R1282D002A SERIES

NO. EA-086-0502

OUTLINE

The R1282D002A is a CMOS-based 2-channel PWM Step-up (as Channel 1)/Step-down (as Channel 2) DC/DC converter controller.

The R1282D002A consists of an oscillator, a PWM control circuit, a reference voltage unit, an error amplifier, a reference current unit, a protection circuit, and an under voltage lockout (UVLO) circuit. A high efficiency Step-up/Step-down DC/DC converter can be composed of this IC with inductors, diodes, power MOSFETs, resisters, and capacitors. Each output voltage and maximum duty cycle can be adjustable with external resistors, while soft-start time can be adjustable with external capacitors and resistors.

As for a protection circuit, if Maximum duty cycle of either Step-up DC/DC converter side or Step-down DC/DC converter side is continued for a certain time, the R1280D002A latches both external drivers with their off state by its Latch-type protection circuit. Delay time for protection is internally fixed typically at 100ms. To release the protection circuit, restart with power-on (Voltage supplier is equal or less than UVLO detector threshold level).

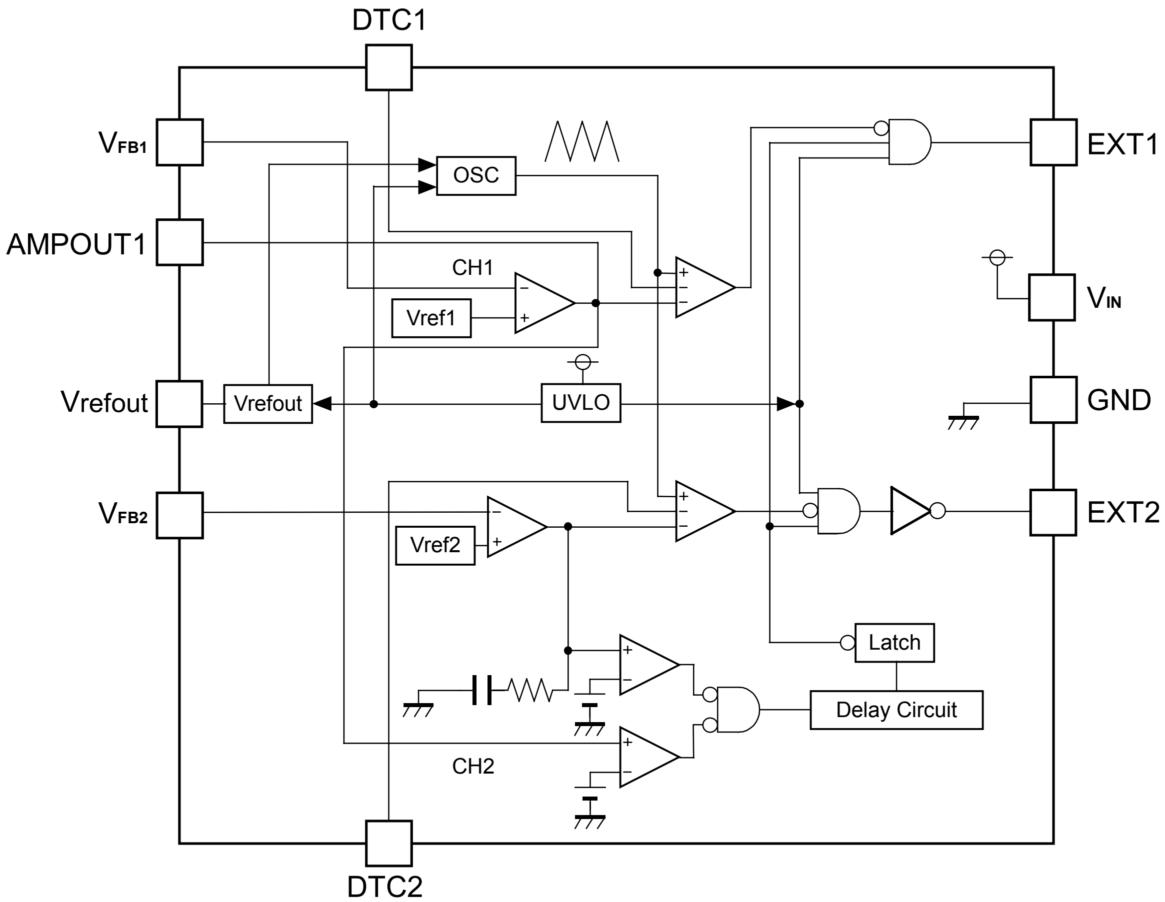
FEATURES

- Input Voltage Range ....2.5V to 5.5V
- Built-in Latch-type Protection Function by monitoring duty cycle (Fixed Delay Time Typ. 100ms)
- Oscillator Frequency..700kHz
- High Accuracy Voltage Reference ....±1.5%
- U.V.L.O. Threshold...Typ. 2.2V (Hysteresis: Typ. 0.2V)
- Small Package ....thin SON-10 (package thickness Max. 0.9mm)

APPLICATIONS

- Constant Voltage Power Source for Portable Equipment.
- Constant Voltage Power Source for LCD and CCD.

BLOCK DIAGRAM



SELECTION GUIDE

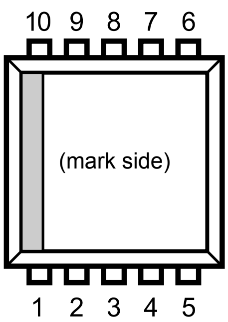
The selection can be made with designating the part number as shown below;

R1282D002A-TR ←Part Number
↑
a

Code	Contents
a	Designation of Taping Type : (Refer to Taping Specifications.)

PIN CONFIGURATION

● SON-10



PIN DESCRIPTION

Pin No	Symbol	Description
1	EXT1	External Transistor of Channel 1 Drive Pin (CMOS Output)
2	GND	Ground Pin
3	AMPOUT1	Amplifier Output Pin of Channel 1
4	DTC1	Maximum Duty Cycle of Channel 1 Setting Pin
5	V_{FB1}	Feedback pin of Channel 1
6	V_{FB2}	Feedback pin of Channel 2
7	DTC2	Maximum Duty Cycle of Channel 2 Setting Pin
8	Vrefout	Reference Output Pin
9	V_{IN}	Voltage Supply Pin of the IC
10	EXT2	External Transistor of Channel 2 Drive Pin (CMOS Output)

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	V_{IN} Pin Voltage	6.5	V
$V_{EXT1,2}$	$V_{EXT1,2}$ Pin Output Voltage	-0.3~$V_{IN}+0.3$	V
$V_{AMPOUT1}$	AMPOUT1 Pin Voltage	-0.3~$V_{IN}+0.3$	V
$V_{DTC1,2}$	DTC1,2 Pin Voltage	-0.3~$V_{IN}+0.3$	V
Vrefout	V_{REFOUT} Pin Voltage	-0.3~$V_{IN}+0.3$	V
$V_{FB1,2}$	V_{FB1},V_{FB2} Pin Voltage	-0.3~$V_{IN}+0.3$	V
$I_{EXT1,2}$	EXT1,2 Pin Output Current	± 50	mA
P_D	Power Dissipation	250	mW
Topt	Operating Temperature Range	-40 to $+85$	°C
Tstg	Storage Temperature Range	-55 to $+125$	°C

