Thermaltake Toughpower GF1 650W

Serial Number

Lab ID TT20650003

Certification ID 251578

Test Result Report ID: 20PS1578A

Certificate Issue Date: Jan 27, 2020

Scheme: ETA-EMI PSU

115V



230V



Scheme: LAMBDA PSU

115V



230V





Aristeidis Bitziopoulos, Certification Body General Manager

General Information

Test Equipment

Electronic Loads	Chroma 63601-5 x2 Chroma 63600-2 Chroma 63640-80-80 x10 Chroma 63610-80-20
AC Sources	Chroma 6530, APM SP300VAC4000W-P, GW Instek ASR-3500
Power Analyzers	Rohde & Schwarz HMC8015 & NPA701
Oscilloscopes	Picoscope 4444, Siglent SDS2104X PLUS
Sound Analyzer	Bruel & Kjaer 2270 G4
Microphone	Bruel & Kjaer Type 4955-A
Temperature Logger	Picoscope TC-08
Tachometer	UNI-T UT372
Multimeters	Keysight 34465A
EMI Analyzer	TekBox TBMR-110M-EU
Isolation Transformer	4kVA
UPS	FSP Champ Tower 3kVA, CyberPower OLS3000E 3kVA
Testing Methodology	Cybenetics PSU Test Protocol

DUT Information(Non-accredited measurements)

Product Identification Details	
Brand	Thermaltake
Model	Toughpower GF1 650W
OEM/ODM	Channel Well Technology
Serial Number	
Product Specifications	
Manufacturer-Provided Information	
Rated Voltage (Vrms)	100-240
Rated Current (Arms)	10
Rated Frequency (Hz)	50-60

Rated Power (W)	650
Operating Temperature (Continuous Full Load) (°C)	
Type	ATX12V
Cable Design	Fully Modular
Warranty	-
Cybenetics Measurements	
Dimensions (W x H x D)	
Weight	
Cooling	
Semi-Passive Operation	✓ (selectable)
Cybenetics Testing Information	
Lab ID	TT20650003
Date of receipt	Jan 2, 2020
Testing Date	Jan 23, 2020
Report Issued Date	Jan 27, 2020
Engineer Name	-
Authorized By the Laboratory Technical Manager	Aristeidis Bitziopoulos
Signature	

Cables and Connectors(Non-accredited measurements)

Modular Cables				
Description	Cable Count	Connector Count (Total)	Gauge	In Cable Capacitors
ATX connector 20+4 pin (590mm)	1	1	16-18AWG	No
4+4 pin EPS12V (650mm)	2	2	16AWG	No
6+2 pin PCIe (500mm+140mm)	2	4	16-18AWG	No
SATA (510mm+145mm+145mm)	3	9	18AWG	No
4-pin Molex (500mm+145mm+145mm+145mm)	1	3	18AWG	No
FDD Adapter (115mm)	1	1	22AWG	No

Power Specifications

Rail		3.3V	5V	12V	5VSB	-12V
Max. Power	Amps	20	20	54	2.5	0.3
	Watts	100		648	12.5	3.6
Total Max. Power (W)		650				

Parts Description

General Data	-
Manufacturer (OEM)	CWT
PCB Type	Double Sided
Primary Side	-
Transient Filter	6x Y caps, 2x X caps, 2x CM chokes
Inrush Protection	NTC Thermistor (MSR 15D2R5) & Relay
Bridge Rectifier(s)	2x GBU1506L (600V, 15A @ 100°C)
APFC MOSFETs	2x Champion GP28S50GN220 (500V, 28A, 0.125Ohm)
APFC Boost Diode	1x Global Power Tech. G3S06008J (600V, 8A @ 150°C)
Hold-up Cap(s)	2x Rubycon (420V, 270uF each or 540uF combined, 3,000h @ 105°C, MXK)
Main Switchers	2x NCE Power NCE65TF130F (650V, 18A @ 100°C, 0.13Ohm)
APFC Controller	Champion CM6500UNX
Resonant Controller	Champion CM6901X
Topology	Primary side: Half-Bridge & LLC converter Secondary side: Synchronous Rectification & DC-DC converters
Secondary Side	-
+12V MOSFETs	8x Advanced Power AP4N1R8CMT-A (45V, 180A @ 25°C, 1.8mOhm)
5V & 3.3V	DC-DC Converters: 4x Advanced Power AP4024GEMT-HF (30V, 60A @ 25°C, 4.5mOhm) PWM Controllers: 2x ANPEC APW7164
Filtering Capacitors	Electrolytic: 6x Chengx (2-4,000h @ 105°C, GR) Polymer: 7x Teapo
Supervisor IC	Weltrend WT7502V (OVP, UVP, SCP, PG)
Fan Model	BOK BDM12025S (120mm, 12V, 0.30A, Rifle Bearing Fan)
5VSB Circuit	-

Rectifier	1x SB1045L SBR (45V, 10A)
Standby PWM Controller	PN8140

Test Results

Temperature & Compliance Info

Temperature Range (°C /°F)	28-32 / 82.4-89.6
ErP Lot 3/6 Ready	✓
(EU) No 617/2013 Compliance	✓

Performance Summary

115V

Accredited	
Average Efficiency (>1450 load combinations)	89.841%
Average Noise Output (>1450 Load Combinations)	30.47dBA
Average PF (>1450 Load Combinations)	0.986
Efficiency With 10W (≤500W) or 2% (>500W) Load	49.777%
Standby Power Consumption	0.0793W
Non-Accredited	
12V Ripple (Full Load)	21.98mV
5V Ripple (Full Load)	13.54mV
3.3V Ripple (Full Load)	19.19mV
5VSB Ripple (Full Load)	10.33mV
12V Load Regulation	0.20%
5V Load Regulation	0.79%
3.3V Load Regulation	1.35%
5VSB Load Regulation	4.49%
Inrush Current	33.250A

