## The maxyz Products: Y-Series

### Features

- RoHS lead free and lead-solder-exempted products are available
- Delivers up to 5 A (28 W)
- Extended input range 9.6 V – 14 V
- No derating up to 85 °C (70 °C for 5V and 3.3V)
- Surface-mount package
- Industry-standard footprint and pinout
- Small size and low profile: 0.80” x 0.45” x 0.247” (20.32 x 11.43 x 6.27mm)
- Weight: 0.079 oz [2.26 g]
- Co-planarity < 0.003"
- Synchronous Buck Converter topology
- Start-up into pre-biased output
- No minimum load required
- Programmable output voltage via external resistor
- Operating ambient temperature: -40 °C to 85 °C
- Remote ON/OFF
- Fixed frequency operation
- Auto-reset output overcurrent protection
- Auto-reset overtemperature protection
- High reliability, MTBF approx. 71.8 Million Hours calculated per Telcordia TR-332, Method I Case 1
- All materials meet UL94, V-0 flammability rating
- UL 60950 recognition in U.S. & Canada, and DEMKO certification per IEC/EN 60950

### Applications

- Intermediate Bus Architectures
- Distributed Power Architectures
- Data communications
- Telecommunications
- Servers, workstations

### Benefits

- High efficiency – no heat sink required
- Reduces total solution board area
- Tape and reel packing
- Compatible with pick &place equipment
- Minimizes part numbers in inventory
- Low cost

### Description

The YM12S05 non-isolated dc-dc converters deliver up to 5A of output current in an industry-standard surface-mount package. Operating from a 9.6-14 VDC input, the YM12S05 converters are ideal choices for Intermediate Bus Architectures where Point-of-Load power (POL) delivery is generally a requirement. They provide an extremely tight regulated programmable output voltage of 0.7525 V to 5.5 V.

The Y-Series of converters provide exceptional thermal performance, even in high temperature environments with minimal airflow. No derating is required up to 85 °C (up to 70 °C for 5 V and 3.3 V outputs), even without airflow at natural convection. This is accomplished through the use of advanced circuitry, packaging and processing techniques to achieve a design possessing ultra-high efficiency, excellent thermal management and a very low body profile.

The low body profile and the preclusion of heat sinks minimize impedance to system airflow, thus enhancing cooling for both upstream and downstream devices. The use of 100% automation for assembly, coupled with advanced power electronics and thermal design, results in a product with extremely high reliability.

## Electrical Specifications

*Conditions: $T_A$=25ºC, Airflow=300 LFM (1.5 m/s), Vin=12Vdc, Vout = 0.7525 - 5.5V, unless otherwise specified.*

| Parameter | Notes | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| **Absolute Maximum Ratings** | | | | | |
| Input Voltage | Continuous | -0.3 | | 15 | Vdc |
| Operating Ambient Temperature | | -40 | | 85 | °C |
| Storage Temperature | | -55 | | 125 | °C |
| **Feature Characteristics** | | | | | |
| Switching Frequency | | | 310 | | kHz |
| Output Voltage Trim Range[1] | By external resistor, See Trim Table 1 | 0.7525 | | 5.5 | Vdc |
| Turn-On Delay Time | Full resistive load | | | | |
| With Vin = (Converter Enabled, then Vin applied) | From Vin = Vin(min) to Vo=0.1* Vo(nom) | | 7.5 | | ms |
| With Enable (Vin = Vin(nom) applied, then enabled) | From enable to Vo= 0.1*Vo(nom) | | 7.5 | | ms |
| Rise time (Full resistive load) | From 0.1*Vo(nom) to 0.9*Vo(nom) | | 7 | | ms |
| ON/OFF Control[2] | | | | | |
| Converter Off | | 2.4 | | Vin | Vdc |
| Converter On | | -5 | | 0.8 | Vdc |

Additional Notes:
1. The output voltage should not exceed 5.5V.
2. The converter is on if the ON/OFF pin is left open.

## Electrical Specifications (continued)

*Conditions: $T_A$=25ºC, Airflow=300 LFM (1.5 m/s), Vin=12Vdc, Vout = 0.7525 - 5.5V, unless otherwise specified.*

| Parameter | Notes | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| **Input Characteristics** | | | | | |
| Operating Input Voltage Range | | 9.6 | 12 | 14 | Vdc |
| Input Under Voltage Lockout | | | | | |
| Turn-on Threshold | | | 9.0 | | Vdc |
| Turn-off Threshold | | | 8.8 | | Vdc |
| Maximum Input Current | 5 Adc Out @ 9.6 Vdc In | | | | |
| | $V_{OUT}$ = 5.0 Vdc | | | 2.9 | Adc |
| | $V_{OUT}$ = 3.3 Vdc | | | 2.0 | Adc |
| | $V_{OUT}$ = 2.5 Vdc | | | 1.6 | Adc |
| | $V_{OUT}$ = 2.0 Vdc | | | 1.4 | Adc |
| | $V_{OUT}$ = 1.8 Vdc | | | 1.25 | Adc |
| | $V_{OUT}$ = 1.5 Vdc | | | 1.0 | Adc |
| | $V_{OUT}$ = 1.2 Vdc | | | 0.8 | Adc |
| | $V_{OUT}$ = 1.0 Vdc | | | 0.7 | Adc |
| Input Stand-by Current (Converter disabled) | | | 1 | | mA |
| Input No Load Current (Converter enabled) | $V_{OUT}$ = 5.0 Vdc | | 65 | | mA |
| | $V_{OUT}$ = 3.3 Vdc | | 47 | | mA |
| | $V_{OUT}$ = 2.5 Vdc | | 35 | | mA |
| | $V_{OUT}$ = 2.0 Vdc | | 28 | | mA |
| | $V_{OUT}$ = 1.8 Vdc | | 25 | | mA |
| | $V_{OUT}$ = 1.5 Vdc | | 20 | | mA |
| | $V_{OUT}$ = 1.2 Vdc | | 17 | | mA |
| | $V_{OUT}$ = 1.0 Vdc | | 15 | | mA |
| Input Reflected-Ripple Current - $i_S$ | See Fig. D for setup. (BW=20MHz) | | | | |
| | $V_{OUT}$ = 5.0 Vdc | | 55 | | $mA_{P-P}$ |
| | $V_{OUT}$ = 3.3 Vdc | | 48 | | $mA_{P-P}$ |
| | $V_{OUT}$ = 2.5 Vdc | | 43 | | $mA_{P-P}$ |
| | $V_{OUT}$ = 2.0 Vdc | | 38 | | $mA_{P-P}$ |
| | $V_{OUT}$ = 1.8 Vdc | | 35 | | $mA_{P-P}$ |
| | $V_{OUT}$ = 1.5 Vdc | | 32 | | $mA_{P-P}$ |
| | $V_{OUT}$ = 1.2 Vdc | | 28 | | $mA_{P-P}$ |
| | $V_{OUT}$ = 1.0 Vdc | | 25 | | $mA_{P-P}$ |
| Input Voltage Ripple Rejection | 120Hz | | 72 | | dB |

## Electrical Specifications (continued)

*Conditions: $T_A$=25ºC, Airflow=300 LFM (1.5 m/s), Vin=12Vdc, Vout = 0.7525 - 5.5V, unless otherwise specified.*

| Parameter | Notes | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| **Output Characteristics** | | | | | |
| Output Voltage Set Point (no load) | | -1.5 | Vout | +1.5 | %Vout |
| Output Regulation[1] | | | | | |
| Over Line | Full resistive load | | 1 | | mV |
| Over Load | From no load to full load | | 0.25 | | %Vout |
| Output Voltage Range (Over all operating input voltage, resistive load and temperature conditions until end of life ) | | -2.5 | | +2.5 | %Vout |
| Output Ripple and Noise - 20MHz bandwidth | Over line, load and temperature (Fig. D) | | | | |
| Peak-to-Peak | $V_{OUT}$ = 5.0 Vdc | | 55 | 70 | $mV_{P-P}$ |
| Peak-to-Peak | $V_{OUT}$ = 0.7525Vdc | | 40 | 50 | $mV_{P-P}$ |
| External Load Capacitance | Plus full load (resistive) | | | | |
| Min ESR > 1mΩ | | | | 1,000 | µF |
| Min ESR > 10 mΩ | | | | 2,000 | µF |
| Output Current Range | | 0 | | 5 | A |
| Output Current Limit Inception ($I_{OUT}$) | | | 10 | | A |
| Output Short- Circuit Current | Short=10 mΩ, continuous | | 2 | | Arms |
| **Dynamic Response** | | | | | |
| Iout step from 2.5A to 5A with di/dt = 5 A/µS | Co = 47 µF ceramic. + 1 µF ceramic | | 100 | | mV |
| Settling Time ($V_{OUT}$ < 10% peak deviation) | | | 20 | | µs |
| Iout step from 5A to 2.5A with di/dt = -5 A/µS | Co = 47 µF ceramic + 1 µF ceramic | | 100 | | mV |
| Settling Time ($V_{OUT}$ < 10% peak deviation) | | | 20 | | µs |
| **Efficiency** | Full load (5A) | | | | |
| | $V_{OUT}$ = 5.0 Vdc | | 92.0 | | % |
| | $V_{OUT}$ = 3.3 Vdc | | 88.5 | | % |
| | $V_{OUT}$ = 2.5 Vdc | | 86.5 | | % |
| | $V_{OUT}$ = 2.0 Vdc | | 84.5 | | % |
| | $V_{OUT}$ = 1.8 Vdc | | 83.5 | | % |
| | $V_{OUT}$ = 1.5 Vdc | | 81.5 | | % |
| | $V_{OUT}$ = 1.2 Vdc | | 79.0 | | % |
| | $V_{OUT}$ = 1.0 Vdc | | 76.0 | | % |

Additional Notes:
1. Trim resistor connected across the GND and TRIM pins of the converter.

## Operations

### Input and Output Impedance

The **Y-Series** converter should be connected via a low impedance to the DC power source. In many applications, the inductance associated with the distribution from the power source to the input of the converter can affect the stability of the converter. It is recommended to use decoupling capacitors (minimum 47µF) placed as close as possible to the converter input pins in order to ensure stability of the converter and reduce input ripple voltage. Internally, the converter has 10µF (low ESR ceramics) of input capacitance.

In a typical application, low - ESR tantalum or POS capacitors will be sufficient to provide adequate ripple voltage filtering at the input of the converter. However, very low ESR ceramic capacitors 47µF-100µF are recommended at the input of the converter in order to minimize the input ripple voltage. They should be placed as close as possible to the input pins of the converter.

The YM12S05 has been designed for stable operation with no external capacitance on the output. It is recommended to place low ESR ceramic capacitors to minimize output ripple voltage. Low ESR ceramic capacitors placed as close as possible to the load are recommended for improved transient performance and lower output voltage ripple.

It is important to keep low resistance and low inductance PCB traces for connecting your load to the output pins of the converter. This is required to maintain good load regulation since the converter does not have a SENSE pin for compensating voltage drops associated with the power distribution system on your PCB.

