BHW Technologies (博泓微科技有限公司)

Advanced RF IC, Antenna, Filter, RF Front-End and Wireless System Solutions

BHW Application Note #005

Sub-1GHz Applications of BHWA350 2-in-1 Wideband Fully Matched Amplifier

Rev. 1.4

Background: Sub-1GHz Wireless for IoT

Background & Challenges:

➤ Sub-1GHz Frequencies such as 315/433/868/915MHz Offer Unique Advantages for Wireless Communications, including Long Range, Low Power and Easy Penetration of Foliage and Obstacles

➤ Sub-1GHz is the Spectrum of Choice for LPWAN (Low-Power Wide-Area Network) Protocols, including LoRa, NB-IoT, SigFox and LTE-M, for Applications such as Asset Tracking , Smart Metering, Smart Cities and Home Automation

➤ Sub-1GHz Frequencies are also Widely used in Other IoT Applications such as ZigBee, Z-Wave, RFID/RAIN and Many Proprietary Systems

➤ RF Power Amplifiers, whether Integrated inside the SoC or Implemented Externally, Play a Critical Role for Successful Deployment of Long-Range Sub-1GHz Products

BHW Solutions & Benefits:

➤ Using Advanced GaAs HBT & ED-PHEMT Technologies, BHW has Developed a Broad Portfolio of High-Performance, Cost-Effect RF Front-End ICs for Various Wireless Applications from 300MHz to 6GHz

➤ BHWA251 is a GaAs HBT PA Capable of Half-Watt Output at 915MHz in a Very Compact 1.5x1.5mm DFN-6L Package

➤ BHWL160 is a GaAs ED-PHEMT LNA with Best-Class Noise Figure of sub-1dB in the 868/915MHz ISM Bands

➤ BHWA350 is a Unique 2-in-1 Cost-Effective Wideband Gain Block with up to 35dB Gain and 21dBm Output Power to Offer an Extra Flexibility in Sub-1GHz System Designs, whether as a Driver or as a Medium-Level Transmitter PA
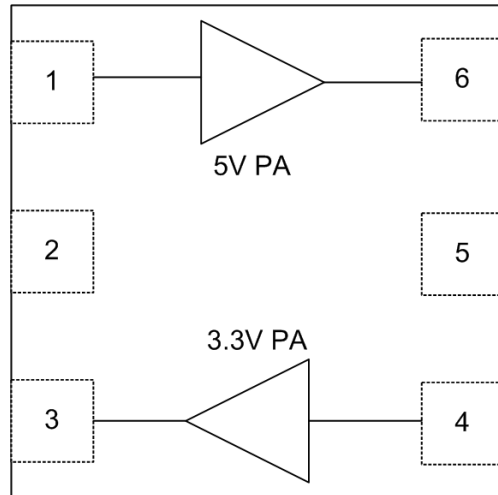
This AppNote Provides Details on Various Use Cases of BHWA350 as well as EVB Test Data. For Complete Front-End Implementation at 868/915MHz, Please Refer to the Companion BHW AppNote #004, "UHF 900MHz RF Front-End Solution Using BHWA251 Half-Watt PA and BHWL160 Sub-1dB-NF LNA".
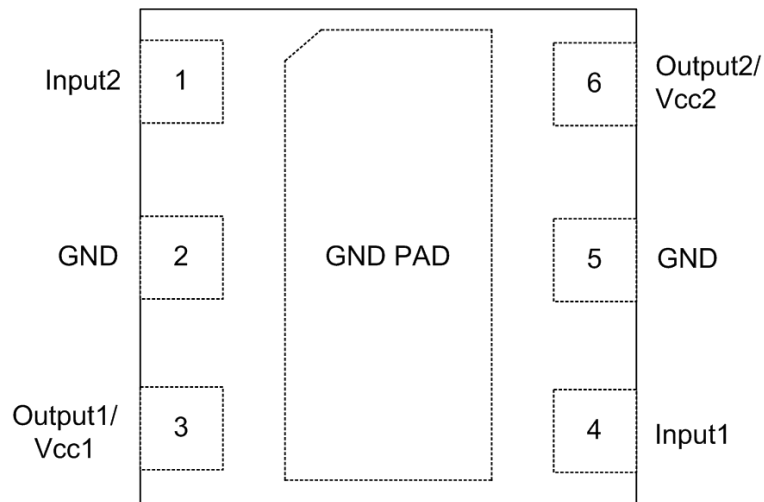
BHWA350 2-in-1 Wideband Matched Amplifier

