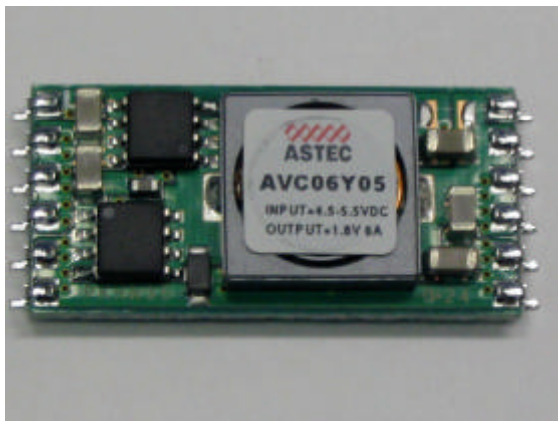


## *AVC 20W Ultra Low Profile DC – DC Module*

*(Pb-free reflow compatible and ROHS Compliant)*

The AVC 20W series is Astec's new Ultra Low Profile, 3.3Vin and 5Vin, SMT non-isolated single output modules with only 6.0mm height. The series also comes with enhanced features such as Remote on/off (ON/OFF), Output voltage adjust, and the protection of S/C and OTP.



### Special Features

- Ultra Low Profile – 6.0mm height
- Efficiency – 93% @ 3.3V
- -40 °C to +85°C Ambient Operating temperature (with derating)
- Open Frame SMT
- Low output ripple and noise
- Regulation to zero load
- Pb-free reflow compatible and ROHS Compliant

### Electrical Parameters

#### Input

Input range      2.96 – 3.63V for 3.3V, 4.5 – 5.5V for 5V  
Efficiency        93% @3.3Vo

#### Control

Enable            ON: ON/OFF pin Open or connect to +Vin  
                      OFF: ON/OFF pin connected to GND

#### Output

Ripple and Noise      50mVp-p (typ) for 5V  
                                  40mVp-p (typ) for 3.3V  
Output Voltage Adjust    +/-10% of Vonom

Isolation                    Non-isolated



**Technical Reference Note**  
**Ultra Low Profile**  
**AVC 20W Series**



AVC 20W Ultra Low Profile Series  
THIS SPECIFICATION COVERS THE REQUIREMENTS

<b>MODEL NAME</b>	<b>SIS CODE</b>	<b>Vout,Iout</b>	<b>Vin</b>
AVC06S04	AVC06S04	1.0V @ 6A	3.3V
AVC06K04	AVC06K04	1.2V @ 6A	3.3V
AVC06M04	AVC06M04	1.5V @ 6A	3.3V
AVC06Y04	AVC06Y04	1.8V @ 6A	3.3V
AVC06D04	AVC06D04	2.0V @ 6A	3.3V
AVC06G04	AVC06G04	2.5V @ 6A	3.3V
AVC06S05	AVC06S05	1.0V @ 6A	5.0V
AVC06K05	AVC06K05	1.2V @ 6A	5.0V
AVC06M05	AVC06M05	1.5V @ 6A	5.0V
AVC06Y05	AVC06Y05	1.8V @ 6A	5.0V
AVC06D05	AVC06D05	2.0V @ 6A	5.0V
AVC06G05	AVC06G05	2.5V @ 6A	5.0V
AVC06F05	AVC06F05	3.3V @ 6A	5.0V



# Technical Reference Note

## Ultra Low Profile AVC 20W Series



### Electrical Specifications

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

T <sub>A</sub> :	25°C (Ambient Air)
ON/OFF (P1):	Open or connect to +Vin
+Vin (P2-4):	2.97- 3.63V for 3.3V 4.5V – 5.5V for 5V
GND (P5-8):	GND
V <sub>o</sub> (P9-11):	Output voltage
ADJ (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	3.3V	V <sub>IN</sub>	0	-	4.6	Vdc
	5.0V	V <sub>IN</sub>	0	-	6.3	Vdc
Operating Temperature (with derating)			-40		85	°C
Storage Temperature	All	T <sub>STG</sub>	-40	-	85	°C
Operating Humidity	All	-	5	-	95	%

### **INPUT SPECIFICATIONS**

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	3.3V	V <sub>IN</sub>	2.97	3.3	3.63	Vdc
	5.0V	V <sub>IN</sub>	4.5	5.0	5.5	Vdc



