

## NHF100-Q24 : Ultra-Wide Input DC/DC converters

### Features

- Ultra-wide 4:1 input ranges
- Industry standard Half-Brick pin map
- Wide operating temperature range with derating ( -40°C to +85°C )
- High efficiency
- Precision thermal protection(Accuracy  $\pm 3^{\circ}\text{C}$ )
- Over current protection
- Input under voltage lock out (UVLO)
- Output over voltage protection
- Remote on/off control
- Output voltage variation (TRM)
- Positive/Negative remote sense
- Input – output isolation
- RoHS directive



### Applications

- Telecommunication/Network equipment
- High current microprocessors and ICs
- Instrumentation / Equipments
- Distributed Power Systems

### Description

NHF100-Q24 series are isolated dc/dc converters that offer the flexibility of operation with both 12V and 24V buses. These units are designed to be highly efficient, precision thermal protection. Features include high isolation, output over-voltage protection, over current limiting, short-circuit protection, thermal shutdown, remote on/off control, output trim and ( $\pm$ )output sense functions.

**NHF100-Q24 Series - Isolated DC/DC Converters**  
 12V/24V Input, Maximum Power : 100W

 Data Sheet  
 Mar. 3, 2008

### Absolute Maximum Ratings

| Parameter                                 | Min.  | Typ. | Max. | Unit | Notes |
|---|-------|------|------|------|-------|
| Input voltage continuous(model dependent) | 10/12 | -    | 36   | Vdc  |       |
| Operating ambient temperature             | -40   | -    | 85   | °C   |       |
| Storage temperature                       | -40   | -    | 105  | °C   |       |
| I/O isolation voltage                     | -     | 1500 | -    | VDC  |       |

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

### Electrical Specifications

Ta=25°C, Airflow rate=400LFM, Vin=24Vdc unless otherwise noted.

#### Input Characteristics

| Parameter  | Symbol          | Min. | Typ. | Max. | Unit |
|--|-----------------|------|------|------|------|
| Operating voltage range  |                 |      |      |      |      |
| NHF100-Q24-3R3   |                 | 12   | 24   | 36   | Vdc  |
| NHF100-Q24-5   |                 | 10   | 24   | 36   | Vdc  |
| Input under voltage lockout (UVLO)   |                 |      |      |      |      |
| NHF100-Q24-3R3   |                 | 10   | -    | 11.7 | Vdc  |
| NHF100-Q24-5   |                 | 8.4  | -    | 9.8  | Vdc  |
| Disabled input current<br>(Remote on/off control)                            |                 | -    | 6.2  | -    | mA   |
| Maximum Input current (At minimum input<br>voltage and maximum output power) | I <sub>in</sub> |      |      |      |      |
| NHF100-Q24-3R3   |                 | -    | 9.4  | -    | A    |
| NHF100-Q24-5   |                 | -    | 12.5 | -    | A    |
| No load input current  |                 |      |      |      |      |
| NHF100-Q24-3R3   |                 | -    | 92   | -    | mA   |
| NHF100-Q24-5   |                 | -    | 82   | -    | mA   |
| Input reflected ripple current<br>(Maximum output power)                     |                 |      |      |      |      |
| NHF100-Q24-3R3   |                 | -    | 88   | -    | mA   |
| NHF100-Q24-5   |                 | -    | 93   | -    | mA   |

