

PROFET Demo Kit

BTS 5241L

BTS 5234G

BTS 5230GS

BTS 6143D



Automotive Power



Never stop thinking.

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1 Hardware Description

1.1 P-DSO-12 Board

The P-DSO-12 Board is equipped with one BTS 5241L in P-DSO-12 power package. It is capable to drive two 55 W channels for blinker applications which might be built by 25 W + 25 W + 5 W bulbs. These combination of loads can be found in the car as front, rear and side blinker.

1.1.1 Technical Data of BTS 5241L

Operating Voltage	$V_{bb(ON)}$	4.5 V .. 28 V
On-state Resistance	R_{ON}	25 m Ω per channel
Nominal load current ¹⁾ continuous blinking (50% duty cycle)	$I_{L(nom)}$	(all channels active) 3.3 A per channel 4.5 A per channel
Current limitation	$I_{L(lim)}$ $I_{L(SCr)}$	40 A 9.5 A
Package		P-DSO-12 (power)

¹⁾ Power dissipation $P_{tot} = 1$ W

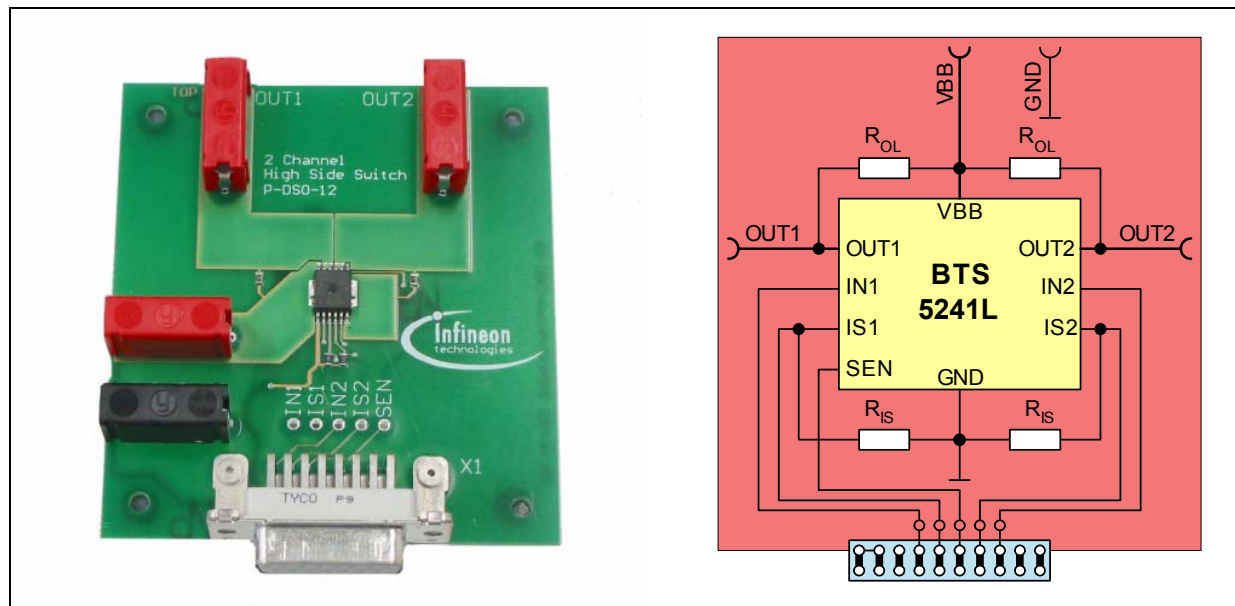


Figure 1 P-DSO-12 Board

1.1.2 Connectors and Plugs

Control Board Connector X1

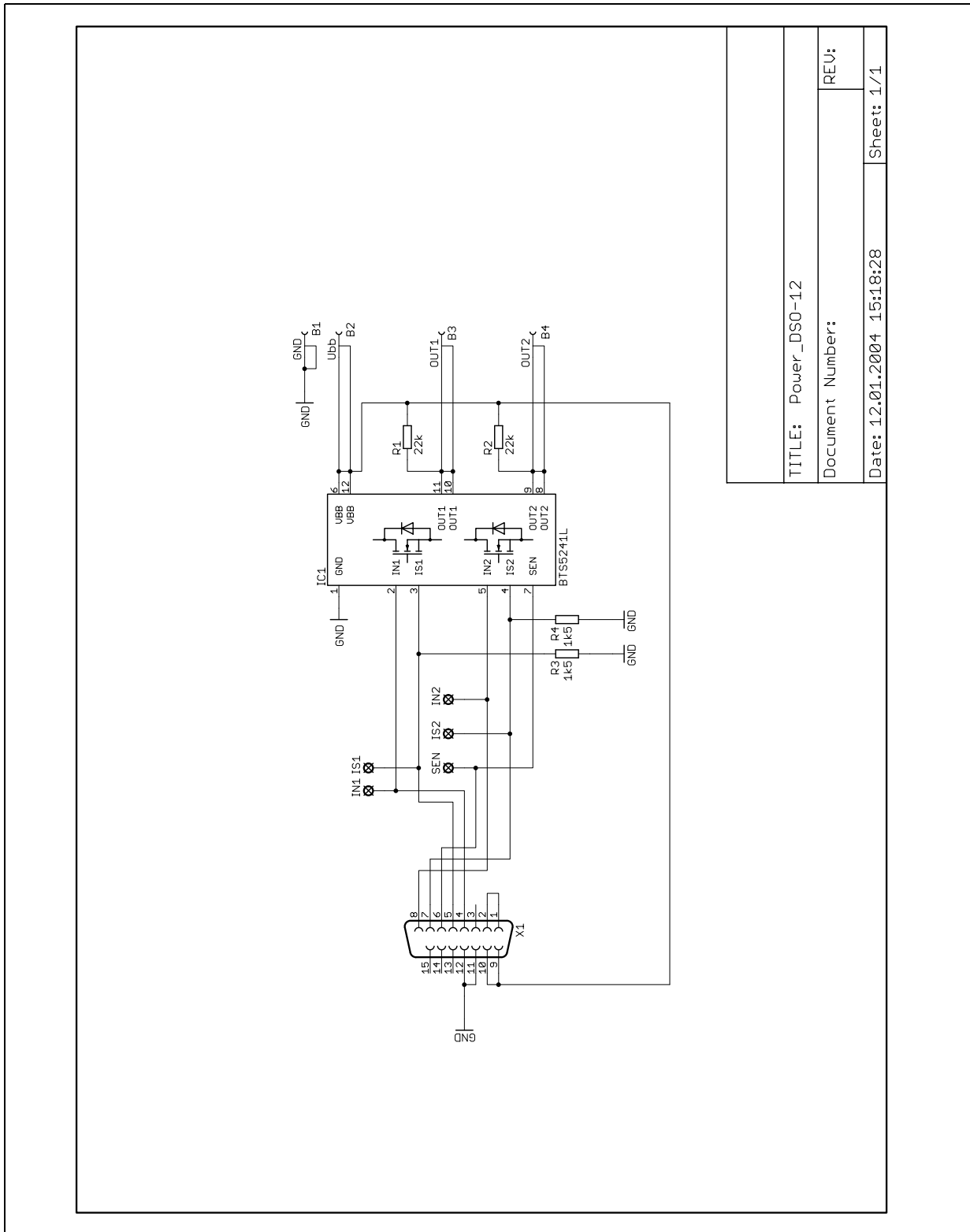
Pin	Description
1	short circuited to provide P-DSO-12 Board detection
2	
3	nc
4	IN channel 1
5	current sense channel 1
6	SEN channel 1/2
7	current sense channel 2
8	IN channel 2

Pin	Description
9	V _{bb}
10	
11	Ground
12	
13	nc
14	nc
15	nc

Power Plugs

Plug	Description
GND	Logic Ground connection for BTS 5241L, also power supply for Control Board
VBB	VBB connection for BTS 5241L, also power supply for Control Board
OUT1	Output 1 of BTS 5241L to connect grounded load
OUT2	Output 2 of BTS 5241L to connect grounded load

1.1.3 Circuit Diagram



1.2 P-DSO-20 Board

The P-DSO-20 Board is equipped with one BTS 5234G in P-DSO-20 package. Two channels with 27 W bulbs each are the focus application for that device.

