

# MC2833

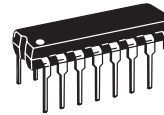
## Low Power FM Transmitter System

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.

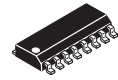
- Wide Range of Operating Supply Voltage (2.8–9.0 V)
- Low Drain Current ( $I_{CC} = 2.9 \text{ mA Typ}$ )
- Low Number of External Parts Required
- – 30 dBm Power Output to 60 MHz Using Direct RF Output
- + 10 dBm Power Output Attainable Using On-Chip Transistor Amplifiers
- Users Must Comply with Local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

### LOW POWER FM TRANSMITTER SYSTEM

#### SEMICONDUCTOR TECHNICAL DATA

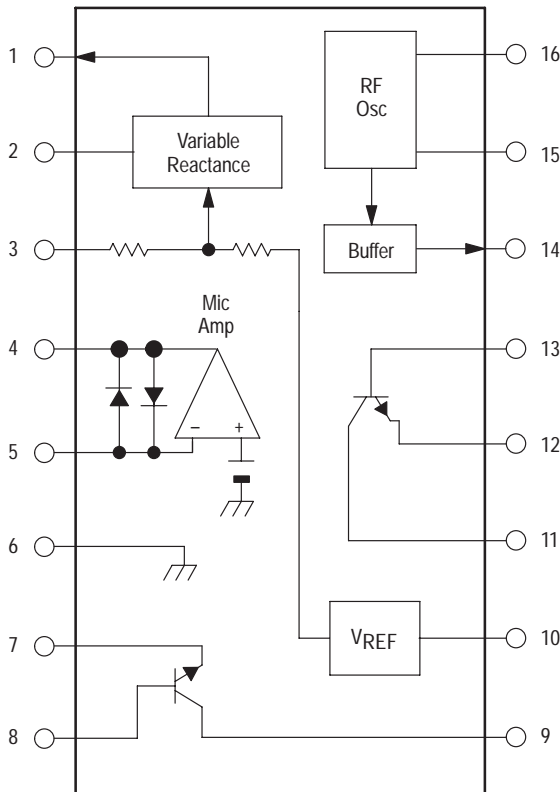


**P SUFFIX**  
PLASTIC PACKAGE  
CASE 648

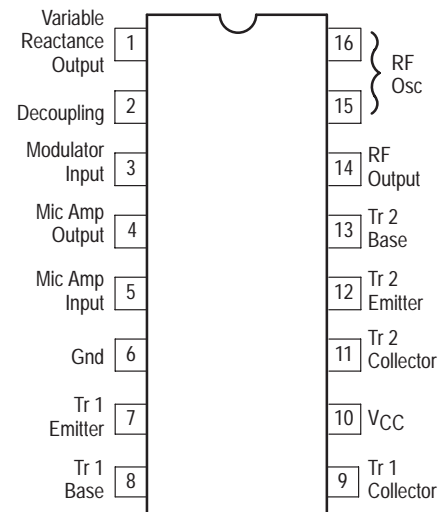


**D SUFFIX**  
PLASTIC PACKAGE  
CASE 751B  
(SO-16)

**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	V <sub>p-p</sub>
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 ( $I_C = 5.0$ $\mu\text{A}$ )	$V_{(BR)CBO}$	15	45	–	V
Collector Emitter Breakdown Voltage ( $I_C = 200$ $\mu\text{A}$ )	$V_{(BR)CEO}$	10	15	–	V
Collector Substrate Breakdown Voltage ( $I_C = 50$ $\mu\text{A}$ )	$V_{(BR)CSO}$	–	70	–	V
Emitter Base Breakdown Voltage ( $I_E = 50$ $\mu\text{A}$ )	$V_{(BR)EBO}$	–	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

