Canova Tech

The Art of Silicon Sculpting

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IEEE802.3cg TF
Proposal for short-reach PCS and line coding

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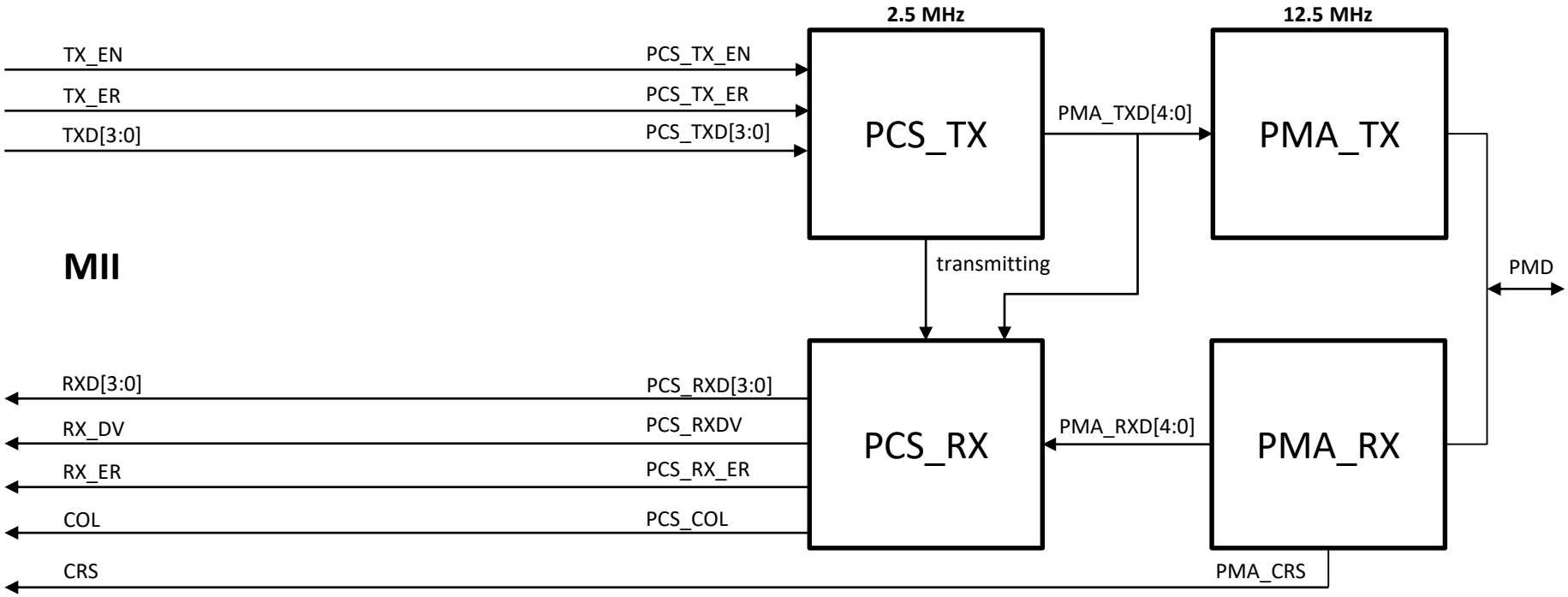
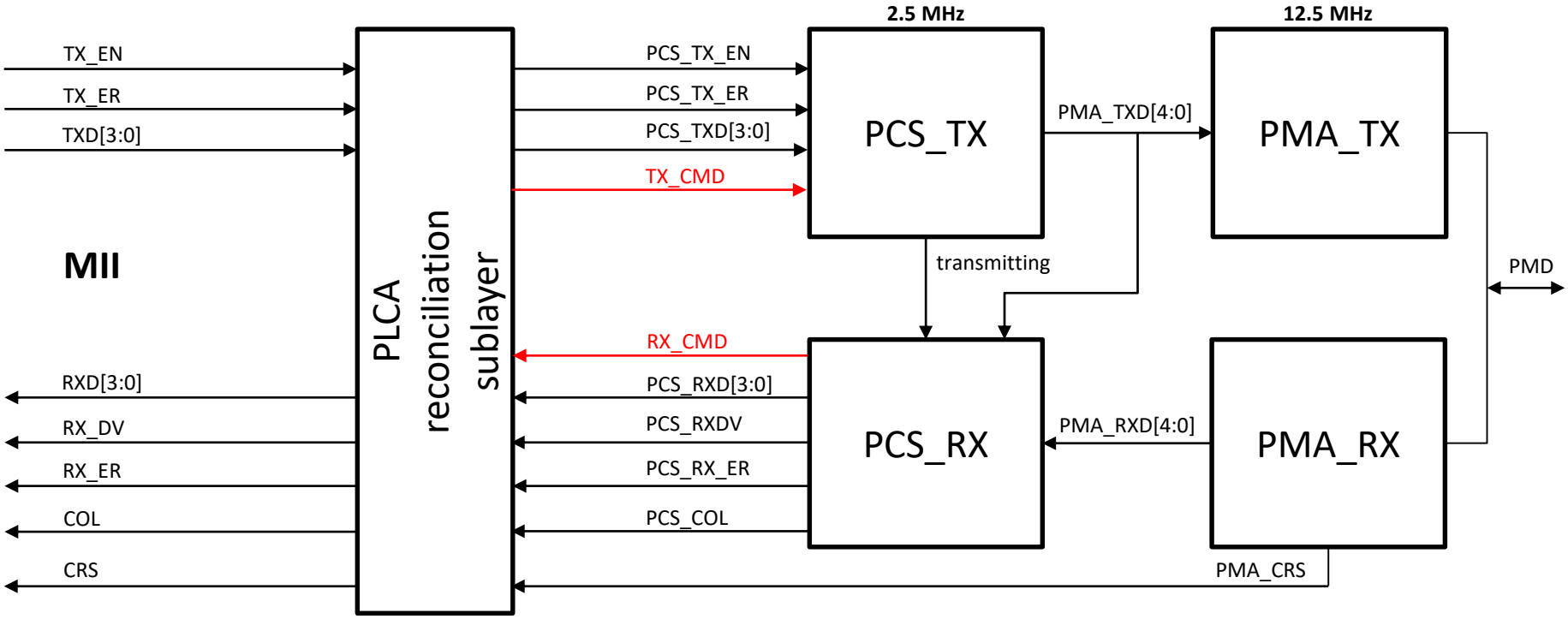
Overview



