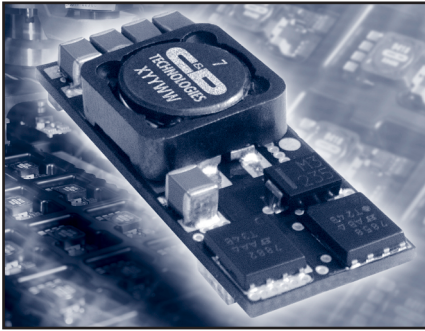




FEATURES

- Industry Standard Footprint
- Short Circuit Protection
- High Efficiency
- Under Voltage Lock Out
- Output Voltage Trimming
- Operating Temperature Range -40°C to 85°C
- SMD Construction
- Optional DC OK Signal
- Options available without Trim and Remote Sense Functionality

DESCRIPTION

The NNL10 series is part of a range of non-isolated, cost effective DC/DC converters offering high precision output voltages from a nominal 3.0–5.5 or 10.0–14.0 intermediate bus where isolation is not required. Available in both SMD and SIP mechanical formats.

SELECTION GUIDE¹

	Nominal Input Voltage	Output Voltage	Output Current		MAX Output Power	Nominal Efficiency
			Min Load	Full Load		
Order Code	V	V	A	A	W	%
NNL10-1	4.0	0.9	0	10.0	9.0	79.7
NNL10-2	4.0	1.0	0	10.0	10.0	81.8
NNL10-3	4.0	1.2	0	10.0	12.0	84.3
NNL10-4	4.0	1.5	0	10.0	15.0	86.5
NNL10-5	4.0	1.8	0	10.0	18.0	88.2
NNL10-6	4.0	2.0	0	10.0	20.0	89.2
NNL10-7	4.0	2.5	0	10.0	25.0	91.2
NNL10-8	4.0	3.3	0	10.0	33.0	92.1
With DCOK	NNL10-9	4.0	0.9	0	10.0	79.7
	NNL10-10	4.0	1.0	0	10.0	81.8
	NNL10-11	4.0	1.2	0	10.0	84.3
	NNL10-12	4.0	1.5	0	10.0	86.5
	NNL10-13	4.0	1.8	0	10.0	88.2
	NNL10-14	4.0	2.0	0	10.0	89.2
	NNL10-15	4.0	2.5	0	10.0	91.2
	NNL10-16	4.0	3.3	0	10.0	92.1

INPUT CHARACTERISTICS¹

Parameter	Conditions	MIN	TYP	MAX	Units
Voltage Range	$V_{NOM} = 4.0V_{DC}$ $V_{OUT} < 2.75V$	3.0		5.5	V
	$V_{NOM} = 4.0V_{DC}$ $V_{OUT} > 3.0V$	4.0		5.5	
Under Voltage Lock Out	Turn On Threshold $V_{NOM} = 4.0V_{DC}$		2.8		V
	Turn Off Threshold $V_{NOM} = 4.0V_{DC}$		2.7		
Reflected Ripple Current			30		mA p-p
Input No Load Current	$V_{IN} = 5.5V$ $V_{OUT} = 0.9V$		100		mA
	$V_{IN} = 5.5V$ $V_{OUT} = 3.3V$		140		
Input Standby Current	$V_{IN} = 5.5V$ Module Disabled		1.5		mA

OUTPUT CHARACTERISTICS¹

Parameter	Conditions	MIN	TYP	MAX	Units
Rated Current	$T_A = -40^{\circ}C$ to $85^{\circ}C$ (see thermal performance characteristics)			10.0	A
Voltage Set Point Accuracy			1.0	2.0	%
Line Regulation	Low line to high line		0.5	1.0	%
Load Regulation	0% load to 100% load			0.55	%
Ripple & Noise	BW = DC to 20MHz		25	50	mVp-p
Voltage Trim		-10		+10	% V_{OUT}
Remote Sense				0.5	V
Transient Response	$I_{OUT} = 5.0A-10.0A-5.0A$, Peak Deviation		100		mV
	$C_{OUT} = 1\mu F//10\mu F$ Settling Time		70		μs
External Load Capacitance			10,000		μF

¹ Specifications typical at $T_A = 25^{\circ}C$, nominal input voltage and rated output current unless otherwise specified.

