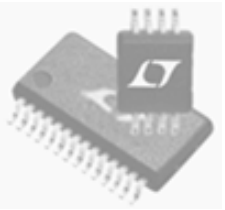
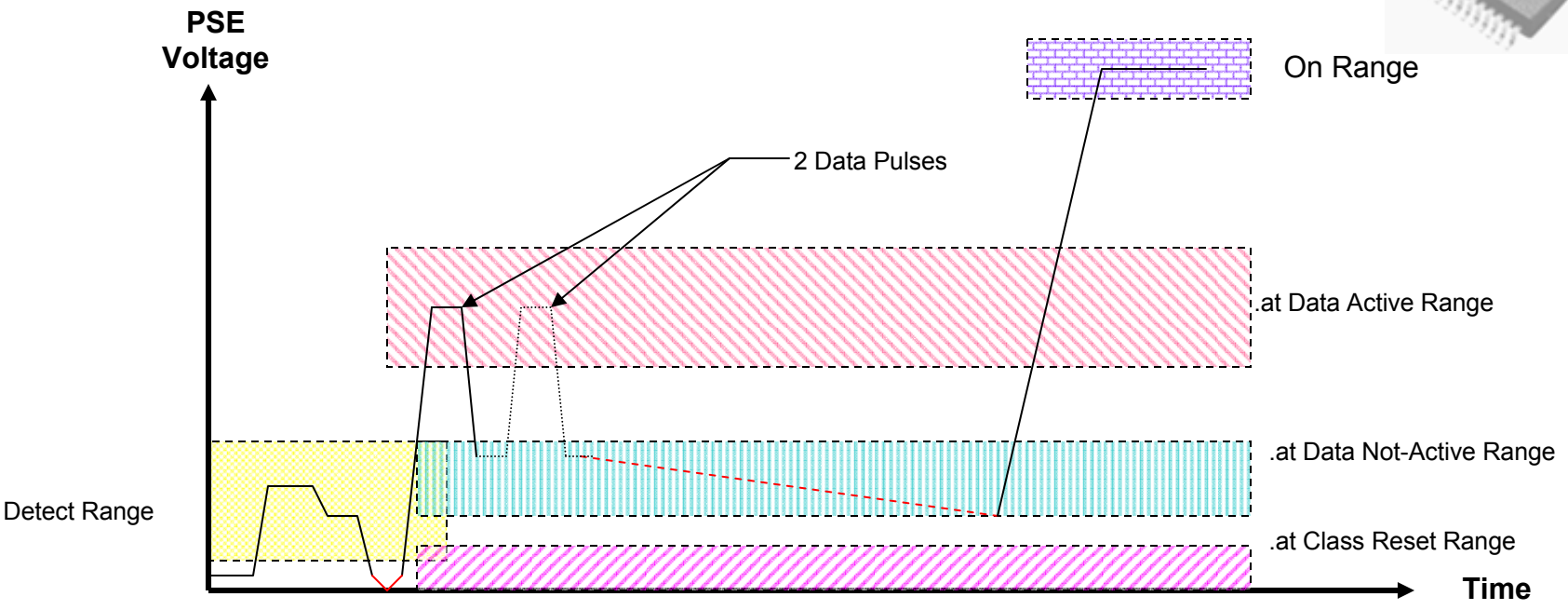


PoE Plus
IEEE 802.3at
Classification Ad Hoc
Extended Classification Using Ping-Pong Scheme with "Return to Signature Range"

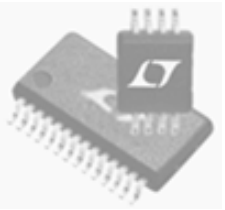
Clay Stanford
Linear Technology

June, 2006

802.3at Classification Using Class Ping-Pong With “Return to Signature” Range



PoEP: IEEE 802.3at Ping-Pong Classification Rules



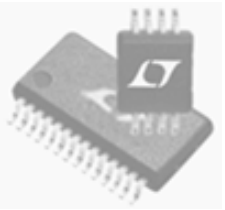
.atPD Rules:

- PD is behind diode bridge so fall time is controlled by internal PD circuits and not PSE port voltage. Therefore an .atPD is required to pull the internal supply down using the classification current until the PD detects the Mark event. Once the PD has detected the Mark, it can stop pulling down on the port. Note that in this scenario, the port voltage may not discharge all the way down to the Mark range. This is not a problem.
- If port voltage goes to reset range, PD clocking is reset and the PD will start ping-pong routine from beginning.

.at System Rules:

- Timing is such that pulses complete within 75mS .af requirement.
- .atPSE generates all clock timing. .atPD is slaved to .atPSE.
- .at maximum time in “Data Not Active” mode is 4mS to limit memory retention requirement if required.

