COAXIAL

Medium Power Amplifier

ZHL-10M4G21W1+
ZHL-10M4G21W1X+

50Ω 10 to 4200 MHz Broadband 2 W SMA Female

THE BIG DEAL

- Broadband, 10 to 4200 MHz
- High Gain, 44 dB Typ.
- High P1dB, +33 dBm, Typ.
- High OIP3, +46 dBm Typ.



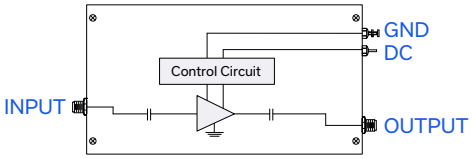
With Heatsink *Without Heatsink*

Generic photo used for illustration purposes only

APPLICATIONS

- Communication Systems
- R&D, Production, and OTA Test Systems
- Test & Measurement Equipment
- General Laboratory Applications

FUNCTIONAL DIAGRAM



PRODUCT OVERVIEW

Mini-Circuits' ZHL-10M4G21W1(X)+ is a medium power broadband amplifier providing more than 1 W of output power with a typical small signal gain of 44 dB over the 10 to 4200 MHz frequency band. The amplifier uses state-of-the-art semiconductor technology and can be used in a wide range of applications. A single supply voltage ensures ease of operation. The amplifier is made with a rugged aluminum housing and can be supplied with or without a heatsink.

KEY FEATURES

Feature	Advantages
Extremely Broadband, 10 to 4200 MHz and High Power, 2 W	One single amplifier that covers the entire frequency band delivering rated power.
High Gain, 44 dB Typ.	High gain allows low drive levels to achieve rated output power which can be obtained from many standard lab generators.
Rugged By Design	Accidental reversing of the polarity of the power supply or accidental open/short (delivering P_{1dB} power) will not damage the amplifier.
High OIP3, +46 dBm Typ.	High OIP3 makes the amplifier suitable for applications requiring high linearity such as digitally modulated signals.
Rugged Enclosure	The solid aluminum enclosure makes the amplifier usable for any application from industrial, to laboratory environments.

REV. B
ECO-028862
ZHL-10M4G21W1(X)+
MCL NY
260320

Medium Power Amplifier

ZHL-10M4G21W1+
ZHL-10M4G21W1X+

50Ω 10 to 4200 MHz Broadband 2 W SMA Female

ELECTRICAL SPECIFICATIONS AT $T_{MOUNTINGBASE}$ = +25 °C, V_{DC} = +28 V

Parameter	Symbol	Condition	Min.	Typ.	Max.	Units
Frequency Range	f		10		4200	MHz
Small Signal Gain	G_{SS}		40	44	47	dB
Small Signal Gain Flatness	$G_{SS-FLAT}$			±1.3	±2.1	dB
Output Power at 1 dB Compression	P_{1dB}		+28	+33		dBm
Output Power at 3 dB Compression	P_{3dB}		+29	+35		dBm
Noise Figure	NF			5.6		dB
Output Third Order Intercept Point	OIP3	P_{OUT} = +20 dBm/tone		+46		dBm
Input VSWR	I-VSWR			1.3	2.4	:1
Output VSWR	O-VSWR			1.5	2.4	:1
DC Supply Voltage	V_{DC}		+26	+28	+30	V
Supply Current	I_{DC}	at P_{3dB}		0.86	1.00	A

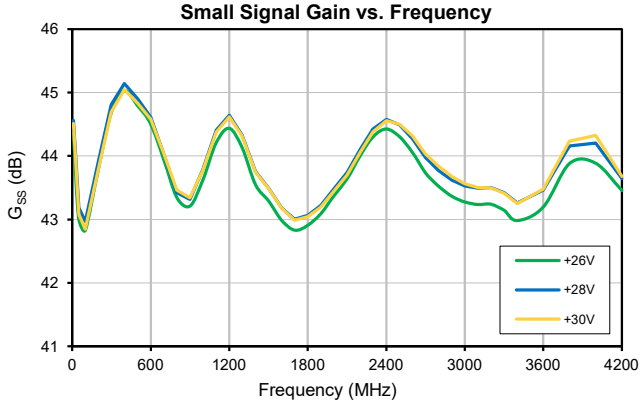
Medium Power Amplifier

ZHL-10M4G21W1+
ZHL-10M4G21W1X+

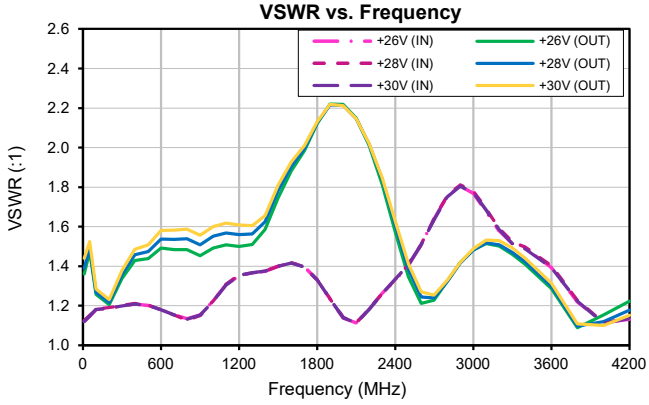
50Ω 10 to 4200 MHz Broadband 2 W SMA Female

