

APA04 Non-isolated Series

Technical Reference Notes

3.3Vdc Input, 5Vdc Output

Power SIPs



Introduction

APA04 non-isolated boost series is non-isolated DC-DC modules featuring high efficiency up to 90%.

APA04 non-isolated boost converter comes in 3.3V and 5V input version and are capable of providing up to 20W of output power in a small size 2.5in. x 0.55in. x 0.33in. The 3.3V input module uses a 3V to 4V input range and provides a 5V output. The 5V input module uses a 4.5V to 5.5 V input range and provides 1.2V, 1.5V, 1.8V, 2.1V, 2.5V, 3.3V output voltage with 6A output current.

APA04 non-isolated boost converter features high efficiency, high power density, wide operating environment temperature range, and easy installation. The typical efficiencies are 90% and the power density is 46.9W/inch³. The operating environment temperature can reach 65°C with natural convection for 5V input and 30°C for 3.3V input.

The APA04 non-isolated boost series is designed to meet CISPR22, FCC Class A, UL, TUV, and CSA certifications.

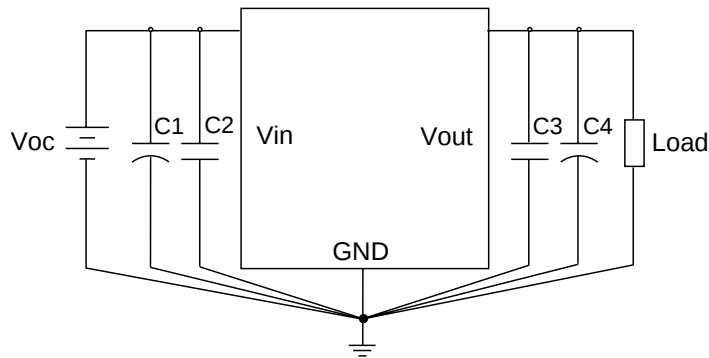
Design Feature

- ☞ Small size: 63.5mm x 14.0mm x 8.38mm
(2.5 in. x 0.55 in. x 0.33in.)
- ☞ High efficiency: 89% typical
- ☞ Extremely high power density
- ☞ Low input reflected ripple current
- ☞ Low output noise and ripple
- ☞ Excellent load regulation
- ☞ Excellent transient response
- ☞ Non-isolated output

Applications

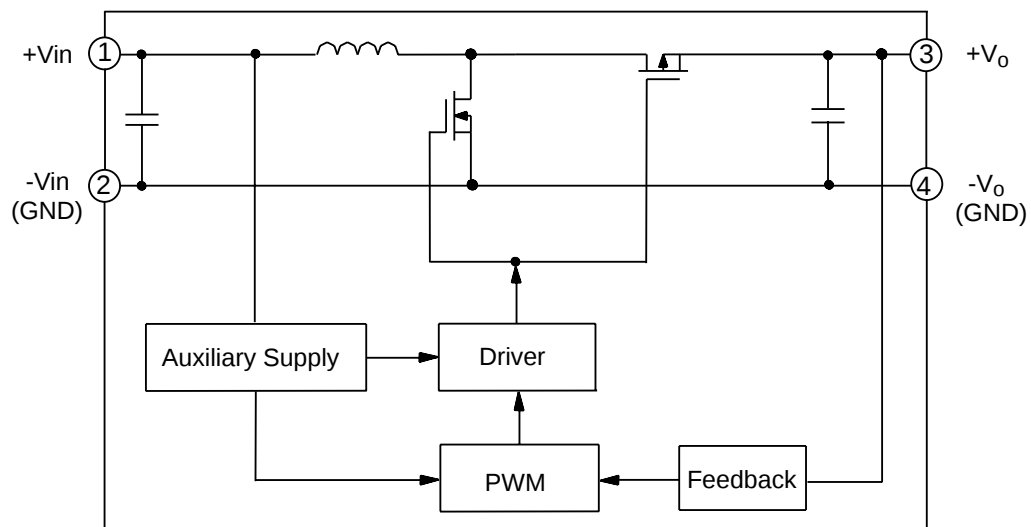
- ☞ Distributed power architecture
- ☞ Servers
- ☞ Workstations
- ☞ Desktop computers