Other customer specified options are available on request. Standard parts are supplied with Remote Sense and Voltage Trim functions. Please contact your sales representative or C&D Technologies account manager for further details.



GENERAL CHARACTERISTICS¹

Parameter	Conditions	MIN	TYP	MAX	Units
Switching Frequency			300		kHz
Start Delay	From power on/remote off		4.0		ms
Remote On/Off	Module On (or pin unconnected)	0		0.3	V
				100	μA
	Module Off	2.6			V
				-500	μA
MTTF		TBA			kHrs

ABSOLUTE MAXIMUM RATINGS

Short circuit protection	Continuous
Remote Sense	V _{OUT} ±0.5V _{DC}
DC OK	-0.2V _{DC} to +17V _{DC} 20mA
Remote ON/OFF	-0.2V _{DC} to +17V _{DC}
Trim	-0.3V _{DC} to V _{OUT}
Input Voltage V _{IN}	6.5V _{DC}
Minimum load	0%

ENVIRONMENTAL¹

Parameter	Conditions	MIN	TYP	MAX	Units
Operation	See thermal performance characteristics	-40		85	°C
Over Temperature Protection	Substrate temperature		115		°C
Storage		-55		125	°C

OUTPUT VOLTAGE TRIMMING

The trimming input on the NNL10 allows output voltage adjustment by +/-10% of nominal output voltage by connection of a resistor or by application of a voltage to the Trim pin.

R_{INTERNAL} VALUES

V _{OUT SET} (V)	R _{INTERNAL} (kΩ)
0.9	5.1
1.0	30.1
1.2	59.0
1.5	100.0
1.8	100.0
2.0	100.0
2.5	78.7
3.3	59.0

FIG.1

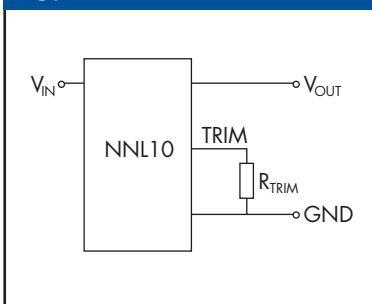
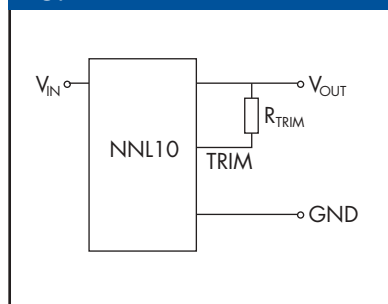


FIG.2



To increase the output voltage, an external resistor (Fig. 1) or voltage source should be connected between the Trim pin and GND pin.

$$R_{\text{TRIM-UP}} = \frac{24.080}{|\Delta V_{\text{OUT}}|} - R_{\text{INTERNAL}} \text{ K}\Omega \quad V_{\text{TRIM-UP}} = 0.8 - \left[\frac{\Delta V_{\text{OUT}} \times R_{\text{INTERNAL}}}{30.100} \right]$$

ΔV_{out} is the required change in output voltage in V

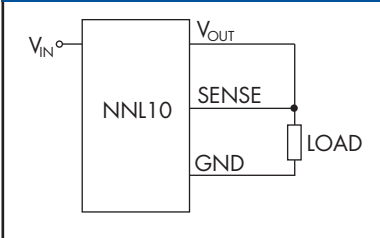
To decrease the output voltage, an external resistor (Fig. 2) or voltage source should be connected between the Trim pin and the V_{OUT} pin.

$$R_{\text{TRIM-DOWN}} = \left[\left(\frac{V_{\text{OUT}} - 0.8}{|\Delta V_{\text{OUT}}|} - 1 \right) \times 30.100 \right] - R_{\text{INTERNAL}} \text{ K}\Omega \quad V_{\text{TRIM-DOWN}} = 0.8 + \left[|\Delta V_{\text{OUT}}| \times \frac{R_{\text{INTERNAL}}}{30.100} \right]$$

The trim pin should be left disconnected if not used.

