CL1210

Space qualified GaN on SiC power amplifier operating from 27 to 31 GHz.

Qorvo TGA2594-HM replacement a,b

Criteria Labs CL1210 is a space qualified power GaN amplifier that can operate from 27 to 31 GHz, achieves 36.5 dBm saturated output power, with a power-added efficiency of 25% and 25dB of small signal gain.

The CL1210 is offered in a hermetically sealed 22-lead 7x7 mm ceramic QFN designed for suface mount to a printed circuit board. The package has a Cu base, offering superior thermal management. The CL1210 is suited to support military and space applications. This part is specifically fabricated to pass stringent PIND and RGA testing as part of Military screening and QCI tests.

Both RF ports have integrated DC blocking capacitors and are fully matched to 50 ohms.

Package: Hermetic, 22-pin, 7.0mm x 7.0mm x 1.27mm

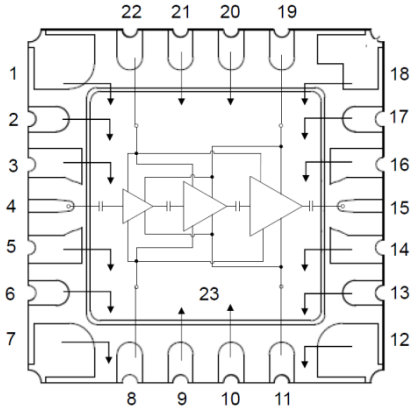
Product Features

- Frequency range: 27 - 31 GHz
- Pout: 36.5 dBm at Pin = 14 dBm
- PAE: 25% CW
- Small Signal Gain: 25 dB
- IM3: -35 dBc @ 25dBm Pout / Tone
- Bias: Vd=+20V, Idq=140ma, Vg=- 3.0 V Typical

Applications:

- Military SATCOM Terminals
- Space Satellite Communications
- Ka Band High Power Amplifiers

Functional Block Diagram



Pin Configuration

Pin #	Symbol
1,2,3,5,6,7,9,10,12, 13, 14, 16,17,18,20,21	GND
23 (pkg base)	GND
4	RF In
15	RF Out
8 *	Vg1
11 *	Vd1
22	Vg2
19	Vd2

- Recommended only connecting one pair of Vg/Vd connections. (Vg1 / Vd1 or Vg2 / Vd2)

a. Suitability for model replacement within a system must be determined and is solely the responsibility of the customer.
b. The Qorvo TGM2543-SM part number is used for identification and comparison purposes only.

Criteria Labs 706 Brentwood St., Austin, TX 78752
www.criterialabs.com 512-637-4500

Absolute Maximum Ratings		
Parameter	Rating	Units
Device Current (Id)	1.4 A	mA
Drain Voltage (Vd)	+29.5	V
Gate Voltage Range, Vg	-5.0 to 0.0	V
Gate 1 current range, Ig @ T=85*C	-3.0 to +17.0	mA
Power Dissipation (Pdiss), 85*C	15W	
RF Input Power, CW, 50 ohms	+30.0	dBm
Channel Temperature (Tch)	275	°C
Storage Temperature Range	-55 to +150	°C
Mounting Temperature (30 seconds)	260	°C
Moisture Sensitivity Level	Hermetic	
ESD Rating - Human body Model (HBM)	Class 1A	
Package Thermal Resistance	10.3	°C / W

Recommended Operating Conditions				
	Min	typ	Max	Units
Parameter				
Drain Voltage (Vd)		20		V
Drain Current (Idq)		140		mA
Drain Current Under RF Drive (Id_drive)	See plots Pg 7			
Gate Voltage Vg		-3		V
Gate Current Under RF Drive (Ig_drive)	See plots Pg 7			
Temperature (Tbase)	-40		+85	°C

Caution! ESD sensitive device.

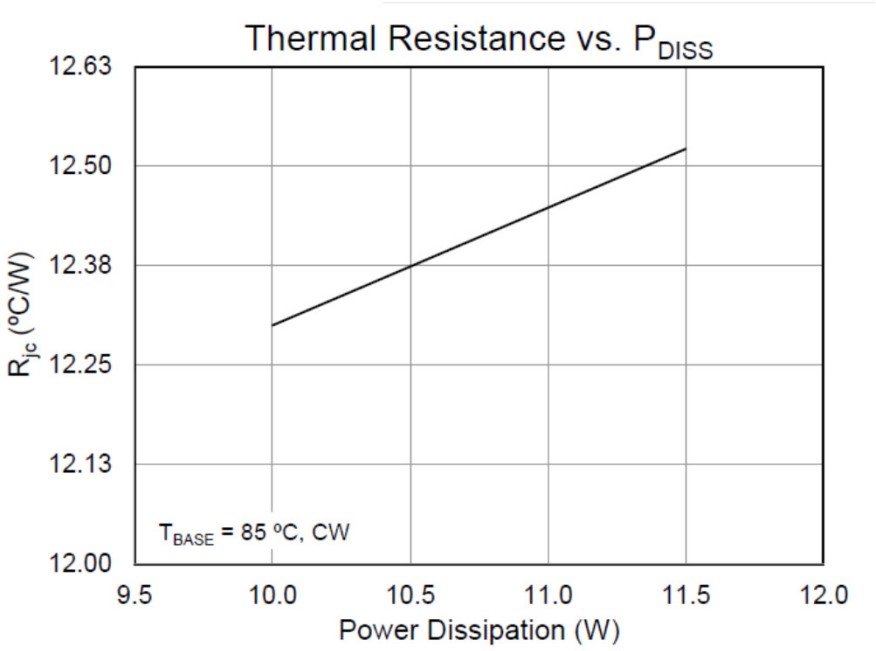
Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

