

CX28250

Transitioning from CX28250 to M29701

Application Note

Products Affected: CX28250, M29701

1. Introduction

The CX28250 device is a single port OC-3 ATM-SONET Physical Layer Device. Mindspeed has previously announced the End of Life (EOL) for the CX28250. Mindspeed recommends the CX29701 as a replacement of the CX28250.

The CX29701 is part of the CX2970x family of OC-3 ATM/POS Framer. The family consists of the single port CX29701, 2-port CX29702, and 4-Port CX29704. All devices support both ATM and POS mode.

Mindspeed provides a software driver for both the CX28250 and the CX2970x family. The driver is referred to as the Telecom Application Package (TAP) Device Driver.

The purpose of this application note is to provide guidance for customers to transition from the CX28250 to M29701. It compares the differences in hardware and software features of the two devices. By understanding the differences, customers can update their design accordingly to accommodate the M29701.

The analysis is based on M29701-14 and CX28250-26. The TAP version used was 6.50. POS related features of the M29701 are not discussed.

1.1 Reference Documents:

- CX28250 Datasheet
- CX29701/2/4 Datasheet
- CX28250 TAP Device Driver Software Guide
- CX29704 TAP Device Driver Software Guide

2. *Hardware*

The hardware items analyzed and discussed are:

- Mechanical/Power
- Microprocessor Interface
- Utopia Interface
- Line Side Interface
- SONET processing
- Diagnostics Capabilities
- Available H/W counters

2.1 *Mechanical/Power*

The CX28520 is a 15mm x 15mm 156 pin PBGA device while the M29701 is a 27mm x 27mm 272 pin PBGA device. They are both industrial temperature grade device (-40C - +85C). They both require 3.3V analog and 3.3V digital power. The CX28250 average power dissipation is 0.5W while the M29701 typical power dissipation is 1.9W.

2.2 *Microprocessor Interface*

The microprocessor interface on the CX28250 is an 8 bit data interface with a 7 bit address bus. The interface can be configured for either asynchronous or synchronous mode. The registers within the CX28250 are 8 bits. The M29701 microprocessor interface is a 16 bit data interface with a 9 bit address bus. The interface only support asynchronous mode. Registers within the M29701 are 16 bits.

Table 1. *Microprocessor Interface*

	CX28250	M29701
Mode	Asynchronous or Synchronous	Asynchronous
Data Bus	8 bits	16 bits
Address Bus	7 bits	9 bits
Registers	8 bits	16 bits

2.3 *Utopia Interface*

The CX28250 Utopia interface is an 8/16 bit interface. It supports both Uni-phy (Utopia Level 1) and Multi-PHY (Utopia Level 2) operation. For Utopia Level 1, it supports both byte level and cell level handshaking. For Utopia Level 2, it only supports cell level handshaking. Parity is selectable to be even or odd. The interface runs at up to 50MHz.

The M29701 Utopia interface is only a 16 bit interface that runs from 20MHz to 50MHz. It only supports Utopia Level 2 with cell level handshaking. Parity is fixed at odd parity. For designs which require multiple ports, the M29702 and M29704 support multiple CLAV signals per device in addition to single CLAV. It also supports direct CLAV status.

Table 2. Utopia Interface

	CX28250	M29701
Utopia Level	Level 1 and Level 2	Level 2
Bus Width	8 or 16 bits	16 bits
Bus Speed	Up to 50MHz	20MHz - 50MHz
Handshaking Mode	Cell level or Byte level (UL2 supports only cell level)	Cell level
Clav Mode	Single Clav	Single Clav / up to 4 Clavs (M29704) / direct status
Parity	Odd or Even	Odd

2.4 *Line Side Interface*

The line side interface of the CX28250 and M29701 are nearly identical. They both have PECL interfaces which meet GR253 jitter specification. Both the CX28250 and M29701 can synthesize its 155 MHz clock from a 19.44 MHz PLL reference clock input. PLL filtering for the M29701 consist of single resistor and single capacitor while the CX28250 requires a network consisting of 6 capacitors and 3 resistors. In addition to the reference clock input, the CX28250 provides support for an external 155MHz input. The M29701 does not support external 155Mhz input.

One minor difference is the Signal Detect input on the CX28250 is a TTL input while the M29701 input is a PECL input.

2.5 SONET Processing

The table below summarizes the SONET processing of the CX28250 and M29701.

