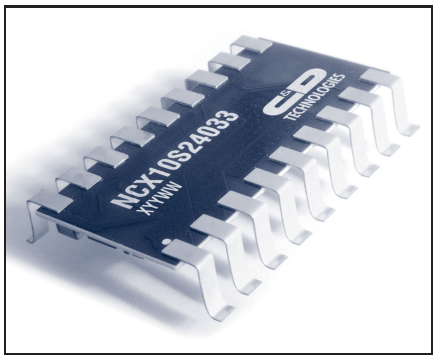
C&D TECHNOLOGIES
Power Solutions

NCX10S SERIES

Isolated 10W Single Output DC/DC Converters



FEATURES

- High Efficiency to 82%
- 500V Input to Output Isolation
- Industry Standard Pinout
- UL 60950 Recognition Pending
- Non Latching Current Limit
- Constant 400kHz Frequency
- Versatile Control Options
- Continuous Rating to 10W @85°C
- Operation to Zero Load
- Protected Against Load Faults
- Internal Over Temperature Protection
- Uses No Electrolytic Capacitors

DESCRIPTION

The NCX10S series of DC/DC Converters combines ease of application with versatility and is available in two pin patterns based on popular industry standards. High efficiency enables full rating to be achieved in a small package without heatsinking, and a high surge capability will provide for start-up and transient loads, whilst being thermally protected against sustained overload. The NCX10S series is currently undergoing testing by Underwriters Laboratory (UL) to UL 60950 for functional insulation.

SELECTION GUIDE[1]

Order Code	Nominal Input Voltage	Output Voltage	Output Current	Power Consumption at 0% Load	Power Consumption at Shutdown	Efficiency (MIN)	Isolation Capacitance
	V	V	A	mW	mW	%	pF
NCX10S24033	24	3.4	3.1	270	26	78	23
NCX10S24050	24	5.1	2.0	280	25	82	26
NCX10S48033	48	3.4	3.1	500	44	79	29
NCX10S48050	48	5.1	2.0	510	45	82	32
NCX10S24033Y	24	3.4	3.1	270	26	78	23
NCX10S24050Y	24	5.1	2.0	280	25	82	26
NCX10S48033Y	48	3.4	3.1	500	44	79	29
NCX10S48050Y	48	5.1	2.0	510	45	82	32

INPUT CHARACTERISTICS[1]

Parameter	Conditions	MIN	NOM	MAX	Units
Voltage Range	Continuous operation, 24V input types	18	24	36	V
	Continuous operation, 48V input types	36	48	75	

OUTPUT CHARACTERISTICS[1]

Parameter	Conditions		MIN	TYP	MAX	Units
Voltage Set Point Error	50% load				1.0	%
Overall Voltage Error	Substrate temperature –40 to 110°C Load 0% - 100% Input specified range				2.5	%
Temperature Coefficient of Output Voltage (slope)					250	ppm°C
Deviation of Output Voltage	Temperature MIN - MAX				1.0	%
Current Limit	Continuous short circuit causes no damage					
Overload Output Current	95% of nominal output voltage	NCX10S24033		153		% of rated Output Current
		NCX10S24050		170		
		NCX10S48033		148		
		NCX10S48050		164		
Line Regulation	Operating voltage range, 50% load				0.1	%
Load Regulation	0% - 100% rated load[2]				0.5	%
Ripple	rms				1.0	%

CONTROL CHARACTERISTICS

Parameter	Conditions	MIN	TYP	MAX	Units
Voltage Trimming Range	At rated load, Trim control at either output	±10			%
Remote Switch Input (voltage relative to input negative)	Not operating	-0.3	0	1.5	V
	Operating, open circuit voltage V_{IN} MIN to MAX	2.6	5.0	6.1	
Start Delay	Time from application of valid input voltage to output being in specification			10	ms
Switching Frequency		360	400	440	kHz

ABSOLUTE MAXIMUM RATINGS

Input voltage, 24V input types	–0.3V to 40V
Input voltage, 48V input types	–0.3V to 80V
Output Voltage	–0.3V to regulated voltage
Output trim control	–1V to +30V relative to output return
Shutdown control	–0.3V to 6V relative to input return

1 Specifications typical at T_A=25°C, nominal input voltage and rated output current unless otherwise specified.
2 A minimum load of 10% of rating is recommended for typical applications, see application notes.

