Ultra High Efficiency Non-Isolated Type DC-DC Converter

Bellnix

BST-6A Series

BST series is a 6A output ultra small size, low profile, ultra high efficiency,low noise and non-isolated type DC-DC converter developed for Distributed Power Architecture (DPA). The output voltage is adjustable in a wide range. For 4V input model, it is adjustable in the range of 0.75V-3.3V, and for 12V input model, it is adjustable in the range of 0.75V-5.0V. Furthermore, a tracking function is built-in as a standard and it is easy to compose sequence circuits for applications required for power supply sequences of FPGA etc.

<Features>

-Low Profile, Ultra Small Size (W=27.9 L=11.4 H=7.1mm)
- Adjustable Output Voltage
- Input/ Output Non-Isolated Type
- High Efficiency 94%, 89.5%
- Wide Operating Temp. Range -40°C to +85°C
- SMD Type
- Long-Life, High Performance, Low Price
- Wide Input Voltage Range
- Built-in Over-Current Protection
- Tracking Function
- Remote ON/OFF Control
- High Reliability with the Latest SMD Structure
- No Electrolytic Capacitor

<Model, Rating, Specification>

Table 1

Model	Input		Output			Efficiency(%) (Vo=3.3V,6A)	Package
	Rating Voltage (V)	Voltage Range (V)	Rating Voltage (V)	Adjustable Range (V)	Current (A)		
BST04-0.7S06PCM	4.0	2.8 - 5.5	0.75	0.75 - 3.3	6	94.0	SMD
BST12-0.7S06PCM	12.0	10.0 - 14.0	0.75	0.75 - 5.0	6	89.5	SMD

<Outline>

Dimensions: mm (Inches)

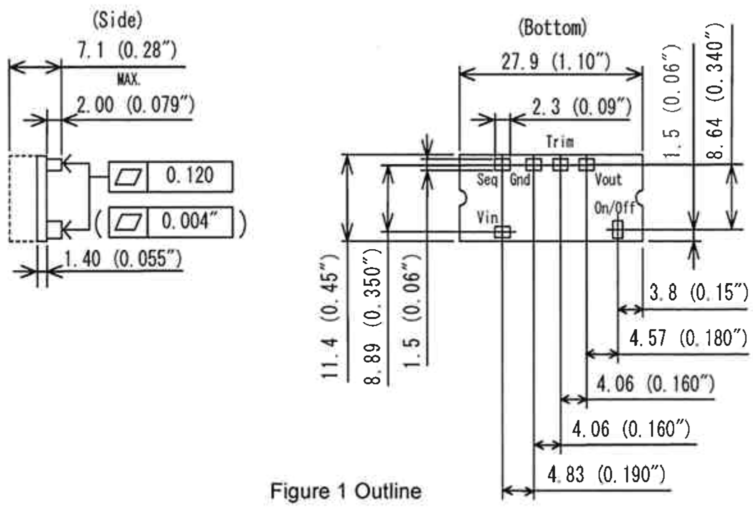


Figure 1 Outline

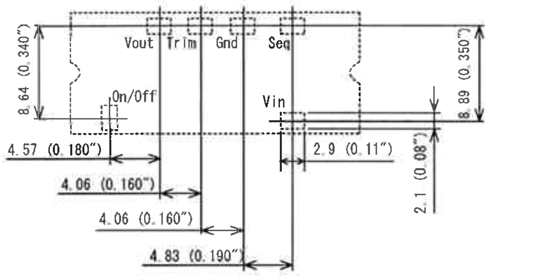


Figure 2 Recommended PWB PAD LAYOUT (Top View)

Table 2

Pin	Symbol	Function
1	On/Off	Remote On/Off control
2	Vin	+Input pin
3	Seq	Tracking function pin
4	Gnd	Input/output GND pin
5	Trim	Output voltage adjustable pin
6	Vout	+Output pin

Pin no. is not shown for the unit.
Pin substances: Copper
Plating: Tin plating after nickel plating.

<Absolute Maximum Ratings>

Table 3

Item	Symbol (unit)	BST04-0.7S06PCM		BST12-0.7S06PCM	
		min	max	min	max
Input voltage	Vin (V)	0	+5.8	0	+15
TRACK voltage	TRACK (V)	0	Vin,max.	0	Vin,max.
Operating ambient temp.	Ta (°C)	-40	+85	-40	+85
Storage temp.	Tstg (°C)	-55	+125	-55	+125

<Electrical Characteristics> BST04-0.7S06PCM

(Unless otherwise specified, Ta=25℃, Airflow=300LFM, Vin=5.0V, Io=rating) Table 4

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Characteristics						
Input Voltage Range	Vin	Vout≦Vin-0.5V	2.8		5.5	V
UVLO Turn-on Voltage Threshold				2.2		V
UVLO Turn-off Voltage Threshold				2.0		V
Maximum Input Current	Iin	Vin=+2.8V to +5.5V Io=6A			6.0	A
No-Load Input Current	Iin	Io= 0A		70	100	mA
Off Converter Input Current	Iin			20	30	mA
Output Characteristics						
Output Voltage Set Point	Vo	Vin=+5.0V Io=6A	0.7375	0.7525	0.7675	V
Output Voltage Adjustable Range	Vo		(0.752)		3.3	V
Output Voltage Regulation Over Line Over Load Over Temperature Total Output Voltage Range		 Vin=+2.8V to +5.5V Io= 0A to 6A Ta=-40 to +85℃ Input, load, temperature	 -3.0	 0.3 0.4 0.8 	 +3.0	 % % % %
Output Voltage Ripple and Noise Peak to Peak RMS		Bandwidth = 20MHz 1μ ceramic, 10μ tantalum 1μ ceramic, 10μ tantalum		 40 10	 60 15	 mV mV
Output Current Range (Temp. derating required)	Io		0		6	A
Output Voltage Over−Shoot at Start-up					5	%
Output DC Current-Limit Inception				220		% Io
Output Short-Circuit Current(Hiccup Mode)		Io,s/c		3.5		Adc
Dynamic Characteristics						
Dynamic Load Response Positive Step Change in Output Current Negative Step Change in Output Current Setting Time to 10% of Peak Devitation		10μF Tan & 1μF Ceramic load cap, 2.5A/μs 50% Io, max to 100% Io, max 100% Io, max to 50% Io, max		 160 160 25	 220 220 	 mV mV μs
Turn-On Transient Start-Up Time, From Input Output Voltage Rise Time		Io=Io.max Vin=Vin,min, Vo=10% of Vo,set Time for Vo to rise from 10% to 90% of Vo,set		 2 2	 4 5	 ms ms
Maximum Output Startup Capacitive Load		Full Load : 1mΩ≦Esr Full Load : 10mΩ≦Esr			1000 3000	μF μF
Efficiency						
Vo=3.3V Vo=1.8V Vo=0.75V	η	Vin=5V Io=6A		94.0 89.0 81.0		%
Feature Characteristics						
Switching Frequency				300		kHz
On/Off Control Logic High Voltage Logic Low Voltage Logic Low Current Logic High Current		 Module On Von/off Module Off Von/off Module On, Ion/off Module Off, Ion/off	 -0.2 	 0.2	 Vin,max 0.3 10 1.0	 V V μA mA
Tracking Slew Rate			0.1		2	V/msec
Tracking Delay Time		Delay from Vin.min to application of tracking voltage	10			msec
Tracking Accuracy		Power-up 2V/mS Power-down 1V/mS		100 200	200 400	mV mV
Over-Temperature Shutdown				130		℃
Weight				6.5	7.5	g

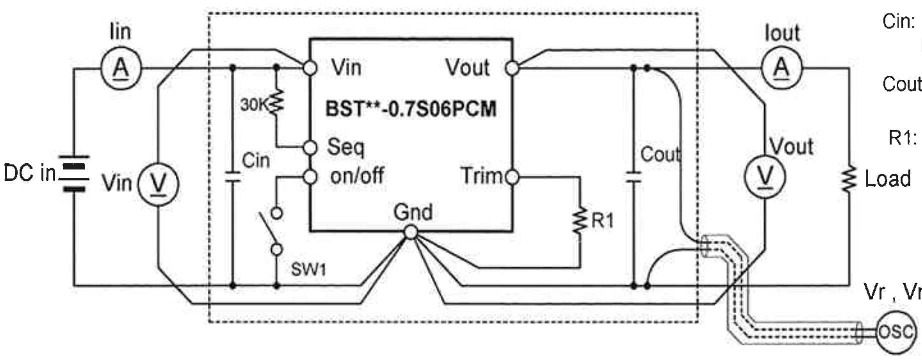
<Electrical Characteristics> BST12-0.7S06PCM

