AEE 50W Series

50 Watts

DC/DC Converter

Total Power: 50 Watts
Input Voltage: 9 to 36 Vdc
18 to 75 Vdc
# of Outputs: Single

Special Features

- Smallest Encapsulated 50W Converter
- Package Size 2.0" x 1.0" x 0.4"
- Ultra-wide 4:1 Input Range
- Excellent Efficiency up to 92%
- Output Current Up to 10A
- I/O-isolation Voltage 1500VDC
- Under-Voltage Shutdown
- Over Current and Over Voltage Protection
- Remote ON/OFF control
- Shielded Metal Ccase with isolated Baseplate
- Heatsink (Optional)
- 3 Years Product Warranty

Safety

cUL/UL/CSA 60950-1
IEC/EN 60950-1

Product Descriptions

The AEE 50W series is the latest generation of high performance dc-dc converter modules setting a new standard concerning power density. The product offers fully 50W in an encapsulated shielded metal package with dimensions of just 2.0"x1.0"x 0.4". All models provide ultra-wide 4:1 input voltage range and tight output voltage regulation.

State-of the-art circuit topology provides a very high efficiency up to 92% which allows an operating temperature range of -40 ^{O}C to +80 ^{O}C. Further features include remote On/Off, trimmable output voltage as well as overload protection and over-temperature protection.

Typical applications for these converters are battery operated equipment, instrumentation, distributed power architectures in communication and industrial electronics and other space critical applications

Model Numbers

Model	Input Voltage	Output Voltage	Maximum Load	Efficiency
AEE10F18-L	9-36Vdc	3.3V	10A	90%
AEE10A18-L	9-36Vdc	5V	10A	91%
AEE04B18-L	9-36Vdc	12V	4.17A	92%
AEE03C18-L	9-36Vdc	15V	3.33A	92%
AEE02H18-L	9-36Vdc	24V	2.08A	91%
AEE10F36-L	18-75 Vdc	3.3V	10A	90%
AEE10A36-L	18-75 Vdc	5V	10A	91%
AEE04B36-L	18-75 Vdc	12V	4.17A	92%
AEE03C36-L	18-75 Vdc	15V	3.33A	92%
AEE02H36-L	18-75 Vdc	24V	2.08A	91%

Options

Heatsink (-HS)

Electrical Specifications

Absolute Maximum Ratings

Stress in excess of those listed in the “Absolute Maximum Ratings” may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply’s reliability.

Table 1. Absolute Maximum Ratings:

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Voltage Operating -Continuous	24V input Models 48V input Models	$V_{IN,DC}$	-0.7 -0.7	- -	50 100	Vdc Vdc
Maximum Output Power	All	$P_{O,max}$	-	-	50	W
Isolation Voltage [1] Input to output	All models		1500	-	-	Vdc
Isolation Resistance 500Vdc	All models		1000	-	-	Mohm
Isolation Capacitance 100KHz, 1V	All models		-	-	2200	pF
Operating Case Temperature	All	T_{CASE}	-	-	+105	^{O}C
Storage Temperature	All	T_{STG}	-50		+125	^{O}C
Humidity (non-condensing) Operating Non-operating	 All All		 - -	 - -	 95 95	 % %
MTBF	MIL-STD-217F, TA =+25^{O}C,Ground Benign		233500	-	-	Hours

Note 1 - For 60 second

Input Specifications

Table 2. Input Specifications:

Parameter		Condition	Symbol	Min	Nom	Max	Unit
Operating Input Voltage, DC	24V Input Models 48V Input Models	All	$V_{IN,DC}$	9 18	24 48	36 75	Vdc
Start-up Threshold Voltage	24V Input Models 48V Input Models	All	$V_{IN,ON}$	- -	- -	9 18	Vdc
Under Voltage Lockout	24V Input Models 48V Input Models	All	$V_{IN,under}$	- -	7.5 16	- -	Vdc
Input reflected ripple current	24V Input Models 48V Input Models	0 to 500MHz,4.7uH source impedance	$I_{IN,ripple}$	- -	30 20	- -	mA
Input Current	AEE10F18-L AEE10A18-L AEE04B18-L AEE03C18-L AEE02H18-L AEE10F36-L AEE10A36-L AEE04B36-L AEE03C36-L AEE02H36-L	$V_{IN,DC=}V_{IN,nom}$	$I_{IN,full\ load}$	- - - - - - - - - -	1528 2290 2267 2263 2286 764 1145 1134 1134 1143	- - - - - - - - - -	mA
No Load Input Current (V_O On, I_O = 0A)	AEE10F18-L AEE10A18-L AEE04B18-L AEE03C18-L AEE02H18-L AEE10F36-L AEE10A36-L AEE04B36-L AEE03C36-L AEE02H36-L	$V_{IN,DC=}V_{IN,nom}$	I_{IN,no_load}	- - - - - - - - - -	80 60 80 80 80 40 30 60 60 50	- - - - - - - - - -	mA
Efficiency @Max. Load	AEE10F18-L AEE10A18-L AEE04B18-L AEE03C18-L AEE02H18-L AEE10F36-L AEE10A36-L AEE04B36-L AEE03C36-L AEE02H36-L	$V_{IN,DC=}V_{IN,nom}$ $I_O=I_{O,max}$ T_A =25 ^OC	η	- - - - - - - - - -	90 91 92 92 91 90 91 92 92 91	- - - - - - - - - -	%

Input Specifications

Table 2. Input Specifications con't:

Parameter		Condition	Symbol	Min	Nom	Max	Unit
Start Up Time	Power Up	$V_{IN,DC=}V_{IN,nom}$ Constant Resistive Load		-	-	30	mS
	Remote On/Off			-	-	30	
Remote On/OFF Control		Remote ON Remote OFF		3.5 0	- -	12 1.2	Vdc
Remote Off Stand by Input Current		All		-	2.5	-	mA
Input Current of Remote Control Pin		All		-	0.5	-	mA
Internal Filter Type		All	Internal LC Filter (for EN55022,Class A)				

Output Specifications

Table 3. Output Specifications:

Parameter		Condition	Symbol	Min	Nom	Max	Unit
Output Voltage Set-Point	AEE10F18-L AEE10A18-L AEE04B18-L AEE03C18-L AEE02H18-L AEE10F36-L AEE10A36-L AEE04B36-L AEE03C36-L AEE02H36-L	$V_{IN,DC}=V_{IN,nom}$ $I_O=I_{O,max}$ T_A =25 ^OC	V_O	3.27 4.95 11.88 14.85 23.76 3.27 4.95 11.88 14.85 23.76	3.3 5 12 15 24 3.3 5 12 15 24	3.33 5.05 12.12 15.15 24.24 3.33 5.05 12.12 15.15 24.24	Vdc
Output Current	AEE10F18-L AEE10A18-L AEE04B18-L AEE03C18-L AEE02H18-L AEE10F36-L AEE10A36-L AEE04B36-L AEE03C36-L AEE02H36-L	Convection cooling	I_O	- - - - - - - - - -	- - - - - - - - - -	10 10 4.17 3.33 2.08 10 10 4.17 3.33 2.08	A
V_O Load Capacitance	AEE10F18-L AEE10A18-L AEE04B18-L AEE03C18-L AEE02H18-L AEE10F36-L AEE10A36-L AEE04B36-L AEE03C36-L AEE02H36-L	All		- - - - - - - - - -	- - - - - - - - - -	26000 17000 3000 2000 750 26000 17000 3000 2000 750	uF
Output Ripple, pk-pk	AEE10F18-L AEE10A18-L AEE04B18-L AEE03C18-L AEE02H18-L AEE10F36-L AEE10A36-L AEE04B36-L AEE03C36-L AEE02H36-L	20MHz bandwidth, measured with a 1uF MLCC and a 10uF Tantalum Capacitor	V_O	- - - - - - - - - -	100 100 150 150 150 150 150 100 100 150	- - - - - - - - - -	mV

Output Specifications

Table 3. Output Specifications con't:

Parameter		Condition	Symbol	Min	Nom	Max	Unit
Line Regulation		$V_{IN,DC=}V_{IN,min}$ to $V_{IN,max}$	$\pm\%V_O$	-	-	0.5	%
Load Regulation		$I_O=I_{O,min}$ to $I_{O,max}$	$\pm\%V_O$	-	-	0.5	%
Trim Range	24V Models	All	$\%V_O$	-10		+20	%
	Other Models	All	$\%V_O$	-10		+10	%
Switching Frequency		All	f_{SW}	-	285	-	KHz
V_O Dynamic Response	Peak Deviation Settling Time	25% load change	$\pm\%V_O$ t_s	- -	3 250	5 -	% uSec
Temperature Coefficient		All	$\%/^OC$	-	-	0.02	%
Output Over Current Protection[1]		All	$\%I_{O,max}$	-	150	-	%
Output Short Circuit Protection		All		Hiccup Automatic Recovery			
Output Over Voltage Protection	AEE10F18-L AEE10A18-L AEE04B18-L AEE03C18-L AEE02H18-L AEE10F36-L AEE10A36-L AEE04B36-L AEE03C36-L AEE02H36-L	All	V_O	- - - - - - - - - -	3.9 6.2 15 18 30 3.9 6.2 15 18 30	- - - - - - - - - -	Vdc

Note 1 - Hiccup Automatic Recovery

AEE10F18-L Performance Curves

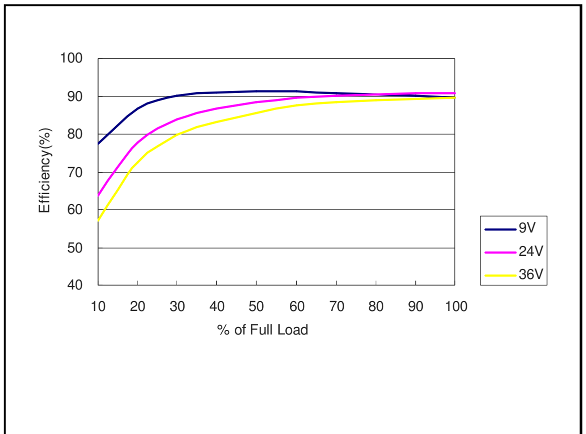


Figure 1: **AEE10F18-L Efficiency Versus Output Current Curve**
Vin = 9 to 36Vdc Load: Io = 0 to 10A

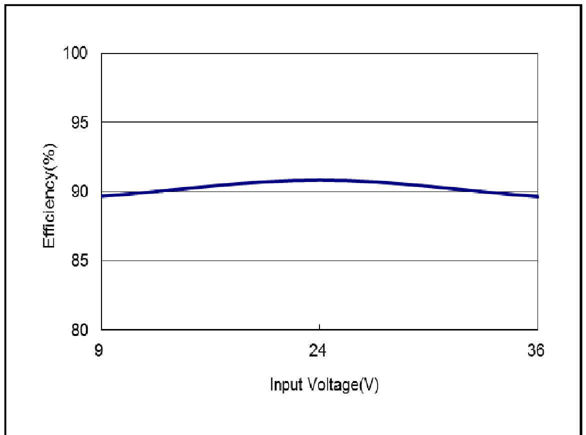


Figure 2: **AEE10F18-L Efficiency Versus Input Voltage Curve**
Vin = 9 to 36Vdc Load: Io = 10A

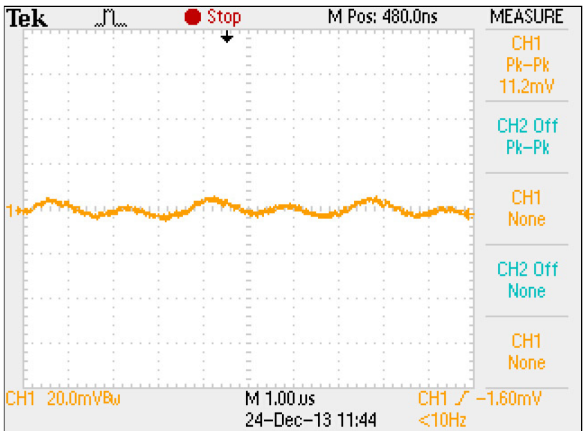


Figure 3 **AEE10F18-L Ripple and Noise Measurement**
Vin = 24Vdc Load: Io = 10A
Ch 1: Vo

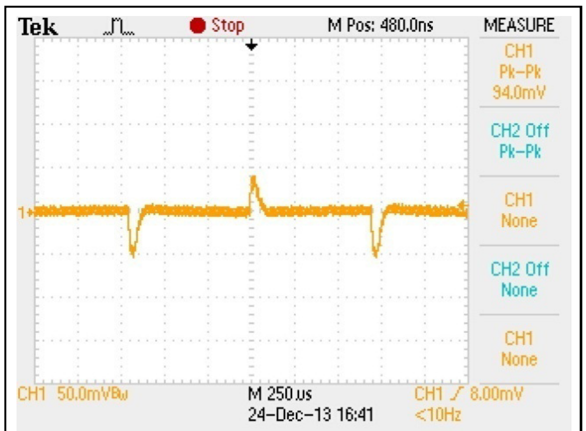


Figure 4: **AEE10F18-L Transient Response**
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

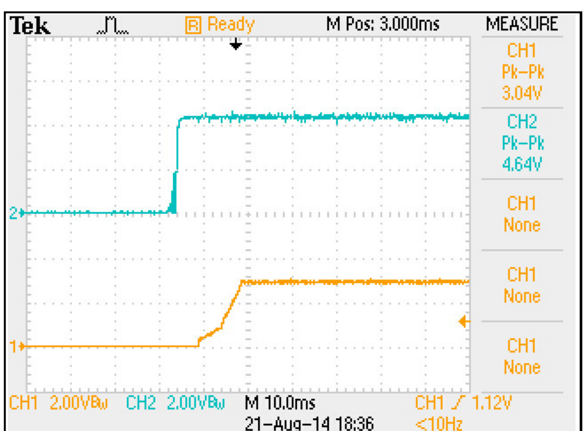


Figure 5: **AEE10F18-L Output Voltage Startup Characteristic by ON/OFF**
Vin = 24Vdc Load: Io = 10A
Ch1: Vo Ch2: Remote On/Off

