

GemCore Serial Lite PRO

Technical Specifications



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Printed in France.

Document Reference: DOC107979A1

Document Version:1.1

December 19, 2002

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Introduction

This document provides information about the GemCore™ Serial Lite PRO (GSLP) chip, and in particular about its hardware characteristics and performances. A typical smart card reader diagram is also provided with integration guidelines. The description of the product operating mode is given in the document “*GemCore Serial Lite PRO V1.4 Reference Manual*”.

Who Should Read This Book

This document is intended for electronics engineers.

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GemCore Serial Lite PRO Technical Features

General Description

GemCore Serial Lite PRO is designed to simplify the integration of smart card interfaces in electronic devices.

It manages the electrical interface and communication with ISO 7816-1/2/3/4 compatible smart cards and memory cards.

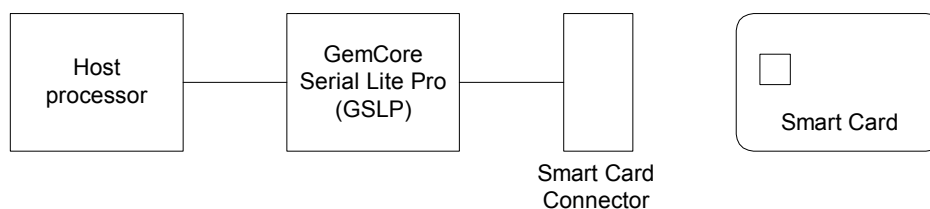


Figure 1 - Basic Architecture of a Smart Card Reader

The connection with the host processor is achieved via a serial asynchronous link; the rate can be selected from a range from 1200 to 115,200 bps.

The software inside the GemCore chip handles a communication protocol with the host system called the Gemplus Block Protocol (GBP).

A GBP Interface Library Kit can be provided, upon request. It consists of the source code of the GBP communication layer between the host and GemCore. It is written in the C language. See the Gemplus developers' site at www.gemplus.com.

Smart Card Interface

| | |
|---------------------------|--|
| Compliance with Standards | <ul style="list-style-type: none">• ISO/IEC 7816-1, 2, 3 and 4• EMV V96• CB• Mondex, Proton,ZKA, other: contact Gemplus |
| Supported Smart Cards | <ul style="list-style-type: none">• Number of smart cards supported = 1• Asynchronous cards, T=0, T=1• Synchronous/memory cards using a command interpreter• EMV or non-EMV cards |
| Transmission Speed | <ul style="list-style-type: none">• 9.6 Kbps to 115 Kbps |
| Electrical Interface | <ul style="list-style-type: none">• Card power supply: 1.8V/3V/5V• ESD protection on card pins: 4 KV - human body model• Card presence or insertion detection• Short circuit current limitation |

Host Interface

| | |
|----------------|--|
| Physical Layer | <ul style="list-style-type: none">• Serial asynchronous link• Programmable transmission speed from 1,200 bps to 115,200 bps• Format: 8 bits, no parity, 1 stop bit• Adjustable signal voltage |
| Protocol | <ul style="list-style-type: none">• Gemplus Block Protocol (GBP)• GBP Interface Library Kit source code |

Chip Power Supply

| | |
|-----------------|--|
| Voltage | <ul style="list-style-type: none">• VCC: 2.85 V to 5.4 V |
| Consumption | <ul style="list-style-type: none">• 8 mA typical• 150 mA max - smart card powered |
| Power Down Mode | <ul style="list-style-type: none">• 100 μA max power down current• Power down/Power up by host command |

Additional Features

| | |
|-------------------|--|
| Temperature Range | <ul style="list-style-type: none">• Operating range: 0°C to +70°C• Extended operating range: contact Gemplus• Storage: -65°C to +150°C |
| Package | <ul style="list-style-type: none">• 24 pins (SS0P24-type) |
| LED Management | <ul style="list-style-type: none">• The LED is on when the card is powered on |

Pin Description

Pinout

The following figure shows the GemCore Serial Lite PRO 24-pin SSOP pinout:

