3.0V to 12V, Integrated 2.5A MOSFET 1ch Boost Converter

BD8314NUV

General Description

BD8314NUV is a high-efficiency step-up switching regulator with built-in power MOSFET that can output 8V or 10V from a 4-battery voltage supply such as Li1cell, Li2cell, or a 5V fixed power supply line. The built-in 80mΩ N-Channel FET switch is capable of handling output current up to 2.5A (DC). This IC has a flexible phase compensation system and a switching frequency of 1.2MHz allowing the use of smaller external output inductor and capacitor making the construction of a compact power supply really easy.

Features

- Built-in 2.5A (DC)/14V N-Channel FET Switch
- On-Chip Phase Compensation between Input and Output of ERROR AMP.
- Output Current:
  - 600mA at 10V (3.5V to 10V Input)
  - 600mA at 8V (3.0V to 8.0V Input)
- Built-In Soft-Start Function.
- Built-In Timer Latch System for Short Circuit Protection Function.

Applications

Portable Equipment like DSC/DVC Powered by 4 Dry Batteries or Li2cell

Key Specifications

- Input Voltage Range: 3.0V to 12V
- Output Voltage Range: 4.0V to 12V
- Switching Frequency: 1.2MHz(Typ)
- Nch FET ON-Resistance: 80mΩ(Typ)
- Standby Current: 0μA (Typ)
- Operating Temperature Range: -25°C to +85°C

Package

W (Typ) x D (Typ) x H (Max)

VSON010V3030
3.00mm x 3.00mm x 1.00mm

Typical Application Circuit

Input: 3.0V to 10V, Output: 10V / 500 mA

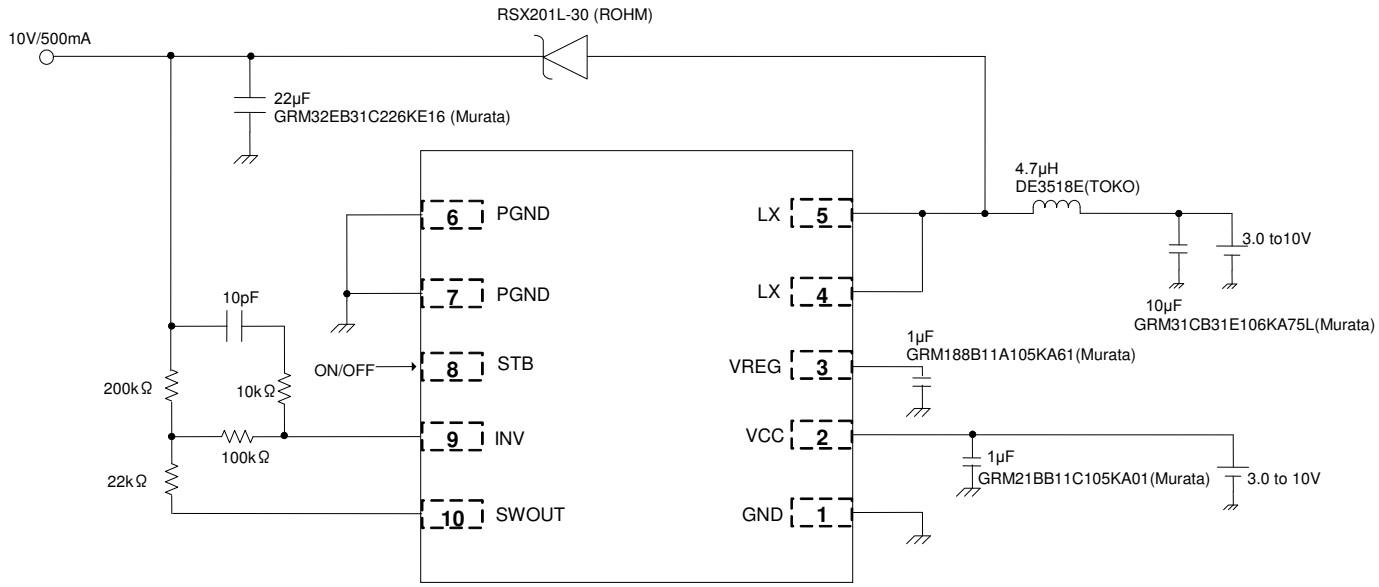


Figure 1. Typical Application Circuit

Pin Configuration

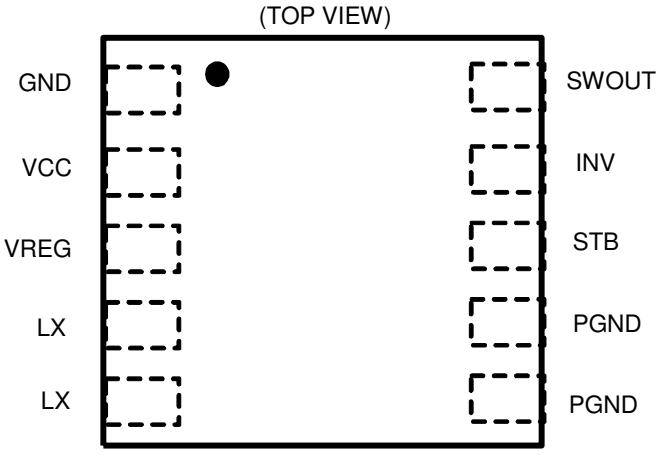


Figure 2. Pin Configuration

Pin Description

Pin No.	Pin Name	Function
1	GND	Ground pin
2	VCC	Supply voltage input pin
3	VREG	5V output terminal of regulator for internal circuit
4 , 5	LX	Power switch terminal for coil
6 , 7	PGND	Power transistor ground pin
8	STB	ON/OFF terminal
9	INV	ERROR AMP input pin
10	SWOUT	STBSW for split resistance

Block Diagram

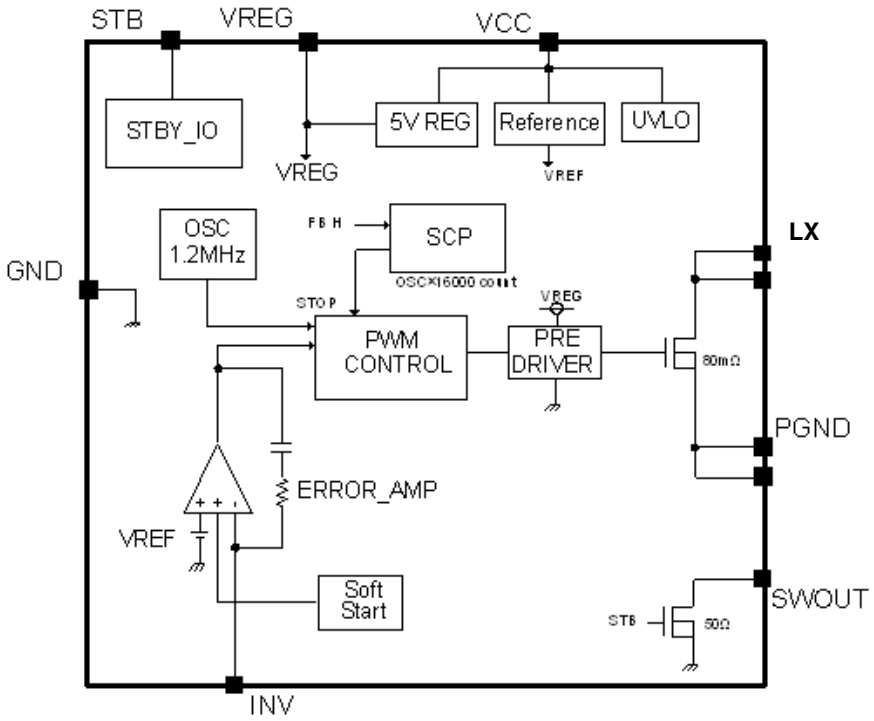


Figure 3. Block Diagram

Description of Blocks

(1) VREF
This block generates the 1.0V internal reference voltage of the ERROR AMP.

(2) UVLO
This circuit prevents low voltage malfunction of the internal circuit during activation of the power supply voltage or during low power supply voltage. It monitors the VREG pin voltage, Turns OFF all output FET and DC/DC converter output, and resets the timer latch of the internal SCP circuit and soft-start circuit when VREG voltage becomes lower than 2.4V. Typical UVLO hysteresis is 100 mV.

(3) SCP
SCP is a timer latch system for short circuit protection. When the INV pin is set at 1.0V or lower, the internal SCP circuit starts counting. The internal counter is in-sync with OSC so that the latch circuit activates after a lapse of 13.3 msec or after the counter counts about 16000 oscillations, and then the DC/DC converter output is Turned OFF. To reset the latch circuit, Turn OFF the STB pin once. Then, turn it ON again or Turn ON the power supply voltage again.

(4) OSC
OSC block produces saw tooth waveform signal with operating frequency fixed at 1.2 MHz.

(5) ERROR AMP
The Error amplifier detects the output signal and outputs PWM control signals. The internal reference voltage is set at 1.0 V. A primary phase compensation device of 200 pF, 62 kΩ is built-in between the inverting input terminal and the output terminal of this ERROR AMP.