(Unless otherwise specified, Ta=25℃, Airflow=300LFM, Vin=12.0V, Io=rating) Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Characteristics						
Input Voltage Range	Vin		10	12	14	V
UVLO Turn-on Voltage Threshold				9.5		V
UVLO Turn-off Voltage Threshold				8.5		V
Maximum Input Current	Iin	Vin= +10V to +14V Io=6A			3.4	A
No-Load Input Current	Iin	Io= 0A		100	130	mA
Off Converter Input Current	Iin			10	30	mA
Output Characteristics						
Output Voltage Set Point	Vo	Vin=+12V Io=6A	0.7375	0.7525	0.7675	V
Output Voltage Adjustable Range	Vo		(0.752)		5.0	V
Output Voltage Regulation Over Line Over Load Over Temperature Total Output Voltage Range		 Vin=+10V to +14V Io =0A to 6A Ta=-40℃ to +85℃ Input, load, temperature	 -3.0	 0.2 0.4 0.4	 +3.0	 % % % %
Output Voltage Ripple and Noise Peak to Peak RMS		Bandwidth = 20MHz 1µ ceramic, 10µ tantalum 1µ ceramic, 10µ tantalum		 30 12	 75 30	 mV mV
Output Current Range (Temp derating required)	Io		0		6	A
Output Voltage Over-Shoot at Start-up					5	%
Output DC Current-Limit Inception				200		% Io
Output Short-Circuit Current(Hiccup mode)		Io,s/c		2		Adc
Dynamic Characteristics						
Dynamic Load Response Positive Step Change in Output Current Negative Step Change in Output Current Setting Time to 10% of Peak Devitation		10µF Tan & 1µF ceramic load cap, 2.5A/µs 50% Io, max to 100% Io, max 100% Io, max to 50% Io, max		 200 200 25	 300 300	 mV mV µs
Turn-On Transient Start-Up Time, From Input Output Voltage Rise Time		Io=Io.max Vin=Vin,min, Vo=10% of Vo,set Time for Vo to rise from 10% to 90% of Vo,set		 3 4	 5 6	 ms ms
Maximum Output Startup Capacitive Load		Full Load : 1mΩ≦Esr Full Load : 10mΩ≦Esr			1000 3000	µF µF
Efficiency						
Vo=5.0V Vo=1.8V Vo=0.75V	η	Vin=12V Io = 6A		91.5 85.5 73.5		%
Feature Characteristics						
Switching Frequency				300		kHz
On/Off Control Logic High Voltage Logic Low Voltage Logic Low Current Logic High Current		 Module On, Von/off Module Off, Von/off Module On, Ion/off Module Off, Ion/off	 -0.2	 0.2	 Vin,max 0.3 10 1.0	 V V µA mA
Tracking Slew Rate			0.1		2	V/msec
Tracking Delay Time		Delay from Vin.min to application of tracking voltage	10			msec
Tracking Accuracy		Power-up 2V/mS Power-down 1V/mS		100 200	200 400	mV mV
Over-Temperature Shutdown				120		℃
Weight				6.5		g

<Measurement Circuit>

1. Standard Measurement Circuit



Cin: BST04=47μF ceramic // 2×100μF tantalum
BST12= 2×22μF ceramic

Cout: 1μF ceramic // 10μF tantalum
(Common for BST04 and 12)

R1: Vout Up Resistance

Figure 3

2. Output Ripple Noise Measurement Circuit

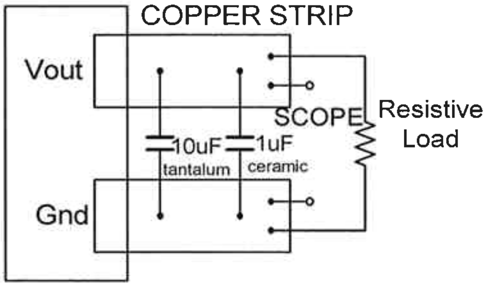
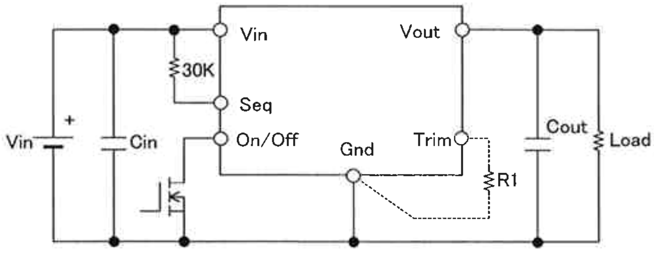


Figure 4

<Standard Connection Circuit Diagram>



Cin: BST04 6A = 47μF ceramic // 2×100μF tantalum
BST12 6A=2×22μF ceramic
Cout: 1μF ceramic // 10μF tantalum
(Common for BST04 and 12)

Figure 5

<Input Filter>

Low impedance supply is required for input supply to BST series. There is possibility to effect the stable operation of the module if the input supply impedance becomes high impedance. It is also required to connect to the input of the module as close as possible to keep the input ripple of the input capacitor minimum and to make the stable operation of the module certain.

A low ESR polymer or a ceramic capacitor is recommended for an input additional capacitor (Cin) to maintain low input voltage ripple. The input ripple voltage (mVp-p) data when an additional capacitor is mounted to the input, is shown in figure 6-8.

When operating several DC-DC converters using the same input power supply, or operating with cascade connection, beat frequency influence may appear on output voltage or beat sound due to mutual interference. So, when connecting like this, be sure to compose a L-C filter to the input line.

BST04-0.7S06PCM

1. 2×100μF tantalum / / 47μF ceramic ----- Figure 6
   Iout=6A
2. 4×100μF tantalum / / 2×47μF ceramic ----- Figure7
   Iout=6A

BST12-0.7S06PCM

3. 2×47μF tantalum, 2×22μF ceramic ----- Figure 8
   Iout=6A

The ripple current calculated by the equation below will flow into the input capacitor (Cin). Give consideration to the capacitance ripple current for selecting capacitors.

$$Irms = Iout\sqrt{\frac{Vout}{Vin}\left(1-\frac{Vout}{Vin}\right)}\,Arms$$

BST04-0.7S06PCM

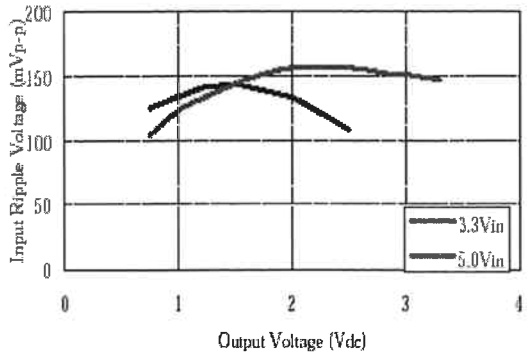


Figure 6 Input voltage ripple VS Output voltage
Cin=2×100μF tantalum // 47μF ceramic
Iout= 6A

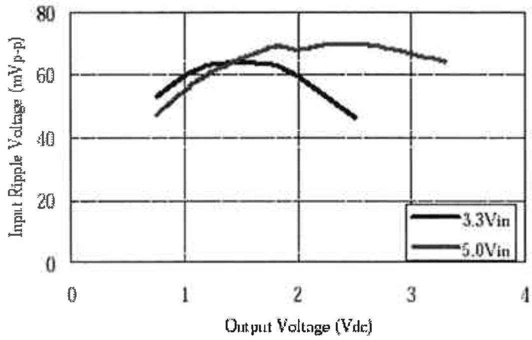


Figure 7 Input voltage ripple VS Output voltage
Cin=4×100μF tantalum //2× 47μF ceramic
Iout= 6A

BST12-0.7S06PCM

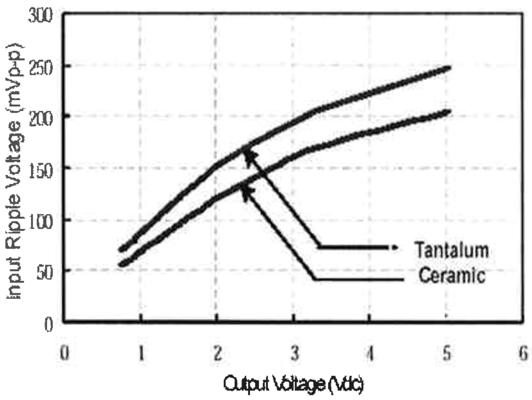


Figure 8 Input voltage ripple VS Output voltage
Cin=2×47μF tantalum 2×22μF ceramic
Vin=12V , Iout= 6A

<Remote ON/Off Control>

BST series has an On/Off pin for remote On/Off operation. As shown in figure 9, connect a NPN transistor between the Gnd pin and On/Off pin.

The converter will operate when On/Off pin is at open mode, and the converter will stop at low mode.

When On/Off control is not used, connect On/Off pin to open or Vin.

On/Off-Gnd open: Output voltage On

On/Off-Gnd short: Output voltage Off

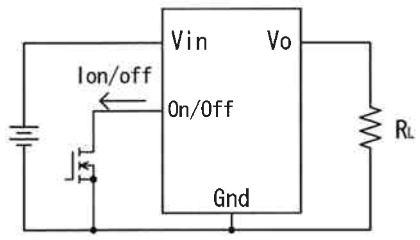


Figure 9

<Output Voltage Programming>

The output voltage of BST series can be programmed to any voltage between 0.75V and 3.3V (for BST12 model, up to 5.0V). When programming the output, input and output voltage difference of 0.5V ($Vo+0.5V \leqq Vin$) or more is required. There are two ways of programming, one using external voltage and the other using an external resistor.

1. Programming with external voltage

Output voltage (Vo) can be programmed by applying external voltage between the TRIM and GND pins (Figure 10).

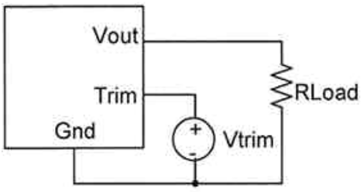


Figure 10 Connection circuit for external voltage programming

To calculate the external voltage Vtrim of **BST04-0.7S06PCM** for programming, use the following equation:

$$Vtrim = 0.7 - 0.1698 \times (Vo - 0.7525)$$

Ex.) To program the Vout to 3.3V, Vtrim is calculated as follows

$$Vtrim = 0.7 - 0.1698 \times (3.3 - 0.7525) = 0.267V$$

To calculate the external voltage Vtrim of **BST12-0.7S06PCM** for programming, use the following equation:

$$Vtrim = 0.7 - [(Vo - 0.7525) \times 0.0667]$$

Ex.) To program the Vout to 3.3V, Vtrim is calculated as follows

$$Vtrim = 0.7 - [(3.3 - 0.7525) \times 0.0667] = 0.530V$$

Typical example for voltage control

Table 6

Vo(V)	Vtrim(V)	
	BST04-0.7S06PCM	BST12-0.7S06PCM
0.7525	Open	Open
1.2	0.624	0.670
1.5	0.573	0.650
1.8	0.522	0.630
2.5	0.403	0.583
3.3	0.267	0.530
5.0	———	0.4167

2. Programming with resistance

Output voltage (Vo) can be programmed by connecting a resistance between the TRIM and GND pins (Figure 11).

