# SRBH-06H1A1

## Non-Isolated DC-DC Converter

The SRBH-06H1A1 is part of the low-cost non-isolated DC-DC power converter series providing up to 6 A output current.

The output is closely regulated and the efficiency of 3.3 VDC output is typically 89% at full load.

Typical features include remote on/off, input under-voltage lockout, over current protection and short circuit protection.

### Key Features & Benefits

- 8 - 36 VDC Input
- 3.3 - 5 VDC @ 6 A Output
- Non-Isolated Output
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- OCP/SCP
- Remote On/Off
- Input Under-Voltage Lockout
- Low Cost
- Class II, Category 2, Non-Isolated DC/DC Converter (refer to IPC-9592B)

RoHS Compliant

### Applications

- Distributed Power Architectures
- Data Networking Equipment
- Telecommunications Applications

## 1. MODEL SELECTION

| MODEL NUMBER | OUTPUT VOLTAGE | INPUT VOLTAGE | MAX. OUTPUT CURRENT | MAX. OUTPUT POWER | TYPICAL EFFICIENCY |
|---|---|---|---|---|---|
| SRBH-06H1A1G<br>SRBH-06H1A1R | 3.3 - 5 V | 8 - 36 V | 6 A | 30 W | 89% (Vo = 3.3 V, Io = 6 A) |

### PART NUMBER EXPLANATION

| S | R | BH | - | 06 | H | 1A | 1 | x |
|---|---|---|---|---|---|---|---|---|
| Mounting Type | RoHS Status | Series Name | | Output Current | Input Range | Output Voltage | Active Logic | Package Type |
| SMD | RoHS | Arrow Head | | 6 A | 8 – 36 V | 3.3 - 5.0 V | Active High | R – Tape & Reel Package<br>G – Tray Package |

## 2. ABSOLUTE MAXIMUM RATINGS

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Continuous Non-operating Input Voltage | | -0.3 | - | 38 | V |
| Remote On/Off | | -0.3 | - | 12 | V |
| Ambient Temperature | | -40 | - | 85 | °C |
| Storage Temperature | | -40 | - | 125 | °C |
| Altitude | | - | - | 2000 | m |

**NOTE:** Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

## 3. INPUT SPECIFICATIONS

All specifications are typical at 25°C unless otherwise stated.

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Operating Input Voltage | | 8 | - | 36 | V |
| Input Current (full load) | Vin = 12 V, Vo = 3.3 V, Io = 6 A | - | 1.9 | - | A |
| Input Current (no load) | | - | 30 | - | mA |
| Remote Off Input Current | | - | 1.7 | - | mA |
| Input Reflected Ripple Current (rms) | 1 µH, 2*100 µF/50 V electrolytic capacitors, 3*4.7 µF/50 V ceramic capacitor at the input. | - | 50 | 100 | mA |
| Input Reflected Ripple Current (pk-pk) | | - | 70 | 150 | mA |
| $I^2t$ Inrush Current Transient | | - | - | 1 | $A^2s$ |
| Turn on Voltage Threshold | Input under voltage lockout (UVLO). | - | 7 | 7.5 | V |
| Turn off Voltage Threshold | | 3.5 | 4 | - | V |

**CAUTION:** All specifications are typical at nominal input, full load at 25°C unless noted.

## 4. OUTPUT SPECIFICATIONS

All specifications are typical at nominal input, full load at 25°C unless otherwise stated.

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Output Voltage Set Point | Vin = 12 V, Io = 50% full load | 3.234 | 3.300 | 3.366 | V |
| Load Regulation | | - | ±10 | ±20 | mV |
| Line Regulation | | - | ±10 | ±20 | mV |
| Regulation Over Temperature | -40 °C to 85 °C | - | 30 | 50 | mV |
| Ripple and Noise (pk-pk) | Vout = 3.3 V | - | 60 | 100 | mV |
| Ripple and Noise (rms) | | - | 25 | 50 | mV |
| Output Current Range | | 0 | - | 6 | A |
| Output DC Current Limit | Hiccup mode | 7 | 10 | 13 | A |
| Turn on Time (from Vin) | | - | 6 | 10 | ms |
| Turn on Time (from Enable) | | - | 1 | - | ms |
| Output Capacitance | | 220 | - | 1200 | µF |
| ***Transient Response*** | | | | | |
| △V 50%~100% of Max Load | di/dt = 0.5 A/µs; Vin = 12 V; Vout = 3.3 V; with a 220 µF Oscan capacitor at the output | - | 100 | 200 | mV |
| Settling Time | | - | 300 | 500 | µs |
| △V 100%~50% of Max Load | | - | 100 | 200 | mV |
| Settling Time | | - | 300 | 500 | µs |

