

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 Class A / FCC part 15 Level A without external components
- Recommended external filter configuration can be added to meet EN55022 Class B / FCC part 15 Level B

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

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.

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}	
	$\pm 5V$	$V_{o, \text{set}}$	± 4.90	± 5.00	± 5.10	V_{dc}	
	$\pm 12V$	$V_{o, \text{set}}$	± 11.76	± 12.00	± 12.24	V_{dc}	
	$\pm 15V$	$V_{o, \text{set}}$	± 14.70	± 15.00	± 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	± 150	-	± 1500	mA
		$\pm 12V$	I_o	± 63	-	± 625	mA
		$\pm 15V$	I_o	± 50	-	± 500	mA
e) Efficiency ($V_I = V_{I, \text{nom}}$; I_o, 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	



Technical Reference Note AEE (15W) Family



OUTPUT SPECIFICATIONS (Cont.)

Parameter	Device	Symbol	Min	Typ	Max	Unit
g) External Load Capacitance Single Output	2.5V / 3.3V	-	-	-	5,000	uF
	5V	-	-	-	4,000	uF
	12V / 15V	-	-	-	800	uF
	Dual Output	±5V	-	-	±2,000	uF
		±12V / ±15V	-	-	±400	uF
h) 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/±5V	-	-	5	%Vo
		12V/±12V/15V/±15V	-	-	2	%Vo
	Peak Deviation Settling Time (to $V_{o, nom}$)	All	-	-	300	μsec
	i) Turn-On Time ($I_o = I_{o, max}$; V_o within 1%)	All	-	-	5	10
j) Output Voltage Overshoot ($I_o = I_{o, max}$; $T_A = 25^\circ C$)	All	-	-	1	4	%Vo

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	-	-	MΩ
Calculated MTBF ($I_o = I_{o, max}$; $T_A = 25^\circ C$)	All	-	700K	1M	-	Hours
Weight	All	-	-	-	40	g

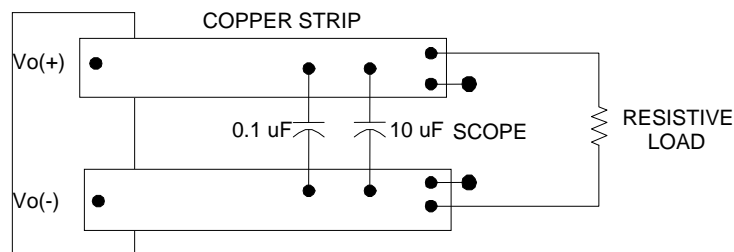
Basic Operation and Features

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 μ F @50V X7R ceramic capacitor and a 10 μ 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.

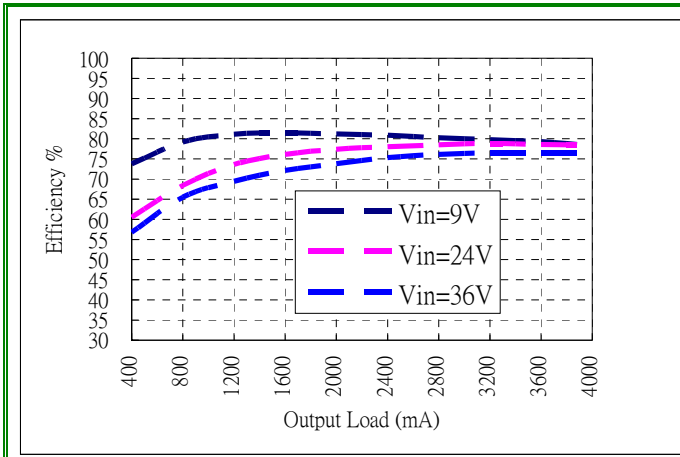
Figure 1 : Peak-to-Peak Output Noise Measurement Test Setup



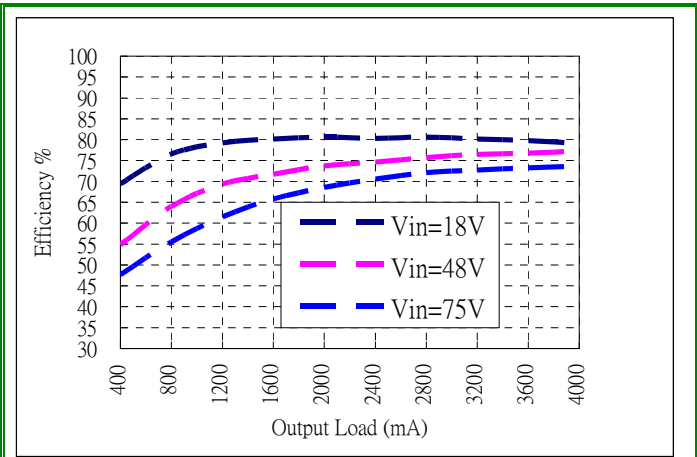
Technical Reference Note AEE (15W) Family