ISOLATION CHARACTERISTICS

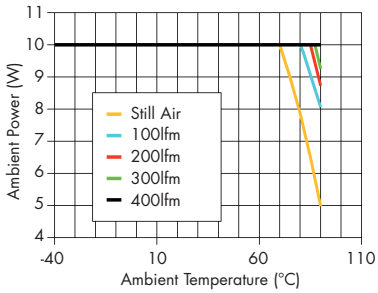
Parameter	Conditions	MIN	TYP	MAX	Units
Isolation Voltage	Flash tested for 1 second	1000			VDC
Resistance	V_{ISO}=500VDC	1			GΩ

ENVIRONMENTAL CHARACTERISTICS

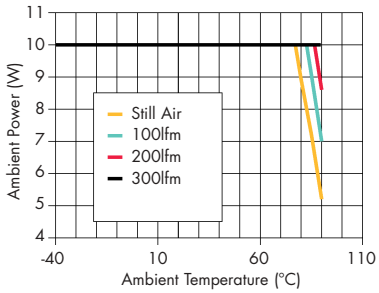
Parameter	Conditions	MIN	TYP	MAX	Units
Substrate Temp.	Full load	–40		125	°C
Storage	Absolute MAX internal temperature	–40		125	°C
Thermal Protection	Operates at substrate temperature		150		°C

THERMAL PERFORMANCE

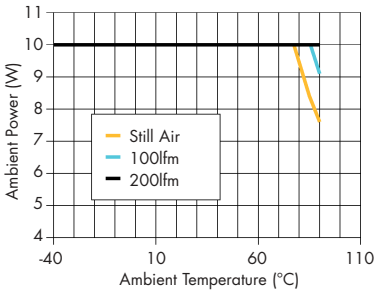
NCX10S24033



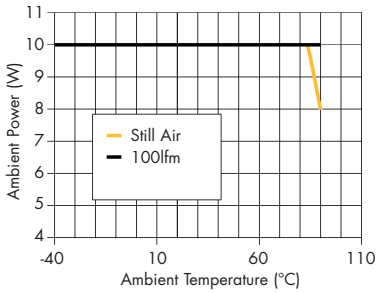
NCX10S24050



NCX10S48033



NCX10S48050



UL 60950 RECOGNITION (Maximum permissable load in still air)

Part Number	-40°C	25°C	70°C	75°C	80°C	85°C	90°C	Units
NCX10S24033	10.0	10.0	10.0	9.0	7.9	6.5	5.0	W
NCX10S24050	10.0	10.0	10.0	10.0	8.9	7.2	5.2	
NCX10S48033	10.0	10.0	10.0	9.5	8.4	7.1	5.5	
NCX10S48050	10.0	10.0	10.0	10.0	10.0	9.6	8.0	

APPLICATION NOTES

In a typical application, the NCX10S series of DC/DC converters require nothing more than a dc supply of correct polarity and voltage to generate its specified output. These notes are intended to offer help in the use of other facilities offered by these converters, and to provide assistance in achieving their full potential.

VOLTAGE TRIMMING

The trimming (adjust) input on the secondary side allows output voltage adjustment within the capability of the power circuit.

When open circuit, the trimming pin ADJ operates at near half the output voltage. A basic trimming arrangement consists of a potentiometer of 10kΩ to 100kΩ connected across the output, with its wiper connected to the ADJ pin (see figure 1). Dependent on model, the output will be reduced by about 15% when the wiper is at the positive output, or increased by about 24% when at the negative rail. Regulation will be maintained to at least 10% adjustment either way.

