

**SERIES:** PESE1-M | **DESCRIPTION:** DC-DC CONVERTER**FEATURES**

- 1 W isolated output
- unregulated output
- compact SMT package
- single/dual output models
- continuous short circuit protection
- extended temperature range (-40~105°C)
- 3 kVdc Vdc isolation
- no load input current as low as 5 mA
- efficiency up to 85%
- UL 62368 approval
- designed to meet EN/BS EN 62368



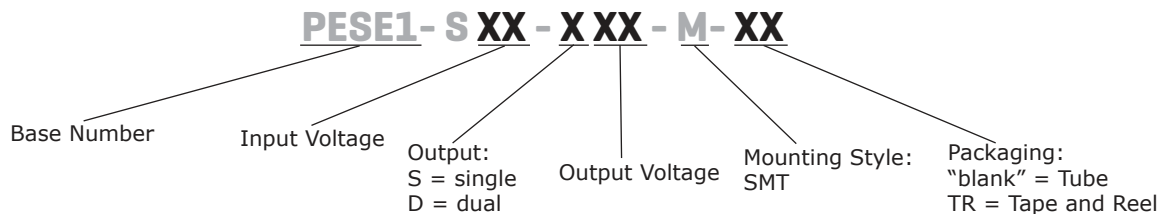
MODEL	input voltage		output voltage (Vdc)	output current		output power max (W)	ripple & noise <sup>1</sup> max (mVp-p)	efficiency <sup>2</sup> typ (%)
	typ (Vdc)	range (Vdc)		min (mA)	max (mA)			
PESE1-S3-S3-M <sup>4</sup>	3.3	2.97~3.63	3.3	30	303	1	100	77
PESE1-S3-S5-M <sup>4</sup>	3.3	2.97~3.63	5	20	200	1	100	82
PESE1-S3-S9-M <sup>4</sup>	3.3	2.97~3.63	9	11	111	1	100	84
PESE1-S3-S12-M <sup>4</sup>	3.3	2.97~3.63	12	8	83	1	100	84
PESE1-S3-S15-M <sup>4</sup>	3.3	2.97~3.63	15	7	67	1	100	84
PESE1-S3-S24-M <sup>4</sup>	3.3	2.97~3.63	24	4	42	1	100	84
PESE1-S5-S3-M	5	4.5~5.5	3.3	30	303	1	75	74
PESE1-S5-S5-M	5	4.5~5.5	5	20	200	1	75	82
PESE1-S5-S9-M	5	4.5~5.5	9	12	111	1	75	83
PESE1-S5-S12-M	5	4.5~5.5	12	9	84	1	75	83
PESE1-S5-S15-M	5	4.5~5.5	15	7	67	1	75	83
PESE1-S5-S24-M	5	4.5~5.5	24	4	42	1	100	85
PESE1-S5-D5-M	5	4.5~5.5	±5	±10	±100	1	75	82
PESE1-S5-D9-M	5	4.5~5.5	±9	±6	±56	1	75	83
PESE1-S5-D12-M	5	4.5~5.5	±12	±5	±42	1	75	83
PESE1-S5-D15-M	5	4.5~5.5	±15	±4	±34	1	75	83
PESE1-S5-D24-M	5	4.5~5.5	±24	±3	±21	1	100	85
PESE1-S12-S5-M	12	10.8~13.2	5	20	200	1	75	82
PESE1-S12-S9-M	12	10.8~13.2	9	12	111	1	75	83
PESE1-S12-S12-M	12	10.8~13.2	12	9	84	1	75	83
PESE1-S12-S15-M	12	10.8~13.2	15	7	67	1	75	83
PESE1-S12-S24-M	12	10.8~13.2	24	4	42	1	100	85
PESE1-S12-D5-M	12	10.8~13.2	±5	±10	±100	1	75	82
PESE1-S12-D9-M	12	10.8~13.2	±9	±6	±56	1	75	83
PESE1-S12-D12-M	12	10.8~13.2	±12	±5	±42	1	75	83
PESE1-S12-D15-M	12	10.8~13.2	±15	±4	±34	1	75	83
PESE1-S12-D24-M	12	10.8~13.2	±24	±3	±21	1	100	85

