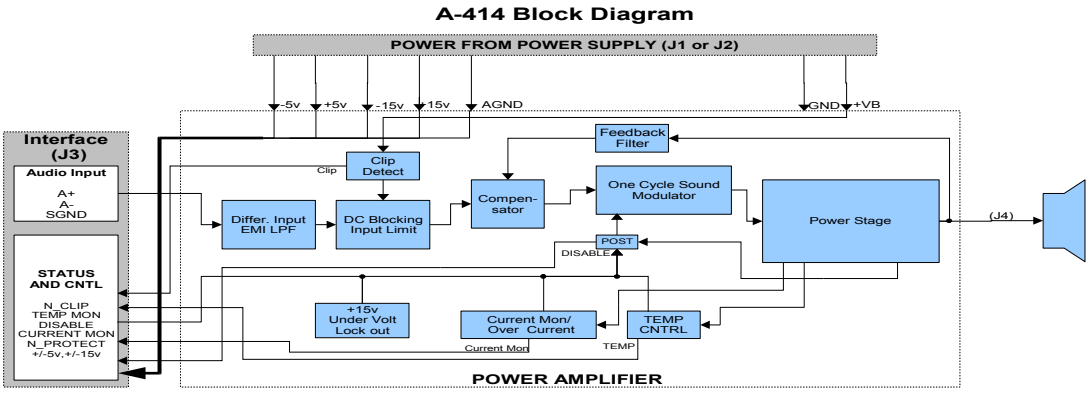
Features

- Proprietary "One Cycle Sound™" Control
- Rated Power: 500 Watts @ 4 Ohms
- 117dBA dynamic Range
- THD+N < 0.03%, 0.1W to Rated Power
- Amplifier Efficiency 96%
- Efficiency Including P-500-CE > 85%
- Damping Factor > 375 @ 100Hz 4 Ohms
- DC offset < 25mV
- Remote Disable
- Compatible with the P-500-72 and R-400 Power Supplies
- Small Footprint 4 x 2 Inch (100 x 50 mm)
- Output Feedback
- Over Current Protection: Short to Ground
- Over Current Protection: Shorted Load
- Temperature Protection and Monitor
- Output current monitor
- Indicator Drivers: Power, Clip, Protection
- Power Supply Under Voltage Lockout
- Clickless Turn-on

Product Description:

Based on the PowerPhysics proprietary "One Cycle Sound" control method, the A-414 provides up to 400 Watts of high-fidelity audio power into 4 ohm speakers prior to clipping and 500 Watts using common measurements. With over 600,000 corrections per second PowerPhysics amplifiers' sound quality rival any amplifier topology, at any price level.

True to the military heritage of the A-404, the robust design of the A-414 features protection and monitoring of both temperature and output current. This information is ideally suited for off board analysis such as real time load power calculations, load detection, and system thermal management. The amplifier is fully protected against any type of output short or speaker fault to provide low maintenance, long term operation.



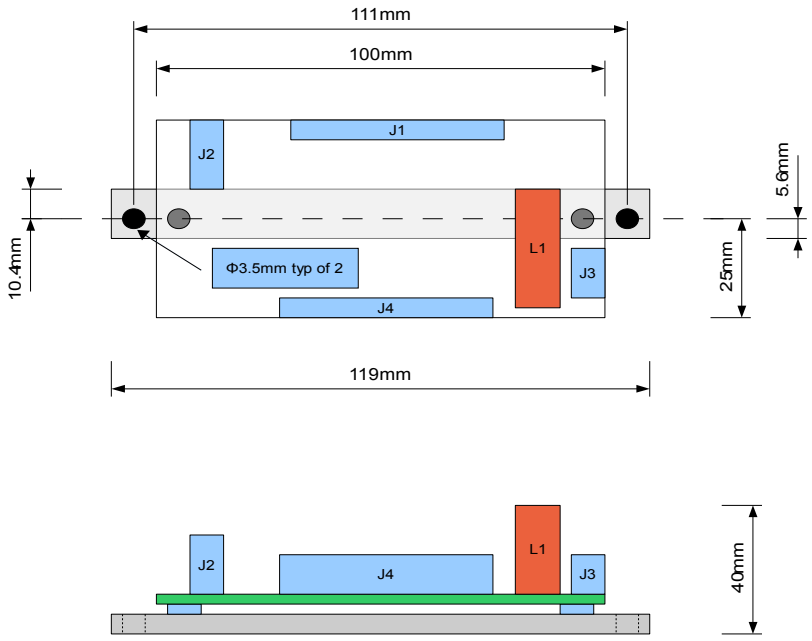


Figure 1: Amplifier Outline, Connector and Mounting Hole Locations

A-414 Amplifier specifications:

