COAXIAL

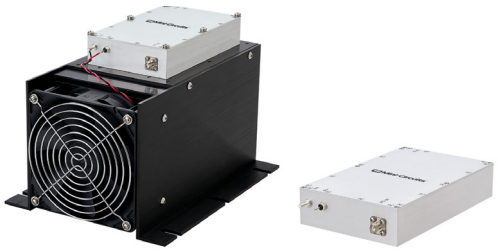
High Power Amplifier

ZHL-5W-422+
ZHL-5W-422X+

50Ω 5W 500 to 4200 MHz SMA

THE BIG DEAL

- High Power, 5 Watt
- Excellent IP3, +45 dBm typ.
- Excellent IP2, +55 dBm typ.
- High efficiency, 30% typ. at saturation
- Class A amplifier
- No damage with an open or short output load under full CW output power[1]
- Shuts off when base plate temperature exceeds +85°C
- Over voltage protection, shuts off above +35V
- Reverse Polarity Protected
- Unconditionally stable



Generic photo used for illustration purposes only

Model No.	ZHL-5W-422+	ZHL-5W-422X+▲
Case Style	BT1896	
Connectors	SMA	

+RoHS Compliant
The +Suffix identifies RoHS Compliance.
See our website for methodologies and qualifications

APPLICATIONS

- Transmitters
- Defense
- Amateur radio, FM, TV
- Laboratory use

PRODUCT OVERVIEW

The ZHL-5W-422+ is a Class A, high-power amplifier providing very wide bandwidth for a broad array of military, commercial and testing applications. Excellent flatness across its entire operating frequency range makes it ideal for systems where consistent performance across frequency is required. The amplifier provides high-efficiency while withstanding open and short loads under full CW output power. The unit is unconditionally stable and features robust protection from high temperature extremes, overvoltages, and reverse polarity errors, making it suitable for demanding lab environments, satellite communications, line-of-sight links, defense applications, radio and television broadcast transmissions and more. Housed in an aluminum alloy case measuring 9.85 x 7.3 x 6.4", it features SMA connectors at both ports and an optional heat sink and fan for cooling.

KEY FEATURES

Feature	Advantages
Very wide bandwidth	Supports a broad range of system and test lab applications.
Flat Gain, ±1 dB	Provides consistent performance across frequency, minimizing the need for external equalizing networks in wideban d applications.
High Efficiency, 30% typ. at saturation	Delivers 5W output power with low DC power consumption for reliable, cost-efficient performance.
Built-in self-protection	In instances of power supply overvoltage or excessive heat buildup within the housing, an automatic sensing feature signals the unit to power down. The unit is capable of withstanding potentially-damaging excessive drive current, "unshorting" (DC supply turn-on transients), power supply polarity reversal, and open/short loads at the output.
Unconditional stability	Provides reliable performance independent of input and load conditions.

REV. C
ECO-017723
ZHL-5W-422+
MCL NY
230502

ELECTRICAL SPECIFICATIONS AT 25°C

Parameter	Condition (MHz)	ZHL-5W-422+ ZHL-5W-422X+ ▲ Min.	Typ.	Max.	Units
Frequency Range		500	—	4200	MHz
Gain[3]	500 - 4200	20	25	—	dB
Gain Flatness[3]	500 - 4200	—	±1.0	±1.7	dB
Output Power at 1dB compression	500 - 4200	+34	+35	—	dBm
Output Power at 3dB compression	500 - 4200	+36	+37	—	dBm
Noise Figure	500 - 4200	—	7	12	dB
Output third order intercept point[2]	500 - 4200	+40	+45	—	dBm
Output second order intercept point[2]	500 - 4200	+50	+55	—	dBm
Input VSWR[3]	500 - 4200	—	1.7	2.3	:1
Non-Harmonic Spurious at Pout=5W	500 - 4200	—	—	-60	dBc
Second and Third Harmonics at Pout=2.5W	500 - 4200	—	—	-20	dBc
DC Supply Voltage		—	+28	30	V
Supply Current[4]		—	2	3	A

1. At constant open or short load 28V nominal supply voltage
2. Measured with 2 tones, 1 MHz apart, +20 dBm/tone
3. Measurements with small signal, Pin=-15dBm input
4. Power supply should be capable of delivering 6A at start up.

