

# **SERVICE MANUAL SUPPLEMENT**

## **MUSICOM MASTER RECEIVER**

### **REFERENCE:**

**SERVICE MANUAL FOR MUSICOM MASTER RECEIVER  
MODELS 2500; 2501; 2502; and 2600 (NUTONE PART NO.  
45880-1)**

**MULTIPLEX & SWITCHING, text, pages 18, 20, 21, and 23.**

**Original Multiplex Module PC Board Layout, page 21.**

**Master Unit Schematic Diagram, center-fold.**

**Interstage Wiring Diagram, pages 51-53.**

**SERVICE MANUAL FOR MODEL 2510A/B MASTER INTERCOM  
CONTROL (NUTONE PART NO. 45880-3)**

**NuTone Housing Products**

Product specifications subject to change without notice.

**Scovill**

Madison & Red Bank Roads, Cincinnati, Ohio 45227

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Part No. FS1070

## General

(1) Original production units of the Musicom Master Unit used the Multiplex Module, Complete Assembly Part No. 41160-000. This assembly can be identified by the Part No. "37574" that is printed on its PC Board, and by the tuning coils that are mounted on this board.

(2) Later production units of the Musicom Master Unit use the Multiplex Module, complete Assembly Part No. 42107-000. This later assembly can be identified by the Part No. "37682" that is

printed on its PC Board, and by the absence of tuning coils, since they are not required in this later circuit.

(3) This later Multiplex PC assembly may be used as a direct replacement in earlier production units.

(3.1) The wiring-color-code that is used with these later production Modules is the same as that used for the original production Multiplex Modules.

## THEORY OF OPERATION

(See Schematic Diagram, page 4)

(1) The Multiplex Module is powered by a regulated +12Vdc that is connected at (p) on the PC Board. This voltage is connected, through a red wire, from terminal (r) on the Master Unit's Power Supply Module. This regulated +12Vdc supplies Vcc to Z261 and to the four transistors Q261-Q264.

(2) Ground terminal (g) (or (k)) on the Multiplex Board is connected through a black wire to circuit common ground terminal (l) on the Power Supply Module.

(3) The detected (but not de-emphasized) f-m audio signal is connected from (p) on the FM Tuner Module, through a shielded cable, to (r) on the Multiplex Module, and then through C261 to Z261-2.

(3.1) The shielded cable is grounded only at (s) on the Multiplex Module.

(4) Z261 is a monolithic silicon integrated circuit (IC) that is designed for FM stereo demodulation with an automatic internal stereo/monaural switch.

(4.1) Z261 (NuTone Part No. 36668-000) is a Motorola type MC1310P. This device is also supplied by RCA, No. CA1310E; and by National Semiconductor, No. LM1310/LM1310E.

(4.1.1) Complete specifications for these devices and description of their operation may be found in the Linear Integrated Circuit Technical Literature that is published by the manufacturers.

(4.2) The device has excellent channel separation, being typically in the order of 40 db (minimum 35 db) with an input signal of 2.8V (p-p) at Z261-2).

(4.3) Its ultrasonic frequency rejection to the output is in the order of 35 db for 19 KHz. and 45 db for 38 KHz.

(5) When the received signal is f-m stereo, the signal to Z261-2 is a composite, consisting of left and right audio channels; and pilot tone.

(5.1) The left audio signal will be fed out at Z261-4, and the right audio signal will be fed out at Z261-5.

(6) If an f-m monaural signal is received, the same monaural audio signal will be fed from the decoder outputs Z261-4 and Z261-5.

(7) DECODERS OPTIMUM MULTIPLEX ALIGNMENT PROCEDURE: With no input signal at Z261-2, adjust R262 until 19.00 KHz. is read at Z261-10. Use an accurate frequency counter instrument.

(7.1) The on-board oscillator generates 76 KHz. which is divided for the 38 KHz. regeneration loop, which is also divided in order to supply 19 KHz. oscillator output to Z261-10. This 19 KHz. signal is phase-locked with the received 19 KHz. pilot tone. With the oscillator phase-locked to the pilot tone, the 38 KHz. output of the first divider is in the correct phase for decoding a stereo signal.

(7.2) Note that Z261-10 is normally floating and is used only for measuring the 19.00 KHz.