Unless otherwise specified, f = 1kHz, R_L=4Ω, Ta=25 ºC, Vbus=80v

Parameters	*Symbols*	*Test Condition/ Comment*	*Min*	*Typ*	*Max*	*Unit*
Load Resistance	R_L		2.5	-	-	Ω
Max Output Power	P_{max}	f=20Hz-20KHz (1% THD)	-	500	-	W
Ouput Power	Po	f=20Hz-20kHz (0.1% THD)	-	400	-	W
Sensitivity	V_{sen}	Input Signal to 500W	-	3.5	-	Vrms
Gain	A		21.5	22	22.5	dB
Mute Gain	A_{mute}	Disable Pin pulled low.	-45	-	-	dB
Distortion	THD+N	10Hz< f <20kHz, 100mW< Pout < P_o	-	.03	.05	%
Freq. Response	f	20Hz-20kHz	-	+/- 0.5	-	dB
Noise Floor	V_{NF}	Input Shorted, A-weighted	-	70	80	µV
Damping Factor	DF	R_L = 4 ohms @ 100 Hz	-	375	-	Ω/Ω
Power Bandwidth	BW_{pw}	Output Power: P_{max}	-	60k	-	Hz
Small Signal Bandwidth	BW_{sm}	Output Power: 1Watt	-	90k	-	Hz
Dynamic Range	SNR	500W@ 4 ohms , A-weighting	114.8	115.5	-	dB
P.O.S.T. Duration	Tpost		1	-	2	Sec
Current Sense Gain	Acs			.125		V/A
Turn off threshold for the +15v	UVLO	Below this value the amplifier will turn off	-	10	-	V
Turn on threshold for the +15v input	$V_{start15}$	With Vstart5 =5v, above this level the amp will start	-	12	-	V
Turn off threshold for the +5v	UVLO5	Below this value the amplifier will turn off		4.2		V
Turn on threshold for the +5v input	V_{start5}	With Vstart15 = 15, above this level the amp will start		4.4		V
Maximum Current	I_{max}		23	26	29	A

A-414 Power Supply Requirements:

Unless otherwise specified, f = 1kHz, R_L=4Ω, Ta=25 ºC, Vbus=80v

Voltage	Normal Op Current	Disable mode Current	Minimum	Maximum	COMMENT
+15v	55mA	65ma	+14.5v	+15.5v	
-15v	0	0	-15.5v	-14.5v	Not used by A-414. It passes through to Audio Input Connector for use in Pre-amp.
+5v	67mA	60mA	4.8	5.2	
-5v	49mA	45mA	-5.2	-4.8	
+BUS	63mA @ idle 8A @ Pmax	0mA	30v	85v	

Notes:

1. During shutdown of the supplies, ensure the -5v tracks or is greater in magnitude to the +5v supply (i.e. $|V_{-5}|$ must be >= V_{+5} during turn off sequence.) . This will be automatic if the +5v and -5v power sources are turned off at the same time and they have the same energy storage capacitance values. The -5v current is less than the +5v current draw on the A-414.

