



3 V SUPER MINIMOLD L-BAND SI MMIC DOWNCONVERTER

UPC2756TB

FEATURES

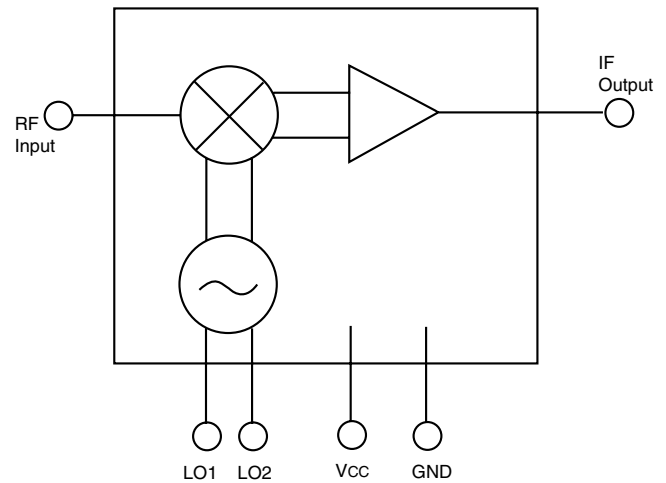
- **HIGH DENSITY SURFACE MOUNTING:**
6 Pin Super Minimold or SOT-363 package
- **WIDE BAND OPERATION:**
RF = 0.1 to 2.0 GHz
IF = 10 to 300 MHz
- **ON BOARD OSCILLATOR**
- **SUPPLY VOLTAGE:**
Vcc = 2.7 TO 3.3 V

DESCRIPTION

NEC's UPC2756TB is a silicon MMIC integrated circuit manufactured using the NESAT III process. The device consists of a double balance mixer, an IF amplifier and a built-in LO. This device is suitable as a L-BAND downconverter for the receiver stage of wireless systems. The UPC2756TB is pin compatible and has comparable performance as the larger UPC2756T, so it is suitable for use as a replacement to help reduce system size. The IC housed in a 6 pin super minimold or SOT-363 package.

NEC's stringent quality assurance and test procedures ensure the highest reliability and performance.

INTERNAL BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS (T_A = 25°C, V_{cc} = 3 V, Z_L = Z_s = 50 Ω)

| PART NUMBER PACKAGE OUTLINE | | UPC2756TB S06 | | | |
|--------------------------------|--|------------------|------------|------------|----------|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX |
| I _{CC} | Circuit Current (no signal) | mA | 3.5 | 6.0 | 8.0 |
| f _{RF} | RF Frequency Response (3 dB down from the gain at f _{RF} = 900 MHz, f _{IF} = 150 MHz) | GHz | 0.1 | | 2.0 |
| f _{IF} | IF Frequency Response (3 dB down from the gain at f _{RF} = 900 MHz, f _{IF} = 150 MHz) | MHz | 10 | 300 | |
| CG | Conversion Gain ¹ f _{RF} = 900 MHz, f _{IF} = 150 MHz f _{RF} = 1.6 GHz, f _{IF} = 20 MHz | dB dB | 11 11 | 14 14 | 17 17 |
| NF | Noise Figure f _{RF} = 900 MHz, f _{IF} = 150 MHz f _{RF} = 1.6 GHz, f _{IF} = 20 MHz | dB dB | | 10 13 | 13 16 |
| PSAT | Saturated Output Power ² f _{RF} = 900 MHz, f _{IF} = 150 MHz f _{RF} = 1.6 GHz, f _{IF} = 20 MHz | dBm dBm | -11 -15 | -8 -12 | |
| OIP ₃ | SSB Output 3rd Order Intercept Point f _{RF} = 0.8~2.0 GHz, f _{IF} = 100 MHz | dBm | | +4 | |
| ISO | LO Leakage, f _{LO} = 0.8~2.0 GHz at RF pin at IF pin | dBm dBm | | -35 -23 | |
| PN | Phase Noise ³ , f _{osc} = 1.9 GHz | dBc/Hz | | -68 | |
| R _{TH} (J-A) | Thermal Resistance (Junction to Ambient) Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB | °C/W | | | 325 |

