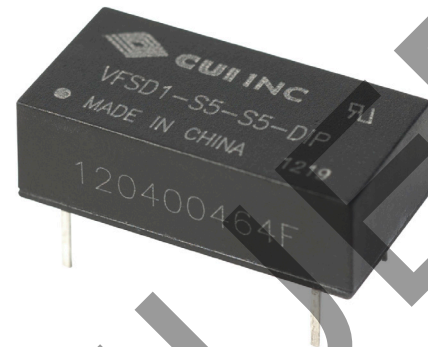


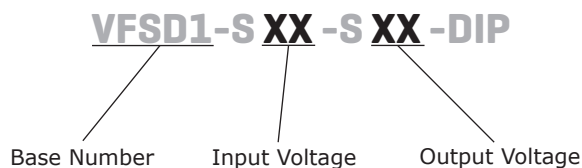
SERIES: VFSD1-DIP | DESCRIPTION: DC-DC CONVERTER
FEATURES

- 1 W isolated output
- industry standard 14 pin DIP package
- unregulated
- single output (3.3~24 V)
- small footprint
- 3,000 V isolation
- short circuit protection
- temperature range (-40~85°C)
- efficiency up to 82%



MODEL	input voltage		output voltage (Vdc)	output current		output power max (W)	ripple noise max (mVp-p)	efficiency typ (%)	UL60950
	typ (Vdc)	range (Vdc)		min (mA)	max (mA)				
VFSD1-S5-S3.3-DIP	5	4.5 ~ 5.5	3.3	30	300	1	75	74	NO
VFSD1-S5-S5-DIP	5	4.5 ~ 5.5	5	20	200	1	75	70	YES
VFSD1-S5-S9-DIP	5	4.5 ~ 5.5	9	12	111	1	75	75	YES
VFSD1-S5-S12-DIP	5	4.5 ~ 5.5	12	9	83	1	75	78	YES
VFSD1-S5-S15-DIP	5	4.5 ~ 5.5	15	7	67	1	75	80	YES
VFSD1-S5-S24-DIP	5	4.5 ~ 5.5	24	5	42	1	75	78	NO
VFSD1-S12-S3.3-DIP	12	10.8 ~ 13.2	3.3	30	300	1	75	75	NO
VFSD1-S12-S5-DIP	12	10.8 ~ 13.2	5	20	200	1	75	72	YES
VFSD1-S12-S9-DIP	12	10.8 ~ 13.2	9	12	111	1	75	76	YES
VFSD1-S12-S12-DIP	12	10.8 ~ 13.2	12	9	83	1	75	79	YES
VFSD1-S12-S15-DIP	12	10.8 ~ 13.2	15	7	67	1	75	81	YES
VFSD1-S12-S24-DIP	12	10.8 ~ 13.2	24	5	42	1	75	79	NO
VFSD1-S15-S3.3-DIP	15	13.5 ~ 16.5	3.3	30	300	1	75	73	NO
VFSD1-S15-S5-DIP	15	13.5 ~ 16.5	5	20	200	1	75	74	NO
VFSD1-S15-S12-DIP	15	13.5 ~ 16.5	9	12	111	1	75	75	NO
VFSD1-S15-S15-DIP	15	13.5 ~ 16.5	12	9	83	1	75	79	NO
VFSD1-S15-S15-DIP	15	13.5 ~ 16.5	15	7	67	1	75	79	NO
VFSD1-S15-S24-DIP	15	13.5 ~ 16.5	24	5	42	1	75	79	NO
VFSD1-S24-S3.3-DIP	24	21.6 ~ 26.4	3.3	30	300	1	75	76	NO
VFSD1-S24-S5-DIP	24	21.6 ~ 26.4	5	20	200	1	75	73	YES
VFSD1-S24-S9-DIP	24	21.6 ~ 26.4	9	12	111	1	75	77	YES
VFSD1-S24-S12-DIP	24	21.6 ~ 26.4	12	9	83	1	75	80	YES
VFSD1-S24-S15-DIP	24	21.6 ~ 26.4	15	7	67	1	75	82	YES
VFSD1-S24-S24-DIP	24	21.6 ~ 26.4	24	5	42	1	75	80	NO

Note: 1. Ripple and noise measured at 20 mHz BW

PART NUMBER KEY**INPUT**

parameter	conditions/description	min	typ	max	units
input voltage	5 V model	4.5	5	5.5	Vdc
	12 V model	10.8	12	13.2	Vdc
	15 V model	13.5	15	16.5	Vdc
	24 V model	21.6	24	26.4	Vdc
input filter	C filter				

