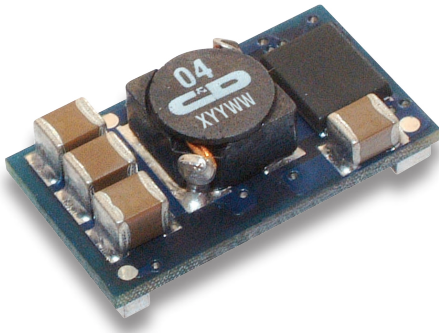




FEATURES

- 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). UL60950 recognition pending.

SELECTION GUIDE¹

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

INPUT CHARACTERISTICS¹

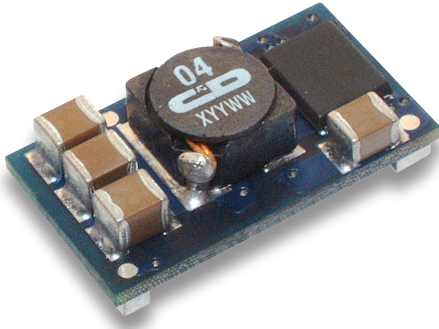
Parameter	Conditions	Min.	Typ.	Max.	Units
Voltage range	NNL05-9 V _{OUT} < 2.75V	3.0		5.5	V
	NNL05-9 V _{OUT} > 3.0V	4.0		5.5	
	NNL05-10	10.0		14.0	
Under voltage lock out	NNL05-9	Turn on threshold	2.11		V
		Turn off threshold	1.96		
	NNL05-10	Turn on threshold	7.85	8.25	
		Turn off threshold	7.75	8.20	
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

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





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

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%

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 x {V_{OUT} - 0.7525})

To calculate V_{TRIM} for NNL05-10:
V_{TRIM} = (0.7-0.0667 x {V_{OUT} - 0.7525})

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

Fig.1

Fig.2

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

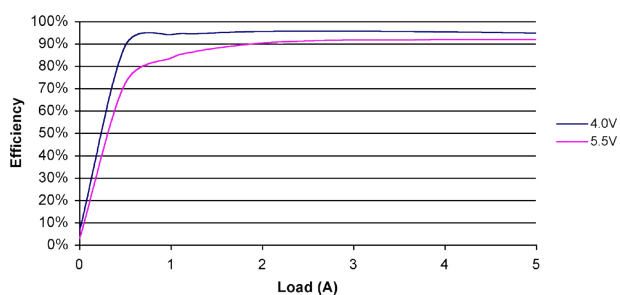
Table 2: NNL05-10 R_{TRIM} & V_{TRIM}

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

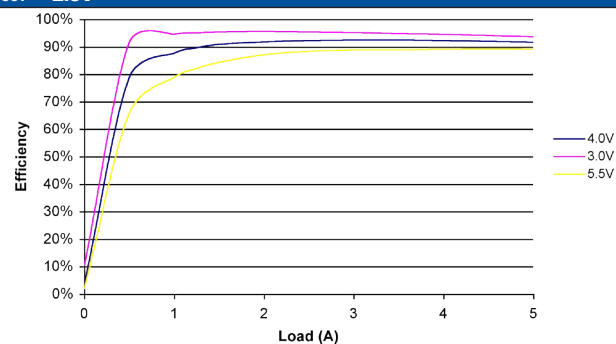
¹ Specifications typical at T_A =25°C, nominal input voltage and rated output current unless otherwise specified.

