RICOH

R1242S SERIES

30V Input 3A Buck DC/DC converter

NO.EA-191-111123

OUTLINE

The R1242S Series are CMOS-based 30V Input, 3A, Synchronous Rectified Step-down DC/DC Converters with built-in Highside Switch. Each of these ICs contains Nch Highside Tr. (Typ. 0.1Ω) and can supply maximum 3A output current. In order to reduce heat generation caused by energy loss, FET can be used as Lowside switch. Lowside switch turns off when ICs shut down. Each of these ICs consists of the followings: an oscillator, a PWM control circuit, a voltage reference unit, an error amplifier, a phase compensation circuit, a slope control circuit, a soft-start circuit, protection circuits, an internal regulator, a switch, and so on. Also, each of these ICs consists of the following external components: an inductor, resistors, an external FET, and capacitors.

The R1242S Series operates with Current Mode Topology, which does not require any sense resistor. As a result, these ICs can achieve high speed and high efficiency. The oscillator frequencies for each version are set as follows; adjustable between 330kHz to 1000kHz for versions A and B, 330kHz for versions C and D, 500kHz for versions E and F, and 1000kHz for versions G and H.

Each of these ICs are equipped with the protection functions, such as Peak Current Limit function, Latch function, Fold back function, Thermal-Shutdown function, and Undervoltage-Lockout (UVLO) function. Peak Current Limit function restricts the maximum current into 4.5A. Latch function (comes with versions A, C, E, and G) shuts off the output if current limit detection continues for a certain period of time. Fold back function (comes with versions B, D, F, and H) reduces the initial oscillator frequencies into 1/4 when output is short-circuited.

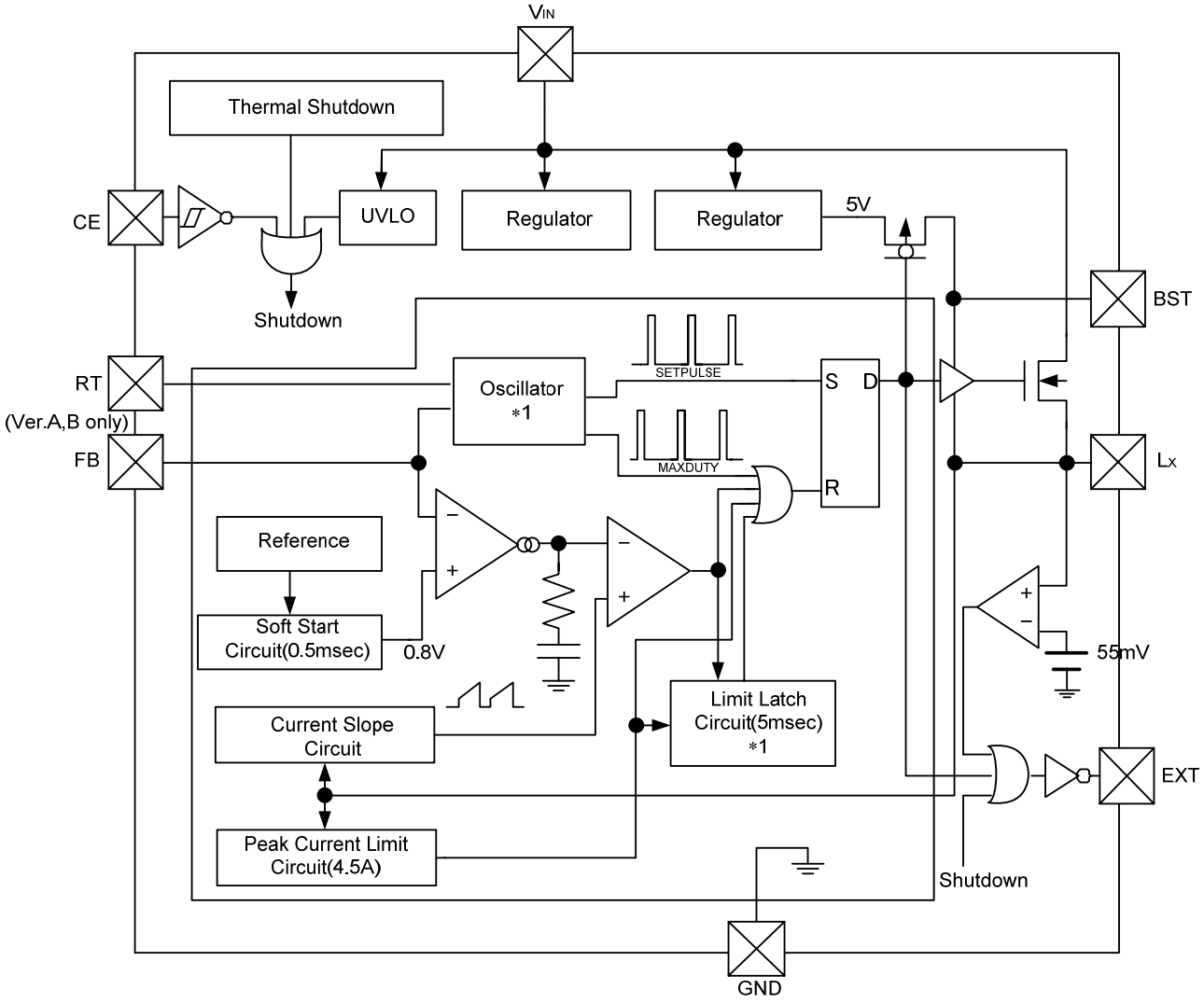
FEATURES

- Operating Voltage ..... 5V ~ 30V
- Supply Current ..... Typ. 0.8mA (Set V_{OUT}=1.0V@V_{IN}=30V)
- Internal Nch MOSFET Driver (Ron=100mΩTyp.)
- External Nch MOSFET Drive Buffer for Synchronous Operation
- Adjustable Output Voltage with External Resistor ..... 0.8V ~ 15V
- Feed Back Voltage ..... 0.8V with 1.5% accuracy
- Output Current 3A
- Peak Current Limit Function ..... Typ. 4.5A
- UVLO Function
- Internal Soft Start Time ..... Typ. 0.5ms
- Maximum Duty Cycle ..... Typ. 88%
- UVLO Detector Threshold ..... Typ. 3.6V
- Thermal Shutdown Function ..... Typ. 160°C, with 30°C hysteresis
- Operating Frequency ..... Version A/B adjustable from 330kHz to 1MHz
  Version C/D 330kHz
  Version E/F 500kHz
  Version G/H 1000kHz
- Built-in Foldback Protection and its frequency ..... 1/4 at fold condition: Ver.B
  83kHz: Ver.D, 125kHz: Ver.F, 250kHz: Ver.H
- Short Protection Function for Internal Boost Regulator
- Short Protection delay time for Output Latch ..... Typ. 5ms : Ver.A/C/E/G
- Ceramic Capacitor Compatible
- Stand-by Function: 0μA (Typ.), Max. 20μA (@V_{IN}=30V, CE="L")
- Package HSOP-8E

APPLICATIONS

- Power source for digital home appliance
- Power source for hand-held communication equipment, cameras, video instruments such as VCRs, camcorders.
- Power source for battery-powered equipment.
- Battery Charger

Block Diagram



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Ver	fosc	Short Protection
A	Adjustable	Latch
B	Adjustable	Fold back
C	330kHz	Latch
D	330kHz	Fold back
E	500kHz	Latch
F	500kHz	Fold back
G	1000kHz	Latch
H	1000kHz	Fold back

Selection Guide

In the R1242 Series, short-circuit protection functions and frequency types can be selected from the followings; Short-circuit protection functions: Latch or Fold back; Frequency types: Adjustable or Fixed. Fixed frequencies are selectable from 330kHz, 500kHz, or 1000kHz.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1242S001∗-E2-FE	HSOP-8E	1,000 pcs	Yes	Yes

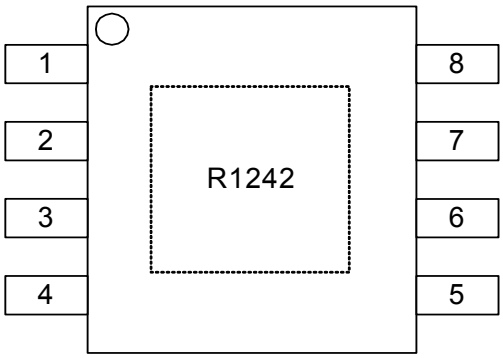
∗ : Latch or Fold back, frequency can be selected at the user's request

Code	Frequency	Latch Type protection	Fold back Type protection
A	Adjustable	Yes	No
B	Adjustable	No	Yes
C	330kHz	Yes	No
D	330kHz	No	Yes
E	500kHz	Yes	No
F	500kHz	No	Yes
G	1000kHz	Yes	No
H	1000kHz	No	Yes

PIN CONFIGURATIONS

●**HSOP-8E**

TOP VIEW



PIN DESCRIPTIONS

- **R1242S001A/B**

PIN No.	Symbol	Description
1	CE	Chip Enable Pin (Active with “H”)
2	EXT	Gete Drive Pin
3	BST	Bootstrap Pin
4	V_{IN}	Power Supply Pin
5	L_X	L_X Switching Pin
6	GND	Ground Pin
7	FB	Feedback Pin
8	RT	Frequency Setting Pin

∗ Tab is GND level. (They are connected to the reverse side of this IC.)
∗ The tab must be connected to the GND.

- **R1242S001C/D/E/F/G/H**

PIN No.	Symbol	Description
1	CE	Chip Enable Pin (Active with “H”)
2	EXT	Gate Drive Pin
3	BST	Bootstrap Pin
4	V_{IN}	Power Supply Pin
5	L_X	L_X Switching Pin
6	GND	Ground Pin
7	FB	Feedback Pin
8	TEST	TEST Pin. OPEN or connect to GND

∗ Tab is GND level. (They are connected to the reverse side of this IC.)
∗ The tab must be connected to the GND.

