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R2A20101BM/NP
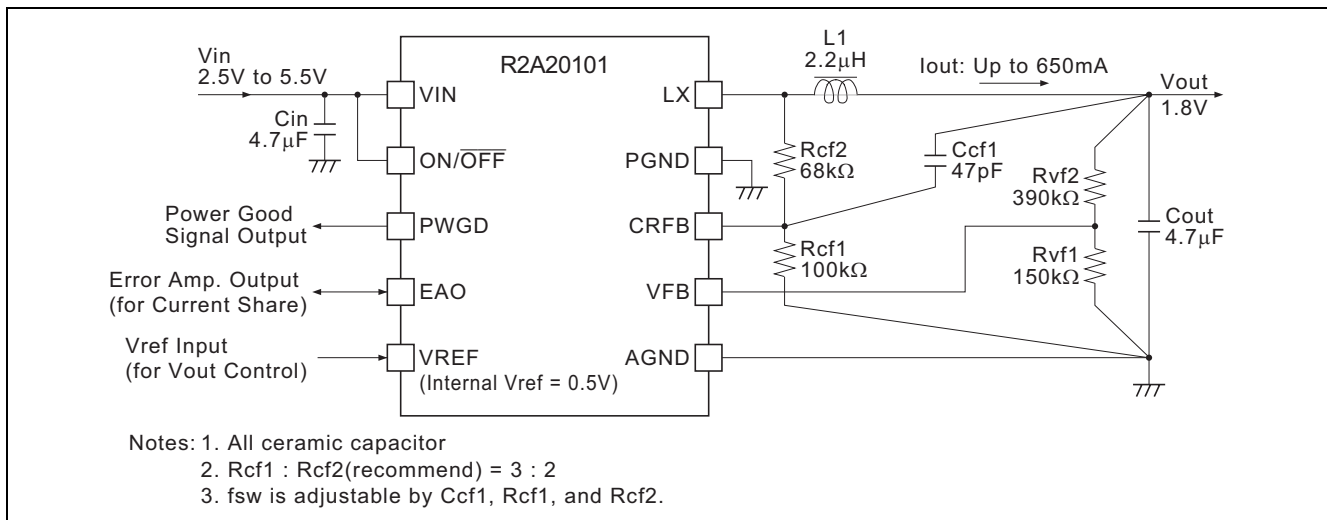
Monolithic Synchronous Step-Down DC/DC Converter

Features

- Built-in low Ron power MOS FETs
  Pch Ron = 0.30 Ω (Typ), Nch Ron = 0.14 Ω (Typ)
- High switching frequency: 2 MHz (Max)
- Output current: 650 mA (Max)
- Output ON/OFF control
- Vout control
- Power good monitor
- Current share for redundant power supply operation
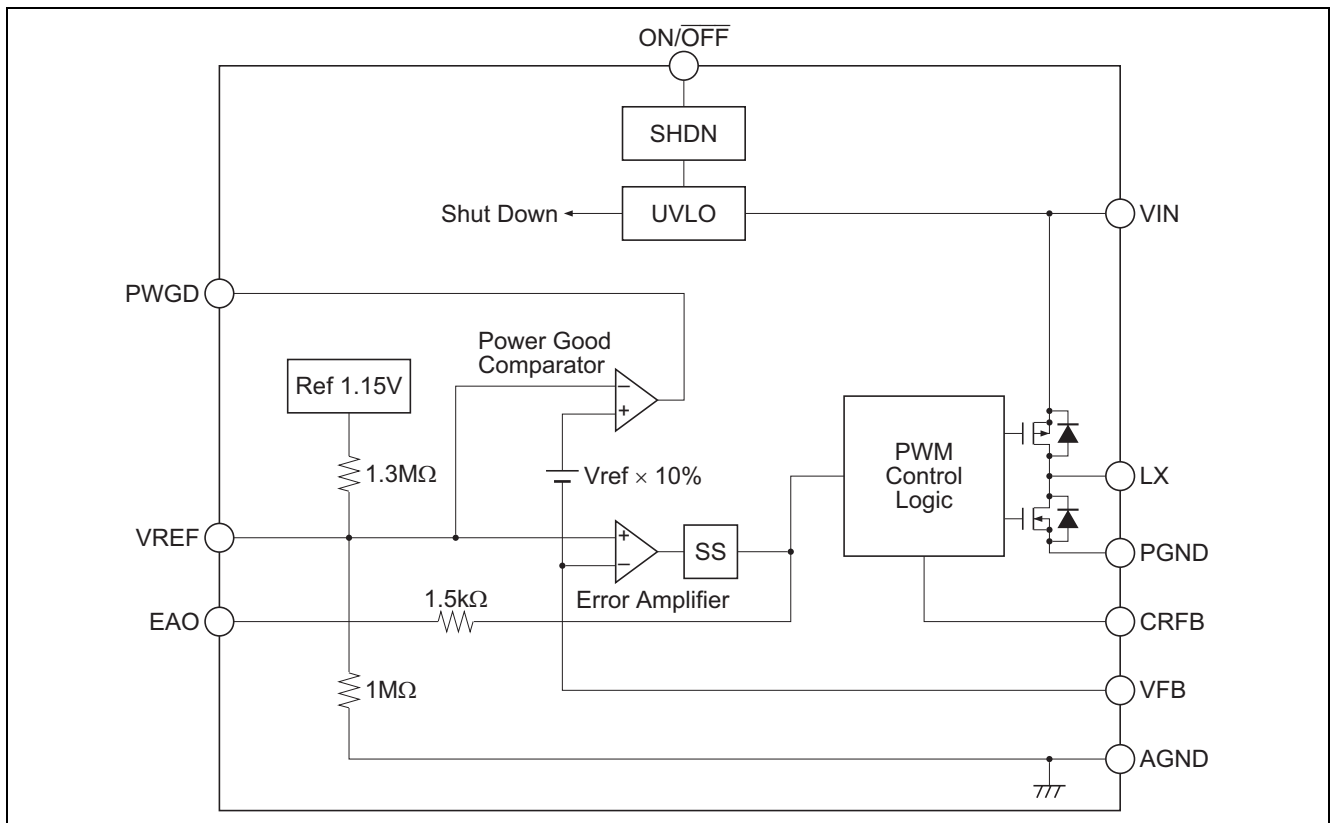- Vout = 0.5 V to (VIN – 0.5) V