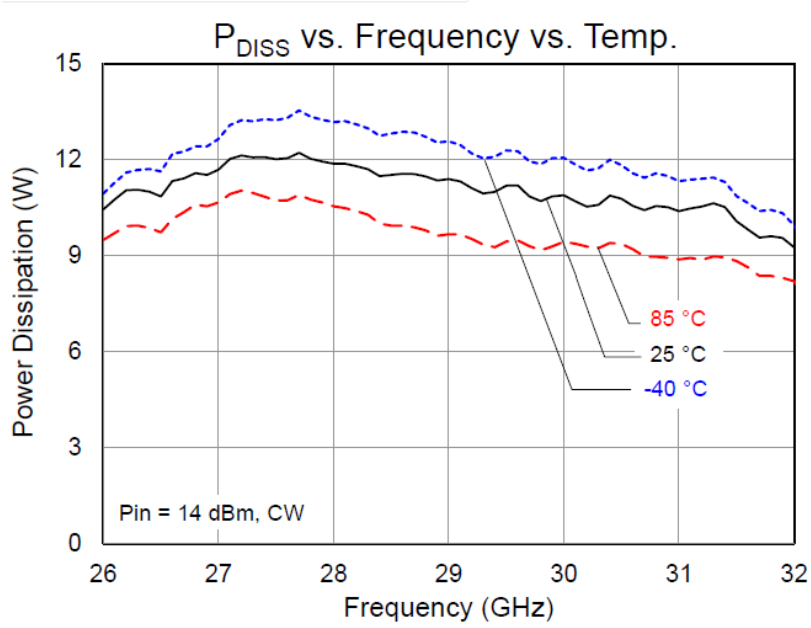
Electrical Specifications

Test conditions unless otherwise noted: 25*C, Vd=+20 V, Idq=140mA, Vg= -3.0V, CW.

	CL1210 Specifications			Units
Parameter	Min	typ	Max	
Operational Frequency Range	27		31	GHz
Small Signal Gain		25		dB
Input Return Loss		>5		dB
Output Return Loss		>5		dB
Output Power @ Pin= 14 dBm		36.5		dBm
Power Added Efficiency @ Pin = 14 dBm		25		%
IM3 (Pout / Tone = 25 dBm / Tone)		-35		dBc
IM5 (Pout / Tone = 25 dBm / Tone)		-43		dBc
Small Signal Gain Temperature Coefficient		-0.05		dB/*C
Output Power Temperature Coefficient		-0.04		dB/*C

Typical Thermal Performance

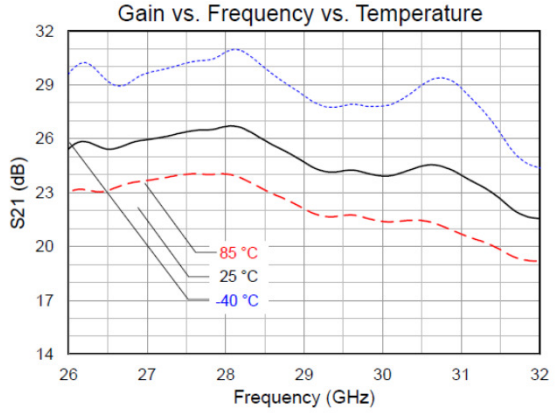




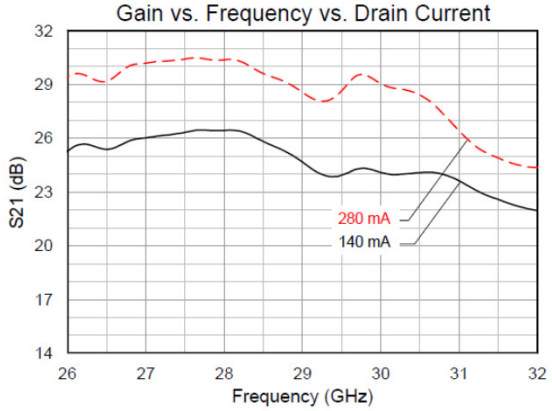
Typical Performance – Small Signal

Conditions unless otherwise specified: Vd = +20V, Idq = 140mA, Vg = -3V Typical, CW.