TYPICAL PERFORMANCE DATA AT $T_{MOUNTINGBASE}$ = +25 °C, 50Ω

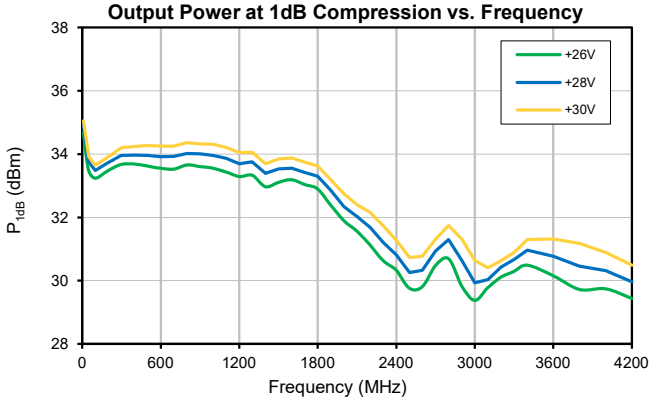
Small Signal Gain vs. Frequency



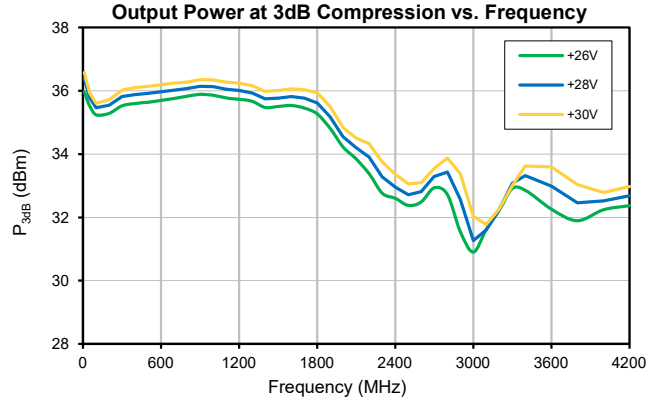
VSWR vs. Frequency



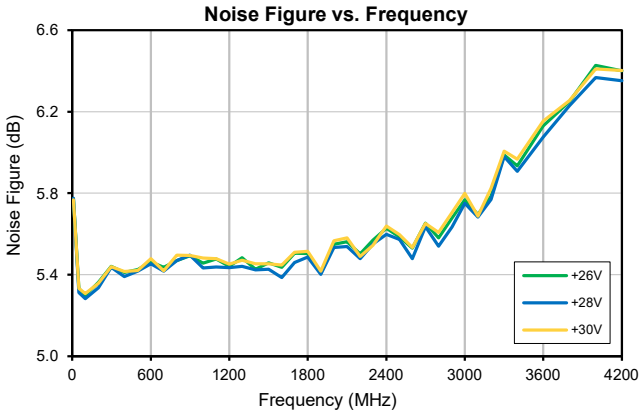
Output Power at 1dB Compression vs. Frequency



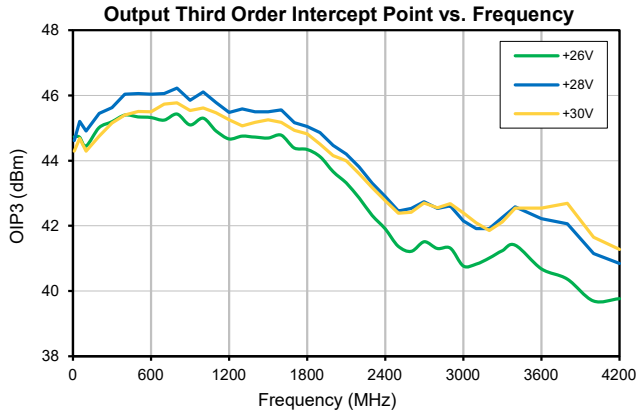
Output Power at 3dB Compression vs. Frequency



Noise Figure vs. Frequency



Output Third Order Intercept Point vs. Frequency



ABSOLUTE MAXIMUM RATINGS

Parameter	Ratings	
Operating Temperature	ZHL-10M4G21W1+	$T_{AMBIENT}$: -20 °C to +65 °C
	ZHL-10M4G21W1X+	$T_{MOUNTINGBASE}$: -20 °C to +85 °C
Storage Temperature	-55 °C to +100 °C	
No damage with an open or short at P_{OUT} = +30 dBm CW for 2 minutes max.		
RF Input Power (No Damage)	0 dBm	
DC Operating Voltage	+30 V	
Total Power Dissipation	30 W	

