TLE7242G Evaluation Board

4 Channel Fixed Frequency Constant Current Control IC

Automotive Power

Never stop thinking.

TLE7242G Evaluation Board

Revision History: 2006-09-01 V1.0

Previous Version:

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1 Hardware Description

1.1 Packing List

The following items are included in the TLE7242G Evaluation Kit:

- Evaluation board (PCB)
- CD with documentation and software
- USB cable

1.2 Overview of the TLE7242G Evaluation Kit

This evaluation kit is designed to demonstrate the performance of the TLE7242G, a high precision 4 channel, fixed frequency, low-side constant current driver in Smart Power Technology (SPT).

The IC regulates the load current using an integrated closed loop PI current controller. When using a 0.2 Ohm external shunt the range of output current is approximately 0 to 1.2 A with a resolution of 0.78 mA.

The TLE7242G has embedded protection, diagnosis, and is programmable for specific application requirements. Diagnostic information and configuration settings are accessed via a SPI interface.

Benefit of the TLE7242G Evaluation Kit:

1. All necessary hardware and components required for an evaluation are included. Allows rapid evaluation of the TLE7242G with little time and cost investment by the customer.
2. Software can control the TLE7242G without a deep understanding of the communication protocol and SPI command structure.
3. Custom command sequences can be programmed and executed in real time. This feature can be used, for example, to sweep the solenoid current at a controlled rate for solenoid pressure versus current characterization.

1.3 Board Overview

The TLE7242G Evaluation board consists of a TLE7242G 4 Channel Fixed Frequency Constant Current Control IC, a XC164CM Microcontroller (µC) and a FT232BM (FTDI) USB-to-serial converter. All needed additional components (e.g. voltage regulators) are included to enable the user to begin evaluating the device very quickly.

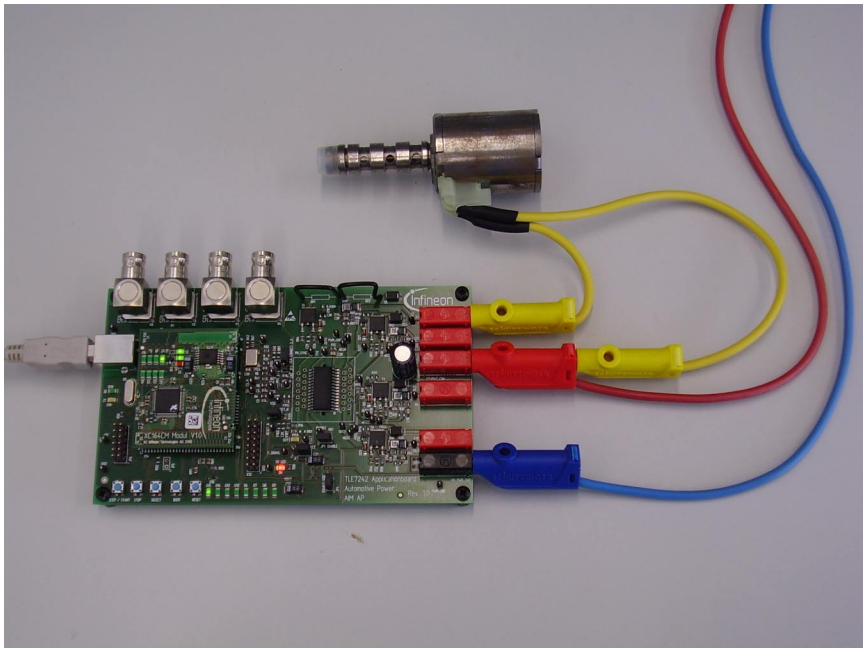


Figure 1 TLE7242G Evaluation board, top view

1.3.1 Simplified Schematic

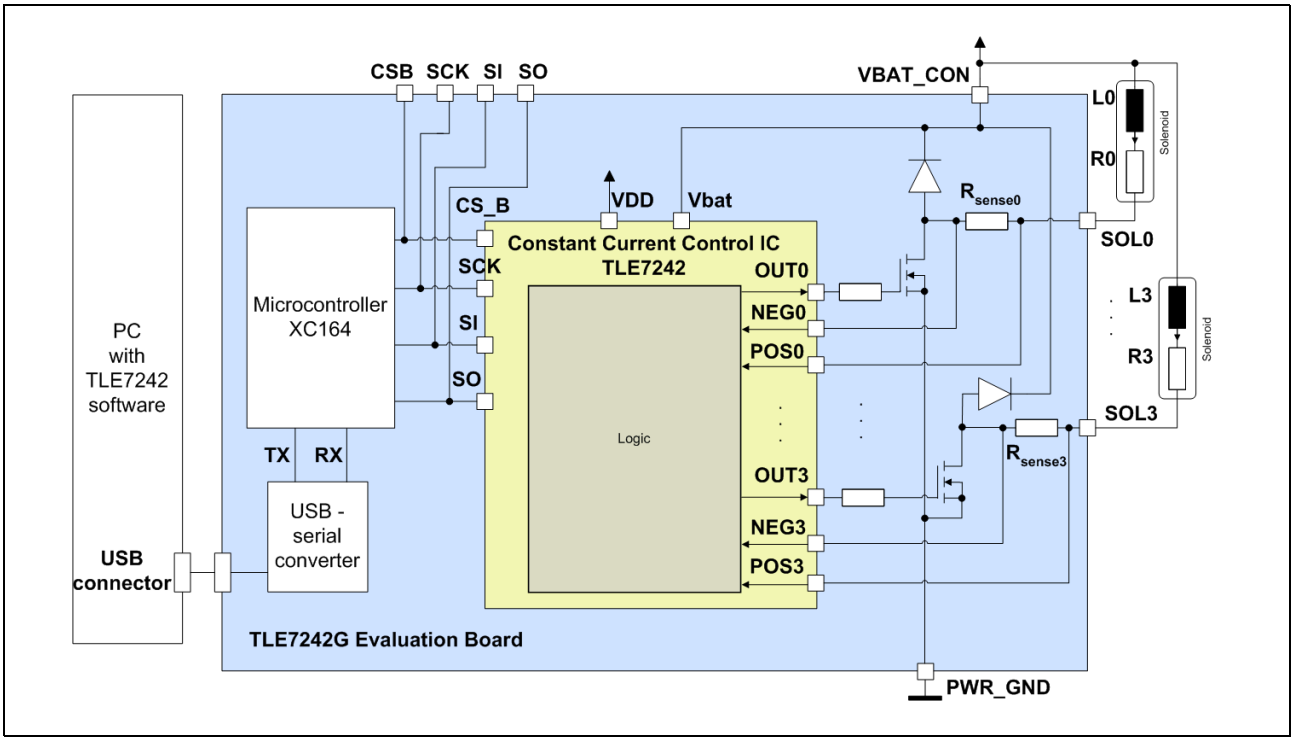


Figure 2 Simplified Schematic

1.3.2 Connectors and Plugs

Power Plugs

Plug	Description
PWR_GND	Power-GND. To avoid ground-shift via the GND wire from supply to PCB, please use the plug on the PCB as reference node for external signal sources
VBAT_CON	Power Supply voltage. Nominal 12V. Operation voltage 5.7V to 42V. Absolute Maximum Rating -42V to 42V
SOLx	Output to connect the load

USB Plug

With this plug (USB B) the communication to the personal computer (PC) is realized.

BNC Plugs

There are 4 BNC connectors on the board. An Oscilloscope can be connected to monitor the SPI commands between µC and TLE7242G. These connectors can be used also to control the TLE7242G via an external signal generator.

2 Getting Started

This section describes how to start working with the TLE7242G Evaluation board.

PC System Requirements: NT, 2000 or XP

2.1 Connecting the board

1. Supply the board

Connect a voltage source with 12V to the connectors VBAT_CON (+) and PWR_GND (-) of the board. The current consumption should be about 200mA.

2. Check jumpers

Please check the jumpers on the TLE7242G Evaluation board. JP1, JP2, JP4, JP5 (3 pin jumper, connect the 2 pins on the right) and JP7 (3 pin jumper, connect the upper 2 pins) should be mounted (closed).

If the board is properly supplied, LED D4 on the TLE7242G Evaluation board will flash. LED D9 and LED D10 will flash on the XC164CM Modul. In addition to this, LED D15 on the TLE7242G Evaluation board and LED D5 on the XC164CM Modul will blink.

3. Connect USB cable

Connect the USB cable to the USB connector on the TLE7242G Evaluation board and to the PC.

2.2 Installing PC software

2.2.1 Install driver

To enable USB communication with the board, a device driver has to be installed (FTDI USB-serial-chip).

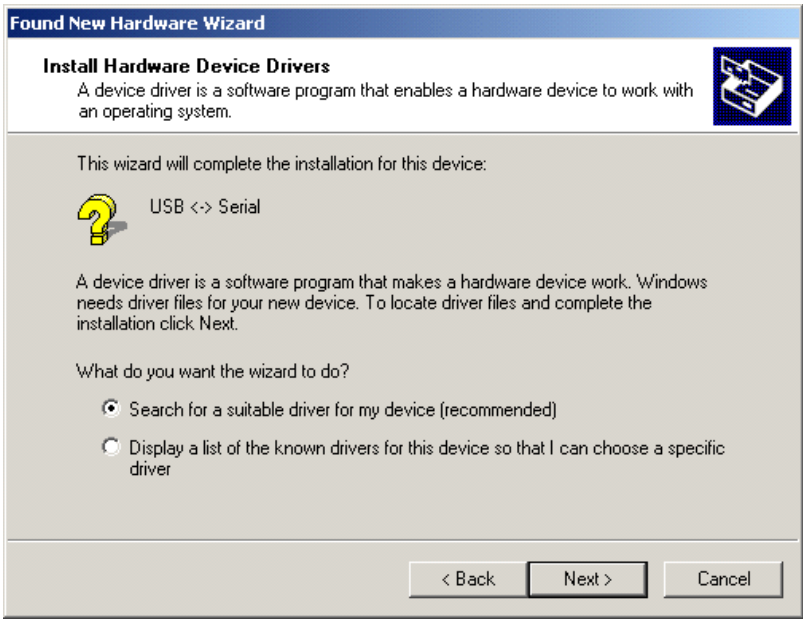
After connecting the USB cable the "Found New Hardware"- window will appear. If the window will not appear you maybe already have the USB driver installed on your PC. In this case refer to **Chapter 2.2.2**.

The "Found New Hardware Wizard" starts.

