

Cisco GainMaker GaN High Gain Dual 1 GHz System Amplifier with 5-85/102-1002 MHz Split

Consumer bandwidth demand continues to grow at a rapid rate every year. As a result, cable operators with DOCSIS[®]-based equipment have begun introducing fiber deeper and deeper into the network. They want to reduce service group sizes and ultimately double or quadruple (or more!) bandwidth speeds. The Cisco[®] GainMaker[®] High Gain Dual (HGD) System Amplifier using gallium nitride (GaN) is an ideal product for deep fiber applications. Why? Because with higher output levels, up to 58 dBmV, and significantly improved linearity and performance, longer reach needs can be met. This GaN amplifier carries on Cisco's legacy of simple, reliable and fast installation and setup. Furthermore, the Cisco GainMaker HGD System Amplifier can scale to meet the needs of all HFC network architectures (one product for all amplifier applications).

The Cisco GainMaker HGD System Amplifier provides two high-level forward RF outputs (main and auxiliary), with the option to create a third RF output by using an optional plug-in auxiliary path signal director. All GainMaker products share common plug-in accessories and perform to 1 GHz in the forward path. The system amplifiers in this portfolio provide multiple forward RF output ports, while the line extenders provide a single forward RF output port.

Cisco GainMaker 1 GHz system amplifier modules have increased gain to allow drop in for 750-MHz spacing and are mechanically compatible with previous Cisco GainMaker System Amplifier II, II+, and III housing bases, often allowing upgrade to higher bandwidth with no respacing or resplicing. The DC power supply is modular and located in an updated housing lid for easy access. All Cisco GainMaker 1 GHz system amplifier modules are factory configured with reverse amplifier, diplex filters, thermal compensation circuit, forward interstage pads, and equalizer to promote optimal performance. Optional single-pilot automatic gain control (AGC) configurations are also available.

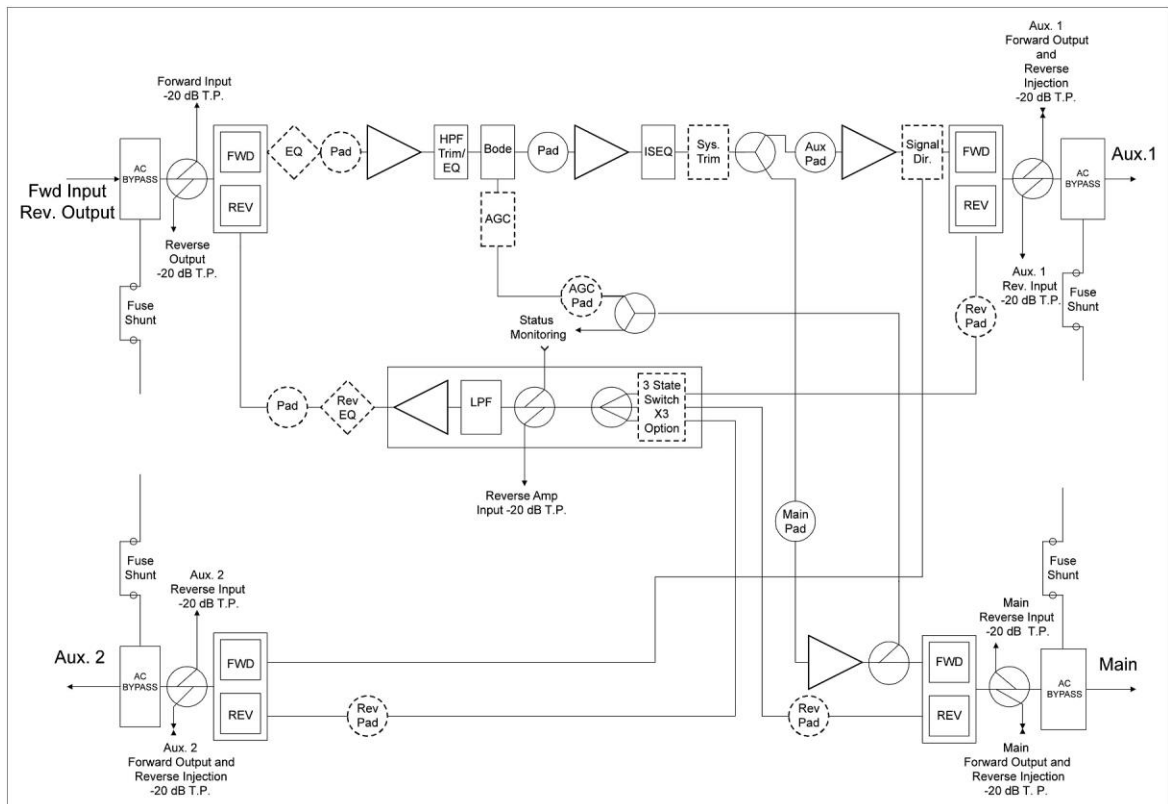
Figure 1. Cisco GainMaker HGD System Amplifier