EFFICIENCY v LOAD GRAPHS (NNL05-9)

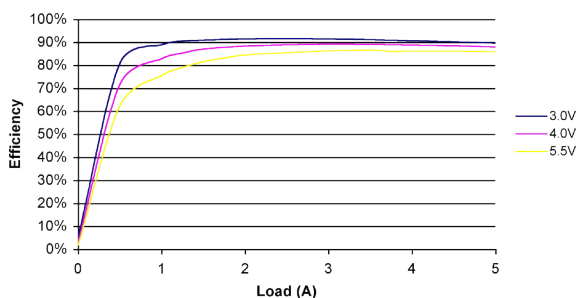
V_{OUT} = 3.3V



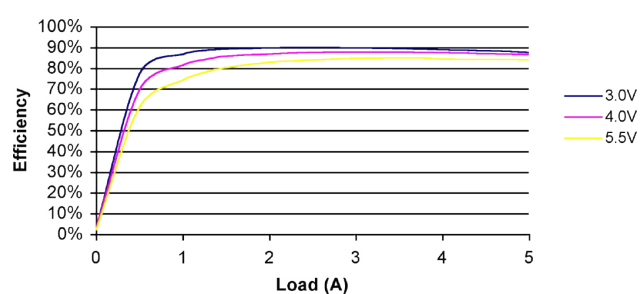
V_{OUT} = 2.5V



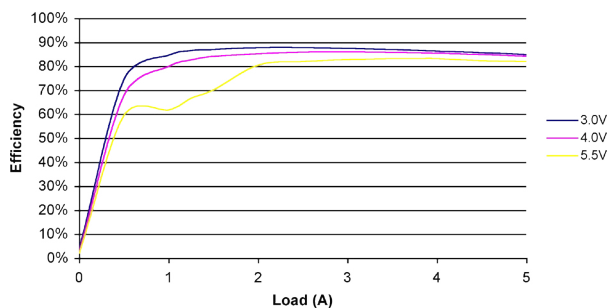
V_{OUT} = 1.8V



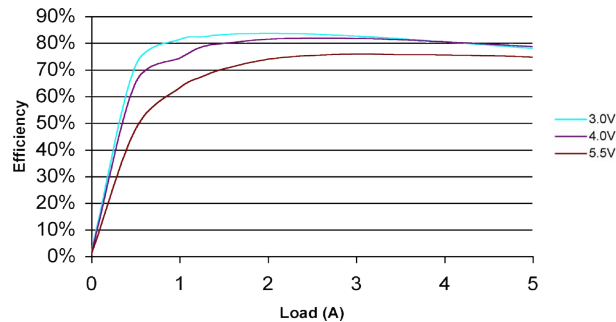
V_{OUT} = 1.5V



V_{OUT} = 1.2V

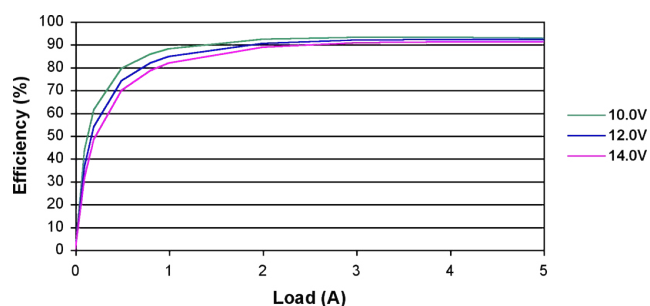


V_{OUT} = 0.75V

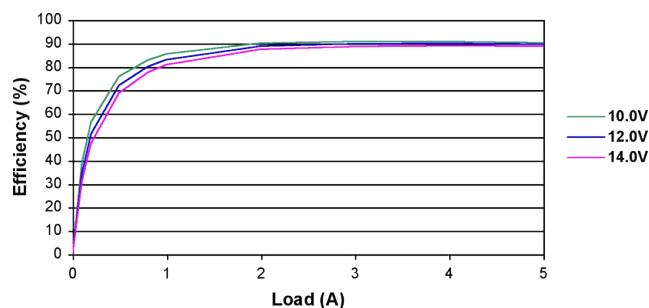


EFFICIENCY v LOAD GRAPHS (NNL05-10)

