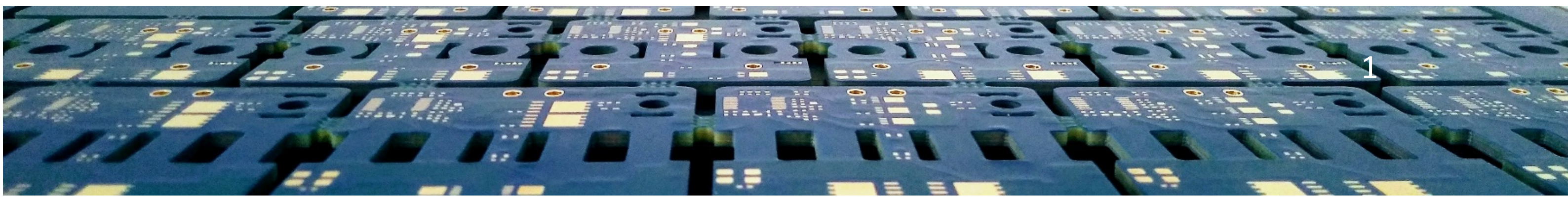
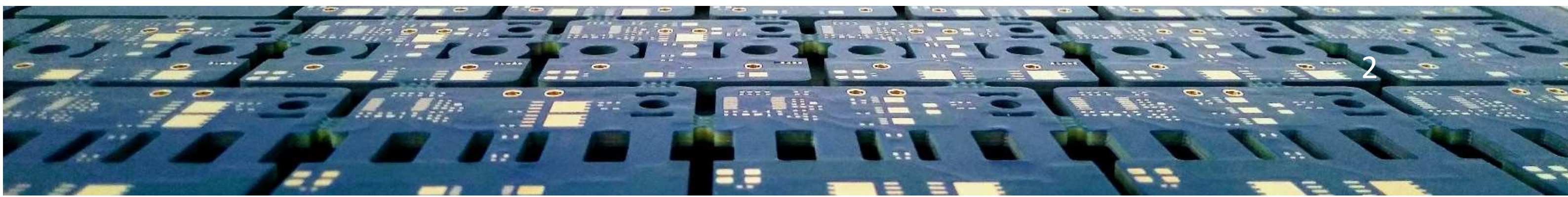
Contents:



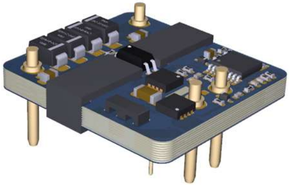
About APEX Converters

From 1W isolated converters to 1000W front-end power supplies, along with filtering and isolation solutions, our current offering exceeds over 40 standard models developed in our design and manufacturing center.

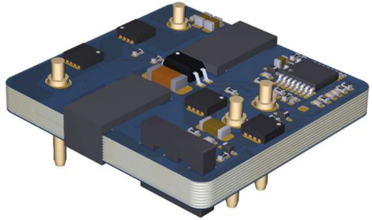
APEX's technical sales managers, reliably support the power requirements of local and global manufacturers of telecommunications equipment, data management systems, industrial controls, transportation electronics, energy systems, and more.



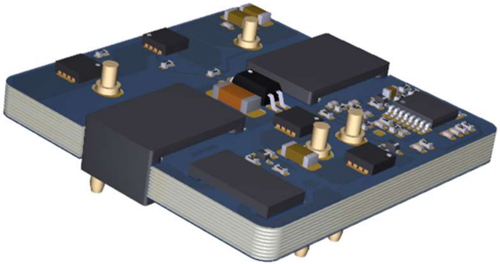
DC/DC CONVERTERS



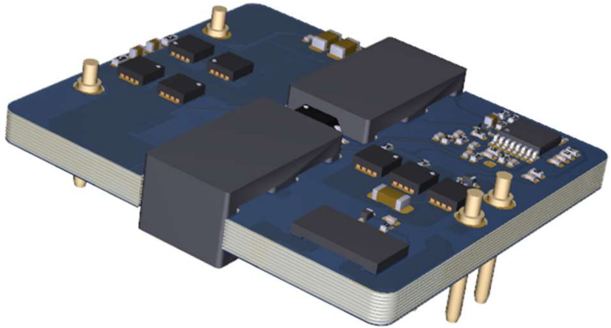
APX 15(15W)



APX 30(30W)

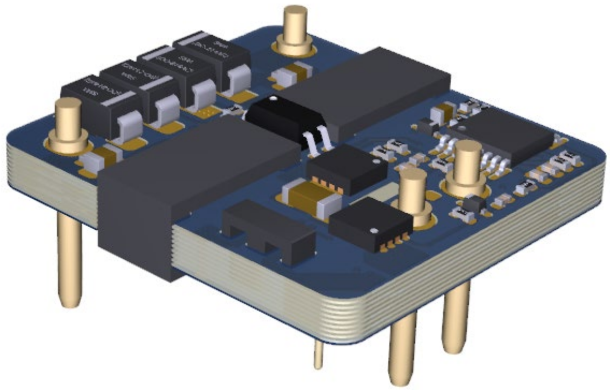


APX 50(50W)

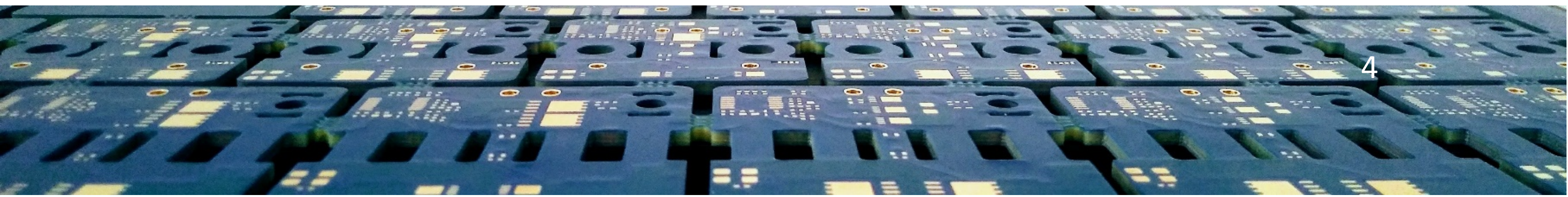


APX 100(100W)

The APX15 Series is a family of isolated high-performance dc-dc converter modules with ultra-wide 4:1 input voltage ranges which come in a rugged, sealed industry standard 1/10 brick package. A very high efficiency allows full power operation without forced air cooling at 60°C. The very wide input voltage range makes these converters interesting solution for battery operated systems. Typical applications are in telecom, datacom, industry control and railway systems for on board power distribution. These series is available in many optional designs on demand. For aerospace, military and medical applications order as "options" table.

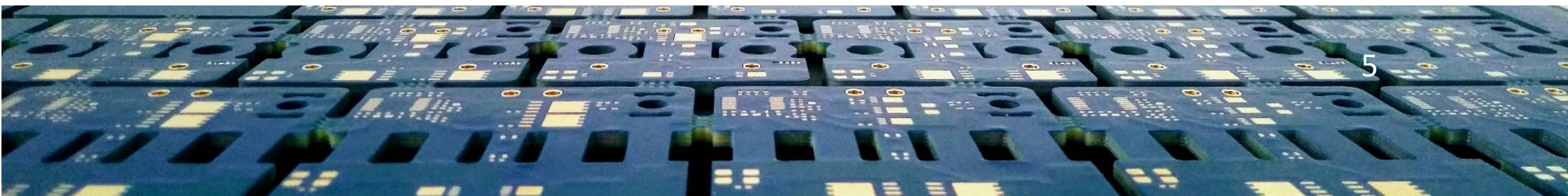


DC/DC CONVERTERS: APX 15



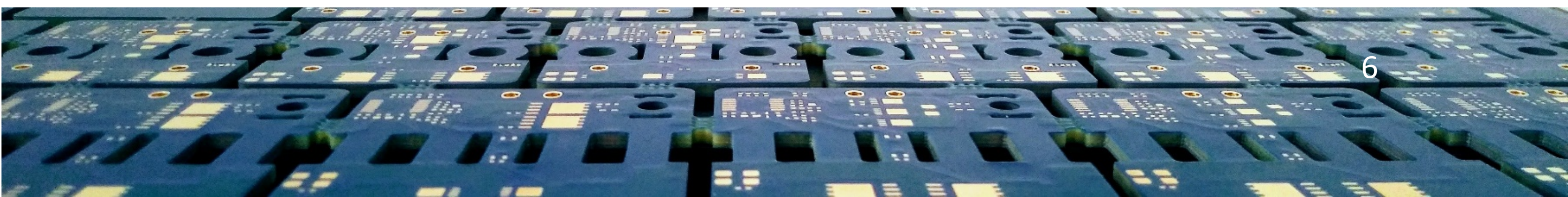
Features:

- Ultra wide 4:1 input voltage ranges 9–36, 18–72 VDC
- Very high efficiency up to 92%
- No minimum load
- Soft start
- Adjustable output voltage +10/10%
- Remote On/Off input
- Under voltage lock-out circuit
- Over temperature protection
- lifetime product guarantee



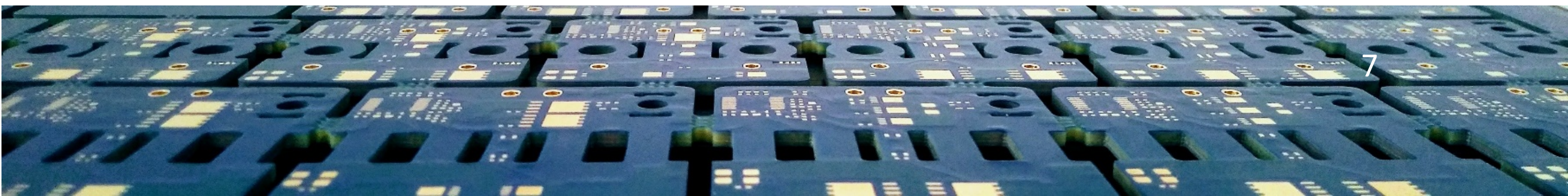
Standard Models

Order code	Input voltage	Output voltage	Output current max.	Efficiency typ.
APX15-24DS3.3-B10A	9 – 36 VDC (24 VDC nominal)	3.3VDC	4.5 A	85%
APX15-24DS05-B10A		5 VDC	3 A	92%
APX15-24DD12-B10A		12 VDC	1.25 A	89%
APX15-24DD15-B10A		15 VDC	1 A	85%
APX15-24DB12-B10A		+/-12VDC	0.625 A	85%
APX15-24DB15-B10A		+/-15VDC	0.5 A	85%
APX15-48DS3.3-B10A	18 – 72 VDC (48 VDC nominal)	3.3 VDC	4.5 A	85%
APX15-48DS05- B10A		5 VDC	3 A	92%
APX15-48DD12-B10A		12 VDC	1.25 A	89%
APX15-48DD15-B10A		15 VDC	1 A	85%
APX15-48DB12-B10A		+/-12VDC	0.625 A	85%
APX15-48DB15-B10A		+/-15VDC	0.5 A	85%

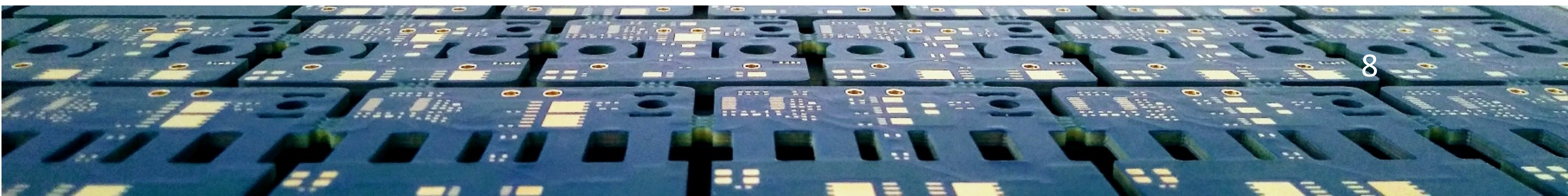


Options	
APEX-HS1	Heat-sink for standard version (incl. mounting screws and thermal pad)
APEX-MT1	Military version
On demand (backorder with MOQ)	Input filter to meet EMC results

