

### *AEE (15W) Isolated DC/DC Converter Module*

#### *Industry Standard Size, 2" x 1" x 0.44"*

#### *9-36V/18-75V Inputs, 2.5V/3.3V/5V/±5V/12V/±12V/15V/±15V Outputs*

The AEE (15W) Isolated DC/DC Converter is Astec's 4:1 wide input voltage family for low power applications. With efficiency up to 84% typical for 5V module, this product is allowed to work at operating temperature range from -40°C to 71°C and a wide input voltage range of 4:1. Single-output and dual-output models are available for a wide range of applications in telecommunication, transportation equipment, etc.. Housed in small package, 2" x 1" x 0.44", with industry standard pinout, AEE family eases the PCB designs and mechanical designs of customers' end products.



**Industry Standard Size**  
2" x 1" x 0.44"

### Special Features

- Wide 4:1 input range
- High efficiency, 84% @ 5V
- -40°C to 90°C case surface operating temperature
- Input / Output isolation 1.5KVdc
- Low output ripple and noise
- Shielded metal case with size (2"x1"x0.44")
- Industrial standard pinout
- Lead-free soldering pins
- Fixed switching frequency (300KHz)
- Built-in input filter meets EN55022 / FCC Class A without external components

### Environmental Specifications

- Operating temperature: -40°C to +71°C
- Storage temperature: -55°C to +105°C
- MTBF: 1 million hours
- RoHS Compliant

### Electrical Parameters

#### Input

Input range	9-36 VDC; 18-75 VDC
Input Surge	50V / 100ms; 100V / 100ms
Efficiency	84% @ 5V (Typical)

#### Output

Regulation (Line, Load, Temp)	<2%
Ripple and noise	2% typical (100mV p-p max @ 5V)
Transient Response	5% max deviation with 50% load to full load 300uS (max) recovery
Short Circuit Protection	Indefinite

#### Safety

UL, cUL 60950 Recognized (File no. E186249)  
EN 60950  
IEC 60950





## Technical Reference Note AEE (15W) Family



### AEE (15W) SERIES

THIS SPECIFICATION COVERS THE REQUIREMENTS  
FOR AN INDUSTRY STANDARD PACKAGE OF 2"x1"x0.44", 4:1 INPUT RANGE,  
15W, SINGLE OUTPUT AND DUAL OUTPUT ISOLATED DC/DC CONVERTER

#### PART NUMBERS

MODEL NAME / SIS CODE	Nominal Vin / Range of Vin	Vout / Iout
AEE04G18-LS	24V / 9-36V	2.5V / 4A
AEE04F18-LS	24V / 9-36V	3.3V / 4A
AEE03A18-LS	24V / 9-36V	5V / 3A
AEE01AA18-LS	24V / 9-36V	±5V / ±1.5A
AEE01B18-LS	24V / 9-36V	12V / 1.25A
AEE00BB18-LS	24V / 9-36V	±12V / ±0.625A
AEE01C18-LS	24V / 9-36V	15V / 1A
AEE00CC18-LS	24V / 9-36V	±15V / ±0.5A
AEE04G36-LS	48V / 18-75V	2.5V / 4A
AEE04F36-LS	48V / 18-75V	3.3V / 4A
AEE03A36-LS	48V / 18-75V	5V / 3A
AEE01AA36-LS	48V / 18-75V	±5V / ±1.5A
AEE01B36-LS	48V / 18-75V	12V / 1.25A
AEE00BB36-LS	48V / 18-75V	±12V / ±0.625A
AEE01C36-LS	48V / 18-75V	15V / 1A
AEE00CC36-LS	48V / 18-75V	±15V / ±0.5A



## Technical Reference Note AEE (15W) Family



### ELECTRICAL SPECIFICATIONS

Unless otherwise indicated, specifications apply over all operating input voltage and temperature conditions. Standard test conditions on a single unit:-

Tambient :	25°C
+Vin :	24V ±2% (AEExxxx18-LS)
	48V ±2% (AEExxxx36-LS)
-Vin :	Return pin for +Vin
+Vout :	Connect to load
-Vout :	Connect to load (return)

### ABSOLUTE MAXIMUM RATINGS

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

Parameter	Device	Symbol	Min	Typ	Max	Unit
a) Input Voltage:						
Continuous:	AEExxxx18-LS	$V_I$	0	-	36	$V_{dc}$
Transient (100ms)	AEExxxx18-LS	$V_{I,trans}$	0	-	50	$V_{dc}$
Continuous:	AEExxxx36-LS	$V_I$	0	-	75	$V_{dc}$
Transient (100ms)	AEExxxx36-LS	$V_{I,trans}$	0	-	100	$V_{dc}$
b) Operating Temperature						
Ambient	All	$T_A$	-40	-	71	°C
Case Surface		$T_C$	-40	-	100	°C
c) Storage Temperature	All	$T_{STG}$	-55	-	105	°C
d) Operating Humidity	All	-	-	-	95	%
e) I/O Isolation (Conditions : 0.5mA for 60 sec)						
Input-Output	All	-	-	-	1500	$V_{dc}$
f) Output Power						
	2.5V	$P_{o,max}$	-	-	10	W
	3.3V	$P_{o,max}$	-	-	13.2	W
	Others	$P_{o,max}$	-	-	15	W