Functional Block Diagram

5V PA

3.3V PA

Package Pin-Out
(Top "See-Through" View)

Input2 — 1
GND — 2
Output1/ Vcc1 — 3

GND PAD

6 — Output2/ Vcc2
5 — GND
4 — Input1

DFN-6L 1.5x1.5x0.55mm

Product Overview:

➢ Advanced GaAs/InGaP HBT Process
➢ Fully Matched Input/Output Ports
➢ Broadband 100MHz - 6GHz Operation
➢ Gain: 18/16/10dB at 0.9/2.45/5.5GHz (Single)
➢ Gain: 35/32/20dB at 0.9/2.45/5.5GHz (Cascade)
➢ Psat: 15/14/13dBm at 0.9/2.45/5.5GHz (3.3V)
➢ Psat: 21/19/18dBm at 0.9/2.45/5.5GHz (5V)
➢ Low Quiescent Current 25/55mA at 3.3/5V
➢ Integrated ESD Protection on All Ports (1KV HBM)
➢ Ultra-Small 1.5x1.5mm DFN Package
➢Two Independent Power Amplifiers in One Package

Applications:

➢ VHF/UHF/2.45GHz/5GHz Wireless Audio
➢ 2.4GHz Wi-Fi, ZigBee/THREAD/Thread/IoT
➢ 5-6GHz Wi-Fi Drivers or Power Boosters
➢ 315/433/868/915MHz Sub-1GHz Applications
➢ 700-3000MHz Small Cells and Cellular Repeaters
➢ Linear Driver for High-PAPR Waveforms such as OFMD, WCDMA, LTE/5G
➢ Generic Driver Amplifier from VHF/UHF to C-Band

