

# M66281FP

## 5120 × 8-Bit × 2 Line Memory

REJ03F0254-0200  
Rev.2.00  
Sep 14, 2007

### Description

The M66281FP is high speed line memory that uses high performance silicon gate CMOS process technology and adopts the FIFO (First In First Out) structure consisting of 5120 words × 8 bits × 2.

Since memory is available to simultaneously output 1 line delay and 2 line delay data, the M66281FP is optimal for the compensation of data of multiple lines.

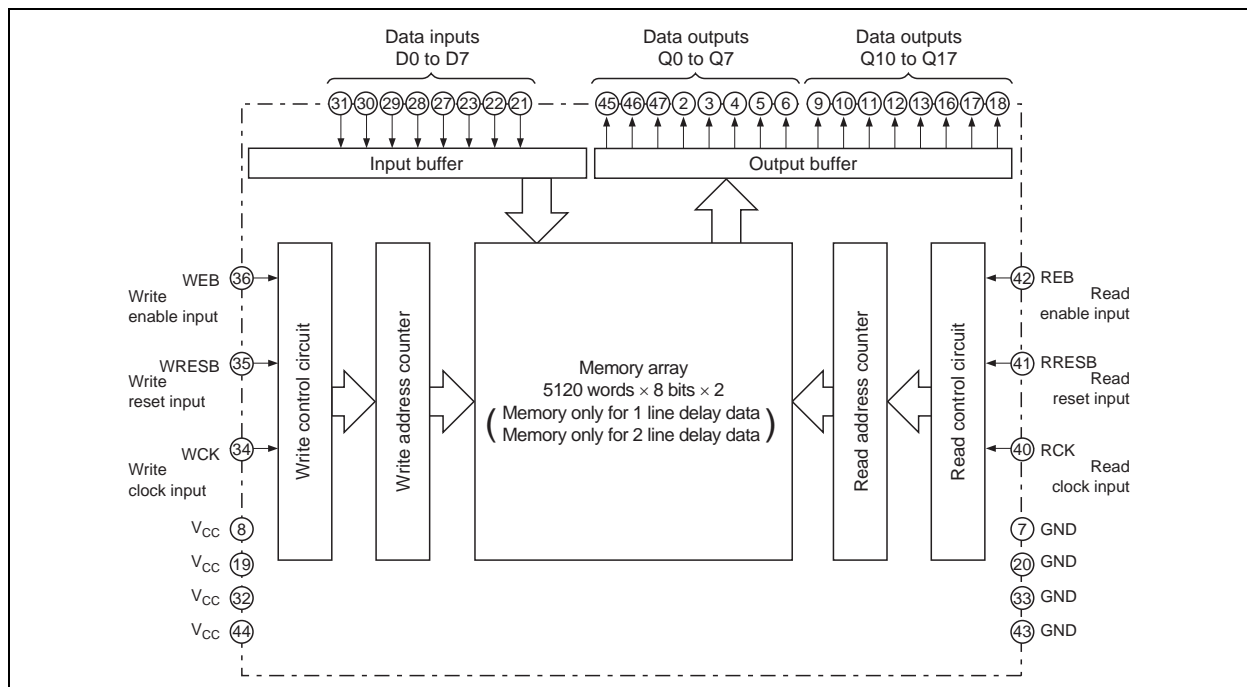
### Features

- Memory configuration: 5120 words × 8 bits × 2 (dynamic memory)
- High speed cycle: 25 ns (Min)
- High speed access: 18 ns (Max)
- Output hold: 3 ns (Min)
- Reading and writing operations can be completely carried out independently and asynchronously
- Variable length delay bit
- Input/output: TTL direct connection allowable
- Output: 3 states
- Q00 to Q07: 1 line delay
- Q10 to Q17: 2 line delay

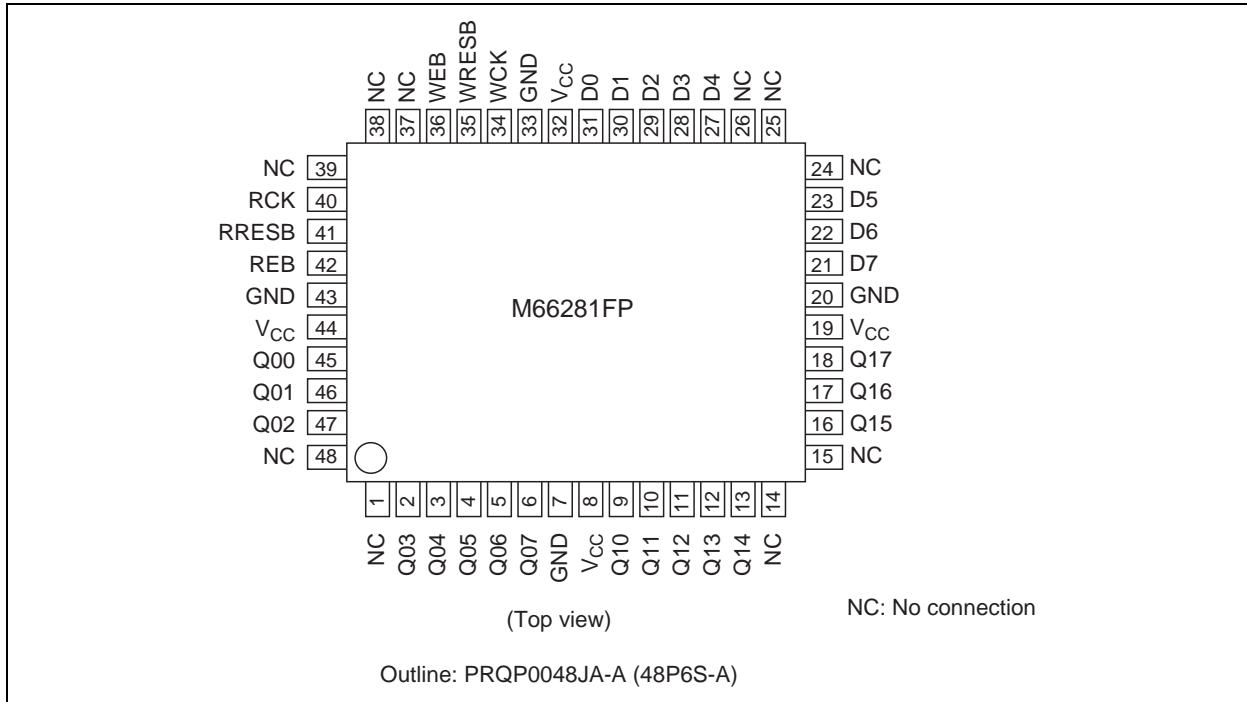
### Application

Digital copying machine, laser beam printer, high speed facsimile, etc.

