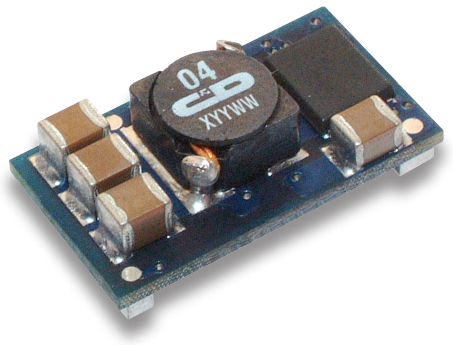
NNL05 Series

Non-isolated DC/DC Converters



FEATURES

- Industry standard footprint
- Short circuit protection
- High efficiency
- Under voltage lock out
- Fully adjustable output voltage
- Operating temperature range -40°C to 85°C
- Fully adjustable output voltage
- SMD Construction

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 (optional tape and reel packaging on request).

SELECTION GUIDE[1]

Order Code	Input Voltage V (nom.)	Output Voltage V	Output Current Min. Load A	Output Current Full Load A	User Select Voltage V_{OUT}	Efficiency % (min.)
NNL05-9[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
NNL05-10[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]

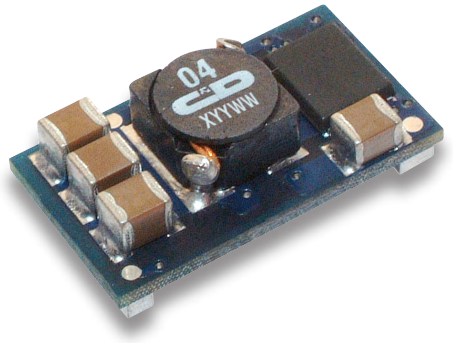
Parameter	Conditions		Min.	Typ.	Max.	Units
Voltage range	NNL05-9 V_{OUT} < 2.75V		3.0		5.5	V
	NNL05-9 V_{OUT} > 3.0V		4.0		5.5	
	NNL05-10		10.0		14.0	
Under voltage lock out	NNL05-9	Turn on threshold		2.11		V
		Turn off threshold		1.96		
	NNL05-10	Turn on threshold	7.85		8.25	
		Turn off threshold	7.75		8.20	
Reflected ripple current	NNL05-9			12.0		mA p-p
	NNL05-10			20.0		
Input no load current	NNL05-9	V_{IN} = 5.5V V_{OUT} = 0.75V		70		mA
		V_{IN} = 5.5V V_{OUT} = 3.3V		100		
	NNL05-10	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	T_A = –40°C to 85°C (see thermal performance characteristics)				5.0	A
Voltage set point accuracy	Using 1% tolerance resistor		-2.0		+2.0	%
Line regulation	Low line to high line	NNL05-9			1.0	%
		NNL05-10			0.1	
Load regulation	0% load to 100% load	NNL05-9			1.0	%
		NNL05-10			0.2	
Ripple & noise	BW = DC to 20MHz with 1µF ceramic and 10µF tantalum	NNL05-9		30		mV p-p
		NNL05-10 0.75V		9		
		NNL05-10 5.0V		20		
Transient response	NNL05-9 I_{OUT} = 2.5A–5.0A–2.5A	Peak deviation		60		mV
		Settling time		25		µs
	NNL05-10 I_{OUT} = 2.5A–5.0A–2.5A	Peak deviation		70		mV
		Settling time		35		µs
Current limit inception				9.0		A

3

1 Specifications typical at T_A =25°C, nominal input voltage and rated output current unless otherwise specified.
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.
3 UL recognition for NNL05-10 is pending.



