ROHM SEMICONDUCTOR

User's Guide

Switching Regulator Series

Step-up and inverted 2-channel DC/DC converter with Built-in Power MOSFET

BD8316GWL-EVK-001

Introduction

This user's guide will provide the steps necessary to operate the BD8316GWL EVK-001 evaluation board and evaluate ROHM's BD8316GWL Step-up and Inverted 2-channel DC/DC converter. Component selection, operating procedures and application data are included.

Description

The BD8316GWL converter is a power supply solution designed for portable devices. It can operate with a wide input voltage range of 2.5V~5.5V and has a 1µA standby current. It is possible to enable and disable each channel. Users can select which channel to output to, by changing the STB1 and STB2 pins to High or Low. The small package design is suitable for miniaturizing the power supply.

Application

LCD Battery
CCD Battery
Portable items that are represented by mobile phone and DSC

Features

Wide input voltage range of 2.5V to 5.5 V
High frequency operation 1.6MHz
Incorporates Nch FET of 230mΩ/22V and Pch Pow FET of 230m Ω/15V
Incorporates Soft Start (4.2msec (typ)) and high side switch of boost channel
Independent ON/OFF signal (STB).
Built-in discharge SW for inverted channel
Small package UCSP50L1(1.8mm x 1.5mm, 4 x 3 grid, 11pin, WLCSP)
Circuit protection OCP, SCP, UVLO, TSD

Key Specifications

Input Voltage Range:	2.5 V to 5.5 V
Output Boost Voltage:	Input Voltage (max) to 18 V
Output Inverted Voltage:	-9.0 V to -1.0 V
Maximum SW Current:	1 A (max)
Switching Frequency:	1.6 MHz (Typ)
Standby Current:	1 µA (max)

Package

	W(Typ) x D(Typ) x H(Max)
UCSP50L1(11pin)	1.8mm x 1.5mm x 0.5mm

Evaluation Board Operating Limits

Parameter	Symbol	Limit			Unit	Conditions
		MIN	TYP	MAX		
Supply Voltage	V_{DD}	2.5	-	4.5	V	MAX is limited by LX Max Duty
Output Current	I_{OUT}	-0.2	-	0.2	A	VDD>2.7V, VO1=-5.6V, VO2=+5.6V

