

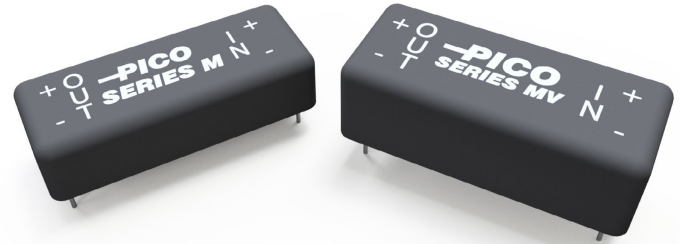
Series M & MV

1.25W Isolated Proportional Low Profile DC-DC Converter

PICO
Electronics, Inc.

PRODUCT OVERVIEW

The M & MV series are unregulated DC-DC converters with upgraded MIL screened / qualified components and expanded operating temperature range. The epoxy insulated shielded case is in an ultra-miniature encapsulated package – as small as 1.250" x 0.500" x 0.300". Over 100 models are available in both single and dual isolated outputs as well as high output voltages - up to 500V. They can operate over the wide temperature range of -55°C to +85°C without derating, a heat sink or active cooling.



FEATURES

- JANTX Diodes
- MIL screened transformers, capacitors and resistors
- Hermetically sealed transistors
- Up to 1.25W output at +85°C ambient
- Encapsulated semiconductors, conservatively rated for maximum reliability
- Ultra-miniature size – down to 0.300" height
- 5 to 48V input models
- Up to 500V output models
- Up to 1000VDC isolation at 100MΩ
- Five-sided or six-sided shielded case
- Single and dual isolated output
- No heat sink or derating required

Contact Pico for part number of available options:

- Select screening per MIL-STD-883:
Stabilization Bake
Temperature Cycle
Burn-In
- Special Input Voltage, Output Voltage, Isolation Voltage or Output Power
- Tighter output voltage tolerances

5	M	5	S
NOM. INPUT VOLTAGE	Series Name	NOM. OUTPUT VOLTAGE	NUMBER OF OUTPUTS
5 = 5V 12 = 12V 15 = 15V 24 = 24V 28 = 28V	M	3.3 = 3.3V 5 = 5V 5.2 = 5.2V 9 = 9V 12 = 12V 15 = 15V 24 = 24V 28 = 28V 48 = 48V	S = SINGLE D = DUAL
5 = 5V 12 = 12V 15 = 15V 24 = 24V 28 = 28V	MV	100 = 100V 150 = 150V 200 = 200V 250 = 250V 300 = 300V 350 = 350V 400 = 400V 450 = 450V 500 = 500V	S = SINGLE

MODEL LIST

SERIES M, SINGLE OUTPUT

Through Hole	Input Voltage [VDC]	Output Voltage [VDC]	Output Current		Efficiency ⁽¹⁾ [%] typ.	Input Current		Output Ripple ⁽²⁾ [Vp-p max]	Output Voltage Tolerance ⁽¹⁾ [±VDC]
			Min. [mA]	Max. [mA]		No Load [mA] typ.	Full Load [mA] typ.		
5M3.3S	5	3.3	0	303	60	80	333	0.2	0.2
5M5S		5		200	65	65	308	0.2	0.25
5M5.2S		5.2		192	65	65	308	0.2	0.25
5M9S		9		139	71	80	352	0.15	0.3
5M12S		12		104	74	80	338	0.15	0.4
5M15S		15		83	74	90	338	0.12	0.4
5M24S		24		52	77	90	325	0.1	0.5
5M28S		28		45	76	90	329	0.1	0.5
5M48S		48		26	77	90	325	0.1	1
12M3.3S		12		3.3	303	60	40	139	0.2
12M5S	5			200	67	40	124	0.15	0.25
12M5.2S	5.2			192	67	40	124	0.15	0.25
12M9S	9			139	74	40	141	0.15	0.3
12M12S	12			104	76	40	137	0.12	0.4
12M15S	15			83	76	40	137	0.12	0.4
12M24S	24			52	78	40	134	0.08	0.5
12M28S	28			45	80	40	130	0.08	0.5
12M48S	48	26		80	40	130	0.08	1	
15M3.3S	15	3.3		303	60	35	111	0.2	0.2
15M5S		5		200	67	35	100	0.15	0.25
15M5.2S		5.2	192	67	35	100	0.15	0.25	
15M9S		9	139	74	35	113	0.15	0.3	
15M12S		12	104	76	35	110	0.12	0.4	
15M15S		15	83	76	35	110	0.12	0.4	
15M24S		24	52	78	35	107	0.08	0.5	
15M28S		28	45	80	35	104	0.08	0.5	
15M48S	48	26	80	35	104	0.08	1		
24M3.3S	24	3.3	303	60	16	69	0.2	0.2	
24M5S		5	200	67	13	62	0.15	0.25	
24M5.2S		5.2	192	67	13	62	0.15	0.25	
24M9S		9	139	74	15	70	0.15	0.3	
24M12S		12	104	75	15	69	0.1	0.4	
24M15S		15	83	78	15	67	0.1	0.4	
24M24S		24	52	82	15	64	0.1	0.5	
24M28S		28	45	79	15	66	0.1	0.5	
24M48S	48	26	80	16	65	0.07	1		