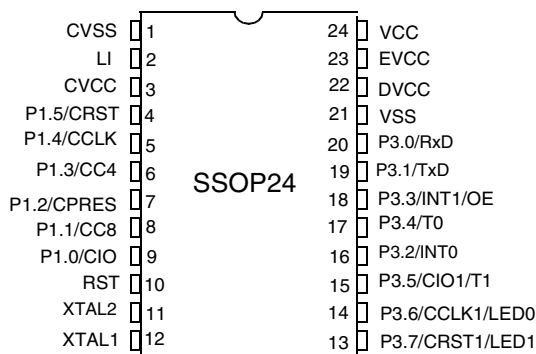


Figure 2 - GemCore Serial Lite PRO 24-pin SSOP Pinout

Signals

| Port | Signal Name | Internal Power Supply | ESD | Type | Description |
|------|-------------|-----------------------|-----|------|---|
| P1.0 | CIO | CV _{CC} | 4KV | I/O | Smart card interface function Card I/O - Pull-up medium must be < 20 K Ω |
| P1.1 | CC8 | CV _{CC} | 4KV | I/O | Smart card interface function Card contact 8 - Pull-up medium must be < 20K Ω |
| P1.2 | CPRES | V _{CC} | 4KV | I | Smart card interface function Card presence |
| P1.3 | CC4 | CV _{CC} | 4KV | I/O | Smart card interface function Card contact 4 - Pull-up medium must be < 20K Ω |

Table 1 - Description of the Pins

| Port | Signal Name | Internal Power Supply | ESD | Type | Description |
|------|-------------|-----------------------|-----|------|---|
| P1.4 | CCLK | V_{CC} | 4KV | O | Smart card interface function Card clock |
| P1.5 | CRST | V_{CC} | 4KV | O | Smart card interface function Card reset - Pull-up medium must be $<20K\Omega$ |
| P3.0 | RxD | V_{CC} | | I | UART function Receive data input |
| P3.1 | TxD | V_{CC} | | O | UART function Transmit data output |
| P3.2 | INT0 | V_{CC} | | I/O | Input/Output function P3.2 is a bidirectional I/O port with internal pull-ups. |
| P3.3 | INT1 | V_{CC} | | I/O | Input/Output function P3.3 is a bidirectional I/O port with internal pull-ups. |
| P3.4 | | V_{CC} | | I/O | Input/Output function P3.4 is a bidirectional I/O port with internal pull-ups. |
| P3.5 | CIO1 | V_{CC} | | I/O | Input/Output function P3.5 is a bidirectional I/O port with internal pull-ups. |
| P3.6 | CCLK1 | V_{CC} | | O | LED function These pins can be directly connected to the cathode of the standard LED without external current limiting resistors. The typical current of each output can be programmed by software to 2, 4 or 10 mA (LEDCON register). |
| P3.7 | CRST1 | V_{CC} | | I/O | Input/Output function P3.7 is a bidirectional I/O port with internal pull-ups. |
| RST | | V_{CC} | | I/O | Reset Input Holding this pin low for 64 oscillator periods while the oscillator is running resets the device. Port pins are driven to their reset conditions when a voltage lower than V_{IL} is applied, regardless of whether the oscillator is running. This pin has an internal pull-up resistor which allows the device to be reset by connecting a capacitor between this pin and V_{SS} . Asserting \overline{RST} when the chip is in Idle mode or Power-Down mode returns the chip to normal operation. The output is active for at least 12 oscillator periods when an internal reset occurs. |

Table 1 - Description of the Pins

| Port | Signal Name | Internal Power Supply | ESD | Type | Description |
|-------|-------------|-----------------------|-----|------|--|
| XTAL1 | | V _{CC} | | I | Input to the on-chip inverting oscillator amplifier To use the internal oscillator, a crystal/resonator circuit is connected to this pin. If an external oscillator is used, its output is connected to this pin. |
| XTAL2 | | V _{CC} | | O | Output of the on-chip inverting oscillator amplifier To use the internal oscillator, a crystal/resonator circuit is connected to this pin. If an external oscillator is used, XTAL2 may be left unconnected. |
| VCC | | | | PWR | Supply Voltage V _{CC} is used to power the internal voltage regulators and internal I/Os. |
| LI | | | | PWR | DC/DC Input LI must be tied to V _{CC} through an external coil (typically 4,7 μH) and provide the current for the pump charge of the DC/DC converter. |
| CVCC | | | | PWR | Card Supply Voltage CV _{CC} is the programmable voltage output for the card interface. It must be connected to an external decoupling capacitor. |
| DVCC | | | | PWR | Digital Supply Voltage DV _{CC} is used to supply the digital core and internal I/O's. It is internally connected to the output of a 3 V voltage regulator and must be connected to an external decoupling capacitor. |
| EVCC | | V _{CC} | | PWR | Extra Supply Voltage EV _{CC} is used to supply the level shifters of UART interface I/O pins. It must be connected to an external decoupling capacitor. |
| CVSS | | | | GND | DC/DC Ground CV _{SS} is used to sink high shunt currents from the external coil. |
| VSS | | | | GND | Ground |