### ON/OFF (Pin 1)

The ON/OFF pin (Pin 1) is used to turn the power converter on or off remotely via a system signal that is referenced to GND (Pin 4). The typical connections are shown in Fig. A.

To turn the converter on the ON/OFF pin should be at logic low or left open, and to turn the converter off the ON/OFF pin should be at logic high or connected to Vin.

The ON/OFF pin is internally pulled-down. A TTL or CMOS logic gate, open collector (open drain) transistor can be used to drive the ON/OFF pin. When using open collector (open drain) transistor, add a pull-up resistor (R*) of 75K to Vin as shown in Fig. A.

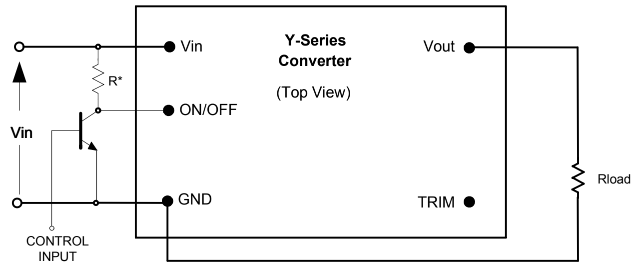



**Fig. A:** Circuit configuration for ON/OFF function.

This device must be capable of:

- sinking up to 0.2 mA at a low level voltage of ≤ 0.8 V
- sourcing up to 0.25 mA at a high logic level of 2.3V – 5V
- sourcing up to 0.75 mA when connected to Vin.

### Output Voltage Programming (Pin 3)

The output voltage can be programmed from 0.7525V to 5.5V by connecting an external resistor between TRIM pin (Pin 3) and GND pin (Pin 4); see Fig. B. Note that when trim resistor is not connected, output voltage of the converter is 0.7525V.

A trim resistor, $R_{TRIM}$, for a desired output voltage can be calculated using the following equation:

$$\mathbf{R_{TRIM}} = \frac{\mathbf{10.5}}{\mathbf{(V_{O\text{-}REQ} - 0.7525)}} - \mathbf{1} \qquad [\mathrm{k}\Omega]$$

where,
$\mathbf{R_{TRIM}}$ = Required value of trim resistor [kΩ]
$\mathbf{V_{O\text{-}REQ}}$ = Desired (trimmed) output voltage [V]

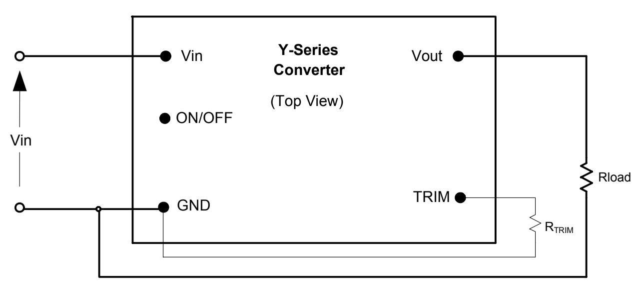



**Fig. B:** Configuration for programming output voltage.

Note that the tolerance of a trim resistor directly affects the output voltage tolerance. It is recommended to use standard 1% or 0.5% resistors; for tighter tolerance, two resistors in parallel are recommended rather than one standard value from Table 1.

Ground pin of the trim resistor should be connected directly to the converter GND pin with no voltage drop in between. Table 1 provides the trim resistor values for popular output voltages.

| Table 1: Trim Resistor Value | | |
|---|---|---|
| $V_{0\text{-}REG}$ [V] | $R_{TRIM}$ [kΩ] | The Closest Standard Value [kΩ] |
| 0.7525 | open | |
| 1.0 | 41.42 | 41.2 |
| 1.2 | 22.46 | 22.6 |
| 1.5 | 13.05 | 13.0 |
| 1.8 | 9.02 | 9.09 |
| 2.0 | 7.42 | 7.50 |
| 2.5 | 5.01 | 4.99 |
| 3.3 | 3.12 | 3.09 |
| 5.0 | 1.47 | 1.47 |
| 5.5 | 1.21 | 1.21 |

The output voltage can be also programmed by external voltage source. To make trimming less sensitive, a series external resistor Rext is recommended between TRIM pin and programming voltage source. Control Voltage can be calculated by the formula:

$$V_{CTRL} = 0.7 - \frac{(1+R_{EXT})(V_{O\text{-}REQ} - 0.7525)}{15} \qquad [V]$$

where

$V_{CTRL}$ = Control voltage [V]

$R_{EXT}$ = External resistor between TRIM pin and voltage source; the value can be chosen depending on the required output voltage range [kΩ].

Control voltages with $R_{EXT} = 0$ and $R_{EXT} = 15K$ are shown in Table 2.

| Table 2: Control Voltage [Vdc] | | |
|---|---|---|
| $V_{0\text{-}REG}$ [V] | $V_{CTRL}$ ($R_{EXT}$ = 0) | $V_{CTRL}$($R_{EXT}$ = 15K) |
| 0.7525 | 0.700 | 0.700 |
| 1.0 | 0.684 | 0.436 |
| 1.2 | 0.670 | 0.223 |
| 1.5 | 0.650 | -0.097 |
| 1.8 | 0.630 | -0.417 |
| 2.0 | 0.617 | -0.631 |
| 2.5 | 0.584 | -1.164 |
| 3.3 | 0.530 | -2.017 |
| 5.0 | 0.417 | -3.831 |
| 5.5 | 0.384 | -4.364 |

## Protection Features

### Input Under-Voltage Lockout

Input under-voltage lockout is standard with this converter. The converter will shut down when the input voltage drops below a pre-determined voltage; it will start automatically when Vin returns to a specified range.

The input voltage must be typically 9.0V for the converter to turn on. Once the converter has been turned on, it will shut off when the input voltage drops below typically 8.8V.

### Output Over-Current Protection (OCP)

The converter is protected against over-current and short circuit conditions. Upon sensing an over-current condition, the converter will enter hiccup mode. Once over-load or short circuit condition is removed, Vout will return to nominal value.

### Over-Temperature Protection (OTP)

The converter will shut down under an over-temperature condition to protect itself from overheating caused by operation outside the thermal derating curves, or operation in abnormal conditions such as system fan failure. After the converter has cooled to a safe operating temperature, it will automatically restart.

### Safety Requirements

The converter meets North American and International safety regulatory requirements per UL60950 and EN60950. The maximum DC voltage between any two pins is Vin under all operating conditions. Therefore, the unit has ELV (extra low voltage) output; it meets SELV requirements under the condition that all input voltages are ELV.

The converter is not internally fused. To comply with safety agencies requirements, a recognized fuse with a maximum rating of 7.5 Amps must be used in series with the input line.

## Characterization

### General Information

The converter has been characterized for many operational aspects, to include thermal derating (maximum load current as a function of ambient temperature and airflow) for vertical and horizontal mounting, efficiency, start-up and shutdown parameters, output ripple and noise, transient response to load step-change, overload and short circuit.

The figures are numbered as Fig. x.y, where x indicates the different output voltages, and y associates with specific plots (y = 1 for the vertical thermal derating, …). For example, Fig. x.1 will refer to the vertical thermal derating for all the output voltages in general.

The following pages contain specific plots or waveforms associated with the converter. Additional comments for specific data are provided below.

**Test Conditions**

All data presented were taken with the converter soldered to a test board, specifically a 0.060" thick printed wiring board (PWB) with four layers. The top and bottom layers were not metalized. The two inner layers, comprising two-ounce copper, were used to provide traces for connectivity to the converter.

The lack of metalization on the outer layers as well as the limited thermal connection ensured that heat transfer from the converter to the PWB was minimized. This provides a worst-case but consistent scenario for thermal derating purposes.

All measurements requiring airflow were made in the vertical and horizontal wind tunnel facilities using Infrared (IR) thermography and thermocouples for thermometry.

Ensuring components on the converter do not exceed their ratings is important to maintaining high reliability. If one anticipates operating the converter at or close to the maximum loads specified in the derating curves, it is prudent to check actual operating temperatures in the application. Thermographic imaging is preferable; if this capability is not available, then thermocouples may be used. . It is recommended the use of AWG #40 gauge thermocouples to ensure measurement accuracy. Careful routing of the thermocouple leads will further minimize measurement error. Refer to Fig. C for optimum measuring thermocouple locations.

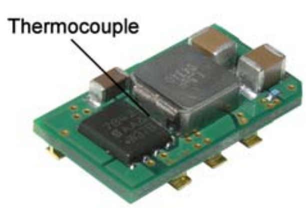



**Fig. C:** Location of the thermocouple for thermal testing.

**Thermal Derating**

Load current vs. ambient temperature and airflow rates are given in Figs. x.1 to x.2 for maximum temperature of 120°C. Ambient temperature was varied between 25°C and 85°C, with airflow rates from 30 to 500 LFM (0.15m/s to 2.5 m/s), and vertical and horizontal converter mounting.

For each set of conditions, the maximum load current is defined as the lowest of:

(i) The output current at which any MOSFET temperature does not exceed a maximum specified temperature (120°C) as indicated by the thermographic image, or

(ii) The maximum current rating of the converter (5A)

During normal operation, derating curves with maximum FET temperature less than or equal to 120°C should not be exceeded. Temperature on the PCB at the thermocouple location shown in Fig. C should not exceed 120°C in order to operate inside the derating curves.

**Efficiency**

Figure x.3 shows the efficiency vs. load current plot for ambient temperature of 25ºC, airflow rate of 200 LFM (1 m/s) and input voltages of 9.6V, 12V and 14V.

**Power Dissipation**

Fig. x.4 shows the power dissipation vs. load current plot for Ta = 25ºC, airflow rate of 200 LFM (1 m/s) with vertical mounting and input voltages of 9.6V, 12V and 14V.

**Ripple and Noise**

The output voltage ripple waveform is measured at full rated load current. Note that all output voltage waveforms are measured across a 1 µF ceramic capacitor.

The output voltage ripple and input reflected ripple current waveforms are obtained using the test setup shown in Fig. D.