Performance Charts:

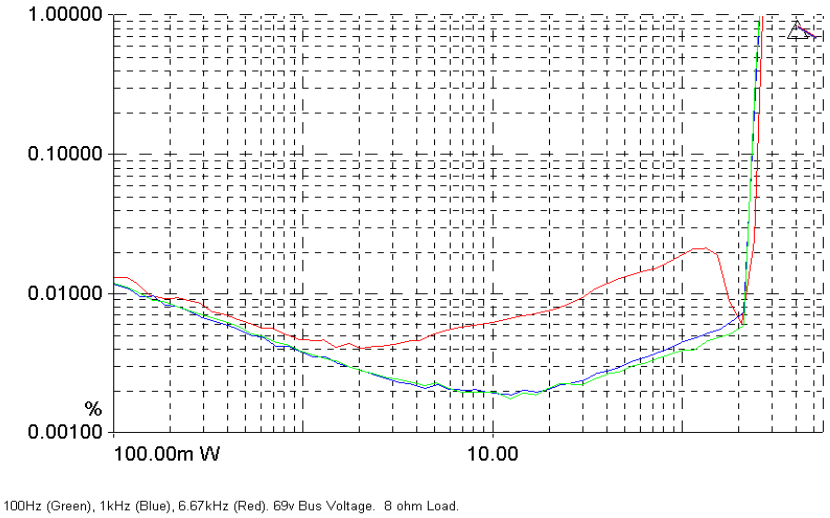


Figure 2: THD+N Distortion - 8 Ohms

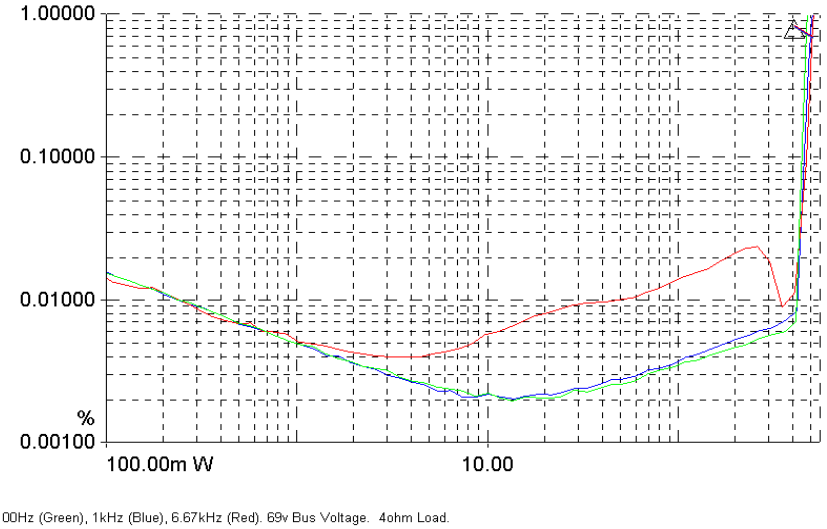


Figure 3: THD+N Distortion – 4 Ohms

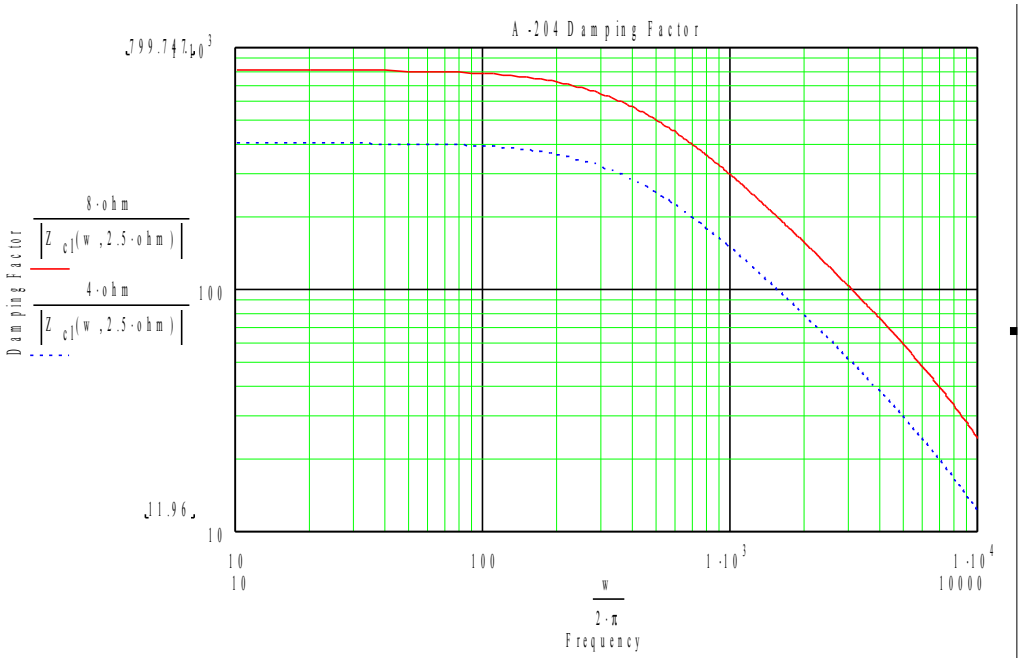
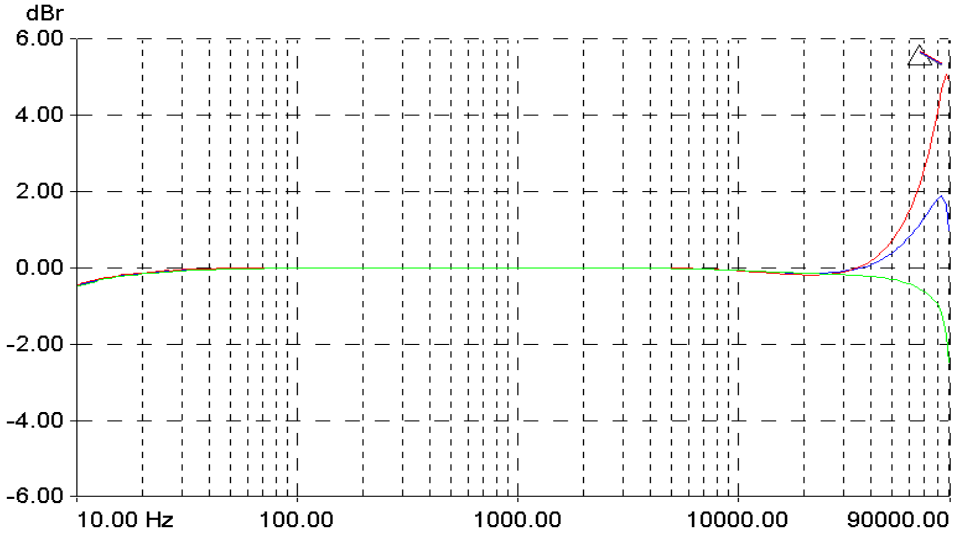


Figure 4: Damping Factor (calculated)



4 Ohm (green), 8 Ohm (blue), Open (red).

Figure 5: Frequency response

Connector pinout:

Audio Interface Connector (J2: 2x7 pin .1" Header 3M 30314-6002HB)

Pin	SIGNAL
1	GND
2	Audio +
3	Audio -
4	GND
5	+15
6	-15
7	GND
8	CURRENT MON
9	TEMP MON
10	N_PROTECT
11	DISABLE
12	N_CLIP
13	+5v
14	-5v

Power Connector (J1,J4: 1x9 pin JST B9P-VH. Only one connector is need, the other can be used for as a pass through for multi-channel amplifiers)

Pin	SIGNAL
1	+80v
2	+80v
3	POWER GND
4	POWER GND
5	+15v
6	-15v
7	+5v
8	-5v
9	AGND

Speaker Output (J3 (1x3 JST B3P-VH)

J3

Pin	SIGNAL
1	OUT +
2	GND
3	OUT -

Amplifier Operation:

CLIP INDICATOR:

The N_CLIP pins are active pull down signals that indicated when the amplifier is being clipped. The clip level is set so that the distortion of the amplifier is approximately 0.1% or higher. This Pin has a 1kohm current limiting resistor so that an LED can be directly driven by attaching an LED between this Pin and +5v or +15v. Alternatively, To sense this signal with an external processor , an external 10k ohm pull up resistor to 5v can be used (Figure 6). See Table 1 for further information about the amplifier status pins.

