

AX-550

CREDIT CARD OUTLINE DIRECT SEQUENCE TRANSCEIVER

Product Line Advance Information

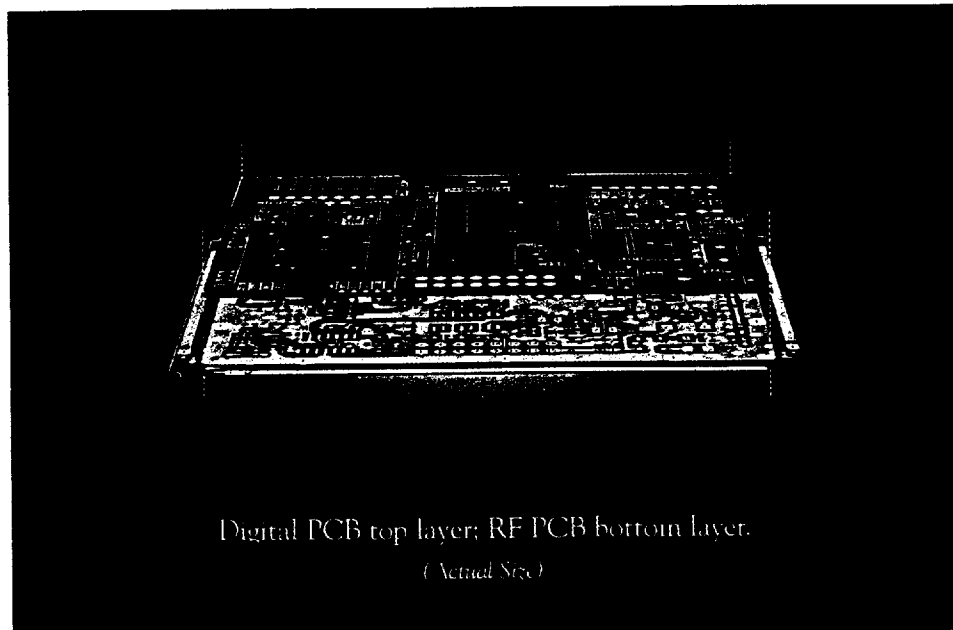
The AX-550 Credit Card Transceiver represents an innovative leap in digital signal processing techniques combined with over twelve years of spread spectrum experience. Electronic components which once caused lot-to-lot manufacturing variation, reduced sensitivity and difficult to compensate temperature drift, have been absorbed into the patent-pending digital signal processing architecture. This innovative approach actually accepts the frequency inaccuracy of related transmit-only devices, allowing for less expensive transmitter designs while maintaining high performance.

In battery mode, the novel spread spectrum acquisition technique uses windowing to post-process signals with the RF section powered off. This power miser approach enables multi-year battery life. The frequency diversity version automatically picks the best out of three channels, providing an additional 50 dB of jamming protection. In repeater mode, the on-board processor can store and forward messages from distant or difficult to reach transmitters.

If more processing power is needed, the AX-550 is compatible with the AX-540 receive-only device, the industrial temperature range AX-560 analog transceiver, the industrial quad DSP AX-570 high-end transceiver as well as all AX-602 Custom ASIC-based transmitters. The AX-560 industrial analog transceiver has won by a wide margin every product face-off to date. The high-end DSP AX-570, however, takes that performance to a new level, operating within an unprecedented 0.4 dB of theoretic sensitivity, over -40° to +85°C.

FEATURE LIST

- Advanced DSP Extended Range Technology
- FCC Unlicensed Operation
- Extended Battery Life Mode Provides 3+ Years of Life
- Battery Low Indication
- Repeater Mode
- Controller Mode Senses and Activates External Inputs and Driver Output
- Supports CSMA (listen before talk)
- 8 Frequency Channels and 6 CDMA Channels
- Frequency and Antenna Diversity to Reduce Signal Fading
- 31 Byte Messages (128 byte option)
- Fast Synthesizer, 500 μ s settling time
- 19.2 Kb/s and 57.6 Kb/s on-air versions
- Excellent Jam Resistance, 60 dB Out-of-Channel Rejection
- -110 dBm Sensitivity
- Enables Low Cost Crystals in Transmit-only Devices
- CRC 16/32 Error Detection w/1 bit correction
- 32 KHz Oscillator/Timer with 5 μ A Sleep Mode
- 128 Bytes E²ROM (optional)
- Internal Watch-dog Timer
- Uses Axonn AX-602 Spread Spectrum ASIC
- Patented and patent-pending technology



Digital PCB top layer; RF PCB bottom layer.

