Technical Explanation TechEx® Board SiC MiniSKiiP

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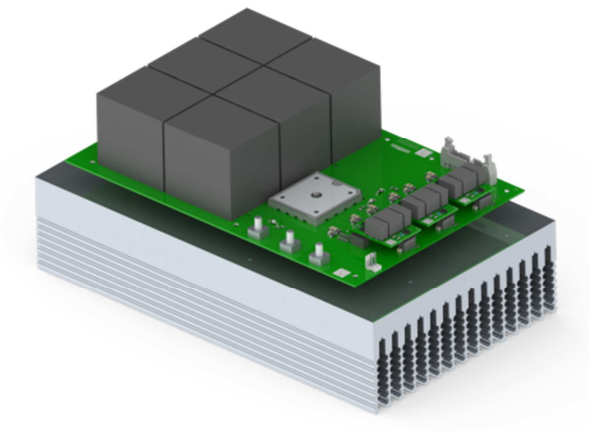
Keyword: SiC MOSFET Eval Kit

Please consider the technical explanation of SKYPER 12 R – L5069901 as all electrical functions are described in there.

1. Introduction

The Board SiC MiniSKiiP with SKYPER 12 R is an adapter board which can be used for driving SiC MOSFETs in the MiniSKiiP housing. The board can be directly plugged on the module.

Figure 1: Board SiC MiniSKiiP with SKYPER 12 R - 45138101



- Fits to full SiC MiniSKiiP SKiiP 26ACM12V17
- 3~ adapter board
- Gate voltages +18V/-5V
- I_{outave}=50mA @85°C
- Application board, no plan for qualification

Safe short circuit handling with SoftOff

Important:
Please make sure to consider the technical explanation of SKYPER 12 R – L5069901.