No. 62UG014E Rev.002
SEP.2021

Evaluation Board

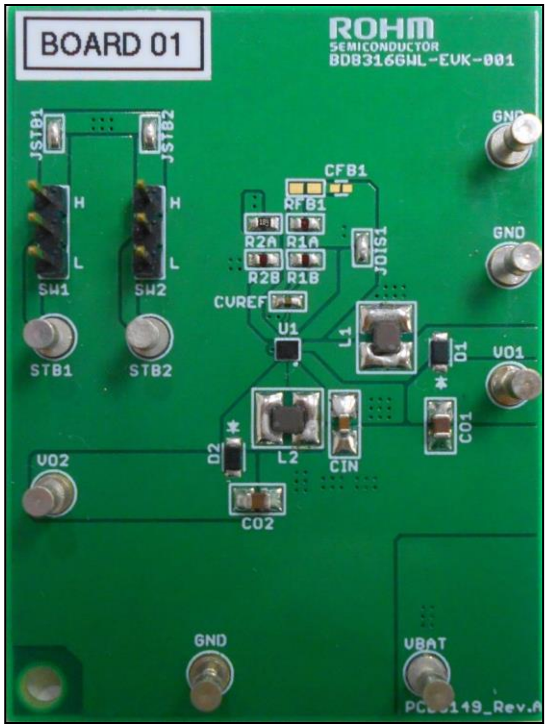

Figure 1. BD8316GWL-EVK-001 Evaluation Board

Board Schematic

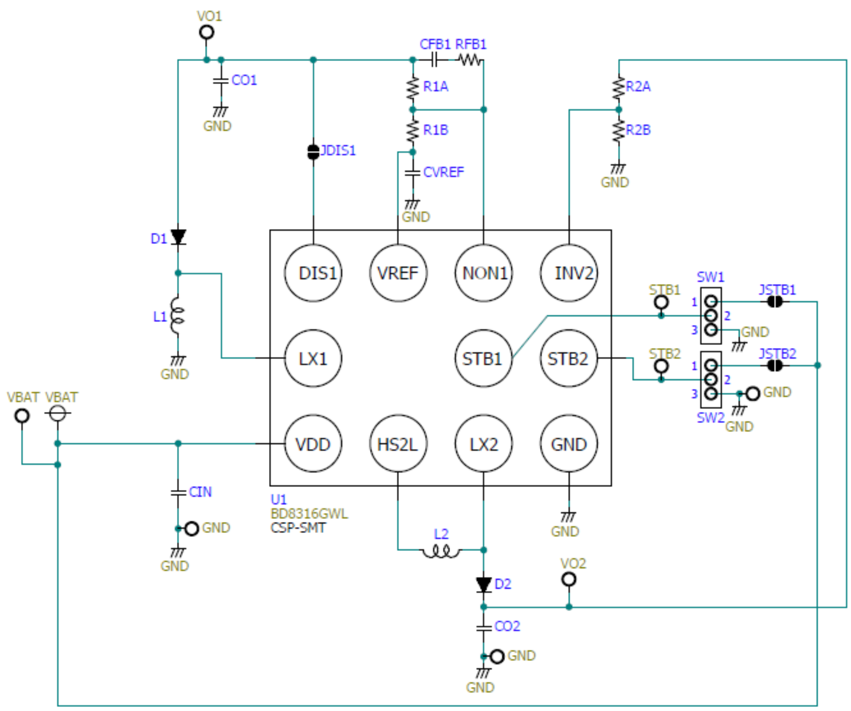

Figure 2. BD8316GWL-EVK-001 Board Schematic

Output ON/OFF Control

The table below shows output voltage ON/OFF control with the STB1 and STB2 pin settings.

Table 1. VO1 ON/OFF Control Settings

STB1 Pin	VO1
HIGH (≥ 1.5 V)	Enable
LOW (≤ 0.3 V)	Shutdown

Table 2. VO2 ON/OFF Control Settings

STB2 Pin	VO2
HIGH (≥ 1.5 V)	Enable
LOW (≤ 0.3 V)	Shutdown

Evaluation Board BOM

The table below is the Evaluation Board Bill of Materials. Part numbers and manufacturers are included.

Table 3. Bill of Materials

Reference	Part Number	Manufacturer	Description [Unit: inch(mm)]	Qty.
CIN	GRM188C71A475KE11D	Murata	4.7μF, 10V, X7S, 0603(1608)	1
CVREF	GRM155R71A104KA01J	Murata	0.1μF, 10V, X7R, 0402(1005)	1
CO1, CO2	GRT21BR61E226ME13L	Murata	22μF, 25V, X5R, 0805(2012)	2
CFB1	-	-	Open	1
L1, L2	74405024047	Wurth Electronics	4.7μH, 1A, 1008(2520)	2
D1, D2	RBE2VAM20ATR	ROHM	20V, 2A, 1006(2516)	2
R1A	MCR03EZPFX5602	ROHM	56kΩ, 1/10W, 1%, 0603(1608)	1
R1B	MCR03EZPFX1002	ROHM	10kΩ, 1/10W, 1%, 0603(1608)	1
RFB1	-	-	Open	1
R2A	MCR03EZPFX1803	ROHM	180kΩ, 1/10W, 1%, 0603(1603)	1
R2B	MCR03EZPFX3002	ROHM	30kΩ, 1/10W, 1%, 0603(1603)	1
JDIS, JSTB1, JSTB2	-	-	Short	3
SW1, SW2	68000-103HLF	AMPHENOL	CONN HEADER VERT, 3POS, 2.54MM	2
GND	1502-2	Keystone Electronics	TEST POINT PC MULTI PURPOSE	2
VO1, VO2	1502-2	Keystone Electronics	TEST POINT PC MULTI PURPOSE	4
STB1, STB2	1502-2	Keystone Electronics	TEST POINT PC MULTI PURPOSE	2
VBAT	1502-2	Keystone Electronics	TEST POINT PC MULTI PURPOSE	2
U1	BD8316GWL-E2	ROHM	2ch Inverting Boost DC/DC	1