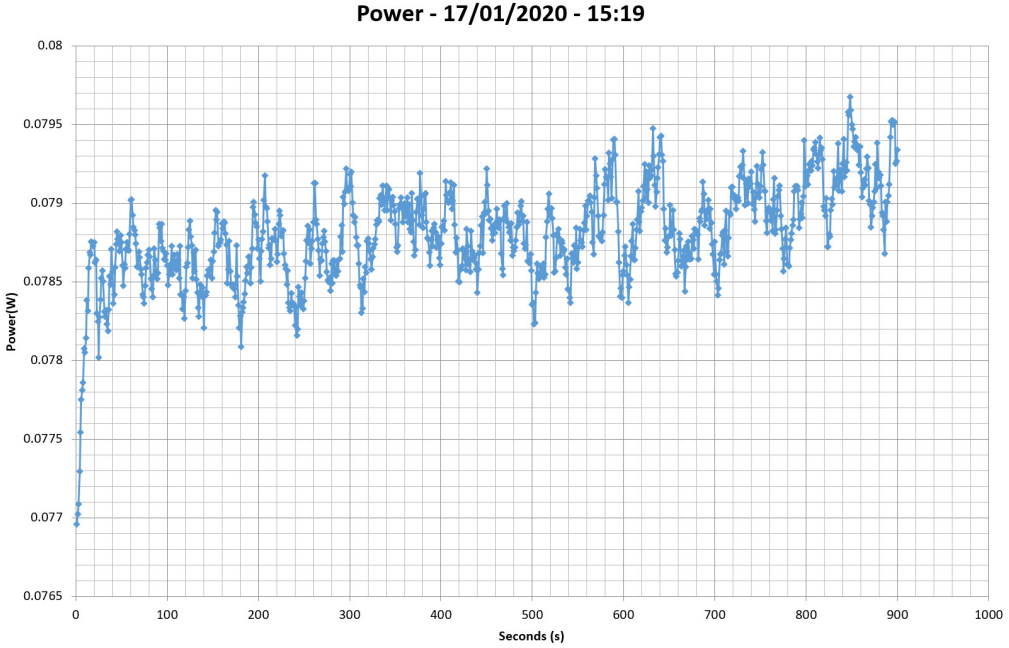
230V		
Accredited		
Average Efficiency (>1450 load combinations)		91.713%
Average Noise Output (>1450 Load Combinations)		30.63dBA
Average PF (>1450 Load Combinations)		0.934
Efficiency With 10W (≤500W) or 2% (>500W) Load		-
Standby Power Consumption		0.1076W
Non-Accredited		
12V Ripple (Full Load)		23.28mV
5V Ripple (Full Load)		13.82mV
3.3V Ripple (Full Load)		18.34mV
5VSB Ripple (Full Load)		9.70mV
12V Load Regulation		0.20%
5V Load Regulation		0.88%
3.3V Load Regulation		1.29%
5VSB Load Regulation		4.35%
Inrush Current		57.984A
Hold-Up Time & PWR_OK Signal		18.20ms
AC Loss to PWR_OK Hold Up Time		16.80ms
PWR_OK Inactive to DC Loss Delay		1.40ms
PSU Timings: T1 (20% / 100%)	85.0ms	82.0ms
PSU Timings: T3 (20% / 100%)	287.0ms	290.0ms
OPP (0.00°C / 0.00°C)	-	-

Hold-Up Time & PWR_OK Signal

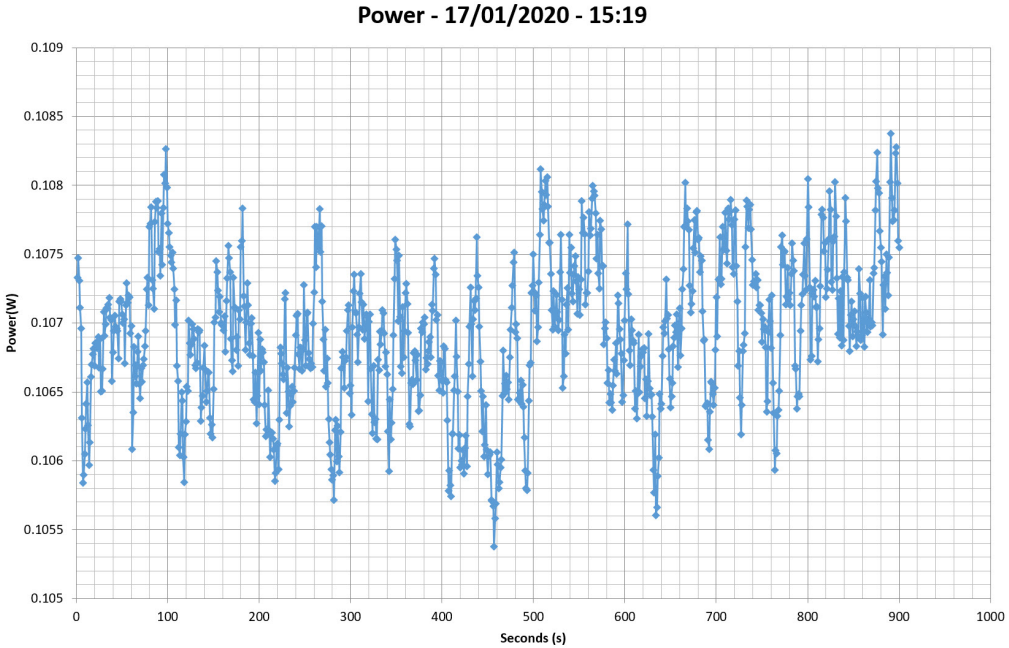
Hold-Up Time (ms)	18.2
AC Loss to PWR_OK Hold Up Time (ms)	16.8
PWR_OK Inactive to DC Loss Delay (ms)	1.4