Table 1 - Description of the Pins

Electrical Characteristics

Absolute Maximum Ratings

| | | |
|---------------------------------|----------------------------|---|
| Ambient Temperature Under Bias | -25°C to +85°C | Stresses at or above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions may affect device reliability. This value is based on the maximum allowable die temperature and the thermal resistance of the package. |
| Storage Temperature | -65°C to + 150°C | |
| Voltage on V_{CC} to V_{SS} | -0.5 V to + 6.0 V | |
| Voltage on Any Pin to V_{SS} | -0.5 V to $V_{CC} + 0.5$ V | |

DC Parameters

$T_A = 0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$; $V_{SS} = 0\text{ V}$; $V_{CC} = 2.85\text{V}$ to 5.4V ; $F=7.36\text{MHz}$ to 16MHz .

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|----------------------|--|--------------------|------|--------------------|--------|---|
| V_{IL} | Input low voltage | -0.5 | | $0.2 V_{CC} - 0.1$ | V | |
| V_{IH} | Input high voltage except XTAL1, $\overline{\text{RST}}$ | $0.2 V_{CC} + 0.9$ | | $V_{CC} + 0.5$ | V | |
| V_{IH1} | Input high voltage, XTAL1, $\overline{\text{RST}}$ | $0.7 V_{CC}$ | | $V_{CC} + 0.5$ | V | |
| I_{CC} | Digital supply output current | 10 | | | mA | $C_L = 100\text{ nF}$ $F = 16\text{ MHz} \times 1$ |
| DV_{CC} | Digital supply voltage | 2.65 | 2.9 | 3.0 | V | $C_L = 100\text{ nF}$ |
| V_{PFDP} | Power fail high level threshold | | 2.55 | | V | |
| V_{PFDM} | Power fail low level threshold | | 2.45 | | V | |
| t_{rise}, t_{fall} | V_{DD} rise and fall time | $1\mu\text{s}$ | | 600 | second | |

Table 2 - Core DC Parameters (XTAL, $\overline{\text{RST}}$)

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|-----------|----------------------|----------------------|-----------|-----------------|------|--------------------------|
| V_{IL} | Input low voltage | -0.5 | | 0.4 | V | |
| V_{IH} | Input high voltage | $0.7 \times EV_{CC}$ | EV_{CC} | $EV_{CC} + 0.5$ | V | External EV_{CC} mode |
| V_{OL} | Output low voltage | | | 0.4 | V | $I_{OL} = 1.2\text{ mA}$ |
| V_{OH} | Output high voltage | $0.8 \times EV_{CC}$ | | EV_{CC} | V | External EV_{CC} mode |
| I_{CC} | Extra supply current | | | +3 | mA | $C_L = 100\text{ nF}$ |
| EV_{CC} | Extra supply voltage | 1.6 | | V_{CC} | V | External EV_{CC} mode |

Table 3 - Serial Interface DC Parameters (P3.0, P3.1, P3.3 and P3.4)

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|----------|--------------------------|-----|-----|-----|------|-----------------|
| I_{OL} | Output low current, P3.6 | 2 | 4 | 8 | mA | |

Table 4 - LED Outputs DC Parameters (P3.6)

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|-----------|---------------------|-----|-----|-------------------|------|---|
| C_{CC} | Card supply current | 60 | | 121 105 102 | mA | $V_{CC} = 5.4\text{V}$ $V_{CC} = 4\text{V}$ $V_{CC} = 2.85\text{V}$ |
| CV_{CC} | Card supply voltage | 4.6 | | 5.4 | V | $I_{CARD} = 55\text{mA}$ |

