Contents

The S-2860B and the S-2864B are low power 8K×8-bit parallel E^{2}PROMs. The S-2860B features wide operating voltage range, and the S-2864B features 5-V single power supply. Since provided with 32-byte page write function, they can perform fast programming operation.

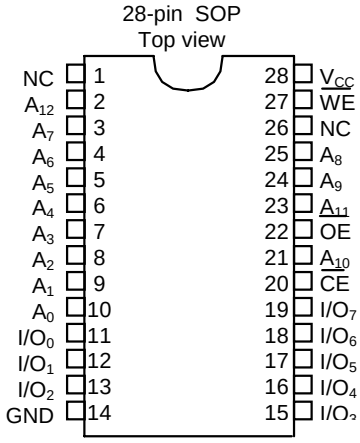
■ Features

- Access time: 150 ns
  (V_{CC}=5 V±10%, Ta=0 °C to 70 °C).
- Low power consumption.
  Operating: 30 mA max. (V_{CC}=5 V±10%)
  Standby: 1 μA max. (VCC=5 V±10%)
- Operating voltage range

	S-2860B	S-2864B
Read:	1.8 to 5.5 V	5 V±10%
Write:	2.7 to 5.5 V	5 V±10%

- Write inhibition
  S-2860B: 2.1 V typ
  S-2864B: 3.5 V typ
- Data polling
- Page write for 32 bytes
- Rewritings : 10^5 times
- Data retention: 10 years
- Program noise immunity
- Package: 28-pin SOP/TSOP
- Supply in bare chip is also available

■ Pin Assignment



Pin name	Function
A_0 to A_{12}	Address input
I/O_0 to I/O_7	Data input / output
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
V_{CC}	Power supply voltage
GND	Ground (0 V)

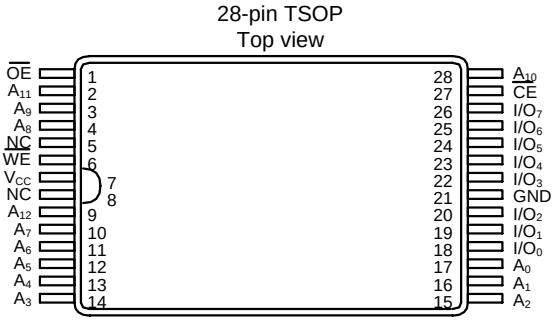


Figure 1

■ Block Diagram

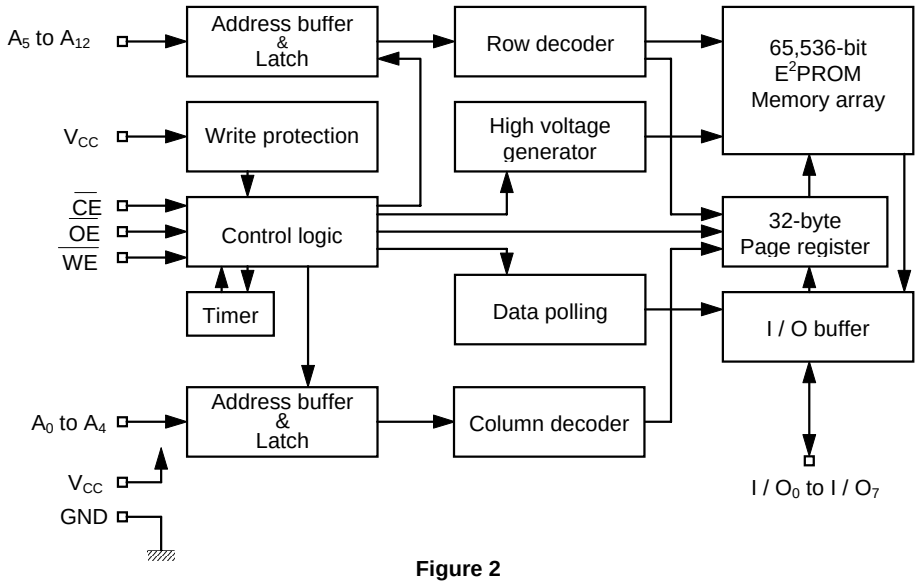


Figure 2

■ Operation Mode

Table 1

Mode	$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	I/O
Read	L	L	H	Data output
Write	L	H	L	Data input
Write inhibition	×	×	H	—
	×	L	×	—
Standby	H	×	×	High-Z

