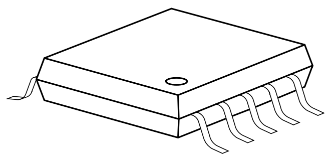
GaAs Support IC

BGV503 / BGV903

Preliminary Data Sheet

Negative Voltage Generator for biasing GaAs FET and Power Amplifier

Support chips – BGV503, BGV903 – for cellular phones



- BGV503: one-stage charge-pump with additional regulator for biasing GaAs-FET's
- BGV903: two-stage charge-pump without regulator
- Operating Voltage Range: + 2.2 V … 5.0 V
- Typical Output Voltage: – 2.5 V (BGV503) (V_{cc} = 3.0 V; I_{out} = 3 mA) – 5.1 V (BGV903)
- Output Current: 3 mA
- p-p Output Voltage Ripple: 25 mV … 40 mV@ C_{out} = 1 µF; I_{out} = 3 mA
- Integrated Oscillator f_{OSZ}: 230 kHz
- Standby Supply Current: < 5 µA
- Logic-Level Shutdown Mode
- Bare Chip Dimensions: 1.2×2.0 mm^2

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

Type	Marking	Ordering Code (taped)	Package
BGV503	BGV503	Q62702-L0132	P-TSSOP-10-2
BGV903	BGV903	Q62702-L0131	P-TSSOP-10-2

BGV503 (one-stage charge-pump with regulator)

Characteristics	Limit Values			Unit	Test Conditions
	min.	typ.	max.		
Input Voltage Range	2.7	–	5.0	V	–
Ground (V_{ss})	–	0	–	V	–
Output Voltage	–	– 2.1	– 1.4	V	V_{cc} = 2.7 V; I_{out} = 3 mA
	–	– 2.5	– 1.7	V	V_{cc} = 3.0 V; I_{out} = 3 mA
	–	– 4.6	– 3.9	V	V_{cc} = 5.0 V; I_{out} = 3 mA
Power Efficiency	–	76	–	%	V_{cc} = 3.0 V; R_{load} = 1 kΩ
Output Voltage Ripple[1)]	–	20	–	mV	V_{cc} = 3.0 V; I_{out} = 0 mA
	–	100	–	mV	V_{cc} = 3.0 V; I_{out} = 3 mA
No-Load Supply Current	–	0.4	2.0	mA	V_{cc} = 3.0 V
Voltage Conversion Efficiency	–	99.6	–	%	I_{out} = 0 mA
Shutdown/Enable Input Bias Current	–	–	1	µA	–
Shutdown Input Supply Current	–	–	5	µA	–
Turn On Time	–	51	–	µs	–
Temperature Range	– 25	–	100	°C	–

1) C_{out} = 100 nF

BGV903 (two-stage charge-pump)

Characteristics	Limit Values			Unit	Test Conditions
	min.	typ.	max.		
Input Voltage Range	2.7	–	5.0	V	–
Ground (V_{ss})	–	0	–	V	–
Output Voltage	–	– 4.4	– 3.3	V	V_{cc} = 2.7 V; I_{out} = 3 mA
	–	– 5.1	– 4.0	V	V_{cc} = 3.0 V; I_{out} = 3 mA
	–	– 9.2	– 8.2	V	V_{cc} = 5.0 V; I_{out} = 3 mA
Power Efficiency	–	72	–	%	V_{cc} = 3.0 V; R_{load} = 1 kΩ
Output Voltage Ripple[1]	–	30	–	mV	V_{cc} = 3.0 V; I_{out} = 0 mA
	–	100	–	mV	V_{cc} = 3.0 V; I_{out} = 3 mA
No-Load Supply Current	–	0.9	2.0	mA	V_{cc} = 3.0 V
Voltage Conversion Efficiency	–	98.2	–	%	I_{out} = 0 mA
Shutdown/Enable Input Bias Current	–	–	1	µA	–
Shutdown Input Supply Current	–	–	5	µA	–
Turn On Time	–	77	–	µs	–
Temperature Range	– 25	–	100	°C	–

1) C_{out} = 100 nF

Bare Chip

Characteristics	Limit Values			Unit	Test Conditions
	min.	typ.	max.		
Input Voltage Range	2.7	–	5.0	V	–
Ground (V_{ss})	–	0	–	V	–
Output Voltage[1]	–	– 4.4	– 3.3	V	V_{cc} = 2.7 V; I_{out} = 3 mA
	–	– 5.0	– 4.0	V	V_{cc} = 3.0 V; I_{out} = 3 mA
	–	– 9.2	– 8.2	V	V_{cc} = 5.0 V; I_{out} = 3 mA
Power Efficiency[1]	–	73	–	%	V_{cc} = 3.0 V; R_{load} = 1 kΩ
Output Voltage Ripple[2]	–	30	–	mV	V_{cc} = 3.0 V; I_{out} = 0 mA
	–	100	–	mV	V_{cc} = 3.0 V; I_{out} = 3 mA
No-Load Supply Current[1]	–	1.0	2.0	mA	V_{cc} = 3.0 V
Output Voltage[3]	–	– 3.6	–	V	V_{cc} = 2.7 V; I_{out} = 3 mA
	–	– 4.3	–	V	V_{cc} = 3.0 V; I_{out} = 3 mA
	–	– 8.5	–	V	V_{cc} = 5.0 V; I_{out} = 3 mA
Power Efficiency[3]	–	63	–	%	V_{cc} = 3.0 V; I_{out} = 3 mA
Output Voltage Ripple[3]	–	10	–	mV	V_{cc} = 3 V; I_{out} = 3 mA
Shutdown/Enable Input Bias Current	–	–	1	µA	–
Shutdown Input Supply Current	–	–	5	µA	–
Turn On Time[1]	–	77	–	µs	–
Temperature Range	– 25	–	100	°C	–

1) without lowpass-filter
2) C_{out} = 100 nF
3) with lowpass-filter C_{out} = 100 nF; C_{filt} = 100 nF

Note: Typical values are measured at T_A = 25 °C

Max- and Min-values are over the whole temperature-range of – 25 °C < T_A < 100 °C

Functional Block Diagram

The applied supply voltage (V_{cc}) is inverted (BGV503) and additionally doubled (BGV903) to a negative output voltage (nv). Regarding the Bare-Chip you have two alternatives:

Either you prefer an output voltage that is only inverted (capacitor between c1d and c2p) or one that is inverted and doubled (capacitors between c1d-c1p and c2d-c2p).

