# PSE and PD State Diagrams

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Presentation Objectives

- Propose changes related to detection that will simplify the PSE state diagram without affecting operation of the PSE

- Propose definitions for PSE state diagram variables, timers, and functions.

- Propose definitions for PD state diagram variables, and timers.

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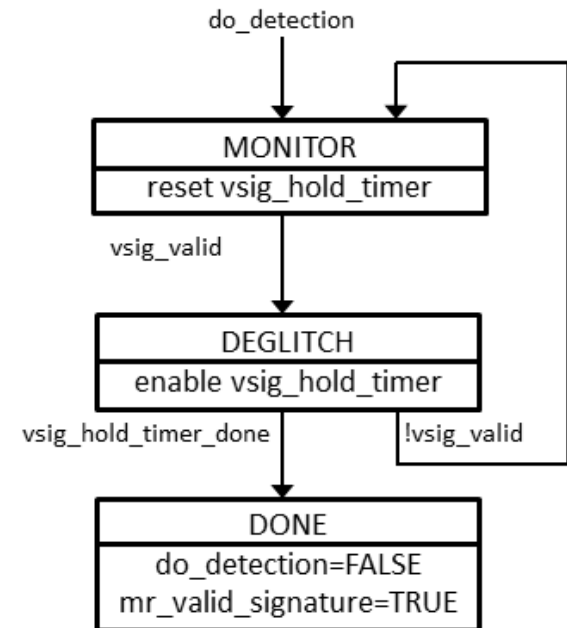
Simplification of PSE State Diagram
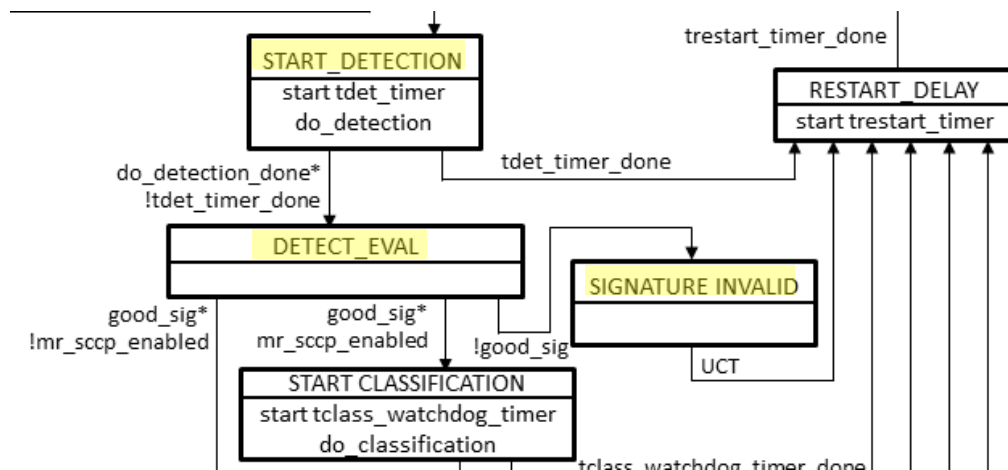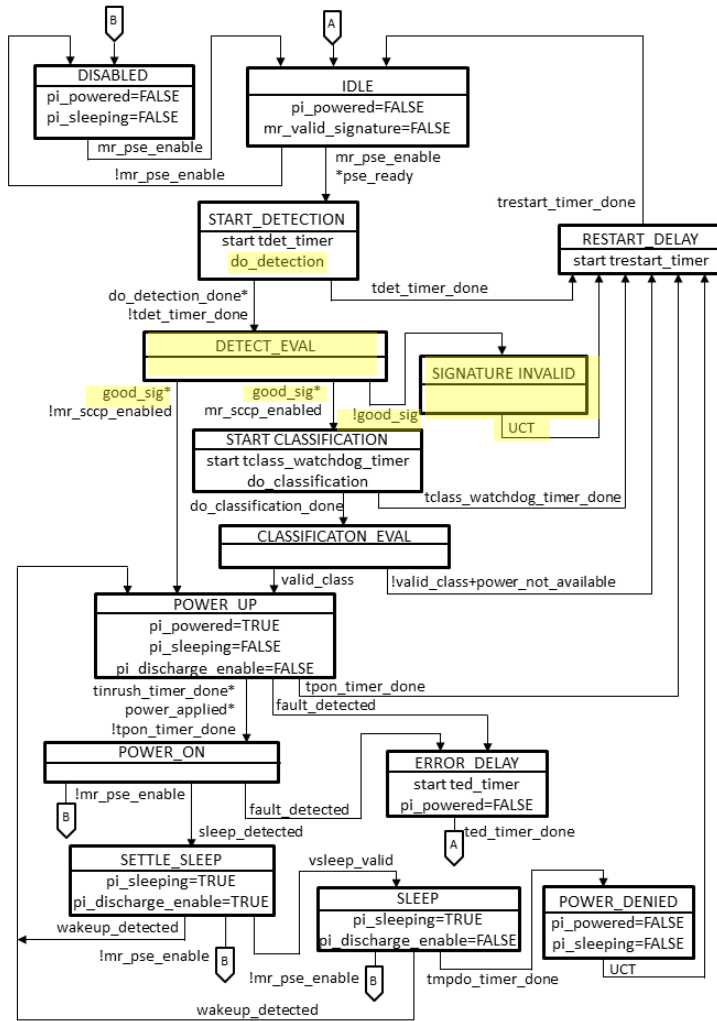

