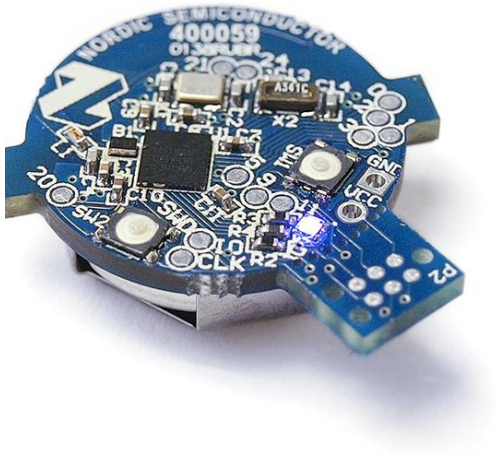
Power management

nRF52 Global Tech Tour

Agenda

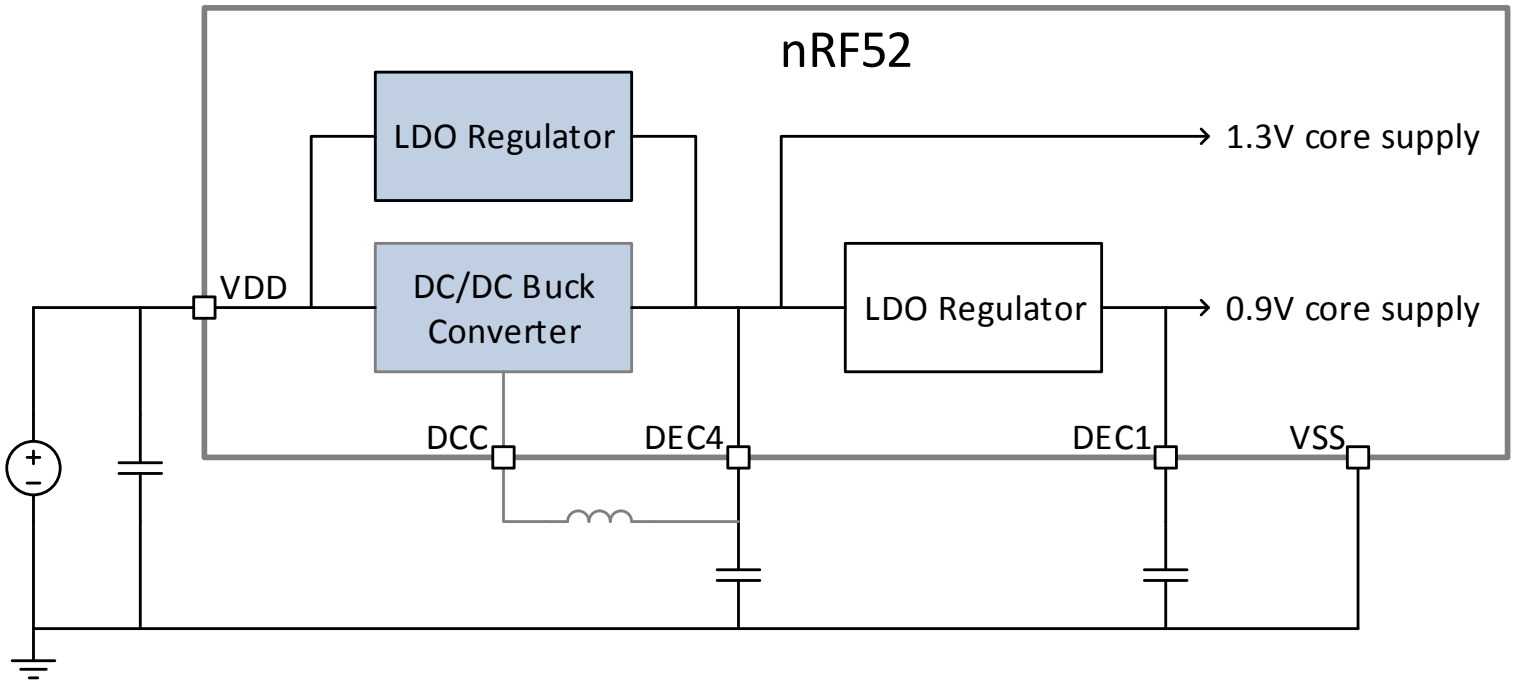
- Power regulators
- Power Management
- POF
- HF-clock