PoEP: IEEE 802.3at Ping-Pong: .at/.af Interaction



.atPSE with .afPD:

- If .atPSE sees 0-0, 1-1, 2-2, 3-3, or 4-4, it assumes .afPD and powers per .af spec, i.e. 15.4W, 4W, 7W, 15.4W, or 15.4W respectively

.atPSE with .atPD:

- If .atPSE sees 1-2, 1-3, etc, (none of which are 0), it knows PD is an .atPD.

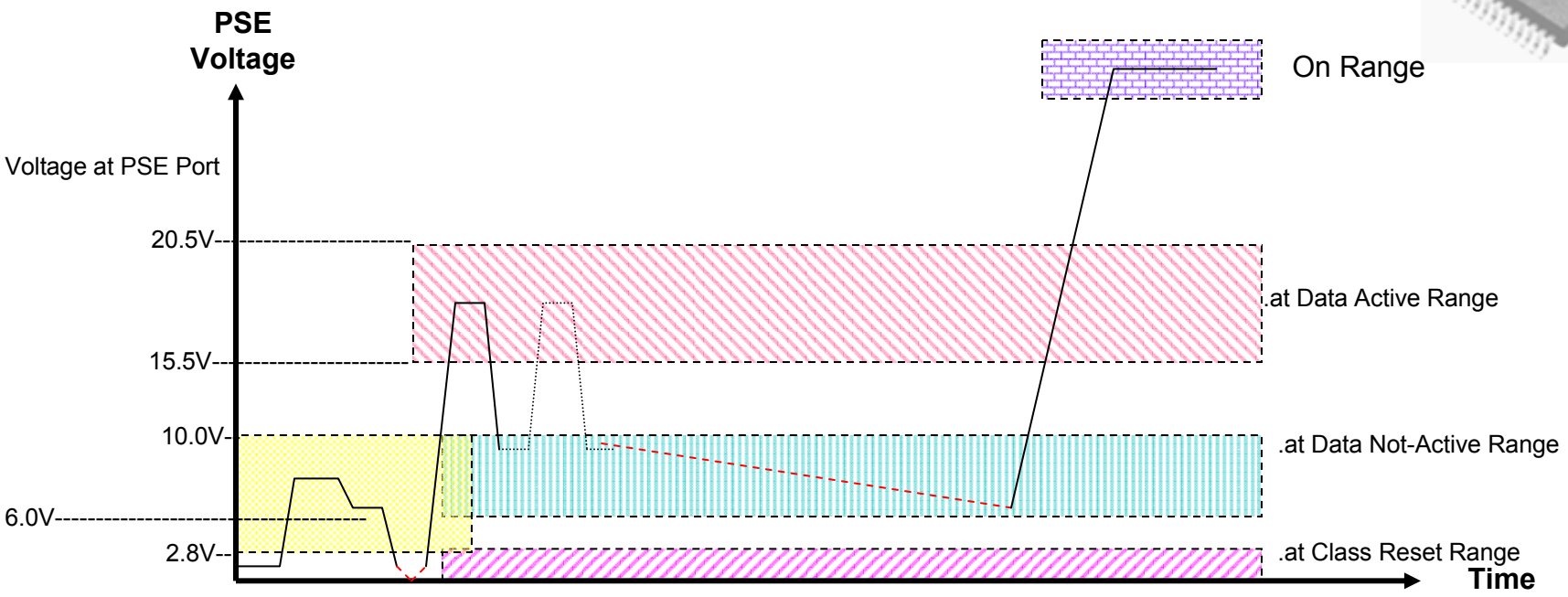
.afPSE with .atPD:

- If .afPSE sees .atPD, it will use first class. Therefore, new 2W .atPD should use class 1-x, so that .afPSE allocates 4W. Similarly, new 11W .atPD should use 3-x so that .afPSE allocates 15.4W.

Comments

- .afPD may not pull internal PD supply down quickly between pulses but it doesn't matter. Using "Return to Signature", .afPD might "float" at some voltage 10-15V, but will return to class range when PSE drives port back to class voltage.
- Class 0 is not used by .atPD because Class 0 can be 0mA and would not pull port low. Port needs to be pulled low by .atPD so that .atPD can see that .atPSE is toggling classification voltage.

