STM32L4 suffix ‘P’ 와 외부 SMPS 로 저전력 애플리케이션 구현하기

STMicroelectronics

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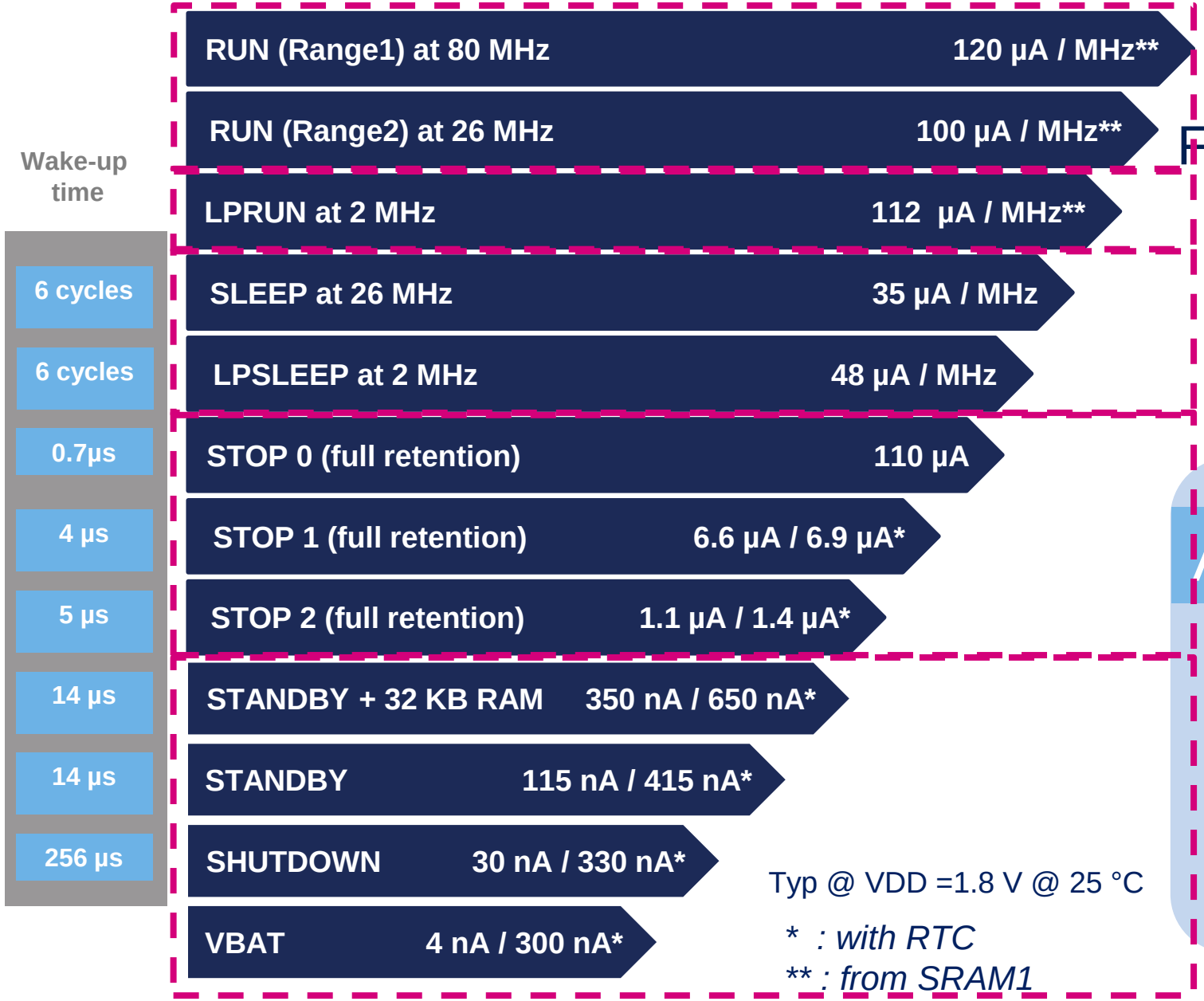
STM32L4