BHWA350 5V Single PA for UHF 300-1000MHz

Application Schematic for 5V PA
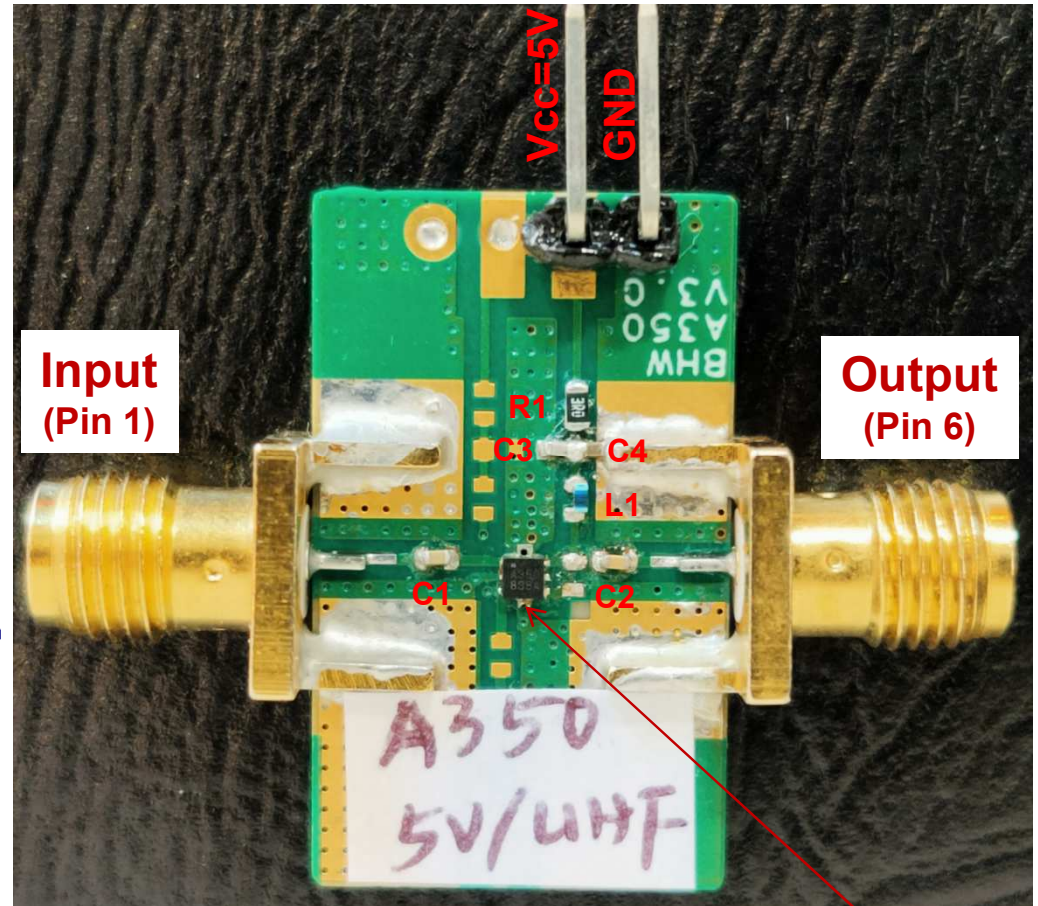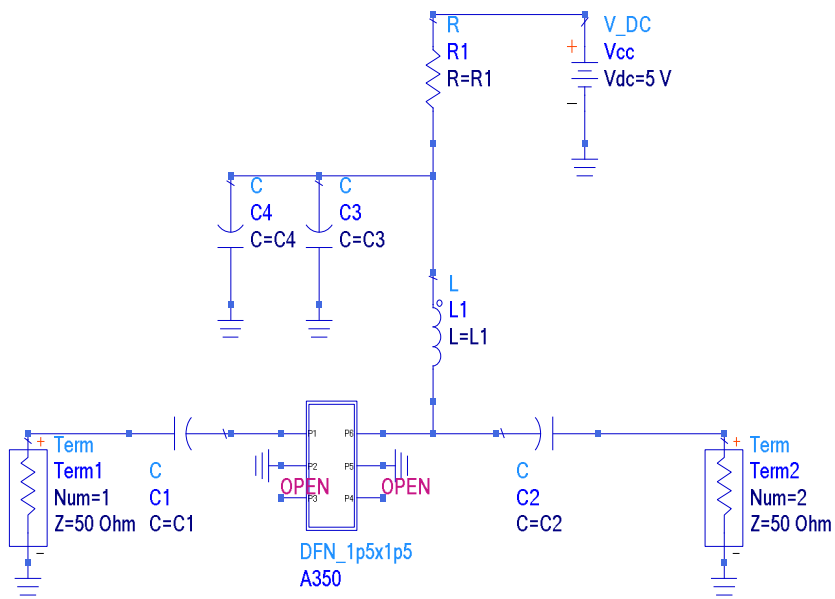