### MODEL (CONTINUED)

	input voltage		output voltage	output current		output power	ripple & noise <sup>1</sup>	efficiency <sup>2</sup>
	typ (Vdc)	range (Vdc)	(Vdc)	min (mA)	max (mA)	max (W)	max (mVp-p)	typ (%)
PESE1-S15-S5-M	15	13.5~16.5	5	20	200	1	75	82
PESE1-S15-S15-M	15	13.5~16.5	15	7	67	1	75	83
PESE1-S15-D15-M	15	13.5~16.5	±15	±4	±34	1	75	83
PESE1-S24-S5-M	24	21.6~26.4	5	20	200	1	75	82
PESE1-S24-S9-M	24	21.6~26.4	9	12	111	1	75	83
PESE1-S24-S12-M	24	21.6~26.4	12	9	84	1	75	83
PESE1-S24-S15-M	24	21.6~26.4	15	7	67	1	75	83
PESE1-S24-S24-M	24	21.6~26.4	24	4	42	1	100	85
PESE1-S24-D5-M	24	21.6~26.4	±5	±10	±100	1	75	82
PESE1-S24-D9-M	24	21.6~26.4	±9	±6	±56	1	75	83
PESE1-S24-D12-M	24	21.6~26.4	±12	±5	±42	1	75	83
PESE1-S24-D15-M	24	21.6~26.4	±15	±4	±34	1	75	83
PESE1-S24-D24-M	24	21.6~26.4	±24	±3	±21	1	100	85

- Notes:
1. Measured at nominal input, 20 MHz bandwidth oscilloscope, with 10 µF tantalum and 1 µF ceramic capacitors on the output.
  2. Measured at nominal input voltage, full load.
  3. All specifications are measured at Ta=25°C, humidity < 75%, nominal input voltage, and rated output load unless otherwise specified.
  4. Model is not UL certified.

### PART NUMBER KEY



**INPUT**

parameter	conditions/description	min	typ	max	units
operating input voltage	3.3 Vdc input models	2.97	3.3	3.63	Vdc
	5 Vdc input models	4.5	5	5.5	Vdc
	12 Vdc input models	10.8	12	13.2	Vdc
	15 Vdc input models	13.5	15	16.5	Vdc
	24 Vdc input models	21.6	24	24.4	Vdc
surge voltage	for maximum of 1 second				
	3.3 Vdc input models	-0.7		5	Vdc
	5 Vdc input models	-0.7		9	Vdc
	12 Vdc input models	-0.7		18	Vdc
	15 Vdc input models	-0.7		21	Vdc
	24 Vdc input models	-0.7		30	Vdc
current	3.3 Vdc input models	3.3 Vdc output models		416	mA
		5 Vdc output models		389	mA
		all other models		379	mA
	5 Vdc input models	3.3, 5 Vdc output models		286	mA
		±5 Vdc output models all other models		257 254	mA mA
	12 Vdc input models	5, ±5 Vdc output models		107	mA
9, 12, 15, ±9, ±12, ±15 Vdc output models		106	mA		
24, ±24 Vdc output models		103	mA		
15 Vdc input models	5 Vdc output models		86	mA	
	15, ±15 Vdc output models		85	mA	
24 Vdc input models	5, 9, 12, 15, ±5, ±9, ±12, ±15 Vdc output models 24, ±24 Vdc output models		55 53	mA mA	
filter	filter capacitor				

**OUTPUT**

parameter	conditions/description	min	typ	max	units
maximum capacitive load <sup>4</sup>	3.3, 5 Vdc output models			2,400	μF
	±5 Vdc output models			1,200	μF
	9 Vdc output models			1,000	μF
	12, 15 Vdc output models			560	μF
	24, ±12, ±15 Vdc output models			220	μF
	±5 Vdc output models			1,200	μF
	±9 Vdc output models			470	μF
	±24 Vdc output models			100	μF
voltage accuracy	see tolerance envelope curves				
line regulation	for Vin change of 1%				
	3.3 Vdc output models all other models			±1.5 ±1.2	% %
load regulation	from 10% to full load				
	3.3 Vdc output models			20	%
	5, ±5 Vdc output models all other models			15 10	% %
switching frequency	100% load, nominal input voltage		270		kHz
temperature coefficient	at full load		±0.02		%/°C

Note: 4. Tested at input voltage range and full load.