X : Don't care

■ Absolute Maximum Ratings

Table 2

Parameter	Symbol	Ratings	Unit
Power supply voltage	V_{CC}	–0.3 to +7.0	V
Input voltage	V_{IN}	–0.3 to V_{CC}+0.3	V
Output voltage	V_{OUT}	–0.3 to V_{CC}	V
Storage temperature under bias	T_{bias}	–50 to +95	°C
Storage temperature	T_{stg}	–65 to +150	°C

■ Recommended Operating Conditions

Table 3

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
Power supply voltage	V_{CC}	S-2860B	Read	1.8	—	5.5	V
			Write	2.7	—	5.5	V
		S-2864B		4.5	5.0	5.5	V
High level input voltage	V_{IH}	V_{CC}=2.7 to 5.5 V		2.2	—	V_{CC}+0.3	V
		V_{CC}=1.8 to 2.7 V		0.8×V_{CC}	—	V_{CC}+0.3	V
Low level input voltage	V_{IL}	V_{CC}=4.5 to 5.5 V		–0.3	—	0.8	V
		V_{CC}=2.7 to 4.5 V		–0.3	—	0.4	V
		V_{CC}=1.8 to 2.7 V		–0.3	—	0.2×V_{CC}	V
Operating temperature	T_{opr}			–40	—	85	°C

■ DC Electrical Characteristics

1. S-2860B

Table 4

(Ta=–40°C to 85°C)

Parameter	Symbol	Conditions	5 V±10%			3 V±10%			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
Current consumption (Read)	I_{CC1}	$\overline{CE}\le V_{IL}$, $V_{IN}\le V_{IL}$ or $V_{IN}\ge V_{IH}$ I_{OUT}=0 mA, f=1/t_{RC}	—	—	30	—	—	15	mA
	I_{CC2}	$\overline{CE}\le$0.2 V, $V_{IN}\le$0.2 V or $V_{IN}\ge V_{CC}$–0.2 V I_{OUT}=0 mA, f=1/t_{RC}	—	—	25	—	—	10	mA
Current consumption (Program)	I_{CC3}	$\overline{CE}\le V_{IL}$, $V_{IN}\le V_{IL}$ or $V_{IN}\ge V_{IH}$	—	—	30	—	—	15	mA
	I_{CC4}	$\overline{CE}\le$0.2 V, $V_{IN}\le$0.2 V or $V_{IN}\ge V_{CC}$–0.2 V	—	—	25	—	—	10	mA
Standby current	I_{SB1}	$\overline{CE}\ge V_{IH}$	—	—	1	—	—	0.5	mA
	I_{SB2}	$\overline{CE}\ge V_{CC}$–0.2 V	—	—	1.0	—	—	1.0	µA
Input leakage current	I_{LI}	V_{IN}=GND to V_{CC}	—	—	1.0	—	—	1.0	µA
Output leakage current	I_{LO}	$V_{I/O}$=GND to V_{CC}	—	—	1.0	—	—	1.0	µA
High level output voltage	V_{OH}	5-V operation: I_{OH}=–400 µA 3-V operation: I_{OH}=–100 µA	2.4	—	—	2.4	—	—	V
Low level output voltage	V_{OL}	5-V operation: I_{OL}=2.1 mA 3-V operation: I_{OL}=400 µA	—	—	0.4	—	—	0.4	V

