

MC2833

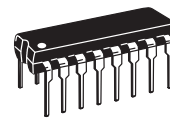
Low Power FM Transmitter System

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.

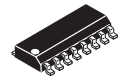
- Wide Range of Operating Supply Voltage (2.8–9.0 V)
- Low Drain Current ($I_{CC} = 2.9 \text{ mA Typ}$)
- Low Number of External Parts Required
- – 30 dBm Power Output to 60 MHz Using Direct RF Output
- + 10 dBm Power Output Attainable Using On-Chip Transistor Amplifiers
- Users Must Comply with Local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

LOW POWER FM TRANSMITTER SYSTEM

SEMICONDUCTOR TECHNICAL DATA

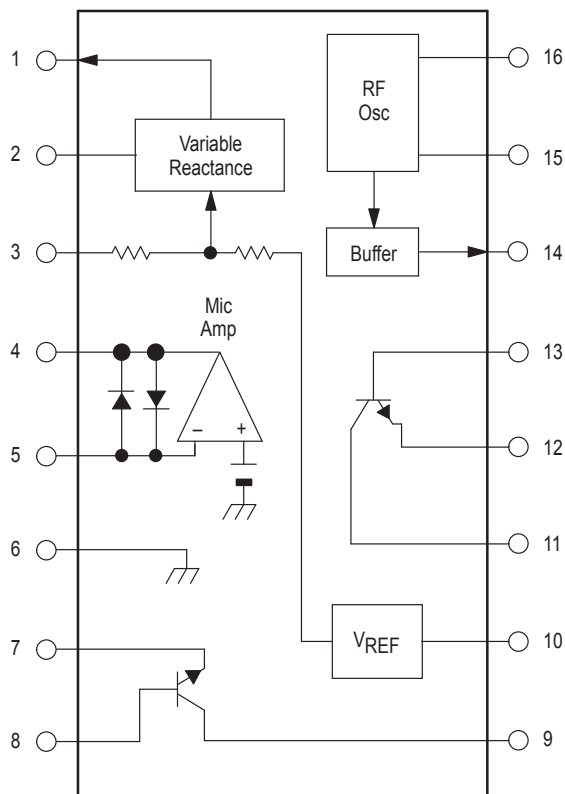


P SUFFIX
PLASTIC PACKAGE
CASE 648

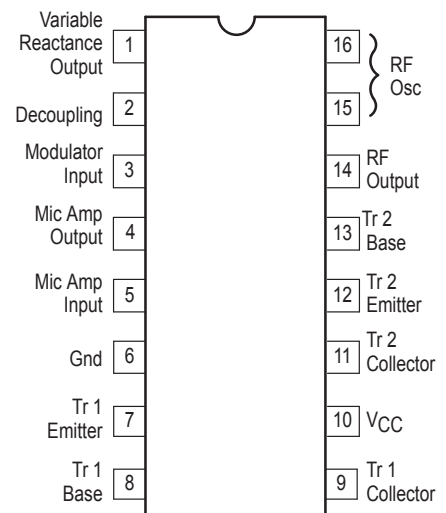


D SUFFIX
PLASTIC PACKAGE
CASE 751B
(SO-16)

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 |

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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 |