# Technical Reference Note

## Ultra Low Profile

### AVC 20W Series



#### OUTPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit	
Output Voltage Setpoint ( $V_{IN}=V_{IN,min}$ to $V_{IN,max}$ at $I_O=I_{O,max}$ )	AVC06S04	$V_{O,SET}$	0.97	1.0	1.03	Vdc	
	AVC06K04	$V_{O,SET}$	1.0	1.2	1.236	Vdc	
	AVC06M04	$V_{O,SET}$	1.455	1.5	1.545	Vdc	
	AVC06Y04	$V_{O,SET}$	1.746	1.8	1.854	Vdc	
	AVC06D04	$V_{O,SET}$	1.94	2.0	2.06	Vdc	
	AVC06G04	$V_{O,SET}$	2.425	2.5	2.575	Vdc	
	AVC06S05	$V_{O,SET}$	0.97	1.0	1.03	Vdc	
	AVC06K05	$V_{O,SET}$	1.0	1.2	1.236	Vdc	
	AVC06M05	$V_{O,SET}$	1.455	1.5	1.545	Vdc	
	AVC06Y05	$V_{O,SET}$	1.746	1.8	1.854	Vdc	
	AVC06D05	$V_{O,SET}$	1.94	2.0	2.06	Vdc	
	AVC06G05	$V_{O,SET}$	2.425	2.5	2.575	Vdc	
	AVC06F05	$V_{O,SET}$	3.201	3.3	3.63	Vdc	
	Output Voltage Adjust ( $V_{IN}=V_{IN,min}$ to $V_{IN,max}$ at $I_O=I_{O,max}$ , $V_{IN} > V_{OUT} + 1V$ for 5V series $V_{IN} > V_{OUT} + 0.5V$ for 3.3V series)	All		-10		+10	%
Output Current Range	All	$I_O$	0	-	6	A	
Output Ripple and Noise Peak to Peak: 5Hz to 20MHz	5V <sub>in</sub>	-	-	50	100	mV <sub>PK-PK</sub>	
	3.3V <sub>in</sub>			40	80	mV <sub>PK-PK</sub>	
Efficiency $T_a = 25^\circ C$ . $V_{in} = 5.0V$ , $I_o = 4A$	1.0V	$\eta$	78	82	-	%	
	1.2V	$\eta$	80	84	-	%	
	1.5V	$\eta$	82	86	-	%	
	1.8V	$\eta$	84	88	-	%	
	2.0V	$\eta$	85	89	-	%	
	2.5V	$\eta$	87	91	-	%	
	3.3V	$\eta$	89	93	-	%	
	$T_a = 25^\circ C$ . $V_{in} = 3.3V$ , $I_o = 4A$	1.0V	$\eta$	80	84	-	%
		1.2V	$\eta$	83	87	-	%
		1.5V	$\eta$	85	89	-	%
		1.8V	$\eta$	86	90	-	%
		2.0V	$\eta$	88	92	-	%
		2.5V	$\eta$	89	93	-	%
	ON/OFF PIN (High Level Voltage)	5V <sub>in</sub>		4.2	-	-	V
3.3V <sub>in</sub>			2.7	-	-	V	
5V <sub>in</sub>			-	-	1.2	V	
3.3V <sub>in</sub>			-	-	0.4	V	
ON/OFF PIN (Low Level Voltage)	5V <sub>in</sub>		-	-	-	V	
	3.3V <sub>in</sub>		-	-	-	V	



**Technical Reference Note**  
**Ultra Low Profile**  
**AVC 20W Series**

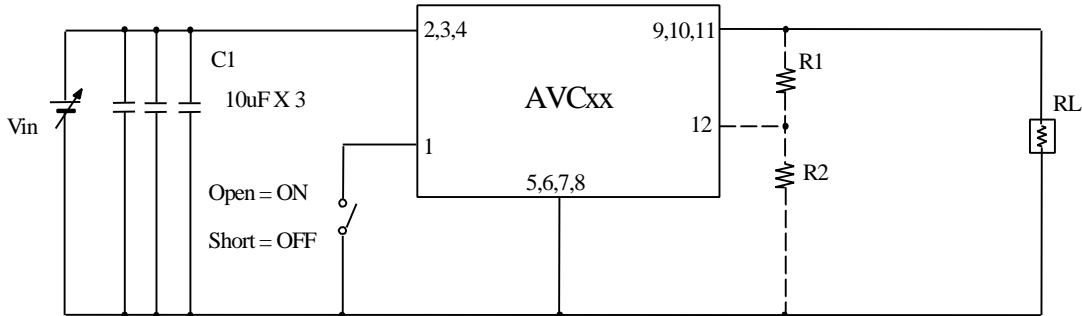
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Notes: If output is shorted to GND, or the module is heated abnormally, the DC-DC Converter will shut down.  
After removal the abnormal mode, the DC-DC Converter will re-start by re-input the Vin or toggling the ON/OFF pin.