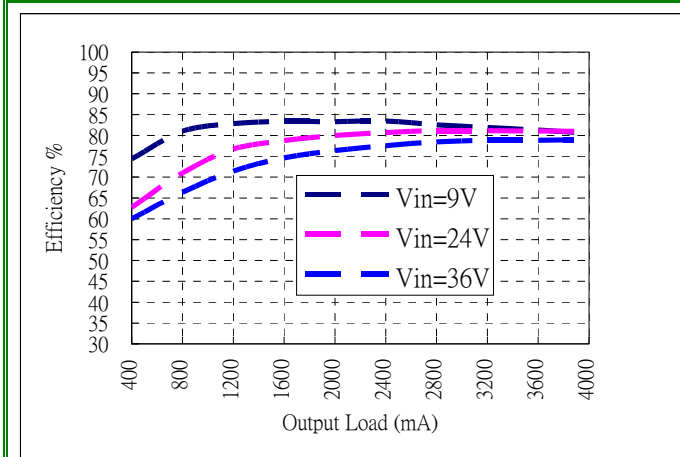
Performance Curves – Efficiency Curve



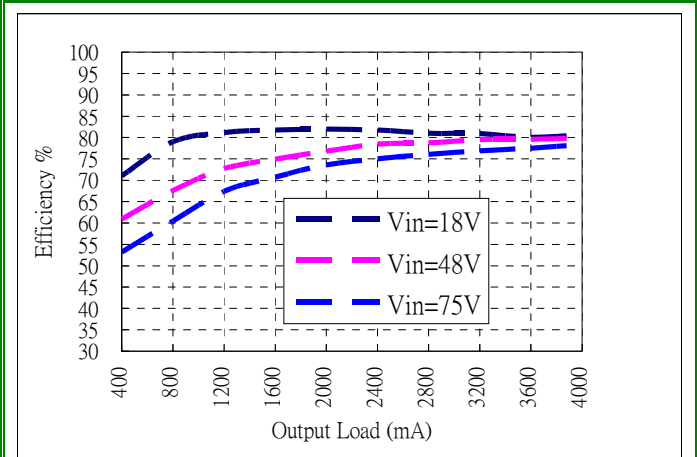
Efficiency vs. Load @ +25° Ambient, AEE04G18-LS



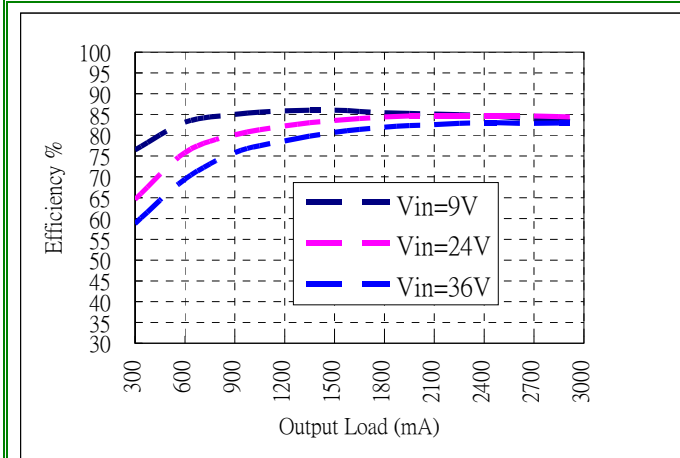
Efficiency vs. Load @ +25° Ambient, AEE04G36-LS



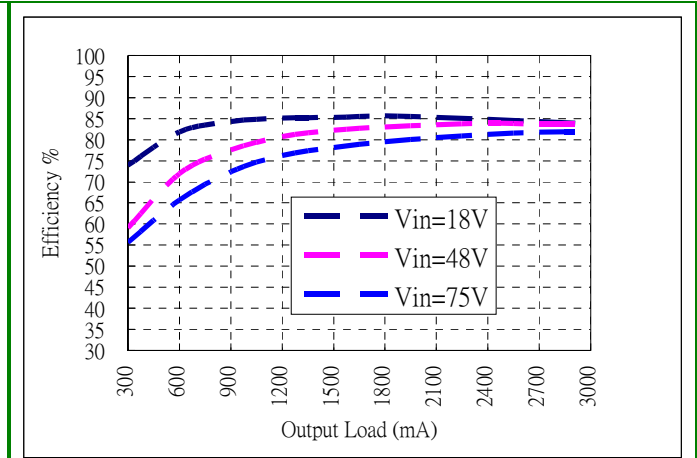
Efficiency vs. Load @ +25° Ambient, AEE04F18-LS



Efficiency vs. Load @ +25° Ambient, AEE04F36-LS



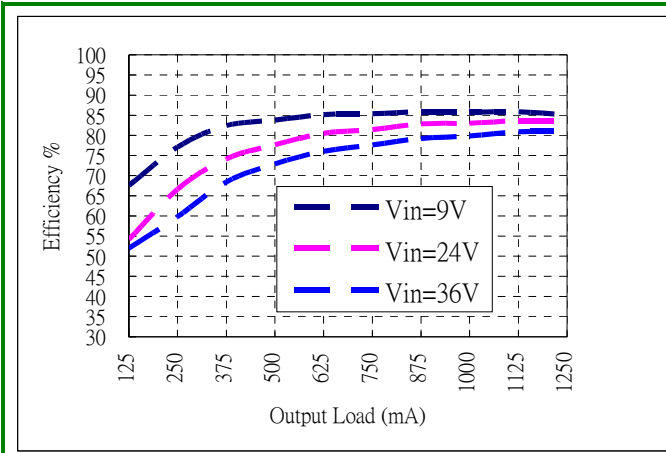
Efficiency vs. Load @ +25° Ambient, AEE03A18-LS



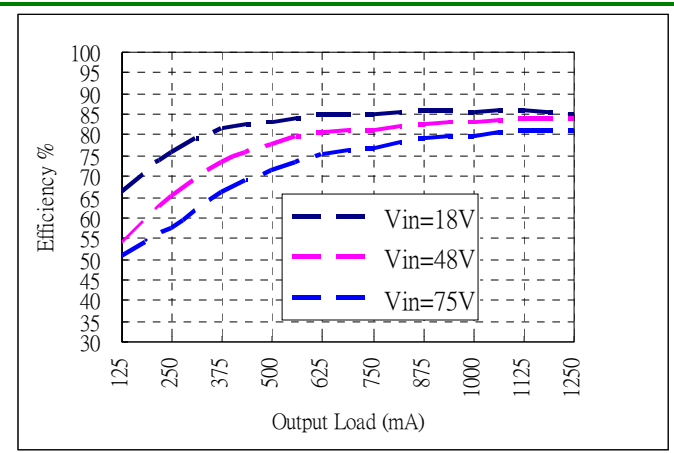
Efficiency vs. Load @ +25° Ambient, AEE03A36-LS



