

Dual Mode Cellular Downconverter 869 - 893 MHz

MADCSM0011
V2

Features

- Dual Mode Downconverter with LO Amplifier
- 3mm 12-Lead PQFN Package
- Operates over 2.7 V to 5 V Supply Voltage
- High Gain: 12.5 dB Typical
- High Input Intercept Point: +8 dBm Typical
- Low Current Draw: 12 mA Typical
- Adjustable IP3 Level
- Low LO Drive Level: -10 dBm

Description

M/A-COM's MADCSM0011 integrated downconverter combines a downconverting mixer, an IF amplifier, a LO buffer amplifier and an output mode switch. The MADCSM0011 is packaged in a low cost 3mm 12-Lead PQFN package with an exposed pad for improved high frequency grounding.

M/A-COM designed the MADCSM0011 for handsets requiring wide dynamic range and low power consumption. A mode switch is incorporated into the MADCSM0011 to switch between CDMA and AMPs operation.

The MADCSM0011 is fabricated using M/A-COM's 0.5-micron low noise E/D GaAs MESFET process. The process features full passivation for increased performance and reliability.

Ordering Information¹

Part Number	Package
MADCSM0011	Bulk Packaging
MADCSM0011TR	Tape and Reel (1K Reel)
MADCSM0011SMB	Sample Test Board

1. Reference Application Note M513 for reel size information.

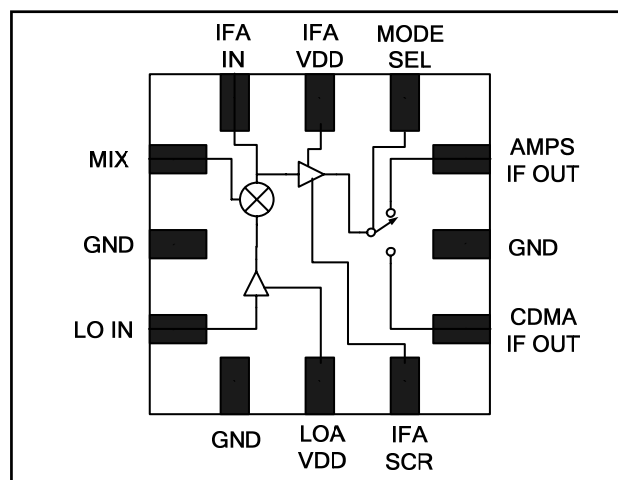
Absolute Maximum Ratings^{2,3}

Parameter	Absolute Maximum
Voltage	6 V
Input Power	0 dBm
Operating Temperature	-30°C to +85°C
Storage Temperature	-65°C to +150°C

2. Exceeding any one or combination of these limits may cause permanent damage to this device.

3. M/A-COM does not recommend sustained operation near these survivability limits.

Functional Block Diagram



Pin Configuration

Pin No.	Pin Name	Description
1	MIX	Mixer RF Input/Mixer IF Output
2	GND	DC and RF Ground
3	LO IN	Local oscillator input (-10 to -5 dBm)
4	GND	DC and RF Ground
5	LOA V _{DD}	LOA supply voltage; RF bypassing required
6	IFA SRC	Parallel RC network determines the IFA Current, Gain and IIP3
7	CDMA IF OUT	CDMA IF Output of downconverter; IF matching required
8	GND	DC and RF Ground
9	AMPS IF OUT	AMPS IF Output of downconverter; IF matching required
10	MODE SEL	Selects between AMPs and CDMA IF Output
11	IFA V _{DD}	IFA supply voltage; RF bypassing required
12	IFA IN	IFA Input

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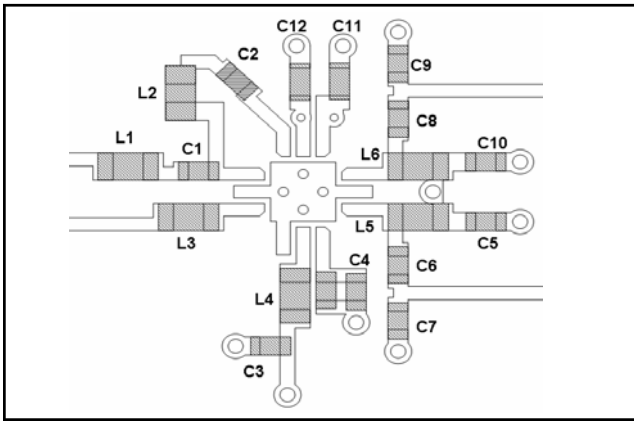
Electrical Specifications⁴:

Test Conditions: $V_{DD} = 3.0\text{ V}$, $R_F = 880\text{ MHz}$, $I_F = 85\text{ MHz}$, $L_O = 965\text{ MHz}$, $T_A = +25^\circ\text{C}$

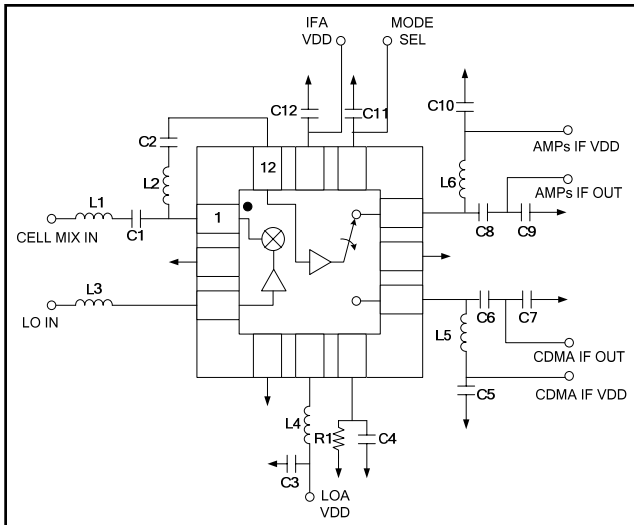
Parameter	Test Conditions	Units	Min	Typ	Max
Conversion Gain	LO Pin = -10 dBm	dB	10	12.5	15
Noise Figure	LO Pin = -10 dBm	dB	—	7.5	—
Input Intercept Point	LO Pin = -10 dBm	dBm	6	8	—
Return Loss	RF, LO Pin = -10 dBm LO, LO Pin = -10 dBm	dB dB	— —	12 13	— —
Isolation	RF to IF, LO Pin = -10 dBm LO to IF, LO Pin = -10 dBm	dB dB	25 18	36 21	— —
I_{DD}	LO Pin = -10 dBm	mA	—	12	15

4. All measurements are for both output modes.

Recommended PCB Configuration



Sample Board Schematic



External Circuitry Parts List

Part	Value	Case Size	Purpose
C1	2.7 pF	0402	Mixer Input RF Matching
C2	1000 pF	0402	Mixer to IFA Matching
C3,C5, C10,C12	0.1 μF	0402	V_{DD} Bypass
C4	0.1 μF	0402	IFA Source Bypass
C6,C8	33 pF	0402	IFA Output Matching
C7,C9	12 pF	0402	IFA Output Matching
C11	0.1 μF	0402	Vmode Bypass
L1	16 nH	0603	Mixer Input RF Matching
L2	270 nH	0603	Mixer to IFA Matching
L3	15 nH	0603	LOA Input Matching
L4	15 nH	0603	LOA Matching
L5,L6	150 nH	0603	IFA Output Matching
R1	34 Ohms	0402	IFA Source Resistor

Operating Instructions

M/A-COM's MADCSM0011 is a highly integrated MMIC dual mode downconverter for operation in the 800-900 MHz Cellular frequency band. The downconverter provides exceptional RF performance while consuming low DC current and is packaged in a low cost plastic package. It is ideal for lightweight battery operated portable radio systems.

The MADCSM0011 consists of a single-ended mixer, an LO buffer amplifier, a single-ended IF amplifier and a mode switch. Surface mount resistors, inductors and capacitors are used in conjunction with the downconverter to optimize the trade-offs among performance, tunability and ease of use. The sample board schematic shows the downconverter and required off-chip components.

The mixer is a single-ended mixer that provides exceptional linearity and isolation with low loss and no DC current. An off-chip inductor (L2) and capacitor (C2) are required to match the output of the mixer to the input of the IF buffer amplifier.

