

TRAINING DATA TRANSPORT

5242500 ARINC 629 CURRENT MODE COUPLER (CMC)

- ❑ Current Mode Implementation of ARINC 629
- ❑ Interfaces To SCI Serial Interface Module (SIM) (5242300)
- ❑ Supports Stub Lengths to 40 Meters
- ❑ High Speed Operation (Transmit $P_d < 50$ nsec)



GENERAL OVERVIEW

The 5242500 Current Mode Coupler (CMC) provides the interface between the Serial Interface Module (SIM - SCI 5242300) and the ARINC 629 current mode communications bus. The CMC includes dual transmit and receive channels, channel selection control, bus shunt circuitry, and a "receive only" mode of operation. Figure 2 is a block diagram representation of the CMC's functional units. Each transmit/receive channel in the CMC consists of a bus driver and a transimpedance amplifier. The bus driver is responsible for doublet transmission onto the current mode data bus while the

impedance amplifier transfers bus doublets to the stub cable. The CMC's channel selection circuitry monitors the doublet polarity received from the SIM via the stub interface and enables the corresponding channel. The CMC's shunt circuitry presents a low impedance load to the current mode bus under power-on and power-off conditions. The CMC provides receive only mode of operation where both transmit channels are disabled. The receive-only mode is determined by the polarity of the power lines supplied by the SIM.

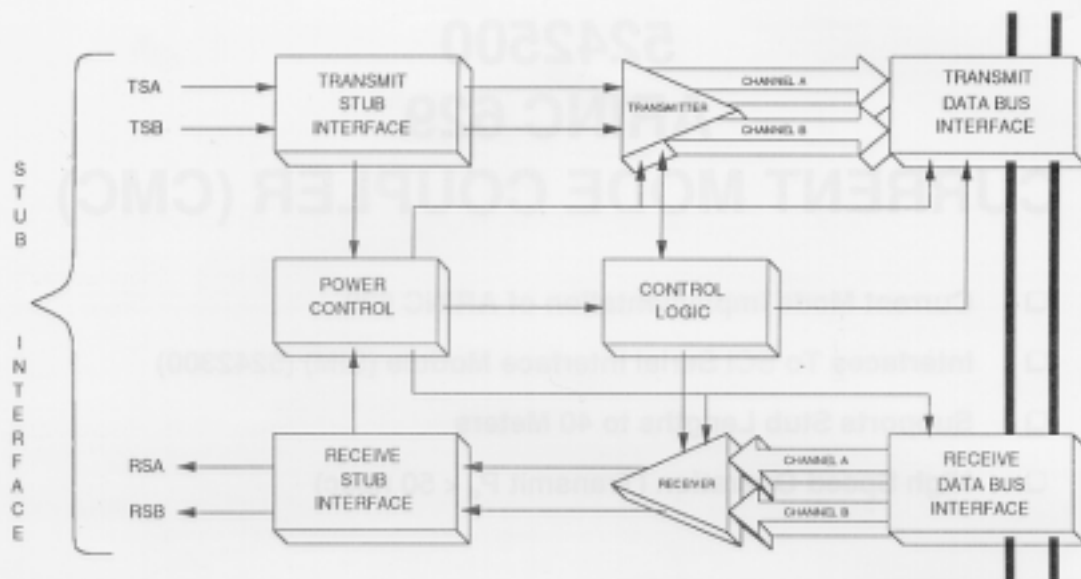


Figure 2. CMC Block Diagram

OPERATION

The CMC is used in conjunction with the SIM to interface a Terminal Controller to the ARINC 629 current mode data bus. A five conductor connector, Boeing Standard BACC 63CB10-05SN, provides the coupler interface to the stub cable, utilizing the pin out configuration shown in Figure 3 and the pin descriptions listed in Table 1. Internal coupler shields are electrically connected to the inside portion of the stub interface connector's body. The ground return for the CMC's internal shield is then provided through the circumferential connection of the connector plug to its mating backshell, Sunbank SB01L1F1004W2. The CMC is magnetically coupled to the current mode data bus by two individual transformers: one being transmit and the other receive. The bus transformers are comprised of windings and two ferrite E-cores which encompass the current mode data bus cable when the coupler is installed.