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Figure 1. Test Circuit

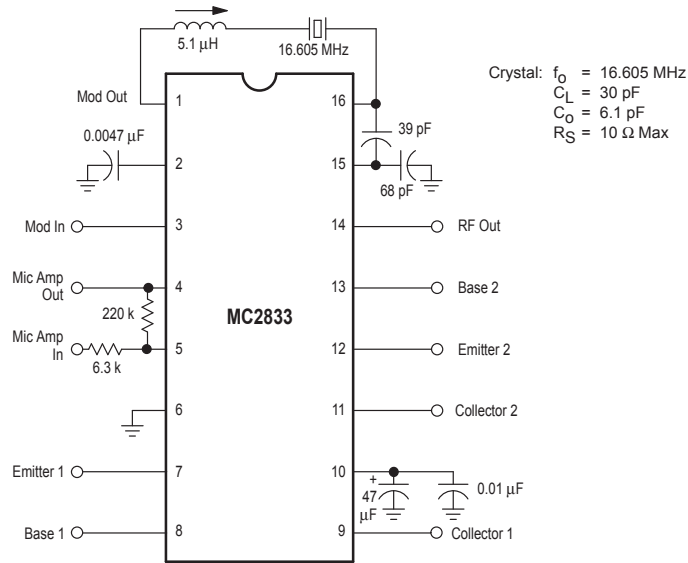
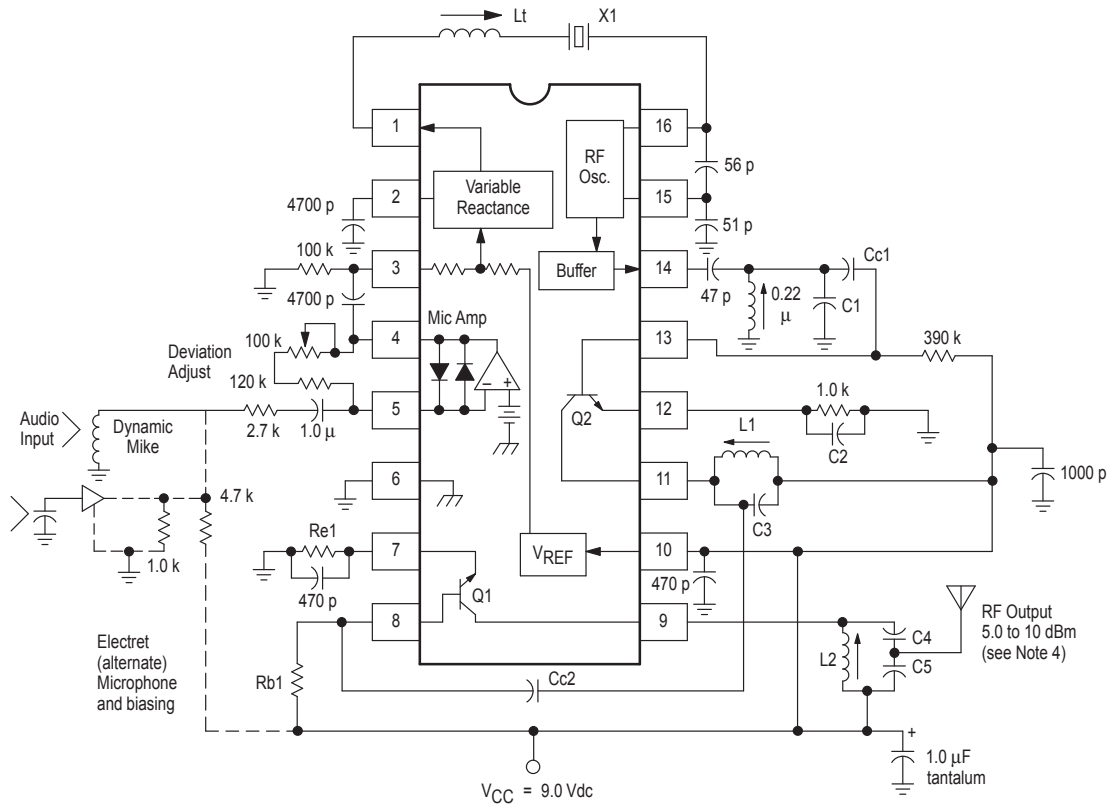


Figure 2. Single Chip VHF Narrowband FM Transmitter



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 |
|-----------|----------|---------|---------|---------|-----|-------|------|------|------|--------|------|------|-------|
| 49.7 MHz | 16.5667 | 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 |
| 144.6 MHz | 12.05 | 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 144.6 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 144.6 MHz transmitter.
- All coils used are 7 mm shielded inductors, CoilCraft series M1175A, M1282A–M1289A, M1312A or equivalent.
- Power output is $\approx +10 \text{ dBm}$ for 49.7 MHz and 76 MHz transmitters, and $\approx +5.0 \text{ dBm}$ for the 144.6 MHz transmitter at $V_{CC} = 8.0 \text{ V}$. 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.

