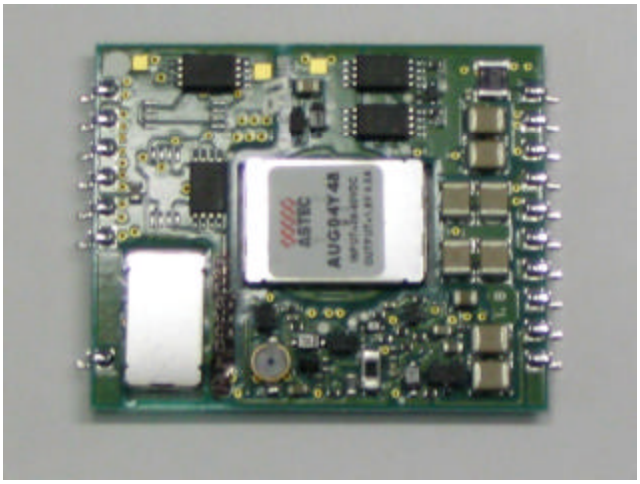
Technical Reference Note
Ultra Low Profile
AUG 15W Series

AUG 15W Ultra Low Profile DC – DC Module

(Pb-free reflow compatible and ROHS Compliant)

The AUG 15W series is Astec's new Ultra Low Profile, 48Vin, SMT isolated single output modules. With the Ultra Low Profile SMT design (only 4.3mm height), the module can be flexible mounted on the top side or the bottom side of motherboard. The AUG 15W series also comes with enhanced features such as Remote on/off (RC), parallel Application (PO), Power Good (ALM), and the protection of OVP, OCP and UVLO.



Special Features

- **Ultra Low Profile – 4.3mm height**
- **Efficiency – 89% @ 5V**
- **-40 °C to +85°C Ambient Operating temperature (0.2m/s air flow)**
- **Open Frame SMT**
- **Low output ripple and noise**
- **Regulation to zero load**
- **CISPR22, Class A for Conduct and Radiated EMI**
- **Parallel Application**
- **UL/cUL 60950, CE Mark**
- **Pb-free reflow compatible and ROHS Compliant**

Electrical Parameters

Input

Input range	**36 – 60Vdc**
	60 – 75Vdc (forced air 1.0m/s)
Efficiency	**89% @5Vo**

Control

Enable	**ON: RC pin connected to –Vin or Open**
	OFF: RC pin connected to +Vin

Output

Line / Load Regulation	**+5%, -3%**
Ripple and Noise	**50mVp-p**
OVP	**120% of Vonom (Latch-up)**
OCP	**5.3A for 1.2V** **4.5A for 1.8V –3.3V** **3.1A for 5V**
LVP	**90% of Vonom (Latch-up)**
Isolation	**1500VDC (1 minute)**

AUG 15W Ultra Low Profile Series
THIS SPECIFICATION COVERS THE REQUIREMENTS

MODEL NAME	SIS CODE	Vout,Iout
AUG05K48	AUG05K48	1.2V @ 5.2A
AUG04Y48	AUG04Y48	1.8V @ 4.5A
AUG04G48	AUG04G48	2.5V @ 4.5A
AUG04F48	AUG04F48	3.3V @ 4.5A
AUG03A48	AUG03A48	5V @ 3A

Electrical Specifications

STANDARD TEST CONDITION on a single unit, unless otherwise specified.

T_A:	25°C (Ambient Air)
+Vin (P16-17):	36 – 60Vdc
	60 – 75Vdc (forced air 1m/s)
-Vin (P18-19):	Return for +Vin
RC (P13):	Open
+Vo (P2-4):	Connect to load
-Vo (P5-6):	Return for +Vo
PO (P14):	Open
ALM(P12):	Open

ABSOLUTE MAXIMUM RATINGS

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or in any other conditions in excess of those given in the operational sections of the specs. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Input Voltage						
Continuous		V_{IN}	36	-	60	Vdc
Continuous (1m/s LFM)		V_{IN}	60		75	Vdc
Transient (200µs, 42V/10/µs rate)		$V_{IN,trans}$	-	-	90	Vdc
Operating Temperature (0.2m/s air flow)			-40		85	ºC
Storage Temperature	All	T_{STG}	-40	-	90	ºC
Operating Humidity	All	-	10	-	95	%

INPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage		V_{IN}	36	48	60	Vdc
Input Voltage (1m/s LFM)		V_{IN}	60		75	Vdc
Turn-on Voltage			32		36	Vdc
Turn-off Voltage			30		34	Vdc
Maximum Input Current[2] (V_{IN} = 0 to $V_{IN,max}$; I_O = $I_{O,max}$)	All	$I_{IN,max}$	-	-	1.0	A

Note: 1. This power module is not internally fused. The use of an input line fuse (GMA-10A Bussman fuse or equivalent) is recommended.
2. The value is static only and rated for UL/cUL safety. In-rush current to charge internal capacitors is not specified.

OUTPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Voltage Setpoint	AUG05K48	$V_{O,SET}$		1.2		Vdc
(V_{IN}=$V_{IN,min}$ to $V_{IN,max}$ at	AUG04Y48	$V_{O,SET}$		1.8		Vdc
I_O=$I_{O,max}$)	AUG04G48	$V_{O,SET}$		2.5		Vdc
	AUG04F48	$V_{O,SET}$		3.3		Vdc
	AUG03A48	$V_{O,SET}$		5.0		Vdc
Output Regulation:						
Line: V_{IN}=$V_{IN,min}$ to $V_{IN,max}$	All	-	-3	-	+5	%
Load: I_O=$I_{O,min}$ to $I_{O,max}$	All	-	-3	-	+5	%
Output Ripple and Noise						
Peak to Peak: 5Hz to 20MHz	All	-	-	-	50	mV_{PK-PK}
Output Current Range	1.2V	I_O	0	-	5.2	A
	1.8V	I_O	0	-	4.5	A
	2.5V	I_O	0	-	4.5	A
	3.3V	I_O	0	-	4.5	A
	5.0V	I_O	0	-	3	A
Output Current Limit Inception[3]	1.2V	I_O	-	5.3	-	A
	1.8V	I_O	-	4.65	-	A
	2.5V	I_O	-	4.65	-	A
	3.3V	I_O	-	4.65	-	A
	5.0V	I_O	-	3.1	-	A
Over Voltage Protection	All			120		%Vo
Low Voltage Protection	All			90		%Vo
Efficiency						
Ta = 25ºC. Vin =48V, Io=Iomax	1.2V	η	77	82	-	%
	1.8V	η	79	84	-	%
	2.5V	η	81	86	-	%
	3.3V	η	83	88	-	%
	5.0V	η	84	89	-	%

Note: 3. This feature is only for module protection and is not intended for customer application. The value is specified at 25C ambient air temperature.

OUTPUT SPECIFICATIONS (*Continued*)

Parameter	Device	Symbol	Min	Typ	Max	Unit
Switching Frequency	1.2V	-	-	510	-	KHz
	1.8V	-	-	520	-	KHz
	2.5V	-	-	600	-	KHz
	3.3V	-	-	640	-	KHz
	5.0V	-	-	640	-	KHz
Dynamic Response: Slew Rate	All	$\Delta I_O/\Delta t$	-	0.3 x Io / 100uS	-	A/µs
Load Change: 50% - 100% I_O,max	All	-	-	-	10	$\%V_O$
Load Change: 100% to 50% $I_{O,max}$	All	-	-	-	10	$\%V_O$
Turn-On time (Input to Output)[5] I_O = Iomax; V_{IN} = $V_{IN,nom}$ to $V_{O,nom}$	All	-	15	-	250	ms

Note: 5. Input to Output Turn-On time is defined as the difference between t1 and t2: where t1 is the time when the input voltage reaches the minimum V_{IN} (V_{IN} = $V_{IN,MIN}$) and t2 is the time when the output voltage reaches it's specified range (V_O = $V_{O,SET-Min}$).

ISOLATION SPECIFICATION

Input to Output Isolation: 1500Vdc (1 minute)

SAFETY APPROVAL

The AUG (15W) is certified under the following agencies:

- UL/cUL 60950, and CE Mark.

The module shall not be considered approved and carry safety agency logos until this has been authorized by Safety and QA / QC management.

Basic Operation and Features

Over Current Limit Inception (OCP)
The Isolated DC-DC converter limits output current when the current is over the maximum output current due to abnormality such as overload or short circuit. When over current condition continues and output voltage decreases to the point of low voltage protection, the DC-DC converter will be in latch up mode. To restore the output, remove the abnormality and re-set the input voltage under 5V for 1 second minimum.

Over Voltage Protection (OVP)
The Isolated DC-DC converter stops the operation when the output voltage is over the specified Over Voltage Protection point, the converter will be in latch up mode after 0.5ms*. To restore the output, re-set the input voltage under 5V for 1 second minimum.

Notes*: Output voltage might exceed the point at which OVP starts to function under the specific condition of transient input voltage or output current change. Therefore, OVP is set to wait for the mask time 0.5ms.

Low Voltage Protection (LVP)
If output voltage is under the specified Low Voltage Protection point, the converter will halt the operation. After typical 500ms mask period, the converter will be in latch up mode. To restore the output, re-set the input voltage under 5V for 1 second minimum.

Remote On/Off Control (RC)
If RC pin is open or connected to –Vin, the converter is turned on. If RC is connected to +Vin, the converter is turned off.