Board Operating Procedure

1. Set the state of the output pin with the jumper(SW1, SW2) settings at STB1 and STB2 pin of the IC. (refer to Table 1 and Table 2)
2. Connect the power supply's GND to the GND pin on the evaluation board.
3. Connect the power supply's VCC to the VBAT pin on the evaluation board. This will provide VDD to the IC. Please note that VDD should be within the range of 2.5V to 4.5V.
4. For VO1, connect the electronic load's GND to the VO1 pin on the evaluation board and force electronic load to the GND pin on the evaluation board. Connect the voltmeter to the GND and the VO1 pins.
5. For VO2, connect the electronic load's GND to the GND pin on the evaluation board and force electronic load to the VO2 pin on the evaluation board. Connect the voltmeter to the GND and the VO2 pins.
6. Turn on the power supply and the IC starts up. The output voltage can be measured at the VO1 and VO2 pins. Now turn on the load. The load can be increased up to 0.2A.

Board Layout

EVK PCB information

Number of Layers	Material	Board Size	Copper Thickness
4	FR-4	45 mm x 60 mm x 1.6 mmt	1oz

The following are layers of the BD8316GWL Evaluation Board(BD8316GWL-EVK-001)

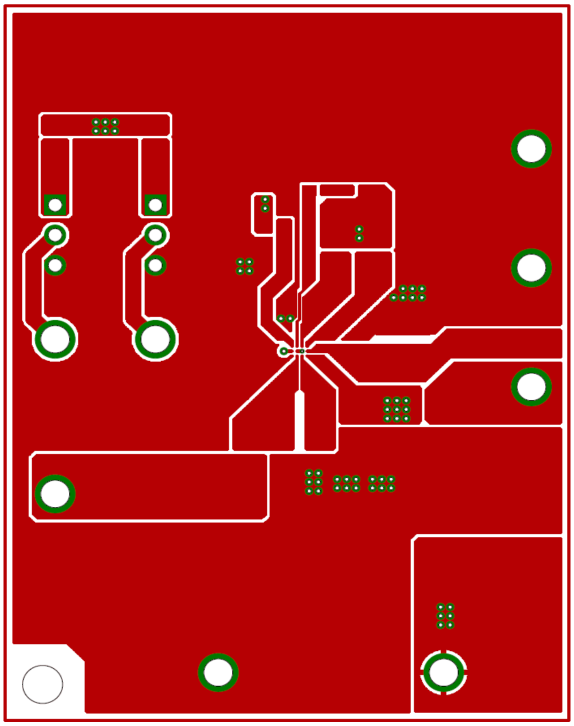

Figure 3. Top Layer

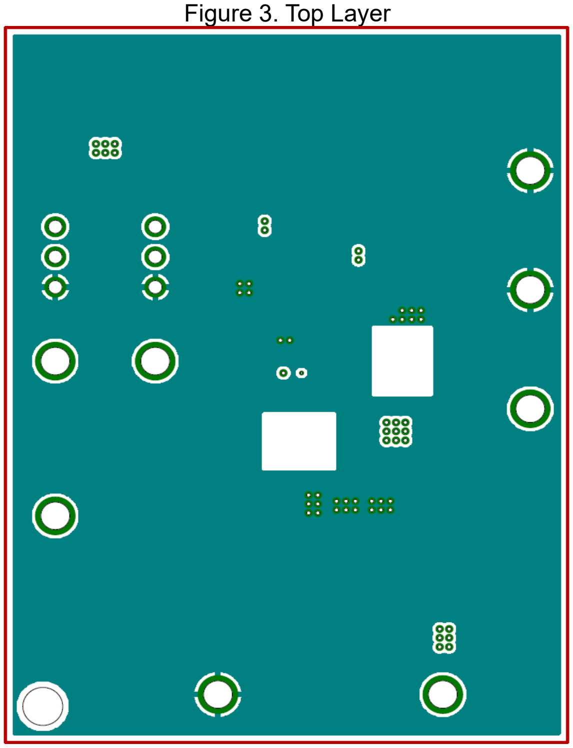

Figure 4. Middle Layer 1

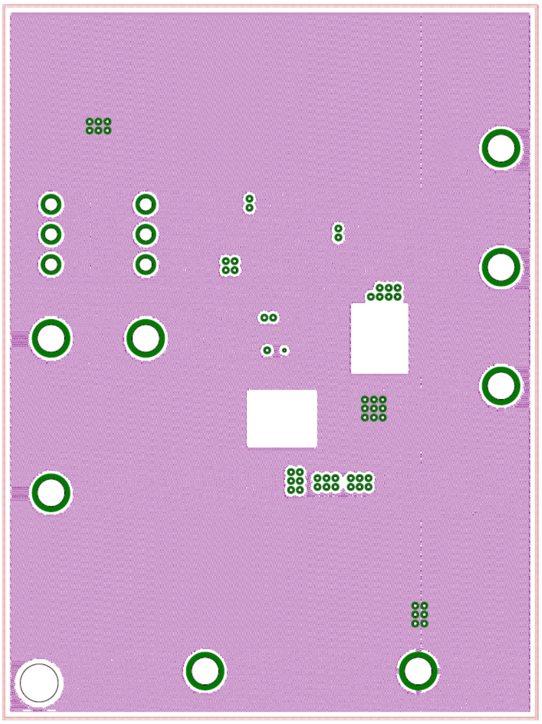

Figure 5. Middle Layer 2

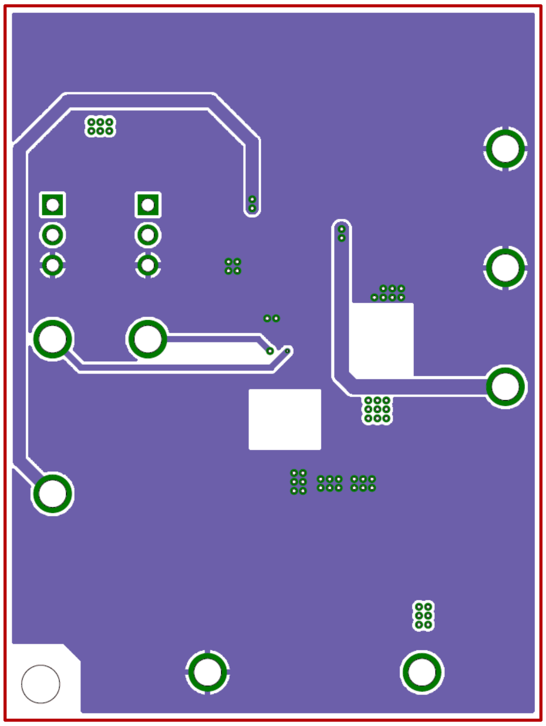

Figure 6. Bottom Layer

Reference Application Data

The following are graphs of efficiency, output voltage, load response, startup and shutdown.

