POLITECNICO DI TORINO

ESAME DI STATO PER L'ABILITAZIONE ALLA PROFESSIONE DI INGEGNERE

SEZIONE A – RAMO "ELETTRONICA" – TEMA 1

PROVA PRATICA DEL 25 GIUGNO 2002

Si intende progettare un sistema di misura per la pressione di un pneumatico, che faccia uso di un sensore di pressione a ponte. La misura effettuata deve essere trasformata in un segnale di frequenza *f* variabile tra 885 MHz (minima pressione misurabile dal sensore, inferiore a 1 atm) e 950 MHz (massima pressione misurabile dal sensore). Sulla base dei data sheet a disposizione, si richiede di:

1. scegliere il sensore di pressione ed il VCO più adatti alle richieste;

2. identificare lo schema a blocchi del sistema elettronico richiesto, compreso del circuito di alimentazione del sensore e dell'eventuale blocco da interporre tra sensore e VCO;

3. progettare i blocchi del sistema identificato al passo precedente, in un primo tempo trascurando tutti gli offset presenti nel sistema, assumendo una tensione di alimentazione continua di 5 V. Per realizzare il generatore di corrente per alimentare il sensore, si faccia uso di un diodo Zener da 1.2 V, mentre se dovesse fare uso di amplificatori operazionali, li si consideri ideali. Si ricorda che la bridge impedance del sensore è il valore nominale di ognuna delle resistenze del ponte;

4. modificare il progetto in modo da prevedere l'introduzione di un meccanismo di compensazione per gli offset dei vari componenti.

Sensing element/Absolute — FPBS Data sheet

Features

- Very small size(ϕ 5.8mm)
- Surface mount package
- Non-corrosive gas, Water or Sea water

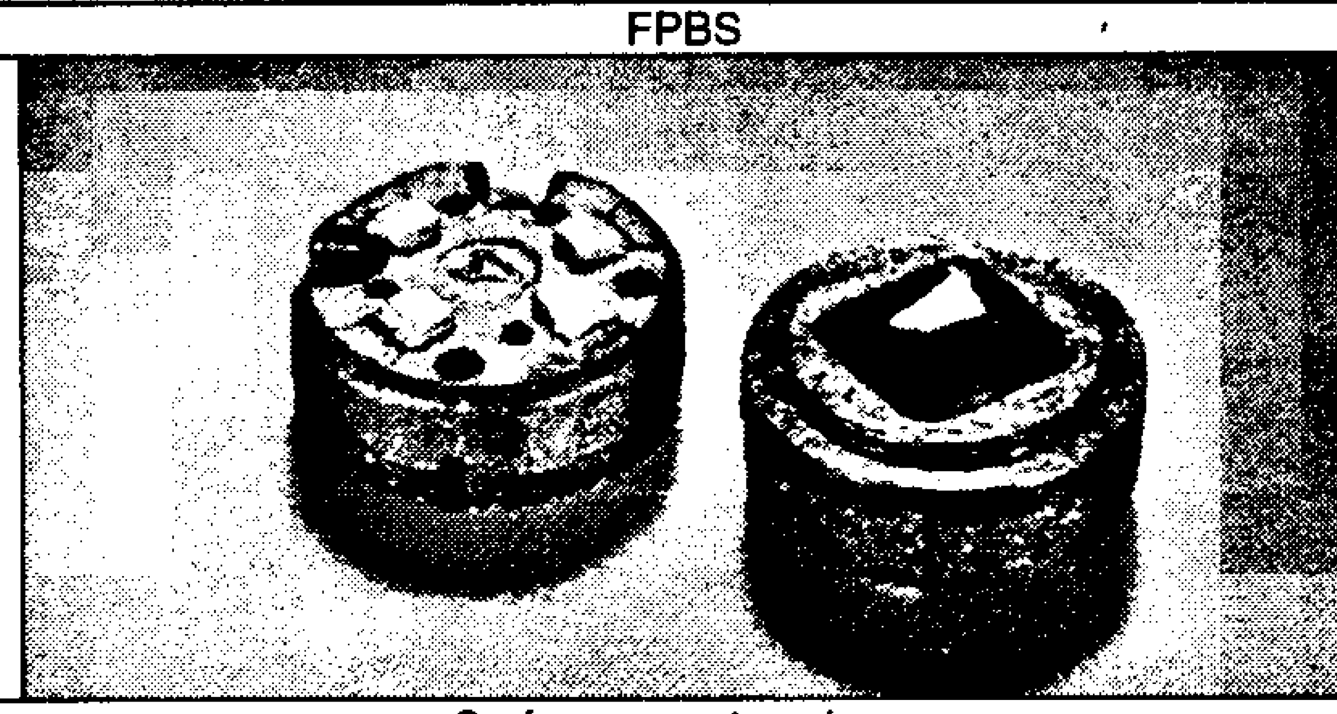
Applications

- Barometer, Relative altimeter
- Weather forecast
- Altitude compensation
- Diving depth meter

Part number for ordering

FPBS - 04 A

- Model: FPBS
- Rated pressure
- Pressure type: A : Absolute pressure

Pressure type	Absolute pressure
	FPBS
Model	
Package configuration	Surface mount package

Measurable pressure range(kPa·abs)	Part number for ordering
42.6~434.7	FPBS-04A
101.3~905.5	FPBS-82A

Specifications

Model/Rated pressure	04A	82A	unit
Recommended operating conditions			
Pressure type	Absolute pressure		—
Rated pressure	434.7	905.5	kPa·abs
	3.4	8.2	kg/cm²·abs
Measurable pressure range	42.6~434.7	101.3~905.5	kPa·abs
Pressure media	Non-corrosive gas, Water or Sea water		—
Excitation current(Constant)	0.15		mADC
Absolute maximum rating			
Maximum load pressure	1961	2942	kPa·abs
Maximum excitation current	3		mADC
Operating temperature	−20~70	−20~70	℃
Storage temperature	−30~85		℃
Operating humidity	30~80 (No dew condensation)		%RH
Electric performances/characteristics (Excitation current I=0.15mA constant, Ambient temperature Ta=25℃)			
Full scale span voltage	2.5~7.0	5.0~9.0	mV
Offset voltage	1.0~11.0 (at 62.1kPa·abs)	1.0~3.0 (at 101.3kPa·abs)	mV
Bridge impedance	3000~4500		Ω
Mechanical response time	2 (For the reference)		msec
Accuracy: Temperature sensitivity of offset (TSO)	±5/10~40℃	±5/5~35℃	%FS
Accuracy: Temperature coefficient of sensitivity (TCS)	2.5/10~40℃	2.5/5~35℃	%FS
Accuracy: Linearity	±0.5 (NL1), −6.5~0 (NL2)	±0.5	%FS

Note ; ※It's not available when pressure media always contact.