**NHF100-Q24 Series - Isolated DC/DC Converters**  
 12V/24V Input, Maximum Power : 100W

 Data Sheet  
 Mar. 3, 2008

**Output Characteristics**

| Parameter  | Symbol | Min. | Typ.      | Max.      | Unit |
|--|--------|------|-----------|-----------|------|
| Output voltage tolerance   | $V_o$  | -    | -         | 2         | %    |
| Output regulation;   |        |      |           |           |      |
| - Line regulation  |        | -    | $\pm 0.2$ | $\pm 0.5$ | %    |
| - Load regulation  |        | -    | $\pm 0.2$ | $\pm 0.5$ | %    |
| Output current   | $I_o$  |      |           |           |      |
| NHF100-Q24-3R3   |        | 0    | -         | 30        | A    |
| NHF100-Q24-5   |        | 0    | -         | 20        | A    |
| Output current limit(Automatic recovery)   |        | 105  | -         | -         | %    |
| Output ripple and noise,<br>( $V_{in} = 24V$ , $I_o = \text{Max output current}$ ,<br>$1\mu F$ ceramic + $15\mu F$ tantalum,<br>Bandwidth : 20MHz, See fig.23) |        |      |           |           |      |
| NHF100-Q24-3R3   |        | -    | -         | 75        | mV   |
| NHF100-Q24-5   |        | -    | -         | 75        | mV   |
| Efficiency   |        |      |           |           |      |
| NHF100-Q24-3R3   |        |      |           |           |      |
| $V_{in} = 12V$ , 50% Load  |        | -    | 91.6      | -         | %    |
| $V_{in} = 12V$ , 100% Load   |        | -    | 88.0      | -         | %    |
| $V_{in} = 24V$ , 50% Load  |        | -    | 90.7      | -         | %    |
| $V_{in} = 24V$ , 100% Load   |        | -    | 88.5      | -         | %    |
| NHF100-Q24-5   |        |      |           |           |      |
| $V_{in} = 12V$ , 50% Load  |        | -    | 90.9      | -         | %    |
| $V_{in} = 12V$ , 100% Load   |        | -    | 84.8      | -         | %    |
| $V_{in} = 24V$ , 50% Load  |        | -    | 89.6      | -         | %    |
| $V_{in} = 24V$ , 100% Load   |        | -    | 85.2      | -         | %    |
| Dynamic load response<br>( $1\mu F$ ceramic + $15\mu F$ tantalum, 50% to<br>75 %, 75% to 50%, Slew rate = $0.1A/\mu s$ ,<br>See fig.23)                        |        |      |           |           |      |
| NHF100-Q24-3R3   |        | -    | $\pm 200$ | $\pm 250$ | mV   |
| NHF100-Q24-5   |        | -    | $\pm 150$ | $\pm 250$ | mV   |

**NHF100-Q24 Series - Isolated DC/DC Converters**  
 12V/24V Input, Maximum Power : 100W

 Data Sheet  
 Mar. 3, 2008

|                                      |  |   |      |     |    |
|--------------------------------------|--|---|------|-----|----|
| Recovery time(with in 1% Nominal Vo) |  |   |      |     |    |
| NHF100-Q24-3R3                       |  | - | 200  | 300 | μs |
| NHF100-Q24-5                         |  | - | 150  | 300 | μs |
| Start-up time                        |  | - | 2    | 4   | ms |
| Turn-on overshoot                    |  | - | 0    | -   | %  |
| Maximum output capacitance           |  |   |      |     |    |
| NHF100-Q24-3R3                       |  | - | 2200 | -   | μF |
| NHF100-Q24-5                         |  | - | 470  | -   | μF |

**Isolation Specifications**

| Parameter                | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------|--------|------|------|------|------|
| I/O isolation voltage    |        |      |      |      |      |
| - Input-output           |        | -    | 1500 | -    | Vdc  |
| - Input-case             |        | -    | 1000 | -    | Vdc  |
| - Output-case            |        | -    | 1000 | -    | Vdc  |
| I/O isolation resistance | RISO   | -    | 100  | -    | MΩ   |
| Isolation capacitance    | CISO   | -    | 4.7  | -    | nF   |

**General Specifications**

| Parameter                              | Symbol | Min.                                   | Typ. | Max. | Unit           |
|--|--------|--|------|------|----------------|
| Switching Frequency                    |        | 320                                    | 350  | 380  | KHz            |
| Remote ON/OFF (Positive Logic)         |        |  |      |      |                |
| On = open                              |        | 2.5                                    | -    | 7    | Vdc            |
| Off = short to Vin-                    |        | 0                                      | -    | 0.8  | Vdc            |
| Output voltage trim range              |        | -                                      | -    | ±10  | %              |
| Output voltage remote sense range      |        | -                                      | -    | 10   | %              |
| Over-temperature shutdown              |        | -                                      | 100  | -    | °C             |
| Over-temperature accuracy              |        | -                                      | ±3   | -    | °C             |
| Over temperature restart hysteresis    |        | -                                      | -    | 11   | °C             |
| MTBF(Io=80%, Ta=25°C, Air flow=400LFM) |        | 179200                                 |      |      | hrs            |
| Dimensions(W.H.L.)                     |        | 58.4 x 61 x 12.7<br>(2.28 x 2.4 x 0.5) |      |      | mm<br>(inches) |
| Weight                                 |        | -                                      | 180  | -    | g              |