Typ @ VDD =1.8 V @ 25 °C

** : with RTC*

*** : from SRAM1*

FlexPowerControl

- Efficient running
- 8 low-power modes, several sub-modes
- High flexibility

Application benefits

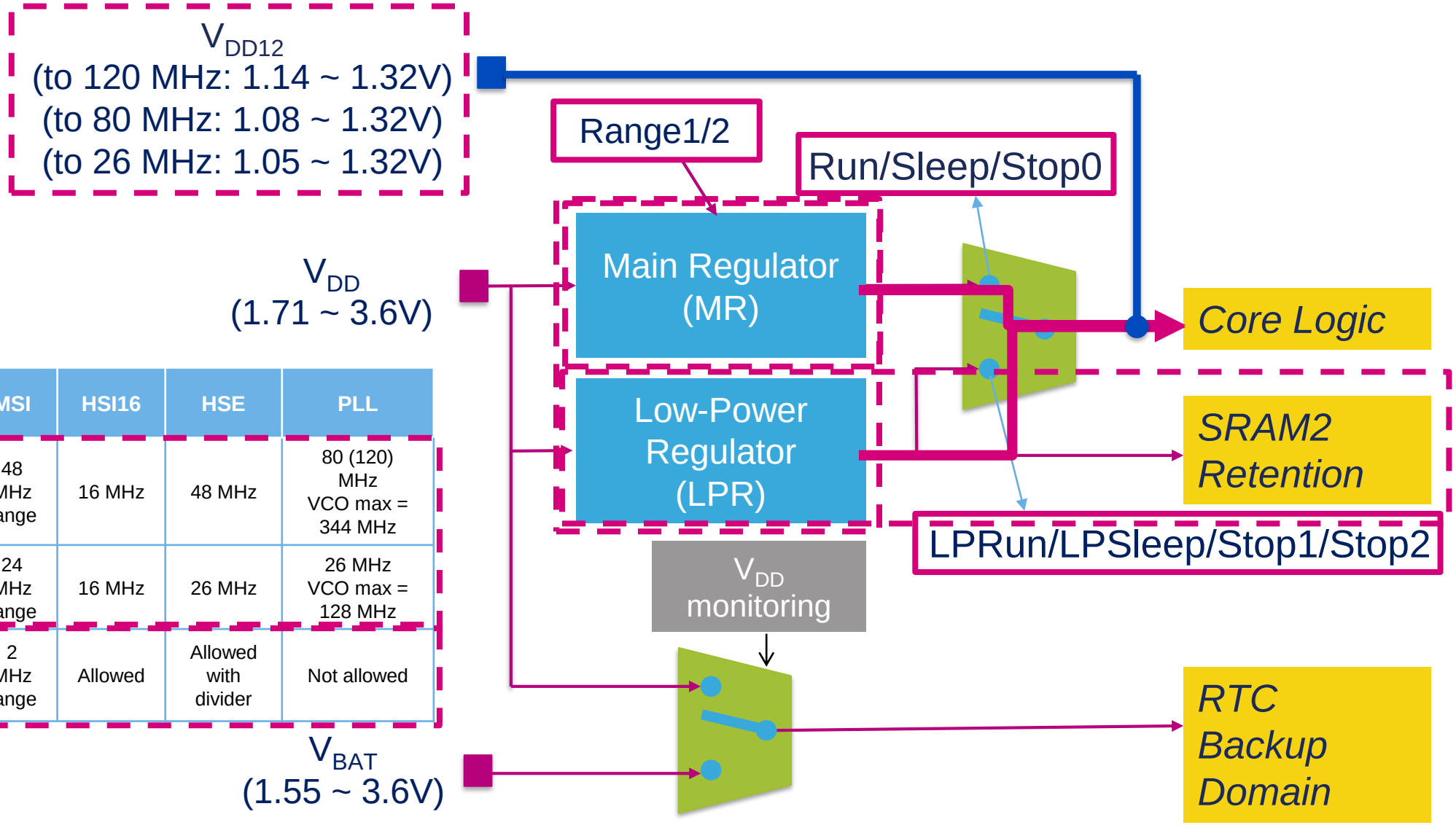
- High performance

➔ CoreMark score = 273

- Outstanding power efficiency

➔ ULPBbench score = 150

Internal voltage regulators



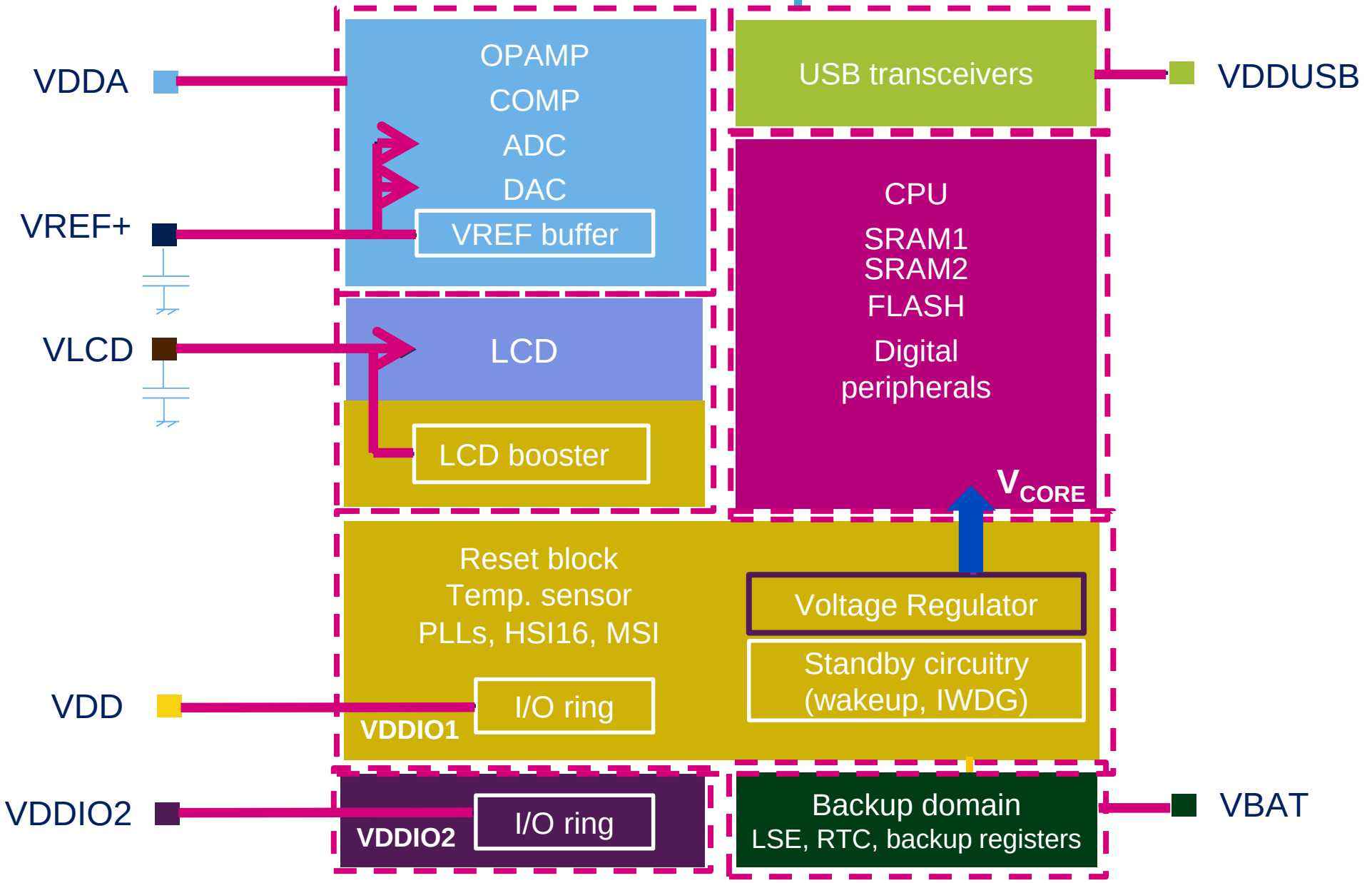
Voltage range	SYS CLK	MSI	HSI16	HSE	PLL
Range 1	80 (120) MHz max	48 MHz range	16 MHz	48 MHz	80 (120) MHz VCO max = 344 MHz
Range 2	26 MHz max	24 MHz range	16 MHz	26 MHz	26 MHz VCO max = 128 MHz
Low-power run	2 MHz max	2 MHz range	Allowed	Allowed with divider	Not allowed