OUTPUT

parameter	conditions/description	min	typ	max	units
voltage accuracy	see tolerance envelope graph				
line regulation	for V_{in} change of $\pm 1\%$			± 1.2	%
load regulation	10 ~ 100% full load		10	15	%
switching frequency	100% load, nominal input voltage	83	100	125	kHz
temperature coefficient	100% load			± 0.03	%/ $^{\circ}\text{C}$

PROTECTIONS

parameter	conditions/description	min	typ	max	units
short circuit protection				1	s

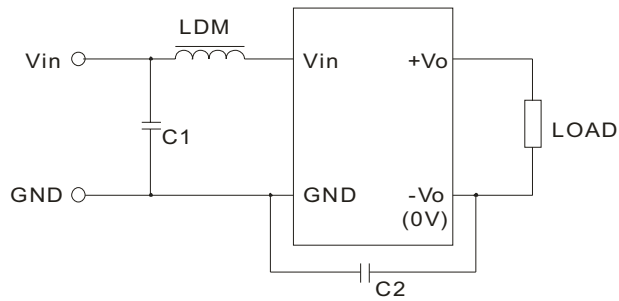
SAFETY AND COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	tested for 1 minute at 1 mA max.	3,000			Vdc
isolation resistance	at 500 Vdc	1,000			M Ω
isolation capacitance	input to output, 100 kHz / 0.1 V		20		pF
safety approvals	UL60950 (E222736)				
RoHS compliant	yes				
MTBF	MIL-HDBK-217F, 25 $^{\circ}\text{C}$	3,500,000			hours

ENVIRONMENTAL

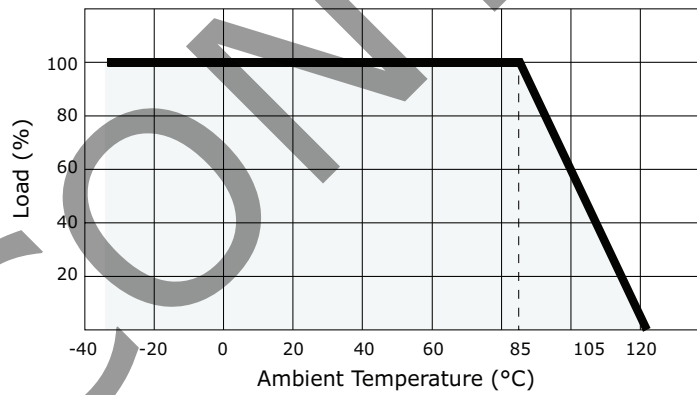
parameter	conditions/description	min	typ	max	units
operating temperature		-40		85	$^{\circ}\text{C}$
storage temperature		-55		125	$^{\circ}\text{C}$
storage humidity	non-condensing			95	%
temperature rise	at full load		25		$^{\circ}\text{C}$
lead temperature	1.5 mm from case for 10 seconds			300	$^{\circ}\text{C}$

EMC RECOMMENDED CIRCUIT



RECOMMENDED EXTERNAL CIRCUIT PARAMETERS	Vin = 5V	Vin = 12V	Vin = 15V	Vin = 24V
C1	475 k / 50 V			
LDM	6.8 μ H			
C2	---		470 pF / 2 kV	