---

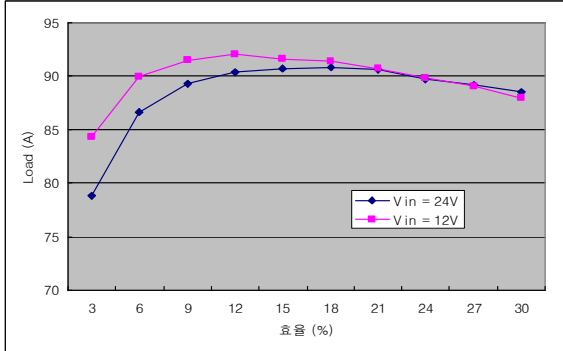
**NHF100-Q24 Series - Isolated DC/DC Converters**  
12V/24V Input, Maximum Power : 100WData Sheet  
Mar. 3, 2008**Environmental**

| Parameter             | Symbol | Min. | Typ. | Max. | Unit |
|-----------------------|--------|------|------|------|------|
| Operating Temperature |        | -40  | -    | 85   | °C   |
| Storage Temperature   |        | -40  | -    | 105  | °C   |

**Characteristic Curves**

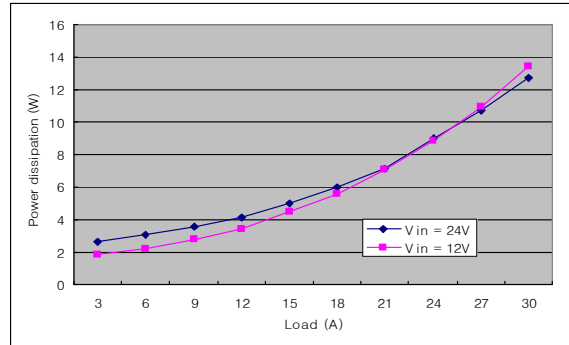
The following Fig.1~10 provide typical characteristics for the NHF100-Q24-3R3 (3.3V, 30A).

**Efficiency**



[Fig.1] Efficiency for 12V and 24V input at 25°C, 400LFM.

**Power Dissipation**

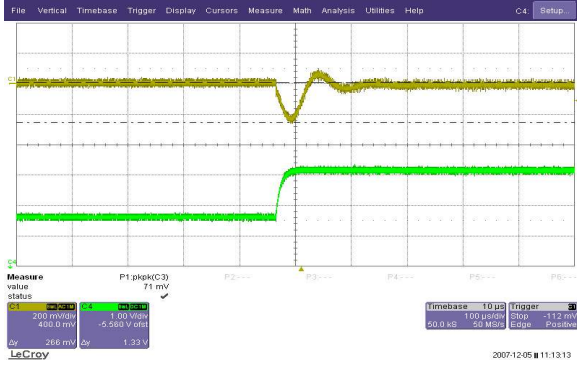


[Fig.2] Power dissipation for 12V and 24V input at 25°C, 400LFM.

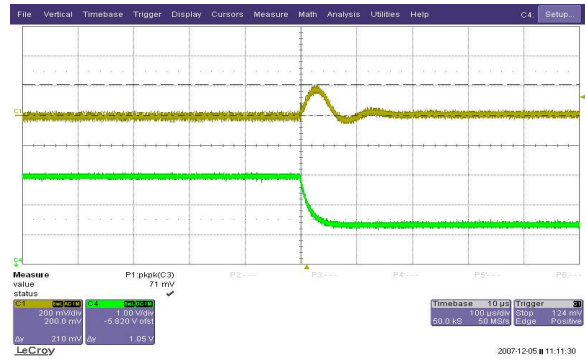
**NHF100-Q24 Series - Isolated DC/DC Converters**  
 12V/24V Input, Maximum Power : 100W

Data Sheet  
 Mar. 3, 2008

**Output Load Transient Response**

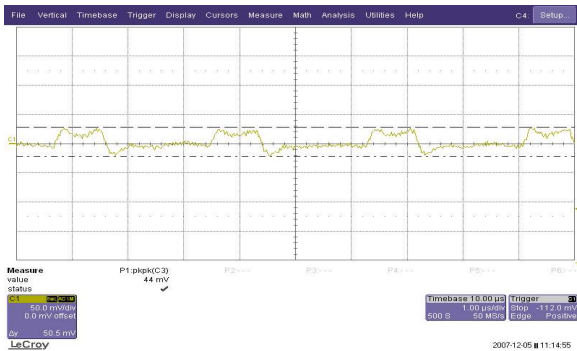


[Fig.5] Load step: 50%-75% of  $I_o$ ,  $di/dt=$  0.1A/us (CH1: 200mV, CH2 : 5A/div, 100us/div)



