

# MB87077

## 6-bit, 4-channel Electronic Volume Controller

The Fujitsu MB87077 is a 6-bit, 4-channel electronic volume controller. A digital signal input controls gain every 0.5 dB step from 0dB to -32dB. It has been fabricated in CMOS technology and designed to operate with low power. Its digital inputs and outputs are TTL compatible.

The MB87077 is available in a 24-pin plastic DIP or SOP package.

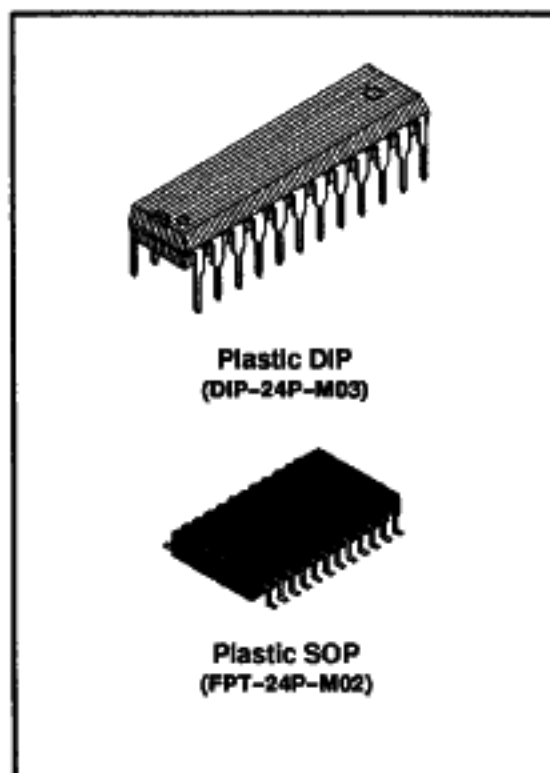
- Gain variable range: 0 dB to -32 dB by 0.5 dB or -∞
- Gain variable range is expanded to connect two channels serially (0 dB to -64 dB)
- Each channel gain can be set respectively
- Low power consumption: 12 mW at +5 V
- Easy microprocessor interface (6-bit parallel I/O)
- Test function is provided (to confirm internal data)
- Data is initialized by reset signal (all channels are set to 0db)
- Single power supply: +5 V
- Logic I/O is TTL compatible
- Package and ordering information:
  - 24-pin plastic DIP, order as MB87077P
  - 24-pin plastic SOP, order as MB87077PF

### ABSOLUTE MAXIMUM RATINGS

| Parameter               | Symbol           | Pin Name                           | Value  | Unit |
|-------------------------|------------------|------------------------------------|--|------|
| Positive Supply Voltage | V <sub>DD</sub>  | V <sub>DD</sub>                    | -0.3 to +6                                   | V    |
| Negative Supply Voltage | V <sub>SS</sub>  | V <sub>SS</sub>                    | -6 to +0.3                                   | V    |
| Digital Input Voltage   | V <sub>DI</sub>  | All digital input pins             | -0.3 to V <sub>DD</sub> +0.3                 | V    |
| Analog Input Voltage    | V <sub>AI</sub>  | A <sub>10</sub> to A <sub>13</sub> | V <sub>SS</sub> -0.3 to V <sub>DD</sub> +0.3 | V    |
| Digital Output Voltage  | V <sub>DO</sub>  | All digital output pins            | -0.3 to V <sub>DD</sub> +0.3                 | V    |
| Analog Output Voltage   | V <sub>AO</sub>  | A <sub>03</sub> to A <sub>03</sub> | V <sub>SS</sub> -0.3 to V <sub>DD</sub> +0.3 | V    |
| Digital Output Current  | I <sub>DO</sub>  | All digital output pins            | -10 to 10                                    | mA   |
| Analog Output Current   | I <sub>AO</sub>  | A <sub>00</sub> to A <sub>03</sub> | -10 to 10                                    | mA   |
| Storage Temperature     | T <sub>STG</sub> |                                    | -40 to +125                                  | °C   |

— Note —

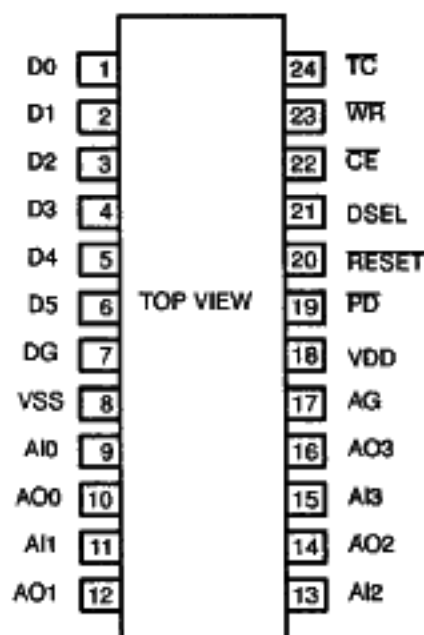
Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



Plastic DIP  
(DIP-24P-M03)

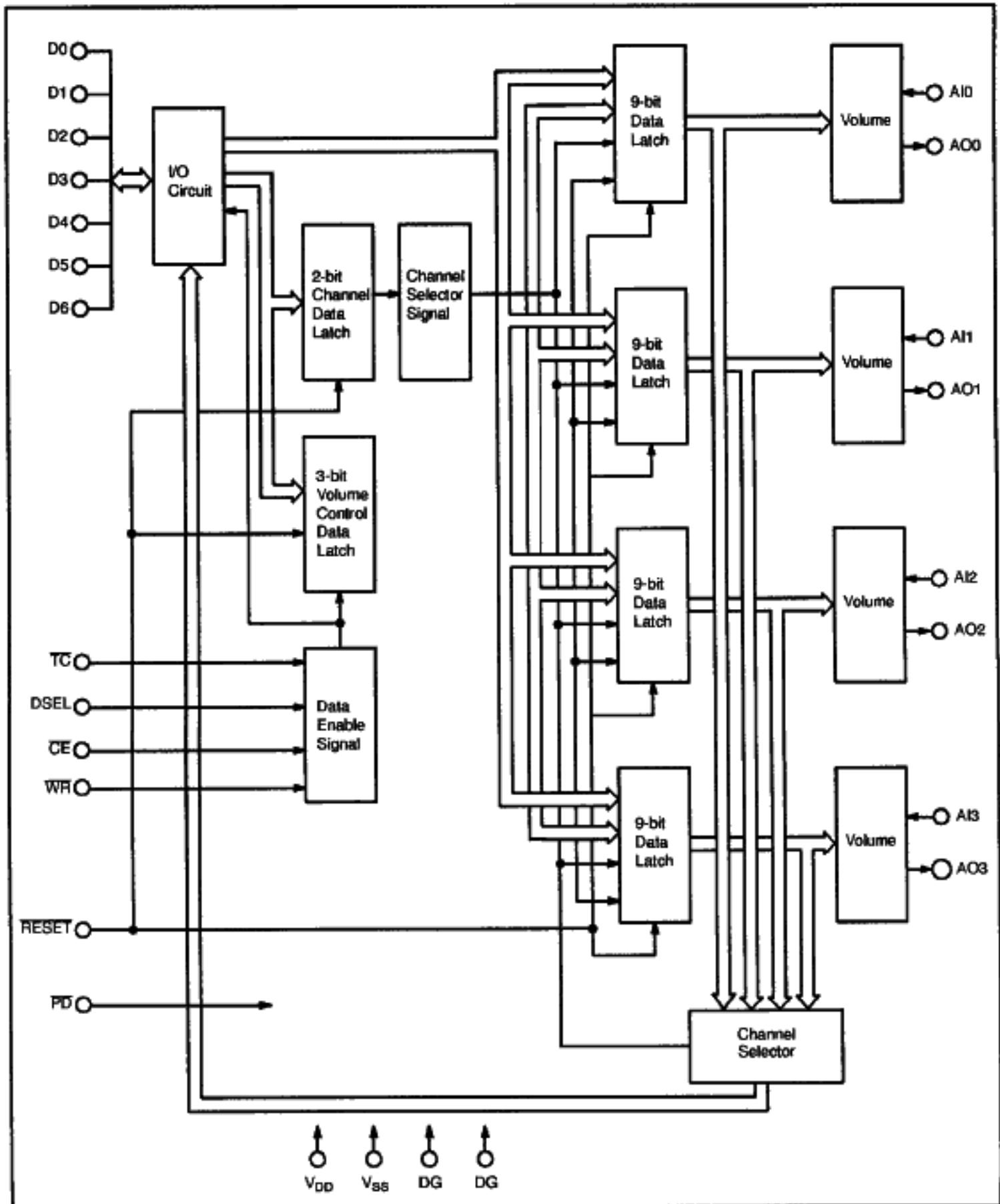
Plastic SOP  
(FPT-24P-M02)

