

# 2.5 Watt Hybrid

## Features

- Efficiency optimized for low power applications
- Proton resistant 100K rad hard
- SEU resistant
- Typical no load quiescent current 8mA at 28 VDC
- Completely self contained Thick Film Hybrid DC-DC Converter
- No external filter caps required
- Fully isolated design
- "Inhibit-not" function
- Power on soft start
- 100 kHz operation for low ripple and fast response time
- Built-in EMI input filter meets MIL-STD-461C requirements CE01, CE03, CS01, CS02 and CS06
- Short circuit and overvoltage protection
- Capability of external sync for switching frequencies
- Built-in test capability

## Specifications

**INPUT:** 28 VDC nominal  
 Range: 16 to 50 VDC continuous  
 Survives 80 V transients/MIL-STD-704A

**ISOLATION:**  
 Input to case: 500 VDC  
 Input to output: 500 VDC  
 Output to case: 100 VDC

**ENVIRONMENT:**  
 Storage temperature: -55°C to +150°C  
 Shock: 50 G's  
 Acceleration: 500 G's  
 Vibration: 30 G's

Grades EU, L, R & S:  
 Full Power Output at  $T_{case} = +85^{\circ}C$   
 Linearly derates to zero at  $T_{case} = +115^{\circ}C$

Grades LE, RE & SE:  
 Full Power Output at  $T_{case} = +125^{\circ}C$   
 Linearly derates to zero at  $T_{case} = +135^{\circ}C$

Grades L & LE:  
 TID up to 45kRad(Si)  
 No SEE up to 60MeV\*cm<sup>2</sup>/mg

**WEIGHT:** 50 grams typical

## Note

All units operate to no load. Minimum load is the measurement point for load regulation.

## Case Dimensions

Units: inches | millimeters

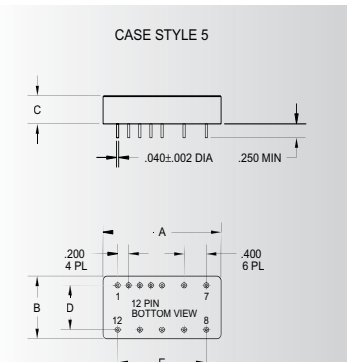
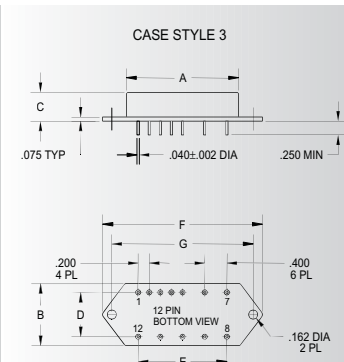
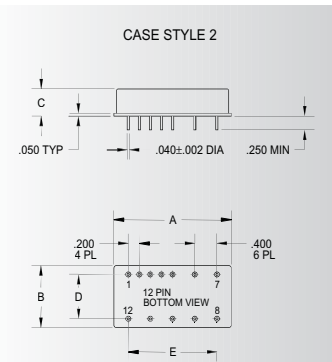
Case Style	A	B	C	D	E	F	G
2	2.130   54.102	1.120   28.448	0.375   9.525	0.800   20.320	1.600   40.640	—   —	—   —
3 F	2.130   54.102	1.120   28.448	0.375   9.525	0.800   20.320	1.600   40.640	2.890   73.406	2.550   64.770
5 G	2.130   54.102	1.120   28.448	0.375   9.525	0.800   20.320	1.600   40.640	—   —	—   —
6 GF	2.130   54.102	1.120   28.448	0.375   9.525	0.800   20.320	1.600   40.640	2.890   73.406	2.550   64.770
8 UF	2.160   54.864	1.510   38.354	0.495   12.573	—   —	1.600   40.640	2.890   73.406	2.550   64.770