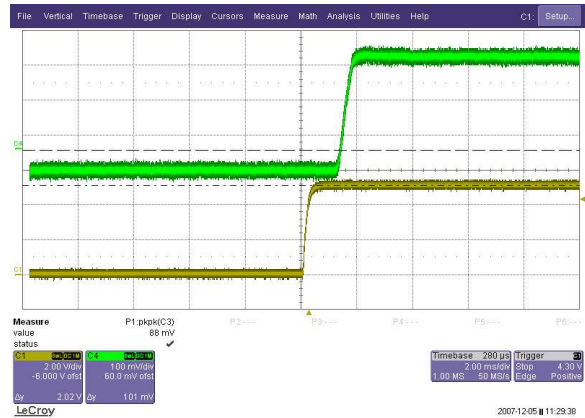
[Fig.6] Load step: 70%-50% of  $I_o$ ,  $di/dt=$  0.1A/us (CH1: 200mV, CH2 : 5A/div, 100us/div)

**Output Ripple/Noise**



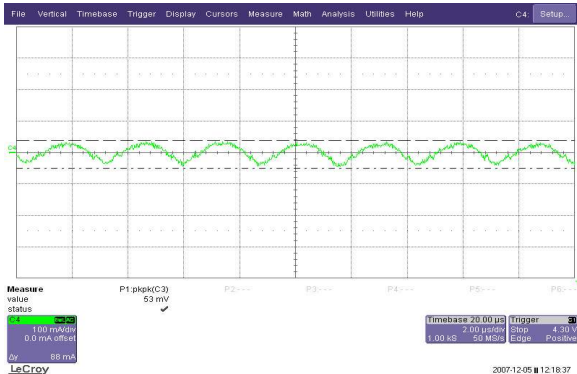
[Fig.7] Output ripple & noise (50mV/div)  
 (1µF ceramic + 15µF tantalum,  
 Bandwidth : 20MHz, See fig.23

**Start-up from On/off input**



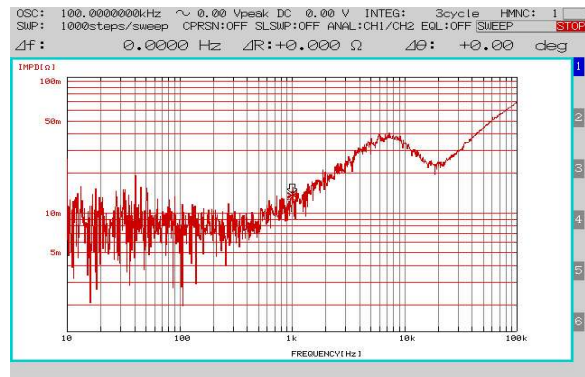
[Fig.8] Ch2:  $V_o$ , Ch3: On/off input(2ms/div)

**Input Reflected Ripple Current**



[Fig.9] Input reflect ripple current (100mA/div)

**Output Impedance**

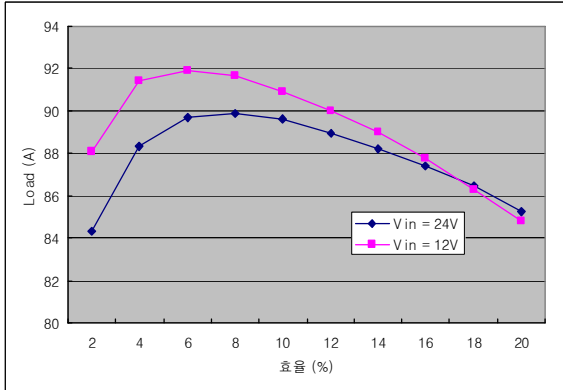


[Fig.10] Output impedance at 100% Load

### Characteristic Curves

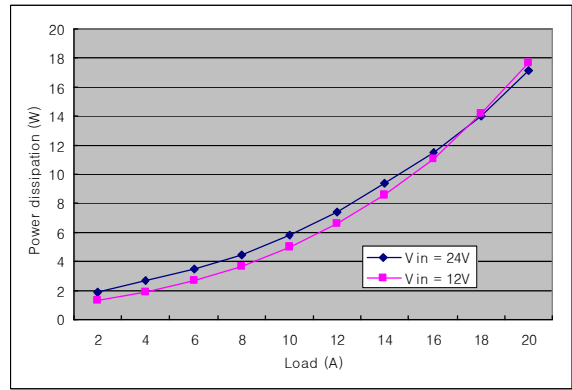
The following Fig.11~20 provide typical characteristics for the NHF100-Q24-5 (5, 20A).

#### Efficiency



[Fig. 11] Efficiency for 12V and 24V input at 25°C, 400LFM.