(6) PWM COMP
PWM COMP is the voltage-to-pulse-width converter for controlling the output voltage corresponding to input voltage.
It compares the internal SLOPE waveform with the ERROR AMP output voltage, then, controls the pulse width of the output to the driver. Maximum duty is set at 85%.

(7) SOFT START
The Soft-start block prevents inrush current during startup by gradually increasing the output voltage of the DC/DC converter. Soft-start time is in-sync with the internal OSC so that the output voltage of the DC/DC converter reaches the set voltage after about 10000 oscillations.

(8) PRE DRIVER
CMOS inverter circuit for driving the built-in Nch FET.

(9) STBY_IO
Voltage applied on STB pin (8 pin) controls the ON/OFF state of the IC. The IC Turns ON when a voltage of 2.5V or higher is applied and Turns OFF when the terminal is open or 0V is applied. A pull-down resistor approximately 400 kΩ is built-in.

(10) Nch FET SW
This is an internal FET switch that powers the output through the coil of the DC/DC converter. It is an 80 mΩ Nch FET SW that is capable of withstanding up to 14V across. Since the current rating of this FET is 2.5 A(DC), it should be used within 3.5 A including the DC current (Less than 2.5A) and ripple current of the coil.

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Maximum Applied Power Voltage	V_{CC}, V_{LX}	14	V
Maximum Input Voltage	V_{SWOUT}, V_{INV}	14	V
Maximum Input Current	I_{INMAX}	3.5	A
Power Dissipation	Pd	0.70 (Note 1)	W
Operating Temperature Range	Topr	-25 to +85	°C
Storage Temperature Range	Tstg	-55 to +150	°C
Junction Temperature	Tjmax	+150	°C

(Note 1) When used at Ta = 25°C or more installed on a 74.2 x 74.2 x 1.6[t] mm board, the rating is reduced by 5.6 mW/°C.
Caution: Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

Recommended Operating Conditions (Ta = 25°C)

Parameter	Symbol	Rating	Unit
Power Supply Voltage	V_{CC}	3.0 to 12	V
Output Voltage	V_{OUT}	4.0 to 12	V
Maximum Input Current (DC)	I_{maxDC}	2.5	V

Electrical Characteristics (Unless otherwise specified, Ta = 25°C, V_{CC} = 7.4V)

Parameter		Symbol	Limit			Unit	Conditions
			Min	Typ	Max		
[Low Input Voltage Malfunction Prevention Circuit]							
Detection Threshold Voltage		V_{UV}	-	2.4	2.6	V	VREG Monitor
Hysteresis Range		ΔV_{UVHY}	50	100	200	mV	
[Oscillator]							
Oscillation Frequency		f_{OSC}	1.1	1.2	1.3	MHz	
[Regulator]							
Output Voltage		V_{REG}	4.65	5.0	5.35	V	
[ERROR AMP]							
INV Threshold Voltage		V_{INV}	0.99	1.00	1.01	V	
Input Bias Current		I_{INV}	-50	0	+50	nA	V_{CC}=11.0V , V_{INV}=5.5V
Soft-Start Time		t_{SS}	5.3	8.8	12.2	msec	
[PWM Comparator]							
LX Max Duty		D_{MAX1}	77	85	93	%	
[SWOUT]							
ON-Resistance		$R_{ONSWOUT}$	-	50	100	Ω	
[Output]							
LX NMOS ON-Resistance		R_{ON}	-	80	150	mΩ	
LX Leak Current		I_{LEAK}	-1	0	+1	μA	
[STB]							
STB Pin Control Voltage	Operation	V_{STBH}	2.5	-	V_{CC}	V	
	No-Operation	V_{STBL}	-0.3	-	+0.3	V	
STB Pin Pull-Down Resistance		R_{STB}	250	400	700	kΩ	
[Circuit Current]							
Standby Current VCC		I_{STB}	-	-	1	μA	
Circuit Current at Operation VCC		I_{CC}	-	600	900	μA	V_{INV}=1.2V

Typical Performance Curves

(Unless otherwise specified, Ta = 25°C, V_{CC} = 7.4V)

