NB600-48/72/96-12 : Isolated DC/DC Converters
36 – 75V/50 – 100V/60 – 120V Input Range, Maximum Power : 600W

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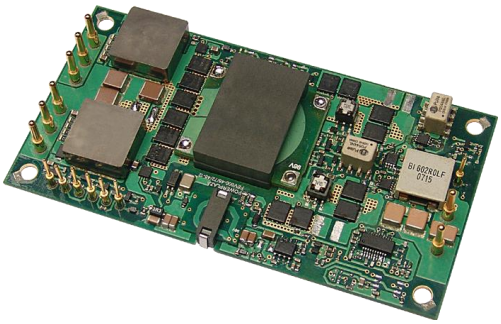
NB600-48/72/96-12 : Isolated DC/DC converters

Features

- Industry standard Full-Brick
- High efficiency, typ. 92% at full load
- 1500Vdc input to output isolation
- Output over voltage protection
- Input over voltage protection
- Input under voltage protection
- Over temperature protection
- Over current protection
- Short circuit protection
- Remote control
- Remote sense
- Output voltage adjust function (Trim)
- Power good function
- Aux voltage 10V, 50mA
- RoHS directive



Applications

- Server, storage, network, and communications infrastructure
- Instrumentation / Equipments

NB600 series are a high efficiency, isolated dc-dc power modules providing up to 600W in an industry full brick footprint, which makes it an ideal choice for high current and high power applications. The series feature an input voltage range of 36-75V, 50-100V, 60-120V and an output power of 12V/50A.

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NB600-48-12 Absolute Maximum Ratings

Parameter	Min.	Typ.	Max.	Unit	Notes
Input voltage continuous	0	-	80	Vdc	
Operating temp. (Baseplate temp.)	-40	-	95	˚C	
Storage temperature	-40	-	125	˚C	
I/O isolation voltage	-	1500	-	VDC	

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

NB600-48-12 Electrical Specifications

Ta=25℃, Vin=48Vdc unless otherwise noted.

Input Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating voltage range	Vin	36	48	75	Vdc
Input under voltage lockout					
Turn-on threshold		-	32.8	-	Vdc
Turn-off threshold		-	30.5	-	Vdc
Input over-voltage protection					
Turn-on threshold		-	78	-	Vdc
Turn-off threshold		-	83	-	Vdc
Disabled input current (Remote on/off control, module disabled)		-	9	-	mA
No load input current (Io = 0, Module enabled)		-	426	-	mA
Maximum Input current (Vin = Vin,min, Io = Io,max)	I_{in}	-	18.6	-	A
Input reflected ripple current (Io = Io,max)		-	0.2	-	A

Output Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Output voltage set point	V_o	-	12	-	V
Output regulation; - Line regulation(Vin=Vin,min to Vin,max)		-	-	±0.5	%

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- Load regulation(Io=Io,mim to Io,max)		-	-	±0.5	%
Output adjust range		10.8	-	13.2	V
Output current	Io	0	-	50	A
Output current limit(Automatic recovery)		105	-	-	%
Output ripple and noise, (Io = Io,max, 1μF ceramic + 15μF tantalum, Bandwidth : 20MHz)		-	-	120	mV
Efficiency (Vin = 48V, 100% Load)		-	91.2	-	%
Dynamic load response (Load change from Io = 50% to 75 % , 75% to 50% of Io,max, Slew rate = 0.2A/μs)		-	±594	-	mV
Recovery time(within 1% of Vo,nom) (Load change from Io = 50% to 75 % , 75% to 50% of Io,max, Slew rate = 0.2A/μs)		-	92	-	μs
Output Over-voltage Protection		-	125	-	%
Start-up time (Io=Io,max, On/off control)		-	49.6	-	ms
Turn-on overshoot		-	0	2	%
Auxiliary output voltage		-	10	-	V
Auxiliary output current		-	-	0.05	A

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Switching Frequency		-	165	-	KHz
Remote control pin voltage ((CNT+) – (CNT-))					
On		Short Vin- or 0 to 0.5Vdc			Vdc
Off		Open or 4.5 to 15Vdc			Vdc
Output voltage remote sense range		-	-	10	%
Over-temperature protection (Baseplate)		-	100	-	℃
Over-temperature accuracy		-	±3	-	℃
Dimensions		116.8 x 61.0 x 12.7 (4.60 x 2.40 x 0.50)			mm (inches)
Weight		-	150	-	g

