

# 31 Watt Quad Output DC/DC Converter



Unless otherwise stated, these specifications apply for  $T_A=25^\circ\text{C}$ ,  $V_{in}=V_{nom}$ , and maximum rated load [1].

<b>Model</b>	<b>70Q5.12SR</b>
<b>Features</b>	31 Watt Quad Output
<b>Outputs</b>	2 x 5.1V @ 1.4A and 2 x 12V @ 0.7A

## Input Parameters

Input Voltage Range	min typ max	40 VDC 75 VDC 120 VDC
Input Surge Voltage, 3s max	max	135 VDC
Input Current, No Load	typ	12 mADC
Input Current, Maximum Load	typ	502 mADC
Efficiency	typ	82%
Delay Time at Start-up, Input Voltage to Output	typ	1 Sec
Input Start-up Voltage	typ	38 V
Input Turn-off Voltage	typ	35 V
Input Reflected Ripple (2)	typ	30 mA RMS
Recommended Fuse	typ	(3)

## General

Switching Frequency	typ	225 kHz
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## Isolation (4)

Input to Output Isolation, 10 $\mu$ A leakage max	min	1544 VDC
Isolation Between Outputs	min	200 VDC
Input to Output Capacitance	typ	750 pF

## Environmental

Case Thermal Impedance (5)	typ	3.8 $^\circ\text{C}/\text{Watt}$
Case Operating Temperature Range, No Derating	min max	-40 $^\circ\text{C}$ +100 $^\circ\text{C}$
Ambient Operating Temperature Range	min max	-40 $^\circ\text{C}$ +71 $^\circ\text{C}$
Overtemperature Shutdown, Case Temp.	typ	110 $^\circ\text{C}$
Storage Range	min max	-40 $^\circ\text{C}$ +110 $^\circ\text{C}$
Weight	typ	5.3 oz.

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## Output Parameters

### +5.1V OUTPUTS (EACH OUTPUT) Vo1, Vo4

Output Vo1 Voltage, Setpoint Accuracy, Vo1 and Vo4 at Typical Load	min typ max	5.00 VDC 5.10 VDC 5.20 VDC
Output Vo4 Voltage Balance, Delta voltage from Vo1. Vo1 and Vo4 at Typical Load	min typ max	-0.03 VDC 0 VDC +0.03 VDC
Rated Load Range (12)	min typ max	0.050 ADC 0.7 ADC 1.4 ADC
Load Regulation, 0.14 to 1.4A (6)	typ	$\pm 0.4\%$
Cross Regulation, 0.14 to 1.4A (7)	typ	$\pm 3.1\%$
Line Regulation: Vin = Min - Max	typ max	$\pm 0.2\%$ $\pm 1.0\%$
Temperature Coefficient (8)	max	200 ppm/ $^\circ\text{C}$
Noise & Ripple, 20 MHz bw (2)	typ max	30 mV P-P 80 mV P-P
Dynamic Response, 0.70 to 1.0A (9)	typ	100 mV pk
Transient Response, 0.70 to 1.0A (9)	typ	600 $\mu\text{s}$
Capacitive Load, both outputs combined (10) Includes Load Current Capability at Start-up (see application notes)	max	4000 $\mu\text{F}$
Short Circuit Protection, Output to Common		Continuous
Restart after short circuit		Auto

### +12V OUTPUTS (EACH OUTPUT) Vo2, Vo3

Output Vo2 Voltage, Setpoint Accuracy, Vo2 and Vo3 at Typical Load	min typ max	11.76 VDC 12.00 VDC 12.24 VDC
Output Vo3 Voltage Balance, Delta voltage from Vo2. Vo2 and Vo3 at Typical Load	min typ max	-0.06 VDC 0 VDC +0.06 VDC
Rated Load Range (12)	min typ max	0.015 ADC 0.35 ADC 0.70 ADC
Load Regulation, 0.07 to 0.70A (6)	typ	$\pm 0.2\%$
Cross Regulation, 0.07 to 0.70A (7)	typ	$\pm 1.8\%$
Line Regulation: Vin = Min - Max	typ max	$\pm 0.1\%$ $\pm 1.0\%$
Temperature Coefficient (8)	max	200 ppm/ $^\circ\text{C}$
Noise & Ripple, 20 MHz bw (2)	typ max	40 mV P-P 120 mV P-P
Dynamic Response, 0.30 to 0.45A (9)	typ	200 mV pk
Transient Response, 0.30 to 0.45A (9)	typ	600 $\mu\text{s}$
Capacitive Load, (10)	max	680 $\mu\text{F}$
Short Circuit Protection, Output to Common		Continuous
Restart after short circuit		Auto