**PROTECTIONS**

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

## SAFETY AND COMPLIANCE

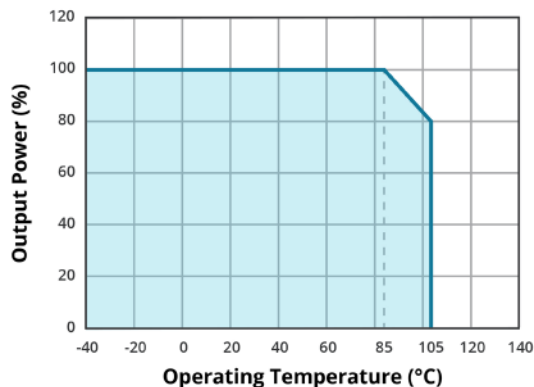
parameter	conditions/description	min	typ	max	units
isolation voltage	input to output for 1 minute at 1 mA	3,000			Vdc
isolation resistance	input to output at 500 Vdc	1,000			MΩ
isolation capacitance	input to output, 100 kHz / 0.1 V		20		pF
safety approvals	certified to 62368-1: UL designed to meet 62368: EN/BS EN				
conducted emissions	CISPR32/EN55032, class B (external circuit required, see Figures 3, 4)				
radiated emissions	CISPR32/EN55032, class B (external circuit required, see Figures 3, 4)				
ESD	IEC/EN61000-4-2, air ± 8 kV; contact ± 4 kV, class B				
MTBF	as per MIL-HDBK-217F, 25°C	3,500,000			hours
RoHS	yes				

## ENVIRONMENTAL

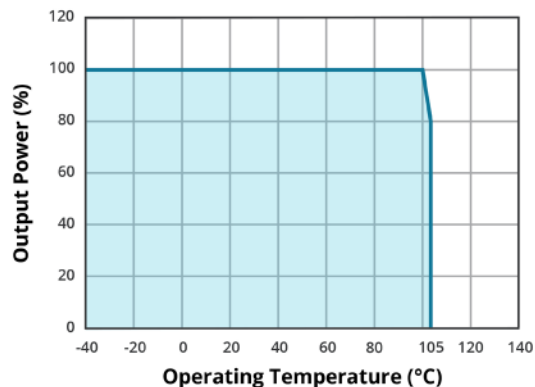
parameter	conditions/description	min	typ	max	units
operating temperature	see derating curves	-40		105	°C
storage temperature		-55		125	°C
storage humidity	non-condensing			95	%
case temperature rise	3.3 Vdc output model at 25°C all other models at 25°C		25 15		°C °C