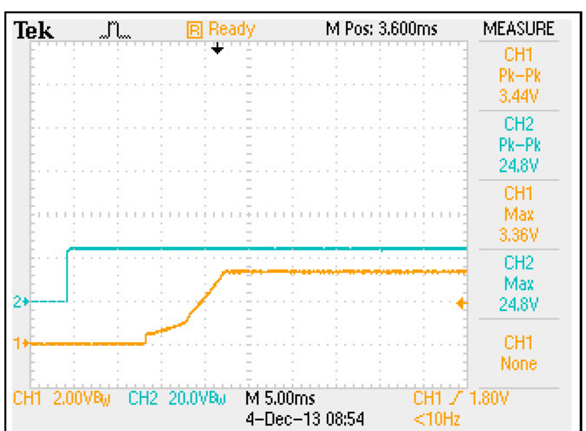


Figure 6: **AEE10F18-L Output Voltage Startup Characteristic by Vin**
Vin = 24Vdc Load: Io = 10A
Ch1: Vo Ch2: Vin

AEE10F18-L Performance Curves

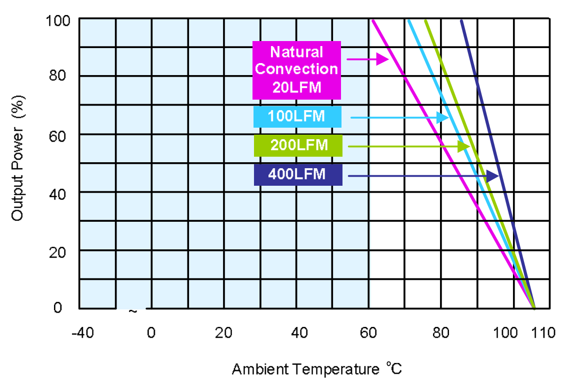


Figure 7: AEE10F18-L Derating Curves (without heatsink)
Vin = 24Vdc Load: Io = 0 to 10A

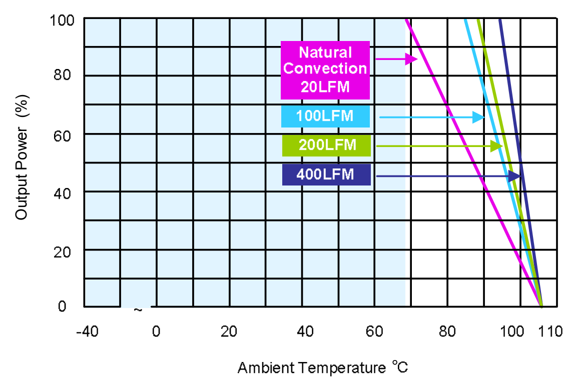


Figure 8: AEE10F18-L Derating Curves (with heatsink)
Vin = 24Vdc Load: Io = 0 to 10A

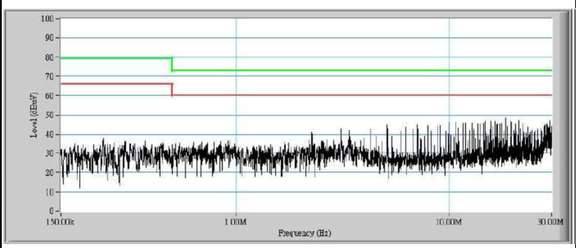


Figure 9: AEE10F18-L Conduction Emission of EN550122 Class A
Vin = 24Vdc Load: Io = 10A

Note - All test conditions are at 25 ^{O}C

AEE10A18-L Performance Curves

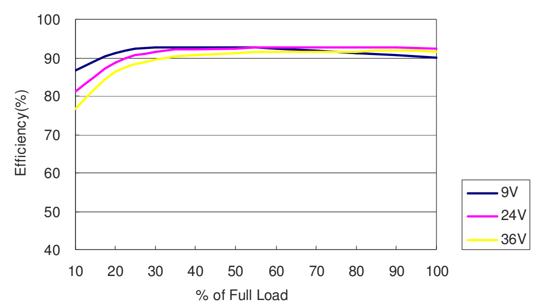


Figure 10: AEE10A18-L Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to 10A

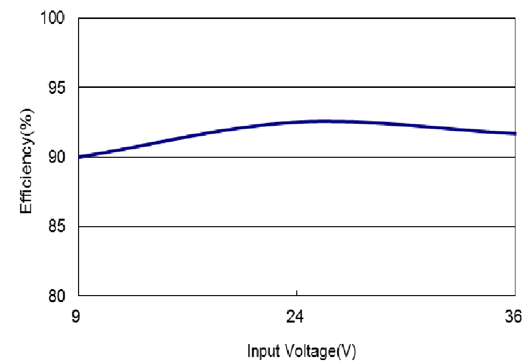


Figure 11: AEE10A18-L Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 10A

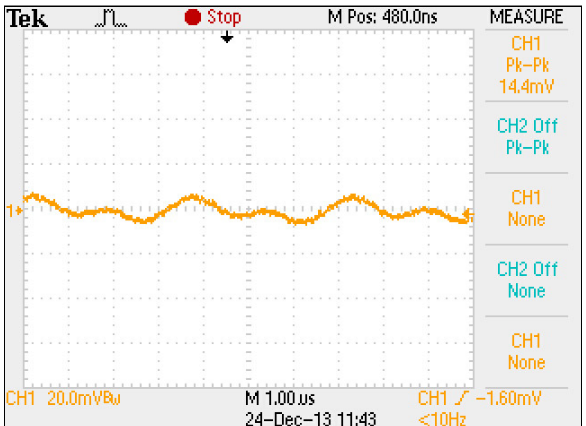


Figure 12: AEE10A18-L Ripple and Noise Measurement
Vin = 24Vdc Load: Io = 10A
Ch 1: Vo

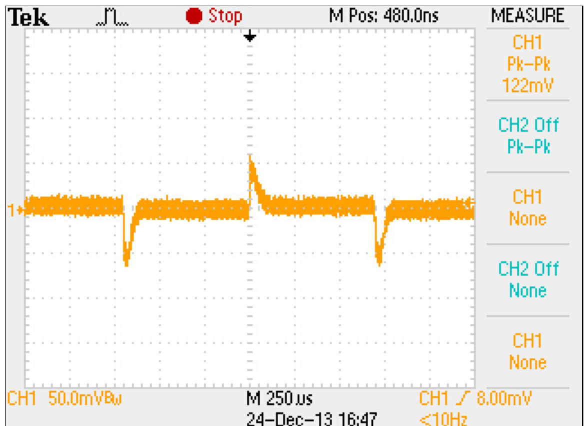


Figure 13: AEE10A18-L Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

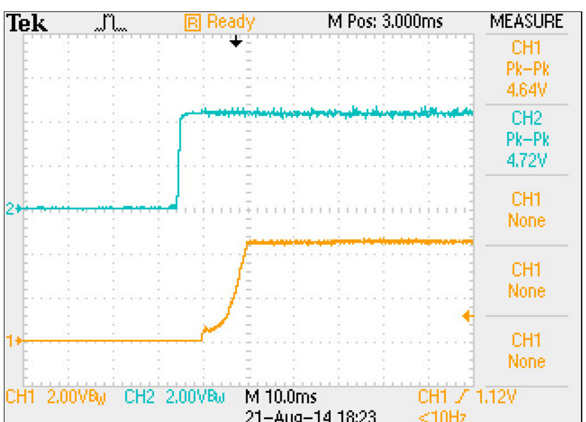


Figure 14: AEE10A18-L Output Voltage Startup Characteristic by ON/OFF
Vin = 24Vdc Load: Io = 10A
Ch1: Vo Ch2: Remote On/Off

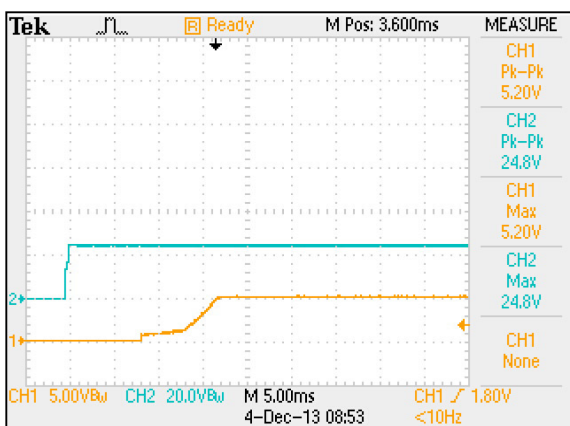


Figure 15: AEE10A18-L Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = 10A
Ch1: Vo Ch2: Vin

AEE10A18-L Performance Curves

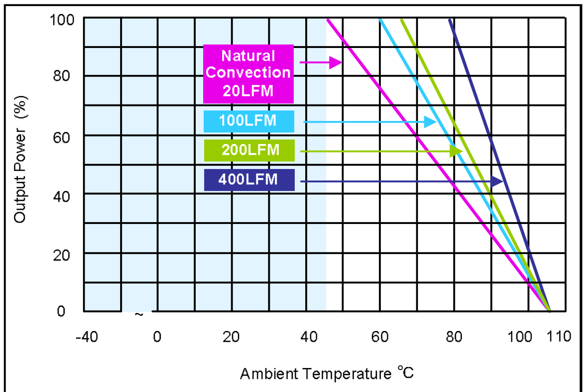


Figure 16: AEE10A18-L Derating Curves (without heatsink)
Vin = 24Vdc Load: Io = 0 to 10A

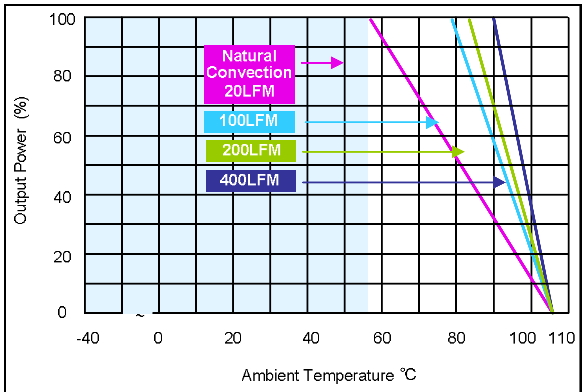


Figure 17: AEE10A18-L Derating Curves (with heatsink)
Vin = 24Vdc Load: Io = 0 to 10A

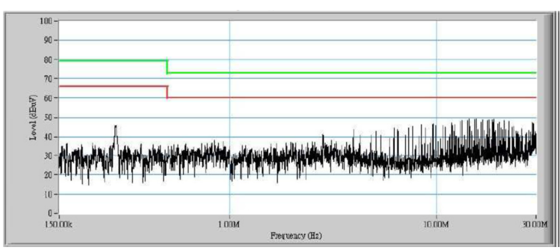


Figure 18: AEE10A18-L Conduction Emission of EN550122 Class A
Vin = 24Vdc Load: Io = 4A

Note - All test conditions are at 25 °C

AEE04B18-L Performance Curves

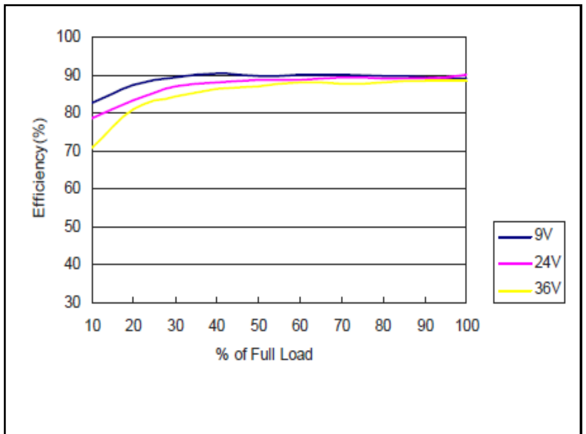


Figure 19: AEE04B18-L Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to 4.17A

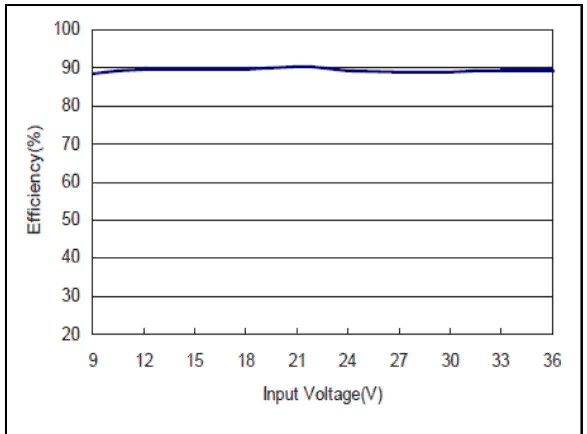


Figure 20: AEE04B18-L Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 4.17A

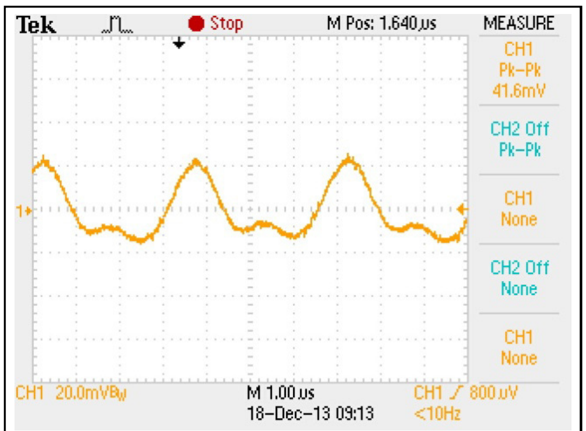


Figure 21: AEE04B18-L Ripple and Noise Measurement
Vin = 24Vdc Load: Io = 4.17A
Ch 1: Vo

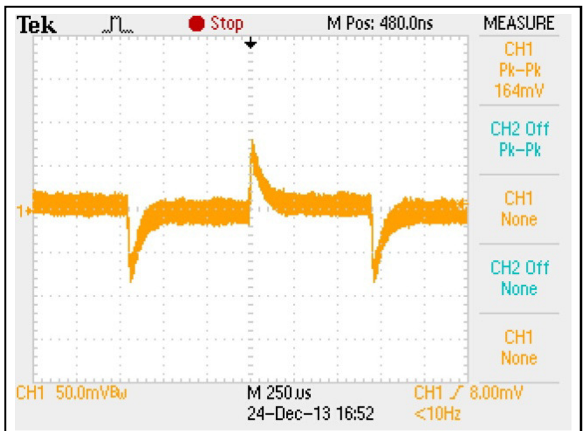


Figure 22: AEE04B18-L Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

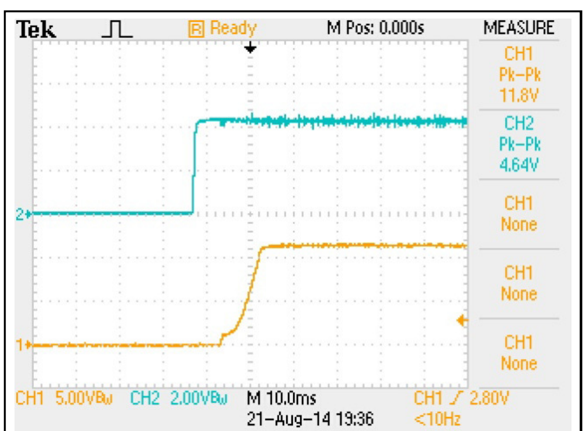


Figure 23: AEE04B18-L L Output Voltage Startup Characteristic by ON/OFF
Vin = 24Vdc Load: Io = 4.17A
Ch1: Vo Ch2: Remote On/Off