Absolute Maximum Ratings

(GND=0V)

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	-0.3 ~ 32	V
V_{BST}	Boost Pin Voltage	V_{LX} - 0.3 ~ V_{LX} + 6	V
V_{LX}	L_X Pin Voltage	-0.3 ~ V_{IN} + 0.3	V
V_{CE}	CE Pin Input Voltage	-0.3 ~ V_{IN} + 0.3	V
V_{FB}	VFB Pin Voltage	-0.3 ~ 6	V
V_{EXT}	EXT Pin Voltage	-0.3 ~ 6	V
V_{RT}	RT Pin Voltage	-0.3 ~ 6	V
P_D	Power Dissipation (HSOP-8E) *	2.9	W
Ta	Operating Temperature Range	-40 ~ 85	ºC
Tstg	Storage Temperature Range	-55 ~ 125	ºC

∗) For Power Dissipation, please refer to PACKAGE INFORMATION.

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.
The functional operation at or over these absolute maximum ratings is not assured.

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

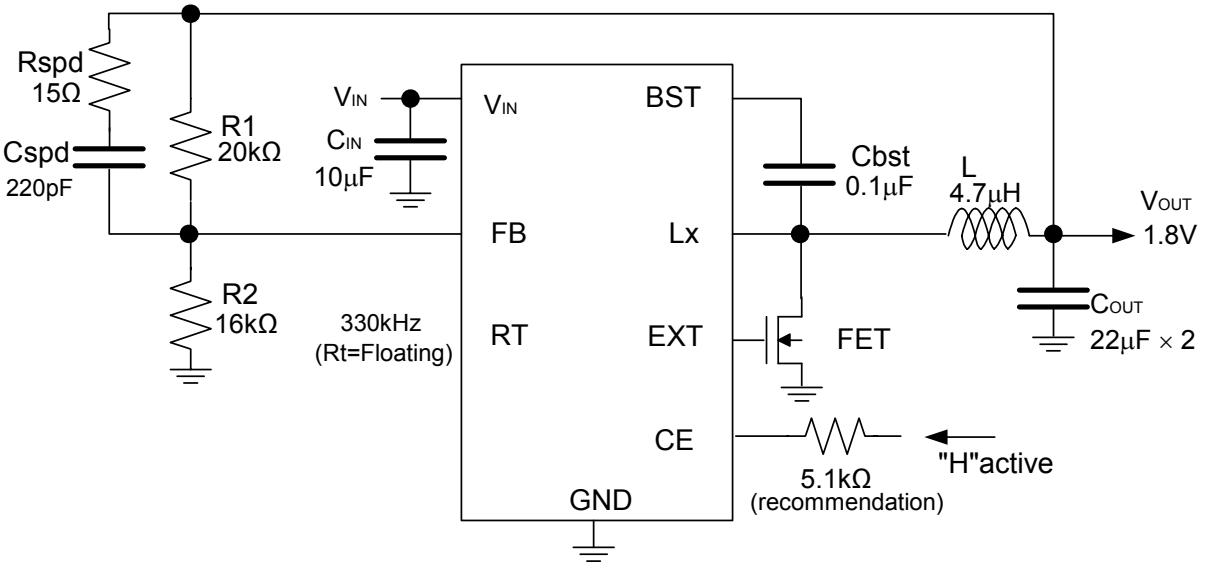
Electrical Characteristics

(Otherwise notified in Conditions, V_{IN}= 12V, Ta=25ºC)

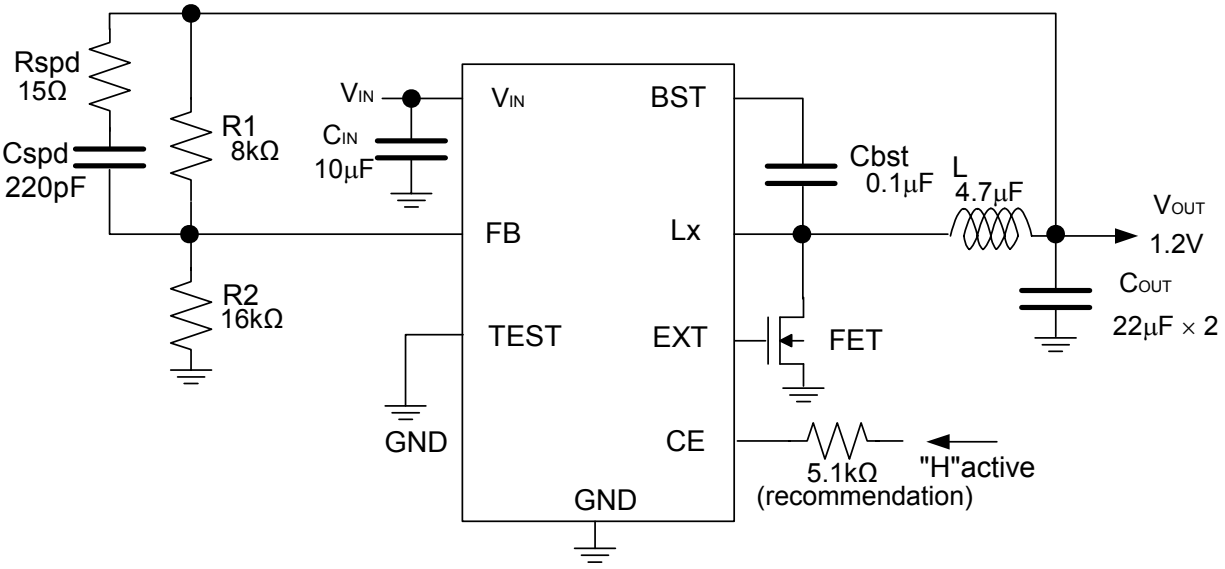
Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
V_{IN}	Operating Input Voltage		5.0		30	V
I_{IN}	V_{IN} Consumption Current	V_{IN}=30V, V_{FB}=1.0V	0.45	0.80	1.20	mA
V_{UVLO1}	UVLO Detect Voltage	Falling	V_{UVLO2} -0.5		V_{UVLO2} -0.3	V
V_{UVLO2}	UVLO Released Voltage	Rising	3.7	4.0	4.3	V
V_{FB}	VFB Voltage Tolerance		0.788	0.800	0.812	V
$\Delta V_{FB}/\Delta Ta$	VFB Voltage Temperature Coefficient	-40ºC ≤ Ta ≤ 85ºC		±100		ppm/ ºC
fosc	Oscillator Frequency (Ver. A/B)	RT=GND	900	1000	1100	kHz
		RT=floating	290	330	375	kHz
		RT=120kΩ	450	500	550	kHz
	Oscillator Frequency (Ver. C/D)		300	330	370	kHz
	Oscillator Frequency (Ver. E/F)		450	500	550	kHz
	Oscillator Frequency (Ver. G/H)		900	1000	1100	kHz
V_{FLB}	Fold back Frequency	V_{FB}<0.56,RT=GND (Ver. B)		250		kHz
		V_{FB} <0.56 (Ver. D)		83		kHz
		V_{FB} <0.56 (Ver. F)		125		kHz
		V_{FB} <0.56 (Ver. H)		250		kHz
Maxduty	Max. Duty Cycle	RT=120kΩ (Ver. A/B) V_{IN}=9V (Ver. C/D)	82	88	95	%
tstart	Soft Start Time			0.5		ms
t_{DLY}	Delay Time for Latch Protection	(Ver. A/C/E/G)		5		ms
R_{LXH}	Lx High Side Switch ON Resistance			0.1		Ω
I_{LXHOFF}	Lx High Side Switch Leakage Current			0	20	μA
I_{LIMLXH}	Lx High Side Switch Limited Current			4.5		A
V_{CEH}	CE “H” Input Voltage		1.7			V
V_{CEL}	CE “L” Input Voltage				0.4	V
I_{FB}	VFB Input Current		-1.0		1.0	μA
I_{CEH}	CE “H” Input Current		-1.0		1.0	μA
I_{CEL}	CE “L” Input Current		-1.0		1.0	μA
T_{TSD}	Thermal Shutdown Detect Temperature	Hysteresis 30ºC		160		ºC
Istandby	Standby Current	V_{IN}=30V, V_{CE}=0V		0	20	μA
R_{RISE}	EXT “H” Switch On Resistance	I_{EXT}=-100mA	6		11	Ω
R_{FALL}	EXT “L” Switch On Resistance	I_{EXT}=100mA	0.5		1.5	Ω
V_{EXTLIM}	Detecting Voltage for Low Side Switch Current Limit		36	55	76	mV

