

**384-OUTPUT TFT-LCD SOURCE DRIVER  
(COMPATIBLE WITH 256-GRAY SCALES)****DESCRIPTION**

The  $\mu$ PD16750 is a source driver for TFT-LCDs capable of dealing with displays with 256-gray scales. Data input is based on digital input configured as 8 bits by 6 dots (2 pixels), which can realize a full-color display of 16,777,216 colors by output of 256 values  $\gamma$ -corrected by an internal D/A converter and 8-by-2 external power modules. Because the output dynamic range is as large as  $V_{DD2} - 0.2$  V to  $V_{SS2} + 0.2$  V, level inversion operation of the LCD's common electrode is rendered unnecessary. Also, to be able to deal with dot-line inversion, n-line inversion and column line inversion when mounted on a single side, this source driver is equipped with a built-in 8-bit D/A converter circuit whose odd output pins and even output pins respectively output gray scale voltages of differing polarity. Assuring a maximum clock frequency of 40 MHz when driving at 3.0 V, this driver is applicable to XGA-standard TFT-LCD panels and SXGA TFT-LCD panels. This driver is applicable to SXGA TFT-LCD panels by input display signal 2 systems (Clock divide).

**FEATURES**

- CMOS level input
- 384 outputs
- Input of 8 bits (gradation data) by 6 dots
- Capable of outputting 256 values by means of 8-by-2 external power modules (16 units) and a D/A converter
- Output dynamic range:  $V_{DD2} - 0.2$  V to  $V_{SS2} + 0.2$  V
- High-speed data transfer:  $f_{CLK} = 40$  MHz (internal data transfer speed when operating at 3.0 V)
- Apply for dot-line inversion, n-line inversion and column line inversion
- Output voltage polarity inversion function (POL)
- Display data inversion function (POL21/22)
- Logic power supply voltage ( $V_{DD1}$ ) : 3.3 V  $\pm$  0.3 V
- Driver power supply voltage ( $V_{DD2}$ ) : 9.0 V  $\pm$  0.5 V
- Low power control function (LPC)

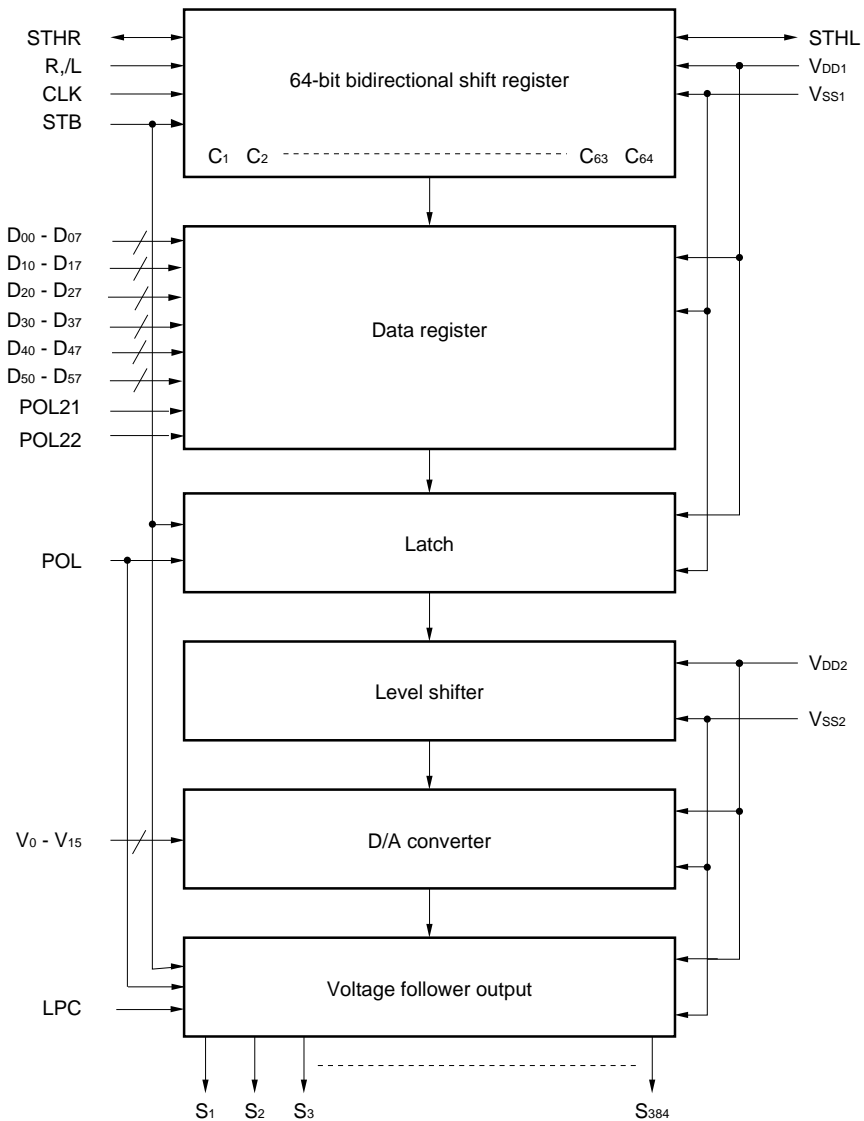
**ORDERING INFORMATION**

| Part Number        | Package           |
|--------------------|-------------------|
| $\mu$ PD16750N-xxx | TCP (TAB package) |

**Remark** The TCP's external shape is customized. To order the required shape, please contact one of our sales representatives.

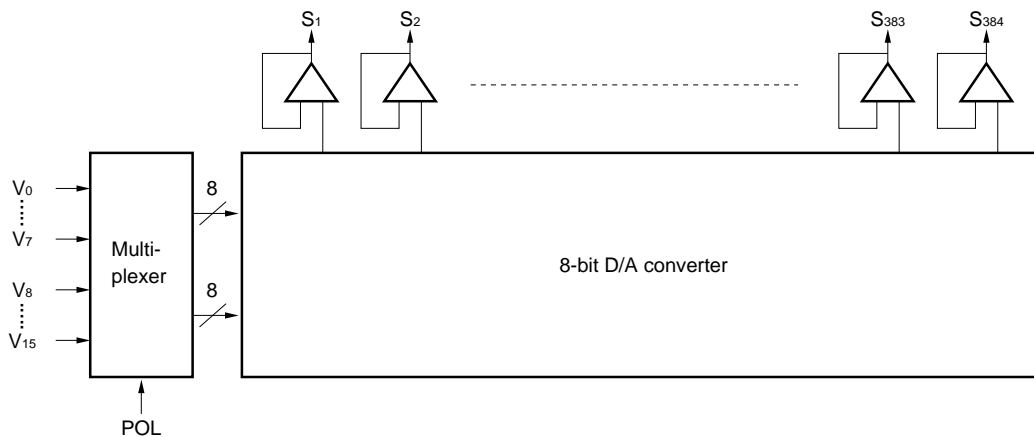
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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

1. BLOCK DIAGRAM

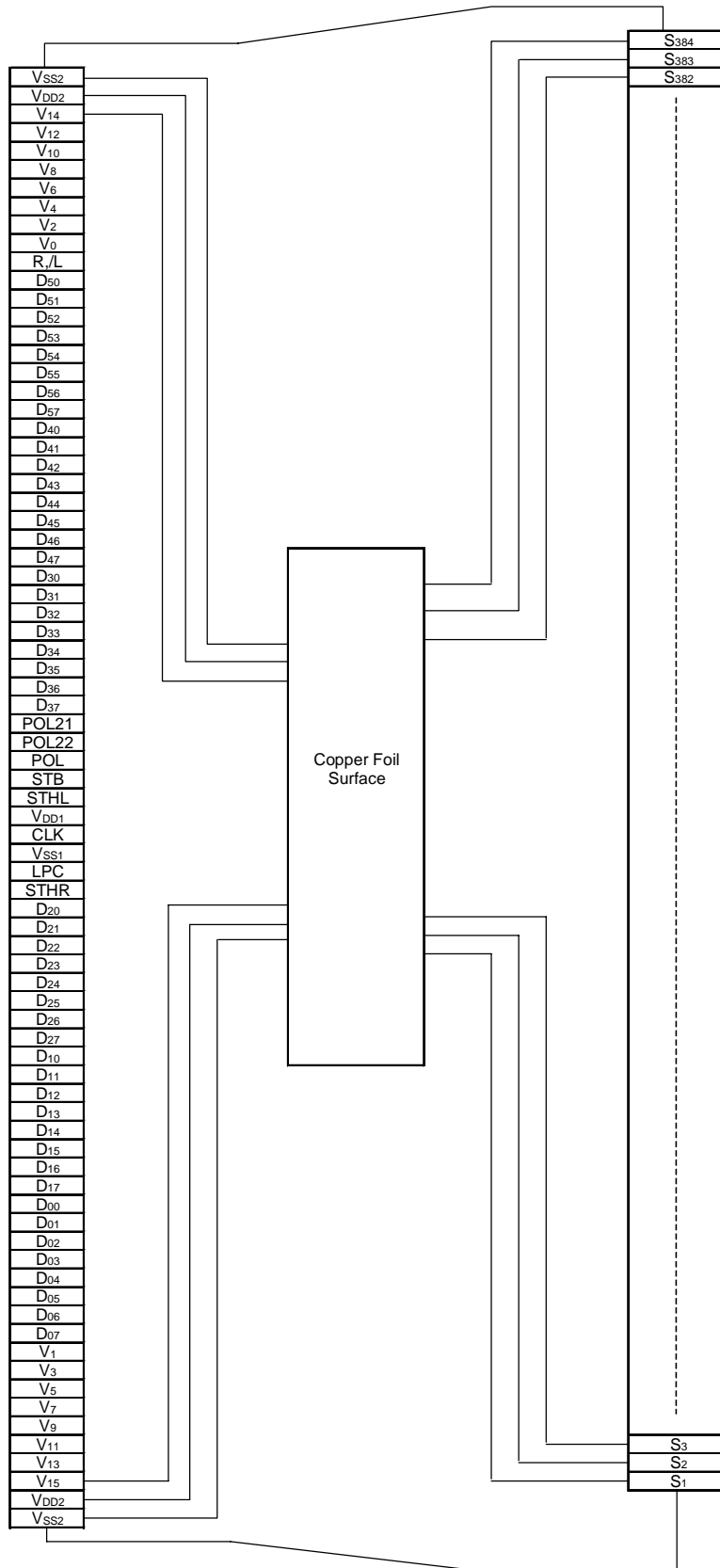


**Remark** /xxx indicates active low signal.

2. RELATIONSHIP BETWEEN OUTPUT CIRCUIT AND D/A CONVERTER



3. PIN CONFIGURATION (μPD16750N-xxx)



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**Remark** This figure does not specify the TCP package.

4. PIN FUNCTIONS

| Pin Symbol                         | Pin Name                             | Description   |
|------------------------------------|--------------------------------------|---|
| S <sub>1</sub> to S <sub>384</sub> | Driver output                        | The D/A converted 256-gray-scale analog voltage is output.  |
| D <sub>00</sub> to D <sub>07</sub> | Display data input                   | The display data is input with a width of 48 bits, viz., the gray scale data (8 bits) by 6 dots (2 pixels).<br>D <sub>x0</sub> : LSB, D <sub>x7</sub> : MSB   |
| D <sub>10</sub> to D <sub>17</sub> |                                      |   |
| D <sub>20</sub> to D <sub>27</sub> |                                      |   |
| D <sub>30</sub> to D <sub>37</sub> |                                      |   |
| D <sub>40</sub> to D <sub>47</sub> |                                      |   |
| D <sub>50</sub> to D <sub>57</sub> |                                      |   |
| R,/L                               | Shift direction control input        | These refer to the start pulse input/output pins when driver ICs are connected in cascade.<br>The shift directions of the shift registers are as follows.<br>R,/L = H : STHR input, S <sub>1</sub> → S <sub>384</sub> , STHL output<br>R,/L = L : STHL input, S <sub>384</sub> → S <sub>1</sub> , STHR output   |
| STHR                               | Right shift start pulse input/output | R,/L = H : Becomes the start pulse input pin.<br>R,/L = L : Becomes the start pulse output pin.   |
| STHL                               | Left shift start pulse input/output  | R,/L = H : Becomes the start pulse output pin.<br>R,/L = L : Becomes the start pulse input pin.   |
| CLK                                | Shift clock input                    | Refers to the shift register's shift clock input. The display data is incorporated into the data register at the rising edge of the 64th clock after the start pulse input, the start pulse output reaches the high level, thus becoming the start pulse of the next-level driver.  |
| STB                                | Latch input                          | The contents of the data register are transferred to the latch circuit at the rising edge. And, at the falling edge, the gray scale voltage is supplied to the driver. It is necessary to ensure input of one pulse per horizontal period.  |
| POL                                | Polarity input                       | POL = L : The S <sub>2n-1</sub> output uses V <sub>0</sub> to V <sub>7</sub> as the reference supply. The S <sub>2n</sub> output uses V <sub>8</sub> to V <sub>15</sub> as the reference supply.<br>POL = H : The S <sub>2n-1</sub> output uses V <sub>8</sub> to V <sub>15</sub> as the reference supply. The S <sub>2n</sub> output uses V <sub>0</sub> to V <sub>7</sub> as the reference supply.<br>S <sub>2n-1</sub> indicates the odd output: and S <sub>2n</sub> indicates the even output. Input of the POL signal is allowed the setup time(t <sub>POL-STB</sub> ) with respect to STB's rising edge.  |
| POL21<br>POL22                     | Data inversion                       | Data inversion can invert when display data is loaded.<br>POL21/22 = H : Data inversion loads display data after inverting it.<br>POL21/22 = L : Data inversion does not invert input data.<br>POL21: D <sub>00</sub> to D <sub>07</sub> , D <sub>10</sub> to D <sub>17</sub> , D <sub>20</sub> to D <sub>27</sub><br>POL22: D <sub>30</sub> to D <sub>37</sub> , D <sub>40</sub> to D <sub>47</sub> , D <sub>50</sub> to D <sub>57</sub>   |
| LPC                                | Low power control input              | The output buffer constant current source is blocked, reducing current consumption. In lower power mode (LPC = L: DC-level input possible), the ordinary static current consumption can be reduced by approx. 33 %.   |
| V <sub>0</sub> to V <sub>15</sub>  | γ-corrected power supplies           | Input the γ-corrected power supplies from outside by using operational amplifier. Make sure to maintain the following relationships. During the gray scale voltage output, be sure to keep the gray scale level power supply at a constant level.<br>V <sub>DD2</sub> - 0.2 V > V <sub>0</sub> > V <sub>1</sub> > V <sub>2</sub> > V <sub>3</sub> > V <sub>4</sub> > V <sub>5</sub> > V <sub>6</sub> > V <sub>7</sub> > 0.5 V <sub>DD2</sub><br>0.5 V <sub>DD2</sub> - 0.3 V > V <sub>8</sub> > V <sub>9</sub> > V <sub>10</sub> > V <sub>11</sub> > V <sub>12</sub> > V <sub>13</sub> > V <sub>14</sub> > V <sub>15</sub> > V <sub>SS2</sub> + 0.2 V |
| V <sub>DD1</sub>                   | Logic power supply                   | 3.3 V ± 0.3 V   |
| V <sub>DD2</sub>                   | Driver power supply                  | 9.0 V ± 0.5 V   |
| V <sub>SS1</sub>                   | Logic ground                         | Grounding   |
| V <sub>SS2</sub>                   | Driver ground                        | Grounding   |

- Cautions**
1. The power start sequence must be  $V_{DD1}$ , logic input, and  $V_{DD2}$  &  $V_0$  to  $V_{15}$  in that order. Reverse this sequence to shut down (Simultaneous power application to  $V_{DD2}$  and  $V_0$  to  $V_{15}$  is possible.).
  2. To stabilize the supply voltage, please be sure to insert a 0.1- $\mu$ F bypass capacitor between  $V_{DD1}$ - $V_{SS1}$  and  $V_{DD2}$ - $V_{SS2}$ . Furthermore, for increased precision of the D/A converter, insertion of a bypass capacitor of about 0.01  $\mu$ F is also advised between the  $\gamma$ -corrected power supply terminals ( $V_0, V_1, V_2, \dots, V_{15}$ ) and  $V_{SS2}$ .

5. RELATIONSHIP BETWEEN INPUT DATA AND OUTPUT VOLTAGE VALUE

This product incorporates a 8-bit D/A converter whose odd output pins and even output pins output respectively gray scale voltages of differing polarity with respect to the LCD's counter electrode (common electrode) voltage. The D/A converter consists of ladder resistors.

Figure 5-1 shows the relationship between the driving voltages such as liquid-crystal driving voltages  $V_{DD2}$  and  $V_{SS2}$ , common electrode potential  $V_{COM}$ , and  $\gamma$ -corrected voltages  $V_0$  to  $V_{15}$  and the input data. Be sure to maintain the voltage relationships of

$$V_{DD2} - 0.2\text{ V} > V_0 > V_1 > V_2 > V_3 > V_4 > V_5 > V_6 > V_7 > 0.5 V_{DD2},$$

$$0.5 V_{DD2} - 0.3\text{ V} > V_8 > V_9 > V_{10} > V_{11} > V_{12} > V_{13} > V_{14} > V_{15} > V_{SS2} + 0.2\text{ V}$$

Figures 5-2 and 5-3 show the relationship between the input data and the output voltage. This driver IC is designed for only single-sided mounting. Therefore, please do not use it for  $\gamma$ -corrected power supply level inversion in double-sided mounting.