Application

- POL (Point of Load) power supplies
- Power supply for microcomputer systems
  MCU-Core, I/O, Memory (DDR, SRAM, FLASH, HDD, etc.), FPGA, DSP, Graphic Processor
- Battery powered equipment systems
  Cellular phone (CDMA power amplifier, MCU, DSP, ASIC), PDA, Digital camera, Portable game, Handy terminal

Operating Circuit Example

Notes: 1. All ceramic capacitor
2. Rcf1 : Rcf2(recommend) = 3 : 2
3. fsw is adjustable by Ccf1, Rcf1, and Rcf2.

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Block Diagram

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings	Unit	Note
Power supply voltage	V_{IN}	6	V	1
ON/$\overline{OFF}$, PWGD, EAO, VREF, LX, CRFB, VFB terminal voltage	V_{MAX}	−0.3 to (V_{IN} + 0.3)	V	1
PGND terminal voltage	V_{PGND}	−0.3 to +0.3	V	1
Operating ambient temperature	Topr(Ta)	−40 to +85	°C	
Junction temperature 1	Tjmax1	+125	°C	
Junction temperature 2	Tjmax2	+150	°C	2
Storage temperature	Tstg	−55 to +150	°C	

Notes: 1. Rated voltages are with reference to the AGND pin.

2. Operation by Tjmax2 is made within 24 hours through life.

Pin Arrangement

R2A20101BM
(CSP-15)

R2A20101NP
(QFN-24)

(Bottom view)