Typical application

R1242S001A/B V_{OUT}=1.8V 330kHz



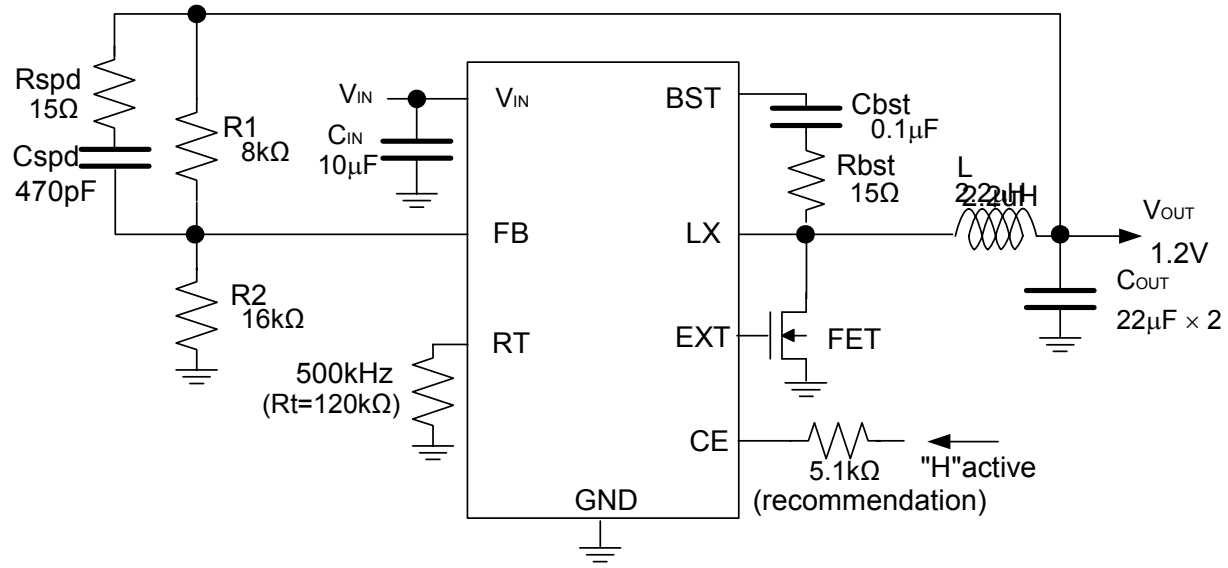
R1242S001C/D V_{OUT}=1.2V 330kHz



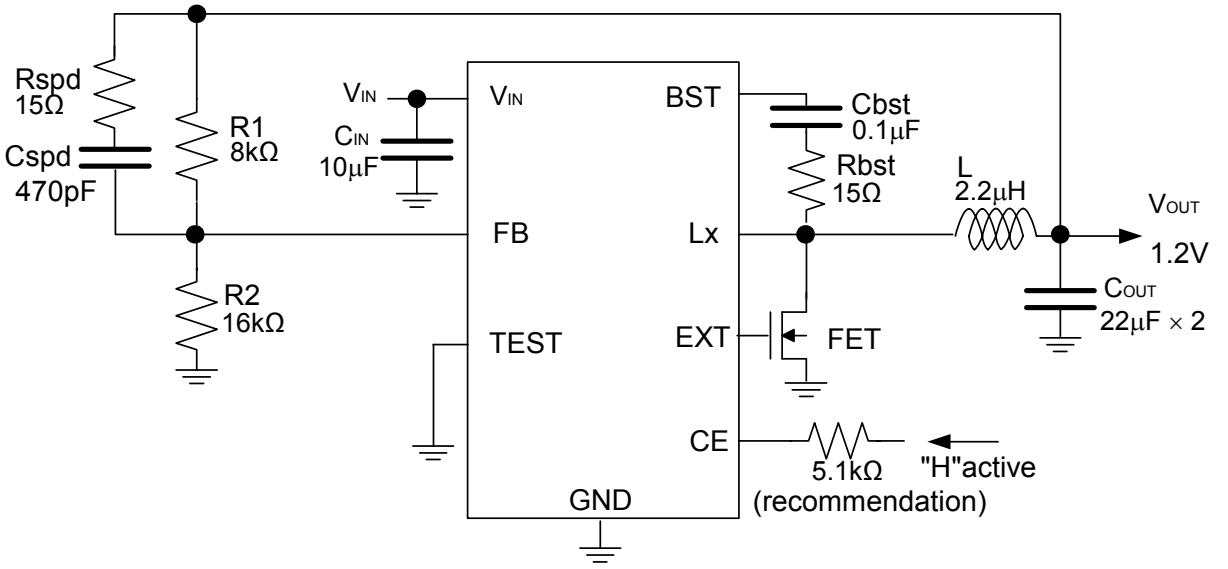
Recommendation parts

C_{IN}	10μF KTS500B106M55N0T00 (Nippon Chemi-Con)
C_{OUT}	22μF GRM31CR71A226M (Murata)
Cbst	0.1μF GRM21BB11H104KA01L (Murata)
L	4.7μH VLF10045T-4R7N6R1 (TDK)
FET	TPC8031 (TOSHIBA)

R1242S001A/B V_{OUT}=1.2V 500kHz



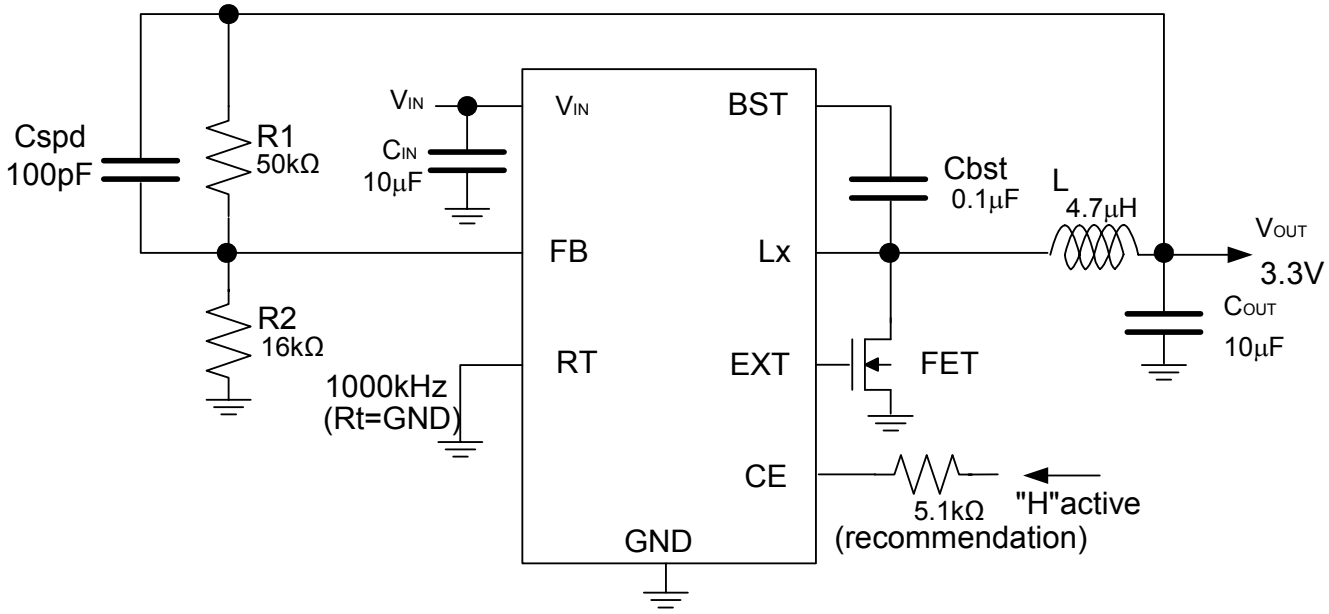
R1242S001E/F V_{OUT}=1.2V 500kHz



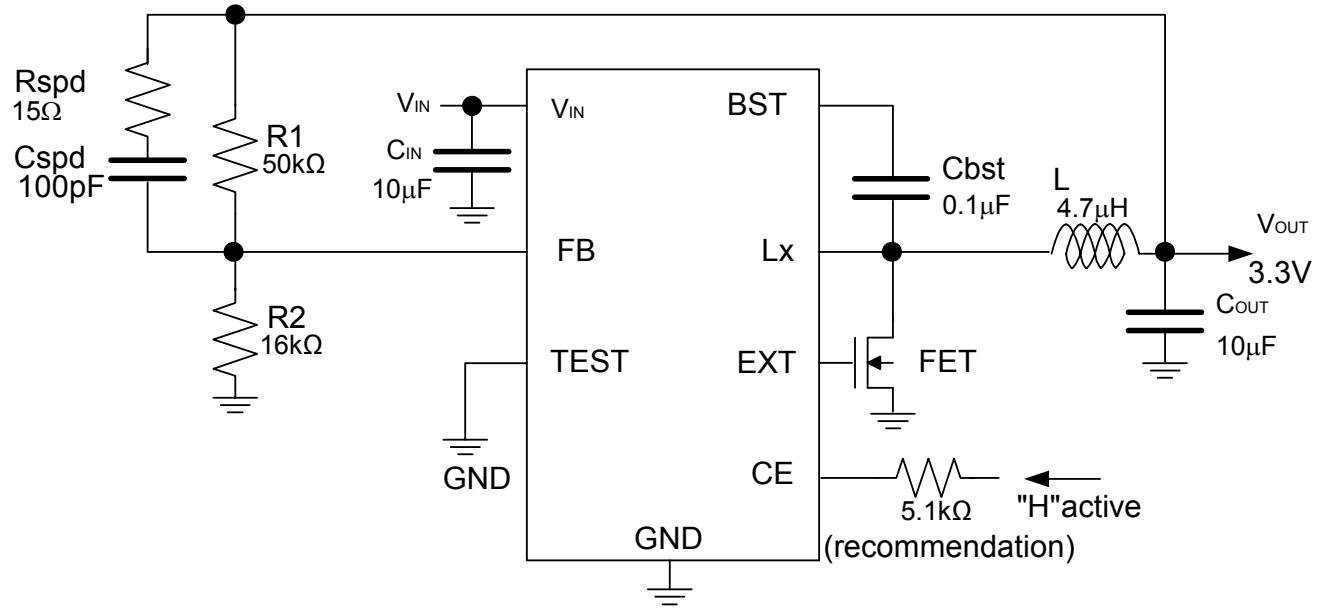
Recommendation parts

C_{IN}	10μF KTS500B106M55N0T00 (Nippon Chemi-Con)
C_{OUT}	22μF GRM31CR71A226M (Murata)
Cbst	0.1μF GRM21BB11H104KA01L (Murata)
L	2.2μH RLF7030T-2R2M5R4 (TDK)
FET	TPC8031 (TOSHIBA)

R1242S001A/B V_{OUT}=3.3V 1000kHz



R1242S001G/H V_{OUT}=3.3V 1000kHz



Recommendation parts

C_{IN}	10μF KTS500B106M55N0T00 (Nippon Chemi-Con)
C_{OUT}	10μF GRM31CR71E106K (Murata)
Cbst	0.1μF GRM21BB11H104KA01L (Murata)
L	4.7μH VLF10045T-4R7N6R1 (TDK)
FET	SSM3K14T (TOSHIBA)

Notes Concerning to External Parts

External components must be connected as close as possible to the ICs and their wiring must be short as possible. Especially, the capacitor must be connected with the shortest distance between V_{IN} and GND pins. If the impedances of the power supply line and the GND line are high, the operation can be unstable due to the switching current which fluctuates the electric potential of the inside the ICs. The impedances of power supply line and GND line must be as low as possible. When designing their wirings, it is necessary to give careful consideration to the large current flowing into the power supply, GND, Lx, V_{OUT} and inductor. The wiring of output voltage setting resistance (R1) and the wiring of inductor must be separated from load wiring.

The ceramic capacitors with low ESR (Equivalent Series Resistance) must be used for the ICs. The recommended value for the C_{IN} capacitor between V_{IN} and GND is equal or more than 10μF.

