



2.4GHz GaAs RF Front-End Module with PA, LNA and Switch

Description

BHWM258 is a Transmit/Receive RF Front-End Module in advanced GaAs process that integrates a power amplifier with 21dBm saturated power, a low noise amplifier and an SPDT switch. With high PA power efficiency and low LNA noise figure, BHWM258 features the industry's leading performance for 2.4GHz applications including Bluetooth/BLE, ZigBee/CSA, Thread/Matter and other IoT connectivity devices. BHWM258 has ESD protection at all I/O ports. It is housed in a simple miniature 2x2mm 8-L DFN (Dual Flat No-Lead) package.

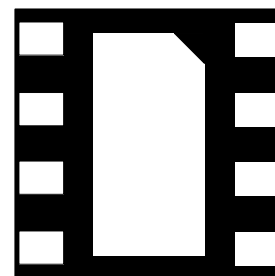
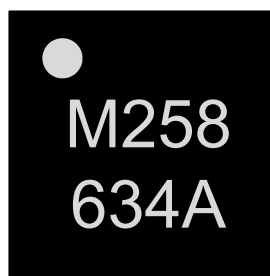
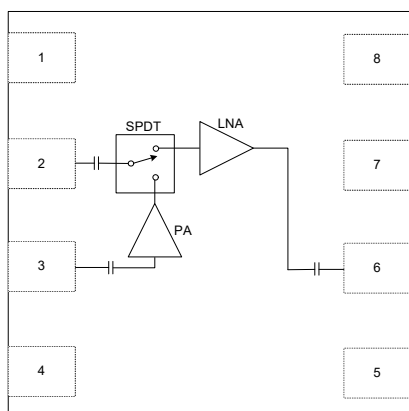
Key Features

- Advanced GaAs Process
- Tx Power: 21dBm/3.3V at Antenna (CW)
- Tx Total Current: 105mA @ 20dBm, 3.3V
- Tx Gain: 13dB
- Rx Gain/Noise Figure: 13dB/2dB at 3.3V
- LNA High-Linearity: Input P1dB~-2dBm at 3.3V
- Robust ESD: $\pm 700\text{V}$ HBM; $\pm 2\text{kV}$ CDM
- Compact 2x2mm DFN-8L Package

Key Applications

- 2.4GHz IoT Module Range Extension
- Asset Tracking
- Smart Meters, Smart Buildings
- LE Audio, Auracast
- Bluetooth NTN
- Wireless Microphone/Video
- ZigBee/Thread/Matter Range Booster
- Generic 2.4GHz TDD Radio Designs

Functional Block and Package Information

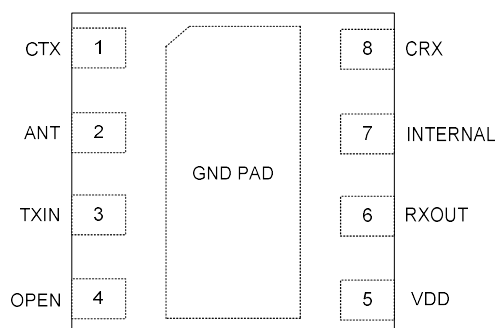


2x2x0.75mm 8L DFN



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Pin Assignment and Pin Description



(Top “See-Through” View)

Pin #	Pin Name	Description
1	CTX	Control Voltage for Transmit Mode
2	ANT	Antenna Port
3	TXIN	RF Port for PA Input in Transmit Mode
4	OPEN	Must be kept OPEN
5	VDD	DC Power Supply for PA and LNA
6	RXOUT	LNA Output in Receive Mode
7	INTERNAL	Must Connect to GND with 1uF Bypass Capacitor
8	CRX	Control Voltage for Receive Mode

Absolute Maximum Ratings

Parameter		Rating	Unit
Maximum Supply Voltage		4.5	V
Maximum Control Voltage		3.6	V
Maximum Supply Current		200	mA
Maximum Input Power to PA		+15	dBm
Maximum Input Power to LNA		+10	dBm
Operation Temperature		-40 to +85	°C
Storage Temperature		-40 to +150	°C
Moisture Sensitivity Level		MSL1	

Note: Do not exceed any single or combination of the above parameters. Sustained operation at or above the Absolute Maximum Ratings may result in permanent damage to the device. Maximum Input Power Rating assumes 50-Ohm load impedance.