### Pin Assignment



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

Figure 1. MB87077 Block Diagram



## PIN DESCRIPTIONS

|               | Pin No. | Pin Name        | Description  |
|---------------|---------|-----------------|--|
| Power Supply  | 18      | V <sub>DD</sub> | Positive supply voltage, +5V   |
|               | 8       | V <sub>SS</sub> | Negative supply voltage, -5V   |
|               | 17      | AG              | Ground for analog circuitry  |
|               | 7       | DG              | Ground for digital circuitry   |
| Digital Input | 21      | DSEL            | Data select input (TTL interface).<br>When this pin is set at high level, DSC1, DSC2, EN, C0 and C32 are in the write enable mode. When this pin is set at low level, GD0 to GD5 are in the write enable mode.   |
|               | 22      | CE              | Chip enable input (TTL interface). When this pin is set at low level, data input/output is available.<br>When this pin is at high level, data input/output is inhibited and the pin is set to a high impedance state.<br>This pin is pulled up by a high resistance. |
|               | 23      | WR              | Data write clock input (TTL interface).<br>Data is written at every rising edge of this clock.   |
|               | 24      | TC              | Digital signal input/output select input (TTL interface).<br>When this pin is at high level, data can be written through D0 to D5. When this pin is at low level, data can be read output from D0 to D5.<br>This pin is pulled up by a high resistance.              |
|               | 19      | PD              | Power down select input (TTL interface).<br>When this pin is at low level, the power down mode is selected. When this pin is at high level, the operation mode is selected.<br>This pin is pulled up by a high resistance.   |
|               | 20      | RESET           | Reset input (TTL interface).<br>When this pin is at low level, the data latches for all channels are initialized and the value is set as 0 dB.<br>This pin is pulled up by a high resistance.  |