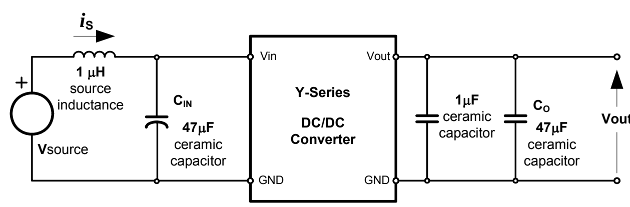



**Fig. D:** Test Set-up for measuring input reflected ripple currents, $i_S$ and output voltage ripple.

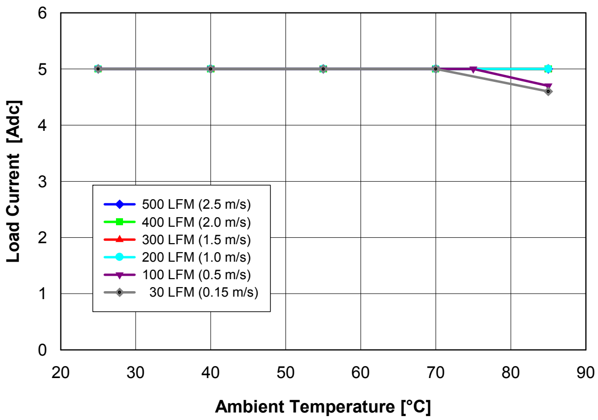



**Fig. 5.0V.1:** Available load current vs. ambient temperature and airflow rates for Vout = 5.0V converter mounted vertically with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

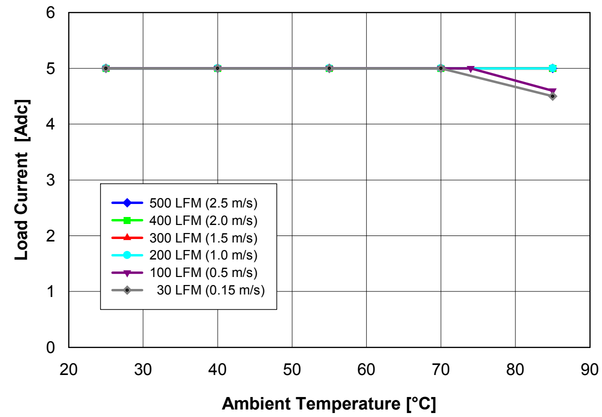



**Fig. 5.0V.2:** Available load current vs. ambient temperature and airflow rates for Vout = 5.0V converter mounted horizontally with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

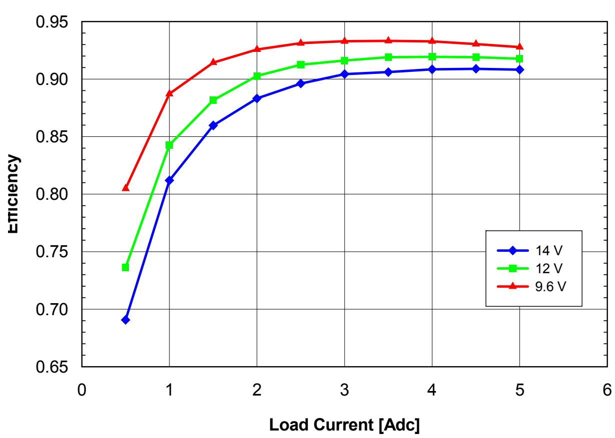



**Fig. 5.0V.3:** Efficiency vs. load current and input voltage for Vout = 5.0V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

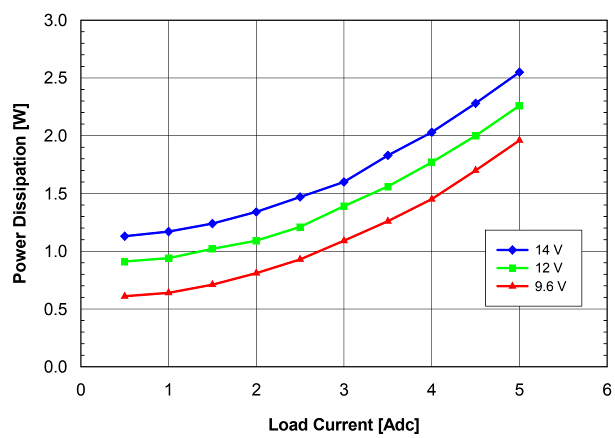



**Fig. 5.0V.4:** Power Loss vs. load current and input voltage for Vout = 5.0V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

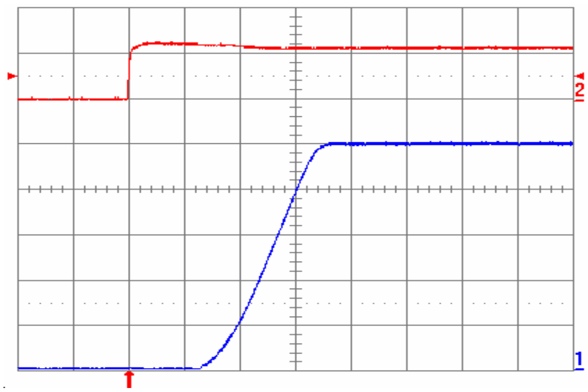


**Fig. 5.0V.5:** Turn-on transient for Vout = 5.0V with application of Vin at full rated load current (resistive) and 47μF external capacitance at Vin = 12V. Top trace: Vin (10V/div.); Bottom trace: output voltage (1V/div.); Time scale: 5 ms/div.

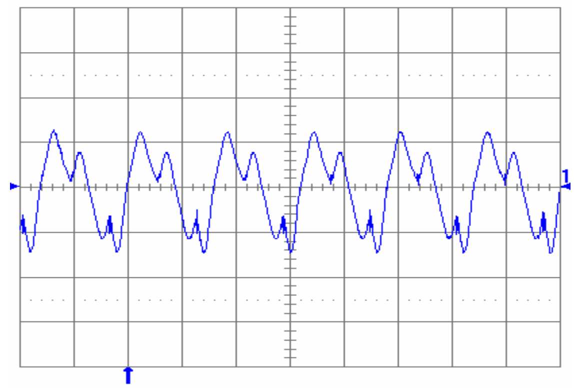


**Fig. 5.0V.6:** Output voltage ripple (10mV/div.) at full rated load current into a resistive load with external capacitance 47μF ceramic + 1μF ceramic and Vin = 12V for Vout = 5.0V. Time scale: 2 μs/div.

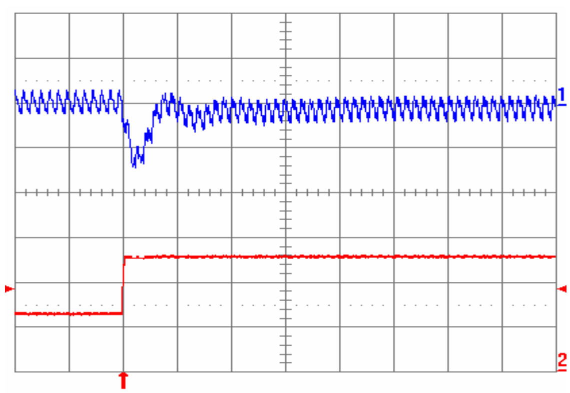


**Fig. 5.0V.7:** Output voltage response for Vout = 5.0V to positive load current step change from 2.5A to 5A with slew rate of 5A/μs at Vin = 12V. Top trace: output voltage (100mV/div.); Bottom trace: load current (2A/div.). Co = 47μF ceramic. Time scale: 20μs/div.

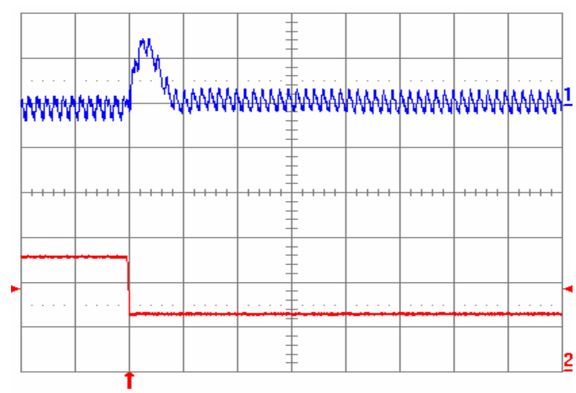


**Fig. 5.0V.8:** Output voltage response for Vout = 5.0V to negative load current step change from 5A to 2.5A with slew rate of -5A/μs at Vin = 12V. Top trace: output voltage (100mV/div.); Bottom trace: load current (2A/div.). Co = 47μF ceramic. Time scale: 20μs/div.

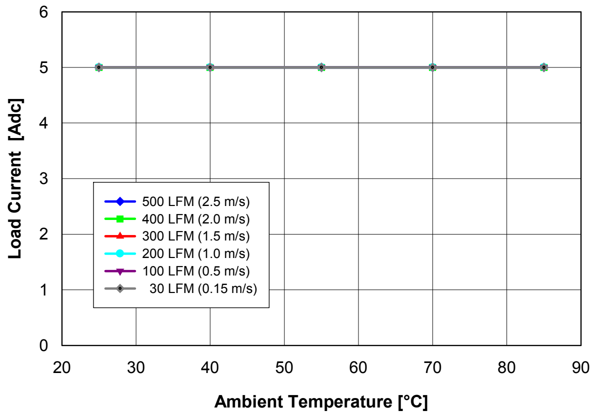



**Fig. 3.3V.1:** Available load current vs. ambient temperature and airflow rates for Vout = 3.3V converter mounted vertically with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

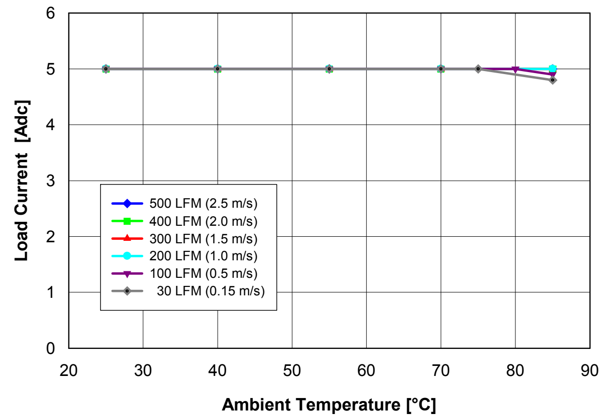



**Fig. 3.3V.2:** Available load current vs. ambient temperature and airflow rates for Vout = 3.3V converter mounted horizontally with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

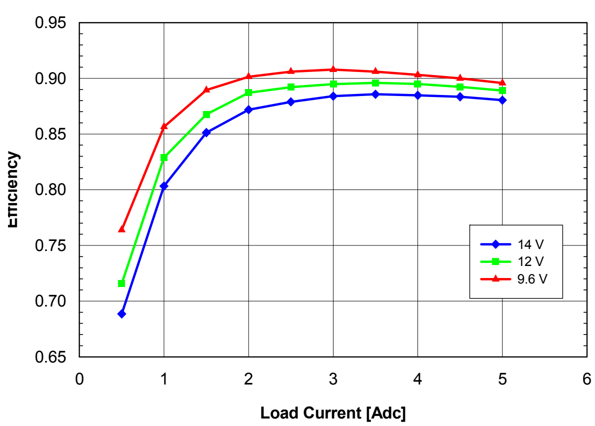



**Fig. 3.3V.3:** Efficiency vs. load current and input voltage for Vout = 3.3V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