DERATING CURVES

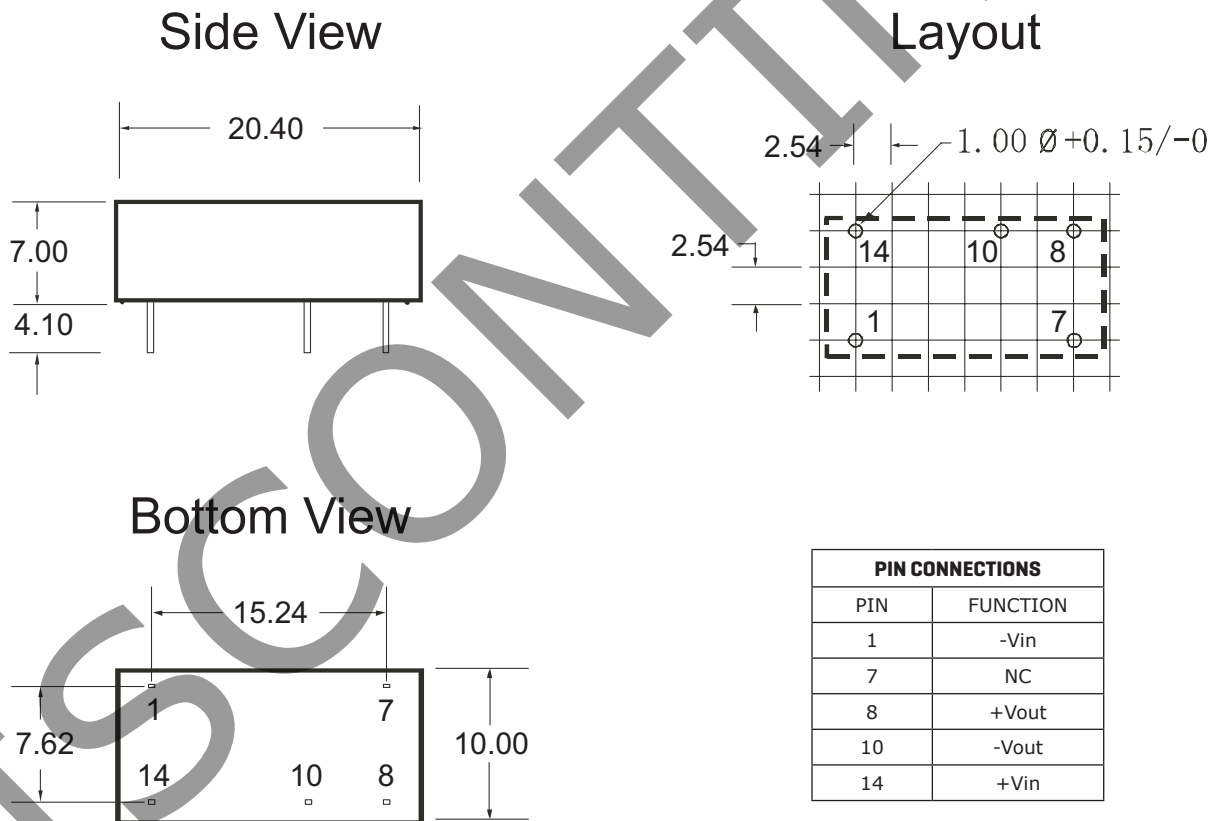


MECHANICAL

parameter	conditions/description	min	typ	max	units
dimensions	20.40 x 10.00 x 7.00 (0.803 x 0.340 x 0.276 inch)				mm
case material	Plastic (UL94-V0)				
weight			2.4		g

MECHANICAL DRAWING

units: mm

tolerance: ± 0.25 pin section tolerance: ± 0.10 mm

APPLICATION NOTES

1. Input filtering

To reduce the reflected ripple current and minimize EMI, especially when the converter input is more than 2" away from the DC source, it is recommended to connect a low ESR electrolytic capacitor between V_{in} and Gnd. The values suggested are as shown in Table 1. If additional filtering is required, the capacitance may be increased, or expanded to an LC network as shown in Figure 1.

Table 1

Input Voltage	External Input Capacitance
5 V	4.7 μ F
12 V	2.2 μ F
15 V	2.2 μ F
24 V	1.0 μ F

Figure 1



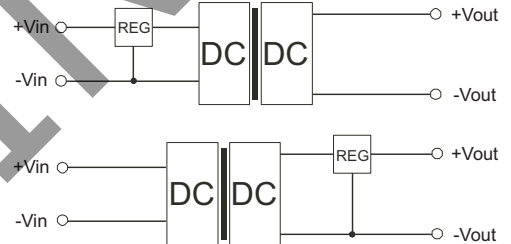
2. Output filtering

An output capacitor is needed to meet output ripple requirements as shown in Table 2. Output capacitance may be increased for additional filtering, but should not exceed 10 μ F or expanded to an LC network as in Figure 1.

Table 2

Output Voltage	External Output Capacitance
3.3, 5 V	4.7 μ F
9 V	2.2 μ F
12 V	1.0 μ F
15 V	0.47 μ F
24 V	0.33 μ F

Figure 2



3. Minimum loading

The converter needs a minimum of 10% loading to maintain output regulation. Operation under no-load conditions will not cause immediate damages but may reduce reliability, and cause performance not to meet specifications.

4. Regulation

With a semi-regulated design, the converter's output voltage varies with load current and will change proportionally to the input voltage. If regulated output is needed, an external regulator can be used as shown in Figure 2.

5. Protection

The converter has minimal protection against input over-voltage or output over-load, and may be permanently damaged if exposed to these conditions. An input clamping device can be used for input voltage limiting. An input fuse or an output fuse can also be used to protect against over-loading.

6. External Regulator

An external 3-terminal regulator can be connected to the output of the converter to achieve full regulation. Make sure the converter's output voltage provides sufficient head room for the regulator. An additional benefit is that the built-in protection features in the regulator, such as OCP, OTP, etc, will protect the converter also. In a complimentary supply, a negative output regulator must be used to achieve the negative regulated output.

REVISION HISTORY

rev.	description	date
1.0	initial release	05/12/2006
1.01	new template applied	12/09/2010
1.02	new template applied, V-Infinity branding removed	07/17/2012
1.03	picture updated	09/05/2012
1.04	updated spec	07/11/2013
1.05	updated spec	03/14/2016

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



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