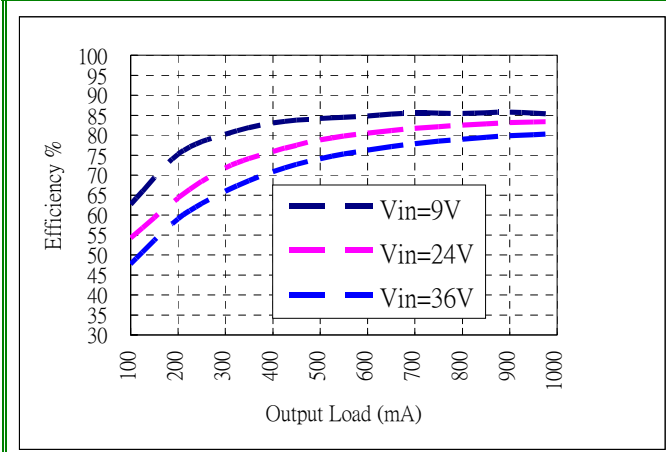
Technical Reference Note AEE (15W) Family



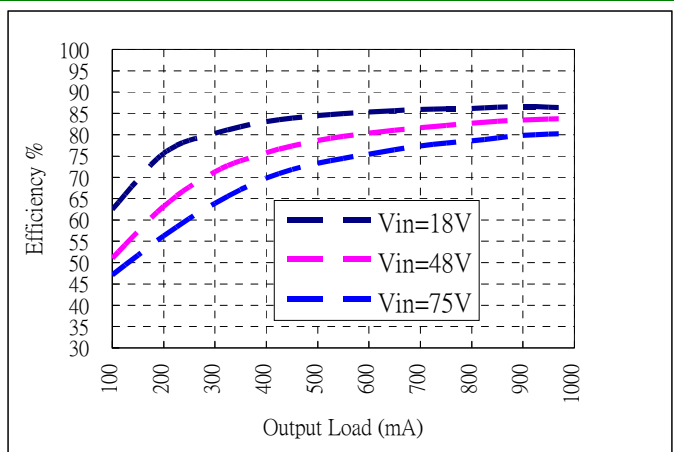
Efficiency vs. Load @ +25° Ambient, AEE01B18-LS



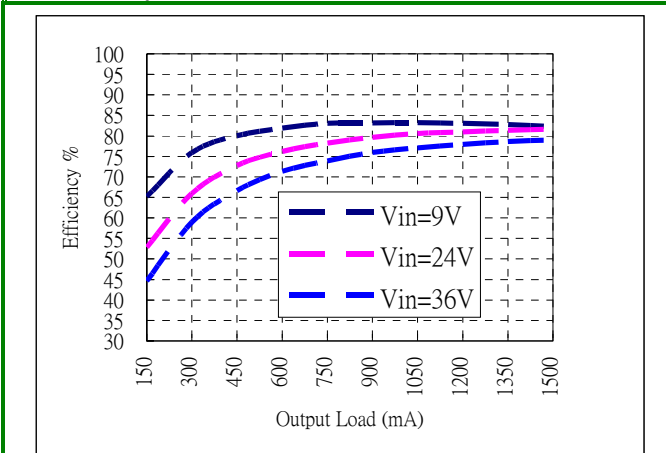
Efficiency vs. Load @ +25° Ambient, AEE01B36-LS



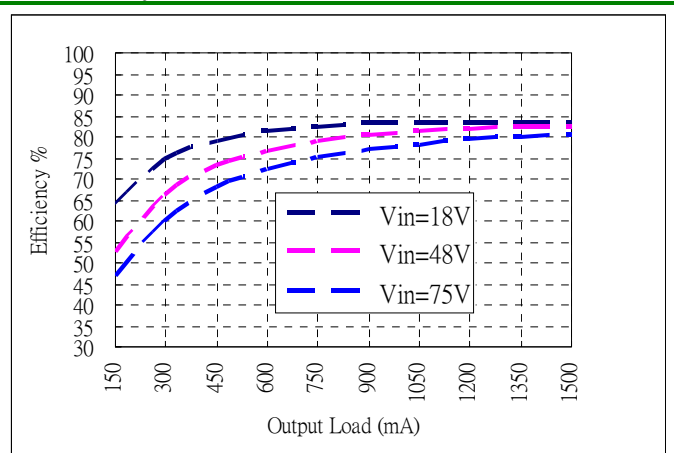
Efficiency vs. Load @ +25° Ambient, AEE01C18-LS



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



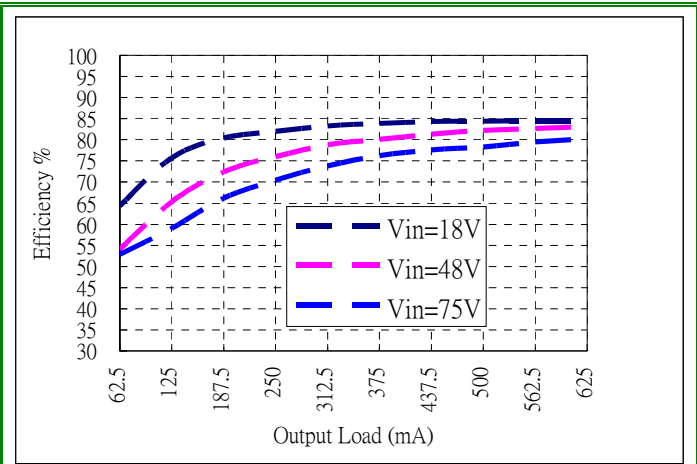
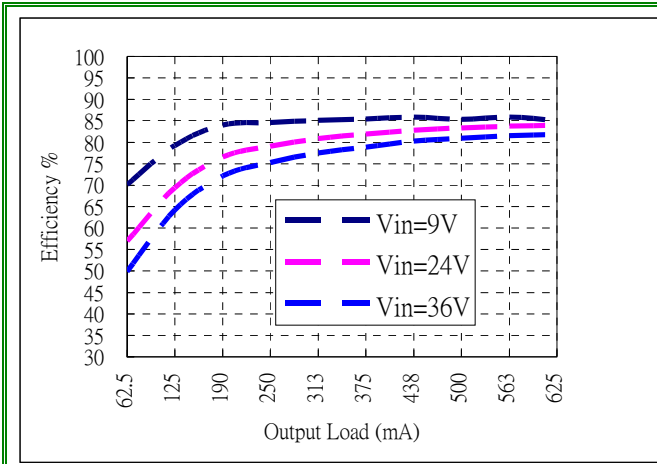
Efficiency vs. Load @ +25° Ambient, AEE01AA18-LS



