

## APIX Demonstration Kit

The APIX Demonstration Kit is designed to demonstrate the combined transmission of video, data and power supply using only one small-size STP-cable. It transmits digital graphics up to SVGA resolution over one standard STP cable across distances of up to 15m. Interfacing to DVI-D and TTL RGB is supported.

### Features:

- Supports DVI-D and digital RGB video
- Resolutions up to SVGA
- RS232 UART Interface for full-duplex sideband communication
- Up to 15m distance
- Power over APIX for single +5V power supply

### Applications:

- In-car information Displays
- Automotive Dashboard Displays
- Head-up Displays
- Vision Systems
- Security Systems
- Remote Terminals
- Hand-held equipment

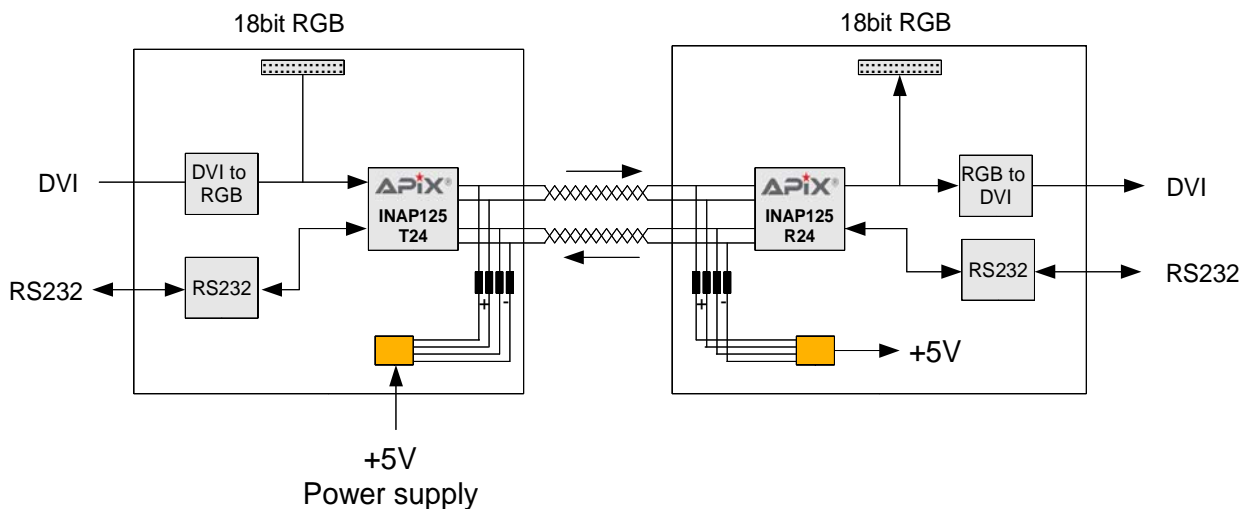


Figure 1: APIX Demonstration Kit Overview

## Table of contents

<b>1.0 Overview</b> .....	<b>3</b>
<b>2.0 Hardware Description</b> .....	<b>4</b>
2.1 APIX Demonstration Kit Transmitter ADK_TX .....	4
2.1.1 Connectors and interfaces .....	4
2.1.2 Pin assignments .....	5
2.2 APIX Demonstration Kit Receiver ADK_RX .....	9
2.2.1 Connectors and Interfaces .....	9
2.2.2 Pin assignments .....	10
<b>3.0 Getting Started</b> .....	<b>13</b>
3.1 Power Supply .....	13
3.2 Auxiliary power supply and DVI DDC control (RJ45 only) .....	13
3.3 Using ADK Kit for DVI extension (default) .....	14
3.4 Using ADK for transmission of parallel RGB video data (optional) .....	15
3.5 UART interfacing .....	15
3.6 Status signaling LED's .....	15
<b>4.0 Characteristics</b> .....	<b>16</b>
<b>5.0 Mechanical Dimensions</b> .....	<b>16</b>
<b>6.0 Revision History</b> .....	<b>17</b>
<b>7.0 References</b> .....	<b>17</b>

## 1.0 Overview

The APIX Demonstration Kit offers video and full-duplex data communication over a one shielded twisted pair cable (STP). The kit supports video transmissions ranging from QVGA to SVGA in 18 bit quality (262144 colors), which may be supplied and received either via a standard DVI-D or via parallel RGB TTL video.

