0.1-10.0 GHz Low Noise, Medium Power pHEMT in a Surface Mount Plastic Package

Mimix BROADBAND™

October 2007 - Rev 25-Oct-07

CFS0103-SB
RoHS

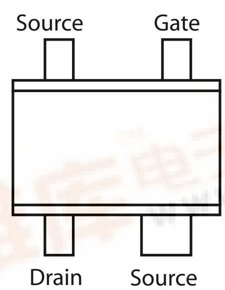
Features

- AlGaAs/InGaAs/AlGaAs Pseudomorphic High Electron Mobility Transistor (pHEMT)
- High Dynamic Range
- Low Current and Voltage
- Bias Point 3V and 40 mA
- 0.4 dB Noise Figure at 2 GHz
- 16 dBm P1dB at 2 GHz
- 26 dBm OIP3 at 2 GHz
- 300µm Gate Width
- Excellent Uniformity
- Low-Cost, Surface-Mount Package (SOT-343)
- RoHS Compliant Construction
- Low Thermal Resistance: 170ºC/W

Applications

- Low Noise Amplifiers and Oscillators Operating over the RF and Microwave Frequency Ranges
- Cellular/PCS/GSM/W-CDMA
- Mobile Handsets, Base Station Receivers and Tower-Mount Amplifiers
- Wimax, WLAN, LEO, GEO, WLL/RLL, GPS and MMDS Applications
- General Purpose Discrete pHEMT for Other Ultra Low-Noise and Medium Power Applications

Functional Diagram (SOT-343)



Description

Mimix's pHEMT technology is tested and proven in military, space and commercial applications. Mimix's proven workhorse, the CF001-03, is now available in packaged form as the CFS0103-SB.

The CFS0103-SB is a high dynamic range, low noise, pHEMT packaged in a 4-lead SOT-343 surface mount plastic package. It is intended for many applications operating in the 0.1 GHz to 10 GHz frequency range.

Mimix's high performance packaged pHEMTs are ideal for use in all applications where low noise figure, high gain, medium power and good intercept is required. The CFS0103-SB is the perfect solution for the first or second stage of a base station LNA due to the excellent combination of low noise figure and linearity. It is also well suited as a medium power driver stage in pole-top amplifiers and other transmit functions, particularly as the low thermal resistance allows extended power dissipation when voltage and current are adjusted for increased power and linearity.

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Electrical Characteristics

Ta=25ºC, Typical device RF parameters measured in test system.

Parameters	Test Conditions		Min	Typ	Max	Units
Saturated Drain Current[1]	Vds=3V, Vgs=0V		50	70	100	mA
Pinch-off Voltage [1]	Vds=1.5V, Ids=10% of Idss		-0.8	-0.65	-0.5	V
No RF, Quiescent Bias Current	Vgs=0.35V, Vds=3V			30		mA
Transconductance[1]	Vds=2.5V. Gm=Idss/Vp		75	110		mmho
Gate to Drain Leakage Current	Vgd = 9				150	µA
Gate Leakage Current	Vgd=Vgs= -4V			10	150	µA
Noise Figure (optimized in a fixed tuned system)	f=1000MHz	Vds=2V, Ids=10mA		0.3		dB
		Vds=2V, Ids=20mA		0.3		dB
		Vds=3V, Ids=20mA		0.3		dB
		Vds=3V, Ids=40mA		0.3		dB
	f=2GHz	Vds=2V, Ids=10mA		0.45		dB
		Vds=2V, Ids=20mA		0.4		dB
		Vds=3V, Ids=20mA		0.4		dB
		Vds=3V, Ids=40mA		0.4	0.9	dB
Associated Gain [2]	f=1000MHz	Vds=2V, Ids=10mA		19.7		dB
		Vds=2V, Ids=20mA		20.8		dB
		Vds=3V, Ids=20mA		21.1		dB
		Vds=3V, Ids=40mA		22.4		dB
	f=2GHz	Vds=2V, Ids=10mA		18		dB
		Vds=2V, Ids=20mA		15.5		dB
		Vds=3V, Ids=20mA		15.7		dB
		Vds=3V, Ids=40mA	15	18		dB
Output Third Order Intercept Point	f=1000MHz	Vds=2V, Ids=10mA		16		dBm
		Vds=2V, Ids=20mA		21		dBm
		Vds=3V, Ids=20mA		21.5		dBm
		Vds=3V, Ids=40mA		26.5		dBm
	f=2GHz	Vds=2V, Ids=10mA		18		dBm
		Vds=2V, Ids=20mA		22		dBm
		Vds=3V, Ids=20mA		26		dBm
		Vds=3V, Ids=40mA		29		dBm
1 dB Gain Compression Point [2]	f=1000MHz	Vds=2V, Ids=10mA		10		dBm
		Vds=2V, Ids=20mA		11.5		dBm
		Vds=3V, Ids=20mA		15.5		dBm
		Vds=3V, Ids=40mA		16		dBm
	f=2GHz	Vds=2V, Ids=10mA		10		dBm
		Vds=2V, Ids=20mA		11.5		dBm
		Vds=3V, Ids=20mA		15.5		dBm
		Vds=3V, Ids=40mA		16		dBm