2. Application hints

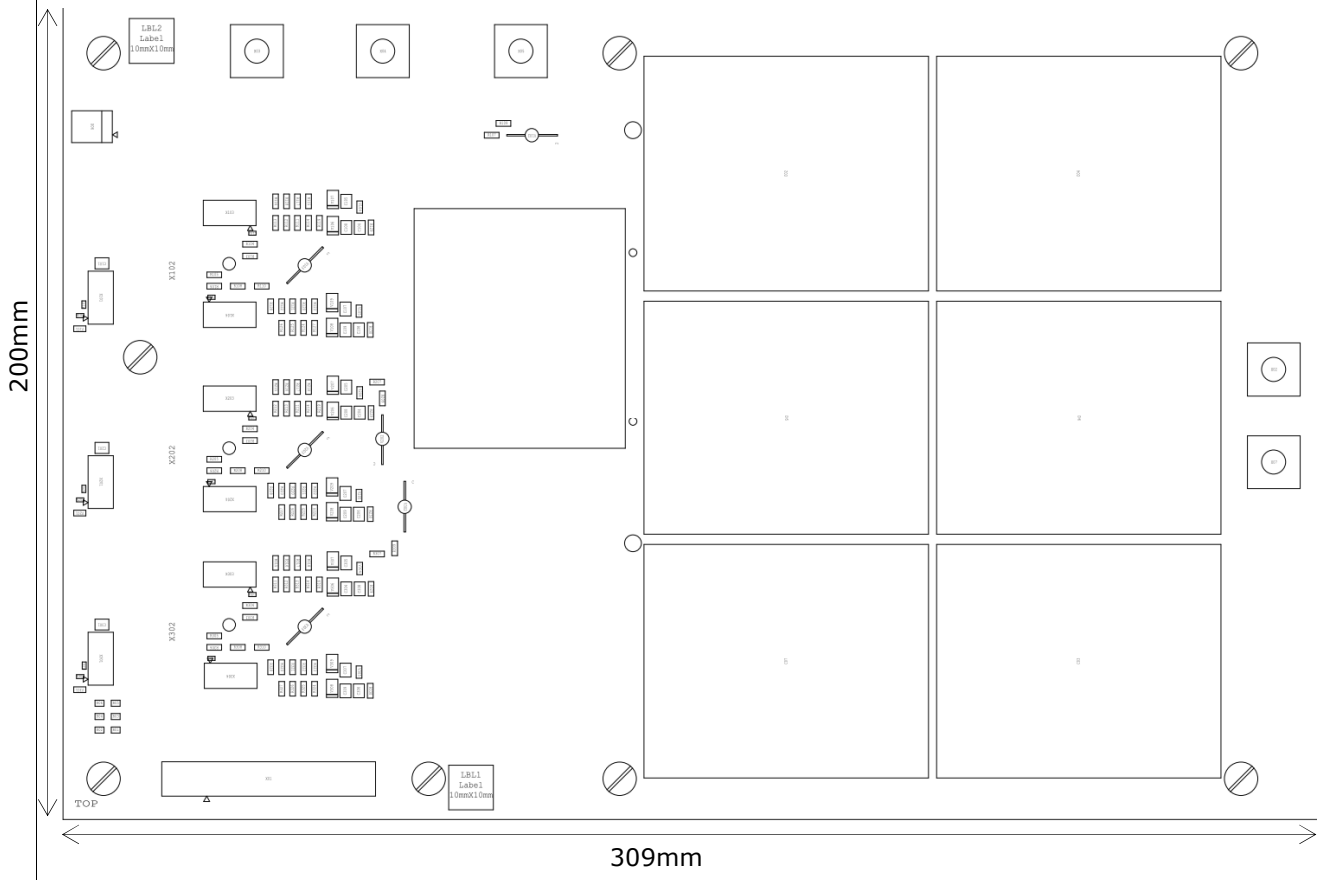
- Gate resistors

The gate resistors can be assembled via SMD process. Gate resistors values should be chosen as low as possible to have low switching losses. But over voltages over the full temperature range during