ELECTRICAL CHARACTERISTICS

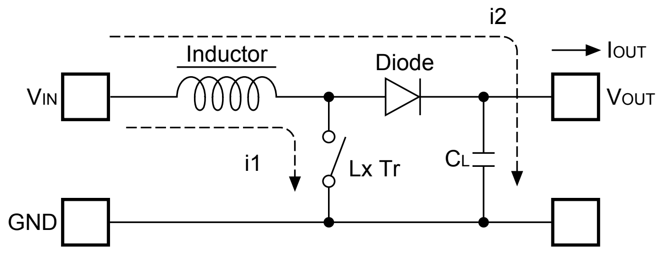
Topt=25°C

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating Input Voltage		2.5		5.5	V
V_{REFOUT}	V_{REFOUT} Voltage Tolerance	V_{IN}=3.3V, I_{OUT}=1mA	1.478	1.500	1.522	V
I_{ROUT}	V_{REFOUT} Output Current	V_{IN}=3.3V	20			mA
$\Delta V_{REFOUT}/\Delta V_{IN}$	V_{REFOUT} Line Regulation	2.5V ≦ V_{IN} ≦ 5.5V		2	6	mV
$\Delta V_{REFOUT}/\Delta I_{OUT}$	V_{REFOUT} Load Regulation	1mA ≦ I_{ROUT} ≦ 10mA V_{IN}=3.3V		6	12	mV
I_{LIM}	V_{REFOUT} Short Current Limit	V_{IN}=3.3V, V_{REFOUT}=0V		25		mA
$\Delta V_{REFOUT}/\Delta T$	V_{REFOUT} Voltage Temperature Coefficient	−40°C ≦ Topt ≦ 85°C		±150		ppm/°C
V_{FB1}	V_{FB1} Voltage	V_{IN}=3.3V	0.985	1.000	1.015	V
$\Delta V_{FB1}/\Delta T$	V_{FB1} Voltage Temperature Coefficient	−40°C ≦ Topt ≦ 85°C		±150		ppm/°C
$\Delta V_{FB2}/\Delta T$	V_{FB2} Voltage Temperature Coefficient	−40°C ≦ Topt ≦ 85°C		±150		ppm/°C
$I_{VFB1,2}$	$V_{FB1,2}$ Input Current	V_{IN}=5.5V,V_{FB1} or V_{FB2}=0V or 5.5V	−0.1		0.1	μA
f_{OSC}	Oscillator Frequency	EXT1,2 Pins at no load, V_{IN}=3.3V	595	700	805	kHz
I_{DD1}	Supply Current	V_{IN}=5.5V, EXT1,2 pins at no load		1.4	3.0	mA
R_{EXTH1}	EXT1 "H" ON Resistance	V_{IN}=3.3V, I_{EXT}=−20mA		4.0	8.0	Ω
R_{EXTL1}	EXT1 "L" ON Resistance	V_{IN}=3.3V, I_{EXT}=20mA		2.7	5.0	Ω
R_{EXTH2}	EXT2 "H" ON Resistance	V_{IN}=3.3V, I_{EXT}=−20mA		4.0	8.0	Ω
R_{EXTL2}	EXT2 "L" ON Resistance	V_{IN}=3.3V, I_{EXT}=20mA		3.7	8.0	Ω
T_{DLY}	Delay Time for Protection	V_{IN}=3.3V, V_{FB1}=1.1V→0V	60	100	140	ms
V_{UVLOD}	UVLO Detector Threshold		2.10	2.20	2.35	V
V_{UVLO}	UVLO Released Voltage			V_{UVLOD} +0.20	2.48	V
V_{DTC10}	CH1 Duty=0%	V_{IN}=3.3V	0.1	0.2	0.3	V
$V_{DTC1100}$	CH1 Duty=100%	V_{IN}=3.3V	1.1	1.2	1.3	V
V_{DTC20}	CH2 Duty=0%	V_{IN}=3.3V	0.1	0.2	0.3	V
$V_{DTC2100}$	CH2 Duty=100%	V_{IN}=3.3V	1.1	1.2	1.3	V
A_{V1}	CH1 Open Loop Gain	V_{IN}=3.3V		110		dB
F_{T1}	CH1 Single Gain Frequency Band	V_{IN}=3.3V, A_{V1}=0dB		1.9		MHz
V_{ICR1}	CH1 Input Voltage Range	V_{IN}=3.3V		0.7 to V_{IN}		V
I_{AMPL}	CH1 Sink Current	V_{IN}=3.3V, $V_{AMPOUT1}$=1.0V,V_{FB1}=V_{FB1}+ 0.1V	70	115		μA
I_{AMPH}	CH1 Source Current	V_{IN}=3.3V, $V_{AMPOUT1}$=1.0V,V_{FB1}=V_{FB1}− 0.1V		−1.4	−0.7	mA
A_{V2}	CH2 Open Loop Gain	V_{IN}=3.3V		60		dB
F_{T2}	CH2 Single Gain Frequency Band	V_{IN}=3.3V, A_{V2}=0dB		600		kHz
V_{ICR2}	CH2 Input Voltage Range	V_{IN}=3.3V		−0.2 to V_{IN}−1.3		V
V_{FB2}	CH2 Reference Voltage	V_{IN}=3.3V	0.985	1.000	1.015	V

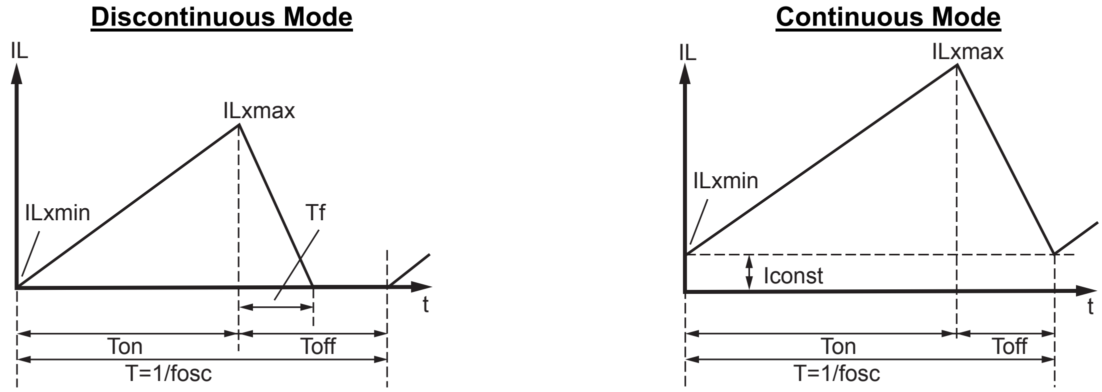
Operation of Step-up DC/DC Converter and Output Current

Step-up DC/DC Converter makes higher output voltage than input voltage by releasing the energy accumulated during on time of L_X Transistor on input voltage.

<Basic Circuit>



<Current through L>



Step 1. L_X Tr. is on, then the current IL=i1 flows, and the energy is charged in L. In proportion to the on time of L_X Tr. (Ton), IL=i1 increases from IL=IL_Xmin=0 and reaches IL_Xmax.

Step 2. When the L_X Tr. is off, L turns on Schottky Diode (SD), and IL=i2 flows to maintain IL=IL_Xmax.

Step 3. IL=i2 gradually decreases, and after Tf passes, IL=IL_Xmin=0 is true, then SD turns off. Note that in the case of the continuous mode, before IL=IL_Xmin=0 is true, Toff passes, and the next cycle starts, then L_X Tr. turns on again.
In this case, IL_Xmin>0, therefore IL=IL_Xmin>0 is another starting point and IL_X max increases.