Table 3. SONET Processing Summary

	Byte	CX28250		M29701	
		Transmit	Receive	Transmit	Receive
Section	A1/A2	0xF6/28 or disable 0x00	Monitor OOF	0xF6/28 or invert 3 rd A1 and 1 st A2 for LOF	Monitor OOF
	J0	0x1 or from trace buffer	Monitor trace buffer for change	0x1 or insert via register	Capture into register
	Z0 ₁ , Z0 ₂	0x2/0x3 or from registers	Store into registers. Monitor for change	0x2/0x3	Not checked
	B1	Calculated or error insertion	Checked and counted on error	Calculated or error insertion	Checked and counted on error
	E1			Insert via register	Capture into register
	F1			Insert via register	Capture into register
	D1, D2, D3	0x0 or insert via TxDL interface	Capture to StatOut interface	0x0 or insert via DCC interface	Capture to DCC interface
Line	H1/H2	SONET: 0x620A/0x93FF ptr SDH: 0x6A0A/0x9BFF ptr	Full GR.253 pointer processor	SONET: 0x620A/0x93FF ptr SDH: 0x6A0A/0x9BFF ptr	Full GR.253 pointer processor
	H3	0x00	Full GR.253 pointer processor	0x00	Full GR.253 pointer processor
	B2	Calculated or error insertion	Checked, errors counted	Calculated or error insertion	Checked, errors counted
	K1/K2	Insert via register	Captured, interrupt on change	Insert via register	Captured, interrupt on change
	D4-D12	0x0 or insert via TxDL interface	Capture to StatOut interface	0x0 or insert via DCC interface	Capture to DCC interface
	S1	Insert via register	Captured, interrupt on change	Insert via register	Captured, interrupt on change
	M1	Auto generate for REI-L	Checked, errors counted	Insert via register or auto generate for REI-L	Checked, errors counted
	E2			0x0 or insert via DCC interface	Capture to DCC interface
	Z2	From RXZ2	Captured, interrupt on error		
Path	J1	0x0 or from trace buffer	Monitor trace buffer, interrupt on change	0x0 or from trace buffer	Monitor trace buffer, interrupt on change
	B3	Calculated or error insertion	Checked, errors counted	Calculated or error insertion	Checked, errors counted
	G2	0x13 or insert via register	Checked, interrupt on error	0x13 or insert via register	Checked, interrupt on error
	G1	Path REI, RDI inserted	Checked, errors counted	Path REI, RDI inserted	Checked, errors counted
	F2			Insert via register	Capture to register
	Z3/F3			Insert via register	Capture to register
	Z4/K3			Insert via register	Capture to register
	Z5/N1			Insert via register	Caputre to register

2.6 *Miscellaneous*

2.6.1 *Loopback*

The CX28250 and M29701 each provide loopback support at 3 different points within the device. The table below summarizes this.

Table 4. *Loopback Capabilities*

	CX28250	M29701
Line Loopback	Loopback occurs at the line side PECL interface. RX is passed to TX and is also passed onto ATM Utopia interface.	Loopback occurs at the line side SERDES. RX is passed to TX and is also passed onto ATM Utopia interface.
Source Loopback	Traffic sourced from Utopia is loopbacked from the TX Line interface to the RX Line interface. Traffic is also sent out the line side.	Traffic sourced from Utopia is loopbacked from the TX SONET framer to the RX SONET framer (prior to the Line interface block). Traffic is also sent out the line side.
System Loopback	Traffic received from the RX line side loopbacked at the ATM Utopia interface back toward the TX line side.	Traffic received from the RX line side loopbacked at the ATM Cell processor (prior to the ATM Utopia interface) back toward the TX line side. Traffic is also forwarded to the ATM Utopia interface.

2.6.2 *Hardware Counters*

The table below list the hardware counters available in the CX28250 and M29701.

Table 5. *Available Counters*

	CX28250	M29701
Receive Cells	19 bits	32 bits
Transmit Cells	19 bits	32 bits
Path REI	16 bits	16 bits
Line REI	18 bits	32 bits
Path BIP Errors	16 bits	16 bits
Section BIP Errors	16 bits	16 bits
Line BIP Errors	18 bits	32 bits
Correctable HEC Errors	8 bits	16 bits
Uncorrectable HEC Errors	8 bits	16 bits
Non-matching Cells	16 bits	-
OOF Events	8 bits	-
LOCD Events	8 bits	-
Uncorrectable HEC Errors	8 bits	16 bits

3. Software

The TAP device driver software is designed to support various Mindspeed physical layer devices. The TAP is partitioned into a common set of core driver files and a device specific set. The common portion is within the “drv” directory of the TAP while the device specific portion is within the “cx29704” (or “cx28250”) directory.

