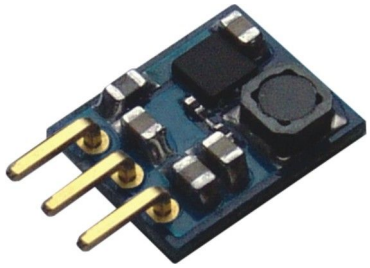
**78NS1R5A-5(V)Series– Non-isolated DC/DC Converters**
**4.5 – 5.5Vdc Input, 1.0Vdc to 3.3Vdc Output, 1.5A Output**

Data Sheet
Dec. 29, 2008

# 78NS1R5A-5 Series – 3-Terminal Non-isolated DC/DC converters

## Features

- Low Output Ripple and Noise
- Wide operating temperature range
  ( -40°C to +85°C )
- 4.5Vdc ~ 5.5Vdc input range
- Dimensions 9.9 x 12.0 x 3.4 (mm)
- UVLO (Typ. 3.7 Vin)
- Output Over Current Protection
- Over Temperature Protection
- Long Life Design
- Cost-efficiency open frame design
- RoHS directive



## Applications

- Telecommunication equipment
- Network equipment
- Distributed power systems
- Industrial application

## Description

78NS1R5A-5 Series is 1.5A 3-terminal non-isolated DC/DC converter offering low cost and space-efficient solution, Features include precisely regulation, input under voltage lockout, output over current protection and over temperature protection.

The -40°C to 85°C operating temperature range makes the 78NS1R5A-5 series ideal for mixed analog/digital subsystems, data communication equipments, distributed power systems. It is an excellent choice for both new design-information network system and upgrading older systems.

**78NS1R5A-5(V)Series– Non-isolated DC/DC Converters**
**4.5 – 5.5Vdc Input, 1.0Vdc to 3.3Vdc Output, 1.5A Output**

Data Sheet
Dec. 29, 2008

## Absolute Maximum Ratings

| Parameter | Min | Max | Unit | Notes |
|---|---|---|---|---|
| Input Voltage | -0.3 | 6 | Vdc | |
| Operating Ambient Temperature | -40 | 85 | ˚C | |
| Storage Temperature | -40 | 85 | ˚C | |

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device

## Electrical Specifications

### Input Characteristics

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Operating Input voltage Range | $V_{IN}$ | 4.5 | | 5.5 | V |
| Maximum Input Current ($V_{IN}$ = 4.5V, $V_{OUT}$ = 3.3V, $I_{OUT}$ = 1.5A) | $I_{IN,max}$ | | | 1.3 | A |
| UVLO Threshold | $V_{IN,Rising}$ | 3.4 | 3.7 | 4.0 | V |
| | Hysteresis | | 150 | | mV |
| No Load Input Current | | | | | |
| 78NS1R5A-5-1R0V | | | | 18 | mA |
| 78NS1R5A-5-1R2V | | | | 18 | mA |
| 78NS1R5A-5-1R5V | | | | 18 | mA |
| 78NS1R5A-5-1R8V | | | | 18 | mA |
| 78NS1R5A-5-2R0V | | | | 18 | mA |
| 78NS1R5A-5-2R5V | | | | 18 | mA |
| 78NS1R5A-5-3R3V | | | | 18 | mA |
| Input Reflected Ripple Current ($V_{IN}$ = 5.0V, $V_{OUT}$ = 3.3V, $I_{OUT}$ = 1.5A) | $I_{reflect,ripple}$ | | | | mApp |

**78NS1R5A-5(V)Series– Non-isolated DC/DC Converters**
**4.5 – 5.5Vdc Input, 1.0Vdc to 3.3Vdc Output, 1.5A Output**

Data Sheet
Dec. 29, 2008

## Output Characteristics

$T_A$ = +25˚C, Vin = 4.5 ~ 5.5V unless otherwise specified

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Output Voltage Range | $V_{OUT}$ | 1.0 | - | 3.3 | V |
| Output Voltage Tolerance | $V_{OUT,Tol}$ | -3 | - | +3 | %, $V_{OUT}$ |
| Output Current | $I_{OUT}$ | | | 1.5 | A |
| Output Regulation;<br>- Line Regulation ($V_{IN}$ = 4.5 V to 5.5 V)<br>- Load Regulation ($I_{OUT}$ = 0 A to 1.5 A) | | <br>-0.2<br>-2.0 | <br>-<br>- | <br>+0.2<br>+2.0 | <br>%, $V_{OUT}$<br>%, $V_{OUT}$ |
| Output Over Current Protection (Automatic recovery) | | 2200 | 2600 | 3500 | mA |
| Output Ripple and Noise ($V_{IN}$ = 5V, $I_{OUT}$ = 1.5 A, Bandwidth 20MHz, $C_{OUT,EXT}$ = 100uF(OSCON)) | $V_{ripple\&noise}$ | - | - | 20 | $mV_{PP}$ |
| Efficiency<br>78NS1R5A-5-1R0V<br>78NS1R5A-5-1R2V<br>78NS1R5A-5-1R5V<br>78NS1R5A-5-1R8V<br>78NS1R5A-5-2R0V<br>78NS1R5A-5-2R5V<br>78NS1R5A-5-3R3V<br>($V_{IN}$ = 5V, $I_{OUT}$ = 1.5A) | <br>η<br>η<br>η<br>η<br>η<br>η<br>η | | <br>65<br>69<br>72<br>76<br>77<br>81<br>85 | | <br>%<br>%<br>%<br>%<br>%<br>%<br> |
| Dynamic Load Response ($I_{OUT}$ = 50% to 100 % to 50%, See the Fig.9) | | -2 | | +2 | %, $V_{OUT}$ |
| Recovery Time (with in 1% Nominal Vo) | | | 100 | | μs |
| Start – Up Time | | | 700 | | μs |
| Turn – on overshoot | | | 5 | | % |
| External Output Capacitance | $C_{OUT,EXT}$ | | | | μF |
| Switching frequency | $f_{SW}$ | 1.0 | 1.3 | 1.6 | MHz |