REMOTE SENSE

FIG.3



The remote sense function compensates for voltage drops from the output of the NNL10 to the load point by regulating the output voltage at the load point. The voltage drop must not exceed 0.5V, although Trim and remote sense functions can be used in combination with each other, the maximum voltage increase is 0.5V.

When increasing the output voltage the maximum output power of the NNL10 must not exceed the maximum output figures stated in the selection guide.

OUTPUT SEQUENCING

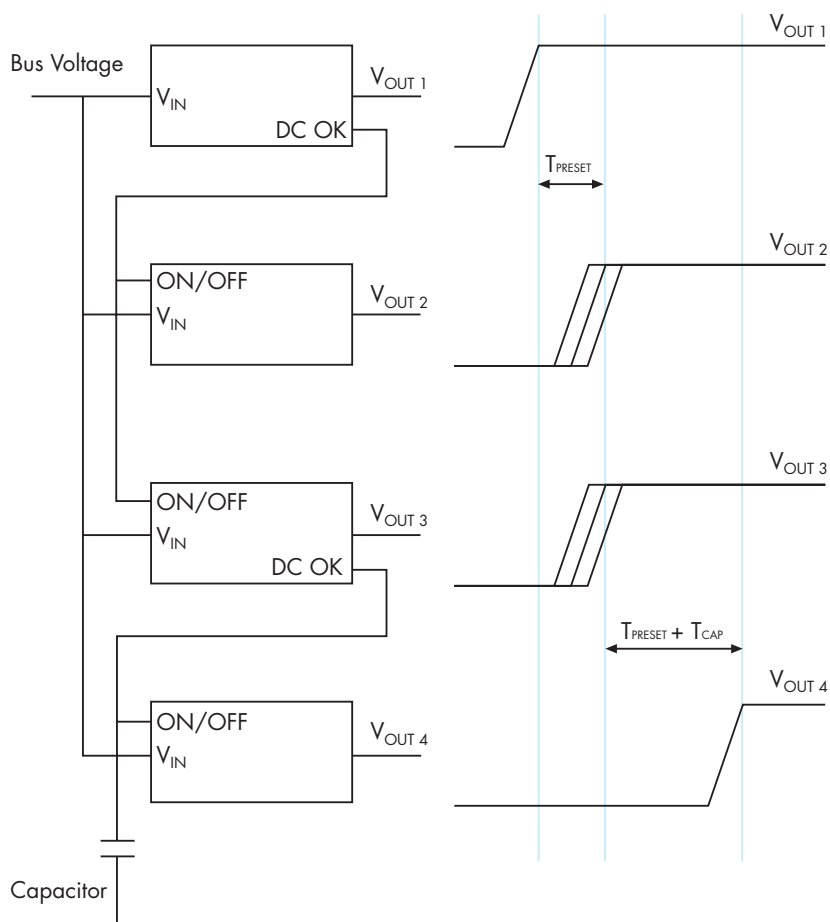
To simplify output sequencing, the NNL10 series offers an optional single wire interconnection that performs this function. Using this connection, up to four devices can be 'daisy chained' together, with the 'DC OK' signal from one converter signifying that the next converter can be enabled. A capacitor, simply connected to the daisy chain link, provides a settable delay in the sequence of the converters starting.

Typical capacitor values and corresponding delays are shown in the table below.

Figure 4 shows a typical sequencing configuration, along with the voltage outputs that it produces. As well as reducing component count, making use of the 'built-in' sequencing capability means that only a single PCB track is required for a full sequencing solution.

