NHF100-Q48 Series - Isolated DC/DC Converters
24/48V Input, Maximum Power : 100W

Data Sheet
Mar. 3, 2008

NHF100-Q48 : 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℃ to 85℃)
- High efficiency
- Precision thermal protection(Accuracy ±3℃)
- Over current protection
- Under voltage lock out (UVLO)
- Output over voltage protection
- Remote on/off control
- Output voltage variation (TRM)
- Positive/Negative remote sense
- RoHS directive

Applications

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

Description

NHF100-Q48 series are isolated dc/dc converters that offer the flexibility of operation with both 24V and 48V 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 (±)output sense functions.

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Absolute Maximum Ratings

Parameter	Min.	Typ.	Max.	Unit	Notes
Input voltage continuous(model dependent)	18/22	-	75	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℃, Airflow rate=400LFM, Vin=48Vdc unless otherwise noted.

Input Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating voltage range					
NHF100-Q48-3R3		22	48	75	Vdc
NHF100-Q48-5		18	48	75	Vdc
Input under voltage lockout (UVLO)					
NHF100-Q48-3R3		18.5	-	19.7	Vdc
NHF100-Q48-5		16.2	-	17.9	Vdc
Disabled input current (Remote on/off control)		-	6.2	-	mA
Maximum Input current (At minimum input voltage and maximum output power)	I_{in}				
NHF100-Q48-3R3		-	4.98	-	A
NHF100-Q48-5		-	6.36	-	A
No load input current					
NHF100-Q24-3R3		-	80	-	mA
NHF100-Q24-5		-	48.5	-	mA
Input reflected ripple current (Maximum output power)					
NHF100-Q24-3R3		-	150	-	mA
NHF100-Q24-5		-	144	-	mA

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Output Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Output voltage tolerance	Vo	-	-	2	V
Output regulation;					
- Line regulation		-	±0.2	±0.5	%
- Load regulation		-	±0.2	±0.5	%
Output current	Io				
NHF100-Q48-3R3		0	-	30	A
NHF100-Q48-5		0	-	20	A
Output current limit(Automatic recovery)		105	-	-	%
Output ripple and noise, (Vin = 48V, Io = Max output current, 1μF ceramic + 15μF tantalum, Bandwidth : 20MHz, See fig.23)					
NHF100-Q48-3R3		-	-	75	mV
NHF100-Q48-5		-	-	75	mV
Efficiency					
NHF100-Q48-3R3					
Vin = 24V, 50% Load		-	91.8	-	%
Vin = 24V, 100% Load		-	88.9	-	%
Vin = 48V, 50% Load		-	90.9	-	%
Vin = 48V, 100% Load		-	89.2	-	%
NHF100-Q48-5					
Vin = 24V, 50% Load		-	91.7	-	%
Vin = 24V, 100% Load		-	87.0	-	%
Vin = 48V, 50% Load		-	90.6	-	%
Vin = 48V, 100% Load		-	86.5		%
Dynamic load response (1uF ceramic + 15uF tantalum, 50% to 75 %, 75% to 50%, Slew rate = 0.1A/μs See fig.23)					
NHF100-Q48-3R3		-	±200	±250	mV
NHF100-Q48-5		-	±105	±250	mV

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Recovery time(with in 1% Nominal Vo)					
NHF100-Q48-3R3		-	250	300	μs
NHF100-Q48-5		-	200	300	μs
Start-up time		-	2	4	ms
Turn-on overshoot		-	0	-	%
Maximum output capacitance					
NHF100-Q48-3R3		-	1470	-	μF
NHF100-Q48-5		-	1470	-	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	-	℃
Over-temperature accuracy		-	±3-	-	℃
Over temperature restart hysteresis		-	-	11	℃
MTBF(Io=80%, Ta=25℃, Airflow = 400LFM)		179200			hrs
Dimensions(W.H.L.)		58.4 x 61 x 12.7 (2.28 x 2.4 x 0.5)			mm (inches)
Weight		-	180	-	g