(Bottom view)
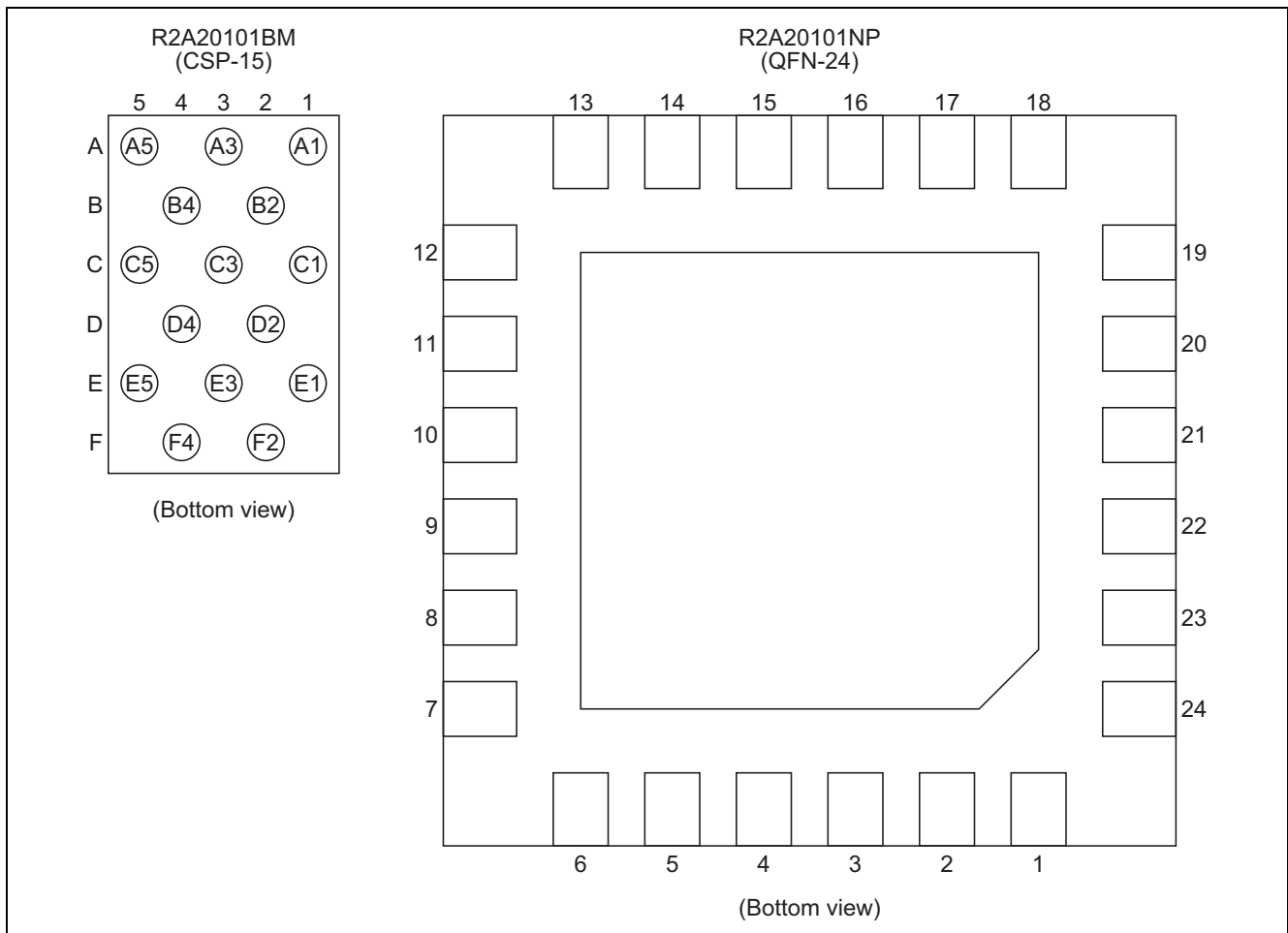
Pin Description

Pin No.		Pin Name	Pin Function
R2A20101BM (CSP-15)	R2A20101NP (QFN-24)		
A1, A3, A5	15, 16, 17	PGND	Power ground
B2, B4	11, 20	LX	Inductor connection node
C1, C3, C5	10, 21	VIN	Power supply voltage input
D4	22	ON/$\overline{\text{OFF}}$	Output on/off control input
D2	9	CRFB	CR feedback input
E5	23	PWGD	Power good monitor output
E1	8	VFB	Feedback voltage input
F4	2	EAO	Error amplifier output (for current share)
E3	5	VREF	Vout control voltage input
F2	4	AGND	Analog ground (IC chip ground voltage)

Note: Please apply solder to pins 1, 3, 6, 7, 12, 13, 14, 18, 19, and 24 even though they are NC pins.
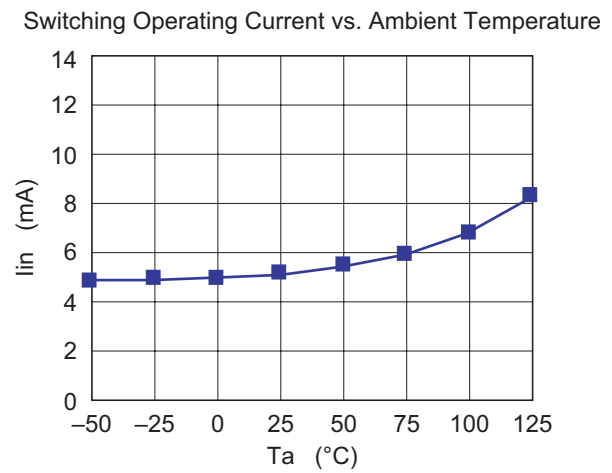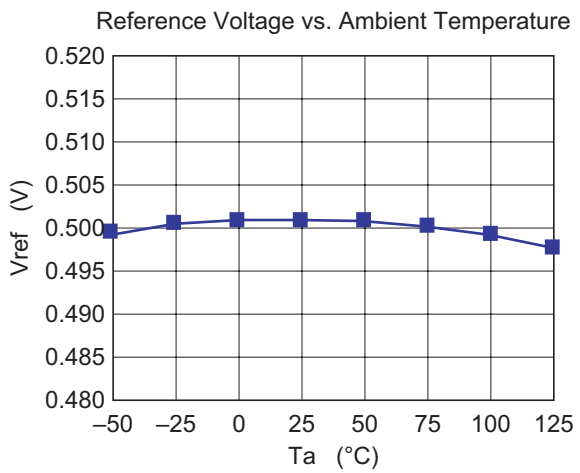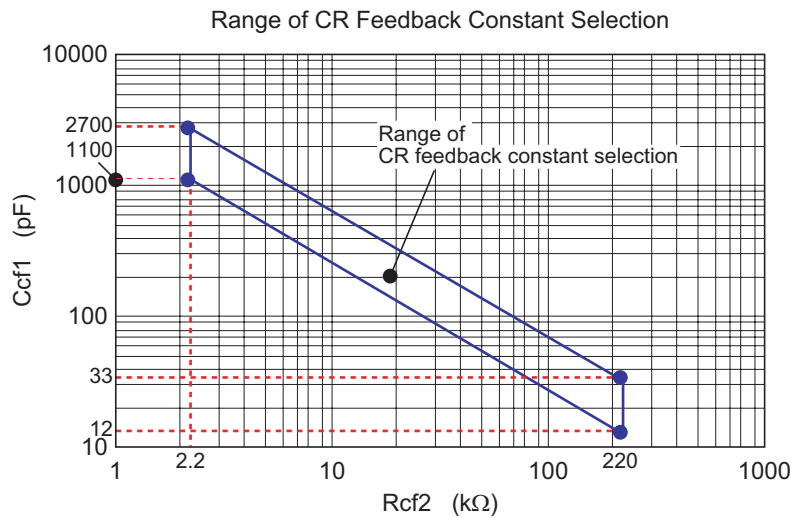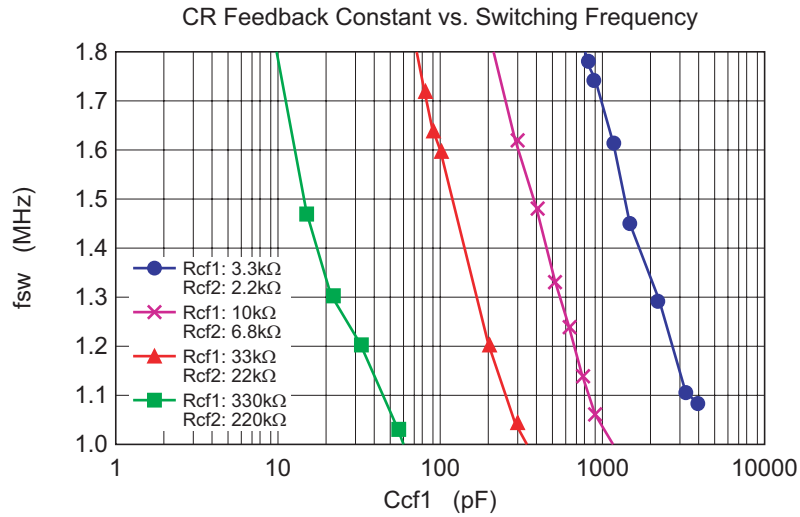Solder on the underside pads improves heat-radiation characteristics.

