

0.6A step-down DC-DC convertor IC Monolithic IC MM3472

Outline

MM3472 series is a synchronous rectifying step-down DC/DC converter which is focused on space minimizing design, high oscillation frequency (2.25MHz) and high efficiency by fewer external components (1 coil and 2 capacitors) in order to meet miniaturization and low power consumption.

The package realizes space reduction of the mount area by mounting to the small SSON-6L.

Features

(1) Input Voltage Range	2.0V ~ 5.5V
(2) Output Voltage Range	0.8V ~ 3.3V
(3) FB Voltage (PWM mode)	$V_{FB} \pm 1.5\%$
(4) FB Voltage (PFM mode)	$V_{FB} \pm 2\%$
(5) Output Current	600mA
(6) Oscillation Frequency	2.25MHz (typ.)
(7) Quiecent Current (Not swtching)	11 μ A(typ.)
(8) Efficiency	($V_{IN}=3.6V$, $V_{OUT}=1.8V$) $I_o=0.01mA$: 25% $I_o=100mA$: 90%
(9) Protect Function	UVLO、Soft start、Current limit、Thermal shutdown
(10) PWM/PFM Control	Automatic

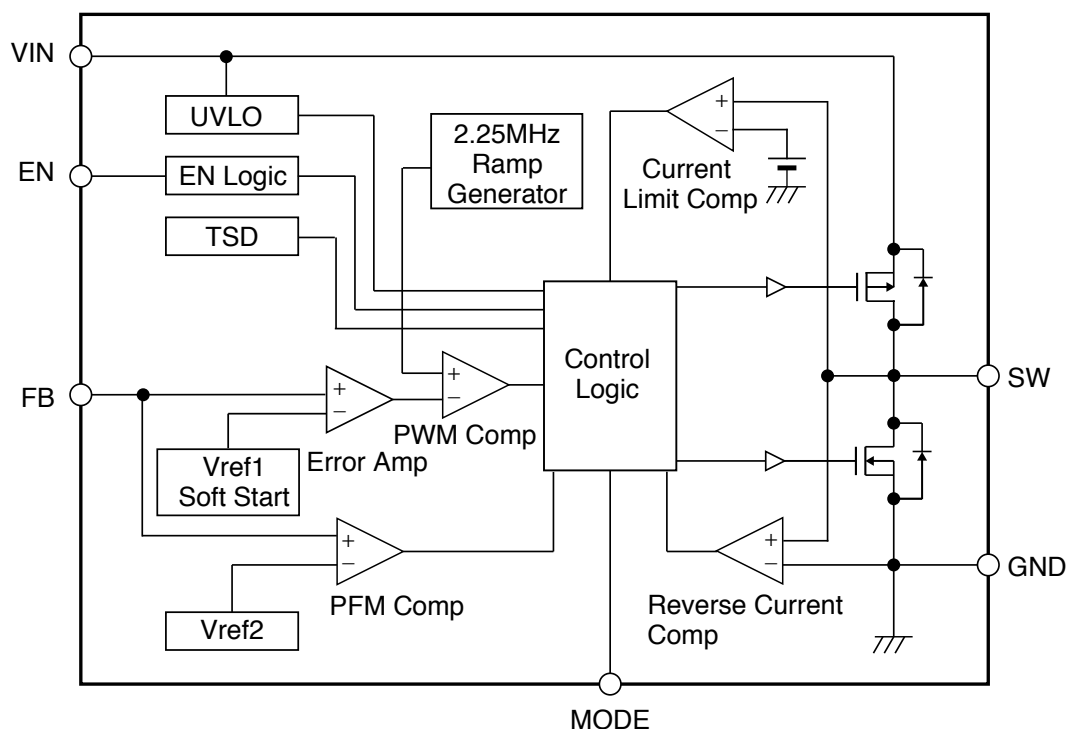
Packages

SSON-6L

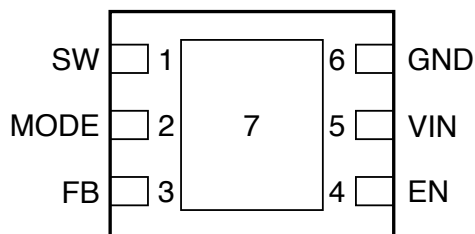
Applications

- (1) Mobile Phone
- (2) Digital Still Cameras
- (3) Battery-Operating Devices

Block diagram



Pin description



Top view

Pin No.	Symbol	Function
1	SW	Power switch pin
2	MODE	Mode pin (Pull below GND+0.3V to operate automatic PWM/PFM mode control, Pull above $V_{IN}-0.3V$ to operate PWM mode only. Please avoid use in the state that is floating)
3	FB	Output voltage feedback pin
4	EN	Enable pin (Pull above $V_{IN} - 0.3V$ to enable, pull below GND+0.3V to disable. Please avoid use in the state is floating.)
5	VIN	Power supply input pin
6	GND	Ground pin
7	TPAD	Thermal pad (Thermal pad must be connected to GND to use the best electrical characteristics.)