Low-power modes summary

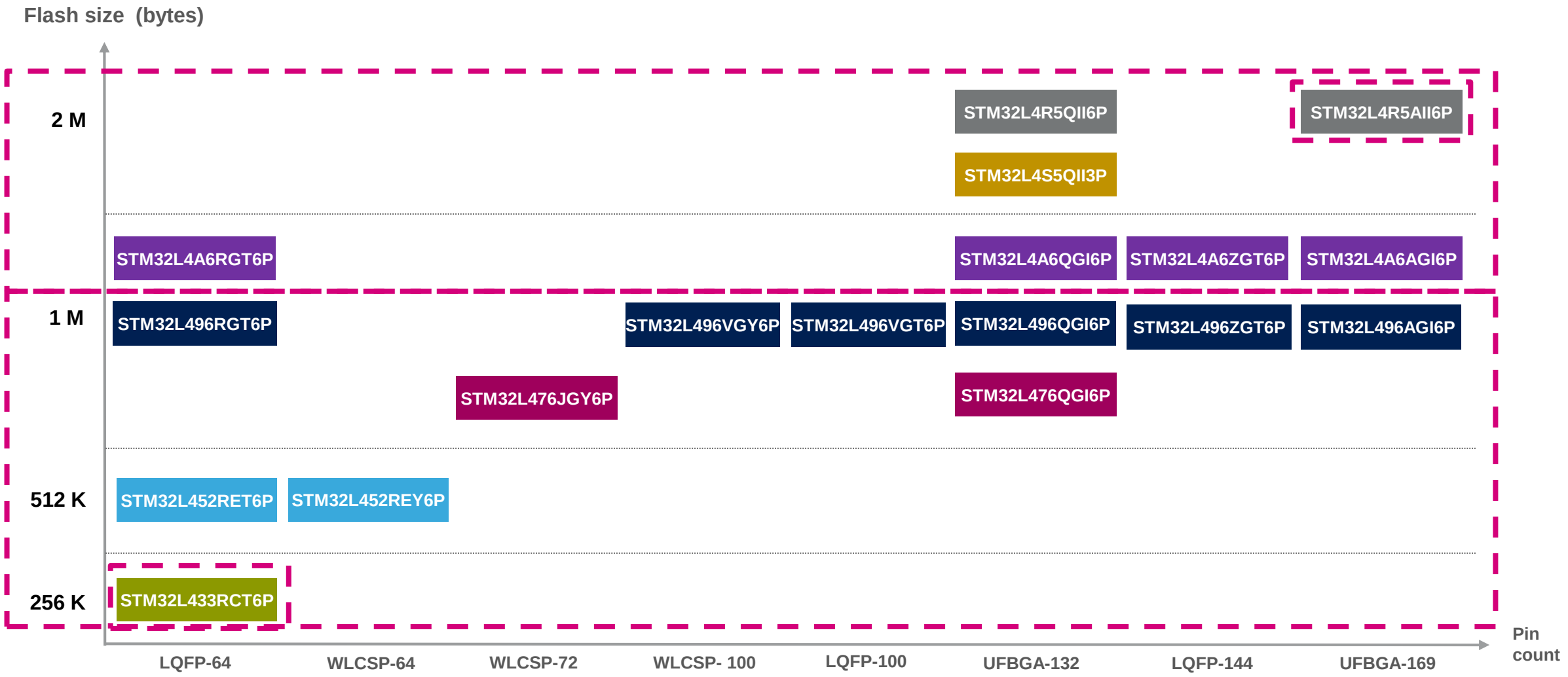
ModeW	Regulator	CPU	Flash	SRAM	Clocks	Peripherals	Consumption @ 1.8V	Wakeup time
Run	MR (Range 1)	**Yes**	**ON(1)**	**ON**	Any	All	127 µA/MHz	N/A
	MR (Range 2)					All except OTG, RNG	111 µA/MHz	
LPRun	LPR	**Yes**	**ON(1)**	**ON**	Any except PLL	All except OTG, RNG	136 µA/MHz	
Sleep	MR (Range 1)	No	**ON(1)**	**ON(2)**	Any	All Any IT or event	37 µA/MHz	6 cycles
	MR (Range 2)						35 µA/MHz	
LPSleep	LPR	No	**ON(1)**	**ON(2)**	Any except PLL	All except OTG, RNG Any IT or event	40 µA/MHz	6 cycles
Stop 0	MR (Range 1)	No	OFF	**ON**	LSE/LSI	Reset pin, all I/Os BOR,PVD,PVM,RTC,LCD,IWDG, COMPx,DACx,OPAMPx,USARTx, LPUART,I2Cx,LPTIMx,OTG_FS,SWPMI	110µA	0.7 µA RAM 5µA Flash memory
Stop 1	LPR						6.6 µA w/o RTC 6.9 µA w/RTC	4 µA RAM 6 µA Flash memory
Stop 2	LPR	No	OFF	**ON**	LSE/LSI	Reset pin, all I/Os BOR,PVD,PVM,RTC,LCD,IWDG, COMPx,LPUART,I2C3,LPTIM1	1.1 µA w/o RTC 1.4 µA w/RTC	5 µA RAM 7 µA Flash memory
Standby	LPR	DOWN	OFF	**SRAM2 ON**	LSE/LSI	Reset pin, 5 WKUPx pins BOR, RTC, IWDG	+ 235 nA	14 µs
	OFF			DOWN			115 nA w/o RTC 415 nA w/RTC	
Shutdown	OFF	DOWN	OFF	DOWN	LSE	Reset pin, 5 WKUPx pins RTC	30 nA w/o RTC 330 nA w/RTC	250 µs

1. Can be put in power-down and clock can be gated off
2. SRAM1 and SRAM2 can be gated off independently

Flexible power schemes

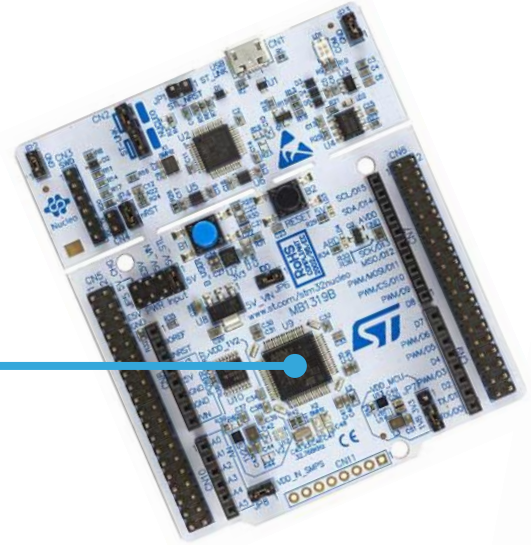


STM32 Suffix P (External SMPS)

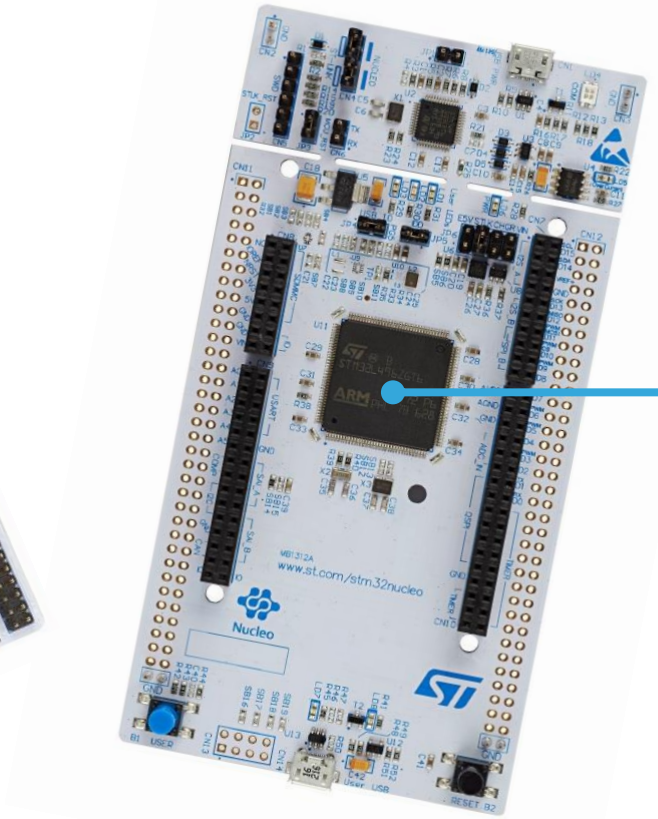


As of September, 2018

Nucleo boards for STM32 Suffix P



Nucleo-64
(NUCLEO-L433RC-**P**)
(NUCLEO-L452RE-**P**)