(Actual Size)

RECEIVER

Operating Frequency Band	902 - 928 MHz, programmable
Sensitivity (Average Power)	-110 dBm
Attenuation, programmable (for sensitivity/range reduction; one step)	15 dB Step
Process Gain, (code on-off per FCC Regulations)	12 dB
Selectivity (Out-of-channel CW Jammer Rejection)	-60 dBc @ ± 3 MHz from Center Frequency
Front-End Overload (maximum signal input)	-25 dBm
Image Response	-50 dB
Intermodulation Distortion, 3rd Order Input Intercept	-30 dBm
Band Edge Filter Roll Off (± 58 KHz)	2 dB max
Crystal Accuracy (over temp)	± 15 ppm
Code Division Multiple Access Channels, CDMA	6
Channel Frequencies (real-time selectable)	8, in 3 MHz steps standard
Synthesizer Lock Time:	
From Sleep Mode including Crystal Stabilization	3 ms
Run Mode, Crystal Stable, Transmit-to-Receive/Receive-to-Transmit	1 ms
Run Mode, Crystal Stable, 3 MHz Step	500 μ s

ON BOARD TRANSMITTER

Transmit Power Output	100 mW
Transmit Spectrum (occupied BW)	-40 dBc @ ± 3 MHz from Center Frequency
Spread Spectrum Modulation	BPSK
Chip Code Length	63 Chips
Chip Rate	1.22 Mc/s
Data Modulation (software selectable)	ASK/BPSK
On-Air Data Rate (software selectable)	19.2 Kb/s ASK (19.2 Kb/s, 57.6 Kb/s BPSK version)
Crystal Accuracy (over temp)	± 15 ppm

REMOTE TRANSMIT-ONLY DEVICE COMPATIBILITY

(other transmitter parameters same as above)

Crystal Accuracy (over temp)	± 50 ppm
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SYSTEM LEVEL

Watch Dog Timer	2 Sec
RF Link Integrity Output Message SNR and Correlation Level	2 Bytes
Data Integrity Verification, On Air	16/32 Bit CRC
Error Correction, On Air	1 Bit
Message Preamble Time (mode dependent)	1.5 to 4.8 ms
Data Message Size	7 Bytes: Logical Filter, Status and CRC plus 0-31 user-definable Bytes <i>(Up to 128 user-definable bytes with expanded CPU RAM)</i>
Receiver Addressability (multidrop serial)	14 Receivers
Serial Interface:	
Data (selectable)	UART, 8 Bit Data, 1.2 to 38.4 K Baud
Electrical	Pseudo RS-232 (0, 5 V levels), RS-485 (optional)
Protocol	Enhanced Binary Message Protocol
Remote Hardware Reset	27ms break; ASCII Zero@300 Baud
Magnetic Programming Interface (optional)	
Carrier Frequency	1 MHz
Data Modulation	ASK
Data Rate	9.6 Kb/s
External Event Inputs (from AX-602)	4
Contact Closure De-bounce Time	50 ms
Pull-up Resistors	1M Ohm to V_{CC}
Outputs	2
Driver, One	Open collector, 5 V, 100 mA sink, reverse current diode to V_{BAT}
Logic, One	CMOS, 0, 5V, 15 mA sink, 1mA source, max

SLEEP-MODE WAKE-UP OPTIONS

Timer (programmable)	50 ms to 17 minutes
External Event Inputs (programmable)	Upon transition (w/50ms debounce)
Magnetic Programming Interface (optional)	Upon 100 ms break character