With the PWM controller, switching times during the time unit are fixed. By controlling T_{on}, output voltage is maintained.

Output Current and Selection of External Components

Output Current of Step-up Circuit and External Components

There are two modes, or discontinuous mode and continuous mode for the PWM step-up switching regulator depending on the continuous characteristic of inductor current.

During on time of the transistor, when the voltage added on to the inductor is described as V_{IN}, the current is $V_{IN} \times t/L$.

Therefore, the electric power, P_{ON}, which is supplied with input side, can be described as in next formula.

$$P_{ON} = \int_0^{Ton} V_{IN}^2 \times t/L \; dt \quad \text{.......... Formula 1}$$

With the step-up circuit, electric power is supplied from power source also during off time. In this case, input current is described as $(V_{OUT}-V_{IN}) \times t/L$, therefore electric power, P_{OFF} is described as in next formula.

$$P_{OFF} = \int_0^{Tf} V_{IN} \times (V_{OUT} - V_{IN}) t/L \; dt \quad \text{.......... Formula 2}$$

In this formula, Tf means the time of which the energy saved in the inductance is being emitted. Thus average electric power, P_{AV} is described as in the next formula.

$$P_{AV} = 1/(Ton + Toff) \times \{\int_0^{Ton} V_{IN}^2 \times t/L \; dt + \int_0^{Tf} V_{IN} \times (V_{OUT} - V_{IN}) t/L \; dt\} \quad \text{.......... Formula 3}$$

In PWM control, when Tf=Toff is true, the inductor current becomes continuos, then the operation of switching regulator becomes continuous mode.

In the continuous mode, the deviation of the current is equal between on time and off time.

$$V_{IN} \times Ton/L = (V_{OUT}-V_{IN}) \times Toff/L \quad \text{.......... Formula 4}$$

Further, the electric power, P_{AV} is equal to output electric power, $V_{OUT} \times I_{OUT}$, thus,

$$I_{OUT} = f_{OSC} \times V_{IN}^2 \times Ton^2/\{2 \times L \times (V_{OUT}-V_{IN})\} = V_{IN}^2 \times Ton/(2 \times L \times V_{OUT}) \quad \text{.......... Formula 5}$$

When I_{OUT} becomes more than $V_{IN} \times Ton \times Toff/(2 \times L \times (Ton+Toff))$, the current flows through the inductor, then the mode becomes continuous. The continuous current through the inductor is described as

Iconst, then,

$$I_{OUT} = f_{OSC} \times V_{IN}^2 \times Ton^2/(2 \times L \times (V_{OUT}-V_{IN})) + V_{IN} \times Iconst/V_{OUT} \quad \text{.......... Formula 6}$$

In this moment, the peak current, $IL_x max$ flowing through the inductor and the driver Tr. is described as follows:

$IL_x max = Iconst + V_{IN} \times Ton/L$ .... Formula 7

With the formula 4,6, and $IL_x max$ is,

$IL_x max = V_{OUT}/V_{IN} \times I_{OUT} + V_{IN} \times Ton/(2 \times L)$ .... Formula 8

Therefore, peak current is more than I_{OUT}. Considering the value of $IL_x max$, the condition of input and output, and external components should be selected.

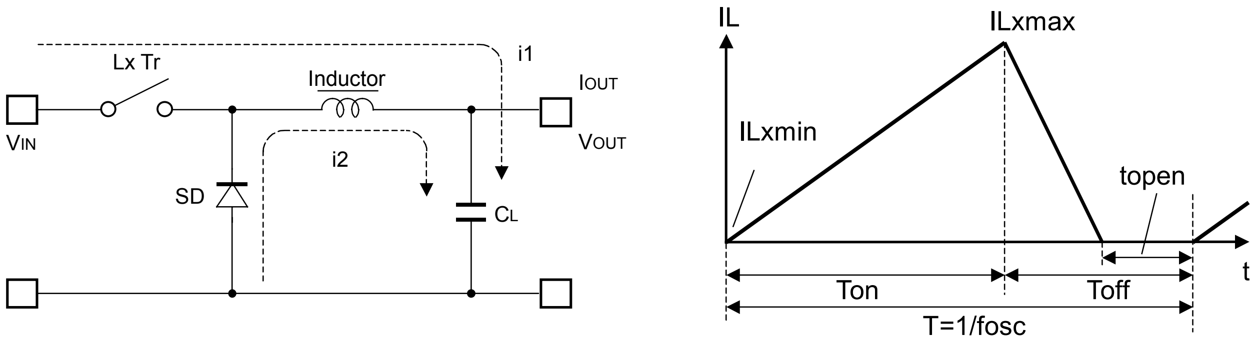
In the formula 7, peak current $IL_x max$ at discontinuous mode can be calculated. Put $Iconst = 0$ in the formula.

The explanation above is based on the ideal calculation, and the loss caused by L_X switch and external components is not included. The actual maximum output current is between 50% and 80% of the calculation. Especially, when the IL_X is large, or V_{IN} is low, the loss of V_{IN} is generated with the on resistance of the switch. As for V_{OUT}, Vf (as much as 0.3V) of the diode should be considered.

Operation of Inverting DC/DC converter and Output Current

The step-down DC/DC converter charges energy in the inductor when Lx transistor is ON, and discharges the energy from the inductor when Lx 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 Circuits>



Step 1. Lx Tr. turns on and current IL (=i1) flows, and energy is charged into CL. At this moment, IL increases from ILmin. (=0) to reach ILmax. in proportion to the on-time period(ton) of LX Tr.

Step 2. When Lx Tr. turns off, Schottky diode (SD) turns on in order that L maintains IL at ILmax, and current IL (=i2) flows.

Step 3. IL decreases gradually and reaches ILmin. after a time period of topen, and SD turns off, provided that in the continuous mode, next cycle starts before IL becomes to 0 because toff time is not enough. In this case, IL value is from this ILmin (>0).

In the case of PWM control system, the output voltage is maintained by controlling the on-time period (ton), with the oscillator frequency (fosc) being maintained constant.

Discontinuous Conduction Mode and Continuous Conduction Mode

The maximum value (ILmax) and the minimum value (ILmin) current which flow through the inductor is the same as those when Lx Tr. is ON and when it is OFF.

The difference between ILmax and ILmin, which is represented by ΔI;

$\Delta I = ILmax - ILmin = V_{OUT} \times topen / L = (V_{IN} - V_{OUT}) \times ton/L$ ･･･Equation A

wherein, $T = 1/fosc = ton + toff$

$duty (\%) = ton/T \times 100 = ton \times fosc \times 100$

$topen \leqq toff$

In Equation A, $V_{OUT} \times topen/L$ and $(V_{IN} - V_{OUT}) \times ton/L$ are respectively shown the change of the current at ON, and the change of the current at OFF.

When the output current (I_{OUT}) is relatively small, topen < toff as illustrated in the above diagram. In this case, the energy is charged in the inductor during the time period of ton and is discharged in its entirely during the time period of toff, therefore ILmin becomes to zero (ILmin=0). When Iout is gradually increased, eventually, topen becomes to toff (topen=toff), and when I_{OUT} is further increased, ILmin becomes larger than zero (ILmin>0). The former mode is referred to as the discontinuous mode and the latter mode is referred to as continuous mode.

In the continuous mode, when Equation A is solved for ton and assumed that the solution is tonc,

$tonc = T \times V_{OUT}/V_{IN}$ ･･･ Equation B

When ton<tonc, the mode is the discontinuous mode, and when ton=tonc, the mode is the continuous mode.