The full-duplex sideband communication is accessible through a standard RS232 interface or via pin headers. Offering Power-over-APIX, the kit requires only 1 power supply connected to either the transmitter or the receiver board.

The kit is available in two options, offering either the RJ45 connector or the Rosenberger HSD connector.

Ordering Code	Description
APIX_ADK_RJ	Demonstration Kit with RJ45 Connectors and 10 meters CAT5 cable
APIX_ADK_HSD	Demonstration Kit with Rosenberger HSD connector and 5 meters Leoni Dacar 538 cable

**Table 1: Ordering Information**

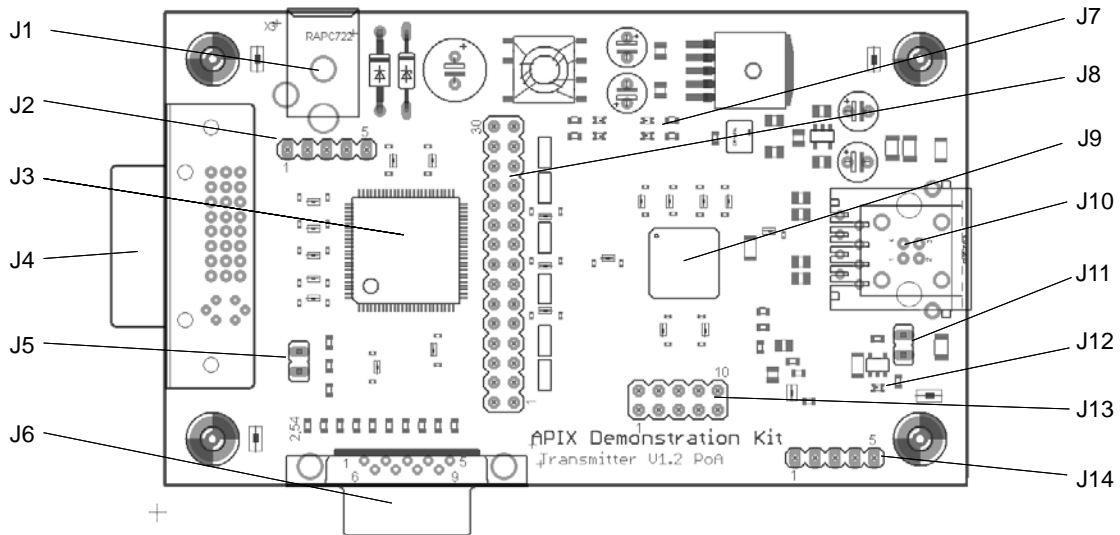
### Kit contents :

- One Transmitter board ADK Tx
- One Receiver board ADK Rx
- Connection cable
- 5V AC/DC supply
- Apix Demonstration Kit CD containing
  - ADK User Manual (this document)
  - Application Notes
  - Datasheets
  - Schematics
  - Gerberfiles

## 2.0 Hardware Description

### 2.1 APIX Demonstration Kit Transmitter ADK\_TX

#### 2.1.1 Connectors and interfaces



**Figure 2: Connectors and interfaces**

Item	Name	Description
J1	X3	Power Plug for 5V power supply
J2	CON3	Programming adapter for DDC proxy EEPROM
J3	IC2	DVI-D receiver
J4	X4	DVI input connector
J5	JP1	jumper to tri-state parallel DVI outputs
J6	X5	SUB-D9 connectr for UART interfacing
J7	LED1-4	LEDs for status signaling
J8	CON1	connector for APIX parallel video input data interface
J9	IC1	APIX Transmitter INAP125T24
J10	X1	Rosenberger HSD / RJ45 Connector <sup>a</sup>
J11	JP9	Board reset jumper