Power Regulator control



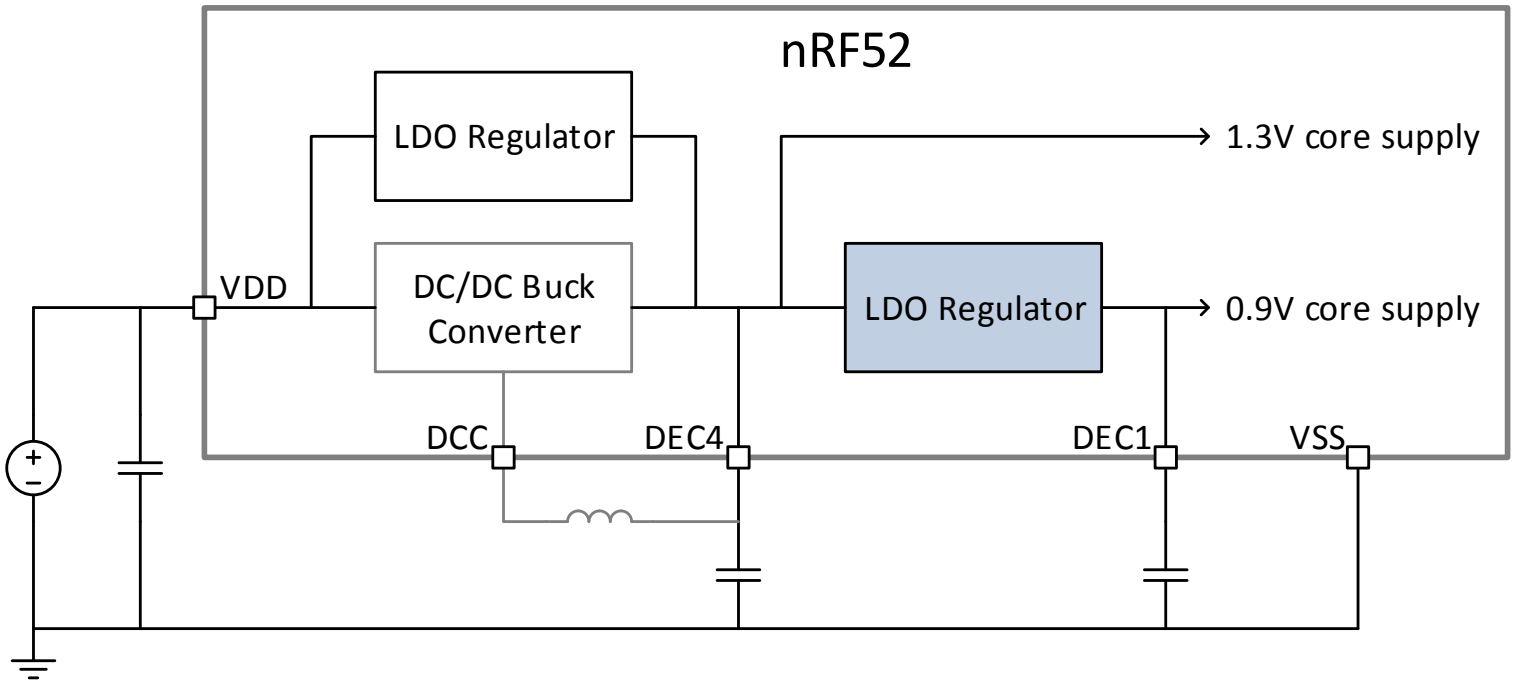
- Fully automated regulator control
- Each module requests the power regulator it needs, when it needs it