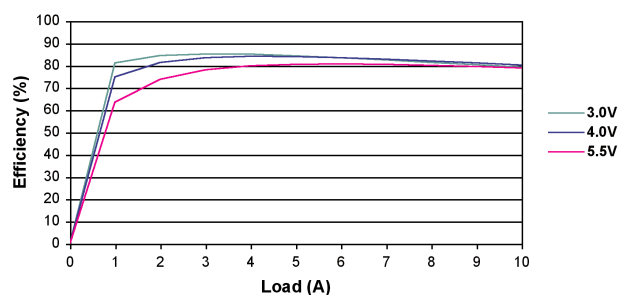
V _{IN}	Capacitor Value	Delay
3.0VDC	0.22μF	1.8mS
5.5VDC	0.22μF	0.6mS

FIG.4

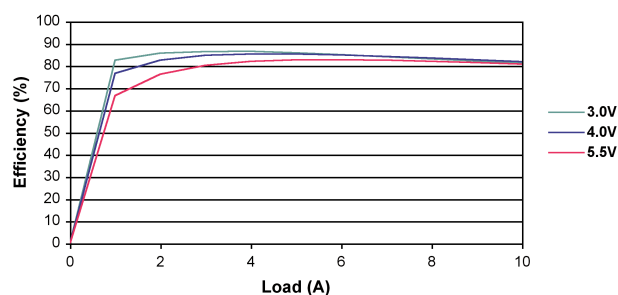


EFFICIENCY v LOAD GRAPHS (NNL10 $V_{NOM} = 4.0V_{DC}$)