Typical Application



C1 : Recommended 220 μ F Electrolytic Capacitor
C2 : Recommended 2.2 μ F Ceramic Capacitor
C3 : Recommended 2.2 μ F Ceramic Capacitor
C4 : Recommended 100 μ F Electrolytic Capacitor

Block Diagram



APA04 Non-Isolated Power SIPs
3.3V Input, 5V Output

Absolute Maximum Rating

Characteristic	Min	Typ	Max	Units	Notes
Input Voltage(continuous)			4.5	Vdc	100ms non-repetitive referring to the derating curve
Input Voltage(peak/surge)			5	Vdc	
Operating temperature	-25		85	°C	
storage temperature	-40		125	°C	

Input Characteristics

Characteristic	Min	Typ	Max	Units	Notes
Input Voltage Range	3	3.3	4	Vdc	
Input Reflected Ripple Current (p-p)		2	5	%lin	

General Specifications

Characteristic	Min	Typ	Max	Units	Notes
MTBF		2,000		k Hrs	Bellcore TR332, 25°C
Pin solder temperature			260	°C	wave solder < 10 s
Hand Soldering Time			5	s	iron temperature 425°C
Weight		7		grams	

APA04 Non-Isolated Power SIPs
3.3V Input, 5V Output

APA04A03 Output Characteristics

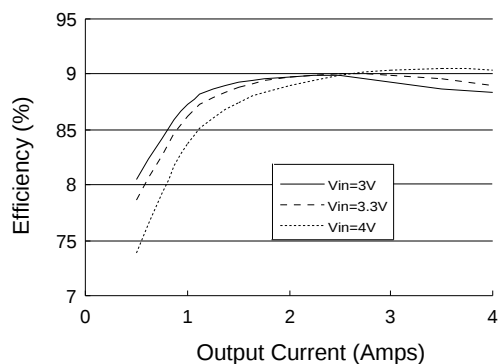
Characteristic	Min	Typ	Max	Units	Notes
Power		20		W	
Output Current			4	A	
Line Regulation		0.1	0.5	%Vo	Vin=3~4V, Io=4A
Load Regulation		0.1	0.5	%Vo	Io=0~4A, Vin=3.3V
Efficiency		89		%	
Dynamic Response					
25%-50% load		60		mV	Ta=25°C, DI/Dt=1A/10μs
		100		μs	Ta=25°C, DI/Dt=1A/10μs
50%-75% load		60		mV	Ta=25°C, DI/Dt=1A/10μs
		100		μs	Ta=25°C, DI/Dt=1A/10μs
Output Setpoint Voltage	-1	0	+1	%Vo	Vin=3.3V, Io=4A
Temperature Coefficient		0.01		%Vo/°C	
Ripple (rms)			50	mV	(0 to 20MHz BW)
Noise (p-p)			50	mV	(0 to 20MHz BW)
Switching Frequency		230		kHz	

Ordering Information

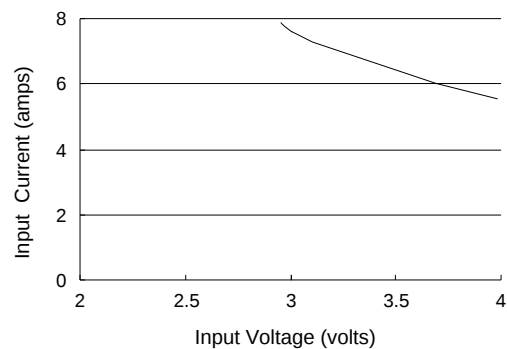
Model Number	Input Voltage	Output Voltage	Output Current	Ripple (mV rms)	Noise (mV pp)	Efficiency typ
APA04A03	3.0-4.0V	5V	4A	50	50	89%

Characteristic Curves (at 25°C)