Figure 5-1. Relationship between Input Data and  $\gamma$ -corrected Power Supplies

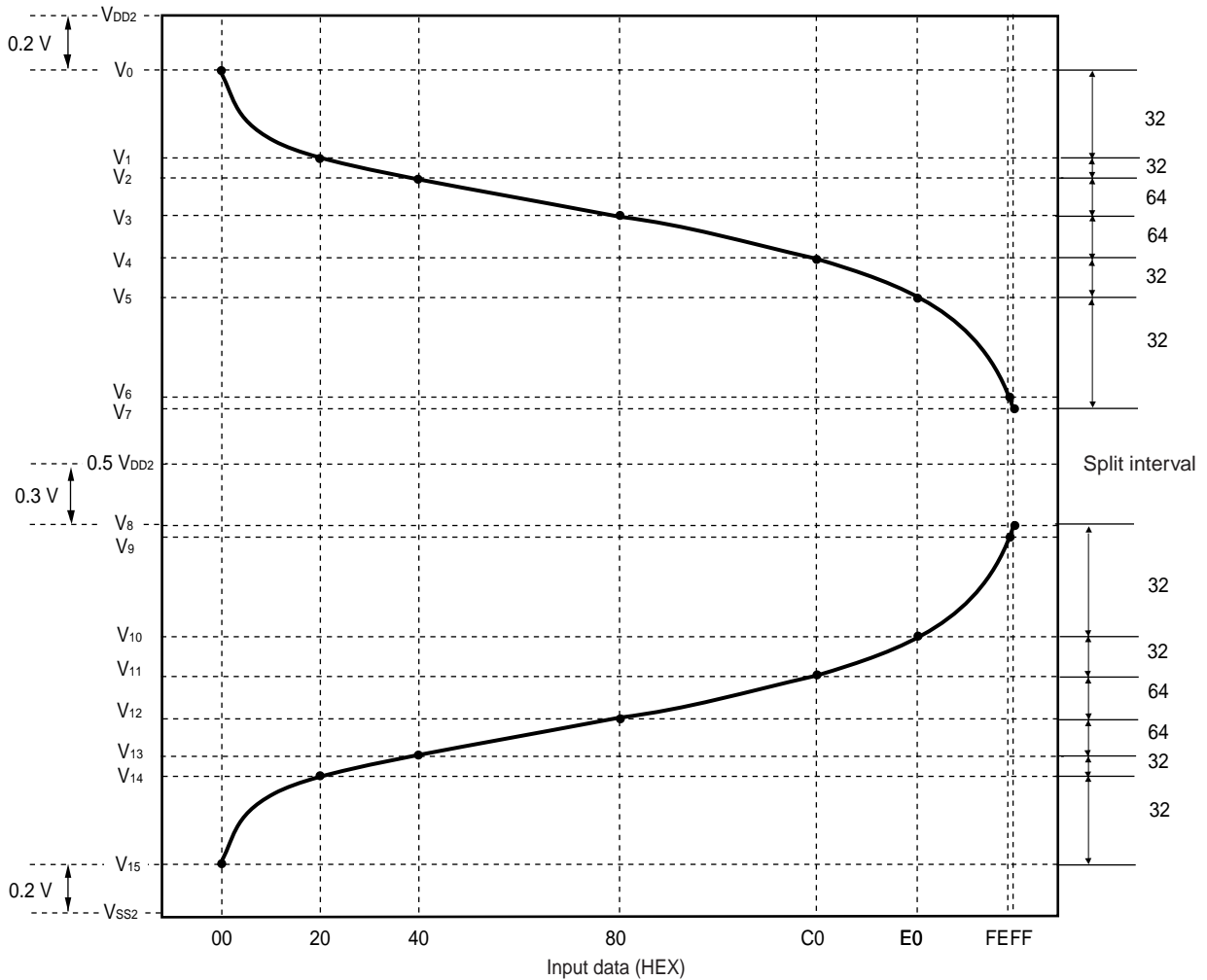
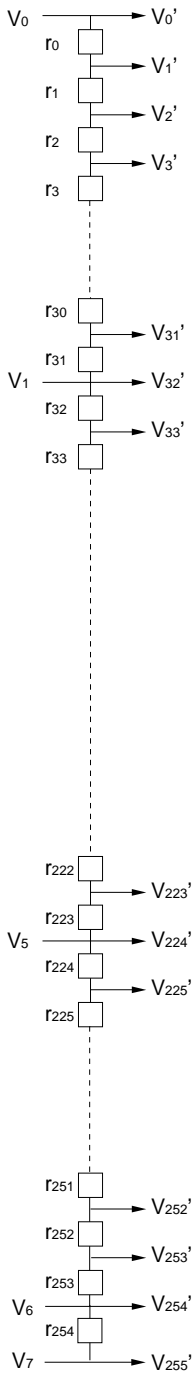


Figure 5-2. Relationship between Input Data and Output Voltage (1/4)

$V_{DD2} - 0.2\text{ V} > V_0 > V_1 > V_2 > V_3 > V_4 > V_5 > V_6 > V_7 > 0.5 V_{DD2}$ , POL21/22 = L



| Data | Dx7 | Dx6 | Dx5 | Dx4 | Dx3 | Dx2 | Dx1 | Dx0 | Output voltage   |   |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------------------|---|
| 00H  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | V <sub>0'</sub>  | V <sub>0</sub>                                      |
| 01H  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | V <sub>1'</sub>  | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 02H  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | V <sub>2'</sub>  | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 03H  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 1   | V <sub>3'</sub>  | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 04H  | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | V <sub>4'</sub>  | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 05H  | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | V <sub>5'</sub>  | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 06H  | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 0   | V <sub>6'</sub>  | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 07H  | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | V <sub>7'</sub>  | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 08H  | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | V <sub>8'</sub>  | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 09H  | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 1   | V <sub>9'</sub>  | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 0AH  | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 0   | V <sub>10'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 0BH  | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | V <sub>11'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 0CH  | 0   | 0   | 0   | 0   | 1   | 1   | 0   | 0   | V <sub>12'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 0DH  | 0   | 0   | 0   | 0   | 1   | 1   | 0   | 1   | V <sub>13'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 0EH  | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 0   | V <sub>14'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 0FH  | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | V <sub>15'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 10H  | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 0   | V <sub>16'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 11H  | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | V <sub>17'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 12H  | 0   | 0   | 0   | 1   | 0   | 0   | 1   | 0   | V <sub>18'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 13H  | 0   | 0   | 0   | 1   | 0   | 0   | 1   | 1   | V <sub>19'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 14H  | 0   | 0   | 0   | 1   | 0   | 1   | 0   | 0   | V <sub>20'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 15H  | 0   | 0   | 0   | 1   | 0   | 1   | 0   | 1   | V <sub>21'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 16H  | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 0   | V <sub>22'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 17H  | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | V <sub>23'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 18H  | 0   | 0   | 0   | 1   | 1   | 0   | 0   | 0   | V <sub>24'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 19H  | 0   | 0   | 0   | 1   | 1   | 0   | 0   | 1   | V <sub>25'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 1AH  | 0   | 0   | 0   | 1   | 1   | 0   | 1   | 0   | V <sub>26'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 1BH  | 0   | 0   | 0   | 1   | 1   | 0   | 1   | 1   | V <sub>27'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 1CH  | 0   | 0   | 0   | 1   | 1   | 1   | 0   | 0   | V <sub>28'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 1DH  | 0   | 0   | 0   | 1   | 1   | 1   | 0   | 1   | V <sub>29'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 1EH  | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 0   | V <sub>30'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 1FH  | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | V <sub>31'</sub> | V <sub>1</sub> +(V <sub>0</sub> -V <sub>1</sub> ) X |
| 20H  | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 0   | V <sub>32'</sub> | V <sub>1</sub>                                      |
| 21H  | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | V <sub>33'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 22H  | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 0   | V <sub>34'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 23H  | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 1   | V <sub>35'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 24H  | 0   | 0   | 1   | 0   | 0   | 1   | 0   | 0   | V <sub>36'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 25H  | 0   | 0   | 1   | 0   | 0   | 1   | 0   | 1   | V <sub>37'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 26H  | 0   | 0   | 1   | 0   | 0   | 1   | 1   | 0   | V <sub>38'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 27H  | 0   | 0   | 1   | 0   | 0   | 1   | 1   | 1   | V <sub>39'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 28H  | 0   | 0   | 1   | 0   | 1   | 0   | 0   | 0   | V <sub>40'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 29H  | 0   | 0   | 1   | 0   | 1   | 0   | 0   | 1   | V <sub>41'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 2AH  | 0   | 0   | 1   | 0   | 1   | 0   | 1   | 0   | V <sub>42'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 2BH  | 0   | 0   | 1   | 0   | 1   | 0   | 1   | 1   | V <sub>43'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 2CH  | 0   | 0   | 1   | 0   | 1   | 1   | 0   | 0   | V <sub>44'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 2DH  | 0   | 0   | 1   | 0   | 1   | 1   | 0   | 1   | V <sub>45'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 2EH  | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 0   | V <sub>46'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 2FH  | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | V <sub>47'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 30H  | 0   | 0   | 1   | 1   | 0   | 0   | 0   | 0   | V <sub>48'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 31H  | 0   | 0   | 1   | 1   | 0   | 0   | 0   | 1   | V <sub>49'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 32H  | 0   | 0   | 1   | 1   | 0   | 0   | 1   | 0   | V <sub>50'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 33H  | 0   | 0   | 1   | 1   | 0   | 0   | 1   | 1   | V <sub>51'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 34H  | 0   | 0   | 1   | 1   | 0   | 1   | 0   | 0   | V <sub>52'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 35H  | 0   | 0   | 1   | 1   | 0   | 1   | 0   | 1   | V <sub>53'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 36H  | 0   | 0   | 1   | 1   | 0   | 1   | 1   | 0   | V <sub>54'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 37H  | 0   | 0   | 1   | 1   | 0   | 1   | 1   | 1   | V <sub>55'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 38H  | 0   | 0   | 1   | 1   | 1   | 0   | 0   | 0   | V <sub>56'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 39H  | 0   | 0   | 1   | 1   | 1   | 0   | 0   | 1   | V <sub>57'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 3AH  | 0   | 0   | 1   | 1   | 1   | 0   | 1   | 0   | V <sub>58'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 3BH  | 0   | 0   | 1   | 1   | 1   | 0   | 1   | 1   | V <sub>59'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 3CH  | 0   | 0   | 1   | 1   | 1   | 1   | 0   | 0   | V <sub>60'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 3DH  | 0   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | V <sub>61'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 3EH  | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 0   | V <sub>62'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |
| 3FH  | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | V <sub>63'</sub> | V <sub>2</sub> +(V <sub>1</sub> -V <sub>2</sub> ) X |

| rn  | (Ω)   |
|-----|-------|
| r0  | 400.0 |
| r1  | 362.5 |
| r2  | 325.0 |
| r3  | 287.5 |
| r4  | 250.0 |
| r5  | 222.5 |
| r6  | 195.0 |
| r7  | 170.0 |
| r8  | 145.0 |
| r9  | 120.0 |
| r10 | 120.0 |
| r11 | 120.0 |
| r12 | 95.0  |
| r13 | 95.0  |
| r14 | 95.0  |
| r15 | 75.0  |
| r16 | 75.0  |
| r17 | 75.0  |
| r18 | 62.5  |
| r19 | 62.5  |
| r20 | 62.5  |
| r21 | 50.0  |
| r22 | 50.0  |
| r23 | 50.0  |
| r24 | 37.5  |
| r25 | 37.5  |
| r26 | 37.5  |
| r27 | 37.5  |
| r28 | 37.5  |
| r29 | 37.5  |
| r30 | 37.5  |
| r31 | 37.5  |
| r32 | 35.0  |
| r33 | 35.0  |
| r34 | 35.0  |
| r35 | 35.0  |
| r36 | 35.0  |
| r37 | 35.0  |
| r38 | 35.0  |
| r39 | 35.0  |
| r40 | 32.5  |
| r41 | 32.5  |
| r42 | 32.5  |
| r43 | 32.5  |
| r44 | 32.5  |
| r45 | 32.5  |
| r46 | 32.5  |
| r47 | 32.5  |
| r48 | 30.0  |
| r49 | 30.0  |
| r50 | 30.0  |
| r51 | 30.0  |
| r52 | 30.0  |
| r53 | 30.0  |
| r54 | 30.0  |
| r55 | 30.0  |
| r56 | 27.5  |
| r57 | 27.5  |
| r58 | 27.5  |
| r59 | 27.5  |
| r60 | 27.5  |
| r61 | 27.5  |
| r62 | 27.5  |
| r63 | 27.5  |

Caution There is no connection between V7 and V8 in the chip.

Figure 5-2. Relationship between Input Data and Output Voltage (2/4)

V<sub>DD2</sub> - 0.2 V > V<sub>0</sub> > V<sub>1</sub> > V<sub>2</sub> > V<sub>3</sub> > V<sub>4</sub> > V<sub>5</sub> > V<sub>6</sub> > V<sub>7</sub> > 0.5 V<sub>DD2</sub>, POL21/22 = L



| Data | D <sub>x7</sub> | D <sub>x6</sub> | D <sub>x5</sub> | D <sub>x4</sub> | D <sub>x3</sub> | D <sub>x2</sub> | D <sub>x1</sub> | D <sub>x0</sub> | Output voltage     |                          |
|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--------------------|--------------------------|
| 40H  | 0               | 1               | 0               | 0               | 0               | 0               | 0               | 0               | V <sub>64</sub> '  | V <sub>2</sub>           |
| 41H  | 0               | 1               | 0               | 0               | 0               | 0               | 0               | 1               | V <sub>65</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 42H  | 0               | 1               | 0               | 0               | 0               | 0               | 1               | 0               | V <sub>66</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 43H  | 0               | 1               | 0               | 0               | 0               | 0               | 1               | 1               | V <sub>67</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 44H  | 0               | 1               | 0               | 0               | 0               | 1               | 0               | 0               | V <sub>68</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 45H  | 0               | 1               | 0               | 0               | 0               | 1               | 0               | 1               | V <sub>69</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 46H  | 0               | 1               | 0               | 0               | 0               | 1               | 1               | 0               | V <sub>70</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 47H  | 0               | 1               | 0               | 0               | 0               | 1               | 1               | 1               | V <sub>71</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 48H  | 0               | 1               | 0               | 0               | 1               | 0               | 0               | 0               | V <sub>72</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 49H  | 0               | 1               | 0               | 0               | 1               | 0               | 0               | 1               | V <sub>73</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 4AH  | 0               | 1               | 0               | 0               | 1               | 0               | 1               | 0               | V <sub>74</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 4BH  | 0               | 1               | 0               | 0               | 1               | 0               | 1               | 1               | V <sub>75</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 4CH  | 0               | 1               | 0               | 0               | 1               | 1               | 0               | 0               | V <sub>76</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 4DH  | 0               | 1               | 0               | 0               | 1               | 1               | 0               | 1               | V <sub>77</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 4EH  | 0               | 1               | 0               | 0               | 1               | 1               | 1               | 0               | V <sub>78</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 4FH  | 0               | 1               | 0               | 0               | 1               | 1               | 1               | 1               | V <sub>79</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 50H  | 0               | 1               | 0               | 1               | 0               | 0               | 0               | 0               | V <sub>80</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 51H  | 0               | 1               | 0               | 1               | 0               | 0               | 0               | 1               | V <sub>81</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 52H  | 0               | 1               | 0               | 1               | 0               | 0               | 1               | 0               | V <sub>82</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 53H  | 0               | 1               | 0               | 1               | 0               | 0               | 1               | 1               | V <sub>83</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 54H  | 0               | 1               | 0               | 1               | 0               | 1               | 0               | 0               | V <sub>84</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 55H  | 0               | 1               | 0               | 1               | 0               | 1               | 0               | 1               | V <sub>85</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 56H  | 0               | 1               | 0               | 1               | 0               | 1               | 1               | 0               | V <sub>86</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 57H  | 0               | 1               | 0               | 1               | 0               | 1               | 1               | 1               | V <sub>87</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 58H  | 0               | 1               | 0               | 1               | 1               | 0               | 0               | 0               | V <sub>88</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 59H  | 0               | 1               | 0               | 1               | 1               | 0               | 0               | 1               | V <sub>89</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 5AH  | 0               | 1               | 0               | 1               | 1               | 0               | 1               | 0               | V <sub>90</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 5BH  | 0               | 1               | 0               | 1               | 1               | 0               | 1               | 1               | V <sub>91</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 5CH  | 0               | 1               | 0               | 1               | 1               | 1               | 0               | 0               | V <sub>92</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 5DH  | 0               | 1               | 0               | 1               | 1               | 1               | 0               | 1               | V <sub>93</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 5EH  | 0               | 1               | 0               | 1               | 1               | 1               | 1               | 0               | V <sub>94</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 5FH  | 0               | 1               | 0               | 1               | 1               | 1               | 1               | 1               | V <sub>95</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 60H  | 0               | 1               | 1               | 0               | 0               | 0               | 0               | 0               | V <sub>96</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 61H  | 0               | 1               | 1               | 0               | 0               | 0               | 0               | 1               | V <sub>97</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 62H  | 0               | 1               | 1               | 0               | 0               | 0               | 1               | 0               | V <sub>98</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 63H  | 0               | 1               | 1               | 0               | 0               | 0               | 1               | 1               | V <sub>99</sub> '  | V <sub>3+(V2-V3)</sub> X |
| 64H  | 0               | 1               | 1               | 0               | 0               | 1               | 0               | 0               | V <sub>100</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 65H  | 0               | 1               | 1               | 0               | 0               | 1               | 0               | 1               | V <sub>101</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 66H  | 0               | 1               | 1               | 0               | 0               | 1               | 1               | 0               | V <sub>102</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 67H  | 0               | 1               | 1               | 0               | 0               | 1               | 1               | 1               | V <sub>103</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 68H  | 0               | 1               | 1               | 0               | 1               | 0               | 0               | 0               | V <sub>104</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 69H  | 0               | 1               | 1               | 0               | 1               | 0               | 0               | 1               | V <sub>105</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 6AH  | 0               | 1               | 1               | 0               | 1               | 0               | 1               | 0               | V <sub>106</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 6BH  | 0               | 1               | 1               | 0               | 1               | 0               | 1               | 1               | V <sub>107</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 6CH  | 0               | 1               | 1               | 0               | 1               | 1               | 0               | 0               | V <sub>108</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 6DH  | 0               | 1               | 1               | 0               | 1               | 1               | 0               | 1               | V <sub>109</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 6EH  | 0               | 1               | 1               | 0               | 1               | 1               | 1               | 0               | V <sub>110</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 6FH  | 0               | 1               | 1               | 0               | 1               | 1               | 1               | 1               | V <sub>111</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 70H  | 0               | 1               | 1               | 1               | 0               | 0               | 0               | 0               | V <sub>112</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 71H  | 0               | 1               | 1               | 1               | 0               | 0               | 0               | 1               | V <sub>113</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 72H  | 0               | 1               | 1               | 1               | 0               | 0               | 1               | 0               | V <sub>114</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 73H  | 0               | 1               | 1               | 1               | 0               | 0               | 1               | 1               | V <sub>115</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 74H  | 0               | 1               | 1               | 1               | 0               | 1               | 0               | 0               | V <sub>116</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 75H  | 0               | 1               | 1               | 1               | 0               | 1               | 0               | 1               | V <sub>117</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 76H  | 0               | 1               | 1               | 1               | 0               | 1               | 1               | 0               | V <sub>118</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 77H  | 0               | 1               | 1               | 1               | 0               | 1               | 1               | 1               | V <sub>119</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 78H  | 0               | 1               | 1               | 1               | 1               | 0               | 0               | 0               | V <sub>120</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 79H  | 0               | 1               | 1               | 1               | 1               | 0               | 0               | 1               | V <sub>121</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 7AH  | 0               | 1               | 1               | 1               | 1               | 0               | 1               | 0               | V <sub>122</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 7BH  | 0               | 1               | 1               | 1               | 1               | 0               | 1               | 1               | V <sub>123</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 7CH  | 0               | 1               | 1               | 1               | 1               | 1               | 0               | 0               | V <sub>124</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 7DH  | 0               | 1               | 1               | 1               | 1               | 1               | 0               | 1               | V <sub>125</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 7EH  | 0               | 1               | 1               | 1               | 1               | 1               | 1               | 0               | V <sub>126</sub> ' | V <sub>3+(V2-V3)</sub> X |
| 7FH  | 0               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | V <sub>127</sub> ' | V <sub>3+(V2-V3)</sub> X |