## Technical Reference Note AEE (15W) Family



### INPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit	
a) Operating Input Voltage	AEExxxx18-LS	$V_I$	9	24	36	$V_{dc}$	
	AEExxxx36-LS	$V_I$	18	48	75	$V_{dc}$	
b) Maximum Input Current AEExxxx18-LS ( $V_I = 0$ to $V_{I,max}$ ; $I_o = I_{o,max}$ )	2.5V	$I_{I,max}$	-	-	2.5	A	
	3.3V	$I_{I,max}$	-	-	3	A	
	5V / $\pm 5V$	$I_{I,max}$	-	-	3	A	
	12V / $\pm 12V$	$I_{I,max}$	-	-	3	A	
	15V / $\pm 15V$	$I_{I,max}$	-	-	3	A	
	AEExxxx36-LS ( $V_I = 0$ to $V_{I,max}$ ; $I_o = I_{o,max}$ )	2.5V	$I_{I,max}$	-	-	1.5	A
		3.3V	$I_{I,max}$	-	-	1.5	A
		5V / $\pm 5V$	$I_{I,max}$	-	-	1.5	A
		12V / $\pm 12V$	$I_{I,max}$	-	-	1.5	A
		15V / $\pm 15V$	$I_{I,max}$	-	-	1.5	A
		-	-	-	-	-	-
	c) No Load Input Power ( $V_I = V_{I,nom}$ )	All	-	-	-	0.5	W
	d) Recommended External Fuse Ratings	AEExxxx18-LS	2.5V	-	3	-	A
			3.3V	-	4	-	A
5V / $\pm 5V$			-	4	-	A	
12V / $\pm 12V$			-	4	-	A	
15V / $\pm 15V$			-	4	-	A	
AEExxxx36-LS		2.5V	-	2	-	A	
		3.3V	-	2	-	A	
		5V / $\pm 5V$	-	2	-	A	
		12V / $\pm 12V$	-	2	-	A	
		15V / $\pm 15V$	-	2	-	A	
		-	-	-	-	-	-
		-	-	-	-	-	-

**CAUTION: This power module is not internally fused. An input fuse must always be used.**



# Technical Reference Note AEE (15W) Family



## OUTPUT SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit	
a) Output Voltage Setpoint ( $V_I = V_{I, \min}$ to $V_{I, \max}$ ; $I_o = I_{o, \max}$ ; $T_A = 25^\circ\text{C}$ )	2.5V	$V_{o, \text{set}}$	2.45	2.50	2.55	$V_{dc}$	
	3.3V	$V_{o, \text{set}}$	3.23	3.30	3.37	$V_{dc}$	
	5V	$V_{o, \text{set}}$	4.90	5.00	5.10	$V_{dc}$	
	12V	$V_{o, \text{set}}$	11.76	12.00	12.24	$V_{dc}$	
	15V	$V_{o, \text{set}}$	14.70	15.00	15.30	$V_{dc}$	
	$\pm 5V$	$V_{o, \text{set}}$	$\pm 4.90$	$\pm 5.00$	$\pm 5.10$	$V_{dc}$	
	$\pm 12V$	$V_{o, \text{set}}$	$\pm 11.76$	$\pm 12.00$	$\pm 12.24$	$V_{dc}$	
	$\pm 15V$	$V_{o, \text{set}}$	$\pm 14.70$	$\pm 15.00$	$\pm 15.30$	$V_{dc}$	
b) Output Regulation: Line ( $V_I = V_{I, \max}$ to $V_{I, \min}$ ; $I_o = I_{o, \max}$ )	All	-	-	-	0.5	%	
	Load ( $V_I = V_{I, \text{nom}}$ ; $I_o = I_{o, \min}$ to $I_{o, \max}$ )	All	-	-	0.5	%	
	Cross ( $V_I = V_{I, \text{nom}}$ ; $I_o = +I_{o, \max}, -I_{o, \min}$ or $+I_{o, \min}, -I_{o, \max}$ to $+I_{o, \max}, -I_{o, \min}$ )	$\pm 5V/\pm 12V/\pm 15V$	-	-	-	4	%
	Temperature ( $T_c = -40^\circ\text{C}$ to $+90^\circ\text{C}$ )	All	-	-	-	1	% $V_o$
c) Output Ripple and Noise (Across $1\mu\text{F}$ @50V, X7R ceramic capacitor & $10\mu\text{F}$ @25V tantalum capacitor) See Figure 1. Peak-to-Peak (5 Hz to 20 MHz)	2.5V/3.3V/5V/ $\pm 5V$	-	-	-	100	mVp-p	
	12V/ $\pm 12V$ /15V/ $\pm 15V$	-	-	-	120	mVp-p	
d) Rated Output Current Single Output	2.5V	$I_o$	400	-	4000	mA	
	3.3V	$I_o$	400	-	4000	mA	
	5V	$I_o$	300	-	3000	mA	
	12V	$I_o$	125	-	1250	mA	
	15V	$I_o$	100	-	1000	mA	
	Dual Output	$\pm 5V$	$I_o$	$\pm 150$	-	$\pm 1500$	mA
		$\pm 12V$	$I_o$	$\pm 63$	-	$\pm 625$	mA
		$\pm 15V$	$I_o$	$\pm 50$	-	$\pm 500$	mA
e) Efficiency ( $V_I = V_{I, \text{nom}}$ ; $I_o, \text{max}$ ; $T_A = 25^\circ\text{C}$ )	2.5V	-	-	79	-	%	
	3.3V	-	-	80	-	%	
	5V	-	-	84	-	%	
	12V	-	-	84	-	%	
	15V	-	-	84	-	%	
	$\pm 5V$	-	-	82	-	%	
	$\pm 12V$	-	-	83	-	%	
	$\pm 15V$	-	-	83	-	%	
f) Switching Frequency	All	-	270	300	330	KHz	

### OUTPUT SPECIFICATIONS (Cont.)

Parameter	Device	Symbol	Min	Typ	Max	Unit
g) Dynamic Response : ( $\Delta I_o/\Delta t = 0.08A/\mu s$ ; $V_I = V_{I, nom}$ ; $T_A = 25^\circ C$ )						
Load Change from $I_o = 50\%$ to 100% of $I_{o, max}$	2.5V/3.3V/5V/ $\pm 5V$	-	-	-	5	% $V_o$
	12V/ $\pm 12V$ /15V/ $\pm 15V$	-	-	-	2	% $V_o$
Peak Deviation Settling Time (to $V_{o, nom}$ )	All	-	-	-	300	$\mu sec$
h) Turn-On Time ( $I_o = I_{o, max}$ ; $V_o$ within 1%)	All	-	-	5	10	msec
i) Output Voltage Overshoot ( $I_o = I_{o, max}$ ; $T_A = 25^\circ C$ )	All	-	-	1	4	% $V_o$