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Electrical Specifications: Transmit Mode (TXIN to ANT)

Parameter	Condition	Specification			Unit
		Min.	Typ.	Max.	
Operating Frequency		2.4		2.5	GHz
Operating Voltage		1.2	3.3	4.2	V
Logic Control Voltage	For CTX=High	1.2	3.3	3.6	V
Quiescent Current*	VDD=CTX=3.3V, CRX=0		80		mA
Shutdown Current	VDD=3.3V, CTX=CRX=0		1		uA
Small-Signal Gain	Pin=-30dBm		13		dB
Saturated Output Power**	VDD=3.3V,		21		dBm
Output P1dB	VDD=3.3V		20		dBm
Total Current	VDD=3.3V, Pout=20dBm		105		mA
Second Harmonic	At Pout=20dBm, 3.3V VDD		-10		dBm/MHz
Input Return Loss	2.4-2.5GHz		10		dB
Output Return Loss	2.4-2.5GHz		10		dB
Isolation	2.4-2.5GHz		25		dB
Ramp-On Time	10-90%, 100pF Shunt Cap on CTX		30	100	ns
Stability (Load VSWR)	Pin=+13dBm (PA Saturated)		10:1		

*Quiescent current can be controlled with a serial resistor R1 on CTX line, or reduced by using lower CTX control voltage.

**Saturated output power is ~22dBm for non-CW applications with lower-than-100% duty cycle.

Electrical Specifications: Receive Mode (ANT to RXOUT)

Parameter	Condition	Specification			Unit
		Min.	Typ.	Max.	
Operating Frequency		2.4		2.5	GHz
Operating Voltage		1.2	3.3	4.2	V
Logic Control Voltage	For CRX=High	1.2	3.3	3.6	V
Rx Current*	VDD=CRX=3.3V, CTX=0		8		mA
Rx Gain	Pin=-30dBm		13		dB
Shutdown Current	VDD=3.3V, CTX=CRX=0		0.5		uA
Rx Noise Figure	VDD=CRX=3.3V, CTX=0		2		dB
Input P1dB			-2		dBm
IIP3			+6		dBm
Input Return Loss			10		dB
Output Return Loss			6		dB
Isolation			25		dB
Ramp-On Time	10-90%, 100pF Shunt Cap on CRX		50	100	ns
Stability (Mu Factor)		1			

* Rx current can be reduced by inserting a serial resistor on CRX line, or using lower CRX control voltage.

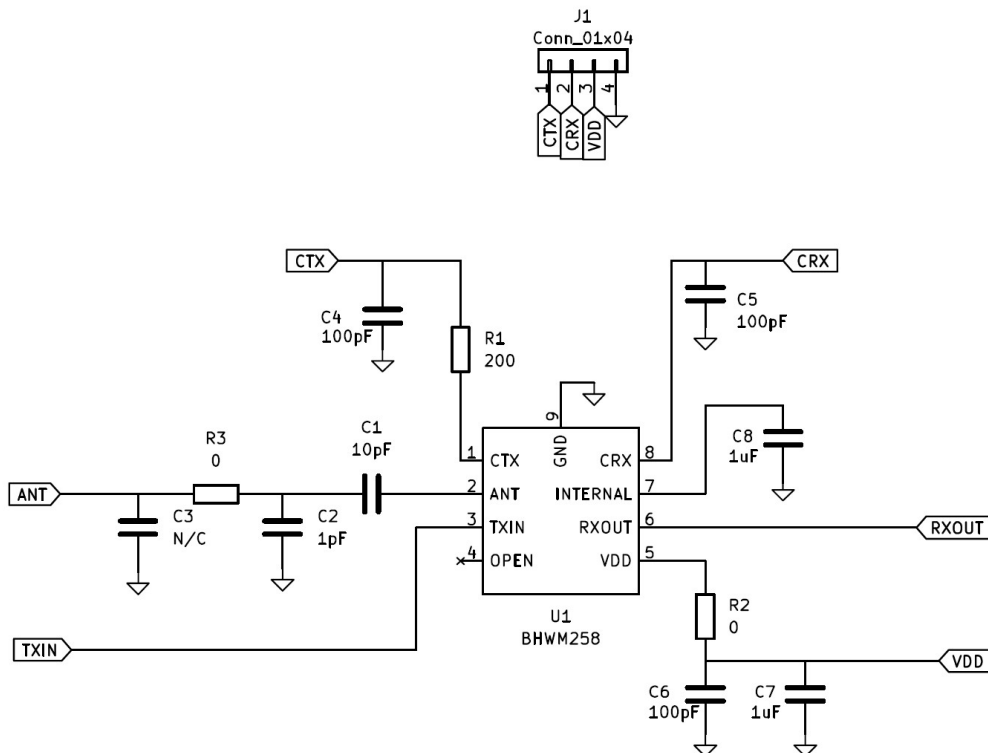


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Logic Control

CTX (Pin 1)	CRX (Pin 8)	Mode of Operation
1	0	Transmit (PA On)
0	1	Receive (LNA On)
0	0	Shutdown
1	1	Not Allowed