If finer adjustment is required, a resistor may be included between the wiper and the pin. For example, 62kΩ will restrict a 3.3V model to ±5% adjustment range. The corresponding values for the 5V model is 56kΩ.

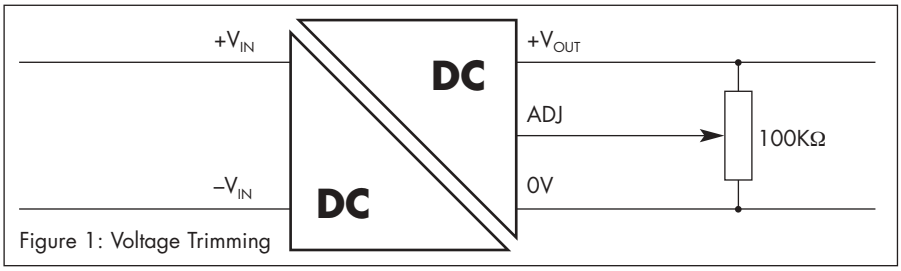


Figure 1: Voltage Trimming

APPLICATION NOTES

SET VOLTAGE

The output voltage is set to 100mV above nominal, to offset resistive losses and thus assist with worst case error calculations. This allowance can be altered with a single fixed resistor, connected from the trimming pin to one of the output pins.

OTHER TRIMMING FUNCTIONS

The voltage applied to the trim pin need not be from a potentiometer. The trim facility may be driven electronically to provide "margining", remote sense, active load sharing, current control or remote programming (There is a minimum output voltage below which control is not possible).

SHUTDOWN & UNDER VOLTAGE TRIM

When the shutdown pin (Pin 11) is shorted to the negative input, the converter will stop. Its current consumption will then be less than 1mA at nominal supply voltage. The shutdown/UV adjust pin serves the dual function of shutting the converter down into a low power state, and allowing adjustment of the under voltage start threshold.

To shut the unit down this pin should be taken to below 1.5V, using either an isolating diode (figure 2) with the anode connected to the shutdown pin or using an open collector pulldown (figure 3).

The UV threshold can be controlled either via a resistor connected between the pin and 0V, or by connecting a series 1MΩ resistor to a voltage of between 0V and 2.5V.

The variation of startup voltage with either parallel resistor or applied voltage is shown in figures 4 & 5. Note that voltage should not be applied directly to the pin without a series resistor or diode.

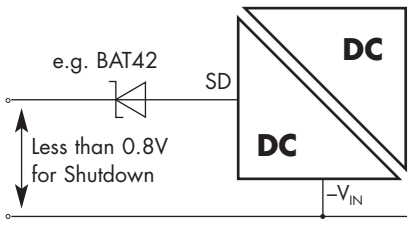


Figure 2: Shutdown with Isolating Diode

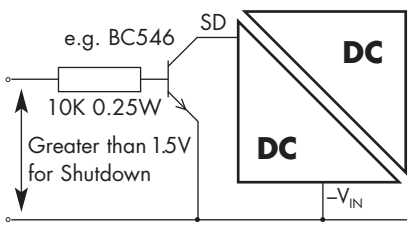


Figure 3: Shutdown with Open Collector Pulldown

If the shutdown pin is to be connected to a long wire, it is recommended that a capacitor decouples the pin to the supply common in order to avoid the risk of injecting noise into the converter circuit. A series resistor may also be helpful. Values of 10nF and 1kΩ may be used.

Many converters may be switched together simply by linking the primary control pins via a schottky signal diode anode to the control pin. The primary common pins must also be linked, see figure 6.

FILTERING

The module includes a basic level of filtering, sufficient for many applications. Where lower noise levels are desired, filters can easily be added to achieve any required noise performance.

A DC/DC converter generates noise in two principle forms: that which is radiated from its body and that conducted on its external connections. There are three separate modes of conducted noise: input differential, output differential and input-output.