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Electrical Characteristics

(Ta = 25°C, Vin = 3.6 V, ON/$\overline{\text{OFF}}$ = Vin, unless otherwise specified.)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input voltage range	Vin	2.5	—	5.5	V	
UVL threshold high	Vuvl-Hi	2.0	2.3	2.5	V	VFB = CRFB = GND, Vin = rising
UVL hysteresis	Vuvl-Hys	0.15	0.22	0.29	V	
Quiescent supply current	Iss	20	45	80	μA	
Shutdown supply current	Ishdn	—	0.0	1.0	μA	ON/$\overline{\text{OFF}}$ = 0V
Reference voltage	Vref	0.485	0.500	0.515	V	
Vref line regulation	dVref/dVin	(−0.4)	0.1	(0)	%/V	Vin = 2.5 to 5.5V
Vref temperature stability	dVref/dTa	—	(±100)	—	ppm/°C	Ta = −40 to +85°C
VREF sink current	Ivref-sink	1.3	3.7	8.0	μA	Vref = 2.5V
VREF source current	Ivref-source	0.3	0.9	2.0	μA	Vref = 0V
VFB leakage current	Ileak-VFB	−1	0	+1	μA	VFB = 1/2 × Vin
Pch FET on resistance	Ron-Pch	—	0.30	0.50	Ω	VFB = CRFB = 0V, ILX = −100mA
Nch FET on resistance	Ron-Nch	—	0.14	0.25	Ω	VFB = CRFB = Vin, ILX = 100mA
Pch FET leakage current	Ileak-Pch	—	—	1.0	μA	ON/$\overline{\text{OFF}}$ = 0V, LX = 0V
Nch FET leakage current	Ileak-Nch	—	—	1.0	μA	ON/$\overline{\text{OFF}}$ = 0V, LX = Vin
Peak current limit	Ipeak-Limit	0.7	—	—	A	
ON/$\overline{\text{OFF}}$ threshold high	Von/off-Hi	1.0	1.45	1.85	V	ON/$\overline{\text{OFF}}$ = rising
ON/$\overline{\text{OFF}}$ threshold low	Von/off-Lo	0.75	1.24	1.65	V	ON/$\overline{\text{OFF}}$ = falling
ON/$\overline{\text{OFF}}$ leakage current	Ileak-on/off	−1	0	+1	μA	ON/$\overline{\text{OFF}}$ = Vin
ON/$\overline{\text{OFF}}$ input current	Iinput-on/off	—	1.4	5	μA	ON/$\overline{\text{OFF}}$ = 0.9V
Switching frequency	fsw	Adjustable by external Ccf1, Rcf1, Rcf2			Hz	
Soft start time	tss	56 × Rcf1/(Rcf1 + Rcf2) × Vout			μs	
Power good threshold	Vth-PGood	(−15)	−10	(−5)	%	Vref = 0.5V
Power good VOL	Ipg-VOL	20	—	—	μA	PWGD = 0.2V, VFB = 0V
Power good VOH	Ipg-VOH	−10	—	—	μA	PWGD = 3.4V, VFB = 0.5V
Output voltage load regulation	dVout/dIout	—	±0.7	—	%/A	L = 2.2μH, Vout = 1.8V, Iout = 0 to 650mA

Note: ( ) is design spec.

Main Characteristics

CR Feedback Constant vs. Switching Frequency

Legend:
- Rcf1: 3.3kΩ / Rcf2: 2.2kΩ
- Rcf1: 10kΩ / Rcf2: 6.8kΩ
- Rcf1: 33kΩ / Rcf2: 22kΩ
- Rcf1: 330kΩ / Rcf2: 220kΩ

X-axis: Ccf1 (pF)
Y-axis: fsw (MHz)

Range of CR Feedback Constant Selection

Range of CR feedback constant selection

X-axis: Rcf2 (kΩ)
Y-axis: Ccf1 (pF)

Reference Voltage vs. Ambient Temperature

X-axis: Ta (°C)
Y-axis: Vref (V)

Switching Operating Current vs. Ambient Temperature

X-axis: Ta (°C)
Y-axis: Iin (mA)

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Shutdown Current vs. Ambient Temperature

Vout Line Regulation

Vout = 1.8V, Iout = 0A

Vout Load Regulation

Vin = 3.6V, Vout = 1.8V

VREF Impressed Voltage vs. Vout

- Vout (Ta = −40°C)
- Vout (Ta = 85°C)
- EAO (Ta = −40°C)
- EAO (Ta = 85°C)

Transient Response Characteristics

VIN = 3.6V
Vout = 1.8V
Iout = 0 <-> 650mA

50μs/div

Vout(100mV/div.)

Iout: 0mA->650mA->0mA

Iout(500mV/div.)
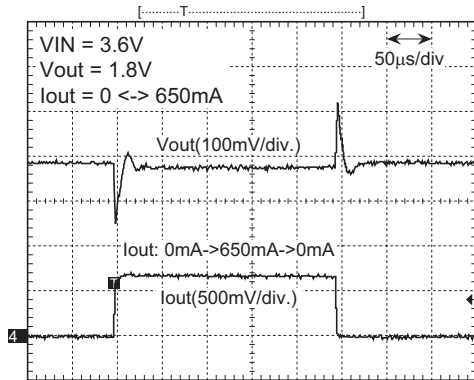
Application Circuit Example