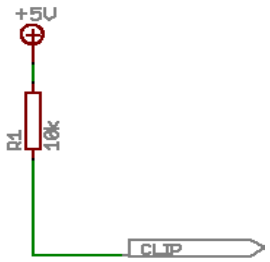


Figure 6: Clip Signal External Pull up Resistor

PROTECT INDICATOR:

The N_PROTECT pin is an active pull down signal that indicates when the amplifier is being placed in Protect Mode. This occurs during the Power On Self Test (POST) and if the amplifier has reached over temperature or over current limits. This signal is also pulled low when the amplifier is being disabled externally by pulling the TEMP signals low (see below). This Pin has a 1kohm current limiting resistor so that an LED can be directly driven by attaching an LED between this pin and +5v or +15v. Alternatively, To sense this signal with an external processor , an external 10k ohm pull up resistor to 5v can be used (Figure 6). See Table 1 for further information about the amplifier status pins.

DISABLING THE AMPIFIER:

The amplifier can be disabled by pulling up the disable pin. When this signal is released, the amplifier will turn on after the POST (see below).

OVER CURRENT OPERATION:

If the amplifier hits its over current limit threshold (I_{max}), it will disable the output stage and trigger the power on self test (POST). The POST will in turn pull both the N_CLIP and N_PROTECT signals low, indicating to an external processor that an over current condition occurred. It will then try to restart. It will do this until the short or over current condition is removed.

CURRENT MONITORING OPERATION:

The output current is monitored by the CURRENT MON pin and has a gain of A_{cs}. The current monitor reaches it Imax at 3.25volts. The voltage on the CURRENT MON pin represents the output current by the following equation:

$$V_{currentmonitor} = 0.125 I_{out} + Fs_{NOISE}$$

The voltage on the CURRENT MON pin is a bipolar signal (+3.5v to -3.5v max range) that also contains a certain amount of switching frequency noise. While this switching frequency noise is a small percentage of the full range signal, additional filtering may be required if used to detect low current applications (i.e. Speaker model detection using impedance). (see Figure 7 and Figure 8) below .