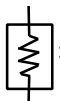
### Basic Operation and Features

Test Circuit

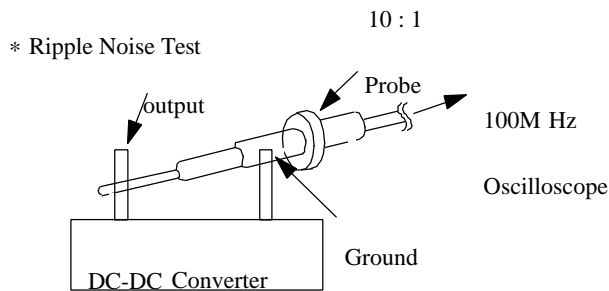


C1: GRM42-6B106K10×3 parallel (MURATA)

$V_{in}$   : DC Power Supply  
Model HP6621A, HP equivalent

RL  : Electronic Load Device  
Model EUL150  $\alpha$  XL, Fujitsu DENSO equivalent

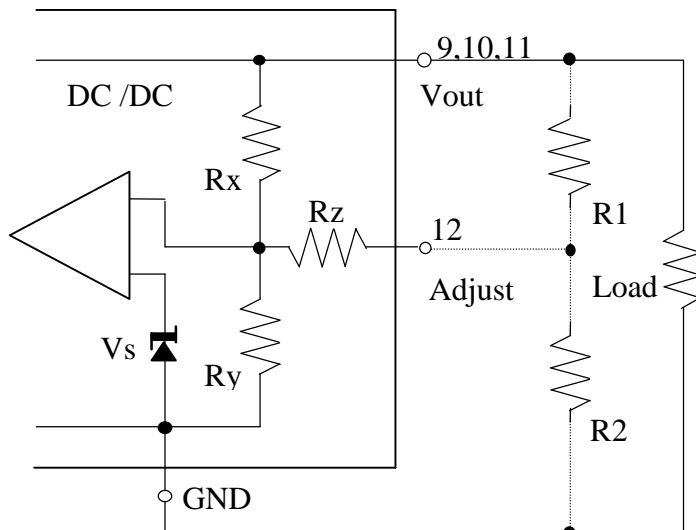
Pin5,6,7 and 8 are connected inside of DC-DC converter.  
However, please make sure that they are connected outside in order to prevent malfunction by noise.



### 11. Output Voltage adjustment

- When Adjust-pin (12pin) is left open, DC-DC converter applies nominal output voltage.
- Resistors connected between Adjust-pin(12pin) to Vout-pin (9~11pin) will decrease the output voltage between 90% ~ 100% of the nominal output voltage.(Vout-Down control)
- Resistors connected between Adjust-pin(12pin) to GND-pin (5~8pin) will increase the output voltage between 100% ~ 110% of the nominal output voltage.(Vout-Up control)
- The following equations give the required external-resistor value to adjust the output voltage to Voadj. When you change the output voltage, it is necessary to evaluate the characteristics of DC-DC converter at your board conditions.
- When Vout-Up is used, the input voltage must higher than the output voltage the following rate:
- 

AVC (Vin=3.3V)	Vin > Vout+0.5V
AVC (Vin=5V)	Vin > Vout+1.0V



Trim down the output voltage,

$$R1 = \frac{R_x * R_y (V_{oadj} - V_s)}{R_x * V_s - R_y (V_{oadj} - V_s)} - R_z$$

$$R2 = \text{Open}$$

Trim up the output voltage,

$$R1 = \text{Open}$$

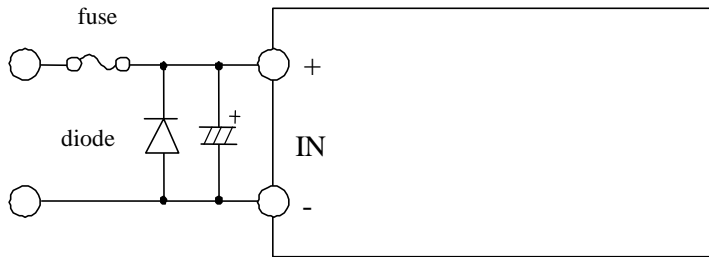
$$R2 = \frac{R_x * R_y * V_s}{R_y (V_{oadj} - V_s) - R_x * V_s} - R_z$$

<Internal parameter of DC-DC converter>

Nominal Output Voltage	[V]	1.0	1.2	1.5	1.8	2.0	2.5	3.3
Rx	[KΩ]	4.7	3.6	4.7	4.7	5.6	6.8	8.2
Ry	[KΩ]	29.73	14.64	16.16	8.40	7.00	6.80	4.60
Rz	[KΩ]	1.0	1.0	2.2	5.6	10.0	15.0	18.0
Vs	[V]	0.864	0.963	1.162	1.154	1.111	1.250	1.186

Be sure to provide an appropriate fail-safe function on your product to prevent a second damage that may be caused by the abnormal function or the failure of our product.

Please connect the input terminal by right polarity. If you connect this by mistake, it may break the DC-DC converter. In the case of destruction of the DC-DC converter inside, over input current may flow, and so DC-DC converter maybe occurred abnormal temperature rise, or your product may be damaged. Please add diode and fuse as following to protect them.



Standard of fuse : current rating

$$3.3V_{in} \quad : \quad 0.8 \times I_{outMax.} \times V_{out} \quad [A]$$

$$5.0V_{in} \quad : \quad 0.6 \times I_{outMax.} \times V_{out} \quad [A]$$

Please select diode and fuse after confirming the operation.