**Table 2: Connectors and interfaces**

Item	Name	Description
J12	LED5	Board reset status LED
J13	CON2	Connector for APIX sideband data interface
J14	CON4	Programming adapter for INAP125T24 configuration EEPROM

**Table 2: Connectors and interfaces**

a. Please see Section 1.0 for different board options

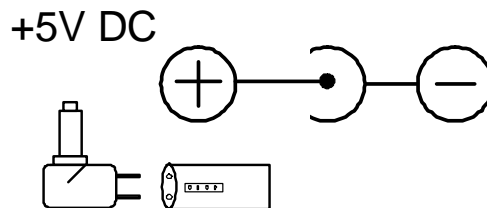
### 2.1.2 Pin assignments

#### 2.1.2.1 J4 - DVI Connector (DVI-D video input)

Pin	Signal Assignment	Pin	Signal Assignment	Pin	Signal Assignment
1	TMDS Data2-	9	TMDS Data1-	17	TMDS Data0-
2	TMDS Data2+	10	TMDS Data1+	18	TMDS Data0+
3	TMDS Data2 Shield	11	TMDS Data1 Shield	19	TMDS Data0 Shield
4	N.C.	12	N.C.	20	N.C.
5	N.C.	13	N.C.	21	N.C.
6	DDC Clock	14	+5V Power	22	TMDS Clock Shield
7	DDC Data	15	GND	23	TMDS Clock+
8	N.C.	16	Hot Plug Detect	24	TMDS Clock-

**Table 3: ADLTX - DVI input Connector pin assignment**

#### 2.1.2.2 J1 – power supply connector



**Figure 3: J1 - Power plug pin assignment**

2.1.2.3 J6 - Sub-D9 RS232/UART connector

Pin	Signal Assignment	Pin	Signal Assignment
1	GND	6	N.C.
2	RXD	7	N.C.
3	TXD	8	N.C.
4	N.C.	9	N.C.
5	N.C.		

Table 4: J6 - Sub-D9 RS232/UART connector pin assignment

2.1.2.4 J2 - Programming adapter for DDC proxy EEPROM

Pin	Signal Assignment	Pin	Signal Assignment
1	DDC_SCL	4	GND
2	DDC_SDA	5	+3V3
3	reserved		

Table 5: J2 Programming adapter for DDC proxy EEPROM

2.1.2.5 J8 - connector for APIX pixel and control data input

Pin	Signal Assignment	Pin	Signal Assignment
1	GND	2	GND
3	PX_DATA17	4	PX_DATA16
5	PX_DATA14	6	PX_DATA12
7	PX_DATA11	8	PX_DATA9
9	GND	10	GND
11	PX_DATA8	12	PX_DATA7
13	PX_DATA6	14	PX_DATA5
15	PX_DATA4	16	PX_DATA3
17	PX_DATA2	18	PX_DATA1
19	GND	20	GND
21	PX_DATA0	22	PX_DATA10
23	PX_DATA15	24	PX_DATA13

Table 6: J8 - connector for APIX pixel and control data input

Pin	Signal Assignment	Pin	Signal Assignment
25	PX_CLK	26	PX_CTRL2
27	PX_CTRL1	28	PX_CTRL0
29	GND	30	GND

Table 6: J8 - connector for APIX pixel and control data input

2.1.2.6 J13 - connector for APIX sideband interface

Pin	Signal Assignment	Pin	Signal Assignment
1	GND	2	SBDOWN_DATA[0]
3	GND	4	SBUP_DATA[0]
5	GND	6	SBUP_CLK
7	GND	8	SBUP_DATA[1]
9	GND	10	SBDOWN_DATA[1]

Table 7: J13 - connector for APIX sideband interface

2.1.2.7 J10 - RJ45 connector

Pin	Signal Assignment	Pin	Signal Assignment
1	APIX SDOUT+	5	APIX SDIN-
2	APIX SDOUT-	6	Auxiliary GND (optional)
3	Auxiliary Power (optional)	7	DDC Clock (optional)
4	APIX SDIN+	8	DDC Data (optional)