PSE State Machine Detection Related States

- Simplification of the detection related states is possible in the PSE state diagram.
  - As is, the SIGNATURE_INVALID state is superfluous and the !good_sig arc to it can be eliminated.
  - The do_detection function can be replaced with a simple detection state diagram.
  - Given the simple nature of detection, the DETECT_EVAL state appears to be redundant.

Proposed PD detection state diagram

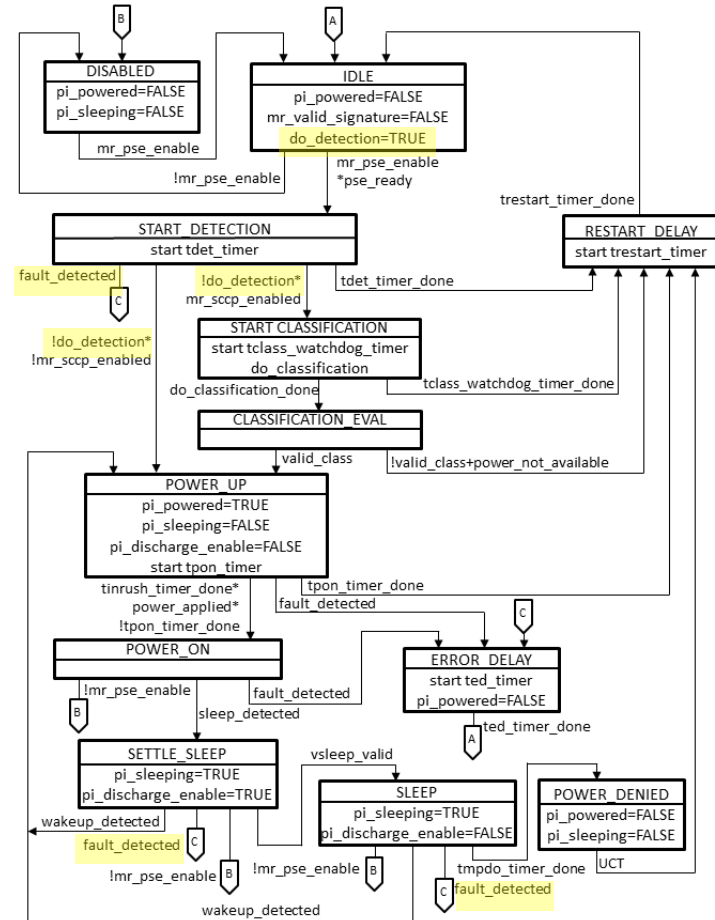- PD detection is performed during the START_DETECTION state and makes the DETECT_EVAL state redundant.

- tdet_timer sets a timeout on the do_detection function and bounds the upper value of C_{PD} during detection.

- vsig_valid indicates when the PD signature voltage is in the range of V_{good} in Table 104-4.

- vsig_hold_timer de-glitches vsig_valid.
  - What is a reasonable de-glitch time?