▲ Heat sink and fan not included. Alternative heat sinking and heat removal must be provided by the user to limit maximum base-plate temperature to 85°C, in order to ensure proper performance. For reference, this requires thermal resistance of user's external heat sink to be 0.3°C/W max.

ABSOLUTE MAXIMUM RATINGS

Parameter	Ratings
Operating Temperature	-20°C to +50°C
Storage Temperature	-55°C to +100°C
Base Plate Temperature	+85°C
Input RF Power (no damage)	+20 dBm

Permanent damage may occur if any of these limits are exceeded.

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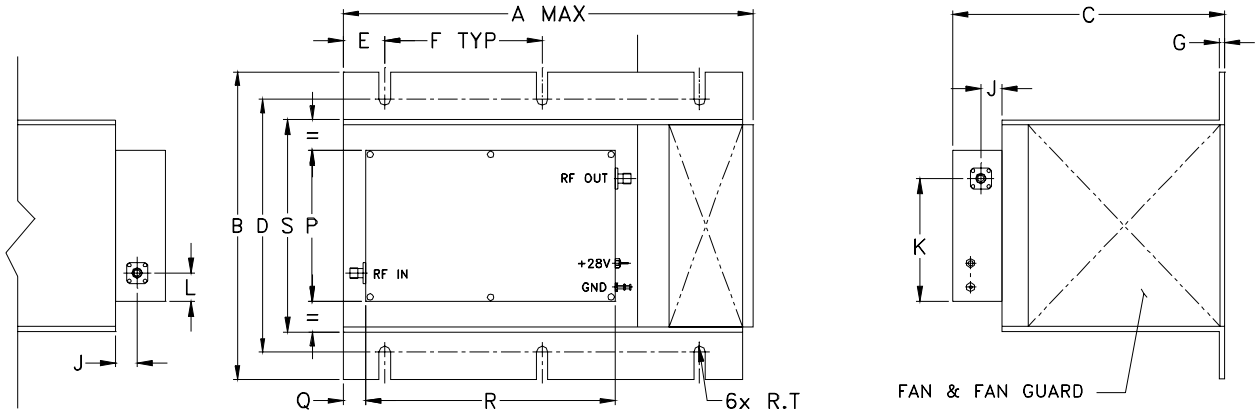
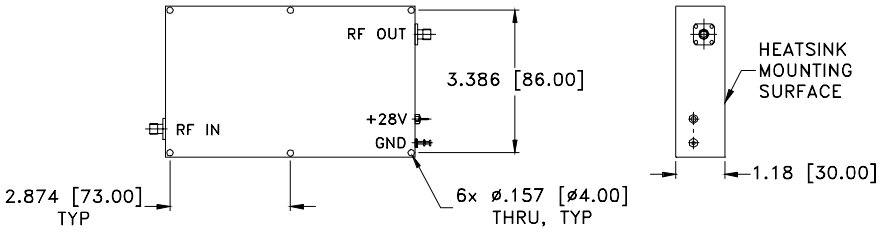
OUTLINE DRAWING FOR MODELS WITH HEATSINK



OUTLINE DRAWING FOR MODELS WITHOUT HEATSINK



OUTLINE DIMENSIONS (Inch / mm)

A	B	C	D	E	F	G	J	K	L	P	Q	R	S	T	wt
9.85	7.3	6.4	6.43	1.00	3.75	.13	.51	2.91	.67	3.58	.53	5.94	5.1	.135	grams*
250.19	185.42	162.56	163.32	25.40	95.25	3.30	12.95	73.91	17.02	90.93	13.46	150.88	129.54	3.43	4265