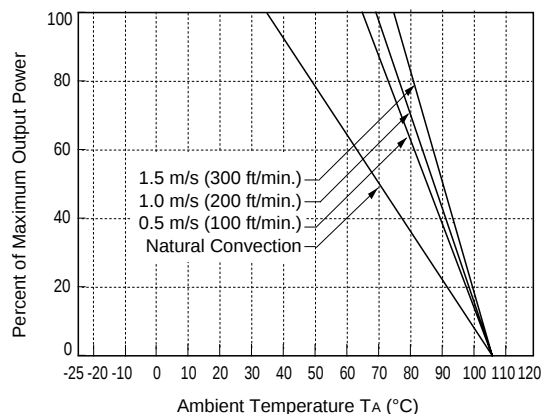
Typical Efficiency APA04A03



Typical Input-output APA04A03

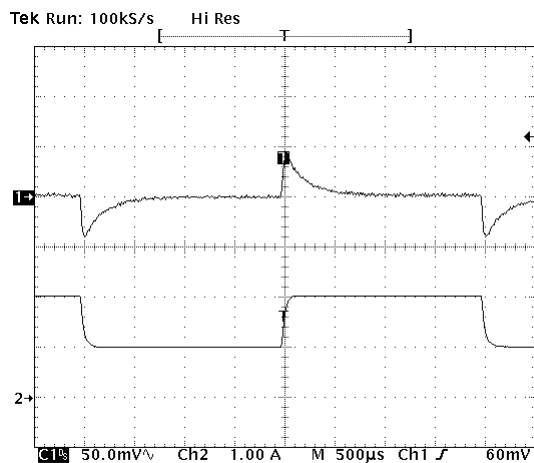


APA04A03 Derating Curves
@ Rated 3.3Vin

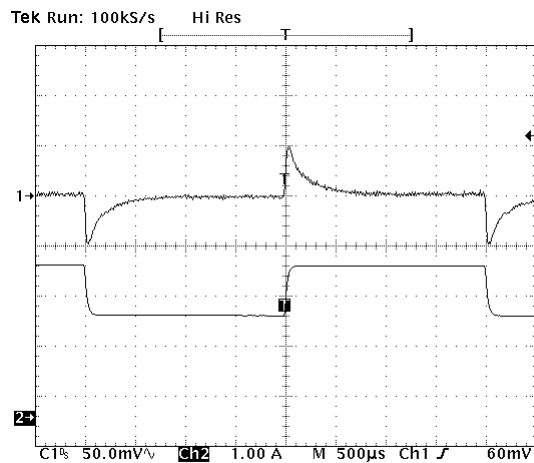


Characteristic Curves (at 25°C)

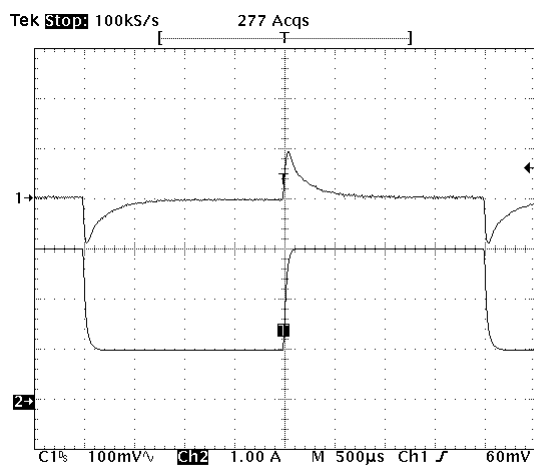
Typical Transient Response
25%-50%-25%Load
APA04A03



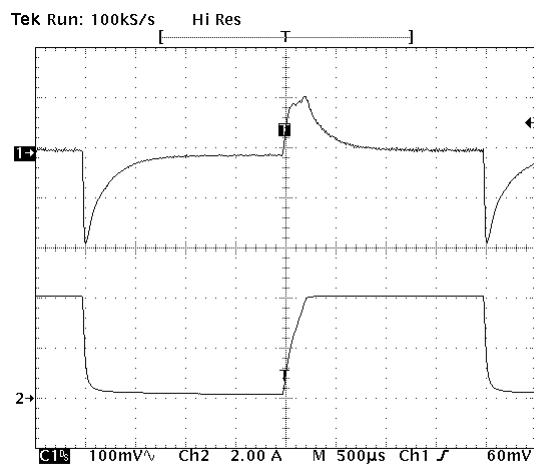
Typical Transient Response
50%-75%-50%Load
APA04A03