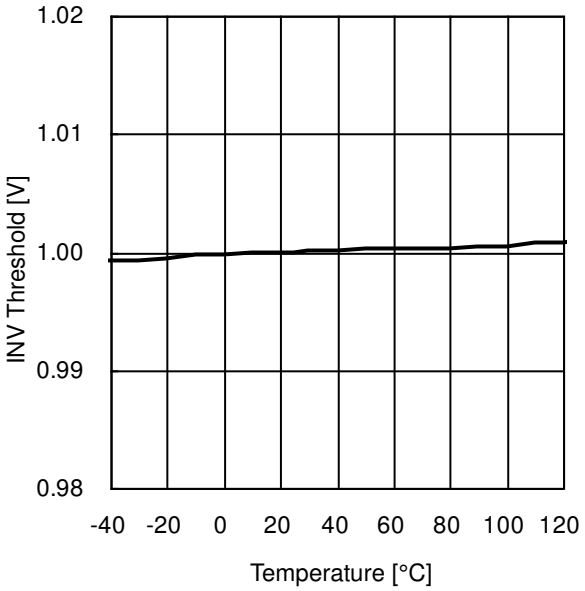


Figure 4. INV Threshold vs Temperature

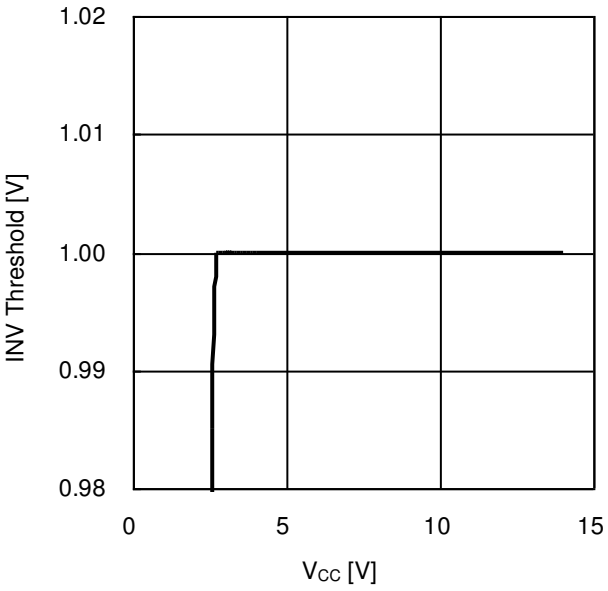


Figure 5. INV Threshold vs V_{CC}

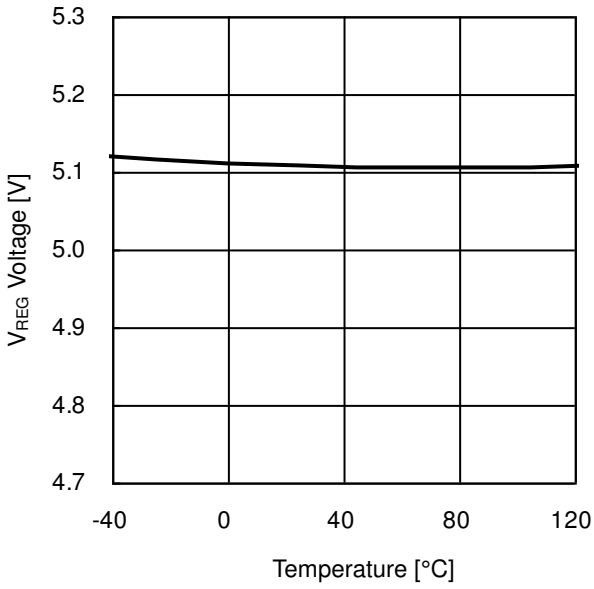


Figure 6. V_{REG} Voltage vs Temperature

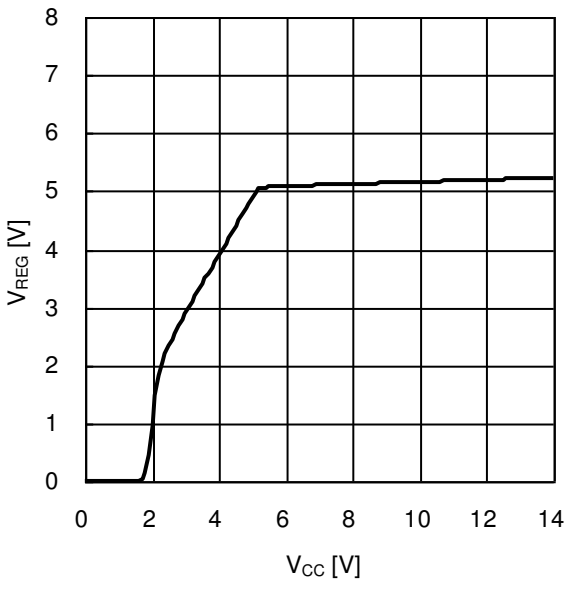


Figure 7. V_{REG} vs V_{CC}

Typical Performance Curves - continued

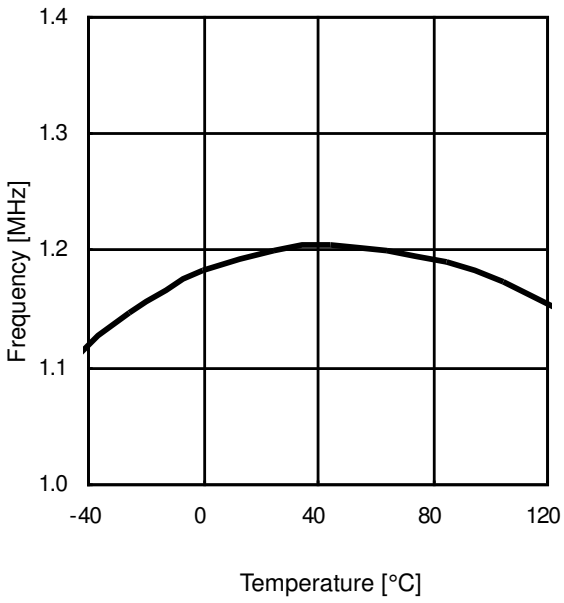


Figure 8. Frequency vs Temperature

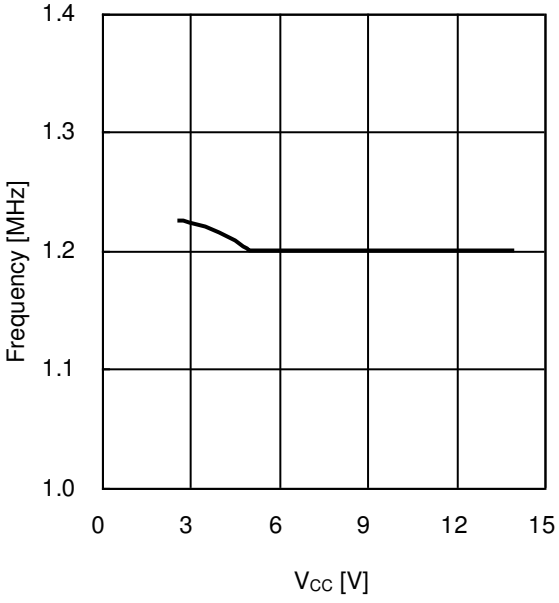


Figure 9. Frequency vs V_{CC}

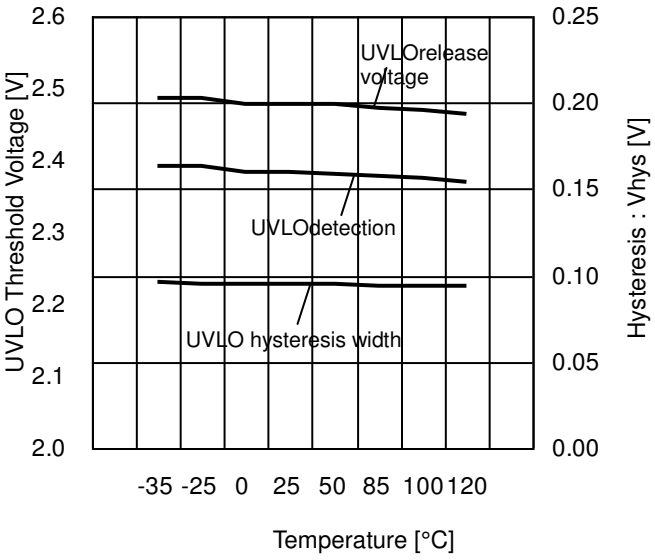


Figure 10. UVLO Threshold Voltage vs Temperature

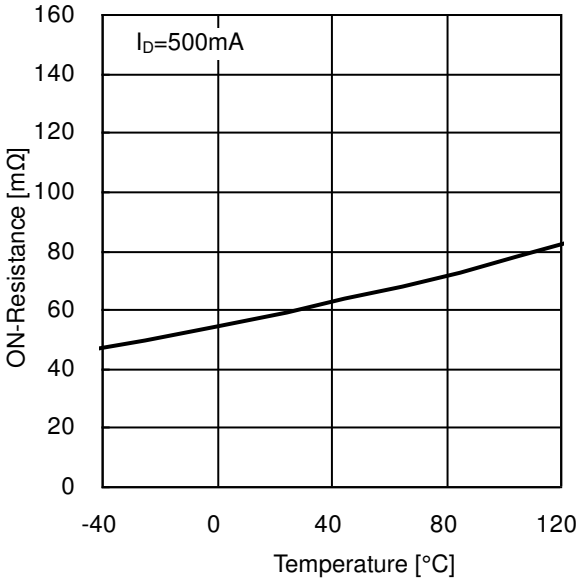


Figure 11. ON-Resistance vs Temperature

Typical Performance Curves - continued

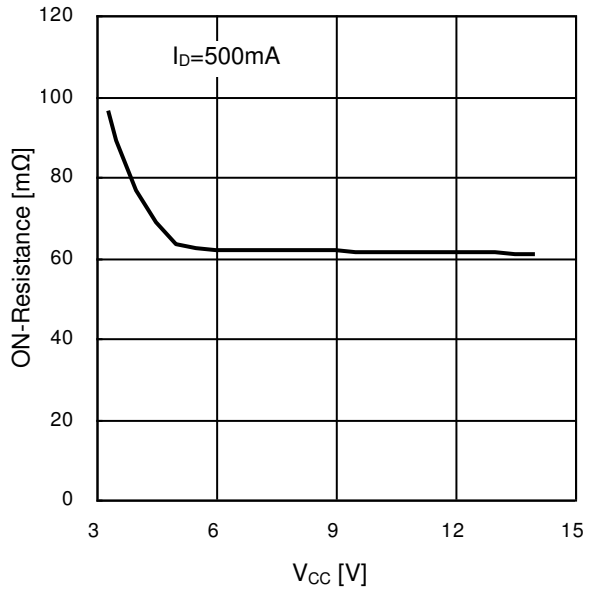


Figure 12. ON-Resistance vs V_{CC}