ABSOLUTE MAXIMUM RATINGS

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

MTTF

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

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

GENERAL CHARACTERISTICS[1]

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

ENVIRONMENTAL 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	NNL05-9		110		°C
		NNL05-10		118		

OUTPUT VOLTAGE ADJUSTMENT

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

To calculate the resistor value for NNL05-9:

$$R_{TRIM} = \left[\frac{21070}{V_{OUT} - 0.75} - 5110 \right] \Omega$$

To calculate the resistor value for NNL05-10:

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

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

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

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

Fig.1

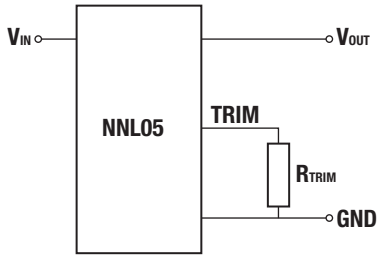


Table 1: NNL05-9 R_{TRIM} & V_{TRIM}

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

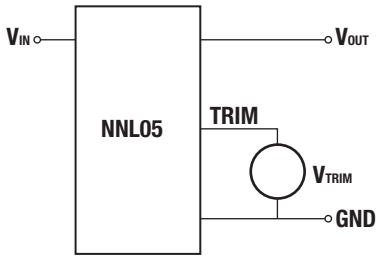


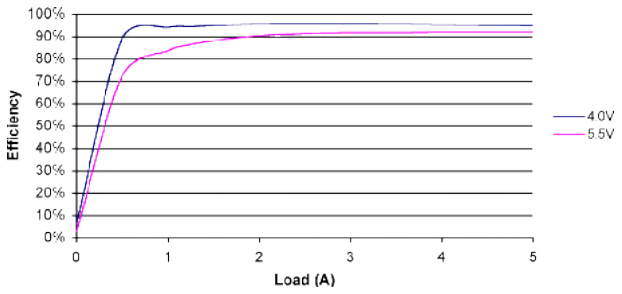
Table 2: NNL05-10 R_{TRIM} & V_{TRIM}

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

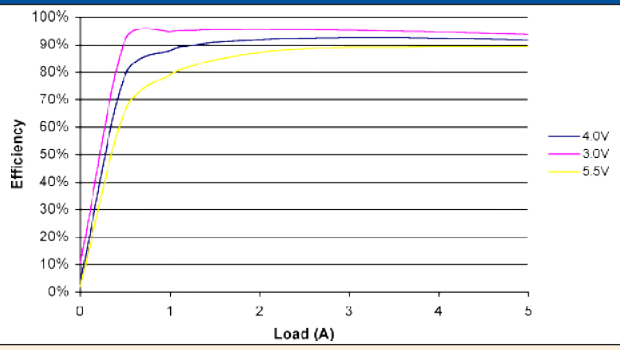
1 Specifications typical at T_A =25°C, nominal input voltage and rated output current unless otherwise specified.

EFFICIENCY v LOAD GRAPHS (NNL05-9)

