## LCD CONTROLLER/DRIVER FOR DOT MATRIX DISPLAY OF JIS LEVEL 1 AND JIS LEVEL 2 KANJI SETS

## DESCRIPTION

The $\mu$ PD16681 is a single-chip controller driver that can display Japanese text; including JIS Level 1 kanji, JIS Level 2 kanji, hiragana, and katakana. Each chip can display up to four lines containing up to eight full width characters (11 $x 12$ dots), or up to four lines containing up to 16 half width characters ( $5 \times 12$ dots), as well 96 pictographs.

## FEATURES

- LCD controller/driver for dot matrix display of JIS Level 1 and JIS Level 2 kanji sets
- On-chip ROM for character generation
-JIS Level 1 + Level 2 kanji ( $11 \times 12$ dots) : 6,355 characters
-JIS non-kanji characters ( $11 \times 12$ dots) : 453 characters
-Other characters (symbols, etc.) ( $11 \times 12$ dots): 256 characters
-Half width alphanumeric characters ( $5 \times 12$ dots) : 192 characters
- On-chip RAM for character generation
-8 types ( $12 \times 13$ dots)
- On-chip boost circuit : switchable between $3 x$ and $4 x$ modes
- RAM for pictograph data displays : 96 bits
- Outputs : 96 segments, 52 commons
- Duty settings : $1 / 39$ or $1 / 52$
- Switchable data inputs : serial or 8-bit parallel
- On-chip divider resistor
- Selectable bias settings ( $1 / 8$ bias, $1 / 7$ bias, or $1 / 6$ bias)
- On-chip oscillation circuit


## ORDERING INFORMATION

| Part number | Package | ROM code |
| :---: | :---: | :---: |
| $\mu$ PD16681W-011 | Wafer | Standard |
| $\mu$ PD16681P-011 | Chip (COG compliant) | Standard |

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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 signals.

## 2. PIN CONFIGURATION (Pad Layout)

Chip size : $2.80 \times 10.48 \mathrm{~mm}^{2}$


Table 2-1. Pad Layout

| $\begin{aligned} & \text { PAD } \\ & \text { No. } \end{aligned}$ | Pin Name | $\mathrm{X}(\mu \mathrm{m})$ | $Y(\mu \mathrm{~m})$ | $\begin{aligned} & \text { PAD } \\ & \text { No. } \end{aligned}$ | Pin Name | $\mathrm{X}(\mu \mathrm{m})$ | $Y(\mu \mathrm{~m})$ | $\begin{aligned} & \text { PAD } \\ & \text { No. } \end{aligned}$ | Pin Name | $\mathrm{X}(\mu \mathrm{m})$ | $Y(\mu \mathrm{~m})$ | $\begin{aligned} & \text { PAD } \\ & \text { No. } \end{aligned}$ | Pin Name | $\mathrm{X}(\mu \mathrm{m})$ | $\mathrm{Y}(\mu \mathrm{m})$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | DUMMY1 | -1273 | 4800 | 61 | DAcha | -1273 | -2400 | 121 | SEG90 | 1273 | -3735 | 181 | $\mathrm{SEG}_{30}$ | 1273 | 1665 |
| 2 | VLCbS1 | -1273 | 4680 | 62 | AMPснa | -1273 | -2520 | 122 | SEG89 | 1273 | -3645 | 182 | SEG29 | 1273 | 1755 |
| 3 | VLCBS1 | -1273 | 4560 | 63 | SEGINv | -1273 | -2640 | 123 | $\mathrm{SEG}_{88}$ | 1273 | -3555 | 183 | SEG28 | 1273 | 1845 |
| 4 | VLCBS2 | -1273 | 4440 | 64 | COMInv | -1273 | -2760 | 124 | SEG87 | 1273 | -3465 | 184 | SEG27 | 1273 | 1935 |
| 5 | VLCbS2 | -1273 | 4320 | 65 | OSCIn | -1273 | -2880 | 125 | SEG86 | 1273 | -3375 | 185 | SEG26 | 1273 | 2025 |
| 6 | VLCBS3 | -1273 | 4200 | 66 | OSCout | -1273 | -3000 | 126 | SEG85 | 1273 | -3285 | 186 | $\mathrm{SEG}_{25}$ | 1273 | 2115 |
| 7 | VLCbS3 | -1273 | 4080 | 67 | OSCbri | -1273 | -3120 | 127 | SEG84 | 1273 | -3195 | 187 | SEG 24 | 1273 | 2205 |
| 8 | AMPout | -1273 | 3960 | 68 | Do/DATA | -1273 | -3240 | 128 | SEG83 | 1273 | -3105 | 188 | SEG ${ }_{23}$ | 1273 | 2295 |
| 9 | AMPout | -1273 | 3840 | 69 | D1 | -1273 | -3360 | 129 | SEG82 | 1273 | -3015 | 189 | SEG22 | 1273 | 2385 |
| 10 | AMPIN(-) | -1273 | 3720 | 70 | D2 | -1273 | -3480 | 130 | SEG81 | 1273 | -2925 | 190 | SEG21 | 1273 | 2475 |
| 11 | AMPIN(-) | -1273 | 3600 | 71 | $\mathrm{D}_{3}$ | -1273 | -3600 | 131 | SEG80 | 1273 | -2835 | 191 | SEG20 | 1273 | 2565 |
| 12 | AMPIN( $(+)$ | -1273 | 3480 | 72 | D4 | -1273 | -3720 | 132 | SEG79 | 1273 | -2745 | 192 | SEG19 | 1273 | 2655 |
| 13 | AMPIN(+) | -1273 | 3360 | 73 | $\mathrm{D}_{5}$ | -1273 | -3840 | 133 | $\mathrm{SEG}_{78}$ | 1273 | -2655 | 193 | SEG ${ }_{18}$ | 1273 | 2745 |
| 14 | VLC5 | -1273 | 3240 | 74 | D6 | -1273 | -3960 | 134 | SEG77 | 1273 | -2565 | 194 | SEG17 | 1273 | 2835 |
| 15 | VLC5 | -1273 | 3120 | 75 | $\mathrm{D}_{7}$ | -1273 | -4080 | 135 | $\mathrm{SEG}_{76}$ | 1273 | -2475 | 195 | SEG16 | 1273 | 2925 |
| 16 | VLC5 | -1273 | 3000 | 76 | WS | -1273 | -4200 | 136 | SEG75 | 1273 | -2385 | 196 | SEG15 | 1273 | 3015 |
| 17 | VLC4 | -1273 | 2880 | 77 | STB | -1273 | -4320 | 137 | SEG74 | 1273 | -2295 | 197 | SEG14 | 1273 | 3105 |
| 18 | VLC4 | -1273 | 2760 | 78 | E/SCK | -1273 | -4440 | 138 | $\mathrm{SEG}_{73}$ | 1273 | -2205 | 198 | SEG ${ }_{13}$ | 1273 | 3195 |
| 19 | VLC4 | -1273 | 2640 | 79 | /RESET | -1273 | -4560 | 139 | SEG72 | 1273 | -2115 | 199 | SEG12 | 1273 | 3285 |
| 20 | VLC3 | -1273 | 2520 | 80 | TESTout | -1273 | -4680 | 140 | SEG71 | 1273 | -2025 | 200 | SEG ${ }_{11}$ | 1273 | 3375 |
| 21 | VLC3 | -1273 | 2400 | 81 | DUMMY2 | -1273 | -4800 | 141 | SEG70 | 1273 | -1935 | 201 | SEG10 | 1273 | 3465 |
| 22 | VLC3 | -1273 | 2280 | 82 | DUMMY3 | -1273 | -4920 | 142 | SEG69 | 1273 | -1845 | 202 | SEG9 | 1273 | 3555 |
| 23 | VLC2 | -1273 | 2160 | 83 | DUMMY4 | -1120 | -5113 | 143 | SEG68 | 1273 | -1755 | 203 | SEG8 | 1273 | 3645 |
| 24 | VLC2 | -1273 | 2040 | 84 | DUMMY5 | -1030 | -5113 | 144 | SEG67 | 1273 | -1665 | 204 | SEG7 | 1273 | 3735 |
| 25 | VLC2 | -1273 | 1920 | 85 | $\mathrm{COM}_{27}$ | -940 | -5113 | 145 | SEG66 | 1273 | -1575 | 205 | SEG6 | 1273 | 3825 |
| 26 | VLC1 | -1273 | 1800 | 86 | $\mathrm{COM}_{28}$ | -850 | -5113 | 146 | SEG65 | 1273 | -1485 | 206 | SEG5 | 1273 | 3915 |
| 27 | VLC1 | -1273 | 1680 | 87 | $\mathrm{COM}_{29}$ | -760 | -5113 | 147 | SEG64 | 1273 | -1395 | 207 | SEG4 | 1273 | 4005 |
| 28 | VLC1 | -1273 | 1560 | 88 | $\mathrm{COM}_{30}$ | -670 | -5113 | 148 | SEG63 | 1273 | -1305 | 208 | SEG3 | 1273 | 4095 |
| 29 | VLCD | -1273 | 1440 | 89 | $\mathrm{COM}_{31}$ | -580 | -5113 | 149 | SEG62 | 1273 | -1215 | 209 | SEG 2 | 1273 | 4185 |
| 30 | VLCD | -1273 | 1320 | 90 | $\mathrm{COM}_{32}$ | -490 | -5113 | 150 | SEG61 | 1273 | -1125 | 210 | SEG 1 | 1273 | 4275 |
| 31 | VLCD | -1273 | 1200 | 91 | $\mathrm{COM}_{33}$ | -400 | -5113 | 151 | SEG60 | 1273 | -1035 | 211 | $\mathrm{COM}_{26}$ | 1273 | 4365 |
| 32 | $\mathrm{C1}^{+}$ | -1273 | 1080 | 92 | $\mathrm{COM}_{34}$ | -310 | -5113 | 152 | SEG59 | 1273 | -945 | 212 | $\mathrm{COM}_{25}$ | 1273 | 4455 |
| 33 | $\mathrm{C1}^{+}$ | -1273 | 960 | 93 | $\mathrm{COM}_{35}$ | -220 | -5113 | 153 | SEG58 | 1273 | -855 | 213 | COM24 | 1273 | 4545 |
| 34 | $\mathrm{C} 1^{+}$ | -1273 | 840 | 94 | COM 36 | -130 | -5113 | 154 | SEG57 | 1273 | -765 | 214 | COM 23 | 1273 | 4635 |
| 35 | $\mathrm{C}^{-}$ | -1273 | 720 | 95 | $\mathrm{COM}_{37}$ | -40 | -5113 | 155 | SEG56 | 1273 | -675 | 215 | $\mathrm{COM}_{22}$ | 1273 | 4725 |
| 36 | C1 ${ }^{-}$ | -1273 | 600 | 96 | $\mathrm{COM}_{38}$ | 50 | -5113 | 156 | SEG55 | 1273 | -585 | 216 | COM 21 | 1273 | 4815 |
| 37 | $\mathrm{C1}^{-}$ | -1273 | 480 | 97 | $\mathrm{COM}_{39}$ | 140 | -5113 | 157 | SEG54 | 1273 | -495 | 217 | DUMMY10 | 1273 | 4905 |
| 38 | C2 ${ }^{+}$ | -1273 | 360 | 98 | COM40 | 230 | -5113 | 158 | SEG53 | 1273 | -405 | 218 | DUMMY11 | 1273 | 4995 |
| 39 | C2 ${ }^{+}$ | -1273 | 240 | 99 | COM41 | 320 | -5113 | 159 | SEG52 | 1273 | -315 | 219 | DUMMY12 | 950 | 5113 |
| 40 | $\mathrm{C} 2^{+}$ | -1273 | 120 | 100 | $\mathrm{COM}_{42}$ | 410 | -5113 | 160 | SEG51 | 1273 | -225 | 220 | $\mathrm{COM}_{20}$ | 860 | 5113 |
| 41 | $\mathrm{C} 2^{-}$ | -1273 | 0 | 101 | $\mathrm{COM}_{43}$ | 500 | -5113 | 161 | SEG50 | 1273 | -135 | 221 | $\mathrm{COM}_{19}$ | 770 | 5113 |
| 42 | C2- | -1273 | -120 | 102 | $\mathrm{COM}_{44}$ | 590 | -5113 | 162 | SEG49 | 1273 | -45 | 222 | $\mathrm{COM}_{18}$ | 680 | 5113 |
| 43 | $\mathrm{C} 2^{-}$ | -1273 | -240 | 103 | $\mathrm{COM}_{45}$ | 680 | -5113 | 163 | SEG48 | 1273 | 45 | 223 | COM 17 | 590 | 5113 |
| 44 | $\mathrm{C3}^{+}$ | -1273 | -360 | 104 | $\mathrm{COM}_{46}$ | 770 | -5113 | 164 | SEG47 | 1273 | 135 | 224 | $\mathrm{COM}_{16}$ | 500 | 5113 |
| 45 | $\mathrm{C3}^{+}$ | -1273 | -480 | 105 | COM47 | 860 | -5113 | 165 | SEG46 | 1273 | 225 | 225 | COM15 | 410 | 5113 |
| 46 | $\mathrm{C3}^{+}$ | -1273 | -600 | 106 | DUMMY6 | 950 | -5113 | 166 | SEG45 | 1273 | 315 | 226 | COM14 | 320 | 5113 |
| 47 | $\mathrm{C3}^{-}$ | -1273 | -720 | 107 | DUMMY7 | 1040 | -5113 | 167 | SEG44 | 1273 | 405 | 227 | $\mathrm{COM}_{13}$ | 230 | 5113 |
| 48 | $\mathrm{C3}^{-}$ | -1273 | -840 | 108 | DUMMY8 | 1273 | -4905 | 168 | SEG43 | 1273 | 495 | 228 | $\mathrm{COM}_{12}$ | 140 | 5113 |
| 49 | C3- | -1273 | -960 | 109 | $\mathrm{COM}_{48}$ | 1273 | -4815 | 169 | $\mathrm{SEG}_{42}$ | 1273 | 585 | 229 | $\mathrm{COM}_{11}$ | 50 | 5113 |
| 50 | VDD1 | -1273 | -1080 | 110 | COM49 | 1273 | -4725 | 170 | SEG41 | 1273 | 675 | 230 | $\mathrm{COM}_{10}$ | -40 | 5113 |
| 51 | VDD1 | -1273 | -1200 | 111 | $\mathrm{COM}_{50}$ | 1273 | -4635 | 171 | SEG40 | 1273 | 765 | 231 | $\mathrm{COM}_{9}$ | -130 | 5113 |
| 52 | VDD2 | -1273 | -1320 | 112 | COM51 | 1273 | -4545 | 172 | SEG39 | 1273 | 855 | 232 | COM8 | -220 | 5113 |
| 53 | VDD2 | -1273 | -1440 | 113 | DUMMY9 | 1273 | -4455 | 173 | SEG38 | 1273 | 945 | 233 | $\mathrm{COM}_{7}$ | -310 | 5113 |
| 54 | VDD2 | -1273 | -1560 | 114 | $\mathrm{PCOM}_{2}$ | 1273 | -4365 | 174 | $\mathrm{SEG}_{37}$ | 1273 | 1035 | 234 | $\mathrm{COM}_{6}$ | -400 | 5113 |
| 55 | Vss | -1273 | -1680 | 115 | SEG96 | 1273 | -4275 | 175 | SEG36 | 1273 | 1125 | 235 | $\mathrm{COM}_{5}$ | -490 | 5113 |
| 56 | $\mathrm{V}_{\text {ss }}$ | -1273 | -1800 | 116 | SEG95 | 1273 | -4185 | 176 | $\mathrm{SEG}_{35}$ | 1273 | 1215 | 236 | $\mathrm{COM}_{4}$ | -580 | 5113 |
| 57 | Vss | -1273 | -1920 | 117 | SEG94 | 1273 | -4095 | 177 | SEG34 | 1273 | 1305 | 237 | $\mathrm{COM}_{3}$ | -670 | 5113 |
| 58 | Vss | -1273 | -2040 | 118 | SEG93 | 1273 | -4005 | 178 | SEG33 | 1273 | 1395 | 238 | $\mathrm{COM}_{2}$ | -760 | 5113 |
| 59 | Vss | -1273 | -2160 | 119 | SEG92 | 1273 | -3915 | 179 | SEG32 | 1273 | 1485 | 239 | $\mathrm{COM}_{1}$ | -850 | 5113 |
| 60 | VEXT | -1273 | -2280 | 120 | SEG91 | 1273 | -3825 | 180 | SEG31 | 1273 | 1575 | 240 | $\mathrm{PCOM}_{1}$ | -940 | 5113 |
|  |  |  |  |  |  |  |  |  |  |  |  | 241 | DUMMY13 | -1030 | 5113 |

## 3. PIN FUNCTIONS

### 3.1 Power Supply System Pins

| Pin Symbol | Pin Name | Pad No. | I/O | Description |
| :---: | :---: | :---: | :---: | :---: |
| VDD | Logic power supply pin Boost circuit power supply pin | 50-54 | - | Power supply pins for logic and boost circuit |
| Vss | Logic ground Driver ground | 55-59 | - | Ground pins for logic and driver circuit |
| VLCD | Driver power supply pins | 29-31 | - | Power supply pins for driver. Output pin for internal boost circuit. Connect a $1-\mu \mathrm{F}$ capacitor between these pins and the V ss pins for boosting. <br> If not using the internal boost circuit, a direct driver power supply can be input. |
| VLCI - V LC5 | Reference power supply pins for driver | 14-28 | - | These are reference power supply pins for the LCD driver. Leave these pins open if an internal bias has been selected. Connect a capacitor to ground. |
| VLCbS1 - Vlcbs3 | Bias value setting pins | 2-7 | - | When selecting an internal bias, the bias value can be changed connecting these pins outside of the IC. |
| $\begin{aligned} & \mathrm{C}_{1}^{+}, \mathrm{C}_{1}^{-} \\ & \mathrm{C}_{2}^{+}, \mathrm{C}_{2}^{-} \\ & \mathrm{C}_{3}{ }^{+}, \mathrm{C}_{3}^{-} \end{aligned}$ | Capacitor connection pins | 32-49 | - | These are capacitor connection pins for the boost circuit. Connect a $1-\mu \mathrm{F}$ capacitor. |

### 3.2 Logic System Pins

| Pin Symbol | Pin Name | Pad No. | I/O | Description |
| :---: | :---: | :---: | :---: | :---: |
| Ws | Select word length | 76 | 1 | Use this pin to select the word length. An 8-bit parallel interface is used for high level and a serial interface is used for low level. This setting cannot be changed after the power has been switched on. |
| DAсна | Select D/A converter | 61 | I | Use this pin to select whether or not to use the D/A converter for regulating the LCD driver voltage. Select high level to use the D/A converter or low level to not use it. |
| STB | Strobe | 77 | 1 | This is used for the device's select signal and strobe signal for communication. Communication is initialized at the rising edge or falling edge of STB. <br> Command data receive standby status occurs at the falling edge of STB. Communication is enabled when STB is low. <br> Also, enabled status or the shift clock is ignored when STB is high. |
| E/SCK | Enable/shift clock | 78 | 1 | This is an input enable pin for data when the parallel interface is used. During the read-in operation, data is captured in the interface buffer at the signal's rising edge. During a read-out operation, data is read-out from the interface buffer at the signal's falling edge. <br> When using a serial interface, this pin is used for the data shift clock. During the read-in operation, data is captured in the shift register at the signal's rising edge. During a read-out operation, data is read from the shift register at the signal's falling edge. |
| Do/DATA | Data bus/data | 68 | I/O | This pin is used for data bus bit Do when using the parallel interface. When using the serial interface, it is an I/O pin (tri-state) for commands and display data. |
| $\mathrm{D}_{1}-\mathrm{D}_{7}$ | Data bus | 69-75 | I/O | These pins are used for data bus bits $D_{1}$ to $D_{7}$ when using the parallel interface. <br> It should be fixed high or low when using the serial interface. |
| TESTout | Test output | 80 | 0 | This is a test output pin. Leave this pin open when using the device. |
| /RESET | Reset | 79 | 1 | This pin is used for internal resets at low-level. |
| AMP cha $^{\text {a }}$ | Op amp switch for LCD driver's power supply level | 62 | 1 | This pin is used to control the op amp that works with the LCD driver's power supply level. High-power mode is set when at low level and normal mode is set when at high level. |
| $\mathrm{V}_{\text {Ext }}$ | Reference power supply switch | 60 | 1 | This pin is used to select the reference power supply circuit's supply mode. High level sets external mode and low level sets internal mode. |
| SEGINv | Segment direction switch | 63 | 1 | This pin is used to control the segment output direction. Low level sets forward direction and high level sets reverse direction. |
| COMinv | Common scan direction switch | 64 | 1 | This pin is used to switch the common scan direction. Low level sets forward direction and high level sets reverse direction. |
| OSCIn | Oscillator pins | 65 | 1 | These pins are connected to a $100-\mathrm{k} \Omega$ resistance. When using an external oscillator, input to OSCin and leave OSCout unconnected. |
| OSCout |  | 66 | O |  |
| OSCbri | External clock for blink function | 67 | 1 | This is an input pin for the $2-\mathrm{Hz}$ external clock. Internally, it is divided by half to generate a $1-\mathrm{Hz}$ signal that is used as the synchronization signal for the blink function. |

