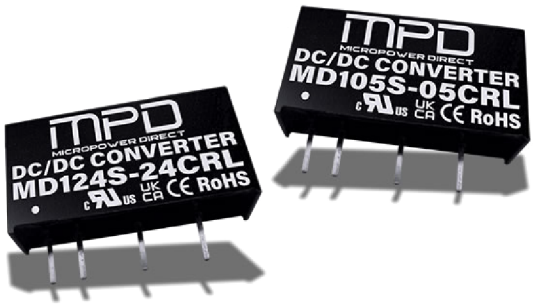
MD100CRL

1W, Miniature, Isolated SIP DC/DC Converters



Key Features:

- 1W Output Power
- Miniature SIP Package
- Efficiency to 85%
- 1500 VDC Isolation Voltage
- –40°C to +105°C Temp
- MTBF >3.5 Million Hours
- Single Output
- Short Circuit Protection
- Industry Standard Pin-Out

Electrical Specifications

Typical @ +25°C, nominal input voltage & rated output load unless noted. Subject to change without notice.

INPUT

Parameter	Conditions	Min.	Typ.	Max.	Units
Input Voltage Range	3.3 VDC Input	2.97	3.3	3.63	VDC
	5 VDC Input	4.5	5	5.5	
	12 VDC Input	10.8	12	13.2	
	15 VDC Input	13.5	15	16.5	
	24 VDC Input	21.6	24	26.4	
Reflected Ripple Current	—	—	15	—	mA
Surge Voltage, 1 s max.	3.3 VDC Input	–0.7	—	5	VDC
	5 VDC Input	–0.7	—	9	
	12 VDC Input	–0.7	—	18	
	15 VDC Input	–0.7	—	21	
	24 VDC Input	–0.7	—	30	
Input Filter	Capacitance Filter				—
Hot Plug	Not Available				—

OUTPUT

Parameter	Conditions		Min.	Typ.	Max.	Units
Output Voltage Accuracy	See Output Regulation Curves (Page 3)					—
Line Regulation	Input Voltage Variation ±1%	3.3 Vout	—	—	±1.5	%
		Other Output	—	—	±1.2	
Load Regulation, Note 1	See Load Regulation Table (Page 2)					%
Ripple & Noise, Note 2	20 MHz Bandwidth	Other Output	—	30	75	mVp-p
		24 VDC Output	—	50	100	
Temperature Coefficient	Full Load		—	±0.02	—	%/°C
Short-Circuit Protection	Continuous, Self-Recovery					—

GENERAL

Parameter	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage	Input – Output, 60 s, leakage < 1 mA	1,500	—	—	VDC
Insulation Resistance	500 VDC	1,000	—	—	MΩ
Isolation Capacitance	100 kHz / 0.1 V	—	20	—	pF
Switching Frequency	3.3 VDC Input	—	220	—	kHz
	5 VDC Input	—	270	—	
	12 / 15 / 24 VDC Input	—	260	—	
Operating Temperature	5 VDC Input — Derate when Ta ≥ 85°C	–40	—	+105	°C
	Other Inputs — Derate when Ta ≥ 100°C	–40	—	+105	
Storage Temperature	—	–55	—	+125	°C
Case Temperature Rise	Ta = 25°C, full load	—	25	—	°C
Cooling	Free Air Convection				—
Storage Humidity	5 – 95 %RH, Non-Condensing				%RH
Vibration	12 / 15 / 24 VDC Input	10 – 150 Hz, 5 G, 0.75 mm along X, Y, Z			—
Case Size	0.774 × 0.236 × 0.400 in [19.65 × 6.00 × 10.16 mm]				—
Case Material	Black Plastic, UL 94V-0, Flame- & Heat-Resistant				—
Weight	2.1 g [0.074 oz] (Typ.)				—

RELIABILITY

Parameter	Conditions	Min.	Typ.	Max.	Units
MTBF	MIL-HDBK-217F @ 25°C	3,500	—	—	kHrs
Pin Soldering	1.5 mm from case, 10 s	—	—	300	°C
Safety Standards	UL 62368-1, EN 62368-1, BS EN 62368-1 (See Selection Guide)				—