Core Supplies



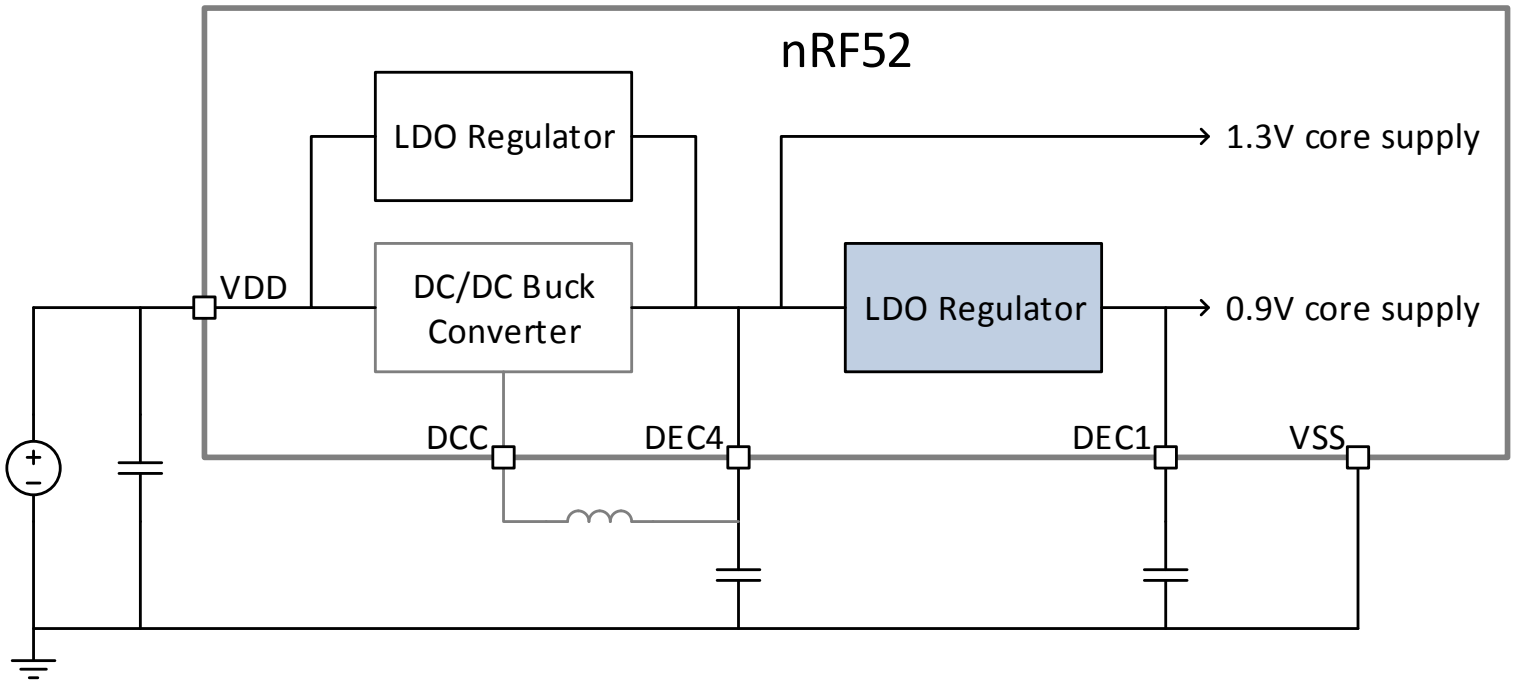
- 1.3 V core supply
  - Default from internal LDO linear regulator
  - Optionally from DC/DC buck converter for improved efficiency
  - Both have refresh mode for high efficiency at low loads

Core Supplies



- 0.9 V core supply
  - Provided by internal LDO linear regulator fed from 1.3 V supply
  - ULP mode for high efficiency at low loads

Core Supplies



- The system will automatically switch between regulators and regulator modes depending on system activity
- VDD input range: 1.7V- 3.6V for all regulators

BUT:

- The core supplies can't be used to power external circuits!