1.2.1 Technical Data of BTS 5234G

Operating Voltage	$V_{bb(ON)}$	4.5 V .. 28 V
On-state Resistance	R_{ON}	60 m Ω per channel
Nominal load current ¹⁾ continuous blinking (50% duty cycle)	$I_{L(nom)}$	(all channels active) 2.5 A per channel 3.3 A per channel
Current limitation	$I_{L(lim)}$ $I_{L(SCr)}$	23 A 6 A
Package		P-DSO-20

¹⁾ Power dissipation $P_{tot} = 1$ W

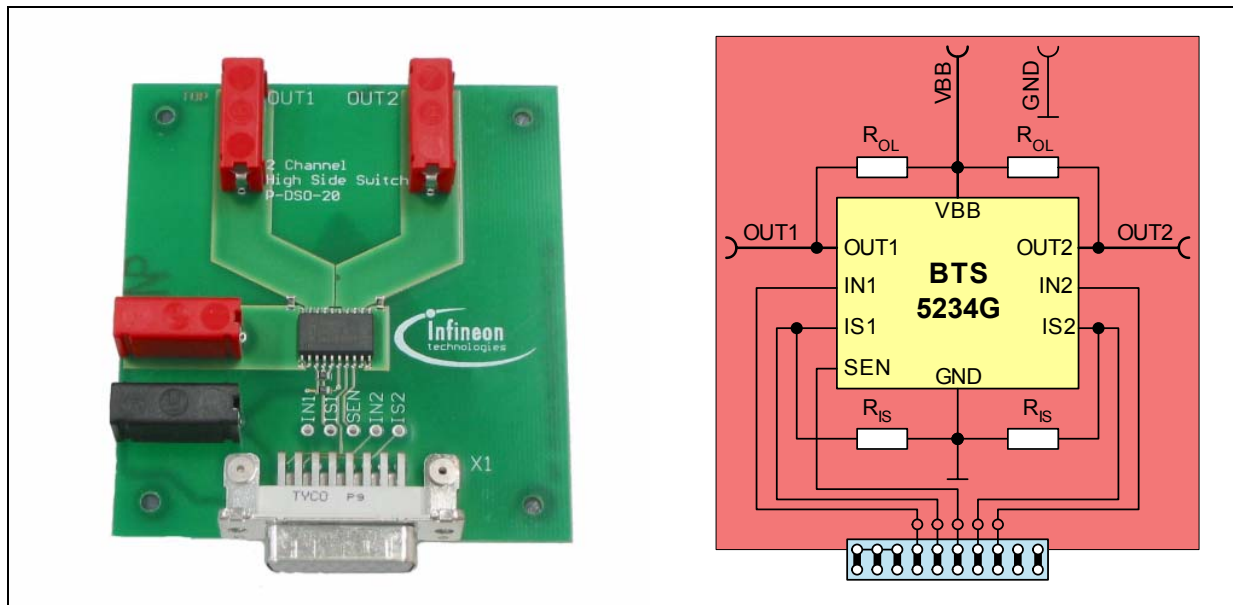


Figure 2 P-DSO-20 Board

1.2.2 Connectors and Plugs

Control Board Connector X1

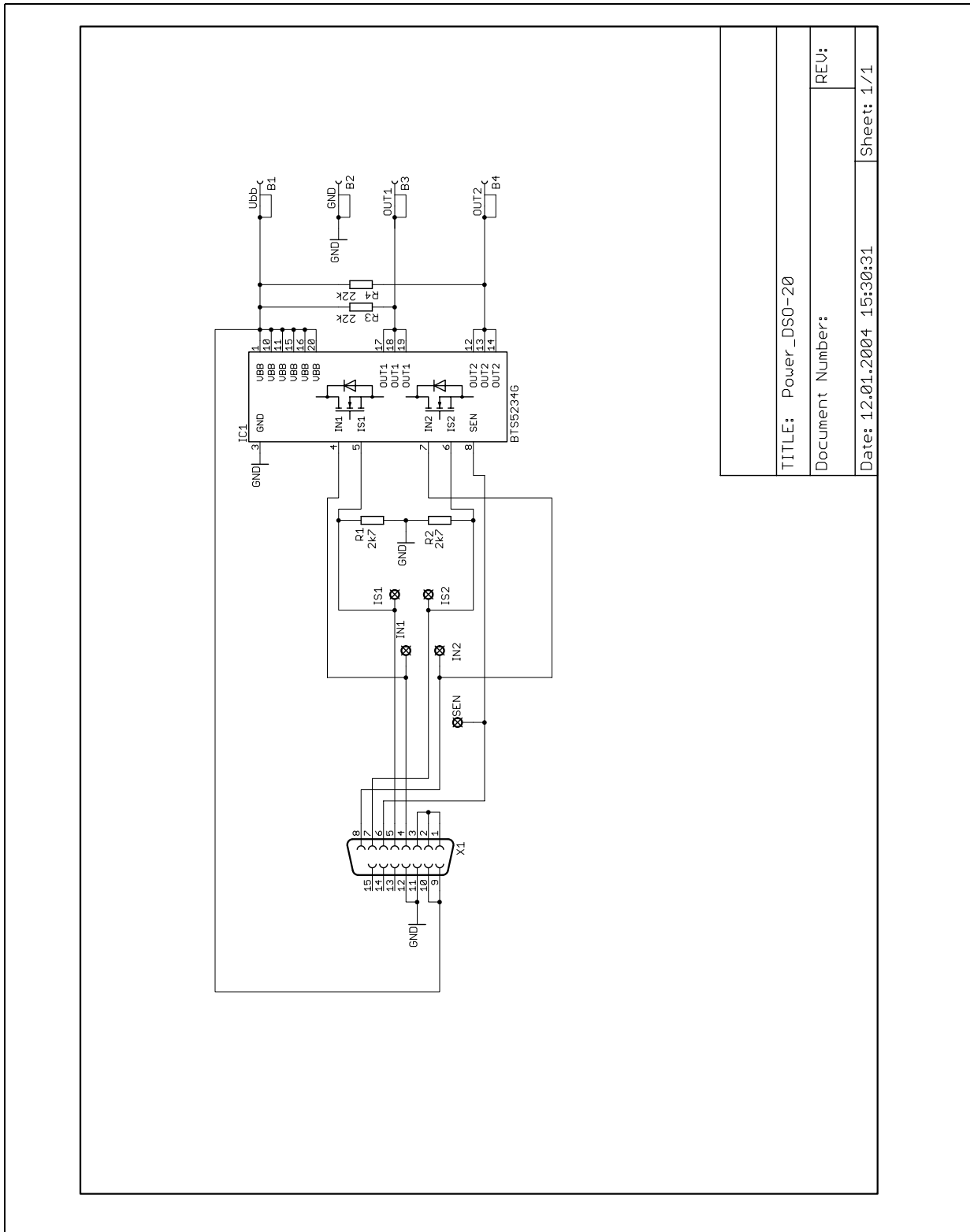
Pin	Description
1	short circuited to provide P-DSO-20 Board detection
2	
3	
4	IN channel 1
5	current sense channel 1
6	SEN channel 1/2
7	current sense channel 2
8	IN channel 2

Pin	Description
9	V _{bb}
10	
11	Ground
12	
13	nc
14	nc
15	nc

Power Plugs

Plug	Description
GND	Logic Ground connection for BTS 5234G, also power supply for Control Board
VBB	VBB connection for BTS 5234G, also power supply for Control Board
OUT1	Output 1 of BTS 5234G to connect grounded load
OUT2	Output 2 of BTS 5234G to connect grounded load

1.2.3 Circuit Diagram



1.3 P-DSO-14 Board

The P-DSO-14 Board is equipped with two BTS 5230GS in P-DSO-14 package. Four channels with 10 W bulbs each are the focus application for that device.

