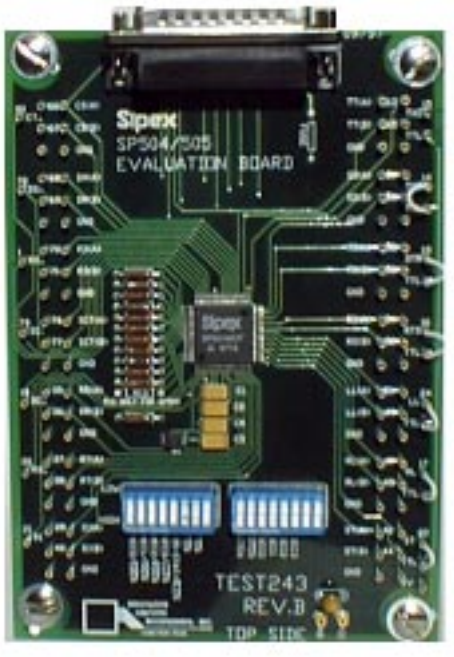
SP504/505 Evaluation Board Manual

- Easy Evaluation for the SP504 or SP505 Multi-Protocol Transceiver
- Probe Points Accessable to Driver and Receiver I/O Pins
- DB-25 Serial Port Connector Adheres to EIA-530 Pinout
- Interface Mode Select Through On-Board DIP Switches
- Driver Inputs Can Be Easily Configured to a TTL DC or AC Input
- Convenient Layout of Driver and Receiver Access Pins
- Compact 6" X 4" Size



DESCRIPTION...

The **SP50x Evaluation Board** is designed to analyze the **SP504** or **SP505** multi-protocol transceivers. The evaluation board provides access points to all of the driver and receiver I/O pins so that the user can measure electrical characteristics and waveforms of each signal. The **SP50x Evaluation Board** also includes a DB-25 serial port connector which is configured to a EIA-530 pinout. This allows easy connections to other DTE or DCE systems as well as network analyzers.

The next section describes the **SP50x Evaluation Board** including configuration instructions for either the **SP504** or **SP505**. A schematic of the board and the PCB layout are also included. Product pinouts, product protocol tables, and DB-25 pinout assignment table are also included for convenience.

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BOARD LAYOUT

I/O Pinouts

The **SP504/SP505 Evaluation Board** has been designed to easily and conveniently provide access to all inputs and outputs to the device under test. Position the board with the DB-25 connector at the top and the DIP switches at the bottom. From this orientation, all driver inputs and outputs are located on the right-hand side of the board while all receiver inputs and outputs are located on the left-hand side of the board.

The access pins are arranged in groups of eight pins for each driver and seven pins for each receiver. Starting at the "TxC" driver located at the upper right-hand corner of the board, the first two rows of pins are TT(a). These are the TxC driver output TT(a) connections. There are two probe pins to accomodate loads, multiple test clips, etc. Below the TT(a) pins are two TT(b) pins. The last two pins below the TT(b) pins are ground pins.

Located in front of the TT(a), TT(b) and ground pins are two pins marked TxC and TTL. The TxC pin is the input to the TxC driver while the TTL pin is connected to a common bus. This common TTL bus provides a convenient way to connect some or all driver inputs to a common TTL signal.

The remaining six drivers are arranged similar to the TxC driver.

The receivers are laid out similar to the drivers, but on the opposite side of the board. Starting at the upper left-hand corner of the evaluation board are two pins on the same row marked CS(a). These are the CTS receiver input CS(a) connections. Below the CS(a) pins are two CS(b) pins. Below the CS(b) pins are two ground pins.

In front of the six CS(a), CS(b) and ground pins is a single pin marked CTS. This is the TTL output from the CTS receiver.

Again, the remaining receivers are similarly laid out.

DIP Switches

At the bottom of the evaluation board are two DIP switches. A switch placed in an "up" position configures a logic HIGH while a "down" position configures a logic LOW. The right-hand DIP switch is used to configure the driver and receiver mode select for the **SP505** device or just the driver mode select for the **SP504** device. These four mode select switches are marked TDEC3-TDEC0. The right-hand DIP switch also controls the SCT receiver enable line, SCTEN, and the decoder latch control, LATCH, in the **SP505**. Please note that logic LOW is off (rocker down) as labeled on the DIP switch, not high or low as labeled on the evaluation board.