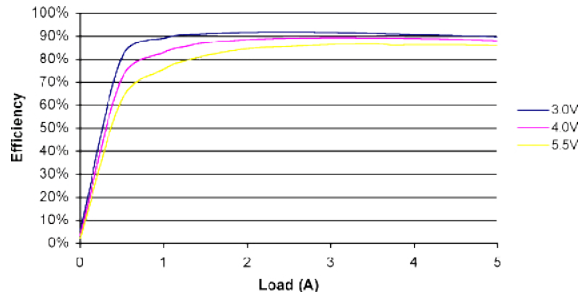
VOUT = 3.3V



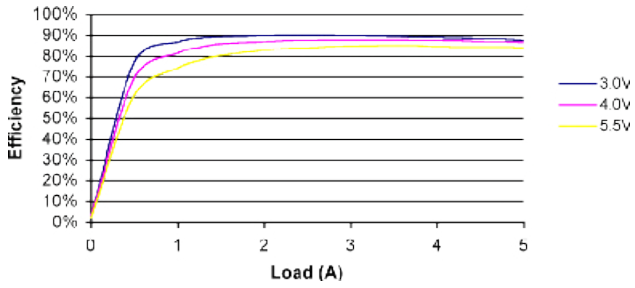
VOUT = 2.5V



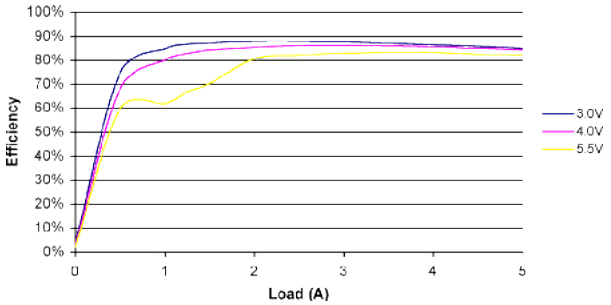
VOUT = 1.8V



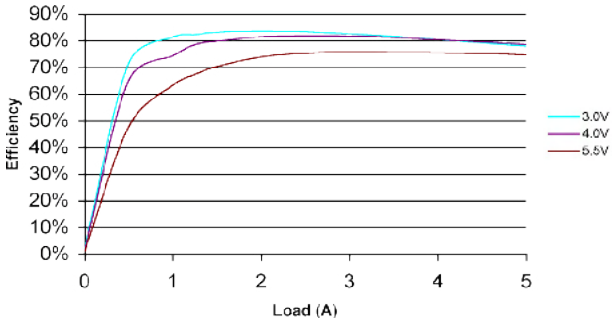
VOUT = 1.5V



VOUT = 1.2V

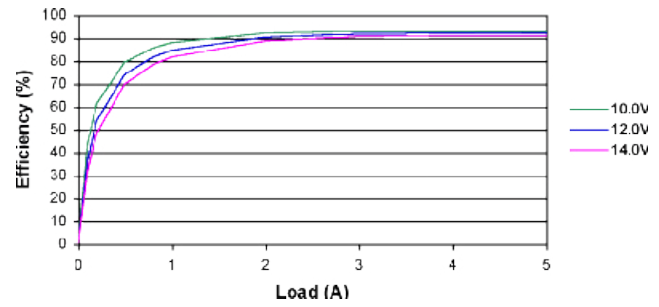


VOUT =0.75V

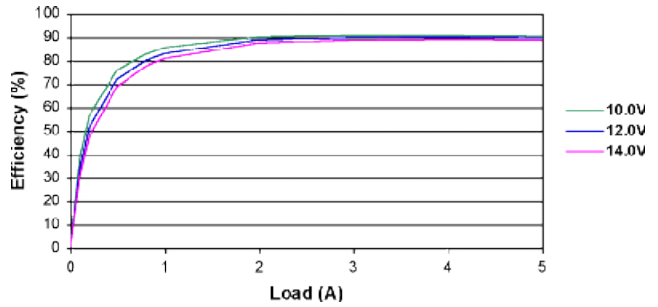


EFFICIENCY v LOAD GRAPHS (NNL05-10)