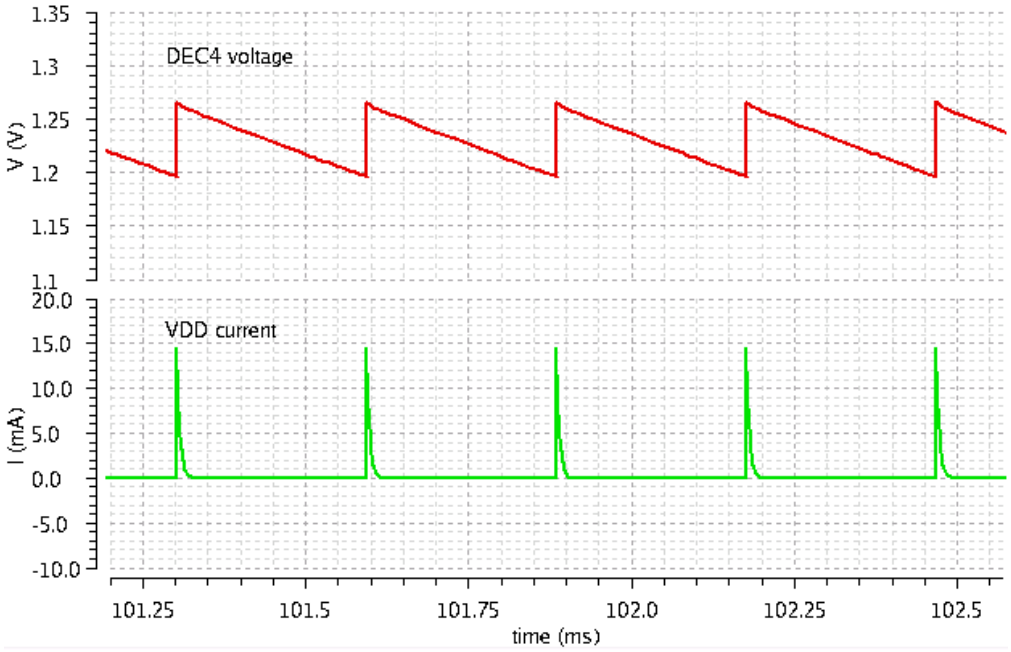
Regulator Modes

- The regulator voltages are dynamically scaled to minimize power consumption

Case*	l.3 V regulator	0.9 V regulator	1.3 V voltage	0.9 V voltage	Comment
1	LDO (refresh)	LDO (ULP)	1.22 V w/ripple	0.75 V w/ripple	System on- Idle
2	LDO (normal)	LDO (normal)	1.26 V	1.1 V	HFCLK running
3	DC/DC (refresh)	LDO (normal)	1.22 V w/ripple	1.0 V	HFCLK running, low activity
4	DC/DC (normal)	LDO (normal)	1.26 V	1.1 V	HFCLK running, high activity

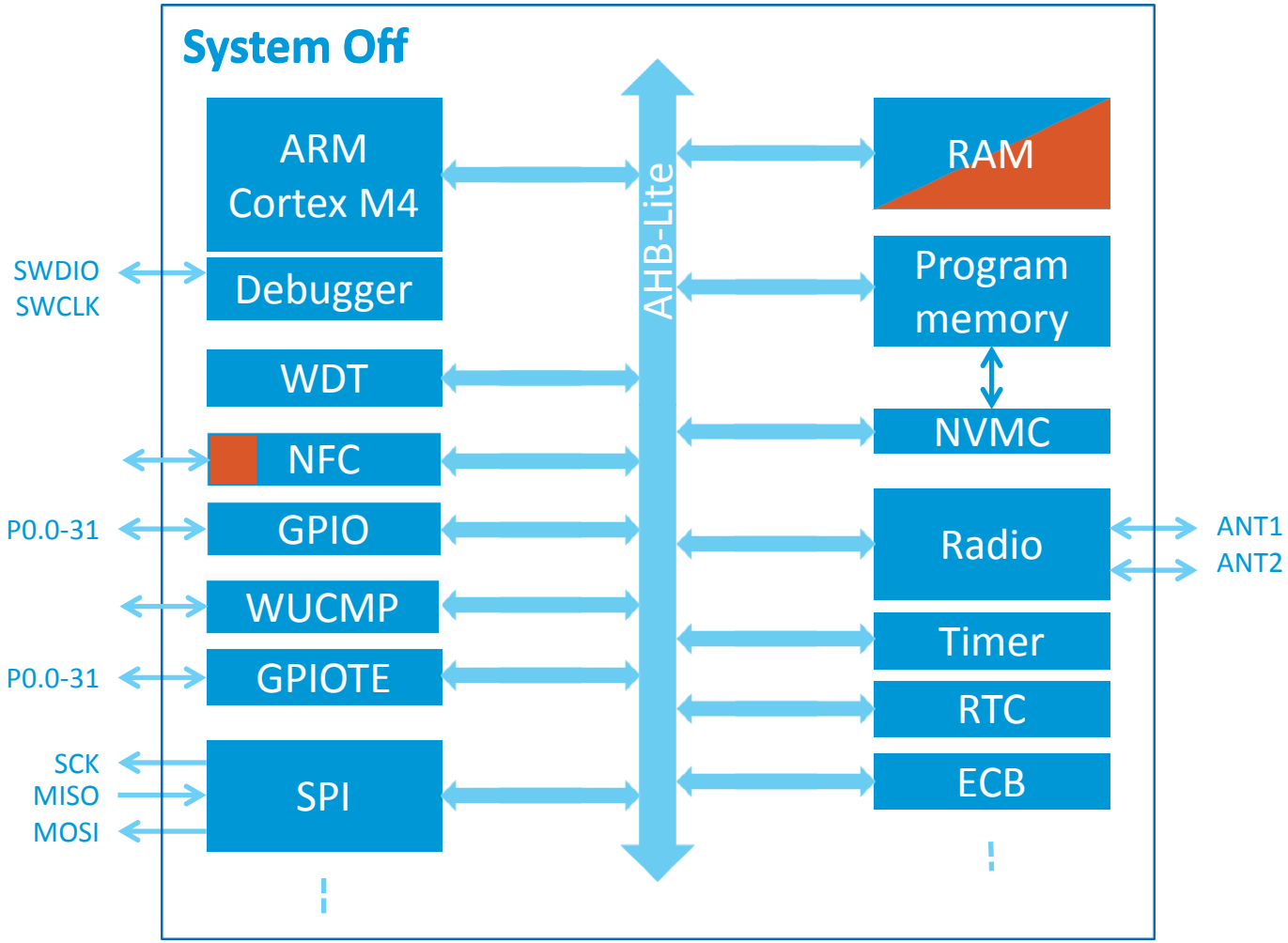
*) Regulator mode combinations other than those shown here are not applicable