EMI CHARACTERISTICS

Parameter	Conditions	Criteria	Level
Radiated Emissions	CISPR / EN 55032	—	Class B
Conducted Emissions	CISPR / EN 55032	—	Class B
ESD	IEC / EN 61000-4-2	B	±8 kV Air, ±6 kV Contact

MicroPower Direct

46 Eastman Street, Unit 1
Easton, MA 02375 USA

T: (781) 344-8226
E: sales@micropowerdirect.com
W: www.micropowerdirect.com

MICROPOWER DIRECT

Model Selection Guide

UL	Model Number	Input				Output			Full-Load Efficiency (%, Typ.)	Reflected Ripple Current (mA, Typ.)	Capacitive Load (µF Max.) Note 3
		Nominal (VDC)	Range (VDC)	Full-Load (mA, Typ.)	No-Load (mA, Typ.)	Voltage (VDC)	Current (mA, Max.)	Current (mA, Min.)			
	MD103S-03CRL	3.3	2.97 - 3.63	384	10	3.3	303	30	79	15	2400
	MD103S-05CRL	3.3	2.97 - 3.63	370	18	5	200	20	82	15	2400
	MD103S-09CRL	3.3	2.97 - 3.63	370	18	9	111	11	85	15	1000
	MD103S-12CRL	3.3	2.97 - 3.63	370	18	12	83	8	82	15	560
	MD103S-15CRL	3.3	2.97 - 3.63	370	18	15	67	7	82	15	560
	MD103S-24CRL	3.3	2.97 - 3.63	370	18	24	42	4	84	15	220
	MD105S-03CRL	5	4.5 - 5.5	270	8	3.3	303	30	74	15	2400
●	MD105S-05CRL	5	4.5 - 5.5	244	8	5	200	20	82	15	2400
	MD105S-09CRL	5	4.5 - 5.5	241	12	9	111	12	83	15	1000
	MD105S-12CRL	5	4.5 - 5.5	241	12	12	84	9	83	15	560
	MD105S-15CRL	5	4.5 - 5.5	241	18	15	67	7	83	15	560
	MD105S-24CRL	5	4.5 - 5.5	241	18	24	42	4	85	15	220
	MD112S-03CRL	12	10.8 - 13.2	105	8	3.3	303	30	75	15	2400
●	MD112S-05CRL	12	10.8 - 13.2	105	8	5	200	20	80	15	2400
●	MD112S-09CRL	12	10.8 - 13.2	105	8	9	111	12	80	15	1000
	MD112S-12CRL	12	10.8 - 13.2	105	8	12	83	9	80	15	560
	MD112S-15CRL	12	10.8 - 13.2	105	8	15	67	7	81	15	560
	MD112S-24CRL	12	10.8 - 13.2	105	8	24	42	5	81	15	220
	MD115S-05CRL	15	13.5 - 16.5	84	8	5	200	20	80	15	2400
	MD115S-09CRL	15	13.5 - 16.5	84	8	9	111	12	80	15	1000
	MD115S-12CRL	15	13.5 - 16.5	84	8	12	83	9	80	15	560
	MD115S-15CRL	15	13.5 - 16.5	84	8	15	67	7	81	15	560
	MD115S-24CRL	15	13.5 - 16.5	84	8	24	42	5	81	15	220
	MD124S-03CRL	24	21.6 - 26.4	56	8	3.3	303	30	75	15	2400
●	MD124S-05CRL	24	21.6 - 26.4	53	8	5	200	20	79	15	2400
	MD124S-09CRL	24	21.6 - 26.4	53	8	9	111	12	80	15	1000
	MD124S-12CRL	24	21.6 - 26.4	52	8	12	83	9	81	15	560
	MD124S-15CRL	24	21.6 - 26.4	52	8	15	67	7	81	15	560
●	MD124S-24CRL	24	21.6 - 26.4	52	8	24	42	4	81	15	220

● *Models with cURus / UL 62368-1 recognition. All models comply with EN 62368-1 / BS EN 62368-1 and are RoHS compliant. Contact factory for the safety-standard status of other models.*

