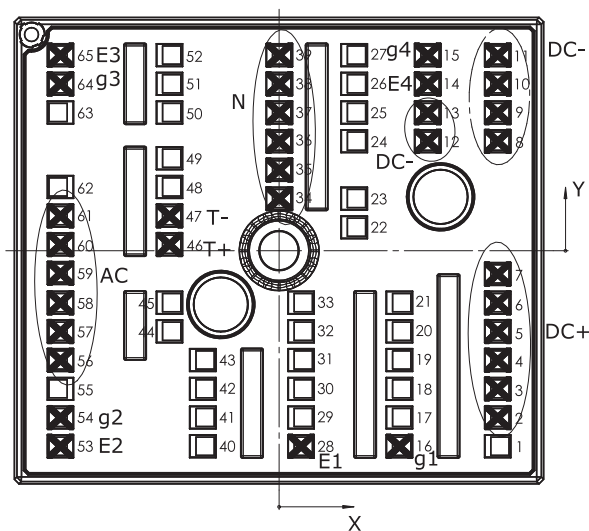


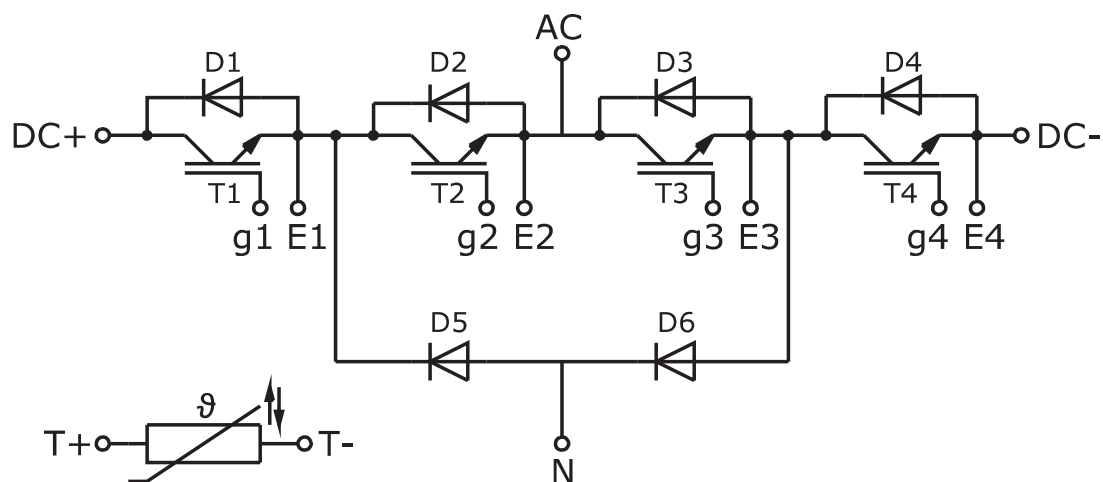
Fig. 12: Typ. Diode5 recovery charge

Pin out											
Pin	X	Y	Function	Pin	X	Y	Function	Pin	X	Y	Function
1	24,38	-21,80		23	8,38	5,80		45	-12,23	-5,80	
2	24,38	-18,60	DC+	24	8,38	12,20		46	-12,23	0,70	T+
3	24,38	-15,40	DC+	25	8,38	15,40		47	-12,23	3,90	T-
4	24,38	-12,20	DC+	26	8,38	18,60		48	-12,23	7,10	
5	24,38	-9,00	DC+	27	8,38	21,80		49	-12,23	10,30	
6	24,38	-5,80	DC+	28	2,46	-21,80	E1	50	-12,23	15,40	
7	24,38	-2,60	DC+	29	2,46	-18,60		51	-12,23	18,60	
8	24,38	12,20	DC-	30	2,46	-15,40		52	-12,23	21,80	
9	24,38	15,40	DC-	31	2,46	-12,20		53	-24,38	-21,80	E2
10	24,38	18,60	DC-	32	2,46	-9,00		54	-24,38	-18,60	g2
11	24,38	21,80	DC-	33	2,46	-5,80		55	-24,38	-15,40	
12	16,58	12,20	DC-	34	0,03	5,80	N	56	-24,38	-12,20	AC
13	16,58	15,40	DC-	35	0,03	9,00	N	57	-24,38	-9,00	AC
14	16,58	18,60	E4	36	0,03	12,20	N	58	-24,38	-5,80	AC
15	16,58	21,80	g4	37	0,03	15,40	N	59	-24,38	-2,50	AC
16	13,42	-21,80	G1	38	0,03	18,60	N	60	-24,38	0,70	AC
17	13,42	-18,60		39	0,03	21,80	N	61	-24,38	3,90	AC
18	13,42	-15,40		40	-8,51	-21,80		62	-24,38	7,10	
19	13,42	-12,20		41	-8,51	-18,60		63	-24,38	15,40	
20	13,42	-9,00		42	-8,51	-15,40		64	-24,38	18,60	g3
21	13,42	-5,80		43	-8,51	-12,20		65	-24,38	21,80	E3
22	8,38	2,60		44	-12,23	-9,00					

all values in mm



Pinout and Dimensions



Pinout

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

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