### 3.3 Driver System Pins

| Pin Symbol | Pin Name | Pad No. | 1/0 | Description |
| :---: | :---: | :---: | :---: | :---: |
| SEG1 - SEG96 | Segment | 115-210 | 0 | Segment output pins |
| $\begin{aligned} & \mathrm{COM}_{1}- \\ & \mathrm{COM} \end{aligned}$ | Common | $\begin{gathered} 85-105 \\ 109-112 \\ 211-216 \\ 220-239 \\ \hline \end{gathered}$ | O | Common output pins <br> $1 / 52$ duty : Use COM 1 to COM51. <br> $1 / 39$ duty : Use $\mathrm{COM}_{1}$ to $\mathrm{COM}_{19}$, $\mathrm{COM}_{27}$ to $\mathrm{COM}_{45}$, <br> leave $\mathrm{COM}_{20}$ to $\mathrm{COM}_{26}, \mathrm{COM}_{46}$ to $\mathrm{COM}_{51}$ open. |
| PCOM ${ }_{1}$ $\mathrm{PCOM}_{2}$ | Pictograph common | $\begin{aligned} & 240 \\ & 114 \end{aligned}$ | O | Common output pins for pictographs <br> The same signal is output from $\mathrm{PCOM}_{1}$ and $\mathrm{PCOM}_{2}$. |
| AMPIN(t) | Op amp inputs | 10-13 | I | These are input pins for the op amp that regulates the LCD driver voltage. <br> Leave the $\mathrm{AMPIN}_{\mathrm{IN}_{(+)}}$pin unconnected when using the on-chip D/A converter. When not using the D/A converter, a reference voltage must be input. <br> Connect the AMPIN(-) pin to a resistor used to regulate the LCD voltage. (See diagram below.) |
| AMPout | Op amp outputs | 8,9 | 0 | These are output pins for the op amp that regulates the LCD driver voltage. Normally, they are connected to resistors that are used to regulate the LCD voltage. (See diagram below.) <br> Since the AMPout pins are used to stabilize the on-chip amp's output, we recommend connecting them to a capacitor that is rated between 0.1 and $1.0 \mu \mathrm{~F}$. |
| DUMMY | DUMMY pins | $\begin{gathered} 1,81-84, \\ 106-108, \\ 113, \\ 217-219, \\ 241 \\ \hline \end{gathered}$ | - | DUMMY pins are not connected to the internal circuit. Leave open if they are not used. |

Figure 3-1. Voltage Control Circuit


## 4. POWER SUPPLY CIRCUIT

A switchable ( $3 x$ or $4 x$ ) boost circuit is included to generate a current for driving the LCD. A connection to a boostrelated capacitor is used to switch the boost circuit's setting.
The VExt pin (H: external, L: internal) is used to switch between using an external LCD driver power supply or the on-chip boost circuit.

### 4.1 Boost Circuit

When using the internal power supply, connect the boost-related capacitor between $\mathrm{C}_{1}{ }^{+}$and $\mathrm{C}_{1}{ }^{-}, \mathrm{C}_{2}{ }^{+}$and $\mathrm{C}_{2}^{-}$, and $\mathrm{C}_{3}{ }^{+}$and $\mathrm{C}_{3}{ }^{-}$. Also, connect the capacitor for level stabilization between VLCD and Vss, and set VExt low to boost the potential between VDD and Vss from 3 to 4 times.
Since the boost circuit uses signals from the internal oscillation circuit, the oscillation circuit must be operating. The relation between the boosted voltage and the potential is described below.
The $\mathrm{C}_{1}{ }^{+}, \mathrm{C}_{1}^{-}, \mathrm{C}_{2}{ }^{+}, \mathrm{C}_{2}{ }^{-}, \mathrm{C}_{3}{ }^{+}, \mathrm{C}_{3}{ }^{-}$and VDD pins all relate to the boost circuit, so the wire impedance should be minimized.

Figure 4-1. 3x and 4x Boost Mode


Note When set for $3 x$ boost, connect boost-related capacitors between $\mathrm{C}_{2}{ }^{-}$and $\mathrm{C}_{3}{ }^{+}$and $\mathrm{C}_{1}{ }^{+}$and $\mathrm{C}_{1}{ }^{-}$.

### 4.2 Regulation of LCD Driver Voltage

### 4.2.1 When not using internal power supply select or $D / A$ converter $\left(V_{E x T}=L, D A c h A=L\right)$

When using the internal power supply, the boosted voltage is used as the power supply for the op amp incorporated in the IC for the LCD driver's voltage. A common mode amplifier circuit can be configured by connecting external resistors R1 and R2 and inputting the reference voltage VREF to AMPIN( + ), and this configuration can be used to regulate the potential of the LCD driver voltage VLC1. If using a thermistor to regulate the LCD driver voltage to suit the liquid crystals' temperature characteristics, we recommend connecting in parallel to R2.
The LCD driver voltage VLC1 can be determined using the following formula.
$\mathrm{V}_{\text {LC1 }}=$ AMPout $=\left(1+\frac{\mathrm{R}^{\prime}}{\mathrm{R} 1}\right) \mathrm{V}_{\text {REF }}$
$\mathrm{R}^{\prime}=\frac{\mathrm{R} 2 \cdot \mathrm{Rth}}{\mathrm{R} 2+\mathrm{Rth}}$

Figure 4-2. When Not Using Internal Power Supply Select or D/A Converter


### 4.2.2 When using internal power supply select and $D / A$ converter ( $V_{\text {ext }}=L, D A c h a=H$ )

Using the D/A converter enables commands to be entered to control the reference voltage VREF that is input to the + input of the op amp for the LCD driver voltage.
The D/A converter function sets 6-bit data to the D/A converter set register to set one of the 64 modes for the reference voltage Vref between Vdd and 1/2 Vdo.
The formula for VLC1 is the same as in 4.2.1 When not using internal power supply select or D/A converter $\left(\right.$ Vext $\left.^{\prime}=\mathrm{L}, \mathrm{DAcha}=\mathrm{L}\right)$ above .

Figure 4-3. Using Internal Power Supply Select and D/A Converter


### 4.2.3 When using an external power supply ( $\mathrm{VEXT}_{\mathrm{EXT}}=\mathrm{H}$ )

When an external power supply is used for the LCD driver voltage, the op amp incorporate in the $\mu$ PD16681 (used for the LCD driver voltage) is in OFF mode. Consequently, the LCD driver's op amp and D/A converter function cannot be used when using an external power supply. Instead, regulate the LCD driver voltage by inputting directly to the VLCD and VLC1 pins.

## Cautions 1. Maintain the following relation for the voltage input to the VLcd and VLc1 pins: VLcd > VLC1

2. Since the DAcha, $\operatorname{AMPin}(+)^{\text {, }}$, and $\operatorname{AMPIN(-)}$ pins are CMOS inputs, they should be fixed either high or low.
3. The AMPout pin should be left unconnected.

### 4.3 Reference Voltage

### 4.3.1 When using internal power supply ( $\mathrm{Vext}_{\mathrm{Ex}}=\mathrm{L}$ )

When using the internal power supply, the $\mu$ PD16681's on-chip divider resistor is used to create the six-level potential (VLc1, VLc2, Vlc3, Vlc4, Vlc5, and Vss) required for the LCD driver.

### 4.3.2 When using an external power supply ( $\mathrm{VExt}_{\mathrm{Ex}}=\mathrm{H}$ )

When use of an external power supply has been selected, the op amp incorporated in the $\mu$ PD16681 for the LCD driver level power supply is in OFF mode, so a reference potential must be directly input to VLc1, VLc2, VLc3, VLc4, and VLc5.
Ordinarily, these levels are generated by dividing the resistance. Since large resistance values result in poorer LCD display quality, be sure to select a resistance value that suits the type of LCD panel to be used.

The display quality can be improved by connecting capacitors between the level pins and ground pins. As with the resistance values described above, the capacitance values of the capacitors should be selected to suit the divided resistance values and the type of LCD panel to be used.

### 4.4 Control of Op Amp for Level Power Supply

Input to the AMPсна pin is used to control the op amp for the LCD driver level power supply.

- High power mode (AMPcha = L)

This mode maximizes the LCD drive current supply capacity in the op amp for the LCD driver level power supply.

- Normal mode (AMPcha = H)

This mode uses a lower LCD drive current supply capacity in the op amp for the LCD driver level power supply, which is suitable for charging the capacitor used to stabilize the external level.

Caution For either mode, be sure to connect a level stabilization capacitor (rated from about 0.1 to $1.0 \mu \mathrm{~F}$ ) for the VLC1 to VLC5 pins. Poorer display quality results when these capacitors are not connected.

Figure 4-4. Reference Voltage Circuit


### 4.5 Bias Value Settings

The bias value can be set as $1 / 6$ bias, $1 / 7$ bias, or $1 / 8$ bias by selecting an internal bias for the ( $\mu$ PD16681 and by connecting externally from the IC among Vlcbs1, VlCbs2, and VLCBS3 pins.

| Bias Value | Connected Pin |
| :--- | :--- |
| $1 / 8$ bias | VLCBS1, VLCBS2, and VLCBS3 leave open |
| $1 / 7$ bias | Between VLCBS1 and VLCBS2 or between VLCBS2 <br> VLCBS3 |
| $1 / 6$ bias | Between VLCBS 1 and VLCBS3 and VLCBS2 leave open |

### 4.6 Power Supply Circuit Use Example

Figure 4-5. Using Internal Power Supply and Normal Mode
A) $4 x$ boost (D/A converter is not used.)

B) $3 x$ boost


Remarks 1. $\mathrm{C}_{1}=1.0 \mu \mathrm{~F}, \mathrm{C}_{2}=1.0 \mu \mathrm{~F}$
2. Leave $\mathrm{C}_{2}{ }^{+}$and $\mathrm{C}_{3}{ }^{-}$pins open during $3 x$ boost.
3. Leave $\mathrm{AMP}_{(+)}$open when using the $\mathrm{D} / \mathrm{A}$ converter.

Figure 4-6. Using External Power Supply Circuit
A) Use $1 / 8$ bias


Remark
Fix all open input pins high or low.

## 5. LCD DISPLAY DRIVER

Either a $1 / 52$ duty driver or a $1 / 39$ duty driver can be selected for the $\mu$ PD16681. Both drivers output a drive waveform using the two-frame AC drive method.

### 5.1 1/52 Duty Driver

When the $1 / 52$ duty driver is selected for the $\mu$ PD16681, a select signal is output once per frame from the dot block's common outputs (COM1 to COM51) and from the pictograph block's common outputs (same signal output from $\mathrm{PCOM}_{1}$ and $\mathrm{PCOM}_{2}$ ).

Figure 5-1. 1/52 Duty Driver


### 5.2 1/39 Duty Driver

When the $1 / 39$ duty driver is selected for the $\mu$ PD16681, a select signal is output once per frame from the dot block's common outputs ( $\mathrm{COM}_{1}$ to $\mathrm{COM}_{19}, \mathrm{COM}_{27}$ to $\mathrm{COM}_{45}$ ) and from the pictograph block's common outputs (same signal output from $\mathrm{PCOM}_{1}$ and $\mathrm{PCOM}_{2}$ ).

Figure 5-2 1/39 Duty Driver


## 6. DESCRIPTION OF BLOCKS

### 6.1 Display Data RAM (DDRAM)

DDRAM is RAM that contains display data consisting of a 16 -bit character code plus a character attribute code. The RAM capacity is $16 \times 72$ bits, which means that up to 72 characters can be stored in RAM.
The following table shows correspondences between DDRAM addresses and LCD display positions. For further description of these correspondences, see the section 7.1 LCD display and DDRAM addresses.

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 1 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1st line | 00H | 01H | 02H | 03H | 04H | 05H | 06H | 07H | 08H | 09H | OAH | OBH | OCH | ODH | OEH | OFH | 10 H | 11H |
| 2nd line | 12H | 13 H | 14H | 15H | 16H | 17H | 18H | 19H | 1 AH | 1BH | 1 CH | 1DH | 1EH | 1FH | 20 H | 21H | 22 H | 23 H |
| 3rd line | 24H | 25H | 26H | 27H | 28H | 29H | 2AH | 2BH | 2CH | 2DH | 2EH | 2FH | 30 H | 31H | 32 H | 33H | 34H | 35H |
| 4th line | 36H | 37H | 38H | 39H | 3AH | 3BH | 3 CH | 3DH | 3EH | 3FH | 40H | 41H | 42H | 43H | 44H | 45H | 46H | 47H |

### 6.2 Full Width (11x12 dots) Character Generator ROM (FCGROM)

FCGROM generates a total of 7,064 full width character patterns, of which 6,355 are JIS Level $1+$ Level 2 kanji, 453 are non-kanji characters and 256 other symbols. These character patterns are displayed in $11 \times 12$ dot font patterns based on 12-bit character codes. The section entitled 7.2.2 Full Width(11 x 12 dots) Character Code Setting Examples describes the correspondence between the character codes set to DDRAM and this full width font pattern. Also, see the section entitled 7.2 Character Codes for a description of the correspondence between the JIS code and the character code set to DDRAM.

### 6.3 Half Width( $5 \times 12$ dots) Character Generator ROM (HCGROM)

FCGROM generates a total of 192 half width ( $5 \times 12$ dots) character patterns, displayed in $5 \times 12$ dot font patterns. The section entitled 7.2 Character Codes describes the correspondence between the character code set to DDRAM and the half width font patterns.

### 6.4 Character Generator RAM (CGRAM)

CGRAM is RAM to which the user can freely set character patterns. Eight types of $12 \times 13$ dot character patterns can be defined. To display a character pattern that has been stored in CGRAM, the user specifies a value ranging from "000H" to "007H".

The relation between character codes and CGRAM addresses used to access CGRAM is shown below.

Figure 6-1. The Relation between Character Codes and CGRAM Addresses


Remarks 1. CGRAM is selected when the high-order nine bits ( C 11 to C 3 ) of a character code are all zeros. At that time, the low-order three bits ( C 2 to C 0 ) corresponds to CGRAM addresses 7 to 5 ( A 7 to A ). (Three bits: eight types.)
2. Display ON is selected when the CGRAM data value is " 1 ". Display OFF is selected when this data value is " 0 ".
3. The CGRAM address $0(A 0)$ corresponds to the left and right sides of the character pattern.
4. The high-order two bits of CGRAM are used to control the display attributes of the pattern corresponding to the low-order six bits. In such cases, any display attribute specification made for DDRAM is ignored. When the value of the high-order two bits is "00", CGRAM's pattern is displayed.
5. CGRAM addresses 4 to 1 (A4 to A1) corresponds to the line position of the character pattern. (Four bits : 13 lines) The ORed result with the cursor is taken and displayed on the 12 th line.

### 6.5 Pictograph Display RAM (PDRAM)

PDRAM is the RAM that contains pictograph display data that has been assigned to $\mathrm{PCOM}_{1}$ and PCOM . The data display function is ON when the data value is " 1 " and OFF when the data value is " 0 ".
After data is written, the address counter is automatically incremented (by one), and the value after 0FH is 00 H .
The correspondence between output from various segments and PDRAM addresses is shown below.

PCOM1, PCOM 2

| Address | Segment Output No. |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
| OOH | X | X | 6 | 5 | 4 | 3 | 2 | 1 |
| 01H | X | X | 12 | 11 | 10 | 9 | 8 | 7 |
| 02H | X | X | 18 | 17 | 16 | 15 | 14 | 13 |
| 03H | X | X | 24 | 23 | 22 | 21 | 20 | 19 |
| 04H | X | X | 30 | 29 | 28 | 27 | 26 | 25 |
| 05H | X | X | 36 | 35 | 34 | 33 | 32 | 31 |
| 06H | X | X | 42 | 41 | 40 | 39 | 38 | 37 |
| 07H | X | X | 48 | 47 | 46 | 45 | 44 | 43 |
| 08H | X | X | 54 | 53 | 52 | 51 | 50 | 49 |
| 09H | X | X | 60 | 59 | 58 | 57 | 56 | 55 |
| OAH | X | X | 66 | 65 | 64 | 63 | 62 | 61 |
| OBH | X | X | 72 | 71 | 70 | 69 | 68 | 67 |
| OCH | X | X | 78 | 77 | 76 | 75 | 74 | 73 |
| ODH | X | X | 84 | 83 | 82 | 81 | 80 | 79 |
| OEH | X | X | 90 | 89 | 88 | 87 | 86 | 85 |
| OFH | X | X | 96 | 95 | 94 | 93 | 92 | 91 |

Remark $X$ : Don't care

### 6.6 Pictograph Blink Data RAM (PBRAM)

PBRAM is the RAM that contains pictograph blink data that has been assigned to $\mathrm{PCOM}_{1}$ and $\mathrm{PCOM}_{2}$. A data value of " 1 " is written to the address of the pictograph to be set for a blink display.

After data is written, the address counter is automatically incremented (by one), and the value after 0FH is 00 H .
The correspondence between output from various segments and PBRAM addresses is shown below.
$\mathrm{PCOM}_{1}, \mathrm{PCOM}_{2}$

| Address | Segment Output No. |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | b 7 | b 6 | b 5 | b 4 | b 3 | b 2 | b 1 | b 0 |  |
| 00H | X | X | 6 | 5 | 4 | 3 | 2 | 1 |  |
| 01H | X | X | 12 | 11 | 10 | 9 | 8 | 7 |  |
| 02H | X | X | 18 | 17 | 16 | 15 | 14 | 13 |  |
| 03H | X | X | 24 | 23 | 22 | 21 | 20 | 19 |  |
| 04H | X | X | 30 | 29 | 28 | 27 | 26 | 25 |  |
| 05H | X | X | 36 | 35 | 34 | 33 | 32 | 31 |  |
| 06H | X | X | 42 | 41 | 40 | 39 | 38 | 37 |  |
| 07H | X | X | 48 | 47 | 46 | 45 | 44 | 43 |  |
| 08H | X | X | 54 | 53 | 52 | 51 | 50 | 49 |  |
| 09H | X | X | 60 | 59 | 58 | 57 | 56 | 55 |  |
| 0AH | X | X | 66 | 65 | 64 | 63 | 62 | 61 |  |
| 0BH | X | X | 72 | 71 | 70 | 69 | 68 | 67 |  |
| 0CH | X | X | 78 | 77 | 76 | 75 | 74 | 73 |  |
| 0DH | X | X | 84 | 83 | 82 | 81 | 80 | 79 |  |
| 0EH | X | X | 90 | 89 | 88 | 87 | 86 | 85 |  |
| 0FH | X | X | 96 | 95 | 94 | 93 | 92 | 91 |  |

Remark X : Don't care

### 6.7 Relation between Addresses and Various ROM and RAM Devices

The $\mu$ PD16681 assigned FCGROM addresses as shown below to HCGROM, CGRAM, and user-defined ROM.

| Type | No. of Characters |  |
| :--- | :---: | :--- |
| JIS kanji | 6355 | Address Range |
| Non-JIS kanji | 453 | Same as kanji ROM IC as kanji ROM IC |
| Half width alphanumeric <br> characters | 192 | Uses addresses 0080H to 039FH in the kanji ROM IC |
| User defined | 256 | Uses addresses 1000H to 101FH in the kanji ROM IC |
| CGRAM | 8 | Uses addresses 0000H to 0007H in the kanji ROM IC |

## 7. LCD DISPLAY

The $\mu$ PD16681's LCD display can display four lines containing up to 8 characters ( $11 \times 12$ dots) or 16 characters ( 5 $\times 12$ dots) and 96 pictographs.


Remark The same select signal is output from $\mathrm{PCOM}_{1}$ and $\mathrm{PCOM}_{2}$.