Table 8: J10 - RJ45 connector

2.1.2.8 J10 - Rosenberger HSD connector

Pin	Signal Assignment	Pin	Signal Assignment
1	APIX SDOUT-	3	APIX SDOUT+
2	APIX SDIN+	4	APIX SDIN-

Table 9: J10 - Rosenberger HSD connector

**2.1.2.9 J14 - Programming adapter for INAP125R24 configuration EEPROM**

Pin	Signal Assignment	Pin	Signal Assignment
1	M_CLK	4	GND
2	M_DIDO	5	VCCIO
3	M_CS		

**Table 10: J12 - Programming adapter for INAP125R24 configuration EEPROM**

## 2.2 APIX Demonstration Kit Receiver ADK\_RX

### 2.2.1 Connectors and Interfaces

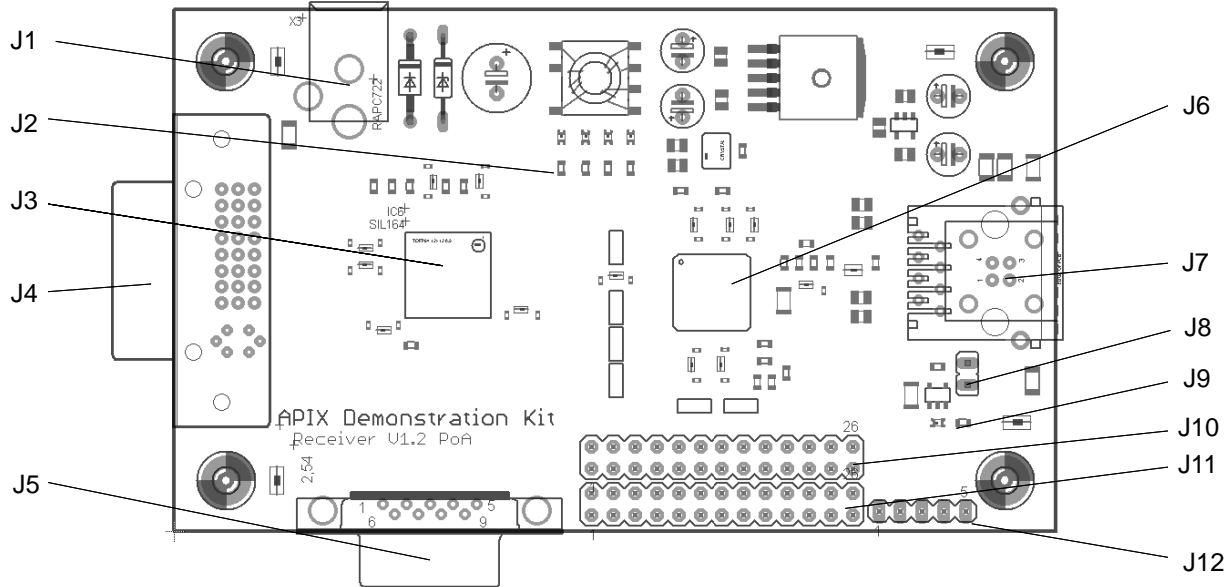


Figure 4: ADK Receiverboard Top view

Item	Name	Description
J1	X3	Power Plug for 5V power supply
J2	LED1-4	LEDs for status signaling
J3	IC6	DVI-D transmitter
J4	X4	DVI output connector
J5	X5	SUB-D9 connector for UART interfacing
J6	IC1	APIX Transmitter INAP125R24
J7	X2	Rosenberger HSD / RJ45 Connector
J8	JP9	Board reset jumper
J9	LED5	Board reset status LED
J10	CON1	connector for APIX parallel video and sideband data interfacing
J11	CON2	connector for APIX parallel video and sideband data interfacing
J12	CON3	Programming adapter for INAP125R24 configuration EEPROM