*Continued on next page*

## PIN DESCRIPTIONS (continued)



|                  | Pin No. | Pin Name | Description  |         |      |         |     |                      |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
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| Digital I/O Pins | 1       | D0       | <p>When TC = H is at CE = L, data can be written through D0 to D5. When TC = L is at CE = L, data can be read out from D0 to D5.</p> <p>When DSEL is at high level, DSC1, DSC2, EN, C0 and C32 are in the read/write enable modes. When DSEL is at low level, GD0 to GD5 are in the read/write enable modes.</p> <p><b>Channel Setting</b></p> <table border="1"> <thead> <tr> <th>DSC2</th> <th>DSC1</th> <th>Channel</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>L</td> <td>0</td> </tr> <tr> <td>L</td> <td>H</td> <td>1</td> </tr> <tr> <td>H</td> <td>L</td> <td>2</td> </tr> <tr> <td>H</td> <td>H</td> <td>3</td> </tr> </tbody> </table> <p><b>Digital I/O Setting</b></p> <table border="1"> <thead> <tr> <th>TC</th> <th>DSEL</th> <th>D0</th> <th>D1</th> <th>D2</th> <th>D3</th> <th>D4</th> <th>D5</th> <th>I/O Modes</th> </tr> </thead> <tbody> <tr> <td rowspan="2">H</td> <td>H</td> <td>DSC</td> <td>DSC</td> <td>EN</td> <td>C0</td> <td>C32</td> <td>X</td> <td rowspan="2">Input mode (setting)</td> </tr> <tr> <td>L</td> <td>GD0</td> <td>GD1</td> <td>GD2</td> <td>GD3</td> <td>GD4</td> <td>GD5</td> </tr> <tr> <td rowspan="2">L</td> <td>H</td> <td>DSC</td> <td>DSC</td> <td>EN</td> <td>C0</td> <td>C32</td> <td>L</td> <td rowspan="2">Output mode (check)</td> </tr> <tr> <td>L</td> <td>GD0</td> <td>GD1</td> <td>GD2</td> <td>GD3</td> <td>GD4</td> <td>GD5</td> </tr> </tbody> </table> <p><b>Electrical Volume Setting</b></p> <table border="1"> <thead> <tr> <th colspan="10">Data*</th> <th rowspan="2">Gain (dB)</th> </tr> <tr> <th>GD5</th> <th>GD4</th> <th>GD3</th> <th>GD2</th> <th>GD1</th> <th>GD0</th> <th>EN</th> <th>C0</th> <th>C32</th> <th>D (G)</th> </tr> </thead> <tbody> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>63</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>62</td><td>-0.5</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>61</td><td>-1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>60</td><td>-1.5</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>59</td><td>-2</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>58</td><td>-2.5</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>57</td><td>-3</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>56</td><td>-3.5</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>32</td><td>-15.5</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>31</td><td>-16</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>7</td><td>-28</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>6</td><td>-28.5</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>5</td><td>-29</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>4</td><td>-29.5</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>3</td><td>-30</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>2</td><td>-30.5</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>-31</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>-31.5</td></tr> <tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>X</td><td>1</td><td>-</td><td>-32</td></tr> <tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>1</td><td>0</td><td>-</td><td>0</td></tr> <tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>X</td><td>X</td><td>-</td><td>-∞</td></tr> </tbody> </table> | DSC2    | DSC1 | Channel | L   | L                    | 0     | L         | H | 1 | H | L | 2 | H | H | 3 | TC | DSEL | D0 | D1 | D2 | D3 | D4 | D5 | I/O Modes | H | H | DSC | DSC | EN | C0 | C32 | X | Input mode (setting) | L | GD0 | GD1 | GD2 | GD3 | GD4 | GD5 | L | H | DSC | DSC | EN | C0 | C32 | L | Output mode (check) | L | GD0 | GD1 | GD2 | GD3 | GD4 | GD5 | Data* |  |  |  |  |  |  |  |  |  | Gain (dB) | GD5 | GD4 | GD3 | GD2 | GD1 | GD0 | EN | C0 | C32 | D (G) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 63 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 62 | -0.5 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 61 | -1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 60 | -1.5 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 59 | -2 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 58 | -2.5 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 57 | -3 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 56 | -3.5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 32 | -15.5 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 31 | -16 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 7 | -28 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 6 | -28.5 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 5 | -29 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 4 | -29.5 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 3 | -30 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | -30.5 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | -31 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -31.5 | X | X | X | X | X | X | 1 | X | 1 | - | -32 | X | X | X | X | X | X | 1 | 1 | 0 | - | 0 | X | X | X | X | X | X | 0 | X | X | - | -∞ |
|                  | DSC2    | DSC1     |  | Channel |      |         |     |                      |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
|                  | L       | L        |  | 0       |      |         |     |                      |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
|                  | L       | H        |  | 1       |      |         |     |                      |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
|                  | H       | L        |  | 2       |      |         |     |                      |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
|                  | H       | H        |  | 3       |      |         |     |                      |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| TC               | DSEL    | D0       | D1   | D2      | D3   | D4      | D5  | I/O Modes            |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| H                | H       | DSC      | DSC  | EN      | C0   | C32     | X   | Input mode (setting) |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