Notes:

1. P_{RF} = -40 dBm.
2. P_{RF} = -10 dBm.
3. See Application Circuit.

ABSOLUTE MAXIMUM RATINGS¹ (T_A = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|------------------|--------------------------------------|-------|-------------|
| V _{CC} | Supply Voltage | V | 5.5 |
| P _T | Total Power Dissipation ² | mW | 200 |
| T _{OP} | Operating Temperature | °C | -40 to +85 |
| T _{STG} | Storage Temperature | °C | -55 to +150 |

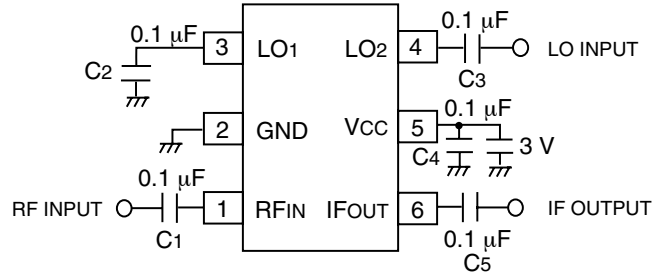
Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB (T_A = +85°C).

RECOMMENDED OPERATING CONDITIONS

| SYMBOLS | PARAMETERS | UNITS | MIN | TYP | MAX |
|-----------------|-----------------------|-------|-----|-----|-----|
| V _{CC} | Supply Voltage | V | 2.7 | 3.0 | 3.3 |
| T _{OP} | Operating Temperature | °C | -40 | +25 | +85 |

TEST CIRCUIT

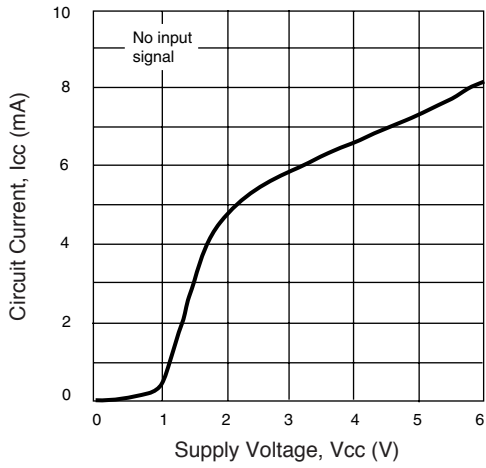


PIN FUNCTIONS

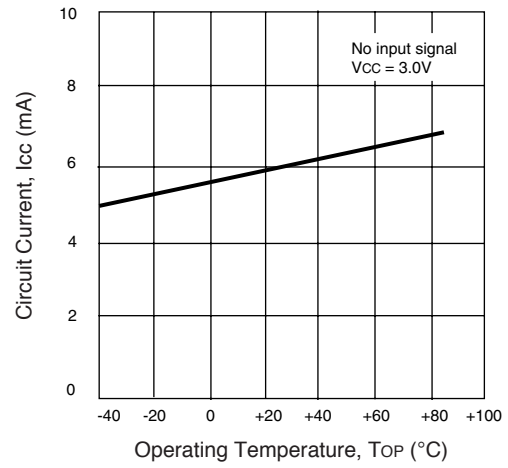
| Pin No. | Symbol | Applied Voltage (V) | Pin Voltage (V) | Description | Internal Equivalent Circuit |
|---------|--------|---------------------|-----------------|--|-----------------------------|
| 1 | RFIN | – | 1.2 | Signal input pin to double balanced mixer. This pin must be coupled to the signal source with a blocking capacitor. | |
| 2 | GND | 0 | – | Ground pin. This pin should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. | |
| 3 | LO1 | – | 1.2 | These pins are both the base-collectors of a differential amplifier configured to oscillate when equipped with an external tank resonator circuit. Each pin must be coupled to the tank circuit with a blocking capacitor. In the case of an external LO source, bypass the unused pin with a capacitor to ground. | |
| 4 | LO2 | – | 1.2 | | |
| 5 | VCC | 2.7 to 3.3 | – | Power supply pin. This pin should be externally equipped with a bypass capacitor to minimize ground impedance. | |
| 6 | IFOUT | – | 1.7 | Output of single-ended push-pull IF buffer amplifier. This is an emitter-follower output with low impedance. This pin must be coupled to the next stage with a blocking capacitor. | |