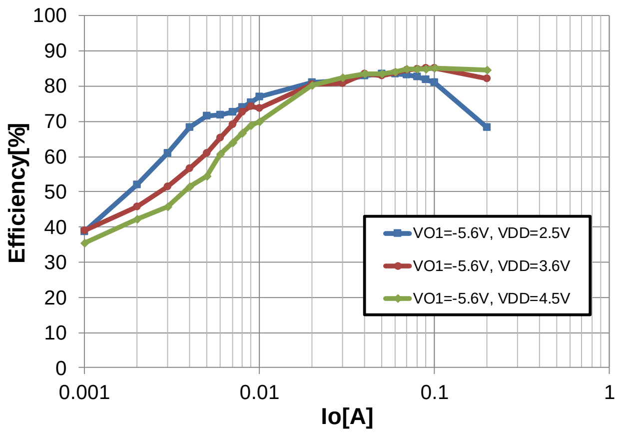

Figure 7. VO1 Power Conversion
Efficiency vs Output Current

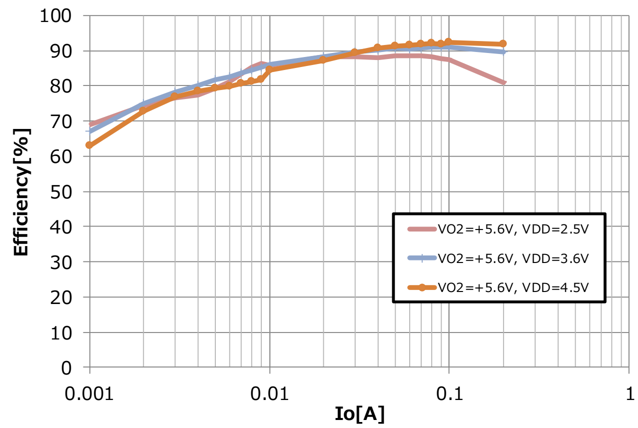

Figure 8. VO2 Power Conversion
Efficiency vs Output Current

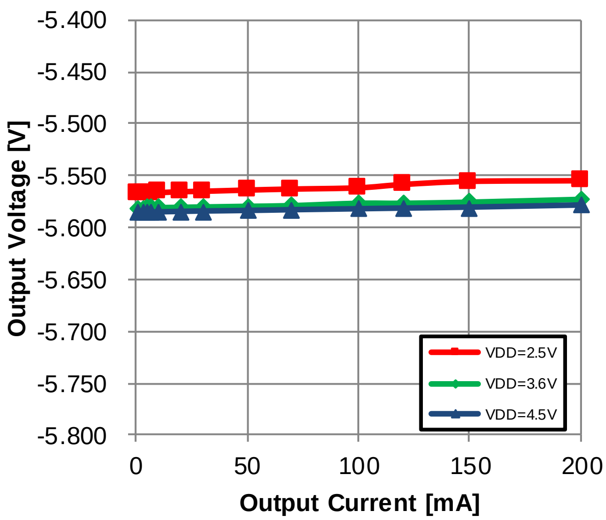

Figure 9. VO1 Load Regulation
Output Voltage vs Output Current

