

**SERIES:** PGNM2-S | **DESCRIPTION:** DC-DC CONVERTER

**FEATURES**

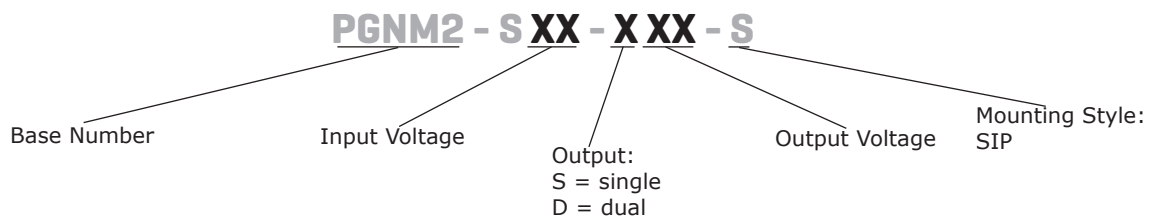
- 2W isolated output
- unregulated single/dual outputs
- 6,000 Vdc isolation
- certified to EN/UL 60601-1 (1 x MOPP, 2 x MOOP)
- designed to meet EN 62368-1
- leakage current less than 2  $\mu$ A
- -40 °C ~ 105 °C operating temperature
- continuous output short circuit protection
- reinforced insulation



MODEL	input voltage		output voltage (Vdc)	output current		output power max (W)	ripple & noise <sup>1</sup> max (mVp-p)	efficiency <sup>2</sup> typ (%)
	typ (Vdc)	range (Vdc)		min (mA)	max (mA)			
PGNM2-S12-D5-S	12	10.8~13.2	±5	±20	±200	2	150	80
PGNM2-S12-D9-S	12	10.8~13.2	±9	±11	±111	2	120	82
PGNM2-S12-D12-S	12	10.8~13.2	±12	±9	±83	2	120	83
PGNM2-S12-D15-S	12	10.8~13.2	±15	±7	±67	2	120	84
PGNM2-S12-S5-S	12	10.8~13.2	5	40	400	2	150	80
PGNM2-S12-S9-S	12	10.8~13.2	9	22	222	2	120	82
PGNM2-S12-S12-S	12	10.8~13.2	12	17	167	2	120	84
PGNM2-S12-S15-S	12	10.8~13.2	15	14	133	2	120	84
PGNM2-S15-D5-S	15	13.5~16.5	±5	±20	±200	2	150	78
PGNM2-S15-D9-S	15	13.5~16.5	±9	±11	±111	2	120	80
PGNM2-S15-D15-S	15	13.5~16.5	±15	±7	±67	2	120	80
PGNM2-S15-S5-S	15	13.5~16.5	5	40	400	2	150	80
PGNM2-S15-S15-S	15	13.5~16.5	15	14	133	2	120	83
PGNM2-S24-D5-S	24	21.6~26.4	±5	±20	±200	2	150	79
PGNM2-S24-D9-S	24	21.6~26.4	±9	±11	±111	2	120	81
PGNM2-S24-D12-S	24	21.6~26.4	±12	±9	±83	2	120	82
PGNM2-S24-D15-S	24	21.6~26.4	±15	±7	±67	2	120	81
PGNM2-S24-S5-S	24	21.6~26.4	5	40	400	2	150	79
PGNM2-S24-S9-S	24	21.6~26.4	9	22	222	2	120	81
PGNM2-S24-S12-S	24	21.6~26.4	12	17	167	2	120	82
PGNM2-S24-S15-S	24	21.6~26.4	15	14	133	2	120	84
PGNM2-S24-S24-S	24	21.6~26.4	24	9	83	2	120	84

Notes: 1. Measured at nominal input, 20 MHz bandwidth oscilloscope.  
 2. Measured at full load.  
 3. All specifications are measured at Ta=25°C, humidity < 75%, nominal input voltage, and rated output load unless otherwise specified.

## PART NUMBER KEY



## INPUT

parameter	conditions/description	min	typ	max	units
operating input current (full load/ no load)	12 Vdc input models		210/15	220/-	mA
	15 Vdc input models		167/15	176/-	mA
	24 Vdc input models		106/15	111/-	mA
surge voltage	for maximum of 1 second				
	12 Vdc input models	-0.7		18	Vdc
	15 Vdc input models	-0.7		21	Vdc
	24 Vdc input models	-0.7		30	Vdc
reflected ripple current <sup>4</sup>				200	mA
filter	filter capacitor				

Note: 4. Refer to DC-DC Converter Application notes for detailed description of reflected ripple current test

## OUTPUT

parameter	conditions/description	min	typ	max	units
maximum capacitive load <sup>5</sup>	9 Vdc output models			680	μF
	12, 15, 24 Vdc input models	±9, 12, 15 Vdc output models		470	μF
		24, ±12, ±15 Vdc output models		220	μF
		±5 Vdc output models		1,000	μF
	12, 15 Vdc input models	5 Vdc output models		1,000	μF
	24 Vdc input models	5 Vdc output models		2,200	μF
voltage accuracy	see tolerance envelope curves				
line regulation	for Vin change of 1%			1.2	%
load regulation	from 10% to full load			20	%
	5 Vdc output models all other models			15	%
switching frequency	at nominal input, full load		200		kHz
temperature coefficient	at full load		±0.02		%/°C

Note: 5. The capacitive loads of positive and negative outputs are identical.

