

600mA Step-down DC/DC Converter with Synchronous Rectifier

NO.EA-305-180529

OUTLINE

The RP507K001B is a CMOS-based 600mA⁽¹⁾ step-down DC/DC converter with synchronous rectifier. Internally, a single converter consists of an oscillator, a reference voltage unit, an error amplifier, a switching control circuit, a soft-start circuit, an under voltage lockout (UVLO) circuit, an over current protection circuit, a thermal shutdown circuit and switching transistors.

Replacing diodes with built-in switching transistors improves the efficiency of rectification. Therefore, by simply using an inductor, resistors and capacitors as the external components, a low ripple high efficiency synchronous rectifier step-down DC/DC converter can be easily configured.

The RP507K001B has an over current protection circuit which supervises the inductor peak current in each switching cycle, and turns the high-side driver off if the current exceeds the Lx current limit. The RP507K001B also contains a thermal shutdown circuit which detects overheating of the converter and stops the converter operation to protect it from damage if the junction temperature exceeds the specified temperature.

The RP507K001B is PWM/VFM auto switching control in which mode automatically switches from PWM mode to high-efficiency VFM mode in low output current.

The RP507K001B is available in DFN(PLP)1616-6D package which achieves high-density mounting on boards. For an input capacitor (C_{IN}) and an output capacitor (C_{OUT}), the smaller sized 0402/1005 (inch/ mm) capacitor can be used. Output voltage is adjustable with external divider resistors.

FEATURES

- Input Voltage Range 2.3V to 5.5V (Absolute maximum rating: 6.5V)
- Output Voltage Range 0.7V to 5.5V
(Note: As for 1.0V or less, input voltage range is limited.)
- Feedback Voltage Accuracy $\pm 9\text{mV}$ ($V_{\text{FB}}=0.6\text{V}$)
- Temperature-Drift Coefficient of Feedback Voltage
..... Typ. $\pm 100\text{ppm}/^\circ\text{C}$
- Oscillator Frequency Typ. 2.0MHz
- Maximum Duty Cycle 100%
- Built-in Driver ON Resistance Typ. Pch. 0.38Ω , Nch. 0.3Ω ($V_{\text{IN}}=3.6\text{V}$)
- Supply Current (at no load) Typ. $34\mu\text{A}$
- Standby Current Max. $5\mu\text{A}$
- UVLO Detector Threshold Typ. 2.0V
- Soft-start Time Typ. $150\mu\text{s}$
- Lx Current Limit Circuit Typ. 1A
- Package DFN(PLP)1616-6D

⁽¹⁾ This is an approximate value, because output current depends on conditions and external components.

RP507K001B

NO.EA-305-180529

APPLICATIONS

- Power source for portable equipment such as cellular, PDA, DSC, Notebook PC, smartphone
- Power source for Li-ion battery-used equipment

SELECTION GUIDE

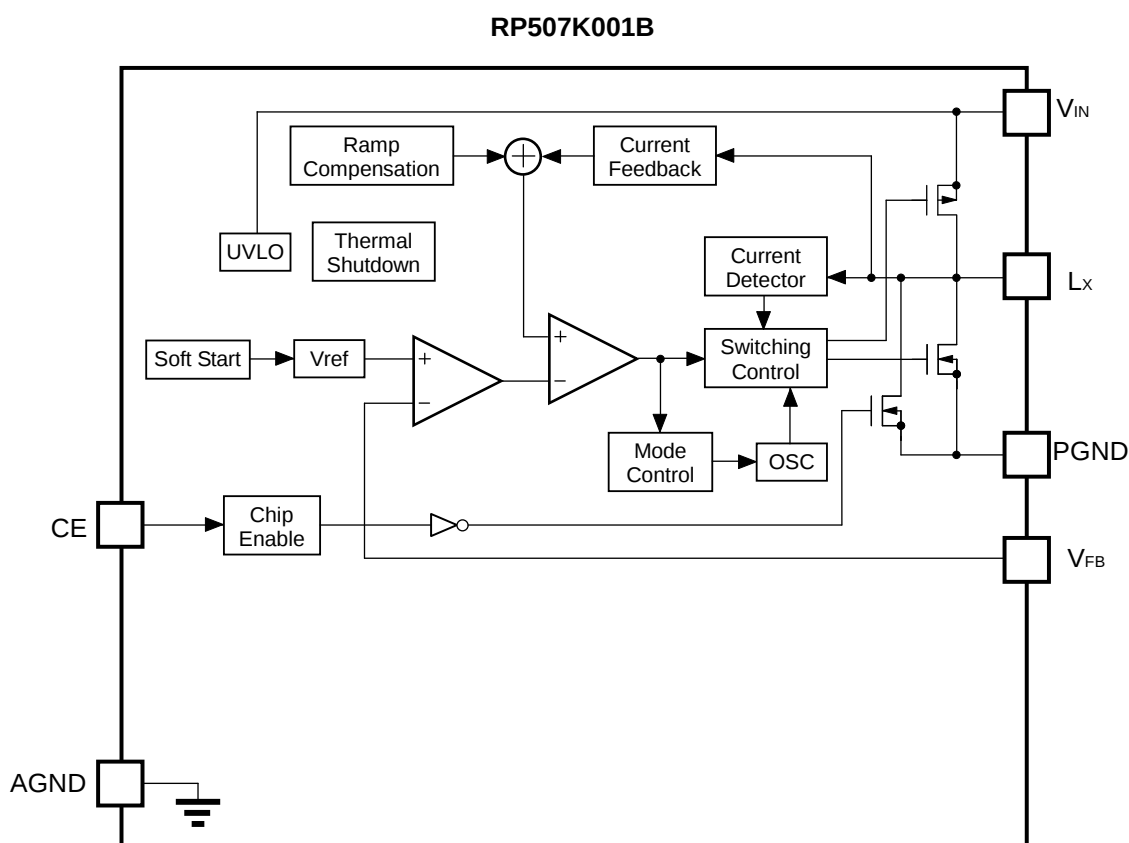
Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
RP507K001B-TR	DFN(PLP)1616-6D	5,000pcs	Yes	Yes

Output voltage (V_{SET}) is adjustable with external divider resistors.

Recommended output voltage range is from 0.7V to 5.5V.

RP507K001B has an auto-discharge function⁽¹⁾.

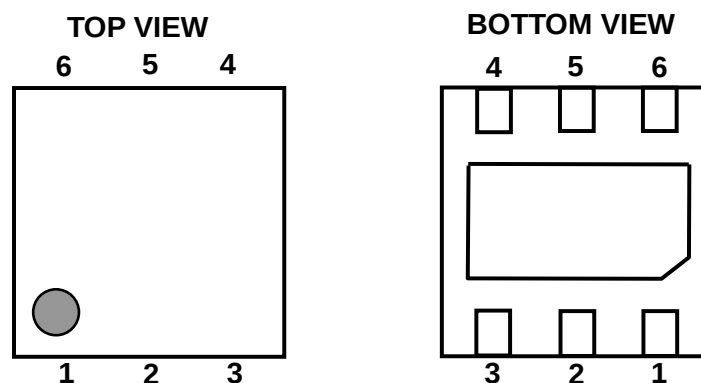
BLOCK DIAGRAMS



⁽¹⁾ Auto-discharge function quickly lowers the output voltage to 0V, when the chip enable signal is switched from the active mode to the standby mode, by releasing the electrical charge accumulated in the external capacitor.

PIN DESCRIPTIONS

• DFN(PLP)1616-6D



RP507K: DFN(PLP)1616-6D

Pin No.	Symbol	Description
1	CE	Chip Enable Pin ("H" Active)
2	AGND	Ground Pin ⁽¹⁾
3	PGND	Ground Pin ⁽¹⁾
4	L _x	L _x Switching Pin
5	V _{IN}	Input Pin
6	V _{FB}	Feedback Pin

The exposed tab on the bottom of the package enhances thermal performance and is electrically connected to GND (substrate level). It is recommended that the exposed tab be connected to the ground plane on the board or otherwise be left open.

⁽¹⁾ No.2 pin and No.3 pin must be wired to the GND plane when mounting on boards.

ABSOLUTE MAXIMUM RATINGS

Absolute Maximum Ratings

(AGND=PGND=0V)

Symbol	Item	Rating	Unit
V_{IN}	V_{IN} Input Voltage	-0.3 to 6.5	V
V_{LX}	L_x Pin Voltage	-0.3 to $V_{IN} + 0.3$	V
V_{CE}	CE Pin Input Voltage	-0.3 to 6.5	V
V_{FB}	V_{FB} Pin Voltage	-0.3 to 6.5	V
I_{LX}	L_x Pin Output Current	1	A
P_D	Power Dissipation ⁽¹⁾ (DFN(PLP)1616-6D, JEDEC STD. 51-7)	1580	mW
T_j	Junction Temperature	-40 to 125	°C
T_{stg}	Storage Temperature Range	-55 to 125	°C

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 are not assured.

RECOMMENDED OPERATING CONDITIONS

Recommended Operating Conditions

Symbol	Item		Rating	Unit
V_{IN}	Input Voltage	$1.0V \leq V_{SET}^{(2)}$	2.3 to 5.5	V
		$0.9V \leq V_{SET} < 1.0V$	2.3 to 5.25	
		$0.7V \leq V_{SET} < 0.9V$	2.3 to 4.5	
T_a	Operating Temperature Range		-40 to 85	°C

RECOMMENDED OPERATING CONDITIONS

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 ratings by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

⁽¹⁾ Refer to *POWER DISSIPATION* for detailed information.

⁽²⁾ V_{SET} = Set Output Voltage

ELECTRICAL CHARACTERISTICS

● RP507K001B

(Ta=25°C)

Symbol	Item	Conditions	Min.	Typ.	Max.	Unit
V _{FB}	Feedback Output Voltage	V _{IN} =V _{CE} =3.6V	0.591	0.600	0.609	V
ΔV _{FB} /ΔT	Feedback Output Voltage Temperature Coefficient	-40°C ≤ Ta ≤ 85°C		±100		ppm/°C
f _{osc}	Oscillator Frequency	V _{IN} =V _{CE} =3.6V (V _{SET} ⁽¹⁾ ≤2.6V), V _{IN} =V _{CE} =V _{SET} +1V (V _{SET} >2.6V)	1.7	2.0	2.3	MHz
I _{DD}	Supply Current	V _{IN} =V _{CE} =V _{FB} =3.6V		32	45	μA
I _{standby}	Standby Current	V _{IN} =5.5V, V _{CE} =0V		0	5	μA
I _{CEH}	CE "H" Input Current	V _{IN} =V _{CE} =5.5V	-1	0	1	μA
I _{CEL}	CE "L" Input Current	V _{IN} =5.5V, V _{CE} =0V	-1	0	1	μA
I _{VFBH}	VFB "H" Input Current	V _{IN} =V _{FB} =5.5V, V _{CE} =0V	-1	0	1	μA
I _{VFBL}	VFB "L" Input Current	V _{IN} =5.5V, V _{CE} =V _{FB} =0V	-1	0	1	μA
t _{dis}	Auto Discharge Time ⁽²⁾	V _{IN} =2.3V, V _{CE} =0V, C _{OUT} =10μF		5	10	ms
I _{LXLEAKH}	Lx Leakage Current "H"	V _{IN} =V _{LX} =5.5V, V _{CE} =0V	-1	0	5	μA
I _{LXLEAKL}	Lx Leakage Current "L"	V _{IN} =5.5V, V _{CE} =V _{LX} =0V	-5	0	1	μA
V _{CEH}	CE "H" Input Voltage	V _{IN} =5.5V	1.0			V
V _{CEL}	CE "L" Input Voltage	V _{IN} =2.3V			0.4	V
R _{ONP}	On Resistance of Pch Tr.	V _{IN} =3.6V, I _{LX} =-100mA		0.38		Ω
R _{ONN}	On Resistance of Nch Tr.	V _{IN} =3.6V, I _{LX} =-100mA		0.3		Ω
Maxduty	Maximum Duty Cycle		100			%
t _{start}	Soft-start Time	V _{IN} =V _{CE} =3.6V (V _{SET} ≤2.6V), V _{IN} =V _{CE} =V _{SET} +1V (V _{SET} >2.6V)		150	300	μs
I _{LXLIM}	Lx Current Limit	V _{IN} =V _{CE} =3.6V (V _{SET} ≤2.6V), V _{IN} =V _{CE} =V _{SET} +1V (V _{SET} >2.6V)	800	100 0		mA
V _{UVLO1}	UVLO Detector Threshold	V _{IN} =V _{CE}	1.9	2.0	2.1	V
V _{UVLO2}	UVLO Released Voltage	V _{IN} =V _{CE}	2.0	2.1	2.2	V
T _{TSD}	Thermal Shutdown Temperature	Junction Temperature		140		°C
T _{TSR}	Thermal Shutdown Released Temperature	Junction Temperature		100		°C

Note: Test circuit is "OPEN LOOP" and AGND=PGND=0V unless otherwise specified.