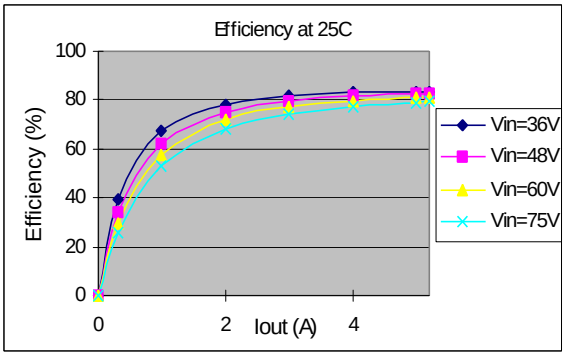
Alarm Output (ALM)
The Alarm output will be down to the –Vin level (Open Drain Output) at the condition of Over Voltage Protection or Low Voltage Protection. The maximum sink current in ALM pin is 10mA. When operating in parallel application, all operating units can be simultaneously halt by connecting all the ALM pins together, in the condition of Over Voltage Protection or Low Voltage Protection caused by any single converter. Maximum number for parallel operation is 10 units

Synchronous Turn On/Off
Connect the PO (parallel Operation) pins of all operating units together will synchronize the turn on / off time in parallel application.

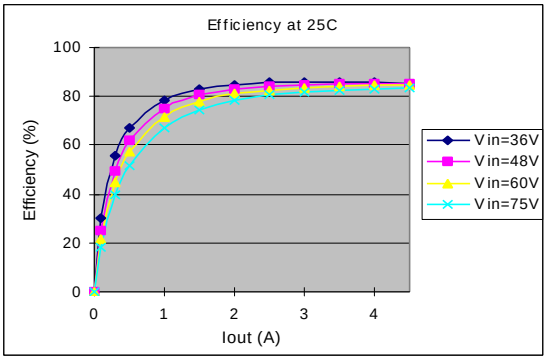
MODULE PIN ASSIGNMENT

PIN #	DESIGNATION	
P1, 10, 11, 20	NC	Mechanical supplemental contact pins
P2, 3, 4	+Vo	+ Output
P5, 6	-Vo	- Output
P12	ALM	Alarm Output
P13	RC	Remote On/Off
P14	PO	Parallel Operation
P15	NC	-
P16, 17	+Vin	+ Input
P18, 19	-Vin	- Input

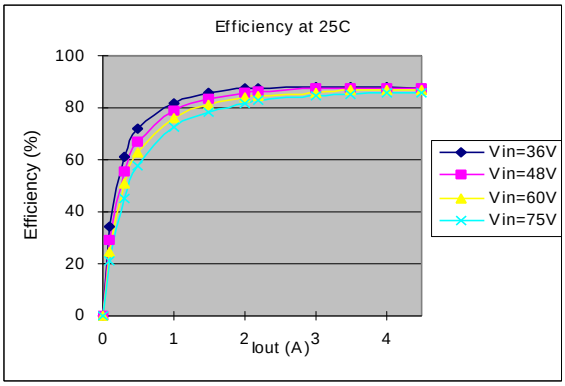
Performance Curves



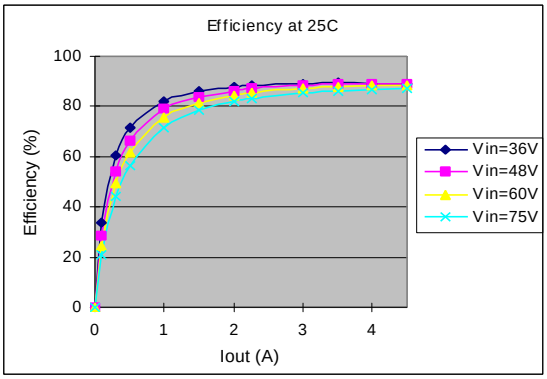
Efficiency vs. Load Current Curves for 1.2Vo



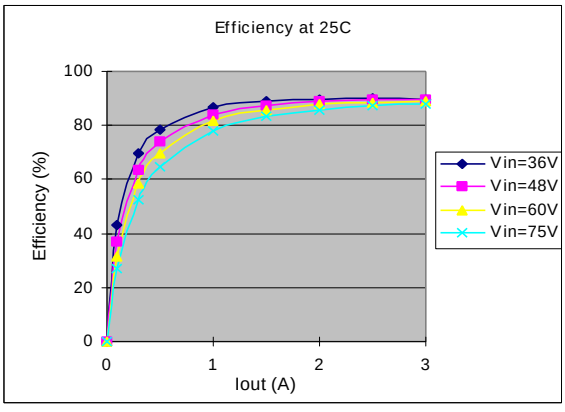
Efficiency vs. Load Current Curves for 1.8Vo