#### Power Dissipation



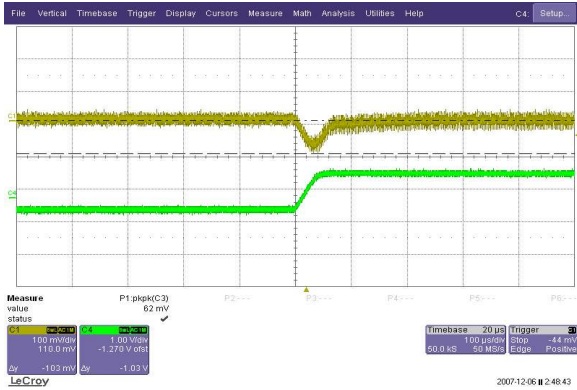
[Fig. 12] Power dissipation for 12V and 24V input at 25°C, 400LFM.



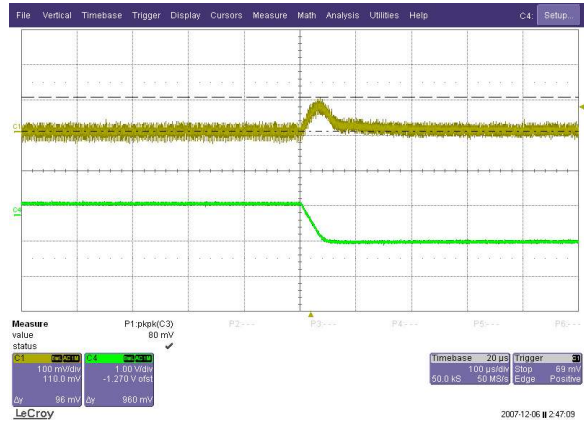
**NHF100-Q24 Series - Isolated DC/DC Converters**  
**12V/24V Input, Maximum Power : 100W**

Data Sheet  
 Mar. 3, 2008

**Output Load Transient Response**

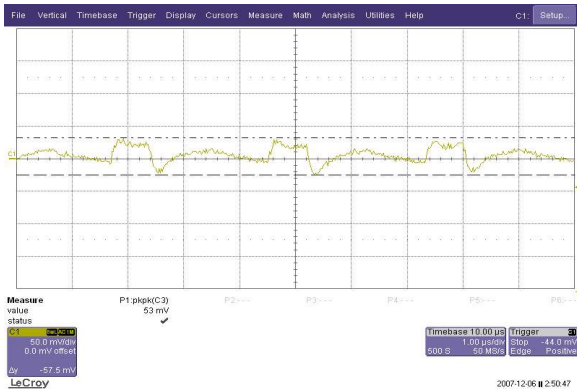


[Fig.15] Load step: 50%-75% of  $I_o$ ,  $di/dt=0.1A/us$  (CH1: 100mV, CH2: 5A/div, 100us/div)



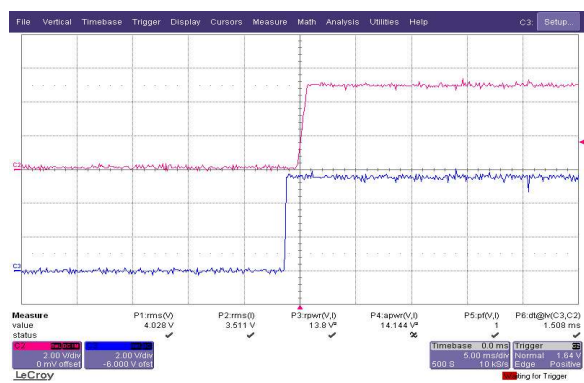
[Fig.16] Load step: 70%-50% of  $I_o$ ,  $di/dt=0.1A/us$  (CH1: 100mV, CH2: 5A/div, 100us/div)

**Output Ripple/Noise**



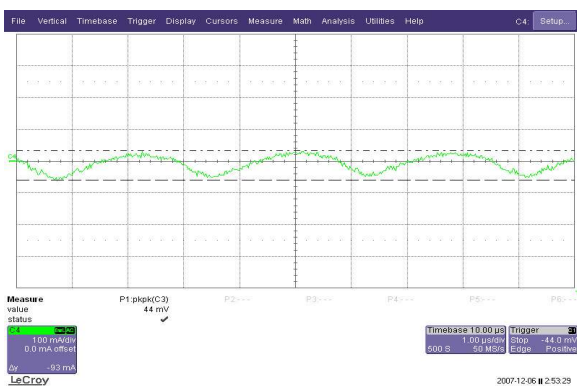
[Fig.17] Output ripple & noise (50mV/div)  
 (1 $\mu$ F ceramic + 15 $\mu$ F tantalum),  
 Bandwidth : 20MHZ, See fig.23