⁽¹⁾ V_{SET}= Set Output Voltage⁽²⁾ It starts when the CE pin is low and ends when V_{OUT} ≤ V_{SET} × 0.1.

THEORY OF OPERATION

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

The step-down DC/ DC converter charges energy in the inductor when $L \times Tr.$ turns "ON", and discharges the energy from the inductor when $L \times Tr.$ turns "OFF" and operates with less energy loss, so that a lower output voltage (V_{OUT}) than the input voltage (V_{IN}) can be obtained.

The operation of the step-down DC/ DC converter is explained in the following figures.

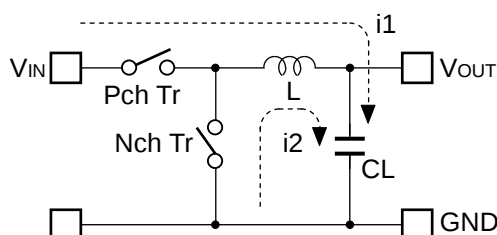


Figure 1. Basic Circuit

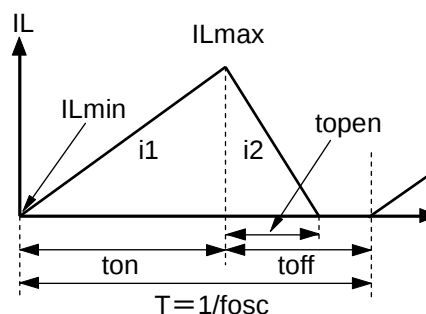


Figure 2. Inductor Current (I_L) flowing through Inductor

- Step1.** Pch Tr. turns "ON" and I_L ($i1$) flows, L is charged with energy. At this moment, $i1$ increases from the minimum inductor current (I_{Lmin}), which is 0A, and reaches the maximum inductor current (I_{Lmax}) in proportion to the on-time period (t_{on}) of Pch Tr.
- Step2.** When Pch Tr. turns "OFF", L tries to maintain I_L at I_{Lmax} , so L turns Nch Tr. "ON" and I_L ($i2$) flows into L .
- Step3.** $i2$ decreases gradually and reaches I_{Lmin} after the open-time period (t_{open}) of Nch Tr., and then Nch Tr. turns "OFF". This is called discontinuous current mode.
- As the output current (I_{OUT}) increases, the off-time period (t_{off}) of Pch Tr. runs out before I_L reaches I_{Lmin} . The next cycle starts, and Pch Tr. turns "ON" and Nch Tr. turns "OFF", which means I_L starts increasing from I_{Lmin} . This is called continuous current mode.

In the case of PWM control system, V_{OUT} is maintained by controlling t_{on} . During PWM control, the oscillator frequency (f_{osc}) is being maintained constant.

As shown in Figure 2. when the step-down DC/ DC operation is constant, I_{Lmin} and I_{Lmax} during t_{on} of Pch Tr. would be same as during t_{off} of Pch Tr.

The current differential between I_{Lmax} and I_{Lmin} is described as ΔI .

$$\Delta I = I_{Lmax} - I_{Lmin} = V_{OUT} \times t_{open} / L = (V_{IN} - V_{OUT}) \times t_{on} / L \dots \dots \dots \text{Equation 1}$$

However,

$$T = 1 / f_{osc} = t_{on} + t_{off}$$

$$\text{Duty (\%)} = t_{on} / T \times 100 = t_{on} \times f_{osc} \times 100$$

$$t_{open} \leq t_{off}$$

In Equation 1, " $V_{OUT} \times t_{open} / L$ " shows the amount of current change in "OFF" state. Also, " $(V_{IN} - V_{OUT}) \times t_{on} / L$ " shows the amount of current change at "ON" state.

Discontinuous Mode and Continuous Mode

As illustrated in Figure 3., when I_{OUT} is relatively small, $t_{open} < t_{off}$. In this case, the energy charged into L during t_{on} will be completely discharged during t_{off} , as a result, $I_{Lmin} = 0$. This is called discontinuous mode.

When I_{OUT} is gradually increased, eventually $t_{open} = t_{off}$ and when I_{OUT} is increased further, eventually $I_{Lmin} > 0$. This is called continuous mode.

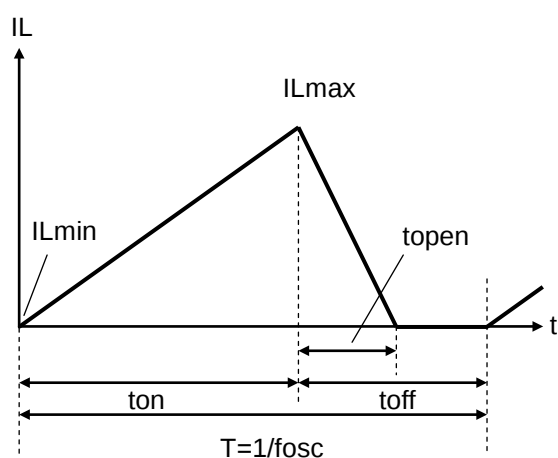


Figure 3. Discontinuous Mode

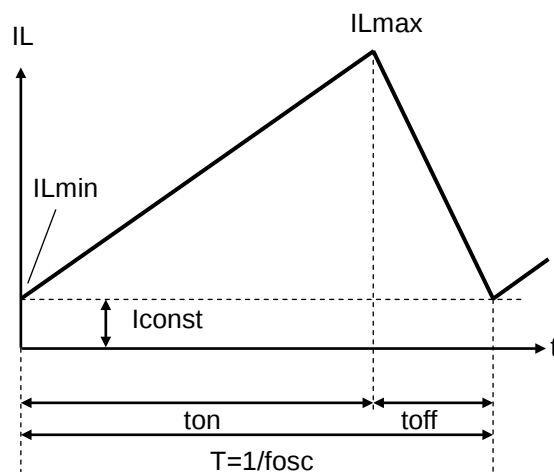


Figure 4. Continuous Mode

In the continuous mode, the solution of Equation 1 is described as t_{onc} .

$$t_{onc} = T \times V_{OUT} / V_{IN} \dots\dots\dots \text{Equation 2}$$

When $t_{on} < t_{onc}$, it is discontinuous mode, and when $t_{on} = t_{onc}$, it is continuous mode.

VFM Mode

In low output current, the IC automatically switches into VFM mode in order to achieve high efficiency. In VFM mode, t_{on} is forced to end when the inductor current reaches the pre-set I_{Lmax} . In the VFM mode, I_{Lmax} is typically set to 180mA. When t_{on} reaches 1.5 times of $T=1/f_{osc}$, t_{on} will be forced to end even if the inductor current is not reached I_{Lmax} .

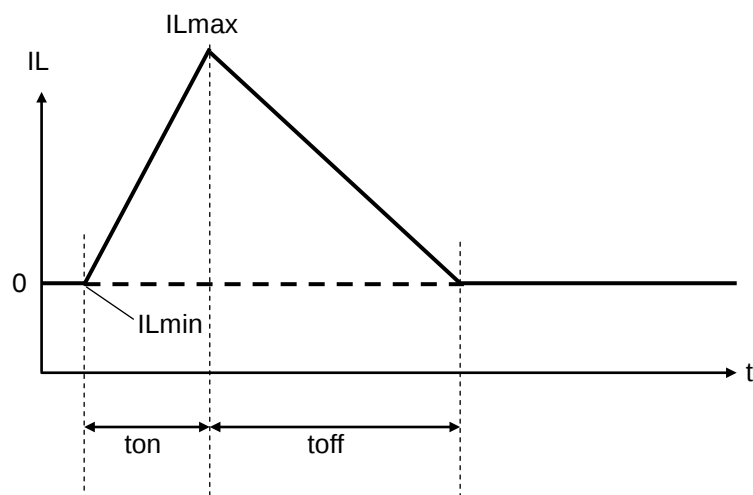


Figure 5. VFM Mode

Output Current and Selection of External Components

The following equations explain the relationship between output current and peripheral components used in the diagrams in "TYPICAL APPLICATIONS".

Ripple Current P-P value is described as I_{RP} , ON resistance of Pch Tr. is described as R_{ONP} , ON resistance of Nch Tr. is described as R_{ONN} , and DC resistor of the inductor is described as R_L .

First, when Pch Tr. is "ON", the following equation is satisfied.

$$V_{IN} = V_{OUT} + (R_{ONP} + R_L) \times I_{OUT} + L \times I_{RP} / t_{on} \dots \dots \dots \text{Equation 3}$$

Second, when Pch Tr. is "OFF" (Nch Tr. is "ON"), the following equation is satisfied.

$$L \times I_{RP} / t_{off} = R_{ONN} \times I_{OUT} + V_{OUT} + R_L \times I_{OUT} \dots \dots \dots \text{Equation 4}$$

Put Equation 4 into Equation 3 to solve ON duty of Pch Tr. ($D_{ON} = t_{on} / (t_{off} + t_{on})$):

$$D_{ON} = (V_{OUT} + R_{ONN} \times I_{OUT} + R_L \times I_{OUT}) / (V_{IN} + R_{ONN} \times I_{OUT} - R_{ONP} \times I_{OUT}) \dots \dots \dots \text{Equation 5}$$

Ripple Current is described as follows:

$$I_{RP} = (V_{IN} - V_{OUT} - R_{ONP} \times I_{OUT} - R_L \times I_{OUT}) \times D_{ON} / f_{osc} / L \dots \dots \dots \text{Equation 6}$$

Peak current that flows through L, and Lx Tr. is described as follows:

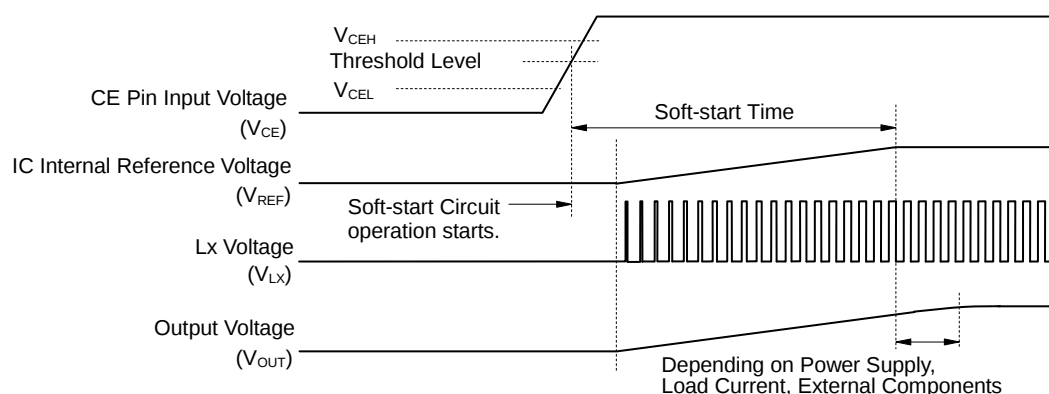
$$I_{Lxmax} = I_{OUT} + I_{RP} / 2 \dots \dots \dots \text{Equation 7}$$

- ★ Please consider I_{LxMAX} when setting conditions of input and output, as well as selecting the external components.
- ★ The above calculation formulas are based on the ideal operation of the ICs in continuous mode.

