AMERICAN AND EUROPEAN FONTS IN STANDARD CHARACTER GENERATORS

Ten popular American and European 64-character subsets for displays and printers are now available from National as single-chip, standard character generators. These parts, listed in Table 1, are sold off-the-shelf without a ROM masking charge.

The ROMs are static, bipolar-compatible types, operating without clocks on standard power supplies. Row and column access times are typically 450 and 700 ns respectively. An MM4240/MM5240 2560-bit ROM is used for the 5 x 7 horizontal-scan fonts and an MM4241/MM5241 3072-bit ROM for the 7 x 5 vertical-scan fonts. The MM4240 and MM4241 operate at −55°C to +125°C and the MM5240 and MM5241 at −25°C to +70°C.

Input-output configurations and character formats for the ROMs are shown in Figures 1 and 2. Application Note *AN-40 The Systems Approach to Character Generators* gives examples of line and column address-control logic, and CRT and printer operating techniques.

TYPE NUMBER	CODE	64-CHARACTER SUBSET	FIGURE
Horizontal Scan (5 x 7)			
MM4240AA/MM5240AA	ASCII	Upper-case alphanumeric	3
MM4240AE/MM5240AE	ASCII	Lower-case alpha and symbols	4
MM4240ABU/MM5240ABU	Hollerith	Upper-case alphanumeric	5
MM4240ABZ/MM5240ABZ	EBCDIC-8	Upper-case alphanumeric	6
MM4240ACA/MM5240ACA	EBCDIC	Upper-case alphanumeric (IBM)	7
Vertical Scan (7 x 5)			
MM4241ABL/MM5241ABL	ASCII	Upper-case alphanumeric	8
MM4241ABV/MM5241ABV	ECMA	Upper-case A/N, Scandinavian	9
MM4241ABW/MM5241ABW	ECMA	Upper-case A/N, German	10
MM4241ABX/MM5241ABX	ECMA	Upper-case A/N, general European (French, British, Italian)	11
MM4241ABY/MM5241ABY	ECMA	Upper-case A/N, Spanish	12

TABLE 1. Single-Chip, Standard Horizontal-Scan and Vertical-Scan Character Generators

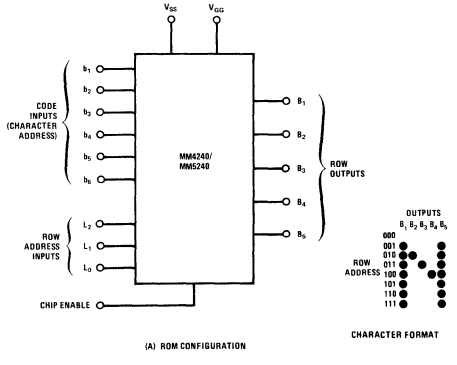

FIGURE 1. Horizontal-Scan Character Generator ROM

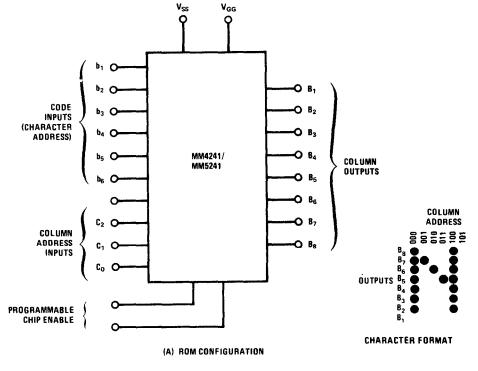

FIGURE 2. Vertical-Scan Character Generator ROM

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Note that each ROM has a chip-enable input to permit multi-ROM operation with common control logic. For instance, two horizontal-scan ASCII character generators may be operated in tandem to obtain upper and lower-case characters. In this case, chip-enable would be controlled with bit b_6 of the normal 7-bit ASCII code, and its complement, $\overline{b_6}$.

HORIZONTAL SCAN FONTS

The subsets of 64 5 x 7 characters in the horizontal-scan fonts are the ones most commonly used in low-cost TV and CRT raster-scan displays and dot-matrix line printers.