*580 grams without heatsink

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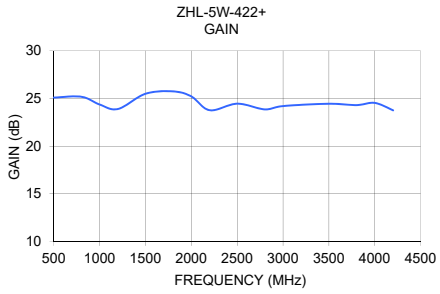
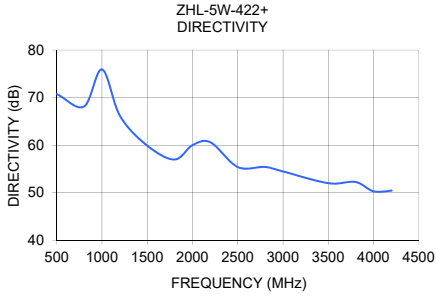
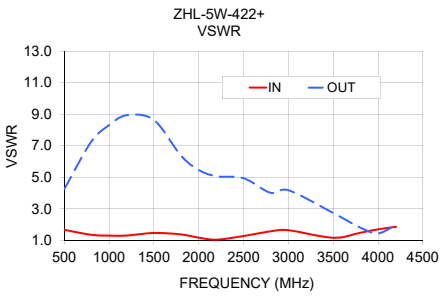
50Ω 5W 500 to 4200 MHz SMA

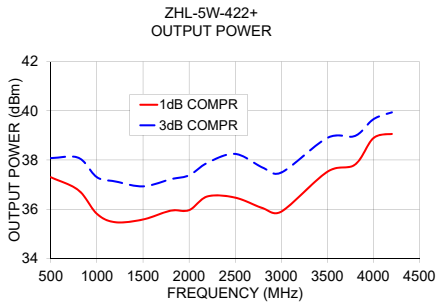
TYPICAL PERFORMANCE DATA / GRAPHS

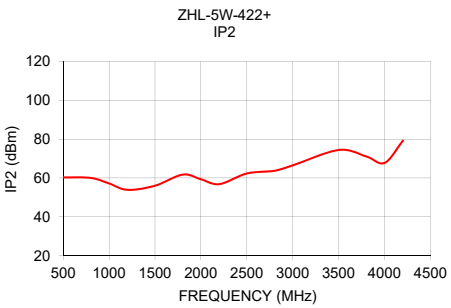
FREQUENCY (MHz)	GAIN (dB)	DIRECTIVITY (dB)	VSWR (:1)		POUT at 1 dB COMPR. (dBm)	POUT at 3 dB COMPR. (dBm)	OUTPUT IP2 (dBm)	OUTPUT IP3 (dBm)
			IN	OUT				
500.00	25.10	70.74	1.67	4.26	37.30	38.08	60.31	46.80
800.00	25.19	68.10	1.36	7.25	36.77	38.09	60.04	46.79
1000.00	24.37	75.92	1.31	8.31	35.81	37.30	57.19	46.10
1200.00	23.90	66.09	1.31	8.95	35.47	37.13	53.89	45.93
1500.00	25.50	59.88	1.47	8.64	35.58	36.93	56.01	46.10
1800.00	25.75	56.97	1.38	6.39	35.94	37.22	61.72	47.32
2000.00	25.22	59.99	1.18	5.47	35.96	37.38	59.35	47.37
2200.00	23.77	60.57	1.05	5.07	36.52	37.89	56.82	46.02
2500.00	24.46	55.38	1.28	4.95	36.47	38.25	62.31	46.43
2800.00	23.86	55.41	1.58	4.02	36.04	37.69	63.70	46.75
3000.00	24.21	54.46	1.65	4.19	35.90	37.49	66.50	46.32
3500.00	24.45	51.99	1.17	2.74	37.52	38.90	74.41	47.25
3800.00	24.31	52.25	1.49	1.82	37.81	38.98	71.07	46.43
4000.00	24.54	50.28	1.70	1.45	38.89	39.66	67.76	47.03
4200.00	23.76	50.43	1.86	2.01	39.06	39.94	79.22	47.60