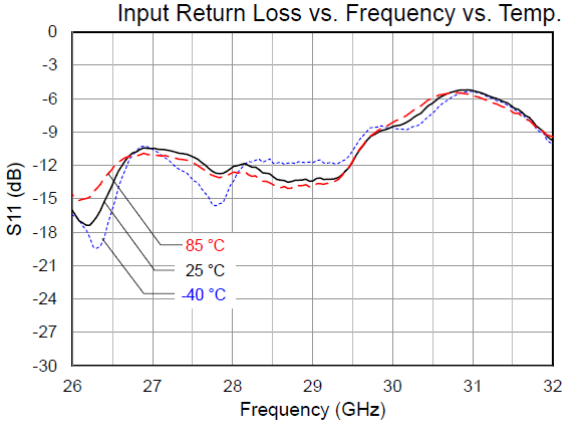
Gain vs. Frequency vs. Temperature



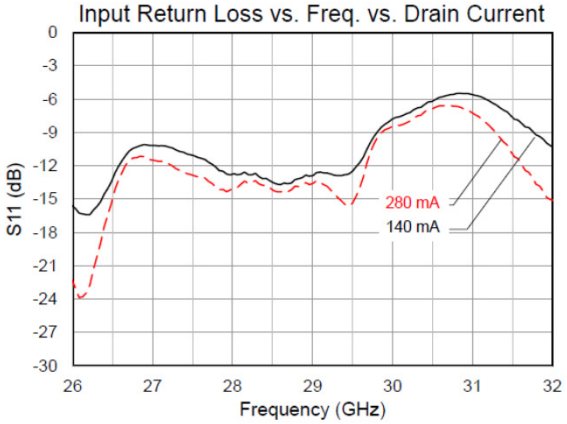
Gain vs. Frequency vs. Drain Current



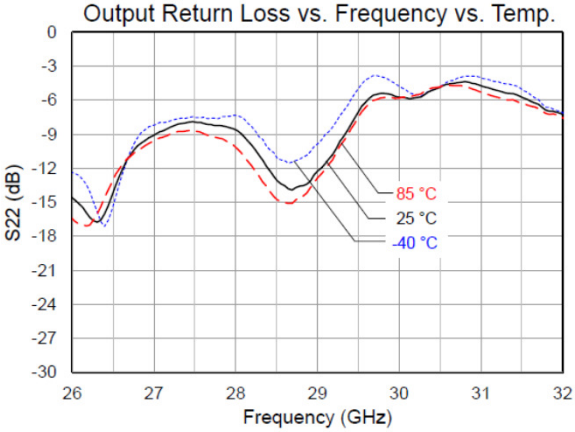
Input Return Loss vs. Frequency vs. Temp.



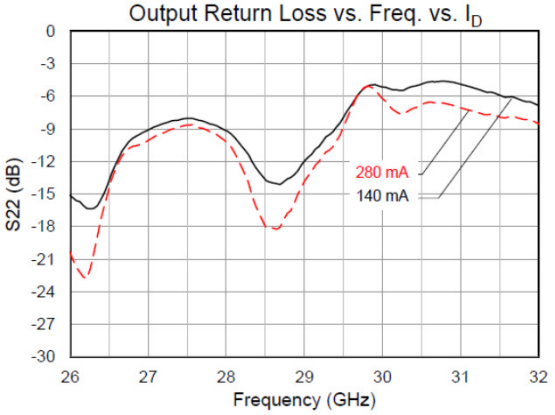
Input Return Loss vs. Freq. vs. Drain Current



Output Return Loss vs. Frequency vs. Temp.