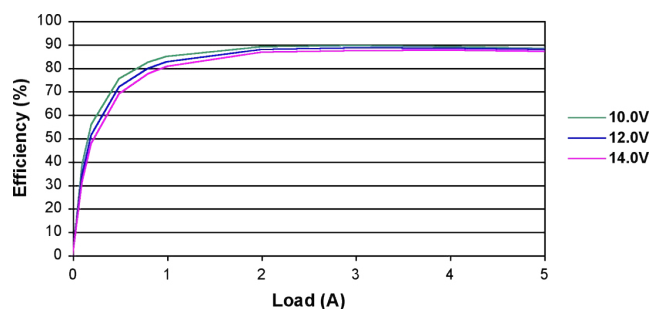
V_{OUT} = 5.0V



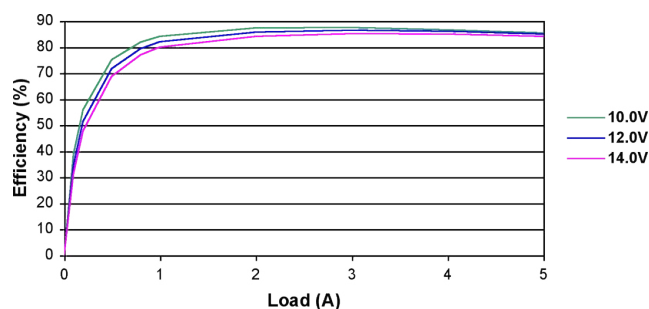
V_{OUT} = 3.3V



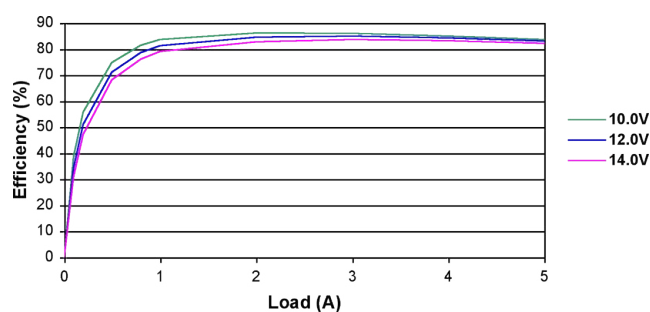
V_{OUT} = 2.5V



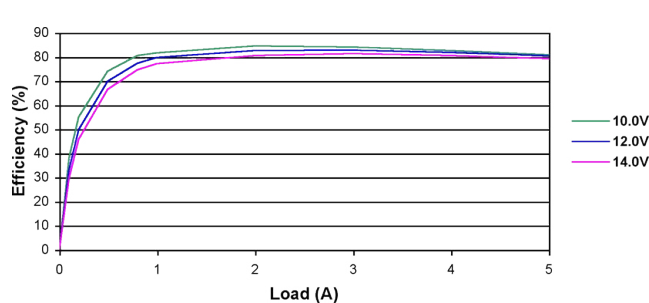
V_{OUT} = 1.8V



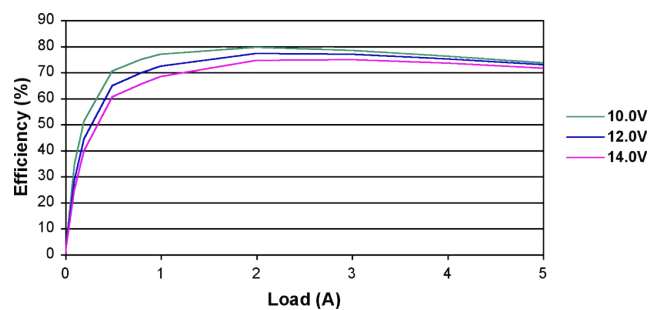
V_{OUT} = 1.5V



V_{OUT} = 1.2V

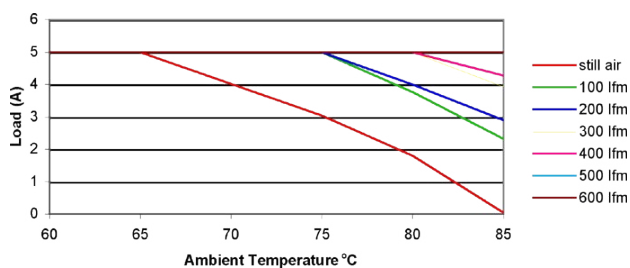


V_{OUT} = 0.75V

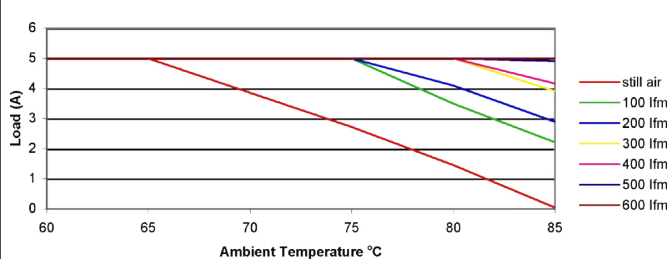


THERMAL DERATING GRAPHS (NNL05-9)