2. S-2864B

Table 5

(Ta=–40°C to 85°C, V_{CC}=5 V±10%)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current consumption (Read)	I_{CC1}	$\overline{CE}\le V_{IL}$, $V_{IN}\le V_{IL}$ or $V_{IN}\ge V_{IH}$ I_{OUT}=0 mA, f=1/t_{RC}	—	—	30	mA
	I_{CC2}	$\overline{CE}\le$0.2 V, $V_{IN}\le$0.2 V or $V_{IN}\ge V_{CC}$–0.2 V I_{OUT}=0 mA, f=1/t_{RC}	—	—	25	mA
Current consumption (Program)	I_{CC3}	$\overline{CE}\le V_{IL}$, $V_{IN}\le V_{IL}$ or $V_{IN}\ge V_{IH}$	—	—	30	mA
	I_{CC4}	$\overline{CE}\le$0.2 V, $V_{IN}\le$0.2 V or $V_{IN}\ge V_{CC}$–0.2 V	—	—	25	mA
Standby current	I_{SB1}	$\overline{CE}\ge V_{IH}$	—	—	1	mA
	I_{SB2}	$\overline{CE}\ge V_{CC}$–0.2 V	—	—	1.0	µA
Input leakage current	I_{LI}	V_{IN}=GND to V_{CC}	—	—	1.0	µA
Output leakage current	I_{LO}	$V_{I/O}$=GND to V_{CC}	—	—	1.0	µA
High level output voltage	V_{OH}	I_{OH}=–400 µA	2.4	—	—	V
Low level output voltage	V_{OL}	I_{OL}=2.1 mA	—	—	0.4	V

■ Rewriting Times

Table 6

Parameter	Symbol	Min.	Typ.	Max.	Unit
Rewriting times	N_W	10^5	—	—	times/byte

■ Pin Capacitance

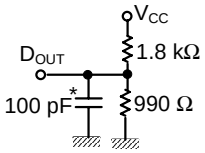
Table 7

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Input capacitance	C_{IN}	V_{IN}=0 V	—	—	10	pF
Input / output capacitance	$C_{I/O}$	$V_{I/O}$=0 V	—	—	10	pF

■ AC Electrical Characteristics

Table 8 Measuring conditions

Parameter	S-2860B	S-2864B
Input pulse levels	V_{IL}=0.2 V V_{IH}=2.4 V	V_{IL}=0.4 V V_{IH}=2.4 V
Input rise and fall time	10 ns	10 ns
I/O reference level	1.5 V	1.5 V
Output load	See Figure 3	See Figure 3



* (When measuring t_{CLZ}, t_{OLZ}, t_{CHZ}, t_{OHZ}, t_{WHZ}, t_{WLZ}) : 5pF

Figure 3 Output load measuring circuit

1. Read Cycle

(1) 5-V operation

Table 9

(V_{CC}=5 V±10%)

Parameter	Symbol	0°C to 70°C		–40°C to 85°C		Unit
		Min.	Max.	Min.	Max.	
Read cycle time	t_{RC}	150	—	200	—	ns
$\overline{CE}$ access time	t_{CE}	—	150	—	200	ns
Address access time	t_{AA}	—	150	—	200	ns
$\overline{OE}$ access time	t_{OE}	—	70	—	90	ns
Output enable time ($\overline{CE}$)	t_{CLZ}	10	—	10	—	ns
Output enable time ($\overline{OE}$)	t_{OLZ}	10	—	10	—	ns
Output disable time ($\overline{CE}$)	t_{CHZ}	10	70	10	90	ns
Output disable time ($\overline{OE}$)	t_{OHZ}	10	70	10	90	ns
Output data hold time	t_{OH}	5	—	5	—	ns

(2) 3-V operation (S-2860B only)

Table 10

(V_{CC}=3 V±10%)

Parameter	Symbol	0°C to 70°C		–40°C to 85°C		Unit
		Min.	Max.	Min.	Max.	
Read cycle time	t_{RC}	400	—	500	—	ns
$\overline{CE}$ access time	t_{CE}	—	400	—	500	ns
Address access time	t_{AA}	—	400	—	500	ns
$\overline{OE}$ access time	t_{OE}	—	200	—	250	ns
Output enable time ($\overline{CE}$)	t_{CLZ}	25	—	30	—	ns
Output enable time ($\overline{OE}$)	t_{OLZ}	25	—	30	—	ns
Output disable time ($\overline{CE}$)	t_{CHZ}	25	200	30	250	ns
Output disable time ($\overline{OE}$)	t_{OHZ}	25	200	30	250	ns
Output data hold time	t_{OH}	10	—	15	—	ns

2. Write Cycle

(1) 5-V operation

Table 11

(V_{CC}=5 V±10%)