### Block Diagram



Pin Arrangement



## Absolute Maximum Ratings

(Ta = 0 to 70°C, unless otherwise noted)

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	V <sub>CC</sub>	-0.3 to +4.6	V	Value based on the GND pin
Input voltage	V <sub>I</sub>	-0.3 to V <sub>CC</sub> + 0.3	V	
Output voltage	V <sub>O</sub>	-0.3 to V <sub>CC</sub> + 0.3	V	
Power dissipation	P <sub>d</sub>	540	mW	*
Storage temperature	T <sub>stg</sub>	-55 to 150	°C	

Note: \* Ta = 0 to 63°C. Ta &gt; 63°C are derated at -9 mW / °C

## Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	V <sub>CC</sub>	2.7	3.15	3.6	V
Supply voltage	GND	—	0	—	V
Operating temperature	T <sub>opr</sub>	0	—	70	°C

## Electrical Characteristics

(Ta = 0 to 70°C, V<sub>CC</sub> = 2.7 to 3.6 V, GND = 0 V, unless otherwise noted)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions	
High-level input voltage	V <sub>IH</sub>	2.0	—	—	V		
Low-level input voltage	V <sub>IL</sub>	—	—	0.8	V		
High-level output voltage	V <sub>OH</sub>	V <sub>CC</sub> - 0.4	—	—	V	I <sub>OH</sub> = -4 mA	
Low-level output voltage	V <sub>OL</sub>	—	—	0.4	V	I <sub>OL</sub> = 4 mA	
High-level input current	I <sub>IH</sub>	—	—	1.0	μA	V <sub>I</sub> = V <sub>CC</sub>	WEB, WRESB, WCK, REB, RRESB, RCK, D0 to D7
Low-level input current	I <sub>IL</sub>	—	—	-1.0	μA	V <sub>I</sub> = GND	WEB, WRESB, WCK, REB, RRESB, RCK, D0 to D7
Off-state high-level output current	I <sub>OZH</sub>	—	—	5.0	μA	V <sub>O</sub> = V <sub>CC</sub>	
Off-state low-level output current	I <sub>OZL</sub>	—	—	-5.0	μA	V <sub>O</sub> = GND	
Average supply current during operation	I <sub>CC</sub>	—	—	150	mA	V <sub>I</sub> = V <sub>CC</sub> , GND, Output open t <sub>WCK</sub> , t <sub>RCK</sub> = 25 ns	
Input capacitance	C <sub>I</sub>	—	—	10	pF	f = 1 MHz	
Off-time output capacitance	C <sub>O</sub>	—	—	15	pF	f = 1 MHz	

## Function

When write enable input WEB is set to "L", the contents of data inputs D0 to D7 are written into memory only for 1 line delay data in synchronization with a rising edge of write clock input WCK to perform writing operation. When this is the case, the write address counter of memory only for 1 line delay data is incremented simultaneously.

When WEB is set to "H", the writing operation is inhibited and the write address counter of memory only for 1 line delay data stops.

When write reset input WRESB is set to "L", the write address counter of memory only for 1 line delay data is initialized.

When read enable input REB is set to "L", the contents of memory only for 1 line delay data are output to data outputs Q00 to Q07 and the contents of memory only for 2 line delay data are output to Q10 to Q17 in synchronization with a rising edge of read clock input RCK to perform reading operation.

When this is the case, the read address counters of memory only for 1 line delay data and memory only for 2 line delay data are incremented simultaneously.

In addition, data of Q00 to Q07 is written into memory only for 2 line delay data in synchronization with a rising edge of RCK. When this is the case, the write address counter of memory only for 2 line delay data is then incremented.

When REB is set to "H", operation for reading data from memory only for 1 line delay and from memory only for 2 line delay data is inhibited and the read address counter of each memory stops.

Outputs Q00 to Q07 and Q10 to Q17 are placed in a high impedance state. In addition, the write address counter of memory only for 2 line delay data then stops.

When read reset input RRESB is set to "L", the read address counters of memory only for 1 line delay data as well as the write address counter and read address counter of memory only for 2 line delay data are then initialized.

## Switching Characteristics

( $T_a = 0$  to  $70^\circ\text{C}$ ,  $V_{CC} = 2.7$  to  $3.6$  V, GND = 0 V, unless otherwise noted)

Item	Symbol	Min	Typ	Max	Unit
Access time	$t_{AC}$	—	—	18	ns
Output hold time	$t_{OH}$	3	—	—	ns
Output enable time	$t_{OEN}$	3	—	18	ns
Output disable time	$t_{ODIS}$	3	—	18	ns

## Timing Requirements

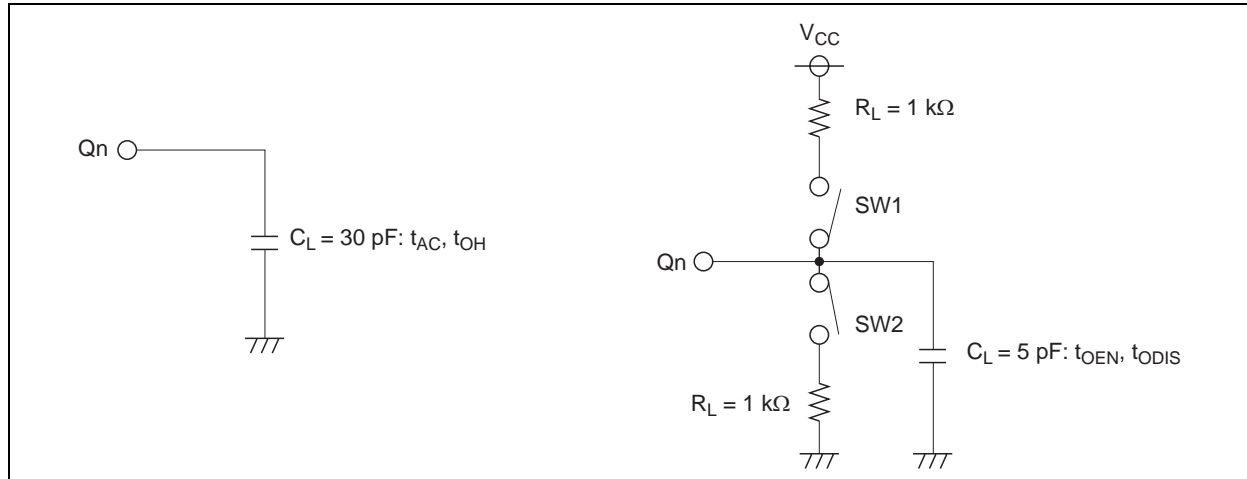
( $T_a = 0$  to  $70^\circ\text{C}$ ,  $V_{CC} = 2.7$  to  $3.6$  V, GND = 0 V, unless otherwise noted)

Item	Symbol	Min	Typ	Max	Unit
Write clock (WCK) cycle	$t_{WCK}$	25	—	—	ns
Write clock (WCK) "H" pulse width	$t_{WCKH}$	11	—	—	ns
Write clock (WCK) "L" pulse width	$t_{WCKL}$	11	—	—	ns
Read clock (RCK) cycle	$t_{RCK}$	25	—	—	ns
Read clock (RCK) "H" pulse width	$t_{RCKH}$	11	—	—	ns
Read clock (RCK) "L" pulse width	$t_{RCKL}$	11	—	—	ns
Input data setup time for WCK	$t_{DS}$	7	—	—	ns
Input data hold time for WCK	$t_{DH}$	3	—	—	ns
Reset setup time for WCK/RCK	$t_{RESS}$	7	—	—	ns
Reset hold time for WCK/RCK	$t_{RESH}$	3	—	—	ns
Reset non-selection setup time for WCK/RCK	$t_{NRESS}$	7	—	—	ns
Reset non-selection hold time for WCK/RCK	$t_{NRESH}$	3	—	—	ns
WEB setup time for WCK	$t_{WES}$	7	—	—	ns
WEB hold time for WCK	$t_{WEH}$	3	—	—	ns
WEB non-selection setup time for WCK	$t_{NWES}$	7	—	—	ns
WEB non-selection hold time for WCK	$t_{NWEH}$	3	—	—	ns
REB setup time for RCK	$t_{RES}$	7	—	—	ns
REB hold time for RCK	$t_{REH}$	3	—	—	ns
REB non-selection setup time for RCK	$t_{NRES}$	7	—	—	ns
REB non-selection hold time for RCK	$t_{NREH}$	3	—	—	ns
Input pulse up/down time	$t_r, t_f$	—	—	20	ns
Data hold time*	$t_H$	—	—	20	ms

Notes: Perform reset operation after turning on power supply.