VOLTAGE SUPPLY

Voltage	7.2V to 6.0V min, Battery; (12V +/- .5V DC version)
Battery	Two External 3.6 V Lithium Cells
Battery Low Warning	6.2 V

CURRENT REQUIREMENTS

Sleep-Mode (wake-up timer running in battery mode; must be added to below listed currents)	5 μ A
Serial Communications, Active	25 mA
Receiver, Active Average	130 mA
Receiver Average Current (widowed mode for battery operation)	
60 Second Receive Data Update	9 μ A
5 Second Receive Data Update (reduced RF sensitivity)	24 μ A
(Immediate updates if externally commanded - transmit/listen mode)	
Transmitter, Active @ 100 mW output power	140 mA
Transmitter Average Current:	
One transmission every 30 seconds	36 μ A
One transmission every 10 minutes	2 μ A

LED INDICATORS

Trip (Potential Incoming Message)	Yellow
Valid Received Message	Green
Transmit Active	Red

CONNECTORS

(see back page)

Four Ext. Event Inputs, One Open Collector Output, One μ C Output, 7.2V/12V Version Power, GND	8 Pin, Male; J1
Serial Communication (4), One μ C Output, Mag Loop Input, 7.2V/12V Version Power, GND	8 Pin, Male; J2

ANTENNAS

Diversity (Software Selectable)	Polar, 2 Branch, 12 dB Improvement
Antenna Type	PCB printed, 2 Receive, 1 Transmit

DIMENSIONS

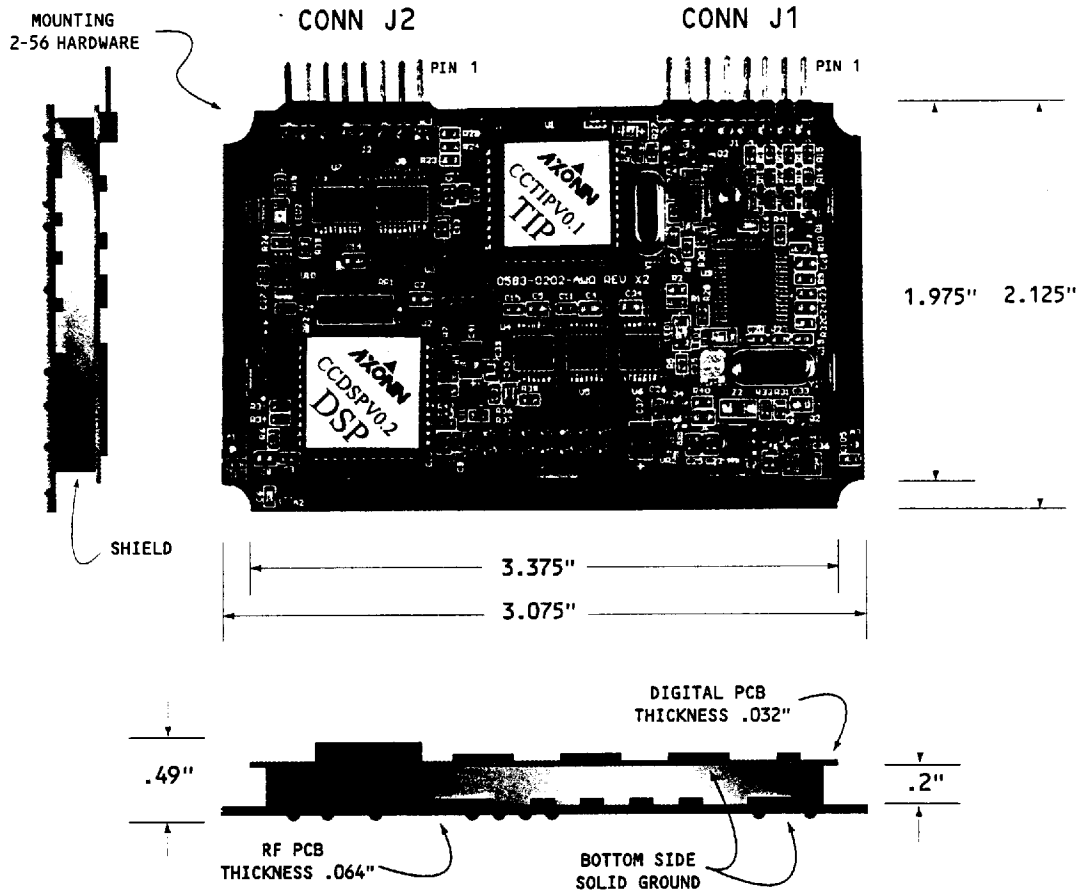
Credit Card Sized	3.375" x 2.125" x 0.49" thick (batteries external)
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ENVIRONMENTAL