**78NS1R5A-5(V)Series– Non-isolated DC/DC Converters**
**4.5 – 5.5Vdc Input, 1.0Vdc to 3.3Vdc Output, 1.5A Output**

Data Sheet
Dec. 29, 2008

## General Specifications

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| MTBF | | | $4.0 \times 10^6$ | | hrs |
| Weight | | | 0.58 | | Grams |
| Dimensions (W x H x L) | | | 10.2 x 12.0 x 3.3 | | mm |

## Environmental

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Operating Temperature | | -40 | | 85 | ˚C |
| Operating Humidity (RH non-condensing) | | | | | % |
| Storage Temperature | | -40 | | 85 | ˚C |
| Lead Temperature (Soldering, 10 [sec]) | | | | 300 | ˚C |

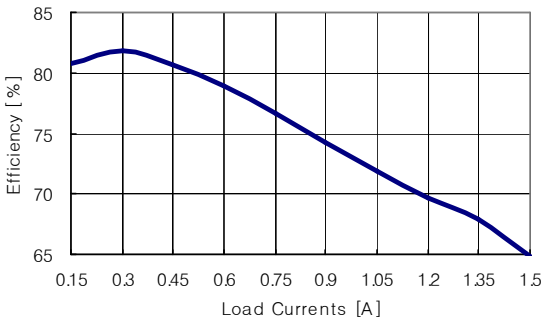
**78NS1R5A-5(V)Series– Non-isolated DC/DC Converters**
**4.5 – 5.5Vdc Input, 1.0Vdc to 3.3Vdc Output, 1.5A Output**