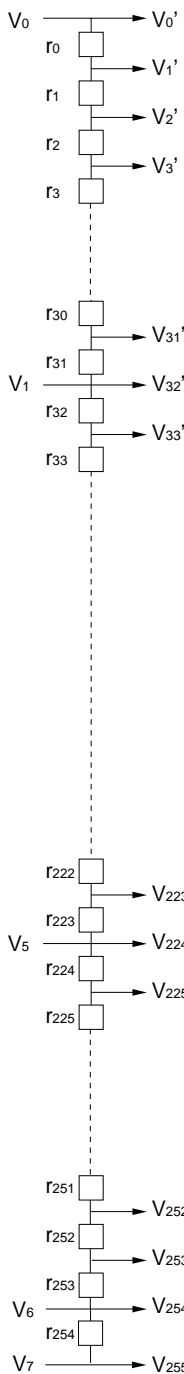
| rn   | (Ω)  |
|------|------|
| r64  | 25.0 |
| r65  | 25.0 |
| r66  | 25.0 |
| r67  | 25.0 |
| r68  | 25.0 |
| r69  | 25.0 |
| r70  | 25.0 |
| r71  | 25.0 |
| r72  | 25.0 |
| r73  | 25.0 |
| r74  | 25.0 |
| r75  | 25.0 |
| r76  | 25.0 |
| r77  | 25.0 |
| r78  | 25.0 |
| r79  | 25.0 |
| r80  | 25.0 |
| r81  | 25.0 |
| r82  | 25.0 |
| r83  | 25.0 |
| r84  | 25.0 |
| r85  | 25.0 |
| r86  | 25.0 |
| r87  | 25.0 |
| r88  | 25.0 |
| r89  | 25.0 |
| r90  | 25.0 |
| r91  | 25.0 |
| r92  | 25.0 |
| r93  | 25.0 |
| r94  | 25.0 |
| r95  | 25.0 |
| r96  | 25.0 |
| r97  | 25.0 |
| r98  | 25.0 |
| r99  | 25.0 |
| r100 | 25.0 |
| r101 | 25.0 |
| r102 | 25.0 |
| r103 | 25.0 |
| r104 | 25.0 |
| r105 | 25.0 |
| r106 | 25.0 |
| r107 | 25.0 |
| r108 | 25.0 |
| r109 | 25.0 |
| r110 | 25.0 |
| r111 | 25.0 |
| r112 | 25.0 |
| r113 | 25.0 |
| r114 | 25.0 |
| r115 | 25.0 |
| r116 | 25.0 |
| r117 | 25.0 |
| r118 | 25.0 |
| r119 | 25.0 |
| r120 | 25.0 |
| r121 | 25.0 |
| r122 | 25.0 |
| r123 | 25.0 |
| r124 | 25.0 |
| r125 | 25.0 |
| r126 | 25.0 |
| r127 | 25.0 |

Caution There is no connection between V<sub>7</sub> and V<sub>8</sub> in the chip.



Figure 5-2. Relationship between Input Data and Output Voltage (3/4)

V<sub>DD2</sub> - 0.2 V > V<sub>0</sub> > V<sub>1</sub> > V<sub>2</sub> > V<sub>3</sub> > V<sub>4</sub> > V<sub>5</sub> > V<sub>6</sub> > V<sub>7</sub> > 0.5 V<sub>DD2</sub>, POL21/22 = L



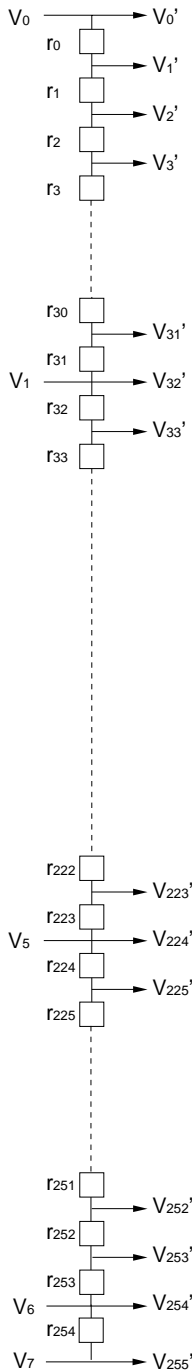
| Data | Dx7 | Dx6 | Dx5 | Dx4 | Dx3 | Dx2 | Dx1 | Dx0 | Output voltage    |                        |   |                 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-------------------|------------------------|---|-----------------|
| 80H  | 1   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | V <sub>128'</sub> | V <sub>3</sub>         |   |                 |
| 81H  | 1   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | V <sub>129'</sub> | V <sub>4+(V3-V4)</sub> | X | 1875.0 / 1900.0 |
| 82H  | 1   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | V <sub>130'</sub> | V <sub>4+(V3-V4)</sub> | X | 1850.0 / 1900.0 |
| 83H  | 1   | 0   | 0   | 0   | 0   | 0   | 1   | 1   | V <sub>131'</sub> | V <sub>4+(V3-V4)</sub> | X | 1825.0 / 1900.0 |
| 84H  | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | V <sub>132'</sub> | V <sub>4+(V3-V4)</sub> | X | 1800.0 / 1900.0 |
| 85H  | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | V <sub>133'</sub> | V <sub>4+(V3-V4)</sub> | X | 1775.0 / 1900.0 |
| 86H  | 1   | 0   | 0   | 0   | 0   | 1   | 1   | 0   | V <sub>134'</sub> | V <sub>4+(V3-V4)</sub> | X | 1750.0 / 1900.0 |
| 87H  | 1   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | V <sub>135'</sub> | V <sub>4+(V3-V4)</sub> | X | 1725.0 / 1900.0 |
| 88H  | 1   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | V <sub>136'</sub> | V <sub>4+(V3-V4)</sub> | X | 1700.0 / 1900.0 |
| 89H  | 1   | 0   | 0   | 0   | 1   | 0   | 0   | 1   | V <sub>137'</sub> | V <sub>4+(V3-V4)</sub> | X | 1675.0 / 1900.0 |
| 8AH  | 1   | 0   | 0   | 0   | 1   | 0   | 1   | 0   | V <sub>138'</sub> | V <sub>4+(V3-V4)</sub> | X | 1650.0 / 1900.0 |
| 8BH  | 1   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | V <sub>139'</sub> | V <sub>4+(V3-V4)</sub> | X | 1625.0 / 1900.0 |
| 8CH  | 1   | 0   | 0   | 0   | 1   | 1   | 0   | 0   | V <sub>140'</sub> | V <sub>4+(V3-V4)</sub> | X | 1600.0 / 1900.0 |
| 8DH  | 1   | 0   | 0   | 0   | 1   | 1   | 0   | 1   | V <sub>141'</sub> | V <sub>4+(V3-V4)</sub> | X | 1575.0 / 1900.0 |
| 8EH  | 1   | 0   | 0   | 0   | 1   | 1   | 1   | 0   | V <sub>142'</sub> | V <sub>4+(V3-V4)</sub> | X | 1550.0 / 1900.0 |
| 8FH  | 1   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | V <sub>143'</sub> | V <sub>4+(V3-V4)</sub> | X | 1525.0 / 1900.0 |
| 90H  | 1   | 0   | 0   | 1   | 0   | 0   | 0   | 0   | V <sub>144'</sub> | V <sub>4+(V3-V4)</sub> | X | 1500.0 / 1900.0 |
| 91H  | 1   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | V <sub>145'</sub> | V <sub>4+(V3-V4)</sub> | X | 1475.0 / 1900.0 |
| 92H  | 1   | 0   | 0   | 1   | 0   | 0   | 1   | 0   | V <sub>146'</sub> | V <sub>4+(V3-V4)</sub> | X | 1450.0 / 1900.0 |
| 93H  | 1   | 0   | 0   | 1   | 0   | 0   | 1   | 1   | V <sub>147'</sub> | V <sub>4+(V3-V4)</sub> | X | 1425.0 / 1900.0 |
| 94H  | 1   | 0   | 0   | 1   | 0   | 1   | 0   | 0   | V <sub>148'</sub> | V <sub>4+(V3-V4)</sub> | X | 1400.0 / 1900.0 |
| 95H  | 1   | 0   | 0   | 1   | 0   | 1   | 0   | 1   | V <sub>149'</sub> | V <sub>4+(V3-V4)</sub> | X | 1375.0 / 1900.0 |
| 96H  | 1   | 0   | 0   | 1   | 0   | 1   | 1   | 0   | V <sub>150'</sub> | V <sub>4+(V3-V4)</sub> | X | 1350.0 / 1900.0 |
| 97H  | 1   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | V <sub>151'</sub> | V <sub>4+(V3-V4)</sub> | X | 1325.0 / 1900.0 |
| 98H  | 1   | 0   | 0   | 1   | 1   | 0   | 0   | 0   | V <sub>152'</sub> | V <sub>4+(V3-V4)</sub> | X | 1300.0 / 1900.0 |
| 99H  | 1   | 0   | 0   | 1   | 1   | 0   | 0   | 1   | V <sub>153'</sub> | V <sub>4+(V3-V4)</sub> | X | 1272.5 / 1900.0 |
| 9AH  | 1   | 0   | 0   | 1   | 1   | 0   | 1   | 0   | V <sub>154'</sub> | V <sub>4+(V3-V4)</sub> | X | 1245.0 / 1900.0 |
| 9BH  | 1   | 0   | 0   | 1   | 1   | 0   | 1   | 1   | V <sub>155'</sub> | V <sub>4+(V3-V4)</sub> | X | 1217.5 / 1900.0 |
| 9CH  | 1   | 0   | 0   | 1   | 1   | 1   | 0   | 0   | V <sub>156'</sub> | V <sub>4+(V3-V4)</sub> | X | 1190.0 / 1900.0 |
| 9DH  | 1   | 0   | 0   | 1   | 1   | 1   | 0   | 1   | V <sub>157'</sub> | V <sub>4+(V3-V4)</sub> | X | 1162.5 / 1900.0 |
| 9EH  | 1   | 0   | 0   | 1   | 1   | 1   | 1   | 0   | V <sub>158'</sub> | V <sub>4+(V3-V4)</sub> | X | 1135.0 / 1900.0 |
| 9FH  | 1   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | V <sub>159'</sub> | V <sub>4+(V3-V4)</sub> | X | 1107.5 / 1900.0 |
| A0H  | 1   | 0   | 1   | 0   | 0   | 0   | 0   | 0   | V <sub>160'</sub> | V <sub>4+(V3-V4)</sub> | X | 1080.0 / 1900.0 |
| A1H  | 1   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | V <sub>161'</sub> | V <sub>4+(V3-V4)</sub> | X | 1050.0 / 1900.0 |
| A2H  | 1   | 0   | 1   | 0   | 0   | 0   | 1   | 0   | V <sub>162'</sub> | V <sub>4+(V3-V4)</sub> | X | 1020.0 / 1900.0 |
| A3H  | 1   | 0   | 1   | 0   | 0   | 0   | 1   | 1   | V <sub>163'</sub> | V <sub>4+(V3-V4)</sub> | X | 990.0 / 1900.0  |
| A4H  | 1   | 0   | 1   | 0   | 0   | 1   | 0   | 0   | V <sub>164'</sub> | V <sub>4+(V3-V4)</sub> | X | 960.0 / 1900.0  |
| A5H  | 1   | 0   | 1   | 0   | 0   | 1   | 0   | 1   | V <sub>165'</sub> | V <sub>4+(V3-V4)</sub> | X | 930.0 / 1900.0  |
| A6H  | 1   | 0   | 1   | 0   | 0   | 1   | 1   | 0   | V <sub>166'</sub> | V <sub>4+(V3-V4)</sub> | X | 900.0 / 1900.0  |
| A7H  | 1   | 0   | 1   | 0   | 0   | 1   | 1   | 1   | V <sub>167'</sub> | V <sub>4+(V3-V4)</sub> | X | 870.0 / 1900.0  |
| A8H  | 1   | 0   | 1   | 0   | 1   | 0   | 0   | 0   | V <sub>168'</sub> | V <sub>4+(V3-V4)</sub> | X | 840.0 / 1900.0  |
| A9H  | 1   | 0   | 1   | 0   | 1   | 0   | 0   | 1   | V <sub>169'</sub> | V <sub>4+(V3-V4)</sub> | X | 807.5 / 1900.0  |
| AAH  | 1   | 0   | 1   | 0   | 1   | 0   | 0   | 1   | V <sub>170'</sub> | V <sub>4+(V3-V4)</sub> | X | 775.0 / 1900.0  |
| ABH  | 1   | 0   | 1   | 0   | 1   | 0   | 1   | 1   | V <sub>171'</sub> | V <sub>4+(V3-V4)</sub> | X | 742.5 / 1900.0  |
| ACH  | 1   | 0   | 1   | 0   | 1   | 1   | 0   | 0   | V <sub>172'</sub> | V <sub>4+(V3-V4)</sub> | X | 710.0 / 1900.0  |
| ADH  | 1   | 0   | 1   | 0   | 1   | 1   | 0   | 1   | V <sub>173'</sub> | V <sub>4+(V3-V4)</sub> | X | 677.5 / 1900.0  |
| AEH  | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 0   | V <sub>174'</sub> | V <sub>4+(V3-V4)</sub> | X | 645.0 / 1900.0  |
| AFH  | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | V <sub>175'</sub> | V <sub>4+(V3-V4)</sub> | X | 612.5 / 1900.0  |
| B0H  | 1   | 0   | 1   | 1   | 0   | 0   | 0   | 0   | V <sub>176'</sub> | V <sub>4+(V3-V4)</sub> | X | 580.0 / 1900.0  |
| B1H  | 1   | 0   | 1   | 1   | 0   | 0   | 0   | 1   | V <sub>177'</sub> | V <sub>4+(V3-V4)</sub> | X | 545.0 / 1900.0  |
| B2H  | 1   | 0   | 1   | 1   | 0   | 0   | 1   | 0   | V <sub>178'</sub> | V <sub>4+(V3-V4)</sub> | X | 510.0 / 1900.0  |
| B3H  | 1   | 0   | 1   | 1   | 0   | 0   | 1   | 1   | V <sub>179'</sub> | V <sub>4+(V3-V4)</sub> | X | 475.0 / 1900.0  |
| B4H  | 1   | 0   | 1   | 1   | 0   | 1   | 0   | 0   | V <sub>180'</sub> | V <sub>4+(V3-V4)</sub> | X | 440.0 / 1900.0  |
| B5H  | 1   | 0   | 1   | 1   | 0   | 1   | 0   | 1   | V <sub>181'</sub> | V <sub>4+(V3-V4)</sub> | X | 405.0 / 1900.0  |
| B6H  | 1   | 0   | 1   | 1   | 0   | 1   | 1   | 0   | V <sub>182'</sub> | V <sub>4+(V3-V4)</sub> | X | 370.0 / 1900.0  |
| B7H  | 1   | 0   | 1   | 1   | 0   | 1   | 1   | 1   | V <sub>183'</sub> | V <sub>4+(V3-V4)</sub> | X | 335.0 / 1900.0  |
| B8H  | 1   | 0   | 1   | 1   | 1   | 0   | 0   | 0   | V <sub>184'</sub> | V <sub>4+(V3-V4)</sub> | X | 300.0 / 1900.0  |
| B9H  | 1   | 0   | 1   | 1   | 1   | 0   | 0   | 1   | V <sub>185'</sub> | V <sub>4+(V3-V4)</sub> | X | 262.5 / 1900.0  |
| BAH  | 1   | 0   | 1   | 1   | 1   | 0   | 1   | 0   | V <sub>186'</sub> | V <sub>4+(V3-V4)</sub> | X | 225.0 / 1900.0  |
| BBH  | 1   | 0   | 1   | 1   | 1   | 0   | 1   | 1   | V <sub>187'</sub> | V <sub>4+(V3-V4)</sub> | X | 187.5 / 1900.0  |
| BCH  | 1   | 0   | 1   | 1   | 1   | 1   | 0   | 0   | V <sub>188'</sub> | V <sub>4+(V3-V4)</sub> | X | 150.0 / 1900.0  |
| BDH  | 1   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | V <sub>189'</sub> | V <sub>4+(V3-V4)</sub> | X | 112.5 / 1900.0  |
| BEH  | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 0   | V <sub>190'</sub> | V <sub>4+(V3-V4)</sub> | X | 75.0 / 1900.0   |
| BFH  | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | V <sub>191'</sub> | V <sub>4+(V3-V4)</sub> | X | 37.5 / 1900.0   |

