



|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Type                                  | MN103004K                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | MN103016K      |
| Command ROM (x64-bit)                 | 256 K-byte                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 256 K-byte     |
| Data RAM (x32-bit)                    | 10 K-byte                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10 K-byte      |
| Package<br>(Old Package)              | QFP208-P-2828F *Pb free , FLGA239-C-1313<br>(QFP208-P-2828A)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | FLGA239-C-1313 |
| Minimum Instruction<br>Execution Time | 25 ns (at 2.7 V to 3.6 V, 40 MHz)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |
| Interrupts                            | • RESET • IRQ × 8 • NMI • Timer × 22 • Input capture × 14 • PWM × 4 • SIF × 16 • DMAC × 4 • WDT<br>• A/D • System error                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |
| Timer Counter                         | Timer counter 0 to 3: 32-bit × 1 (interval timer, event count, toggle output, interrupt, A/D conversion trigger)<br>Clock source ..... IOCLK; IOCLK/8; IOCLK/32; external clock input; underflow of timer counter<br>Interrupt source ..... underflow of timer counter 0, 1, 2, 3<br><br>Timer counter 4 to 7: 32-bit × 1<br>(interval timer, event count, toggle output, interrupt, clock source for serial I/F, generation of timer synchronous output timing)<br>Clock source ..... IOCLK; IOCLK/8; IOCLK/32; external clock input; underflow of timer counter<br>Interrupt source ..... underflow of timer counter 4, 5, 6, 7<br><br>Timer counter 8 to B: 32-bit × 1<br>(interval timer, event count, toggle output, interrupt, clock source for serial I/F, generation of timer synchronous output timing)<br>Clock source ..... IOCLK; IOCLK/8; IOCLK/32; external clock input; underflow of timer counter<br>Interrupt source ..... underflow of timer counter 8, 9, A, B<br><br>*: each of timer counters 0 to 3, 4 to 7, and 8 to B can be changed to an 8-, 16-, or 24-bit timer counter.<br><br>Timer counter 10 to 13: 16-bit × 4 (interval timer, event count, toggle output, interrupt, DMA start)<br>Clock source ..... IOCLK; IOCLK/8; IOCLK/32; external clock input;<br>underflow of timer counter 0, 1, 2<br>Interrupt source ..... underflow of timer counter 10, 11, 12, 13<br><br>Timer counter 14, 15: 16-bit × 2<br>(interval timer, event count, toggle output, PMW output, interrupt, input capture (2 lines), one-shot output, external trigger start, generation of timer synchronous output timing, DMA start)<br>Clock source ..... IOCLK; IOCLK/8; external clock input (2 lines);<br>underflow of timer counter 0, 1; 2-phase encode<br>Interrupt source ..... overflow of timer 14, 15; underflow of timer 14, 15; coincidence of compare register with binary counter or at capture<br><br>Watchdog timer: 16- to 25-bit × 1 |                |
| DMA Controller                        | Number of channels: 2<br>Unit of transfer: 8/16/32 bits<br>Max. Transfer cycles: 65535<br>Staring factor: external interrupt, timer factor, PNM factor, serial transmission/reception factor,<br>A/D conversion finish, software factor<br>Transfer method: 2-bus cycle transfer<br>Adressing modes: fixed, increment, decrement<br>Transfer modes: word transfer, burst transfer, intermittent transfer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |

|                         |                                                                                                                                                                                            |  |  |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| <b>Serial Interface</b> | Serial 0, 1: 7-, 8-bit × 2 (clock synchronous mode, start-stop synchronous mode, I <sup>2</sup> C mode)                                                                                    |  |  |
|                         | Serial 2: 7-, 8-bit × 1 (start-stop synchronous mode)                                                                                                                                      |  |  |
|                         | Serial 3 to 7: 7-, 8-bit × 5 (clock synchronous mode)                                                                                                                                      |  |  |
|                         | Clock source ..... (clock synchronous mode, start-stop synchronous mode)<br>IOCLK; underflow of timer counter; external clock (I <sup>2</sup> C mode)<br>IOCLK; underflow of timer counter |  |  |