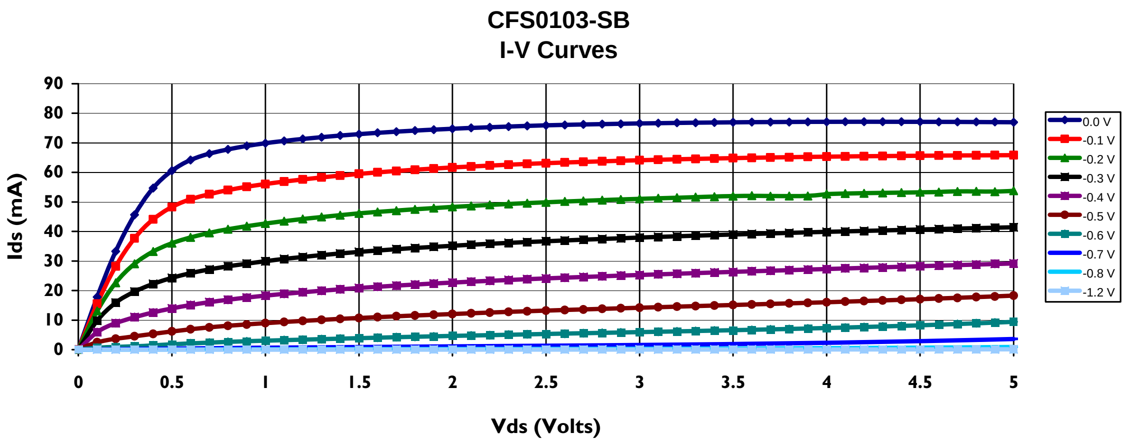
Notes:
1. Guaranteed at wafer probe.
2. Measurements obtained at fixed tuned system.

Absolute Maximum Ratings[1]

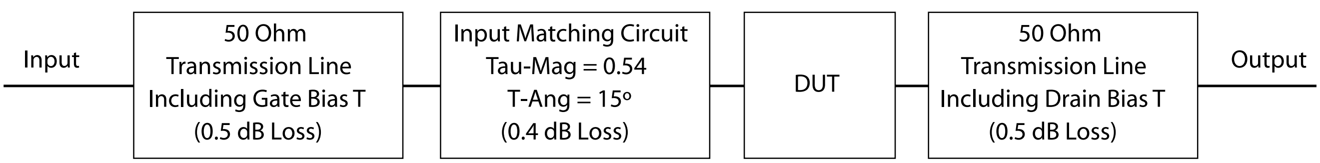
Parameter	Rating	Parameter	Rating	Parameter	Rating
Drain-Source Voltage [2]	+5.5 V	Drain Current [2]	Idss [3] A	Channel Temperature	+175ºC
Gate-Source Voltage [2]	-5.0 V	Total Pwr Dissipation	560 mW	Storage Temperature	-65ºC to +160ºC
Gate-Drain Voltage [2]	-5.0 V	RF Input Power	17 dBm	Thermal Resistance	170ºC/W