| rn   | (Ω)  |
|------|------|
| r128 | 25.0 |
| r129 | 25.0 |
| r130 | 25.0 |
| r131 | 25.0 |
| r132 | 25.0 |
| r133 | 25.0 |
| r134 | 25.0 |
| r135 | 25.0 |
| r136 | 25.0 |
| r137 | 25.0 |
| r138 | 25.0 |
| r139 | 25.0 |
| r140 | 25.0 |
| r141 | 25.0 |
| r142 | 25.0 |
| r143 | 25.0 |
| r144 | 25.0 |
| r145 | 25.0 |
| r146 | 25.0 |
| r147 | 25.0 |
| r148 | 25.0 |
| r149 | 25.0 |
| r150 | 25.0 |
| r151 | 25.0 |
| r152 | 27.5 |
| r153 | 27.5 |
| r154 | 27.5 |
| r155 | 27.5 |
| r156 | 27.5 |
| r157 | 27.5 |
| r158 | 27.5 |
| r159 | 27.5 |
| r160 | 30.0 |
| r161 | 30.0 |
| r162 | 30.0 |
| r163 | 30.0 |
| r164 | 30.0 |
| r165 | 30.0 |
| r166 | 30.0 |
| r167 | 30.0 |
| r168 | 32.5 |
| r169 | 32.5 |
| r170 | 32.5 |
| r171 | 32.5 |
| r172 | 32.5 |
| r173 | 32.5 |
| r174 | 32.5 |
| r175 | 32.5 |
| r176 | 35.0 |
| r177 | 35.0 |
| r178 | 35.0 |
| r179 | 35.0 |
| r180 | 35.0 |
| r181 | 35.0 |
| r182 | 35.0 |
| r183 | 35.0 |
| r184 | 37.5 |
| r185 | 37.5 |
| r186 | 37.5 |
| r187 | 37.5 |
| r188 | 37.5 |
| r189 | 37.5 |
| r190 | 37.5 |
| r191 | 37.5 |

Caution There is no connection between V<sub>7</sub> and V<sub>8</sub> in the chip.

Figure 5-2. Relationship between Input Data and Output Voltage (4/4)

$$V_{DD2} - 0.2\text{ V} > V_0 > V_1 > V_2 > V_3 > V_4 > V_5 > V_6 > V_7 > 0.5 V_{DD2}$$



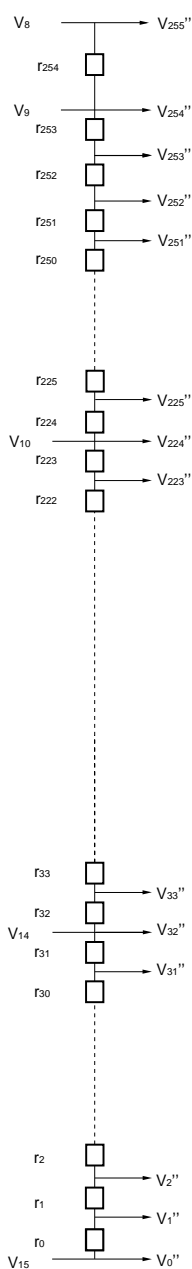
| Data | Dx7 | Dx6 | Dx5 | Dx4 | Dx3 | Dx2 | Dx1 | Dx0 | Output voltage    |                          |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-------------------|--------------------------|
| C0H  | 1   | 1   | 0   | 0   | 0   | 0   | 0   | 0   | V <sub>192'</sub> | V <sub>4</sub>           |
| C1H  | 1   | 1   | 0   | 0   | 0   | 0   | 0   | 1   | V <sub>193'</sub> | V <sub>5+(V4-V5)</sub> X |
| C2H  | 1   | 1   | 0   | 0   | 0   | 0   | 1   | 0   | V <sub>194'</sub> | V <sub>5+(V4-V5)</sub> X |
| C3H  | 1   | 1   | 0   | 0   | 0   | 0   | 1   | 1   | V <sub>195'</sub> | V <sub>5+(V4-V5)</sub> X |
| C4H  | 1   | 1   | 0   | 0   | 0   | 1   | 0   | 0   | V <sub>196'</sub> | V <sub>5+(V4-V5)</sub> X |
| C5H  | 1   | 1   | 0   | 0   | 0   | 1   | 0   | 1   | V <sub>197'</sub> | V <sub>5+(V4-V5)</sub> X |
| C6H  | 1   | 1   | 0   | 0   | 0   | 1   | 1   | 0   | V <sub>198'</sub> | V <sub>5+(V4-V5)</sub> X |
| C7H  | 1   | 1   | 0   | 0   | 0   | 1   | 1   | 1   | V <sub>199'</sub> | V <sub>5+(V4-V5)</sub> X |
| C8H  | 1   | 1   | 0   | 0   | 1   | 0   | 0   | 0   | V <sub>200'</sub> | V <sub>5+(V4-V5)</sub> X |
| C9H  | 1   | 1   | 0   | 0   | 1   | 0   | 0   | 1   | V <sub>201'</sub> | V <sub>5+(V4-V5)</sub> X |
| CAH  | 1   | 1   | 0   | 0   | 1   | 0   | 1   | 0   | V <sub>202'</sub> | V <sub>5+(V4-V5)</sub> X |
| CBH  | 1   | 1   | 0   | 0   | 1   | 0   | 1   | 1   | V <sub>203'</sub> | V <sub>5+(V4-V5)</sub> X |
| CCH  | 1   | 1   | 0   | 0   | 1   | 1   | 0   | 0   | V <sub>204'</sub> | V <sub>5+(V4-V5)</sub> X |
| CDH  | 1   | 1   | 0   | 0   | 1   | 1   | 0   | 1   | V <sub>205'</sub> | V <sub>5+(V4-V5)</sub> X |
| CEH  | 1   | 1   | 0   | 0   | 1   | 1   | 1   | 0   | V <sub>206'</sub> | V <sub>5+(V4-V5)</sub> X |
| CFH  | 1   | 1   | 0   | 0   | 1   | 1   | 1   | 1   | V <sub>207'</sub> | V <sub>5+(V4-V5)</sub> X |
| D0H  | 1   | 1   | 0   | 1   | 0   | 0   | 0   | 0   | V <sub>208'</sub> | V <sub>5+(V4-V5)</sub> X |
| D1H  | 1   | 1   | 0   | 1   | 0   | 0   | 0   | 1   | V <sub>209'</sub> | V <sub>5+(V4-V5)</sub> X |
| D2H  | 1   | 1   | 0   | 1   | 0   | 0   | 1   | 0   | V <sub>210'</sub> | V <sub>5+(V4-V5)</sub> X |
| D3H  | 1   | 1   | 0   | 1   | 0   | 0   | 1   | 1   | V <sub>211'</sub> | V <sub>5+(V4-V5)</sub> X |
| D4H  | 1   | 1   | 0   | 1   | 0   | 1   | 0   | 0   | V <sub>212'</sub> | V <sub>5+(V4-V5)</sub> X |
| D5H  | 1   | 1   | 0   | 1   | 0   | 1   | 0   | 1   | V <sub>213'</sub> | V <sub>5+(V4-V5)</sub> X |
| D6H  | 1   | 1   | 0   | 1   | 0   | 1   | 1   | 0   | V <sub>214'</sub> | V <sub>5+(V4-V5)</sub> X |
| D7H  | 1   | 1   | 0   | 1   | 0   | 1   | 1   | 1   | V <sub>215'</sub> | V <sub>5+(V4-V5)</sub> X |
| D8H  | 1   | 1   | 0   | 1   | 1   | 0   | 0   | 0   | V <sub>216'</sub> | V <sub>5+(V4-V5)</sub> X |
| D9H  | 1   | 1   | 0   | 1   | 1   | 0   | 0   | 1   | V <sub>217'</sub> | V <sub>5+(V4-V5)</sub> X |
| DAH  | 1   | 1   | 0   | 1   | 1   | 0   | 1   | 0   | V <sub>218'</sub> | V <sub>5+(V4-V5)</sub> X |
| DBH  | 1   | 1   | 0   | 1   | 1   | 0   | 1   | 1   | V <sub>219'</sub> | V <sub>5+(V4-V5)</sub> X |
| DCH  | 1   | 1   | 0   | 1   | 1   | 1   | 0   | 0   | V <sub>220'</sub> | V <sub>5+(V4-V5)</sub> X |
| DDH  | 1   | 1   | 0   | 1   | 1   | 1   | 0   | 1   | V <sub>221'</sub> | V <sub>5+(V4-V5)</sub> X |
| DEH  | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 0   | V <sub>222'</sub> | V <sub>5+(V4-V5)</sub> X |
| DFH  | 1   | 1   | 0   | 1   | 1   | 1   | 1   | 1   | V <sub>223'</sub> | V <sub>5+(V4-V5)</sub> X |
| E0H  | 1   | 1   | 1   | 0   | 0   | 0   | 0   | 0   | V <sub>224'</sub> | V <sub>5</sub>           |
| E1H  | 1   | 1   | 1   | 0   | 0   | 0   | 0   | 1   | V <sub>225'</sub> | V <sub>6+(V5-V6)</sub> X |
| E2H  | 1   | 1   | 1   | 0   | 0   | 0   | 1   | 0   | V <sub>226'</sub> | V <sub>6+(V5-V6)</sub> X |
| E3H  | 1   | 1   | 1   | 0   | 0   | 0   | 1   | 1   | V <sub>227'</sub> | V <sub>6+(V5-V6)</sub> X |
| E4H  | 1   | 1   | 1   | 0   | 0   | 1   | 0   | 0   | V <sub>228'</sub> | V <sub>6+(V5-V6)</sub> X |
| E5H  | 1   | 1   | 1   | 0   | 0   | 1   | 0   | 1   | V <sub>229'</sub> | V <sub>6+(V5-V6)</sub> X |
| E6H  | 1   | 1   | 1   | 0   | 0   | 1   | 1   | 0   | V <sub>230'</sub> | V <sub>6+(V5-V6)</sub> X |
| E7H  | 1   | 1   | 1   | 0   | 0   | 1   | 1   | 1   | V <sub>231'</sub> | V <sub>6+(V5-V6)</sub> X |
| E8H  | 1   | 1   | 1   | 0   | 1   | 0   | 0   | 0   | V <sub>232'</sub> | V <sub>6+(V5-V6)</sub> X |
| E9H  | 1   | 1   | 1   | 0   | 1   | 0   | 0   | 1   | V <sub>233'</sub> | V <sub>6+(V5-V6)</sub> X |
| EAH  | 1   | 1   | 1   | 0   | 1   | 0   | 1   | 0   | V <sub>234'</sub> | V <sub>6+(V5-V6)</sub> X |
| EBH  | 1   | 1   | 1   | 0   | 1   | 0   | 1   | 1   | V <sub>235'</sub> | V <sub>6+(V5-V6)</sub> X |
| ECH  | 1   | 1   | 1   | 0   | 1   | 1   | 0   | 0   | V <sub>236'</sub> | V <sub>6+(V5-V6)</sub> X |
| EDH  | 1   | 1   | 1   | 0   | 1   | 1   | 0   | 1   | V <sub>237'</sub> | V <sub>6+(V5-V6)</sub> X |
| EEH  | 1   | 1   | 1   | 0   | 1   | 1   | 1   | 0   | V <sub>238'</sub> | V <sub>6+(V5-V6)</sub> X |
| EFH  | 1   | 1   | 1   | 0   | 1   | 1   | 1   | 1   | V <sub>239'</sub> | V <sub>6+(V5-V6)</sub> X |
| F0H  | 1   | 1   | 1   | 1   | 0   | 0   | 0   | 0   | V <sub>240'</sub> | V <sub>6+(V5-V6)</sub> X |
| F1H  | 1   | 1   | 1   | 1   | 0   | 0   | 0   | 1   | V <sub>241'</sub> | V <sub>6+(V5-V6)</sub> X |
| F2H  | 1   | 1   | 1   | 1   | 0   | 0   | 1   | 0   | V <sub>242'</sub> | V <sub>6+(V5-V6)</sub> X |
| F3H  | 1   | 1   | 1   | 1   | 0   | 0   | 1   | 1   | V <sub>243'</sub> | V <sub>6+(V5-V6)</sub> X |
| F4H  | 1   | 1   | 1   | 1   | 0   | 1   | 0   | 0   | V <sub>244'</sub> | V <sub>6+(V5-V6)</sub> X |
| F5H  | 1   | 1   | 1   | 1   | 0   | 1   | 0   | 1   | V <sub>245'</sub> | V <sub>6+(V5-V6)</sub> X |
| F6H  | 1   | 1   | 1   | 1   | 0   | 1   | 1   | 0   | V <sub>246'</sub> | V <sub>6+(V5-V6)</sub> X |
| F7H  | 1   | 1   | 1   | 1   | 0   | 1   | 1   | 1   | V <sub>247'</sub> | V <sub>6+(V5-V6)</sub> X |
| F8H  | 1   | 1   | 1   | 1   | 1   | 0   | 0   | 0   | V <sub>248'</sub> | V <sub>6+(V5-V6)</sub> X |
| F9H  | 1   | 1   | 1   | 1   | 1   | 0   | 0   | 1   | V <sub>249'</sub> | V <sub>6+(V5-V6)</sub> X |
| FAH  | 1   | 1   | 1   | 1   | 1   | 0   | 1   | 0   | V <sub>250'</sub> | V <sub>6+(V5-V6)</sub> X |
| FBH  | 1   | 1   | 1   | 1   | 1   | 0   | 1   | 1   | V <sub>251'</sub> | V <sub>6+(V5-V6)</sub> X |
| FCH  | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 0   | V <sub>252'</sub> | V <sub>6+(V5-V6)</sub> X |
| FDH  | 1   | 1   | 1   | 1   | 1   | 1   | 0   | 1   | V <sub>253'</sub> | V <sub>6+(V5-V6)</sub> X |
| FEH  | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 0   | V <sub>254'</sub> | V <sub>6</sub>           |
| FFH  | 1   | 1   | 1   | 1   | 1   | 1   | 1   | 1   | V <sub>255'</sub> | V <sub>7</sub>           |

| rn    | (Ω)     |
|-------|---------|
| r192  | 42.5    |
| r193  | 42.5    |
| r194  | 42.5    |
| r195  | 42.5    |
| r196  | 42.5    |
| r197  | 42.5    |
| r198  | 42.5    |
| r199  | 42.5    |
| r200  | 47.5    |
| r201  | 47.5    |
| r202  | 47.5    |
| r203  | 47.5    |
| r204  | 47.5    |
| r205  | 47.5    |
| r206  | 47.5    |
| r207  | 47.5    |
| r208  | 52.5    |
| r209  | 52.5    |
| r210  | 52.5    |
| r211  | 52.5    |
| r212  | 52.5    |
| r213  | 52.5    |
| r214  | 52.5    |
| r215  | 52.5    |
| r216  | 57.5    |
| r217  | 57.5    |
| r218  | 57.5    |
| r219  | 57.5    |
| r220  | 57.5    |
| r221  | 57.5    |
| r222  | 57.5    |
| r223  | 57.5    |
| r224  | 57.5    |
| r225  | 70.0    |
| r226  | 70.0    |
| r227  | 70.0    |
| r228  | 82.5    |
| r229  | 82.5    |
| r230  | 82.5    |
| r231  | 95.0    |
| r232  | 95.0    |
| r233  | 95.0    |
| r234  | 112.5   |
| r235  | 112.5   |
| r236  | 112.5   |
| r237  | 130.0   |
| r238  | 130.0   |
| r239  | 147.5   |
| r240  | 147.5   |
| r241  | 165.0   |
| r242  | 165.0   |
| r243  | 182.5   |
| r244  | 182.5   |
| r245  | 200.0   |
| r246  | 200.0   |
| r247  | 225.0   |
| r248  | 225.0   |
| r249  | 250.0   |
| r250  | 250.0   |
| r251  | 300.0   |
| r252  | 300.0   |
| r253  | 350.0   |
| r254  | 350.0   |
| TOTAL | 15002.5 |

Caution There is no connection between V<sub>7</sub> and V<sub>8</sub> in the chip.

