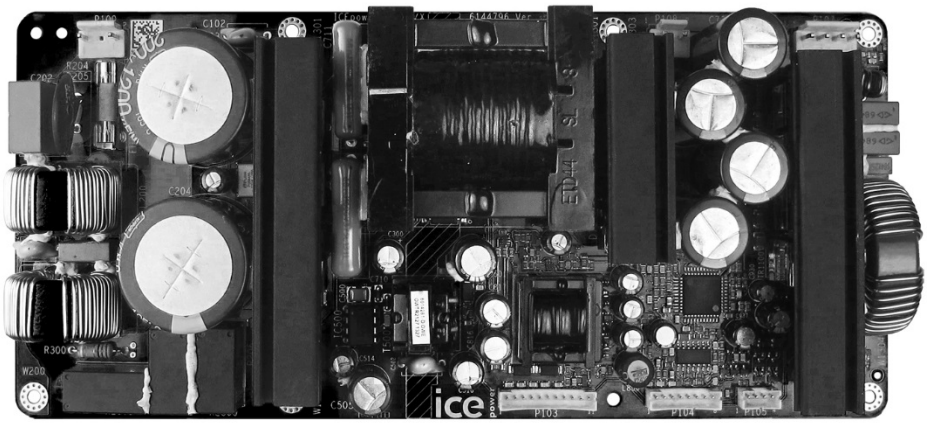
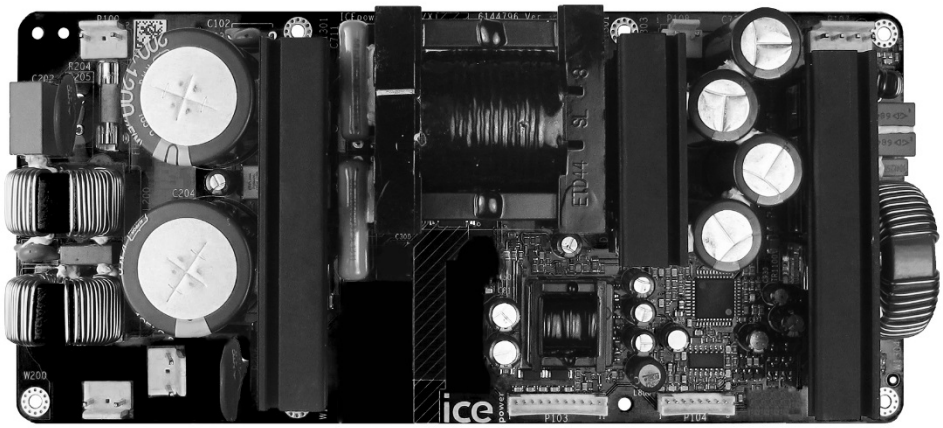
ICEpower a/s, Gl. Lundtoftevej 1b, DK-2800 Kgs. Lyngby
Phone [45] 96 84 11 22, Fax [45] 96 84 57 99, CVR-no. 25053591
info@icepower.dk, www.icepower.dk



700ASC



700ASX

ICEpower700ASC
ICEpower700ASX

Single Channel 700W ICEpower Amplifiers with Integrated Power Supply

Contents

General Description

ICEpower700ASC and ICEpower700ASX are fully integrated, compact and efficient audio power conversion solutions, available in two variants:

- **ICEpower700ASC** supports universal mains operation and complies to ErP and Energy Star® requirements
- **ICEpower700ASX** is designed for applications where standby converter and universal mains operation are not required

ICEpower700ASC and 700ASX (hereafter called ICEpower700ASC/X) are designed for highly competitive consumer and professional audio products, e.g. subwoofers, A/V amplifiers, active speakers and multi way systems. ICEpower700ASC/X are EMC and safety pre-approved including amplifier hanger options. ICEpower700ASC/X enables fast design-in and minimum time to market.

Features	ASC	ASX
Suitable for CE and FCC approved designs; EMC and safety pre-approved	✓	✓
Fully integrated amplifier and power supply with mains-converter and auxiliary-converter	✓	✓
ICEpower amplifier hanger support for easy addition of amplifier channels (with 300AC)	✓	✓
Designed for flexible mounting and, if needed, easy mechanical interface to external heat sinking for even higher continuous power capability	✓	✓
Patented HCOM modulation and control techniques for excellent audio performance	✓	✓
Sound optimized soft clipping	✓	✓
Thermal and over-current protection	✓	✓
Standby converter with low standby power consumption	✓	–
Universal mains	✓	–
Manual mains voltage selection	–	✓
Wake-on-signal, logic triggers and programmable LED drivers	✓	–

Key Specifications

- 700 W @ 1 % THD+N, 20 Hz – 20 kHz, 4 Ω
- 117 dBA dynamic range
- THD+N = 0.005 % @ 1 W (4 Ω, 1 kHz)
- THD+N = 0.0008 % @ 50 W (4 Ω, 100 Hz)
- CCIF IM distortion = 0.0003 %, 10 W, 4 Ω, 18.5 kHz / 1 kHz
- High output current limit of 30 A
- Low output impedance of 6 mΩ
- 84 % total efficiency @ 700 W, 4 Ω
- ±15V / 0.5A regulated AUX power supply
- Dimensions (w × d × h) = 220 mm × 100 mm × 46 mm
  8.66 in × 3.94 in × 1.81 in
- Weight ASC / ASX 790 g / 750 g
  28 oz / 26.5 oz

Key Specifications ASC only

- Universal mains operation (100-240 V, 50-60 Hz)
- Standby converter with 5.1 V, 1 A output
- Standby power consumption 170 mW @ 230 V
- Standby payload 200 mW
- ErP (1275/2008/EC) compliant
- Energy Star®v3.0 compliant

Release Notes

PCB Version	Data Sheet Version	Date	Revised by	Description
E	1.00	September 8, 2014	HKS/SMK	Release version
E	1.10	October 6, 2014	HKS	Connectors overview p. 8 updated

Block Diagram

700ASC

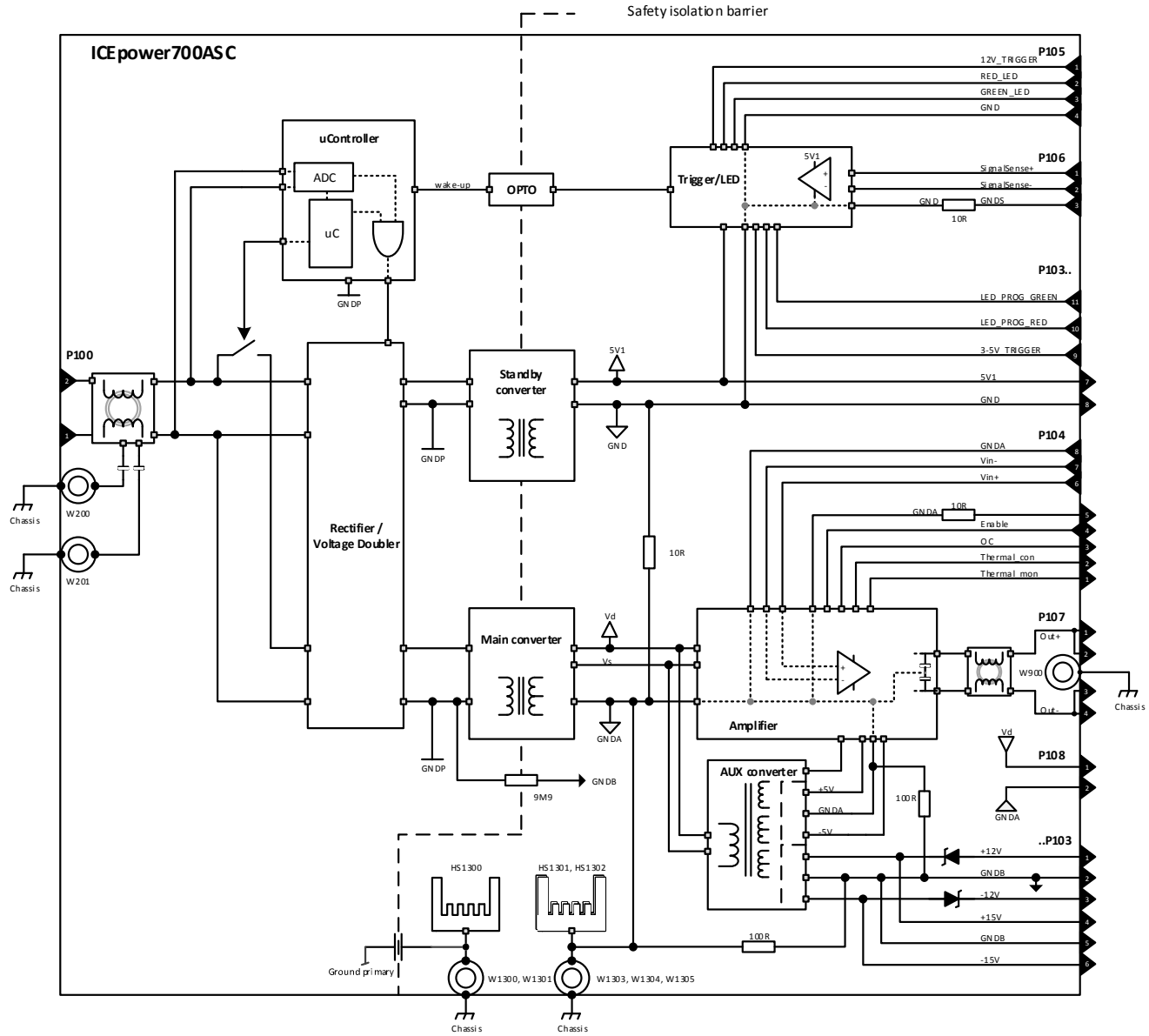


Figure 1: ICEpower700ASC block diagram

700ASX

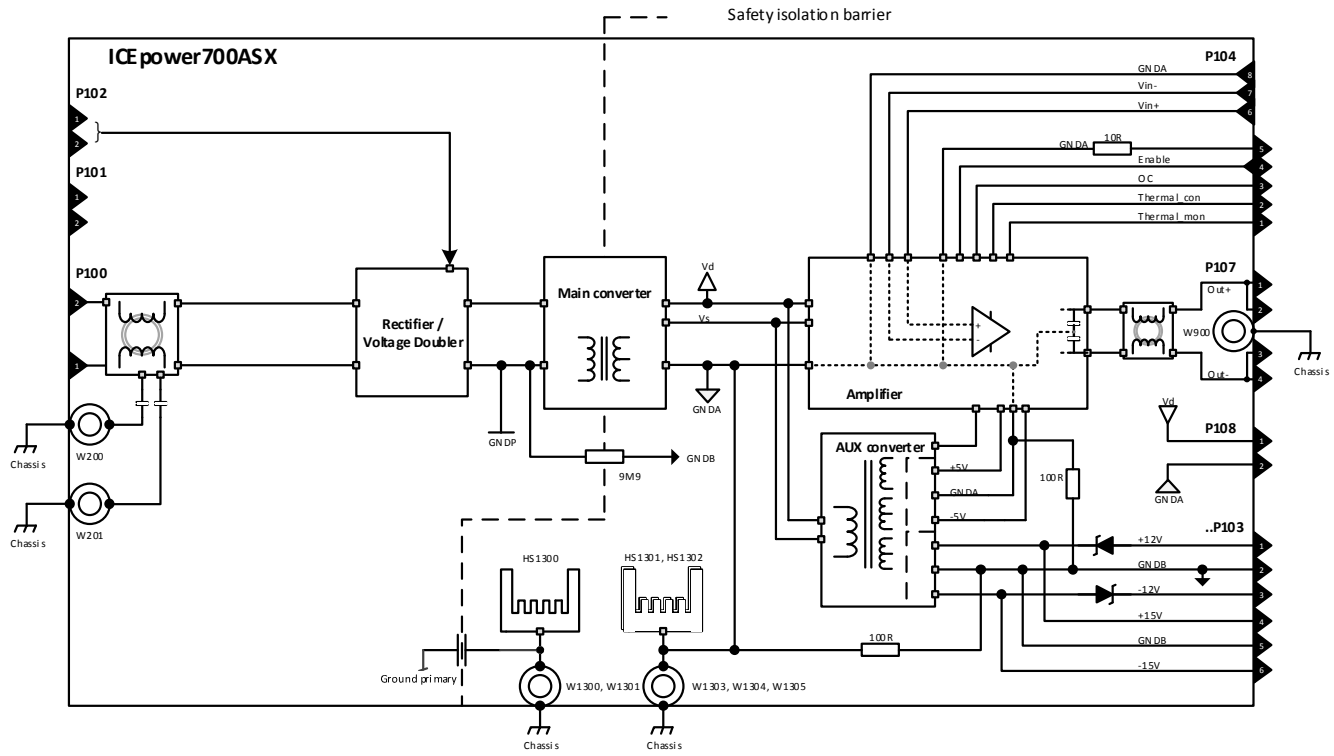


Figure 2: ICEpower700ASX block diagram

Connectors

The ICEpower700ASC/X modules come with industry standard connectors selected for long-term reliability.