Notes:
1. Operation of this device above any one of these parameters may cause permanent damage
2. Assumes DC quiescent conditions. RF OFF.
3. Vgs=0V

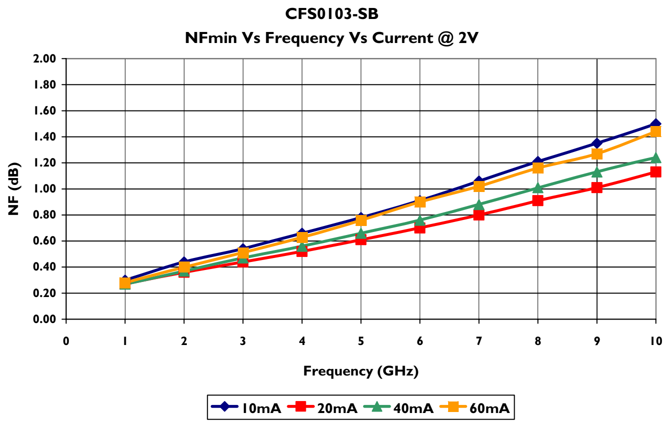
Typical Pulsed I-V Performance

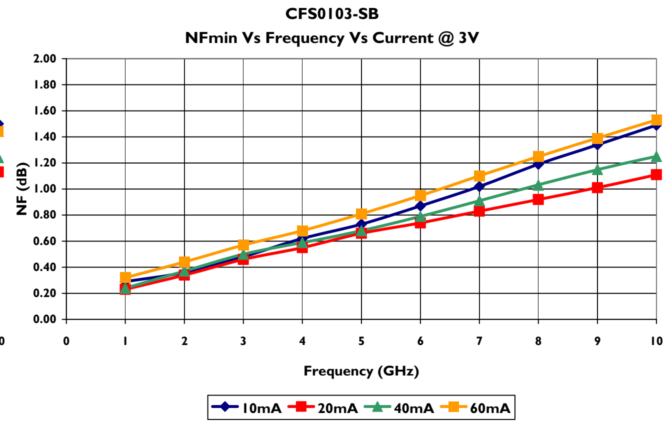


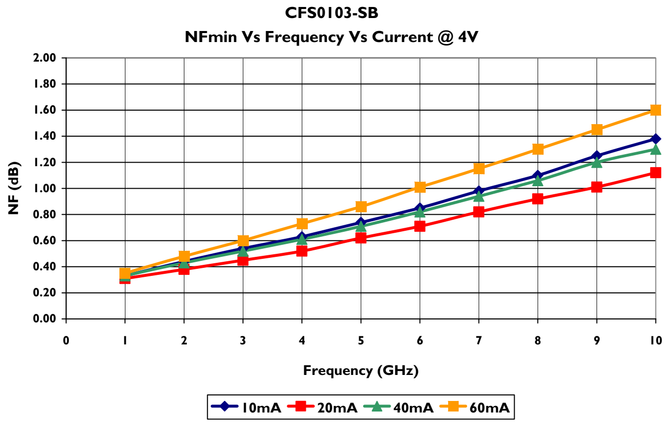
Block diagram of 2.0 GHz production test board used for Noise Figure, Associated Gain, P1dB, and OIP3 measurements.
Circuit Losses have been de-embedded from actual Measurements.

