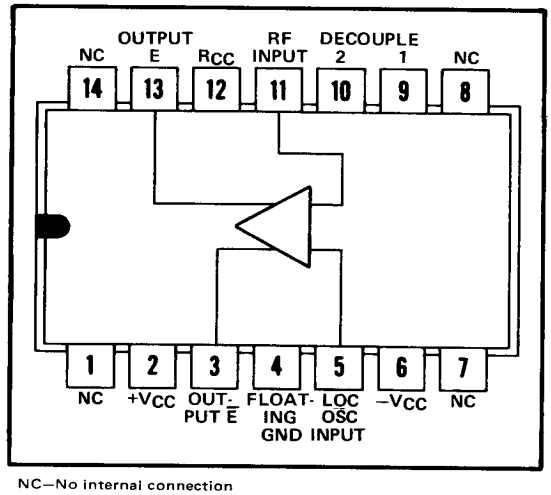
TYPES TL442M, TL442C BALANCED MIXERS

BULLETIN NO. DL-S 11430, OCTOBER 1979

FORMERLY SN56514, SN76514

- Flat Response to 100 MHz
- Local Oscillator IF Isolation . . . 30 dB Typ
- Local Oscillator RF Isolation . . . 60 dB Typ
- RF-IF Isolation . . . 30 dB Typ
- Conversion Gain . . . 14 dB Typ
- Use with 12-V or ±6-V Power Supplies

J OR N DUAL-IN-LINE PACKAGE
(TOP VIEW)



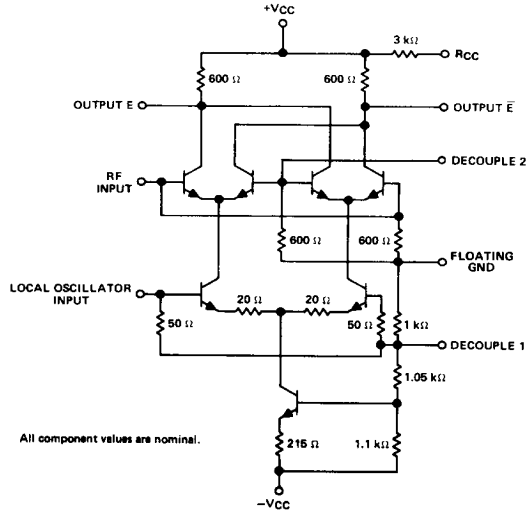
NC—No internal connection

description

The TL442M and TL442C are doubly balanced mixers that utilize two cross-coupled, differential transistor pairs driven by a third balanced pair. The circuit features a flat response over a wide band of frequencies. Operation from single or split power supplies is possible. Refer to typical application data.

The TL442M is characterized for operation over the full military temperature range of –55°C to 125°C; the TL442C is characterized for operation from 0°C to 70°C.

schematic



6

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)	18 V
Input voltage (see Notes 1 and 2)	7 V
Continuous output current (see Note 3)	10 mA
Continuous total power dissipation at (or below) 25°C free-air temperature (see Note 4)	500 mW
Operating free-air temperature range: TL442M Circuits	−55°C to 125°C
TL442C Circuits	0°C to 70°C
Storage temperature range	−65°C to 150°C

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}		12		V
Local oscillator input voltage (see Note 5)		250	300	mV rms
RF input voltage (see Note 5)		10	30	mV rms
Operating free-air temperature range: TL442M Circuits	−55		125	°C
TL442C Circuits	0		70	°C

electrical characteristics at 25°C free-air temperature, V_{CC} = 12 V

PARAMETER		TEST FIGURE	TEST CONDITIONS	TL442M			TL442C			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_O	Quiescent output voltage	1		9.6	10.5	11.3	9.6	10.5	11.3	V
I_{CC}	Supply current	1		5.5	7.4	10.9	5.5	7.4	10.9	mA
G_C	Conversion gain (single-ended output)	2	f_{RF} and f_{LO} = 100 kHz thru 40 MHz	11	14	17	11	14	17	dB
LOIFI	Local oscillator to IF isolation	3	f_{LO} = 100 kHz thru 40 MHz	15	29†			29†		dB
LORFI	Local oscillator to RF isolation	3	f_{LO} = 100 kHz thru 40 MHz	40	52†			52†		dB
RFIFI	RF to IF isolation	4	f_{RF} = 100 kHz thru 40 MHz	15	28†			28†		dB

†The typical values are at 40 MHz.