Parameter	Symbol	0°C to 70°C		−40°C to 85°C		Unit
		Min.	Max.	Min.	Max.	
Write cycle time	t_{WC}	—	10	—	10	ms
Address setup time	t_{AS}	0	—	0	—	ns
Address hold time	t_{AH}	120	—	150	—	ns
Write setup time	t_{CS}	0	—	0	—	ns
Write hold time	t_{CH}	0	—	0	—	ns
$\overline{CE}$ pulse width	t_{CW}	120	—	150	—	ns
$\overline{OE}$ setup time	t_{OES}	15	—	20	—	ns
$\overline{OE}$ hold time	t_{OEH}	15	—	20	—	ns
$\overline{WE}$ pulse width	t_{WP}	120	—	150	—	ns
Data setup time	t_{DS}	85	—	100	—	ns
Data hold time	t_{DH}	0	—	0	—	ns
Page load time (page data setting time)	t_{PL}	0.3	30	0.3	30	µs
Page load time (page data write start time)	t_{PDL}	100	—	100	—	µs

(2) 3-V operation (S-2860B only)

Table 12

(V_{CC}=3 V±10%)

Parameter	Symbol	0°C to 70°C		−40°C to 85°C		Unit
		Min.	Max.	Min.	Max.	
Write cycle time	t_{WC}	—	10	—	10	ms
Address setup time	t_{AS}	0	—	0	—	ns
Address hold time	t_{AH}	300	—	350	—	ns
Write setup time	t_{CS}	0	—	0	—	ns
Write hold time	t_{CH}	0	—	0	—	ns
$\overline{CE}$ pulse width	t_{CW}	300	—	350	—	ns
$\overline{OE}$ setup time	t_{OES}	30	—	35	—	ns
$\overline{OE}$ hold time	t_{OEH}	30	—	35	—	ns
$\overline{WE}$ pulse width	t_{WP}	300	—	350	—	ns
Data setup time	t_{DS}	180	—	210	—	ns
Data hold time	t_{DH}	0	—	0	—	ns
Page load time (page data setting time)	t_{PL}	0.3	30	0.3	30	µs
Page load time (page data write start time)	t_{PDL}	100	—	100	—	µs