1. Current Share 1 (Redundant, Hot Swap type)

Note: Dotted line is not always necessary.
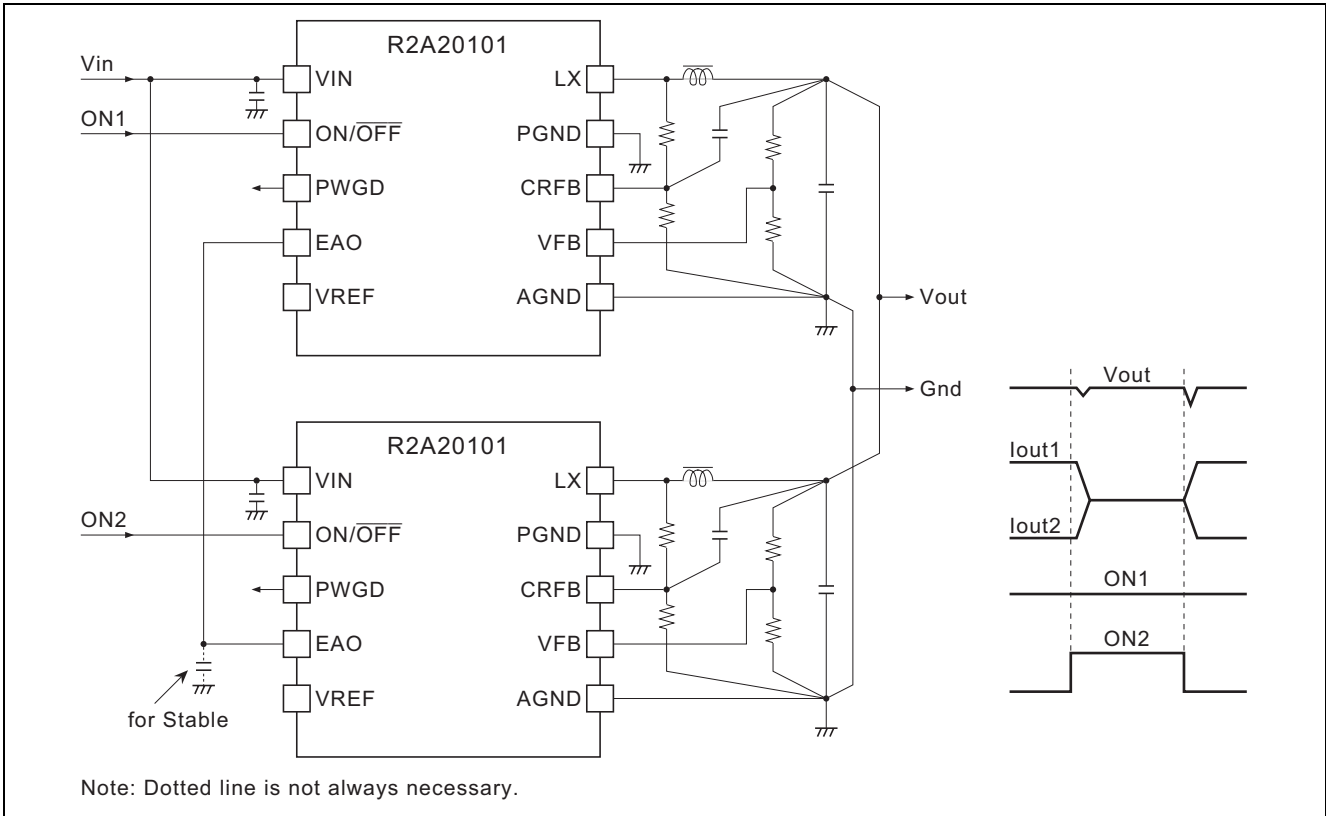
2. Current Share 2 (Accuracy type)

Note: Dotted line is not always necessary.

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3. Sequential Start-up

for Soft start time adjustment

for Sequencing

for Soft start time adjustment

Note: Dotted line is not always necessary.

4. Tracking

for Vout control

for Tracking

Note: Dotted line is not always necessary.

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Package Dimensions

Preliminary

Unit: mm

(Bottom view)