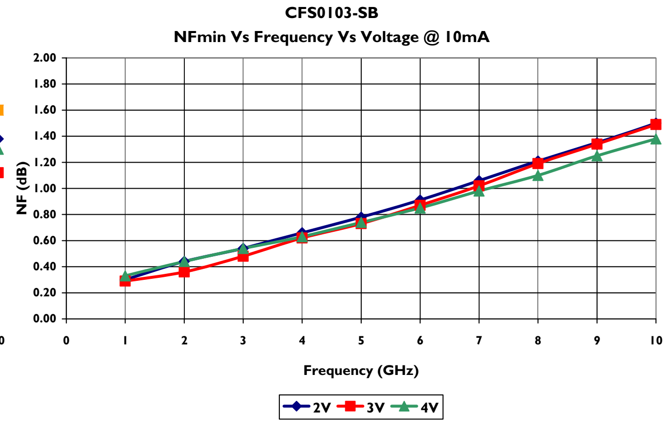


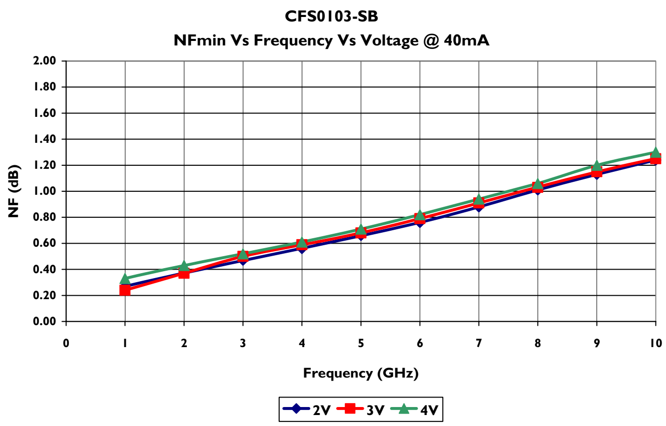
Typical Performance

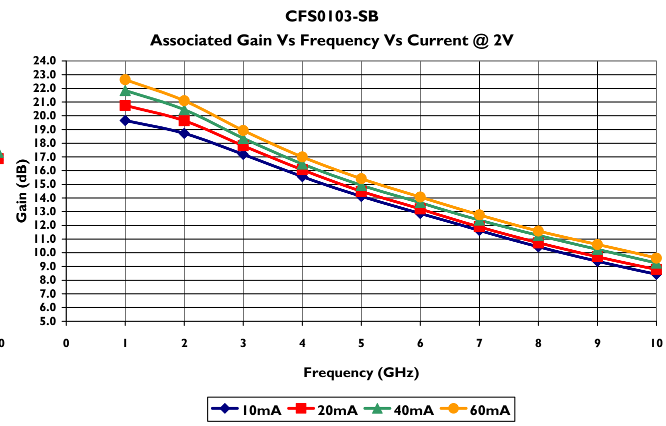




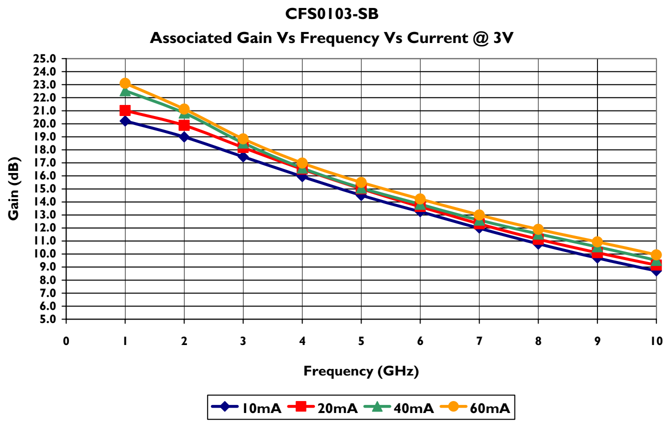