The switching frequency (clk) of the charge-pump is determined by the integrated oscillator and is between 100 kHz and 400 kHz. It is possible to stop the operating of the IC by connecting disq to a voltage lower than 1 V (shutdown mode). The driver (drive) ensures that the MOS-switches of the charge-pump are operated at the correct time. To reduce the ripple in the output voltage the low pass filter can be used in the Bare-Chip-Solution connecting an external filter-capacitor between pin cfilt and V_{ss}. This filtered voltage can be taken out at pin fnv. The regulator can be used to control the biasing of GaAs-FET current-mirrors (see **Figure 5**).

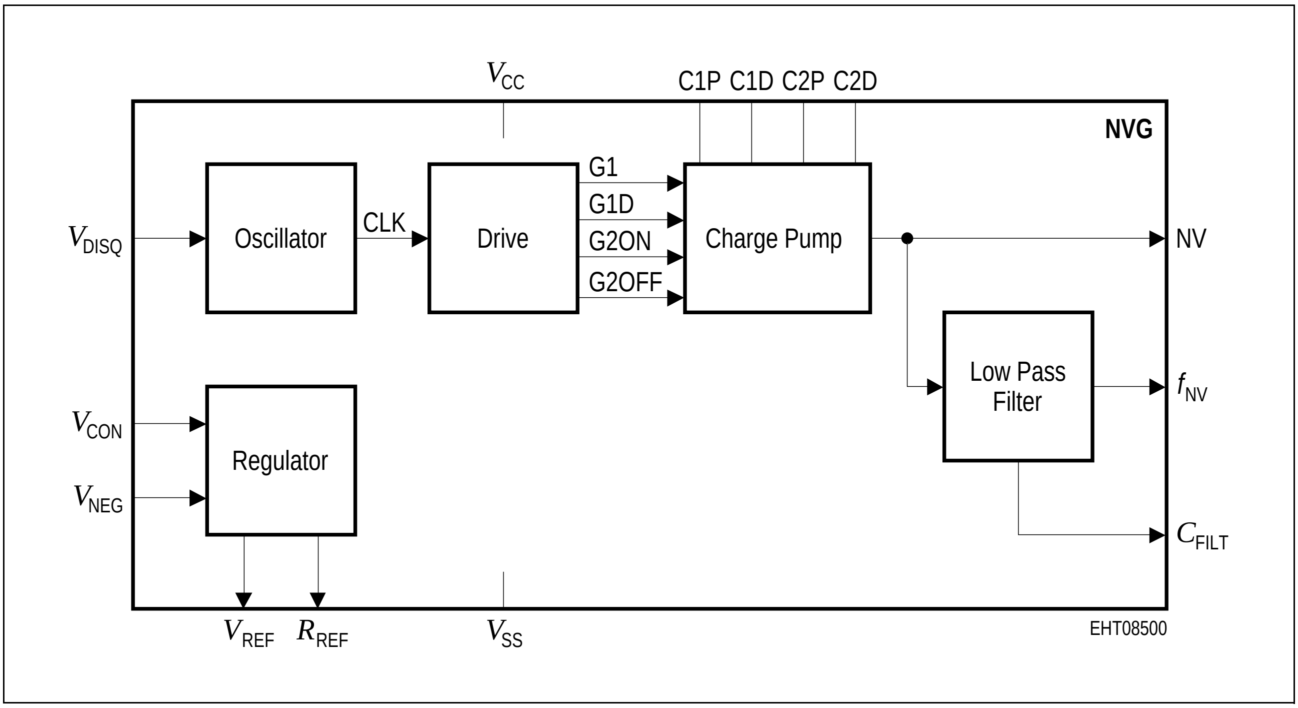


Figure 1 Block Diagram of the Negative Voltage Generator

Pin Configuration of Packaged Devices BGV503/BGV903

Package: P-TSSOP-10-2

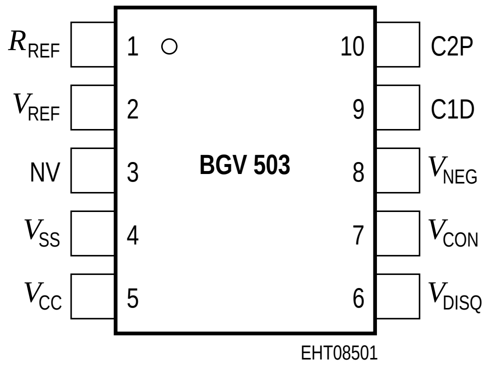


Figure 2 BGV503 One-stage Charge Pump with Regulator

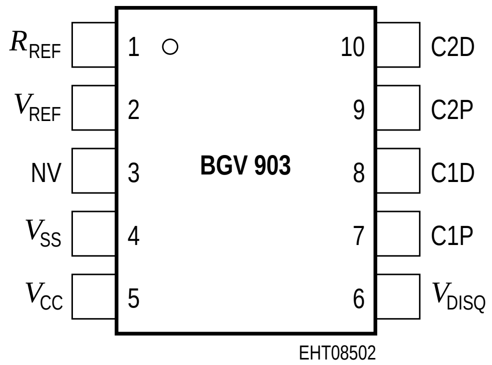


Figure 3 BGV903 Two-stage Charge Pump without Regulator

Pin #	BGV503	BGV903	Configuration
1	R_{REF}	R_{REF} (n.c.)	Reference resistor of the regulator
2	V_{REF}	V_{REF} (n.c.)	Reference voltage of the regulator
3	NV	NV	Negative output-voltage
4	V_{SS}	V_{SS}	Ground connection
5	V_{CC}	V_{CC}	Positive supply voltage
6	V_{disq}	V_{disq}	Enable (TTL compatible)
7	V_{CON} –	– C1P	Control-voltage of the regulator Pump-capacitor 1
8	V_{NEG} –	– C1D	Negative supply-voltage of the regulator Pump-capacitor 1
9	C1D –	– C2P	Pump-capacitor 1 Pump-capacitor 2
10	C2P –	– C2D	Pump-capacitor 1 Pump-capacitor 2

