TriQuint SEMICONDUCTOR

CGB 241
Datasheet

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)

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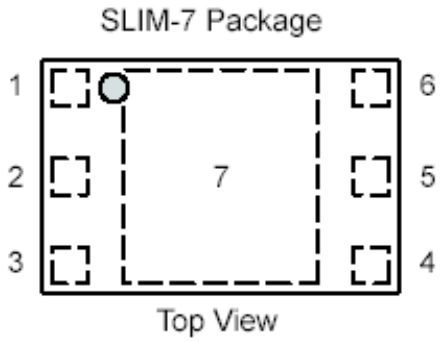
Applications:

- 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

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

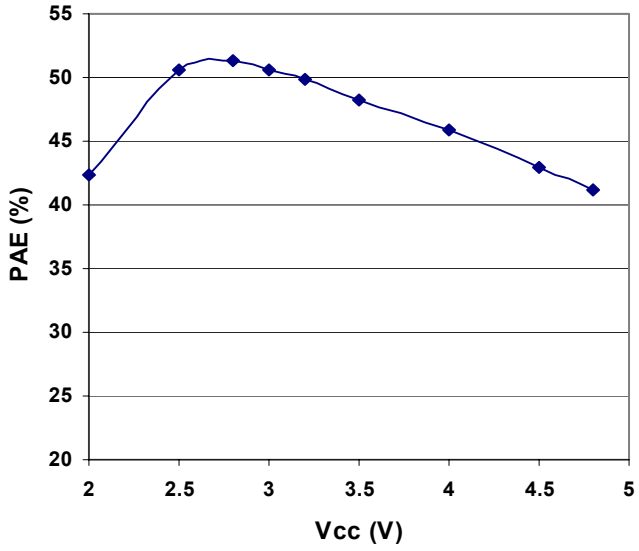
Electrical Characteristics in CGB241 Reference Design (cont.)

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		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		dBc	P_{IN} = + 3 dBm V_{CTR} = 2.5 V
Turn-Off Current	$I_{CC,OFF}$		1		uA	V_{CC} = 3.2 V V_{CTR} < 0.4 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

