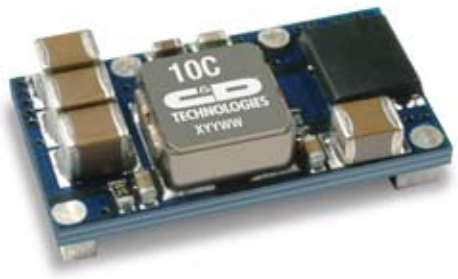


FEATURES

- RoHS compliant
- Industry standard footprint
- Short circuit protection
- High efficiency
- Under voltage lock out
- Fully adjustable output voltage
- Operating temperature range -40ºC to 85ºC
- SMD Construction
- UL60950 recognized

DESCRIPTION

The NNL05 series is part of a range of non-isolated, cost effective DC/DC converters offering high precision output voltages from a nominal 3.0-5.5V or 10.0-14.0V intermediate bus where isolation is not required. Currently available in SMD format and packaged in stackable trays or tape and reel packaging. The product range has been recognized by the Underwriters Laboratory (UL) to UL60950, file number E179522 applies.

SELECTION GUIDE

Order Code[1]	Input Voltage	Output Voltage	Output Current		User Select Voltage	Efficiency
			Min. Load	Full Load		
	V (nom.)	V	A	A	V_{OUT}	% (Min.)
NNL05-9C[2]	4	Adjustable between 0.75 & 3.3	0	5.0	0.75	78
					1.2	83
					1.5	85
					1.8	87
					2.5	90
					3.3	94
NNL05-10C[2]	12	Adjustable between 0.75 & 5.0	0	5.0	0.75	71
					1.2	78
					1.5	80
					1.8	83
					2.5	85
					3.3	87
					5.0	90

INPUT CHARACTERISTICS[1]

Parameter	Conditions		Min.	Typ.	Max.	Units
Voltage range	NNL05-9C V_{OUT} < 2.75V		3.0		5.5	V
	NNL05-9C V_{OUT} > 3.0V		4.0		5.5	
	NNL05-10C		10.0		14.0	
Under voltage lock out	NNL05-9C	Turn on threshold		2.11		V
		Turn off threshold		1.96		
	NNL05-10C	Turn on threshold	7.85		8.25	
		Turn off threshold	7.75		8.20	
Reflected ripple current	NNL05-9C			12.0		mA p-p
	NNL05-10C			20.0		
Input no load current	NNL05-9C	V_{IN} = 5.5V V_{OUT} = 0.75V		70		mA
		V_{IN} = 5.5V V_{OUT} = 3.3V		100		
	NNL05-10C	V_{IN} = 12.0V V_{OUT} = 0.75V		15		
		V_{IN} = 12.0V V_{OUT} = 5.0V		75		
Input standby current	Module Disabled			5.0		mA

OUTPUT CHARACTERISTICS

Parameter	Conditions		Min.	Typ.	Max.	Units
Rated current	TA = –40°C to 85°C (see thermal performance characteristics)				5.0	A
Voltage set point accuracy	Using 1% tolerance resistor		-3.0		+2.0	%
Line regulation	Low line to high line	NNL05-9C			1.0	%
		NNL05-10C			0.1	
Load regulation	0% load to 100% load	NNL05-9C			1.0	%
		NNL05-10C			0.2	
Ripple & noise	BW = DC to 20MHz with 1µF ceramic and 10µF tantalum capacitors	NNL05-9C		30		mV p-p
		NNL05-10C 0.75V		9		
		NNL05-10C 5.0V		20		
Transient response	NNL05-9C I_{OUT} = 2.5A–5.0A–2.5A	Peak deviation		60		mV
		Settling time		25		µs
	NNL05-10C I_{OUT} = 2.5A–5.0A–2.5A	Peak deviation		70		mV
		Settling time		35		µs
Current limit inception				9.0		A

1. If components are required in tape and reel format suffix order code with -R, e.g. NNL05-9C-R.
2. A 330µF low ESR capacitor, approx 17mΩ at 100kHz to 300kHz must be fitted at the input to the NNL DC/DC converter to ensure stability under all the operating conditions.

All specifications typical at T_A =25°C, nominal input voltage and rated output current unless otherwise specified.

RoHS COMPLIANT 2002/95/EC

c UL us

ABSOLUTE MAXIMUM RATINGS

Short circuit protection		Continuous
Input voltage V_{IN}	NNL05-9C	6.0V
	NNL05-10C	15.0V
Trim voltage	NNL05-9C	-0.35V to V_{OUT}
	NNL05-10C	-0.3V to V_{OUT}
Remote on/off	NNL05-9C	-0.35V to 6.0V
	NNL05-10C	-0.3V to +V_{OUT}
Minimum load		0%

GENERAL CHARACTERISTICS[1]

Parameter	Conditions		Min.	Typ.	Max.	Units
Switching frequency				300		kHz
Start delay	NNL05-9C			5.0		ms
	NNL05-10C			7.0		
Remote on/off	NNL05-9C	Module on (or pin unconnected)	0		0.5	V
					-0.4	mA
		Module off	2.6		V_{IN}	V
			1.0			mA
	NNL05-10C	Module on (or pin unconnected)	0		0.5	V
					-0.4	mA
		Module off	2.5		V_{IN}	V
			0.125		1.0	mA

TEMPERATURE CHARACTERISTICS[1]

Parameter	Conditions		Min.	Typ.	Max.	Units
Operation	See thermal performance characteristics		-40		85	°C
Storage	Absolute Max. internal temperature		-55		125	°C
Over temperature protection	Operates at substrate temperature	NNL05-9C		110		°C
		NNL05-10C		118		

OUTPUT VOLTAGE ADJUSTMENT

The trimming (adjust) input on the device allows output voltage adjustment from 0.75V to 3.3Vdc (NNL05-9C) or 5.0 (NNL05-10C) by using a resistor as shown in fig.1 or by applying a voltage between trim and common pins as shown in fig.2.