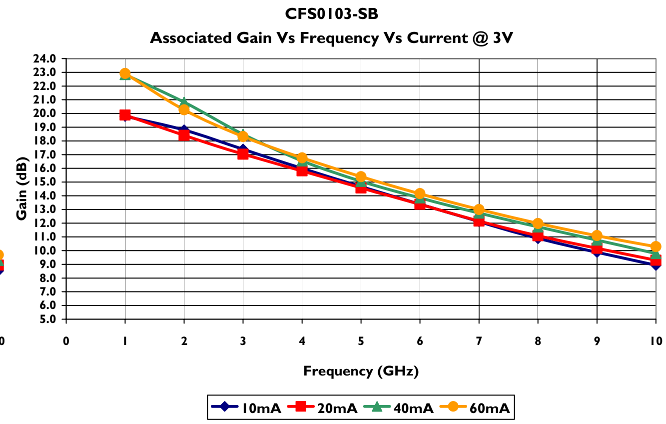


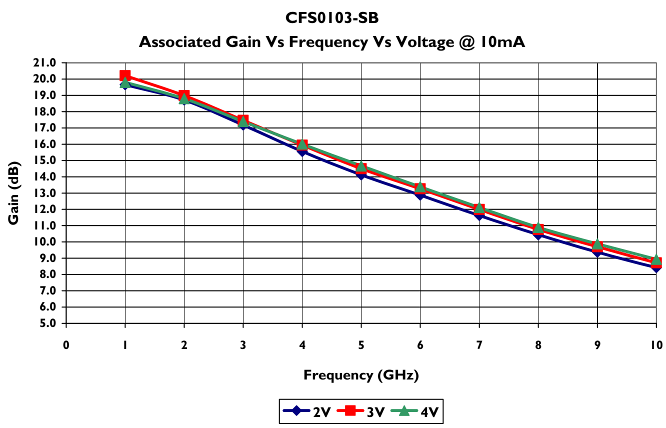


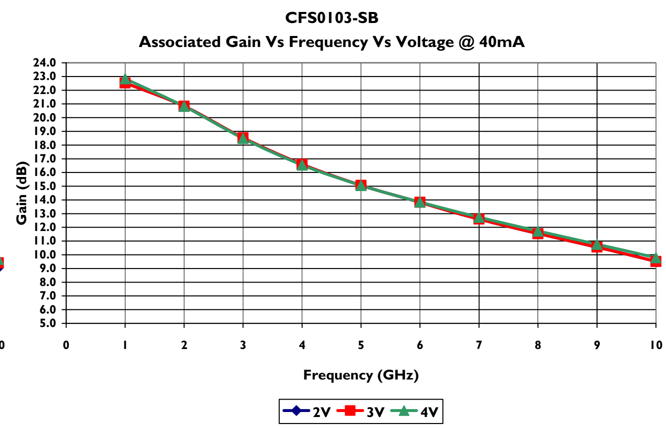


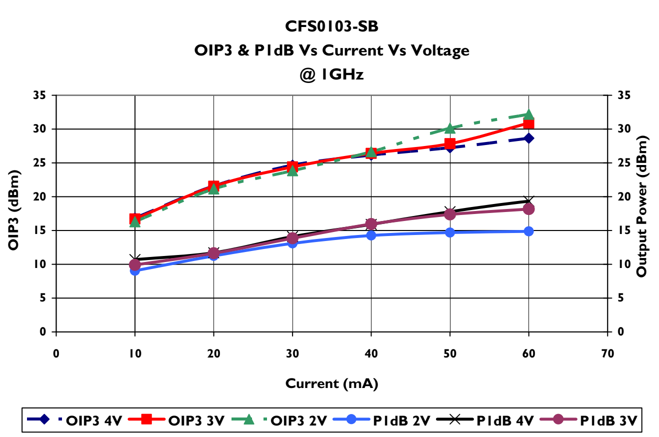
Typical Performance (cont.)