**Start-up from On/off input**



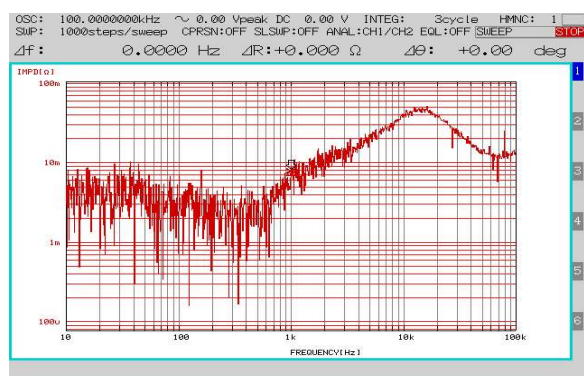
[Fig.18] Ch2:  $V_o$ , Ch3: On/off input (5ms/div)

**Input Reflected Ripple Current**



[Fig.19] Input reflect ripple current (100mA/div)

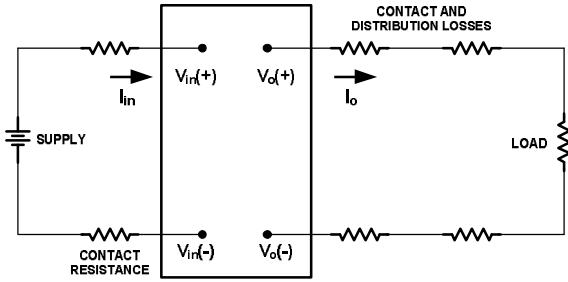
**Output Impedance**



[Fig.20] Output impedance at 100%

**TEST Configurations**

**Output Voltage and Efficiency**



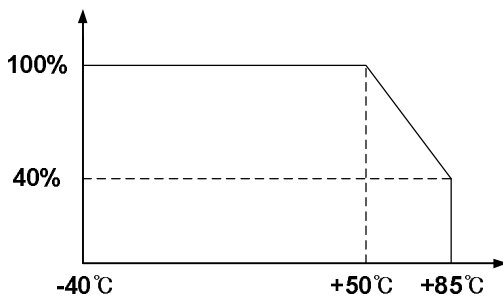
[Fig.21]

\*All measurements are taken at the module terminals when socketing, place Kelvin connections at module terminals to Avoid measurement errors due to socket contact resistance.

**Efficiency**

$$\eta = \left( \frac{[V_o(+)-V_o(-)] \times I_o}{[V_{in}(+)-V_{in}(-)] \times I_{in}} \right) \times 100\%$$

**Thermal Considerations**



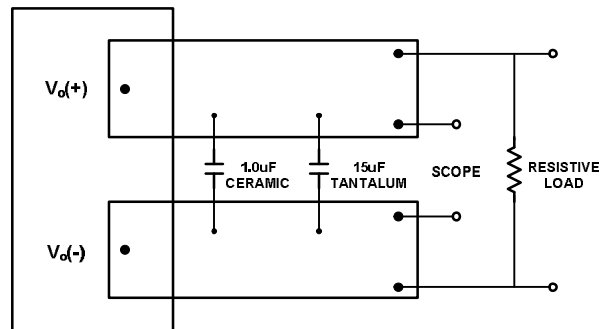
[Fig.22]

This products has wide operating temperature range from -40°C to +85°C.

However, it should be required a enough air flow for more reliable operation. Output derating curve provide designers with a quantity of a current under the desired ambient temperature and velocity of airflow.

**Output load transient response / ripple & noise Test**

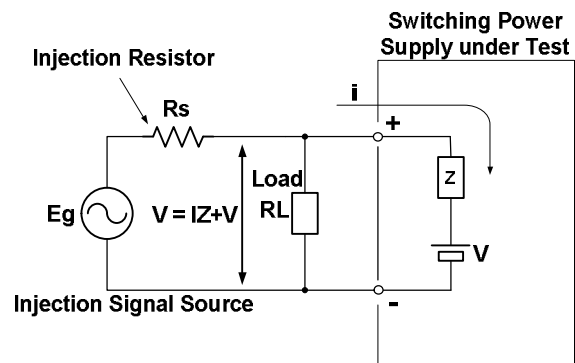
Output load transient response and ripple & noise are measured in figure 13. And the probe ground should be less than 1/2 inch to measure exact data.



[Fig.23]

**Output Impedance**

Figure14 is output impedance measurement block diagram. Here we measure output impedance by Introducing small test signal current into the switching power supply output and measuring voltage drop caused by the output impedance to understand the behavior of the power supply when the load fluctuates at high speed or when reactive load is connected.