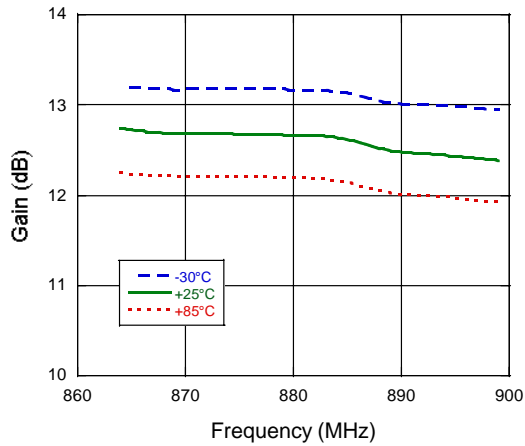
The IF output is selected by the mode switch. Each output port is the open drain of the IF buffer amplifier. This allows maximum flexibility of the intermediate frequency and IF filter. A matching network such as that shown herein can be used to match to 50 ohms from the output impedance of the buffer to the input impedance of the filter at the 85.38 MHz intermediate frequency. The inductor also acts as a choke for the DC supply line. Elements L5, C6 and C7 (CDMA mode) and L6, C8 and C9 (AMPS mode) provide the necessary impedance transformations.

The LO input port is matched on-chip to 50 ohms. An LO buffer amplifier amplifies the -10 dBm input signal to the level required to drive the mixer. The performance is optimum with a drive level of -7 dBm.

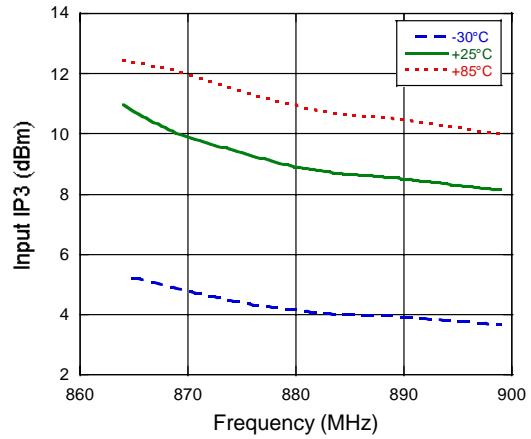
All DC supply lines must be properly bypassed at RF frequencies to obtain optimum performance and at a lower frequency to maintain unconditional stability. Capacitors C3, C4, C5, C10, C11 and C12 are RF bypass capacitors for the IFA and LOA. The value and placement of these capacitors is critical in determining the frequency response of these amplifiers.