NOTES: 1. All d-c voltage values are with respect to $-V_{CC}$ terminal.
2. This rating applies to the local-oscillator input, RF input, and Decouple 2.
3. This value applies for both outputs simultaneously.
4. For operation above 25°C free-air temperature, refer to Dissipation Derating Table. In the J package, TL442M chips are alloy-mounted; TL442C chips are glass-mounted.
5. All signal voltages are with respect to the floating-ground terminal. Alternatively, the RF input may be applied differentially between the RF input terminal and Decouple 2.

DISSIPATION DERATING TABLE

PACKAGE	POWER RATING	DERATING FACTOR	ABOVE T_A
J(Alloy-Mounted Chip)	500 mW	11.0 mW/°C	105°C
J(Glass-Mounted Chip)	500 mW	8.2 mW/°C	89°C
N	500 mW	9.2 mW/°C	96°C

Also see Dissipation Derating Curves, Section 2.

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

PARAMETER MEASUREMENT INFORMATION

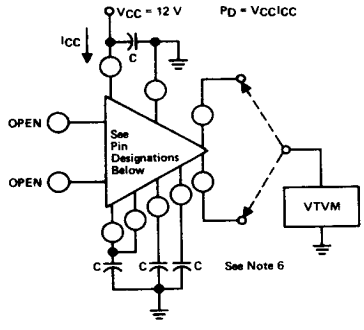


FIGURE 1–V_O, I_{CC}, and P_D

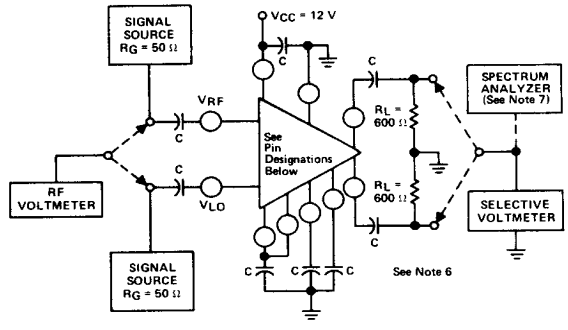


FIGURE 2–G_C

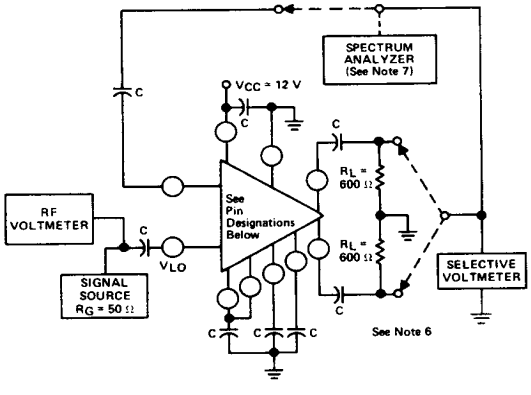


FIGURE 3–LOIFI and LORFI

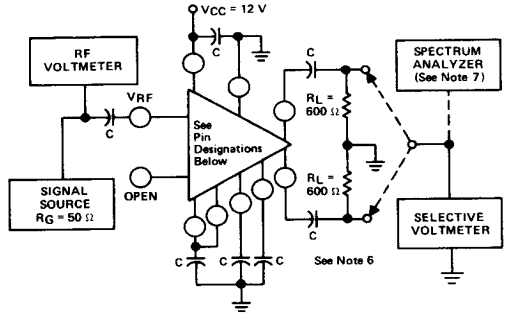
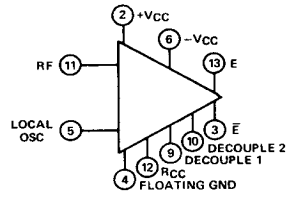


FIGURE 4–RFIFI

Pin Designations: For all test circuits appearing in this data sheet, terminal functions are defined by their relative positions as shown in the drawings in this block.



NOTES: 6. Capacitor C comprises the following capacitors in parallel: 1 μF, 0.1 μF, and 0.0015 μF.
7. The spectrum analyzer is used for frequencies above the normal range of the selective voltmeter.