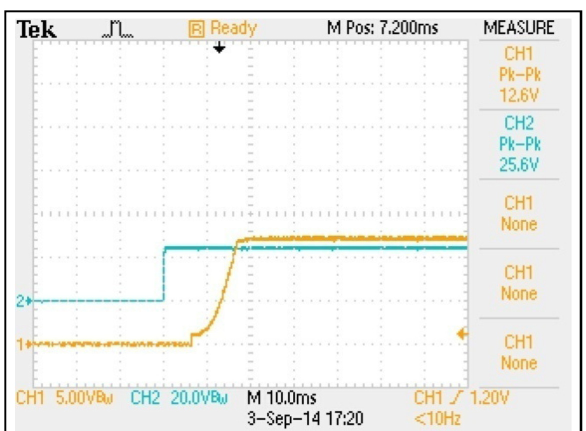


Figure 24: AEE04B18-L Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = 4.17A
Ch1: Vo Ch2: Vin

AEE04B18-L Performance Curves

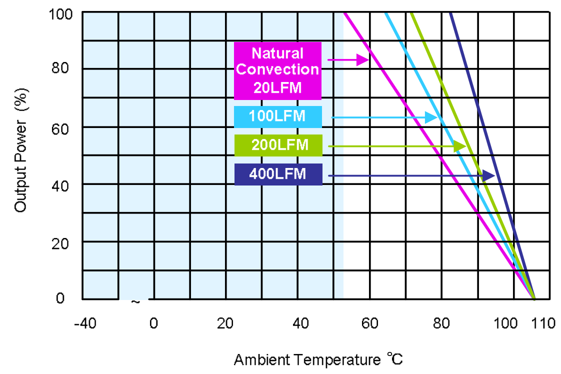


Figure 25: AEE04B18-L Derating Curves (without heatsink)
Vin = 24Vdc Load: Io = 0 to 4.17A

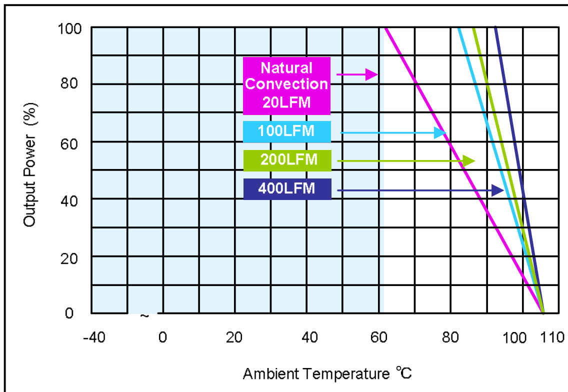


Figure 26: AEE04B18-L Derating Curves (with heatsink)
Vin = 24Vdc Load: Io = 0 to 4.17A

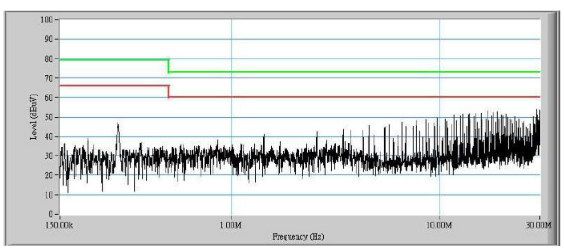


Figure 27: AEE04B18-L Conduction Emission of EN550122 Class A
Vin = 24Vdc Load: Io = 4.17A

Note - All test conditions are at 25 ^{O}C

AEE03C18-L Performance Curves

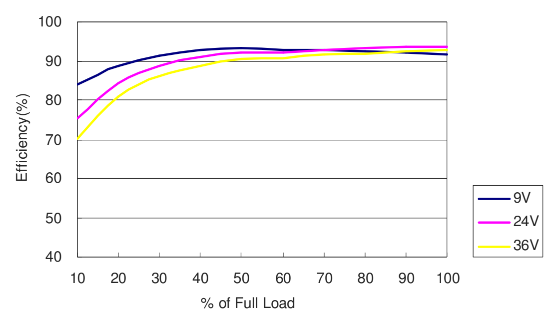


Figure 28: AEE03C18-L Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to 3.33A

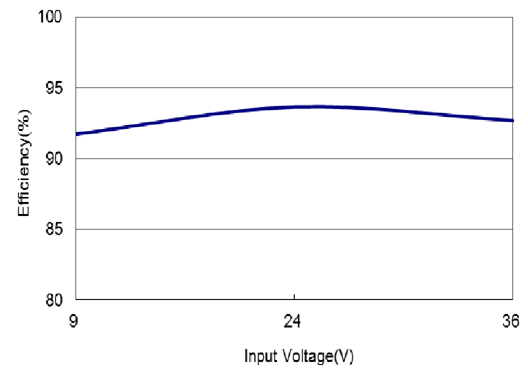


Figure 29: AEE03C18-L Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 3.33A

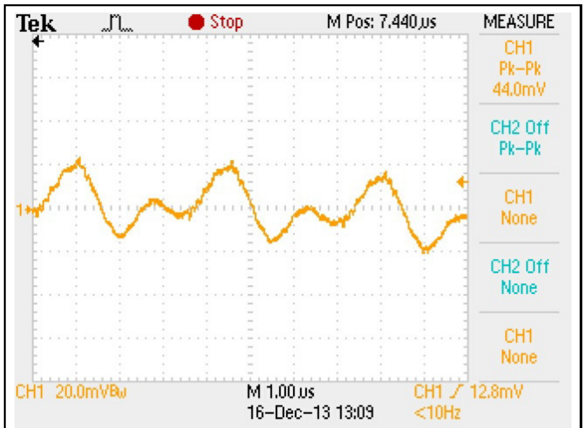


Figure 30: AEE03C18-L Ripple and Noise Measurement
Vin = 24Vdc Load: Io = 3.33A
Ch 1: Vo

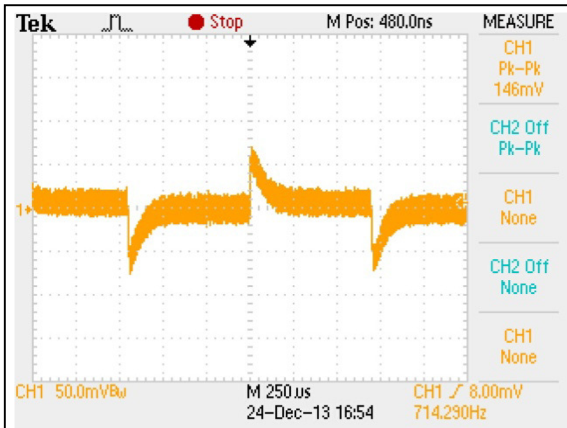


Figure 31: AEE03C18-L Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

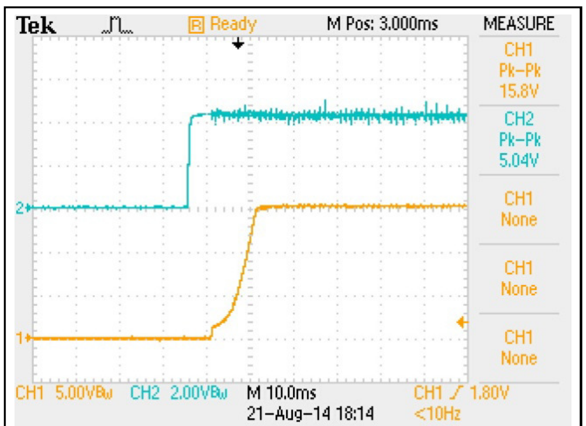


Figure 32: AEE03C18-L Output Voltage Startup Characteristic by ON/OFF
Vin = 24Vdc Load: Io = 3.33A
Ch1: Vo Ch2: Remote On/Off

Figure 33: AEE03C18-L Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = 3.33A
Ch1: Vo Ch2: Vin

AEE03C18-L Performance Curves

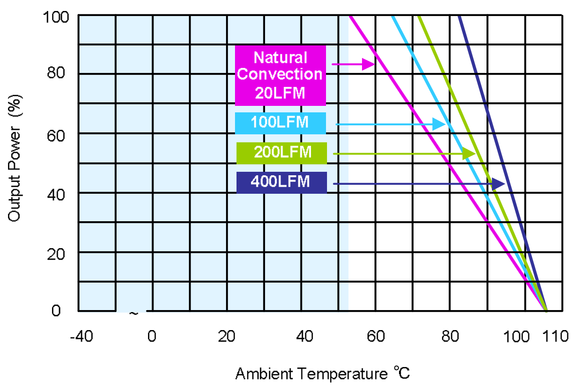


Figure 34: AEE03C18-L Derating Curves (without heatsink)
Vin = 24Vdc Load: Io = 0 to 3.33A

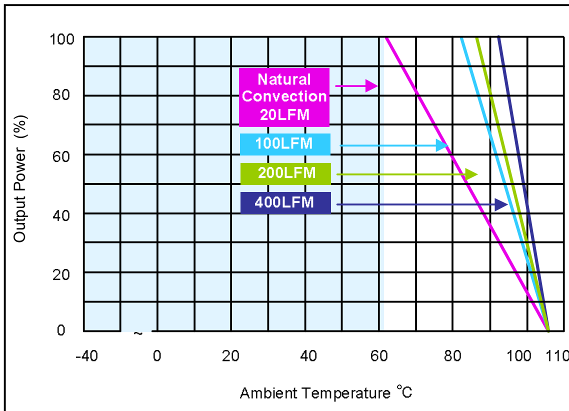


Figure 35: AEE03C18-L Derating Curves (with heatsink)
Vin = 24Vdc Load: Io = 0 to 3.33A

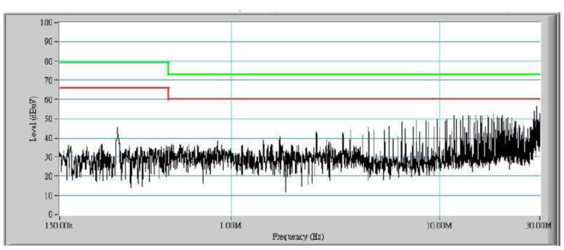


Figure 36: AEE03C18-L Conduction Emission of EN550122 Class A
Vin = 24Vdc Load: Io = 3.33A

Note - All test conditions are at 25 °C

AEE02H18-L Performance Curves

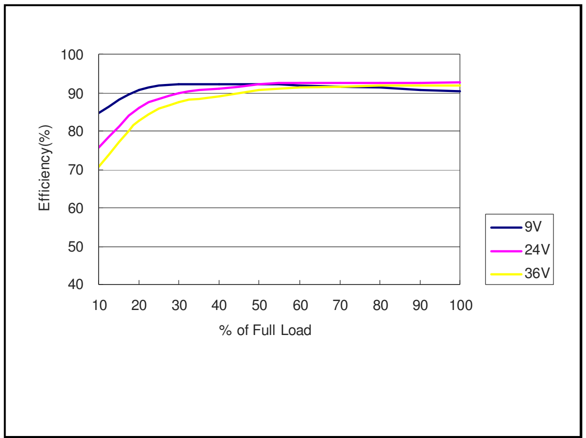


Figure 37: AEE02H18-L Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to 2.08A

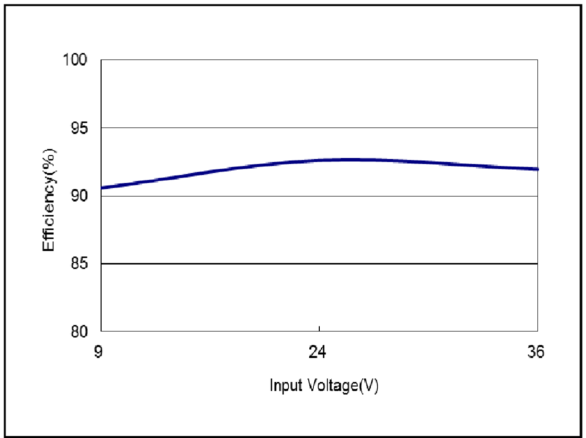


Figure 38: AEE02H18-L Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 2.08A

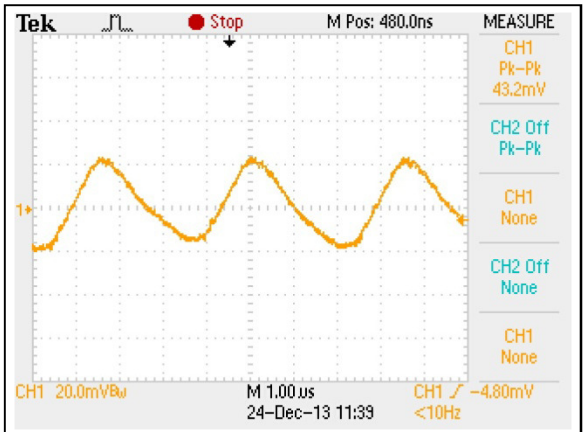


Figure 39: AEE02H18-L Ripple and Noise Measurement
Vin = 24Vdc Load: Io = 2.08A
Ch 1: Vo