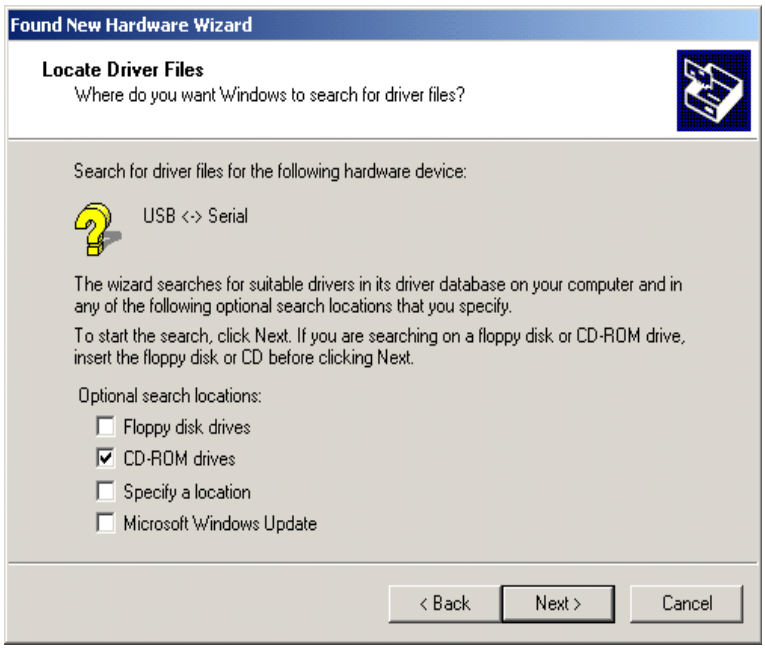
Insert the CD into the CD-ROM drive of the computer.

Click “Next”.

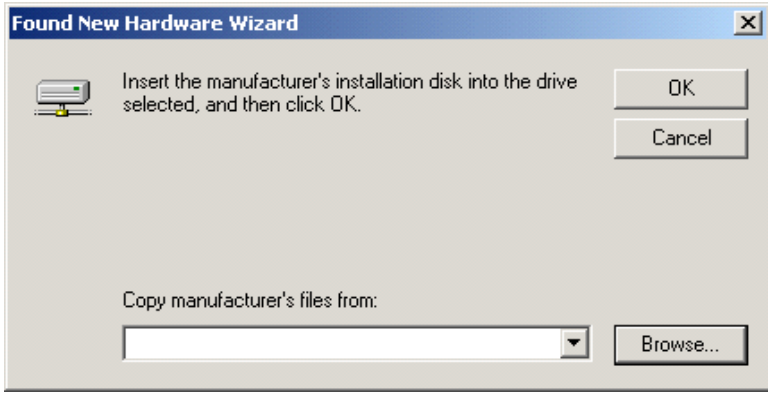
Select "Search for a suitable driver for my device (recommended)" and click "Next".



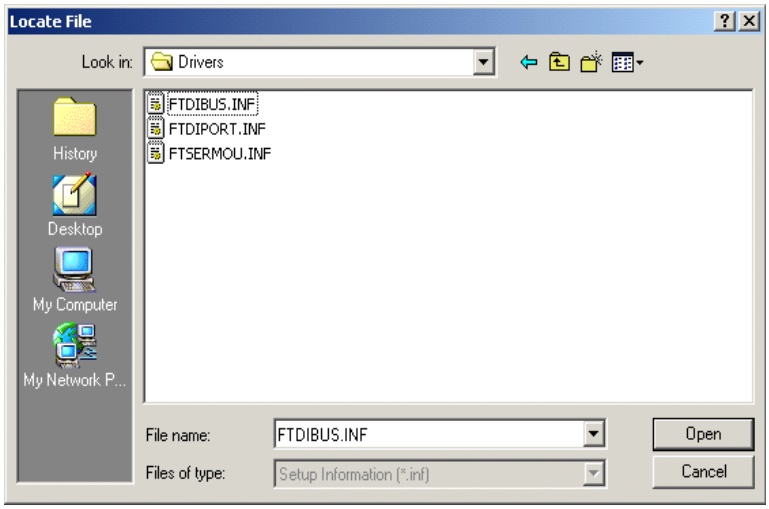
The driver files are located on the CD- ROM. Select "CD- ROM drives" and click "Next".



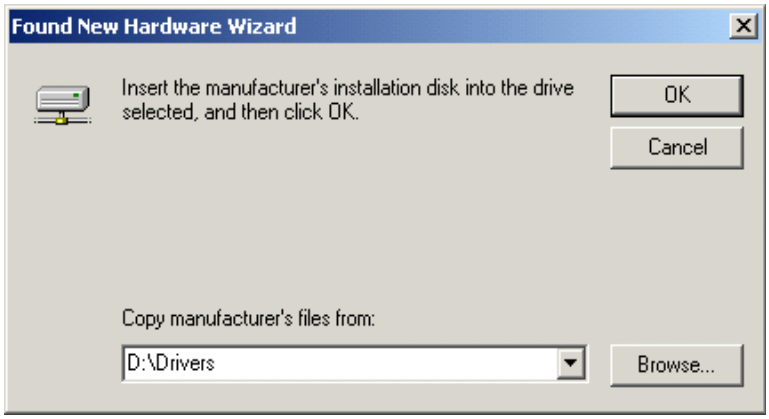
Specify the path to the driver files. Click "Browse".



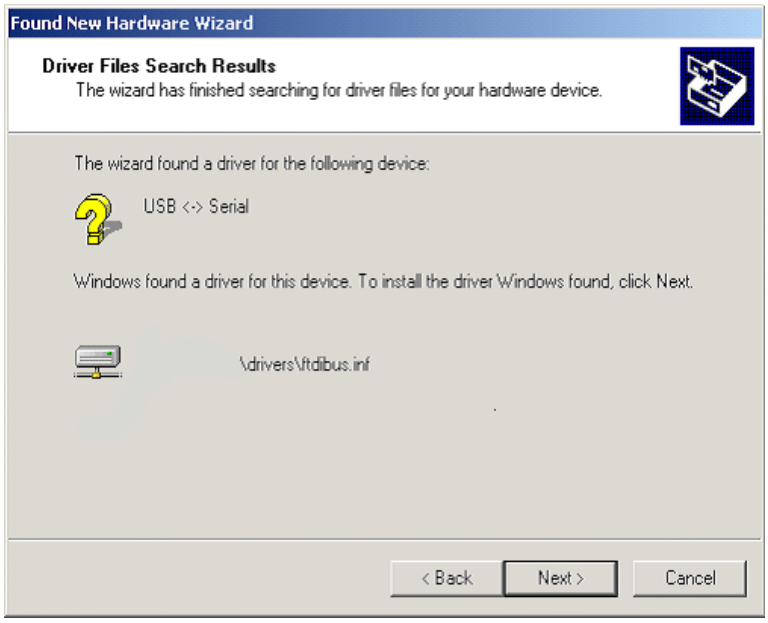
Browse to the CD-ROM directory, change to the directory “drivers” and click “Open”.



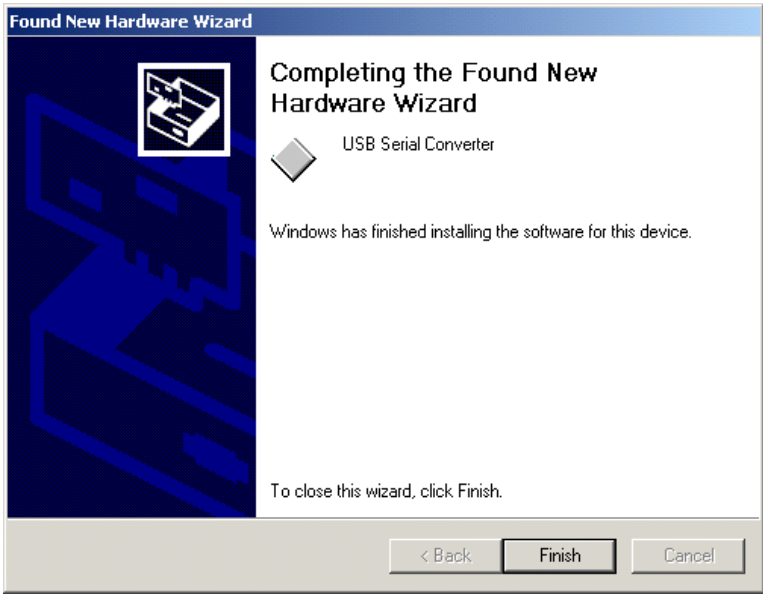
Click “OK”.



Click “Next”.



Click “Finish”.



A second installation window opens, please proceed in the same way as shown above (**Chapter 2.2.1**).

2.2.2 Install software

The TLE7242G Evaluation Board is intended to be used in conjunction with the PC-software “Infineon TLE7242_SPI_2_4”. Current version during creation of this document is 2_4. Please take a look in the file *TLE7242G_Evaluation_Kit_Revision_History.txt* to see if there is a newer software version already available. The latest software version is included on the CD.

The PC sends serial commands over a USB cable to the board. The USB-to-serial converter provides standard “RS232” signals to the µC. The µC processes the commands. It acts as SPI master, the TLE7242G as SPI slave. Diagnosis from the TLE7242G diagnosis will be received by the controller and sent back to the PC.

Installation Instructions

1. Insert the TLE7242G Evaluation Board CD into the CD-ROM drive of the computer and change to the folder: *Installer*
2. Start the file *setup.exe*
3. Follow the instructions of the setup program.

Note: Administrator permission for the PC is required for successful installation.

2.3 Starting the TLE7242G software

After installation, the software can be started via

Start -> Programs -> Infineon TLE7242_SPI -> TLE7242_SPI_2_4.