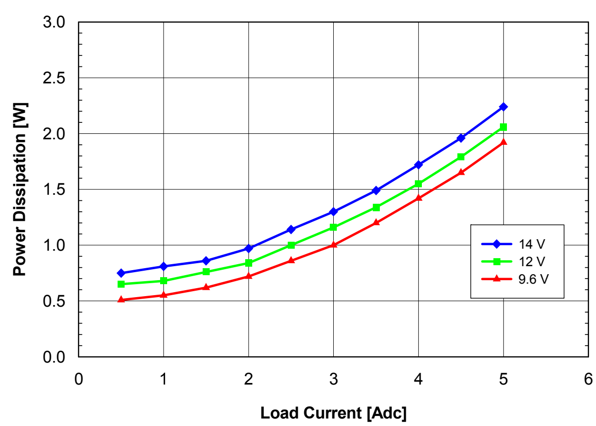



**Fig. 3.3V.4:** Power Loss vs. load current and input voltage for Vout = 3.3V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

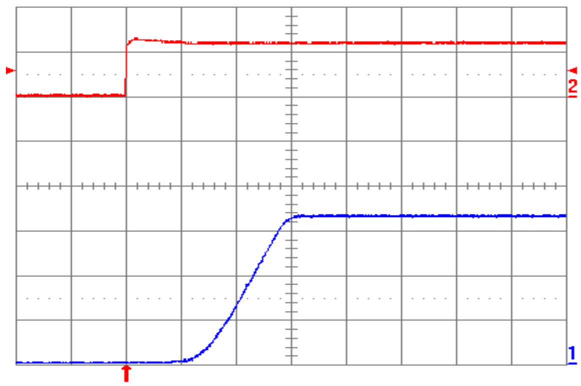


**Fig. 3.3V.5:** Turn-on transient for Vout = 3.3V with application of Vin = 12V at full rated load current (resistive) and 47μF external capacitance. Top trace: Vin (10V/div); Bottom trace: Vout (1V/div); Time scale: 2 ms/div.

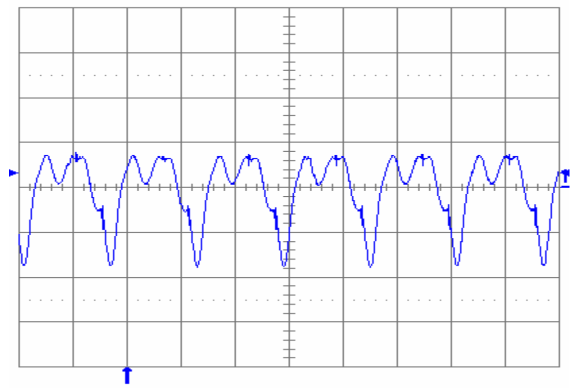


**Fig. 3.3V.6:** Output voltage ripple (10mv/div) at full rated load current into a resistive load with external capacitance 47μF ceramic + 1μF ceramic and Vin = 12V for Vout = 3.3V. Time scale: 2 μs/div.

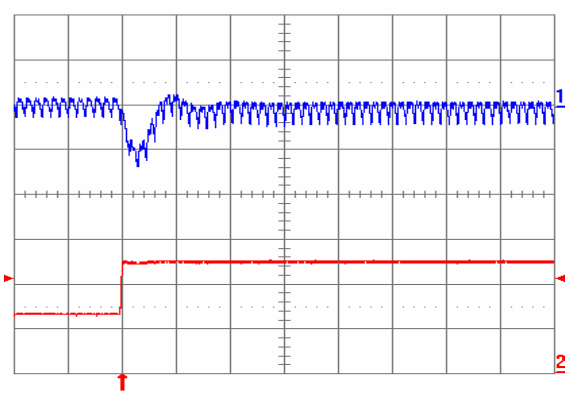


**Fig. 3.3V.7:** Output voltage response for Vout = 3.3V to a positive load current step change from 2.5A to 5A with a slew rate of 5A/μs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47μF ceramic. Time scale: 20 μs/div.

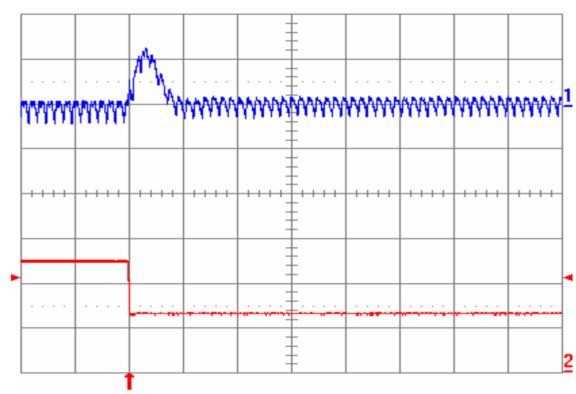


**Fig. 3.3V.8:** Output voltage response for Vout = 3.3V to a negative load current step change from 5A to 2.5A with a slew rate of -5A/μs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47μF ceramic. Time scale: 20 μs/div.

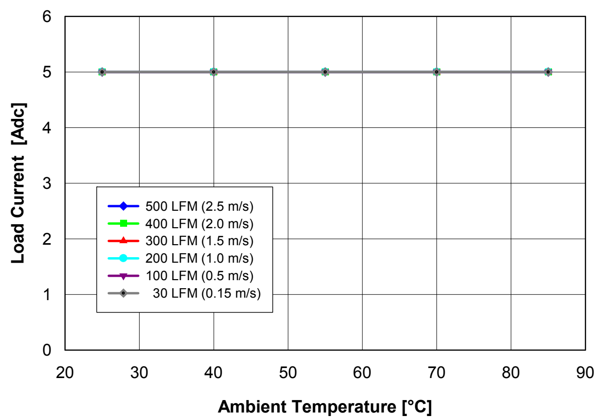



**Fig. 2.5V.1:** Available load current vs. ambient temperature and airflow rates for Vout = 2.5V converter mounted vertically with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

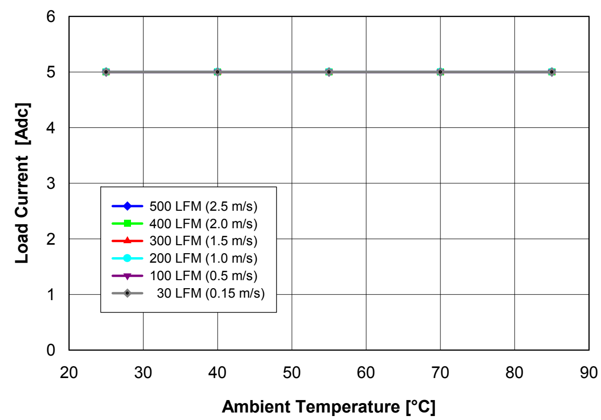



**Fig. 2.5V.2:** Available load current vs. ambient temperature and airflow rates for Vout = 2.5V converter mounted horizontally with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

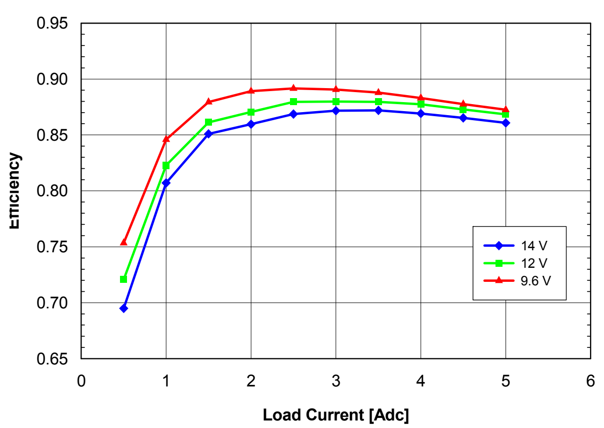



**Fig. 2.5V.3:** Efficiency vs. load current and input voltage for Vout = 2.5V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

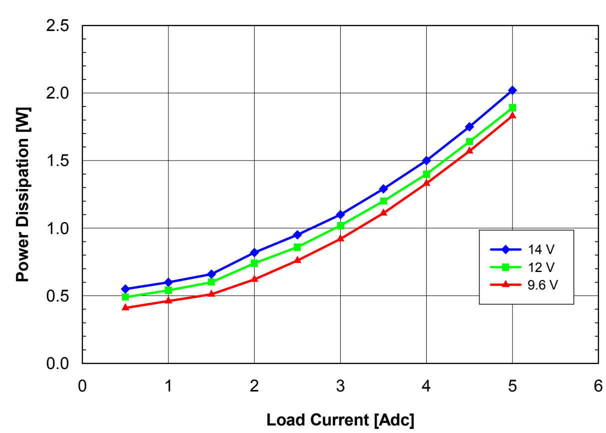



**Fig. 2.5V.4:** Power Loss vs. load current and input voltage for Vout = 2.5V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°.

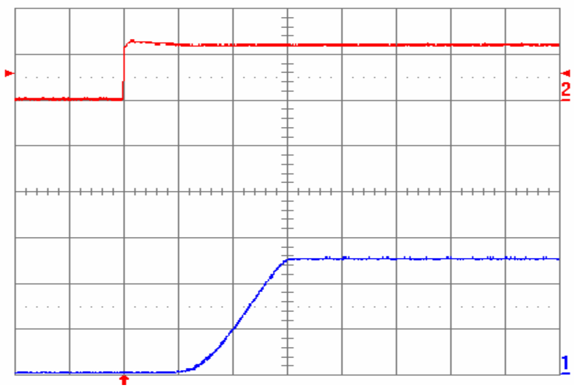


**Fig. 2.5V.4:** Turn-on transient for Vout = 2.5V with application of Vin = 12V at full rated load current (resistive) and 47µF external capacitance. Top trace: Vin (10V/div); Bottom trace: Vout (1V/div); Time scale: 2 ms/div.

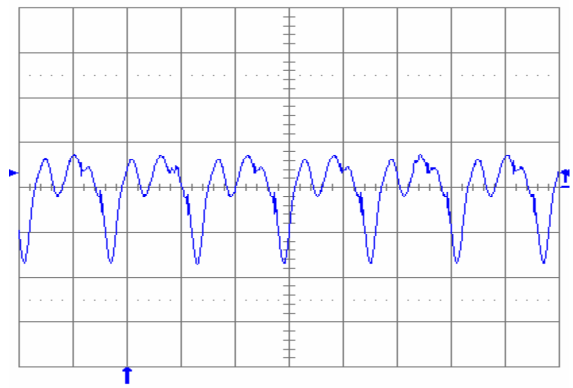


**Fig. 2.5V.5:** Output voltage ripple (10mv/div) at full rated load current into a resistive load with external capacitance 47µF ceramic + 1µF ceramic and Vin = 12V for Vout = 2.5V. Time scale: 2 µs/div.