Absolute maximum rating

(Except where noted otherwise : Ta=25°C)

Item	Symbol	Rating	Unit
VIN power supply pin voltage	V_{IN}	-0.3 ~ +6.0	V
SW pin voltage	V_{SW}	-0.3 ~ $V_{IN}+0.3$, 6.0	V
EN pin voltage	V_{EN}	-0.3 ~ +6.0	V
FB pin voltage	V_{FB}	-0.3 ~ +6.0	V
Storage temperature	T_{STG}	-55 ~ +150	°C
Power dissipation	P_d	~ 180 (Alone)	mW

Recommended Operation conditions

Item	Symbol	Condition	Unit
Operating ambient temperature	T_{OPR}	-40 ~ +85	°C
Operating voltage	V_{OPR}	2.0 ~ 5.5	V

Electrical characteristics

(Except where noted otherwise : $V_{IN}=V_{EN}=3.6V$, $V_{OUT}=1.8V$, $V_{MODE}=0V$, $T_a=25^{\circ}C$)

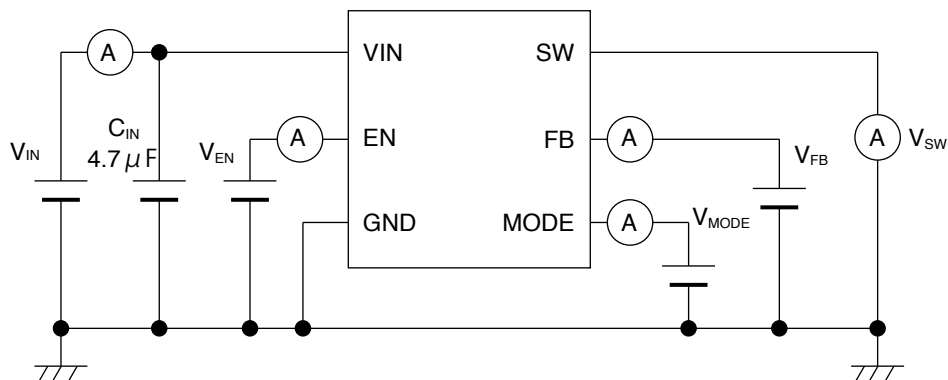
Item	Symbol	Measurment conditions	Min.	Typ.	Max.	Unit
Feed back voltage (PWM mode)	V_{FBPWM}		0.591	0.600	0.609	V
Feed back voltage (PFM mode)	V_{FBPFM}		0.588	0.600	0.612	V
Output voltage range	V_{OUTR}		0.8		3.3	V
Output voltage temperature characteristics * 1	$\Delta V_{OUT} / \Delta V$	$-40^{\circ}C \leq T \leq 85^{\circ}C$ (PWM mode)		± 100		ppm/ $^{\circ}C$
Supply current (No switching)	I_Q	$V_{IN}=3.6V$, $V_{FB}=0.8V$		11	17	μA
Shutdown current	I_{OFF}	$V_{EN}=GND$		0.1	1	μA
Highside Tr on resistance * 1	R_{ONH}	$V_{IN}=3.6V$, $I_{DS}=0.1A$		0.24		Ω
Lowside Tr on resistance * 1	R_{ONL}	$V_{IN}=3.6V$, $I_{DS}=0.1A$		0.20		Ω
Highside Tr current limit * 1	I_{LIN}			1.1		A
Osillation frequency	f_{OSC}		2.0	2.25	2.50	MHz
EN pin high level voltage	V_{ENH}	V_{EN} is rising	$V_{IN} - 0.3$			V
EN pin low level voltage	V_{ENL}	V_{EN} is faling			GND+0.3	V
EN pin input current	I_{EN}	$V_{EN}=5.5V$		0.01	1	μA
MODE pin high level voltage	V_{MODEH}	V_{MODE} is rising	$V_{IN} - 0.3$			V
MODE pin low level voltage	V_{MODEL}	V_{MODE} is faling			GND+0.3	V
MODE pin input current	I_{MODE}	$V_{MODE}=5.5V$		0.01	1	μA
UVLO voltage	V_{UVLO}	V_{IN} is rising			2.0	V
UVLO hysteresis voltage	ΔV_{UVLO}			0.12		V
Soft start time	T_{SS}	$V_{EN}=0V$ to V_{IN}	0.15	0.3	0.6	ms
Thermal shutdown temperature * 1	T_{TSD}			140		$^{\circ}C$

(*1) The parameter is quaranteed by design.