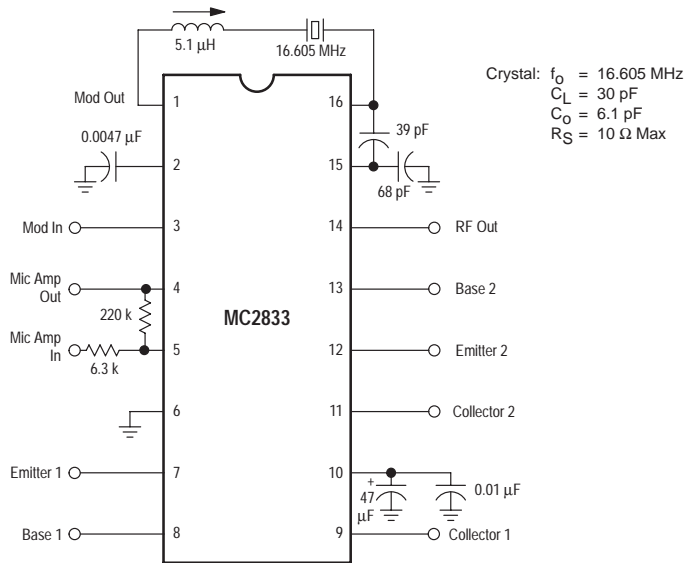
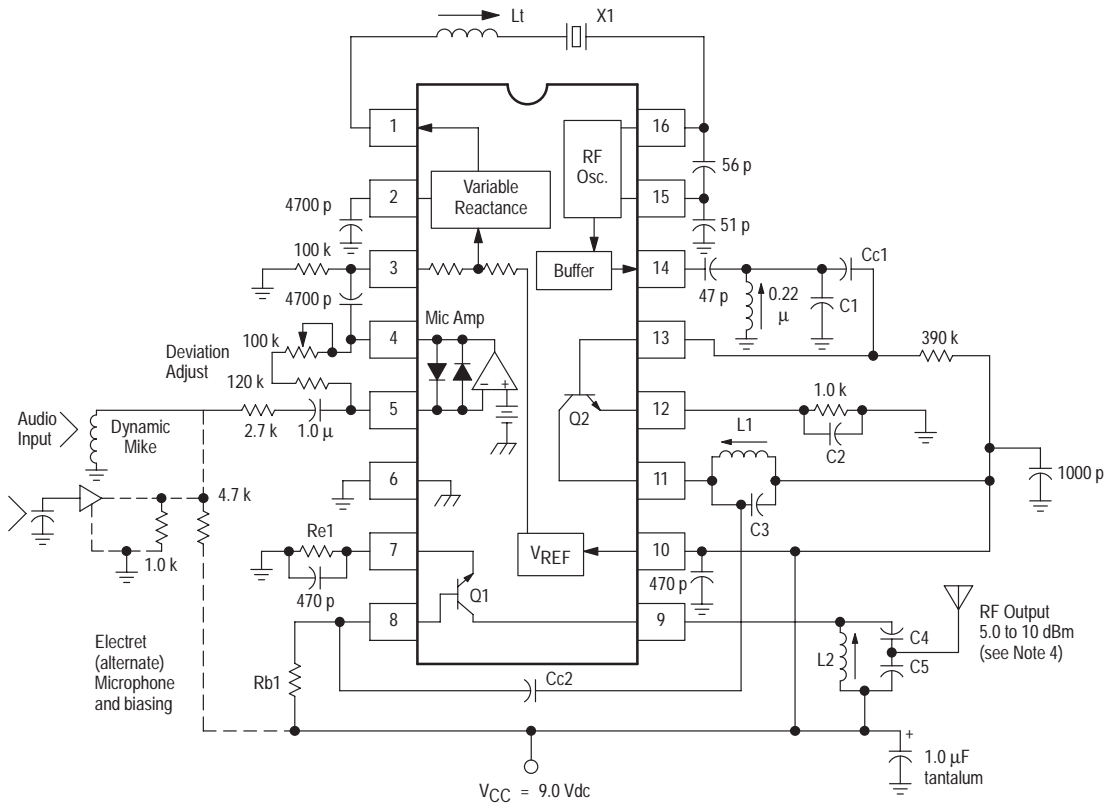


Figure 2. Single Chip VHF Narrowband FM Transmitter



**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 ≈ +10 dBm for 49.7 MHz and 76 MHz transmitters, and ≈ +5.0 dBm for the 144.6 MHz transmitter at V<sub>CC</sub> = 8.0 V. Power output drops with lower V<sub>CC</sub>.
- 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)

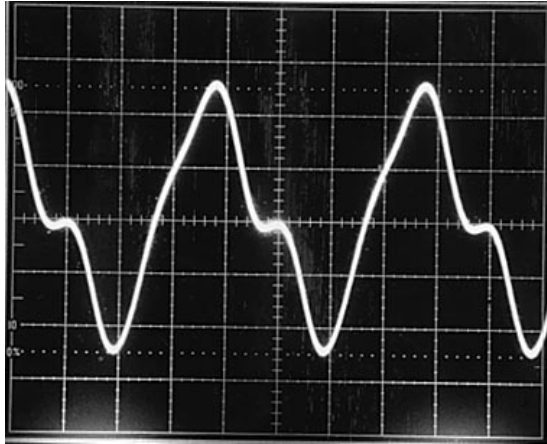


Figure 4. Input to Doubler (Pin 13)  
(49.7 MHz x 3 Component)

