19-1382; Rev 1; 9/99

EVALUATION KIT MANUALS FOLLOW DATA SHEET

MAXIM

400MHz to 2.5GHz Upconverter Mixers

MAX2660/MAX2661/MAX2663/MAX2671/MAX2673

General Description

The MAX2660/MAX2661/MAX2663/MAX2671/MAX2673 miniature, low-cost, low-noise upconverter mixers are designed for low-voltage operation and are ideal for use in portable consumer equipment. Signals at the IF input port are mixed with signals at the local oscillator (LO) port using a double-balanced mixer. These upconverter mixers operate with IF input frequencies between 40MHz and 500MHz, and upconvert to output frequencies as high as 2.5GHz.

These devices offer a wide range of supply currents and output intercept levels to optimize system performance. Supply current is essentially constant over the specified supply voltage range. Additionally, when the devices are in a typical configuration with $V_{\overline{SHDN}}$ = 0, a shutdown mode reduces the supply current to less than 1µA.

The MAX2660/MAX2661/MAX2663/MAX2671 are offered in the space-saving 6-pin SOT23 package. For applications requiring balanced IF ports, choose the MAX2673 in the 8-pin µMAX package.

Applications

400MHz/900MHz/2.4GHz ISM

Hand-Held Radios

Wireless Local Area Networks (WLANs)

IEEE 802.11 and Wireless Data

Personal Communications Systems (PCS)

Cellular and Cordless Phones

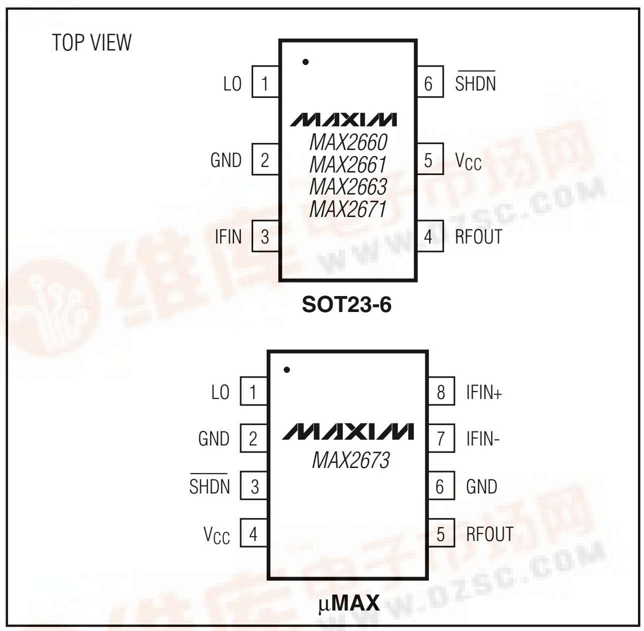
Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE	TOP MARK
MAX2660EUT-T	-40°C to +85°C	6 SOT23-6	AAAF
MAX2661EUT-T	-40°C to +85°C	6 SOT23-6	AAAG
MAX2663EUT-T	-40°C to +85°C	6 SOT23-6	AAAL
MAX2671EUT-T	-40°C to +85°C	6 SOT23-6	AAAJ
MAX2673EUA	-40°C to +85°C	8 µMAX	—

Features

- ♦ **RF Output Frequencies: 400MHz to 2.5GHz**
- ♦ **Low Noise Figure: 9.3dB (900MHz, MAX2671)**
- ♦ **+2.7V to +5.5V Single Supply**
- ♦ **High Output Intercept Point (OIP3)**
  - **5.9dBm at 4.8mA (MAX2660)**
  - **7.1dBm at 8.3mA (MAX2661)**
  - **0.7dBm at 3.0mA (MAX2663)**
  - **9.6dBm at 11.8mA (MAX2671)**
  - **7.6dBm at 20.5mA (MAX2673)**
- ♦ **1µA Shutdown Mode**
- ♦ **Ultra-Small Surface-Mount Packaging**

Pin Configurations



Typical Operating Circuits and Functional Diagram appear at end of data sheet.

Selector Guide

PART	ICC (mA)	OUTPUT IP3 (dBm) AT 900MHz	GAIN (dB) AT 2450MHz	LO BUFFER	SINGLE-ENDED OR DIFFERENTIAL IF	PACKAGE
MAX2660	4.8	5.9	4.6	No	Single Ended	6 SOT23
MAX2661	8.3	7.1	8.2	No	Single Ended	6 SOT23
MAX2663	3.0	0.7	1.4	No	Single Ended	6 SOT23
MAX2671	11.8	9.6	8.9	Yes	Single Ended	6 SOT23
MAX2673	20.5	7.6	8.6	Yes	Differential	8 µMAX

400MHz to 2.5GHz Upconverter Mixers

ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND ....-0.3V to +6.0V
IFIN_ Input Power (50Ω source).....................................+10dBm
LO Input Power (50Ω source) ....+10dBm
SHDN, RFOUT, IFIN_, LO to GND..............-0.3V to (V_{CC} + 0.3V)
Continuous Power Dissipation (T_A = +70°C)
8-Pin µMAX (derate 4.1mW/°C above +70°C).............330mW
6-Pin SOT23-6 (derate 8.7mW/°C above +70°C) 696mW
Operating Temperature Range ....-40°C to +85°C
Junction Temperature ....+150°C
Storage Temperature Range ....-65°C to +160°C
Lead Temperature (soldering, 10sec) ....+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = +2.7V to +5.5V, $\overline{SHDN}$ = +2V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = $\overline{SHDN}$ = +3.0V, T_A = +25°C. Minimum and maximum values are guaranteed over temperature by design and characterization.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Supply Current (LO and IFIN_ Unconnected)	I_{CC}	MAX2660		4.8	6.6	mA
		MAX2661		8.3	11.3	
		MAX2663		3.0	4.1	
		MAX2671		11.8	16.6	
		MAX2673		20.5	26.8	
Shutdown Supply Current	I_{CC}	$\overline{SHDN}$ = GND, MAX2660		0.1		µA
		$\overline{SHDN}$ = GND, MAX2661		0.2		
		$\overline{SHDN}$ = GND, MAX2663		0.1		
		$\overline{SHDN}$ = GND, MAX2671		0.2		
		$\overline{SHDN}$ = GND, MAX2673		0.8		
		$\overline{SHDN}$ = 0.5V, V_{CC} = 2.7V to 3.6V			5	
		$\overline{SHDN}$ = 0.5V, V_{CC} = 3.6V to 5.5V			15	
Shutdown Input Voltage High	V_{IH}		2		V_{CC}	V
Shutdown Input Voltage Low	V_{IL}		0		0.5	V
Shutdown Input Bias Current	I_{IN}		-5	0.2	5	µA

AC ELECTRICAL CHARACTERISTICS

(V_{CC} = $\overline{SHDN}$ = +3.0V, T_A = +25°C, unless otherwise noted. Minimum and maximum values are guaranteed by design and characterization.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
MAX2660 (P_{LO} = -5dBm, P_{IFIN} = -30dBm, Circuit of Figure 1)					
Conversion Gain	f_{IF} = 45MHz, f_{LO} = 445MHz, f_{RF} = 400MHz		7.0		dB
	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		7.0		
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz	3.9	5.9	8.1	
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		4.6		
Gain Variation Over Temperature	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz, T_A = -40°C to +85°C		±1.2	±1.6	dB
Output Third-Order Intercept	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		5.9		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		5.7		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		4.1		