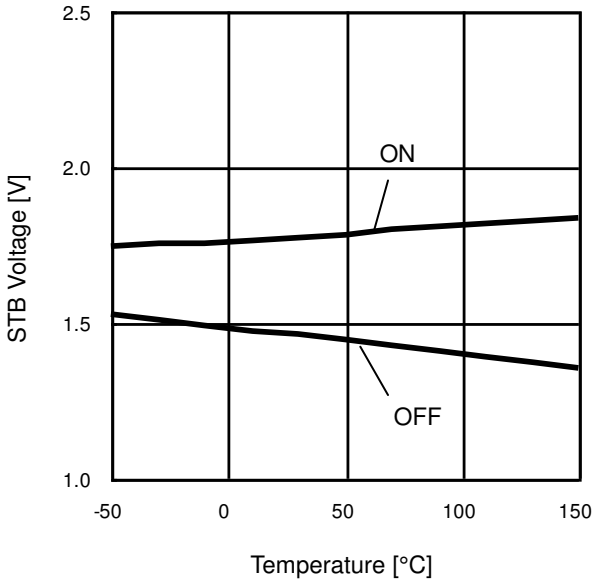


Figure 13. STB Voltage vs Temperature

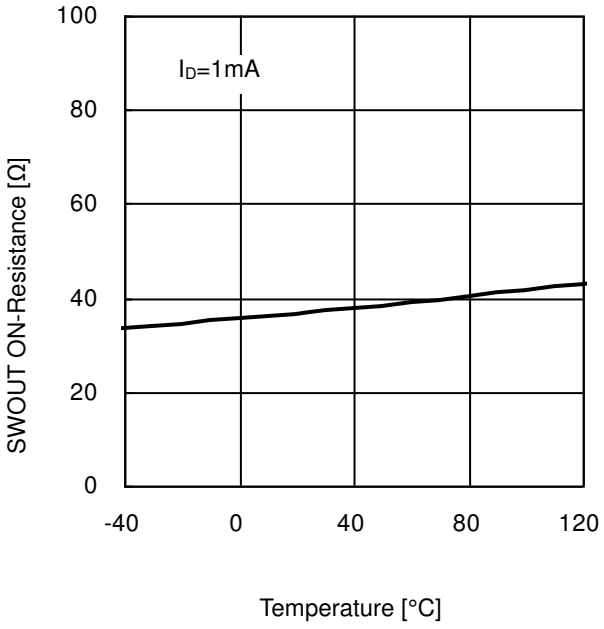


Figure 14. SWOUT ON-Resistance vs Temperature

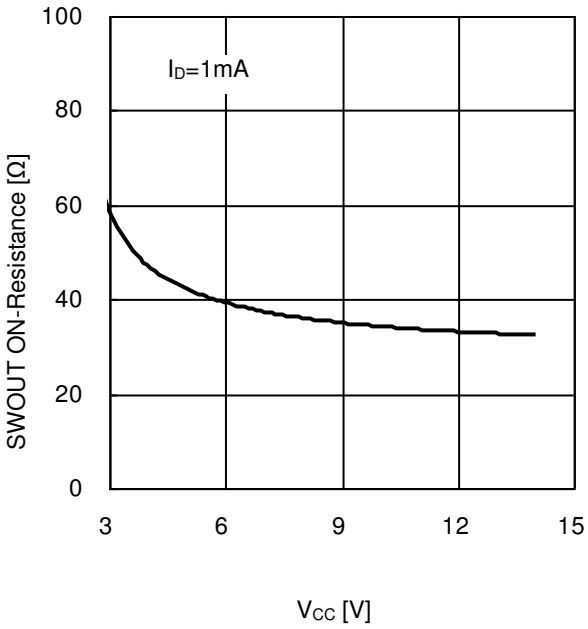


Figure 15. SWOUT ON-Resistance vs V_{CC}

Typical Performance Curves - continued

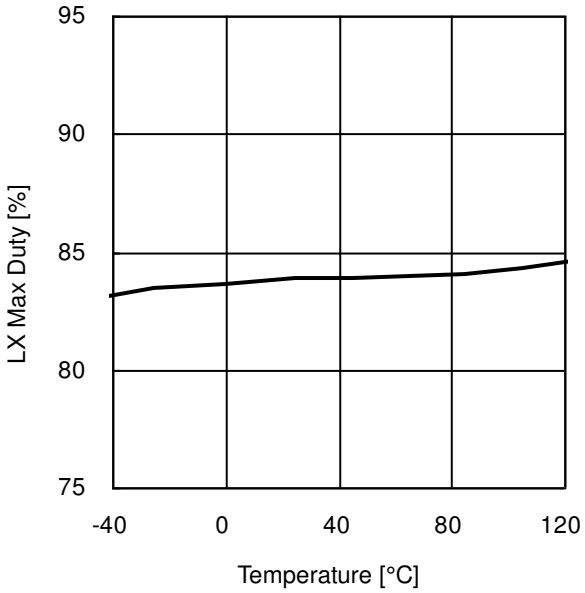


Figure 16. LX Max Duty vs Temperature

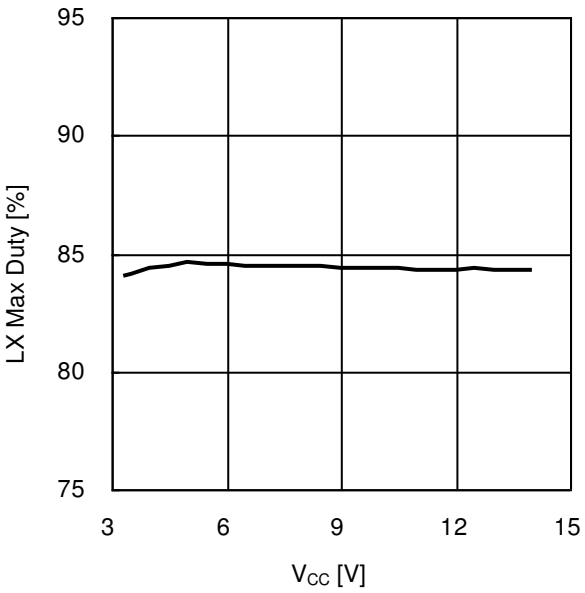


Figure 17. LX Max Duty vs V_{CC}

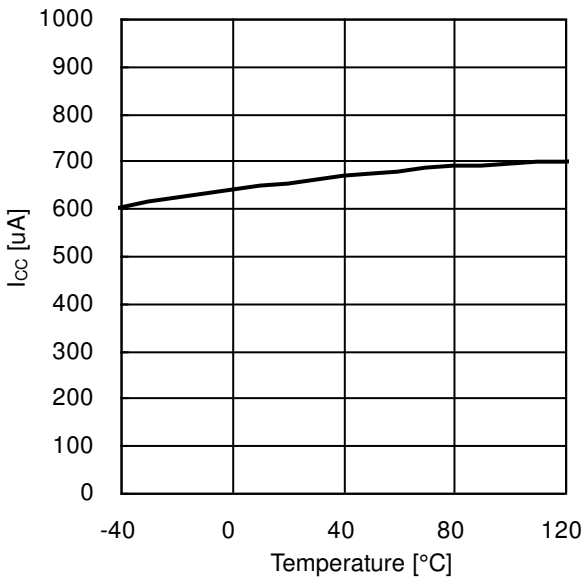


Figure 18. I_{CC} vs Temperature

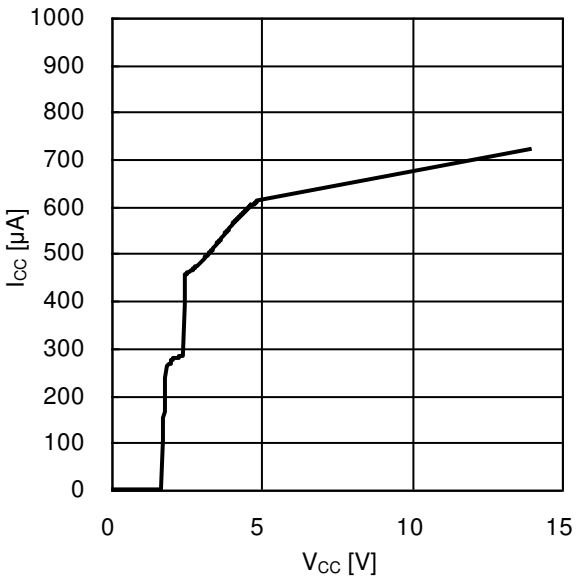


Figure 19. I_{CC} vs V_{CC}

Application Information

● **Example of Application** Input: 3.0V to 10V, Output: 10V / 500mA

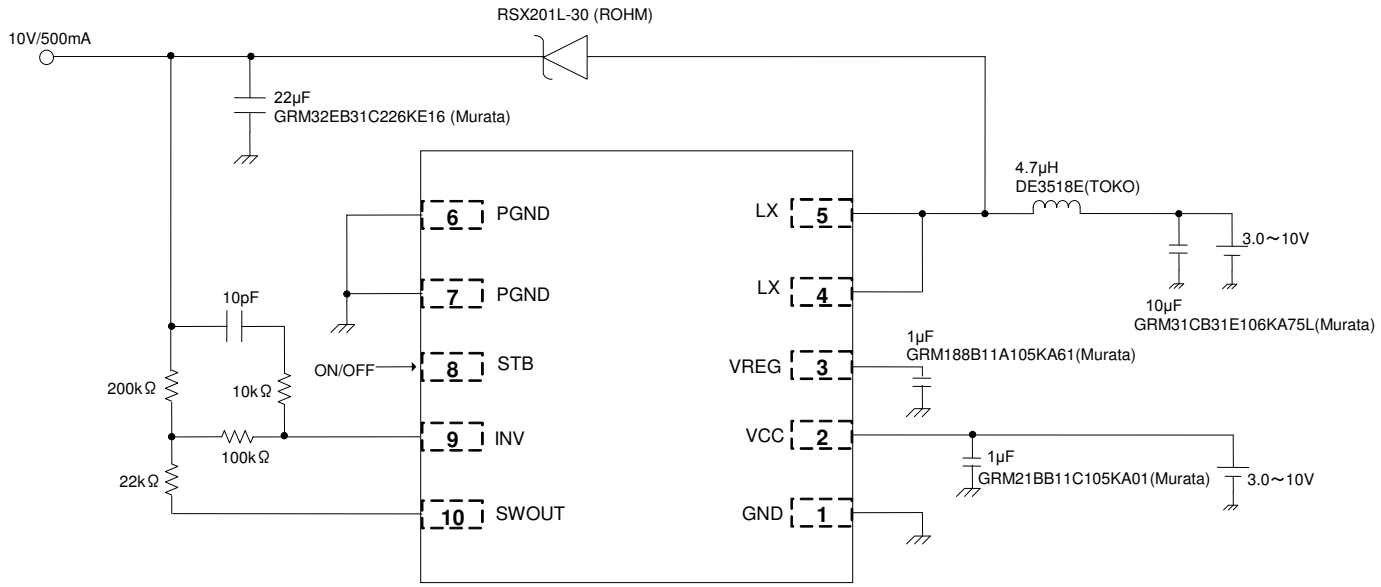


Figure 20. Reference Application Diagram