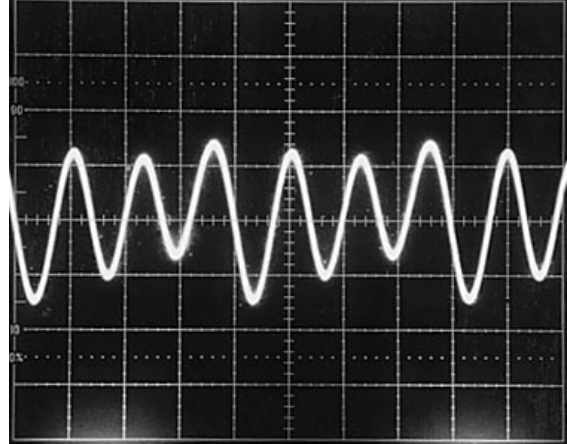


Figure 5. Doubler Output 76 MHz (Pin 11)

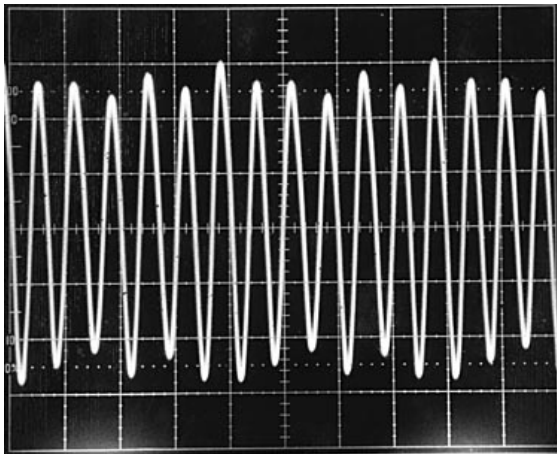


Figure 6. Spectrum

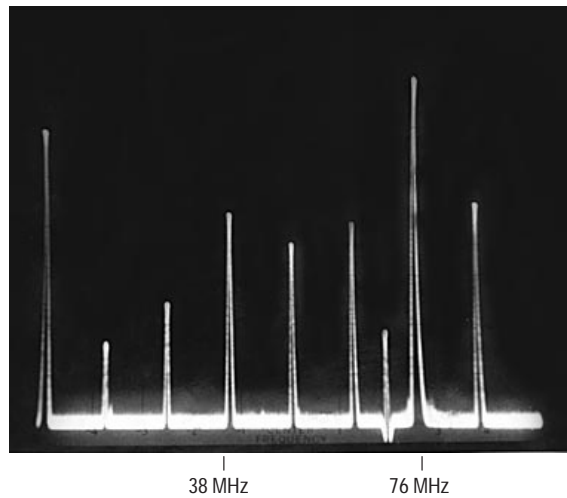


Figure 7. Output Spectrum (49.7 MHz)

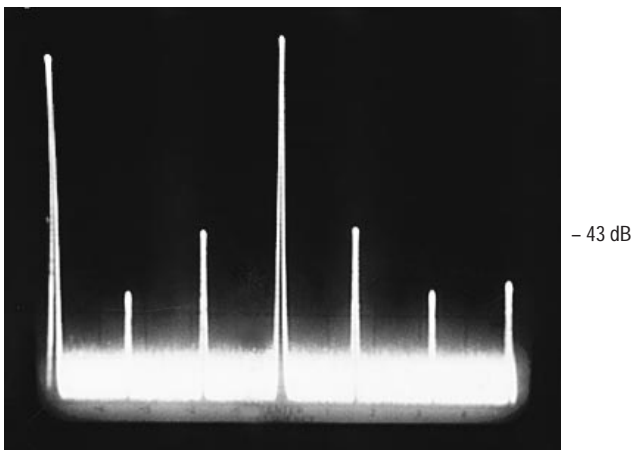
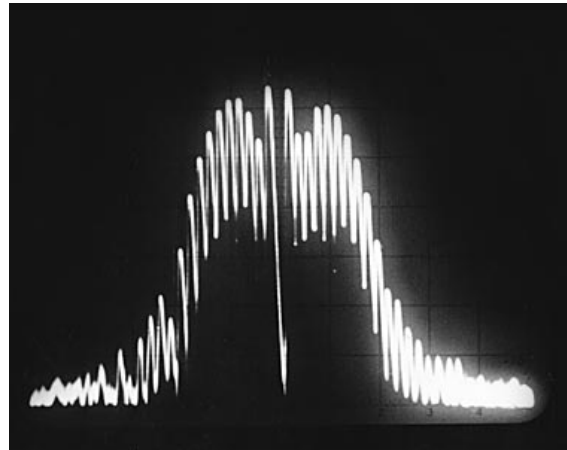