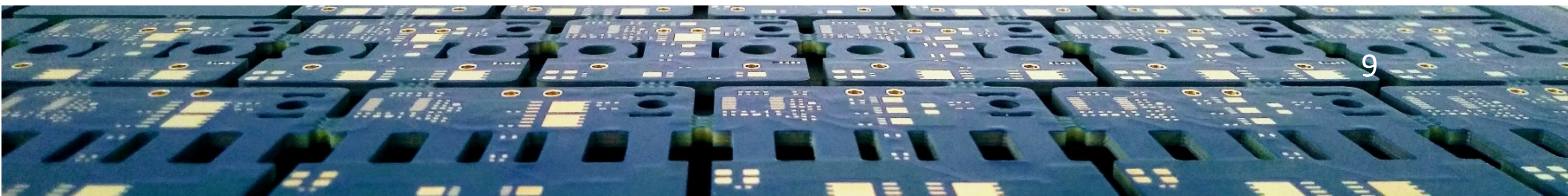
Input Specifications		
Input current at no load (nominal input voltage)	24 Vin models 48 Vin models	25 mA 20mA
Start-up voltage	24 Vin models 48 Vin models	9.0 VDC max. 18 VDC max.
Under voltage shut down (lock-out circuit)	24 Vin models 48 Vin models	8-8.5 VDC 16-16.5 VDC
Surge voltage (10 sec. max.)	24 Vin models 48 Vin models	40 VDC 80 VDC
Recommended input fuse (slow blow, useful for reverse voltage protection)	24/48 Vin models	5 A



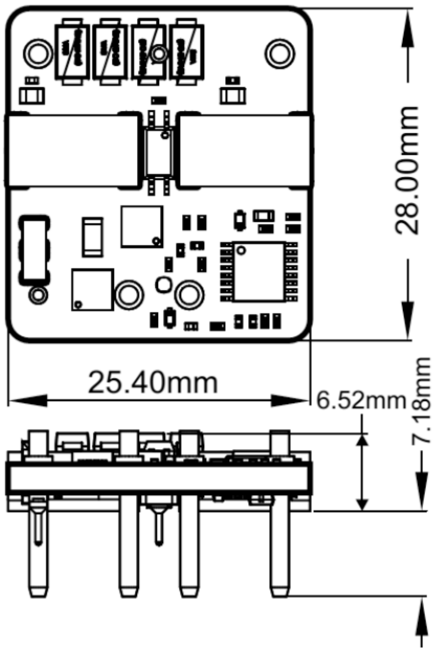
Output Specifications		
Voltage set accuracy (at full load, nominal input)		±1%
Output voltage adjustment		±10% by external resistor
Regulation	-Input variation Vin min. to Vin max. -Load variation (0 – 100%)	0.1% max. 0.1% max.
Temperature coefficient		±0.02% /k
Minimum load		Not required
Ripple and noise (20MHZ bandwidth)	3.3 VDC MODELs 5VDC MODELs 12VDC MODELs 15VDC MODELs	100mVp-p typ. 100mVp-p typ. 200mVp-p typ. 300mVp-p typ.
Start-up time (nominal Vin and constant resistive load)		100 ms typ. (at power On or remote on)
Transient response (25% load step change)		200µs max.
Output current limitation		at 120 -150% of Iout max.
Over voltage protection		at 115 -130% of Vout nom.
Short circuit protection		Continuous, automatic recovery.
Max. capacitive load	3.3 VDC MODELs 5 VDC MODELs 12 VDC MODELs 15 VDC MODELs	40000µF 40000µF 7000µF 3000µF

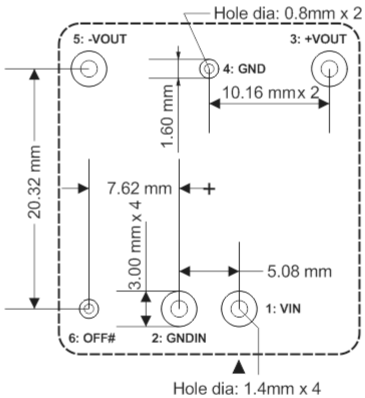


General Specifications		
Casing material	24/48 Vin models	Metal
Potting material		Epoxy
Base material		FR4

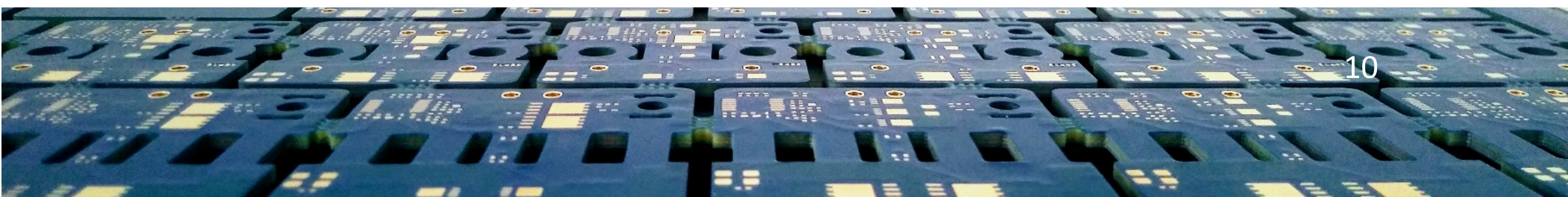


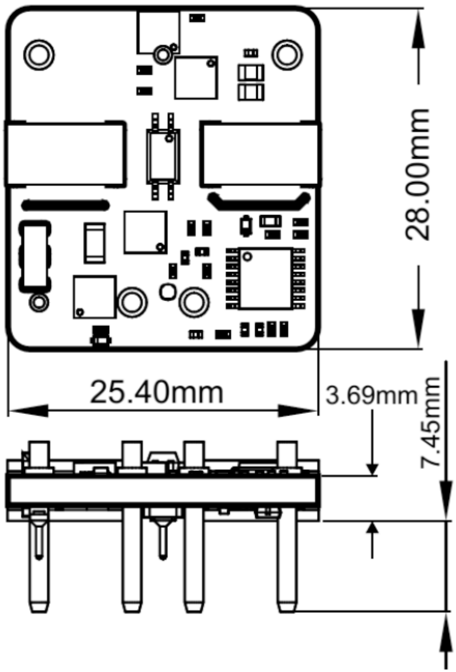
Dimensions and Pin-out

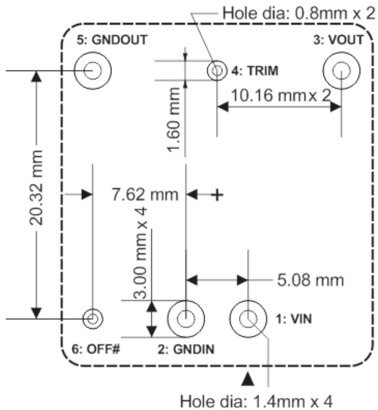




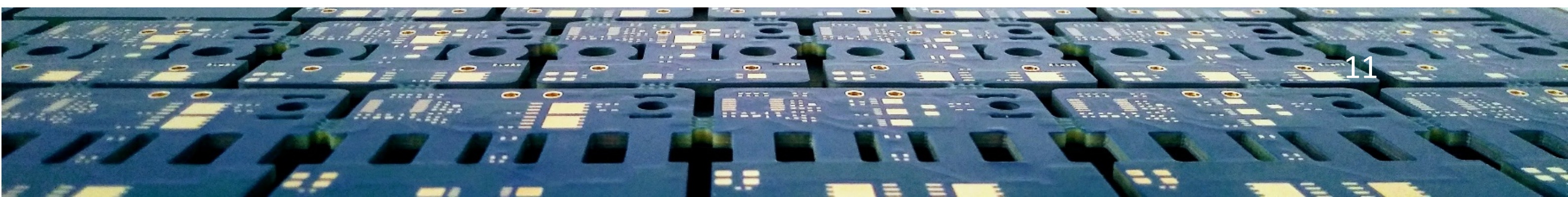
PIN-OUT	
1	+Vin
2	GND in
3	+Vout
4	GND out
5	-Vout
6	Remote On/Off



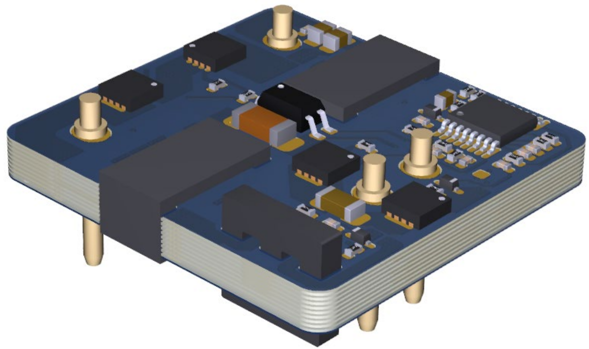




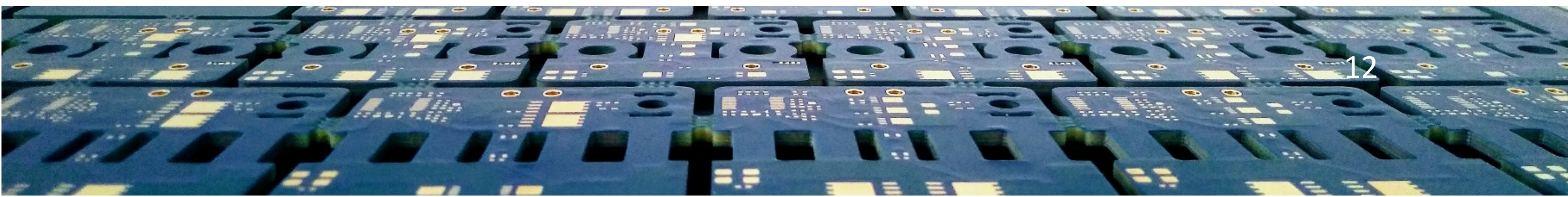
PIN-OUT	
1	+Vin
2	GND in
3	+Vout
4	Trim
5	GND out
6	Remote On/Off



The APX30 Series is a family of isolated high-performance dc-dc converter modules with ultra-wide 4:1 input voltage ranges which come in a rugged, sealed industry standard 1/6 brick package. A very high efficiency allows full power operation without forced air cooling at 60°C. The very wide input voltage range makes these converters interesting solution for battery operated systems. Typical applications are in telecom, datacom, industry control and railway systems for on board power distribution. These series is available in many optional designs on demand. For aerospace, military and medical applications order as "options" table.