Graphs

115V

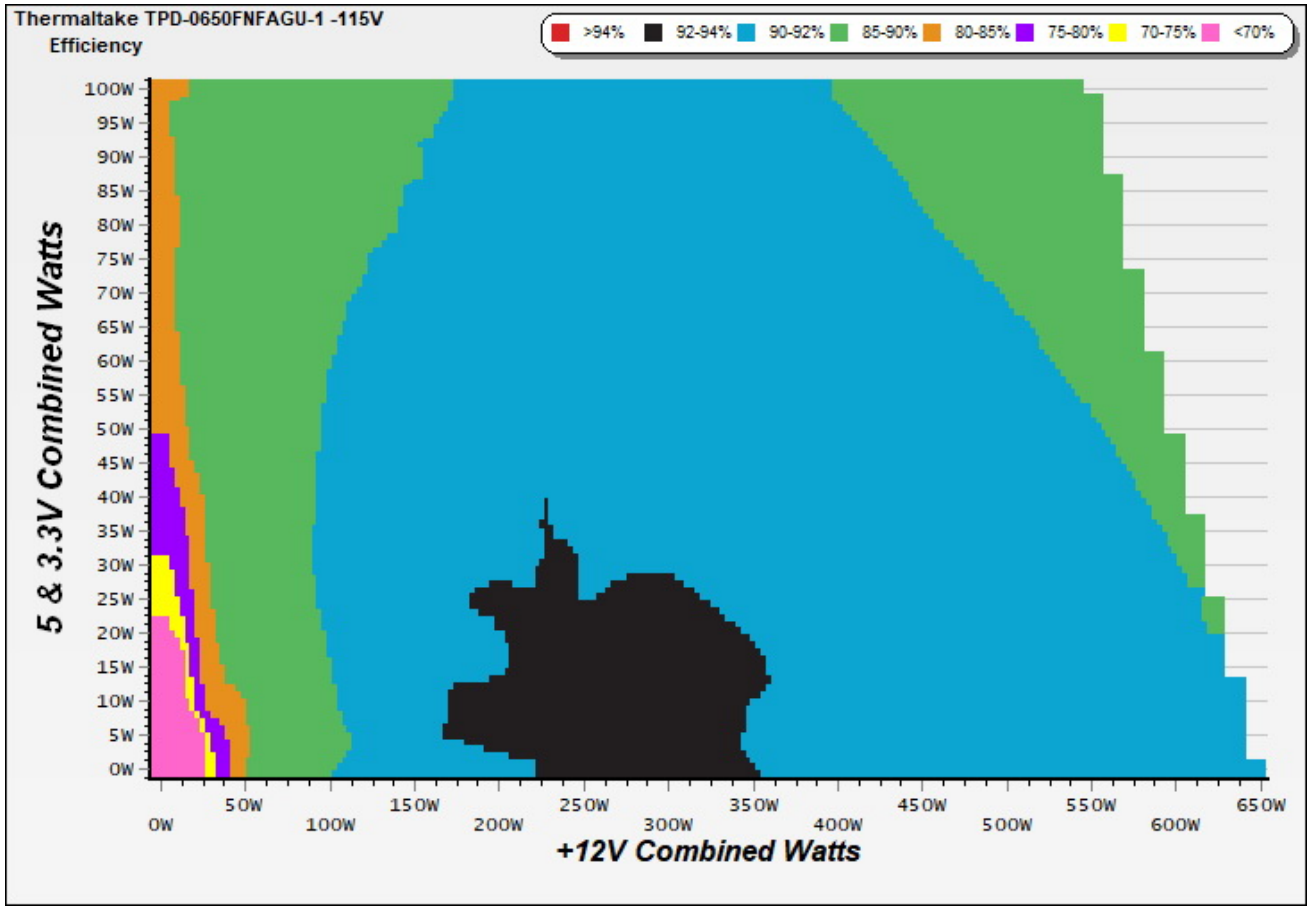


230V



Efficiency Graph

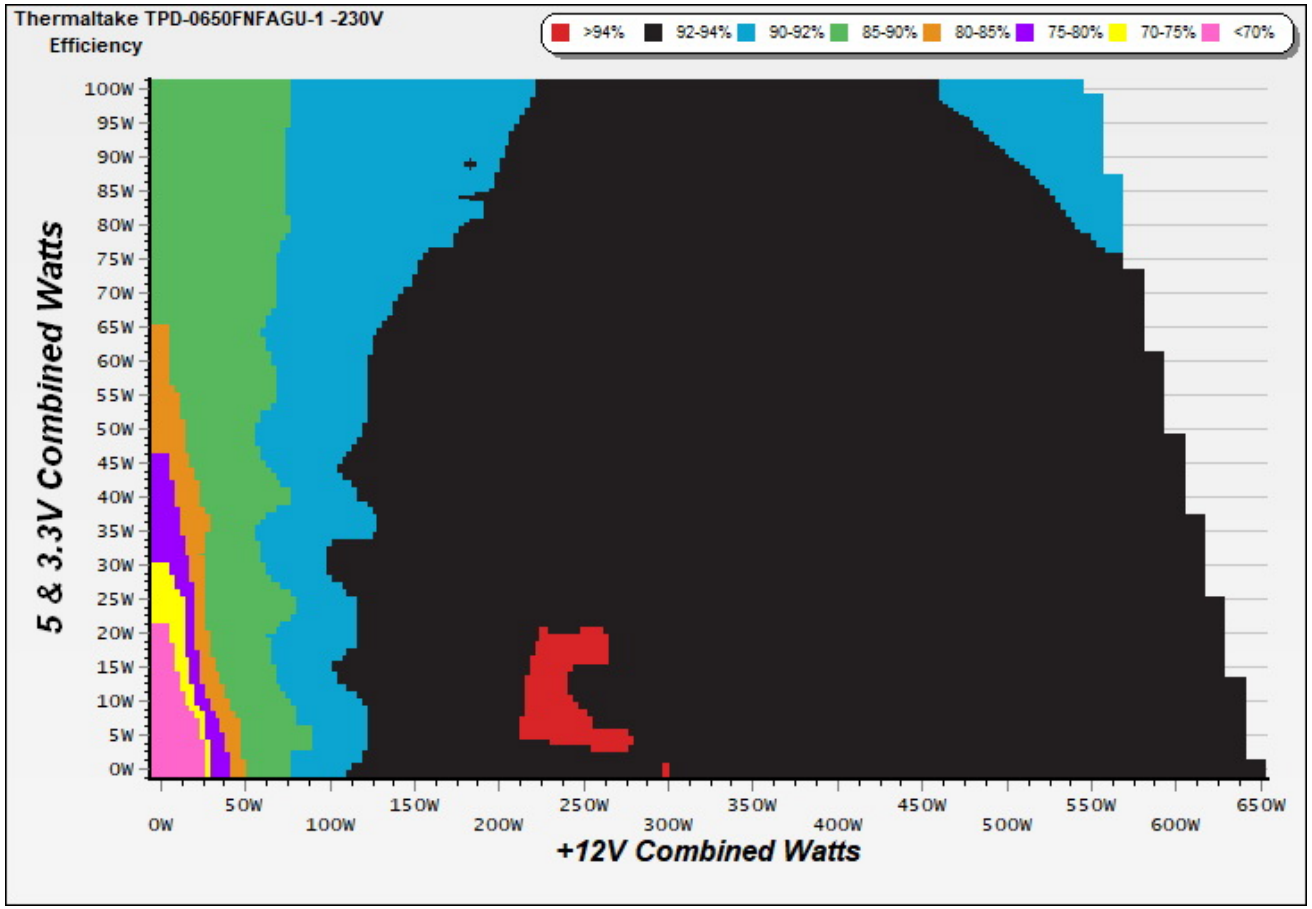
115V



INFO

This graph depicts the PSU`s efficiency throughout its entire operational range. For the generation of the efficiency and noise graphs we set our loaders to auto mode through our custom-made software before trying thousands of possible load combinations