standard switch off and during short circuit switch off are the limiting factor and must be checked.

- SoftOff

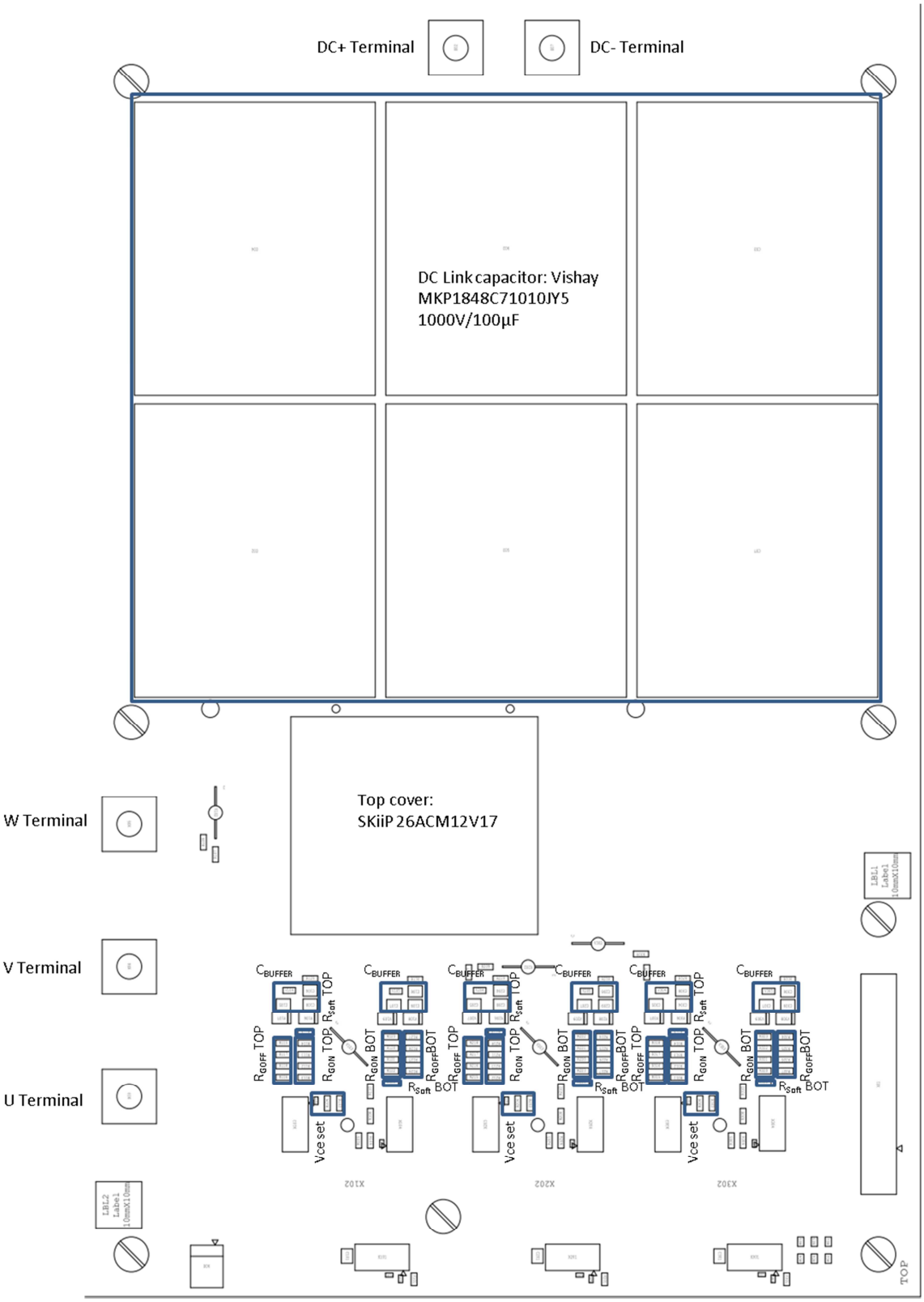
The SoftOff resistor has to be set according to the required DC link voltage and has to be proven during short circuit conditions.