● **Reference Application Data 1**

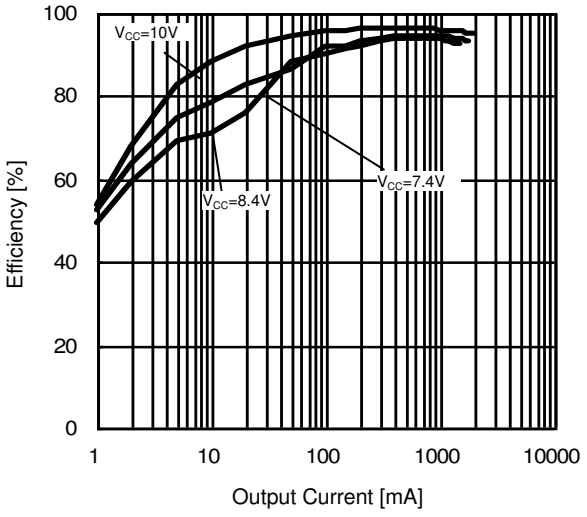


Figure 21. Power Conversion Efficiency 1

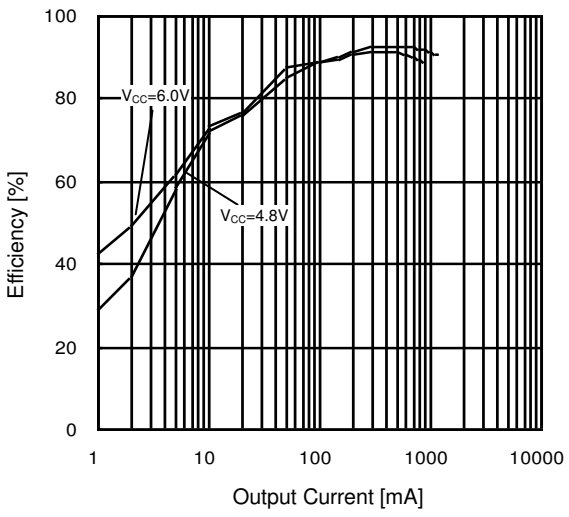


Figure 22. Power Conversion Efficiency 2

Reference Application Data 1 - continued

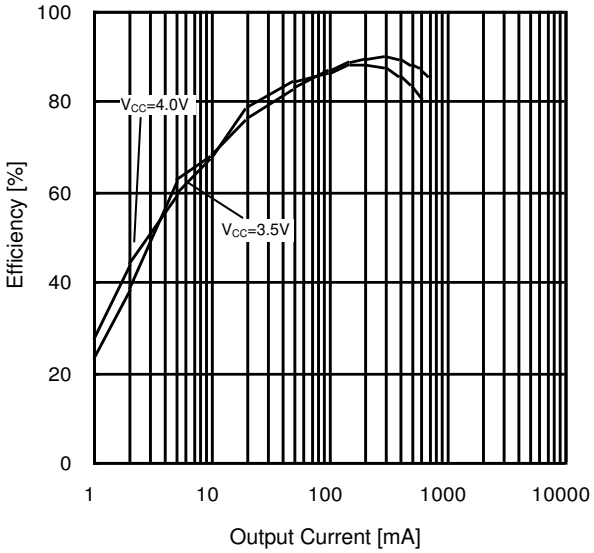


Figure 23. Power Conversion Efficiency 3

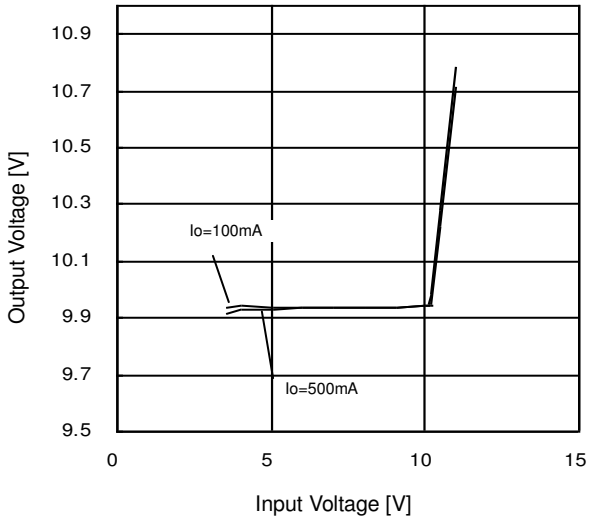


Figure 24. Line Regulation

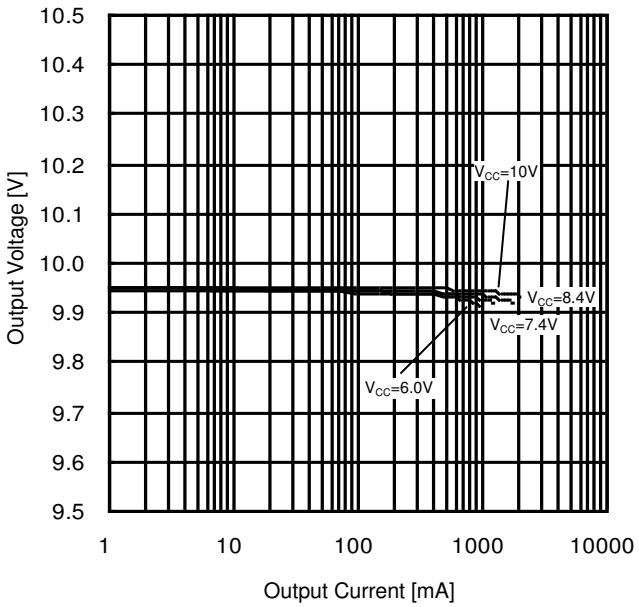


Figure 25. Load Regulation 1

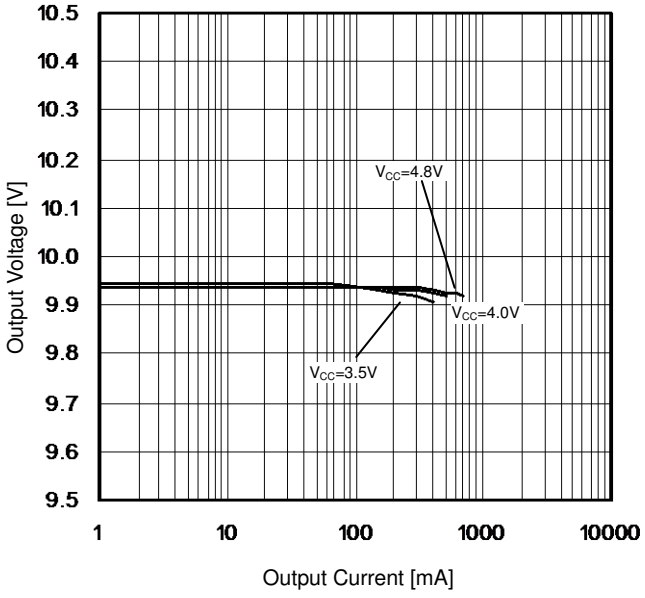


Figure 26. Load Regulation 2

Reference Application Data 1 - continued

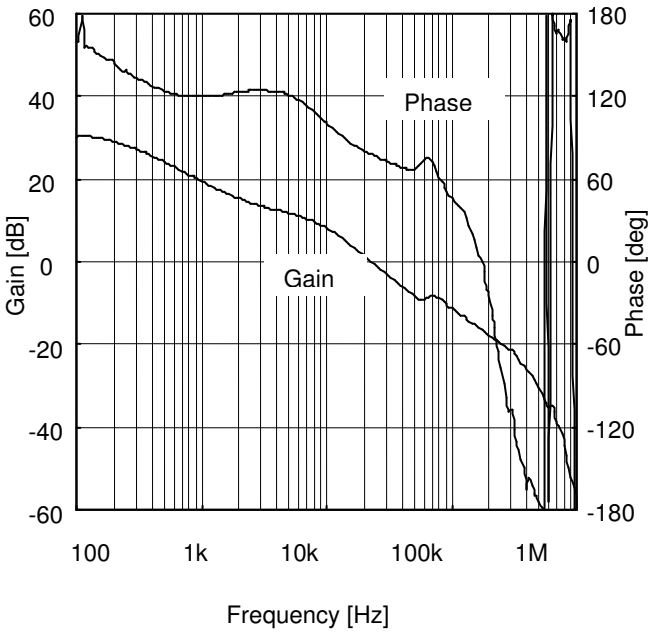


Figure 27. Frequency Response Property 1
(V_{CC} = 3.0V, I_O = 200 mA)

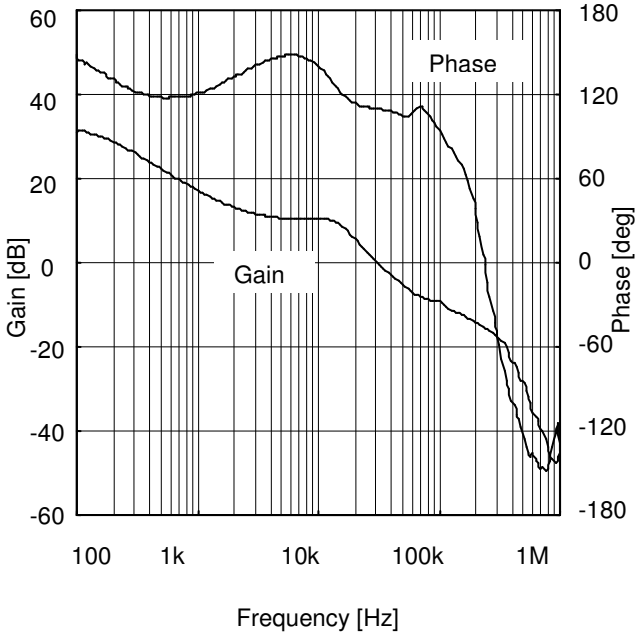


Figure 28. Frequency Response Property 2
(V_{CC} = 6.0V, I_O= 200 mA)