The common portion provides a consistent API to the initialization, configuration, diagnostic, Failure Monitoring (FM) and Performance Monitoring (PM) functions. The device specific portion handles the low level access functions that are specific to each device.

The effort to port from using the CX28520 TAP to CX2970x TAP is mostly seamless due to the common API and common core driver portion. The driver hides the device specific configuration and control. In addition the FM and PM functions are mostly standards driven which allows for a simple transition from the CX28250 to CX29701.

The porting effort encompasses understanding the differences in the functions and TAP driver parameters which are handled within the device specific portion of the driver.

3.1 API Functions

The table below provides a comparison of the device specific functions for the 2 devices. Comments are provided on whether they are the same and why they may differ.

Functions related to POS operations were omitted from the analysis as there are no equivalent POS functions within the CX28250.

Table 6. API Functions

CX28250	CX2970X	Comment
CX28250_TOH_FM_status	CX29704_TOH_FM_status	Same functionality except the 2970x driver supports the S1 functionality while the 28250 does not.
CX28250_POH_FM_status	CX29704_POH_FM_status	28250 driver have not implemented support for J1 trace function, Un-equipped, and RFI.
CX28250_TOH_PM_preset	CX29704_TOH_PM_preset	Same functionality.
CX28250_POH_PM_preset	CX29704_POH_PM_preset	28250 driver have not implemented support for J1 trace function, Un-equipped, and RFI.
CX28250_TOH_PM_status	CX29704_TOH_PM_status	Same functionality.
CX28250_POH_PM_status	CX29704_POH_PM_status	Same functionality.
CX28250_TOH_layer_init	CX29704_TOH_layer_init	Function is not used.
CX28250_TOH_PM_init	CX29704_TOH_PM_init	Same functionality.
CX28250_TOH_PM_curr_to_prev	CX29704_TOH_PM_curr_to_prev	Same functionality.
CX28250_TOH_PM_process	CX29704_TOH_PM_process	Same functionality.
CX28250_TOH_PM_reset	CX29704_TOH_PM_reset	Same functionality.
CX28250_TOH_PM_TCA_process	CX29704_TOH_PM_TCA_process	Function is not used.
CX28250_TOH_PM_tick	CX29704_TOH_PM_tick	Same functionality.
CX28250_TOH_parm_set	CX29704_TOH_parm_set	Same functionality.
CX28250_TOH_parm_get	CX29704_TOH_parm_get	Same functionality.
CX28250_OH_TOH_init	CX29704_OH_TOH_init	Function not used in the 28250 driver.

Table 6. API Functions

CX28250	CX2970X	Comment
CX28250_TOH_PM_TC_default	CX29704_TOH_PM_TC_default	Same functionality.
CX28250_POH_layer_init	CX29704_POH_layer_init	Function is not used.
CX28250_POH_PM_init	CX29704_POH_PM_init	Same functionality.
CX28250_POH_PM_curr_to_prev	CX29704_POH_PM_curr_to_prev	Same functionality.
CX28250_POH_PM_process	CX29704_POH_PM_process	Same functionality.
CX28250_POH_PM_reset	CX29704_POH_PM_reset	Same functionality.
CX28250_POH_PM_TCA_process	CX29704_POH_PM_TCA_process	Function is not used.
CX28250_POH_PM_tick	CX29704_POH_PM_tick	Same functionality.
CX28250_POH_parm_set	CX29704_POH_parm_set	Function handles parameters that are handled differently than the normal drv driver. For 28250 and 2970x, they are essentially the same since the TAP parameter DRV_ENABLE_ENHANCE_RDI in 28250 is the same as DRV_XMT_ERDI_MODE_P in 29704.
CX28250_POH_parm_post_set	CX29704_POH_parm_post_set	2970x version implements the path trace function which is not implemented in the 28250 driver.
CX28250_POH_parm_get	CX29704_POH_parm_get	2970x version implements the path trace function which is not implemented in the 28250 driver.
-	CX29704_POH_trace_set	Configures the 2970x trace buffers. Not implemented in 28250.
-	CX29704_POH_trace_get	Gets the 2970x trace buffers. Not implemented in 28250.
	CX29704_oh_get_td	Part of the trace buffer utility. Not implemented in 28250.
CX28250_OH_POH_init	CX29704_OH_POH_init	Same functionality.
CX28250_OH_POH_all_access	CX29704_OH_POH_all_access	Same functionality.
CX28250_ATM_parm_set	CX29704_ATM_parm_set	CX29704 calls the its own specific CX29704_ATM_PM_reset functions while CX82580 call the generic DRV_ATM_PM_init.
CX28250_ATM_PM_init	CX29704_ATM_PM_init	Same functionality.
CX28250_ATM_PM_reset	CX29704_ATM_PM_reset	Same functionality.
CX28250_ATM_PM_tick	CX29704_ATM_PM_tick	Same functionality.
CX28250_ATM_PM_process	CX29704_ATM_PM_process	These are the same except the CX8250 does not count the transmit idle/unassigned counts.
CX28250_ATM_PM_curr_to_prev	CX29704_ATM_PM_curr_to_prev	Same functionality.
CX28250_ATM_PM_TCA_process	CX29704_ATM_PM_TCA_process	Same functionality.
CX28250_ATM_FM_status	CX29704_ATM_FM_status	Same functionality.
CX28250_ATM_PM_preset	CX29704_ATM_PM_preset	Same functionality.
CX28250_ATM_PM_status	CX29704_ATM_PM_status	Similar functionality. 28250 contains more threshold value control.
CX28250_ATM_init	-	Stub function in 28250.