## 5. GENERAL SPECIFICATION

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| Efficiency | Vin = 12 V, Vo = 3.3 V, full load | 87 | 89 | - | % |
| Switching Frequency | | - | 300 | - | kHz |
| Output Trim Range | | 3.3 | - | 5 | V |
| Weight | | - | 4.3 | - | g |
| MTBF | | - | 426,574,0 | - | hours |
| Dimensions (L × W × H) | | | 0.885 x 0.512 x 0.320 | | inch |
| | | | 22.48 x 13.00 x 8.13 | | mm |

## 6. CONTROL/SUPERVISORY SPECIFICATIONS

| PARAMETER | DESCRIPTION | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|
| ***Enable*** | | | | | |
| Signal Low (Unit Off) | ENABLE pin open, unit on | -0.3 | - | 1 | V |
| Signal High(Unit On) | | 2.8 | - | 12 | V |
| Sourcing current | | - | - | 10 | µA |



## 7. EFFICIENCY DATA

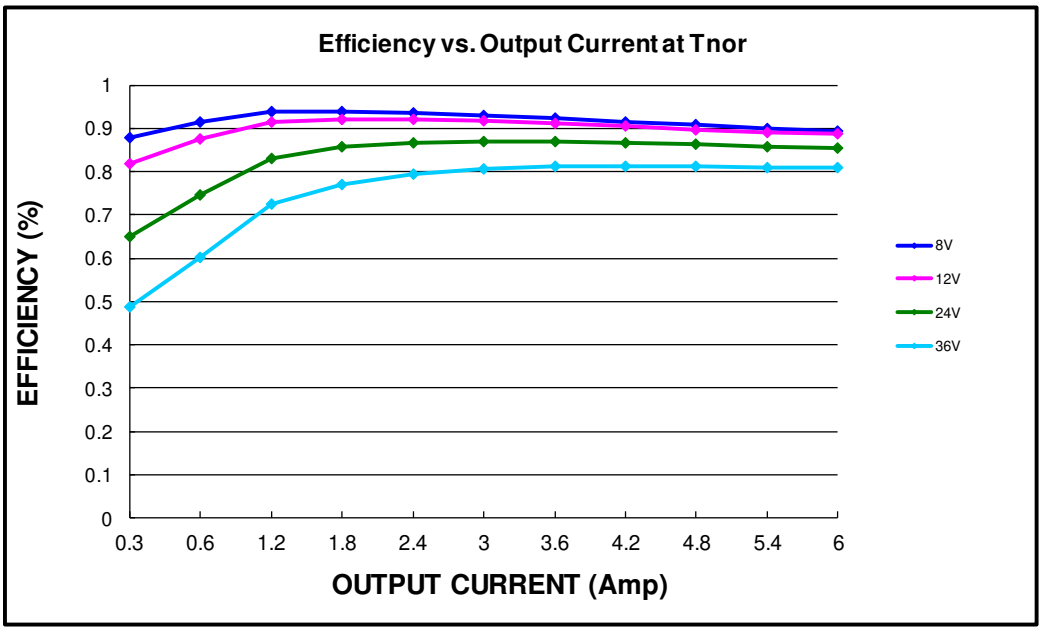



*Figure 1. Efficiency data*

## 8. THERMAL DERATING CURVE

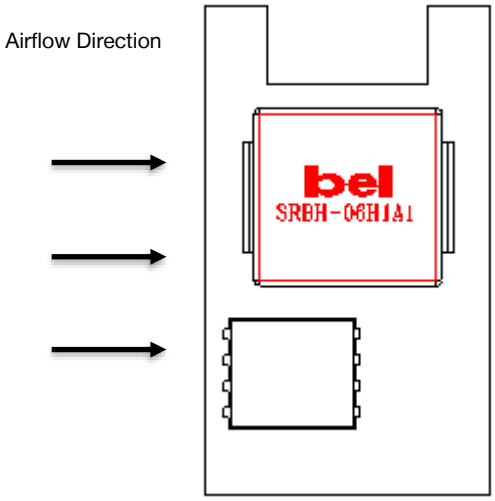