|                  | L       | GD0      | GD1  | GD2     | GD3  | GD4     | GD5 |                      |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| L                | H       | DSC      | DSC  | EN      | C0   | C32     | L   | Output mode (check)  |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
|                  | L       | GD0      | GD1  | GD2     | GD3  | GD4     | GD5 |                      |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| Data*            |         |          |  |         |      |         |     |                      |       | Gain (dB) |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| GD5              | GD4     | GD3      | GD2  | GD1     | GD0  | EN      | C0  | C32                  | D (G) |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 1                | 1       | 1        | 1  | 1       | 1    | 1       | 0   | 0                    | 63    | 0         |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 1                | 1       | 1        | 1  | 1       | 0    | 1       | 0   | 0                    | 62    | -0.5      |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 1                | 1       | 1        | 1  | 0       | 1    | 1       | 0   | 0                    | 61    | -1        |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 1                | 1       | 1        | 1  | 0       | 0    | 1       | 0   | 0                    | 60    | -1.5      |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 1                | 1       | 1        | 0  | 1       | 1    | 1       | 0   | 0                    | 59    | -2        |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 1                | 1       | 1        | 0  | 1       | 0    | 1       | 0   | 0                    | 58    | -2.5      |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 1                | 1       | 1        | 0  | 0       | 1    | 1       | 0   | 0                    | 57    | -3        |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 1                | 1       | 1        | 0  | 0       | 0    | 1       | 0   | 0                    | 56    | -3.5      |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 1                | 0       | 0        | 0  | 0       | 0    | 1       | 0   | 0                    | 32    | -15.5     |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 0                | 1       | 1        | 1  | 1       | 1    | 1       | 0   | 0                    | 31    | -16       |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 0                | 0       | 0        | 1  | 1       | 1    | 1       | 0   | 0                    | 7     | -28       |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 0                | 0       | 0        | 1  | 1       | 0    | 1       | 0   | 0                    | 6     | -28.5     |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 0                | 0       | 0        | 1  | 0       | 1    | 1       | 0   | 0                    | 5     | -29       |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 0                | 0       | 0        | 1  | 0       | 0    | 1       | 0   | 0                    | 4     | -29.5     |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 0                | 0       | 0        | 0  | 1       | 1    | 1       | 0   | 0                    | 3     | -30       |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 0                | 0       | 0        | 0  | 1       | 0    | 1       | 0   | 0                    | 2     | -30.5     |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 0                | 0       | 0        | 0  | 0       | 1    | 1       | 0   | 0                    | 1     | -31       |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| 0                | 0       | 0        | 0  | 0       | 0    | 1       | 0   | 0                    | 0     | -31.5     |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| X                | X       | X        | X  | X       | X    | 1       | X   | 1                    | -     | -32       |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| X                | X       | X        | X  | X       | X    | 1       | 1   | 0                    | -     | 0         |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
| X                | X       | X        | X  | X       | X    | 0       | X   | X                    | -     | -∞        |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |
|                  |         |          | <p>* X = don't care.<br/>When data is reset, data is set at 0 dB<br/>(code 111111100)</p>  |         |      |         |     |                      |       |           |   |   |   |   |   |   |   |   |    |      |    |    |    |    |    |    |           |   |   |     |     |    |    |     |   |                      |   |     |     |     |     |     |     |   |   |     |     |    |    |     |   |                     |   |     |     |     |     |     |     |       |  |  |  |  |  |  |  |  |  |           |     |     |     |     |     |     |    |    |     |       |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |   |    |      |   |   |   |   |   |   |   |   |   |    |       |   |   |   |   |   |   |   |   |   |    |     |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |       |   |   |   |   |   |   |   |   |   |   |     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |

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## PIN DESCRIPTIONS (continued)

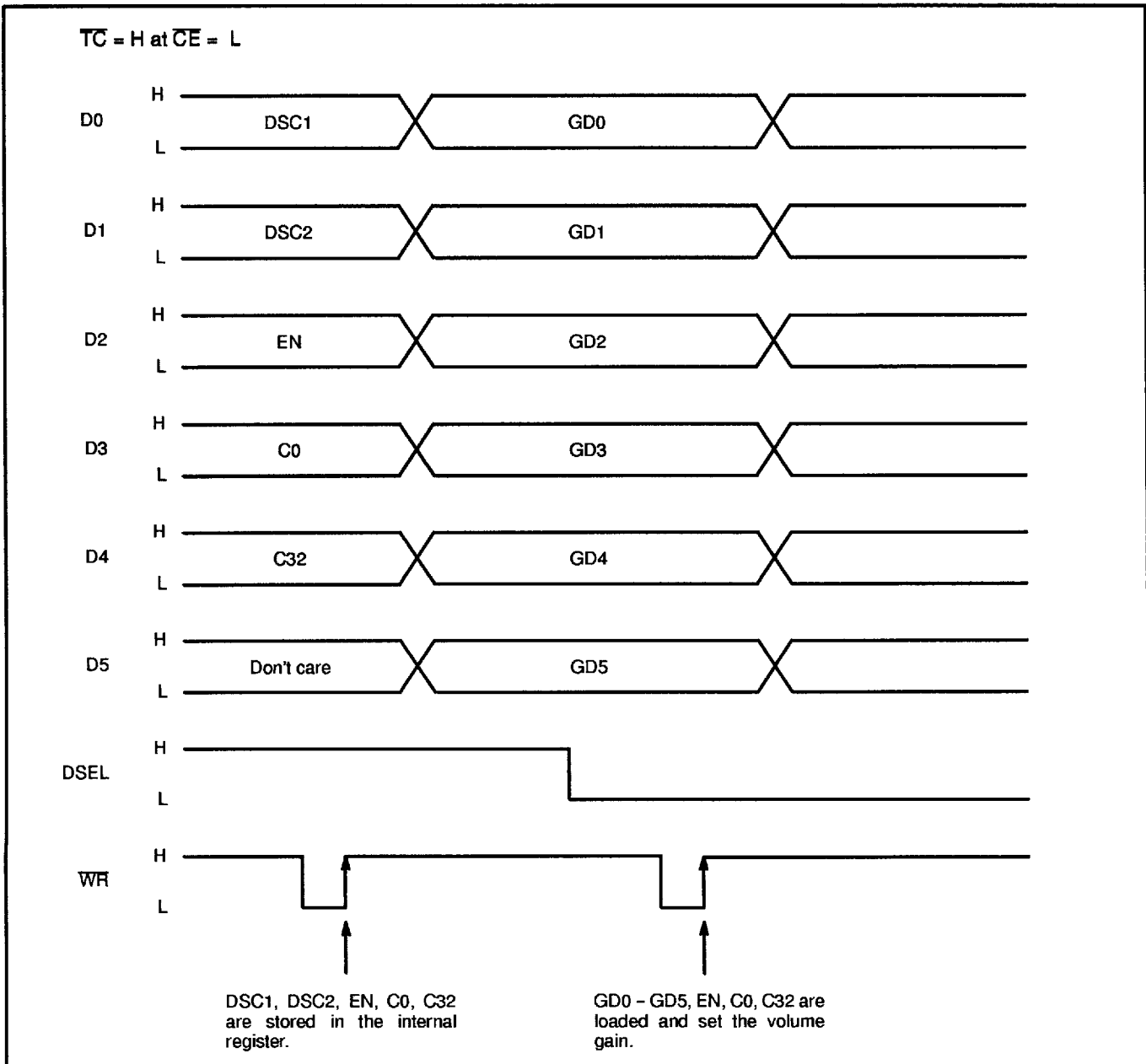
|               | Pin No. | Pin Name | Description   |
|---------------|---------|----------|---|
| Analog Input  | 9       | AI0      | Analog input of channel 0.  |
|               | 11      | AI1      | Analog input of channel 1.  |
|               | 13      | AI2      | Analog input of channel 2.  |
|               | 15      | AI3      | Analog input of channel 3.  |
| Analog Output | 10      | AO0      | Analog output of channel 0.<br>When in a power down mode, this pin is pulled down by a high resistance. |
|               | 12      | AO1      | Analog output of channel 1.<br>When in a power down mode, this pin is pulled down by a high resistance. |
|               | 14      | AO2      | Analog output of channel 2.<br>When in a power down mode, this pin is pulled down by a high resistance. |
|               | 16      | AO3      | Analog output of channel 3.<br>When in a power down mode, this pin is pulled down by a high resistance. |