## 7．1 LCD Display and DDRAM Addresses

The character code used in the $\mu$ PD16681 contains 16 bits（character code＋character attribute code）．When data is stored to an address in DDRAM，a combination of full width（ $11 \times 12$ dots）and half width（ $5 \times 12$ dots）characters can be displayed on the LCD．
The relation between the DDRAM＇s character area and the actual LCD display when displaying a combination of full width and half width characters is shown below．

Figure 7－1．The Relation between The DDRAM＇s Character Area and The Actual LCD Display

LCD display：

| 日 |  | 本 |  | 電 |  | 気 |  | 株 |  | 式 |  | 会 |  | 社 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 神 |  | 奈 |  | 川 |  | 県 |  | 川 |  | 崎 |  | 市 |  | 幸 |  |
| 区 |  | 塚 |  | 越 |  | 三 |  | 丁 |  | 目 |  | 4 | 8 | 4 | ＂＂ |
| T | E | L | ． | 0 | 4 | 4 | － | 5 | 4 | 8 | － | 8 | 8 | 8 | 2 |

＂＂：Half width（ $5 \times 12$ dots）space

DDRAM：

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1st line | 00 H | 01H | 02H | 03H | 04H | 05H | 06H | 07H | 08H | 09H | OAH | OBH | 0 CH | ODH | OEH | OFH | 10 H | 11H |
| 2nd line | 12H | 13H | 14H | 15H | 16H | 17H | 18H | 19H | 1AH | 1BH | 1 CH | 1DH | 1EH | 1FH | 20 H | 21H | 22 H | 23H |
| 3rd line | 24H | 25H | 26 H | 27H | 28 H | 29H | 2AH | 2BH | 2CH | 2DH | 2EH | 2FH | 30 H | 31H | 32 H | 33H | 34H | 35H |
| 4th line | 36 H | 37H | 38H | 39H | 3AH | 3BH | 3CH | 3DH | 3EH | 3FH | 40 H | 41H | 42H | 43H | 44H | 45H | 46H | 47H |

Remark Shaded areas indicate addresses．
Address characters that are not displayed are used as data for character scrolling．

## 7．2 Character Codes

The $\mu$ PD16681 is able to combine full width characters（ $11 \times 12$ dots）and half width characters（ $5 \times 12$ dots）in the same display．The character data that is stored in DDRAM is displayed starting from the top left corner of the LCD screen．A one－dot character interval is added to the left of each character font．
Both full width（ $11 \times 12$ dots）and half width（ $5 \times 12$ dots）characters are handled using 16 －bit code lengths and are stored in DDRAM．The 16 －bit code format uses the low－order 13 bits as the character code．The remaining 3 bits are the high－order 3 bits，which specify the character width（full or half）and the display attribute．The MSB is the select bit indicating full width or half width character code：＂ 0 ＂specifies full width characters and＂ 1 ＂specifies half width characters．The character attribute code is assigned to the next two bits，and can specify attributes such as blinking for individual characters．（See the section 7．3 Display Attributes．）

## 7．2．1 Code format



Full width（11 x 12 dots）character／
Half width（ $5 \times 12$ dots）character specification

### 7.2.2 Full width ( $11 \times 12$ dots) character code setting examples

The following shows the correspondence between 16-bit JIS code and the $\mu$ PD16681's 13-bit character code. This correspondence varies according to the values of the high-order 3 bits ( $\mathrm{b} 17, \mathrm{~b} 16$, and b15) in the first byte of the JIS code.
Convert JIS code as shown below to generate character code for the $\mu$ PD16681.
(1) JIS level 1 kanji and non-kanji characters

Table 7-1. When $(b 17, b 16, b 15)=(0,1,0)$

| JIS C 6226 | First byte |  |  |  |  |  |  | Second byte |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | b17 | b16 | b15 | b14 | b13 | b12 | b11 | b27 | b26 | b25 | b24 | b23 | b22 | b21 |
| Character code |  |  |  |  | C9 | C8 | C7 | C6 | C5 | C4 | C3 | C2 | C1 | C0 |

Remark $\mathrm{C} 12=\mathrm{C} 6=\mathrm{C} 5=0$

Table 7-2. When $(b 17, b 16, b 15)=(0,1,1)$ or $(1,0,0)$

| JIS C 6226 | First byte |  |  |  |  |  |  | Second byte |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | b17 | b16 | b15 | b14 | b13 | b12 | b11 | b27 | b26 | b25 | b24 | b23 | b22 | b21 |
| Character code | C11 |  |  | C10 | C9 | C8 | C7 | C6 | C5 | C4 | C3 | C2 | C1 | C0 |

Remark $\mathrm{C} 12=0$
(2) JIS level 2 kanji and non-kanji characters

Table 7-3. When $(b 17, b 16, b 15)=(1,1,1)$

| JIS C 6226 | First byte |  |  |  |  |  |  | Second byte |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | b17 | b16 | b15 | b14 | b13 | b12 | b11 | b27 | b26 | b25 | b24 | b23 | b22 | b21 |
| Character code |  |  |  |  | C9 | C8 | C7 | C11 | C10 | C4 | C3 | C 2 | C1 | C0 |

Remark $\mathrm{C} 12=1, \mathrm{C} 6=\mathrm{C} 5=0$

Table 7-4. When $(b 17, b 16, b 15)=(1,0,1)$ or $(1,1,0)$

| JIS C 6226 | First byte |  |  |  |  |  |  | Second byte |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | b17 | b16 | b15 | b14 | b13 | b12 | b11 | b27 | b26 | b25 | b24 | b23 | b22 | b21 |
| Character code |  | C11 |  | C10 | C9 | C8 | C7 | C6 | C5 | C4 | C3 | C2 | C1 | co |

Remark C12 $=1$
(3) CGRAM

| D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | X | X | 0 | 0 | 0 | 0 | 0 |


| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | 0 | 0 | 0 | 0 | u 2 | u 1 | u 0 |

Remark CGRAM addresses for user font: u2 to u0

### 7.3 Display Attributes

In the $\mu$ PD16681, the character code is assigned to 12 bits of the 16 -bit data that is specified as full width $(11 \times 12$ dots) characters or half width ( $5 \times 12$ dots) characters and the display attribute code is assigned to two of the remaining four bits. Normal display or blink display mode can be specified for each character unit.
The blink cycle for blink display mode is 64 frames, so that display blinks on or off once every 32 frames.

### 7.3.1 Character code format



Full width(11 x 12 dots) character/
Half width ( $5 \times 12$ dots) character specification
7.3.2 Display attribute specifications

| A1 | A0 | Display Mode |
| :---: | :---: | :--- |
| 0 | 0 | Normal display |
| 0 | 1 | Reverse display |
| 1 | 0 | Character blink |
| 1 | 1 | Reverse character blink |

### 7.3.3 Display examples

(1) Normal display

(2) Reverse display

(3) Blink display

(4) Reverse blink display


## 8. COMMANDS

### 8.1 Basic format



Note The command (1 or 2 bytes) immediately follows the falling edge of the STB signal, and whatever is sent after that is recognized as data.

Table 8-1. Command List

| Command |  |  |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |  |
| Desescription |  |  |  |  |  |  |  |  |  |
| Reset | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |  |
| Display ON/OFF | 0 | 0 | 0 | 0 | 1 | b2 | b1 | b0 |  |
| Standby | 0 | 0 | 0 | 1 | 0 | b2 | b1 | b0 |  |
| Duty setting | 0 | 0 | 0 | 1 | 1 | 0 | b1 | b0 |  |
| Cursor control | 0 | 0 | 0 | 1 | 1 | 1 | b1 | b0 |  |
| D/A converter setting | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |  |
| Scroll control | 0 | 0 | 1 | 1 | b3 | b2 | b1 | b0 |  |
| Blink setting | 0 | 1 | 0 | 0 | 0 | 0 | b1 | b0 |  |
| Address register | 0 | 1 | 0 | 0 | 1 | 0 | b1 | b0 |  |
| Data R/W mode | 1 | 0 | 1 | 1 | 0 | b2 | b1 | b0 |  |
| Test mode | 1 | 0 | 1 | 0 | b3 | b2 | b1 | b0 |  |

### 8.1.1 Reset

This command resets all of the commands in the $\mu$ PD16681.

$$
\begin{array}{ll}
\text { MSB } & \text { LSB }
\end{array}
$$

| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

### 8.1.2 Display ON/OFF

This command controls the display's ON/OFF status.

```
MSB LSB
\begin{array} { | l | l | l | l | l | l | l | l | } { \hline 0 } & { 0 } & { 0 } & { 0 } & { 1 } & { b 2 } & { \text { b1 } } & { \text { b0 } } \\ { \hline } \end{array}
Selection
000 : LCD OFF (SEGn, COMn, PCOMn = Vss)
001 : LCD OFF (SEGn, COMn, PCOMn = non-select waveform)
111:LCD ON
```


### 8.1.3 Standby

This command stops the DC/DC converter, which reduces the supply current. The display is set to OFF mode $(S E G n, C O M n=V s s)$.

```
MSB LSB
\begin{tabular}{|l|l|l|l|l|l|l|l|}
\hline 0 & 0 & 0 & 1 & 0 & b2 & b1 & b0 \\
\hline
\end{tabular}
Selection
000 : Normal operation
001 : Standby (stop DC/DC converter, fulll display off \({ }^{\text {Note }}\), stop OSC)
```

Note $\mathrm{SEG} \mathrm{n}, \mathrm{COM}, \mathrm{PCOMn}=\mathrm{VEE}$

### 8.1.4 Duty setting

This command specifies the duty setting.


Note Use COM1 to COM19 and COM27 to COM45, leave COM20 to COM26 and COM46 to COM51 open when setting 1/39 duty.

### 8.1.5 Cursor control

This command controls the cursor's ON/OFF status.

## MSB LSB



00 : Cursor OFF ${ }^{\text {Note1 }}$
10 : Cursor ON (no blink) Note2
11 : Cursor ON (blink) ${ }^{\text {Note3 }}$

Notes 1. 00 : Sets cursor to OFF mode.
2. 10 : Sets cursor to ON mode (cursor is displayed). The cursor is displayed at the character which occupies the display position of the currently specified DDRAM address. The "address register" + "data R/W command" combination is used to set data to DDRAM addresses. When accessing RAM, the address counter in RAM is automatically incremented ( +1 ) or decremented ( -1 ), and the cursor is moved accordingly.
3. 11 : This sets the cursor to ON mode and causes the cursor to blink. The blink cycle is 64 frames. The correspondence between the cursor and the RAM address is the same as when the cursor is blinking.

Remark The cursor display function is valid only when the display attribute specifies "normal display" ( $\mathrm{A} 0=0, \mathrm{~A} 1=0$ ).

### 8.1.6 D/A converter set 1

The D/A converter's output for the LCD driver is set in 64 steps from Vdo to 1/2 Vdo.


Remark This value is set to 20 H after a reset.

### 8.1.7 Scroll control

This controls scrolling of displayed characters.
The individual bits in the selection are allocated to their respective display lines. When the data value is " 1 ", scrolling is enabled for that line. The distance of the dots' leftward (horizontal) motion is selected via the extended selection register that is input after the command. The dot move distance varies depending on the current LCD display status and the contents of DDRAM. For details, see the section 8.4 Scrolling.


### 8.1.8 Pictograph blink setting

This command performs blink control for the pictograph at addresses where the blink (PBRAM) data value is " 1 ".

```
MSB LSB
```



```
00 : Stop blink (blink frequency \(=\) fosc/319488)
01 : Stop blink (blink frequency \(=\mathrm{f}_{\mathrm{BR}}{ }^{\text {Note }} / 2\) )
10 : Start blink (blink frequency \(=\) fosc/319488)
11 : Start blink (blink frequency \(=\) far1 \(^{\text {Note }} / 2\) )
```

Note This refers to the frequency of the external clock that is input from the OSCBR1 pin.

### 8.1.9 Data R/W command

This command performs data read/write operations.


Notes 1. During increment mode, when the current address is the last address the next address becomes 00 H . During decrement mode, when the current address is 00 H , the next address becomes the last address.
2. Data read mode is cancelled at the rising edge of the STB signal (mode is switched to command/data write mode).

Caution During a serial data transfer, write data in 8-bit or 16-bit segments. If the rising edge of STB occurs during the data transfer operation, the operation is not guaranteed.

### 8.1.10 Test mode

This command sets the test mode. The test mode is only for confirming the IC's operation. Regular or continuous use while in test mode is not guaranteed.

> MSB LSB


0000 : Normal operation 0001 to 1111 : Test mode

### 8.2 Address Register

This command selects the address type and specifies addresses.


## Caution Operation is not guaranteed if an invalid address is set.

### 8.3 Reset

The contents of the various registers appear as shown below after a reset (command reset or hardware [pin] reset).

| Command | Register Contents |  |  |  |  |  |  |  | Description |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |  |
| Display ON/OFF | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | $\begin{aligned} & \text { LCD OFF } \\ & \left(\text { SEG }_{n}, \mathrm{COM} \mathrm{n}, \mathrm{PCOM} \mathrm{n},=\mathrm{V} s \mathrm{~s}\right. \text { ) } \end{aligned}$ |
| Standby | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | Normal operation |
| Duty setting | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1/52 duty |
| Cursor control | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | Cursor OFF |
| D/A converter setting | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | Set to 20H |
| Scroll control | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | No specified scroll line |
| Blink setting | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | Blink stop |
| Address register | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | DDRAM is specified |
| Data R/W mode | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | Data write/increment (+1) |
| Test mode | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Normal operation |

## 8．4 Scrolling

Character scrolling is controlled by inputting scroll control commands（8 bits）plus scroll dot count data（8 bits）．The line to be scrolled is specified by the scroll control command and the scroll dot count data sets the number of dots to be scrolled．When this command is input，the characters on the specified line are shifted leftward by the specified number of dots．
The number of dots that can be scrolled differs according to the contents of the data stored in DDRAM（see 8．4．1 Scrollable number of dots and 8．4．2 Display and scroll amounts）．Consequently，if scrolling is specified for an amount of data that exceeds the scrollable data，the character data，only the scrollable data is shifted and overwritten，and scrolling must be performed again．

Cautions 1．For character scrolling，be sure to input a scroll control command（8 bits）plus the amount of scrolled data（8 bits）．
2．If the characters on a scrolled line have various character attributes（normal／blink／reverse／ reverse／blink），the character display may become garbled after scrolling．This problem does not occur when all of the characters on the line have the same character attribute．

## 8．4．1 Scrollable number of dots

Scroll amount $=$（ 12 dots $\times$ number of non－displayed full width characters that are stored in DDRAM）

+ (6 dots x number of non-displayed half width characters that are stored in DDRAM)


## 8．4．2 Display and scroll amounts

LCD display：

| 日 |  | 本 |  | 電 |  | 気 |  | 株 |  | 式 |  | 会 |  | 社 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 神 |  | 奈 |  | 川 |  | 県 |  | 川 |  | 崎 |  | 市 |  | 幸 |  |
| T | E | L | ： | 0 | 4 | 4 | － | 5 | 4 | 8 | － | 8 | 8 | 8 | 2 |
| F | A | X | ． | 0 | 4 | 4 | － | 5 | 4 | 8 | － | 7 | 9 | 1 | 0 |

DDRAM status ：

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1st line | OOH | 01H | 02H | 03H | 04H | 05H | 06H | 07H | 08H | 09H | OAH | OBH | OCH | 0DH | 0EH | 0FH | 10H | 11H |
| 2nd line | 12H | 13 H | 14H | 15H | 16 H | 17H | 18H | 19H | 1AH | 1BH | 1 CH | 1DH | 1EH | 1FH | 20 H | 21H | 22 H | 23H |
| 3rd line | 24H | 25H | 26 H | 27H | 28 H | 29 H | 2AH | 2BH | 2 CH | 2DH | 2EH | 2FH | 30 H | 31H | 32 H | 33 H | 34H | 35H |
| 4th line | 36 H | 37H | 38 H | 39H | 3AH | 3BH | 3 CH | 3DH | 3EH | 3FH | 40 H | 41H | 42H | 43H | 44H | 45H | 46H | 47H |

Remark Shaded areas indicate addresses．
Address characters that are not displayed are used as data for character scrolling．

Character memory contents ：

| 1st line | 日 | 本 | 電 | 気 | 株 | 式 | 会 | 社 | 半 | 䆃 | 体 | ソ | リ | ュ | － | シ | $\exists$ | ン |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2nd line | 神 | 奈 | 川 | 県 | 川 | 崎 | 市 | 幸 | 区 | 塚 | 越 | 三 | 丁 | 目 | 4 | 8 | 4 | $\square$ |
| 3rd line | T | E | L | ． | 0 | 4 | 4 | － | 5 | 4 | 8 | － | 3 | 8 | 8 | 2 | P | B |
| 4th line | F | A | X | ： | 0 | 4 | 4 | － | 5 | 4 | 8 | － | 7 | 9 | 1 | 0 | 夜 | 間 |

Remarks 1．Shaded areas indicate addresses．
2．First line：＂半導体ソリューション＂（10 full width（ $11 \times 12$ dots）characters）
Second line：＂区塚越三丁目＂（6 full width（ $11 \times 12$ dots）characters），
＂ 484 ＂$\square$（ 4 half width（ $5 \times 12$ dots）characters）
Third line ：＂PB＂（ 2 half width（ $5 \times 12$ dots）characters）
Fourth line ：＂夜間＂$(2$ full width（ $5 \times 12$ dots）characters）
Scrollable dot counts；
First line ：（ 12 dots $\times 10$ characters $)+(6$ dots $\times 0$ characters $)=120$ dots
Second line ：（ 12 dots $\times 6$ characters）$+(6$ dots $\times 4$ characters $)=96$ dots
Third line ：（ 12 dots $\times 0$ characters）$+(6$ dots $\times 2$ characters $)=12$ dots
Fourth line ：（ 12 dots $\times 2$ characters）$+(6$ dots $\times 0$ characters $)=24$ dots
If scroll count data that exceeds the scrollable number of dots is entered using the scroll control command，all dots that are in the area that goes beyond the DDRAM addresses are output as OFF data．

### 8.5 Serial Communication Format

(1) Reception 1 (command write, 1 byte)

(2) Reception 2 (command/data write, 2 bytes or more)

(3) Transmission (command/data read)


### 8.6 Parallel Communication Format

(1) 8-bit parallel interface


## 9. COMMAND EXAMPLES

Table 9-1. Initial Setting (1/39 duty) + Data Input

| STB | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Status |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Hard Reset |  |  |  |  |  |  |  |  |  |
| H | X | X | X | X | X | X | X | X |  |
| L | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | Duty setting (1/39 duty) |
| H | X | X | X | X | X | X | X | X |  |
| L | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | Address register (DDRAM address selection) |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | DDRAM address: 00 H |
| H | X | X | X | X | X | X | x | X |  |
| L | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | Data write, address is incremented starting from current address |
|  | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | Data for first character |
|  | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |  |
|  | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | Data for second character |
|  | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |  |
|  | : |  |  |  |  |  |  |  |  |
|  | D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | Data for 54th character |
|  | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |  |
| H | X | X | X | X | X | X | X | X |  |
| L | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | Address register (PDRAM address selection) |
| H | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | PDRAM address: 00 H |
| L | X | X | X | X | X | X | X | X |  |
| L | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | Data write, address is incremented starting from current address |
|  | X | X | D | D | D | D | D | D | PDRAM: data at 00H |
|  | X | X | D | D | D | D | D | D | PDRAM: data at 01H |
|  | : |  |  |  |  |  |  |  |  |
|  | X | X | D | D | D | D | D | D | PDRAM: data at 0FH |
| H | X | X | X | X | X | X | X | X |  |
| L | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | Address register (PBRAM address selection) |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | PBRAM address : 00 H |
| H | X | X | X | X | X | X | X | X |  |
| L | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | Data write, address is incremented starting from current address |
|  | X | X | D | D | D | D | D | D | PBRAM: data at 00 H |
|  | X | X | D | D | D | D | D | D | PBRAM: data at 01H |
|  | : |  |  |  |  |  |  |  |  |
|  | X | X | D | D | D | D | D | D | PBRAM: data at 0FH |
| H | X | X | X | X | X | X | X | X |  |
| L | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | Display ON |
| H | X | X | X | X | X | X | X | X |  |
| To next processing |  |  |  |  |  |  |  |  |  |

Remark X: Don't care

Table 9-2. CGRAM Data Write

| STB | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Status |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Start |  |  |  |  |  |  |  |  |  |
| H | X | X | X | X | X | X | X | X |  |
| L | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | Address register (CGRAM address selection) |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | CGRAM address: 00 H |
| H | X | X | X | X | X | X | X | X |  |
| L | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | Data write, address is incremented starting from current address |
|  | A | A | D5 | D4 | D3 | D2 | D1 | D0 | Data for first character (at 000H) <br> Data in first line of pattern |
|  | A | A | D5 | D4 | D3 | D2 | D1 | D0 |  |
|  | A | A | D5 | D4 | D3 | D2 | D1 | D0 | Data for first character (at 000H) <br> Data in second line of pattern |
|  | A | A | D5 | D4 | D3 | D2 | D1 | D0 |  |
|  | : |  |  |  |  |  |  |  |  |
|  | A | A | D5 | D4 | D3 | D2 | D1 | D0 | Data for Xth character (at 00 mH ) <br> Data in nth line of pattern |
|  | A | A | D5 | D4 | D3 | D2 | D1 | D0 |  |
| H | X | X | X | X | X | X | X | X |  |
| To next processing |  |  |  |  |  |  |  |  |  |

Remark X: Don't care

## 10. ELECTRICAL SPECIFICATIONS

Absolute Maximum Ratings ( $\mathrm{T}_{\mathrm{A}}=\mathbf{2 5}^{\circ} \mathrm{C}$, V ss $=\mathbf{0} \mathrm{V}$ )

| Parameter | Symbol | Rating | Unit |
| :---: | :---: | :---: | :---: |
| Supply voltage (4x boost) | VDD | -0.3 to +3.75 | V |
| Supply voltage (3x boost) | VDD | -0.3 to +5.0 | V |
| Driver supply voltage | VLCD | -0.3 to $+15.0, V_{\text {do }} \leq V_{L C D}$ | V |
| Driver reference supply input voltage | VıC1-VıC5 | -0.3 to VLCD +0.3 | V |
| Logic system input voltage | VIN1 | -0.3 to VdD+0.3 | V |
| Logic system output voltage | Vout1 | -0.3 to $\mathrm{VDD}+0.3$ | V |
| Logic system input/output voltage | V1/01 | -0.3 to VdD+0.3 | V |
| Driver system input voltage | VIN2 | -0.3 to VLCD +0.3 | V |
| Driver system output voltage | Vout2 | -0.3 to VLCD +0.3 | V |
| Operating ambient temperature | $\mathrm{T}_{\text {A }}$ | -40 to +85 | ${ }^{\circ} \mathrm{C}$ |
| Storage temperature | $\mathrm{T}_{\text {stg }}$ | -55 to +150 | ${ }^{\circ} \mathrm{C}$ |

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

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
| :--- | :--- | :--- | :--- | :--- | :---: |
| Supply voltage (4x boost) | VDD | 2.45 |  | 3.0 | V |
| Supply voltage (3x boost) | VDD | 2.45 |  | 4.0 | V |
| Driver supply voltage | VLCD | 5.0 | 10 | 12 | V |
| Logic system input voltage | VIN | 0 |  | VDD | V |
| Driver system input voltage | VLC1-VLC5 | 0 |  | VLCD | V |

Remarks 1. When using an external power supply, be sure to maintain these relations:

$$
\mathrm{V}_{\mathrm{SS}}<\mathrm{V}_{\text {LC5 }}<\mathrm{V}_{\text {LC4 }}<\mathrm{V}_{\text {LC3 }}<\mathrm{V}_{\mathrm{LC} 2}<\mathrm{V}_{\mathrm{LC} 1} \leq \mathrm{V}_{\mathrm{LCD}}
$$

2. Maintain $V_{D D} \leq V_{L C D}$ when turning the power on or off.
3. Keep voltage input to the $\mathrm{AMPIN}_{(+)}$pin between 1.0 V and $\mathrm{VDD}_{\mathrm{D}}$ when using an internal power supply but not using the D/A converter.