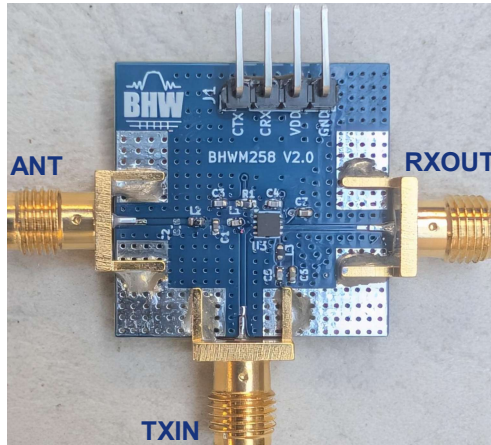
Application Schematic





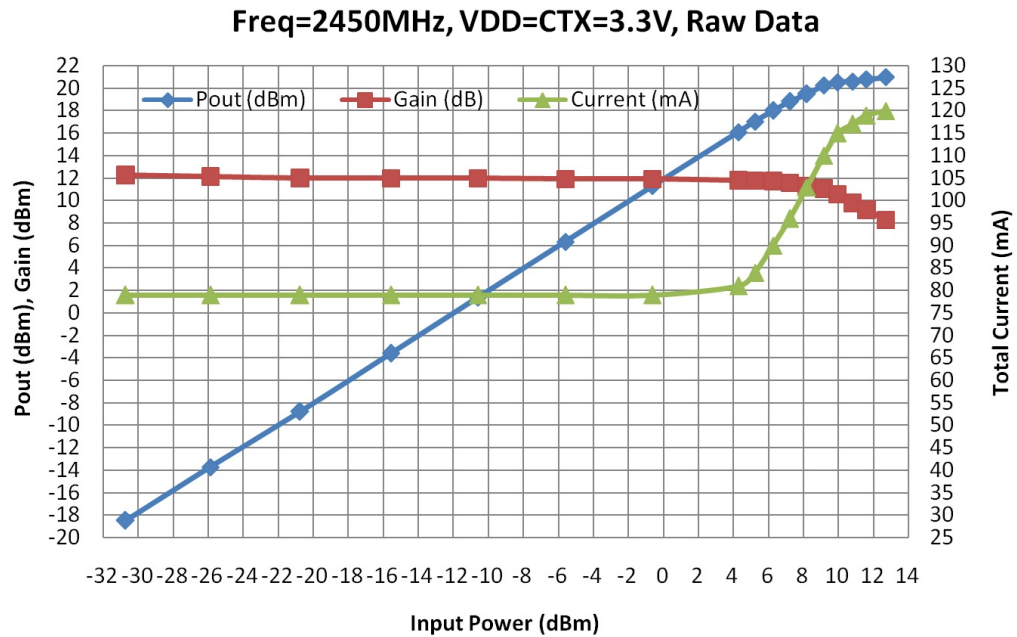
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Evaluation Board



Note: Refer to Application Schematic for details of BOM.