## TRUTH TABLE

| PD | RESET | CE | TC | DSEL | WR  | D0 to D5  | Operator Mode       |
|----|-------|----|----|------|---|---|---------------------|
| 0  | X     | X  | X  | X    | X   |   | Power down mode     |
| 1  | 0     | X  | X  | X    | X   |   | Gain is initialized |
| 1  | 1     | 1  | X  | X    | X   | Inhibit data input/output<br>(high impedance)           |                     |
| 1  | 1     | 0  | 0  | 1    | X   | Data stored in SCH1, SCH2,<br>EN, C0 and C32 are output | Data output mode    |
| 1  | 1     | 0  | 0  | 0    | X   | Data stored in D0 to D5 are output                      | Data output mode    |
| 1  | 1     | 0  | 1  | 1    |  | Data stored in SCH1, SCH2, EN,<br>C0 and C32 are input  | Data output mode    |
| 1  | 1     | 0  | 1  | 0    |  | Data stored in D0 to D5 are input                       | Data output mode    |

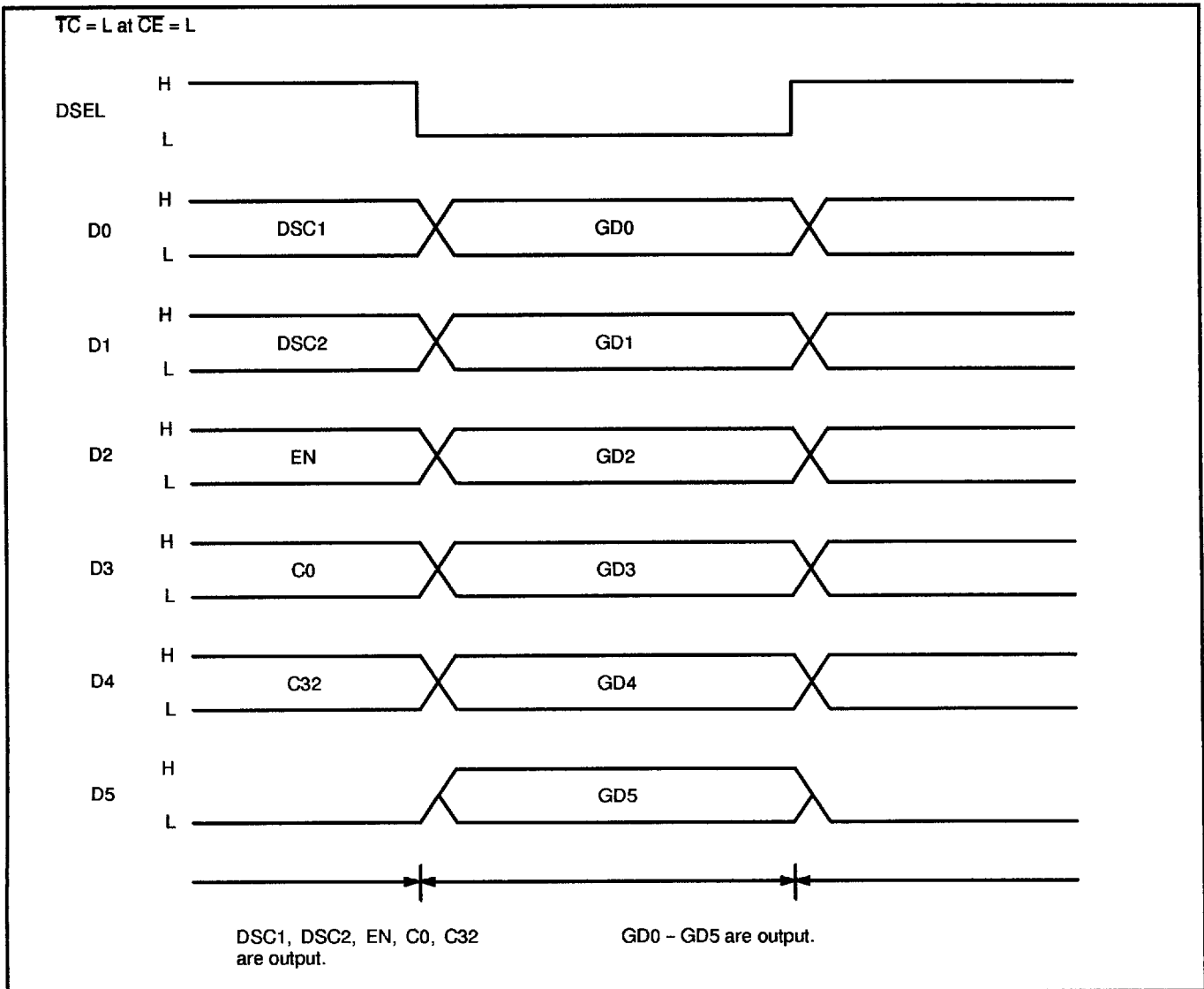
Note: X = don't care.