Figure 5-3. Relationship between Input Data and Output Voltage (1/4)

0.5 VDD2 - 0.3 V > V8 > V9 > V10 > V11 > V12 > V13 > V14 > V15 > VSS2 + 0.2 V, POL21/22 = L



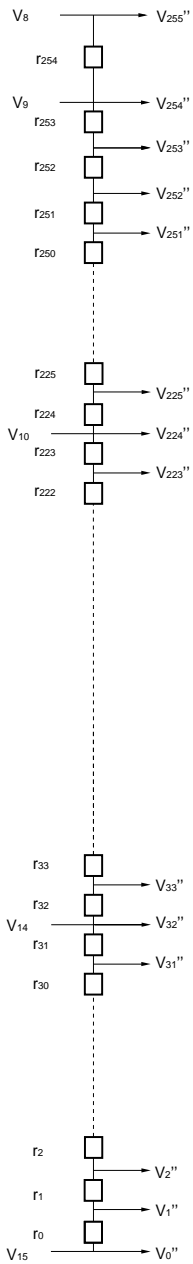
| Data | Dx7 | Dx6 | Dx5 | Dx4 | Dx3 | Dx2 | Dx1 | Dx0 | Output voltage   |                 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|------------------|-----------------|
| 00H  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | V0 <sup>n</sup>  | V15             |
| 01H  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | V1 <sup>n</sup>  | V15+(V14-V15) X |
| 02H  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | V2 <sup>n</sup>  | V15+(V14-V15) X |
| 03H  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 1   | V3 <sup>n</sup>  | V15+(V14-V15) X |
| 04H  | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | V4 <sup>n</sup>  | V15+(V14-V15) X |
| 05H  | 0   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | V5 <sup>n</sup>  | V15+(V14-V15) X |
| 06H  | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 0   | V6 <sup>n</sup>  | V15+(V14-V15) X |
| 07H  | 0   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | V7 <sup>n</sup>  | V15+(V14-V15) X |
| 08H  | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | V8 <sup>n</sup>  | V15+(V14-V15) X |
| 09H  | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 1   | V9 <sup>n</sup>  | V15+(V14-V15) X |
| 0AH  | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 0   | V10 <sup>n</sup> | V15+(V14-V15) X |
| 0BH  | 0   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | V11 <sup>n</sup> | V15+(V14-V15) X |
| 0CH  | 0   | 0   | 0   | 0   | 1   | 1   | 0   | 0   | V12 <sup>n</sup> | V15+(V14-V15) X |
| 0DH  | 0   | 0   | 0   | 0   | 1   | 1   | 0   | 1   | V13 <sup>n</sup> | V15+(V14-V15) X |
| 0EH  | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 0   | V14 <sup>n</sup> | V15+(V14-V15) X |
| 0FH  | 0   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | V15 <sup>n</sup> | V15+(V14-V15) X |
| 10H  | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 0   | V16 <sup>n</sup> | V15+(V14-V15) X |
| 11H  | 0   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | V17 <sup>n</sup> | V15+(V14-V15) X |
| 12H  | 0   | 0   | 0   | 1   | 0   | 0   | 1   | 0   | V18 <sup>n</sup> | V15+(V14-V15) X |
| 13H  | 0   | 0   | 0   | 1   | 0   | 0   | 1   | 1   | V19 <sup>n</sup> | V15+(V14-V15) X |
| 14H  | 0   | 0   | 0   | 1   | 0   | 1   | 0   | 0   | V20 <sup>n</sup> | V15+(V14-V15) X |
| 15H  | 0   | 0   | 0   | 1   | 0   | 1   | 0   | 1   | V21 <sup>n</sup> | V15+(V14-V15) X |
| 16H  | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 0   | V22 <sup>n</sup> | V15+(V14-V15) X |
| 17H  | 0   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | V23 <sup>n</sup> | V15+(V14-V15) X |
| 18H  | 0   | 0   | 0   | 1   | 1   | 0   | 0   | 0   | V24 <sup>n</sup> | V15+(V14-V15) X |
| 19H  | 0   | 0   | 0   | 1   | 1   | 0   | 0   | 1   | V25 <sup>n</sup> | V15+(V14-V15) X |
| 1AH  | 0   | 0   | 0   | 1   | 1   | 0   | 1   | 0   | V26 <sup>n</sup> | V15+(V14-V15) X |
| 1BH  | 0   | 0   | 0   | 1   | 1   | 0   | 1   | 1   | V27 <sup>n</sup> | V15+(V14-V15) X |
| 1CH  | 0   | 0   | 0   | 1   | 1   | 1   | 0   | 0   | V28 <sup>n</sup> | V15+(V14-V15) X |
| 1DH  | 0   | 0   | 0   | 1   | 1   | 1   | 0   | 1   | V29 <sup>n</sup> | V15+(V14-V15) X |
| 1EH  | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 0   | V30 <sup>n</sup> | V15+(V14-V15) X |
| 1FH  | 0   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | V31 <sup>n</sup> | V15+(V14-V15) X |
| 20H  | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 0   | V32 <sup>n</sup> | V14             |
| 21H  | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | V33 <sup>n</sup> | V14+(V13-V14) X |
| 22H  | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 0   | V34 <sup>n</sup> | V14+(V13-V14) X |
| 23H  | 0   | 0   | 1   | 0   | 0   | 0   | 1   | 1   | V35 <sup>n</sup> | V14+(V13-V14) X |
| 24H  | 0   | 0   | 1   | 0   | 0   | 1   | 0   | 0   | V36 <sup>n</sup> | V14+(V13-V14) X |
| 25H  | 0   | 0   | 1   | 0   | 0   | 1   | 0   | 1   | V37 <sup>n</sup> | V14+(V13-V14) X |
| 26H  | 0   | 0   | 1   | 0   | 0   | 1   | 1   | 0   | V38 <sup>n</sup> | V14+(V13-V14) X |
| 27H  | 0   | 0   | 1   | 0   | 0   | 1   | 1   | 1   | V39 <sup>n</sup> | V14+(V13-V14) X |
| 28H  | 0   | 0   | 1   | 0   | 0   | 1   | 0   | 0   | V40 <sup>n</sup> | V14+(V13-V14) X |
| 29H  | 0   | 0   | 1   | 0   | 1   | 0   | 0   | 1   | V41 <sup>n</sup> | V14+(V13-V14) X |
| 2AH  | 0   | 0   | 1   | 0   | 1   | 0   | 1   | 0   | V42 <sup>n</sup> | V14+(V13-V14) X |
| 2BH  | 0   | 0   | 1   | 0   | 1   | 0   | 1   | 1   | V43 <sup>n</sup> | V14+(V13-V14) X |
| 2CH  | 0   | 0   | 1   | 0   | 1   | 1   | 0   | 0   | V44 <sup>n</sup> | V14+(V13-V14) X |
| 2DH  | 0   | 0   | 1   | 0   | 1   | 1   | 0   | 1   | V45 <sup>n</sup> | V14+(V13-V14) X |
| 2EH  | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 0   | V46 <sup>n</sup> | V14+(V13-V14) X |
| 2FH  | 0   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | V47 <sup>n</sup> | V14+(V13-V14) X |
| 30H  | 0   | 0   | 1   | 1   | 0   | 0   | 0   | 0   | V48 <sup>n</sup> | V14+(V13-V14) X |
| 31H  | 0   | 0   | 1   | 1   | 0   | 0   | 0   | 1   | V49 <sup>n</sup> | V14+(V13-V14) X |
| 32H  | 0   | 0   | 1   | 1   | 0   | 0   | 1   | 0   | V50 <sup>n</sup> | V14+(V13-V14) X |
| 33H  | 0   | 0   | 1   | 1   | 0   | 0   | 1   | 1   | V51 <sup>n</sup> | V14+(V13-V14) X |
| 34H  | 0   | 0   | 1   | 1   | 0   | 1   | 0   | 0   | V52 <sup>n</sup> | V14+(V13-V14) X |
| 35H  | 0   | 0   | 1   | 1   | 0   | 1   | 0   | 1   | V53 <sup>n</sup> | V14+(V13-V14) X |
| 36H  | 0   | 0   | 1   | 1   | 0   | 1   | 1   | 0   | V54 <sup>n</sup> | V14+(V13-V14) X |
| 37H  | 0   | 0   | 1   | 1   | 0   | 1   | 1   | 1   | V55 <sup>n</sup> | V14+(V13-V14) X |
| 38H  | 0   | 0   | 1   | 1   | 1   | 0   | 0   | 0   | V56 <sup>n</sup> | V14+(V13-V14) X |
| 39H  | 0   | 0   | 1   | 1   | 1   | 0   | 0   | 1   | V57 <sup>n</sup> | V14+(V13-V14) X |
| 3AH  | 0   | 0   | 1   | 1   | 1   | 0   | 1   | 0   | V58 <sup>n</sup> | V14+(V13-V14) X |
| 3BH  | 0   | 0   | 1   | 1   | 1   | 0   | 1   | 1   | V59 <sup>n</sup> | V14+(V13-V14) X |
| 3CH  | 0   | 0   | 1   | 1   | 1   | 1   | 0   | 0   | V60 <sup>n</sup> | V14+(V13-V14) X |
| 3DH  | 0   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | V61 <sup>n</sup> | V14+(V13-V14) X |
| 3EH  | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 0   | V62 <sup>n</sup> | V14+(V13-V14) X |
| 3FH  | 0   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | V63 <sup>n</sup> | V14+(V13-V14) X |

| rn  | (Ω)   |
|-----|-------|
| r0  | 400.0 |
| r1  | 362.5 |
| r2  | 325.0 |
| r3  | 287.5 |
| r4  | 250.0 |
| r5  | 222.5 |
| r6  | 195.0 |
| r7  | 170.0 |
| r8  | 145.0 |
| r9  | 120.0 |
| r10 | 120.0 |
| r11 | 120.0 |
| r12 | 95.0  |
| r13 | 95.0  |
| r14 | 95.0  |
| r15 | 75.0  |
| r16 | 75.0  |
| r17 | 75.0  |
| r18 | 62.5  |
| r19 | 62.5  |
| r20 | 62.5  |
| r21 | 50.0  |
| r22 | 50.0  |
| r23 | 50.0  |
| r24 | 37.5  |
| r25 | 37.5  |
| r26 | 37.5  |
| r27 | 37.5  |
| r28 | 37.5  |
| r29 | 37.5  |
| r30 | 37.5  |
| r31 | 37.5  |
| r32 | 35.0  |
| r33 | 35.0  |
| r34 | 35.0  |
| r35 | 35.0  |
| r36 | 35.0  |
| r37 | 35.0  |
| r38 | 35.0  |
| r39 | 35.0  |
| r40 | 32.5  |
| r41 | 32.5  |
| r42 | 32.5  |
| r43 | 32.5  |
| r44 | 32.5  |
| r45 | 32.5  |
| r46 | 32.5  |
| r47 | 32.5  |
| r48 | 30.0  |
| r49 | 30.0  |
| r50 | 30.0  |
| r51 | 30.0  |
| r52 | 30.0  |
| r53 | 30.0  |
| r54 | 30.0  |
| r55 | 30.0  |
| r56 | 27.5  |
| r57 | 27.5  |
| r58 | 27.5  |
| r59 | 27.5  |
| r60 | 27.5  |
| r61 | 27.5  |
| r62 | 27.5  |
| r63 | 27.5  |

Caution There is no connection between V7 and V8 in the chip.

Figure 5-3. Relationship between Input Data and Output Voltage (2/4)

0.5 V<sub>DD2</sub> – 0.3 V > V<sub>8</sub> > V<sub>9</sub> > V<sub>10</sub> > V<sub>11</sub> > V<sub>12</sub> > V<sub>13</sub> > V<sub>14</sub> > V<sub>15</sub> > V<sub>SS2</sub> + 0.2 V, POL21/22 = L