Load Regulation

Input	Output	Condition	Typ. (±%)	Max. (±%)
3.3 VDC Input	3.3 Vout	10% – 100% Load	12	18
	Other Outputs		8	15
5 VDC Input	3.3 Vout	10% – 100% Load	15	20
	5 Vout		10	15
	9 Vout		8	10
	12 Vout		7	10
	15 Vout		6	10
	24 Vout		5	10
12 / 15 / 24 VDC Input	3.3 Vout	10% – 100% Load	8	20
	5 Vout		5	15
	9 / 12 / 15 Vout		3	10
	24 Vout		2	10

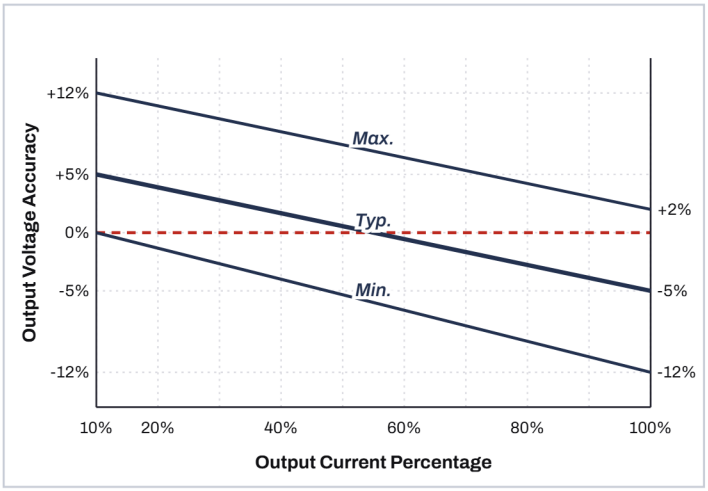
Notes

1. Load regulation is measured over 10% – 100% load and varies with the input / output combination; refer to the Load Regulation table above for the per-combination values.
2. Output ripple & noise are measured at 20 MHz bandwidth using the "parallel-cable".
3. Maximum capacitive load was tested across the full input voltage range and under full-load conditions.
4. Unless otherwise specified, parameters in this datasheet are measured at Ta = 25°C, humidity < 75% RH, with nominal input voltage and rated output load.
5. To further reduce input and output ripple, an external capacitor filter network may be added at the input and output terminals (see Typical Application Circuit, Fig. 1 and Table 1). Do not exceed the Max. Cap. Load values listed in the Selection Guide — excessive output capacitance can cause start-up problems.
6. For EMC compliance, use the recommended filter circuit shown in Fig. 2 and the component values in Table 2.
7. To ensure efficient and reliable operation, output load should be no less than 10% of rated load. For very light loads, connect a bleed resistor in parallel with the output so that combined power draw is ≥ 10% of rated.

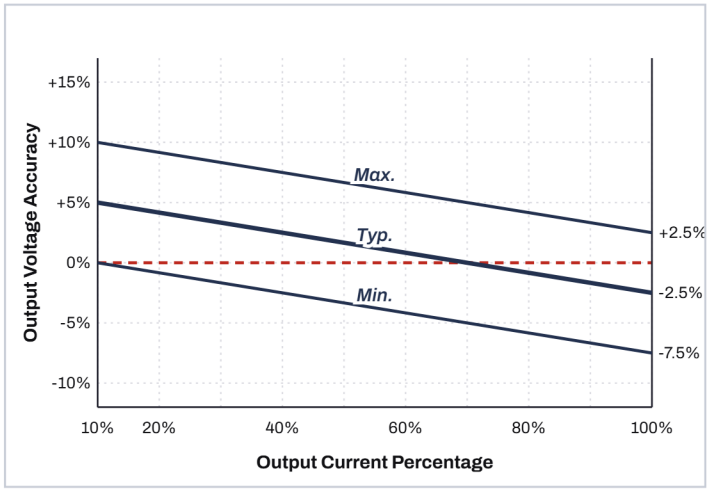
Performance Curves — Output Regulation

Typical performance @ +25°C ambient. Output voltage variation is shown vs. output load (%); deviation is symmetric ±, so curves represent the worst-case envelope.