## TRIM

12V Output Adjust Range	typ	0 to +8%
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## ON/OFF

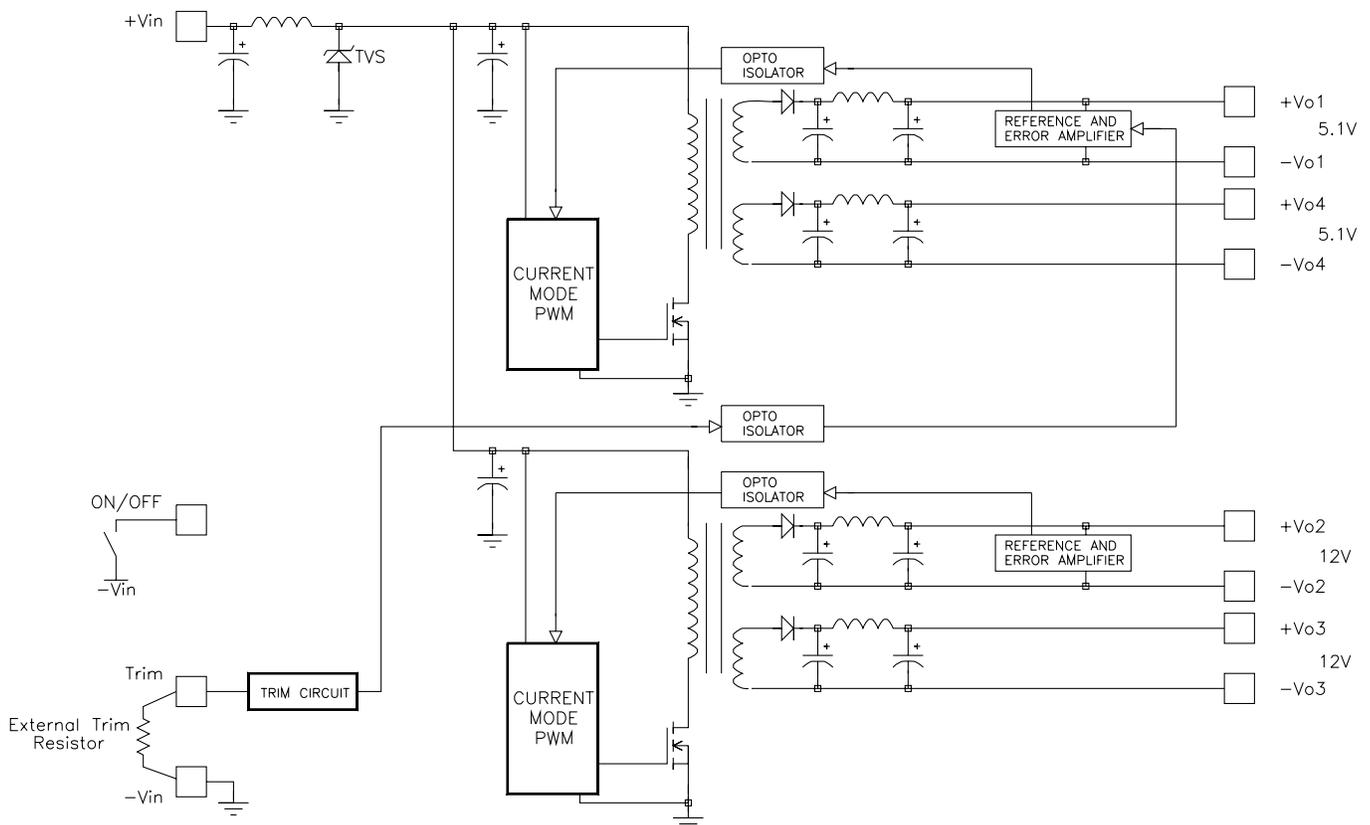
ON Logic Level or Leave Pin 8 Open. Reference to Pin 2 (-Vin)	min max	>3.5 VDC 20 VDC
OFF Logic Level, Reference to Pin 2 (-Vin)	min max	0 VDC <1.0 VDC
Input Resistance	typ	20 K ohm
Converter Input Idle Current, Pin 8 = OFF	typ	2 mA
Delay Time to Re-start, Pin 8 to Output	typ	1 Sec