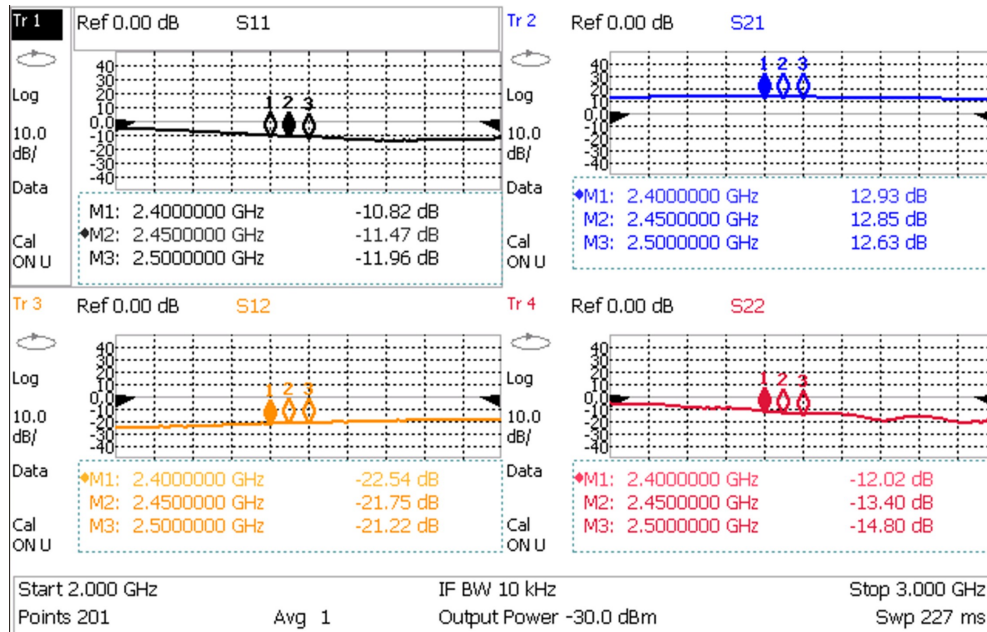
RF Characteristics



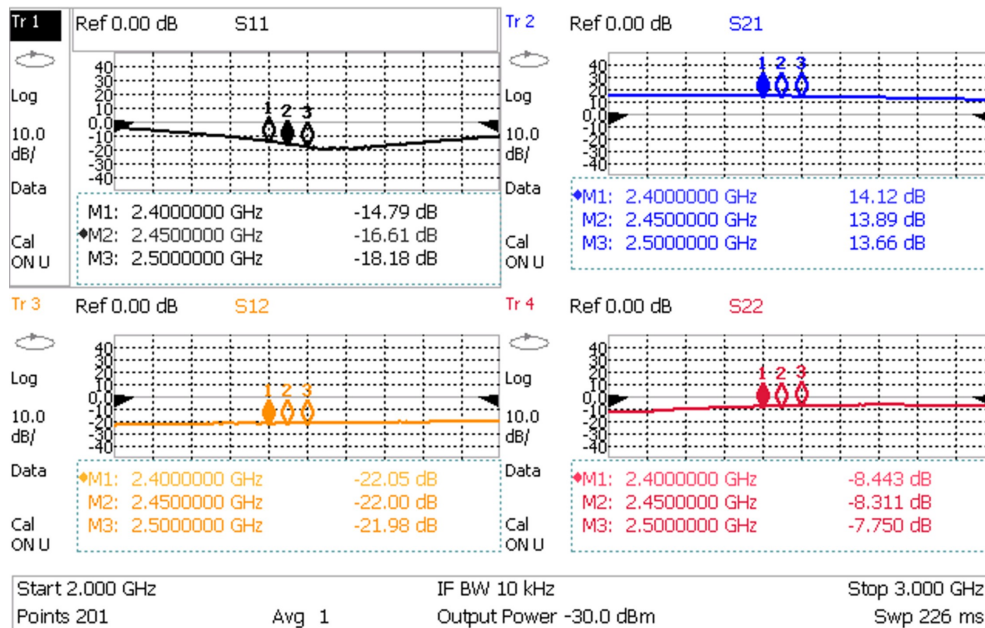
Typical Tx CW Power Sweep Data at VDD=CTX=3.3V



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Typical S-Parameters in Tx Mode, VDD=CTX=3.3V, CRX=0