The selections of inductor (L) and output capacitor (C_{OUT}) can be different according to the ICs' oscillation frequencies, output voltages and input voltages. Refer to "Recommended Value for Each Output Voltage" on the next page and select the most suitable values at the conditions of use.

The internal phase compensation is built in the ICs; therefore, if the values selected are largely deviated from the recommended values, the operation may result in unstable.

The over current protection circuit could be influenced by self-heating of the ICs and heat dissipation of the PCB environment.

In order to prevent self-turning on, FET with smaller gate resistance and with smaller Cgd / Cgs (capacities between gate drains and the capacities between gate sources) should be selected.

The output voltage (V_{OUT}) can be calculated as $V_{OUT} = V_{FB} \times (R1+R2)/R2$. The various voltage settings are possible by changing the values of R1 and R2. However, R2 value must be equal or less than 16kΩ.

Rspd prevents the deterioration in the regulation characteristics, which is caused by spike noise occurred in V_{OUT}. Spike noise is largely depending on the PCB layout. If the PCB board layout is optimized, there is no need of Rspd; however, if the spike noise is a concern, Rspd with 15Ω or so should be used.

After the completion of soft start, latch function (for versions A, C, E, and G) starts to work. The internal counter starts counting up when the over current protection circuit activates the limited current detection. When the internal counter counts up to 5ms, which is typical latch timer period, latch function turns off the output. The turned off output can be reset when CE pin is changed to "L", and also VIN pin voltage is became less than 3.6V (Typ.), which is UVLO detecting voltage. If the output voltage increases more than the setting voltage (FB pin voltage is 0.8V (Typ.)) within the latch timer period, the counter restores the default. If the power-supply voltage's start-up is slow and the output voltage is not reached to the setting voltage within the latch timer period after the soft start, the careful attention is required.

After the soft start, fold back function (for Version B, D, F, and H) starts to work. The fold back function limits the oscillation frequencies into 1/4 when (FB pin voltage decreases to less than 0.56V (Typ.)). If the power-supply voltage's start-up is slow and the output voltage is not reached to the 70% of the setting voltage even for a short period of time after the soft start, the careful attention is required.

The ICs are not supporting Nonsynchronous rectification using a diode as a rectifier.

The table on the next page shows the recommended values for setting frequency and setting output voltage.

R1242Recommended Value for Each Output Voltage

330kHz

V_{OUT}[V]	0.8	1.2	1.2	1.5	1.5	1.8	1.8	2.5	2.5	3.3	5	9	15
V_{IN}_range[V]	5~14	~12	9~30	5~10	10~30	5~15	12~30	5~15	12~30	5~30	7~30	15~30	20~30
L[μH]	2.2	10	4.7	10	4.7	15	4.7	15	10	15	15	15	15
C_{OUT}[μF]	100	22	44	22	44	22	44	22	22	22	22	22	22
Cspd[pF]	-	470	470	220	220	470	220	220	220	220	220	220	220->100
R1[Ω]	-	8000	8000	14000	14000	20000	20000	34000	34000	50000	84000	164000	284000
R2[Ω]	-	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000

500kHz

V_{OUT}[V]	0.8	1.0	1.2	1.5	1.5	1.8	1.8	2.5	3.3	5	9	12	15
V_{IN}_range[V]	~9	~10	5~15	5~18	7~19	5~23	9~21	5~29	5~30	7~30	15~30	18~30	20~30
L[μH]	2.2	2.2	2.2	4.7	2.2	4.7	2.2	10	10	10	10	15	15
C_{OUT}[μF]	100	44	44	44	44	44	44	22	22	22	22	22	22
Cspd[pF]	-	1000	470	220	220	220	220	220	220	220	220	470	220
R1[Ω]	-	4000	8000	14000	14000	20000	20000	34000	50000	84000	164000	28000	284000
R2[Ω]	-	16000	16000	16000	16000	16000	16000	16000	16000	16000	16000	2000	16000

1000kHz

V_{OUT}[V]	0.8	1.2	1.5	1.8	2.5	3.3	5	5	9	15
V_{IN}_range[V]	5~7	5~10	5~15	5~15	5~19	5~30	7~12	12~30	15~30	20~30
L[μH]	1.5	2.2	2.2	4.7	4.7	4.7	4.7	4.7	4.7	10
C_{OUT}[μF]	100	22	22	22	22	10	10	10	10	10
Cspd[pF]	-	220	100	220	220	100	100	56	56	100
R1[Ω]	-	8000	14000	20000	34000	50000	84000	84000	164000	284000
R2[Ω]	-	16000	16000	16000	16000	16000	16000	16000	16000	16000

R1242Recommendation parts

Symbol	Condition	Value	Parts Name	MFR
C_{IN}		10μF/50V	UMK325BJ106MM-T	TAIYO YUDEN
		10μF/50V	KTS500B106M55N0T00	Nippon Chemi-Con
		10μF/10V	GRM31CR71A106K	muRata
C_{OUT}	V_{OUT}>10V	10μF/50V	KTS500B106M55N0T00	Nippon Chemi-Con
	10V>V_{OUT}>1.8V	10μF/25V	GRM31CR71E106K	muRata
	V_{OUT}<1.8V	22μF/10V	GRM31CR71A226M (at the diode rectifier, the specified condition only)	muRata
Cbst		0.1μF/50V	GRM21BB11H104KA01L	muRata
L	1.5μH±30%/4.0A	1.5μH	SLF7055T-3PF-1R5N4R0	TDK
	2.2μH±20%/5.4A	2.2μH	RLF7030T-2R2M5R4	TDK
	4.7μH±30%/6.1A	4.7μH	VLF10045T-4R7N6R1	TDK
	10μH±20%6.2A	10μH	VLF12060T-100M6R2	TDK
	15μH±20%5.0A	15μH	VLF12060T-150M5R0	TDK
FET	30V/4A	57mΩ	SSM3K14T	TOSHIBA
	30V/13A	14.3mΩ	TPCC8003-H	TOSHIBA
	30V/11A	9.8mΩ	TPCP8005-H	TOSHIBA
	30V/11A	10.1mΩ	TPC8031-H	TOSHIBA
R_{CE}	Up Diode is connected between CE pin and V_{IN} pin as an ESD protection element. If there is a possibility that the CE pin voltage becomes higher than the V_{IN} pin voltage, it is recommended to insert a 5kΩ resistance or more in order to prevent the large current flowing from CE pin into V_{IN} pin.			

Operating Frequency

In the application circuit of the R1242S001A/B, the 330kHz operation is selected by leaving Rt open. Connecting a 200kΩ to 0Ω resistor between Rt(pin 8) and ground can be used to set the switching frequency to approximately 450kHz to 1000kHz. To calculate the Rt resistor, use the equation below:

*(Between 330kHz and 450kHz switching frequency can be also set by connecting the appropriate resistor according to the next equation.)

Rt=120000/(2/(1000000/f_{osc}-1)-1) [Ω]

The switching frequency vs. Rt value is shown in Figure 1 and Figure 2.

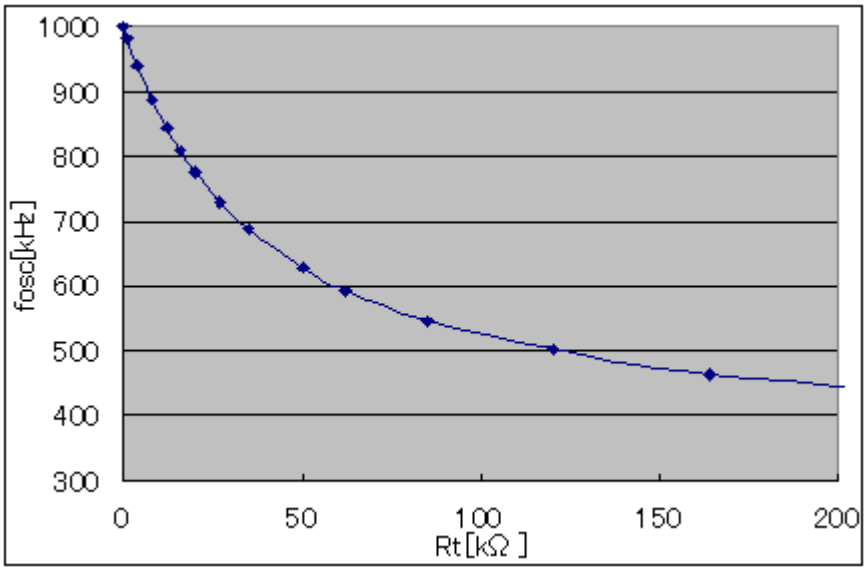


Figure 1: Linearscale

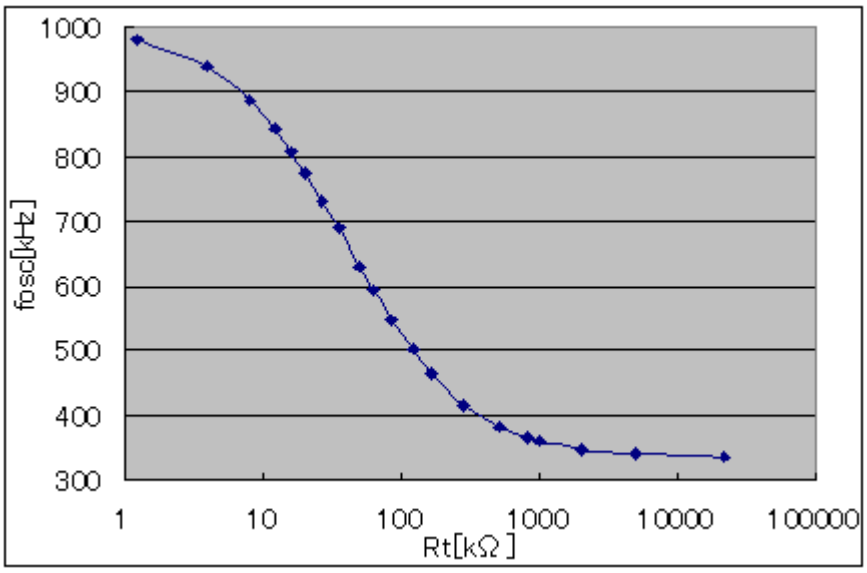
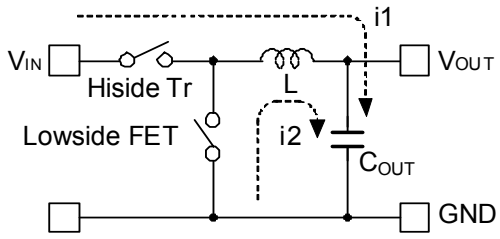