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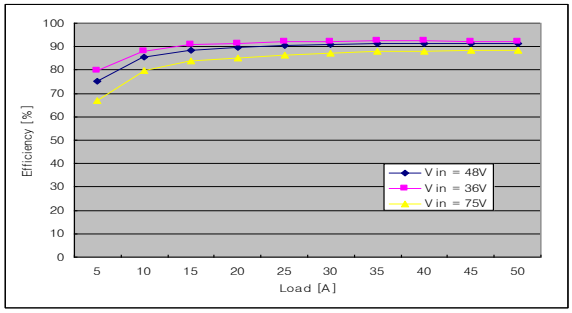
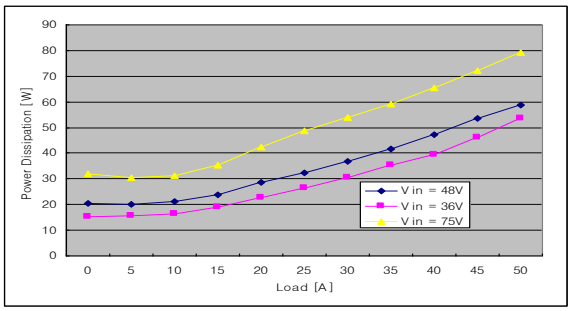
Characteristic Curves

Efficiency



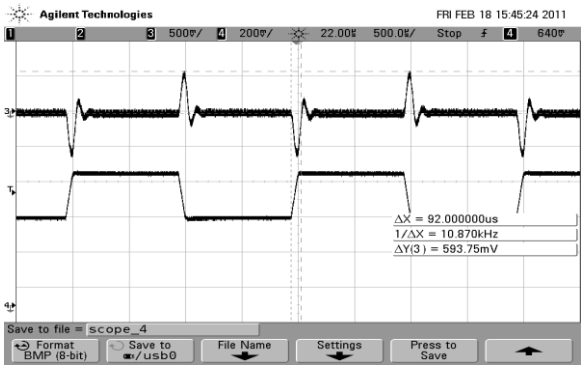
[Fig.1] Efficiency for 36V, 48V, 75V input voltage at 25℃

Power Dissipation



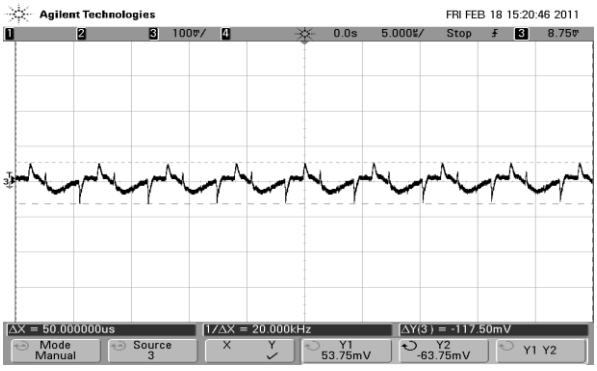
[Fig.2] Power dissipation for 36V, 48V, 75V input voltage at 25℃

Output Load Transient Response



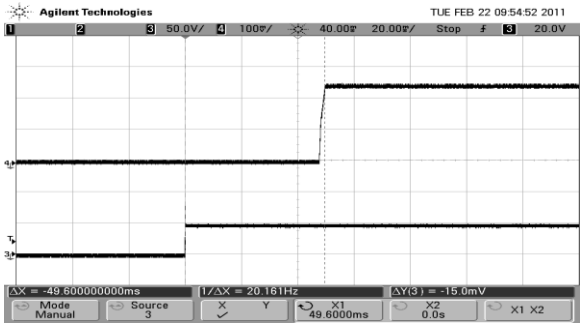
[Fig. 3] Load step: 50%-75-50% of Io, di/dt= 0.2A/us (CH3: 500mV, CH4: 10A/div, 0.5ms/div)