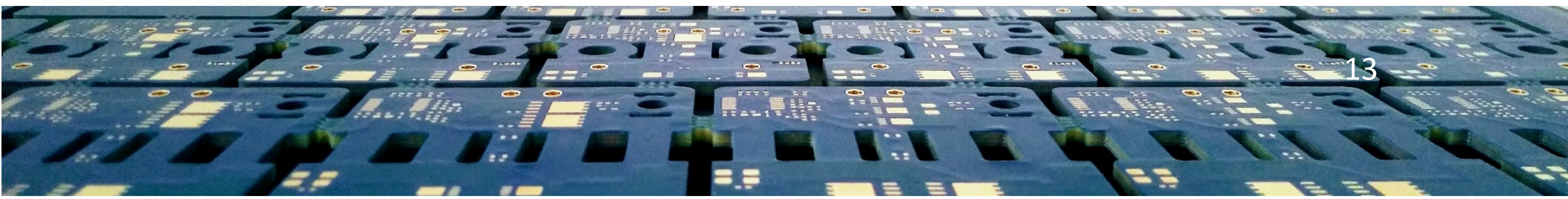


DC/DC CONVERTERS: APX 30



Features:

- Ultra-wide 4:1 input voltage ranges 9–36, 18–72 VDC
- Very high efficiency up to 92%
- No minimum load
- Soft start
- Adjustable output voltage +10/10%
- Remote On/Off input
- Under voltage lock-out circuit
- Over temperature protection
- lifetime product guarantee

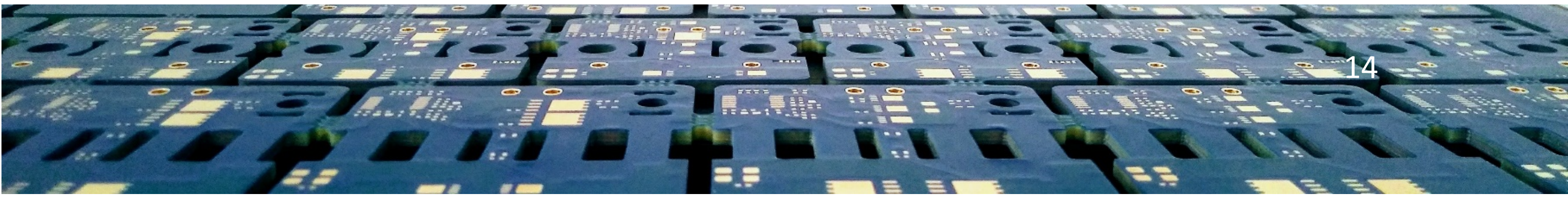


Standard Models

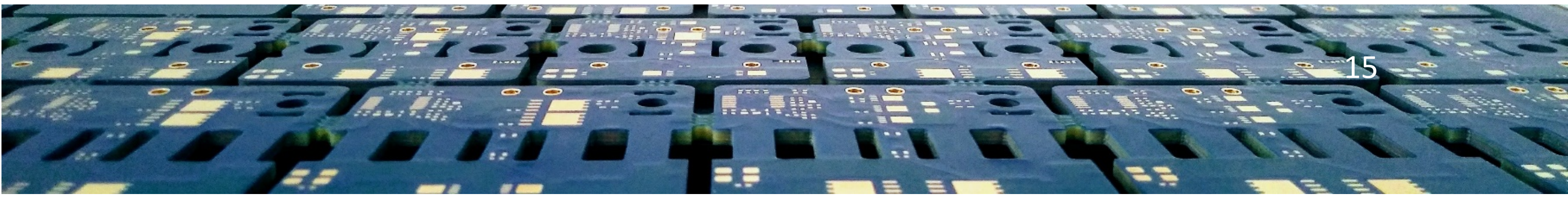
Order code	Input voltage	Output voltage	Output current max.	Efficiency typ.
APX30-24DS05-B04A	9-36 VDC (24 VDC nominal)	5 VDC	6 A	92%
APX30-24DS12-B04A		12 VDC	2.5 A	92%
APX30-24DS15-B04A		15 VDC	2 A	91%
APX30-48DS05-B04A	18-72 VDC (48 VDC nominal)	5 VDC	6 A	92%
APX30-48DS12-B04A		12 VDC	2.5 A	92%
APX30-48DS15-B04A		15 VDC	2 A	91%

Options

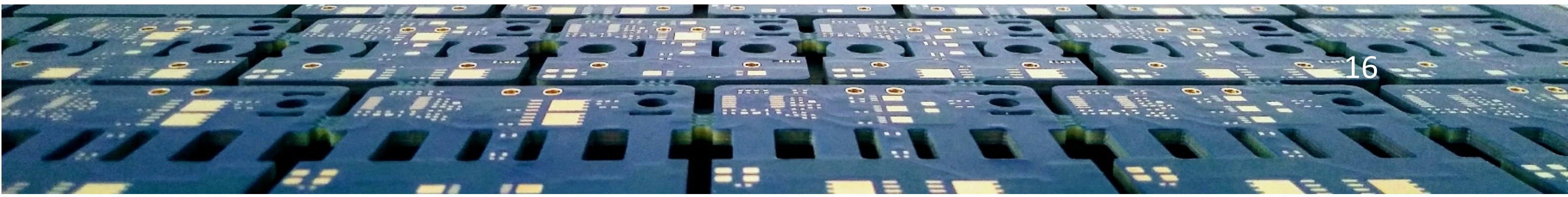
APEX-HS1	Heat-sink for standard version (incl. mounting screws and thermal pad)
APEX-MT1	Military version
On demand (backorder with MOQ)	Input filter to meet EMC results



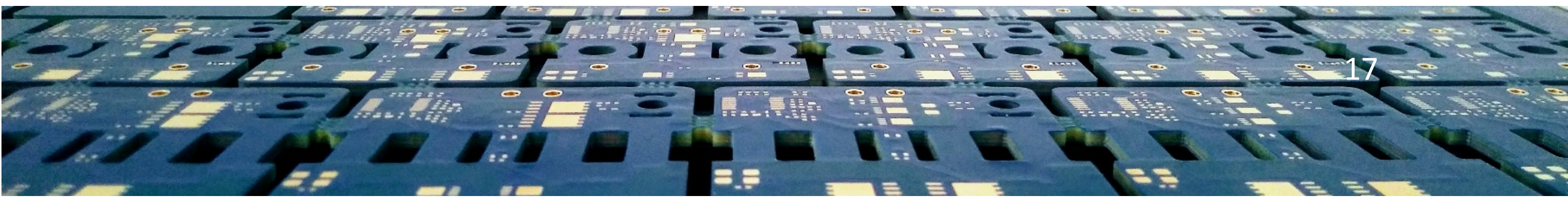
Input Specifications		
Input current at no load (nominal input voltage)	24 Vin models 48 Vin models	25 mA 20mA
Start-up voltage	24 Vin models 48 Vin models	9.0 VDC max. 18 VDC max.
Under voltage shut down (lock-out circuit)	24 Vin models 48 Vin models	8-8.5 VDC 16-16.5 VDC
Surge voltage (10 sec. max.)	24 Vin models 48 Vin models	40 VDC 80 VDC
Recommended input fuse (slow blow, useful for reverse voltage protection)	24/48 Vin models	6 A



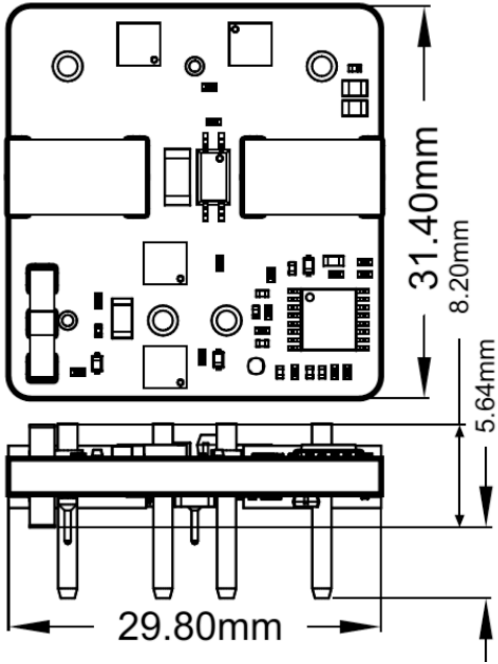
Output Specifications		
Voltage set accuracy (at full load, nominal input)		±1%
Output voltage adjustment		±10% by external resistor
Regulation	-Input variation Vin min. to Vin max. -Load variation (0 – 100%)	0.1% max. 0.1% max.
Temperature coefficient		±0.02% /k
Minimum load		Not required
Ripple and noise(20MHZ bandwidth)	5VDC MODELs 12VDC MODELs 15VDC MODELs	100mVp-p typ. 200mVp-p typ. 300mVp-p typ.
Start-up time(nominal Vin and constant resistive load)		100 ms typ.(at power On or remote on)
Transient response (25% load step change)		200μs max.
Output current limitation		at 120 -150% of Iout max.
Over voltage protection		at 115 -130% of Vout nom.
Short circuit protection		Continuous, automatic recovery.
Max. capacitive load	5 VDC MODELs 12 VDC MODELs 15 VDC MODELs	40000μF 7000μF 3000μF

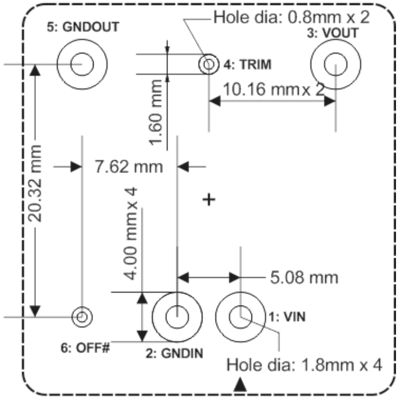


General Specifications		
Casing material	24/48 Vin models	Metal
Potting material		Epoxy
Base material		FR4

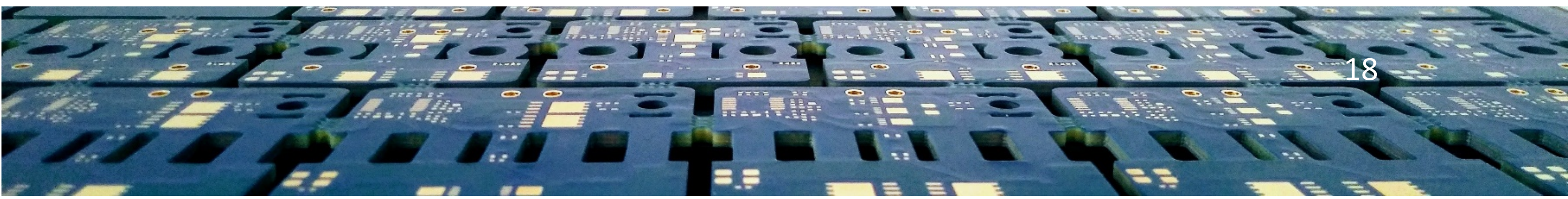


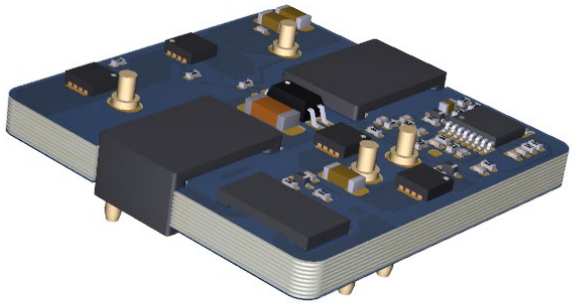
Dimensions and Pin-out





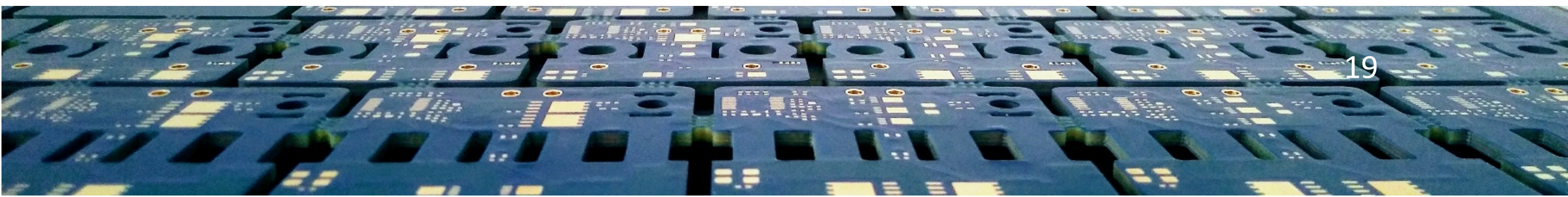
PIN-OUT	
1	+Vin
2	GND in
3	+Vout
4	Trim
5	GND out
6	Remote On/Off





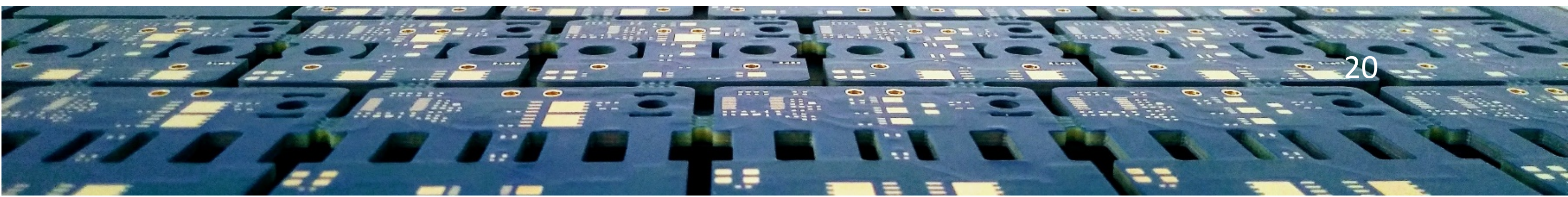
DC/DC CONVERTERS: APX 50

The APX50 Series is a family of isolated high-performance dc-dc converter modules with ultra-wide 4:1 input voltage ranges which come in a rugged, sealed industry standard 1/6 brick package. A very high efficiency allows full power operation without forced air cooling at 60°C. The very wide input voltage range makes these converters interesting solution for battery operated systems. Typical applications are in telecom, datacom, industry control and railway systems for on board power distribution. These series is available in many optional designs on demand. For aerospace, military and medical applications order as "options" table.