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

DETERMINING MAXIMUM THERMAL RESISTANCE OF USERS' EXTERNAL HEATSINK

$$\textit{MAXIMUM THERMAL RESISTANCE} = \frac{\textit{MAXIMUM OPERATING CASE TEMP} - \textit{MAXIMUM USER AMBIENT TEMP}}{\textit{POWER DISSIPATION}}$$

Example:	MAXIMUM MOUNTING BASE TEMP = +85 °C (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE) MAXIMUM USER AMBIENT TEMP = +65 °C (USER DEFINED) POWER DISSIPATION = 30 WATTS (CHECK MAXIMUM RATINGS TABLE FOR THIS VALUE) THEN MAXIMUM ALLOWABLE THERMAL RESISTANCE = 0.66 °C/W

Medium Power Amplifier

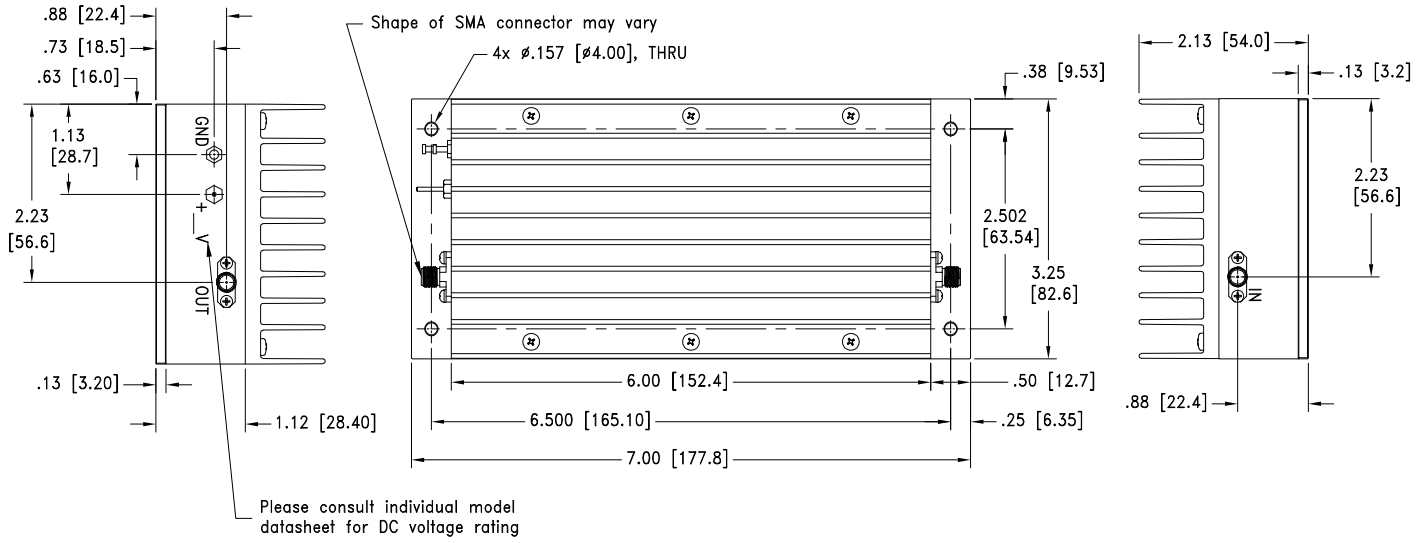
ZHL-10M4G21W1+
ZHL-10M4G21W1X+

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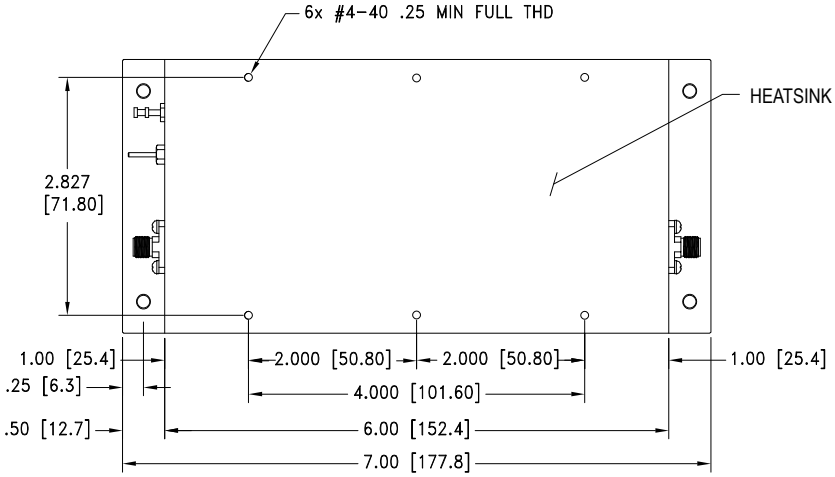
COAXIAL CONNECTIONS

IN (RF-IN)	SMA female
OUT (RF-OUT)	SMA female

CASE STYLE DRAWING WITH HEATSINK (ZHL-10M4G21W1+)



CASE STYLE DRAWING WITHOUT HEATSINK (ZHL-10M4G21W1X+)



Weight: 900.0 grams. Weight without heatsink: 600.0 grams
Dimensions are in inches [mm]. Tolerances: 2 Pl.±03; 3 Pl. ±.015 Inch

ADDITIONAL INFORMATION IS AVAILABLE ON OUR DASHBOARD.