### FEATURE SPECIFICATIONS

Parameter	Device	Symbol	Min	Typ	Max	Unit
Undervoltage Lockout Turn-on Point	AEExxxx18-LS	-	-	8.7	9	V
	AEExxxx36-LS	-	-	16.5	18	V
Turn-off Point	AEExxxx18-LS	-	6.5	8	-	V
	AEExxxx36-LS	-	13	16	-	V
Isolation Capacitance	All	-	-	1000	-	PF
Isolation Resistance	All	-	10	-	-	$M\Omega$
Calculated MTBF ( $I_o = I_{o, max}$ ; $T_A = 25^\circ C$ )	All	-	700K	1M	-	Hours
Weight	All	-	-	-	40	g

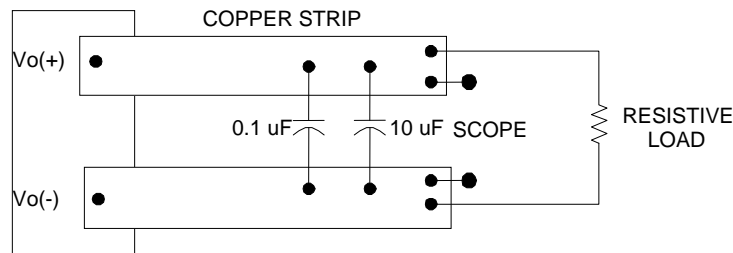
## Basic Operation and Features

The AEE converters were designed specifically to address applications where high power density is required. These modules provide 1500Vdc isolation and operate from the input ranges of 9V-36V and 18V-75V with standard features such as OCP.

## Output Overcurrent Protection

To provide protection in an output overload or short circuit condition, the converter is equipped with current limiting circuitry and can endure the fault condition for an unlimited duration. At the point of current-limit inception, the converter goes into “Hiccup Mode”, causing the output current to be limited both in peak and duration. The converter operates normally once the output current is brought back into its specified range.

## TEST SETUP



Note: Use a 0.1 $\mu$ F @50V X7R ceramic capacitor and a 10 $\mu$ F @ 25V tantalum capacitor. Scope measurement should be made using a BNC socket. Position the load between 51 mm and 76 mm (2 in. and 3 in.) from module.

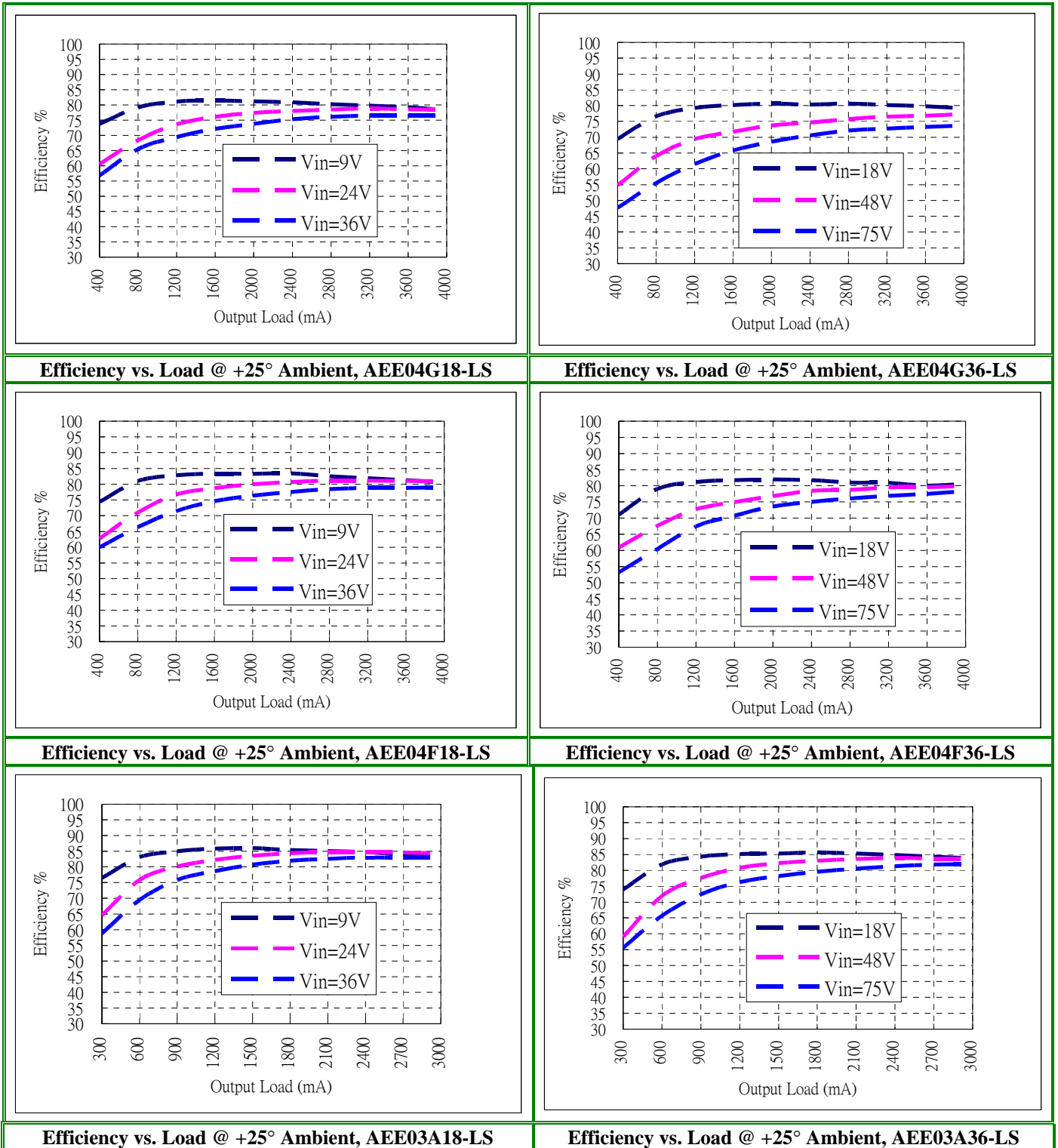
**Figure 1 : Peak-to-Peak Output Noise Measurement Test Setup**