## PROTECTIONS

parameter	conditions/description	min	typ	max	units
short circuit protection	continuous, auto recovery				

## SAFETY AND COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	input to output for 1 minute at 1 mA	5,000			Vac
		6,000			Vdc
isolation resistance	input to output at 500 Vdc	1,000			MΩ
leakage current <sup>6</sup>	at 230 Vac, 50/60 Hz			2	μA
isolation capacitance	input to output, 100 kHz / 0.1 V		4		pF

## SAFETY AND COMPLIANCE (CONTINUED)

parameter	conditions/description	min	typ	max	units
safety approvals	certified to 60601-1: EN, BS EN, UL designed to meet 62368-1: EN/BS EN				
conducted emissions	12 Vdc input	CISPR32/EN55032 CLASS B (see Fig. 4. for recommended circuit) EN60601-1-2/CISPR 11 GROUP1 CLASS B (see Fig. 4. for recommended circuit)			
	15, 24 Vdc input	CISPR32/EN55032 CLASS A (see Fig. 4. for recommended circuit) EN60601-1-2/CISPR 11 GROUP1 CLASS A (see Fig. 4. for recommended circuit)			
radiated emissions	12 Vdc input	CISPR32/EN55032 CLASS B (see Fig. 4. for recommended circuit) EN60601-1-2/CISPR 11 GROUP1 CLASS B (see Fig. 4. for recommended circuit)			
	15, 24 Vdc input	CISPR32/EN55032 CLASS A (see Fig. 4. for recommended circuit) EN60601-1-2/CISPR 11 GROUP1 CLASS A (see Fig. 4. for recommended circuit)			
ESD	EN60601-1-2 (IEC/EN61000-4-2) Air ±15kV, Contact ±8kV, perf. Criteria B				
MTBF	as per MIL-HDBK-217F, 25°C	19,360,000			hours
creepage & clearance distance		5			mm
RoHS	yes				

Note: 6. Leakage current and reinforced insulation is based on 250 VAC, 50/60 Hz system input voltage

## ENVIRONMENTAL

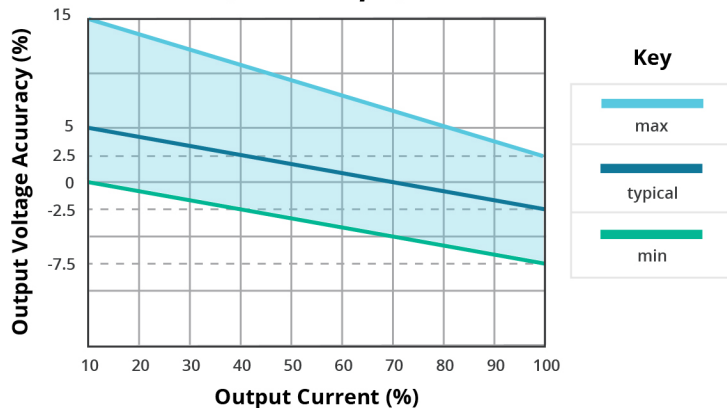
parameter	conditions/description	min	typ	max	units
operating temperature	see derating curves	-40		105	°C
storage temperature		-55		125	°C
storage humidity	non-condensing	5		95	%
case temperature rise			25		°C

## SOLDERABILITY

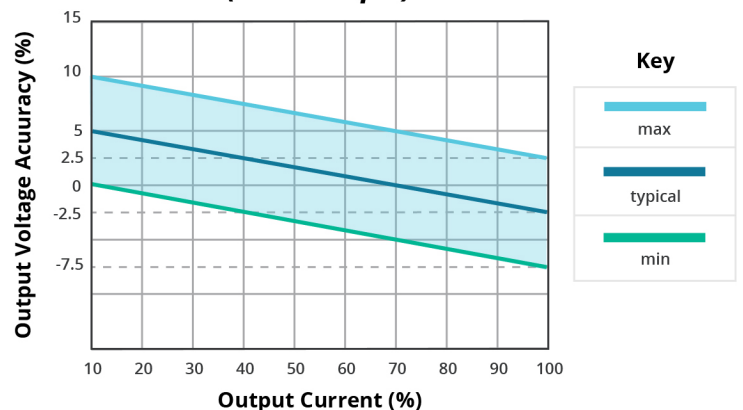
parameter	conditions/description	min	typ	max	units
pin soldering temperature	1.5 mm from case for 10 seconds			300	°C