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

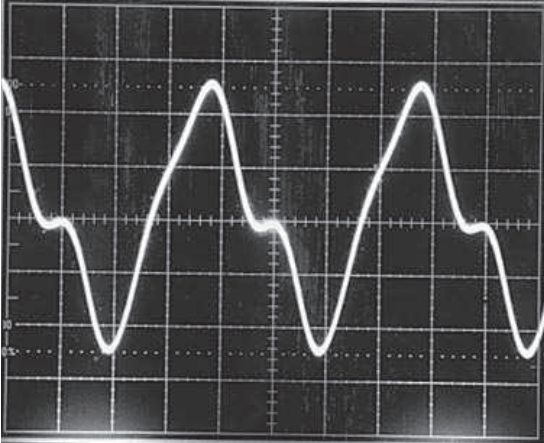


Figure 4. Input to Doubler (Pin 13)
(49.7 MHz x 3 Component)

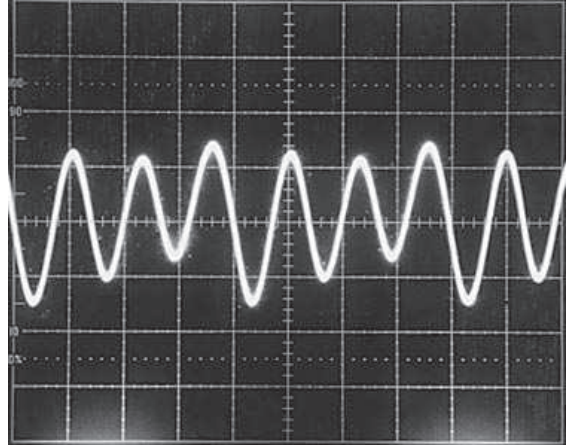


Figure 5. Doubler Output 76 MHz (Pin 11)

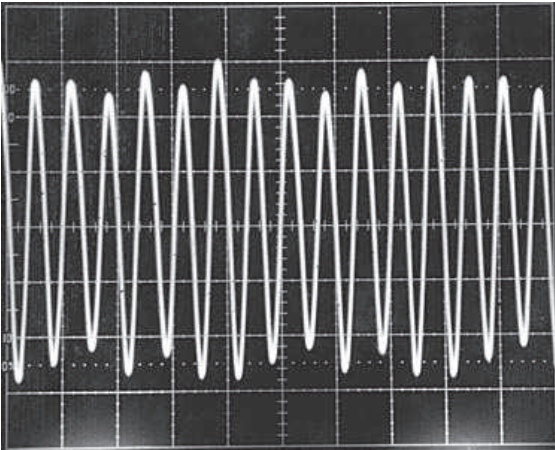


Figure 6. Spectrum

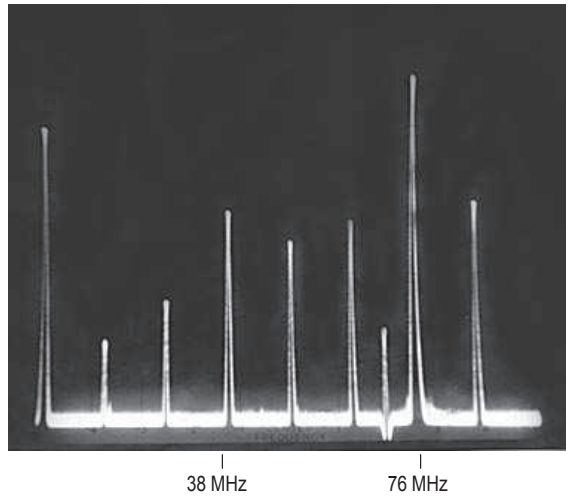


Figure 7. Output Spectrum (49.7 MHz)

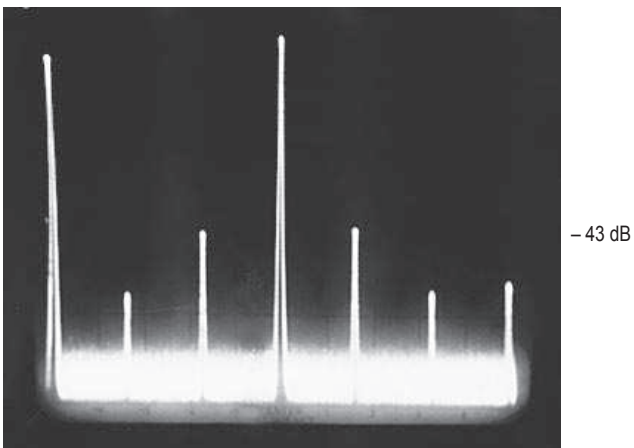
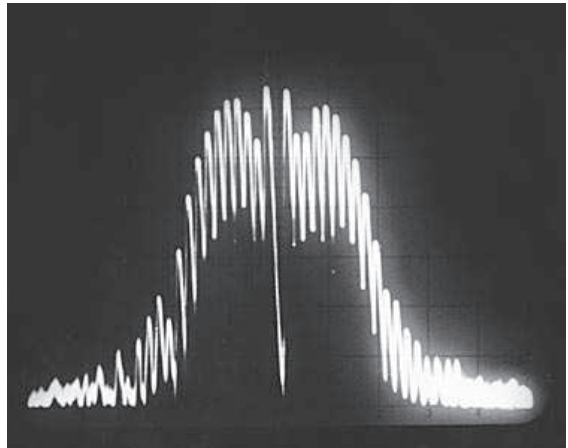