Performance Data	Table Graphs S-Parameter (S2P Files) Data Set (.zip file)
RoHS Status	Compliant
Environmental Ratings	ENV23T3

ORDERING INFORMATION

Model No. Links	ZHL-10M4G21W1+	ZHL-10M4G21W1X+
Option	With Heatsink	Without Heatsink
Case Style	U36	
Connector	IN (SMA female) / OUT (SMA female)	

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

Typical Performance Data

Frequency (MHz)	Small Signal Gain (dB)			Isolation (dB)			VSWR (:1) In			VSWR (:1) Out		
	26V	28V	30V	26V	28V	30V	26V	28V	30V	26V	28V	30V
10	44.36	44.56	44.51	90.89	82.66	89.36	1.12	1.13	1.12	1.36	1.39	1.44
50	43.03	43.18	43.08	92.85	94.14	89.22	1.15	1.15	1.15	1.47	1.49	1.52
100	42.83	42.97	42.85	102.64	100.28	96.72	1.18	1.18	1.18	1.26	1.27	1.28
200	43.79	43.92	43.80	98.34	105.30	100.37	1.19	1.19	1.19	1.21	1.22	1.23
300	44.69	44.81	44.70	103.11	98.25	92.58	1.20	1.20	1.20	1.34	1.36	1.38
400	45.03	45.14	45.05	97.18	96.68	100.11	1.21	1.21	1.21	1.43	1.46	1.49
500	44.79	44.90	44.83	95.07	94.89	98.48	1.20	1.20	1.20	1.44	1.47	1.51
600	44.51	44.61	44.58	91.34	92.80	95.76	1.18	1.18	1.18	1.49	1.54	1.58
700	43.95	44.03	44.04	99.62	97.43	95.55	1.15	1.15	1.15	1.48	1.54	1.58
800	43.35	43.42	43.46	94.61	92.56	97.74	1.13	1.13	1.13	1.48	1.54	1.59
900	43.21	43.31	43.35	94.24	94.44	94.95	1.15	1.15	1.15	1.45	1.51	1.56
1000	43.63	43.79	43.78	91.14	90.31	93.04	1.23	1.22	1.22	1.49	1.55	1.60
1100	44.21	44.41	44.37	90.13	90.57	91.05	1.31	1.31	1.31	1.51	1.57	1.62
1200	44.44	44.64	44.62	89.05	89.82	92.02	1.35	1.36	1.35	1.50	1.56	1.61
1300	44.12	44.33	44.32	88.70	89.79	93.07	1.36	1.37	1.37	1.51	1.56	1.61
1400	43.55	43.75	43.75	91.77	89.54	90.51	1.37	1.38	1.38	1.58	1.62	1.66
1500	43.29	43.49	43.49	89.82	89.59	90.77	1.40	1.40	1.40	1.75	1.78	1.81
1600	42.99	43.18	43.17	87.88	90.56	90.03	1.42	1.42	1.42	1.88	1.90	1.93
1700	42.83	43.00	42.99	91.58	91.94	91.60	1.40	1.40	1.40	1.98	2.00	2.01
1800	42.91	43.06	43.04	87.10	89.19	89.65	1.33	1.33	1.33	2.12	2.13	2.13
1900	43.09	43.22	43.20	87.28	88.46	88.69	1.23	1.23	1.23	2.22	2.22	2.22
2000	43.37	43.48	43.45	86.14	90.60	89.21	1.14	1.14	1.14	2.22	2.21	2.21
2100	43.64	43.74	43.70	84.91	86.03	86.92	1.11	1.11	1.11	2.15	2.15	2.15
2200	44.00	44.10	44.06	84.80	88.05	86.16	1.18	1.18	1.18	2.01	2.02	2.02
2300	44.31	44.43	44.38	83.11	86.09	83.95	1.26	1.26	1.26	1.81	1.84	1.85
2400	44.43	44.58	44.56	84.86	85.04	84.66	1.33	1.33	1.33	1.57	1.61	1.63
2500	44.30	44.49	44.50	84.22	85.29	84.08	1.40	1.41	1.41	1.35	1.39	1.41
2600	44.06	44.28	44.32	84.12	84.42	85.02	1.51	1.51	1.51	1.21	1.24	1.27
2700	43.73	43.98	44.03	84.21	84.65	86.18	1.64	1.64	1.64	1.23	1.24	1.25
2800	43.52	43.77	43.84	83.53	84.11	86.92	1.76	1.76	1.75	1.33	1.32	1.33
2900	43.37	43.62	43.67	84.70	86.51	85.24	1.81	1.81	1.80	1.42	1.42	1.42
3000	43.28	43.53	43.57	84.93	84.85	86.91	1.77	1.78	1.77	1.48	1.48	1.49
3100	43.24	43.49	43.50	84.42	87.22	86.57	1.67	1.69	1.68	1.51	1.52	1.53
3200	43.24	43.50	43.50	84.01	86.44	87.34	1.58	1.59	1.58	1.50	1.51	1.53
3300	43.14	43.42	43.41	85.22	86.89	86.74	1.51	1.52	1.51	1.46	1.47	1.49
3400	42.98	43.26	43.25	87.05	87.77	87.14	1.49	1.50	1.49	1.41	1.42	1.44
3600	43.20	43.46	43.48	83.47	89.07	85.33	1.39	1.40	1.39	1.29	1.30	1.31
3800	43.88	44.16	44.23	85.60	85.54	87.84	1.22	1.23	1.22	1.09	1.10	1.11
4000	43.89	44.20	44.33	87.74	88.32	87.84	1.11	1.12	1.11	1.15	1.12	1.10
4200	43.46	43.64	43.68	84.91	85.08	85.78	1.13	1.13	1.13	1.22	1.18	1.15