Evaluating equations

- V(P,T) is defined as the output voltage at Pressure kPa·abs, Temperature T.
- Full scale span voltage
  (04A) : = SPAN[62.1～111.1kPa]=SPAN04(25)
  =V(111.1,25)−V(62.1,25)
  (82A) : = SPAN[101.3～905.5kPa]=SPAN82(25)
  =V(905.5,25)−V(101.3,25)

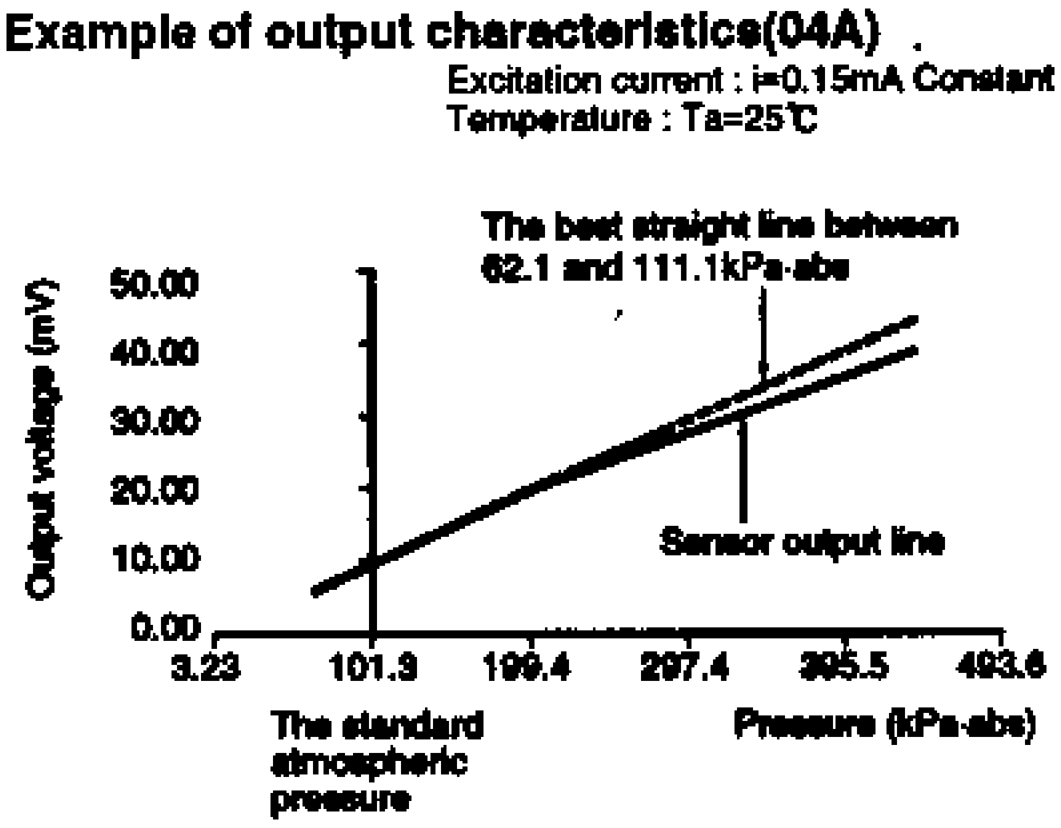
Offset voltage
(04A) : = V(62.1,25)
(82A) : = V(101.3,25)

Temperature sensitivity of offset (TSO)
(04A) : = (V(62.1,40)−V(62.1,10)/SPAN04(25)×100
(82A) : = (V(101.3,35)−V(101.3,5)/SPAN82(25)×100

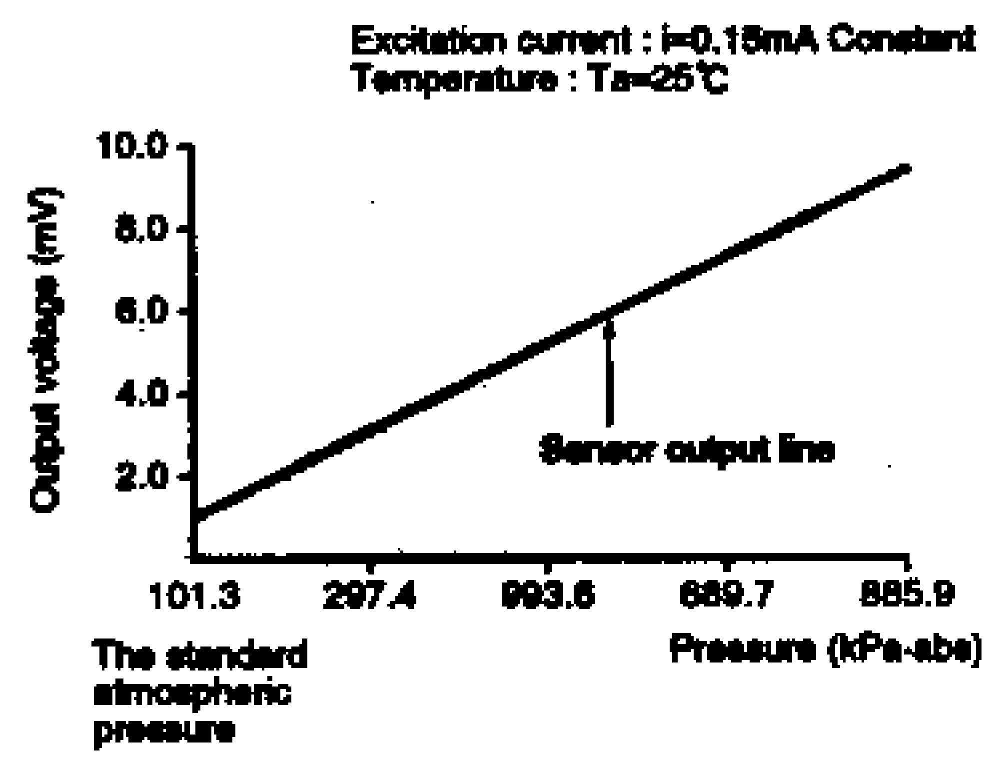
Temperature coefficient of sensitivity(TCS)
(04A) : = (SPAN04MAX.−SPAN04MIN.)/SPAN1(25)×100
(82A) : = (SPAN82MAX.−SPAN82MIN.)/SPAN2(25)×100
SPAN MAX : = The value is bigger of SPAN04 or SPAN82.
SPAN MIN : = The value is smaller of SPAN04 or SPAN82.

Linearity
(04A) : NL1= (V(86.6,25)−(V(62.1,25)+V(111.1,25))/2)
/SPAN04(25)×100
NL2= (V(434.7,25)−(333.4×SPAN04(25)/49.0+V(101.3,25)))
/(434.7×SPAN04(25)/49.0)×100
(82A) : = (V(503.4,25)−(V(101.3,25)+V(905.5,25))/2)
/SPAN82(25)×100

●Example of output characteristics(04A)