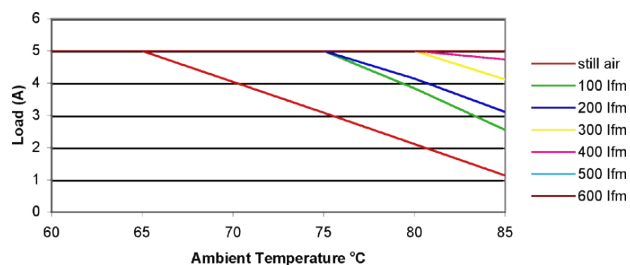
$V_{OUT} = 3.3V$



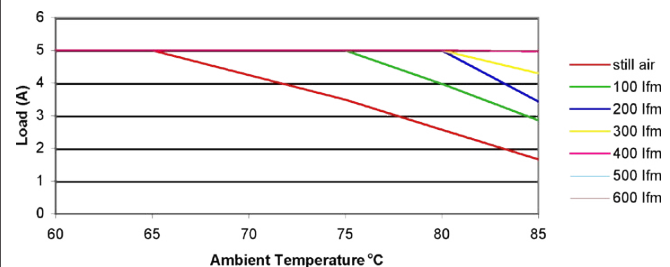
$V_{OUT} = 2.5V$



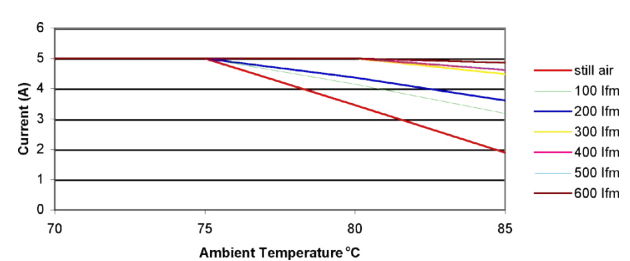
$V_{OUT} = 1.8V$



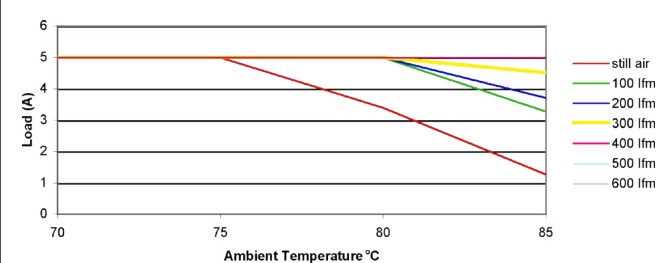
$V_{OUT} = 1.5V$



$V_{OUT} = 1.2V$



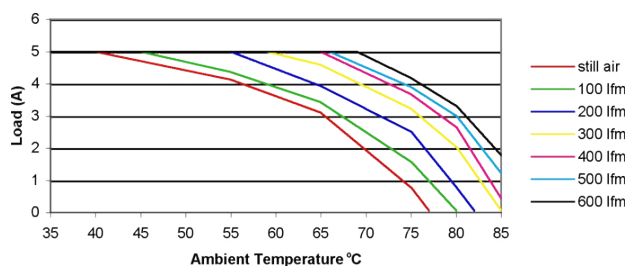
$V_{OUT} = 0.75V$



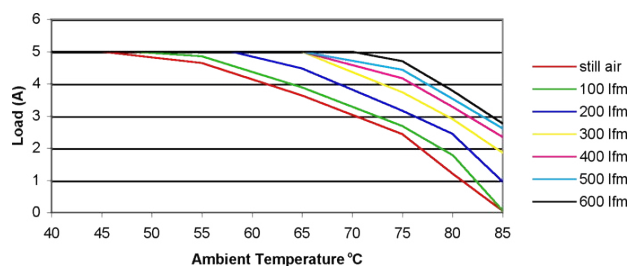
All derating graphs shown are for an input voltage, $V_{IN} = 5.5V$