To calculate the resistor value for NNL05-9C:

$$R_{TRIM} = \left[\frac{21070}{V_{OUT} - 0.7525} - 5110\ \Omega \right]$$

To calculate the resistor value for NNL05-10C:

$$R_{TRIM} = \left[\frac{10500}{V_{OUT} - 0.7525} - 1000\ \Omega \right]$$

To calculate V_{TRIM} for NNL05-9C:
$V_{TRIM} = (0.7 – 0.1698 \times \{V_{OUT} – 0.7525\})$

To calculate V_{TRIM} for NNL05-10C:
$V_{TRIM} = (0.7 – 0.0667 \times \{V_{OUT} – 0.7525\})$

Tables 1 & 2 provide R_{TRIM} and V_{TRIM} Values for the most commonly required output voltages.

Fig.1

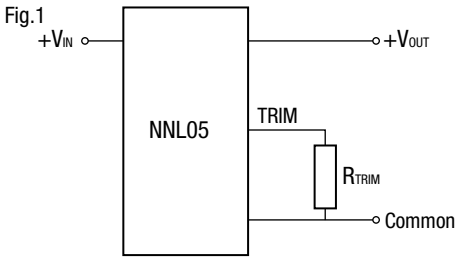


Table 1: NNL05-9C R_{TRIM} & V_{TRIM}

$V_{OUT\ SET}$ (V)	R_{TRIM} (kΩ)	V_{TRIM} (V)
0.75	Open	Open
1.2	41.71	0.624
1.5	22.98	0.573
1.8	14.96	0.505
2.5	6.93	0.403
3.3	3.15	0.267

Fig.2

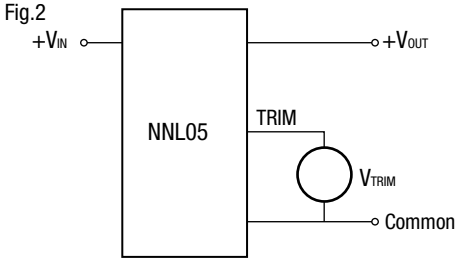


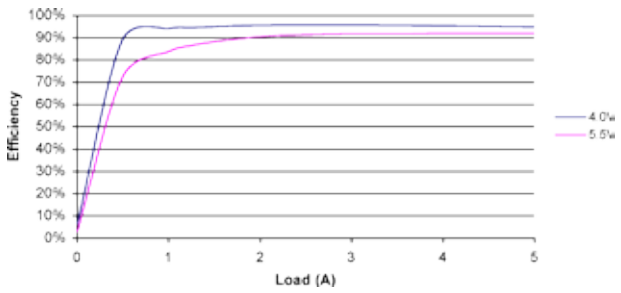
Table 2: NNL05-10C R_{TRIM} & V_{TRIM}

$V_{OUT\ SET}$ (V)	R_{TRIM} (kΩ)	V_{TRIM} (V)
0.75	Open	Open
1.2	22.46	0.670
1.5	13.05	0.650
1.8	9.024	0.630
2.5	5.009	0.583
3.3	3.122	0.530
5.0	1.472	0.4166

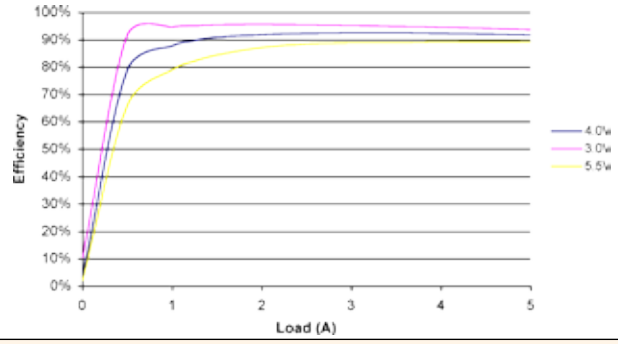
1. Specifications typical at T_A =25°C, nominal input voltage and rated output current unless otherwise specified.

EFFICIENCY v LOAD GRAPHS (NNL05-9C)