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

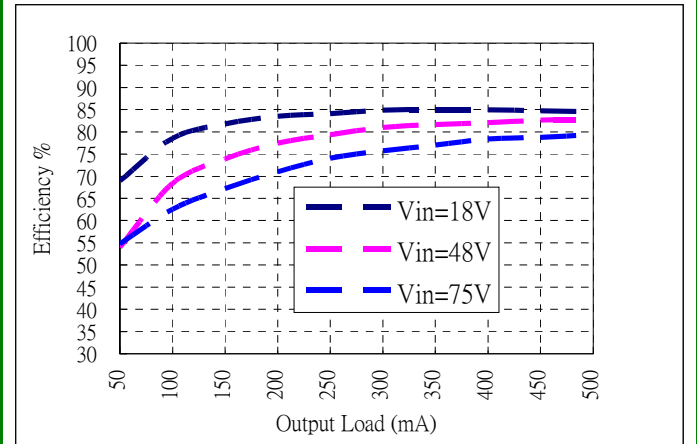
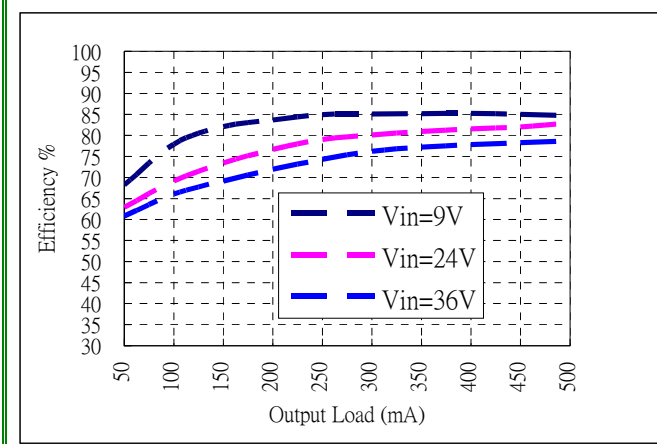


Technical Reference Note AEE (15W) Family



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

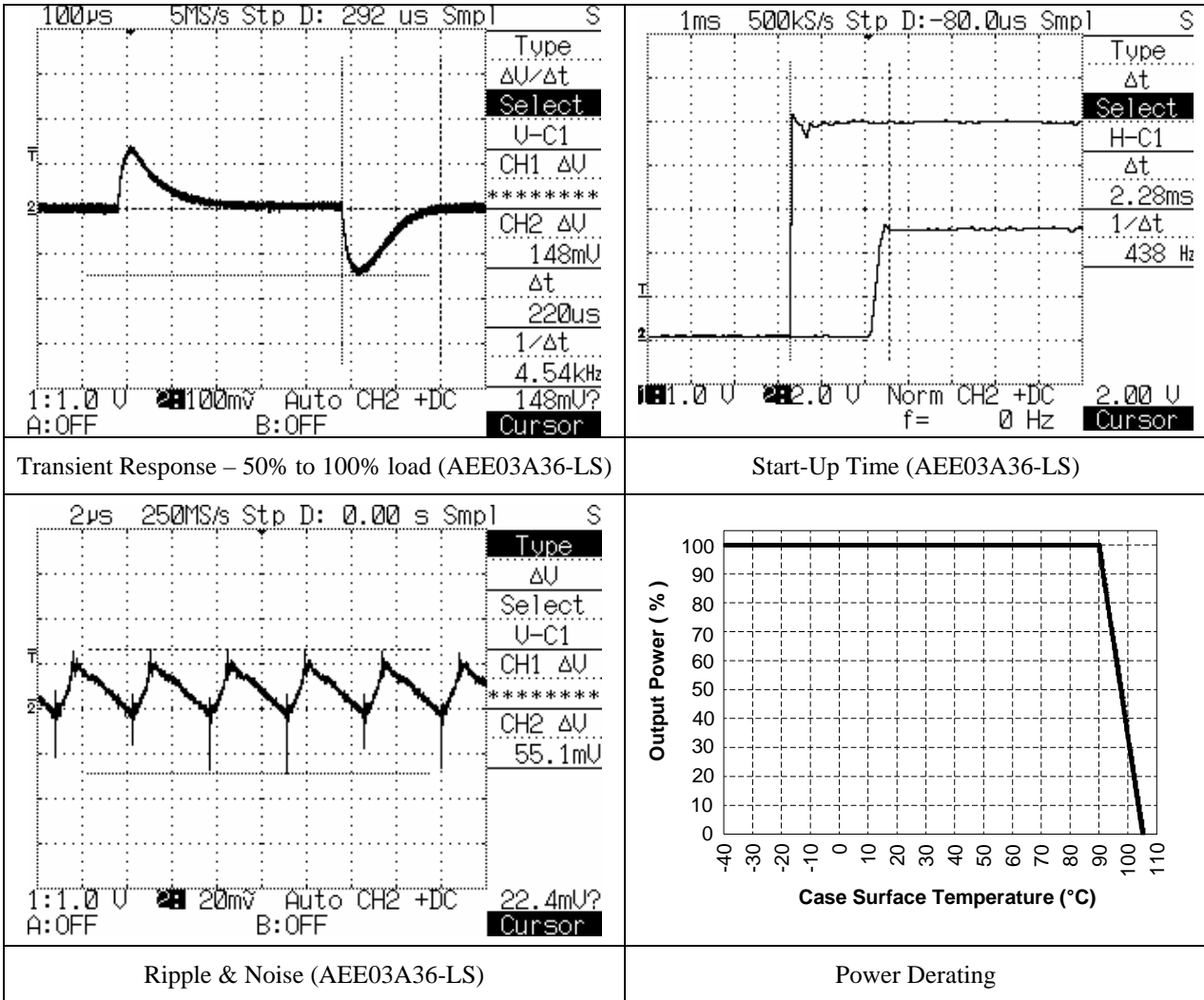
Efficiency vs. Load @ +25° Ambient, AEE00BB36-LS