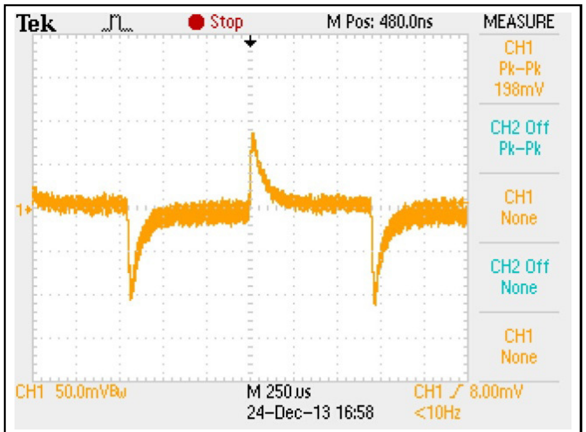


Figure 40: AEE02H18-L Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

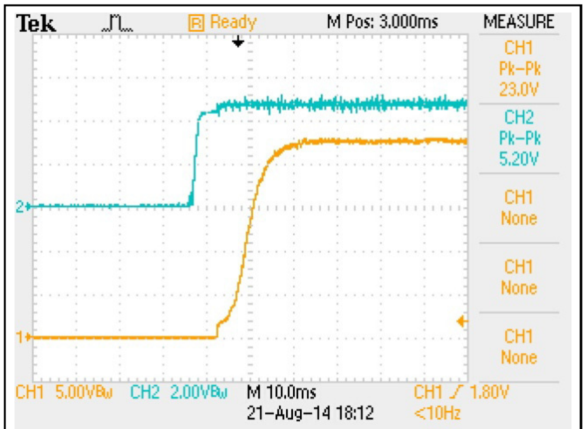


Figure 41: AEE02H18-L Output Voltage Startup Characteristic by ON/OFF
Vin = 24Vdc Load: Io = 2.08A
Ch1: Vo Ch2: Remote On/Off

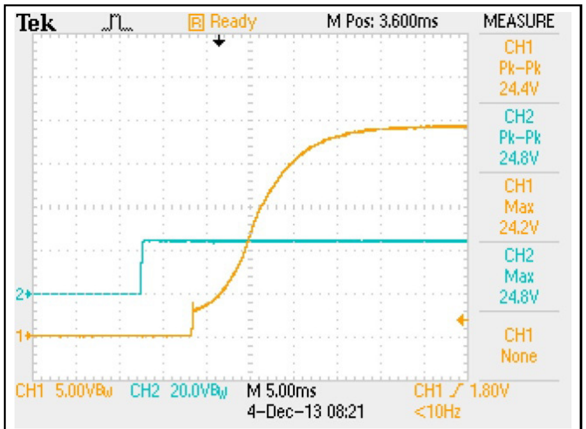


Figure 42: AEE02H18-L Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = 2.08A
Ch1: Vo Ch2: Vin

AEE02H18-L Performance Curves

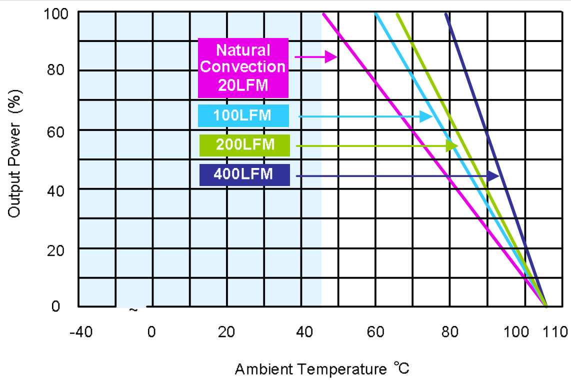


Figure 43: AEE02H18-L Derating Curves (without heatsink)
Vin = 24Vdc Load: Io = 0 to 2.08A

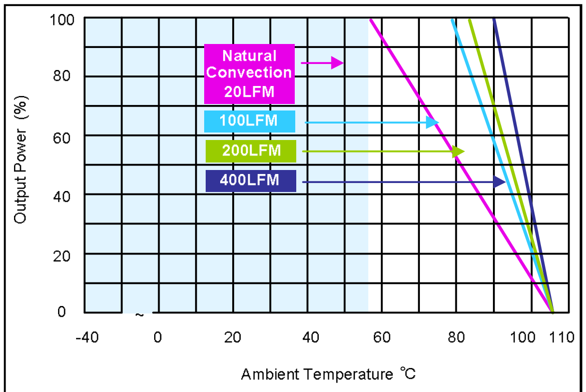


Figure 44: AEE02H18-L Derating Curves (with heatsink)
Vin = 24Vdc Load: Io = 0 to 2.08A

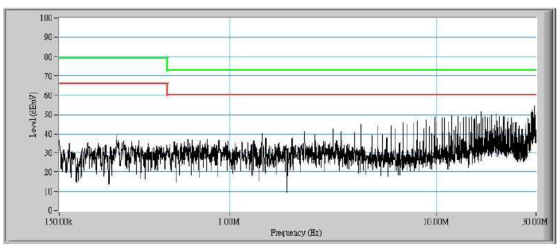


Figure 45: AEE02H18-L Conduction Emission of EN550122 Class A
Vin = 24Vdc Load: Io = 2.08A

Note - All test conditions are at 25 °C

AEE10F36-L Performance Curves

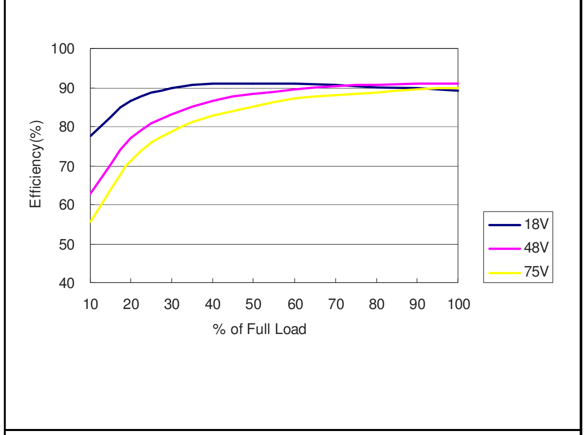


Figure 46: AEE10F36-L Efficiency Versus Output Current Curve
Vin = 9 to 36Vdc Load: Io = 0 to 10A

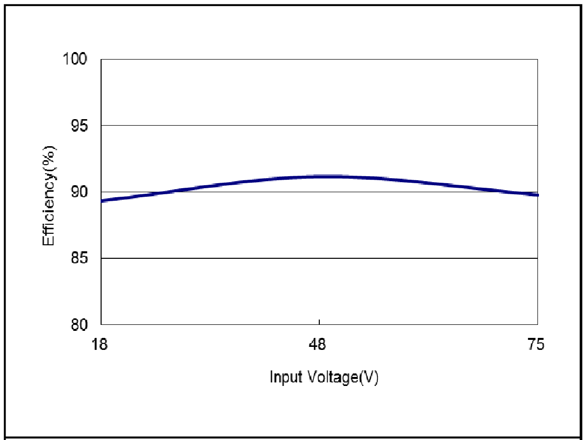


Figure 47: AEE10F36-L Efficiency Versus Input Voltage Curve
Vin = 9 to 36Vdc Load: Io = 10A

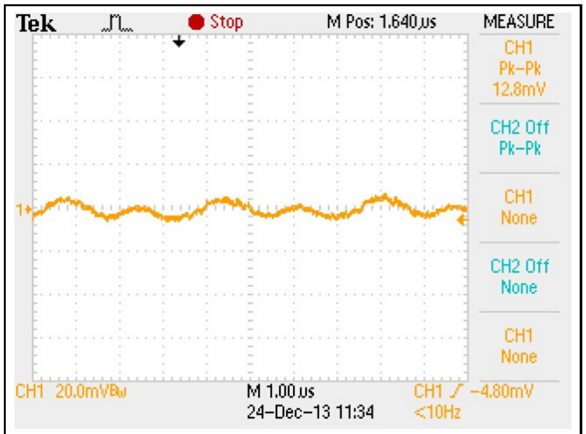


Figure 48: AEE10F36-L Ripple and Noise Measurement
Vin = 24Vdc Load: Io = 10A
Ch 1: Vo

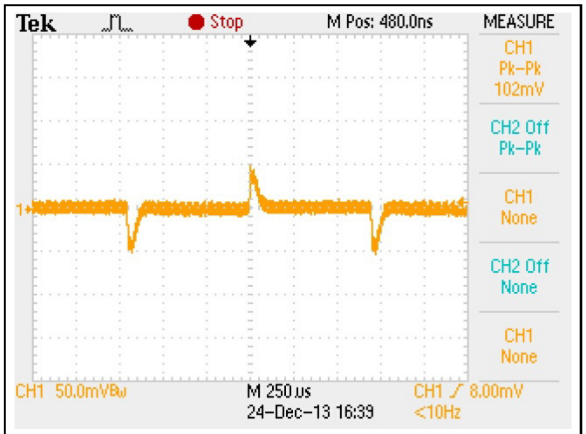


Figure 49: AEE10F36-L Transient Response
Vin = 24Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

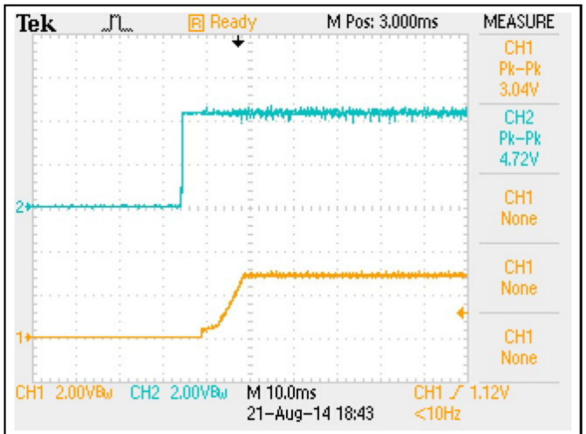


Figure 50: AEE10F36-L Output Voltage Startup Characteristic by ON/OFF
Vin = 24Vdc Load: Io = 10A
Ch1: Vo Ch2: Remote On/Off

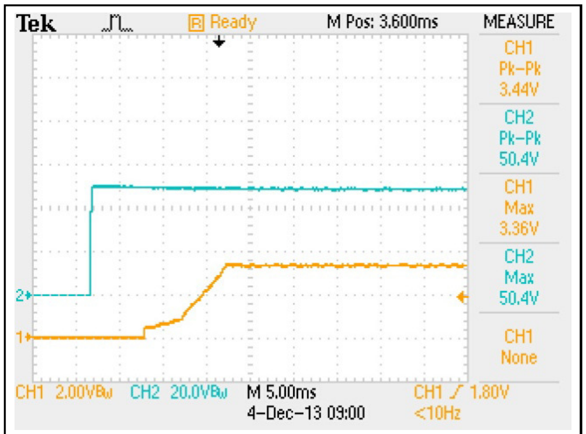


Figure 51: AEE10F36-L Output Voltage Startup Characteristic by Vin
Vin = 24Vdc Load: Io = 10A
Ch1: Vo Ch2: Vin

AEE10F36-L Performance Curves

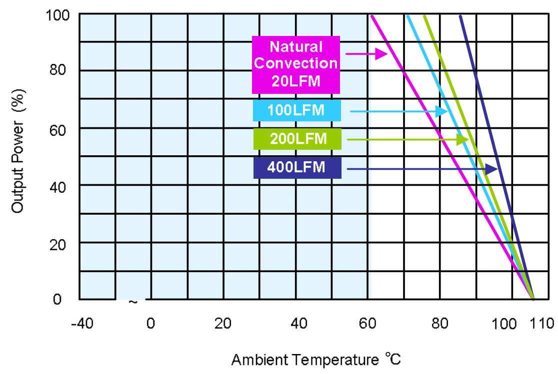


Figure 52: AEE10F36-L Derating Curves (without heatsink)
Vin = 24Vdc Load: Io = 0 to 10A

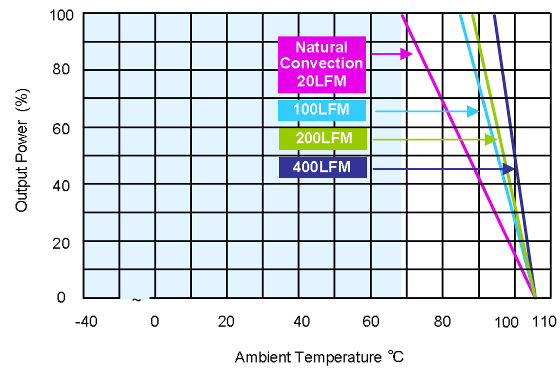


Figure 53: AEE10F36-L Derating Curves (with heatsink)
Vin = 24Vdc Load: Io = 0 to 10A

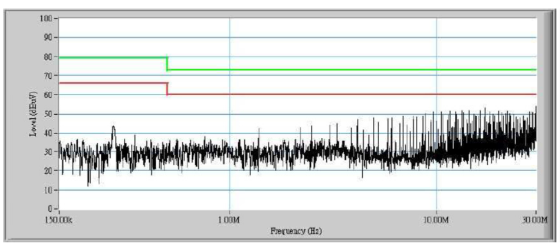


Figure 54: AEE10F36-L Conduction Emission of EN550122 Class A
Vin = 24Vdc Load: Io = 10A

Note - All test conditions are at 25 ^{O}C

AEE10A36-L Performance Curves

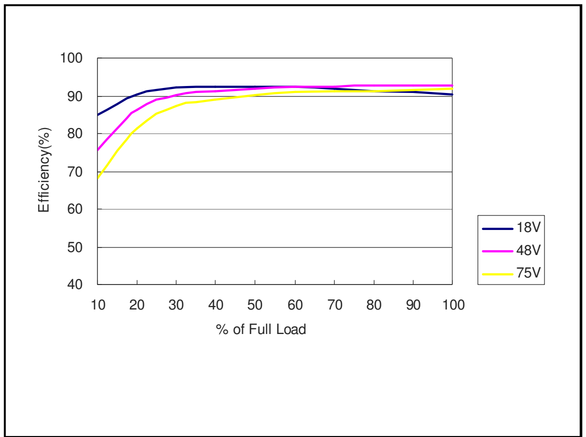


Figure 55: AEE10A36-L Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to 10A

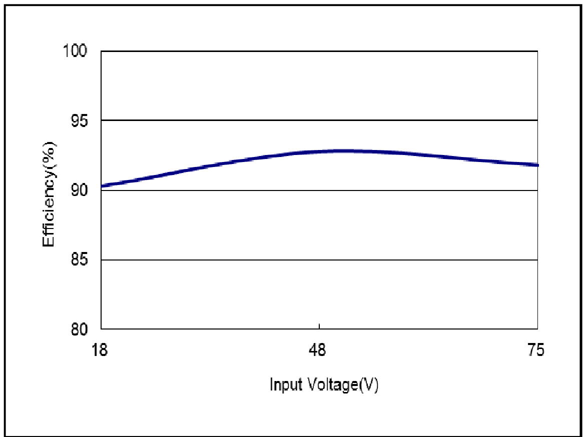


Figure 56: AEE10A36-L Efficiency Versus Input Voltage Curve
Vin = 18 to 75Vdc Load: Io = 10A

