Glary Power Technology

High Performance DC/DC Converters

Mountains in Taiwan

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Six-side Metal Enclosed

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Glary Power Technology

UH2H 500W／42A
1/2 Brick DC/DC Converters

- High efficiency ..... 91%@12V/42A
  ..... 91%@28V/18A
- High power density .....144W/in^3
- Low profile (Open Frame) ..... 0.50”(12.7mm)
- Standard footprint ..... 2.66”×2.62”
- Operation temperature ..... -40°C~110°C
- Sink-Plate (SP) flexible thermal managing capability (see drawing)

The UH2H series provides up to 500W/42A outputs with industry standard half brick package. The efficient SR stage is combined with patented “Buck Reset” topology for reduce power loss to achieve 144W/in3 power density. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 300V (200~400V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
UH2H480abcd-xef	200V~420V	554W	48V/10.5A	504W	91.0%
UH2H280abcd-xef	200V~420V	554W	28V/18.0A	504W	91.0%
UH2H120abcd-xef	200V~420V	554W	12V/42.0A	504W	91.0%

* Options for **UH2H series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
- **c** (Standoff Height): **0**: 0.02”
- **d** (Base-Plate/Module Thickness): **E**: Metallic enclosure with 1.0mm Metal Plate /0.48”
- **x** (Current Share): **N:** Without Current Share **S:** Secondary current share
- **ef** (Output): **00** to **A0** for output current rating

Example: **UH2H280P20E-N18** is a ***UH2H*** series half brick 200~400V to 28V/18A dc/dc converter with positive control logic, 0.20” pin length, 0.02” of standoff height and 1.0mm metal plate. It features no current share function and the total height is 0.02”+0.44”=0.46”

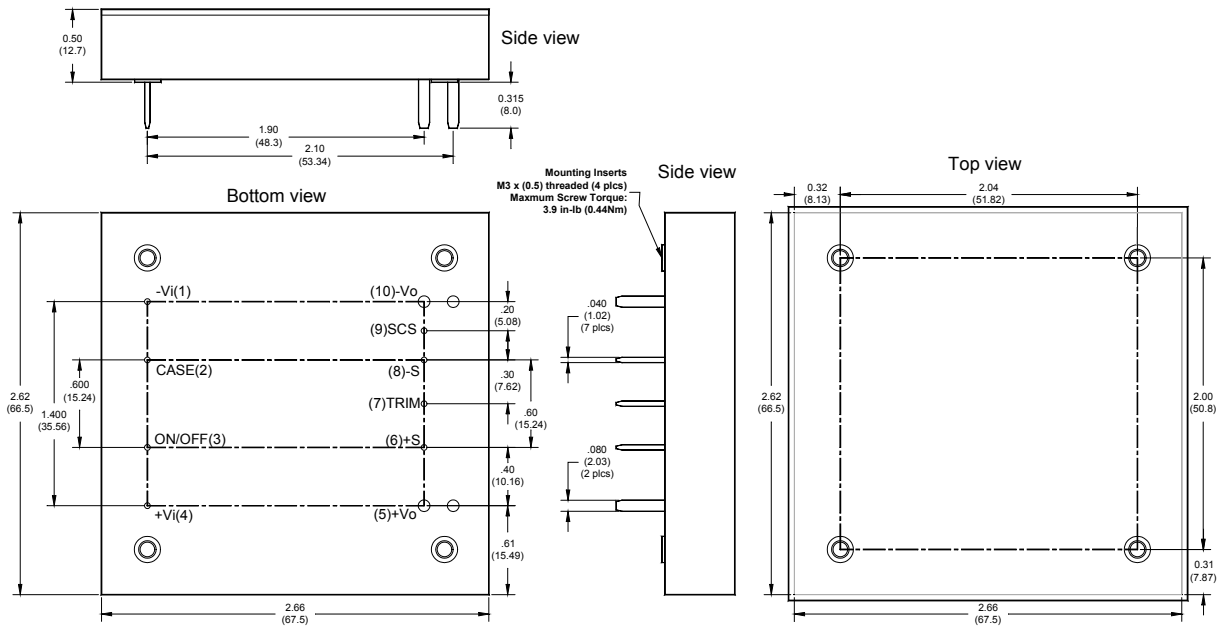
ABSOLUTE MAXIMUM RATINGS		
Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	300V Models	+190V to +420Vdc
	Transient (100ms):	
	300V Models	450V Maximum
Isolation Voltage	Input to Output	3.0KVdc
	Input to Case	1.5KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION		
Conversion Efficiency	Typical	See table
Switching Frequency	Typical	160KHz
MTBF	Bellcore	2.23×10^6 hrs @GB/25°C.
	TR-332 issue 6	(UH2H280abcd-N18)
OTP	Internal	110°C±5°C (T_C)
Weight		163g/1mm Metal Plate

CONTROL FUNCTIONS		
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS		
Operation Voltage Range	300V Models	+200V to +400Vdc
Reflected Ripple Current	L_{EXT} = 20uH	30mA(rms)/200mAp-p
Input Over Voltage Protection		+435VMax.
Turn-On Voltage Threshold	300V Models	+190V to +198Vdc
Turn-Off Voltage Threshold	300V Models	+185V to +194Vdc
Off State Input Current	V_{NOM}	8mA Max
Latch-State Input Current	V_{NOM}	12mA Max
Input Capacitance	300V Models	4.7uF Max

OUTPUT SPECIFICATIONS		
Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	5%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±4%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	100ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-Vi	Negative input	**1**
CASE	Base plate	**2**
ON/OFF	Remote control. To turn-on and turn-off output.	**3**
+Vi	Positive input	**4**
+Vo	Positive output	**5**
+S	Positive remote sense	**6**
TRIM	Output voltage adjust	**7**
-S	Negative remote sense	**8**
SCS	Secondary current share bus	**9**
-Vo	Negative output	**10**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 87g／1.0mm Metal Plate
94g／3.0mm Sink-Plate

Base plate: Aluminum alloy with anode oxide

Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit**:**

TBD	TBD

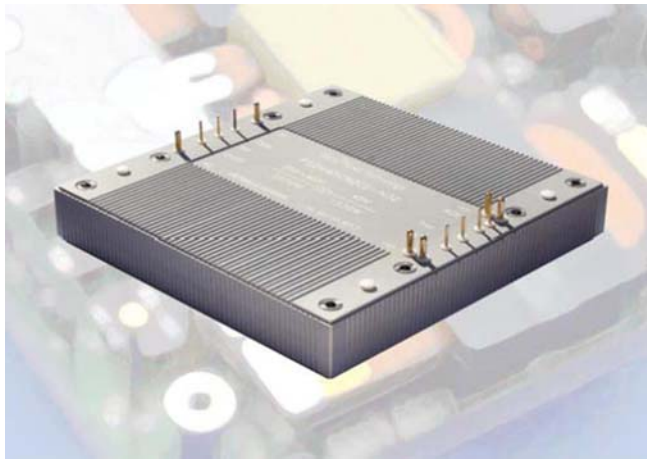
Important Note:
※General specifications and the performances are related to standard series only, no special customer specification display here except requested items.
※In order to secure effective usage of converter and the validity of Glary's service and warranty coverage, please carefully go through the application notes stated at the end of this document. For needs of usage beyond the application notes, please contact us or our regional sales representative office for help.

Glary Power Technology

PS 2000W／120A
PowerSquare DC/DC Converter

- High efficiency ..... 92%@48V/42A
  ..... 92%@28V/72A
  ..... 92%@12V/120A
- High deliver power 2000W
- Outline footprint ..... 5.2”×5.0”×0.75”
- Operation temperature ..... -40°C~110°C

The *PowerSquare* series provides up to 2000W/120A outputs with industry standard full brick pin assignment. The high thermal conductivity silicone potted six-sides metal package is designed for applications under extreme environmental conditions. The efficient SR stage is combined with patented “Buck Reset” topology for reduce power loss to achieve 102W/in3 power density. The multi-layer single side circuit board design plus the unique module structure is able to enhance the thermal performance and improve its reliability. Modules are designed for Industrial, Telecom, Servers, Networking equipments and other applications that use a 300V (200V~400V) input bus.



Part Number *	Maximum Input		Maximum Output		Efficiency
PS2H480abcd-xef	200V~420V	2191W	48V/42A	2016W	92%
PS2H280abcd-xef	200V~420V	2191W	28V/72A	2016W	92%

Part Number *	Maximum Input		Maximum Output		Efficiency
PS2H240abcd-xef	200V~420V	2166W	24V/83A	1992W	92%
PS2H120abcd-xef	200V~420V	1565W	12V/120A	1440W	92%

* Options for **PS series** are listed as follows:

a (Enable Logic):	**P**: Positive **N**: Negative
b (Pin Length):	**0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
c (Standoff Height):	**0**: 0.04”
d (Base-Plate/Module Thickness):	**E**: Metallic enclosure with 1.5mm Metal Plate /0.75”
x (Current Share):	**N:** Without Current Share **S:** Secondary current share
ef (Output):	**00** to **A0** for output current rating

Example: **PS2H280P20E-S54** is a ***PowerSquare*** series 200V~400V to 28V/54A dc/dc converter features current share function with positive control logic, 0.20” pin length, 0.04” of standoff height. The total height of this module is 0.04”+0.75”=0.79”

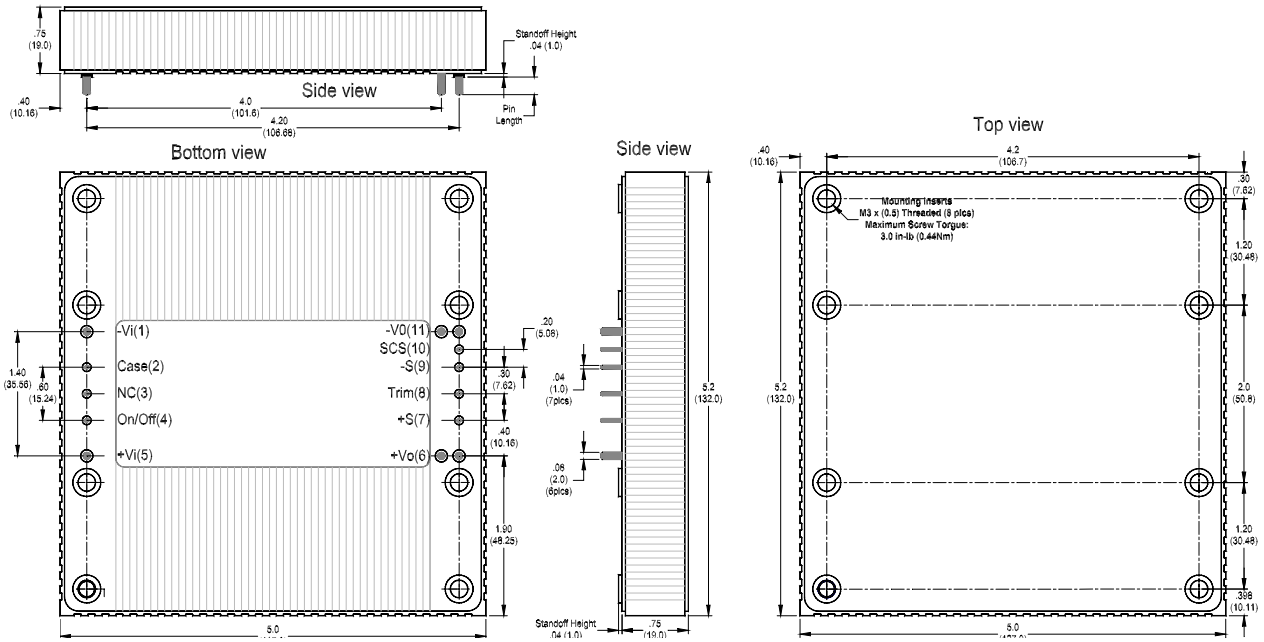
ABSOLUTE MAXIMUM RATINGS		
Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	300V Models	+190V to +420Vdc
	Transient (100ms):	
	300V Models	450V Maximum
Isolation Voltage	Input to Output	3.0KVdc
	Input to Case	1.5KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION		
Conversion Efficiency	Typical	See table
Switching Frequency	Typical	160KHz
MTBF	Bellcore	1.55×10^6 hrs@GB/25°C.
	TR-332 issue 6	(PS2H480P20E-N42)
OTP	Internal	110°C±5°C (T_C)
Weight		800g/1.5mm Metal Plate

CONTROL FUNCTIONS		
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS		
Operation Voltage Range	300V Models	+200V to +400Vdc
Reflected Ripple Current	L_{EXT} = 20uH	30mA(rms)/200mAp-p
Input Over Voltage Protection		+435VMax.
Turn-On Voltage Threshold	300V Models	+190V to +198Vdc
Turn-Off Voltage Threshold	300V Models	+185V to +194Vdc
Off State Input Current	V_{NOM}	12mA Max
Latch-State Input Current	V_{NOM}	20mA Max
Input Capacitance	300V Models	10.0uF Max

OUTPUT SPECIFICATIONS		
Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	5%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±6%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	100ms/250ms



Module Mechanical Data

Connection

Designation	Function Description	Pin #
-Vi	Negative input	**1**
CASE	Connected to base plate	**2**
NC	No connection	**3**
ON/OFF	Remote control. To turn-on and turn-off output.	**4**
+Vi	Positive input	**5**
+Vo	Positive output	**6**
+S	Positive remote sense	**7**
TRIM	Output voltage adjust	**8**
-S	Negative remote sense	**9**
SCS	Secondary current chare bus	**10**
-Vo	Negative output	**11**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 800g

Base plate: Aluminum alloy with anode oxide

Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

TBD	TBD

Important Note:
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Glary Power Technology

Enclosed COE 130W／50A 1/8 Brick DC/DC Converters

- •High efficiency ..... 92%@12V/11A
  ..... 91%@5.0V/25A
- • High power density .....102W/in^3
- • Standard Height ..... 0.50”(12.7mm)
- • Outline footprint .....2.42”×1.07”
- • Operation temperature ..... -40°C~110°C

The Enclosed COE series provides up to 130W/50A outputs with industry standard eighth brick pin assignment. The high thermal conductivity silicone potted six-sides metal package is designed for applications under extreme environmental conditions. The efficient SR stage is combined with patented “Buck Reset” topology for reduce power loss to achieve 102W/in^3 power density. The multi-layer single side circuit board design plus the metal-plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
COE48120abcd-ef	36V~75V	145W	12.0V/11A	132W	92%
COE48070abcd-ef	36V~75V	138W	7.0V/18A	126W	91%
COE48050abcd-ef	36V~75V	138W	5.0V/25A	125W	91%
COE48033abcd-ef	36V~75V	111W	3.3V/30A	99W	90%
COE48025abcd-ef	36V~75V	114W	2.5V/40A	100W	89%
COE48018abcd-ef	36V~75V	106W	1.8V/50A	90W	87%
COE48015abcd-ef	36V~75V	90W	1.5V/50A	75W	85%

Part Number *	Maximum Input		Maximum Output		Efficiency
COE24120abcd-ef	18V~36V	133W	12.0V/10A	120W	92%
COE24050abcd-ef	18V~36V	139W	5.0V/25A	125W	91%
COE24033abcd-ef	18V~36V	111W	3.3V/30A	99W	90%
COE24025abcd-ef	18V~36V	114W	2.5V/40A	125W	89%
COE24018abcd-ef	18V~36V	106W	1.8V/50A	90W	87%
COE24015abcd-ef	18V~36V	90W	1.5V/50A	75W	85%

* Options for **COE series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
- **c** (Standoff Height): **0**: 0.02”
- **d** (Base-Plate/Module Thickness): **U**: 3.0mm Metal Plate /0.48” **W**: 3.0mm Sink Plate /0.48”
  V: 5.0mm Metal Plate /0.56”
- **ef** (Output): **00** to **50** for output current rating

Example: **COE48120P20U-11** is a ***COE*** series eighth brick 48V to 12V/11A dc/dc converter with positive control logic, 0.20” pin length, 0.02” of standoff height, Metallic enclosure with 3.0mm Metal Plate. The total height of this module is 0.02”+0.48”=0.50”

ABSOLUTE MAXIMUM RATINGS

Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION

Conversion Efficiency	Typical	See table
Switching Frequency	Typical	330KHz
MTBF	Bellcore	4.80×10^6 hrs@GB/25°C.
	TR-332 issue 6	(COE48050abcd-25)
OTP	Internal	110°C±5°C (T_C)
Weight	3mm metal plate	55g
	5mm metal plate	65g

CONTROL FUNCTIONS

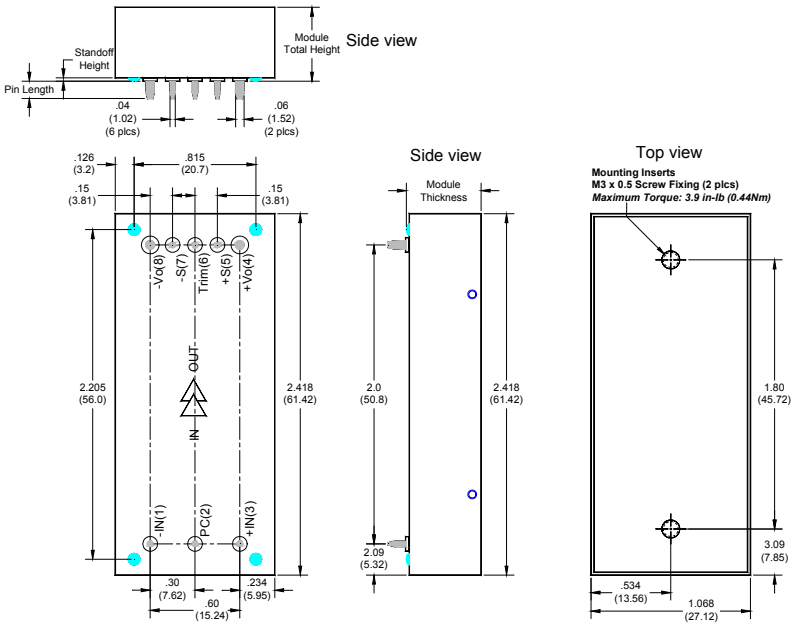
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS

Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	20mA(rms)/60mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	22.0uF Max
	48V Models	10.0uF Max

OUTPUT SPECIFICATIONS

Voltage Accuracy	Typical	±1.0%
Line Regulation	Full Input Range	±0.2%
Load Regulation	0%~100%	±0.2%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±3%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-IN	Negative input	**1**
PC	Remote control. To turn-on and turn-off output.	**2**
+IN	Positive input	**3**
+Vo	Positive output	**4**
+S	Positive remote sense	**5**
TRIM	Output voltage adjust	**6**
-S	Negative remote sense	**7**
-Vo	Negative output	**8**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 55g／3.0mm Metal Plate
65g／5.0mm Metal Plate

Base plate: Aluminum alloy with anode oxide

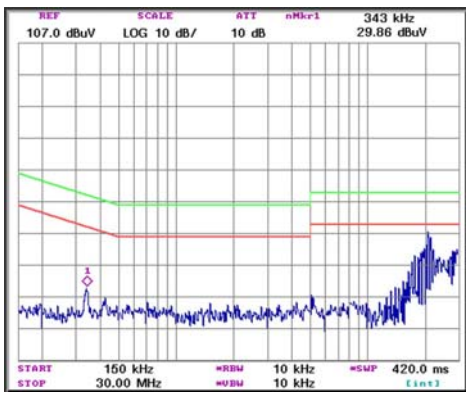
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

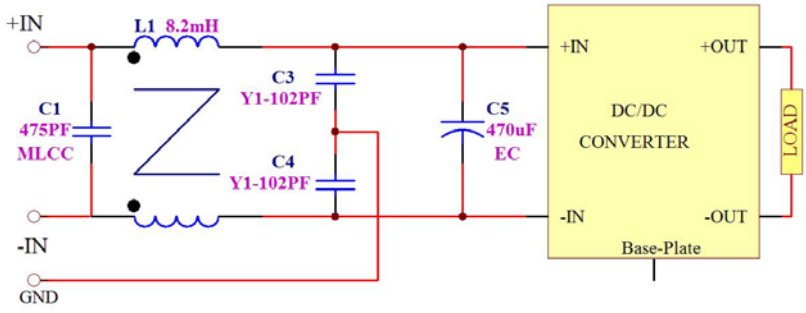
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for COE48050N20M-25