1.3.1 Technical Data of BTS 5230GS

Operating Voltage	$V_{bb(ON)}$	4.5 V .. 28 V
On-state Resistance	R_{ON}	140 m Ω per channel
Nominal load current	$I_{L(nom)}$	(all channels active) 1.5 A per channel
	continuous	
Current limitation	$I_{L(LIM)}$	8 A
	$I_{L(SCr)}$	2 A
Package		P-DSO-14

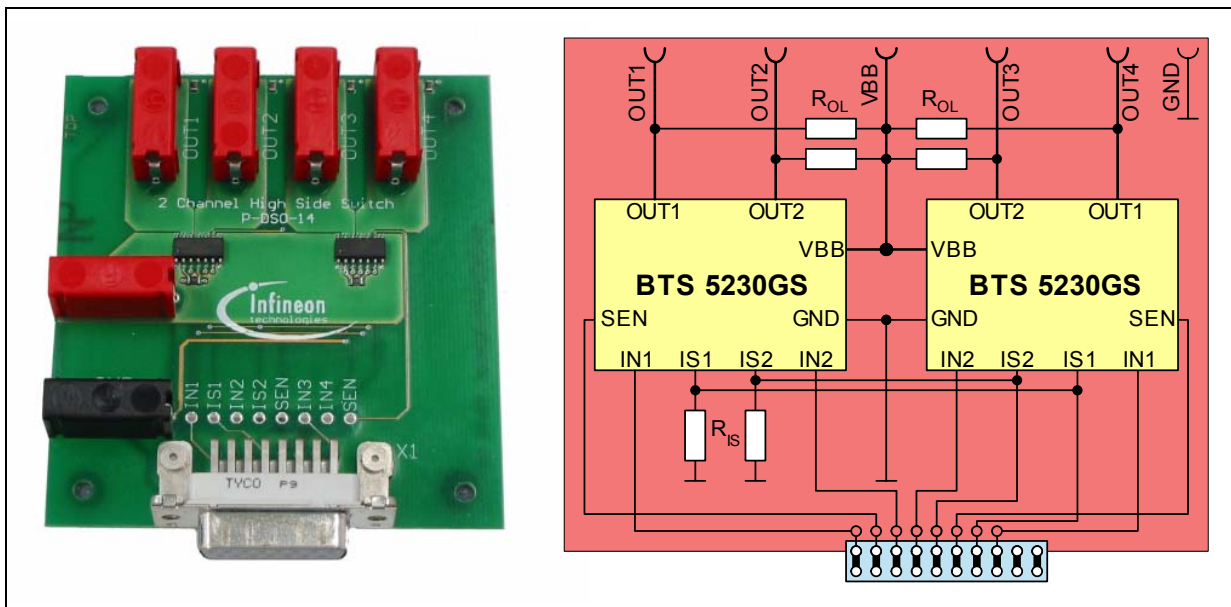


Figure 3 P-DSO-14 Board

1.3.2 Connectors and Plugs

Control Board Connector X1

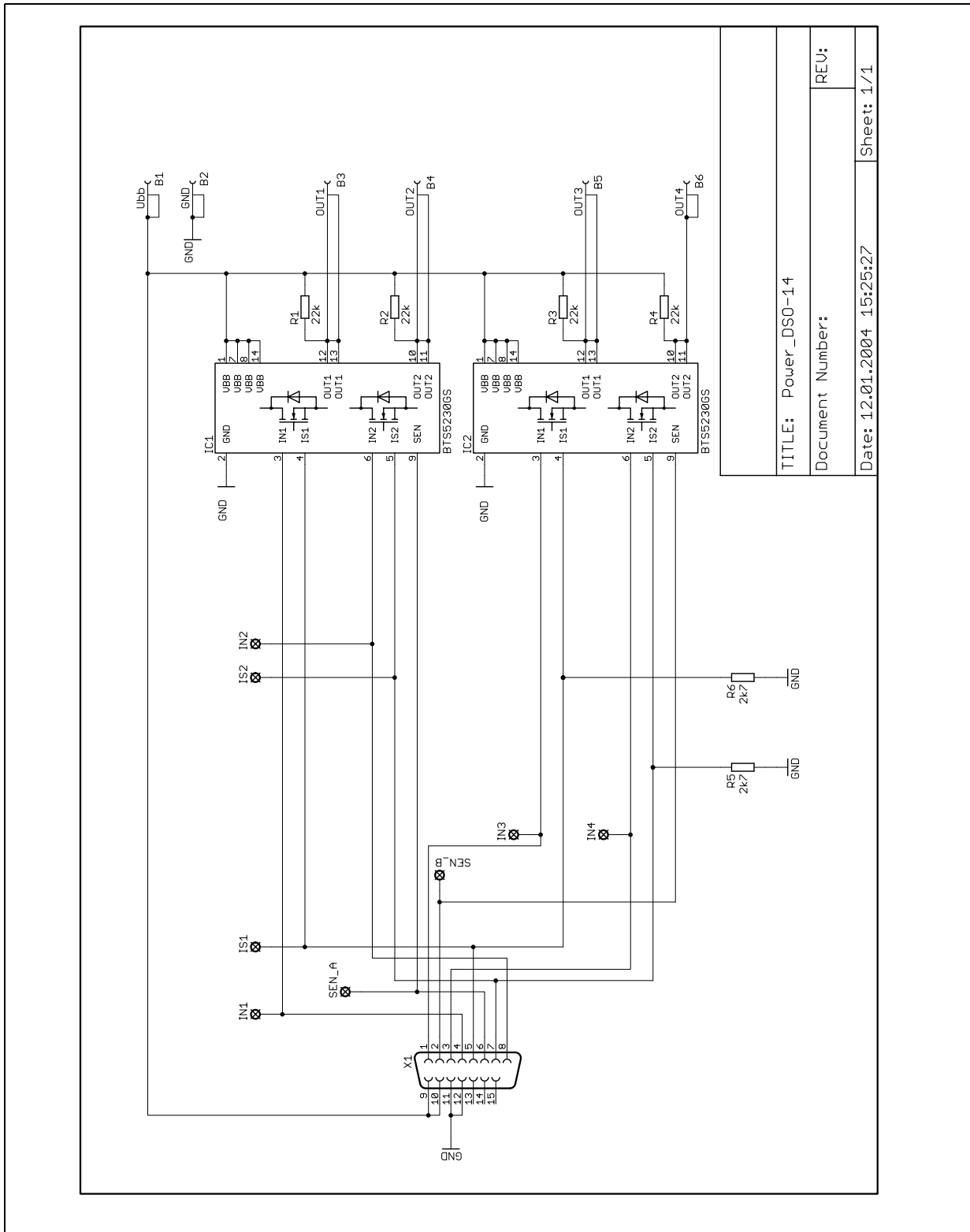
Pin	Description
1	IN channel 1 IC2
2	SEN channel 1/2 IC2
3	IN channel 2 IC2
4	IN channel 1 IC1
5	current sense channel 1
6	CLA channel 1/2 IC1
7	current sense channel 2
8	IN channel 2 IC1

Pin	Description
9	V _{bb}
10	
11	Ground
12	
13	nc
14	nc
15	nc

Power Plugs

Plug	Description
GND	Logic Ground connection for BTS 5230GS, also power supply for Control Board
VBB	VBB connection for BTS 5230GS, also power supply for Control Board
OUT1	Output 1 of BTS 5230GS (IC1) to connect grounded load
OUT2	Output 2 of BTS 5230GS (IC1) to connect grounded load
OUT3	Output 1 of BTS 5230GS (IC2) to connect grounded load
OUT4	Output 2 of BTS 5230GS (IC2) to connect grounded load

1.3.3 Circuit Diagram



1.4 Power HIC Board

The Power HIC Board is equipped with two BTS 6143D high current PROFET in TO-252 (DPAK) package. As standard application low beam and high beam with 55 W / 60 W can be handled by that high side switch.