700ASC Connectors Overview

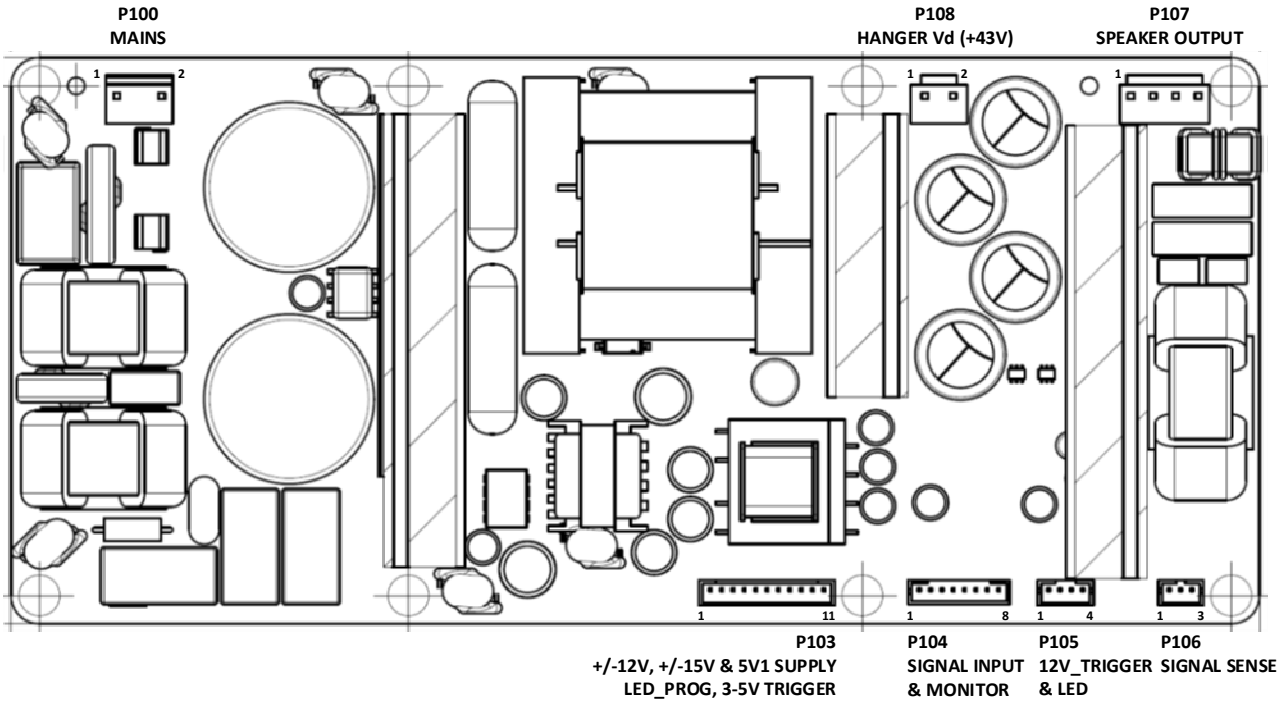


Figure 3: ICEpower700ASC connectors overview

700ASX Connectors Overview

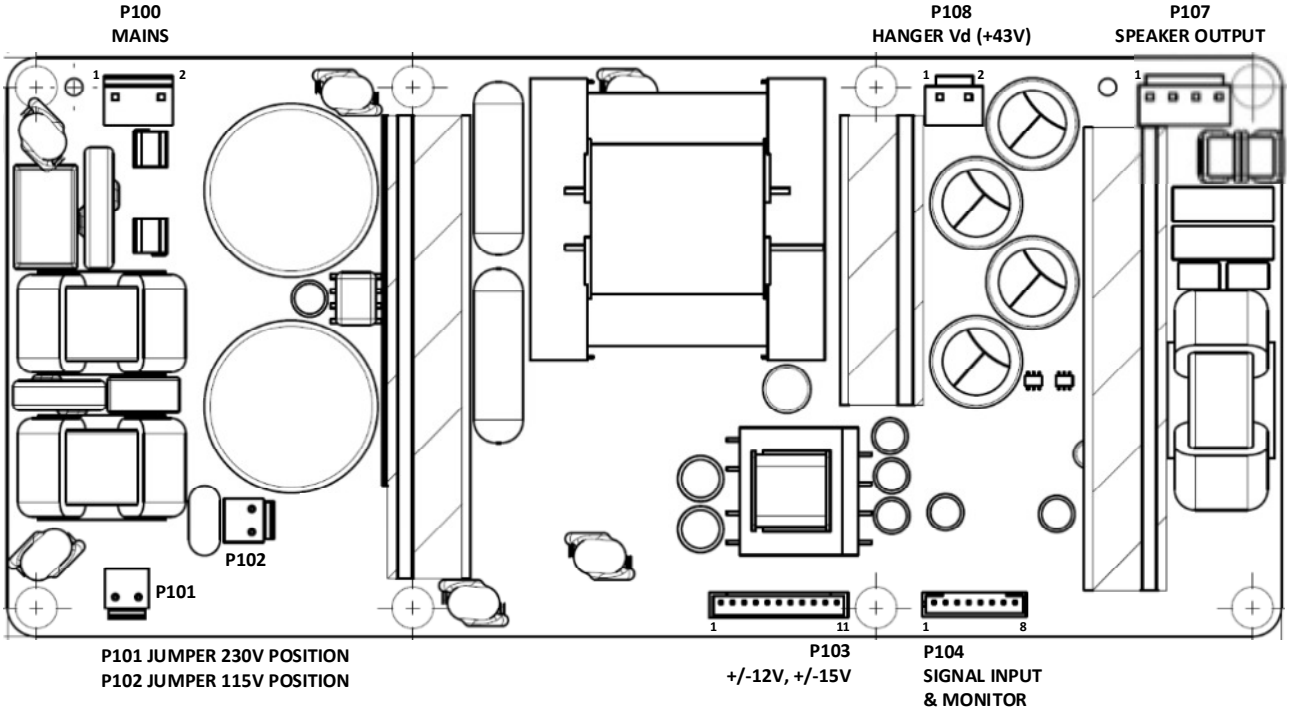


Figure 4: ICEpower700ASX connectors overview

P100: Mains Connector

Type: JST B2P3-VH(LF)(SN)				Applies to	
PIN	**Function**	**Description**	**Type**	**ASC**	**ASX**
1	Neutral	Neutral AC	Input	✓	✓
2	Live	Live AC	Input	✓	✓

Table 1: Mains connector

P101: Mains Voltage Selection 230 V

Type: JST B2P-VH(LF)(SN)				Applies to	
PIN	**Function**	**Description**	**Type**	**ASC**	**ASX**
1	N/C	Not connected, jumper parking	N/C	-	✓
2	N/C	Not connected, jumper parking	N/C	-	✓

Table 2: Mains voltage selection 230 V

P102: Mains Voltage Selection 115 V

Type: JST B2P-VH(LF)(SN)				Applies to	
PIN	**Function**	**Description**	**Type**	**ASC**	**ASX**
1	CapCenter	Center point of the two bulk capacitors	Output	-	✓
2	Live	Live AC after EMC filter	Output	-	✓

Table 3: Mains voltage selection 115 V

P103: Auxiliary Supply Connector

Type: JST B11B-PH-K-S(LF)(SN)				Applies to	
PIN	**Function**	**Description**	**Type**	**ASC**	**ASX**
1	+12V	For one ICEpower300AC hanger only! Positive supply	Output	✓	✓
2	GNDB	For one ICEpower300AC hanger only! Ground terminal	GND	✓	✓
3	-12V	For one ICEpower300AC hanger only! Negative supply	Output	✓	✓
4	+15V	Positive regulated auxiliary supply	Output	✓	✓
5	GNDB	Ground terminal for the auxiliary supply section.	GND	✓	✓
6	-15V	Negative regulated auxiliary supply	Output	✓	✓
7	5V1	Regulated standby converter supply	Output	✓	-
8	GND	Ground terminal for the standby converter and control section	GND	✓	-
9	3-5V_trigger	Logic trigger for controlling On/Standby mode	Input	✓	-
10	LED_PROG_RED	Programming pin for red LED driver	Input	✓	-
11	LED_PROG_GREEN	Programming pin for green LED driver	Input	✓	-

Table 4: Auxiliary Supply connector

P104: Signal Connector Specifications

Type: JST B8B-PH-K-S(LF)(SN)				Applies to	
PIN	**Function**	**Description**	**Type**	**ASC**	**ASX**
1	Thermal monitor	Amplifier temperature monitoring	Output	✓	✓
2	Thermal shutdown	Amplifier thermal shutdown monitor	Output	✓	✓
3	OC	Amplifier over current monitor	Output	✓	✓
4	Amplifier Enable	Amplifier enable	Input / Output	✓	✓
5	GNDD	Ground terminal for the Amplifier Enable and monitor section.	GND	✓	✓
6	Signal+	Positive audio signal input	Input	✓	✓
7	Signal-	Negative audio signal input	Input	✓	✓
8	GNDA	Ground terminal for the signal section.	GND	✓	✓

Table 5: Signal connector specifications

P105: Trigger / LED Connector Specifications

Type: JST B4B-PH-K-S(LF)(SN)				Applies to	
PIN	**Function**	**Description**	**Type**	**ASC**	**ASX**
1	12V_trigger	Logic trigger for controlling On/Standby mode	Input	✓	-
2	RED_LED	Red LED driver output	Output	✓	-
3	GREEN_LED	Green LED driver output	Output	✓	-
4	GND	Ground terminal for the standby converter and control section	GND	✓	-

Table 6: Trigger/LED connector

P106: Signal Sense Connector Specifications

Type: JST B3B-PH-K-S(LF)(SN)				Applies to	
PIN	**Function**	**Description**	**Type**	**ASC**	**ASX**
1	Signal Sense+	Positive audio input for wake-on-signal	Input	✓	-
2	Signal Sense-	Negative audio input for wake-on-signal	Input	✓	-
3	Signal Sense, GND	Ground for the Signal Sense section	GND	✓	-

Table 7: Signal Sense connector

P107: Speaker Connector

Type: JST B4P-VH(LF)(SN)				Applies to	
PIN	**Function**	**Description**	**Type**	**ASC**	**ASX**
1	Vo+	Amplifier positive output	Output	✓	✓
2	Vo+	Amplifier positive output	Output	✓	✓
3	Vo-	Amplifier negative output	Output	✓	✓
4	Vo-	Amplifier negative output	Output	✓	✓

Table 8: Speaker connector

P108: Hanger Vd Connector

Type: JST B02P-NV(LF)(SN)				Applies to	
PIN	**Function**	**Description**	**Type**	**ASC**	**ASX**
1	Vd, +43 V	For ICEpower hanger only! DC positive supply	Output	✓	✓
2	GNDA	For ICEpower hanger only! DC ground	Output	✓	✓

Table 9: Hanger connector

Absolute Maximum Ratings

Absolute maximum ratings indicate limits above which damage may occur.

Mains Input Section

700ASC with Universal Mains

Connector	Parameter	Value	Units	ASC	ASX
P100: 1, 2	Maximum mains voltage	264	V_{AC}	✓	-
P100: 1, 2	Minimum mains voltage	85	V_{AC}	✓	-
P100: 1, 2	Maximum mains frequency	65	Hz	✓	-
P100: 1, 2	Minimum mains frequency	45	Hz	✓	-

Table 10: Absolute maximum ratings, mains input section

700ASX with Jumper Mounted in P101 (230 V mode)

Connector	Parameter	Value	Units	ASC	ASX
P100: 1, 2	Maximum mains voltage	264	V_{AC}	-	✓
P100: 1, 2	Minimum mains voltage	195	V_{AC}	-	✓
P100: 1, 2	Maximum mains frequency	65	Hz	-	✓
P100: 1, 2	Minimum mains frequency	45	Hz	-	✓

Table 11: Absolute maximum ratings, mains input section

700ASX with Jumper Mounted in P102 (115 V mode)

Connector	Parameter	Value	Units	ASC	ASX
P100: 1, 2	Maximum mains voltage	132	V_{AC}	-	✓
P100: 1, 2	Minimum mains voltage	85	V_{AC}	-	✓
P100: 1, 2	Maximum mains frequency	65	Hz	-	✓
P100: 1, 2	Minimum mains frequency	45	Hz	-	✓

Table 12: Absolute maximum ratings, mains input section

Auxiliary Supplies

Connector: Pin	Parameter	Value	Unit	ASC	ASX
P103: 4, 5, 6	Maximum current draw from +/-15 V No hanger connected One ICEpower300AC hanger connected Two ICEpower300AC hangers connected	 500 415 330	mA	✓	✓
P103: 4, 5 P103: 6, 5	Maximum external capacitance +/-15 V	470	uF	✓	✓
P103: 7, 8	Maximum current draw from 5V1 in Standby mode	50	mA	✓	-
P103: 7, 8	Maximum current draw from 5V1 in Operational mode	1.0	A	✓	-
P103: 7, 8	Maximum external capacitance 5V1	1000	uF	✓	-

Table 13: Absolute maximum ratings, auxiliary supply

Input Section

Connector: Pin	Parameter	Value	Unit	ASC	ASX
P104: 6, 8 P104: 7, 8	Maximum voltage range on audio input pin	±12	V_p	✓	✓
P103: 9, 8	Maximum 3 V - 5 V trigger voltage	37	V	✓	-
P103: 10, 11, 8	Maximum LED programming voltage	5.3	V	✓	-
P105: 1, 4	Maximum 12 V trigger voltage	45	V	✓	-
P106: 1, 3	Maximum current on Signal Sense (clamping at ±2.5 V, otherwise Zin > 1 MΩ)	10	mA	✓	✓
P106: 2, 3	Maximum current on Signal Sense (clamping at ±2.5 V, otherwise Zin = 47 kΩ)	10	mA	✓	✓

Table 14: Absolute maximum ratings, input section

Output Section

Connector: Pin	Parameter	Value	Units	ASC	ASX
P107: (1+2), (3+4)	Minimum amplifier load resistance	2.5	Ω	✓	✓
P107: (1+2), (3+4)	Maximum current draw from amplifier output	30	A	✓	✓
P107: (1+2), (3+4)	Maximum amplifier pure capacitive load	220	nF	✓	✓

Table 15: Absolute maximum ratings, output section

Environmental Specifications

Parameter	Conditions	Min	Typ	Max	Units
Ambient temperature, operating	Natural convection cooling	0		50	°C
Ambient temperature, storage		-40		70	°C
Ambient temperature, shelf		0		60	°C
Relative humidity	Non-condensing			85	%
Altitude, operating				2000	m
Vibration level 700ASC	Measured on relays, all directions			4	g

Table 16. Environment specifications

Power Specifications

Unless otherwise specified. T_a = 25 °C, f = 1 kHz, R_L = 4 Ω, 230 V mains

Parameter	Conditions	Min	Typ	Max	Units	ASC	ASX
Nominal DC voltage	Mains input within range		+43.5		V	✓	✓
Positive analog/digital supply	Mains input within range	+4.9	+5.1	+5.3	V	✓	✓
Positive analog supply	Mains input within range	+14.3	+15,3	+16.0	V	✓	✓
Negative analog supply	Mains input within range	-16.0	-15,3	-14.3	V	✓	✓
Time of maximum rated output power	700 W out. No preheating.		>300		s	✓	✓
Continuous output power without thermal shutdown. (4 Ω)	Thermal stab. @ T_a = 25 °C.		270		W	✓	✓
Continuous output power without thermal shutdown. (8 Ω)	Thermal stab. @ T_a = 25 °C.		270		W	✓	✓
Quiescent power consumption (amplifier disabled)	Amplifier Enable pin low		7		W	✓	✓
Quiescent power consumption (amplifier enabled)	Po = 0 W		18		W	✓	✓
Standby power consumption	I_{LED} = 0 A, I_{5V1} = 0 A, 230 VAC		170		mW	✓	-
Total power efficiency	Po = 100 W 4 Ω Po = 700 W 4 Ω		76 84		%	✓	✓

Table 17: Power specifications

Audio Specifications

Unless otherwise specified, f = 1 kHz, Po = 1 W, T_a = 25 °C.

Measurements were done using an Audio Precision AES17 20 kHz 7th order measurement filter unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Units
Output power @ 1 % THD+N f = 1 kHz	R_L = 4 Ω 230 V_{ac} / 50 Hz, 115 V_{ac} / 60 Hz, 100 V_{ac} / 50 Hz, 85 V_{ac} / 50 Hz		 720 720 700 560		
Output power @ 1 % THD+N 20 Hz < f < 20 kHz	R_L = 4 Ω 230 V_{ac} / 50 Hz, 115 V_{ac} / 60 Hz, 100 V_{ac} / 50 Hz, 85 V_{ac} / 50 Hz		 710 650 560 490		W
THD+N in 4 Ω (AES17 measurement filter)	f = 100 Hz, P_O =1 W		0.006		%
Output referenced idle noise	20 Hz < f < 20 kHz A-weighted Unweighted	 50 80	 70 100	 130 160	µV
Nominal Voltage Gain	f = 1 kHz		27,4		dB
Frequency response	f = 20 Hz – 20 kHz, R_L = 4 Ω – inf. Ω		±0.5	±0.7	dB
Upper bandwidth limit (-3 dB)	R_L = 4 Ω		70		kHz
Lower bandwidth limit (-3 dB)	R_L = All loads		1.5		Hz
Abs. output impedance	f = 1 kHz		7		mΩ
Load impedance range		2,5	4	∞	Ω
Dynamic range	A-weighted at 700 W @ 4 Ω		117		dB
Intermodulation (CCIF)	f =18.5 kHz / 1 kHz, P_O = 10 W		0.0003		%
Transient intermodulation (DIM30)	P_O = 10 W		0.003		%

Table 18: General audio specifications

Electrical Specifications

General

Unless otherwise specified, T_a = 25 °C.