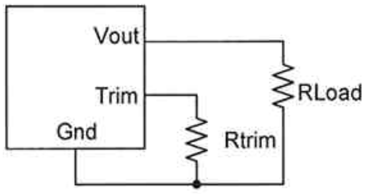


Figure 11 Connection circuit for resistance programming

To calculate the resistance Rtrim for programming, use the following equation: (Common equation for BST04 and BST12)

$$Rtrim = \left(\frac{R1}{Vo - 0.7525} - R2 \right) \Omega$$

Table 7

Vo(V)	Rtrim (Ω)	
	BST04-0.7S06PCM	BST12-0.7S06PCM
Rtrim	Resistance value for programming	
Vo	Desired output voltage	
R1	21070	10500
R2	5110	1000

To program the Vout of BST04-0.7S06PCM to 1.8V, Rtrim is calculated as follows

$$Rtrim = \left(\frac{21070}{1.8 - 0.7525} - 5110 \right) \Omega \fallingdotseq 15k\Omega$$

To program the Vout of BST12-0.7S06PCM to 3.3V, Rtrim is calculated as follows

$$Rtrim = \left(\frac{10500}{3.3 - 0.7525} - 1000 \right) \Omega \fallingdotseq 3.122k\Omega$$

Typical example of resistance programming control

Table 8

Vo(V)	Rtrim(kΩ)	
	BST04-0.7S06PCM	BST12-0.7S06PCM
0.7525	Open	Open
1.2	41.97	22.464
1.5	23.08	13.047
1.8	15.00	9.024
2.5	6.95	5.009
3.3	3.16	3.122
5.0	———	1.472

<Output Voltage Tracking>

For BST series, output voltage tracking during power-up and power-down of the converter is possible by using the Seq pin.

The following three types of tracking method is possible.

1 Sequential operation
2 Ratio-Metric tracking
3 Simultaneous tracking

Tracking operation applies the control voltage from modules or external voltages to the Seq pin and makes the control voltage track the output voltage. This simplifies the task at power-up and power-down.

Also by connecting DC-DC converters together, a composition to track their output voltage will be made.

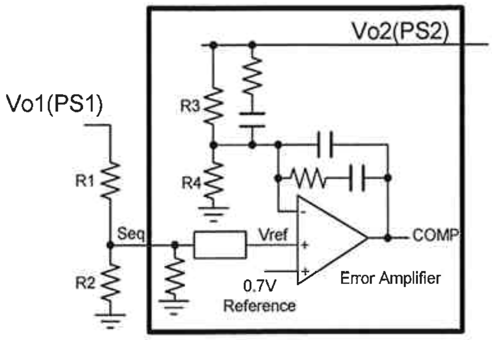


Figure 12 Tracking Diagram

1. Sequenctial operation

Sequential operation is shown in figure 13. By composing a circuit of PWRGD signal from PS1(5V) with components such as resistance-capacitor etc. inside the dotted line, the control voltage will be input to Seq pin of PS2(3.3V). Figure 14 and 15 show the wave form at operation. Figure 14 (Power-Up) shows a wave form of ; power-up the PS1(5V) first, and once the PS1(5V) reaches a stable voltage, PWRGD signal of PS1 will be output. Then time constant will be generated by the time constant circuit composed of components such as R-C etc. inside the dotted line, and will be input to Seq pin of PS2(3.3V) and control the PS2(3.3V). Figure 15 (Power-Down) shows the wave form of PS1 (5V) output voltage using the off signal which has been output at approximately 90% or below the rating voltage and off-controlling the PS2(3.3V).

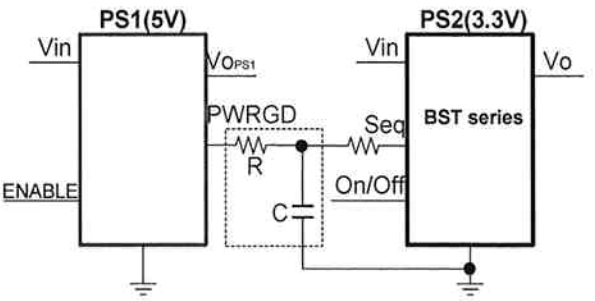


Figure 13 Example for Sequential operation connection

Note:
- There is no PWRGD function or pin for BST series.
- Time constant circuit (C-R) inside the dotted line of figure 13 is a block diagram. In practical use, compose a circuit which suits the practical usage.
- The output ripple may increase by connecting a capacitor between Seq and Gnd pin. Be sure not to connect any capacitor to the Seq pin.

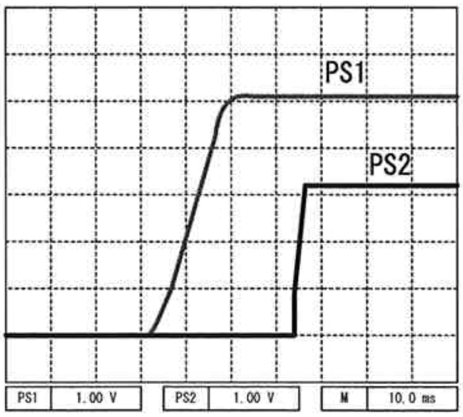


Figure 14 Sequential operation (Power-Up)

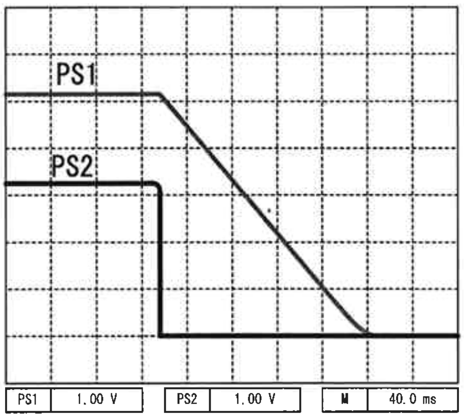


Figure 15 Sequential operation (Power-Down)

2. Ratio-Metric tracking operation

Ratio-Metric operation is implemented by the control voltage and R1 resistance value connected to the Seq pin. The tracking is implemented by the control voltage PS1(Vo1) and resistance value R1, R2 shown in figure 16. The resistance value of R2 inside the converter is set to 20kΩ, so it depends on R1 and PS1(Vo1).

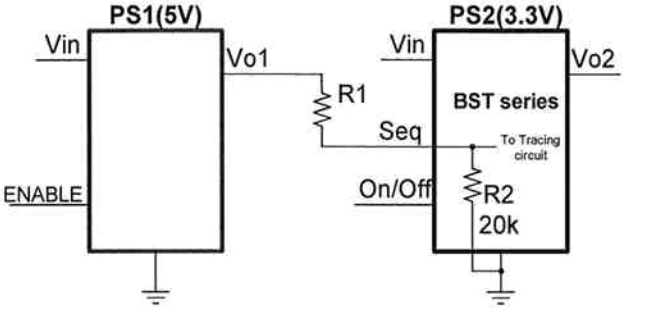


Figure 16 Ratio-Metric tracking connection method

Ratio-Metric tracking Case 1

Following is how to calculate the value of R1.

First, calculate the voltage difference when the output voltage of PS1(Vo1) and PS2(Vo2) is stable. ΔV=Vo1-Vo2 (Refer to figure 17, 18)

$$R1 = \frac{(Vo2 + \Delta V) - Vref}{Vref} \times 20k\Omega$$ Equation 1

Note 1: Vref=0.4×Vo2, refer to table 9

Note 2: ΔV=voltage difference between Vo1 and Vo2

Example) PS1: Vo1=5V, PS2: Calculate the R1 at Vo2=3.3V

ΔV=5-3.3=1.7V Vref=0.4×3.3V=1.32V

$$R1 = \frac{(3.3 + 1.7) - 1.32}{1.32} \times 20k\Omega = 55.75k\Omega$$

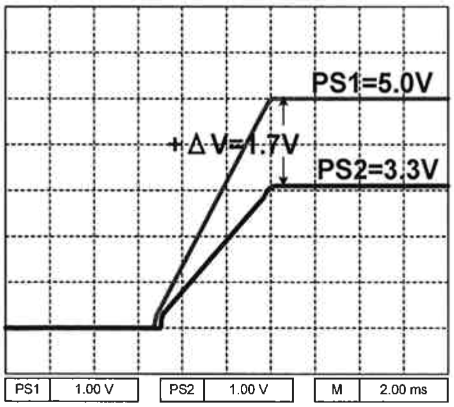


Figure 17 Ratio-Metric tracking Case 1 (Power-up)

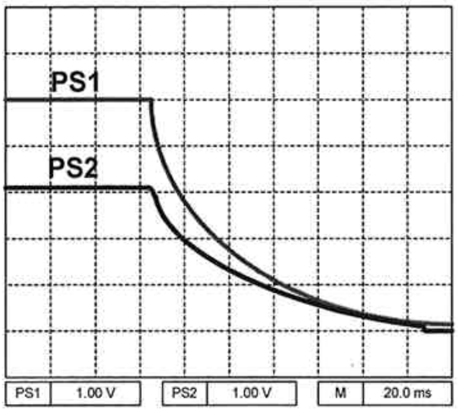


Figure 18 Ratio-Metric tracking Case 1 (Power-down)