[Fig.24]

**NHF100-Q24 Series - Isolated DC/DC Converters**  
 12V/24V Input, Maximum Power : 100W

Data Sheet  
 Mar. 3, 2008

**General Functions**

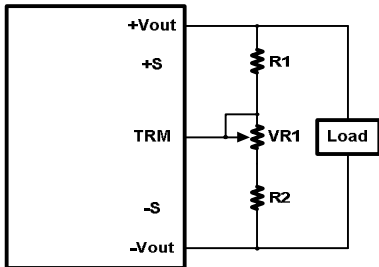
**Remote On/Off Control (CNT)**

By using CNT pin you can control the output without turning the input power on or off. This unit is positive-polarity device. Positive-polarity device is enabled when pin is left open or is pulled up to high. And positive-polarity device is disabled when pin2 is pulled down to low with respect to -Vin.

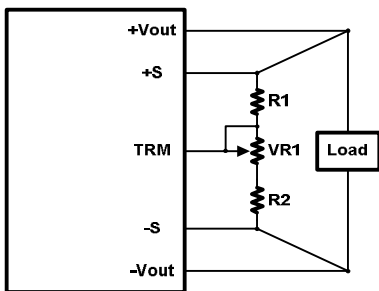
**Output voltage variation (Trim)**

Output Voltage adjusted by using trim pin within  $\pm 10\%$  of output voltage.

Resistors should be located close to the converters. If the trim function is not used, leave the trim pin open. And If  $\pm$ sense are used, change from figure15 to figure16.



[fig.25]

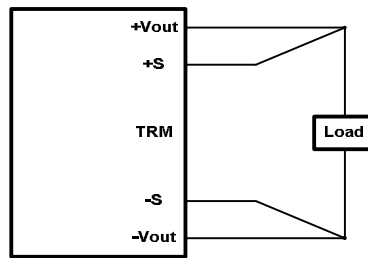


[fig.26]

| Output Voltage | VR   | R1  | R2   |
|----------------|------|-----|------|
| 3.3V           | 500Ω | 1kΩ | 560Ω |
| 5V             | 1kΩ  | 1kΩ | 680Ω |

**Remote Sense**

The sense inputs correct for output voltage drops along the conductors that connect the converter's output pins to the load. This output voltage drop should not be allowed to exceed 0.5V. Consider using heavier wire if this drop is excessive.



[fig.27]

**Over Voltage Protection (OVP)**

If the output voltage rises to a fault condition, which could be damaging to the load circuitry, the sensing circuitry will power down the PWM controller causing the output voltage to decrease.

**Over current Protection (OCP)**

The products built in over current protection circuit which operate when the output current is over 105% of rating and automatically recovers when over current condition is removed.