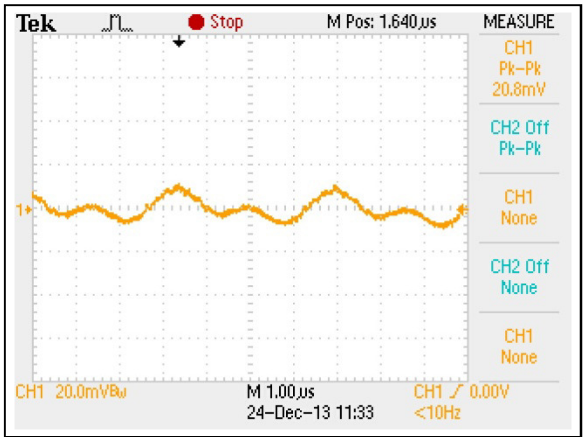


Figure 57: EE10A36-L Ripple and Noise Measurement
Vin = 48Vdc Load: Io = 10A
Ch 1: Vo

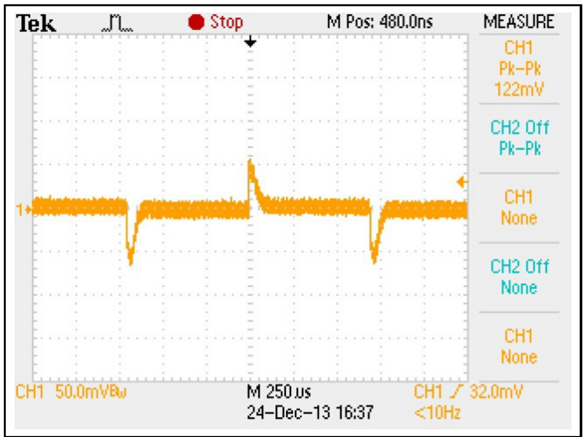


Figure 58: AEE10A36-L Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

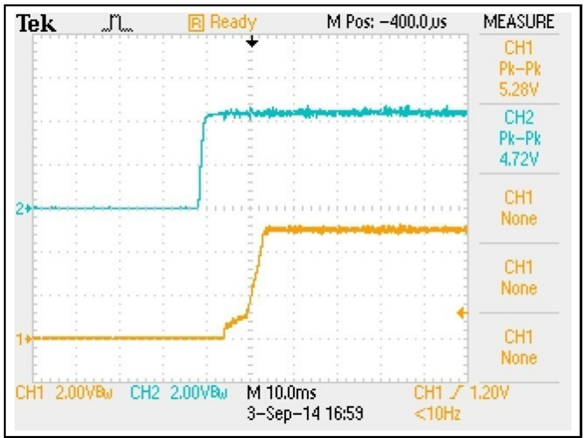


Figure 59: AEE10A36-L Output Voltage Startup Characteristic by ON/OFF
Vin = 48Vdc Load: Io = 10A
Ch1: Vo Ch2: Remote On/Off

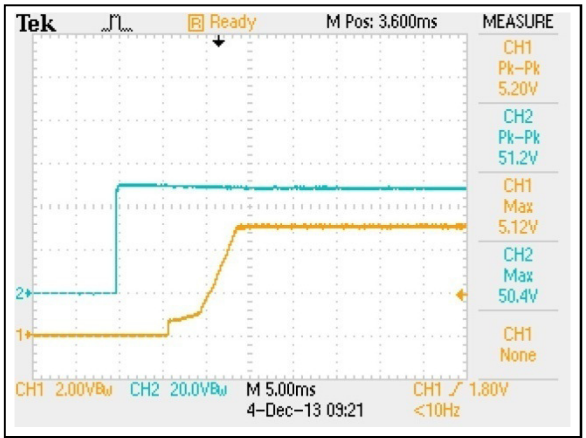


Figure 60: AEE10A36-L Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = 10A
Ch1: Vo Ch2: Vin

AEE10A36-L Performance Curves

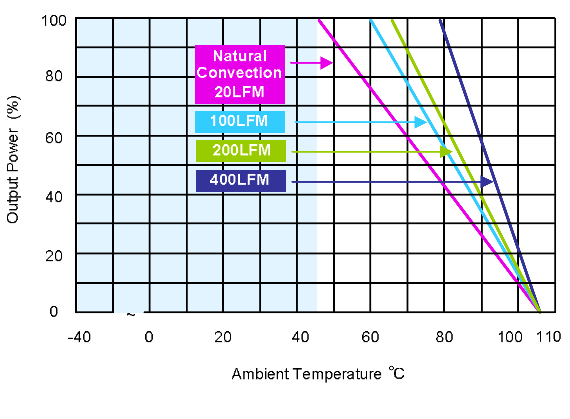


Figure 61: AEE10A36-L Derating Curves (without heatsink)
Vin = 48Vdc Load: Io = 0 to 10A

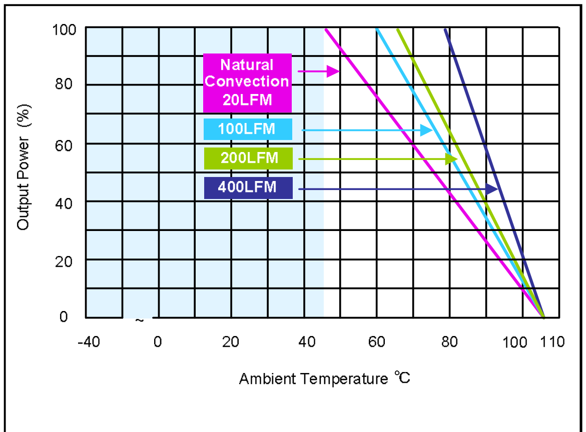


Figure 62: AEE10A36-L Derating Curves (with heatsink)
Vin = 48Vdc Load: Io = 10A

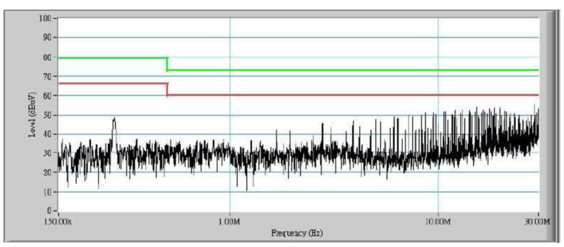


Figure 63: AEE10A36-L Conduction Emission of EN550122 Class A
Vin = 24Vdc Load: Io = 10A

Note - All test conditions are at 25 °C

AEE04B36-L Performance Curves

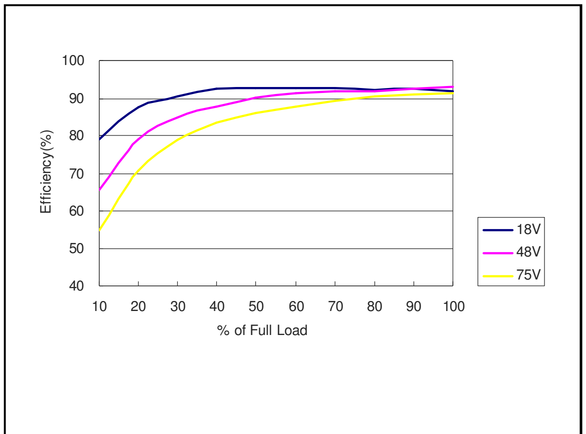


Figure 64: AEE04B36-L Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to 4.17A

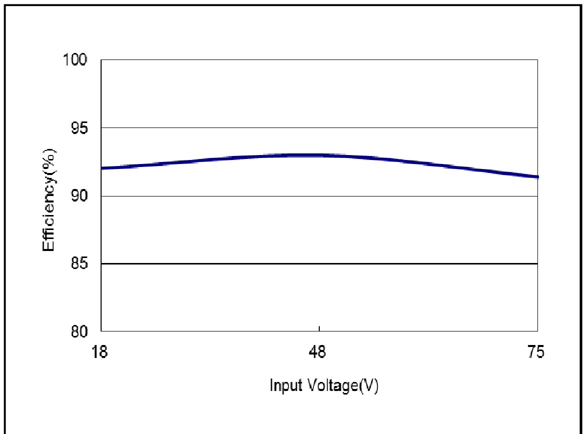


Figure 65: AEE04B36-L Efficiency Versus Input Voltage Curve
Vin = 18-75 Vdc Load: Io = 4.17A

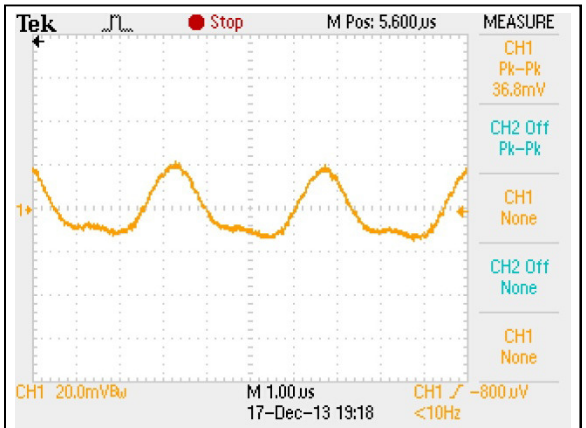


Figure 66: AEE04B36-L Ripple and Noise Measurement
Vin = 48Vdc Load: Io = 4.17A
Ch 1: Vo

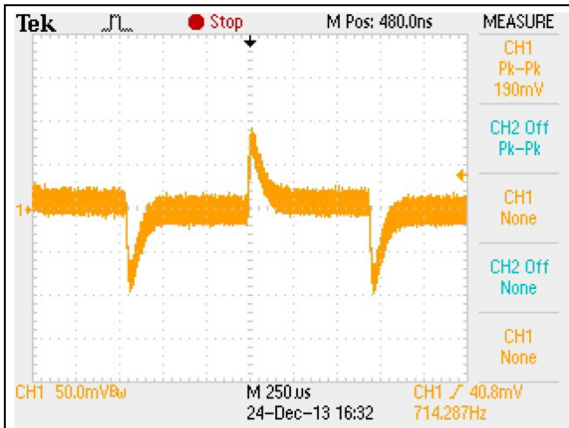


Figure 67: AEE04B36-L Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

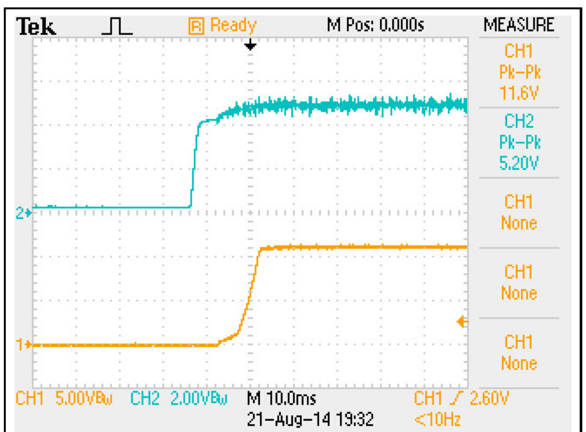


Figure 68: AEE04B36-L Output Voltage Startup Characteristic by ON/OFF
Vin = 48Vdc Load: Io = 4.17A
Ch1: Vo Ch2: Remote On/Off

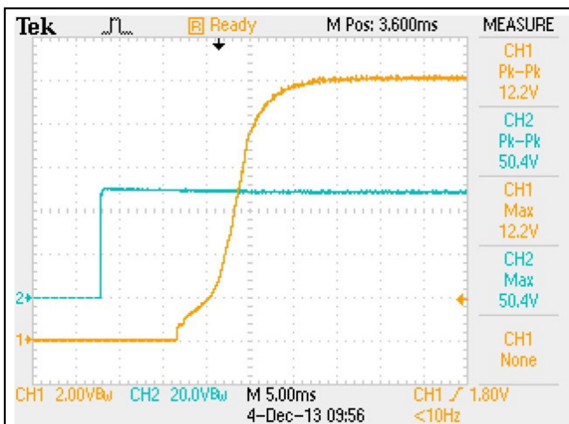


Figure 69: AEE04B36-L Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = 4.17A
Ch1: Vo Ch2: Vin

AEE04B36-L Performance Curves

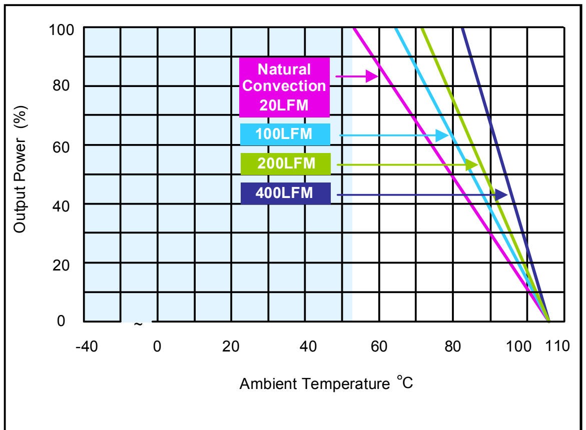


Figure 70: AEE04B36-L Derating Curves (without heatsink)
Vin = 48Vdc Load: Io = 0 to 4.17A

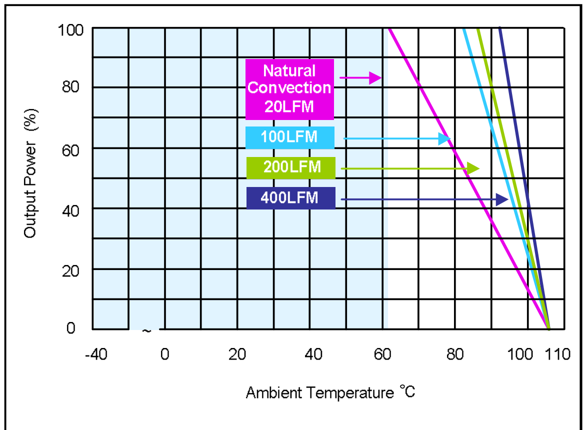


Figure 71: AEE04B36-L Derating Curves (with heatsink)
Vin = 48Vdc Load: Io = 0 to 4.17A