TYPICAL CHARACTERISTICS

QUIESCENT OUTPUT VOLTAGE
vs
FREE-AIR TEMPERATURE

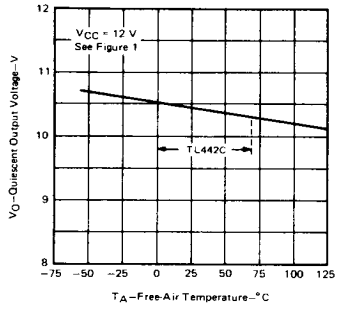


FIGURE 5

TOTAL POWER DISSIPATION
vs
FREE-AIR TEMPERATURE

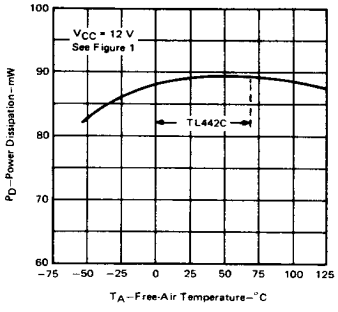


FIGURE 6

CONVERSION GAIN
vs
SUPPLY VOLTAGES

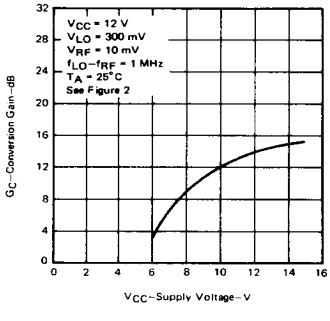


FIGURE 7

CONVERSION GAIN
vs
LOCAL OSCILLATOR VOLTAGE

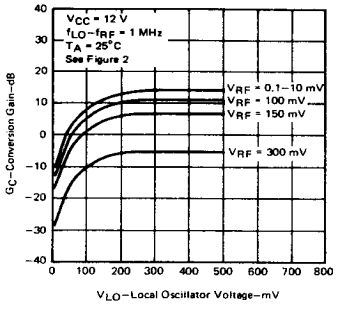


FIGURE 8

CONVERSION GAIN
vs
FREQUENCY

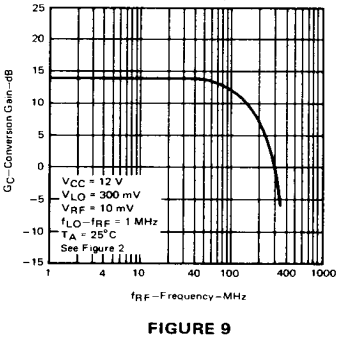


FIGURE 9

CONVERSION GAIN
vs
FREE-AIR TEMPERATURE

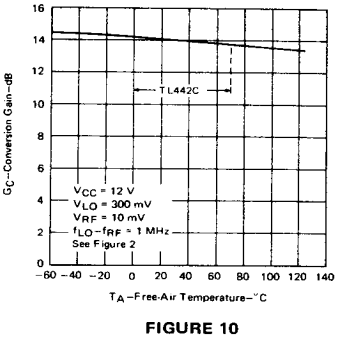


FIGURE 10

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

TYPICAL CHARACTERISTICS

LOCAL OSCILLATOR TO IF ISOLATION
vs
FREQUENCY

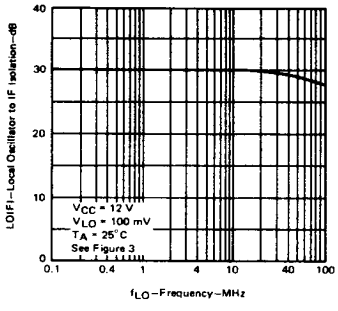


FIGURE 11

LOCAL OSCILLATOR TO IF ISOLATION
vs
FREE-AIR TEMPERATURE

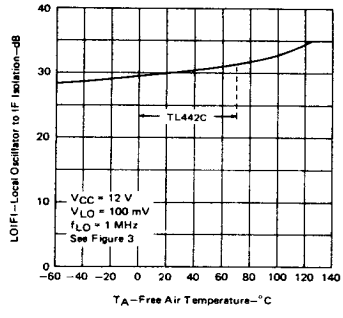


FIGURE 12

LOCAL OSCILLATOR TO RF ISOLATION
vs
FREQUENCY

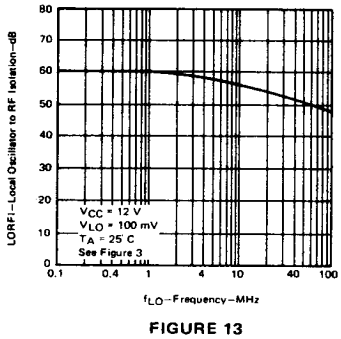


FIGURE 13

LOCAL OSCILLATOR TO RF ISOLATION
vs
FREE-AIR TEMPERATURE

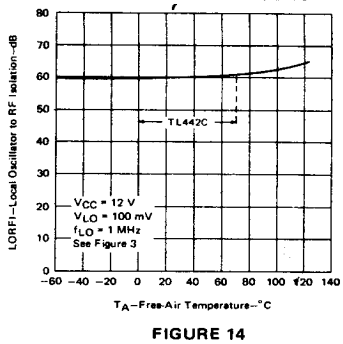


FIGURE 14

RF TO IF ISOLATION
vs
FREQUENCY

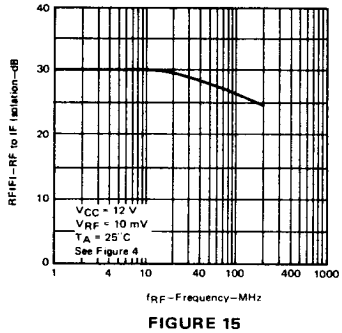


FIGURE 15

RF TO IF ISOLATION
vs
FREE-AIR TEMPERATURE

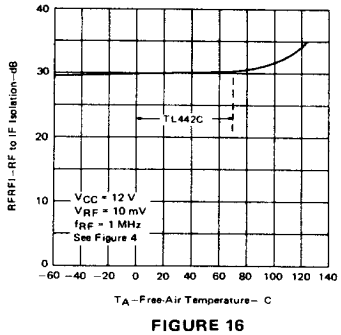


FIGURE 16

6

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

TYPICAL CHARACTERISTICS

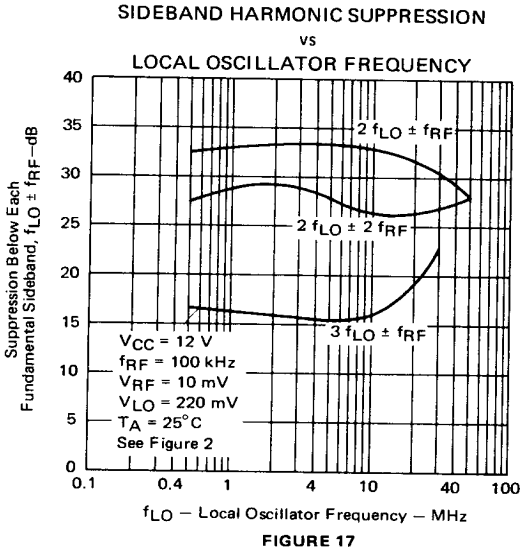


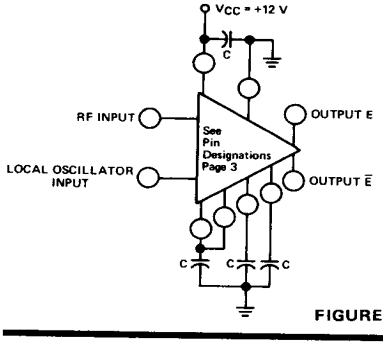
FIGURE 17

TYPICAL APPLICATION DATA

The TL442M and TL442C balanced mixers are designed to have considerable circuit flexibility, which results in a wide range of applications. Typical applications include use as balanced modulators for sideband-suppressed-carrier generation, product detectors for demodulation, frequency converters, and frequency or phase modulators. In addition, the TL442M and TL442C may be used in control systems and analog computers as low-level multipliers or squaring circuits.

For operation from a single 12-V supply, connect the positive terminal of the supply to $+V_{CC}$, the negative terminal to $-V_{CC}$, and the floating-ground terminal to R_{CC}. For operation from two 6-V supplies, leave R_{CC} open and connect the positive terminal of one supply to $+V_{CC}$, the negative terminal of the other supply to $-V_{CC}$, and the remaining terminals of the two supplies to the floating-ground terminal. Electrical characteristics will be unchanged with the use of either power supply option. External bypass capacitors, as shown in Figure 18, should be used for optimum performance.

The mixer's electrical performance and the inherent IC advantages of size, reliability, and component matching make it very desirable for use in communication and control systems.



NOTE: Capacitor C comprises the following capacitors in parallel: 1 μF, 0.1 μF, and 0.0015 μF.

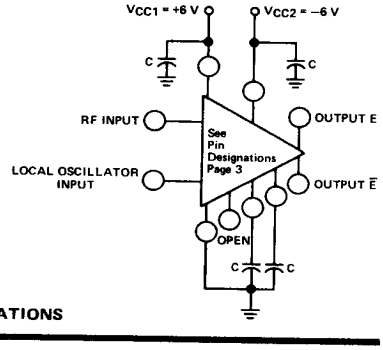


FIGURE 18—EXTERNAL CAPACITOR CONFIGURATIONS

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 225012 • DALLAS, TEXAS 75265