- \* For 1 line access, the following conditions must be satisfied:  
 WEB high-level period  $\leq 20$  ms – 5120 •  $t_{WCK}$  – WRESB low-level period  
 REB high-level period  $\leq 20$  ms – 5120 •  $t_{RCK}$  – RRESB low-level period

## Switching Characteristics Measurement Circuit



Input pulse level: 0 to 3 V

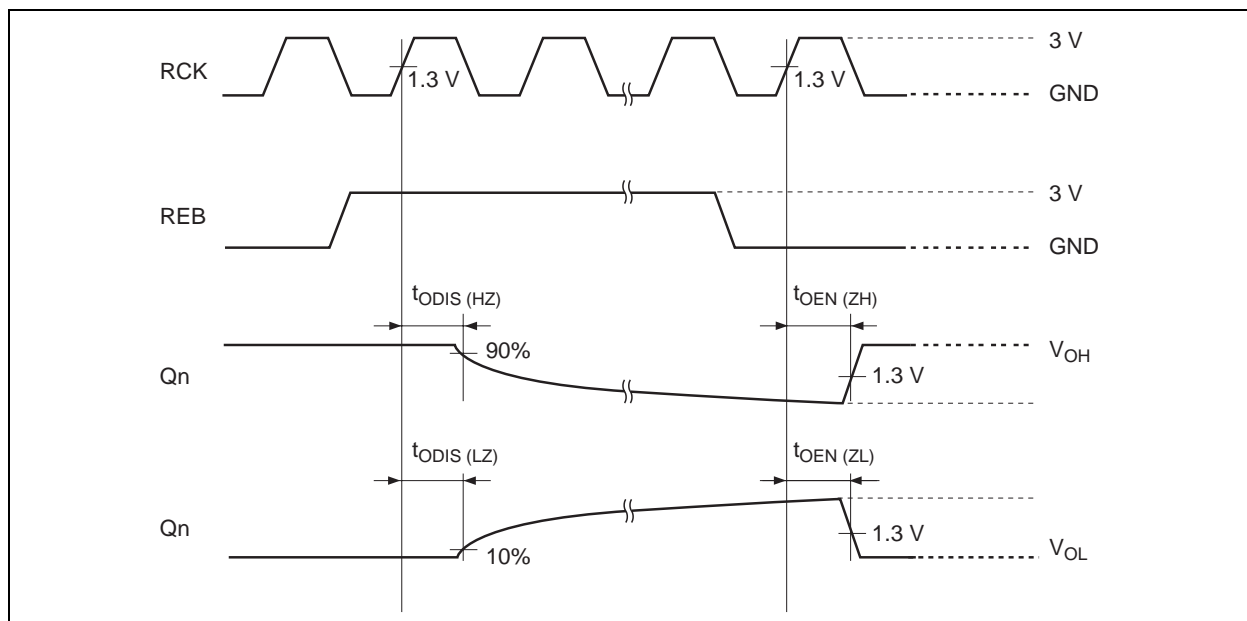
Input pulse up/down time: 3 ns

Judging voltage Input: 1.3 V

Output: 1.3 V (However,  $t_{ODIS(LZ)}$  is judged with 10% of the output amplitude, while  $t_{ODIS(HZ)}$  is judged with 90% of the output amplitude)

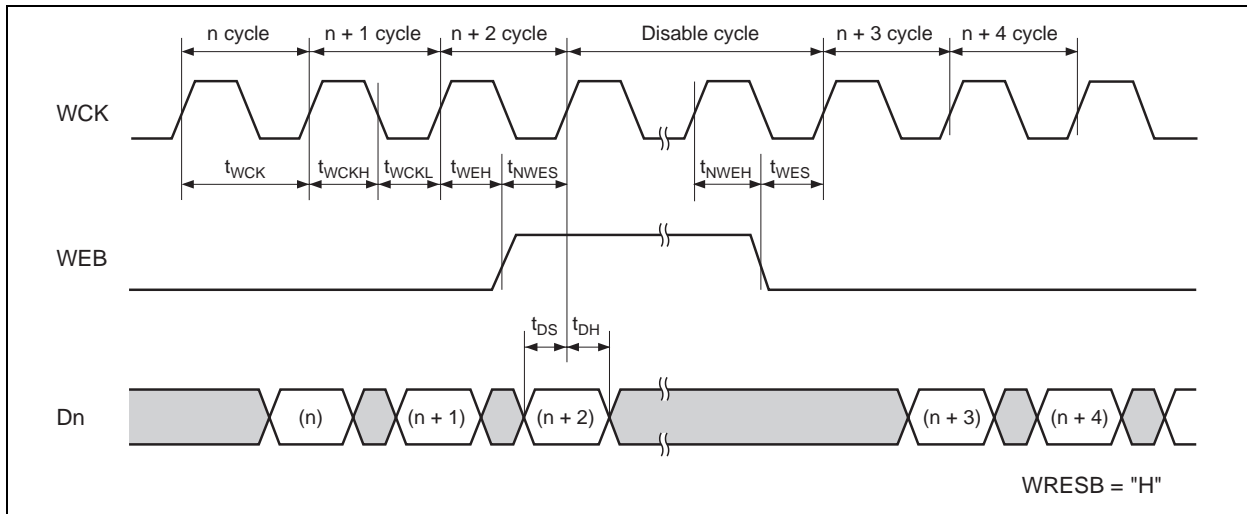
Load capacitance  $C_L$  includes the floating capacity of connected lines and input capacitance of probe.

Item	SW1	SW2
$t_{ODIS(LZ)}$	Close	Open
$t_{ODIS(HZ)}$	Open	Close
$t_{OEN(ZL)}$	Close	Open
$t_{OEN(ZH)}$	Open	Close

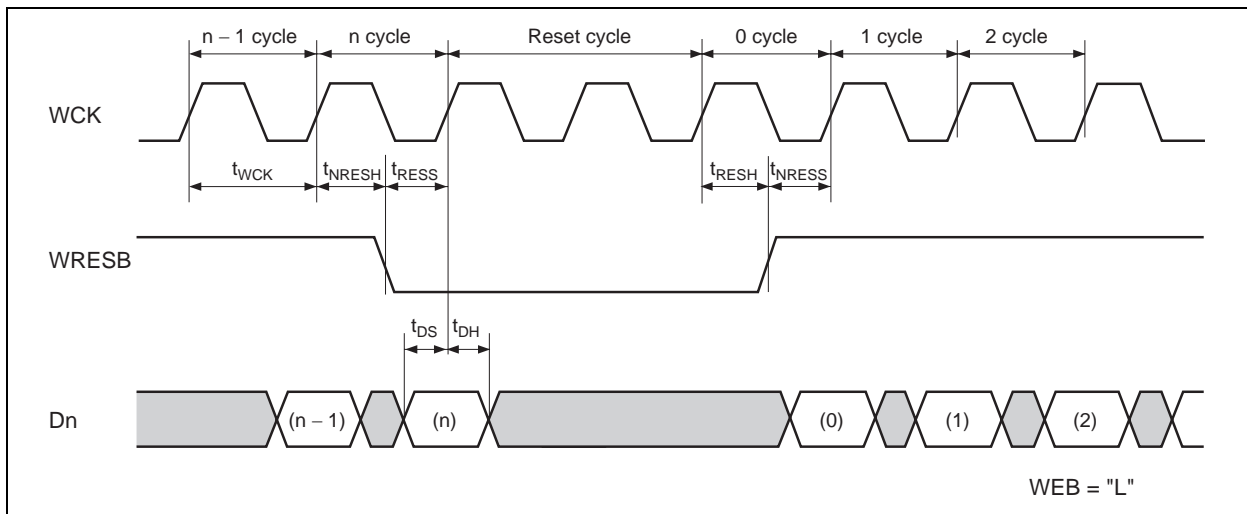
 $t_{ODIS}$  and  $t_{OEN}$  Measurement Condition