Figure 2: Dimensions



3. How to start

Figure 3: How to start with SiC adapter board



3.1.1 Safe operating area

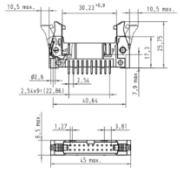
To utilize the fast switching performance of SiC an assembly with low stray inductance should be realized. The gate voltages of the SKYPER 12 R has been shifted to SiC values (+18V/-5V) on the adapter board. The short circuit proofed time of SiC is with roughly 4 µs much shorter than standard Si devices (10µs). The gate off resistors a dimensioned according to the over voltage behavior during switch off and the gate on resistors accordingly to the diode characteristic.

The adapter board has been tested with the following settings:

Table 1: SOA parameter	
V_{DClink}=	800V
I_{max}=	60A (1,5x times I_{NOM})
Tested values @25°C:	
R_{GOFF}=0,25Ω/ R_{GON}=1Ω:	800V, 60A -> higher R_{GON} can be used for further damping
Losses @600V/40A:	**0,9mJ in each phase**
Short circuit @500V and @ L=0,3µH between AC-/+ or DC terminal ok	RGSOFT=28 Ω

3.1.2 26P primary side pinning

Figure 4: Connector X01 (Harting DIN 41651 – 26 P)



Product information of suitable female connectors and distributor contact information is available at e.g. http://www.harting.com (part number 09 18 520 7 904).

Table 2: Controller Interface

PIN	Signal	Function	Specification
X10:01	Shield		
X10:02	BOT HB1 IN	Switching signal input for low side IGBT phase U (half bridge1)	positive 15V CMOS logic
X10:03	ERROR HB1 OUT	Error signal phase U (half bridge1)	LOW = NO ERROR; open collector output
X10:04	TOP HB1 IN	Switching signal input for high side IGBT phase U (half bridge1)	positive 15V CMOS logic
X10:05	BOT HB2 IN	Switching signal input for low side IGBT phase V (half bridge2)	positive 15V CMOS logic
X10:06	ERROR HB2 OUT	Error signal phase V (half bridge2)	LOW = NO ERROR; open collector output
X10:07	TOP HB2 IN	Switching signal input for high side IGBT phase V (half bridge2)	positive 15V CMOS logic
X10:08	BOT HB3 IN	Switching signal input for low side IGBT phase W (half bridge3)	positive 15V CMOS logic
X10:09	ERROR HB3 OUT	Error signal phase W (half bridge 3)	LOW = NO ERROR; open collector output
X10:10	TOP HB3 IN	Switching signal input for high side IGBT phase W (half bridge 3)	positive 15V CMOS logic