Figure 2: Logscale

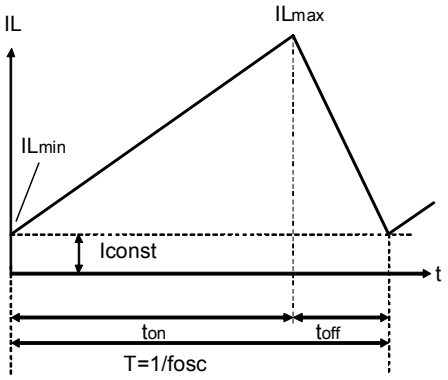
Operation of step-down DC/DC converter and Output Current

The DC/DC converter charges energy in the inductor when L_X transistor is ON, and discharges the energy from the inductor when L_X transistor is OFF and controls with less energy loss, so that a lower output voltage than the input voltage is obtained. The operation will be explained with reference to the following diagrams:

<Basic Circuit>



<Current through L>



- Step1. Hiside Tr. Turns on and current IL (=i1) flows, and energy is charged into C_{OUT}. At this moment, IL increases from IL_{min} to reach IL_{max} in proportion to the on-time period (t_{on}) of Hiside Tr.
- Step2. When Hiside Tr. Turns off, Synchronous rectifier Lowside FET turns on in order that L maintains IL at IL_{max}, and current IL (=i2) flows.
- Step3. IL decreases from IL_{max} to reach IL_{min} in proportion to the off-time period (t_{off}) of Hiside Tr.

In the case of PWM control system, the output voltage is maintained by controlling the on-time period (t_{on}), with the oscillator frequency (f_{osc}) being maintained constant.

The maximum value (IL_{max}) and the minimum value (IL_{min}) of the current flowing through the inductor are the same as those when Hiside Tr. Turns on and off.

Output Current and selection of External components

The relation between the output current and external components is as follows:

When Hiside Tr. Of L_X is ON:

(Wherein, Ripple Current p-p value is described as I_{RP}, ON resistance of Hiside Tr. And Lowside FET of L_X are respectively described as R_{ONH} and R_{ONL}, and the DC resistor of the inductor is described as R_L.)

$$V_{IN} = V_{OUT} + (R_{ONH} + R_L) \times I_{OUT} + L \times I_{RP} / ton \quad \text{..... Equation 1}$$

When Hiside Tr. Of Lx is “OFF” (Lowside FET is “ON”):

$$L \times I_{RP} / toff = R_{ONL} \times I_{OUT} + V_{OUT} + R_L \times I_{OUT} \quad \text{..... Equation 2}$$

Put Equation 2 to Equation 1 and solve for ON duty of Hiside Tr., $D_{ON} = ton / (toff + ton)$,

$$D_{ON} = (V_{OUT} + (R_{ONL} + R_L) \times I_{OUT})/(V_{IN} + (R_{ONL} – R_{ONH}) \times I_{OUT}) \quad \text{..... Equation 3}$$

Ripple Current is as follows:

$$I_{RP} = (V_{IN} – V_{OUT} – R_{ONH} \times I_{OUT} – R_L \times I_{OUT}) \times D_{ON} / fosc / L \quad \text{..... Equation 4}$$

wherein, peak current that flows through inductor, Hiside Tr, and Lowside FET is as follows:

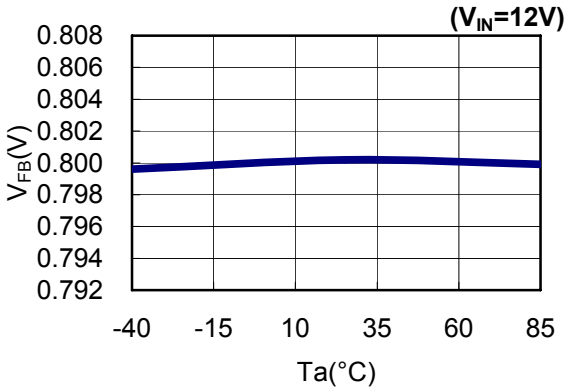
$$ILmax = I_{OUT} + I_{RP} / 2 \quad \text{..... Equation 5}$$

Consider IL_{max}, condition of input and output and select external components.

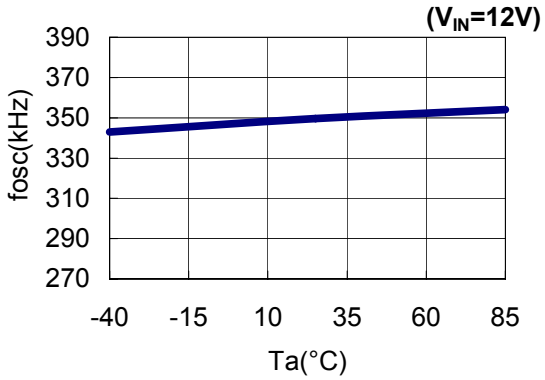
∗The above explanation is directed to the calculation in an ideal case in continuous mode.

TYPICAL CHARACTERISTICS

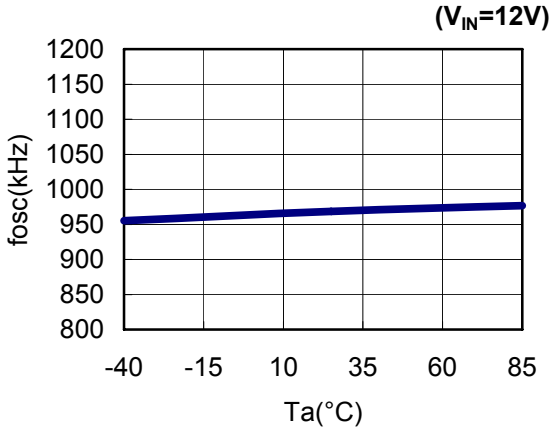
1)FB Voltage



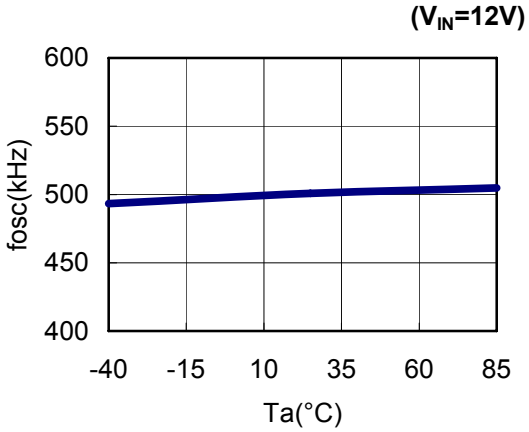
2)Oscillator Frequency(ver.A,B Rt=floating)



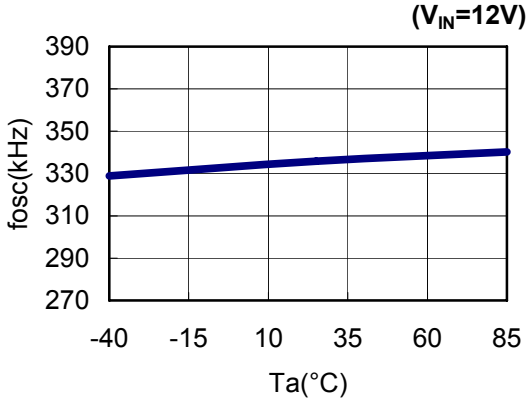
3)Oscillator Frequency(ver.A,B Rt=GND)



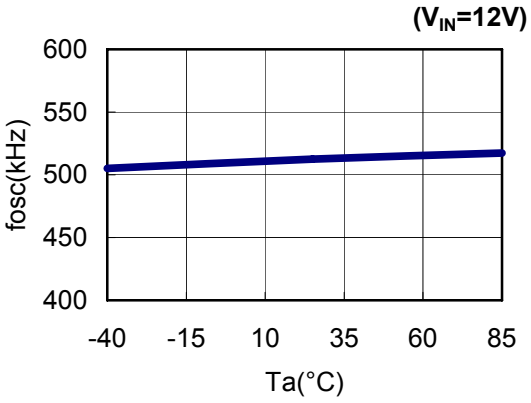
4)Oscillator Frequency(ver.A,B Rt=120kΩ)



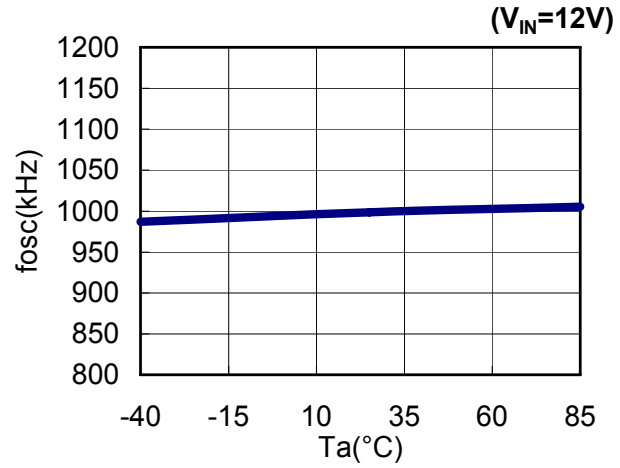
5)Oscillator Frequency(ver.C,D)



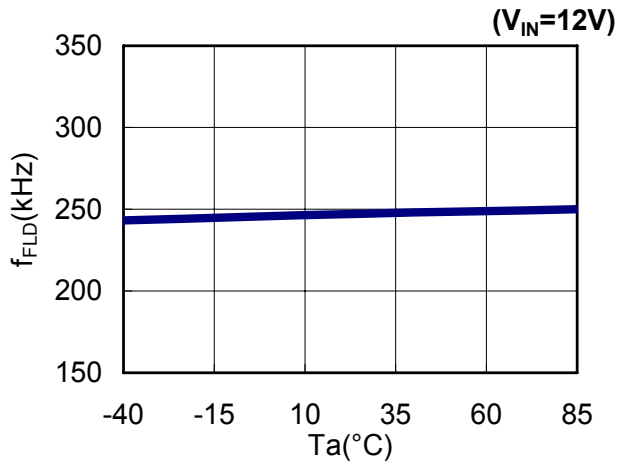
6) Oscillator Frequency(ver.E,F)