AC ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = $\overline{SHDN}$ = +3.0V, T_A = +25°C, unless otherwise noted. Minimum and maximum values are guaranteed by design and characterization.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
MAX2660 (P_{LO} = -5dBm, P_{IFIN} = -30dBm, Circuit of Figure 1) (continued)					
Output 1dB Compression Point	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-8.4		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-10.8		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-11.4		
Noise Figure (Single Sideband)	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 1900MHz		9.9		dB
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		11.8		
	f_{IF} = 350MHz, f_{LO} = 2100MHz, f_{RF} = 2450MHz		11.9		
LO Emission from RF Port	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-22.0		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-20.7		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-22.5		
Maximum LO Input VSWR	f = 600MHz to 2500MHz, 50Ω source impedance		2.2		
Maximum Output Spurious Emissions	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz (Note 1)		-70		dBm
Turn-On Time	(Note 2)		2		µs
Turn-Off Time	From $\overline{SHDN}$ low to I_{CC} < 100µA		2		µs
MAX2661 (P_{LO} = -5dBm, P_{IFIN} = -30dBm, Circuit of Figure 1)					
Conversion Gain	f_{IF} = 45MHz, f_{LO} = 445MHz, f_{RF} = 400MHz		10.2		dB
	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		10.7		
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz	7.0	8.5	10.2	
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		8.2		
Gain Variation Over Temperature	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz, T_A = -40°C to +85°C		±1.2	±1.5	dB
Output Third-Order Intercept	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		7.1		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		6.0		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		7.3		
Output 1dB Compression Point	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-6.0		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-7.2		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-6.2		
Noise Figure (Single Sideband)	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		9.8		dB
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		11.6		
	f_{IF} = 350MHz, f_{LO} = 2100MHz, f_{RF} = 2450MHz		11.8		
LO Emission from RF Port	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-22.9		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-21.6		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-23.5		
Maximum LO Input VSWR	f = 600MHz to 2500MHz, 50Ω source impedance		2.2		
Maximum Output Spurious Emissions	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz (Note 1)		-57.3		dBm
Turn-On Time	(Note 2)		2		µs
Turn-Off Time	From $\overline{SHDN}$ low to I_{CC} < 100µA		2		µs

AC ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = $\overline{SHDN}$ = +3.0V, T_A = +25°C, unless otherwise noted. Minimum and maximum values are guaranteed by design and characterization.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
MAX2663 (P_{LO} = -5dBm, P_{IFIN} = -30dBm, Circuit of Figure 1)					
Conversion Gain	f_{IF} = 45MHz, f_{LO} = 445MHz, f_{RF} = 400MHz		2.0		dB
	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		3.4		
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz	-0.1	2.1	4.2	
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		1.4		
Gain Variation Over Temperature	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz, T_A = -40°C to +85°C		±1.1	±1.8	dB
Output Third-Order Intercept	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		0.7		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-1.4		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-2.8		
Output 1dB Compression Point	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-12.3		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-13.3		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-14.3		
Noise Figure (Single Sideband)	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		10.7		dB
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		12.2		
	f_{IF} = 350MHz, f_{LO} = 2100MHz, f_{RF} = 2450MHz		12.7		
LO Emission from RF Port	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-22.7		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-21.0		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-21.6		
Maximum LO Input VSWR	f = 600MHz to 2500MHz, 50Ω source impedance		2.1		
Maximum Output Spurious Emissions	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz (Note 1)		-67		dBm
Turn-On Time	(Note 2)		2		µs
Turn-Off Time	From $\overline{SHDN}$ low to I_{CC} < 100µA		2		µs
MAX2671 (P_{LO} = -10dBm, P_{IFIN} = -30dBm, Circuit of Figure 1)					
Conversion Gain	f_{IF} = 45MHz, f_{LO} = 445MHz, f_{RF} = 400MHz		10.0		dB
	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		11.2		
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz	6.7	9.3	11.9	
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		8.9		
Gain Variation Over Temperature	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz, T_A = -40°C to +85°C		±1.1	±1.3	dB
Output Third-Order Intercept	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		9.6		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		8.3		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		9.4		
Output 1dB Compression Point	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-5.5		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-6.4		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-6.0		

AC ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = $\overline{SHDN}$ = +3.0V, T_A = +25°C, unless otherwise noted. Minimum and maximum values are guaranteed by design and characterization.)

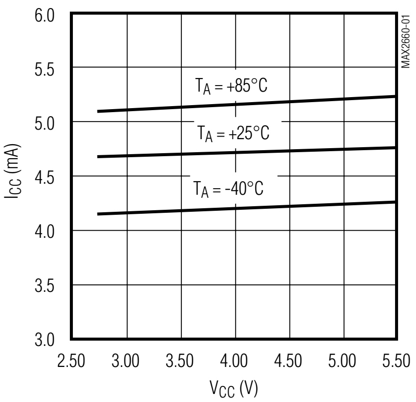
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
MAX2671 (P_{LO} = -10dBm, P_{IFIN} = -30dBm, Circuit of Figure 1) (continued)					
Noise Figure (Single Sideband)	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		9.3		dB
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		10.7		
	f_{IF} = 350MHz, f_{LO} = 2100MHz, f_{RF} = 2450MHz		11.3		
LO Emission from RF Port	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-40.3		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-35.7		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-36.8		
Maximum LO Input VSWR	f = 600MHz to 2500MHz, 50Ω source impedance		2.2		dBm
Maximum Output Spurious Emissions	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz (Note 1)		-56		dBm
Turn-On Time	(Note 2)		2		µs
Turn-Off Time	From $\overline{SHDN}$ low to I_{CC} < 100µA		2		µs
MAX2673 (P_{LO} = -10dBm, $P_{IFIN\_}$ = -30dBm, Circuit of Figure 2)					
Conversion Gain	f_{IF} = 45MHz, f_{LO} = 445MHz, f_{RF} = 400MHz		12.6		dB
	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		12.3		
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz	7.8	9.2	10.6	
	fIF = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		8.6		
Gain Variation Over Temperature	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz, T_A = -40°C to +85°C		±1.0	±1.4	dB
Output Third-Order Intercept	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		7.6		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		5.9		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		4.5		
Output 1dB Compression Point	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-2.1		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-5.9		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-8.3		
Noise Figure (Single Sideband)	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		9.7		dB
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		10.1		
	f_{IF} = 350MHz, f_{LO} = 2100MHz, f_{RF} = 2450MHz		10.4		
LO Emission from RF Port	f_{IF} = 70MHz, f_{LO} = 970MHz, f_{RF} = 900MHz		-29.4		dBm
	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz		-27.9		
	f_{IF} = 240MHz, f_{LO} = 2210MHz, f_{RF} = 2450MHz		-26.6		
Maximum LO Input VSWR	f = 600MHz to 2500MHz, 50Ω source impedance		2.2		
Maximum Output Spurious Emissions	f_{IF} = 70MHz, f_{LO} = 1830MHz, f_{RF} = 1900MHz (Note 1)		-59.7		dBm
Turn-On Time	(Note 2)		2		µs
Turn-Off Time	From $\overline{SHDN}$ low to I_{CC} < 100µA		2		µs

Note 1: Excluding LO harmonics and products of LO harmonics by first-order IF.
Note 2: From $\overline{SHDN}$ high to output within 1dB of final output power, f_{RF} = 900MHz, f_{IF} = 70MHz.

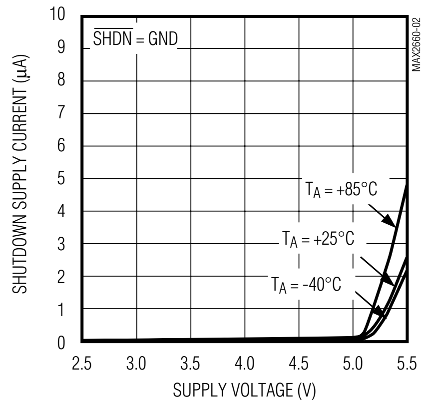
Typical Operating Characteristics

(V_{CC} = $\overline{SHDN}$ = +3.0V, *Typical Operating Circuits*, P_{LO} = -5dBm (MAX2660/MAX2661/MAX2663), P_{LO} = -10dBm (MAX2671/MAX2673), P_{IFIN} = -30dBm, T_A = +25°C, unless otherwise noted.)

