

BG1V2RHA 1.215V Bandgap Voltage Reference

Introduction

BG1V2RHA is a radiation hardened bandgap that delivers a 1.215V voltage reference. It is a trimless voltage reference, achieving a 90 ppm/°C maximum temperature variation over -55°C to 145°C range.

Table 1. General Characteristics

Parameter	Value
Supply voltage	3.3V
Placement	Core
Height	319.2 μm
Width	487.2 μm
Area	0.156 mm^2

Figure 1. Pin Diagram

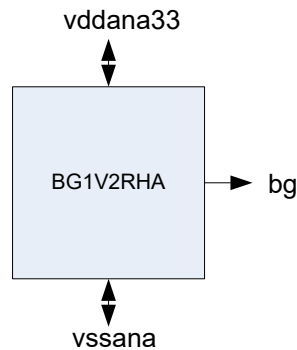


Table of Contents

Introduction.....	1
1. Pin Description.....	3
2. Specifications.....	4
3. Radiation Hardness.....	5
4. Typical Application.....	6
5. Testability Requirements.....	7
6. Integration Guidelines.....	8
6.1. Placement and General Rules.....	8
6.2. Supplies Routing and Decoupling.....	8
6.3. Analog Signals Routing.....	8
6.4. Routing Constraints.....	8
7. Revision History.....	9
The Microchip Website.....	10
Product Change Notification Service.....	10
Customer Support.....	10
Microchip Devices Code Protection Feature.....	10
Legal Notice.....	10
Trademarks.....	11
Quality Management System.....	11
Worldwide Sales and Service.....	12

1. Pin Description

The pinout details for the BG1V2RHA bandgap voltage reference are listed in the following table.

Table 1-1. Pinout

Pin Name	I/O	Related Supply	Description
bg	O	vddana33	Analog bandgap voltage
vddana33	power	—	Analog power supply
vssana	ground	—	Analog ground supply

2. Specifications

The following table lists the electrical characteristics of BG1V2RHA over operating temperature range ($T_J = -55^{\circ}\text{C}$ to 145°C), $V_{IN} = 3.3\text{V}$, and $C_L = 470\text{ nF}$, unless otherwise noted.

The typical values are at $T_J = 25^{\circ}\text{C}$.

Table 2-1. Electrical Characteristics

Parameter		Test Conditions	Min	Typ	Max	Unit
VDDA33	Supply voltage		2.25	3.3	3.6	V
C_{load}	Load capacitance				10	pF
V_{bg}	Output voltage		1.206	1.216	1.226	V
I_{gnda}	Current consumption	After startup, no load		50	80	μA
t_{start}	Startup time	After VDDA33 is in specs			200	μs
T_{co}	Temperature coefficient	$-55^{\circ}\text{C} < T_J < 145^{\circ}\text{C}$			90	ppm/ $^{\circ}\text{C}$
ΔV_{bg}	Line regulation	$2.25\text{V} < VDDA33 < 3.6\text{V}$			3	mV/V
PSRR	Power supply rejection ratio	DC to 100 Hz	35			dB
		10 kHz to 100 kHz	20			dB
		DC to 100 Hz, $C_{load} = 10\text{ pF}$	35			dB
		10 kHz to 100 kHz, $C_{load} = 10\text{ pF}$	20			dB

3. Radiation Hardness

The following table lists the radiation performance characteristics of BG1V2RHA.