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

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

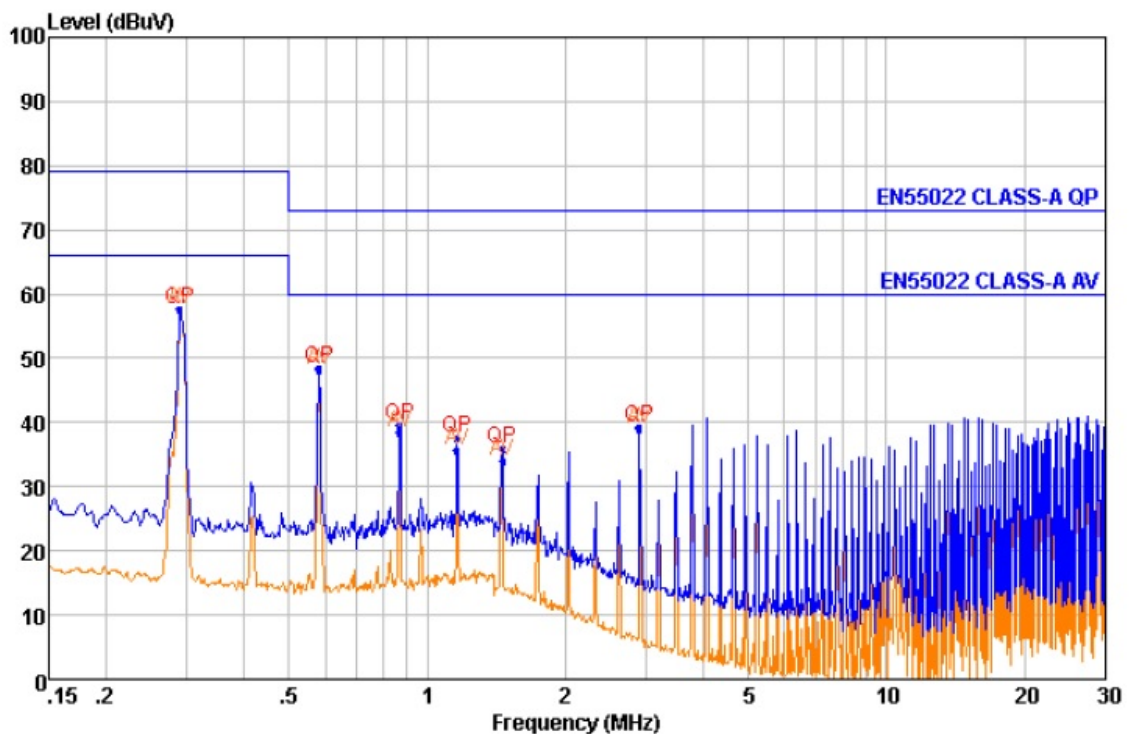
Performance Curves



Conducted EMI Performance

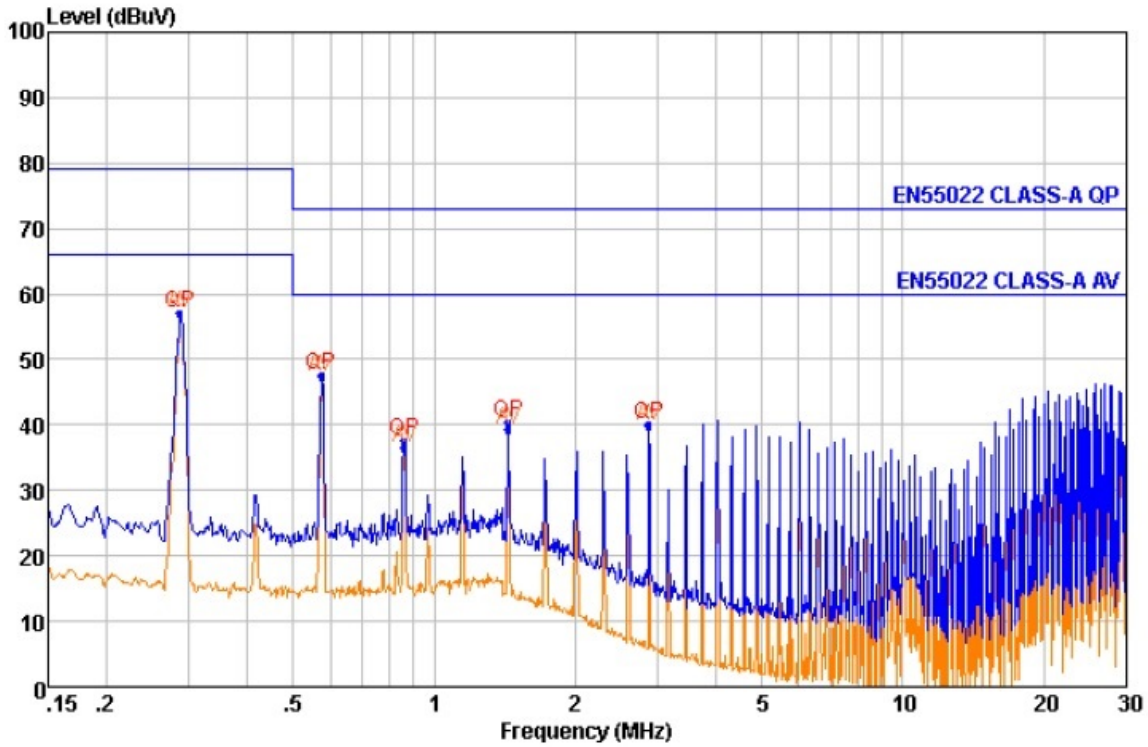
Compliance with EN55022 Class A / FCC part 15 Level A without external components