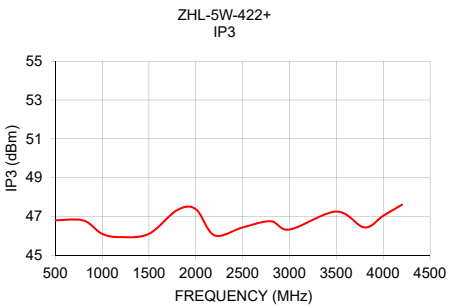












NOTES

A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/terms/viewterm.html

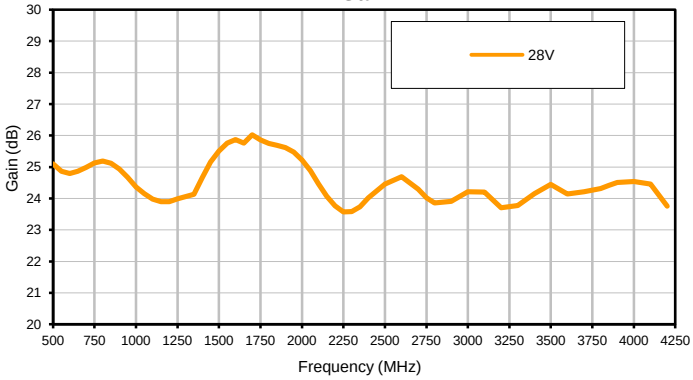
High Power Amplifier ZHL-5W-422+

Typical Performance Data

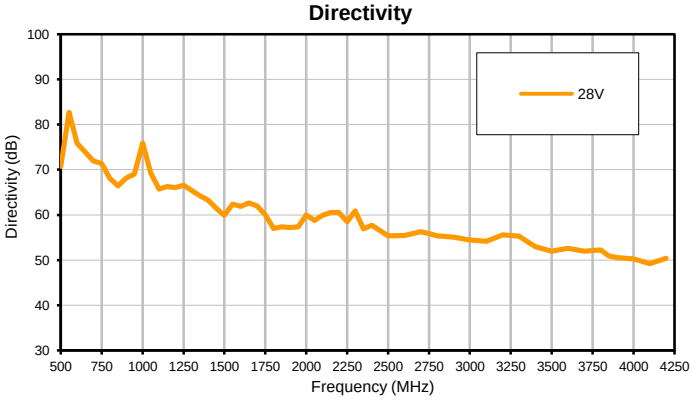
FREQ. (MHz)	GAIN (dB) 28V	DIRECTIVITY (dB) 28V	VSWR (:1) IN 28V	VSWR (:1) OUT 28V	NOISE FIGURE (dB) 28V	POUT @ 1 dB COMPRESSION (dBm) 28V	POUT @ 3 dB COMPRESSION (dBm) 28V	OUTPUT IP2 (dBm) 28V	OUTPUT IP3 (dBm) 28V
500.0	25.10	70.74	1.67	4.26	9.03	37.30	38.08	60.31	46.80
550.0	24.86	82.68	1.50	4.79	8.87	37.38	37.95	60.58	46.78
600.0	24.79	75.82	1.41	5.31	8.55	37.31	38.03	59.86	46.72
650.0	24.86	73.86	1.38	5.83	8.39	37.28	38.11	59.12	46.68
700.0	24.99	71.95	1.37	6.35	8.08	37.15	38.17	59.44	46.73
750.0	25.13	71.35	1.37	6.83	7.82	36.81	37.92	59.47	46.75
800.0	25.19	68.10	1.36	7.25	7.57	36.77	38.09	60.04	46.79
850.0	25.12	66.45	1.35	7.60	7.43	36.59	37.82	59.38	46.84
900.0	24.93	68.20	1.33	7.87	7.37	36.35	37.66	59.66	46.73
950.0	24.67	69.01	1.32	8.12	7.31	36.11	37.49	58.56	46.53
1000.0	24.37	75.92	1.31	8.31	7.22	35.81	37.30	57.19	46.10
1050.0	24.15	69.35	1.30	8.51	7.04	35.53	37.34	55.58	45.96
1100.0	23.98	65.71	1.29	8.72	7.04	35.53	37.14	54.80	45.83
1150.0	23.90	66.27	1.30	8.86	7.04	35.56	37.11	54.31	45.81
1200.0	23.90	66.09	1.31	8.95	7.09	35.47	37.13	53.89	45.93
1250.0	23.99	66.55	1.33	9.04	7.11	35.42	36.99	53.98	46.07
1350.0	24.13	64.21	1.40	8.90	7.33	35.58	36.90	55.68	46.27
1400.0	24.66	63.30	1.44	8.95	7.11	35.48	36.69	55.69	46.05
1450.0	25.16	61.47	1.46	8.81	7.15	35.63	36.74	56.12	46.05
1500.0	25.50	59.88	1.47	8.64	7.14	35.58	36.93	56.01	46.10
1550.0	25.76	62.41	1.47	8.27	7.28	35.44	36.78	56.85	46.27
1600.0	25.87	61.91	1.46	7.80	7.26	35.71	37.07	58.08	46.52
1650.0	25.76	62.66	1.44	7.34	7.31	35.43	37.26	59.15	46.77
1700.0	26.02	61.99	1.43	6.61	7.41	36.01	37.56	60.70	47.41
1750.0	25.86	60.07	1.41	6.61	7.43	35.86	37.55	61.22	47.41