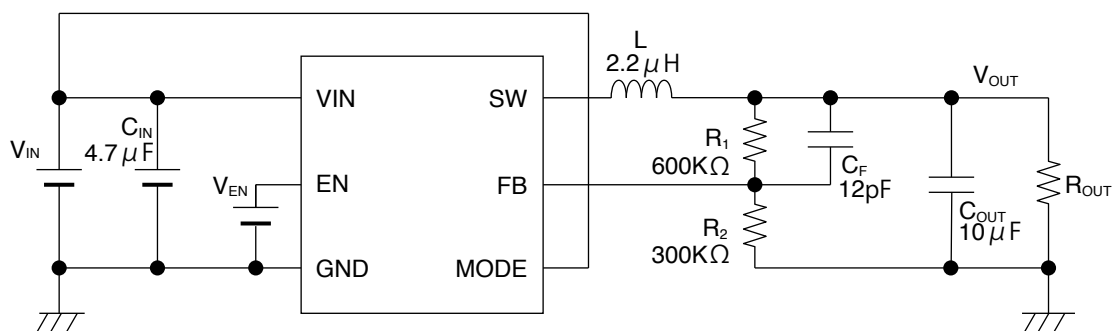
Measurment circuit

(Except where noted otherwise: $V_{IN}=V_{EN}=3.6V$, $V_{OUT}=1.8V$, $V_{MODE}=0V$, $T_a=25^{\circ}C$)

A.

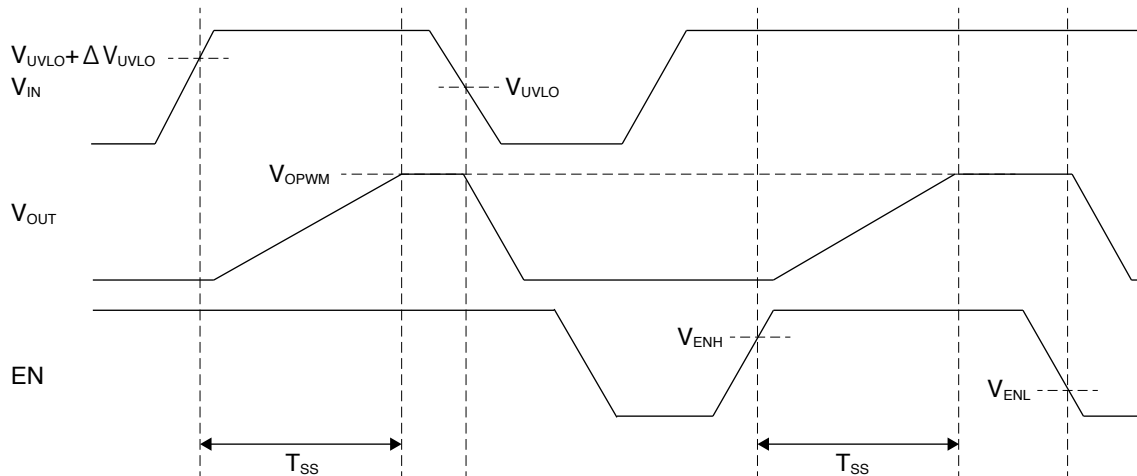


B.