## DERATING CURVES

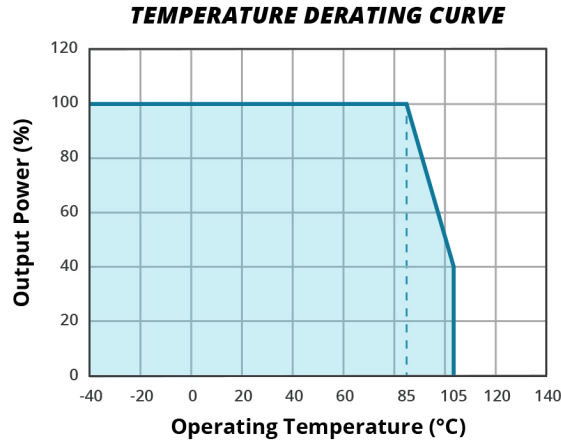
**OUTPUT REGULATION CURVE**  
5 Vdc output model  
(nominal input)



**OUTPUT REGULATION CURVE**  
all other output models  
(nominal input)



## DERATING CURVES (CONTINUED)



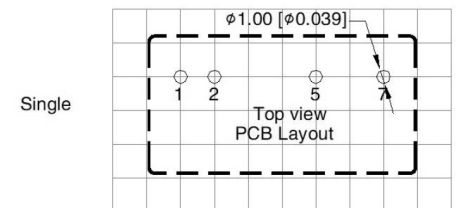
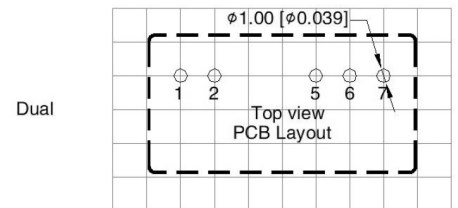
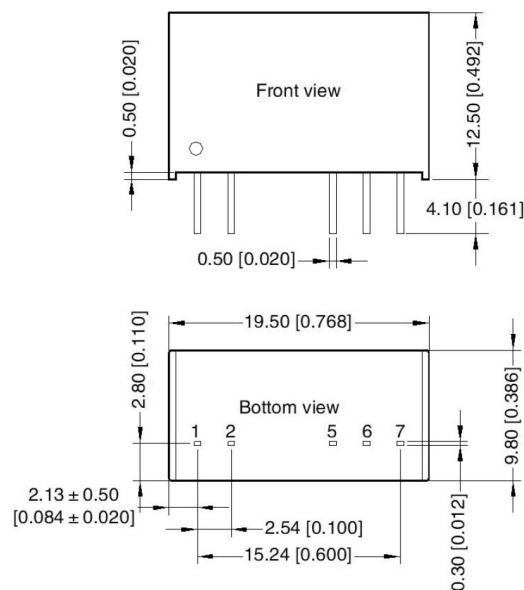
## MECHANICAL

parameter	conditions/description	min	typ	max	units
dimensions	19.50 x 9.80 x 12.50 [0.768 x 0.386 x 0.492 inch]				mm
case material	black flame-retardant and heat-resistant plastic (UL94V-0)				
weight			4		g

## MECHANICAL DRAWING

units: mm [inch]  
 tolerance:  $\pm 0.50 [\pm 0.020]$   
 pin section tolerance:  $\pm 0.10 [\pm 0.004]$

PIN CONNECTIONS		
PIN	Function	
	Single	Dual
1	Vin	Vin
2	GND	GND
5	0V	-Vout
6	No Pin	0V
7	+Vout	+Vout



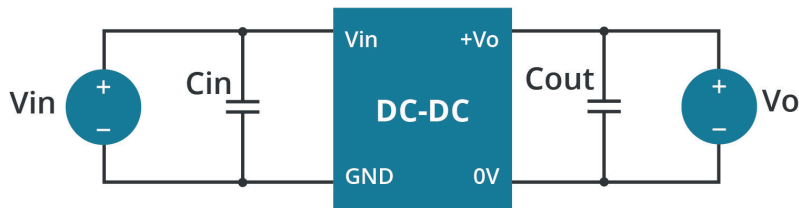
Note: Grid 2.54\*2.54mm

## APPLICATION CIRCUIT

Input and/or output ripple can be further reduced, by connecting a filter capacitor from the input and/or output terminals to ground as shown in Fig. 1 & 2. Choosing suitable filter capacitor values is very important for a smooth operation of the modules, particularly to avoid start-up problems caused by capacitor values that are too high. For recommended input and output capacitor values refer to Table 1 & 2.

The simplest device for output voltage regulation, over-voltage and over-current protection is a linear voltage regulator with overheat.

