Circuit for Evaluation of Custom Vocabulary EPROM Prototype Set

National Semiconductor
Linear Brief 54
Fred Wickersham

EPROM PROTOTYPE

In the process of developing a product with a "custom" generated vocabulary, it may be necessary to develop special circuitry for listening to and evaluating your prototype synthesized vocabulary prior to committing to read only memory (ROM) production.

The prototype set will normally be supplied by National Semiconductor in the form of 2716 EPROM (Intel pinout) sets. The SPC (speech processor chip, part number MM54104) communication with EPROM sets *does* require some external hardware considerations which may not be necessary in the final ROM application, especially in multiple EPROM-equivalent ROM situations. (For example, four 16k-bit 2716 EPROMs equal one 64k-bit ROM.)

Shown on next page is a recommended circuit which shows proper interface between 2716 EPROMs and the SPC. The circuit covers vocabularies from the minimum system of one 2716 (16k bits) to larger vocabularies of eight 2716s (128k bits). It is also true, that in an application requiring only one 2716, the MM74LS138 decoder device can be eliminated by connecting pin 20 of the 2716 to V_{SS} (ground). The remaining unused pins 36, 37 and 38 of the SPC can be left unconnected in this case.

UNUSED SPEC INPUTS

In any DIGITALKER™ design, an applications suggestion is in the area of unused input pins of the SPC. It should be understood that the number of different expressions and coincident addresses, as designated by the custom vocabulary, determines how many of the SW word address pins (pins 8–15) on the SPC are utilized. Vocabularies of less than 128 addresses will not use SW 8; vocabularies of less than 64 addresses will not use SW 7 or SW 8, and etc. These unused SW pins must be tied to V_{SS} (ground) to simplify the application. In fact, *any* unused *input* to the SPC must be tied to V_{SS}.

FILTERING

Use of the DIGITALKER is quite straightforward, however, a point on application that must be covered in this brief concerns the frequency response of the output speech. The ultimate quality of the DIGITALKER will strongly depend upon the filter, amplifier and speaker choices made by the user. For that reason, it is important to understand the output characteristics of the device.