Note 1: Tested at nominal input voltage and full output load.

Note 2: 10µF, 75V high quality low ESR capacitor is required across the output.

MODEL LIST

SERIES M, SINGLE OUTPUT

Through Hole	Input Voltage [VDC]	Output Voltage [VDC]	Output Current		Efficiency ⁽¹⁾ [%] typ.	Input Current		Output Ripple ⁽²⁾ [Vp-p max]	Output Voltage Tolerance ⁽¹⁾ [±VDC]
			Min. [mA]	Max. [mA]		No Load [mA] typ.	Full Load [mA] typ.		
28M3.3S	28	3.3	0	303	60	15	59	0.2	0.2
28M5S		5		200	68	12	53	0.15	0.25
28M5.2S		5.2		192	68	12	53	0.15	0.25
28M9S		9		139	76	14	59	0.15	0.3
28M12S		12		104	78	14	57	0.12	0.4
28M15S		15		83	79	14	57	0.1	0.4
28M24S		24		52	81	14	55	0.09	0.5
28M28S		28		45	81	14	55	0.09	0.5
28M48S		48		26	80	15	56	0.09	1

Note 1: Tested at nominal input voltage and full output load.

Note 2: 10µF, 75V high quality low ESR capacitor is required across the output.

SERIES M, DUAL OUTPUT

Through Hole	Input Voltage [VDC]	Output Voltage Per Output [VDC]	Output Current Per Output		Efficiency ⁽¹⁾ [%] typ.	Input Current		Output Ripple Per Output ⁽³⁾ [Vp-p max]	Output Voltage Tolerance Per Output ⁽¹⁾ [±VDC]
			Min. [mA]	Max. [mA]		No Load [mA] typ.	Full Load [mA] typ.		
5M5D	5	5	0	100	65	65	308	0.2	0.25
5M9D		9		69	71	80	352	0.15	0.3
5M12D		12		52	74	80	338	0.15	0.4
5M15D		15		42	74	90	338	0.12	0.4
5M24D		24		26	77	90	325	0.1	0.5
5M28D		28		22	76	90	329	0.1	0.5
5M48D		48		13	77	90	325	0.1	1
12M5D	12	5	0	100	67	40	124	0.15	0.25
12M9D		9		69	74	40	141	0.15	0.3
12M12D		12		52	76	40	137	0.12	0.4
12M15D		15		42	76	40	137	0.12	0.4
12M24D		24		26	78	40	134	0.08	0.5
12M28D		28		22	80	40	130	0.08	0.5
12M48D		48		13	80	40	130	0.05	1
15M5D	15	5	0	100	67	35	100	0.15	0.25
15M9D		9		69	74	35	113	0.15	0.3
15M12D		12		52	76	35	110	0.12	0.4
15M15D		15		42	76	35	110	0.12	0.4
15M24D		24		26	78	35	107	0.08	0.5
15M28D		28		22	80	35	104	0.08	0.5
15M48D		48		13	80	35	104	0.05	1

Note 1: Tested at nominal input voltage and full output load.

Note 3: 10µF, 75V high quality low ESR capacitor is required across each output.