(8) SECONDARY METHOD OF MULTIPLEX DECODER ALIGNMENT: With the receiver tuned to a known FM stereo broadcast, adjust R262 until the stereo indicator lamp M261 (in center of AM/FM dial on front panel) is turned ON. To find the center of the lock-in range, determine the limits of R262's tuning with the lamp ON, and set its indicator in center of range.

(8.1) If decoder can not be adjusted with either of the two methods, check antenna; FM Tuner alignment; operating voltages; indicator lamp; wiring; position of Stereo/Monaural Switch and/Function Selector Switch. etc.

(9) In a properly functioning unit, when an f-m stereo signal is received, Z261's on-board electronic switch turns on (saturates) a switching transistor whose collector is then connected to ground through its emitter and a 2-ohm resistor, and it can safely sink 75 milliamps at Z261-10.

(10) See Reference on front cover: The regulated +12Vdc at the cathode of Zener diode D516 is fed from the Power Supply Module, through an orange wire to one section of the Stereo/Monaural Switch.

(10.1) When the Stereo/Monaural Switch is in STEREO position, the +12Vdc is fed to the common terminal of Section 2—front, of the Function Selector Switch.

(10.2) When the Function Selector Switch is in No. 1 position (REMOTE) or No. 2 position (FM), the +12Vdc will be connected through a brown wire to one side of the stereo indicator lamp M261.

(10.2.1) M261 (Sylvania type 12ESB, NuTone Part No. 31813-000) is rated at 35-45 milliamps at 12 volts.

(10.3) The other side of M261 is connected, through a brown wire, to terminal (t) on the Multiplex Module, and then to Z261-10. Thus when Z261-10 is grounded as shown in paragraph (9) above, the lamp will be turned ON.

(11) R263 and C266 supply 39 microsecond de-emphasis to the left audio output signal at Z261-4.

(11.1) R265 and C267 supply 39 microsecond de-emphasis to the right audio output signal at Z261-4.

(12) The left audio output is fed through the 38 KHz. notch filter P1.

(12.1) The right audio output is fed through the 38 KHz. notch filter P2.

(13) Although the stereo decoder Z621 has excellent high-frequency rejection to the output, the 38 KHz. notch filters are used to protect high-frequency transducers (speakers, tweeters) by keeping the 38 KHz. out of the amplifiers; and pre-

vents harmonics from beating with the bias oscillator of tape recorders which may be used to record the entertainment program from Tape Output Jacks of the Master Unit.

(14) The left (Channel A) audio is fed from P1-3, through C273; (m); and an orange wire to terminal 3, front and rear, Section 1 of the Function Selector Switch.

(14.1) The right (Channel B) audio is fed from P2-3, through C272; (n); and an orange/white wire to terminal 3, front and rear, Section 3 of the Function Selector Switch.

(15) When the Function Selector Switch is in the FM (No. 3) position, the left channel audio will be fed through the Master Unit's Channel A pre-amplifier and power amplifier; and the right channel audio will be fed through the Master Unit's Channel B preamplifier and power amplifier.

(15.1) If the received f-m signal is monaural, the same monaural audio signal will be fed through both channels.

(16) The detected AM audio signal is fed from (k) on the AM Tuner Module, through a green wire, to (c) on the Multiplex Module, and then through R276; (b); and a white wire to terminal 2, front and rear, Sections 1 and 3 of the Function Selector Switch.

(16.1) When Function Selector Switch is in AM (No. 2) position, the a-m audio signals will be amplified through both Channel A and Channel B preamplifier and power amplifier.

## AM-FM REMOTE SWITCHING

(1) When the MUSICOM system includes the Model 2510 or Model N-2510 INTERCOM MASTER CONTROL, the entertainment program may be switched from AM to FM or from FM to AM at the 2510 (or N-2510) or at any of the remote Inside or Patio Speaker Controls.

(1.1) The Function Selector Switch must be in the REMOTE (No. 1) position.

(1.2) When in REMOTE/AM mode the entertainment program will be a preselected and tuned AM radio broadcast.

(1.3) When in REMOTE/FM mode, the entertainment program will be one of six preselected and tuned FM radio broadcasts.

(1.4) Remote FM Station selection is covered in the MUSICOM MASTER RECEIVER SERVICE MANUAL (Part No. 45880-1), pages 14-16.

(1.4.1) Remote AM-FM switching is covered on pages 20-23.