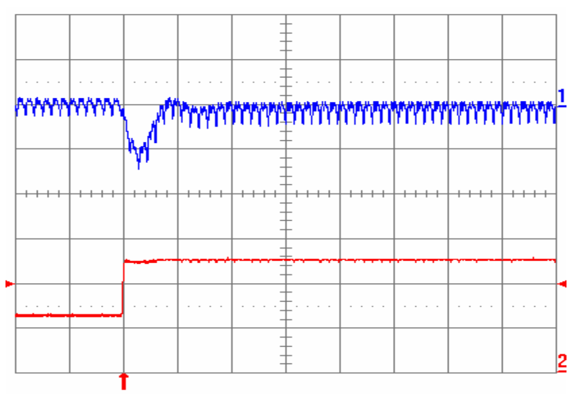


**Fig. 2.5V.7:** Output voltage response for Vout = 2.5V to a positive load current step change from 2.5A to 5A with a slew rate of 5A/µs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47µF ceramic. Time scale: 20 µs/div.

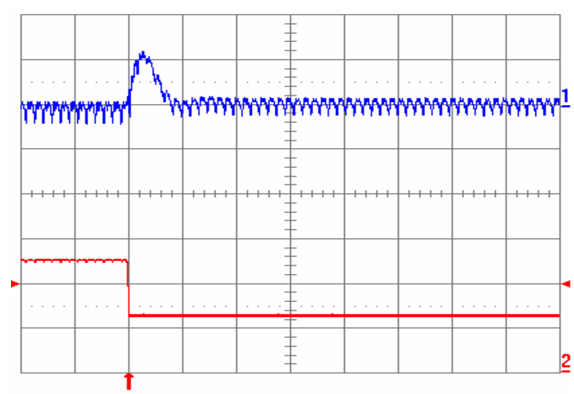


**Fig. 2.5V.8:** Output voltage response for Vout = 2.5V to a negative load current step change from 5A to 2.5A with a slew rate of -5A/µs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47µF ceramic. Time scale: 20 µs/div.

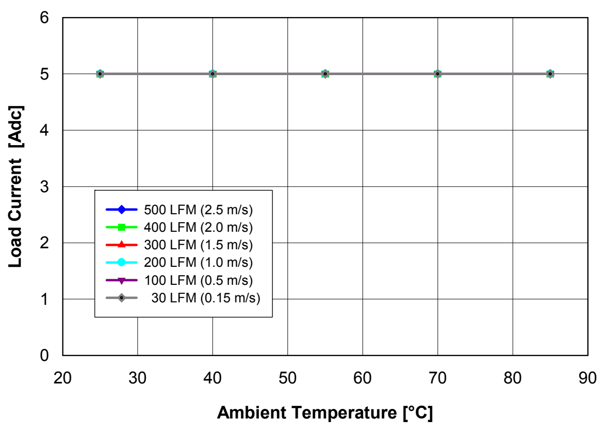



**Fig. 2.0V.1:** Available load current vs. ambient temperature and airflow rates for Vout = 2.0V converter mounted vertically with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

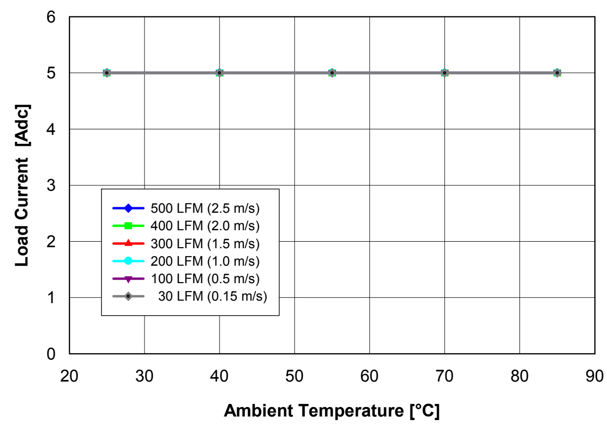



**Fig. 2.0V.2:** Available load current vs. ambient temperature and airflow rates for Vout = 2.0V converter mounted horizontally with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

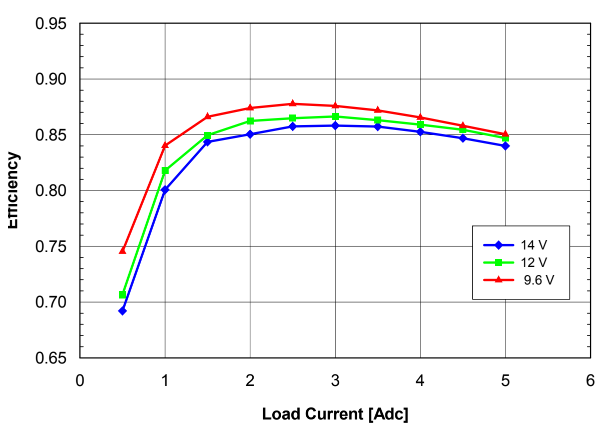



**Fig. 2.0V.3:** Efficiency vs. load current and input voltage for Vout = 2.0V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°.

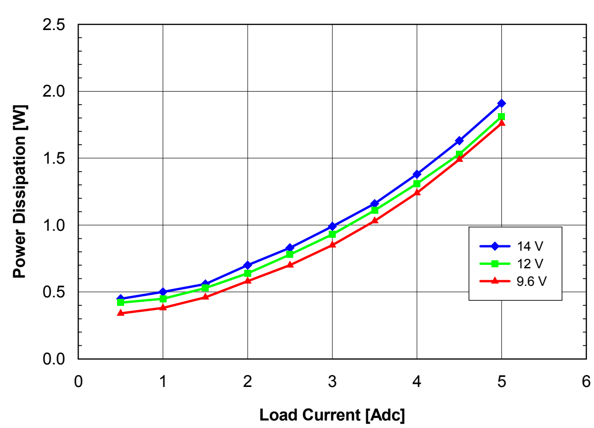



**Fig. 2.0V.4:** Power Loss vs. load current and input voltage for Vout = 2.0V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°.

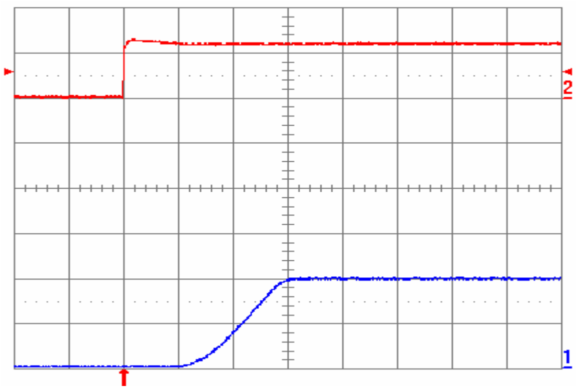



**Fig. 2.0V.5:** Turn-on transient for Vout = 2.0V with application of Vin = 12V at full rated load current (resistive) and 47μF external capacitance. Top trace: Vin (10V/div); Bottom trace: Vout (1V/div); Time scale: 2 ms/div.

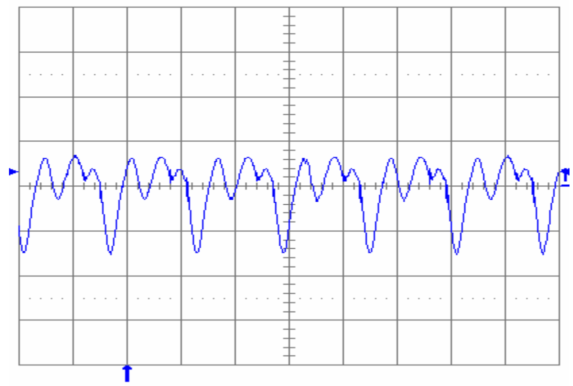


**Fig. 2.0V.6:** Output voltage ripple (10mv/div) at full rated load current into a resistive load with external capacitance 47μF ceramic + 1μF ceramic and Vin = 12V for Vout = 2.0V. Time scale: 2 μs/div.

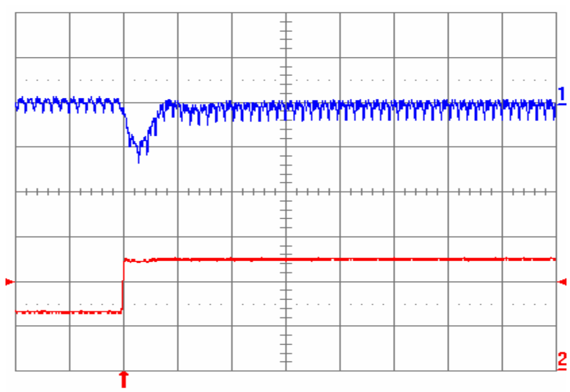



**Fig. 2.0V.7:** Output voltage response for Vout = 2.0V to a positive load current step change from 2.5A to 5A with a slew rate of 5A/μs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47μF ceramic. Time scale: 20 μs/div.

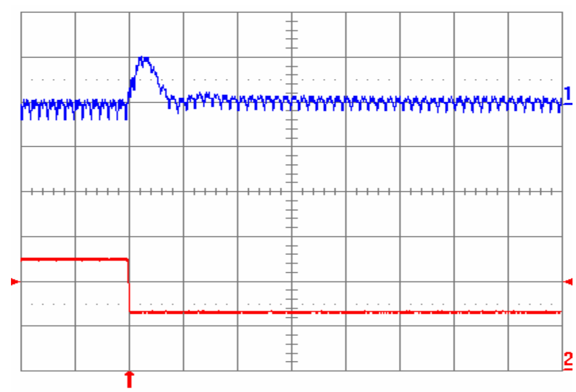



**Fig. 2.0V.8:** Output voltage response for Vout = 2.0V to a negative load current step change from 5A to 2.5A with a slew rate of -5A/μs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47μF ceramic. Time scale: 20 μs/div.