THERMAL DERATING GRAPHS (NNL05-10)

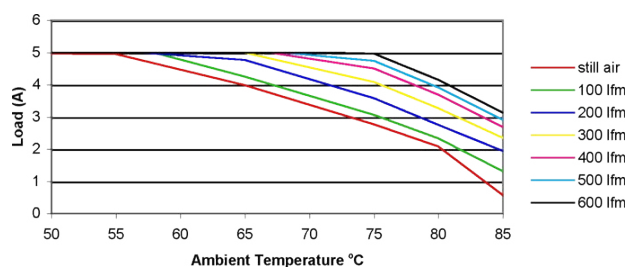
$V_{OUT} = 5.0V$



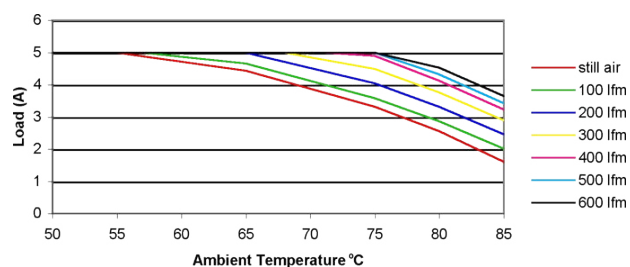
$V_{OUT} = 3.3V$



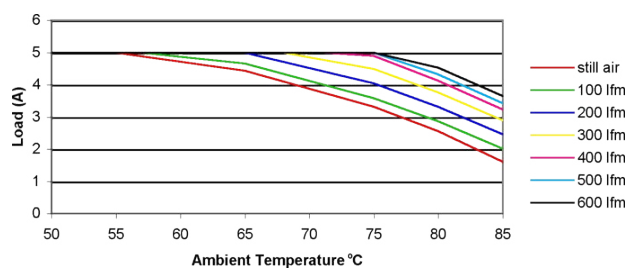
$V_{OUT} = 2.5V$



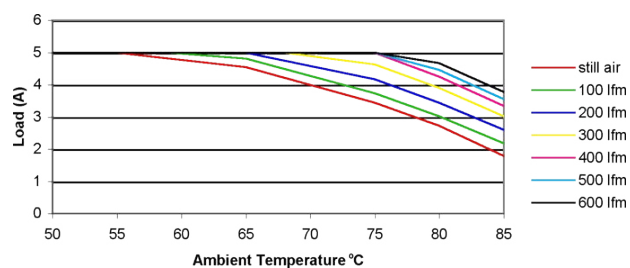
$V_{OUT} = 1.8V$



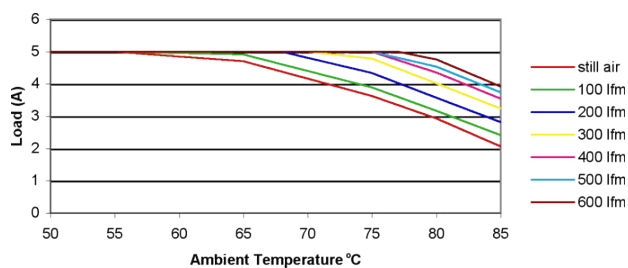
$V_{OUT} = 1.5V$



$V_{OUT} = 1.2V$



$V_{OUT} = 0.75V$

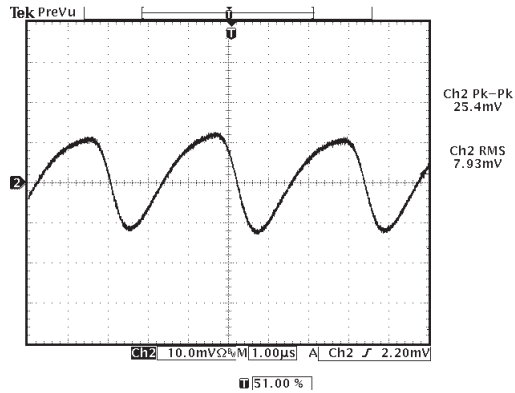