# Technical Reference Note AEE (15W) Family



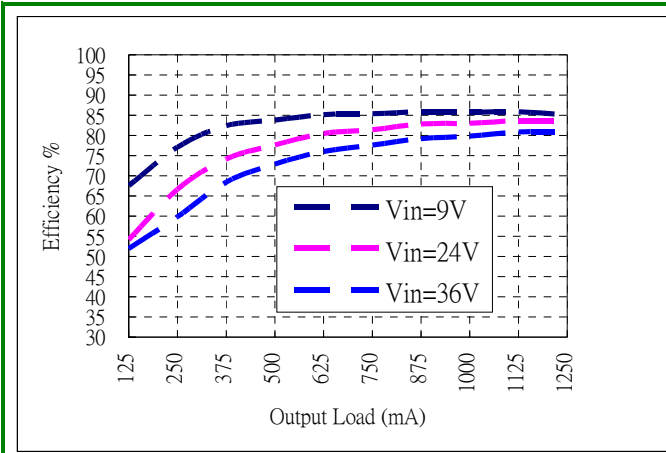
## Performance Curves – Efficiency Curve



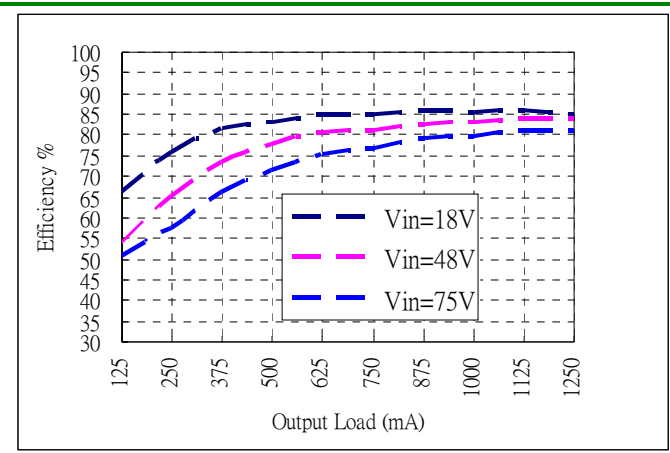




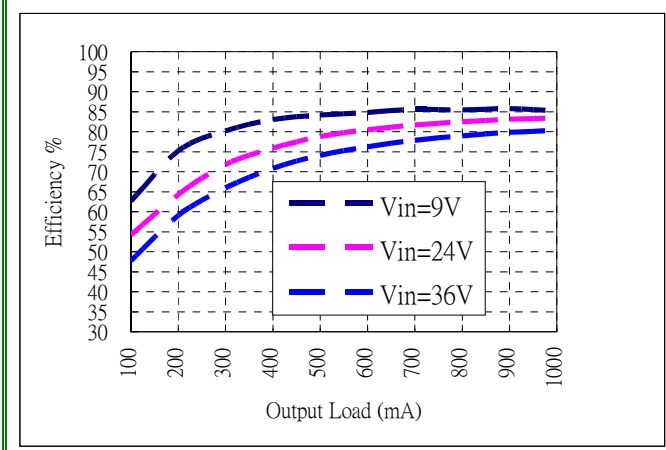
# Technical Reference Note AEE (15W) Family



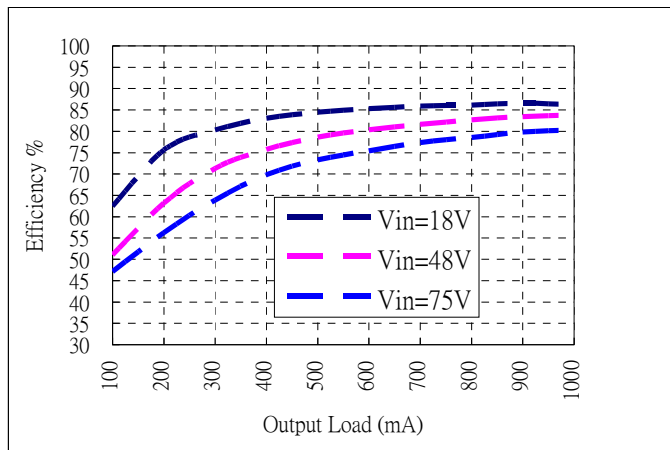
**Efficiency vs. Load @ +25° Ambient, AEE01B18-LS**



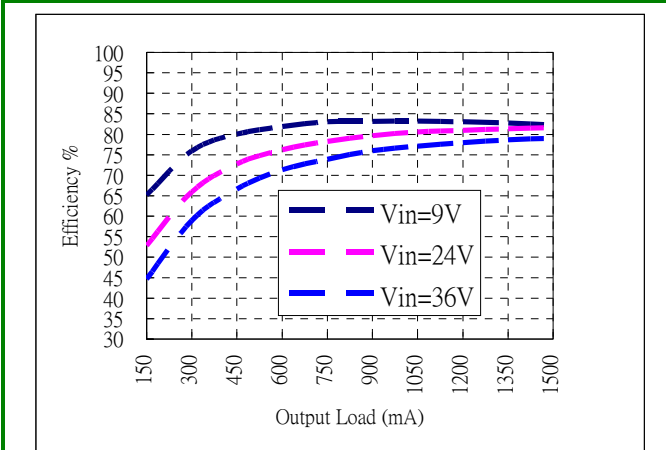
**Efficiency vs. Load @ +25° Ambient, AEE01B36-LS**



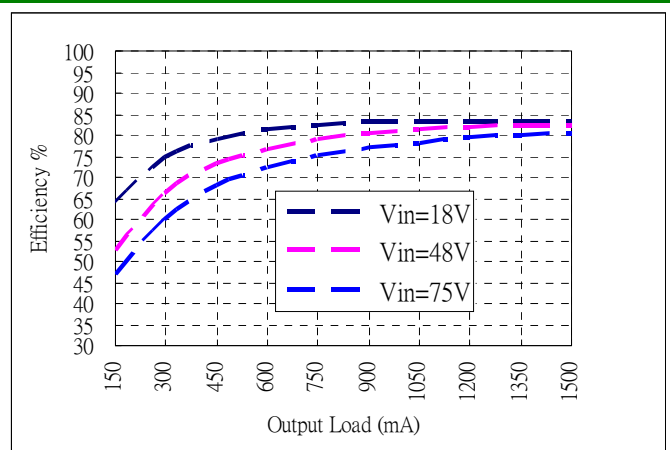
**Efficiency vs. Load @ +25° Ambient, AEE01C18-LS**