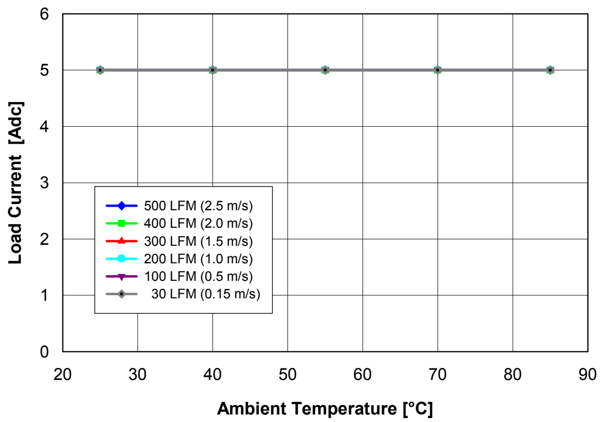



**Fig. 1.8V.1:** Available load current vs. ambient temperature and airflow rates for Vout = 1.8V converter mounted vertically with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

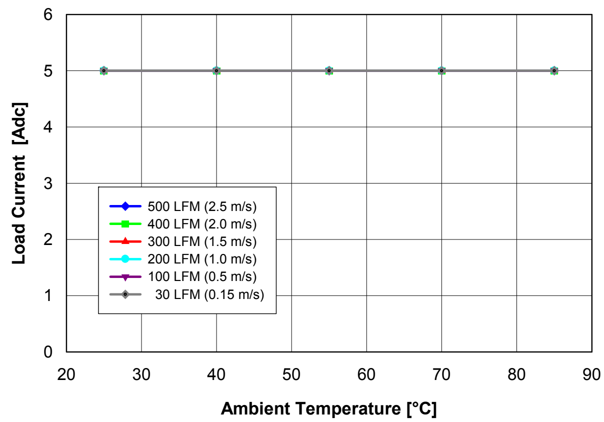



**Fig. 1.8V.2:** Available load current vs. ambient temperature and airflow rates for Vout = 1.8V converter mounted horizontally with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

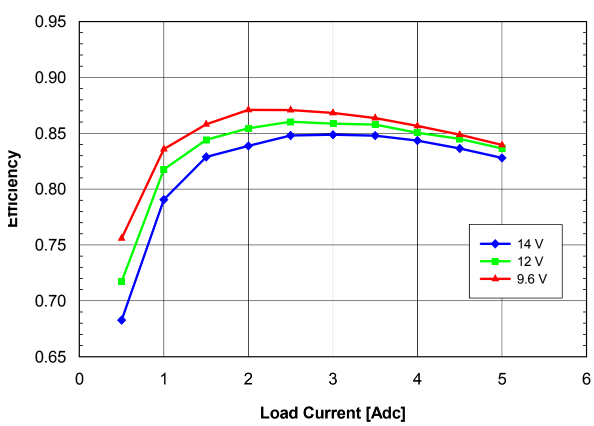



**Fig. 1.8V.3:** Efficiency vs. load current and input voltage for Vout = 1.8V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

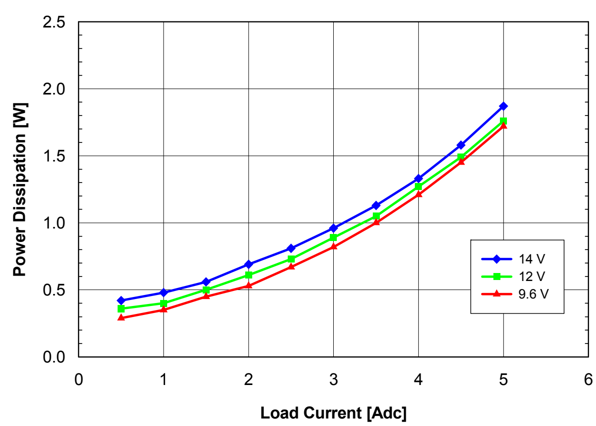



**Fig. 1.8V.4:** Power Loss vs. load current and input voltage for Vout = 1.8V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°.

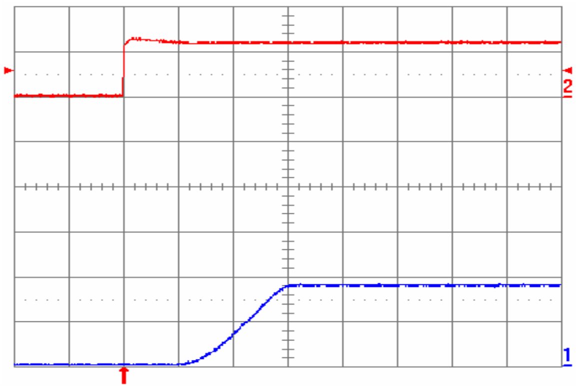



**Fig. 1.8V.5:** Turn-on transient for Vout = 1.8V with application of Vin = 12V at full rated load current (resistive) and 47µF external capacitance. Top trace: Vin (10V/div); Bottom trace: Vout (1V/div); Time scale: 2 ms/div.

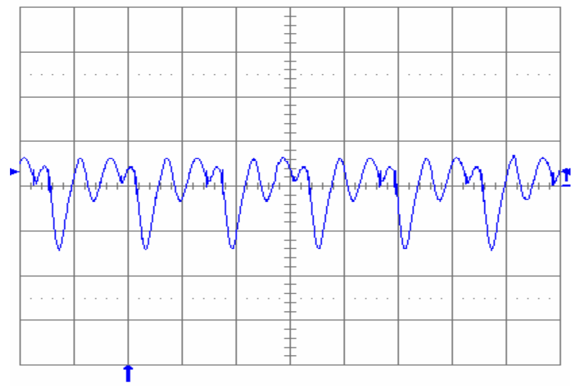



**Fig. 1.8V.6:** Output voltage ripple (10mv/div) at full rated load current into a resistive load with external capacitance 47µF ceramic + 1µF ceramic and Vin = 12V for Vout = 1.8V. Time scale: 2 µs/div.

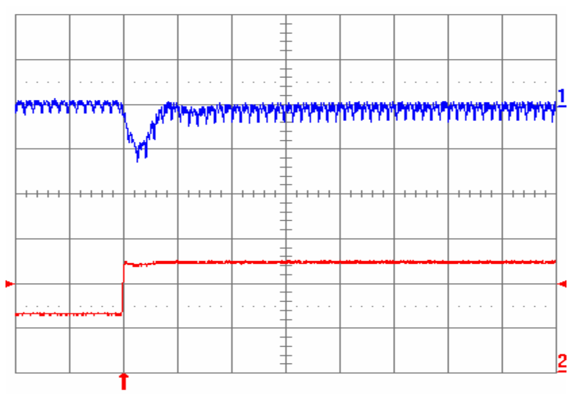



**Fig. 1.8V.7:** Output voltage response for Vout = 1.8V to a positive load current step change from 2.5A to 5A with a slew rate of 5A/µs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47µF ceramic. Time scale: 20 µs/div.

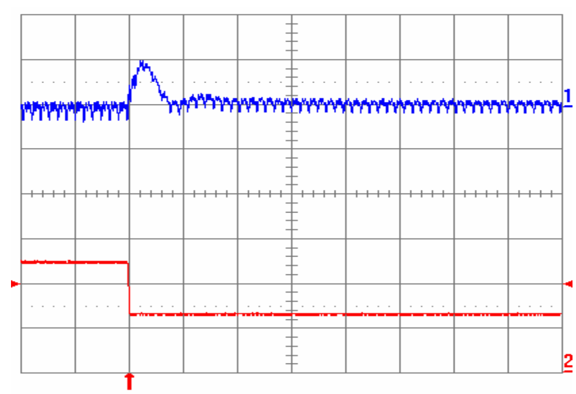



**Fig. 1.8V.8:** Output voltage response for Vout = 1.8V to a negative load current step change from 5A to 2.5A with a slew rate of -5A/µs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47µF ceramic. Time scale: 20 µs/div.

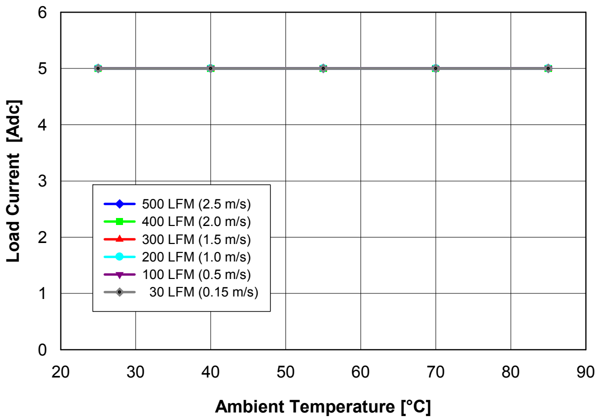



**Fig. 1.5V.1:** Available load current vs. ambient temperature and airflow rates for Vout = 1.5V converter mounted vertically with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

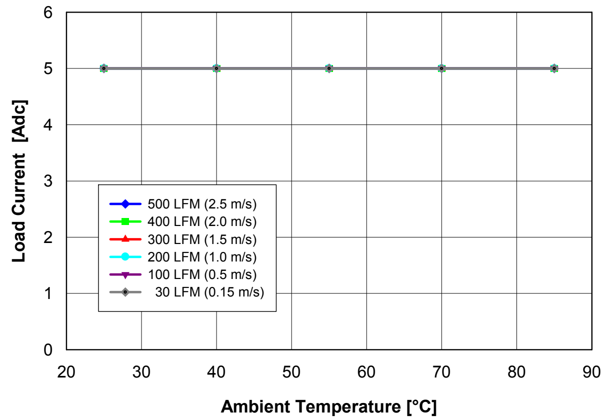



**Fig. 1.5V.2:** Available load current vs. ambient temperature and airflow rates for Vout = 1.5V converter mounted horizontally with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

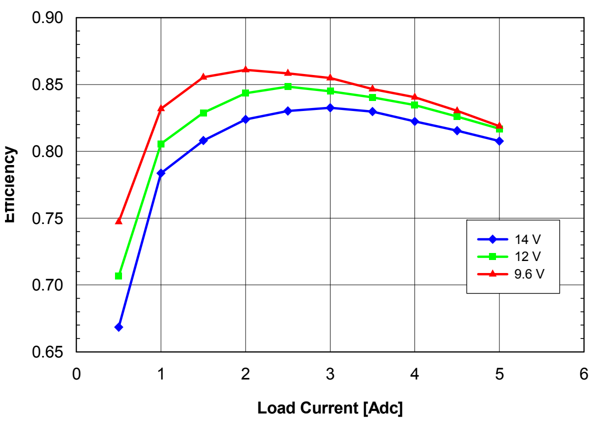



**Fig. 1.5V.3:** Efficiency vs. load current and input voltage for Vout = 1.5V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

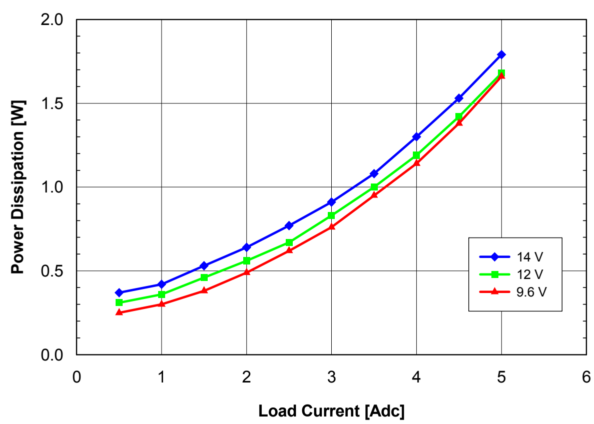



**Fig. 1.5V.4:** Power Loss vs. load current and input voltage for Vout = 1.5V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

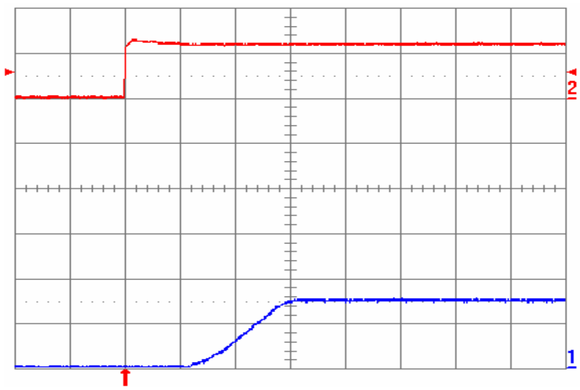


**Fig. 1.5V.5:** Turn-on transient for Vout = 1.5V with application of Vin = 12V at full rated load current (resistive) and 47µF external capacitance. Top trace: Vin (10V/div); Bottom trace: Vout (1V/div); Time scale: 2 ms/div.