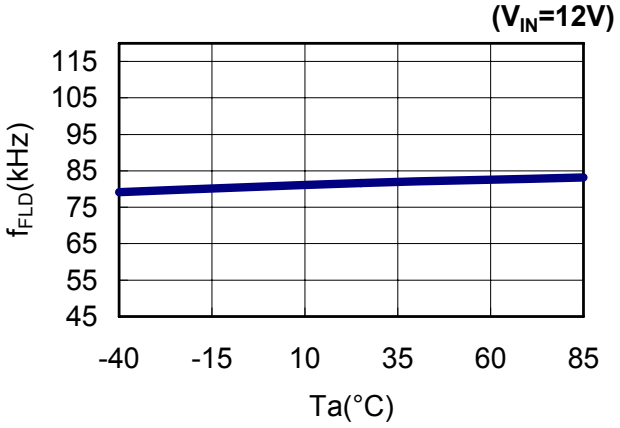
7) Oscillator Frequency(ver.G,H)



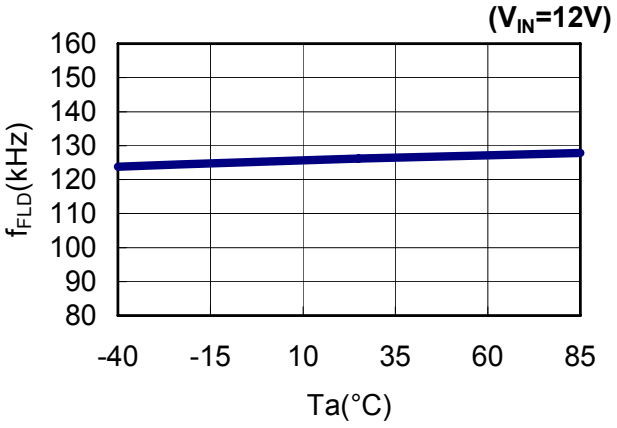
8) Fold-Back Frequency(ver.A,B Rt=GND)



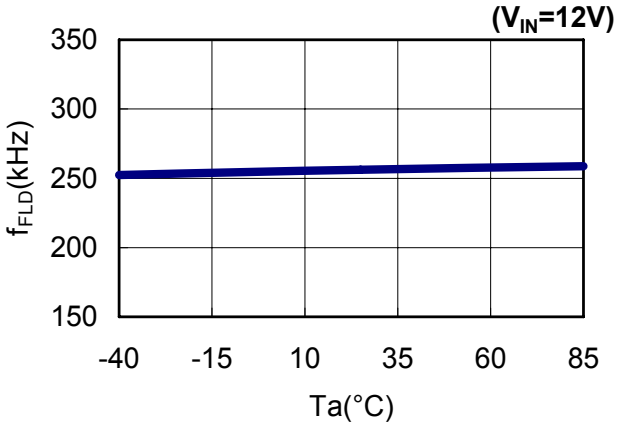
9) Fold-Back Frequency(ver.C,D)



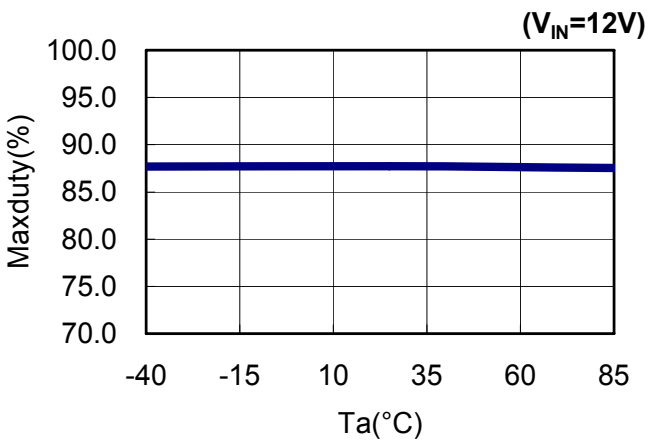
10) Fold-Back Frequency(ver.E,F)



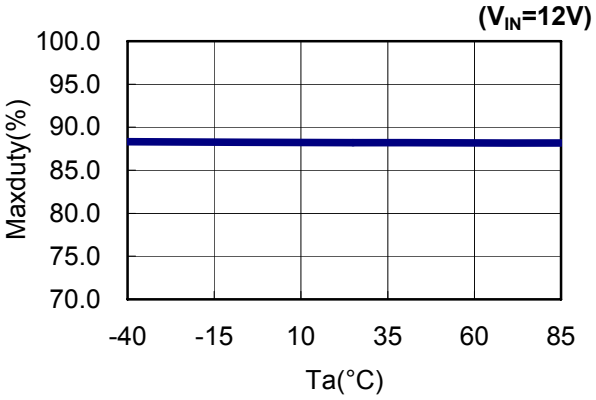
11) Fold-Back Frequency(ver.G,H)



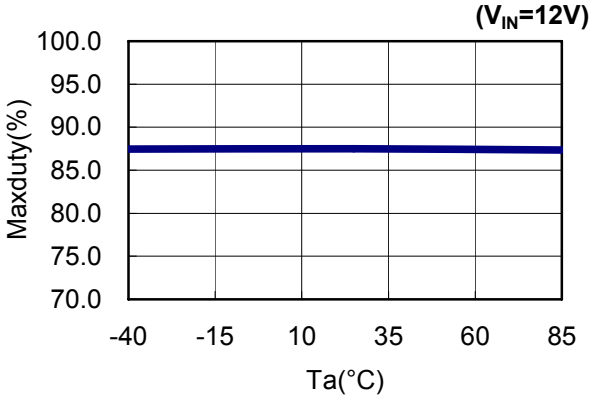
12) Maxduty(ver.A,B Rt=floating)



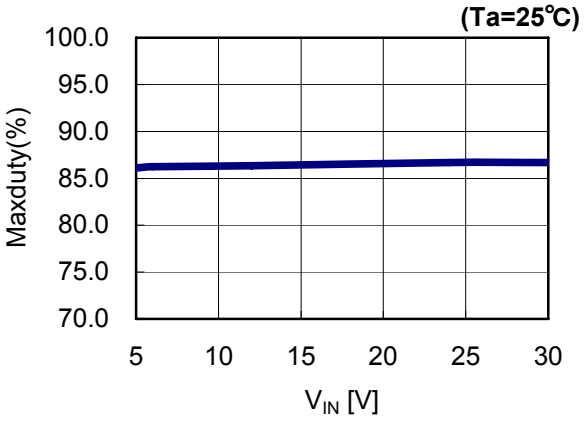
13) Maxduty(ver.C,D)



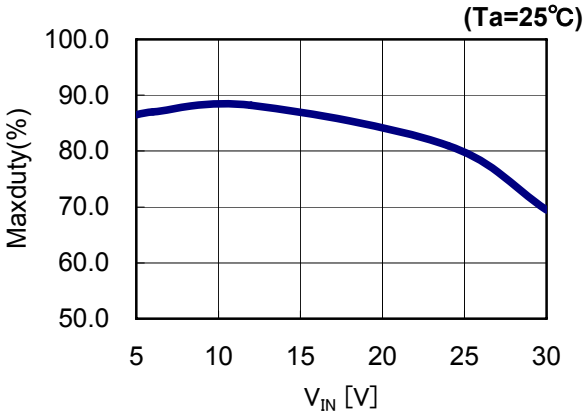
14) Maxduty(ver.G,H)



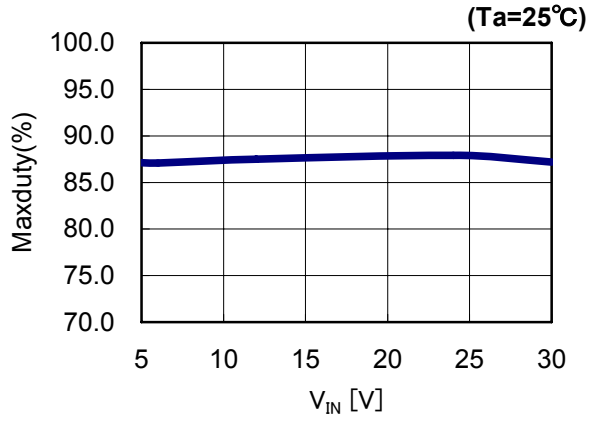
15) Maxduty(ver.A,B Rt=GND)



16) Maxduty(ver.C,D)



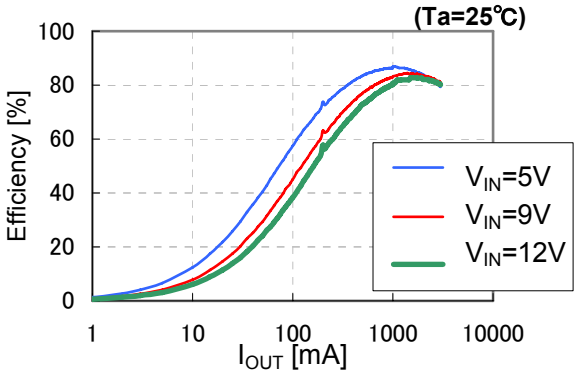
17) Maxduty(ver.G,H)