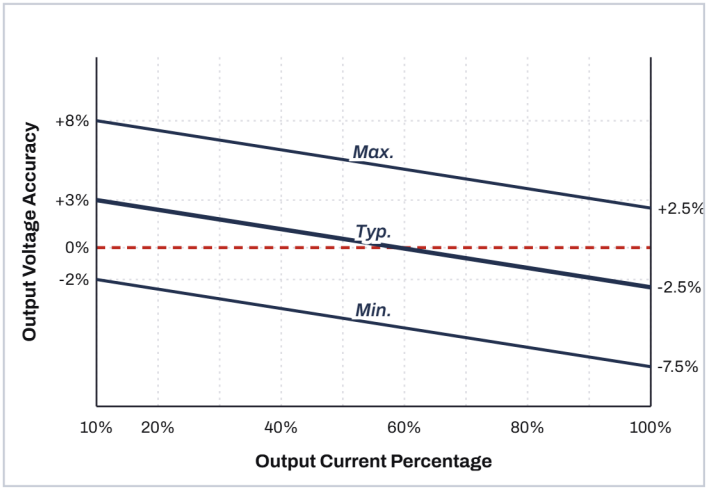
Output Regulation Curve — 3.3 VDC Output



Output Regulation Curve — 3.3 / 5 VDC Input, Other Outputs

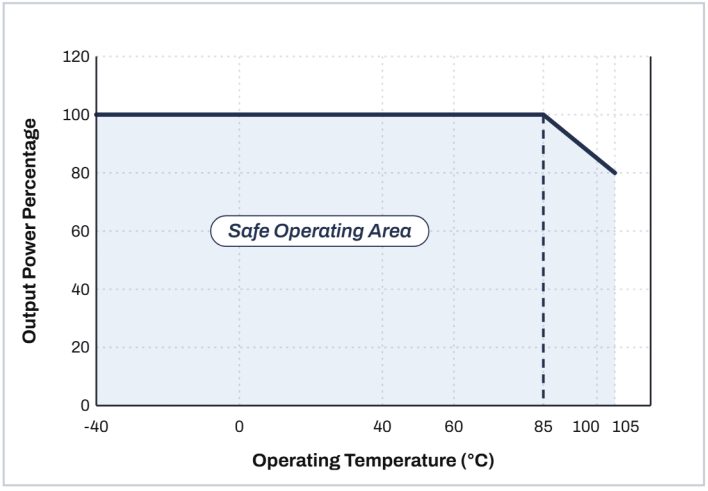


Output Regulation Curve — 12 / 15 / 24 VDC Input, Other Outputs

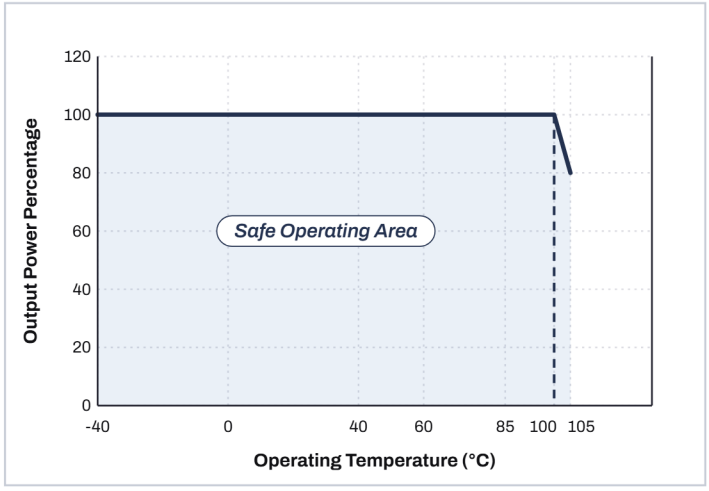


Temperature Derating

Temperature Derating — 5 VDC Input



Temperature Derating — 3.3 / 12 / 15 / 24 VDC Input

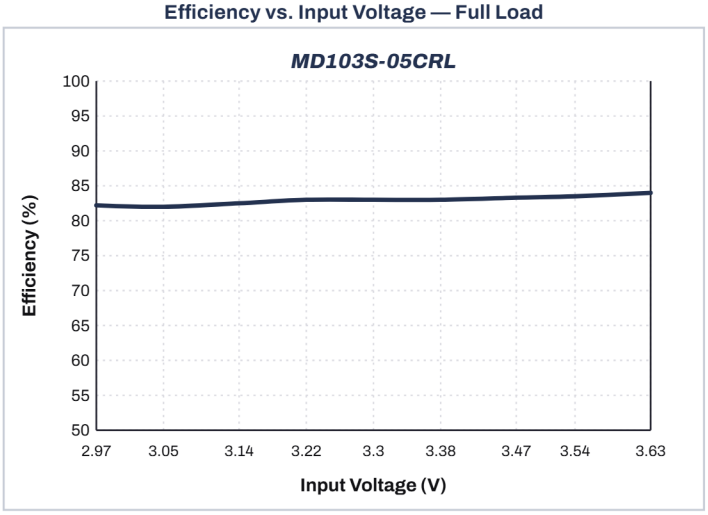