The left-hand DIP switch is used to configure the **SP504** receiver mode select pins RDEC3-RDEC0. But internally within the **SP505**, the receiver and driver mode select lines are grouped together as common select lines DEC3-DEC0 which are identified on the evaluation board as TDEC3-TDEC0 on the right-hand DIP switch. Thus, on the left-hand DIP switch for the **SP505** device, the RDEC3-RDEC0 positions are instead used to control the individual driver tri-state controls,/RLEN, /LLEN, /RSEN, /TREN & /SDEN.

R13

On the left-center position of the evaluation board, immediately to the left of the **SP504** or **SP505** device, is a column of resistors. There are eleven resistors required for the **SP504** device on the evaluation board. Therefore, there should be one open position marked for resistor R13 only for **SP505**. If the evaluation board is being used for the **SP505**, then this position must be fitted with a 500 ohm 1% resistor. This R13 is the pull-down resistor for the /RLEN control line which is a TTL input. The R13 is left open for the **SP504** because pin 18 is a TTL output (V35_STAT) on the **SP504**.

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Fuse

At the upper right-hand side of the board, just below the DB-25 connector, is a location for a fuse. There must either be a fuse, a low value resistor (1 to 10 ohms) or a jumper wire installed at this location. A one amp fuse is recommended.

V35_STAT

As mentioned previously, the **SP504** device has a TTL output labled V35_STAT. When the **SP504** is configured to V.35 mode, this pin provides a high level TTL output. In all other modes, this pin provides a low level TTL output. The V35_STAT output is used to control FET switches which switch 150 ohm V.35 termination resistors in or out of the **SP504** circuit configuration. This feature is labeled on the **SP50x Evaluation Board** but is not used. The rocker switch for V35_STAT must be in the OFF position (rocker down) when using **SP504** board.

USING THE EVALUATION BOARD

On the bottom righ-hand side of the evaluation board are two pins identified as GND and V_{CC}. Connect this GND to the power supply ground. Connect V_{CC} to a +5 volt DC power supply. If possible, limit the supply current to 0.5-1.0 Amp. Do not switch power on when connecting power to the evaluation board.

All Drivers Active with Single TTL input

SP504

On the right-hand side of the evaluation board, connect jumper wires between all seven driver inputs (TxC, TxD, DTR, RTS, LL, RL, and ST) to each of the corresponding TTL pin on the right hand side. Next, configure the mode selection to the desired mode using TDEC3-TDEC0 on the right-hand DIP switch and RDEC3-RDEC0 on the left-hand DIP switch if the **SP504** is used. Connect a system clock or signal generator with a TTL-level output and a frequency within the acceptable range of the driver under test to any of the TTL pins. The common bus will route the signal to each driver with a jumper installed to the TTL bus. Ensure that /STEN and /TTEN enable switches on the left-hand DIP switch have been set to low position (rocker down) to enable the drivers. Once the power is on and the driver inputs receive a signal, the driver outputs can be analyzed with a oscilloscope or digital multi-meter. The mode selection can be performed at any time using the TDEC and RDEC positions on the DIP switches.

SP505

This is similar to the SP505 except that the RDEC positions on the left DIP switch are now low-active enable lines for the ST, DTR, RTS, and LL drivers. The V35_STAT is now the low-active RL driver enable pin.

DRIVER/RECEIVER LOOPBACK

SP504

This example uses the ST driver looped back into the SCT receiver. First, configure the mode select for the desired mode using RDEC3-RDEC0 on the left-hand DIP switch and TDEC3-TDEC0 on the right-hand DIP switch. Connect a jumper wire between an ST(a) pin and an SCT(a) pin. If your mode select is for a differential driver/receiver, then also connect a jumper wire between an ST(b) pin and an SCT(b) pin. Next, connect a signal generator to the ST pin. The signal generator output must be a TTL-level output at a frequency within the acceptable range of the driver mode under test. Set /STEN to logic low (rocker down) and SCTEN to logic high (rocker up). The driver outputs are connected back to the receiver inputs so that driver input to receiver output delays can be examined. This configuration is similar for the other drivers.