Features

- High-performance GaN gain stage technology
- Plug-in accessories that are common to all Cisco GainMaker Nodes and Cisco GS7000 products (i.e., attenuator pads, equalizers, diplexers and crowbar)
- Amplifier cover that provides access to RF Test Points
- Power supply mounted in housing lid for efficient thermal dissipation (60 and 90 VAC powering capability)
- 15A current capacity (steady state) and 25A surge survivability
- Optional three-state reverse switch (on/off/-6 dB) that allows each reverse input to be isolated for noise and ingress troubleshooting (status monitoring required)
- Quadrature amplitude modulation (QAM) and analog pilot AGC available (optional)
- AGC with thermal backup, which eliminates disruptive RF output variation in the event of pilot loss
- Reverse input pad and RF test point for each reverse input port to allow optimum reverse path design and alignment
- Surge-resistant circuitry that helps ensure gain stage protection without fuses or other failure-causing devices

Figure 2. Block Diagram



Specifications

Table 1. General Station Performance

General Station Performance	Units	Forward	Reverse	Notes
Pass band	MHz	105-1002	5-85	10
Amplifier type	-	GaN	PP	
Frequency response	dB	± 0.5	± 0.5	
Auto slope and gain range	dB	± 5.5	n/a	
Return Loss	dB	16	16	7
Maximum AC through current (continuous)	Amps	15	-	
Maximum AC through current (surge)	Amps	25	-	
Hum modulation @ 12A (over specified frequency range)	dB	70 (105-870 MHz) 60 (870-1002 MHz)	60 (5-10 MHz) 70 (11-85 MHz)	
Hum modulation @ 15A (over specified frequency range)	dB	65 (105-870 MHz) 60 (870-1002 MHz)	60 (5-10 MHz) 65 (11-85 MHz)	
Test points (± 0.5 dB)	dB	-20	-20	
Reference output level @ 1002 MHz 870 MHz 750 MHz 650 MHz 550 MHz 105 MHz	dBmV	56.0 54.0 52.2 50.5 49.0 42.3	35 (@85 MHz) 35 (@ 5 MHz)	
Reference Output Tilt (105-1002 MHz)	dB	13.7	-	1

Table 2. Forward Station Performance

Forward Station Performance	Units	Auto/Thermal with 10.5 dB I/S EQ	Notes
Operational gain (minimum)	dB	44	2, 10
Internal tilt (± 0.5 dB)	dB	13.8	3
Noise figure @ 105 MHz	dB	8.5	2
Noise figure @ 1 GHz	dB	8.0	2
73 NTSC Channels (CW) with digital			4
Composite triple beat	dB	70	9
Cross modulation	dB	66	5, 9
Composite second order (high side)	dB	68	9
Composite intermodulation noise (CIN)	dB	60	8, 9

Table 3. Reverse Station Performance

Reverse Station Performance	Units		Notes
Operational gain (minimum)	dB	19.0	6, 7
Internal tilt (± 0.5 dB)	dB	-0.5	3
Noise figure	dB	12	6, 7
6 NTSC Channels (CW)			
Composite triple Beat	dB	92	9
Cross modulation	dB	80	5, 9
Composite second order (high side)	dB	82	9

Unless otherwise noted, specifications reflect typical performance and are referenced to 68°F (20°C). Specifications are based upon measurements made in accordance with SCTE/ANSI standards (where applicable), using standard frequency assignments.