Derate output power linearly from the knee temperature to 0% at +105°C. The 5 VDC input models derate above +85°C; the 3.3, 12, 15 and 24 VDC input models derate above +100°C. Natural air-cooled applications only.

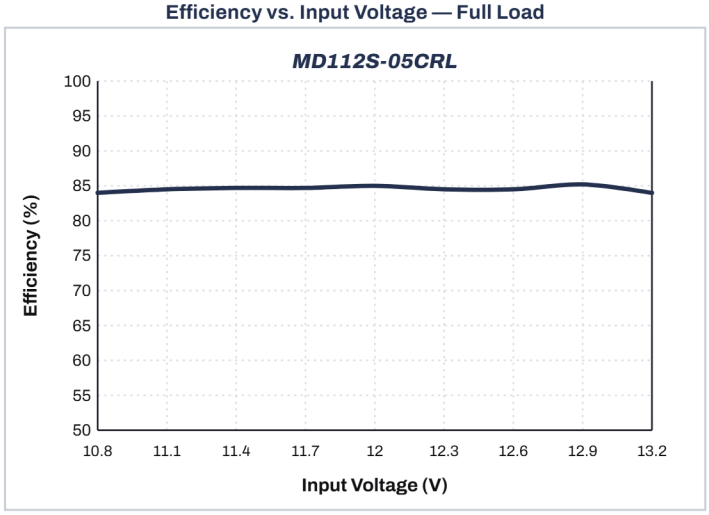
Performance Curves — Efficiency

Representative efficiency curves at +25°C ambient. The MD103S-05CRL is shown for 3.3 VDC input operation; the MD112S-05CRL is shown for 12 VDC input operation. Other models in the family follow similar curve shapes.

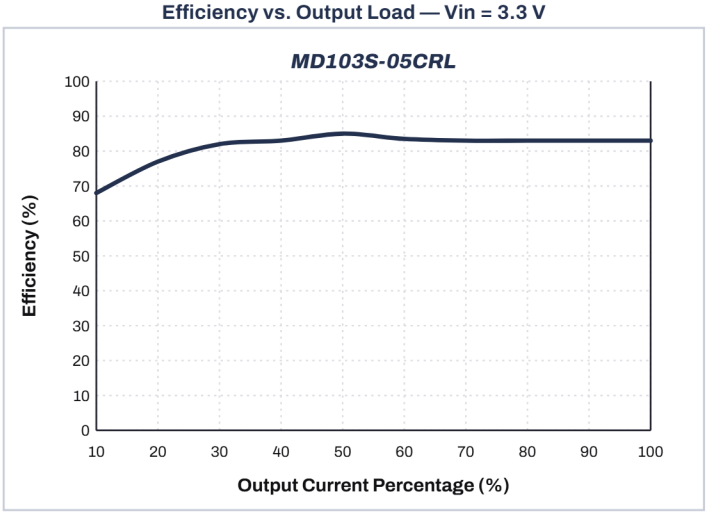
Efficiency vs. Input Voltage — Full Load