Features:

- Ultra-wide 4:1 input voltage ranges 9–36, 18–72 VDC
- Very high efficiency up to 93%
- No minimum load
- Soft start
- Adjustable output voltage +10/10%
- Remote On/Off input
- Under voltage lock-out circuit
- Over temperature protection
- lifetime product guarantee

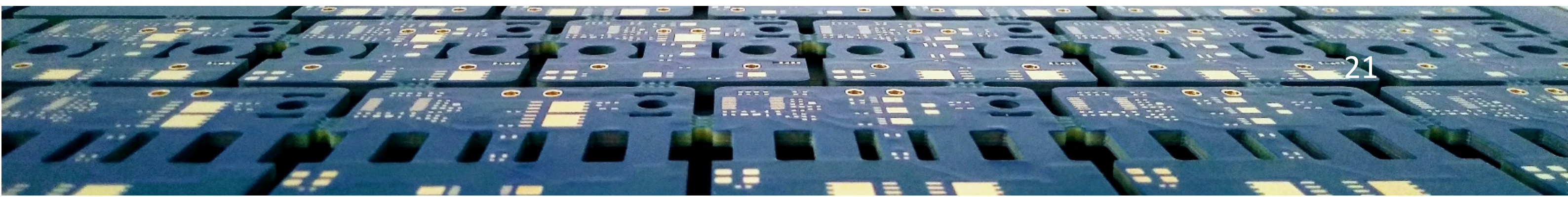


Standard Models

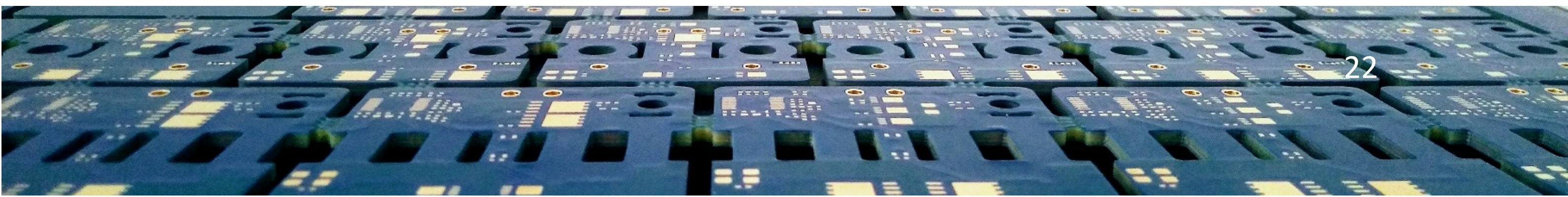
Order code	Input voltage	Output voltage	Output current max.	Efficiency typ.
APX50-24DS05-B06A	9-36 VDC (24 VDC nominal)	5 VDC	10 A	92%
APX50-24DS12-B06A		12 VDC	4.2 A	93%
APX50-24DS15-B06A		15 VDC	3.3 A	90%
APX50-48DS05-B06A	18-72 VDC (48 VDC nominal)	5 VDC	10 A	92%
APX50-48DS12-B06A		12 VDC	4.2 A	93%
APX50-48DS15-B06A		15 VDC	3.3 A	90%

Options

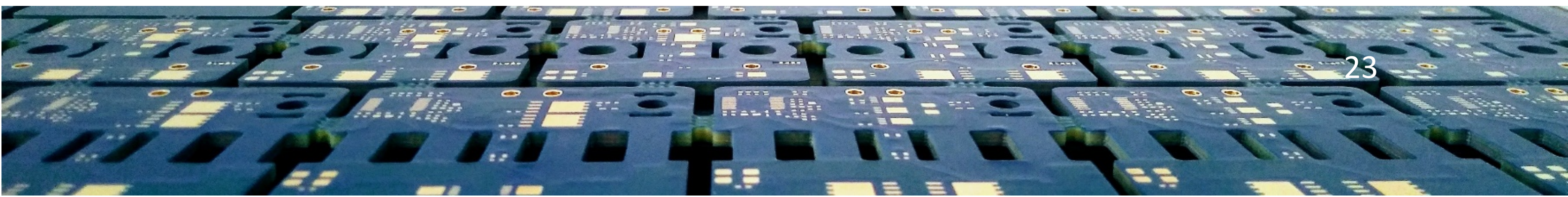
APEX-HS1	Heat-sink for standard version (incl. mounting screws and thermal pad)
APEX-MT1	Military version
On demand (backorder with MOQ)	Input filter to meet EMC results



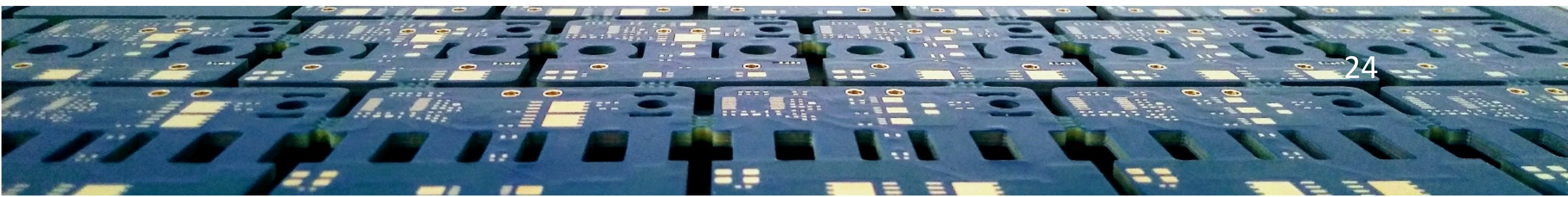
Input Specifications		
Input current at no load (nominal input voltage)	24 Vin models 48 Vin models	25 mA 20mA
Start-up voltage	24 Vin models 48 Vin models	9.0 VDC max. 18 VDC max.
Under voltage shut down (lock-out circuit)	24 Vin models 48 Vin models	8-8.5 VDC 16-16.5 VDC
Surge voltage (10 sec. max.)	24 Vin models 48 Vin models	40 VDC 80 VDC
Recommended input fuse (slow blow, useful for reverse voltage protection)	24/48 Vin models	10 A



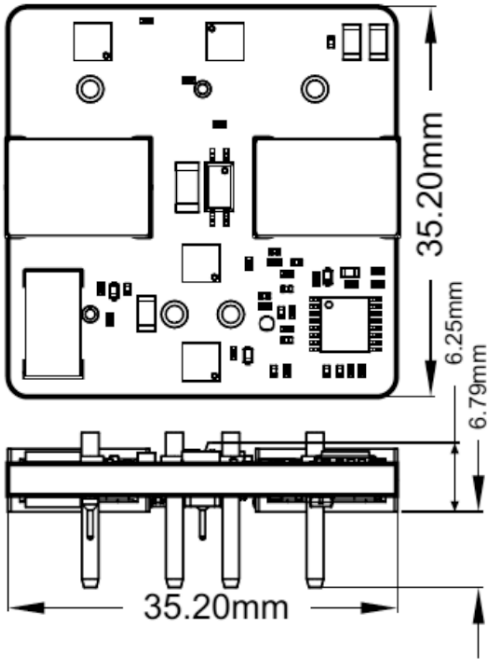
Output Specifications		
Voltage set accuracy (at full load, nominal input)		±1%
Output voltage adjustment		±10% by external resistor
Regulation	-Input variation Vin min. to Vin max. -Load variation (0 – 100%)	0.1% max. 0.1% max.
Temperature coefficient		±0.02% /k
Minimum load		Not required
Ripple and noise(20MHZ bandwidth)	5VDC MODELs 12VDC MODELs 15VDC MODELs	100mVp-p typ. 200mVp-p typ. 300mVp-p typ.
Start-up time(nominal Vin and constant resistive load)		100 ms typ.(at power On or remote on)
Transient response (25% load step change)		200μs max.
Output current limitation		at 120 -150% of Iout max.
Over voltage protection		at 115 -130% of Vout nom.
Short circuit protection		Continuous, automatic recovery.
Max. capacitive load	5 VDC MODELs 12 VDC MODELs 15 VDC MODELs	40000μF 7000μF 3000μF

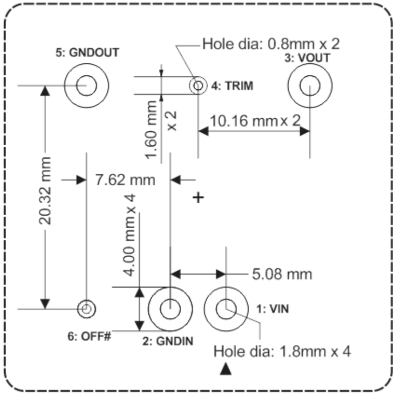


General Specifications		
Casing material	24/48 Vin models	Metal
Potting material		Epoxy
Base material		FR4

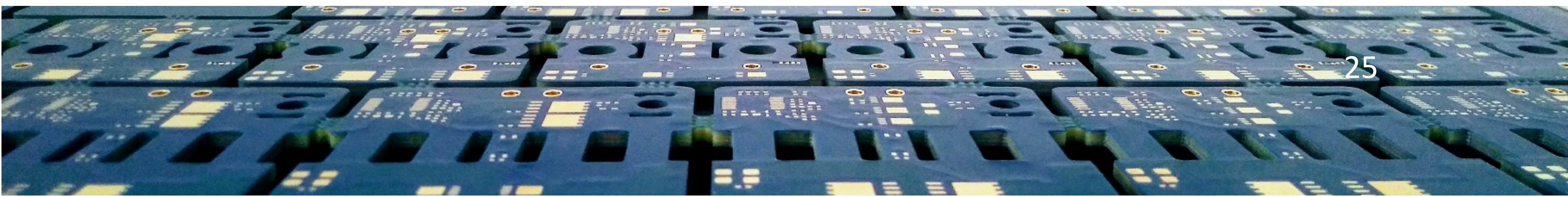


Dimensions and Pin-out

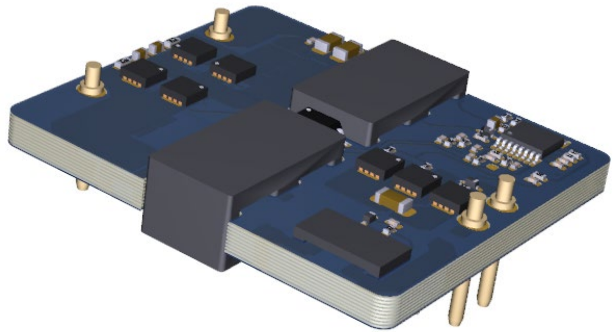




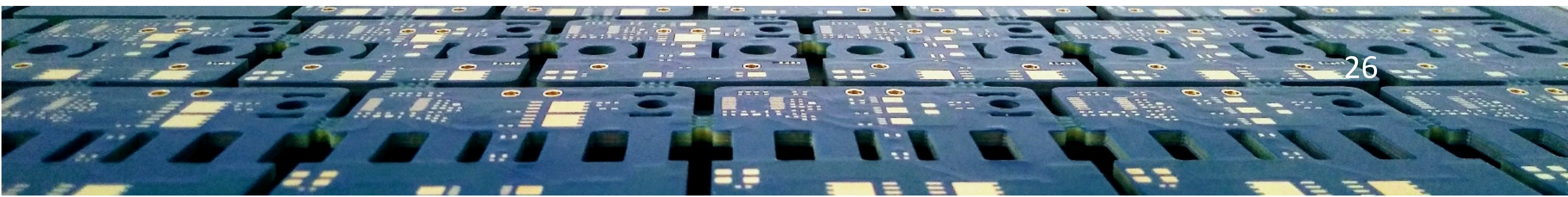
PIN-OUT	
1	+Vin
2	GND in
3	+Vout
4	Trim
5	-GND out
6	Remote On/Off



The APX100 Series is a family of isolated high-performance dc-dc converter modules with ultra-wide 4:1 input voltage ranges which come in a rugged, sealed industry standard 1/4 brick package. A very high efficiency allows full power operation without forced air cooling at 60°C. The very wide input voltage range makes these converters interesting solution for battery operated systems. Typical applications are in telecom, datacom, industry control and railway systems for on board power distribution. These series is available in many optional designs on demand. For aerospace, military and medical applications order as "options" table.