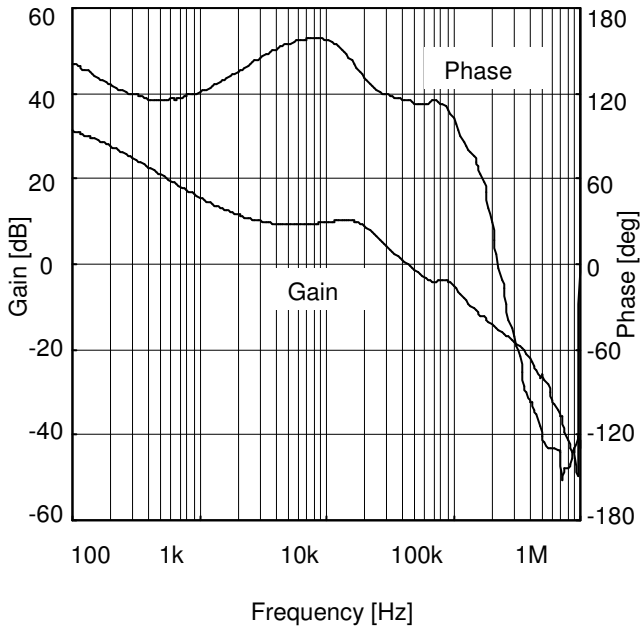


Figure 29. Frequency Response Property 3
(V_{CC} = 8.4 V, I_O= 200 mA)

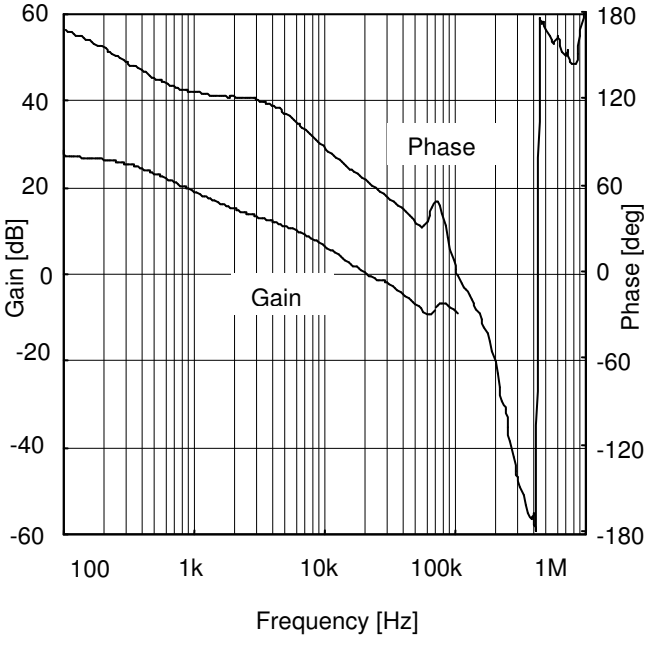


Figure 30. Frequency Response Property 4
(V_{CC} = 3.0 V, I_O= 500 mA)

Reference Application Data 1 - continued

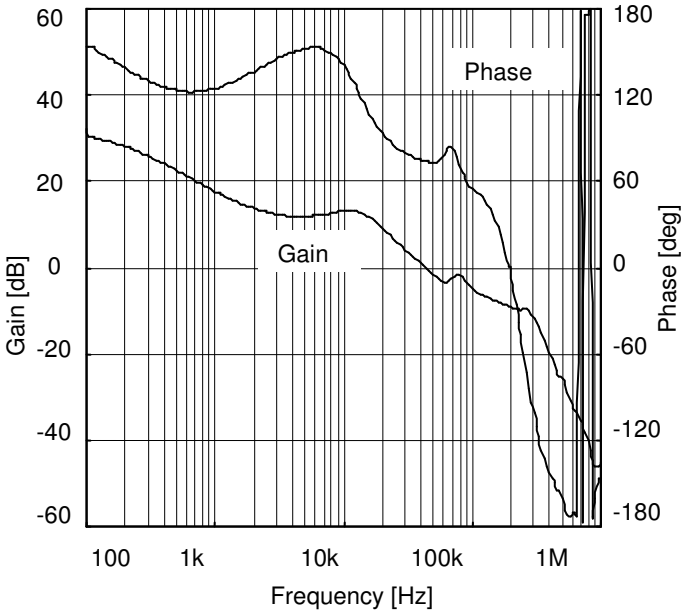


Figure 31. Frequency Response Property 5
(V_{CC} = 6.0 V, I_O = 500 mA)

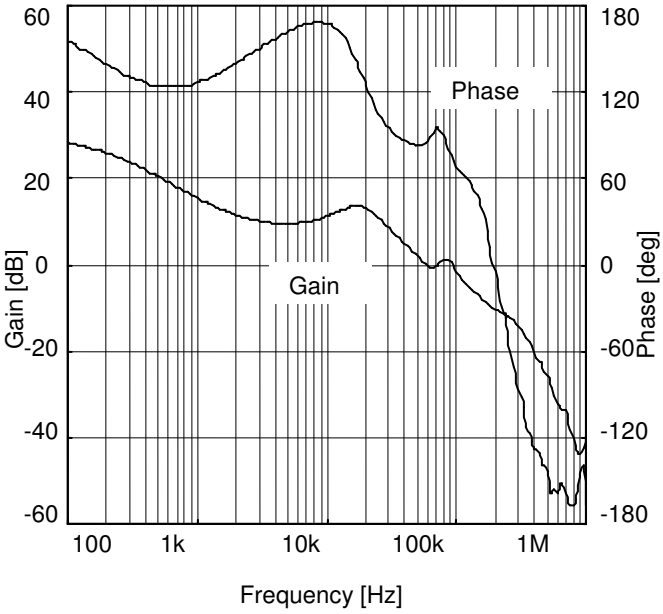
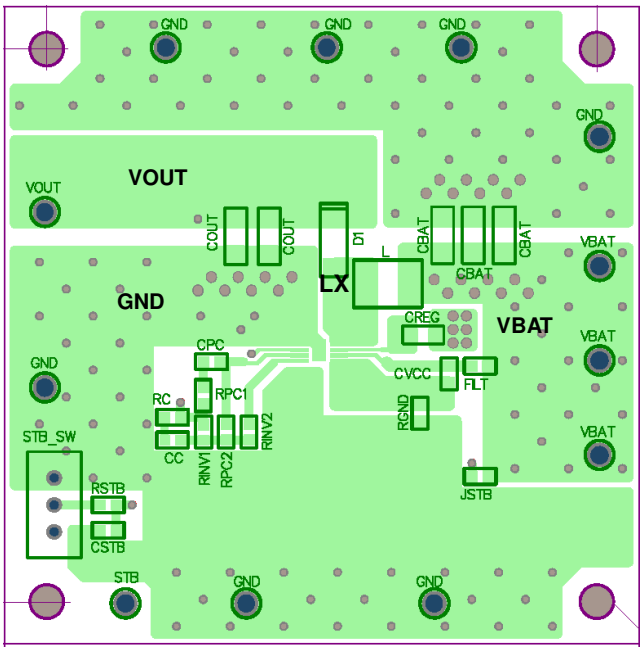


Figure 32. Frequency Response Property 6
(V_{CC} = 8.4 V, I_O = 500 mA)

- **Reference Board Pattern**



The heat sink on the rear should be a GND plane of low impedance in same potential with the PGND plane.
It is recommended to install a GND pin in a system as shown in the drawing without connecting it directly to this PGND.

- **Limits of The Lowest Power Supply Voltage to Start Up**

In case the output voltage of the DC/DC converter is used as input to VCC to supply power to the IC, the actual voltage at VCC upon startup will drop by V_F voltage of the external diode.
The worst condition is shown as below.

VCC terminal voltage - V_F voltage of external diode ≥ the worst voltage of UVLO reset voltage (=2.8V)

Please use this IC with caution considering the needed start up voltage and load current.

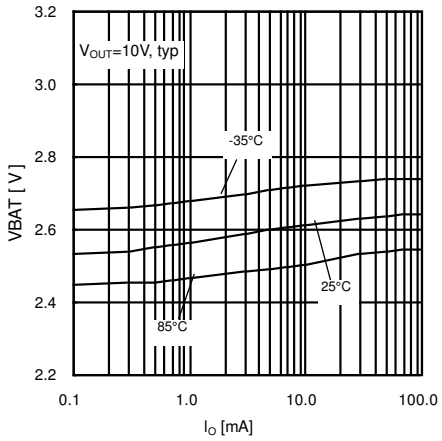


Figure 33. Start-up Voltage vs Load Current

- **Selection of Part for Applications**

(1) Inductor
A shielded inductor with low DCR (direct resistance component) that satisfies the current rating (current value, Ipeak as shown in the equation below) is recommended.
Inductor values affect inductor ripple current, which will cause output ripple.
Ripple current can be reduced by increasing the coil L value and/or increasing the switching frequency

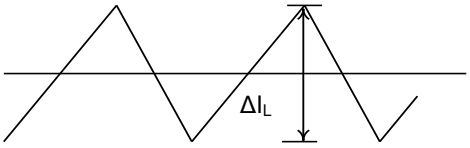


Figure 34. Inductor Current

$$I_{PEAK} = I_{OUT}\left(\frac{V_{OUT}}{V_{IN}}\right)/\eta + \Delta I_L/2 \quad [A] \qquad \cdot\cdot\cdot (1)$$

$$\Delta I_L = \frac{V_{IN}}{L} \times \frac{V_{OUT} - V_{IN}}{V_{OUT}} \times \frac{1}{f} \quad [A] \qquad \cdot\cdot\cdot (2)$$

where:
η is the Efficiency
ΔI_L is the Output Ripple Current
f is the Switching Frequency

As a guide, inductor ripple current should be set at about 20% to 50% of the maximum input current.

