TIMING BUDGET FOR MAC AND SERDES

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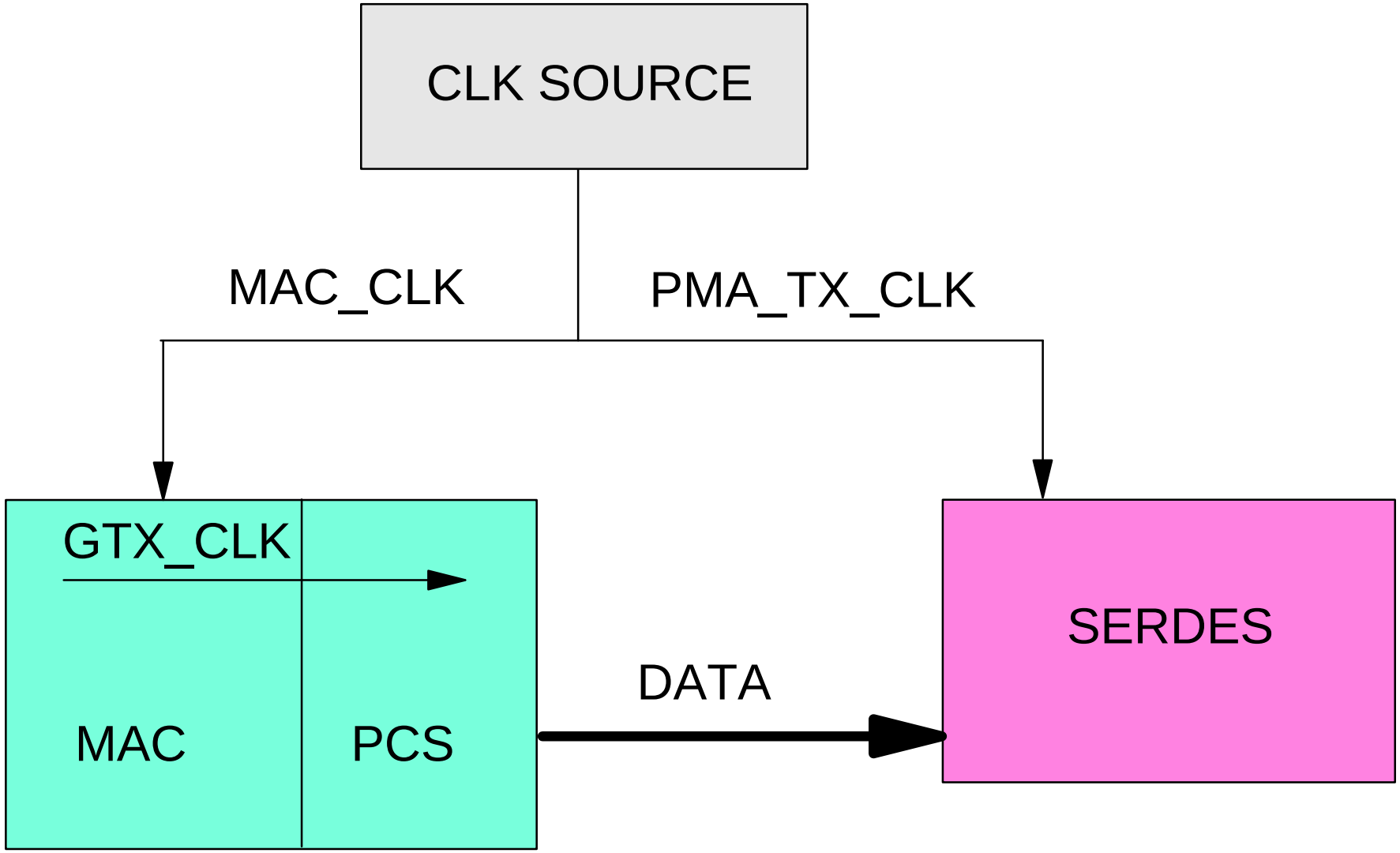
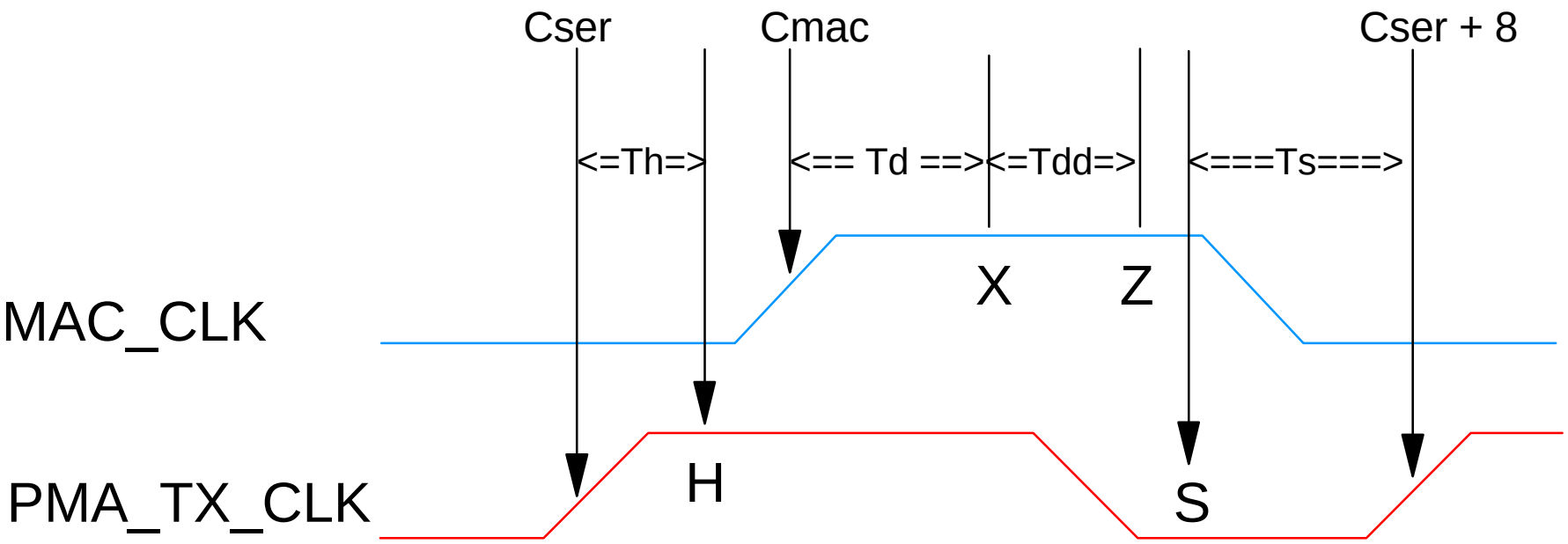