Figure 2. Volume Data Setting Timing Diagram



Continued on next page

Figure 2. Volume Data Setting Timing Diagram (continued)



## RECOMMENDED OPERATING CONDITIONS

| Parameter                      | Symbol          | Pin Name               | Value     |      |                 | Unit |   |
|--------------------------------|-----------------|------------------------|-----------|------|-----------------|------|---|
|                                |                 |                        | Min       | Typ  | Max             |      |   |
| Positive Supply Voltage        | V <sub>DD</sub> | V <sub>DD</sub>        | 4.75      | 5.0  | 5.25            | V    |   |
| Negative Supply Voltage        | V <sub>SS</sub> | V <sub>SS</sub>        | -5.25     | -5.0 | -4.75           | V    |   |
| Digital Input Voltage          | V <sub>DI</sub> | All digital input pins | 0         |      | V <sub>DD</sub> | V    |   |
| Analog Input Voltage           | V <sub>AI</sub> | AIO<br>AI1             | +5 V +10% | -2.5 |                 | 2.5  | V |
|                                |                 | AI2<br>AI3             | +5 V +5%  | -3.0 |                 | 3.0  | V |
| Analog Output Load Resistance  | R <sub>AL</sub> | AO0 - AO3              | 30        |      |                 | kΩ   |   |
| Analog Output Load Capacitance | C <sub>AL</sub> | AO0 - AO3              |           |      | 50              | pF   |   |
| Operating Temperature          | T <sub>A</sub>  |                        | -20       |      | 70              | °C   |   |
| Analog Input Frequency         | f <sub>AI</sub> |                        | 0         |      | 20              | kHz  |   |

## ELECTRICAL CHARACTERISTICS

(V<sub>DD</sub> = +5 V +5%, V<sub>SS</sub> = -5 V +5%, T<sub>A</sub> = -20 to +70°C, dBm referenced to 600 Ω)

| Parameter                        | Symbol           | Pin Name                                 | Condition  | Value              |      |                 | Unit |    |
|----------------------------------|------------------|--|--|--------------------|------|-----------------|------|----|
|                                  |                  |  |  | Min                | Typ  | Max             |      |    |
| Positive Supply Current          | I <sub>DD1</sub> | V <sub>DD</sub>                          | No Load  | P <sub>D</sub> = H |      | 1.2             | 2.0  | mA |
|                                  | I <sub>DD2</sub> |  |  | P <sub>D</sub> = L |      |                 | 0.5  | mA |
| Negative Supply Current          | I <sub>SS1</sub> | V <sub>SS</sub>                          |  | P <sub>D</sub> = H | -2.0 | -1.2            |      | mA |
|                                  | I <sub>SS2</sub> |  |  | P <sub>D</sub> = L | -0.5 |                 |      | mA |
| Digital Input Low Voltage        | V <sub>IL</sub>  | All digital input pins                   |  | 0                  |      | 0.8             | V    |    |
| Digital Input High Voltage       | V <sub>IH</sub>  |  |  | 2.2                |      | V <sub>DD</sub> | V    |    |
| Digital Input Low Current        | I <sub>IL</sub>  | D0 - D5<br>WR, DSEL                      | V <sub>I</sub> = GND                                   | -10                |      | 10              | μA   |    |
| Digital Input High Current       | I <sub>IH</sub>  |  | V <sub>I</sub> = V <sub>DD</sub>                       | -10                |      | 10              | μA   |    |
| Digital Output Low Voltage       | V <sub>OL</sub>  | All digital output pins                  | I <sub>OL</sub> = 2mA                                  | 0                  |      | 0.4             | V    |    |
| Digital Output High Voltage      | V <sub>OH</sub>  |  | I <sub>OH</sub> = 2mA                                  | 2.6                |      | V <sub>DD</sub> | V    |    |
| Supply Deviation Rejection Ratio | S <sub>VRD</sub> | V <sub>DD</sub> , All analog output pins | Supply Voltage Deviation<br>ΔV <sub>SV</sub> = ±150 mA | 60                 |      |                 | dB   |    |
|                                  | S <sub>VRS</sub> | V <sub>SS</sub> , All analog output pins |  | 60                 |      |                 | dB   |    |

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## ELECTRICAL CHARACTERISTICS (continued)

| Parameter                      | Symbol        | Pin Name   | Condition   | Value                 |         |                     | Unit      |      |
|--------------------------------|---------------|--|---|-----------------------|---------|---------------------|-----------|------|
|                                |               |  |   | Min                   | Typ     | Max                 |           |      |
| Pull up Current                | $I_{PLU}$     | RESET, TC<br>PD, CE  | $V_I = GND$   | -100                  | -50     | -25                 | $\mu A$   |      |
| Analog Input Resistance        | $R_{AIN}$     | All Analog<br>Output Pins  |   | 100                   | 150     | 300                 | $k\Omega$ |      |
| Analog Output Voltage          | $V_{AO}$      |  | Offset Voltage                                      |                       | -25     | 0                   | 25        | mV   |
|                                |               |  | AC<br>Volt.   | $+5V \pm 10\%$        | 0       |                     | 5         | Vp-p |
|                                | $+5V \pm 5\%$ |  |   | 0                     |         | 6                   | Vp-p      |      |
| Analog Output<br>Maximum Gain  | $G_{MAX}$     |  | Analog<br>Input<br>5Vp-p                            | Gain code<br>"111111" | -0.5    | 0                   | +0.5      | dB   |
| Analog Output Step             | $\Delta G$    |  | Below<br>20 kHz                                     | $63 > D(G) > 0$       | 0.25    | 0.5                 | 0.75      | dB   |
| Analog Output Gain             | $G$           |  |   |                       | (Typ)-1 | $\frac{D(G)-63}{2}$ | (Typ)+1   | dB   |
| Harmonic Noise                 | $N_{HH}$      |  | Input = 5Vp-p<br>1 kHz, $G = 0dB$                   |                       | 60      | 80                  |           | dB   |
| Output Noise                   | $N_{IC1}$     |  | Input = GND,<br>$G = 0dB$<br>BW = 0.3 kHz - 20 kHz  |                       |         |                     | -65       | dBm  |
|                                | $N_{IC2}$     |  | Input = GND,<br>$G = 0dB$<br>BW = 0.3 kHz - 3.4 kHz |                       |         |                     | -70       | dBm  |
| Cross Talk between<br>Channels | $N_{CT}$      | 1 channel<br>AIN = 5Vp-p<br>Remains channels<br>AIN = GND<br>$G = 0dB$ ( $N = 0 - 3$ ) |   | 70                    | 80      |                     | dB        |      |