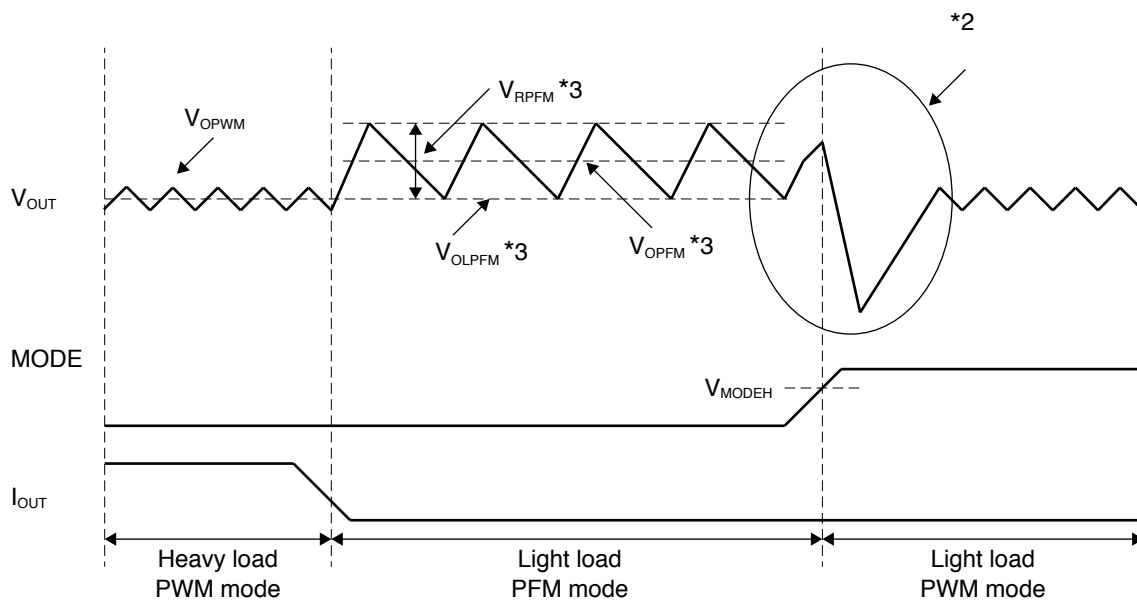


Timing chart

Start up operation



PWM/PFM mode operation



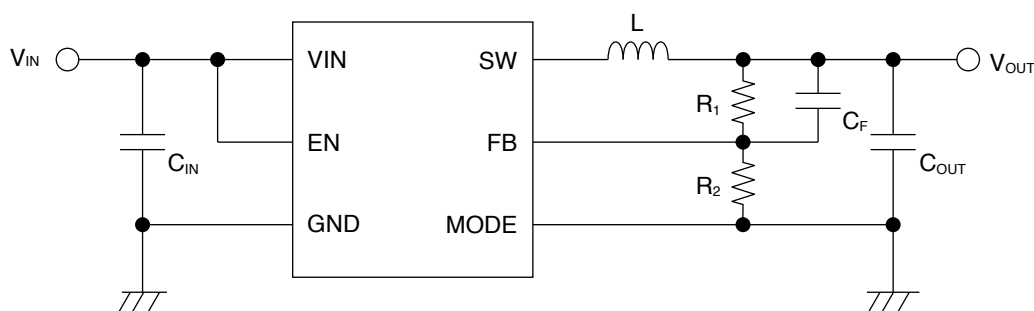
*2. Please note is there output uner-shoot at PFM-to-PWM transition.

*3. During PFM mode the average output voltage V_{OPFM} is added 0.5 times the ripple V_{RPFM} to the lower output voltage V_{OLPFM} . The V_{OLPFM} is calculated by the following equation.

$$V_{OLPFM} = V_{FBPFM} \times (R_1 + R_2) \div R_2$$

R_1 and R_2 is output feedback resistor, the V_{FBPFM} is feedback voltage during PFM mode.

Application circuit



Recommend parts

Output voltage	Part					
	L	C _{IN}	C _{OUT}	R ₁	R ₂	C _F
0.8V	2.2 μ H	4.7 μ F	10 μ F	100K Ω	300K Ω	12pF
1.2V				300K Ω		12pF
1.5V				450K Ω		12pF
1.8V				600K Ω		12pF
2.5V				950K Ω		8pF
3.3V				1.35M Ω		8pF

L : 2.2 μ H C3-P1.2RA (Mitsumi)
 C_{IN} : 4.7 μ F GRM188R60J475KE19D (Murata)
 C_{OUT} : 10 μ F GRM188R60J106KE47D (Murata)