MM4240AA/MM5240AA contains the ASCII-6 preferred graphic subset, formed from ASCII-7 by ignoring bit b_6. The remaining six bits form two octal address characters. One is formed by the three more significant bits, b_7, b_5 and b_4, and the second by b_3, b_2 and b_1.

Also, characters 36 and 37 in ASCII (x3.4 1968)* are respectively a carat (or circumflex), and an underscore. These are awkward in a video display, so they are replaced by the more useful arrows. (The arrows are related to characters in an older teletypewriter set.) This font, shown in Figure 3, is also described on the MM4240/MM5240 data sheet (which should be referred to for operating characteristics of all the horizontal-scan character generators).

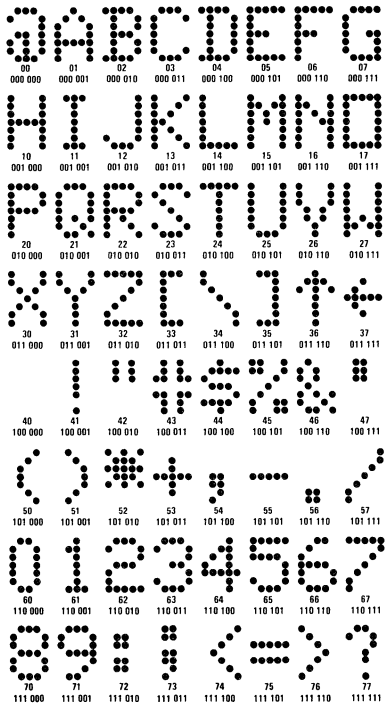

FIGURE 3. MM4240AA/MM5240AA Horizontal-Scan ASCII-7 Graphic Subset

MM4240AE/MM5240AE generates unique symbols describing the ASCII-7 control codes, as well as lower-case letters (Figure 4). The designer may not wish to display or dot-print the symbols. Since the symbols are generated only when the most significant address bit is logic "0", this bit line may be used to disable the chip, and blank the screen when control signals are transmitted. If not, the system designer can use the symbols as he likes.

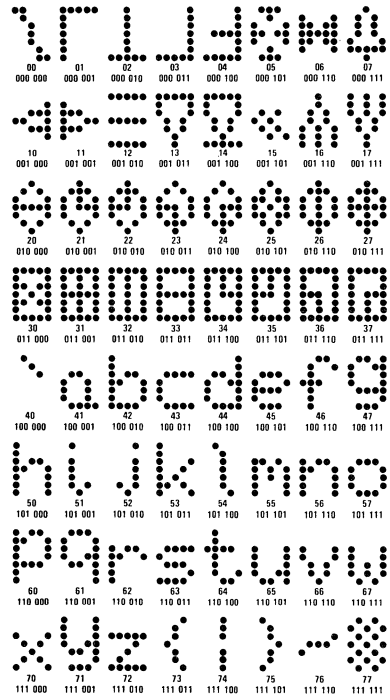

FIGURE 4. MM4240AE/MM5240AE Horizontal-Scan ASCII-7 Lower-Case Graphic and Control Symbol Subset

The Hollerith character subset in Figure 5b is formed by using six gates to compress the 12-line Hollerith code to the 6-bit address for 64 characters, as shown in Figure 5a

As shown in Figure 6, an ASCII-compatible subset is provided by the EBCDIC-8 character generator (MM4240ABZ/MM5240ABZ) by simply ignoring the two most significant bits, b_0 and b_1, in the EBCDIC-8 code. The ABZ version follows the ANSI standard, while the ACA version follows the IBM style. A cent sign, and IBM's logical OR and logic NOT signs are given by the ACA subset (characters 12, 17, and 37). And a plus or minus sign is provided, as character 52. (See Figure 7.)