Package Code	CSP-15
JEDEC	—
JEITA	—
Mass (reference value)	—

Preliminary

Unit: mm

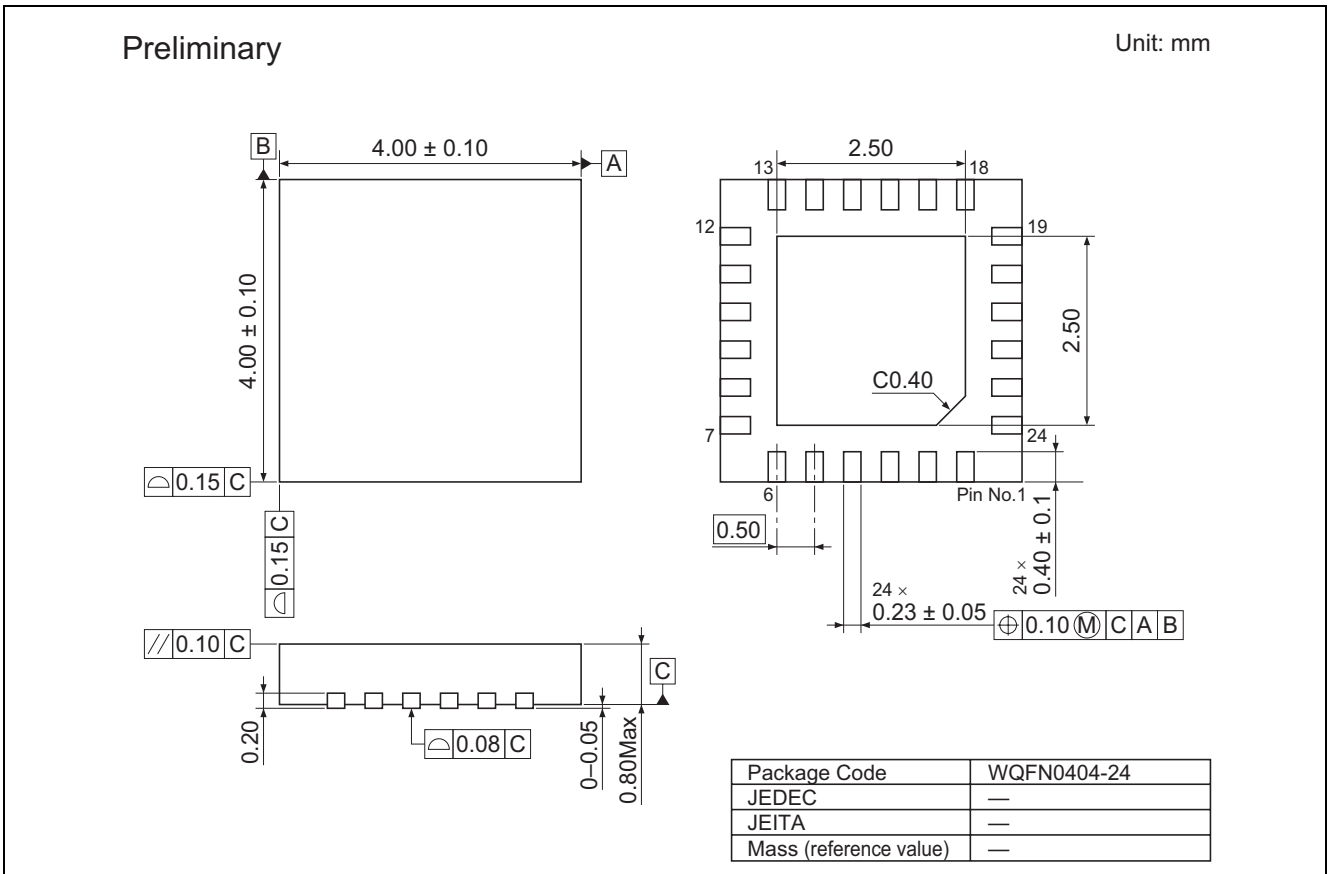