(1.5) Attention is called to the RELAY CONTROL PC BOARD SCHEMATIC DIAGRAM in the MODEL 2510 MASTER INTERCOM CONTROL SERVICE MANUAL (Part No. 45880-3).

(2) The left (Channel A) f-m audio signal from P1-3 is also connected through C271 to the base of Q261.

(2.1) The right (Channel B) f-m audio signal from P2-3 is also connected through C274 to the base of Q262.

(3) The a-m audio signal from R276 is also connected through C279 to the base of transistors Q263 and Q264.

(4) The emitters of Q261 and Q264 are both connected through R270 to ground.

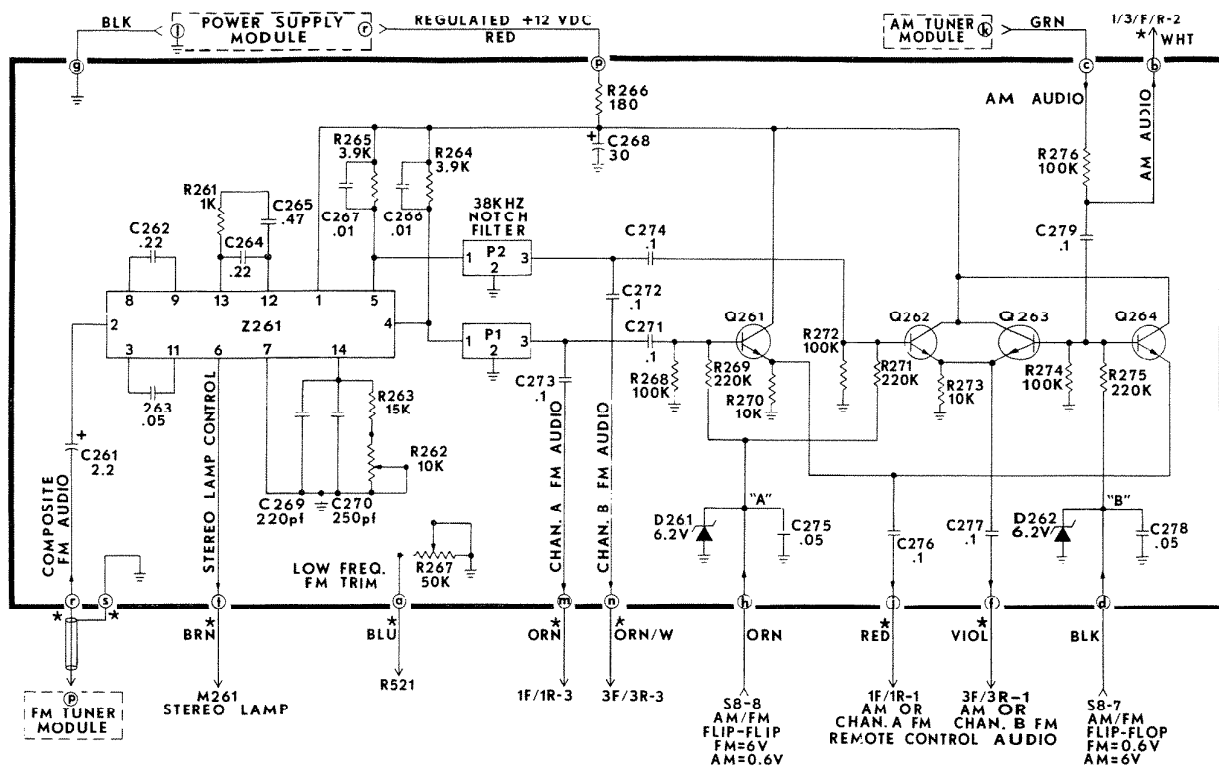
(4.1) When Q261 is ON, Q264 is OFF, and the current through R270 is the emitter follower current of Q261—Channel A FM Audio.

(4.2) When Q261 is OFF, Q264 is ON, and the current through R270 is the emitter follower current of Q264—Channel A AM Audio.

(5) The emitters of Q262 and Q263 are both connected through R273 to ground.

(5.1) When Q262 is ON, Q263 is OFF, and the current through R273 is the emitter follower current of Q262—Channel B FM Audio.

(5.2) When Q262 is OFF, Q263 is ON, and the current through R273 is the emitter follower current of Q263—Channel B AM Audio.