Table 11: Connectors and interfaces

## 2.2.2 Pin assignments

### 2.2.2.1 J4 - DVI Connector (DVI-D video output)

Pin	Signal Assignment	Pin	Signal Assignment	Pin	Signal Assignment
1	TMDS Data2-	9	TMDS Data1-	17	TMDS Data0-
2	TMDS Data2+	10	TMDS Data1+	18	TMDS Data0+
3	TMDS Data2 Shield	11	TMDS Data1 Shield	19	TMDS Data0 Shield
4	N.C.	12	N.C.	20	N.C.
5	N.C.	13	N.C.	21	N.C.
6	DDC Clock	14	+5V Power	22	TMDS Clock Shield
7	DDC Data	15	GND	23	TMDS Clock+
8	N.C.	16	Hot Plug Detect	24	TMDS Clock-

Table 12: DVI output connector pin assignment

### 2.2.2.2 J1 – power supply connector

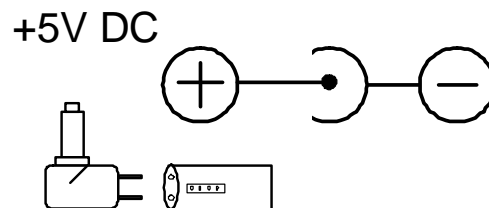


Figure 5: J1 - Power plug pin assignment

### 2.2.2.3 J5 - Sub-D9 RS232/UART connector

Pin	Signal Assignment	Pin	Signal Assignment
1	GND	6	N.C.
2	RXD	7	N.C.
3	TXD	8	N.C.
4	N.C.	9	N.C.
5	N.C.		

Table 13: J6 - Sub-D9 RS232/UART connector pin assignment

2.2.2.4 J10 - connector for APIX parallel video and sideband data interfacing

Pin	Signal Assignment	Pin	Signal Assignment
1	GND	2	SBUP_Data0
3	GND	4	PX_DATA14
5	GND	6	PX_DATA12
7	GND	8	PX_DATA8
9	GND	10	PX_DATA5
11	GND	12	PX_DATA2
13	GND	14	PX_DATA3
15	GND	16	PX_DATA1
17	GND	18	PX_DATA10
19	GND	20	PX_CTRL1
21	GND	22	PX_CLK
23	GND	24	PX_DATA17
25	SBDOWN_CLK	26	SBDOWN_Data1

Table 14: J10 - connector for APIX parallel video and sideband data interfacing

2.2.2.5 J11 - connector for APIX parallel video and sideband data interfacing

Pin	Signal Assignment	Pin	Signal Assignment
1	GND	2	SBDOWN_Data0
3	GND	4	PX_DATA15
5	GND	6	PX_DATA13
7	GND	8	PX_DATA11
9	GND	10	PX_DATA9
11	GND	12	PX_DATA7
13	GND	14	PX_DATA6
15	GND	16	PX_DATA4
17	GND	18	PX_DATA0
19	GND	20	PX_CTRL2

Table 15: J11 - connector for APIX parallel video and sideband data interfacing

Pin	Signal Assignment	Pin	Signal Assignment
21	GND	22	PX_CTRL0
23	GND	24	PX_DATA16
25	GND	26	SBUP_Data1

**Table 15: J11 - connector for APIX parallel video and sideband data interfacing**

**2.2.2.6 J7 - RJ45 connector**

Pin	Signal Assignment	Pin	Signal Assignment
1	APIX SDIN+	5	APIX SDOUT-
2	APIX SDIN-	6	Auxiliary GND (optional)
3	Auxiliary Power (optional)	7	DDC Clock (optional)
4	APIX SDOUT+	8	DDC Data (optional)

**Table 16: J7 - RJ45 connector**

**2.2.2.7 J7 - Rosenberger HSD connector**

Pin	Signal Assignment	Pin	Signal Assignment
1	APIX SDOUT-	3	APIX SDOUT+
2	APIX SDIN+	4	APIX SDIN-