Table 4. Station Delay Characteristics

Station Delay Characteristics			
Forward (Chrominance to Luminance Delay)		Reverse (Group Delay in 1.5 MHz bandwidth)	
Frequency (MHz)	Delay (ns)	Frequency (MHz)	Delay (ns)
109.25 to 112.83	13	5.0 to 6.5	60
115.25 to 118.83	7	6.5 to 8.0	22
121.25 to 124.83	5	8.0 to 9.5	12
		80.5 to 82.0	10
		82.0 to 83.5	13
		83.5 to 85.0	18

Table 5. Station Powering Data

Station Powering Data														
Cisco GainMaker High Gain Dual	I DC (Amps)		AC Voltage											
			90	85	80	75	70	65	60	55	50	45	40	35
Thermal	1.51	AC current (A)	0.69	0.69	0.66	0.67	0.66	0.68	0.77	0.83	0.89	0.99	1.11	1.31
		Power (W)	41.2	41.1	41.0	40.8	40.7	40.7	40.6	40.6	40.6	40.6	40.5	40.6
AGC	1.56	AC current (A)	0.70	0.70	0.68	0.69	0.68	0.70	0.79	0.85	0.92	1.02	1.16	1.35
		Power (W)	42.5	42.4	42.3	42.2	42.0	42.0	41.9	41.9	41.9	41.9	42.0	42.2
AGC with status monitor and reverse switch	1.70	AC current (A)	0.73	0.73	0.72	0.73	0.73	0.77	0.86	0.92	1.01	1.12	1.27	1.46
		Power (W)	46.2	46.1	46.0	45.9	45.8	45.7	45.6	45.6	45.6	45.6	45.8	46.0

Data is based on stations configured for two-way operation. AC currents specified are based on measurements made with typical CATV type ferroresonant AC power supply (quasi-square wave), and Cisco GainMaker System Amplifier power supply (2.5A, 24 VDC, pn 734771).

DC supply has a user configurable 30V, 40V, or 50 VAC under voltage lockout circuit. Default setting is 30V. 40V or 50 VAC. Under-voltage lockout may be selected by changing the position of the lockout jumper.

Notes:

- Reference output tilt is specified as "LINEAR" tilt (as opposed to "cable" tilt).
- Forward gain and noise figure measured with 0 dB input EQ and 1 dB input pad.
- Down tilt, the effect of cable, is represented by a (-). Up tilt, the effect of equalization, is represented by a (+).
- 73 CW NTSC channels loaded from 115 to 550 MHz. Digital refers to 550-1002 MHz loading with QAM carriers at -6 dB levels relative to analog video carrier levels.
- X-mod (@ 15.75 kHz) specified using 100 percent synchronous modulation and frequency selective measurement device.
- Reverse gain and noise figure for station with 0 dB reverse input pad, 0 dB reverse output EQ, and 1 dB output pad.
- Reverse operational gain, noise figure, and return loss are specified without reverse switch option. If switch is installed, reduce gain by 0.5 dB, increase noise figure by 0.5 dB, and decrease Return loss by 1 dB.
- Composite Intermodulation noise is a broadband noise-like distortion product associated with QAM loading.
- Distortion performance at reference output levels and tilt. Contact Cisco Systems Engineering for CIN calculation.
- The gain at 102 MHz is < 1.5 dB below the gain at 105 MHz. 102 to 105 MHz is recommended for out of band communication only. No video carriers should be used between 102 and 105 MHz.

Unless otherwise noted, specifications reflect typical performance and are referenced to 68°F (20°C). Specifications are based upon measurements made in accordance with SCTE/ANSI standards (where applicable), using standard frequency assignments.

Table 6. Physical Specifications

Environmental	
Operating temperature range	-40 to 140°F (-40 to 60°C)
Mechanical	
Housing dimensions (L x H x D)	17.3 in. x 7.2 in. x 7.8 in. (439.4 mm x 182.9 mm x 198.1 mm)
Weight	
<ul style="list-style-type: none"> Housing with power supply Module 	12 lb, 5 oz (5.6 kg) 5 lb, 5 oz (2.4 kg)

Ordering Information

The Cisco GainMaker High Gain Dual System Amplifier is available in a wide variety of configurations. The desired configuration is “built” by accessing the Cisco Commerce Workspace tool at <https://cisco-apps.cisco.com/cisco/psn/commerce>. The user specifies the new Assemble To Order (ATO) Product ID for the GainMaker System Amplifier High Gain Dual “GMSA-HGD” and the tool steps through the available options, from which to choose. Services may also be selected during this process. Once all the desired options are selected, the configuration and price are displayed. When the “Done” radio button is clicked, the configuration can be exported and saved for future use or immediate ordering. This page contains ordering information for required and optional accessories. Please consult with your Account Representative, Customer Service Representative, or System Engineer to determine the best configuration for your particular application.