Fig. 1 Case of External Clocks for MAC and SERDES



Cser = time point for rising edge of PMA_TX_CLK at SERDES pin
Cmac = time point for rising edge of MAC_CLK at MAC pin
Td = delay from clock at MAC (Cmac) to data out of MAC
Tdd = delay of data from MAC to SERDES
Ts = setup time of SERDES
Th = hold time of SERDES

Fig. 2 Timing Relationships for Fig. 1

Timing point Z corresponds to data entering the SERDES. Z must be after H and before S:

(01) Cmac + Td + Tdd + Ts < Cser + 8
(02) Cser + Th < Cmac + Td + Tdd

Rewriting these we obtain:

(03) (Cmac - Cser) + Td + Tdd + Ts < 8
(04) (Cmac - Cser) + Td + Tdd > Th

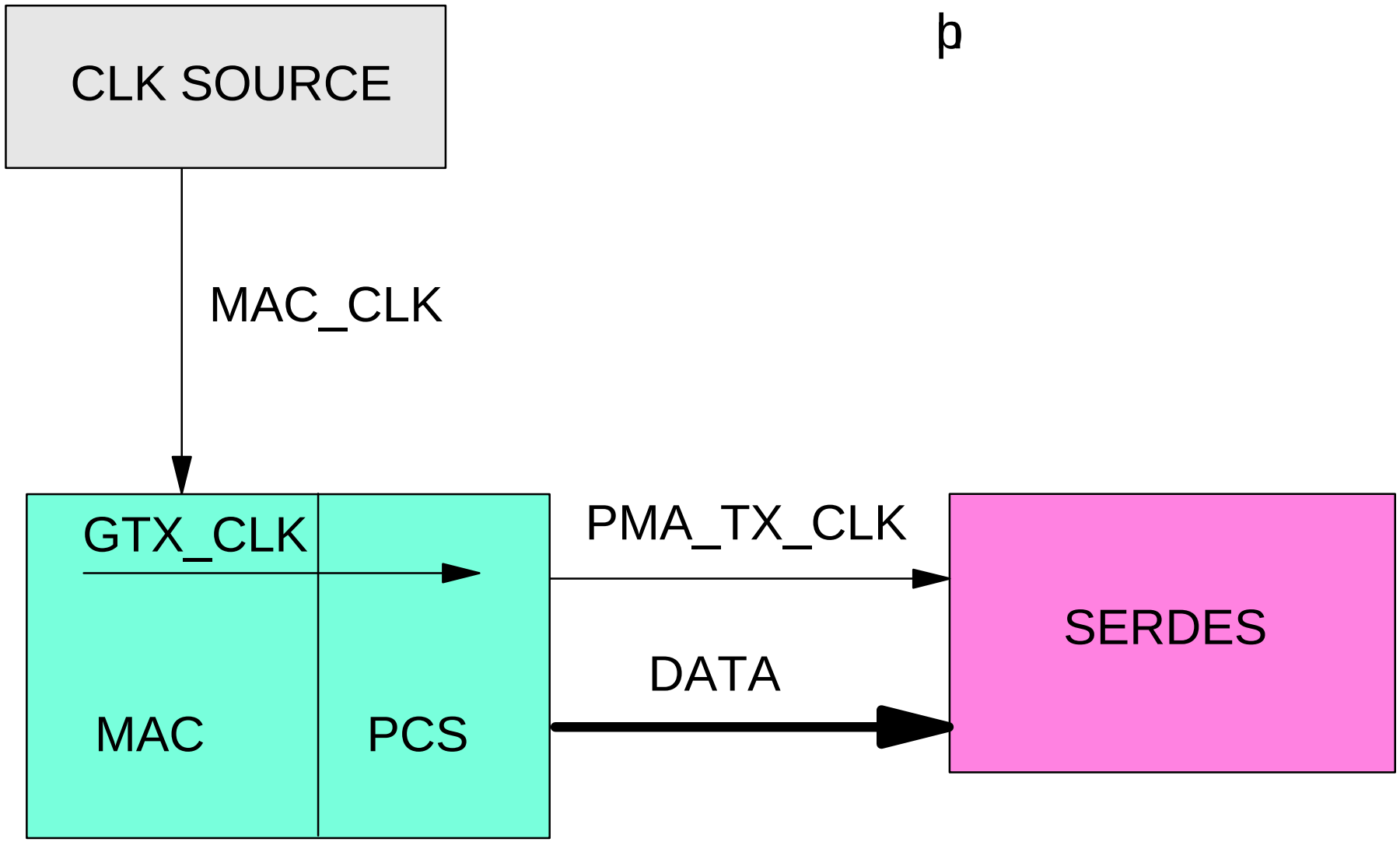
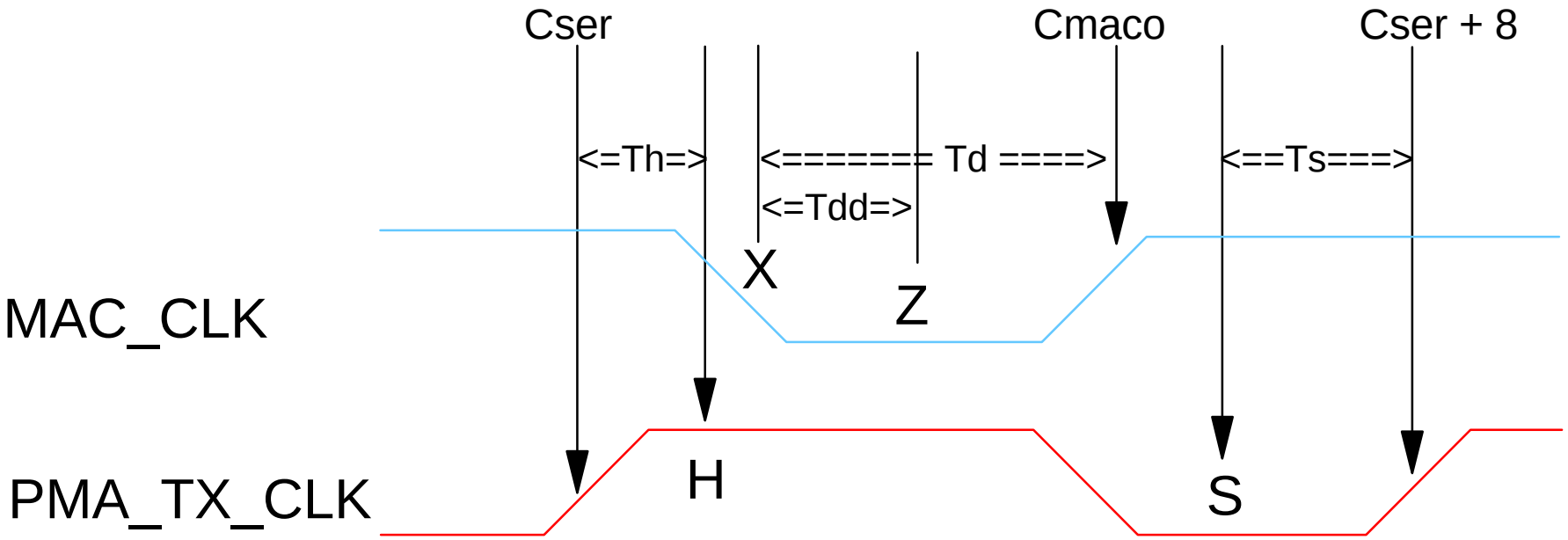


