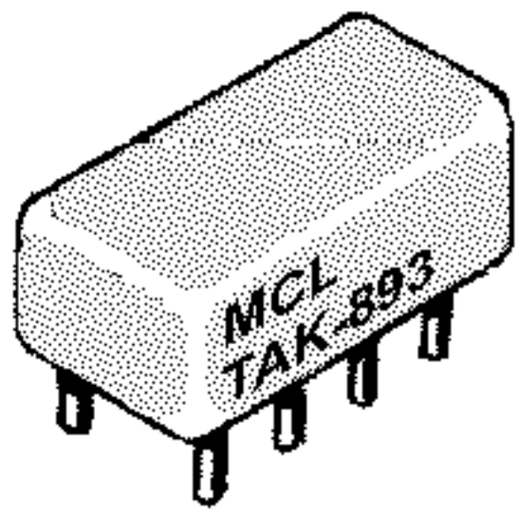
G-QRP DATA SHEET

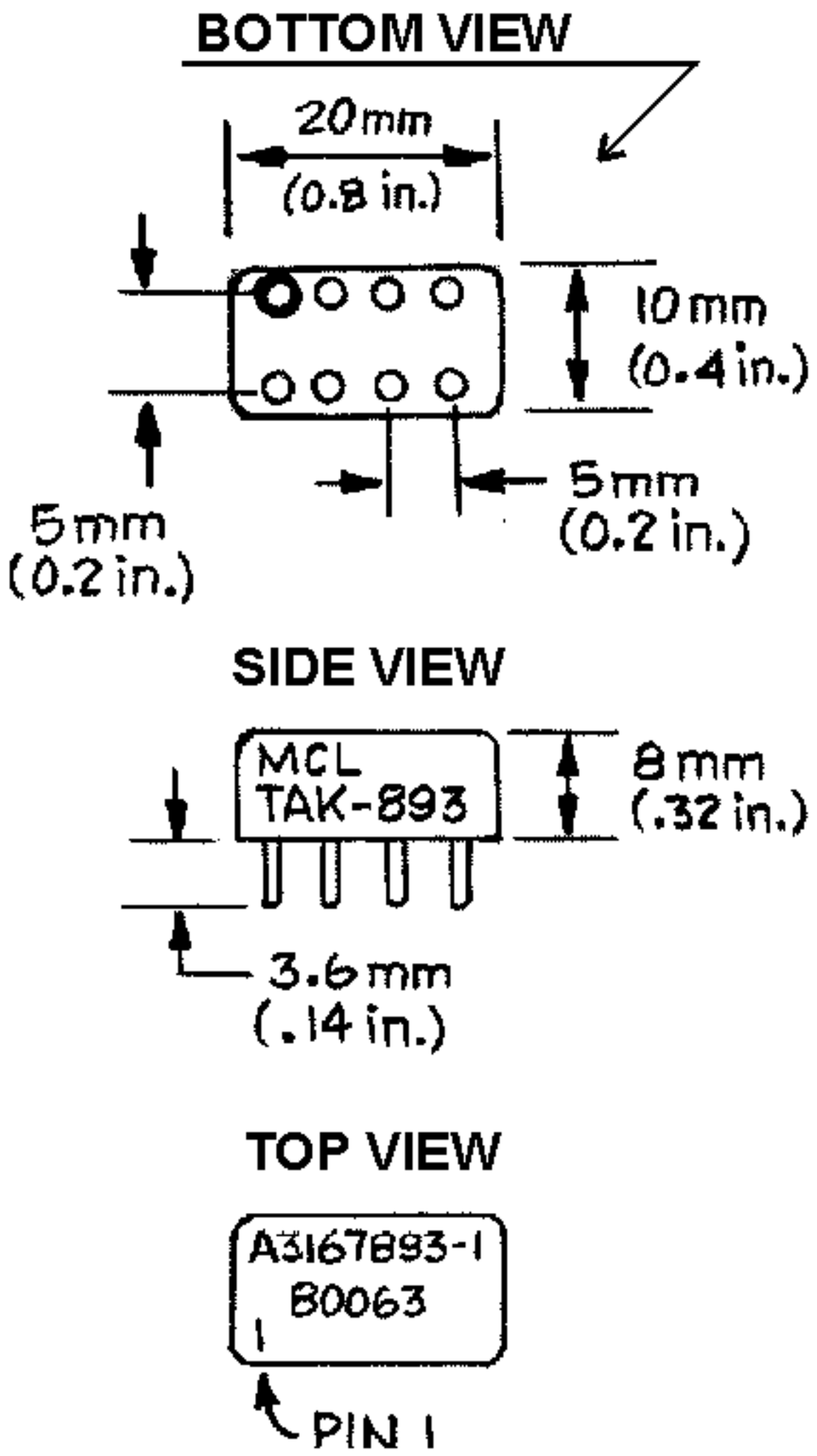
TAK-893



50-ohm MIXER

The **TAK-893** is a custom Level 17 passive **double balanced mixer** (DBM) manufactured by Mini-Circuits Labs (www.minicircuits.com) and similar to their TAK-3 mixer. It is an excellent receive or transmit mixer with high dynamic range and IP3 -- requiring +17dBm of LO drive. Level 7 (+7dBm LO drive) can be used if higher conversion loss is acceptable. The TAK-893 can be used where any 50-ohm passive mixer is specified with proper LO drive.

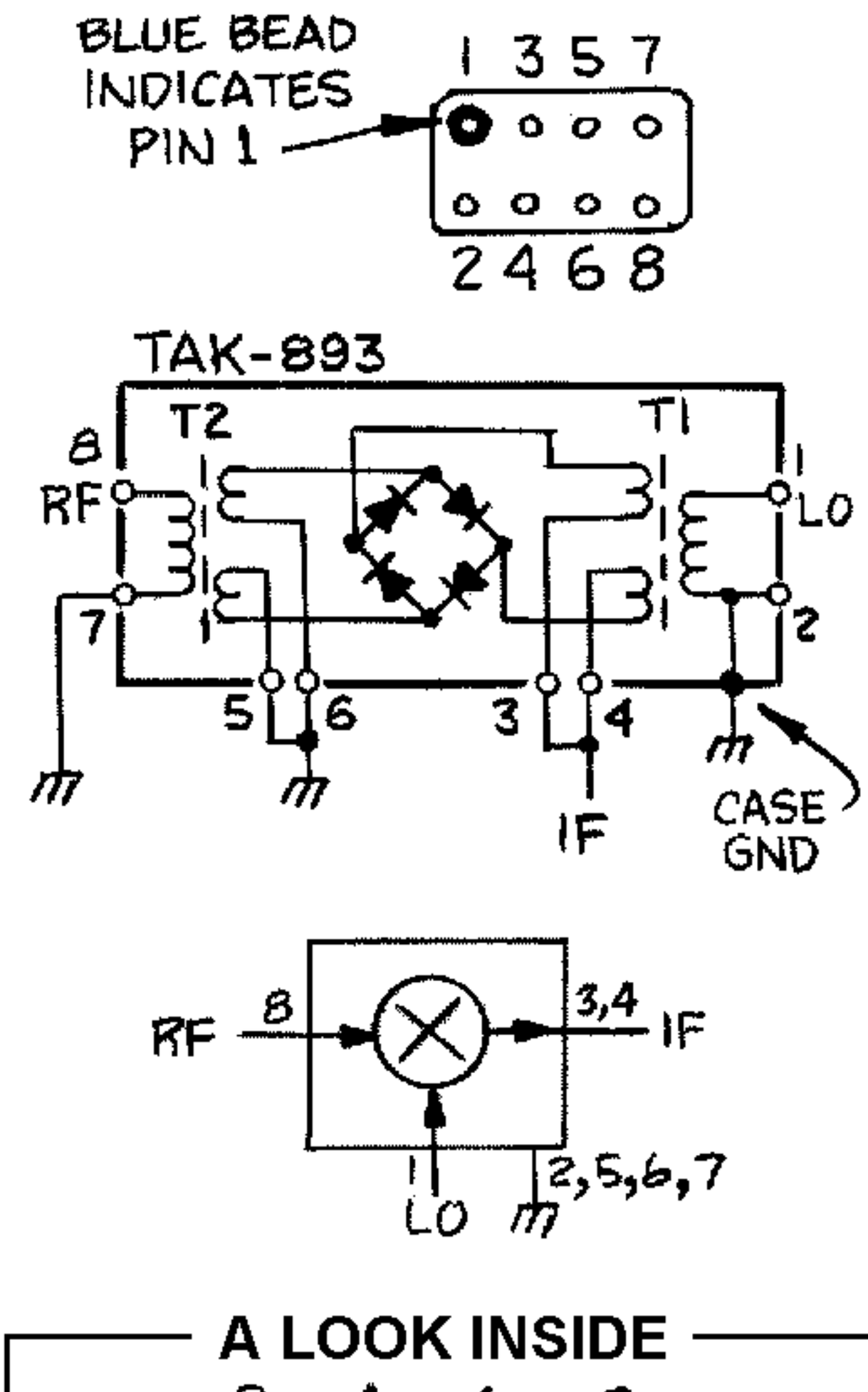
• MECHANICAL •



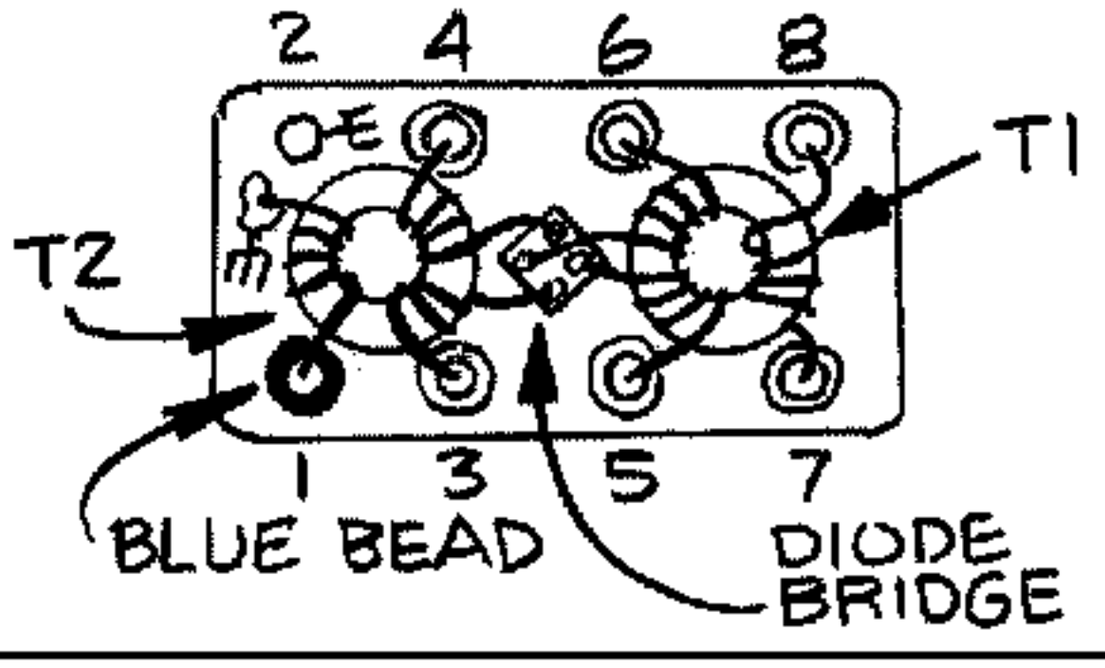
NOTES:

1. Hermetically sealed in a nickel plated steel can.
2. Pin 2 is the case ground
3. Ground pins 2,5,6 & 7 externally.
4. Pins 3 & 4 must be connected together externally (IF output).

• ELECTRICAL •



A LOOK INSIDE



G-QRP DATA SHEET

TAK-893

SPECIFICATIONS:

From Mini-Circuits "Designers Handbook" and Catalog for the TAK-3 (similar to TAK-893)

FREQUENCY			LO DRIVE	RF INPUT	3rd Order Intercept
RF Input	LO Input	IF Output			
.05-300 MHz	.05-300 MHz	DC-300 MHz	+17dBm	+14dBm	+20dBm

Description of Specifications:

Frequency - the range of frequencies on each port for which the mixer is guaranteed to operate.

LO Drive - the local oscillator drive level for which the other specifications are based.

RF Input - maximum input power for which no distortion will occur. This is also the *1dB compression* point of the mixer.

3rd Order Intercept (IP3) - is a theoretical level for which an adjacent signal will cause distortion. The IP3 is about 7 to 10dB above the 1dB compression point. The higher the IP3, the less prone the mixer is to interference from strong, nearby stations. The IP3 of the TAK-893 is very high by mixer standards.

Conversion Loss - the loss in the mixer when converting the RF to the IF frequency. Passive mixers always convert with a loss.

LO-RF Isolation - a measure of how much of the LO power appears on the RF port. The higher the isolation, the less *LO leakage*.

LO-IF Isolation - a measure of how much of the LO power appears on the IF port.

FREQ (MHz)	Conversion Loss	Isolation LO-RF	Isolation LO-IF
2	4.6 dB	62 dB	56 dB
10	4.8 dB	64 dB	56 dB
20	5.0 dB	57 dB	53 dB
50	4.7 dB	47 dB	46 dB
100	4.5 dB	37 dB	38 dB
200	5.0 dB	31 dB	32 dB
300	6.6 dB	37 dB	32 dB

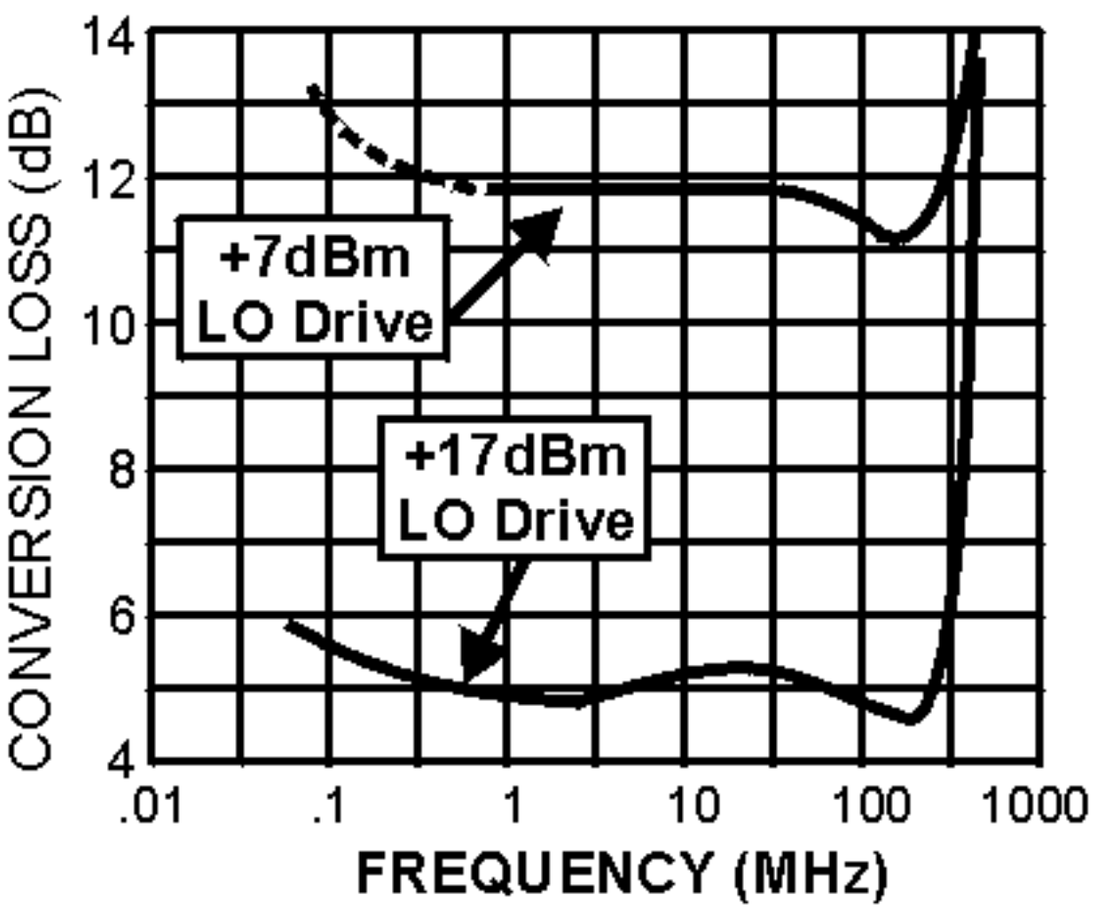


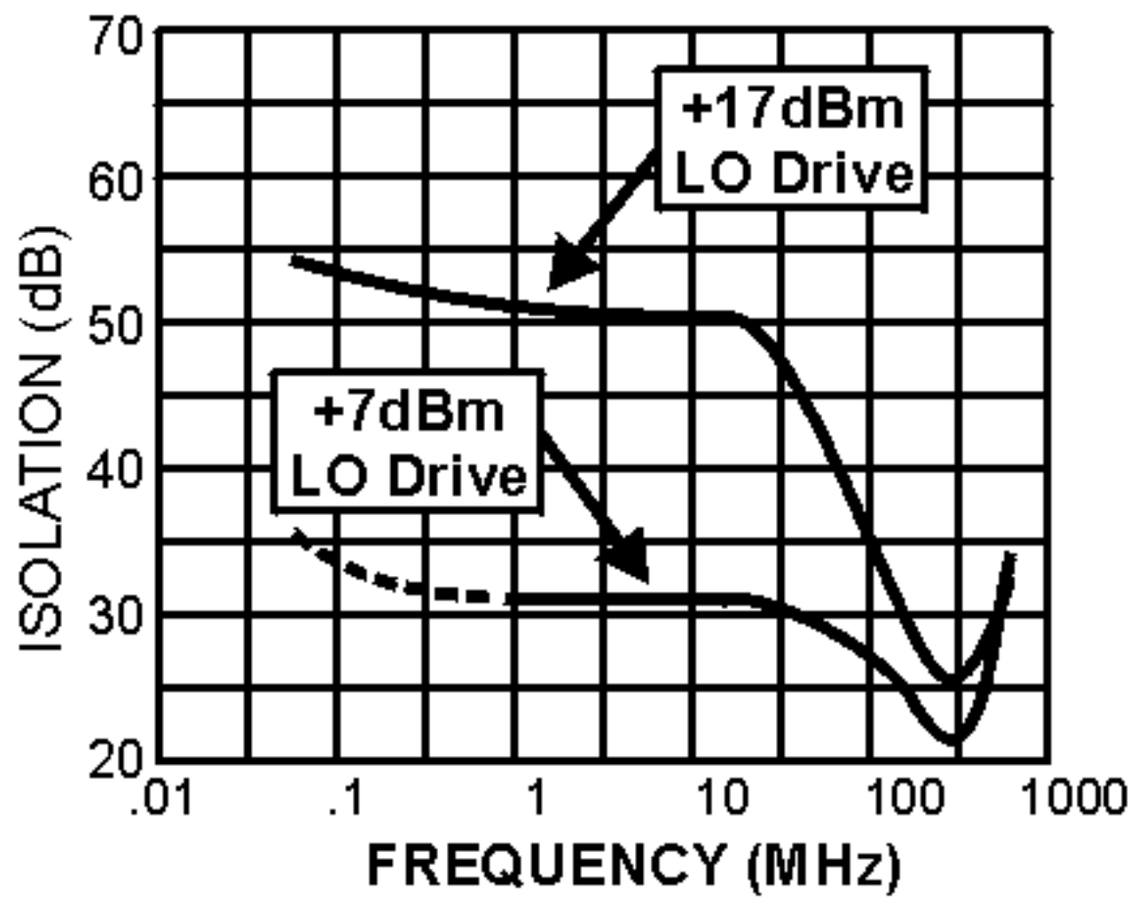
Chart demonstrates how the conversion loss changes with frequency and LO drive. The lowest conversion loss is in the 1-100 MHz portion with +17dBm, and higher losses with the lower (+7dBm) LO drive. +17dBm curve from MiniCircuits data book; +7dBm curve from NA5N lab tests (see Application Notes).

TAK-893 Specific Notes:

The TAK-893 is virtually identical to the TAK-3. The largest concern for the QRPer is selecting the proper LO drive level.

+7dBm (medium level) LO drive is the level used by level 7 passive mixers, such as the SBL, SRA and ADE series. Circuits using these mixers will be delivering about +7dBm to the LO port. The TAK-893 can be driven at +7dBm, but at the expense of about 10-12dB of additional conversion loss, requiring an amplifier stage before or after the TAK-893 to compensate for this higher loss.

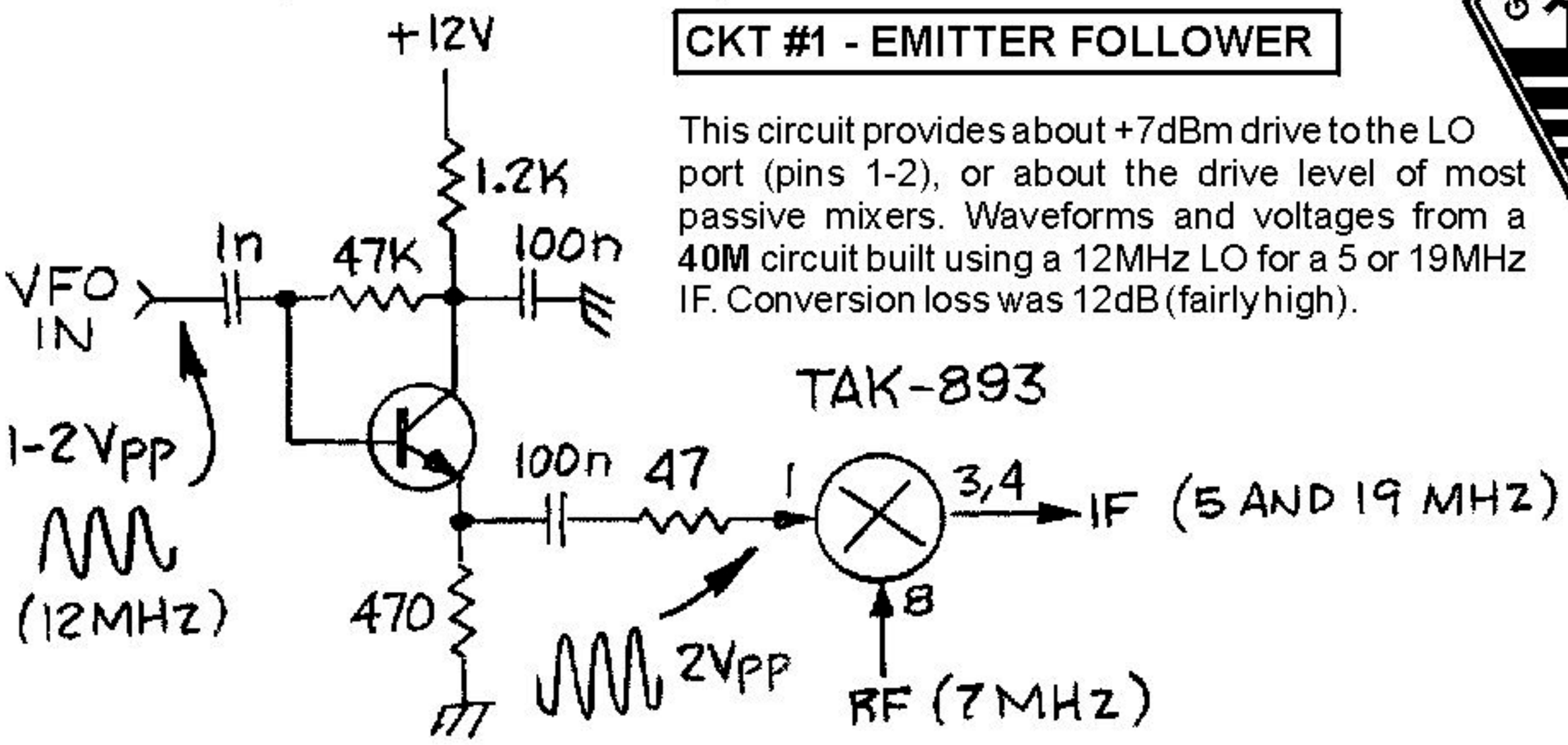
+17dBm (high level) drive is recommended for the TAK-893 to achieve the specifications listed above. The disadvantage is a more complex drive circuit and a higher current draw to produce +17dBm power. A high level drive circuit is shown in the application notes that uses a relatively simple circuit and requires only about 10-12mA of current draw for the optimal conversion loss of 5-6dB.



LO-IF isolation is also frequency and LO drive level dependent, with the best isolation at HF.

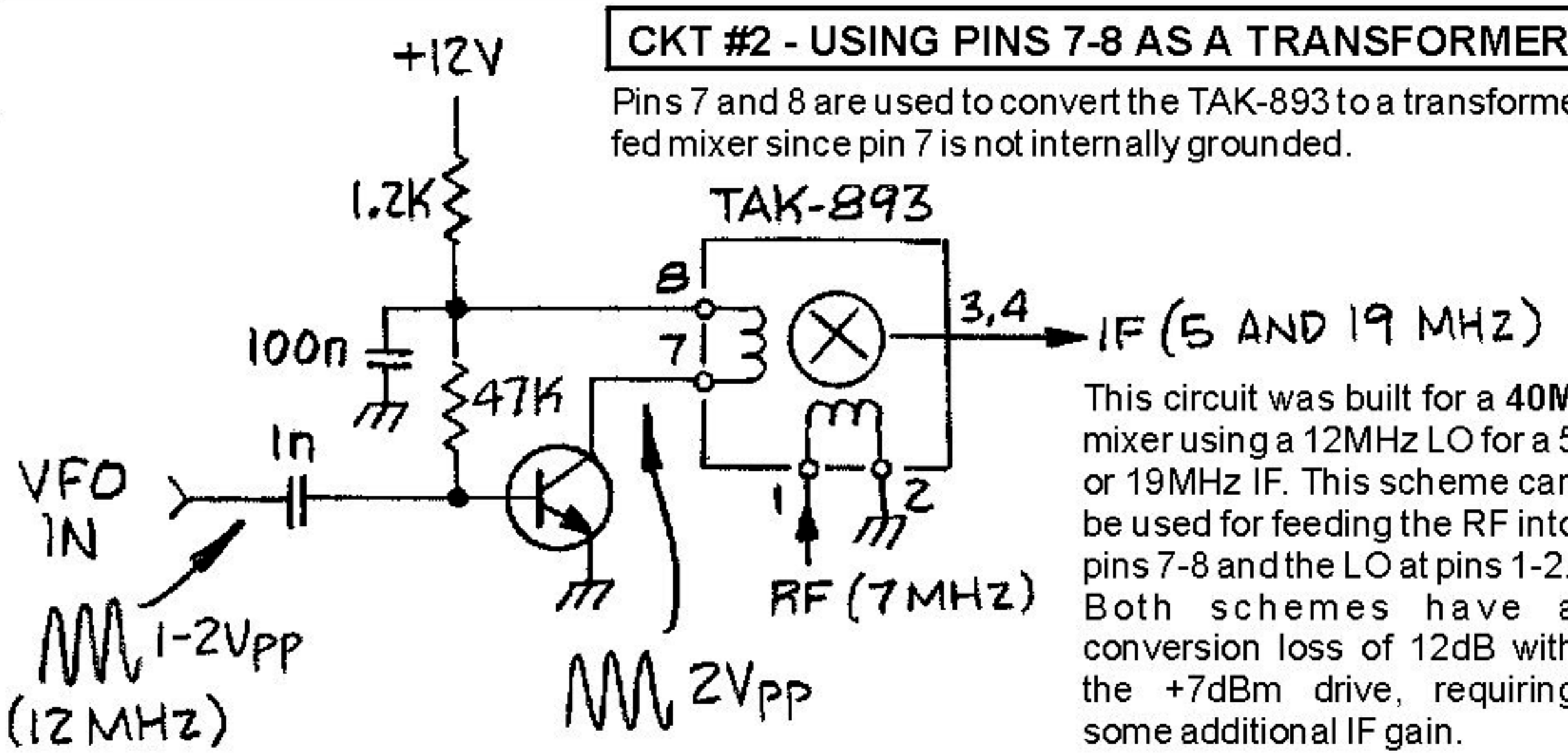
TAK-893 APPLICATION NOTES (1)

LEVEL 7 (MEDIUM LEVEL) LO DRIVER



CKT #1 - EMITTER FOLLOWER

This circuit provides about +7dBm drive to the LO port (pins 1-2), or about the drive level of most passive mixers. Waveforms and voltages from a **40M** circuit built using a 12MHz LO for a 5 or 19MHz IF. Conversion loss was 12dB (fairly high).

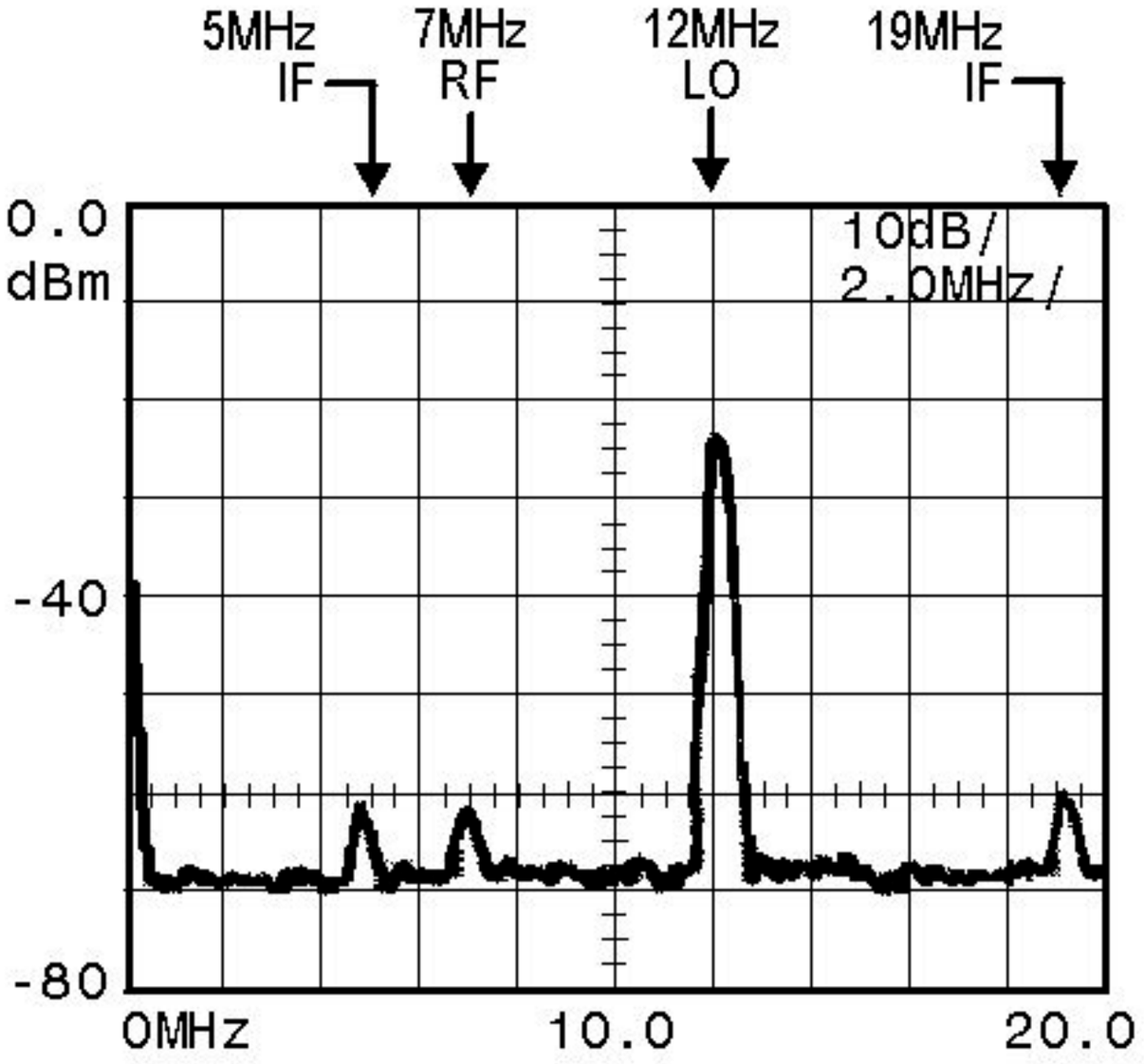


CKT #2 - USING PINS 7-8 AS A TRANSFORMER

Pins 7 and 8 are used to convert the TAK-893 to a transformer fed mixer since pin 7 is not internally grounded.

This circuit was built for a **40M** mixer using a 12MHz LO for a 5 or 19MHz IF. This scheme can be used for feeding the RF into pins 7-8 and the LO at pins 1-2. Both schemes have a conversion loss of 12dB with the +7dBm drive, requiring some additional IF gain.

LAB TESTS



RF input: 7.00MHz at -50dBm
LO input: 12.00MHz at +7dBm
IF output: **5**.00MHz at -62dBm
and 19.00MHz at -62dBm

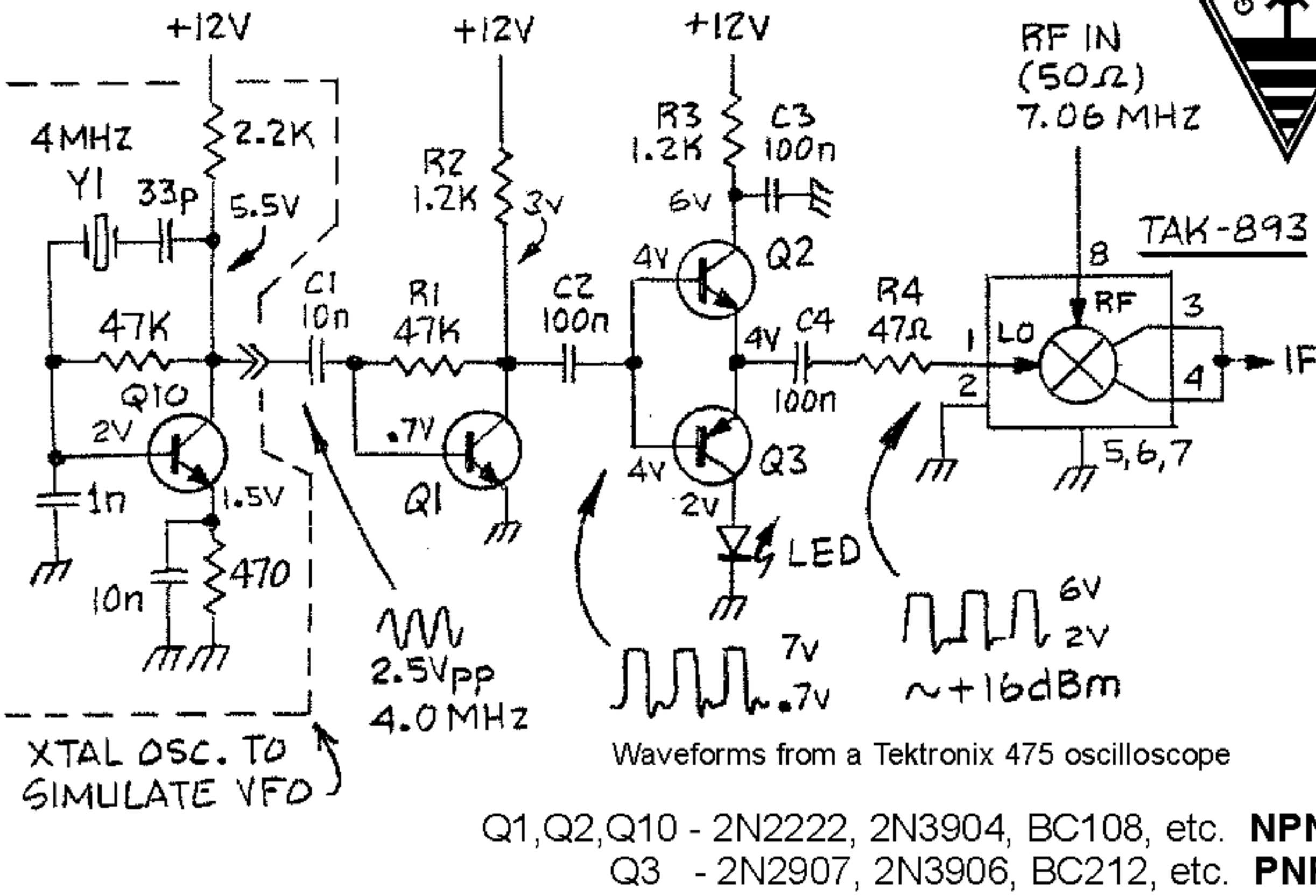
RESULTS:

Conversion loss: 12dB
LO-IF Isolation: -31dB
1dB compression: +14dBm
IP3: approx. +20dBm

Better port-to-port isolation and less conversion loss is obtained with a higher LO drive. See next Application Note.

TAK-893 APPLICATION NOTES (2)

LEVEL 17 (HIGH LEVEL) LO DRIVER



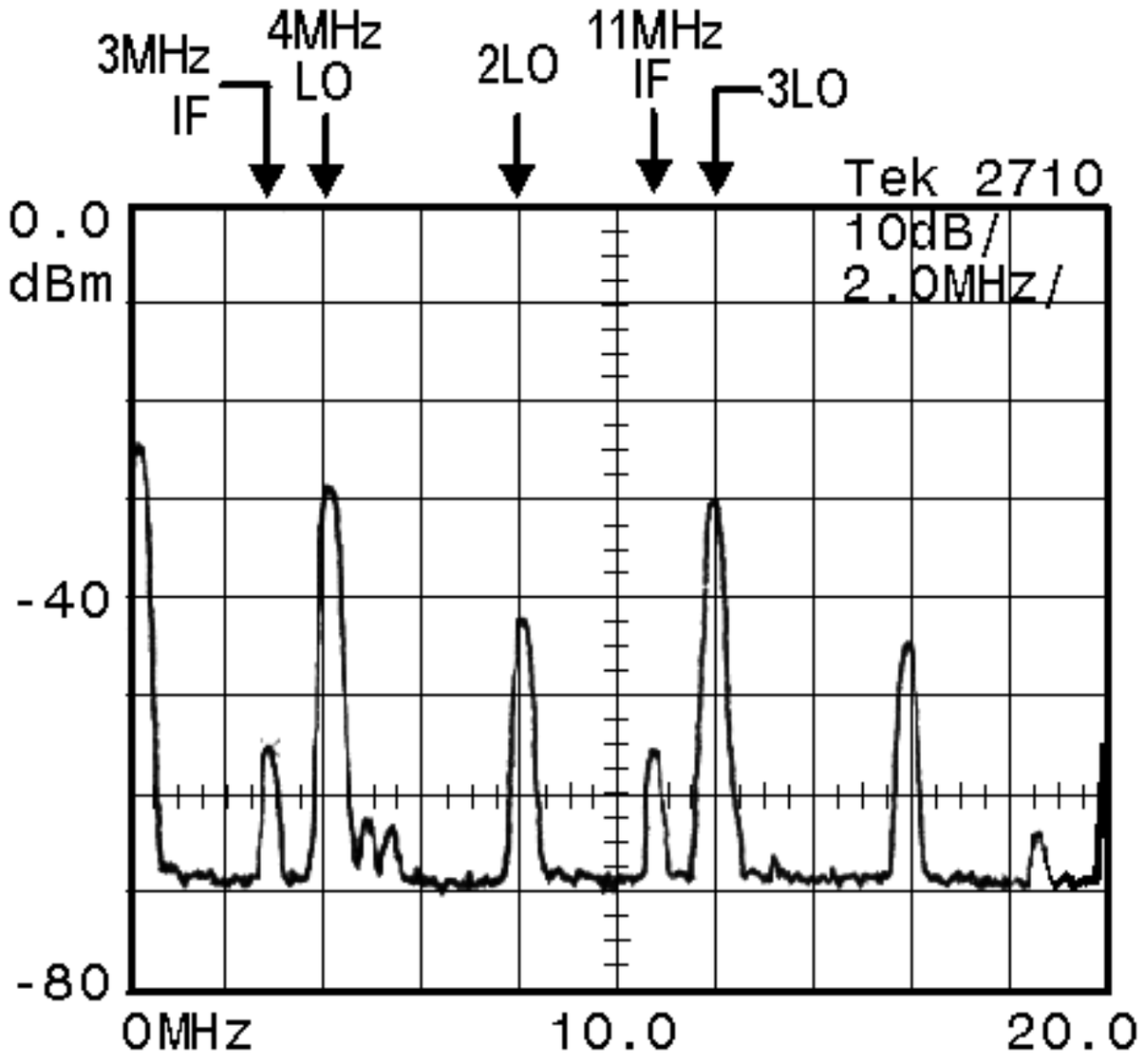
Waveforms from a Tektronix 475 oscilloscope

Q1,Q2,Q10 - 2N2222, 2N3904, BC108, etc. **NPN**
Q3 - 2N2907, 2N3906, BC212, etc. **PNP**

LED limits current and visual indication of LO drive
Total current draw approx. 15mA, including Q10 crystal oscillator
Q1 8-10dB amplifier Q2-Q3 NPN-PNP "totem pole" emitter follower

LAB TESTS

Above driver designed by Paul Harden, NA5N for testing the TAK-893 DBM's. Circuit tested at 80M through 2M and at different LO frequencies from 2-22MHz. Results below shown for **40M** and fairly typical for the other HF bands.



RF input: 7.059MHz at -50dBm
LO input: 4.000MHz at +16dBm
IF output: 3.059MHz at -56dBm
and 11.059MHz at -55dBm
(11.059MHz is a common crystal)

RESULTS:

Conversion loss: 5-6dB
LO-IF Isolation: -46dB
1dB compression: +14dBm
IP3: approx. +20dBm or greater

Spectrum Analyzer: Tektronix 2710
O-scope waveforms: Tektronix 475
Signal generator: H-P 8657B