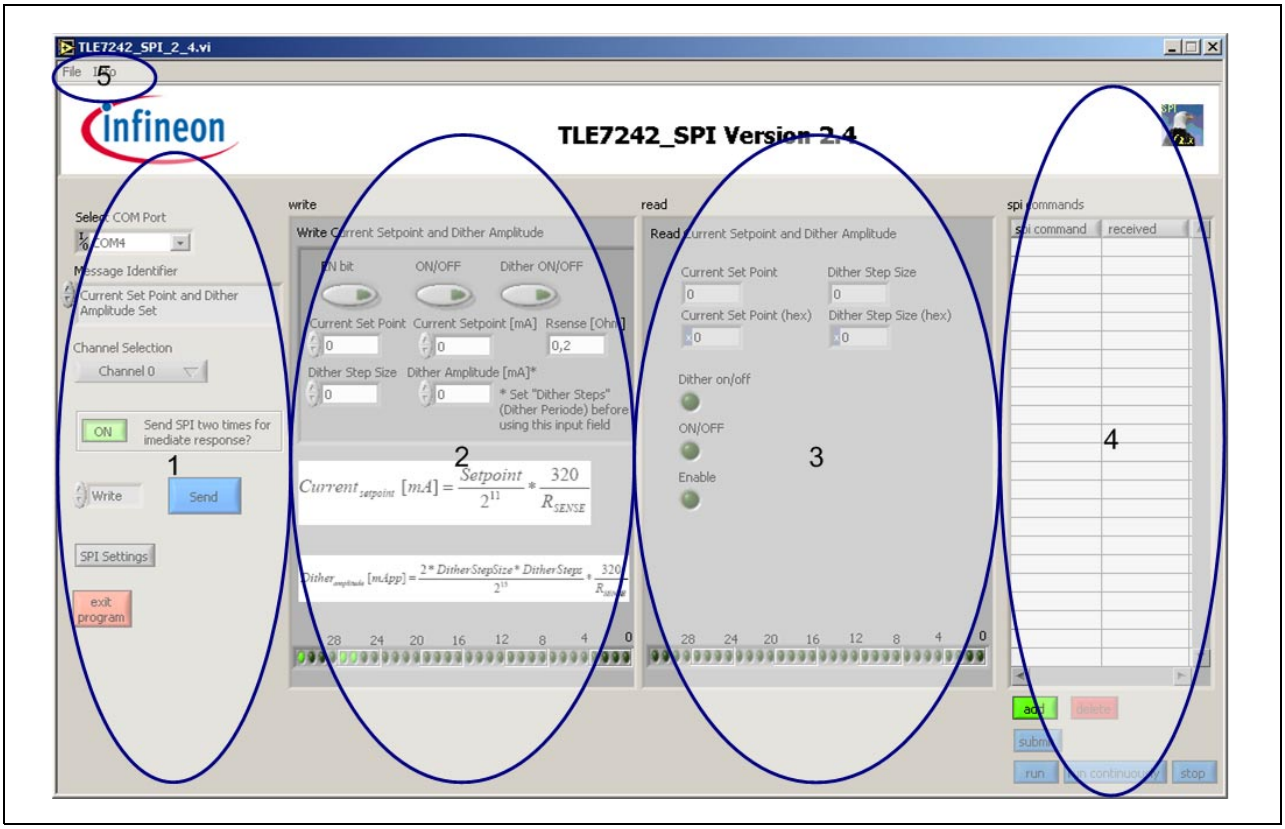
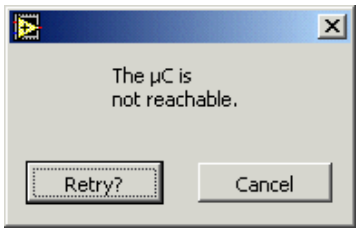


Figure 3 User interface screen

Section	Description
1	In this section the communication port can be selected, commands to send can be chosen and single commands can be transmitted
2	By changing the command in the “Message Identifier” message box in section 1, different options will be displayed. The binary indicator helps to see which SPI word will be sent by clicking on the “SEND” button
3	After sending a command, the received diagnosis will be shown in this section

Section	Description
4	In this section sequences of commands can be created, submitted to the controller and the received diagnosis can be observed. A sequence will be started by clicking the “Run” or the “Run Continuously” button
5	In this section the actual sequence can be saved and previous stored sequence can be loaded. Also some program information is available in this section

After starting the software a pop-up window similar to that one shown below can appear. Click “Cancel”.



During driver installation (**Chapter 2.2.1**) a driver was installed to create a virtual COM port on the PC. The software tries to connect to COM 4 during the first start. If the connection was not successful the pop-up window shown above will appear. The correct COM port has to be selected now:

1. Select one of the COM ports in the “Select COM Port” window in section 1.
2. Push the “SEND” button

If the software could connect to the board sucessfully the pop-up window will not appear any more and the LED D9 on the TLE7242G Evaluation board will flash (if it could not connect try another port).

Note: Within this software COM4 is sometimes called ASLR4:. Change the port for example to ASLR3: for COM3 or to ASLR5: for COM5,...

The installation is finished now. Proceed to **Chapter 3**.

Note: Connect the USB cable between the TLE7242G Evaluation Board *and the PC always before starting the PC software (the board must not be supplied). Otherwise the correct COM Port will not be visible.*

3 Application Examples

3.1 Program a load current to see the accuracy of the TLE7242G

1. Connect an ohmic and inductive load in series between the SOL0 and the VBAT_CON plug. Suggested values for R and L: R = 5Ohm, L = 10mH.
2. In section 1 the Message Identifier “Current Set Point and Dither Amplitude Set” is preselected, please do not change this setting.
3. Write “400” in the “Current Setpoint [mA]” field (section 2) to program a load current of 400mA. The sense resistor on the TLE7242G Evaluation board has a value of 200mOhm, this is also the default setting in the software (to change the sense resistorvalue in the software please refer to **Chapter 3.3**)
4. Click the “SEND” button (blue), a similar picture as shown below should appear. In section 3 the SPI response of the TLE7242G can be observed.

Note: By pushing the “SEND” button the LED D8 on the TLE7242G Evaluation board will flash for a short while.

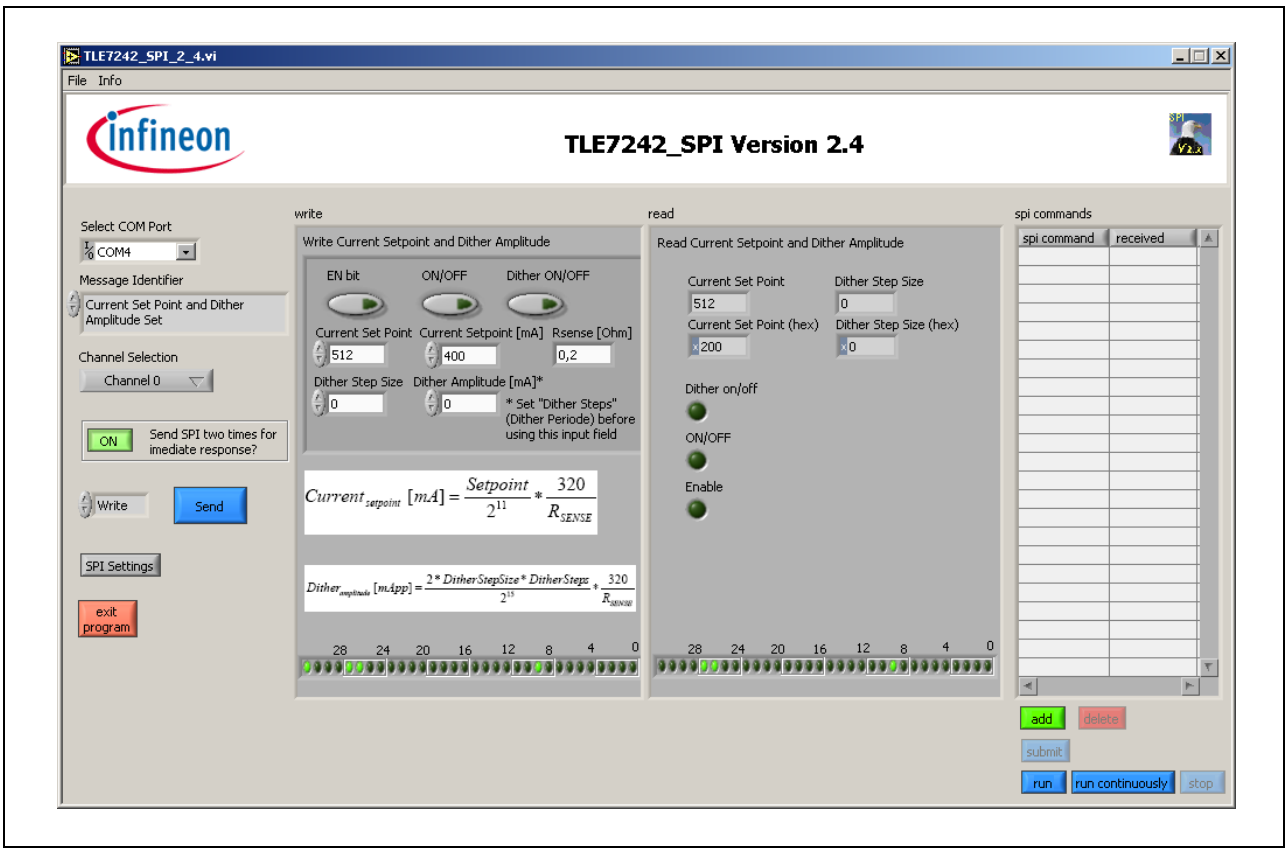


Figure 4 User Interface screen - program a load current

Observe the SPI communication signals between the µC and the TLE7242G

1. Connect an oscilloscope to the BNC connectors of the TLE7242G Evaluation board. Alternatively, a oscilloscope with voltage probes connected to the test points (CS_B, SCK, SI, SO) next to the TLE7242G device can be used.

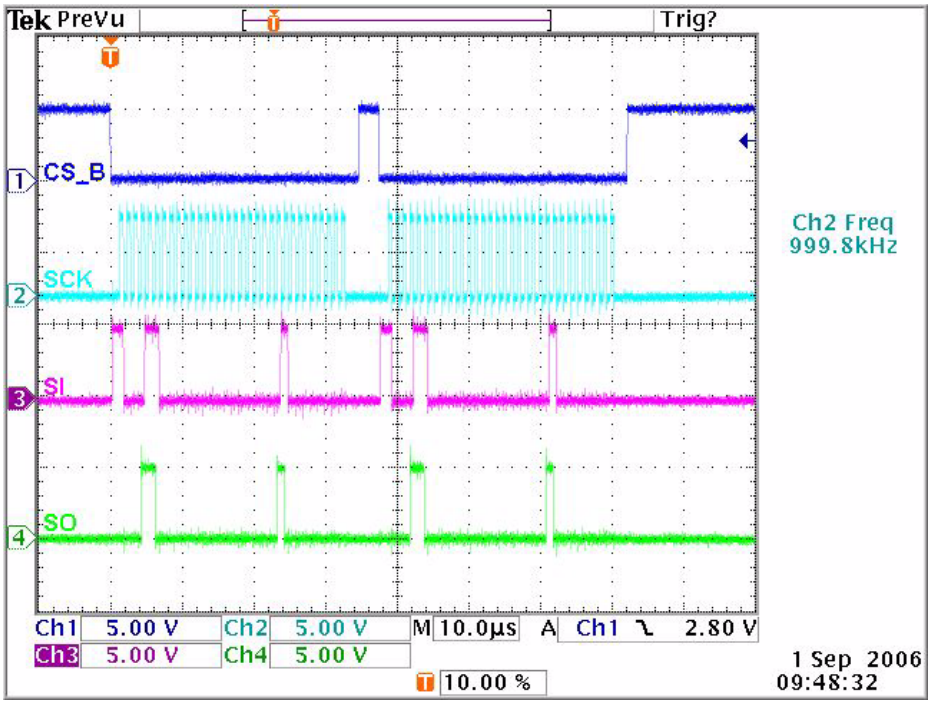


Figure 5 TLE7242G SPI communication

On the screen above it can be seen that the same command was sent two times. The µC software sends the command two times automatically.