**Efficiency vs. Load @ +25° Ambient, AEE01C36-LS**



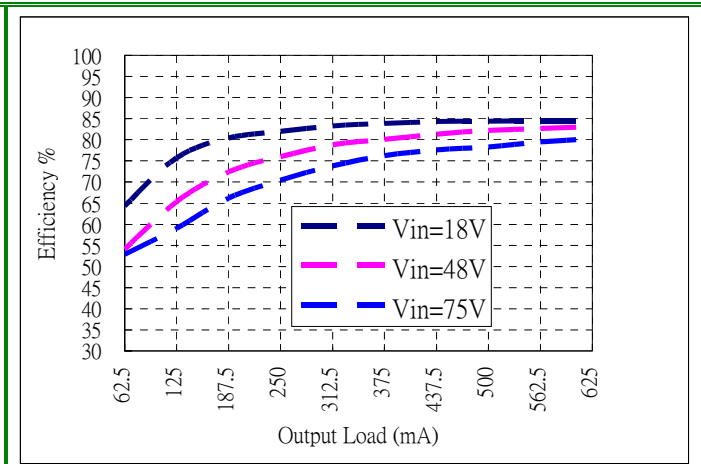
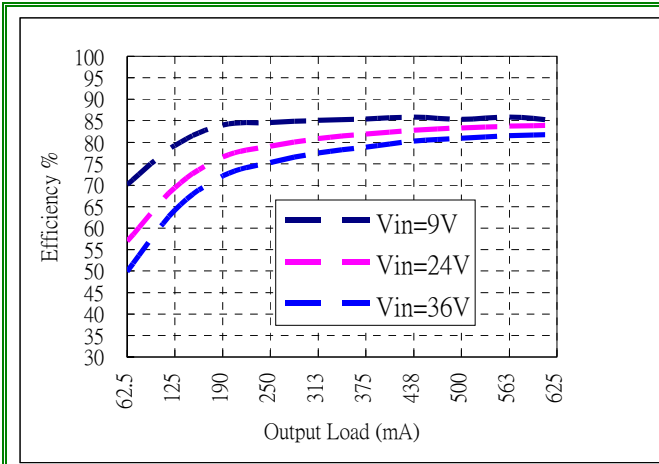
**Efficiency vs. Load @ +25° Ambient, AEE01AA18-LS**



**Efficiency vs. Load @ +25° Ambient, AEE01AA36-LS**

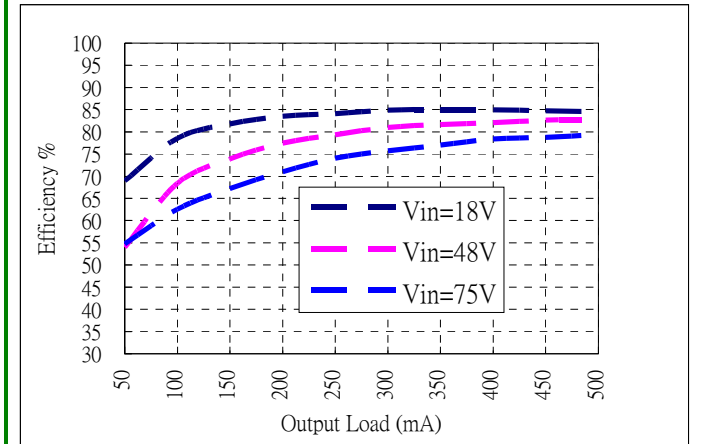
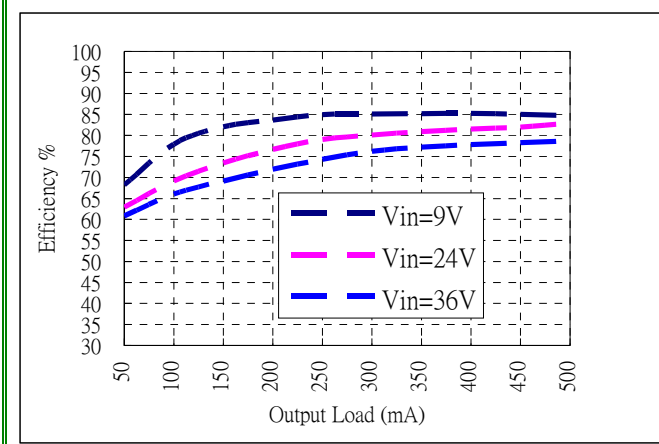