MODEL LIST

SERIES M, DUAL OUTPUT

Through Hole	Input Voltage [VDC]	Output Voltage Per Output [VDC]	Output Current Per Output		Efficiency ⁽¹⁾ [%] typ.	Input Current		Output Ripple Per Output ⁽³⁾ [Vp-p max]	Output Voltage Tolerance Per Output ⁽¹⁾ [±VDC]
			Min. [mA]	Max. [mA]		No Load [mA] typ.	Full Load [mA] typ.		
24M5D	24	5	0	100	67	13	62	0.15	0.25
24M9D		9		69	74	15	70	0.15	0.3
24M12D		12		52	75	15	69	0.1	0.4
24M15D		15		42	78	15	67	0.1	0.4
24M24D		24		26	82	15	64	0.1	0.5
24M28D		28		22	79	15	66	0.1	0.5
24M48D		48		13	80	16	65	0.07	1
28M5D	28	5		100	68	12	53	0.15	0.25
28M9D		9		69	76	14	59	0.15	0.3
28M12D		12		52	78	14	57	0.12	0.4
28M15D		15		42	79	14	57	0.1	0.4
28M24D		24		26	81	14	55	0.09	0.5
28M28D		28		22	81	14	55	0.09	0.5
28M48D		48		13	80	15	56	0.09	1

Note 1: Tested at nominal input voltage and full output load.

Note 3: 10µF, 75V high quality low ESR capacitor is required across each output.

SERIES MV

Through Hole	Input Voltage [VDC]	Output Voltage [VDC]	Output Current		Efficiency ⁽¹⁾ [%] typ.	Input Current ⁽¹⁾ [mA] typ.	Output Ripple ⁽⁴⁾ [Vp-p max]	Output Voltage Tolerance ⁽¹⁾ [±VDC]
			Min. ⁽⁵⁾ [mA]	Max. [mA]				
5MV100	5	100	1.25	12.5	78	321	0.9	3
5MV150		150	0.83	8.3	76	329	0.9	4.5
5MV200		200	0.625	6.25	75	333	0.9	6
5MV250		250	0.5	5	75	333	0.9	7.5
5MV300		300	0.416	4.16	70	357	1.2	9
5MV350		350	0.357	3.57	70	357	1.2	10.5
5MV400		400	0.312	3.12	70	357	1.2	12
5MV450		450	0.277	2.77	70	357	1.5	13.5
5MV500		500	0.25	2.5	70	357	1.5	15
12MV100	12	100	1.25	12.5	80	130	0.9	3
12MV150		150	0.83	8.3	79	132	0.9	4.5
12MV200		200	0.625	6.25	78	134	0.9	6
12MV250		250	0.5	5	75	139	0.9	7.5
12MV300		300	0.416	4.16	75	139	1.2	9
12MV350		350	0.357	3.57	75	139	1.2	10.5
12MV400		400	0.312	3.12	75	139	1.2	12
12MV450		450	0.277	2.77	75	139	1.5	13.5
12MV500		500	0.25	2.5	75	139	1.5	15

MODEL LIST

SERIES MV

Through Hole	Input Voltage [VDC]	Output Voltage [VDC]	Output Current		Efficiency ⁽¹⁾ [%] typ.	Input Current ⁽¹⁾ [mA] typ.	Output Ripple ⁽⁴⁾ [Vp-p max]	Output Voltage Tolerance ⁽¹⁾ [±VDC]
			Min. ⁽⁵⁾ [mA]	Max. [mA]				
15MV100	15	100	1.25	12.5	80	104	0.9	3
15MV150		150	0.83	8.3	79	105	0.9	4.5
15MV200		200	0.625	6.25	78	107	0.9	6
15MV250		250	0.5	5	75	111	0.9	7.5
15MV300		300	0.416	4.16	75	111	1.2	9
15MV350		350	0.357	3.57	75	111	1.2	10.5
15MV400		400	0.312	3.12	75	111	1.2	12
15MV450		450	0.277	2.77	75	111	1.5	13.5
15MV500		500	0.25	2.5	75	111	1.5	15
24MV100	24	100	1.25	12.5	76	69	0.9	3
24MV150		150	0.83	8.3	73	71	0.9	4.5
24MV200		200	0.625	6.25	73	71	0.9	6
24MV250		250	0.5	5	70	74	0.9	7.5
24MV300		300	0.416	4.16	73	71	1.2	9
24MV350		350	0.357	3.57	73	71	1.2	10.5
24MV400		400	0.312	3.12	73	71	1.2	12
24MV450		450	0.277	2.77	73	71	1.5	13.5
24MV500		500	0.25	2.5	73	71	1.5	15
28MV100	28	100	1.25	12.5	75	60	0.9	3
28MV150		150	0.83	8.3	76	59	0.9	4.5
28MV200		200	0.625	6.25	75	60	0.9	6
28MV250		250	0.5	5	70	64	0.9	7.5
28MV300		300	0.416	4.16	73	61	1.2	9
28MV350		350	0.357	3.57	73	61	1.2	10.5
28MV400		400	0.312	3.12	73	61	1.2	12
28MV450		450	0.277	2.77	73	61	1.5	13.5
28MV500		500	0.25	2.5	73	61	1.5	15

Note 1: Tested at nominal input voltage and full output load.