Timing Chart**(1) Soft-start Time****Starting-up with CE Pin**

The IC starts to operate when the CE pin voltage (V_{CE}) exceeds the threshold voltage. The threshold voltage is preset between CE "H" input voltage (V_{CEH}) and CE "L" input voltage (V_{CEL}).

After the start-up of the IC, soft-start circuit starts to operate. Then, after a certain period of time, the reference voltage (V_{REF}) in the IC gradually increases up to the specified value.

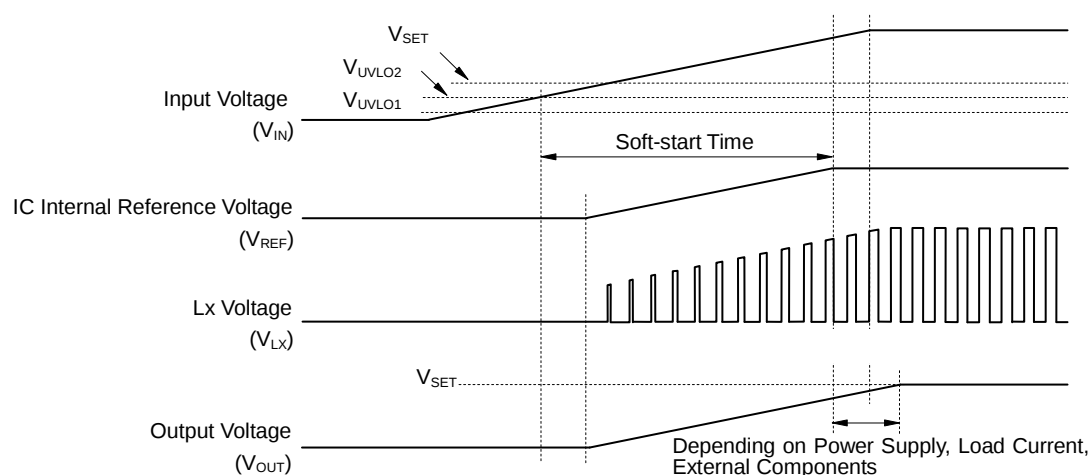


Soft-start time starts when soft-start circuit is activated, and ends when the reference voltage reaches the specified voltage.

- ★ Soft start time is not always equal to the turn-on speed of the step-down DC/ DC converter. Please note that the turn-on speed could be affected by the power supply capacity, the output current, the inductance value and the C_{OUT} value.

Starting-up with Power Supply

After the power-on, when V_{IN} exceeds the UVLO released voltage (V_{UVLO2}), the IC starts to operate. Then, soft-start circuit starts to operate and after a certain period of time, V_{REF} gradually increases up to the specified value. Soft-start time starts when soft-start circuit is activated, and ends when V_{REF} reaches the specified value.



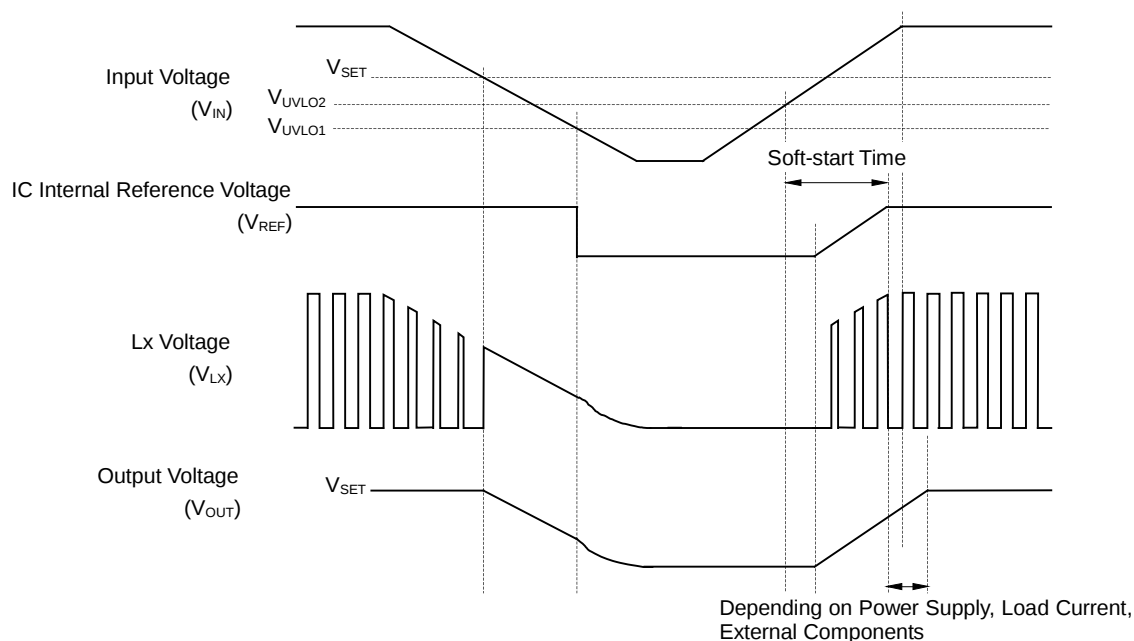
- ★ Please note that the turn-on speed of V_{OUT} could be affected by the power supply capacity, the output current, the inductance value, the C_{OUT} value and the turn-on speed of V_{IN} determined by C_{IN} .

(2) Under Voltage Lockout (UVLO) Circuit

If V_{IN} becomes lower than V_{SET} , the step-down DC/DC converter stops the switching operation and ON duty becomes 100%, and then V_{OUT} gradually drops according to V_{IN} .

If the V_{IN} drops more and becomes lower than the UVLO detector threshold (V_{UVLO1}), the UVLO circuit starts to operate, V_{REF} stops, and Pch and Nch built-in switch transistors turn "OFF". As a result, V_{OUT} drops according to the C_{OUT} capacitance value and the load.

To restart the operation, V_{IN} needs to be higher than V_{UVLO2} . The timing chart below shows the voltage shifts of V_{REF} , V_{LX} and V_{OUT} when V_{IN} value is varied.

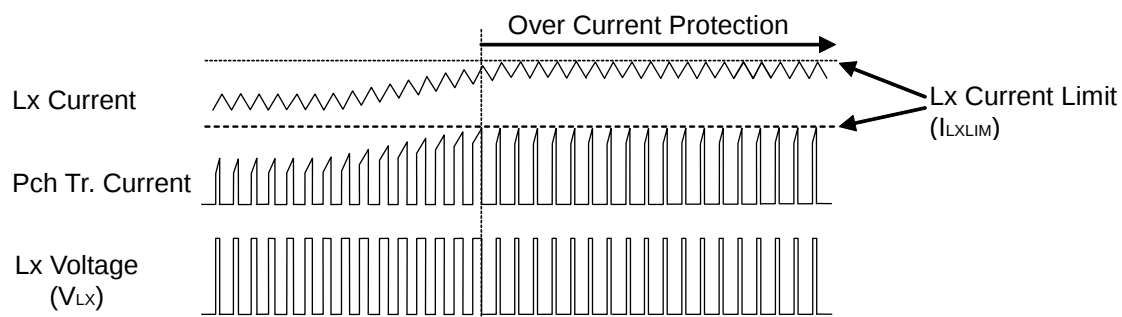


- ★ Falling edge (operating) and rising edge (releasing) waveforms of V_{OUT} could be affected by the initial voltage of C_{OUT} and the output current of V_{OUT} .

(3) Over Current Protection Circuit

Over current protection circuit supervises the inductor peak current (the peak current flowing through Pch Tr.) in each switching cycle, and if the current exceeds the L_x current limit (I_{LXLIM}), it turns off Pch Tr. I_{LXLIM} of the RP507K001B is set to Typ.1000mA.

Notes: I_{LXLIM} could be easily affected by self-heating or ambient environment. If the V_{IN} drops dramatically or becomes unstable due to short-circuit, protection operation could be affected.



APPLICATION INFORMATION

Typical Application

(Adjustable Output Voltage Type)

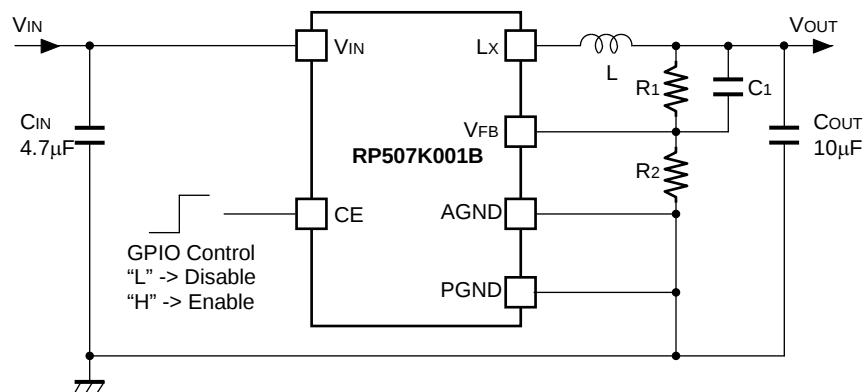
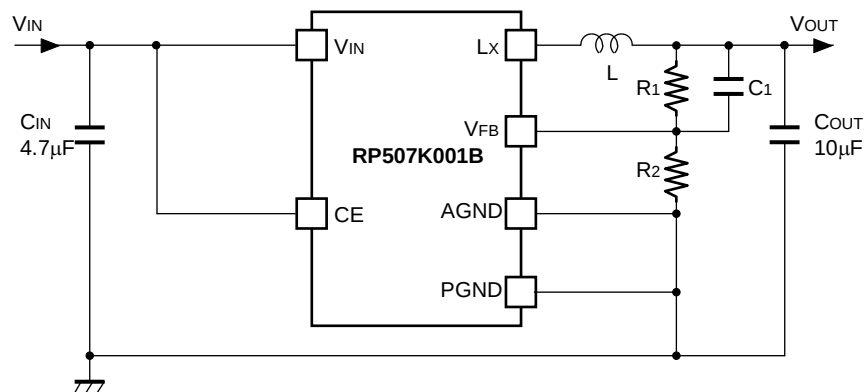
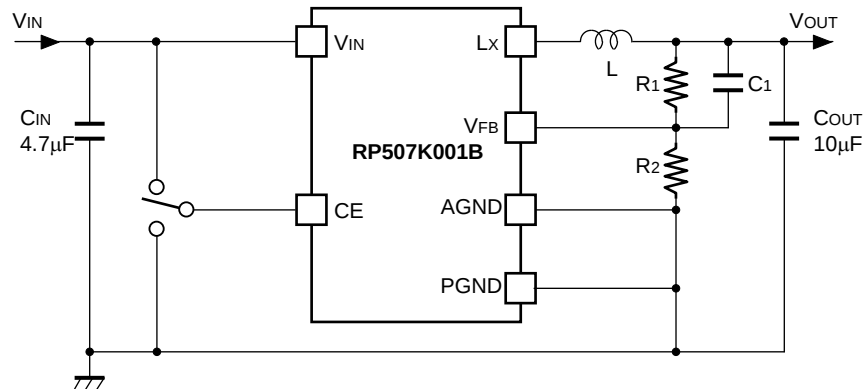


Table 1. Recommended Components

Symbol	Value	Components	Part Number
C _{IN}	4.7μF	Ceramic Capacitor	C1005X5R0J475M (TDK) JMK105BBJ475MV (Taiyo Yuden) GRM155R60J475ME47 (Murata)
C _{OUT}	10μF	Ceramic Capacitor	GRM155R60J106ME44 (Murata) JMK105CBJ106MV (Taiyo Yuden)
L	2.2μH	Inductor	LQM21PN2R2NGC (Murata) CIG21L2R2MNE (Samsung Electro-Mechanics) MIPSZ2012D2R2 (FDK)
	4.7μH		CIG21L4R7MNE (Samsung Electro-Mechanics) MIPS2520D4R7 (FDK)

TECHNICAL NOTES

When using the RP507K001B, please consider the following points.