Figure 8. Modulation Spectrum  
(1.0 kHz Showing Carrier Null)



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Figure 9. 144.6 MHz/x12 Multiplier

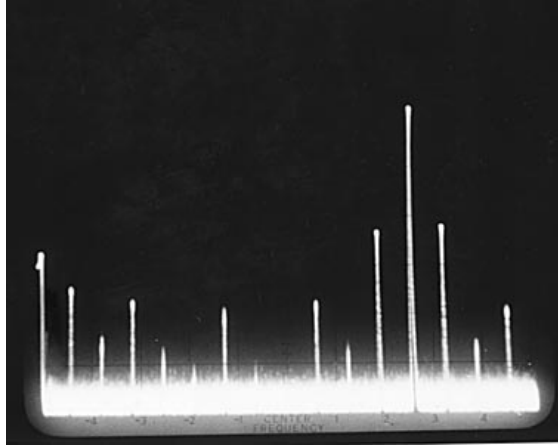


Figure 10. Circuit Side View

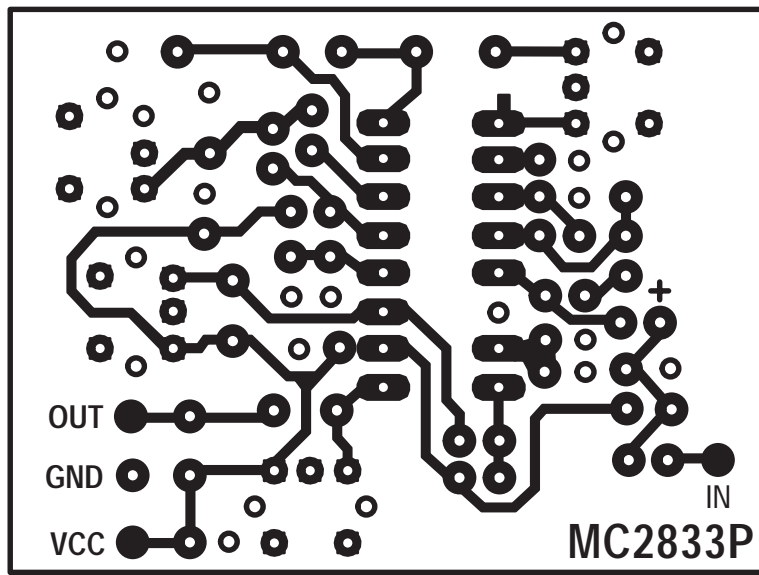
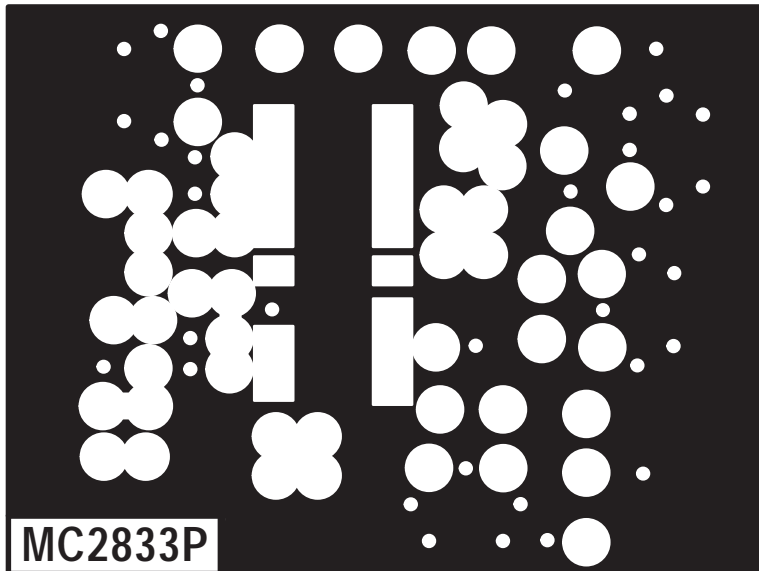