**NOTE:** The PC Modules are supplied with the wires, that are marked with an asterisk (\*), connected to the solder terminals indicated. The other interconnecting wires are supplied with, and connected to the other Modules and components so indicated.

### MULTIPLEX & SWITCHING CIRCUIT ASSEMBLY NO. 42107-000 SCHEMATIC DIAGRAM

(6) Although Q261-Q264 are emitter follower amplifiers with a gain approaching, but slightly less than unity; their primary function is as switches that control whether or not an AM or FM audio signal is fed to the Channel A and B preamplifiers and power amplifiers.

(7) Q261 and Q262 are turned ON at the same time; and thus Q263 and Q264 are turned OFF.

(7.1) Q263 and Q264 are turned ON at the same time; and thus Q261 and Q262 are turned OFF.

(8) OFF and ON switching of transistors Q261/Q262 and Q263/Q264 is controlled by a flip-flop (one-kick multivibrator circuit on the Relay Control PC Board in the Model 2510-B (or N-2510-B) Intercom Master Control Unit.

(8.1) Transistors TR608 and TR609 and their associated circuit components make up the flip-flop.

(8.2) The collector of TR608 is connected, through S8-8; and black wire, to (d) and Point B on the Multiplex Module.

(8.2.1) The collector of TR609 is connected, through S8-7; and orange wire, to (h) and Point A on the Multiplex Module.

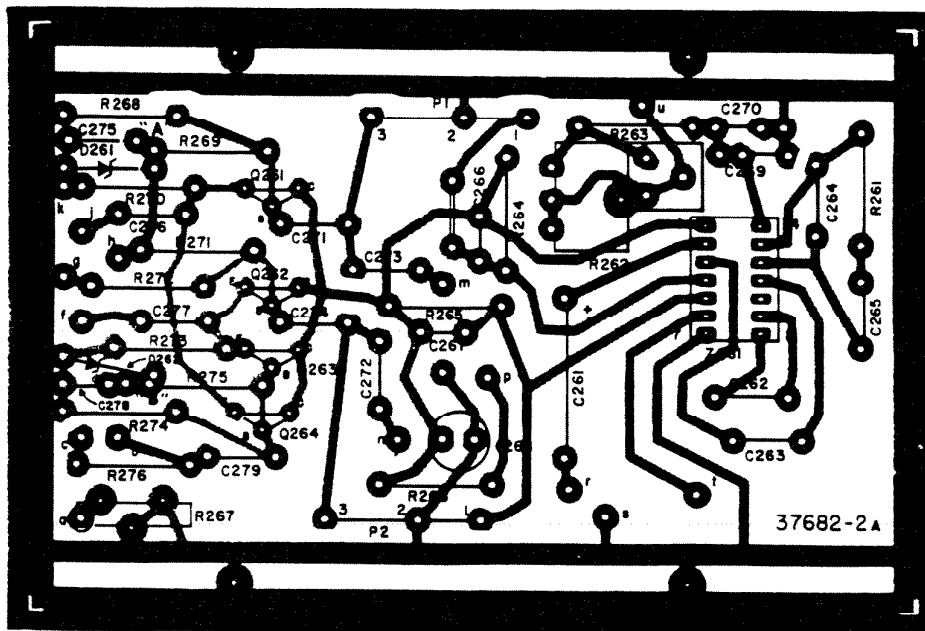
(8.3) When the MUSICOM Master Unit is first turned ON, one of the transistors (TR608 or TR609) will be turned ON (other transistor will be turned OFF).

(8.4) The two sections of the flip-flop circuit are symmetrical, but because of permissible manufacturing tolerances, the components will vary slightly. There will be a slight difference in the voltages applied to the transistors' elements and with the highly regenerative nature of this circuit, the voltage difference will cause one transistor to be turned ON and the other transistor to be turned OFF.