- AGND and PGND must be wired to the GND plane when mounting on boards.
- Ensure the V_{IN} and AGND/ PGND lines are sufficiently robust. A large switching current flows through the AGND/ PGND lines, the V_{DD} line, the V_{OUT} line, an inductor, and L_X . If their impedance is too high, noise pickup or unstable operation may result. Set the external components as close as possible to the IC and minimize the wiring between the components and the IC, especially between a capacitor (C_{IN}) and the V_{IN} pin. The wiring between a resistor for setting output voltage (R_1) and an inductor (L) and between L and Load should be separated.
- Choose a low ESR ceramic capacitor. The capacitance of C_{IN} should be more than or equal to 4.7 μ F. The capacitance of a capacitor (C_{OUT}) should be 10 μ F.
- The Inductance value should be set within the range of 1.5 μ H to 4.7 μ H. However, the inductance value is limited by output voltage, so please refer to the table below. The phase compensation of this IC is designed according to the C_{OUT} and L values. Choose an inductor that has small DC resistance, has enough allowable current and is hard to cause magnetic saturation. If the inductance value of an inductor is extremely small, the peak current of L_X may increase. The increased L_X peak current reaches " L_X limit current" to trigger over current protection circuit even if the load current is less than 600mA.

Table 2. Set Output Voltage Range vs. Inductance Range

Set Output Voltage (V)	Inductance		
V_{SET}	L=1.5 μ H	L=2.2 μ H	L=4.7 μ H
0.7~1.0	Ok	Good	-
1.1~1.7	-	Good	-
1.8~2.5	-	Good	Ok
2.6~	-	Ok	Good

- Over current protection circuit may be affected by self-heating or power dissipation environment.
- The output voltage (V_{OUT}) is adjustable by changing the R_1 and R_2 values as follows.

$$V_{OUT} = V_{FB} \times (R_1 + R_2) / R_2 \quad (0.7V \leq V_{OUT} \leq 5.5V)$$

- The recommended resistance values for R_1 , R_2 and C_1 are as follows.

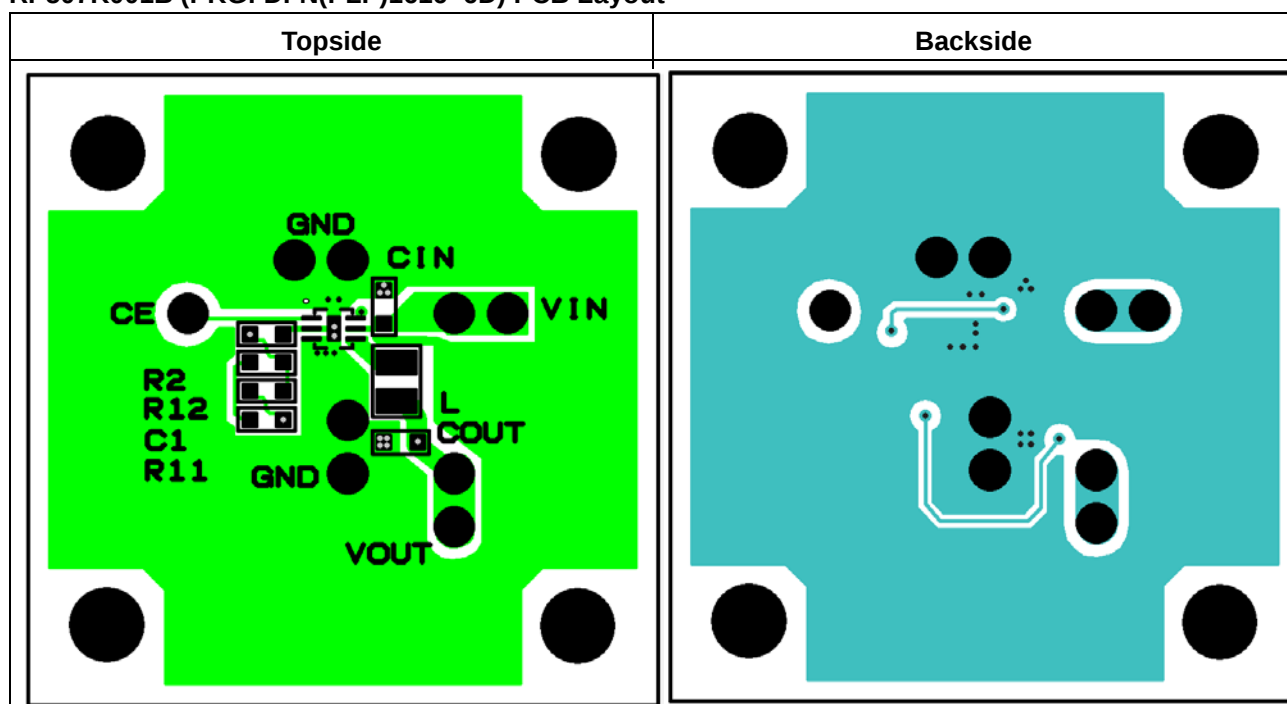
Table 3. Set Output Voltage Range vs. Resistor & Capacitor Range

Set Output Voltage (V)	Resistor (k Ω)		Capacitor (pF)
V_{SET}	R_1	R_2	C_1
1.0	120	180	22
1.2	180	180	22
1.5	270	180	22
1.8	240	120	22
2.5	380	120	15
2.8	275	75	15
3.3	270	60	15

- ★ The performance of power source circuits using this IC largely depends on the peripheral circuits. When selecting the peripheral components, please consider the conditions of use. Do not allow each component, PCB pattern and the IC to exceed their respected rated values (voltage, current, and power) when designing the peripheral circuits.

Reference PCB Layout

RP507K001B (PKG: DFN(PLP)1616-6D) PCB Layout

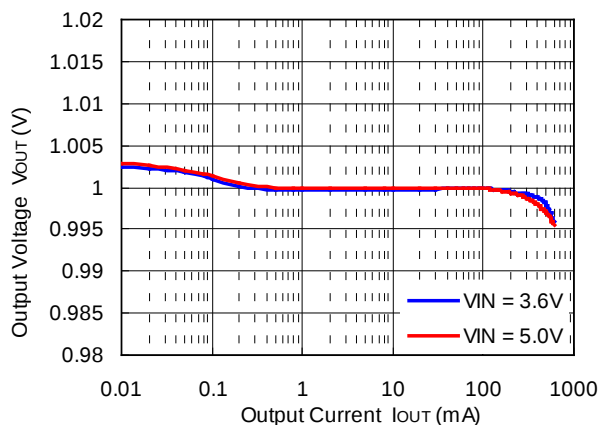


* R_{11} and R_{12} are arranged as a substitute for R_1 so that two resistors can be connected in series.

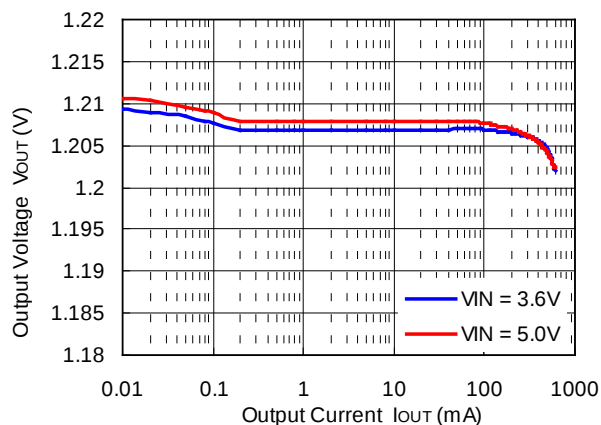
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current