Reason: The TLE7242G always sends the diagnosis word requested during the previous SPI command. The second SO word includes the requested diagnosis word. This diagnosis word is also displayed in the user interface of the Infineon TLE7242_SPI_2_4 software, section 3 (see **Figure 4**). In the case shown above both SO diagnosis words are the same (because the same command was sent before).

Note: This software feature can be disabled by changing the status of the "Send SPI two times for immediate response" button from "On" to "Off".

See the TLE7242G current control behavior

1. Connect an oscilloscope voltage probe to the test point SOL0 to monitor the voltage at the load
2. Connect an oscilloscope current probe to the cable connected to the load.

3. For more precise DC measurements, connect a high precision Multimeter (for example Keithley 2001) in the load current path. Such a multimeter is necessary to monitor the load current with high accurracy (0.1%).

An oscilloscope screen similar to the example below can be observed.

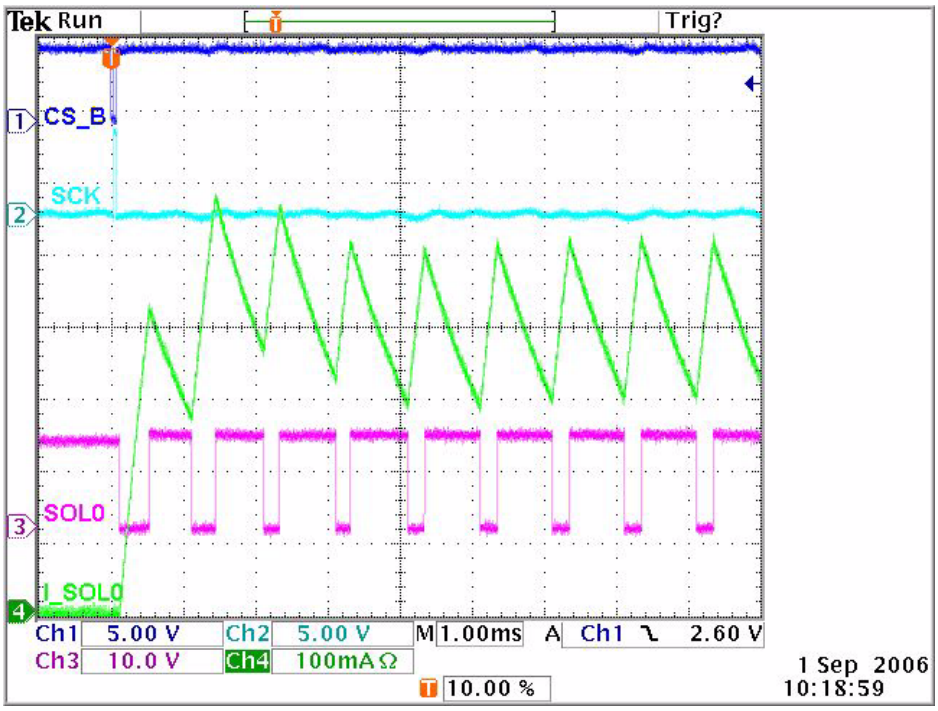


Figure 6 Current control behavior

If the same command will be sent again the current will not rise again as shown above (because the current is already programmed to 400mA).

How to reset the current to 0mA again:

- Program 0mA using the “Average current Setpoint (mA)” field or

- Push the “RESET” button on the TLE7242G Evaluation board. This causes two actions:

1. Resets the µC

Note: This action does not reset the TLE7242G

2. The µC will program a load current of 0 mA on all 4 channels automatically after coming out of a reset condition

3.2 Programming a sequence

With this software it is possible to program sequences in the memory of the µC. Custom sequences can be created by pushing the “Add” button in the TLE7242G user interface (section 4 in **Figure 3**). An example sequence can be found on the CD, how to use it see the description below:

1. Click “Sequence” and then “Load” (section 5 in **Figure 3**)
2. Browse to the folder “sequences” on the CD
3. Select the file with the name “TLE7242_step.seq” and Click “Ok”. The sequence will be loaded in section 4
4. Click “Submit” to transfer the sequence to the memory of the µC
5. Click “Run” to command the µC sending the sequence to the TLE7242G

Note: After the sequence has started, it cannot be interrupted. It must be completed before being allowed to start again.

During the sequence runs real time behavior between the µC and the TLE7242G can be assumed. After the sequence has completed, all diagnosis words stored in the memory of the µC will be sent to the PC and displayed in section 4.

To test the diagnosis disconnect the load connected at SOL0. Choose the Message Identifier “Diagnostic Read” and click “SEND”. The “Open Load on” or the “Open Load off” indicator of Channel 0 in section 3 will flash.

Note: Please do not disconnect the load during a high load current is programmed. This can cause voltage spikes on the supply line which can reset the FT232BL USB-to-serial converter. Under certain circumstances the PC software will crash by this effect.

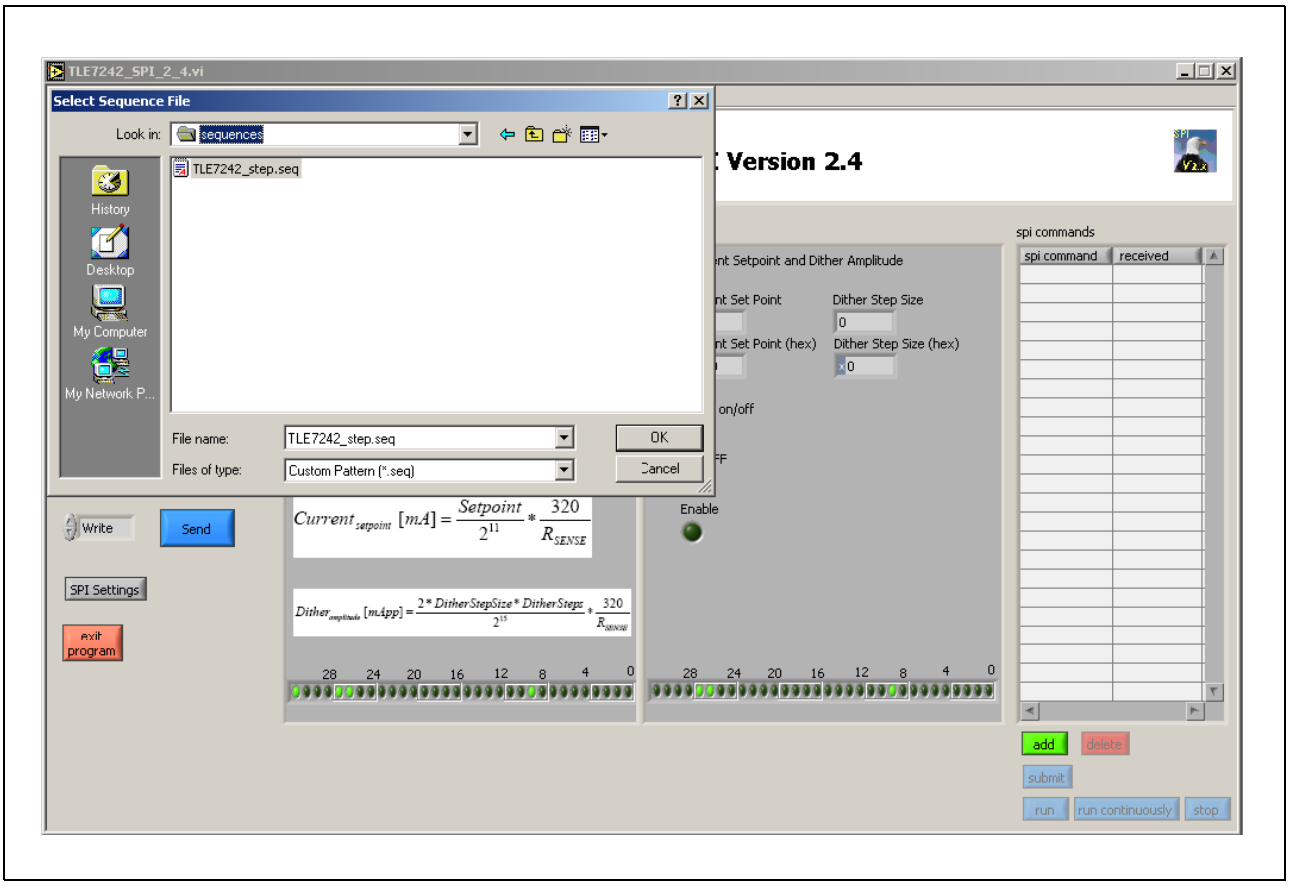


Figure 7 User interface screen - loading a sequence

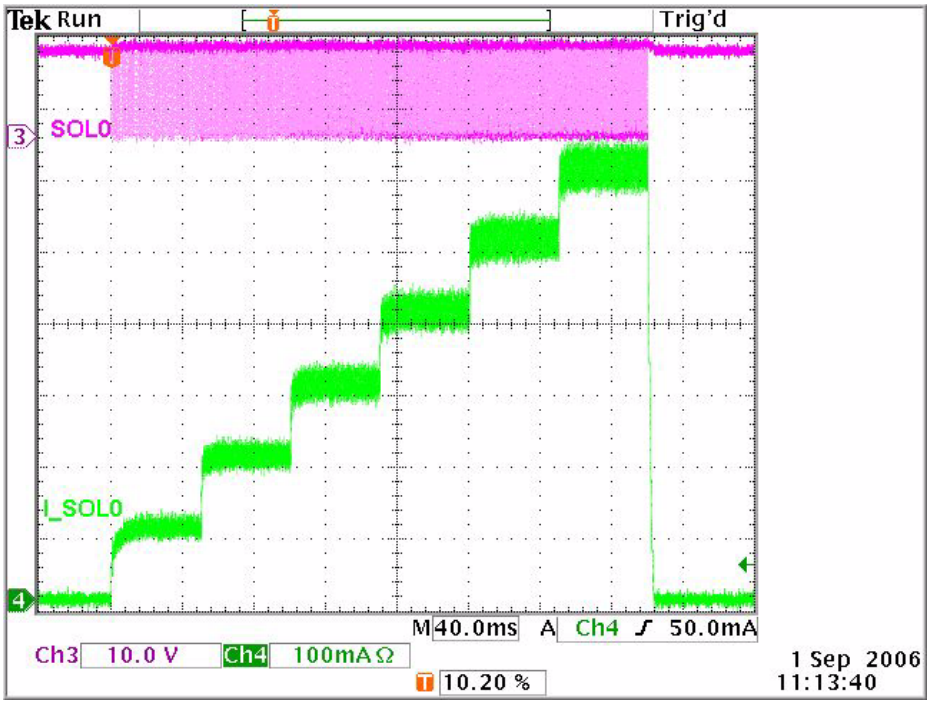


Figure 8 Load current during example sequence

Every current step in **Figure 8** has a duration of 50 ms. This is the default value after starting the software. It can be changed by clicking the button “SPI settings” in the software. It is also possible to change the SPI speed here. The values have to be read as described below:

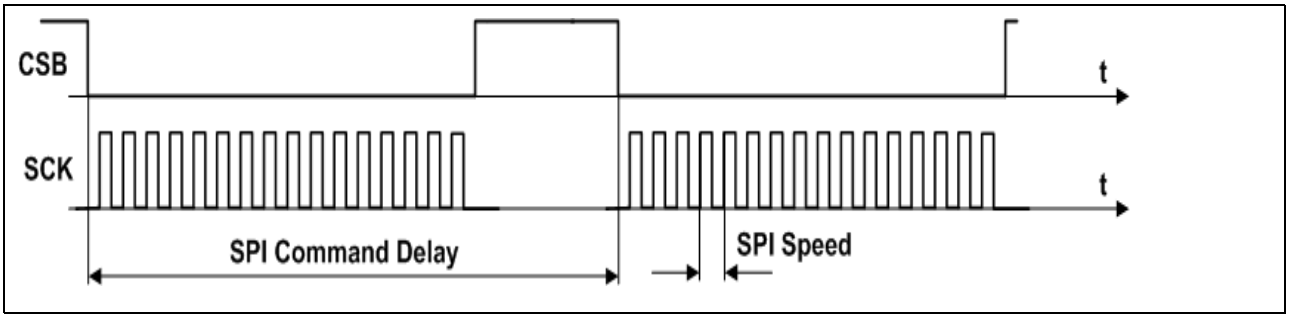


Figure 9 Setting SPI Speed and SPI Command Delay

3.3 Change Rsense value and CLK setting in the PC software

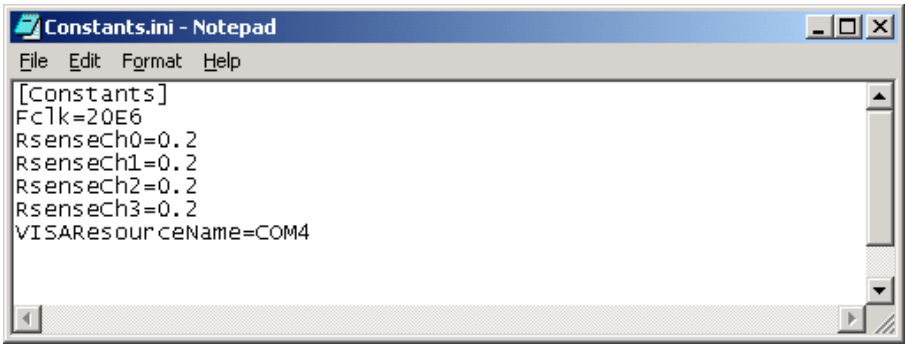
It is possible to change the Rsense value for Channel 0 to 3 and also the Clock frequency which is used by the Infineon TLE7242_SPI_2_4 PC software to calculate the programmed currents and the timings.

Note: It is only necessary to change these settings if you like to solder a different sense resistor than 200mOhm on the board or if you want to use a different Clock frequency than 20 MHz.

1. Open the file Constants.ini, it can be found in the installation directory of the Infineon TLE7242_SPI_2_4 software.

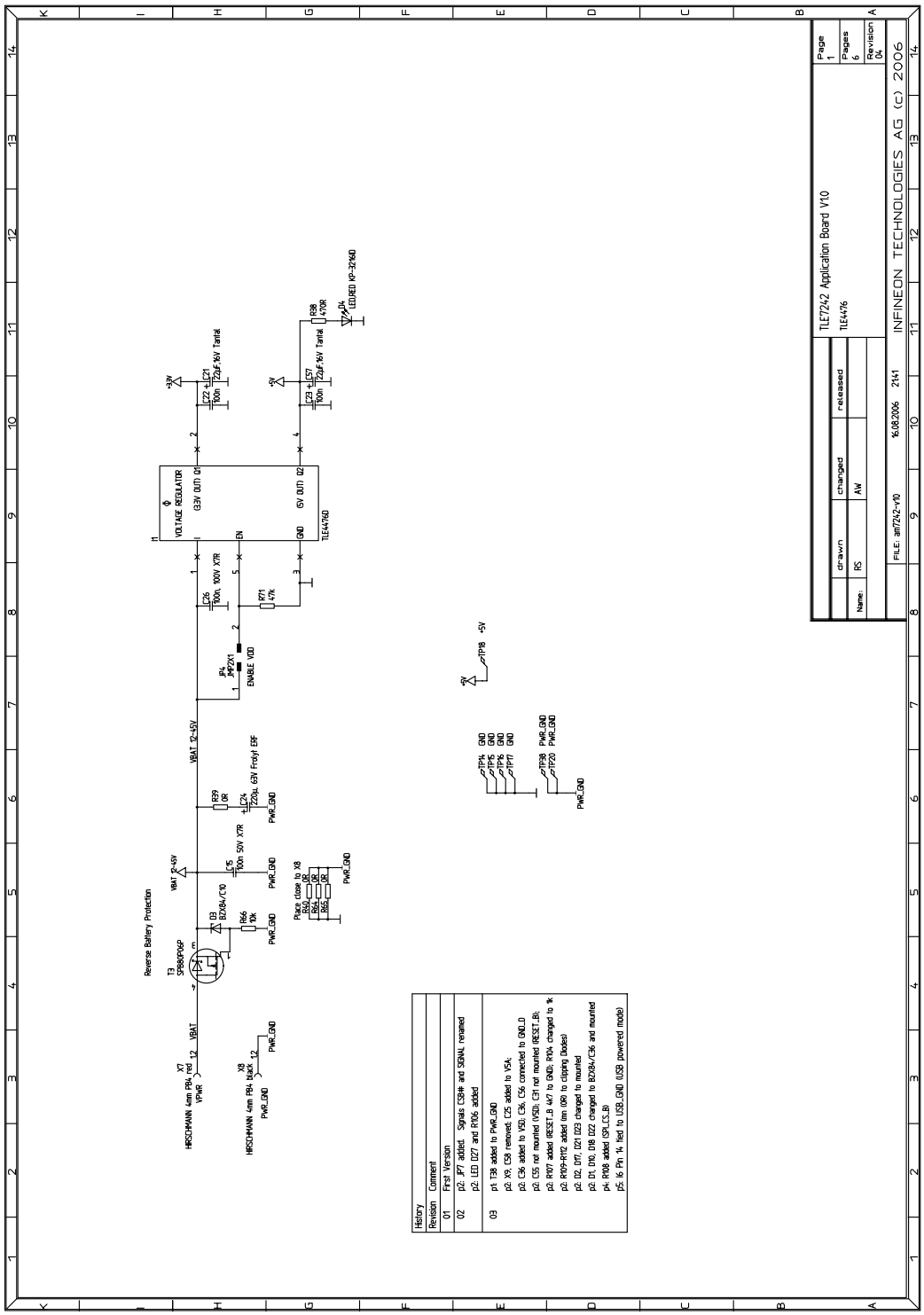
Typical directory: C:\Program Files\TLE7242_SPI_2_4\Constants.ini)

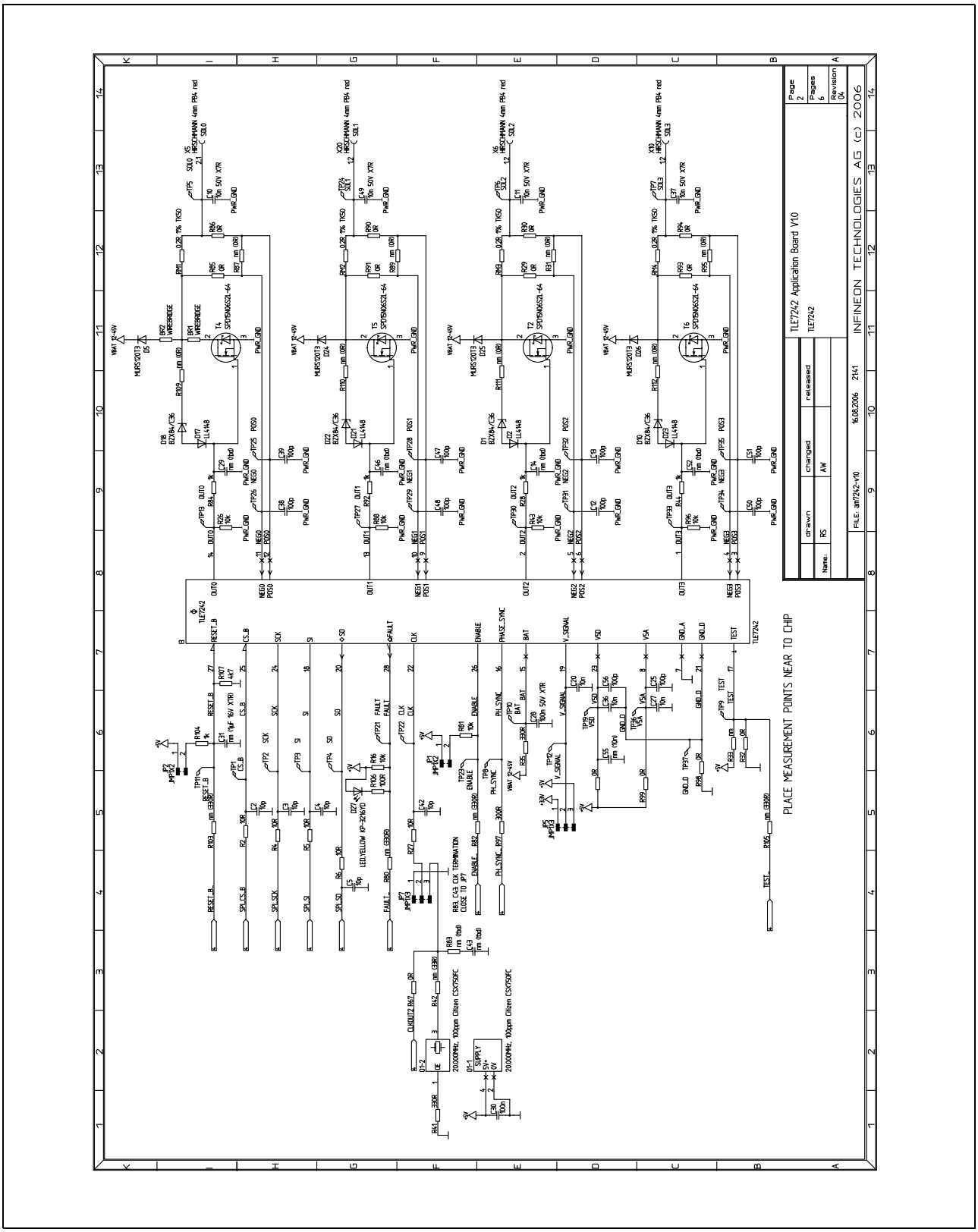
2. Change the settings as needed to adapt to different configurations of the TLE7242G Evaluation Board (see also screenshot below).