|                 |              |     |                    |
|-----------------|--------------|-----|--------------------|
| <b>I/O Pins</b> | <b>I/O</b>   | 155 | • Common use : 137 |
|                 | <b>Input</b> | 16  | • Common use : 16  |

|                   |                 |
|-------------------|-----------------|
| <b>A/D Inputs</b> | 10-bit × 16-ch. |
|-------------------|-----------------|

|            |                                                                                           |
|------------|-------------------------------------------------------------------------------------------|
| <b>PWM</b> | 12-, 14-bit resolution × 4-ch. (dedicated), 16-bit resolution × 2-ch. (common with timer) |
|------------|-------------------------------------------------------------------------------------------|

|            |                                                      |
|------------|------------------------------------------------------|
| <b>ICR</b> | 28-bit × 13-ch. + 16-bit × 4-ch. (common with timer) |
|------------|------------------------------------------------------|

|            |                                    |
|------------|------------------------------------|
| <b>OCR</b> | 16-bit × 4-ch. (common with timer) |
|------------|------------------------------------|

|                                 |                                    |
|---------------------------------|------------------------------------|
| <b>Timer Synchronous Output</b> | 4-bit (synchronous output) × 2-ch. |
|---------------------------------|------------------------------------|

|                                   |  |
|-----------------------------------|--|
| <b>Electrical Characteristics</b> |  |
| Supply current                    |  |

| Parameter                  | Symbol | Condition                                                                                                     | Limit |     |      | Unit |
|----------------------------|--------|---------------------------------------------------------------------------------------------------------------|-------|-----|------|------|
|                            |        |                                                                                                               | min   | typ | max  |      |
| Operating supply current   | IDD1   | VDDH, VDDDB, VDD, PVDD, AVDD = 3.0 V<br>VI = VDDH (VDDDB) or VSS<br>At internal = 40 MHz<br>Output open       |       |     | 150  | mA   |
| Supply current at stopping | IDD4   | VDDH, VDDDB, VDD, PVDD, AVDD = 3.6 V<br>VI = VDDH (VDDDB) or VSS<br>fosc = oscillation stopped<br>Output open |       |     | 150* | μA   |

(Ta = −20°C to +85°C)

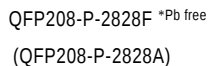
\*FLGA239-C-1313

| A/D conversion performance    |        |                                               |       |     |     |      |
|-------------------------------|--------|-----------------------------------------------|-------|-----|-----|------|
| Parameter                     | Symbol | Condition                                     | Limit |     |     | Unit |
|                               |        |                                               | min   | typ | max |      |
| Resolution                    |        |                                               |       |     | 10  | Bits |
| A/D conversion absolute error |        | VREF+ = 3.0 V<br>A/D conversion clock = 5 MHz |       |     | ± 7 | LSB  |
| A/D conversion relative error |        |                                               |       |     | ± 5 | LSB  |
| A/D conversion time           |        |                                               | 2.8   |     |     | μs   |

(Ta = −20°C to +85°C, AVDD = 3.0 V, AVSS = 0 V)

See the next page for pin assignment and support tool.