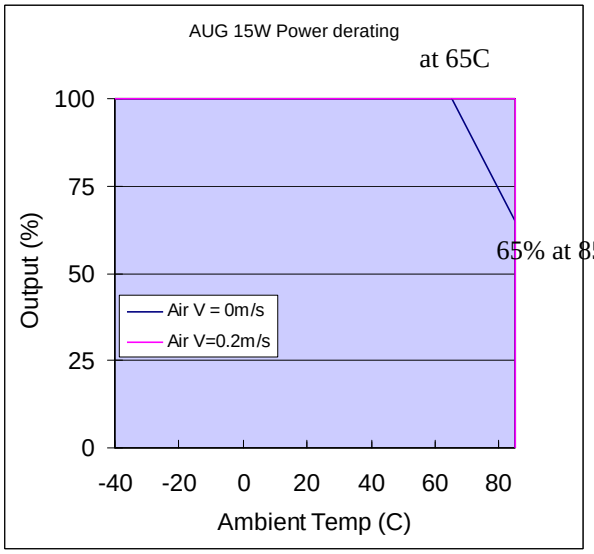
Efficiency vs. Load Current Curves for 2.5Vo



Efficiency vs. Load Current Curves for 3.3Vo



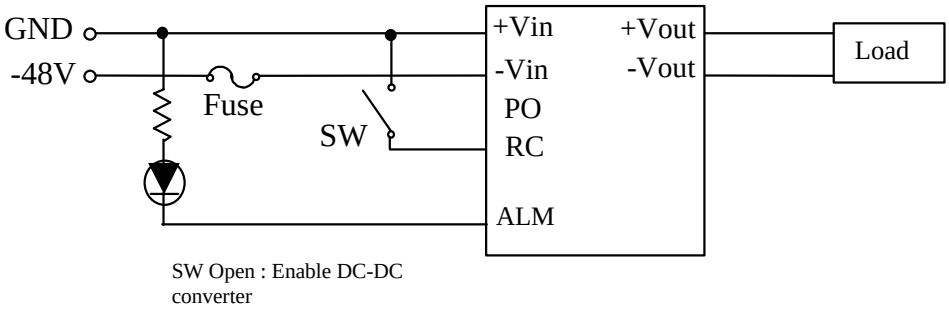
Efficiency vs. Load Current Curves for 5.0Vo



Derating Curve for the AUG 15W Series

Typical Application Circuit

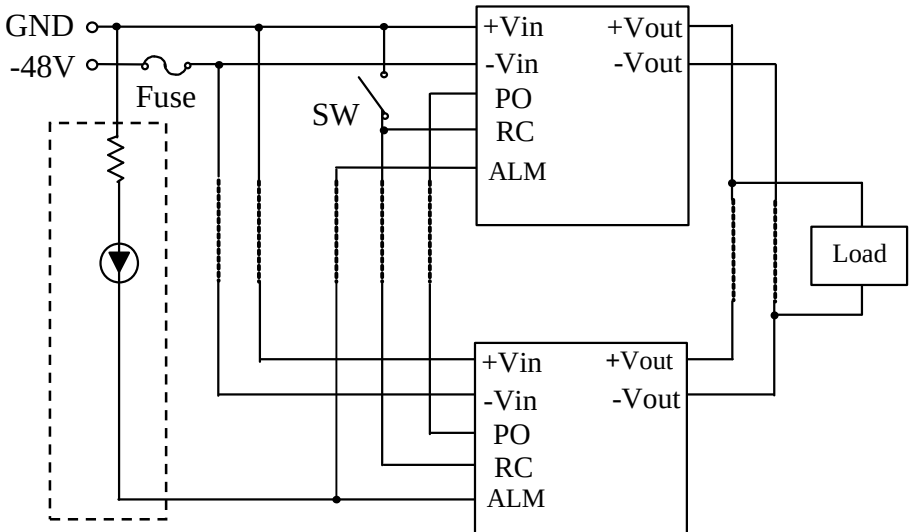
A) Single Operation



SW Open : Enable DC-DC converter

Figure 1

B) Parallel Operation (A single power supply connects to multiple DC-DC converters to apply for higher output current more than rated one from a DC-DC converter)



SW Close : Halt all DC-DC converter with RC connected together
Maximum units in parallel: 10pcs

Figure 2

i) All PO pins should be connected together
ii) All DC-DC converters with ALM pins connected will stop the operation when one single converter is halted in mode protected by LVP or OVP.
iii) LED is optionally connected to ALM pin for the notice of DC-DC converter stoppage.

C) Multiple Operation: A single power supply connects to multiple DC-DC converters to individually distribute output current to multiple independent loads.