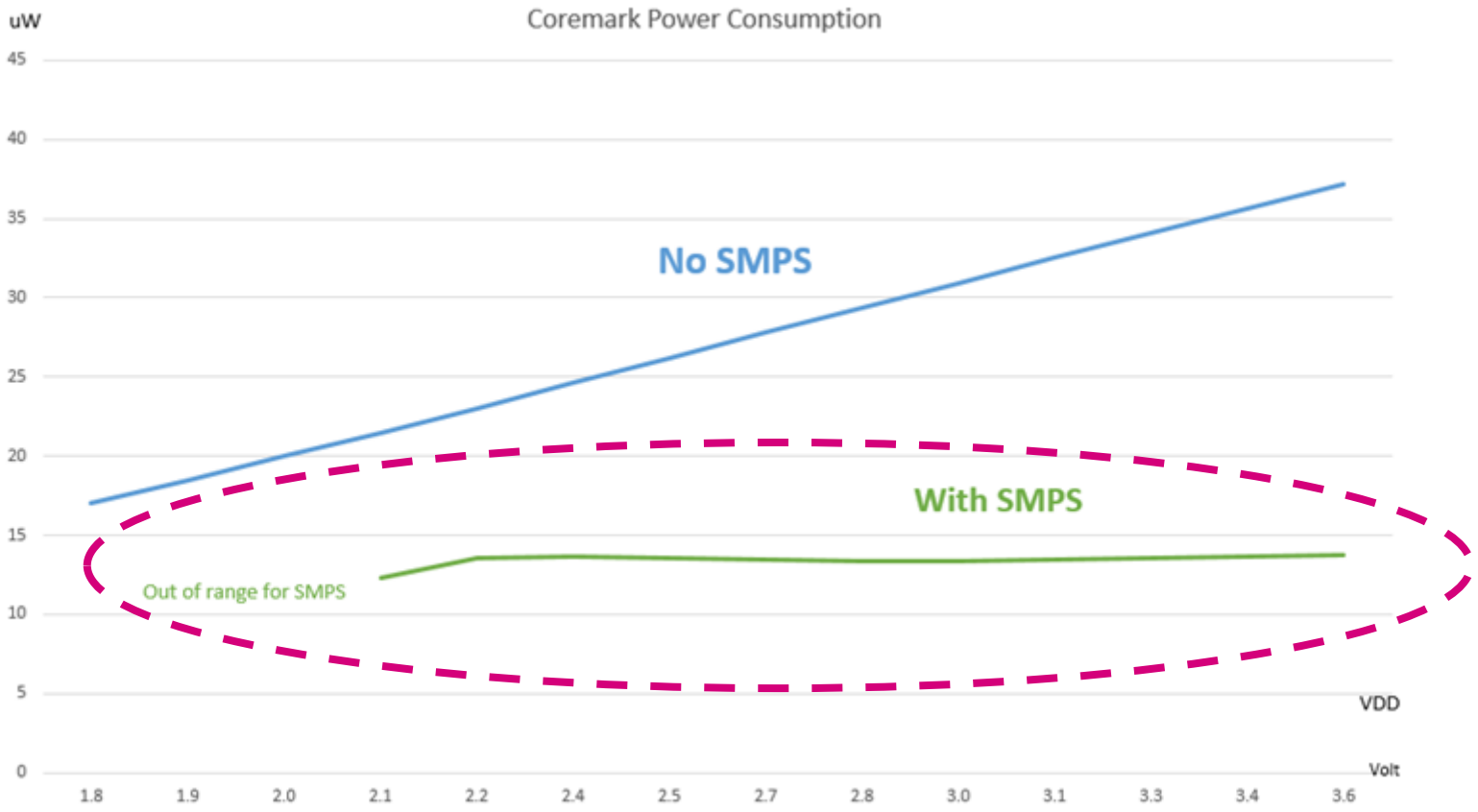


Nucleo-144
(NUCLEO-L496ZG-**P**)
(NUCLEO-L4R5ZI-**P**)

As of September, 2018

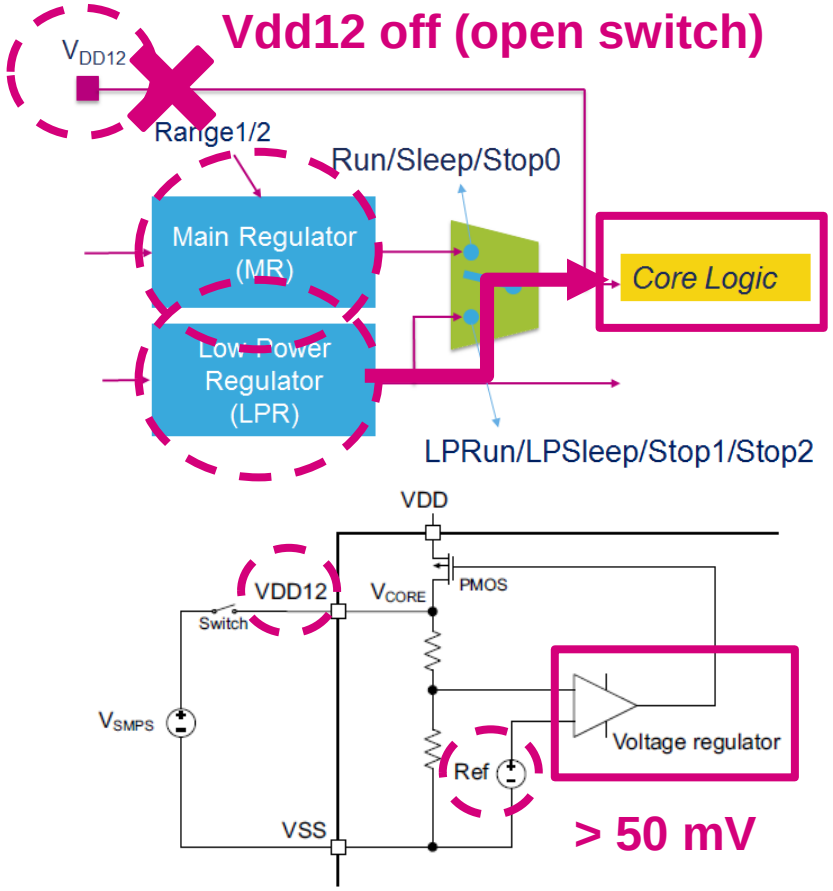
STM32L4 ext. SMPS

- Nucleo-L496ZG-**P**, Vdd=3.3V, Vdd12=1.1V 조건에서 전력 효율
  - 온보드 SMPS : ADP5301ACBZ-2-R7