*Figure 2. Airflow direction*

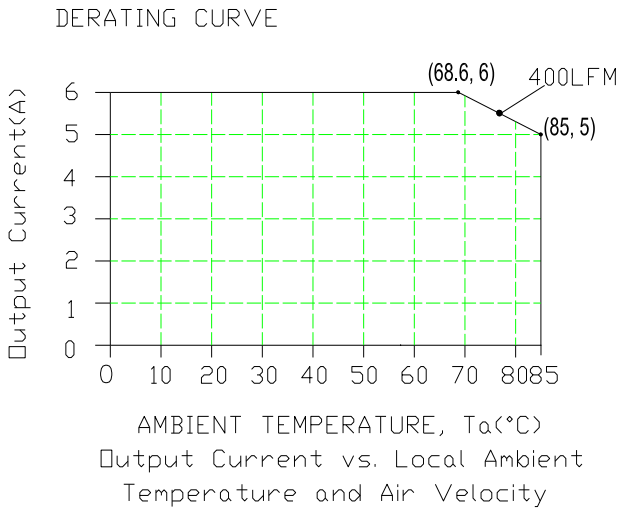



*Figure 3. Thermal derating curve @ Vin = 12 V, Vo = 3.3 V*

## 9. RIPPLE AND NOISE WAVEFORM

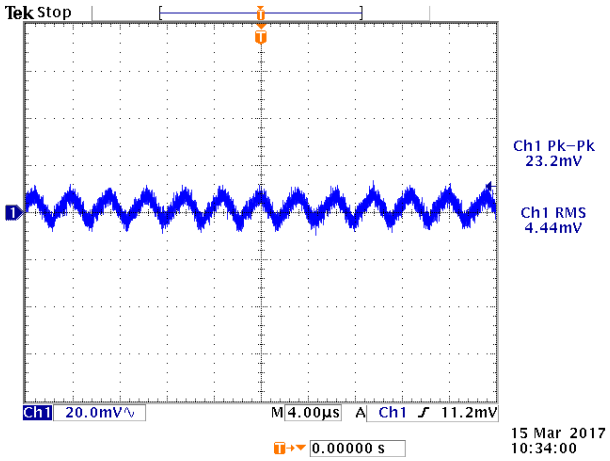



*Figure 4. Ripple and noise at no load, Vin = 12 V*

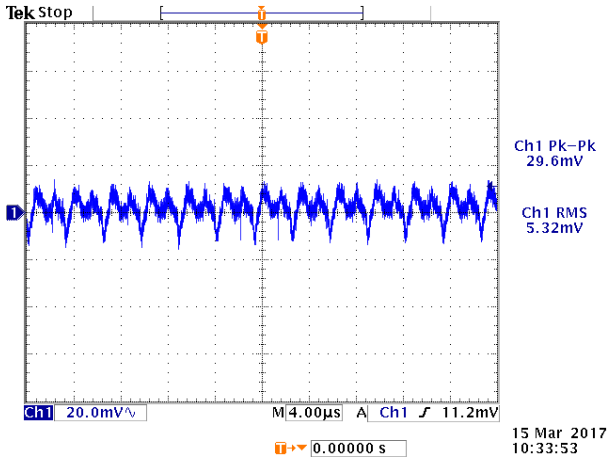



*Figure 5. Ripple and noise at full load, Vin = 12 V*

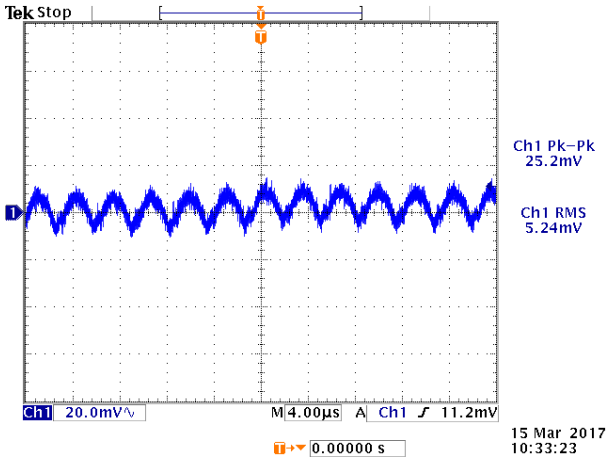



*Figure 6. Ripple and noise at no load, Vin = 24 V*

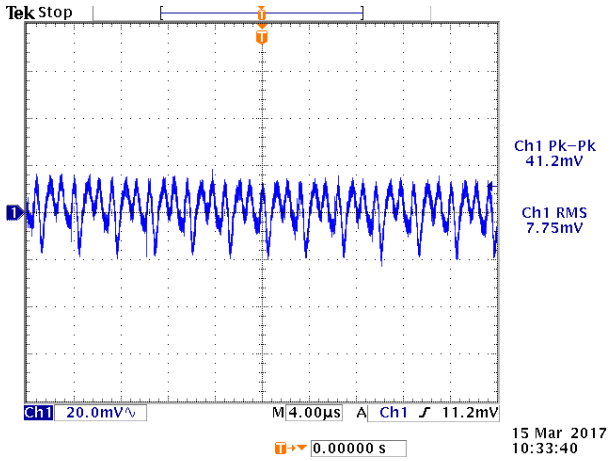



*Figure 7. Ripple and noise at full load, Vin = 24 V*



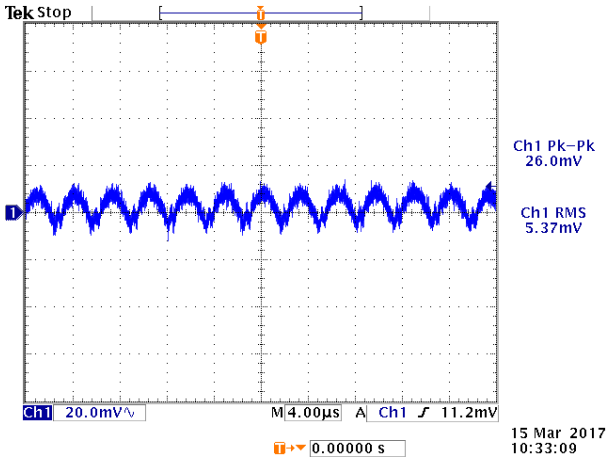



*Figure 8. Ripple and noise at no load, Vin = 36 V*

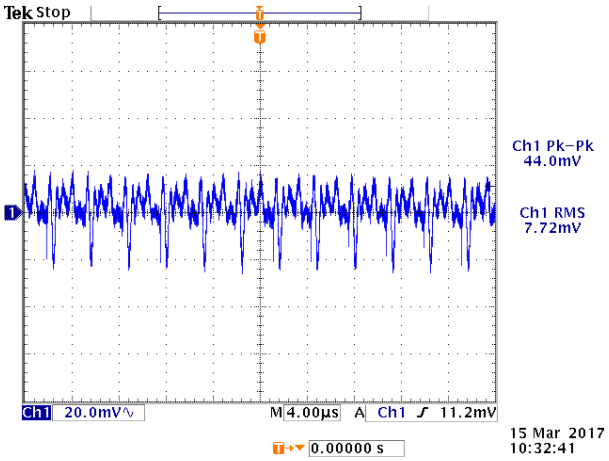



*Figure 9. Ripple and noise at full load, Vin = 36 V*

**Note:** Ripple and Noise at 3.3 VDC output, with a 220 µF oscan capacitor cap at the output, Ta = 25°C

## 10. STARTUP & SHUTDOWN

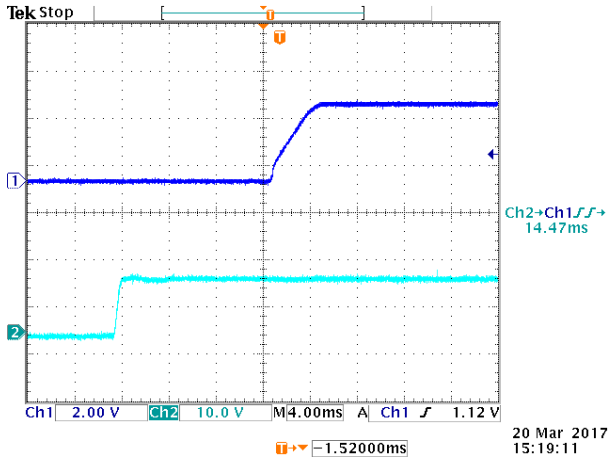