1.4.1 Technical Data of BTS 6143D

Operating Voltage	$V_{bb(ON)}$	5.5 V .. 38 V	
On-state Resistance	R_{ON}	10 m Ω	
Nominal load current ¹⁾	$I_{L(nom)}$	continuous	6.8 A
		blinking (50% duty cycle)	9.1 A
Current limitation	$I_{L12(SCr)}$	75 A	
Package		TO-252 (DPAK)	

¹⁾ Power dissipation $P_{tot} = 1$ W

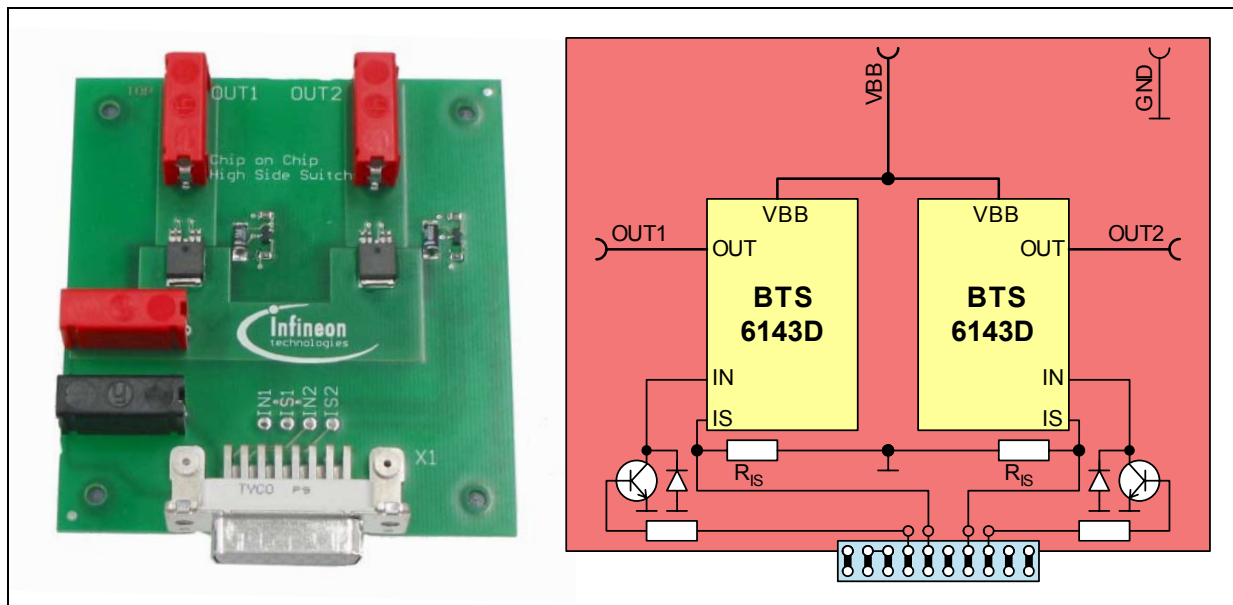


Figure 4 Power HIC Board

1.4.2 Connectors and Plugs

Control Board Connector X1

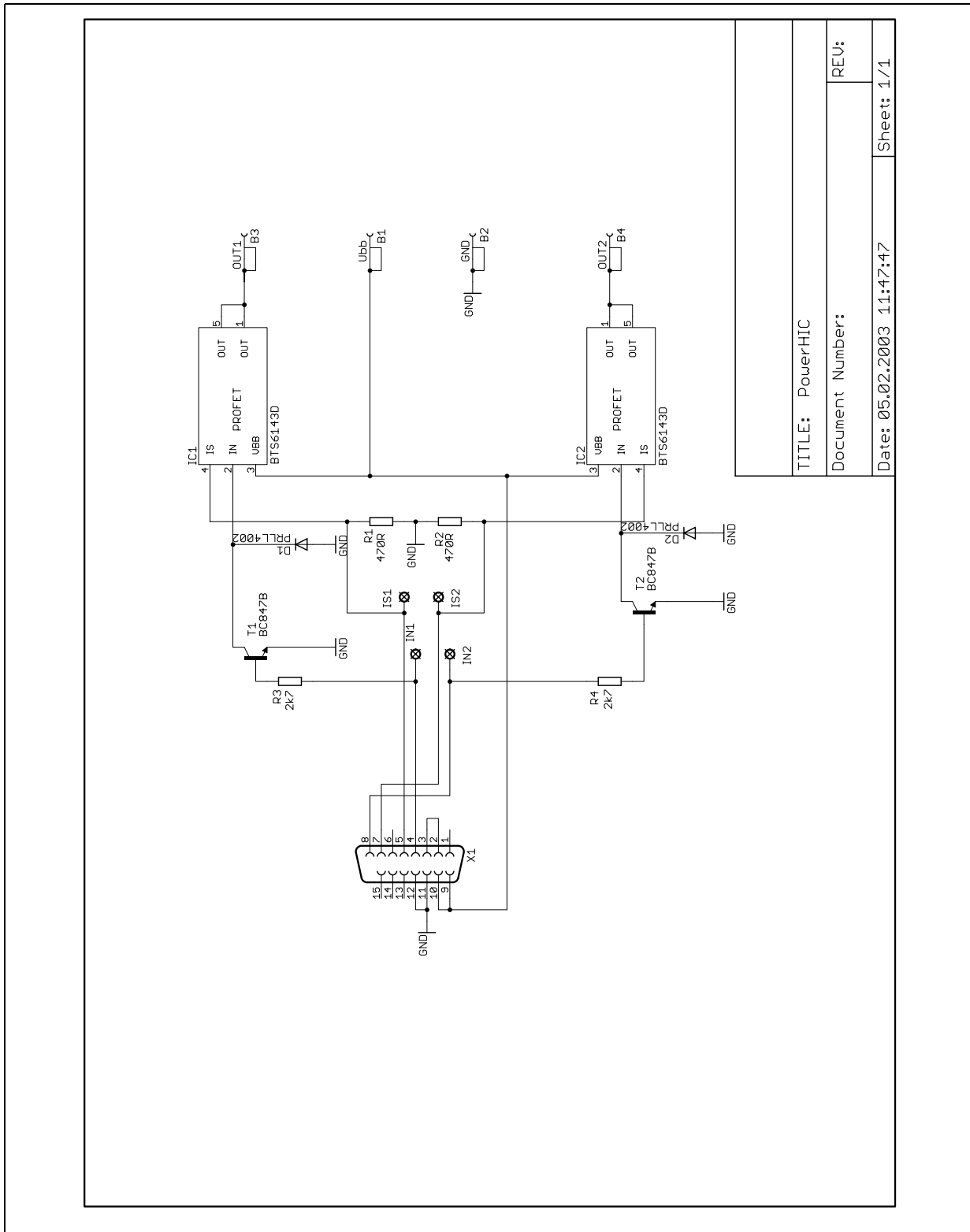
Pin	Description
1	nc
2	short circuited to provide Power HIC Board detection
3	
4	IN channel 1
5	current sense channel 1
6	nc
7	current sense channel 2
8	IN channel 2

Pin	Description
9	V _{bb}
10	
11	Ground
12	
13	nc
14	nc
15	nc

Power Plugs

Plug	Description
GND	Logic Ground connection for BTS 6143D, also power supply for Control Board
VBB	VBB connection for BTS 6143D, also power supply for Control Board
OUT1	Output of first BTS 6143D to connect grounded load
OUT2	Output of second BTS 6143D to connect grounded load

1.4.3 Circuit Diagram



1.5 Control Board

The control board is equipped with a C868BA μ C. It is built to be reverse polarity protected. The software is stored in an EEPROM and downloaded via RS232 serial interface. The power boards are directly connected to the control board.