Typical Transient Response
25%-75%-25%Load
APA04A03

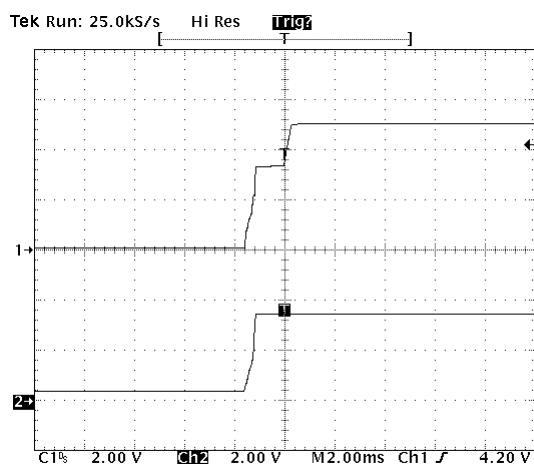


Typical Transient Response
0%-100%-0%Load
APA04A03

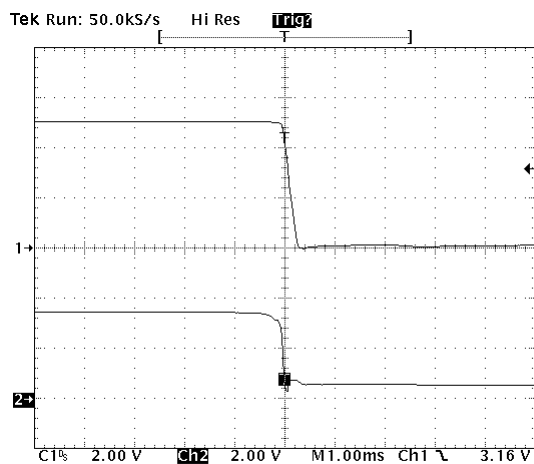


Characteristic Curves (at 25°C) continued

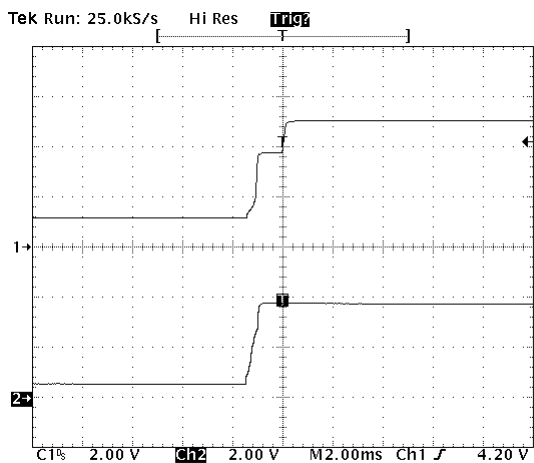
Startup With Full Load



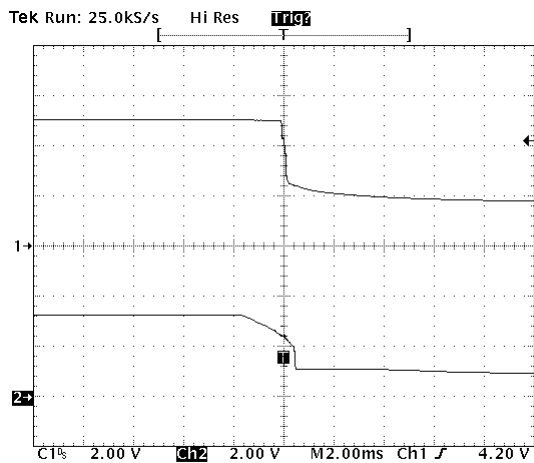
Shut-down With Full Load



Startup With no Load



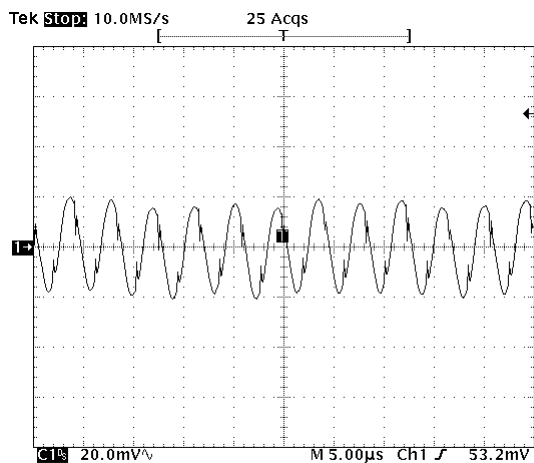
Shut-down With no Load



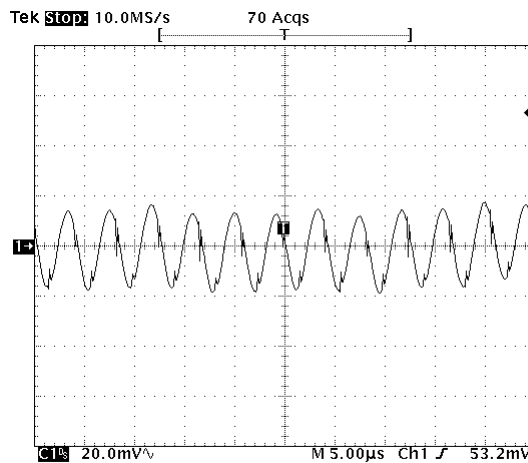
Note: CH1 is output, Ch2 is input.

Characteristic Curves (at 25°C) continued

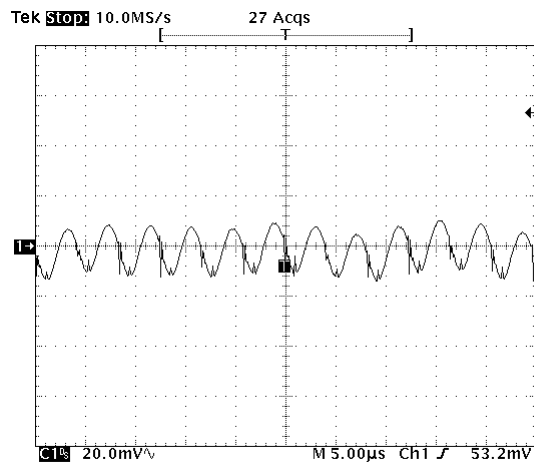
Ripple and Noise
 $V_{in}=3V$, $I_o=4A$



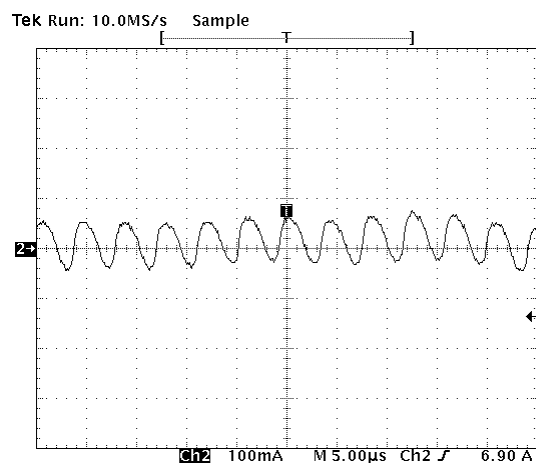
Ripple and Noise
 $V_{in}=3.3V$, $I_o=4A$



Ripple and Noise
 $V_{in}=4V$, $I_o=4A$



Input Reflected-ripple Current
 $V_{in}=3.3V$, $I_o=4A$



Input Characteristics

The APA04 non-isolated boost power module has no internal fuse. An external fuse must always be employed! To meet international safety requirements, an input line fuse should be used. Input wires and copper coil must be capable of conducting a current of 1.5 times the value of the fuse. If one of the input lines is connected to chassis ground, then the fuse must be placed in the other input line.

A fuse with ratings of 20A is recommended for APA04 non-isolated boost series.

Safety Considerations

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e., UL1950, CSA C22.2 No. 950-95, and VDE 0805 (EN60950, IEC950).