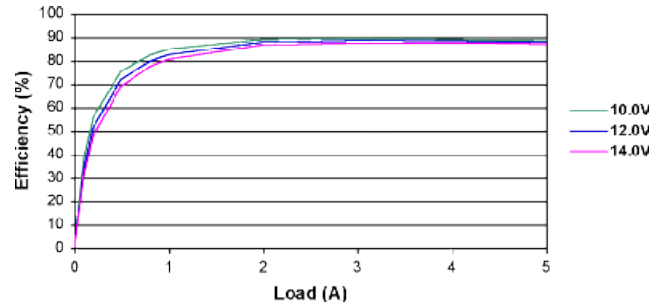
VOUT = 5.0V



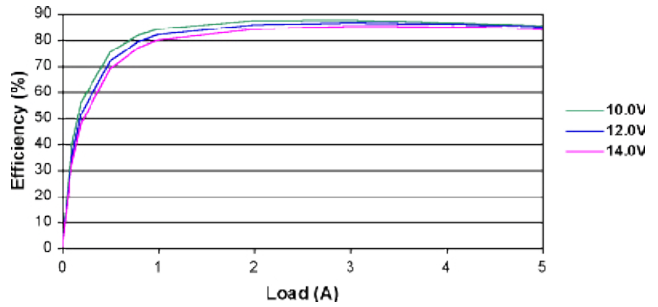
VOUT = 3.3V



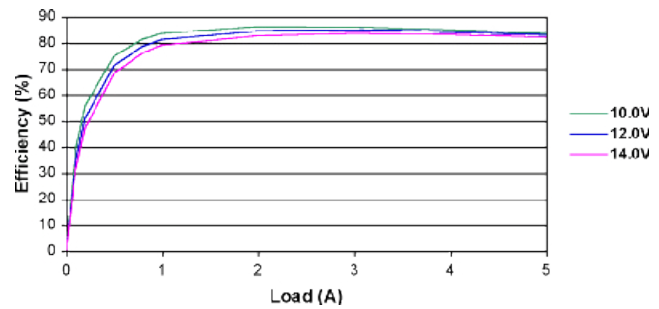
VOUT = 2.5V



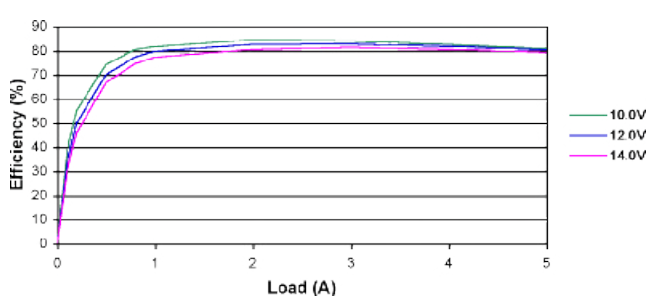
VOUT = 1.8V



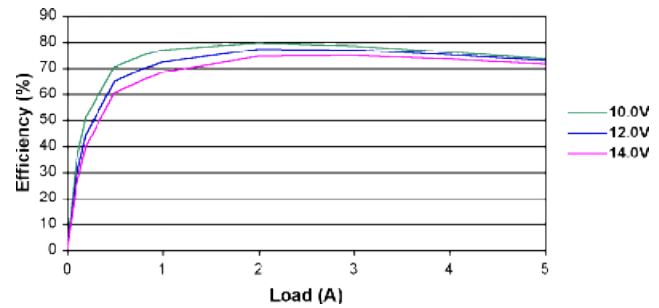
VOUT = 1.5V



VOUT =1.2V

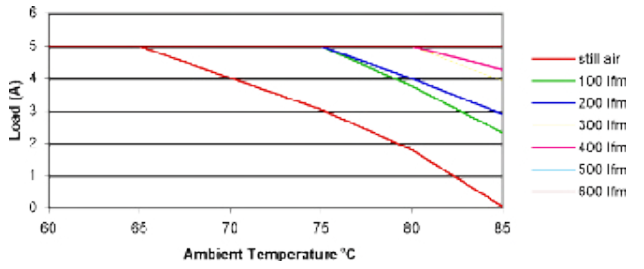


VOUT =0.75V

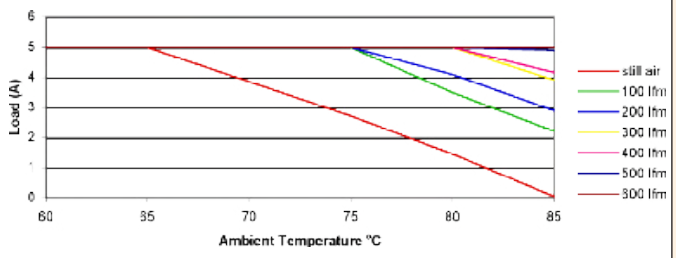


THERMAL DERATING GRAPHS (NNL05-9)