SP505

The same approach for the **SP504** above can be applied for the **SP505**. However, the **SP505** can be programmed internally for loopback. DEC_0 to DEC_3 should be configured as "1010", respectively for a single ended loopback. DEC_0 to DEC_3 should be configured as "1011", respectively for a differential loopback.

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V.35 MODE

SP504

The SP504 requires 150 ohm V.35 termination resistors to be installed between SD(b) & ground, ST(b) & ground and TT(b) and ground for compliant V.35 operation. Resistors should be 1/4 watt 1% tolerance. Be sure to remove the V.35 termination resistors when using any other mode.

SP505

The **SP505** contains all necessary V.35 termination resistors internally. Therefore, no external termination resistors are necessary for the **SP505** device for compliant V.35 operation.

V.11 (RS-422) MODE

SP504

The **SP504** may require termination resistors to be installed onto the receiver inputs for clock and data signals. Per the V.11 specification, cable termination is optional but is recommended to reduce signal crosstalk and reflection on the transmission line when operating at higher speeds (over 300kbps). If needed, a 120ohm resistor should be placed between the A and B inputs of the clock and data receivers. Specifically, RD(a) & RD(b), RT(a) & RT(b), and SCT(a) & SCT(b). The resistors should be removed when not operating in a mode using RS-422.

SP505

The **SP505** contains all necessary V.11 termination resistors internally. Therefore, no external termination resistors are necessary for the **SP505** device for compliant V.11 operation.

USING THE DB-25 CONNECTOR

The DB-25 connector is configured as a DTE for a EIA-530 pinout. In order to connect to other DCE equipment or network analyzers (i.e. TTC's Fireberd 6000A), the RxC receiver output must loop back into the TxC driver input. The RxD output can also be looped back to the TxD input.

If connecting the evaluation board to a microcontroller such as the Motorola MC68360, jumper wires of the driver inputs and receiver outputs must connect to the uC's appropriate pins.

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SP504 Pin Assignments

Pin #	Pin Name	Pin Function	Pin Description
		Clock & Data Group	
1	RxD	TTL Output	Receive Data RxD receiver.
14	TxD	TTL Input	Transmit Data TxD driver.
15	TxC	TTL Input	Transmit clock TT driver.
20	RxC	TTL Output	Receive clock RxC receiver.
22	ST	TTL Input	Send timing ST driver.
37	RT(a)	Analog Input	Receive timing RxC receiver.
38	RT(b)	Analog Input	Receive timing RxC receiver.
42	ST(a)	Analog Output	Send timing ST driver.
44	ST(b)	Analog Output	Send timing ST driver.
59	SD(b)	Analog Output	Send data TxD driver.
61	SD(a)	Analog Output	Send data TxD driver.
63	TT(a)	Analog Output	Terminal timing TxC driver.
65	TT(b)	Analog Output	Terminal timing TxC driver.
70	RD(a)	Analog Input	Receive data RxD receiver.
71	RD(b)	Analog Input	Receive data RxD receiver.
76	SCT(a)	Analog Input	Serial clock transmit SCT receiver.
77	SCT(b)	Analog Input	Serial clock transmit SCT receiver.
79	SCT	TTL Output	Serial clock transmit SCT receiver.

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SP504 Pin Assignments (cont)

Pin #	Pin Name	Pin Function	Pin Description
		Control Line Group	
13	DTR	TTL Input	Data terminal ready DTR driver.
16	RTS	TTL Input	Ready to send RTS driver.
17	RL	TTL Input	Remote loopback RL driver.
18	V35_STAT	TTL Output	Outputs logic high in V.35 mode.
19	DCD	TTL Output	Data carrier detect DCD receiver.
21	RI	TTL Output	Ring indicate RI receiver.
24	LL	TTL Input	Local loopback LL driver.
35	RR(a)	Analog Input	Data carrier detect DCD receiver.
36	RR(b)	Analog Input	Data carrier detect DCD receiver.
39	IC(a)	Analog Input	Incoming call RI receiver.
40	IC(b)	Analog Input	Incoming call RI receiver.
45	RL(b)	Analog Output	Remote loopback RL driver.
47	RL(a)	Analog Output	Remote loopback RL driver.
49	LL(b)	Analog Output	Local loopback LL driver.
51	LL(a)	Analog Output	Local loopback LL driver.
52	RS(b)	Analog Output	Ready to send RTS driver.
54	RS(a)	Analog Output	Ready to send RTS driver.
56	TR(b)	Analog Output	Terminal ready DTR driver.
58	TR(a)	Analog Output	Terminal ready DTR driver.
66	CS(a)	Analog Input	Clear to send CTS receiver.
67	CS(b)	Analog Input	Clear to send CTS receiver.
68	DM(a)	Analog Input	Data mode DSR receiver.
69	DM(b)	Analog Input	Data mode DSR receiver.
78	DSR	TTL Output	Data set ready DSR receiver.
80	CTS	TTL Output	Clear to send CTS receiver.