*Figure 10. Startup*

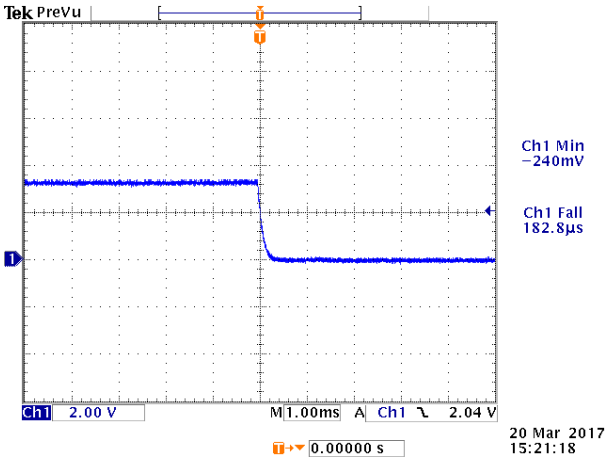



*Figure 11. Shutdown*

**Test Condition:** Vin = 12 V, Iout = 6 A, with a 220 µF oscan capacitor at the output.

## 11. TRANSIENT RESPONSE WAVEFORMS

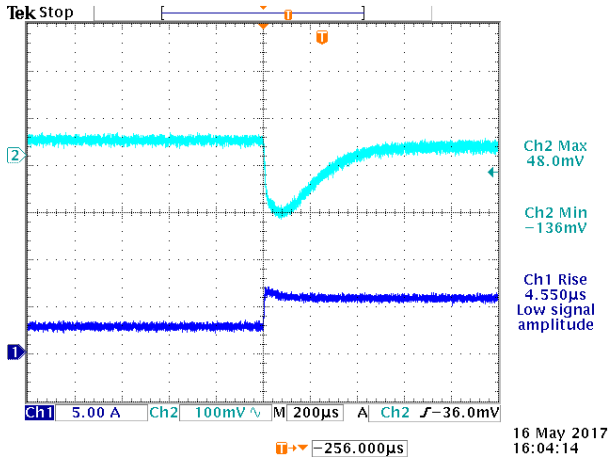



*Figure 12. 50% to 100% load transient at 12 Vdc input 5 Vdc output and Ta = 25°C*

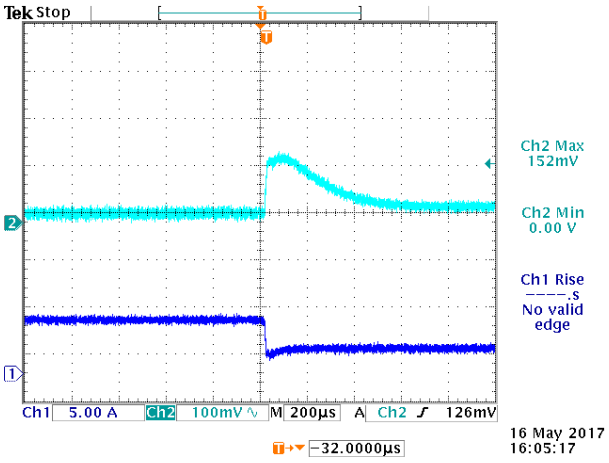



*Figure 13. 100% to 50% load transient at 12 Vdc input, 5 Vdc output and Ta = 25°C*

**Test Condition:** di/dt = 0.5 A/µs, Vin = 12 V, with a 220 µF oscan capacitor at the output.



## 12. INPUT UNDER-VOLTAGE LOCKOUT

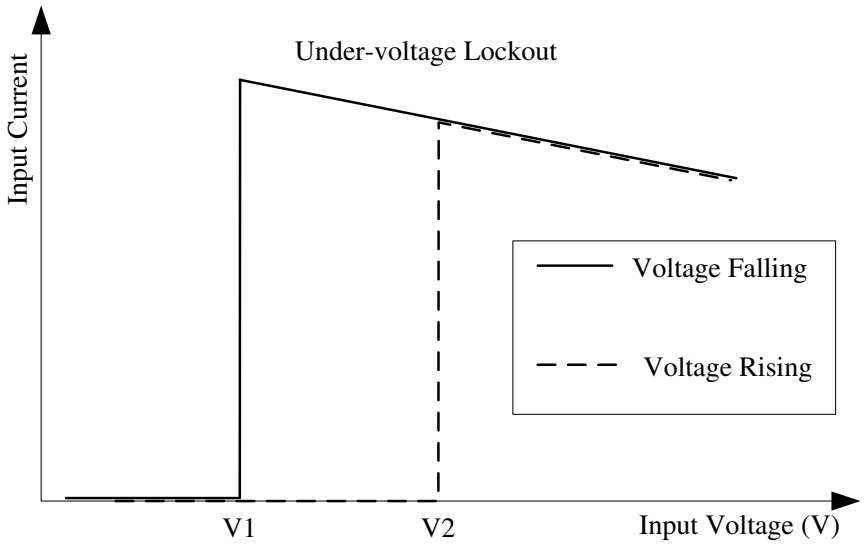



*Figure 14. Input under-voltage lockout*

*V1 = 4 V*

*V2 = 7 V*

## 13. OUTPUT VOLTAGE TRIM

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vnom = 3.3 V) are shown below. The Trim Down resistor should be connected between the Trim pin and Vout. The Trim Up resistor should be connected between the Trim pin and Ground. Only one of the resistors should be used for any given application.

$$R_{trimdown} = \frac{151.6}{V_{nom} - V_{adj}} - 70.2$$

$$R_{trimup} = \frac{33.7}{V_{adj} - V_{nom}} - 14$$

## 14. SOLDERING INFORMATION

The SRBH-06H1A1 modules are designed to be compatible with reflow soldering process. The suggested Pb-free solder paste is Sn/Ag/Cu(SAC). The recommended reflow profile using Sn/Ag/Cu solder is shown in the following. Recommended reflow peak temperature is 245°C while the part can withstand peak temperature of 260°C maximum for 10seconds. This profile should be used only as a guideline. Many other factors influence the success of SMT reflow soldering. Since your production environment may differ, please thoroughly review these guidelines with your process engineers.