Data Sheet
Dec. 29, 2008

# Characteristic Curves

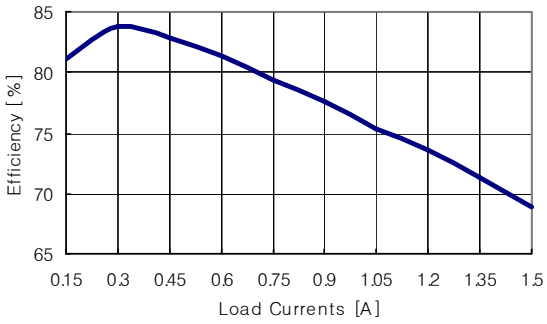
## Efficiency Curves

**- 78NS1R5A-5-1R0 -**



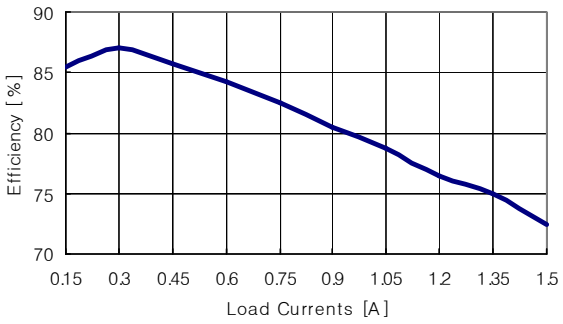

Vin=5V, Vo=1.0V@1.5A , At 25°C

**- 78NS1R5A-5-1R2 -**



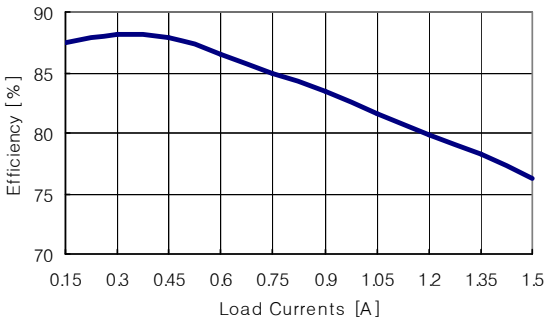

Vin=5V, Vo=1.2V@1.5A , At 25°C

**- 78NS1R5A-5-1R5 -**




Vin=5V, Vo=1.5V@1.5A , At 25°C

**- 78NS1R5A-5-1R8 -**



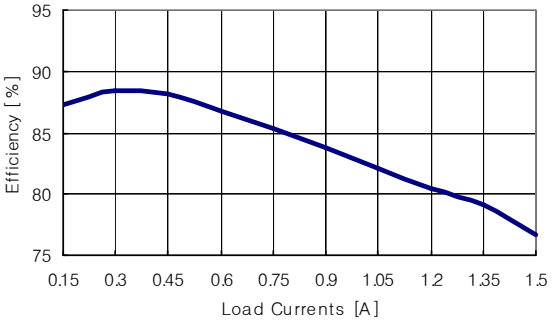

Vin=5V, Vo=1.8V@1.5A , At 25°C

**78NS1R5A-5(V)Series– Non-isolated DC/DC Converters**
**4.5 – 5.5Vdc Input, 1.0Vdc to 3.3Vdc Output, 1.5A Output**

Data Sheet
Dec. 29, 2008

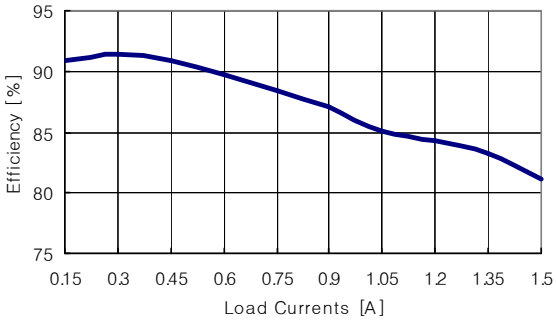
## Efficiency Curves

**- 78NS1R5A-5-2R0 -**



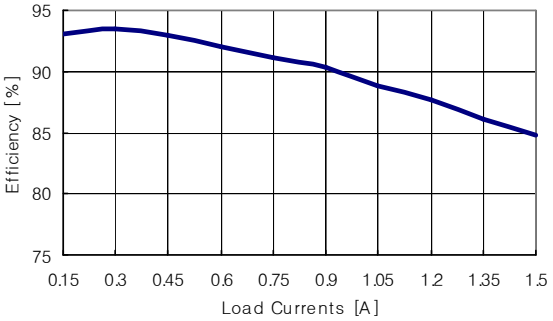

Vin=5V, Vo=2.0V@1.5A , At 25°C

**- 78NS1R5A-5-2R5 -**




Vin=5V, Vo=2.5V@1.5A , At 25°C

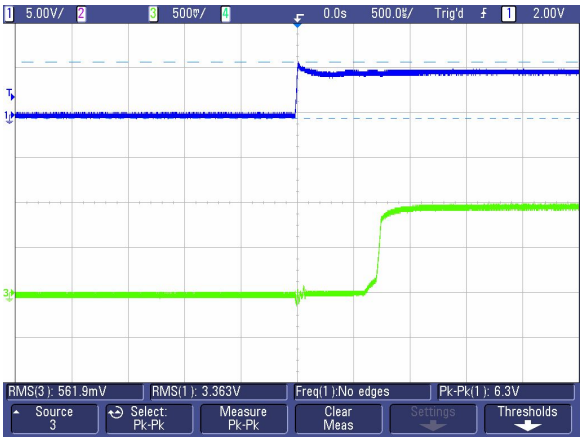