TYPICAL PERFORMANCE CURVES (TA = 25°C)

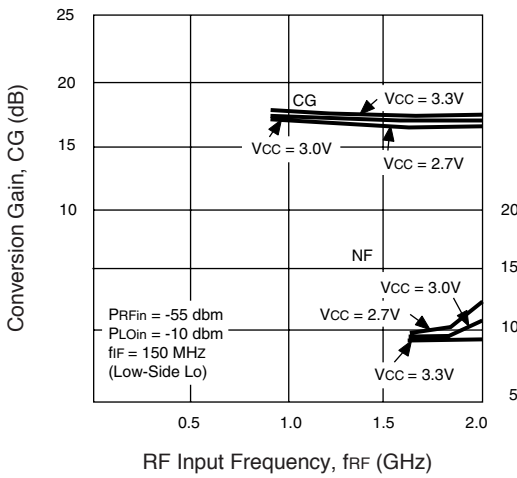
CIRCUIT CURRENT vs. VOLTAGE



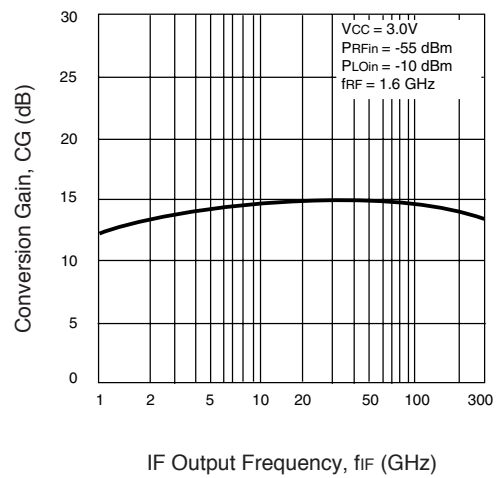
CIRCUIT CURRENT vs. TEMPERATURE



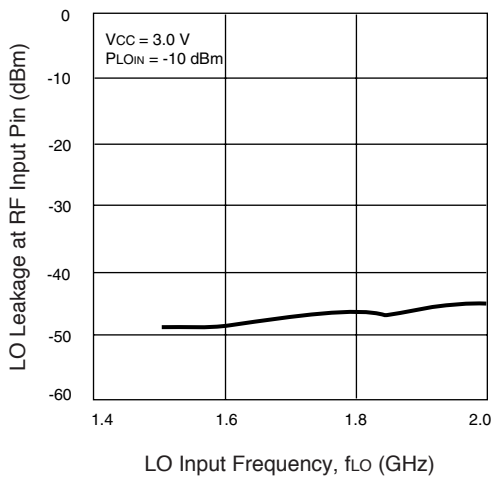
CONVERSION GAIN AND NOISE FIGURE vs. RF INPUT FREQUENCY



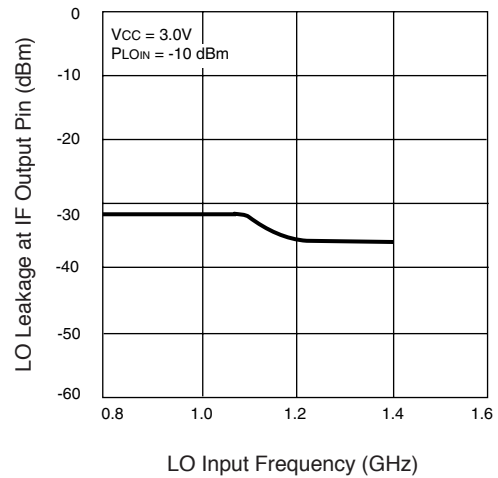
CONVERSION GAIN vs. IF OUTPUT FREQUENCY



LO LEAKAGE AT RF PIN vs. LO FREQUENCY

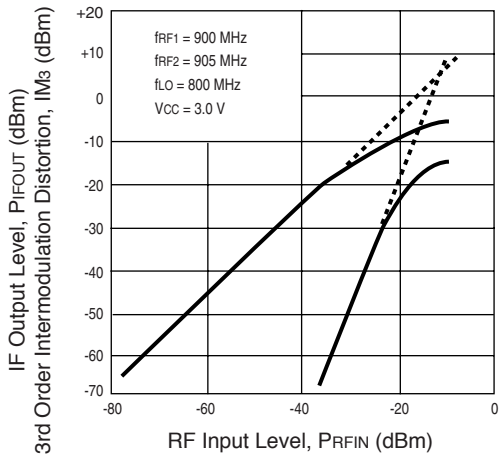


LO LEAKAGE AT IF PIN vs. LO FREQUENCY

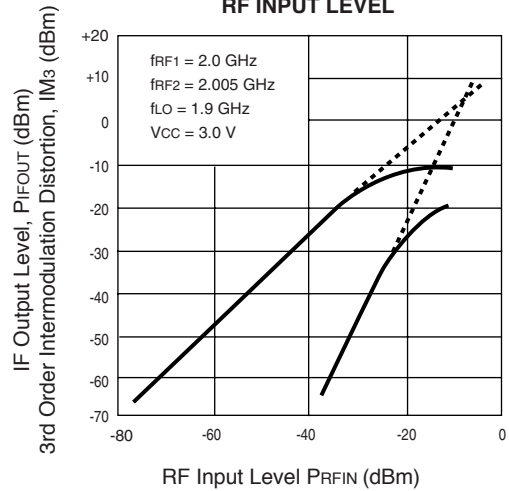


TYPICAL PERFORMANCE CURVES (TA = 25°C)

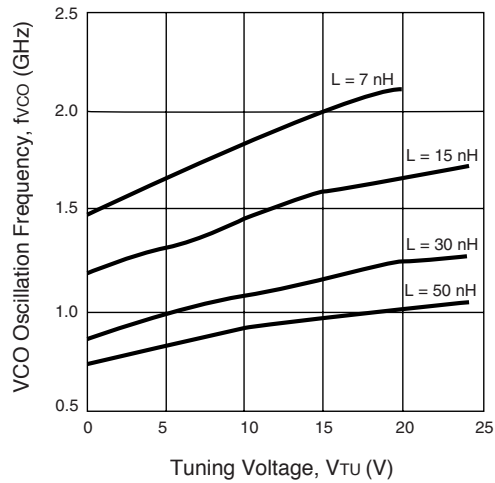
IF OUTPUT LEVEL AND IM3 vs. RF INPUT LEVEL



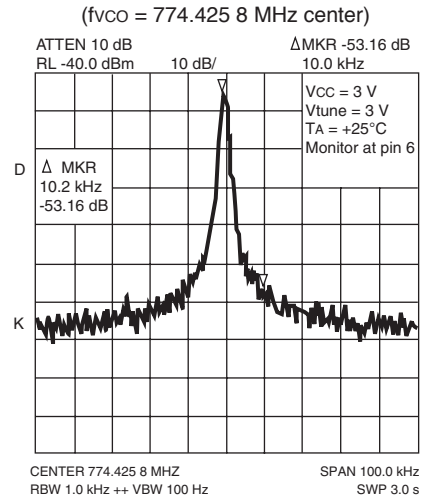
IF OUTPUT LEVEL AND IM3 vs. RF INPUT LEVEL



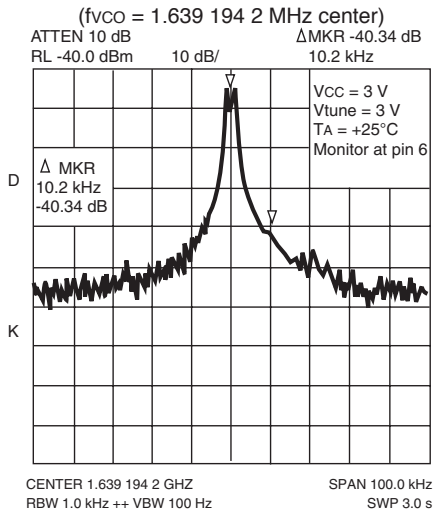
VCO OSCILLATION FREQUENCY vs. TUNING VOLTAGE



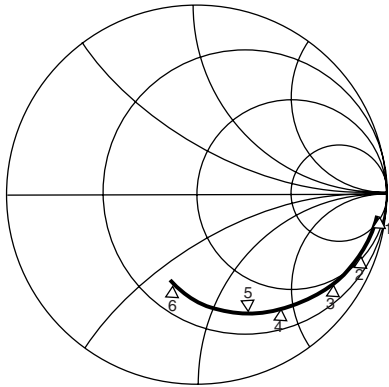
VCO PHASE NOISE



VCO PHASE NOISE

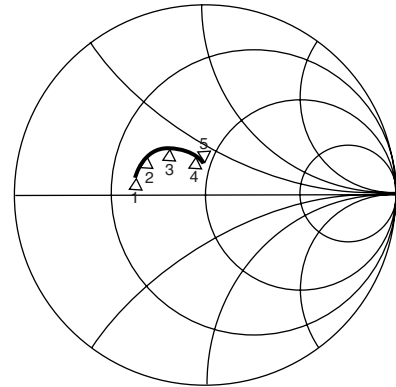


TYPICAL SCATTERING PARAMETERS



RF Port
Vcc = 3.0 V
Start 0.10 GHz
Stop 3.10 GHz

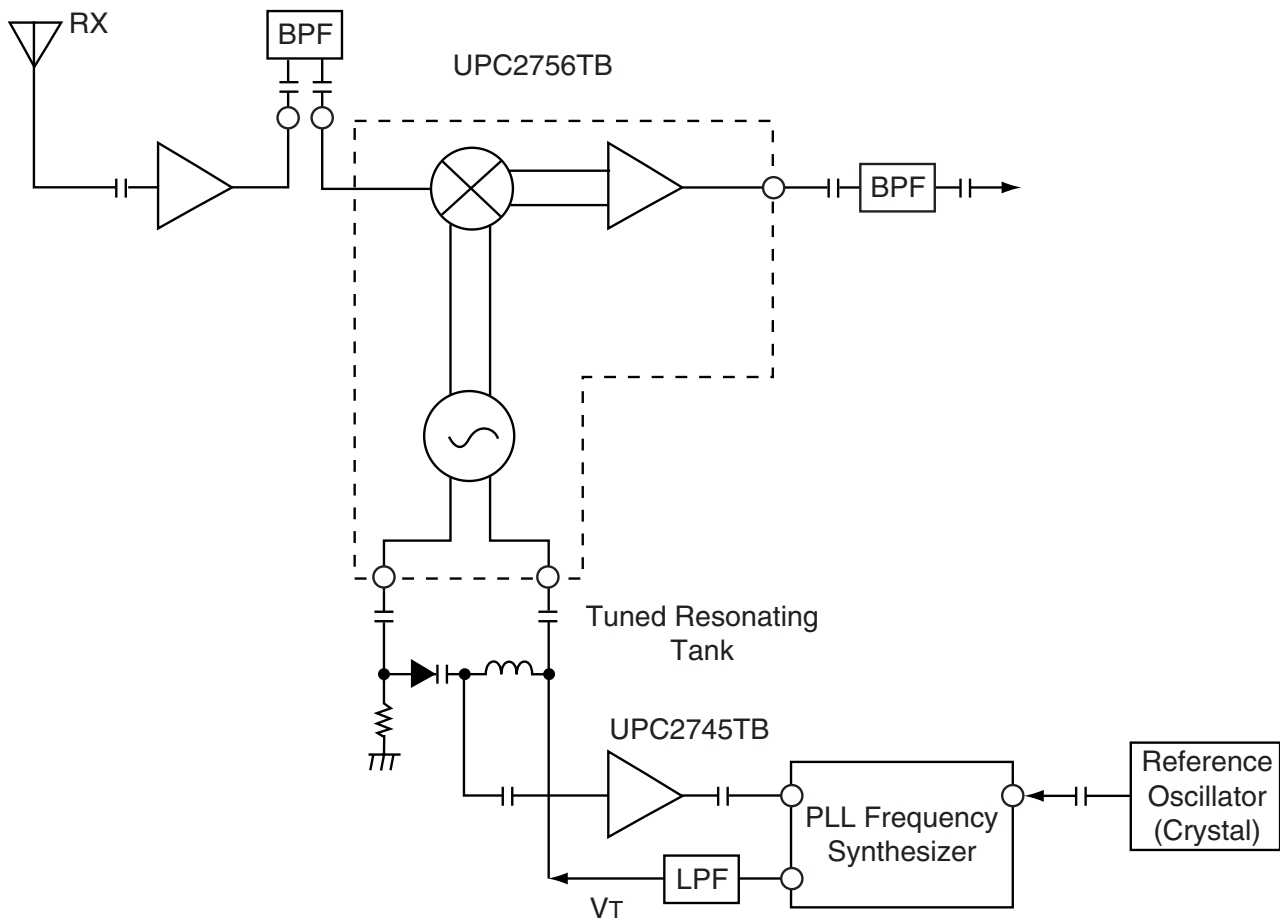
| | | | |
|----|----------|---------|------------|
| 1: | 100 MHz | 519.8 Ω | -j 1.1 Ω |
| 2: | 500 MHz | 59.3 Ω | -j 281.0 Ω |
| 3: | 900 MHz | 38.3 Ω | -j 157.0 Ω |
| 4: | 1500 MHz | 31.5 Ω | -j 90.1 Ω |
| 5: | 1900 MHz | 28.5 Ω | -j 67.9 Ω |
| 6: | 3000 MHz | 25.7 Ω | -j 31.7 Ω |



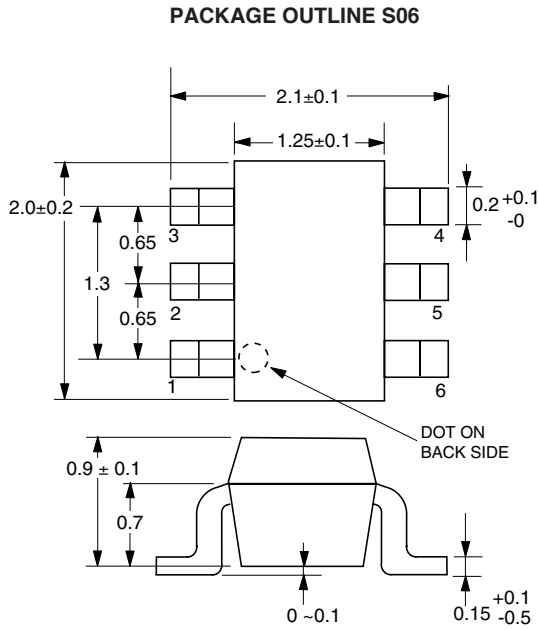
RF Port
Vcc = 3.0 V
Start 0.05 GHz
Stop 3.00 GHz

| | | | |
|----|---------|--------|-----------|
| 1: | 50 MHz | 22.5 Ω | +j 6.1 Ω |
| 2: | 80 MHz | 24.2 Ω | +j 11.3 Ω |
| 3: | 130 MHz | 30.2 Ω | +j 16.6 Ω |
| 4: | 240 MHz | 42.6 Ω | +j 17.5 Ω |
| 5: | 300 MHz | 46.6 Ω | +j 15.6 Ω |

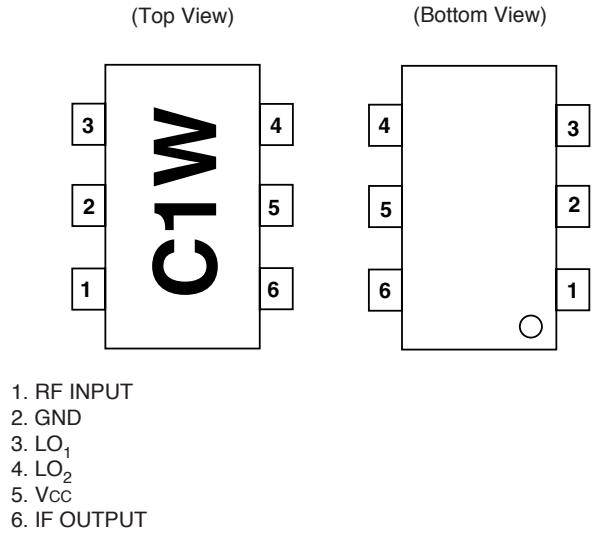
SYSTEM APPLICATION EXAMPLE



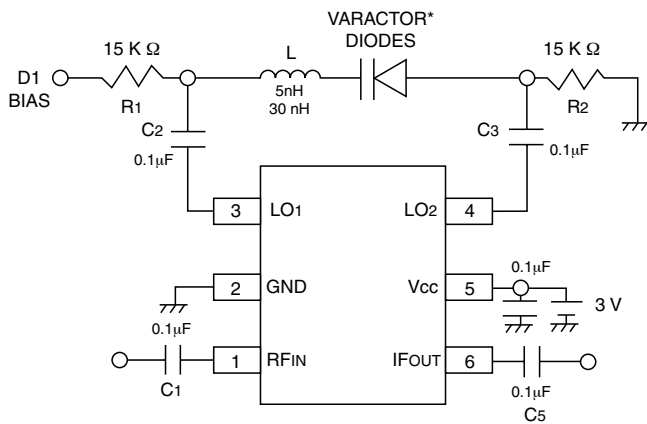
OUTLINE DIMENSIONS (Units in mm)



LEAD CONNECTIONS



APPLICATION CIRCUIT EXAMPLE



* Recommended Varactor Diodes: Alpha SMV1204-4, Toshiba 1SV186 or equivalent

ORDERING INFORMATION

| PART NUMBER | QTY |
|----------------|---------|
| UPC2756TB-E3-A | 3K/Reel |

Note:
Embossed Tape, 8 mm wide,
Pins 1, 2, 3 are in tape pull-out direction.

Life Support Applications

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| Restricted Substance per RoHS | Concentration Limit per RoHS (values are not yet fixed) | Concentration contained in CEL devices | |
|-------------------------------|---|--|-----|
| | | -A | -AZ |
| Lead (Pb) | < 1000 PPM | Not Detected | (*) |
| Mercury | < 1000 PPM | Not Detected | |
| Cadmium | < 100 PPM | Not Detected | |
| Hexavalent Chromium | < 1000 PPM | Not Detected | |
| PBB | < 1000 PPM | Not Detected | |
| PBDE | < 1000 PPM | Not Detected | |

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