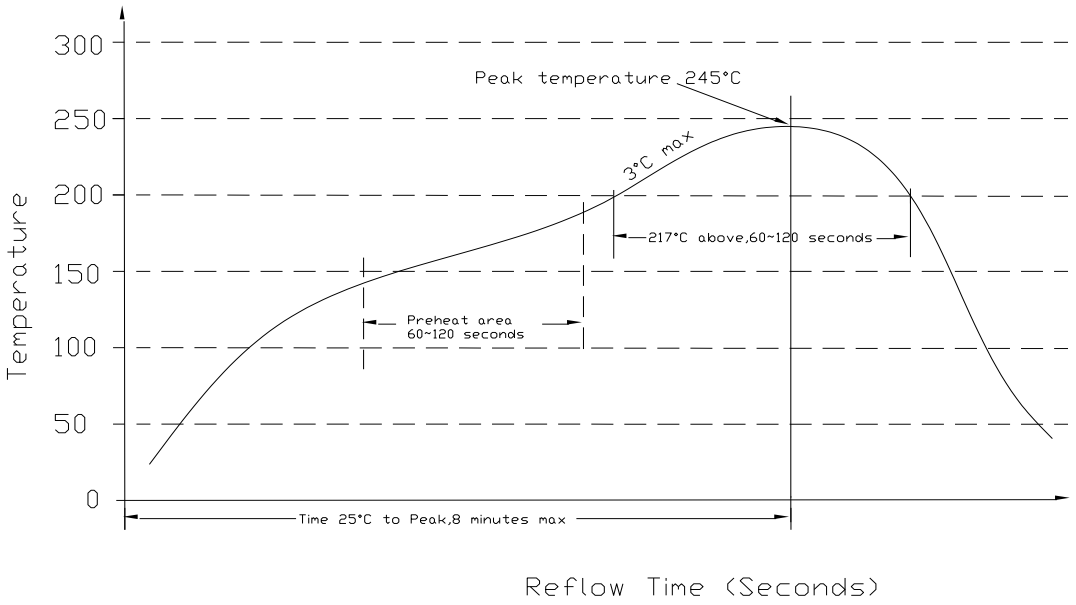



*Figure 15. Soldering information*

## 15. MSL RATING

The SRBH-06H1A1 modules have a MSL rating of 3.

## 16. STORAGE AND HANDING

The SRBH-06H1A1 modules are designed to be compatible with J-STD-033 Rev:A (Handling, Packing, Shipping and Use of Moisture /Reflow Sensitive surface Mount devices). Moisture barrier bags (MBB) with desiccant are applied. The recommended storage environment and handling procedure is detailed in J-STD-033.

## 17. PRE-BAKING

This component has been designed, handled, and packaged ready for Pb-free reflow soldering. If the assembly shop follows J-STD-033 guidelines, no pre-bake of this component is required before being reflowed to a PCB. Our packaging tray can only withstand temperature of 70°C max.