1.5.1 Technical Data of Control Board

Operating Voltage	4 V .. 36 V
EEPROM (AT 25LC640)	8 kilobyte
Power Supply (TLE 4266-2GS V33)	3.3 V
Micro Controller (C868BA)	C800 based 8 bit, 3.3 V

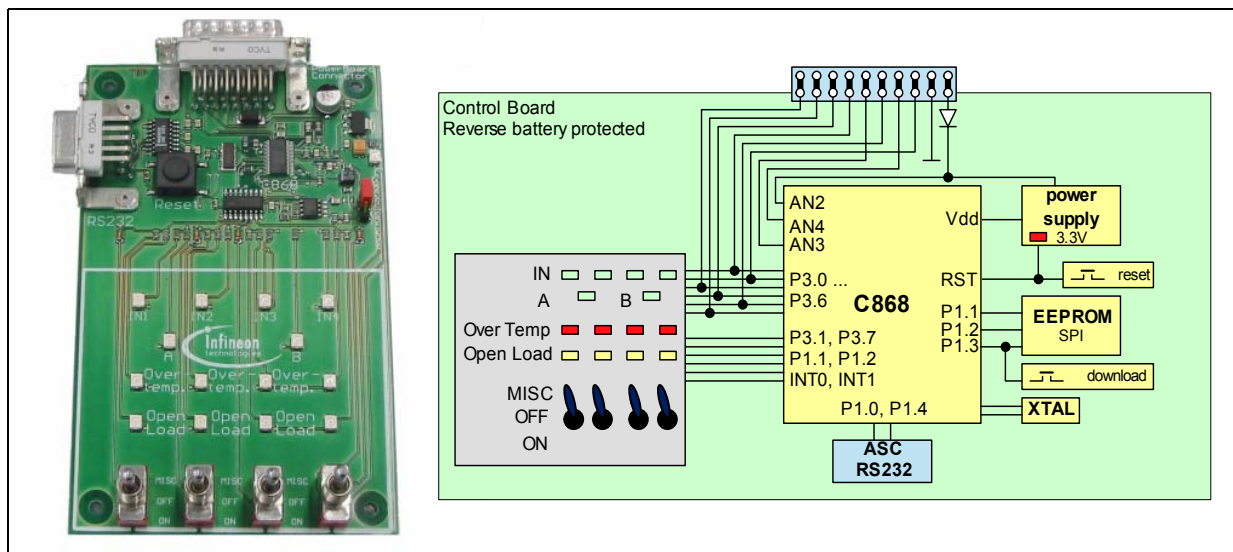


Figure 5 Control Board

1.5.2 Connectors and Plugs

Power Board Connector X2

Pin	Description
1	C868: P3.4
2	C868: P3.5
3	C868: P3.6
4	C868: P3.0
5	C868: AN3
6	C868: P3.3
7	C868: AN4
8	C868: P3.2

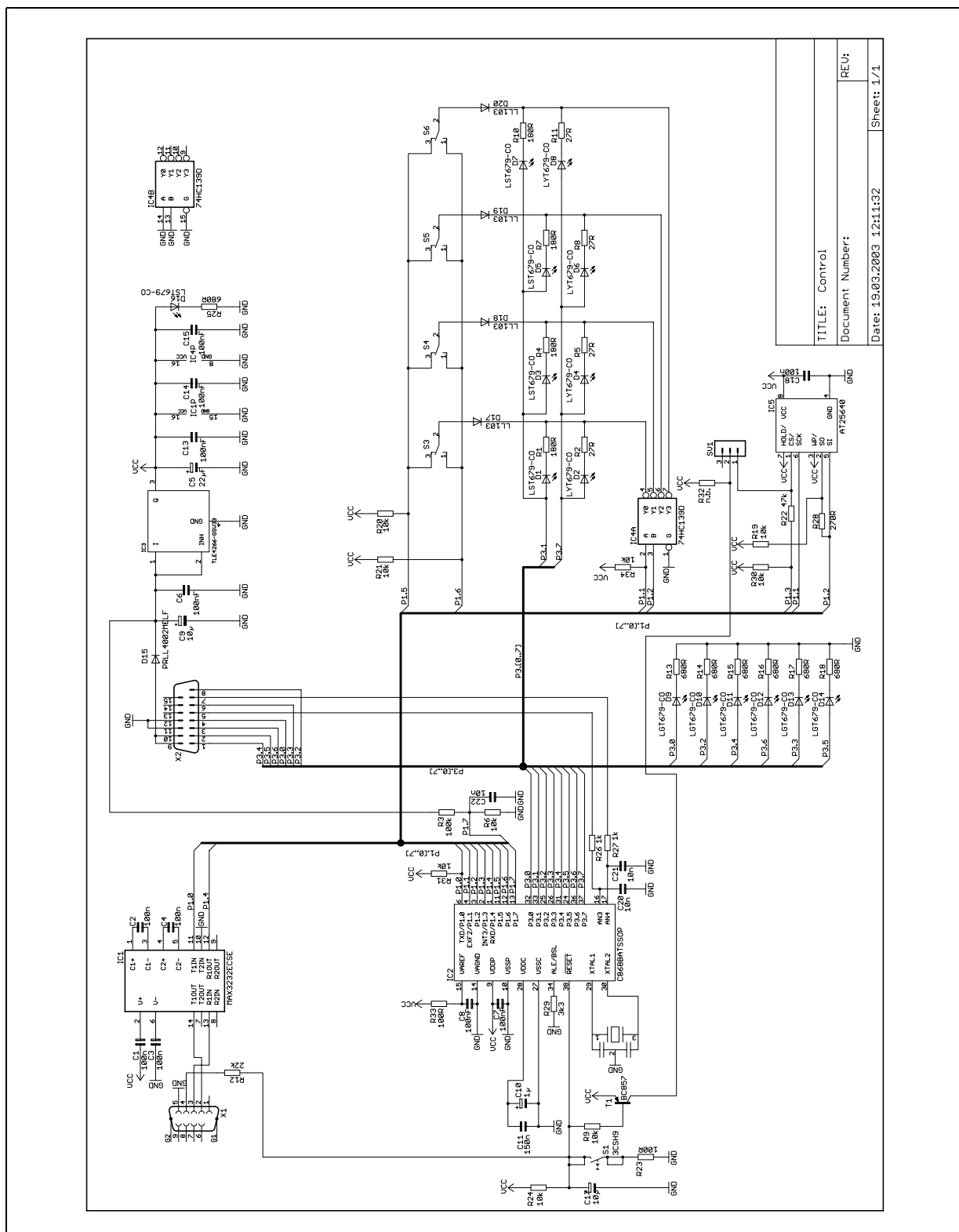
Pin	Description
9	V _{bb}
10	
11	Ground
12	
13	nc
14	nc
15	nc

RS232 Connector X1

Pin	Description
1	nc
2	TXD of C868
3	RXD of C868
4	connected to reset C868 via 22 kΩ resistor
5	GND

Pin	Description
6	nc
7	nc
8	nc
9	nc

1.5.3 Circuit Diagram



2 Software Description

The Profet Demo Kit is shipped including following firmware.

2.1 Main Function

When a switch (S1 .. S4) is switched to ON position, the according channel is switched on by performing V_{bb} dependent PWM. When a switch is switched to MISC position, the according channel is blinking.

The firmware detects the connected power board. The included firmware uses this information to set up different thresholds for diagnosis purpose.

2.2 Details on Firmware Modules

2.2.1 Diagnosis

Diagnosis is performed about every 10 ms. According to the IS signal in combination with IN signal, the diagnosis result is given to the diagnosis LEDs. This means in detail:

board name	LEDs	normal operation	over temp	open load	low load	open load
IN signal			1 (ON)			0 (OFF)
Power SO-12	OT	0	1		0	0
	OL	0	1		1	1
Power DSO-20	OT	0	1		0	0
	OL	0	1		1	1
Power DSO-14	OT	0	1		0	0
	OL	0	1		1	1
Power HIC	OT	0	1	0	-	-
	OL	0	0	1	-	-

The sense enable function is used for all types of power boards, even when not necessary for the two channel boards.

2.2.2 Low Load: Blink Double Speed

In case of low load, the blink frequency is doubled. Low load detection is working at V_{bb} range of 7 V to 17 V.

board name	normal load per channel	low load per channel	open load
Power SO-12	21 W + 21 W + 5 W	< 21 W + 21 W / 2 + 5 W	< 100 mA
Power DSO-20	21 W (or 27 W)	< 11 W	< 50 mA
Power DSO-14	10 W	< 4.5 W	< 50 mA
Power HIC	55 W	-	< 200 mA

Double speed blinking is performed on the affected channel only.

2.2.3 V_{bb} Dependent PWM

Depending on power supply voltage V_{bb} the channels are PWMed. The PWM frequency is 100 Hz. The duty cycle DC is adjusted in that way that the nominal luminance of the normal loads is ensured for V_{bb} greater than 13.5 V. The nominal luminance is given at 13.5 V. The relation between V_{bb} and DC is not calculated in real time, but stored in a table.

All channels are PWMed synchronously.

3 Download Software

The C868 Loader provides an easy way to download software files in intel hex format to the C868 SRAM or via a special routine to the EEPROM via SPI.