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## Notes

- (1) Test conditions, unless noted:  $T_{amb} = +25^{\circ}\text{C}$ ,  $V_{in} = 75\text{VDC}$ , and Maximum Load. No connection to the Trim pin or the ON/OFF pin (both left open).
- (2) Output noise is measured with a 10 $\mu\text{F}$  25V tantalum capacitor in parallel with a 0.1 $\mu\text{F}$  ceramic capacitor connected from each positive output to its respective negative output pins. Measurement bandwidth is 0-20 MHz for peak to peak, and 10kHz to 1MHz for RMS. Input Reflected Ripple current is measured into a 2 $\mu\text{H}$  source.
- (3) External fusing should be used for system protection due to a catastrophic failure.
- (4) Capacitance is total from input to all outputs tied together. The case is electrically floating. Isolation is tested with no external connection to the case.
- (5) Case thermal impedance is defined as the case temperature rise above ambient per package watt dissipated.
- (6) Load regulation is defined as the change in output voltage due to a load change as indicated, referenced from Typical Load. Load currents on both outputs are equal and simultaneously changed.
- (7) Cross regulation is defined as the change in one output due to a load change in the adjacent output of the same PWM system. Starting condition is both outputs at Typical Load. The output being measured is maintained at Typical Load, while the other load is changed over the range shown.
- (8) Temperature coefficient is defined for case temperatures. Output voltage deviation is calculated as the maximum resulting from either A) 25 $^{\circ}\text{C}$  case to maximum operating case temperature, or B) 25 $^{\circ}\text{C}$  case to minimum operating case temperature.
- (9) Transient Response is defined as the time for the output to settle to within a 1% error band due to the step load change indicated. All of the other outputs are at Typical load. Dynamic response is defined as the peak overshoot during the transient.
- (10) 4,000 $\mu\text{F}$  is the total on the Vo1 and Vo4 outputs combined. 680 $\mu\text{F}$  is the total on the Vo2 and Vo3 outputs combined.
- (11) Water Washability - Calex DC/DC converters are designed to withstand most solder/wash processes. Careful attention should be used when assessing the applicability in your specific manufacturing process. Converters are not hermetically sealed.
- (12) No harm to the unit when operated at No Load. Output voltage at No Load may be significantly lower than the typical/nominal value.

SR Quad Block Diagram



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## Application Notes

### Output Paralleling and Series Connection

The outputs are isolated from the input and from each other, which allows connecting the outputs in any series combination to obtain higher voltages.

Any output with the same nominal output voltage rating can be paralleled together for a higher output current capability. The user must keep the parallel wire connections short and each must be less than 50 milliohms resistance for the high side and return lines in order to maintain the current balance between the paralleled outputs. Do not parallel a 12V output with a 5.1V output.

### Output Overcurrent Limiting

Output overcurrent is sensed on the primary side at each PWM section. An overcurrent in either PWM section will cause both PWM sections to shutdown and go into a hic-cup mode, where they will try to automatically re-start.

### Trim

The Trim function simultaneously only changes the 5V outputs (Vo1 and Vo4). Default is to leave the pin open. A resistor from the Trim pin to  $-V_{in}$  will increase both 5V outputs at the same time.

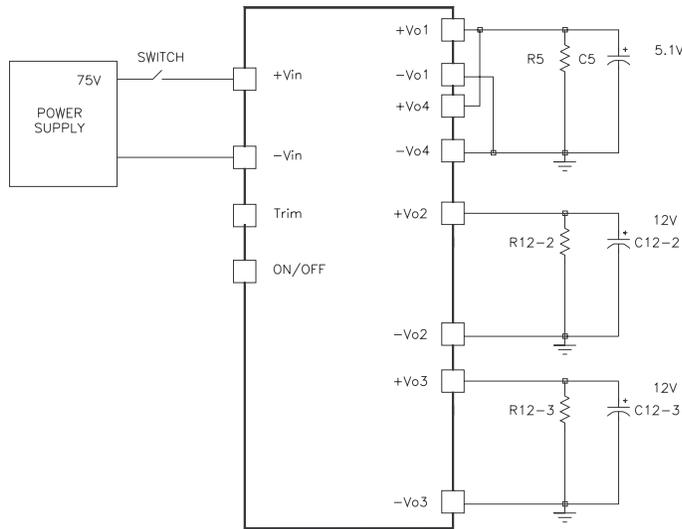
### Load Current Capability at Start-up

The Test circuit is shown below. Test the +5.1V with a DC load of 2A, and the 12V with a DC load of 600mA on each output. The SR quad has sufficient output current capability to start with the loads shown. Typical rise time is 8ms.