## Operation Timing

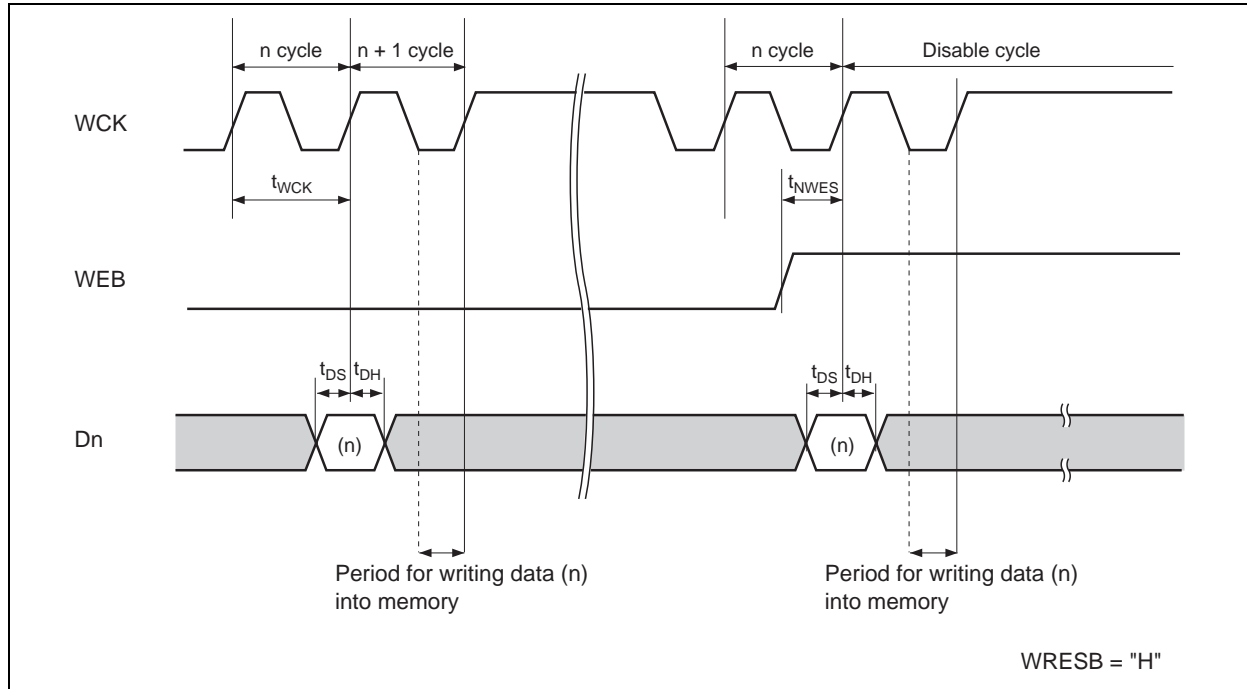
### Write Cycle



### Write Reset Cycle



## Matters that Needs Attention when WCK Stops



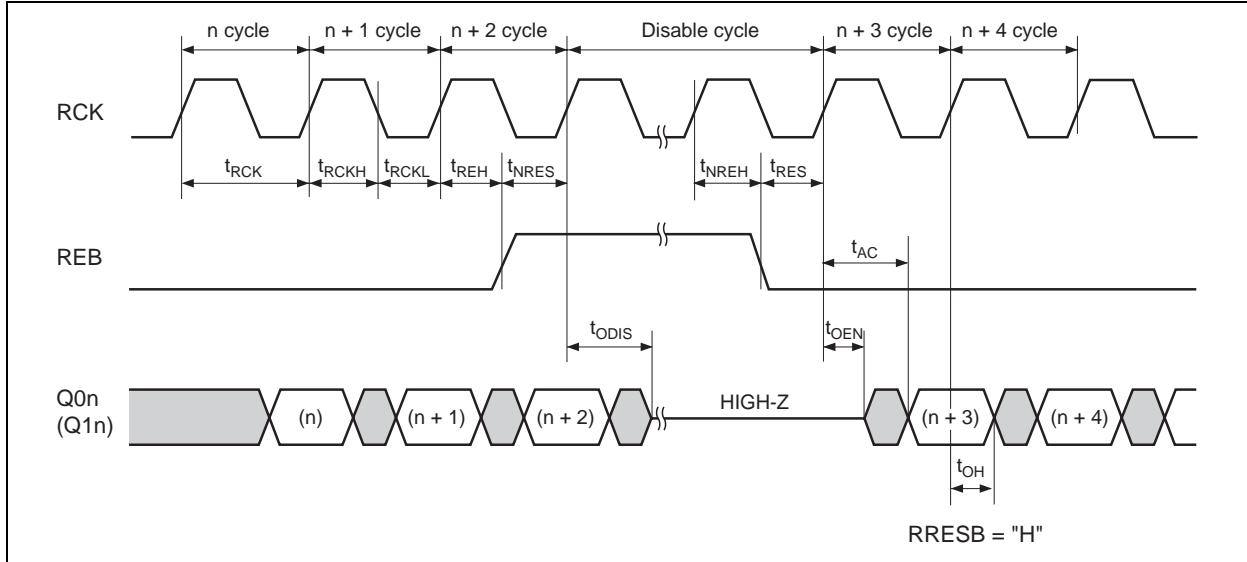
Input data of n cycle is read at the rising edge after WCK of n cycle and writing operation starts in the WCK low-level period of n + 1 cycle. The writing operation is complete at the falling edge after n + 1 cycle.

To stop reading write data at n cycle, enter WCK before the rising edge after n + 1 cycle.