## AC CHARACTERISTICS

(V<sub>DD</sub> = +5 V +5%, V<sub>SS</sub> = -5 V +5%, T<sub>A</sub> = -20 to +70°C, dBm referenced to 600 Ω)

| Parameter                           | Symbol            | Pin Name                 | Value |     |     | Unit |
|-------------------------------------|-------------------|--------------------------|-------|-----|-----|------|
|                                     |                   |                          | Min   | Typ | Max |      |
| WR High Width                       | t <sub>WHWR</sub> | WR                       | 500   |     |     | ns   |
| WR Low Width                        | t <sub>WLWR</sub> | WR                       | 500   |     |     | ns   |
| DATA Set up Time                    | t <sub>SD</sub>   | D0 - D5, WR              | 200   |     |     | ns   |
| DSEL Set up Time                    | t <sub>SDS</sub>  | DSEL, WR                 | 200   |     |     | ns   |
| TC Set up Time                      | t <sub>STC</sub>  | TC, WR                   | 200   |     |     | ns   |
| CE Set up Time                      | t <sub>SCE</sub>  | CE, WR                   | 200   |     |     | ns   |
| DATA Hold Time                      | t <sub>HD</sub>   | D0 - D5, WR              | 200   |     |     | ns   |
| DSEL Hold Time                      | t <sub>HDS</sub>  | DSEL, WR                 | 200   |     |     | ns   |
| TC Hold Time                        | t <sub>HTC</sub>  | TC, WR                   | 200   |     |     | ns   |
| CE Hold Time                        | t <sub>HCE</sub>  | CE, WR                   | 200   |     |     | ns   |
| Rise Time 1                         | t <sub>r1</sub>   | WR                       | 0     |     | 20  | ns   |
| Fall Time 1                         | t <sub>f1</sub>   | WR                       | 0     |     | 20  | ns   |
| Rise Time 2                         | t <sub>r2</sub>   | D0 - D5,<br>CE, TC, DSEL | 0     |     | 20  | ns   |
| Fall Time 2                         | t <sub>f2</sub>   | D0 - D5,<br>CE, TC, DSEL | 0     |     | 20  | ns   |
| Digital Input Low Width             | t <sub>WLRP</sub> | RESET, PD                | 1     |     |     | μs   |
| DATA Output Enable Switching Time 1 | t <sub>DOE1</sub> | TC,<br>D0 - D5           |       |     | 500 | ns   |
| DATA Output Enable Switching Time 2 | t <sub>DOE2</sub> | TC,<br>D0 - D5           |       |     | 500 | ns   |
| DATA Output Switching Time          | t <sub>DCH</sub>  | DSEL<br>D0 - D5          |       |     | 500 | ns   |

**Note:** Please refer to the timing diagram for test conditions.

Figure 3. Timing Diagram

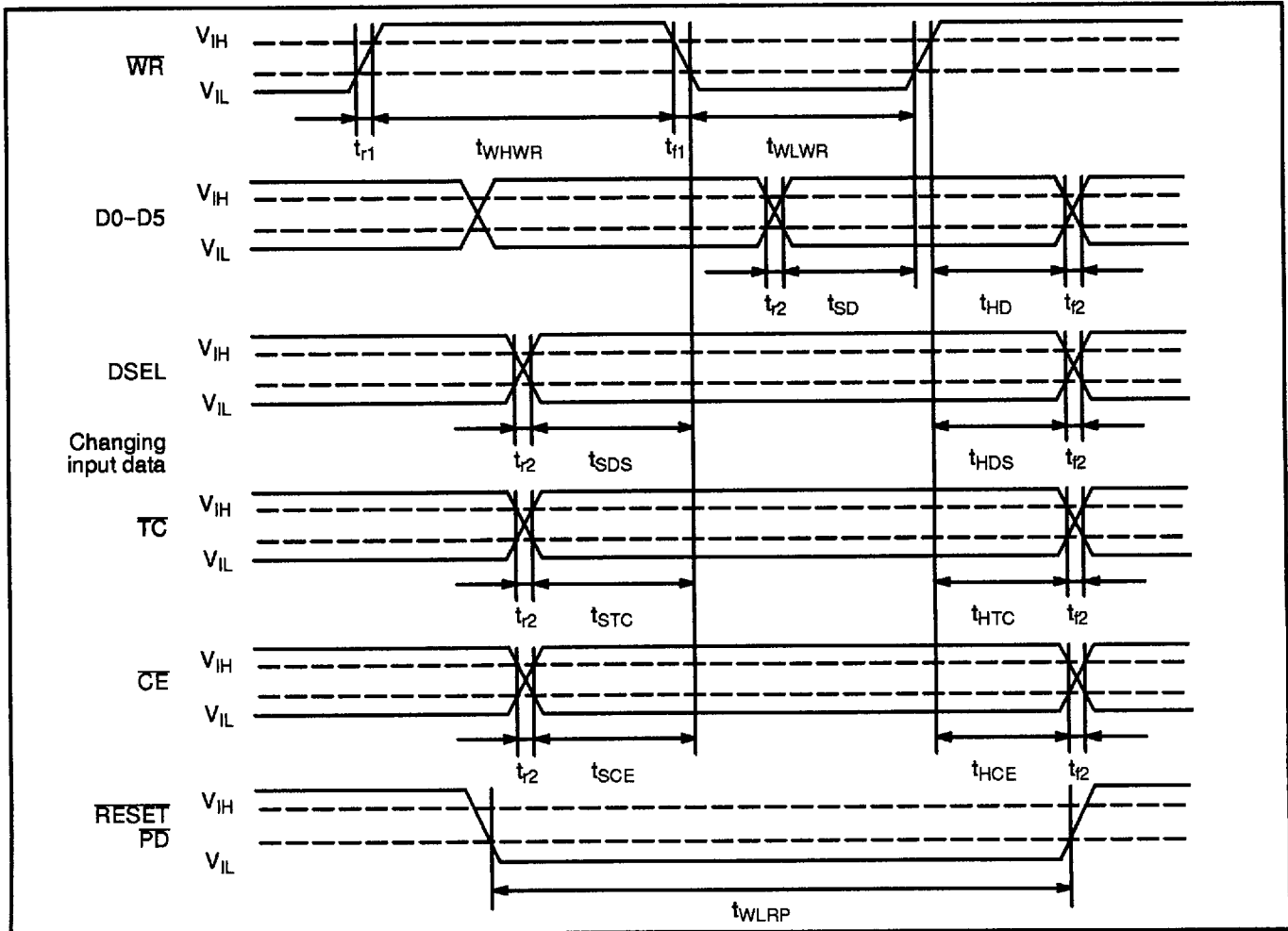
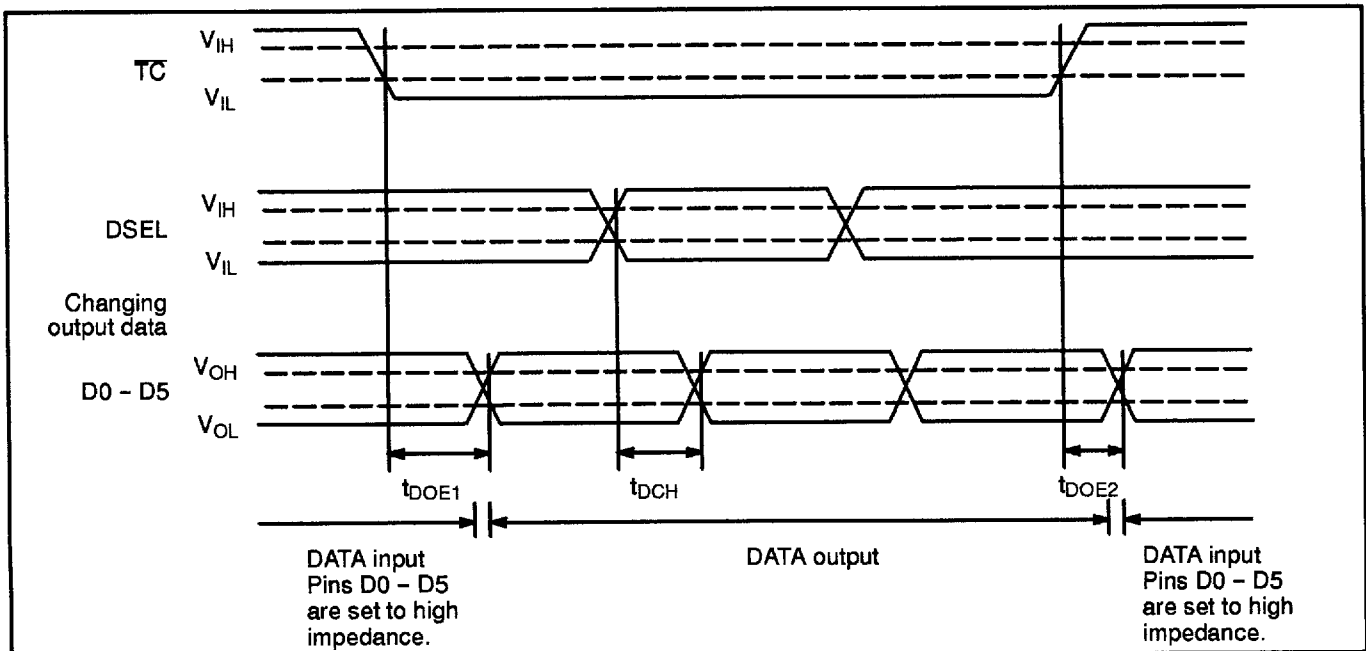
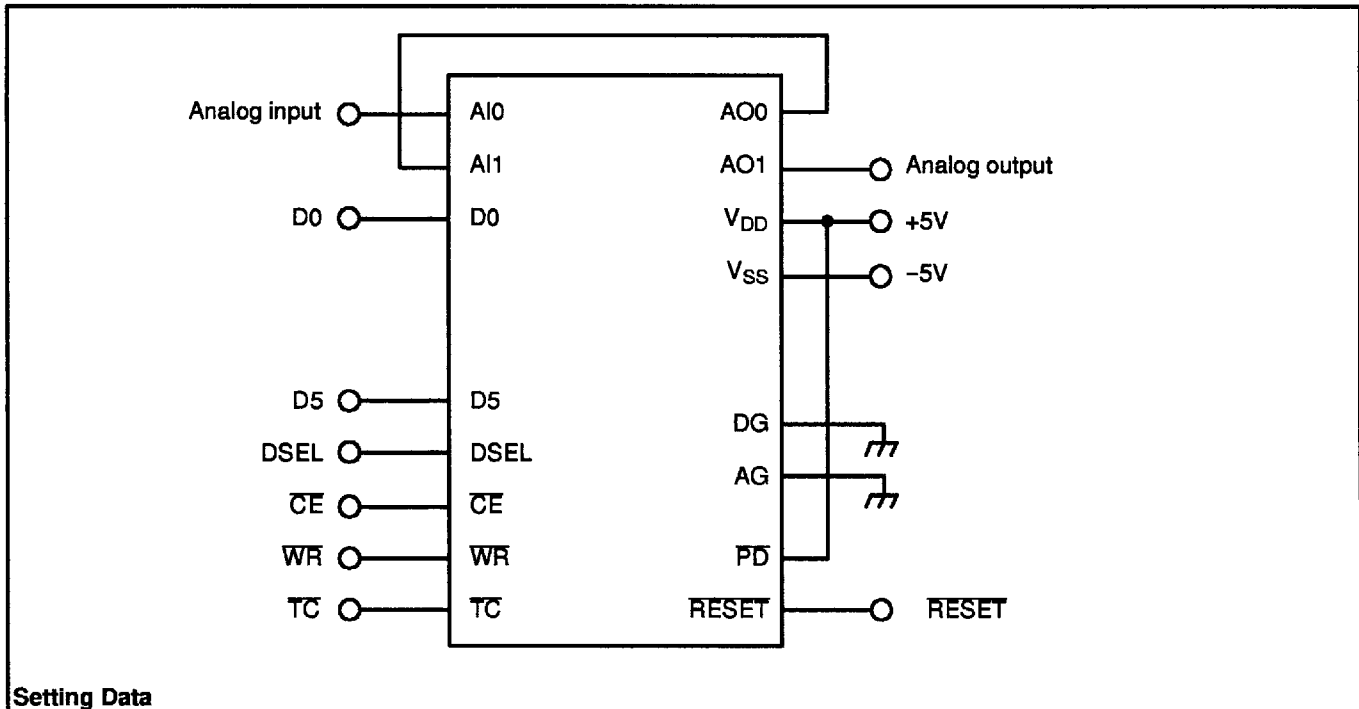