Environmental

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

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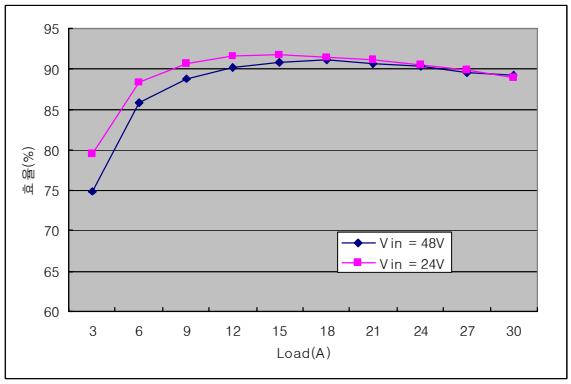
Characteristic Curves

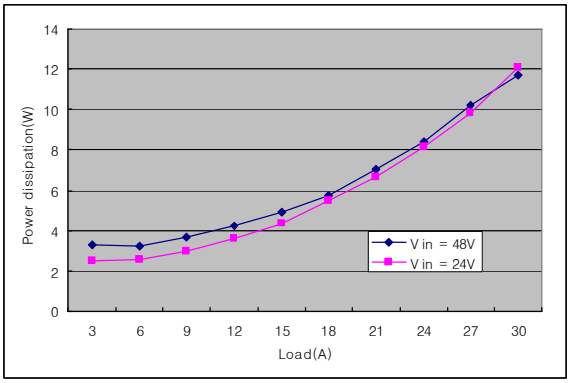
The following Fig.1~10 provide typical characteristics for the NHF100-Q48-3R3 (3.3V, 30A).

Efficiency



[Fig.1] Efficiency for 24V and 48V input at 25℃, 400LFM.

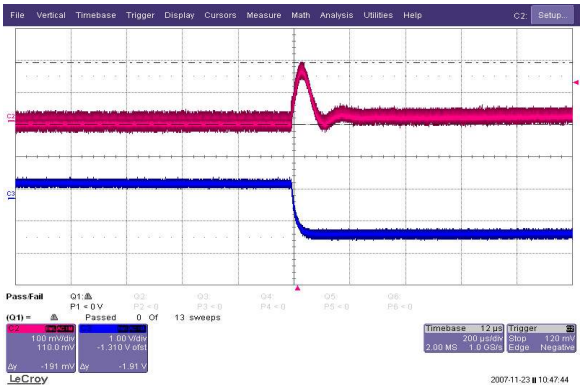
Power Dissipation



[Fig.2] Power dissipation for 24V and 48V input at 25℃, 400LFM.

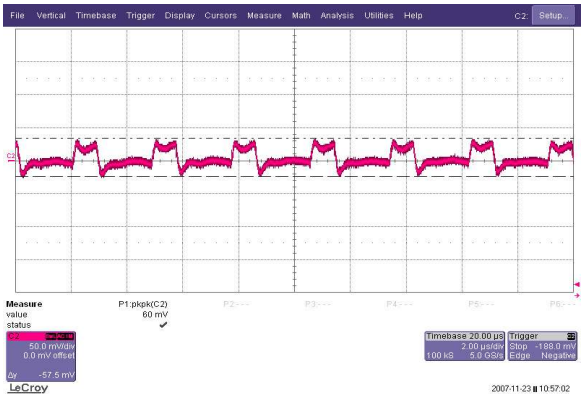
Output Load Transient Response

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



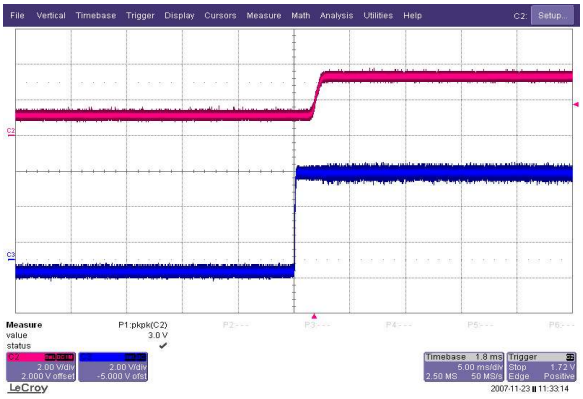
[Fig.6] Load step: 70%-50% of Io, di/dt= 0.1A/us (CH1: 100mV, CH2: 5A/div, 200us/div)