X10:11	Overtemp. OUT	Overtemperature error	LOW = NO ERROR; open collector output
X10:12	reserved	GND	
X10:13	reserved	GND	
X10:14	reserved	GND	
X10:15	reserved	GND	
X10:16	reserved	GND	
X10:17	reserved	GND	
X10:18	GND	Power ground	
X10:19	GND	Power ground	
X10:20	reserved	GND	
X10:21	reserved	GND	
X10:22	reserved	GND	
X10:23	reserved	GND	
X10:24	reserved	GND	
X10:25	reserved	GND	
X10:26	reserved	GND	

4. Setting parameters

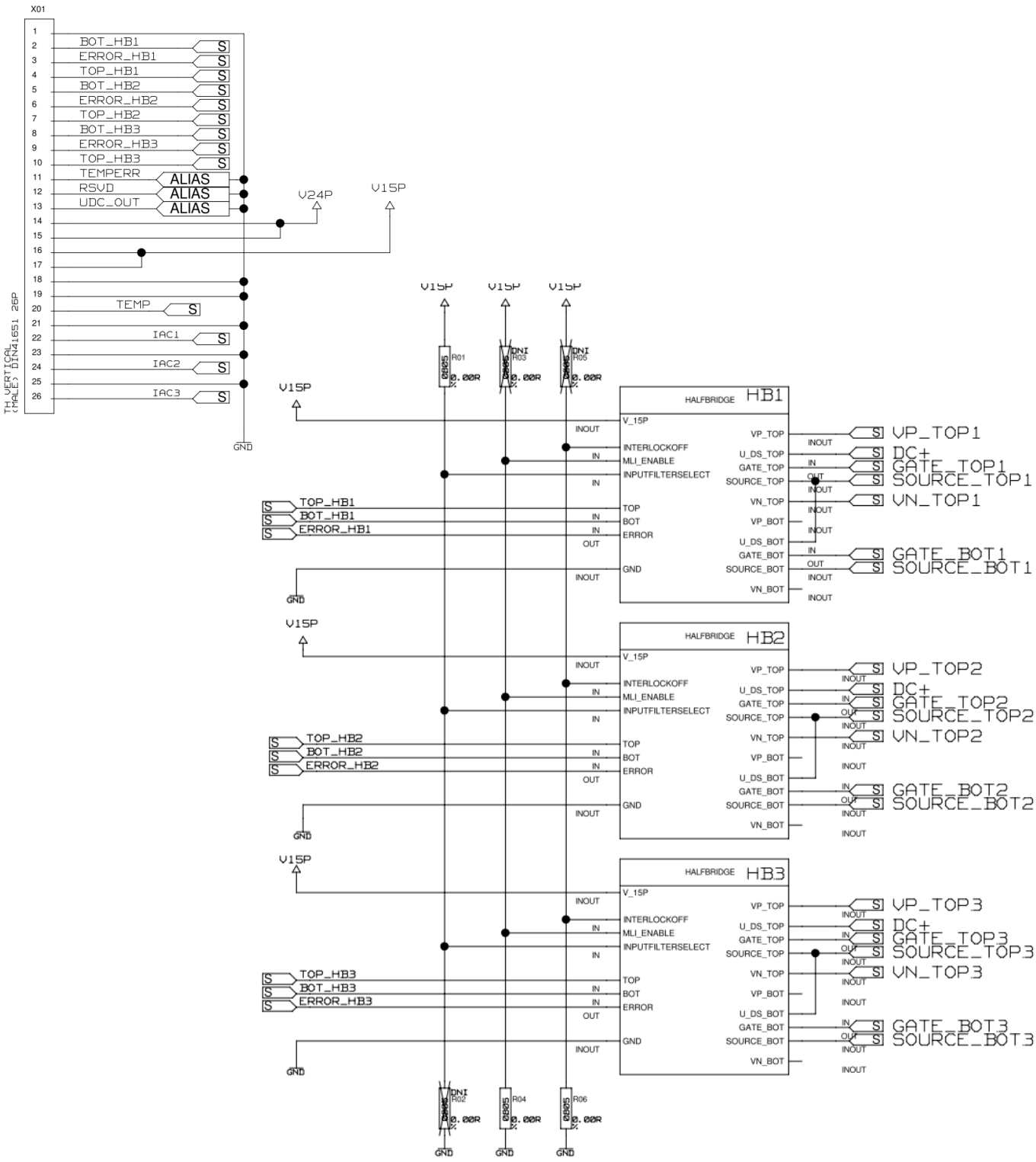
Function	Component	Specification	
Error Off	15V (R03=0Ω / R04 not populated) High=error message	GND (default) (R03 not populated/ R04=0Ω) Low=switch off by driver	
Input filter	15V (default) (R01= 0Ω / R02 not populated) High=analogue filter	GND (default) (R01 not populated/ R02=0Ω) Low=digital filter	
Interlock	15V (R05=0Ω / R06 not populated) High=No interlock	GND (default) (to be modified for higher fsw) (R05=0Ω / R06 not populated) Low=Interlock 2µs	
R_{GON} TOP	R111-114	Gate on resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
R_{GOFF} TOP	R115-118	Gate off resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
$R_{GSoftOFF}$ TOP	R119	Gate softoff resistor	Default: Equipped with 1 Ω per resistor
R_{GON} BOT	R120-123	Gate on resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
R_{GOFF} BOT	R124-127	Gate off resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
$R_{GSoftOFF}$ BOT	R128	Gate softoff resistor	Default: Equipped with 1 Ω per resistor
R_{GON} TOP	R211-214	Gate on resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
R_{GOFF} TOP	R215-218	Gate off resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
$R_{GSoftOFF}$ TOP	R219	Gate softoff resistor	Default: Equipped with 1 Ω per resistor
R_{GON} BOT	R220-223	Gate on resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
R_{GOFF} BOT	R224-227	Gate off resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
$R_{GSoftOFF}$ BOT	R228	Gate softoff resistor	Default: Equipped with 1 Ω per resistor
R_{GON} TOP	R311-314	Gate on resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
R_{GOFF} TOP	R315-318	Gate off resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
$R_{GSoftOFF}$ TOP	R319	Gate softoff resistor	Default: Equipped with 1 Ω per resistor
R_{GON} BOT	R320-323	Gate on resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor

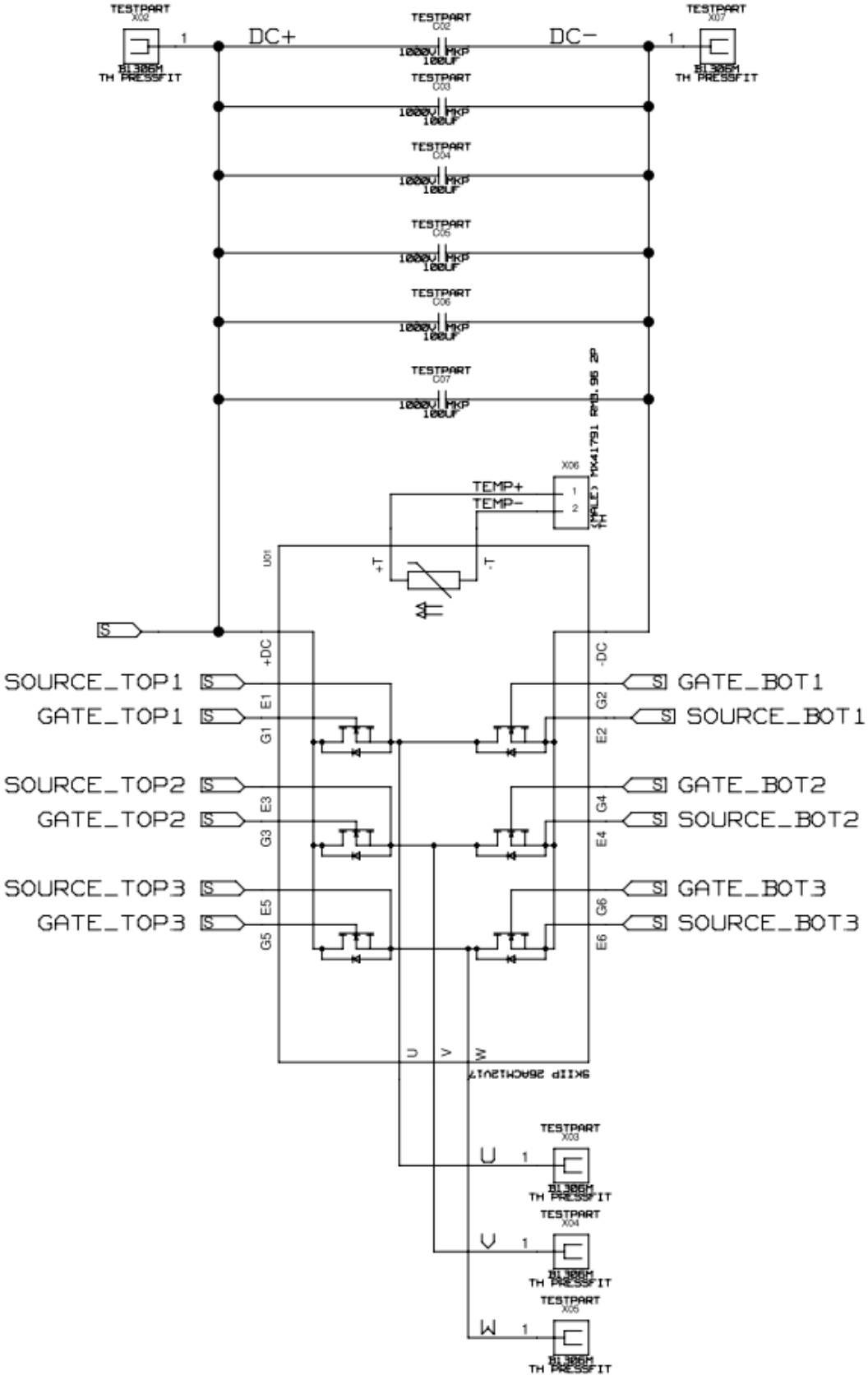
R_{GOFF} BOT	R324-327	Gate off resistor, 4x in parallel	Default: Equipped with 1 Ω per resistor
$R_{GSoftOFF}$ BOT	R328	Gate softoff resistor	Default: Equipped with 1 Ω per resistor
$R_{VCEconf}$ 1 TOP	R104, 204, 304	Threshold voltage for Vce monitoring	Default: 33,2k Ω
$C_{VCEconf}$ 1 TOP	C102, 202, 302	Blanking time for Vce monitoring	Default: 150pF
$R_{VCEconf}$ 2 BOT	R106, 206, 306	Threshold voltage for Vce monitoring	Default: 33,2k Ω
$C_{VCEconf}$ 2 BOT	C103, 203, 303	Blanking time for Vce monitoring	Default: 150pF
C_{BOOST} 15V TOP	C104, 108, 204, 208, 304, 308	Buffer capacitor, depending on IGBT gate charge	Default: 2x 4,7µF on adapterboard + SKYPER 12 capacitance
C_{BOOST} -8V TOP	C105, 205, 305	Buffer capacitor, depending on IGBT gate charge	Default: 1x 10µF on adapterboard + SKYPER 12 capacitance
C_{BOOST} 15V BOT	C106, 109, 206, 209, 306, 309	Buffer capacitor, depending on IGBT gate charge	Default: 2x 4,7µF on adapterboard + SKYPER 12 capacitance
C_{BOOST} -8V BOT	C107, 207, 307	Buffer capacitor, depending on IGBT gate charge	Default: 1x 10µF on adapterboard + SKYPER 12 capacitance