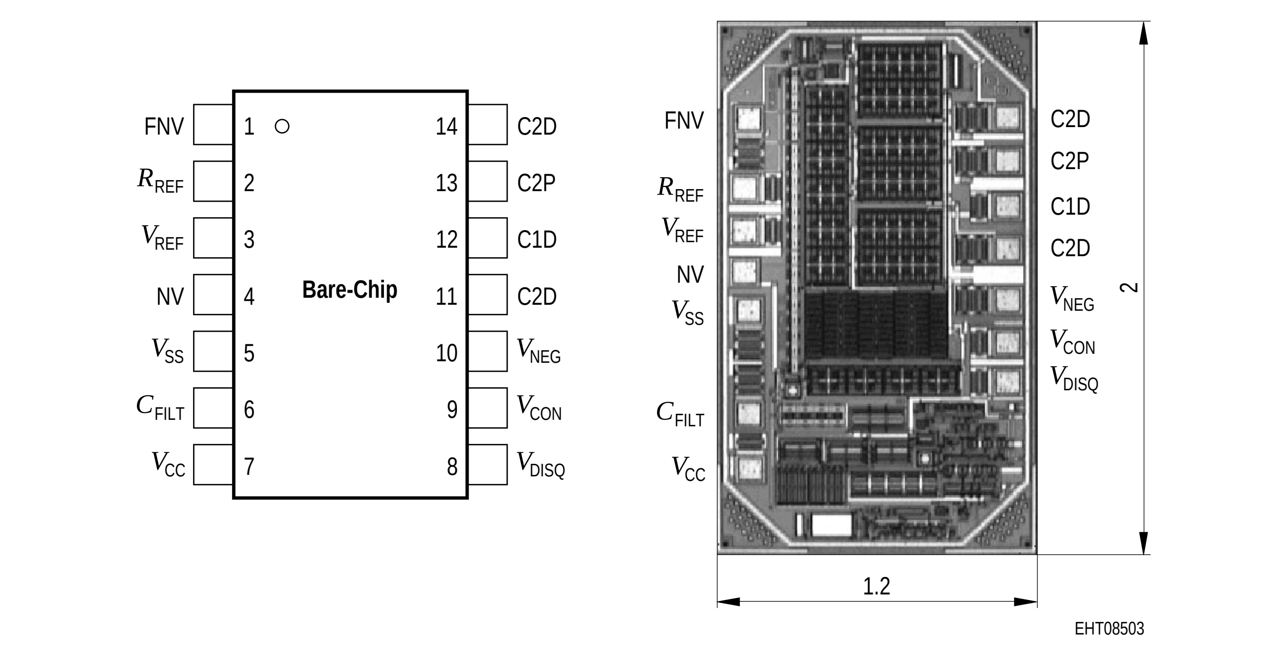


Figure 4 Pad Definition and Top View of the Bare-Chip with Lateral Dimensions

Pin Configuration Bare-Chip

Pin #	Bare-chip	Configuration
1	F_{NV}	Filtered negative output voltage
2	R_{REF}	Reference resistor of the regulator
3	V_{REF}	Reference voltage of the regulator
4	NV	Negative output-voltage
5	V_{SS}	Ground connection
6	C_{FILT}	Filter-capacitor
7	V_{CC}	Positive supply voltage
8	V_{disq}	Disable, active low (enable)
9	V_{CON}	Control-voltage of the regulator
10	V_{NEG}	Negative supply-voltage of the regulator
11	C1P	Pump-capacitor 1
12	C1D	Pump-capacitor 1
13	C2P	Pump-capacitor 2
14	C2D	Pump-capacitor 2

Typical Applications

For all applications use capacitors with low effective series resistance (ESR) to maintain a low dropout voltage and a low p-p voltage ripple.

An additional capacitor in the supply line (between V_{cc} and V_{ss}) is useful to reduce both the AC input impedance and, as a consequence, the spikes in the supply voltage, resulting from the current peaks when the IC is switching. The value of this capacitance depends on the circuit configuration; 1 µF is regarded as sufficient.