- Transmit path
  - MII data is conveyed to PCS TX functions and 4B/5B encoded at 2.5 MBd nominal rate
  - PMA TX serializes 5B symbols into Differential Manchester Encoded (DME) stream at 12.5 MBd nominal rate
- Receive Path
  - PMA RX decodes DME stream into 5B symbols for the PCS RX to process. The chosen PCS coding allows the PMA RX to recover the correct bit phase and align on 5B symbol boundary, losing up to the initial 5B symbol of each transmission.
  - PMA RX performs carrier sense by detecting DME activity (transitions) on the line
  - Collision Detection is performed at PCS level by detecting mismatch between transmitted and received symbols

Overview



- PLCA functions are implemented by an optional reconciliation sublayer
  - Dedicated PCS primitives to handle BEACON and SYNC insertion/extraction
  - Allows TSSI to insert timestamps at proper time, avoiding the jitter that would be added by PLCA variable delays
- PLCA functions can be dynamically enabled/disabled by management interface

Line Coding

- 5B data is serialized LSB first and encoded using DME as in figure 98-4 and 98-5 of 802.3bp with the exception of timings

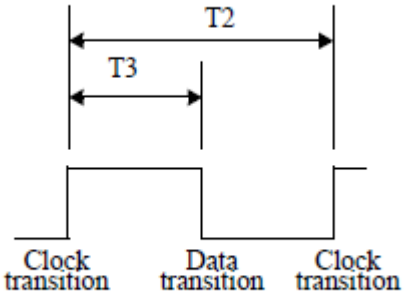


Figure 98–5—DME page transition timing

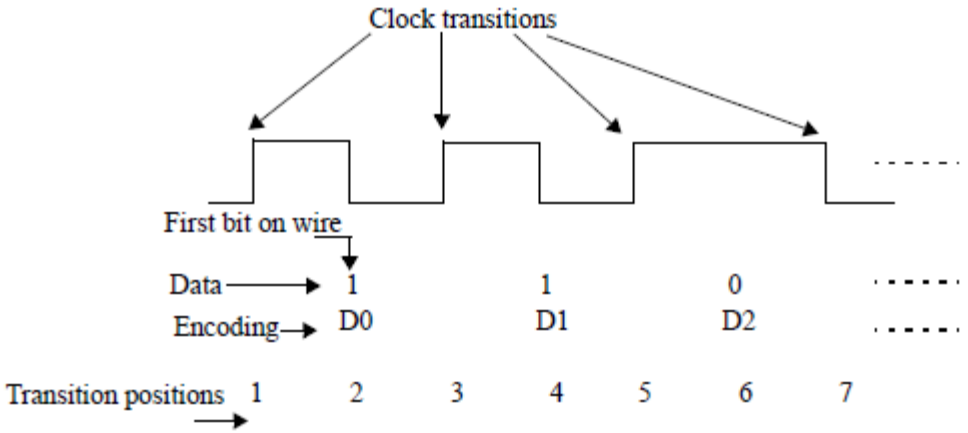


Figure 98–4—Data bit encoding within DME pages

	Parameters	Min	Typ	Max	Units
T2	Clock transition to clock transition		80		ns
T3	Clock transition to data transition (data = 1)		40		ns