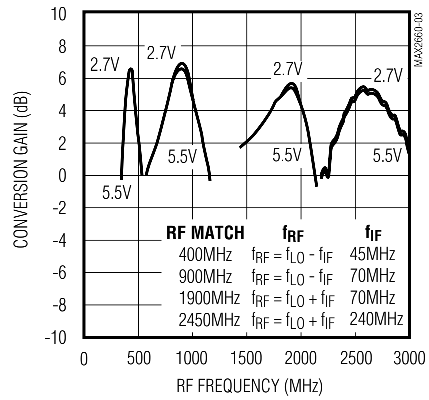
MAX2660
SUPPLY CURRENT vs. SUPPLY VOLTAGE



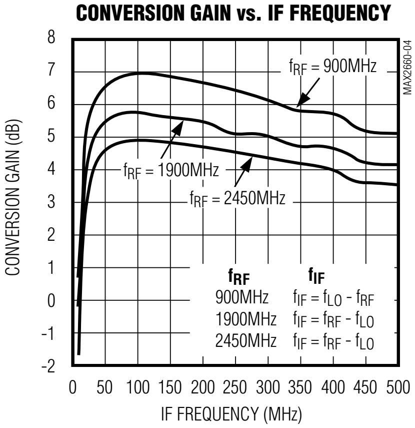
MAX2660
SHUTDOWN SUPPLY CURRENT vs. SUPPLY VOLTAGE



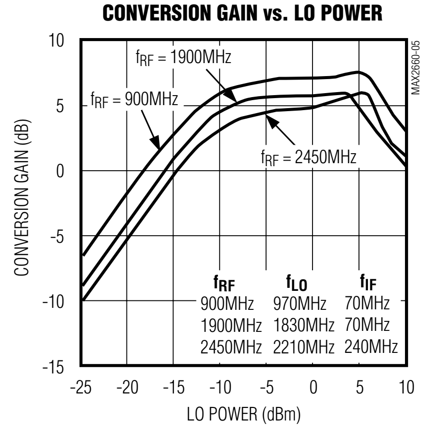
MAX2660
CONVERSION GAIN vs. RF FREQUENCY



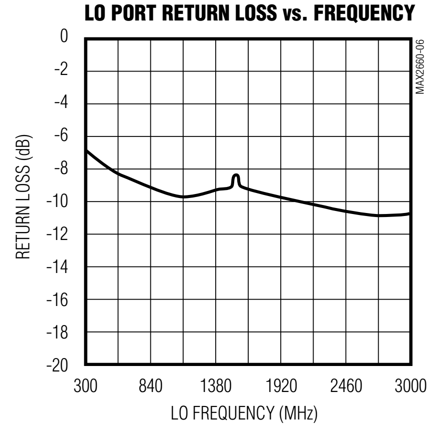
MAX2660
CONVERSION GAIN vs. IF FREQUENCY



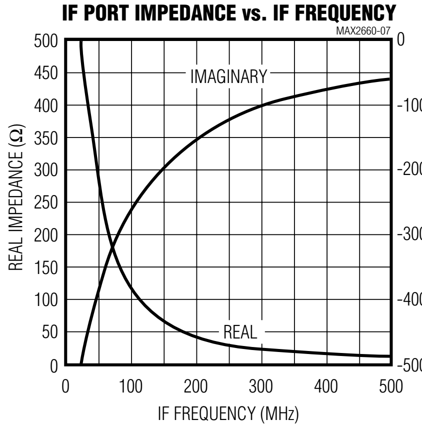
MAX2660
CONVERSION GAIN vs. LO POWER



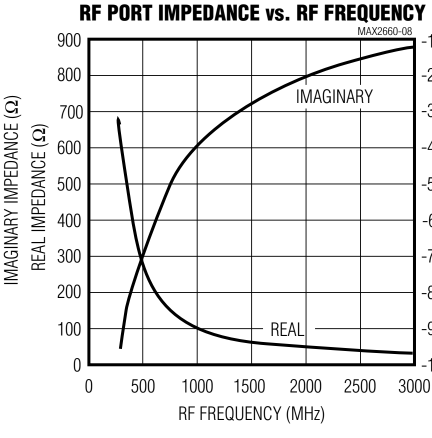
MAX2660
LO PORT RETURN LOSS vs. FREQUENCY



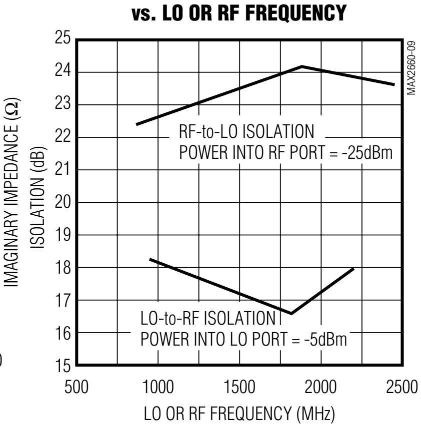
MAX2660
IF PORT IMPEDANCE vs. IF FREQUENCY



MAX2660
RF PORT IMPEDANCE vs. RF FREQUENCY



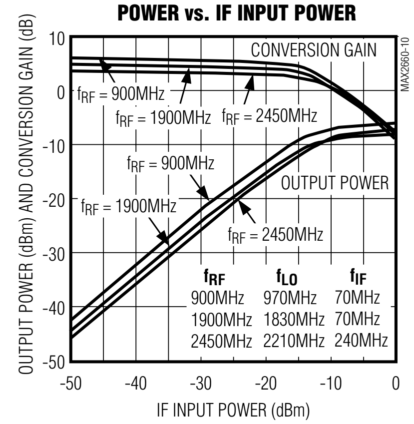
MAX2660
LO-to-RF AND RF-to-LO ISOLATION vs. LO OR RF FREQUENCY



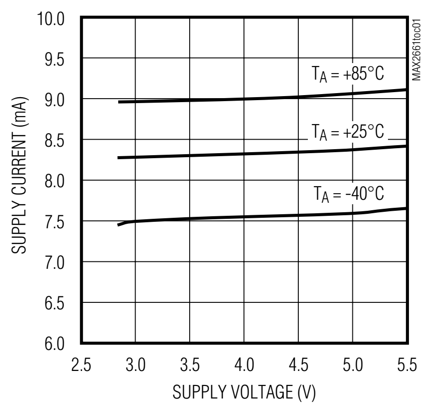
Typical Operating Characteristics (continued)

(V_{CC} = $\overline{SHDN}$ = +3.0V, *Typical Operating Circuits*, P_{LO} = -5dBm (MAX2660/MAX2661/MAX2663), P_{LO} = -10dBm (MAX2671/MAX2673), P_{IFIN} = -30dBm, T_A = +25°C, unless otherwise noted.)

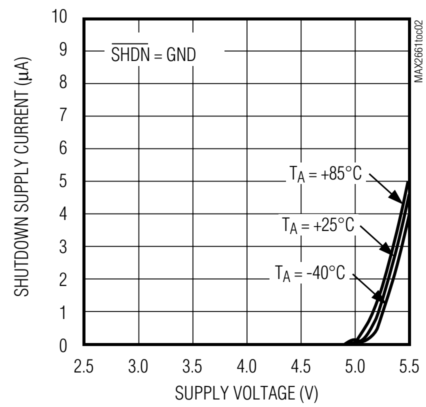
MAX2660 CONVERSION GAIN AND OUTPUT POWER vs. IF INPUT POWER



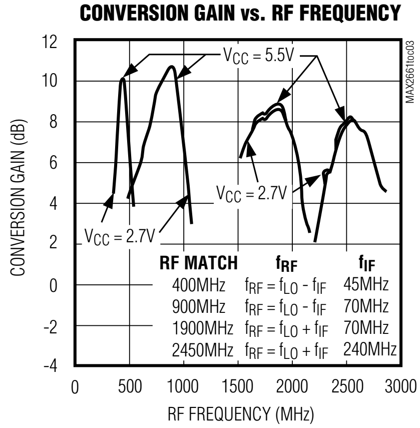
MAX2661 SUPPLY CURRENT vs. SUPPLY VOLTAGE



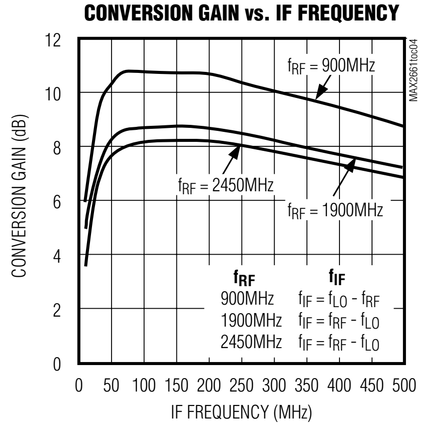
MAX2661 SHUTDOWN SUPPLY CURRENT vs. SUPPLY VOLTAGE



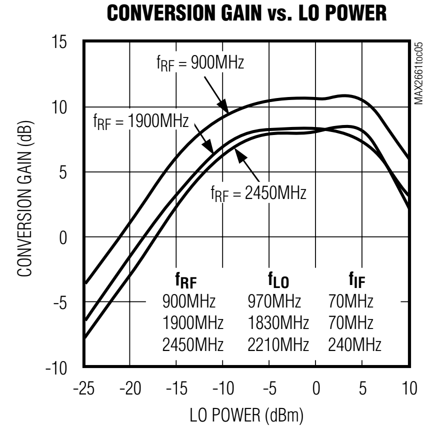
MAX2661 CONVERSION GAIN vs. RF FREQUENCY