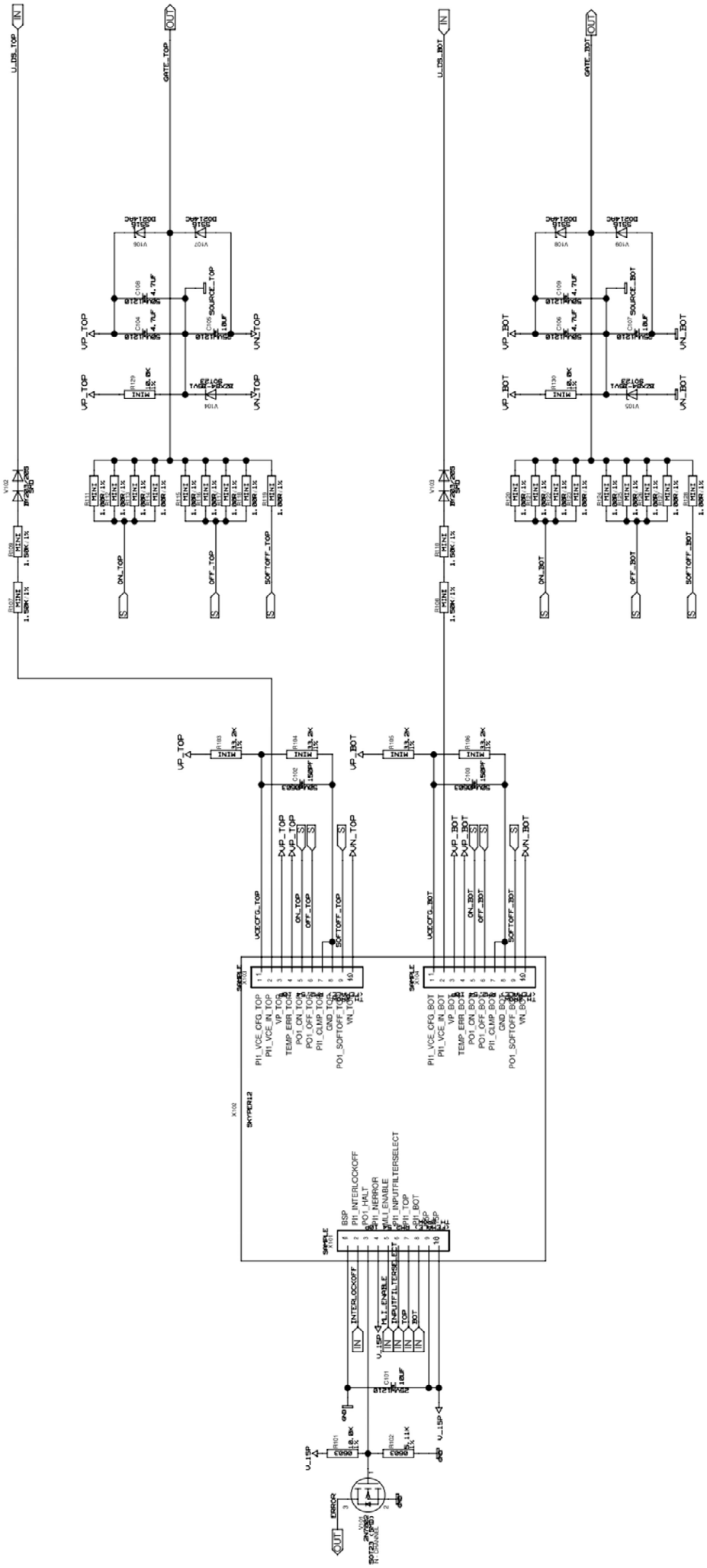
4.1 Circuit diagram

The circuit diagram PDF files can be sent out on request.

Figure 5: Circuit diagram




DC+
DC-
TEMP+
TEMP-
SOURCE_TOP1
GATE_TOP1
SOURCE_TOP2
GATE_TOP2
SOURCE_TOP3
GATE_TOP3
GATE_BOT1
SOURCE_BOT1
GATE_BOT2
SOURCE_BOT2
GATE_BOT3
SOURCE_BOT3
U
V
W



HISTORY

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