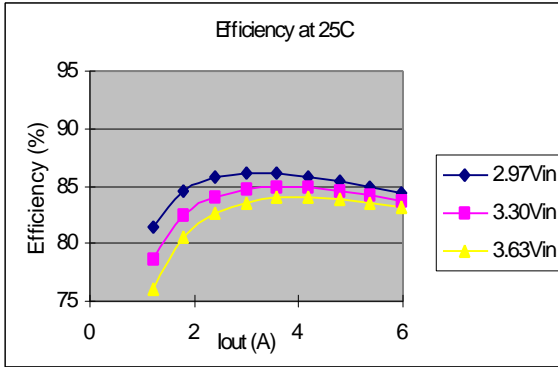
# Technical Reference Note

## Ultra Low Profile

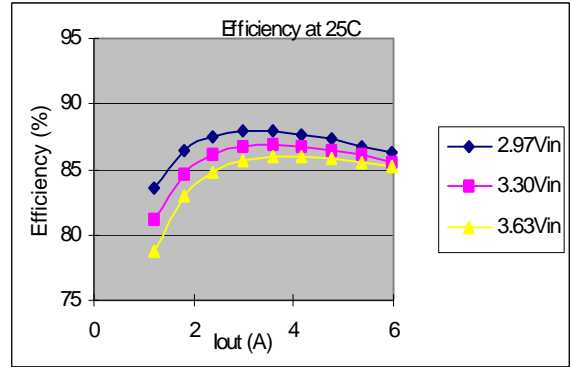
### AVC 20W Series



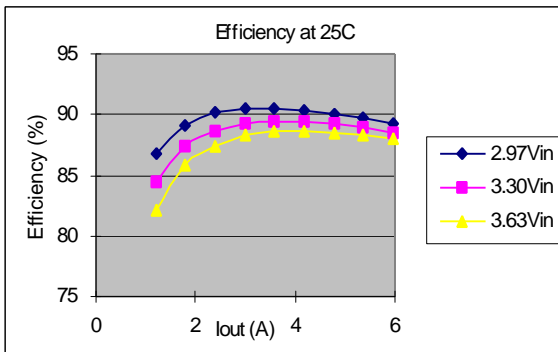
### Performance Curves



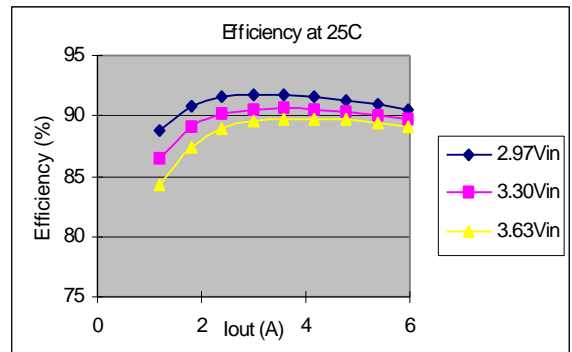
Efficiency vs. Load Current Curves for AVC06S04



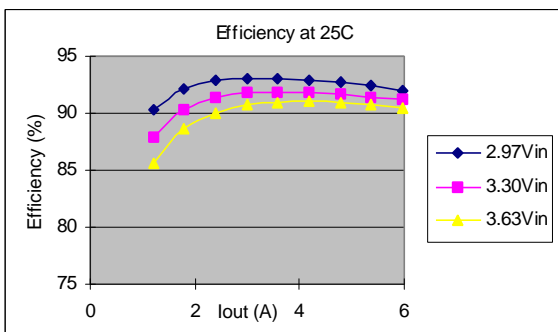
Efficiency vs. Load Current Curves for AVC06K04



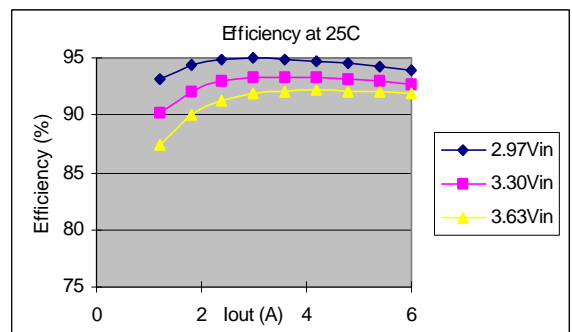
Efficiency vs. Load Current Curves for AVC06M04



Efficiency vs. Load Current Curves for AVC06Y04



Efficiency vs. Load Current Curves for AVC06D04



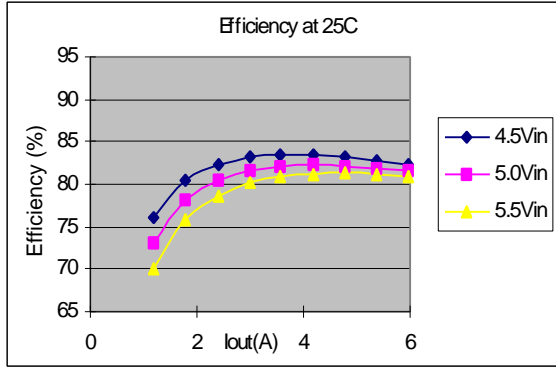
Efficiency vs. Load Current Curves for AVC06G04