Electrical characteristics (unless otherwise specified, $T_{A}=-40$ to $+85^{\circ} \mathrm{C}, \mathrm{VDD}=2.45$ to 3.0 V during 4 x boost mode or 2.45 to 4.0 V during $3 x$ boost mode)

| Parameter | Symbol | Condition | MIN. | TYP. | MAX. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| High-level input voltage | $\mathrm{V}_{\mathrm{IH}}$ |  | 0.8 VDD |  |  | V |
| Low-level input voltage | VIL |  |  |  | 0.2VDo | V |
| High-level input current | І H1 | Except for Do/DATA and $\mathrm{D}_{1}$ to $\mathrm{D}_{7}$ |  |  | 1 | $\mu \mathrm{A}$ |
| Low-level input current | IL1 | Except for Do/DATA and $\mathrm{D}_{1}$ to $\mathrm{D}_{7}$ |  |  | -1 | $\mu \mathrm{A}$ |
| High-level output voltage | Vor | lout $=-1.5 \mathrm{~mA}$, except OSCout | $V_{\text {Do }}-0.5$ |  |  | V |
| Low-level output voltage | VoL | lout $=4 \mathrm{~mA}$, except OSCout |  |  | 0.5 | V |
| High-level leakage current | ILoh | Do/DATA and $\mathrm{D}_{1}$ to $\mathrm{D}_{7}$, $\mathrm{V}_{\text {Inout }}=\mathrm{V}_{\mathrm{DD}}$ |  |  | 10 | $\mu \mathrm{A}$ |
| Low-level leakage current | ILoL | Do/DATA and $\mathrm{D}_{1}$ to $\mathrm{D}_{7}$, Vinout $=\mathrm{V}_{\text {ss }}$ |  |  | -10 | $\mu \mathrm{A}$ |
| Common output ON resistance | Rcom | $\mathrm{V}_{\mathrm{LC}} \rightarrow \mathrm{COM}_{\mathrm{n}}, \mathrm{V}_{\text {LCD }} \geq 3 \mathrm{~V}_{\text {do }}$, $\mathrm{LLOL}=50 \mu \mathrm{~A}$ |  |  | 2 | $\mathrm{k} \Omega$ |
| Segment output ON resistance | Rseg | $\mathrm{V}_{\text {LC }} \rightarrow \mathrm{SEG}_{\mathrm{n}}, \mathrm{V}_{\text {LCD }} \geq 3 \mathrm{~V}$ Dd, $\mathrm{ILOL}=50 \mu \mathrm{~A}$ |  |  | 4 | k $\Omega$ |
| Driver voltage (boost voltage) | VLCD | During 3x boost | 2.7 VDD |  | 3.0 VDD | V |
|  |  | During 4 x boost | 3.6VDD |  | 4.0 VDD | V |
| Current consumption (normal mode) | $1 \mathrm{do11}$ | fosc $=375 \mathrm{kHz}$, all display OFF data output, <br> $\mathrm{V}_{\mathrm{DD}}=3.0 \mathrm{~V}$ during $3 \times$ boost mode |  | 100 | 180 | $\mu \mathrm{A}$ |
|  |  | fosc $=375 \mathrm{kHz}$, all display OFF data output, <br> $\mathrm{V}_{\mathrm{DD}}=3.0 \mathrm{~V}$ during 4 x boost mode |  | 135 | 210 | $\mu \mathrm{A}$ |
| Current consumption (high-power mode) | Ido12 | fosc $=375 \mathrm{kHz}$, all display OFF data output, <br> $\mathrm{V}_{\mathrm{DD}}=3.0 \mathrm{~V}$ during $3 x$ boost mode |  | 150 | 280 | $\mu \mathrm{A}$ |
|  |  | fosc $=375 \mathrm{kHz}$, all display OFF data output, <br> $V_{D D}=3.0 \mathrm{~V}$ during $4 x$ boost mode |  | 200 | 340 | $\mu \mathrm{A}$ |
| Driver system current consumption (VDD) (Standby) | IDD21 | $\mathrm{V}_{\mathrm{DD}}=3.0 \mathrm{~V}$ |  | 1 | 10 | $\mu \mathrm{A}$ |

Remark The TYP. value is a reference value when $\mathrm{TA}_{\mathrm{A}}=25^{\circ} \mathrm{C}$

## Test Circuit



## Switching characteristics (unless otherwise specified, $\mathrm{T}_{\mathrm{A}}=-40$ to $+85^{\circ} \mathrm{C}$ )

$V_{D D}=2.45$ to 2.7 V

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Oscillation frequency | fosc | Self-oscillation, oscillation resistance $\mathrm{R}=100 \mathrm{k} \Omega$ | 180 |  | 500 | kHz |
| Transfer delay time | tPHL | SCK $\downarrow \rightarrow$ DATA $\downarrow$ |  |  | 60 | ns |
| Transfer delay time | tpLH | SCK $\downarrow \rightarrow$ DATA $\uparrow$ |  |  | 60 | ns |

Remark The TYP. value is a reference value when $\mathrm{TA}_{\mathrm{A}}=25^{\circ} \mathrm{C}$

VDD $=2.7$ to 3.3 V

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Oscillation frequency | fosc | Self-oscillation, <br> oscillation resistance $R=100 \mathrm{k} \Omega$ | 240 | 378 | 560 | kHz |
| Transfer delay time | tPHL | SCK $\downarrow \rightarrow$ DATA $\downarrow$ |  |  | 60 | ns |
| Transfer delay time | tPLH | SCK $\downarrow \rightarrow$ DATA $\uparrow$ |  |  | 60 | ns |

Remark Use the following equation to determine the time per frame.
1 frame = 1/fosc $\times 96 \times$ number of duty
fosc $=375 \mathrm{kHz}$, Given a $1 / 52$ duty,
1 frame $=2.67 \mu \mathrm{~s}(96 \times 52=13.1 \mathrm{~ms} \cong 75 \mathrm{~Hz})$

## Required timing conditions (unless otherwise specified, $\mathrm{T}_{\mathrm{A}}=-40$ to $+85^{\circ} \mathrm{C}$ )

Common (1) (VDD = 2.45 to 2.7 V )

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Clock frequency | fosc | OSCIN external clock | 180 |  | 500 | kHz |
| High-level clock pulse width | twhс1 | OSCIN external clock | 600 |  |  |  |
| Low-level clock pulse width | twLC1 | OSCIN external clock | ns |  |  |  |
| High-level clock pulse width | twhc2 | OSCBRI external clock | 600 |  |  | ns |
| Low-level clock pulse width | twLC2 | OSCBRI external clock | 400 |  |  | ns |
| Rise/fall time | tr,tf | OSCBRI external clock | 400 |  |  | ns |
| Reset pulse width | twre | /RESET pin | 50 |  |  | $\mu \mathrm{~ns}$ |
| Reset cancellation time | trRe | /RESET pin | 50 |  |  | $\mu \mathrm{~s}$ |

Remark The TYP. value is a reference value when $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$.

Common (2) (VDD = 2.7 to 3.3 V )

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Clock frequency | fosc | OSCIn external clock | 240 | 375 | 560 | kHz |
| High-level clock pulse width | twhc1 | OSCIn external clock | 500 |  |  | ns |
| Low-level clock pulse width | twLC1 | OSCin external clock | 500 |  |  | ns |
| High-level clock pulse width | twhc2 | OSCbri external clock | 400 |  |  | ns |
| Low-level clock pulse width | twLC2 | OSCbrı external clock | 400 |  |  | ns |
| Rise/fall time | tr, tif | OSCbri external clock |  |  | 100 | ns |
| Reset pulse width | twre | /RESET pin | 50 |  |  | $\mu \mathrm{s}$ |
| Reset cancellation time | trre | /RESET pin | 50 |  |  | $\mu \mathrm{s}$ |

Remark The TYP. value is a reference value when $\mathrm{TA}_{\mathrm{A}}=25^{\circ} \mathrm{C}$.

Serial interface (1) (VDD $=2.45$ to 2.7 V )

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Shift clock cycle | tcyk | SCK | 600 |  |  | ns |
| High-level shift clock pulse width | twhk | SCK | 300 |  |  | ns |
| Low-level shift clock pulse width | twlk | SCK | 210 |  |  | ns |
| Shift clock hold time | thstbk | STB $\downarrow \rightarrow$ SCK $\downarrow$ | 260 |  |  | ns |
| Data setup time | tbs1 | DATA $\rightarrow$ SCK $\uparrow$ | 40 |  |  | ns |
| Data hold time | toh1 | SCK $\uparrow \rightarrow$ DATA | 40 |  |  | ns |
| STB hold time | thkstb | SCK $\uparrow \rightarrow$ STB $\uparrow$ | 260 |  |  | ns |
| STB pulse width | twstb |  | 210 |  |  | ns |
| Wait time | twalt | 8th CLK $\uparrow \rightarrow$ 1st CLK $\downarrow$ | 260 |  |  | ns |

Remark The TYP. value is a reference value when $\mathrm{TA}_{\mathrm{A}}=25^{\circ} \mathrm{C}$.

Serial interface (2) (VDD = 2.7 to 3.3 V )

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Shift clock cycle | tcrk | SCK | 500 |  |  | ns |
| High-level shift clock pulse width | twhk | SCK | 260 |  |  | ns |
| Low-level shift clock pulse width | twLk | SCK | 210 |  |  | ns |
| Shift clock hold time | thstbk | STB $\downarrow \rightarrow$ SCK $\downarrow$ | 260 |  |  | ns |
| Data setup time | tDS1 | DATA $\rightarrow$ SCK $\uparrow$ | 40 |  |  | ns |
| Data hold time | toh1 | SCK $\uparrow \rightarrow$ DATA | 40 |  |  | ns |
| STB hold time | thкstв | SCK $\uparrow \rightarrow$ STB $\uparrow$ | 260 |  |  | ns |
| STB pulse width | twSTB |  | 210 |  |  | ns |
| Wait time | twalt | 8th CLK $\uparrow \rightarrow 1$ st CLK $\downarrow$ | 260 |  |  | ns |

Remarks 1. The TYP. value is a reference value when $\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}$.
2. For details, see 8.5 Serial Communication Format (3) Transmission (command/data read).

Parallel interface (1) (VDD $=2.45$ to 2.7 V )

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Enable cycle time | tcyce | $E \uparrow \rightarrow E \uparrow$ | 600 |  |  | ns |
| High-level enable pulse width | twhe | E | 300 |  |  | ns |
| Low-level enable pulse width | twLe | E | 210 |  |  | ns |
| STB pulse width | twSTB |  | 210 |  |  | ns |
| STB hold time | twкstb |  | 260 |  |  | ns |
| Enable hold time | thstbk |  | 260 |  |  | ns |
| Data setup time | tDs2 | $\mathrm{D}_{0}$ to $\mathrm{D}_{7} \rightarrow \mathrm{E} \uparrow$ | 40 |  |  | ns |
| Data hold time | tDH2 | $\mathrm{D}_{0}$ to $\mathrm{D}_{7} \rightarrow \mathrm{E} \downarrow$ | 40 |  |  | ns |

Remark The TYP. value is a reference value when $\mathrm{TA}_{\mathrm{A}}=25^{\circ} \mathrm{C}$.

Parallel interface (2) (VDD = 2.7 to 3.3 V )

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Enable cycle time | tcyce | $E \uparrow \rightarrow E \uparrow$ | 500 |  |  | ns |
| High-level enable pulse width | twhe | E | 260 |  |  | ns |
| Low-level enable pulse width | twle | E | 210 |  |  | ns |
| STB pulse width | twstb |  | 210 |  |  | ns |
| STB hold time | twkstb |  | 260 |  |  | ns |
| Enable hold time | thstbk |  | 260 |  |  | ns |
| Data setup time | tos2 | $\mathrm{D}_{0}$ to $\mathrm{D}_{7} \rightarrow \mathrm{E} \uparrow$ | 40 |  |  | ns |
| Data hold time | toh2 | $\mathrm{D}_{0}$ to $\mathrm{D}_{7} \rightarrow \mathrm{E} \downarrow$ | 40 |  |  | ns |

Remark The TYP. value is a reference value when $\mathrm{TA}_{\mathrm{A}}=25^{\circ} \mathrm{C}$.

## AC timing measurement voltages



## AC characteristics waveforms



Serial interface (input)


## Serial interface (output)



8-bit parallel interface


## Reset



## 11．CHARACTER CODE TABLES（standard ROM code，$\mu$ PD16681W／P－011）

The following tables show the correspondences between character codes and characters．Character codes ranging from 0000 H to 0007 H are assigned to CGRAM and those ranging from 1000 H to 1380 H are assigned to an area that is defined by the user when establishing custom ROM codes．
$\star \quad$ Character allocation table（1）
$\mathrm{C} 12=0$