Ratio-Metric tracking Case 2

For case 2, PS2 rises first at power up and falls second at power down. Calculate R1 by equation 2.
First, calcluate the voltage difference ΔV=Vo1-Vo2 of PS1(Vo1) and PS2(Vo2) when the output voltage of PS2 is stable. (Refer to figure 19, 20)

$$R1 = \frac{(Vo2 - \Delta V) - Vref}{Vref} \times 20k\Omega \quad \text{Equation 2}$$

Note 1: Vref=0.4×Vo2, refer to table 9
Note 2: ⊿V=Voltage difference of Vo1 and Vo2 when PS2(Vo2) reaches the rating voltage

Example) PS1: Vo1=5V, PS2: Calculate the R1 at Vo2=3.3V
Vref=0.4×Vo2=0.4×3.3V=1.32V
Voltage difference of PS2(Vo2) at rating voltage and PS1(Vo1) will be set at ΔV=1.3V.

$$R1 = \frac{(3.3 - 1.3) - 1.32}{1.32} \times 20k\Omega = 10.303k\Omega$$

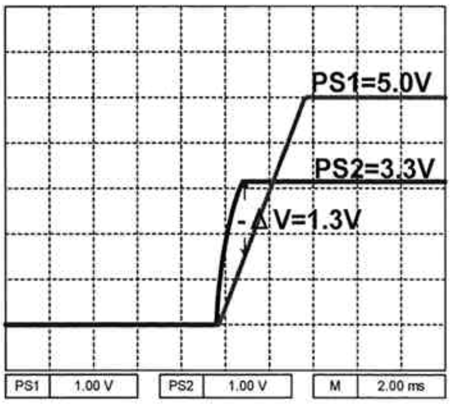


Figure 19. Ratio-Metric tracking Case 2 (Power-up)

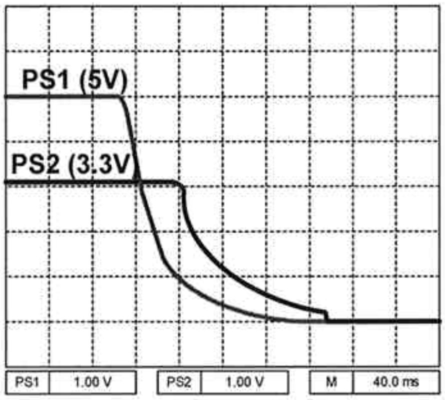


Figure 20 Ratio-Metric tracking Case 2 (Power-down)

Typical example of output voltage Vo2(PS2) vs. Vref

Table 9

Vo2 (PS2)	Vref (=0.4×Vo2)
0.7525	0.3
1.2	0.48
1.5	0.6
1.8	0.72
2.5	1.0
3.3	1.32
5.0	2.0

3. Simultaneous tracking operation

Similarly to ratio-metric tracking, simultaneous tracking is implemented by using a voltage divider around Seq pin. For simultaneous tracking operation, there is no voltage difference between PS1(Vo1) and PS2(Vo2), and is used at power-up and power-down. The simultaneous tracking operation can be accomplished by putting R1 equal to 30kΩ through PS1(Vo1) to Seq pin of PS2(Vo2).

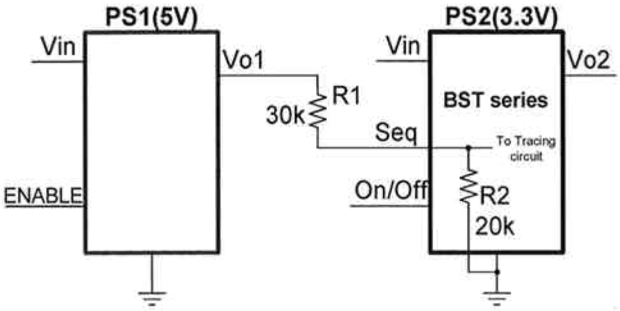


Figure 21 Simultaneous tracking connection method

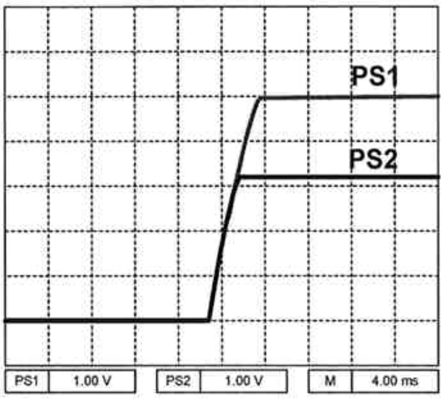


Figure 22 Simultaneous tracking Case 1 (Power-up)

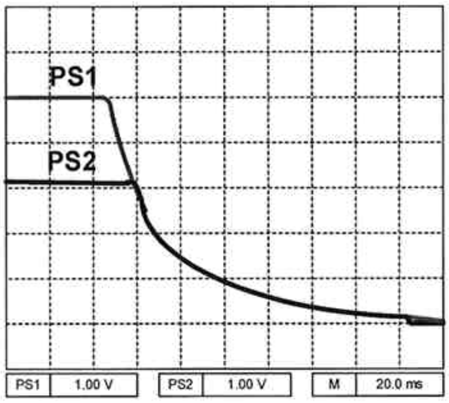


Figure 23 Simultaneous tracking Case 1 (Power-down)

4. Precautions for using the tracking function

1) The initial condition for tracking operation is to set the On/Off control pin of PS2 "On", and then apply voltage to the input pin of PS1 and PS2.
2) For the Seq pin potential, it is required to keep it 0V as it is for 10msec. or more after the input voltage reaches Vin-min voltage.
3) This short period is to initialize the soft-start. Until PS2 completes the soft-start operation, it will not track the voltage of PS1. When the soft-start operation completes, PS2 can start tracking the Seq pin voltage.
4) At power-down due to input interception, proper tracking operation is not possible when the input voltage of converters each other becomes minimun or below. So it is a good way to use the On/Off of PS1 to implement power tracking at power-down.
5) The absolute maximum voltage of Seq pin does not exceed the input voltage.
6) When not using the tracking operation, connect from Seq pin to +Vin with a 30kΩ resistance.
7) When the Seq pin voltage is short, the output setting voltage will fall. So be careful that the Seq pin voltage does not go short.

<Over-Temperature Shutdown>

When this BST series is used under unfavorable conditions and the temperature exceeds the over-temperature threshold, the non-latch method over-temperature protection will operate. Once the temperature detection component comes up to approx. 115℃(for 4V input products) or approx. 120°C(for 12V input products), the operation will start.

<Over-Current Protection>

To provide protection in an output over load fault condition, the unit is equipped with internal over-current protection. When the over-current protection is triggered, the unit enters hiccup mode. The units operate normally once the fault condition is removed.
Over-current protection will limit the current of the constant current type. Once the over-current condition is solved, the converter will go back to normal constant voltage operation.

<Safety Considerations>

For safety-agency approval the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standards, i.e.,UL/cUL 60950 (US & Canada) recognized and TUV (EN60950) conforms.
For the converter output to be considered meeting the requirements of safety extra-low voltage (SELV), the input must meet SELV requirements. The power module has extra-low voltage (ELV) outputs when all inputs are ELV.
The input to these units is to be provided with a maximum 6A of glass type fast-acting fuse in the ungrounded lead.

<Thermal Derating>

This converter operates in a wide temperature range, however when the ambient temperature is high, proper heat radiation by cooling is required. The thermal derating shown below is a support for proper use of the converter and thermal designing. For certain cooling, it is required to check your own equipment's temperature under both maximum ambient temperature and cooling ventilated condition with the converter mounted inside the device/ system. When checking with your own equipment, the hot spot temperature shall not exceed 105℃.

Following is the heat radiation pattern conditions of derating

- PCB substance: FR-4, t1.6
- Size: 90mm×160mm

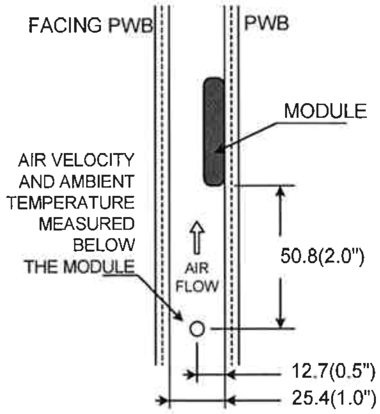
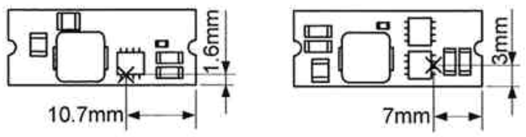


Figure 24 Thermal derating (testing conditions)



BST04-0.7S06PCM BST12-0.7S06PCM

Figure 25 Hot spot at temperature measurement

BST04-0.7S06PCM Derating Curve

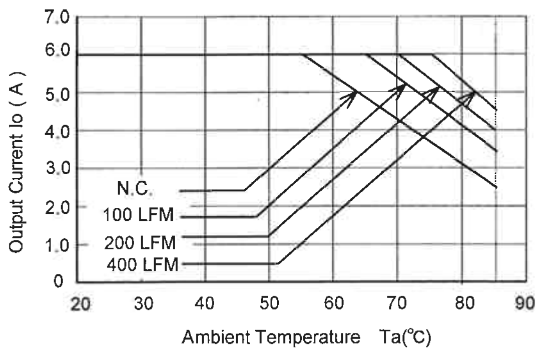


Figure 26 Thermal derating curve (Vin=5.0V, Vo=3.3V)