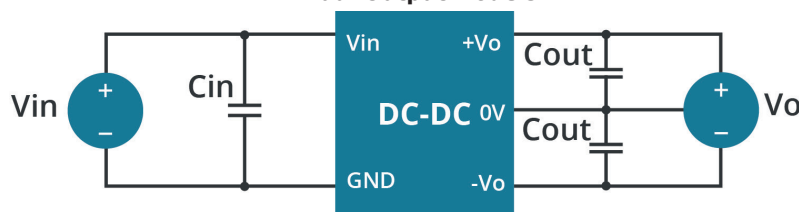
**Figure 1**  
Single Output Models



**Table 1**

Vin (Vdc)	Cin (μF/V)	Vo (Vdc)	Cout (μF/V)
12	10μF/25V	5	10μF/16V
15	4.7μF/25V	9	10μF/16V
24	2.2μF/50V	12	2.2μF/25V
-	-	15	1μF/25V
-	-	24	0.47μF/50V

**Figure 2**  
Dual Output Models



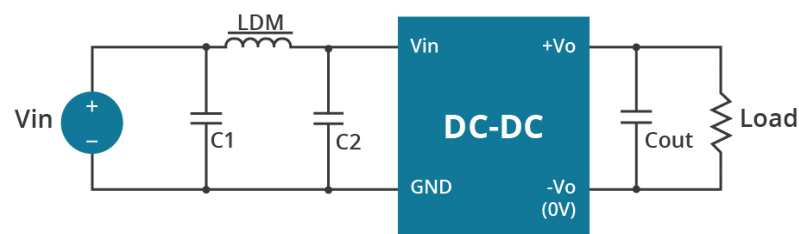
**Table 2**

Vin (Vdc)	Cin (μF/V)	Vo (Vdc)	Cout (μF/V)
12	10μF/25V	-	-
15	1μF/25V	±5, ±9	4.7μF/16V
24	2.2μF/50V	±12, ±15	1μF/25V

## EMC CLASS B RECOMMENDED CIRCUIT

### 15, 24 V INPUT MODELS

**Figure 3**



**Table 3**

Recommended External Circuit Components	
Vin	15, 24 V
C1/C2	4.7 μF / 50 V
Cout	refer to Cout in Tables 1, 2
LDM	22 μH

## EMC CLASS B RECOMMENDED CIRCUIT (CONTINUED)

### 12, 15, 24 V INPUT MODELS

Figure 4

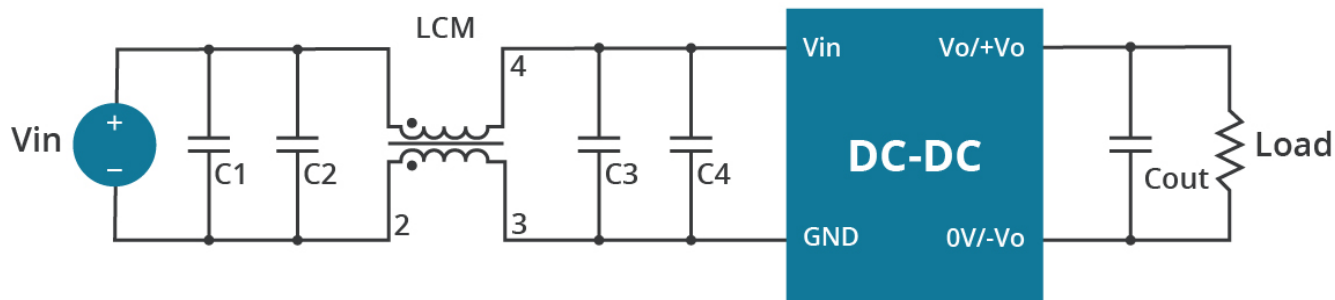


Table 4

Recommended External Circuit Components		
$V_{in}$	12, 15, 24 V	
$C1/C2$	4.7 $\mu\text{F}$ / 50 V	
$C3$	dual 24V outputs	100 $\mu\text{F}$ / 50 V
	all other outputs	4.7 $\mu\text{F}$ / 50 V
$C4$	dual 24V outputs	--
	all other outputs	4.7 $\mu\text{F}$ / 50 V
$C_{out}$	refer to $C_{out}$ in Tables 1, 2	
LCM	22 $\mu\text{H}$	

### Minimum Output Load Requirement

For a reliable and efficient operation of the converter, the minimum load should never be less than 10% of the rated output load.

If the total required output power is below 10%, a parallel bleeding resistor is required on the output, ensuring that the sum of the power consumption is always maintained at 10% minimum

## REVISION HISTORY

rev.	description	date
1.0	initial release	09/06/2023
1.01	table 4 updated	09/26/2023

The revision history provided is for informational purposes only and is believed to be accurate.



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