Internal Vcore switching

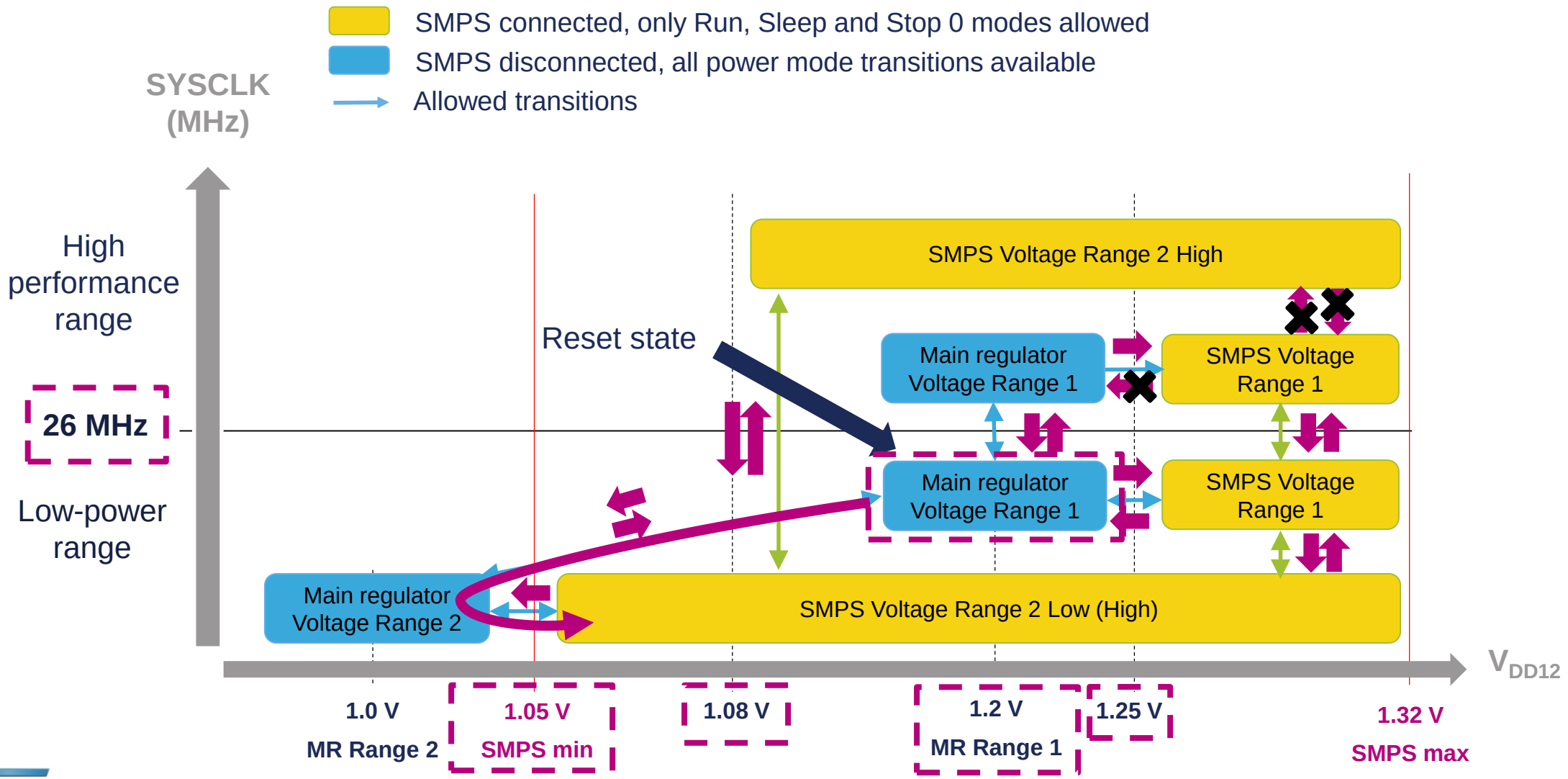
- Vcore
  - Vdd12 입력 핀 전압이 내부 LDO (Main regulator) 의 출력 전압 보다 50 mV 이상 큰 경우 Vdd12 입력이 Vcore 전원으로 자동 스위칭 된다
  - Low power regulator 를 사용할때는 Vdd12 입력핀과 외부 SMPS 연결 금지 (또는 외부 SMPS 출력 off)



Main Regulator (LDO) Range	Voltage	Frequency
Range 1 Boost (STM32L4+)	1.28 V	~ 120 MHz
Range 1	1.2 V	~ 80 MHz
Range 2	1.0 V	~ 26 MHz

Vdd12 ext. SMPS Range	Voltage	Frequency
Range 1	1.25 V 이상	~ 120 MHz
Range 2 High	1.14 V 이상	~ 120 MHz
	1.08 V 이상	~ 80 MHz
Range 2 Low	1.05 V 이상	~ 26 MHz