BGV503

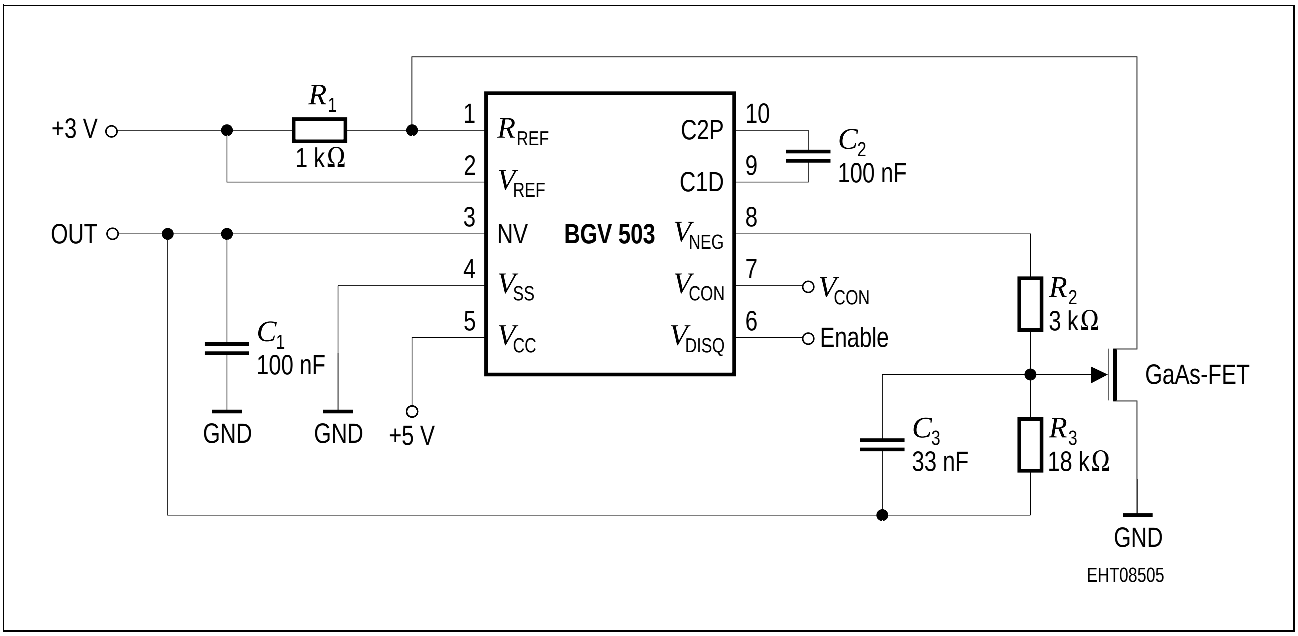


Figure 5 BGV503; One-Stage-Inverting Charge-Pump with GaAs-FET Regulator

BGV903

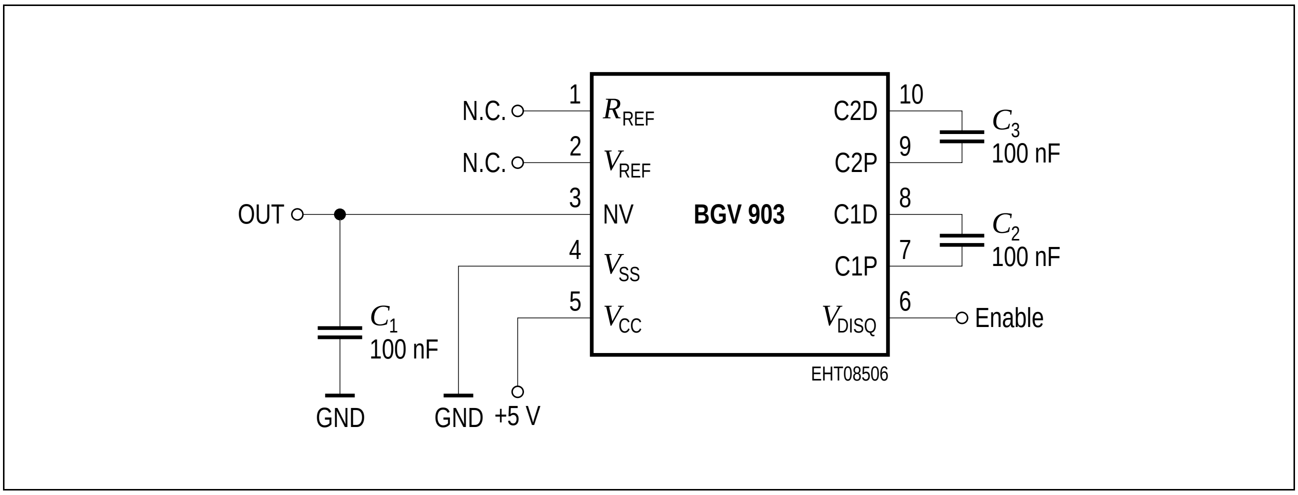


Figure 6 BGV903; Two-Stage-Inverting Charge-Pump

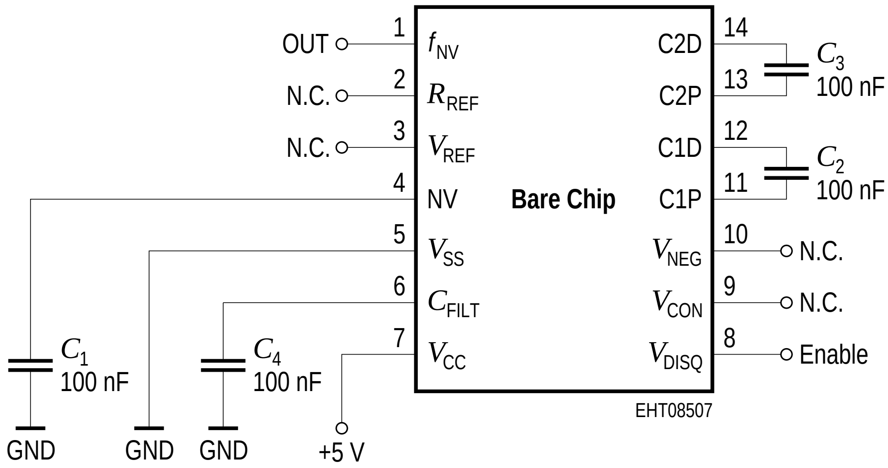


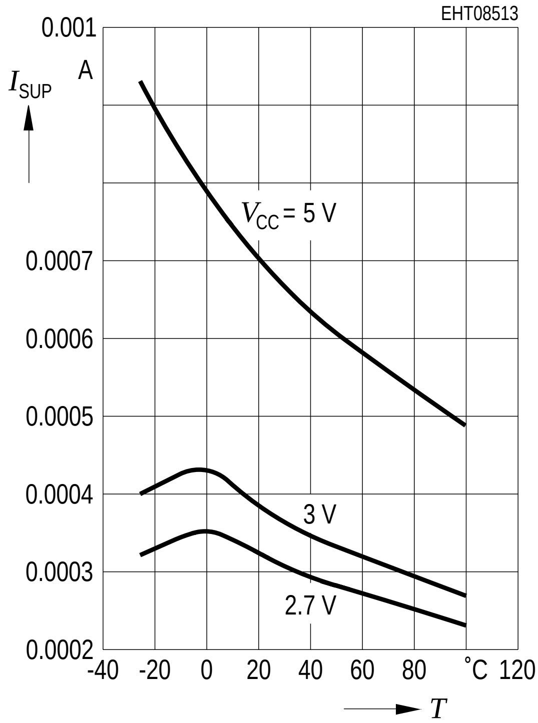
Figure 7 Bare-Chip-Solution; Two-Stage Inverting Charge-Pump with Integrated Lowpass-Filter

Typical Operating Characteristics

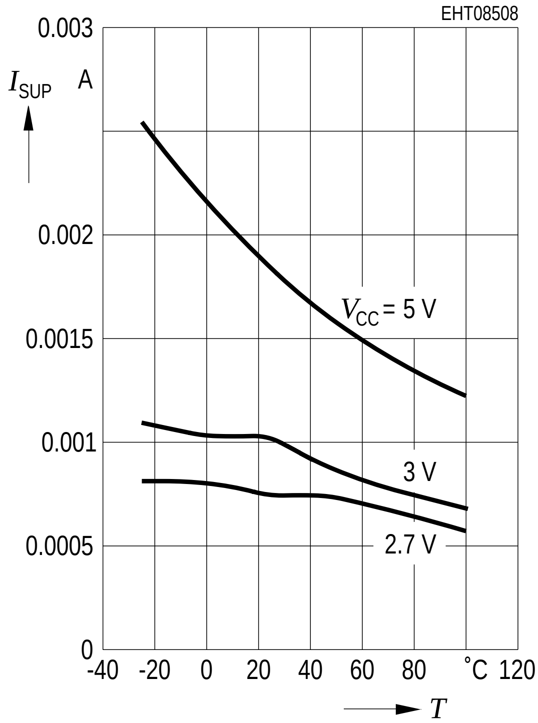
(external configuration see **Figure 5**, **Figure 6**, **Figure 7**).