Operating conditions

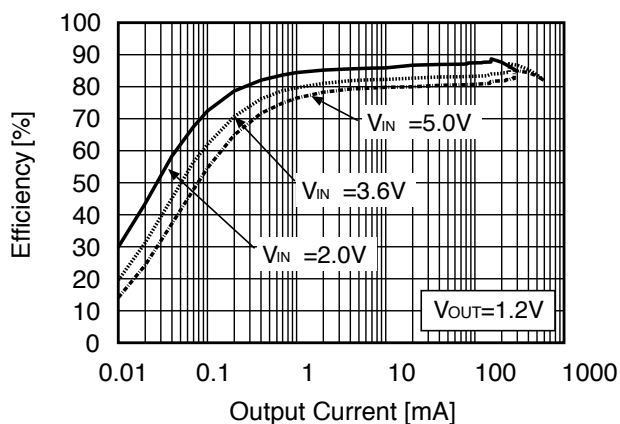
Output voltage	Input voltage	Maximum output current
0.8V	$2.0V \leq V_{IN} < 2.2V$	0.3A
	$2.2V \leq V_{IN} \leq 5.5V$	0.6A
1.2V	$2.0V \leq V_{IN} < 2.2V$	0.3A
	$2.2V \leq V_{IN} \leq 5.5V$	0.6A
1.5V	$2.0V \leq V_{IN} < 2.2V$	0.15A
	$2.2V \leq V_{IN} < 2.4V$	0.3A
	$2.4V \leq V_{IN} \leq 5.5V$	0.6A
1.8V	$2.2V \leq V_{IN} < 2.4V$	0.15A
	$2.4V \leq V_{IN} < 2.6V$	0.3A
	$2.6V \leq V_{IN} \leq 5.5V$	0.6A
2.5V	$2.8V \leq V_{IN} < 3.0V$	0.15A
	$3.0V \leq V_{IN} < 3.2V$	0.3A
	$3.2V \leq V_{IN} \leq 5.5V$	0.6A
3.3V	$3.8V \leq V_{IN} < 4.0V$	0.15A
	$4.0V \leq V_{IN} < 4.2V$	0.3A
	$4.2V \leq V_{IN} \leq 5.5V$	0.6A

Note : This current doesn't necessary guarantee to operate. Please evaluate the actual application to set the constant of external parts.

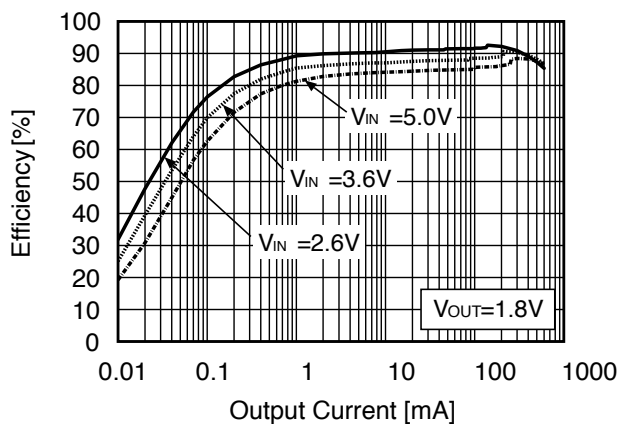
Characteristics

(Except where noted otherwise : $T_a=25^{\circ}\text{C}$)