When SRAM is selected, the hex-file is loaded into the SRAM memory area and executed immediately. This enables a quick testing of C868 programs.

For a download to the EEPROM, at first, the hex-file is loaded to the SRAM memory area. After that, a post loader routine is loaded to the XRAM memory area automatically. After execution in XRAM, the post loader will transfer the bytes stored in SRAM to the EEPROM. To make sure, download has been successful, there is no automatic reset of the device.

3.1 Download Procedure

The C868 Loader can be seen in following figure.

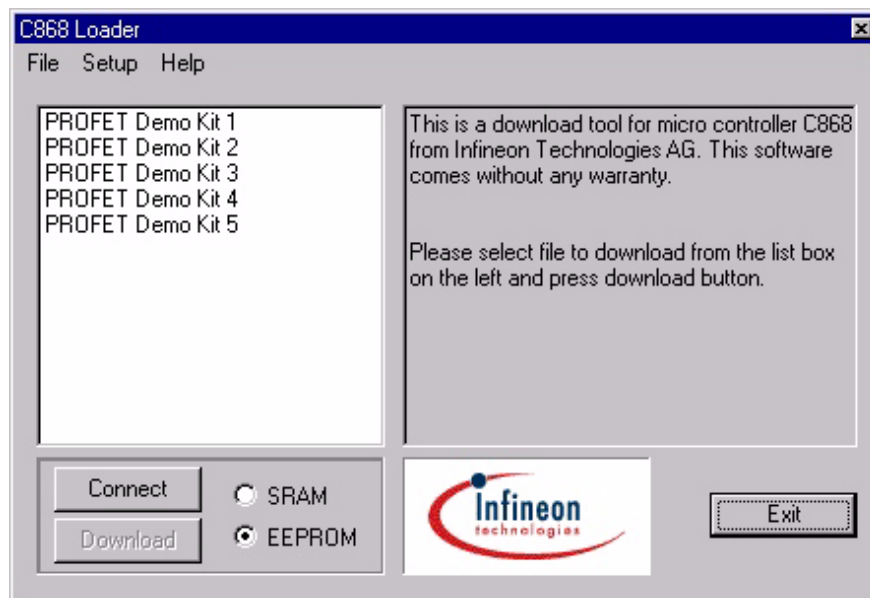


Figure 6 C868 Load Software

To download a hex file from the software list, following steps have to be made:

1. set jumper in position download
2. select destination and desired entry in software list box
3. double click entry or press button "download"
4. the button will vanish and a progress bar appears.¹⁾ The progress bar shows the current address of byte transfer to the memory. As a result, the progress bar does not necessarily show a continuous status. This depends on the structure of the hex-file.

¹⁾ please watch out for any alert that might show problems during communication

5. after download has been finished, the progress bar is replaced by the download button again. The loader keeps the target system connected.
6. when destination EEPROM was chosen, set jumper in position normal and cycle button "Disconnect", "Connect".

The software list box shows all files with extension ".hex". It is filled at program startup only. When there is a file with the same filename but extension ".txt", a description is shown as soon as the entry is selected in the software list box.

3.2 Using DTR Line as Reset Signal

The DTR handshake line is used to reset the micro controller. The button "Connect" provides a mechanism to change the level of that handshake line.

- Button shows "Connect": The level at DTR is -12 V or high impedance¹⁾
- Button shows "Disconnect": The level at DTR is +12 V, system is running

During Download, the DTR line is handled automatically. It is set to -12 V for about 200 ms. After that, the level is raised to +12 V and the system waits about 200 ms again to ensure that the hardware did setup all other levels. Now download begins. After download has been finished, the loader changes to connect state automatically.

When automatic reset handling should be disabled, resistor R12 has to be removed.

3.3 Setup Dialog

To enable utilization of the C868 loader with many hardware platforms, the baud rate and the communication port can be selected with the setup dialog.

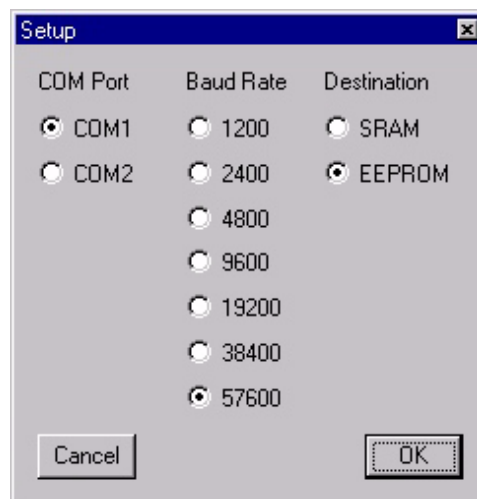


Figure 7 Setup Dialog

¹⁾ This depends on the hardware built into your computer

Download Software

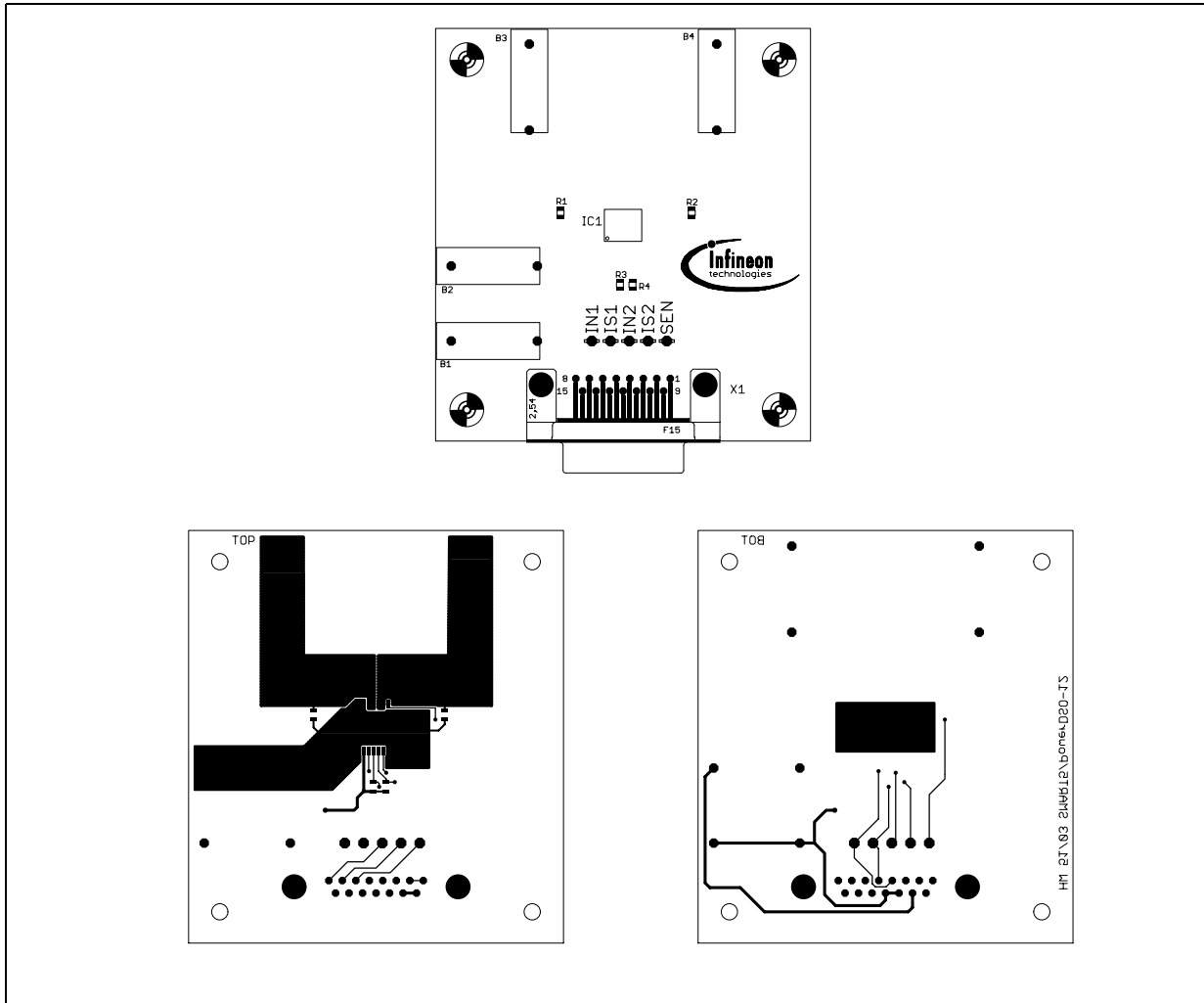
The supported communication ports are COM1 and COM2, which are opened at download or during running system (button shows "Disconnect"). When system is not running (disconnected) and no download is performed, the communication port is closed and can be used by other software.