Typical Performance Data

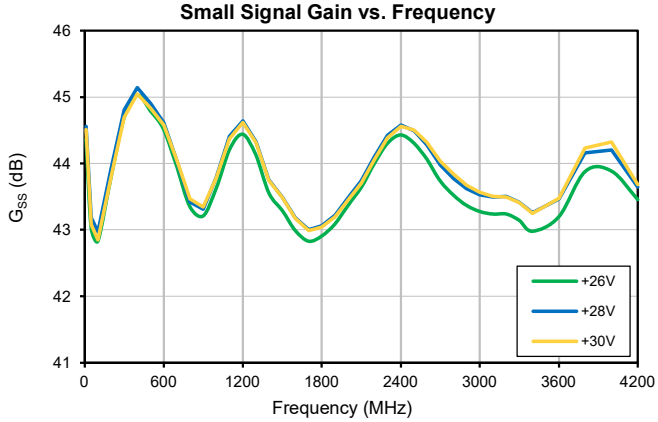
Frequency (MHz)	P_{OUT} @ 1 dB Compression (dBm)			P_{OUT} @ 3 dB Compression (dBm)		
	26V	28V	30V	26V	28V	30V
10	34.67	34.92	35.05	35.97	36.39	36.58
50	33.49	33.74	33.91	35.54	35.78	35.94
100	33.23	33.48	33.64	35.24	35.46	35.61
200	33.48	33.74	33.92	35.29	35.54	35.72
300	33.68	33.96	34.20	35.53	35.81	36.02
400	33.68	33.97	34.24	35.60	35.88	36.11
500	33.62	33.96	34.27	35.64	35.92	36.14
600	33.55	33.92	34.25	35.69	35.97	36.19
700	33.53	33.93	34.25	35.76	36.02	36.24
800	33.66	34.02	34.36	35.82	36.07	36.27
900	33.61	34.01	34.32	35.89	36.14	36.36
1000	33.55	33.95	34.31	35.86	36.13	36.34
1100	33.43	33.87	34.20	35.77	36.05	36.27
1200	33.29	33.69	34.05	35.73	36.01	36.24
1300	33.33	33.76	34.06	35.67	35.93	36.16
1400	32.97	33.39	33.69	35.47	35.75	35.98
1500	33.11	33.53	33.84	35.50	35.77	36.01
1600	33.19	33.55	33.88	35.53	35.81	36.06
1700	33.03	33.42	33.75	35.46	35.76	36.02
1800	32.90	33.30	33.62	35.27	35.62	35.94
1900	32.38	32.86	33.19	34.81	35.18	35.51
2000	31.89	32.34	32.75	34.22	34.54	34.84
2100	31.56	32.02	32.40	33.84	34.20	34.51
2200	31.12	31.68	32.15	33.37	33.91	34.32
2300	30.63	31.22	31.74	32.76	33.28	33.76
2400	30.32	30.81	31.28	32.60	32.96	33.36
2500	29.76	30.26	30.73	32.38	32.72	33.05
2600	29.81	30.33	30.77	32.49	32.82	33.09
2700	30.47	30.93	31.31	32.94	33.29	33.55
2800	30.69	31.30	31.75	32.74	33.42	33.88
2900	29.83	30.63	31.30	31.55	32.57	33.38
3000	29.37	29.93	30.64	30.91	31.26	32.03
3100	29.78	30.04	30.41	31.61	31.60	31.77
3200	30.11	30.42	30.63	32.23	32.26	32.27
3300	30.29	30.67	30.89	32.91	33.08	33.01
3400	30.49	30.96	31.30	32.86	33.33	33.63
3600	30.15	30.77	31.32	32.26	32.98	33.59
3800	29.72	30.46	31.17	31.89	32.46	33.03
4000	29.74	30.32	30.90	32.24	32.52	32.78
4200	29.44	29.96	30.48	32.37	32.68	32.98