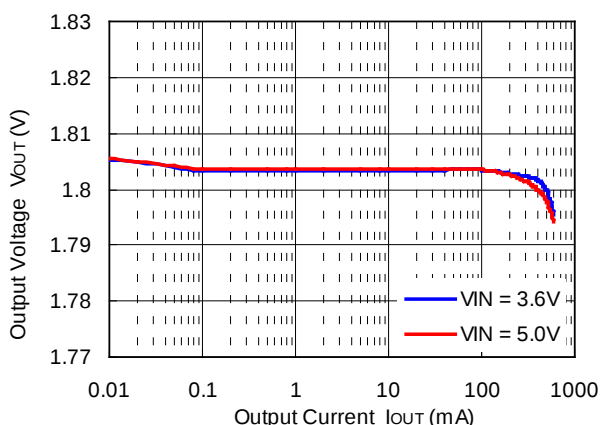
RP507K001B $V_{OUT}=1.0V$



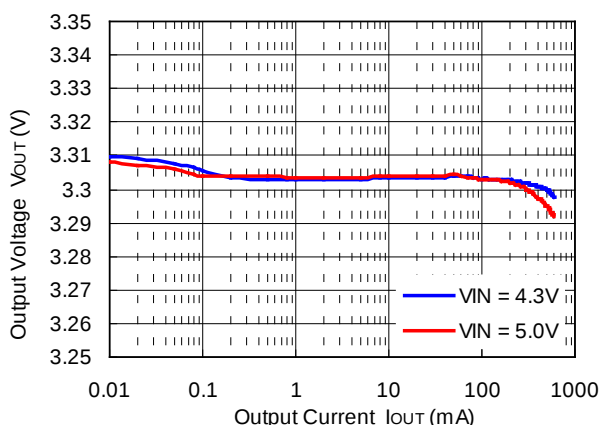
RP507K001B $V_{OUT}=1.2V$



RP507K001B $V_{OUT}=1.8V$

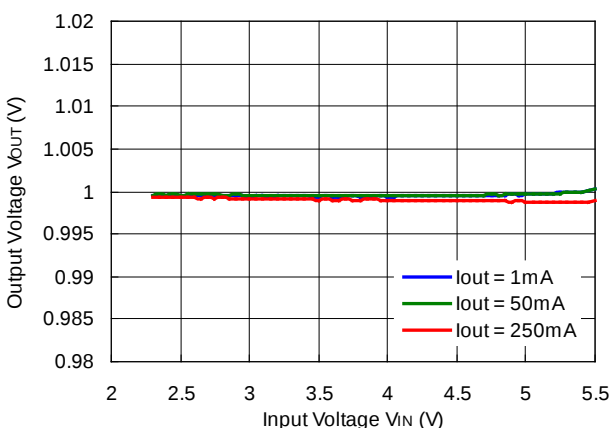


RP507K001B $V_{OUT}=3.3V$

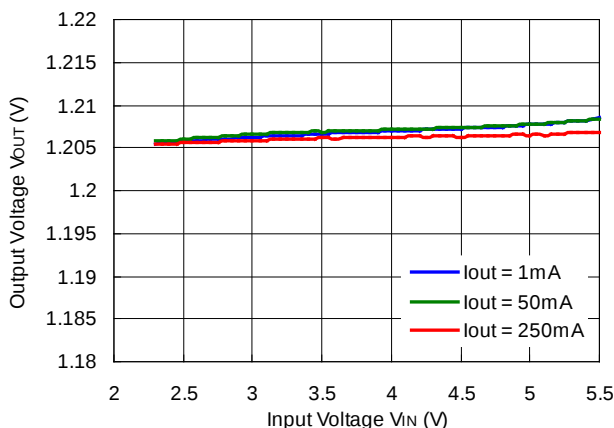


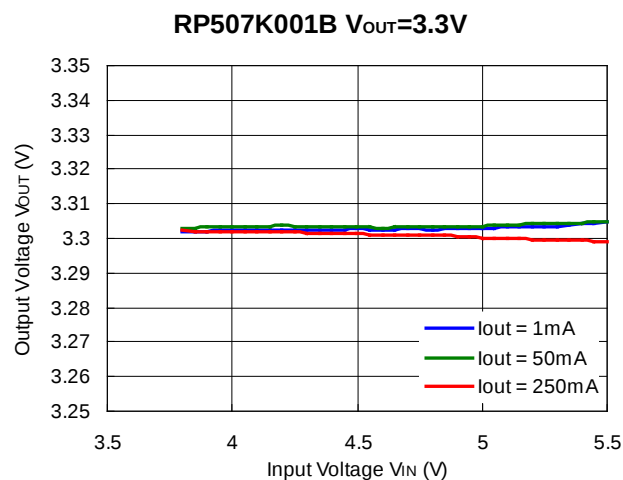
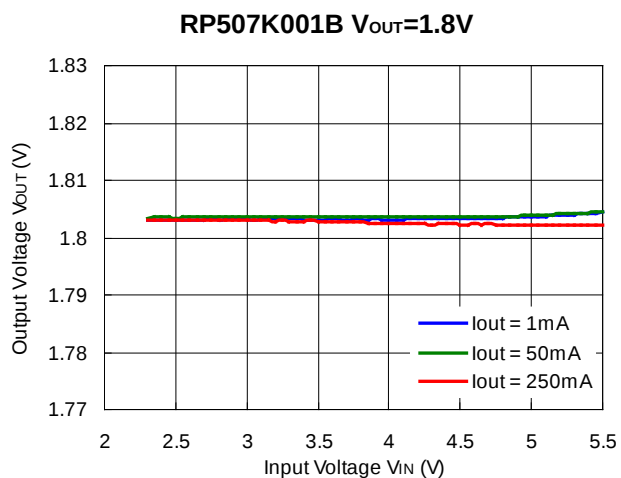
2) Output Voltage vs. Input Voltage

RP507K001B $V_{OUT}=1.0V$



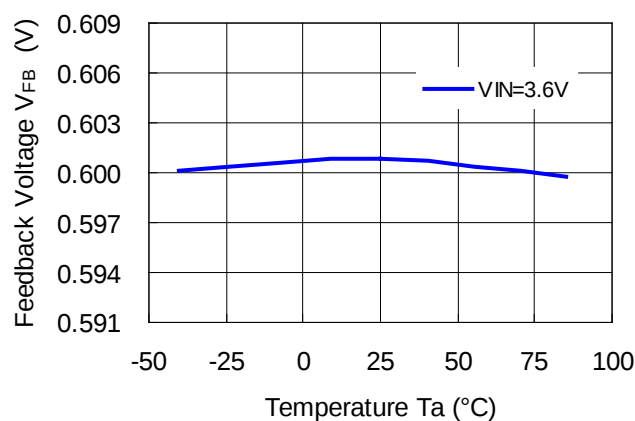
RP507K001B $V_{OUT}=1.2V$





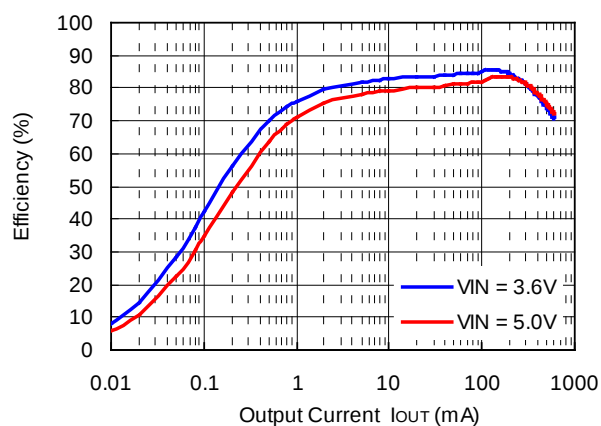
3) Feedback Voltage vs. Temperature

RP507K001B

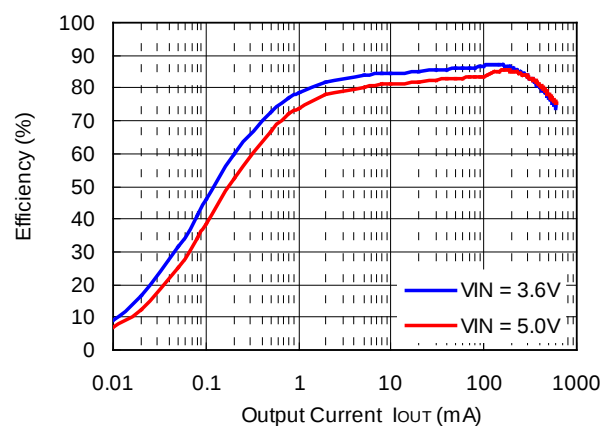


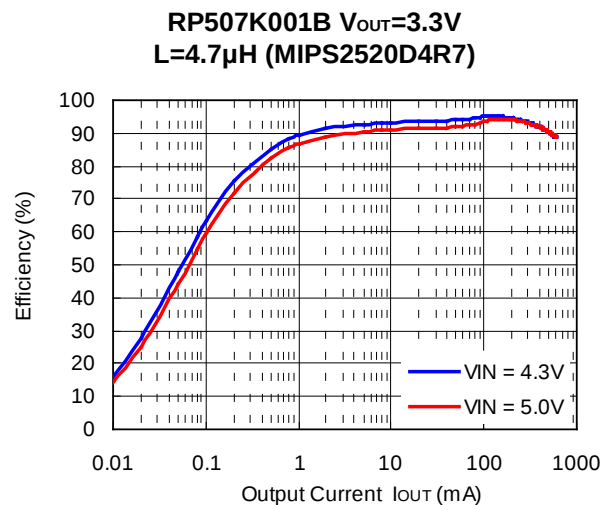
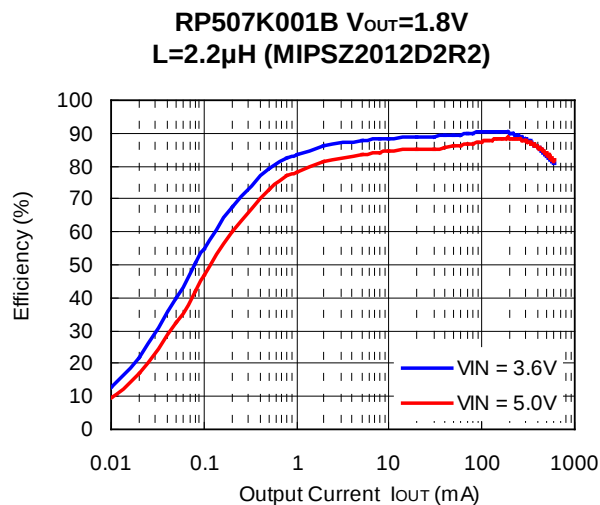
4) Efficiency vs. Output Current

RP507K001B $V_{OUT}=1.0V$
 $L=2.2\mu H$ (MIPSZ2012D2R2)



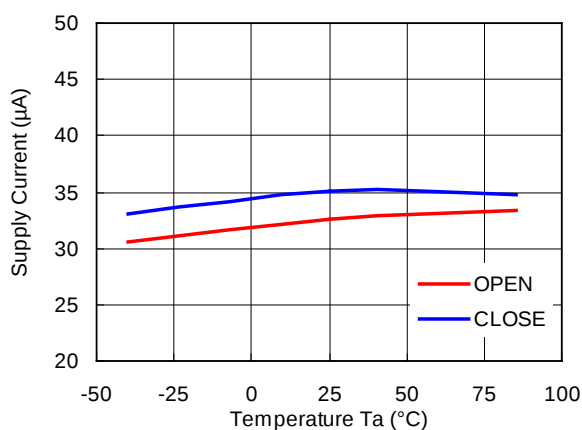
RP507K001B $V_{OUT}=1.2V$
 $L=2.2\mu H$ (MIPSZ2012D2R2)





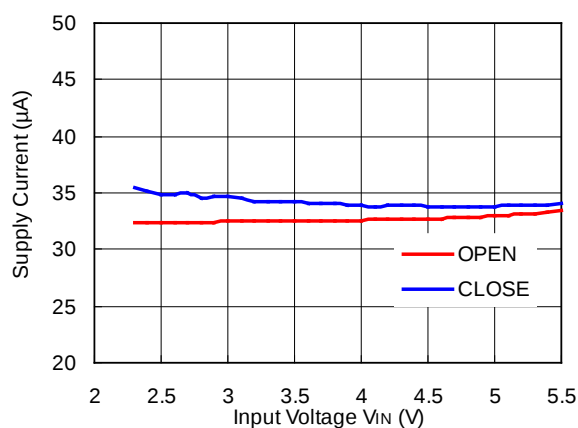
5) Supply Current vs. Temperature

RP507K001B $V_{OUT}=1.8V$ ($V_{IN}=3.6V$)



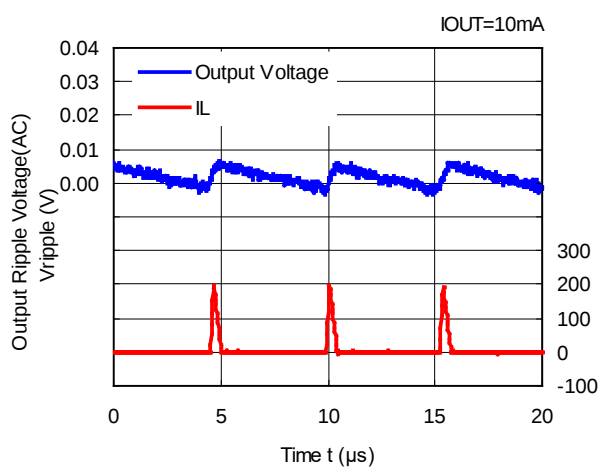
6) Supply Current vs. Input Voltage

RP507K001B $V_{OUT}=1.8V$

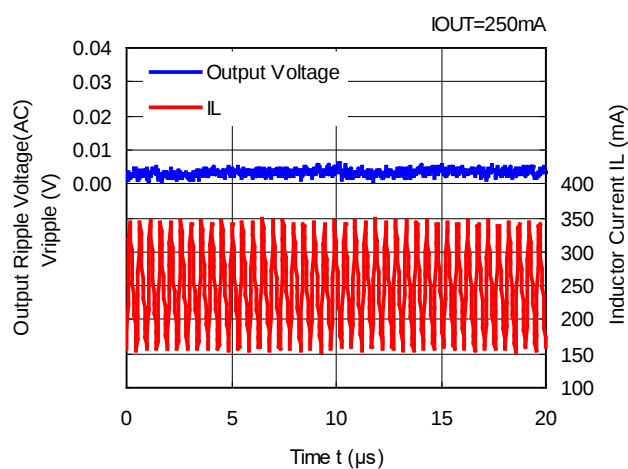


7) DC/DC Output Waveform

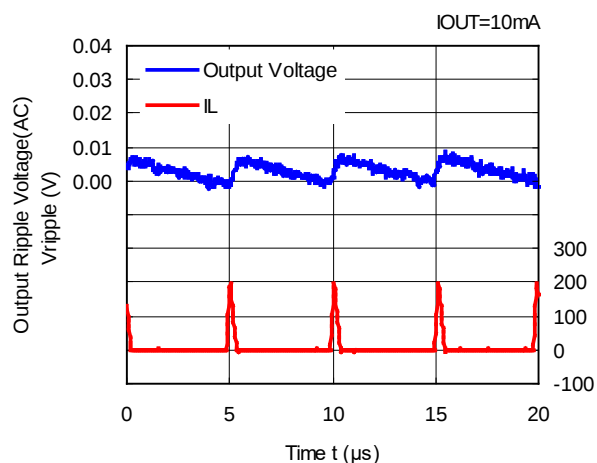
RP507K001B $V_{OUT}=1.0V$ ($V_{IN}=3.6V$)