**Table 17: J7 - Rosenberger HSD connector**

**2.2.2.8 J12 - Programming adapter for INAP125R24 configuration EEPROM**

Pin	Signal Assignment	Pin	Signal Assignment
1	M_CLK	4	GND
2	M_DIDO	5	VCCIO
3	M_CS		

**Table 18: J12 - Programming adapter for INAP125R24 configuration EEPROM**

### 3.0 Getting Started

#### 3.1 Power Supply

The APIX Demonstration Kit comprises two boards, Transmitter and Receiver. Only **one** of these requires one **single +5V supply** provided by the attached power supply. The other board is supplied via the powered board through the STP cable.

**!! Do not power both boards !!**

The „remote“ board is supplied via „Power over APIX“, using the differential datalines to also transmit the 5V supply voltage. The power supply is coupled onto the high speed lines using 1μH inductors as illustrated in Figure 6.

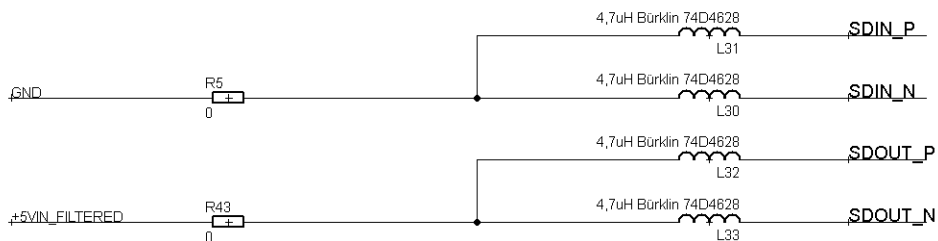


Figure 6: Power over APIX circuitry

#### 3.2 Auxiliary power supply and DVI DDC control (RJ45 only)

The RJ45 connector offers two additional pair of wires, which may be used for another power supply (e.g. 12V for display backlight) and DDC control data. In order to use the additional power supply lines for external power, the supply needs to be soldered to R37 (V<sub>CC</sub>) and R42 (GND), which are left open by default. Please see Figure 7 for details on the connector.

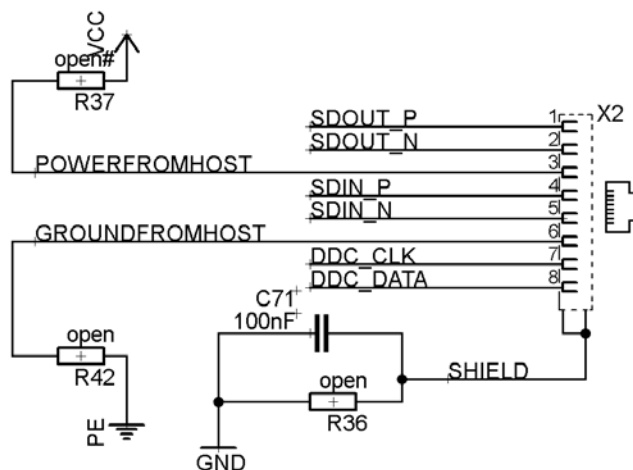
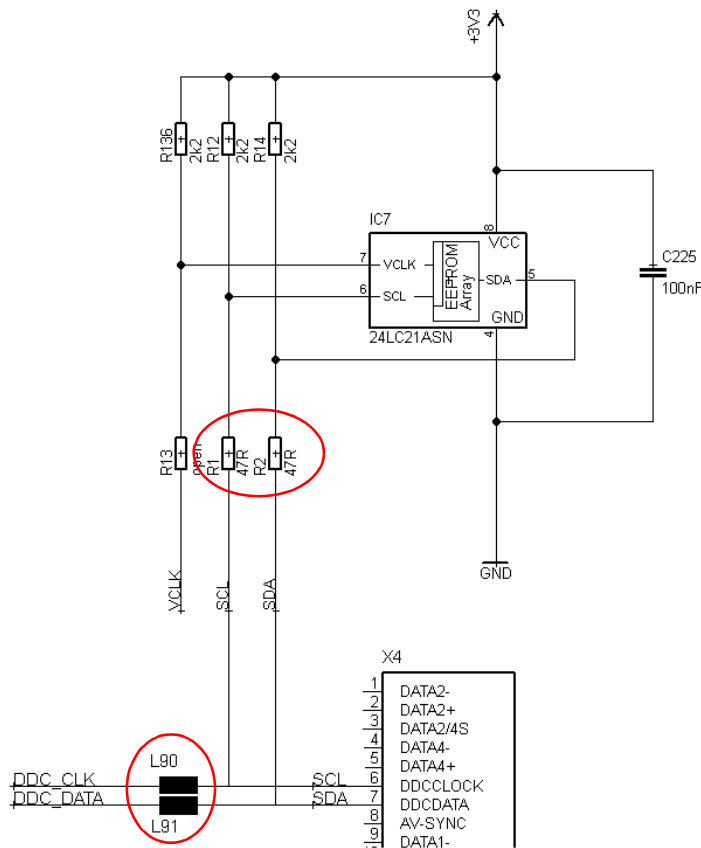