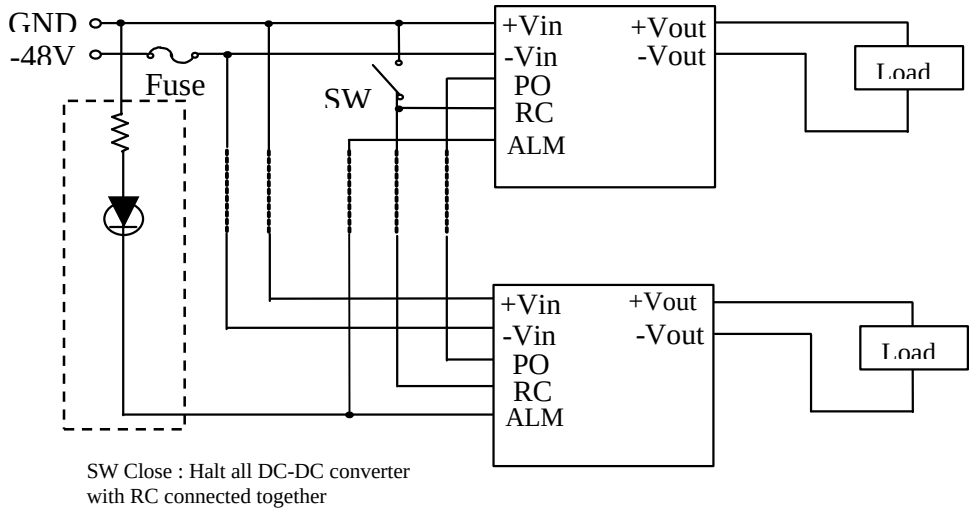
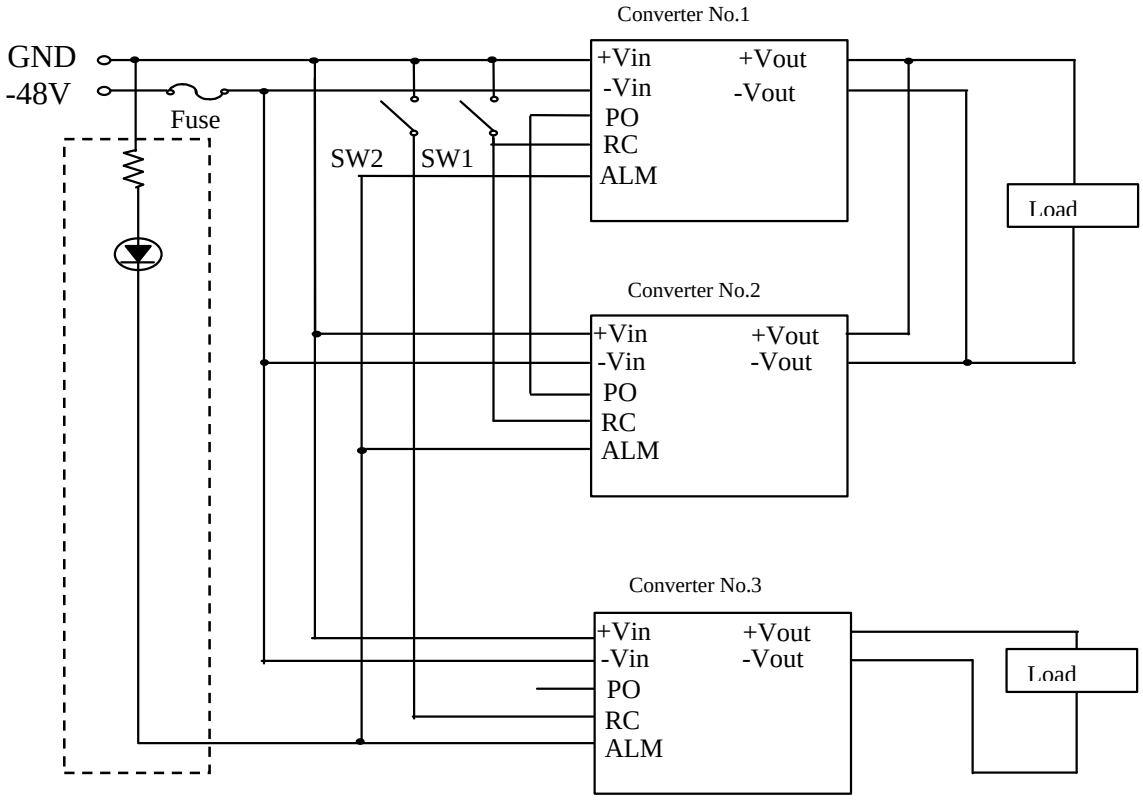


Figure 3

i) All DC-DC converters with ALM pins connected will stop the operation when one single converter is halted in mode protected by LVP or OVP.
ii) LED is optionally connected to ALM pin for the notice of DC-DC converter stoppage.