Temperature	-10 to +60°C, Standard; (-40 to +85°C optional)
Humidity	5 to 95% Non-condensing

Note: All performance parameters are typical @ 6.8V and 25°C

Mechanical Detail



CONN J1			
PIN	NAME	DIRECTION	VOLTAGE MAX
1	ALARM 1	Input	0 - V _{CC}
2	ALARM 2	Input	0 - V _{CC}
3	ALARM 3	Input	0 - V _{CC}
4	ALARM 4	Input	0 - V _{CC}
5	OC_OUT	Output	V _{BAT} /12.5V
6	V-BAT/12V (VER)	Power	7.2V/12.5V
7	μC_IN_OUT	Input/Output	0 - V _{CC}
8	GND	Power	n/a

CONN J2							
PSEUDO RS-232 TTL SERIAL MODE				RS485 OPTION			
PIN	NAME	DIRECTION	VOLTAGE MAX	PIN	NAME	DIRECTION	VOLTAGE MAX
1	MSG_AVAIL-	Output	0 - V _{CC}	1	MSG_AVAIL-	Output	0 - V _{CC}
2	SER_RTS	Input	0 - V _{CC}	2	n/c	-	-
3	SER_CTS	Output	0 - V _{CC}	3	n/c	-	-
4	MAG_LOOP	Input	0 - V _{CC}	4	MAG_LOOP	Input	0 - V _{CC}
5	V_BAT/12V (VER)	Power	7.2V/12.5V	5	V_BAT/12V (VER)	Power In	7.2V/12.5V
6	SER_TX	Output	0 - V _{CC}	6	RS485B	I/O, current loop	See Max 485
7	SER_RX	Input	0 - V _{CC}	7	RS485A	I/O, current loop	See Max 485
8	GND	Power	n/a	8	GND	Power	n/a

NOTE: V_{CC} drops to 2.8V during sleep mode to conserve current

I-TERO

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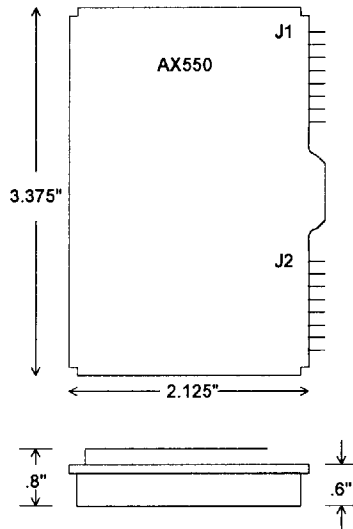


Figure 1

General:

AX550 transceivers represent an innovative leap in digital signal processing techniques combined with over a decade of spread spectrum experience. AX550's can both transmit and receive spread spectrum messages to provide communication data links with superior RF performance.

AX550 transceivers have four digital external event inputs. The AX550-485 also provides an RS485 interface and the AX550 provides a TTL logic level serial interface. This flexibility allows these transceivers to interface with external alarms as well as interface with computer-based monitoring stations.

Itero technology allows someone with little or no RF expertise to use spread spectrum RF technology with minimum effort. AX550 transceivers do not require FCC licensing. FCC certification is required for products incorporating AX550's.