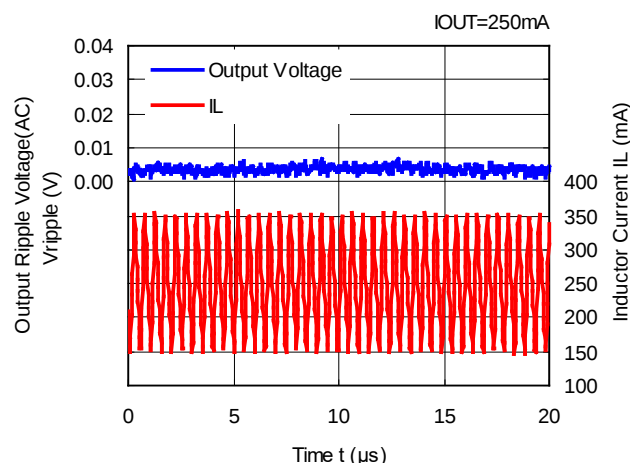
RP507K001B $V_{OUT}=1.0V$ ($V_{IN}=3.6V$)



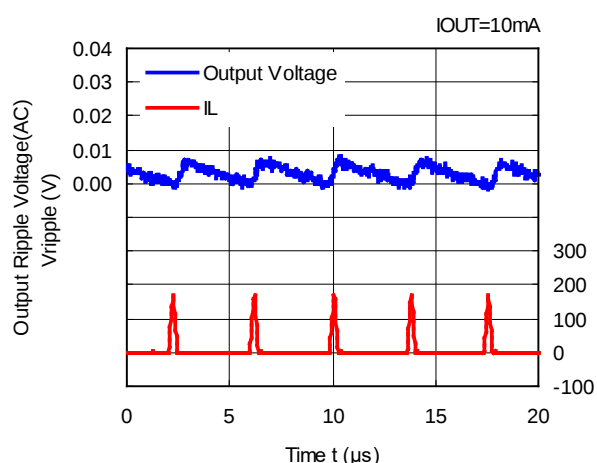
RP507K001B $V_{OUT}=1.2V$ ($V_{IN}=3.6V$)



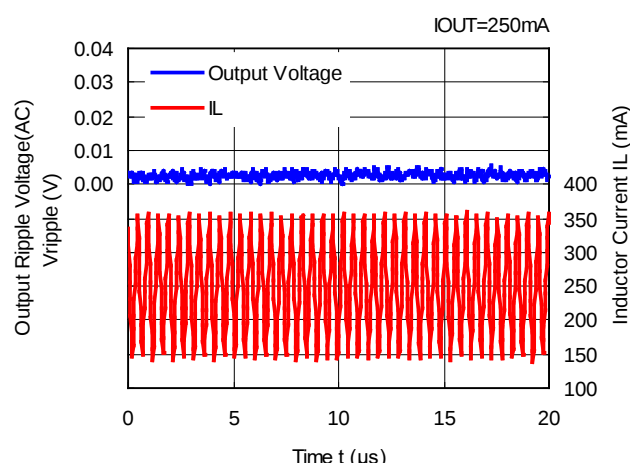
RP507K001B $V_{OUT}=1.2V$ ($V_{IN}=3.6V$)



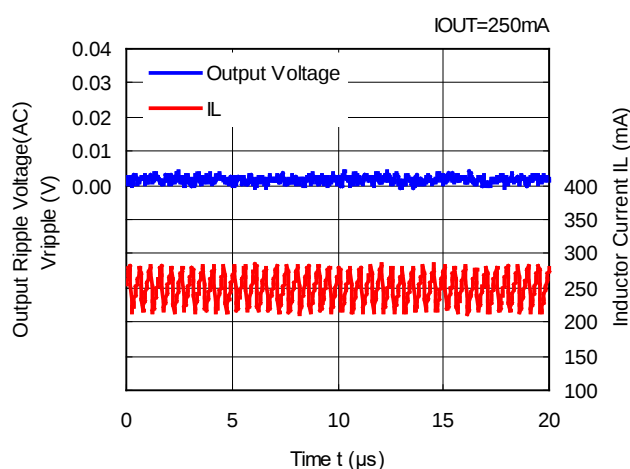
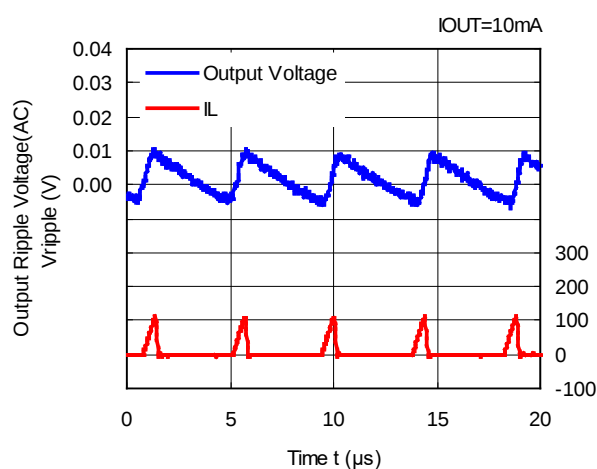
RP507K001B $V_{OUT}=1.8V$ ($V_{IN}=3.6V$)



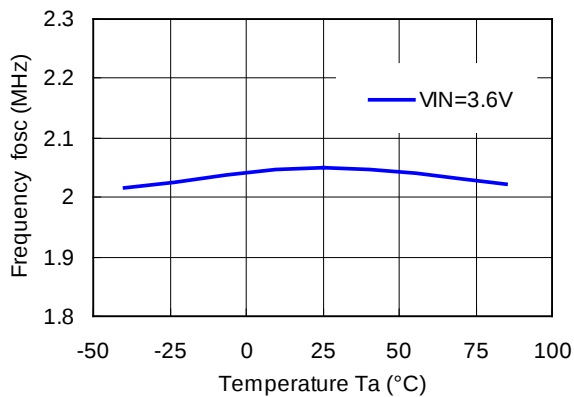
RP507K001B $V_{OUT}=1.8V$ ($V_{IN}=3.6V$)



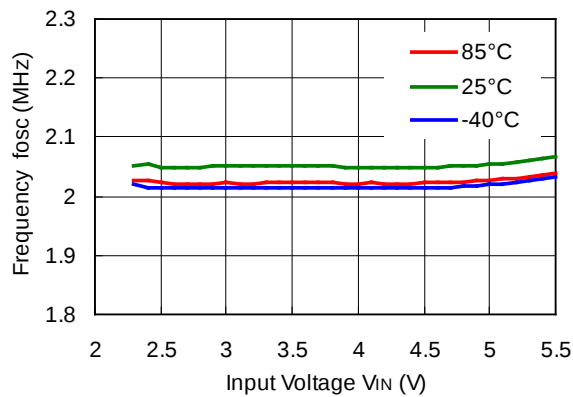
RP507K001B $V_{OUT}=3.3V$ ($V_{IN}=4.3V$)



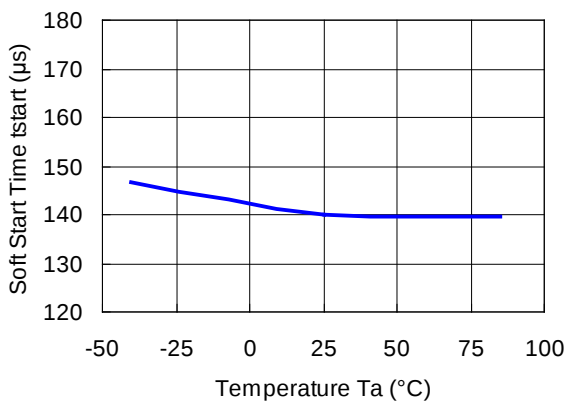
8) Oscillator Frequency vs. Temperature



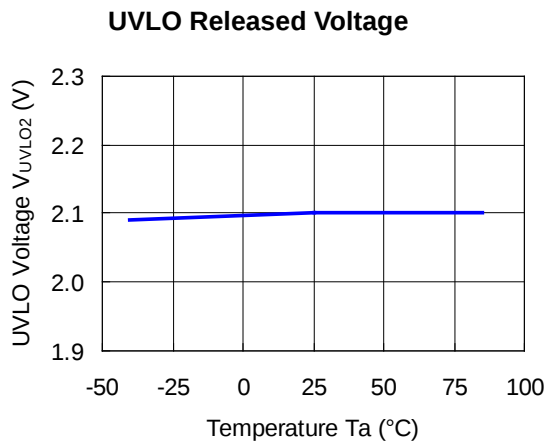
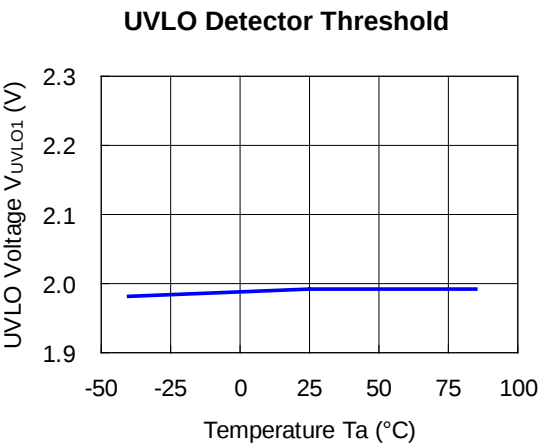
9) Oscillator Frequency vs. Input Voltage



10) Soft-start Time vs. Temperature

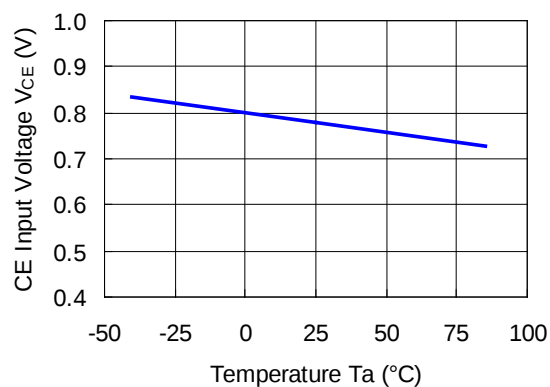


11) UVLO Detector Threshold / Released Voltage vs. Temperature

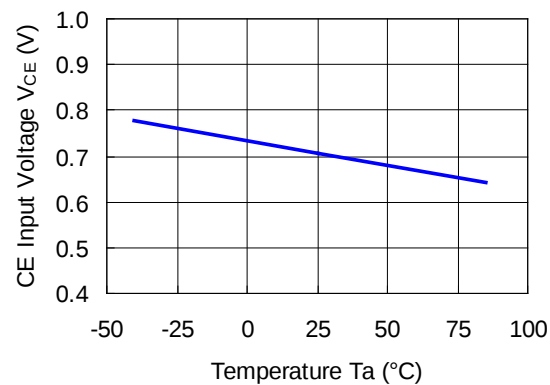


12) CE Input Voltage vs. Temperature

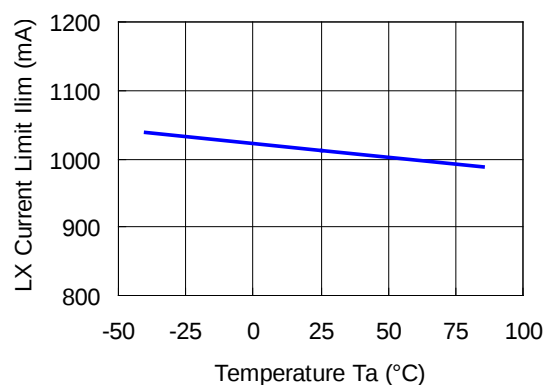
CE“H” Input Voltage($V_{IN}=5.5V$)