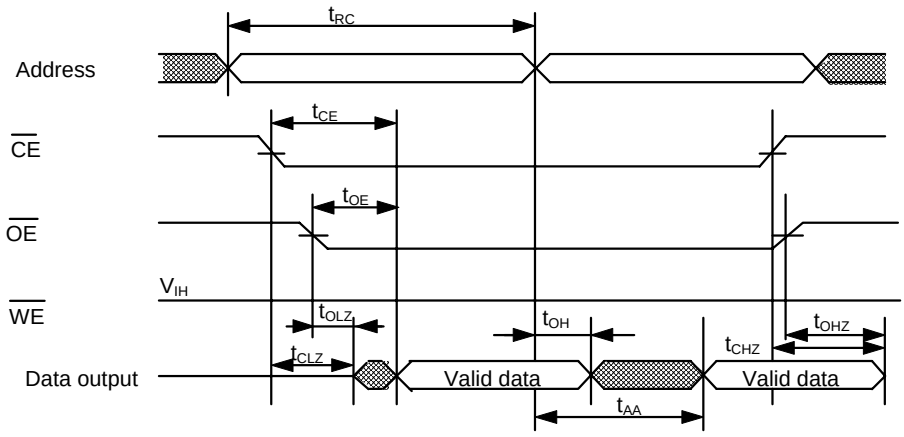


Figure 4 Read cycle

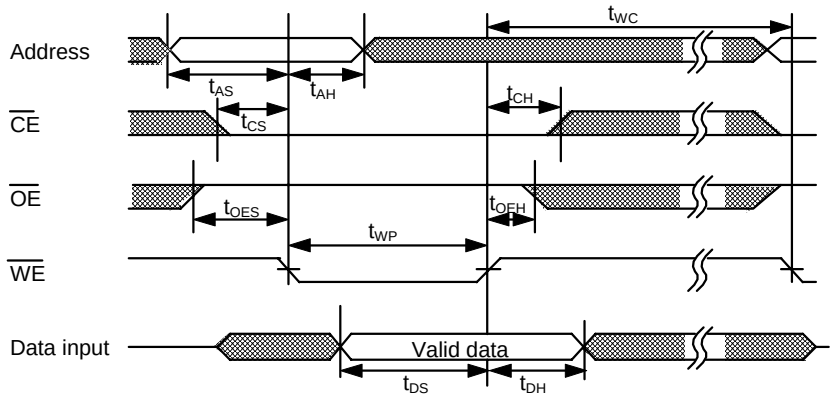


Figure 5 $\overline{WE}$ controlled write cycle

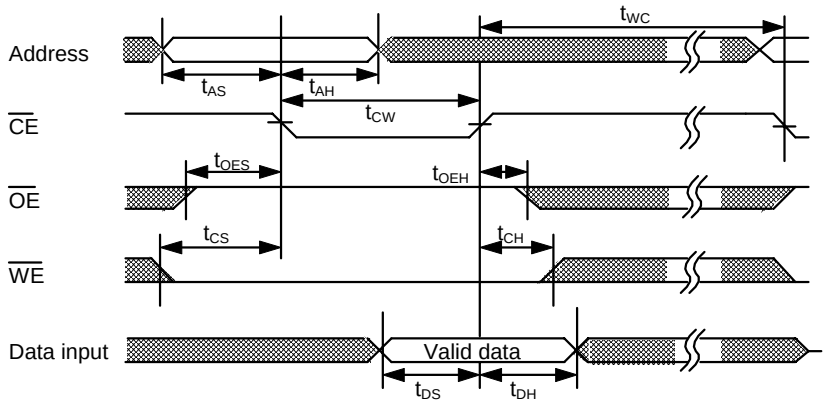


Figure 6 $\overline{CE}$ controlled write cycle

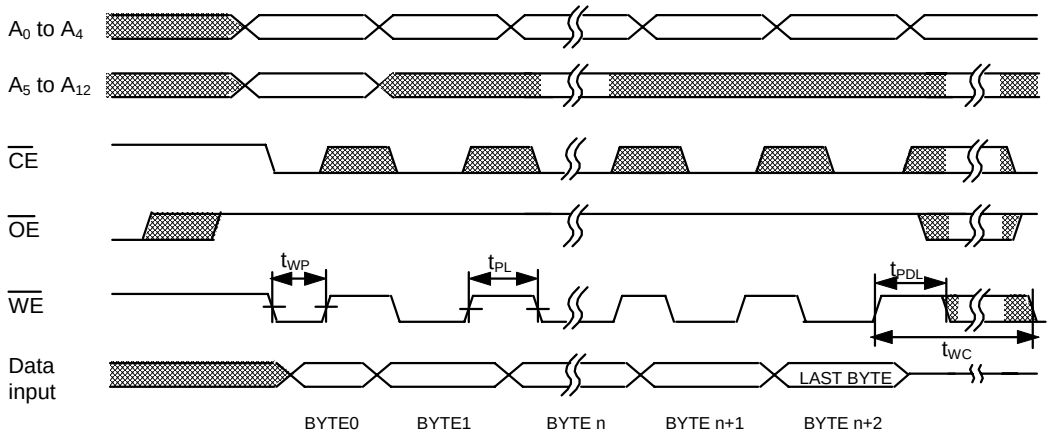


Figure 7 Page write cycle

■ Operation

(1) Read mode
This mode outputs data to I/O_0 to I/O_7 when both $\overline{CE}$ and $\overline{OE}$ are low and when $\overline{WE}$ is high. The data bus is high impedance when either $\overline{CE}$ or $\overline{OE}$ is high.

(2) Byte write mode
A byte write cycle starts when both $\overline{CE}$ and $\overline{WE}$ are low and $\overline{OE}$ is high. $\overline{CE}$-and $\overline{WE}$-controlled write cycles are available. The address is latched at the falling of $\overline{CE}$ or $\overline{WE}$ whichever occurs last, and the data is latched at the rising of $\overline{CE}$ or $\overline{WE}$ whichever occurs first.

(3) Page write mode
In this mode, 1 page program operation of 32 bytes is completed in 10 ms, and all memory area is written within 3 second because the device organization is 256-page × 32-byte. When starting this mode, first, addresses A_5 to A_{12} assign the page, then A_0 to A_4 assign the address to each byte within the page sequencially or at random. Less than 32 bytes of program is available. This address assignment is performed while 0.3 µs≤t_{PL}≤30 µs, and the program operation starts when t_{PDL}≥100 µs.