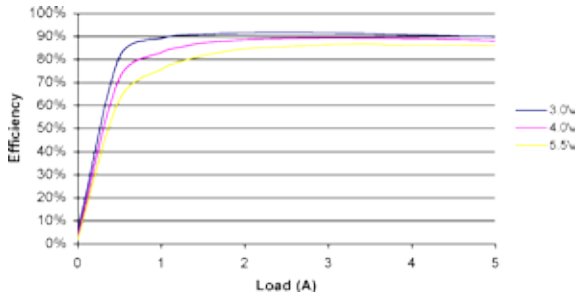
VOUT = 3.3V



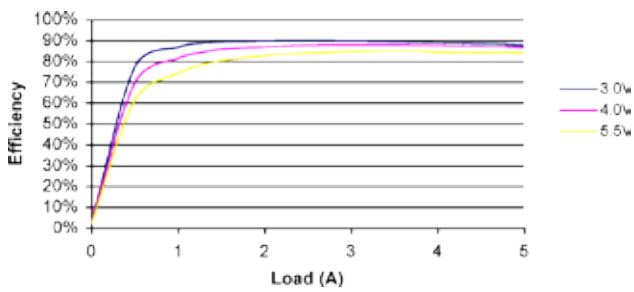
VOUT = 2.5V



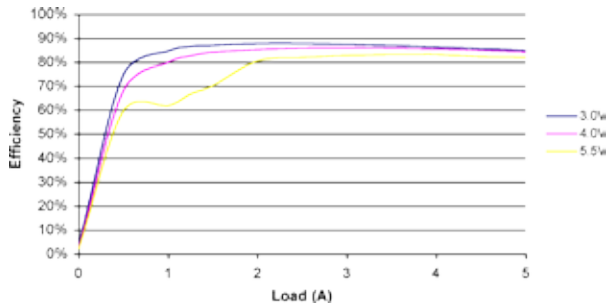
VOUT = 1.8V



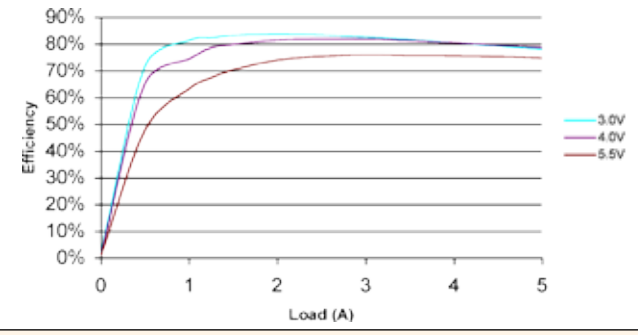
VOUT = 1.5V



VOUT = 1.2V

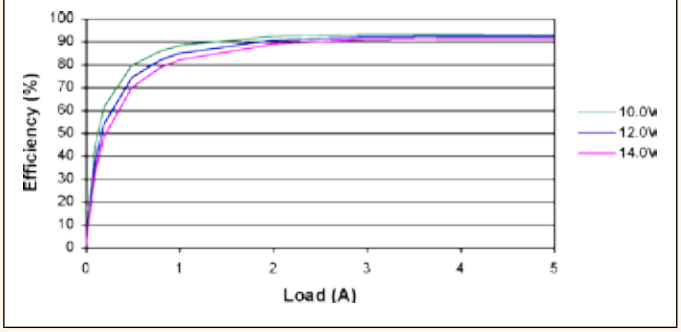


VOUT =0.75V

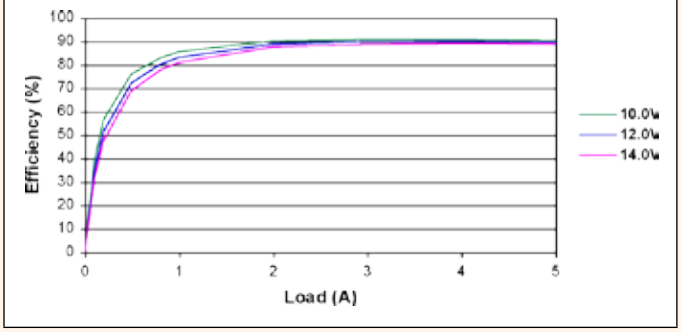


EFFICIENCY v LOAD GRAPHS (NNL05-10C)