Table 6. API Functions

CX28250	CX2970X	Comment
CX28250_ATM_parm_post_set	-	Not really used since return value is DRV_UNPROCESSED.
CX28250_ATM_parm_get	-	Not really used since return value is DRV_UNPROCESSED.
CX28250_post_init	-	Not really used since all it does is disable the trace functionality which is not implemented in the 28250 driver.
CX28250_init_registers	-	Specific to 28250. There is no equivalent function in the 2970x.
CX28250_ATM_layer_init	-	Specific to 28250. There is no equivalent function in the 2970x.
-	CX29704_dmode_set	Function is used to configure the variants of 29701, 702, and 704. Call as part of the init functions.
CX28250_post_init	CX29704_config_func	These are the device specific equivalent functions.
CX28250_init	CX29704_init	These are the device specific equivalent functions.
CX28250_intr_off	CX29704_intr_off	These are the device specific equivalent functions.
CX28250_intr_on	CX29704_intr_on	These are the device specific equivalent functions.
CX28250_intr_query	CX29704_intr_query	These are the device specific equivalent functions.
	CX29704_mode_set	Allows switching between POS and ATM mode.
CX28250_parm_get	CX29704_parm_get	Handles the driver specific TAP parameters.
CX28250_parm_set	CX29704_parm_set	Handles the driver specific TAP parameters. See the TAP parameter section for more details.
CX28250_pre_init	CX29704_pre_init	Device specific initialization handler. Differences include the POS init of the 2970x driver.
CX28250_set_K_values	CX29704_set_K_values	Same functionality.
-	CX29704_intr_port	Not used.
-	CX29704_intr_handler	Calls the RDI handler which handles the ERDI codes in the G1 bytes. Functionality not supported in 28250.
-	CX29704_read_trace	Reads the trace buffer. Functionality not implemented in the 28250 driver.
-	CX29704_write_trace	Reads the trace buffer. Functionality not implemented in the 28250 driver.
-	CX29704_bulk_fetch	Facilitates gathering of FM and PM status. Only used for debug monitor.
CX28250_special_write	-	Not used.

Table 6. API Functions

CX28250	CX2970X	Comment
CX28250_special_read	-	Used to read 28250 registers that contains a mixture of r/w and clear on read bits. 2970x does not have these registers.
-	CX29704_fifo_ovr_handler	Required for handling a specific 2970x non-conformance.
-	CX29704_rx_fifo_reset	Required for handling a specific 2970x non-conformance.
-	CX29704_rdi_handler	Used to handle sending ERDI codes in the G1 bytes. Not supported in 28250.

3.2 TAP Parameters

The driver specific handler of TAP parameters is mostly handled inside the driver specific “parm_set” function. These are listed for better understanding of the equivalent TAP parameters and of the differences in the two devices and drivers.

POS related parameters are not listed below.