## 18. MECHANICAL DIMENSIONS

### OUTLINE

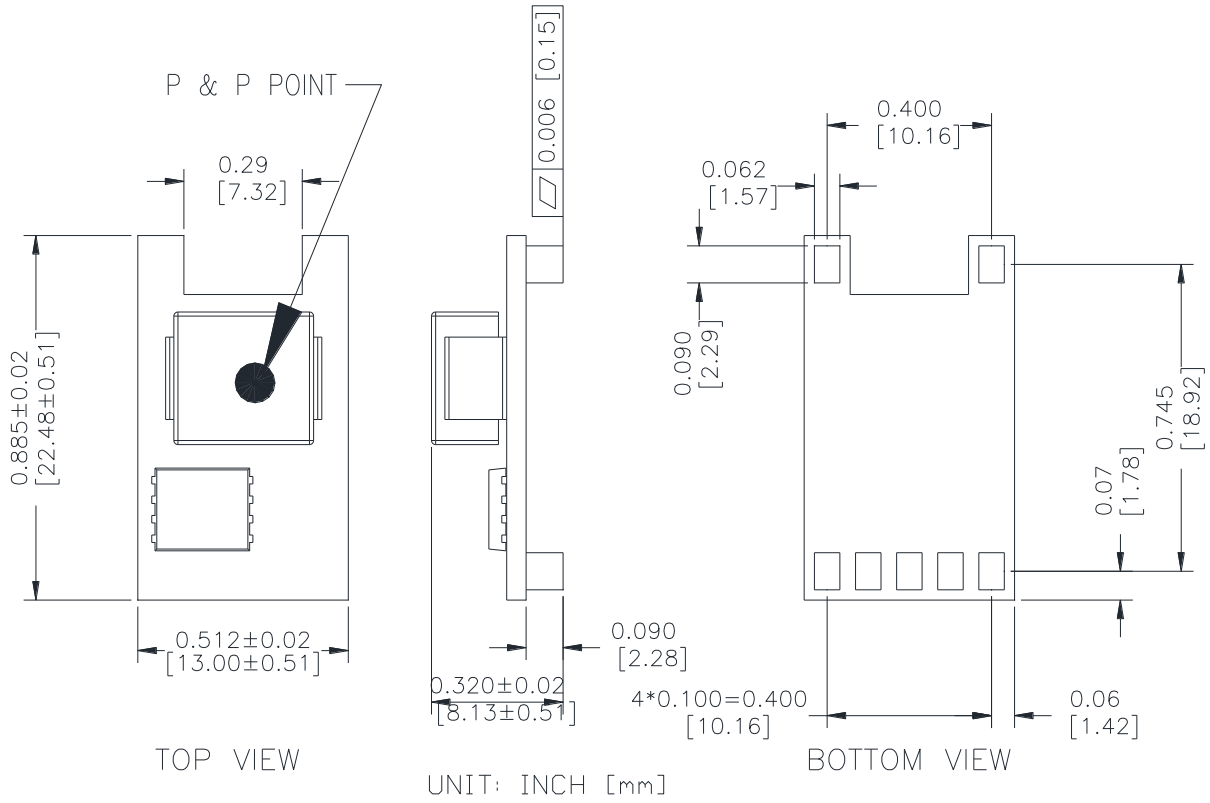



*Figure 16. Outline*

**NOTES:**

1) All Pins: Material - Copper Alloy;
   Finish – Gold plated
2) Un-dimensioned components are shown for visual reference only.
3) All dimensions in inch [mm]; Tolerances: x.xx +/-0.02 inch [0.51 mm]. x.xxx +/-0.010 inch [0.25 mm].

## PIN DEFINITIONS

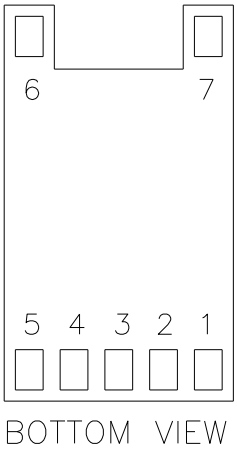



*Figure 17. Pins*

| PIN | FUNCTION | PIN | FUNCTION |
|---|---|---|---|
| 1 | Remote On/Off | 5 | Trim |
| 2 | Vin | 6 | N/A |
| 3 | GND | 7 | N/A |
| 4 | Vout | | |