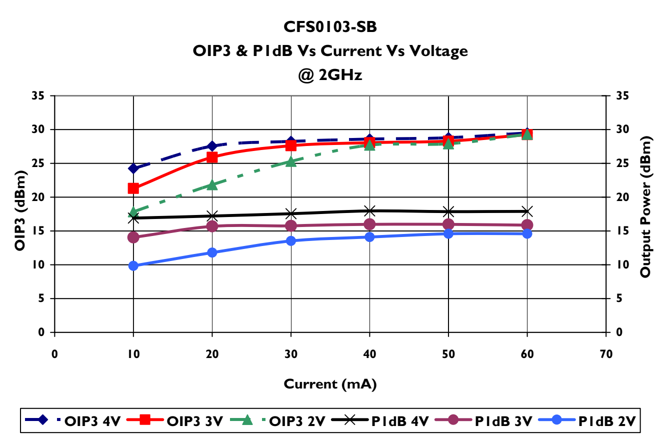












Considerations When Designing for Optimum Noise Figure Using Noise Parameters

For any two-port network, the noise figure gives a measure of the amount of noise added to a signal transmitted through that network. In this datasheet we have given the NFmin and the corresponding optimum source resistance values for the device under various bias conditions. NFmin represents the true minimum noise figure when the device is presented with an impedance matching network that transforms the source impedance typically 50 ohms to that optimum noise matching impedance referred to as Gopt. All stability considerations still apply, of course. If the calculated Rollet stability factor (K) is less than 1, then the source and load reflection coefficients must be carefully chosen. For an accurate graphical depiction of the unstable regions, it is best to draw stability circles.

In practice the impedance that minimizes the noise figure is different from the impedance that minimizes the return loss. Matching techniques such as inductive feedback will be used to bring the noise match closer to this gain match. An additional inherent danger of this technique is the increased instability of the design at higher frequencies. As the frequency increases the source inductance will also increase, this increases the amount of feedback to the devices source up to an oscillation level. This issue can be reduced by carefully choosing the input and output matching topology so that the transducer gain is limited at the frequency of potential oscillation. Design of a high pass / low pass matching network on the input and output is one solution that addresses this problem. Careful simulation is essential using the wideband s-parameters provided and can only be achieved through careful modeling of all components utilized in the design, including:

1. Accurate high frequency models for all surface mount components used.

2. Accurate models of the board characteristics including loss tangents and metal thickness.

3. Use of Via holes and via pads instead of perfect grounds where used.

In any case if the reflection coefficient of the chosen matching network is other than Gopt, then the noise figure of the device will be greater than NFmin. The losses of the matching circuits are also non-zero and it must be considered that the noise figure of the completed amplifier is equal to the noise figure of the device plus the losses of the matching network preceding the device.

The losses of the matching networks are related to the Q of the components and associated printed circuit board loss. In general larger gate width devices will typically have a lower Gopt as compared to smaller gate width devices. Matching to higher impedance devices requires very hi-Q components in order to minimize circuit losses. The main reason for using smaller gate width devices is the trade-off of current consumption and optimum noise performance.

Typical Reflow Profiles

Reflow Profile	SnPb	Pb Free
Ramp Up Rate	3-4 °C/sec	3-4 °C/sec
Activation Time and Temperature	60-120 sec @ 140-160 °C	60-180 sec @ 170-200 °C
Time Above Melting Point	60-150 sec	60-150 sec
Max Peak Temperature	240 °C	265 °C
Time Within 5 °C of Peak	10-20 sec	10-20 sec
Ramp Down Rate	4-6 °C/sec	4-6 °C/sec

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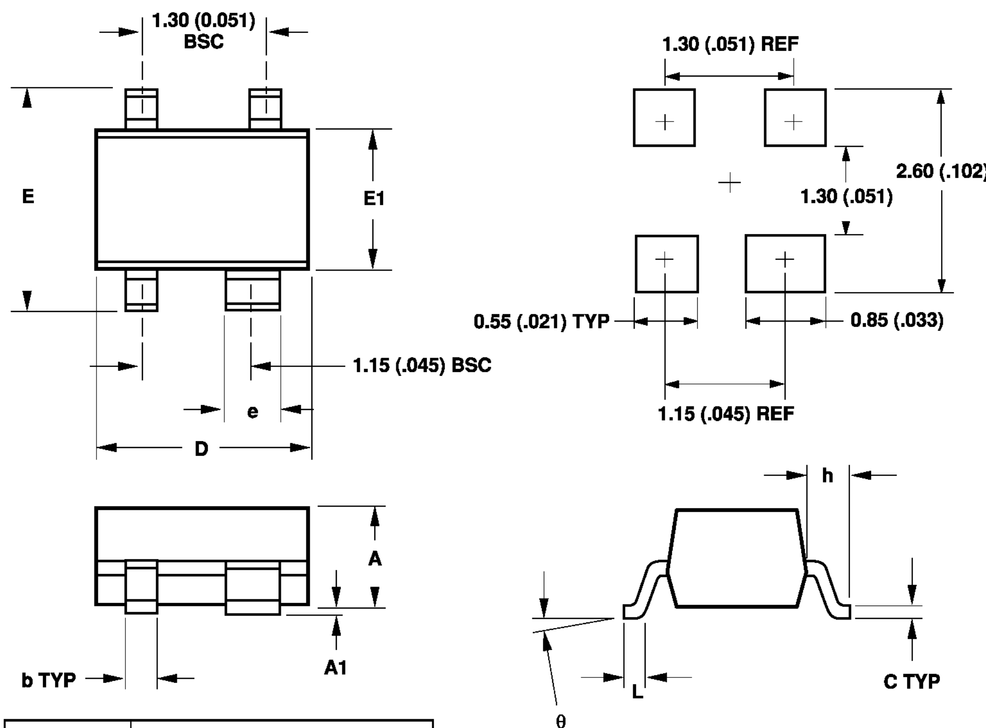
Physical Dimensions - SB Package (SOT-343)