Figure 11. Ground Plane on Component Side

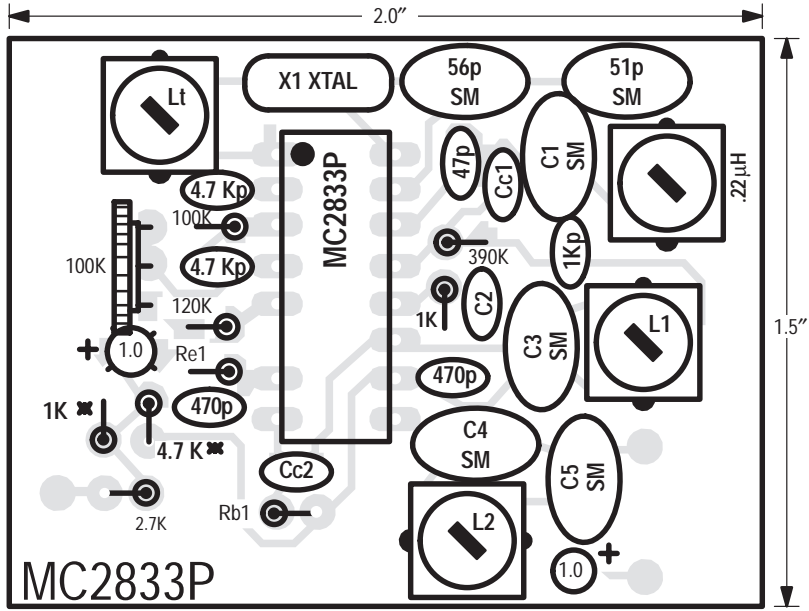


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Figure 12. Component View



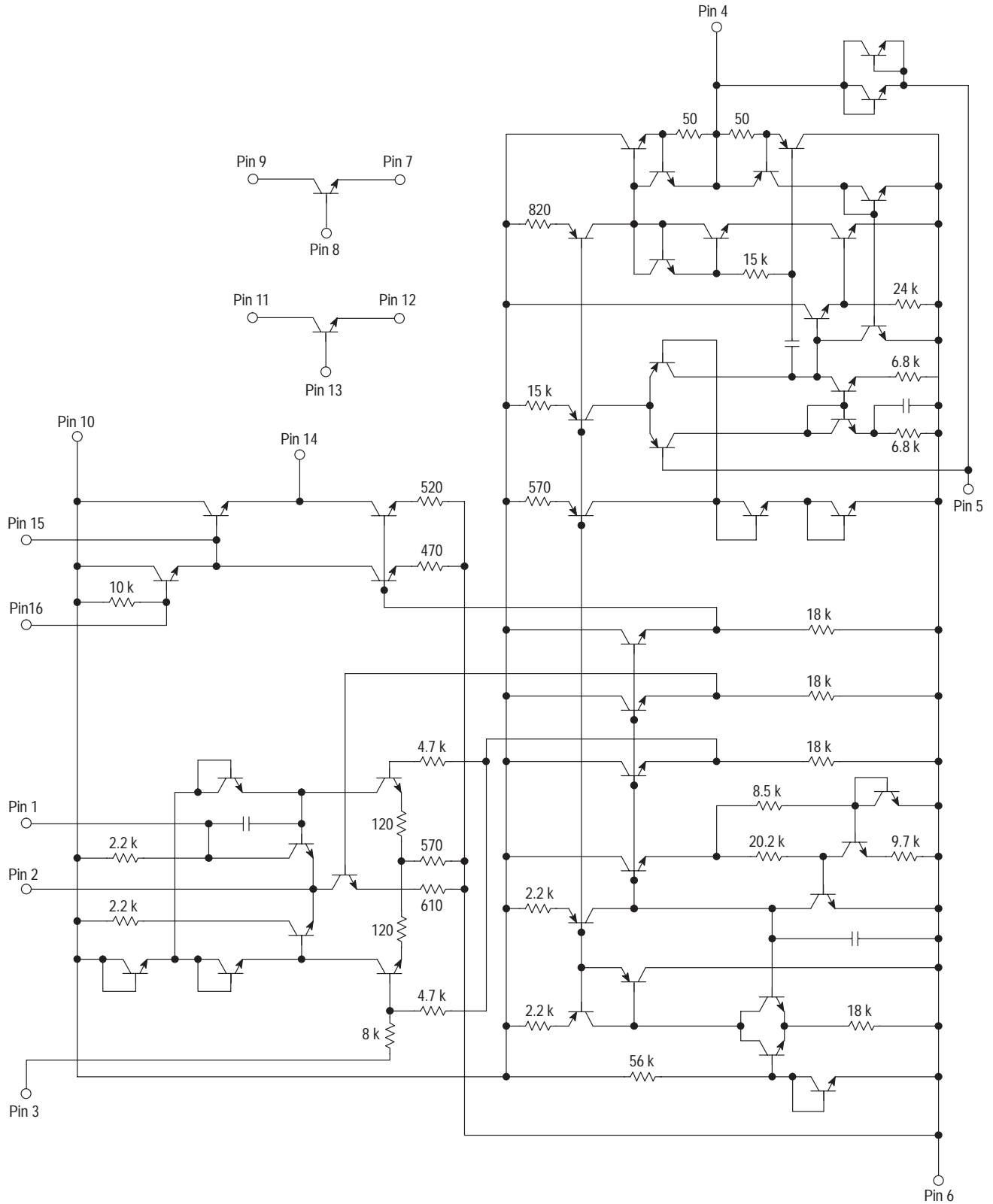
- NOTES:**
- Positive artwork provided.
  - Drill holes must be plated to ensure making all ground ( $V_{EE}$ ) connections!
  - Resistors labelled \* are used for biasing of electret microphone if used.
  - Capacitors labelled "SM" are silver mica.
  - Final board size 1.5"  $\times$  2.0".