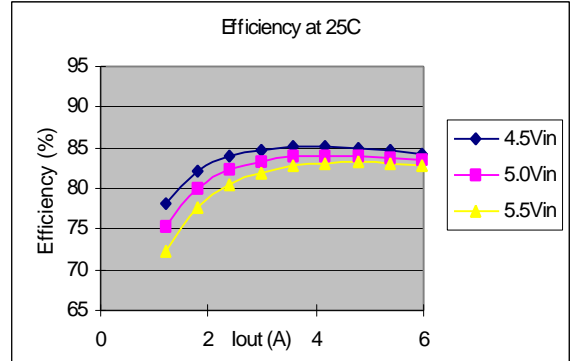
# Technical Reference Note

## Ultra Low Profile

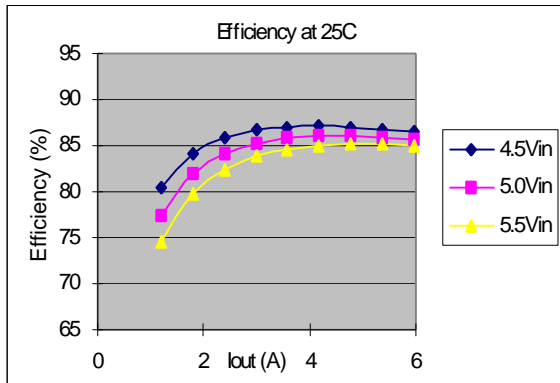
### AVC 20W Series



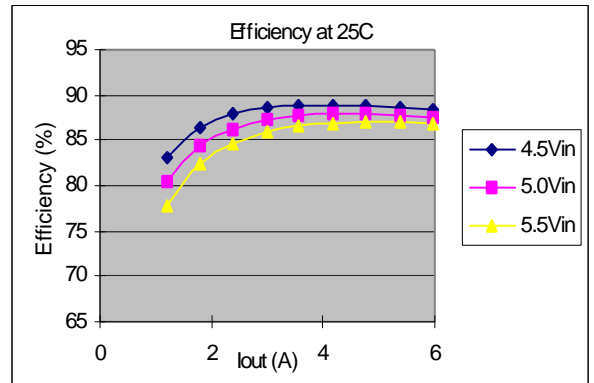
Efficiency vs. Load Current Curves for AVC06S05



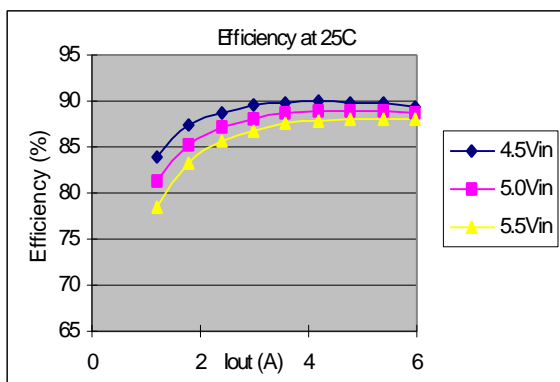
Efficiency vs. Load Current Curves for AVC06K05



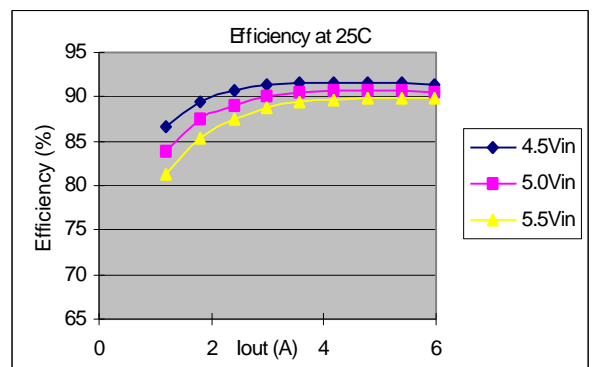
Efficiency vs. Load Current Curves for AVC06M05



Efficiency vs. Load Current Curves for AVC06Y05



Efficiency vs. Load Current Curves for AVC06D05



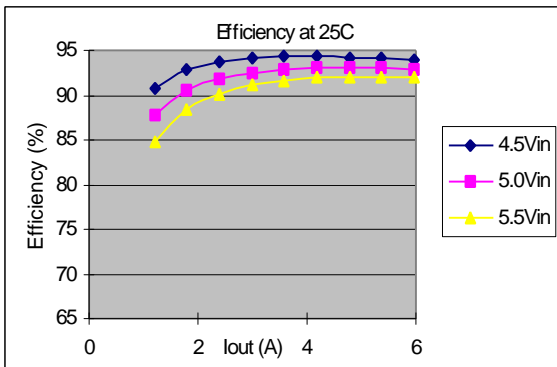
Efficiency vs. Load Current Curves for AVC06G05