Table 7. Required Accessories

Required Accessories	Part Number
Plug-in Pads (attenuators): Available in 0.5 dB steps from 0 to 20.5 dB <ul style="list-style-type: none"> 1 required for forward input 1 required for AGC, if applicable* 4 required for reverse (3 input, 1 output) *To determine AGC pad value, subtract 34 dB from the design value main port RF output level at the AGC pilot frequency	589693 (0 dB) sequentially thru 589734 (20.5 dB)
Plug-in Forward Cable Equalizer: Available in 1.5 dB steps from 0 to 30 dB at 1002 MHz <ul style="list-style-type: none"> 1 required for forward input 	4007228 (0 dB) sequentially thru 4007248 (30 dB)
Plug-in Reverse Cable Equalizer: Available in 1 dB steps from 0 to 12 dB at 85 MHz <ul style="list-style-type: none"> 1 required for reverse output - unless design value is 0 dB (0 dB EQ is provided) 	712719 (0 dB) and 4036769 (1 dB) sequentially thru 4036780 (12 dB)
Plug-in Signal Director for Auxiliary output: 1 required, chose from the following: <ul style="list-style-type: none"> Jumper Two-way Splitter DC-8 Directional Coupler DC-12 Directional Coupler 	4008208 4008364 4008365 4008366

The optional accessories listed in Table 8 may be ordered separately.

Table 8. Optional Accessories

Optional Accessories	Part Number
24V Power Supply for Cisco GainMaker HGD	734771
230 VAC Crowbar Surge Protector (plug-in, one per station)	715973
Plug-in Inverse Equalizer: Simulates cable equivalent tilts (creates tilt opposite that of equalizers). Use in place of forward input EQ as needed to maintain proper output tilt in short spaced locations. Available in approx. 1.6 dB "cable equivalent" steps from 1.6 to 16.2 dB	4007486 (1.6 dB) sequentially thru 4007495 (16.2 dB)
Long Reach Test Point Adapter	562580
Status Monitoring Transponder	Refer to the Cisco GainMaker Status Monitoring Transponder Data Sheet. http://www.cisco.com/c/en/us/products/video/transponders/index.html

The housing options listed in Table 9 may be included with the product if ordered using the Cisco GainMaker Ordering Matrix. They may also be ordered separately.

Table 9. Housing Options

Cisco GainMaker System Amplifier Housing: 1 required housing includes housing base, lid, wiring harness, and 24V power supply # 4022846. All housings have 15 amp capacity.	Part Number
<ul style="list-style-type: none"> Uncoated 4-port housing without external test point access 	4026387
<ul style="list-style-type: none"> Chromate Plated 4-port housing without external test point access 	4026388
<ul style="list-style-type: none"> Uncoated 4-port housing with external test point access 	4026385
<ul style="list-style-type: none"> Chromate Plated 4-port housing with external test point access 	4026386
Cisco GainMaker System Amplifier Housing Upgrade Kit: 1 required if upgrading an existing SA II, II+, or III housing to allow use of Cisco GainMaker System Amplifier modules. Includes a Cisco GainMaker System Amplifier housing lid, wiring harness, and 24V power supply # 4022846.	
<ul style="list-style-type: none"> Uncoated 4 port housing lid without external test point access 	4026389
<ul style="list-style-type: none"> Painted 4 port housing lid without external test point access 	4026390
<ul style="list-style-type: none"> Uncoated 4 port housing lid with external test point access 	4026391
<ul style="list-style-type: none"> Painted 4 port housing lid with external test point access 	4026392
Seizure Upgrade Kit: 1 required if upgrading an existing SAII or SAII+ housing base to allow use of Cisco GainMaker System Amplifier Modules. Includes high current (15A) rated seizure screws and anvils.	548775

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