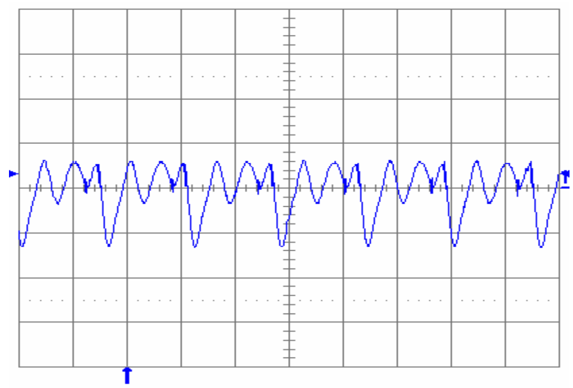


**Fig. 1.5V.6:** Output voltage ripple (10mv/div) at full rated load current into a resistive load with external capacitance 47µF ceramic + 1µF ceramic and Vin = 12V for Vout = 1.5V. Time scale: 2 µs/div.

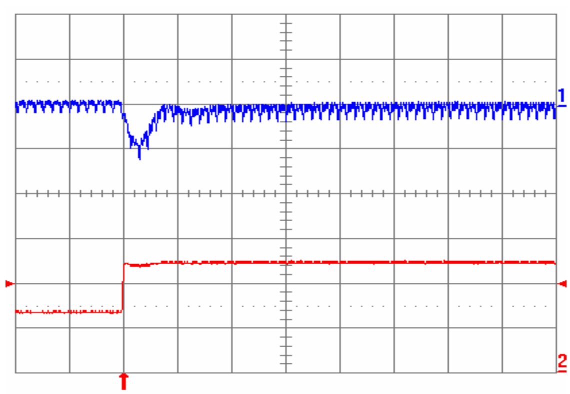


**Fig. 1.5V.7:** Output voltage response for Vout = 1.5V to a positive load current step change from 2.5A to 5A with a slew rate of 5A/µs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47µF ceramic. Time scale: 20 µs/div.

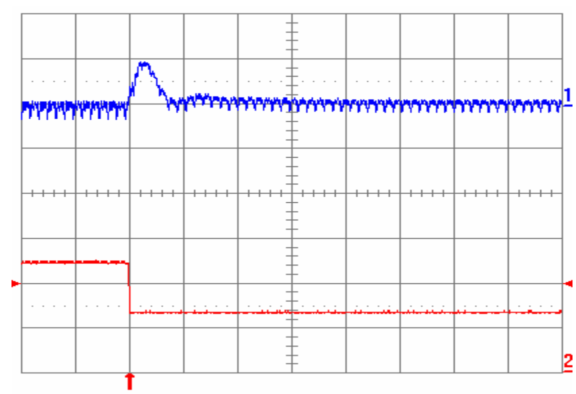


**Fig. 1.5V.8:** Output voltage response for Vout = 1.5V to a negative load current step change from 5A to 2.5A with a slew rate of -5A/µs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47µF ceramic. Time scale: 20 µs/div.

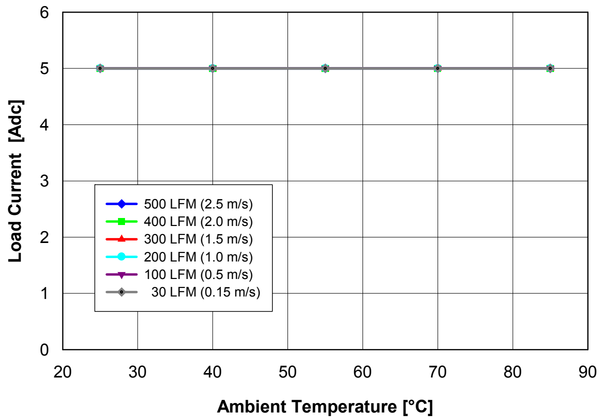



**Fig. 1.2V.1:** Available load current vs. ambient temperature and airflow rates for Vout = 1.2V converter mounted vertically with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

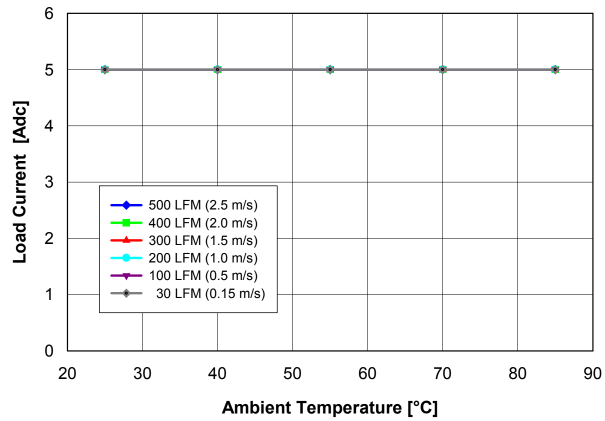



**Fig. 1.2V.2:** Available load current vs. ambient temperature and airflow rates for Vout = 1.2V converter mounted horizontally with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

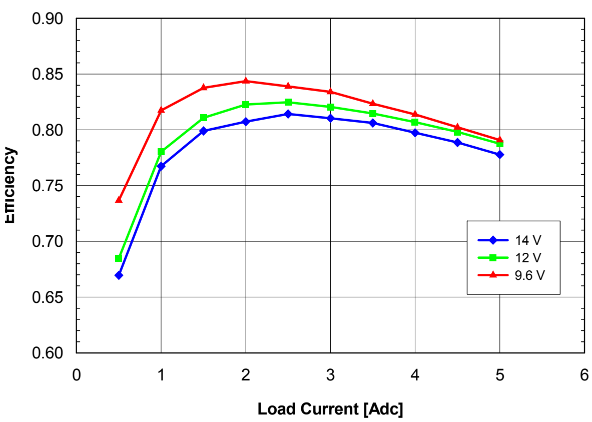



**Fig. 1.2V.3:** Efficiency vs. load current and input voltage for Vout = 1.2V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

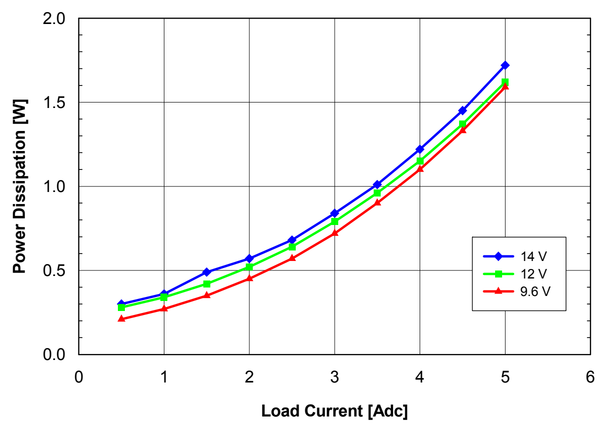



**Fig. 1.2V.4:** Power Loss vs. load current and input voltage for Vout = 1.2V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

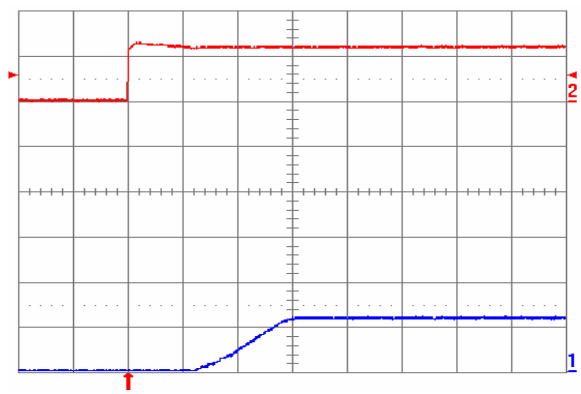


**Fig. 1.2V.5:** Turn-on transient for Vout = 1.2V with application of Vin = 12V at full rated load current (resistive) and 47μF external capacitance. Top trace: Vin (10V/div); Bottom trace: Vout (1V/div); Time scale: 2 ms/div.

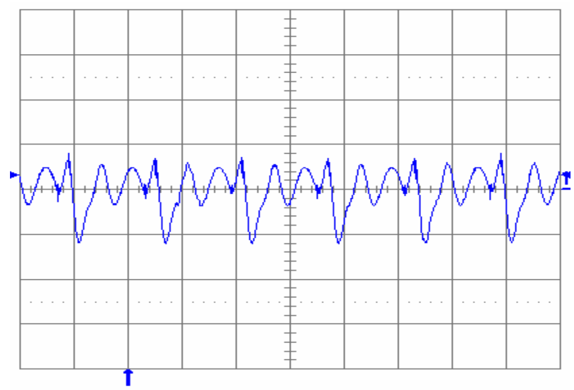


**Fig. 1.2V.6:** Output voltage ripple (10mv/div) at full rated load current into a resistive load with external capacitance 47μF ceramic + 1μF ceramic and Vin = 12V for Vout = 1.2V. Time scale: 2 μs/div.

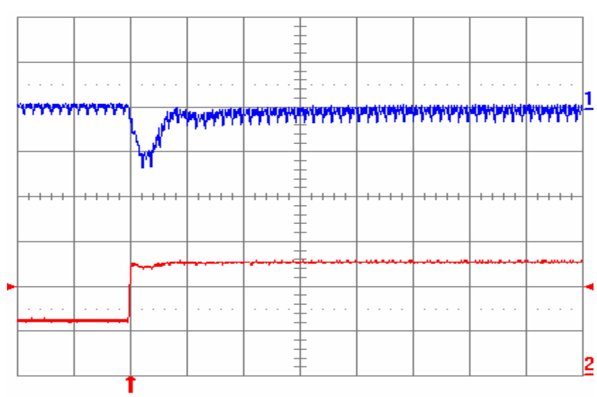


**Fig. 1.2V.6:** Output voltage response for Vout = 1.2V to a positive load current step change from 2.5A to 5A with a slew rate of 5A/μs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47μF ceramic. Time scale: 20 μs/div.

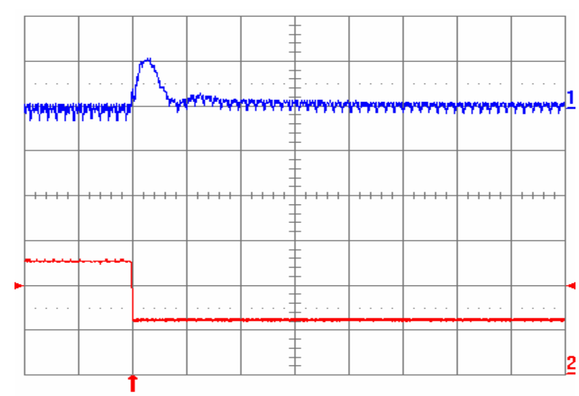


**Fig. 1.2V.8:** Output voltage response for Vout = 1.2V to a negative load current step change from 5A to 2.5A with a slew rate of 5A/μs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47μF ceramic. Time scale: 20 μs/div.