1800.0	25.75	56.97	1.38	6.39	7.44	35.94	37.22	61.72	47.32
1850.0	25.69	57.38	1.34	6.15	7.45	35.97	37.39	61.83	47.24
1900.0	25.62	57.23	1.29	5.93	7.51	36.24	37.56	61.08	47.23
1950.0	25.47	57.33	1.23	5.70	7.55	36.10	37.43	60.16	47.34
2000.0	25.22	59.99	1.18	5.47	7.57	35.96	37.38	59.35	47.37
2050.0	24.88	58.76	1.12	5.28	7.44	36.40	37.47	59.17	47.43
2100.0	24.47	59.90	1.08	5.16	7.45	36.35	37.69	58.69	47.55
2150.0	24.07	60.53	1.05	5.09	7.52	36.35	37.66	59.15	47.69
2200.0	23.77	60.57	1.05	5.07	7.45	36.52	37.89	56.82	46.02
2250.0	23.57	58.48	1.07	5.13	7.46	36.42	37.86	57.99	46.19
2300.0	23.58	60.88	1.11	5.20	7.37	36.09	37.72	59.64	45.96
2350.0	23.74	56.91	1.15	5.25	7.34	36.34	38.10	66.14	45.97
2400.0	24.02	57.72	1.18	5.23	7.27	36.50	38.43	60.79	46.47
2500.0	24.46	55.38	1.28	4.95	7.32	36.47	38.25	62.31	46.43
2600.0	24.69	55.44	1.44	4.30	7.00	36.52	38.05	61.52	46.76
2700.0	24.29	56.33	1.52	4.01	6.98	36.04	37.73	63.84	47.04
2750.0	24.02	55.90	1.55	3.99	6.97	36.25	38.07	64.16	46.83
2800.0	23.86	55.41	1.58	4.02	7.00	36.04	37.69	63.70	46.75
2900.0	23.91	55.08	1.62	4.15	6.92	36.12	37.52	66.56	46.49
3000.0	24.21	54.46	1.65	4.19	6.91	35.90	37.49	66.50	46.32
3100.0	24.20	54.19	1.61	4.05	7.02	36.36	37.55	67.36	46.14
3200.0	23.70	55.57	1.50	3.89	7.14	36.58	38.01	70.03	47.01
3300.0	23.78	55.33	1.34	3.68	7.08	36.76	38.38	71.92	47.15
3400.0	24.15	52.98	1.21	3.36	7.21	37.05	38.74	73.22	47.33
3500.0	24.45	51.99	1.17	2.74	7.13	37.52	38.90	74.41	47.25
3600.0	24.14	52.64	1.19	2.24	6.98	37.46	38.81	80.31	46.33
3700.0	24.21	52.01	1.31	2.09	7.09	37.99	39.04	79.61	46.60
3800.0	24.31	52.25	1.49	1.82	7.08	37.81	38.98	71.07	46.43
3850.0	24.42	50.92	1.58	1.69	6.94	38.28	39.01	72.41	46.25
3900.0	24.51	50.58	1.64	1.57	7.03	37.96	38.82	67.02	46.14
4000.0	24.54	50.28	1.70	1.45	7.36	38.89	39.66	67.76	47.03
4100.0	24.46	49.23	1.76	1.61	7.48	38.96	40.04	73.66	47.48
4200.0	23.76	50.43	1.86	2.01	7.57	39.06	39.94	79.22	47.60