Operating conditions: V_{cc} = 3 V, V_{disq} = 2 V, T_A = 25 °C,
$C_1 = C_2 = C_3 = C_4$ = 100 nF, unless otherwise noted.

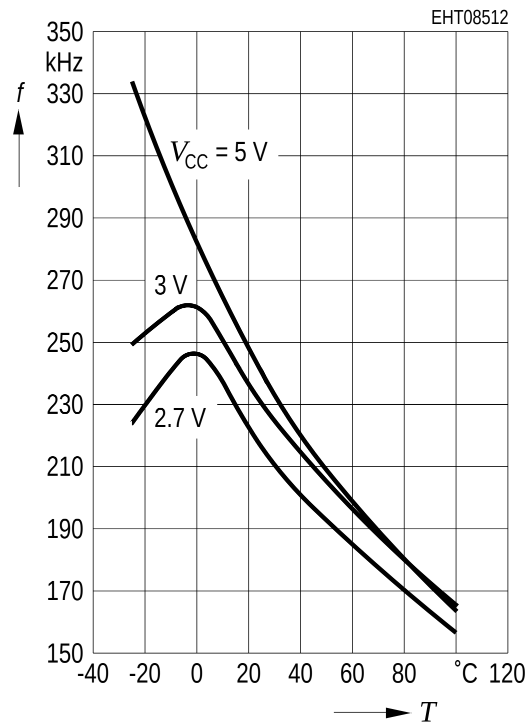
BGV503: Supply Current vs. Temperature @ I_{out} = 0 mA



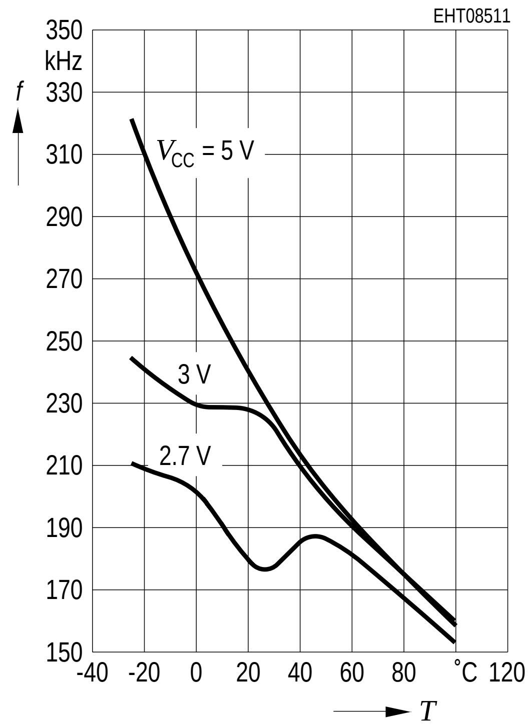
BGV903: Supply Current vs. Temperature @ I_{out} = 0 mA



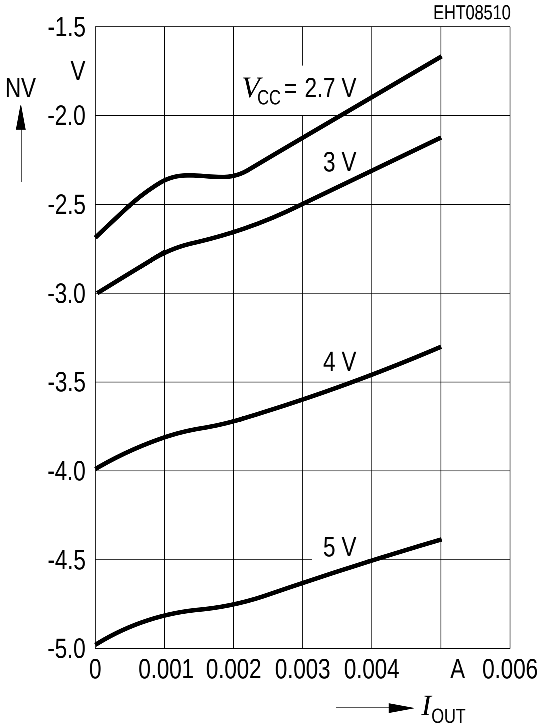
BGV503: Oscillator Frequency vs. Temperature @ I_{out} = 3 mA



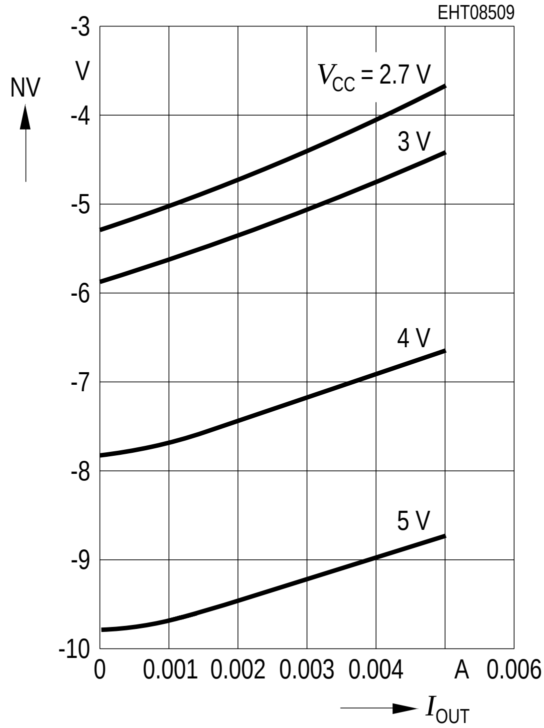
BGV903: Oscillator Frequency vs. Temperature @ I_{out} = 3 mA