Typical Performance Data

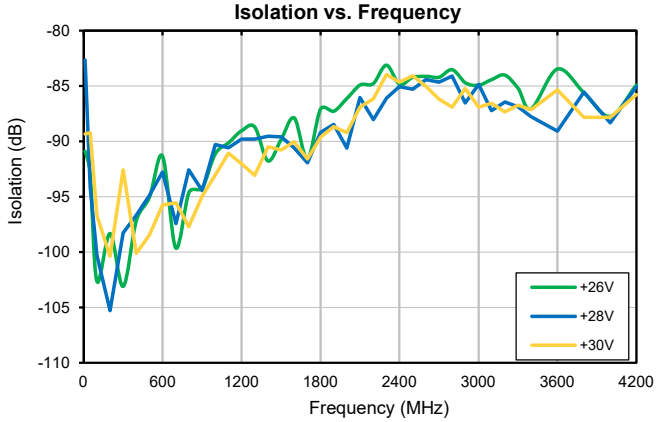
Frequency (MHz)	OIP3 (dBm)			Noise Figure (dB)		
	26V	28V	30V	26V	28V	30V
10	44.73	44.61	44.28	5.77	5.77	5.77
50	44.72	45.20	44.68	5.33	5.31	5.33
100	44.44	44.91	44.28	5.30	5.28	5.31
200	45.00	45.45	44.76	5.36	5.34	5.36
300	45.19	45.62	45.15	5.44	5.44	5.44
400	45.40	46.04	45.40	5.41	5.39	5.42
500	45.34	46.05	45.51	5.43	5.42	5.42
600	45.32	46.04	45.50	5.46	5.45	5.48
700	45.24	46.06	45.73	5.44	5.42	5.42
800	45.43	46.22	45.77	5.47	5.47	5.50
900	45.10	45.85	45.54	5.49	5.50	5.50
1000	45.30	46.10	45.62	5.46	5.43	5.48
1100	44.91	45.78	45.46	5.48	5.44	5.48
1200	44.67	45.48	45.25	5.44	5.43	5.45
1300	44.75	45.59	45.07	5.48	5.44	5.47
1400	44.72	45.50	45.18	5.43	5.42	5.45
1500	44.70	45.50	45.25	5.46	5.43	5.45
1600	44.78	45.55	45.18	5.44	5.39	5.45
1700	44.39	45.17	44.93	5.51	5.46	5.51
1800	44.34	45.04	44.83	5.50	5.49	5.51
1900	44.11	44.86	44.51	5.41	5.40	5.42
2000	43.66	44.46	44.16	5.55	5.53	5.57
2100	43.31	44.20	43.99	5.56	5.54	5.58
2200	42.85	43.80	43.60	5.50	5.48	5.49
2300	42.31	43.31	43.17	5.57	5.55	5.54
2400	41.90	42.89	42.77	5.63	5.60	5.64
2500	41.38	42.46	42.38	5.59	5.57	5.60
2600	41.21	42.53	42.41	5.53	5.48	5.53
2700	41.51	42.74	42.70	5.65	5.63	5.65
2800	41.30	42.54	42.55	5.58	5.54	5.61
2900	41.31	42.61	42.68	5.68	5.63	5.70
3000	40.77	42.15	42.40	5.77	5.75	5.80
3100	40.83	41.91	42.10	5.70	5.68	5.69
3200	41.01	41.92	41.86	5.78	5.77	5.82
3300	41.24	42.25	42.12	5.99	5.98	6.01
3400	41.41	42.58	42.54	5.93	5.91	5.97
3600	40.68	42.22	42.55	6.13	6.08	6.15
3800	40.36	42.06	42.69	6.25	6.23	6.26
4000	39.69	41.14	41.65	6.43	6.37	6.41
4200	39.77	40.84	41.27	6.40	6.35	6.40