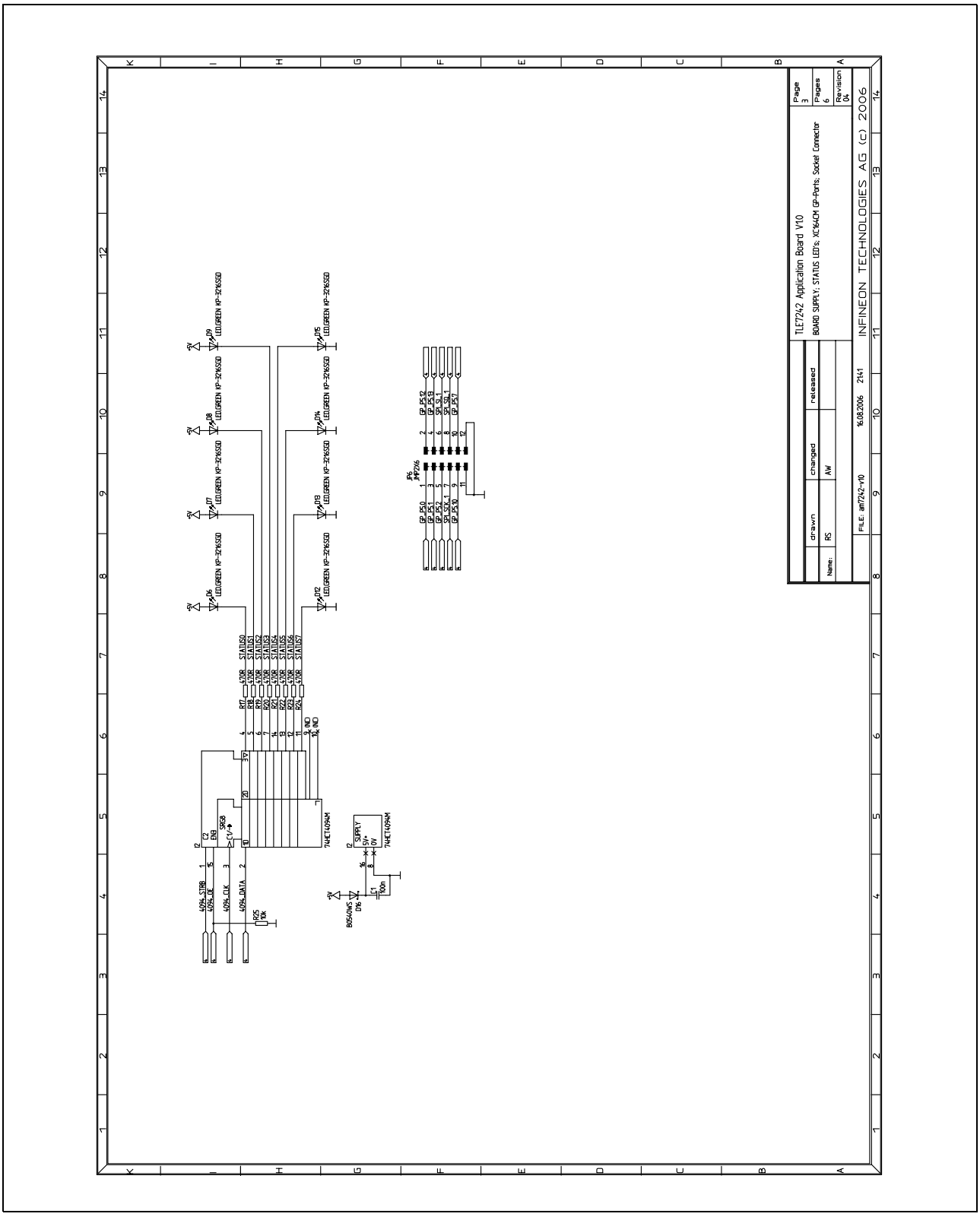
4 Schematic

4.1 Application Board TLE7242G Rev. 1.0

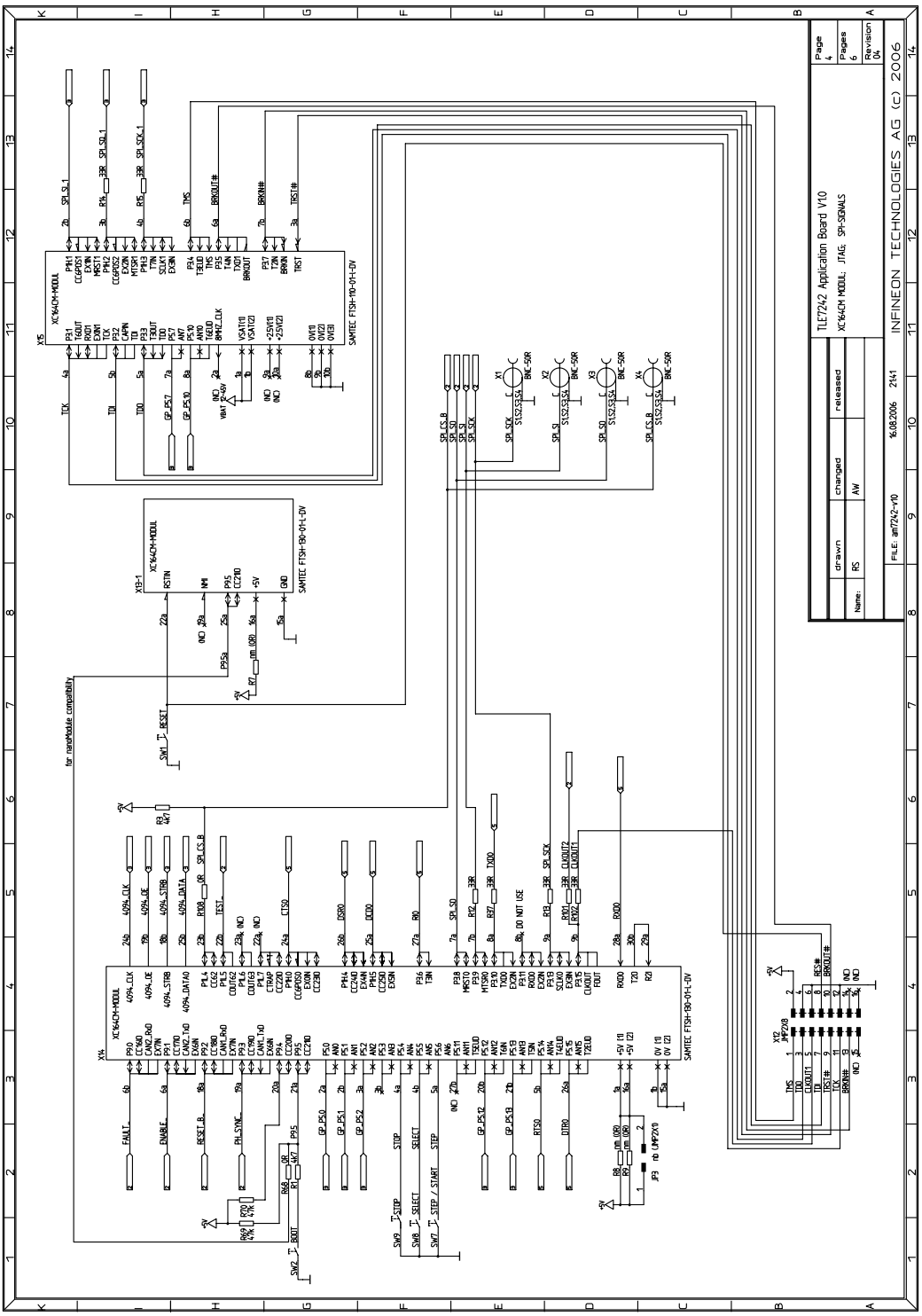



TLE7242 Application Board V10
TLE7242
INFINEON TECHNOLOGIES AG (c) 2006
PLACE MEASUREMENT POINTS NEAR TO CHIP

Schematic


TLE7242 Application Board V10
BOARD SUPPLY; STATUS LED's; XC164CM GP-Ports; Socket Connector
INFINEON TECHNOLOGIES AG (c) 2006
Page 3
Pages 6
Revision 04
drawn
changed
released
Name:
RS
AW
FILE: am7242-v10
16.08.2006
2141
74HCT4094M
4094_STRB
4094_OE
4094_CLK
4094_DATA
SUPPLY
5V+
0V
BO540WS
D16
C1
100n
R25
10k
LED,GREEN KP-3216SGD
STATUS0
STATUS1
STATUS2
STATUS3
STATUS4
STATUS5
STATUS6
STATUS7
GP_PS0
GP_PS1
GP_PS2
GP_PS3
GP_PS4
GP_PS5
GP_PS6
GP_PS7
GP_PS12
GP_PS13
SPI_SL1
SPI_SCK_1
SPI_SDI_1
JMP2X6

