SIEMENS

ICs for Communications

ISDN Terminal Equipment

Capacitive Coupling of the S-Interface Receiver
Using the IPAC

IPAC PSB/F 2115 Version 1.1
IPAC PSB/F 2115 Version 1.2

Application Note 10.98

PSB/F 2115 **Revision History:**		**Current Version: 10.98**
Previous Version:		Application Note 02.98
Page (in previous Version)	Page (in current Version)	Subjects (major changes since last revision)
		Added common mode voltage protection

For questions on technology, delivery and prices please contact the Semiconductor Group Offices in Germany or the Siemens Companies and Representatives worldwide: see our webpage at http://www.siemens.de/semiconductor/communication

Edition 10.98

Published by Siemens AG,
HL SC,
Balanstraße 73,
81541 München

Attention please!

As far as patents or other rights of third parties are concerned, liability is only assumed for components, not for applications, processes and circuits implemented within components or assemblies.

The information describes the type of component and shall not be considered as assured characteristics.

Terms of delivery and rights to change design reserved.

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Siemens Office, Semiconductor Group.

Siemens AG is an approved CECC manufacturer.

Packing

Please use the recycling operators known to you. We can also help you – get in touch with your nearest sales office. By agreement we will take packing material back, if it is sorted. You must bear the costs of transport.

For packing material that is returned to us unsorted or which we are not obliged to accept, we shall have to invoice you for any costs incurred.

Components used in life-support devices or systems must be expressly authorized for such purpose!

Critical components[1] of the Semiconductor Group of Siemens AG, may only be used in life-support devices or systems[2] with the express written approval of the Semiconductor Group of Siemens AG.

1 A critical component is a component used in a life-support device or system whose failure can reasonably be expected to cause the failure of that life-support device or system, or to affect its safety or effectiveness of that device or system.

2 Life support devices or systems are intended (a) to be implanted in the human body, or (b) to support and/or maintain and sustain human life. If they fail, it is reasonable to assume that the health of the user may be endangered.

Abstract

This Application Note describes the capacitive coupling of the IPAC to the S interface. It also shows the circuit diagrams and explains what must be considered when using this kind of interface coupling.

The interface solution presented has been approved by Stollmann GmbH (Hamburg, Germany) with the Stollmann Terminal Adapter (SIPB 72115-TA) at the official approval bodies in Germany.

1 S-Interface Circuit

Compared to the standard S-interface circuit there is neither a choke in transmit direction nor in receive direction (see Figure 1). The receive path is connected to the S interface of the IPAC by two 2.2 nF/500 V capacitors (available in SMD1206 package), the transmit path uses a transformer.