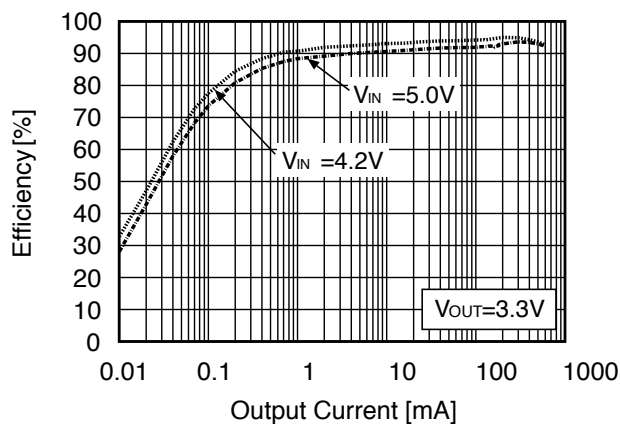
Efficiency



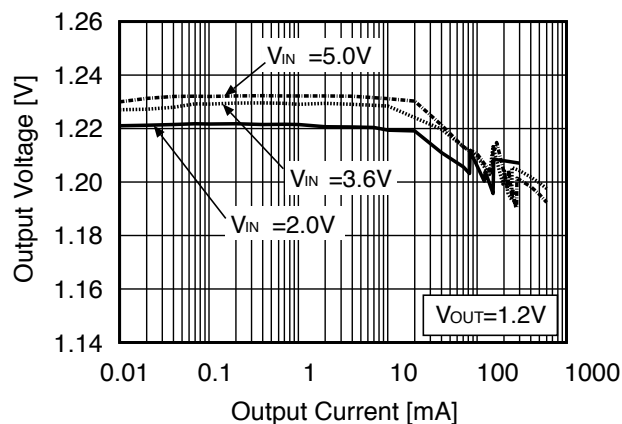
Efficiency



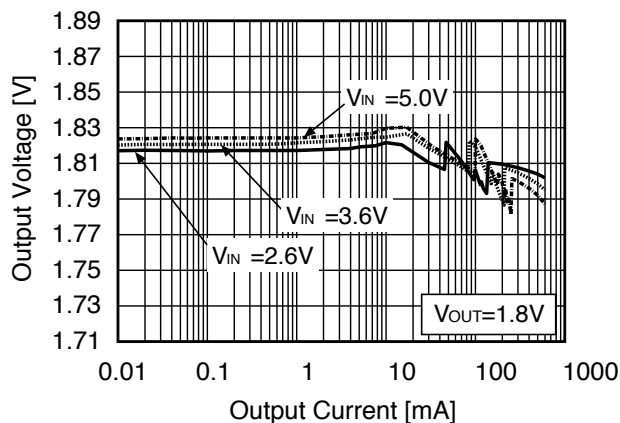
Efficiency



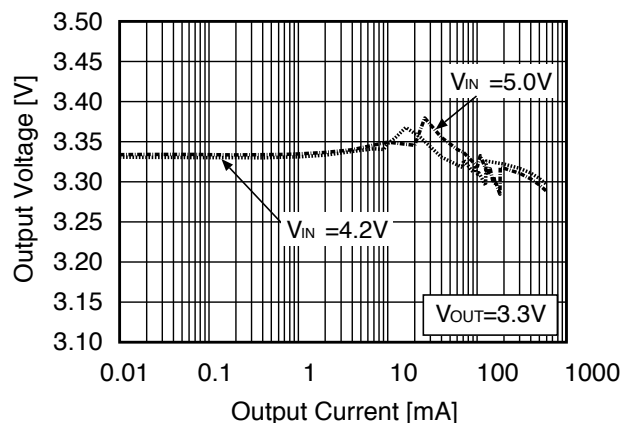
Load regulation



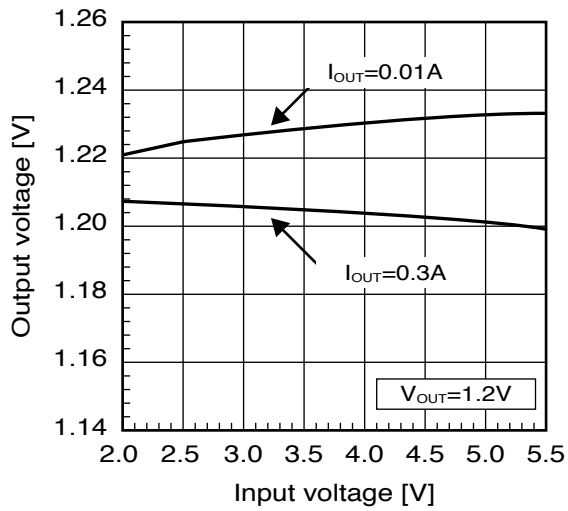
Load regulation



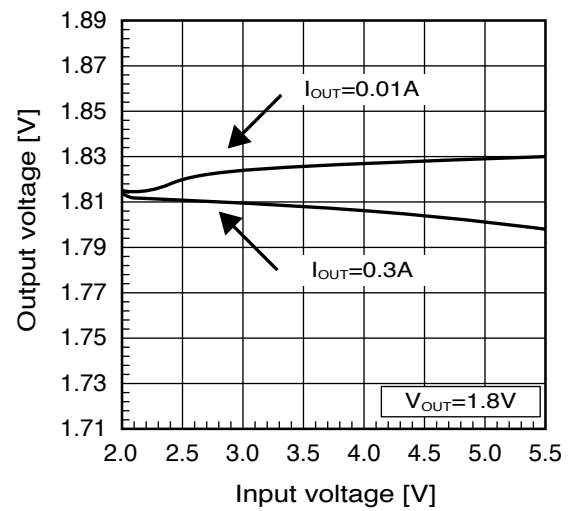
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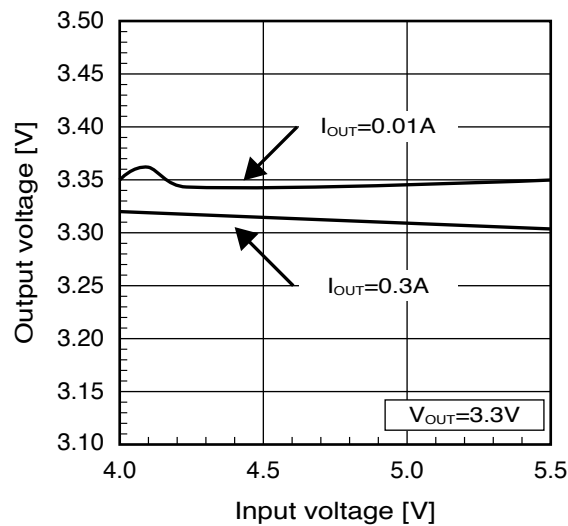
Line regulation