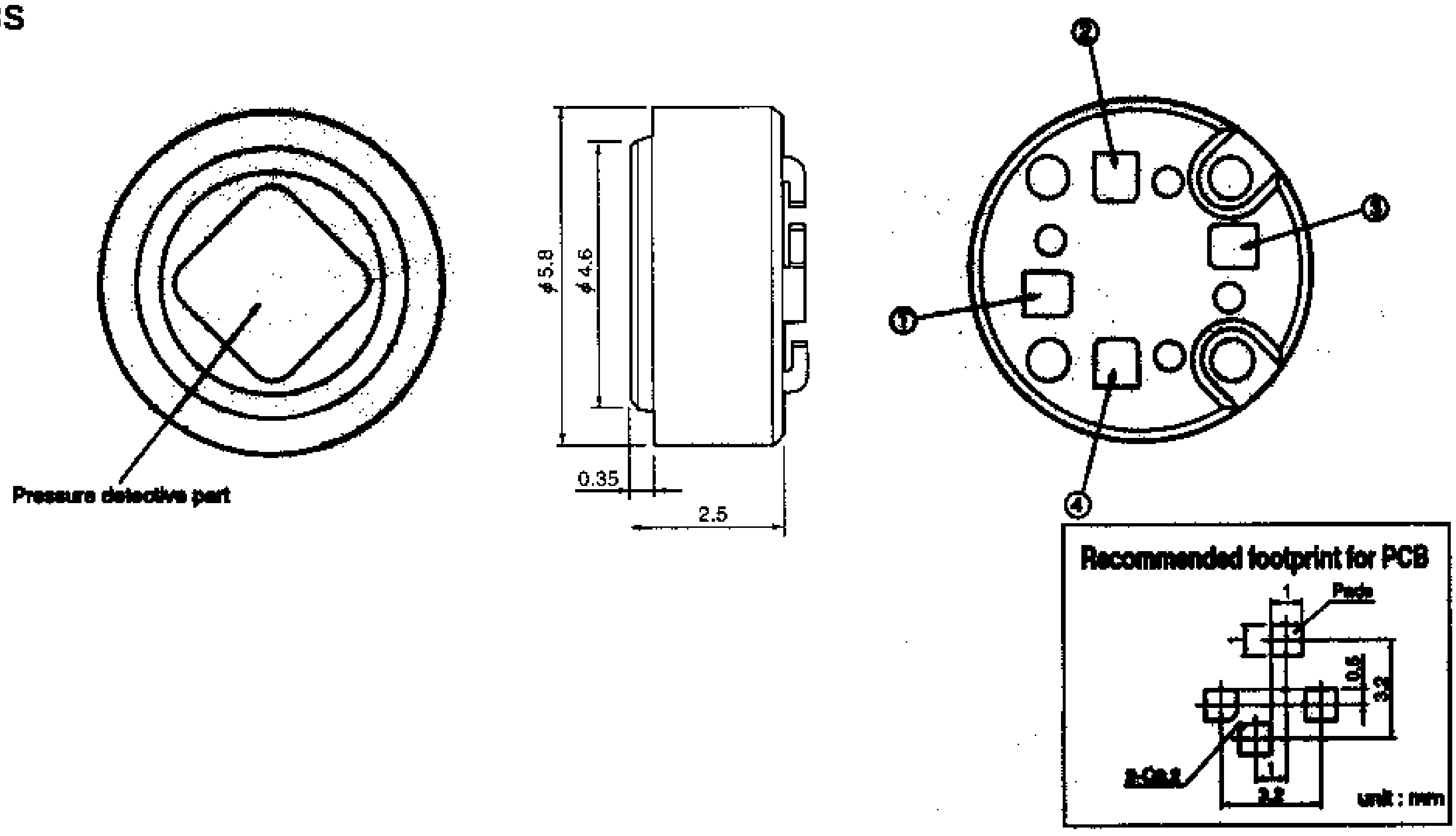
●Example of output characteristics(82A)



■Outline dimensions■

Unit : mm

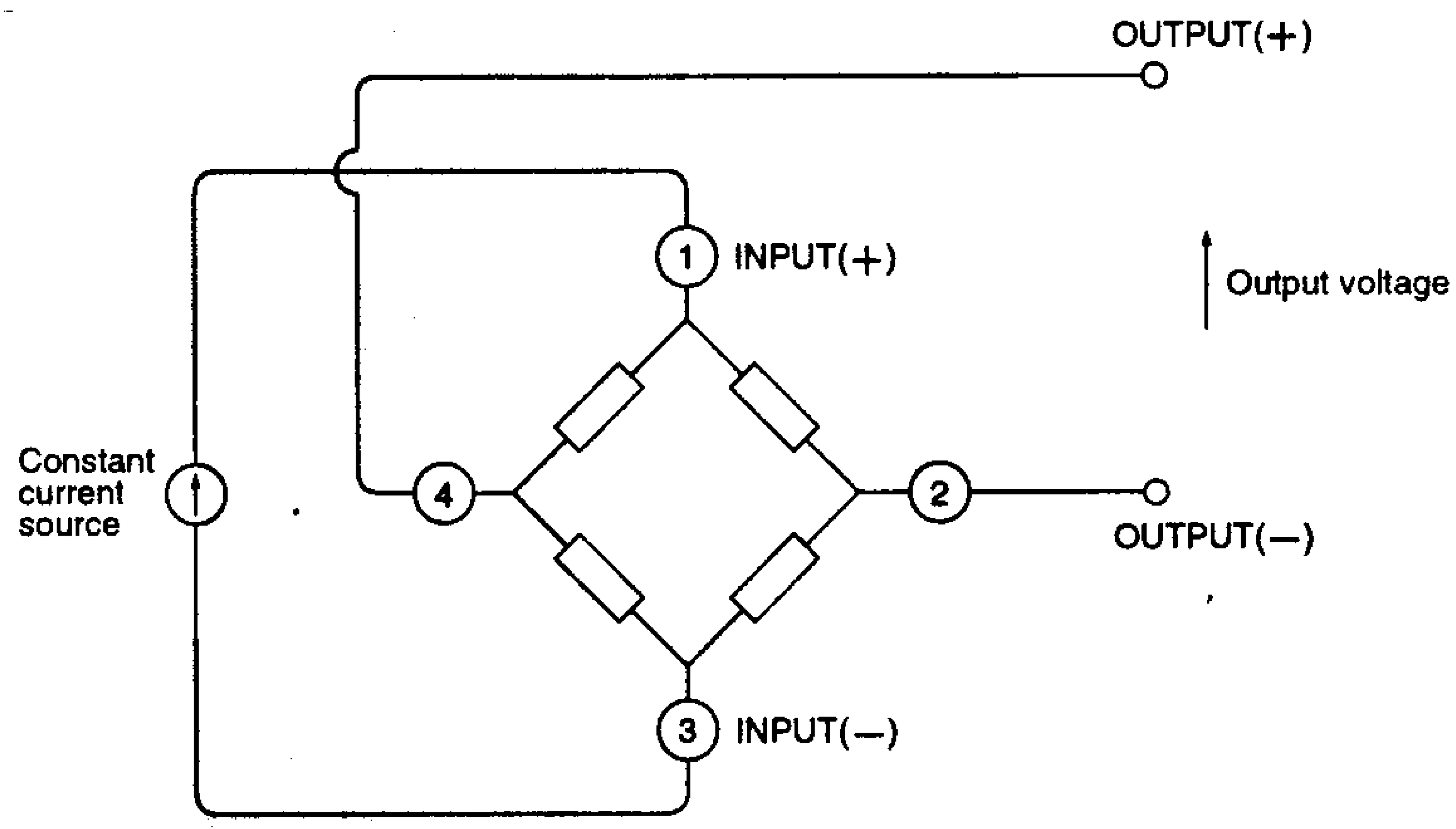
FPBS



■ Connection diagram ■

Unit : mm

FPBS



Note ; Please read instruction "Notes" before using the sensor.
Fujikura reserves the right to change specifications without notice.

Fujikura Ltd.

If you have any questions regarding technical issues or specifications, please contact us.
Sensor Engineering Department 5-1 Kiba 1-chome, Koto-ku, Tokyo 135-8512, Japan
Phone +81-(0)3-5606-1072 Fax. +81-(0)3-5606-1538
E-mail : sensor@fujikura.co.jp

19-1528; Rev 1; 5/00

EVALUATION KIT MANUAL FOLLOWS DATA SHEET

MAXIM

Monolithic Voltage-Controlled Oscillators

General Description

The MAX2622/MAX2623/MAX2624 self-contained voltage-controlled oscillators (VCOs) combine an integrated oscillator and output buffer in a miniature 8-pin µMAX package.

The inductor and varactor elements of the tank circuits are integrated on-chip, greatly simplifying application of the part. In addition, the center frequency of oscillation and frequency span are factory preset to provide a guaranteed frequency range versus control voltage. An external tuning voltage controls the oscillation frequency. The output signals are buffered by an amplifier stage matched on-chip to 50Ω.

The MAX2622/MAX2623/MAX2624 operate from a +2.7V to +5.5V supply voltage and require only 8mA of supply current. In shutdown mode, the supply current is reduced to 0.1µA.