| Data | D <sub>x7</sub> | D <sub>x6</sub> | D <sub>x5</sub> | D <sub>x4</sub> | D <sub>x3</sub> | D <sub>x2</sub> | D <sub>x1</sub> | D <sub>x0</sub> | Output voltage                |  |      |        |
|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------------------------|--|------|--------|
| 40H  | 0               | 1               | 0               | 0               | 0               | 0               | 0               | 0               | V <sub>64</sub> <sup>n</sup>  | V <sub>13</sub>  |      |        |
| 41H  | 0               | 1               | 0               | 0               | 0               | 0               | 0               | 1               | V <sub>65</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 25   | / 1600 |
| 42H  | 0               | 1               | 0               | 0               | 0               | 0               | 1               | 0               | V <sub>66</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 50   | / 1600 |
| 43H  | 0               | 1               | 0               | 0               | 0               | 0               | 1               | 1               | V <sub>67</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 75   | / 1600 |
| 44H  | 0               | 1               | 0               | 0               | 0               | 1               | 0               | 0               | V <sub>68</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 100  | / 1600 |
| 45H  | 0               | 1               | 0               | 0               | 0               | 1               | 0               | 1               | V <sub>69</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 125  | / 1600 |
| 46H  | 0               | 1               | 0               | 0               | 0               | 1               | 1               | 0               | V <sub>70</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 150  | / 1600 |
| 47H  | 0               | 1               | 0               | 0               | 0               | 1               | 1               | 1               | V <sub>71</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 175  | / 1600 |
| 48H  | 0               | 1               | 0               | 0               | 1               | 0               | 0               | 0               | V <sub>72</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 200  | / 1600 |
| 49H  | 0               | 1               | 0               | 0               | 1               | 0               | 0               | 1               | V <sub>73</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 225  | / 1600 |
| 4AH  | 0               | 1               | 0               | 0               | 1               | 0               | 1               | 0               | V <sub>74</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 250  | / 1600 |
| 4BH  | 0               | 1               | 0               | 0               | 1               | 0               | 1               | 1               | V <sub>75</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 275  | / 1600 |
| 4CH  | 0               | 1               | 0               | 0               | 1               | 1               | 0               | 0               | V <sub>76</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 300  | / 1600 |
| 4DH  | 0               | 1               | 0               | 0               | 1               | 1               | 0               | 1               | V <sub>77</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 325  | / 1600 |
| 4EH  | 0               | 1               | 0               | 0               | 1               | 1               | 1               | 0               | V <sub>78</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 350  | / 1600 |
| 4FH  | 0               | 1               | 0               | 0               | 1               | 1               | 1               | 1               | V <sub>79</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 375  | / 1600 |
| 50H  | 0               | 1               | 0               | 1               | 0               | 0               | 0               | 0               | V <sub>80</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 400  | / 1600 |
| 51H  | 0               | 1               | 0               | 1               | 0               | 0               | 0               | 1               | V <sub>81</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 425  | / 1600 |
| 52H  | 0               | 1               | 0               | 1               | 0               | 0               | 1               | 0               | V <sub>82</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 450  | / 1600 |
| 53H  | 0               | 1               | 0               | 1               | 0               | 0               | 1               | 1               | V <sub>83</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 475  | / 1600 |
| 54H  | 0               | 1               | 0               | 1               | 0               | 1               | 0               | 0               | V <sub>84</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 500  | / 1600 |
| 55H  | 0               | 1               | 0               | 1               | 0               | 1               | 0               | 1               | V <sub>85</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 525  | / 1600 |
| 56H  | 0               | 1               | 0               | 1               | 0               | 1               | 1               | 0               | V <sub>86</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 550  | / 1600 |
| 57H  | 0               | 1               | 0               | 1               | 0               | 1               | 1               | 1               | V <sub>87</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 575  | / 1600 |
| 58H  | 0               | 1               | 0               | 1               | 1               | 0               | 0               | 0               | V <sub>88</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 600  | / 1600 |
| 59H  | 0               | 1               | 0               | 1               | 1               | 0               | 0               | 1               | V <sub>89</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 625  | / 1600 |
| 5AH  | 0               | 1               | 0               | 1               | 1               | 0               | 1               | 0               | V <sub>90</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 650  | / 1600 |
| 5BH  | 0               | 1               | 0               | 1               | 1               | 0               | 1               | 1               | V <sub>91</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 675  | / 1600 |
| 5CH  | 0               | 1               | 0               | 1               | 1               | 1               | 0               | 0               | V <sub>92</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 700  | / 1600 |
| 5DH  | 0               | 1               | 0               | 1               | 1               | 1               | 0               | 1               | V <sub>93</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 725  | / 1600 |
| 5EH  | 0               | 1               | 0               | 1               | 1               | 1               | 1               | 0               | V <sub>94</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 750  | / 1600 |
| 5FH  | 0               | 1               | 0               | 1               | 1               | 1               | 1               | 1               | V <sub>95</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 775  | / 1600 |
| 60H  | 0               | 1               | 1               | 0               | 0               | 0               | 0               | 0               | V <sub>96</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 800  | / 1600 |
| 61H  | 0               | 1               | 1               | 0               | 0               | 0               | 0               | 1               | V <sub>97</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 825  | / 1600 |
| 62H  | 0               | 1               | 1               | 0               | 0               | 0               | 1               | 0               | V <sub>98</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 850  | / 1600 |
| 63H  | 0               | 1               | 1               | 0               | 0               | 0               | 1               | 1               | V <sub>99</sub> <sup>n</sup>  | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 875  | / 1600 |
| 64H  | 0               | 1               | 1               | 0               | 0               | 1               | 0               | 0               | V <sub>100</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 900  | / 1600 |
| 65H  | 0               | 1               | 1               | 0               | 0               | 1               | 0               | 1               | V <sub>101</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 925  | / 1600 |
| 66H  | 0               | 1               | 1               | 0               | 0               | 1               | 1               | 0               | V <sub>102</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 950  | / 1600 |
| 67H  | 0               | 1               | 1               | 0               | 0               | 1               | 1               | 1               | V <sub>103</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 975  | / 1600 |
| 68H  | 0               | 1               | 1               | 0               | 1               | 0               | 0               | 0               | V <sub>104</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1000 | / 1600 |
| 69H  | 0               | 1               | 1               | 0               | 1               | 0               | 0               | 1               | V <sub>105</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1025 | / 1600 |
| 6AH  | 0               | 1               | 1               | 0               | 1               | 0               | 1               | 0               | V <sub>106</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1050 | / 1600 |
| 6BH  | 0               | 1               | 1               | 0               | 1               | 0               | 1               | 1               | V <sub>107</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1075 | / 1600 |
| 6CH  | 0               | 1               | 1               | 0               | 1               | 1               | 0               | 0               | V <sub>108</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1100 | / 1600 |
| 6DH  | 0               | 1               | 1               | 0               | 1               | 1               | 0               | 1               | V <sub>109</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1125 | / 1600 |
| 6EH  | 0               | 1               | 1               | 0               | 1               | 1               | 1               | 0               | V <sub>110</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1150 | / 1600 |
| 6FH  | 0               | 1               | 1               | 0               | 1               | 1               | 1               | 1               | V <sub>111</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1175 | / 1600 |
| 70H  | 0               | 1               | 1               | 1               | 0               | 0               | 0               | 0               | V <sub>112</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1200 | / 1600 |
| 71H  | 0               | 1               | 1               | 1               | 0               | 0               | 0               | 1               | V <sub>113</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1225 | / 1600 |
| 72H  | 0               | 1               | 1               | 1               | 0               | 0               | 1               | 0               | V <sub>114</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1250 | / 1600 |
| 73H  | 0               | 1               | 1               | 1               | 0               | 0               | 1               | 1               | V <sub>115</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1275 | / 1600 |
| 74H  | 0               | 1               | 1               | 1               | 0               | 1               | 0               | 0               | V <sub>116</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1300 | / 1600 |
| 75H  | 0               | 1               | 1               | 1               | 0               | 1               | 0               | 1               | V <sub>117</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1325 | / 1600 |
| 76H  | 0               | 1               | 1               | 1               | 0               | 1               | 1               | 0               | V <sub>118</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1350 | / 1600 |
| 77H  | 0               | 1               | 1               | 1               | 0               | 1               | 1               | 1               | V <sub>119</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1375 | / 1600 |
| 78H  | 0               | 1               | 1               | 1               | 1               | 0               | 0               | 0               | V <sub>120</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1400 | / 1600 |
| 79H  | 0               | 1               | 1               | 1               | 1               | 0               | 0               | 1               | V <sub>121</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1425 | / 1600 |
| 7AH  | 0               | 1               | 1               | 1               | 1               | 0               | 1               | 0               | V <sub>122</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1450 | / 1600 |
| 7BH  | 0               | 1               | 1               | 1               | 1               | 0               | 1               | 1               | V <sub>123</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1475 | / 1600 |
| 7CH  | 0               | 1               | 1               | 1               | 1               | 1               | 0               | 0               | V <sub>124</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1500 | / 1600 |
| 7DH  | 0               | 1               | 1               | 1               | 1               | 1               | 0               | 1               | V <sub>125</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1525 | / 1600 |
| 7EH  | 0               | 1               | 1               | 1               | 1               | 1               | 1               | 0               | V <sub>126</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1550 | / 1600 |
| 7FH  | 0               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | V <sub>127</sub> <sup>n</sup> | V <sub>13</sub> +(V <sub>12</sub> -V <sub>13</sub> ) X | 1575 | / 1600 |

| m    | (Ω)  |
|------|------|
| r64  | 25.0 |
| r65  | 25.0 |
| r66  | 25.0 |
| r67  | 25.0 |
| r68  | 25.0 |
| r69  | 25.0 |
| r70  | 25.0 |
| r71  | 25.0 |
| r72  | 25.0 |
| r73  | 25.0 |
| r74  | 25.0 |
| r75  | 25.0 |
| r76  | 25.0 |
| r77  | 25.0 |
| r78  | 25.0 |
| r79  | 25.0 |
| r80  | 25.0 |
| r81  | 25.0 |
| r82  | 25.0 |
| r83  | 25.0 |
| r84  | 25.0 |
| r85  | 25.0 |
| r86  | 25.0 |
| r87  | 25.0 |
| r88  | 25.0 |
| r89  | 25.0 |
| r90  | 25.0 |
| r91  | 25.0 |
| r92  | 25.0 |
| r93  | 25.0 |
| r94  | 25.0 |
| r95  | 25.0 |
| r96  | 25.0 |
| r97  | 25.0 |
| r98  | 25.0 |
| r99  | 25.0 |
| r100 | 25.0 |
| r101 | 25.0 |
| r102 | 25.0 |
| r103 | 25.0 |
| r104 | 25.0 |
| r105 | 25.0 |
| r106 | 25.0 |
| r107 | 25.0 |
| r108 | 25.0 |
| r109 | 25.0 |
| r110 | 25.0 |
| r111 | 25.0 |
| r112 | 25.0 |
| r113 | 25.0 |
| r114 | 25.0 |
| r115 | 25.0 |
| r116 | 25.0 |
| r117 | 25.0 |
| r118 | 25.0 |
| r119 | 25.0 |
| r120 | 25.0 |
| r121 | 25.0 |
| r122 | 25.0 |
| r123 | 25.0 |
| r124 | 25.0 |
| r125 | 25.0 |
| r126 | 25.0 |
| r127 | 25.0 |

Caution There is no connection between V<sub>7</sub> and V<sub>8</sub> in the chip.

Figure 5-3. Relationship between Input Data and Output Voltage (3/4)

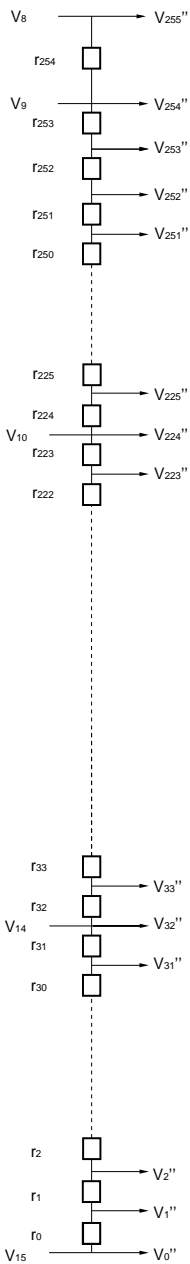
0.5 V<sub>DD2</sub> - 0.3 V > V<sub>8</sub> > V<sub>9</sub> > V<sub>10</sub> > V<sub>11</sub> > V<sub>12</sub> > V<sub>13</sub> > V<sub>14</sub> > V<sub>15</sub> > V<sub>SS2</sub> + 0.2 V, POL21/22 = L

| Data | Dx7 | Dx6 | Dx5 | Dx4 | Dx3 | Dx2 | Dx1 | Dx0 | Output voltage      |  | r    | (Ω)  |
|------|-----|-----|-----|-----|-----|-----|-----|-----|---------------------|--|------|------|
| 80H  | 1   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | V <sub>128</sub> '' | V <sub>12</sub>  | r128 | 25.0 |
| 81H  | 1   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | V <sub>129</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r129 | 25.0 |
| 82H  | 1   | 0   | 0   | 0   | 0   | 0   | 1   | 0   | V <sub>130</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r130 | 25.0 |
| 83H  | 1   | 0   | 0   | 0   | 0   | 0   | 1   | 1   | V <sub>131</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r131 | 25.0 |
| 84H  | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | V <sub>132</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r132 | 25.0 |
| 85H  | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 1   | V <sub>133</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r133 | 25.0 |
| 86H  | 1   | 0   | 0   | 0   | 0   | 1   | 1   | 0   | V <sub>134</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r134 | 25.0 |
| 87H  | 1   | 0   | 0   | 0   | 0   | 1   | 1   | 1   | V <sub>135</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r135 | 25.0 |
| 88H  | 1   | 0   | 0   | 0   | 1   | 0   | 0   | 0   | V <sub>136</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r136 | 25.0 |
| 89H  | 1   | 0   | 0   | 0   | 1   | 0   | 0   | 1   | V <sub>137</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r137 | 25.0 |
| 8AH  | 1   | 0   | 0   | 0   | 1   | 0   | 1   | 0   | V <sub>138</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r138 | 25.0 |
| 8BH  | 1   | 0   | 0   | 0   | 1   | 0   | 1   | 1   | V <sub>139</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r139 | 25.0 |
| 8CH  | 1   | 0   | 0   | 0   | 1   | 1   | 0   | 0   | V <sub>140</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r140 | 25.0 |
| 8DH  | 1   | 0   | 0   | 0   | 1   | 1   | 0   | 1   | V <sub>141</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r141 | 25.0 |
| 8EH  | 1   | 0   | 0   | 0   | 1   | 1   | 1   | 0   | V <sub>142</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r142 | 25.0 |
| 8FH  | 1   | 0   | 0   | 0   | 1   | 1   | 1   | 1   | V <sub>143</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r143 | 25.0 |
| 90H  | 1   | 0   | 0   | 1   | 0   | 0   | 0   | 0   | V <sub>144</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r144 | 25.0 |
| 91H  | 1   | 0   | 0   | 1   | 0   | 0   | 0   | 1   | V <sub>145</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r145 | 25.0 |
| 92H  | 1   | 0   | 0   | 1   | 0   | 0   | 1   | 0   | V <sub>146</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r146 | 25.0 |
| 93H  | 1   | 0   | 0   | 1   | 0   | 0   | 1   | 1   | V <sub>147</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r147 | 25.0 |
| 94H  | 1   | 0   | 0   | 1   | 0   | 1   | 0   | 0   | V <sub>148</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r148 | 25.0 |
| 95H  | 1   | 0   | 0   | 1   | 0   | 1   | 0   | 1   | V <sub>149</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r149 | 25.0 |
| 96H  | 1   | 0   | 0   | 1   | 0   | 1   | 1   | 0   | V <sub>150</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r150 | 25.0 |
| 97H  | 1   | 0   | 0   | 1   | 0   | 1   | 1   | 1   | V <sub>151</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r151 | 25.0 |
| 98H  | 1   | 0   | 0   | 1   | 1   | 0   | 0   | 0   | V <sub>152</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r152 | 27.5 |
| 99H  | 1   | 0   | 0   | 1   | 1   | 0   | 0   | 1   | V <sub>153</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r153 | 27.5 |
| 9AH  | 1   | 0   | 0   | 1   | 1   | 0   | 1   | 0   | V <sub>154</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r154 | 27.5 |
| 9BH  | 1   | 0   | 0   | 1   | 1   | 0   | 1   | 1   | V <sub>155</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r155 | 27.5 |
| 9CH  | 1   | 0   | 0   | 1   | 1   | 1   | 0   | 0   | V <sub>156</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r156 | 27.5 |
| 9DH  | 1   | 0   | 0   | 1   | 1   | 1   | 0   | 1   | V <sub>157</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r157 | 27.5 |
| 9EH  | 1   | 0   | 0   | 1   | 1   | 1   | 1   | 0   | V <sub>158</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r158 | 27.5 |
| 9FH  | 1   | 0   | 0   | 1   | 1   | 1   | 1   | 1   | V <sub>159</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r159 | 27.5 |
| A0H  | 1   | 0   | 1   | 0   | 0   | 0   | 0   | 0   | V <sub>160</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r160 | 30.0 |
| A1H  | 1   | 0   | 1   | 0   | 0   | 0   | 0   | 1   | V <sub>161</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r161 | 30.0 |
| A2H  | 1   | 0   | 1   | 0   | 0   | 0   | 1   | 0   | V <sub>162</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r162 | 30.0 |
| A3H  | 1   | 0   | 1   | 0   | 0   | 0   | 1   | 1   | V <sub>163</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r163 | 30.0 |
| A4H  | 1   | 0   | 1   | 0   | 0   | 1   | 0   | 0   | V <sub>164</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r164 | 30.0 |
| A5H  | 1   | 0   | 1   | 0   | 0   | 1   | 0   | 1   | V <sub>165</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r165 | 30.0 |
| A6H  | 1   | 0   | 1   | 0   | 0   | 1   | 1   | 0   | V <sub>166</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r166 | 30.0 |
| A7H  | 1   | 0   | 1   | 0   | 0   | 1   | 1   | 1   | V <sub>167</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r167 | 30.0 |
| A8H  | 1   | 0   | 1   | 0   | 1   | 0   | 0   | 0   | V <sub>168</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r168 | 32.5 |
| A9H  | 1   | 0   | 1   | 0   | 1   | 0   | 0   | 1   | V <sub>169</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r169 | 32.5 |
| AAH  | 1   | 0   | 1   | 0   | 1   | 0   | 1   | 0   | V <sub>170</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r170 | 32.5 |
| ABH  | 1   | 0   | 1   | 0   | 1   | 0   | 1   | 1   | V <sub>171</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r171 | 32.5 |
| ACH  | 1   | 0   | 1   | 0   | 1   | 1   | 0   | 0   | V <sub>172</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r172 | 32.5 |
| ADH  | 1   | 0   | 1   | 0   | 1   | 1   | 0   | 1   | V <sub>173</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r173 | 32.5 |
| AEH  | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 0   | V <sub>174</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r174 | 32.5 |
| AFH  | 1   | 0   | 1   | 0   | 1   | 1   | 1   | 1   | V <sub>175</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r175 | 32.5 |
| BOH  | 1   | 0   | 1   | 1   | 0   | 0   | 0   | 0   | V <sub>176</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r176 | 35.0 |
| B1H  | 1   | 0   | 1   | 1   | 0   | 0   | 0   | 1   | V <sub>177</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r177 | 35.0 |
| B2H  | 1   | 0   | 1   | 1   | 0   | 0   | 1   | 0   | V <sub>178</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r178 | 35.0 |
| B3H  | 1   | 0   | 1   | 1   | 0   | 0   | 1   | 1   | V <sub>179</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r179 | 35.0 |
| B4H  | 1   | 0   | 1   | 1   | 0   | 1   | 0   | 0   | V <sub>180</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r180 | 35.0 |
| B5H  | 1   | 0   | 1   | 1   | 0   | 1   | 0   | 1   | V <sub>181</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r181 | 35.0 |
| B6H  | 1   | 0   | 1   | 1   | 0   | 1   | 1   | 0   | V <sub>182</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r182 | 35.0 |
| B7H  | 1   | 0   | 1   | 1   | 0   | 1   | 1   | 1   | V <sub>183</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r183 | 35.0 |
| B8H  | 1   | 0   | 1   | 1   | 1   | 0   | 0   | 0   | V <sub>184</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r184 | 37.5 |
| B9H  | 1   | 0   | 1   | 1   | 1   | 0   | 0   | 1   | V <sub>185</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r185 | 37.5 |
| BAH  | 1   | 0   | 1   | 1   | 1   | 0   | 1   | 0   | V <sub>186</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r186 | 37.5 |
| BBH  | 1   | 0   | 1   | 1   | 1   | 0   | 1   | 1   | V <sub>187</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r187 | 37.5 |
| BCH  | 1   | 0   | 1   | 1   | 1   | 1   | 0   | 0   | V <sub>188</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r188 | 37.5 |
| BDH  | 1   | 0   | 1   | 1   | 1   | 1   | 0   | 1   | V <sub>189</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r189 | 37.5 |
| BEH  | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 0   | V <sub>190</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r190 | 37.5 |
| BFH  | 1   | 0   | 1   | 1   | 1   | 1   | 1   | 1   | V <sub>191</sub> '' | V <sub>12</sub> +(V <sub>11</sub> -V <sub>12</sub> ) X | r191 | 37.5 |

Caution There is no connection between V<sub>7</sub> and V<sub>8</sub> in the chip.