230V

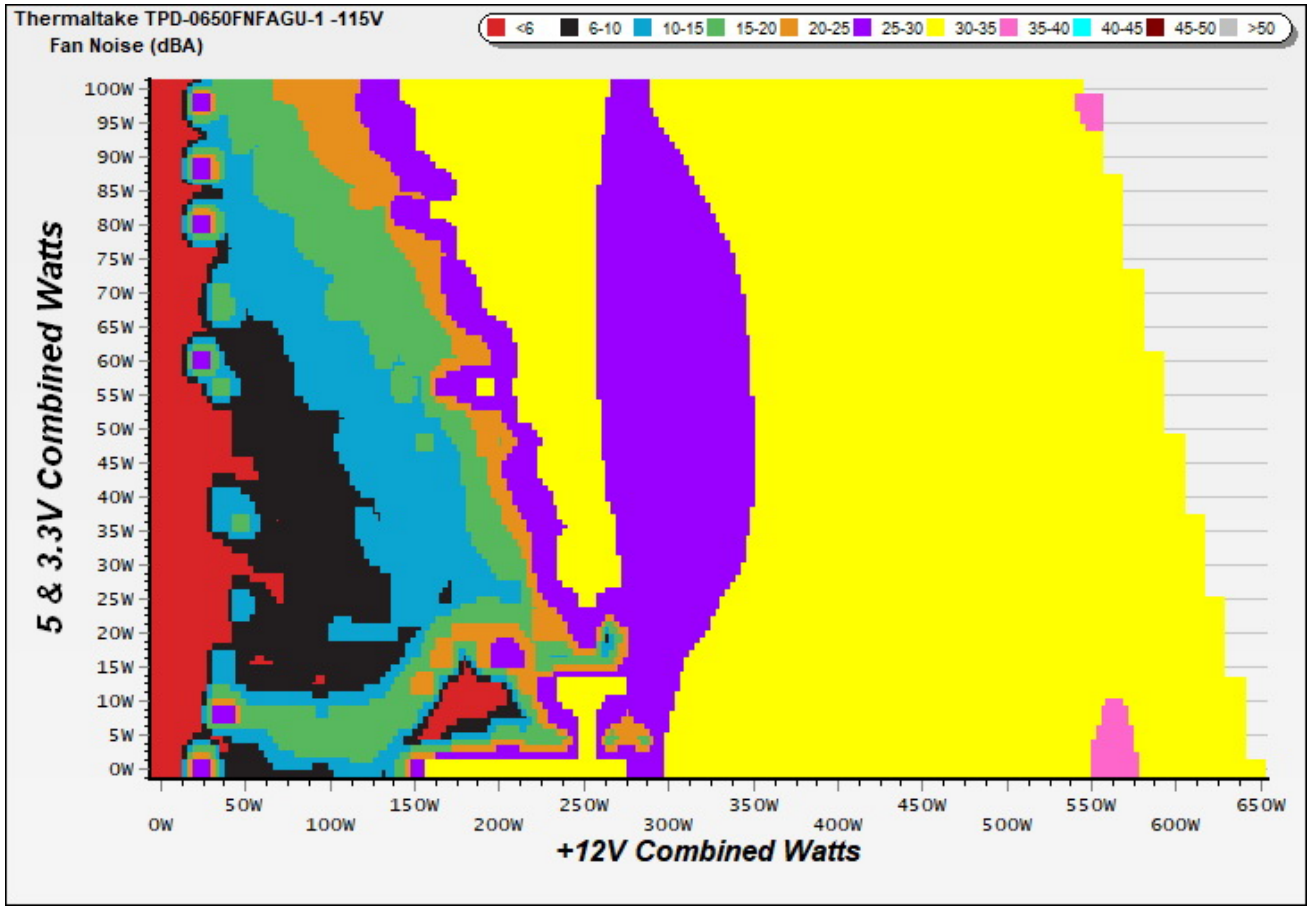


INFO

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Noise Graph

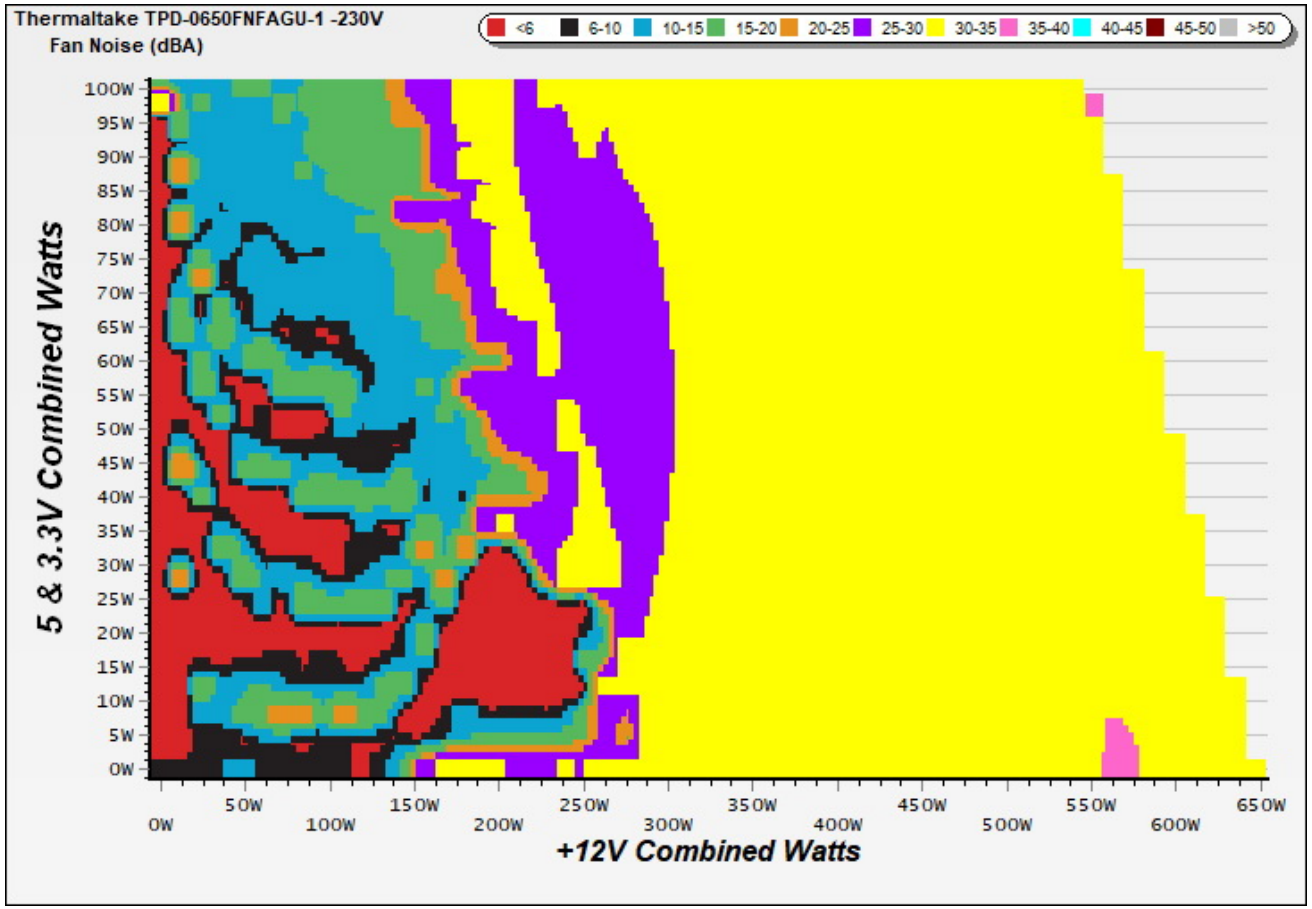
115V



INFO

The PSU`s noise in its entire operational range and under 30-32 °C ambient is depicted in this graph. The X axis represents the load on the +12V rail(s) while the Y axis is the load on the minor rails