## DERATING CURVES

**TEMPERATURE DERATING CURVE**  
3.3 Vdc input models

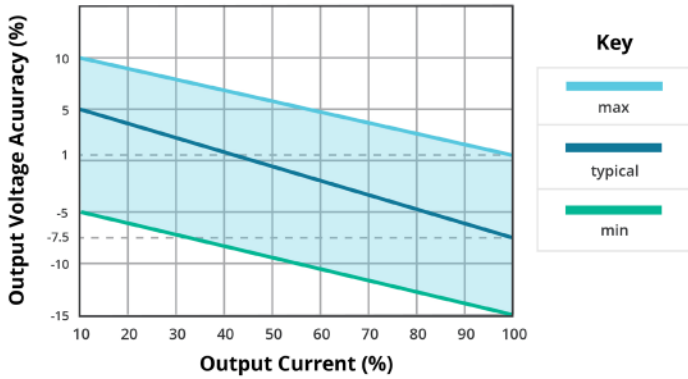


**TEMPERATURE DERATING CURVE**  
all other input models

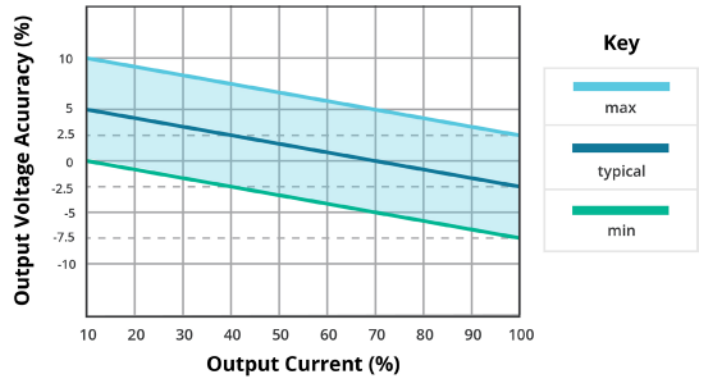


## DERATING CURVES (CONTINUED)

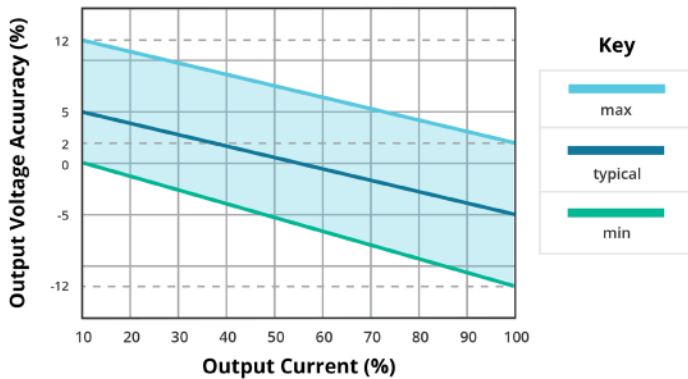
**OUTPUT REGULATION CURVE**  
3.3 Vdc input / 3.3 Vdc output  
(nominal input)



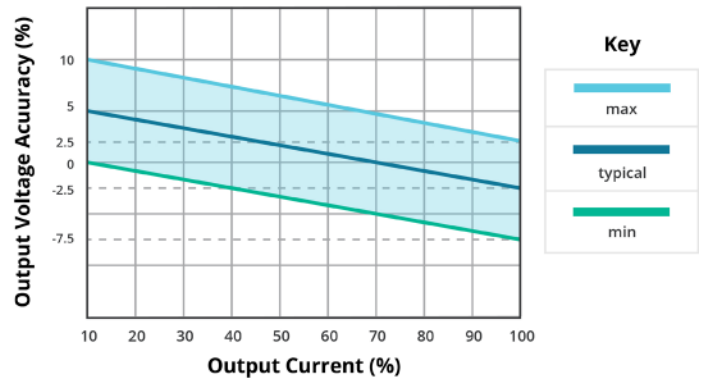
**OUTPUT REGULATION CURVE**  
3.3 Vdc input / all other output models  
(nominal input)



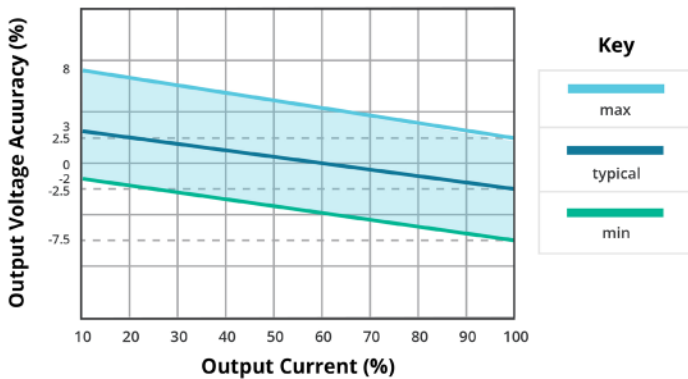
**OUTPUT REGULATION CURVE**  
5 Vdc input / 3.3 Vdc output model  
(nominal input)