Applications

866MHz to 868MHz European ISM Band (MAX2622)

DECT 1/2 Frequency LO (MAX2623)

902MHz to 928MHz ISM Band, ±10.7MHz IF (MAX2623)

902MHz to 928MHz ISM Band, 45MHz to 70MHz IF (MAX2624)

Features

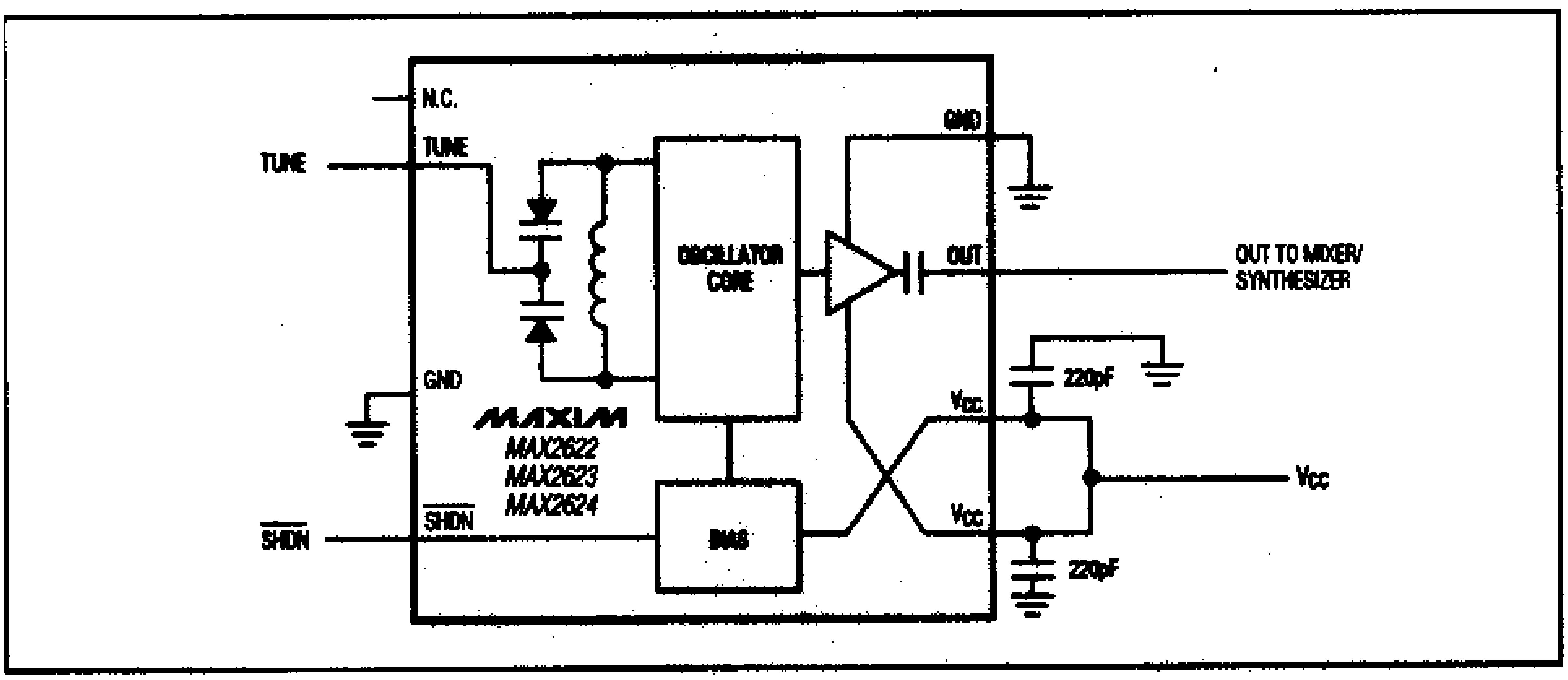
- **Fully Monolithic**
- **Guaranteed Performance**
- **On-Chip 50Ω Output Match**
- **Wide Choice of Frequencies**
  - **855MHz to 881MHz (MAX2622)**
  - **885MHz to 950MHz (MAX2623)**
  - **947MHz to 998MHz (MAX2624)**
- **+2.7V to +5.5V Single-Supply Operation**
- **Low-Current Shutdown Mode**
- **Smaller than Modules (8-Pin µMAX Package)**

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX2622EUA	-40°C to +85°C	8 µMAX
MAX2623EUA	-40°C to +85°C	8 µMAX
MAX2624EUA	-40°C to +85°C	8 µMAX

Pin Configuration appears at end of data sheet.

Typical Operating Circuit



ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND ....-0.3V to +6V
TUNE, $\overline{SHDN}$ to GND ....-0.3V to (V_{CC} + 0.3V)
OUT to GND ....-0.3V to (V_{CC} + 0.6V)
Continuous Power Dissipation (T_A = +70°C)
8-Pin μMAX (derate 5.7mW/°C above T_A = +70°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) ....+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

(*Typical Operating Circuit*, V_{CC} = +2.7V to +5.5V, V_{TUNE} = 1.4V, $V_{\overline{SHDN}}$ = 2V, OUT = unconnected, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = +3V, T_A = +25°C.) (Note 1)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage		2.7		5.5	V
Supply Current			8	11.5	mA
Shutdown Supply Current	$V_{\overline{SHDN}} \le 0.6V$		0.1	5	μA
$\overline{SHDN}$ Input Voltage Low				0.6	V
$\overline{SHDN}$ Input Voltage High		2.0			V
$\overline{SHDN}$ Input Current Low	$V_{\overline{SHDN}} \le 0.6V$	-0.5		0.5	μA
$\overline{SHDN}$ Input Current High	$V_{\overline{SHDN}} \ge 2.0V$	-0.5		0.5	μA
TUNE Input Current	$0.4V \le V_{TUNE} \le 2.4V$		0.01		nA

AC ELECTRICAL CHARACTERISTICS

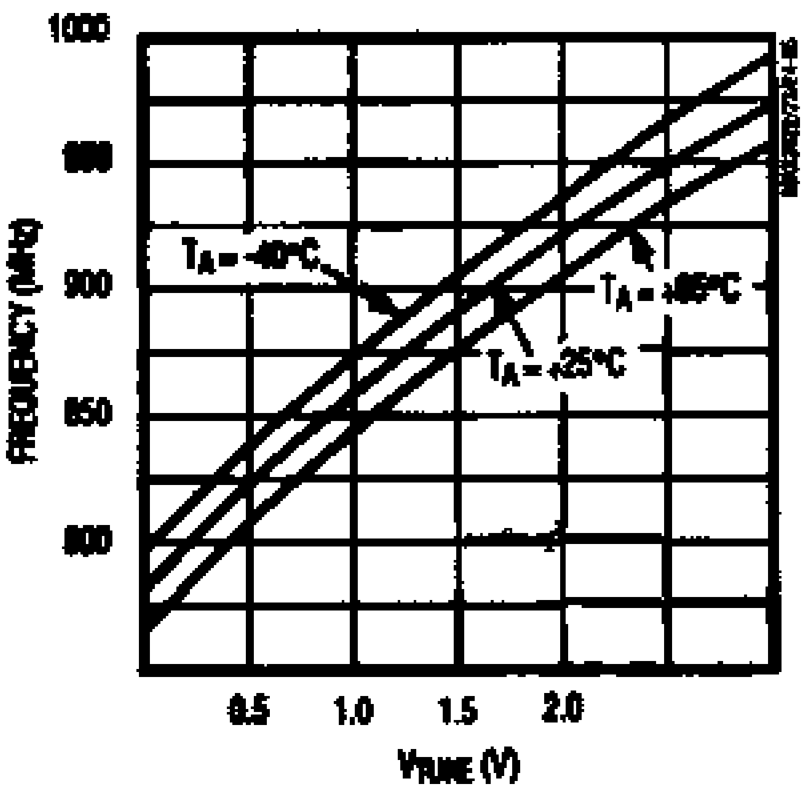
(*Typical Operating Circuit*, V_{CC} = +2.7V to +5.5V, V_{TUNE} = 0.4V to 2.4V, $V_{\overline{SHDN}}$ = 2V, T_A = +25°C, unless otherwise noted. Typical values measured at V_{CC} = +3V.) (Note 1)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Oscillator Frequency Range	MAX2622, V_{TUNE} = 0.4V to 2.4V, T_A = -40°C to +85°C	855		881	MHz
	MAX2623, V_{TUNE} = 0.4V to 2.4V, T_A = -20°C to +75°C	885		950	
	MAX2624, V_{TUNE} = 0.4V to 2.4V, T_A = -40°C to +85°C	947		998	
Phase Noise	f_{OFFSET} = 100kHz		-101		dBc/Hz
	f_{OFFSET} = 1MHz		-119		
Noise Floor			-151		dBm/Hz
Maximum Tuning Gain (Note 2)	V_{TUNE} = 0.4V to 2.4V		75	100	MHz/V
Output Power	V_{TUNE} = 0.4V (Note 3)		-3		dBm
Return Loss (Note 3)			-10		dB
Harmonics			-27		dBc
Load Pulling	VSWR = 2:1, all phases		0.75		MHz_{p-p}
Supply Pushing	V_{CC} stepped from 2.8V to 3.3V		280		kHz/V