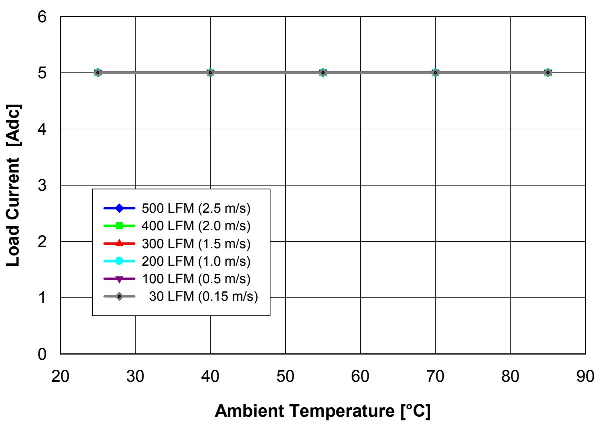



**Fig. 1.0V.1:** Available load current vs. ambient temperature and airflow rates for Vout = 1.0V converter mounted vertically with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

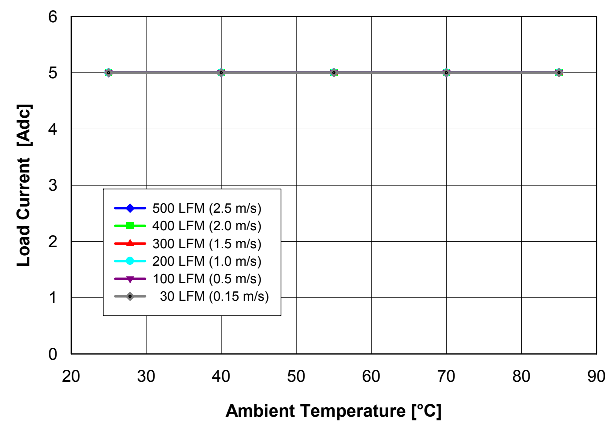



**Fig. 1.0V.2:** Available load current vs. ambient temperature and airflow rates for Vout = 1.0V converter mounted horizontally with Vin = 12V, air flowing from pin 5 to pin 1 and maximum MOSFET temperature ≤ 120°C.

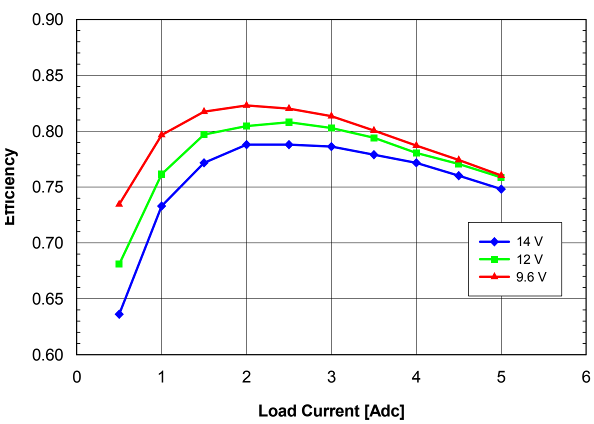



**Fig. 1.0V.3:** Efficiency vs. load current and input voltage for Vout = 1.0V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°C.

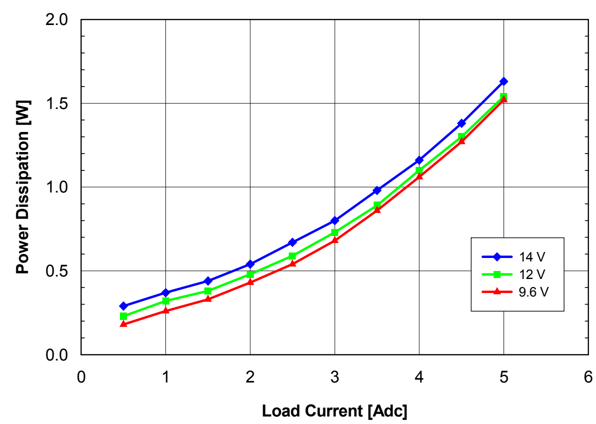



**Fig. 1.0V.4:** Power Loss vs. load current and input voltage for Vout = 1.0V converter mounted vertically with air flowing from pin 5 to pin 1 at a rate of 200 LFM (1 m/s) and Ta = 25°.

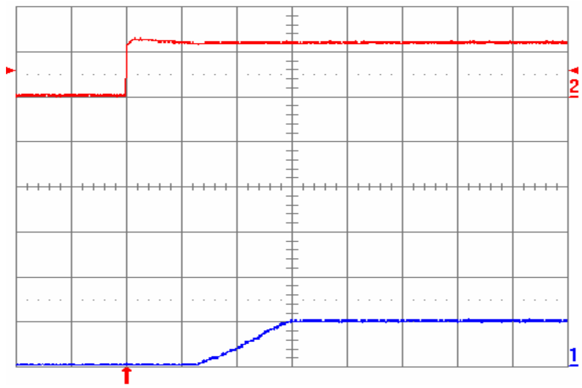


**Fig. 1.0V.5:** Turn-on transient for Vout = 1.0V with application of Vin = 12V at full rated load current (resistive) and 47μF external capacitance. Top trace: Vin (10V/div); Bottom trace: Vout (1V/div); Time scale: 2 ms/div.

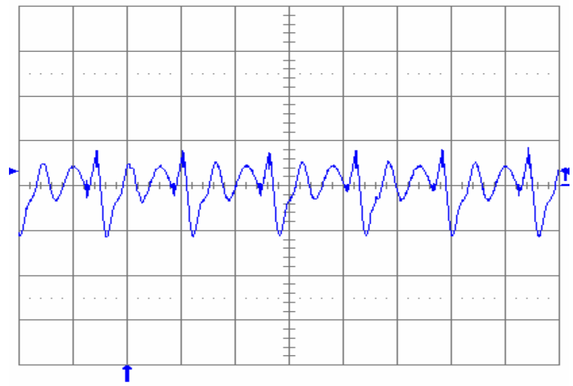


**Fig. 1.0V.6:** Output voltage ripple (10mv/div) at full rated load current into a resistive load with external capacitance 47μF ceramic + 1μF ceramic and Vin = 12V for Vout = 1.0V. Time scale: 2 μs/div.

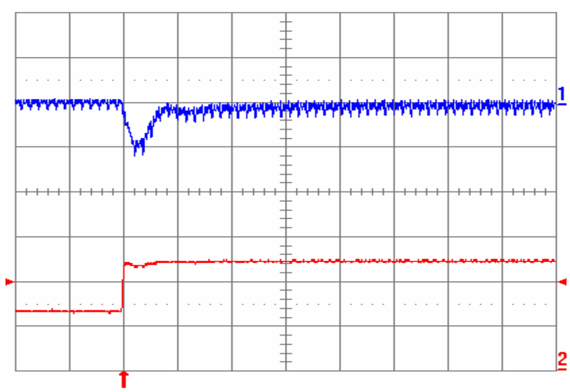


**Fig. 1.0V.7:** Output voltage response for Vout = 1.0V to a positive load current step change from 2.5A to 5A with a slew rate of 5A/μs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47μF ceramic. Time scale: 20 μs/div.

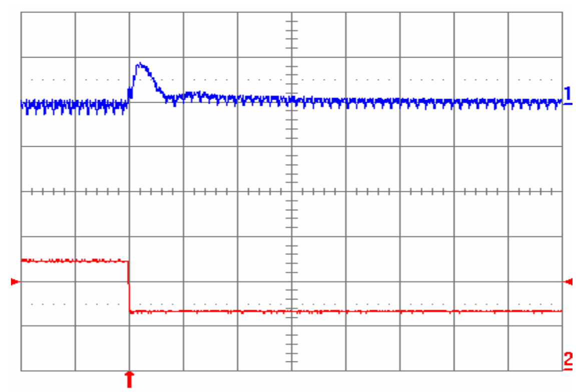
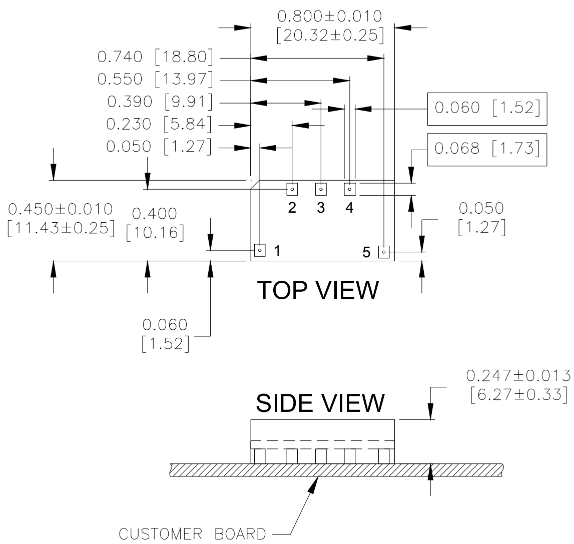


**Fig. 1.0V.8:** Output voltage response for Vout = 1.0V to a negative load current step change from 5A to 2.5A with a slew rate of 5A/μs at Vin = 12V. Top trace: output voltage (100mv/div); Bottom trace: load current (2A/div). Co = 47μF ceramic. Time scale: 20 μs/div.

## Physical Information




**YM12S Pinout (Surface Mount)**

| Pad/Pin Connections | |
|---|---|
| **Pad/Pin #** | **Function** |
| 1 | ON/OFF |
| 2 | Vout |
| 3 | TRIM |
| 4 | GND |
| 5 | Vin |

**YM12S Platform Notes**

- All dimensions are in inches [mm]
- Connector Material: Copper
- Connector Finish: Gold over Nickel
- Module Weight: 0.079 oz [2.26 g]
- Module Height: 0.260" Max., 0.234" Min.
- Recommended Surface-Mount Pads: Min. 0.080" X 0.112" [2.03 x 2.84]

## Converter Part Numbering Scheme

| Product Series | Input Voltage | Mounting Scheme | Rated Load Current | RoHS Compatible |
|---|---|---|---|---|
| **YM** | **12** | **S** | **05** | **G** |
| Y-Series | 9.6V – 14V | S ⇒ Surface Mount | 5A (0.7525V to 5.5V) | No Suffix ⇒ RoHS lead-solder-exempt compliant<br><br>G ⇒ RoHS Compliant |

The example above describes P/N YM12S05G: 9.6V – 14V input, surface mount, 5A at 0.7525V to 5.5V output, and RoHS compliant. Please consult factory regarding availability of a specific version.

NUCLEAR AND MEDICAL APPLICATIONS - Power-One products are not designed, intended for use in, or authorized for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems without the express written consent of the respective divisional president of Power-One, Inc.

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