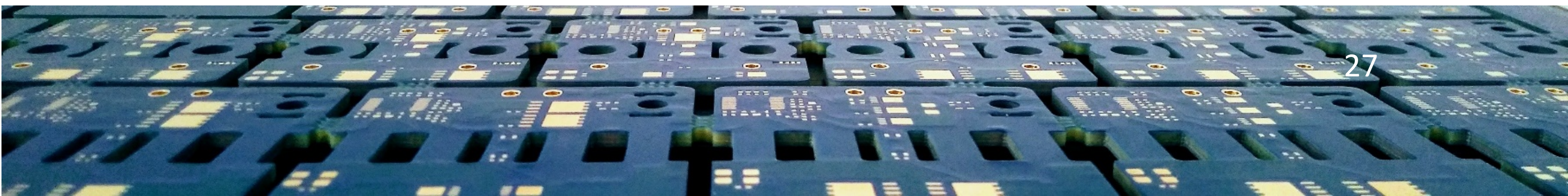


DC/DC CONVERTERS: APX 100



Features:

- Ultra-wide 4:1 input voltage ranges 9–36, 18–72 VDC
- Very high efficiency up to 93%
- No minimum load
- Soft start
- Adjustable output voltage +10/10%
- Remote On/Off input
- Under voltage lock-out circuit
- Over temperature protection
- lifetime product guarantee

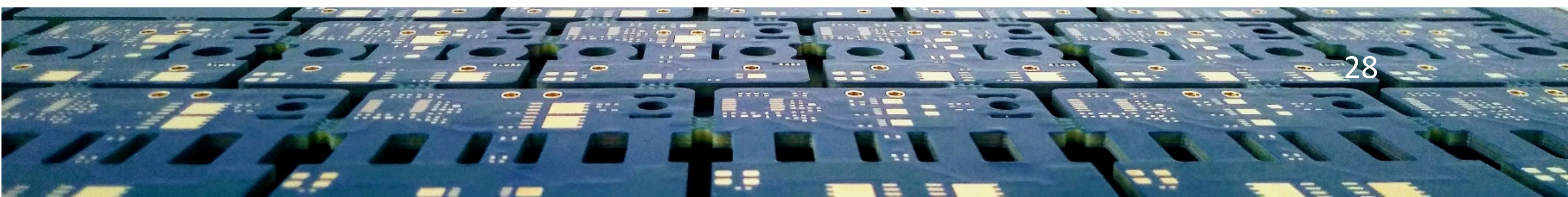


Standard Models

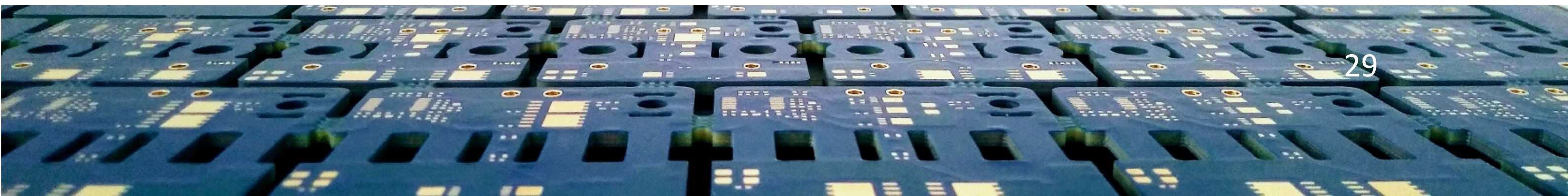
Order code	Input voltage	Output voltage	Output current max.	Efficiency typ.
APX100-24DS05-B04A	9-36 VDC (24 VDC nominal)	5 VDC	20 A	90%
APX100-24DS12-B04A		12 VDC	8.3 A	90%
APX100-24DS15-B04A		15 VDC	6.6 A	91%
APX100-48DS05-B04A	18-72 VDC (48 VDC nominal)	5 VDC	20 A	90%
APX100-48DS12-B04A		12 VDC	8.3 A	90%
APX100-48DS15-B04A		15 VDC	6.6 A	91%

Options

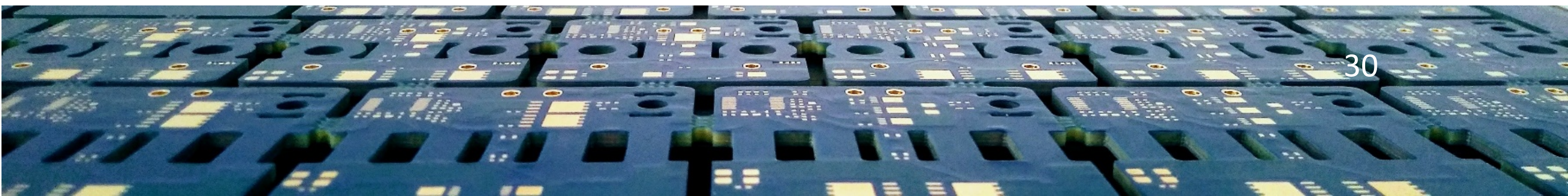
APEX-HS1	Heat-sink for standard version (incl. mounting screws and thermal pad)
APEX-MT1	Military version
On demand (backorder with MOQ)	Input filter to meet EMC results



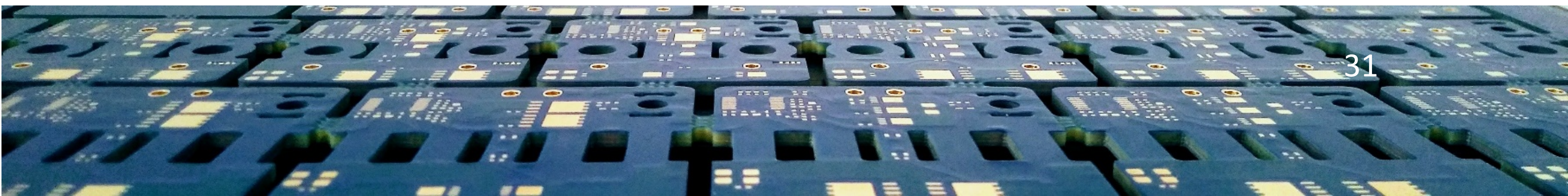
Input Specifications		
Input current at no load (nominal input voltage)	24 Vin models 48 Vin models	25 mA 20mA
Start-up voltage	24 Vin models 48 Vin models	9.0 VDC max. 18 VDC max.
Under voltage shut down (lock-out circuit)	24 Vin models 48 Vin models	8-8.5 VDC 16-16.5 VDC
Surge voltage (10 sec. max.)	24 Vin models 48 Vin models	40 VDC 80 VDC
Recommended input fuse (slow blow, useful for reverse voltage protection)	24/48 Vin models	20 A



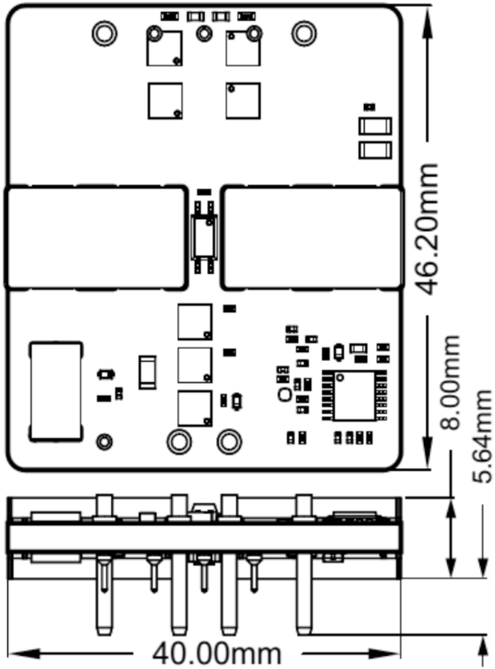
Output Specifications		
Voltage set accuracy (at full load, nominal input)		±1%
Output voltage adjustment		±10% by external resistor
Regulation	-Input variation Vin min. to Vin max. -Load variation (0 – 100%)	0.1% max. 0.1% max.
Temperature coefficient		±0.02% /k
Minimum load		Not required
Ripple and noise(20MHZ bandwidth)	5VDC MODELs 12VDC MODELs 15VDC MODELs	100mVp-p typ. 200mVp-p typ. 300mVp-p typ.
Start-up time(nominal Vin and constant resistive load)		100 ms typ.(at power On or remote On)
Transient response (25% load step change)		200µs max.
Output current limitation		at 120 -150% of Iout max.
Over voltage protection		at 115 -130% of Vout nom.
Short circuit protection		Continuous, automatic recovery.
Max. capacitive load	5 VDC MODELs 12 VDC MODELs 15 VDC MODELs	40000µF 7000µF 3000µF

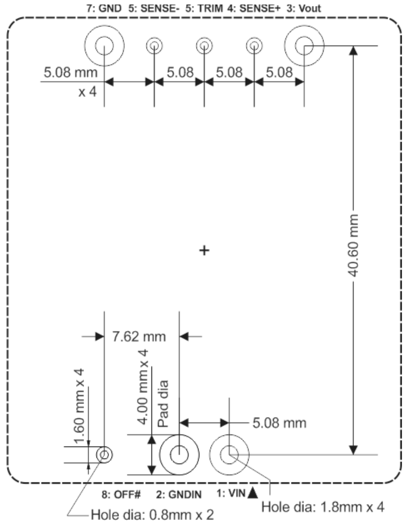


General Specifications		
Casing material	24/48 Vin models	Metal
Potting material		Epoxy
Base material		FR4

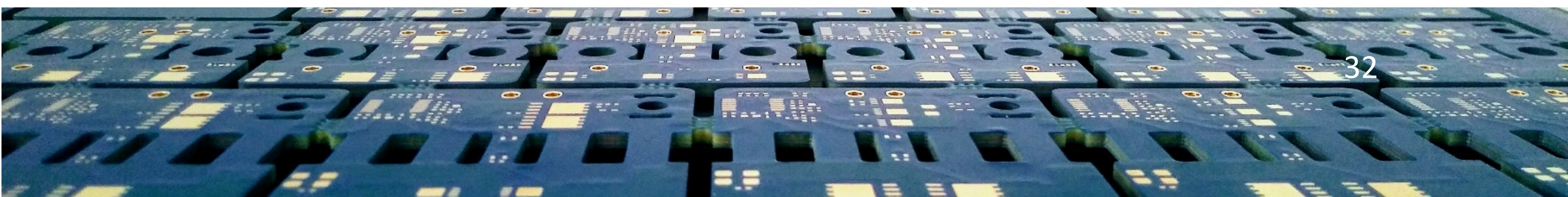


Dimensions and Pin-out





PIN-OUT	
1	+Vin
2	GND in
3	+Vout
4	Trim
5	-GND out
6	Remote On/Off



Part Number Structure

APX 100-24D S 05-B08 A

APEX POWER Abbreviation
APX

Maximum Rated Output
100 — Power in Watt

Input Voltage Range
24D = 9-36 Volts (24V nominal)
48D = 18-72 Volts (48V nominal)
A=1:1 B=2:1 C=3:1 D=4:1 E=5:1 …