Schematic


TLE7242 Application Board V1.0
XC164CM MODUL; JTAG; SPI-SIGNALS
INFINEON TECHNOLOGIES AG (c) 2006
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released
Name:
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16.08.2006
2141
FILE: am7242-v10
Page 4
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Revision 04
for nanoModule compatibility
XC164CM-MODUL
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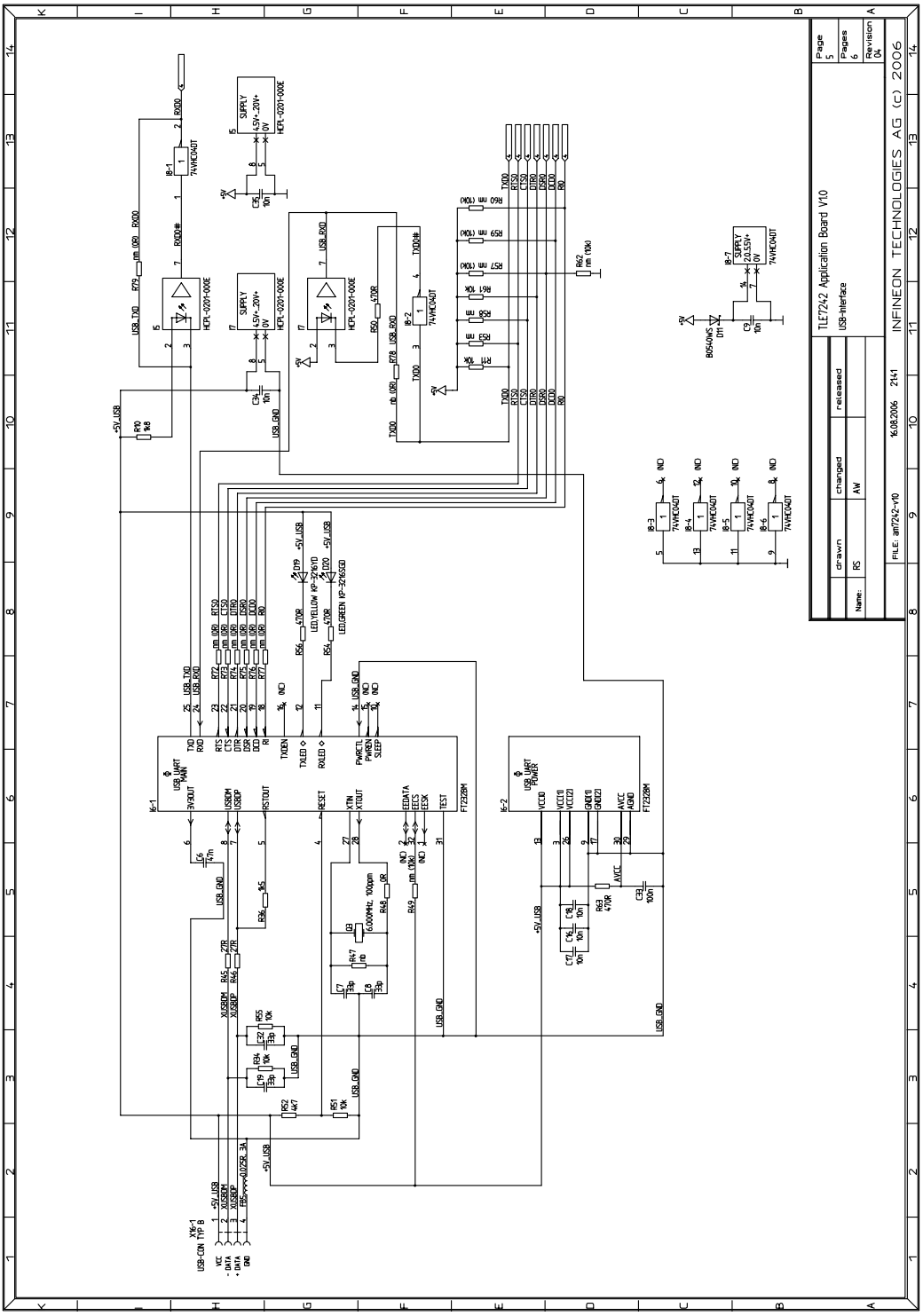
SAMTEC FTSH-130-01-L-DV
SAMTEC FTSH-130-01-L-DV
DO NOT USE

Schematic


TLE7242 Application Board V1.0
USB-Interface
INFINEON TECHNOLOGIES AG (c) 2006
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Pages 6
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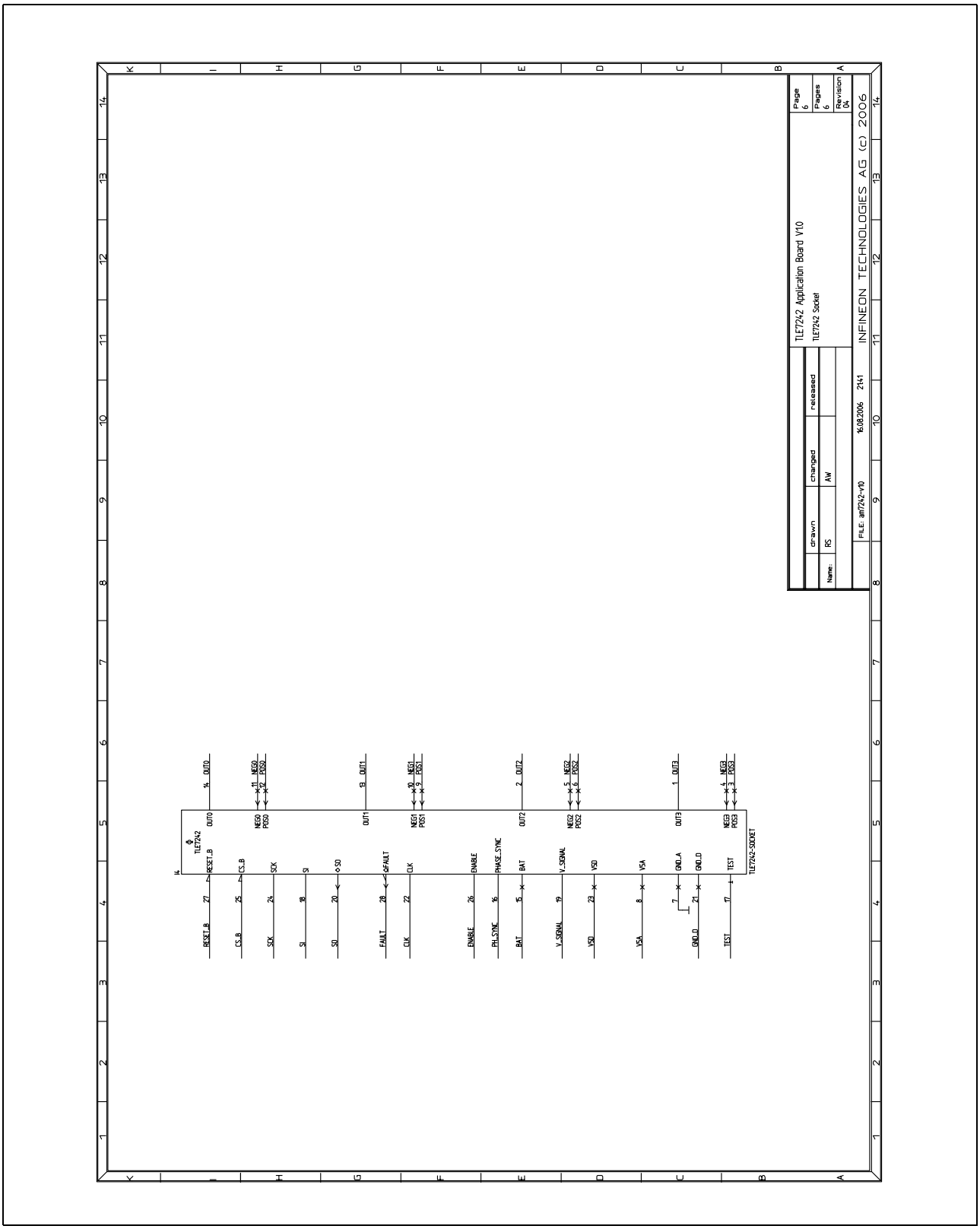
2141
FILE: am7242-v10