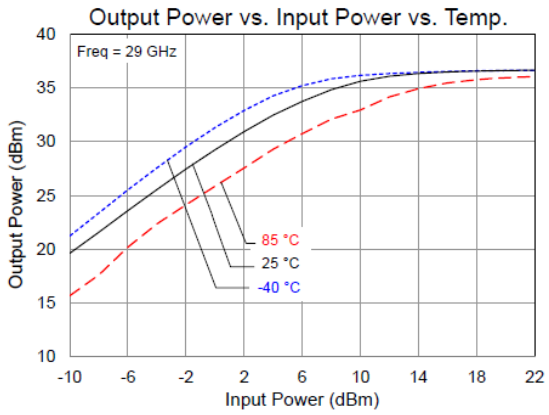


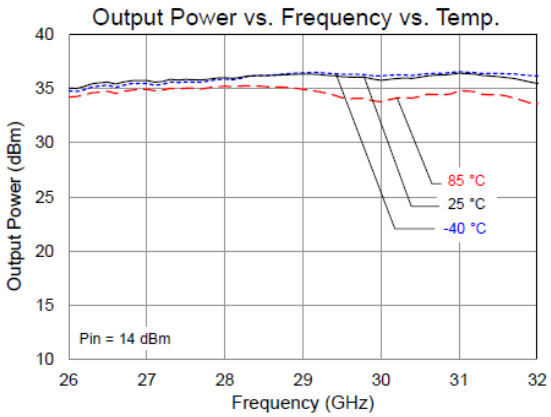
Output Return Loss vs. Freq. vs. I_D

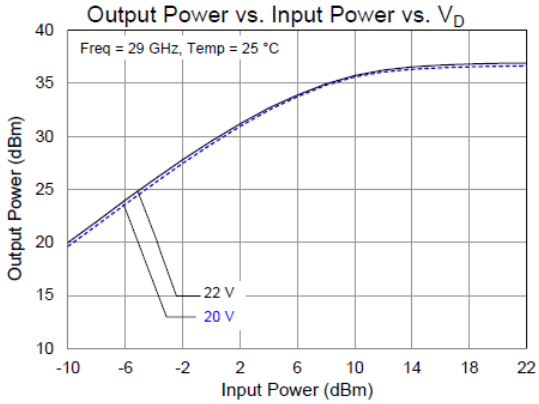


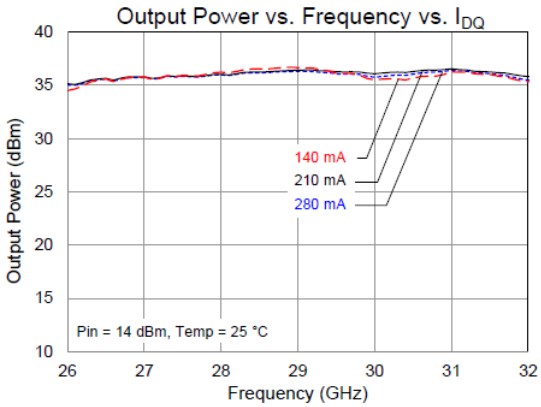
Typical Performance – Large Signal

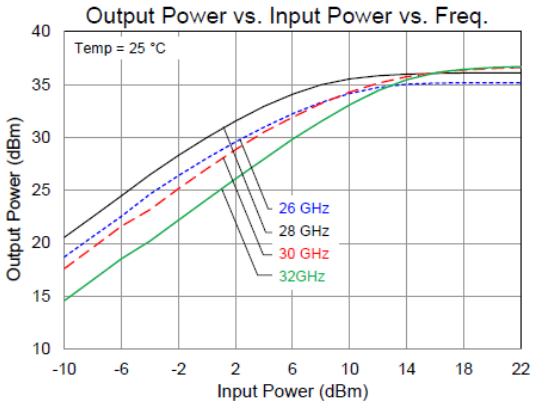
Conditions unless otherwise specified: Vd = +20V, Idq = 140mA, Vg = -3V Typical, CW.