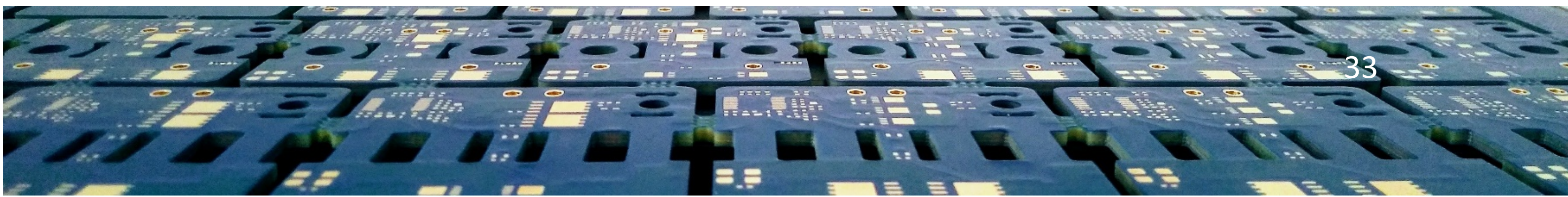
Output Configuration
S=Single output
B=Double Output
M=Multi Output

Nominal Output Voltage
3.3 to 15 Volts

Package Size
B8= 1/8 Brick Brick= 11 in^2

Version
A

***Note:**
Some model number combinations may not Available. Contac Apex Power Solutions.



Technical Notes

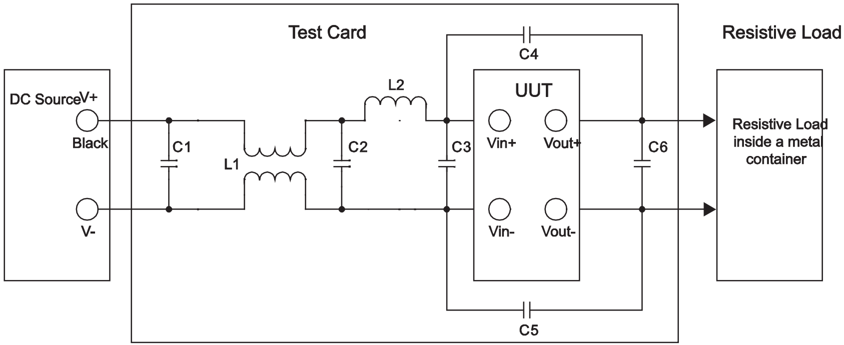


Figure 1. Conducted Emissions Test Circuit

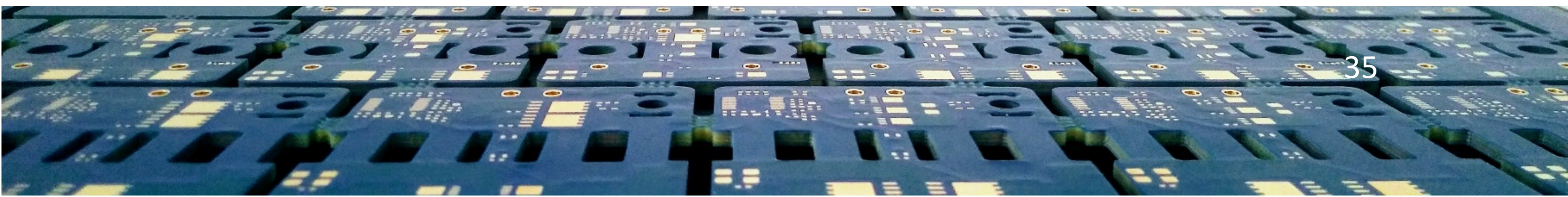
Input Fusing

Certain applications and/or safety agencies may require fuses at the inputs of power conversion components. Fuses should also be used when there is the possibility of sustained input voltage reversal which is not current-limited. For greatest safety, we recommend a fast blow fuse installed in the +Vin input supply line. The installer must observe all relevant safety standards and regulations. For safety agency approvals, install the converter in compliance with the end-user safety standard.

Input Under-Voltage Shutdown and Start-Up Threshold

Under normal start-up conditions, converters will not begin to regulate properly until the rising input voltage exceeds and remains at the Start-Up Threshold Voltage (see Specifications). Once operating, converters will not turn off until the input voltage drops below the Under-Voltage Shutdown Limit. Subsequent restart will not occur until the input voltage rises again above the Start-Up Threshold. This built-in hysteresis prevents any unstable on/off operation at a single input voltage.

Users should be aware however of input sources near the Under-Voltage Shutdown whose voltage decays as input current is consumed (such as capacitor inputs), the converter shuts off and then restarts as the external capacitor recharges. Such situations could oscillate. To prevent this, make sure the operating input voltage is well above the UV Shutdown voltage AT ALL TIMES.

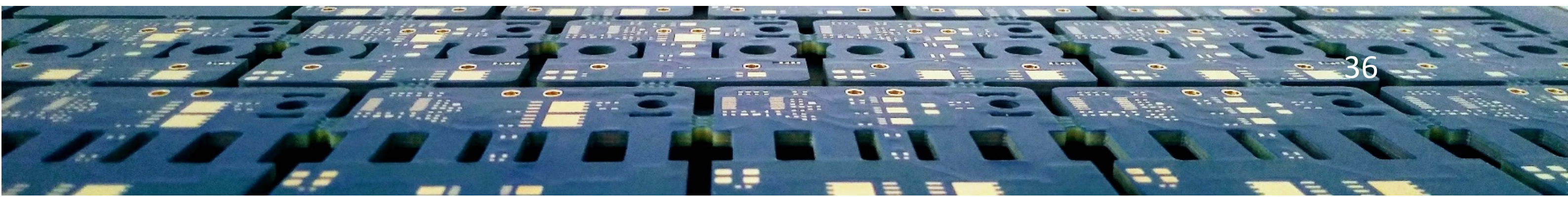


Start-Up Delay

Assuming that the output current is set at the rated maximum, the Vin to Vout Start-Up Delay (see Specifications) is the time interval between the point when the rising input voltage crosses the Start-Up Threshold and the fully loaded regulated output voltage enters and remains within its specified regulation band. Actual measured times will vary with input source impedance, external input capacitance, input voltage slew rate and final value of the input voltage as it appears at the converter.

These converters include a soft start circuit to moderate the duty cycle of the PWM controller at power up, thereby limiting the input inrush current.

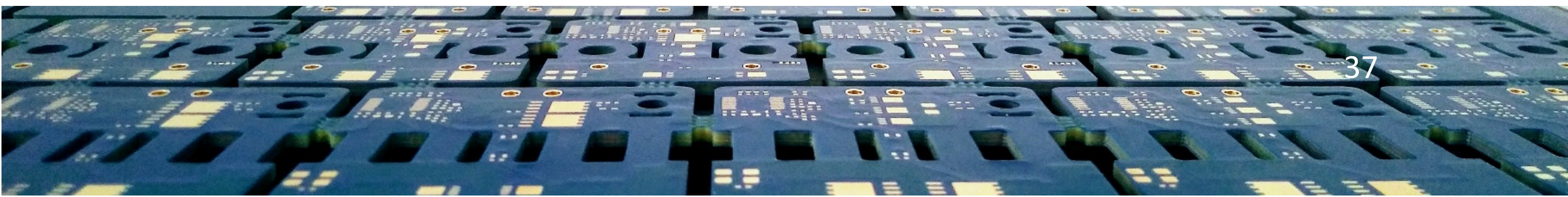
The On/Off Remote Control interval from inception to VOUT regulated assumes that the converter already has its input voltage stabilized above the Start-Up Threshold before the On command. The interval is measured from the On command until the output enters and remains within its specified regulation band. The specification assumes that the output is fully loaded at maximum rated current.



Input Source Impedance

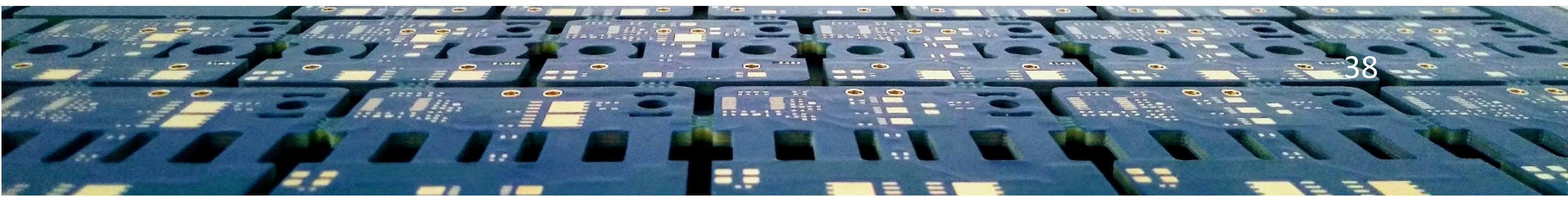
These converters will operate to specifications without external components, assuming that the source voltage has very low impedance. Since real-world voltage sources have finite impedance, performance is improved by adding external filter components. Sometimes only a small ceramic capacitor is sufficient. Since it is difficult to totally characterize all applications, some experimentation may be needed. Note that external input capacitors must accept high speed switching currents.
Because of the switching nature of DC/DC converters, the input of these converters must be driven from a source with both low AC impedance and adequate DC input regulation. Performance will degrade with increasing input inductance. Excessive input inductance may inhibit operation. The DC input regulation specifies that the input voltage, once operating, must never degrade below the Shut-Down Threshold

under all load conditions. Be sure to use adequate trace sizes and mount components close to the converter.



I/O Filtering, Input Ripple Current and Output Noise

All models in this converter series are tested and specified for input reflected ripple current and output noise using designated external input/output components, circuits and layout as shown in the figures below. External input capacitors (CIN in the figure2) serve primarily as energy storage elements, minimizing line voltage variations caused by transient IR drops in the input conductors. Users should select input capacitors for bulk capacitance (at appropriate frequencies), low ESR and high RMS ripple current ratings. In the figure below, the CBUS and LBUS components simulate a typical DC voltage bus. Specific system configurations may require additional considerations. Please note that the values of Cin, LBUS and CBUS may vary according to the specific converter model.



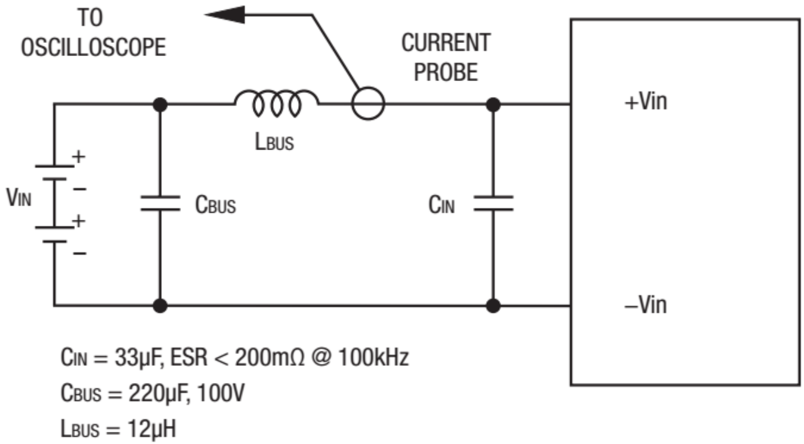
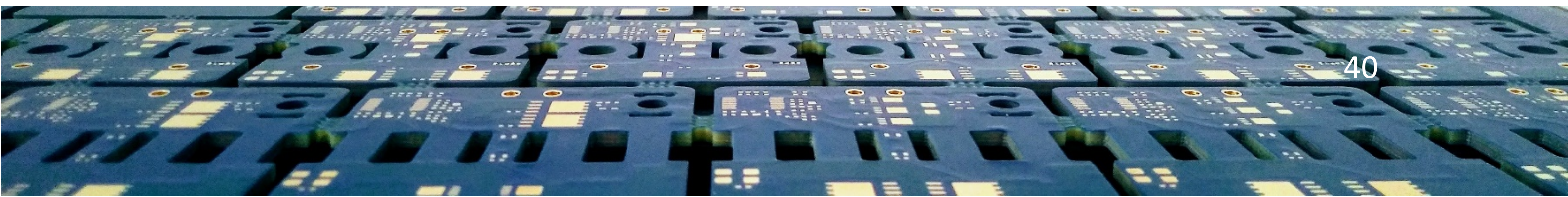


Figure 2. Measuring Input Ripple Current

In critical applications, output ripple and noise (also referred to as periodic and random deviations or PARD) may be reduced by adding filter elements such as multiple external capacitors. Be sure to calculate component temperature rise from reflected AC current dissipated inside capacitor ESR. In figure 3, the two copper strips simulate real-world printed circuit impedances between the power supply and its load. In order to minimize circuit errors and standardize tests between units, scope measurements should be made using BNC connectors or the probe ground should not exceed one half inch and soldered directly to the fixture.