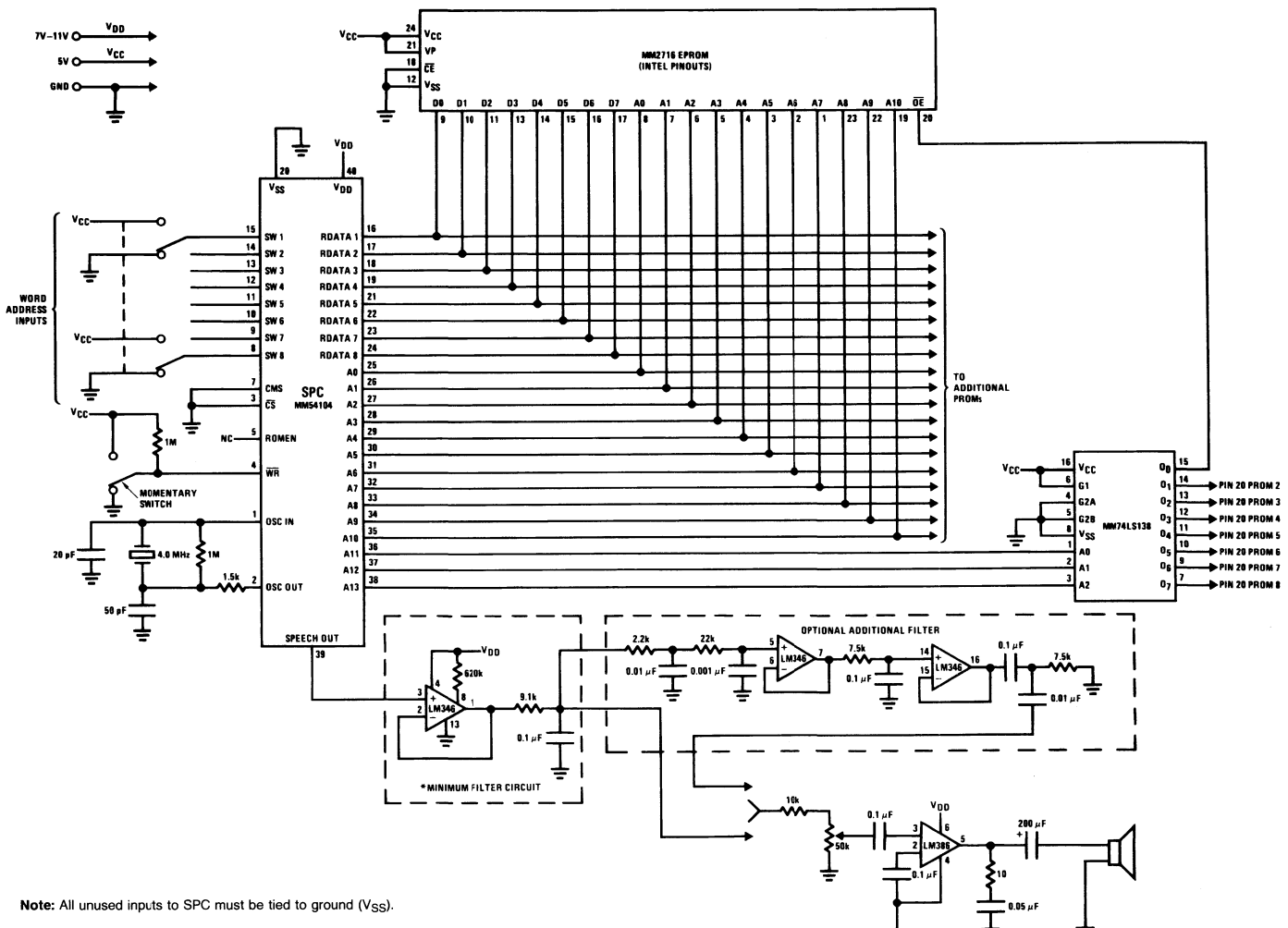
Because the synthesized speech data is derived from a differentiated and sampled input signal, it is necessary to pass the output waveform of the MM54104 through a low-pass filter with a cutoff frequency of approximately 200 Hz and an attenuation characteristic of 20 dB/decade. This compensates for the high frequency pre-emphasis used in the synthesis technique. If the system of interest has a natural roll-off near 200 Hz, this low-pass filter can be eliminated. The important item is that the entire audio system should have a cutoff frequency of approximately 200 Hz. The placement of the cutoff frequency may be adjusted for the particular type of voice being synthesized. A low pitched man's voice might sound better with a 100 Hz cutoff point while women's and children's voices may show improvements with a 300 Hz cutoff.

As an example of how the overall frequency response of a particular application can mimimize the need for extra filtering, consider the DIGITALKER as a voice announcement circuit in a telephone system.

In this case, the telephone network provides a natural attenuation to high frequencies that balances the SPC high frequency pre-emphasis. As a result, the low-pass filter previously mentioned can be eliminated. However, because signal frequencies above 3 kHz must be attenuated before they are allowed to pass into the telephone network, a cut-off filter of 3400 Hz may be required in place of the previously mentioned 200 Hz low-pass filter. A good filter for this application is the National Semiconductor AF133 active filter.

In addiltion to the 200 Hz to 3400 Hz low-pass filter, an extra stage of low-pass filtering can be used for frequencies above 7 kHz. This filter is optional and is normally only used to further reduce sampling noise. Most systems can omit this filter, especially if the overall system bandwidth is not very wide. A second optional filter can be included to limit the overall low frequency response of the system. This high-pass filter would normally cutoff below 200 Hz (adjusted to match the 200 Hz low-pass if provided). This high-pass filter limits low frequency noise, and can usually be omitted if system characteristics do not require this function.

Recommended Circuit for Evaluating up to 8 Custom Encoded EPROMs (2716)



Note: All unused inputs to SPC must be tied to ground (V_{SS}).

TL/H/8738–1

*Recommended filter requirements. See text and MM54104 data sheet for complete filter application suggestions.