Connector Pinouts:

J1-1	Status 0	Alarm/Status Input # 0
J1-2	Status 1	Alarm/Status Input # 1
J1-3	Status 2	Alarm/Status Input # 2
J1-4	Status 3	Alarm/Status Input # 3
J1-5	DIGOUT1	Open Collector Output
J1-6	Reserved	No Connect
J1-7	DIGOUT2	TTL or CMOS Output
J1-8	GND	Ground

		AX550	AX550-485
J2-1	MSGAVAIL-	Serial Handshake Output	same
J2-2	SERRTS	Serial Input	n/c
J2-3	SERCTS	Serial Output	n/c
J2-4	Reserved	No Connect	same
J2-5	VIN	Supply Voltage (+7.2V)	same
J2-6	SERTX	Serial Output	RS485B current loop
J2-7	SERRX	Serial Input	RS485A current loop
J2-8	GND	Ground	same

Specification:

All AX550 transceivers can be configured for either battery-powered or continuous line-powered operation. In battery-powered mode, AX550's use advanced sleep circuitry to maintain system data throughput requirements. The transceiver uses direct sequence spread spectrum modulation methods. This method of data transmission complies with FCC part 15.247 regulations.

The transceivers interface to customer hardware by means of two in-line connectors. The 8-pin connector J1 contains the four alarm/status input signals, two digital outputs, and a ground.

The 8-pin connector J2 contains either a serial TTL or an RS485 interface, a ground, and a supply voltage input.

AX550 Characteristics:

Receiver Characteristics:

Operating frequency band	902 - 928 MHz, programmable
Sensitivity (average power)	- 110 dBm
Attenuation, programmable	15 dB step (sensitivity/range reduction)
Process Gain (code on-off)	> 10 dB (per FCC regulations)
Selectivity (jammer rejection)	-60 dBc @ ±3 MHz from center
Front-end overload	-25 dBm
Image response	-50 dB
Intermodulation distortion	-30 dBm
Band edge filter roll-off (±58 kHz)	2 dB max
Crystal accuracy (over temp)	± 15 ppm
CDMA channels	6
Channel frequencies (real-time)	8, in 3 MHz steps standard
Synthesizer lock time:	
from sleep mode	3 ms
run mode transmit-to-receive	1 ms
run mode receive-to-transmit	1 ms
run mode, 3 MHz step	500 µs

Transmitter Characteristics:

Transmit Power Output	100 mW
Transmit Spectrum	-40 dBc @ ±3 MHz from center
Spread spectrum modulation	BPSK
Chip code length	63 chips
Chip rate	1.22 Mc/s
Data modulation	ASK
On-air data rate (ASK)	19.2 kbit/s
Crystal accuracy (over temp)	± 15 ppm

System Level:

Watch dog timer	2 sec
RF link integrity output	2 bytes SNR and correlation level
Date integrity	16/32-bit CRC
Error correction, on air	1 bit
Message preamble time	4.8 ms
Data message size	7 bytes plus 0-31 user bytes (up to 128 user bytes with added RAM)
Receiver addressability	127 receivers per RS485 serial network

Licensed under one or more of the following Patents: 4977577; 506713 5095493; 5119396; 5265120; Re.35829; 5408217; 5457713; PCT/US95/0473 PCT/US95/02690; PCT/US96/09314; PCT/US96/18721; Patents Pending; 08/769138; 08/485007; 08/559913; 08/929891

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AX550 Characteristics (cont):

Serial Interface:

data (selectable) electrical	UART, 8-bit data, 1.2 to 19.2k Baud AX550: TTL logic (0, 5V levels) AX550-485: RS-485
protocol	Automation Serial Protocol (ASP)
remote hardware reset	27 ms break; ASCII Zero @ 300 Baud

Digital inputs

contact closure debounce	50 ms
pullup resistors	1 M Ω to Vcc

Outputs

Dig Out 1	open collector, 5 V, 100 mA sink, reverse current diode to VIN
Dig Out 2	CMOS, 0-5 V, 15 mA sink, 1 mA source, max

Sleep Mode Wake-up Options:

Timer (programmable)	50 ms to 17 minutes
External event inputs	On transition (with 50 ms debounce), programmable

Voltage Supply:

Voltage Input	5.0V to 7.2V
Battery	two external 3.0 or 3.6 V lithium cells
Battery Low Warning	5.1 V threshold

Power Requirements:

Sleep mode	15 μ A
Serial communications, active	25 mA
Receiver, active (average)	130 mA
Transmitter, active @ 100mW output power	140 mA

LED Indicators:

Trip (potential incoming message)	Yellow
Valid received message	Green
Transmit active	Red

Antennas:

Diversity (receive only)	Polar, 2 branch, 12 dB improvement (software selectable)
Antenna type	Bent wire, 2 receive, 1 transmit

Dimensions:

Credit card outline	3.375" x 2.125" x 0.6" thick (batteries external)
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Environmental:

Operating temperature	-10 to +60 ° C (AX550, AX550-485) -40 to +85 ° C (AX550E, AX550E-485)
Operating humidity	0 to 95% non-condensing

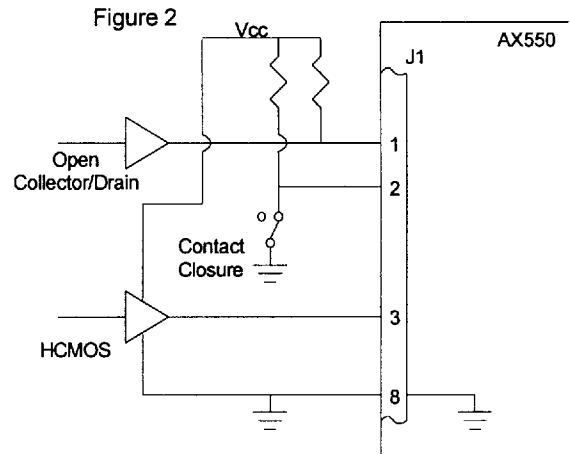
Transceiver Setup:

AX550 transceivers utilize the serial port to initialize the parameters. Parameters which can be configured through this interface include the Group Number, spreading code, etc. Refer to the following documents for detailed information:

Itero RF System Level Requirements
Itero RF Serial Communications Protocol

Digital Input Interface (J1-1 through J1-4):

Each of the four digital inputs must be driven with an HCMOS or open collector/drain or contact closure device. The voltage range for these input signals is from 0.0 V to 3.5 V.



Digital Output Interface (J1-5, 7):

The digital outputs may be commanded through the serial interface.

Figure 3 shows an example circuit where the Digital Output 1 signal is used to drive a relay.

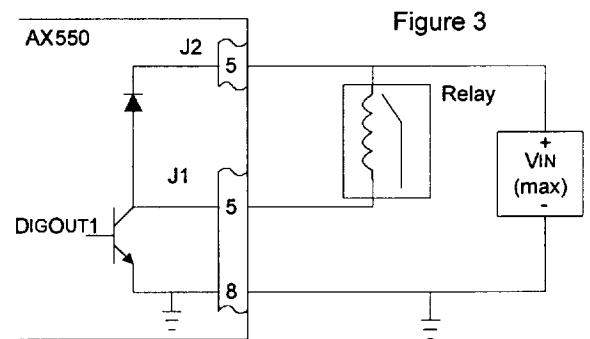
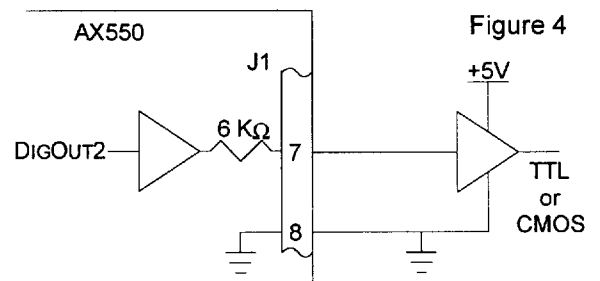


Figure 4 shows an example circuit where the Digital Output 2 signal is used to drive a TTL logic gate or CMOS logic gate.



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