SYMBOL	DIMENSIONS	
	MIN.	MAX.
A	0.80 (0.031)	1.00 (0.039)
A1	0 (0)	0.10 (0.004)
b	0.25 (0.010)	0.35 (0.014)
C	0.10 (0.004)	0.20 (0.008)
D	1.90 (0.075)	2.10 (0.083)
E	2.00 (0.079)	2.20 (0.087)
e	0.55 (0.022)	0.65 (0.025)
h	0.450 TYP (0.018)	
E1	1.15 (0.045)	1.35 (0.053)
L	0.10 (0.004)	0.35 (0.014)
θ	0	10

DIMENSIONS ARE IN MILLIMETERS (INCHES)

Handling and Assembly Information

CAUTION! - Mimix Broadband MMIC Products contain gallium arsenide (GaAs) which can be hazardous to the human body and the environment. For safety, observe the following procedures:

- Do not ingest.
- Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.
- Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.

Life Support Policy - Mimix Broadband's products are not authorized for use as critical components in life support devices or systems without the express written approval of the President and General Counsel of Mimix Broadband. As used herein: (1) Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user. (2) A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

Package Attachment - This packaged product from Mimix Broadband is provided as a rugged surface mount package compatible with high volume solder installation. Care should be taken not to apply heavy pressure to the top or base material to avoid package damage. Vacuum tools or other suitable pick and place equipment may be used to pick and place this part. Care should be taken to ensure that there are no voids or gaps in the solder connection so that good RF, DC and ground connections are maintained. Voids or gaps can eventually lead not only to RF performance degradation, but reduced reliability and life of the product due to thermal stress.

Mimix Lead-Free RoHS Compliant Program - Mimix has an active program in place to meet customer and governmental requirements for eliminating lead (Pb) and other environmentally hazardous materials from our products. All Mimix RoHS compliant components are form, fit and functional replacements for their non-RoHS equivalents. Lead plating of our RoHS compliant parts is 100% matte tin (Sn) over copper alloy and is backwards compatible with current standard SnPb low-temperature reflow processes as well as higher temperature (260°C reflow) "Pb Free" processes.

Ordering Information

Part Number for Ordering	Description
CFS0103-SB-0G00	Matte Tin plated RoHS compliant SOT-343 surface mount package in bulk quantity
CFS0103-SB-0G0T	Matte Tin plated RoHS compliant SOT-343 surface mount package in tape and reel
PB-CFS0103-SB-00A0	Evaluation Board for 900MHz with SMA connectors
PB-CFS0103-SB-00B0	Evaluation Board for 1900MHz ~ 2700 with SMA connectors
PB-CFS0103-SB-00D0	Evaluation Board for 3500MHz with SMA connectors

We also offer the plastic packages with SnPb (Tin-Lead) or NiPdAu plating. Please contact your regional sales manager for more information regarding different plating types

Caution: ESD Sensitive
Appropriate precautions in handling, packaging and testing devices must be observed.

Proper ESD procedures should be followed when handling this device.