Typical Performance Curves vs. Temperature

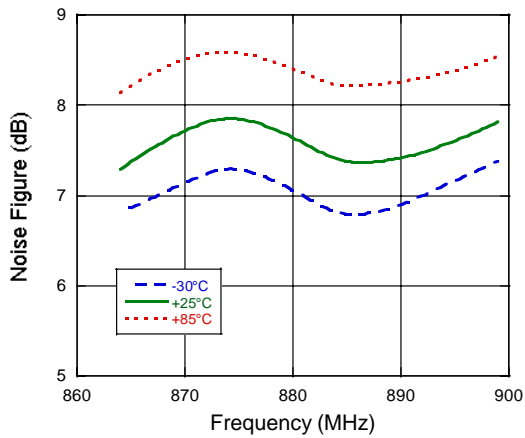
Conversion Gain



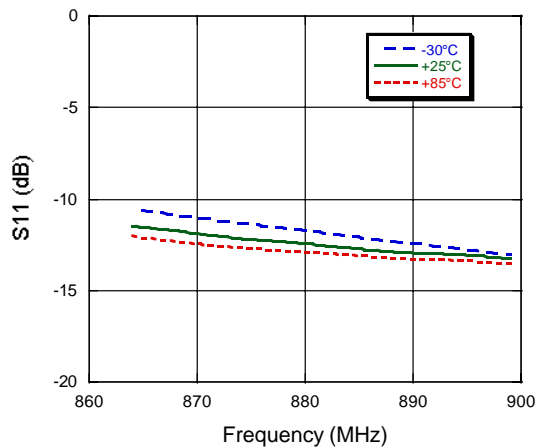
Input IP3



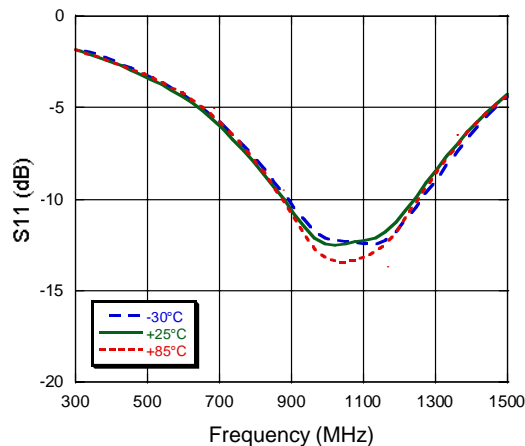
Noise Figure



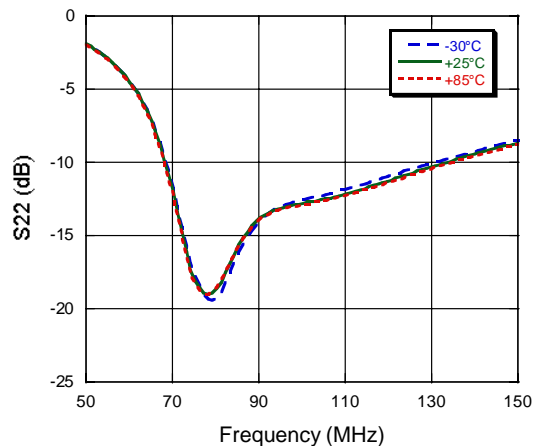
RF Return Loss



LO Return Loss

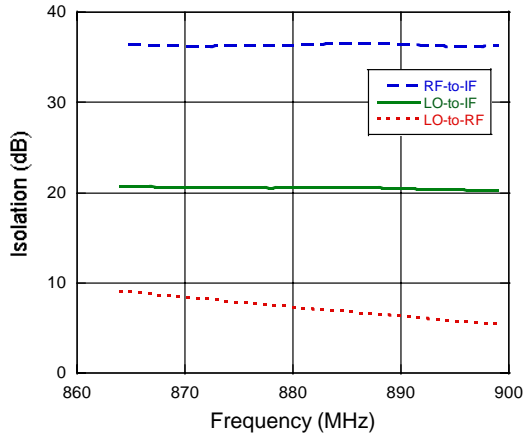


IF Return Loss



Typical Performance Curves vs. Temperature

Isolation



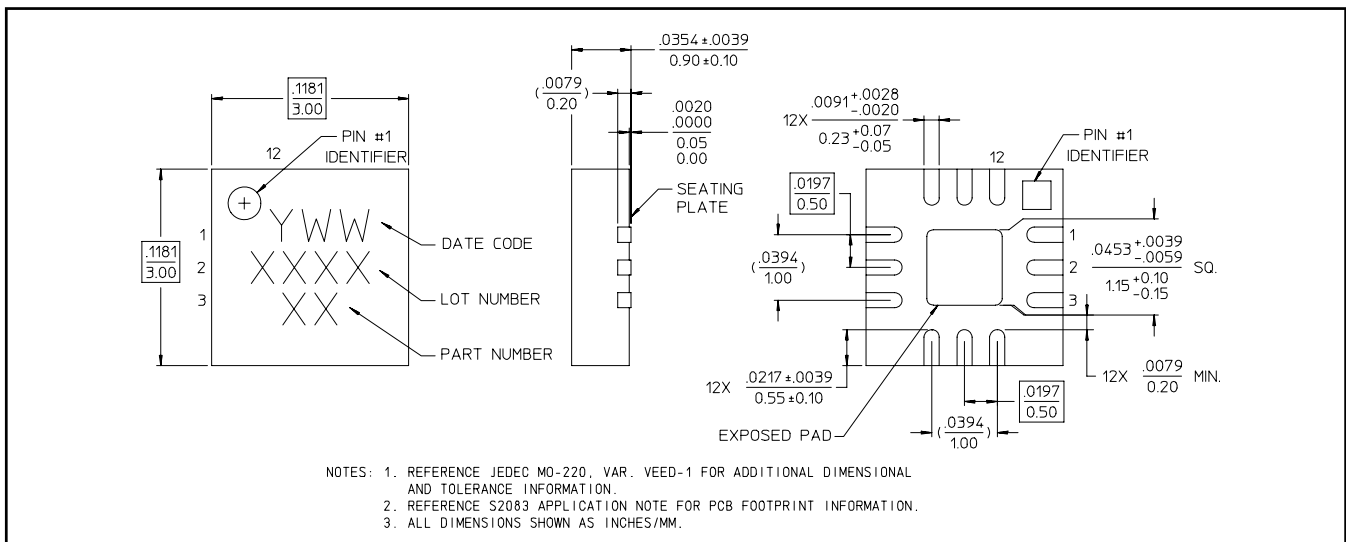
Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

3 mm 12-Lead PQFN[†]



[†] Meets JEDEC moisture sensitivity level 1 requirements.