SINGLE OUTPUT DEVICES		4690-S02 (2.5W)			4690-S02.5 (2.5W)			4690-S03.3 (2.5W)			4690-S05 (2.5W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output voltage	—	+1.9	+2.0	+2.1	+2.4	+2.5	+2.6	+3.2	+3.3	+3.4	+4.9	+5.0	+5.1
Output current	$V_{in min} - V_{in max}$	125mA	—	1.25A	0.1A	—	1A	75mA	—	0.75A	0.50mA	—	0.50A
Efficiency	$P_{out} = \text{max rated load}$	70%	74%	—	72%	77%	—	67%	69%	—	73%	77%	—
Line regulation	$P_{out} = \text{max rated load}$ $V_{in min} - V_{in max}$	—	10mV	30mV	—	10mV	30mV	—	10mV	30mV	—	10mV	50mV
Load regulation	$P_{out} = 10\%$ to F.L.	—	50mV	100mV	—	62mV	125mV	—	75mV	250mV	—	0.1V	0.3V
Output ripple	F.L. BW 2 MHz mV <sub>pp</sub>	—	30	65	—	30	65	—	3	100	—	40	125

SINGLE OUTPUT DEVICES		4690-S05.2 (2.5W)			4690-S12 (2.5W)			4690-S15 (2.5W)			4690-S28 (2.5W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output voltage	—	+5.1	+5.2	+5.3	+11.9	+12.0	+12.1	+14.9	+15.0	+15.1	+27.8	+28.0	+28.2
Output current	$V_{in min} - V_{in max}$	48mA	—	480mA	20.8mA	—	0.208A	16.7mA	—	0.167A	9mA	—	90mA
Efficiency	$P_{out} = \text{max rated load}$	77%	82%	—	81%	85%	—	81%	86%	—	81%	86%	—
Line regulation	$P_{out} = \text{max rated load}$ $V_{in min} - V_{in max}$	—	10mV	50mV	—	20mV	100mV	—	25mV	125mV	—	50mV	250mV
Load regulation	$P_{out} = 10\%$ to F.L.	—	0.1V	0.2V	—	0.25V	0.5V	—	0.3V	0.6V	—	600mV	1.2V
Output ripple	F.L. BW 2 MHz mV <sub>pp</sub>	—	40	85	—	60	150	—	75	180	—	150	350

Model No.	Case Style	Pin Count	Mounting
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4690	2	12	Solder Sealed Flangeless PCB Mount
4690 F	3	12	Solder Sealed PCB Mount with Flange
4690 G	5	12	Seam Weld Flangeless PCB Mount
4690 GF	6	12	Seam Weld PCB Mount with Flange
4690 UF	8	12	Seam Weld Chassis Mount with Flange



TOLERANCES: ALL DIMENSIONS ±0.01 EXCEPT F = MAX, C = +0.01/-0.02; DRAWINGS IN INCHES.

# DC-DC CONVERTERS

## PROTON RAD HARD 100K+™ SERIES

# 4690

**MAGNETICALLY ISOLATED**



**28 VDC**

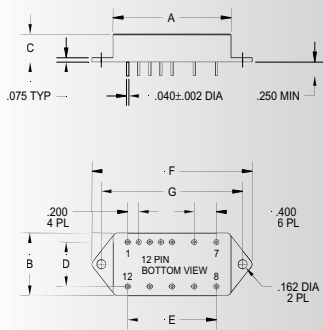
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DUAL OUTPUT DEVICES		4690-D05 (2.5W)			4690-D12 (2.5W)			4690-D15 (2.5W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output voltage	$+I_{out} = -I_{out}$	+4.9 -4.9	+5.0 -5.0	+5.1 -5.1	+11.9 -11.9	+12.0 -12.0	+12.1 -12.1	+14.9 -14.9	+15.0 -15.0	+15.1 -15.1
Output current*	$V_{in min} - V_{in max}$	±25mA	—	±250mA	±10.4mA	—	±104mA	±8.3mA	—	±83mA
Efficiency	$P_{out} = \text{max rated load}$	71%	82%	—	81%	85%	—	81%	86%	—
Line regulation	$P_{out} = \text{max rated load}$ $V_{in min} - V_{in max}$	—	±10mV	±250mV	—	±20mV	±100mV	—	±25mV	±250mV
Load regulation†	$P_{out} = 10\%$ to F.L.	—	±50mV	±300mV	—	±250mV	±0.5V	—	±0.3V	±0.6V
Output ripple	F.L. BW 2 MHz mV <sub>pp</sub>	—	40	85	—	60	150	—	75	180