(4) Data polling
This function is to output the complement data written last on I/O_7 and to output low to I/O_0 to I/O_6. This operation is performed by read operation during write cycle.

(5) Erase all mode
All data is erased when $\overline{OE}$ is 13 V and both $\overline{CE}$ and $\overline{WE}$ are low. During erase all mode, A_0 to A_{12} and I/O_0 to I/O_7 must be fixed to either high or low.

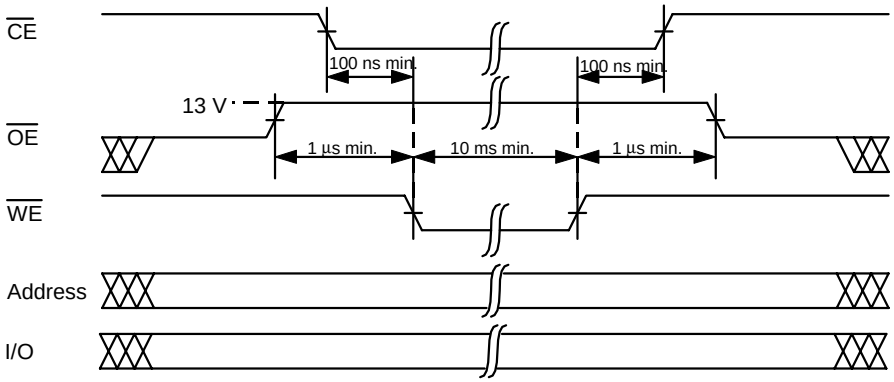


Figure 8

(6) Write inhibition
Write operation is inhibited in the following cases :
- When power supply voltage is under write inhibit voltage (V_{WI}).
  S-2864B : V_{WI}=3.5 V typ.
  S-2860B : V_{WI}=2.1 V typ.
- When $\overline{OE}$ is low, or $\overline{WE}$ is high.

(7) Program noise immunity
$\overline{CE}$, $\overline{OE}$ and $\overline{WE}$ are noise protected for preventing erroneous write operation of power on and off. Less than 20 ns write pulse will not activate a write cycle at 5-V opeation, and less than 50 ns at 3-V operation. See Figure 9.

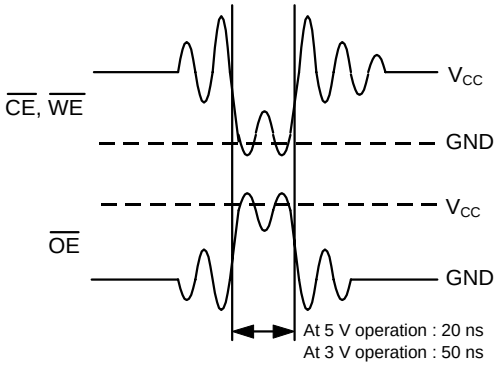


Figure 9

■ Dimensions (Unit : mm)