Fig. 3 Case of External Clocks for MAC and SERDES



Cser = time point for rising edge of PMA_TX_CLK at SERDES pin
Cmaco = time point for rising edge of PMA_TX_CLK at MAC pin
Td = delay from data out of MAC to clock at MAC (Cmaco)
Tdd = delay of data from MAC to SERDES
Ts = setup time of SERDES
Th = hold time of SERDES

Fig. 4 Timing Relationships for Fig. 2

Timing point Z corresponds to data entering the SERDES. Z must be after H and before S:

(05) Cmaco - Td + Tdd + Ts < Cser + 8
(06) Cser + Th < Cmaco - Td + Tdd

Rewriting these we obtain:

(07) (Cmaco - Cser) - Td + Tdd + Ts < 8
(08) (Cmaco - Cser) - Td + Tdd > Th

Note that the only difference between equations (3,4) and (7,8) is the sign of Td.

We now try to obtain constraints for tolerances

Define

D = Cmac - Cser for equations (3,4)

D = Cser + 8 - Cmaco for equations (7,8)

Equations (3,4) yield

(09) 8 = Dmax + Tdmax + Tddmax + Ts

(10) 0 = Dmin + Tdmin + Tddmin - Th

Subtracting (09) - (10) we get

(11) 8 - Ts - Th = (Dmax - Dmin) + (Tdmax - Tdmin) + (Tddmax - Tddmin)