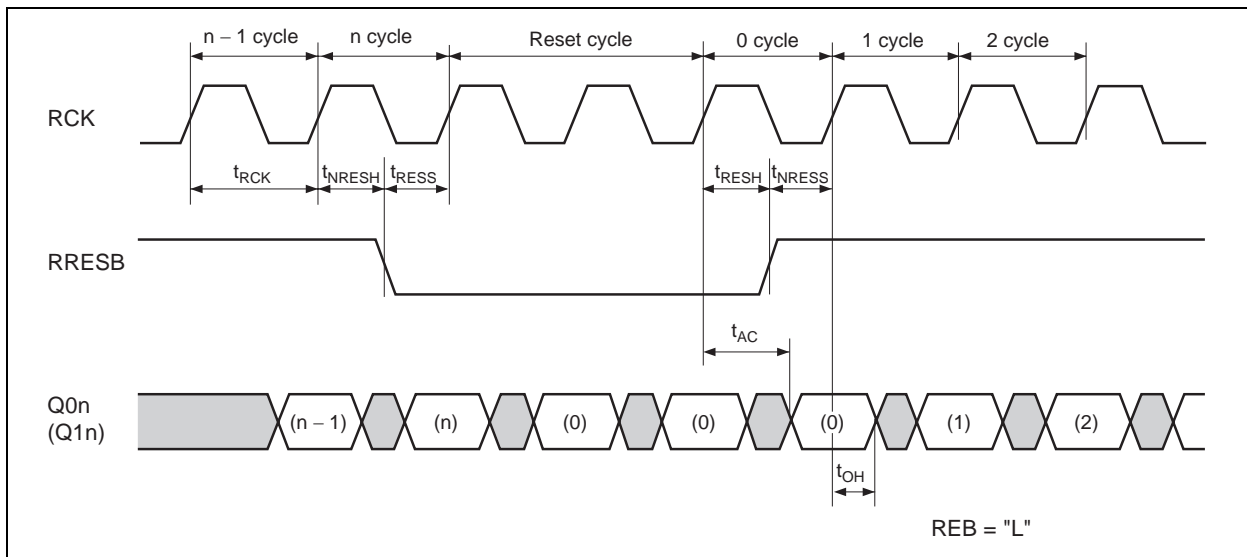
When the cycle next to n cycle is a disable cycle, WCK for a cycle requires to be entered after the disable cycle as well.



Read Cycle

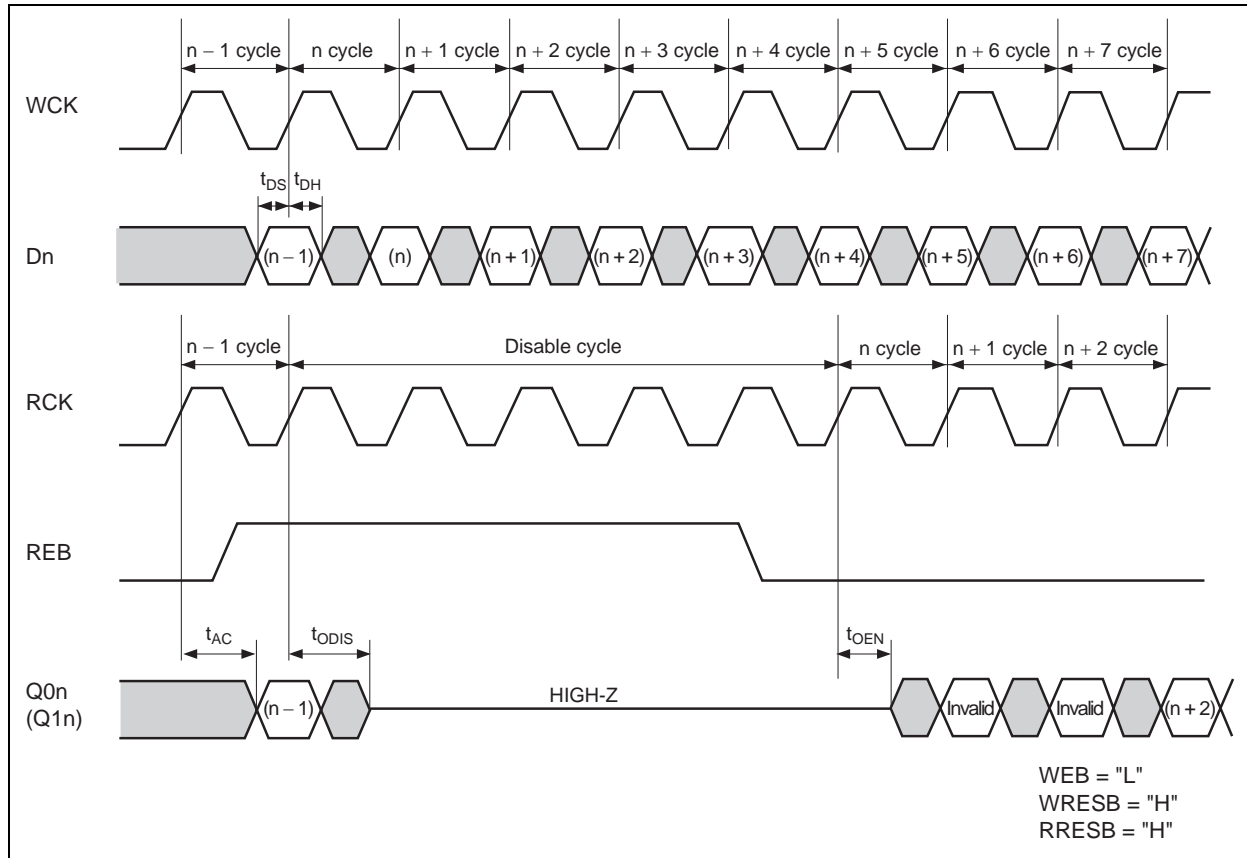


Read Reset Cycle



### Notes on Reading of Written Data in Read Disable

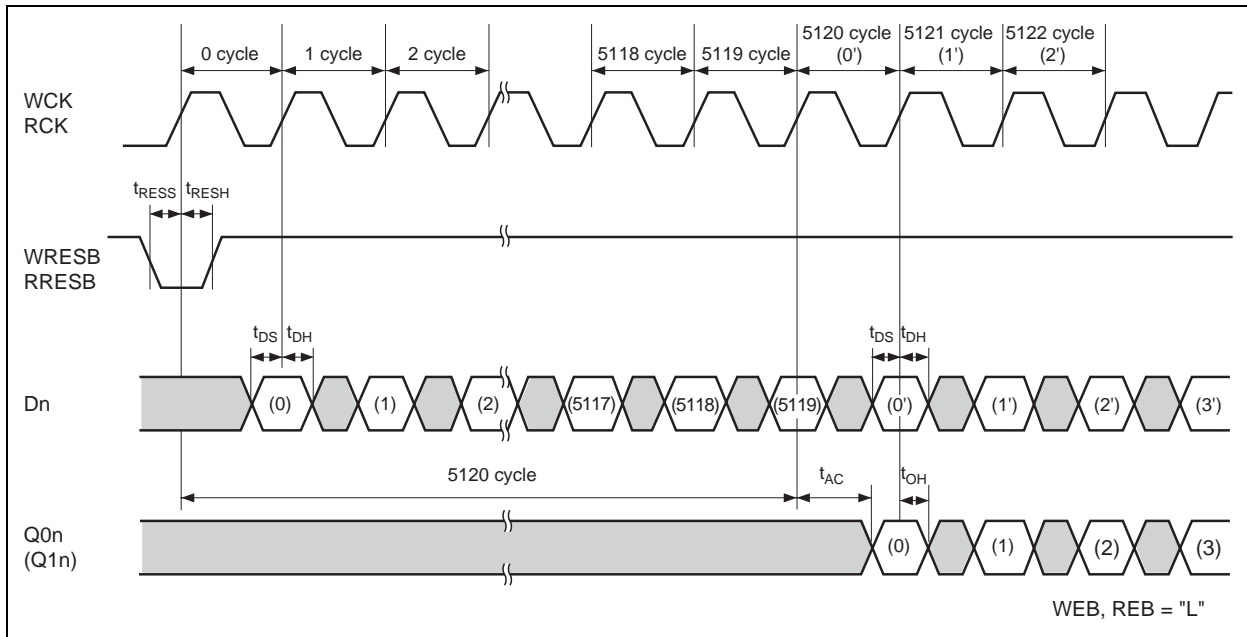
When writing operation is performed at  $n$  cycle and  $n + 1$  cycle on the writing side in the read disable period after  $n - 1$  cycle on the reading side, output at  $n$  cycle and  $n + 1$  cycle after read enable is invalid. For output at  $n + 2$  cycle and after, however, data written in the read disable period is to be output.