| $\rightarrow$ | $\rightarrow$ | $\rightarrow$ | $\rightarrow$ | － | $\rightarrow$ | $\rightarrow$ | － | － | － | － | － | $\rightarrow-$ | － | $\rightarrow$ | $\rightarrow$ | 0 | $\bigcirc$ | － | － | － | － | 0 | 0 | $\bigcirc$ | 0 | $\bigcirc$ | － | － | $\bigcirc$ | － | 0 | 3 |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\rightarrow$ | $\rightarrow$ | $\rightarrow$ | － | － | － | － | － 0 | － | － | － | － | － 0 | － | － | － | － | － | － | $\rightarrow$ | － | － | － | $\rightarrow$ | － | － | － | － | 0 | － | － | － | ？ |  |  |  |  |  |  |  |
| $\rightarrow$ | $\rightarrow$ | － | － | 0 | － | 0 | － | － | － | － | $\rightarrow$ | O 0 | － | － | － | － | － | － | － | － | － | － | － | $\rightarrow$ | － | － | － | － | － | 0 | － | 8 |  |  |  |  |  |  |  |
| $\rightarrow$ | $\rightarrow$ | $\bigcirc$ | 0 | － | － | 0 | － | － | － | － | $\bigcirc$ | － | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ | － | － | 0 | 0 | － | － | － | $\bigcirc$ | $\rightarrow$ | $\rightarrow$ | $\bigcirc$ | 0 | $\rightarrow$ | $\rightarrow$ | 0 | － | 8 |  |  |  |  |  |  |  |
| $\rightarrow$ | $\bigcirc$ | － | $\bigcirc$ | $\rightarrow$ | 0 | － | $\bigcirc$ | － | $\bigcirc$ | － | $\bigcirc$ | － 0 | $\bigcirc$ | － | $\bigcirc$ | $\rightarrow$ | $\bigcirc$ | － | $\bigcirc$ | － | $\bigcirc$ | － | $\bigcirc$ | $\rightarrow$ | 0 | － | $\bigcirc$ | － | $\bigcirc$ | － | $\bigcirc$ | 3 |  |  |  |  |  |  |  |
| $\omega$ | © | O | $\infty$ | N | § | N | ＋ | N | N | $\stackrel{\sim}{\sim}$ | O | $\stackrel{\rightharpoonup}{\circ}$ | $\stackrel{\rightharpoonup}{\infty}$ | $\nu$ | $\vec{\sigma}$ | $\vec{v}$ | $\stackrel{\rightharpoonup}{+}$ | $\stackrel{\rightharpoonup}{\omega}$ | $\stackrel{\rightharpoonup}{N}$ | $\pm$ | $\stackrel{\rightharpoonup}{0}$ | $\bigcirc$ | $\infty$ | $\checkmark$ | 0 | Or | $\rightarrow$ | $\omega$ | $N$ | $\rightarrow$ | 0 |  | 8 | $\bigcirc$ | 8 | E | \＆ | G | 8 |
| $\bigcirc$ |  | 上 | C ${ }^{+}$ |  | $\triangleleft$ | $\cdots$ |  | ठ |  | W， | it |  | $\subset$ | 1 | ＋ |  |  |  |  |  |  |  |  |  | － | $\cdots$ |  |  | （®） |  |  | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | － | $\bigcirc$ |
| $コ$ |  | $\times$ | F | 』 | III | 11 |  | $\bigcirc$ | 8 | $\psi$ | ut | D | $\bigcirc$ | ？ |  | ＞ | ＞ | y | Ot |  | $\checkmark$ | 妥 | 1 |  | － | ＋ | － | 0 | ＞ | － |  | $\rightarrow$ | － | － | 0 | 0 | － | $\bigcirc$ | $\bigcirc$ |
| 0 |  | H | ${ }^{+}$ | $\sigma$ | ． 11 | ＊ |  |  | $\infty$ | H | ut， | 0 |  | $=$ |  | ण | ه | － | \％ |  | $\square$ |  | － |  | ＋ | こ | $\checkmark$ | $\sigma$ | － |  | Q | N | $\bigcirc$ | － | － | － | － | － | $\bigcirc$ |
| $\bigcirc$ |  | ナ | む | $\bigcirc$ | 会 | $\wedge$ |  |  | $\checkmark$ | ご | U | 0 |  | － |  | － | $\neg$ | $\rightarrow$ | こ |  | $\square$ | $\bigcirc$ | 7 |  | $\cdots$ | 41 | － | $\bigcirc$ | $\bigcirc$ | \＃ | $\stackrel{8}{3}$ | $\omega$ | $\rightarrow$ | － | $\bigcirc$ | $\bigcirc$ | － | － | $\bigcirc$ |
| － |  | ナ | す | $\bigcirc$ | V | $V$ |  |  | os | し | U | ס |  | ！ |  | $\neg$ | － | $\rightarrow$ | 5 |  | D | $\square$ | $\lrcorner$ |  | $\because$ | － | － | $\bigcirc$ | － | $\infty$ | － | ＋ | － | － | － | － | － | － | － |
| $<$ |  | Н | F | － | 4 | $11 \wedge$ |  |  | $m$ | E | U． | m |  | ： |  | $\square$ | m | $\checkmark$ | $u$ |  | － | $\bigcirc$ | $\llcorner$ |  | ＊ | $+$ | ． | － | m | ® | $\stackrel{\text { \％}}{\text {＋}}$ | or | － | － | － | $\bigcirc$ | － | － | $\bigcirc$ |
| 8 |  | Н | $\theta$ | $\rightarrow$ | S | IV |  |  | or | 4 | － | 7 |  | $\square$ |  | m | N | $\checkmark$ | $v_{1}$ |  | $\checkmark$ | $\cdot$ | $\Gamma$ |  | $\rightarrow$ | 11 | v | ＋ | 7 | $\infty$ | ¢ | or | $\bigcirc$ | $\rightarrow$ | － | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |
| $\times$ |  | 山 | 9 | 09 | 8 | 8 |  |  | $s$ | －1！ | N | $\bigcirc$ |  | $\square$ |  | m： | 工 | H | Nr |  | 4 | ．． | T |  | 钢 | $\pm$ | － | 09 | $\bigcirc$ |  |  | $\checkmark$ | $\rightarrow$ | $\rightarrow$ | $\cdots$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |
| ᄃ |  | Ш | 9 | Ј | $\because$ | $\because$ |  |  | © | T | $\cdots$ | エ |  | L： |  | そ | （1） | H | － N |  | ※ | $\cdots$ | － |  | ＋ | $\rightarrow$ | － | Ј | エ | － |  | $\infty$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |
| ᄃ |  | $\checkmark$ | 5 | －－ | $\checkmark$ | 9 |  |  | － | T． | $n$ | － |  | － |  | $\omega$ | － | 4 | Ot |  | －11 | － | $\perp$ |  | － | － | $\checkmark$ | － | － | $\checkmark$ |  | $\omega$ | － | $\bigcirc$ | $\bigcirc$ | － | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |
| E |  | こ | こ | － | $\leftrightharpoons$ | to |  |  | ふ | ＋ | 9） | $c>$ | $>$ | $\bigcirc$ |  | $\leq$ | ス | 4 | \％ |  | $\downarrow$ | － | $\vdash$ |  | г | $=$ | н | －． | $c$ | ＊ |  | $\stackrel{\rightharpoonup}{\circ}$ | $\bigcirc$ | － | $\bigcirc$ | － | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |
| E |  | $\stackrel{\rightharpoonup}{*}$ | en | $\bar{\lambda}$ |  | $\square$ |  |  | $\cdots$ | 11 | त | 入 | ＜ | $\checkmark$ |  | 5 | $>$ | y | $\stackrel{y}{7}$ |  | $\uparrow$ |  | ＋ |  | 4 | r | ＊ | 匹 | त | ＋ |  | 三 | － | － | 0 | － | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |
| $\sigma$ |  | $\Gamma$ | 戸 | － |  | $\square$ |  |  | ： | x | $\mathscr{F}$ | $\ulcorner$ | 」 | $\square$ |  | ス | 3 | y， | \％ |  | $\rightarrow$ |  | 1 |  | － | $\checkmark$ | ＋ | － | － | － |  | $\stackrel{\rightharpoonup}{N}$ | $\bigcirc$ | 0 | － | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |
| $\underline{\square}$ |  | $\square$ | 0 | 3 |  | $\square$ |  |  | e | － | के | 3 | $\downarrow$ | $\checkmark$ |  | コ | z | H | ก |  | $\leftarrow$ |  | － |  | － | $>$ | ＋ | 三 | 3 | 1 |  | $\stackrel{\rightharpoonup}{\omega}$ | － | 0 | $\rightarrow$ | $\rightarrow$ | 0 | 0 | $\bigcirc$ |
| $\sigma$ |  | $\checkmark$ | ＊ | コ |  | $\bigcirc$ |  |  | on | $\backslash$ | $\theta$ | Z | ， | $\square$ |  | 3 | M | H | 「H， |  | II |  | 7 |  | V | ＊ | ш | J | 2 |  |  | $\pm$ | $\bigcirc$ | － | $\rightarrow$ | － | － | $\bigcirc$ | $\bigcirc$ |
| $\omega$ |  | $\checkmark$ | せ | 0 |  | H |  |  | － | ン | \＃ | $\bigcirc$ | ＜ | $\checkmark$ |  | 工 | O | ง | ヘ |  |  |  | － |  | $\square$ | 山 | こ | － | 0 | $\checkmark$ |  | $\vec{\sigma}$ | $\rightarrow$ | $\rightarrow$ | $\rightarrow$ | － | 0 | 0 | $\bigcirc$ |
| $\delta$ |  | H | ¢ | $\bigcirc$ |  | $\Theta$ |  |  | 7 | ン． | $\overline{\text { ¢ }}$ | 0 － | 山 | $\sim$ |  | 0 | $=$ | い | 今 | 0 |  |  | L |  | 파 | ＂ | ＇ | ס | $\bigcirc$ | $\bigcirc$ |  | $\stackrel{\rightharpoonup}{\sigma}$ | 0 | － | － | $\bigcirc$ | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ |
| $\square$ |  | W | 300 | $\bigcirc$ |  | $\theta$ |  | $\sim$ | $\bigcirc$ | ＞ | $\overline{4}$ | $\bigcirc$ |  | － |  | $\checkmark$ | O | Y | $\mp$ | － |  |  | $\Gamma$ |  | ＋ | － | $\checkmark$ | $\bigcirc$ | $\bigcirc$ | $\rightarrow$ |  | $\pm$ | $\rightarrow$ | － | $\bigcirc$ | $\bigcirc$ | － | $\bigcirc$ | $\bigcirc$ |
|  |  | $\checkmark$ | Rt | $\bigcirc$ | Do | \％ |  | 0 | 9 | $\pi$ | $¢$ | ग |  | 人 |  | 0 | M | Y． | $\mp$ | N |  |  | T |  | ज | $\times$ | $\rightarrow$ | － | $\pm$ | N |  | $\stackrel{\rightharpoonup}{\infty}$ | $\bigcirc$ | － | $\bigcirc$ | $\bigcirc$ | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ |
|  |  | V | く | 0 | $8{ }^{\circ}$ | ○ |  | $\square$ | ल | $\pi$ | C． | 0 |  | $\checkmark$ |  | $\bigcirc$ | － | ப | 1 | $\omega$ |  | ， | － |  | B | ＋ | $\checkmark$ | 0 | $\infty$ | $\omega$ |  | $\stackrel{\rightharpoonup}{6}$ | $\rightarrow$ | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ |
|  |  | J： |  | － | \＃ | \＃ |  | 7 | c | $\pi_{0}$ | ¢ | －1 |  | ล |  | $\neg$ | ＜ | U， | 「！ | $\rightarrow$ |  | ＂ | $\perp$ |  | $\times$ | $\pm$ | H | ＋ | －1 | － |  | O | $\bigcirc$ | $\bigcirc$ | － | $\bigcirc$ | － | $\bigcirc$ | $\bigcirc$ |
|  |  | $y$ |  | $ᄃ$ | － | $\infty$ |  | $\checkmark$ | $\theta$ | $\checkmark$ | is | $\subset$ |  | $\approx$ |  | ＜ | $\theta$ | $\ddagger$ | Nt | O |  | r | F |  | －1． | ＋ | ＋ | $=$ | C | v |  | $\bigcirc$ | － | $\bigcirc$ | － | 0 | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ |
|  |  | $\checkmark$ |  | ＜ | － | ＊ |  | 0 | x | V， | y： | ＜ |  | $\neg$ |  | $\theta$ | $\times$ | わ． | 4t | の |  | v＊ | ＋ |  | $\rightarrow$ | ш | $\because$ | ＜ | $<$ | a |  | N | $\bigcirc$ | － | － | 0 | － | $\bigcirc$ | $\bigcirc$ |
|  |  |  |  | ミ | ＋ | （8） |  | ©： | ＊ | $\cup_{0}$ | \％ | $\Sigma$ |  | ᄂ |  | $\times$ | $\epsilon$ | 人＇ | $\bigcirc$ | $\checkmark$ |  | $=$ | T |  | $\leftarrow$ | $\checkmark$ | ＋ | ＜ | $\geq$ | $\checkmark$ |  | $\stackrel{N}{\omega}$ | － | － | － | 0 | － | 0 | $\bigcirc$ |
|  |  |  |  | $\times$ | ＋ | cos |  | $x$ | $\varepsilon$ | $\rangle$ | $>$ | $\times$ |  | $\square$ |  | ᄃ | 0 | い | 「＂ | $\infty$ |  | H） | － |  | $\llcorner$ | $=$ | $v$ | $\times$ | $\times$ | $\infty$ |  | N | 0 | 0 | $\bigcirc$ | $\rightarrow$ | $\rightarrow$ | 0 | $\bigcirc$ |
|  |  |  |  | $<$ | $\rightarrow$ | \％ |  | $\omega$ |  | $\geq$ | $\geqslant$ | $<$ |  | $\smile$ |  | 工 |  | $\lambda$ | 4 | 0 |  | 公 | $\perp$ |  | $\because$ | F | $\rightarrow$ | ＜ | $<$ | $\bigcirc$ |  | N | － | － | － | $\rightarrow$ | － | 0 | $\bigcirc$ |
|  |  |  |  | N |  | ＊ |  | s |  | $\rangle$ | $\rangle$ | N |  | － |  | E |  | $\cdots$ | 4 |  | $\pi$ | 8 | 1 |  |  | － | ப | N | N | ．． |  | N | $\bigcirc$ | － | O | $\rightarrow$ | $\rightarrow$ | － | － |
|  |  |  |  |  |  | 0 |  | s： |  | 斗 | $\overline{\text { Y }}$ |  |  | － |  | E |  | 寸 | 尔 |  | U | $\bigcirc$ | 1 |  |  | － | \＃ | － | $\square$ | $\cdots$ |  | $\bigcirc$ | $\rightarrow$ | － | $\bigcirc$ | － | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ |
|  |  |  |  |  |  | $\bigcirc$ |  | त |  | 为 | $\overline{\text { \＃}}$ |  | N | ＋ |  | Ј |  | は， | 垵 |  | In | 1 | T |  |  | $\checkmark$ | ご | － | ＊ | $\wedge$ |  | $\cdots$ | $\bigcirc$ | $\bigcirc$ | $\rightarrow$ | $\rightarrow$ | － | $\bigcirc$ | $\bigcirc$ |
|  |  |  |  |  |  | （0） |  | 〕 |  | 为 | $\overline{\text { H }}$ |  | $\vdash$ | 1 |  | $\underline{\square}$ |  | － | N |  | U | 1 | － |  |  | $\cdots$ | $>$ | － | $\smile$ | 11 |  | ® | $\rightarrow$ | $\bigcirc$ | $\cdots$ | $\rightarrow$ | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ |
|  |  |  |  |  | 0 | $\diamond$ |  | 3 |  | 小 | \％ |  |  | $1+$ |  | Ј |  | C | N |  | $\cap$ | ＇ | － |  |  |  | は | $\downarrow$ |  | $\checkmark$ |  | $\stackrel{\text { O }}{ }$ | $\bigcirc$ | $\rightarrow$ | － | $\rightarrow$ | $\rightarrow$ | $\bigcirc$ | $\bigcirc$ |
|  |  |  |  |  |  |  |  | I |  | III | 7 |  | 0 | $\times$ |  | $\omega$ |  | （1） | i |  | U | $\backslash$ | － |  |  |  | － |  |  | ． |  | $\stackrel{\omega}{\omega}$ | － | $\rightarrow$ | $\rightarrow$ | $\rightarrow$ | － | $\bigcirc$ | $\bigcirc$ |

Half width （ $5 \times 12$ dots） character

## Character allocation table（2）

$\mathrm{C} 12=0$

|  |  |  |  |  |  | C6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | C5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  | C4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  | C3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  | C2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|  |  |  |  |  |  | C1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |  |
|  |  |  |  |  |  | CO | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
|  |  | C9 |  |  |  |  | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 |
| 0 | 0 | 0 |  | 0 | 0 | 0 |  | 亜 | 叫 | 娃 | 阿 | 哀 | 愛 | 挨 | 姶 | 逢 | 葵 | 西 | 䅖 | 悪 | 握 | 渥 | 旭 | 葦 | 芦 | 鯵 | 梓 | 圧 | 斡 | 扱 | 宛 | 姐 | 虻 | 飴 | 絢 | 綾 | 鮎 | 或 |
| 0 | 0 | 0 |  | 0 | 1 | 1 |  | 院 | 陰 | 隠 | 韻 | 吋 | 右 | 宇 | 烏 | 羽 | 过 | 雨 | 卯 | 鴉 | 窺 | \＃ | 碓 | 臼 | 渦 | 嘘 | 唄 | 節 | 蔚 | 鰻 | 姥 | 厩 | 浦 | 瓜 | 閏 | 噂 | 云 | 運 |
| 0 | 0 | 0 |  | 1 | 0 | 2 |  | 押 | 旺 | 横 | 欧 | 殴 | 王 | 翁 | 襖 | 鴬 | 鴎 | 黄 | 岡 | 沖 | 荻 | 億 | 屋 | 憶 | 臆 | 桶 | 牡 | 乙 | 俺 | 卸 | 恩 | 温 | 穏 | 音 | 下 | 化 | 仮 | 何 |
| 0 | 0 | 0 |  | 1 | 1 | 3 |  | 魁 | 晦 | 械 | 海 | 灰 | 界 | 皆 | 絵 | 芥 | 蟹 | 開 | 階 | 貝 | 凱 | 奻 | 外 | 咳 | 害 | 崖 | 慨 | 概 | 涯 | 碍 | 盍 | 街 | 該 | 鎧 | 骸 | 浬 | 檠 | 蛙 |
| 0 | 0 | 1 |  | 0 | 0 | 4 |  | 粥 | 刈 | 文 | 瓦 | 乾 | 㑆 | 冠 | 寒 | 刊 | 勘 | 勧 | 巻 | 喚 | 堪 | 姦 | 完 | 官 | 寛 | 干 | 幹 | 患 | 感 | 慣 | 憾 | 換 | 敢 | 相 | 桓 | 棺 | 款 | 歓 |
| 0 | 0 | 1 |  | 0 | 1 | 5 |  | 機 | 帰 | 毅 | 気 | 汽 | 畿 | 祈 | 季 | 稀 | 紀 | 徽 | 規 | 記 | 貴 | 起 | 軌 | 輝 | 飢 | 騎 | 鬼 | 黾 | 偽 | 儀 | 妓 | 宜 | 戯 | 技 | 擬 | 欺 | 特 | 疑 |
| 0 | 0 | 1 |  | 1 | 0 | 6 |  | 供 | 侠 | 僑 | 爻 | 競 | 共 | 凶 | 協 | 匡 | 卿 | 叫 | 喬 | 境 | 峡 | 強 | 疆 | 怯 | 恐 | 恭 | 挟 | 教 | 橋 | 況 | 狂 | 狭 | 矯 | 胸 | 脅 | 興 | 蓠 | 郷 |
| 0 | 0 | 1 |  | 1 | 1 | 7 |  | 掘 | 窟 | 沓 | 靴 | 䜌 | 窪 | 熊 | 隈 | 粂 | 栗 | 繰 | 桑 | 鍬 | 勲 | 君 | 薫 | 訓 | 群 | 軍 | 郡 | 卦 | 袈 | 祁 | 係 | 傾 | 刑 | 兄 | 啓 | 圭 | 珪 | 型 |
| 0 | 1 | 0 |  | 0 | 0 | 8 |  | 検 | 権 | 率 | 犬 | 献 | 研 | 硯 | 絹 | 県 | 肩 | 見 | 謙 | 賢 | 軒 | 遣 | 鍵 | 険 | 顕 | 験 | 鹸 | 元 | 原 | 厳 | 幻 | 弦 | 減 | 源 | 玄 | 現 | 絃 | 舷 |
| 0 | 1 | 0 |  | 0 | 1 | 9 |  | 后 | 喉 | 坑 | 垢 | 好 | 孔 | 孝 | 宏 | 工 | 工丂 | 巷 | 幸 | 広 | 康 | 康 | 弘 | 恒 | 慌 | 抗 | 拘 | 控 | 攻 | 昂 | 晃 | 更 | 杭 | 校 | 梗 | 構 | 江 | 洪 |
| 0 | 1 | 0 |  | 1 | 0 | 10 |  | 此 | 頃 | 今 | 困 | 坤 | 堲弤 | 婚 | 恨 | 朁 | 昏 | 昆 | 根 | 相 | 混 | 痕 | 紺 | 艮 | 魂 | 些 | 佐 | 叉 | 噯 | 嵯 | 左 | 差 | 査 | 沙 | 瑳 | 砂 | 詐 | 鎖 |
| 0 | 1 | 0 |  | 1 | 1 | 11 |  | 察 | 拶 | 撮 | 擦 | 札 | 殺 | 薩 | 雑 | 䎞 | 鯖 | 捌 | 錆 | 鮫 | 皿 | 晒 | 三 | 傘 | 参 | 山 | 惨 | 撒 | 散 | 栈 | 燦 | 珊 | 産 | 算 | 纂 | 虫 | 讃 | 賛 |
| 0 | 1 | 1 |  | 0 | 0 | 12 |  | 次 | 滋 | 治 | 爾 | 䨐 | 痔 | 磁 | 示 | 而 | 耳 | 自 | 蒔 | 辞 | 汐 | 鹿 | 式 | 識 | 鴫 | 竺 | 軸 | 宍 | 雱 | 七 | 叱 | 執 | 失 | 嫉 | 室 | 悉 | 湿 | 漆 |
| 0 | 1 | 1 |  | 0 | 1 | 13 |  | 宗 | 就 | 州 | 修 | 愁 | 拾 | 洲 | 秀 | 秋 | 終 | 紼 | 習 | 臭 | 舟 | 蒐 | 衆 | 襲 | 讐 | 蹴 | 輯 | 週 | 酋 | 酬 | 集 | 醜 | 什 | 住 | 充 | 十 | 従 | 戎 |
| 0 | 1 | 1 |  | 1 | 0 | 14 |  | 勝 | 匠 | 升 | 召 | 哨 | 商 | 唱 | 嘗 | 奨 | 妾 | 娼 | 宵 | 将 | 小 | 少 | 尚 | 庄 | 床 | 廠 | 彰 | 承 | 抄 | 招 | 掌 | 捷 | 昇 | 昌 | 昭 | 晶 | 松 | 梢 |
| 0 | 1 | 1 |  | 1 | 1 | 15 |  | 拭 | 植 | 殖 | 燭 | 織 | 職 | 色 | 触 | 食 | 蝕 | 辱 | 尻 | 伸 | 信 | 侵 | 唇 | 娠 | 寝 | 審 | 心 | 慎 | 振 | 新 | 晋 | 森 | 榛 | 浸 | 深 | 申 | 沴 | 真 |
| 1 | 0 | 0 |  | 0 | 0 | 16 |  | 澄 | 摺 | 寸 | 世 | 瀬 | 畒 | 是 | 凄 | 制 | 勢 | 姓 | 征 | 性 | 成 | 政 | 整 | 星 | 晴 | 棲 | 栖 | 正 | 清 | 牲 | 生 | 盛 | 精 | 聖 | 声 | 製 | 西 | 誠 |
| 1 | 0 | 0 |  | 0 | 1 | 17 |  | 緎 | 羡 | 腺 | 殀 | 船 | 薦 | 詮 | 賎 | 践 | 選 | 遷 | 銭 | 銑 | 閦 | 鮮 | 前 | 善 | 漸 | 然 | 全 | 禅 | 繕 | 膳 | 榞 | 噌 | 塑 | 岨 | 措 | 曾 | 曽 | 楚 |
| 1 | 0 | 0 |  | 1 | 0 | 18 |  | 臓 | 蔵 | 贈 | 造 | 促 | 側 | 則 | 即 | 息 | 捉 | 束 | 測 | 足 | 速 | 俗 | 属 | 賊 | 族 | 続 | 卒 | 袖 | 其 | 揃 | 存 | 孫 | 尊 | 損 | 村 | 遜 | 他 | 多 |
| 1 | 0 | 0 |  | 1 | 1 | 19 |  | 叩 | 但 | 達 | 辰 | 奪 | 脱 | 巽 | 竪 | 辿 | 棚 | 谷 | 狸 | 鱈 | 樽 | 誰 | 丹 | 単 | 嘆 | 坦 | 担 | 探 | 旦 | 歎 | 淡 | 湛 | 炭 | 短 | 端 | 篻 | 綻 | 耽 |
| 1 | 0 | 1 |  | 0 | 0 | 20 |  | 帖 | 帳 | 庁 | 弓 | 張 | 彫 | 徴 | 懲 | 挑 | 暢 | 朝 | 潮 | 牒 | 町 | 眺 | 聴 | 脹 | 腸 | 蝶 | 調 | 諜 | 超 | 跳 | 銚 | 長 | 頂 | 鳥 | 勅 | 渉 | 直 | 朕 |
| 1 | 0 | 1 |  | 0 | 1 | 21 |  | 邸 | 鄭 | 釘 | 鼎 | 泥 | 摘 | 擢 | 敵 | 滴 | 的 | 笛 | 適 | 鏑 | 溺 | 哲 | 徹 | 撤 | 轍 | 迭 | 鉄 | 典 | 填 | 天 | 展 | 店 | 添 | 纏 | 甜 | 貼 | 較 | 顛 |
| 1 | 0 | 1 |  | 1 | 0 | 22 |  | 董 | 蕩 | 藤 | 討 | 謄 | 豆 | 踏 | 逃 | 透 | 鐙 | 陶 | 頭 | 騰 | 闘 | 働 | 動 | 同 | 堂 | 導 | 憧 | 撞 | 洞 | 瞳 | 童 | 胴 | 萄 | 道 | 銅 | 峠 | 鴇 | 居 |
| 1 | 0 | 1 |  | 1 | 1 | 23 |  | 如 | 尿 | 韮 | 任 | 娃 | 忍認 | 認 | 濡 | 襧 | 袮 | 寧 | 葱 | 猫 | 熱 | 年 | 念捻 | 捻 | 撚 | 燃 | 粘 | 乃 | 唒 | 之 | 埜 | 囊 | 悩 | 濃 | 納 | 能 | 脳 | 膿 |
| 1 | 1 | 0 |  | 0 | 0 | 24 |  | 函 | 箱 | 硲 | 箸 | 肇 | 䇢 | 櫨 | 幡 | 肌 | 畑 | 畠 | 八 | 鉢 | 溌 | 発 | 醗 | 髪 | 伐 | 罰 | 抜 | 筏 | 閥 | 䲧 | 噺 | 塙 | 蛤 | 隼 | 伴 | 判 | 半 | 反 |
| 1 | 1 | 0 |  | 0 | 1 | 25 |  | 鼻 | 柊 | 稗 | 匹 | 正 | 髭彦 | 彦 | 膝 | 菱 | 时 | 弼 | 必 | 畢 | 筆 | 逼 | 桧始 | 姫 | 媛 | 紐 | 百 | 謬 | 俵 | 彪 | 標 | 水 | 漂 | 嘌 | 票 | 表 | 評 | 豹 |
| 1 | 1 | 0 |  | 1 | 0 | 26 |  | 福 | 腹 | 複 | 覆 | 淵 | 弗 | 払 | 沸 | 仏 | 物 | 鮒 | 分 | 吻 | 噴 | 墳 | 憤 | 扮 | 焚 | 奮 | 粉 | 䔬 | 紛 | 雰 | 文 | 聞 | 丙 | 併 | 兵 | 塀 | 幣 | 平 |
| 1 | 1 | 0 |  | 1 | 1 | 27 |  | 法 | 泡 | 点 | 砲 | 縫 | 胞 | 芳 | 萌 | 蓬 | 蜂 | 隹 | 訪 | 豊 | 邦 | 鋒 | 飽 | 鳳 | 鵬 | 乏 | 亡 | 傍 | 剖 | 坊 | 妨 | 帽 | 忘 | 忙 | 房 | 暴 | 望 | 某 |
| 1 | 1 | 1 |  | 0 | 0 | 28 |  | 漫 | 蒂 | 味 | 未 | 魅 | 已 | 箕 | 岬 | 密 | 蜜 | 湊 | 衰 | 稔 | 脈 | 妙 | 粍 | 民 | 眠 | 務 | 夢 | 無 | 圱 | 矛 | 霧 | 鴗 | 椋 | 婿 | 娘 | 冥 | 名 | 命 |
| 1 | 1 | 1 |  | 0 | 1 | 29 |  | 諭 | 輸 | 唯 | 佑 | 優 | 勇 | 友 | 宥 | 幽 | 悠 | 憂 | 揖 | 有 | 柚湥 | 涌涌 | 涌猪 | 猶 | 猷 | 由 | 祐 | 裕 | 誘 | 遊 | 邑 | 郵 | 雄 | 融 | 夕 | 予 | 余 | 与 |
| 1 | 1 | 1 |  | 1 | 0 | 30 |  | 痢 | 裏 | 裡 | 里 | 離 | 陸 | 律 | 率 | 立 | 葎 | 掠 | 略 | 劉 | 流渭 | 溜玨 | 琉留 | 留 | 硫 | 粒 | 隆 | 童 | 龍 | 侶 | 慮 | 旅 | 虜 | 了 | 亮 | 僚 | 両 | 凌 |
| 1 | 1 | 1 |  | 1 | 1 | 31 |  | 蓮 | 連 | 鍊 | 呂 | 魯 | 櫓 | 炣 | 賂 | 路 | 露 | 労 | 婁 | 廊 | 弄 | 朗 | 楼 | 榔 | 浪 | 漏 | 牢 | 狼 | 篭 | 老 | 壟 | 葻 | 郎 | 六 | 麓 | 禄 | 肋 | 録 |