D1.1 PSE State Diagram vs. Proposed Simplified PSE State Diagram

D1.1

Proposed

Proposed PSE State Diagram Variable Definitions

Variable Name	Definition
do_classification_done	A Boolean variable indicating that the PSE has concluded serial communication after performing a read of the PD information byte and any additional implementation dependent read or write commands.
do_detection	A Boolean variable indicating that a valid detection sequence needs to be completed before the power-up sequence can proceed. True when a valid detection sequence needs to be completed.
tdet_timer_done	This Boolean variable indicates the status of the tdet_timer. True when the tdet_timer has expired.
fault_detected	A Boolean variable indicating the PSE output current has faulted because the port current exceeded I_{CUT} for at least T_{CUT}. True after the PSE has faulted.
I_{Port}	PSE output current as measured at the PI.
mr_mps_valid	This Boolean variable indicates the presence or absence of a valid MPS.
mr_pse_enable	A Boolean control variable that enables or disables PSE operation.
mr_sccp_enabled	A Boolean variable indicating whether the Serial Communication Classification Protocol (SCCP) is supported by the PSE. If true, SCCP is supported. If false, SCCP is not supported.
mr_valid_signature	This Boolean variable indicates the PD signature is valid.
pi_discharge_enable	This Boolean variable indicates if the PSE is discharging the PI to VSleep. See 104.3.6.4.
pi_powered	A Boolean variable that controls the circuitry the PSE uses to power the PD. If false, the PSE shall not apply power to the PI (default). If true, the PSE shall apply power to the PI.
pi_sleeping	A Boolean variable that controls the circuitry the PSE uses to power the PD. True when the PSE applies Vsleep at the PI.
power_applied	A Boolean variable indicating that the PSE has begun steady state operation by having asserted pi_powered, completed the ramp of voltage, and is not in a current limiting mode. If false, the PSE is either not applying power or has begun applying power but is still in POWER_UP. If true, the PSE has begun steady state operation.
power_not_available	A Boolean variable that is asserted in an implementation-dependent manner when the PSE is no longer capable of sourcing sufficient power to support the attached PD. Sufficient power is defined by classification. If false, the PSE is able to source power to the attached PD. If true, the PSE is no longer able to source power to the attached PD.
pse_ready	A Boolean variable that is asserted in an implementation-dependent manner to probe the link segment. If true, the PSE is ready to probe the link segment. If false, the PSE is not ready to probe the link segment.
sleep_detected	A Boolean variable indicating that the average value of I_{Port} is less than or equal to the I_{Sleep} threshold current and that the PSE shall transition to the SLEEP state. See 104.3.6.4.
valid_class	A Boolean variable indicating that a valid class information byte was obtained from the PD during SCCP. If true then valid. If false then invalid.
vsleep_valid	A Boolean variable indicating that the PI was discharged to the range of Vsleep before exiting the SETTLE_SLEEP state. True if V_{PI} is in the range of V_{sleep}.
vsig_valid	A Boolean variable indicating that V_{PI} is in the range of V_{good} during the DO_DETECTION state.
wakeup_detected	A Boolean variable indicating that the PD is requesting full power at the PI or an external wakeup request has been received by the PSE and that the PSE shall forward the request to the PD. See 104.3.6.4.

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Proposed PSE State Diagram Timer Definitions