Recommended BOM for 300-1000MHz at Vcc=V5:
- DC Block: C1=C2=470pF
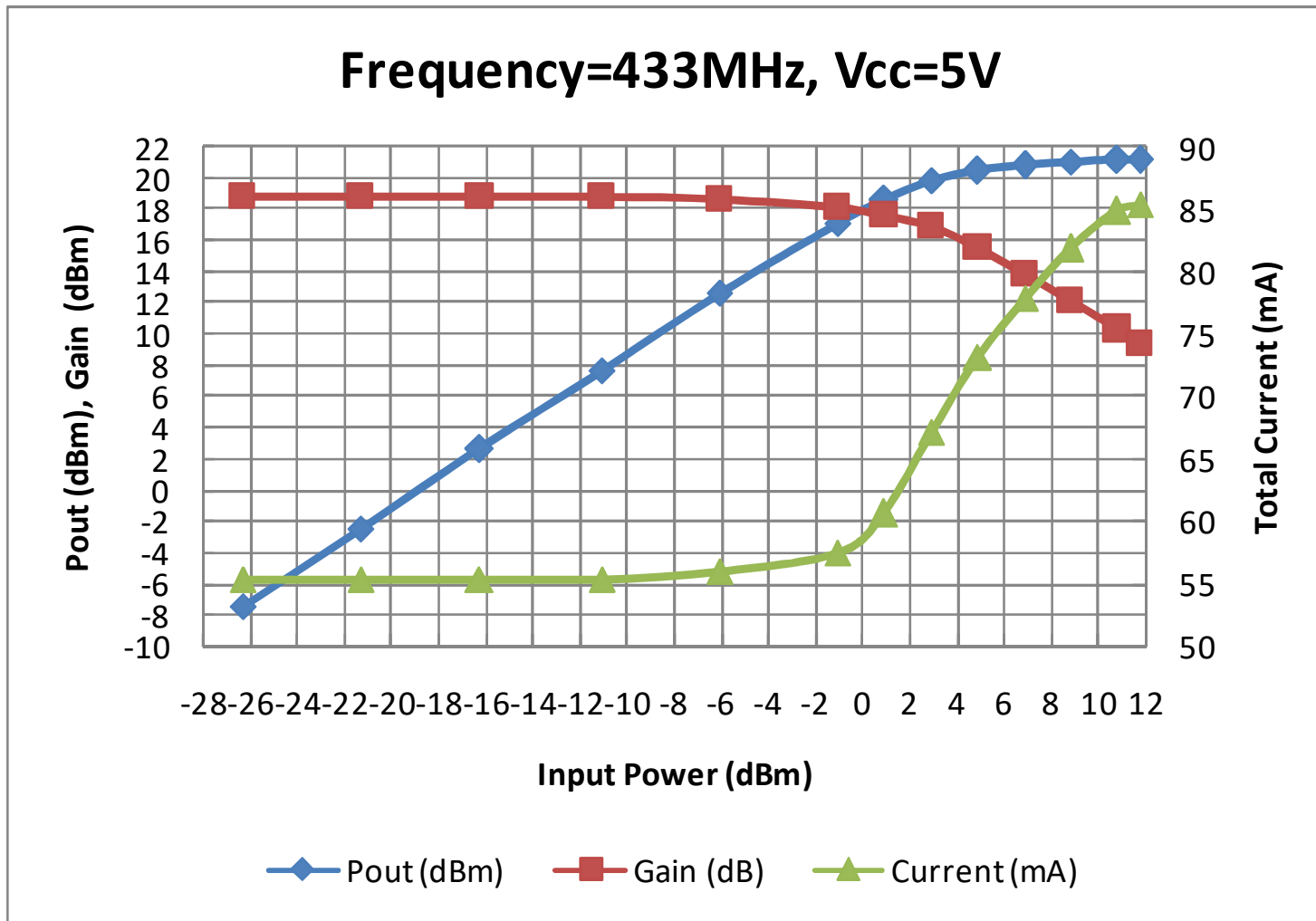- DC Feed: L1=27nH, R1=1 Ohm
- Vcc Bypass: C3=100pF, C4=1uF