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SP504 Pin Assignments (cont)

Pin #	Pin Name	Pin Function	Pin Description
		Control Registers	
2	RDEC0	TTL Input	Receiver mode select line.
3	RDEC1	TTL Input	Receiver mode select line.
4	RDEC2	TTL Input	Receiver mode select line.
5	RDEC3	TTL Input	Receiver mode select line.
6	TTEN	TTL Input	Enable control TT driver (active low).
7	SCTEN	TTL Input	Enable control SCT receiver (active high).
9	TDEC3	TTL Input	Driver mode select line.
10	TDEC2	TTL Input	Driver mode select line.
11	TDEC1	TTL Input	Driver mode select line.
12	TDEC0	TTL Input	Driver mode select line.

Power Supplies

Pins 25, 33, 41 48, 55, 62, 73, 74 connect to Vcc +5 volts.

Pins 29, 34, 43, 46, 50, 53, 57, 60, 64, 72, 75 connect to ground.

Pin 27 is Vdd +10 volts. Connect 22uF 16 volt capacitor between pin 27 and Vcc.

Pin 32 is Vss -10 volts. Connect 22uF 16 volt capacitor between pin 32 and ground.

Pins 26 & 30 are C1+ & C1-. Connect 22uF 16 volt capacitor between pin26 & pin 30.

Pins 28 & 31 are C2+ & C2-. Connect 22uF 16 volt capacitor between pin28 & pin 31.

Note: NC pins should be left floating as internal signals may be present.
Ensure all Vcc and ground connections are made before operating device.

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SP505 Pin Assignments

Pin #	Pin Name	Pin Function	Pin Description
		Clock & Data Group	
1	RxD	TTL Output	Receive Data RxD receiver.
14	TxD	TTL Input	Transmit Data TxD driver.
15	TxC	TTL Input	Transmit clock TT driver.
20	RxC	TTL Output	Receive clock RxC receiver.
22	ST	TTL Input	Send timing ST driver.
37	RT(a)	Analog Input	Receive timing RxC receiver.
38	RT(b)	Analog Input	Receive timing RxC receiver.
42	ST(a)	Analog Output	Send timing ST driver.
44	ST(b)	Analog Output	Send timing ST driver.
59	SD(b)	Analog Output	Send data TxD driver.
61	SD(a)	Analog Output	Send data TxD driver.
63	TT(a)	Analog Output	Terminal timing TxC driver.
65	TT(b)	Analog Output	Terminal timing TxC driver.
70	RD(a)	Analog Input	Receive data RxD receiver.
71	RD(b)	Analog Input	Receive data RxD receiver.
76	SCT(a)	Analog Input	Serial clock transmit SCT receiver.
77	SCT(b)	Analog Input	Serial clock transmit SCT receiver.
79	SCT	TTL Output	Serial clock transmit SCT receiver.