*American National Standards Institute (ANSI)

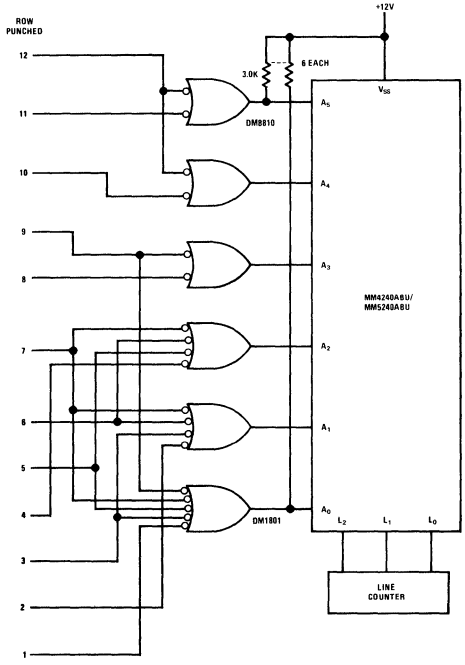

FIGURE 5a. MM4240ABU/MM5240ABU Typical Address Inputs

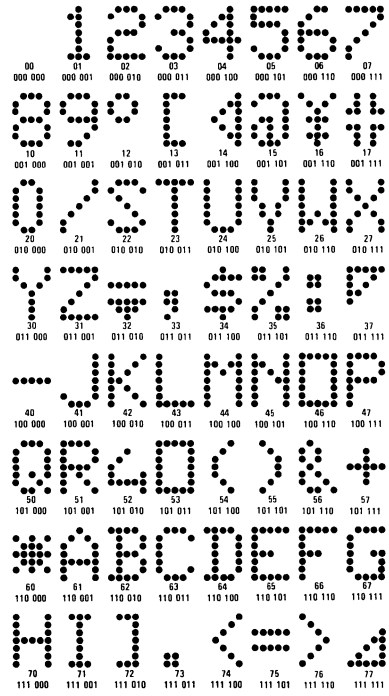

FIGURE 5b. MM4240ABU/MM5240ABU Horizontal Scan Hollerith Graphics Subset

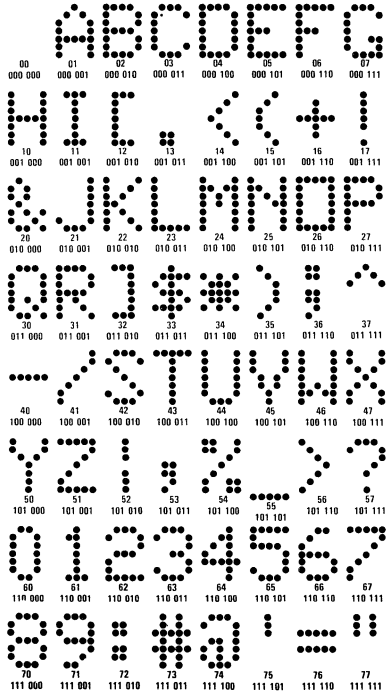

FIGURE 6. MM4240BABZ/MM5240BABZ Horizontal-Scan EBCDIC-8 Graphic Subset

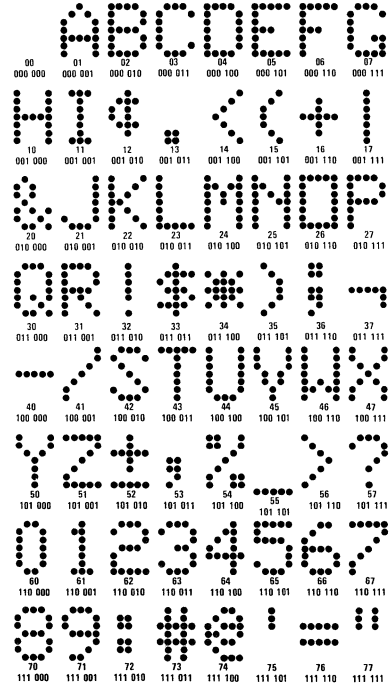

FIGURE 7. MM4240ACA/MM5240ACA Horizontal-Scan IBM EBCDIC Graphic Subset

VERTICAL SCAN FONTS

All five of the standard vertical-scan subsets in Figures 8 through 12 are generated with 6-bit codes derived from code recommendations R646 of the International Organization for Standardization. These recommendations cover ASCII-7, European ECMA-7 and CCITT alphabet number 5.