Note 4: 0.1µF, 1kV capacitor is required across the output.

Note 5: Maintain minimum 10% of rated load to prevent a voltage surge.

SPECIFICATIONS (Nominal V_{IN} , Full Load, $T_A = +25^\circ\text{C}$, 1 hour warm up unless otherwise specified)
INPUT

Parameter	Condition		Min.	Typ.	Max.	Units
Input Voltage Range	5V input models	Series M	4	5	6.5	VDC
		Series MV	4.5	5	5.5	
	9V input models	Series M	9	12	15	
		Series MV	10.8	12	13.2	
	15V input models	Series M	12	15	18	
		Series MV	13.5	15	16.5	
	24V input models	Series M	17	24	28	VDC
		Series MV	21.6	24	26.4	
	28V input models	Series M	21	28	32	
		Series MV	25.2	28	30.8	
48V input models	Series M	25	48	50		
	Series MV	43.2	48	52.8		

OUTPUT

Parameter	Condition		Min.	Typ.	Max.	Units
Line Regulation	Output voltage is directly proportional to input voltage					
Output Power	Series M	$\leq 5.2\text{V}$ output models	-	-	1	W
		All other output models	-	-	1.25	
	Series MV		0.125	-	1.25	

ENVIRONMENTAL

Parameter	Condition	Min.	Typ.	Max.	Units
Operating Temperature Range	Ambient without derating	-55	-	+85	$^\circ\text{C}$
Storage Temperature Range	Ambient	-55	-	+125	$^\circ\text{C}$
Temperature Coefficient	$\leq 9\text{V}$ output models	-	0.05	-	$\%/\text{C}$
	All other output models	-	0.02	-	
Cooling	Free Air Convection				

GENERAL

Parameter	Condition	Min.	Typ.	Max.	Units
Isolation Voltage	Series M	500	-	-	VDC
	Series MV	1000	-	-	
Insulation Resistance		100	-	-	$\text{M}\Omega$
Switching Frequency		20	-	40	kHz
Size (L x W x H)	Series M	1.25 x 0.5 x 0.3 (31.75 x 12.7 x 7.62)			inches (mm)
	Series MV	1.25 x 0.55 x 0.4 (31.75 x 13.97 x 10.16)			
Weight	Series M	-	9	-	grams
	Series MV	-	10.5	-	
Case	Series M	5-Sided Epoxy Insulated Metal			
	Series MV	6-Sided Epoxy Insulated Metal			
Potting	Vacuum Impregnated Epoxy				
Box Packaging (W x L x H)	4.8 x 3.25 x 1.15 (121.92 x 82.55 x 29.21)				inches (mm)

SPECIFICATIONS (Nominal V_{IN} , Full Load, $T_A = +25^\circ\text{C}$, 1 hour warm up unless otherwise specified)

UPGRADED MILITARY QUALIFIED COMPONENTS

Component	Standard
Diodes	JANTX
Transformers	MIL-PRF-27, Class S, Grade 5
Capacitors	MIL-C-39003, S Level, MIL-C-55681, S Level
Resistors	MIL-R-39008, S Level, MIL-PRF-39017, S Level
Transistors	Hermetically Sealed, Screened per MIL-S-19500, Table II, JAN TX