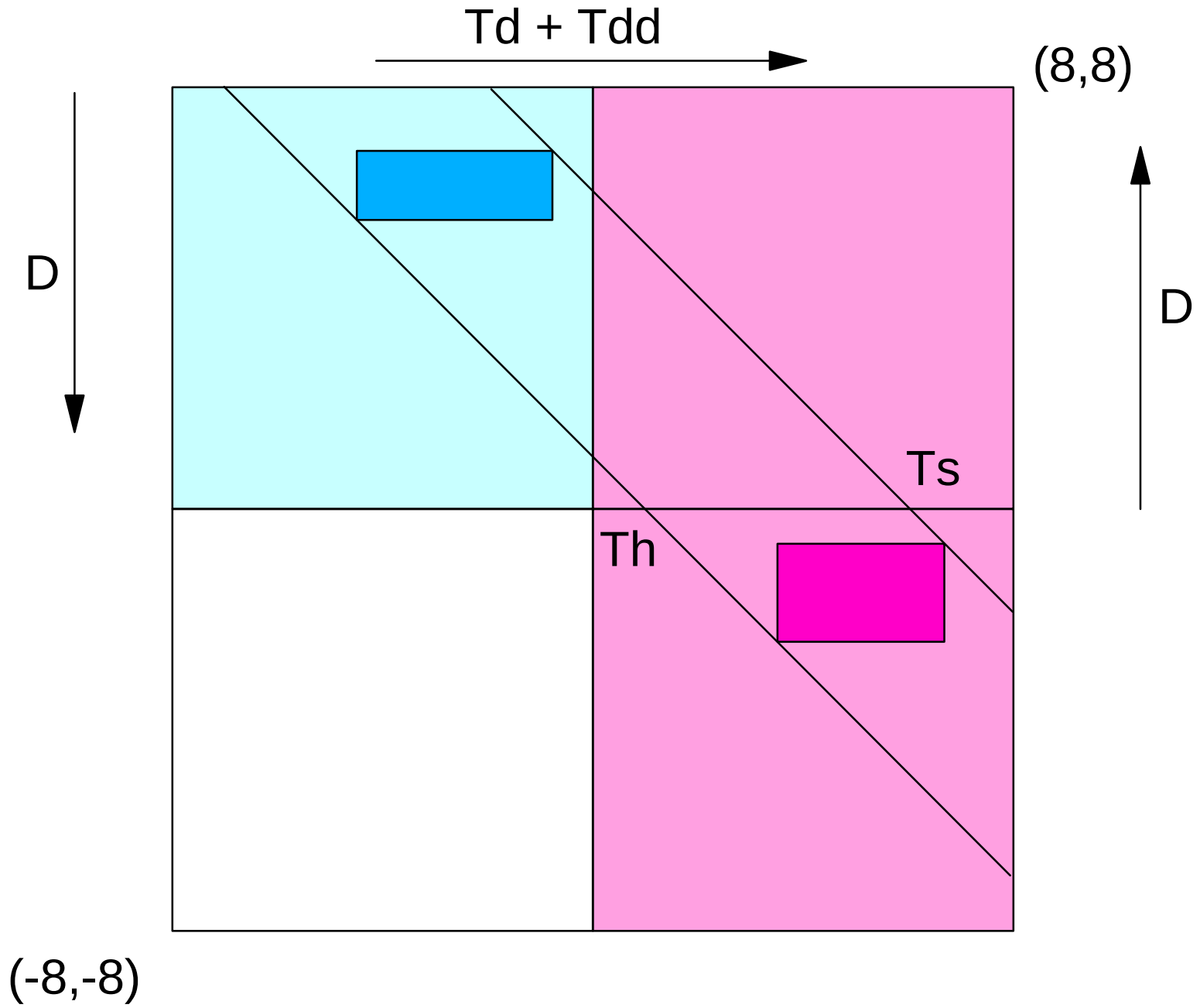
Equations (7,8) yield

(12) 8 = Dmax + Tdmax - Tddmin + Th

(13) 0 = Dmin + Tdmin - Tddmax - Ts

Subtracting (12) - (13) we get

(14) 8 - Ts - Th = (Dmax - Dmin) + (Tdmax - Tdmin) + (Tddmax - Tddmin)


Td + Tdd
(8,8)
D
D
Ts
Th
(-8,-8)