Output Ripple/Noise



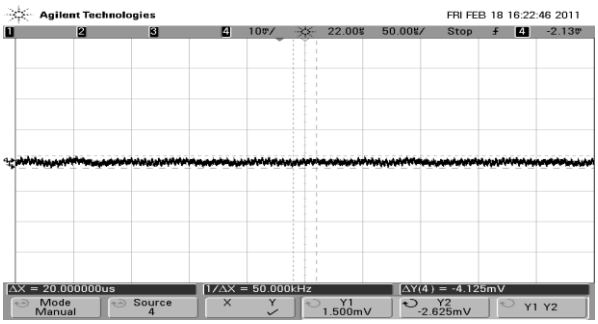
[Fig. 4] Output ripple & nosie (100mV/div)

Start-up from Input Voltage



[Fig.5] Ch4: Vo, Ch3: Input voltage (20ms/div)

Input Reflect Ripple Current



[Fig.6] Input reflect ripple current (0.5A/div)

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NB600-72-12 Absolute Maximum Ratings

Parameter	Min.	Typ.	Max.	Unit	Notes
Input voltage continuous	0	-	100	Vdc	
Operating temp. (Baseplate temp.)	-40	-	95	˚C	
Storage temperature	-40	-	125	˚C	
I/O isolation voltage	-	1500	-	VDC	

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

NB600-72-12 Electrical Specifications

Ta=25℃, Vin=72Vdc unless otherwise noted.

Input Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating voltage range	Vin	50	72	100	Vdc
Input under voltage lockout					
Turn-on threshold		-	45.5	-	Vdc
Turn-off threshold		-	43.5	-	Vdc
Input over-voltage protection					
Turn-on threshold		-	97	-	Vdc
Turn-off threshold		-	104	-	Vdc
Disabled input current (Remote on/off control, module disabled)		-	9	-	mA
No load input current (Io = 0, Module enabled)			247		mA
Maximum Input current (Vin = Vin,min, Io = Io,max)	I_{in}	-	13.2	-	A
Input reflected ripple current (Io = Io,max)		-	0.6	-	mA

Output Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Output voltage set point	V_o	-	12	-	V
Output regulation; - Line regulation(Vin=Vin,min to Vin,max)		-	-	±0.5	%

NB600-48/72/96-12 : Isolated DC/DC Converters
36 – 75V/50 – 100V/60 – 120V Input Range, Maximum Power : 600W

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- Load regulation(Io=Io,mim to Io,max)		-	-	±0.5	%
Output adjust range		10.8	-	13.2	V
Output current	Io	0	-	50	A
Output current limit(Automatic recovery)		105	-	-	%
Output ripple and noise, (Io = Io,max, 1μF ceramic + 15μF tantalum, Bandwidth : 20MHz)		-	-	120	mV
Efficiency (Vin = 48V, 100% Load)		-	92.1	-	%
Dynamic load response (Load change from Io = 50% to 75 % , 75% to 50% of Io,max, Slew rate = 0.2A/μs)		-	537	-	mV
Recovery time(within 1% of Vo,nom) (Load change from Io = 50% to 75 % , 75% to 50% of Io,max, Slew rate = 0.2A/μs)		-	156		μs
Output Over-voltage Protection		-	125	-	%
Start-up time (Io=Io,max, On/off control)		-	150	-	ms
Turn-on overshoot		-	0	2	%
Auxiliary output voltage		-	10	-	V
Auxiliary output current		-	-	0.05	A

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Switching Frequency		-	330	-	KHz
Remote control pin voltage ((CNT+) – (CNT-))					
On		Short Vin- or 0 to 0.5Vdc			Vdc
Off		Open or 4.5 to 15Vdc			Vdc
Output voltage remote sense range		-	-	10	%
Over-temperature protection (Baseplate)		-	100	-	℃
Over-temperature accuracy		-	±3	-	℃
Dimensions		116.8 x 61.0 x 12.7 (4.60 x 2.40 x 0.50)			mm (inches)
Weight		-	150	-	g

NB600-48/72/96-12 : Isolated DC/DC Converters
36 – 75V/50 – 100V/60 – 120V Input Range, Maximum Power : 600W