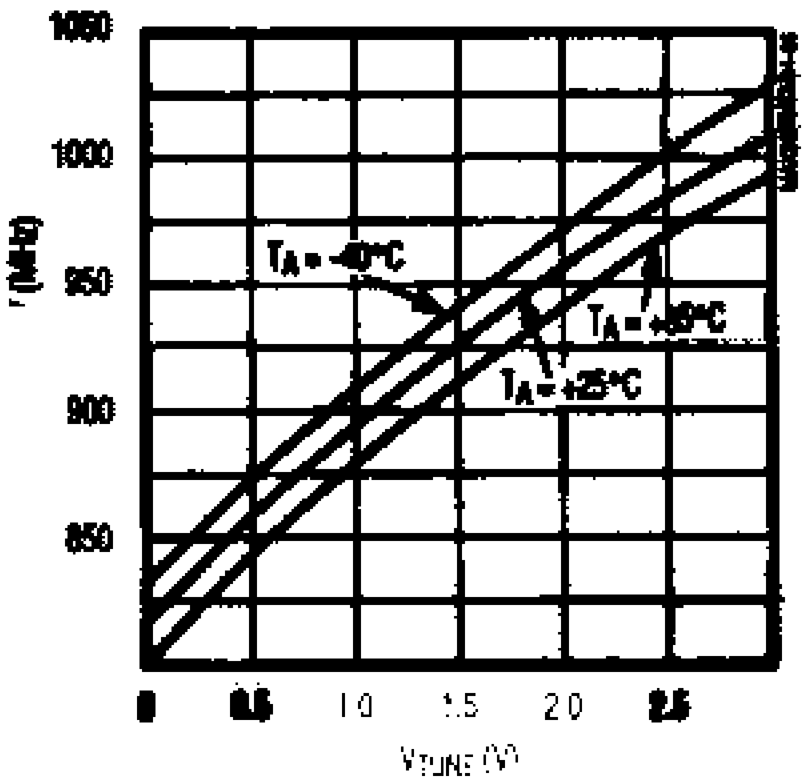
Note 1: Specifications are production tested at T_A = +25°C. Limits over temperature are guaranteed by design and characterization.
Note 2: Tuning gain is measured at V_{TUNE} = 0.4V with a 0.2V step to 0.6V. At low V_{TUNE}, tuning gain is highest.
Note 3: Measurements taken on MAX262_ EV kit.

Typical Operating Characteristics

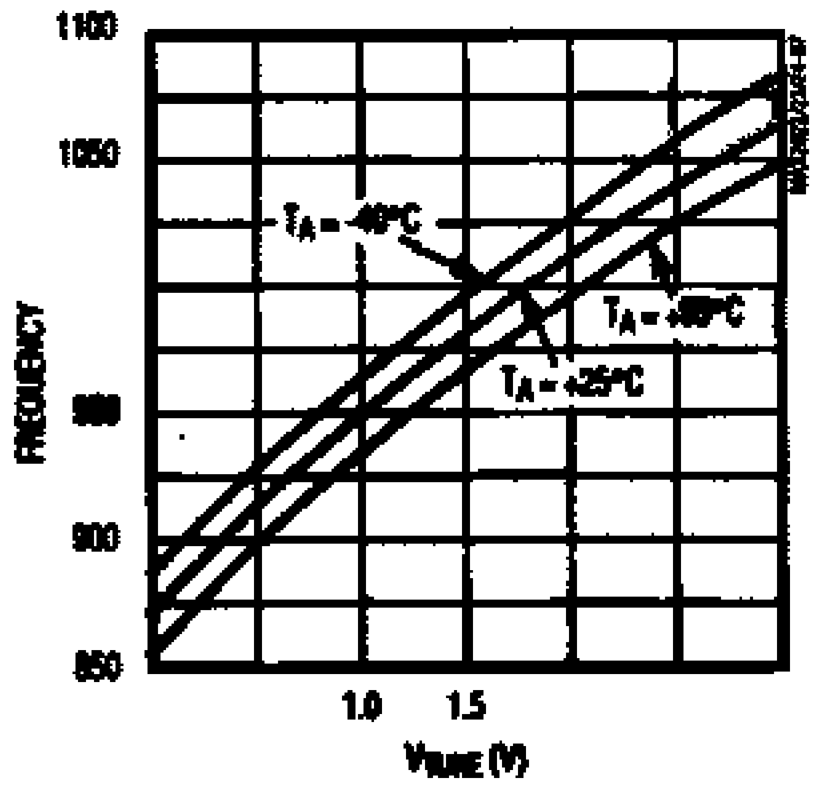
(V_{CC} = +3.0V, V_{TUNE} = 0.4V to 2.4V, $V_{\overline{SHDN}}$ = 2V, T_A = +25°C, unless otherwise noted.)