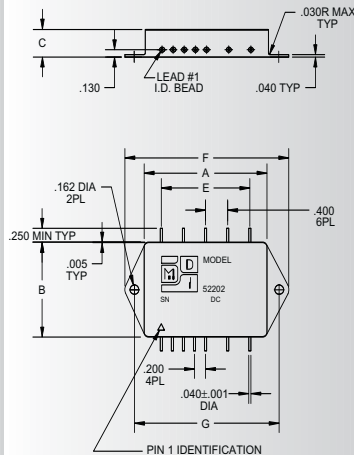
Notes: \*Up to 90% full power available from either output if rated output power is not exceeded; †balanced load conditions.

TRIPLE OUTPUT DEVICES		4690-T05 (2.5W)			4690-T12 (2.5W)			4690-T15 (2.5W)		
PARAMETER	CONDITION	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX
Output voltage	$+I_{out} = -I_{out}$	+4.9 -4.9	+5.0 -5.0	+5.1 -5.1	+11.9 -11.9	+12.0 -12.0	+12.1 -12.1	+14.9 -14.9	+15.0 -15.0	+15.1 -15.1
Output current	$V_{in min} - V_{in max}$	30mA ±20mA	—	250mA ±125mA	30mA ±20mA	—	250mA ±52mA	30mA ±20mA	—	250mA ±42mA
Efficiency	$P_{out} = \text{max rated load}$	65%	70%	—	72%	77%	—	73%	78%	—
Line regulation	$P_{out} = \text{max rated load}$ $V_{in min} - V_{in max}$	—	10mV 100mV	50mV 200mV	—	10mV 100mV	50mV 200mV	—	10mV 100mV	50mV 200mV
Load regulation	$P_{out} = 10\%$ to F.L.	—	10mV 100mV	50mV 200mV	—	10mV 100mV	50mV 200mV	—	10mV 100mV	50mV 200mV
Output ripple	F.L. BW 2 MHz mV <sub>pp</sub>	—	40	85	—	40	85	—	40	85

CASE STYLE 6



CASE STYLE 8



**4690-SXX output <24 VDC**

Pin 1	bit	Pin 7	+ input
Pin 2	inhibit not	Pin 8	main output
Pin 3	soft start	Pin 9	main output ret
Pin 4	sync	Pin 10	N/C
Pin 5	N/C	Pin 11	N/C
Pin 6	input ret	Pin 12	N/C

**4690-SXX output ≥24 VDC**

Pin 1	bit	Pin 7	+ input
Pin 2	inhibit not	Pin 8	N/C
Pin 3	soft start	Pin 9	N/C
Pin 4	sync	Pin 10	main output
Pin 5	N/C	Pin 11	N/C
Pin 6	input ret	Pin 12	main output ret

**4690-DXX**

Pin 1	bit	Pin 7	+ input
Pin 2	inhibit not	Pin 8	N/C
Pin 3	soft start	Pin 9	N/C
Pin 4	sync	Pin 10	+ dual output
Pin 5	N/C	Pin 11	dual output ret
Pin 6	input ret	Pin 12	- dual output

**4690-TXX**

Pin 1	bit	Pin 7	+ input
Pin 2	inhibit not	Pin 8	main output
Pin 3	soft start	Pin 9	main output ret
Pin 4	sync	Pin 10	+ dual output
Pin 5	N/C	Pin 11	dual output ret
Pin 6	input ret	Pin 12	- dual output

Please specify **GRADE LEVEL** for your application. EU grade units will be shipped if no option is specified.

**EU** Engineering Units  
**R** 100 KRAD, +85°C military/aerospace

**RE** 100 KRAD, +125°C military/aerospace  
**S** 100 KRAD, +85°C space

**SE** 100 KRAD, +125°C space

L 45 K, +85°C military/aerospace

LE 45 K, +125°C military/aerospace

Revised 2015-10-14