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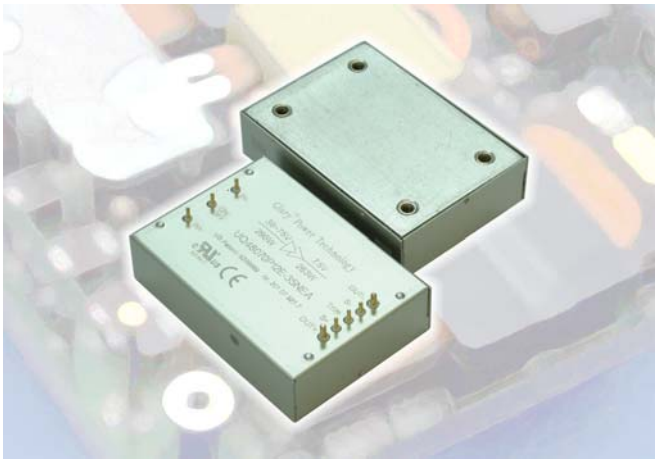
Glary Power Technology

Enclosed UQ 300W／60A 1/4 Brick DC/DC Converters

- High efficiency ..... 92%@12V/25A
  ..... 91%@5.0V/60A
- High power density .....145W/in^3
- Standard Height ..... 0.50"(12.7mm)
- Outline footprint ..... 2.42"×1.70"
- Operation temperature ..... -40°C~110°C



The Enclosed UQ series provides up to 300W/60A outputs industry standard quarter brick pin assignment. The high thermal conductivity silicone potted six-sides metal package is designed for applications under extreme environmental conditions. The efficient SR stage is combined with patented "Buck Reset" topology for reduce power loss to achieve 145W/in^3 power density. The multi-layer single side circuit board design plus the metal-plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
UQ48120abcd-ef	36V~75V	326W	12V/25A	300W	92%
UQ48070abcd-ef	36V~75V	308W	7.0V/40A	280W	91%
UQ48050abcd-ef	36V~75V	330W	5.0V/60A	300W	91%
UQ48033abcd-ef	36V~75V	221W	3.3V/60A	198W	90%

Part Number *	Maximum Input		Maximum Output		Efficiency
UQ24120abcd-ef	18V~36V	330W	12V/25A	300W	91%
UQ24070abcd-ef	18V~36V	308W	7.0V/40A	280W	91%
UQ24050abcd-ef	18V~36V	330W	5.0V/60A	300W	91%
UQ24033abcd-ef	18V~36V	221W	3.3V/60A	198W	90%

* Options for **UQ series** are listed as follows:

a (Enable Logic): **P**: Positive **N**: Negative
b (Pin Length): **0**: 0.12" **1**: 0.16" **2**: 0.20" **3**: 0.24"
c (Standoff Height): **0**: 0.02"
d (Base-Plate/Module Thickness): **U**: Metallic enclosure with 3.0mm Metal Plate /0.48"
V: Metallic enclosure with 5.0mm Metal Plate /0.56"
ef (Output): **00** to **60** for output current rating

Pb RoHS 2002/95/EC

Example: **UQ48120P20U-21** is a ***UQ*** series quarter brick 48V to 12V/21A dc/dc converter features metallic enclosure with positive control logic, 0.20" pin length, 0.02" of standoff height and 3.0mm Metal Plate. The total height of this module is 0.02"+0.48"=0.50"

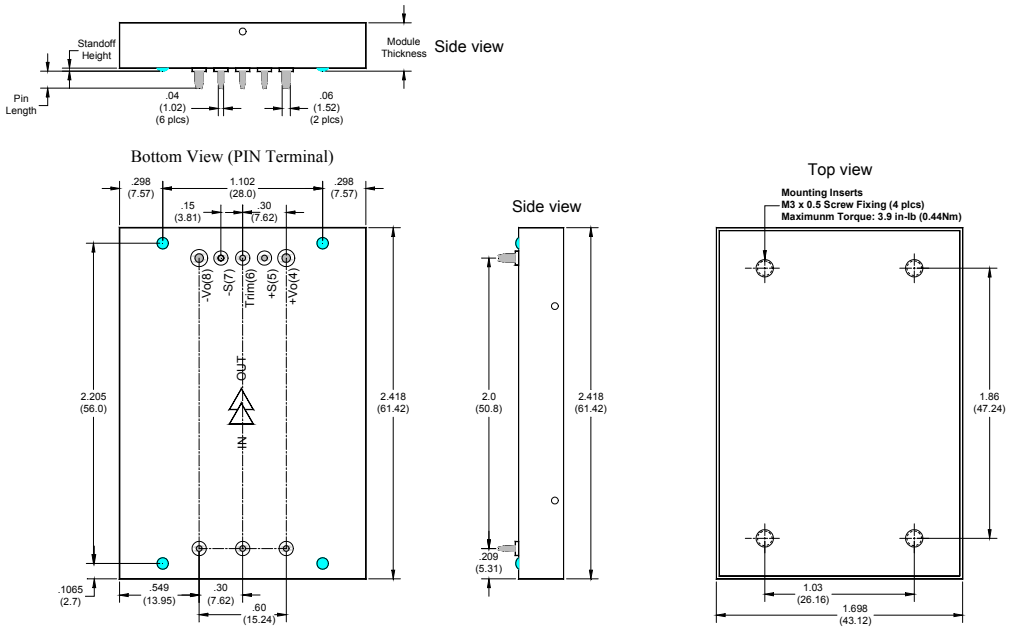
ABSOLUTE MAXIMUM RATINGS		
Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION		
Conversion Efficiency	Typical	See table
Switching Frequency	Typical	330KHz
MTBF	Bellcore	2.96×10^6 hrs@GB/25°C.
	TR-332 issue 6	(UQ48050abcd-60)
OTP	Internal	110°C±5°C (T_C)
Weight	3mm metal plate	105g
	5mm metal plate	119g

CONTROL FUNCTIONS		
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS		
Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	30mA(rms)/100mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	33.0uF Max
	48V Models	12.0uF Max

OUTPUT SPECIFICATIONS		
Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	0%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±4%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-IN	Negative input	**1**
PC	Remote control. To turn-on and turn-off output.	**2**
+IN	Positive input	**3**
+Vo	Positive output	**4**
+S	Positive remote sense	**5**
TRIM	Output voltage adjust	**6**
-S	Negative remote sense	**7**
-Vo	Negative output	**8**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 105g／3.0mm Metal Plate
119g／5.0mm Metal Plate

Base plate: Aluminum alloy with anode oxide

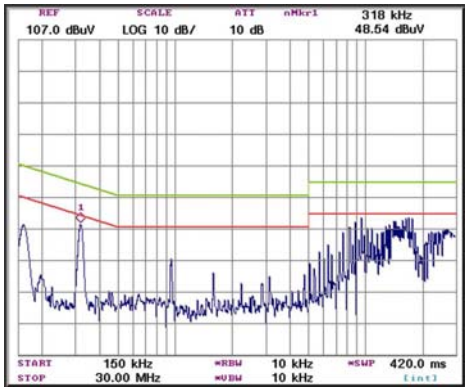
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

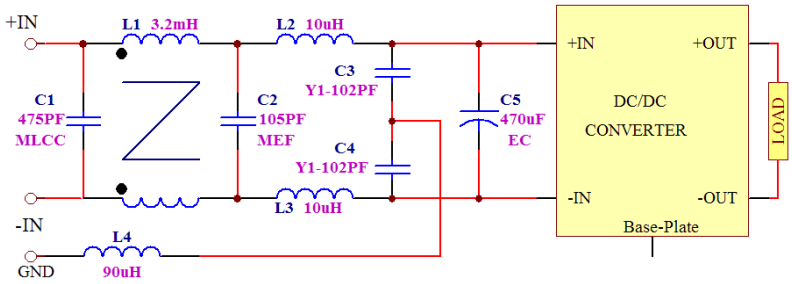
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for UQ48120P20M-21





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Glary Power Technology

Enclosed CBQ 125W／25A 1/4 Brick DC/DC Converters

- High efficiency ..... 90%@5.0V/25A
  ..... 89%@3.3V/25A
- High power density .....101W/in^3
- Low profile ..... 0.37"(9.4mm)
- Outline footprint ..... 2.3"×1.45"
- Operation temperature ..... -40°C~110°C

The Enclosed CBQ series provides up to 125W/25A outputs with six-sides metal enclosed package. The efficient SR stage is combined with patented "Buck Reset" topology for reduce power loss to achieve 101W/in^3 power density, The multi-layer single side circuit board design is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
CBQ10048S5V0-Labc	36V~75V	139W	5.0V/25A	125W	90%
CBQ10048S3V3-Labc	36V~75V	94W	3.3V/25A	83W	89%
CBQ10048S2V5-Labc	36V~75V	73W	2.5V/25A	63W	87%
CBQ10048S2V0-Labc	36V~75V	59W	2.0V/25A	50W	85%
CBQ10048S1V8-Labc	36V~75V	53W	1.8V/25A	45W	85%
CBQ10048S1V5-Labc	36V~75V	46W	1.5V/25A	38W	83%

Part Number *	Maximum Input		Maximum Output		Efficiency
CBQ10024S5V0-Labc	18V~36V	141W	5.0V/25A	125W	89%
CBQ10024S3V3-Labc	18V~36V	95W	3.3V/25A	83W	88%
CBQ10024S2V5-Labc	18V~36V	74W	2.5V/25A	63W	86%
CBQ10024S2V0-Labc	18V~36V	59W	2.0V/25A	50W	85%
CBQ10024S1V8-Labc	18V~36V	54W	1.8V/25A	45W	84%
CBQ10024S1V5-Labc	18V~36V	46W	1.5V/25A	38W	83%

* Options for **CBQ series** are listed as follows:

a (Enable Logic): **P**: Positive **N**: Negative

b (Pin Length): **0**: 0.12" **1**: 0.16" **2**: 0.20" **3**: 0.24"

c (Package Option): **E**: Metallic enclosure 1.0mm with Metal Plate / 0.37"

Example: **CB100Q48S5V0-LP2E** is a ***CBQ*** series half brick 48V to 5V/25A dc/dc converter with positive control logic, 0.20" pin length, Metallic enclosure 1.0mm with Metal Plate. The total height of this module is 0.02"+0.37"=0.39"

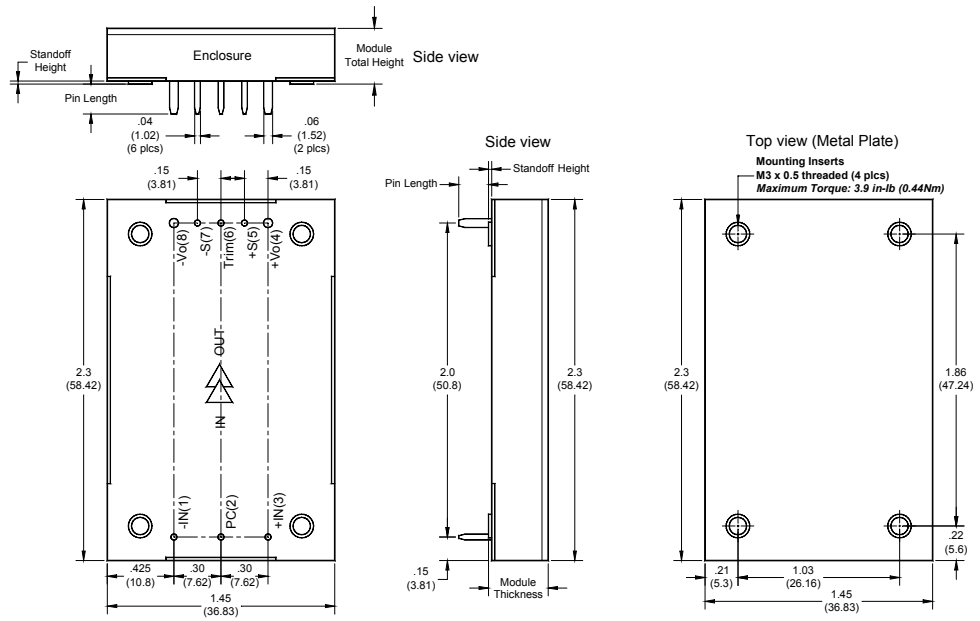
ABSOLUTE MAXIMUM RATINGS		
Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION		
Conversion Efficiency	Typical	See table
Switching Frequency	Typical	330KHz
MTBF	Bellcore	4.57×10^6 hrs @GB/25°C.
	TR-332 issue 6	(CBQ10048S5V0-LP2E)
OTP	Internal	110°C±5°C (T_C)
Weight	Metallic enclosure	55g / 1.0mm Metal Plate

CONTROL FUNCTIONS		
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS		
Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	20mA(rms)/60mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	22.0uF Max
	48V Models	10.0uF Max

OUTPUT SPECIFICATIONS		
Voltage Accuracy	Typical	±1.0%
Line Regulation	Full Input Range	±0.3%
Load Regulation	0%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±3%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection

Designation	Function Description	Pin #
-IN	Negative input	**1**
PC	Remote control. To turn-on and turn-off output.	**2**
+IN	Positive input	**3**
+Vo	Positive output	**4**
+S	Positive remote sense	**5**
TRIM	Output voltage adjust	**6**
-S	Negative remote sense	**7**
-Vo	Negative output	**8**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 55g

Base plate: Aluminum alloy with anode oxide

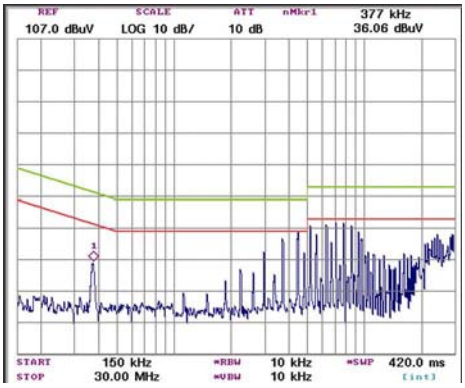
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

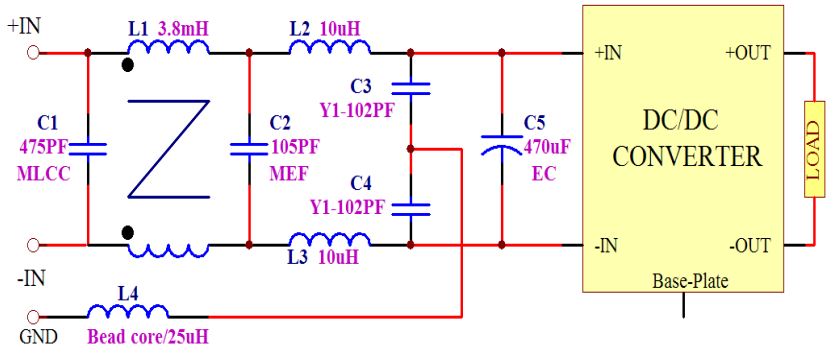
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for CBQ10048S5V0-LP2E





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Glary Power Technology

NH 336W／21A
1/2 Brick DC/DC Converters

- High efficiency ..... 90%@12V/21A
  ..... 90%@28V/11A
  ..... 89%@48V/7A
- High power density .....169W/in^3
- Low profile (Open Frame) ..... 0.36"(9.1mm)
- Standard footprint ..... 2.30"×2.40"
- Operation temperature ..... -40°C~110°C
- Sink-Plate (SP) flexible thermal managing capability (see drawing)

The NH series provides up to 336W/21A outputs with industry standard half brick package. The efficient Non-SR technology is combined with ultra low leakage inductance magnetic design to gives converters "SR-like" conversion efficiency. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
NH48480abcd-ef	36V~75V	378W	48V/7.0A	336W	89%
NH48280abcd-ef	36V~75V	342W	28V/11A	308W	90%
NH48240abcd-ef	36V~75V	323W	24V/12A	288W	89%
NH48240abcd-ef	36V~72V	174W	24V/6.5A	156W	90%
NH48120abcd-ef	36V~75V	280W	12V/21A	252W	90%

Part Number *	Maximum Input		Maximum Output		Efficiency
NH24480abcd-ef	18V~36V	381W	48V/7.0A	336W	88%
NH24280abcd-ef	18V~36V	342W	28V/11A	308W	90%
NH24240abcd-ef	18V~36V	323W	24V/12A	288W	89%
NH24120abcd-ef	18V~36V	280W	12V/21A	252W	90%

* Options for **NH series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12" **1**: 0.16" **2**: 0.20" **3**: 0.24"
- **c** (Standoff Height): **0**: 0.02" **1**: 0.08" **2**: 0.16"
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate / 0.34" **A**: 3.0mm Sink-Plate / 0.42"
  B: 5.0mm Sink-Plate/0.50"
  E: Metallic enclosure 1.0mm with Metal Plate / 0.37"
- **ef** (Output): **00** to **21** for output current rating

c UL us E219417 CE

Pb RoHS 2002/95/EC

Example: **NH48240P00B-11** is a ***NH*** series half brick 36~72Vin to 24V/11A dc/dc converter with positive control logic, 0.12" pin length, 0.02" of standoff height and 5.0mm Sink-Plate. The total height of this module is 0.02"+0.50"=0.52"

ABSOLUTE MAXIMUM RATINGS

Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION

Conversion Efficiency	Typical	See table
Switching Frequency	Typical	340KHz
MTBF	Bellcore	4.11×10^6 hrs@GB/25°C.
	TR-332 issue 6	(NH24280N20M-11)
OTP	Internal	110°C±5°C (T_C)
Weight	Open Frame	60g / 1.0mm Metal Plate
	Metallic enclosure	95g / 1.0mm Metal Plate

CONTROL FUNCTIONS

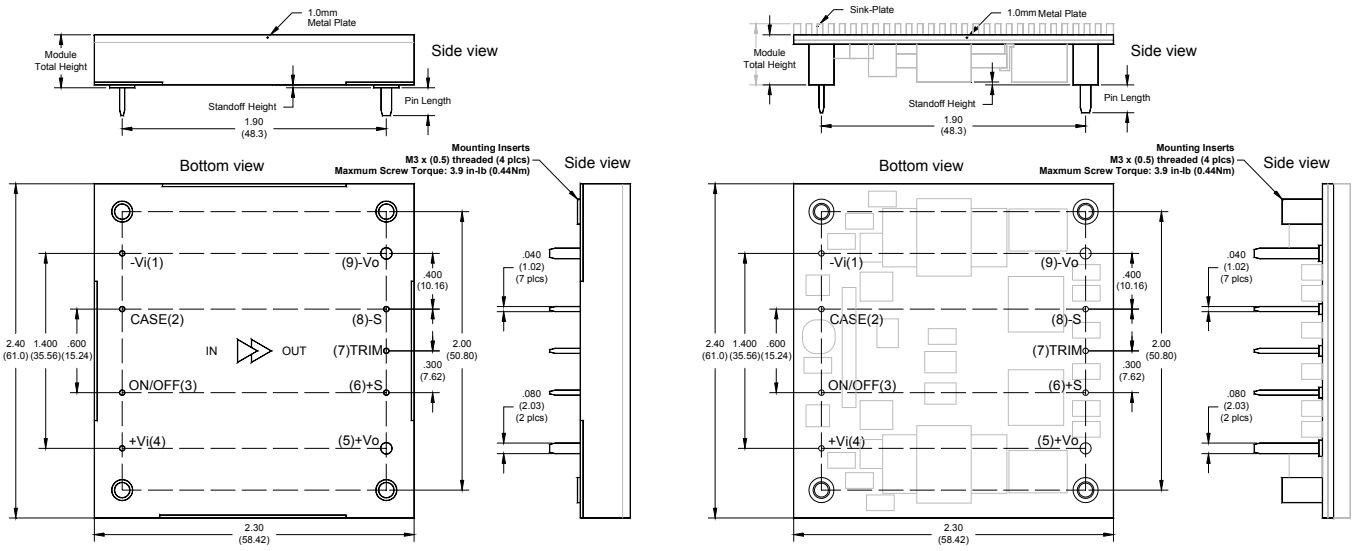
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS

Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	30mA(rms)/100mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	42.0uF Max
	48V Models	15.0uF Max

OUTPUT SPECIFICATIONS

Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	5%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±4%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Six-side Metal Enclosed　　Open frame

Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-Vi	Negative input	**1**
CASE	Connected to base plate	**2**
ON/OFF	Remote control. To turn-on and turn-off output.	**3**
+Vi	Positive input	**4**
+Vo	Positive output	**5**
+S	Positive remote sense	**6**
TRIM	Output voltage adjust	**7**
-S	Negative remote sense	**8**
-Vo	Negative output	**9**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 60g／Open frame (1.0mm Metal-Plate)
95g／Six-side metal enclosed

Base plate: Aluminum alloy with anode oxide

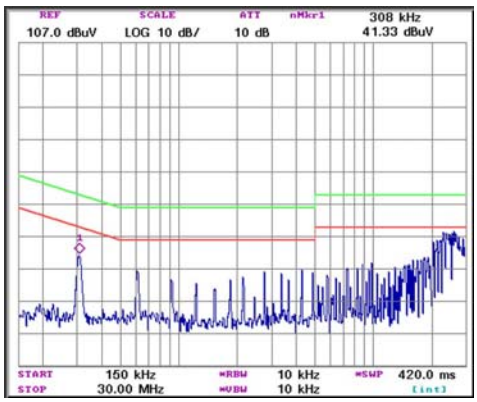
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

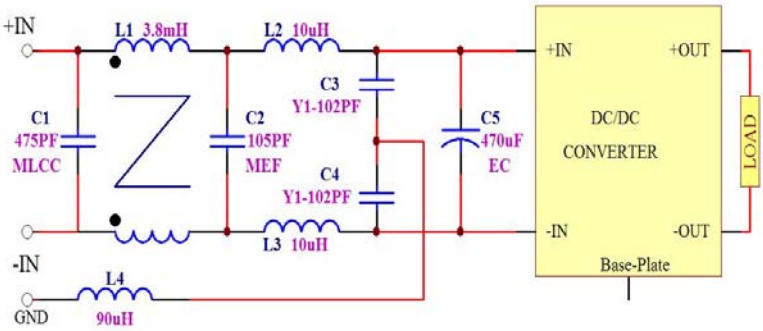
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit of NH24280N20M-11





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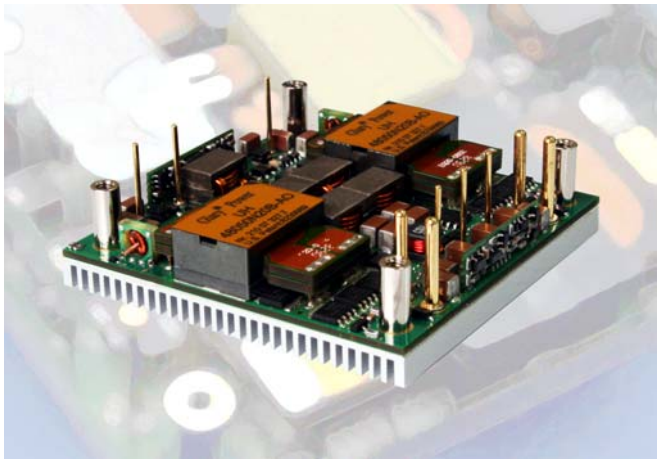
Glary Power Technology

UH 800W／67A
1/2 Brick DC/DC Converters

- High efficiency ..... 92%@12V/67A
  ..... 92%@28V/29A
- High power density .....298W/in^3
- Low profile (Open Frame) ..... 0.46”(11.7mm)
- Standard footprint ..... 2.42”×2.46”
- Operation temperature ..... -40°C~110°C
- Sink-Plate (SP) flexible thermal managing capability (see drawing)



The UH series provides up to 800W/67A outputs with industry standard half brick package. The efficient SR stage is combined with patented “Buck Reset” topology for reduce power loss to achieve 298W/in3 power density. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
UH48480abcd-xef	36V~75V	887W	48V/17A	816W	92.0%
UH48280abcd-xef	36V~75V	883W	28V/29A	812W	92.0%
UH48120abcd-xef	36V~75V	874W	12V/67A	804W	92.0%

* Options for **UH series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
- **c** (Standoff Height): **0**: 0.02” **1**: 0.08” **2**: 0.16”
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate/0.44”
  A: 3.0mm Sink-Plate/0.55” **B**: 5.0mm Sink-Plate/0.60”
- **x** (Current Share): **N:** Without Current Share **S:** Secondary current share
- **ef** (Output): **00** to **C0** for output current rating

Example: **UH48280P20M-N29** is a ***UH*** series half brick 36~75V to 28V/29A dc/dc converter with positive control logic, 0.20” pin length, 0.02” of standoff height and 1.0mm metal plate. It features no current share function and the total height is 0.02”+0.44”=0.46”

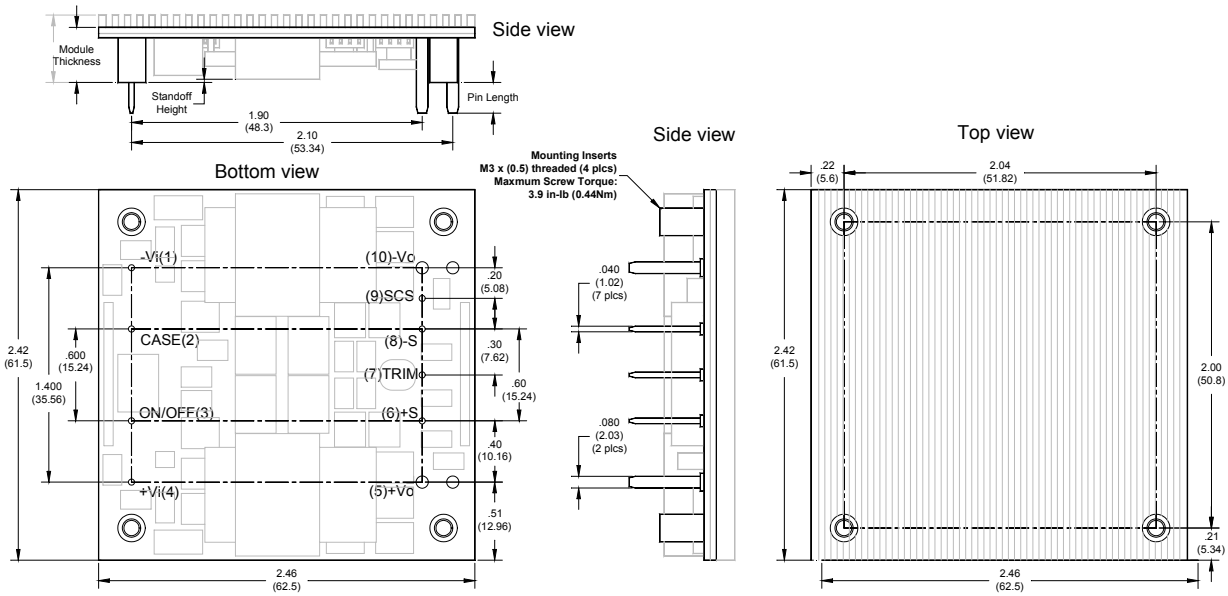
ABSOLUTE MAXIMUM RATINGS		
Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION		
Conversion Efficiency	Typical	See table
Switching Frequency	Typical	300KHz
MTBF	Bellcore	2.51×10^6 hrs @GB/25°C.
	TR-332 issue 6	(UH48280abcd-N29)
OTP	Internal	110°C±5°C (T_C)
Weight	Open Frame	87g/1mm Metal Plate
		94g/3mm Sink Plate

CONTROL FUNCTIONS		
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS		
Operation Voltage Range		
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 20uH	50mA(rms)/200mAp-p
Power ON Voltage Range		
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges		
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance		
	48V Models	22.0uF Max

OUTPUT SPECIFICATIONS		
Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	0%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±6%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	50ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-Vi	Negative input	**1**
CASE	Base plate	**2**
ON/OFF	Remote control. To turn-on and turn-off output.	**3**
+Vi	Positive input	**4**
+Vo	Positive output	**5**
+S	Positive remote sense	**6**
TRIM	Output voltage adjust	**7**
-S	Negative remote sense	**8**
SCS	Secondary current share bus	**9**
-Vo	Negative output	**10**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 87g／1.0mm Metal Plate
94g／3.0mm Sink-Plate

Base plate: Aluminum alloy with anode oxide

Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit

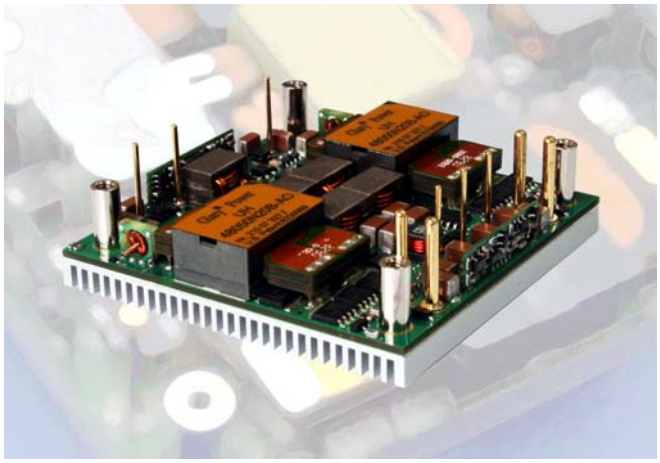
TBD	TBD

Important Note:
※General specifications and the performances are related to standard series only, no special customer specification display here except requested items.
※In order to secure effective usage of converter and the validity of Glary's service and warranty coverage, please carefully go through the application notes stated at the end of this document. For needs of usage beyond the application notes, please contact us or our regional sales representative office for help.

Glary Power Technology

UH 600W／120A
1/2 Brick DC/DC Converters

- High efficiency ..... 92%@48V/12A
  .....92%@28V/21A
- High power density .....219W/in^3
- Low profile (Open Frame) ..... 0.46”(11.7mm)
- Standard footprint ..... 2.42”×2.46”
- Operation temperature ..... -40°C~110°C
- Sink-Plate (SP) flexible thermal managing capability (see drawing)



The UH series provides up to 600W/120A outputs with industry standard half brick package. The efficient SR stage is combined with patented “Buck Reset” topology for reduce power loss to achieve 219W/in3 power density. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
UH48480abcd-xef	36V~75V	627W	48V/12A	576W	92%
UH48280abcd-xef	36V~75V	640W	28V/21A	588W	92%
UH48120abcd-xef	36V~75V	653W	12V/50A	600W	92%
UH48050abcd-xef	36V~75V	550W	5V/100A	500W	91%
UH48033abcd-xef	36V~75V	440W	3.3V/120A	396W	90%

Part Number *	Maximum Input		Maximum Output		Efficiency
UH24480abcd-xef	18V~36V	548W	48V/10.5A	504W	92%
UH24280abcd-xef	18V~36V	548W	28V/18A	504W	92%
UH24120abcd-xef	18V~36V	548W	12V/42A	504W	92%
UH24050abcd-xef	18V~36V	550W	5V/100A	500W	91%
UH24033abcd-xef	18V~36V	440W	3.3V/120A	396W	90%

* Options for **UH series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
- **c** (Standoff Height): **0**: 0.02” **1**: 0.08” **2**: 0.16”
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate/0.44”
  A: 3.0mm Sink-Plate/0.55” **B**: 5.0mm Sink-Plate/0.60”
- **x** (Current Share): **N:** Without Current Share **S:** Secondary current share
- **ef** (Output): **00** to **C0** for output current rating

Example: **UH48050P20M-NA0** is a ***UH*** series half brick 48V to 5.0V/100A dc/dc converter with positive control logic, 0.20” pin length, 0.02” of standoff height and 1.0mm metal plate. It features no current share function and the total height is 0.02”+0.44”=0.46”

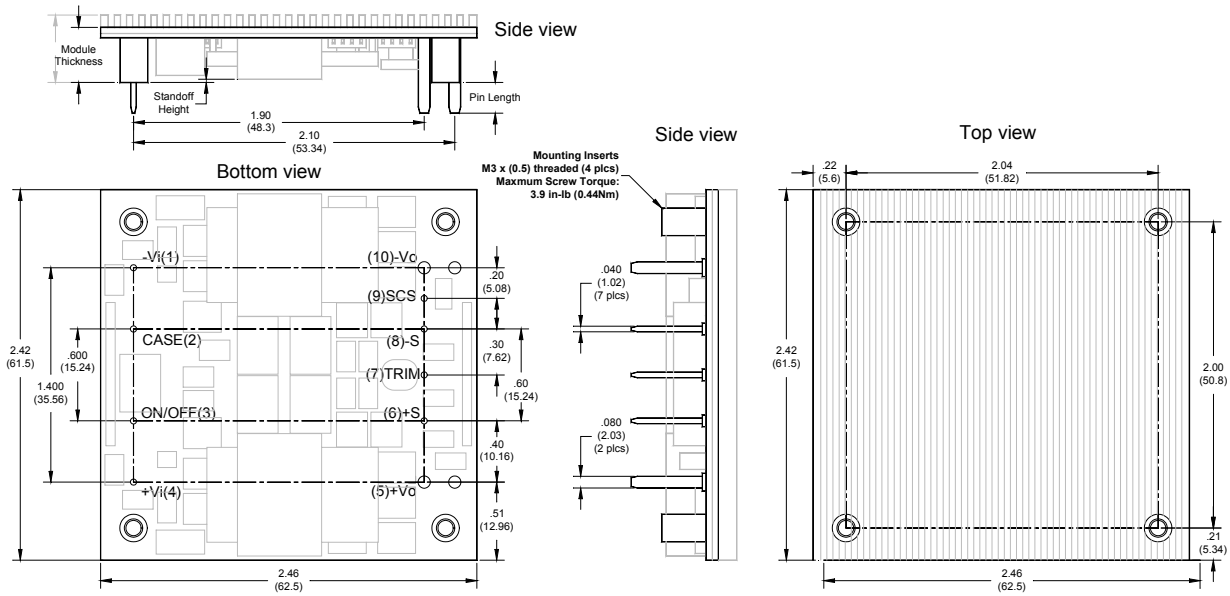
ABSOLUTE MAXIMUM RATINGS		
Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION		
Conversion Efficiency	Typical	See table
Switching Frequency	Typical	300KHz
MTBF	Bellcore	2.51×10^6 hrs @GB/25°C.
	TR-332 issue 6	(UH48050abcd-NA0)
OTP	Internal	110°C±5°C (T_C)
Weight	Open Frame	87g/1mm Metal Plate
		94g/3mm Sink Plate

CONTROL FUNCTIONS		
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS		
Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	80mA(rms)/300mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	48.0uF Max
	48V Models	20.0uF Max

OUTPUT SPECIFICATIONS		
Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	0%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±6%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	50ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-Vi	Negative input	**1**
CASE	Base plate	**2**
ON/OFF	Remote control. To turn-on and turn-off output.	**3**
+Vi	Positive input	**4**
+Vo	Positive output	**5**
+S	Positive remote sense	**6**
TRIM	Output voltage adjust	**7**
-S	Negative remote sense	**8**
SCS	Secondary current share bus	**9**
-Vo	Negative output	**10**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 87g／1.0mm Metal Plate
94g／3.0mm Sink-Plate

Base plate: Aluminum alloy with anode oxide

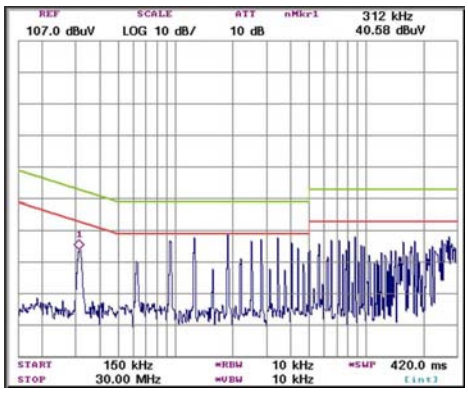
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

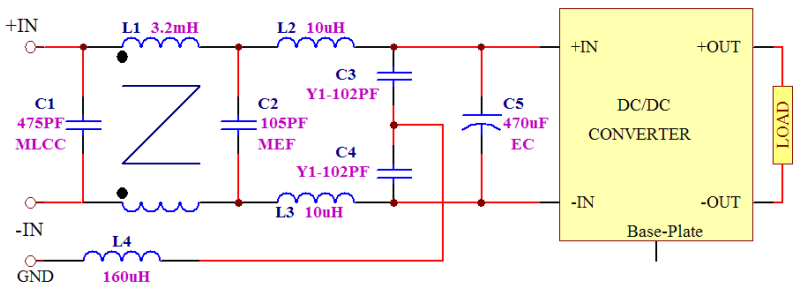
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for UH48120P20M-S50





Important Note:
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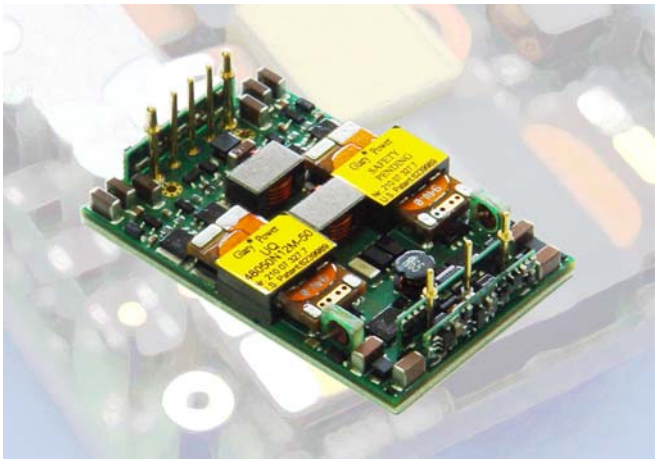
Glary Power Technology

Open Frame UQ 300W／60A 1/4 Brick DC/DC Converters

- High efficiency ..... 92%@12V/25A
  ..... 91%@5.0V/60A
- High power density ..... 235W/in^3
- Low profile (Open Frame) ..... 0.36”(9.1mm)
- Standard footprint ..... 2.30”×1.54”
- Operation temperature ..... -40°C~110°C
- Sink-Plate (SP) flexible thermal managing capability (see drawing)



The UQ series provides up to 300W/60A outputs with industry standard quarter brick package. The efficient SR stage is combined with patented “Buck Reset” topology for reduce power loss to achieve 235W/in^3 power density. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
UQ48120abcd-ef	36V~75V	326W	12V/25A	300W	92%
UQ48070abcd-ef	36V~75V	308W	7.0V/40A	280W	91%
UQ48050abcd-ef	36V~75V	330W	5.0V/60A	300W	91%
UQ48033abcd-ef	36V~75V	221W	3.3V/60A	198W	90%

Part Number *	Maximum Input		Maximum Output		Efficiency
UQ24120abcd-ef	18V~36V	330W	12V/25A	300W	91%
UQ24070abcd-ef	18V~36V	308W	7.0V/40A	280W	91%
UQ24050abcd-ef	18V~36V	330W	5.0V/60A	300W	91%
UQ24033abcd-ef	18V~36V	221W	3.3V/60A	198W	90%

* Options for **UQ series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
- **c** (Standoff Height): **0**: 0.02” **1**: 0.08” **2**: 0.16”
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate/0.34” **S**: 3.0mm Metal Plate/0.42” **Z**: 5.0mm Metal Plate/0.50” **A**: 3.0mm Sink-Plate/0.42” **B**: 5.0mm Sink-Plate/0.50”
- **ef** (Output): **00** to **60** for output current rating

Example: **UQ48050P20M-50** is a ***UQ*** series quarter brick 48V to 5.0V/50A dc/dc converter with positive control logic, 0.20” pin length, 0.02” of standoff height and 1.0mm metal plate. The total height of this module is 0.02”+0.34”=0.36”