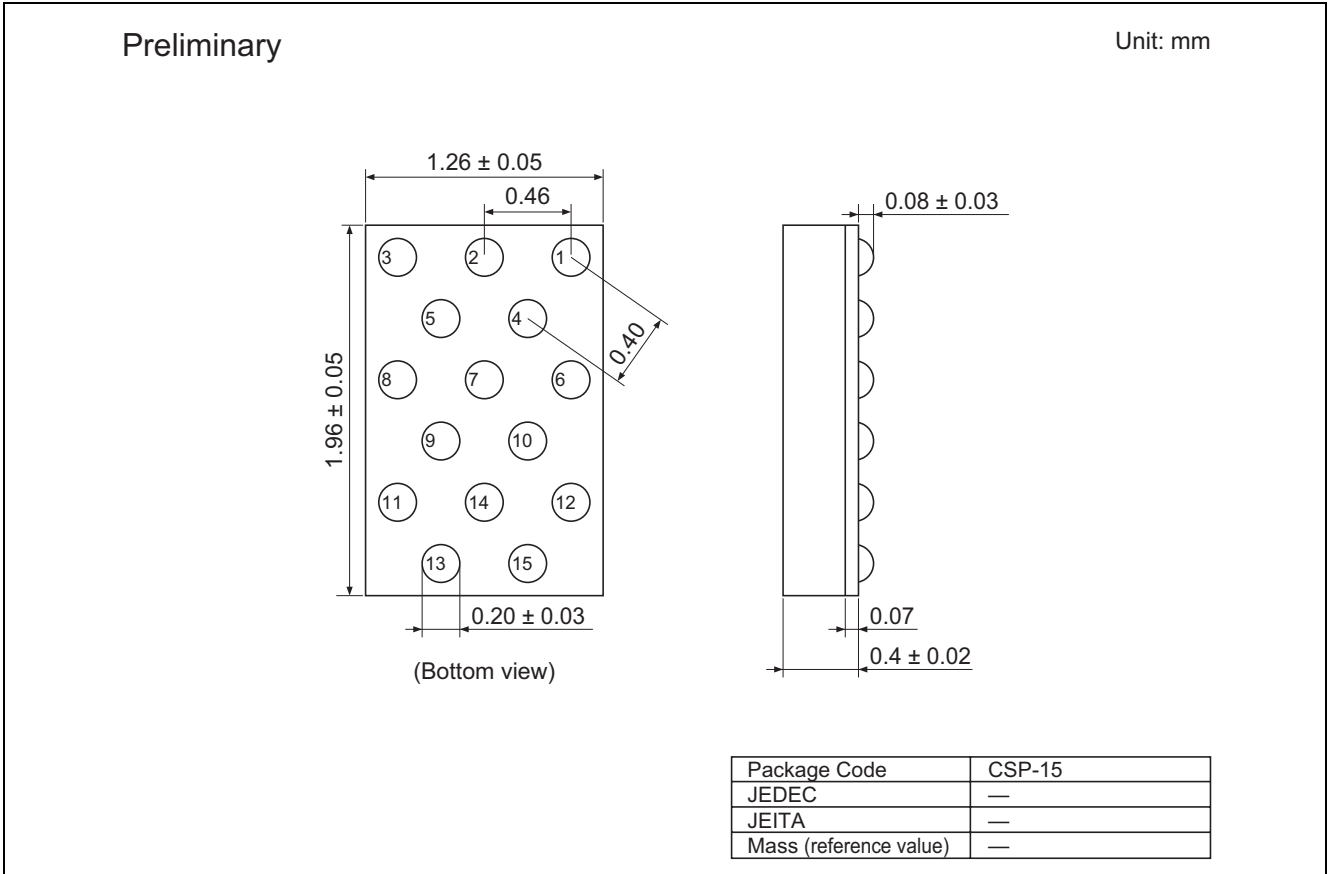| Package Code	WQFN0404-24
JEDEC	—
JEITA	—
Mass (reference value)	—
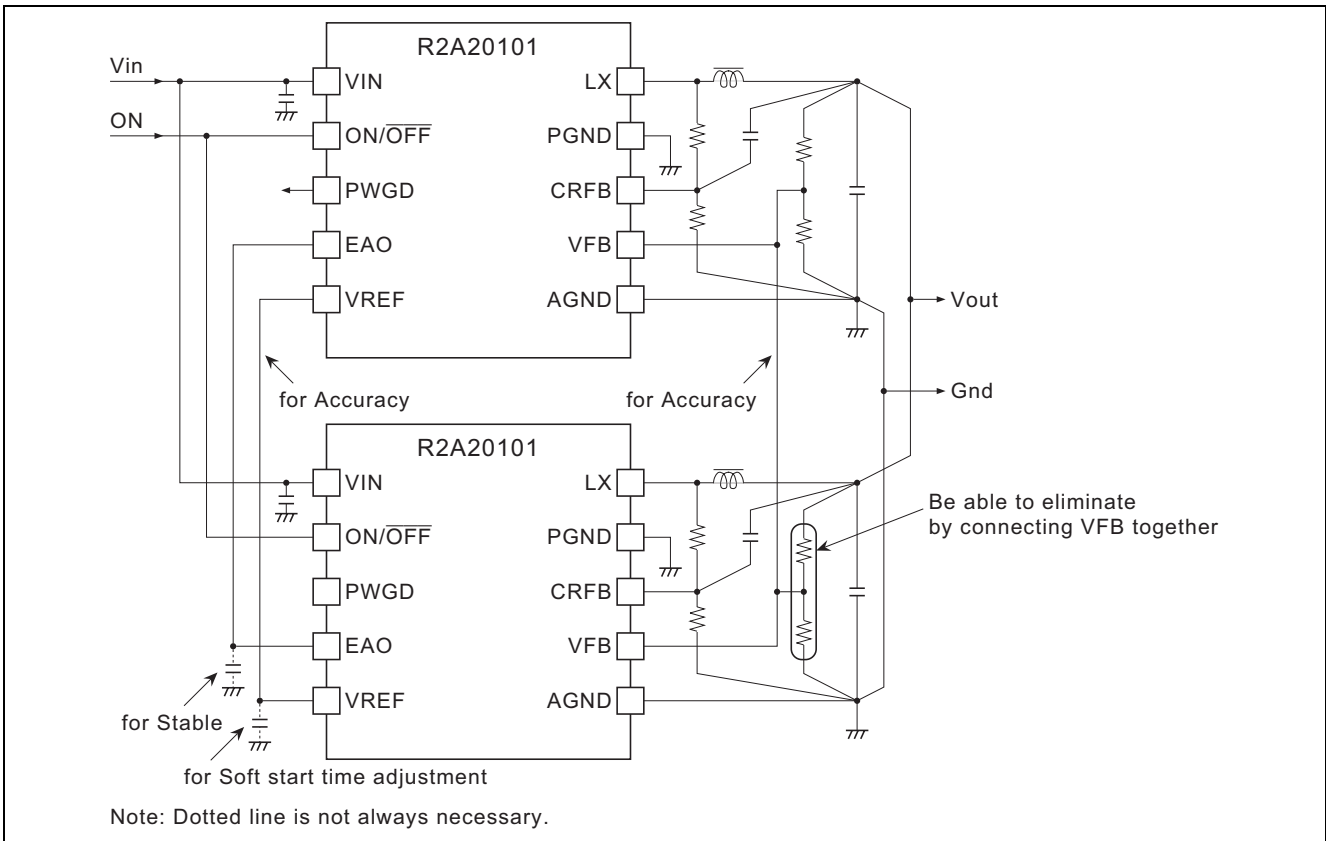