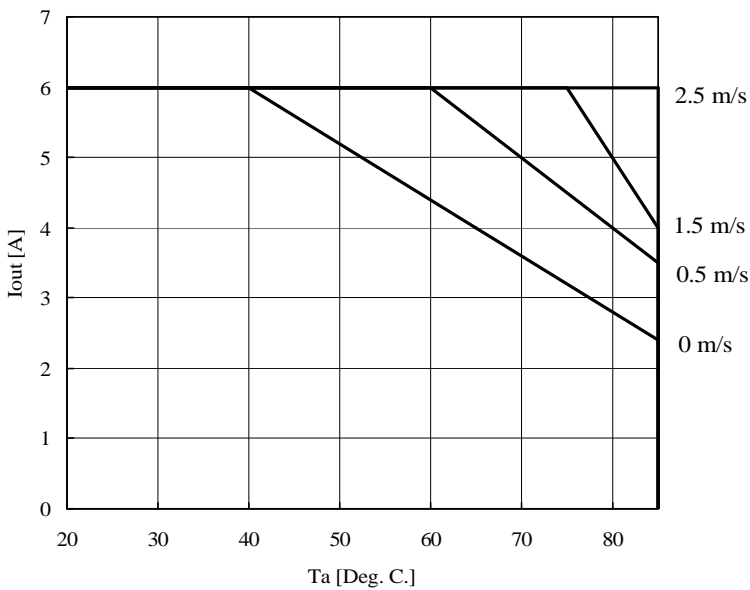
# Technical Reference Note

## Ultra Low Profile

### AVC 20W Series

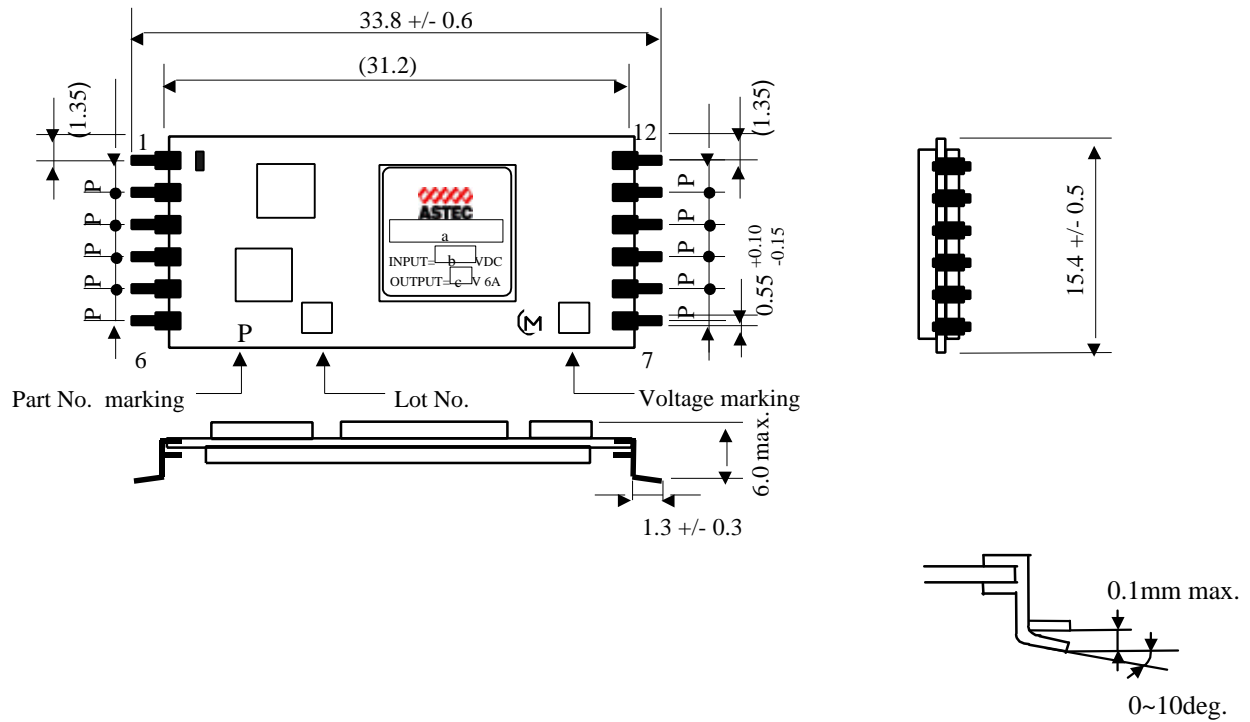


Efficiency vs. Load Current Curves for AVC06F05



Derating performance for the AVC series

### Mechanical Specifications



Pin No	Symbol	Pin No	Symbol
1	ON/OFF	7	GND
2	+Vin	8	GND
3	+Vin	9	Vout
4	+Vin	10	Vout
5	GND	11	Vout
6	GND	12	Adjust