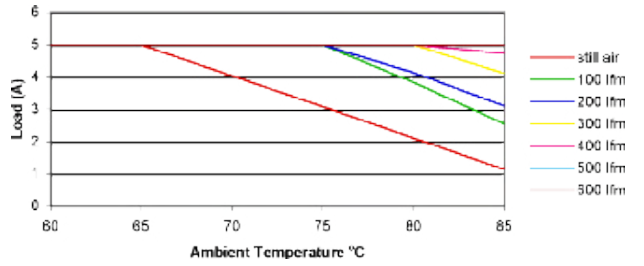
VOUT = 3.3V



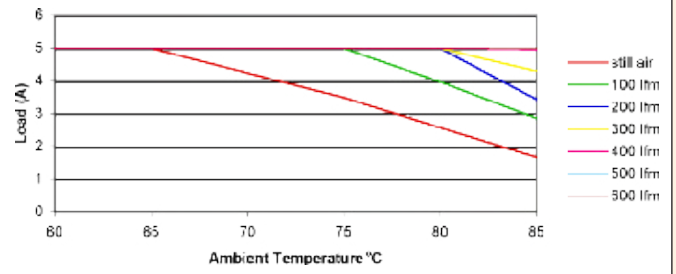
VOUT = 2.5V



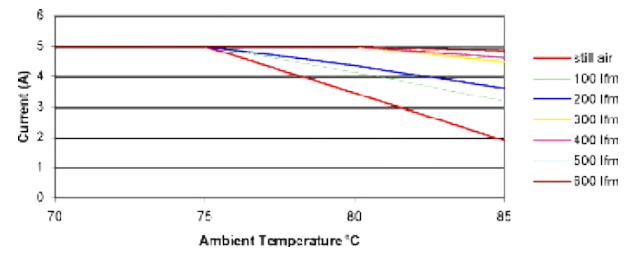
VOUT = 1.8V



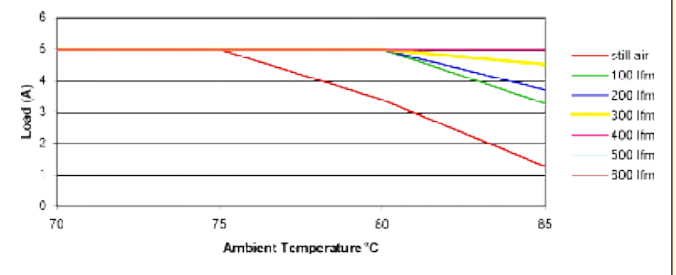
VOUT = 1.5V



VOUT = 1.2V



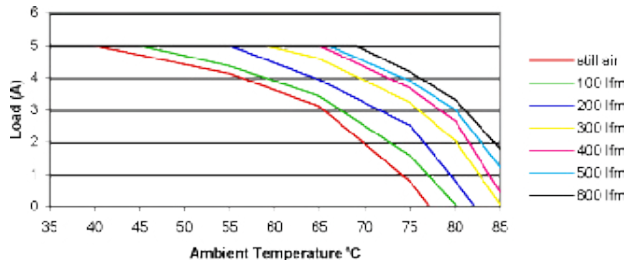
VOUT =0.75V



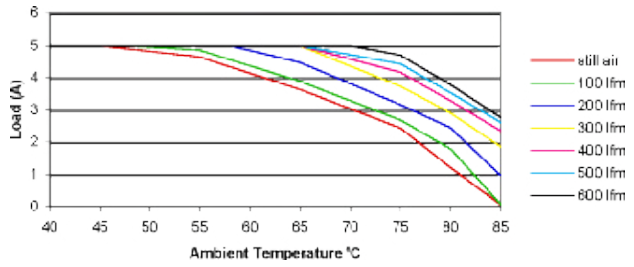
All derating graphs shown are for an input voltage, V_{IN} = 5.5V

THERMAL DERATING GRAPHS (NNL05-10)