Schematic


TLE7242 Application Board V1.0
TLE7242 Socket
INFINEON TECHNOLOGIES AG (c) 2006
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Revision 04
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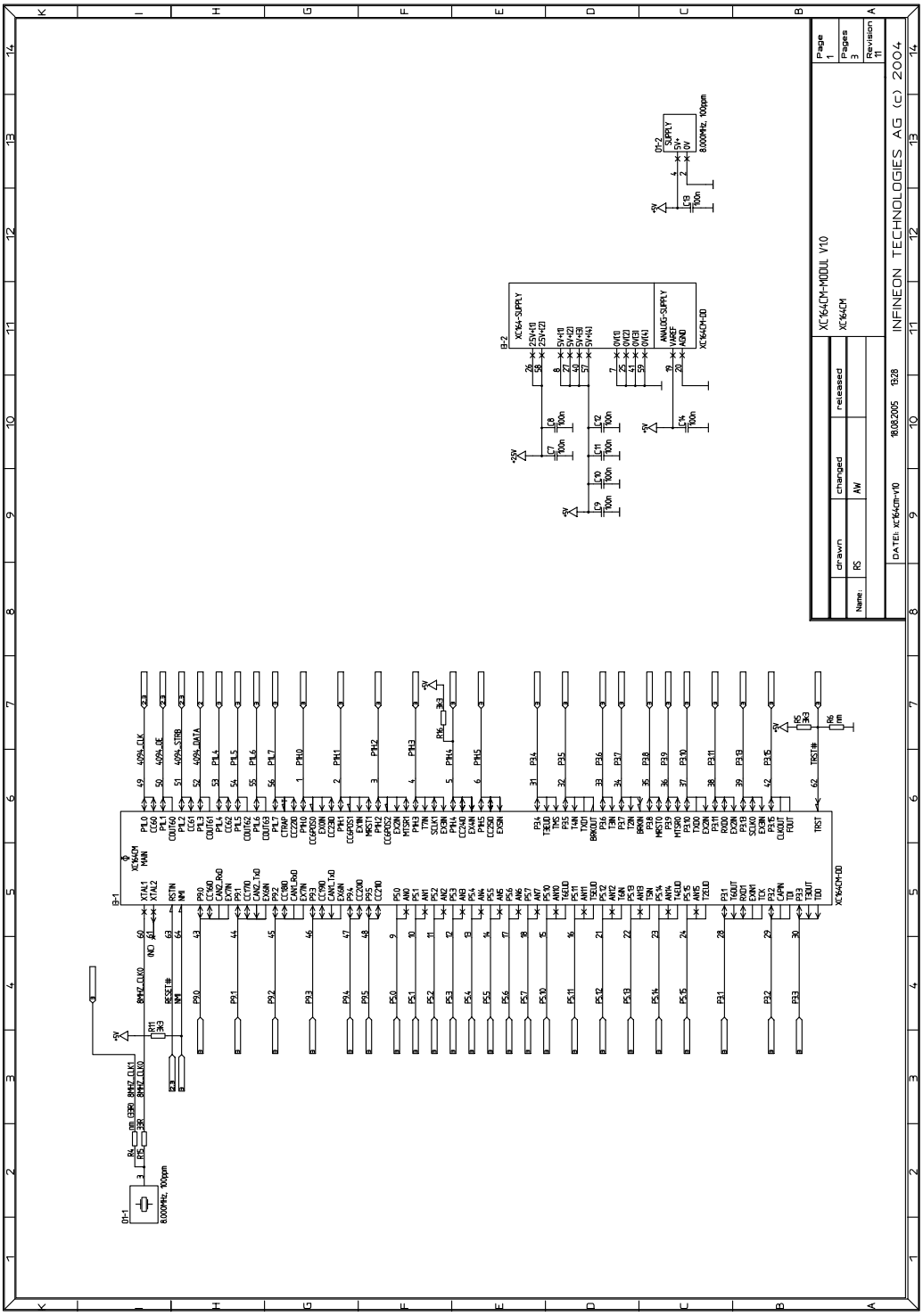
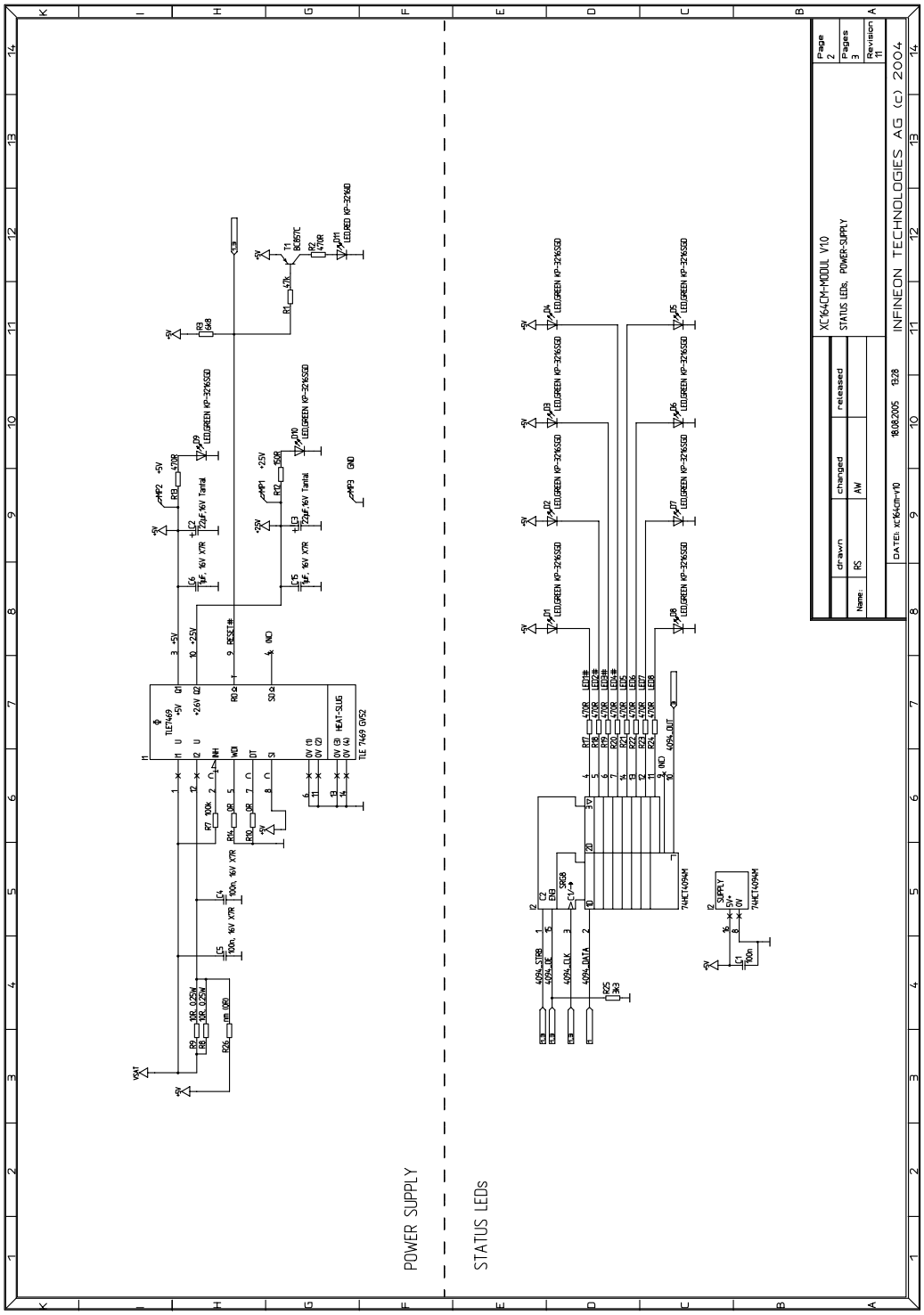
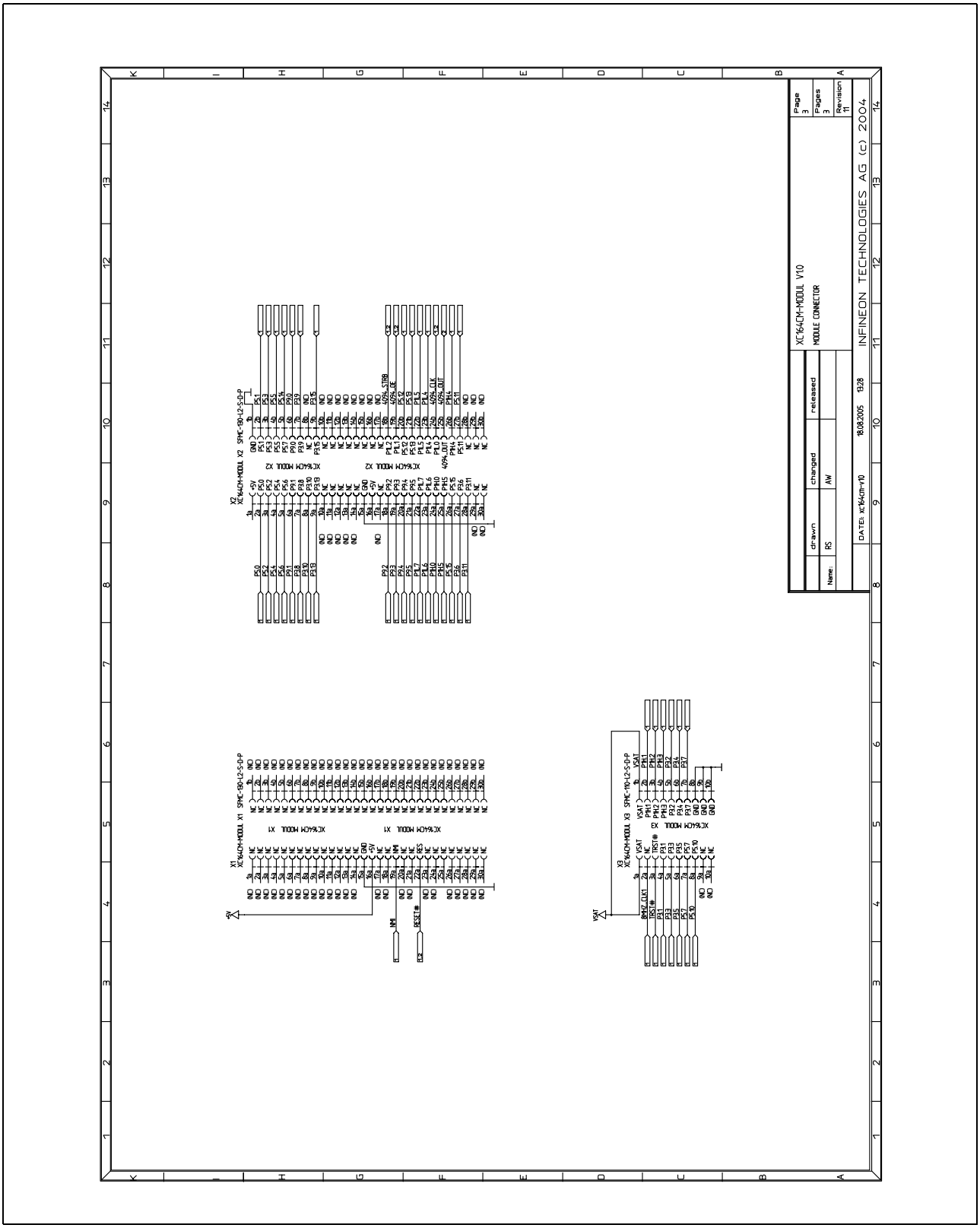
RS
AW
FILE: am7242-v10
16.08.2006
2141
TLE7242
TLE7242-SOCKET
RESET_B
CS_B
SCK
SI
SO
FAULT
CLK
ENABLE
PHASE_SYNC
BAT
V_SIGNAL
V5D
V5A
GND_A
GND_D
TEST
OUT0
OUT1
OUT2
OUT3
NEG0
POS0
NEG1
POS1
NEG2
POS2
NEG3
POS3

4.2 XC164CM Module




POWER SUPPLY
STATUS LEDs
XC164CM-MODUL V10
STATUS LEDs, POWER-SUPPLY
INFINEON TECHNOLOGIES AG (c) 2004

Schematic


XC164CM-MODUL V10
MODULE CONNECTOR
INFINEON TECHNOLOGIES AG (c) 2004
drawn
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Name:
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AW
DATE: xc164cm-v10
18.08.2005
13:28
Page
3
Pages
3
Revision
11

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Unternehmensweit orientieren wir uns dabei auch an „top“ (Time Optimized Processes), um Ihnen durch größere Schnelligkeit den entscheidenden Wettbewerbsvorsprung zu verschaffen.

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