



Low Power FM Transmitter System

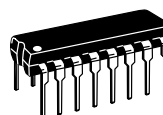
MC2833 is a one-chip FM transmitter subsystem designed for cordless telephone and FM communication equipment. It includes a microphone amplifier, voltage controlled oscillator and two auxiliary transistors.

- Wide Range of Operating Supply Voltage (2.8–9.0 V)
- Low Drain Current ($I_{CC} = 2.9 \text{ mA Typ}$)
- Low Number of External Parts Required
- – 30 dBm Power Output to 60 MHz Using Direct RF Output
- + 10 dBm Power Output Attainable Using On–Chip Transistor Amplifiers
- Users Must Comply with Local Regulations on R.F. Transmission (FCC, DOT, P.T.T., etc)

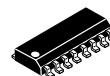
MC2833

LOW POWER FM TRANSMITTER SYSTEM

SEMICONDUCTOR TECHNICAL DATA

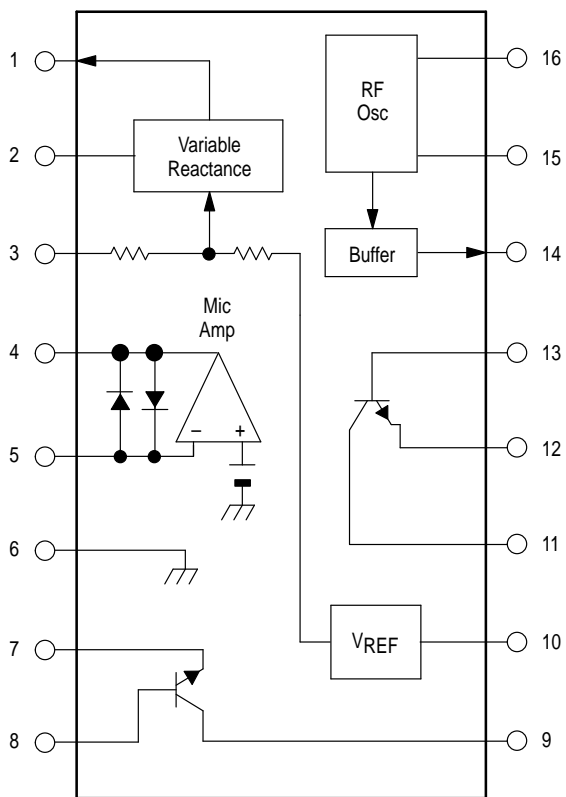


P SUFFIX
PLASTIC PACKAGE
CASE 648

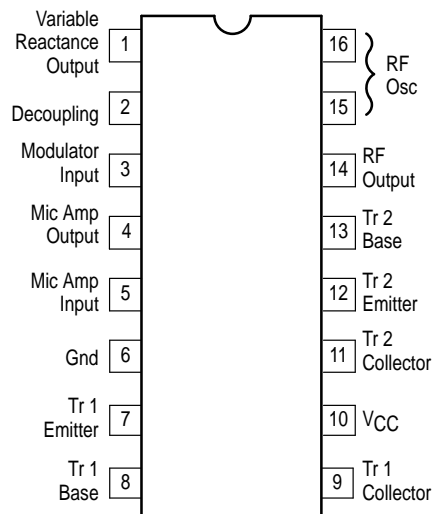


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CASE 751B
(SO–16)

Representative Block Diagram



PIN CONNECTIONS



ORDERING INFORMATION

| Device | Operating Temperature Range | Package |
|---------|---|-------------|
| MC2833D | $T_A = -30 \text{ to } +75^\circ\text{C}$ | SO–16 |
| MC2833P | | Plastic DIP |

MAXIMUM RATINGS

| Ratings | Symbol | Value | Unit |
|--------------------------------|-----------|---------------|------|
| Power Supply Voltage | V_{CC} | 10 (max) | V |
| Operating Supply Voltage Range | V_{CC} | 2.8–9.0 | V |
| Junction Temperature | T_J | + 150 | °C |
| Operating Ambient Temperature | T_A | – 30 to + 75 | °C |
| Storage Temperature Range | T_{stg} | – 65 to + 150 | °C |

ELECTRICAL CHARACTERISTICS ($V_{CC} = 4.0$ V, $T_A = 25^\circ\text{C}$, unless otherwise noted)

| Characteristics | Symbol | Pin | Min | Typ | Max | Unit |
|---------------------------------|----------|-----|-----|-----|-----|------|
| Drain Current (No input signal) | I_{CC} | 10 | 1.7 | 2.9 | 4.3 | mA |

FM MODULATOR

| | | | | | | |
|--|---------------|---------|----------|----------|---------|---------|
| Output RF Voltage ($f_o = 16.6$ MHz) | $V_{out\ RF}$ | 14 | 60 | 90 | 130 | mVrms |
| Output DC Voltage (No input signal) | V_{dc} | 14 | 2.2 | 2.5 | 2.8 | V |
| Modulation Sensitivity ($f_o = 16.6$ MHz) ($V_{in} = 0.8$ V to 1.2 V) | SEN | 3 14 | 7.0 – | 10 – | 15 – | Hz/mVdc |
| Maximum Deviation ($f_o = 16.6$ MHz) ($V_{in} = 0$ V to 2.0 V) | Fdev | 3 14 | 3.0 – | 5.0 – | 10 – | kHz |

MIC AMPLIFIER

| | | | | | | |
|--|----------------|--------|---------|---------|---------|------|
| Closed Loop Voltage Gain ($V_{in} = 3.0$ mVrms) ($f_{in} = 1.0$ kHz) | A_v | 4 5 | 27 – | 30 – | 33 – | dB |
| Output DC Voltage (No input signal) | $V_{out\ dc}$ | 4 | 1.1 | 1.4 | 1.7 | V |
| Output Swing Voltage ($V_{in} = 30$ mVrms) ($f_{in} = 1.0$ kHz) | $V_{out\ P-P}$ | 4 | 0.8 | 1.2 | 1.6 | Vp-p |
| Total Harmonic Distortion ($V_{in} = 3.0$ mVrms) ($f_{in} = 1.0$ kHz) | THD | 4 | – | 0.15 | 2.0 | % |

AUXILIARY TRANSISTOR STATIC CHARACTERISTICS

| Characteristics | Symbol | Min | Typ | Max | Unit |
|--|---------------|-----|-----|-----|------|
| Collector Base Breakdown Voltage ($I_C = 5.0$ μA) | $V_{(BR)CBO}$ | 15 | 45 | – | V |
| Collector Emitter Breakdown Voltage ($I_C = 200$ μA) | $V_{(BR)CEO}$ | 10 | 15 | – | V |
| Collector Substrate Breakdown Voltage ($I_C = 50$ μA) | $V_{(BR)CSO}$ | – | 70 | – | V |
| Emitter Base Breakdown Voltage ($I_E = 50$ μA) | $V_{(BR)EBO}$ | – | 6.2 | – | V |
| Collector Base Cut Off Current ($V_{CB} = 10$ V) ($I_E = 0$) | I_{CBO} | – | – | 200 | nA |
| DC Current Gain ($I_C = 3.0$ mA) ($V_{CE} = 3.0$ V) | h_{FE} | 40 | 150 | – | – |

AUXILIARY TRANSISTOR DYNAMIC CHARACTERISTICS

| | | | | | |
|---|----------|---|-----|---|-----|
| Current Gain Bandwidth Product ($V_{CE} = 3.0$ V) ($I_C = 3.0$ mA) | f_T | – | 500 | – | MHz |
| Collector Base Capacitance ($V_{CE} = 3.0$ V) ($I_C = 0$) | C_{CB} | – | 2.0 | – | pF |
| Collector Substrate Capacitance ($V_{CS} = 3.0$ V) ($I_C = 0$) | C_{CS} | – | 3.3 | – | pF |

MC2833

Figure 1. Test Circuit

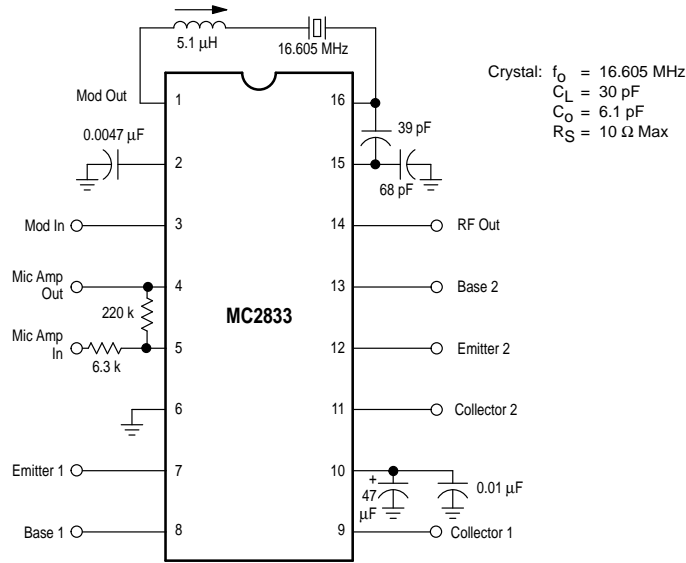
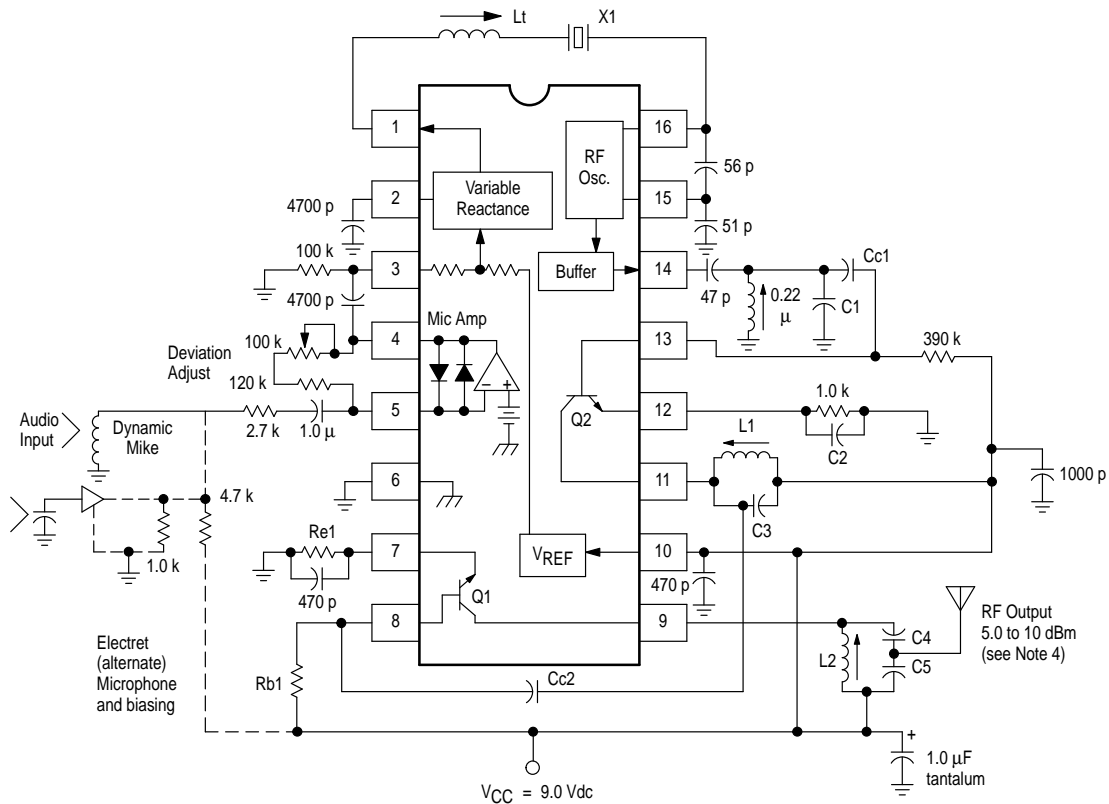


Figure 2. Single Chip VHF Narrowband FM Transmitter



NOTES:

1. Components versus output frequency:

| Output RF | X1 (MHz) | Lt (μH) | L1 (μH) | L2 (μH) | Re1 | Rb1 | Cc1 | Cc2 | C1 | C2 | C3 | C4 | C5 |
|-----------|----------|---------|---------|---------|-----|-------|------|------|------|--------|------|------|-------|
| 50 MHz | 16.6667 | 3.3-4.7 | 0.22 | 0.22 | 330 | 390 k | 33 p | 33 p | 33 p | 470 p | 33 p | 47 p | 220 p |
| 76 MHz | 12.6000 | 5.1 | 0.22 | 0.22 | 150 | 300 k | 68 p | 10 p | 68 p | 470 p | 12 p | 20 p | 120 p |
| 144 MHz | 12 | 5.6 | 0.15 | 0.10 | 150 | 220 k | 47 p | 10 p | 68 p | 1000 p | 18 p | 12 p | 33 p |

- Crystal X1 is fundamental mode, calibrated for parallel resonance with a 32 pF load. The final output frequency is generated by frequency multiplication within the MC2833 IC. The RF output buffer (Pin 14) and Q2 transistor are used as a frequency tripler and doubler, respectively, in the 76 and 144 MHz transmitters. The Q1 output transistor is a linear amplifier in the 49.7 MHz and 76 MHz transmitters, and a frequency doubler in the 144 MHz transmitter.
- All coils used are 7 mm shielded inductors, CoilCraft series M1175A, M1282A-M1289A, M1312A or equivalent.
- Power output is ≈ +10 dBm for 50 MHz and 76 MHz transmitters, and ≈ +5.0 dBm for the 144 MHz transmitter at V_{CC} = 8.0 V. Power output drops with lower V_{CC}.
- All capacitors in microfarads, inductors in Henries and resistors in Ohms unless otherwise specified.
- Other frequency combinations may be set-up by simple scaling of the 3 examples shown.

Figure 3. Buffer/Multiplier (x3, Pin 14)
(16 MHz Fundamental)

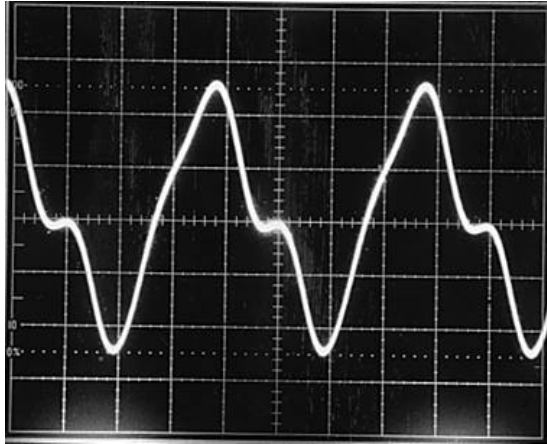


Figure 4. Input to Doubler (Pin 13)
(50 MHz x 3 Component)

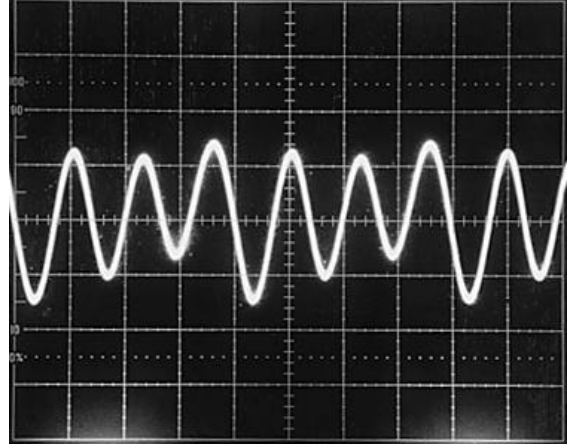


Figure 5. Doubler Output 76 MHz (Pin 11)

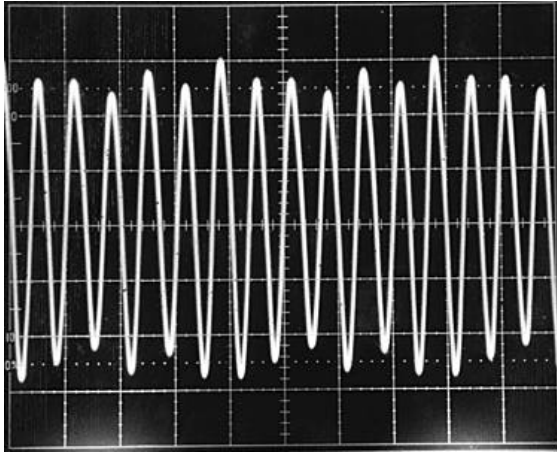


Figure 6. Spectrum

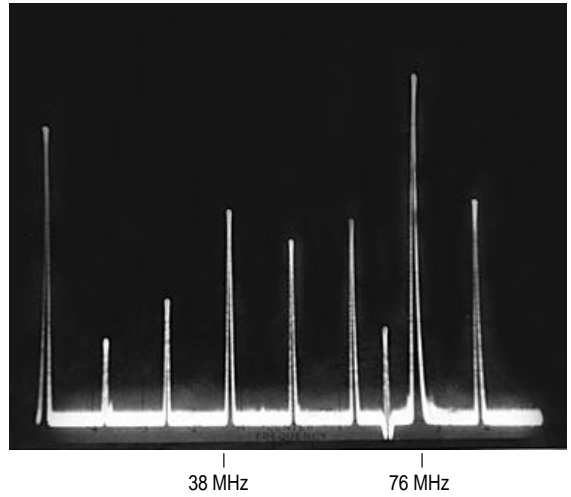


Figure 7. Output Spectrum (50 MHz)

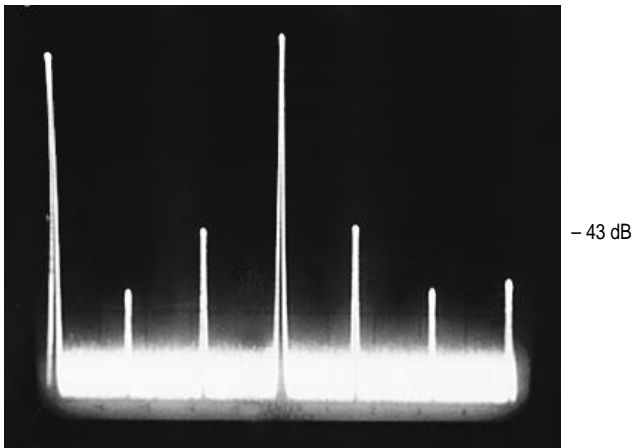
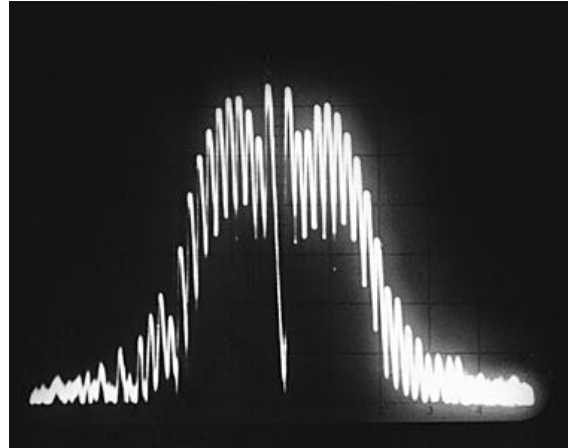


Figure 8. Modulation Spectrum
(1.0 kHz Showing Carrier Null)



MC2833

Figure 9. 144 MHz/x12 Multiplier

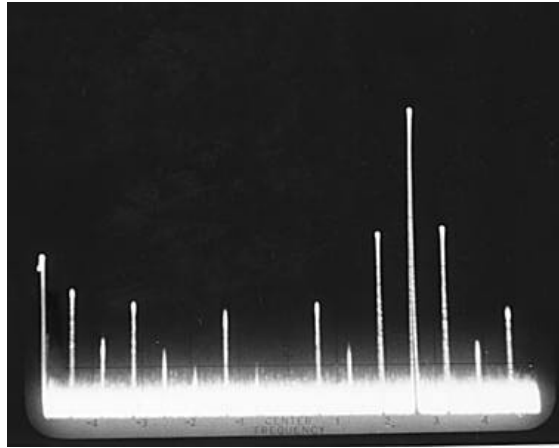


Figure 10. Circuit Side View

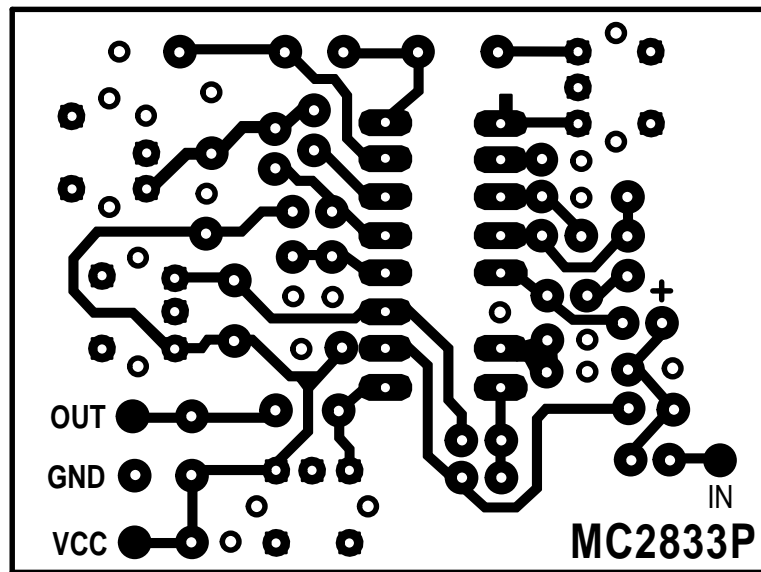
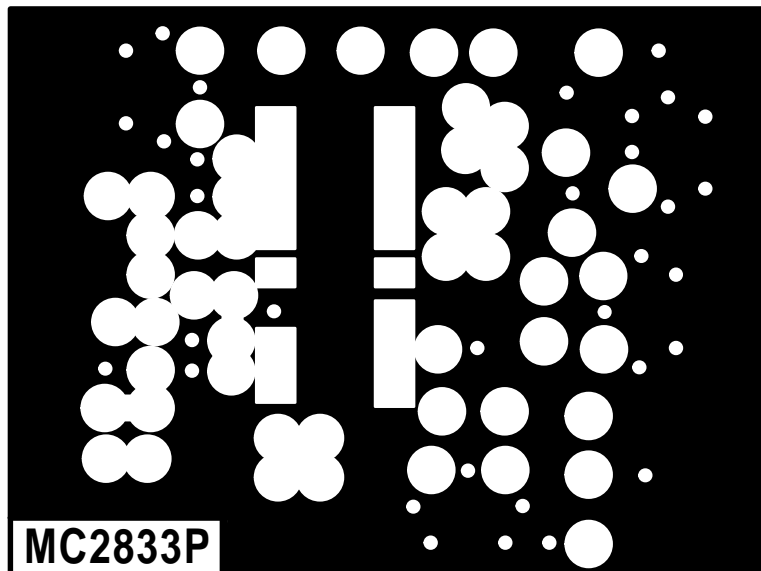
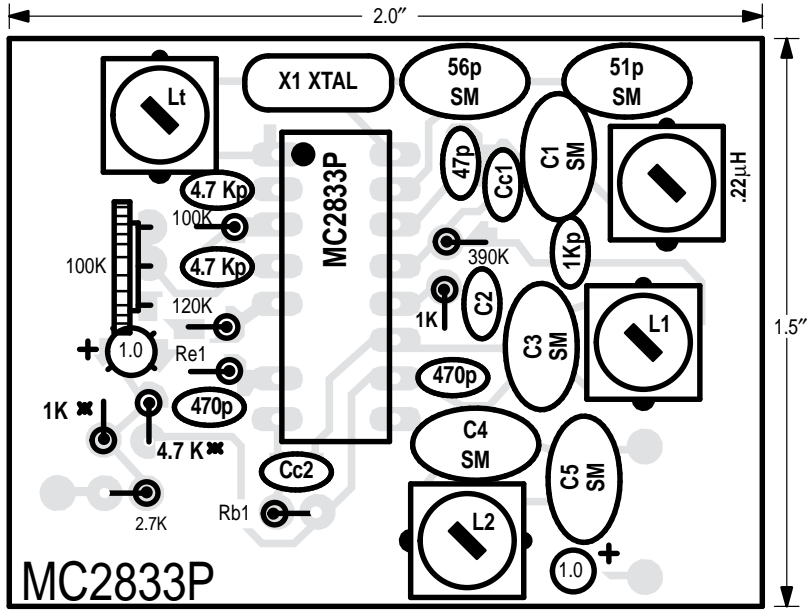


Figure 11. Ground Plane on Component Side



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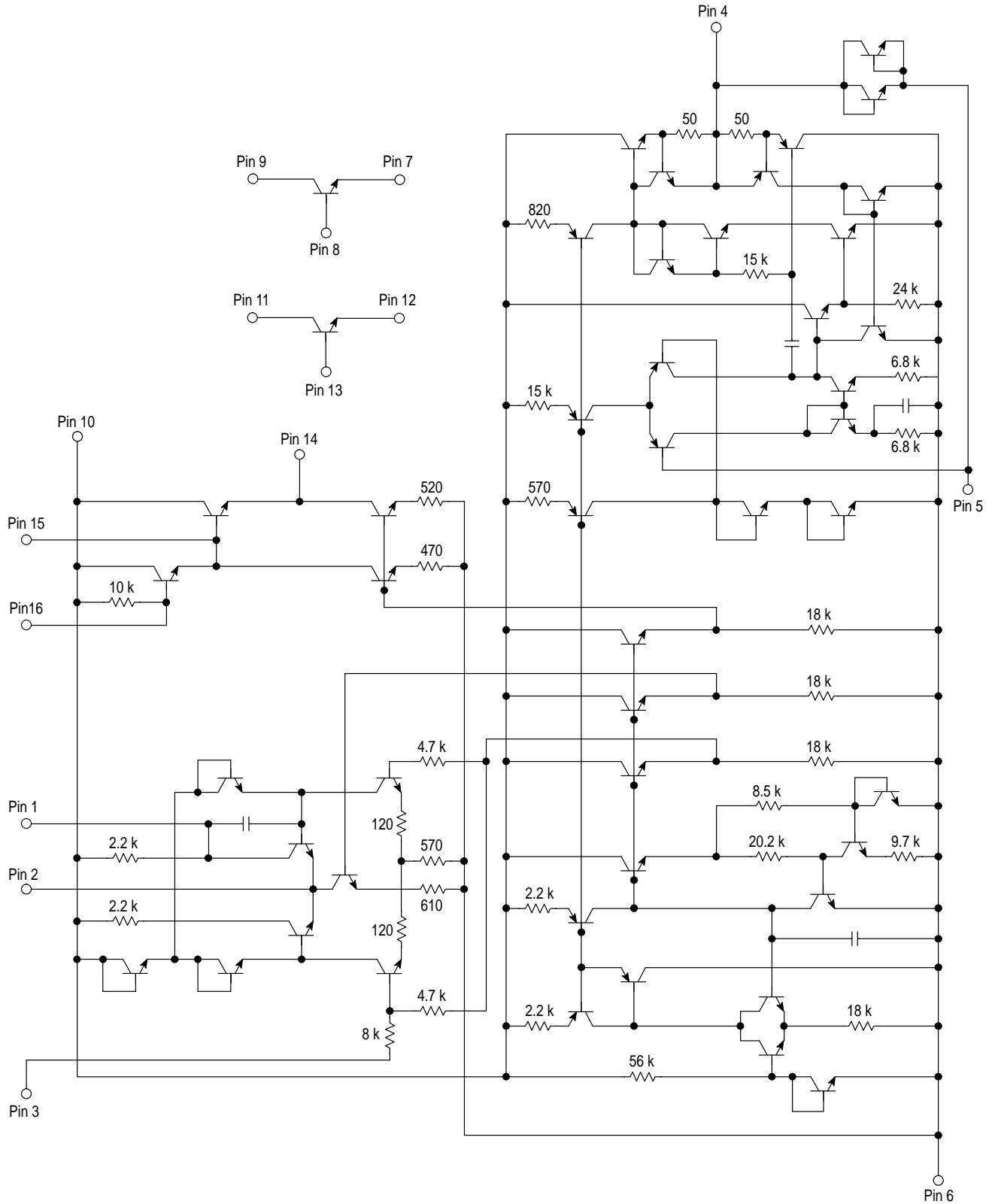
Figure 12. Component View



- NOTES:**
- Positive artwork provided.
 - Drill holes must be plated to ensure making all ground (V_{EE}) connections!
 - Resistors labelled * are used for biasing of electret microphone if used.
 - Capacitors labelled "SM" are silver mica.
 - Final board size 1.5" × 2.0".

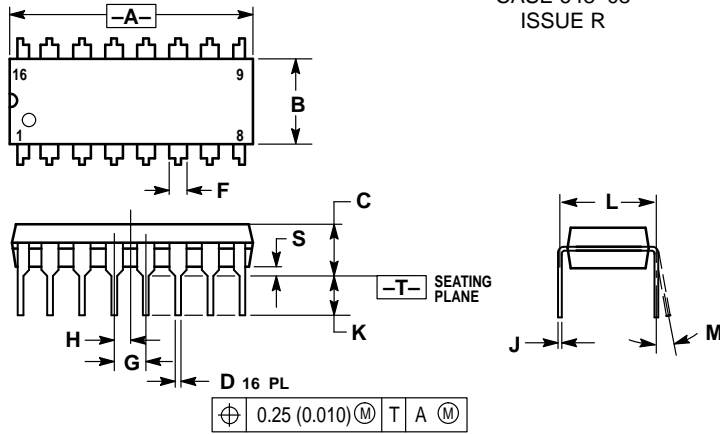
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Figure 13. Circuit Schematic



OUTLINE DIMENSIONS

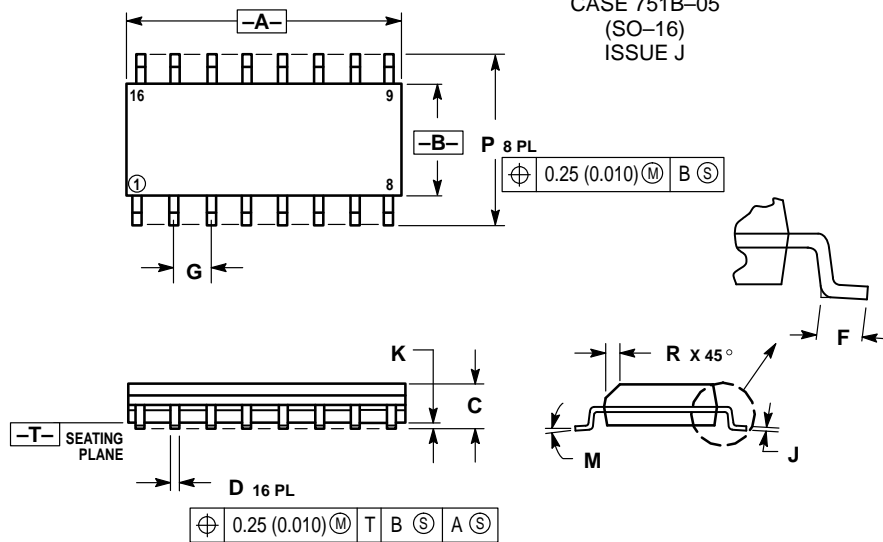
P SUFFIX
PLASTIC PACKAGE
CASE 648-08
ISSUE R



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
 4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
 5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.740 | 0.770 | 18.80 | 19.55 |
| B | 0.250 | 0.270 | 6.35 | 6.85 |
| C | 0.145 | 0.175 | 3.69 | 4.44 |
| D | 0.015 | 0.021 | 0.39 | 0.53 |
| F | 0.040 | 0.70 | 1.02 | 1.77 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.050 BSC | | 1.27 BSC | |
| J | 0.008 | 0.015 | 0.21 | 0.38 |
| K | 0.110 | 0.130 | 2.80 | 3.30 |
| L | 0.295 | 0.305 | 7.50 | 7.74 |
| M | 0° | | 10° | |
| S | 0.020 | 0.040 | 0.51 | 1.01 |

D SUFFIX
PLASTIC PACKAGE
CASE 751B-05
(SO-16)
ISSUE J



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
 5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 9.80 | 10.00 | 0.386 | 0.393 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0° | | 7° | |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

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