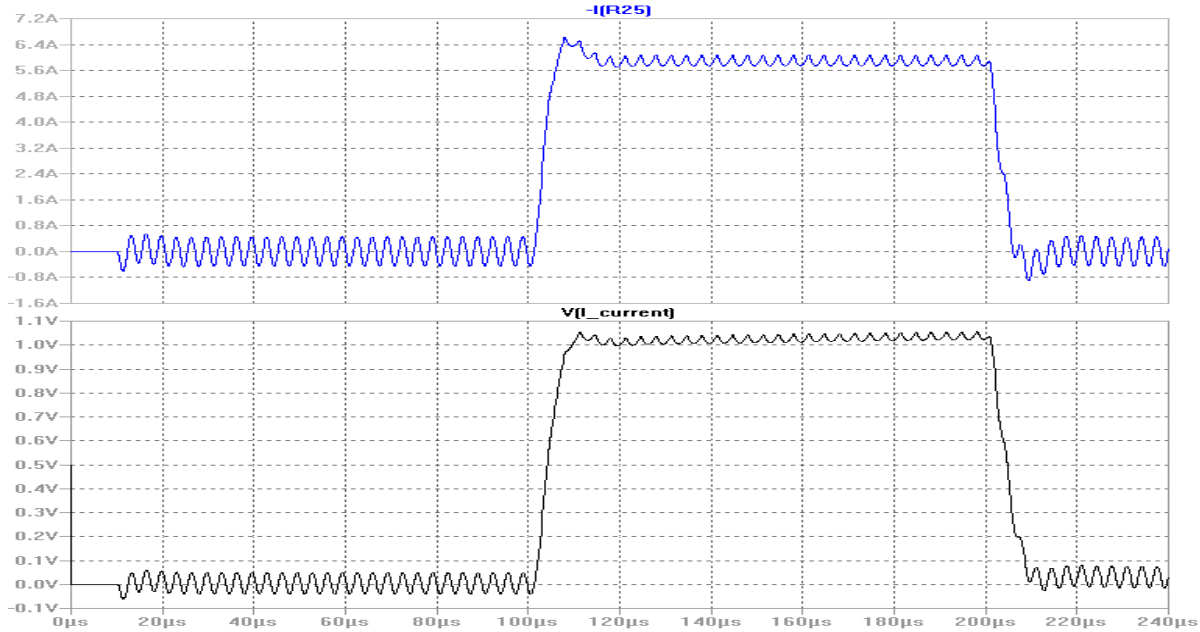


Figure 7: V(L_current) = Current Monitor Voltage; -I(R25) = Output Current

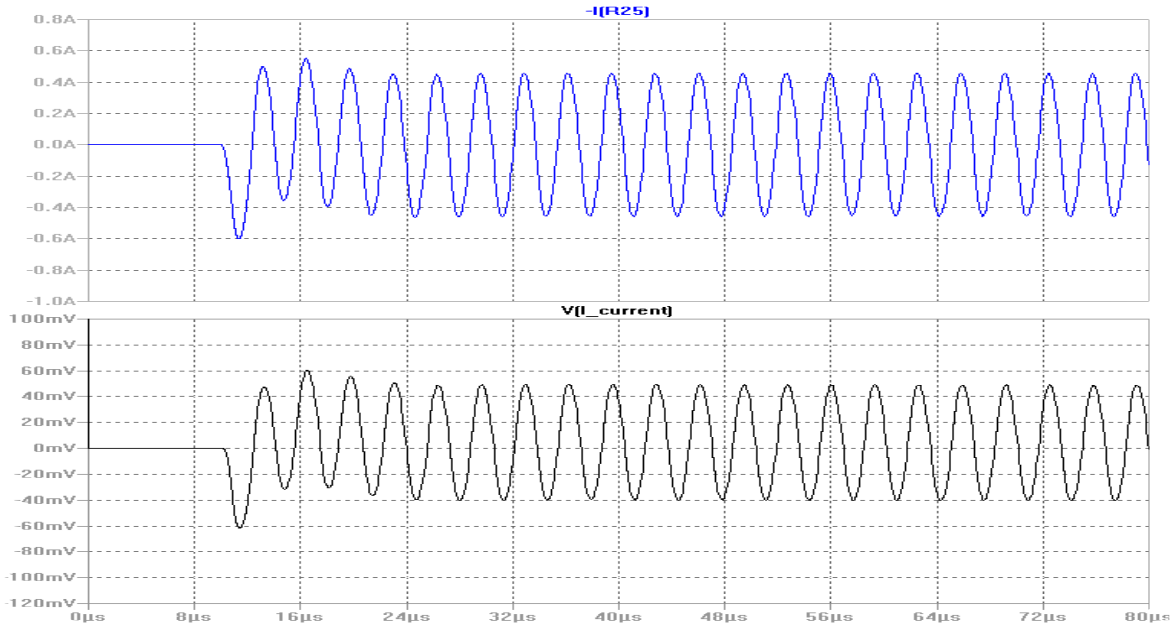


Figure 8: Zoom Showing Switching frequency Noise: V(L_current) = Current Monitor.

POWER ON SELF TEST (POST):

At startup of the amplifier, it will go through a POWER ON SELF TEST (POST) for no less than 1 seconds. This test will disable the amplifier and pull the N_PROTECT and N_CLIP pins low.

UNDER VOLTAGE LOCK OUT (UVLO):

At initial power up, the amplifier will not start until the +15v and +5v are above their minimum threshold levels ($V_{start15}$, V_{start5}). Before these level the POST will be initiated. However, Above this voltage, it will remain operating until the +15v or +5v drops below the UVLO threshold.

TEMPERATURE MONITORING:

Each amplifier has a temperature monitoring output (Temp) that represents the power MOSFET temperatures. The Temp voltage versus temperature is shown below (TEMP(T) curve). The amplifier will go into PROTECT mode and will shutdown the amplifier if the sensed temperature goes above the maximum permissible MOSFET operating temperature. If the amplifier goes into protect mode, it will remain off until the Sensed temperature drops below 84% of the maximum permissible temperature (See HYST(T) Curve). The temperature pin is directly connected to the amplifier thermistor circuitry. Any sensing of this pin must be high in impedance (i.e. Greater than 100k) or the temperature monitoring circuit will be effected.