Parameter	Conditions	Min	Typ	Max	Unit	ASC	ASX
Nominal mains voltage range		100		240	Vac	✓	✓
Nominal mains frequency range		50		60	Hz	✓	✓
Switching frequency	Idle	460	510	560	kHz	✓	✓
Switching frequency range (amplifier)	Idle to full scale	90		560	kHz	✓	✓
Switching frequency (power supply)		70	140	340	kHz	✓	✓
Switching frequency	Standby mode, I_{5V1} = 0 A		18		kHz	✓	-
Burst frequency	Standby mode		500		Hz	✓	-
Switching frequency	Operational mode, I_{5V1} = 1.0 A		100		kHz	✓	-
Micro controller clock frequency	Operational mode		8		MHz	✓	-

Table 19: Electrical specifications

±15 V Auxiliary Converter

Unless otherwise specified, T_a = 25 °C.

Parameter	Conditions	Min	Typ	Max	Unit
Tolerance of ±15 V		±15.1	±15.4	±15.7	V
Load regulation	0 A ≤ I±15 V ≤ 0.5 A		0.6		V
Ripple of ±15 V	$I_{±15V}$ = 0.5 A		0.25		V_{pp}
Load transition regulation	$I_{±15V}$ step up/down 0.2 A, 0.5 A		0.4		V_{pp}
±15 V overload protection	0 °C ≤ Ta ≤ 50 °C		0,9		A

Table 20: ±15 V Auxiliary converter electrical specifications

700ASC 5.1 V Standby Converter

Unless otherwise specified, T_a = 25 °C.

Parameter	Conditions	Min	Typ	Max	Unit
Tolerance of 5V1		4.9	5.1	5.3	V
Load regulation	0 A ≤ I_{5V1} ≤ 1.0 A		50		mV
Mains regulation	I_{5V1} = 1.0 A		10		mV
Temperature variation regulation	0 °C ≤ T_a ≤ 50 °C, I_{5V1} = 1.0 A		30		mV
Ripple of 5V1	I_{5V1} = 1.0 A		50		mV_{pp}
Load transition regulation	I_{5V1} step up/down 0.2 A, 1.0 A		0.2		Vp
Maximum output current available from 5V1 ensuring standby power consumption < 0.5 W	230 VAC, no LED		40		mA
5V1 overload protection	0 °C ≤ T_a ≤ 50 °C, steady state	1.05		2.0	A

Table 21: 5.1 V Standby converter electrical specifications

700ASC Trigger/LED Section

Unless otherwise specified, T_a=25 °C.

Parameter	Conditions	Min	Typ	Max	Unit
Signal Sense - Trigger Level	Sine wave 1 kHz		1.5		mV
3-5V trigger – Trigger Level			1.3		V
3-5V trigger – Off Level			1.2		V
12V trigger – Trigger Level			2.7		V
12V trigger – Off Level			2.6		V
Minimum green LED current	LED_PROG_GREEN open		270		uA
Minimum red LED current	LED_PROG_RED open		270		uA
Maximum green LED current	LED_PROG_GREEN shorted to 5V1		6.3		mA
Maximum red LED current	LED_PROG_RED shorted to 5V1		3.8		mA
Available output voltage at maximum red LED current	LED_PROG_RED shorted to 5V1	3.9	4.3		V
Available output voltage at maximum green LED current	LED_PROG_GREEN shorted to 5V1	3.9	4.3		V

Table 22: Trigger/LED electrical specifications

Mechanical Specifications

The ICEpower700ASC/X are designed for mounting bottom down via spacers and/or via heat sinks and spacers.
Find below the outer dimensions in [mm] of the ICEpower700ASC/X modules.
For drill guides, refer to the section Mechanical Mounting pages 41 and 42.

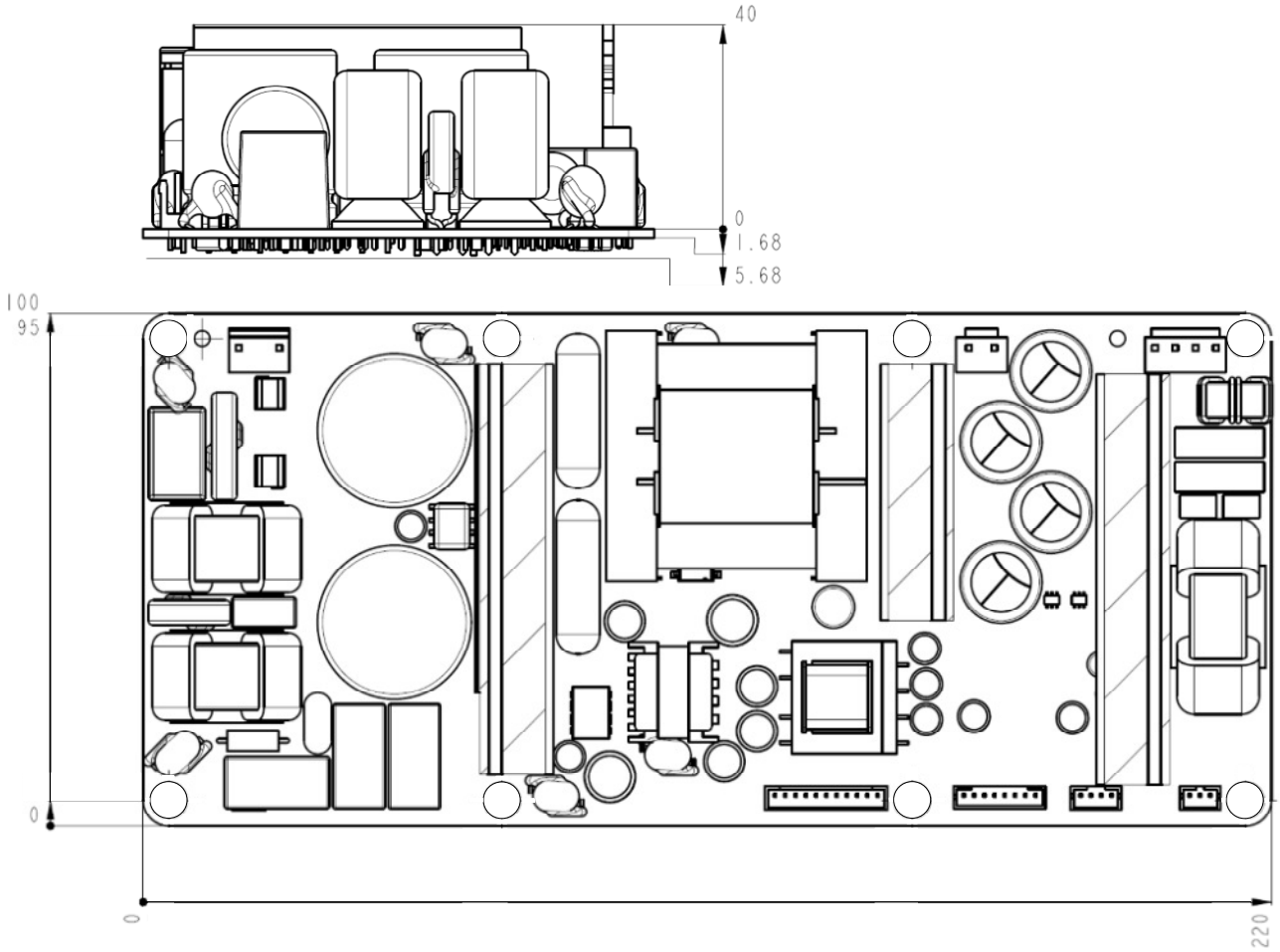


Figure 5: Outer dimensions ICEpower700ASC/X

A minimum clearance of 12 mm around the module is recommended for safety and ventilation reasons.

Typical Performance Characteristics

Frequency Response

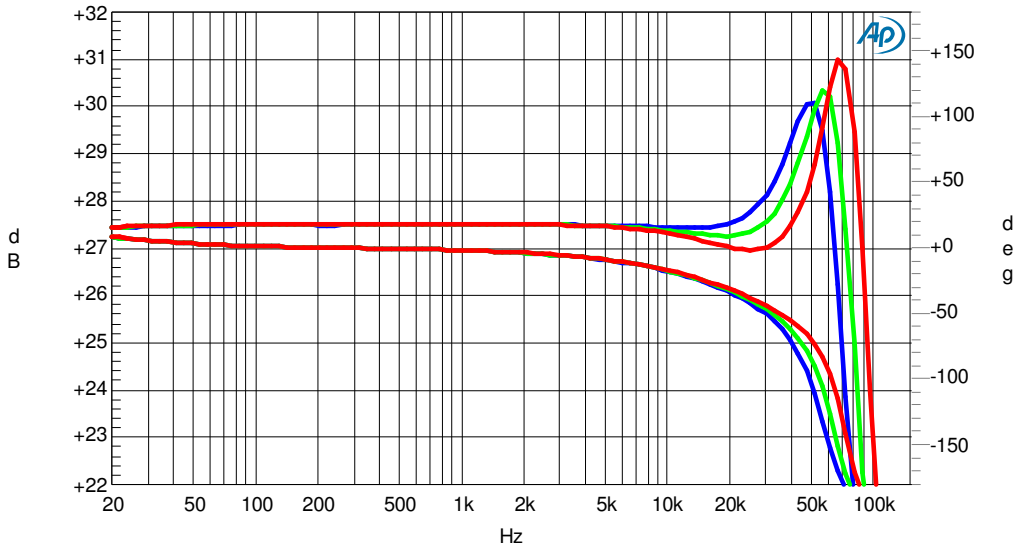


Figure 6: Frequency response in 4 Ω (blue), 8 Ω (green) and open load (red). Top – amplitude. Bottom – phase

Harmonic Distortion and Noise

All measurements are done with an Audio Precision AES17 20 kHz 7th order measurement filter.

THD+N vs. Power

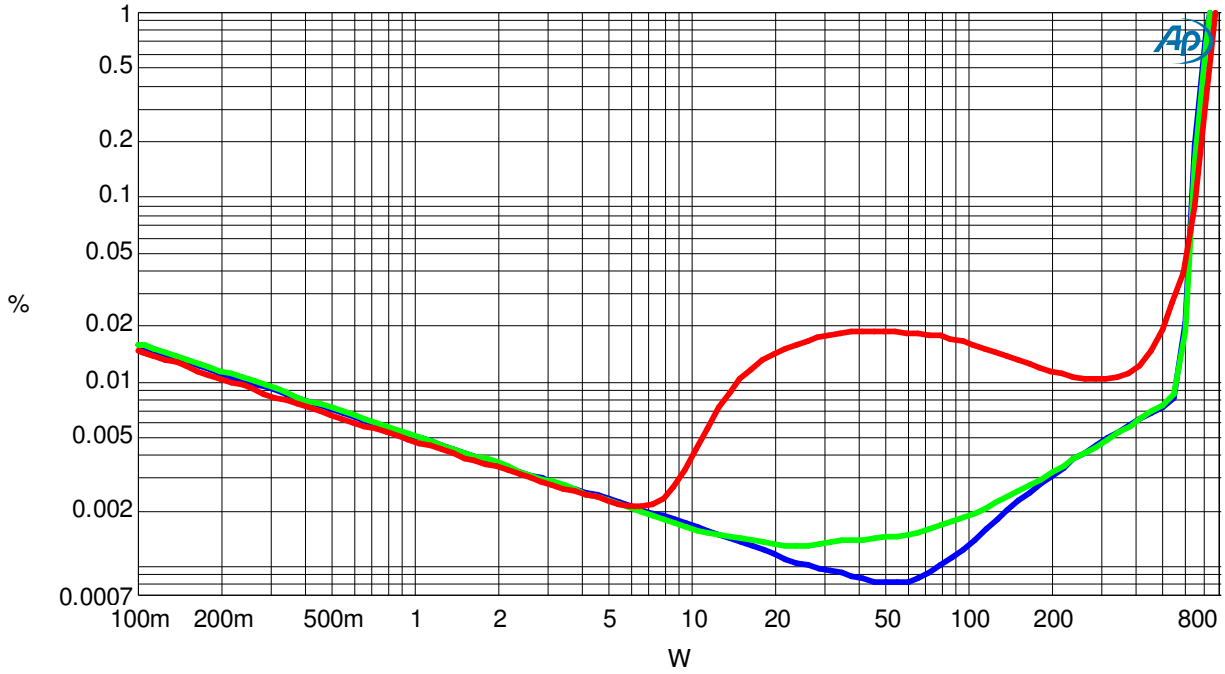


Figure 7: THD+N vs. Po at 100 Hz (blue), 1 kHz (green) and 6.67 kHz (red), 4 Ω, 230 Vac / 50 Hz

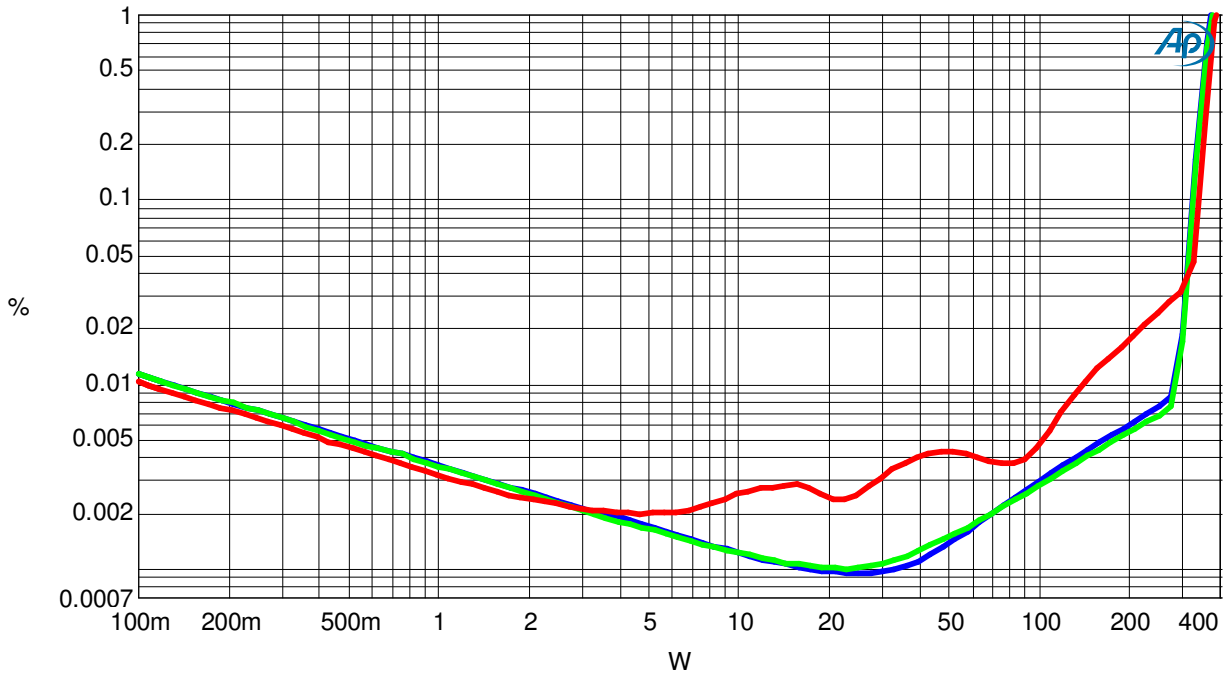


Figure 8: THD+N vs. Po at 100 Hz (blue), 1 kHz (green) and 6.67 kHz (red), 8 Ω, 230 Vac / 50 Hz