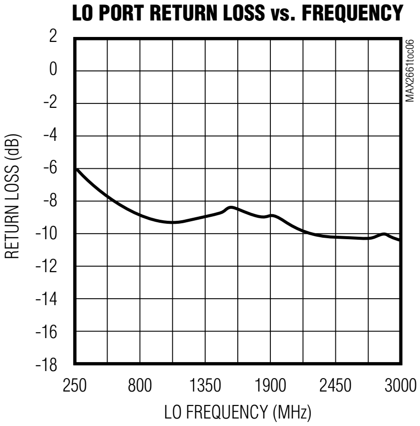
MAX2661 CONVERSION GAIN vs. IF FREQUENCY



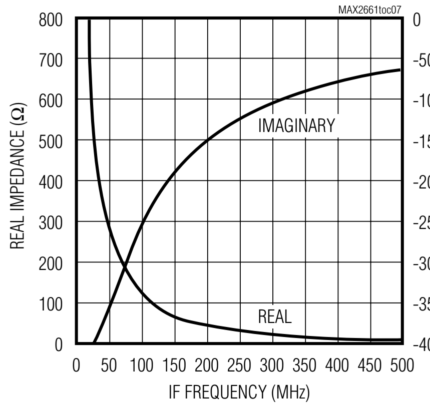
MAX2661 CONVERSION GAIN vs. LO POWER



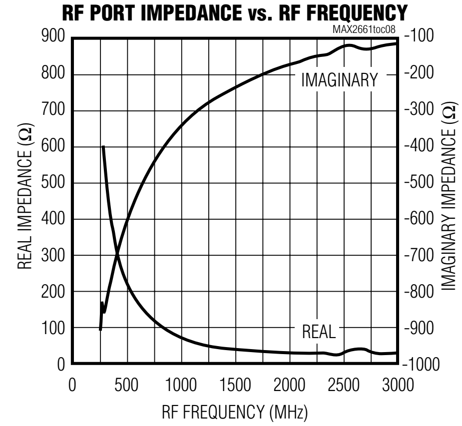
MAX2661 LO PORT RETURN LOSS vs. FREQUENCY



MAX2661 IF PORT IMPEDANCE vs. IF FREQUENCY



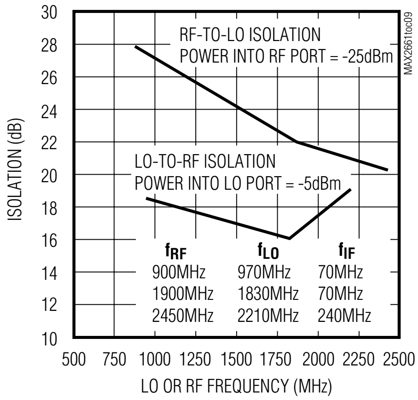
MAX2661 RF PORT IMPEDANCE vs. RF FREQUENCY



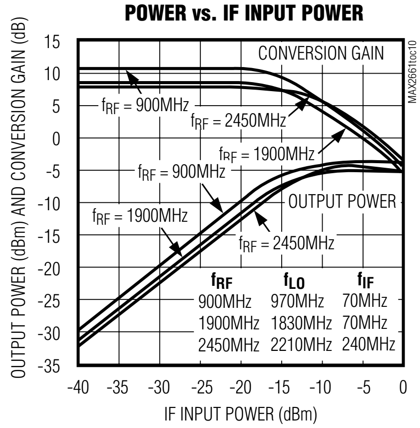
Typical Operating Characteristics (continued)

(V_{CC} = $\overline{SHDN}$ = +3.0V, *Typical Operating Circuits*, P_{LO} = -5dBm (MAX2660/MAX2661/MAX2663), P_{LO} = -10dBm (MAX2671/MAX2673), P_{IFIN} = -30dBm, T_A = +25°C, unless otherwise noted.)

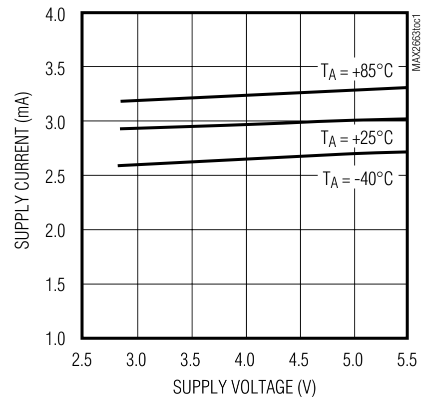
MAX2661
LO-to-RF AND RF-TO-LO ISOLATION vs. LO OR RF FREQUENCY



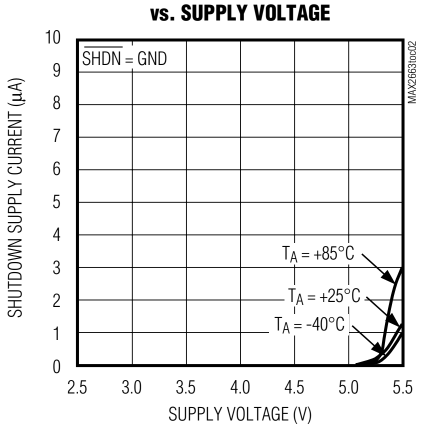
MAX2661
CONVERSION GAIN AND OUTPUT POWER vs. IF INPUT POWER



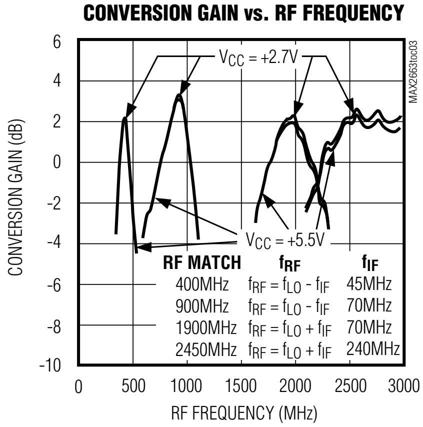
MAX2663
SUPPLY CURRENT vs. SUPPLY VOLTAGE



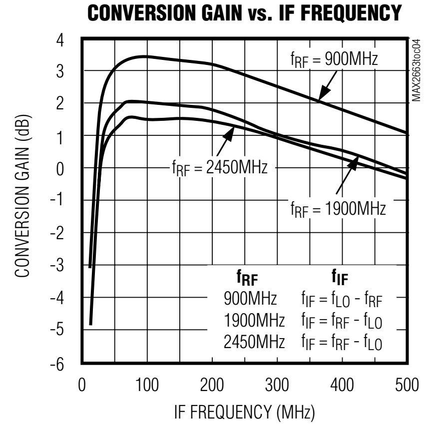
MAX2663
SHUTDOWN SUPPLY CURRENT vs. SUPPLY VOLTAGE



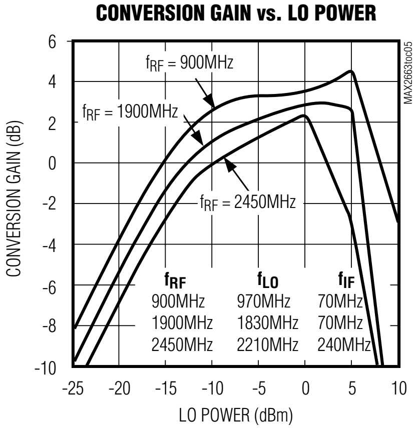
MAX2663
CONVERSION GAIN vs. RF FREQUENCY



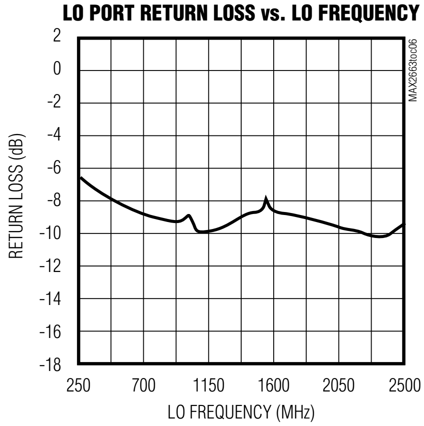
MAX2663
CONVERSION GAIN vs. IF FREQUENCY