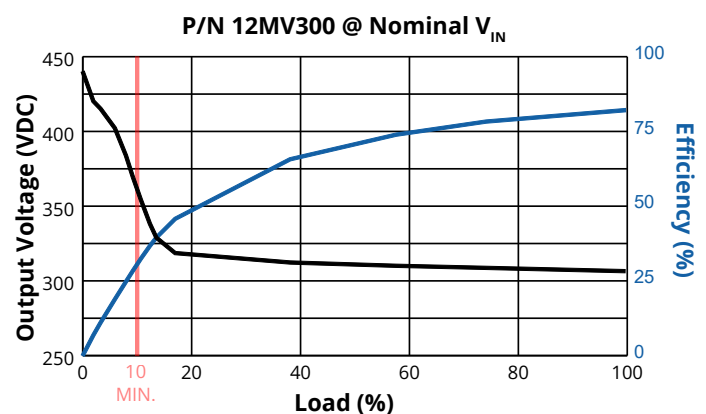
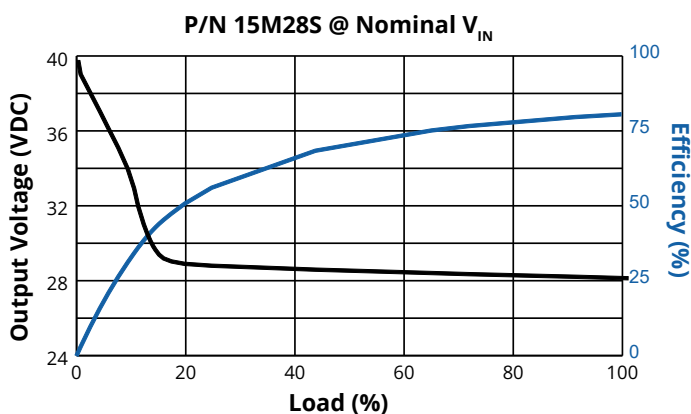
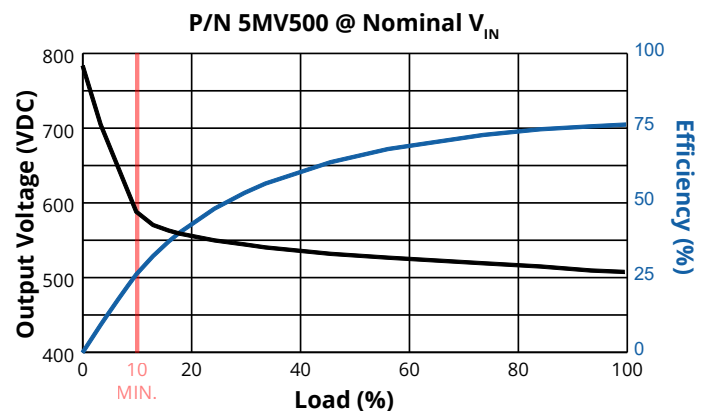
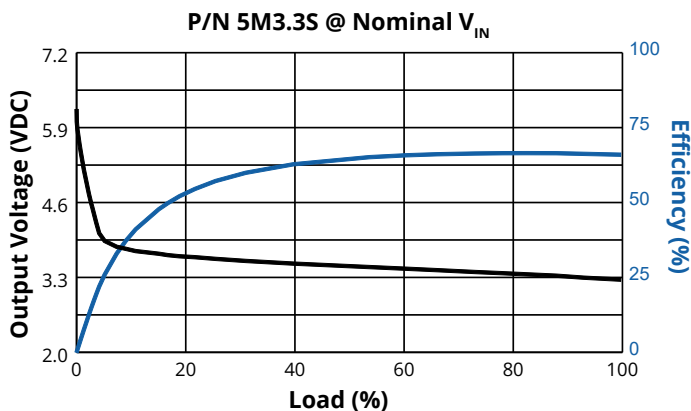
DESIGNED TO MEET

Test	Referenced Standard	Description
Vibration	MIL-STD-202	Method 204, Vibration, High Frequency, Condition D
Shock	MIL-STD-202	Method 213, Shock (Specified Pulse), Condition I
Humidity	MIL-STD-202	Method 106, Moisture Resistance
Altitude	MIL-STD-202	Method 105, Barometric Pressure (Reduced), Condition D

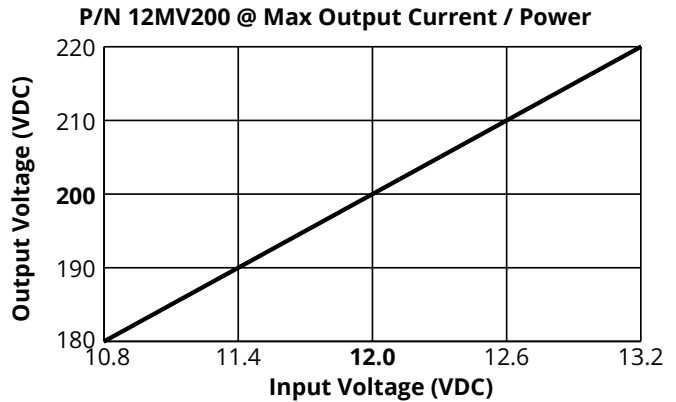
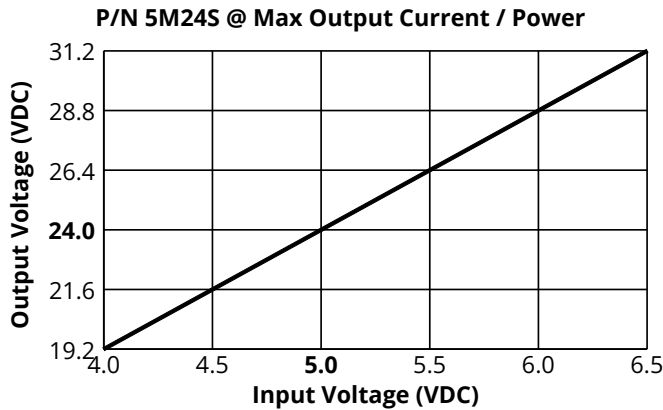
OPTIONS AVAILABLE - CONTACT PICO FOR PART NUMBER