The ASCII subset for American use, in Figure 8, is practically identical to the horizontal-scan subset. Those in Figures 9 through 12 follow preferred character styles in the countries indicated. The underscore (character 37) is dropped below the line so that it may be used as a cursor.

Vertical-scan character generators are generally used in dot-matrix tape printers, ink-dot spray printers and high-definition sawtooth or pedestal-scan CRT displays. They may also be used to control raster-scan TV tubes or CRTs if the tube is turned on its side so that the raster scan is made vertically to provide a page-like format.

With standard programming, the bits in the column outputs are sequenced for a sawtooth scan with dot columns running in the same direction, as illustrated in Figure 13a. For a pedestal scan, Figure 13b, alternate columns can be reversed by putting an 8-bit shift left/shift right TTL shift register (DM74198) on the output as illustrated in Figure 14.

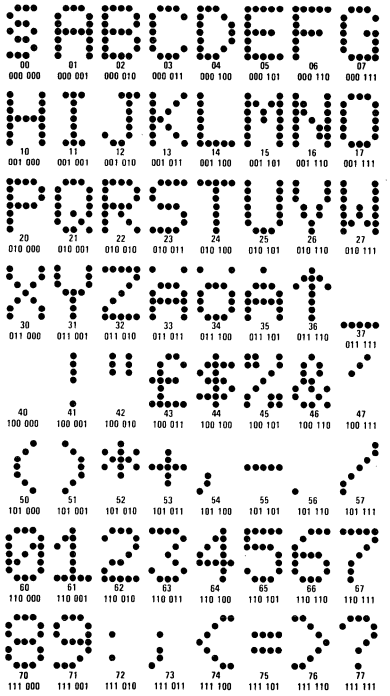

FIGURE 9. MM4241ABV/MM5241ABV Vertical Scan ECMA-7 Font for Scandinavian Use

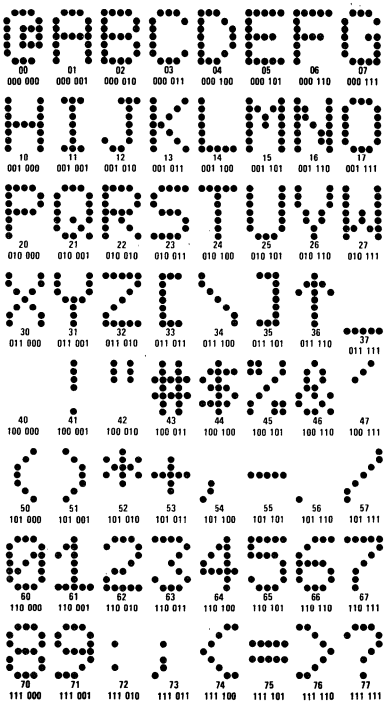

FIGURE 8. MM4241ABL/MM5241ABL Vertical-Scan ASCII-7 Graphic Subset

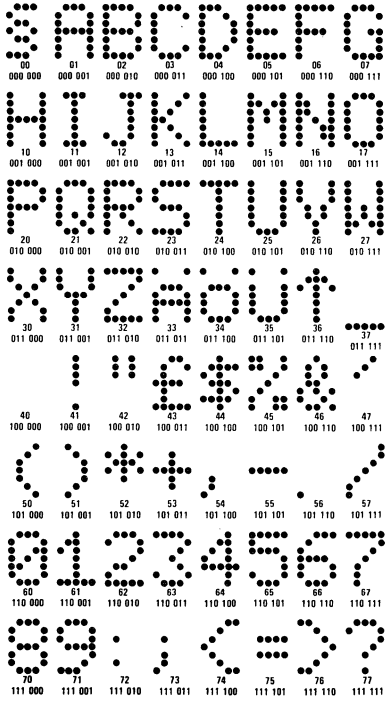