**- 78NS1R5A-5-3R3 -**




Vin=5V, Vo=3.3V@1.5A , At 25°C

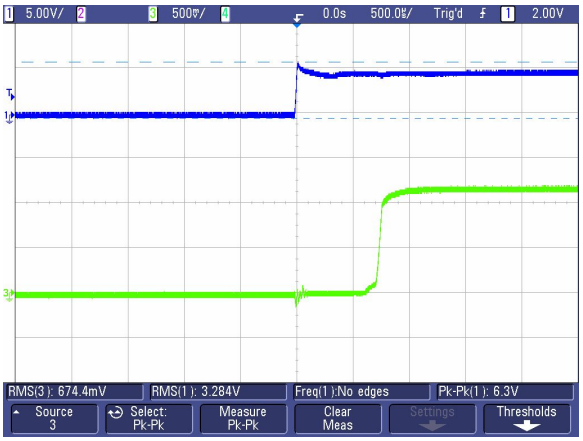
## Start-up from Vin

**- 78NS1R5A-5-1R0 -**



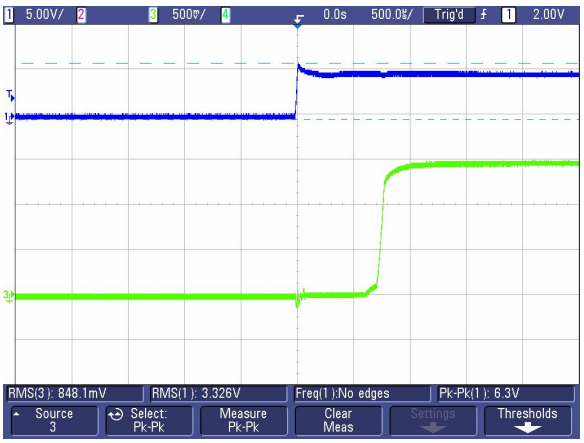

Vin=5V, Vo=1.0V@1.5A , At 25°C

**- 78NS1R5A-5-1R2 -**



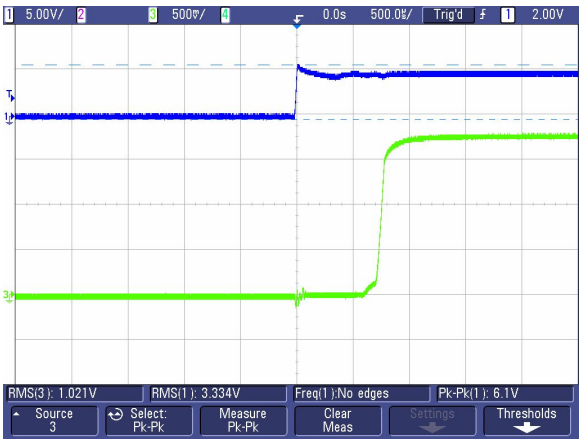

Vin=5V, Vo=1.2V@1.5A , At 25°C

**- 78NS1R5A-5-1R5 -**




Vin=5V, Vo=1.5V@1.5A , At 25°C

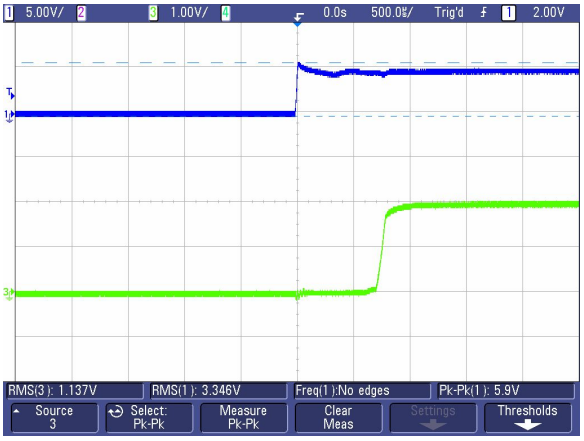
**- 78NS1R5A-5-1R8 -**




Vin=5V, Vo=1.8V@1.5A , At 25°C

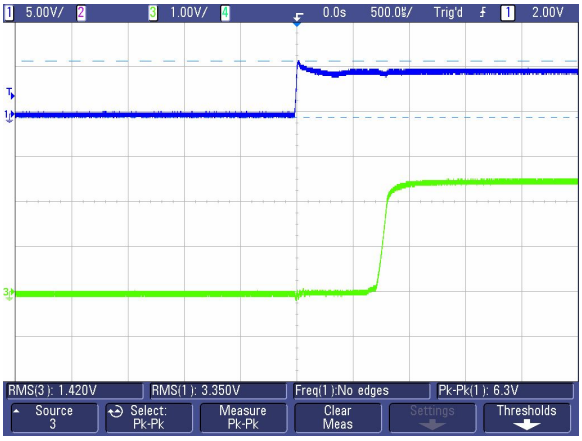
## Start-up from Vin

**- 78NS1R5A-5-2R0 -**



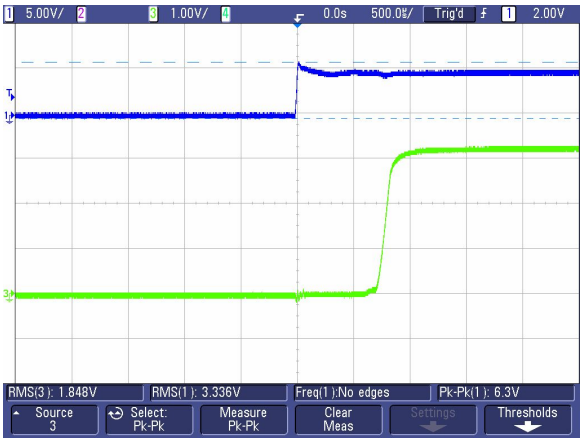

Vin=5V, Vo=2.0V@1.5A , At 25°C

**- 78NS1R5A-5-2R5 -**




Vin=5V, Vo=2.5V@1.5A , At 25°C

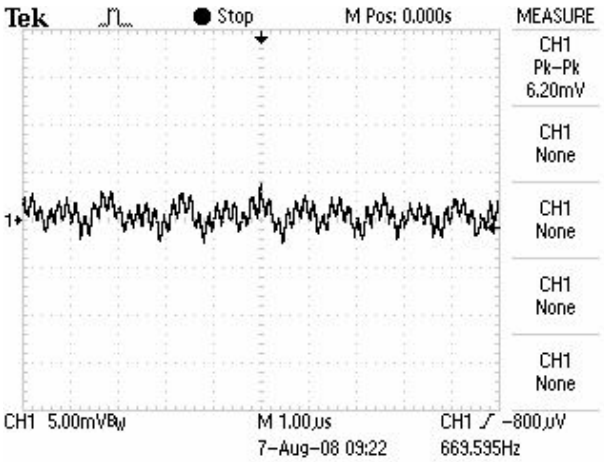
**- 78NS1R5A-5-3R3 -**




Vin=5V, Vo=3.3V@1.5A , At 25°C

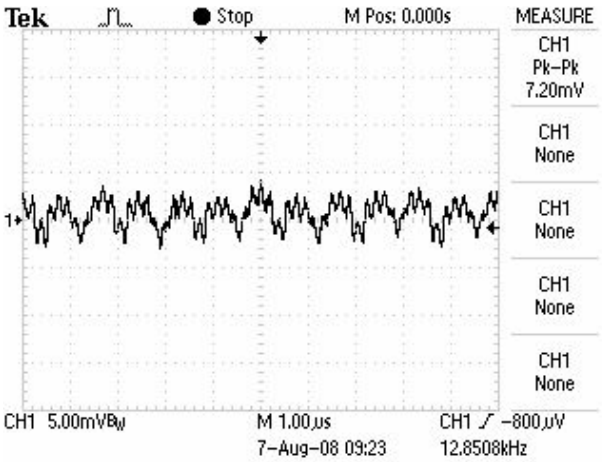
## Output Ripple/Noise (I)