Output Current and Selection of External Components

There are also two modes, or discontinuous mode and continuous mode for the PWM step-down switching regulator depending on the continuous characteristic of inductor current.

During on time of the transistor, when the voltage added on to the inductor is described as $V_{IN}- V_{OUT}$ the current is $(V_{IN}- V_{OUT}) \times t/L$.

Therefore, the electric power, P, which is supplied from the input side, can be described as in next formula.

$$P=\int_0^{Ton} V_{IN} \cdot (V_{IN}-V_{OUT}) \cdot t/ L\, dt \quad \text{Formula 9}$$

Thus average electric power in one cycle, P_{AV} is described as in the next formula.

$$P_{AV} = 1/(Ton+Toff) \int_0^{Ton} V_{IN} \cdot (V_{IN}-V_{OUT}) \cdot t/ L\, dt = V_{IN} \cdot (V_{IN}-V_{OUT}) \cdot Ton^2 / (2 \cdot L\,(Ton+Toff)) \quad \text{Formula 10}$$

This electric power P_{AV} equals to output electric power $V_{OUT} \times I_{OUT}$, thus,

$$I_{OUT} = V_{IN} / V_{OUT} \times (V_{IN} - V_{OUT})´Ton^2/(2 \times L \times (Ton+Toff)) \quad \text{Formula 11}$$

When I_{OUT} increases and the current flows through the inductor continuously, then the mode becomes continuous. In the continuous mode, the deviation of the current equals between Ton and Toff, therefore,

$$(V_{IN}- V_{OUT}) \times Ton/L=V_{OUT} \times Toff/L \quad \text{Formula 12}$$

In this moment, the current flowing continuously through L, is assumed as Iconst, I_{OUT} is described as in the next formula:

$$I_{OUT}=I_{CONST}+V_{OUT} \times Toff /(2 \times L) \quad \text{Formula 13}$$

In this moment, the peak current, $IL_x max$ flowing through the inductor and the driver Tr. is described as follows:

$$IL_x max= I_{OUT} +V_{OUT} \times Toff/(2 \times L) \quad \text{Formula 14}$$

With the formula 12,13, ILxmax is,

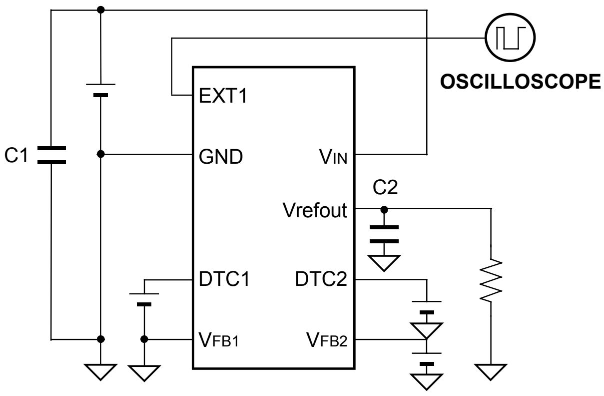
$$Toff=(1-V_{OUT}/V_{IN})/fosc \quad \text{Formula 15}$$

Therefore, peak current is more than I_{OUT}. Considering the value of ILXmax, the condition of input and output, and external components should be selected.

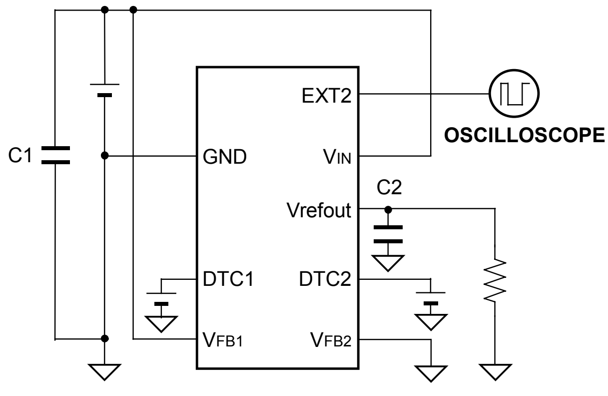
In the formula 14, peak current ILXmax at discontinuous mode can be calculated. Put Iconst=0 in the formula.

The explanation above is based on the ideal calculation, and the loss caused by L_X switch and external components is not included.