Typical Device Performance

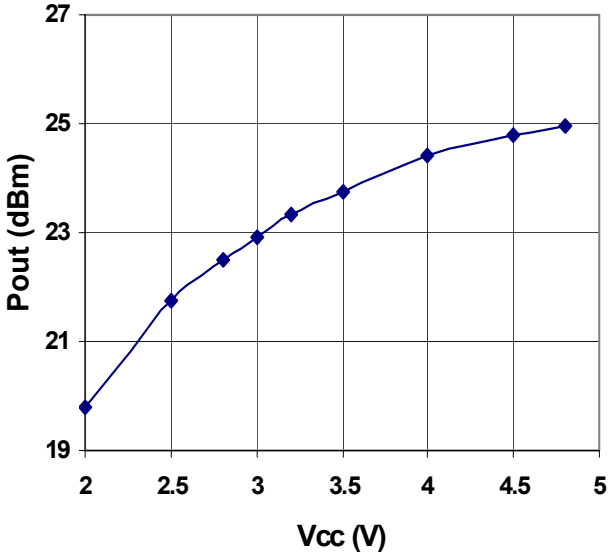
PAE versus Vcc

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

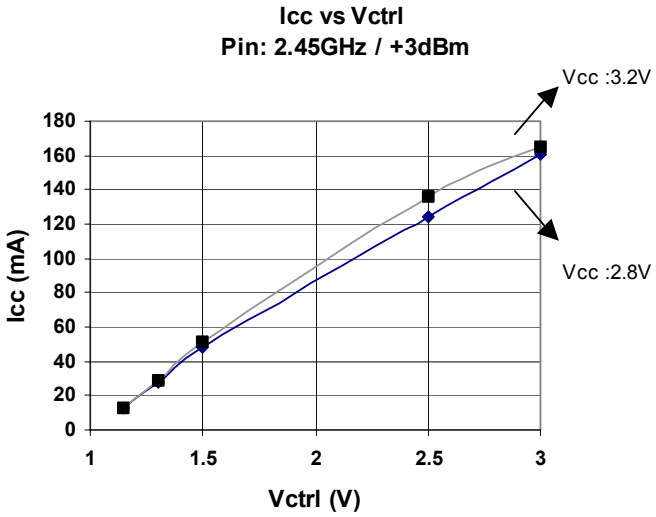


Pout versus Vcc

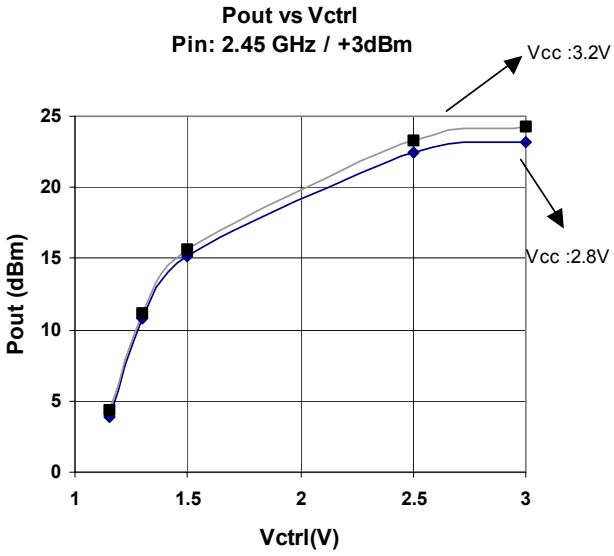
Vcntrl: 2.5V; Pin: +3dBm @ 2.45GHz



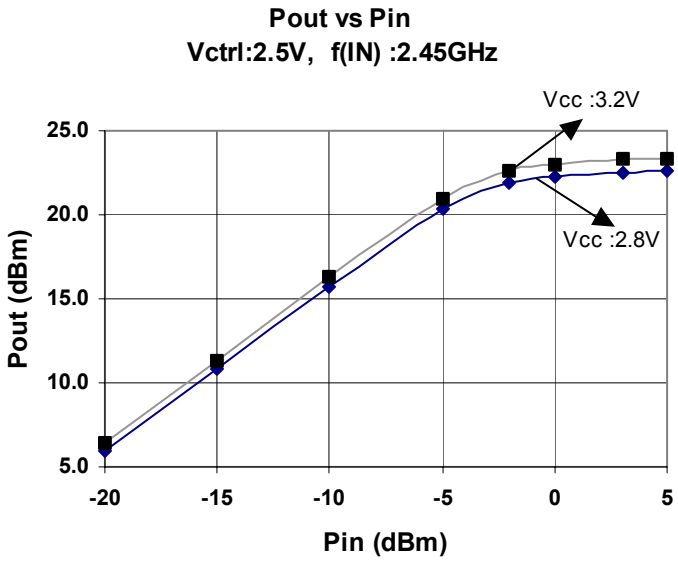
Supply Current $I_{CC} = f(V_{CTR})$



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



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