**- 78NS1R5A-5-1R0 -**



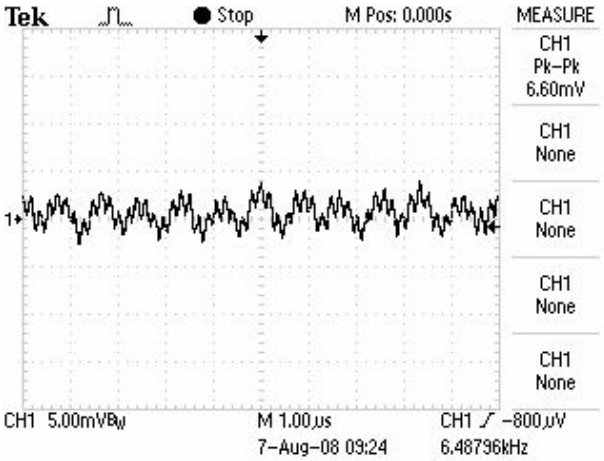

Vin=5V, Vo=1.0V@1.5A , At 25°C

**- 78NS1R5A-5-1R2 -**



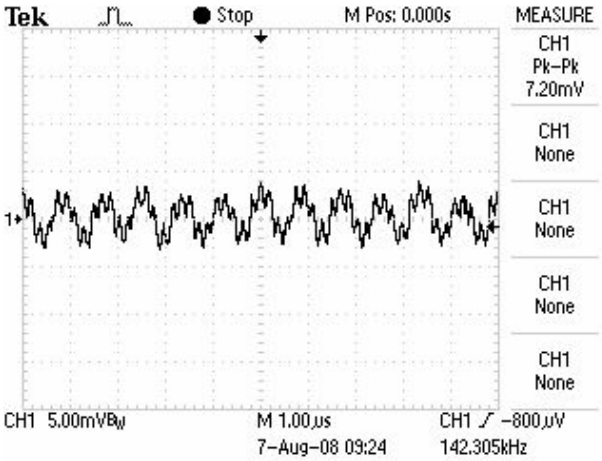

Vin=5V, Vo=1.2V@1.5A , At 25°C

**- 78NS1R5A-5-1R5 -**




Vin=5V, Vo=1.5V@1.5A , At 25°C

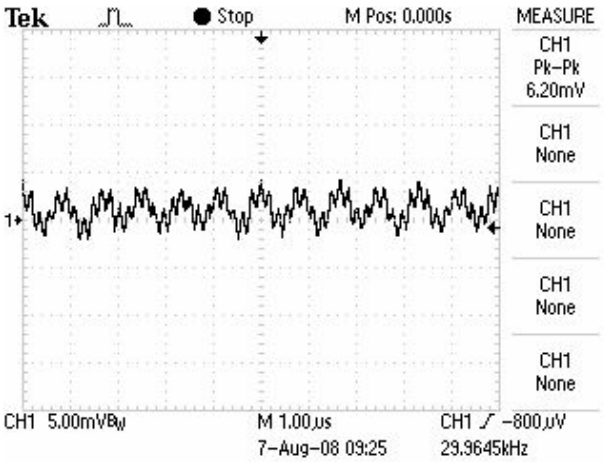
**- 78NS1R5A-5-1R8 -**




Vin=5V, Vo=1.8V@1.5A , At 25°C

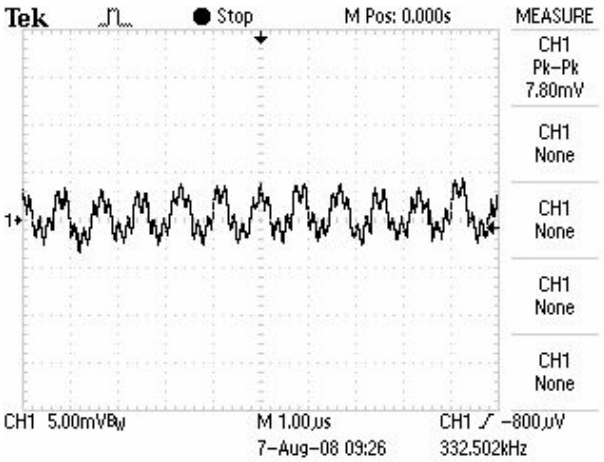
## Output Ripple/Noise (II)

