

1000BASE-T PHY worst-case wake-time budget

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1000BASE-T wake budget when slave initiates wake (1)

- Working backward from a maximum PHY wake time of 16 μ s on the master:
 - Starting point = 16,000 ns
 - Master receive status OK (max) = -2,500 ns
 - Tx latency + Cable prop delay + Rx latency (max) = -878 ns
- =====
- The slave must complete WAKE_SILENT by 12,622 ns (measured from the time wake was initiated)

1000BASE-T wake budget when slave initiates wake (2)

- Working forward from the moment the slave GMII transmit input transitions from LPI to idle:
 - Propagation delay from xMII to media wake 84 ns
 - Wake signal sent by slave (min) 1,200 ns
 - Cable prop delay 550 ns
 - Energy detect in Master assumed to overlap wake
 - Master starts lpi_wakemz_timer
 - lpi_wakemz_timer expires in master 5,000 ns
 - Cable prop delay + latency from master to slave 878 ns
- =====
- The slave begins timing reacquisition at 7,712 ns

1000BASE-T maximum time slave may spend in WAKE_SILENT

- Time slave must leave WAKE_SILENT 12,622 ns
 - Less propagation delay from xMII to media -84 ns
 - Less max. time wake signal sent by slave -1,400 ns
 - Margin to insure system works -200 ns
- =====
- Maximum time slave in WAKE_SILENT 10,938 ns
- Rounding to a maximum of 10.9 μ s

1000BASE-T maximum time slave has to lock timing and scrambler

- Maximum time in WAKE_SILENT 10,900 ns
 - Less time from slave silent 'til master signal arrives -6,428 ns
- =====
- Net time for slave to lock scrambler = 4,472 ns

1000BASE-T wake-time shrinkage

- $T_{TWTS}(M) \leq T_{WTX} + T_{MZ} + (T_{TCP} - T_{TDP})$
 $T_{TWTS}(M) \leq 1.4 + 5 + (.084 - .084) \mu s$
 $T_{TWTS}(M) \leq 6.4 \mu s$
- $T_{TWTS}(S) \leq T_{WTX} + T_{SZ} + (T_{TCP} - T_{TDP})$
 $T_{TWTS}(S) \leq 1.4 + 10.9 + (.084 - .084) \mu s$
 $T_{TWTS}(S) \leq 12.3 \mu s$
- $T_{RWTS}(M) \leq T_W - (T_{TWTS}(S) + T_{TDP}) - T_M - (T_{TCP} + T_M + T_{RCP}) - T_{RDP}$
 $T_{RWTS}(M) \leq 16 - (12.3 + .084) - .550 - (.084 + .550 + .244) - .244 \mu s$
 $T_{RWTS}(M) \leq 1.944 \mu s$
- $T_{RWTS}(S) \leq T_W - (T_{TWTS}(M) + T_{TDP}) - T_M - T_{RDP}$
 $T_{RWTS}(S) \leq 16 - (6.4 + .084) - .550 - .244 \mu s$
 $T_{RWTS}(S) \leq 8.722 \mu s$

Proposed 1000BASE-T timing parameters

Symbol	Description	Value	Units
T_{TWTS}	Alias for $T_{PHY_SHRINK_TX}$	12.3	μs
T_{RWTS}	Alias for $T_{PHY_SHRINK_RX}$	8.8	μs
T_{TDP}	Alias for $T_{PHY_PROP_TX}$	84	ns
T_{RDP}	Alias for $T_{PHY_PROP_RX}$	244	ns
T_{TCP}	PCS and PMA transmit latency for control info.	~84	ns
T_{RCP}	PCS and PMA receive latency for control info.	~244	ns
T_M	Media propagation delay	550	ns
T_W	PHY wake time	16	μs
T_{WTX}	Corresponds to lpi_waketx_timer	1.2-1.4	μs
T_{MZX}	Corresponds to lpi_wakemz_timer	5	μs
T_{SZ}	The max. time the SLAVE spends in WAKE_SILENT	10.9	μs



Thank You



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