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SP505 Pin Assignments (cont)

Pin #	Pin Name	Pin Function	Pin Description
		Control Line Group	
13	DTR	TTL Input	Data terminal ready DTR driver.
16	RTS	TTL Input	Ready to send RTS driver.
17	RL	TTL Input	Remote loopback RL driver.
19	DCD	TTL Output	Data carrier detect DCD receiver.
21	RI	TTL Output	Ring indicate RI receiver.
24	LL	TTL Input	Local loopback LL driver.
35	RR(a)	Analog Input	Data carrier detect DCD receiver.
36	RR(b)	Analog Input	Data carrier detect DCD receiver.
39	IC(a)	Analog Input	Incoming call RI receiver.
40	IC(b)	Analog Input	Incoming call RI receiver.
45	RL(b)	Analog Output	Remote loopback RL driver.
47	RL(a)	Analog Output	Remote loopback RL driver.
49	LL(b)	Analog Output	Local loopback LL driver.
51	LL(a)	Analog Output	Local loopback LL driver.
52	RS(b)	Analog Output	Ready to send RTS driver.
54	RS(a)	Analog Output	Ready to send RTS driver.
56	TR(b)	Analog Output	Terminal ready DTR driver.
58	TR(a)	Analog Output	Terminal ready DTR driver.
66	CS(a)	Analog Input	Clear to send CTS receiver.
67	CS(b)	Analog Input	Clear to send CTS receiver.
68	DM(a)	Analog Input	Data mode DSR receiver.
69	DM(b)	Analog Input	Data mode DSR receiver.
78	DSR	TTL Output	Data set ready DSR receiver.
80	CTS	TTL Output	Clear to send CTS receiver.

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SP505 Pin Assignments (cont)

Pin #	Pin Name	Pin Function	Pin Description
		Control Registers	
2	SDEN	TTL Input	Enable control SD driver (active low).
3	TREN	TTL Input	Enable control TR driver (active low).
4	RSEN	TTL Input	Enable control TR driver (active low).
5	LLEN	TTL Input	Enable control LL driver (active low).
6	TTEN	TTL Input	Enable control TT driver (active low).
7	SCTEN	TTL Input	Enable control SCT receiver (active high).
8	LATCH	TTL Input	Latch control logic high is transparent.
9	TDEC3	TTL Input	Receiver & Driver mode select line.
10	TDEC2	TTL Input	Receiver & Driver mode select line.
11	TDEC1	TTL Input	Receiver & Driver mode select line.
12	TDEC0	TTL Input	Receiver & Driver mode select line.
18	RLEN	TTL Input	Enable control RL driver (active low).

Power Supplies

Pins 25, 33, 41 48, 55, 62, 73, 74 connect to Vcc +5 volts.

Pins 29, 34, 43, 46, 50, 53, 57, 60, 64, 72, 75 connect to ground.

Pin 27 is Vdd +10 volts. Connect 22uF 16 volt capacitor between pin 27 and Vcc.

Pin 32 is Vss -10 volts. Connect 22uF 16 volt capacitor between pin 32 and ground.

Pins 26 & 30 are C1+ & C1-. Connect 22uF 16 volt capacitor between pin26 & pin 30.

Pins 28 & 31 are C2+ & C2-. Connect 22uF 16 volt capacitor between pin28 & pin 31.

Note: Ensure all Vcc and ground connections are made before operating device.

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SP504 ☞ SP505 Pinout Changes

SP504	from	function	to	function	SP505
pin 2	RDEC0	TTL Input	/SDEN	TTL Input	pin 2
pin 3	RDEC1	TTL Input	/TREN	TTL Input	pin 3
pin 4	RDEC2	TTL Input	/RSEN	TTL Input	pin 4
pin 5	RDEC3	TTL Input	/LLEN	TTL Input	pin 5
pin 8	N/C	N/C	/LATCH	TTL Input	pin 8
pin 9	TDEC3	TTL Input	DEC3	TTL Input	pin 9
pin 10	TDEC2	TTL Input	DEC2	TTL Input	pin 10
pin 11	TDEC1	TTL Input	DEC1	TTL Input	pin 11
pin 12	TDEC0	TTL Input	DEC0	TTL Input	pin 12
pin 18	V35_STAT	TTL Output	/RLEN	TTL Input	pin 18

Summary

In the SP504, pins 2-5 control the Mode Input Word used to configure the receivers. Pin 8 is No Connection and pin 18 is the V35_STAT status notification output which is often used to control the V.35 150 ohm termination resistor switches. Pins 9-12 are for the driver Mode Input Word.