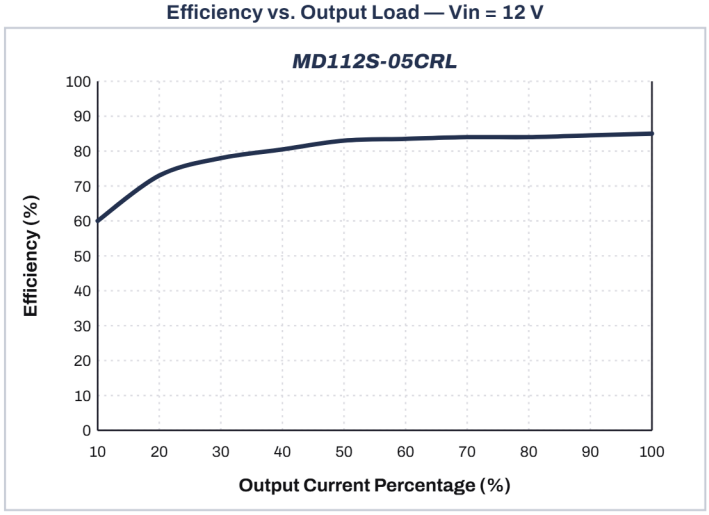
Efficiency vs. Input Voltage — Full Load



Efficiency vs. Output Load — Vin = 3.3 V



Efficiency vs. Output Load — Vin = 12 V



Application & EMC Reference Circuits

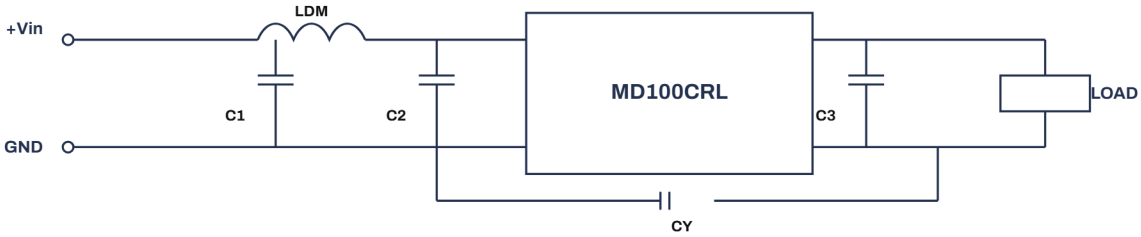
Recommended external filter networks for reducing input/output ripple (Fig. 1) and for meeting EN 55032 Class B emissions (Fig. 2). Refer to Tables 1 and 2 for component values appropriate to each input / output combination.

Fig. 1 — Typical Application Circuit

Vin (VDC)	Cin	Single Vout (VDC)	Cout
3.3	10 µF / 16 V	3.3 / 5	10 µF / 16 V
	—	9 / 12	2.2 µF / 25 V
	—	15 / 24	1 µF / 50 V
5 / 12 / 15 / 24	5 V → 4.7 µF / 16 V	3.3 / 5	10 µF / 16 V
	12 V → 2.2 µF / 25 V	7.2 / 9	2.2 µF / 16 V
	15 V → 2.2 µF / 25 V	12	2.2 µF / 25 V
	24 V → 1 µF / 50 V	15	1 µF / 25 V
	—	24	1 µF / 50 V

Table 1 · Recommended Cin / Cout values by input & output combination.