**- 78NS1R5A-5-2R0 -**



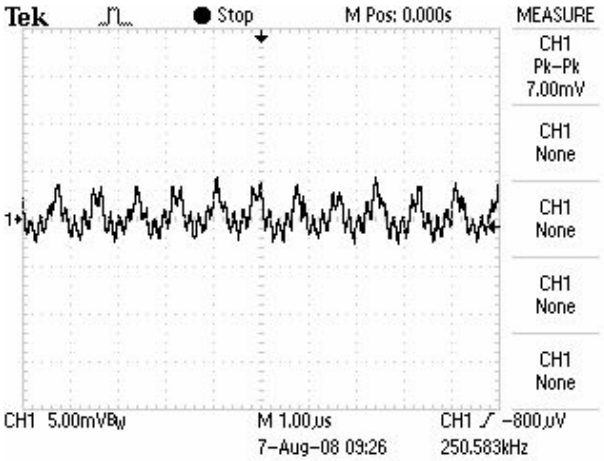

Vin=5V, Vo=2.0V@1.5A , At 25°C

**- 78NS1R5A-5-2R5 -**




Vin=5V, Vo=2.5V@1.5A , At 25°C

**- 78NS1R5A-5-3R3 -**



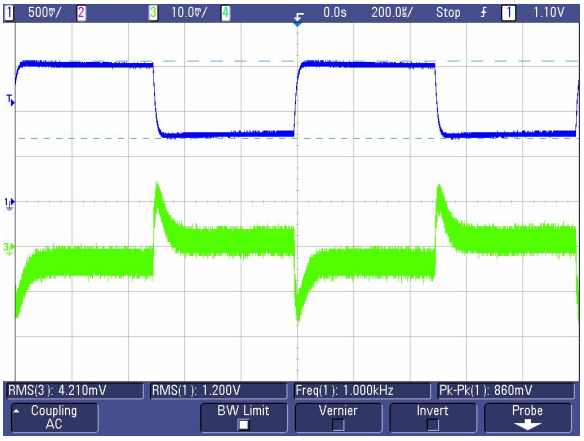

Vin=5V, Vo=3.3V@1.5A , At 25°C

**78NS1R5A-5(V)Series– Non-isolated DC/DC Converters**
**4.5 – 5.5Vdc Input, 1.0Vdc to 3.3Vdc Output, 1.5A Output**

Data Sheet
Dec. 29, 2008

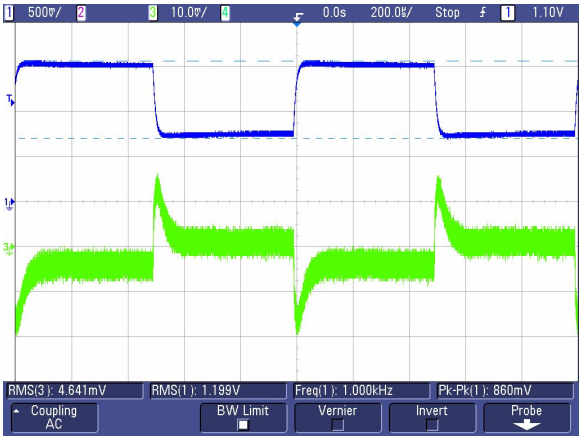
## Output Load Transient Response (I)

**- 78NS1R5A-5-1R0 -**



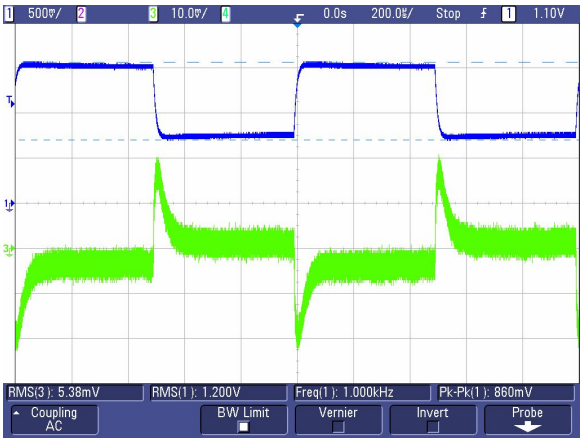

Vin=5V, Vo=1.0V@1.5A , At 25°C

**- 78NS1R5A-5-1R2 -**



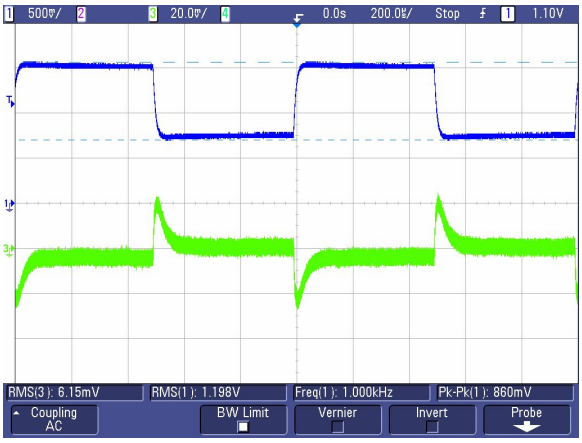

Vin=5V, Vo=1.2V@1.5A , At 25°C

**- 78NS1R5A-5-1R5 -**




Vin=5V, Vo=1.5V@1.5A , At 25°C

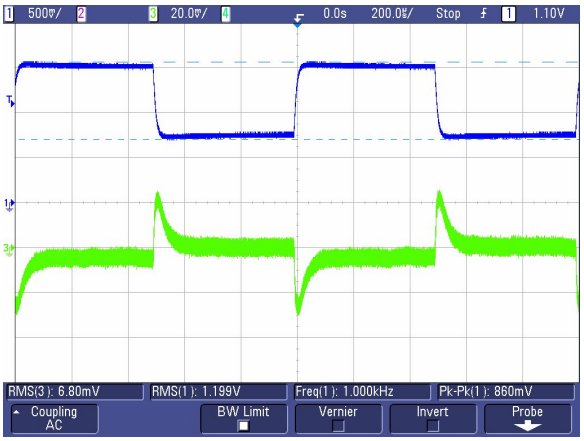
**- 78NS1R5A-5-1R8 -**




Vin=5V, Vo=1.8V@1.5A , At 25°C

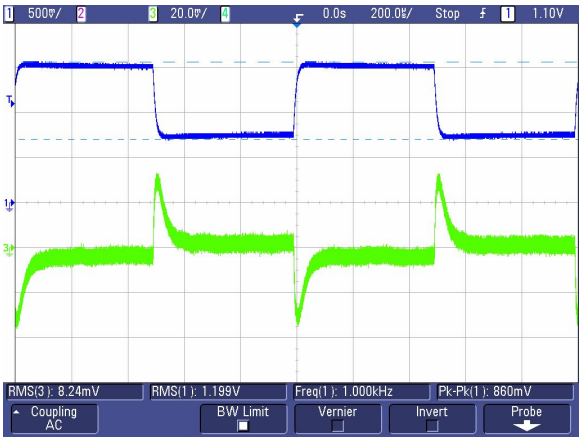
## Output Load Transient Response (II)