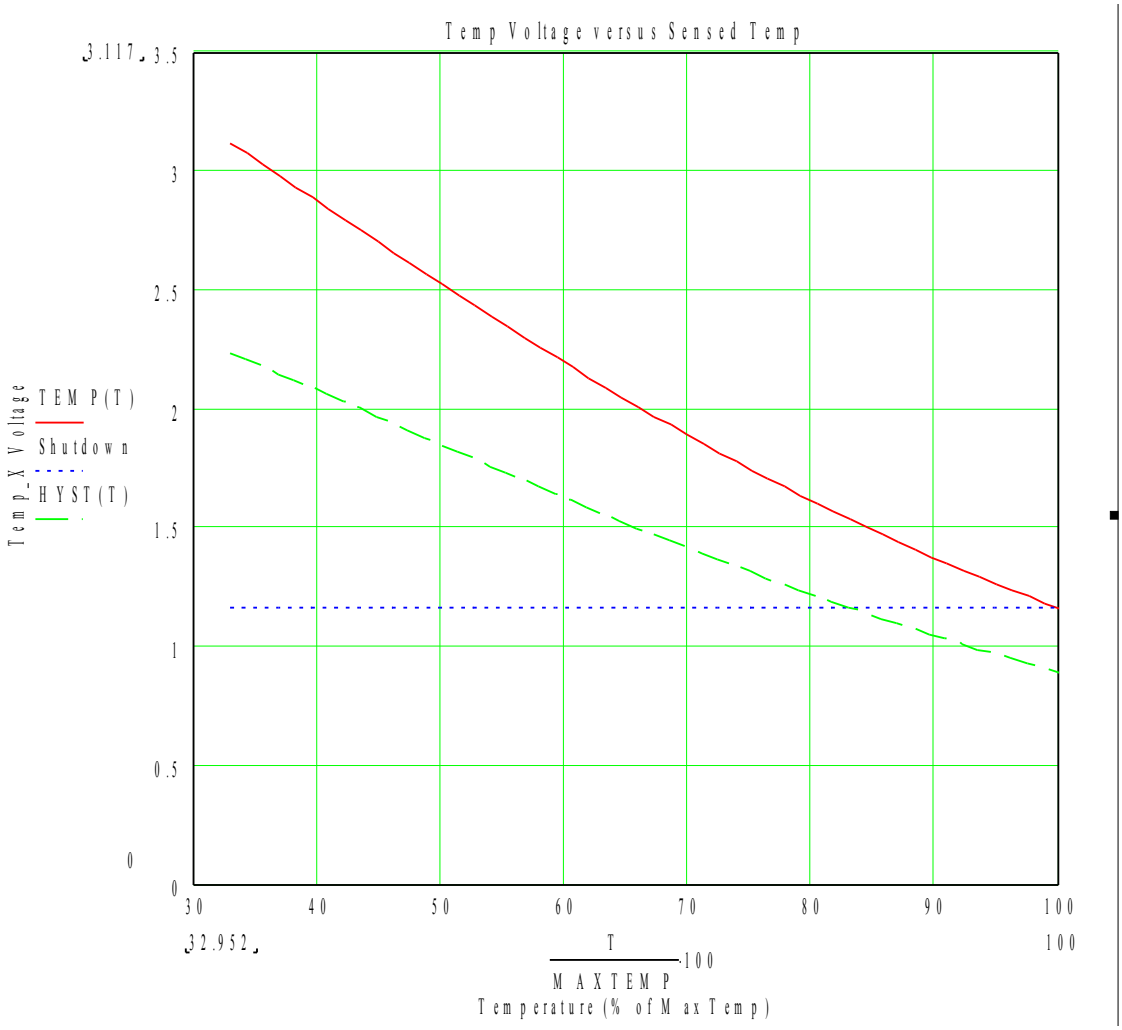


Figure 9: Temp Monitor voltage versus Sensed Temperature

N_CLIP and N_PROTECT Logic Table

When sensing the N_CLIP and N_PROTECT pins with an external processor or directly connecting them to LED's, the following information can be decoded by their states.

N_CLIP	N_PROTECT	State
HIGH (LED OFF)	HIGH (LED OFF)	Normal Operation
HIGH (LED OFF)	LOW (LED ON)	Over Temperature
LOW (LED ON)	HIGH (LED OFF)	Amplifier is Clipping
LOW (LED ON)	LOW (LED ON)	At startup- POST After Startup – Over Current Protection

Table 1: N_CLIP and N_PROTECT Logic Table

Specifications are subject to change without prior notification.

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