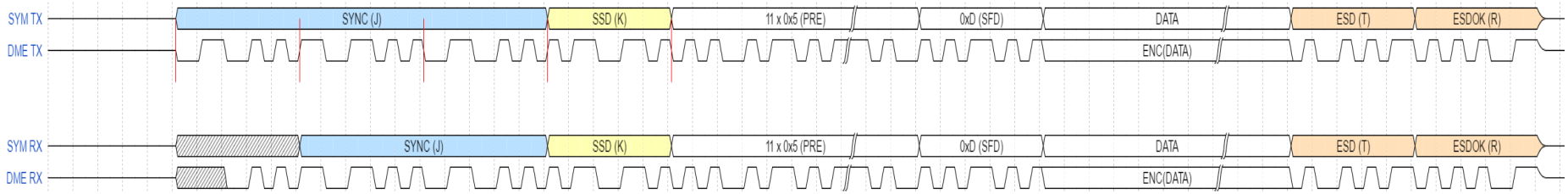
Line Coding

- Transmitter Baud Rate tolerance shall be ± 100ppm of nominal frequency (see T2 and T3)
- Transmitter peak differential output:
  - When measured with 100 Ω termination, transmit differential signal at MDI shall be within range of 1 V ± 30% peak-to-peak
- DME reception:
  - To be able to detect the DME bits, the receiver should have the capability to receive DME signals sent with the electrical specifications of the PHY.

PCS coding

- PCS coding shall be 4B/5B as specified in slide #9.
- Special 5B codes that don't map to any valid 4B codes are used for both inter and intra PHY signaling
  - Special code 'I' (11111) is used to represent SILENCE
    - PMA TX shall put the PMD in a high impedance state on reception of 'I' symbols
    - PMA RX conveys 'I' to PCS RX when no line activity is detected or until alignment of both DME stream and 5B boundary is achieved
  - Special code 'J' (11000) is transmitted before a packet transmission to allow receiver to achieve synchronization
  - Special code 'K' (10001) is transmitted after code 'J' to indicate the start of a packet (SSD)
  - Special code 'T' (01101) is transmitted to signal the end of a packet (ESD), followed by either code 'R' (00111) or 'H' (00100) to indicate whether a transmission error occurred
  - When PLCA function is enabled, special code 'N' is transmitted to indicate a BEACON condition.
    - When PLCA function is not enabled / implemented, such code is just ignored by all other PHY functions, as for any other unknown / invalid 5B code

Packet TX/RX



- PCS TX function replaces the first four 5B-encoded nibbles of packet preamble with the following symbol sequence, to allow receiver synchronization:
  - J, J, J, K (00011 00011 00011 10001)
- PCS TX function then inserts 5B encoded MII data followed by ESD and either ESDOK or EDERR symbols depending on TX_ERR state during packet transmission
- PMA RX exploits the first three '0' DME bits of the first 'J' symbol to synchronize on DME stream, then uses the following two 'J' symbols to align on 5B boundary
- PCS RX detects the 'JK' sequence to regenerate at the proper point in time the packet preamble conveyed to MII, along with the packet data following the SFD.
- RX_ER is regenerated from ESD sequence accordingly
- Pretty similar to what PCS functions do in 802.3bw (100base-T1 PHY).

Thank You !

4B/5B Encoding

Name	4b	5b	Name	4b	5b	Special Function
0	0000	11110	I	-	11111	SILENCE
1	0001	01001	J	-	11000	SYNC
2	0010	10100	K	-	10001	SSD
3	0011	10101	T	-	01101	ESD
4	0100	01010	R	-	00111	ESDOK
5	0101	01011	H	-	00100	ESD
6	0110	01110	N	-	01000	BEACON
7	0111	01111				
8	1000	10010				
9	1001	10011				
A	1010	10110				
B	1011	10111				
C	1100	11010				
D	1101	11011				
E	1110	11100				
F	1111	11101				

CODES REPRESENTING VALID 4B DATA

CODES USED FOR SIGNALING (only for reference)