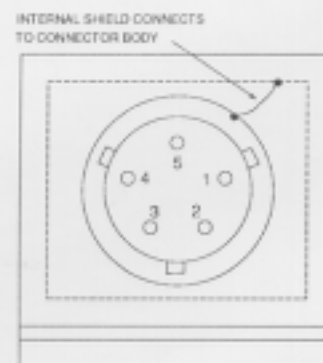


Figure 3. CMC Connector Pinout

Table 1. Coupler Pin Description

PIN #	PIN NAME	I/O	FUNCTION
1	TSB	I	TRANSMIT STUB B
2	TSA	I	TRANSMIT STUB A - TSA & TSB interface receives doublets from SIM for data bus transmission as well as common mode voltage for coupler power.
3	N/C		No Connection
4	RSB	O	RECEIVE STUB B
5	RSA	O	RECEIVE STUB A - RSA & RSB interface supplies data bus traffic to the SIM and receives common mode voltage for coupler power.
Body	CIRCUM. GND	O	CIRCUMFERENTIAL GROUND - Ground reference supplied from the SIM utilized for the CMC internal shield returns. Connection is made circumferentially to the mating backshell.

TRANSMIT DATA TRANSFER

The Current Mode Coupler receives voltage mode doublets from the SIM and converts them to current mode doublets which are then transmitted onto the data bus. The voltage mode doublet received by the CMC is a balanced differential signal measured between TSA and TSB of the stub cable (Fig. 4). The stub doublet consists of a 62.5 nanosecond wide pulse followed by an identical pulse of the opposite polarity. Each stub doublet half-pulse attains a differential peak amplitude of approximately 4.5 volts.

RECEIVE DATA TRANSFER

The Current Mode Coupler receiver receives current mode doublets from the data bus (Fig. 6) and converts them to differential voltage mode stub doublets (Fig. 7) for transmission to the SIM. Each receiver channel consists of a transimpedance amplifier with a fixed differential gain of 60 Ω and buffers to drive the stub receive lines, RSA & RSB. The receiver channel that is

COUPLER POWER MODES

Power to the Current Mode Coupler is supplied by the SIM via the common mode voltages on the stub interfaces TSA/TSB and RSA/RSB. The two modes of coupler operation are the "transmit/receive" and "receive only" mode. The SIM controls the coupler mode of operation through the polarity of the common mode voltages. The coupler transmit/receive mode is enabled when the TSA/TSB common mode voltage supplies +15V and

COUPLER CHANNEL CONTROL

Channel selection for the CMC is determined by the stub doublet polarity on the TSA/TSB lines. The coupler defaults to channel "A" upon initial power-up conditions. The coupler channel control circuitry monitors the polarity of the stub transmit doublet to determine the active channel. The "A" channel is enabled when the

The CMC transfers each stub doublet half excursion to the current mode data bus as a nominal 50 mA peak signal (Fig. 5). The coupler transmit circuitry limits the maximum slew rate of the data bus doublet to 2 A/ μ S. Bus load impedance reflected to the data bus by the transmit driver is minimized via on board shunt control circuitry. The shunt windings of the transmit core present a low impedance load to the data bus when the transmit drivers are inactive or disabled (power down/receive only).

to be used for doublet reception is determined by the coupler channel control circuitry. The channel control circuitry dictates the active and inactive channel by supplying power only to the chosen receiver channel. The receiver input impedance presents a low impedance to the data bus during normal operation (<0.05 Ω) and during coupler power off condition (<0.03 Ω).

RSA/RSB common mode voltage supplies -15V. When in the transmit/receive mode, the coupler maintains one transmit and receive channel. The coupler receive only mode is attained when the SIM supplies +15V common mode on RSA/RSB and -15V common mode on TSA/TSB. In the receive only mode both coupler transmit channels are powered down and one coupler receiver channel is active.

leading doublet half is positive as measured from TSA to TSB. When the leading doublet half is negative, channel "A" is disabled and channel "B" is enabled. The coupler allows the SIM to control channel selection in transmit/receive mode only.