For the module's output to be considered meeting the requirements of safety extra-low voltage (SELV), one of the following must be true:

- 1 All inputs are SELV and floating, with the output also floating.
- 2 All inputs are SELV and grounded, with the output also grounded.
- 3 Any non-SELV input must be provided with reinforced from any other hazardous voltages, including the ac mains, and must have a SELV reliability test performed on it in combination with the converters. Inputs must meet SELV requirements.

If the input meets extra-low voltage (ELV) requirements, then the converter's output is considered ELV.

The input to these units is to be provided with a maximum 20A normal blow fuse in the ungrounded lead.

APA04 Mechanical Considerations

Thermal Performance

APA04 non-isolated module can work properly under natural convection in ambient temperature up to 30°C. If air-flow is applied, it can work in a much wider temperature range(See derating curves for reference). In order to maintain efficient heat dissipation, the converters should be mounted parallel with the air-flow direction.

Soldering

APA04 non-isolated converter is compatible with standard wave soldering techniques. When wave soldering, the converter pins should be preheated for 20-30 seconds at 110°C, and wave soldered at 260°C for less than 10 seconds.

When hand soldering, the iron temperature should be maintained at 425°C and applied to the converter pins for less than 5 seconds. Longer exposure can cause internal damage to the converter. Cleaning can be performed with cleaning solvent IPA or with water.

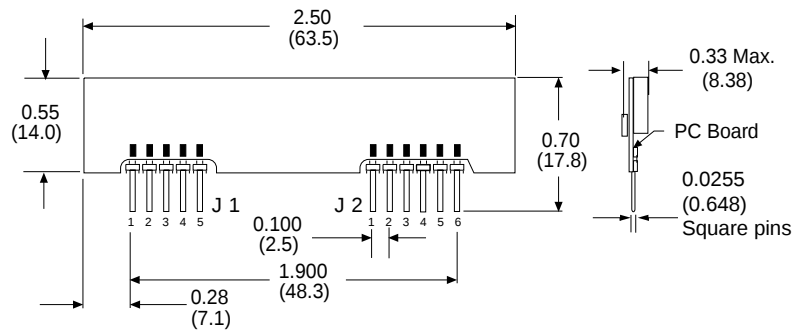
Mechanical Chart

On the next page.

Recommended Hole Pattern

Dimensions are in millimeters (inches).
Component-side footprint.

APA04 Non-Isolated Power SIPs
3.3V Input, 5V Output

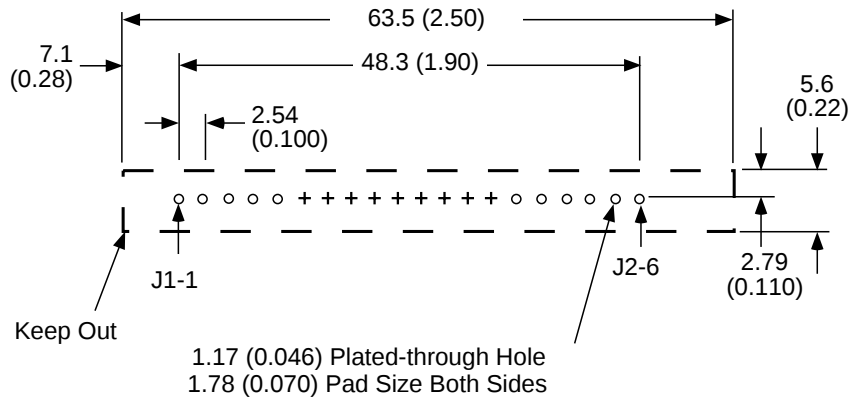


J1-1	+Vout	J2-1	GND
J1-2	+Vout	J2-2	GND
J1-3	+Vout	J2-3	+Vin
J1-4	GND	J2-4	+Vin
J1-5	GND	J2-5	+Vin
		J2-6	+Vin

Tolerances:

Inches	Millimeters
.xx ±0.020	.x ±0.5
.xxx ±0.010	.xx ±0.25
Pins	
±0.002	±0.5

Mechanical Chart



Recommended Hole Pattern