Typical Performance Curves

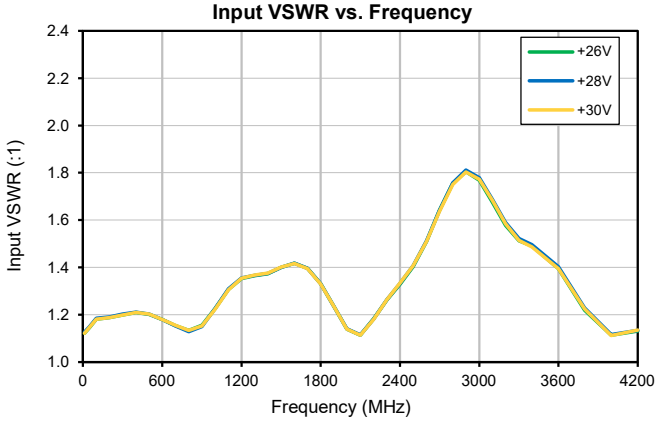
Small Signal Gain vs. Frequency



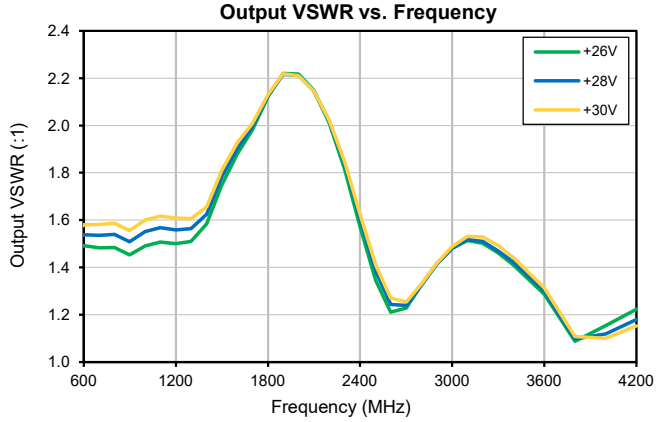
Isolation vs. Frequency



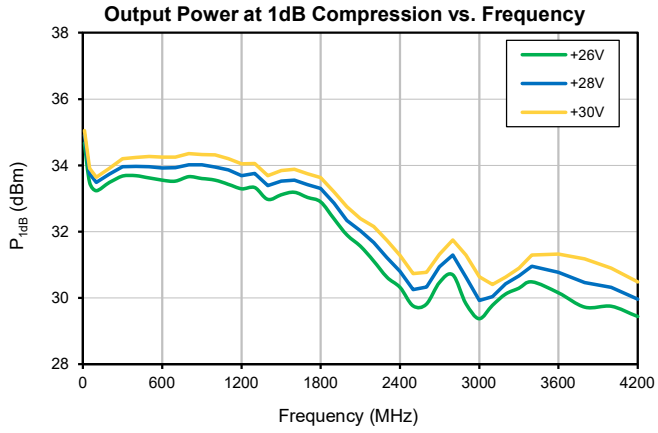
Input VSWR vs. Frequency



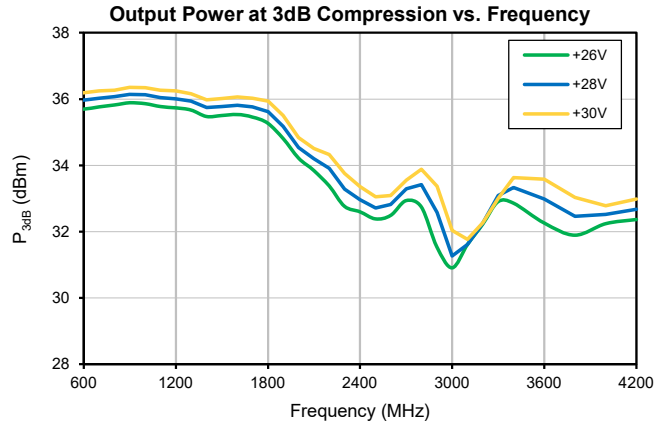
Output VSWR vs. Frequency



Output Power at 1dB Compression vs. Frequency

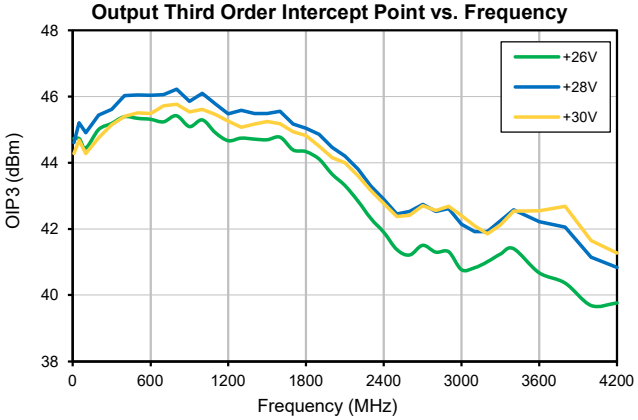


Output Power at 3dB Compression vs. Frequency

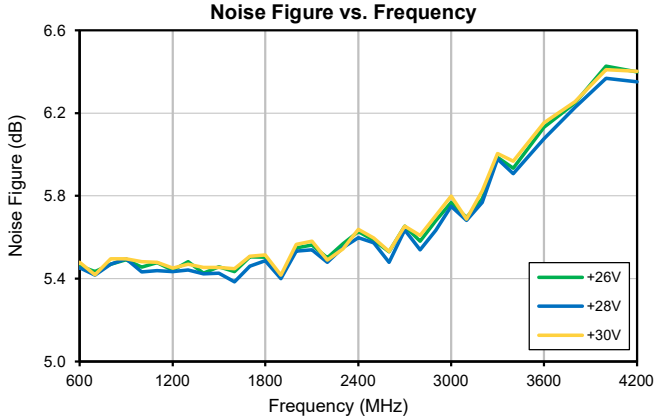


Typical Performance Curves

Output Third Order Intercept Point vs. Frequency

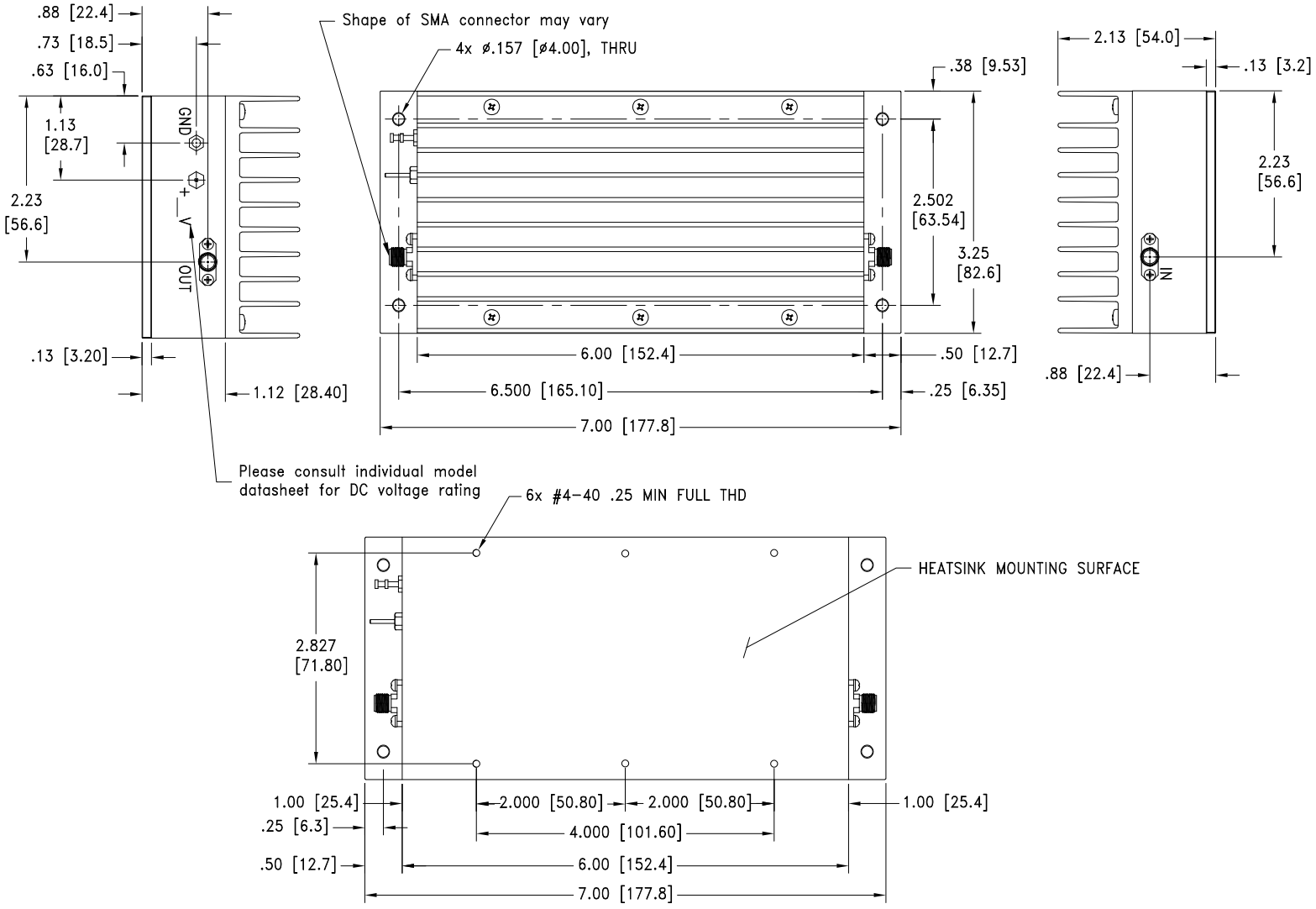


Noise Figure vs. Frequency



Case Style U

Outline Dimensions U36



MOUNTING INFORMATION FOR MODELS WITHOUT HEATSINK

Weight: 900.0 grams Weight without heatsink: 600.0 grams

Dimensions are in inches [mm]. Tolerances: 2 Pl.±03; ; 3 Pl. ±.015 Inch

Notes:

1. Case material: Aluminum alloy.
2. Case finish and mounting bracket finish:
   For RoHS Case Styles: Clear chemical conversion coating, non-chrome or trivalent chrome based.

   For Non-RoHS Case Styles: Yellow hexavalent chrome based conversion coating.
   Due to transition from non-RoHS to RoHS, models will be supplied with either case style finish until the non-RoHS case inventory is depleted.
3. Heat sink finish: Black anodize.

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Environmental Specifications **ENV23T3**

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 65° C Ambient Environment	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 85° C	MIL-STD-202, Method 108
Thermal Shock	-55° to 100°C, 5 cycles	MIL-STD-202, Method 107, Condition A, except 100°C

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