Spectral View (FFT)

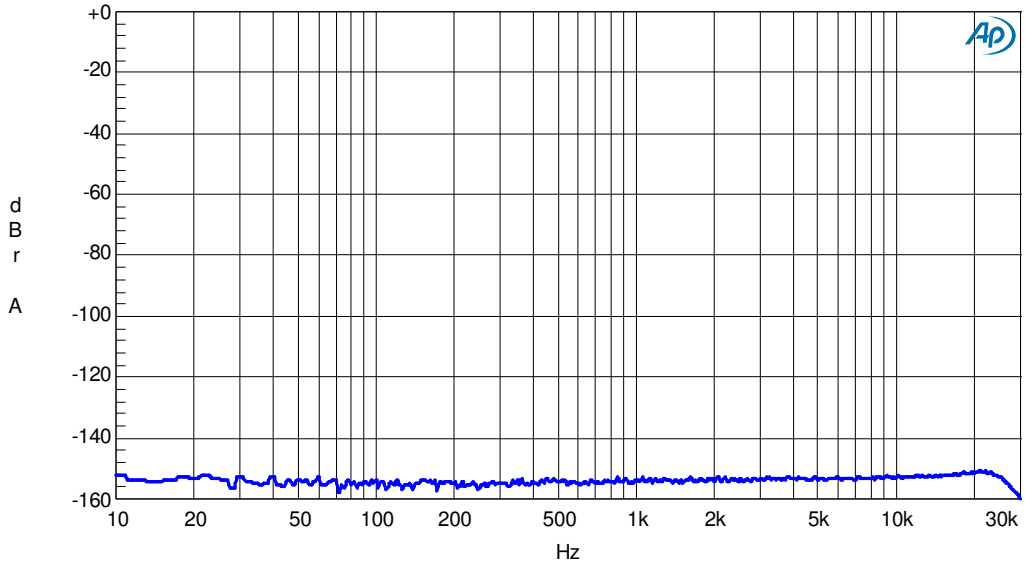


Figure 9: Idle noise (32K FFT). Residual = 70 µV(A), RL = 4 Ω (Relative to 700 W into 4 Ω)

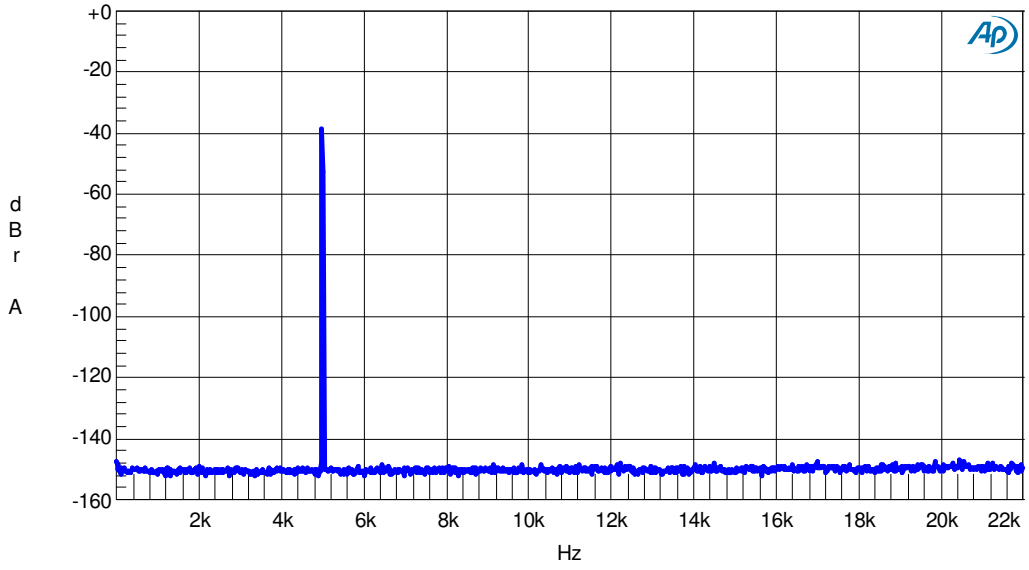


Figure 10: f = 5 kHz. Po = 100 mW, RL = 4 Ω (Relative to 700 W into 4 Ω)

Intermodulation Distortion (CCIF & TIM)

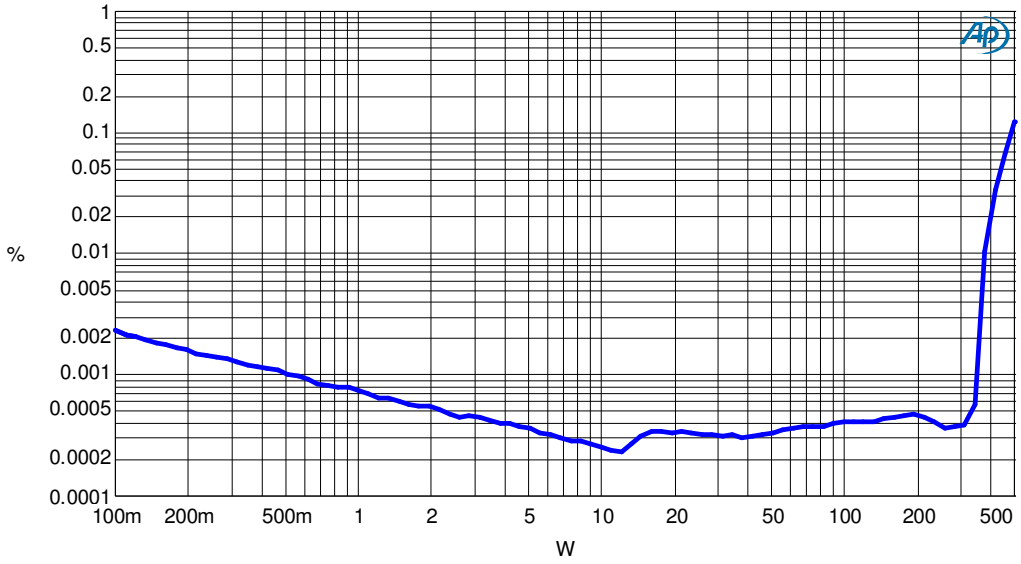


Figure 11: CCIF IMD vs. Output Power, R_L = 4 Ω, f_1 =18 kHz, f_2 = 19 kHz. 1 kHz

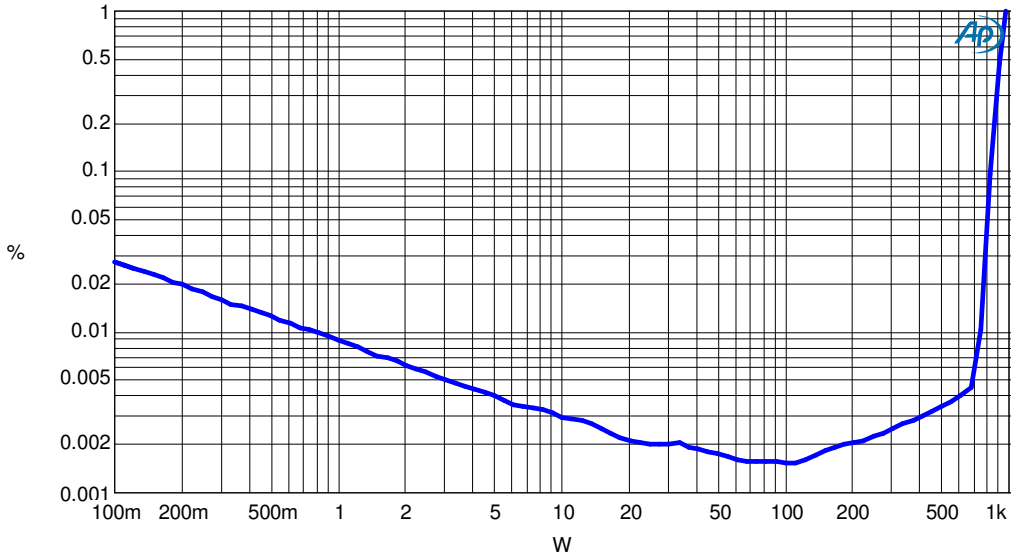


Figure 12: TIM vs. output power. R_L = 4 Ω

Output Impedance

The output impedance is measured using a delta load method where the difference in output amplitude at two different resistive loads is used to calculate the equivalent output impedance of the amplifier. The output impedance is measured directly at the terminals on the PCB.

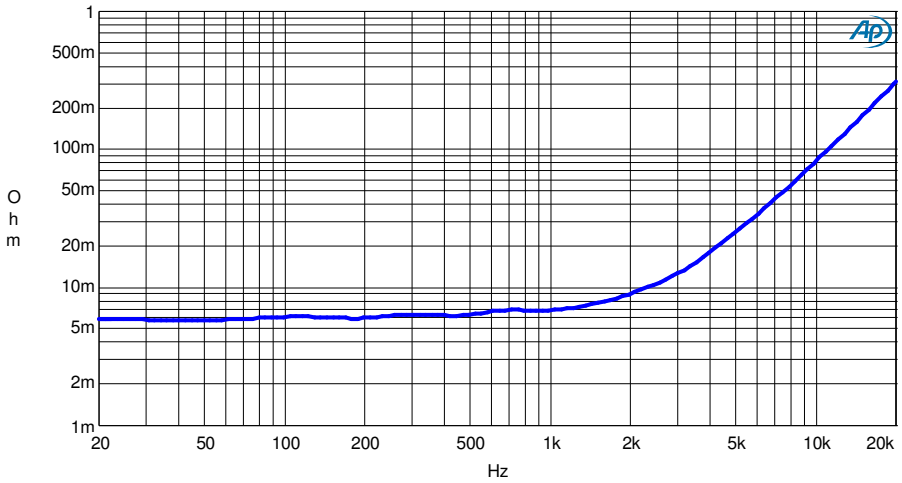


Figure 13: Output impedance at the output terminals

Damping Factor

The damping factor is calculated as the ratio between the output impedance of the amplifier and the load impedance.

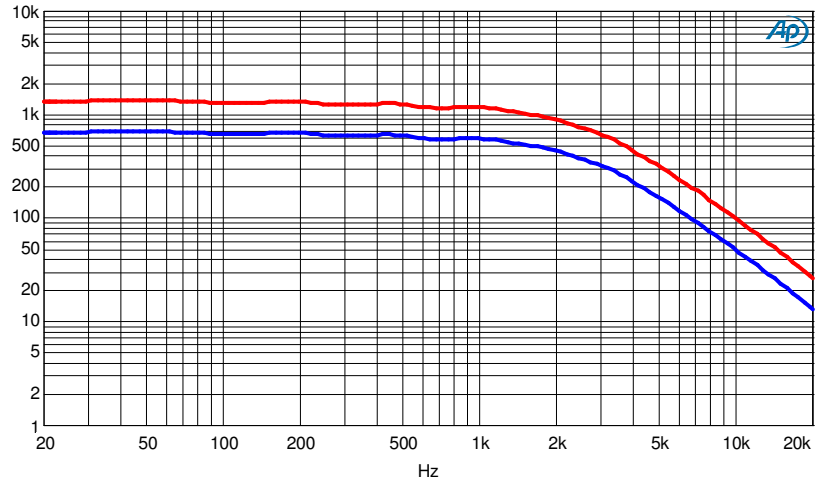


Figure 14: Damping factor vs. frequency 4 Ω (blue) and 8 Ω (red)

With its low output impedance, the ICEpower700ASC/X are designed to be unaffected by loudspeaker loading characteristics. However, care should be taken with purely capacitive loads.

Power Efficiency

The total power efficiency from AC mains to amplifier output.

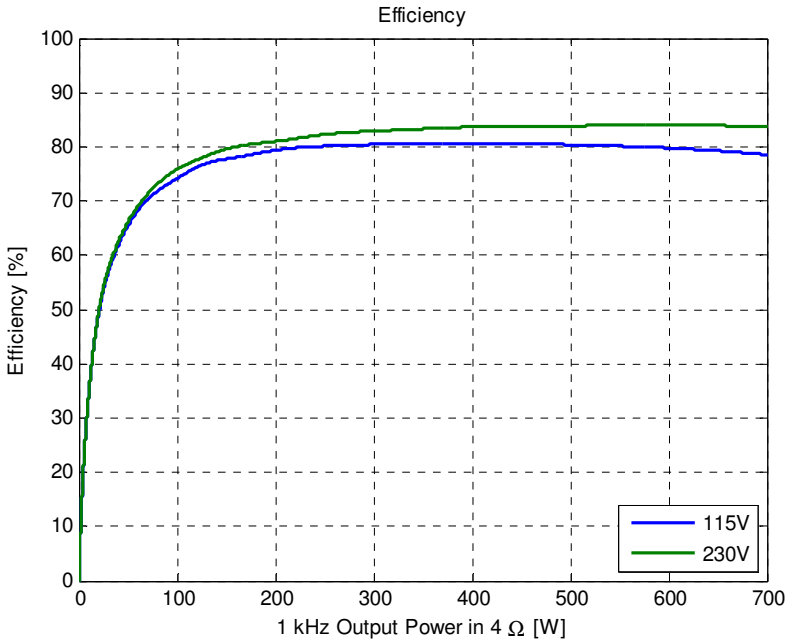


Figure 15: Efficiency vs. output power

Dissipated Power

The total dissipated power within the module from AC mains to amplifier output.

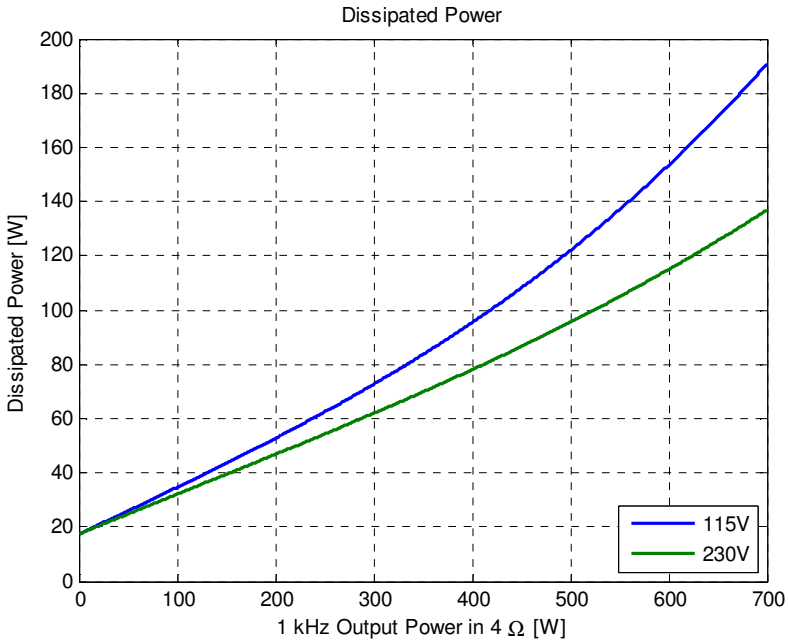


Figure 16: Dissipated power vs. output power

Input/Output Schematics and Features

The ICEpower700ASC/X have a number of useful features described below.

Input Stage

The balanced input buffer has an anti-aliasing filter and a DC blocking capacitor. The input impedance of the signal input section is minimum 8 kΩ over the audio bandwidth, which is an acceptable loading condition for pre-amps, active crossover outputs etc.