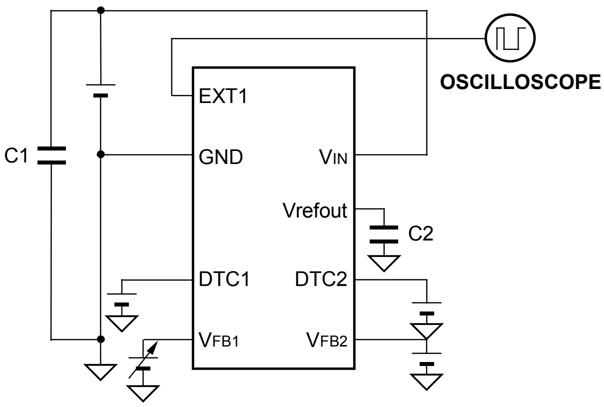
TEST CIRCUITS



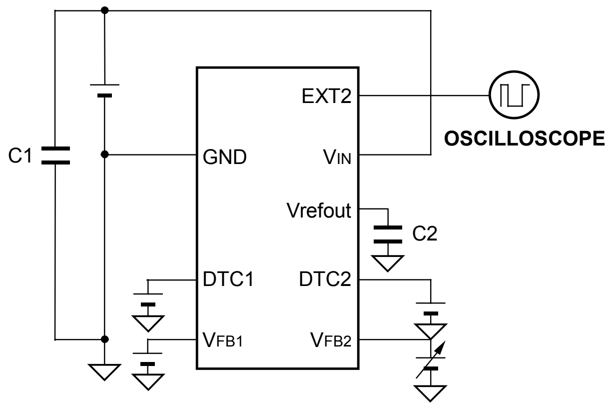
Test Circuit 1



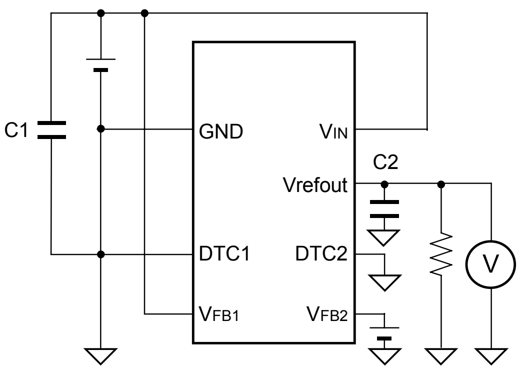
Test Circuit 2



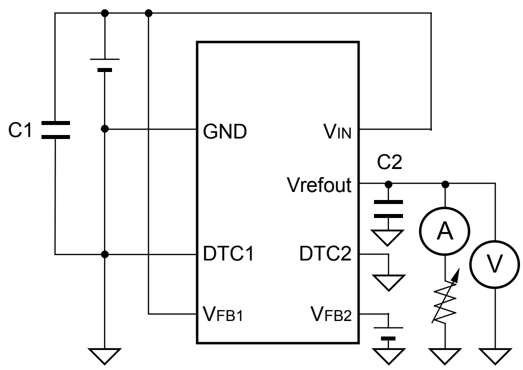
Test Circuit 3



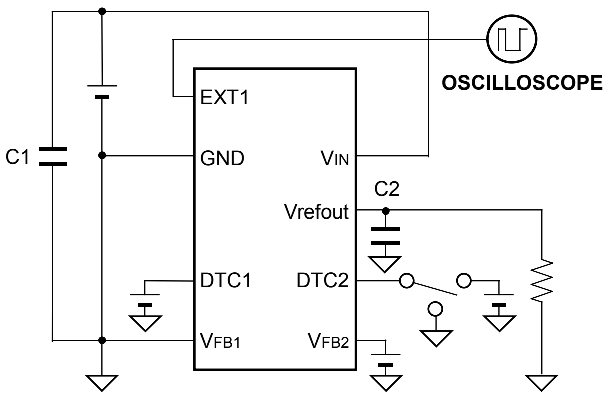
Test Circuit 4



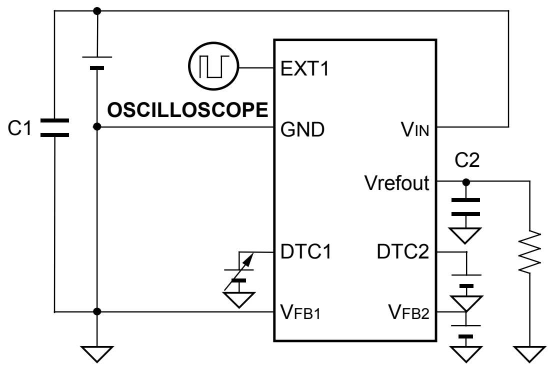
Test Circuit 5



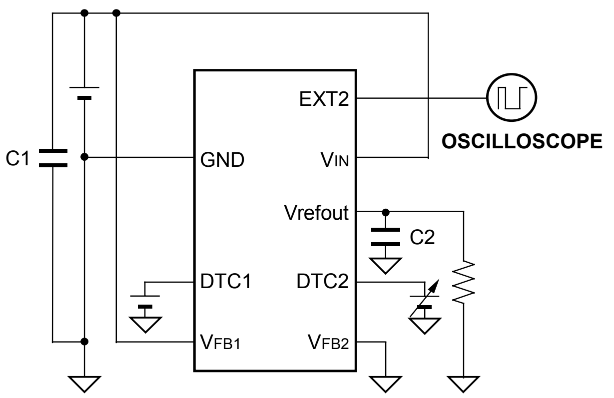
Test Circuit 6



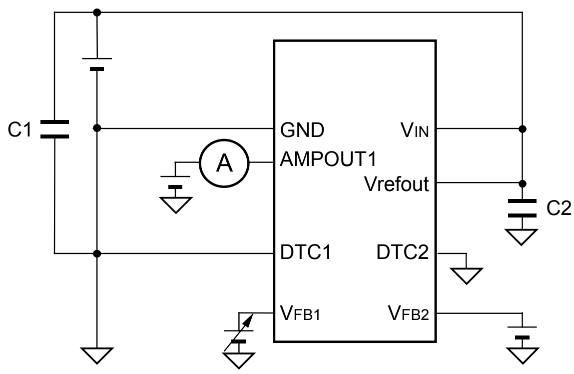
Test Circuit 7



Test Circuit 8



Test Circuit 9



Test Circuit 10

Typical Characteristics shown in the following pages are obtained with test circuits shown above.

Test Circuit 1,2 :	Typical Characteristic 4)
Test Circuit 3 :	Typical Characteristic 5)
Test Circuit 4 :	Typical Characteristic 5)
Test Circuit 5 :	Typical Characteristic 6)
Test Circuit 6 :	Typical Characteristics 7) 8)
Test Circuit 7 :	Typical Characteristic 9)
Test Circuit 8 :	Typical Characteristic 10)
Test Circuit 9 :	Typical Characteristics 10)
Test Circuit 10 :	Typical Characteristics 11) 12)

Note) Capacitors' values of test circuits
Capacitors: Ceramic Type:
C1=4.7μF, C2=1.0μF

Efficiency η(%) can be calculated with the next formula:

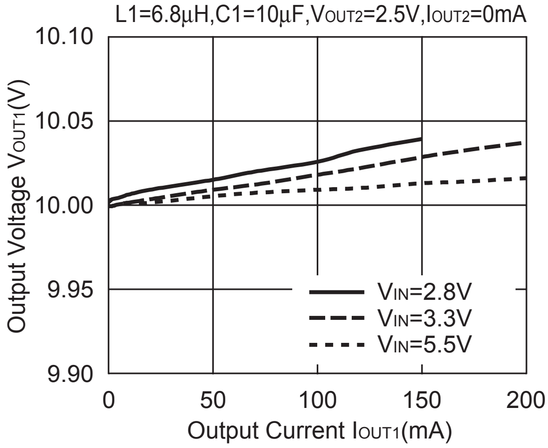
$\eta = (V_{OUT1} \times I_{OUT1} + V_{OUT2} \times I_{OUT2}) / (V_{IN} \times I_{IN}) \times 100$

TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current (Topt=25°C)

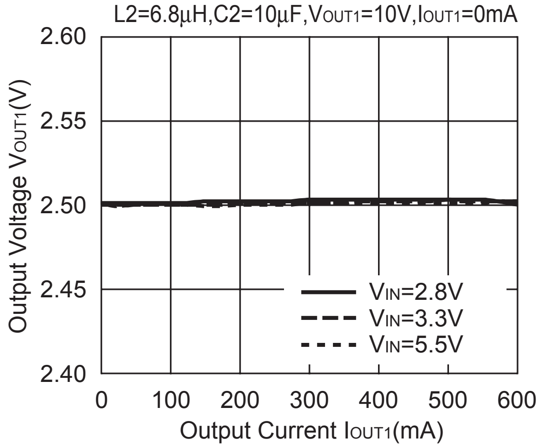
R1282D002A

L1=6.8μH,C1=10μF,VOUT2=2.5V,IOUT2=0mA



R1282D002A

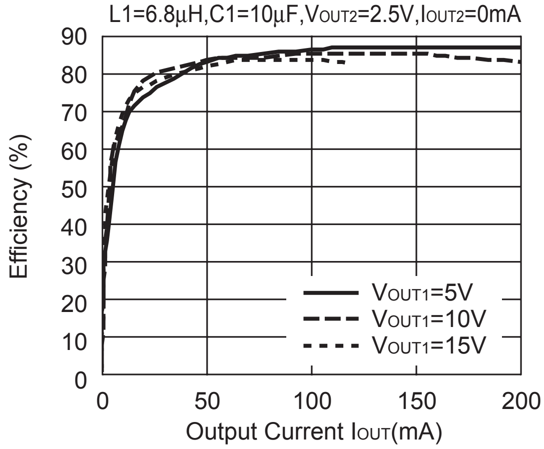
L2=6.8μH,C2=10μF,VOUT1=10V,IOUT1=0mA



2) Efficiency vs. Output Current (VIN=3.3V, Topt=25°C)