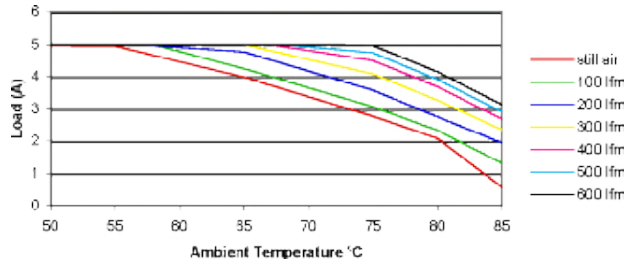
VOUT = 5.0V



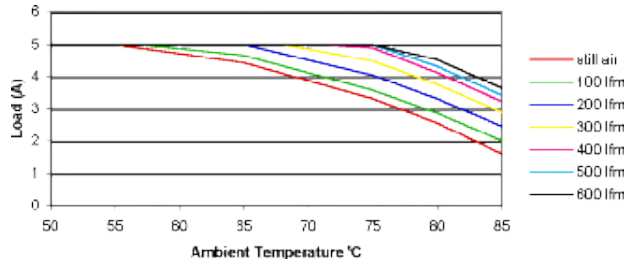
VOUT = 3.3V



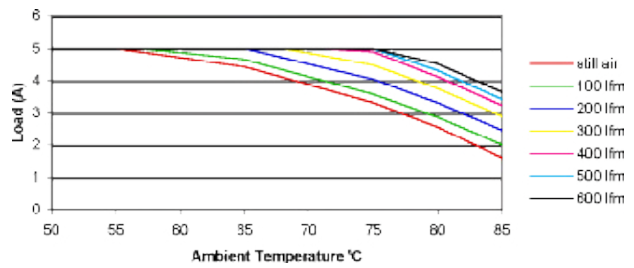
VOUT = 2.5V



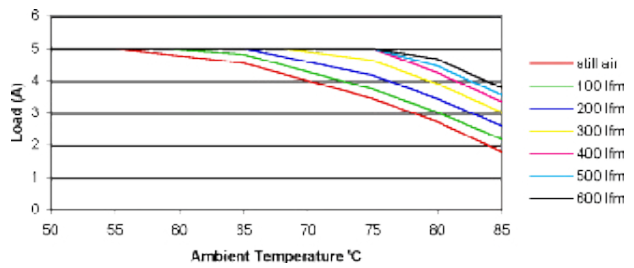
VOUT = 1.8V



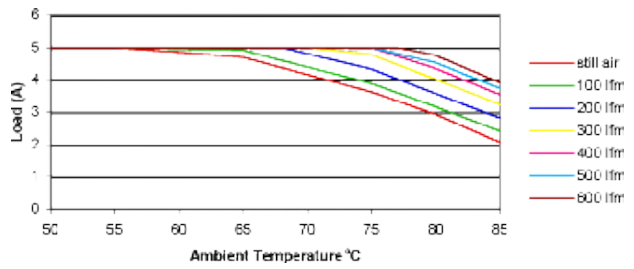
VOUT = 1.5V



VOUT =1.2V



VOUT =0.75V

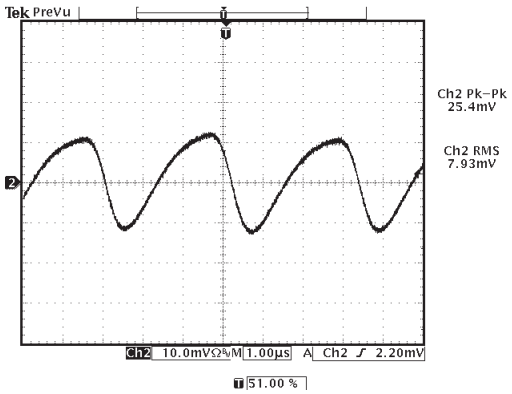


All derating graphs shown are for an input voltage, V_{IN} = 14.0V

CHARACTERISTIC GRAPHS (NNL05-9)