All derating graphs shown are for an input voltage, $V_{IN} = 14.0V$

CHARACTERISTIC GRAPHS (NNL05-9)

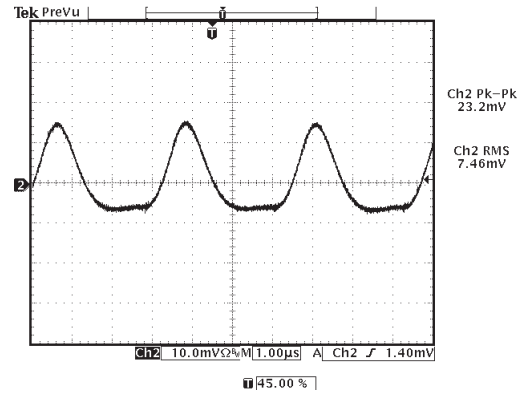
TYPICAL OUTPUT RIPPLE & NOISE

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

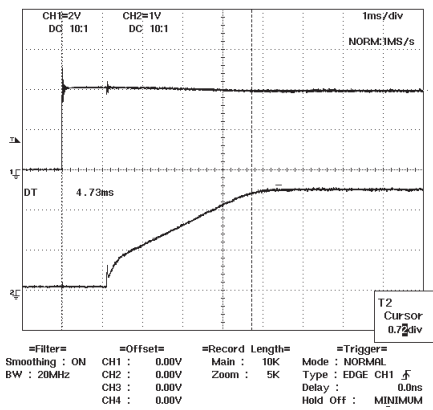


TYPICAL OUTPUT RIPPLE & NOISE

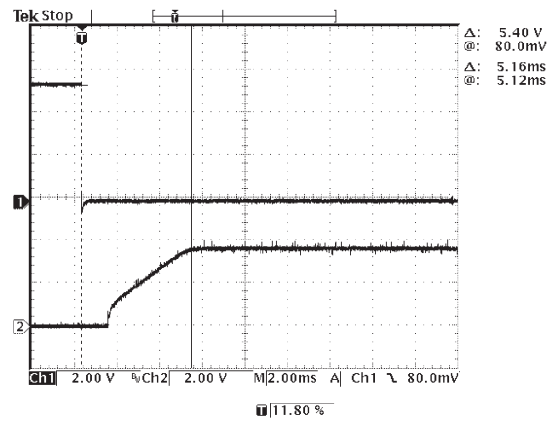
$V_{IN} = 5.0VDC$ $V_{OUT} = 0.75V$ $I_{OUT} = 5.0A$