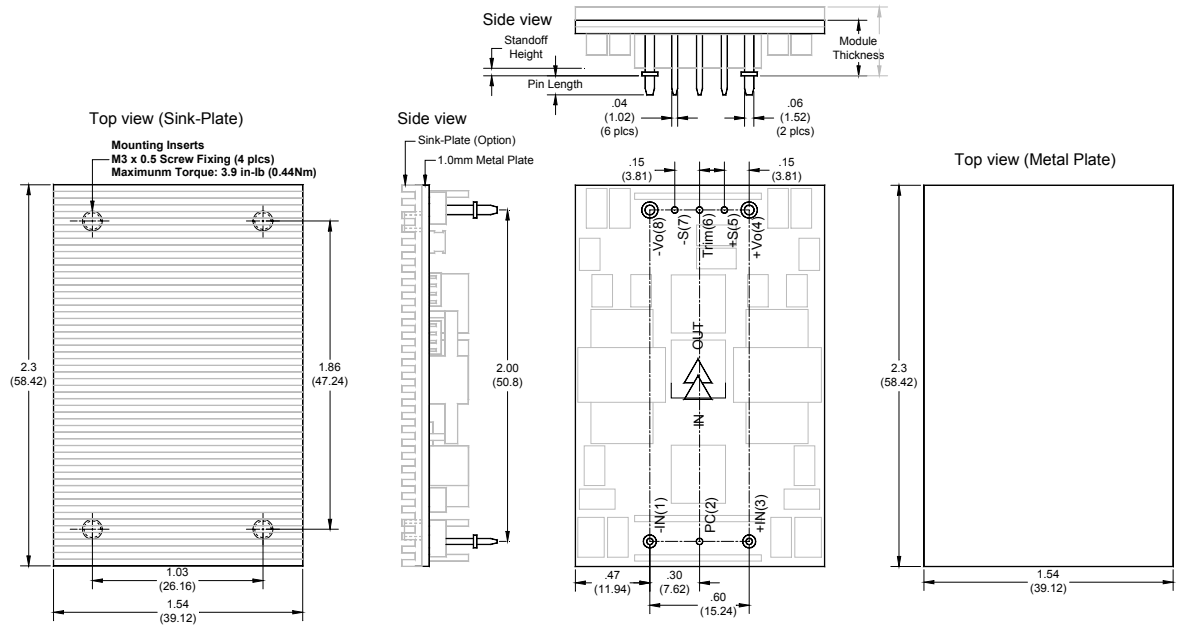
ABSOLUTE MAXIMUM RATINGS		
Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION		
Conversion Efficiency	Typical	See table
Switching Frequency	Typical	330KHz
MTBF	Bellcore	2.96×10^6 hrs@GB/25°C.
	TR-332 issue 6	(UQ48050abcd-60)
OTP	Internal	110°C±5°C (T_C)
Weight	1mm metal plate	43g
	3mm metal plate	56g

CONTROL FUNCTIONS		
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS		
Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	30mA(rms)/100mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	33.0uF Max
	48V Models	12.0uF Max

OUTPUT SPECIFICATIONS		
Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	0%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±4%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-IN	Negative input	**1**
PC	Remote control. To turn-on and turn-off output.	**2**
+IN	Positive input	**3**
+Vo	Positive output	**4**
+S	Positive remote sense	**5**
TRIM	Output voltage adjust	**6**
-S	Negative remote sense	**7**
-Vo	Negative output	**8**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 43g／1.0mm Metal Plate
56g／3.0mm Metal Plate

Base plate: Aluminum alloy with anode oxide

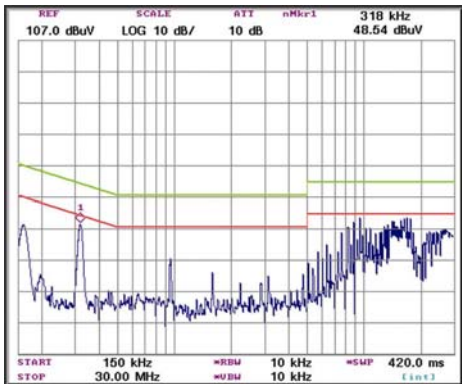
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

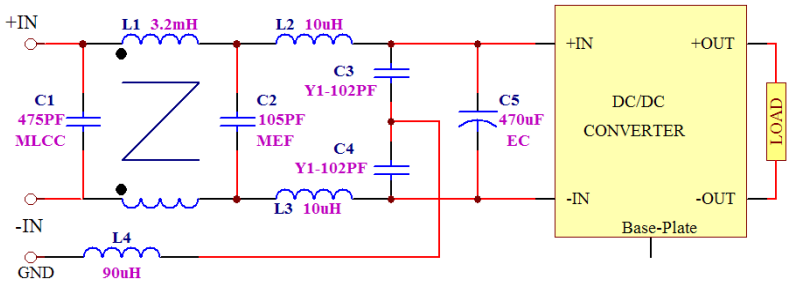
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for UQ48070P20M-35





Important Note:
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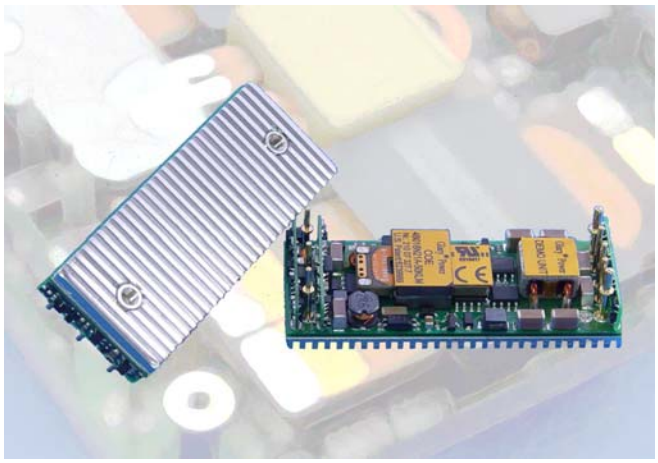
Glary Power Technology

Open Frame COE 132W／50A 1/8 Brick DC/DC Converters

- •High efficiency ..... 92%@12V/11A
  ..... 91%@5.0V/25A
- • High power density .....175W/in^3
- • Low profile (Open Frame) ..... 0.36”(9.1mm)
- • Standard footprint ..... 2.30”×0.91”
- • Operation temperature ..... -40°C~110°C
- •Sink-Plate (SP) flexible thermal managing capability (see drawing)

The COE series provides up to 130W/50A outputs with industry standard eighth brick package. The efficient SR stage is combined with patented “Buck Reset” topology for reduce power loss to achieve 175W/in^3 power density. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.



Part Number *	Maximum Input		Maximum Output		Efficiency
COE48120abcd-ef	36V~75V	145W	12.0V/11A	132W	92%
COE48070abcd-ef	36V~75V	138W	7.0V/18A	126W	91%
COE48050abcd-ef	36V~75V	138W	5.0V/25A	125W	91%
COE48033abcd-ef	36V~75V	111W	3.3V/30A	99W	90%
COE48025abcd-ef	36V~75V	114W	2.5V/40A	100W	89%
COE48018abcd-ef	36V~75V	106W	1.8V/50A	90W	87%
COE48015abcd-ef	36V~75V	90W	1.5V/50A	75W	85%

Part Number *	Maximum Input		Maximum Output		Efficiency
COE24120abcd-ef	18V~36V	133W	12.0V/10A	120W	92%
COE24050abcd-ef	18V~36V	139W	5.0V/25A	125W	91%
COE24033abcd-ef	18V~36V	111W	3.3V/30A	99W	90%
COE24025abcd-ef	18V~36V	114W	2.5V/40A	125W	89%
COE24018abcd-ef	18V~36V	106W	1.8V/50A	90W	87%
COE24015abcd-ef	18V~36V	90W	1.5V/50A	75W	85%

* Options for **COE series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
- **c** (Standoff Height): **0**: 0.02” **1**: 0.08” **2**: 0.16”
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate/0.34” **S**: 3.0mm Metal Plate/0.42”
  A: 3.0mm Sink-Plate/0.42” **B**: 5.0mm Sink-Plate/0.50”
- **ef** (Output): **00** to **50** for output current rating

c UL us E219417 CE

Pb RoHS 2002/95/EC

Example: **COE48050P20A-25** is a ***COE*** series eighth brick 48V to 5.0V/25A dc/dc converter with positive control logic, 0.20” pin length, 0.02” of standoff height and 3.0mm sink-plate. The total height of this module is 0.02”+0.42”=0.44”

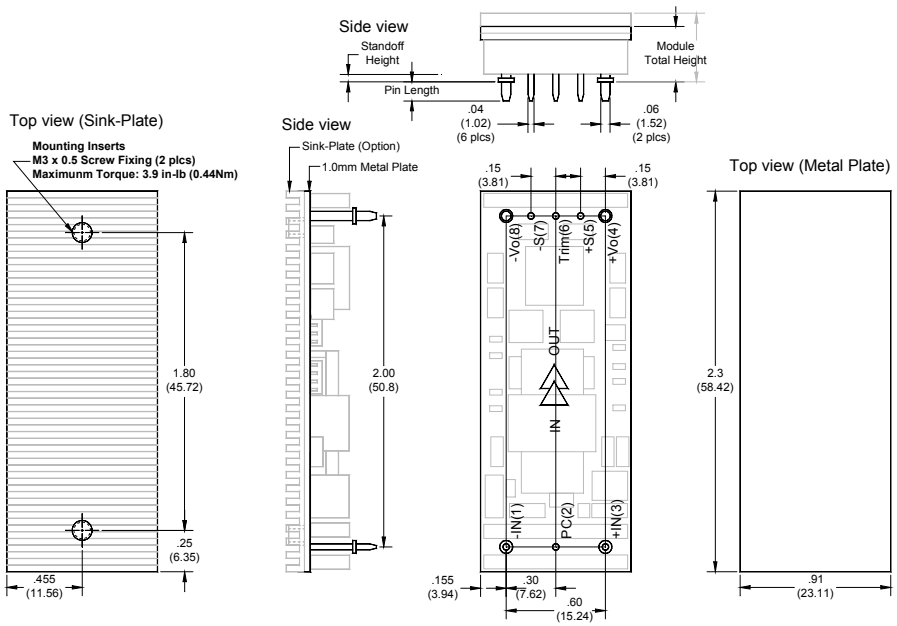
ABSOLUTE MAXIMUM RATINGS		
Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	0.5KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION		
Conversion Efficiency	Typical	See table
Switching Frequency	Typical	330KHz
MTBF	Bellcore	4.80×10^6 hrs@GB/25°C.
	TR-332 issue 6	(COE48050abcd-25)
OTP	Internal	110°C±5°C (T_C)
Weight	1mm metal plate	27g
	3mm metal plate	32g

CONTROL FUNCTIONS		
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS		
Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	20mA(rms)/60mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	22.0uF Max
	48V Models	10.0uF Max

OUTPUT SPECIFICATIONS		
Voltage Accuracy	Typical	±1.0%
Line Regulation	Full Input Range	±0.2%
Load Regulation	0%~100%	±0.2%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±3%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-IN	Negative input	**1**
PC	Remote control. To turn-on and turn-off output.	**2**
+IN	Positive input	**3**
+Vo	Positive output	**4**
+S	Positive remote sense	**5**
TRIM	Output voltage adjust	**6**
-S	Negative remote sense	**7**
-Vo	Negative output	**8**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 27g／1.0mm Metal Plate
32g／3.0mm Metal Plate

Base plate: Aluminum alloy with anode oxide

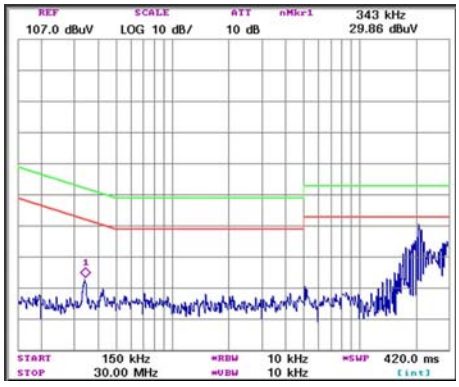
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

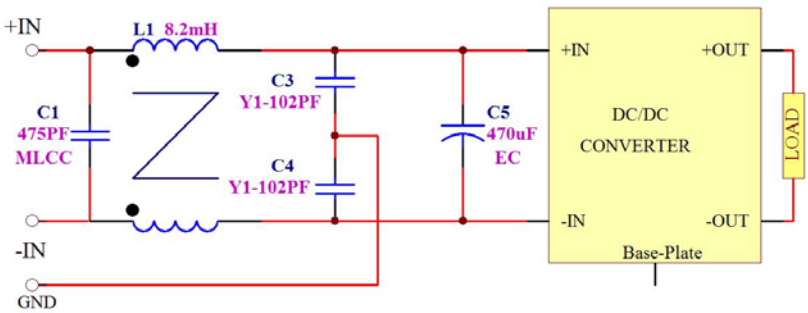
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for COE48050N20M-25





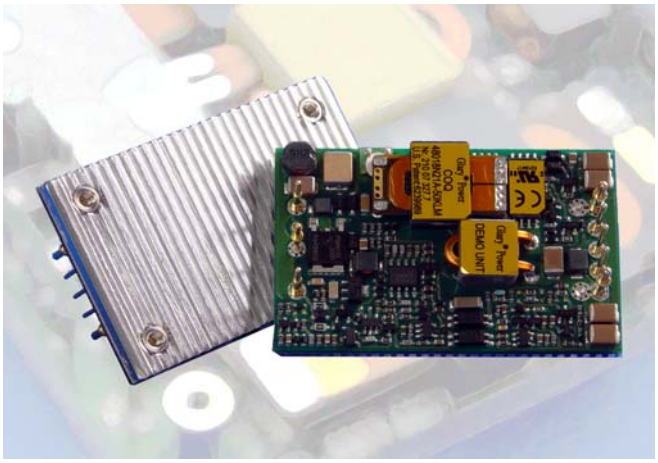
Important Note:
※General specifications and the performances are related to standard series only, no special customer specification display here except requested items.
※In order to secure effective usage of converter and the validity of Glary's service and warranty coverage, please carefully go through the application notes stated at the end of this document. For needs of usage beyond the application notes, please contact us or our regional sales representative office for help.

Glary Power Technology

COQ 175W／50A
1/4 Brick DC/DC Converters

- •High efficiency ..... 91%@12V/14A
  ..... 90%@5.0V/35A
- • High power density .....145W/in^3
- • Low profile (Open Frame) ..... 0.36”(9.1mm)
- • Standard footprint ..... 2.30”×1.45”
- • Operation temperature ..... -40°C~110°C
- •Sink-Plate (SP) flexible thermal managing capability (see drawing)

The COQ series provides up to 175W/50A outputs with industry standard quarter brick package. The efficient SR stage is combined with patented “Buck Reset” topology reduce power loss to achieve 145W/in^3 power density. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.



Part Number *	Maximum Input		Maximum Output		Efficiency
COQ48120abcd-ef	36V~75V	184W	12V/14A	168W	91%
COQ48070abcd-ef	36V~75V	163W	7.0V/21A	147W	90%
COQ48050abcd-ef	36V~75V	195W	5.0V/35A	175W	90%
COQ48033abcd-ef	36V~75V	131W	3.3V/35A	116W	89%
COQ48025abcd-ef	36V~75V	146W	2.5V/50A	125W	86%
COQ48018abcd-ef	36V~75V	106W	1.8V/50A	90W	86%
COQ48015abcd-ef	36V~75V	90W	1.5V/50A	75W	84%

Part Number *	Maximum Input		Maximum Output		Efficiency
COQ24120abcd-ef	18V~36V	160W	12V/12A	144W	91%
COQ24050abcd-ef	18V~36V	168W	5.0V/30A	150W	90%
COQ24033abcd-ef	18V~36V	131W	3.3V/35A	116W	89%
COQ24025abcd-ef	18V~36V	146W	2.5V/40A	125W	86%
COQ24018abcd-ef	18V~36V	106W	1.8V/50A	90W	86%
COQ24015abcd-ef	18V~36V	90W	1.5V/50A	75W	84%

* Options for **COQ series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
- **c** (Standoff Height): **0**: 0.02” **1**: 0.08” **2**: 0.16”
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate/0.34” **S**: 3.0mm Metal Plate/0.42”
  A: 3.0mm Sink-Plate/0.42” **B**: 5.0mm Sink-Plate/0.50”
- **ef** (Output): **00** to **50** for output current rating

c UL us E219417 CE

Pb RoHS 2002/95/EC

Example: **COQ48033P20A-35** is a ***COQ*** series quarter brick 48V to 3.3V/35A dc/dc converter with positive control logic, 0.20” pin length, 0.02” of standoff height and 3.0mm sink-plate. The total height of this module is 0.02”+0.42”=0.44”

ABSOLUTE MAXIMUM RATINGS

Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	0.5KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION

Conversion Efficiency	Typical	See table
Switching Frequency	Typical	330KHz
MTBF	Bellcore	4.41×10^6 hrs@GB/25°C.
	TR-332 issue 6	(COQ48033abcd-35)
OTP	Internal	110°C±5°C (T_C)
Weight	1mm metal plate	29g
	3mm metal plate	43g

CONTROL FUNCTIONS

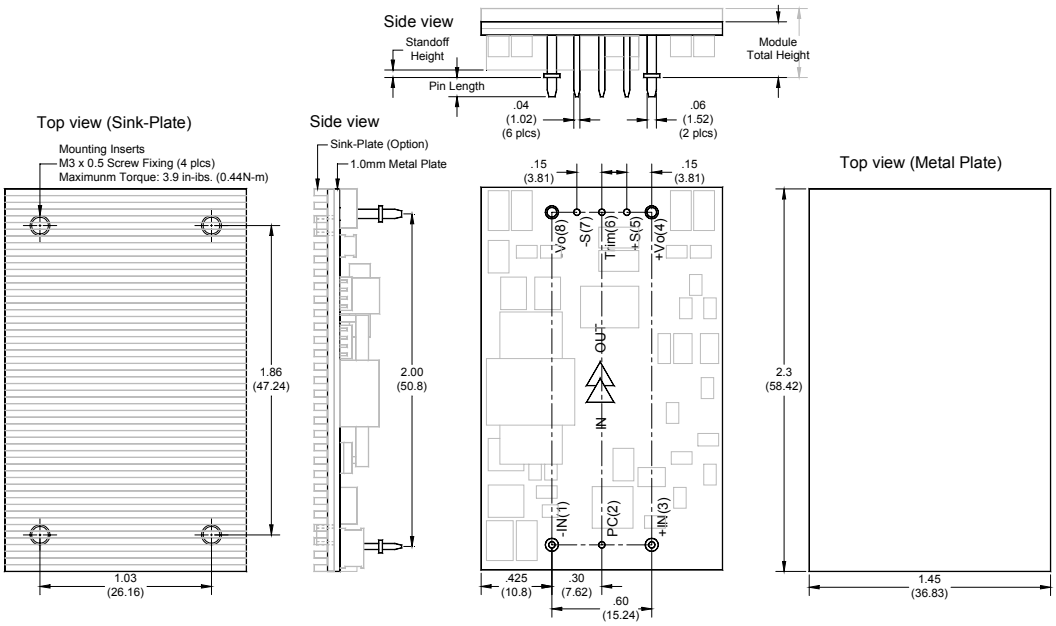
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS

Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	20mA(rms)/60mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	22.0uF Max
	48V Models	10.0uF Max

OUTPUT SPECIFICATIONS

Voltage Accuracy	Typical	±1.0%
Line Regulation	Full Input Range	±0.2%
Load Regulation	0%~100%	±0.2%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±4%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-IN	Negative input	**1**
PC	Remote control. To turn-on and turn-off output.	**2**
+IN	Positive input	**3**
+Vo	Positive output	**4**
+S	Positive remote sense	**5**
TRIM	Output voltage adjust	**6**
-S	Negative remote sense	**7**
-Vo	Negative output	**8**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 29g／1.0mm Metal Plate
43g／3.0mm Metal Plate

Base plate: Aluminum alloy with anode oxide

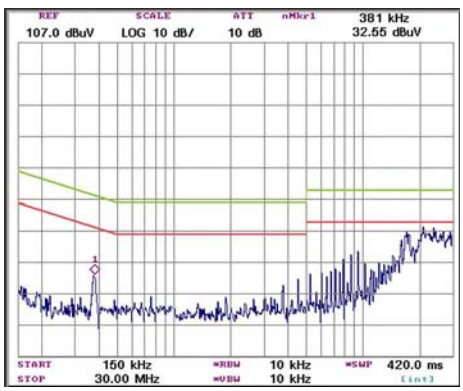
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