Parameter	Referenced Standard	Description
Stabilization Bake	MIL-STD-883	Referenced Method 1008 Non-operating maximum storage temperature for 24 hours
Temperature Cycle	MIL-STD-883	Referenced Method 1010 Non-operating at temperature extremes, 15 mins/temp, 10 cycles
Burn-In	MIL-STD-883	Referenced Method 1015 Max operating temperature for 160 hours

DATA CURVES (Nominal V_{IN} , $T_A = +25^\circ\text{C}$, 1 hour warm up unless otherwise specified)

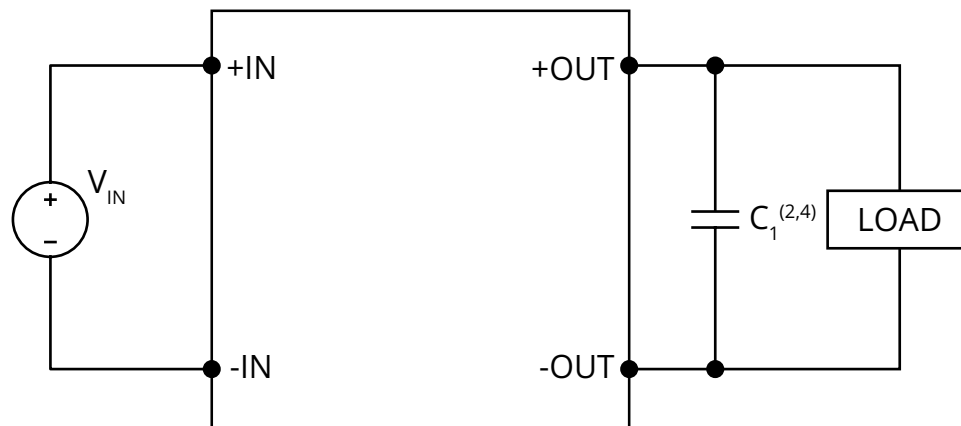


DATA CURVES (Nominal V_{IN} , $T_A = +25^\circ\text{C}$, 1 hour warm up unless otherwise specified)



TYPICAL CONNECTION CIRCUIT

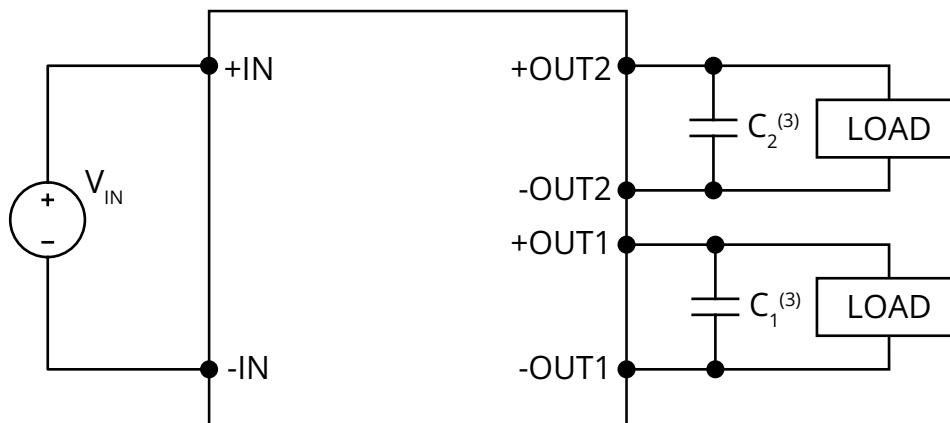
SINGLE OUTPUTS



Note 2: For Series M, a $10\mu\text{F}$, 75V high quality low ESR capacitor is required across the output.

Note 4: For Series MV, a $0.1\mu\text{F}$, 1kV capacitor is required across the output.