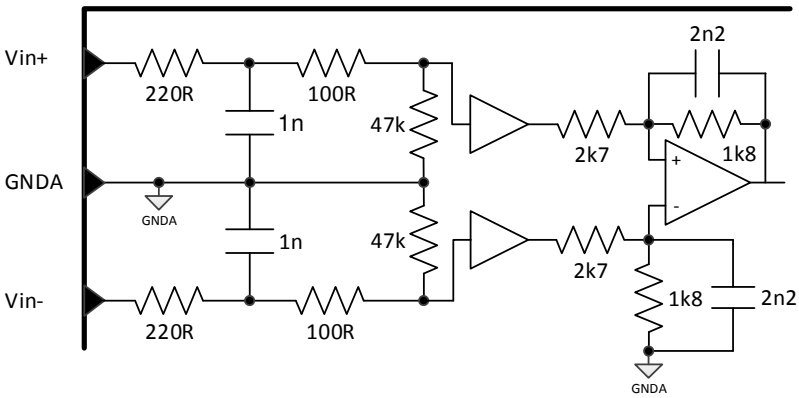


Figure 17: Balanced input buffer

Output Stage

The output stage is a full bridge topology with a 2nd order filter. The filter design is a part of ICEpower's proprietary HCOM topology and has been chosen as the optimal solution between demodulation characteristics, efficiency and filter compactness. The essential output characteristics are:

- The switching residual on the output primarily consists of a single frequency component at the carrier fundamental f_s.
- The system bandwidth is 70 kHz in 4 Ω.

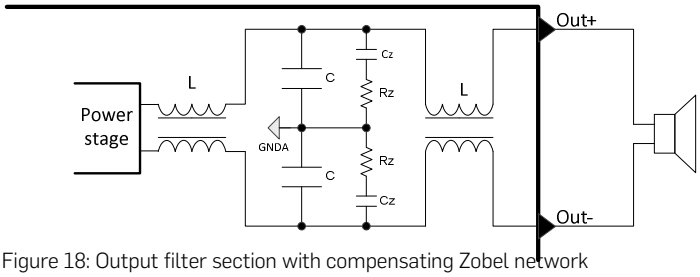


Figure 18: Output filter section with compensating Zobel network

Over Current Monitor Pin

This pin is high (5 V) during normal operation but it is pulled low (0 V) if a short circuit is detected on the speaker output terminals. Other protection features such as Zobel protection and saturation detection also activate this pin. If any of these protection features are activated, the pin will be pulled low (0 V). This pin is output only.

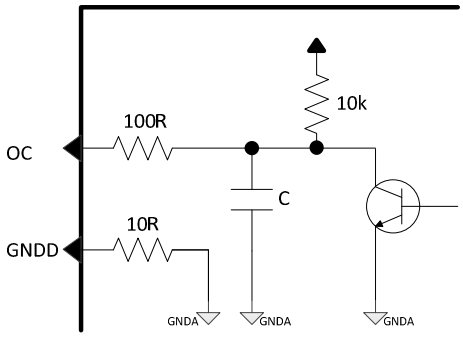


Figure 19: Over current monitor pin

Thermal Shutdown Pin

This pin indicates if the amplifier is shut down due to thermal overload. The pin is high (5 V) under normal conditions. If the amplifier temperature becomes too high, the amplifier shuts down and this pin is pulled low (0 V). This pin is only an output.

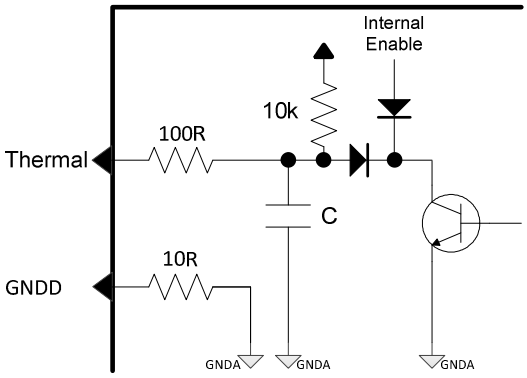


Figure 20: Thermal protection pin interface.

Temperature Monitor Pin

This pin provides an analogue DC voltage representing the temperature sensed on the amplifier. This pin is only an output.

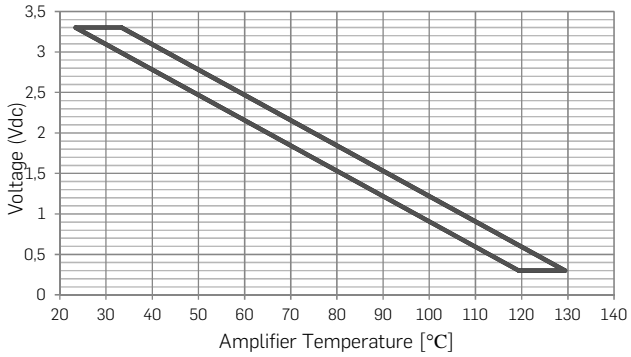


Figure 22: ICEpower700ASC/X Temperature Monitor.

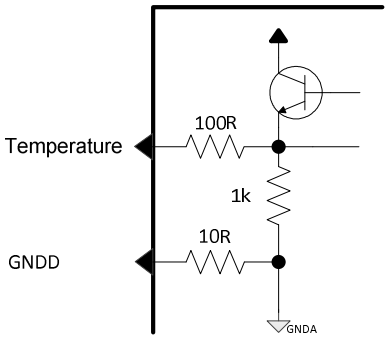


Figure 21: Temperature monitor pin interface.

Amplifier Enable

The Amplifier Enable pin can enable/disable the amplifier. If the pin is left unconnected, the level is high (5 V) and the amplifier is enabled. If the pin is pulled low (0 V) externally, the amplifier will be disabled. The enable pin is pulled low by the internal protection circuitry if the amplifier temperature becomes too high or an amplifier overcurrent is detected. This pin is bidirectional.

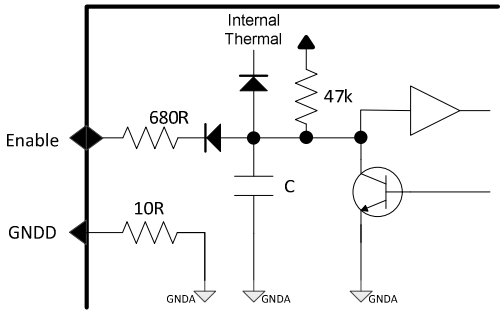


Figure 23: Amplifier enable pin interface

Auxiliary Power Supply

The auxiliary supply can be used to power an external circuit such as a preamplifier or an equalizer/crossover. The maximum current draw from either +15 V or -15 V should never exceed 500 mA including the consumption from any connected hanger(s).

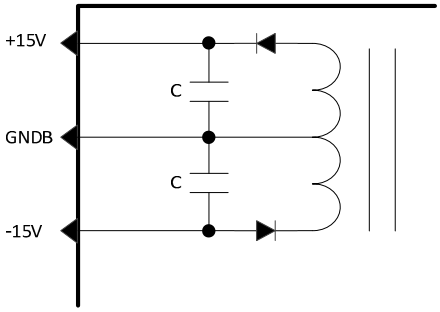


Figure 24: +/-15 V auxiliary supply

Hanger Vd

This high power DC output is only intended for powering stand-alone ICEpower amplifier modules like the ICEpower300AC. Maximum output power including the onboard ICEpower700ASC/X amplifier output power is 700 W.

Warning: The output is not short circuit protected. Continuous overload may permanently damage the power supply.

700ASC Trigger and Signal Sense

Three means are provided to put ICEpower700ASC into Operational mode or Standby mode:

- 12 V trigger
- 3 V - 5 V trigger
- Signal Sense

The trigger levels are found in Table 22.

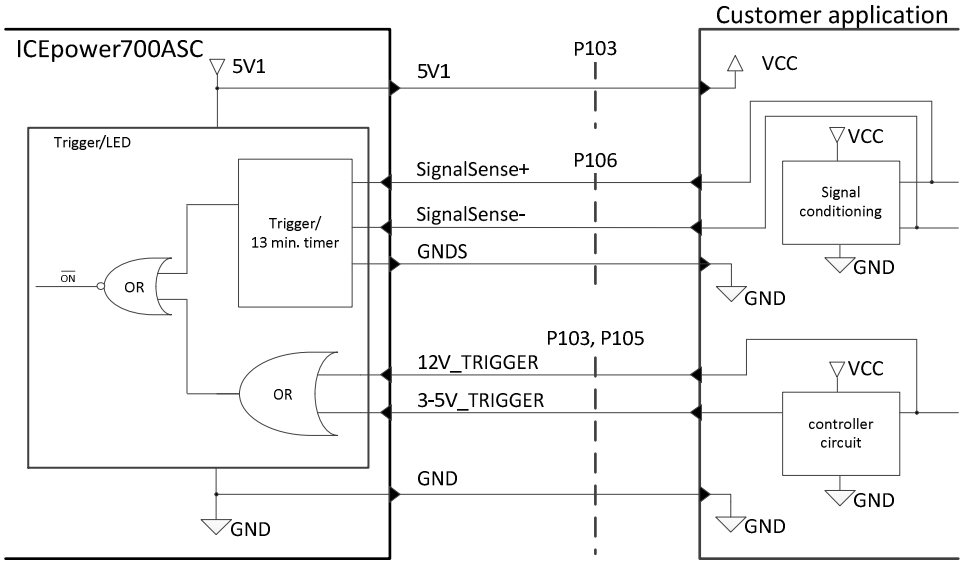


Figure 25: ICEpower700ASC Trigger and Signal Sense connection scheme

The 12 V and 3 V - 5 V triggers are logic triggers. The 12 V trigger and the 3 V – 5 V trigger enable the designer to force operational mode by setting either one or both triggers high. Setting both logic triggers low will force standby mode (provided that no signal has been present at the Signal Sense terminals for at least 13 minutes).

Signal Sense

The Signal Sense function consists of an audio detection circuit and a timer. If an audio signal is present on the Signal Sense terminals, ICEpower700ASC will enter operational mode. If audio is not present at the terminals, the timer will enter standby mode after approximately 13 minutes (provided that the logic triggers are set low).

700ASC LED Programming

ICEpower700ASC features an onboard, programmable LED-driver for indication of operational- and standby-mode with eg. green and red LED's, respectively. The LED's are implemented in the application circuitry as shown in Figure 26.

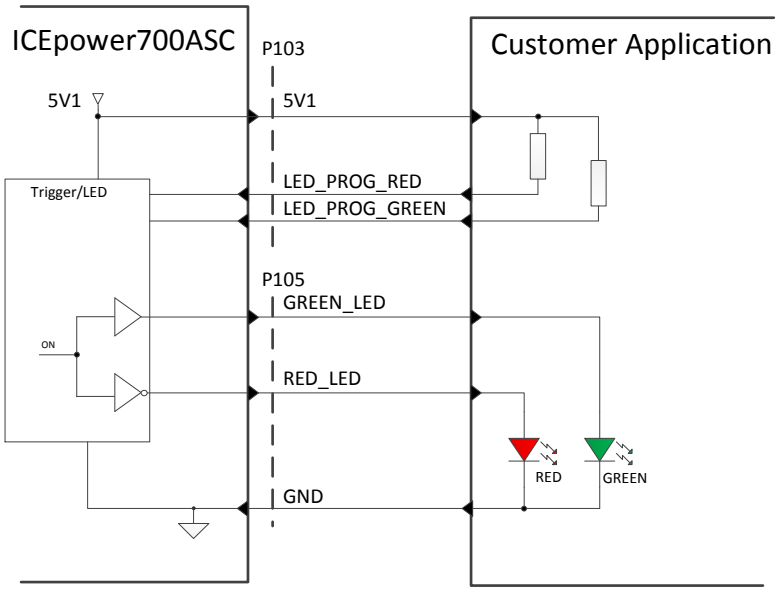


Figure 26: Application of the current programmable LED driver

The LED strength/current can be programmed individually by applying a resistor between the LED_prog-pin and 5V1. The resistor values are selected according to the graph below.

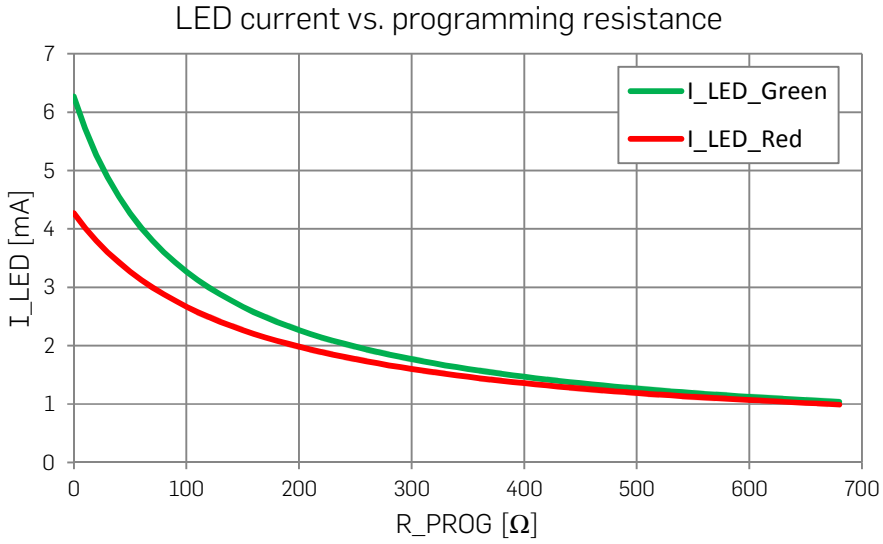


Figure 27: LED intensity/current programming

Operational Timing Diagrams

In the following sections, selected signals during power up/power down are illustrated.

700ASX Timing

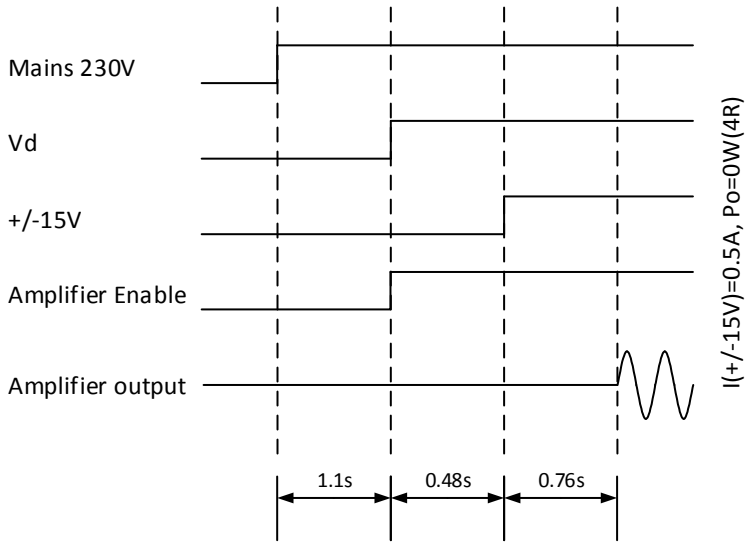


Figure 28: Power up from Mains on ICEpower700ASX, typical timing at 25 °C ambient

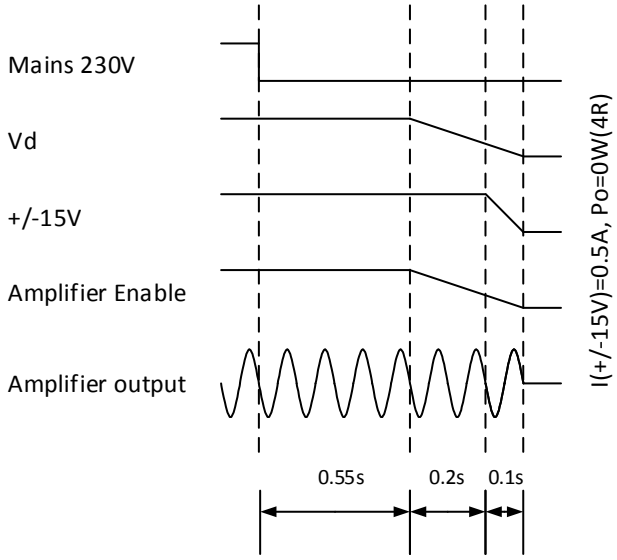


Figure 29: Power down after Mains off ICEpower700ASX, typical timing at 25 °C ambient

700ASC Timing with Trigger input

From the timing diagram below, it is seen i.e. that the user will have 5V1 available 0.6 s after connecting 230 V mains and the user should wait at least 470 ms from trigger activation until current draw from 5V1 is increased above standby current level.

