19-1913; Rev 0; 1/01 EVALUATION KIT MANUAL

FOLLOWS DATA SHEET

2.4GHz Monolithic Voltage-Controlled **Oscillator with Differential Outputs** 

**General Description** 

The MAX2753 is a self-contained voltage-controlled oscillator (VCO) intended for use in 2.4GHz radios that utilize a low-IF or zero-IF architecture. It combines a fully integrated oscillator and output buffer in a miniature 8-pin µMAX package.

The inductor and varactor elements of the tank are integrated on-chip, greatly simplifying application of the part. The only required external components are a couple of supply bypass capacitors. The MAX2753 provides direct connection to the VCO tuning voltage input and the VCO buffer output. The tuning voltage input range is +0.4V to +2.4V, and the oscillator frequency tuning range is factory adjusted to provide guaranteed limits. The output signal is buffered by an amplifier stage (internally matched to  $50\Omega$ ) to provide higher output power and isolate the device from load impedance variations. In addition, the MAX2753 provides differential outputs.

The MAX2753 operates over a +2.7V to +5.5V supply voltage range. Internal regulation of the oscillator supply voltage eliminates the need for an external LDO regulator for the VCO. The MAX2753 also provides a digitally controlled shutdown mode to permit implementation of sophisticated power-supply management. In shutdown, the supply current is reduced to less than 1µA.

**Applications** 

802.11 FHSS WLAN Home RF 2.4GHz Bluetooth ISM Proprietary Radio

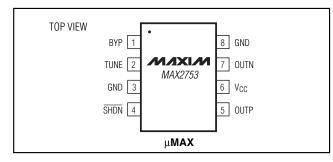
## Features

- Guaranteed Frequency Tuning Range: 2400MHz to 2500MHz
- Compatible with Low-IF or Zero-IF Radio **Architectures**
- Differential Outputs
- On-Chip Tank Circuit
- Internally Matched Output Buffer Amplifier
- 1uA Shutdown Mode
- ♦ +2.7V to +5.5V Supply Voltage Range
- Miniature 8-Pin µMAX Package

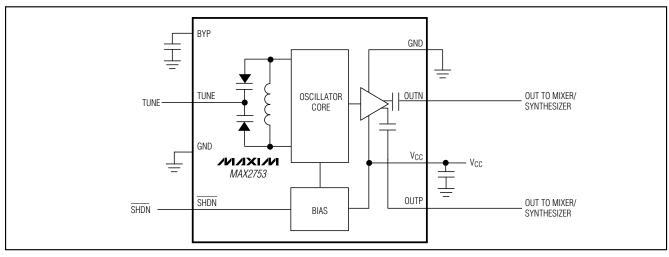
#### **Ordering Information**

PART	TEMP. RANGE	PIN-PACKAGE
MAX2753EUA	-40°C to +85°C	8 μΜΑΧ

#### **Pin Configuration**



## **Typical Operating Circuit**



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For price, delivery, and to place orders, please contact Maxim Distribution at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

#### **ABSOLUTE MAXIMUM RATINGS**

V<sub>CC</sub> to <u>GND</u>.....-0.3V to +6V TUNE, <u>SHDN</u>, BYP, OUTP, OUTN to GND.....-0.3V to (V<sub>CC</sub> + 0.3V) Continuous Power Dissipation ( $T_A = +70^{\circ}$ C) 8-Pin µMAX (derate 5.7mW/°C above  $T_A = +70^{\circ}$ C).....457mW

Operating Temperature Range	40°C to +85°C
Junction Temperature	+150°C
Storage Temperature Range	65°C to +150°C
Lead Temperature (soldering, 10s)	

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

 $(V_{CC} = +2.7V \text{ to } +5.5V, V_{TUNE} = +0.4V \text{ to } +2.4V, V_{\overline{SHDN}} \ge +2V, \text{OUTP} = \text{OUTN} = \text{connected to } 50\Omega \text{ load}, T_A = -40^{\circ}\text{C} \text{ to } +85^{\circ}\text{C}.$ Typical values are at  $V_{CC} = +3.0V$ ,  $T_A = +25^{\circ}\text{C}$ , unless otherwise noted.) (Note 1)