Condition : EN55022 CLASS-A QP LINE
 EUT :
 Model No. : AEE03A18-LS
 EUT Status : DC24V
 Test Mode : LINE
 Test Date : 2016-11-02
 Remark : FULL LOAD



NO.	Freq MHz	Level dBUV	Remark	LISN Factor dB	Cable Loss dB	Limit Line dBUV	Margin dB
1	0.289	57.77	QP	9.46	0.24	79.00	-21.23
2	0.289	57.57	Average	9.46	0.24	66.00	-8.43
3	0.582	48.50	QP	9.30	0.28	73.00	-24.50
4	0.582	48.05	Average	9.30	0.28	60.00	-11.95
5	0.871	39.55	QP	9.27	0.30	73.00	-33.45
6	0.871	38.56	Average	9.27	0.30	60.00	-21.44
7	1.160	37.52	QP	9.28	0.32	73.00	-35.48
8	1.160	35.71	Average	9.28	0.32	60.00	-24.29
9	1.456	35.91	QP	9.30	0.33	73.00	-37.09
10	1.456	34.06	Average	9.30	0.33	60.00	-25.94
11	2.900	39.38	QP	9.31	0.37	73.00	-33.62
12	2.900	39.00	Average	9.31	0.37	60.00	-21.00

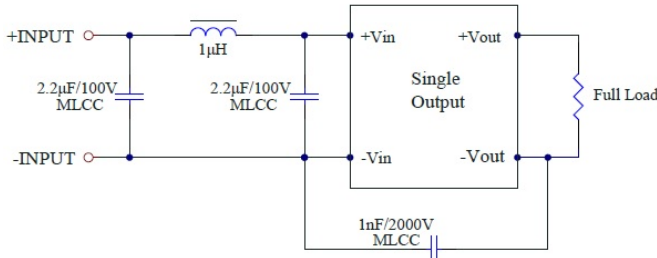
Condition : EN55022 CLASS-A QP NEUTRAL
 EUT :
 Model No. : AEE03A18-LS
 EUT Status : DC24V
 Test Mode : NEUTRAL
 Test Date : 2016-11-02
 Remark : FULL LOAD



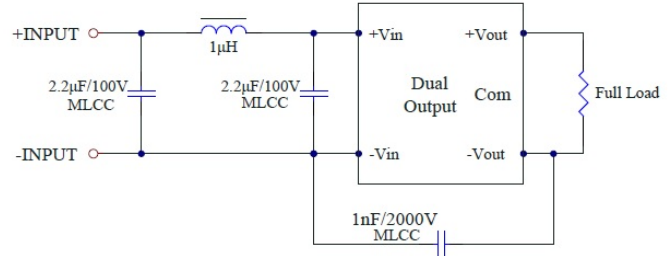
NO.	Freq MHz	Level dBUV	Remark	LISN Factor dB	Cable Loss dB	Limit Line dBUV	Margin dB
1	0.286	57.22	QP	9.37	0.24	79.00	-21.78
2	0.286	57.06	Average	9.37	0.24	66.00	-8.94
3	0.573	47.63	QP	9.36	0.28	73.00	-25.37
4	0.573	47.29	Average	9.36	0.28	60.00	-12.71
5	0.862	37.60	QP	9.37	0.30	73.00	-35.40
6	0.862	36.53	Average	9.37	0.30	60.00	-23.47
7	1.441	40.38	QP	9.38	0.33	73.00	-32.62
8	1.441	39.33	Average	9.38	0.33	60.00	-20.67
9	2.869	40.09	QP	9.41	0.37	73.00	-32.91
10	2.869	39.83	Average	9.41	0.37	60.00	-20.17

Compliance with EN55022 Class B / FCC part 15 Level B with the following recommended external filter configuration :