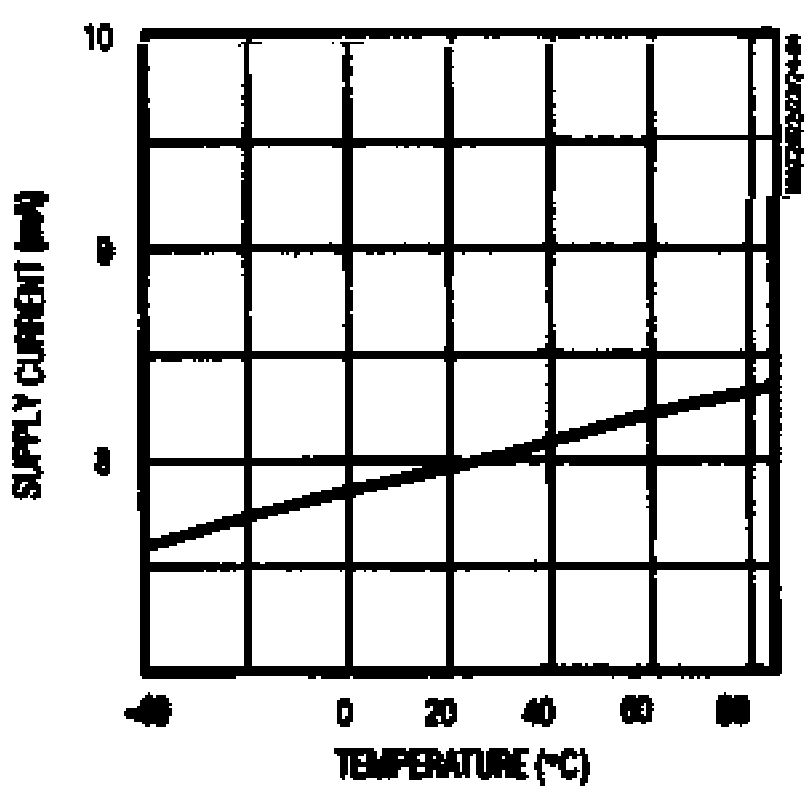
MAX2623
VCO TUNING CURVE



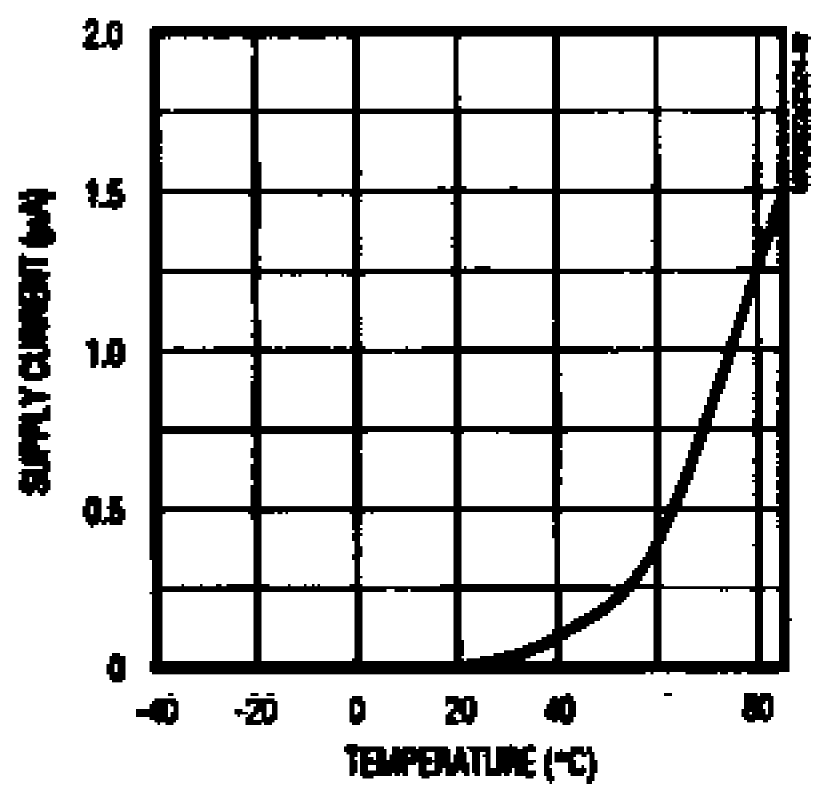
MAX2624
VCO TUNING CURVE



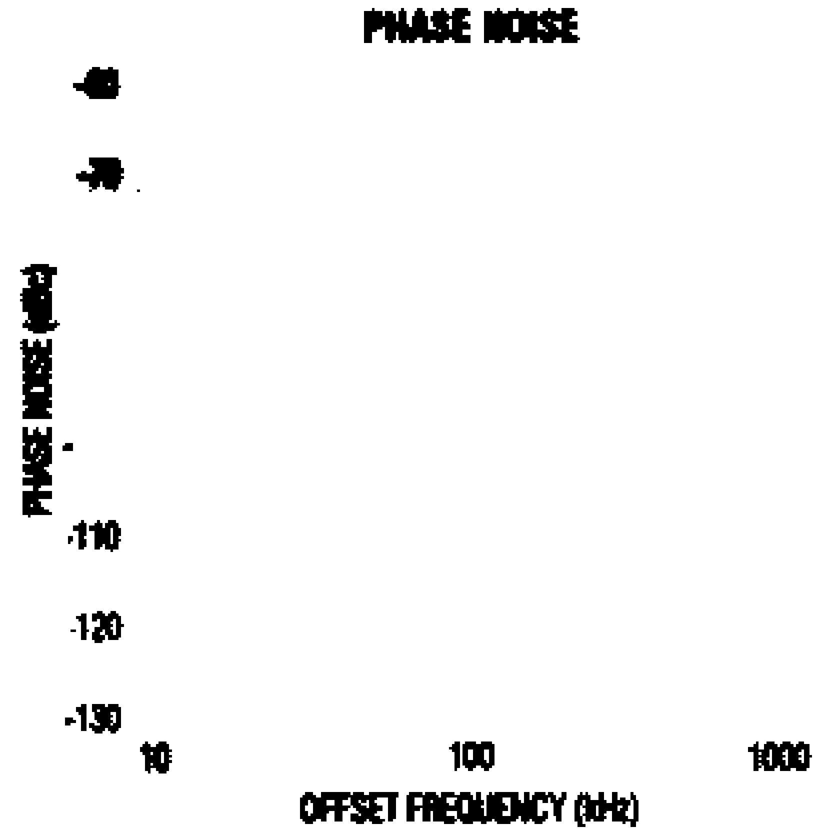
SUPPLY CURRENT
vs. TEMPERATURE



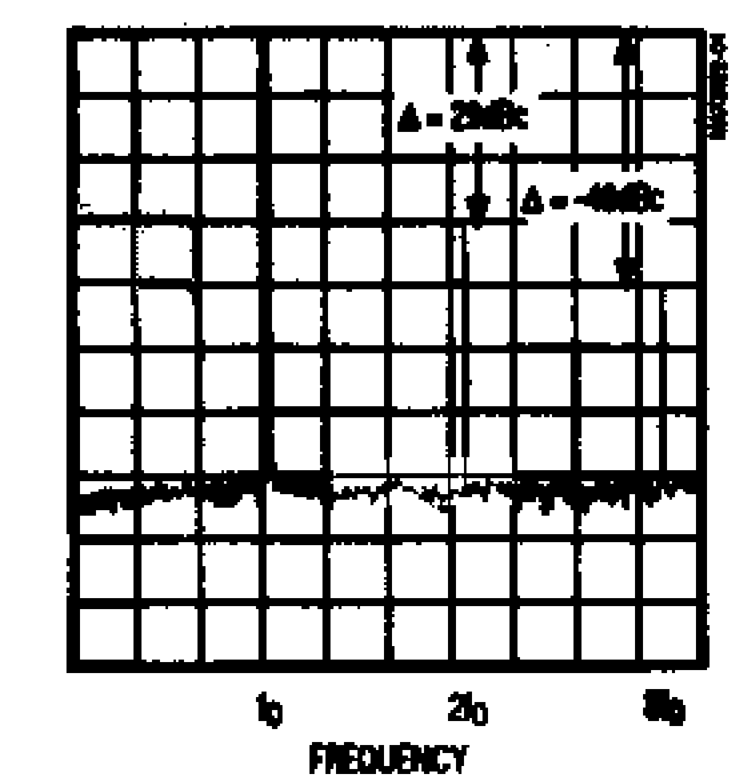
SHUTDOWN SUPPLY CURRENT
vs. TEMPERATURE



PHASE NOISE



NORMALIZED HARMONIC OUTPUT SPECTRUM



Monolithic Voltage-Controlled Oscillators

Pin Description

PIN	NAME	FUNCTION
1	N.C.	No Connection. Not internally connected.
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) adjustment.
3	GND	Ground Connection for Oscillator and Biasing. Requires a low-inductance connection to the circuit board ground plane.
4	$\overline{SHDN}$	Shutdown Logic Input. A high-impedance input logic level low disables the device and reduces supply current to 0.1µA. A logic level high enables the device.
5	V_{CC}	Output Buffer DC Supply Voltage Connection. Bypass with a 220pF capacitor to GND for best high-frequency performance.
6	V_{CC}	Bias and Oscillator DC Supply Voltage Connection. Bypass with a 220pF capacitor to GND for low noise and low spurious content performance from the oscillator.
7	OUT	Buffered Oscillator Output
8	GND	Ground Connection for Output Buffer. Requires a low-inductance connection to the circuit board ground plane.