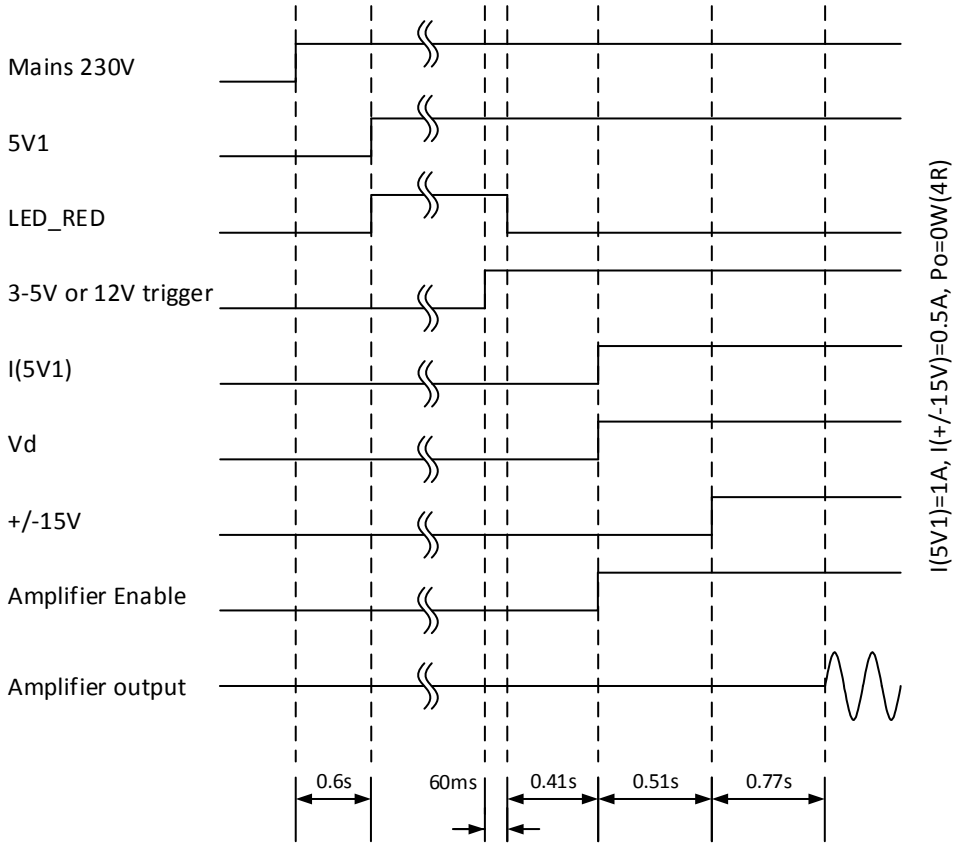


Figure 30: Power up from Mains on and trigger high, typical timing at 25 °C ambient.

From the timing diagram below, it is seen e.g. that the user should decrease current draw from 5V1 down to standby current level, no later than 60 ms from the point when the module is deactivated via trigger.

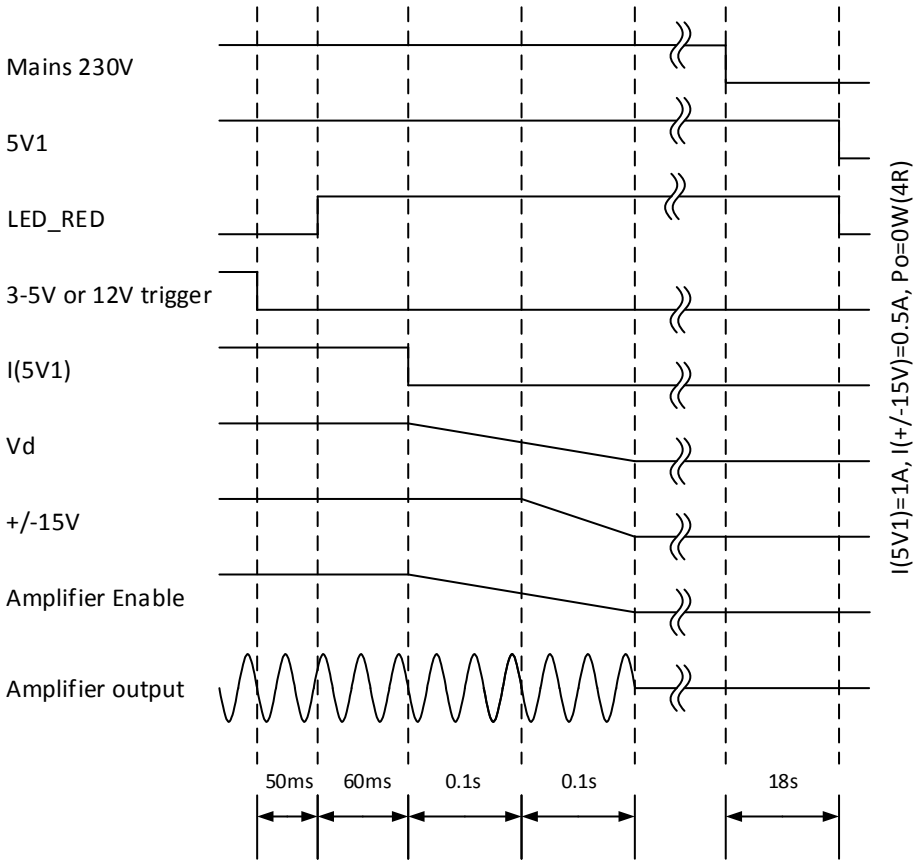


Figure 31: Power down from trigger low and Mains off, typical timing at 25 °C ambient.

700ASC Timing with Signal Sense

From the timing diagram below, it is seen e.g. that when the module is activated via Signal Sense, the user should wait at least 410 ms from LED_RED goes low, and until current draw from 5V1 is increased above standby current level. When the module deactivates and LED_RED goes high, the user has 4 s until current draw from 5V1 should be decreased down to standby current level.

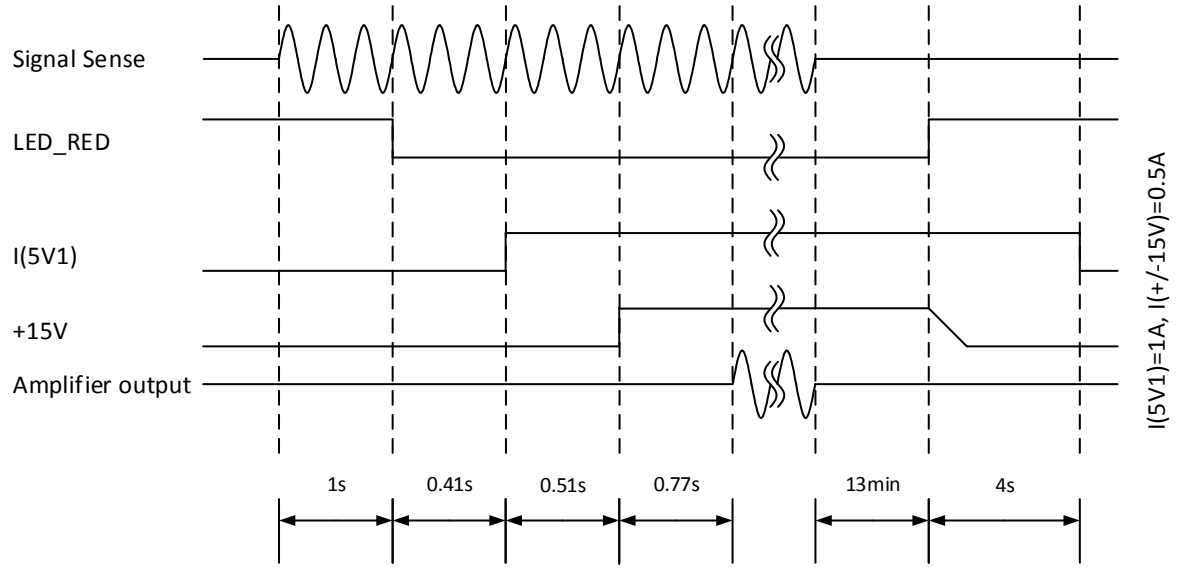


Figure 32: Power up/down on Signal Sense, typical timing at 25 °C ambient with 5mV, 100 Hz input signal.

Protection Features

Power Supply Protection

The power supply of the ICEpower700ASC/X has two protection circuits: over temperature and over current.

The ±15 V auxiliary outputs are over current protected.

The temperature protection is activated if the absolute temperature of the module is too high. This can be caused by high ambient temperature, high load (amplifier and AUX supply) for a long time or a combination of these two parameters.

700ASC Mains Over Voltage Protection

In the unlikely event of over voltage, the ICEpower700ASC will disable the main power supply until set in standby mode by triggers or Signal Sense.

Amplifier Protection

The ICEpower700ASC/X have a number of protection circuits.

These protection circuits handle over current protection, saturation detection, thermal protection and HF protection.

The over current protection circuit is divided into two parts. Pulse-by-pulse protection and loop saturation protection. The pulse-by-pulse protection circuit limits the peak output current to 30 A.
The loop saturation protection circuit detects saturation of the control loop. This condition will typically be allowed for 100 ms to 500 ms which is enough to avoid accidental shutdown at peak currents during music output. This protects the amplifier against excessive heating during short circuits.

The over temperature protection will only occur if the P_{RMS} is greater that the specified Continuous Output Power. In normal use, the amplifier will not shut down if properly mounted.

The HF protection circuit protects the Zobel network against ultrasonic signals (greater than 20 kHz and at full power). This protection circuit has a built-in time constant so it is possible to deliver a high frequency, high amplitude signal for a short time.

700ASC Standby Converter

Overload Protection

The 5V1 output is protected against overload conditions. In the event of an overload or short circuit, the converter will reduce the output power, as illustrated in the figure below.

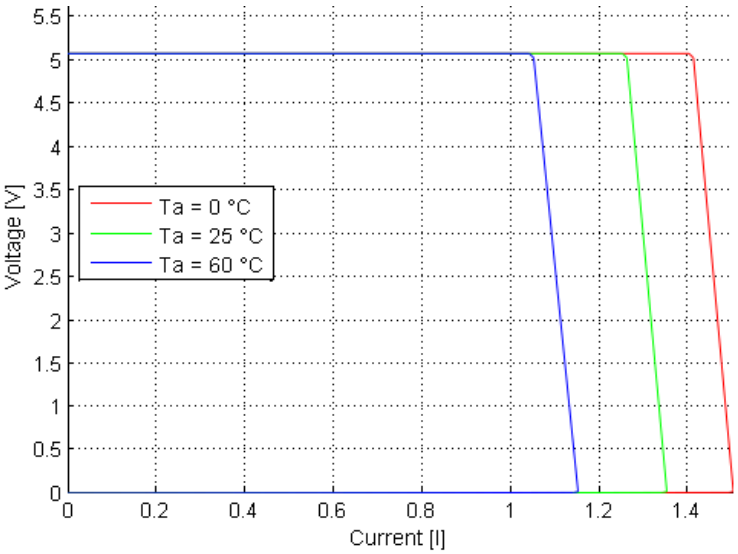


Figure 33: Typical 5V1 Overload Protection Voltage/Current curves

Input under Voltage

For safe operation, the standby converter prevents the system from starting up in case of AC-Line input below rating.

Thermal Protection

The standby converter is thermally protected. In the unlikely event of a temperature rise, the standby converter will shut down before reaching unsafe operating conditions and resume operation once the temperature has dropped to a safe level.

Integration Guideline

This section describes considerations in relation to module integration.

Typical Setup – Wiring diagram

The standalone ICEpower700ASC/X configuration features one audio channel. By adding one or two amplifier hanger modules (ICEpower300AC), ICEpower700ASC/X can be configured with up to three channels.

Below are illustrated two typical configurations of the ICEpower700ASC module: A two channel and a three channel setup. ICEpower700ASX wiring is obtained by disregarding the “700ASC only” connections.