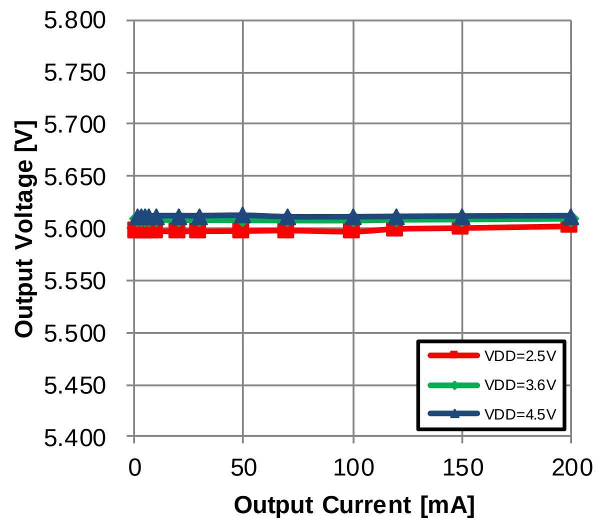

Figure 10. VO2 Load Regulation
Output Voltage vs Output Current

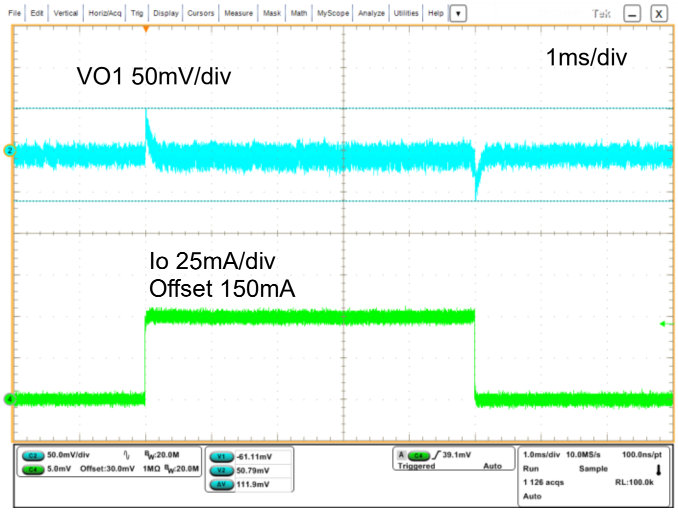

Figure 11. VO1 Current Response
(Output Current: 150mA ↔ 200mA 50mA/µsec)

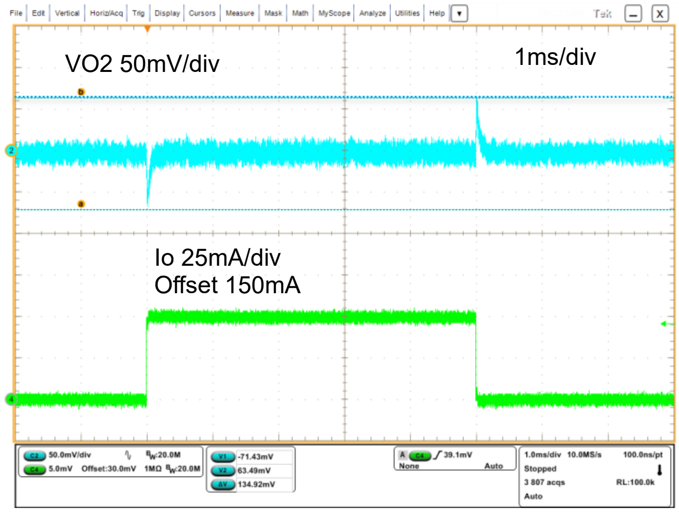

Figure 12. VO2 Current Response
(Output Current: 150mA ↔ 200mA 50mA/µsec)