Pinning

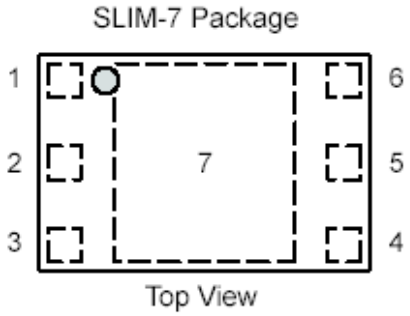


Figure 1 CGB241 Outline: SLIM-7 Package

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

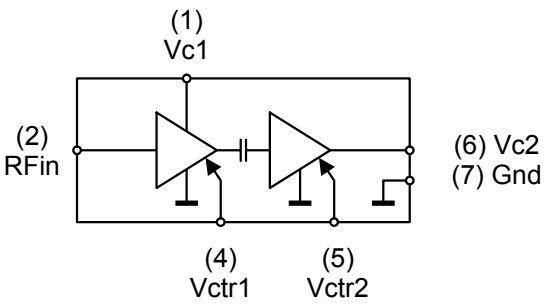


Figure 2 CGB241 Functional Diagram

Application Note 1: CGB241 Reference Design

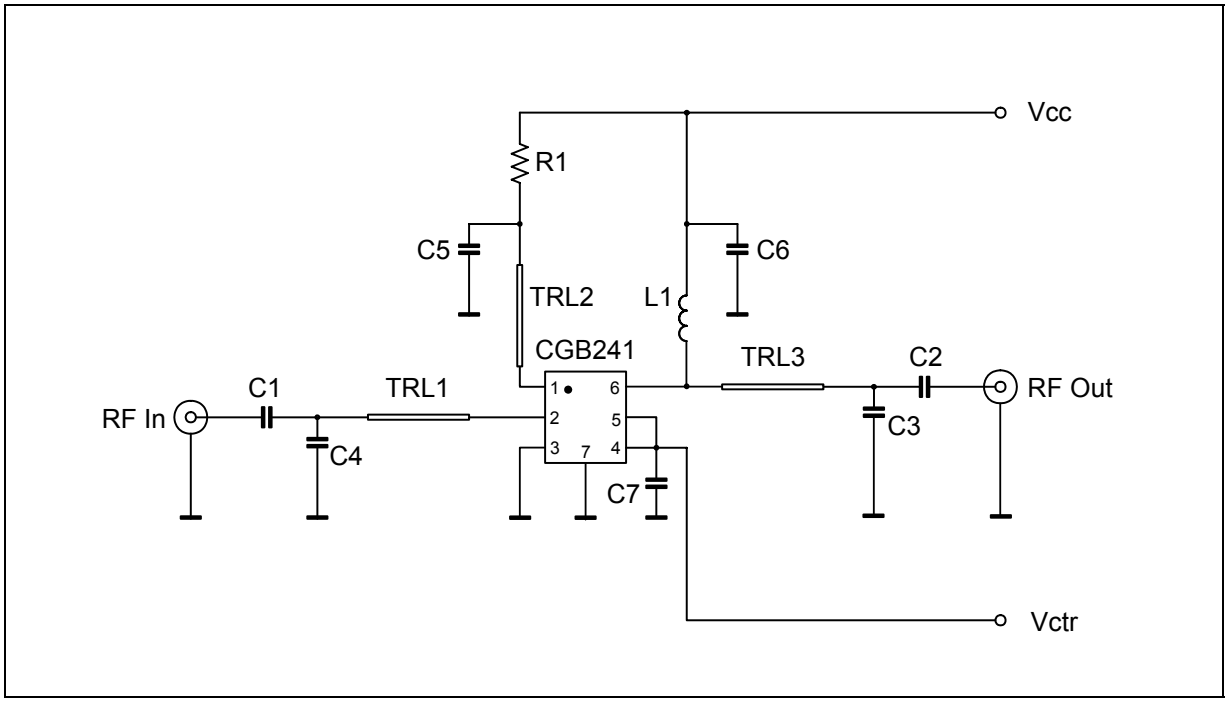


Figure 3 Schematic of CGB241 reference design.

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 Ω	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.