230V

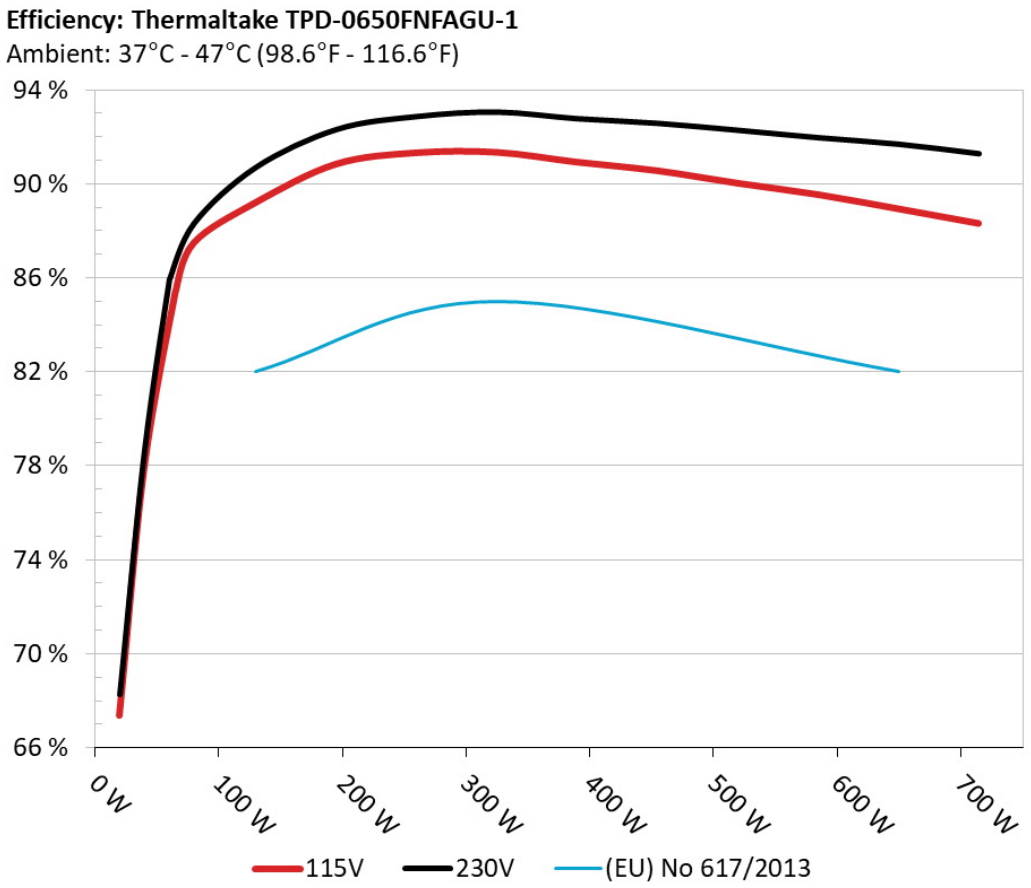


INFO

The PSU`s noise in its entire operational range and under 30-32 °C ambient is depicted in this graph. The X axis represents the load on the +12V rail(s) while the Y axis is the load on the minor rails

Indicative Performance

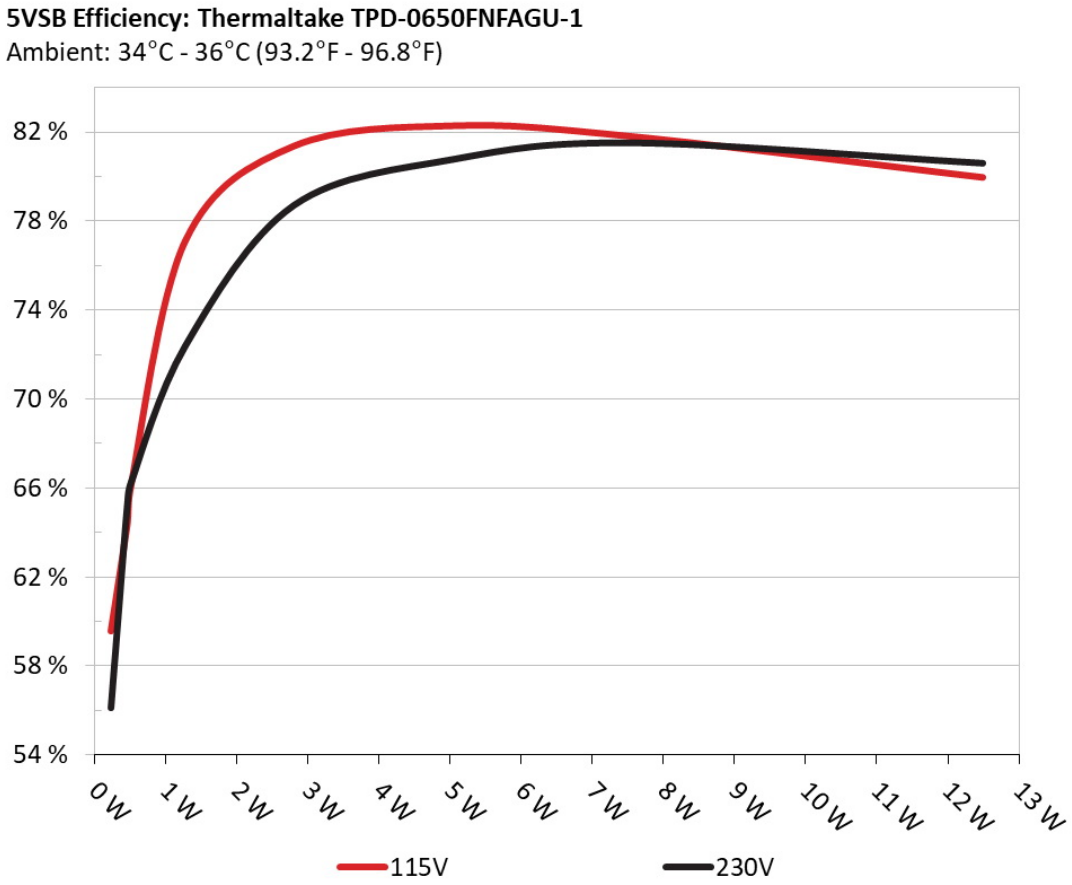
Efficiency under high ambient temperature



INFO

The PSU`s efficiency under high ambient temperatures with 115V and 230V input. For this graph the results of the 10-110% load regulation table are used

5VSB Efficiency



INFO

This graph depicts the efficiency levels of the 5VSB rail with 115V and 230V input

5VSB Efficiency (ERP LOT 3/6 & CEC)

115V

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.230	59.585%	0.044
	5.115V	0.386		115.15V
2	0.090A	0.460	64.426%	0.080
	5.114V	0.714		115.15V
3	0.550A	2.801	81.353%	0.270
	5.091V	3.443		115.15V
4	1.000A	5.071	82.268%	0.347
	5.070V	6.164		115.14V
5	1.500A	7.568	81.781%	0.390
	5.045V	9.254		115.14V
6	2.501A	12.486	79.951%	0.435
	4.993V	15.617		115.14V