D) complex parallel and multiple (Sequence start-up): Two converters supplying the same output voltage for a single load and another converter supplying the different output voltage for another load.

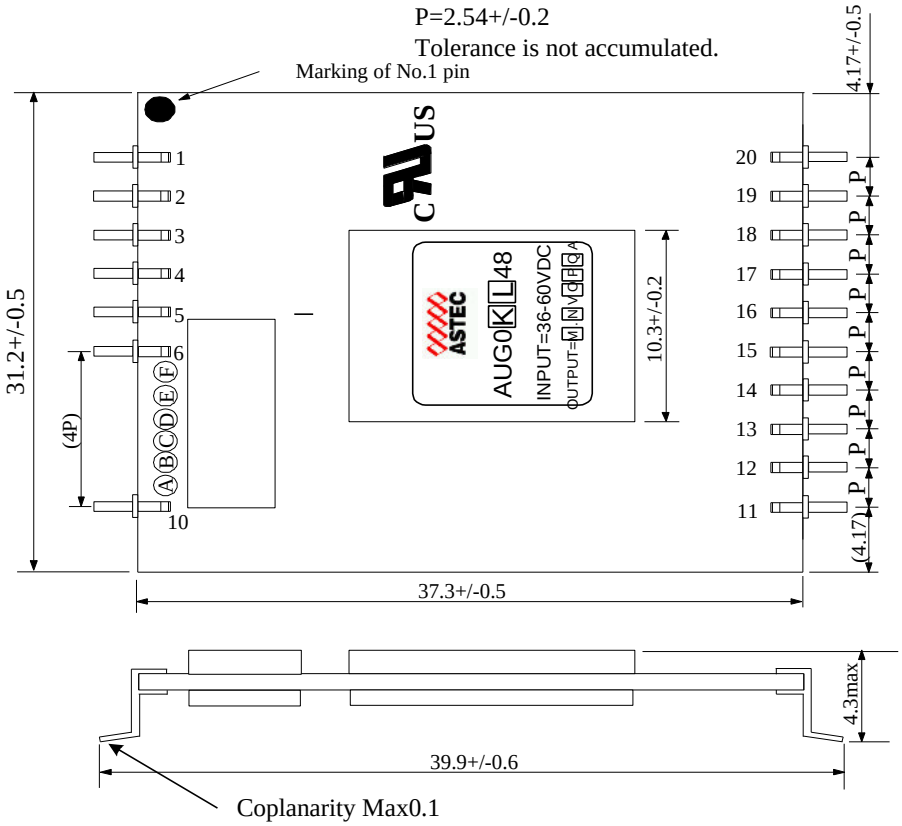


SW1 Close : Halt DC-DC converter No.1 and 2
SW2 Close : Halt DC-DC converter No.3

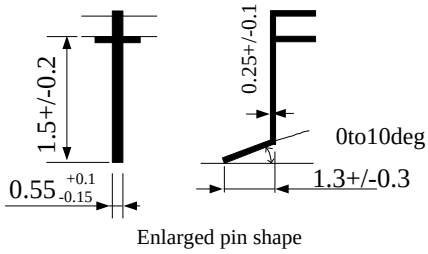
Figure 4

i) PO pins of the converters supplying the same output voltage are connected to the others and another PO pin of the different output voltage converter is not connected.
ii) All three DC-DC converters, which are connected to ALM pins, stop their operation when a single one is halted in mode protected by LVP or OVP.
iii) LED is optionally connected to ALM pin for the notice of DC-DC converter stoppage.

Mechanical Specifications



.Unit : mm



Enlarged pin shape

Pin No	Symbol	Function
1,10,11,20	NC	Mechanical supplemental contact pins
2	+Vout	+Output
3	+Vout	+Output
4	+Vout	+Output
5	-Vout	-Output
6	-Vout	-Output

Pin No	Symbol	Function
12	ALM	Alarm output
13	RC	Remote on/off control
14	PO	Parallel operation
15	NC	-
16	+Vin	+Input
17	+Vin	+Input
18	-Vin	-Input
19	-Vin	-Input

Notes: A : Factory symbol
B : The last number of production year
Example: 2 stands for 2002
C : Production month
(1,2,3,.....,9,O, N, D)