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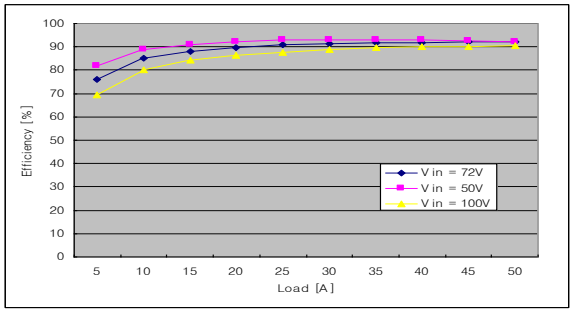
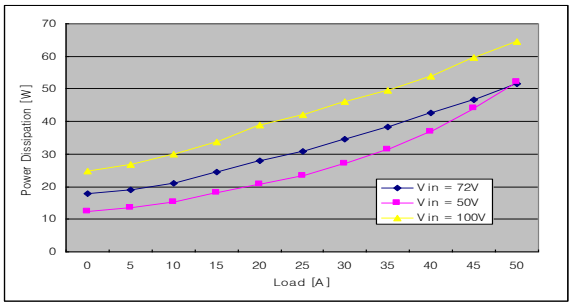
Characteristic Curves

Efficiency



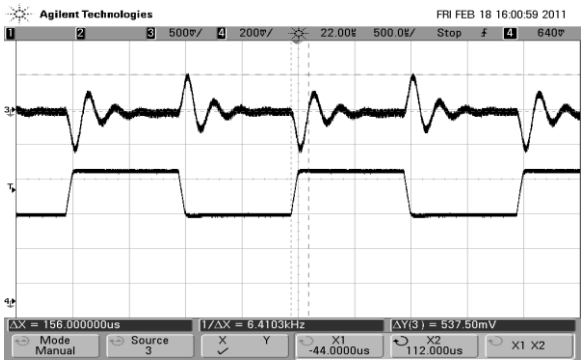
[Fig.7] Efficiency for 36V, 48V, 75V input voltage at 25℃

Power Dissipation



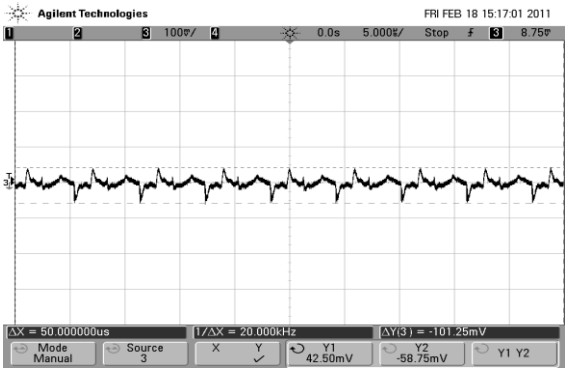
[Fig.8] Power dissipation for 36V, 48V, 75V input voltage at 25℃

Output Load Transient Response



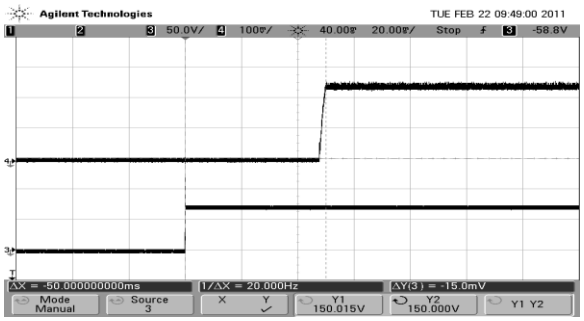
[Fig. 9] Load step: 50%-75-50% of Io, di/dt= 0.2A/us (CH3: 500mV, CH2: 10A/div, 0.5ms/div)

Output Ripple/Noise



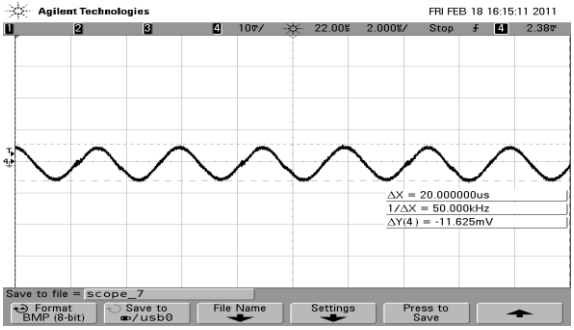
[Fig. 10] Output ripple & nosie (100mV/div)