Regulator Refresh Modes



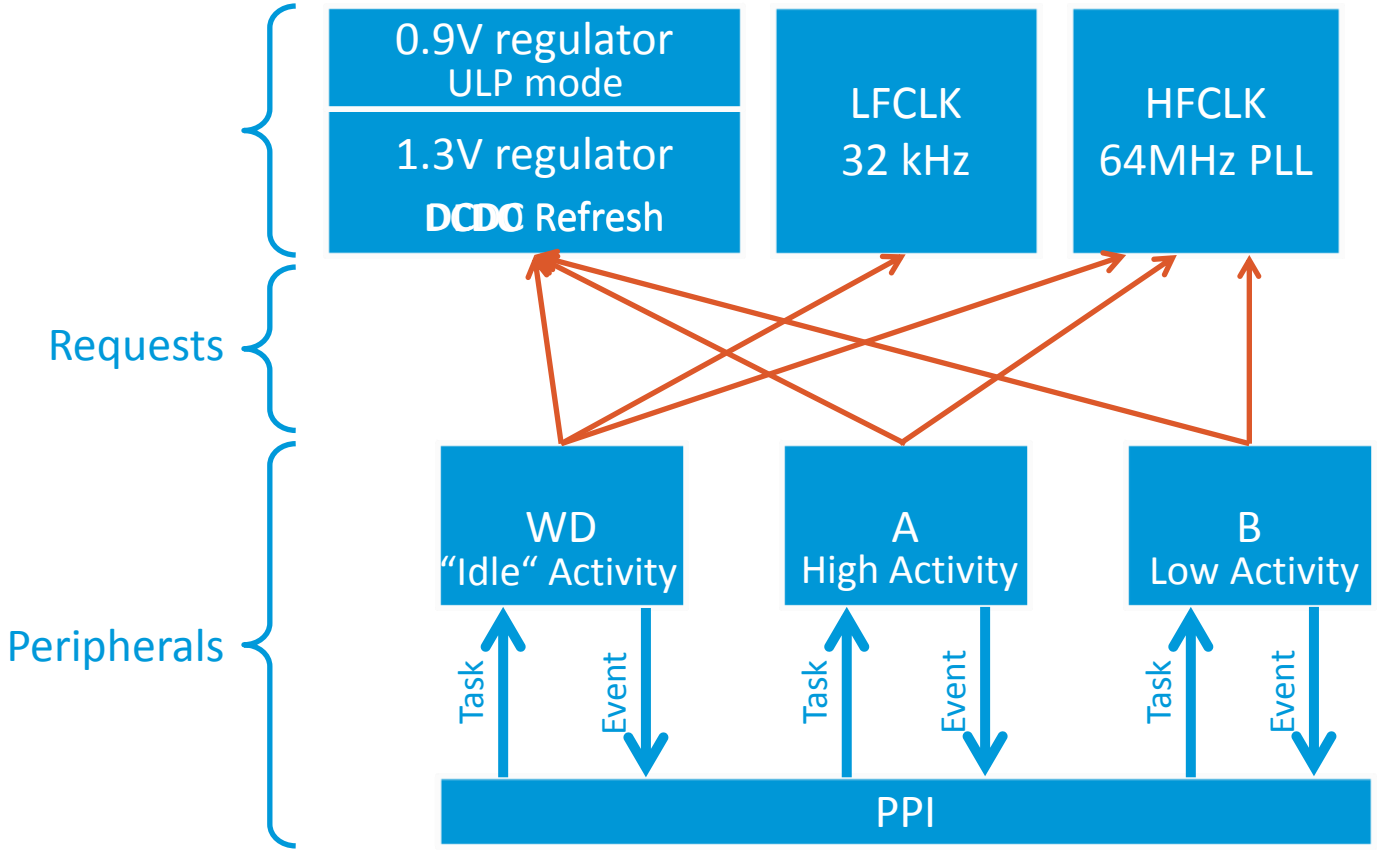
- In refresh mode much of the VDD current is concentrated into short pulses
- Precautions are necessary to measure the current consumption accurately