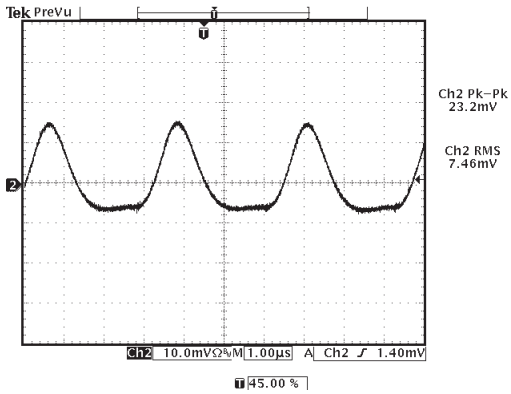
TYPICAL OUTPUT RIPPLE & NOISE

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

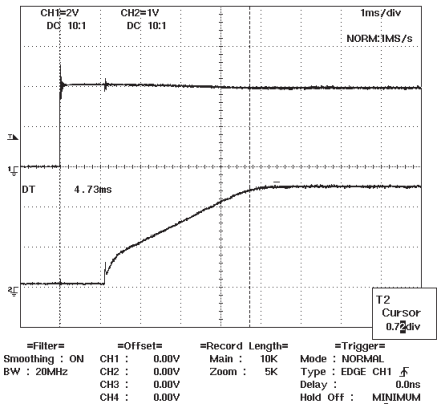


TYPICAL OUTPUT RIPPLE & NOISE

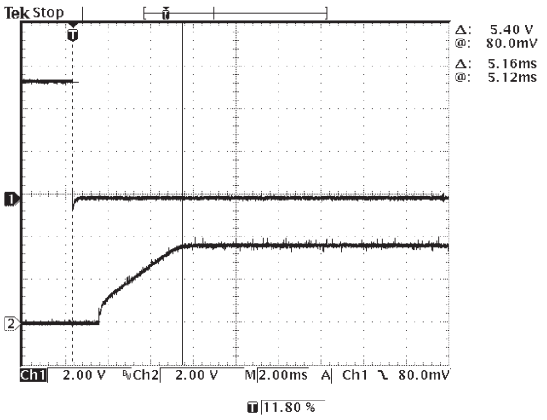
V_{IN} = 5.0VDC V_{OUT} = 0.75V I_{OUT} = 5.0A



TYPICAL START-UP FROM APPLICATION OF VIN

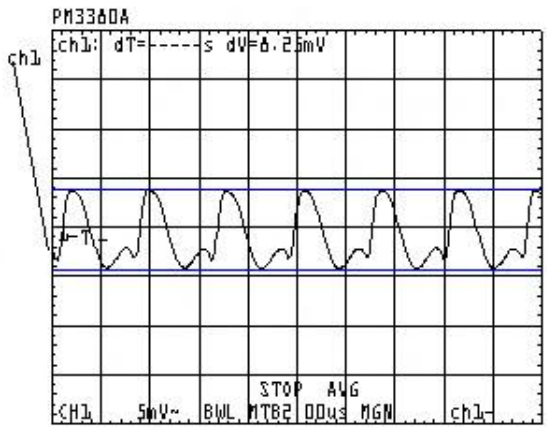


TYPICAL START-UP USING REMOTE ON/OFF

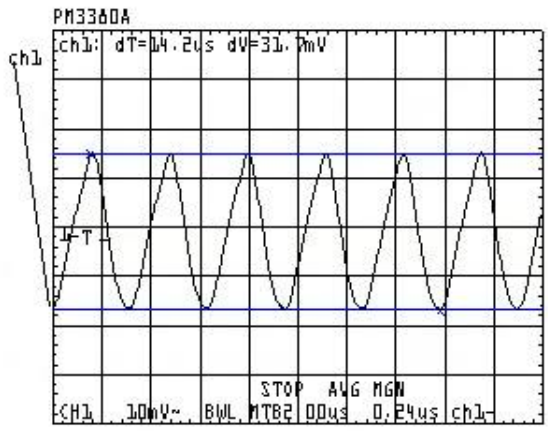


CHARACTERISTIC GRAPHS (NNL05-10)

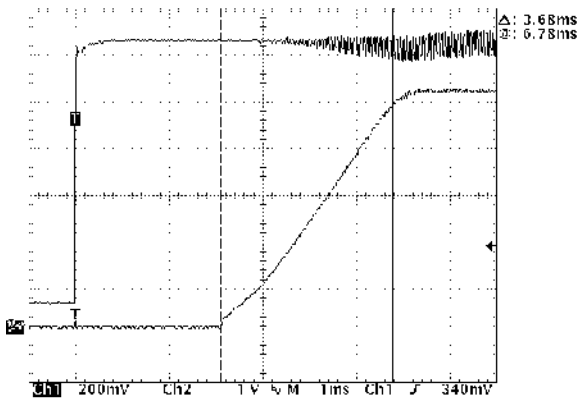
TYPICAL OUTPUT RIPPLE & NOISE (0.75V OUTPUT)