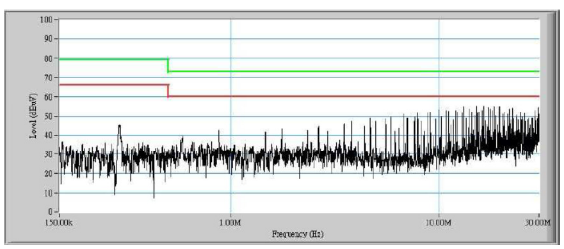


Figure 72: AEE04B36-L Conduction Emission of EN550122 Class A
Vin = 48Vdc Load: Io = 4.17A

Note - All test conditions are at 25 °C

AEE03C36-L Performance Curves

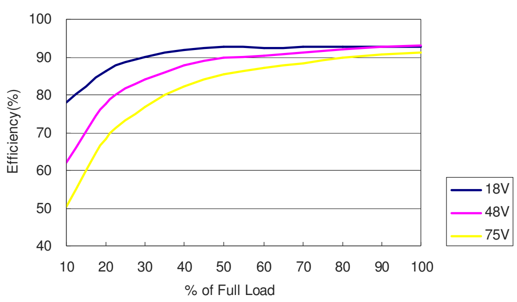


Figure 73: AEE03C36-L Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to 3.33A

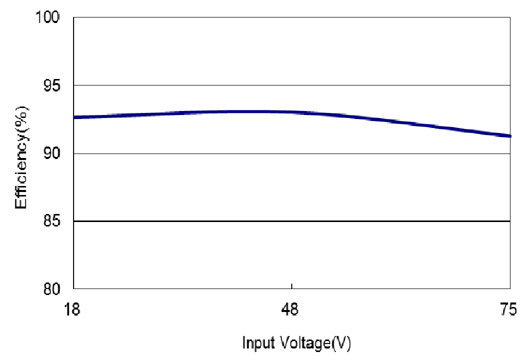


Figure 74: AEE03C36-L Efficiency Versus Input Voltage Curve
Vin = 18-75 Vdc Load: Io = 3.33A

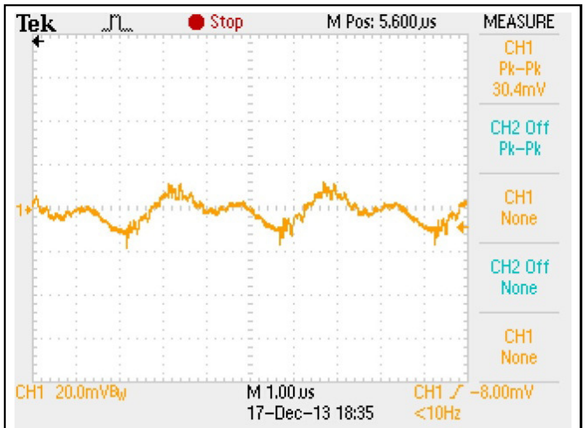


Figure 75: AEE03C36-L Ripple and Noise Measurement
Vin = 48Vdc Load: Io = 3.33A
Ch 1: Vo

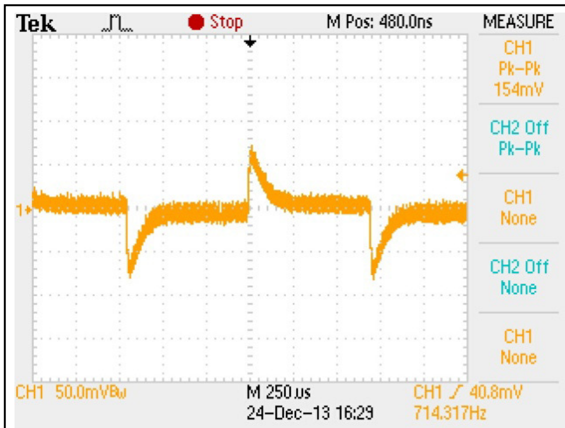


Figure 76: AEE03C36-L Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

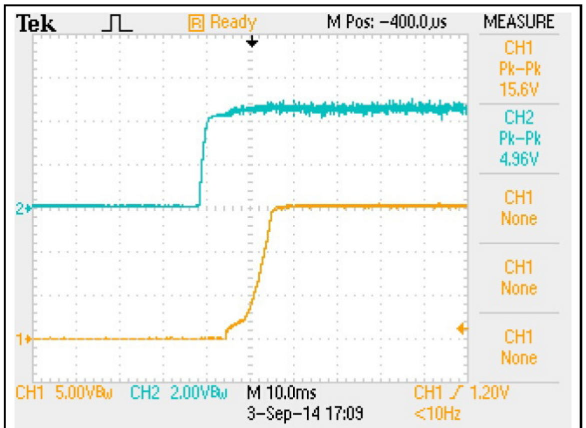


Figure 77: AEE03C36-L Output Voltage Startup Characteristic by ON/OFF
Vin = 48Vdc Load: Io = 3.33A
Ch1: Vo Ch2: Remote On/Off

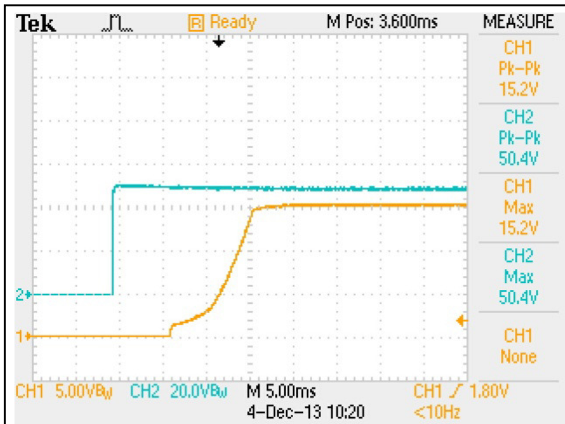


Figure 78: AEE03C36-L Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = 3.33A
Ch1: Vo Ch2: Vin

AEE03C36-L Performance Curves

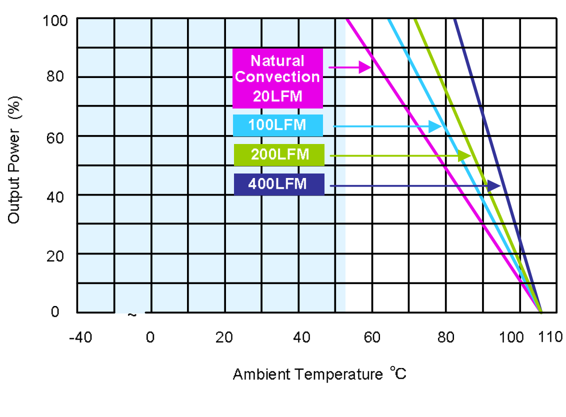


Figure 79: AEE03C36-L Derating Curves (without heatsink)
Vin = 48Vdc Load: Io = 0 to 3.33A

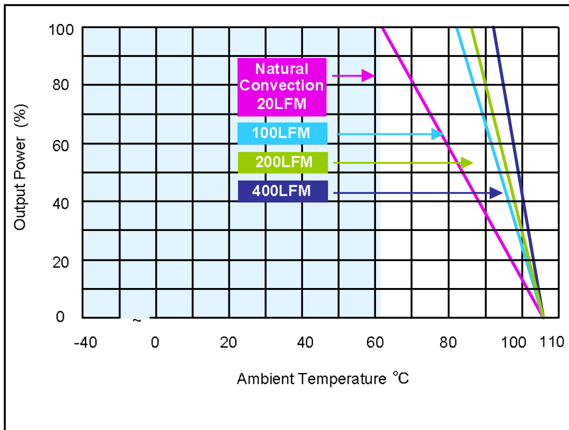


Figure 80: AEE03C36-L Derating Curves (with heatsink)
Vin = 48Vdc Load: Io = 0 to 3.33A

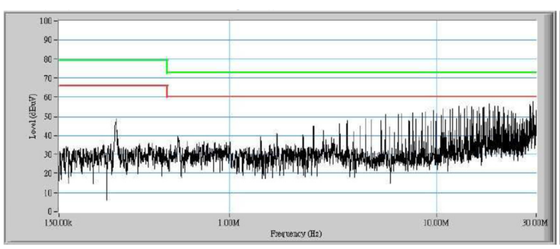


Figure 81: AEE03C36-L Conduction Emission of EN550122 Class A
Vin = 48Vdc Load: Io = 3.33A

Note - All test conditions are at 25 °C

AEE02H36-L Performance Curves

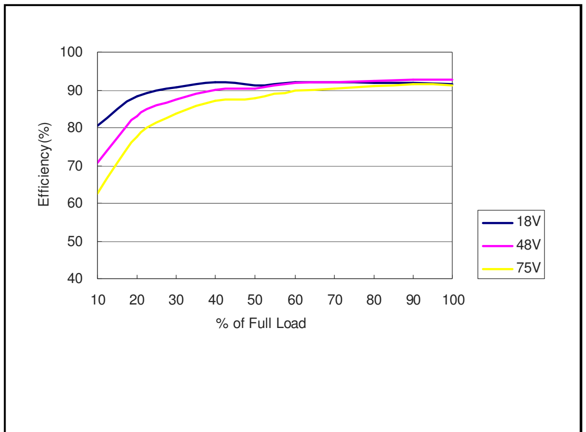


Figure 82: AEE02H36-L Efficiency Versus Output Current Curve
Vin = 18 to 75Vdc Load: Io = 0 to 2.08A

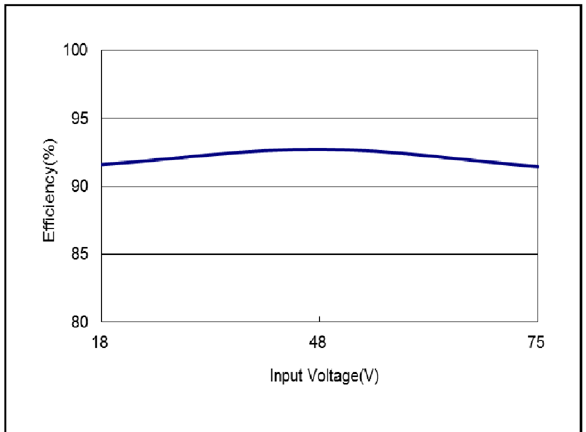


Figure 83: AEE02H36-L Efficiency Versus Input Voltage Curve
Vin = 18-75 Vdc Load: Io = 2.08A

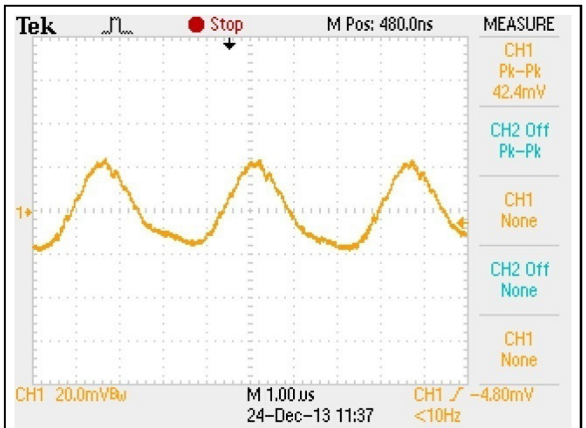


Figure 84 : AEE02H36-L Ripple and Noise Measurement
Vin = 48Vdc Load: Io = 2.08A
Ch 1: Vo

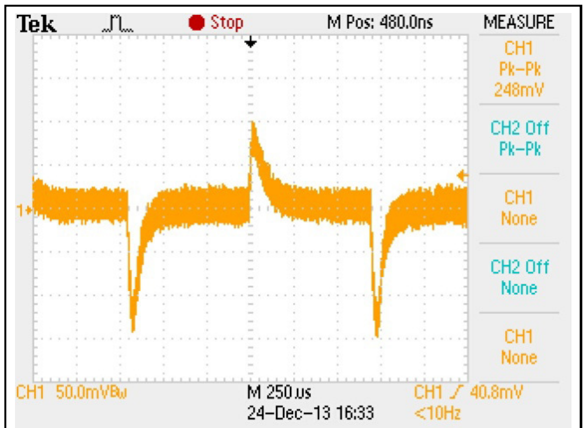


Figure 85: AEE02H36-L Transient Response
Vin = 48Vdc Load: Io = 100% to 75% load change
Ch 1: Vo

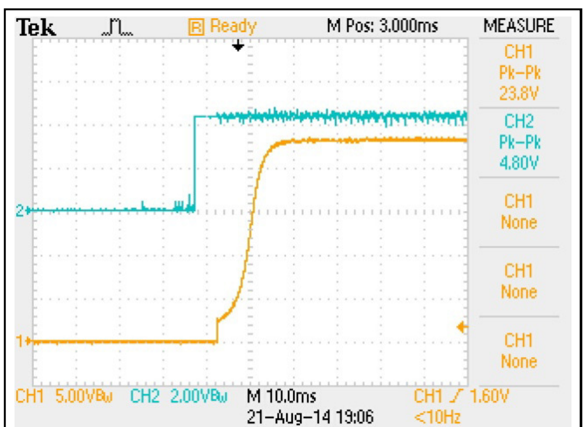


Figure 86: AEE02H36-L Output Voltage Startup Characteristic by ON/OFF
Vin = 48Vdc Load: Io = 2.08A
Ch1: Vo Ch2: Remote On/Off

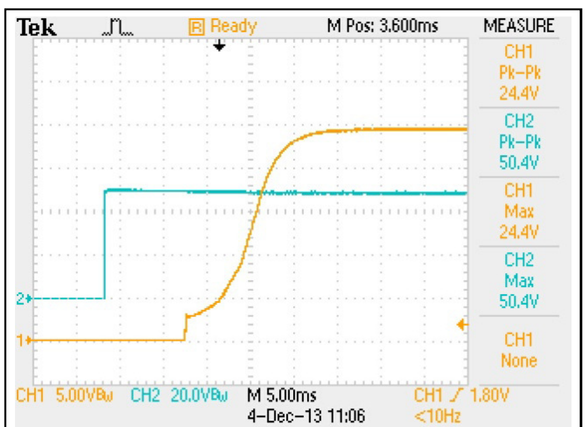


Figure 87: AEE02H36-L Output Voltage Startup Characteristic by Vin
Vin = 48Vdc Load: Io = 2.08A
Ch1: Vo Ch2: Vin