Figure 7: RJ45 connector with additional supply and DVI DDC signals

By default, DVI DDC information for the sending graphics controller is provided by the on-board EEPROM (IC7). In case the DVI device connected to the receiver board is able to provide it's own DDC information, the signals can be forwarded directly to the DVI connector (X4). For this, the onboard DDC EEPROM needs to be disconnected from the DVI connector (X4), by removing R1 and R2. The DDC lines finally should be connected to X4 using the two inductors L90 and L91.

**NOTE** In case the onboard DDC EEPROM is disabled, please make sure the DDC information supplied by the receiver device requests resolution and pixel frequency acceptable for the APIX link. If no DDC information is supplied, the kit may not be recognized by the graphics controller.



**Figure 8: Disabling the on-board DDC EEPROM**

### 3.3 Using ADK Kit for DVI extension (default)

The ADK Tx board provides a DDC proxy at the DVI input connector. That allows to use the ADK extender boards with every standard PC or laptop. The proxy EEPROM contains EDID data that define the useable resolutions up to SVGA.

It is recommended to plug in all connections prior powering up the boards.

1. Connect the ADKTX and ADKRX boards with the included LEONI Dacar 538 cable.
2. Connect the DVI source and sink to the ADKTX and ADKRX boards.
3. Power up the ADKTX and ADKRX boards.
4. Power up PC / Laptop

### 3.4 Using ADK for transmission of parallel RGB video data (optional)

The parallel outputs of the DVI receiver on the ADKTX board can be set to tristate via Jumper J5. Parallel video data can be fed into the APIX transmitter via connector J8.

The video output on the ADKRX board (DVI, TTL) can be selected via parallel resistor arrays. Please contact technical support for further informations.

### 3.5 UART interfacing

The Apix Demonstration Kit provides an UART RS232 extension interface. The transmission of the bi-directional UART data is performed using APIX side band capabilities.

### 3.6 Status signaling LED's

Both the ADKTX and ADKRX boards feature several LEDs. These LEDs make it easy to identify the status of the boards' power supplies and the link synchronization.

LED	Status
LED 1	+3V3 power ok
LED 2	+5V power ok
LED 3	+1V8 power ok
LED 4	APIX upstream error
LED 5	board reset active

Table 19: ADKTX - Status signaling LED's

LED	Status
LED 1	+5V power ok
LED 2	+3V3 power ok
LED 3	+1V8 power ok
LED 4	video / transmission error
LED 5	board reset active

Table 20: ADKRX - Status signaling LED's

## 4.0 Characteristics

Parameter	min	typ	max	
Supply voltage	4.75	5.0	5.25	V
Current consumption ADK TX/RX		0.4		A