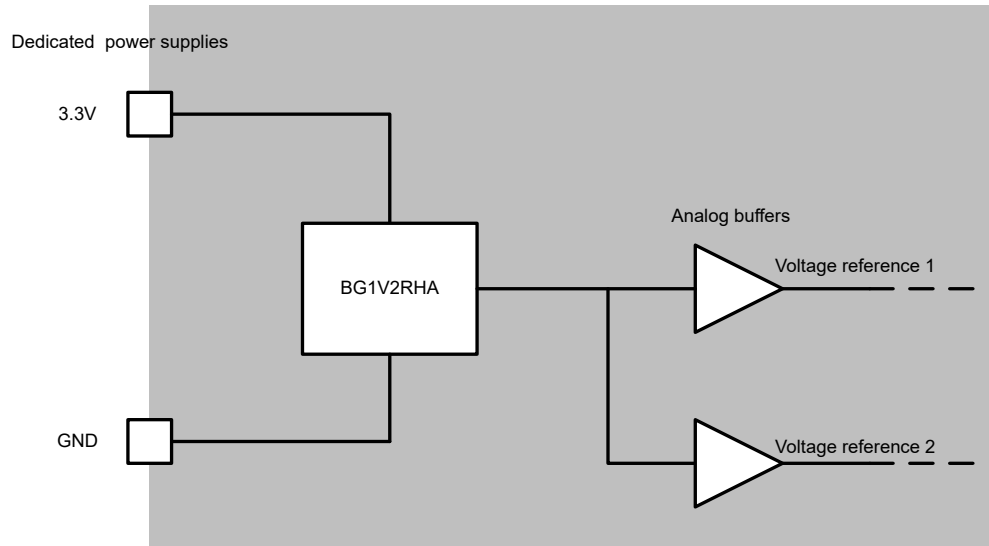
Table 3-1. Radiation Performances

Parameter	Conditions	
TID	ESCC22900 and Mil-Std 883 TM 1019 Input supply voltage Vdd max, Tj = 25°C and total dose rate of 300 rad/h	100 kRads (Si) RHA-R (tested 150 kRads (Si))
SEL	ESCC25100 and JESD57A Input supply voltage Vdd max and Tj = 125°C	> 60 MeV.cm ² /mg
SEU/SET	Input supply voltage Vdd min and Tj = 25°C	> 60 MeV.cm ² /mg

4. Typical Application

In a typical application, the BG1V2RHA voltage reference has its own supply pads. Analog buffers are usually inserted, when reference is provided to different cells to avoid noise propagation between blocks.

Figure 4-1. BG1V2RHA Typical Application



5. Testability Requirements

Unless otherwise specified at the DSR, V_{bg} , output voltage parameter, is to be measured.

For this test, the bg pin must be accessible through a primary I/O and a minimal resistive load must be applied during measurement to ensure the accurate value measurement.

6. Integration Guidelines

The following sections provide guidelines for the system integration.

6.1 Placement and General Rules

The sensitive cell must be placed in a quiet place, far from the pads area. The width of the wires used to connect the cell must be equal to the pin width.

6.2 Supplies Routing and Decoupling

The wires used to connect the cell must have a width equal to the pin width. Power supplies and ground must be star routed. The power supplies must be externally decoupled with large capacitors (1 μ F/100 nF).

6.3 Analog Signals Routing

Unless there is a minimum of 1 μ m space between the output bg and other signals, this analog connection must be made through short and shielded lines. The shielding must be made with analog ground line.

6.4 Routing Constraints

The following table lists the routing constraints of the pins.

Table 6-1. Routing Constraints

Pin Name	Signal Type	Related Power Supply	Max DC Current Flowing (mA)	Max allowed Routing Resistance (Ω)	Max allowed Capacitance to Ground (pF)	Other Constraints
vddana33	Supply	1	1	20	—	Star routed to power supply input
vssana	Supply	1	1	20	—	Star routed to power supply input
bg	Analog	—	—	—	3	No crossing with other signal, shielding to vssana must be inserted in that case. 1 μ m minimum spacing to other signal trace

7. Revision History

Revision	Date	Description
A	September 2020	The following is a summary of changes in revision A of this document. <ul style="list-style-type: none">• Updated the document as per Microchip standards.• Modified the radiation tolerance specification.

The Microchip Website

Microchip provides online support via our website at www.microchip.com/. This website is used to make files and information easily available to customers. Some of the content available includes:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip design partner program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

Product Change Notification Service

Microchip's product change notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, go to www.microchip.com/pcn and follow the registration instructions.

Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Embedded Solutions Engineer (ESE)
- Technical Support

Customers should contact their distributor, representative or ESE for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in this document.

Technical support is available through the website at: www.microchip.com/support

Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Legal Notice

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with

your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Trademarks

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, chipKIT, chipKIT logo, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PackeTime, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TempTrackr, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, FlashTec, Hyper Speed Control, HyperLight Load, IntelliMOS, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, Vite, WinPath, and ZL are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, INICnet, Inter-Chip Connectivity, JitterBlocker, KleerNet, KleerNet logo, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, and Symmcom are registered trademarks of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2020, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-6687-1