## Variable Length Delay Bit

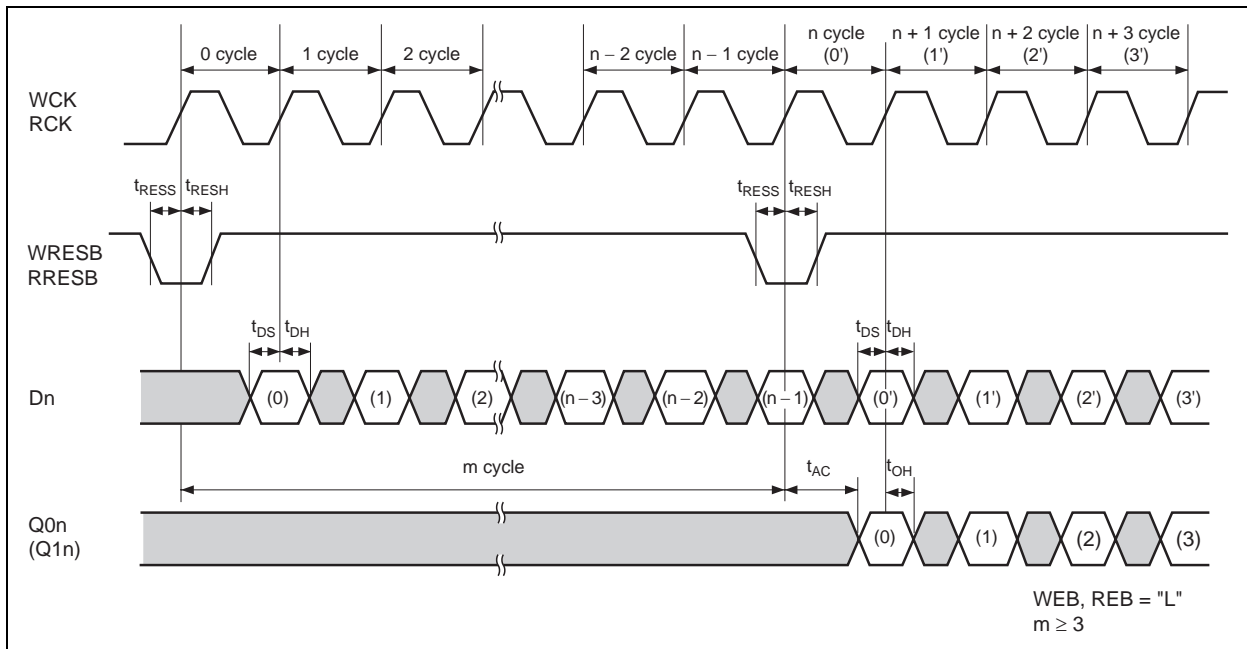
### 1 Line (5120 Bits) Delay

Input data can be written at the rising edge of WCK after write cycle and output data is read at the rising edge of RCK before read cycle to easily make 1 line delay.



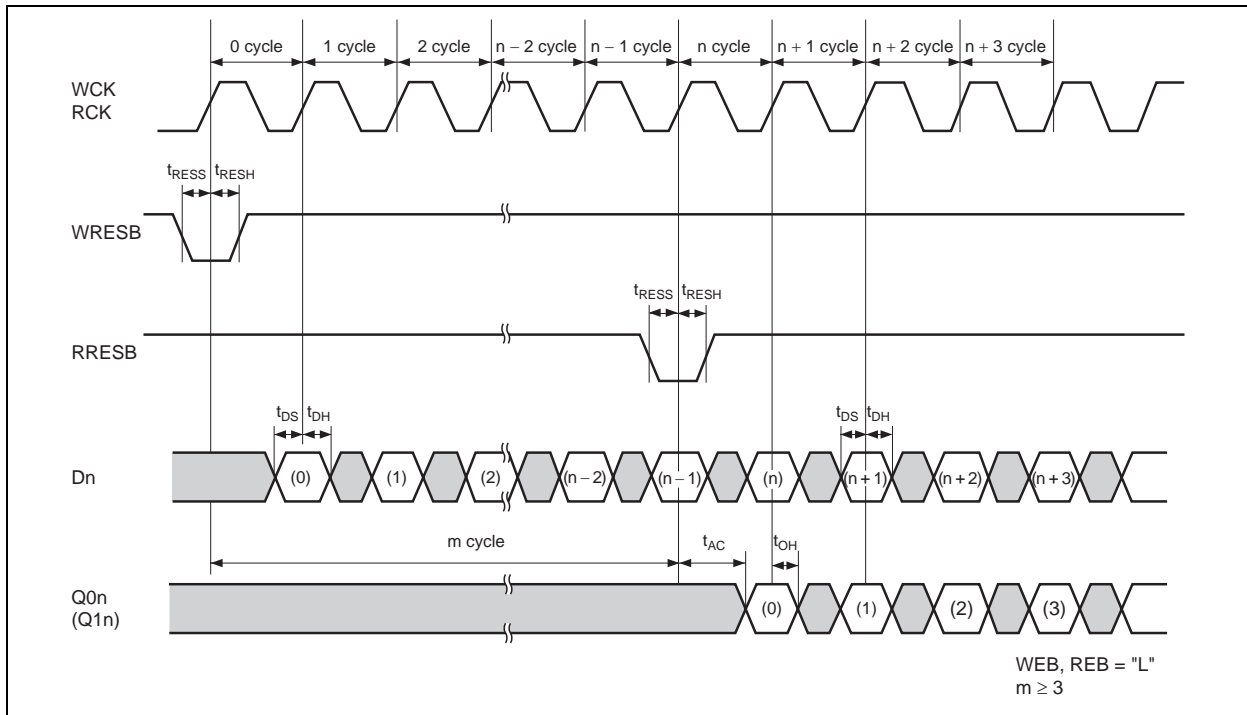
### n-bit Delay Bit

(Reset at cycles according to the delay length)