Start-up from Input Voltage



[Fig.11] Ch4: Vo, Ch3: Input voltage (20ms/div)

Input Reflect Ripple Current



[Fig.12] Input reflect ripple current (0.5A/div)

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NB600-96-12 Absolute Maximum Ratings

Parameter	Min.	Typ.	Max.	Unit	Notes
Input voltage continuous	0	-	120	Vdc	
Operating temp. (Baseplate temp.)	-40	-	95	˚C	
Storage temperature	-40	-	125	˚C	
I/O isolation voltage	-	1500	-	VDC	

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

NB600-96-12 Electrical Specifications

Ta=25℃, Vin=96Vdc unless otherwise noted.

Input Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Operating voltage range	Vin	60	96	120	Vdc
Input under voltage lockout					
Turn-on threshold		-	56.3	-	Vdc
Turn-off threshold		-	53.5	-	Vdc
Input over-voltage protection					
Turn-on threshold		-		-	Vdc
Turn-off threshold		-		-	Vdc
Disabled input current (Remote on/off control, module disabled)		-	9	-	mA
No load input current (Io = 0, Module enabled)			200		mA
Maximum Input current (Vin = Vin,min, Io = Io,max)	I_{in}	-	6.34	-	A
Input reflected ripple current (Io = Io,max)		-	1	-	A

Output Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Output voltage set point	V_o	-	12	-	V
Output regulation; - Line regulation(Vin=Vin,min to Vin,max)		-	-	±0.5	%

NB600-48/72/96-12 : Isolated DC/DC Converters
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- Load regulation(Io=Io,mim to Io,max)		-	-	±0.5	%
Output adjust range		10.8	-	13.2	V
Output current	Io	0	-	50	A
Output current limit(Automatic recovery)		105	-	-	%
Output ripple and noise, (Io = Io,max, 1μF ceramic + 15μF tantalum, Bandwidth : 20MHz)		-	-	120	mV
Efficiency (Vin = 48V, 100% Load)		-	91.9	-	%
Dynamic load response (Load change from Io = 50% to 75 % , 75% to 50% of Io,max, Slew rate = 0.2A/μs)		-	594	-	mV
Recovery time(within 1% of Vo,nom) (Load change from Io = 50% to 75 % , 75% to 50% of Io,max, Slew rate = 0.2A/μs)		-	92		μs
Output Over-voltage Protection		-	125	-	%
Start-up time (Io=Io,max, On/off control)		-	49.6	-	ms
Turn-on overshoot		-	0	2	%
Auxiliary output voltage		-	10	-	V
Auxiliary output current		-	-	0.05	A

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Switching Frequency		-	165	-	KHz
Remote control pin voltage ((CNT+) – (CNT-))					
On		Short Vin- or 0 to 0.5Vdc			Vdc
Off		Open or 4.5 to 15Vdc			Vdc
Output voltage remote sense range		-	-	10	%
Over-temperature protection (Baseplate)		-	100	-	℃
Over-temperature accuracy		-	±3	-	℃
Dimensions		116.8 x 61.0 x 12.7 (4.60 x 2.40 x 0.50)			mm (inches)
Weight		-	150	-	g

NB600-48/72/96-12 : Isolated DC/DC Converters
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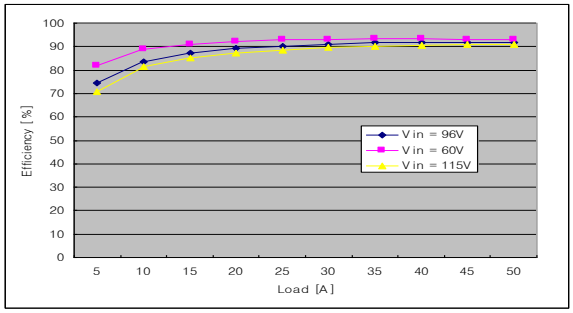
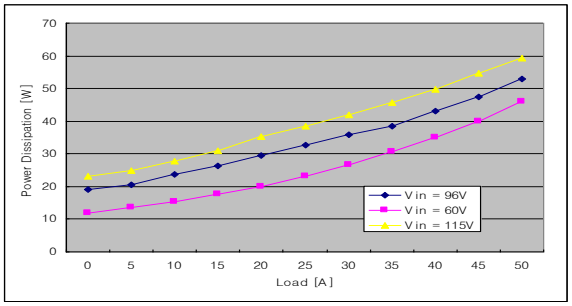
Characteristic Curves