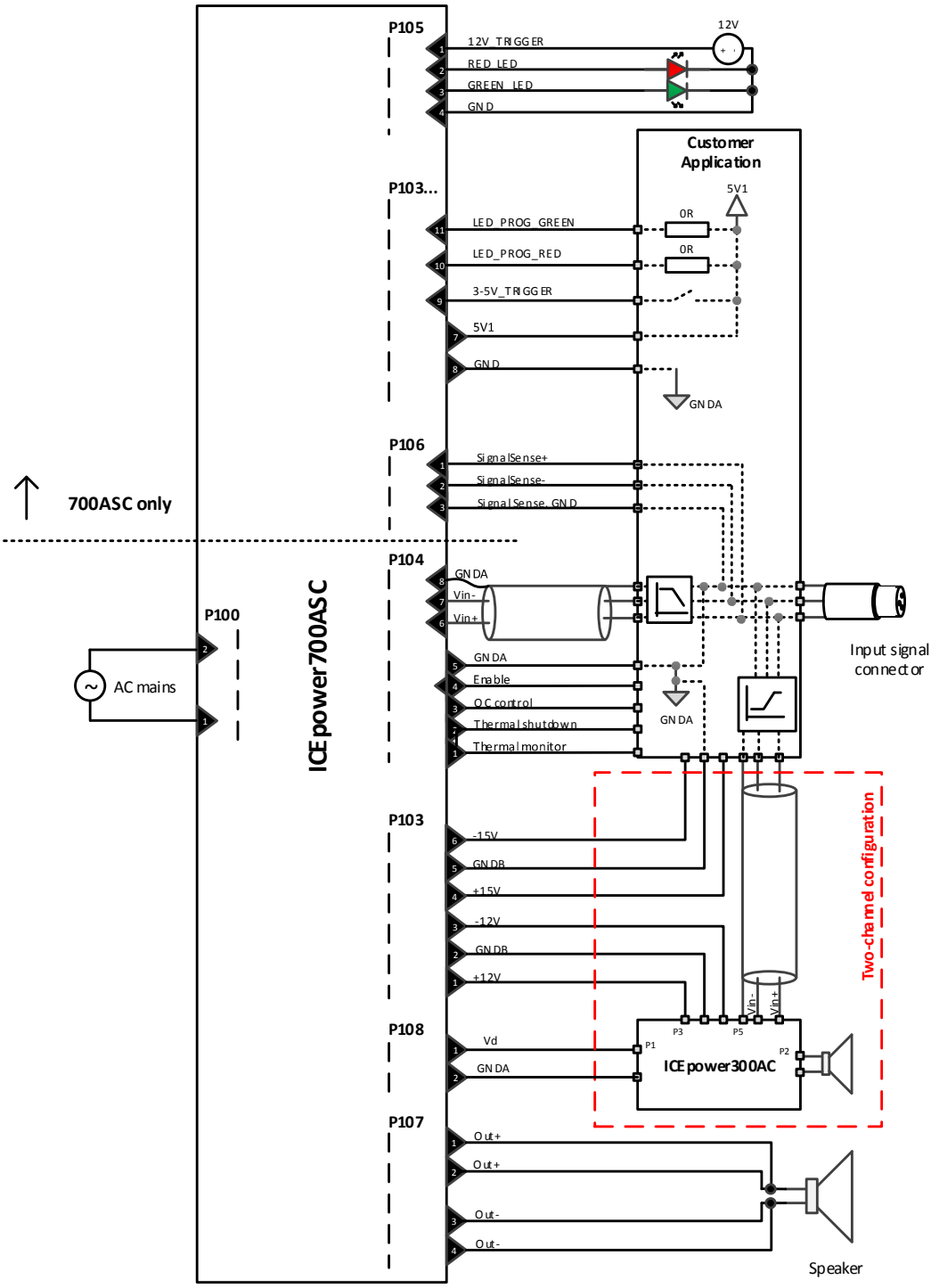


Figure 34: One and two channel configuration, Single Ended audio input

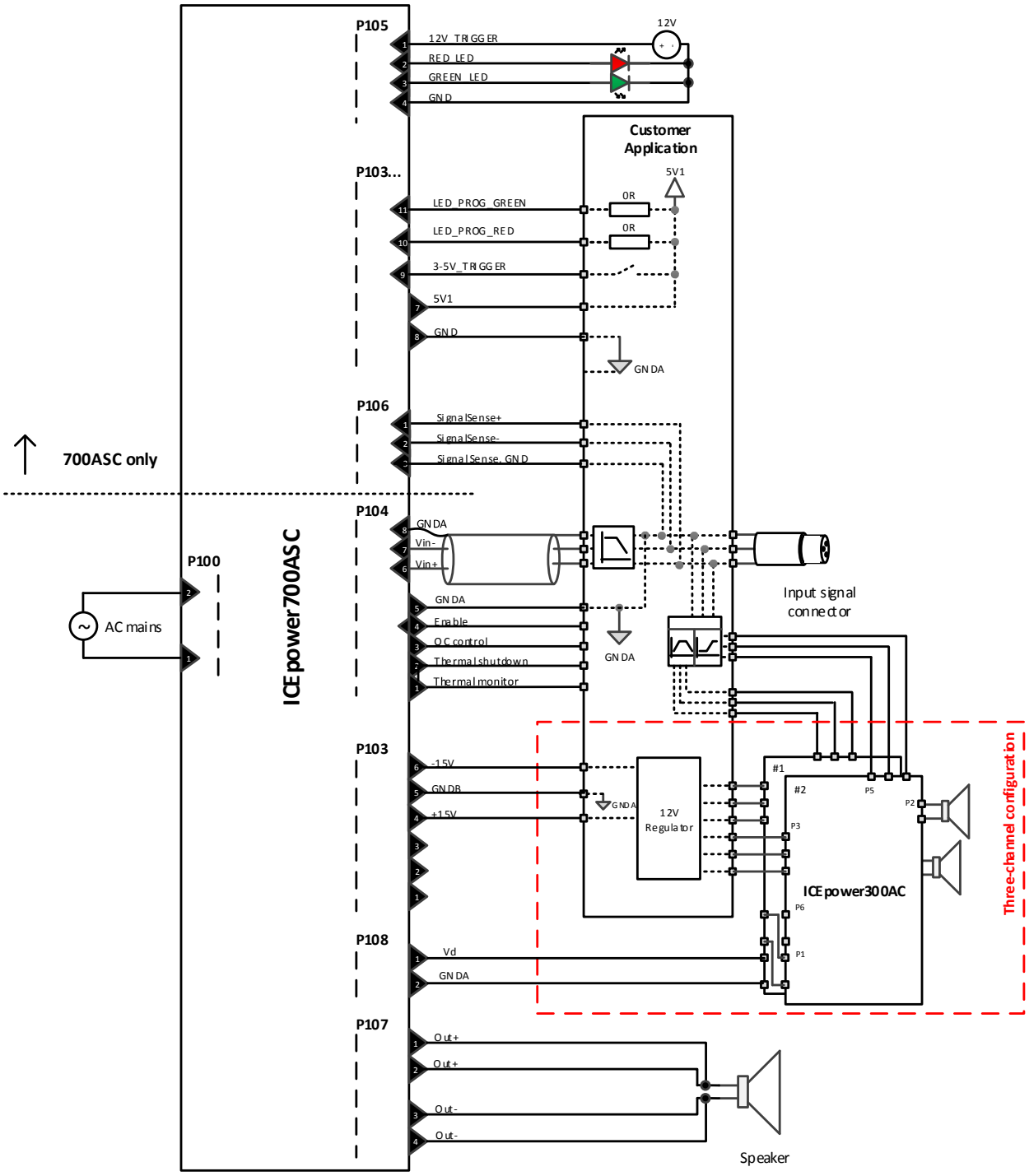


Figure 35: Three channel configuration, Balanced audio input

NOTE: In a three channel configuration the low voltage hanger supply must be derived from the ±15 V which are regulated to ±12 V on the Customer Application board.

Grounding Scheme

In order to avoid ground loops, ICEpower700ASC/X implements ground segregation.
These are named; <*Signal Sense GND*>, <*GND*>, <*GNDA*>, <*GNDB*> and <*GNDD*> and are illustrated in Figure 36.

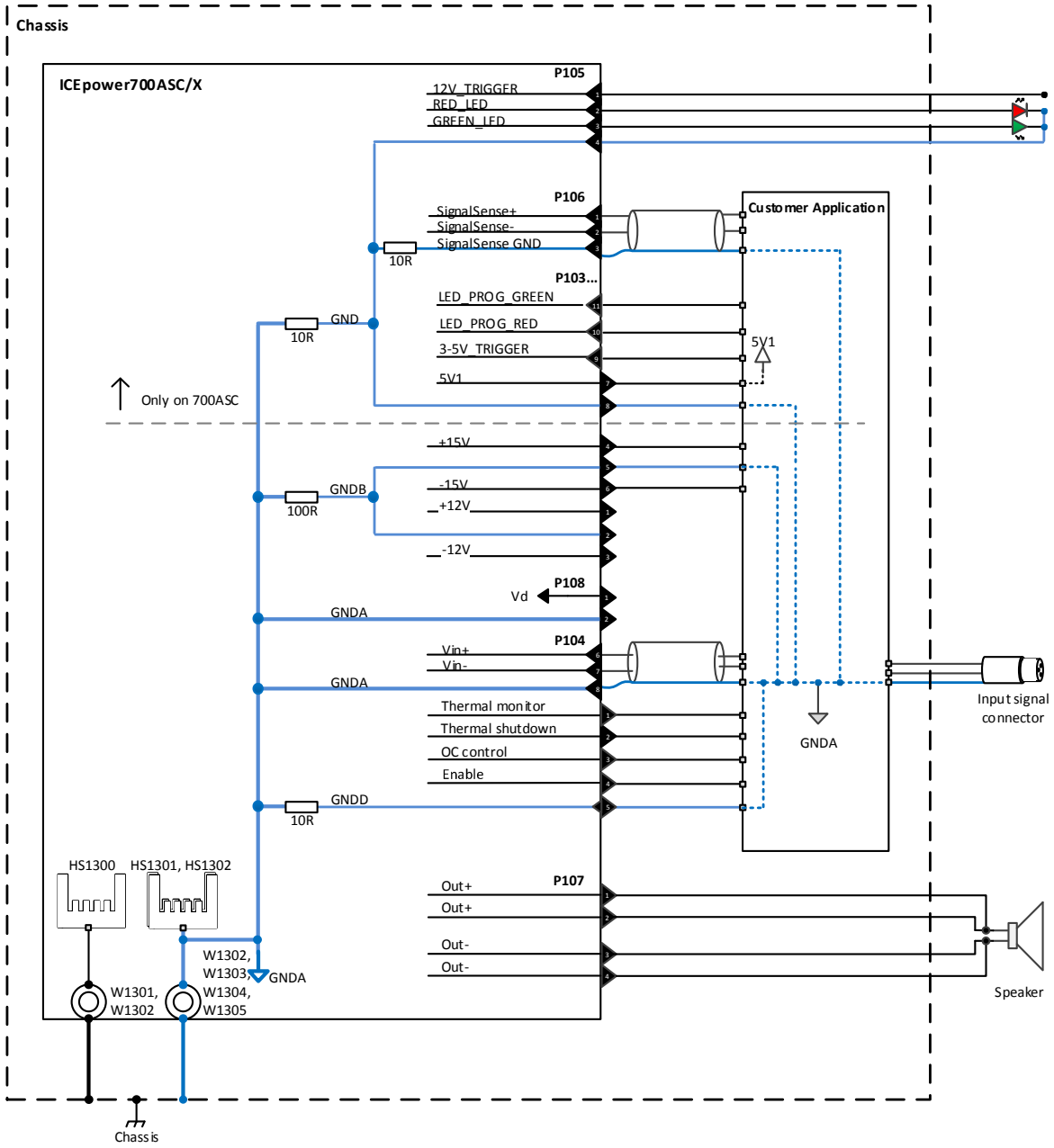


Figure 36: ICEpower700ASC grounding scheme

NOTE: ICEpower700ASX only has <*GNDA*>, <*GNDB*> and <*GNDD*> connections.

To reduce the risk of hum, it is not recommended to connect GNDA directly to Chassis at the input signal connector

EMC management

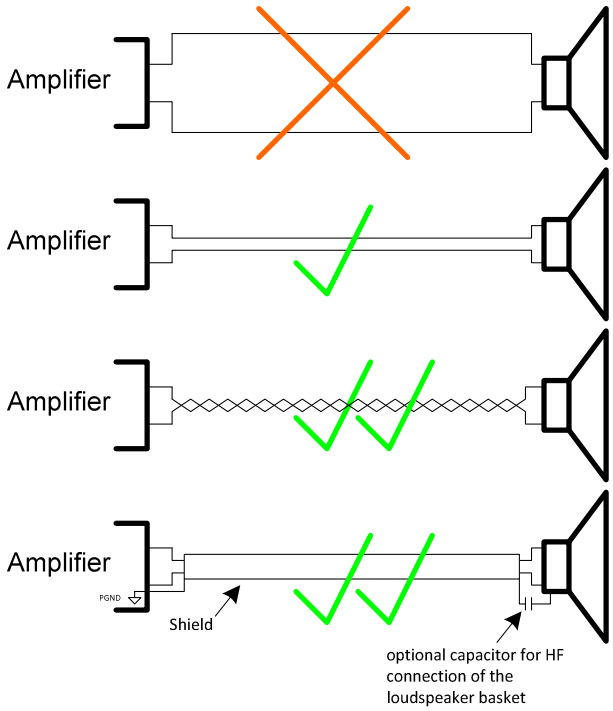
General

ICEpower amplifiers and power supplies utilize the latest switching technology to offer intelligent, compact and efficient audio power conversion systems. However, operating fast switching signals generates unwanted high frequency noise. Unless the necessary design precautions are taken this noise may exceed the standardized EMC limits. This section describes some guidelines to help reduce emission.

ICEpower700ASC/X complies to the required EMC standards. This reduces the challenge of gaining the final product EMC approval.

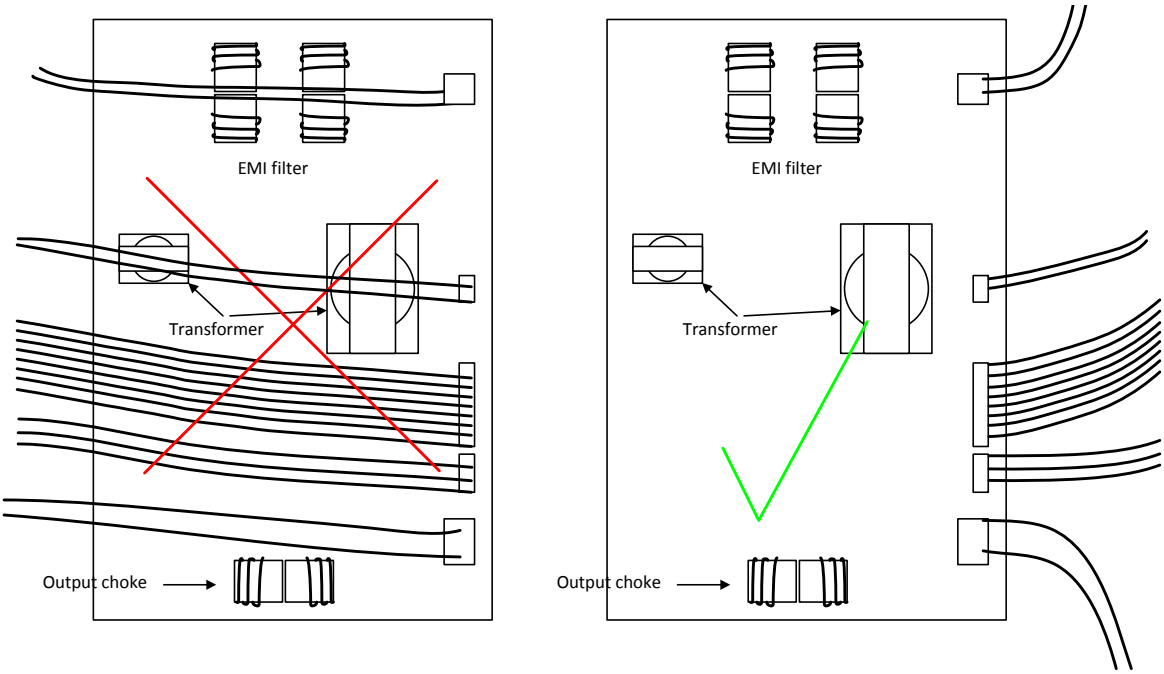
EMC Recommendations

- Loops conducting RF currents emit noise. It is important that speaker cables are twisted, shielded or at least run closely paralleled to reduce the loop area as much as possible. Always route speaker cables as close as possible to Chassis, in order to minimize the resulting ground loop. The same applies to mains and internal power supply cables as well as signal cables.

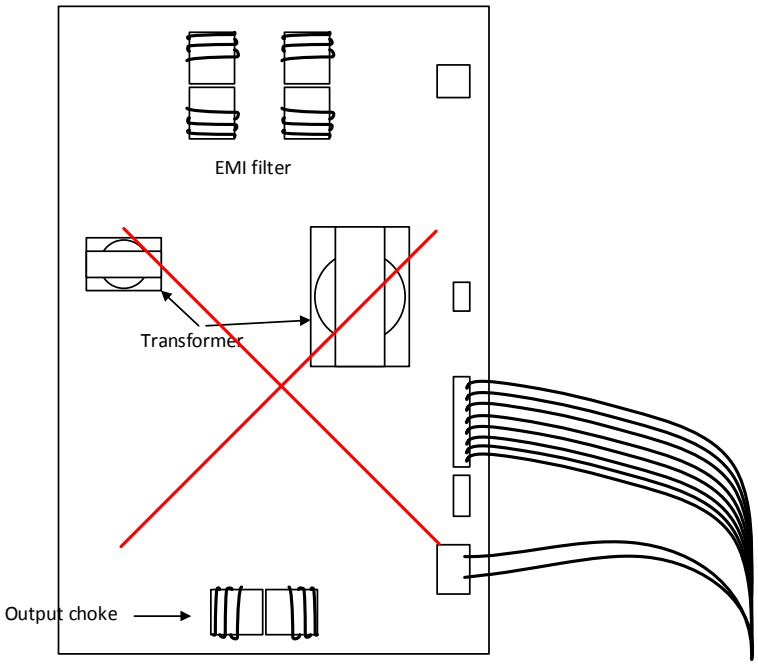


Note: When using shielded loudspeaker cable, the shield should not be connected directly to the basket of the loudspeaker. Loudspeakers may short the voice coil to the basket during heavy load resulting in damage to the module due to the short to ground. This can be avoided by making the connection to the basket through a capacitor.