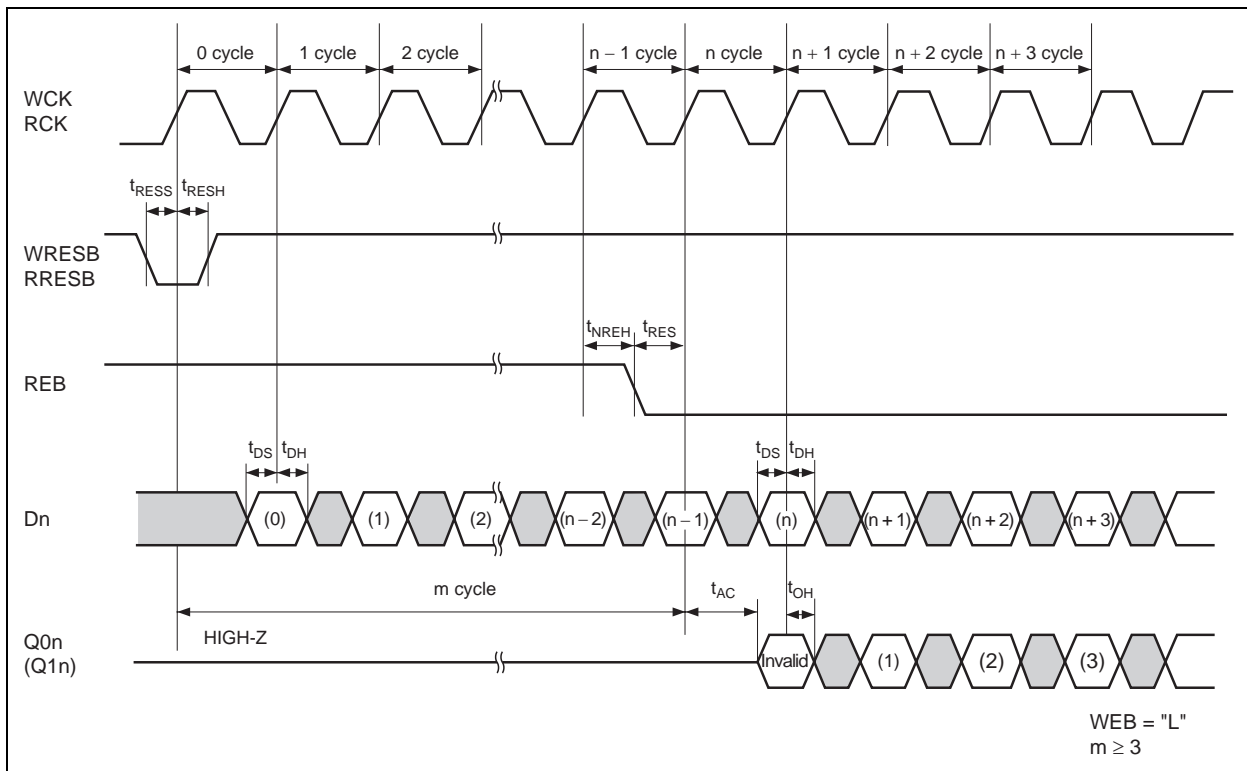
### n-bit Delay 2

(Slides input timings of WRESB and RRESB at cycles according to the delay length)



### n-bit Delay 3

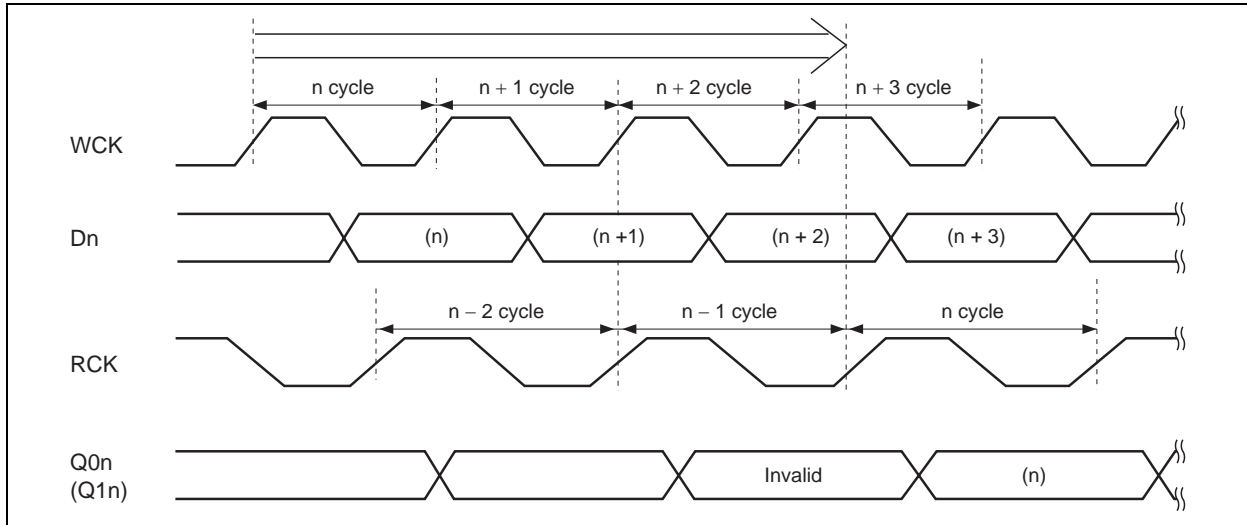
(Slides address by disabling REB in the period according to the delay length)



**Reading Shortest n-cycle Write Data "n"**

(Reading side n - 2 cycle ends after the end of writing side n + 1 cycle)

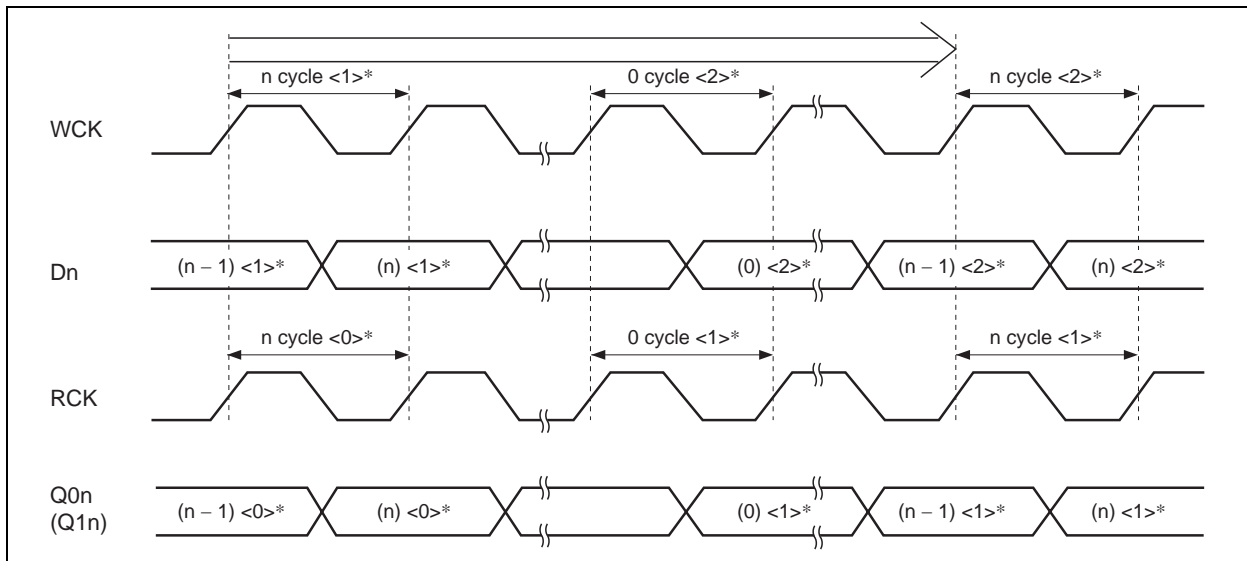
When the reading side n - 2 cycle ends before the end of the writing side n + 1 cycle, output Qn of n cycle is made invalid. In the following diagram, end of reading side n - 2 cycle and end of writing side n + 1 cycle overlap each other. This example can read n cycle data in the shortest time. When this is the case, reading operation at n - 1 cycle is invalid.