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



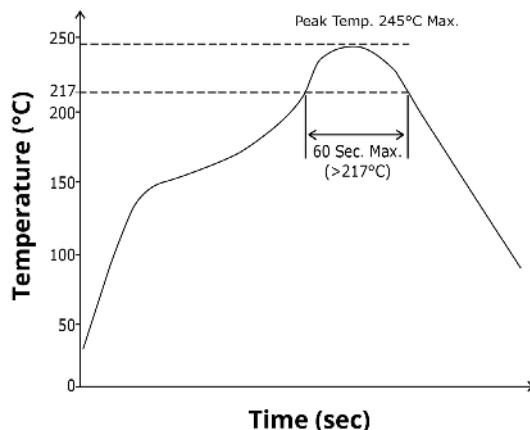
**OUTPUT REGULATION CURVE**  
all other input and output models  
(nominal input)



## SOLDERABILITY

parameter	conditions/description	min	typ	max	units
reflow soldering	see reflow soldering profile Maximum duration >217°C is 60 seconds. For actual application, refer to IPC/JEDEC J-STD-020D.1			245	°C

### WAVE SOLDERING PROFILE



## MECHANICAL

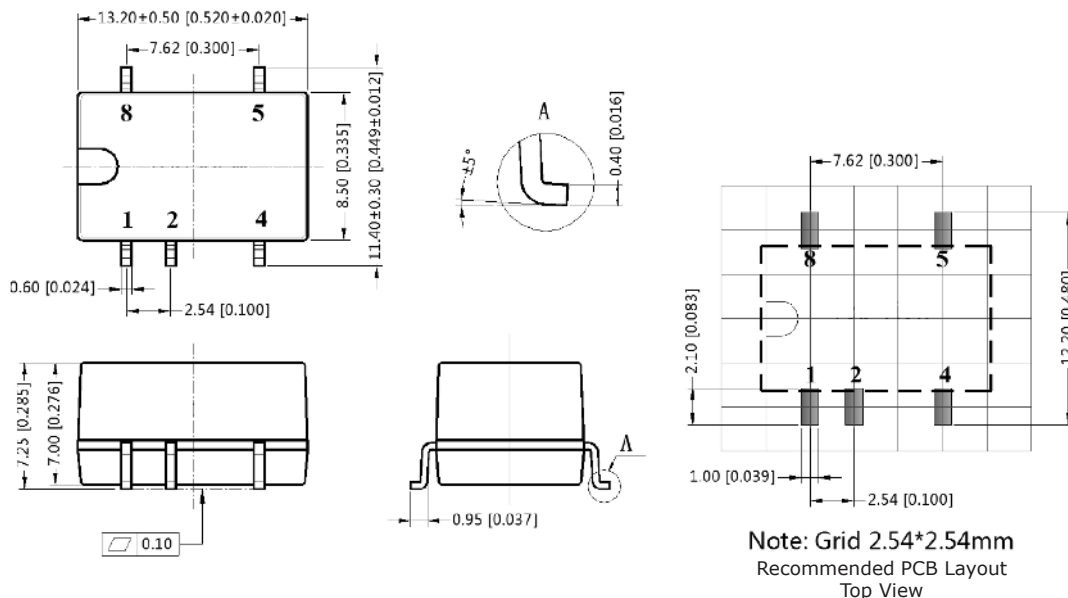
parameter	conditions/description	min	typ	max	units
dimensions	single output models: 13.20 x 11.40 x 7.25 [0.520 x 0.449 x 0.285 inch] dual output models: 15.24 x 11.40 x 7.25 [0.600 x 0.449 x 0.285 inch]				mm
case material	black flame-retardant and heat-resistant plastic (UL94V-0)				
weight			1.4		g

## MECHANICAL DRAWING (SINGLE OUTPUT)

units: mm [inch]  
tolerance: ±0.25[±0.010]  
pin section tolerance: ±0.10[±0.004]