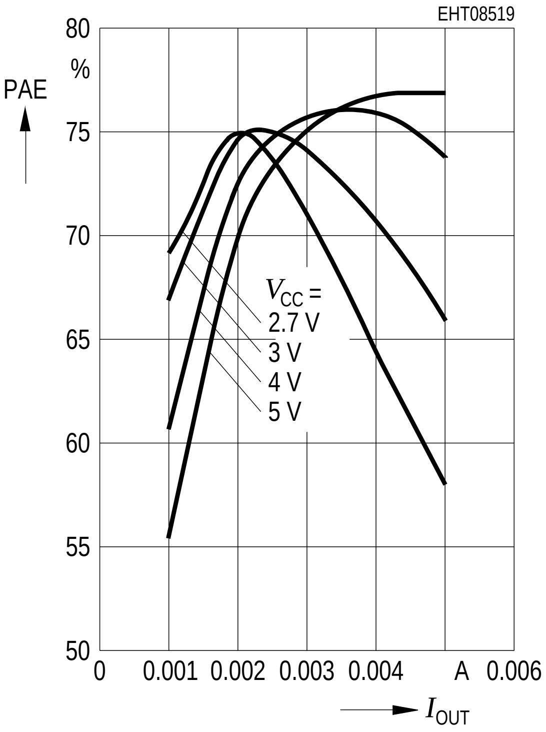
BGV503: Output Voltage vs. Load Current



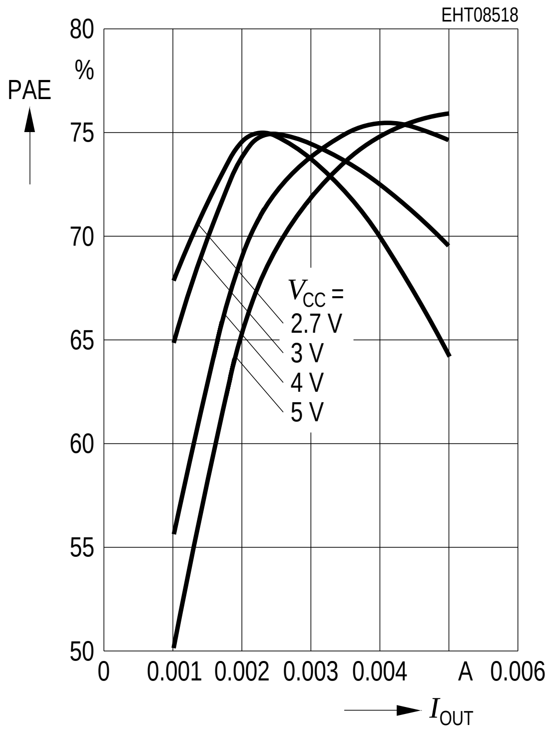
BGV903: Output Voltage vs. Load Current



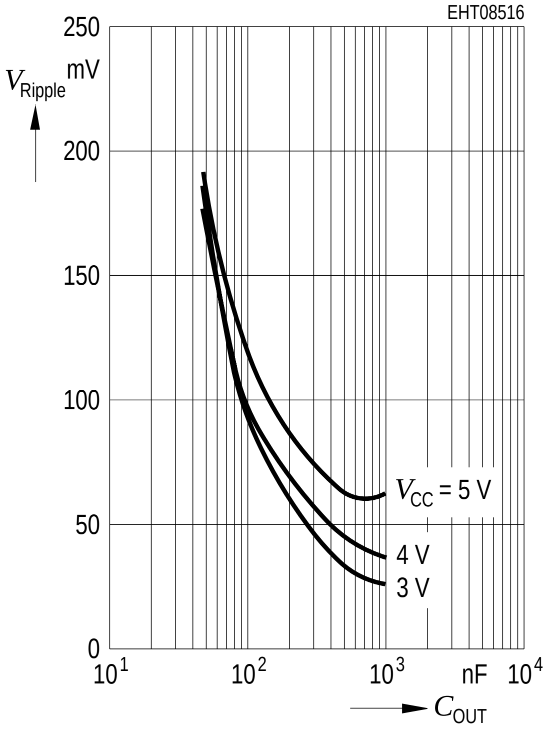
BGV503: Power Efficiency vs. Load Current



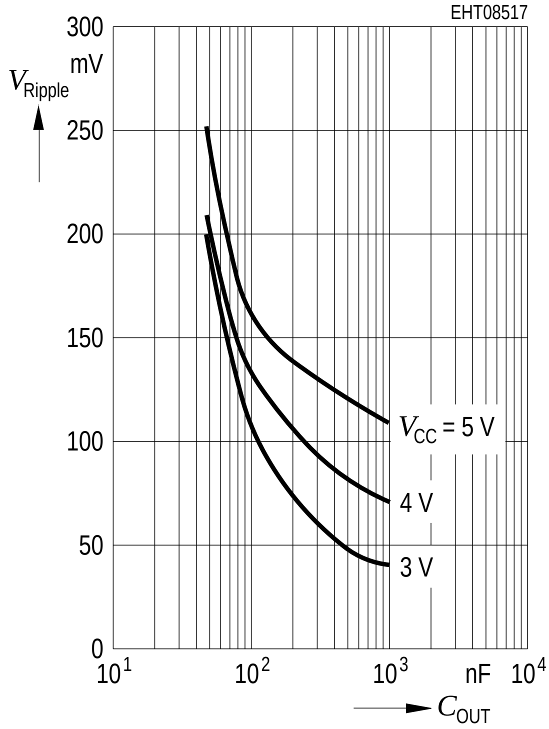
BGV903: Power Efficiency vs. Load Current



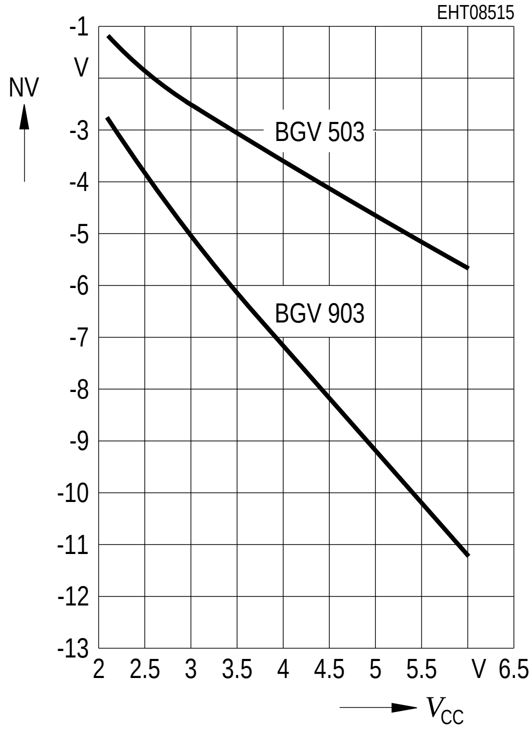
BGV503: Ripple vs. Output-Capacity
@ I_{out} = 3 mA