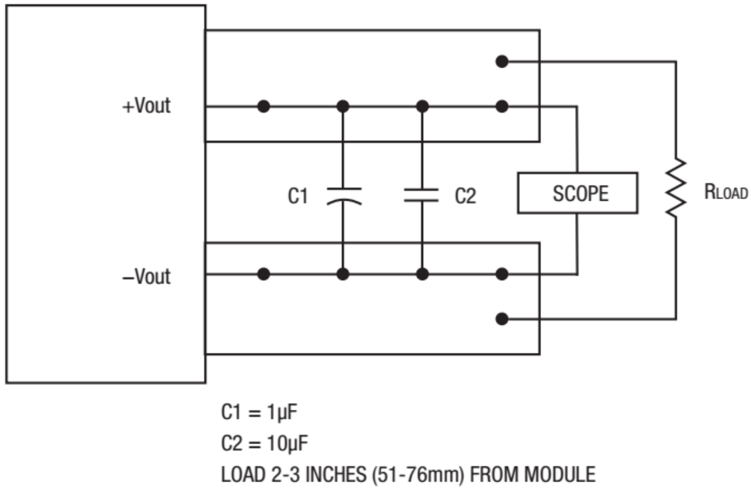


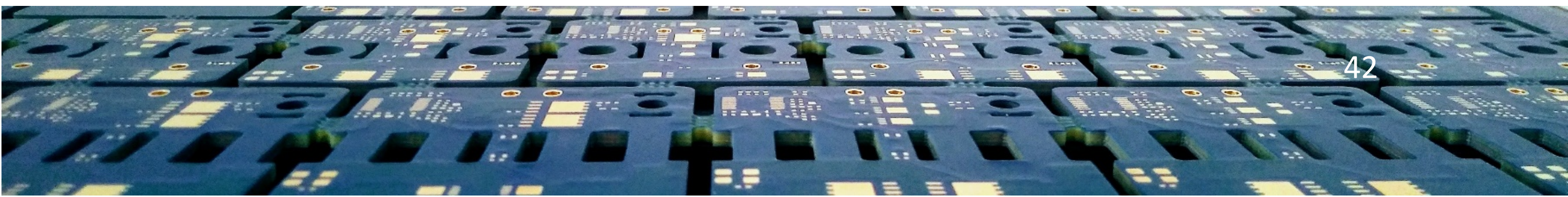
Figure 3. Measuring Output Ripple and Noise (PARD)

Floating Outputs

Since these are isolated DC/DC converters, their outputs are “floating” with respect to their input. The essential feature of such isolation is ideal ZERO CURRENT FLOW between input and output. Real-world converters however do exhibit tiny leakage currents between input and output (see Specifications). These leakages consist of both an AC stray capacitance coupling component and a DC leakage resistance. When using the isolation feature, do not allow the isolation voltage to exceed specifications. Otherwise the converter may be damaged. Designers will normally use the negative output (-Output) as the ground return of the load circuit. You can however use the positive output (+Output) as the ground return to effectively reverse the output polarity.

Thermal Shutdown

To protect against thermal over-stress, these converters include thermal shut- down circuitry. If environmental conditions cause the temperature of the DC/ DC’s to rise above the Operating Temperature Range up to the shutdown temperature, an on-board electronic temperature sensor will power down the unit. When the temperature decreases below the



turn-on threshold, the converter will automatically restart. There is a small amount of hysteresis to prevent rapid on/off cycling. CAUTION: If

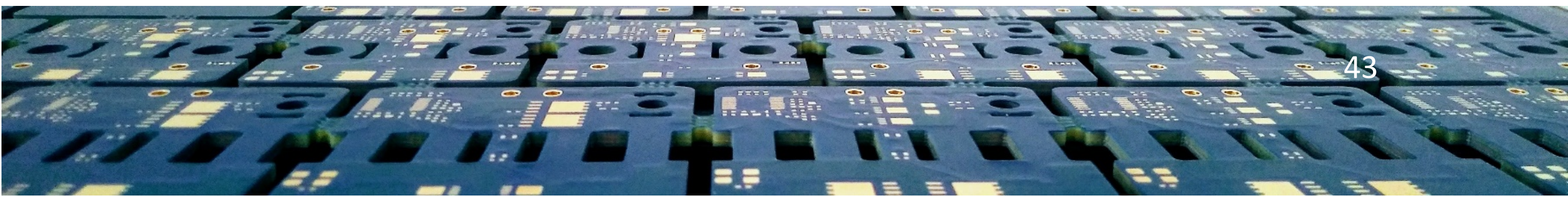
you operate too close to the thermal limits, the converter may shut down suddenly without warning. Be sure to thoroughly test your application to avoid unplanned thermal shutdown.

Temperature Derating Curves

The graphs in this data sheet illustrate typical operation under a variety of conditions. The Derating curves show the maximum continuous ambient air temperature and decreasing maximum output current which is acceptable under increasing

forced airflow measured in Linear Feet per Minute ("LFM"). Note that these are AVERAGE measurements. The converter will accept brief increases in temperature and/or current or reduced airflow as long as the average is not exceeded.

Note that the temperatures are of the ambient airflow, not the converter itself which is obviously running at higher temperature than the outside air. Also note that "natural convection" is defined as very low flow rates which are not using fan-forced airflow.



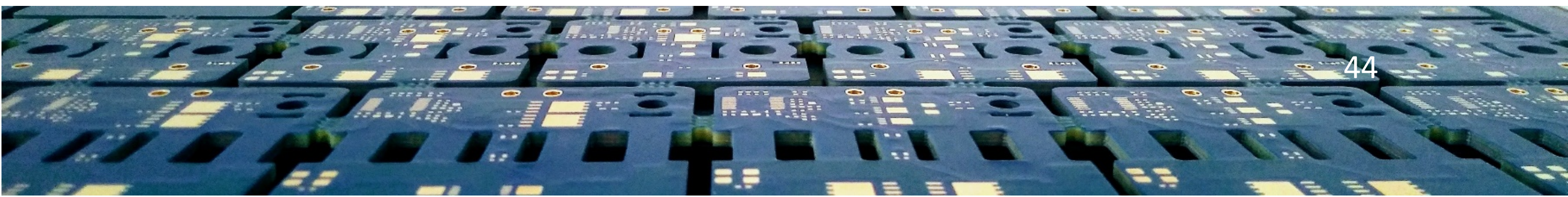
Depending on the application, "natural convection" is usually about 30-65 LFM but is not equal to still air (0 LFM).

Murata Power Solutions makes Characterization measurements in a closed cycle wind tunnel with calibrated airflow. Both thermocouples and an infrared camera system are used to observe thermal performance. Sometimes it is possible to estimate the effective airflow if you thoroughly understand the enclosure geometry, entry/exit orifice areas and the fan flow rate specifications.

CAUTION: If these Derating guidelines are exceeded, the converter may have an unplanned Over Temperature shut down. Also, these graphs are all collected near Sea Level altitude. Be sure to reduce the derating for higher altitude.

Output Overvoltage Protection (OVP)

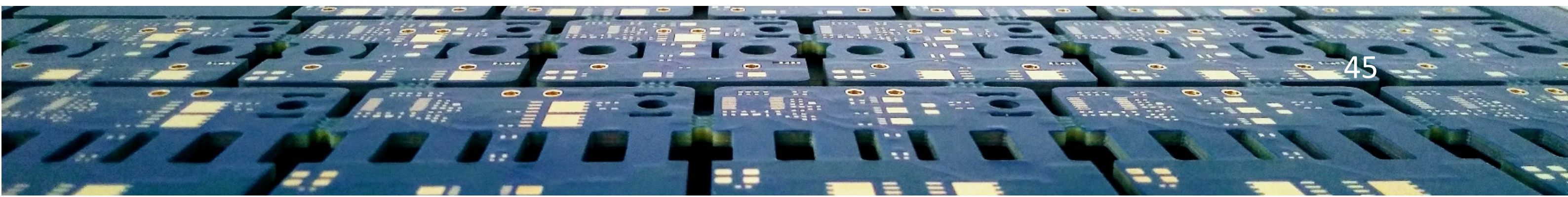
This converter monitors its output voltage for an over-voltage condition using an on-board electronic comparator. If the output exceeds OVP limits, the sensing circuit will power down the unit, and the output voltage will decrease. After a timeout period, the PWM will automatically attempt to restart, causing the output voltage to ramp up to its rated value. It is not necessary to power down and reset the converter for this automatic OVP-recovery



restart. If the fault condition persists and the output voltage climbs to excessive levels, the OVP circuitry will initiate another shutdown cycle. This on/off cycling is referred to as “hiccup” mode.

Current Limiting (Power limit with current mode control)

As power demand increases on the output and enters the specified “limit inception range” limiting circuitry activates in the DC-DC converter to limit/ restrict the maximum current or total power available. Once the current reaches a certain range the output voltage will start to decrease while the output current continues to increase, thereby maintaining constant power, until a minimum voltage set is reached and the converter enters a “hiccup” (on off cycling) mode of operation until the load is reduced below the threshold level, whereupon it will return to a normal mode of operation. Current limit inception is defined as the point where the output voltage has decreased by a pre-specified percentage (usually a 2% decrease from nominal).

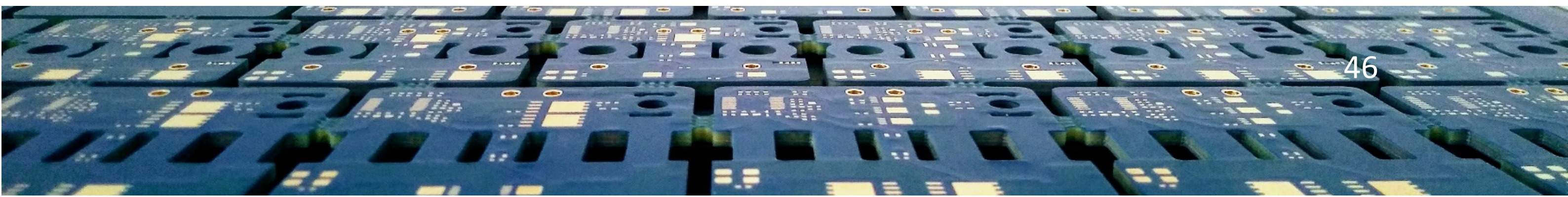


Short Circuit Condition (Current mode control)

The short circuit condition is an extension of the “Current Limiting” condition. When the monitored peak current signal reaches a certain range, the PWM controller’s outputs are shut off thereby turning the converter “off.” This is followed by an extended time out period. This period can vary depending on other conditions such as the input voltage level. Following this time out period, the PWM controller will attempt to re-start the converter by initiating a “normal start cycle” which includes soft start. If the “fault condition” persists, another “hiccup” cycle is initiated. This “cycle” can and will continue indefinitely until such time as the “fault condition” is removed, at which time the converter will resume “normal operation.” Operating in the “hiccup” mode during a fault condition is advantageous in that average input and output power levels are held low preventing excessive internal increases in temperature.

Trimming Output Voltage

PAE converters have a trim capability that enables users to adjust the output voltage from +10% to –20% (refer to the trim equations). Adjustments to the output voltage can be



accomplished with a single fixed resistor as shown in Figures 4 and 5. A single fixed resistor can increase or decrease the output voltage depending on its connection. Resistors should be located close to the converter and have TCR's less than 100ppm/°C to minimize sensitivity to changes in temperature. If the trim function is not used, leave the trim pin open.