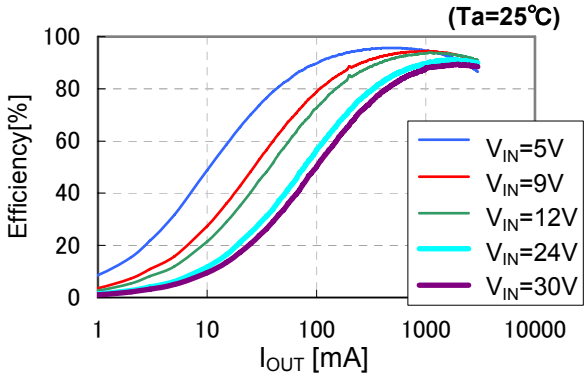
18)Efficiency vs Load Current

fosc=330kHz

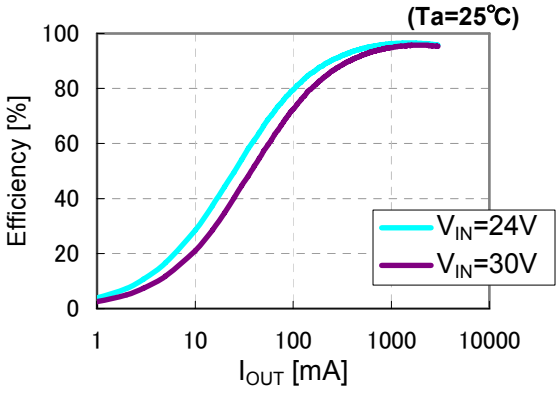
V_{OUT}:0.8V



V_{OUT}:3.3V

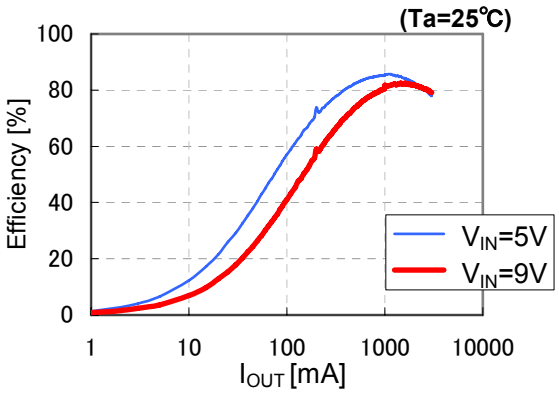


V_{OUT}:15V

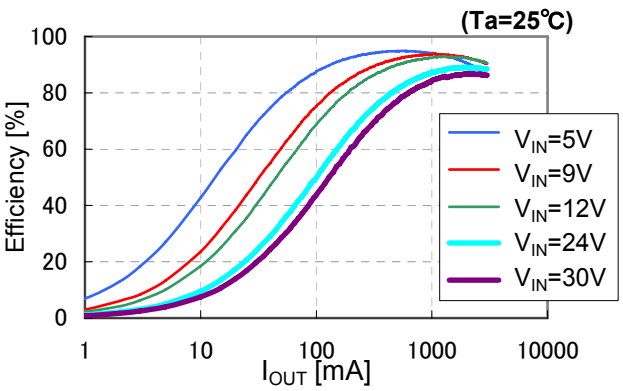


fosc=500kHz

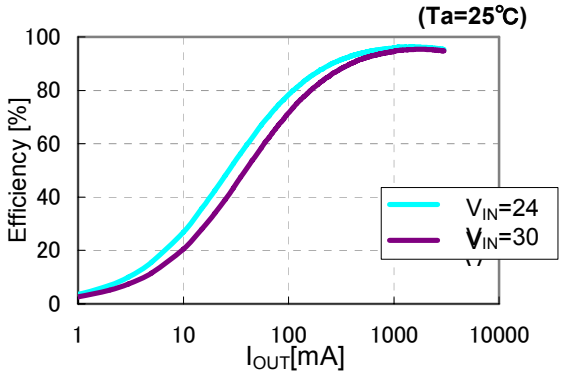
V_{OUT}:0.8V



V_{OUT}:3.3V

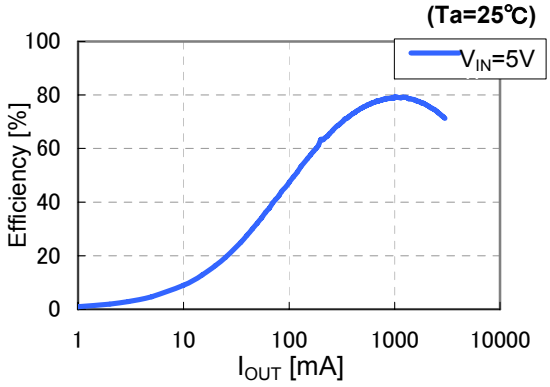


V_{OUT}:15V

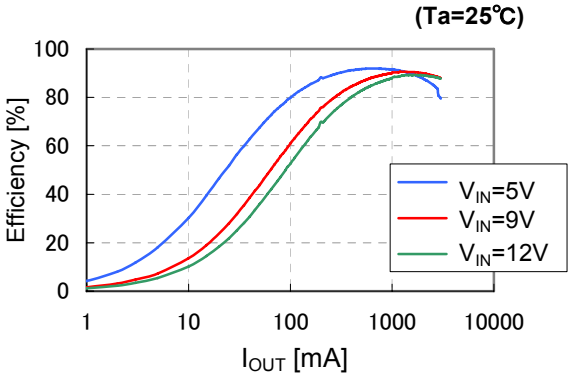


fosc=1000kHz

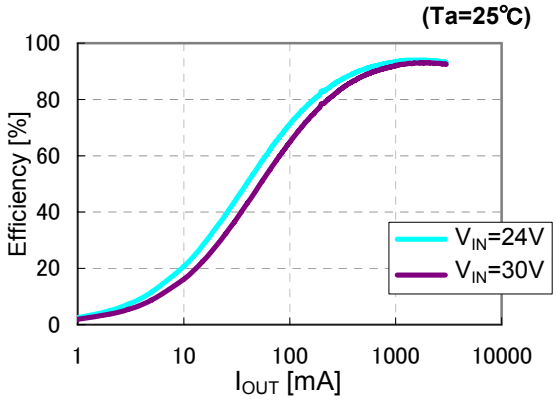
V_{OUT}:0.8V



V_{OUT}:3.3V



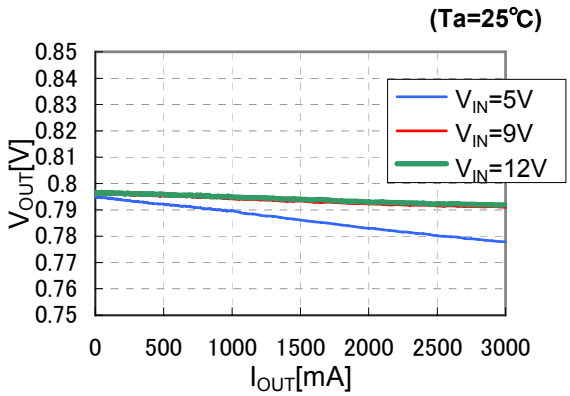
V_{OUT}:15V



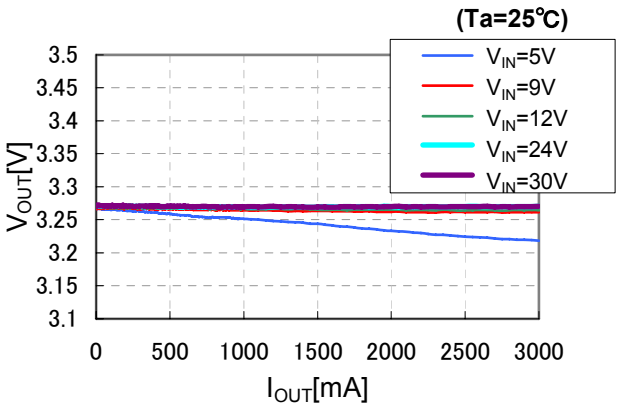
19)Load Regulation

fosc=330kHz

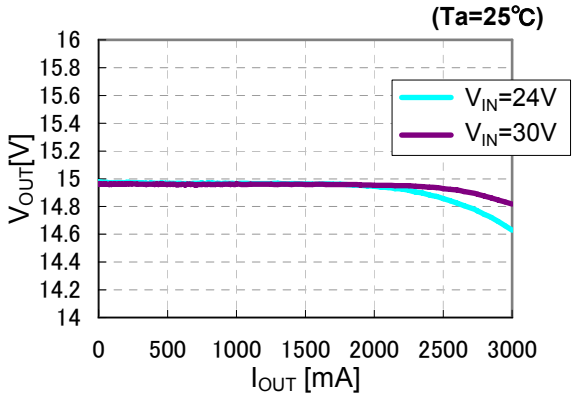
V_{OUT}:0.8V



V_{OUT}:3.3V

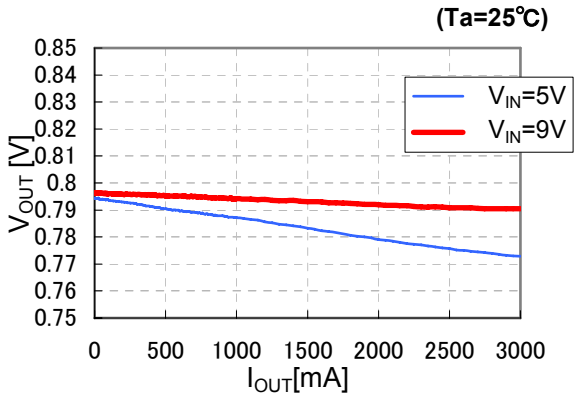


V_{OUT}:15V

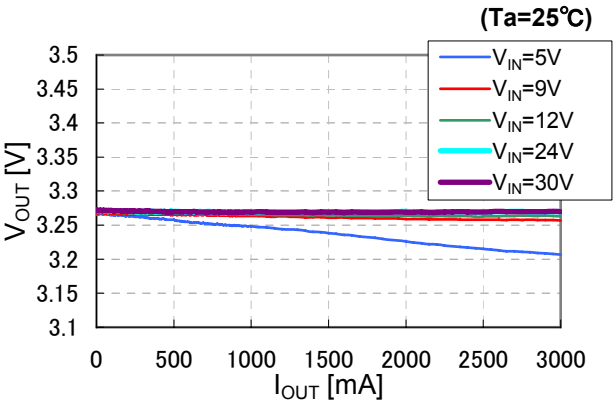


fosc=500kHz

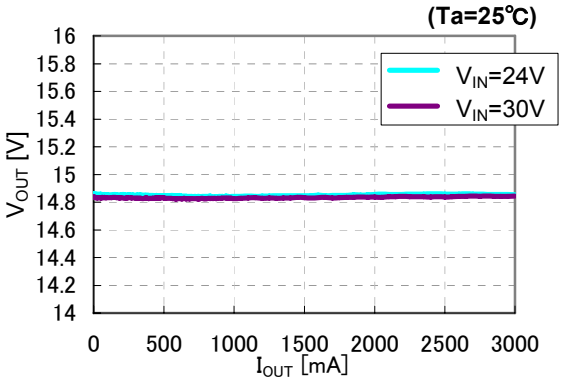
V_{OUT}:0.8V



V_{OUT}:3.3V

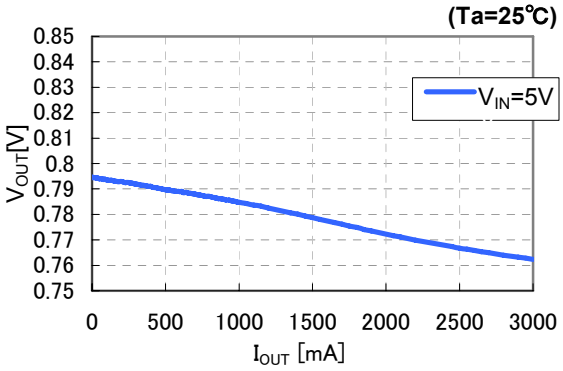


V_{OUT}:15V

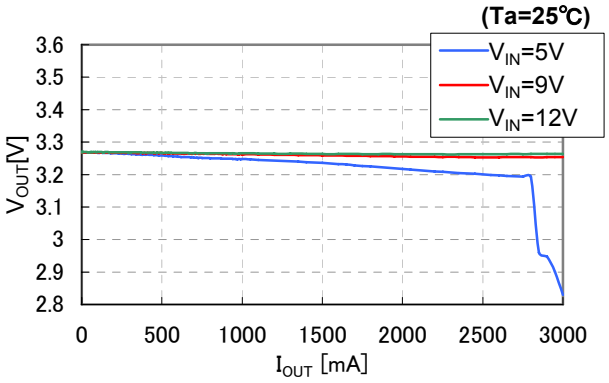


fosc=1000kHz

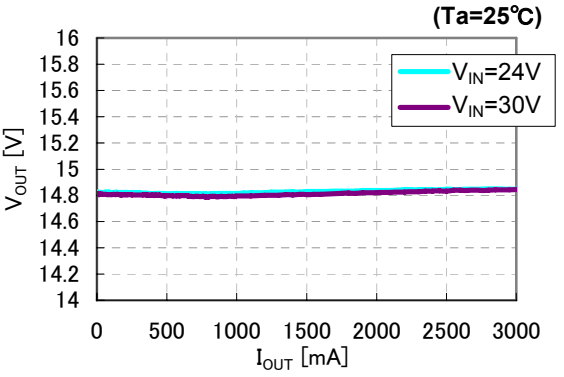
V_{OUT}:0.8V



V_{OUT}:3.3V



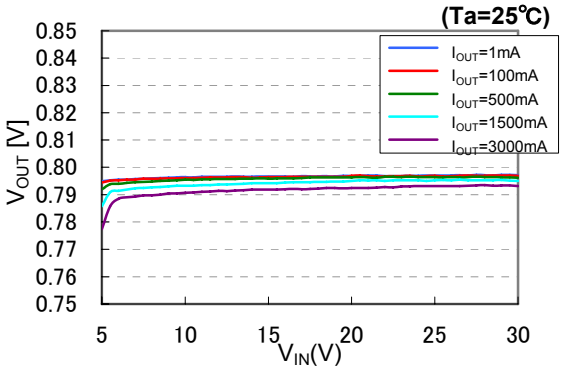
V_{OUT}:15V



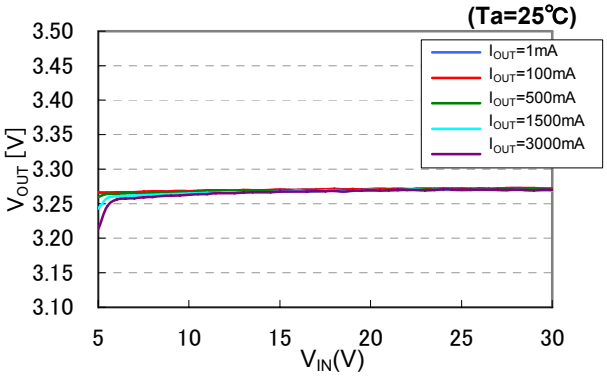