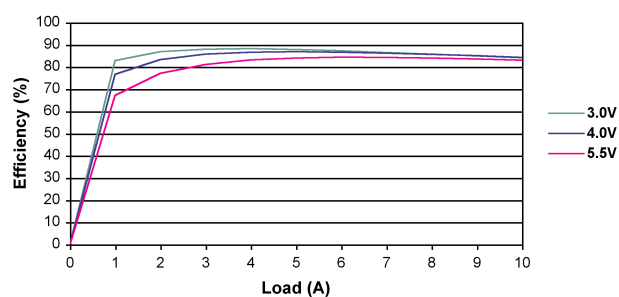
$V_{OUT} = 0.9V$



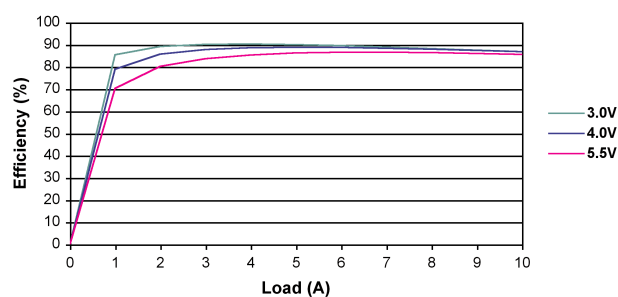
$V_{OUT} = 1.0V$



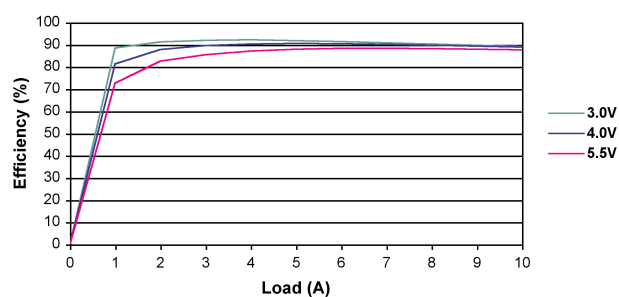
$V_{OUT} = 1.2V$



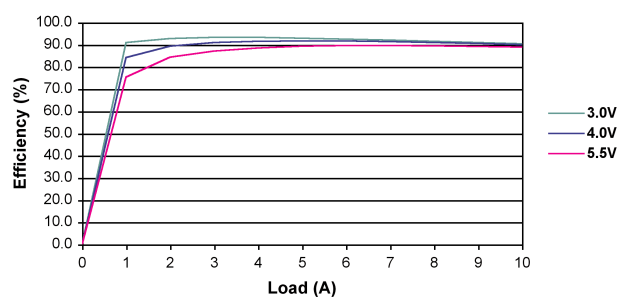
$V_{OUT} = 1.5V$



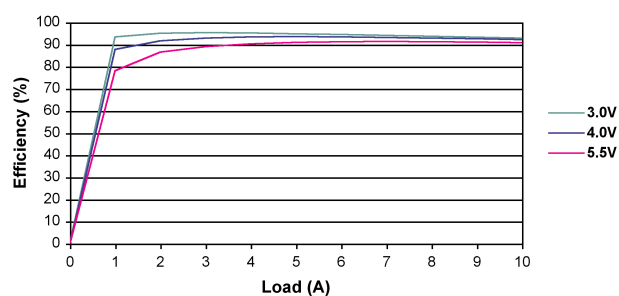
$V_{OUT} = 1.8V$



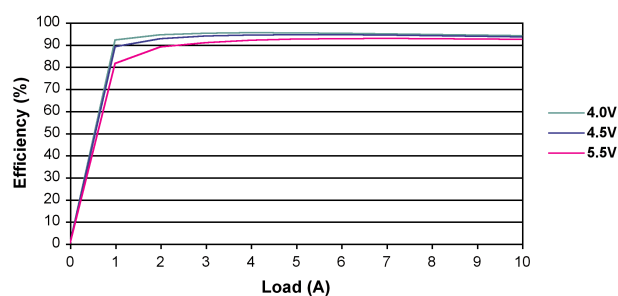
$V_{OUT} = 2.0V$



$V_{OUT} = 2.5V$

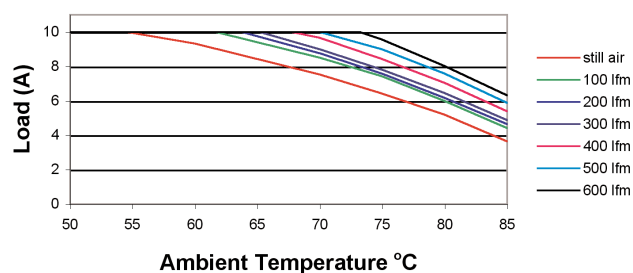


$V_{OUT} = 3.3V$

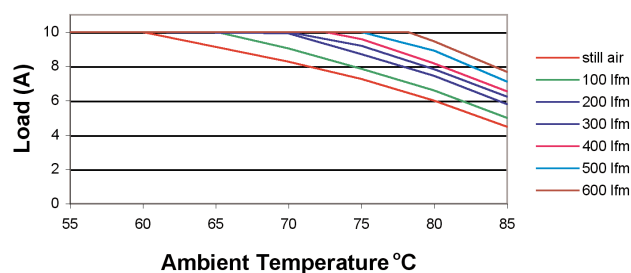


THERMAL DERATING GRAPHS (NNL10 $V_{NOM} = 4.0V_{DC}$)

