LINEAR TECHNOLOGY

DESIGN NOTES

Single Interface Chip Controls Two Smart Cards – Design Note 289

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Introduction

There are considerable challenges to smart card interfacing, including various voltage levels (both input and output) and stringent fault handling requirements. To produce a robust card reading system, designers must comply with extensive and often difficult software as well as hardware standards. Furthermore, there are other complications like in-circuit ESD and pin-to-pin shorts to contend with.

The LTC®1955 dual smart card interface provides all of the required power management, control, ESD and fault detection circuitry for two smart cards. Employing a voltage doubling charge pump and two low dropout linear regulators, this device generates two independent levels of either 5V, 3V or 1.8V from a 2.7V to 5.5V input. Both channels have the required pins to support the EMV (Europay, MasterCard, Visa) and the ISO7816 smart card standards. One channel has extra control pins (smart card contact pad locations C4 and C8) to support existing memory cards. The entire chip is controlled by a microcontroller-friendly serial interface.

Features

The LTC1955 includes considerable security and functionality, yet remains easy to use. Two independent circuits detect the presence or absence of a smart card. Card insertion is debounced with a 40ms delay to ensure that the contacts are well seated before the card is

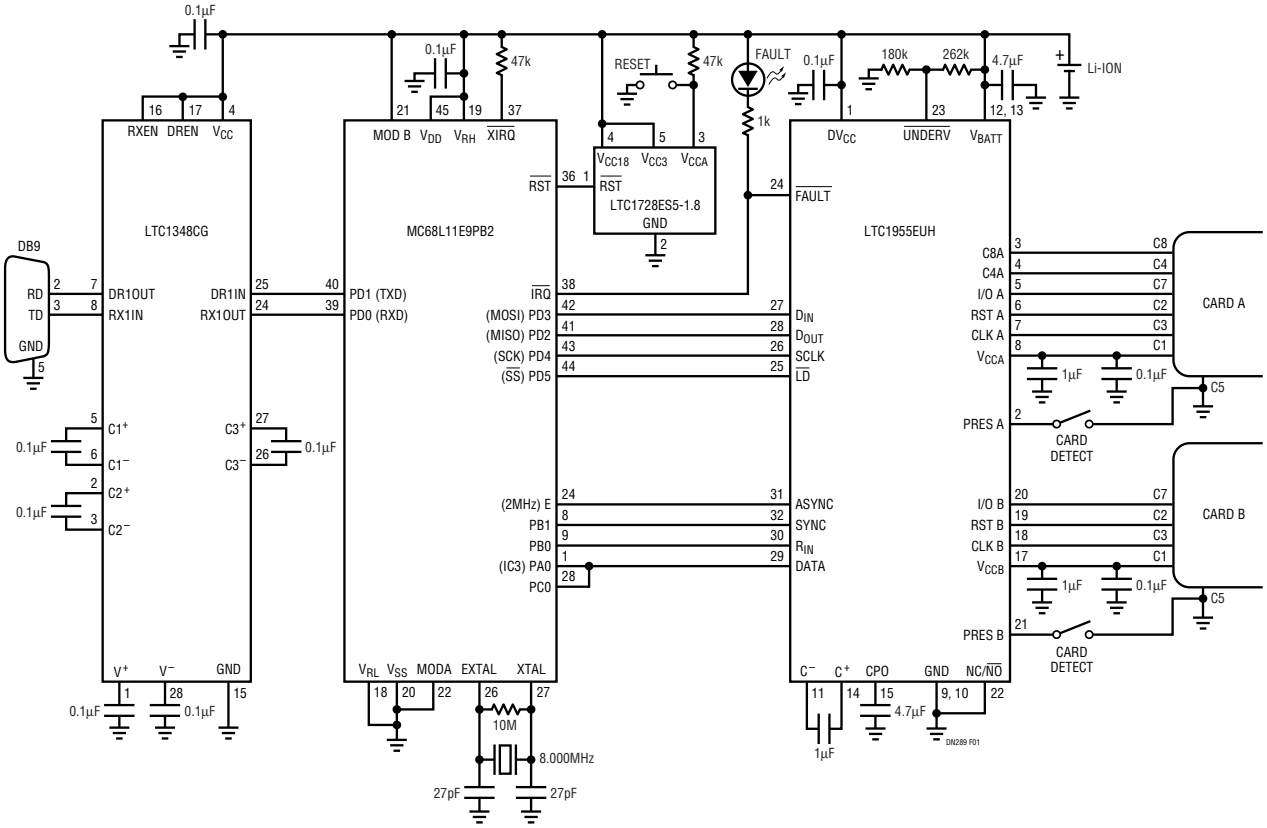

Figure 1. Battery-Powered RS232 to Dual Smart Card Interface

activated. If a card is removed during a transaction, the LTC1955 automatically deactivates it before its pads leave the connector's contact pins. Figure 3 shows the sequencing of the smart card pins during an automatic deactivation.

Providing power to 5V cards from 3V, the charge pump operates in constant frequency mode when heavily loaded and has an autoburst feature for power savings under lightly loaded conditions. The constant frequency operation allows the use of tiny, low profile capacitors. The charge pump is powerful enough to supply both smart cards at rated current requirements.