Note: 1 Production Factory  
 2 Production Year  
 3 Production Month(1,2,3,...9,O,N,D)

Unit Weight: 3.9g

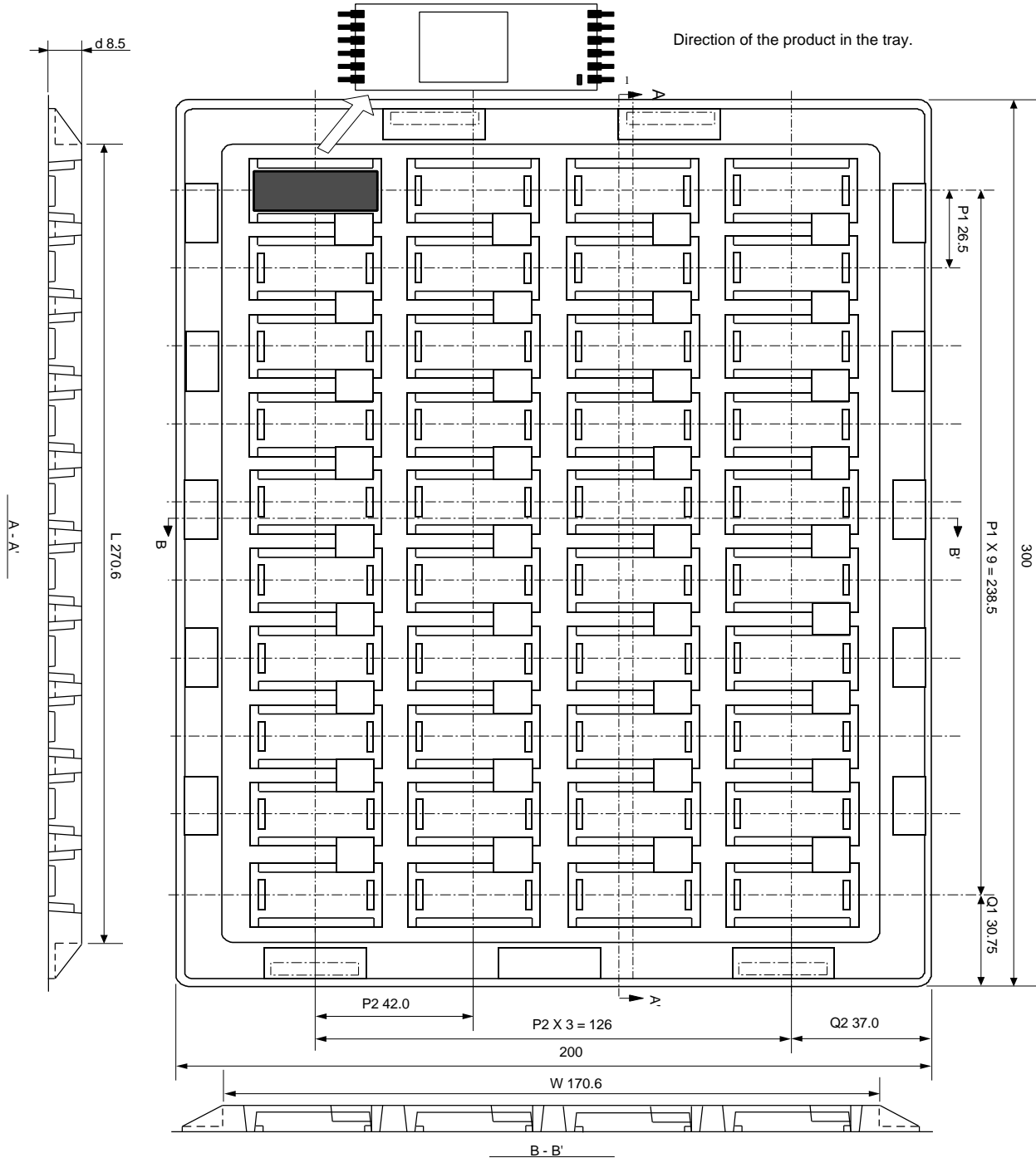
### PACKING AND SHIPPING

#### Trays

Tray Dimensions

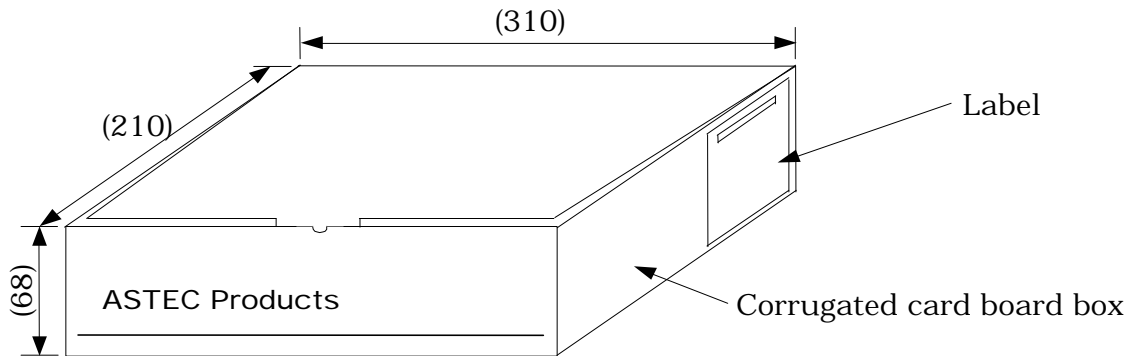
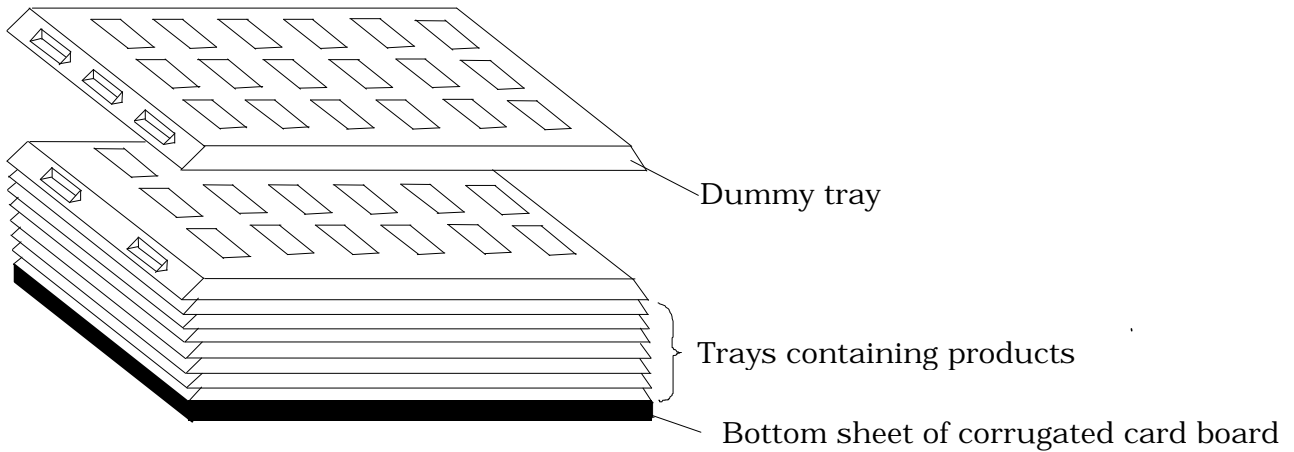
Unit : mm

General tolerance :  $\pm 1.5$



Maximum pieces per a tray : 40pcs/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.

**Reflow Soldering Information**

Soldering

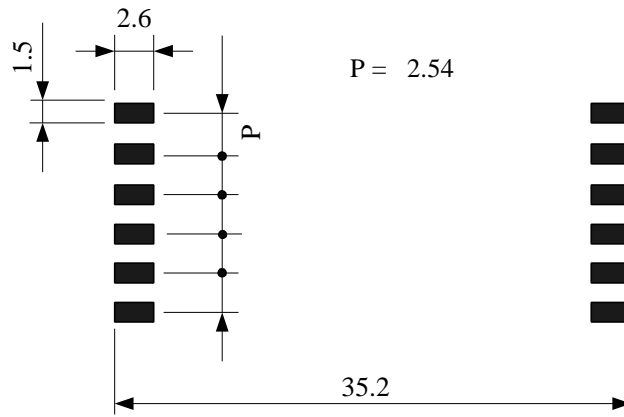
I) Flux

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) Recommendable Solder Land Pattern



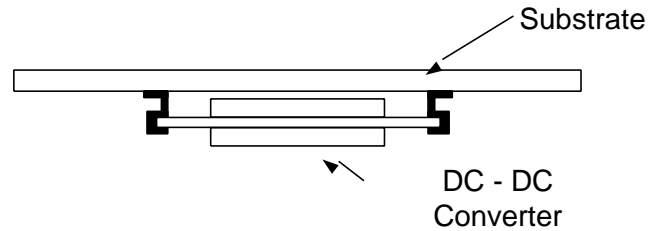
IV) Condition of Soldering – Recommended soldering profile (J-STD-020C):

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
Times :	1 time

V) Do not vibrate for the products on reflow.

Please need to take care temperature control because mounted parts may come off if the product are left under the high temperature.

Do not reflow DC-DC Converter as follows , because DC-DC Converter may fall down from a substrate during reflowing.



### **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.