Output Ripple/Noise



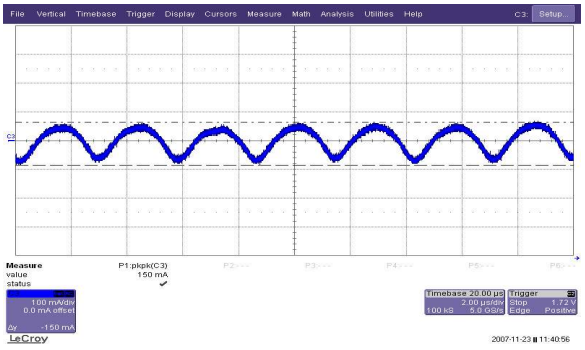
[Fig.7] Output ripple & noise (50mV/div)
(1μF ceramic + 15μF tantalum, See figure13.
Bandwidth : 20MHz, See fig.23

Start-up from On/off input



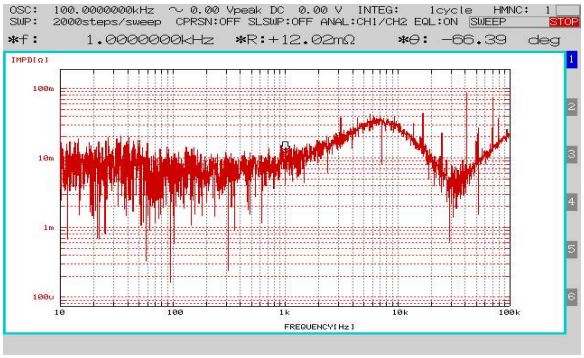
[Fig.8] Ch2: Vout, Ch3: On/off input (5ms/div)

Input Reflected Ripple Current



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

Output Impedance



[Fig.10] Output impedance at 100% Load

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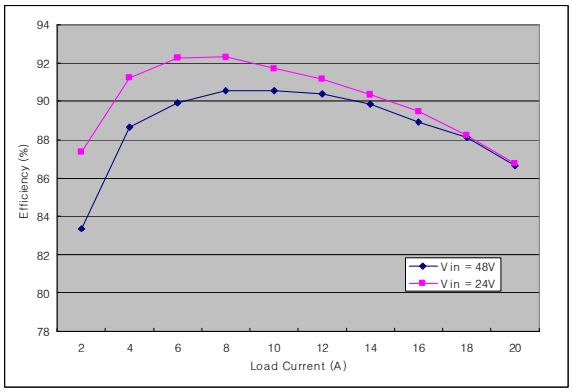
Characteristic Curves

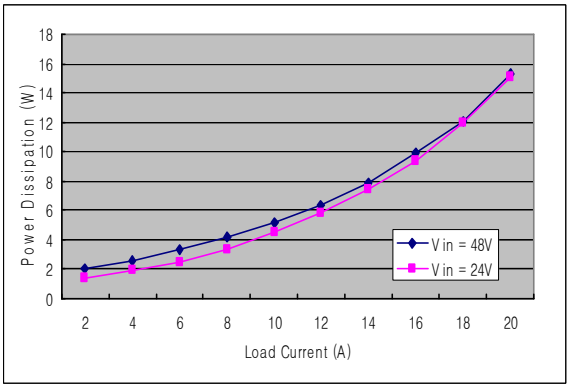
The following Fig.11~20 provide typical characteristics for the NHF100-Q48-5 (5V, 20A).

Efficiency



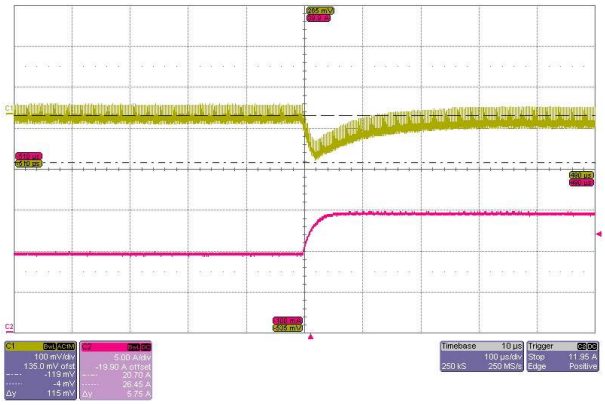
[Fig.11] Efficiency for 24V and 48V input at 25℃, 400LFM.