STM32L4 SMPS/Range transition



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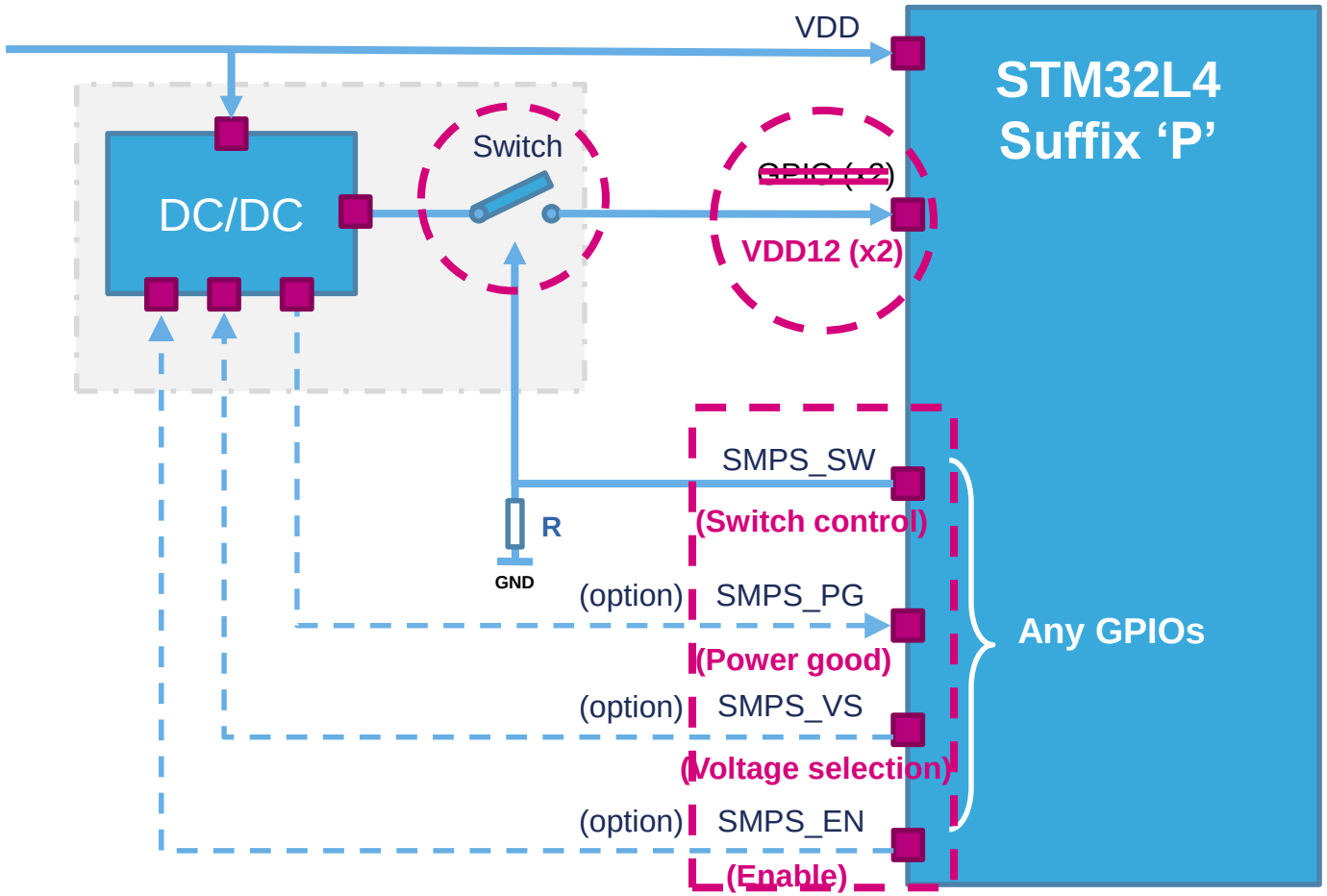
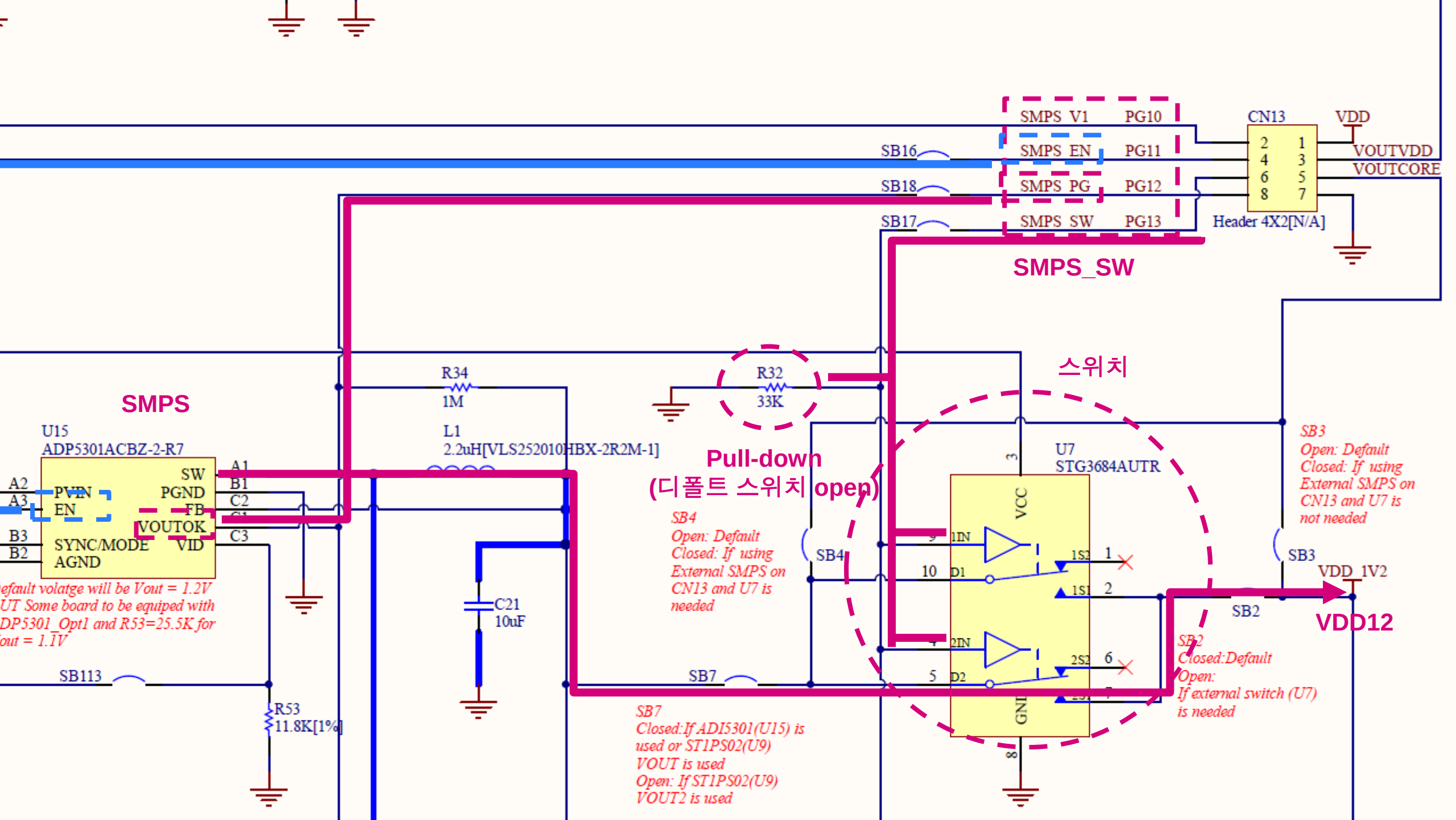
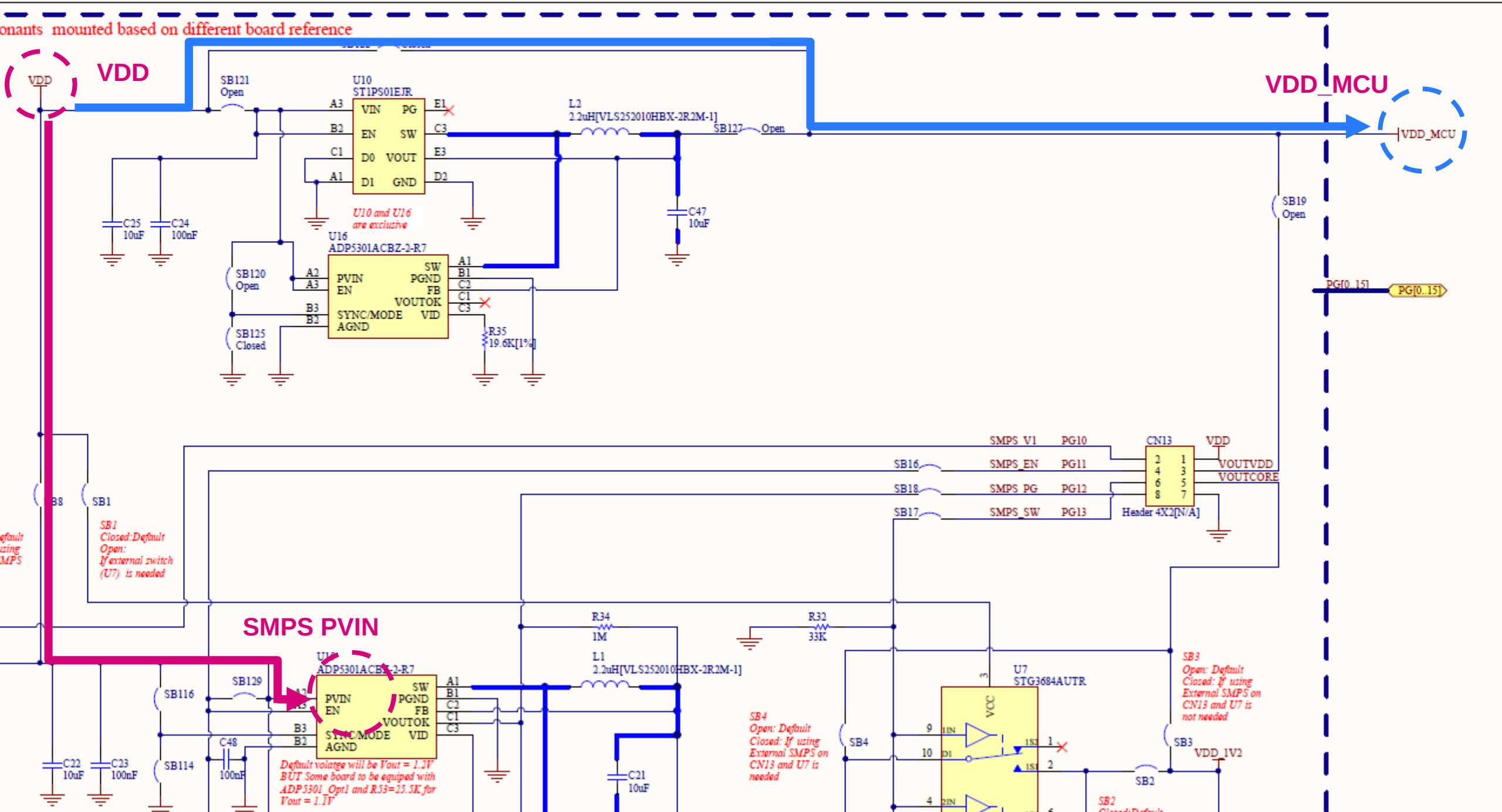
Connection with ext. SMPS