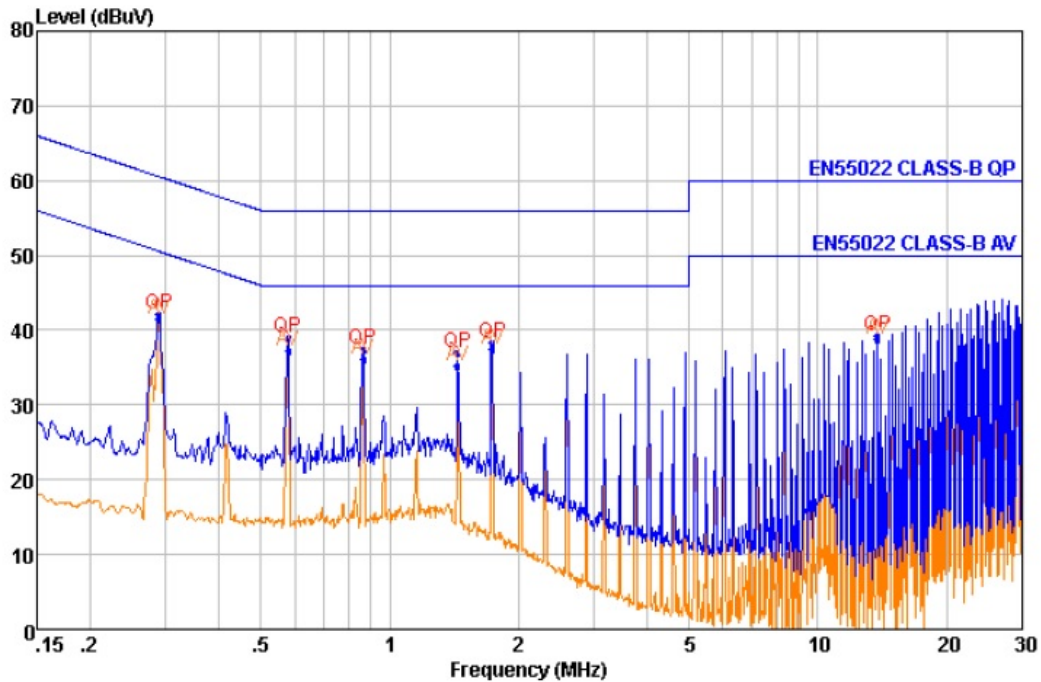
Single output



Dual output

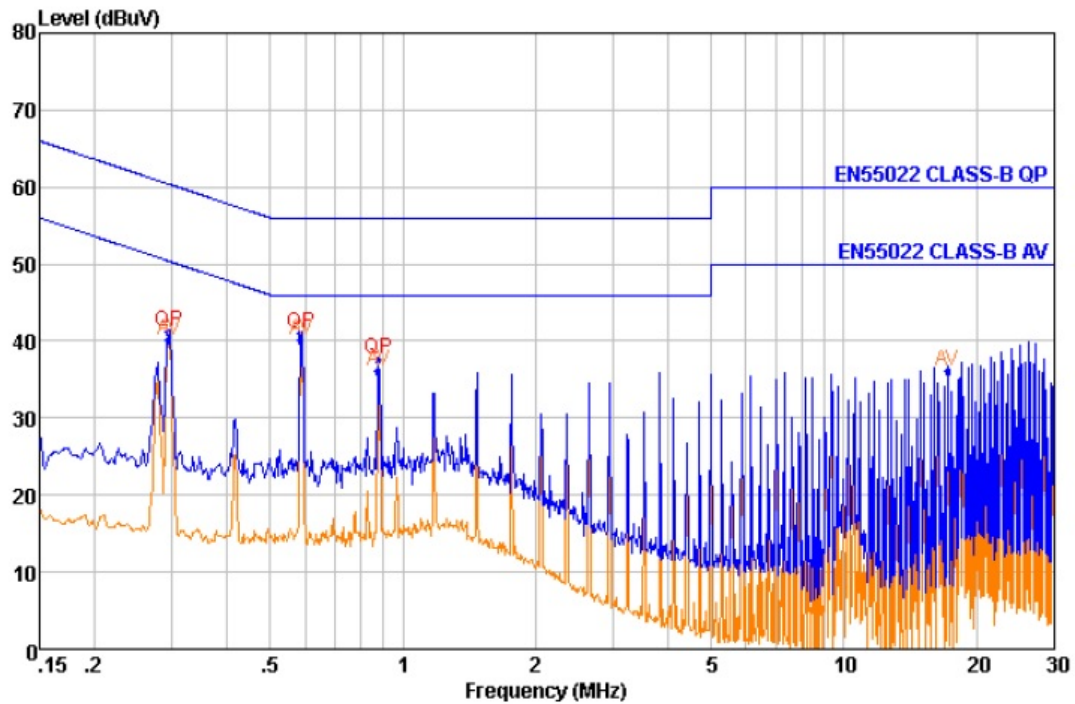


Condition : EN55022 CLASS-B QP LINE
 EUT :
 Model No. : AEE03A18-LS
 EUT Status : DC24V
 Test Mode : LINE
 Test Date : 2016-11-02
 Remark : FULL LOAD



NO.	Freq MHz	Level dBUV	Remark	LISN Factor dB	Cable Loss dB	Limit Line dBUV	Margin dB
1	0.289	42.10	QP	9.46	0.24	60.54	-18.44
2	0.289	41.34	Average	9.46	0.42	50.54	-9.20
3	0.579	38.99	QP	9.30	0.28	56.00	-17.01
4	0.579	37.28	Average	9.30	0.44	46.00	-8.72
5	0.866	37.41	QP	9.27	0.30	56.00	-18.59
6	0.866	36.14	Average	9.27	0.46	46.00	-9.86
7	1.441	36.89	QP	9.30	0.33	56.00	-19.11
8	1.441	35.28	Average	9.30	0.48	46.00	-10.72
9	1.734	38.43	QP	9.31	0.34	56.00	-17.57
10	1.734	37.33	Average	9.31	0.49	46.00	-8.67
11	13.768	39.24	QP	9.36	0.46	60.00	-20.76
12	13.768	38.74	Average	9.36	0.57	50.00	-11.26