1. 28-pin DIP

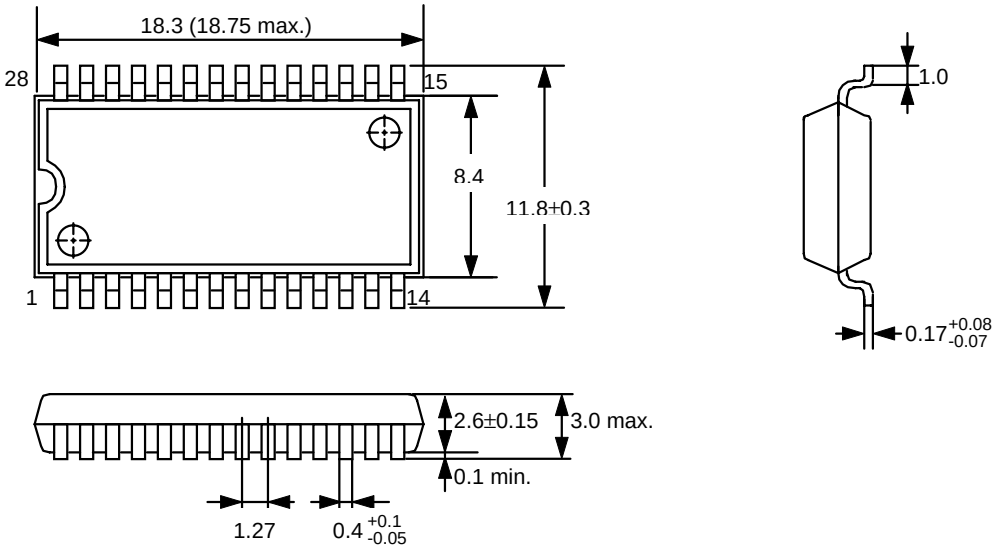


Figure 10

2. 28-pin TSOP

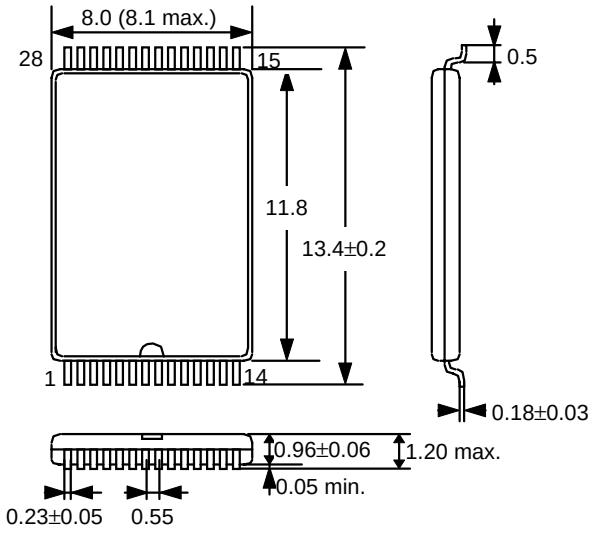


Figure 11

■ Ordering Information

S-286XB XX - XXX

Access time
150 : 150 ns (5 V±10%, 0°C to 70°C)

Package
FE : SOP
TF : TSOP
CA : Bare chip

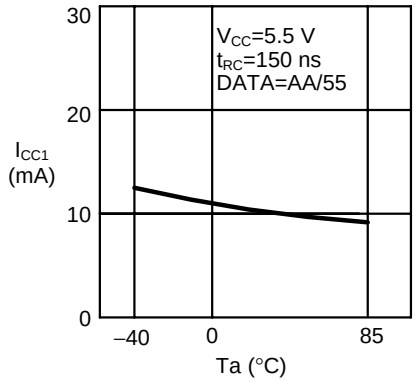
Product name
S-2860B : 1.8 V to 5.5 V (Read)
: 2.7 V to 5.5 V (Write)
S-2864B : 5 V±10%

Note: Each bit is set to 1 before delivery (except bare chip)

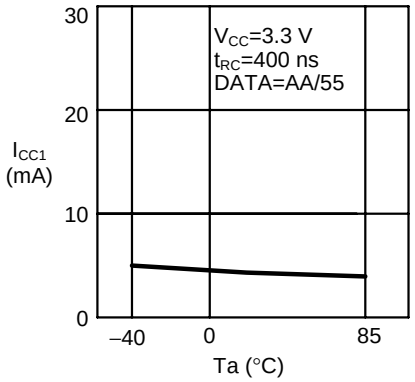
■ Characteristics

1. DC characteristics

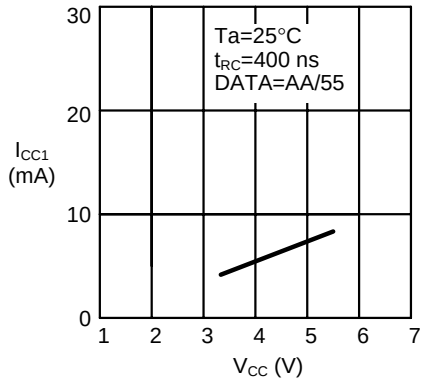
1.1 Current consumption (READ) I_{CC1} – Ambient temperature Ta