Quality Management System

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Worldwide Sales and Service

AMERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
<p>Corporate Office 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Tel: 480-792-7277 Technical Support: www.microchip.com/support Web Address: www.microchip.com</p> <p>Atlanta Duluth, GA Tel: 678-957-9614 Fax: 678-957-1455</p> <p>Austin, TX Tel: 512-257-3370</p> <p>Boston Westborough, MA Tel: 774-760-0087 Fax: 774-760-0088</p> <p>Chicago Itasca, IL Tel: 630-285-0071 Fax: 630-285-0075</p> <p>Dallas Addison, TX Tel: 972-818-7423 Fax: 972-818-2924</p> <p>Detroit Novi, MI Tel: 248-848-4000</p> <p>Houston, TX Tel: 281-894-5983</p> <p>Indianapolis Noblesville, IN Tel: 317-773-8323 Fax: 317-773-5453 Tel: 317-536-2380</p> <p>Los Angeles Mission Viejo, CA Tel: 949-462-9523 Fax: 949-462-9608 Tel: 951-273-7800</p> <p>Raleigh, NC Tel: 919-844-7510</p> <p>New York, NY Tel: 631-435-6000</p> <p>San Jose, CA Tel: 408-735-9110 Tel: 408-436-4270</p> <p>Canada - Toronto Tel: 905-695-1980 Fax: 905-695-2078</p>	<p>Australia - Sydney Tel: 61-2-9868-6733</p> <p>China - Beijing Tel: 86-10-8569-7000</p> <p>China - Chengdu Tel: 86-28-8665-5511</p> <p>China - Chongqing Tel: 86-23-8980-9588</p> <p>China - Dongguan Tel: 86-769-8702-9880</p> <p>China - Guangzhou Tel: 86-20-8755-8029</p> <p>China - Hangzhou Tel: 86-571-8792-8115</p> <p>China - Hong Kong SAR Tel: 852-2943-5100</p> <p>China - Nanjing Tel: 86-25-8473-2460</p> <p>China - Qingdao Tel: 86-532-8502-7355</p> <p>China - Shanghai Tel: 86-21-3326-8000</p> <p>China - Shenyang Tel: 86-24-2334-2829</p> <p>China - Shenzhen Tel: 86-755-8864-2200</p> <p>China - Suzhou Tel: 86-186-6233-1526</p> <p>China - Wuhan Tel: 86-27-5980-5300</p> <p>China - Xian Tel: 86-29-8833-7252</p> <p>China - Xiamen Tel: 86-592-2388138</p> <p>China - Zhuhai Tel: 86-756-3210040</p>	<p>India - Bangalore Tel: 91-80-3090-4444</p> <p>India - New Delhi Tel: 91-11-4160-8631</p> <p>India - Pune Tel: 91-20-4121-0141</p> <p>Japan - Osaka Tel: 81-6-6152-7160</p> <p>Japan - Tokyo Tel: 81-3-6880-3770</p> <p>Korea - Daegu Tel: 82-53-744-4301</p> <p>Korea - Seoul Tel: 82-2-554-7200</p> <p>Malaysia - Kuala Lumpur Tel: 60-3-7651-7906</p> <p>Malaysia - Penang Tel: 60-4-227-8870</p> <p>Philippines - Manila Tel: 63-2-634-9065</p> <p>Singapore Tel: 65-6334-8870</p> <p>Taiwan - Hsin Chu Tel: 886-3-577-8366</p> <p>Taiwan - Kaohsiung Tel: 886-7-213-7830</p> <p>Taiwan - Taipei Tel: 886-2-2508-8600</p> <p>Thailand - Bangkok Tel: 66-2-694-1351</p> <p>Vietnam - Ho Chi Minh Tel: 84-28-5448-2100</p>	<p>Austria - Wels Tel: 43-7242-2244-39 Fax: 43-7242-2244-393</p> <p>Denmark - Copenhagen Tel: 45-4485-5910 Fax: 45-4485-2829</p> <p>Finland - Espoo Tel: 358-9-4520-820</p> <p>France - Paris Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79</p> <p>Germany - Garching Tel: 49-8931-9700</p> <p>Germany - Haan Tel: 49-2129-3766400</p> <p>Germany - Heilbronn Tel: 49-7131-72400</p> <p>Germany - Karlsruhe Tel: 49-721-625370</p> <p>Germany - Munich Tel: 49-89-627-144-0 Fax: 49-89-627-144-44</p> <p>Germany - Rosenheim Tel: 49-8031-354-560</p> <p>Israel - Ra'anana Tel: 972-9-744-7705</p> <p>Italy - Milan Tel: 39-0331-742611 Fax: 39-0331-466781</p> <p>Italy - Padova Tel: 39-049-7625286</p> <p>Netherlands - Drunen Tel: 31-416-690399 Fax: 31-416-690340</p> <p>Norway - Trondheim Tel: 47-72884388</p> <p>Poland - Warsaw Tel: 48-22-3325737</p> <p>Romania - Bucharest Tel: 40-21-407-87-50</p> <p>Spain - Madrid Tel: 34-91-708-08-90 Fax: 34-91-708-08-91</p> <p>Sweden - Gothenberg Tel: 46-31-704-60-40</p> <p>Sweden - Stockholm Tel: 46-8-5090-4654</p> <p>UK - Wokingham Tel: 44-118-921-5800 Fax: 44-118-921-5820</p>