Figure 5-3. Relationship between Input Data and Output Voltage (4/4)

0.5 V<sub>DD2</sub> - 0.3 V > V<sub>8</sub> > V<sub>9</sub> > V<sub>10</sub> > V<sub>11</sub> > V<sub>12</sub> > V<sub>13</sub> > V<sub>14</sub> > V<sub>15</sub> > V<sub>SS2</sub> + 0.2 V, POL21/22 = L



| Data | D <sub>x7</sub> | D <sub>x6</sub> | D <sub>x5</sub> | D <sub>x4</sub> | D <sub>x3</sub> | D <sub>x2</sub> | D <sub>x1</sub> | D <sub>x0</sub> | Output voltage                |  |
|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------------------------|--|
| C0H  | 1               | 1               | 0               | 0               | 0               | 0               | 0               | 0               | V <sub>192</sub> <sup>n</sup> | V <sub>11</sub>  |
| C1H  | 1               | 1               | 0               | 0               | 0               | 0               | 0               | 1               | V <sub>193</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| C2H  | 1               | 1               | 0               | 0               | 0               | 0               | 1               | 0               | V <sub>194</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| C3H  | 1               | 1               | 0               | 0               | 0               | 0               | 1               | 1               | V <sub>195</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| C4H  | 1               | 1               | 0               | 0               | 0               | 1               | 0               | 0               | V <sub>196</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| C5H  | 1               | 1               | 0               | 0               | 0               | 1               | 0               | 1               | V <sub>197</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| C6H  | 1               | 1               | 0               | 0               | 0               | 1               | 1               | 0               | V <sub>198</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| C7H  | 1               | 1               | 0               | 0               | 0               | 1               | 1               | 1               | V <sub>199</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| C8H  | 1               | 1               | 0               | 0               | 1               | 0               | 0               | 0               | V <sub>200</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| C9H  | 1               | 1               | 0               | 0               | 1               | 0               | 0               | 1               | V <sub>201</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| CAH  | 1               | 1               | 0               | 0               | 1               | 0               | 1               | 0               | V <sub>202</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| CBH  | 1               | 1               | 0               | 0               | 1               | 0               | 1               | 1               | V <sub>203</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| CCH  | 1               | 1               | 0               | 0               | 1               | 1               | 0               | 0               | V <sub>204</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| CDH  | 1               | 1               | 0               | 0               | 1               | 1               | 0               | 1               | V <sub>205</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| CEH  | 1               | 1               | 0               | 0               | 1               | 1               | 1               | 0               | V <sub>206</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| CFH  | 1               | 1               | 0               | 0               | 1               | 1               | 1               | 1               | V <sub>207</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D0H  | 1               | 1               | 0               | 1               | 0               | 0               | 0               | 0               | V <sub>208</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D1H  | 1               | 1               | 0               | 1               | 0               | 0               | 0               | 1               | V <sub>209</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D2H  | 1               | 1               | 0               | 1               | 0               | 0               | 1               | 0               | V <sub>210</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D3H  | 1               | 1               | 0               | 1               | 0               | 0               | 1               | 1               | V <sub>211</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D4H  | 1               | 1               | 0               | 1               | 0               | 1               | 0               | 0               | V <sub>212</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D5H  | 1               | 1               | 0               | 1               | 0               | 1               | 0               | 1               | V <sub>213</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D6H  | 1               | 1               | 0               | 1               | 0               | 1               | 1               | 0               | V <sub>214</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D7H  | 1               | 1               | 0               | 1               | 0               | 1               | 1               | 1               | V <sub>215</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D8H  | 1               | 1               | 0               | 1               | 1               | 0               | 0               | 0               | V <sub>216</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| D9H  | 1               | 1               | 0               | 1               | 1               | 0               | 0               | 1               | V <sub>217</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| DAH  | 1               | 1               | 0               | 1               | 1               | 0               | 1               | 0               | V <sub>218</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| DBH  | 1               | 1               | 0               | 1               | 1               | 0               | 1               | 1               | V <sub>219</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| DCH  | 1               | 1               | 0               | 1               | 1               | 1               | 0               | 0               | V <sub>220</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| DDH  | 1               | 1               | 0               | 1               | 1               | 1               | 0               | 1               | V <sub>221</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| DEH  | 1               | 1               | 0               | 1               | 1               | 1               | 1               | 0               | V <sub>222</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| DFH  | 1               | 1               | 0               | 1               | 1               | 1               | 1               | 1               | V <sub>223</sub> <sup>n</sup> | V <sub>11</sub> +(V <sub>10</sub> -V <sub>11</sub> ) X |
| E0H  | 1               | 1               | 1               | 0               | 0               | 0               | 0               | 0               | V <sub>224</sub> <sup>n</sup> | V <sub>10</sub>  |
| E1H  | 1               | 1               | 1               | 0               | 0               | 0               | 0               | 1               | V <sub>225</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| E2H  | 1               | 1               | 1               | 0               | 0               | 0               | 1               | 0               | V <sub>226</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| E3H  | 1               | 1               | 1               | 0               | 0               | 0               | 1               | 1               | V <sub>227</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| E4H  | 1               | 1               | 1               | 0               | 0               | 1               | 0               | 0               | V <sub>228</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| E5H  | 1               | 1               | 1               | 0               | 0               | 1               | 0               | 1               | V <sub>229</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| E6H  | 1               | 1               | 1               | 0               | 0               | 1               | 1               | 0               | V <sub>230</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| E7H  | 1               | 1               | 1               | 0               | 0               | 1               | 1               | 1               | V <sub>231</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| E8H  | 1               | 1               | 1               | 0               | 1               | 0               | 0               | 0               | V <sub>232</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| E9H  | 1               | 1               | 1               | 0               | 1               | 0               | 0               | 1               | V <sub>233</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| EAH  | 1               | 1               | 1               | 0               | 1               | 0               | 1               | 0               | V <sub>234</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| EBH  | 1               | 1               | 1               | 0               | 1               | 0               | 1               | 1               | V <sub>235</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| ECH  | 1               | 1               | 1               | 0               | 1               | 1               | 0               | 0               | V <sub>236</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| EDH  | 1               | 1               | 1               | 0               | 1               | 1               | 0               | 1               | V <sub>237</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| EEH  | 1               | 1               | 1               | 0               | 1               | 1               | 1               | 0               | V <sub>238</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| EFH  | 1               | 1               | 1               | 0               | 1               | 1               | 1               | 1               | V <sub>239</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F0H  | 1               | 1               | 1               | 1               | 0               | 0               | 0               | 0               | V <sub>240</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F1H  | 1               | 1               | 1               | 1               | 0               | 0               | 0               | 1               | V <sub>241</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F2H  | 1               | 1               | 1               | 1               | 0               | 0               | 1               | 0               | V <sub>242</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F3H  | 1               | 1               | 1               | 1               | 0               | 0               | 1               | 1               | V <sub>243</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F4H  | 1               | 1               | 1               | 1               | 0               | 1               | 0               | 0               | V <sub>244</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F5H  | 1               | 1               | 1               | 1               | 0               | 1               | 0               | 1               | V <sub>245</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F6H  | 1               | 1               | 1               | 1               | 0               | 1               | 1               | 0               | V <sub>246</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F7H  | 1               | 1               | 1               | 1               | 0               | 1               | 1               | 1               | V <sub>247</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F8H  | 1               | 1               | 1               | 1               | 1               | 0               | 0               | 0               | V <sub>248</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| F9H  | 1               | 1               | 1               | 1               | 1               | 0               | 0               | 1               | V <sub>249</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| FAH  | 1               | 1               | 1               | 1               | 1               | 0               | 1               | 0               | V <sub>250</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| FBH  | 1               | 1               | 1               | 1               | 1               | 0               | 1               | 1               | V <sub>251</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| FCH  | 1               | 1               | 1               | 1               | 1               | 1               | 0               | 0               | V <sub>252</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| FDH  | 1               | 1               | 1               | 1               | 1               | 1               | 0               | 1               | V <sub>253</sub> <sup>n</sup> | V <sub>10</sub> +(V <sub>9</sub> -V <sub>10</sub> ) X  |
| FEH  | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 0               | V <sub>254</sub> <sup>n</sup> | V <sub>9</sub>   |
| FFH  | 1               | 1               | 1               | 1               | 1               | 1               | 1               | 1               | V <sub>255</sub> <sup>n</sup> | V <sub>8</sub>   |

| r <sub>n</sub> | (Ω)     |
|----------------|---------|
| r192           | 42.5    |
| r193           | 42.5    |
| r194           | 42.5    |
| r195           | 42.5    |
| r196           | 42.5    |
| r197           | 42.5    |
| r198           | 42.5    |
| r199           | 42.5    |
| r200           | 47.5    |
| r201           | 47.5    |
| r202           | 47.5    |
| r203           | 47.5    |
| r204           | 47.5    |
| r205           | 47.5    |
| r206           | 47.5    |
| r207           | 47.5    |
| r208           | 52.5    |
| r209           | 52.5    |
| r210           | 52.5    |
| r211           | 52.5    |
| r212           | 52.5    |
| r213           | 52.5    |
| r214           | 52.5    |
| r215           | 52.5    |
| r216           | 57.5    |
| r217           | 57.5    |
| r218           | 57.5    |
| r219           | 57.5    |
| r220           | 57.5    |
| r221           | 57.5    |
| r222           | 57.5    |
| r223           | 57.5    |
| r224           | 57.5    |
| r225           | 70.0    |
| r226           | 70.0    |
| r227           | 70.0    |
| r228           | 82.5    |
| r229           | 82.5    |
| r230           | 82.5    |
| r231           | 95.0    |
| r232           | 95.0    |
| r233           | 95.0    |
| r234           | 112.5   |
| r235           | 112.5   |
| r236           | 112.5   |
| r237           | 130.0   |
| r238           | 130.0   |
| r239           | 147.5   |
| r240           | 147.5   |
| r241           | 165.0   |
| r242           | 165.0   |
| r243           | 182.5   |
| r244           | 182.5   |
| r245           | 200.0   |
| r246           | 200.0   |
| r247           | 225.0   |
| r248           | 225.0   |
| r249           | 250.0   |
| r250           | 250.0   |
| r251           | 300.0   |
| r252           | 300.0   |
| r253           | 350.0   |
| r254           | 350.0   |
| TOTAL          | 15002.5 |

Caution There is no connection between V<sub>7</sub> and V<sub>8</sub> in the chip.

### 6. RELATIONSHIP BETWEEN INPUT DATA AND OUTPUT PIN

Data format : 8 bits x 2 RGBs (6 dots)

Input width : 48 bits (2-pixel data)

(1) R,/L = H (Right shift)

|        |                                    |                                    |                                    |                                    |     |                                    |                                    |
|--------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|-----|------------------------------------|------------------------------------|
| Output | S <sub>1</sub>                     | S <sub>2</sub>                     | S <sub>3</sub>                     | S <sub>4</sub>                     | ... | S <sub>383</sub>                   | S <sub>384</sub>                   |
| Data   | D <sub>00</sub> to D <sub>07</sub> | D <sub>10</sub> to D <sub>17</sub> | D <sub>20</sub> to D <sub>27</sub> | D <sub>30</sub> to D <sub>37</sub> | ... | D <sub>40</sub> to D <sub>47</sub> | D <sub>50</sub> to D <sub>57</sub> |

(2) R,/L = L (Left shift)

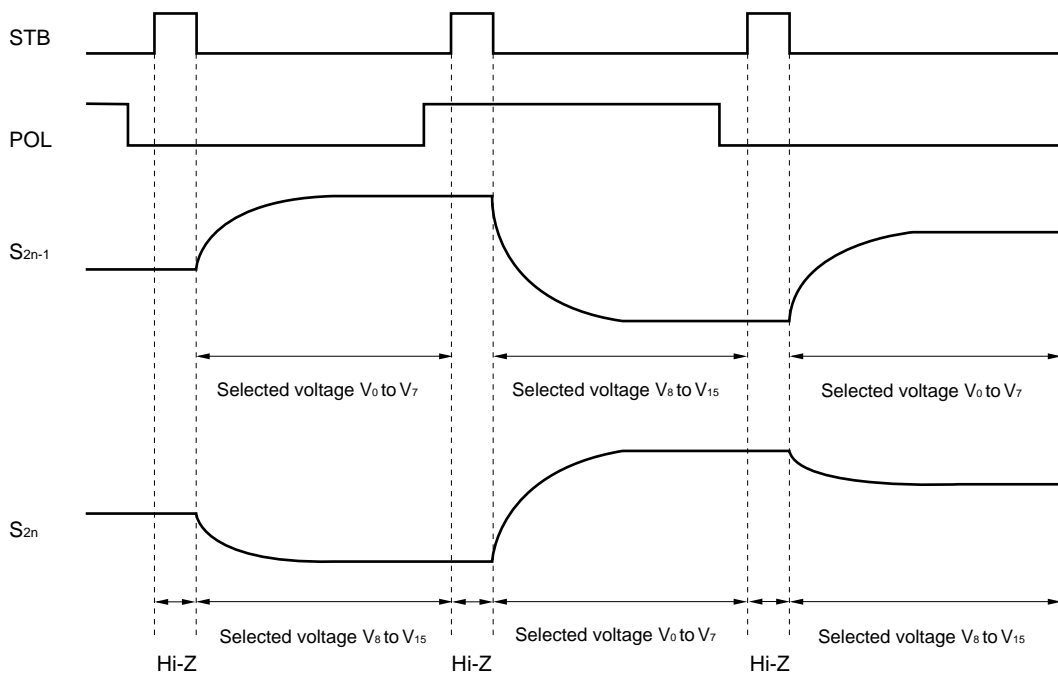
|        |                                    |                                    |                                    |                                    |     |                                    |                                    |
|--------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|-----|------------------------------------|------------------------------------|
| Output | S <sub>1</sub>                     | S <sub>2</sub>                     | S <sub>3</sub>                     | S <sub>4</sub>                     | ... | S <sub>383</sub>                   | S <sub>384</sub>                   |
| Data   | D <sub>00</sub> to D <sub>07</sub> | D <sub>10</sub> to D <sub>17</sub> | D <sub>20</sub> to D <sub>27</sub> | D <sub>30</sub> to D <sub>37</sub> | ... | D <sub>40</sub> to D <sub>47</sub> | D <sub>50</sub> to D <sub>57</sub> |

|     |                                   |                                   |
|-----|-----------------------------------|-----------------------------------|
| POL | S <sub>2n-1</sub> <sup>Note</sup> | S <sub>2n</sub> <sup>Note</sup>   |
| L   | V <sub>0</sub> to V <sub>7</sub>  | V <sub>8</sub> to V <sub>15</sub> |
| H   | V <sub>8</sub> to V <sub>15</sub> | V <sub>0</sub> to V <sub>7</sub>  |

**Note** S<sub>2n-1</sub> (Odd output), S<sub>2n</sub> (Even output)

### 7. RELATIONSHIP BETWEEN STB, POL AND OUTPUT WAVEFORM

The output voltage is written to the LCD panel synchronized with the STB falling edge.