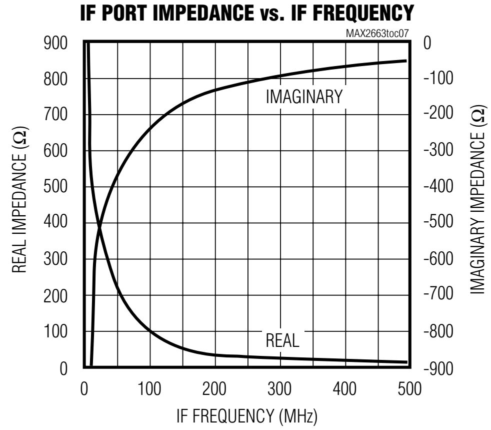
MAX2663
CONVERSION GAIN vs. LO POWER



MAX2663
LO PORT RETURN LOSS vs. LO FREQUENCY



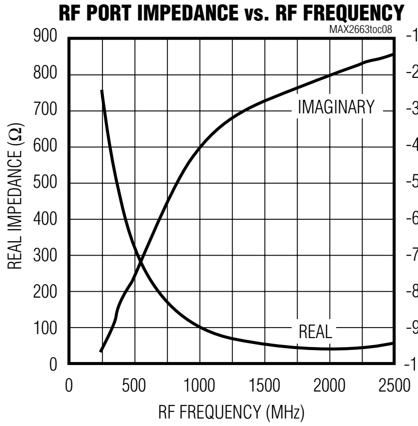
MAX2663
IF PORT IMPEDANCE vs. IF FREQUENCY



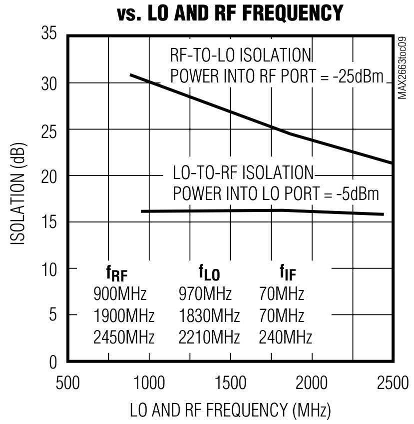
Typical Operating Characteristics (continued)

(V_{CC} = $\overline{SHDN}$ = +3.0V, *Typical Operating Circuits*, P_{LO} = -5dBm (MAX2660/MAX2661/MAX2663), P_{LO} = -10dBm (MAX2671/MAX2673), P_{IFIN} = -30dBm, T_A = +25°C, unless otherwise noted.)

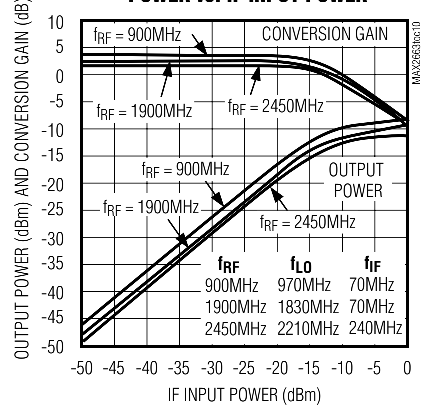
MAX2663
RF PORT IMPEDANCE vs. RF FREQUENCY



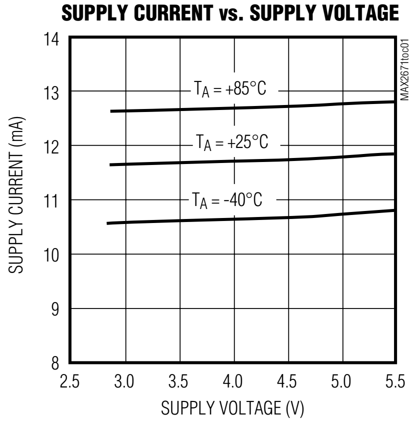
MAX2663
LO-TO-RF AND RF-TO-LO ISOLATION vs. LO AND RF FREQUENCY



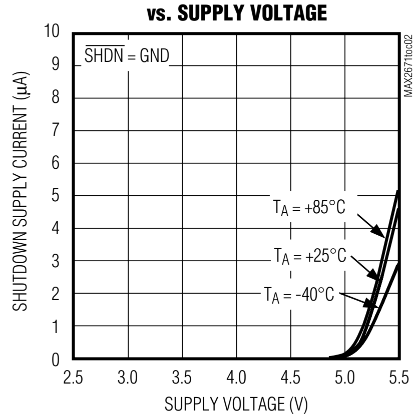
MAX2663
CONVERSION GAIN AND OUTPUT POWER vs. IF INPUT POWER



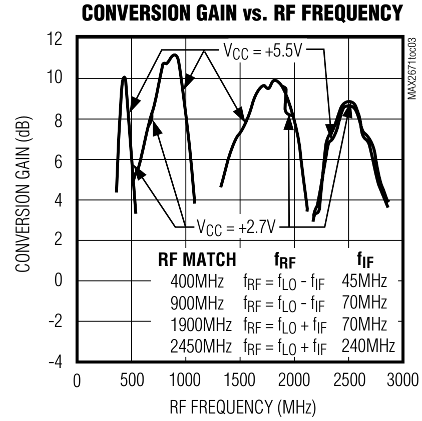
MAX2671
SUPPLY CURRENT vs. SUPPLY VOLTAGE



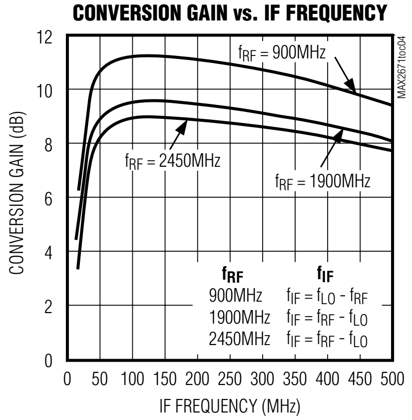
MAX2671
SHUTDOWN SUPPLY CURRENT vs. SUPPLY VOLTAGE



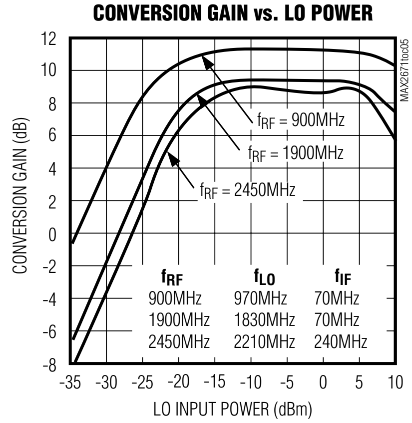
MAX2671
CONVERSION GAIN vs. RF FREQUENCY



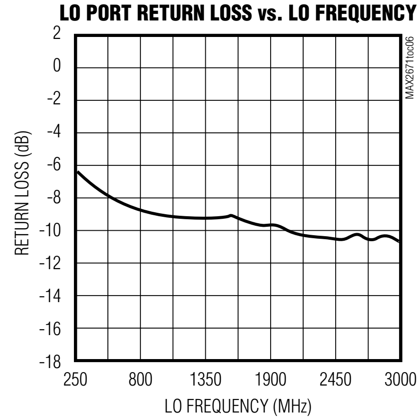
MAX2671
CONVERSION GAIN vs. IF FREQUENCY



MAX2671
CONVERSION GAIN vs. LO POWER



MAX2671
LO PORT RETURN LOSS vs. LO FREQUENCY

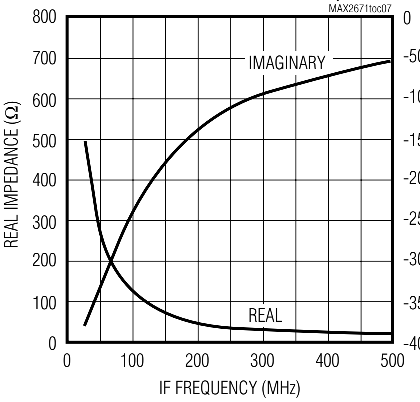


400MHz to 2.5GHz Upconverter Mixers

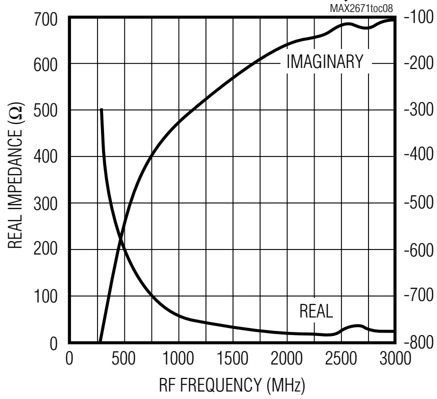
Typical Operating Characteristics (continued)

(V_{CC} = $\overline{SHDN}$ = +3.0V, *Typical Operating Circuits*, P_{LO} = -5dBm (MAX2660/MAX2661/MAX2663), P_{LO} = -10dBm (MAX2671/MAX2673), P_{IFIN} = -30dBm, T_A = +25°C, unless otherwise noted.)