Standard PAE's have a "positive trim" where a single resistor connected from the Trim pin to the +Sense will increase the output voltage. A resistor connected from the Trim Pin to the –Sense will decrease the output voltage.

Trim adjustments greater than the specified +10%/–20% can have an adverse effect on the converter's performance and are not recommended. Excessive voltage differences between VOUT and Sense, in conjunction with trim adjustment of the output voltage, can cause the overvoltage protection circuitry to activate (see Performance Specifications for overvoltage limits).

Temperature/power derating is based on maximum output current and voltage at the converter's output pins. Use of the trim and sense functions can cause output voltages to increase, thereby increasing output power beyond the PAE's specified rating, or cause output voltages to climb into the output overvoltage region. Therefore:

(VOUT at pins) x (IOUT) ≤rated output power

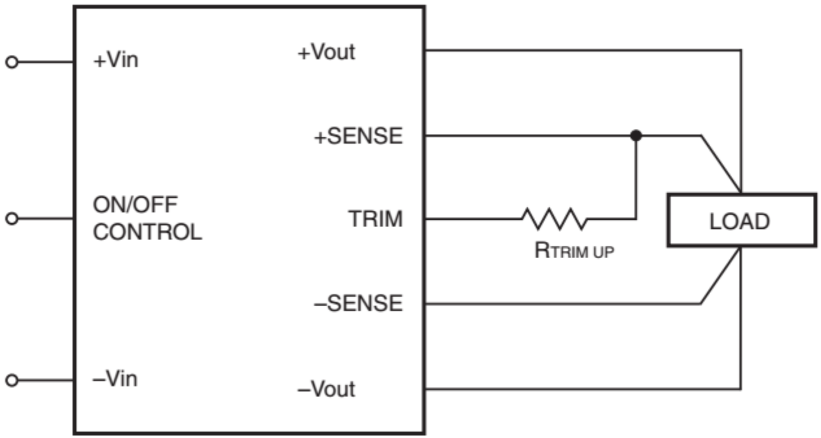


Figure 4. Trim Connections To Increase Output Voltages Using Fixed Resistors

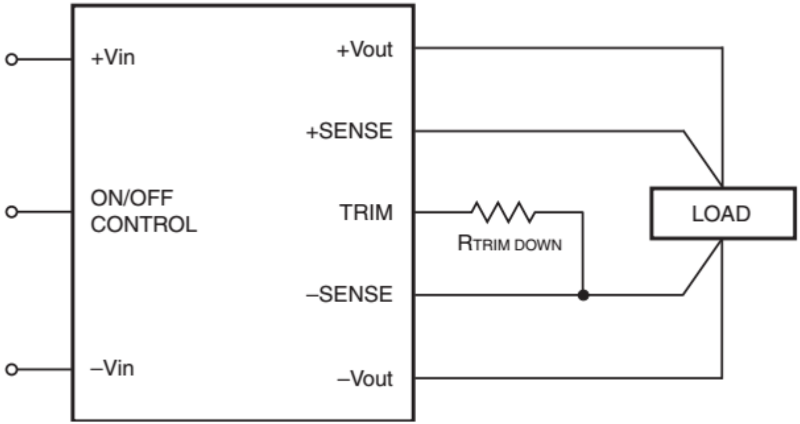


Figure 5. Trim Connections To Decrease Output Voltages Using Fixed Resistors

Remote Sense Input

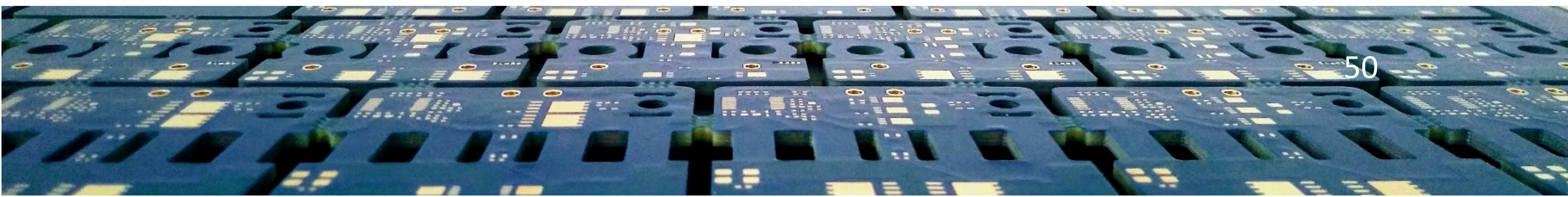
Use the Sense inputs with caution. Sense is normally connected at the load. Sense inputs compensate for output voltage inaccuracy delivered at the load.

This is done by correcting IR voltage drops along the output wiring and the current carrying capacity of PC board etch. This output drop (the difference between Sense and Vout when measured at the converter) should not exceed 0.5V. Consider using heavier wire if this drop is excessive. Sense inputs also improve the stability of the converter and load system by optimizing the control loop phase margin.

Note: The Sense input and power Vout lines are internally connected through low value resistors to their respective polarities so that the converter can operate without external connection to the Sense.

Nevertheless, if the Sense function is not used for remote regulation, the user should connect +Sense to +Vout and –Sense to –Vout at the converter pins.

The remote Sense lines carry very little current. They are also capacitively coupled to the output lines and therefore are in the feedback control loop to regulate and stabilize the



output. As such, they are not low impedance inputs and must be treated with care in PC board layouts. Sense lines on the PCB should run

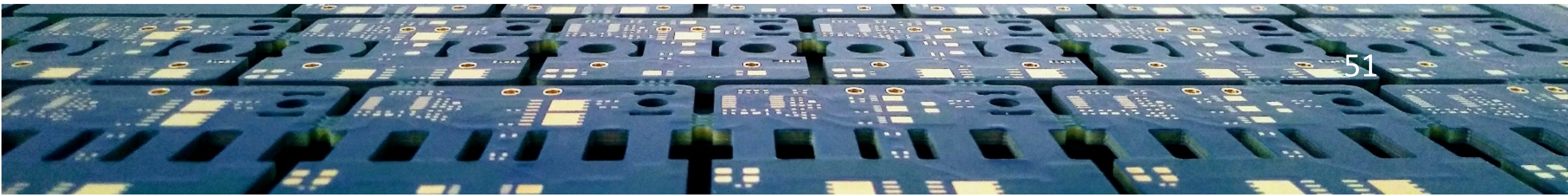
adjacent to DC signals, preferably Ground. In cables and discrete wiring, use twisted pair, shielded tubing or similar techniques.

Any long, distributed wiring and/or significant inductance introduced into the Sense control loop can adversely affect overall system stability. If in doubt, test your applications by observing the converter's output transient response during step loads. There should not be any appreciable ringing or oscillation. You may also adjust the output trim slightly to compensate for voltage loss in any external filter elements. Do not exceed maximum power ratings.

Please observe Sense inputs tolerance to avoid improper operation:

$[Vout(+) - Vout(-)] - [Sense(+) - Sense(-)] \leq 10\%$ of Vout

Output overvoltage protection is monitored at the output voltage pin, not the Sense pin. Therefore, excessive voltage differences between Vout and Sense together with trim adjustment of the output can cause the overvoltage protection circuit to activate and shut down the output.



Power derating of the converter is based on the combination of maximum output current and the highest output voltage. Therefore the designer must ensure:

(Vout at pins) x (Iout) ≤ (Max. rated output power)

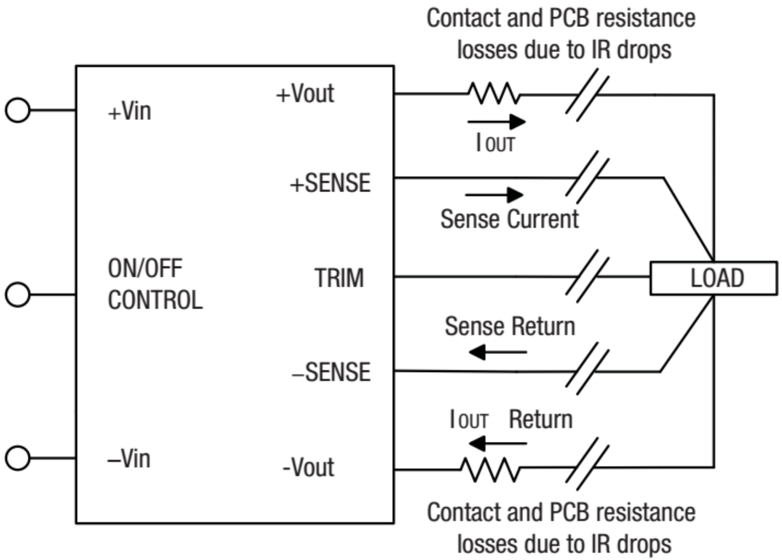


Figure 6. Remote Sense Circuit Configuration

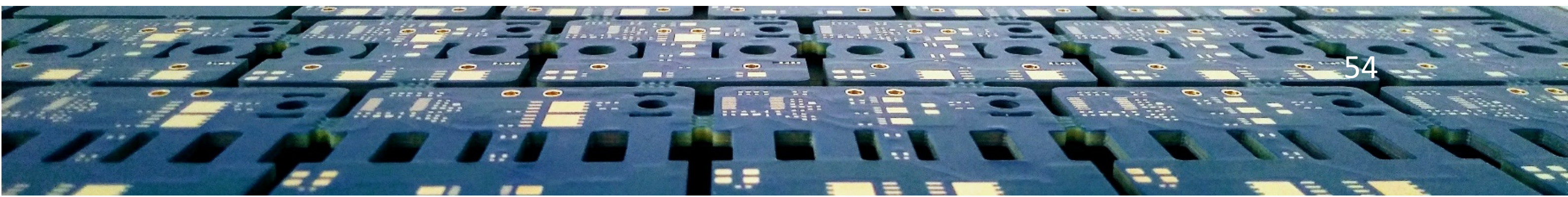
Remote On/Off Control

On the input side, a remote On/Off Control can be specified with either positive or negative logic as follows:

Models are on (enabled) when the On/Off is grounded or brought to within a low voltage (see Specifications) with respect to –VIN. The device is off (disabled) when the On/Off is left open or is pulled high to +13.5VDC Max. with respect to –VIN.

Dynamic control of the On/Off function should be able to sink the specified signal current when brought low and withstand specified voltage when brought high. Be aware too that there is a finite time in milliseconds (see Specifications) between the time of On/Off Control activation and stable, regulated output. This time will vary slightly with output load type and current and input conditions. There are two CAUTIONs for the On/Off Control:

CAUTION: While it is possible to control the On/Off with external logic if you carefully observe the voltage levels, the preferred circuit is either an open drain/open collector transistor or a relay (which can thereupon be controlled by logic). The On/Off prefers to be set at approx. +13.5V (open pin) for the ON state, assuming positive logic.



CAUTION: Do not apply voltages to the On/Off pin when there is no input power voltage. Otherwise the converter may be permanently damaged.

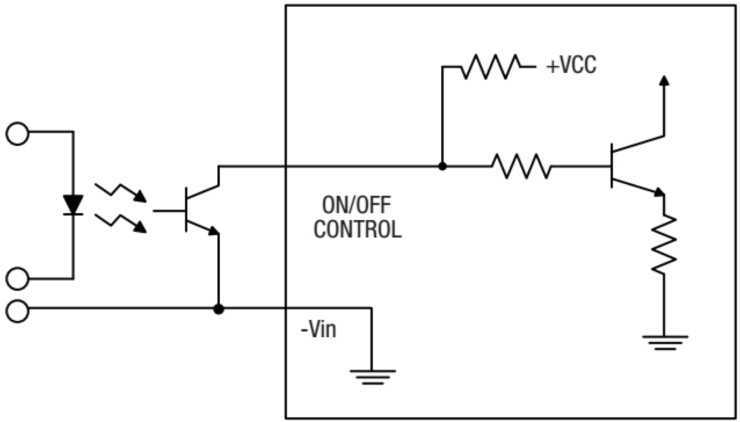


Figure 7. Driving the On/Off Control Pin (suggested circuit)