Table 5 - Smart Card 5V Interface DC Parameters

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|--------------|---------------------|------|-----|------------------|------|--|
| $C_{I_{CC}}$ | Card supply current | 60 | | 110 89 110 | mA | $V_{CC} = 5.4V$ $V_{CC} = 4V$ $V_{CC} = 2.85V$ |
| CV_{CC} | Card supply voltage | 2.76 | | 3.24 | V | $I_{CARD} = 60mA$ |

Table 6 - Smart Card 3V Interface DC Parameters

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|--------------|---------------------|------|-----|------------------|------|--|
| $C_{I_{CC}}$ | Card supply current | 20 | | 109 100 82 | mA | $V_{CC} = 5.4V$ $V_{CC} = 4V$ $V_{CC} = 2.85V$ |
| CV_{CC} | Card supply voltage | 1.68 | | 1.92 | V | $I_{CARD} = 20mA$ |

Table 7 - Smart Card 1.8V Interface DC Parameters

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|----------|----------------------|---|-----|--|-------------|---|
| V_{OL} | Output low voltage | 0 0 | | $0.2 \times CV_{CC}$ 0.4 | V | $I_{OL} = 20\mu A$ (1.8,3V) $I_{OL} = 50\mu A$ (5V) |
| I_{OL} | Output low current | | | 15 | mA | |
| V_{OH} | Output high voltage | $0.7 \times CV_{CC}$ $0.7 \times CV_{CC}$ $CV_{CC} - 0.5$ | | CV_{CC} CV_{CC} CV_{CC} | V V V | $I_{OH} = 20\mu A$ (1.8V) $I_{OH} = 20\mu A$ (3V) $I_{OH} = 50\mu A$ (5V) |
| I_{OH} | Output high current | | | 15 | mA | |
| t_{rF} | Rise and fall delays | | | $8\% \times T$ 22.5 50 | ns | $C_{IN} = 30pF$ (5V) $C_{IN} = 30pF$ (3V) $C_{IN} = 30pF$ (1.8V) |
| | Voltage stability | -0.25 $CV_{CC} - 0.5$ | | $0.4 \times CV_{CC}$ $CV_{CC} + 0.25$ | VV | Low level High level |

Table 8 - Smart Card Clock DC Parameters (Port 1.4)

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|-----------|----------------------|----------------------|-----|-------------------------------------|---------|---|
| V_{IIL} | Input low voltage | 0 | | 0.5 $0.15 \times CV_{CC}$ 0.4 | V | $I_{IL} = 500\mu A$ $I_{IL} = 20\mu A$ |
| I_{IL} | Input low current | | | 500 | μA | |
| V_{IH} | Input high voltage | $0.7 \times CV_{CC}$ | | CV_{CC} | V | $I_{IH} = -20\mu A$ |
| I_{IH} | Input high current | | | -20/+20 | μA | |
| V_{OL} | Output low voltage | 0 | | 0.4 0.4 0.3 | V | $I_{OL} = 1mA$ (5V) $I_{OL} = 1mA$ (3V) $I_{OL} = 1mA$ (1.8V) |
| I_{OL} | Output low current | | | 15 | mA | |
| V_{OH} | Output high voltage | $0.8 \times CV_{CC}$ | | CV_{CC} | V | $I_{OH} = 20\mu A$ (5V, 3V, 1.8V) |
| I_{OH} | Output high current | | | 15 | mA | |
| t_{RtF} | Rise and fall delays | | | 0.8 | μs | $C_{IN} = 30pF$ output |

Table 9 - Smart Card I/O DC Parameters (P1.0)