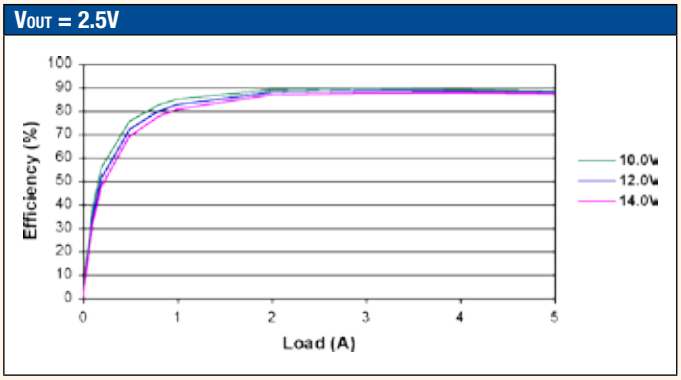
VOUT = 5.0V



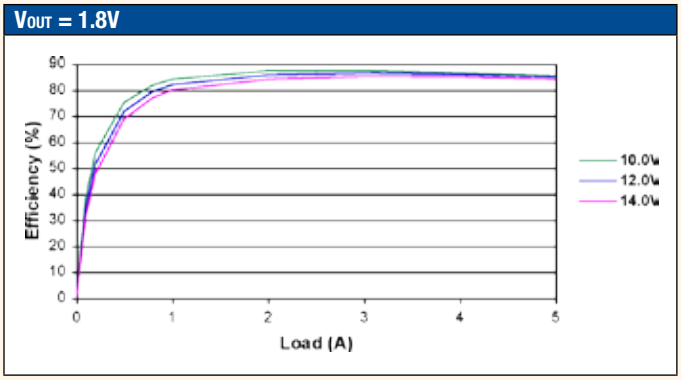
VOUT = 3.3V



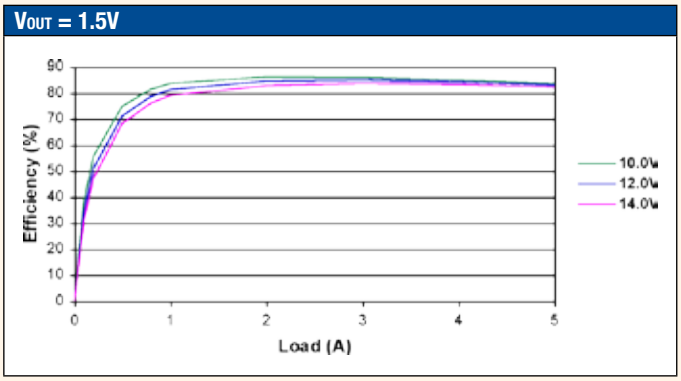
VOUT = 2.5V



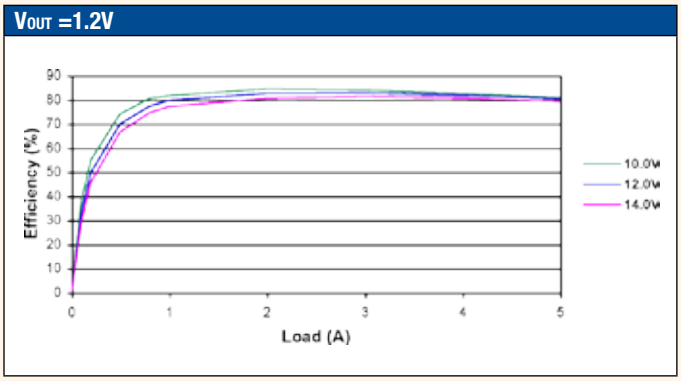
VOUT = 1.8V



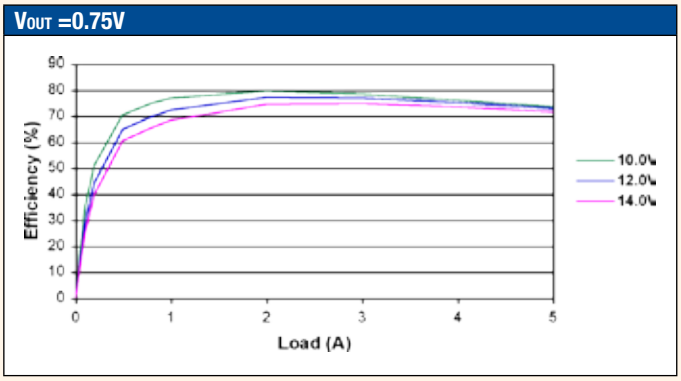
VOUT = 1.5V



VOUT =1.2V

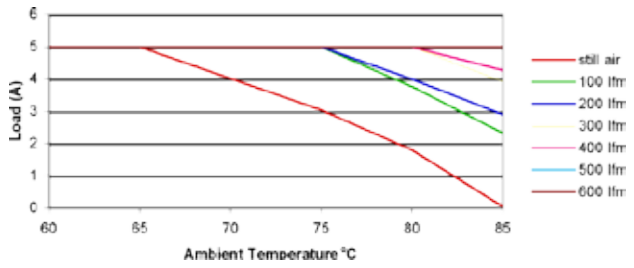


VOUT =0.75V

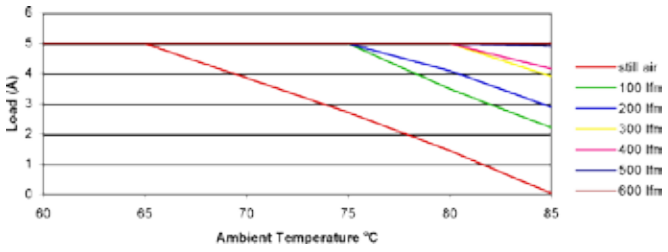


THERMAL DERATING GRAPHS (NNL05-9C)