## Character allocation table（3）

$\mathrm{C} 12=0$

| C6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |  | 1 |  | 1 | 1 | 1 | 1 |  | 1 | 1 | 1 | 1 |  | 1 |  | 1 | 1 |  |  |  |  | 1 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| C5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 |
| c | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |  | 1 |  | 1 |  | 1 |  |  |  |  |
| C3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |  | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |  | 1 |  |  | 1 | 1 |
| C2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 |  | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |  | 1 | 0 | 0 |  |  |  |  |  |  |
|  | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |  | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |  | 0 | 0 | 1 | 1 | 0 | 0 |  |  | 0 |  |  |  |
|  | 0 |  | 0 |  | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |



|  |  | c9 | C8 | C7 |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 1 | 0 | 2 |
| 0 | 0 | 0 | 1 | 1 | 3 |
| 0 | 0 | 1 | 0 | 0 | 4 |
| 0 | 0 | 1 | 0 | 1 | 5 |
| 0 | 0 | 1 | 1 | 0 | 6 |
| 0 | 0 | 1 | 1 | 1 | 7 |
| 0 | 1 | 0 | 0 | 0 | 8 |
| 0 | 1 | 0 | 0 | 1 | 9 |
| 0 | 1 | 0 | 1 | 0 | 10 |
| 0 | 1 | 0 | 1 | 1 | 11 |
| 0 | 1 | 1 | 0 | 0 | 12 |
| 0 | 1 | 1 | 0 | 1 | 13 |
| 0 | 1 | 1 | 1 | 0 | 14 |
| 0 | 1 | 1 | 1 | 1 | 15 |
| 1 | 0 | 0 | 0 | 0 | 16 |
| 1 | 0 | 0 | 0 | 1 | 17 |
| 1 | 0 | 0 | 1 | 0 | 18 |
| 1 | 0 | 0 | 1 | 1 | 19 |
| 1 | 0 | 1 | 0 | 0 | 20 |
| 1 | 0 | 1 | 0 | 1 | 21 |
| 1 | 0 | 1 | 1 | 0 | 22 |
| 1 | 0 | 1 | 1 | 1 | 23 |
| 1 | 1 | 0 | 0 | 0 | 24 |
| 1 | 1 | 0 | 0 | 1 | 25 |
| 1 | 1 | 0 | 1 | 0 | 26 |
| 1 | 1 | 0 | 1 | 1 | 27 |
| 1 | 1 | 1 | 0 | 0 | 28 |
| 1 | 1 | 1 | 0 | 1 | 29 |
| 1 | 1 | 1 | 1 | 0 | 30 |
| 1 | 1 | 1 | 1 | 1 | 31 |


| 乗 | 袷 | 安 | 㢆 | 按 | 暗 | 案 | 闇 | 鞍 | 杏 | 以 | 伊 | 位 | 依 | 偉 | 囲 | 夷 | 委 | 威 | 尉 | 惟 | 意 | 慰 | 易 | 椅 | 為 | 畏 |  | 移 | 維 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 雲 | 荏 | 餌 | 效 | 営 | 貥 | 影 | 映 | 电 | 栄 | 永 | 泳 | 洩 | 瑛 | 盈 | 穎 | 頴 | 英 |  |  |  | 液 |  | 益 |  |  |  |  |  |  |  |  |
|  | 相 | 佳 | 加 | 可 | 嘉 | 夏 | 嫁 | 家 | 昜 |  | 暇 | 果 | 架 |  |  | 火 |  | 禍 | 禾 | 榢 | 囯 | 化 | 可 | 加 |  | 年 |  | 虹 |  |  |  |
|  | 柿 | 䖨 | 鈎 | 畫 | 嚇 | 各 | 廓 | 桩 | 摚 | 格 | 核 | 殻 | 獲 | 確 | 權 | 筧 | 角 | 赫 | 較 | 郭 | 閣 | 唕 | 革 | 学 | 岳 | 楽 |  |  | 掛 | 笠 |  |
|  | 漢 | ；${ }^{1}$ | 潅 | 環 | 甘 | 監 | 看 | 竿 | 管 | 簡 | 絞 | 缶 | 翰 |  | 艦 | 莞 | 観 |  | 貫 |  | 鑑 | 間 | 閉 | 関 | 陥 | 韓 |  | 舘 |  |  |  |
|  | 義 | 蟻 | 誼 | 議 | 肳 | 菊 | 鞠 | 吉 | 吃 | 喫 | 桔 | 橘 |  |  | 杵 | 桼 | 却 |  | 脚 | 虐 | 逆 | 丘 | 久 |  | 休 | 及 |  |  |  | 碞 |  |
|  | 響 | 饗 | 驚 | 仰 | 凝 | 克 | 暁 | 業 | 局 |  | 極 |  |  |  |  | 勤 | 均 |  |  |  |  |  | 琴 |  |  |  |  |  |  |  |  |
| 契 | 形 | 径 | 恵 | 慶 | 慧 | 慗 | 掲 | 携 | 敬 |  | 桂 | 渓 | 畦 | 稽 | 系 | 経 | 継 | 繋 | 卦 | 圣 | 刑 | 虫 | 計 | 詣 | 警 | 軽 |  | 鷂 | 云 | 近 |  |
| 言 | 諺 | 限 | 寽 | 個 | 古 | 呼 | 固 | 姑 | 孤 | 己 | 庫 | 弧 | 戸 | 故 | 枯 |  |  |  | 袄 | 股 |  |  | 虎 | 誇 | 跨 |  |  |  |  |  |  |
|  | 港 | 溝 | 甲 | 皇 | 硬 | 稿 | 糠 | 紅 | 紘 | 絞 | 綱 |  | 考 | 月 | 肱 | 腔 | 管 |  | 巟 | 行 | 衡 |  | 貢 | 購 |  | 酵 | 隹 |  |  |  |  |
|  | 坐 | 座 | 挫 | 債 | 催 | 再 | 最 | 哉 | 塞 | 妻 | 宰 | 彩 | 才 | 採 | 栽 | 歳 | 済 | 災 | 采 | 犀 | 砕 | 砦 | 祭 | 斎 | 細 | 㐘 |  | 載 |  |  |  |
|  | 賶 | 軼 | 暫 | 残 | 仕 | 仔 | 伺 | 使 |  |  | 史 | 嗣 |  |  |  | 姉 | 姿 |  | 死 |  |  |  |  |  |  |  |  |  |  |  |  |
| 疾 | 質 | 実 | 蔀 | 篠 | 偲 | 柴 | 芝 | 屡 |  | 縞 | 舎 | 写 | 射 | 捨 | 赦 | 斜 | 煮 |  | 紗 | 者 | 謝 |  | 遮 | 蛇 | 邪 | 借 |  | 尺 |  |  |  |
|  | 汁 | 渋 | 獣 | 維 | 重 | 釦 | 叔 | 凬 | 宿 | 淑 | 祝 |  |  |  | 熟 | 出 |  |  | 俊 | 峻 | 春 |  | 竣 | 舜 |  | 准 |  | 旬 |  |  |  |
| 樟 | 樵 | 沼 | 消 | 渉 | 湘 | 燅 | 焦 | 照 | 症 | 省 | 硝 | 礁 | 祥 | 称 | 章 | 笑 | 粧 | 紹 | 肖 | 菖 | 蒋 | 蕉 | 衝 | 裳 | 訟 | 証 | 詔 | 詳 | 象 | 賞 |  |
|  | 秦 | 紳 | 臣 | 芯 | 薪 | 親 | 診 | 身 | 辛 | 進 | 針 | 震 | 人 |  | 邓 | 塵 | 王 | 尋 | 辰 |  | 孯 | 訊 | 迅 | 陣 | 勒 | 可 |  | 須 |  |  |  |
|  | 請 | 逝 | 醒 | 青 | 静 | 斉 | 税 | 脆 | 隻 |  | 惜 |  | 斤 |  |  |  |  |  | 績 | 脊 | 責 |  |  | 蹟 |  |  |  |  |  |  |  |
| 狙 | 疏 | 疎 | 礎 | 祖 | 租 | 粗 | 素 | 組 | 蘇 | 訴 | 阻 | 遡 | 鼠 | 僧 | 創 | 双 |  | 倉 | 喪 | 壮 | 奏 | 爽 | 宋 | 層 |  | 惣 |  |  | 浐 |  |  |
|  | 汰 | 記 | 唾 | 堕 | 妥 | 惰 | 打 | 柁 | 舵 |  | 陀 | 駄 |  | 体 | 堆 |  |  |  | 帯 |  | 忩 | 態 | 戴 | 替 |  |  |  | 腿 | 荅 |  |  |
|  | 蛋 | 誕 | 鍛 | 団 | 壇 | 弾 | 断 | 暖 | 檀 | 段 | 男 | 談 | 値 |  | 地 | 弛 | 恥 | 智 | 池 | 痴 | 稚 | 置 | 致 | 蜘 | 遅 | 馳 |  | 畜 | 竹 |  |  |
|  | 珍 | 賃 | 鎮 | 陣 | 津 | 壁 | 椎 | 檤 | 追 |  | 痛 |  | 塚 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 点 | 伝 | 殿 | 澱 | 田 | 電 | 犮 | 吐 | 堵 | 塗 |  | 屠 | 徒 | 斗 | 杜 | 渡 | 登 | 菟 | 賭 |  |  |  | 砥 | 砺 |  |  |  |  |  |  |  |  |
| 得 | 德 | 涜 | 特 | 督 | 秃 | 篤 | 每 | 独 | 読 | 杤 | 橡 | 凸 | 突 | 朢 | 届 | 鳥 | 苫 | 寅 | 酉 | 瀞 | 噸 | 屯 | 惇 | 敦 |  |  |  |  | 吞 |  |  |
|  | 誢 | 蚤 | 巴 | 把 | 播 | 覇 | 杷 | 波 | 派 | 琶 | 破 | 婆 | 罵 | 芭 | 馬 | 俳 | 廃 | 拝 | 排 | 敗 |  | 盃 | 牌 | 背 | 肺 |  | 配 |  | 培 |  |  |
| 叛 | 帆 | 艆 | 斑 | 板 | 汇 | 汎 | 版 | 犯 | 班 | 畔 | 繁 | 般 | 潘 | 販 | 範 | 采 | 煩 | 頒 | 飯 | 挽 | 晩 |  | 盤 |  |  |  |  |  | 否 |  |  |
|  | 描 | 病 | 秒 | 苗 |  | 鋲 | 蒜 | 蛭 | 鰭 | 品 | 彬 | 斌 | 浜 | 瀕 | 貧 | 賓 | 頻 | 敏 | 瓶 |  |  |  |  |  |  |  |  |  |  |  |  |
| 弊 | 柄 | 並 | 蔽 | 閉 | 阹 | 米 | 頁 | 僻 | 壁 |  | 碧 | 別 | 瞥 | 葳 | 䈅 | 偏 | 変 | 片 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 棒 | 冒 | 紡 | 肪 | 膨 | 謀 | 貌 | 貿 | 鍺 | 防 | 吹 | 㚘 | 北 | 僕 | 卜 | 墨 | 撲 | 朴 | 牧 | 晆 | 穆 | 釦 | 勃 | 没 | 殆 |  |  |  | 本 | 翻 |  |  |
| 明 | 盃 | 迷 | 鉻 | 鳴 | 姪 | 牡 | 滅 | 免 | 棉 | 綿 | 緬 | 面 | 麺 | 摸 | 模 | 茂 | 妄 | 孟 | 毛 | 猛 | 盲 | 網 | 耗 |  |  | 木 |  | 目 | 圭 |  |  |
| 誉 | 閏 | 預 | 隹 | 幼 | 妖 | 容 | 庸 | 揚 | 揺 | 擁 | 曜 | 楊 | 様 | 洋 | 溶 | 熔 | 用 | 窯 | 羊 | 耀 | 葉 | 蓉 | 要 | 謡 | 踊 | 遥 | 陽 | 養 | 慾 | 抑 |  |
| 寮 | 料 | 梁 | 涼 | 猟 | 療 | 瞭 | 棱 | 糧 | 良 | 諒 | 遼 | 量 | 陵 | 領 | 力 | 緑 | 倫 | 厘 | 林 | 淋 | 燐 | 相 | 臨 | 輪 | 隣 | 鱗 | 麟 | 瑠 | 塁 | 涙 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Character allocation table（4）

$\mathrm{C} 12=0$

| C 6 | $\mathbf{1}$ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | $\mathbf{1}$ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| C 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| C 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| C 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| C 2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| C 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| C 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |



|  |  |  |  |  |  |  | 97 | 98 | 99 |  | 10 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | 0 | 0 | 0 | 0 | 0 | 萎 | 衣 | 謂 | 違 | 遺 | 医 | 开 | 亥 | 域 | 育 | 郁 | 磯 |  | 壱 | 溢 | 逸 | 稲 | 茨 | 芋 | 鮙 | 允 | 印 | 咽 | 員 | 因 | 因 | 引 | 飲 | 汪 | 綡 |  |
| 0 | 0 | 0 | 0 | 1 |  | 園 | 堰 | 奄 | 宴 | 延 | 怨 | 掩 | 援 | 浻 | 演 | 炎 | 畑 | 煙 | 燕 | 猿 | 紜 | 艶 | 苑 | 薗 | 遠 | 鉛 | 鴐 | 塩 | 於 | 污 | 生 | 凹 | 央 | 奥 | 往 |  |
| 0 | 0 | 0 | 1 | 0 | 2 | 迦 | 過 | 霞辒 | 蚊 | 俄 | 峨 | 我 | 牙 | 画 | 臥 | 芽 | 蛾 | 賀 | 雅 | 餓 | 駕 | 介 | 会 | 解 | 回 | 塊 | 壊 | 廻 | 快 | 怪 | 梅 | 恢 | 懐 | 戒 | 拐 |  |
| 0 | 0 | 0 | 1 |  | 3 | 橿 | 梶 | 解 | 潟 | 割 | 喝 | 恰 | 括 | 活 | 渇 | 滑 | 葛 | 褐 | 轄 | 且 | 鰹 | 叶 | 杹 | 樺 | 鞄 | 株 | 楽 | 車 | 蒲 | 釜 | 鎌 | 噛 | 鴨 | 柏 | 茅 |  |
| 0 | 0 | 1 | 0 | 0 | 4 | 䉷 | 玩 | 癌 | 眼 | 岩 | 羽 | 儥 | 倠 | 頑 | 顔 | 願 | 企 | 伎 | 方 | 喜 | 器 | 基 | 奇 | 嬉 | 奇 | 岐 | 希 | 幾 | 忌 | 揮 | 机 | 旗 | 既 | 期 | 棋 |  |
| 0 | 0 | 1 | 0 | 1 | 5 |  | 求汲 | 汲 | 泣 | 灸 | 球 | 究 | 窮 | 笈 | 級 | 糾 | 給 | 旧 | 牛 | 去 | 居 | 巨 | 拒 | 拠 | 拳 | 渠 | 虚 | 仵 | 距 | 銗 | 漁 | 禦 | 魚 | 亨 | 享 |  |
| 0 | 0 | 1 | 1 | 0 | 6 | 謹 | 近 | 金 | 吟 | 銀 | 九 | 俱 | 可 | 区 | 狗 | 现 | 矩 | 古 | 躯 | 駆 | 駈 | 駒 | 具 | 愚 | 虞 | 喰 | 空 | 偶 | 男 | 遇 | 隅 | 串 | 楖 | 机 | 屑 |  |
| 0 | 0 | 1 | 1 | 1 | 7 |  | 馢 | 撃 | 激 | 隙 | 桁 | 傑 | 欠 | 決 | 揳 | 穴 | 結 | 血 | 訣 | 月 | 件 | 倹 | 倦 | 健 |  | 券 | 剣 | 喧 | 圏 | 堅 | 兼 | 建 | 憲 | 懸 | 拳 |  |
| 0 | 1 | 0 | 0 | 0 | 8 | 伍 | 午 | 呉 | 吾 | 魩 | 後 | 御 | 悟 | 梧 | 檎 | 瑚 | 基 | 語 | 誤 | 謢 | 醐 | 乞 | 鯉 | 交 | 佼 | 侯 | 候 | 倖 | 光 | 公 | 功 | 効 | 勾 | 㫗 | 口 |  |
| 0 | 1 | 0 | 0 | 1 | 9 | 項 | 香 | 高 | 鴻 | 岡 | 劫 | 号 | 合 | 壕 | 拷 | 濠 | 豪 | 冓 | 鿺 | 克 | 刻 | 告 | 国 | 穀 | 酷 | 鵠 | 黒 | 獄 | 漉 | 要 | 壇 | 忽 | 惚 | 骨 | 狛 |  |
| 0 | 1 | 0 | 1 | 0 | 10 | 材 | 罪 | 財 | 冴 | 坂 | 阪 | 堺 | 榊 | 者 | 咲 | 崎 | 埼 | 碕 | 傿 | 作 | 削 | 咋 | 搾 | 昨 | 朔 | 柵 | 窄 | 策 | 索 | 錯 | 桜 | 鮭 | 笹 | 题 | 冊 |  |
| 0 | 1 | 0 | 1 | 1 | 1 | 死 | 氏 | 獅 | 祉 | 私 | 糸 | 紙 | 紫 | 肢 | 脂 | 至 | 視 | 詞 | 詩 | 試 | 誌 | 諮 | 資 | 賜 | 雃 | 飼 | 歯 | 事 | 似 | 侍 | 昌 | 字 | 寺 | 慈 | 持 |  |
| 0 | 1 | 1 | 0 | 0 | 12 | 酌 | 釈 | 錫 | 若 | 寂 | 弱 | 惹 | 主 | 取 | 守 | 手 | 朱 | 殊 | 狩 | 珠 | 種 | 腫 | 趣 | 酒 | 首 | 儒 | 受 | 呪 | 寿 | 授 | 樹 | 綬 | 需 | 囚 | 収 |  |
| 0 | 1 | 1 | 0 | 1 | 13 | 準 | 潤 | 盾 | 純 | 巡 | 遵 | 醒 | 順 | 処 | 初 | 所 | 暑 | 暏 | 渚 | 庶 | 緒 | 署 | 書 | 著 | 諸諸 | 諸 | 助 | 叙 | 女 | 予 | 徐 | 恕 | 鋤 | 除 |  |  |
| 0 | 1 | 1 | 1 | 0 | 14 | 鉦 | 鍾 | 鏱 | 障 | 鞘 | 上 | 丈 | 丞 | 乗 | 几 | 剰 | 城 | 場 | 壌 | 嬢 | 常 | 情 | 擾 | 条 | 杖涠 | 浄 | 状 | 畳 | 嬢 | 蒸 | 譲 | 醸 | 錠 | 嘱 | 埴 |  |
| 0 | 1 | 1 | 1 | 1 | 15 | 逗 | 吹 | 垂 | 帥 | 推 | 水 | 炊 | 睡 | 粋 | 翠 | 衰 | 遂 | 酕 | 錐 | 錘 | 随 | 瑞 | 髄 | 崇 | 高 | 数 | 枢 | 趨 | 雛 | 据 | 杉 | 椙 | 官 | 頗 | 雀 |  |
| 1 | 0 | 0 | 0 | 0 | 16 | 宛 | 節 | 說 | 雪 | 絶 | 舌 | 蝉 | 仙 | 先 | 千 | 占 | 宣 | 専 | 尖 | 川 | 戦 | 扇 | 撰 | 栓 | 梅 | 泉 | 浅 | 洗 | 染 | 潜 | 煎 | 煽 | 旋 | 穿 | 箭 |  |
| 1 | 0 | 0 | 0 | 1 | 17 | 操 | 早 | 曹 | 巣 | 槍 | 槽 | 潧 | 燥 | 争 | 瘦 | 相 | 窓 | 糟 | 総 | 綜 | 聡 | 草 | 荘 | 葬 | 希 | 澡 | 装 | 走 | 送 | 遭 | 鎗 | 霜 | 騒 | 像 | 増 |  |
| 1 | 0 | 0 | 1 | 0 | 18 | 退 | 逮 | 隊 | 黛 | 鯛 | 代 | 台 | 大 | 第 | 醍 | 題 | 鹰 | 滝 | 瀧 | 卓 | 啄 | 宅 | 托 | 択 | 拓沢 | 沢 | 濯 | 琢 | 託 | 鐸 | 濁 | 若 | 茸 | 凩 | 蛸 |  |
| 1 | 0 | 0 | 1 | 1 | 19 | 逐 | 秩 | 窒 | 茶 | 嫡 | 着 | 中 | 仲 | 宙 | 忠 | 抽 | 昼 | 柱 | 注 | 虫 | 衷 | 註 | 酎 | 鋳 | 駐 | 雱 | 㶆 | 猪 | 苧 | 著 | 貯 | 丁 | 兆 | 凋 | 喋 |  |
| 1 | 0 | 1 | 0 | 0 | 20 | 釣 | 鶴 | 亭 | 低 | 停 | 偵 | 剃 | 貞 | 呈 | 堤 | 定 | 帝 | 底 | 庭 | 廷 | 弟 | 悌 | 抵 | 挺 | 提 | 梯 | 汀 | 碇 | 禎 | 程 | 締 | 艇 | 訂 | 諦 |  |  |
| 1 | 0 | 1 | 0 | 1 | 21 | 凍 | 刀 | 唐 | 塔 | 塘 | 套 | 宕 | 島 | 嶋 | 悼 | 投 | 搭 | 東 | 桃 | 梼 | 棟 | 盗 | 淘 | 湯 | 涛 | 灯 | 燈 | 当 | 痘 | 祷 | 等 | 答 | 筒 | 糖 |  |  |
| 1 | 0 | 1 | 1 | 0 | 22 | 奈 | 那 | 内 | 乍 | 凪 | 維 | 倳 | 灘 | 捺 | 鍋 | 楢 | 馴 | 縄 | 㽪 | 南 | 楠 | 軟 | 難 | 汝 |  | 尼 | 式 | 迹 | 匂 | 賑 | 肉 | 虹 | 廿 | 日 | 乳 |  |
| 1 | 0 | 1 | 1 | 1 | 23 | 楳 | 煤 | 珼 | 買 | 売 | 賠 | 陪 | 這 | 蜾 | 秤 | 知 | 萩 | 伯 | 剥 | 博 | 拍 | 柏 | 泊 | 白 | 箔 | 粕 | 舶 | 溥 | 迫 | 暴 | 漠 | 爆 | 縛 | 莫 | 駁 |  |
| 1 | 1 | 0 | 0 | 0 | 24 | 彼 | 悲 | 楽 | 批 | 报 | 斐 | 比 | 泌 | 疲 | 皮 | 碑 | 秘 | 緋 | 罷 | 肥 | 被 | 誹 | 費 | 避 | 非 | 飛 | 樋 | 箥 | 備 | 尾 | 微 | 枇 | 毘 | 琵 | 眉 |  |
| 1 | 1 | 0 | 0 | 1 | 25 | 斧 | 普 | 浮 | 父 | 符 | 腐 | 虙 | 芙 | 譜 | 負 | 賦 | 赴 | 阜 | 附 | 侮 | 擐 | 武 | 寺 | 葡 | 囬 | 部 | 封 | 楓 | 風 | 草 | 蕗 | 伏 | 副 | 復 | 幅 |  |
| 1 | 1 | 0 | 1 | 0 | 26 | 圃 | 捕 | 歩 | 甫 | 補 | 輔 | 穂 | 募 | 墓 | 慕 | 戊 | 暮 | 母 | 簿 | 菩 | 倣 | 俸 | 包 | 呆 | 報 | 奉 | 宝 | 峰 | 逢 | 崩 | 危 | 抱 | 捧 | 放 | 方 |  |
| 1 | 1 | 0 | 1 | 1 | 27 | 摩 | 磨 | 魔 | 麻 | 埋 | 妹 | 昧 | 枚 | 毎 | 哩 | 槙 | 幕 | 膜 | 梑 | 鮪 | 柾 | 鱒 | 桝 | 亦 | 俣又 | 又 | 抹 | 末 | 沫 | 迄 | 低 | 䔵 | 麿 | 万 | 慢 |  |
| 1 | 1 | 1 | 0 | 0 | 28 | 尤 | 戻 | 籾 | 貝 | 問 | 悶 | 紋 | 門 | 为 | 也 | 治 | 夜 | 爺 | 耶 | 野 | 弥 | 吴 | 厄 | 役 | 約 | 薬 | 訳 | 躍 | 靖 | 柳 | 薮 | 鎳 | 俞 | 愈 | 油 | 皟 |
| 1 | 1 | 1 | 0 | 1 | 29 | 沃 | 浴 | 翌 | 翼 | 淀 | 羅 | 螺 | 裸 | 来 | 莱 | 頼 | 雷 | 洛 | 絡 | 落 | 酪 | 乱 | 卵 | 嵐 | 欄 | 濫 | 藍 | 蘭 | 覧 | 利 | 吏 | 履 | 李 | 梨 | 理 |  |
| 1 | 1 | 1 | 1 | 0 | 30 | 類 | 令 | 伶 | 例 | 冷 | 励 | 嶺 | 怜 | 玲 | 礼 | 苓 | 鈴 | 隷 | 零 | 霊 | 麗 | 齢 | 暦 | 歴 | 列 | 劣 | 烈 | 裂 | 廉 | 恋 | 憐 | 漣 | 棟 | 䈴 | 練 |  |

## Character allocation table（5）

$\mathrm{C} 12=1$

|  |  |  |  |  | C6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | C5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|  |  |  |  |  | C4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  | C3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  | C2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|  |  |  |  |  | C1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
|  |  |  |  |  | CO | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 011 | 10 | C9 | C8 | C7 |  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 0 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 0 | 0 | 0 | 1 | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 0 | 0 | 1 | 0 | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 0 | 0 | 1 | 1 | 3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 0 | 0 | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | defin |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 0 | 1 | 5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 1 | 0 | 6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 0 | 1 | 1 | 1 | 7 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 1 | 0 | 0 | 0 | 8 |  | 陜 | 陟 | 陦 | 陲 | 陬 | 隍 | 隘 | 隕 | 隗 | 險 | 隧 | 隱 | 騭 | 隰 | 隴 | 隶 | 隸 | 隹 | 睢 | 售 | 雉 | 雍 | 襍 | 雜 | 霍 | 雕 | 電 | 霄 | 霆 | 需 | 霓 |
| 0 | 1 | 0 | 0 | 1 | 9 |  | 盧 | 顴 | 䫘 | 風 | 颯 | 颱 | 颶 | 飄 | 颼 | 毼 | 飩 | 飫 | 餃 | 餉 | 餒 | 餔 | 餘 | 餡 | 餝 | 䬻 | 餤 | 餅 | 餬 | 喰 | 餽 | 餾 | 饂 | 饉 | 饅 | 饐 | 饋 |
| 0 | 1 | 0 | 1 | 0 | 10 |  | 䯽 | 鬆 | 穆 | 鬚 | 髻 | 䰅 | 臓 | 鬥 | 坯 | 鿾 | 闃 | 玨 | 閎 | 䍖 | 鬲 | 魄 | 魆 | 魏 | 䫺 | 魎 | 魑 | 魘 | 魴 | 鲊 | 鱕 | 鮑 | 鮥 | 鮗 | 鮟 | 鮠 | 鮨 |
| 0 | 1 | 0 | 1 | 1 | 11 |  | 鵝 | 蔦 | 鵤 | 鵑 | 䲨 | 鵙 | 鵲 | 鶉 | 鵣 | 鵣 | 鵯 | 鵺 | 鶚 | 鶤 | 䉆 | 鶕 | 鷄 | 鷁 | 鶻 | 弱 | 䳮 | 鷏 | 鷏 | 鷂 | 熱 | 麃 | 劀 | 䳽 | 鷭 | 鷲 | 㠘 |
| 0 | 1 | 1 | 0 | 0 | 12 |  | 堯 | 槇 | 遙 | 瑤 | 凛 | 熙 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 1 | 1 | 0 | 1 | 13 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 1 | 1 | 1 | 0 | 14 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | nan |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0 | 1 | 1 | 1 | 1 | 15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0 | 0 | 0 | 0 | 16 | 雴 | 霑 | 霏 | 霖 | 霬 | 雷 | 䨐 | 霹 | 霹 | 霓 | 䨚 | 蠋 | 霆 | 靈 | 䨟 | 雲 | 静 | 靠 | 䣱 | 䤄 | 鮞 | 勒 | 靫 | 靭 | 靹 | 鞅 | 靼 | 鞁 | 靺 | 鞆 | 鞋 | 靭 |
| 1 | 0 | 0 | 0 | 1 | 17 | 譏 | 饒 | 饌 | 榩 | 渞 | 馘 | 馥 | 馭 | 馮 | 馼駪 | 駟駺 | 駛 | 駝 | 駘 | 鴽駭 | 駭 | 駮 | 駱 | 駲 | 駻 | 駸 | 騁 | 騏 | 騅 | 駢 | 騙 | 騫 | 騒 | 驅 | 黪 | 驀 | 驃 |
| 1 | 0 | 0 | 1 | 0 | 18 | 鮴 | 鯀 | 鯊 | 鮹 | 鯆 | 鯏 | 鯑 | 鯒 | 鯣 | 鯢 | 鯤 | 鯔 | 鯡 | 鰺 | 鲧 | 鯱 | 鯰 | 鰕 | 鰔 | 鰉 | 鰓 | 鯩 | 鯖 | 鰈 | 鰒 | 䱊 | 鯎 | 鰮 | 鰛 | 鱝 | 鯽 | 鰡 |
| 1 | 0 | 0 | 1 | 1 | 19 | 䳭 | 䳡 | 鸞 | 囫 | 䈅 | 鹽 | 蔍 | 䴤 | 厢 | 麌 | 麒 | 榃 | 轆 | 麝 | 麥 | 麮 | 麸 | 麵 | 麭 | 靡 | 覺 | 黎 | 黏 | 㯮 | 黔 | 黜 | 點 | 䵢 | 黠 | 黥 | 黨 | 黯 |
| 1 | 0 | 1 | 0 | 0 | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0 | 1 | 0 | 1 | 21 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0 | 1 | 1 | 0 | 22 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0 | 1 | 1 | 1 | 23 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 1 | 0 | 0 | 0 | 24 | 鞐 | 鞜 | 鞨 | 鞦 | 鞣 | 鞳 | 靽 | 韃 | 䆏 | 韈 | 韋 | 塪 | 韭 | 齎 | 丕 | 竞 | 韶 | 韵 | 頒 | 頌 | 頸 | 頤 | 頡 | 蕷 | 頽 | 顆 | 顏 | 顋 | 顫 | 顯 | 墍 |  |
| 1 | 1 | 0 | 0 | 1 | 25 | 騾 | 驕 | 驍 | 驛 | 驗 | 驟 | 驢 | 歵 | 驤 | 驩 | 覊 | 騼餛 | 䯈 | 骰 | 骼 | 髀 | 髏 | 髑 | 髓 | 體 | 髞 | 髟 | 䯻 | 髧 | 髦 | 髦 | 髺 | 髮 | 䯻 | 䯻 | 髧 |  |
| 1 | 1 | 0 | 1 | 0 | 26 | 鰰 | 鱇 | 䱝 | 鱆 | 鰾 | 鱚 | 鱠 | 鱧 | 鱶 | 䲐 | 鳥 | 鳥 | 鳮 | 鴉 | 鴈 | 鳫 | 駃 | 鵖 | 鷁 | 煮 | 鶯 | 鴣 | 鴟 | 鵄 | 鴕 | 鴒 | 鵁 | 鴿 | 鵇 | 県 | 鵈 |  |
| 1 | 1 | 0 | 1 | 1 | 27 | 徵 | 星 | 黷 | 粫 | 笼 | 䊇 | 黽 | 㙄 | 擎 | 鼓 | 撉 | 単 | 潟 | 鼾 | 齊 | 齒 | 䟬 | 齙 | 齟 | 齠 | 齡 | 齦 | 謷 | 萄 | 滷 | 臸 | 齲 | 萄 | 䇌 | 龜 | 㪉 |  |
| 1 | 1 | 1 | 0 | 0 | 28 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 1 | 1 | 0 | 1 | 29 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 1 | 1 | 1 | 0 | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 1 | 1 | 1 | 1 | 31 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Character allocation table (6)

$\mathrm{C} 12=1$


## Character allocation table（7）

$\mathrm{C} 12=1$

| C 6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | $\mathbf{1}$ | 1 | 1 | 1 | 1 | $\mathbf{1}$ | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| C 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| C 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| C 2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | $\mathbf{1}$ | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| C 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| CO | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | $\mathbf{1}$ | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |



|  |  | c9 | C8 | C7 |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 1 | 0 | 2 |
| 0 | 0 | 0 | 1 | 1 | 3 |
| 0 | 0 | 1 | 0 | 0 | 4 |
| 0 | 0 | 1 | 0 | 1 | 5 |
| 0 | 0 | 1 | 1 | 0 | 6 |
| 0 | 0 | 1 | 1 | 1 | 7 |
| 0 | 1 | 0 | 0 | 0 | 8 |
| 0 | 1 | 0 | 0 | 1 | 9 |
| 0 | 1 | 0 | 1 | 0 | 10 |
| 0 | 1 | 0 | 1 | 1 | 11 |
| 0 | 1 | 1 | 0 | 0 | 12 |
| 0 | 1 | 1 | 0 | 1 | 13 |
| 0 | 1 | 1 | 1 | 0 | 14 |
| 0 | 1 | 1 | 1 | 1 | 15 |
| 1 | 0 | 0 | 0 | 0 | 16 |
| 1 | 0 | 0 | 0 | 1 | 17 |
| 1 | 0 | 0 | 1 | 0 | 18 |
| 1 | 0 | 0 | 1 | 1 | 19 |
| 1 | 0 | 1 | 0 | 0 | 20 |
| 1 | 0 | 1 | 0 | 1 | 21 |
| 1 | 0 | 1 | 1 | 0 | 22 |
| 1 | 0 | 1 | 1 | 1 | 23 |
| 1 | 1 | 0 | 0 | 0 | 24 |
| 1 | 1 | 0 | 0 | 1 | 25 |
| 1 | 1 | 0 | 1 | 0 | 26 |
| 1 | 1 | 0 | 1 | 1 | 27 |
| 1 | 1 | 1 | 0 | 0 | 28 |
| 1 | 1 | 1 | 0 | 1 | 29 |
| 1 | 1 | 1 | 1 | 0 | 30 |
| 1 | 1 | 1 | 1 | 1 | 31 |