Voltage Ranges and Timing Specification



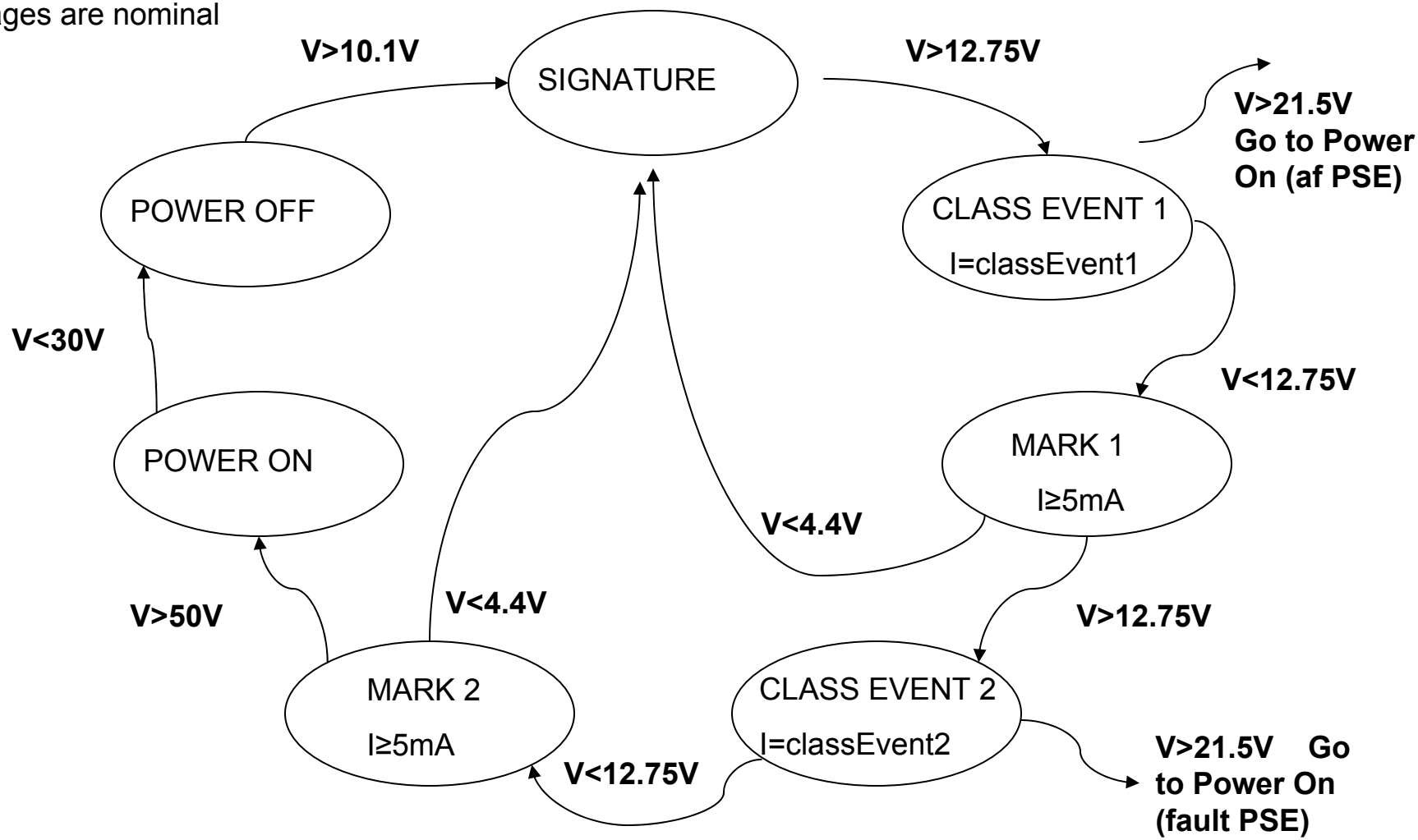
VOLTAGE SPECIFICATIONS		
FUNCTION	MIN (V)	MAX (V)
Classification (at PSE)	15.5	20.5
Mark (at PSE)	6.0	10
Reset Low	0	2.8
Reset High	50	57

TIMING SPECIFICATIONS		
EVENT	MIN (mS)	MAX (mS)
1st Pulse	20	30
1st Mark	2	4
2nd Pulse	10	18
2nd Mark	2	4
TOTAL	34	56

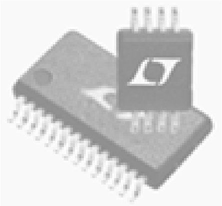
State Diagram

Voltages are at PSE PI

Voltages are nominal



Ping-Pong Class Count



- 12 possible classes

RULES:

2 pulses

AF PD will always be 00, 11, 22, 33, 44

AT PD never uses class 0

1st pulse	2nd pulse	notes	
0	0	AF PSE	
0	1	not allowed	
0	2	not allowed	
0	3	not allowed	
0	4	not allowed	
1	0	not allowed	
1	1	AF PSE	
1	2	AT NEW CLASS	1
1	3	AT NEW CLASS	2
1	4	AT NEW CLASS	3
2	0	not allowed	
2	1	AT NEW CLASS	4
2	2	AF PSE	
2	3	AT NEW CLASS	5
2	4	AT NEW CLASS	6
3	0	not allowed	
3	1	AT NEW CLASS	7
3	2	AT NEW CLASS	8
3	3	AF PSE	
3	4	AT NEW CLASS	9
4	0	not allowed	
4	1	AT NEW CLASS	10
4	2	AT NEW CLASS	11
4	3	AT NEW CLASS	12
4	4	AF PSE	