( ) : Old Package



## Pin Assignment (Continue)

Perspective  
↓

|                |             |                |               |               |               |                 |                  |                   |                |            |            |              |              |             |              |   |
|----------------|-------------|----------------|---------------|---------------|---------------|-----------------|------------------|-------------------|----------------|------------|------------|--------------|--------------|-------------|--------------|---|
| N.D.           | N.D.        | PE7, IRQ7      | NMIRQ         | PE1, IRQ1     | PD0           | PC4             | PC1              | PB1, SY0OT1       | PA2, PWM2      | P94, ICR12 | P91, ICR9  | P84, ICR4    | P80, ICR0    | N.D.        | N.D.         | T |
| N.D.           | N.D.        | N.D.           | PE5, IRQ5     | PE3, IRQ3     | VDD           | PC2             | PB7, SY1OT3      | PB3, SY0OT3       | PA0, PWM0      | P92, ICR10 | P85, ICR5  | P82, ICR2    | N.D.         | N.D.        | N.D.         | R |
| AVDD           | N.D.        | PF0, ADTRG     | VSS           | PE4, IRQ4     | PC6           | PC5             | VSS              | PB5, SY1OT1       | PB0, SY0OT0    | VSS        | VDD        | P87, ICR7    | P77, TM15IOB | N.D.        | P76, TM15IOA | P |
| PG2, AN2       | PG0, AN0    | VREFH          | PE6, IRQ6     | PE2, IRQ2     | PD1           | PC3             | PB6, SY1OT2      | VDDH              | PA1, PWM1      | P90, ICR8  | P83, ICR3  | P74, TM14IOA | P75, TM14IOB | P73, TM13IO | VSS          | N |
| PG3, AN3       | PG5, AN5    | PG1, AN1       | PG4, AN4      | PE0, IRQ0     | PC7           | PC0             | PB2, SY0OT2      | PA3, PWM3         | P95            | P86, ICR6  | P81, ICR1  | P70, TM10IO  | P72, TM12IO  | VDD         | P71, TM11IO  | M |
| PG7, AN7       | PH1, AN9    | PH2, AN10      | PG6, AN6      | PH3, AN11     | PH0, AN8      | PB4, SY1OT0     | N.D.             | N.D.              | P93, ICR11     | P67, TM7IO | P63, TM3IO | P65, TM5IO   | VSS          | P66, TM6IO  | P64, TM4IO   | L |
| PH7, AN15      | PH5, AN13   | PH6, AN14      | AVSS          | PI0           | PH4, AN12     | N.D.            | N.D.             | N.D.              | N.D.           | P60, TM0IO | P54, SBO7  | P62, TM2IO   | P55, SBT7    | P61, TM1IO  | P53, SBT7    | K |
| PI2            | PI3         | PI4            | VDDH          | PI1           | N.D.          | N.D.            | N.D.             | N.D.              | N.D.           | N.D.       | P41, BG    | VDDH         | P51, SBO6    | P52, SBT6   | P50, SBT6    | J |
| PI0, DWE       | PI7         | VSS            | PI5           | PI6           | N.D.          | N.D.            | N.D.             | N.D.              | N.D.           | N.D.       | P35, SBT5  | P34, SBO5    | P40, BR      | VDD2 (VPP)  | VSS          | H |
| PK2, CS2, RAS2 | PK0, CS0    | PK1, CS1, RAS1 | VDD           | PI4           | PI2, DCA51    | N.D.            | N.D.             | N.D.              | N.D.           | P31, SBO4  | P33, SBT5  | P30, SBT4    | P32, SBT4    | VDD         | P25, SBT3    | G |
| OSCO           | PK4, SYSClk | VDDH           | PK3, CS3      | PI3, CAS      | PI1, DCA50    | PN5, A13, ADM13 | N.D.             | N.D.              | PO5, A21       | P24, SBO3  | P21, SBT2  | P22, SBT2    | P15, SBT1    | P23, SBT3   | VSS          | F |
| OSCI           | VSS         | PK7, FRQ5      | PK6, EXMOD1   | PK5, EXMOD0   | PN1, A9, ADM9 | PN3, A11, ADM11 | PO0, A16, DAS    | PO2, A18, DSYSClk | PP0, A24       | PQ2, D2    | PR1, D9    | P13, SBT1    | P20, SBT2    | P14, SBO1   | P12, SBT0    | E |
| MMOD1          | RST         | MMOD0          | PVSS          | PM4, A4, ADM4 | PN0, A8, ADM8 | PN4, A12, ADM12 | PO7, A23         | PO3, A19          | PQ0, D0, AS    | PQ5, D5    | PQ7, D7    | P10, SBT0    | VDDH         | P11, SBO0   | P00, WDOVF   | D |
| PVDD           | N.D.        | PL1, WE1       | PL3, TK       | PM2, A2, ADM2 | PM6, A6, ADM6 | VSS             | PN7, A15, ADM15  | VSS               | PQ3, D3        | VDDH       | PR3, D11   | PR4, D12     | PR6, D14     | N.D.        | N.D.         | C |
| N.D.           | N.D.        | PL2, RE        | PM0, A0, ADM0 | PM1, A1, ADM1 | PM5, A5, ADM5 | PN6, A14, ADM14 | VDDB             | PO6, A22          | PP1, A25       | PQ6, D6    | PR8, D8    | PR5, D13     | N.D.         | N.D.        | N.D.         | B |
| N.D.           | N.D.        | PL0, WE0       | VDDB          | PM3, A3, ADM3 | PM7, A7, ADM7 | PN2, A10, ADM10 | PO1, A17, DRWSEL | PO4, A20          | PQ1, D1, RWSEL | PQ4, D4    | PR2, D10   | VSS          | PR7, D15     | N.D.        | N.D.         | A |
| 16             | 15          | 14             | 13            | 12            | 11            | 10              | 9                | 8                 | 7              | 6          | 5          | 4            | 3            | 2           | 1            |   |