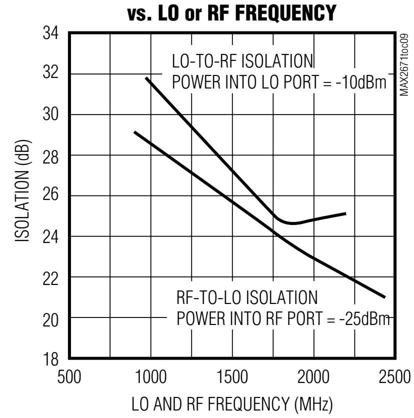
MAX2671
IF PORT IMPEDANCE vs. IF FREQUENCY



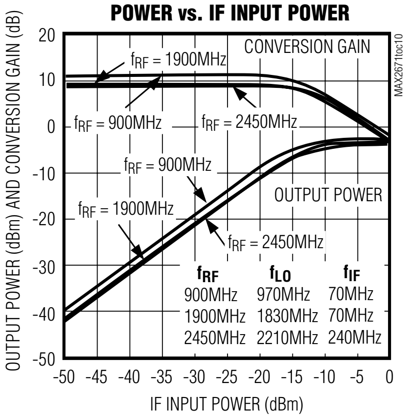
MAX2671
RF PORT IMPEDANCE vs. RF FREQUENCY



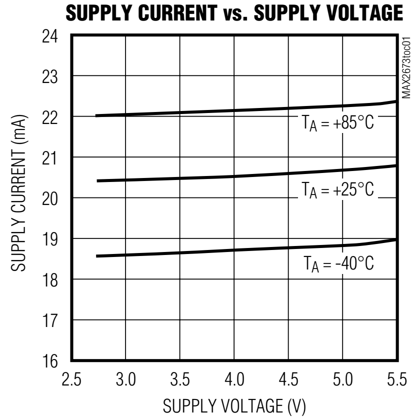
MAX2671
LO-TO-RF AND RF-TO-LO ISOLATION
vs. LO or RF FREQUENCY



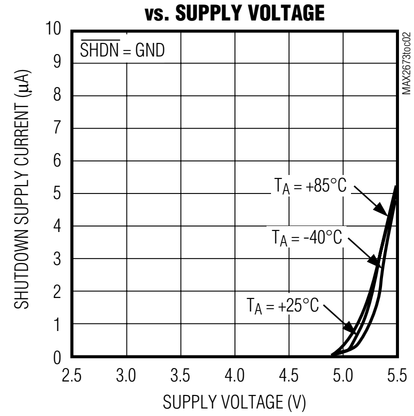
MAX2671
CONVERSION GAIN AND OUTPUT
POWER vs. IF INPUT POWER



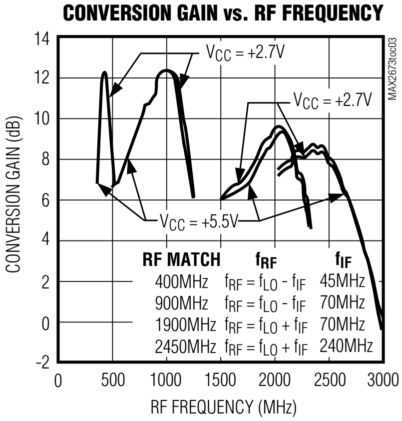
MAX2673
SUPPLY CURRENT vs. SUPPLY VOLTAGE



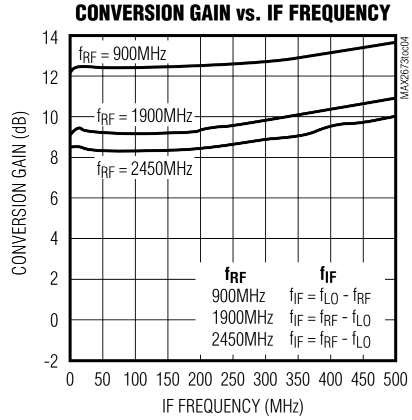
MAX2673
SHUTDOWN SUPPLY CURRENT
vs. SUPPLY VOLTAGE



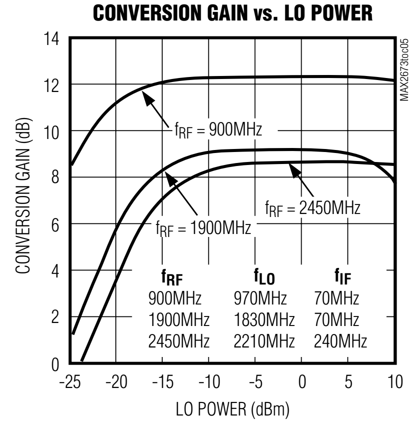
MAX2673
CONVERSION GAIN vs. RF FREQUENCY



MAX2673
CONVERSION GAIN vs. IF FREQUENCY



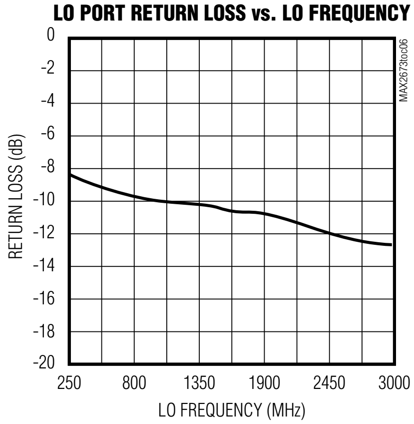
MAX2673
CONVERSION GAIN vs. LO POWER



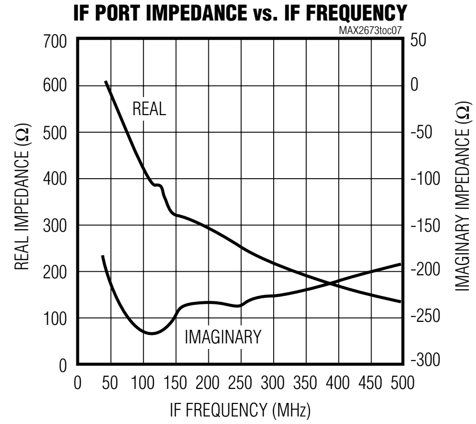
Typical Operating Characteristics (continued)

(V_{CC} = $\overline{SHDN}$ = +3.0V, *Typical Operating Circuits*, P_{LO} = -5dBm (MAX2660/MAX2661/MAX2663), P_{LO} = -10dBm (MAX2671/MAX2673), P_{IFIN} = -30dBm, T_A = +25°C, unless otherwise noted.)

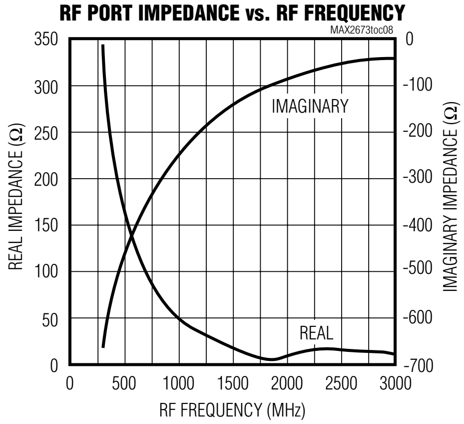
MAX2673
LO PORT RETURN LOSS vs. LO FREQUENCY



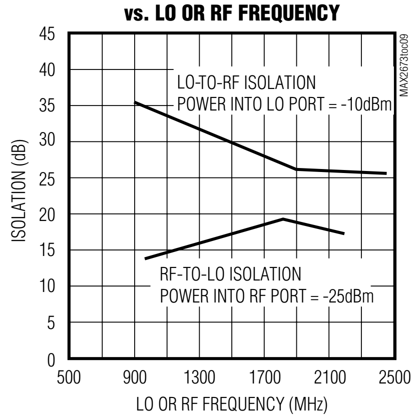
MAX2673
IF PORT IMPEDANCE vs. IF FREQUENCY



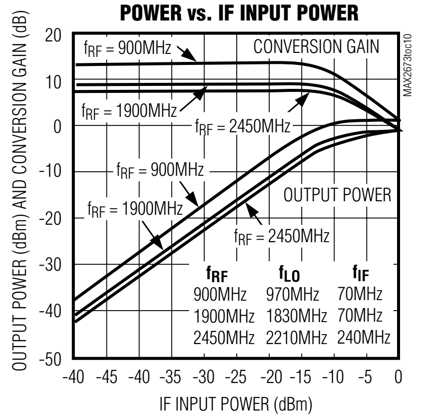
MAX2673
RF PORT IMPEDANCE vs. RF FREQUENCY