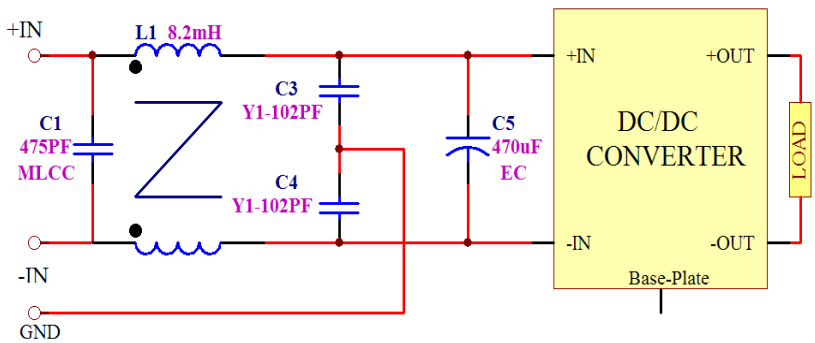
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for COQ48050N20M-25





Important Note:
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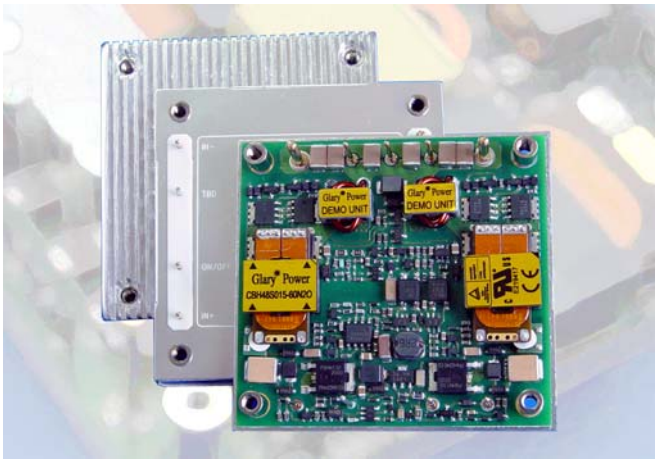
Glary Power Technology

CBH 250W／60A
1/2 Brick DC/DC Converters

- High efficiency ..... 91%@5.0V/50A
  ..... 90%@3.3V/50A
- High power density .....126W/in^3
- Low profile (Open Frame) ..... 0.36"(9.1mm)
- Standard footprint ..... 2.30"×2.40"
- Operation temperature ..... -40°C~110°C
- Sink-Plate (SP) flexible thermal managing capability (see drawing)



The CBH series provides up to 250W/60A outputs with industry standard half brick package. The efficient SR stage is combined with patented "Buck Reset" topology for reduce power loss to achieve 126W/in3 power density. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
CBH48050abcd-ef	36V~75V	280W	5.0V/50A	250W	91%
CBH48033abcd-ef	36V~75V	186W	3.3V/50A	165W	90%
CBH48025abcd-ef	36V~75V	173W	2.5V/60A	150W	87%
CBH48018abcd-ef	36V~75V	127W	1.8V/60A	108W	85%
CBH48015abcd-ef	36V~75V	109W	1.5V/60A	90W	83%

Part Number *	Maximum Input		Maximum Output		Efficiency
CBH24050abcd-ef	18V~36V	280W	5.0V/50A	250W	90%
CBH24033abcd-ef	18V~36V	186W	3.3V/50A	165W	89%
CBH24025abcd-ef	18V~36V	173W	2.5V/60A	150W	87%
CBH24018abcd-ef	18V~36V	127W	1.8V/60A	108W	85%
CBH24015abcd-ef	18V~36V	109W	1.5V/60A	90W	83%

* Options for **CBH series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12" **1**: 0.16" **2**: 0.20" **3**: 0.24"
- **c** (Standoff Height): **0**: 0.02" **1**: 0.08" **2**: 0.16"
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate / 0.34" **A**: 3.0mm Sink-Plate / 0.42"
  B: 5.0mm Sink-Plate/0.50"
  E: Metallic enclosure 1.0mm with Metal Plate / 0.37"
- **ef** (Output): **00** to **60** for output current rating

c UL us E219417

Example: **CBH48050P20M-50** is a ***CBH*** series half brick 48V to 5.0V/50A dc/dc converter with positive control logic, 0.20" pin length, 0.02" of standoff height and 1.0mm metal plate. The total height of this module is 0.02"+0.34"=0.36"

ABSOLUTE MAXIMUM RATINGS

Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION

Conversion Efficiency	Typical	See table
Switching Frequency	Typical	330KHz
MTBF	Bellcore	3.30×10^6 hrs@GB/25°C.
	TR-332 issue 6	(CBH48050abcd-50)
OTP	Internal	110°C±5°C (T_C)
Weight	Open Frame	60g / 1.0mm Metal Plate
	Metallic enclosure	95g / 1.0mm Metal Plate

CONTROL FUNCTIONS

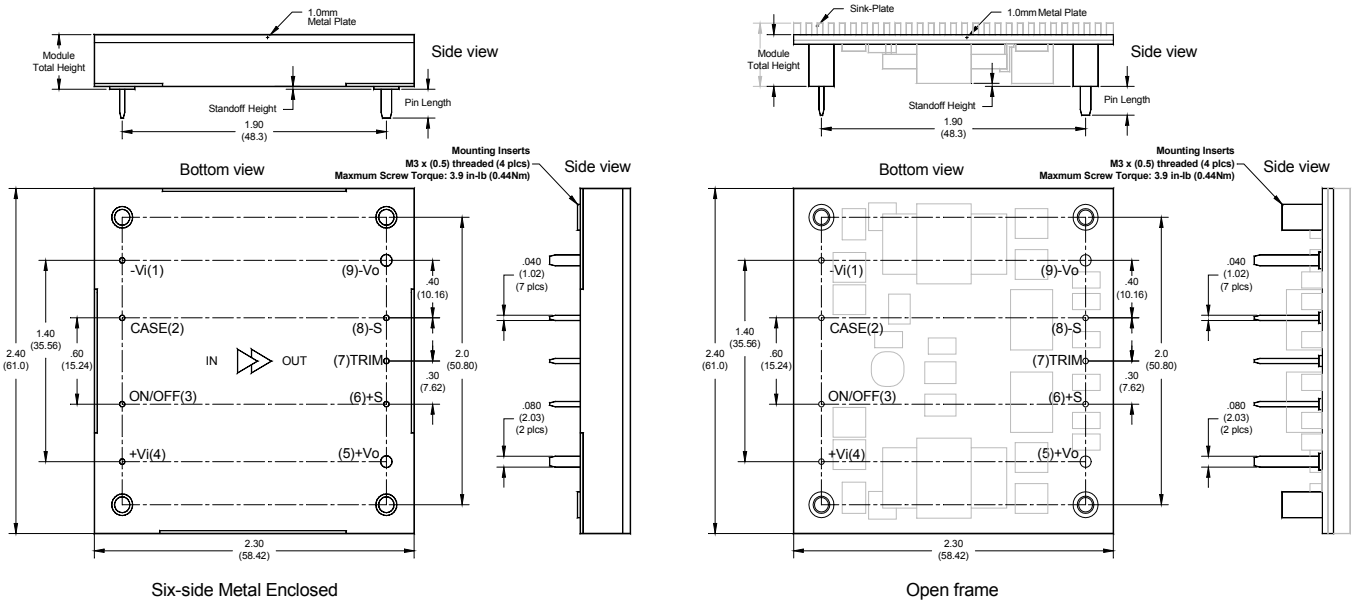
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS

Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	30mA(rms)/100mAp-p
Turn-On Voltage Threshold	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Turn-Off Voltage Threshold	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	42.0uF Max
	48V Models	15.0uF Max

OUTPUT SPECIFICATIONS

Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	0%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±4%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-Vi	Negative input	**1**
CASE	Connected to base plate	**2**
ON/OFF	Remote control. To turn-on and turn-off output.	**3**
+Vi	Positive input	**4**
+Vo	Positive output	**5**
+S	Positive remote sense	**6**
TRIM	Output voltage adjust	**7**
-S	Negative remote sense	**8**
-Vo	Negative output	**9**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 60g／Open frame
95g／Six-side Metallic Enclosure

Base plate: Aluminum alloy with anode oxide

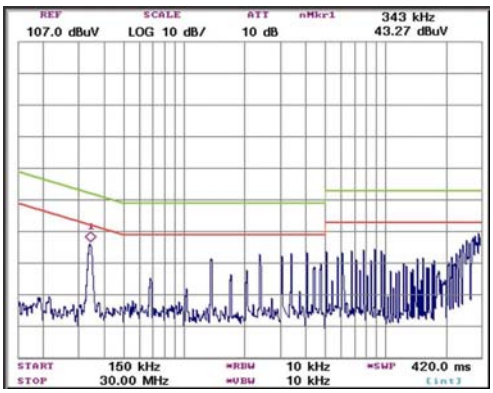
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

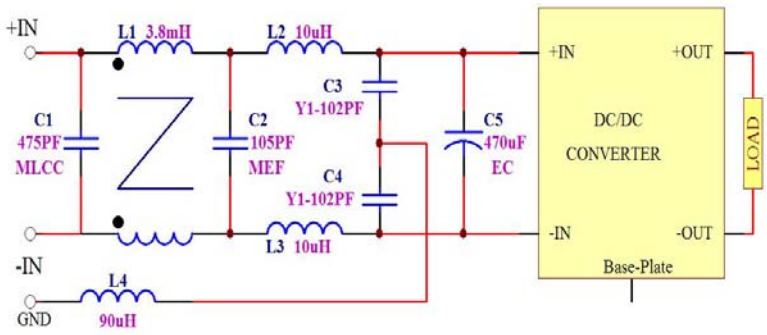
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for CBH48050P20M-50





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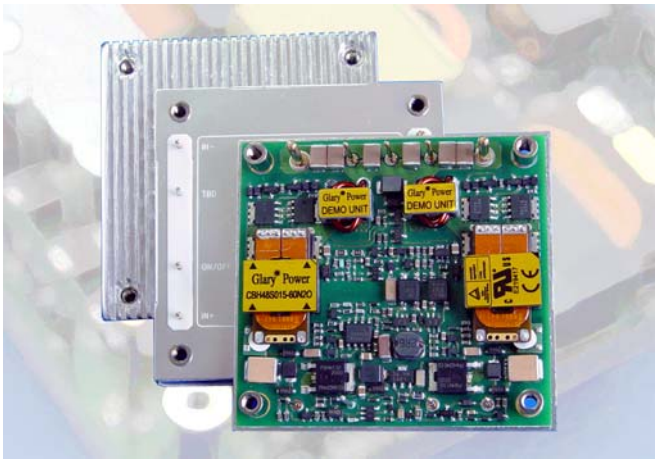
Glary Power Technology

CPH 350W／100A
1/2 Brick DC/DC Converters

- High efficiency ..... 90%@5.0V/70A
  ..... 89%@3.3V/70A
- High power density .....176W/in^3
- Low profile (Open Frame) ..... 0.36"(9.1mm)
- Standard footprint ..... 2.30"×2.40"
- Operation temperature ..... -40°C~110°C
- Sink-Plate (SP) flexible thermal managing capability (see drawing)



The CPH series provides up to 350W/100A outputs with industry standard half brick package. The efficient SR stage is combined with patented "Buck Reset" topology for reduce power loss to achieve 176W/in3 power density. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
CPH48050abcd-ef	36V~75V	390W	5.0V/70A	350W	90%
CPH48033abcd-ef	36V~75V	260W	3.3V/70A	231W	89%
CPH48025abcd-ef	36V~75V	230W	2.5V/80A	200W	88%
CPH48018abcd-ef	36V~75V	215W	1.8V/100A	180W	85%
CPH48015abcd-ef	36V~75V	185W	1.5V/100A	150W	84%

Part Number *	Maximum Input		Maximum Output		Efficiency
CPH24050abcd-ef	18V~36V	395W	5.0V/70A	350W	89%
CPH24033abcd-ef	18V~36V	265W	3.3V/70A	231W	88%
CPH24025abcd-ef	18V~36V	235W	2.5V/80A	200W	87%
CPH24018abcd-ef	18V~36V	220W	1.8V/100A	180W	84%
CPH24015abcd-ef	18V~36V	190W	1.5V/100A	150W	83%

* Options for **CPH series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12" **1**: 0.16" **2**: 0.20" **3**: 0.24"
- **c** (Standoff Height): **0**: 0.02" **1**: 0.08" **2**: 0.16"
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate / 0.34" **A**: 3.0mm Sink-Plate / 0.42"
  B: 5.0mm Sink-Plate/0.50"
  E: Metallic enclosure 1.0mm with Metal Plate / 0.37"
- **ef** (Output): **00** to **100** for output current rating

c UL us E219417 BAUART GEPRÜFT TÜV Rheinland Product Safety TYPE APPROVED CE

Pb RoHS 2002/95/EC

Example: **CPH48050P20M-70** is a ***CPH*** series half brick 48V to 5.0V/70A dc/dc converter with positive control logic, 0.20" pin length, 0.02" of standoff height and 1.0mm metal plate. The total height of this module is 0.02"+0.34"=0.36"

ABSOLUTE MAXIMUM RATINGS

Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION

Conversion Efficiency	Typical	See table
Switching Frequency	Typical	330KHz
MTBF	Bellcore	3.06×10^6 hrs @GB/25°C.
	TR-332 issue 6	(CPH48050abcd-70)
OTP	Internal	110°C±5°C (T_C)
Weight	Open Frame	60g / 1.0mm Metal Plate
	Metallic enclosure	95g / 1.0mm Metal Plate

CONTROL FUNCTIONS

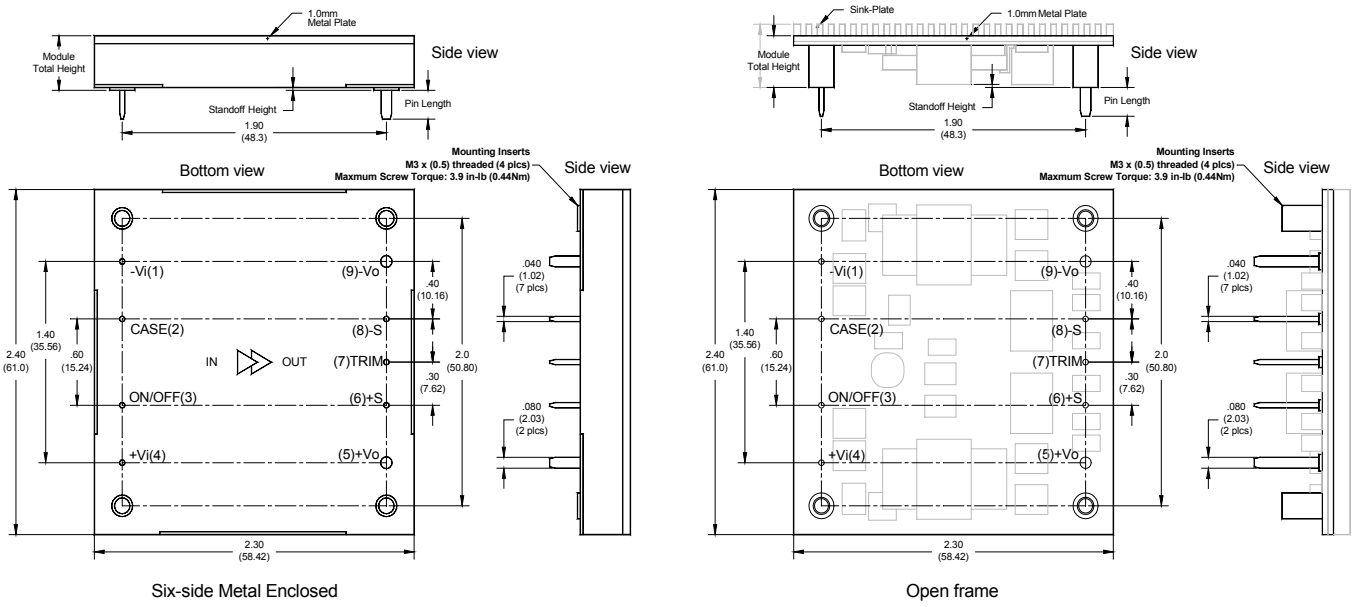
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS

Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	30mA(rms)/100mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	42.0uF Max
	48V Models	15.0uF Max

OUTPUT SPECIFICATIONS

Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	0%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±4%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-Vi	Negative input	**1**
CASE	Connected to base plate	**2**
ON/OFF	Remote control. To turn-on and turn-off output.	**3**
+Vi	Positive input	**4**
+Vo	Positive output	**5**
+S	Positive remote sense	**6**
TRIM	Output voltage adjust	**7**
-S	Negative remote sense	**8**
-Vo	Negative output	**9**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 60g／Open frame
95g／Six-side metal enclosed

Base plate: Aluminum alloy with anode oxide

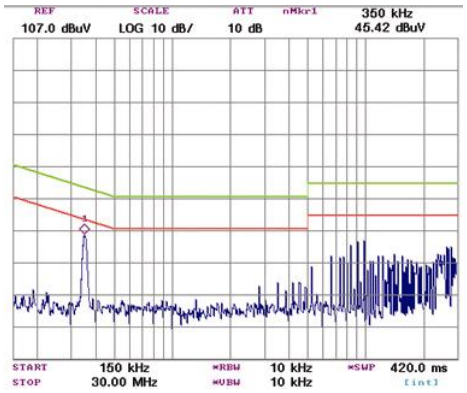
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

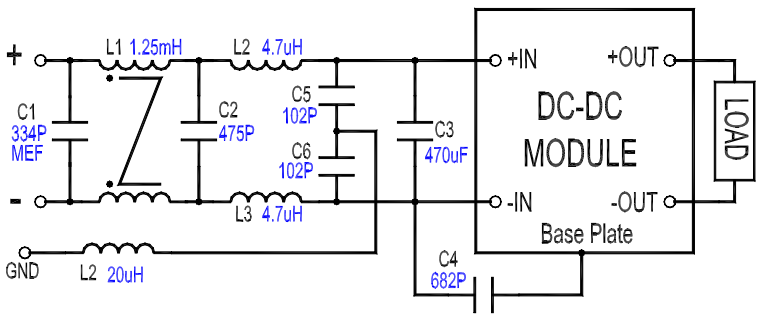
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for CPH48050P20M-70





Important Note:
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Glary Power Technology

TSH 150W／30A
1/2 Brick DC/DC Converters

- High efficiency ..... 90%@28V/5.5A
  ..... 90%@15V/10A
  ..... 89%@12V/13A
- High power density .....78W/in^3
- Low profile (Open Frame) ..... 0.36”(9.1mm)
- Standard footprint ..... 2.30”×2.40”
- Operation temperature ..... -40°C~110°C
- Sink-Plate (SP) flexible thermal managing capability (see drawing)

The TSH series provides up to 150W/30A outputs with industry standard half brick package. The efficient Non-SR technology is combined with ultra low leakage inductance magnetic design to gives converters ”SR-like” conversion efficiency. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
TSH48280abcd-ef	36V~75V	177W	28V/5.5A	154W	90%
TSH48240abcd-ef	36V~75V	180W	24V/6.5A	156W	89%
TSH48150abcd-ef	36V~75V	168W	15V/10A	150W	90%
TSH48120abcd-ef	36V~75V	177W	12V/13A	156W	89%
TSH48050abcd-ef	36V~75V	176W	5.0V/30A	150W	86%

Part Number *	Maximum Input		Maximum Output		Efficiency
TSH24280abcd-ef	18V~36V	177W	28V/5.5A	154W	89%
TSH24240abcd-ef	18V~36V	180W	24V/6.5A	156W	88%
TSH24150abcd-ef	18V~36V	168W	15V/10A	150W	90%
TSH24120abcd-ef	18V~36V	177W	12V/13A	156W	89%
TSH24050abcd-ef	18V~36V	176W	5.0V/30A	150W	86%