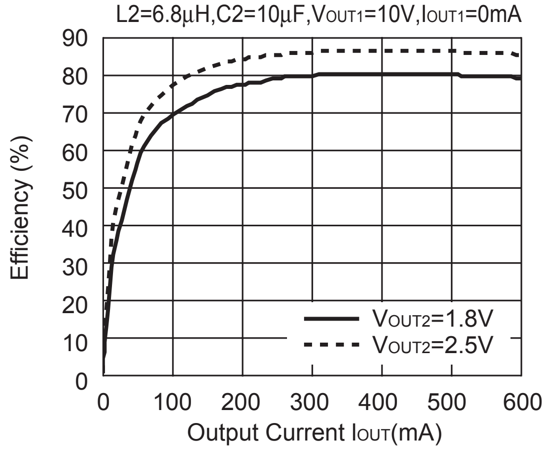
R1282D002A

L1=6.8μH,C1=10μF,VOUT2=2.5V,IOUT2=0mA



R1282D002A

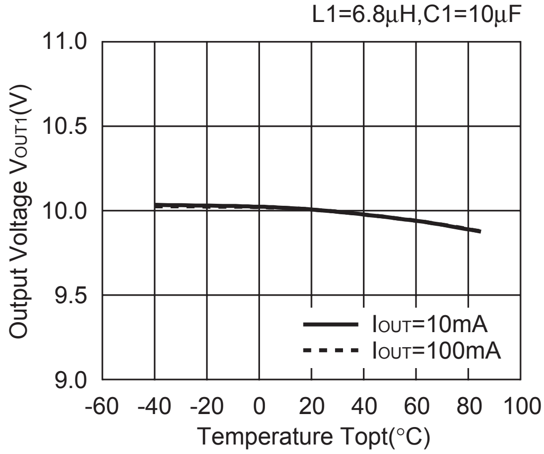
L2=6.8μH,C2=10μF,VOUT1=10V,IOUT1=0mA



3) Output Voltage vs. Temperature (VIN=3.3V)

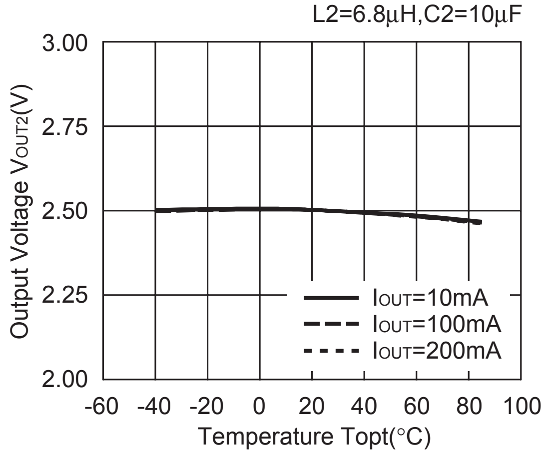
R1282D002A

L1=6.8μH,C1=10μF

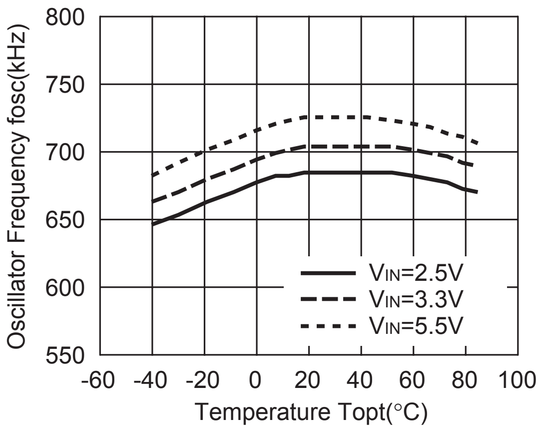


R1282D002A

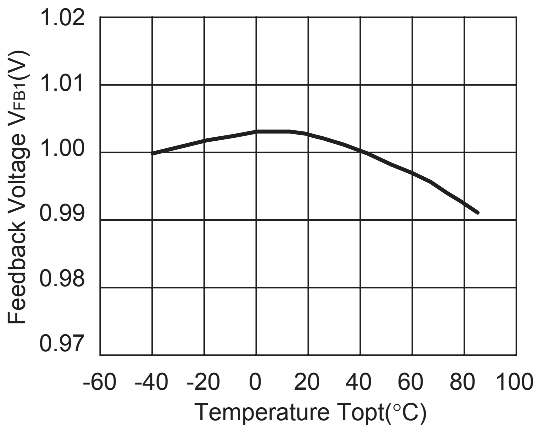
L2=6.8μH,C2=10μF

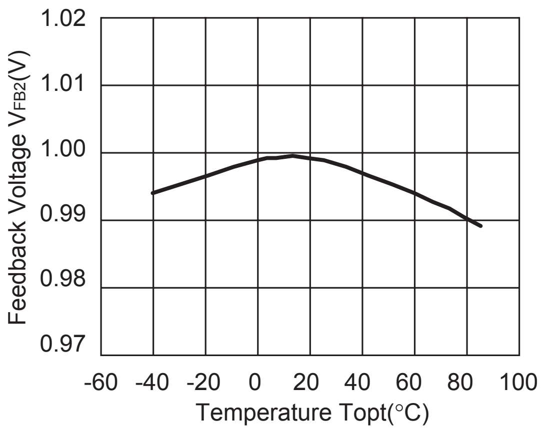


4) Frequency vs. Temperature

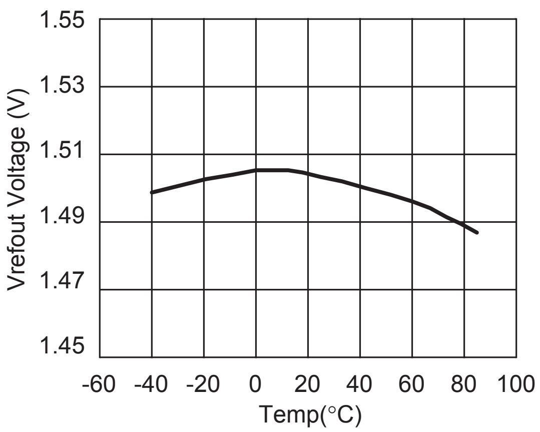


5) Feedback Voltage vs. Temperature (VIN=3.3V)

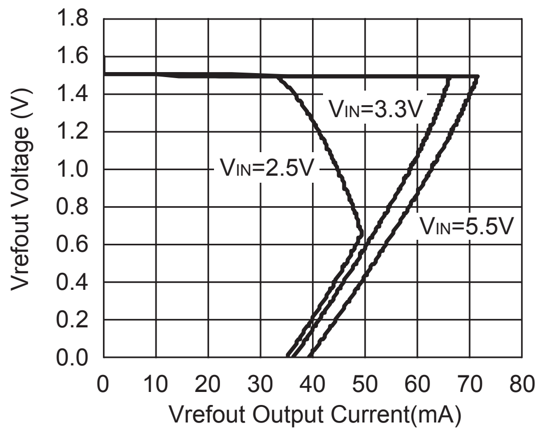




6) Vrefout Voltage vs. Temperature(VIN=3.3V)