PARAMETER	CONDITIONS	MIN	ТҮР	МАХ	UNITS
Supply Voltage		2.7		5.5	V
Supply Current	$T_{A} = +25^{\circ}C$		8.6	13.0	
	$T_{A} = -40^{\circ}C \text{ to } +85^{\circ}C$			13.5	mA
Shutdown Supply Current	V <sub>SHDN</sub> ≤ 0.6V		0.2	1	μΑ
SHDN Input Voltage Low				0.6	V
SHDN Input Voltage High		2.0			V
SHDN Input Current Low	V <sub>SHDN</sub> ≤ 0.6V	-1		1	μΑ
SHDN Input Current High	V <sub>SHDN</sub> ≥ 2.0V	-2		2	μΑ
TUNE Input Current	$0.4V \le V_{TUNE} \le 2.4V$		0.02		nA

### AC ELECTRICAL CHARACTERISTICS

(MAX2753 EV kit, V<sub>CC</sub> = +2.7V to +5.5V, V<sub>TUNE</sub> = +0.4V to +2.4V, V<sub>SHDN</sub>  $\geq$  +2V, OUTP = OUTN = connected to 50 $\Omega$  load, T<sub>A</sub> = +25°C. Typical values are at V<sub>CC</sub> = +3.0V, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	ТҮР	MAX	UNITS
Oscillator Guaranteed Frequency Limits (Note1)	$V_{TUNE} = +0.4V$ to +2.4V, $T_A = -40^{\circ}C$ to +85°C	2400		2500	MHz
Phase Noise	foffset = 4MHz		-130		dBc/Hz
T hase Noise	Noise floor		-153		dBm/Hz
Tuning Gain (Note 2)	f <sub>OSC</sub> = 2400MHz		150		MHz/V
	f <sub>OSC</sub> = 2500MHz		110		
Differential Output Power			-8		dBm
Return Loss	Pins OUTP or OUTN		11		dB
Harmonics	Differential output		-26		dBc
Load Pulling	VSWR = 2:1, all phases, pins OUTP or OUTN		3.4		MHzp-p
Supply Pushing	V <sub>CC</sub> stepped: +3.3V to +2.8V		1.1		MHz/V
Oscillator Turn-On Time (Note 3)	Exiting shutdown		10		μs
Oscillator Turn-Off Time (Note 4)	Entering shutdown		8		μs

**Note 1:** Specifications are production tested at  $T_A = +25^{\circ}C$ . Limits over temperature are guaranteed by design and characterization. **Note 2:** Tuning gain is measured at the oscillator's guaranteed frequency limits.

**Note 3:** Turn-on time to within 3dB of final output power

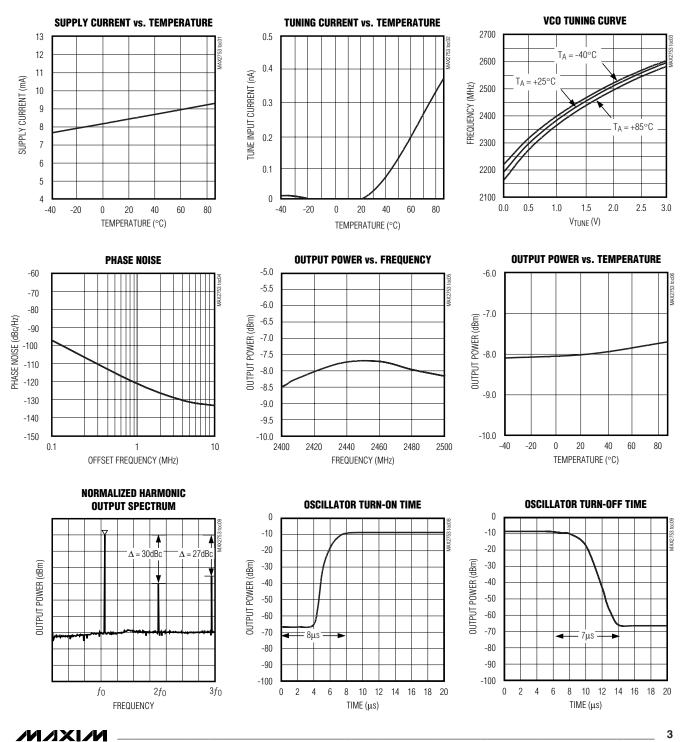
**Note 4:** Turn-off time to output power of -15dBm.

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#### **Typical Operating Characteristics**

(MAX2753 EV kit, V<sub>CC</sub> = +3.0V, V<sub>TUNE</sub> = +0.4V to +2.4V,  $V_{\overline{SHDN}} \ge$  +2V, T<sub>A</sub> = +25°C, unless otherwise noted.)