# Technical Reference Note AEE (15W) Family



Efficiency vs. Load @ +25° Ambient, AEE00BB18-LS

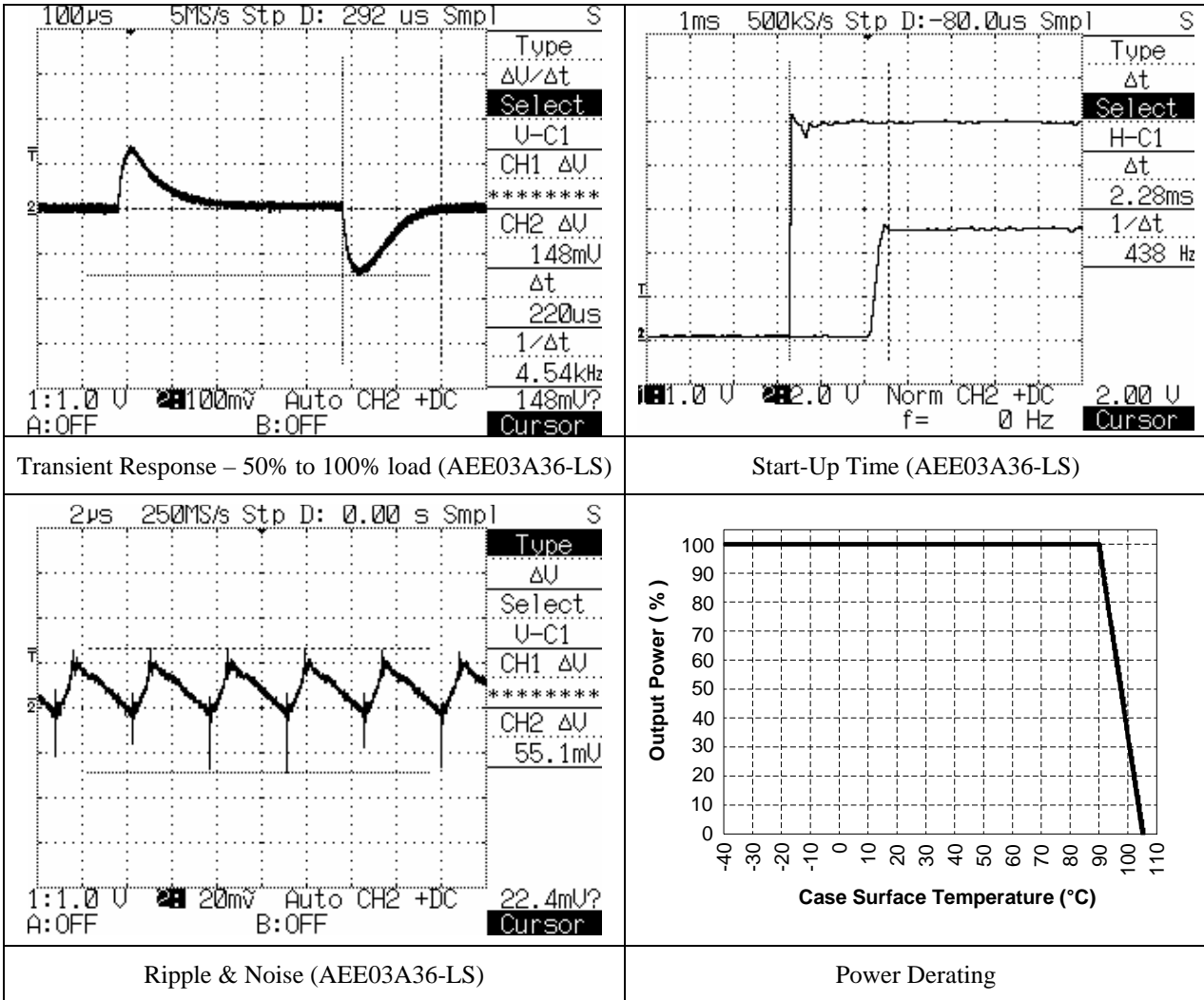
Efficiency vs. Load @ +25° Ambient, AEE00BB36-LS



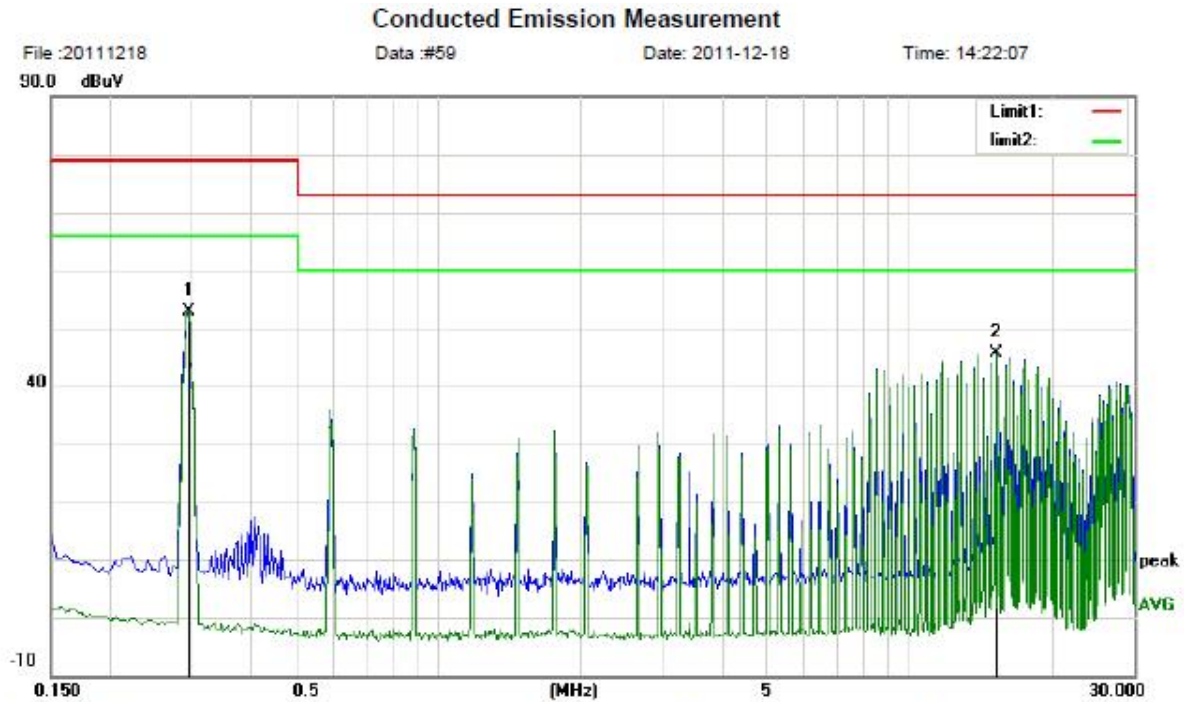
Efficiency vs. Load @ +25° Ambient, AEE00CC18-LS

Efficiency vs. Load @ +25° Ambient, AEE00CC36-LS

Performance Curves



### Conducted EMI Performance



Site Chamber #1	Phase: <i>L</i>	Temperature: 25
Limit: (CE)EN55022 class A_QP	Power: DC 24V	Humidity: 57 %
EUT: DC TO DC		Test Result: Pass
M/N: AEE03A18-L		
Mode: Full Load		
Note:		

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.2940	51.93	0.92	52.85	79.00	-26.15	peak	
2		15.2540	44.71	1.01	45.72	73.00	-27.28	peak	