FLGA239-C-1313

\* C1 has no electrode (pin).  
 \* N.D. has an electrode (pin) but N.C. is not guaranteed.  
 Please design so as not to cause short circuit with other wiring on the user board.  
 \* Each of VDD, VDDB, VDDH and VSS has multiple electrodes (pins).  
 Pins having the same name are internally shorted.  
 \*H2: MN103004K(VDD2), MN103016K(VDD2), MN1030F04K(VPP)

## Support Tool

|                            |                                                            |                                         |
|----------------------------|------------------------------------------------------------|-----------------------------------------|
| In-circuit Emulator        | PX-ICE103004-QFP208-P-2828A                                | Not applicable to FLGA239-C-1313.       |
| On-board Development Tools | PX-ODB103S-O<br>CSIDE-MN10300 (Computex Co., Ltd, product) |                                         |
| Flash Memory Built-in Type | Type                                                       | MN1030F04K                              |
|                            | Command ROM (× 64-bit)                                     | 256 K-byte                              |
|                            | Data RAM (× 32-bit)                                        | 12 K-byte                               |
|                            | Minimum instruction execution time                         | 25 ns (at 3.0 V to 3.6 V, 40 MHz)       |
|                            | Package                                                    | QFP208-P-2828F *Pb free, FLGA239-C-1313 |
|                            | (Old Package)                                              | (QFP208-P-2828A)                        |

## Request for your special attention and precautions in using the technical information and semiconductors described in this material

- (1) An export permit needs to be obtained from the competent authorities of the Japanese Government if any of the products or technologies described in this material and controlled under the "Foreign Exchange and Foreign Trade Law" is to be exported or taken out of Japan.
- (2) The technical information described in this material is limited to showing representative characteristics and applied circuit examples of the products. It does not constitute the warranting of industrial property, the granting of relative rights, or the granting of any license.
- (3) The products described in this material are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).  
Consult our sales staff in advance for information on the following applications:
  - Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
  - Any applications other than the standard applications intended.
- (4) The products and product specifications described in this material are subject to change without notice for reasons of modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (5) When designing your equipment, comply with the guaranteed values, in particular those of maximum rating, the range of operating power supply voltage and heat radiation characteristics. Otherwise, we will not be liable for any defect which may arise later in your equipment.  
Even when the products are used within the guaranteed values, redundant design is recommended, so that such equipment may not violate relevant laws or regulations because of the function of our products.
- (6) When using products for which dry packing is required, observe the conditions (including shelf life and after-unpacking standby time) agreed upon when specification sheets are individually exchanged.
- (7) No part of this material may be reprinted or reproduced by any means without written permission from our company.

## Please read the following notes before using the datasheets

- A. These materials are intended as a reference to assist customers with the selection of Panasonic semiconductor products best suited to their applications.  
Due to modification or other reasons, any information contained in this material, such as available product types, technical data, and so on, is subject to change without notice.  
Customers are advised to contact our semiconductor sales office and obtain the latest information before starting precise technical research and/or purchasing activities.
- B. Panasonic is endeavoring to continually improve the quality and reliability of these materials but there is always the possibility that further rectifications will be required in the future. Therefore, Panasonic will not assume any liability for any damages arising from any errors etc. that may appear in this material.
- C. These materials are solely intended for a customer's individual use.  
Therefore, without the prior written approval of Panasonic, any other use such as reproducing, selling, or distributing this material to a third party, via the Internet or in any other way, is prohibited.