The baud rate can be selected from 1200 baud to 56700 baud. Please note that there are limits for proper data transfer given by the realization of the RS232 circuits at C868 hardware platform.

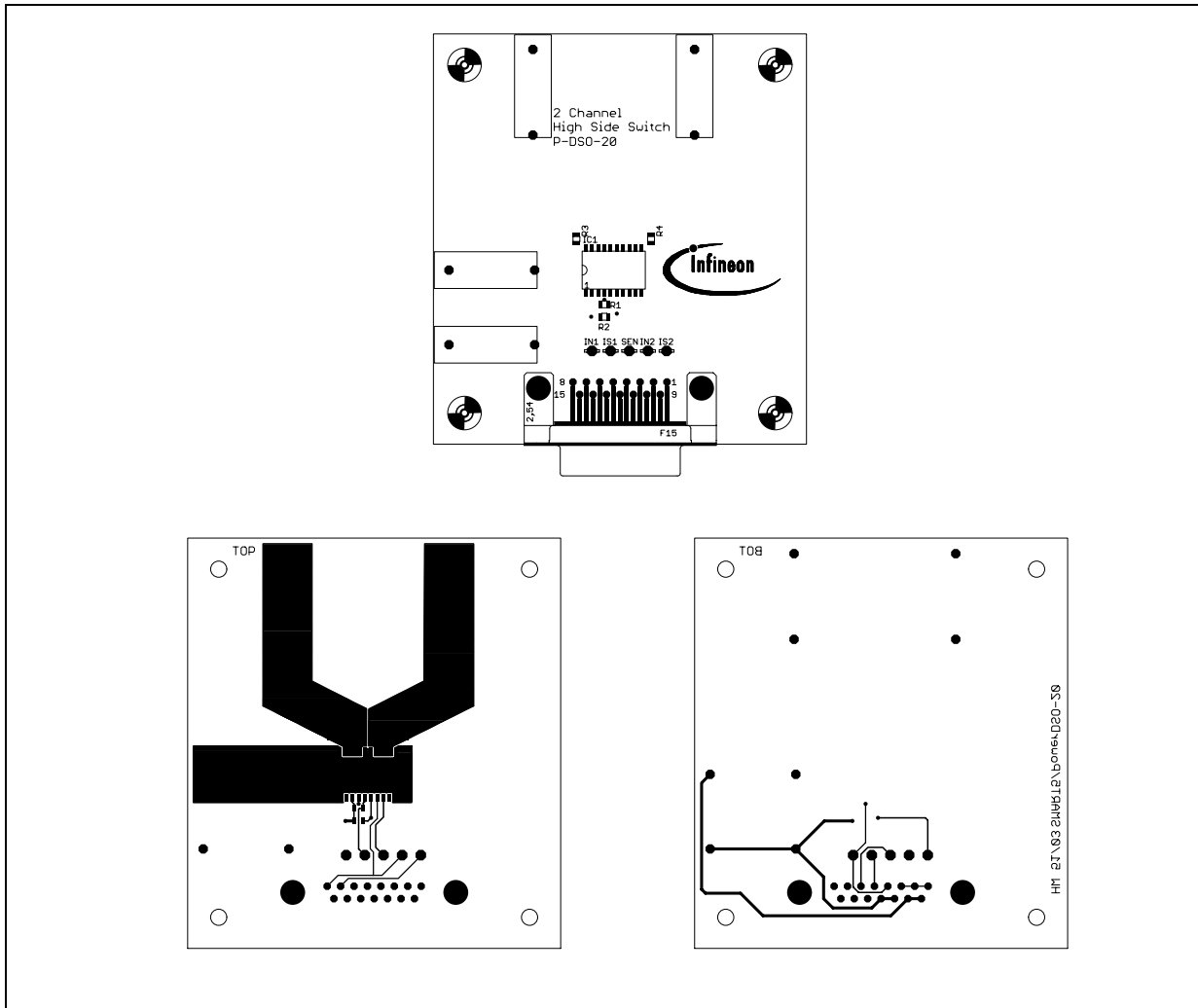
The destination selector shows the same status as the destination selector at the main window.