ELECTRICAL SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS*

Case Temperature -40°C to +85°C
 Storage Temperature -40°C to +85°C
 Voltage on Any Pin
 with Respect to Ground +/-25V
 Power Dissipation 5W

*Notice: Stresses above those listed under "Absolute Maximum Rating" 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 operations sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

D.C. CHARACTERISTICS $T_c = -40^\circ\text{C}$ to $+85^\circ\text{C}$

POWER REQUIREMENTS					
Symbol	Parameter	Min	Max	Unit	Test Conditions
I_{CM}	Supply Current (+15,-15)				Continuous Transmit Worst Case 2MHz Manchester Data
	o Transmit		290	mA _{V_{TR}}	
	o Receive		66	mA _{V_{TR}}	
	o Standby		55	mA _{V_{TR}}	
V_{CM}	Supply Voltage - Transmit	24.6	31.5	V	Minimum and Maximum Bus Doublet

D.C. CHARACTERISTICS $T_c = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$

TRANSMIT						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V_{SH}	Stub Input Voltage - Positive Peak (Fig. 4)	3.0	4.5	5.2	V	TSA - TSB Differential
V_{SL}	Stub Input Voltage - Negative Peak (Fig. 4)	-5.2	-4.5	-3.0	V	TSA - TSB Differential
V_{TSC}	Transmit Stub Common Mode Voltage	+13.5 -15.5	+15.0 -15.0	+15.5 -13.5	V V	Transmit Mode Receive Only
Z_{SI}	Transmit Stub Input Impedance		110		Ω	
Z_{BIT}	Bus Input Impedance - Transmit Coil			0.25 0.24	Ω Ω	Power On Power Off
Z_{BIR}	Bus Input Impedance - Receive Coil			0.05 0.03	Ω Ω	Power On Power Off
V_{SOH}	Stub Receive Output Voltage - Positive Peak (Fig. 7)	1.35	3.0	3.48	V	Receiver Gain = 60 mV/mA
V_{SOL}	Stub Receive Output Voltage - Negative Peak (Fig. 7)	-3.48	-3.0	-1.35	V	Receiver Gain = 60 mV/mA
V_{RSC}	Receive Stub Common Mode Voltage	-15.5 +13.5	-15.0 +15.0	-13.5 +15.5	V V	Transmit Mode Receive Only
Z_{SO}	Stub Load Impedance (RSA - RSB)		100		Ω	Stub Cable Characteristic Impedance
Z_i	Bus Receive Transimpedance	55.5		61.2	Ohm s	
t_{RPD}	Receive Propagation Delay - Bus to Stub			25	nS	

A.C. CHARACTERISTICS $T_c = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$

Symbol	Parameter ¹	Min	Max	Units	Test Conditions ^{2,3}
t_r	Rise Time, +13mA to +35mA	6.6	18	ns	Note 1,2,3
t_{w1}	1st lobe width, +35mA	29.5	75	ns	Note 1,2,3
t_{w1}	1st lobe width, +13mA	54	95	ns	Note 1,2,3
t_{w1}	1st lobe width, +42mA	20	75	ns	Note 1,2,3
t_{w2}	2nd lobe width, -35mA	29.5	75	ns	Note 1,2,3
t_{w2}	2nd lobe width, -13mA	54	95	ns	Note 1,2,3
t_{w2}	2nd lobe exceedance, -42 mA	20	75	ns	Note 1,2,3
t_f	Fall time, -35mA to -13mA	6.6	30	ns	Note 1,2,3
t_w	Total Width (+13 mA to -13 mA)	122	184	ns	Note 1,2,3
I_{l1}	1st lobe Maximum	43	66	mA	Note 1,2,3
I_{l2}	2nd Lobe Maximum	43	66	mA	Note 1,2,3
t_{TPO}	Transmit Propagation Delay - Stub to Bus		50	nS	
t_{CSD}	Channel Switch Delay		250	nS	

1 References to "+, positive" and "-", negative" are relative only to each lobe of the doublet. "1st" lobe may be positive or negative.

2 Single turn bus, 260 Ω

3 Case temperature -40°C to $+85^{\circ}\text{C}$. All specified operating conditions.

Receive

The SIM receives voltage doublets from the coupler as they are picked up from the twisted pair data bus as current doublets. Although the coupler receiver is an active amplifier, it has a fixed gain. Therefore, the amplitude of the doublet received by the SIM from the coupler is indicative of the bus doublet amplitude. It is this feature, along with the fact that the coupler receives its own transmit onto the data bus, that allows the SIM to perform data bus signal analysis of its own transmitted signal. (See Fault Management & BITE). The SIM analyzes each incoming doublet and checks the signal for the proper waveform symmetry and amplitude. The acceptable amplitude is determined by whether the signal was a result of the couplers own transmit or whether it was data from a distant terminal. The receive doublets from distant terminals are required to satisfy one of two amplitudes depending on the status of