Table 7. TAP Parameters

CX28250	CX2970X	Comment
DRV_ONESEC_MODE	DRV_ONESEC_MODE	Configures PM for either polling or one second latching mode.
DRV_SOFT_RESET	DRV_SOFT_RESET	Device specific soft reset.
DRV_FORMAT	DRV_FORMAT	Selects either SONET or SDH.
-	DRV_PORT_POWER_DOWN	Powers down the unused ports in the 2970x.
-	DRV_TIMING_SOURCE	Selects either Ref clock timing or loop timing.
DRV_XMT_CLK_SELECT	-	Selects if the clock is from loop timing or 19.44 PLL or 155MHz clock input.
-	DRV_TEST_MODE	Selects the various loopbacks available in the 2970x.
DRV_ATM_TERMINAL_LOOPBACK	-	Selects 28250 source loopback.
DRV_ATM_CELL_FACILITY_LOOPBACK	-	Selects 28250 loopback 1.
-	DRV_PACKET_OVER_SONET	Selects either ATM or POS mode.
-	DRV_ATM_XMT_CHE_ERROR_INSERT	Controls if correctable HEC errors are transmitted. Function not available in the 28250 driver.
-	DRV_ATM_XMT_UHE_ERROR_INSERT	Controls if un-correctable HEC errors are transmitted. Function not available in the 28250 driver.
-	DRV_ATM_CLAV_MODE	Selects the single Clav, 4 Clav or mux status available in the 2970x Utopia bus. Function is not available in the 28250.
-	DRV_PARITY_REI_MODE	Controls whether parity errors are counted every bit or once per frame. Function is not available in the 28250 driver.
-	DRV_XMT_K1K2_VALUE	inserts value into K1 & K2 bytes

Table 7. TAP Parameters

CX28250	CX2970X	Comment
	DRV_RCV_TIMING_SEL	Selects RCLK pin from either 19.44 recovered clock or 8K frame sync
	DRV_XMT_AUTO_RDI_P	Controls the automatic generation of Path Remote Defect Indication (RDI-P) in the transmit STS data stream upon detection of receive STS Path defects.
	DRV_XMT_ERDI_MODE_P	Controls the selection between 1-bit Path Remote Defect Indication (RDI-P) and Enhanced RDI-P (ERDI-P) when DRV_XMT_AUTO_RDI_P is DRV_ACTIVE. Function is not available in the 28250.
DRV_ATM_UNI_MODE		Controls UNI versus NNI mode. Feature not available in 2970x driver.
DRV_ATM_CELL_RECEIVER		Enable/Disable ATM receiver. Function is not available in the 2970x.
DRV_ATM_XMT_FILL		Controls activation of CLAV on FIFO depth of 1, 2 or 4. Function is not available in the 2970x.
DRV_ATM_XMT_SYNC_POLARITY		Controls the transmit reference polarity. Function is not available in the 2970x.
DRV_ATM_RCV_SYNC_POLARITY		Controls the receive reference polarity. Function is not available in the 2970x.
DRV_ATM_RCV_CLK_EDGE		Select the polarity of the receive clock sampling. Function is not available in the 2970x.
DRV_ATM_XMT_CLK_EDGE		Select the polarity of the transmit clock sampling. Function is not available in the 2970x.
DRV_ATM_XMT_PARITY_TYPE		Selects Utopia bus even or odd parity. 2970x only supports odd parity.
DRV_ATM_UTOPIA_DISABLE		Disables the Utopia input for used in APS backup. Function is not available in the 2970x.
DRV_ATM_UTOPIA2_MODE		Selects either Utopia Level 1 or 2. 29702 is only Utopia Level 2.
DRV_ATM_UTOPIA_BUS_WIDTH		Selects either 8 or 16 bit Utopia bus width. 2970x is 16 bits.
DRV_ATM_XMT_HEC_PATTERN		Generate HEC errors for 1 cell. Function is not available in the 2970x.
DRV_XMT_B1_PATTERN		Generate B1 error. Function is not available in the 2970x.
DRV_XMT_B2_1_PATTERN		Generate B2 error. Function is not available in the 2970x.
DRV_XMT_B2_2_PATTERN		Generate B2 error. Function is not available in the 2970x.
DRV_XMT_B2_3_PATTERN		Generate B2 error. Function is not available in the 2970x.
DRV_XMT_B3_PATTERN		Generate B3 error. Function is not available in the 2970x.

© 2009, Mindspeed Technologies®, Inc. All rights reserved.

Information in this document is provided in connection with Mindspeed Technologies® ("Mindspeed®") products. These materials are provided by Mindspeed as a service to its customers and may be used for informational purposes only. Except as provided in Mindspeed's Terms and Conditions of Sale for such products or in any separate agreement related to this document, Mindspeed assumes no liability whatsoever. Mindspeed assumes no responsibility for errors or omissions in these materials. Mindspeed may make changes to specifications and product descriptions at any time, without notice. Mindspeed makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MINDSPEED PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MINDSPEED FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MINDSPEED SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

Mindspeed products are not intended for use in medical, lifesaving or life sustaining applications. Mindspeed customers using or selling Mindspeed products for use in such applications do so at their own risk and agree to fully indemnify Mindspeed for any damages resulting from such improper use or sale.

www.mindspeed.com

General Information:

Telephone: (949) 579-3000

Headquarters - Newport Beach

4000 MacArthur Blvd., East Tower

Newport Beach, CA 92660