In the SP505, the 4 receiver Mode Input Bits and the 4 driver Mode Input Bits are combined into a single 4 bit Mode Input Word. Pins 2-5 control the ENABLE (active low) function for the drivers TxD, DTR, RTS & LL, respectively. Pin 8 controls the transparent latch /LATCH (active low) function, used to latch in the last Mode Input Word. Pin 18 controls the ENABLE (active low) function for the RL driver. Pins 9-12 control the combined Mode Input Word DEC3, DEC2, DEC1 & DEC0, respectively.

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SP504 Mode Select

Mode	TDEC3	TDEC2	TDEC1	TDEC0	RDEC3	RDEC2	RDEC1	RDEC0
RS- 232	L	L	H	L	L	L	H	L
V.35	H	H	H	L	H	H	H	L
RS-422	L	H	L	L	L	H	L	L
RS-485	L	H	L	H	L	H	L	H
RS-449	H	H	L	L	H	H	L	L
EIA-530	H	H	L	H	H	H	L	H
EIA-530A	H	H	H	H	H	H	H	H
V.36	L	H	H	L	L	H	H	L

Tri-State Control	STEN	TTEN	SCTEN
Active	L	L	L
Tri-State	H	H	L

Note: For V.35 mode, install 150ohm resistors between pin 44 & gnd, pin 59 & gnd and pin 65 & gnd.

DIP switch settings are Rocker Down for "L" and Rocker Up for "H".

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SP505 Mode Select

Mode	DEC3	DEC2	DEC1	DEC0
RS-232	L	L	H	L
V.35	H	H	H	L
RS-422	L	H	L	L
RS-485	L	H	L	H
RS-449	H	H	L	L
EIA-530	H	H	L	H
EIA-530A	H	H	H	H
V.36	L	H	H	L

Tri-State Control	Active	Tri-State
SDEN	L	H
TREN	L	H
RSEN	L	H
RLEN	L	H
LLEN	L	H
STEN	L	H
TTEN	L	H
SCTEN	H	L

Latch Control	Transparent	Latch
LATCH	H	L

Note: DIP switch settings are Rocker Down for "L" and Rocker Up for "H".

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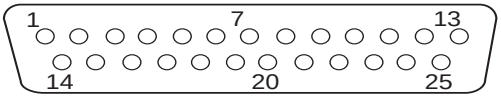
Signal Name	Source	EIA-232		EIA-530		EIA-449		V.35		X.21	
		Mnemonic	Pin	Mnemonic	Pin	Mnemonic	Pin	Mnemonic	Pin	Mnemonic	Pin
Shield	—	—	1	—	1	—	1	—	A	—	1
Transmitted Data	DTE	BA	2	BA (A)	2	SD (A)	4	103	P	Circuit T(A)	2
				BA (B)	14	SD (B)	22	103	S	Circuit T(B)	9
Received Data	DCE	BB	3	BB (A)	3	RD (A)	6	104	R	Circuit R(A)	4
				BB (B)	16	RD (B)	24	104	T	Circuit R(B)	11
Request To Send	DTE	CA	4	CA (A)	4	RS (A)	7	105	C	Circuit C(A)	3
				CA (B)	19	RS (B)	25			Circuit C(B)	10
Clear To Send	DCE	CB	5	CB (A)	5	CS (A)	9	106	D	Circuit I(A)	5
				CB (B)	13	CS (B)	27			Circuit I(B)	12
DCE Ready (DSR)	DCE	CC	6	CC (A)	6	DM (A)	11	107	E		
				CC (B)	22	DM (B)	29				
DTE Ready (DTR)	DTE	CD	20	CD (A)	20	TR (A)	12	108	H *		
				CD (B)	23	TR (B)	30				
Signal Ground	—	AB	7	AB	7	SG	19	102	B	Circuit G	8
Recv. Line Sig. Det. (DCD)	DCE	CF	8	CF (A)	8	RR (A)	13	109	F		
				CF (B)	10	RR (B)	31				
Trans. Sig. Elemt. Timing	DCE	DB	15	DB (A)	15	ST (A)	5	114	Y	Circuit S(A)	6
				DB (B)	12	ST (B)	23	114	AA	Circuit S(B)	13
Recv. Sig. Elemt. Timing	DCE	DD	17	DD (A)	17	RT (A)	8	115	V	Circuit B(A)**	7
				DD (B)	9	RT (B)	26	115	X	Circuit B(B)**	14
Local Loopback	DTE	LL	18	LL	18	LL	10	141	L *		
Remote Loopback	DTE	RL	21	RL	21	RL	14	140	N *		
Ring Indicator	DCE	CE	22	—	—	—	—	125	J *		
Trans. Sig. Elemt. Timing	DTE	DA	24	DA (A)	24	TT (A)	17	113	U *	Circuit X(A)**	7
				DA (B)	11	TT (B)	35	113	W *	Circuit X(B)**	14
Test Mode	DCE	TM	25	TM	25	TM	18	142	NN *		

* - Optional signals
** - Only one of the two X.21 signals, Circuit B or X, can be implemented and active at one time.