**- 78NS1R5A-5-2R0 -**



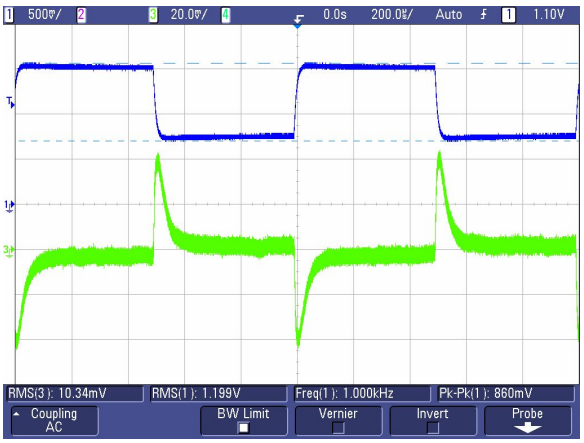

Vin=5V, Vo=2.0V@1.5A , At 25°C

**- 78NS1R5A-5-2R5 -**




Vin=5V, Vo=2.5V@1.5A , At 25°C

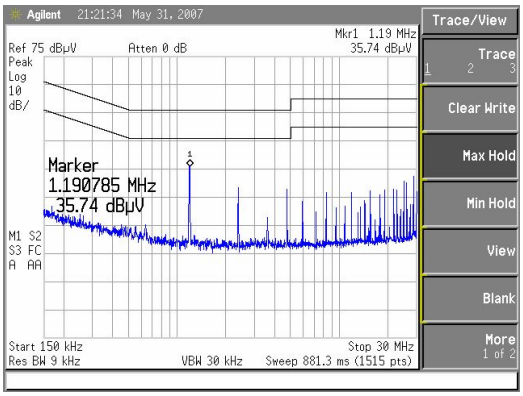
**- 78NS1R5A-5-3R3 -**




Vin=5V, Vo=3.3V@1.5A , At 25°C

## EMI Test

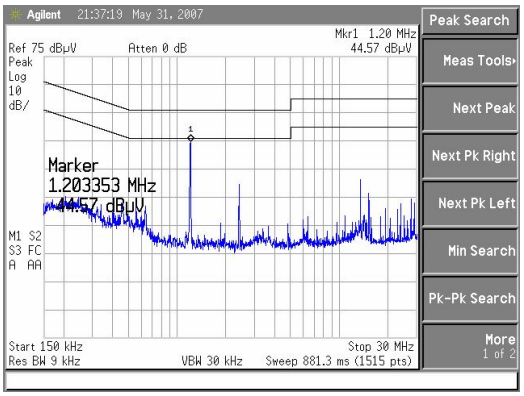
- **78NS1R5A-5-3R3 -**




Vin=5V, Vo=3.3V@0A , At 25°C

(External Cin: 220uF Aluminum Capacitor)

- **78NS1R5A-5-3R3 -**

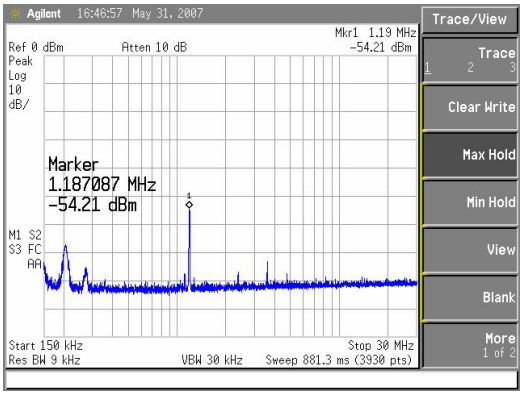



Vin=5V, Vo=3.3V@1.32A , At 25°C

(External Cin : 220uF Aluminum Capacitor)