# Technical Reference Note AEE (15W) Family



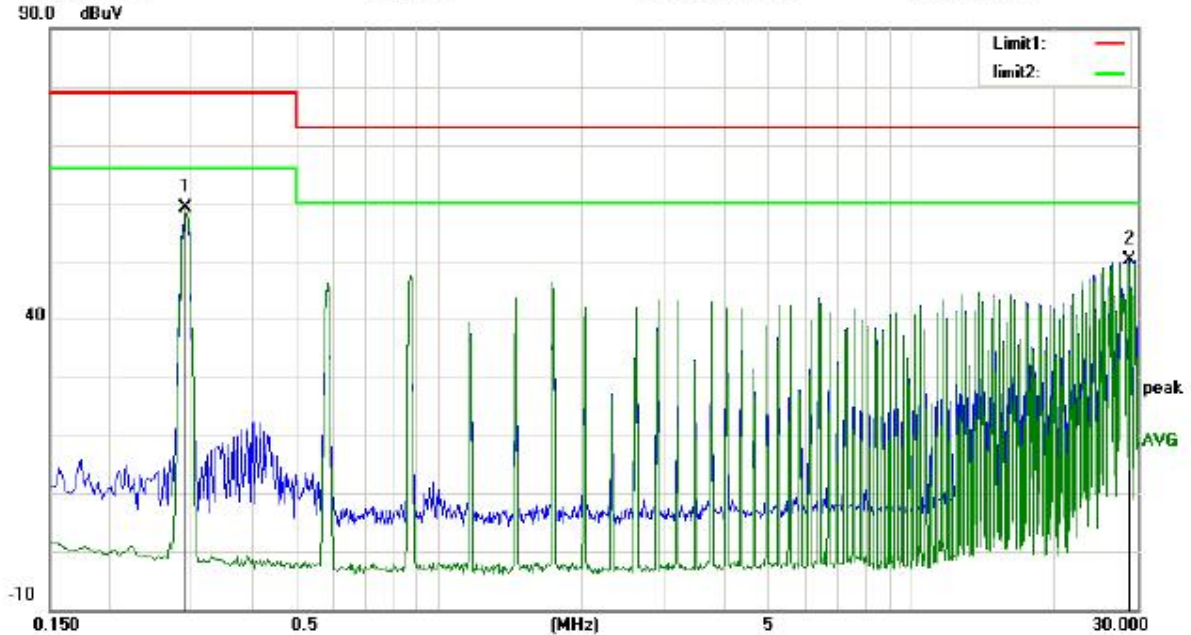
## Conducted Emission Measurement

File :20111218

Data :#60

Date: 2011-12-18

Time: 14:24:24



Site Chamber #1

Phase: *N*

Temperature: 25

Limit: (CE)EN55022 class A\_QP

Power: DC 24V

Humidity: 57 %

EUT: DC TO DC

Test Result: Pass

M/N: AEE03A18-L

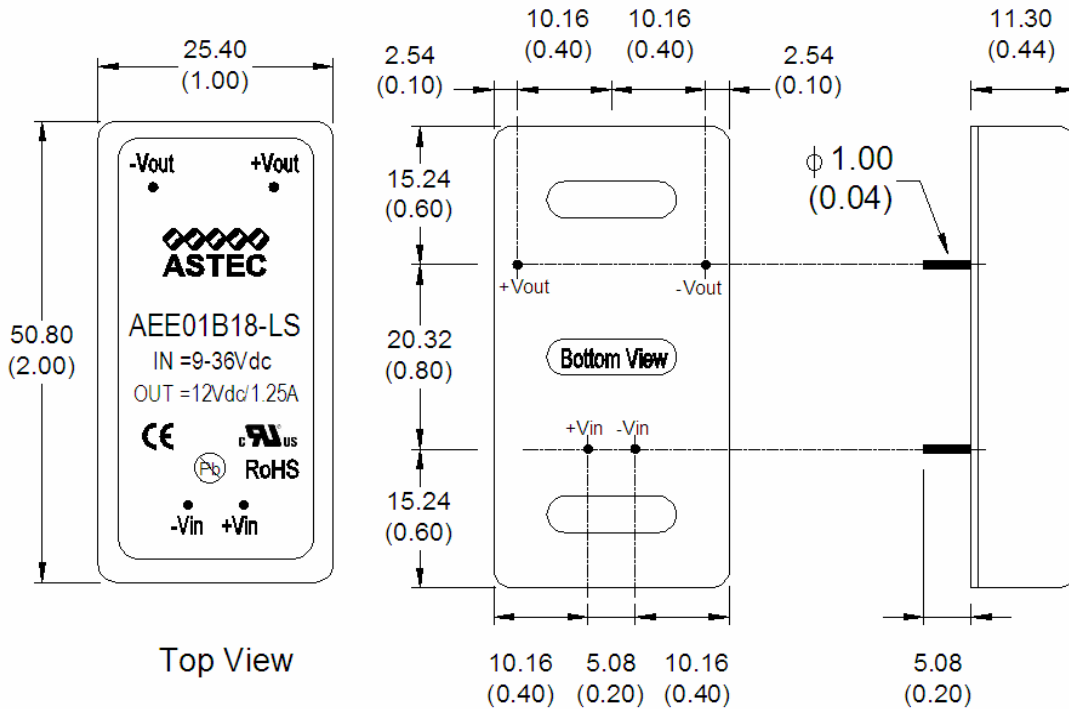
Mode: Full Load

Note:

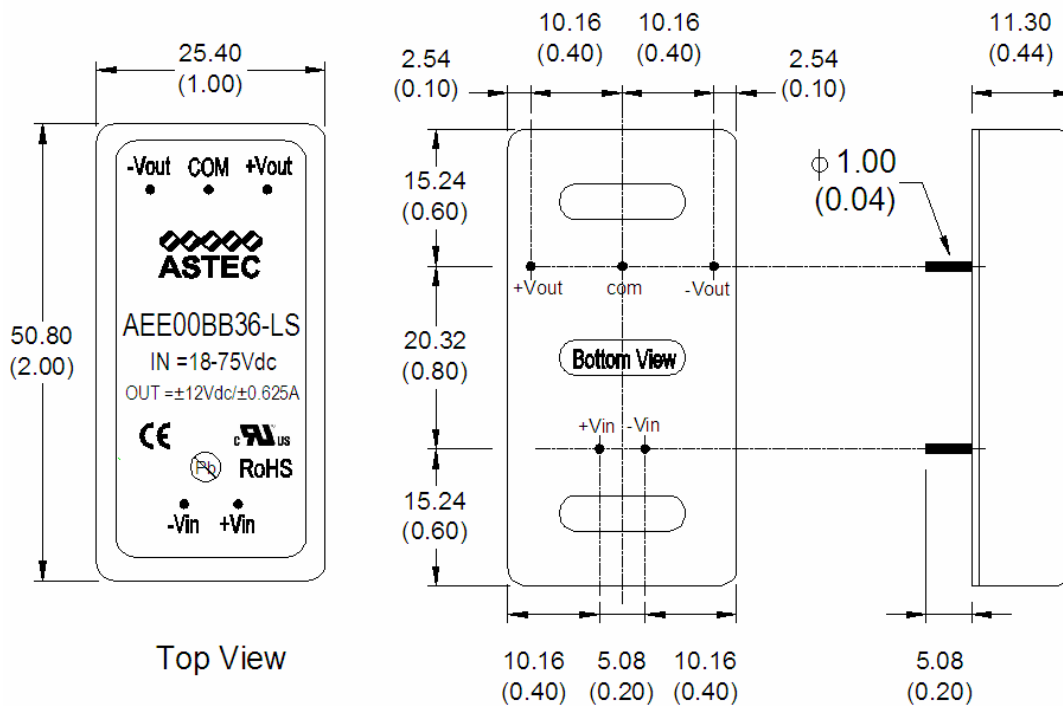
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.2900	58.20	0.93	59.13	79.00	-19.87	peak	
2		28.8660	48.78	1.38	50.16	73.00	-22.84	peak	

## Mechanical Dimensions and Module Pin Assignment

### Single Output



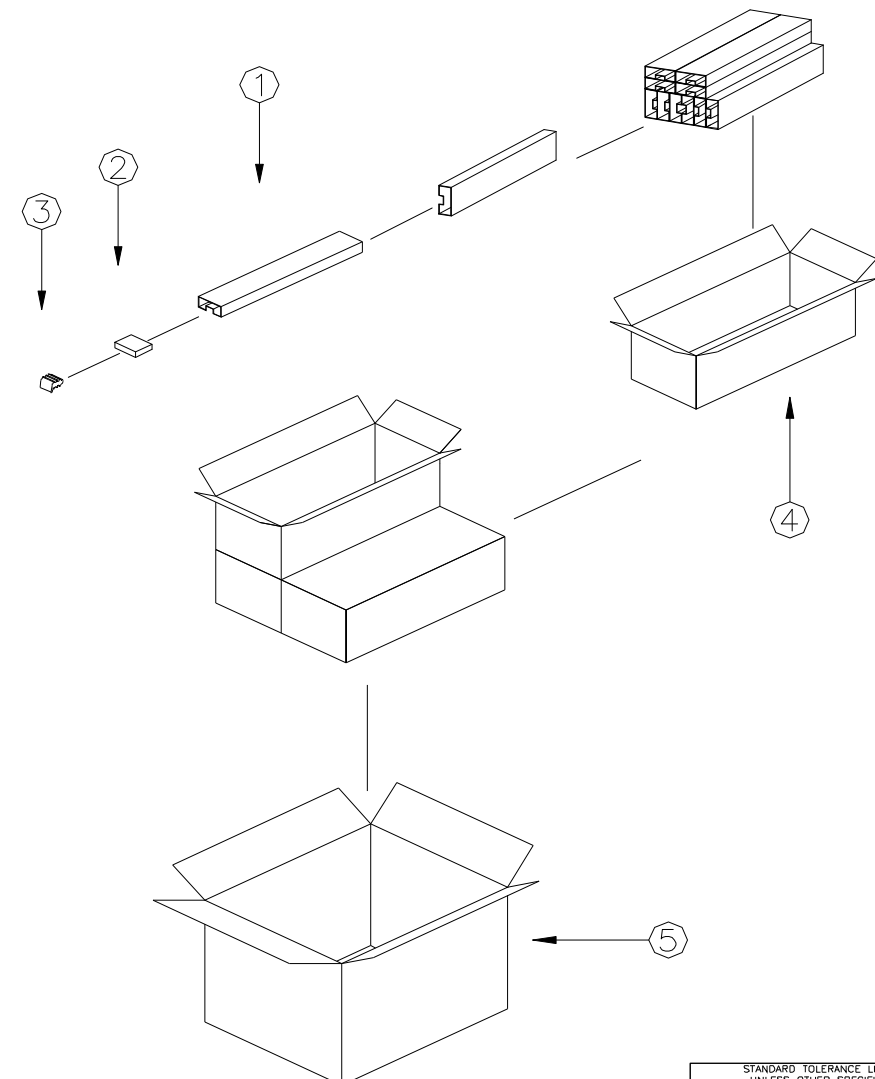
### Dual Output



### Package Information

REV	REF	DESCRIPTION	AUTH	DATE

1. PACKING TUBE: 360\*53.4\*21.4mm ; ONE TUBE = 12 PCS  
 2. PRODUCTS: AEE SERIES  
 3. STOPPER  
 4. INNER CARTON: 388\*159\*115mm  
    ONE INNER CARTON = 10 TUBES = 120 PCS  
 5. OUTER CARTON: 405\*334\*263mm  
    ONE OUTER CARTON = 4 INNER CARTONS = 480 PCS



STANDARD TOLERANCE LIMITS UNLESS OTHER SPECIFIED.			THIRD ANGLE PROJECTION	REV
RANGE	ANGLE	TOLERANCE		
>0~3	±1'	±0.1	UNIT:m/m SCALE 1 : 1	A1
>3~6	±2'	±0.15		
>6~30	±3'	±0.18		
>30~120	±5'	±0.20		



### Recommended Lead-Free Wave Soldering Temperature Profile