TYPICAL START-UP FROM APPLICATION OF V_{IN}

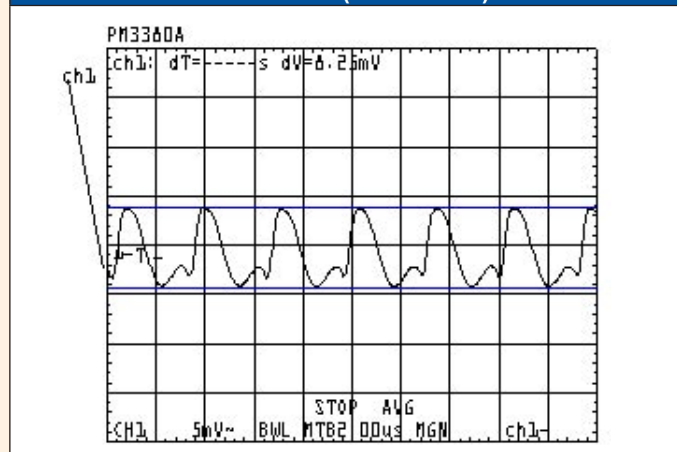


TYPICAL START-UP USING REMOTE ON/OFF

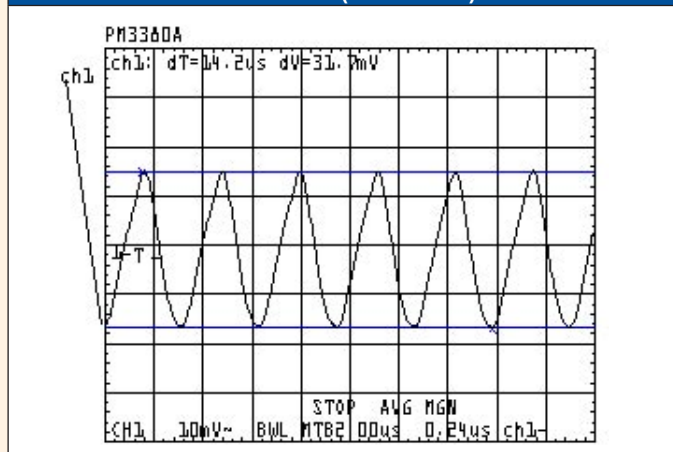


CHARACTERISTIC GRAPHS (NNL05-10)

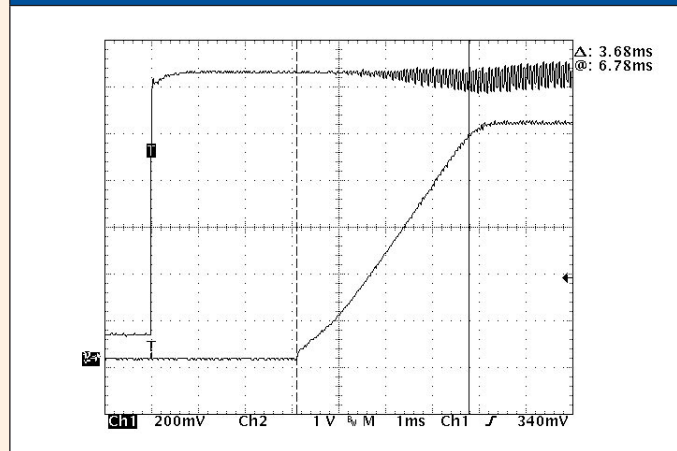
TYPICAL OUTPUT RIPPLE & NOISE (0.75V OUTPUT)



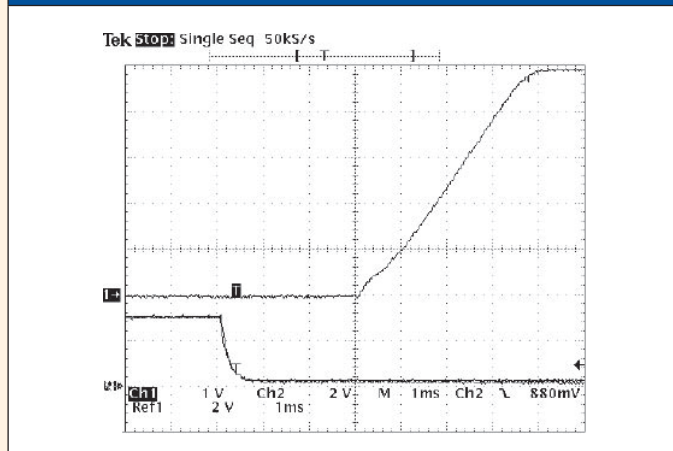
TYPICAL OUTPUT RIPPLE & NOISE (5.0V OUTPUT)