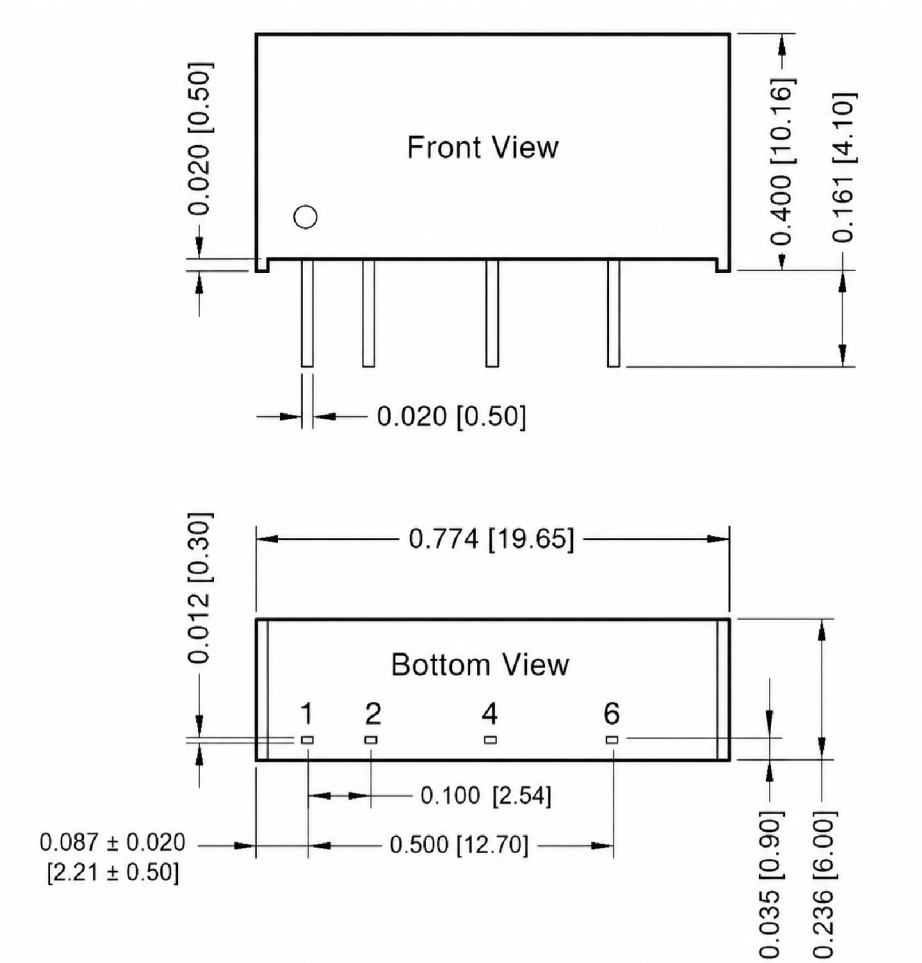
Fig. 2 — EMC Compliance Circuit (CISPR 32 Class B)



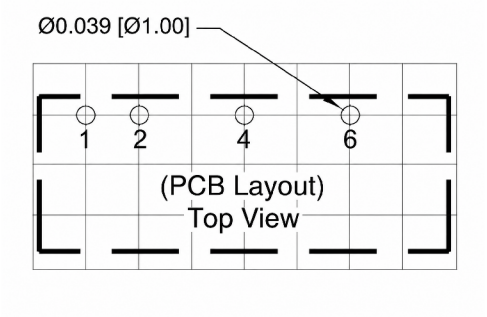
Component	3.3 VDC Input		5 VDC Input		Other Input
	3.3 / 5 Vout	9 – 24 Vout	3.3 / 5 / 9 Vout	12 – 24 Vout	
C1 / C2	4.7 µF / 16 V	4.7 µF / 16 V	4.7 µF / 25 V	4.7 µF / 25 V	4.7 µF / 50 V
CY	—	270 pF / 4 kVDC	100 pF / 2 kV	1,000 pF / 2 kV	270 pF / 2 kV
C3 / C4	Refer to Cout in Table 1				
LDM	6.8 µH				

Table 2 · Recommended EMC filter component values, by input & output combination.

Dimensions and Recommended Layout — Units: inch [mm]



THIRD ANGLE PROJECTION



Pin	Mark
1	+Vin
2	GND
4	0V
6	+Vo

- Unit: inch [mm]
- Pin section tolerances: ±0.004 [±0.10]
- General tolerances: ±0.010 [±0.25]
- Weight = 2.1 g [0.074 oz] (Typ.)
- Case: Black plastic, UL 94V-0, flame- & heat-resistant

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46 Eastman Street, Unit 1, Easton, MA 02375 • TEL: (781) 344-8226 • E-Mail: sales@micropowerdirect.com