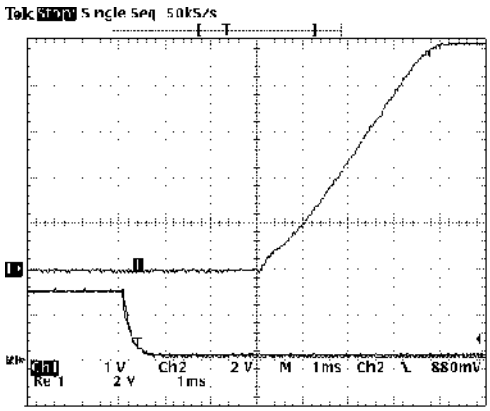
TYPICAL OUTPUT RIPPLE & NOISE (5.0V OUTPUT)



TYPICAL START-UP FROM APPLICATION OF VIN

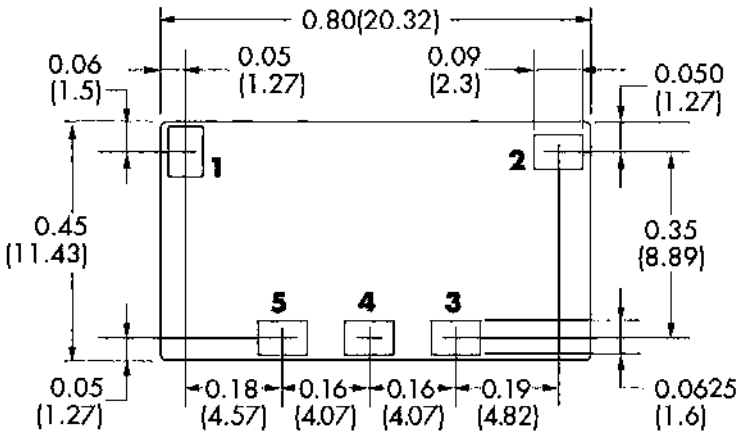


TYPICAL START-UP USING REMOTE ON/OFF



MECHANICAL DIMENSIONS

SURFACE MOUNT PACKAGE STYLE (BOTTOM VIEW)



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

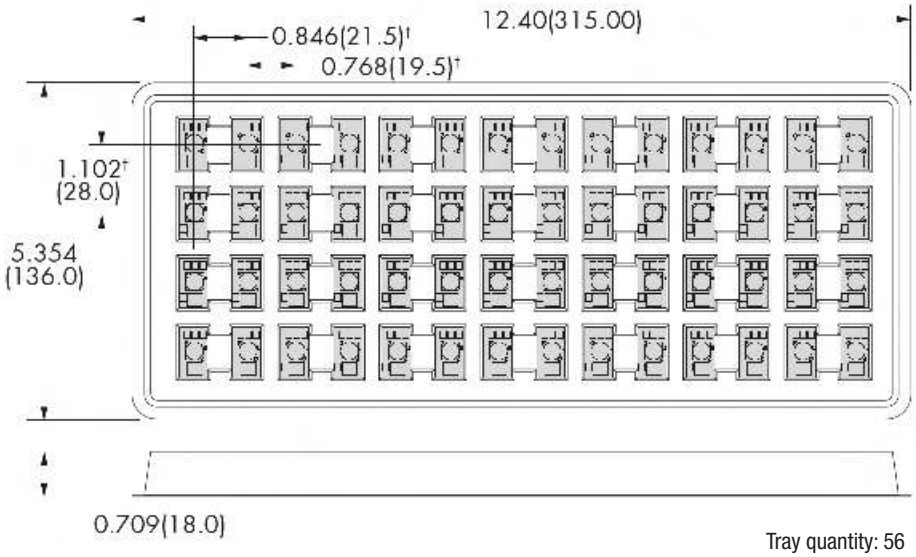
PIN CONNECTIONS

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

PACKAGE WEIGHT

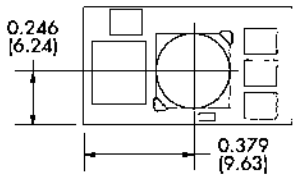
NNL05-9	**2.3g**
NNL05-10	**2.7g**

TRAY DIMENSIONS (TOP VIEW)



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

PICK-UP POINT



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

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