RS-232 & EIA-530 Connector (ISO 2110)
DTE Connector ó DB-25 Pin Male
DCE Connector ó DB-25 Pin Female

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Evaluation Board List of Materials		
Component	**Part Number**	**Manufacturer**
Contact Small Pins	00-15-01-30-27-04-0	Mill-Max Mfg. Corp
22uF Capacitors	T491C226K016AS	Kemet
10uF Capacitors	T351C106K10AS301	Kemet
Schottky Diode	MBRS140T3	Motorola
Resistors	RN55D4990F	Dale
DIP Switches	435640-5	Amp
DB-25 Connector	DB25P-FRS (89N1586)	SPC (Newark Elect.)
Aluminum Spacers		Generic
8x32 Screws		Generic

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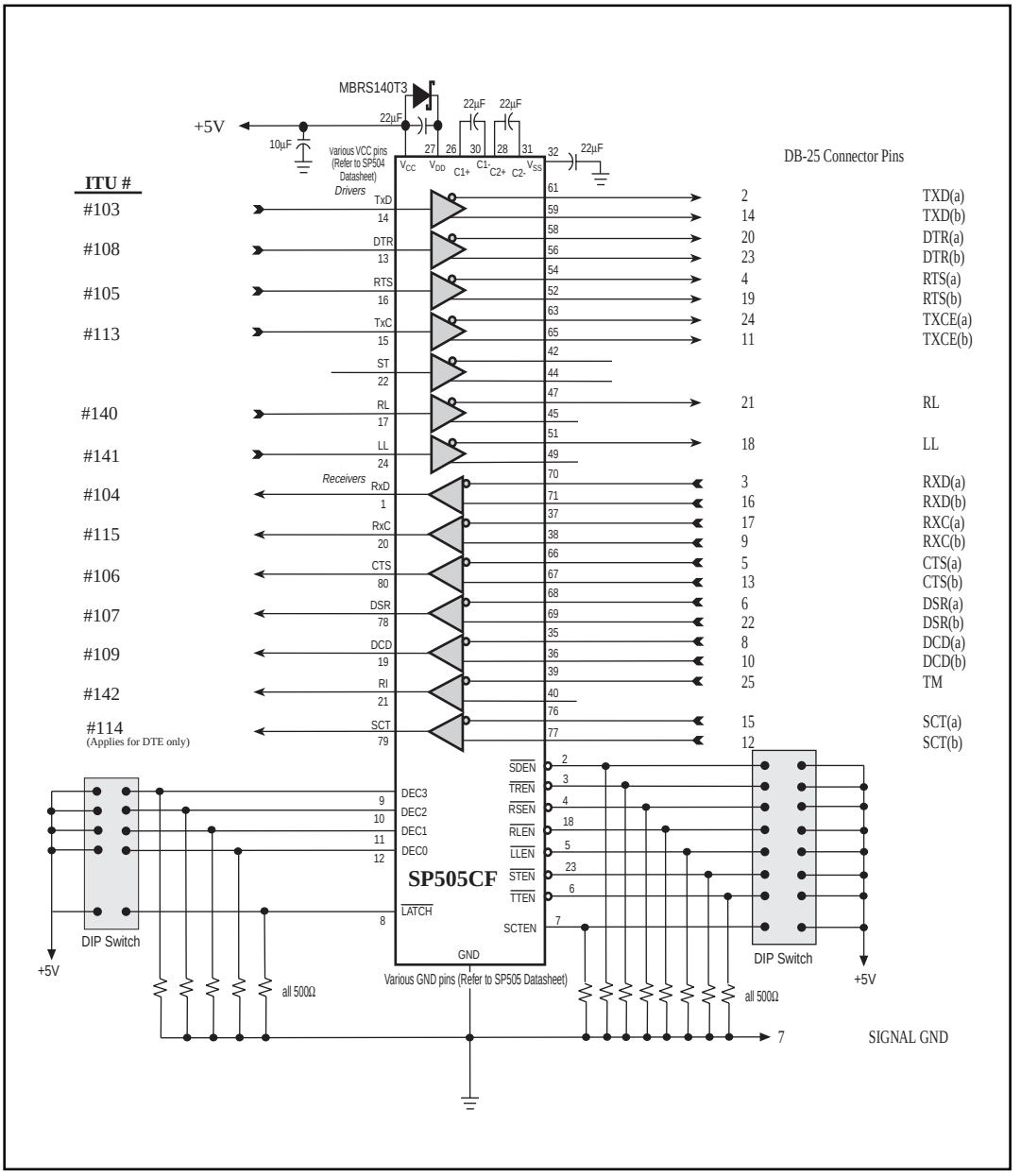