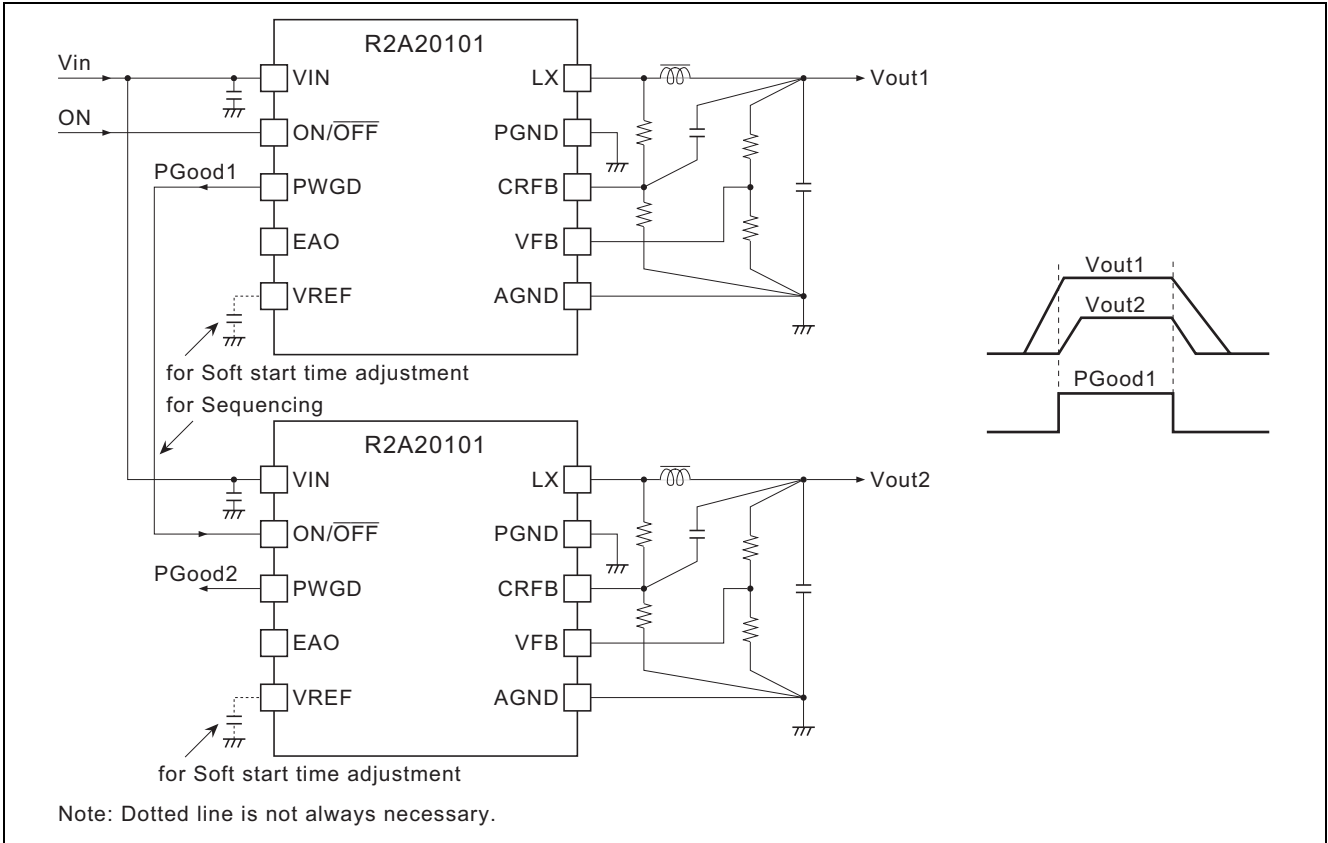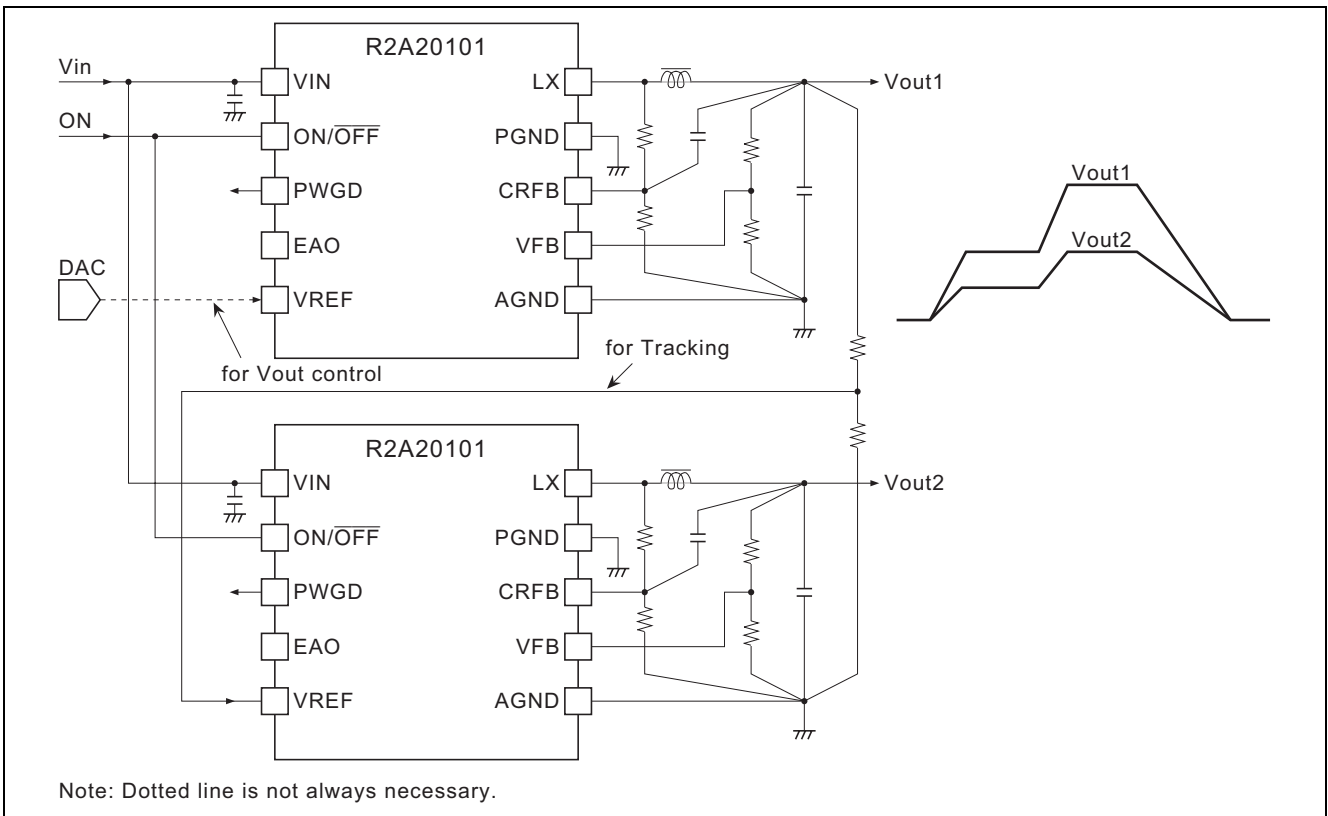
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