### Adding External Inductance

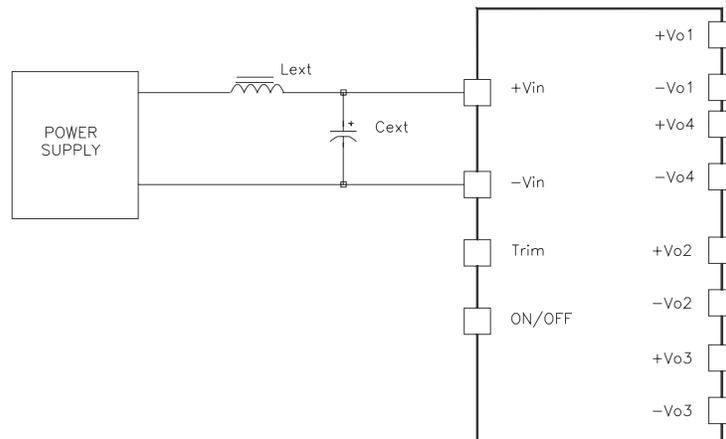
Adding external inductance  $L_{ext}$  as shown below will require the addition of  $C_{ext}$ . Use the formula  $C_{ext} \geq (L_{ext}/6)$ . i.e. adding 20 $\mu$ H will require  $C_{ext}$  to be 3.3 $\mu$ F or greater. For a common mode inductor use it's differential inductance value.

**Load Current Capability at Start-up**

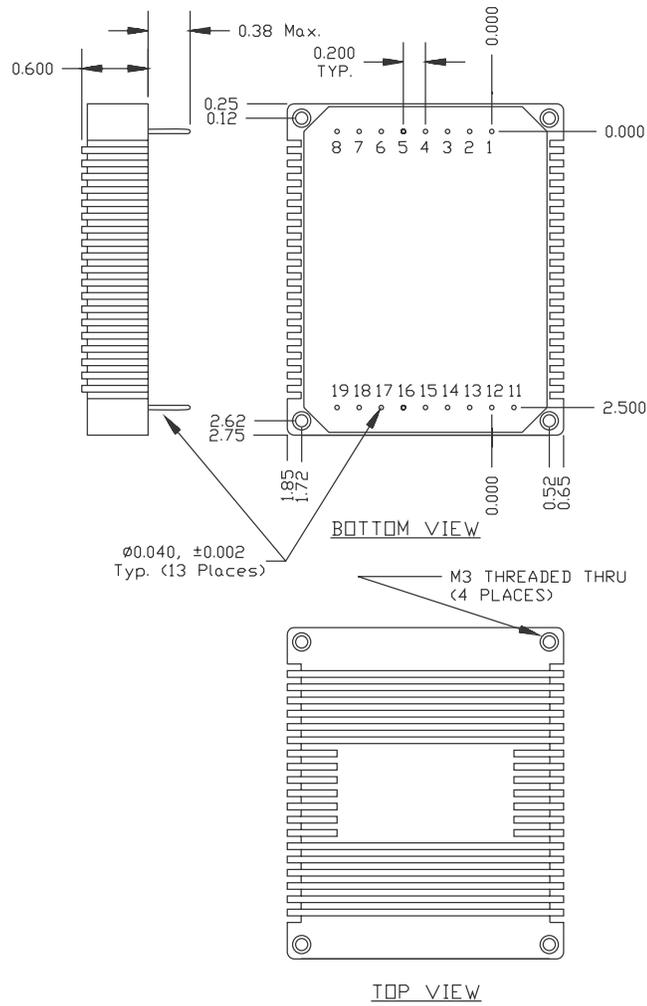


R5	2.5 ohms
C5	4000 $\mu$ F
R12-2	20 ohms
C12-2	330 $\mu$ F
R12-3	20 ohms
C12-3	330 $\mu$ F

**Adding External Inductance**



# 31 Watt Quad Output DC/DC Converter



Mechanical tolerances unless otherwise noted:

X.XX dimensions:  $\pm 0.020$  inches

X.XXX dimensions:  $\pm 0.005$  inches

Pin location shown is for mating PCB.

The case is aluminum, black.

The outer surface of the header is non-conductive.

Pin	Function
1	No Pin
2	-Vin
3	No Pin
4	+Vin
5	Trim
6	No Pin
7	No Pin
8	ON/OFF
11	-Vo3 (12V return)
12	+Vo3 (12V output)
13	-Vo2 (12V output)
14	-Vo2 (12V return)
15	-Vo1 (5V return)
16	+Vo1 (5V output)
17	-Vo4 (5V output)
18	+Vo4 (5V return)
19	Pin, No Connection