PIN CONNECTIONS	
PIN	Function
1	GND
2	Vin
4	0V
5	+Vout
8	NC

NC = No connect

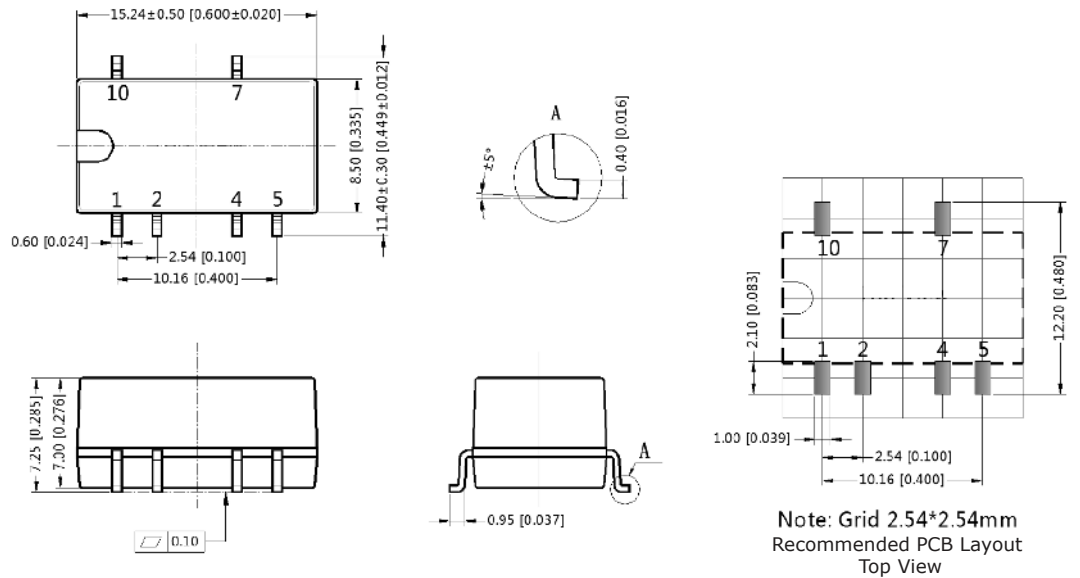


## MECHANICAL DRAWING (DUAL OUTPUT)

units: mm [inch]  
 tolerance:  $\pm 0.25[\pm 0.010]$   
 pin section tolerance:  $\pm 0.10[\pm 0.004]$

PIN CONNECTIONS	
PIN	Function
1	GND
2	Vin
4	0V
5	-Vout
7	+Vout
10	NC

NC = No connect

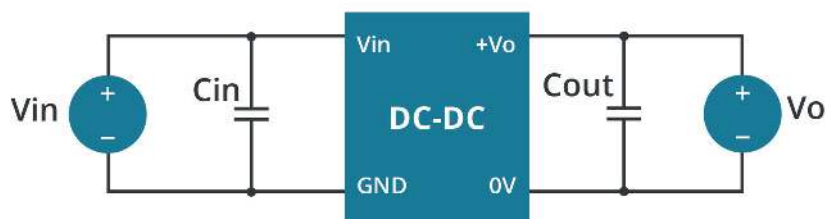


Note: Grid 2.54\*2.54mm  
 Recommended PCB Layout  
 Top View

## APPLICATION CIRCUIT

If you want to further reduce the input and output ripple, a filter capacitor may be connected to the input and output terminals (Figures 1 & 2) provided that the capacitance is less than the maximum capacitive load of the model, otherwise start-up problems may be caused if the capacitance is too large.