Internal low dropout linear regulators independently control the voltage of both smart cards. All three smart card classes (1.8V, 3V and 5V) are supported and the smart card signals are shifted to the appropriate level for the cards, independent of the microcontroller supply voltage (which can range from 1.7V to 5.5V).

The data communication pins (I/O_X and DATA) are bidirectional and full duplex. This feature allows true acknowledge data to be returned to the microcontroller interface. The bidirectional pins also have special accelerating pull-up sources* to ensure fast rise times (see Figure 2). These sources are faster than a resistor without dissipating excessive power when the pin is held low. They sense the edge rate on the pin and compare it to a preset limit. If the limit is exceeded, an additional current source is applied to the pin thereby accelerating its rise time. Once the pin reaches its local supply level the acceleration current is disabled. Figure 2 shows an example of the data waveforms on the smart card and microcontroller pins.

For the smart card clock pins, special clock divider and synchronization circuitry allows easy interfacing to the microcontroller. Separate clock input pins are available to support either asynchronous smart cards or synchronous memory cards.

Ease of Use

Figure 1 shows an example of the LTC1955 used in a dual smart card to RS232 application powered by a single Li-Ion battery. A simple 4-wire command and status interface plus a 4-wire smart card communications interface are all that is required. The command/status serial port can be easily daisy-chained and the smart card communications port can be paralleled to expand this application to four or more smart cards while maintaining the same number of wires to the microcontroller.

Conclusion

Requiring a minimum of external components and available in a small 5mm × 5mm × 0.75mm leadless package, the LTC1955 provides a compact, simple and cost effective solution to the difficult problems facing smart card system designers.

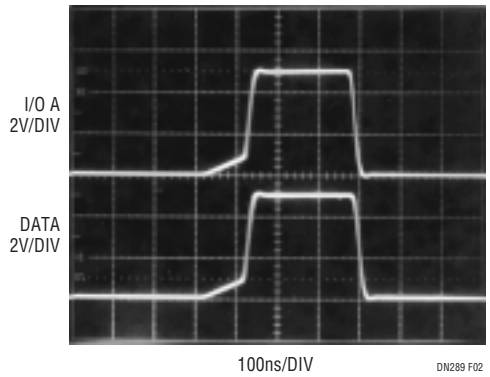

Figure 2. Bidirectional Pin Waveforms with Pull-Up Acceleration

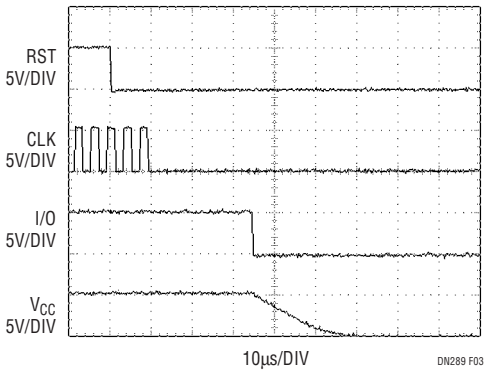

Figure 3. Smart Card Deactivation Sequence

*Patent pending

Data Sheet Download

http://www.linear.com/go/dnLTC1955

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dn289f LT/TP 0702 371.5K • PRINTED IN THE USA