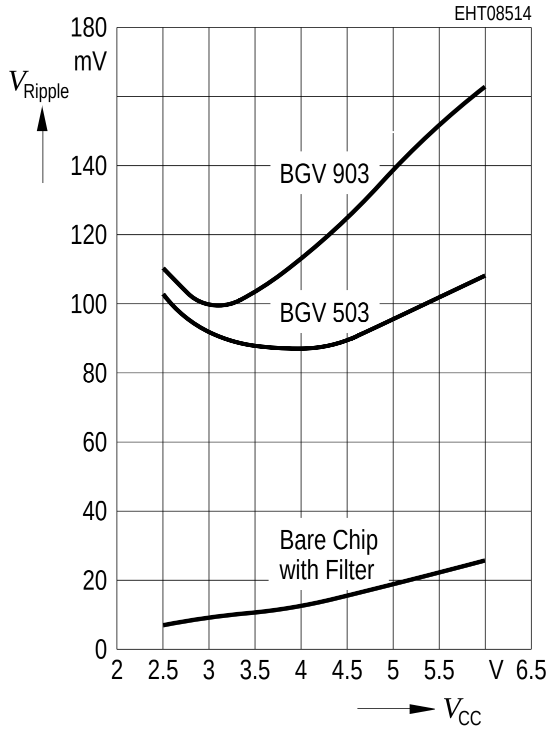
BGV903: Ripple vs. Output-Capacity
@ I_{out} = 3 mA



BGV503/903: Output Voltage vs. Supply Voltage @ I_{out} = 3 mA



Output Ripple vs. Input Voltage
@ I_{out} = 3 mA



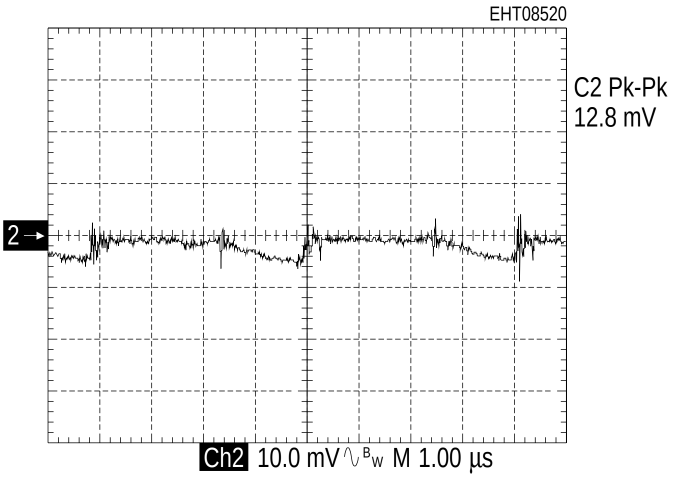


Figure 8 **BGV503: Output Voltage, AC-coupled,** V_{CC} = 3 V, I_{OUT} = 0 mA, C_{OUT} = 100 nF

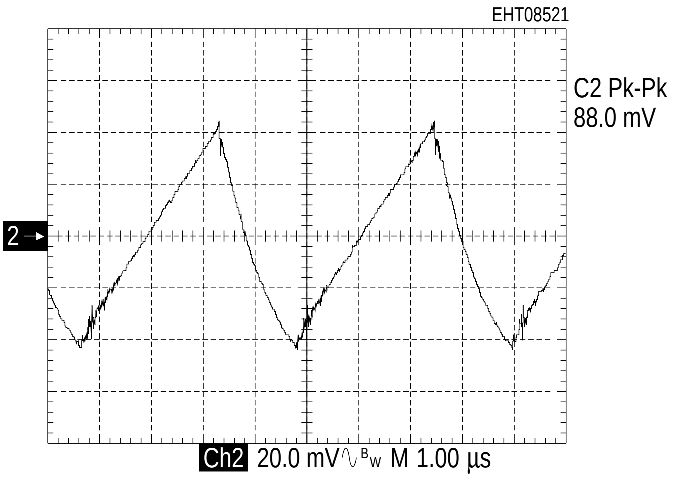


Figure 9 **BGV503: Output Voltage, AC-coupled,** V_{CC} = 3 V, I_{OUT} = 3 mA, C_{OUT} = 100 nF

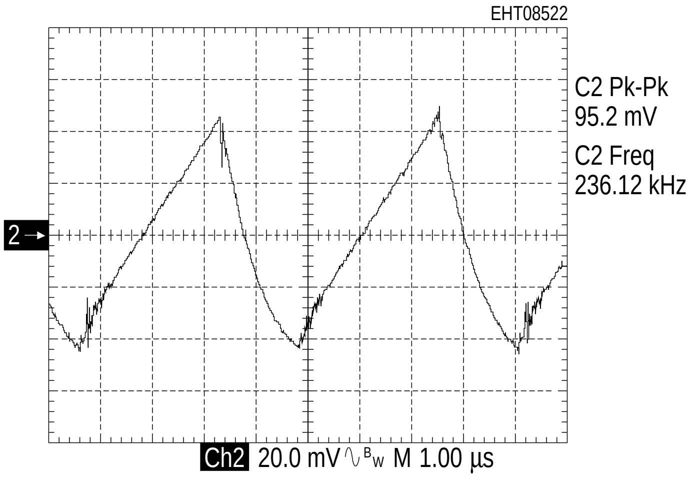


Figure 10 BGV903: Output Voltage, AC-coupled, V_{CC} = 3 V, I_{OUT} = 3 mA, C_{OUT} = 100 nF

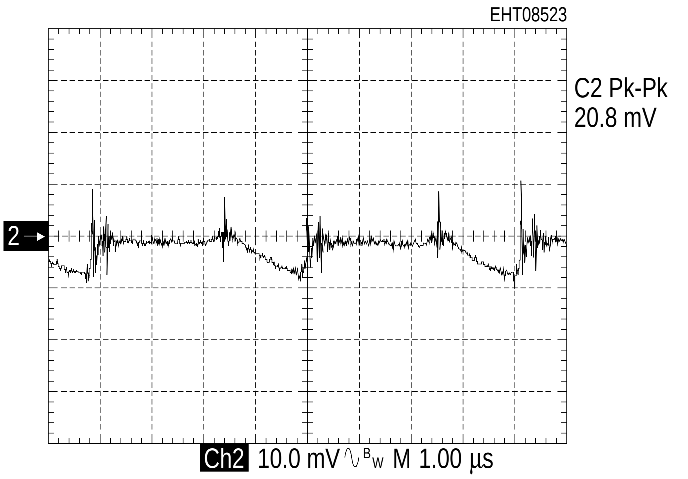


Figure 11 BGV903: Output Voltage, AC-coupled, V_{CC} = 3 V, I_{OUT} = 0 mA, C_{OUT} = 100 nF