Power Dissipation

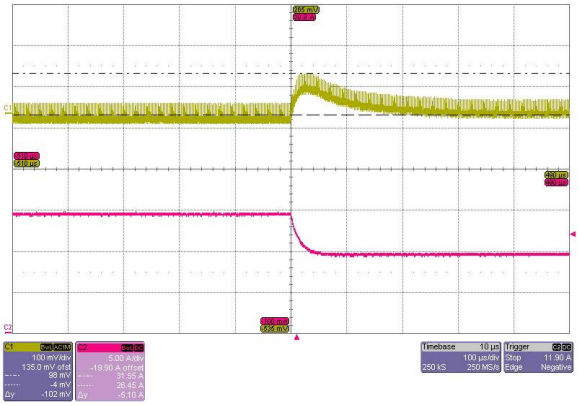


[Fig.12] Power dissipation for 24V and 48V input at 25℃, 400LFM.

Output Load Transient Response

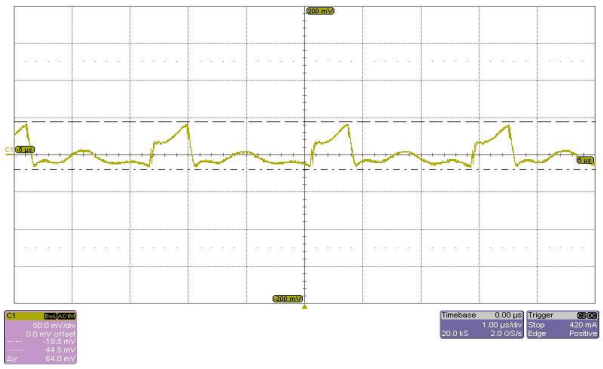


[Fig.15] Load step: 50%-75% of Io, di/dt= 0.1A/us (CH1: 100mV, CH2: 5A/div, 100us/div)



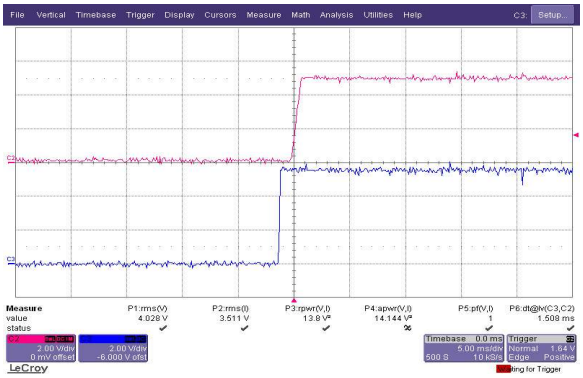
[Fig.16] Load step: 70%-50% of Io(max), di/dt= 0.1A/us (CH1: 100mV, CH2: 5A/div, 100us/div)

Output Ripple/Noise



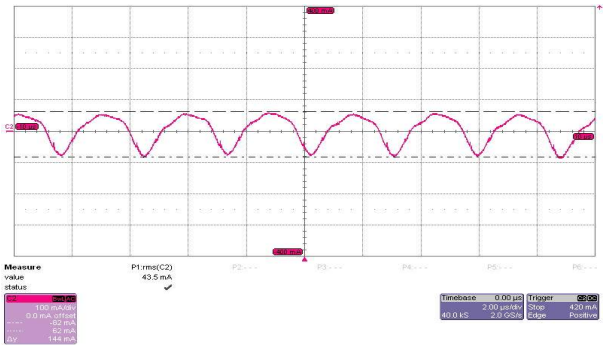
[Fig.17] Output voltage ripple & noise (50mV/div) (1μF ceramic + 15μF tantalum), Bandwidth : 20MHz, See fig.23

Start-up from On/off input



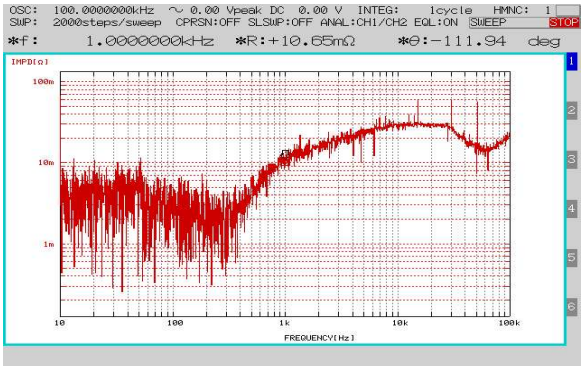
[Fig.18] Ch2: Vo, Ch3: On/off input(5ms/div)

Input Reflected Ripple Current



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

Output Impedance



[Fig.20] Output impedance at 100% Load

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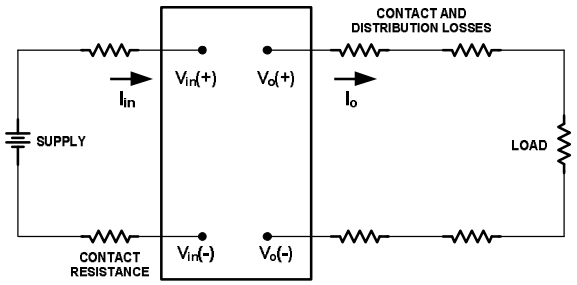
TEST Configurations

Output Voltage and Efficiency



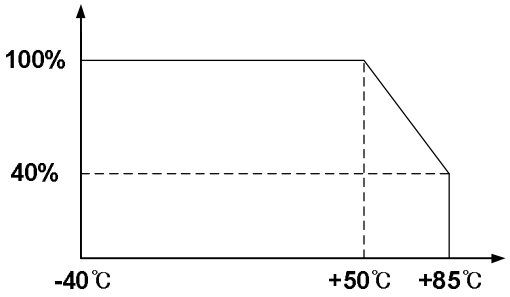
[Fig.21]

*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



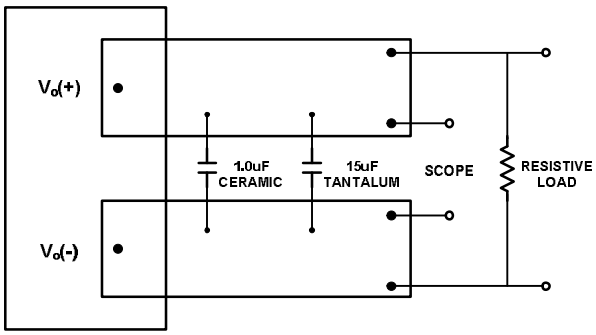
[Fig.22]

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

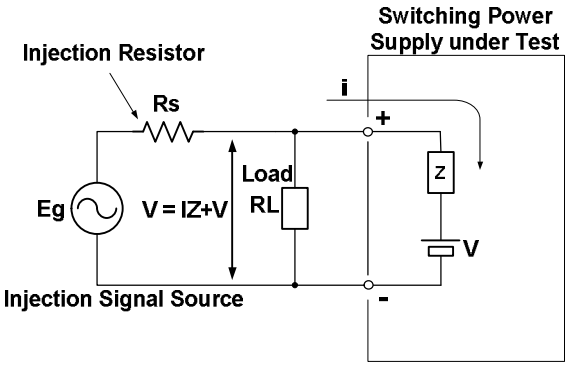
Output load transient response and ripple & noise are measured in figure 13. And the probe ground should be less than 1/2 inch to measure exact data.



[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.



[Fiq.24]

General Functions

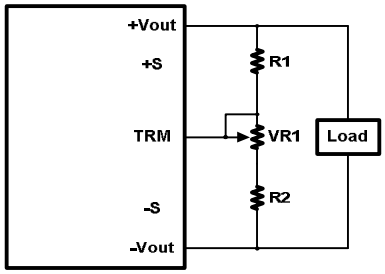
Remote On/Off Control (CNT)

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.

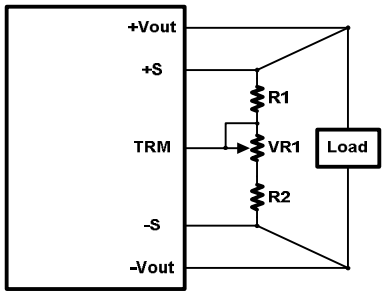
Output voltage variation (Trim)

Output Voltage adjusted by using trim pin within ±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 ±sense are used, change from figure15 to figure16.



[fig.25]

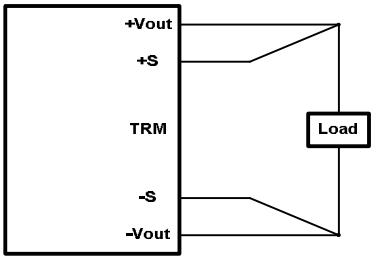


[fig.26]

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 casing 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.