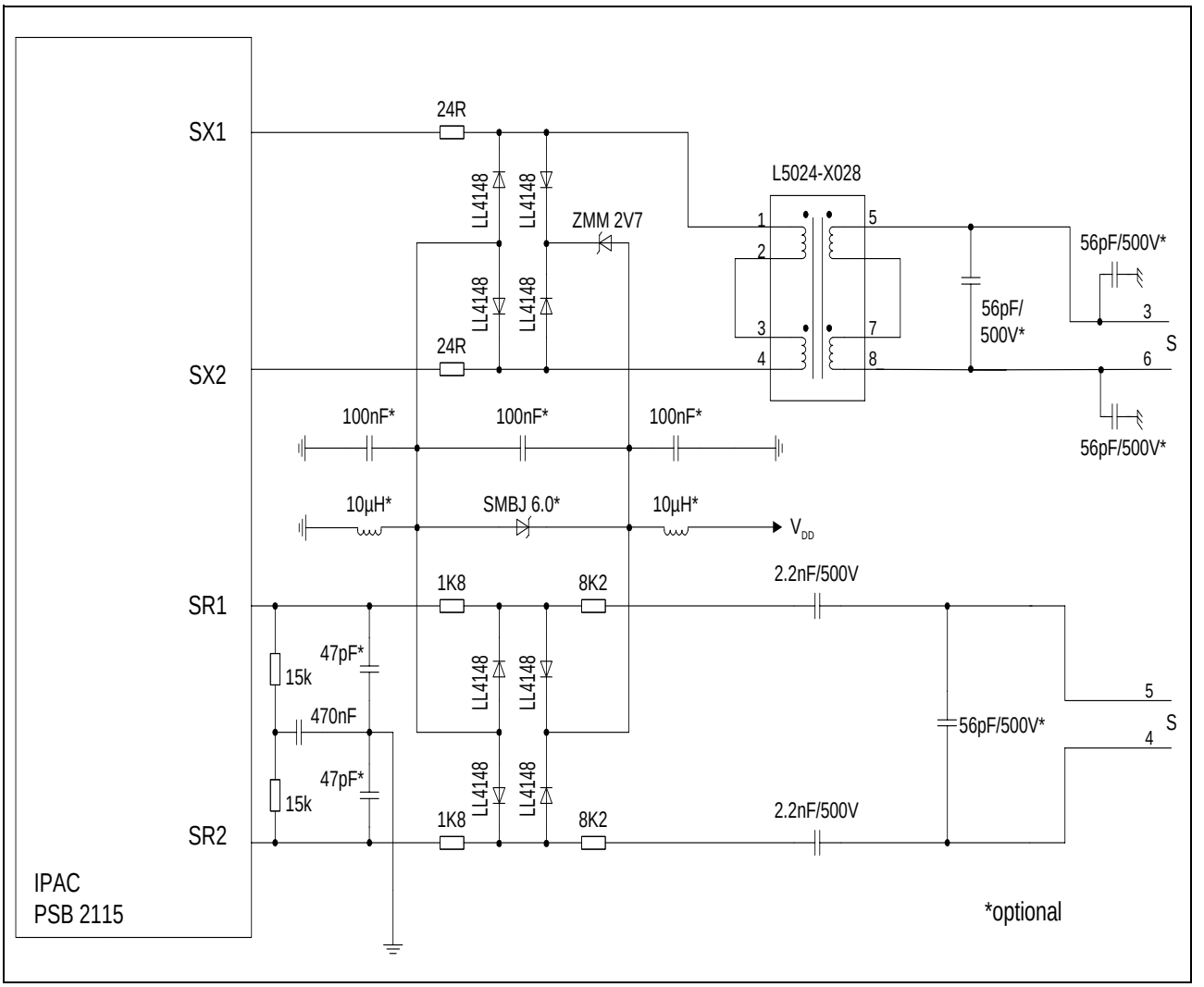

Figure 1 S-Interface

The value of the coupling capacitors at the interface has been chosen based on the turn-on transient current test (phantom power supply at S; ETS 300 012).

The 56 pF/500 V capacitors between both the transmit and receive lines suppress push-pull signals with high frequency in both directions. The voltage resistance at the primary side of S needs to be 500 V since the IEC801 tests use high voltage bursts.

At the transmit line both 56 pF/500 V capacitors are connected to the shield to suppress high frequency noise coming from the PCB.

Both 47 pF capacitors and the resistors at the SR1 and SR2 pins build a low-pass filter suppressing high frequent noise superimposed on the S line while testing conformance of receiver sensitivity according to ETS 300 012.

At the receive side, the two resistors and the capacitor form a filter to short common mode sinusoidal voltages present on the S-interface (like 50/60 Hz voltages coupled from the network termination power supply).

GND and VCC could carry high frequent digital noise. This noise will be coupled via the stray capacitance of the diodes into the S-interface. The result would be unwanted emission via the unshielded S-cable. The 10 µH inductances avoid the coupling from GND and VCC to the S-interface. If properly decoupled GND and VCC are available, the inductances are probably not necessary and can be bridged.

The same is applicable to the 100 nF capacitors. In addition, voltage peaks are compensated before the zener diode SMBJ6.0 breaks through. The SMBJ6.0 zener diode is useful if high energy pulses (surge) are present on S. Currently the surge protection is not mandatory in Germany.

In general, the diode arrays suppress voltage peaks. At the receiver side, this clips both rails to VCC+0.7 V and GND-0.7 V, respectively. In transmit direction there is a 2.7 V zener diode added to the diode array to fulfill the 96 kHz impedance tests with the unit powered off, i.e. the voltage range of the SX1 and SX2 rails lies between GND-0.7 V and VCC+3.4 V or $V_{SMBJ6.0}$+3.4 V (depending on the pulse shape and the influence of the 10 µH inductance connected to VCC and the zener diode).

The splitted 10 k Resistor (1.8 k + 8.2 k) and the diode array limit the voltage and current peaks at the S receiver input of the IPAC.

On the PCB, there should be no power plane in the area of the S-interface. On the primary side of this interface, there should be a clearance of all copper of at least 2.5 mm. This is essential for some approvals to meet safety standards like EN60950.

*Note: The EMI optimization depicted in the schematics was successfully used with the Stollmann Terminal Adapter (SIPB 72115 TA). This TA has its own power supply and is housed in a metal case. The described S-interface circuits give some hints for other designs but they may need to be adapted in other designs. The components marked as "*option" are not mandatory but useful for EMI and noise suppression.*

1.1 Overvoltage Protection

The overvoltage protection is not mandatory for the BAPT approval but EMI and low-voltage guidelines must be guaranteed by the manufacturer.

Low-voltage guidelines: from ETS 300 047-2 page 7, last sentence, it follows that the S-interface is a SELV (Safety Extra-Low Voltage) circuit, i.e. no high-voltage capacitors are necessary (2.2 nF, 56 pF). The used SELV definition is based on EN 60950 (Issue 2, 1996).

ETS 300 047-3: §5.7.1-5.7.3 were measured with TBR3. For the termination networks used in TBR3, no high-voltage capacitors are necessary.

EMI interference immunity EN 50082 with reference to IEC801-4 burst. During this test it is not possible to foresee the voltage peaks at the coupling capacitors (2.2 nF). Therefore 500 Volt capacitors were used.