AEE02H36-L Performance Curves

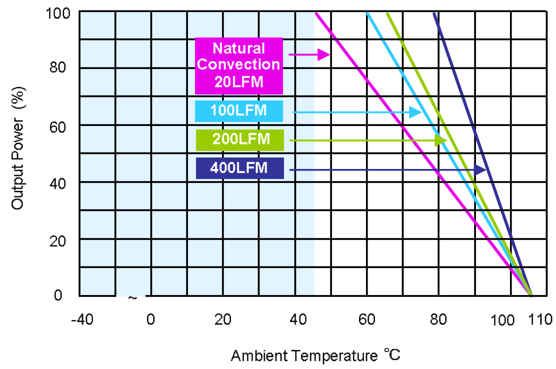


Figure 88: AEE02H36-L Derating Curves (without heatsink)
Vin = 48Vdc Load: Io = 0 to 2.08A

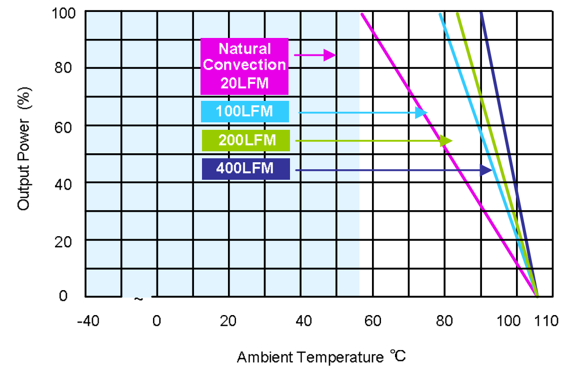


Figure 89: AEE02H36-L Derating Curves (with heatsink)
Vin = 48Vdc Load: Io = 0 to 2.08A

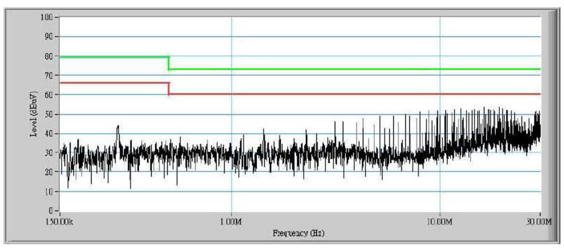
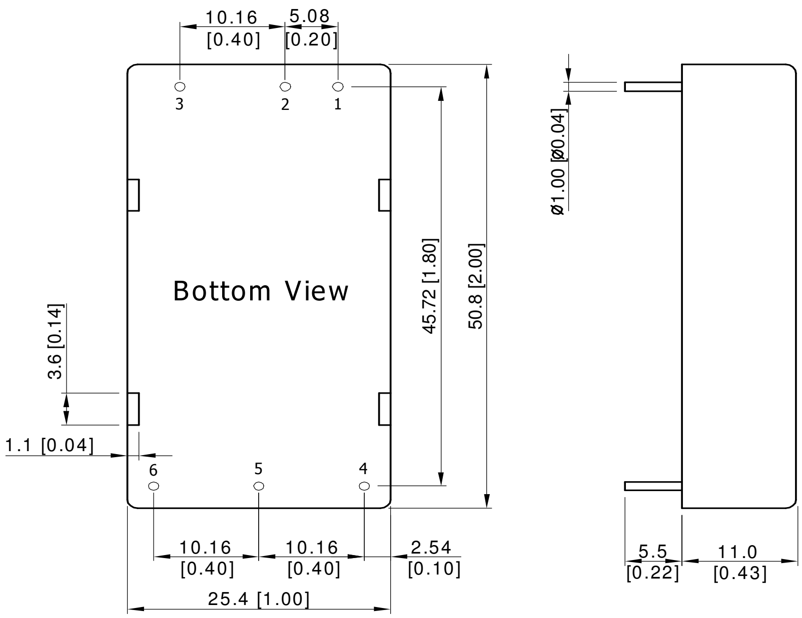


Figure 90: AEE02H36-L Conduction Emission of EN550122 Class A
Vin = 48Vdc Load: Io =2.08A

Note - All test conditions are at 25 ^{o}C

Mechanical Specifications

Mechanical Outlines



Pin Connections

Single output

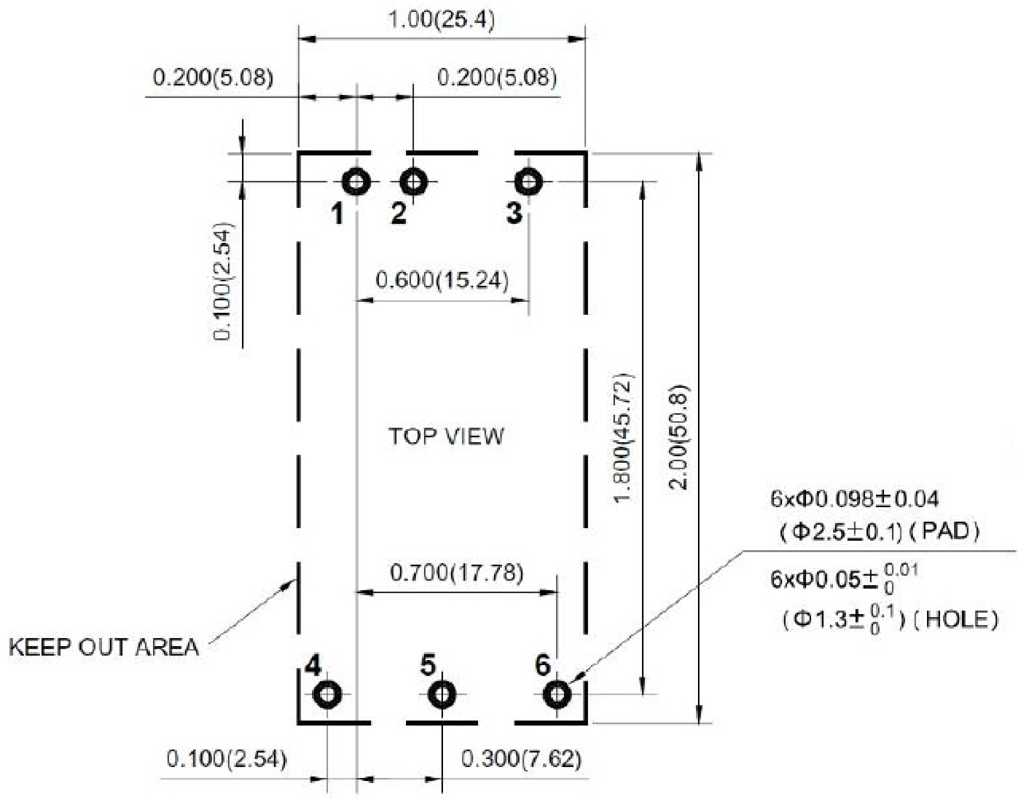
Pin 1 – +Vin
Pin 2 – -Vin
Pin 3 – Remote On/Off
Pin 4 – +Vout
Pin 5 – -Vout
Pin 6 – Trim

Note:
1.All dimensions in mm (inches)
2.Tolerance: X.X±0.25 (X.XX±0.01)
X.XX±0.13 (X.XXX±0.005)
3.Pin diameter 1.0 ±0.05 (0.04±0.002)

Physical Characteristics

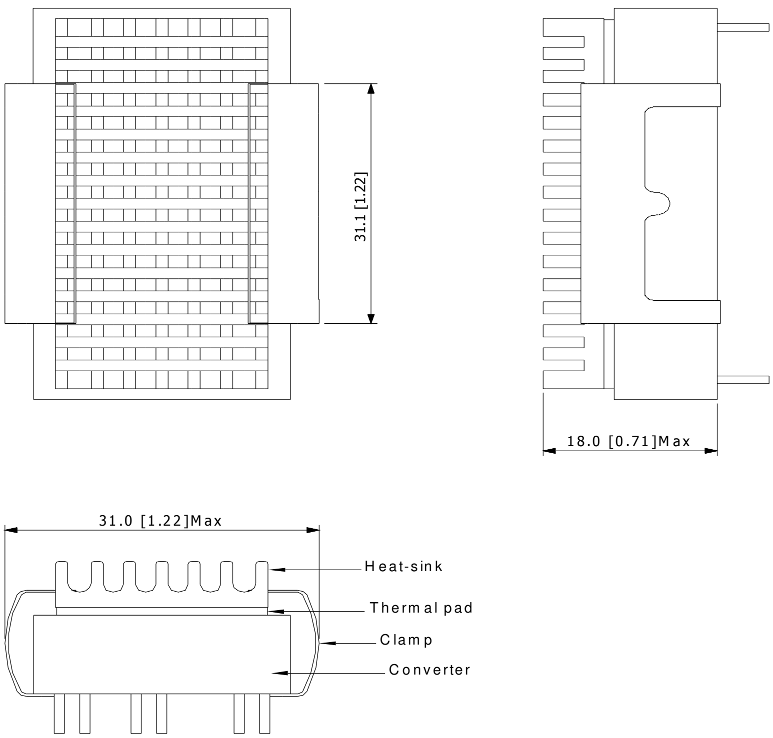
Device code suffix	L
Case Size	50.8x25.4x11mm (2.0x1.0x0.43 inches)
Case Material	Aluminium Alloy, Black Anodized Coating
Base Material	FR4 PCB (flammability to UL 94V-0 rated)
Pin Material	Copper Alloy with Gold Plate Over Nickel Subplate
Potting Material	Epoxy (UL94-V0)
Weight	34g

Recommended Pad Layout



1. All dimensions in Inches (mm)
   Tolerance: x.xx ±0.02" (x.x ±0.5)
   x.xxx ±0.01" (x.xx ±0.25mm)
2. Pin pitch tolerance: ±0.01" (±0.25mm)
3. Pin dimension tolerance: ±0.004" (±0.1mm)

Heatsink (Option - HS)



Heatsink Material: Aluminum

Finish: Black Anodized Coating

Weight: 9g

The advantages of adding a heatsink are:

1. To help heat dissipation and increase the stability and reliability of DC/DC converters at high operating temperature atmosphere.

2. To upgrade the operating temperature of DC/DC converters, please refer to Derating Curve.

Environmental Specifications

EMC Immunity

AEE 50W series power supply is designed to meet the following EMC immunity specifications.

Table 4. EMC Specifications:

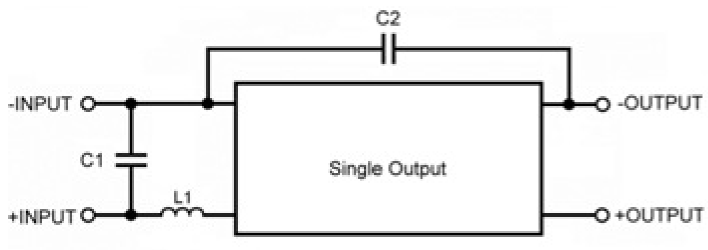
Parameter	Standards & Level	Performance
EMI	EN55022	Class A
ESD	EN61000-4-2 air ±8KV , Contact ±6KV	Perf. Criteria A
Radiated immunity	EN61000-4-3 10V/m	Perf. Criteria A
Fast transient[1]	EN61000-4-4 ±2KV	Perf. Criteria A
Surge[1]	EN61000-4-5 ±1KV	Perf. Criteria A
Conducted immunity	EN61000-4-6 10Vrms	Perf. Criteria A

Note 1 - The AEE 50W series can meet EN61000-4-4 & EN61000-4-5 by adding a capacitor across the input pins. Suggested capacitor: CHEMI-CON KY 220μF/100V.

EMC Considerations

EMI-Filter to meet EN 55022, class A, FCC part 15, level A

Conducted and radiated emissions EN55022 Class A



Recommended Circuit to comply EN55022 Class A Limits

Table 5. Conducted EMI emission specifications

Component	9 – 36V Single	18 – 75V Single
C1	10µF/50V 1210 X7S MLCC	3.3µF/100V 1210 X7S MLCC
C2	1000pF/2KV 1206 MLCC	1000pF/2KV 1206 MLCC
L1	SMTDR54-1R5M-JT8 1.5uH	SMTDR54-6R8M-JT8 6.8uH

Safety Certifications

The AEE 50W series power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 6. Safety Certifications for AEE 50W series power supply system

Document	Description
cUL/UL 60950-1 (CSA certificate)	US and Canada Requirements
IEC/EN 60950-1 (CB-scheme)	European Requirements

Operating Temperature

Table 7. Operating Temperature:

Parameter	Model / Condition	Min	Max		Unit
			Without Heatsink	With Heatsink	
Operating Temperature Range (Natural Convection, See Derating) .	AEE10F18-L AEE10A18-L AEE04B18-L AEE03C18-L AEE02H18-L AEE10F36-L AEE10A36-L AEE04B36-L AEE03C36-L AEE02H36-L	-40	61 46 53 53 46 61 46 53 53 46	69 57 62 62 57 69 57 62 62 57	°C
Thermal Impedance	Natural Convection without Heatsink	12.1	-	-	°C/W
	Natural Convection with Heatsink	9.8	-	-	
	100LFM Convection without Heatsink	9.2	-	-	
	100LFM Convection with Heatsink	5.4	-	-	
	200LFM Convection without Heatsink	7.8	-	-	
	200LFM Convection with Heatsink	4.5	-	-	
	400LFM Convection without Heatsink	5.2	-	-	
	400LFM Convection with Heatsink	3.0	-	-	
Case Temperature		-	105		°C
Thermal Protection	Shutdown Temperature		110		°C
Storage Temperature Range		-50	+125		°C
Humidity (non condensing)		-	95		%
RFI	Six-Sided Shielded, Metal Case				
Lead Temperature (1.5mm from case for 10Sec.)		-	260		°C

Note1 - The “natural convection” is about 20LFM but is not equal to still air (0 LFM).

MTBF and Reliability

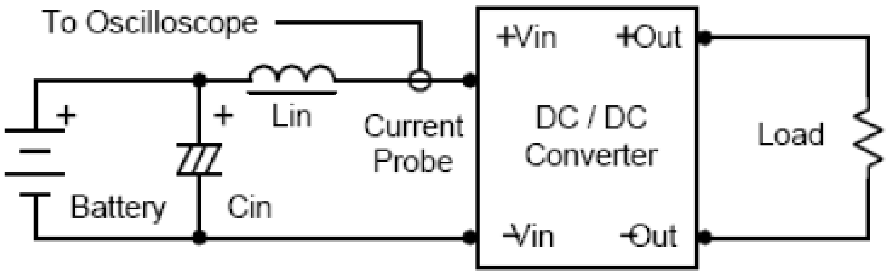
The MTBF of AEE 50W series of DC/DC converters has been calculated using MIL-HDBK 217F NOTICE2, Operating Temperature 25 ^{O}C, Ground Benign.