FIGURE 10. MM4241ABW/MM5241ABW Vertical-Scan ECMA-7 Font for German Use

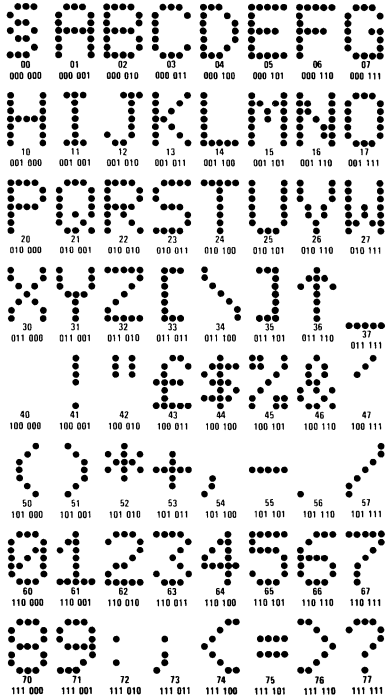

FIGURE 11. MM4241ABX/MM5241ABX Vertical-Scan ECMA-7 Font for General European Use (French, British, Italian)

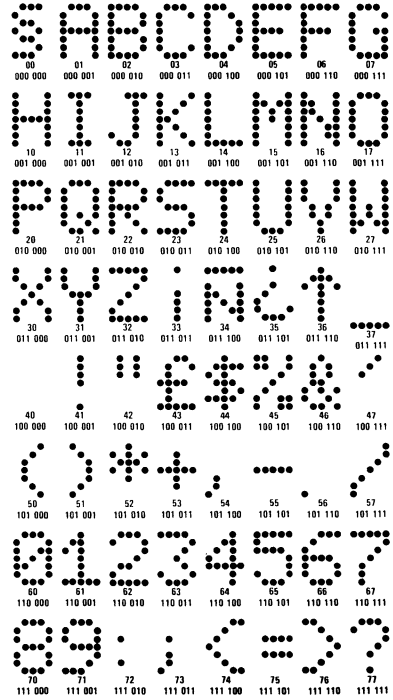

FIGURE 12. MM4241ABY/MM5241ABY Vertical-Scan ECMA-7 Font for Spanish Use

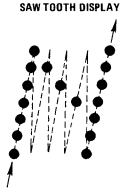

FIGURE 13a. Sawtooth Vertical Scan

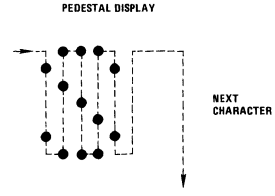

FIGURE 13b. Pedestal Vertical Scan

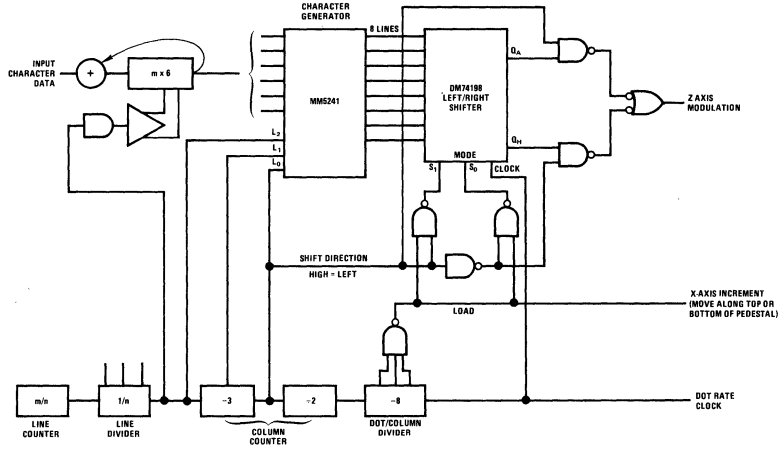

FIGURE 14. Conversion of Sawtooth Output to Pedestal Scan

CUSTOM FONTS

The two ROMs can also be custom-programmed to provide special characters, or fonts larger than 5 x 7. The MM4240/MM5240 actually stores 64 5 x 8 characters or character segments and the MM4241/MM5241 stores 64 8 x 6 characters or segments. They are not limited to 5 x 7 and 7 x 5. For example, the extra height may be used in an otherwise 5 x 7 font to drop the tails of commas, semicolons and lower-case letters below the bottom line of the capital letters. Fonts as large as 16 x 12 are entirely practical without additional control logic, using the chip-enable feature of four MM5241s. Large-font organizations are discussed in AN-40.