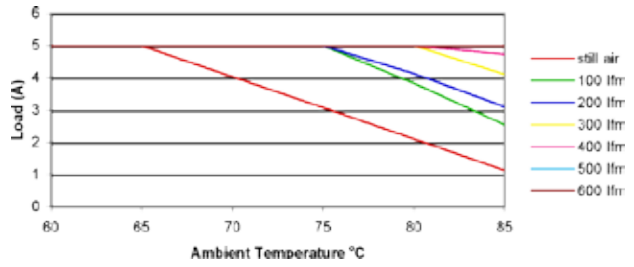
VOUT = 3.3V



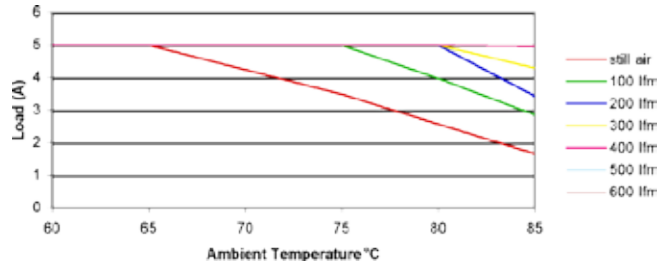
VOUT = 2.5V



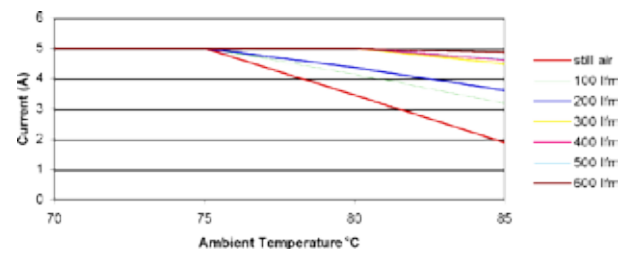
VOUT = 1.8V



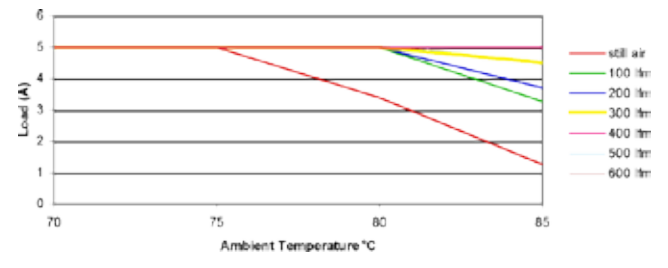
VOUT = 1.5V



VOUT = 1.2V



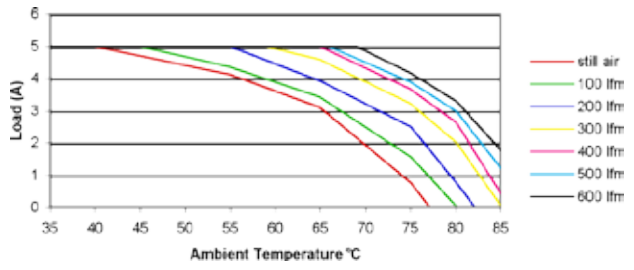
VOUT =0.75V



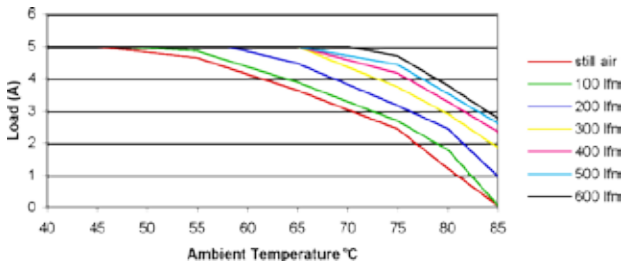
All derating graphs shown are for an input voltage, VIN = 5.5V

THERMAL DERATING GRAPHS (NNL05-10C)

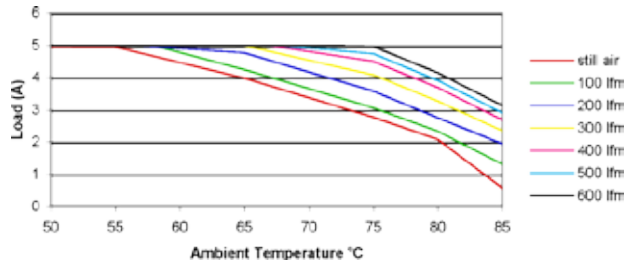
VOUT = 5.0V



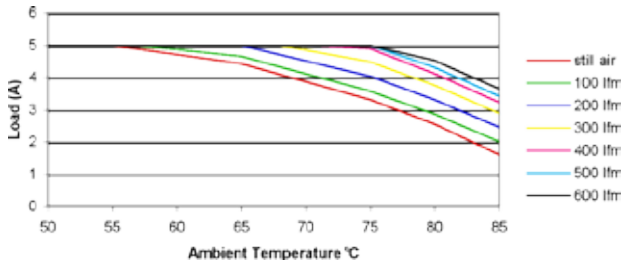
VOUT = 3.3V



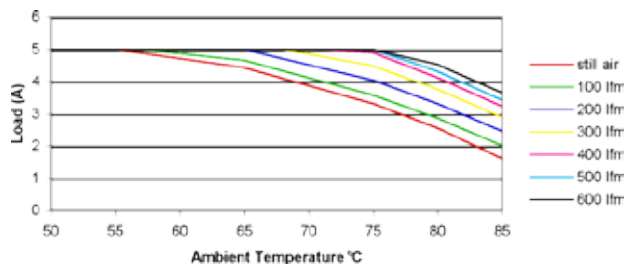
VOUT = 2.5V



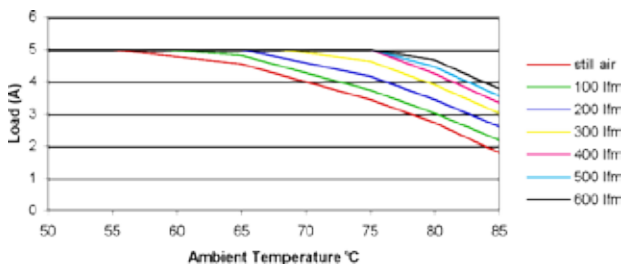
VOUT = 1.8V



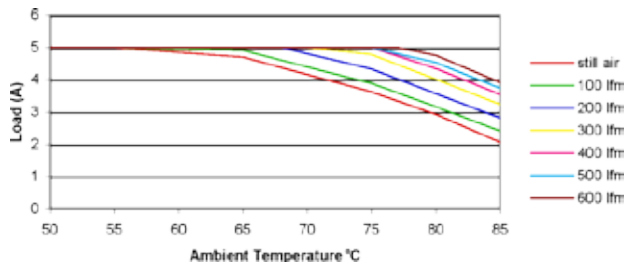
VOUT = 1.5V



VOUT =1.2V



VOUT =0.75V

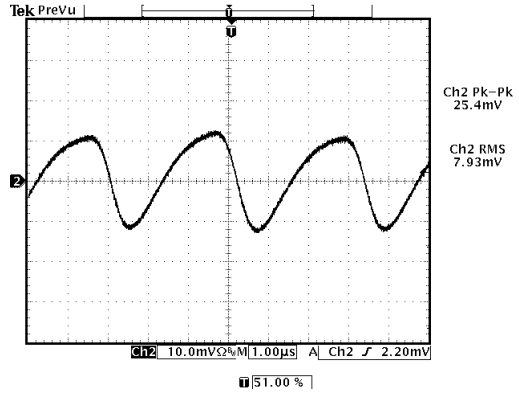


All derating graphs shown are for an input voltage, V_{IN} = 14.0V

CHARACTERISTIC GRAPHS (NNL05-9C)