### **Pin Description**

PIN	NAME	FUNCTION
1	BYP	VCO Bypass. Bypass with a 0.1µF capacitor to GND.
2	TUNE	Oscillator Frequency Tuning Voltage Input. High-impedance input with a voltage input range of +0.4V (low frequency) to +2.4V (high frequency).
3	GND	Ground Connection for Oscillator and Biasing. Requires a low-inductance connection to the circuit board ground plane.
4	SHDN	Shutdown Logic Input. A high-impedance input logic level low disables the device and reduces supply current to less than 1.0µA. A logic level high enables the device.
5	OUTP	Positive Buffered Oscillator Output. Incorporates an internal DC blocking capacitor. OUTP is internally matched to $50\Omega$ .
6	Vcc	DC Supply Voltage Connection. Bypass with a 220pF capacitor to GND for best high frequency performance.
7	OUTN	Negative Buffered Oscillator Output. Incorporates an internal DC blocking capacitor. OUTN is internally matched to $50\Omega$ .
8	GND	Ground Connection for Output Buffer. Requires a low-inductance connection to the circuit board ground plane.

#### **Detailed Description**

#### Oscillator

The MAX2753 VCO is implemented as an LC oscillator topology, integrating all of the tank components onchip. This fully monolithic approach provides an extremely easy-to-use VCO, equivalent to a VCO module. The frequency is controlled by a voltage applied to the TUNE pin, which is internally connected to the varactor. The VCO core uses a differential topology to provide a stable frequency versus supply voltage and improve the immunity to load variations. In addition, there is a differential buffer amplifier following the oscillator core to provide added isolation from load variations and to boost the output power.

#### **Output Buffer**

The oscillator signal from the core drives a differential output buffer amplifier. Each of the two amplifier outputs is internally matched to  $50\Omega$  including an on-chip DC-blocking capacitor. No external DC-blocking capacitor is required, eliminating the need for any external components. The amplifier boosts the oscillator signal to a level suitable for driving most RF mixers.

#### Applications Information

#### **Tune Input**

The tuning input is typically connected to the output of the PLL loop filter. The loop filter provides an appropriately low-impedance source. The input may incorporate an extra RC filter stage to reduce high-frequency noise and spurious signals. Any excess noise on the tuning input is directly translated into FM noise, which can degrade the phase-noise performance of the oscillator. Therefore, it is important to minimize the noise introduced on the tuning input. A simple RC filter with low corner frequency is needed during testing to filter the noise present on the voltage source driving the tuning line.

#### **Layout Issues**

/N/IXI/N

Always use controlled impedance lines (microstrip, coplanar waveguide, etc.) for high-frequency signals. Always place decoupling capacitors as close to the V<sub>CC</sub> pins as possible; for long V<sub>CC</sub> lines, it may be necessary to add additional decoupling capacitors located further from the device. Always provide a low-inductance path to ground, and keep GND vias as close to the device as possible. Thermal reliefs on GND pads are not recommended.

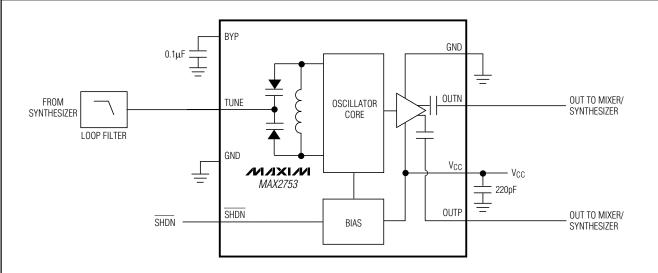
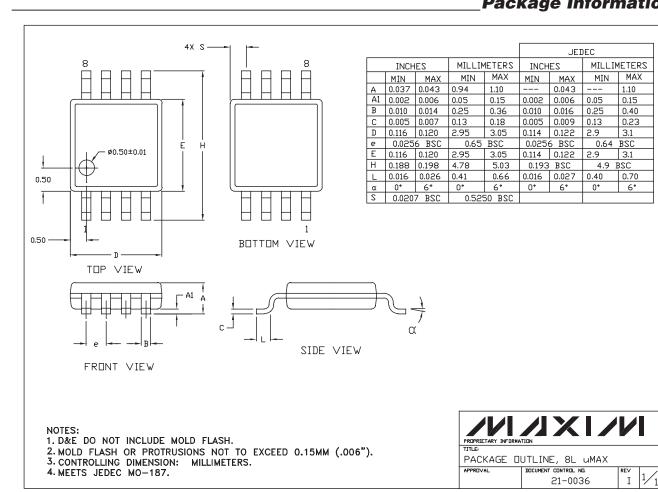


Figure 1. Typical Application Circuit

## Chip Information

TRANSISTOR COUNT: 176 PROCESS: BiPOLAR MAX2753





**Package Information** 

8LUMAXD.EPS

M/IXI/M

**MAX2753**