Model	MTBF	Unit
AEE10F18-L	252,400	Hours
AEE10A18-L	230,900	
AEE04B18-L	244,800	
AEE03C18-L	241,700	
AEE02H18-L	231,900	
AEE10F36-L	256,600	
AEE10A36-L	240,500	
AEE04B36-L	245,700	
AEE03C36-L	242,300	
AEE02H36-L	233,000	

Application Notes

Input Reflected-Ripple Current Test Setup

Input reflected-ripple current is measured with a inductor Lin (4.7µH) and Cin (220uF, ESR < 1.0Ω at 100 KHz) to simulate source impedance. Capacitor Cin, offsets possible battery impedance. Current ripple is measured at the input terminals of the module, measurement bandwidth is 0-500 KHz.

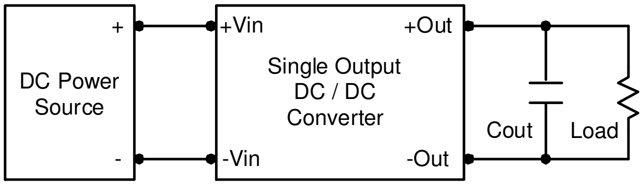


Component	Value	Reference
Lin	4.7µH	-
Cin	220uF (ESR<1.0Ω at 100KHz)	Aluminum Electrolytic Capacitor

.

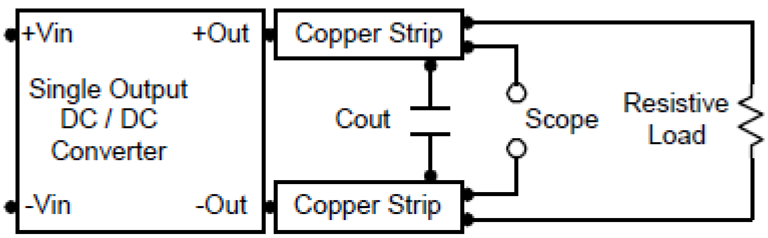
Output Ripple Reduction

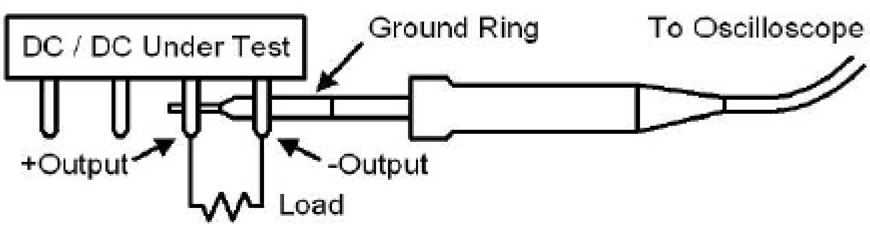
A good quality low ESR capacitor placed as close as practicable across the load will give the best ripple and noise performance. To reduce output ripple, it is recommended to use 4.7uF capacitors at the output.



Peak-to-Peak Output Noise Measurement Test

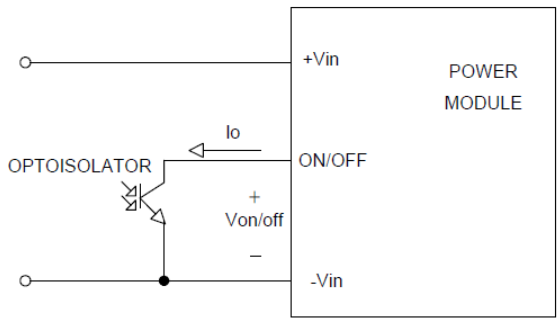
Use a 1uF ceramic capacitor and a 10uF tantalum capacitor. Scope measurement should be made by using a BNC socket, measurement bandwidth is 0-20MHz. Position the load between 50 mm and 75 mm from the DC/DC Converter



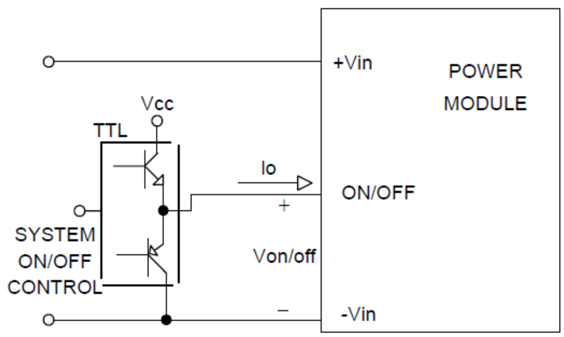


Remote ON/OFF

Positive logic remote on/off turns the module on during a logic high voltage on the remote on/off pin, and off during a logic low. To turn the power module on and off, the user must supply a switch to control the voltage between the on/off terminal and the -Vin terminal. The switch can be an open collector or equivalent. A logic low is 0V to 1.2V. A logic high is 3.5V to 12V. The maximum sink current at the on/off terminal (Pin 3) during a logic low is -100µA.



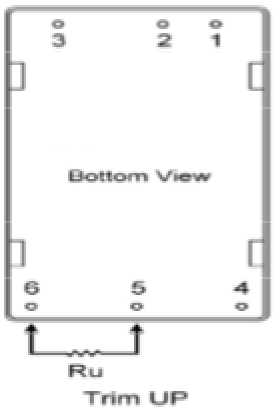
Isolated-Closure Remote ON/OFF

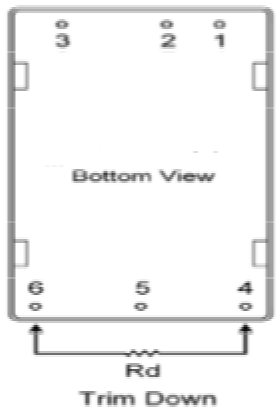


Level Control Using TTL Output

External Output Trimming

Output can be externally trimmed by using the method shown below.





3.3V Output Trim Table

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	63.59	30.28	18.19	11.95	8.13	5.56	3.70	2.31	1.21	0.34	KOhms
Trim up	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**%**
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	70.50	29.28	16.87	10.90	7.34	5.11	3.51	2.32	1.39	0.65	KOhms

5.0V Output Trim Table

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	45.53	20.61	12.31	8.15	5.66	4.00	2.81	1.92	1.23	0.68	KOhms
Trim up	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**%**
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	36.57	16.58	9.92	6.59	4.59	3.25	2.30	1.59	1.03	0.59	KOhms

12V Output Trim Table

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	394.5	179.74	106.08	68.86	46.39	31.36	20.60	12.51	6.21	1.17	KOhms
Trim up	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**%**
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	368.92	161.92	94.97	61.86	42.12	29.00	19.66	12.66	7.23	2.89	KOhms

15V Output Trim Table

Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	572.67	248.63	145.60	94.97	64.87	44.92	30.72	20.10	11.86	5.28	KOhms
Trim up	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**%**
Vout=	Vox1.01	Vox1.02	Vox1.03	Vox1.04	Vox1.05	Vox1.06	Vox1.07	Vox1.08	Vox1.09	Vox1.10	Volts
Ru=	392.98	182.12	108.73	71.43	48.85	33.71	22.86	14.69	8.33	3.23	KOhms

24V Output Trim Table

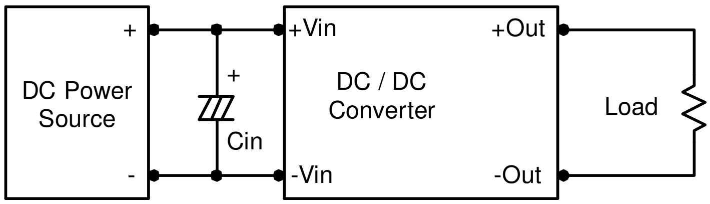
Trim down	1	2	3	4	5	6	7	8	9	10	%
Vout=	Vox0.99	Vox0.98	Vox0.97	Vox0.96	Vox0.95	Vox0.94	Vox0.93	Vox0.92	Vox0.91	Vox0.90	Volts
Rd=	318.05	146.05	85.8	55.51	37.415	26.625	16.515	9.81	4.9785	0.9185	KOhms
Trim up	**2**	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**%**
Vout=	Vox1.02	Vox1.04	Vox1.06	Vox1.08	Vox1.1	Vox1.12	Vox1.14	Vox1.16	Vox1.18	Vox1.20	Volts
Ru=	247.2	109.255	63.38	39.025	27.52	18.39	11.77	7.29	3.308	0.3658	KOhms

Input Source Impedance

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the power module.

In applications where power is supplied over long lines and output loading is high, it may be necessary to use a capacitor at the input to ensure startup.

Capacitor mounted close to the power module helps ensure stability of the unit, it is recommended to use a good quality low Equivalent Series Resistance (ESR < 1.0Ω at 100 KHz) capacitor of a 10uFfor the 24V and 48V devices.



Output Over Current Protection

To provide hiccup mode protection in a fault (output overload) condition, the unit is equipped with internal current limiting circuitry and can endure overload for an unlimited duration.

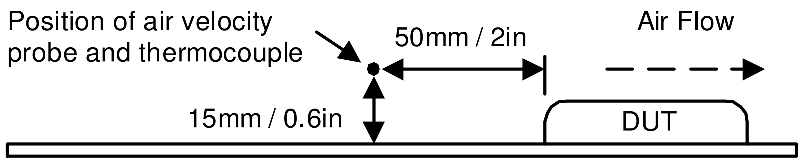
Output Over Voltage Protection

The output overvoltage clamp consists of control circuitry, which is independent of the primary regulation loop, that monitors the voltage on the output terminals.

The control loop of the clamp has a higher voltage set point than the primary loop. This provides a redundant voltage control that reduces the risk of output overvoltage. The OVP level can be found in the output data.

Thermal Considerations

Many conditions affect the thermal performance of the power module, such as orientation, airflow over the module and board spacing. To avoid exceeding the maximum temperature rating of the components inside the power module, the case temperature must be kept below 105 ^{O}C. The derating curves are determined from measurements obtained in a test setup.



Maximum Capacitive Load

The AEE 50W series has limitation of maximum connected capacitance at the output. The power module may be operated in current limiting mode during start-up, affecting the ramp-up and the startup time. The maximum capacitance can be found in the Table 3.

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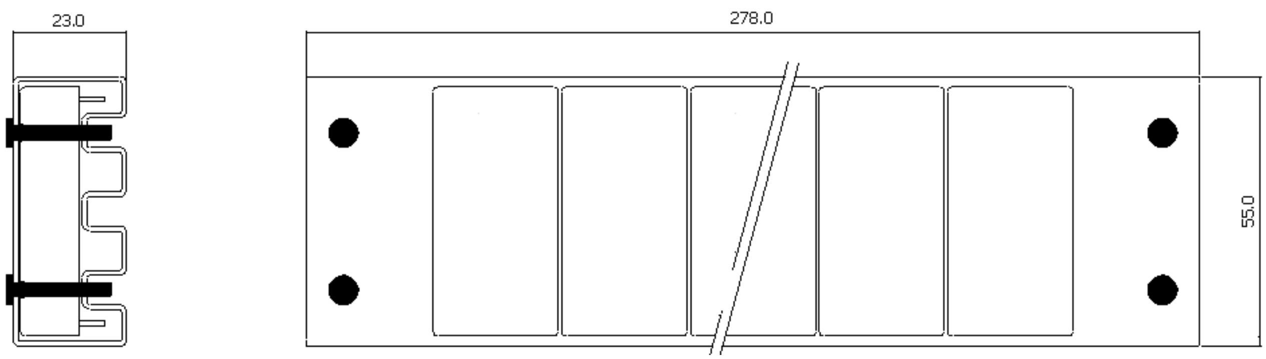
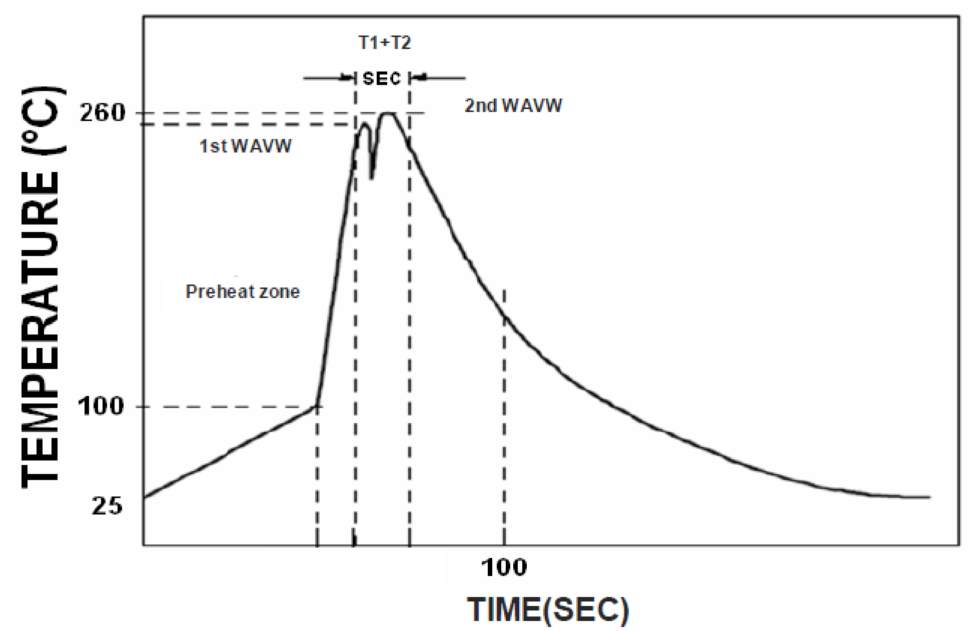
Packaging Information



Soldering and Reflow Considerations

Lead free wave solder profile for AEE 50W Series



Zone	Reference Parameter
Preheat zone	Rise temp speed：3^{O}C/sec max.
	Preheat temp : 100~130^{O}C
Actual heating	Peak temp: 250~260^{O}C Peak Time
	Peak time(T1+T2)：4~6 sec

Reference Solder: Sn-Ag-Cu：Sn-Cu：Sn-Ag
Hand Welding: Soldering iron：Power 60W
Welding Time: 2~4 sec
Temp.: 380~400 ^{O}C

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