* Options for **TSH series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
- **c** (Standoff Height): **0**: 0.02” **1**: 0.08” **2**: 0.16”
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate / 0.34” **A**: 3.0mm Sink-Plate / 0.42”
  B: 5.0mm Sink-Plate/0.50”
  E: Metallic enclosure 1.0mm with Metal Plate / 0.37”
- **ef** (Output): **00** to **30** for output current rating

Example: **TSH24240P20M-07** is a ***TSH*** series half brick 24V to 24V/6.5A dc/dc converter with positive control logic, 0.20” pin length, 0.02” of standoff height and 1.0mm metal plate. The total height of this module is 0.02”+0.34”=0.36”

ABSOLUTE MAXIMUM RATINGS

Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION

Conversion Efficiency	Typical	See table
Switching Frequency	Typical	340KHz
MTBF	Bellcore	4.82×10^6 hrs @GB/25°C.
	TR-332 issue 6	(TSH48280abcd-06)
OTP	Internal	110°C±5°C (T_C)
Weight	Open Frame	60g / 1.0mm Metal Plate
	Metallic enclosure	95g / 1.0mm Metal Plate

CONTROL FUNCTIONS

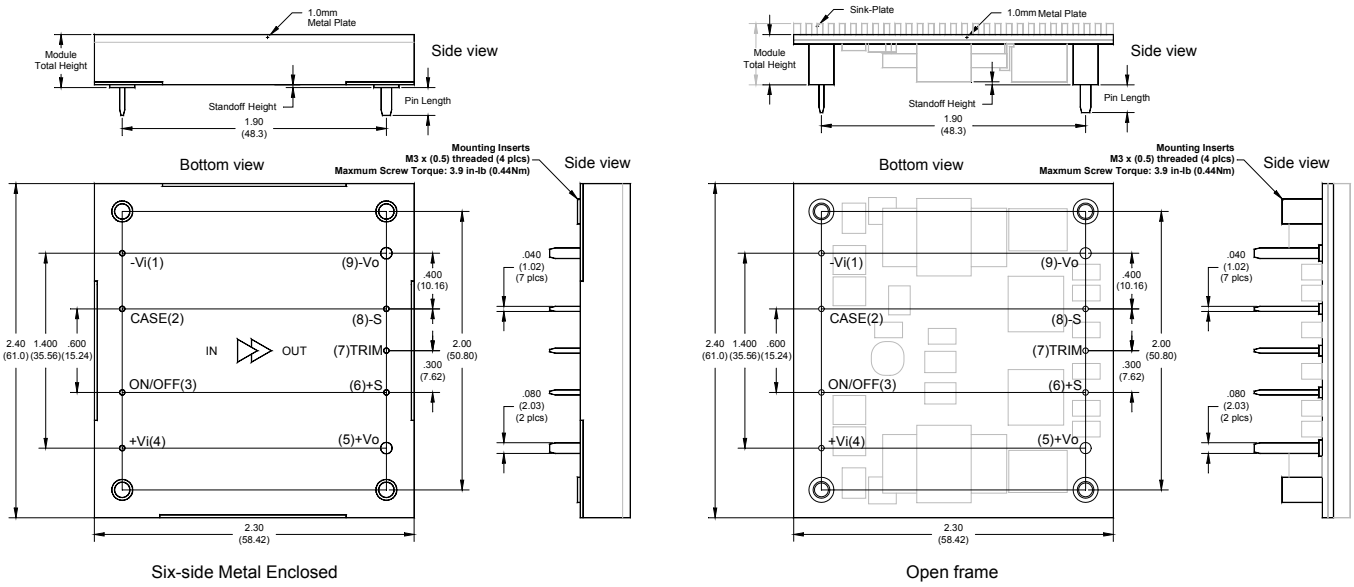
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS

Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	20mA(rms)/60mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	32.0uF Max
	48V Models	12.0uF Max

OUTPUT SPECIFICATIONS

Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	5%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±3%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-Vi	Negative input	**1**
CASE	Connected to base plate	**2**
ON/OFF	Remote control. To turn-on and turn-off output.	**3**
+Vi	Positive input	**4**
+Vo	Positive output	**5**
+S	Positive remote sense	**6**
TRIM	Output voltage adjust	**7**
-S	Negative remote sense	**8**
-Vo	Negative output	**9**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 60g／Open frame
95g／Six-side metal enclosed

Base plate: Aluminum alloy with anode oxide

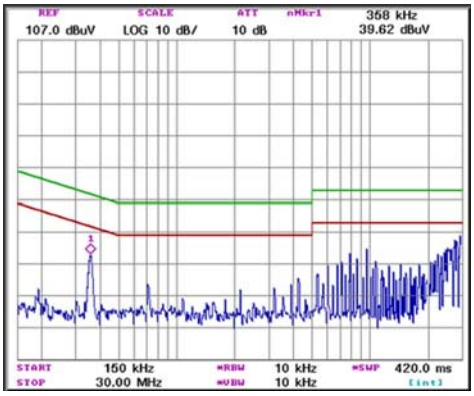
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

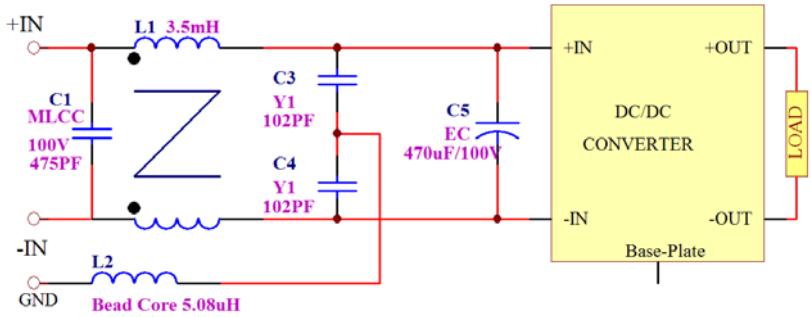
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for TSH48120P20M-13





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Glary Power Technology

PH 310W／50A
1/2 Brick DC/DC Converters

- High efficiency ..... 90%@28V/11A
  ..... 89%@15V/17A
  ..... 88%@12V/21A
- High power density .....156W/in^3
- Low profile (Open Frame) ..... 0.36”(9.1mm)
- Standard footprint ..... 2.30”×2.40”
- Operation temperature ..... -40°C~110°C
- Sink-Plate (SP) flexible thermal managing capability (see drawing)

The PH series provides up to 310W/50A outputs with industry standard half brick package. The efficient Non-SR technology is combined with ultra low leakage inductance magnetic design to gives converters ”SR-like” conversion efficiency. The multi-layer single side circuit board design plus the patented Sink-Plate technology is able to enhance the thermal performance and improve its reliability. Modules are designed for Telecom, Servers, Networking equipments and other applications that use a 24V or 48V (36~75V) input bus.

Part Number *	Maximum Input		Maximum Output		Efficiency
PH48280abcd-ef	36V~75V	355W	28V/11A	310W	90%
PH48240abcd-ef	36V~75V	291W	24V/11A	252W	88%
PH48150abcd-ef	36V~75V	288W	15V/17A	255W	89%
PH48120abcd-ef	36V~75V	291W	12V/21A	252W	88%
PH48050abcd-ef	36V~75V	296W	5.0V/50A	250W	85%

Part Number *	Maximum Input		Maximum Output		Efficiency
PH24280abcd-ef	18V~36V	355W	28V/11A	310W	88%
PH24240abcd-ef	18V~36V	291W	24V/11A	252W	87%
PH24150abcd-ef	18V~36V	288W	15V/17A	255W	89%
PH24120abcd-ef	18V~36V	291W	12V/21A	252W	87%
PH24050abcd-ef	18V~36V	296W	5.0V/50A	250W	85%

* Options for **PH series** are listed as follows:

- **a** (Enable Logic): **P**: Positive **N**: Negative
- **b** (Pin Length): **0**: 0.12” **1**: 0.16” **2**: 0.20” **3**: 0.24”
- **c** (Standoff Height): **0**: 0.02” **1**: 0.08” **2**: 0.16”
- **d** (Base-Plate/Module Thickness): **M**: 1.0mm Metal Plate / 0.34” **A**: 3.0mm Sink-Plate / 0.42”
  B: 5.0mm Sink-Plate/0.50”
  E: Metallic enclosure 1.0mm with Metal Plate / 0.37”
- **ef** (Output): **00** to **50** for output current rating

Example: **PH48280P20M-11** is a ***PH*** series half brick 48V to 28V/11A dc/dc converter with positive control logic, 0.20” pin length, 0.02” of standoff height and 1.0mm metal plate. The total height of this module is 0.02”+0.34”=0.36”

ABSOLUTE MAXIMUM RATINGS

Temperature	Operation	-40°C to +110°C
	Storage	-55°C to +125°C
Input Voltage Range	Operation:	
	24V Models	-0.5V to +40Vdc
	48V Models	-0.5V to +80Vdc
	Transient (100ms):	
	24V Models	50V Maximum
	48V Models	100V Maximum
Isolation Voltage	Input to Output	2.0KVdc
	Input to Case	1.0KVdc
	Output to Case	1.0KVdc
Remote Control		-0.5V to +12Vdc

GENERAL SPECIFICATION

Conversion Efficiency	Typical	See table
Switching Frequency	Typical	340KHz
MTBF	Bellcore	4.11×10^6 hrs @GB/25°C.
	TR-332 issue 6	(PH48280abcd-11)
OTP	Internal	110°C±5°C (T_C)
Weight	Open Frame	60g / 1.0mm Metal Plate
	Metallic enclosure	95g / 1.0mm Metal Plate

CONTROL FUNCTIONS

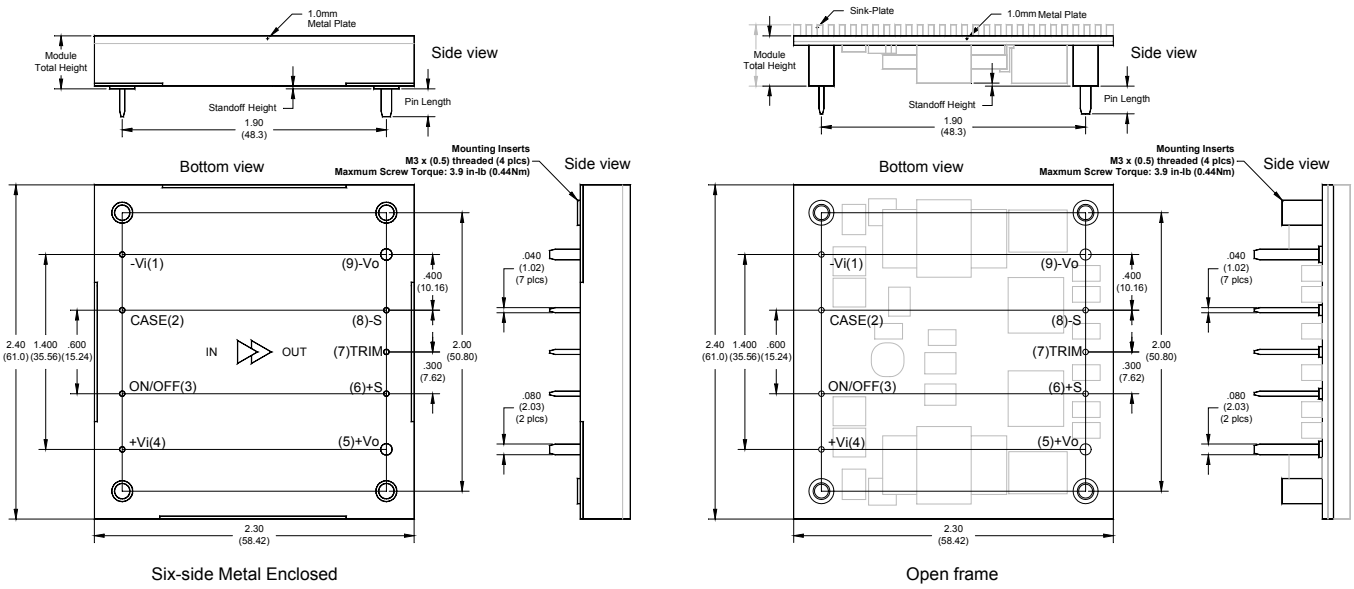
Remote Control	Logic High	+3.0V to +6.5V
	Logic Low	0V to +1.0V
Input Current of Remote Control Pin		-0.5mA ~ +1.5mA

INPUT SPECIFICATIONS

Operation Voltage Range	24V Models	+18V to +36Vdc
	48V Models	+36V to +75Vdc
Reflected Ripple Current	L_{EXT} = 10uH	30mA(rms)/100mAp-p
Power ON Voltage Range	24V Models	+16.5V to +17.9Vdc
	48V Models	+34.5V to +35.8Vdc
Power OFF Voltage Ranges	24V Models	+16.0V to +17.4Vdc
	48V Models	+33.5V to +34.8Vdc
Off State Input Current	V_{NOM}	6mA Max
Latch-State Input Current	V_{NOM}	8mA Max
Input Capacitance	24V Models	42.0uF Max
	48V Models	15.0uF Max

OUTPUT SPECIFICATIONS

Voltage Accuracy	Typical	±1%
Line Regulation	Full Input Range	±0.3%
Load Regulation	5%~100%	±0.3%
Temperature Drift	-40°C ~100°C	±0.03%/°C
Output Tolerance Band	All Conditions	±4%
Ripple & Noise (20MHz)	Peak-Peak (rms)	3% (1%) V_o
Over Voltage Protection	V_{NOM}, 10% Load	115~130 %Vo
Output Current Limits	V_{NOM}	108%~125%
Voltage Trim	V_{NOM}, 10% Load	±10%
Input Ripple Rejection (<1KHz)	V_{NOM}, Full Load	-50dB
Step Load (2.5A/uS)	50%~75% Load	±4%Vo/500us
Start-Up Delay Time	V_{NOM}, Full Load	20ms/250ms



Module Mechanical Data

Connection:

Designation	Function Description	Pin #
-Vi	Negative input	**1**
CASE	Connected to base plate	**2**
ON/OFF	Remote control. To turn-on and turn-off output.	**3**
+Vi	Positive input	**4**
+Vo	Positive output	**5**
+S	Positive remote sense	**6**
TRIM	Output voltage adjust	**7**
-S	Negative remote sense	**8**
-Vo	Negative output	**9**

Dimensions: inches (mm)

Tolerances: .xx±0.02 (.x±0.5)
.xxx±0.01 (.x±0.25)

Weight: 60g／Open frame
95g／Six-side metal enclosed

Base plate: Aluminum alloy with anode oxide

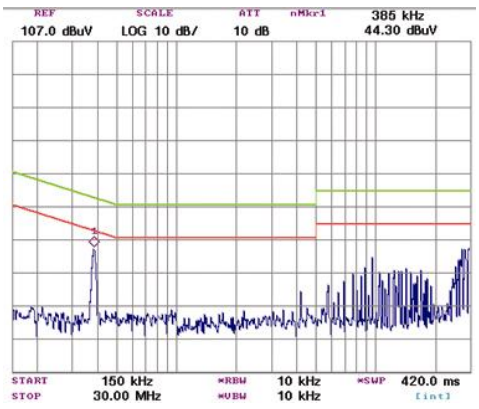
Mounting inserts: Iron alloy with Nickel plated
Maximum Torque: 3.9 in-Ib (0.44Nm)

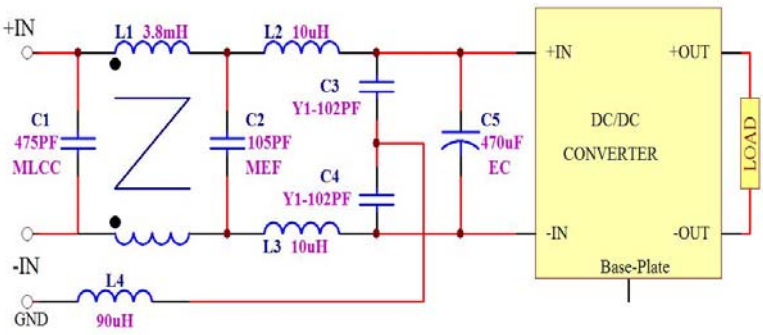
Pin material: Copper alloy or Brass

Pin plating: Golden over Nickel

Referenced EMC Circuit:

The tested curve and referenced EMC circuit for PH48280P20M-11





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General Operating Information

General

Absolute Maximum Ratings

Some ratings, shown in **ABSOLUTE MAXIMUM RATINGS**, are the absolute maximum ratings referring to no destruction or design limits, normally tested with one parameter while exceeding the limits of absolute maximum ratings or electrical characteristics.

The stress exceeding the absolute maximum ratings may cause permanent damage, function and performance degraded. As far as design margin and enhancing system reliability are concerned, it is recommended that Glary DC/DC converters operate below 90˚C of case temperature. The over temperature protection set point is 5˚C ~10˚C higher of maximum operation base plate temperature.

Safety

Standards

All product series of DC/DC converters are designed to comply with UL in accordance with EN60950 Safety of information technology equipment including electrical business equipment. These DC/DC converters meet the U.S. and Canadian Standard for Safety of Information Technology Equipment, Including Electrical Business Equipment applicable requirement in CSA/UL60950. Most product series of DC/DC converters are recognized by UL, CSA and TUV.

Isolation

Operational or Basic insulation is performed in accordance with EN60950. All product series, built in DC-to-DC converter power supplies, should be installed in end-use equipment for printed wiring board or chassis mountable, and intend to be supplied by isolated secondary circuit. Consideration should be given to measure the case temperature to comply with maximum case temperature during module operation.

When the supply to DC/DC converter meets all requirements for SELV, the output is considered to remain SELV limit. For supply voltage from 60V to 75V DC, reinforced insulation must be provided in the 75V power source that isolates the input from the mains. Single fault testing in the 75V supply circuit will be performed in combining with the DC/DC converter to demonstrate that the output meets the requirement for SELV. One pole of the input and the other one of the output are going to be grounded or both circuits are to be kept floated.

The isolation, withstanding 1500V or 2000 DC between input and output depending on different series, 1000V DC between input/output and case with all series, is verified in an electrical strength test.

Flammability

The flammability ratings of plastic parts and PCBs meet UL-94V-0.

Fusing

A fuse should be used at the input of each converter to isolate the failed one from others, keeping the system continue to operate and prevent the damage of power distribution wiring from over heating. A fast blow fuse should be used with 10A~20A rating or less, it is recommended using a fuse with the lowest current rating.

Input Side

Input (+IN, -IN)

Voltage Range

The input voltage range of 36V~75V meets the requirement of European Telecom Standard ETS 300 132-2 for normal input voltage range in -48V(-40.5V~ -57.0V) and –60V(-50.0V~ -72.0V) DC power systems. The absolute maximum continuous input voltage is 75V DC and withstands 100V DC/1sec maximum transient voltage. The range 18V~36V for 24V version is also available.

Input Capacitance

The input characteristic of a DC/DC converter may be referred as a negative impedance element in its input voltage range. Sometimes, oscillation will be occurred when high impedance power source is applied to supply power to a DC/DC converter. An external input capacitor is recommended to reduce the characteristic impedance and eliminate the oscillation between the DC/DC converter and the source.

Generally speaking, a 220uF~470uF capacitor across the input of all DC/DC converter product series will help to insure stability.

ON/OFF Control (ON/OFF or PC)

These product series of DC/DC converter has the remote on/off control pin connecting to primary side control signal ON/OFF power converter. The control signal of ON/OFF pin is referred to the negative power input pin. Two control logic options are available.

Negative Logic

ON: Short to negative power input pin or apply voltage of logic low.

OFF: Opening circuit or apply the voltage of logic high.