**Reading Longest n-cycle Write Data "n": 1 Line Delay**

(When writing side n-cycle <2> starts, reading side n cycle <1> then starts)

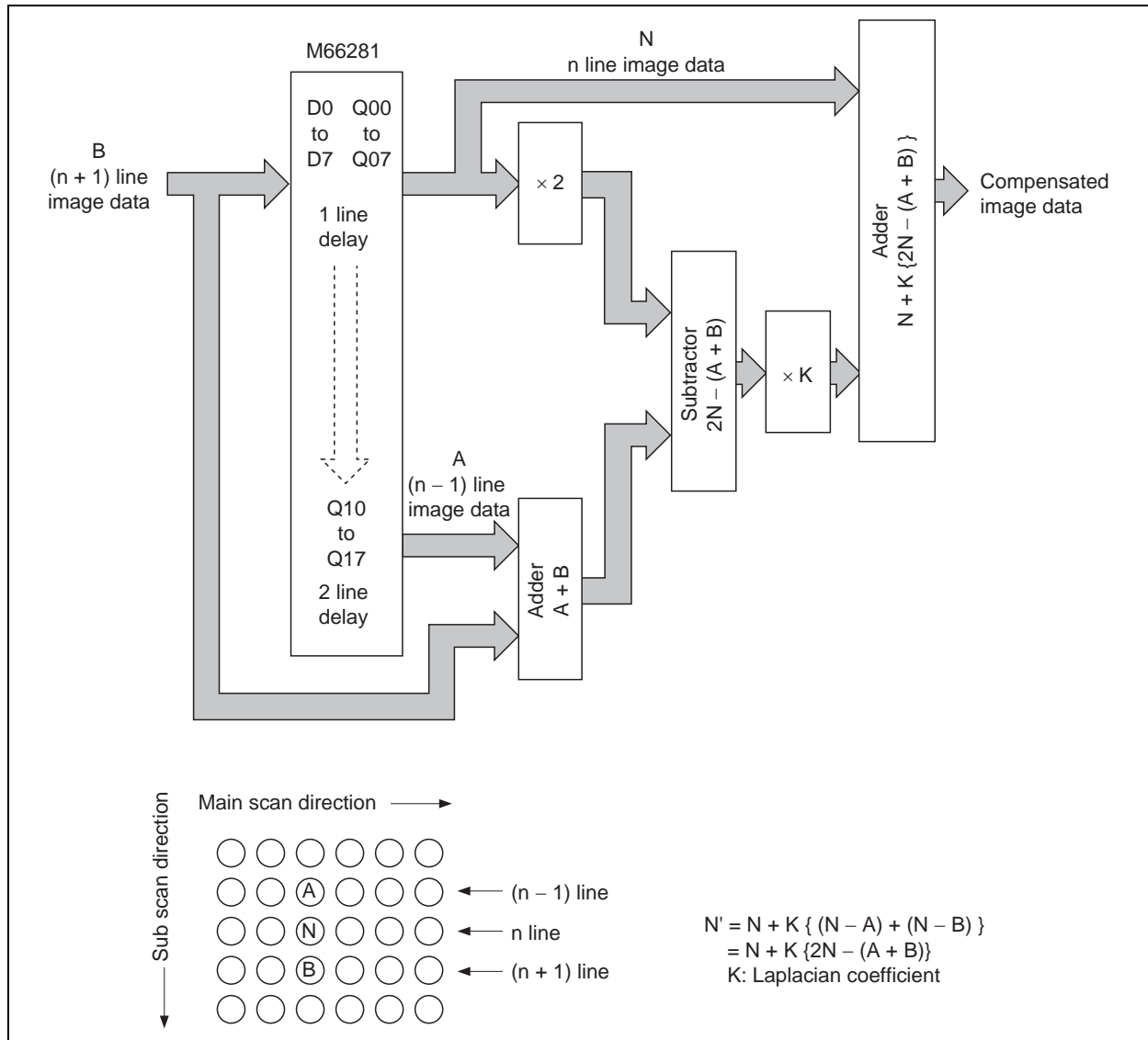
Output Qn of n cycle <1>\* can be read until the start of reading side n cycle <1> and the start of writing side n cycle <2>\* overlap each other.



Note: <0>\*, <1>\* and <2>\* indicate value of lines.

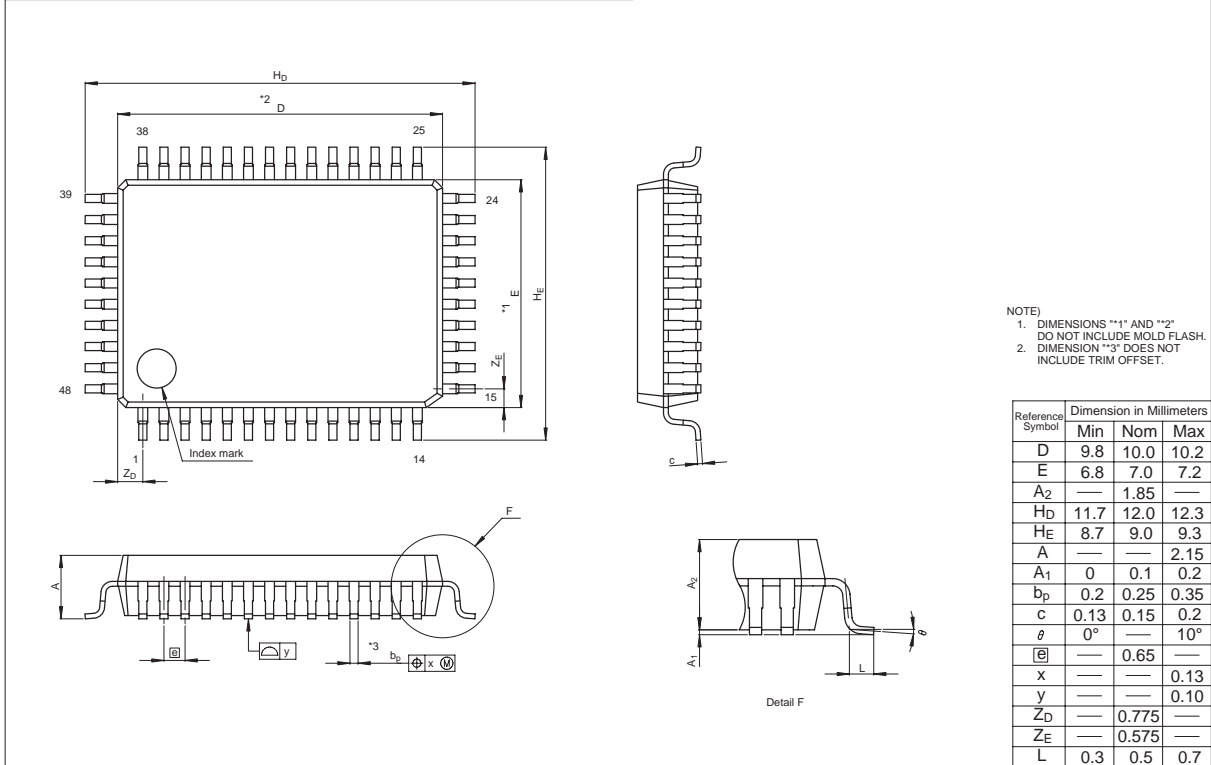
## Application Example

### Sub Scan Resolution Compensation Circuit with Laplacian Filter



### Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-QFP48-7x10-0.65	PRQP0048JA-A	48P6S-A	0.3g



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