**Table 21: DC Characteristics**

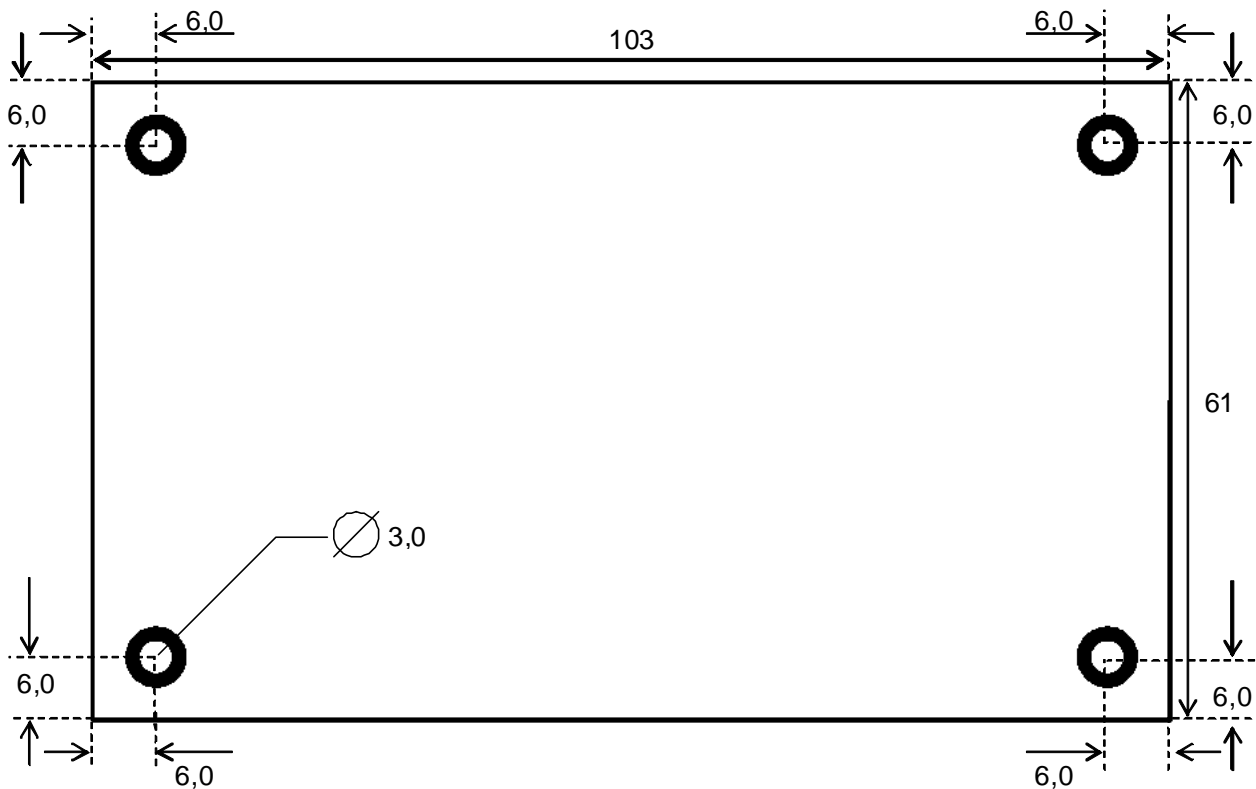
The Apix Display Link Kit handles video resolutions of up to WSVGA. The maximum pixel clock frequency is 40MHz with default INAP125 configuration.

The TTL pixel bus handles 3.3V LVCMOS signals.

UART interface can handle up to 115.2 kBaud/s

## 5.0 Mechanical Dimensions

All dimensions in millimeter



**Figure 9: Mechanical Dimensions**

## 6.0 Revision History

Revision	Date	Changes
1.0	September 2009	Initial Release
1.1	November 2009	Updated Table 8, "J10 - RJ45 connector," on page 7 Updated Table 16, "J7 - RJ45 connector," on page 12

**Table 22: Revision History**

## 7.0 References

- [1] – AN101 - Using APIX Sideband interfaces Application Note, Inova Semiconductors
- [2] – INAP125T/R Datasheets, Inova Semiconductors

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