Detailed Description

Oscillator

The MAX2622/MAX2623/MAX2624 VCOs are implemented as an LC oscillator topology, integrating all of the tank components on-chip. 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 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 an output buffer amplifier. The amplifier is constructed as a common-emitter stage with an integrated on-chip reactive output match. No external DC blocking capacitor is required, eliminating the need for any external components. The output amplifier has its own V_{CC} and GND pins to minimize load-pulling effects. 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 is presumed to provide an appropriately low-impedance source. It 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 in order to filter the noise present on the voltage source driving the tuning line.

Layout Issues

Always use controlled impedance lines (microstrip, coplanar waveguide, etc.) for high-frequency signals. Always place decoupling capacitors as close to the V_{CC} pins as possible; for long V_{CC} 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.

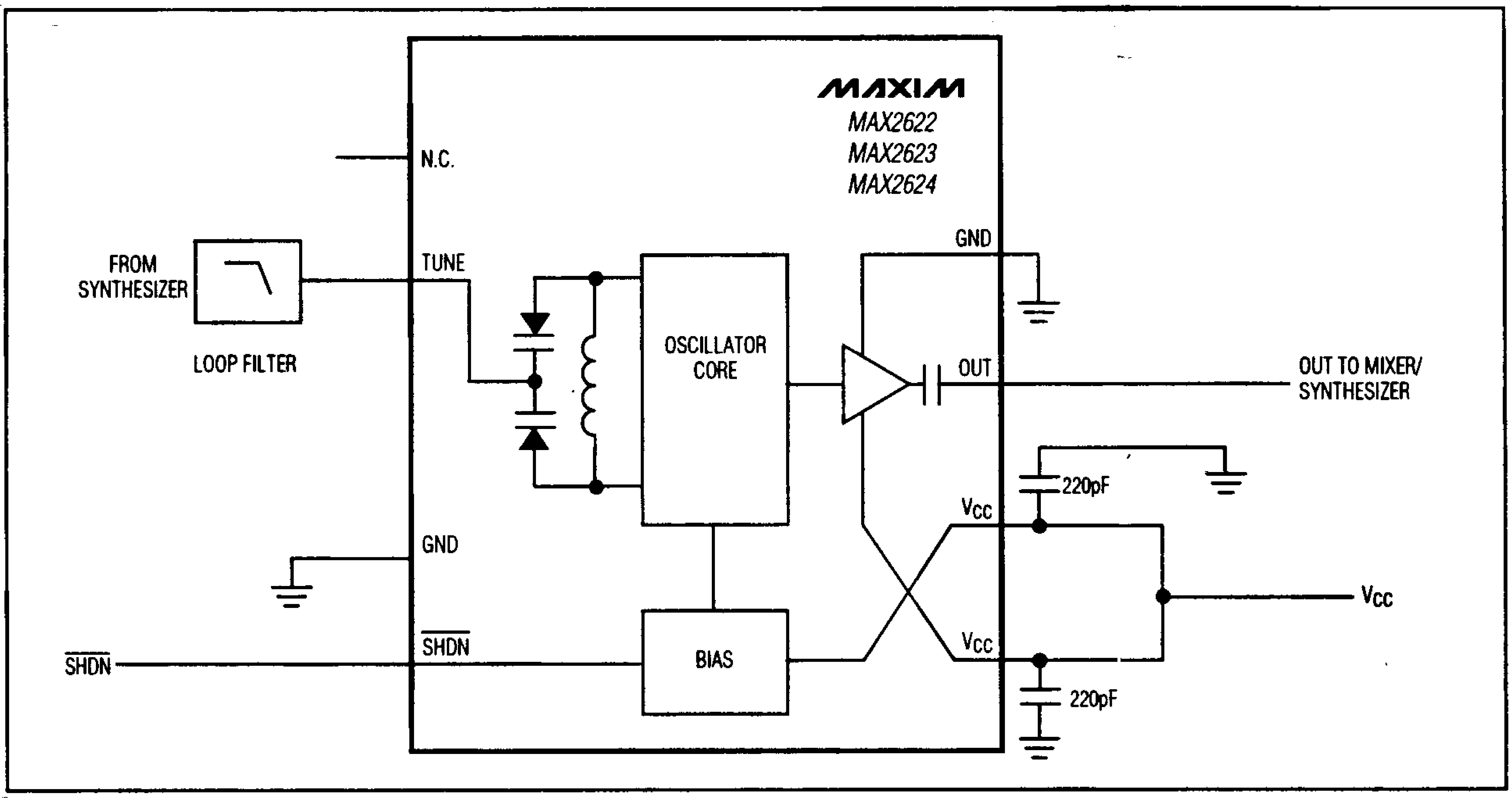
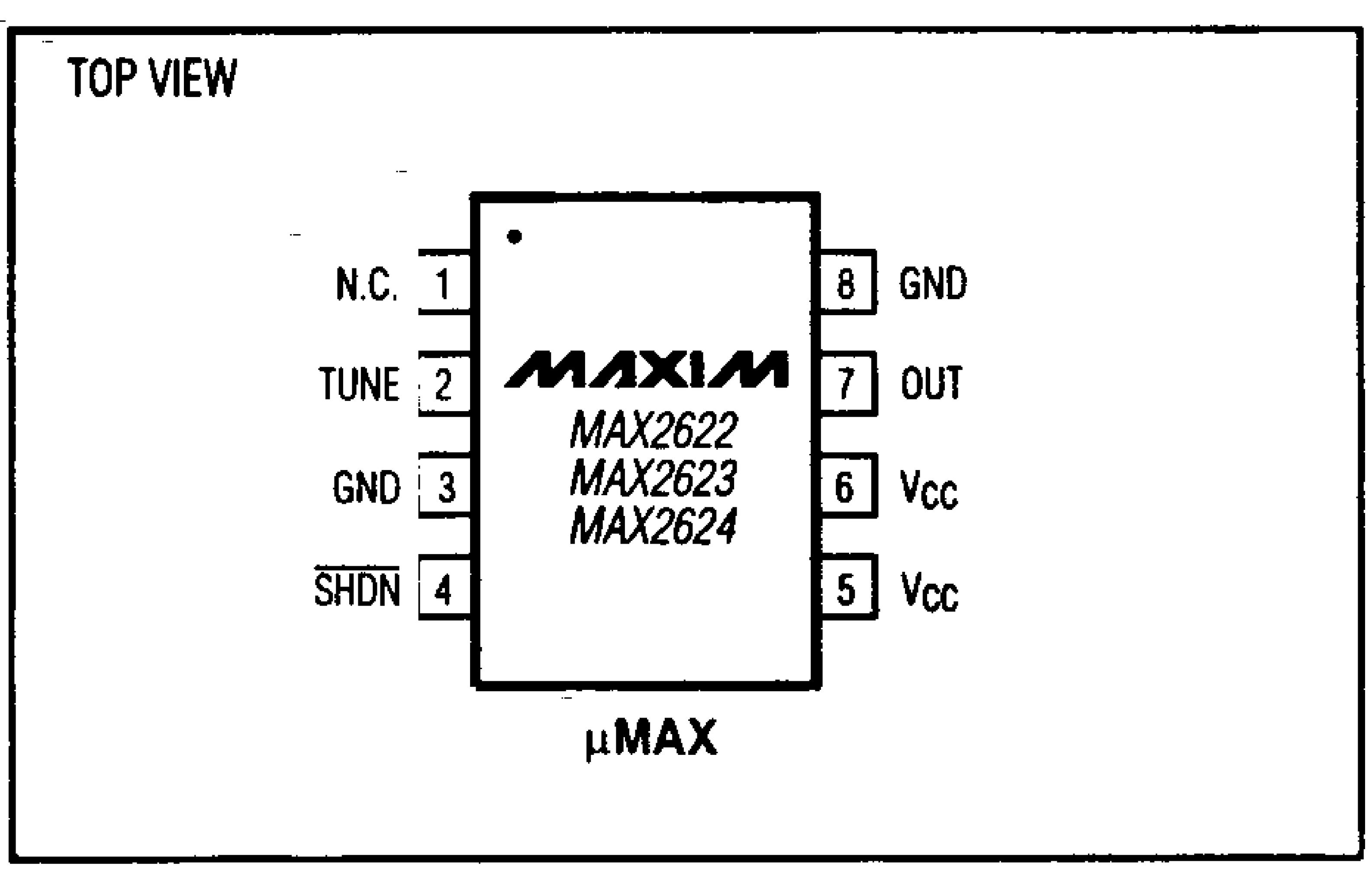
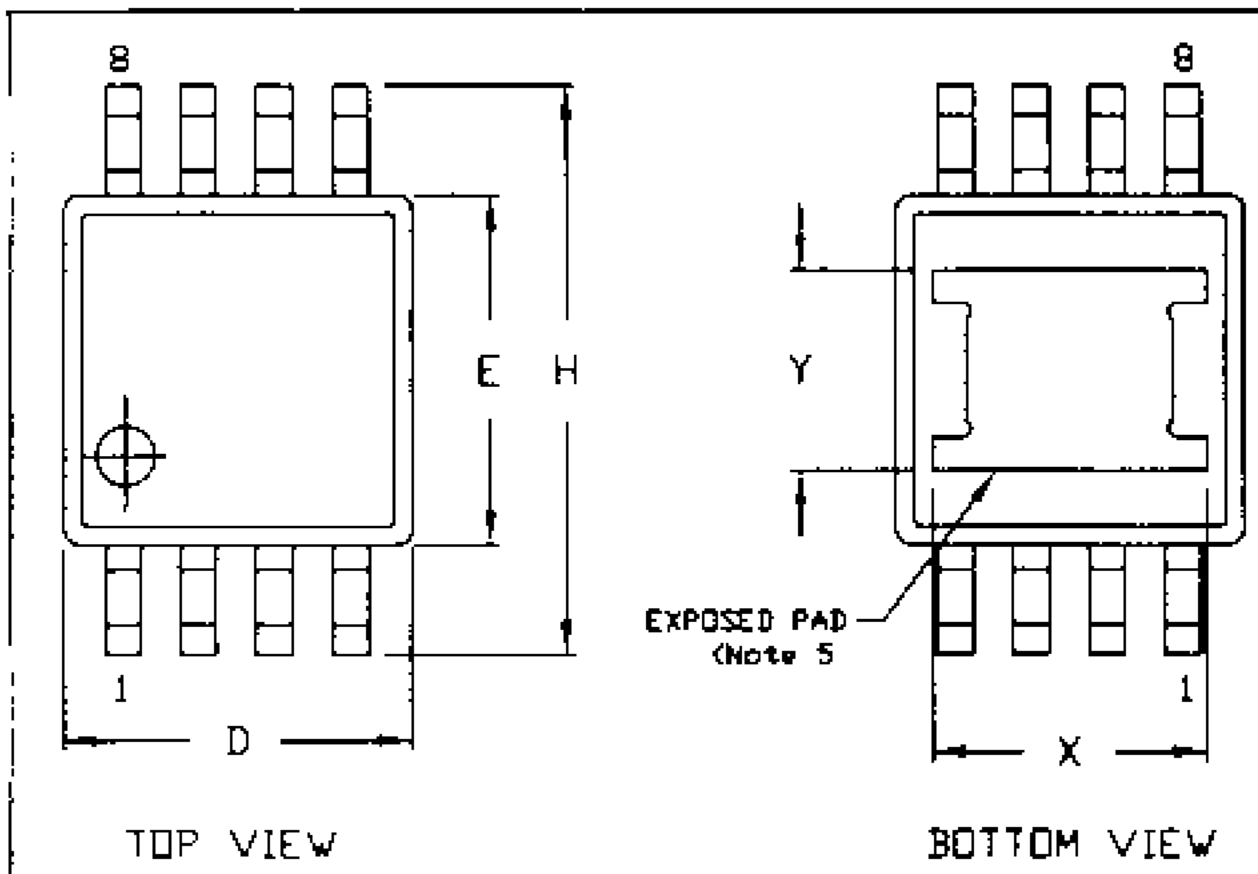