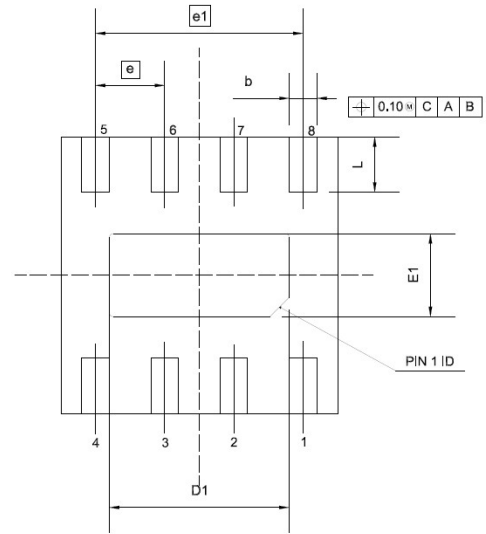
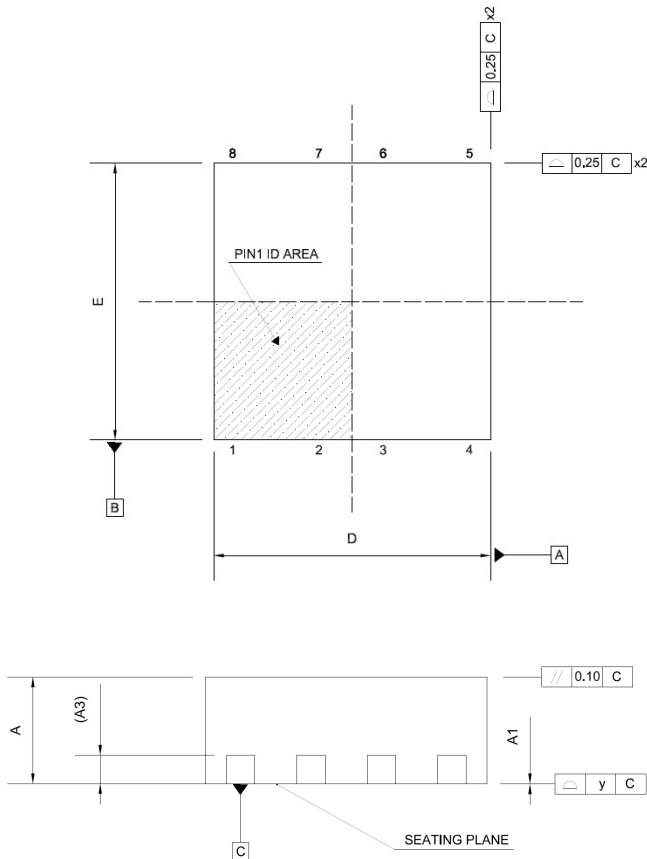


Typical S-Parameters in Rx Mode, VDD=CRX=3.3V, CTX=0



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Package Drawing and Dimensions

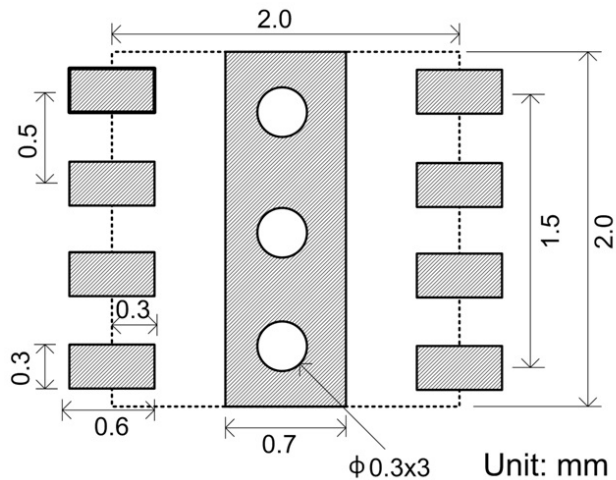


SYMBOL	DIMENSION (MM)			DIMENSION (MIL)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.75	0.80	27.6	29.5	31.5
A1	0.00	0.02	0.05	0	0.8	2
A3	0.02 REF			8 REF		
b	0.15	0.20	0.25	6	8	10
D	2.00 BSC			79 BSC		
D1	1.25	1.30	1.35	49.2	51.2	53.2
E	2.00 BSC			79 BSC		
E1	0.55	0.60	0.65	21.6	23.6	25.6
e	0.50 BSC			19.7 BSC		
e1	1.50 BSC			59 BSC		
L	0.30	0.40	0.50	11.8	15.7	19.7
y			0.08			3

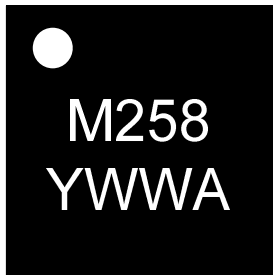


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Recommended Land Pattern



Package Marking



- ← Line 1: Pin 1 Indicator
- ← Line 2: Part Number, M258
- ← Line 3: Datecode, YWWA

Date Code Description

Y: Year Code (e.g., 6 for 2026)

WW: Working Week (01~52)

A: Revision Code (Default=A)



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Recommended Reflow Soldering Profile