TYPICAL START-UP FROM APPLICATION OF VIN

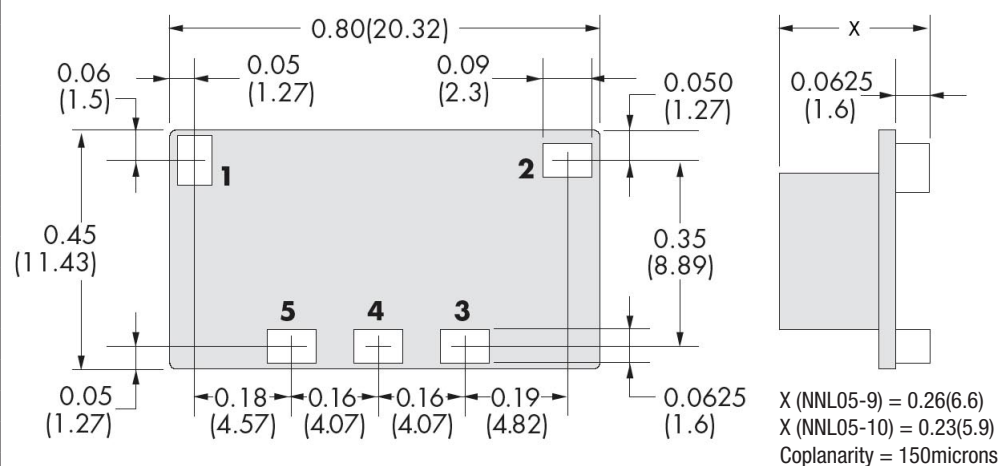


TYPICAL START-UP USING REMOTE ON/OFF



MECHANICAL DIMENSIONS

SURFACE MOUNT PACKAGE STYLE (BOTTOM VIEW)



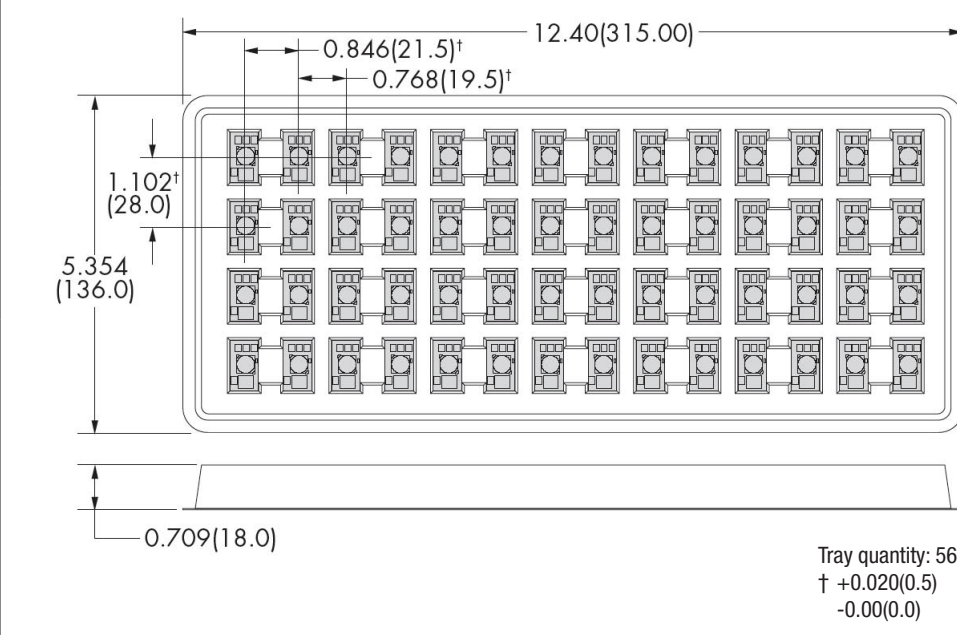
PIN CONNECTIONS

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

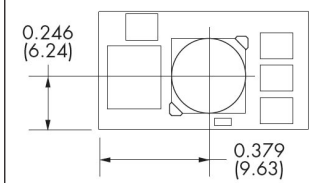
PACKAGE WEIGHT

NNL05-9	2.3g
NNL05-10	2.7g

TRAY DIMENSIONS (TOP VIEW)



PICK-UP POINT



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