20)Line Regulation

fosc=330kHz

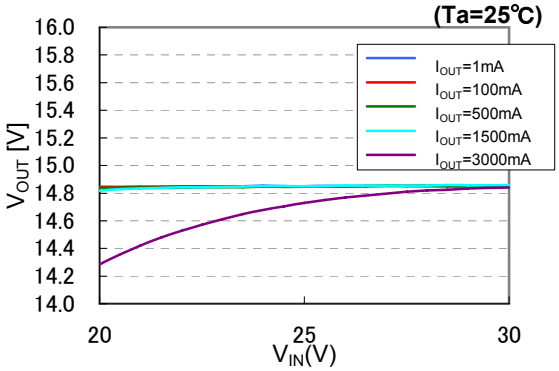
V_{OUT}:0.8V



V_{OUT}:3.3V

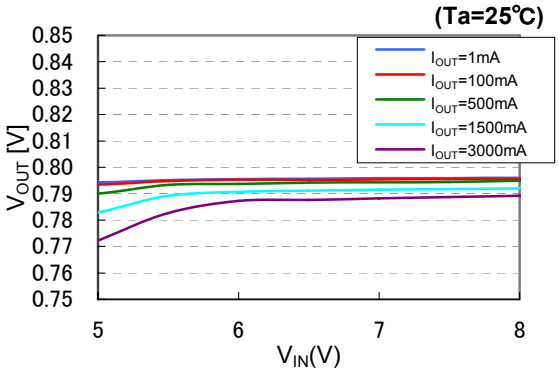


V_{OUT}:15V

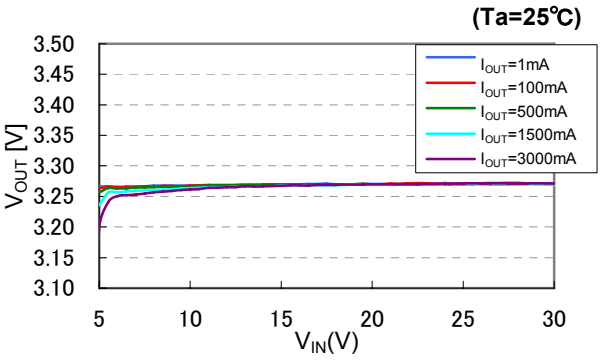


fosc=500kHz

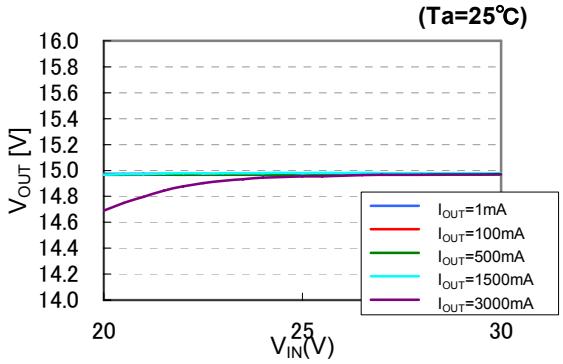
V_{OUT}:0.8V



V_{OUT}:3.3V

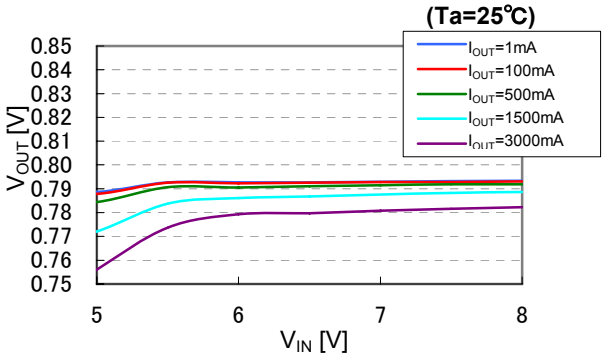


V_{OUT}:15V

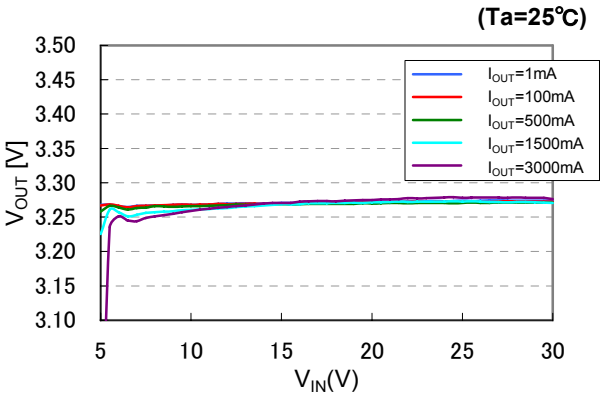


fosc=1000kHz

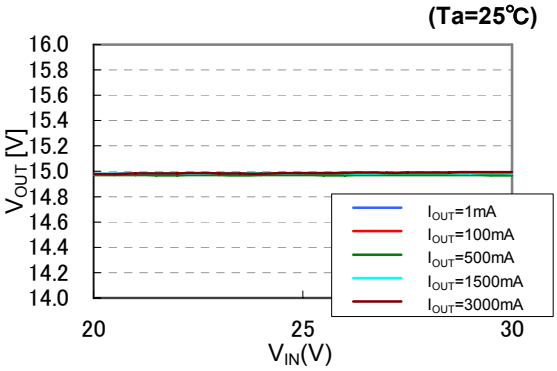
V_{OUT}:0.8V



V_{OUT}:3.3V



V_{OUT}:15V



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■Ricoh awarded ISO 14001 certification.
The Ricoh Group was awarded ISO 14001 certification, which is an international standard for environmental management systems, at both its domestic and overseas production facilities. Our current aim is to obtain ISO 14001 certification for all of our business offices.

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Ricoh completed the organization of the Lead-free production for all of our products. After Apr. 1, 2006, we will ship out the lead free products only. Thus, all products that will be shipped from now on comply with RoHS Directive.

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