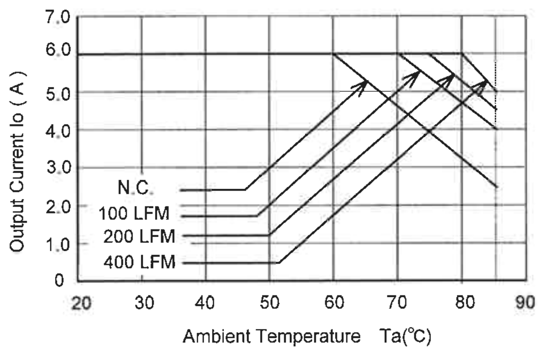


Figure 27 Thermal derating curve (Vin=5.0V, Vo=1.8V)

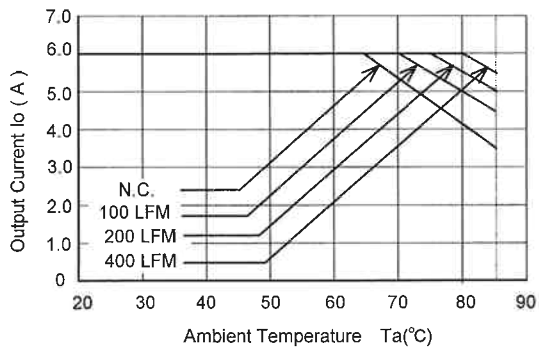


Figure 28 Thermal derating curve (Vin=5.0V, Vo=0.75V)

BST12-0.7S06PCM Derating Curve

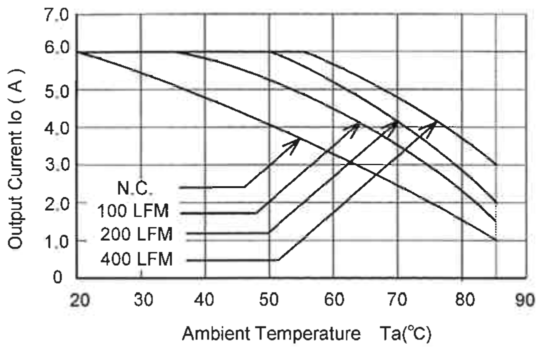


Figure 29 Thermal derating curve (Vin=12V,Vo=5.0V)

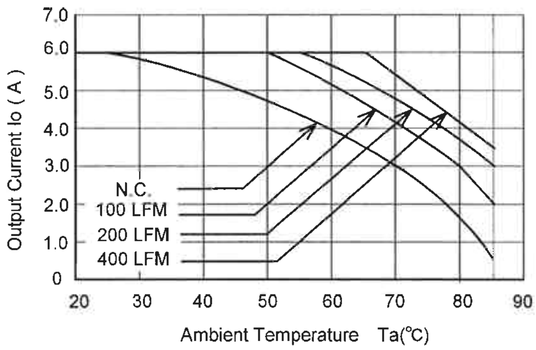


Figure 30 Thermal derating curve (Vin=12V,Vo=3.3V)

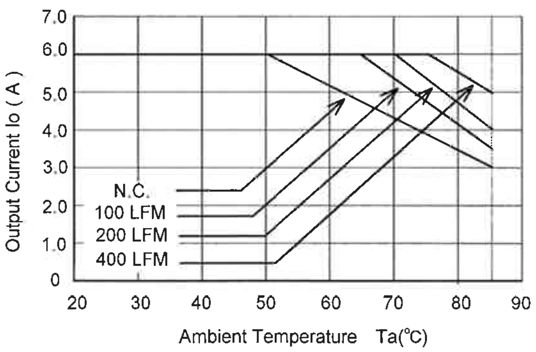


Figure 31 Thermal derating curve (Vin=12V,Vo=0.75V)

<Things to note>

1. Fuse

This coverter does not have a built-in fuse. For safety and system protection, be sure to put a fuse to the input line of the +Vin side.

2. To prevent reverse connection of input power supply

For this converter, if the input voltage is connected in reverse by mistake, it will be damaged. If there is a possibility of reverse connection, please add a protection circuit as shown in figure 32. Be sure that the power supply on the supplying side has the capacity to fuse the fuse.

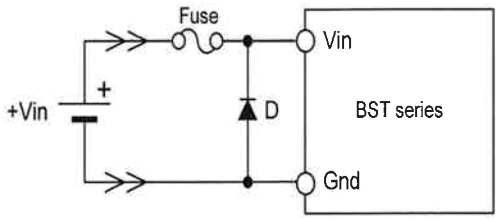


Figure 32

3. Over-Voltage Protection

This converter does not have a built-in over-voltage protection. If the switching element in this converter is damaged in short mode, DC input will go out as it is. However, to avoid damage at over-voltage mode, be sure to add an input intercepting circuit as shown in figure 33.

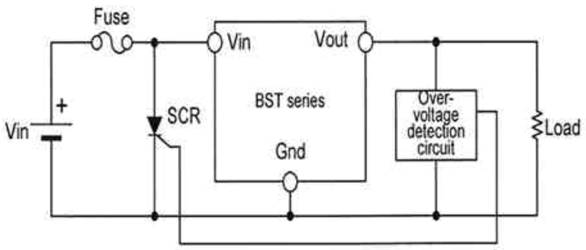


Figure 33

4. Storage conditions and humidity countermeasures before mounting

Storage conditions before being mounted should be ambient temperature 30℃ and ambient humidity 60%RH or below. Also, keep these products in a place where the unit will not be influenced by direct sunshine or poisonous gas (chloric, sulfur etc.).

For dampproof package articles, be sure not to open except under the managed conditions.

<Vibration, Shock>		All amplitude 10mm (1 hour in each of 3 orthogonal axes)
Vibration	5-10Hz	Acceleration 2G (1hour in each of 3 orthogonal axes)
	10-55Hz	20G (3 directions, 3 times each)
Shock	Acceleration	11±5ms
	Shocking time	

<Soldering Conditions>

- This converter is for reflow soldering. Do not vibrate at reflow.
- Flow soldering is not possible for this converter.
- Before reflow soldering the converters which have been left in the opened dry package, be sure to pre-bake the converters under the following conditions.
  - ① taken out of the reel
    - 125°C, 24hours
  - ② still in the reel
    - 1) 40°C, 13days (saturated@30°C/85%RH)
    - or
    - 2) 40°C, 9days (At Limit of Floor Lift+72hr@30°C/60%RH)

Re-baking is also required before reflow soldering if it has been in dry-pack for more than 1year or kept in 30°C/60%RH for more than 168hours with the dry-package opened.

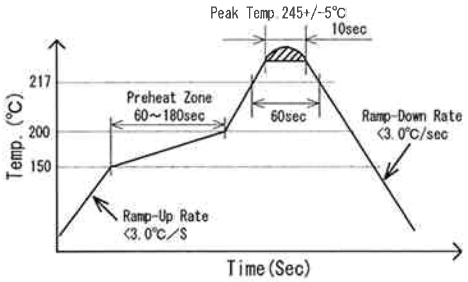


Figure 34 Temperature profile (lead-free)

BST04-0.7S06PCM

<PICK AND LOCATION>

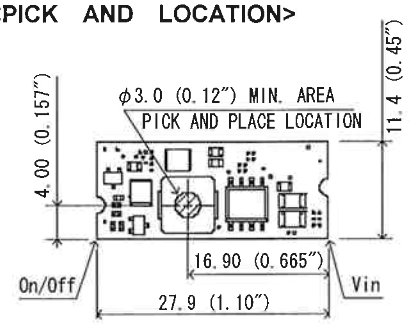


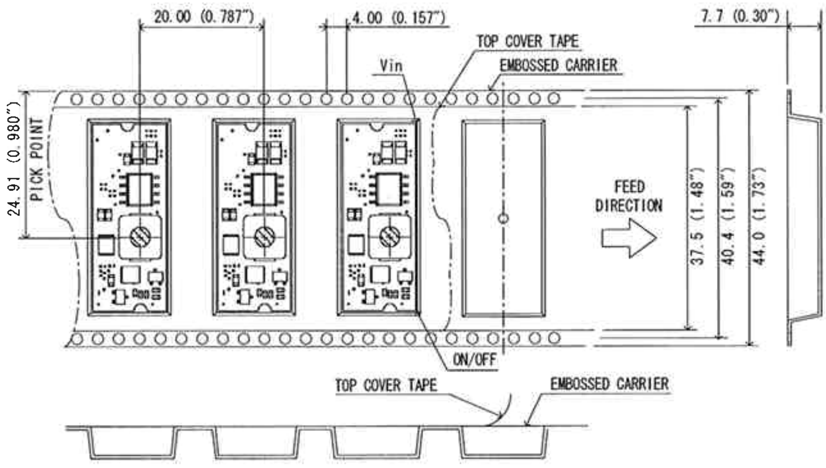
Figure 35

Notes

Dimensions: mm (inches)

Tolerances: X.X mm ± 0.5mm (X.XX in. ± 0.02 in.)
X.XX mm ± 0.25mm (X.XXX in. ± 0.010 in.)

<SURFACE-MOUNT TAPE&REEL>



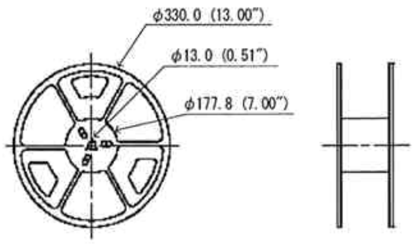


Figure 36

BST12-0.7S06PCM

<PICK AND LOCATION>

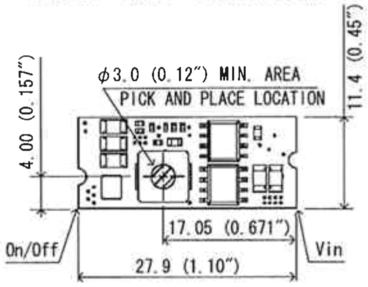


Figure 37

Notes

Dimensions: mm (inches)

Tolerances: X.X mm ± 0.5mm (X.XX in. ± 0.02 in.)
X.XX mm ± 0.25mm (X.XXX in. ± 0.010 in.)