8. ELECTRICAL SPECIFICATIONS

**Absolute Maximum Ratings (T<sub>A</sub> = 25°C, V<sub>SS1</sub> = V<sub>SS2</sub> = 0 V)**

| Parameter                     | Symbol           | Rating                         | Unit |
|-------------------------------|------------------|--------------------------------|------|
| Logic Part Supply Voltage     | V <sub>DD1</sub> | -0.5 to +4.0                   | V    |
| Driver Part Supply Voltage    | V <sub>DD2</sub> | -0.5 to +10.0                  | V    |
| Logic Part Input Voltage      | V <sub>I1</sub>  | -0.5 to V <sub>DD1</sub> + 0.5 | V    |
| Driver Part Input Voltage     | V <sub>I2</sub>  | -0.5 to V <sub>DD2</sub> + 0.5 | V    |
| Logic Part Output Voltage     | V <sub>O1</sub>  | -0.5 to V <sub>DD1</sub> + 0.5 | V    |
| Driver Part Output Voltage    | V <sub>O2</sub>  | -0.5 to V <sub>DD2</sub> + 0.5 | V    |
| Operating Ambient Temperature | T <sub>A</sub>   | -10 to +75                     | °C   |
| Storage Temperature           | T <sub>stg</sub> | -55 to +125                    | °C   |

**Caution** If the absolute maximum rating of even one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

**Recommended Operating Range (T<sub>A</sub> = -10 to +75°C, V<sub>SS1</sub> = V<sub>SS2</sub> = 0 V)**

| Parameter                  | Symbol                            | MIN.                   | TYP. | MAX.                       | Unit |
|----------------------------|-----------------------------------|------------------------|------|----------------------------|------|
| Logic Part Supply Voltage  | V <sub>DD1</sub>                  | 3.0                    | 3.3  | 3.6                        | V    |
| Driver Part Supply Voltage | V <sub>DD2</sub>                  | 8.5                    | 9.0  | 9.5                        | V    |
| High-Level Input Voltage   | V <sub>IH</sub>                   | 0.7 V <sub>DD1</sub>   |      | V <sub>DD1</sub>           | V    |
| Low-Level Input Voltage    | V <sub>IL</sub>                   | 0                      |      | 0.3 V <sub>DD1</sub>       | V    |
| γ-Corrected Voltage        | V <sub>0</sub> to V <sub>7</sub>  | 0.5 V <sub>DD2</sub>   |      | V <sub>DD2</sub> - 0.2     | V    |
|                            | V <sub>8</sub> to V <sub>15</sub> | V <sub>SS2</sub> + 0.2 |      | 0.5 V <sub>DD2</sub> - 0.3 | V    |
| Driver Part Output Voltage | V <sub>O</sub>                    | V <sub>SS2</sub> + 0.2 |      | V <sub>DD2</sub> - 0.2     | V    |
| Clock Frequency            | f <sub>CLK</sub>                  |                        |      | 40                         | MHz  |



**Electrical Characteristics (T<sub>A</sub> = -10 to +75°C, V<sub>DD1</sub> = 3.3 V ± 0.3 V, V<sub>DD2</sub> = 9.0 V ± 0.5 V, V<sub>SS1</sub> = V<sub>SS2</sub> = 0 V)**

| Parameter                                 | Symbol            | Condition   | MIN.                                    | TYP.  | MAX.                   | Unit |    |
|---|-------------------|---|---|-------|------------------------|------|----|
| Input Leak Current                        | I <sub>IL</sub>   |   |   | ±0.1  | ±1.0                   | μA   |    |
| High-Level Output Voltage                 | V <sub>OH</sub>   | STHR (STHL), I <sub>OH</sub> = 0 mA   | V <sub>DD1</sub> - 0.1                  |       | V <sub>DD1</sub>       | V    |    |
| Low-Level Output Voltage                  | V <sub>OL</sub>   | STHR (STHL), I <sub>OL</sub> = 0 mA   | 0                                       |       | 0.1                    | V    |    |
| γ-Corrected Supply Current                | I <sub>γ</sub>    | V <sub>0</sub> to V <sub>7</sub> = V <sub>8</sub> to V <sub>15</sub><br>= 4.0 V   | V <sub>0</sub> pin, V <sub>8</sub> pin  | 225   | 450                    | 900  | μA |
|   |                   |   | V <sub>7</sub> pin, V <sub>15</sub> pin | -900  | -450                   | -225 | μA |
| Driver Output Current                     | I <sub>VOH</sub>  | V <sub>X</sub> = 7.0 V, V <sub>OUT</sub> = 6.5 V <sup>Note</sup>  |   | -185  | -90                    | μA   |    |
|   | I <sub>VOL</sub>  | V <sub>X</sub> = 1.0 V, V <sub>OUT</sub> = 1.5 V <sup>Note</sup>  | 120                                     | 238   |                        | μA   |    |
| Output Voltage Deviation                  | ΔV <sub>O</sub>   | V <sub>O</sub> = 0.2 V to 1.2 V   |   | ±30   | ±50                    | mV   |    |
|   |                   | V <sub>O</sub> = V <sub>DD2</sub> - 1.2 V to V <sub>DD2</sub> - 0.2 V   |   |       |                        |      |    |
|   |                   | V <sub>O</sub> = 1.2 V to 0.5 V <sub>DD2</sub> - 0.3 V  |   | ±10   | ±20                    | mV   |    |
|   |                   | V <sub>O</sub> = 0.5 V <sub>DD2</sub> to V <sub>DD2</sub> - 1.2 V   |   |       |                        |      |    |
| Output Swing Difference Deviation         | ΔV <sub>P-P</sub> | V <sub>O</sub> = 0.2 V to 0.8 V   |   | ±20   | ±40                    | mV   |    |
|   |                   | V <sub>O</sub> = V <sub>DD2</sub> - 0.8 V to V <sub>DD2</sub> - 0.2 V   |   |       |                        |      |    |
|   |                   | V <sub>O</sub> = 0.8 V to 1.2 V   |   | ±10   | ±20                    | mV   |    |
|   |                   | V <sub>O</sub> = V <sub>DD2</sub> - 1.2 V to V <sub>DD2</sub> - 0.8 V   |   |       |                        |      |    |
| Output Swing Average Difference Deviation | AV <sub>O</sub>   | V <sub>O</sub> = 1.2 V to 0.5 V <sub>DD2</sub> - 0.3 V  |   | ±3    | ±10                    | mV   |    |
|   |                   | V <sub>O</sub> = 0.5 V <sub>DD2</sub> to V <sub>DD2</sub> - 1.2 V   |   |       |                        |      |    |
| Output Swing Average Difference Deviation | AV <sub>O</sub>   | V <sub>DD2</sub> = 8.5 V, V <sub>0</sub> = 7.9 V, V <sub>3</sub> = 6.22 V, V <sub>7</sub> = 4.0 V, V <sub>8</sub> = 4.0 V, V <sub>12</sub> = 1.78 V, V <sub>12</sub> = 0.1 V, V <sub>1</sub> , V <sub>2</sub> , V <sub>4</sub> , V <sub>5</sub> , V <sub>6</sub> , V <sub>9</sub> , V <sub>10</sub> , V <sub>11</sub> , V <sub>13</sub> , V <sub>14</sub> : Open, T <sub>A</sub> = 25°C, Input data: 80 H | 4.433                                   | 4.440 | 4.447                  | V    |    |
| Output Voltage Range                      | V <sub>O</sub>    |   | 0.2                                     |       | V <sub>DD2</sub> - 0.2 | V    |    |
| Logic Part Dynamic Current Consumption    | I <sub>DD1</sub>  | V <sub>DD1</sub> , with no load   |   | 0.8   | 6.0                    | mA   |    |
| Driver Part Dynamic Current Consumption   | I <sub>DD2</sub>  | V <sub>DD2</sub> , with no load   |   | 4.5   | 11.0                   | mA   |    |

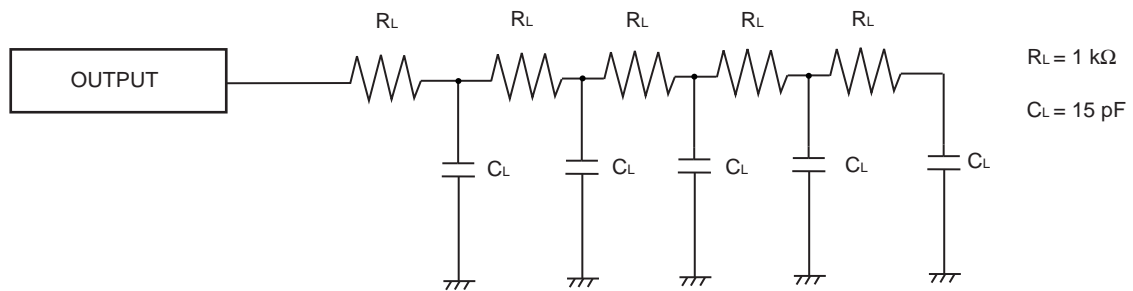
**Note** V<sub>X</sub> refers to the output voltage of analog output pins S<sub>1</sub> to S<sub>384</sub>.  
V<sub>OUT</sub> refers to the voltage applied to analog output pins S<sub>1</sub> to S<sub>384</sub>.

- Cautions**
1. The STB cycle is defined to be 20 μs at f<sub>CLK</sub> = 40 MHz.
  2. The TYP. values refer to an all black or all white input pattern. The MAX. value refers to the measured values in the dot checkerboard input pattern.
  3. Refers to the current consumption per driver when cascades are connected under the assumption of XGA single-sided mounting (8 units).

Switching Characteristics ( $T_A = -10$  to  $+75^\circ\text{C}$ ,  $V_{DD1} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $V_{DD2} = 9.0\text{ V} \pm 0.5\text{ V}$ ,  $V_{SS1} = V_{SS2} = 0\text{ V}$ )

| Parameter                | Symbol     | Condition                                       | MIN. | TYP. | MAX. | Unit          |
|--------------------------|------------|---|------|------|------|---------------|
| Start Pulse Delay Time   | $t_{PLH1}$ | $C_L = 15\text{ pF}$                            |      | 8    | 20   | ns            |
| Driver Output Delay Time | $t_{PLH2}$ | $C_L = 75\text{ pF}$ , $R_L = 5\text{ k}\Omega$ |      | 3    | 6    | $\mu\text{s}$ |
|                          | $t_{PLH3}$ |   |      | 4    | 8    | $\mu\text{s}$ |
|                          | $t_{PHL2}$ |   |      | 3    | 6    | $\mu\text{s}$ |
|                          | $t_{PHL3}$ |   |      | 4    | 8    | $\mu\text{s}$ |
| Input Capacitance        | $C_{i1}$   | STHR (STHL) excluded, $T_A = 25^\circ\text{C}$  |      | 4.8  | 10   | pF            |
|                          | $C_{i2}$   | STHR (STHL), $T_A = 25^\circ\text{C}$           |      | 8.6  | 15   | pF            |

<Measurement Condition>



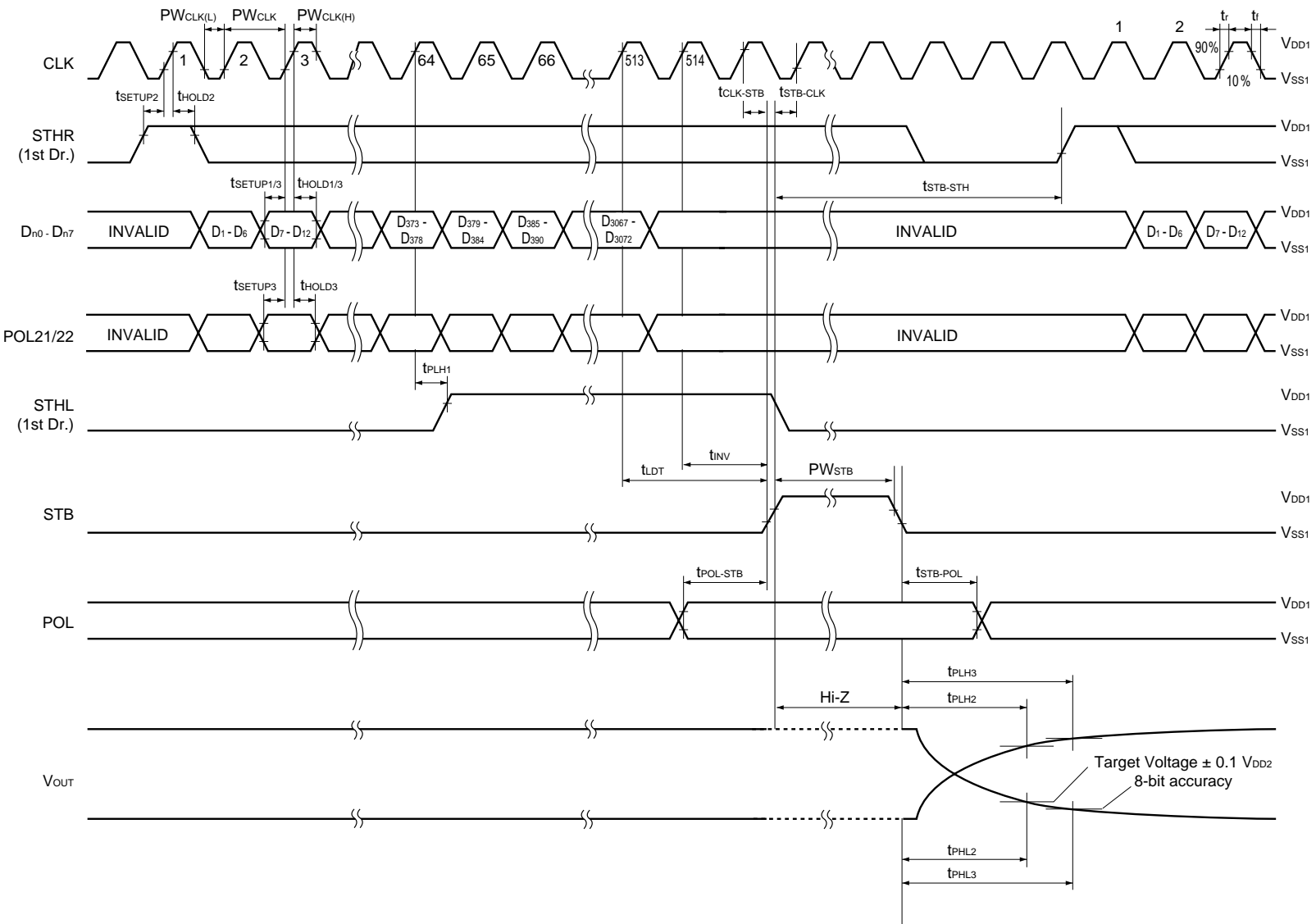
Timing Requirements ( $T_A = -10$  to  $+75^\circ\text{C}$ ,  $V_{DD1} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $V_{SS1} = 0\text{ V}$ ,  $t_r = t_f = 8.0\text{ ns}$ )

| Parameter                        | Symbol        | Condition   | MIN. | TYP. | MAX. | Unit |
|----------------------------------|---------------|---|------|------|------|------|
| Clock Pulse Width                | $PW_{CLK}$    |   | 25   |      |      | ns   |
| Clock Pulse High Period          | $PW_{CLK(H)}$ |   | 4    |      |      | ns   |
| Clock Pulse Low Period           | $PW_{CLK(L)}$ |   | 4    |      |      | ns   |
| Data Setup Time                  | $t_{SETUP1}$  |   | 2    |      |      | ns   |
| Data Hold Time                   | $t_{HOLD1}$   |   | 2    |      |      | ns   |
| Start Pulse Setup Time           | $t_{SETUP2}$  |   | 2    |      |      | ns   |
| Start Pulse Hold Time            | $t_{HOLD2}$   |   | 2    |      |      | ns   |
| ★ POL21/22 Setup Time            | $t_{SETUP3}$  |   | 2    |      |      | ns   |
| ★ POL21/22 Hold Time             | $t_{HOLD3}$   |   | 2    |      |      | ns   |
| Start Pulse Low Period           | $t_{SPL}$     |   | 1    |      |      | CLK  |
| STB Pulse Width                  | $PW_{STB}$    |   | 2    |      |      | μs   |
| Data Invalid Period              | $t_{INV}$     |   | 1    |      |      | CLK  |
| Last Data Timing                 | $t_{LDT}$     |   | 2    |      |      | CLK  |
| CLK-STB Time                     | $t_{CLK-STB}$ | CLK $\uparrow$ $\rightarrow$ STB $\uparrow$                   | 6    |      |      | ns   |
| STB-CLK Time                     | $t_{STB-CLK}$ | STB $\uparrow$ $\rightarrow$ CLK $\uparrow$                   | 6    |      |      | ns   |
| Time Between STB and Start Pulse | $t_{STB-STH}$ | STB $\uparrow$ $\rightarrow$ STHR(STHL) $\uparrow$            | 2    |      |      | CLK  |
| POL-STB Time                     | $t_{POL-STB}$ | POL $\uparrow$ or $\downarrow$ $\rightarrow$ STB $\uparrow$   | -5   |      |      | ns   |
| STB-POL Time                     | $t_{STB-POL}$ | STB $\downarrow$ $\rightarrow$ POL $\downarrow$ or $\uparrow$ | 6    |      |      | ns   |

**Remark** Unless otherwise specified, the input level is defined to be  $V_{IH} = 0.7 V_{DD1}$ ,  $V_{IL} = 0.3 V_{DD1}$ .

9. SWITCHING CHARACTERISTIC WAVEFORM (R,L=H)

Unless otherwise specified, the input level is defined to be  $V_{IH} = 0.7 V_{DD1}$ ,  $V_{IL} = 0.3 V_{DD1}$ .



**10. RECOMMENDED MOUNTING CONDITIONS**

The following conditions must be met for mounting conditions of the μ PD16750.

For more details, refer to the **Semiconductor Device Mounting Technology Manual (C10535E)**.

Please consult with our sales offices in case other mounting process is used, or in case the mounting is done under different conditions.

μ PD16750N-xxx : TCP (TAB Package)

| Mounting Condition | Mounting Method                      | Condition  |
|--------------------|--------------------------------------|--|
| Thermocompression  | Soldering                            | Heating tool 300 to 350°C, heating for 2 to 3 seconds : pressure 100g (per solder)   |
|                    | ACF<br>(Adhesive<br>Conductive Film) | Temporary bonding 70 to 100°C : pressure 3 to 8 kg/cm <sup>2</sup> : time 3 to 5 sec. Real bonding 165 to 180°C: pressure 25 to 45 kg/cm <sup>2</sup> : time 30 to 40 sec. (When using the anisotropy conductive film SUMIZAC1003 of Sumitomo Bakelite,Ltd). |

**Caution** To find out the detailed conditions for mounting the ACF part, please contact the ACF manufacturing company. Be sure to avoid using two or more mounting methods at a time.

[MEMO]

**NOTES FOR CMOS DEVICES****① PRECAUTION AGAINST ESD FOR SEMICONDUCTORS**

Note:

Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

**② HANDLING OF UNUSED INPUT PINS FOR CMOS**

Note:

No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to  $V_{DD}$  or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

**③ STATUS BEFORE INITIALIZATION OF MOS DEVICES**

Note:

Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.

**Reference Documents****NEC Semiconductor Device Reliability/Quality Control System(C10983E)****Quality Grades to NEC's Semiconductor Devices(C11531E)**

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    - Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
    - Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.
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