## RECOMMENDED PAD LAYOUT

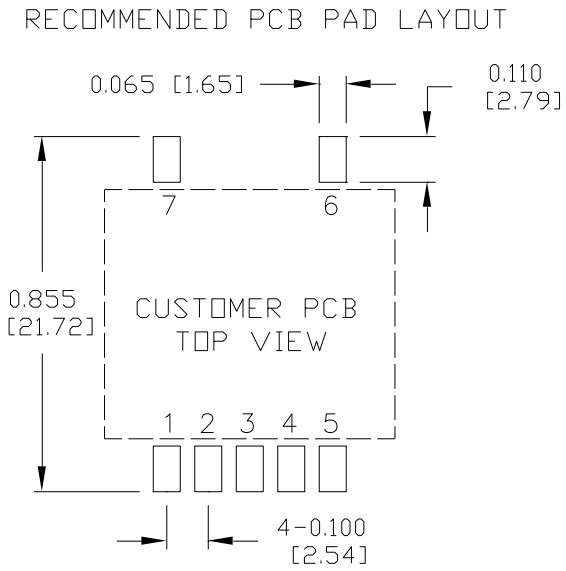



*Figure 18. Recommended pad layout*



## 19. PACKAGING INFORMATION

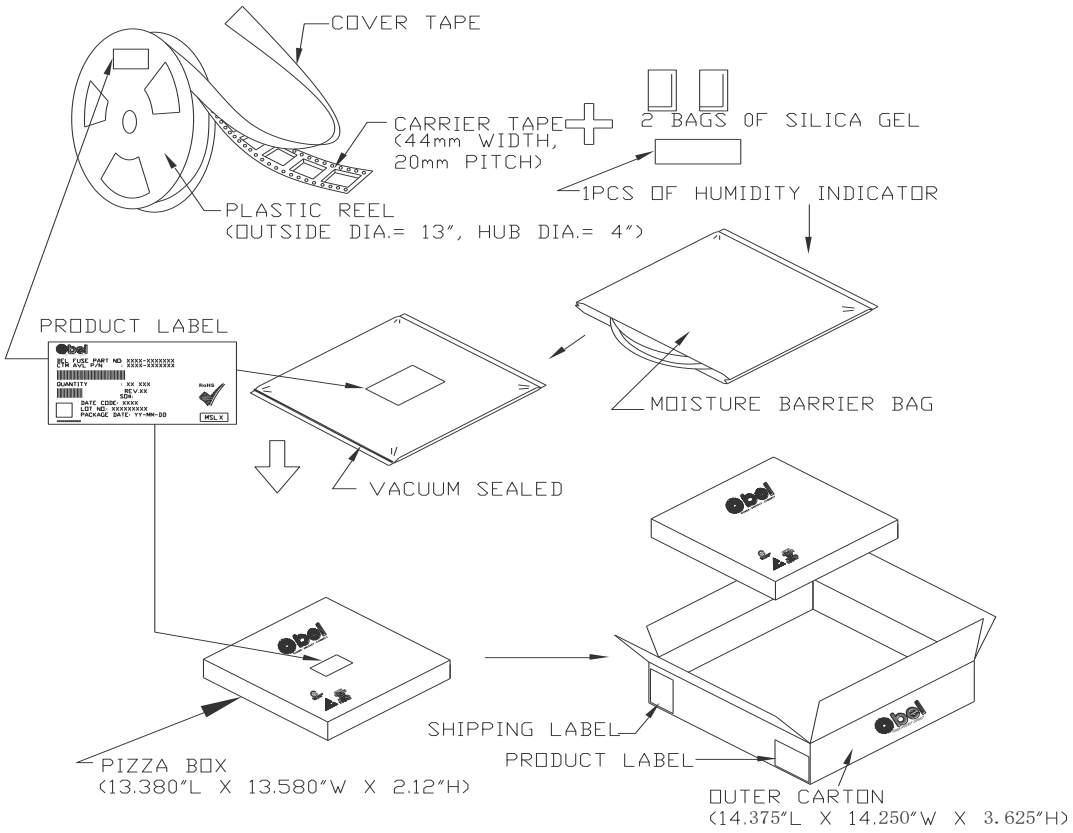
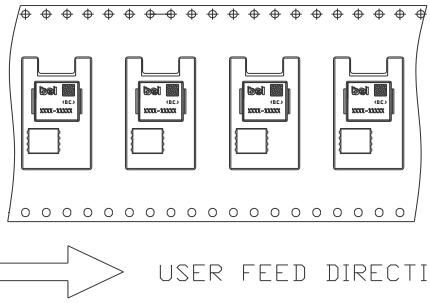



*Figure 19. Packaging information-1*




ORIENTATION OF COMPONENT INSIDE POCKET

| | |
|---|---|
| TAPE WIDTH | 44mm |
| POCKET PITCH | 20mm |
| QUANTITY OF COMPONENTS PER REEL | 320 |
| PLASTIC REEL OUTER DIAMETER | 13 INCHES |
| PLASTIC REEL HUB DIAMETER | 4 INCHES |
| COMPLY WITH EIA 481-2-A | |

*Figure 20. Packaging information-2*



## 20. REVISION HISTORY

| DATE | REVISION | CHANGES DETAIL | APPROVAL |
|---|---|---|---|
| 2017-03-23 | AA | First release. | S.Wang |
| 2017-05-16 | AB | Change MTBF UVLO, Add packaging information. | S.Wang |
| 2017-08-29 | AC | Update Line and load Regulation, Output Current Limit, Transient response, Input Reflected Ripple Current. | S.Wang |
| 2018-04-26 | AD | Update PRE-BAKING. | S.Wang |
| 2018-05-24 | AE | Add G – Tray package, Update MD. | S.Wang |
| 2021-01-11 | AF | Update outline notes to gold plated. | XF.Jiang |
| 2021-07-05 | AG | Add object ID. Add thermal test airflow direction. | XF.Jiang |

**For more information on these products consult: tech.support@psbel.com**

**NUCLEAR AND MEDICAL APPLICATIONS -** Products are not designed or intended for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems.
**TECHNICAL REVISIONS -** The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.