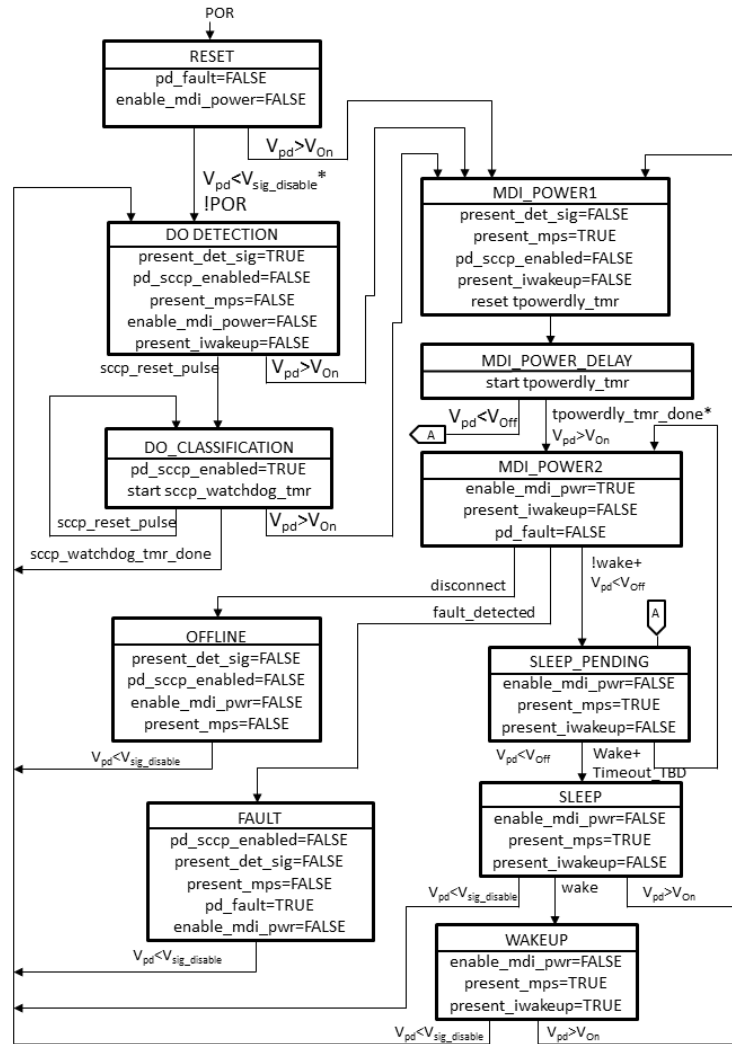| Timer Name	Definition
tclass_watchdog_timer	A timer used to limit the time in the START_CLASSIFICATION state in the event serial communication between the PSE and PD is stalled before the do_classification_done variable has been asserted by the PSE.
tdet_timer	A timer used to limit the time for attempting to detect a PD.
ted_timer	A timer used to regulate a subsequent attempt to power a PD after a error condition that causes a fault.
tinrush_timer	A timer used to monitor the duration of the inrush event.
tmpdo_timer	A timer used to monitor the dropout of MPS.
tpon_timer	A timer used to limit the time for power turn-on.
trestart_timer	A timer used to regulate a subsequent attempt to power a PD after an error condition that does not result in a fault.
vsig_hold_timer	A timer used to de-glitch the PD signature voltage valid output in the detection state machine.

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Proposed PSE Function Definitions

Function name	Definition
do_classification	This function returns the following variables:
	PD info byte: Contents TBD.

D1.1 PD State Diagram

Proposed PD State Diagram Variable Definitions

Variable Name	Definition
disconnect	Boolean variable that indicates a PD no longer requires power from the PI and has reduced its port current below the MPS threshold current, I_{Hold}.
enable_mdi_power	Boolean variable indicating when the PD is enabled to consume full power from the PI.
fault_detected	Boolean variable that indicates a PD no longer requires power as the result of an error condition.
pd_fault	Boolean variable that indicates a PD went offline as the result of an error condition.
pd_sccp_enabled	Boolean variable that indicates a PSE reset pulse has been detected and SCCP serial transaction is pending.
POR	Boolean variable that indicates if the PD is in power-on reset.
present_det_sig	Boolean variable that controls the detection signature presented by the PD at the PI. True if a valid signature is present and false when a non-valid signature is presented.
present_iwakeup	Boolean variable that controls when the PD presents a current in the range of I_{wakeup} at the PI.
present_mps	This Boolean variable controls the application of MPS by the PD. True when the PD presents a valid MPS current.
sccp_reset_pulse	Boolean variable that indicates a SCCP reset pulse has been received by the PD. See 104.6.
sccp_watchdog_tmr_done	Boolean variable that indicates when the SCCP watchdog timer has expired.
tpowerdly_timer_done	Boolean variable that indicates when the tpower delay timer has expired.
V_{On}	PD enable MDI power threshold voltage. The PD enables MDI power at a voltage less than V_{On} when full power at the PI is required.
V_{Off}	PD disable MDI power threshold voltage. The PD disables MDI power at a voltage greater than V_{Off}.
V_{PD}	Voltage at the PD PI.
$V_{sig\_disable}$	PD detection signature disable threshold voltage. The PD disables its current limited constant voltage signature at a voltage greater than $V_{sig\_disable}$.
wake	Boolean variable that indicates when a PD requires full power at the PI and when it is ready to go to sleep. True when full power is required and false when ready for sleep.

Proposed PD State Diagram Timer Definitions

Timer Name	Definition
tpowerdly_timer	A timer used to prevent a PD from drawing more than inrush current during the PSE's POWER_UP state.
sccp_watchdog_tmr	A timer used to limit the time in the DO_CLASSIFICATION state in the event serial communication between the PSE and PD is idle or stalled.

Conclusion

- The PSE state diagram can be simplified without affecting the operation of the PSE.

- A state diagram for PSE detection was presented.

- Definitions for the PSE state diagram's variables, timers, and functions were presented.

- Definitions for the PD state diagram's variables and timers were presented.

Questions?

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