<SURFACE-MOUNT TAPE&REEL>

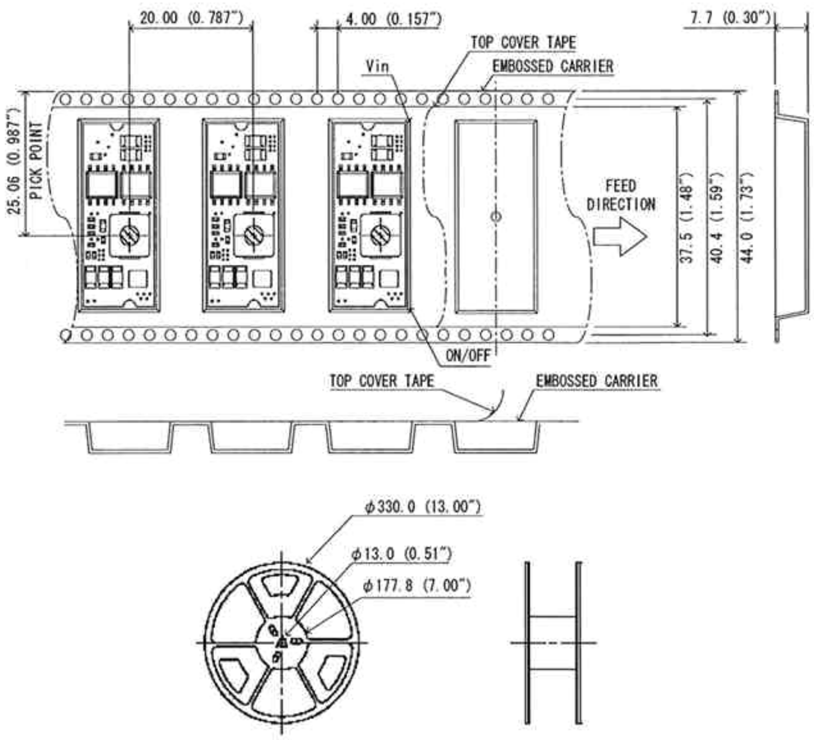


Figure 38

<Characteristics>

1. Efficiency vs. output current

BST04-0.7S06PCM

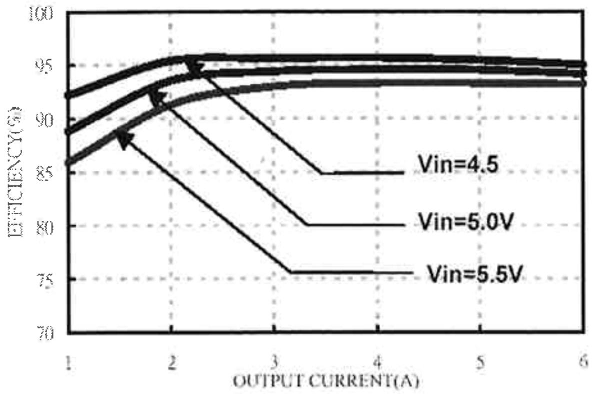


Figure 39 :Converter efficiency vs. output current(3.3V out)

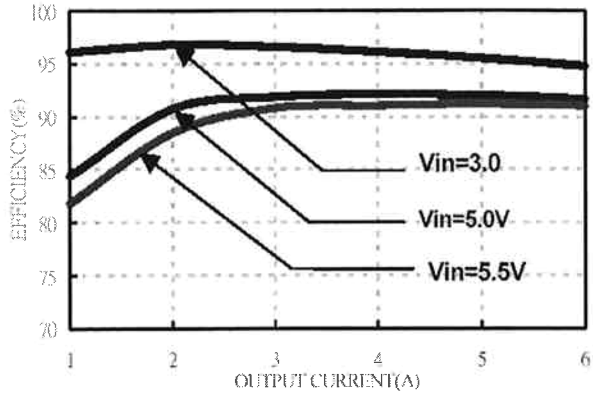


Figure 42 :Converter efficiency vs. output current(2.5V out)

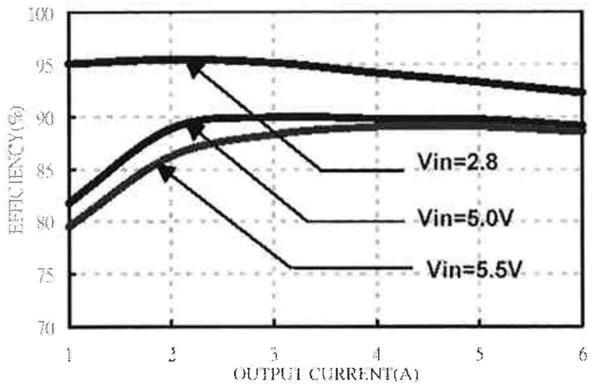


Figure 40 :Converter efficiency vs. output current(1.8V out)

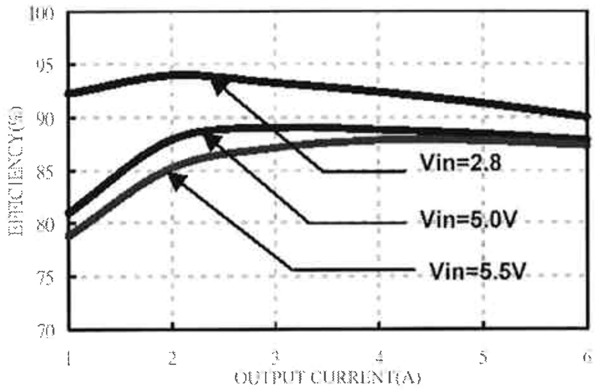


Figure 43 :Converter efficiency vs. output current(1.5V out)

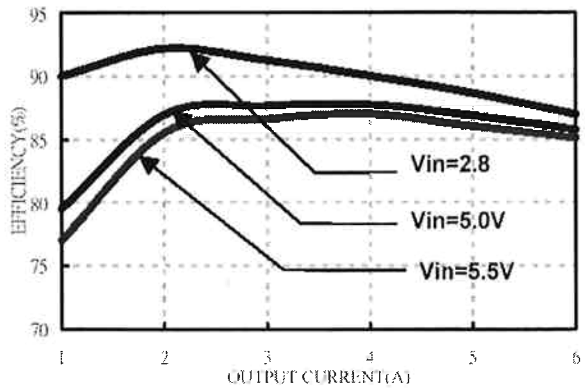


Figure 41 :Converter efficiency vs. output current(1.2V out)

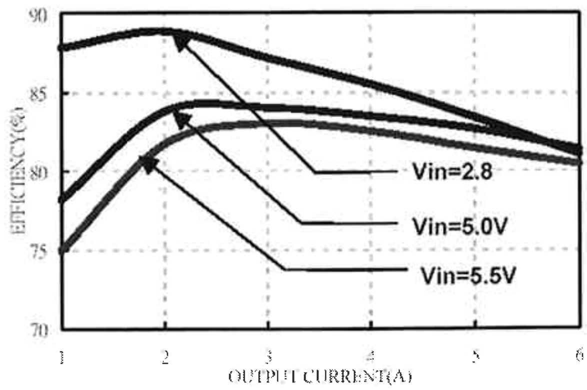


Figure 44 :Converter efficiency vs. output current(0.75V out)

BST12-0.7S06PCM

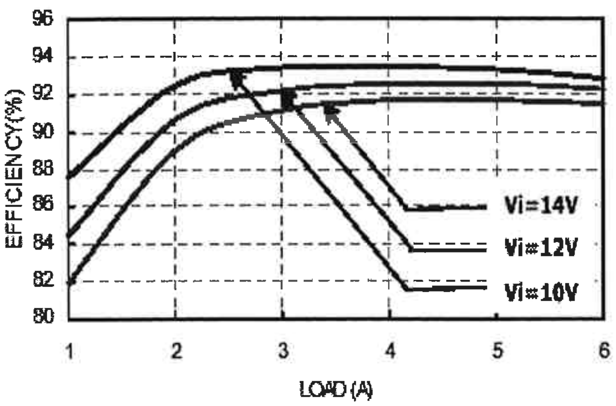


Figure 45 :Converter efficiency vs. output current(5.0V out)

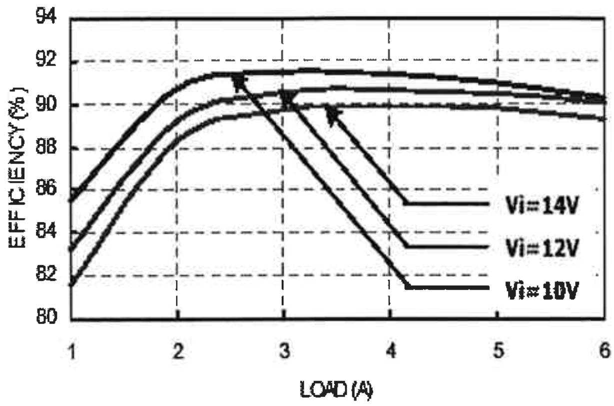


Figure 48 :Converter efficiency vs. output current(3.3V out)

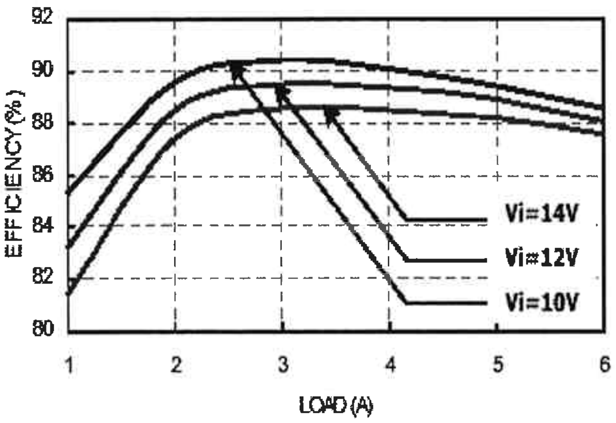


Figure 46 :Converter efficiency vs. output current(2.5V out)