A350 Orientation

Typical CW Power Sweep at 433MHz

Frequency=433MHz, Vcc=5V

Notes:

-Bias Setting: Vcc=5V, R1= 1 Ohm, Icq~55mA

-Measured data include minor losses of SMA connector and PCB feedline

Typical CW Power Sweep at 700MHz
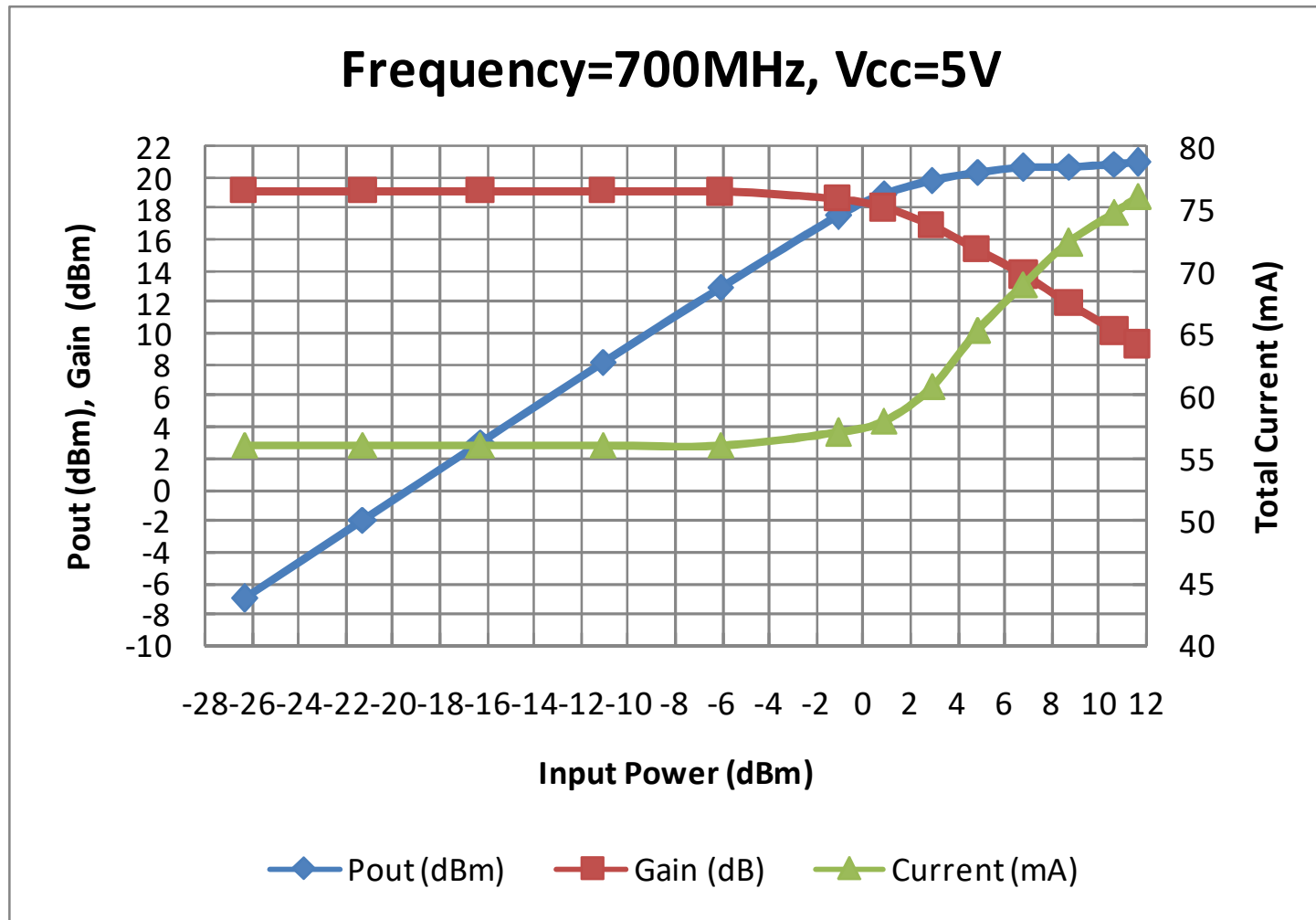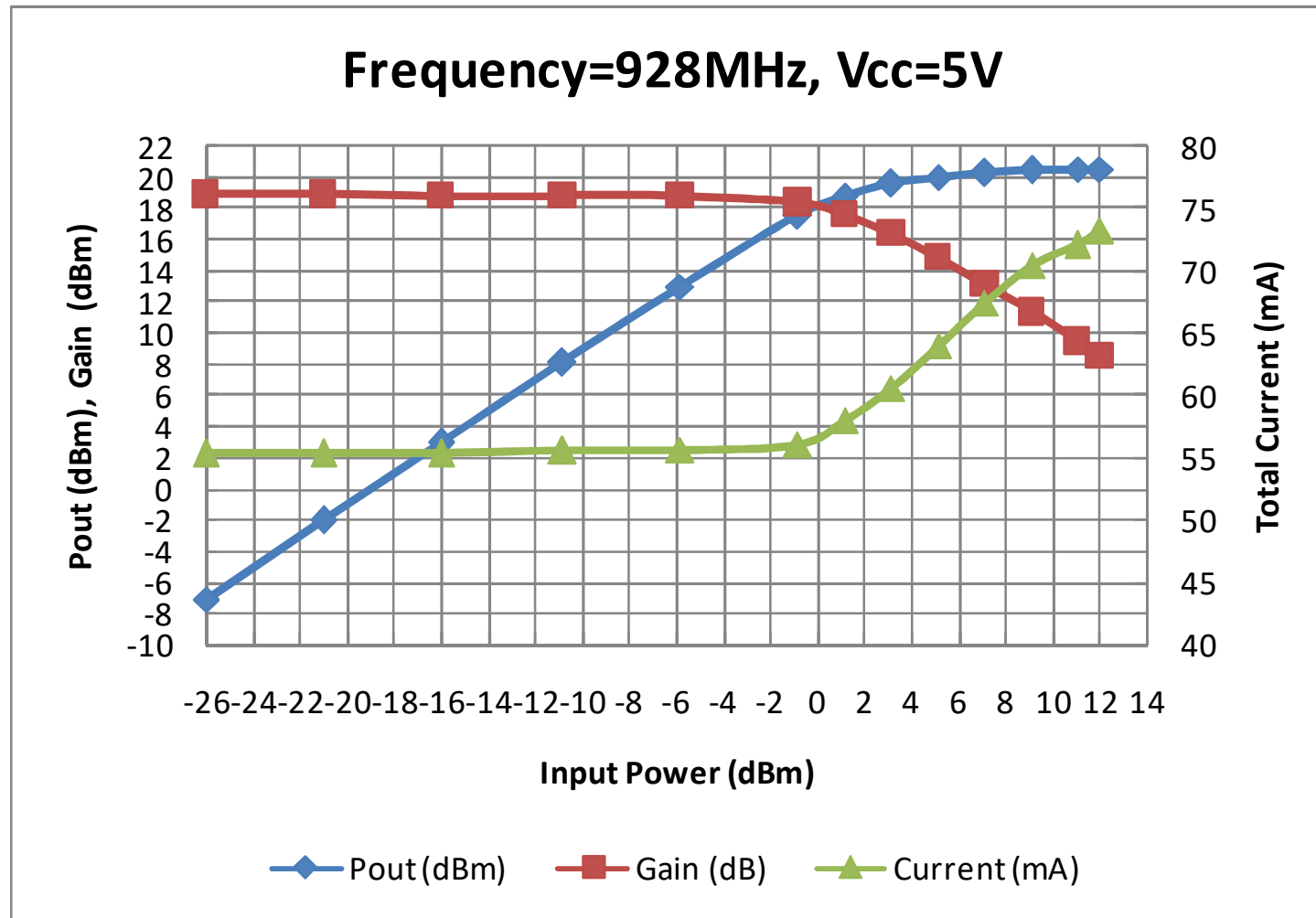