Figure 8. Modulation Spectrum
(1.0 kHz Showing Carrier Null)



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Figure 9. 144.6 MHz/x12 Multiplier

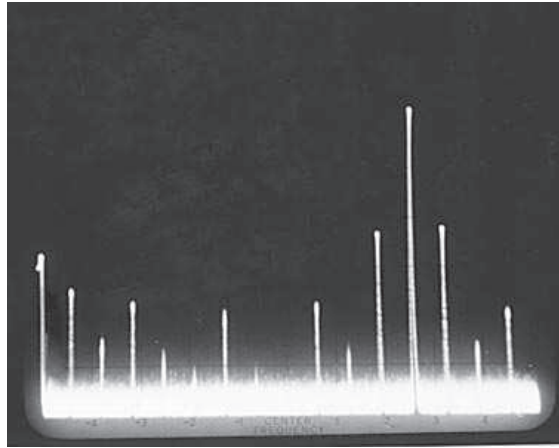


Figure 10. Circuit Side View

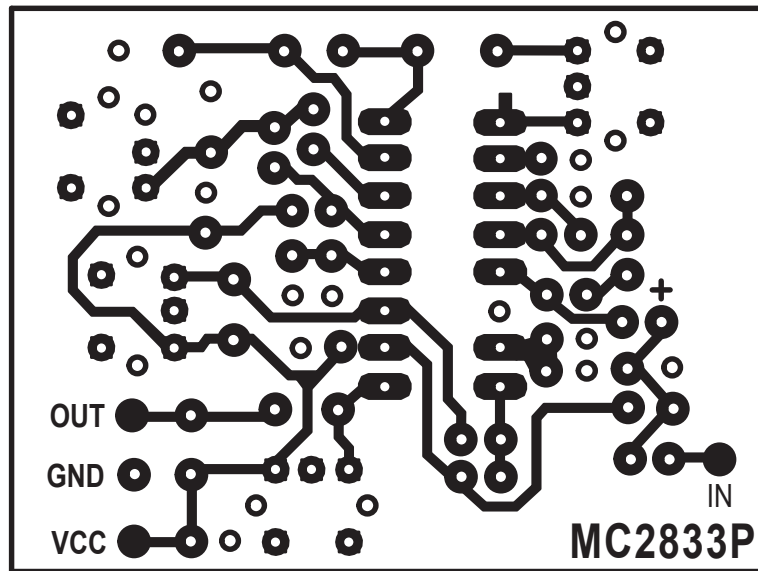
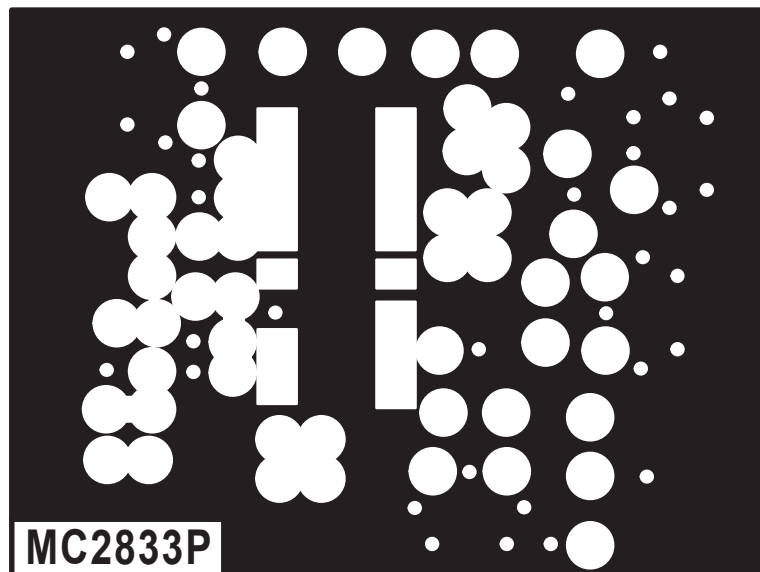
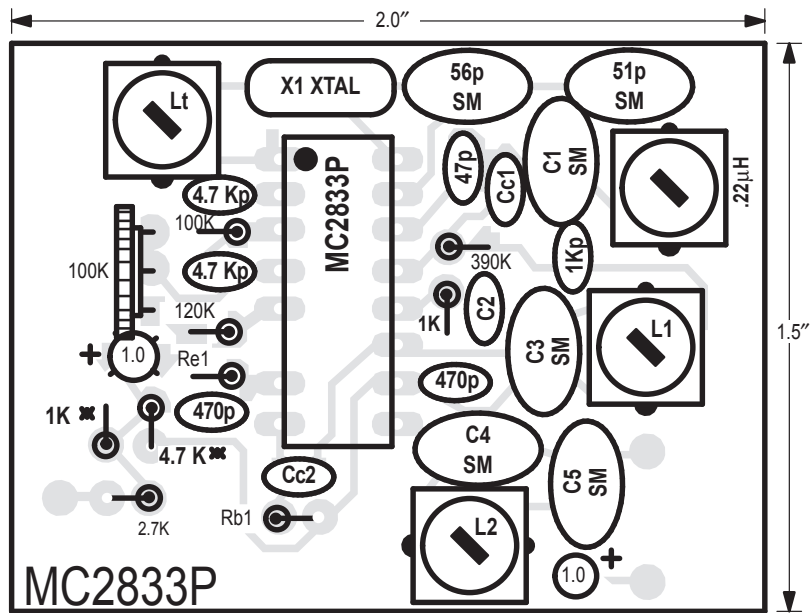


Figure 11. Ground Plane on Component Side



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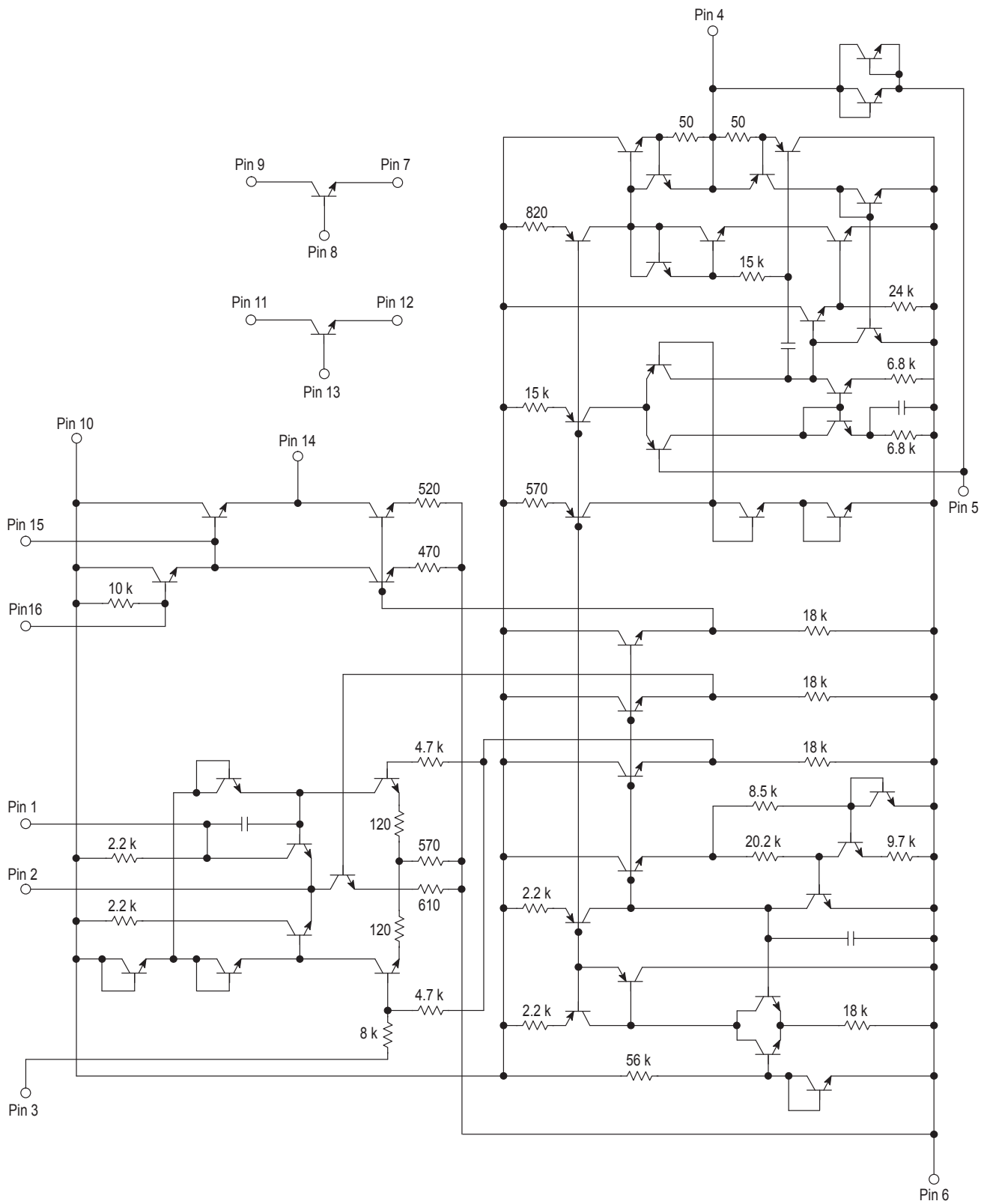
Figure 12. Component View



- 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" x 2.0".

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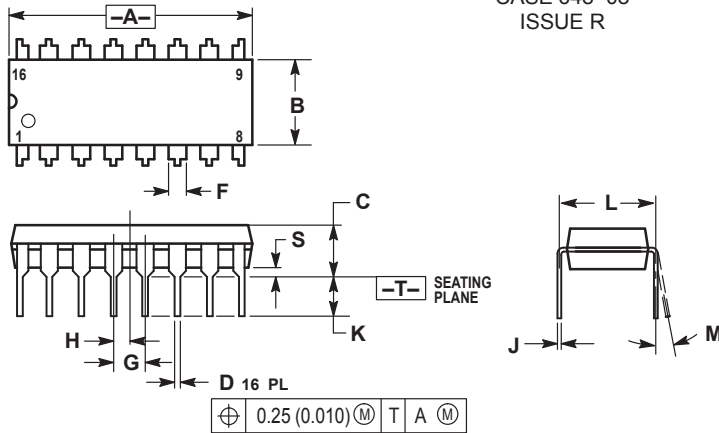
Figure 13. Circuit Schematic



MC2833

OUTLINE DIMENSIONS

P SUFFIX PLASTIC PACKAGE CASE 648-08 ISSUE R

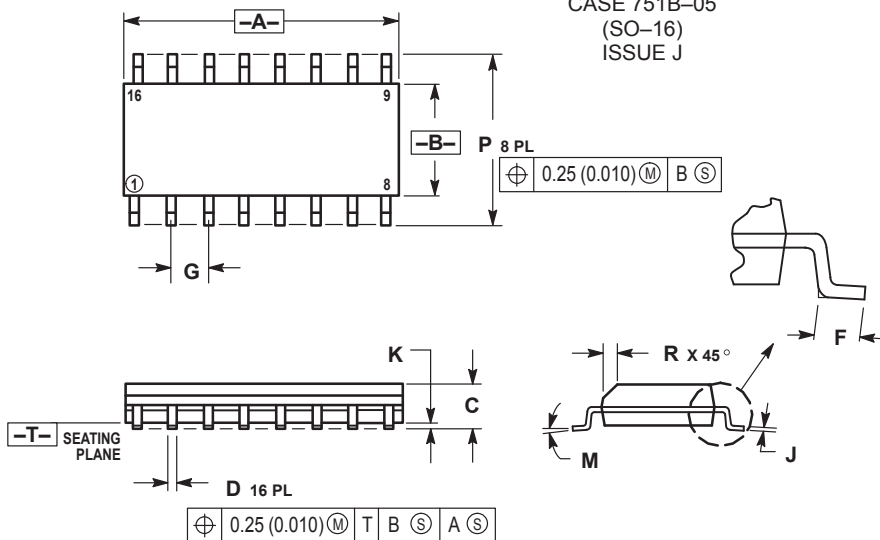


NOTES:

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° | 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° | 0° | 7° |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

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