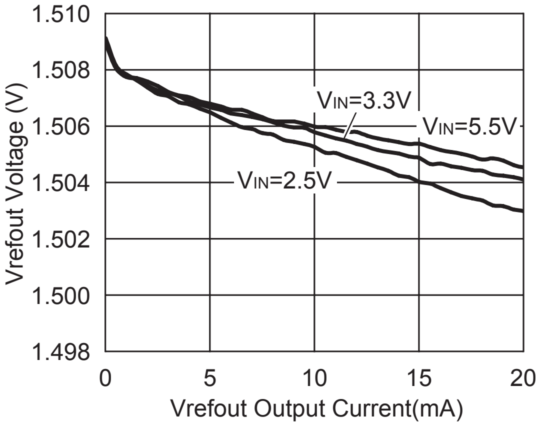


7) Vrefout Output Voltage vs. Output Current



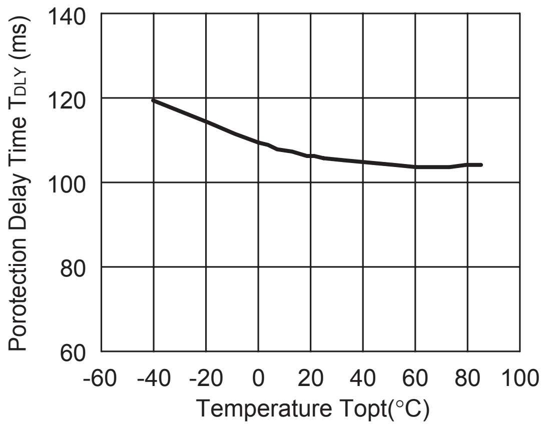
8) Vrefout Output Voltage vs. Output Current

R1282D002A



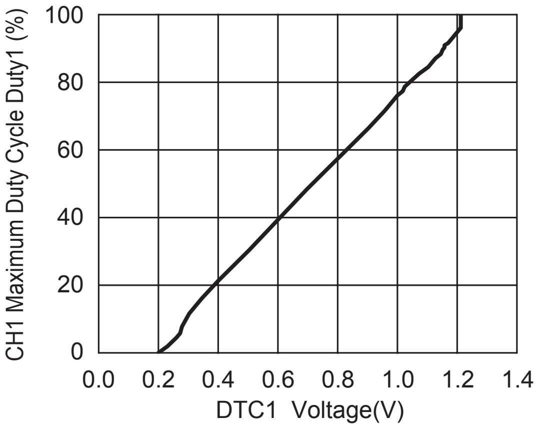
9) Protection Delay Time vs. Temperature (VIN=3.3V)

R1282D002A

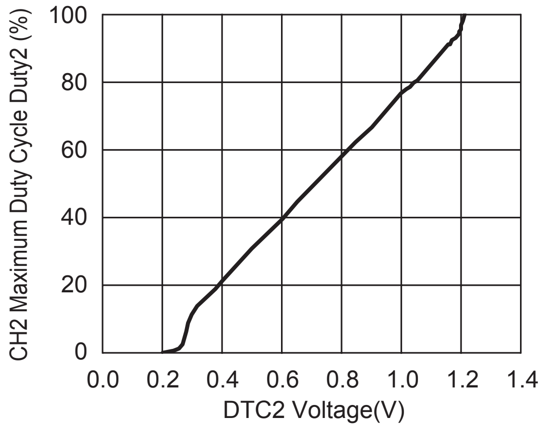


10) Maximum Duty Cycle vs. DTC Voltage (VIN=3.3V)

R1282D002A

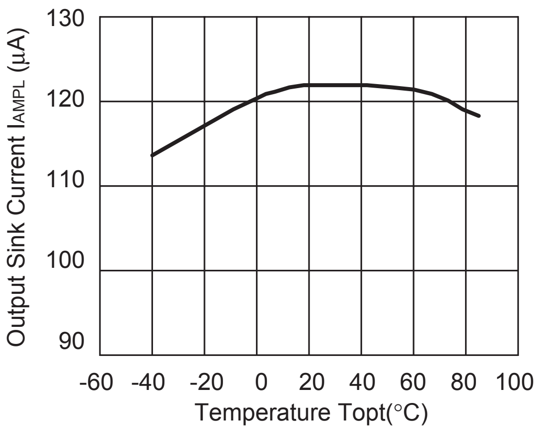


R1282D002A



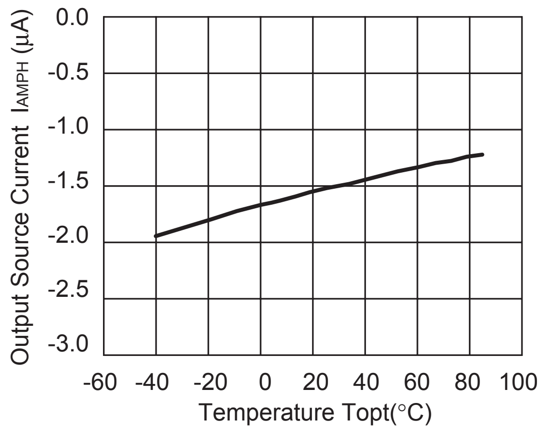
11) Output Sink Current vs. Temperature (VIN=3.3V)

R1282D002A

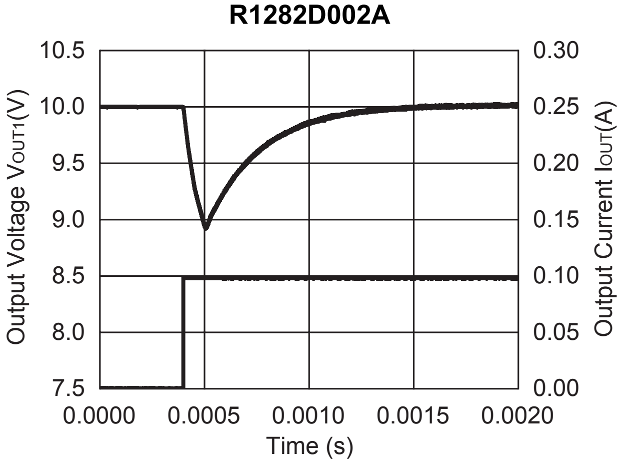


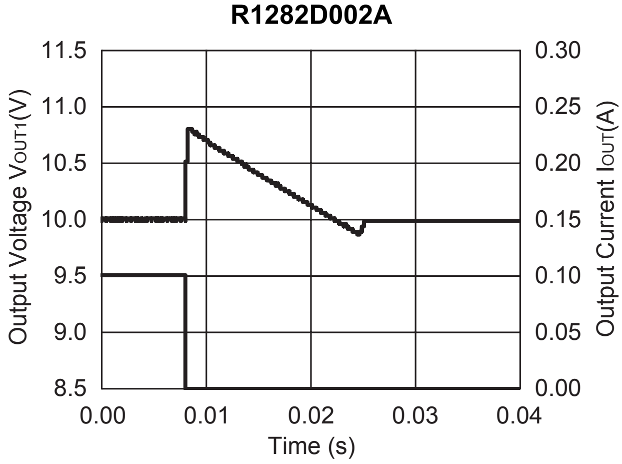
12) Output Source Current vs. Temperature