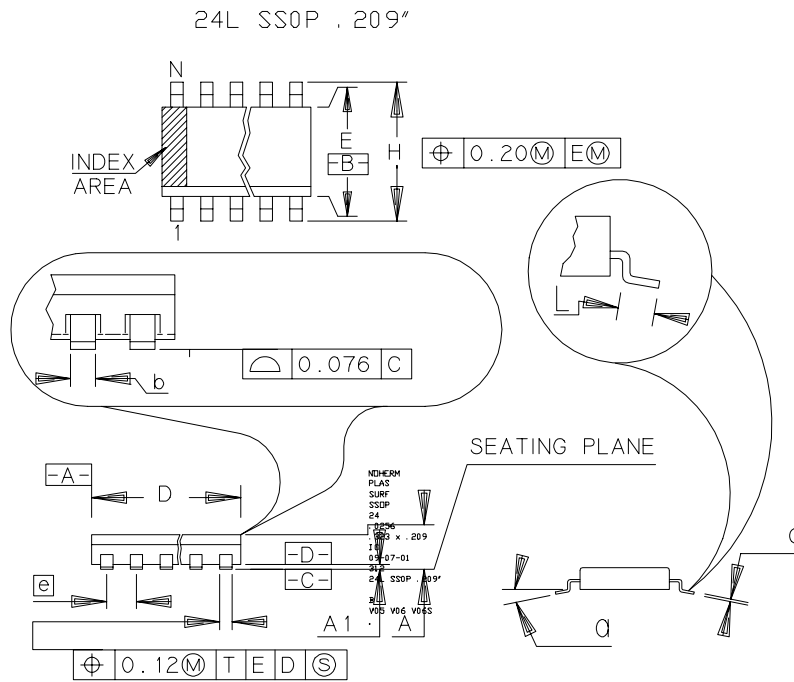
| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|-----------|----------------------|---|-----|--|---------|--|
| V_{OL} | Output low voltage | 0 | | $0.2 \times CV_{CC}$ 0.4 | V | $I_{OL} = 20\mu A$ $I_{OL} = 50\mu A$ |
| I_{OL} | Output low current | | | 15 | mA | |
| V_{OH} | Output high voltage | $CV_{CC} - 0.5$ $0.8 \times CV_{CC}$ | | CV_{CC} | V | $I_{OH} = 50\mu A$ $I_{OH} = 20\mu A$ |
| I_{OH} | Output high current | | | 15 | mA | |
| t_{RtF} | Rise and fall delays | 0 | | 0.8 | μs | $C_{IN} = 30pF$ |
| | Voltage stability | -0.25 $CV_{CC} - 0.5$ | | $0.4 \times CV_{CC}$ $CV_{CC} + 0.25$ | | Low level High level |

Table 10 - Smart Card RST, CC4, CC8, DC Parameters (Port 1.5, P1.3, P1.1)

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|-----------|-----------------------------------|-----|-----|-----|---------|---------------------------|
| t_{OL1} | CPRES weak pull-up output current | 3 | 10 | 25 | μA | P1.2=1, short to V_{SS} |

Table 11 - Card Presence DC Parameters (P1.2)

Mechanical Data



| | MM | | INCH | |
|----|------|------|-------|------|
| A | 1.73 | 1.99 | .068 | .078 |
| A1 | 0.05 | 0.21 | .002 | .008 |
| b | 0.25 | 0.38 | .010 | .015 |
| C | 0.09 | 0.20 | .004 | .008 |
| D | 8.07 | 8.33 | .318 | .328 |
| E | 5.20 | 5.38 | .205 | .212 |
| e | 0.65 | BSC | .0256 | BSC |
| H | 7.65 | 7.90 | .301 | .311 |
| L | 0.63 | 0.95 | .025 | .037 |
| N | | 24 | | 24 |
| q | 0° | 8° | 0° | 8° |

Figure 3 - Mechanical Data

Electrical Schematic

PCB Design Considerations

| Rep | Qty | Description | Reference Part | Package | Manufacturer |
|-----|-----|-----------------------|----------------------------|---------|--------------|
| AVL | | | | | |
| C1 | 1 | Ceramic Capacitor SMD | 10% 100nF | 25 V | 0603 |
| C2 | 1 | Ceramic Capacitor SMD | GRM42-6X5R475K10 4.7µF | 10V | 1206 Murata |
| C3 | 1 | Ceramic Capacitor SMD | GRM42-6X5R475K10 4.7µF | 10V | 1206 Murata |
| C4 | 1 | Ceramic Capacitor SMD | 10% 470pF | 25V | 0603 |
| C5 | 1 | Ceramic Capacitor SMD | 10% 22pF | 25V | 0603 |
| K1 | 1 | Smart card connector | SF1W010S1A | | JAE |
| D1 | 1 | LED 3mA | | | 0805 |
| L1 | 1 | Inductor SMD 4.7µH | LQH3C4R7M34 | | 1210 Murata |
| Q1 | 1 | Resonator ceramic SMD | 14.74 MHz CSTCV14.74MXJ040 | | Murata |
| U1 | 1 | Microcontroller | GemCore Serial Lite PRO | SSOP24 | Gemplus |
| R1 | 0 | Resistor 1/10W | 5% 0R | | 0603 |
| C6 | 01 | Ceramic Capacitor SMD | 10% 82pF | 25V | 0603 |