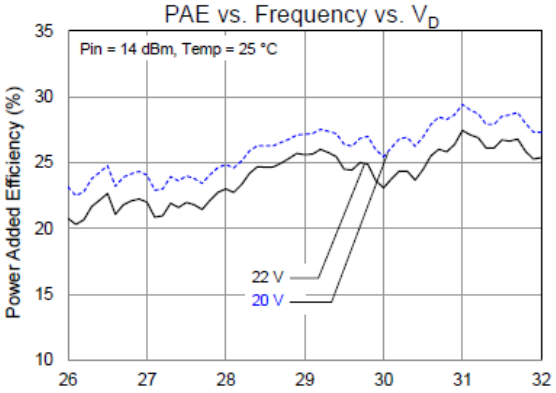


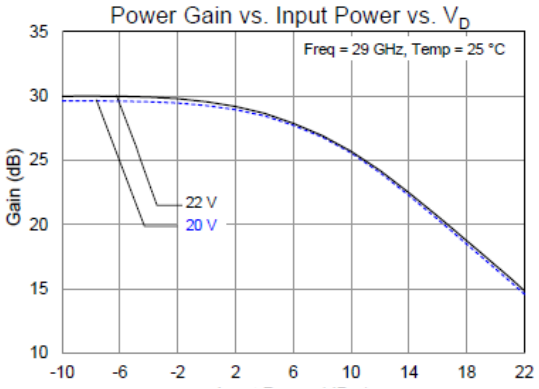


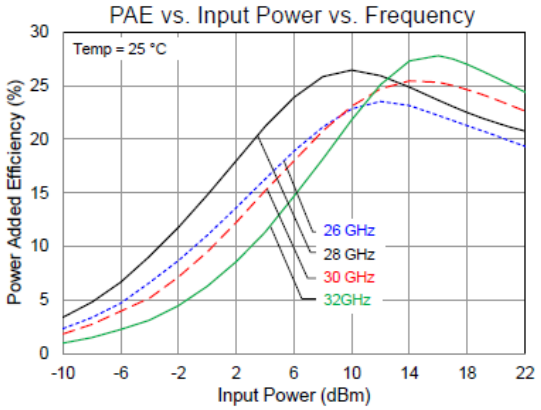


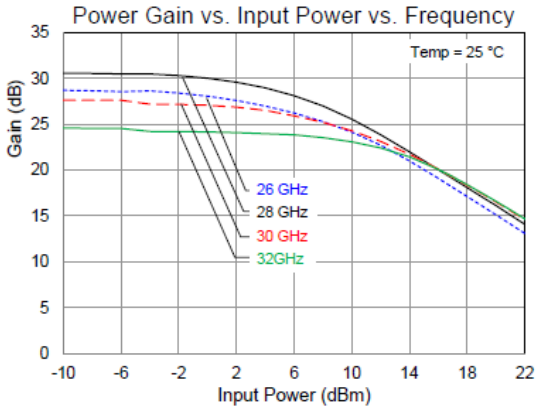
Typical Performance – Large Signal

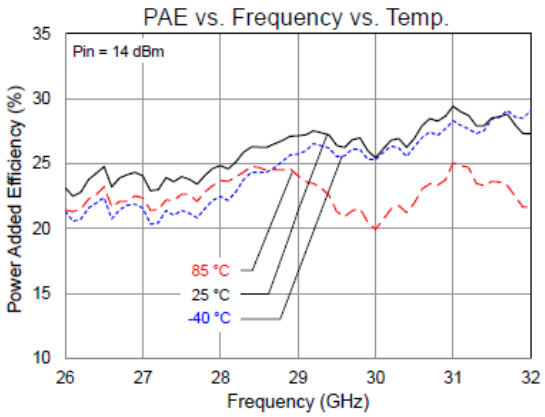
Conditions unless otherwise specified: Vd = +20V, Idq = 140mA, Vg = -3V Typical, CW.

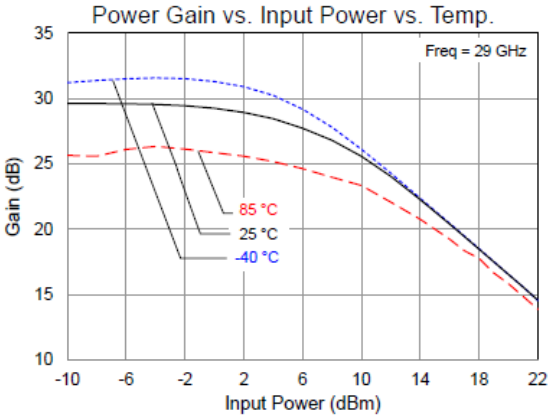






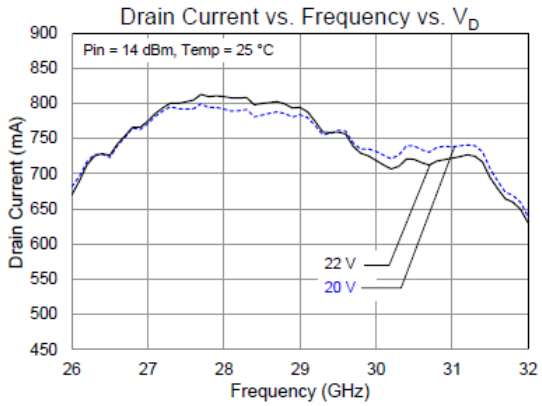


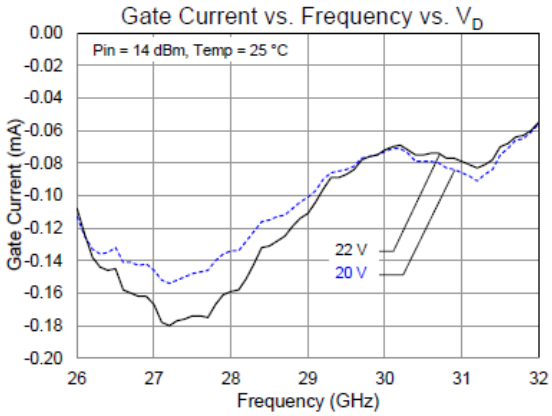


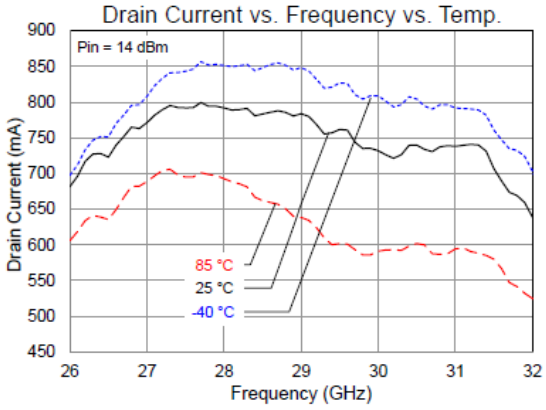


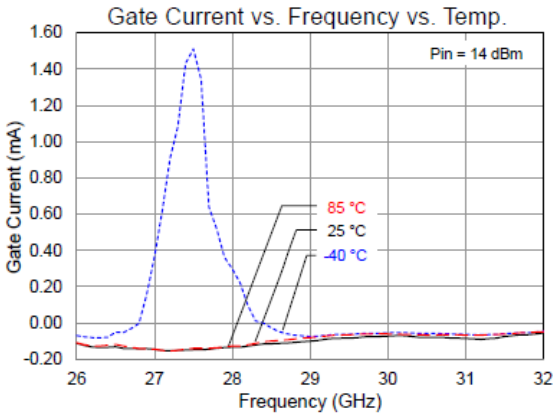
Typical Performance – Small Signal

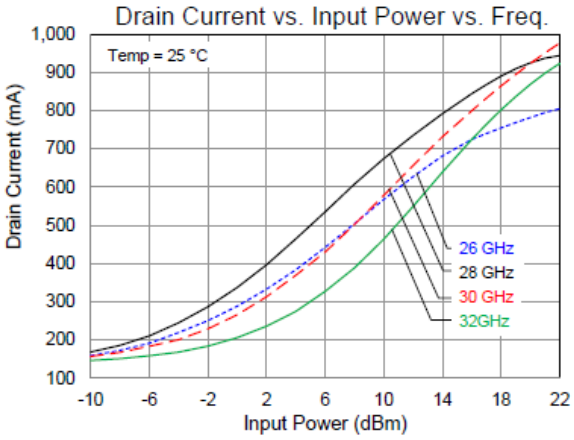
Conditions unless otherwise specified: Vd = +20V, Idq = 140mA, Vg = -3V Typical, CW.