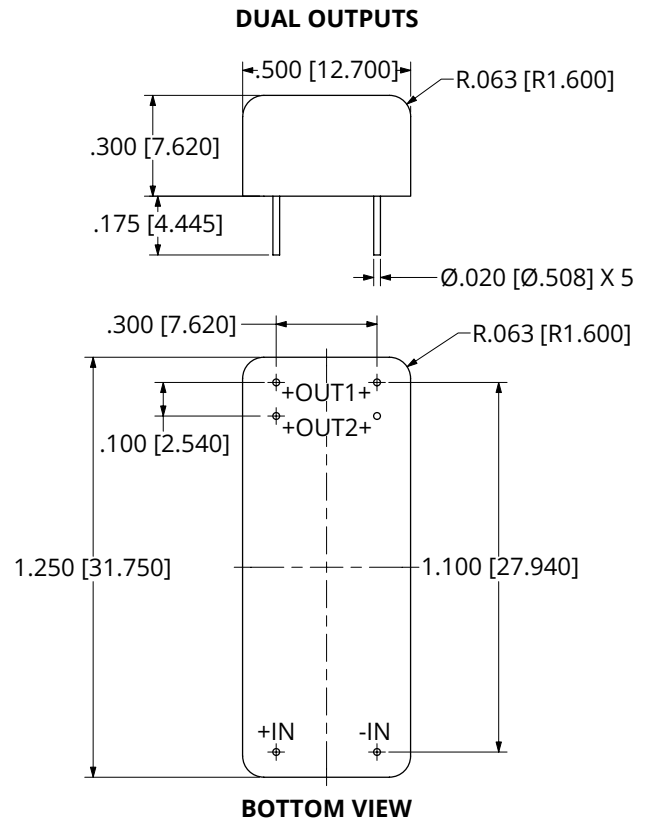
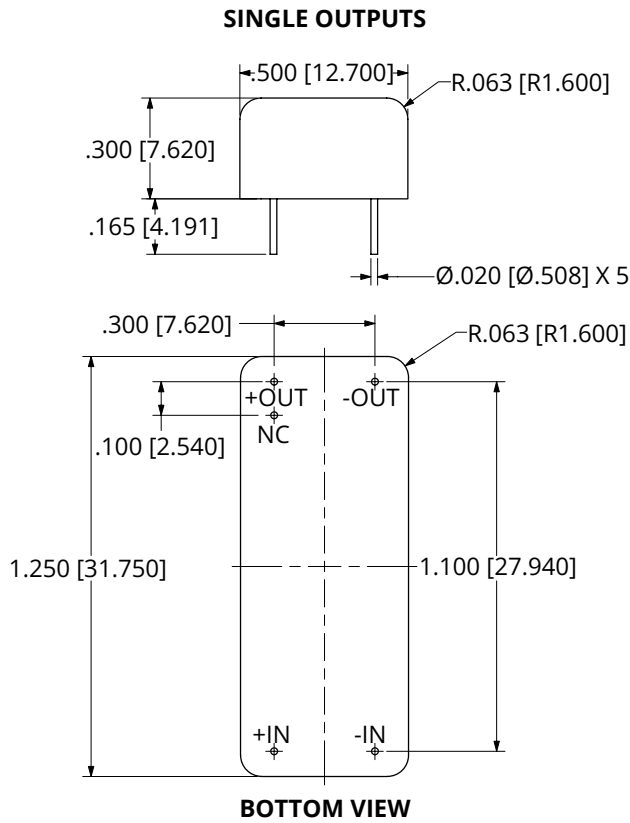
DUAL OUTPUTS



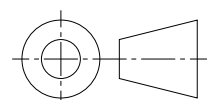
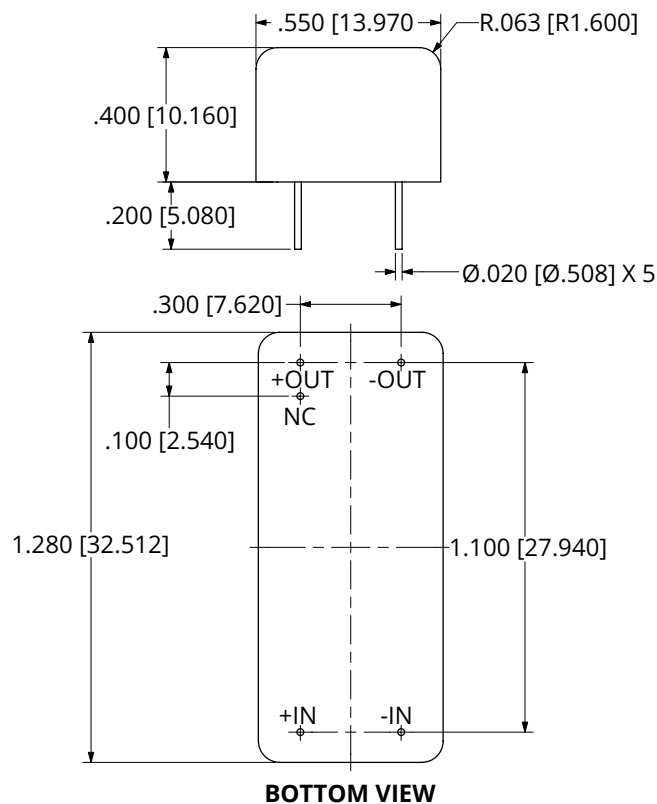
Note 3: For Series M, a $10\mu\text{F}$, 75V high quality low ESR capacitor is required across each output.