230V

Test #	5VSB	DC/AC (Watts)	Efficiency	PF/AC Volts
1	0.045A	0.230	56.098%	0.014
	5.117V	0.410		230.32V
2	0.090A	0.460	65.248%	0.024
	5.115V	0.705		230.32V
3	0.550A	2.801	78.702%	0.114
	5.092V	3.559		230.31V
4	1.000A	5.071	80.787%	0.180
	5.070V	6.277		230.33V
5	1.500A	7.569	81.510%	0.234
	5.045V	9.286		230.32V
6	2.500A	12.486	80.596%	0.303
	4.994V	15.492		230.31V

Supplementary Tests (For Reference)

Typical Load Tests

115V

Test #	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
1	3.591A	1.982A	1.983A	0.990A	64.961	84.906%	1317	31.8	40.27°C	0.955
	12.073V	5.046V	3.330V	5.054V	76.509				45.51°C	115.17V
2	8.212A	2.970A	2.980A	1.192A	130.027	89.199%	1343	32.4	40.66°C	0.977
	12.070V	5.051V	3.325V	5.032V	145.771				46.25°C	115.15V
3	13.174A	3.465A	3.478A	1.397A	195.029	90.839%	1345	32.4	41.16°C	0.986
	12.067V	5.052V	3.321V	5.013V	214.698				47.70°C	115.14V
4	18.138A	3.959A	3.980A	1.603A	260.033	91.322%	1397	33.3	41.21°C	0.991
	12.064V	5.053V	3.318V	4.994V	284.742				48.19°C	115.14V
5	22.760A	4.943A	4.980A	1.811A	325.066	91.342%	1508	35.3	42.19°C	0.993
	12.063V	5.060V	3.313V	4.971V	355.879				49.62°C	115.13V
6	27.333A	5.926A	5.988A	2.000A	389.352	90.927%	1565	36.2	42.36°C	0.995
	12.060V	5.064V	3.308V	4.949V	428.202				50.65°C	115.17V
7	31.987A	6.906A	6.996A	2.233A	454.780	90.558%	1618	37.1	43.41°C	0.996
	12.057V	5.069V	3.303V	4.926V	502.200				52.22°C	115.15V
8	36.639A	7.882A	8.009A	2.448A	520.085	90.022%	1728	39.4	43.56°C	0.996
	12.055V	5.075V	3.296V	4.903V	577.732				52.80°C	115.15V
9	41.694A	8.372A	8.502A	2.454A	585.001	89.540%	1778	39.7	44.48°C	0.997
	12.052V	5.077V	3.293V	4.891V	653.342				54.20°C	115.12V
10	46.684A	8.859A	9.029A	2.566A	649.746	88.935%	1846	40.3	45.65°C	0.997
	12.050V	5.080V	3.289V	4.873V	730.582				56.04°C	115.14V
11	52.075A	8.863A	9.034A	2.571A	714.564	88.315%	1847	40.3	46.86°C	0.997
	12.047V	5.078V	3.288V	4.864V	809.108				57.68°C	115.14V
CL1	0.116A	11.999A	11.999A	0.000A	102.252	83.957%	1436	34.2	42.21°C	0.973
	12.069V	5.117V	3.288V	5.071V	121.791				49.85°C	115.15V

CL2	54.009A	1.000A	1.000A	1.000A	664.078	89.747%	1685	38.3	45.18°C	0.997
	12.049V	5.024V	3.323V	4.976V	739.948				56.03°C	115.13V

The results above are not used in the certification process

230V

Test #	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	Temps (In/Out)	PF/AC Volts
1	3.591A	1.981A	1.984A	0.990A	64.961	85.927%	1306	31.7	40.07°C	0.721
	12.072V	5.048V	3.330V	5.054V	75.600				45.36°C	230.35V
2	8.213A	2.968A	2.980A	1.192A	130.029	90.708%	1335	32.1	40.25°C	0.879
	12.069V	5.054V	3.324V	5.034V	143.349				45.86°C	230.35V
3	13.175A	3.463A	3.479A	1.397A	195.034	92.319%	1374	32.9	41.81°C	0.932
	12.066V	5.055V	3.321V	5.014V	211.260				47.86°C	230.36V
4	18.139A	3.956A	3.978A	1.603A	260.042	92.870%	1441	34.4	42.14°C	0.953
	12.064V	5.058V	3.318V	4.994V	280.005				48.72°C	230.36V
5	22.764A	4.939A	4.983A	1.811A	325.080	93.058%	1481	35.1	42.30°C	0.967
	12.061V	5.064V	3.313V	4.972V	349.330				49.57°C	230.36V
6	27.340A	5.918A	5.989A	2.001A	389.410	92.780%	1578	36.5	42.97°C	0.974
	12.059V	5.070V	3.307V	4.951V	419.713				51.31°C	230.36V
7	31.993A	6.897A	6.998A	2.233A	454.833	92.583%	1627	37.3	43.84°C	0.977
	12.056V	5.077V	3.302V	4.927V	491.271				52.55°C	230.37V
8	36.648A	7.874A	8.006A	2.447A	520.132	92.285%	1671	38.2	44.02°C	0.980
	12.053V	5.082V	3.297V	4.905V	563.617				53.56°C	230.33V
9	41.702A	8.361A	8.503A	2.453A	585.067	91.971%	1800	40.0	44.68°C	0.983
	12.051V	5.085V	3.293V	4.892V	636.140				54.80°C	230.36V
10	46.693A	8.851A	9.029A	2.564A	649.821	91.692%	1786	39.8	45.66°C	0.985
	12.049V	5.085V	3.290V	4.877V	708.703				56.18°C	230.38V
11	52.087A	8.854A	9.031A	2.570A	714.650	91.292%	1848	40.3	46.61°C	0.987
	12.046V	5.084V	3.288V	4.865V	782.816				57.51°C	230.37V
CL1	0.117A	12.001A	12.000A	0.000A	102.361	85.291%	1471	34.8	42.93°C	0.843
	12.068V	5.124V	3.288V	5.070V	120.014				49.39°C	230.39V