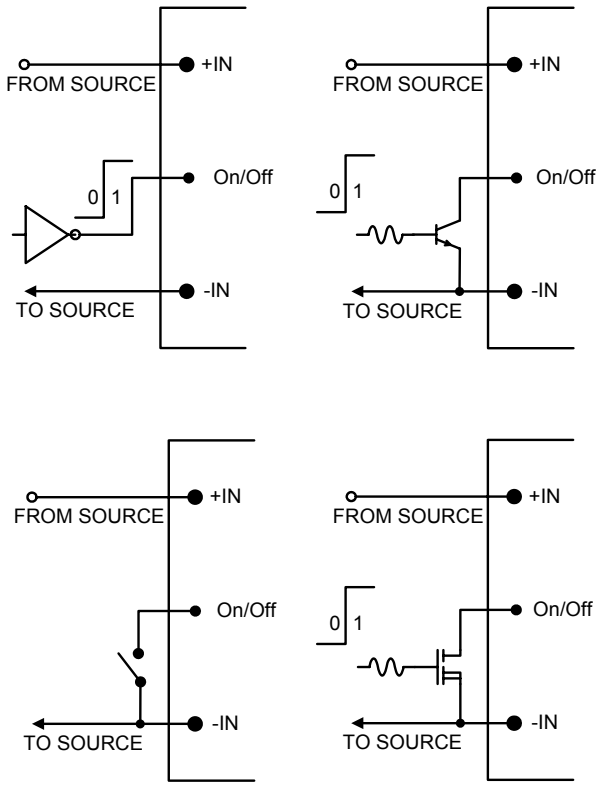
Positive Logic

ON: Opening circuit or apply the voltage of logic high.

OFF: Short to negative power input pin or apply voltage of logic low.

A mechanical switch or an open collector NPN transistor (open drain N channel FET) can be used to drive the ON/OFF pin.

The device must be capable of sinking 1mA minimum at a logic low voltage 1.0V and withstands 12V DC minimum.



Output Side

Output (+OUT, -OUT)

Ripple & Noise

The ripple of DC/DC converters is measured as peak-to-peak voltage from 0 to 20MHz, which includes the noise and fundamental ripple. The ripple and noise can be reduced significantly by paralleling a de-coupling capacitor to the output terminal.

Over Current Protection (OCP)

These DC/DC converters provide OCP function to withstand continuous overload or short circuit condition in the output. The converter will recover to normal operation after the overload is removed. The OCP set point of these DC/DC converters is 105%~120% of rated output current.

Over Voltage Protection (OVP)

These DC/DC converters provide OVP lockout function to prevent the damage of load from over voltage condition on the output. The converter will restart after recycling the input power or control signal of primary control pin. The OVP set point of these DC/DC converters is 125%~140% of rated output voltage.

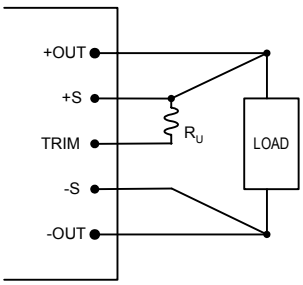
Remote Sense (+S, -S)

These DC/DC converters have the remote sense used to compensate voltage drop due to resistance in the distribution system, it allows voltage regulation at the load or a selected point. It should be noted that the sense line must be located close to a ground trace or a ground panel to reduce noise, a twisted wire pair is recommended for discrete wiring. The sense will compensate 0.5V maximum of voltage drop between the sensed voltage and the voltage of output pins.

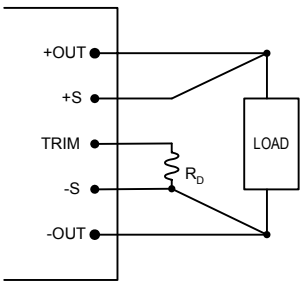
Output Voltage Adjust (TRIM or SC)

These DC/DC converters have the secondary control pin used to adjust output voltage beyond or below nominal output voltage. It should be noted that trim up to be above OVP set point may cause a converter to enter the over voltage protection state. The trim function of these DC/DC converters is exactly like other major competitors' DC/DC converters. The TRIM pin is noise sensitivity. External resistors should be located within 1cm of the converter. If not using the trim feature, leave the TRIM pin open.

TRIM UP: connect a trim resistor (R_U) between TRIM pin and +S pin.



TRIM DOWN: connect a trim resistor (R_D) between SC pin and -S pin.



Output Capacitance

The extra output capacitance is required to improve the voltage regulation when powering a load with significant dynamic current requirement. Putting a low ESR capacitor to the load as close as possible to handle the short duration high frequency component of dynamic load current and put the higher value of electrolytic capacitor to progress the mid-frequency component.

The capacitance, resistance and inductance of distribution system are used as feedback components that would in affecting stability and dynamic response performance of power converter if the remote sense is used.

In generally, 68uF~100uF/A of output current can be used without additional analysis. For example, a 35A DC/DC converter, the de-coupling capacitor up to 4700uF can be used on the premise of not affecting the stability. Capacitor of a higher value, as much capacitance as possible, should be outside of the feedback loop and closing the load should help with insuring the stability. The absolute maximum value of output capacitance is 10,000uF; consult with Glary for higher value of output capacitance.

Quality

Reliability

For example, calculated MTBF in accordance with Bellcore TR-332 issue 6, December 1997 of COE series, is 4,801,570hours (+25ºC), 2,015,270hours (+50ºC), or 940,807hours (+70ºC) to demonstrate the reliability of our products. This represents an average failure rate of 280.265 (+25ºC), 486.211 (+50ºC) and 1,062.918 (+70ºC) failures per million unit hours of operations. The assumptions are full load at +25ºC, +50ºC and +70ºC case temperature under ground benign (GB) environment condition.

Warranty

Glary Power Technology warrants to the original purchaser or the end user that the products conform to this data sheet are free from material and workmanship defects for a period of two years since the date of manufacturing, when the product is used within specified condition and not opened.

Handling

Open frame converters can be damaged from poor handling, excessive mechanical shock, or from a static electric discharge. The units should be:

- Carefully handled and not subjected to mechanical stress
- Treated as an ESD sensitive component
- Stored in a static protective container which physically protects the converter
- The converters should not be stored in plastic bags, or stacked on top of one another in any way

Limitation of Liability

Glary Power Technology does not make any warranties, express or imply including any warranty of merchantability or fitness for a particular purpose (including, but not limited to use in life support applications, where malfunction of product can cause injury to a person's health or life).

General Module Thermal Considerations

General

The Glary DC/DC converter product series are designed to operate in a variety of thermal environments; however sufficient cooling should be helpful for reliable operation. General speaking, the heat is removed from module by conduction, convection and radiation to the surrounding but convection is the most important method for the normal application at sea level. Increased airflow may strongly influence the module thermal performance. Proper cooling can be verified by measuring the temperature of base plate.

The available load current with different ambient air temperature and airflow at nominal input voltage for each model is according to real test done in a wind tunnel. However the actual derating performance of each module may slightly vary compared with the derating curves given by test performed in the data sheet, the 90% of available current shown in the derating curves is the highest recommended value for reliable system design. The actual system design ~~is~~ would in fact strongly affect the derating performance and generally result in three variable factors to affect the module derating performance described as below:

Conversion Efficiency

The heat is generated by power loss, board mount power module convert input power for output to load always has an efficiency between 0%~100%, and the synchronous rectification technology can make power module convert the required power with dramatic efficiency and loss power fewer compared with traditional technology. This leads to a lower temperature rise if the module thermal resistance is the same; it means higher efficiency is better for any kind of cooling conditions because the temperature is always lower and the reliability could also be better secured.

However, most data sheet shows high efficiency with full load condition and not with the real load condition for a practical system. It is better to select a power module that has highest efficiency with specified load condition. This almost leads to a solid answer that to choose a power module rated about 1.2~1.5 times of the required power would be reliable than a power module rated at double of the actual required power or even higher, because large derating always has poor efficiency and more temperature rise. Higher derating always reduces the operation life because the temperature factor has more negative effect on MTBF to further eliminate the positive effect due to reduced electrical stress.

Roughly calculations of Glary COQ module by changing the temperature stress and electrical stress to have different results as below could be used as an example of reference of ~~for~~ power module selection in system design stage. The 10% more of module temperature rise (90ºC at 25ºC to 96.5ºC at 25ºC) will cause life reduce to about 75% of its originally designed figure. Module derating from 100% to 75% will cause life improve by about 2% more.

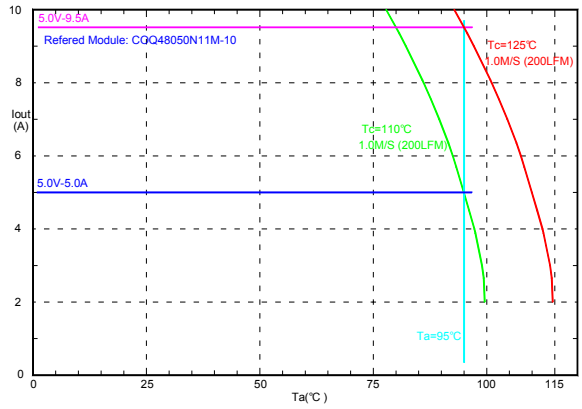
Efficiency change between different modules also has significant effect on the temperature rise to affect the derating performance. This effect can be seen more clearly especially in high temperature operation. For example: Ta=83ºC, maximum allowable temperature Tc=110ºC, Airflow=200LFM, a COQ48050N11M-10 module with 90.2% efficiency can have a 9.5A output current with 5.16W power loss. If the efficiency is 2% lower (88.2%) at 9.5A output, it may loss 6.35W of power and further ~~to~~ cause over temperature to Tc=114ºC or the maximum operable temperature should reduced to Ta=75ºC.

Module Temperature

Follow the result of conversion efficiency section; some ~~of~~ power module makers provide derating curves by increasing the maximum board temperature and semiconductor junction temperature to 125ºC to have better derating performance. This method can operations at high temperature environment. To increase maximum allowable temperature may result in two effects on the thermal characteristics:

The first effect of increasing maximum allowable temperature is that it would increases~~e~~ the temperature rise between module and the air may cause more heat flow through module surface to air ~~if~~ assuming module thermal resistance is constant. Typically the thermal resistance of specified form factor is determined by the properties of air and the contacted surface area. The properties of air are fixed when the temperature and pressure ware specified. The only variation is the air contacted surface area of power module, but same form factor has almost same construction and contacted surface area due to no big difference on the components selection and its counts, so that the thermal resistance can be at the same level. The second effect is to reduce thermal resistance by increasing nature convection due to increased temperature rise. It has about 8% improvement for thermal resistance with nature convection by changing the maximum allowable temperature from Tc=110ºC to Tc=125ºC.

Simple calculations of Glary COQ module by changing the maximum allowable temperature from Tc=110ºC to Tc=125ºC would demonstrate the improvement of derating performance. A COQ48050N11M-10 module with 90.9% efficiency operation under Ta=95ºC, Tc=110ºC and Airflow=200LFM conditions can deliver 5.0A output current with 2.50W power loss. If the allowable maximum temperature is Tc=125ºC, the allowable power loss will go to 4.76W and the available current could be 9.5A. Plot-1 shows comparison of derating curves for reference.



Plot-1: Derating curves for Tc=110ºC and Tc=125ºC

However, even to increase the maximum allowable temperature from Tc=110ºC to Tc=125ºC would make dramatic improvement for derating performance. It pays too much for operation life, most of the circuit components used in modern power modules may reduce~~d~~ its life significantly due to operation under Tc=125ºC condition and the total effect is to reduce module life about 50%. Generally derating rule request 38ºC derating for power semiconductor junction temperature and 15ºC derating for Tg=130ºC rated PCB that means the maximum operation temperature is 112ºC. All Glary products are limited under 110ºC for safe operation and longer life. Set the case temperature of Glary module below 90ºC during operation would be better for high reliability system.

Module Thermal Resistance

Follow the result of module temperature section; the maximum allowable temperature for operation is limited under Tc=110ºC. Glary provide Sink-Plate technology for almost all Glary modules to reduce the module thermal resistance, and further improve thermal performance such as the derating performance and temperature deviation among the components. By choosing the Sink-Plate, the derating performance was improved dramatically and no any compromise for the reliability and operation life that it can be used as integrated heat sink to reduce module thermal resistance when no additional cooling assemblies were attached to the module.

In general Glary modules were design for board mount application but the Sink-Plate has at least 2pcs of M3 screws to allow module to be attached to the casing, or with its heat sink to extent its thermal performance to meet the requirements of high temperature operated system. The Sink-Plate is able to reduce the deflection that it has special geometry to hold flowed gap filler due mounting force during screw mounting process and improve the thermal contact to has unified temperature map to improve the reliability again.

The simple calculations for COQ with different type of base plate are described as below, which may reflected to all Glary products ~~to~~ and give better understanding about thermal performance and derating for specified application conditions:

For the 1.0mm metal plate:

The module thermal resistance θ_M of COQ with 1.0mm metal plate is similar to traditional power module can be listed as below:

θ_M = 11.29 (Free-Air), 7.36 (100LFM), 5.65(200LFM)
4.20 (300LFM), 3.47 (400LFM), 3.03 (500LFM)

The thermal resistance data and efficiency plot in the data sheet can be applied to the equation below to determine the available power with specified operation ambient temperature.

$$P_O = (110\text{-}Ta)/ (\theta_M)(1/\eta\text{-}1)$$

For example: 200LFM at Ta=80ºC for COQ with 1.0mm metal plate. The available power is P_O=(110-80)/ (5.65)(1/0.9-1)=47.6W, or equal to 5.0V/9.5A output also can be seen in the derating plot in the data sheet directly.

For the3.0mm Sink-Plate:

The module thermal resistance θ_{S3} of COQ with 3.0mm Sink-Plate is about 30% lower compared to 1.0mm metal plate COQ module, which is listed as below:

Θ_{S3} = 9.13 (Free-Air), 5.95 (100LFM), 4.49 (200LFM)
3.40 (300LFM), 2.81 (400LFM), 2.45 (500LFM)

The thermal resistance data and efficiency plot in the data sheet can be applied to the equation below to determine the available power with specified operation ambient temperature.

$$P_O = (110\text{-}Ta)/ (\theta_{S3})(1/\eta\text{-}1)$$

For example: 200LFM at Ta=85ºC for COQ with 3.0mm metal plate. The available power is P_O=(110-85)/ (4.49)(1/0.9-1)=50.01W, or equal to 5.0V/10A output.

For the5.0mm Sink-Plate:

The module thermal resistance θ_{S5} of COQ with 5.0mm Sink-Plate is about 50% lower compared to 1.0mm metal plate COQ module were listed as below:

Θ_{S5} = 7.28 (Free-Air), 4.91 (100LFM), 3.17(200LFM)
2.44 (300LFM), 2.01 (400LFM), 1.83 (500LFM)

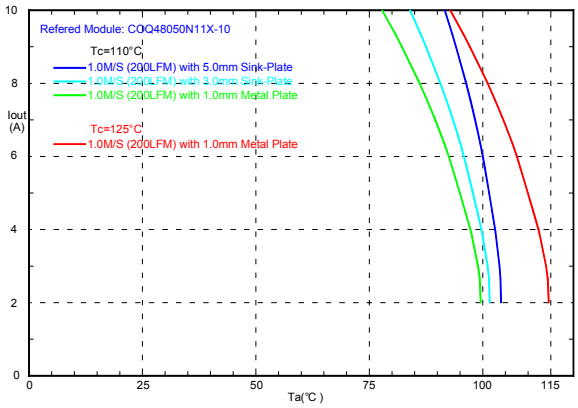
The thermal resistance data and efficiency plot in the data sheet can be applied to the equation below to determine the available power with specified operation ambient temperature.

$$P_O = (110\text{-}Ta)/ (\theta_{S5})(1/\eta\text{-}1)$$

For example: 200LFM at Ta=92ºC for COQ with 5.0mm metal plate. The available power is P_O=(110-93)/(3.17)(1/0.9-1)=48.26W, or equal to 5.0V/9.6A output.

Comparison

Simple comparison between module with 1.0mm metal plat, 3.0mm Sink-Plate, 5.0mm Sink-Plate and change setting for Tc=125ºC can be made by using COQ module shown as Plot-2.



Plot-2: Comparison for Tc=110ºC and Tc=125ºC

The result shows the improvement of derating performance was achieved and very closed to result of Tc=125ºC by using 5.0mm Sink-Plate with no increase on the maximum allowable temperature. The 3.0mm Sink-Plate also have significant improvement for high load condition. The Sink-Plate technology has no significant improvement for the light load condition that it is limited by the fixed no load power consumption.

Conclusion

The high conversion efficiency characteristic is the basic requirement for the modern power module to achieve lowest power loss. However, the latest application is requesting for more power again with smaller package, which may cause higher module temperature. This technical challenge can be solved by two methods. One is to upper the thermal limit for safe operation, which would offer the best effect to extract the available current but pay much for safe operation life.

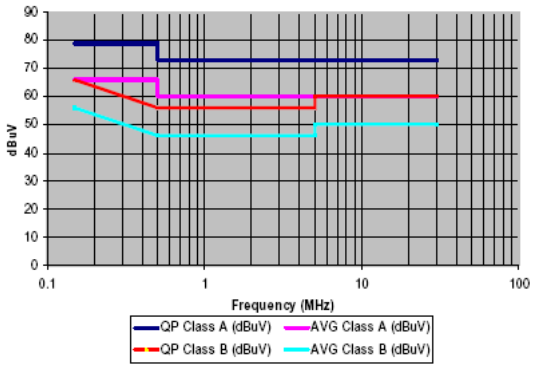
Another method is to reduce the module thermal resistance by adding more air contacted surface area, which would request low profile converter design with single board single component side mounting technology. It is able to cool~~ing~~ down the module and deliver more power with no impact on the reliability and safe operation life.

Module Noise Considerations

Input Side Conducted Noise

Conductive EMC Regulations

In order to achieve a useful EMC filter circuit design, the limits of conducted emissions EN55011/FCC derived from CISPR22 was shown as below and must be well understood.



The class A and class B requirements referring to the industrial standard and the domestic standard depend on the antenna used for detecting the noise. The European standards give a higher limit for quasi-peak antenna and the lower limit for average antenna, and both limits must be met for the equipment to pass. The FCC standards used in North America have similar specifications.

Common Mode Noise

Common mode noise is one major noise source of a power module; it comes from a common-mode current that caused by fast voltage change on switching devices and coupled through capacitances between switching device and other components. The common-mode energy travels on all the lines or wires in the same direction at the same time and results in any device between the lines to perform no attenuation. However, a common mode choke or a ground choke may provide impedance between lines and ground to reduce common current. To connect capacitors between lines and ground properly would also be helpful to reduce the noise.

Differential Mode Noise

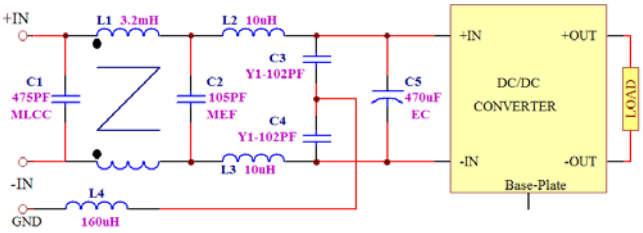
Differential-mode noise is the AC-component of input current that is caused by pulsating switching current in power stage of power module. This produces a noise voltage between the positive and negative input power terminal, which is opposite in direction or phase with respect to each other. Generally, all Glary converters have an internal π filter to differential-mode conducted noise. However, an external capacitor should be placed between input lines to reduce the noise level again to meet EMC requirement. The capacitor should be placed close to the module to minimize the loop cross-sectional area and further reduce possible emission due to high frequency ripple current. To twist the input leads or layout a PCB power planes would also be helpful for noise cancellation and to eliminate second order coupling from near field magnetic flux radiation.

Bandwidth of EMC Components

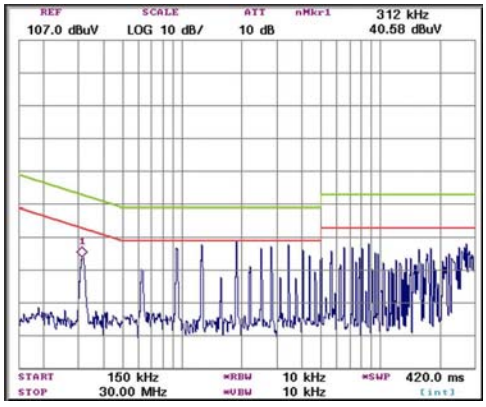
No components are ideal for all frequency ranges. Capacitor may loss its capacitive property when the lead inductance dominates its impedance and inductor will becomes a capacitive element when parasitic capacitance becomes important at high frequency. The Bandwidth of EMC Components should be taking into consideration when designing an EMC filter circuit. To connect ceramic capacitor with electricity capacitor in parallel and connect low inductance inductor with big one could get a better bandwidth.