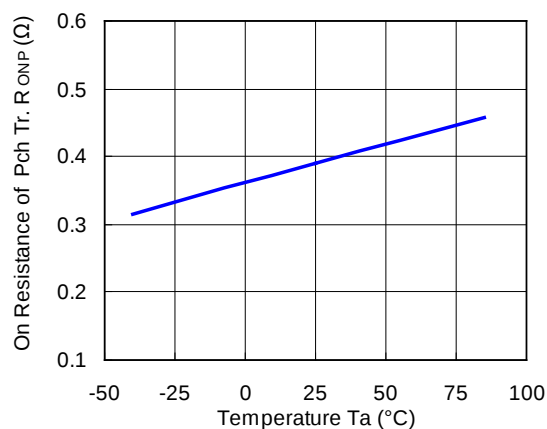
CE“L” Input Voltage ($V_{IN}=2.3V$)



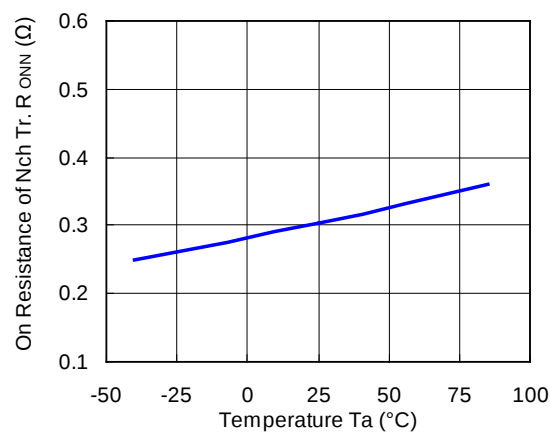
13) L_x Current Limit vs. Temperature



14) On Resistance of Pch Tr. vs. Temperature

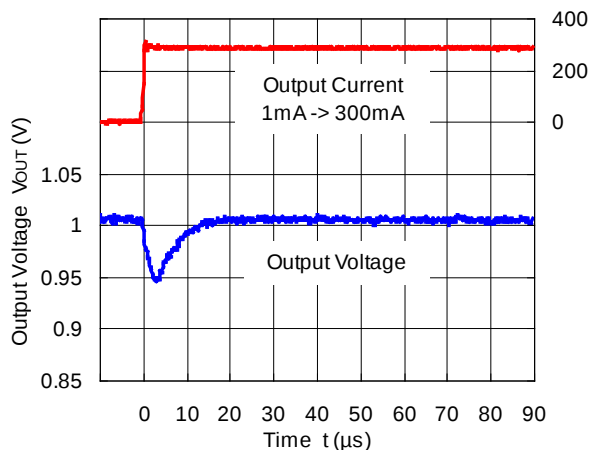


15) On Resistance of Nch Tr. vs. Temperature

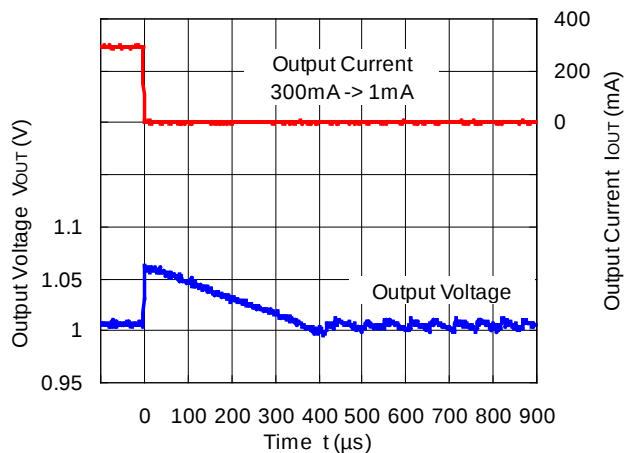


16) Load Transient Response ($C_{OUT}=10\mu F$ GRM155R60J106ME44)

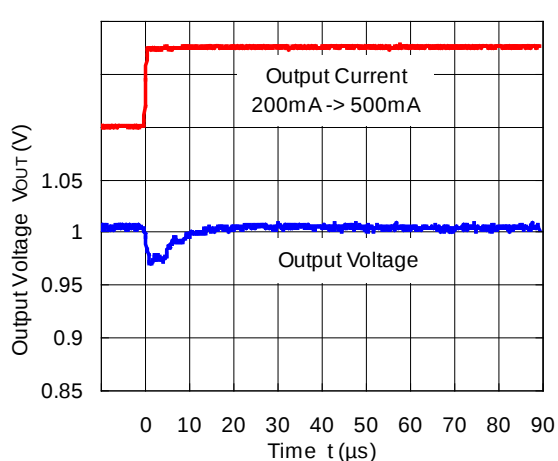
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.0V$)



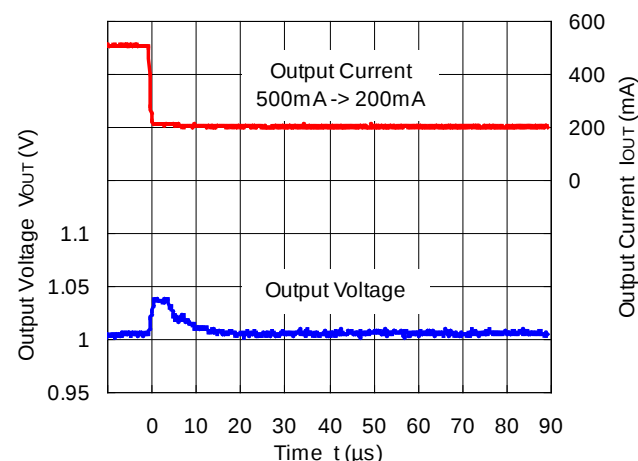
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.0V$)



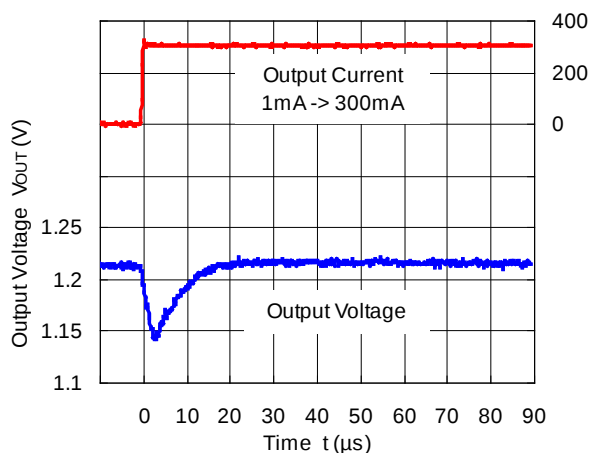
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.0V$)



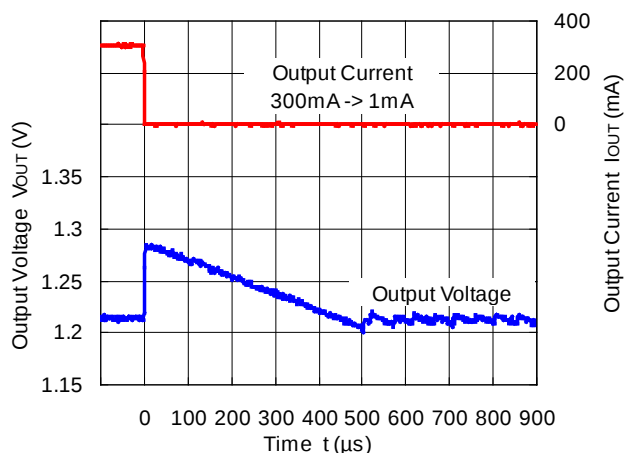
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.0V$)



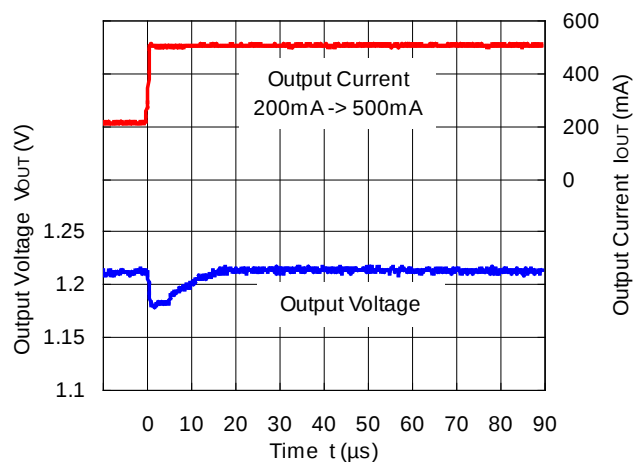
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.2V$)



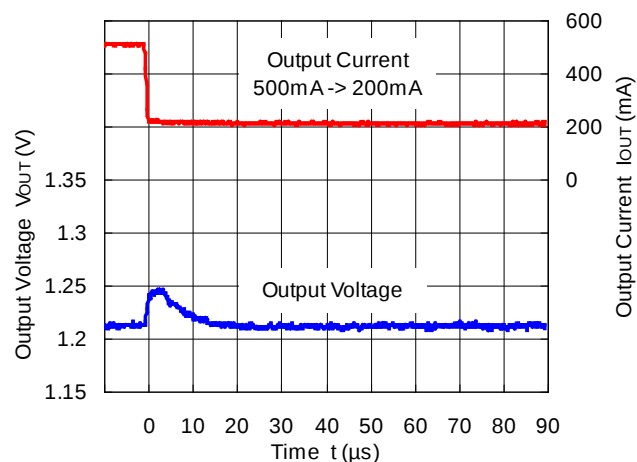
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.2V$)



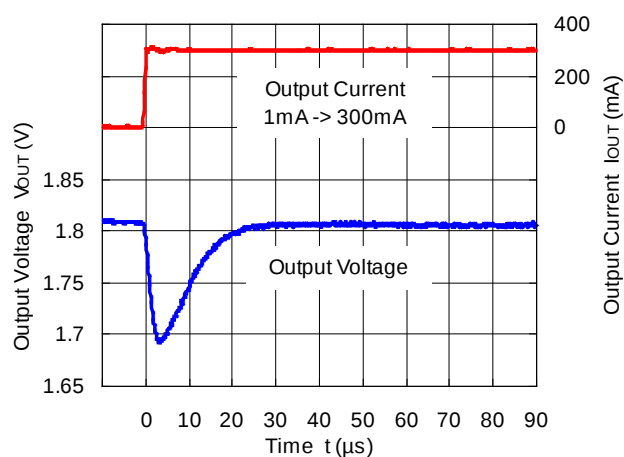
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.2V$)



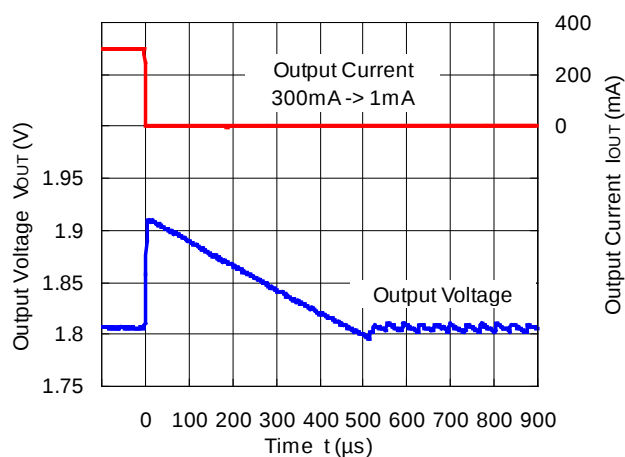
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.2V$)