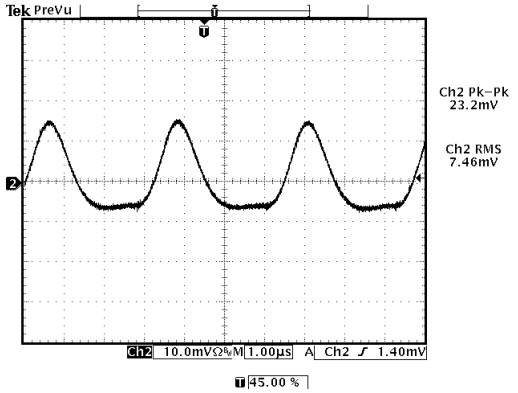
TYPICAL OUTPUT RIPPLE & NOISE

V_{IN} = 5.0VDC V_{OUT} = 3.3V I_{OUT} = 5.0A

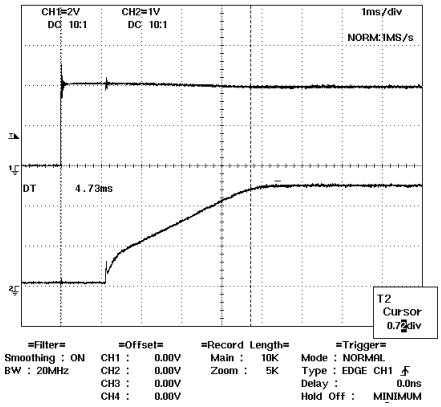


TYPICAL OUTPUT RIPPLE & NOISE

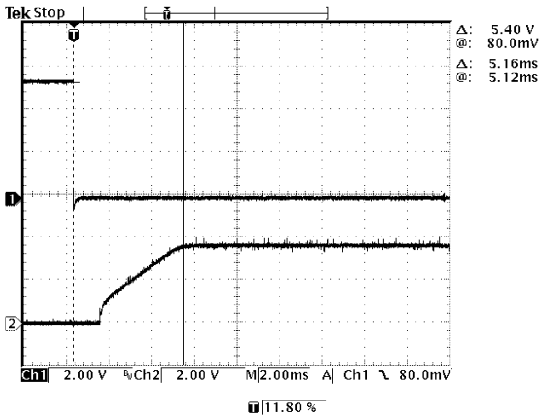
V_{IN} = 5.0VDC V_{OUT} = 0.75V I_{OUT} = 5.0A



TYPICAL START-UP FROM APPLICATION OF VIN



TYPICAL START-UP USING REMOTE ON/OFF



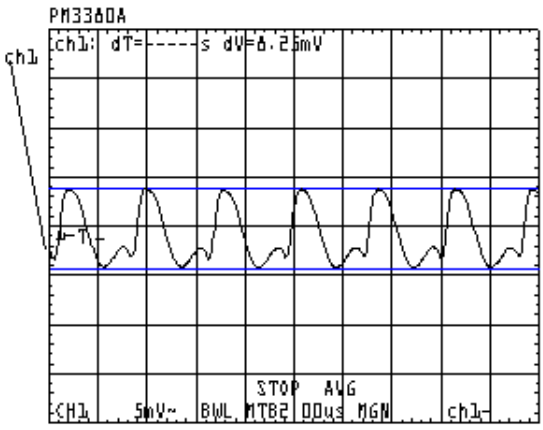
MTTF

MTTF figures calculated by MIL-HDBK-217F ground benign. Ambient temperature 25°C, airflow 200LFM.

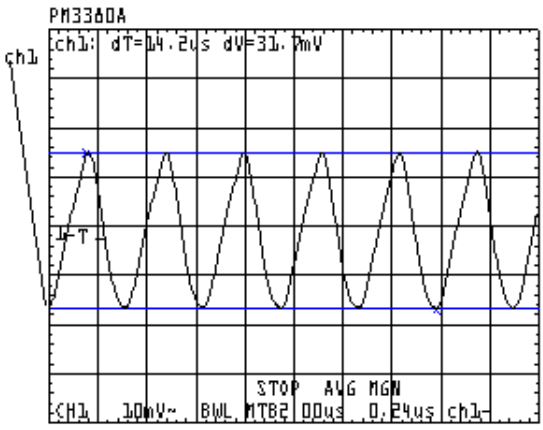
	Conditions	MTTF (Hrs)
NNL05-9C	V_{IN} = 5.5V, V_{OUT} = 3.3V	995057
NNL05-10C	V_{IN} = 12.0V, V_{OUT} = 5.0V	420454

CHARACTERISTIC GRAPHS (NNL05-10C)

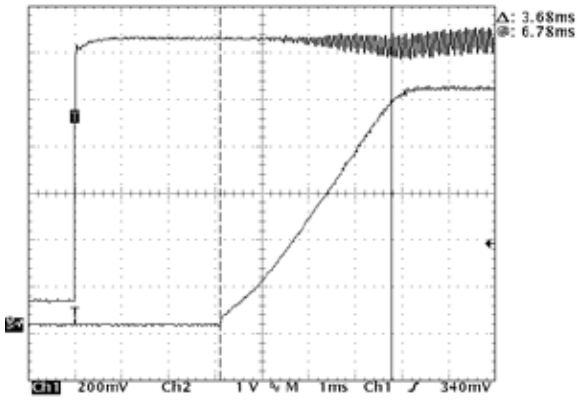
TYPICAL OUTPUT RIPPLE & NOISE (0.75V OUTPUT)