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## Figure 13. Circuit Schematic



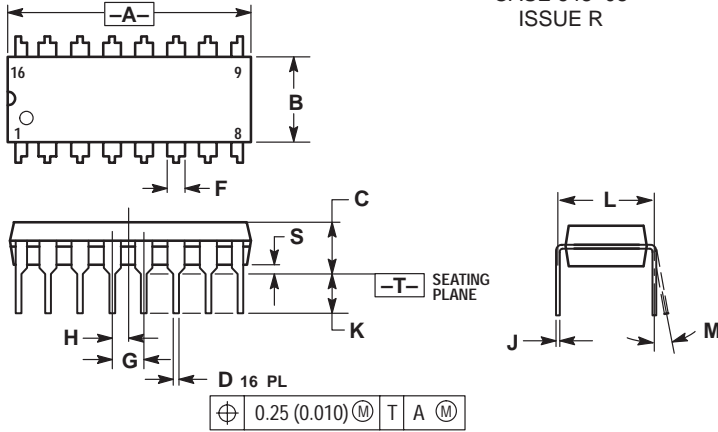
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## OUTLINE DIMENSIONS

### P SUFFIX PLASTIC PACKAGE CASE 648-08 ISSUE R

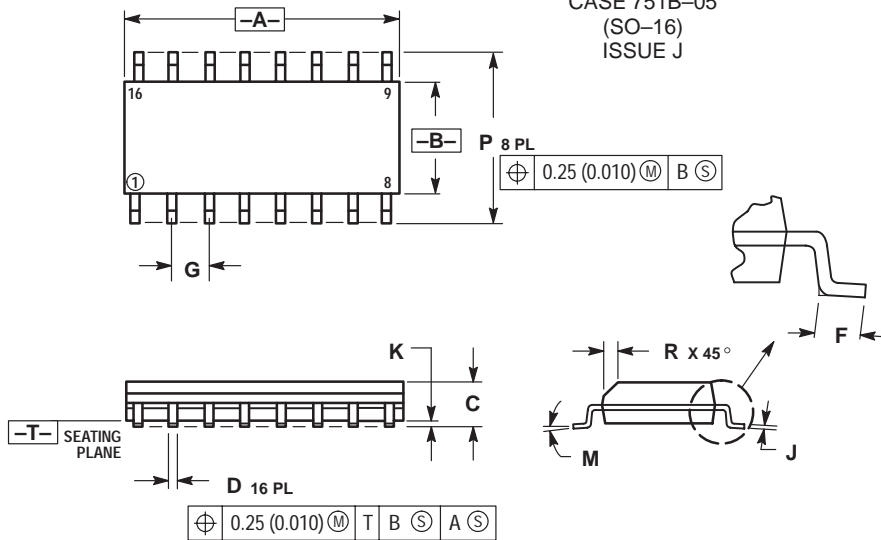


NOTES:

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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