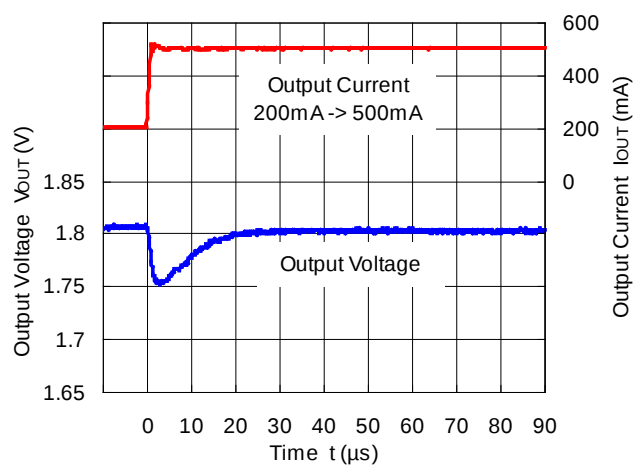
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.8V$)



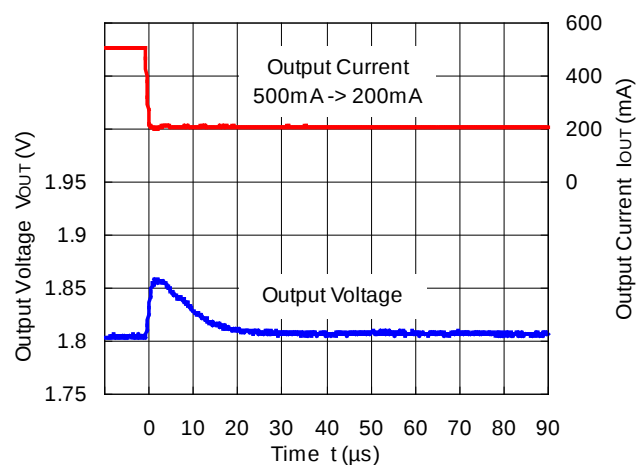
RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.8V$)



RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.8V$)

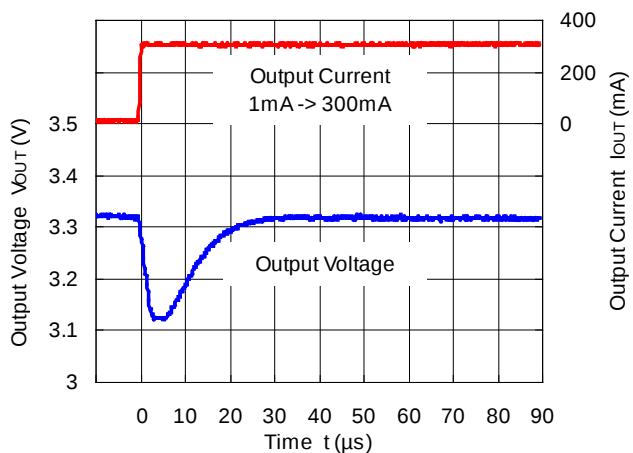
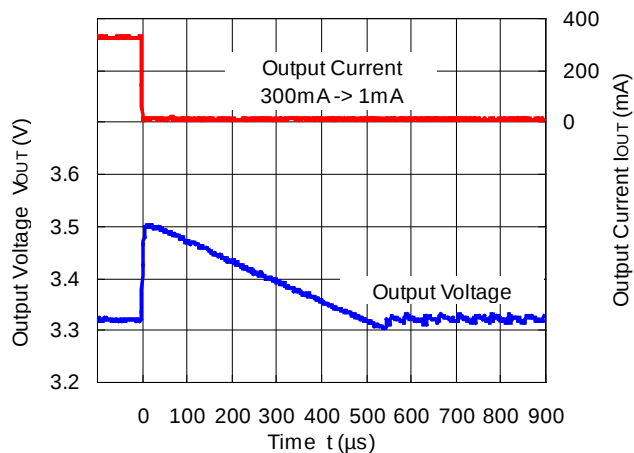
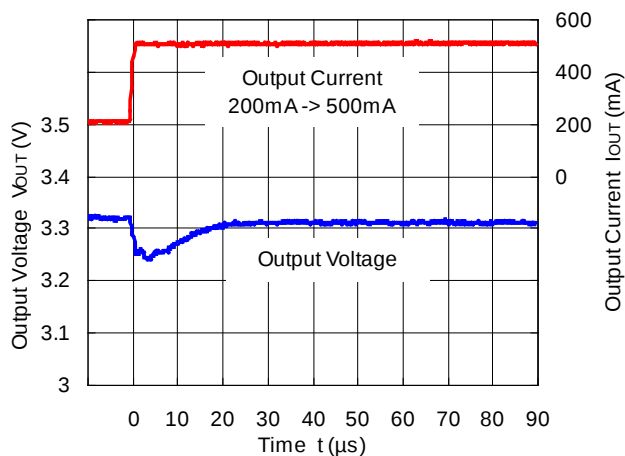
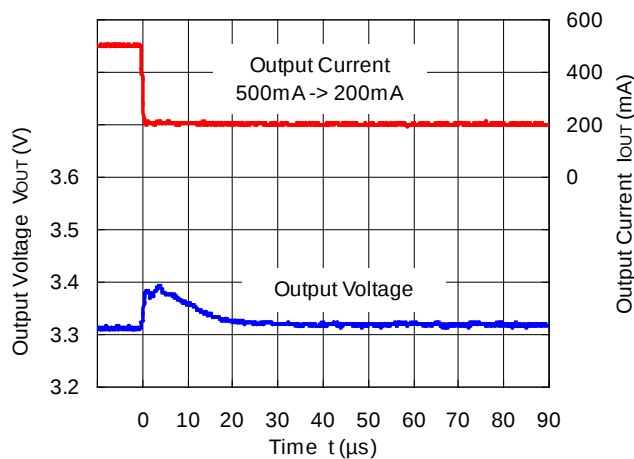


RP507K001B ($V_{IN}=3.6V$, $V_{OUT}=1.8V$)



RP507K001B

NO.EA-305-180529

RP507K001B ($V_{IN}=5.0V$, $V_{OUT}=3.3V$)**RP507K001B ($V_{IN}=5.0V$, $V_{OUT}=3.3V$)****RP507K001B ($V_{IN}=5.0V$, $V_{OUT}=3.3V$)****RP507K001B ($V_{IN}=5.0V$, $V_{OUT}=3.3V$)**

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	φ 0.2 mm × 15 pcs

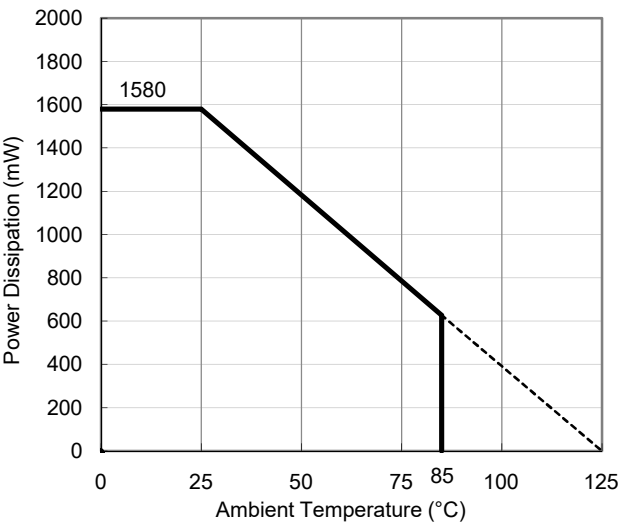
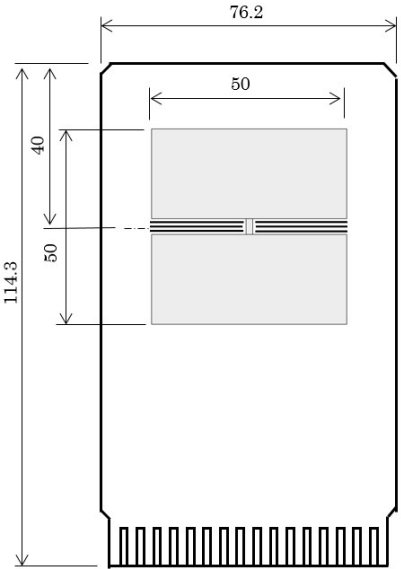
Measurement Result

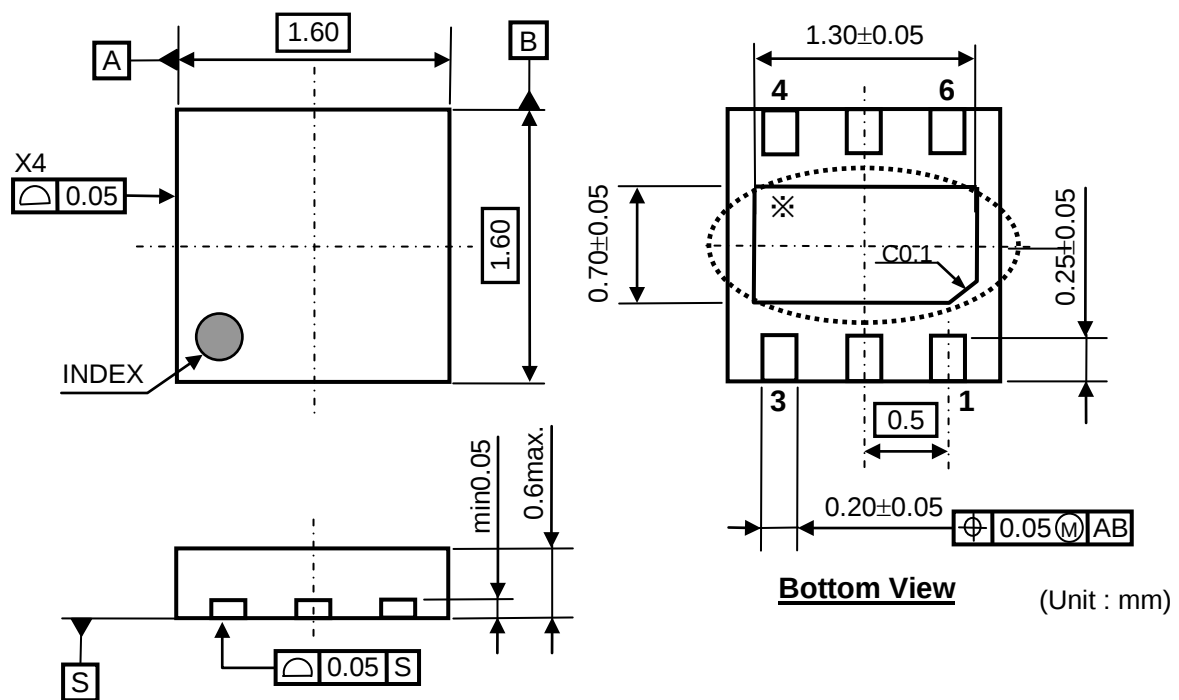
(Ta = 25°C, Tjmax = 125°C)

Item	Measurement Result
Power Dissipation	1580 mW
Thermal Resistance (θ_{ja})	$\theta_{ja} = 63^{\circ}\text{C/W}$
Thermal Characterization Parameter (ψ_{jt})	$\psi_{jt} = 33^{\circ}\text{C/W}$

θ_{ja} : Junction-to-Ambient Thermal Resistance

ψ_{jt} : Junction-to-Top Thermal Characterization Parameter

**Power Dissipation vs. Ambient Temperature****Measurement Board Pattern**



DFN(PLP)1616-6D Package Dimensions (Unit: mm)

* The tab on the bottom of the package shown by circle is a substrate potential (GND). It is recommended that this tab be connected to the ground plane on the board but it is possible to leave the tab floating.



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