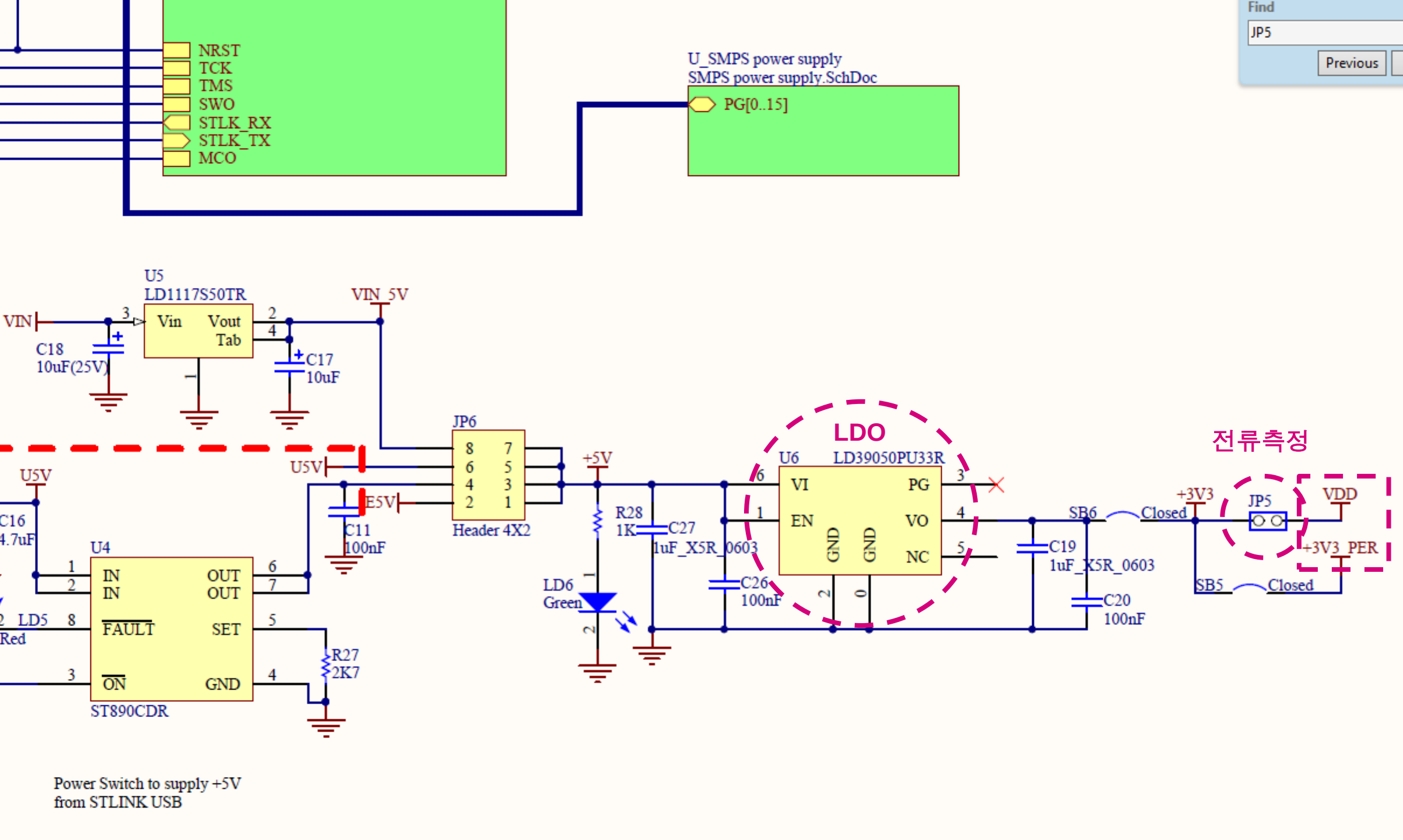


Vdd12 Power supply rules

- Vdd12 입력 전압 1.32 V 초과 금지
  - 노이즈 상황 (리플, 스파이크) 에도 1.32 V 초과 금지
- SYSCLK <= 26 MHz 일 경우에만 Vdd12 연결 또는 연결 해제 전환 가능
- Run, Sleep, Stop0 모드 일때에만 SMPS 연결 가능
- Run, Sleep, Stop0 모드 외에는 SMPS 연결 해제
- POR 리셋 또는 일반 리셋 동안에 SMPS 연결 해제
  - Vdd12 가 1.25 V 보다 작은 경우, 리셋 발생후 1us 이내에 SMPS 연결 해제
  - Vdd12 가 1.25 V 보다 큰 경우, 리셋 발생후 SMPS 연결 해제 불필요