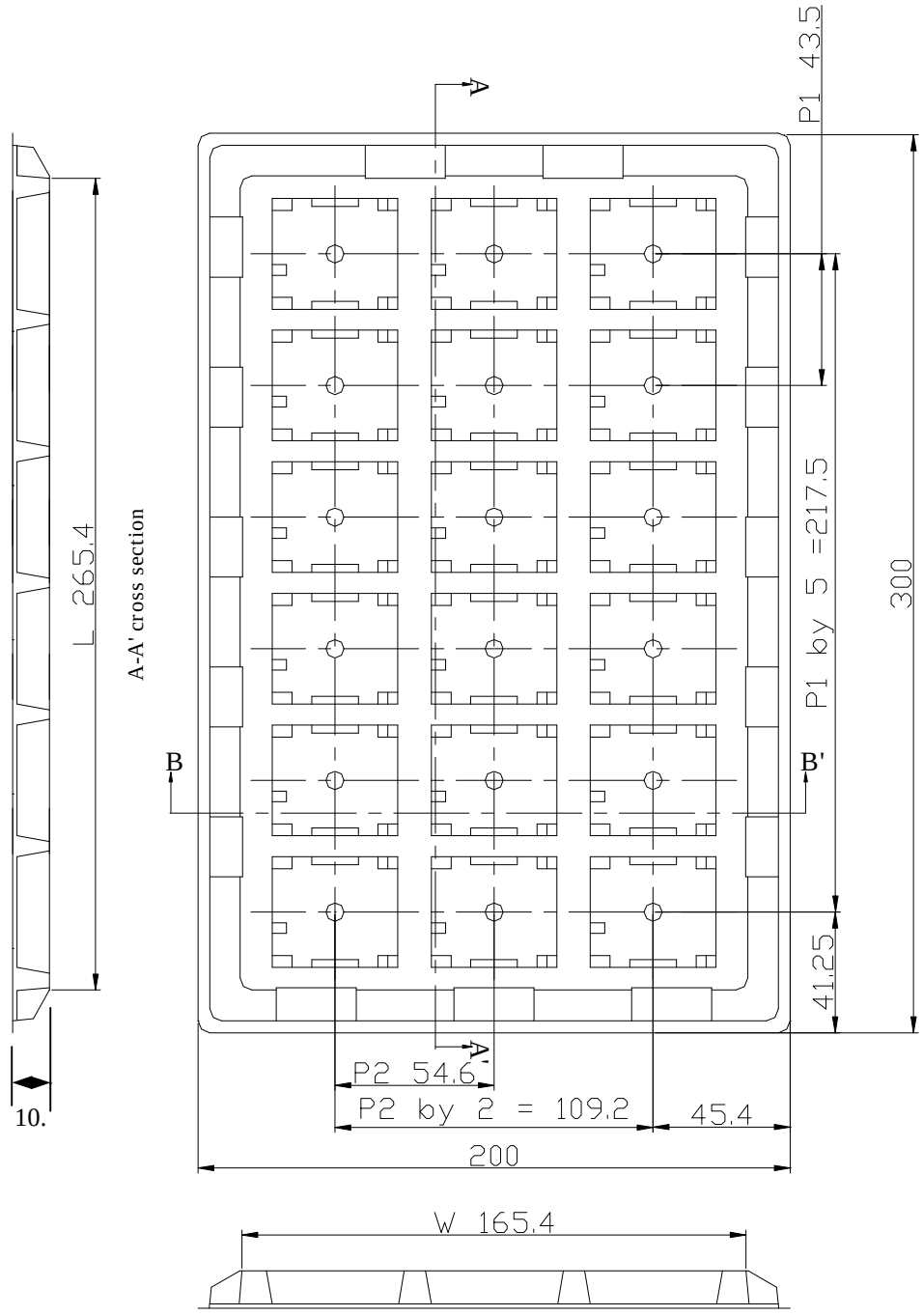
K: Output current symbol
L: Output voltage symbol
M, N: Output voltage
O, P, Q: Output current