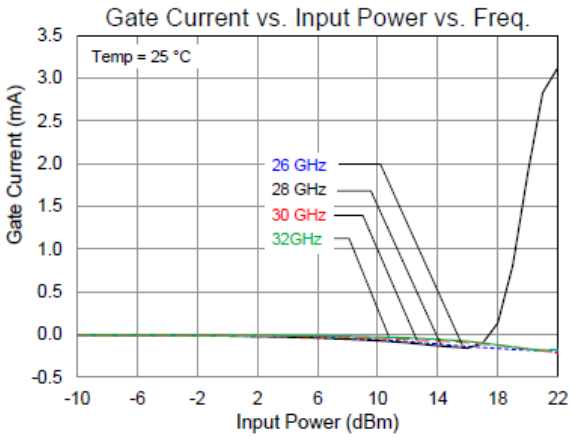






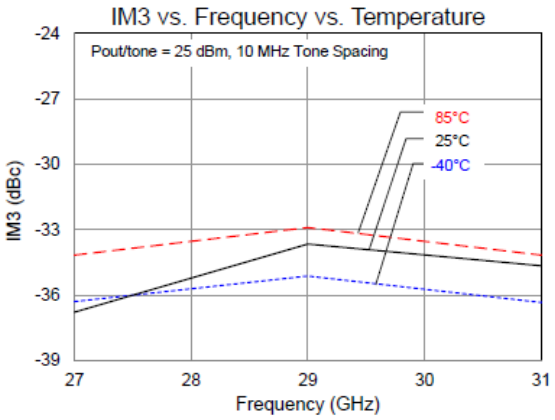


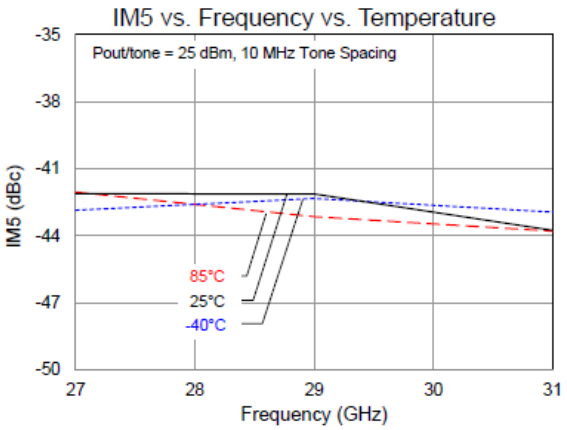


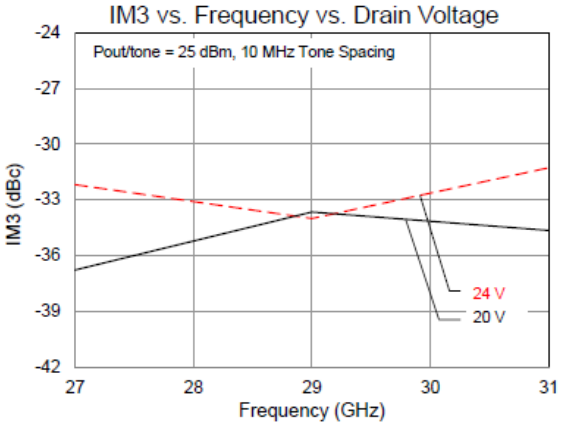


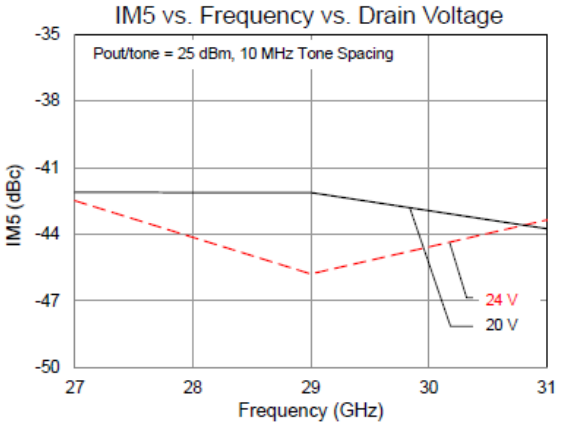
Typical Performance – Large Signal

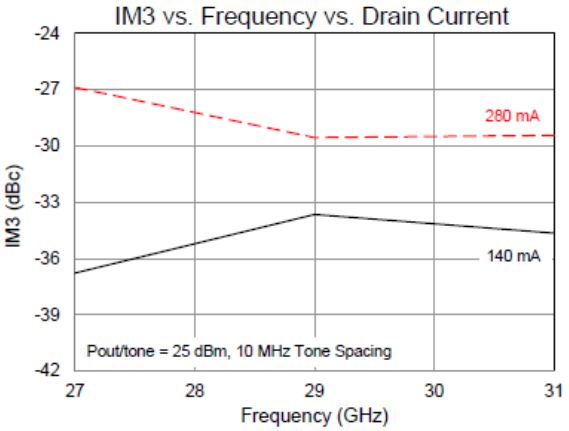
Conditions unless otherwise specified: Vd = +20V, Idq = 140mA, Vg = -3V Typical, CW.

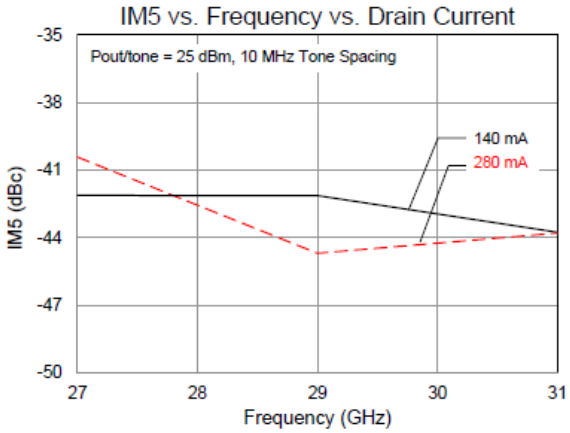




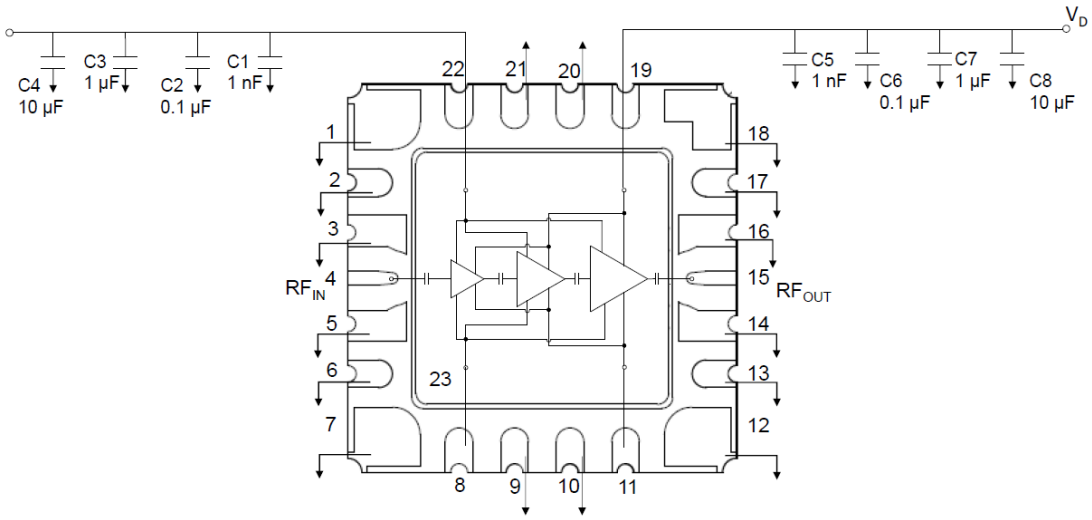






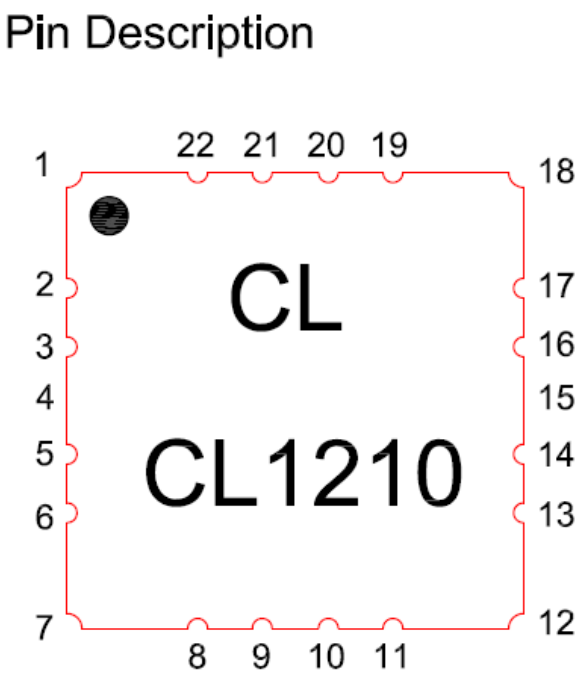


Application Circuit



Bias-Up Procedure	Bias-Down Procedure
Set Id limit to 1.2 A, Ig limit to 10mA	Turn off RF signal
Turn Vg to -5.0V	Reduce Vg to -5.0 V. Ensure Id is approximately 0.0mA
Turn Vd to +20.0 V; Id should be approximately 0.0mA	Turn Vd to 0.0 V
Adjust Vg more positive until Id is 140 ma. Vg should be approximately - 3.0 V typical.	Turn off Vd supply
Apply RF signal	Turn off Vg supply

Pin Description

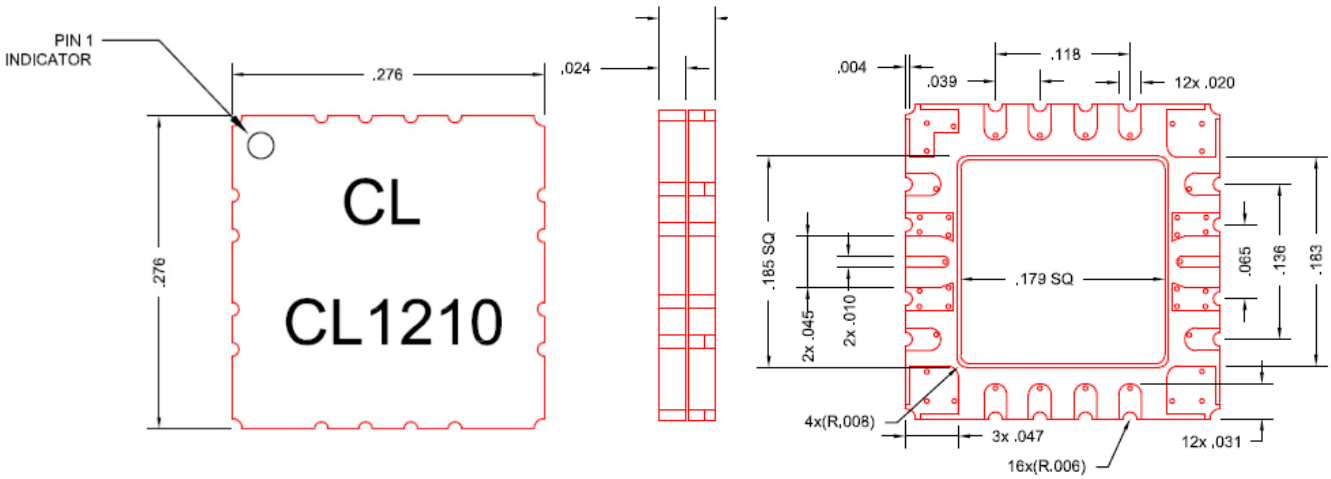


Pin Configuration		
Pin #	Symbol	
1,2,3,5,6,7,9,10,12, 13, 14, 16,17,18,20,21	GND	Connected to Ground
23 (pkg base)	GND	Package Base
4	RF In	Input, matched to 50 ohms, DC blocked
15	RF Out	Output, matched to 50 ohms DC blocked
8 *	Vg1	Gate 1 voltage. Bias network is required
11 *	Vd1	Drain 1 voltage. Bias network is required.
22	Vg2	Gate 2 voltage. Bias network is required
19	Vd2	Drain 2 voltage. Bias network is required.
* Recommended only connecting one pair of Vg/Vd connections.		
Vg1 / Vd1 or Vg2 / Vd2		

Mechanical Information

Package Information and Dimensions

All dimensions in inches and are +/-0.006" unless otherwise noted.

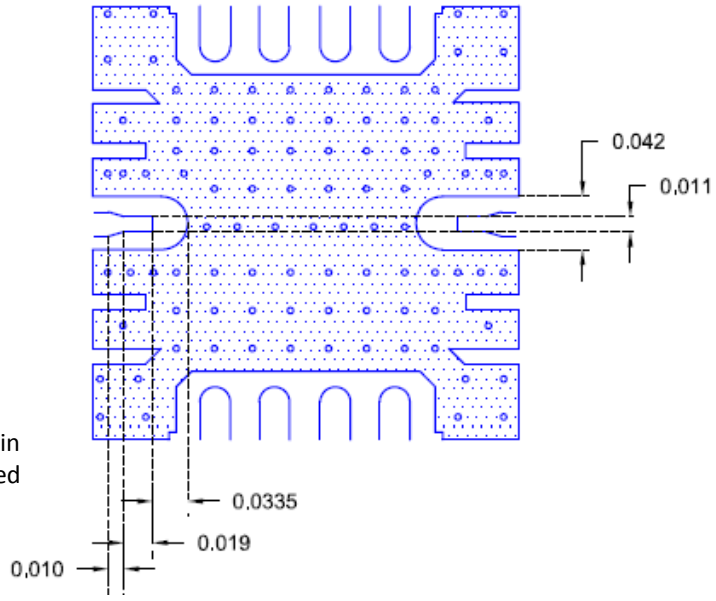


PCB Mounting Pattern

All dimensions in inches

1. The pad pattern shown has been developed and tested for optimized assembly. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.

2. Ground / thermal vias are critical for the proper performance of this device. Vias should use a 0.008in diameter drill, and they are solid filled, copper plated shut or silver filled paste with over plating.



Order Information:

CL1210-X-Y-Z