CGB241

Data Sheet

2-Stage Bluetooth & WLAN InGaP HBT Power Amplifier

Description:

The CGB241 GaAs Power Amplifier MMIC has been especially developed for wireless applications in the 2.4 - 2.5 GHz ISM band (e.g. Bluetooth class 1, or IEEE 802.11b). Its high power added efficiency (typically 50%) and single positive supply operation makes the device ideally suited to handheld applications. The device delivers 22.5 dBm output power at a supply voltage of 3.2 V, with an overall PAE of 50%. The output power can be adjusted using an analog control voltage (V_{CTR}). Simple external input-, interstage-, and output matching circuits are used to adapt to the different requirements of linearity and harmonic suppression in various applications.

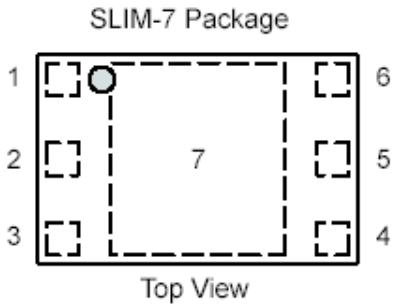
Features:

- 2-stage Bluetooth InGaP HBT power amplifier
- Single voltage supply
- Wide operating voltage range 2.0 - 5.5 V
- P_{OUT} = 22.5 dBm at V_C = 3.2 V
- Overall power added efficiency (PAE) typically 50%
- Analog power control with four power steps
- High PAE at low–power mode
- High harmonic suppression typ. 35 dBc
- Easy external matching concept
- Thin Small Leadless Package (A = 2.6mm^2)

Applications:

- Bluetooth Class 1
- Home RF
- Cordless Phones
- IEEE 802.11b
- ISM-band Spread Spectrum

Package Outline:



Pin Configuration:

1:	Vc1
2:	RFin
3:	NC
4:	Vcntrl1
5:	Vcntrl2
6:	Vc2
7 (paddle):	GND

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Absolute Maximum Ratings

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Max. Supply Voltage	$V_{CC,MAX}$	0	5.5	V
Max. Control Voltage	$V_{CTR,MAX}$	0	3.2	V
Max. Current Stage 1	$I_{C1,MAX}$	0	40	mA
Max. Current Stage 2	$I_{C2,MAX}$	0	160	mA
Max. Total Power Dissipation [1])	P_{TOT}		0.5	W
Max. RF Input Power [2])	$P_{IN,MAX}$		+10	dBm
Channel Temperature [1])	T_{Ch}		150	°C
Storage Temperature	T_{Stg}	- 55	150	°C

[1]) Thermal resistance between junction and pad 7 (= heatsink): R_{THCH} = 100 K/W.
[2]) No RF input signal should be applied at turn on of DC Power. An output VSWR of 1:1 is assumed.

Typical Electrical Characteristics in CGB241 Reference Design

T_A = 25 °C; V_{CC} = 3.2 V; f = 2.4 ... 2.5 GHz; Z_{IN} = Z_{OUT} = 50 Ohms

Parameter	Symbol	Limit Values			Unit	Test Conditions
		min	typ	max		
Supply Current Small-Signal Operation	$I_{CC,SS}$		120	150	mA	P_{IN} = - 10 dBm V_{CTR} = 2.5 V
Power Gain Small-Signal Operation	G_{SS}	24	26		dB	P_{IN} = - 10 dBm V_{CTR} = 2.5 V
Output Power Power Step 1	$P_{OUT,1}$		3		dBm	P_{IN} = + 3 dBm V_{CTR} = 1.15 V
Supply Current Power Step 1	$I_{CC,1}$		15		mA	P_{IN} = + 3 dBm V_{CTR} = 1.15 V
Power Added Efficiency Power Step 1	PAE_1		7		%	P_{IN} = + 3 dBm V_{CTR} = 1.15 V
Output Power Power Step 2	$P_{OUT,2}$		12		dBm	P_{IN} = + 3 dBm V_{CTR} = 1.3 V
Supply Current Power Step 2	$I_{CC,2}$		30		mA	P_{IN} = + 3 dBm V_{CTR} = 1.3 V
Power Added Efficiency Power Step 2	PAE_2		15		%	P_{IN} = + 3 dBm V_{CTR} = 1.3 V

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Electrical Characteristics in CGB241 Reference Design (cont.)

Parameter	Symbol	Limit Values			Unit	Test Conditions
		Min	typ	max		
Output Power Power Step 3	$P_{OUT,3}$		17		dBm	P_{IN} = + 3 dBm V_{CTR} = 1.5 V
Supply Current Power Step 3	$I_{CC,3}$		52		mA	P_{IN} = + 3 dBm V_{CTR} = 1.5 V
Power Added Efficiency Power Step 3	PAE_3		30		%	P_{IN} = + 3 dBm V_{CTR} = 1.5 V
Output Power Power Step 4	$P_{OUT,4}$	22.0	22.5		dBm	P_{IN} = + 3 dBm V_{CTR} = 2.5 V
Supply Current Power Step 4	$I_{CC,4}$		130	170	mA	P_{IN} = + 3 dBm V_{CTR} = 2.5 V
Power Added Efficiency Power Step 4	PAE_4	40	50	-	%	P_{IN} = + 3 dBm V_{CTR} = 2.5 V
2nd Harm. Suppression Power Step 4	h_2		- 35	-10	dBc	P_{IN} = + 3 dBm V_{CTR} = 2.5 V
Turn-Off Current	$I_{CC,OFF}$		0.5		uA	V_{CC} = n/c V_{CTR} < -2.0 V No RF Input
Off-State Isolation	$S_{21,0}$		26		dB	P_{IN} = + 3 dBm V_{CTR} = 0 V
Stable Load VSWR (no oscillation for any phase of load)	$VSWR$			6		P_{IN} = + 3 dBm V_{CC} = 3.2 V V_{CTR} = 2.5 V Z_{IN} = 50 Ohms
Maximum Load VSWR (no damage to device) allowed for 10s RF must not be applied before DC is turned on !	$VSWR$			6		P_{IN} = + 5 dBm V_{CC} = 4.8 V V_{CTR} = 2.5 V Z_{IN} = 50 Ohms

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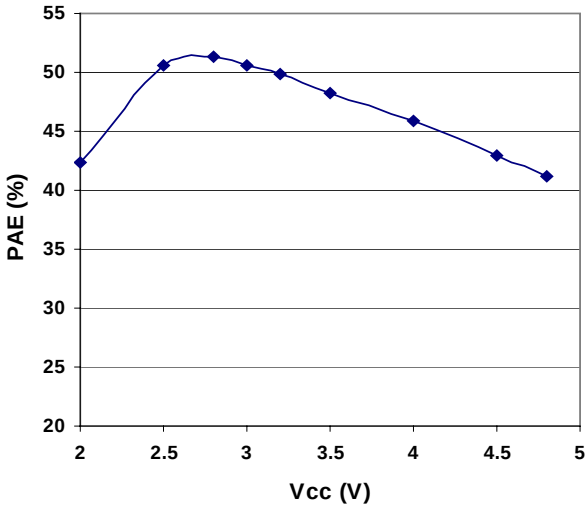
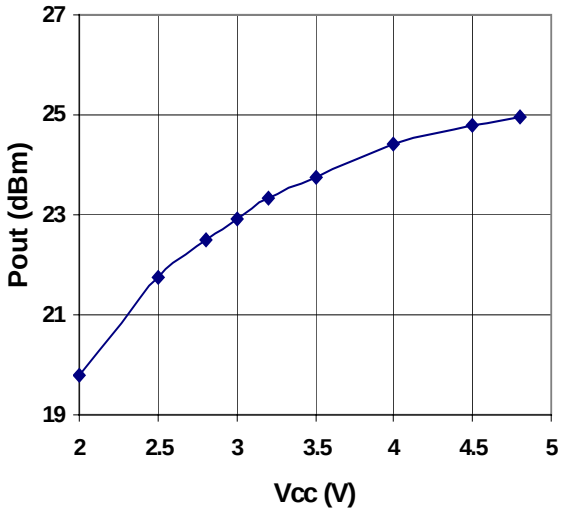
Typical Device Performance

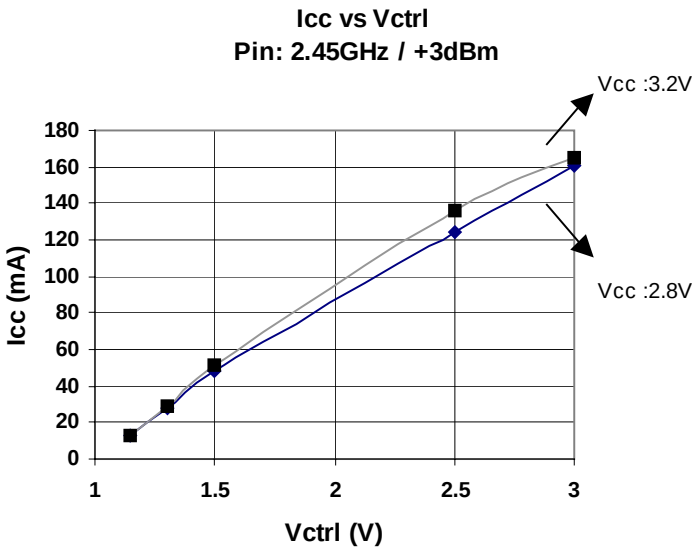
PAE versus Vcc
Vcntrl: 2.5V; Pin: +3 dBm @ 2.45 GHz



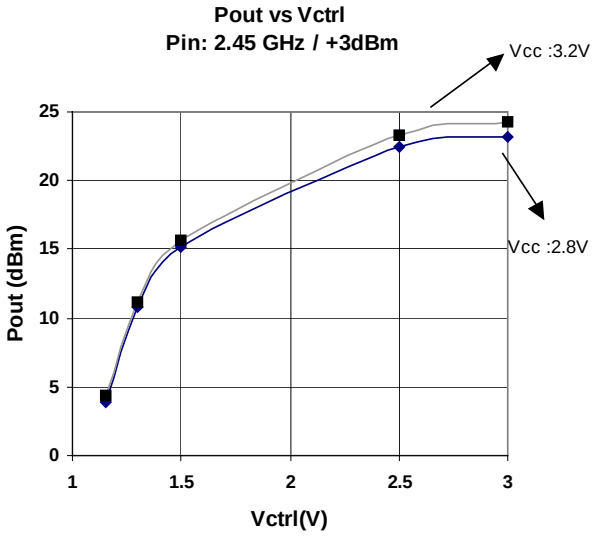
Pout versus Vcc
Vcntrl: 2.5V; Pin: +3 dBm @ 2.45 GHz



Supply Current $I_{CC} = f(V_{CTR})$



Output Power $P_{OUT} = f(V_{CTR})$



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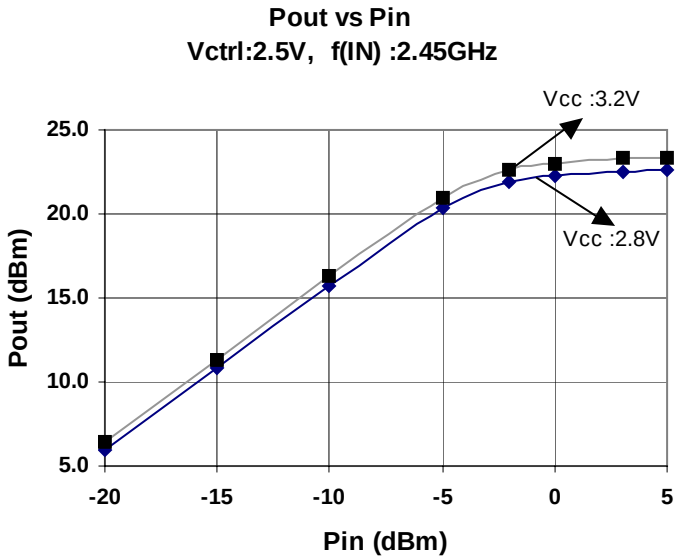
Output Power Compression $P_{OUT} = f\ (\ P_{IN}\ )$



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Pinning

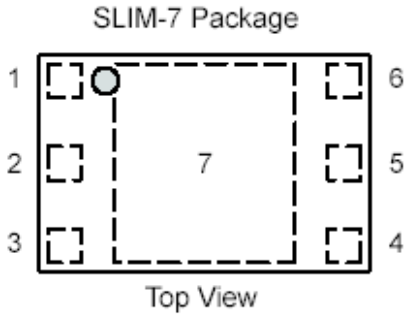

Figure 1 CGB241 Outline: SLIM-7 Package

Pad	Symbol	Function
1	V_{C1}	Supply voltage of 1st stage / interstage match
2	RF_{IN}	RF input
3	NC	No connection; It is recommended to ground this pad as short as possible e.g. by a via under the pad.
4	V_{CTR1}	Control voltage 1st stage
5	V_{CTR2}	Control voltage 2nd stage
6	V_{C2}	Supply voltage of 2nd stage / RF output
7	GND	RF and DC ground (pad located on backside of package) Heatsink. Thermal resistance between junction – pad 7: R_{THCH} = 100 K/W.

Functional Diagram

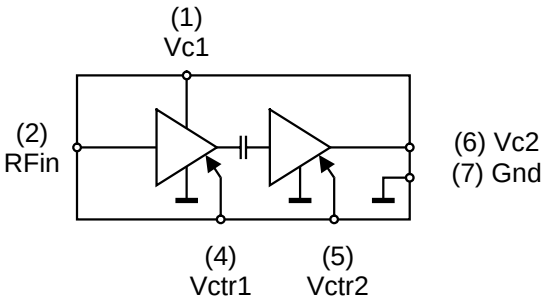

Figure 2 CGB241 Functional Diagram

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Application Note 1: CGB241 Reference Design

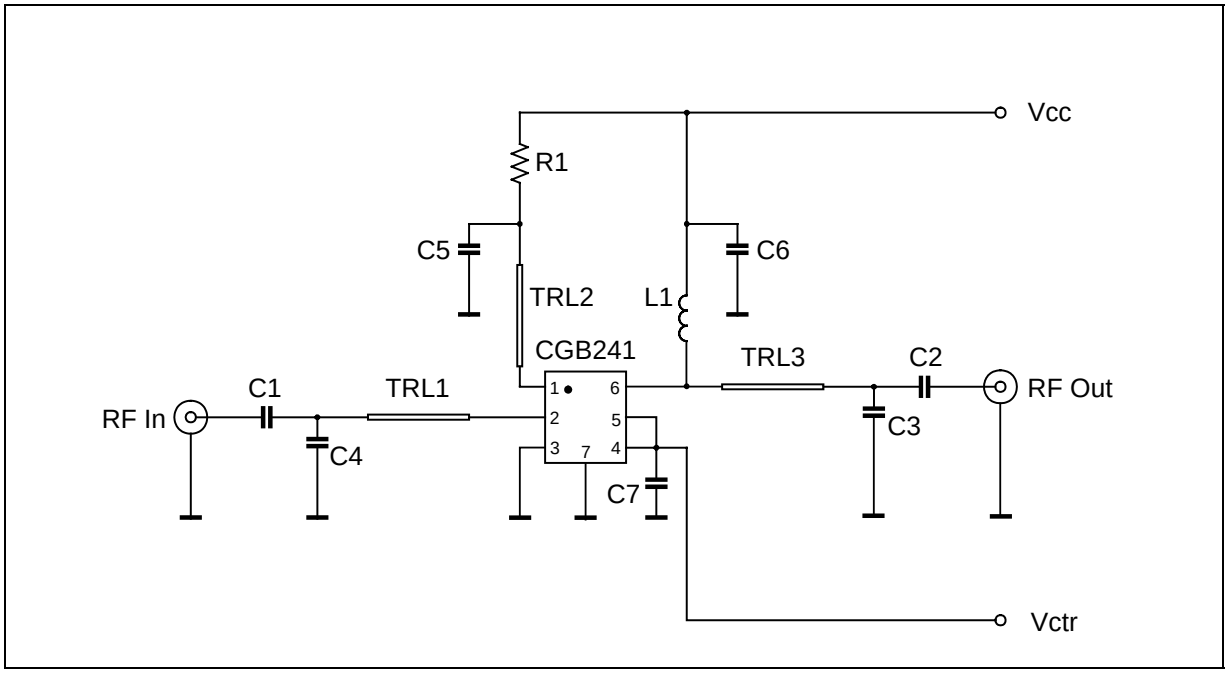

Figure 3 Schematic of CGB241 reference design.

Part	Type	Value	Outline	Source	Part No.
C1	Cer. Capacitor	22 pF	0402	Murata COG	
C2	Cer. Capacitor	22 pF	0402	Murata COG	
C3 [4])	Cer. Capacitor	1.5 pF	0603	AVX ACCU-P	06035J1R5BBT
C4	Cer. Capacitor	2.2 pF	0402	Murata COG	
C5	Cer. Capacitor	10 pF	0402	Murata COG	
C6	Cer. Capacitor	1 µF	0603	Murata X7R	
C7	Cer. Capacitor	1 nF	0402	Murata X7R	
L1	Inductor	22 nH	0603	Toko	LL1608–FS
R1	Resistor	10 R	0402	Mira	
TRL1	Microstrip Line	FR4 substrate; h = 0,2 mm; w = 0,32 mm			
TRL2	Microstrip Line	FR4 substrate; h = 0,2 mm; w = 0,32 mm			
TRL3	Microstrip Line	FR4 substrate; h = 0,2 mm; w = 0,32 mm			

[4]) Cost optimization might take place by using lower-Q AVX-CU capacitors instead of the AccuP version. This will lead to better h_2 performance, however resulting in a loss of about 2% PAE. Line length l is the total distance from the corner of tuning capacitor to the corner of MMIC's package. Length of bend structures measured in the middle of the corresponding conductor.

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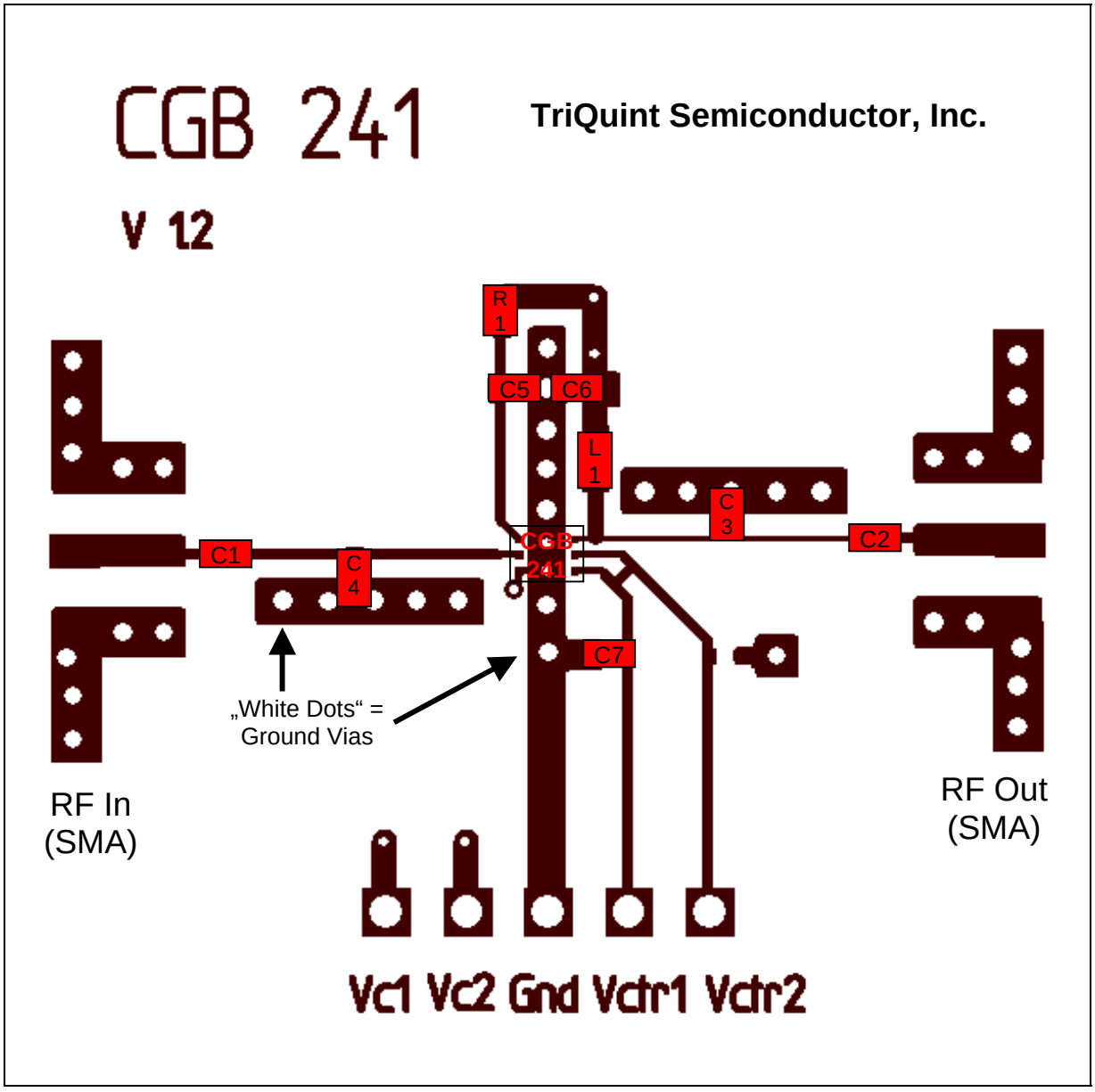


Figure 4 **Layout of CGB241 reference design.**

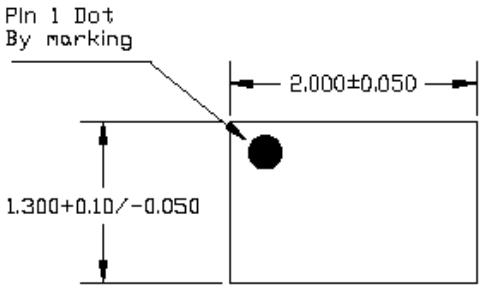
Notes:

Vc1 and Vc2 are connected together on the PCB.

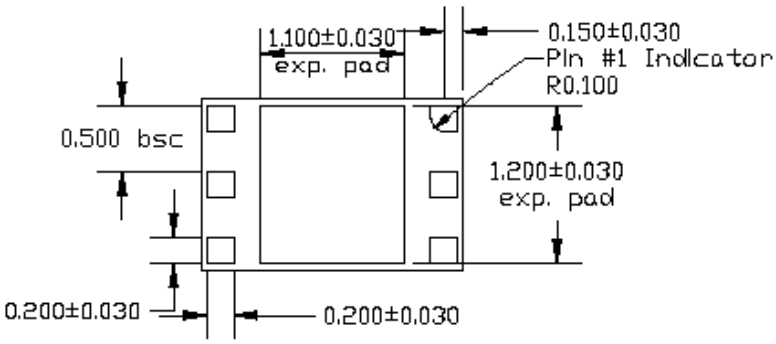
Vctr1 and Vctr2 are connected together on the PCB.

2-Stage Bluetooth & WLAN InGaP HBT Power Amplifier

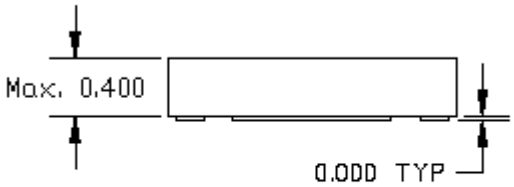
Package Outline of SLIM-7 Package



Top View



Bottom View



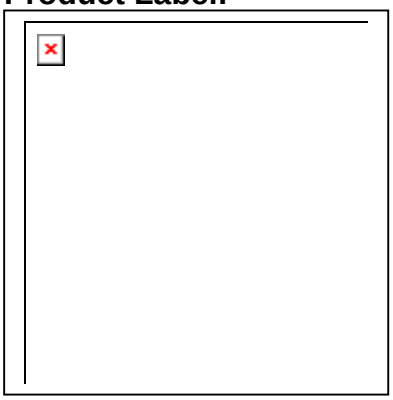
Side View

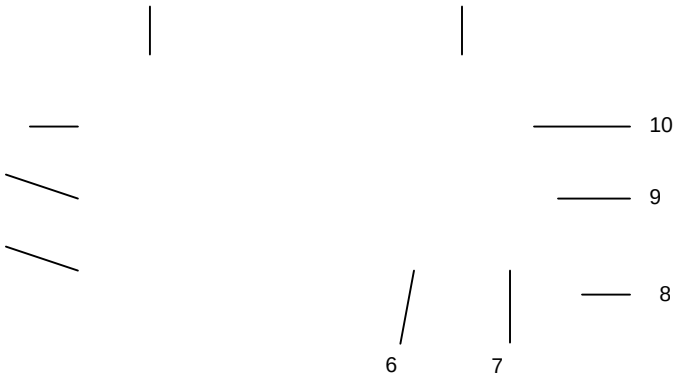
2-Stage Bluetooth & WLAN InGaP HBT Power Amplifier

Part Marking:

White Ink or Laser Mark; XXXX = last 4 digits of lot code.

Product Label:





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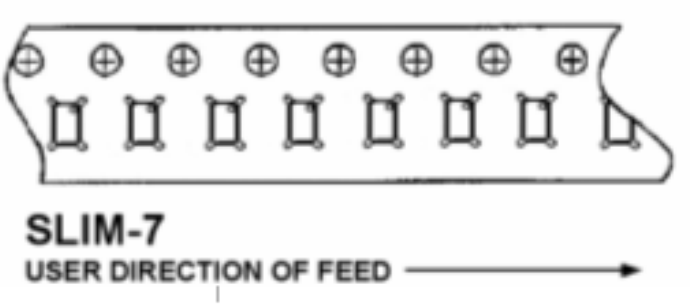
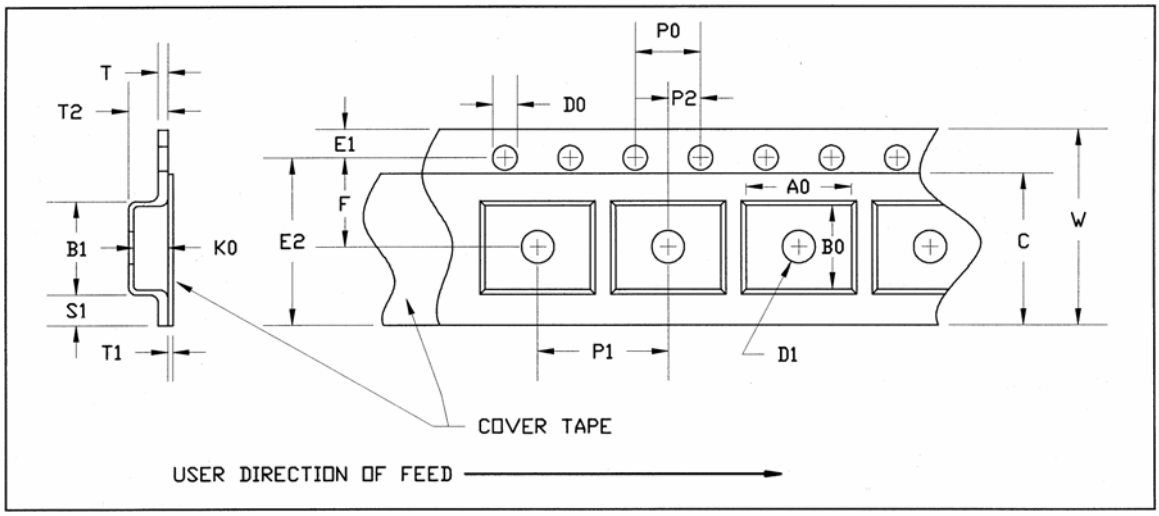
Tape and Reel Information:

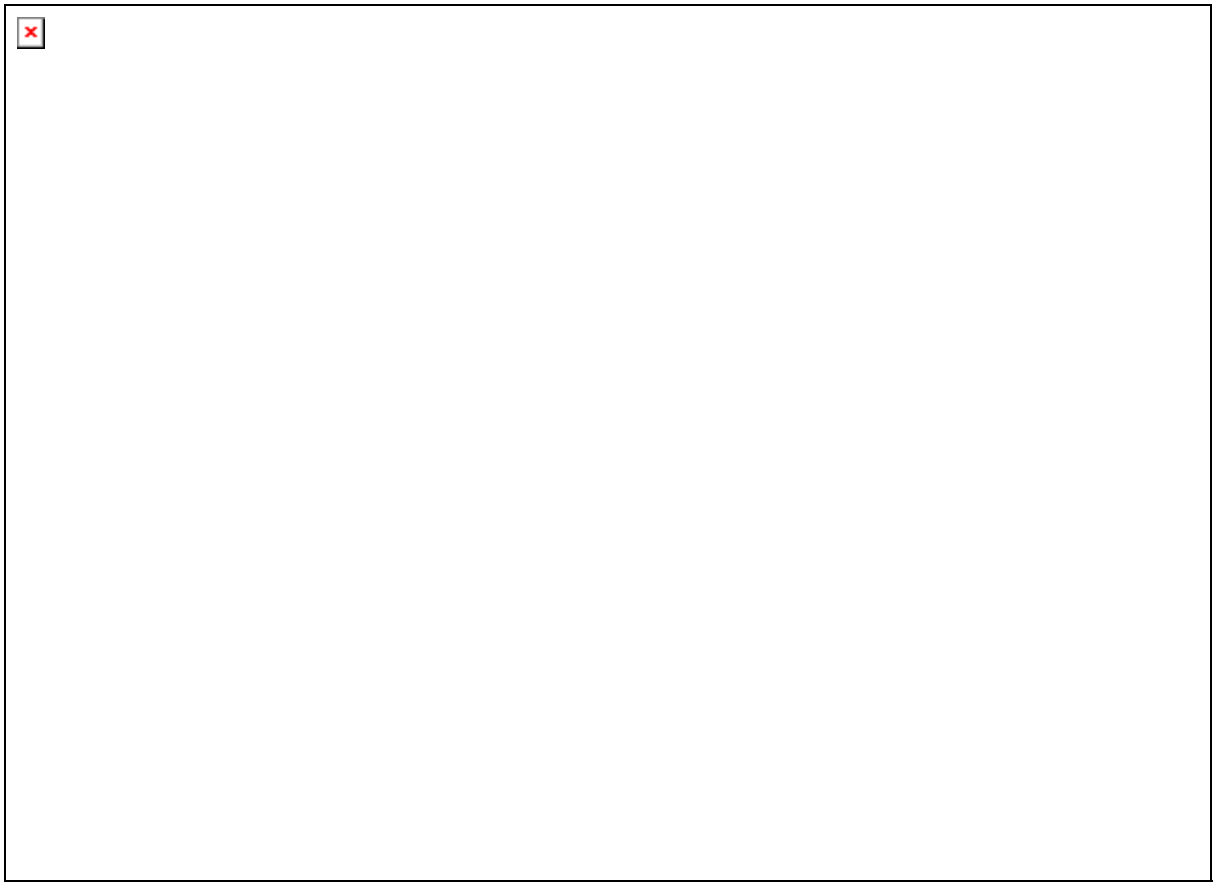




PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
CAVITY	LENGTH	A0	0.062	1.57
	WIDTH	B0	0.087	2.21
	DEPTH	K0	0.023	0.59
	PITCH	P1	0.157	4.00
DISTANCE BETWEEN CENTERLINE	CAVITY TO PERFORATION LENGTH DIRECTION	P2	0.079	2.00
	CAVITY TO PERFORATION WIDTH DIRECTION	F	0.138	3.50
COVER TAPE	WIDTH	C	0.213	5.40
CARRIER TAPE	WIDTH	W	0.315	8.00

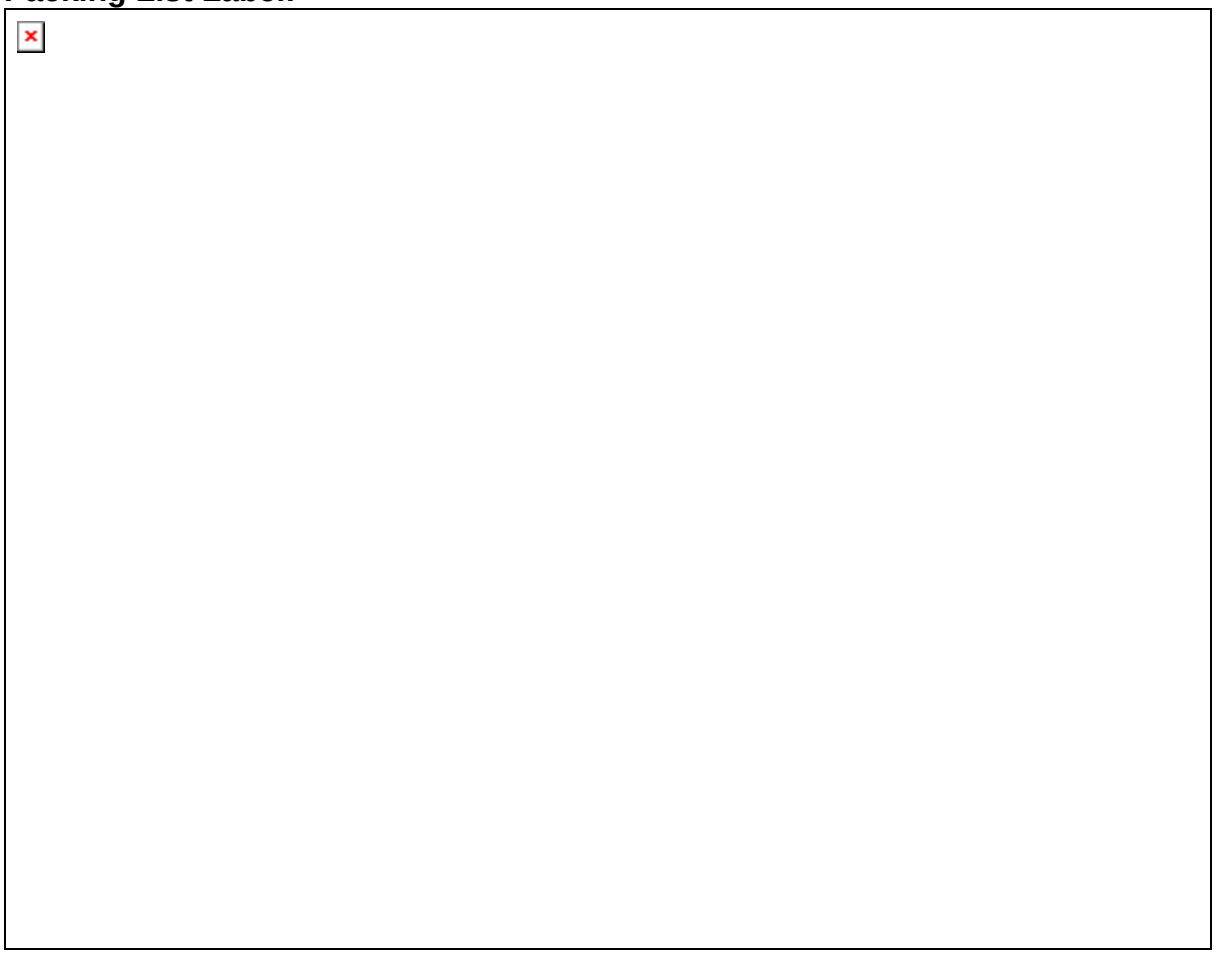
2-Stage Bluetooth & WLAN InGaP HBT Power Amplifier

Carton Label:



2-Stage Bluetooth & WLAN InGaP HBT Power Amplifier

Packing List Label:



CGB241

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Ordering Information:

Type	Marking	Package
CGB241	XXXX	SLIM-7

ESD: **E**lectro**s**tatic **d**ischarge sensitive device
Observe handling precautions!

Moisture: The CGB241 is rated Moisture Sensitivity Level 1 at 260ºC per JEDEC Standard IPC/JEDEC J-STD-020.

RoHS: The CGB241 is compliant with RoHS Directive (Restrictions on the use of certain Hazardous Substances in Electrical and Electronic Equipment).

Additional Information

For latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

Web: www.triquint.com Tel: (503) 615-9000
Email: info_wireless@tqs.com Fax: (503) 615-8902

For technical questions and additional information on specific applications:

Email: info_wireless@tqs.com

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