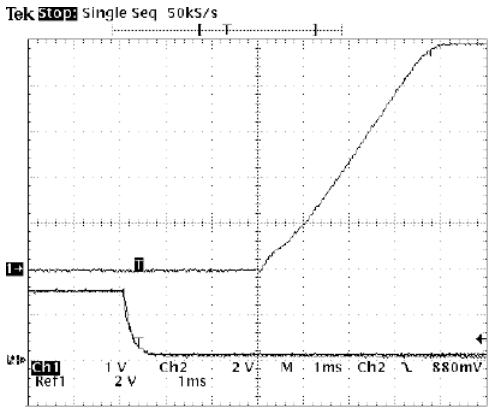
TYPICAL OUTPUT RIPPLE & NOISE (5.0V OUTPUT)



TYPICAL START-UP FROM APPLICATION OF VIN



TYPICAL START-UP USING REMOTE ON/OFF



RoHS COMPLIANCE INFORMATION

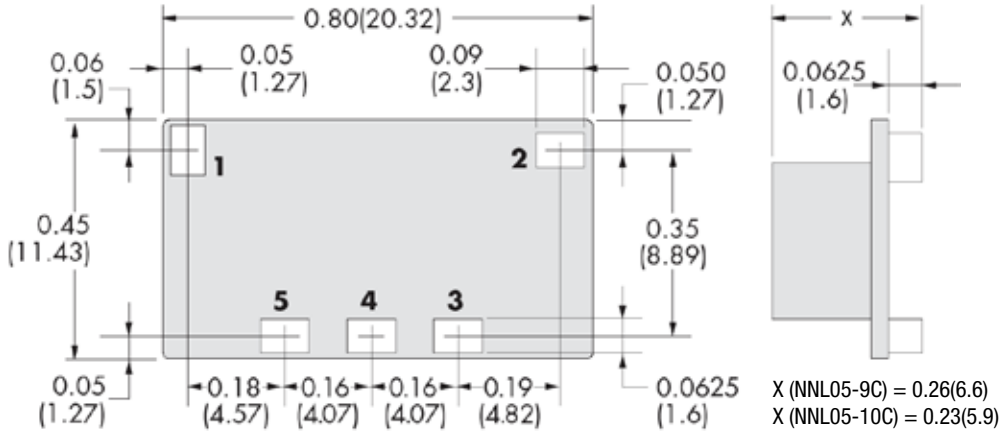
RoHS COMPLIANT 2002/95/EC

This series is compatible with RoHS soldering systems with a peak reflow solder temperature of 245ºC. The pin termination finish on this product series is Matte Tin over Nickel Preplate. The series is backward compatible with Sn/Pb soldering systems. The NNL05-9 has a Moisture Sensitivity Level (MSL) 1. The NNL05-10 has a Moisture Sensitivity Level (MSL) 2.

For further information, please visit www.cd4power.com/rohs

MECHANICAL DIMENSIONS

SURFACE MOUNT PACKAGE STYLE (BOTTOM VIEW)