CL2	54.018A	1.000A	1.002A	1.000A	664.134	92.439%	1755	39.5	45.44°C	0.985
	12.048V	5.023V	3.322V	4.974V	718.460				56.23°C	230.37V

The results above are not used in the certification process

Light Load Tests

115V

Test #	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	PF/AC Volts
1	1.229A	0.496A	0.494A	0.196A	19.993	67.357%	398	8.1	0.778
	12.080V	5.038V	3.336V	5.102V	29.682				115.18V
2	2.459A	0.993A	0.988A	0.393A	39.983	77.897%	844	19.1	0.916
	12.072V	5.040V	3.334V	5.089V	51.328				115.18V
3	3.691A	1.488A	1.484A	0.591A	60.013	85.342%	659	12.8	0.948
	12.074V	5.043V	3.332V	5.075V	70.321				115.18V
4	4.917A	1.983A	1.983A	0.790A	79.961	87.477%	1048	25.3	0.973
	12.072V	5.044V	3.329V	5.062V	91.408				115.17V

The results above are not used in the certification process

230V

Test #	12V	5V	3.3V	5VSB	DC/AC (Watts)	Efficiency	Fan Speed (RPM)	PSU Noise (dB[A])	PF/AC Volts
1	1.229A	0.496A	0.495A	0.196A	19.990	68.288%	572	11.0	0.430
	12.075V	5.039V	3.336V	5.102V	29.273				230.36V
2	2.459A	0.992A	0.989A	0.393A	39.980	78.662%	811	17.9	0.576
	12.071V	5.041V	3.334V	5.089V	50.825				230.35V
3	3.691A	1.487A	1.485A	0.591A	60.009	85.744%	1283	31.1	0.691
	12.073V	5.044V	3.332V	5.075V	69.986				230.35V
4	4.917A	1.982A	1.983A	0.790A	79.958	88.325%	1082	26.3	0.775
	12.071V	5.047V	3.329V	5.062V	90.527				230.35V

The results above are not used in the certification process

Ripple Measurements

115V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	21.7 mV	5.9 mV	10.0 mV	3.5 mV	Pass
20% Load	23.0 mV	6.6 mV	9.8 mV	3.5 mV	Pass
30% Load	17.1 mV	7.2 mV	10.3 mV	4.4 mV	Pass
40% Load	15.0 mV	8.4 mV	11.2 mV	5.4 mV	Pass
50% Load	13.1 mV	9.7 mV	12.5 mV	6.1 mV	Pass
60% Load	14.9 mV	10.5 mV	12.4 mV	6.8 mV	Pass
70% Load	14.0 mV	11.9 mV	13.8 mV	7.3 mV	Pass
80% Load	14.6 mV	12.5 mV	16.4 mV	8.1 mV	Pass
90% Load	13.4 mV	12.2 mV	16.8 mV	8.5 mV	Pass
100% Load	22.0 mV	13.5 mV	19.2 mV	10.3 mV	Pass
110% Load	22.3 mV	14.3 mV	18.8 mV	10.6 mV	Pass
Crossload 1	28.7 mV	10.3 mV	19.5 mV	8.3 mV	Pass
Crossload 2	22.2 mV	11.7 mV	12.8 mV	10.0 mV	Pass

The results above are not used in the certification process

230V

Test	12V	5V	3.3V	5VSB	Pass/Fail
10% Load	20.3 mV	5.7 mV	9.6 mV	3.5 mV	Pass
20% Load	21.8 mV	7.0 mV	10.2 mV	3.6 mV	Pass
30% Load	17.1 mV	6.9 mV	10.0 mV	4.5 mV	Pass
40% Load	14.7 mV	8.2 mV	11.0 mV	5.2 mV	Pass
50% Load	13.4 mV	9.5 mV	11.1 mV	6.0 mV	Pass
60% Load	15.9 mV	10.9 mV	12.3 mV	6.4 mV	Pass
70% Load	13.7 mV	11.8 mV	13.1 mV	6.8 mV	Pass
80% Load	13.5 mV	12.0 mV	17.7 mV	7.5 mV	Pass

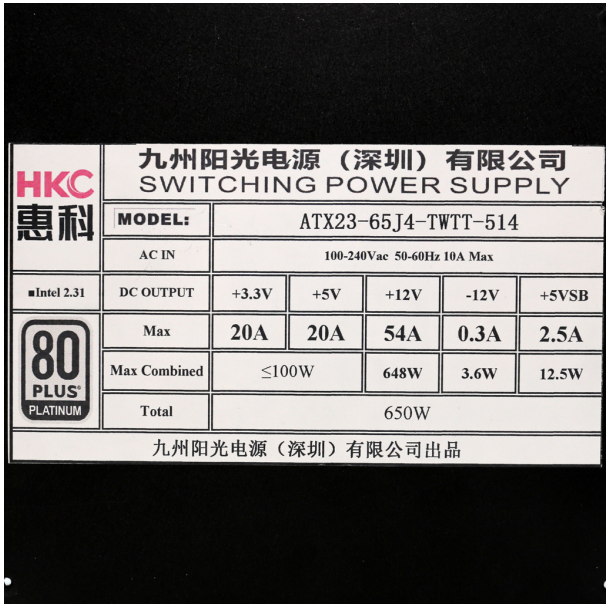
Test	12V	5V	3.3V	5VSB	Pass/Fail
90% Load	13.8 mV	11.9 mV	19.5 mV	8.5 mV	Pass
100% Load	23.3 mV	13.8 mV	18.3 mV	9.7 mV	Pass
110% Load	23.7 mV	13.9 mV	19.3 mV	10.5 mV	Pass
Crossload 1	26.5 mV	10.4 mV	18.8 mV	8.3 mV	Pass
Crossload 2	22.7 mV	11.2 mV	12.1 mV	9.2 mV	Pass

The results above are not used in the certification process

Thermaltake Toughpower GF1 650W



Top side



Power specifications table