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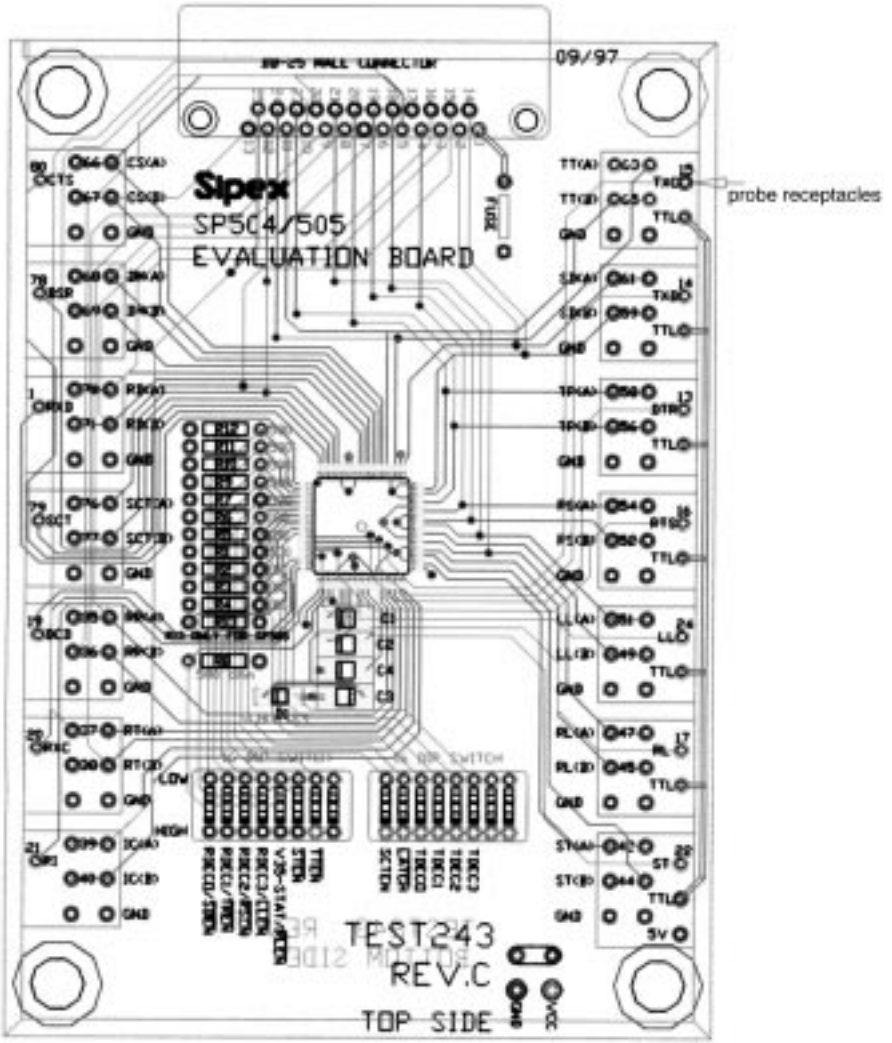

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SIGNAL PROCESSING EXCELLENCE

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