Unit Weight: 8.9g

PACKING AND SHIPPING

Trays

Tray Dimensions

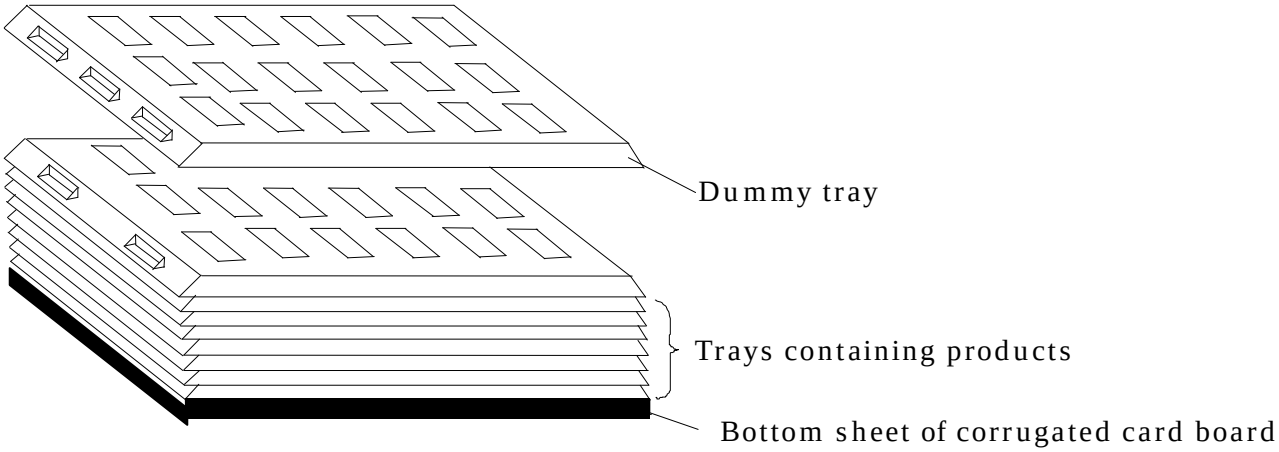


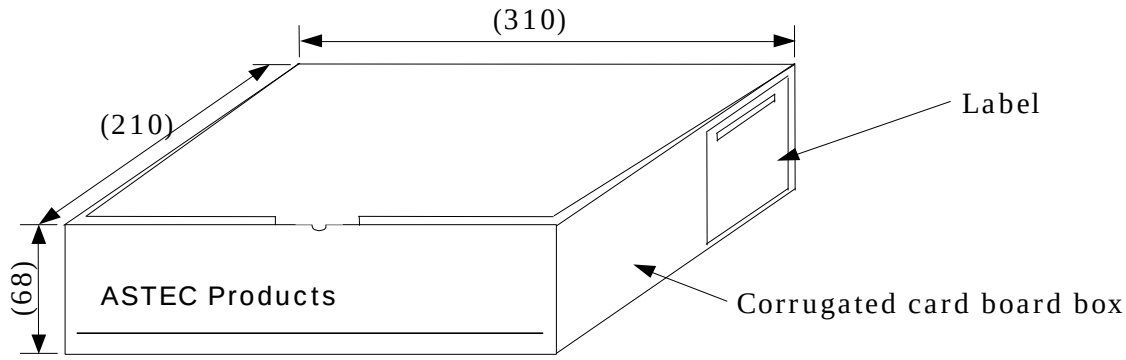
B-B' cross section

Maximum pieces per a tray : 18pcs/tray

Package

Corrugated cardboard box contains trays with products. Tray is heaped with alternately opposite direction to prevent products from contacting against the bottoms of trays.





Numerals in parentheses are reference only.

Unit : mm

Label;written by : Part Number,
: Quantity,
: Inspection Number.
: CE Mark

Reflow Soldering Information

Soldering

I) Flux

Solder the products with Rosin Flux (0.2wt%. chloride or less).
Do not use acid or soluble flux, because they may damage metallic parts and glass parts and may cause defective or reduce quality.

II) Solder

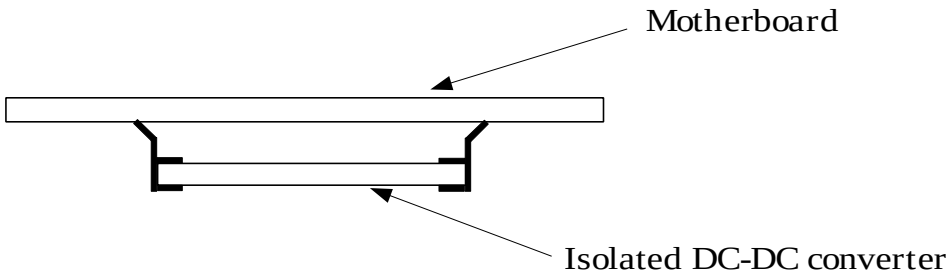
SnAgCu solder compatible

III) Condition of Soldering – Recommended soldering profile (J-STD-020C):

Reflow Profile	:	Infrared or air blow
Preheating	:	150 – 200 deg C for 60 to 150sec
Peak temperature	:	240 ± 5 deg C at surface.
Maximum period above 220deg.C	:	20 – 60sec
Ramp rate	:	lower than 4 deg C / sec

Recommendation

Do not give vibration to products while solder melts under reflow process.
Please handle to wait for products cooled down enough.
Please don't reflow a motherboard mounted the products on the lower side such as a below figure, because the products surely fall down from the motherboard.
If need, we recommend to use supplemental mechanical contact to pins at four corners of a substrate by other adhesive methods, for example, a thermal setting resin rather than soldering.



Recommend Storage Condition

Maximum storage period:	6 months
Storage condition:	30 deg C, 60%RH

Recommend baking the module at 100degC for 24 hours if storage period is longer than 6 months.