Efficiency



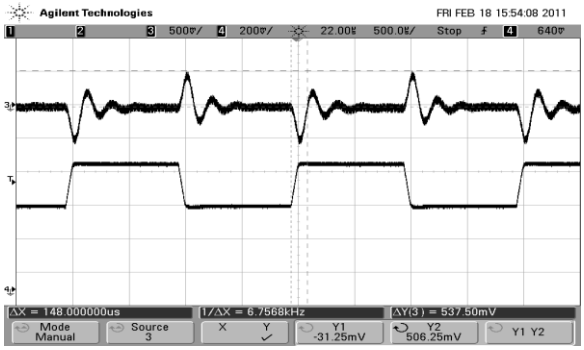
[Fig.13] Efficiency for 36V, 48V, 75V input voltage at 25℃

Power Dissipation



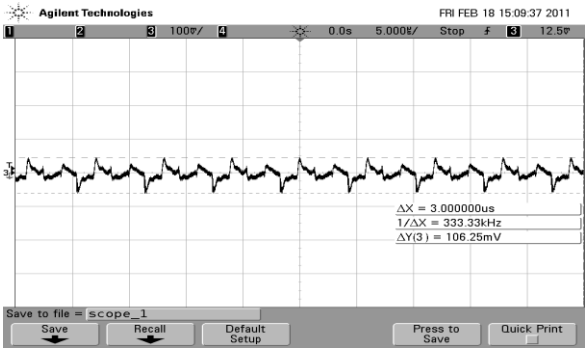
[Fig.14] Power dissipation for 36V, 48V, 75V input voltage at 25℃

Output Load Transient Response



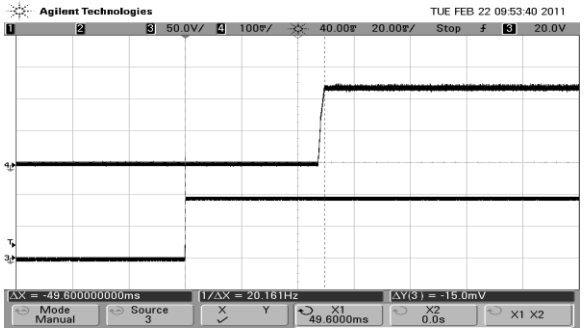
[Fig. 15] Load step: 50%-75-50% of Io, di/dt= 0.2A/us (CH3: 500mV, CH2: 10A/div, 0.5ms/div)

Output Ripple/Noise



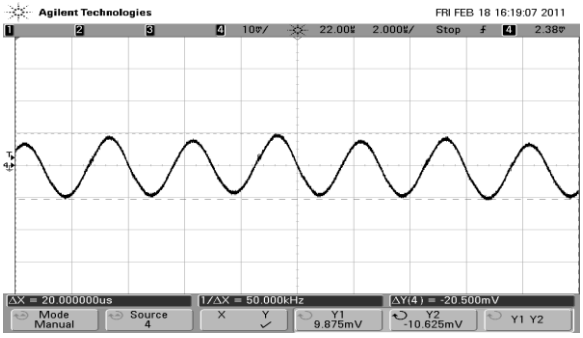
[Fig. 16] Output ripple & noise (100mV)

Start-up from Input Voltage



[Fig.17] Ch4: Vo, Ch3: Input voltage(20ms/div)

Input Reflect Ripple Current



[Fig.18] Input reflect ripple current (0.5A/div)

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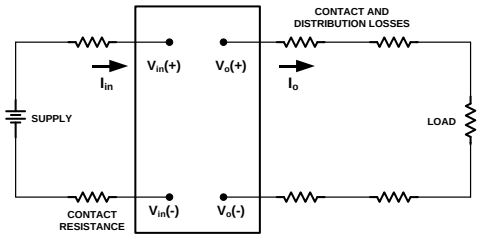
TEST Configurations

Output Voltage and Efficiency



*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

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

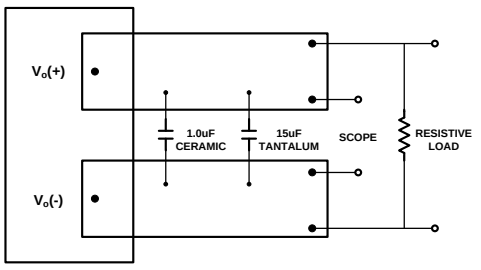
Thermal Considerations

This products has wide operating temperature range from -40˚C to +100˚C at baseplate.