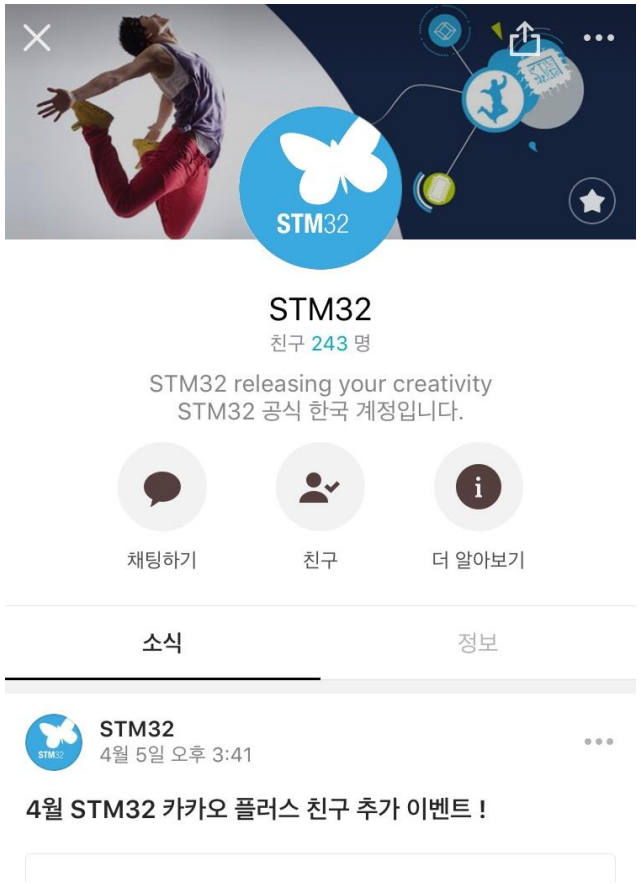

SMPS_V1
SMPS_EN
SMPS_PG
SMPS_SW
PG10
PG11
PG12
PG13
CN13
Header 4X2[N/A]
VDD
VOUTVDD
VOUTCORE
SB16
SB18
SB17
SMPS_SW
스위치
SMPS
U15
ADP5301ACBZ-2-R7
SW
PGND
FB
VOUTOK
VID
SYNC/MODE
AGND
PVIN
EN
R34
1M
L1
2.2uH[VLS252010HBX-2R2M-1]
R32
33K
Pull-down
(디폴트 스위치 open)
C21
10uF
R53
11.8K[1%]
SB113
SB7
SB4
SB3
SB2
U7
STG3684AUTR
VCC
GND
1IN
2IN
1D1
2D2
1S2
2S2
VDD_1V2
VDD12
SB4
Open: Default
Closed: If using
External SMPS on
CN13 and U7 is
needed
SB3
Open: Default
Closed: If using
External SMPS on
CN13 and U7 is
not needed
SB7
Closed:If ADI5301(U15) is
used or ST1PS02(U9)
VOUT is used
Open: If ST1PS02(U9)
VOUT2 is used
SB2
Closed:Default
Open:
If external switch (U7)
is needed


onants mounted based on different board reference
VDD
VDD
SB121
Open
U10
ST1PS01EJR
A3 VIN PG E1
B2 EN SW C3
C1 D0 VOUT E3
A1 D1 GND D2
L2
2.2uH[VLS252010HBX-2R2M-1]
SB127
Open
VDD_MCU
VDD_MCU
C25
10uF
C24
100nF
U10 and U16
are exclusive
C47
10uF
SB19
Open
U16
ADP5301ACBZ-2-R7
SB120
Open
A2 PVIN SW A1
A3 EN PGND B1
FB C2
VOUTOK C1
B3 SYNC/MODE VID C3
B2 AGND
SB125
Closed
R35
19.6K[1%]
PG[0..15]
PG[0..15]
SMPS_V1
PG10
CN13
VDD
SB16
SMPS_EN
PG11
VOUTVDD
SB18
SMPS_PG
PG12
VOUTCORE
SB17
SMPS_SW
PG13
Header 4X2[N/A]
SB8
SB1
SB1
Closed:Default
Open:
If external switch
(U7) is needed
SMPS PVIN
R34
1M
R32
33K
U1
ADP5301ACBZ-2-R7
L1
2.2uH[VLS252010HBX-2R2M-1]
SB129
SB116
SB114
C48
100nF
C22
10uF
C23
100nF
C21
10uF
Default voltage will be Vout = 1.2V
BUT Some board to be equipped with
ADP5301_Opt1 and R53=25.5K for
Vout = 1.1V
SB4
Open: Default
Closed: If using
External SMPS on
CN13 and U7 is
needed
U7
STG3684AUTR
VCC
SB4
SB3
Open: Default
Closed: If using
External SMPS on
CN13 and U7 is
not needed
SB3
VDD_1V2
SB2
SB2
Closed:Default


NRST
TCK
TMS
SWO
STLK_RX
STLK_TX
MCO
U_SMPS power supply
SMPS power supply.SchDoc
PG[0..15]
Find
JP5
Previous
Next
U5
LD1117S50TR
VIN
Vin
Vout
Tab
C18
10uF(25V)
C17
10uF
VIN_5V
JP6
Header 4X2
U5V
E5V
C11
100nF
U4
ST890CDR
IN
OUT
FAULT
SET
ON
GND
R27
2K7
LD5
Red
C16
4.7uF
+5V
R28
1K
C27
1uF_X5R_0603
LD6
Green
LDO
U6
LD39050PU33R
VI
PG
EN
VO
GND
NC
C26
100nF
C19
1uF_X5R_0603
C20
100nF
SB6
Closed
+3V3
JP5
VDD
+3V3_PER
SB5
Closed
전류측정
Power Switch to supply +5V
from STLINK USB

STM32 카카오톡 플러스친구 등록

- STM32와 관련된 최신 소식을 카카오톡으로 편리하게 받아보세요.
  - 검색에서 'STM32' 입력 후 친구등록 또는 QR코드 촬영



- 보드 데모 촬영