the CTHA & CTHB control lines. This allows for those ARINC 629 systems with few couplers and shorter bus lengths to be configured for higher noise immunity. In order to reduce delays in the data translation and transfer function the SIM regenerates the Manchester biphas data transition to the Terminal Controller as soon as the incoming doublet is detected. Should the doublet turn out to be defective or erroneous the SIM will suppress the next two transitions of the incoming Manchester data. The Terminal Controller will detect that the transitions have been suppressed. The SIM determines the end of a message on the twisted wire data bus by counting four (4) consecutive rising edges of RXCK clock without the receipt of a doublet from the coupler. The SIM will then assume a bus quiet condition (RXI & RXN low).

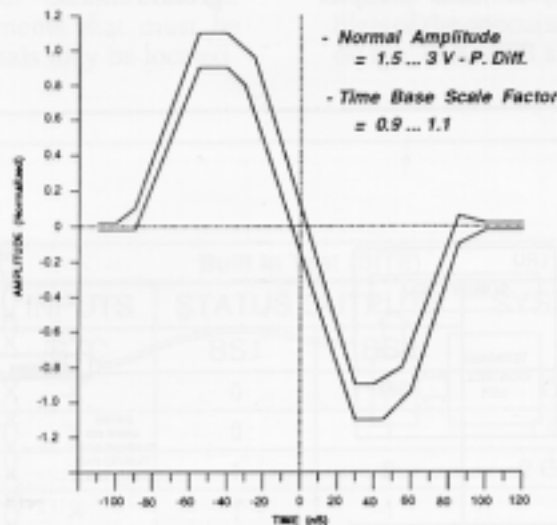


Figure 4. 5242300 SIM Receive Doublet

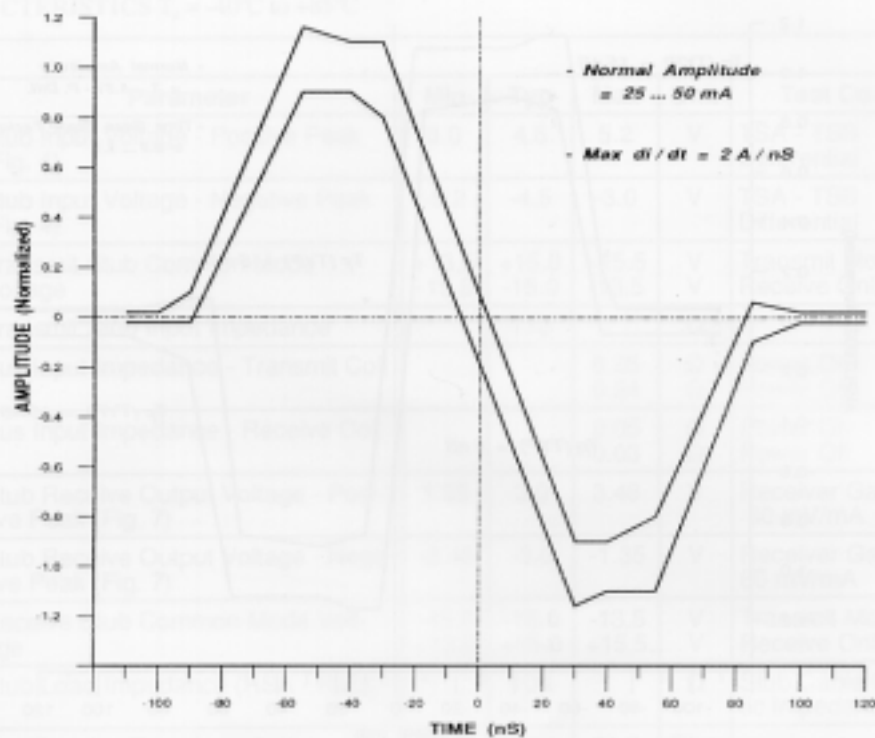


Figure 6. Coupler Input From Bus Cable - Waveform Template

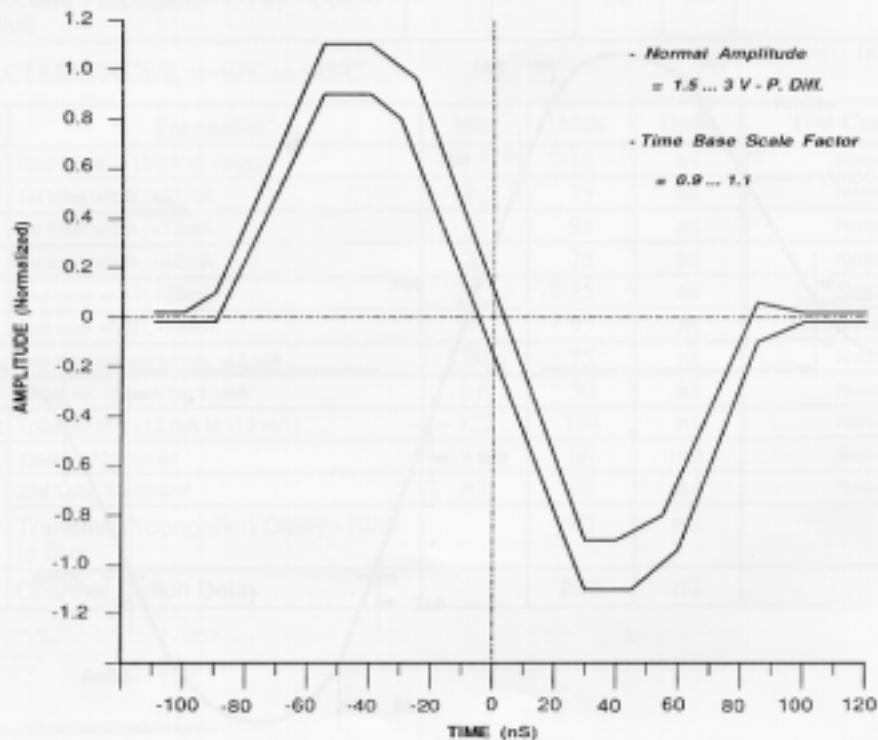


Figure 7. Coupler Output To Receive Stub - Waveform Template

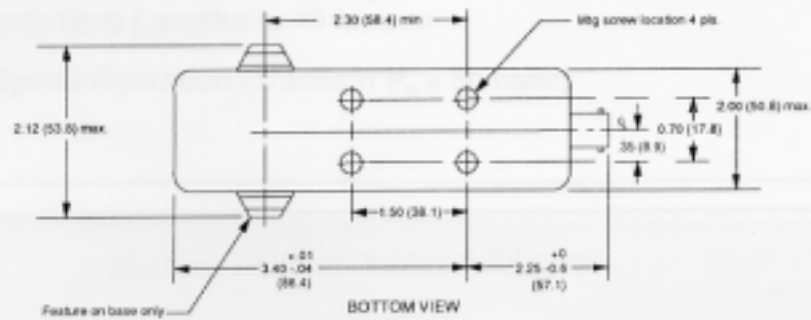
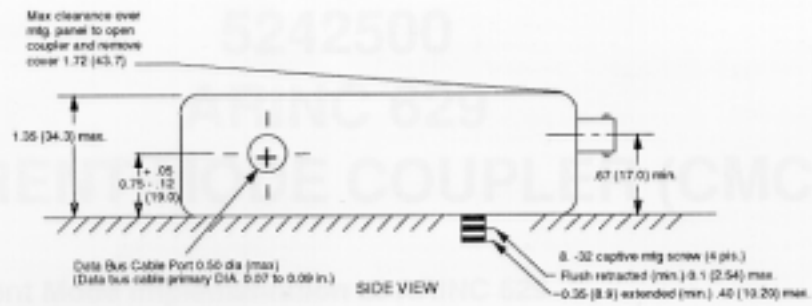


Figure 8. ARINC 629 Coupler Dimensions

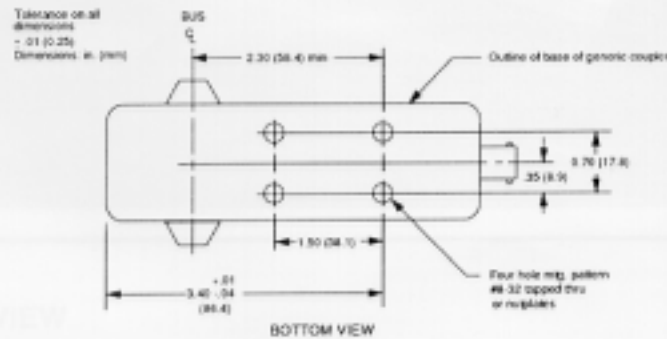


Figure 9. Coupler Mounting Footprint



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