Figure 1. Typical Application Circuit

Pin Configuration

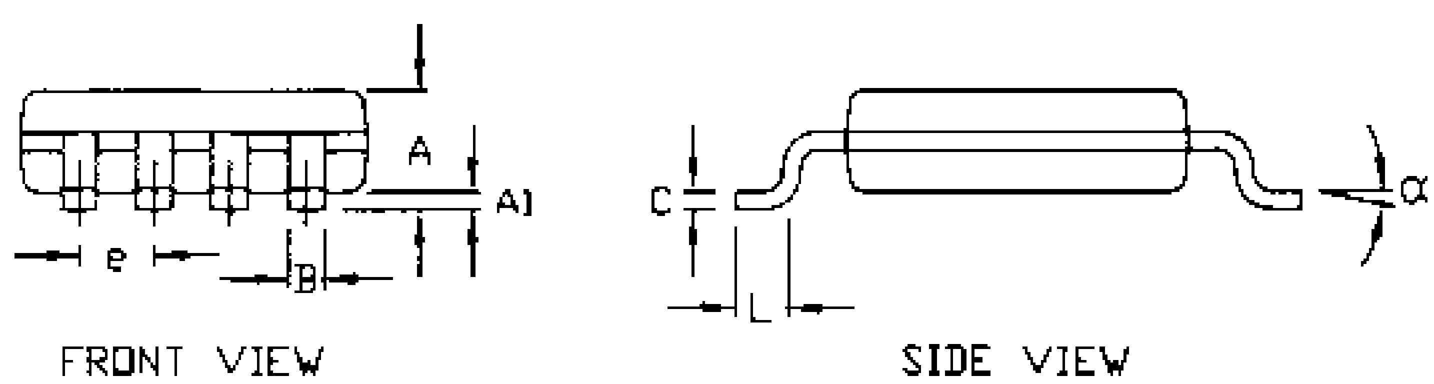


Package Information



					JEDEC			
	INCHES		MILLIMETERS		INCHES		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 (Note 5)



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 (EP) VERSIONS ONLY. SEE INDIVIDUAL PRODUCT DATASHEET TO DETERMINE IF A PRODUCT USES EXPOSED PAD PACKAGE.
6. EXPOSED PAD FLUSH WITH BOTTOM OF PACKAGE WITHIN .002".

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

POLITECNICO DI TORINO

ESAME DI STATO PER L'ABILITAZIONE ALL'ESERCIZIO DELLLA PROFESSIONE DI INGEGNERE

SEZIONE A

I SESSIONE 2002

PARTE B DEL TEMA
COMUNE A TUTTI I SETTORI
(CIVILE ED AMBIENTALE, INDUSTRIALE, DELL'INFORMAZIONE)

Il candidato dovrà dare risposta, in modo schematico, relativamente al tema prescelto compatibilmente al tema stesso, su almeno due delle seguenti domande:

1. principi generali di stima del valore;
2. normative di riferimento;
3. le figure e le responsabilità di chi progetta, esegue e controlla;
4. sostenibilità degli interventi;
5. sicurezza;
6. qualità;
7. conoscenza dei risvolti tariffari.