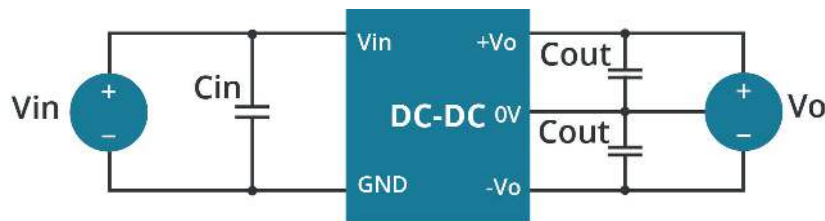
**Figure 1**  
Single Output Models



**Table 1**

Vin (Vdc)	Cin (μF / V)	Vo (Vdc)	Co (μF / V)
3.3	4.7 μF / 16 V	3.3	10 μF / 16 V
		5	10 μF / 16 V
		9	4.7 μF / 16 V
		12	2.2 μF / 16 V
		15	1 μF / 25 V
		24	0.47 μF / 50 V
5	4.7 μF	3.3, 5	10 μF
		9	4.7 μF
		12	2.2 μF
		15	1.0 μF
		24	0.47 μF
12	2.2 μF / 25 V	5	10 μF / 16 V
15	2.2 μF / 25 V	9	2.2 μF / 16 V
24	1 μF / 50 V	12	2.2 μF / 25 V
--	--	15	1 μF / 25 V
--	--	24	1 μF / 50 V

**Figure 2**  
Dual Output Models



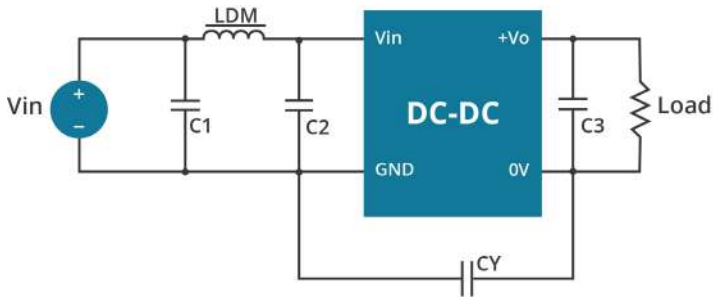
**Table 2**

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

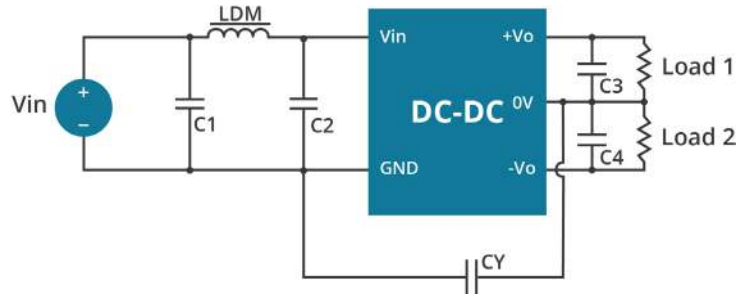


## EMC RECOMMENDED CIRCUIT

**Figure 3**  
Single Output Models



**Figure 4**  
Dual Output Models



**Table 3**

Recommended External Circuit Components				
Vin (Vdc)	Vo (Vdc)	3.3, 5, 9	12, 15, 24	±5, ±9, ±12, ±15, ±24
3.3	C1, C2	4.7 μF / 16 V		-
	C3	refer to the Co in Tables 1		-
	CY	270 μF / 4 kVdc		-
	LDM	6.8 μH		-
5	C1, C2	4.7 μF / 25 V	4.7 μF / 25 V	4.7 μF / 50 V
	C3	refer to the Co in Tables 1, 2		
	CY	--	1 nF / 4 kVdc	270 pF / 3 kV
	LDM	6.8 μH	6.8 μH	6.8 μH
12, 15, 24	C1	4.7 μF / 50 V		
	C2	4.7 μF / 50 V		
	CY	270 μF / 2 kVdc		
	C3, C4	refer to the Co in Tables 1, 2		
	LDM	6.8 μH		

## REVISION HISTORY

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rev.	description	date
1.0	initial release	05/10/2019
1.01	safeties updated in features and safety line, packaging removed	01/14/2021
1.02	model table updated	03/29/2021
1.03	product image updated	04/20/2021
1.04	derating curves and circuit figures updated	07/07/2021
1.05	3.3 Vdc input models added to specification	06/21/2022
1.06	CE certification updated	11/11/2022

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



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