|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 俞 |  |  | 買 | 万回 | 四 | 由 | 冉 凧 | 周胃 | 冓 | 冓 |  |  |  |  |  | 幕 | 幕 | 决 |  |  | 冰 | 况 |  | 准 |  |  |  |  |  |  |
| 卆 | 冉 | \＃ | 世卉 | 卉 | 凖 | 凖 | ワ | 「辰 | 厄 | 外 | 卻卷 | 卷 | 圧 | 鬼犋 | 夏 | 复厥 | 㲀 | 厮 | ム |  | 簒 | 雙 | 叟 | 曼 |  | 叮 | 叮叨 | 吅 |  |  |  |
| 喟 | 竞 |  | 喘 | 喘唧 | 楖單 | 單吘 | 啼喃 | 喃 | 喻喇 | 溂呪 | 呪鳴 | 鳴嗅 | 嗅嗟 | 差嗄 | 啫 |  |  | 遃 | 做 |  |  |  | 嘛 | 連 | 連噎 |  | 營 | 嘴 |  |  |  |
|  | 垩 | 埖 | 花埣 | 卒 | 鉦 | 堙 | 場 | 塲 | 堡䲧 | 䲧塋 | 塋溡 | 準毀 | 毀 | 時堽 | 嶅 | 墅 |  | 墹墟 | 墫 |  | 壞 |  | 堵 |  | 雥 |  |  |  |  |  |  |
|  | 澙 | 嫗 | 區嫦 | 常嫩 | 嫖 | 嫖 㜬 | 䦪孄 | 嫻媴 |  | 嘽壁 | 壁部 | 䦯缴 | 邀 | 菷嬶 |  |  |  | 蛓姚 | 子 |  |  |  | 䋈 |  | 孰 |  |  |  |  |  |  |
|  | 崛 | 芘 | 崔 |  |  | 崚 | 崘 | 崘 |  |  | 嵎崌 | 鬼 | 鬼 |  |  |  |  | 嶂榬 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 㚗 | 彖 | 彗 | 奜巢 | 趿 | 彭 | 彭 | 行 | 行 | 生徂 | 彿 | 弗 | 很 | 很 | 徇 | 從 | 徙 | 徘 | 非徠 | 徨 |  |  |  | 忻 | 忤 | 䛔 |  |  |  |  |  |  |
| 滤 | 憐 |  | 息愧 | 槐慊 | 愿 | 愿 | 愬 | 愬 | 愴愽 | 樓 | 㴔喓 | 熞 | 堅 | 㯃慘 |  | 慚 | 断馝 | 笖慴 | 慯 | 慥 |  |  | 愿 |  |  |  |  |  |  |  |  |
| 拈 | 拜 | 䢁 | 拊 | 拊挑 | 揭 | 鸡拋 | 拉 | 拉 | 挌拮 | 吉拱 |  | 挂 | 挂 | 婁拯 |  | 挩 |  | 爽指 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 收 | 做 | 畋 | 效 | 效敖 | 敕 | 敕唋 | 敍敘 | 敘 | 放做 | 敬敲 | 歒數 | 斂 | 敛 | 變 | 綌解 | 料勘 |  | 矿 | 施 | 每施 | 旁 | 施 | 斻 |  | 䈏 |  |  |  |  |  |  |
|  |  |  |  | 枌㭠 |  | 杆枅 | 枅枅 | 枅砫 |  |  |  |  | 枳 相 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 奧 | 楞 | 楝 | 榁 | 椌 |  | 榅㭼 | 榮槐 | 槐 |  | 槁 | 頃榾 | 槎 | 槎 | 寨等 |  |  |  | 昭柕 | 㶾 |  |  |  | 榕 |  |  |  |  |  |  |  |  |
| 離 | 覷 | 铞 | 㰸欺 | 欨 | 歸 | 歸 | 歿 | 歿 |  | 殄殖 | 秧殍 | 殘 | 残 | 培䫂 |  |  | 䃝幝 | 弹㱴 |  |  | 行 |  | 偙 | 场 | 粅 |  |  |  |  |  |  |
|  |  |  |  | 淬淞 | 松淌 | 淌 | 淒 | 淒 |  |  |  |  | 淕 |  |  |  |  | 促 |  |  | 渾 |  |  |  |  |  |  |  |  |  |  |
| 濱 |  | 濛 | 蒙瀉 | 寫富 | 審澅 | 瀑 | 濐 | 淩 | 緟濾 | 濾瀛 | 济瀚 | 猪 | 猪 | 歷䀋 |  | 漏 | 瀾 | 闌 | 漉 |  | 炎 | 堵 | 䙺 |  | 炬 |  | 炳 |  |  |  |  |
|  |  |  | 狢 |  |  | 狹鮧 |  | 修 |  |  | 猜垷 |  | 猝猴 |  |  |  |  | 猾㢡 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 異 |  |  | 馀畸 | 畸當 | 當疆 | 暿 | 時 | 時 |  | 緼畳 | 畳疗 | 疗 | 疗 |  |  |  |  | 度 |  |  | 疸 | 疼 |  |  |  |  |  |  |  |  |  |
|  |  |  | 眞 | 眞觜 |  | 此睹 | 眷 | 眷 |  |  |  |  | 俥 |  |  |  |  | 者 | 港 |  |  |  | 瞰 |  |  |  |  |  |  |  |  |
|  | 栊 | 秣 | 桿 | 程稍 | 稍稘 | 稘稙 | 椆 | 椆 | 禀禀 | 目稱 | 暞柏 | 毫 | 毫 | 瑢 | 橞 |  |  | 这 | 稳 | 㮽 |  |  |  |  |  |  |  |  |  |  |  |
| 等 |  |  |  | 答筐 | 篦策 | 策籠 | 簀 | 箐 |  |  |  | 睬 | 築 |  |  |  |  | 堍管 |  |  |  |  | 籃 |  | 箕 |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 震 |  | 䢞翠 | 䍂翊 | 乔离 | 翕 | 翔 | 䉘 | 篛殿 |  |  |  | 綒 | 者㸴 |  |  |  | 耙 |  | 耤 | 栍豲 |  | 耻 |  | 聆 |  | 聘 |  |  |  |  |
|  |  |  | 需萛 |  |  | 臈膚 | 濾臓 | 臓 | 第蔵 | 咸臺 |  | 犑 | 里 | 春 |  | 與 |  | 嚄 |  |  |  |  | 舸 |  |  |  |  |  |  |  |  |
| 亘 | 董 |  | 蕒菽 | 菽 | 菘 | 菘㙖 | 莘菁 | 著 | 蒂莀 | 莀 | 波菲 | 菲萍 | 苼 | 朤 | 莽 | 莫 |  | 萄菻 | 葭 |  | 蕓 | 菩 | 冠 |  | 葫 |  |  |  |  |  |  |
|  |  |  | 蘆 | 通 | 部 | 絻 | 蘿 | 儆 |  |  |  |  | 雱 |  |  |  |  |  |  |  |  |  | 蛆 |  |  |  |  |  |  |  |  |
|  | 﨡 |  | 盘 | 盘 | 素 | 表离 | 螨蠋 | 變 | 的竝 | 哅衒 | 行衙 | 衞 | 衞劃 | 等 |  | 袁 | 衰 | 袁 |  |  |  | 内 袂 | 祙袗 |  |  |  |  |  |  |  |  |
|  |  |  |  | 訝訥 | 訥訶 | 話 | 詁詚 | 詛詥 | 詒坘 | 詆言 |  |  | 詭 |  |  |  | 貄 | 本 |  |  |  |  | 甬誚 | 誣 | 巫暻 |  |  |  |  |  |  |
|  | 豼 |  | 戝 | 戝 | 盾食 | 領眧 | 貽貲 | 貲式 | 或戴 | 或 | 既賈 | 真 | 賁賤 |  |  |  |  | 㻩賻 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 䣌 |  | 䡉軛 | 䡉雱 | 表軮 | 軼較 | 軻軫 | 軫輚 | 傤輊 | 輊輅 | 輅輕 | 輕軲 | 軘輙 | 取輓 | 覱 | 輟 |  | 輛䡛 | 替 | 軑 | 輻 | 輹 | 轅 |  | 䡙 |  |  |  |  |  |  |
|  |  |  | 鄰 | 鄰酊 | 配 | 酸 | 剂配 |  |  | 酪酸 | 酳 | 醋 | 醋 |  |  |  |  | 醉醪 |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Character allocation table（8）

C12 $=1$

|  |  |  |  |  | C6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | C5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  | C4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  | C3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|  |  |  |  |  | C2 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
|  |  |  |  |  | C1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
|  |  |  |  |  | C0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
|  |  |  |  |  |  | 96 | 97 | 98 | 99 | 1001 | 10 | 102 | 103 | 10 | 1051 | 106 | 107 | 108 | 109 | 10 |  | 12 | 113 | 114 | 15 | 116 | 117 | 118 | 119 | 20 | 21 | 22 | 123 | 24 | 25 | 126 |
| 0 | 0 | 0 | 0 | 0 | 0 | 俥 | 倚 | 倨 | 倔 | 倪 | 倥 | 倅 | 伜 | 俶 | 倡 | 倩 | 倬 | 俾 | 俯 | 們 | 倆 | 偃 | 假 | 會 | 偕 | 偐 | 偈 | 做 | 偖 | 㤵 | 俪 | 傀 | 傚 | 傅 | 傴 | 教 |
| 0 | 0 | 0 | 0 | 1 | 1 | 凰 | － | 㖤 | 刃 | 刊 | 䚯 | 刎 | 却 | 刪 | 刮 | 刳 | 刹 | 饼 | 剄 | 兛 | 剌 | 剞 | 剔 | 剪 | 剴 | 剩 | 㓣 | 剿 | 剽 | 劍 | 劒 | 劍 | 剱 | 䢃 | 偁 | 辨 |
| 0 | 0 | 0 | 1 | 0 | 2 | 呀 | 听 | 吃 | 吼 | 吮㖞 | 呐 | 吩 | 吝 | 呎 | 咏 | 呵 | 各 | 呟係 | 呱 | 呷 | 呰 | 咒 | 呻 | 咀 | 呶 | 咄 | 咐 | 咆 | 哇 | 咢 | 咸 | 咥 | 咬 | 哄 | 哈 | 咨 |
| 0 | 0 | 0 | 1 | 1 | 3 | 噫 | 噤 | 嘯 | 噬 | 噪 嗃 | 嗃 | 櫺 | 嚊 | 嚠 | 嚏 | 德 | 唖 | 響 | 嚶 | 嚴 | 器 | 嚼 | 囁 | 囃 | 囀 | 㖫 | 囎 | 囑 | 罊 | 口 | 四 | 图 | 分 | 直 | 園 | 園 |
| 0 | 0 | 1 | 0 | 0 | 4 | 摆 | 壤 | 壟 | 壯 | 菅 | 壹 | 壻 | 壼 | 壽 | 久 | 双 | 垷 | 录 | 梦 | 夥 | 夫 | 天 | 夲 | 夸 | 夾 | 竘 | 奕 | 奐 | 奎 | 奚 | 娤 | 奢 | 智 | 阉 | 獎 | 堮 |
| 0 | 0 | 1 | 0 | 1 | 5 | 它 | 宦 | 宸 | 寃 | 寇 | 寉 | 定 | 寐 | 寤 | 實 | 寝 | 寞 | 寥 | 寫 | 㝨 | 筫 | 寶 | 兛 | 將 | 專 | 對 | 尔 | 尠 | 尤 | 发 | 尸 | 尹 | 屁 | 屈 | 屎 | 頁 |
| 0 | 0 | 1 | 1 | 0 | 6 | 巫 | 已 | 压 | 脣 | 帚狦 | 帙 | 帑 | 帛 | 带 | 帷 | 幄 | 幃 | 幀晥 | 幎 | 幗 | 幔 | 幟 | 幢 | 幤 | 幇 | 玕 | 并 | 幺 | 麼 | 广 | 庠 | 廁 | 廂 | 厦 | 廐 | 輾 |
| 0 | 0 | 1 | 1 | 1 | 7 | 古 | 恦 | 怩 | 怎 | 忽 | 怛 | 怕 | 怫 | 電 | 快 | 怺 | 䓌 | 恁 | 恪 | 恷 | 恟 | 恊 | 沍 | 恍 | 恣 | 恃 | 恤 | 恂 | 恬 | 恫 | 羔 | 悁 | 悍 | 惧 | 棝 | 束 |
| 0 | 1 | 0 | 0 | 0 | 8 | 媳 | 馮 | 憫 | 憮 | 懌 慆 | 懊 | 應 | 懐 | 懈 | 懃 | 懆 | 鲂 | 悡 | 罹 | 懔 | 懦 | 浐 | 懶 | 懺 | 㰇 | 㱅 | 懽 | 曜 | 懾 | 戀 | 戈 | 戊 | 戍 | 戊 | 戔 | 戛 |
| 0 | 1 | 0 | 0 | 1 | 9 | 据 | 掾 | 揩 | 䁲 | 揆圌 | 揣 | 揉 | 插 | 揶 | 翤 | 搖 | 搴 | 搆 | 搓 | 搦 | 搶 | 攝 | 搗 | 搨 | 搏 | 摧 | 摯 | 摶 | 摎 | 攪 | 撕 | 撓 | 撥 | 撩 | 撈 | 感 |
| 0 | 1 | 0 | 1 | 0 | 10 | 是 | 旻 | 杳 | 昵 | 袓 | 昴 | 昜 | 㚣 | 晄 | 㛩 | 沓 | 晞 | 書 | 晤 | 晧 | 晨 | 星 | 晢 | 晰 | 暃 | 軍 | 暎 | 暉 | 暄 | 暘 | 暝 | 暨 | 暹 | 曉 | 暾 | 嫯 |
| 0 | 1 | 0 | 1 | 1 | 11 | 梳 | 栫 | 桙 | 档 | 桷 | 桿 | 梟 | 梏 | 梭 | 樞 | 條 | 梛 | 梃 | 檮 | 梹 | 桴 | 梵 | 梠 | 禁 | 椏 | 柏 | 桾 | 楟 | 棊 | 椈 | 棘 | 相 | 椦 | 棡 | 椌 | 棍 |
| 0 | 1 | 1 | 0 | 0 | 12 | 檞 | 槧 | 樅 | 滾 | 樞 | 械 | 樔 | 槫 | 樊 | 樒 | 櫁 | 樣 | 樓 | 橄 | 樌 | 橲 | 樶 | 橸 | 構 | 橢 | 橙 | 橦 | 橈 | 樸 | 樢 | 檐 | 檍 | 檠 | 檄 | 檢 | 榬 |
| 0 | 1 | 1 | 0 | 1 | 13 | 栕 | 氈 | 氓 | 气 | 氛 | 氮 | 氣 | 汞 | 汕 | 江 | 汪 | 沂 | 沍沚 | 沚 | 沁沛 | 沛 | 汾 | 泪 | 汳 | 沒 | 沐 | 泄 | 決 | 泓 | 沽 | 泗 | 泅 | 泝 | 沮 | 沱 | 沾 |
| 0 | 1 | 1 | 1 | 0 | 14 | 滿 | 渝 | 游 | 溂 | 溪 | 溘 | 滉 | 溷 | 滓 | 浱 | 溯 | 滄 | 鼬 | 滔 | 滕 | 溏 | 溥 | 滂 | 溟 | 穎 | 溉 | 灌 | 滬 | 汻 | 滾 | 漿 | 滲 | 欶 | 滯 | 漲 | 滌 |
| 0 | 1 | 1 | 1 | 1 | 15 | 烙 | 焉 | 烽 | 焜 | 焙 | 煥 | 熙 | 熙 | 煦 | 煢 | 煌 | 煖 | 煬 | 熏 | 燻 | 熄 | 嘖 | 慰 | 熬 | 燗 | 熹 | 熾 | 燒 | 燉 | 燔 | 燎 | 燠 | 珵 | 燧 | 燵 | 燼 |
| 1 | 0 | 0 | 0 | 0 | 16 | 玻 | 珀 | 珥 | 珮 | 珞 | 蕾 | 琅 | 瑯 | 琥 | 珸 | 琲 | 珐 | 瑕 | 琿 | 瑟 | 瑙 | 瑁 | 璊 | 瑩 | 瑰 | 頊 | 瑪 | 瑶 | 瑾 | 璋 | 璞 | 壁 | 瓊 | 瓏 | 瓔 | 峃 |
| 1 | 0 | 0 | 0 | 1 | 17 | 涺 | 瘁 | 痰 | 痺 | 痳 | 痳 | 瘋 | 瘍 | 㾍 | 瘟 | 瘧 | 凊 | 癝 | 瘢 | 瘤 | 瘴 | 痤 | 瘻 | 癇 | 癈 | 疼 | 癜 | 瘍 | 癡 | 餈 | 㿑 | 㿗 | 瘄 | 歴 | 癬 | 癰 |
| 1 | 0 | 0 | 1 | 0 | 18 |  | 蠋 |  | 矣 | 矮 | 矼 | 砌 | 砒 | 礦 | 砠 | 礪 | 硅 | 碎 | 硴 | 碆 | 硼 | 碚 | 碌 | 碣 | 碩 | 碪 | 硇 | 磑 | 磆 | 磍 | 磔 | 碾 | 碼 | 磅 | 磊 | 敬 |
| 1 | 0 | 0 | 1 | 1 | 19 | 窐 | 竅 | 竄 | 窿 | 邃實 | 䆬 | 竊 | 竍 | 竏 | 竕 | 竓 | 站 | 竚 | 竝 | 䩂 | 竢 | 竦 | 竭 | 㹉 | 笑 | 笏 | 第 | 笆 | 笳 | 管 | 笙 | 答 | 笵 | 笨 | 笑 | 筐 |
| 1 | 0 | 1 | 0 | 0 | 20 | 鿖 | 篗 | 䉼 | 断 | 䉼 | 粤 | 粭 | 栥 | 粫 | 粡 | 䅜 | 粳 | 粲 | 粱 | 粮 | 粹 | 粽 | 糀 | 糅 | 糂 | 糘 | 糐 | 糜 | 糢 |  | 糯 | 糲 | 櫂 | 糴 | 糺 | 紆 |
| 1 | 0 | 1 | 0 | 01 | 21 | 縲 | 縺 | 繧 | 繝 | 變 | 繞 | 繙 | 繚 | 繹 | 繪 | 繩 | 繼 | 繻 | 紕 | 緕 | 繽 | 縡 | 繿 | 纈 | 繢 | 續 | 纒 | 纐 | 纓 | 絈 | 纖 | 纖 | 繋 | 纜 | 缸 | 缺 |
| 1 | 0 | 1 | 1 | 10 | 22 | 簜 | 聲 | 聰 | 聶 | 聹 | 聴 | 聿 | 肄 | 肆 | 萧 | 肛 | 㝘 | 肚 | 肭 | 冒 | 肬 | 胛 | 胥 | 胙 | 胝 | 胃 | 胚 | 胖 | 脉 | 胯 | 胱 | 脛 | 脩 | 唇 | 脯 | 腋 |
| 1 | 0 | 1 | 1 | 1 | 23 | 艘 | 艨 | 艪 | 艫 | 舮 | 艱 | 艷 | 沜 | 艾 | 苟 | 芒 | 芫 | 艺 | 芻 | 芬 | 茹 | 芭 | 苟 | 䓦 | 苴 | 苳 | 苺 | 莓 | 范 | 苻 | 苹 | 苞 | 茆 | 首 | 茉 | 苙 |
| 1 | 1 | 0 | 0 | 0 | 24 | 葯 | 葹 | 荿 | 葹 | 萾 | 萧 | 高 | 葋 | 蓌 | 著 | 蒻 | 蓚 | 薷 | 秦 | 䒚 | 蓠 | 芳 | 蔡 | 宿 | 葽 | 蔗 | 苶 | 蔬 | 蔟 | 帶 | 苟 | 苓 | 蕀 | 夢 | 蕘 | 䓵 |
| 1 | 1 | 0 | 0 | 01 | 25 | 蛟 | 蛛 | 蛯 | 蜒 | 蜆 | 蜗 | 蜀 | 蜃 | 蛻 | 乓 | 蜉 | 蜍 | 蛹 | 蜊 | 蜴 | 蜿 | 蜷 | 蜻 | 蜥 | 蜩 | 蜚 | 蝠 | 蝟 | 蛤 | 蚪 | 蝎 | 蝴 | 蝗 | 虫 | 蝮 | 蝙 |
| 1 | 1 | 0 | 1 | 10 | 26 | 䘞 | 衸 | 袖 | 裔 | 裘 | 裙 | 裝 | 裏 | 褂 | 裼 | 裴 | 裨 | 裲 | 袆 | 褌 | 褊 | 襍 | 長 | 褞 | 祳 | 褪 | 裭 | 袘 | 襄 | 䖿 | 褶 | 褸 | 襌 | 褝 | 襠 | 襞 |
| 1 | 1 | 0 | 1 | 11 | 27 | 諤 | 諱 | 謔 | 諠 | 諢 | 諷 | 諞 | 謮 | 訶 | 謇 | 謚 | 諡 | 謖 | 䍀 | 該 | 謠 | 詔 | 鞫 | 警 | 謫 | 謾 | 謨 | 譁 | 篇 | 譏 | 譎 | 證 | 詵 | 譛 | 譚 | 諼 |
| 1 | 1 | 1 | 0 | 0 | 28 | 赭 | 㥁 | 赳 | 趁 | 趙 | 跂 | 趾 | 跃 | 跏 | 踖 | 跖 | 跌 | 跛 | 跋 | 跪 | 跫 | 跟 | 跣 | 跼 | 踈 | 踉 | 跿 | 踝 | 踞 | 踐 | 踟 | 蹂 | 踵 | 踰 | 踊 | 蹊 |
| 1 | 1 | 1 | 0 | 01 | 29 | 轓 | 轣 | 轤 | 辜 | 辟 | 辣 | 闢 | 辯 | 込 | 迚 | 迥 | 迢 | 迪䢞 | 迯 | 邇 | 迴 | 逅 | 迹 | 逎 | 逑 | 逕 | 逡 | 逍 | 逞 | 逖 | 逋 | 逧 | 逶 | 逵 | 逹 | 迸 |
| 1 | 1 | 1 | 1 | 0 | 30 | 釬 | 釶 | 鈞 | 釿 | 鈔 | 鈬 | 鈕 | 鈑 | 鈛 | 鉗 | 鉅 | 鉉 | 鉤 | 鉈 | 銕 | 鈿 | 鉋 | 鉐 | 銜 | 銖 | 銓 | 銛 | 鉚 | 鋏 | 䤺 | 銷 | 鋩 | 銔 | 鋺 | 鍄 | 錮 |
| 1 | 1 | 1 | 1 | 11 | 31 | 閏 | 闧 | 閧 | 閭 | 閼 | 閻 | 閹 | 閾 | 闊 | 潤 | 関 | 闍 | 闌 | 閔 | 闆 | 闖 | 關 | 闡 | 䦣 | 闢 | 阶 | 阨 | 际 | 阯 | 陂 | 陌 | 陏 | 陋 | 陷 | 陜 | 陸 |

[MEMO]
[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 VDD 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<br>NEC Semiconductor Device Reliability/Quality Control System (C10983E)<br>Semiconductor Device Mounting Technology (C10535E)

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"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
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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