A Appendix

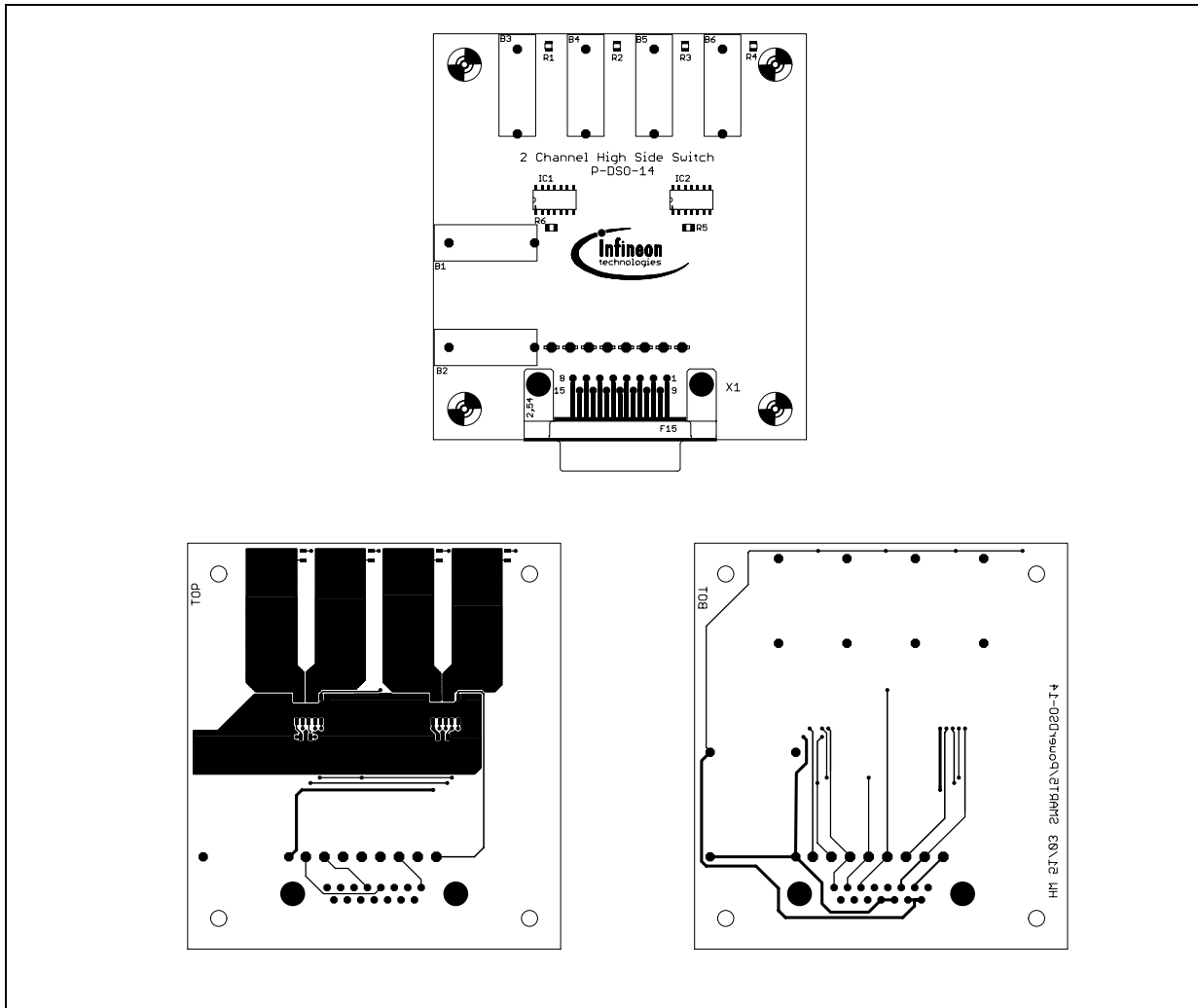
A.1 Board Layout P-DSO-12 Board



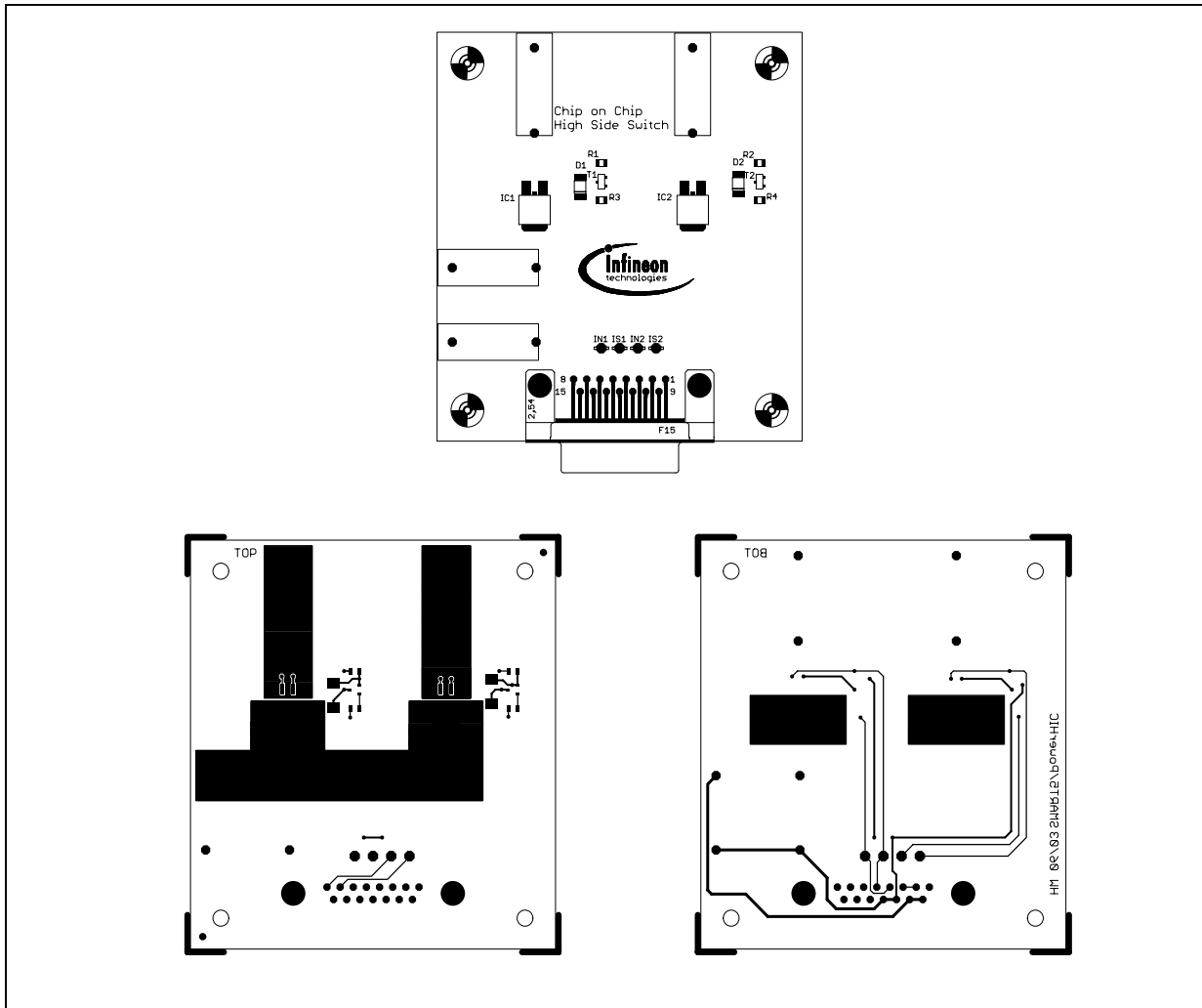
A.2 Board Layout P-DSO-20 Board



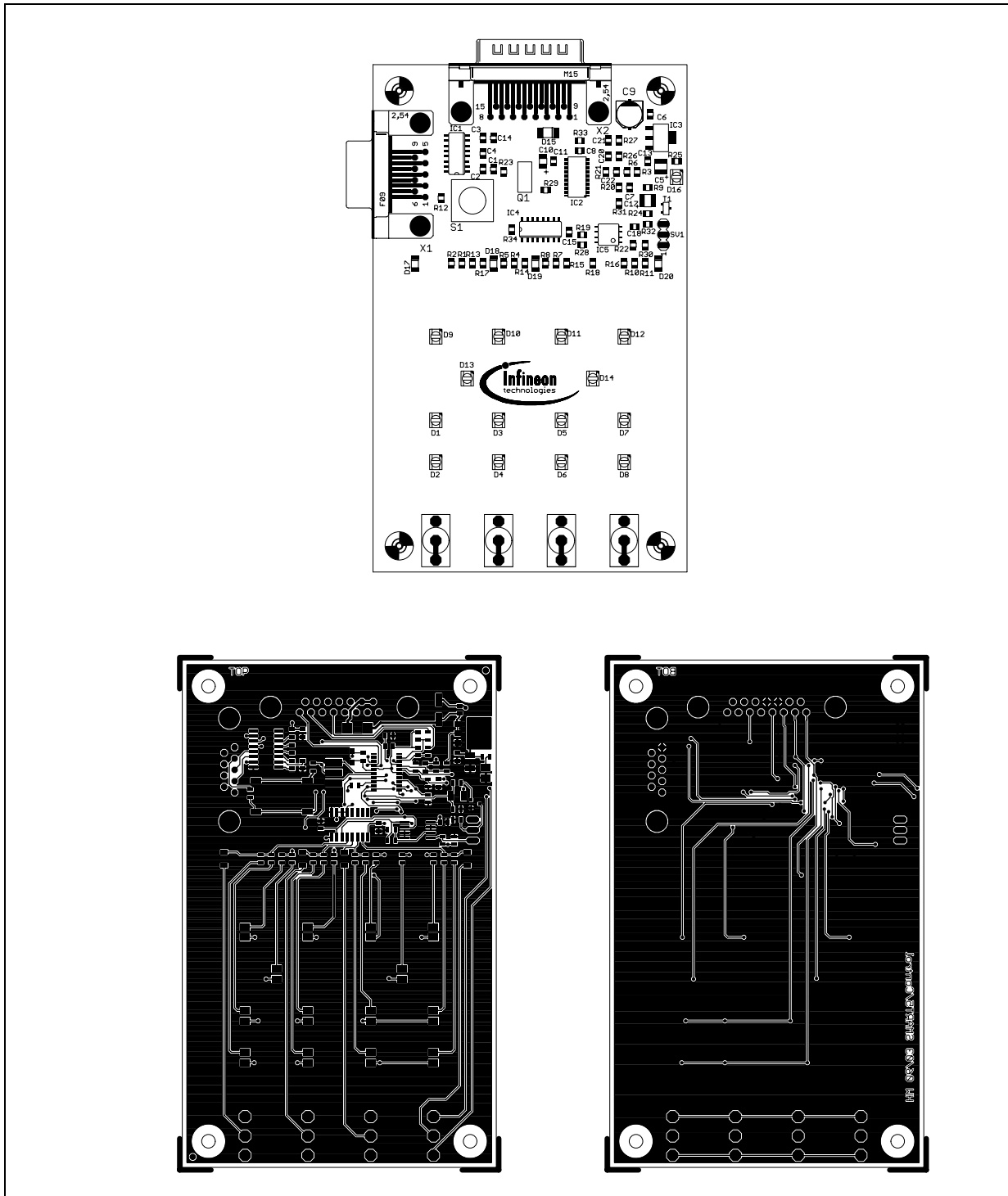
A.3 Board Layout P-DSO-14 Board



A.4 Board Layout Power HIC Board



A.5 Board Layout Control Board





**Tool Description
PROFET Demo Kit**

Download Software

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