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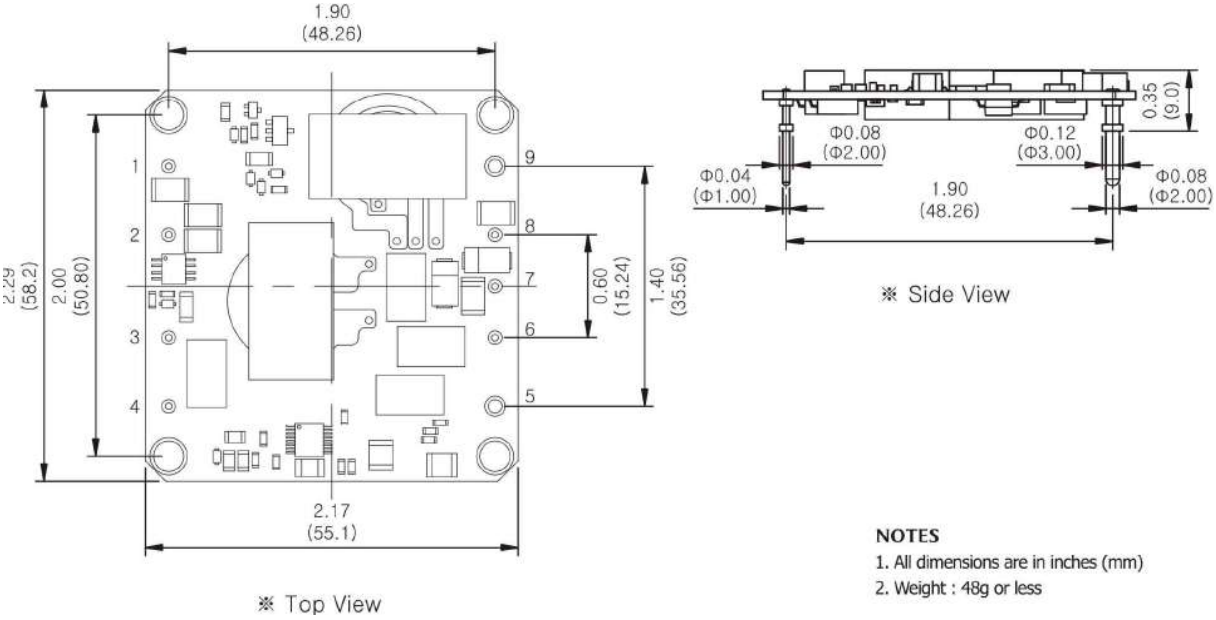
Mechanical Specification



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

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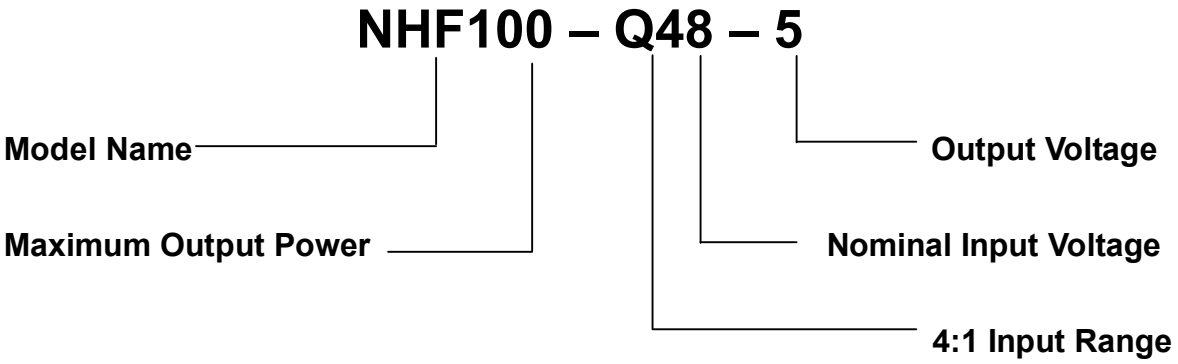
Ordering Information

Input	Output1, Output2	Maximum Power	Ripple & Noise max.	Efficiency Typ.	Model 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



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