Note: Current flowing in the coil that is larger than the coil rating brings it into magnetic saturation, which may lead to lower efficiency or output oscillation. Select an inductor with an adequate margin so that the peak current does not exceed the rated current of the coil.

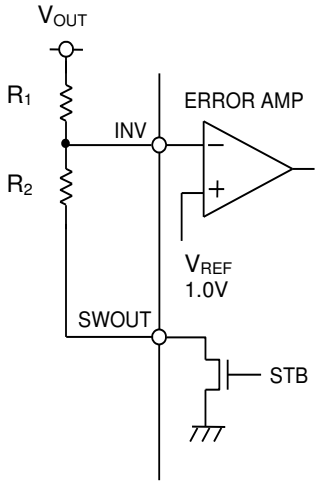
(2) Output Capacitor
A ceramic capacitor with low ESR is recommended for output in order to reduce output ripple.
There must be an adequate margin between the maximum rating and output voltage of the capacitor, taking the DC bias property into consideration.
Output ripple voltage is obtained by the following equation.

$$V_{PP} = I_{OUT} \times \frac{V_{OUT} - V_{IN}}{f \times C_O \times V_{OUT}} + I_{OUT} \times R_{ESR} \quad [V] \qquad \cdot\cdot\cdot (3)$$

Setting must be performed so that output ripple is within the allowable ripple voltage.

(3) Output Voltage Setting

The internal reference voltage of the ERROR AMP is 1.0 V. Output voltage is obtained by Equation (4) of Figure 35, but it should be designed taking into consideration the NMOS ON-Resistance of SWOUT (about 50 Ω).



$$V_O = \frac{(R_1 + R_2)}{R_2} \times 1.0 \quad [V] \qquad \cdot\cdot\cdot (4)$$

Figure 35. Setting of Voltage Feedback Resistance

(4) DC/DC converter frequency response adjustment system

Condition for stable application

The condition for feedback system stability under negative feedback is that the phase delay is 135 °or less when gain is 1 (0 dB). Since DC/DC converter application is sampled according to the switching frequency, the bandwidth G_{BW} of the whole system (frequency at which gain is 0 dB) must be controlled to be equal to or lower than 1/10 of the switching frequency.

In summary, the conditions necessary for the DC/DC converter are:

- Phase delay must be 135°or lower when gain is 1 (0 dB).
- Bandwidth G_{BW} (frequency when gain is 0 dB) must be equal to or lower than 1/10 of the switching frequency.

To satisfy above two items, R_1, R_2, R_3, C_S and R_S in Figure 36 should be set as follows.

(a) R_1, R_2, R_3

BD8314NUV incorporates phase compensation devices of R_4=62kΩ and C_2=200pF. These C_2 and R_1, R_2, and R_3 values decide the primary pole that determines the bandwidth of DC/DC converter.

Primary pole point frequency

$$f_p = \frac{1}{2\pi\left\{A \times \left(\frac{R_1 \times R_2}{R_1 + R_2} + R_3\right) \times C_2\right\}} \qquad \cdot\cdot\cdot (5)$$

DC/DC converter DC Gain

$$DC\ Gain = A \times \frac{1}{B} \times \frac{V_{OUT}}{V_{OUT} - V_{IN}} \qquad \cdot\cdot\cdot (6)$$

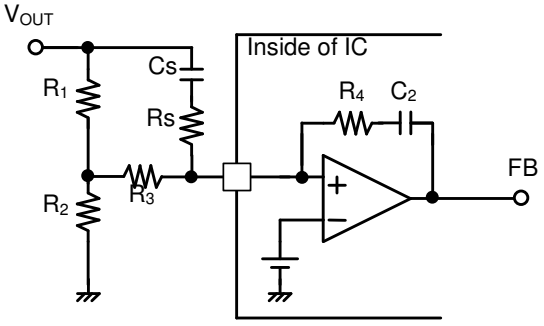


Figure 36. Example of Phase Compensation Setting

where:
A is the ERROR AMP Gain
About 100dB = 10^5
B is the Oscillator Amplification = 0.5
V_{IN} is the Input Voltage
V_{OUT} is the Output Voltage

Using Equations (5) and (6), the frequency f_{sw} of point 0 dB under limitation of the bandwidth of the DC gain at the primary pole point is as shown below.

$$fsw = fp \times DC\,Gain = \frac{1}{2\pi C2 \times \left(\frac{R1 \times R2}{R1 + R2} + R3\right)} \times \frac{1}{B} \times \frac{VOUT}{VOUT - VIN} \quad \cdots (7)$$

It is recommended that f_{sw} should be approximately 10kHz. When load response is difficult, it may be set at approximately 20kHz. By this setting, R_1 and R_2, which determine the voltage value, will be in the order of several hundred kΩ. Therefore, if an appropriate resistance value is not available and if routing may cause noise, the use of R_3 enables easy setting.

(b) Cs and Rs setting

In the step-up DC/DC converter, the secondary pole point is caused by the coil and capacitor as expressed by the following equation.

$$f_{LC} = \frac{1 - D}{2\pi\sqrt{(LCout)}} \quad \cdots (8)$$

$$D:\ ON\ Duty = (V_{OUT} - V_{IN})/V_{OUT}$$

Cout : Output Capacitor

This secondary pole causes a phase rotation of 180°. To secure the stability of the system, put zero points in 2 places to perform compensation.

Zero point by built-in CR $$f_{Z1} = \frac{1}{2\pi R_4 C_2} = 13\ kHz \quad \cdots (9)$$

Zero point by Cs $$f_{Z2} = \frac{1}{2\pi(R_1 + R_3)C_S} \quad \cdots (10)$$

Setting f_{Z2} frequency to be half to 2 times as large as f_{LC} provides an appropriate phase margin.
It is desirable to set Rs at about 1/20 of (R_1+R_3) to cancel any phase boosting at high frequencies.

These pole points are summarized in the figure below. The actual frequency property is different from the ideal calculation because of part constants. If possible, check the phase margin with a frequency analyzer or network analyzer, etc.. Otherwise, check for the presence or absence of ringing by load response waveform and also check for the presence or absence of oscillation under a load of an adequate margin.

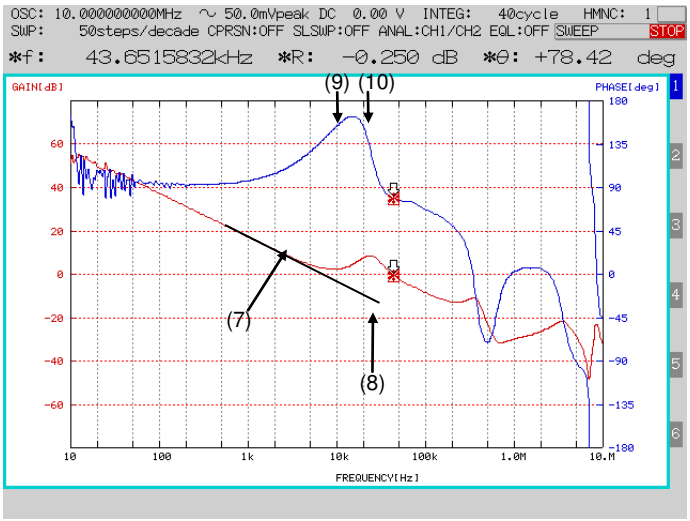
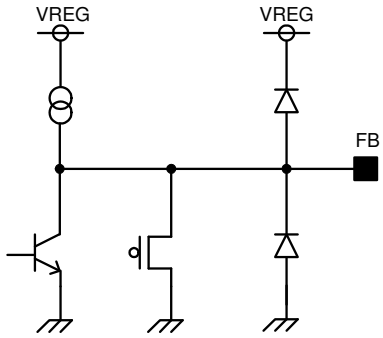


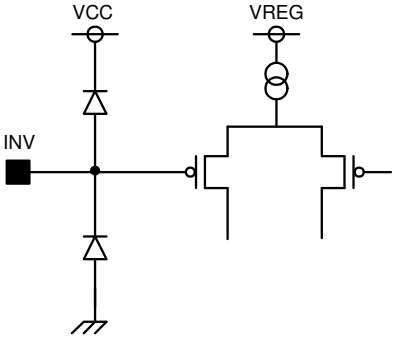
Figure 37. Example of DC/DC Converter Frequency Property
(Measured with FRA5097 by NF Corporation)