This last appears as common mode at the input and the output, and cannot therefore be removed by filtering at the input or output alone. The first level of filtering is to connect a capacitor between input and output returns, to reduce this form of noise. It typically contains high harmonics of the switching frequency, which tend to appear as spikes on surrounding circuits. The voltage rating of this capacitor must match the required isolation voltage. (Due to the great variety in isolation voltage and required noise performance, this capacitor has not been included within the converter.)

Input ripple is a voltage developed across the internal input decoupling capacitor. It is therefore measured with a defined supply source impedance. Although simple series inductance will provide filtering, on its own it can degrade the stability. A shunt capacitor is therefore recommended across the converter input terminals, so that it is fed from a low impedance.

If no filtering is required, the inductance of long supply wiring could also cause a problem, requiring an input decoupling capacitor for stability. An electrolytic will perform well in these situations.

See figure 7 for a recommended configuration to reduce all three conducted modes.

The component values and ratings will depend on the converter rating and voltage, and the required noise performance. The input-output filtering is performed by the common-mode choke on the primary. This could be placed on the output, but would then degrade the regulation and produce less

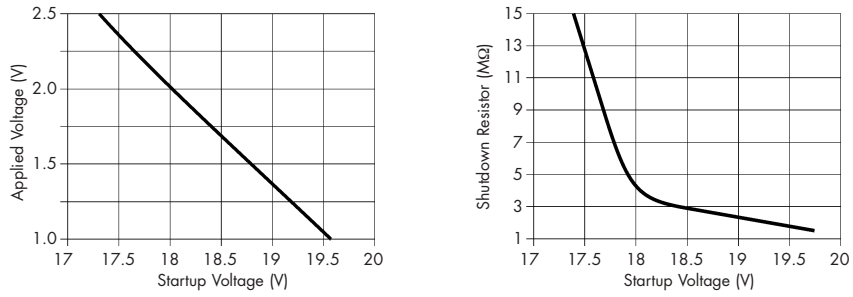


Figure 4: NCX10S24XXX Startup Voltage Vs Startup Pin Resistor/Voltage

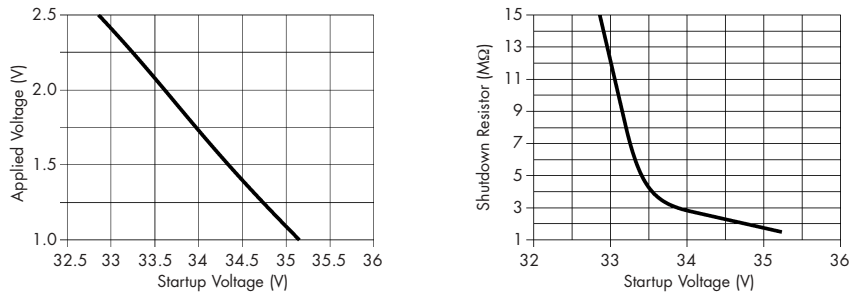


Figure 5: NCX10S48XXX Startup Voltage Vs Startup Pin Resistor/Voltage

APPLICATION NOTES

benefit for a given size, cost, and power loss.

Radiated noise is present in magnetic and electrostatic forms. Thanks to the small size of these units, neither form of noise will be radiated "efficiently", so will not normally cause a problem. Any question of this kind usually better repays attention to conducted signals.

In applications where large transient load swings are expected, for example 10-60% or 25-75%, the fitting of an external electrolytic output capacitor is recommended to reduce voltage over/under shoot. 200µF capacitance will typically reduce a peak excursion to 350mV settling to within 1% V_{NOM} in 1.2ms. Additional externally fitted capacitance will further reduce over/under shoot.