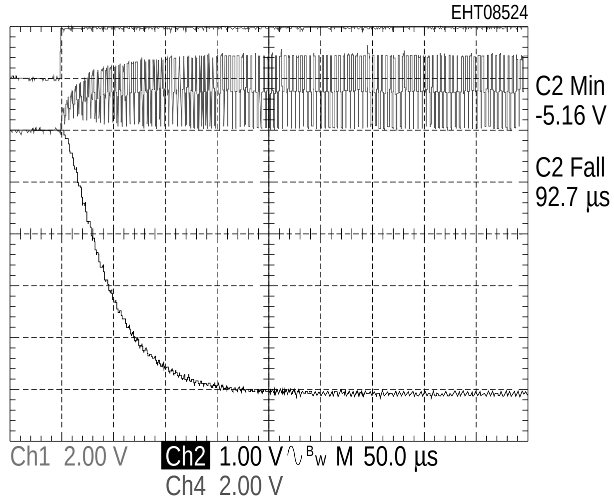


Figure 12 **BGV903: Startup from Shutdown** V_{CC} = 3 V, R_{LOAD} = 1.7 kΩ, C_{OUT} = 100 nF

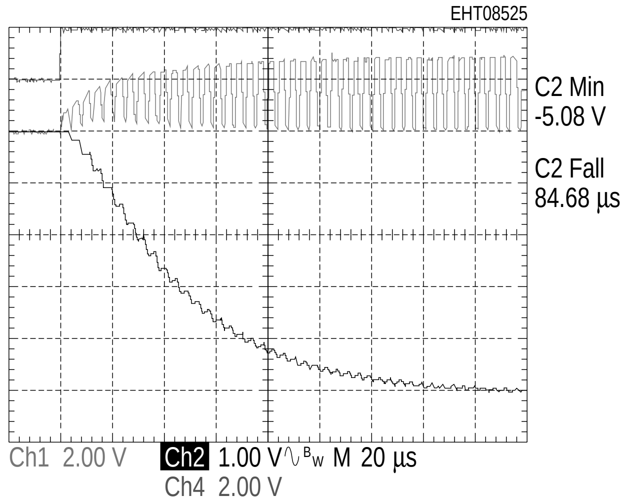


Figure 13 **BGV903: Startup from Shutdown** V_{CC} = 3 V, R_{LOAD} = 1.7 kΩ, C_{OUT} = 100 nF

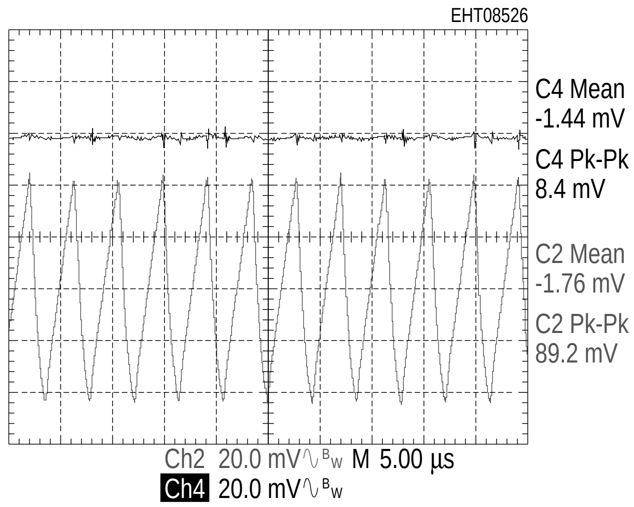
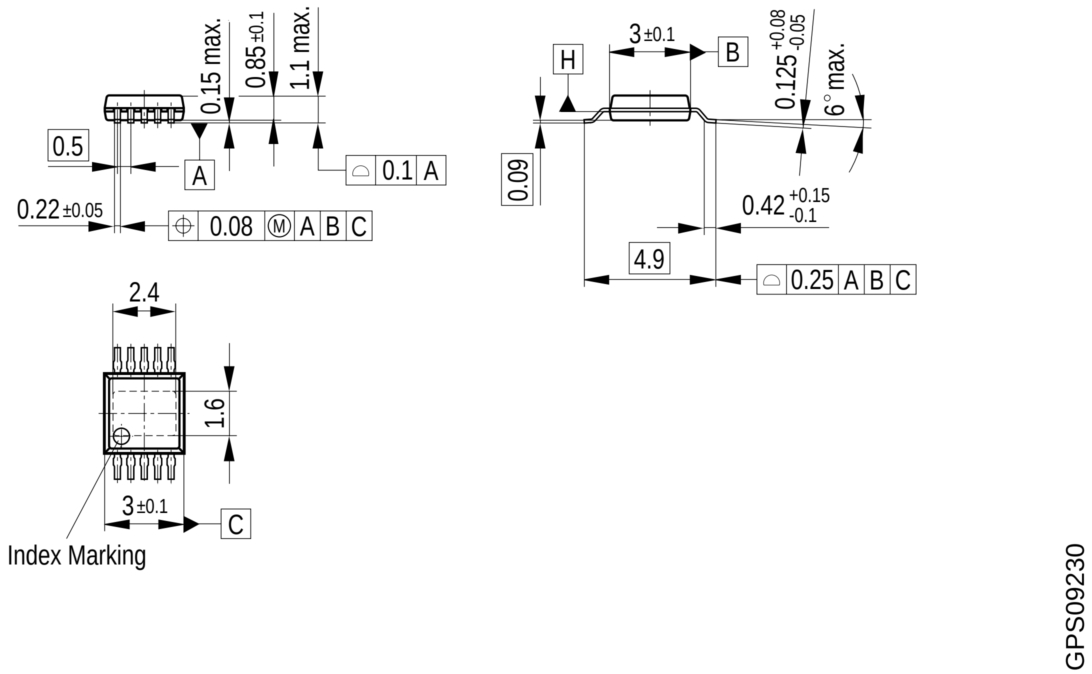


Figure 14 BGV903: Output Voltage and Filtered Output Voltage, V_{CC} = 3 V, I_{OUT} = 3 mA, C_{OUT} = 100 nF

Note: Bandwidth of oscilloscope is 20 MHz.

Package Outlines

P-TSSOP-10-2
(Plastic Thin Shrink Small Outline Package)



Sorts of Packing
Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm