

# **MN101D02D / F / G / H**

**VTR Servo**

|                                           |                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                  |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Type</b>                               | <b>MN101D02D / F / G / H</b>                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                  |
| <b>ROM (×8-Bit)</b>                       | 72 K / 96 K / 128 K / 160 K                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                  |
| <b>RAM (×8-Bit)</b>                       | 2 048 / 3 072 / 4 096 / 5 120                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                  |
| <b>Minimum Instruction Execution Time</b> | With Main Clock operated                                                                                                                                                                                                                                                                                                                                            | <b>0.1397 μs (at 4.0 V to 5.5 V, 14.32 MHz)</b>                                                                                                                                                  |
|                                           | When Sub-Clock operated                                                                                                                                                                                                                                                                                                                                             | <b>71.5 μs (at 2.2 V to 5.5 V fixed to 14.32 MHz internal frequency division)</b>                                                                                                                |
|                                           |                                                                                                                                                                                                                                                                                                                                                                     | <b>61 μs (at 2.2 V to 5.5 V, 32.768 kHz)</b>                                                                                                                                                     |
| <b>Interrupts</b>                         | <ul style="list-style-type: none"> <li>• RESET • Runaway • External 0, 1, 2, 3, 4/key input (P50 to 54) • Timer 0 • Timer 1 • Timer 2 • Timer 3 • Timer 4 • Timer 6 • Capstan FG • Control • HSW • Cylinder FG • Servo VSYNC • Synchronous Output • OSD • XDS • Serial 0 • Serial 1 • Serial 2 • A/D (common with PWM 14 reference frequency) • OSDVSYNC</li> </ul> |                                                                                                                                                                                                  |
| <b>Timer Counter</b>                      | <b>Timer Counter 0: 16-Bit × 1</b> (Timer Output, Clock Function [Max 2s or Max 36h at Cascade-Connecting with Timer 6])                                                                                                                                                                                                                                            |                                                                                                                                                                                                  |
|                                           | Clock Source                                                                                                                                                                                                                                                                                                                                                        | 1/2, 1/4, 1/8, 1/16 of System Clock, Overflow of Timer Counter 6, 1/512 of XI Oscillation Clock or OSC Oscillation Clock                                                                         |
|                                           | Interrupt Source                                                                                                                                                                                                                                                                                                                                                    | Overflow of Timer Counter 0                                                                                                                                                                      |
|                                           | <b>Timer Counter 1: 16-Bit × 1</b> (Timer Output, linear Timer Counter Function)                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                  |
|                                           | Clock Source                                                                                                                                                                                                                                                                                                                                                        | 1/2, 1/4, 1/8, 1/16 of System Clock, CTL Signal                                                                                                                                                  |
|                                           | Interrupt Source                                                                                                                                                                                                                                                                                                                                                    | Overflow of Timer Counter 1                                                                                                                                                                      |
|                                           | <b>Timer Counter 2: 16-Bit × 1</b> (Timer Output, Input Capture (DCTL Specified Edge), Duty Judgment of DCTL Signal)                                                                                                                                                                                                                                                |                                                                                                                                                                                                  |
|                                           | Clock Source                                                                                                                                                                                                                                                                                                                                                        | 1/2, 1/4, 1/8, 1/12, 1/16, 1/24 of System Clock                                                                                                                                                  |
|                                           | Interrupt Source                                                                                                                                                                                                                                                                                                                                                    | Overflow of Timer Counter 2, Input of DCTL Specified Edge, Underflow of Timer 2 Shift Register 4-Bit Counter, Coincidence of Timer 2 Shift Register with Timer 2 Shift Register Compare Register |
|                                           | <b>Timer Counter 3: 16-Bit × 1</b> (Timer Output, Detection of Serial Indexing, Generation of Remote Control Output Carrier Frequency)                                                                                                                                                                                                                              |                                                                                                                                                                                                  |
|                                           | Clock Source                                                                                                                                                                                                                                                                                                                                                        | 1/2, 1/4, 1/8, 1/16 of System Clock                                                                                                                                                              |
|                                           | Interrupt Source                                                                                                                                                                                                                                                                                                                                                    | Overflow of Timer Counter 3                                                                                                                                                                      |
|                                           | <b>Timer Counter 4: 16-Bit × 1</b> (Timer Output, Event Count (P15 Input), Generation of Serial Transmission Clock)                                                                                                                                                                                                                                                 |                                                                                                                                                                                                  |
|                                           | Clock Source                                                                                                                                                                                                                                                                                                                                                        | 1/8, 1/16 of System Clock, External Clock Input                                                                                                                                                  |
|                                           | Interrupt Source                                                                                                                                                                                                                                                                                                                                                    | Overflow of Timer Counter 4, Coincidence of Timer Counter 4 with OCR4                                                                                                                            |
|                                           | <b>Timer Counter 5: 17-Bit × 1</b> (Watchdog, Stable Oscillation Waiting Function)                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                  |
|                                           | Clock Source                                                                                                                                                                                                                                                                                                                                                        | System Clock                                                                                                                                                                                     |
|                                           | Watchdog Interrupt Source                                                                                                                                                                                                                                                                                                                                           | 1/2 <sup>16</sup> , 1/2 <sup>19</sup> of Timer Counter 5                                                                                                                                         |
|                                           | Clear by Stable Oscillation                                                                                                                                                                                                                                                                                                                                         | After 256 Counts by Timer Counter 5 (2 <sup>18</sup> Counts of OSC Oscillation Clock)                                                                                                            |
|                                           | <b>Timer Counter 6: 16-Bit × 1</b> (Clock Function [max. 2 s])                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                  |
|                                           | Clock Source                                                                                                                                                                                                                                                                                                                                                        | 1/512 of OSC Oscillation Clock, XI Oscillation Clock, 1/4, 1/8, 1/64, 1/128 of System Clock                                                                                                      |
|                                           | Interrupt Source                                                                                                                                                                                                                                                                                                                                                    | 1/2 <sup>13</sup> , 1/2 <sup>14</sup> , 1/2 <sup>15</sup> , Overflow of Timer Counter 6                                                                                                          |
| <b>Serial Interface</b>                   | <b>Serial 0: 8-Bit × 1</b> (Synchronous Type/Start-Stop Synchronous Type) (Transfer Direction of MSB/LSB Selectable)                                                                                                                                                                                                                                                |                                                                                                                                                                                                  |
|                                           | Synchronous Type Clock Source                                                                                                                                                                                                                                                                                                                                       | 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256 of System Clock, 2-Division Timer 4 Output, SBT0 Pin Input                                                                                              |
|                                           | Clock for UART                                                                                                                                                                                                                                                                                                                                                      | 8-Division of Above Clock, 2-Division Timer 4 Output, SBT0 Pin Input                                                                                                                             |
|                                           | <b>Serial 1: 8-Bit × 1</b> (Synchronous Type/Remote Control Transmission/Simple Remote Control Receive) (Transfer Direction of MSB/LSB Selectable, Start Condition Function)                                                                                                                                                                                        |                                                                                                                                                                                                  |
|                                           | Clock Source                                                                                                                                                                                                                                                                                                                                                        | 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256 of System Clock, 2-Division Timer 4 Output, SBT1 Pin Input                                                                                              |
|                                           | Remote Control Clock                                                                                                                                                                                                                                                                                                                                                | 2-Division Timer Output                                                                                                                                                                          |

|                                    |              |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------|--------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Serial Interface (Continue)</b> |              |           | <b>Serial 2: 8-Bit × 1 (I<sup>2</sup>C)</b> (Master Transmission/Reception, Slave Transmission/Reception)<br>Clock Source      1/72, 1/80, 1/84, 1/96, 1/102, 1/112, 1/128, 1/144, 1/160, 1/168, 1/192, 1/224, 1/256, 1/320 of System Clock, SCK Pin Input                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>OSD</b>                         |              |           | Accommodation with Menu or Super Impose Display<br>Applicable Broadcasting System    NTSC, PAL, PAL-M, PAL-N<br>Screen Configuration                24 Characters x 2n Rows (n = 1 to 6)<br>Character Type                        Max 512 Character Types (Variable)<br>Character Size                        12 × 18 Dots<br>Enlarged Characters                Each × 2, × 3 or × 4 Settings in Horizontal and Vertical<br>Character Interpolation            None<br>Background Color                  8-Hue Settable (Settable in The Row Unit at Menu Display)<br>Background Intensity              8 Gradations Settable in The Row Unit<br>Character Color                      White<br>Character Intensity                8 Gradations Settable in The Row Unit<br>Frame Function                      1-Dot frame in 4 or 8 Directions<br>Frame Intensity                    4 Gradations Settable in The Row Unit<br>Box Shade Function                Settable in The Character Unit (Only at Composite Output with 128 Character Types or More)<br><br>Blinking                              None (Covered by Software)<br>Inverted Character                Settable in The Character Unit<br>Halftone                            Settable in The Row Unit in 2 Intensity Gradations (Setting in The Row Unit)<br>Input                                Composite Video Signal Input (Output Level: 1 V[p-p] / 2 V[p-p])<br>Clamp Method                      Sync Chip Clamp, Clamp Level in 4 Levels<br>Output                                Composite Video Output<br><br>Digital Output (6 pins)<br>8 Character and Background Colors Each Settable at Digital Output<br><br>Measure Against Image Fluctuation    Built-In AFC Circuit<br>Sync Signal Detection Function    Detection Functions for Horizontal and Vertical Sync Signals (Integral System) With Horizontal Sync Signal Interpolation Function |
| <b>XDS</b>                         |              |           | Built-In U.S. Closed Caption Data Slicer (Optional 2 Line Data can be Extracted)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>ROM Correction</b>              |              |           | Correcting Address Designation    Up to 2 Addresses Possible<br>Correction Method                  Correction Program Being Saved in Internal RAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>I/O Pins</b>                    | <b>I/O</b>   | <b>73</b> | • Common use    73 ports 0, 1, 2, 4, 5, 6, 7, A, B, by-bit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                    | <b>Input</b> | <b>4</b>  | • Common use    4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>A/D</b>                         |              |           | 8-Bit × 12ch (Without S/H)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>PWM</b>                         |              |           | 13-Bit × 2ch (at Repetition Cycle 572 μs, 14.32 MHz),<br>10-Bit × 2ch (at Repetition Cycle 71.5 μs, 14.32 MHz), 14-Bit × 1ch (at Repetition Cycle 1144 μs, 14.32 MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>ICR</b>                         |              |           | 18-Bit × 6ch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>OCR</b>                         |              |           | 16-Bit × 7ch, 8-Bit × 1ch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Special Ports</b>               |              |           | Buzzer Output, 3-State Output (PTO) VLP Pin, Synchronous Output    7, 3-State Synchronous Output    4, Remote Control Receive, CTL Amp, Built-In FG Amp,<br>Output of 1/2 OSC Oscillation Clock (2 V[p-p]), Output of 1/4 OSC Oscillation Clock (1 V[p-p])                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Notes</b>                       |              |           | VISS/VASS Detection Function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Package</b>                     |              |           | QFP-100-P-1818                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

See the next page for electrical characteristics, support tool and pin assignment.

## Electrical Characteristics

### Supply Current

| Parameter                | Symbol | Condition                                                                               | Limit |     |     | Unit |
|--------------------------|--------|-----------------------------------------------------------------------------------------|-------|-----|-----|------|
|                          |        |                                                                                         | min   | typ | max |      |
| Operating Supply Current | IDD1   | 14.32 MHz operation without load, VDD = 5 V                                             |       | 60  | 100 | mA   |
|                          | IDD2   | 1/1024 of 14.32 MHz operation without load, VDD = 2.7 V                                 |       | 2   | 5   | mA   |
|                          | IDD3   | Stop of 14.32 MHz oscillation, VDD = 2.7 V<br>32 kHz oscillation operation without load |       | 50  | 100 | μA   |
| Supply Current at STOP   | IDSP   | Stop of oscillation without load                                                        |       | 0   | 20  | μA   |
| Supply Current at HALT   | IDHT0  | 14.32 MHz oscillation without load, VDD = 5 V                                           |       | 5   | 15  | mA   |
|                          | IDHT1  | Stop of 14.32 MHz oscillation, VDD = 2.7 V<br>32 kHz oscillation operation without load |       | 5   | 20  | μA   |

(Ta = 25 °C±2 °C, VDD = 5.0 V, VSS = 0 V)

### A/D Converter Performance

| Parameter                 | Symbol | Condition        | Limit |     |     | Unit |
|---------------------------|--------|------------------|-------|-----|-----|------|
|                           |        |                  | min   | typ | max |      |
| Conversion Relative Error | ΔNLAD  |                  |       |     | ±3  | LSB  |
| A/D Conversion Time       | tAD    | fosc = 14.32 MHz |       | 8   |     | μs   |
| Analog Input Voltage      |        |                  | 0     |     | 5   | V    |

(Ta = 25 °C±2 °C, VDD = 5.0 V, VSS = 0 V)

## Support Tool

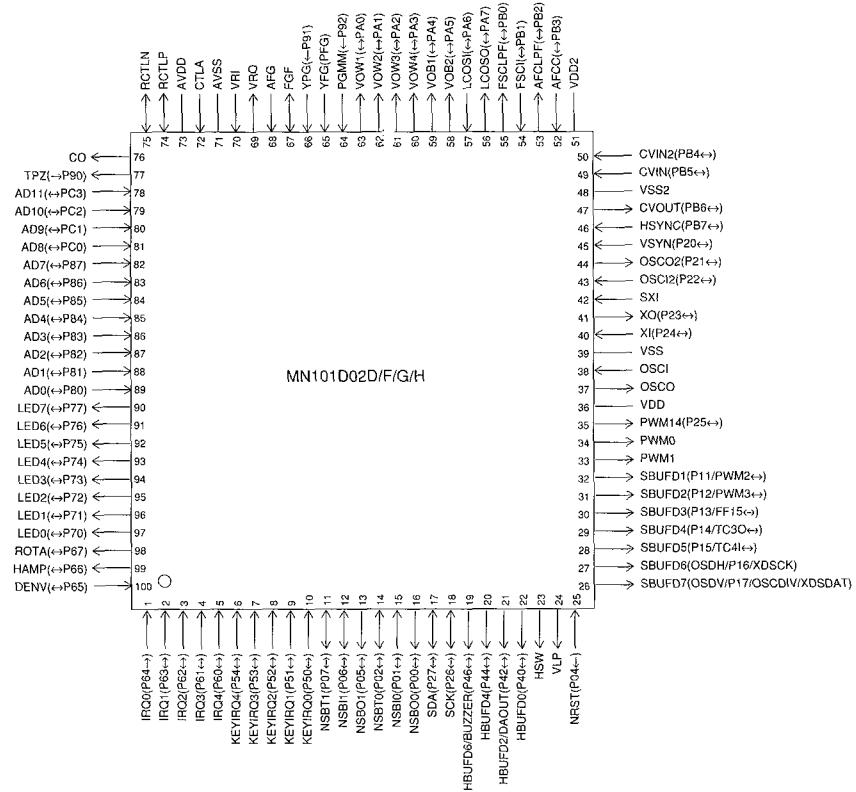
### In-Circuit Emulator

PX-ICE101C / D + PX-PRB101D02-C / D

### EPROM built-in Type

|                                    |                                                                                                                                                                  |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                               | MN101DP02J [ES (Engineering Sample) available]<br>OTP: MN101DP02JAF [ES (Engineering Sample) available]<br>ATP: MN101DP02JAC [ES (Engineering Sample) available] |
| ROM (× 8-Bit)                      | 192 K                                                                                                                                                            |
| RAM (× 8-Bit)                      | 5 120                                                                                                                                                            |
| Minimum Instruction Execution Time | 0.1397 μs (at 4.0 V to 5.5 V, 14.32 MHz)<br>71.5 μs (at 2.2 V to 5.5 V fixed to 14.32 MHz internal division)                                                     |
| Package                            | QFP100-P-1818B<br>OTP: QFP100-P-1818B<br>ATP: With Ceramic Window                                                                                                |

# Pin Assignment



QFP100-P-1818B