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. And the probe ground should be less than 1/2 inch and oscilloscope is set up 20MHz bandwidth to measure exact data.



Protection Functions

Input under-voltage Lockout(UVLO)

At input voltages below the input under-voltage lockout limit, the module operation is disabled. The module will begin to operate once the input voltage is raised above the under-voltage lockout turn-on threshold.

Input Over-Voltage Protection

At input voltages over the input over-voltage lockout limit, the module operation is disabled. The module will begin to operate once the input voltage is downed under the over-voltage lockout turn-on threshold.

Output Over Voltage Protection(OVP)

This protection feature latches in the event of over voltage across the output. Cycling the input voltage resets the latching protection feature.

Over current Protection(OCP)

To provide protection in output overload condition, the unit is equipped with internal current-limiting circuitry. At the point of current-limit inception, the unit enters hiccup mode. Also the module 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.

Pin Functions

Remote On/Off Control (CNT)

Two remote on/off options are available. Positive logic turns module on during a logic high voltage on the ON/Off pin, and off during a logic low.

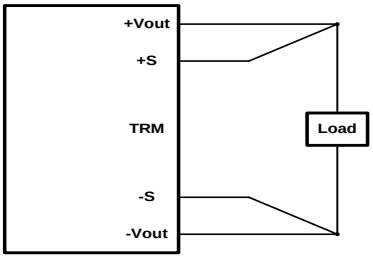
Our module is set up negative logic with default.

If you want positive logic, contact our company.

Remote Sense(±sense)

Remote sense minimizes the effects of distribution losses by regulating the voltage at the remote sense connections. The voltage between the remote-sense pins and the output terminals must not exceed the output voltage sense range given in the specifications.

The amount of power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. When using remote sense and trim, the output voltage of the module cans be increased, which at the same output current would increase the power output of the module. Care should be taken to ensure that the maximum output power of the module remains at or below the maximum rated power.

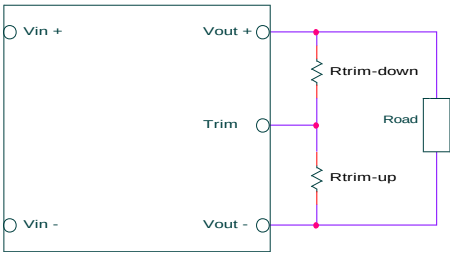


Output voltage adjustment (Trim)

Trimming allows the output voltage set point to be increased or decreased, this is accomplished by connecting an external resistor between the TRIM pin and either the Vo(+) pin or the Vo(-) pin.

Connecting an external resistor (Rtrim-up) between the TRIM pin and the Vo(-) pin increases the output voltage set point.