Frequency=700MHz, Vcc=5V

Notes:

-Bias Setting: Vcc=5V, R1= 1 Ohm, Icq~55mA

-Measured data include minor losses of SMA connector and PCB feedline

BHWA350 5V Single PA for UHF 300-1000MHz

Typical CW Power Sweep at 928MHz

Frequency=928MHz, Vcc=5V

Legend: Pout (dBm), Gain (dB), Current (mA)

Notes:

-Bias Setting: Vcc=5V, R1= 1 Ohm, Icq~55mA

-Measured data include minor losses of SMA connector and PCB feedline

BHW RF Front-End AppNote Library

This is an abridged version of BHW AppNote #005. Please contact BHW Support or your local sales rep/distributor for a complete copy of the document and other related information.

BHW RF Front-End AppNote Library

In addition to standard datasheets and EVB/BOM info, BHW publishes an AppNote series that address various topics on RF front-end design and performance over a wide frequency range from 300MHz to 6GHz, as an effort to assist customers in developing cutting-edge, cost-competitive products:

- BHW AppNote #001 - Cross-Over Cascade of BHWM253 to Boost Tx Power and Rx Sensitivity of 2.4GHz Systems
- BHW AppNote #002 - Accurate Benchmark of GNSS CN0 Using the Power-Splitter Method
- BHW AppNote #003 - Boosting Wi-Fi Tx Power and Rx Sensitivity with BHWA251 and BHWM252
- BHW AppNote #004 - UHF 900MHz RF Front-End Solution Using BHWA251 Half-Watt PA and BHWL160 Sub-1dB-NF LNA
- BHW AppNote #005 - Sub-1GHz Applications of BHWA350 2-in-1 Wideband Fully Matched Amplifier
- BHW AppNote #006 - Low-Noise High-IIP3 LNB Architecture for Dual-Band High-Precision GNSS Using Cascade of BHWL160
- BHW AppNote #007 - UWB RF Front-End Solution Using BHWA350 and BHWM552
- BHW AppNote #008 - High-Power 5.8GHz RF Front-End Solution Using BHWA555 and BHWM552 for ETC, V2X and Wireless Video
- BHW AppNote #009 - 5.8GHz RF Front-End Using BHWA350 and BHWM552 for Wireless Audio
- BHW AppNote #010 - Multi-Constellation GNSS Active Antenna Using BHWL161 Cascade and Single-Fed Dual-Band Antenna
- BHW AppNote #011 - BHWL161 Super-Compact Low-Power Low Noise Amplifier for Range Extension of 2.4GHz RC and IoT
- BHW AppNote #012 - Enabling Cost-Effective High-Precision GNSS Using BHWL161 and Linear-Polarization PCB Antenna
- BHW AppNote #013 - Enabling Long-Range BLE AoA&AoD for High-Precision Indoor Positioning with BHW GaAs RF Front-End ICs
- BHW AppNote #014 - Designing Ultra Low-Power High-Performance GNSS Products Using BHWL160 GaAs PHEMT LNA
- BHW AppNote #015 - BHWL161 GNSS Full-Band High-Performance LNA in Super-Compact 1x1mm DFN with Relaxed Pin Pitch
- BHW AppNote #016 - Improving GNSS NF Measurement Accuracy Using Broadband LNA BHWL161 as Pre-Amp
- BHW AppNote #017 - High-Efficiency, Low-NF 2.4GHz Front-End Solution for IoT Using BHWA251 and BHWM252
- BHW AppNote #018 - Optimizing BHWA555 Wideband One-Watt PA for Long-Range 5.8GHz Transmitter Applications
- BHW AppNote #019 - Miniature 2.4GHz RF Front-End with Integrated Chip Antenna and BHWM253 for TWS and IoT
- BHW AppNote #020 - Doubling the Range for 2.4GHz Music Streaming with BHWR250L Active Integrated Antenna (AIA)

Contact support@bhwtechnologies.com or BHW distributor/representative for your copy of the above and new up-coming documents.