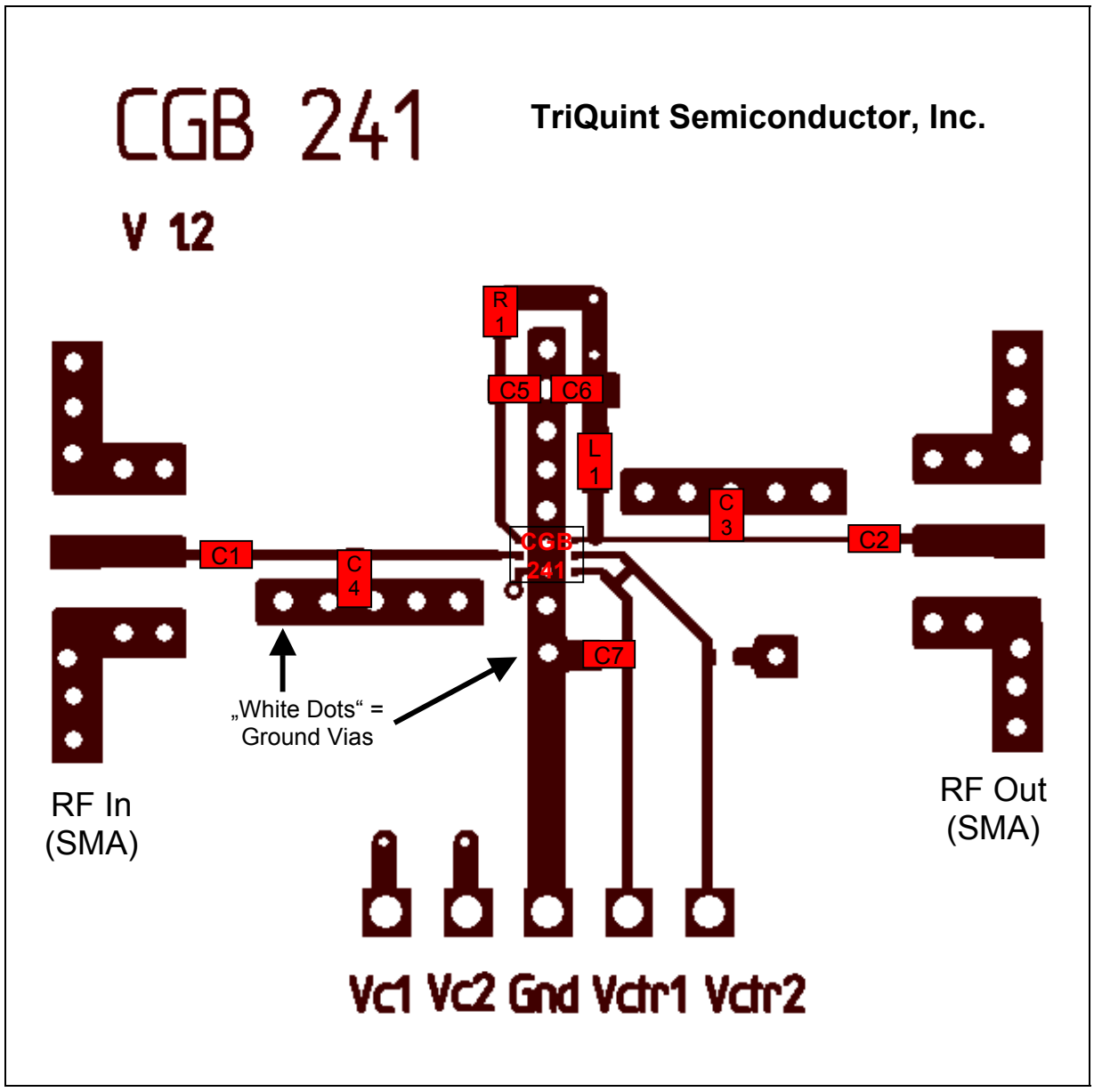


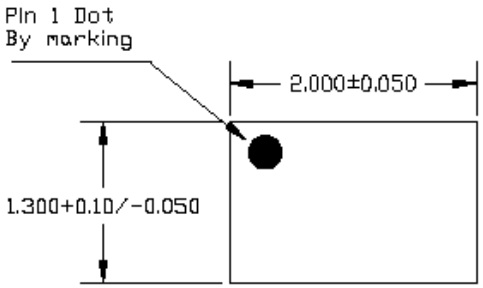
Figure 4 Layout of CGB241 reference design.

Notes:

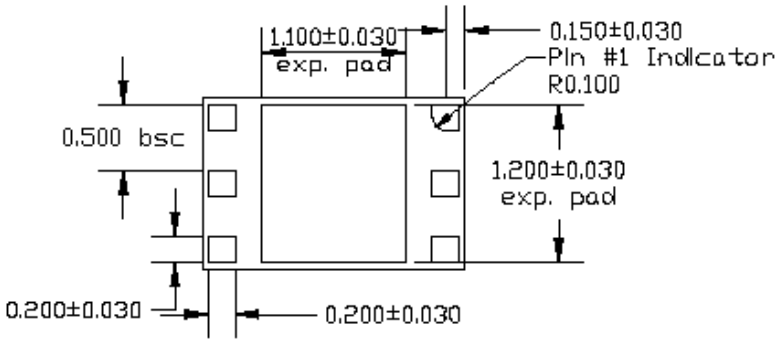
Vc1 and Vc2 are connected together on the PCB.

Vctr1 and Vctr2 are connected together on the PCB.

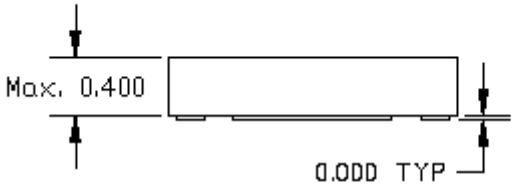
Package Outline of SLIM-7 Package



Top View



Bottom View



Side View

Part Marking:

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

Ordering Information:

Type	Marking	Ordering Code	Package
CGB241	XXXX	t.b.d.	SLIM-7

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

Additional Information

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

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