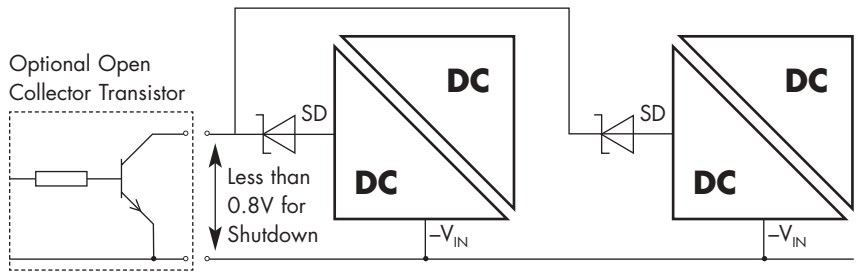


Figure 6: Shutdown with Isolating Diode

PROTECTION

The "absolute maximum" ratings in the specification define conditions which may degrade life but will not result in immediate damage. This section of the application notes deals with those unavoidable or accidental occasions when the ratings are exceeded.

The unit will protect itself against a wide range of abnormal conditions. In others, where failure is inevitable, the consequent hazards have been minimised.

If the supply polarity is reversed, the unit is unable to protect itself. The simple preventative measure of a series diode would add unacceptable power loss for the basic product, but it may be appropriate in some applications to fit this diode externally.

With no polarity protection, tracks and components will safely fail to high impedance, disconnecting the power. A large fault current will occur in this process.

FUSING

Part Number	Recommended Fuses[1]
NCX10S24XX	1.6A
NCX10S48XX	1.0A

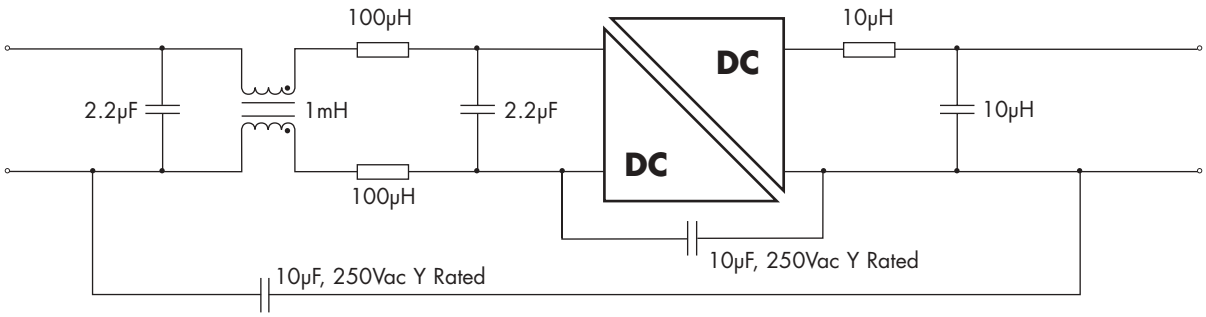
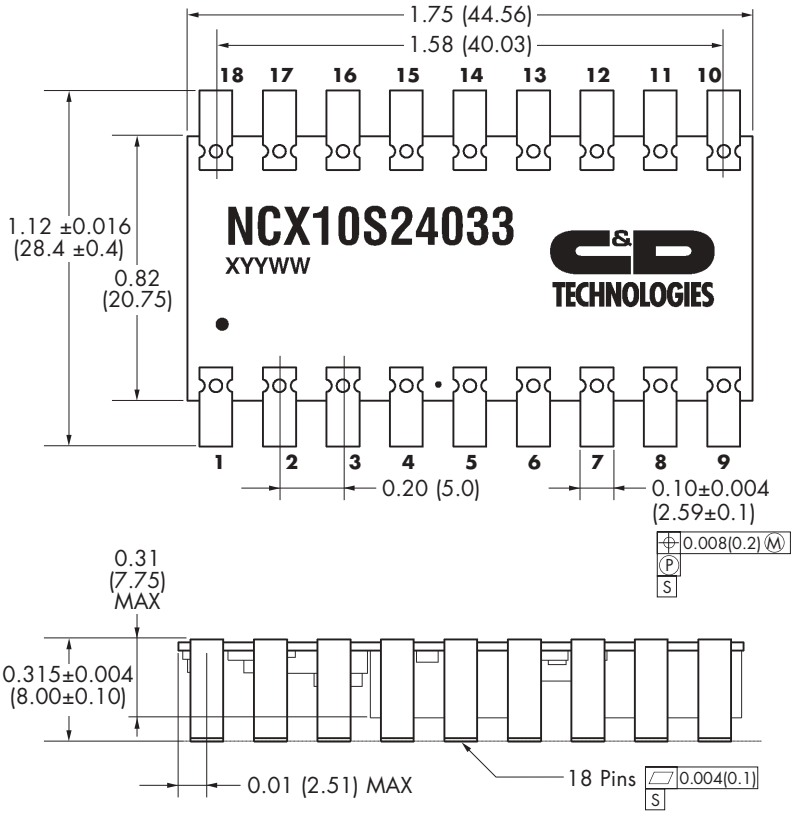