MAX2673
LO-to-RF ISOLATION AND RF-to-LO ISOLATION vs. LO OR RF FREQUENCY



MAX2673
CONVERSION GAIN AND OUTPUT POWER vs. IF INPUT POWER



400MHz to 2.5GHz Upconverter Mixers

Pin Description

PIN		NAME	FUNCTION
MAX2660 MAX2661 MAX2663 MAX2671	MAX2673		
1	1	LO	Local-Oscillator Input. Apply a local-oscillator signal with an amplitude of -10dBm to +5dBm for the MAX2671/MAX2673 or -5dBm to +2dBm for the MAX2660/ MAX2661/ MAX2663. AC-couple to the oscillator with a DC blocking capacitor. Nominal DC voltage is V_{CC} - 0.4V to V_{CC} - 1.0V.
2	2, 6	GND	Mixer Ground. Connect to the ground plane with a low-inductance connection.
3	7, 8	IFIN	Intermediate Frequency Input. AC-couple to the input signal with a DC blocking capacitor. Nominal DC voltage is 1.37V.
4	5	RFOUT	Radio Frequency Output. Open-collector output requires an inductor to V_{CC} that is part of an impedance-matching network. AC-couple to this pin using a blocking capacitor that can be part of the impedance-matching network. See *Applications Information* for details on impedance matching.
5	4	V_{CC}	Voltage Supply Rail, +2.7V to +5.5V. Bypass with a capacitor to the ground plane. Capacitor value depends on desired operating frequency.
6	3	$\overline{SHDN}$	Active-Low Shutdown Pin. Drive low to deactivate all part functions and reduce the supply current to less than 1µA. For normal operation, drive high or connect to V_{CC}.

Detailed Description

The MAX2660/MAX2661/MAX2663/MAX2671/MAX2673 are 2.5GHz double-balanced upconverter mixers designed to provide optimum linearity performance for a specified supply current. These upconverter mixers use single-ended RF, LO, and IF port connections, except for the MAX2673, which uses a differential IF port. An on-chip bias cell provides a low-power shutdown feature. See the *Selector Guide* for device features and comparison.

Applications Information

Local-Oscillator (LO) Input

The LO input is a single-ended broadband port with a return loss of better than 8dB from 600MHz to 2.5GHz. The LO signal is mixed with the input IF signal, and the resulting upconverted output appears on the RFOUT pin. AC-couple the LO pin with a capacitor having less than 3Ω reactance at the LO frequency. The MAX2671/MAX2673 include an internal LO buffer and require an LO signal ranging from -10dBm to +5dBm, while the MAX2660/MAX2661/MAX2663 require an LO signal ranging from -5dBm to +2dBm.

IF Input

The MAX2660/MAX2661/MAX2663/MAX2671 have a single-ended IF input port, while the MAX2673 has a differential IF input port for high-performance interface-to-differential IF filters. AC-couple the IF pin(s) with a capacitor. The typical IF input frequency range is 40MHz to 500MHz. For further information, see the IF Port Impedance vs. IF Frequency graph in the *Typical Operating Characteristics.*

RF Output

The RF output frequency range extends from 400MHz to 2.5GHz. RFOUT is a high-impedance, open-collector output that requires an external inductor to V_{CC} for proper biasing. For optimum performance, implement an impedance-matching network. The configuration and values for the matching network depend on the frequency, performance, and desired output impedance. For assistance in choosing components for optimal performance, see Table 1 as well as the RF Output Impedance vs. RF Frequency graph in the *Typical Operating Characteristics*.

Power Supply and $\overline{SHDN}$ Bypassing

Proper attention to supply bypassing is essential for a high-frequency RF circuit. Bypass V_{CC} with a 10µF capacitor in parallel with an RF capacitor (Table 2). Use separate vias to the ground plane for each of the bypass capacitors and minimize trace length to reduce inductance. Use separate vias to the ground plane for each ground pin. Use low-inductance ground connections.

Decouple $\overline{SHDN}$ with a 100pF capacitor to ground to minimize noise on the internal bias cell. Use a series resistor (typically 100Ω) to reduce coupling of high-frequency signals into the $\overline{SHDN}$ pin.

Layout Issues

A well-designed PC board is an essential part of an RF circuit. For best performance, pay attention to power-supply issues as well as to the layout of the RFOUT matching network.

Power-Supply Layout

To minimize coupling between different sections of the IC, the ideal power-supply layout is a star configuration with a large decoupling capacitor at a central V_{CC} node. The V_{CC} traces branch out from this central node, each going to a separate V_{CC} node in the PC board. At the end of each trace is a bypass capacitor that has low ESR at the RF frequency of operation. This arrangement provides local decoupling at each V_{CC} pin. At high frequencies, any signal leaking out of one supply pin sees a relatively high impedance (formed by the V_{CC} trace inductance) to the central V_{CC} node, and an even higher impedance to any other supply pin, as well as a low impedance to ground through the bypass capacitor.

Impedance-Matching Network Layout

The RFOUT matching network is very sensitive to layout-related parasitics. To minimize parasitic inductance, keep all traces short and place components as close as possible to the chip. To minimize parasitic capacitance, use cutouts in the ground plane (and any other plane) below the matching network components.

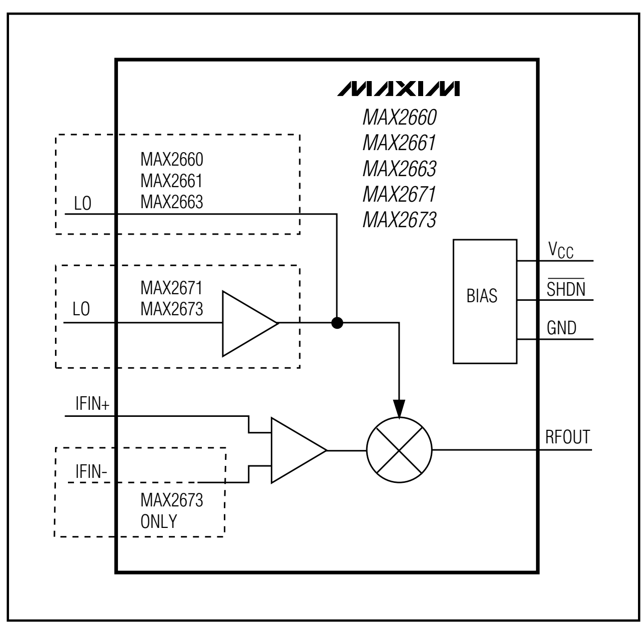
Table 1. RF Output Impedance

PART	RF OUTPUT IMPEDANCE (Ω)			
	AT 400MHz	AT 900MHz	AT 1900MHz	AT 2450MHz
MAX2660	480–j732	126–j459	65–j190	46–j124
MAX2661	357–j649	92–j375	54–j152	38–j99
MAX2663	485–j718	130–j453	65–j188	45–j123
MAX2671	333–j613	82–j360	46–j150	31–j95
MAX2673	220–j530	70–j290	35–j110	32–j70

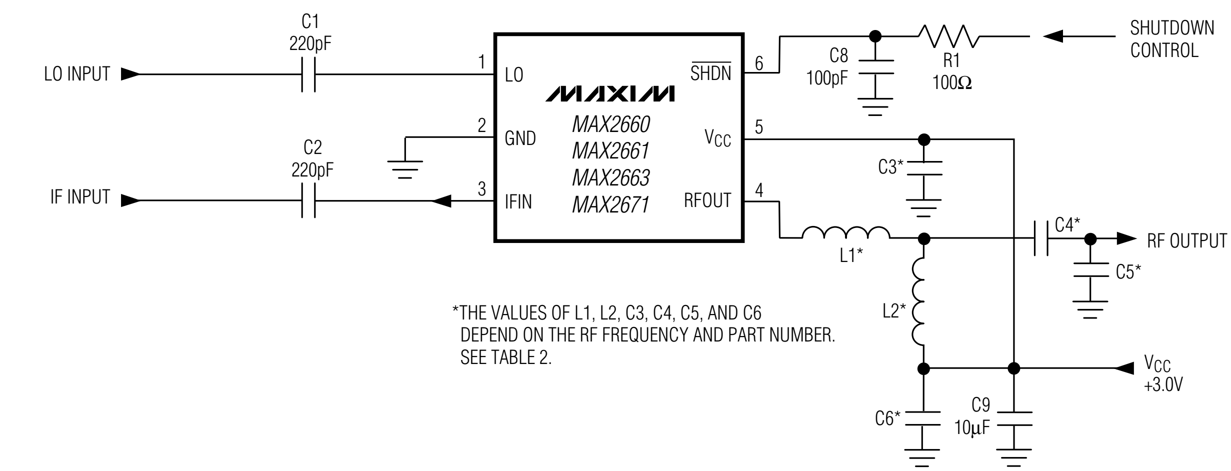
Table 2. Typical Operating Circuit (External Component Values)