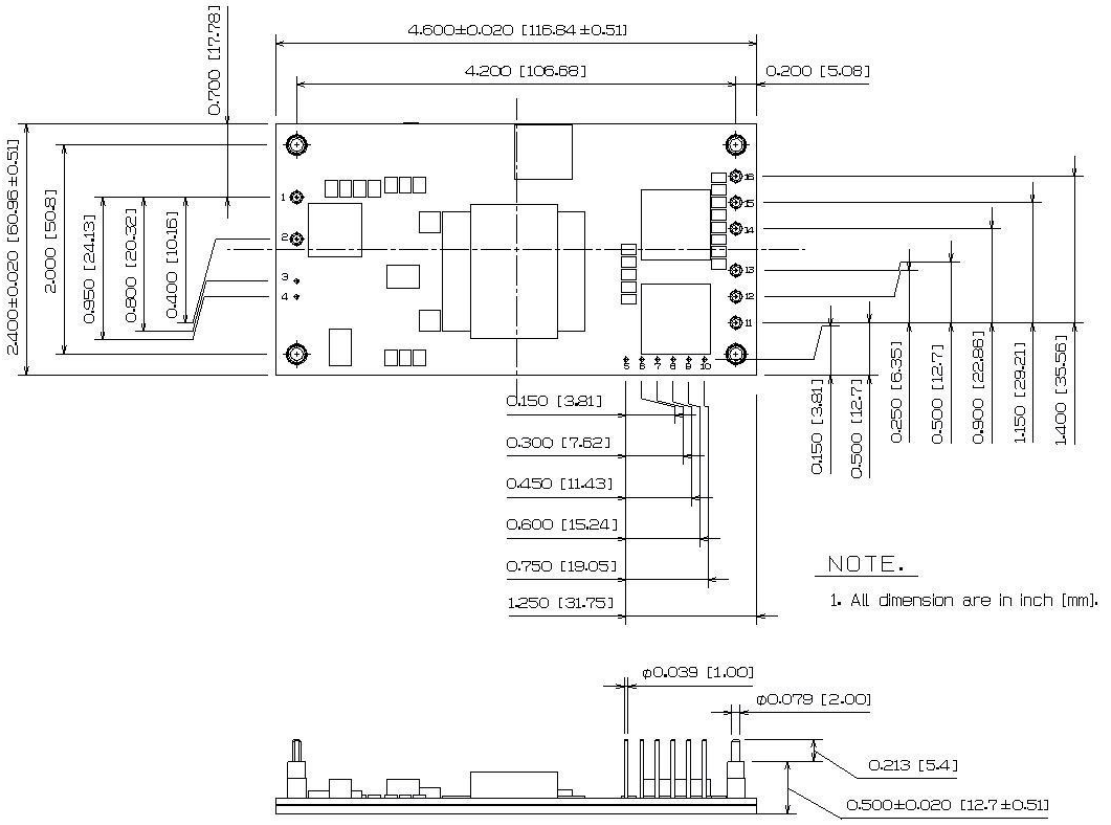
Connecting an external resistor (Rtrim-down) between the TRIM pin and the Vo(+) pin decreases the output voltage set point.



NB600-48/72/96-12 : Isolated DC/DC Converters
36 – 75V/50 – 100V/60 – 120V Input Range, Maximum Power : 600W

Data Sheet
Feb. 01, 2011

Mechanical Specification



Pin Assignments

PIN	Function		
1	-Vin	9	+Sense
2	+Vin	10	-Sense
3	-CNT	11	+Vout
4	+CNT	12	+Vout
5	AUX	13	+Vout
6	PG	14	-Vout
7	NC	15	-Vout
8	Trim	16	-Vout

NB600-48/72/96-12 : Isolated DC/DC Converters
36 – 75V/50 – 100V/60 – 120V Input Range, Maximum Power : 600W

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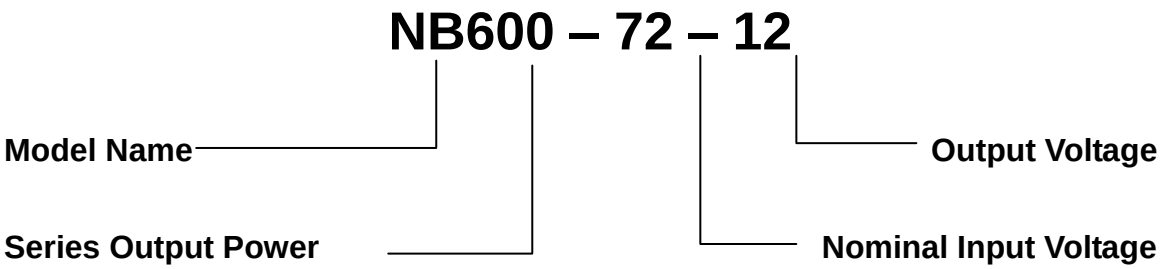
Ordering Information

Input	Output	Maximum Power	Ripple & Noise Max.	Efficiency Typ.	Model Number
36~75V	12 V@50A	600W	120mVp-p	91.2%	NB600-48-12
50~100V	12V@50A	600W	120mVp-p	92.1%	NB600-72-12
60~120V	12V@50A	600W	120mVp-p	91.9%	NB600-96-12

Part Number Structure



HEAD OFFICE & FACTORY

#1402, 14F/L 6th Daeryung TechnoTown 493-6,
Gasan-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