Figure 4. Timing Diagram (CE = L)



Gain variable range is expanded (0 db to -64 dB by 0.5 dB steps) if two channels are connected in series.



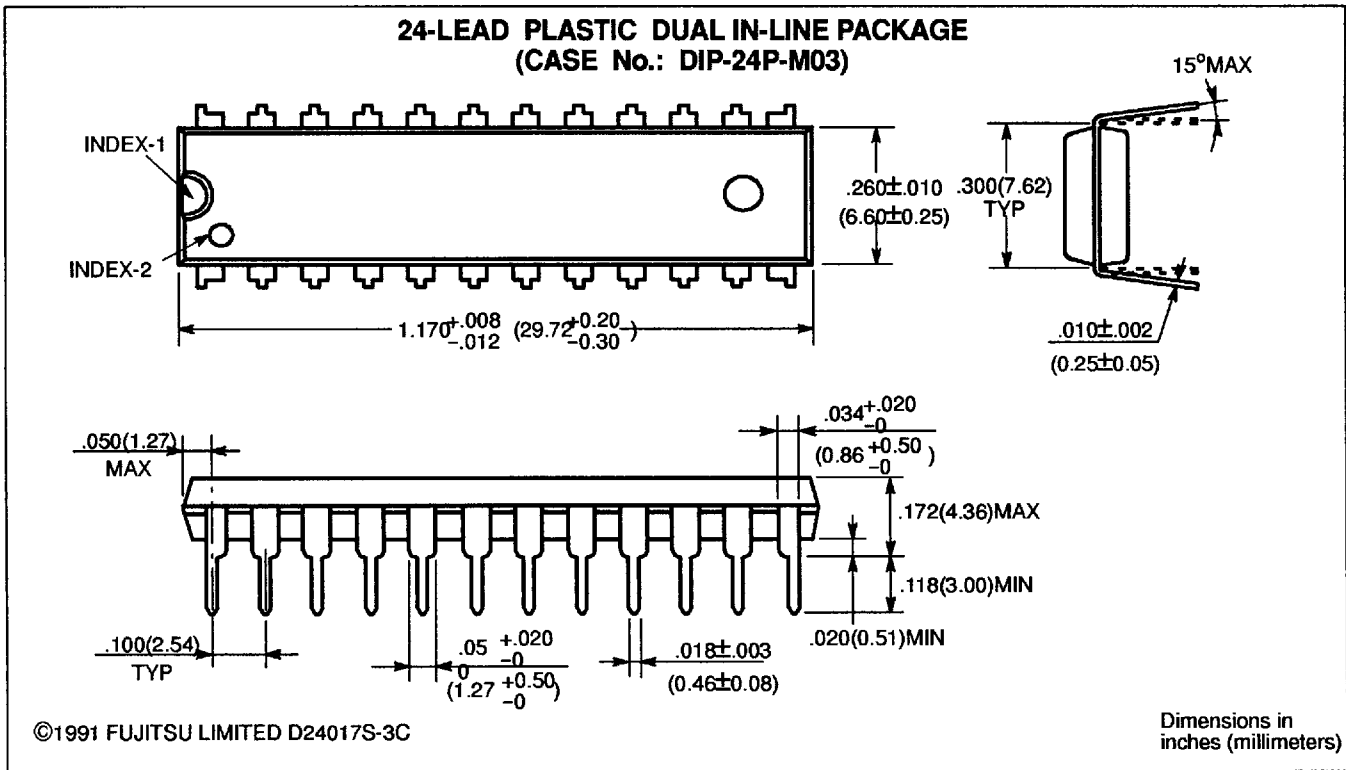
Setting Data

| Setting Gain (dB) | Data Set (channel 0) |     |     |     |     |     |    |    |     | Data Set (channel 1) |     |     |     |     |     |    |    |     |
|-------------------|----------------------|-----|-----|-----|-----|-----|----|----|-----|----------------------|-----|-----|-----|-----|-----|----|----|-----|
|                   | GD5                  | GD4 | GD3 | GD2 | GD1 | GD0 | EN | C0 | C32 | GD5                  | GD4 | GD3 | GD2 | GD1 | GD0 | EN | C0 | C32 |
| 0                 | X                    | X   | X   | X   | X   | X   | 1  | 1  | 0   | 1                    | 1   | 1   | 1   | 1   | 1   | 1  | 0  | 0   |
| -0.5              | X                    | X   | X   | X   | X   | X   | 1  | 1  | 0   | 1                    | 1   | 1   | 1   | 1   | 0   | 1  | 0  | 0   |
| -1.0              | X                    | X   | X   | X   | X   | X   | 1  | 1  | 0   | 1                    | 1   | 1   | 1   | 0   | 1   | 1  | 0  | 0   |
| ⋮                 |                      |     |     |     |     |     |    |    |     |                      |     |     |     |     |     |    |    |     |
| -31.0             | X                    | X   | X   | X   | X   | X   | 1  | 1  | 0   | 0                    | 0   | 0   | 0   | 0   | 1   | 1  | 0  | 0   |
| -31.5             | X                    | X   | X   | X   | X   | X   | 1  | 1  | 0   | 0                    | 0   | 0   | 0   | 0   | 0   | 1  | 0  | 0   |
| -32.0             | 1                    | 1   | 1   | 1   | 1   | 1   | 1  | 0  | 0   | X                    | X   | X   | X   | X   | X   | 1  | 0  | 1   |
| -32.5             | 1                    | 1   | 1   | 1   | 1   | 0   | 1  | 0  | 0   | X                    | X   | X   | X   | X   | X   | 1  | 0  | 1   |
| -33.0             | 1                    | 1   | 1   | 1   | 0   | 1   | 1  | 0  | 0   | X                    | X   | X   | X   | X   | X   | 1  | 0  | 1   |
| ⋮                 |                      |     |     |     |     |     |    |    |     |                      |     |     |     |     |     |    |    |     |
| -63.0             | 0                    | 0   | 0   | 0   | 0   | 1   | 1  | 0  | 0   | X                    | X   | X   | X   | X   | X   | 1  | 0  | 1   |
| -63.5             | 0                    | 0   | 0   | 0   | 0   | 0   | 1  | 0  | 0   | X                    | X   | X   | X   | X   | X   | 1  | 0  | 1   |
| -64.0             | X                    | X   | X   | X   | X   | X   | 1  | 0  | 1   | X                    | X   | X   | X   | X   | X   | 1  | 0  | 1   |

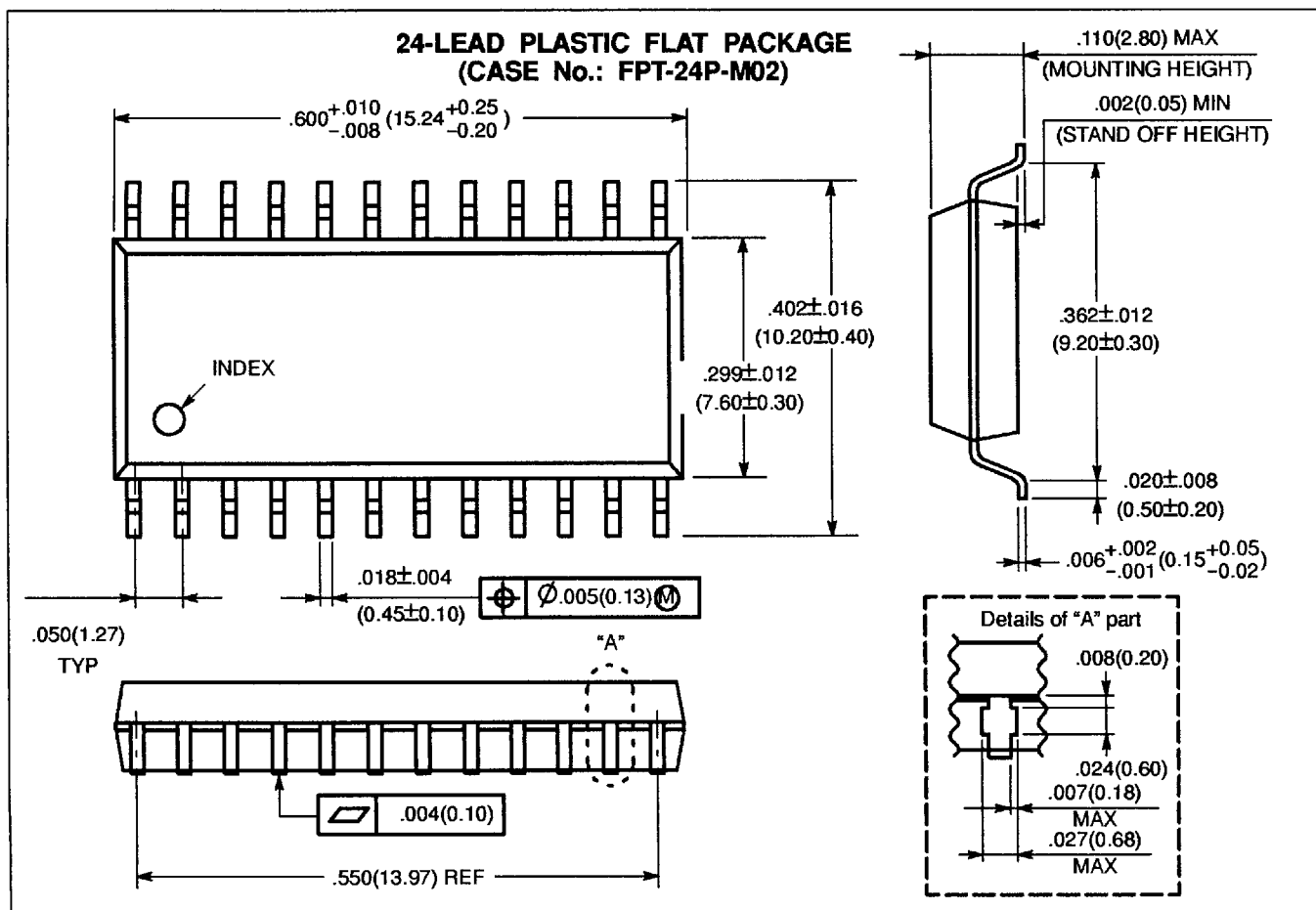
Figure 5. Application Example

Note: X = don't care.

PACKAGE DIMENSIONS



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