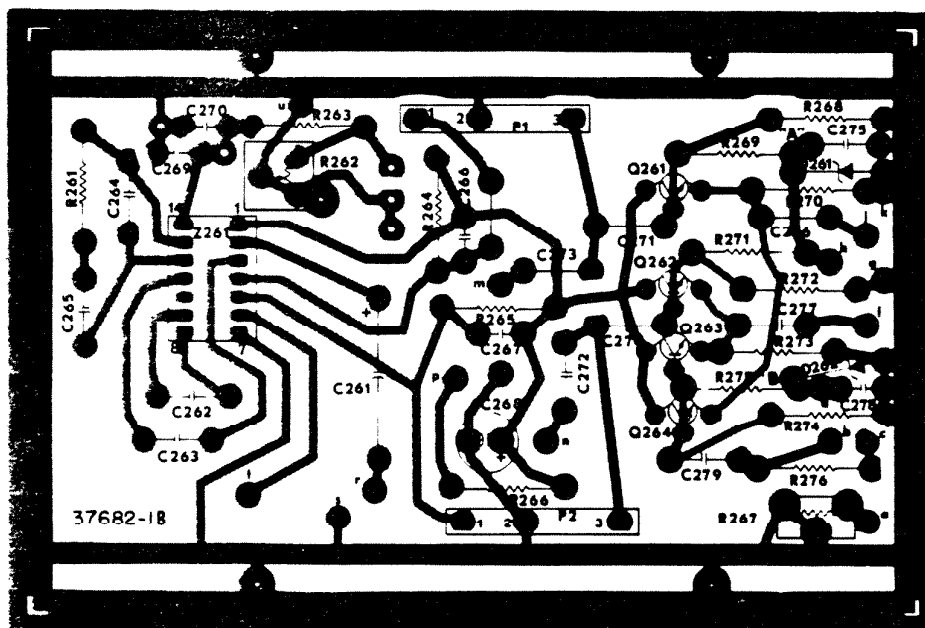
(8.5) The same transistor will be turned ON every time the Master Unit is turned ON, regardless of the flip-flop's state when the Master Unit was turned OFF.

(8.6) NOTE: If a transistor or other component in the flip-flop circuit is replaced, it may change which transistor (TR608 or TR609) is turned ON when power is applied to the Master Unit.

(8.7) The flip-flop outputs can be transposed by activating the AM/FM REMOTE SELECTOR SWITCH on the 2510-B (or N-2510-B) Intercom Master Control Unit or at a remote Inside/Patio Speaker Control.



TOP VIEW: COMPONENT LOCATION



BOTTOM VIEW: PC PATH/COMPONENT LOCATION  
MULTIPLEX & SWITCHING MODULE

(9) **FM MODE:** When TR608 is turned ON, its collector is LOW, and Point B on the Multiplex Module is LOW (approximately 0.6V).

(9.1) When TR608 is ON, TR609 is OFF and its collector is HIGH, and Point A on the Multiplex Module is HIGH (regulated to 6.0V by Zener diode D261).

(9.2) When Point A is at 6.0V, Q261 is forward biased through R220, and the left f-m audio signals are amplified through Q261, and its output connected from the high-side of R270, through C276; (i); and red wire to terminal 1 front and rear, Section 1 of the Function Selector Switch, and if switch is in REMOTE (No. 1) position, these left audio signals will be amplified through the Channel A preamplifier and power amplifier.

(9.2.1) At the same time Q263 and Q264 are held OFF by the LOW at Point B, and the a-m audio signals are not amplified, i.e. they are switched OFF.

(9.3) When Point A is at 6.0V, Q262 is also forward biased through R271, and the right f-m audio signals are amplified through Q262, and its output connected from the high-side of R273, through C277; (f); and violet wire, to terminal 1, front and rear, section 3 of the Function Selector Switch, and if switch is in REMOTE (No. 1) position, these right audio signals will be amplified through the Channel B preamplifier and power amplifier.

(10) **AM MODE:** When TR609 is turned ON, its collector is LOW, and point A on the Multiplex Module is LOW (approximately 0.6V).

(10.1) When TR609 is ON: TR608 is OFF and its collector is HIGH, and Point B on the Multiplex Module is HIGH (regulated to 6.0V by Zener diode D262).

(10.2) When Point B is at 6.0V, Q263 and Q264 are forward biased through R275.

(10.3) When Q264 is forward biased, it will amplify the a-m audio signals, and its output will be connected from the high-side of R270, through C276; (j); and red wire, to terminal 1, front and rear, section 1 of the Function Selector Switch, and if

switch is in REMOTE (No. 1) position, these a-m audio signals will be amplified through the Channel A preamplifier and power amplifier.