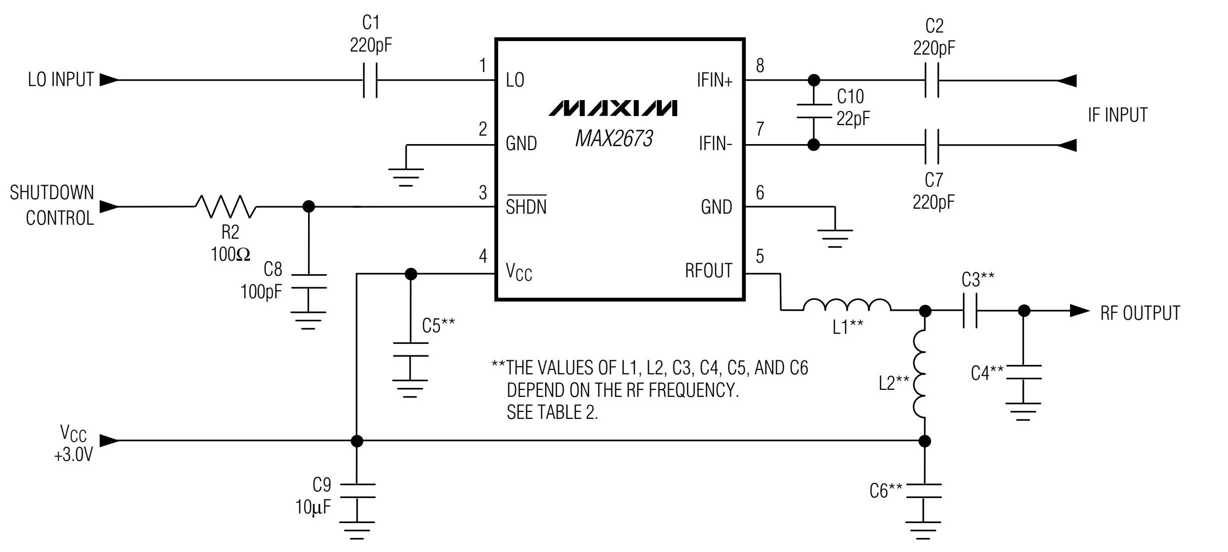
COMPONENT	COMPONENT VALUE AT A GIVEN FREQUENCY (MHz)															
	MAX2660				MAX2661/MAX2671				MAX2663				MAX2673			
	AT 400	AT 900	AT 1900	AT 2450	AT 400	AT 900	AT 1900	AT 2450	AT 400	AT 900	AT 1900	AT 2450	AT 400	AT 900	AT 1900	AT 2450
L1 (nH)	Short	33	8.2	3.3	Short	33	8.2	3.3	Short	33	8.2	3.3	Short	27	5.6	3.9
L2 (nH)	39	18	2.7	2.2	39	18	2.7	1.8	39	18	1.8	1.8	39	18	4.7	6.8
C3 (pF)	470	47	47	47	470	47	47	47	470	47	47	47	3.3	220	10	15
C4 (pF)	3.3	220	220	15	3.3	220	100	220	3.3	220	100	220	6.8	1.5	1.5	1
C5 (pF)	6.8	1	1.5	Open	6.8	1	1.5	Open	6.8	1.8	1.8	Open	470	47	47	47
C6 (pF)	470	47	47	15	470	47	100	47	470	47	100	47	470	100	100	100

Functional Diagram



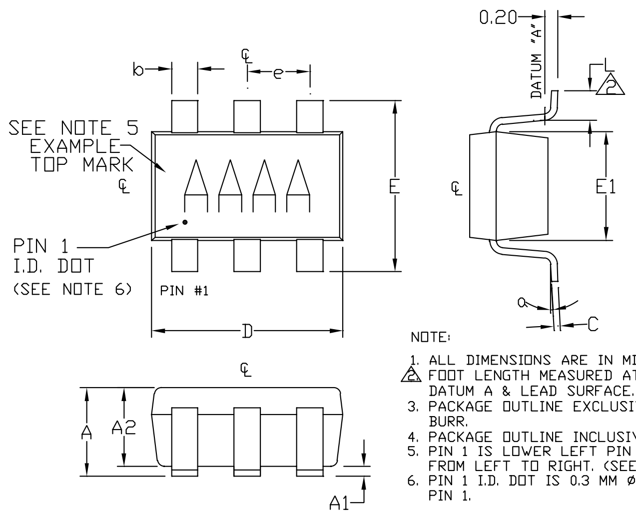
Typical Operating Circuits





Package Information

6LSOT.EPS



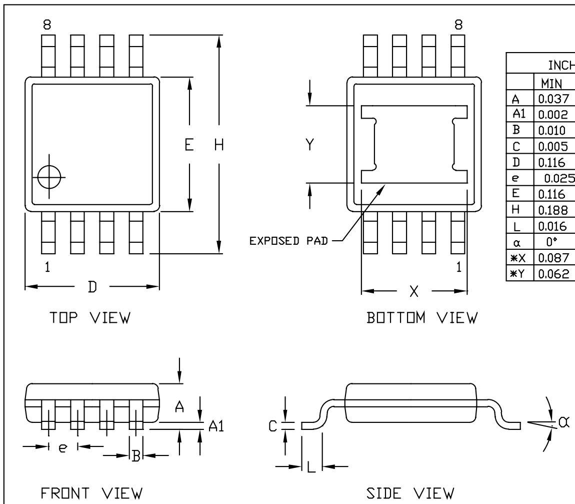
SYMBOL	MIN	MAX
A	0.90	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.35	0.50
C	0.08	0.20
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.75
L	0.35	0.55
e	0.95 REF	
α	0°	10°

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. FOOT LENGTH MEASURED AT INTERCEPT POINT BETWEEN DATUM A & LEAD SURFACE.
3. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH & METAL BURR.
4. PACKAGE OUTLINE INCLUSIVE OF SOLDER PLATING.
5. PIN 1 IS LOWER LEFT PIN WHEN READING TOP MARK FROM LEFT TO RIGHT. (SEE EXAMPLE TOP MARK)
6. PIN 1 I.D. DOT IS 0.3 MM ø MIN. LOCATED ABOVE PIN 1.

MAXIM
PROPRIETARY INFORMATION
TITLE: PACKAGE OUTLINE, SOT23, 6L
APPROVAL | DOCUMENT CONTROL NO. 21-0058 | REV D | 1/1

8LUMAXD.EPS



	INCHES		MILLIMETERS		JEDEC INCHES		JEDEC MILLIMETERS	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	0.037	0.043	0.94	1.10	---	0.043	---	1.10
A1	0.002	0.006	0.05	0.15	0.002	0.006	0.05	0.15
B	0.010	0.014	0.25	0.36	0.010	0.016	0.25	0.40
C	0.005	0.007	0.13	0.18	0.005	0.009	0.13	0.23
D	0.116	0.120	2.95	3.05	0.114	0.122	2.9	3.1
e	0.0256 BSC		0.65 BSC		0.0256 BSC		0.64 BSC	
E	0.116	0.120	2.95	3.05	0.114	0.122	2.9	3.1
H	0.188	0.198	4.78	5.03	0.193 BSC		4.9 BSC	
L	0.016	0.026	0.41	0.66	0.016	0.027	0.40	0.70
α	0°	6°	0°	6°	0°	6°	0°	6°
*X	0.087	0.099	2.210	2.515				
*Y	0.062	0.074	1.575	1.880				

* EXPOSED PAD

NOTES:

1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15 MM (.006").
3. CONTROLLING DIMENSION: MILLIMETERS.
4. MEETS JEDEC MO-187.
5. DIMENSIONS X & Y APPLY TO EXPOSED PAD VERSIONS ONLY.
6. EXPOSED PAD FLUSH WITH BOTTOM OF PACKAGE WITHIN .002".

MAXIM
PROPRIETARY INFORMATION
TITLE: PACKAGE OUTLINE, 8L uMAX
APPROVAL | DOCUMENT CONTROL NO. 21-0036 | REV G | 1/1