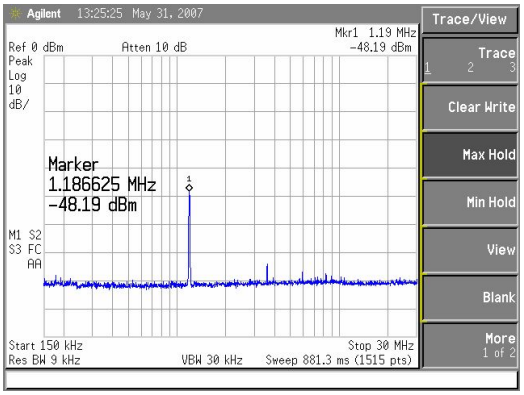
## Output Ripple/Noise

- **78NS1R5A-5-1R0 -**




Vin=5V, Vo=1.0V@0A , At 25°C

- **78NS1R5A-5-3R3 -**

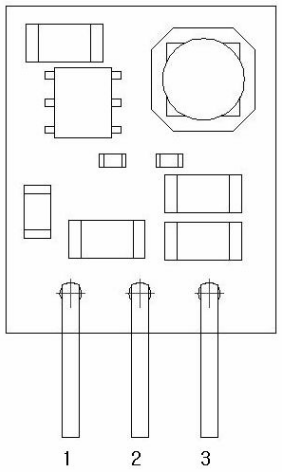



Vin=5V, Vo=3.3V@0A , At 25°C

**78NS1R5A-5(V)Series– Non-isolated DC/DC Converters**
**4.5 – 5.5Vdc Input, 1.0Vdc to 3.3Vdc Output, 1.5A Output**

Data Sheet
Dec. 29, 2008

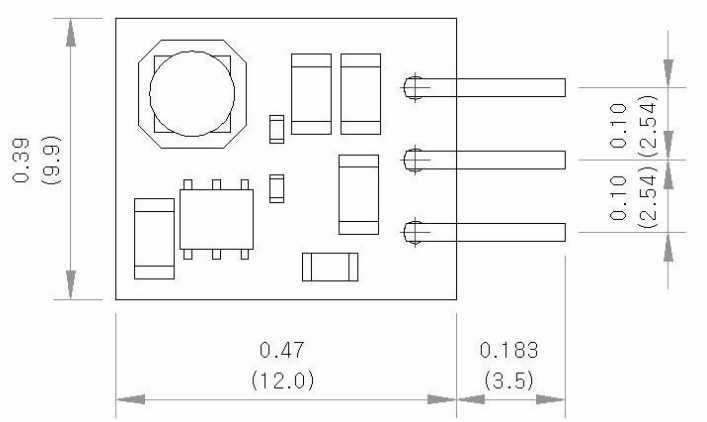
## Pin assignments



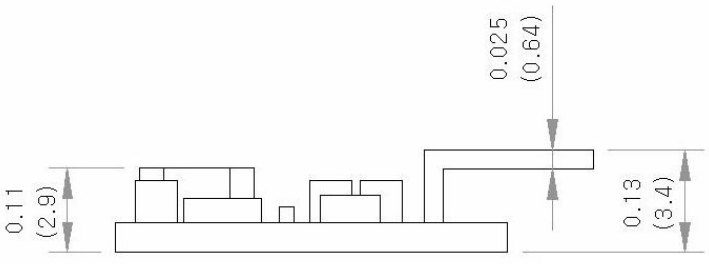

| PIN NO. | NAME | FUNCTION |
|---|---|---|
| 1 | +Vin | Positive terminal for input |
| 2 | COM | Ground |
| 3 | +Vout | Positive terminal for output |

## Mechanical Specification

TOP VIEW




SIDE VIEW




All dimensions are mm(inches)

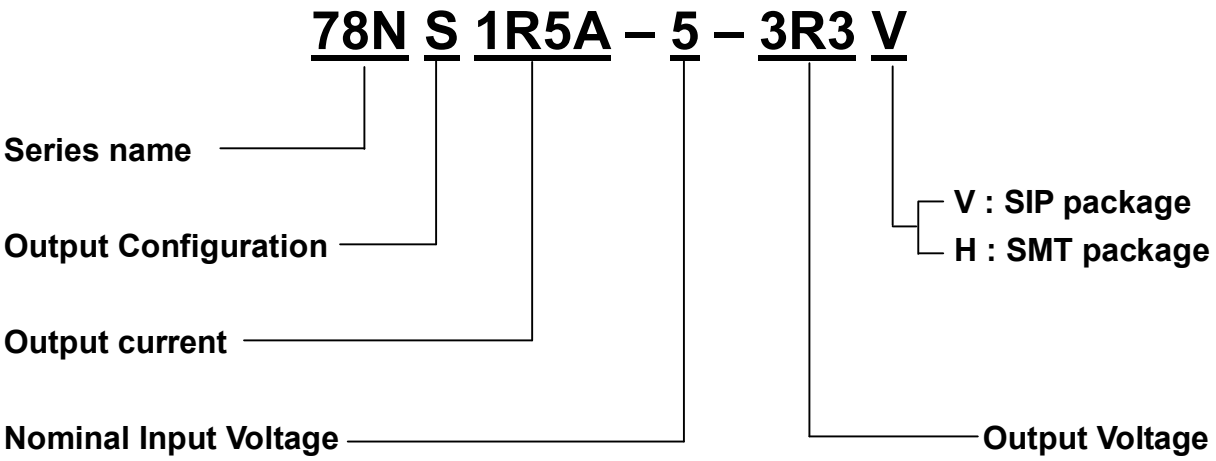
**78NS1R5A-5(V)Series– Non-isolated DC/DC Converters**
**4.5 – 5.5Vdc Input, 1.0Vdc to 3.3Vdc Output, 1.5A Output**

Data Sheet
Dec. 29, 2008

## Ordering Information

| Input | Output | Maximum Power[W] | Ripple & Noise Max.[ $mV_{PP}$] | Efficiency Typ.[%] | Model Number |
|---|---|---|---|---|---|
| 4.5 – 5.5V | 1.0V@1.5A | 1.50 | 20 | 65 | 78NS1R5A-5-1R0V |
| | 1.2V@1.5A | 1.80 | 20 | 69 | 78NS1R5A-5-1R2V |
| | 1.5V@1.5A | 2.25 | 20 | 72 | 78NS1R5A-5-1R5V |
| | 1.8V@1.5A | 2.70 | 20 | 76 | 78NS1R5A-5-1R8V |
| | 2.0V@1.5A | 3.00 | 20 | 77 | 78NS1R5A-5-2R0V |
| | 2.5V@1.5A | 3.75 | 20 | 81 | 78NS1R5A-5-2R5V |
| | 3.3V@1.5A | 4.95 | 20 | 85 | 78NS1R5A-5-3R3V |

## Part Number Structure



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