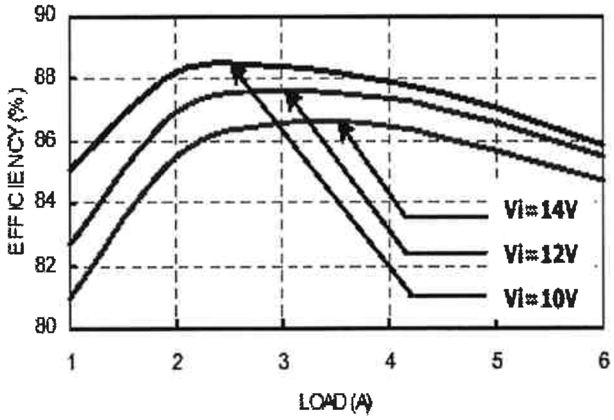


Figure 49 :Converter efficiency vs. output current(1.8V out)

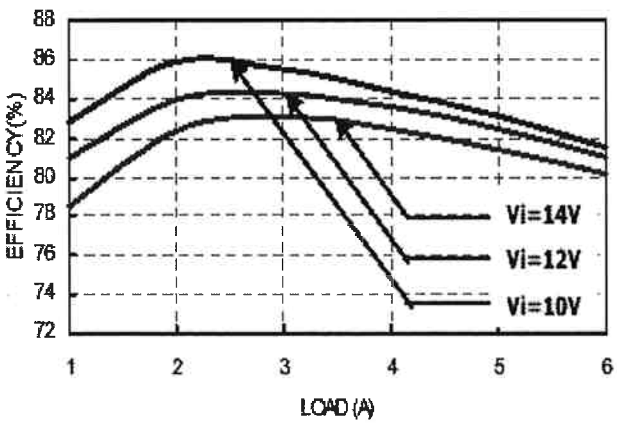


Figure 47 :Converter efficiency vs. output current(1.2V out)

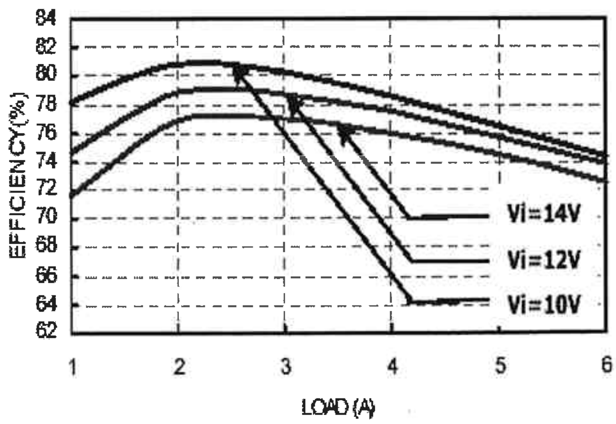


Figure 50 :Converter efficiency vs. output current(0.75V out)