I/O Equivalent Circuit

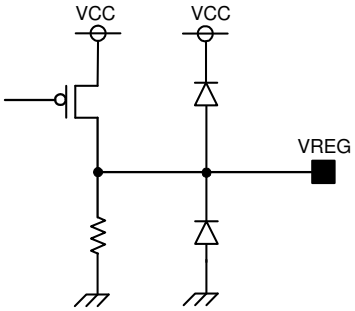
FB



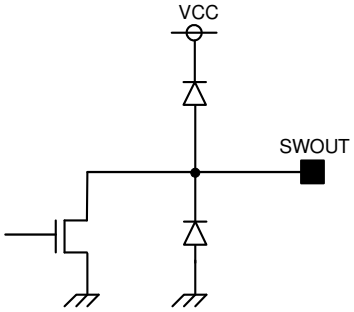
INV



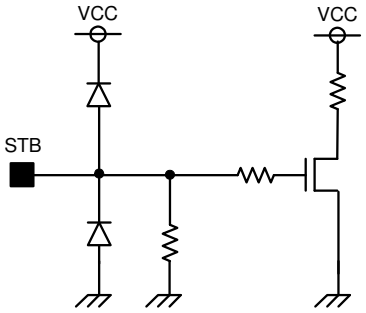
VREG



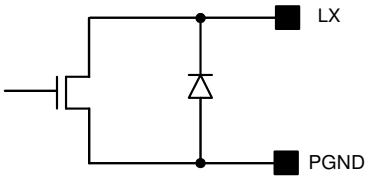
SWOUT



STB



LX, PGND



Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
   Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
   When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Thermal Consideration**
   Should by any chance the power dissipation rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, increase the board size and copper area to prevent exceeding the Pd rating.

6. **Recommended Operating Conditions**
   These conditions represent a range within which the expected characteristics of the IC can be approximately obtained. The electrical characteristics are guaranteed under the conditions of each parameter.

7. **Inrush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

8. **Operation Under Strong Electromagnetic Field**
   Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

9. **Testing on Application Boards**
   When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

10. **Inter-pin Short and Mounting Errors**
    Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

Operational Notes – continued

11. **Unused Input Pins**
Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

12. **Regarding the Input Pin of the IC**
This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):

When GND > Pin A and GND > Pin B, the P-N junction operates as a parasitic diode.
When GND > Pin B, the P-N junction operates as a parasitic transistor.

Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the GND voltage to an input pin (and thus to the P substrate) should be avoided.

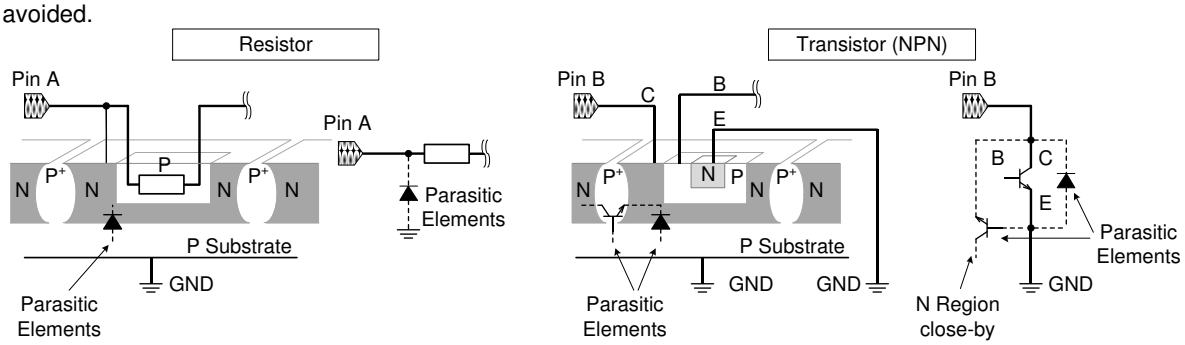


Figure 38. Example of monolithic IC structure

13. **Thermal Shutdown Circuit(TSD)**
This IC has a built-in thermal shutdown circuit that prevents heat damage to the IC. Normal operation should always be within the IC's power dissipation rating. If however the rating is exceeded for a continued period, the junction temperature (Tj) will rise which will activate the TSD circuit that will turn OFF all output pins. When the Tj falls below the TSD threshold, the circuits are automatically restored to normal operation.
Note that the TSD circuit operates in a situation that exceeds the absolute maximum ratings and therefore, under no circumstances, should the TSD circuit be used in a set design or for any purpose other than protecting the IC from heat damage.

Ordering Information

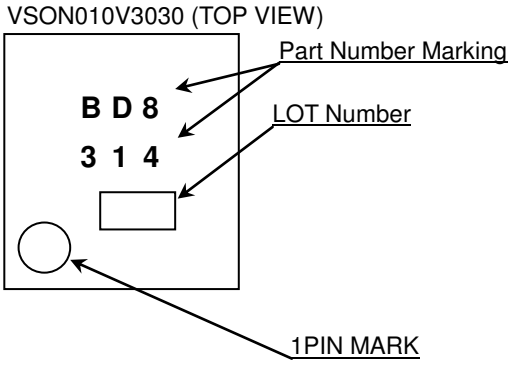
B D 8 3 1 4 N U V - E 2

Part Number

Package
NUV: VSON010V3030

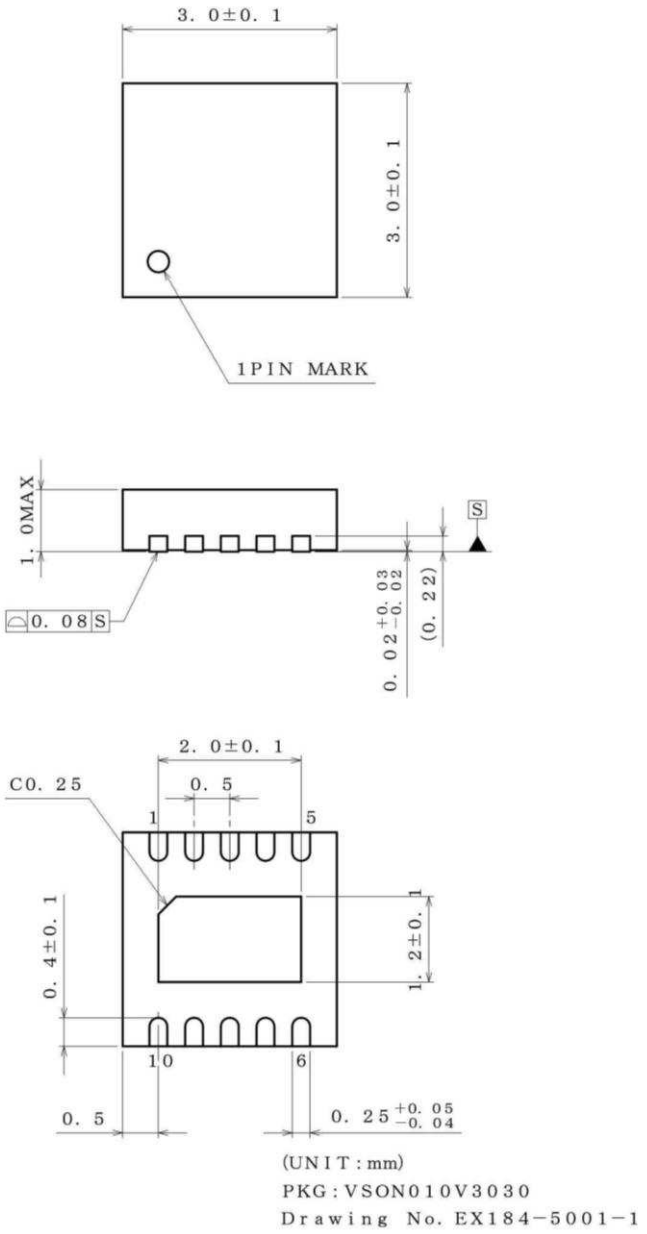
Packaging and forming specification
E2: Embossed tape and reel

Marking Diagram



Physical Dimension, Tape and Reel information

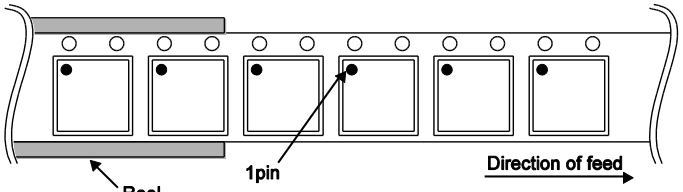
Package Name	VSON010V3030



(UNIT : mm)
PKG : VSON010V3030
Drawing No. EX184−5001−1

<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	3000pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



*Order quantity needs to be multiple of the minimum quantity.

Revision History

Date	Revision	Changes
26.Nov.2014	001	New Release
17.Feb.2015	002	Correction of the Writing.

Notice

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1. Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

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8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
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   - [b] the temperature or humidity exceeds those recommended by ROHM
   - [c] the Products are exposed to direct sunshine or condensation
   - [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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