Typical Performance Curves

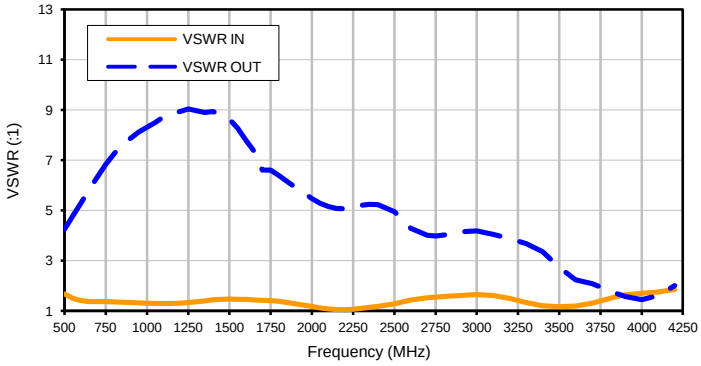
Gain



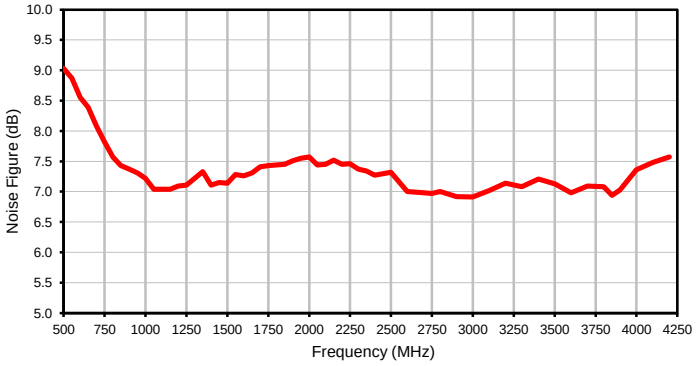
Directivity



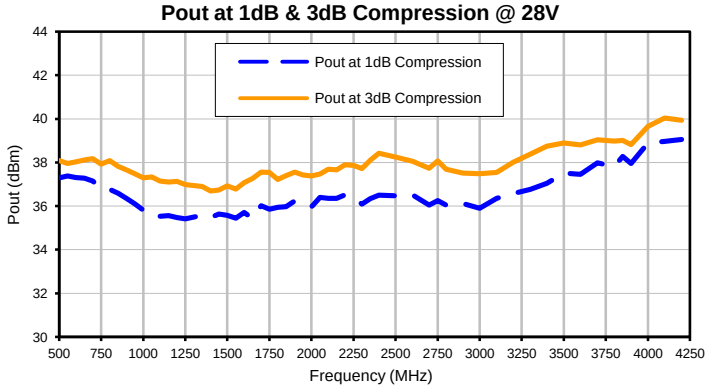
VSWR @ 28V



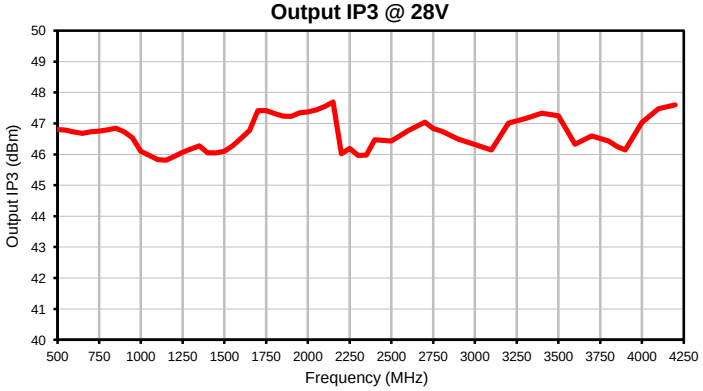
Noise Figure @ 28V



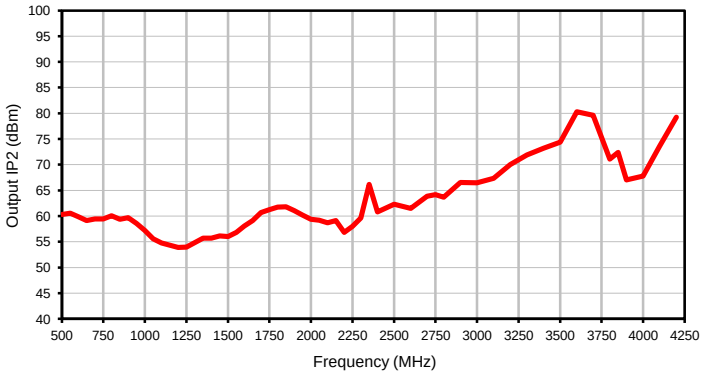
Pout at 1dB & 3dB Compression @ 28V



Output IP3 @ 28V



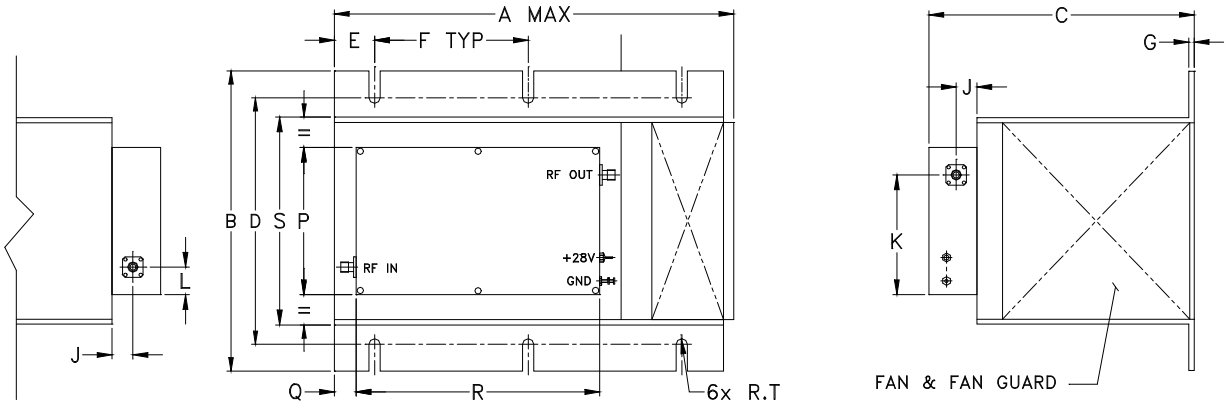
Output IP2 @ 28V



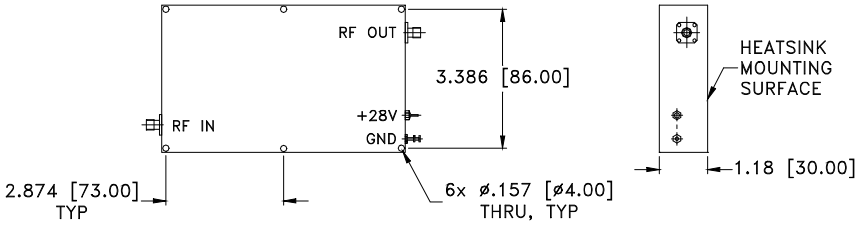
Case Style BT

Outline Dimensions

BT1896



MOUNTING INFORMATION FOR MODELS WITHOUT HEATSINK.



CASE#	A	B	C	D	E	F	G	H	J	K	L	M	N
BT1896	9.85 (250.19)	7.3 (185.42)	6.4 (162.56)	6.00 (152.40)	1.00 (25.40)	3.75 (95.25)	.13 (3.30)	- -	.51 (13.00)	2.91 (74.00)	.67 (17.00)	- -	- -

CASE#	P	Q	R	S	T	WT, GRAM	WT WITHOUT HEATSINK, GRAM
BT1896	3.58 (91.00)	.53 (13.38)	5.94 (151.00)	5.1 (129.54)	.135 (3.43)	4265	580

Dimensions in inches (mm). Tolerances: 1 Pl. ± .1; 2Pl. ± .03; 3 Pl. ± .015

Notes:

1. Case material: Aluminum alloy.
2. Finish:
   For RoHS Case Styles: Clear Chemical conversion coating, non-chrome or trivalent chrome based.
3. Heatsink finish: Black anodize.
4. Refer to the individual model data sheet for the type of connectors available.
5. Recommended screws for mounting model without heat sink on 3/32” thick sheet: #6-32, 1.50” Length.

Mini-Circuits

Environmental Specifications **ENV23T20**

All Mini-Circuits products are manufactured under exacting quality assurance and control standards, and are capable of meeting published specifications after being subjected to any or all of the following physical and environmental test.

Specification	Test/Inspection Condition	Reference/Spec
Operating Temperature	-20° to 50° C Base plate Temperature	Individual Model Data Sheet
Storage Temperature	-55° to 100° C Ambient Environment	Individual Model Data Sheet
Stabilization Bake	(non-operating) 125°C, 24 hours	- - -
Burn-in at Elevated Temp.	(DC on) 160 hours at 50° C base plate Temperature	MIL-STD-202, Method 108
Thermal Shock	-55° to 100°C, 5 cycles	MIL-STD-202, Method 107, Condition A, except 100°C