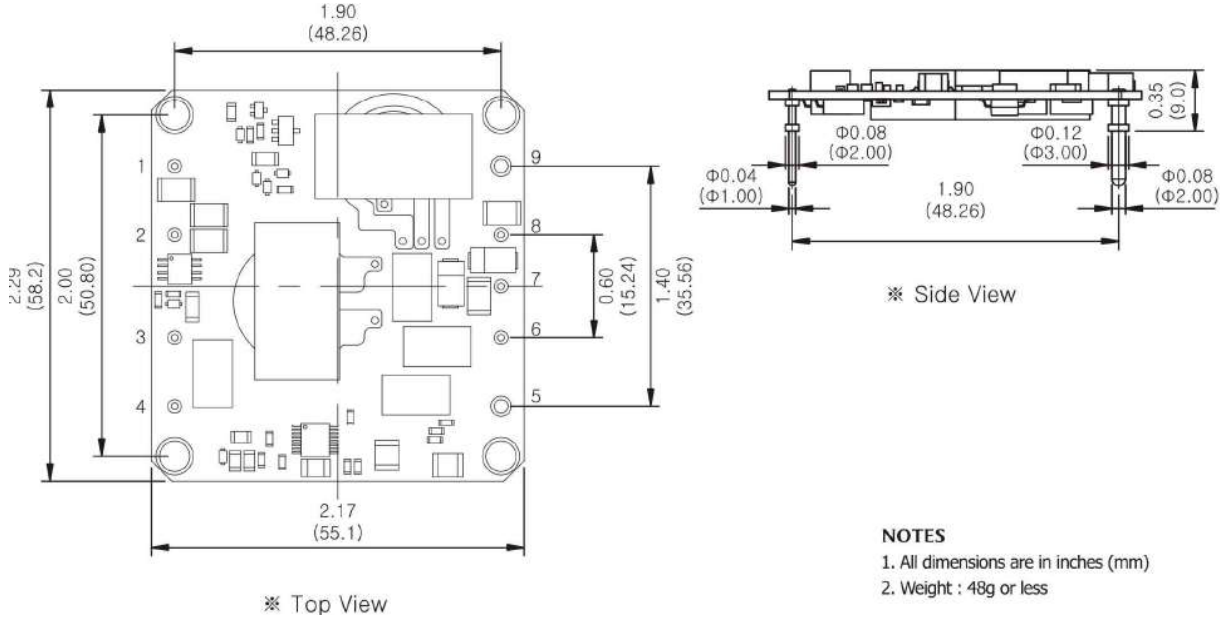
**Over Temperature Shut down (OTP)**

The converters are equipped with precision thermal-shutdown circuitry. If the internal temperature of the converter rises up to the designed operating temperature, a precision temperature sensor will power down the unit. When the internal temperature decreases below the threshold of the temperature sensor, the unit will self start.

**NHF100-Q24 Series - Isolated DC/DC Converters**  
 12V/24V Input, Maximum Power : 100W

Data Sheet  
 Mar. 3, 2008

**Mechanical Specification**

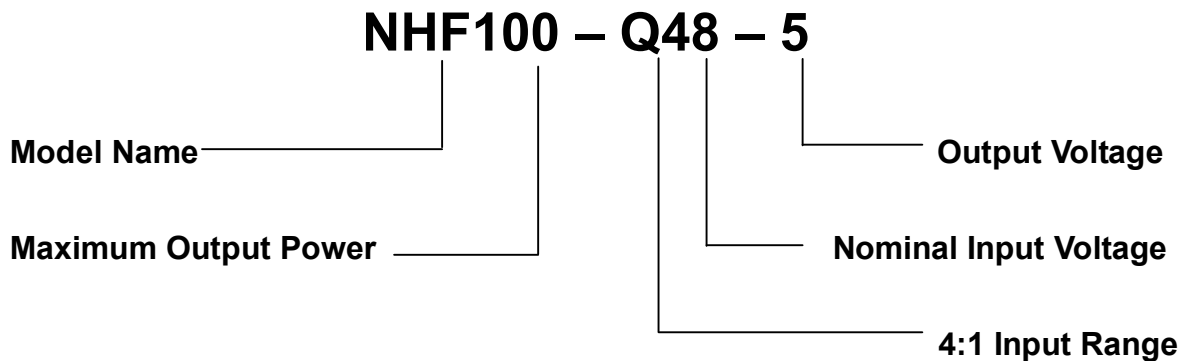


**Pin Assignments**

| PIN NO | NAME   | FUNCTION                 |
|--------|--------|--------------------------|
| 1      | +Vin   | Positive Input voltage   |
| 2      | CNT    | Remote ON/OFF            |
| 3      | Case   | Case                     |
| 4      | -Vin   | Negative input voltage   |
| 5      | -Vout  | Negative output voltage  |
| 6      | -Sense | Negative remote sense    |
| 7      | Trim   | Output voltage variation |
| 8      | +Sense | Positive remote sense    |
| 9      | +Vout  | Positive output voltage  |

**NHF100-Q24 Series - Isolated DC/DC Converters**  
12V/24V Input, Maximum Power : 100WData Sheet  
Mar. 3, 2008**Ordering Information**

| Input  | Output1,<br>Output2 | Maximum<br>Power | Ripple & Noise<br>Max. | Efficiency<br>Typ. | Model<br>Number |
|--------|---------------------|------------------|------------------------|--------------------|-----------------|
| 12~36V | 3.3V@30A            | 99W              | 75mVp-p                | 88.5%              | NHF100-Q24-3R3  |
| 10~36V | 5V@20A              | 100W             | 75mVp-p                | 85.2%              | NHF100-Q24-5    |
| 22~75V | 3.3V@30A            | 99W              | 75mVp-p                | 89.2%              | NHF100-Q48-3R3  |
| 18~75V | 5V@20A              | 100W             | 75mVp-p                | 87.0%              | NHF100-Q48-5    |

**Part Number Structure**

No part of this publication may be copied, transmitted, or stored in a retrieval system or reproduced in any way including, but not limited to, photography, photocopy, or other recording means, without prior written permission from Powerplaza co., Ltd

**HEAD OFFICE & FACTORY**

#1402, 14F/L 6th Daeryung TechnoTown 493-6,  
Gasam-Dong, Kumchon-Gu, Seoul, 153-774,  
Korea

TEL: +82 2 855 4955 | FAX: +82 2 855 4954

**GENERAL SALES INQUIRIES**

Please feel free to

contact : [sales@powerplaza.co.kr](mailto:sales@powerplaza.co.kr)

©2007 Powerplaza co., Ltd. Specification subject to change without notice.