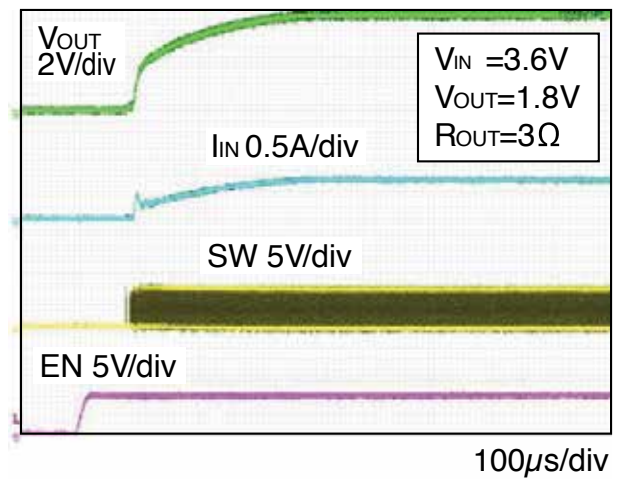
Line regulation



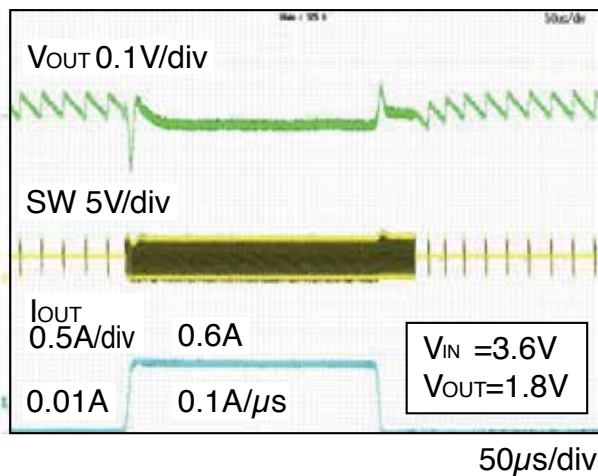
Line regulation



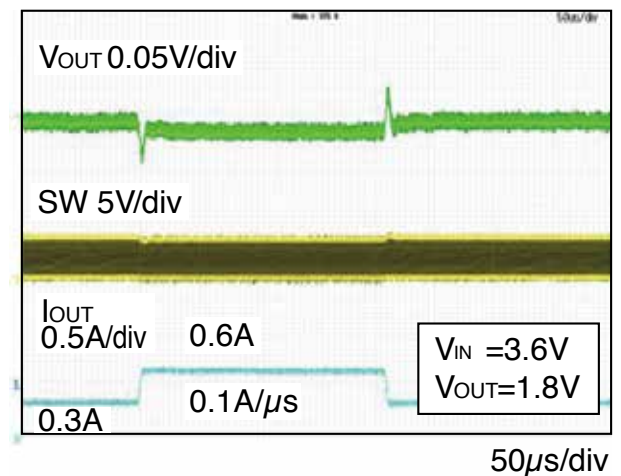
Start-up



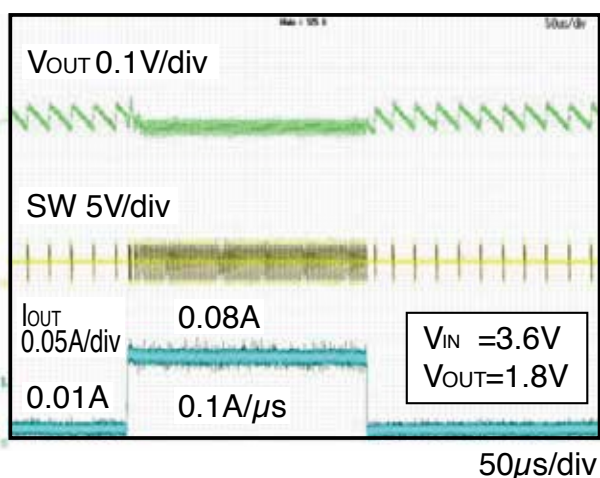
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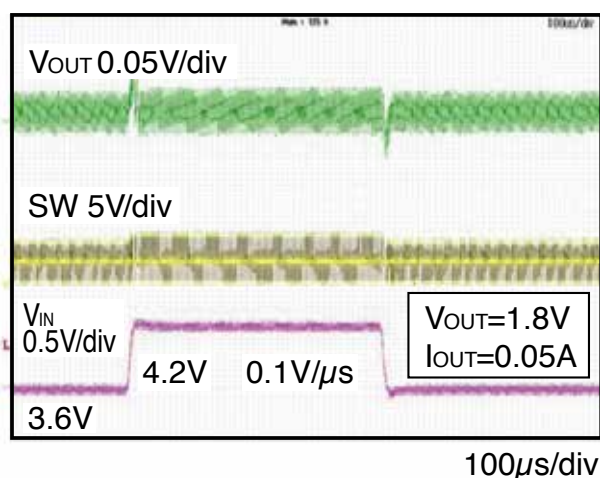