Referenced EMC Circuit

The referenced EMC circuit was made by verifying a 600W UH48120P20M-S50 power module that is shown as below for a reference to design a useful EMC filter fit into system. It should be noted that the circuit values might need to be modified to meet different requirements of each application.



The tested curve is show as below to demonstrate the performance of the referenced EMC filter circuit with UH48120P20M-S50 module.

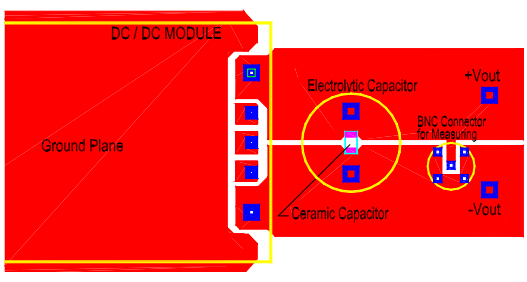


Radiated Noise

The magnetic field radiation and electric field radiation were called “near-field” radiation that decays quickly as a function of distance not usually affects the radiated measurements. However, electromagnetic radiation caused by high frequency current flow through circuit element or traces can be radiated to far distance, it can be minimized by proper board layout to keep all leads with AC current short circuit, twisted or run as ground planes to minimize loop cross-sectional area would be greatly helpful. Glary has six-side metal package option for several product series and could provide extra RFI shielding performance for critical application. It should be noted that in many cases if the device fails in the common mode current test, it will also fail in the radiated-emission test since the lines would carry common mode noise and perform as an antenna to emit radiated noise.

Output Side Ripple/Noise

The output ripple/noise performance can be improved by adding more low-ESR external capacitors closed to output terminals. The reference trace layout that should provide corrective measuring capability and improve output ripple/noise performance is show as below.



General Application Information

Storage/Handling

Module Storage

It is user's liability to avoid module being overexposure to moisture during storage; board mount assembly and board rework. A below 30˚C temperature 85%RH storage condition is acceptable for on production line 24 hours storage maximum to avoid possible risk from wave soldering process.

The solder terminal plating material of Glary module is gold metal, which can meet MSL1 level requirement for long-term storage. However, the module must go through a de-moisture process by being placed into a chamber of 85˚C for 12 hours before use, to prevent the module from risk of explosion caused by heated moisture during soldering process. The recommended module storage condition is 30˚C-60%RH.

Module Handling

The user must take responsibility during storage, board mount assembly and board rework to avoid module over stress due to drop, impact or any kind of tools touch to its surface and components. The user should also prevent the module from the damage of electrostatic discharge. Except for activities following the application notes herein stated, any extra direct work without consulting and/or consensus with Glary, including but not limit to cutting pins, adding or removing potting compound or glues or enclosures, unauthorized electrical and/or mechanical analysis, would result in waiver of Glary's service and warranty liabilities whatsoever.

Soldering

Hand Soldering

Hand soldering is the preferred method for Glary module due to the variability of the amount of solder applied, the time the soldering iron is held on the joint, the temperature of the iron, and the temperature of the solder joint. A temperature-controlled 70W solder iron with 0.125" tip and 425°C setting is suitable for terminal soldering work. The soldering time is 3S~6S for 0.04" terminal pin diameter, 5S~10S for 0.06" terminal pin diameter and 8S~16S for 0.08" terminal pin diameter.

These guidelines above may require modification to optimize the soldering time for your particular circuit board or soldering iron. The exact soldering time and temperature for your specific application can be determined by mounting a thermocouple to the power module terminal using high-temperature solder. The minimum soldering time is defined as the time required for the terminal to reach 125 °C. The maximum soldering time is the time required for the terminal to reach 165 °C. The power module's internal temperature must stay below the storage temperature of 183 °C or at least less than the critical continuous temperature of 183 °C.

Wave Soldering

Glary understands that wave soldering is the most popular soldering method for the solder attachment of through-hole component leads for mass volume productions. Glary power modules are designed to be compatible with single-wave, dual-wave or turbid-wave soldering machines. The suggested soldering process is to keep the power module's internal temperature below 183 °C. The typical recommended preheat temperature range is between 90 °C and 105 °C on the module-side of the circuit board. The pin-side of circuit board preheat temperature is recommended to be greater than 120 °C, and preferable within 100 °C of the solder-wave temperature, a maximum preheat rate of 4°C/s of the solder-wave temperature, a maximum preheat rate of 4°C/s is suggested. The maximum recommended solder pot temperature is 250 °C with a typical solder-wave dwell time of 3 seconds or up to 6 seconds maximum.

Cleaning/Drying

Cleaning

Post solder cleaning is usually the final process of circuit board assembly prior to electrical-board testing. The result of inadequate circuit board cleaning can affect both the reliability of a power module and the testability of the finished circuit-board assembly. Glary power modules are compatible with most cleaning processes but the cleaning materials should be chosen to be compatible with plastic parts or potted material inside the module. Incompatible cleaning material may cause malfunction or reduce its long-term operation reliability.

Drying

The drying process should be equipped with blowers capable of generating 1000cfm of air or above so that the amount of rinse water left to be dried off with heat is minimal. Handheld air guns are not recommended due to the variability and non-consistency of the operation. For open-frame power module constructions with magnetic structures (transformers and inductors) that have un-potted windings or cavities, a heating process of 100°C-0.5 hours inside the chamber is recommended for the assembly to ensure that the moisture and other potential foreign contaminants are driven out from the open windings and cavities to ensure that no residues would affect long-term reliability and isolation voltage.

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Pad Layout

The pad layout ~~for~~ of Glary power module is depending on its current rating. The low current model just requires a simple through hole to carry load current. However, the large current models would introduce high I^2R loss at the solder point, which may cause over heating effect and further reduce the reliability. The pad layout for high current terminal pins becomes the most important consideration of the circuit board design.

Through Hole Size

For the 0.04" (1.0mm) terminal pins: use the 0.05" (1.25mm) diameter plated through hole with minimum 0.08" (2.0mm) diameter solder pad for all modules layout.

For the 0.06" (1.5mm) terminal pins:

Low Current Module: use the 0.075" (1.80mm) diameter plated through hole with minimum 0.12" (3.0mm) diameter solder pad for the circuit board layout.

High Current Module: use the 0.075" (1.80mm) diameter plated through hole with minimum 0.12" (3.0mm) diameter solder pad for the circuit board layout. It is necessary to have 4pcs~8pcs 0.5mm diameter of current distribution via to surround each through hole to reduce the current density and I^2R loss. The optional double pin layout will be necessary when ultra high current module was used.

For the 0.08" (2.0mm) terminal pins:

Low Current Module: use the 0.10" (2.54mm) diameter plated through hole with minimum 0.16" (4.0mm) diameter solder pad for the circuit board layout.

High Current Module: use the 0.10" (2.54mm) diameter plated through hole with minimum 0.16" (4.0mm) diameter solder pad for the circuit board layout. It is necessary to have 5pcs~10pcs 0.5mm diameter of current distribution via to surround each through hole to reduce the current density and I^2R loss. The optional double pin layout will be necessary when ultra high current module was used.

Parallel connection / operations and current share application note

Overview

This document will examine method for active load sharing, basic criteria and performances of such a function on Glary UH and PS module series.

This application note provides also a brief summary about some general guidelines to help accomplishing the task.

System requirements and premises

The basic requirements of a power supply system, consisting of a number of paralleled sources, to increase the total load current are:

-to maintain a regulated output voltage under variations in line or load;

-to control the output current of each supply just to share the total load current equally;

To maximize reliability of the system there are the following features:

-Achieve redundancy, so that a failure of any one supply can be tolerated as long as there is sufficient current capacity available from the remaining power units;

-Implement a load sharing method without any external control system.

In addition, these are the following desirable features:

-to have a common, low bandwidth share bus interconnecting all power units;

-to achieve good load sharing transient response;

-the ability to margin the system output voltage with one control.

In other words, the combination of power supplies behaves like one large supply with equal stress on each of the units. Also, reliability can be better secured by taking advantage of load sharing to incorporate modular redundancy.

Load sharing techniques

There are a number of schemes to achieve load sharing.

Six methods are possible: the following method is passive method while all the rest are active methods.

O-ring diode method

This is the most passive common method of paralleling power modules by using an O-Ring diode on each unit. By using power modules with adjustable outputs, it is possible to 'Balance' the current sharing of the units. By taking a 'differential' voltage measurement at the anodes of the O-Ring diodes current will be shared more equally the closer the differential voltage is to zero. This method has the disadvantage of an additional power loss in the diodes and dissipation of the heat generated in the diodes.

The droop method

The Droop method programs the output impedance of the power supplies to achieve load sharing. It is a simple open loop method, but is not accurate.

The dedicated master

This approach is to select a master module to perform the voltage control and force the remaining modules (slaves) to act as current sources. A dedicated Master approach with current mode supplies will facilitate current sharing but it does not achieve redundancy.

External controller

This method is to use an external controller to perform the load sharing. This is achieved by comparing all loads sharing signals from the individual power units and adjusts the corresponding feedback signal to balance the load currents. This system does perform well but requires an additional controller and multiple connections between the controller and each supply.

Automatic current sharing – average current method

For automatic current sharing no external controller is required and a single share bus interconnects all the supplies. This requires an adjustment amplifier that compares a current signal from the share bus to the individual units current and adjusts the reference of the voltage amp until equal load current distribution is achieved.

The average Current method is a patented technique where each power module's current monitor drives a common share bus via a resistor. While this scheme performs accurate current sharing, it can result in a specific application problem. An example is when a supply runs into current limit, causing the share bus to be loaded down and the output voltage to regulate to the lower adjust limit. A similar failure mode will exist if the share bus is shorted or if any unit on the share bus is inoperative.

Automatic current sharing – highest current method

This technique for automatic current sharing shown compares the highest current module to each individual current, and adjusts the reference voltage accordingly to correct the imbalance of load current.

This technique is similar to the average current method except that the resistor is replaced with a diode, allowing only one unit to communicate on the share bus. This method provides for excellent sharing among the slaves with an error in the master's load current contribution because of the diode.

Internal IC Load Share Regulator has improved this function by replacing the diode with a unidirectional buffer to reduce the master's error. An inoperative or insufficient capacity supply will not effect the sharing of the operational units.

A shorted share bus will disable the reference adjustment section used for load sharing, making the units operate as stand-alone.

A generic load share system with the basic bus connections required performing accurate output voltage control and load sharing is shown in Fig 1. The output voltage is sensed with a fully differential, high-impedance voltage amplifier.

Each individual power supply current is sensed with a differential current amplifier, and it is used for the load share portion of the circuit.

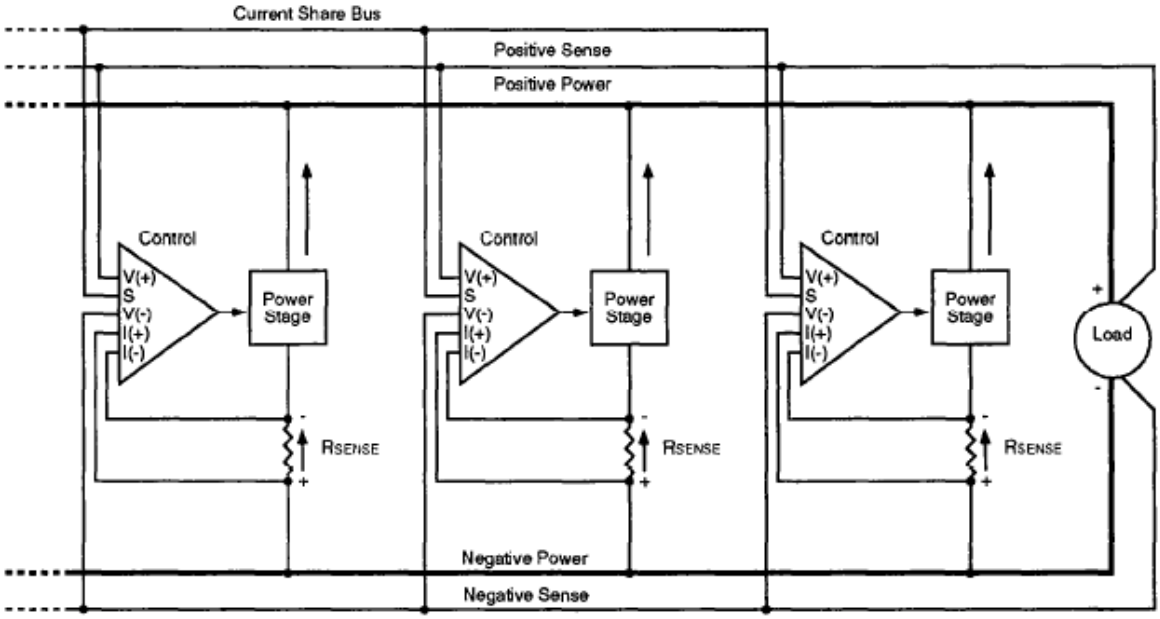

Fig. 1. Basic bus connections required performing accurate output voltage control and load sharing

The share bus signal interconnecting all the paralleled modules is a low-impedance, noise insensitive line. The connection diagram is shown in FIG 2. The following discussion of the voltage and current sharing loops should help the user to understand the operation and features of this technique.

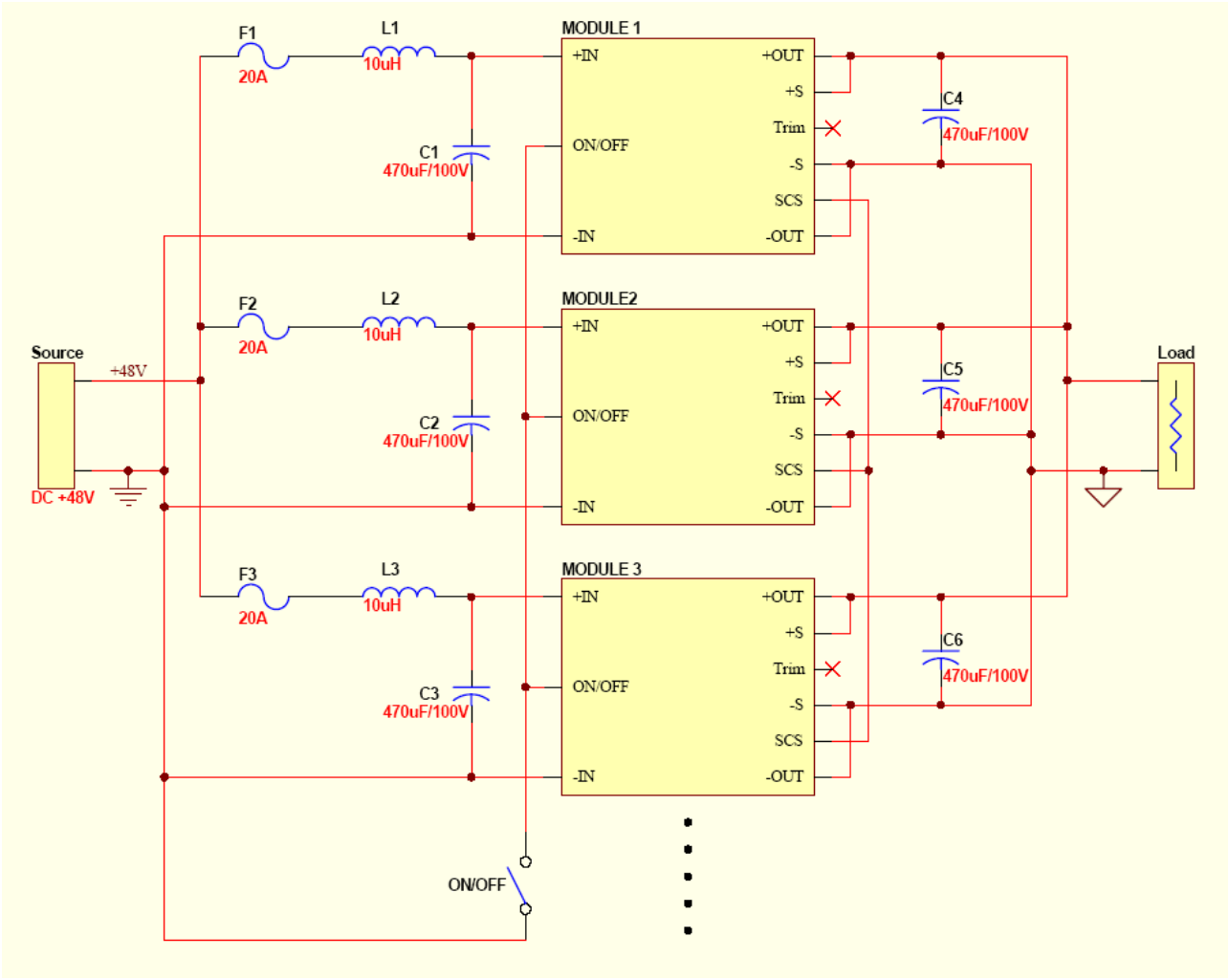

Fig. 2. System connections for modules with independent load sharing

External design basic criteria, design rules, suggestions and reached performances

Layout considerations

It is quite imperative to adopt a symmetrical and “star node” layout of the power circuit with minimum loop area and impedance for each PCB track between modules and load. This basic criterion is also to avoid loop noise generation.

Basic connection diagram to be followed is shown on Fig. 2.

When using units connected in parallel, best suggestion is to not connect **sense pins** unless load is far away from output pin’s module; basic criteria to decide about this issue is related to voltage drop across PCB tracks that is suggested to be less than 0,5% of the output voltage; just in case output voltage drop is higher than what is suggested, sense pins can be conveniently connected to load as shown on Fig. 2

Important issue is: **do not connect trim pins and circuitry** when parallel configuration is adopted in order to not defeat parallel performances.

Electrical ratings and thermal suggestions of power modules connected in parallel

All modules connected in parallel are suggested to be mounted on the same heat sink in order to achieve the best possible thermal coupling. It is the best to space the modules apart over the whole surface of the heat sink to avoid creation of hot spots on the heat sink and to minimize heat density.

The current rating of the whole assembly must not exceed 80% to 90% of the total current capability of the modules just to compensate for unavoidable parameter variations between the modules.

Modules must have very symmetrical designs with very short connections both for power and control terminals. Parasitic resistance of connections has to be very low in order to facilitate a parallel module layout with minimum loop impedance.

Additional external components

External delayed fuse type is suggested to be connected on each output DC/DC lines as close as possible to output pins. This suggested solution is to prevent any burns on the system just in case one module goes on hypothetical short circuit failure and so may sink all the current of the entire system. Alternative or equivalent solution to fuse is OK.

A suggested alternative active solution can be implemented by using the Linear Technology IC LTC4357 (Positive High Voltage Ideal Diode Controller) driving N-channel MOSFETs placed in parallel as substitution of above fuse.

This simple solution enhances system reliability and prevents hazard situations.

The suggested best current trip value of fuse could be around 160% of the maximum output current of each module.

General considerations

Paralleling of power modules with good current sharing can be achieved by following some important guidelines. The above recommendations and greater care and maximum precautions are necessary if the number of paralleled modules increases and become very high.

Theoretically speaking the **maximum number of paralleled modules limitation does not exist; however the maximum quantity suggested is over 16-18 pieces**; the only precaution that is necessary to adopt is a safe and reliable design for the entire system and particular attention to electrical power point of view.

Overall electrical Performances for parallel

-Current share tolerance: **+/-5%**

-Voltage tolerance with current share: **+/-1%**

Mountains in Taiwan

For more information, please contact with
Glary Power Technology:

Headquarter: No. 51, Taichung Ind. Park 42nd Rd.,
Hsi-Tun Dist., Taichung 407,
Taiwan, R.O.C.

E-mail: service@glary.com
Tel: +886 4 23507467
Fax: +886 4 23506841
Internet: www.glary.com

Glary Power Technology *Innovator of Power Converter*