Power Management

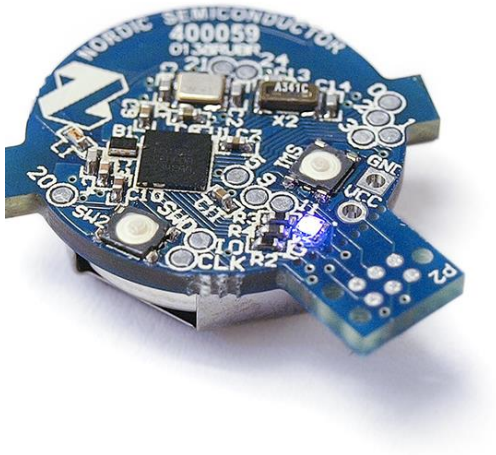


Power and Clock – Automated Control

Example using DCDC



Power Regulator control



- Fully automated regulator control
- Each module requests the power regulator it needs, when it needs it
- The only thing you as a user need to remember is to stop continuously running modules when you do not need them
  - Stop timers when not in use
  - Stop CPU when waiting for interrupts

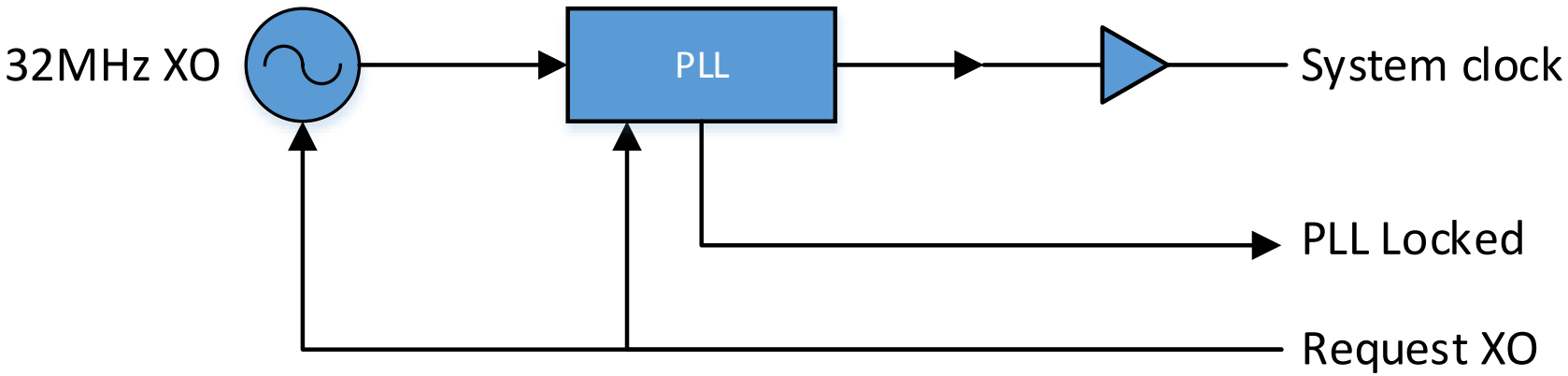
Power-Fail Comparator

- Used to enable graceful shutdown at end of battery life
- More threshold voltage choices than for nRF51
- Hysteresis can optionally be disabled

Parameter	nRF51	nRF52832
POF threshold voltages	2.1 V, 2.3 V, 2.5 V, 2.7 V	1.7 V, 1.8 V, ... , 2.8V
Hysteresis	50 – 100 mV depending on selected threshold	50mV (can be disabled)

HFCLK System nRF52832

- Clock always provided by PLL
- PLL may be free running or locked to an XO
- When XO is started and stable, the PLL will gradually change frequency to match that of the XO and generate a CLOCKREADY event when PLL is locked



HFCLK System nRF52832

- Continuously running clock when switching source
- XO mode will give higher current consumption than free running PLL
- User / SW have to request XO when needed