<Characteristics>
2. Output ripple & noise

BST04-0.7S06PCM

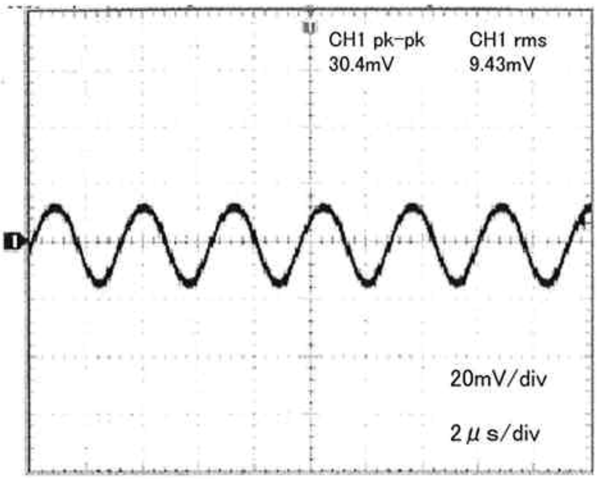


Figure 51 :Output ripple & noise at 5.0Vin 1.8V/6A out

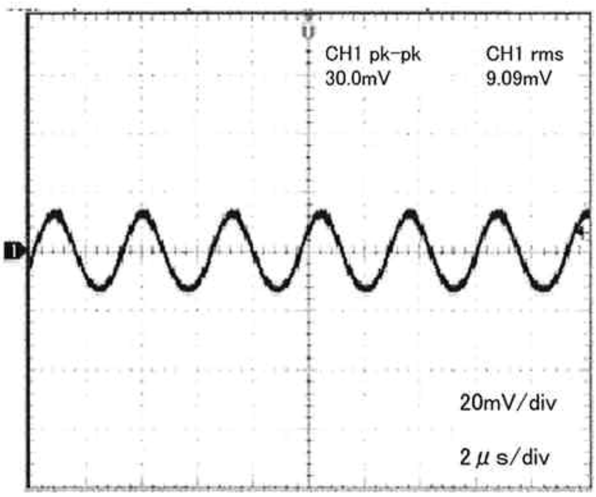


Figure 52 :Output ripple & noise at 5.0Vin 3.3V/6A out

BST12-0.7S06PCM

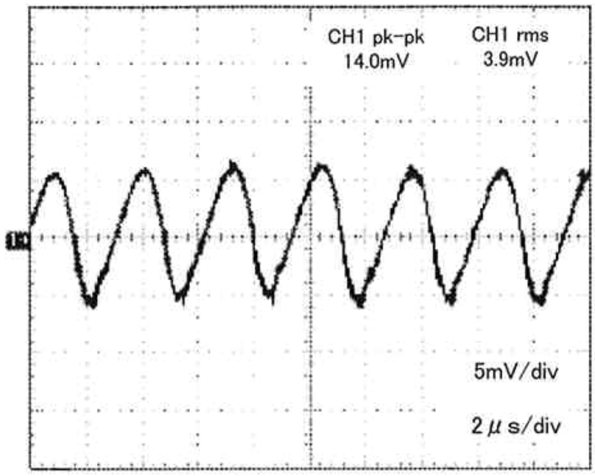


Figure 53 :Output ripple & noise at 12Vin 2.5V/6A out

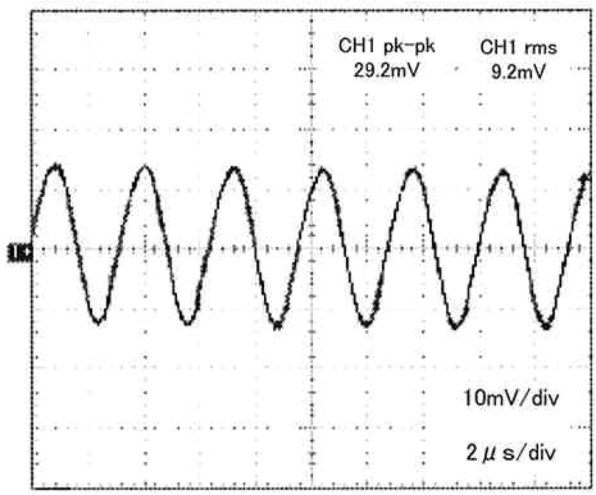


Figure 54 :Output ripple & noise at 12Vin 5.0V/6A out

<Characteristics>

3. Turn on delay time

BST04-0.7S06PCM

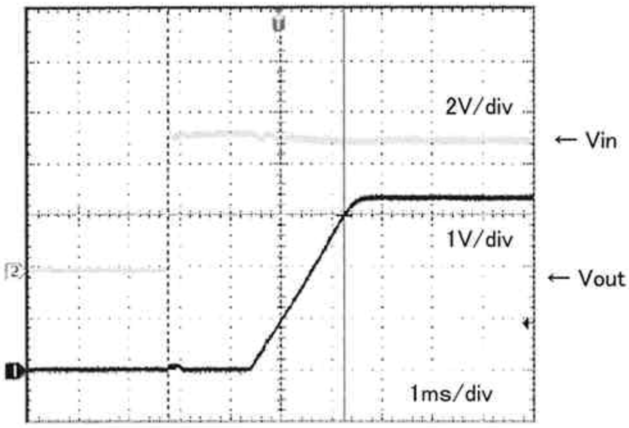


Figure 55 : Turn on delay time at 5.0Vin , 3.3V/6A out

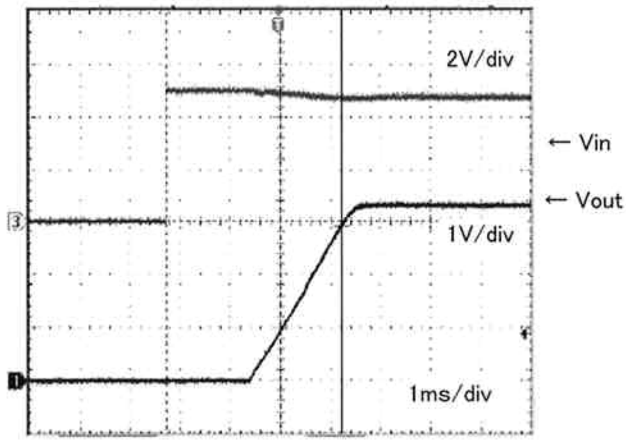


Figure 56 : Turn on delay time at Remote On/Off
5.0Vin , 3.3V/6A out

BST12-0.7S06PCM

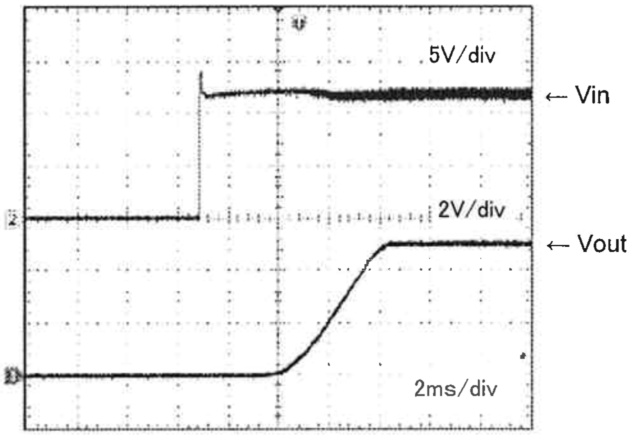


Figure 57 : Turn on delay time at 12Vin , 5.0V/6A out

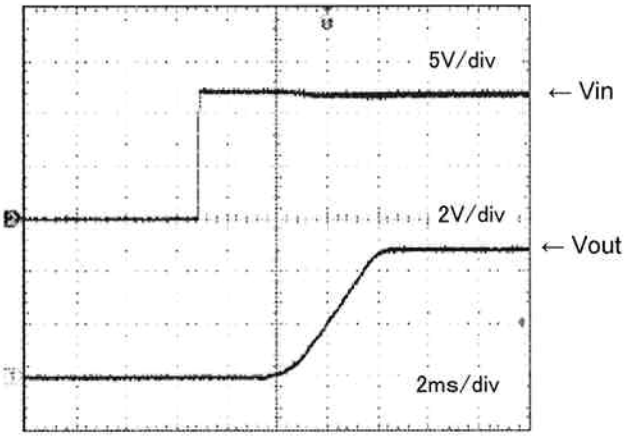


Figure 58 : Turn on delay time at Remote On/Off
12Vin , 5.0V/6A

<Characteristics>

4. Transient response to step load change

BST04-0.7S06PCM

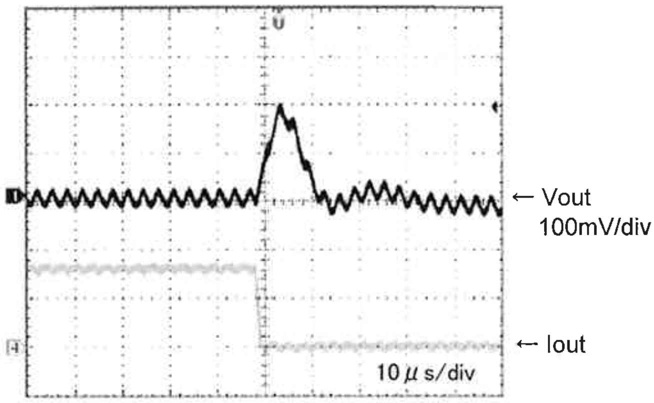


Figure 59 : Typical transient response to step load change at 2.5A/μS from 100% to 50% of Io , max at 5Vin , 3.3V out (Cout=1μceramic , 10μF tantalum)

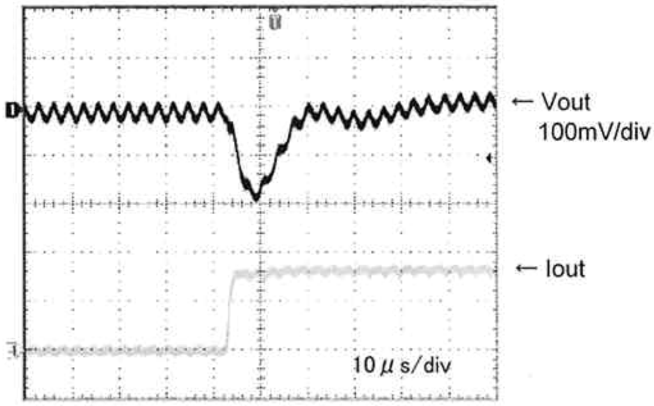


Figure 60 : Typical transient response to step load change at 2.5A/μS from 50% to 100% of Io , max at 5Vin , 3.3V out (Cout=1μceramic , 10μF tantalum)

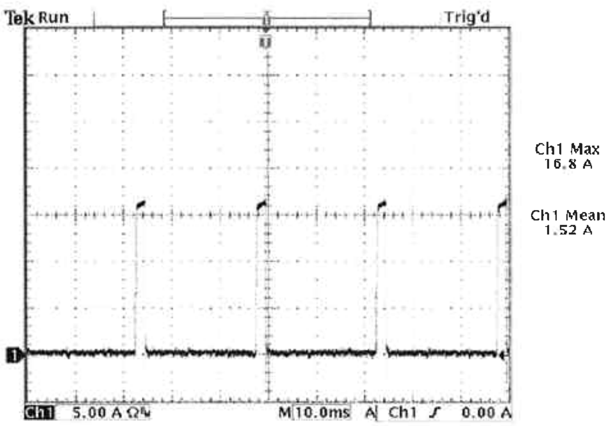


Figure 61 : Output short circuit current 5Vin, 0.75Vout

BST12-0.7S06PCM

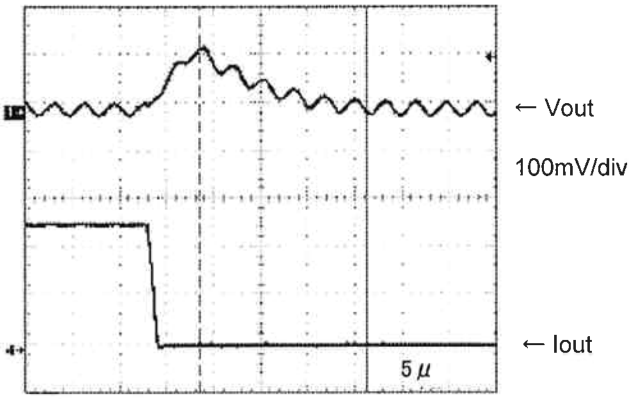


Figure 62 : Typical transient response to step load change at 2.5A/μS from 100% to 50% of Io , max at 12Vin , 5.0V out (Cout=1μceramic , 10μF tantalum)

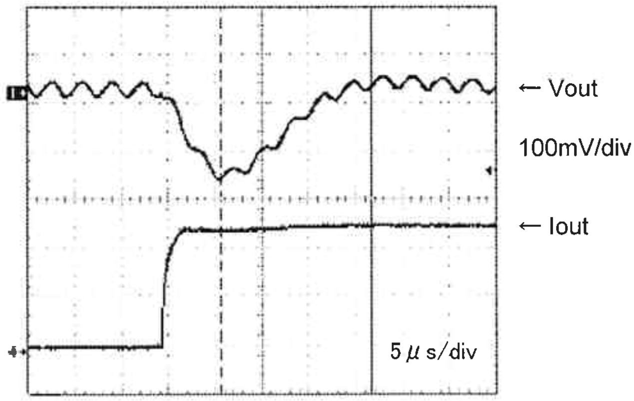


Figure 63 : Typical transient response to step load change at 2.5A/μS from 50% to 100% of Io , max at 12Vin , 5.0V out (Cout=1μceramic , 10μF tantalum)

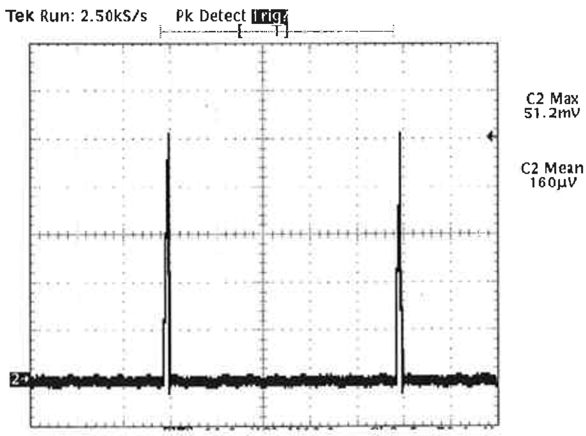


Figure 64 : Output short circuit current 12Vin, 0.75Vout (5A/div)

<Precautions>

- This product intends to be used for general electronic equipments (Clerical work machines, Telecommunications equipments, and Measurement equipments). Therefore, do not use for medical equipments, nuclear power equipments, and trains, etc. the malfunction and damage of which may influence directly to human life and property. Please confirm when using it in the case except general electronic equipment.
- For this product, parallel/series operation is not possible.
- For mounting this product, please do not use connector or socket. The performance may not be fulfilled by the effect of contacting resistor. Mount to print board by soldering.
- The product may be damaged if it is used under nonstandard electric and environmental conditions such as temperature. So please be sure to keep the standards.
- There is a possibility of damage by static. When the worker has electrified static, please earth discharge and working on an earthed worktable will be recommended.
- Do not store in a place where corridible gas may be generated or at a dusty place.
- This product does not have a built in fuse. When it is abnormal, please connect the fuse with + input line as a protection for excessive current flowing into the input. Please make sure that the power supply has the capacity that the fuse can be cut.
- This product does not have a built in over voltage protection. When over voltage is abnormally generated in the module, there is such a mode that the input voltage appears to the output straight, which may cause smoke and ignition. Please make sure to add the over-voltage protection circuit to prevent it.
- No test certificate is attached to this product.

Bellnix Co.,Ltd.
5-7-8 Negishi Minami-ku Saitama-shi, Saitama JAPAN 336-0024
TEL: +81-48-864-7733 FAX: +81-48-861-6402
E-mail:info@bellnix.co.jp
URL http://www.bellnix.co.jp/

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