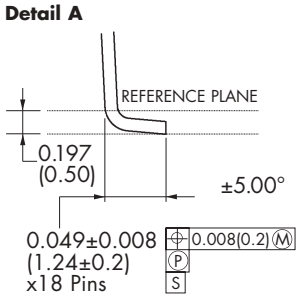
Figure 7: Recommended Configuration to Reduce Noise

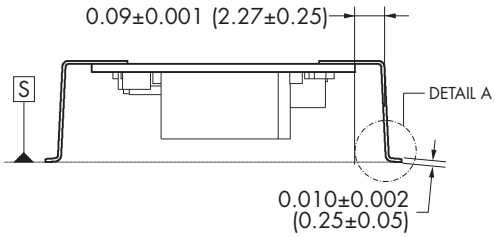
1 Anti surge T-type fuses are recommended

MECHANICAL DIMENSIONS

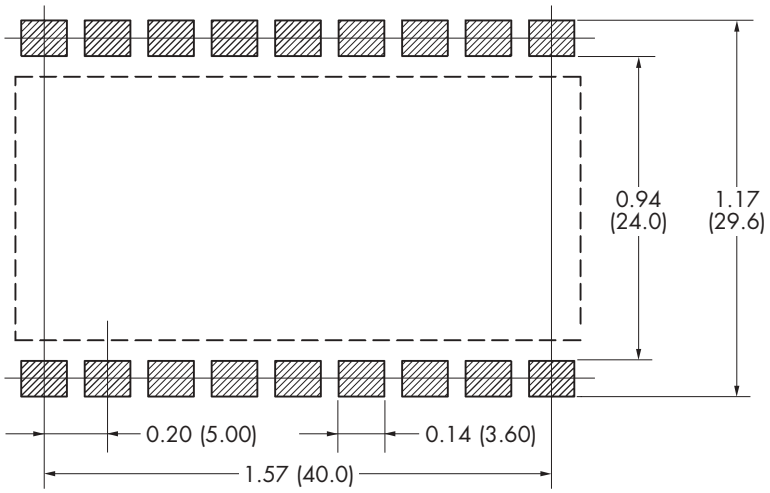
18 Pin SMD Package Style







Recommended Footprint Details



Pin Connections

PIN	NCX10SXXXXX	NCX10SXXXXXY
1	$+V_{OUT}$	$+V_{OUT}$
2	$-V_{OUT}$	$-V_{OUT}$
3-7	NC	NC
8	V_{ADJ}	V_{ADJ}
9-10	NC	NC
11	SD	SD
12-16	NC	NC
17	$-V_{IN}$	$+V_{IN}$
18	$+V_{IN}$	$-V_{IN}$

Package Weight: 8.3g

All pins on a 0.1(2.54) pitch and within ±0.01(0.25) of true position.

Unless otherwise stated all dimensions in inches(mm) ±0.01(0.25).

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