Table 12 - Part List

The R1 resistor is reserved for future use. It should not be mounted but its tracks must be present in case of future necessity. All tracks should be as short as possible. The GND should be designed as a ground plane.

C4 and C5 should be as close as possible to the smart card connector to reduce noise and interference.

R1, C1, C2, C3, L1 and Q1 should be close to U1.

For EMVCo certification, the smart card connector must be equipped with a smart card detection switch. The switch must be closed when the smart card is present in the connector.

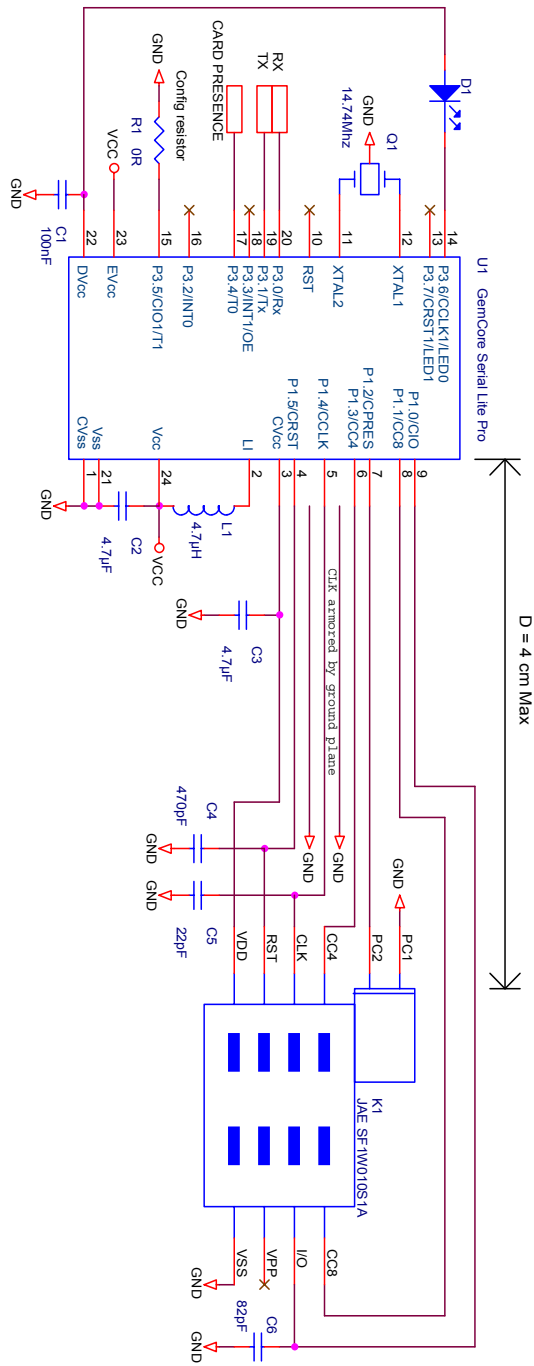


Figure 4 - Electrical Schematic

Note: The R1 resistor is not mounted and it is reserved for future use.

For More Information

For additional information about GemCore Serial Lite PRO, refer to the following documents:

Standards and Specifications

- *ISO 7816 standard, parts 1, 2, 3 and 4.*

Recommended Reading

- *GemCore Serial Lite PRO V1.4 Reference Manual*
- *GBP Interface Library Kit Programmer's Guide*
- *GemCore-Based Reader Testing Guidelines*

Terminology

Abbreviations

| | |
|-------------|--------------------------------------|
| bps | Bits per second |
| GBP | Gemplus Block Protocol |
| GSLP | GemCore Serial Lite PRO |
| ISO | International Standards Organization |
| LED | Light Emitting Diode |