(10.4) When Q263 is forward biased, it will amplify the a-m audio signals, and its output will be connected from the high-side of R273, through C277; (i); and violet wire, to terminal 1, front and rear, section 1 of the Function Selector Switch, and if switch is in REMOTE (No. 1) position, these a-m audio signals will be amplified through the Channel B preamplifier and power amplifier.

(10.4.1) At the same time, Q261 and Q262 are held OFF by the LOW at Point A, and the left and right f-m audio signals are not amplified, i.e. they are switched OFF.

(11) If the Function Selector Switch is in any position other than REMOTE, and the AM/FM REMOTE SELECTOR SWITCH, at the 2510-b (or N-2510-B) or at one of the Inside/Patio Speakers, is activated, the flip-flop will change state and the program to terminal 1 of the Function Selector Switches will be changed, but this will have no effect on the program that is being amplified through the Channel A and B preamplifiers and power amplifiers.

**NOTE: Although the 50K ohm rheostat R267 is mounted on the Multiplex & Switching Module PC Board, it is not used in the multiplex decoding nor in the switching functions. It is connected in series with the FM RF and Oscillator Master Tuning Control Potentiometer R170; and it is used as the low-frequency trimmer when aligning the FM Tuner Module. (See FM ALIGNMENT, page 47, MUSICOM Master Receiver Service Manual, Part No. 45880-1.)**

**REPLACEMENT PARTS LIST**  
**MODEL 2500/2600 MUSICOM SERIES**  
**MULTIPLEX & SWITCHING MODULE**  
**(LATER PRODUCTION UNITS)**

RESISTORS: Value in Ohms  $\pm 10\%$ ,  $\frac{1}{2}$  Watt, Carbon Composition, unless otherwise noted.  
 K = Kilo =  $10^3$

CAPACITORS: Value in micro ( $10^{-6}$ ) Farads  $\pm 20\%$ , 100V, Ceramic Disc, unless otherwise noted.  
 p = pico =  $10^{-12}$

Schematic Symbol	NuTone Part No.	Description
	42107-000	Complete Module PC Assembly
	37682-000	PC Board, only
	31146-038	Screw, #6-32 x $\frac{1}{4}$ " Slotted Hex Hd: PC Assembly to Chassis Mounting
<b>CAPACITORS</b>		
C261	35068-106	2.2, $+100\%$ , $-10\%$ , 50WVDC, Electrolytic
C262, C264 C263, C275 C278	35055-104	.22 $\pm 20\%$ , Polyester Film
C265	35100-146	.05 $\pm 20\%$ , 50V
C266, C267 C268	35055-101 35100-139 35091-104	.47 $\pm 20\%$ , Polyester Film .01 $\pm 20\%$ 33, $+100\%$ , $-10\%$ , 25 WVDC, Electrolytic
C269	35101-149	220pF
C270 C271-C274, C276, C277, C279	35101-160 35100-127	250PF $\pm 5\%$ .1, $+80\%$ , $-20\%$
<b>DIODES</b>		
D261, D262	36594-000	Silicon Zener, 6.2V $\pm 10\%$ Type 1N5234A
<b>FILTERS</b>		
P1, P2	37582-000	38 KHz. Notch, Ratio 38KHz/1KHz = $-35\text{db}$ (minimum) Centralab #ES6-1185

Schematic Symbol	NuTone Part No.	Description
<b>TRANSISTORS</b>		
Q261-Q264	36580-000	NPN Planar Silicon, Low-Noise, Texas Instruments SKA-4220 Motorola SPS-1218 National Semiconductor SMO-7329
<b>RESISTORS</b>		
R261	33101-102	1K
R262	34072-000	10K $\pm 20\%$ , Cermet type Rheostat, Multiplex Decoder 19 KHz. adjustment CTS Type 362U
	34077-000 (Alternate)	10K $\pm 30\%$ Centralab TSalBB103C
R263	33101-153	15K
R264, R265	33101-392	3.9K
R266	33101-181	180
R267	34041-000	50K $\pm 30\%$ , 1/10 Watt CTS Corp Type X-201
R268, R272 R274, R276 R269, R271	33101-104	100K
R275	33101-224	220K
R270, R273	33101-103	10K
<b>INTEGRATED CIRCUIT</b>		
Z261	36668-000	FM Multiplex Decoder, Linear Integrated Circuit Motorola MC1310P RCA CA1310E National Semiconductor LM1310/LM1310E
	39501-000	Socket, 14-pin IC type for Z261