R1282D002A

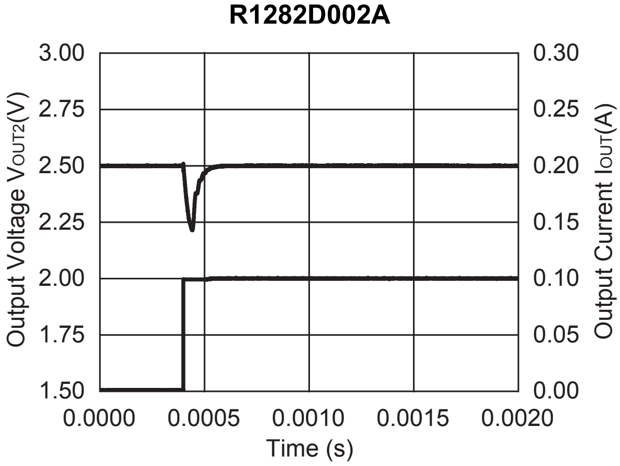


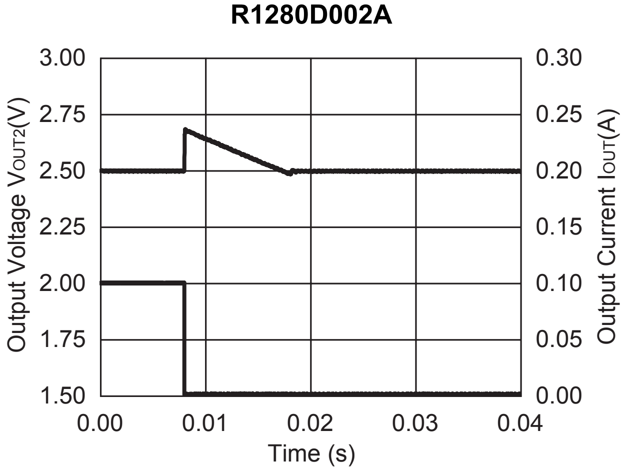
13) Load Transient Response (Step-up Side) VIN=3.3V, L1=6.8μH



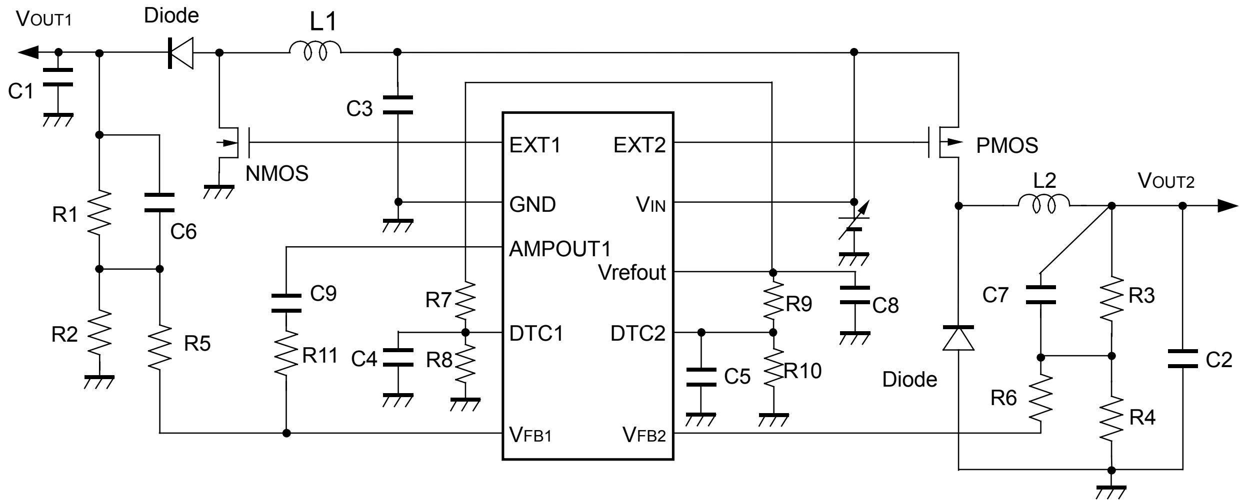


14) Load Transient Response (Step-down Side) VIN=3.3V, L2=6.8μH





TYPICAL APPLICATION AND TECHNICAL NOTES



Components examples

Inductor L1,2	6.8μH LDR655312T (TDK)
Diode	FS1J3 (Origin Electronics)
PMOS	Si3443DV (Siliconix)
NMOS	IRF7601 (International Rectifier)

Resistance As setting resistors total value for the output voltage, R1+R2, R3+R4 recommendation value is 100kW or less.

R1=47kΩ	R2=5.1kΩ	R3=30kΩ	R4=20kΩ
R5=43kΩ	R6=10kWΩ		
R7=R9=22kΩ	R8=R10=43kΩ	R11=220kΩ	

Capacitors Ceramic Type

C1=C2=10μF	C3=4.7μF	C4=0.22μF	C5=0.47μF	C6=120pF
C7=50pF	C8=1μF	C9=1000pF		

Note) Consider the ratings of external components including voltage tolerance. With the transistor in the circuit above, V_{OUT}=15V is the voltage setting limit.

EXTERNAL COMPONENTS

1. How to set the output voltages
   As for step-up side, feedback (V_{FB1}) pin voltage is controlled to maintain 1V, therefore,

   V_{OUT1}: R1+R2=V_{FB1}: R2

   Thus, $V_{OUT1}=V_{FB1}\times(R1+R2)/R2$
   Output Voltage is adjustable with R1 and R2.
   As for Step-down side, Feedback (V_{FB2}) pin voltage follows the next formula,

   V_{OUT2}: R3+R4=V_{FB2} : R4

   Thus, $V_{OUT2}=V_{FB2}\times(R3+R4)/R4$
   Output Voltage is adjustable with R3 and R4.

2. How to set Soft-Start Time and Maximum Duty Cycle
   Soft-start time is adjustable with connecting resistors and a capacitor to DTC pin.
   Soft starting time, T_{SS1} and T_{SS2} are adjustable. Soft-start time can be set with the time constant of RC.
   Soft-start time can be described as in next formula.

   $T_{SS1}\cong RO1\times C4$

   If R10=0Ω, then,

   $T_{SS2}\cong R9\times C5\times \ln((Vrefout-V_{DTC2})/Vrefout)$

   Maximum Duty Cycle is set with the voltage to DTC1 and DTC2.
   Maximum duty cycle is described as follows;
   CH1 (Step-up side)
   Maxduty1$\cong$ (R8/(R7+R8) $\times$Vrefout–0.2)/(1.2–0.2) $\times$100 (%)
   Step-up side maximum duty cycle should be set equal or less than 90%. If the maximum duty cycle is set at high percentage, operation will be unstable.

TECHNICAL NOTES on EXTERNAL COMPONENTS

- External components should be set as close to this IC as possible. Especially, wiring of the capacitor connected to V_{IN} pin should be as short as possible.
- Enforce the ground wire. Large current caused by switching operation flows through GND pin. If the impedance of ground wire is high, internal voltage level of this IC might fluctuate and operation could be unstable.
- Recommended capacitance value of C3 is equal or more than 4.7μF.
- If the spike noise of V_{OUT1} is too large, the noise is feedback from V_{FB1} pin and operation might be unstable. In that case, use the resistor ranging from 10kΩ to 50kΩ as R5 and try to reduce the noise level. In the case of V_{OUT2}, use the resistor as much as 10kΩ as R6.
- Select an inductor with low D.C. current, large permissible current, and uneasy to cause magnetic saturation. If the inductance value is too small, I_{LX} might be beyond the absolute maximum rating at the maximum load.
- Select a Schottky diode with fast switching speed and large enough permissible current.
- Recommended capacitance value of C1 and C2 is as much as Ceramic 10μF. In case that the operation with the system of DC/DC converter would be unstable, add a series resister less than 0.5Ω to each output capacitor or use tantalum capacitors with appropriate ESR. If you choose too large ESR, ripple noise may be forced to V_{FB1} and V_{FB2}, and unstable operation may result. Use a capacitor with fully large voltage tolerance of the capacitor.
- this IC, for the test efficiency, latch release function is included. By forcing (V_{IN}–0.3)V or more voltage to DTC1 pin or DTC2 pin, Latch release function works.
- Performance of the power controller with using this IC depends on external components. Each component, layout should not be beyond each absolute maximum rating such as voltage, current, and power dissipation.