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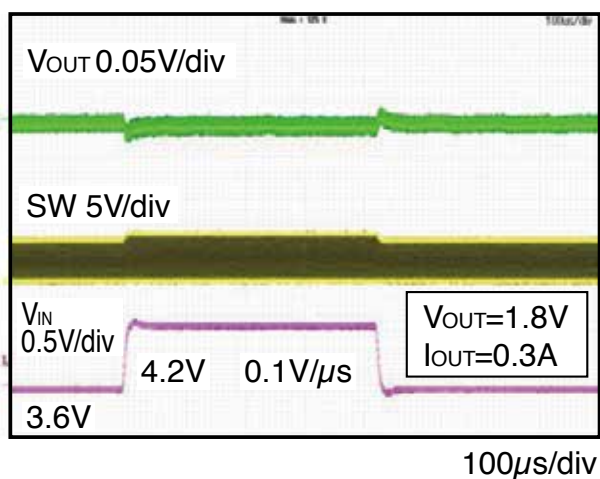
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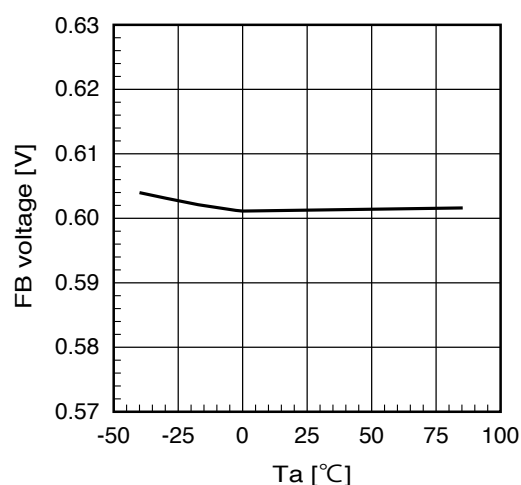
Line transient



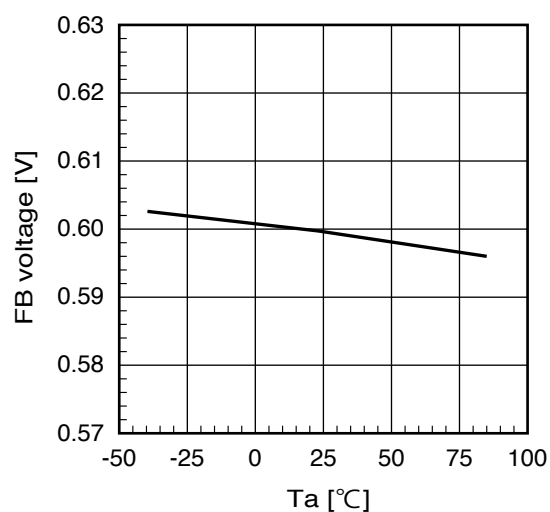
Line transient



FB votage (PWM)



FB votage (PFM)



Oscillation frequency