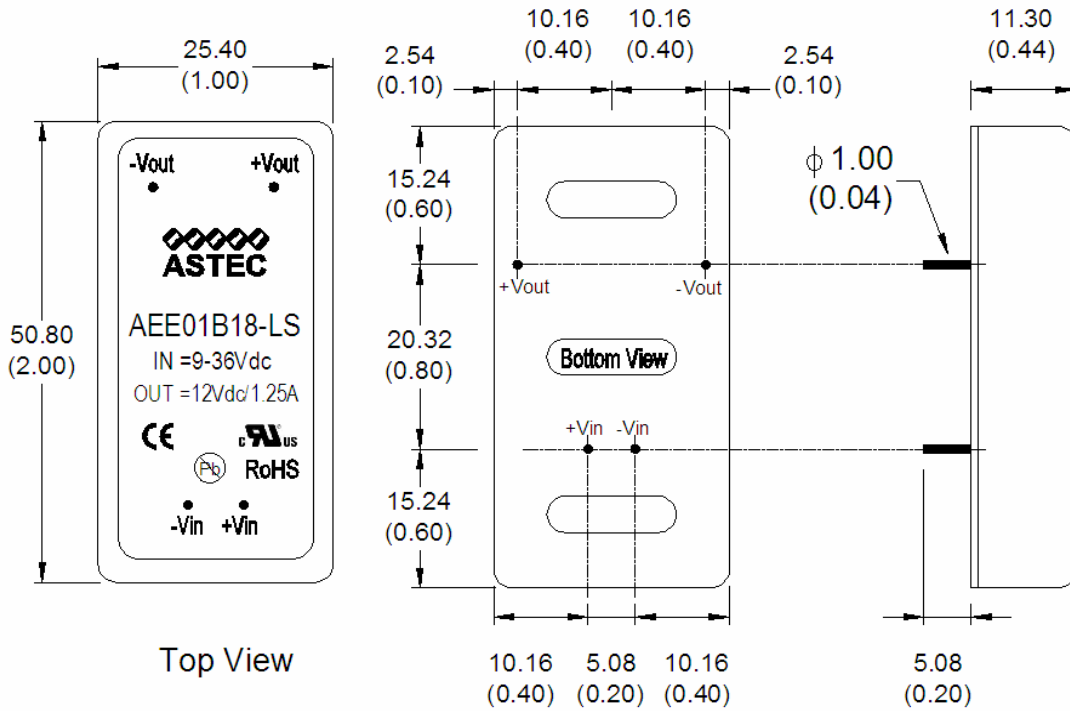
Condition : EN55022 CLASS-B QP NEUTRAL
 EUT :
 Model No. : AEE03A18-LS
 EUT Status : DC24V
 Test Mode : NEUTRAL
 Test Date : 2016-11-02
 Remark : FULL LOAD



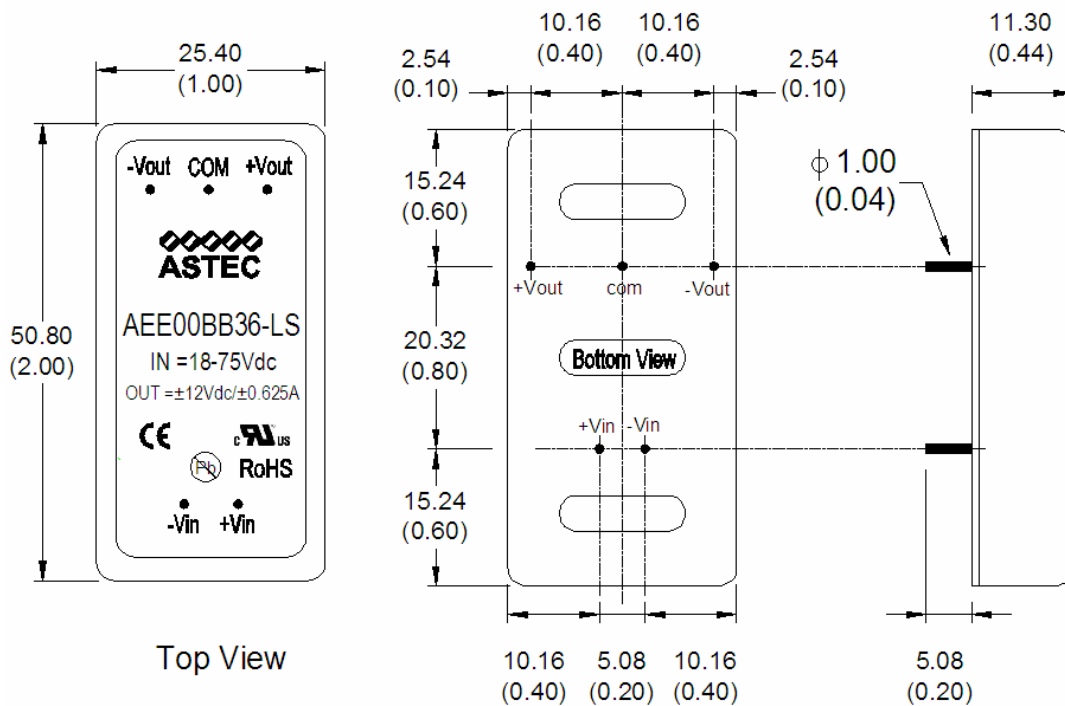
NO.	Freq MHz	Level dBuV	Remark	LISN Factor dB	Cable Loss dB	Limit Line dBuV	Margin dB
1	0.294	41.27	QP	9.37	0.24	60.41	-19.14
2	0.294	40.02	Average	9.37	0.42	50.41	-10.39
3	0.589	41.00	QP	9.36	0.28	56.00	-15.00
4	0.589	40.17	Average	9.36	0.44	46.00	-5.83
5	0.880	37.67	QP	9.37	0.30	56.00	-18.33
6	0.880	36.14	Average	9.37	0.46	46.00	-9.86
7	17.199	36.15	Average	9.78	0.58	50.00	-13.85

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 = 13 PCS
 2. PRODUCTS: AEE SERIES
 3. STOPPER
 4. INNER CARTON: 388*159*115mm
 ONE INNER CARTON = 10 TUBES = 130 PCS
 5. OUTER CARTON: 405*334*263mm
 ONE OUTER CARTON = 4 INNER CARTONS = 520 PCS

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

Recommended Lead-Free Wave Soldering Temperature Profile