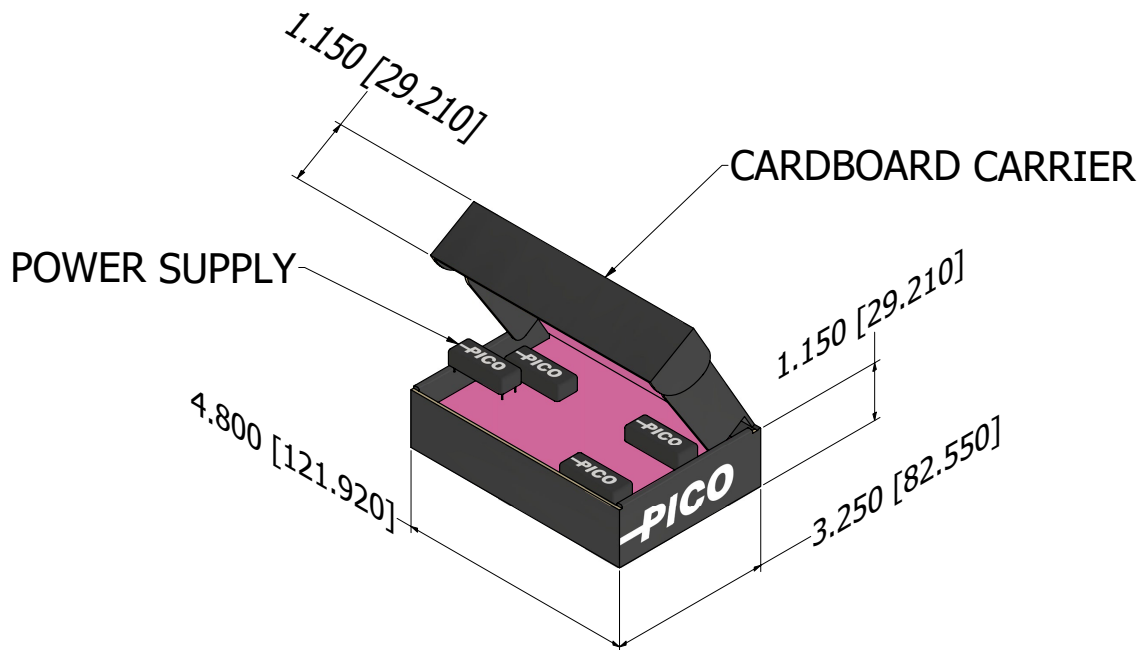
MECHANICAL DRAWINGS

SERIES M



SERIES MV





Pico warrants each product manufactured by us and sold by us or an authorized representative, to be free from defects in material and workmanship. If properly used, it will perform within its applicable specifications for a period of one year after original shipment. Pico's obligation under this guarantee is limited to repairing or replacing our product to the original purchaser. This warranty is in lieu of all other warranties, express or implied and constitutes fulfillment of our obligations to the purchaser. We do not guarantee that the products can be used for a particular purpose other than those solely covered by the product's specifications. Pico must be notified if the product must meet particular certifications and/or standards. We assume no liability, in any event, for consequential damages, for anticipated or lost profits, incidental damages or loss of time or other losses incurred by the purchaser or any third party in connection with products covered by this warranty or otherwise. The purchaser will indemnify and hold Pico harmless for any damages, losses, costs, etc. from usage not within the product's specifications. Pico must be consulted before usage of its products in a nuclear, radioactive or space environment.

We reserve the right to discontinue products without notice, We reserve the right to make modifications to any existing catalog products without notice, at any time, without the obligation to modify units previously sold.