- Do not route cables near the module magnetics.



- Do not bundle input, output or mains cables.



ICEpower has some basic recommendations, which should ease the EMC approval:

- When mounting via bottom side, the best EMC result is obtained when connecting all plated mounting holes to Chassis with low impedance spacers.
- When mounting via top side heat sinks, the best EMC result is obtained when connecting W200 and W201 to chassis with low impedance spacers.

If further reduction of emission is required, it is recommended to decouple all external wires to Chassis at the terminals, and GNDA on customer application board to Chassis.

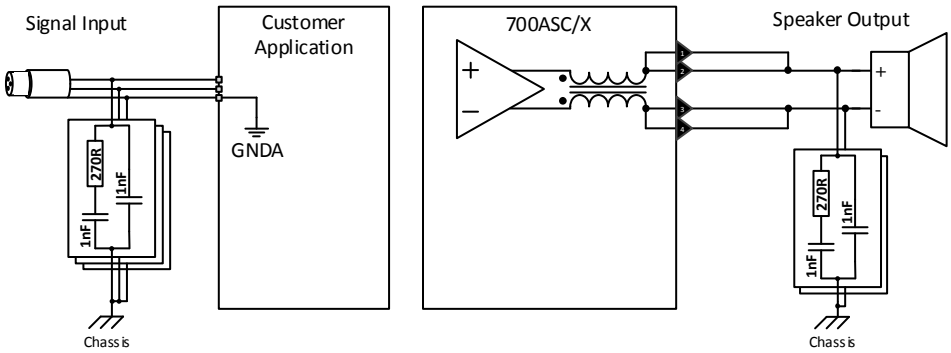


Figure 37: Illustration of decoupling of external wires for improved EMC performance

Thermal Design

ICEpower700ASC/X implements high efficient ICEpower switching technology resulting in low losses.

ICEpower700ASC/X is designed for high continuous power with no requirements for external heat sinking or fans.

However, if higher continuous power rating is required, external heat sinking can be connected directly to the onboard heat sinks. This eliminates the need for fans to the benefit of system robustness and cost.

Mechanical Mounting

The ICEpower700ASC/X module is designed for mounting either on bottom side spacers or by the top side heat sinks.

Mounting on bottom side spacers

The module is mounted by means of 3.5 mm holes in the board. The holes are indicated on the illustration below.

12 mm spacers are recommended for mounting in order to ensure sufficient ventilation around the module and to ensure a proper safety clearance between module and chassis.

Drill Pattern

All dimensions are in [mm].

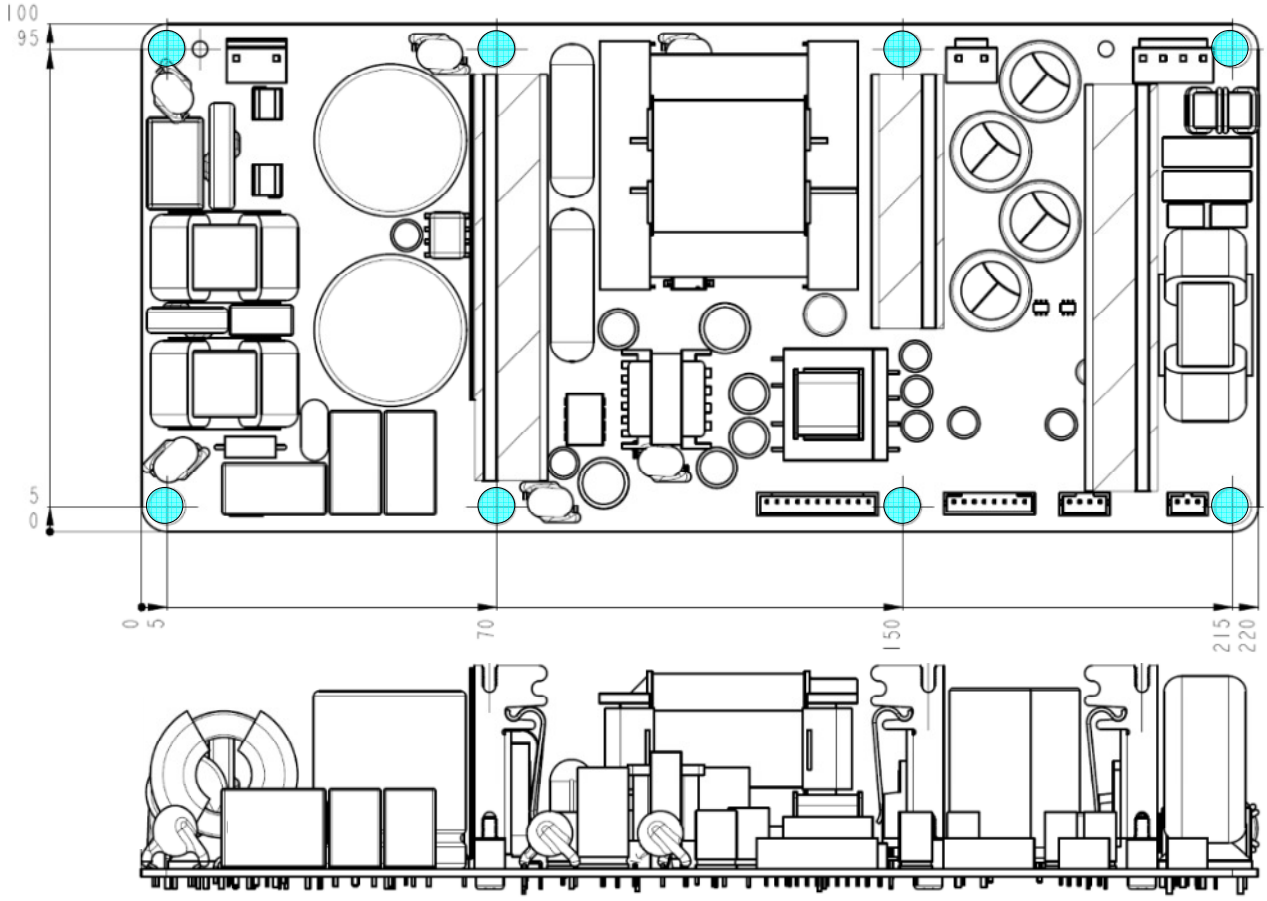


Figure 38: Mounting by bottom side spacers

Mounting by top side Heat Sinks

The ICEpower700ASC/X are designed for flexible mounting and if needed easy mechanical interface to external heat-sinking for even higher continuous power capability.

The module should not be mounted solely by the heat sinks. Use 40 mm spacers for support in the positions marked cyan in Figure 39. Electrically conductive spacers must be used to comply with the EMC regulations.

On the bottom side of the PCB, 12 mm of space from PCB surface to Chassis is recommended for mounting in order to ensure sufficient ventilation around the module and to ensure a proper safety clearance between module and chassis.

Drill Pattern

All dimensions are in [mm].

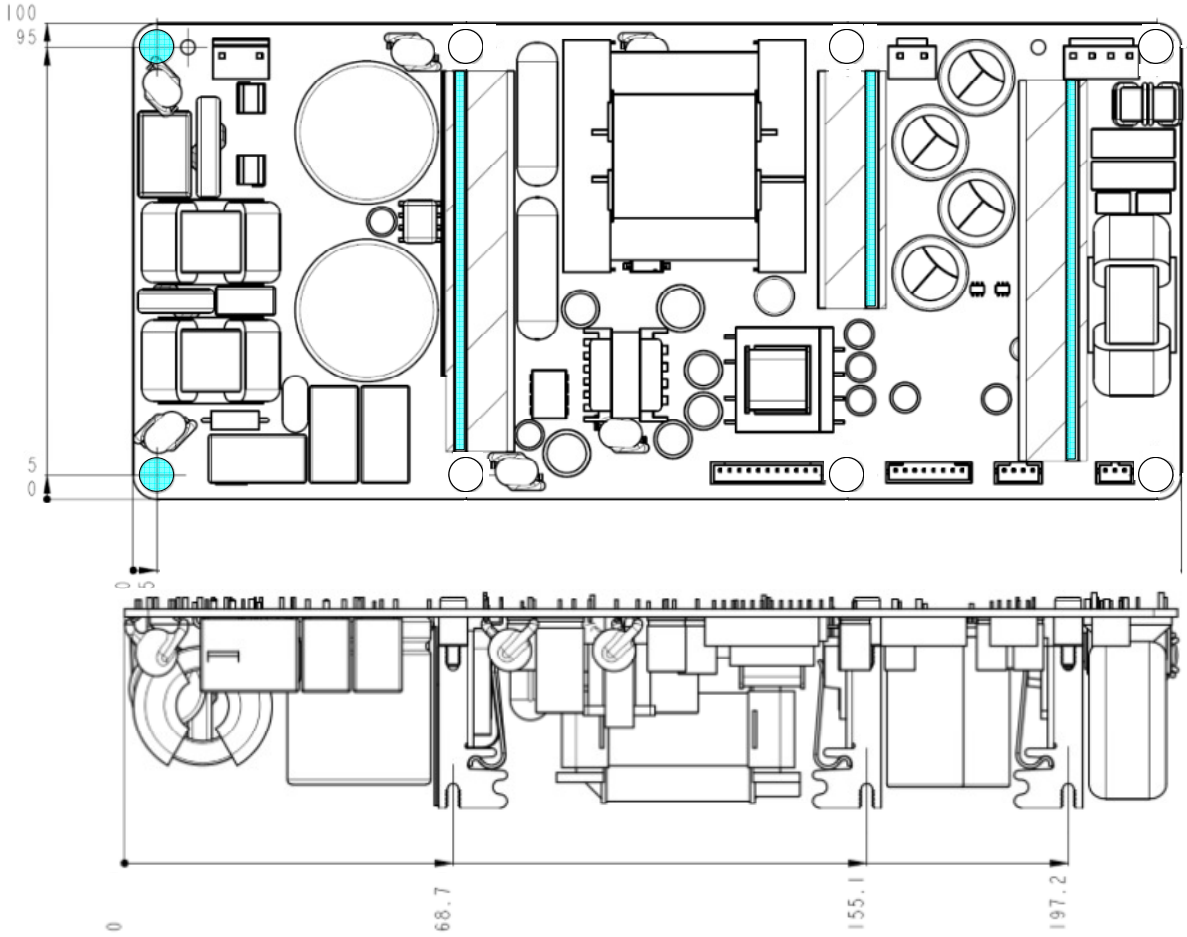
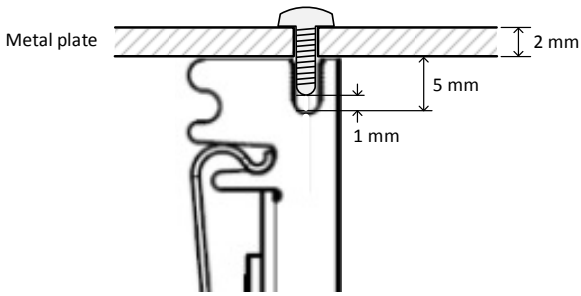


Figure 39: Mounting by top side Heat Sinks

The mounting slots in the top of the onboard heat sinks are designed for use with M3 thread forming screws. Thread forming screws (e.g. Bossard BN5653 M3) must be used in order to avoid burrs, which could cause unintentional short circuits.

The heat sink slot is approximately 5 mm deep. It is recommended to leave 1 mm slack for mechanical tolerances. I.e. to mount the module on a 2 mm plate, a (5-1+2) mm = 6 mm screw is recommended.

A minimum of two screws in the 50 mm heat sink and three screws in the 80 mm heat sinks are recommended.



Standards

ICEpower700ASC/X has been verified to conform to the following standards.

Safety

UL EN 60065:2002 Class II apparatus +A1:2006+A2:2010+A11:2008+A12:2011 UL IEC 60065(ed.7) + am1 + am2	Audio, video and similar electronic apparatus – Safety requirements.

EMC

EN 55013:2001 + A1:2003 + A2:2006 (CISPR 13:2001 + A1:2003 + A2:2006)	Sound and television broadcast receivers and associated equipment - Radio disturbance characteristics - Limits and methods of measurement.
EN 55020:2007 + A11:2011 (CISPR 20:2006)	Sound and television broadcast receivers and associated equipment - Immunity characteristics - Limits and methods of measurement.
EN 61000-3-2:2006 + A1:2009 + A2:2009 (IEC 61000-3-2:2005 + A1:2008 + A2:2009)	Limits for harmonic current EMCssions (equipment input current <= 16 A per phase).
EN 61000-3-3:2008 (IEC 61000-3-3:2008)	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current <= 16 A per phase and not subject to conditional connection.
EN 61000-4-2:2009 (IEC 61000-4-2:2008)	Electrostatic discharge immunity test.
EN 61000-4-3:2006 + A1:2008 + A2:2010 (IEC 61000-4-3:2006 + A1:2007 + A2:2010)	Radiated, radio frequency, electromagnetic field immunity test.
EN 61000-4-4:2004 + A1:2010	Electrical fast transient/burst immunity test.

(IEC 61000-4-4:2004 + C1:2006 + C2:2007 + A1:2010)	
CFR 47 part 15, subpart B, section 15.107(a)	Unintentional radiators, conducted limits.
CFR 47 part 15, subpart B, section 15.109(a)	Unintentional radiators, radiated EMCssion limits.

ESD Warning

ICEpower products are manufactured according to the following ESD precautions:

- ANSI/ESD-S20.20-2007: Protection of Electrical and Electronic Parts, Assemblies and Equipment.

Further handling of the products should comply with the same standard.

The general warranty policy of ICEpower a/s does not cover ESD damaged products due to improper handling.

Packaging and Storing

ESD safe cardboard is used for wrapping:

Order Codes	Description	Part Number
ICEpower700ASC	1 × 700W ICEpower amplifier with integrated ICEpower supply, standby converter & universal mains operation.	8007646
ICEpower700ASX	1 × 700W ICEpower Amplifier with integrated ICEpower supply and manual mains voltage selection jumper.	8007746

Dimensions and weight:

Package	Quantity	Dimensions (w × d × h) [mm]	ASC Gross Weight [kg]	ASX Gross Weight [kg]
Carton	12	390 × 590 × 195	14,7	14,1
Pallet	240	1200 × 800 × 1145	314	302

Storage Humidity and Temperature

Please refer to section Environmental Specifications page 12.

Stacking

Pallets may **not** be stacked on top of each other.

Notes

For additional information about the ICEpower® technology from ICEpower a/s, visit our web site or contact us.

ICEpower a/s
Gl. Lundtoftevej 1b
DK-2800 Kgs. Lyngby
Denmark

Phone +45 96 84 11 22
Fax +45 96 84 57 99

ICEpower.dk
info@icepower.dk

Notice