X (NNL05-9C) = 0.26(6.6)
X (NNL05-10C) = 0.23(5.9)
Coplanarity = 150microns

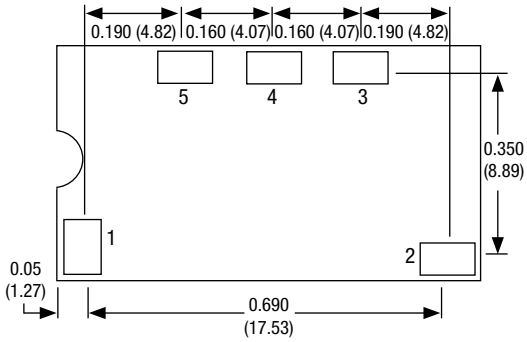
PIN CONNECTIONS

Pin	Function
1	On/Off
2	$+V_{IN}$
3	Common
4	Trim
5	$+V_{OUT}$

PACKAGE WEIGHT

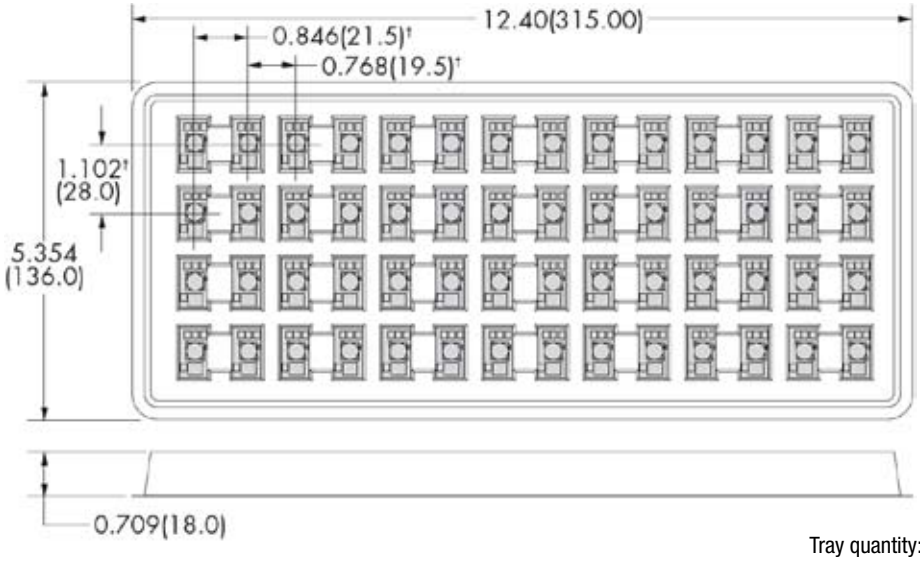
NNL05-9C	2.3g
NNL05-10C	2.7g

RECOMMENDED PAD LAYOUT



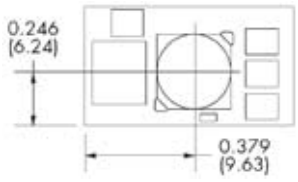
Pad size:
MIN: 0.120 x 0.095 (3.048 x 2.413)
MAX: 0.135 x 0.110 (3.429 x 2.794)

TRAY DIMENSIONS (TOP VIEW)

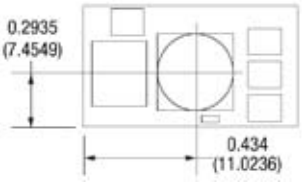


Tray quantity: 56
† +0.020(0.5)
-0.00(0.0)

PICK-UP POINT NNL05-9



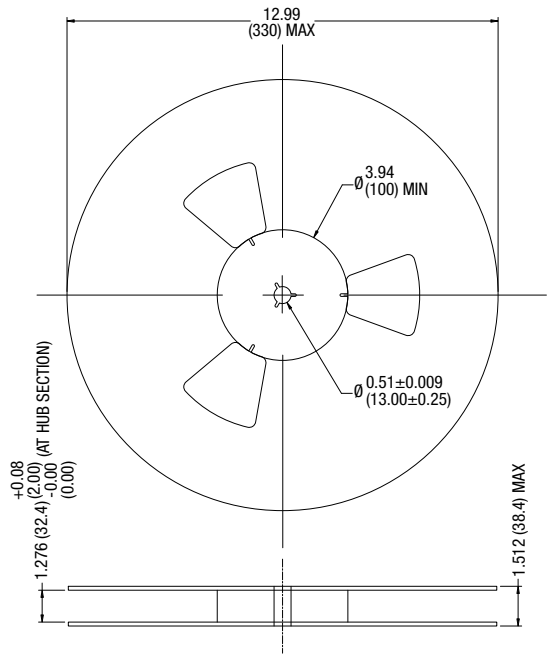
PICK-UP POINT NNL05-10



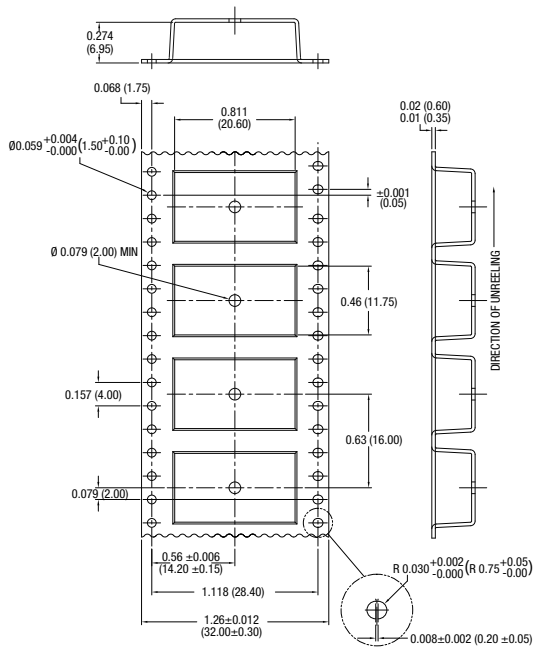
Unless otherwise stated all dimensions in inches(mm) ±0.01(0.25).

TAPE & REEL SPECIFICATIONS

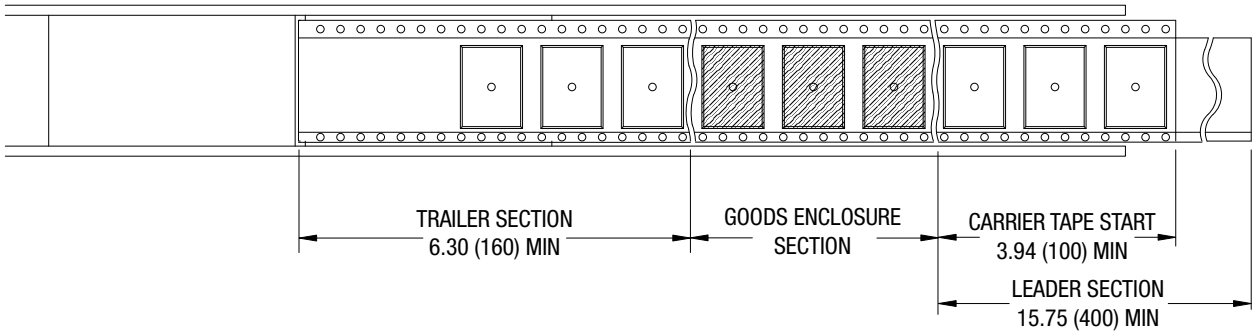
REEL OUTLINE DIMENSIONS



TAPE OUTLINE DIMENSIONS



REEL PACKAGING DETAILS



Reel Quantity : 500

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