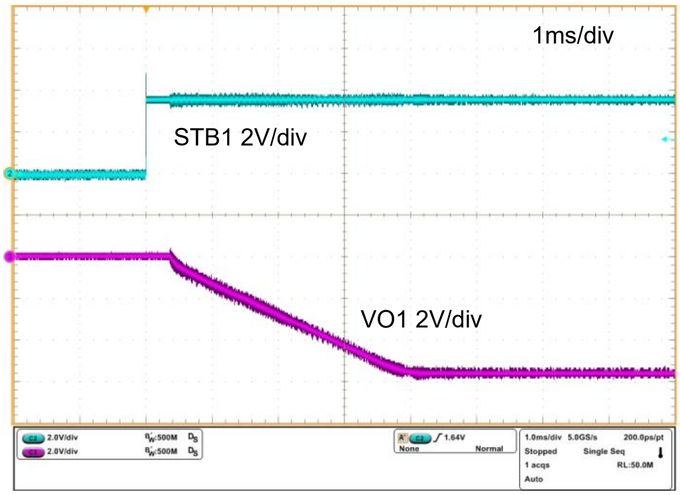

Figure 13. VO1 Startup Waveform

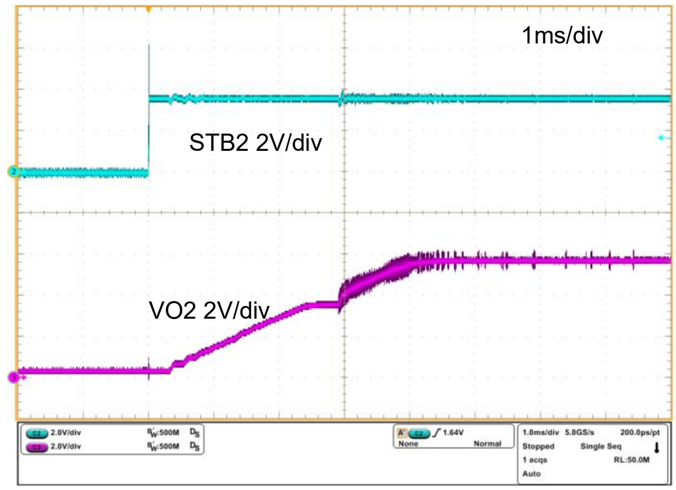

Figure 14. VO2 Startup Waveform

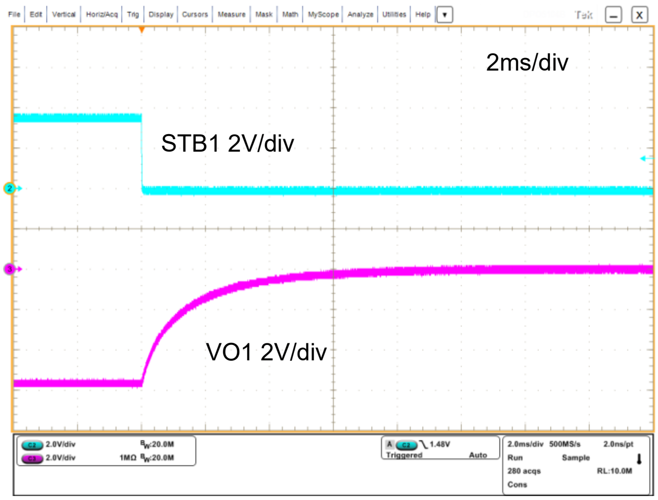

Figure 15. VO1 Discharge Waveform

Products listed in the BOM

The product names listed in the bill of materials are available ones at the time of creating this user's guide. In case some parts are no longer available in the future, select the equivalent products.

Selection of Ceramic Capacitors

In selecting the ceramic capacitors, consider the DC bias characteristics and select the ones with actual capacitance are equivalent. For reference, Figure 16 shows the DC bias characteristics of GRT21BR61E226ME13(Murata) listed in the BOM CO1. Actual capacitance degrades to 8.8μF from the nominal value of 22μF under the condition of 5.6V output(DC bias voltage is 5.6V.) When selecting an alternative component, select the product that has same capacitance under 5.6V of DC bias voltage. (The data in Figure 16 is only as reference. Please check with the capacitor manufacturer for the DC bias characteristics of ceramic capacitors.).

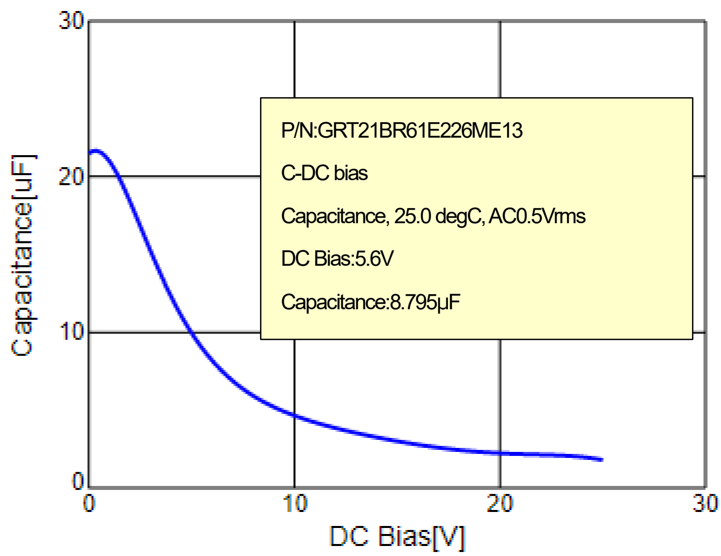

Figure 16. GRT21BR61E226ME13(Murata) DC bias characteristics

Revision History

Date	Revision Number	Description
20. June. 2019	001	Initial release
3. Sep. 2021	002	p.3 Update BOM
		p.7 Update Figure 13 and 14
		p.9 Add “Products listed in the BOM” and “Selection of Ceramic Capacitors”

No. 62UG014E Rev.002
SEP.2021

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