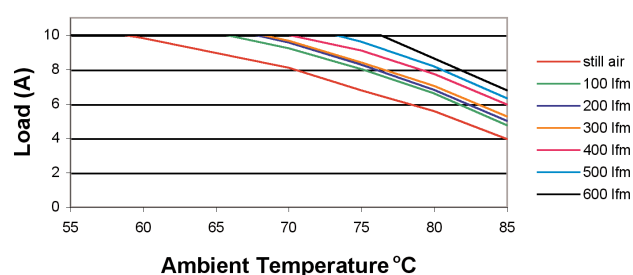
$V_{OUT} = 0.9V$



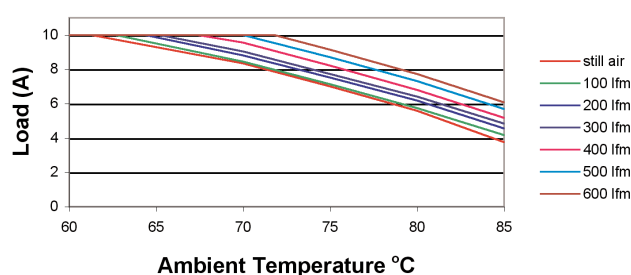
$V_{OUT} = 1.0V$



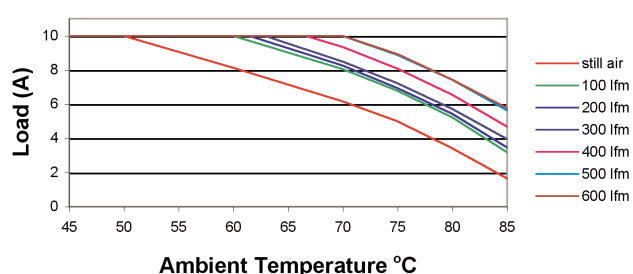
$V_{OUT} = 1.2V$



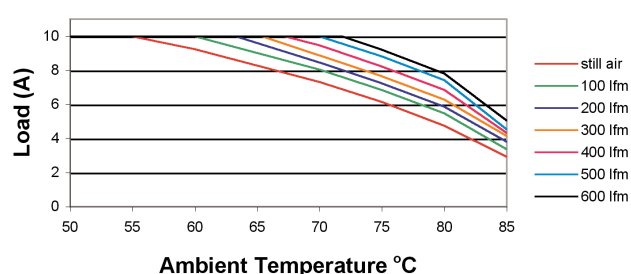
$V_{OUT} = 1.5V$



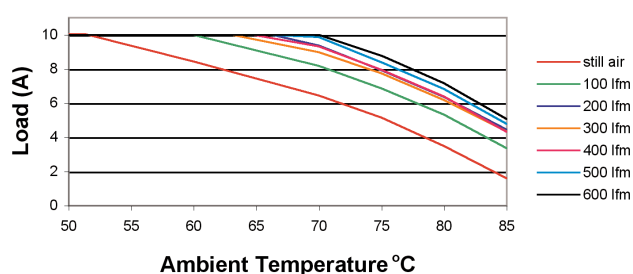
$V_{OUT} = 1.8V$



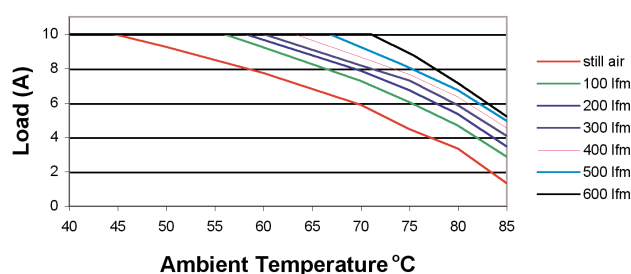
$V_{OUT} = 2.0V$



$V_{OUT} = 2.5V$



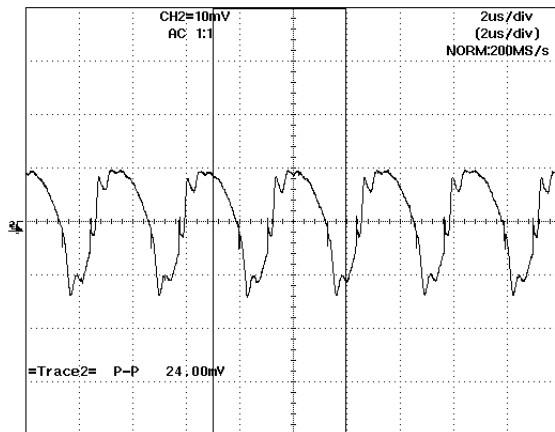
$V_{OUT} = 3.3V$



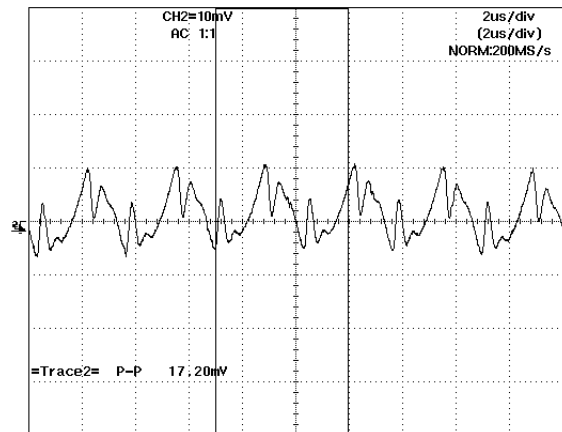
TYPICAL CHARACTERISTICS

OUTPUT RIPPLE & NOISE

$V_{IN} = 4.75V_{DC}$ $V_{OUT} = 3.3V_{DC}$ $I_{OUT} = 10.0A$

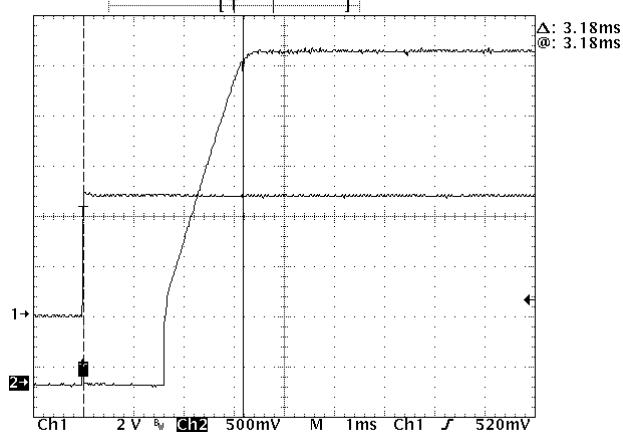


$V_{IN} = 4.0V_{DC}$ $V_{OUT} = 0.9V_{DC}$ $I_{OUT} = 10.0A$



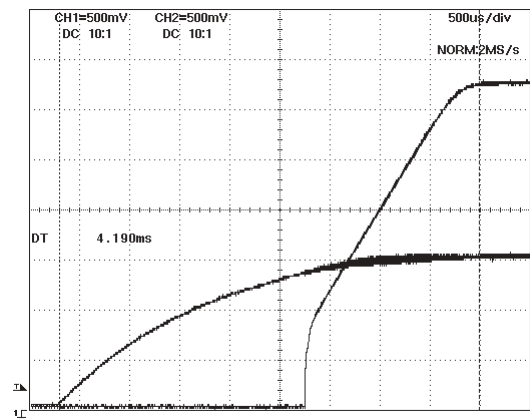
START-UP FROM APPLICATION OF V_{IN}

Tek Stop: Single Seq 50kS/s



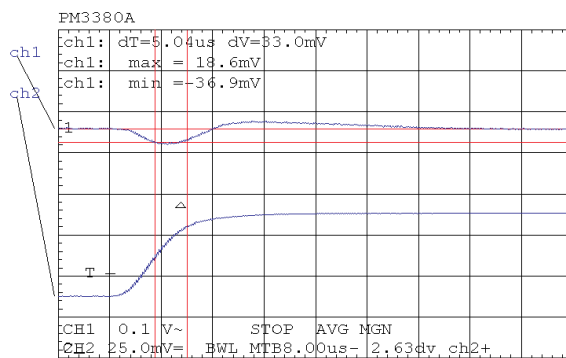
START-UP USING REMOTE ON/OFF

Response when remote on/off driven from an open collector output.

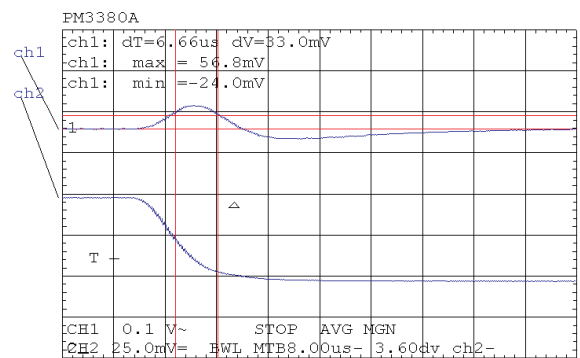


TRANSIENT RESPONSE

$V_{IN} = 4.0V_{DC}$ $V_{OUT} = 3.3V_{DC}$ I_{OUT} Change = 50-100%



$V_{IN} = 4.0V_{DC}$ $V_{OUT} = 3.3V_{DC}$ I_{OUT} Change = 100-50%



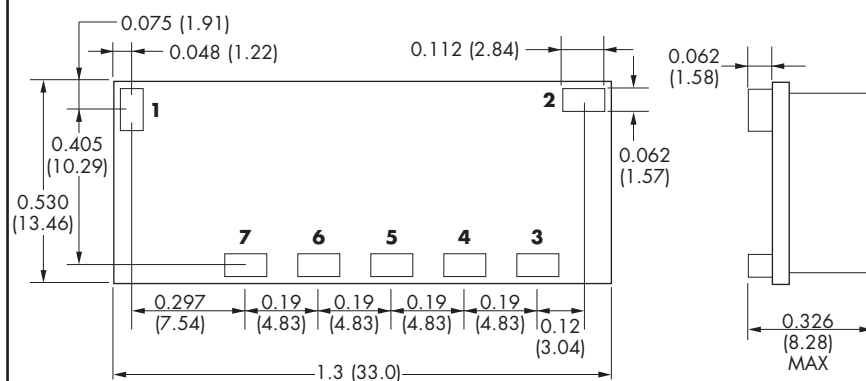
PIN CONNECTIONS

Pin Number						
1	2	3	4	5	6	7
ON/OFF	V _{IN}	DC OK*	GND	V _{OUT}	TRIM	SENSE

* Pin 6 (DC OK) is an optional feature which allows multiple NNL10 DC/DC Converters to have sequenced outputs when used in conjunction with the Remote ON/OFF pin (see application note for further information).

MECHANICAL DIMENSIONS

SMD Package Style Bottom View

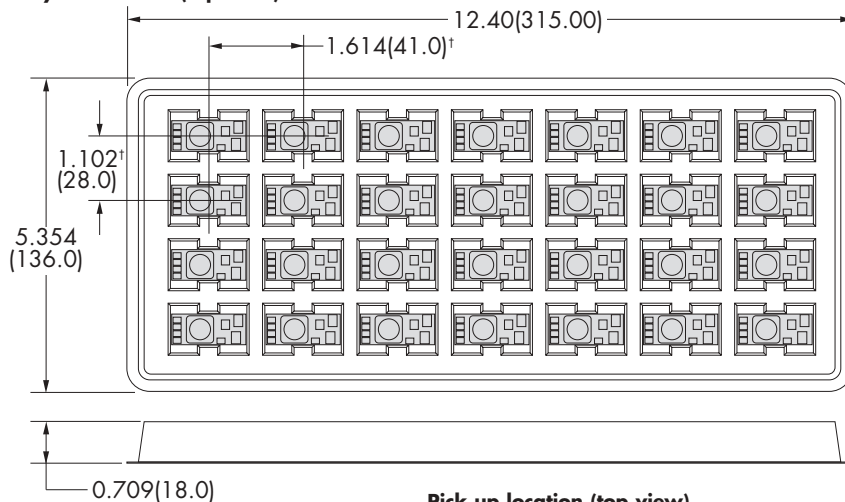


Unless otherwise stated all dimensions in inches(mm) $\pm 0.01(0.25)$.

Weight: 5.7g

PACKAGING

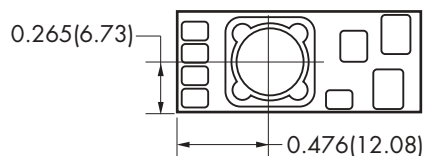
Tray Dimensions (top view)



Tray quantity: 28

† +0.020(0.5)
-0.00(0.0)

Pick up location (top view)



Unless otherwise stated all dimensions in inches(mm) $\pm 0.014(0.35)$.

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NDC NNL10.2

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