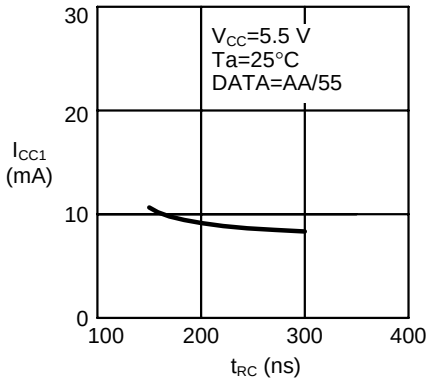
1.2 Current consumption (READ) I_{CC1} – Ambient temperature Ta



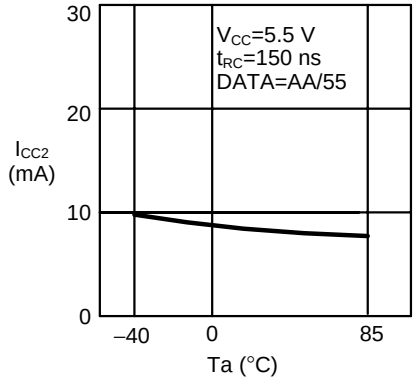
1.3 Current consumption (READ) I_{CC1} – Power supply voltage V_{CC}



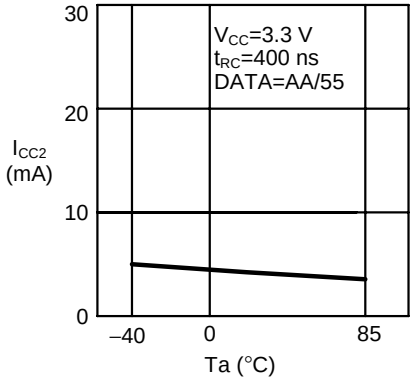
1.4 Current consumption (READ) I_{CC1} – Read cycle time t_{RC}



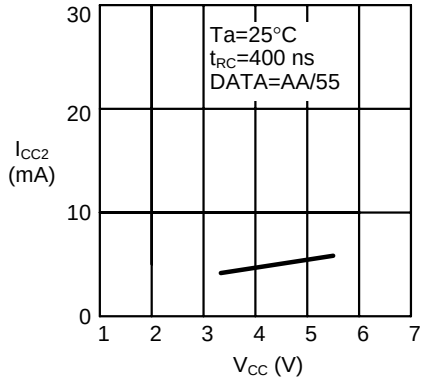
1.5 Current consumption (READ) I_{CC2} – Ambient temperature Ta



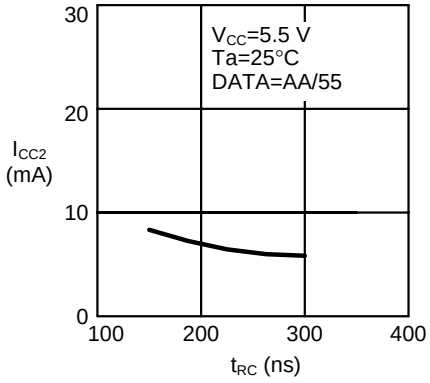
1.6 Current consumption (READ) I_{CC2} – Ambient temperature Ta



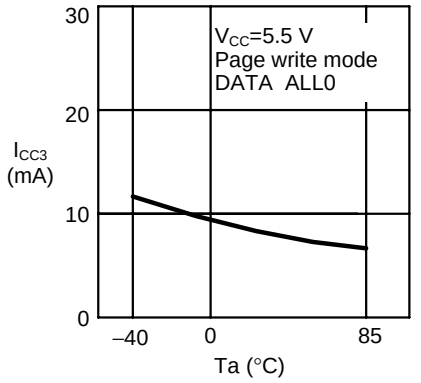
1.7 Current consumption (READ) I_{CC2} – Power supply voltage V_{CC}



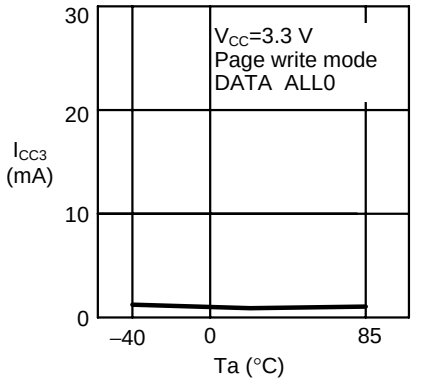
1.8 Current consumption (READ) I_{CC2} – Read cycle time t_{RC}



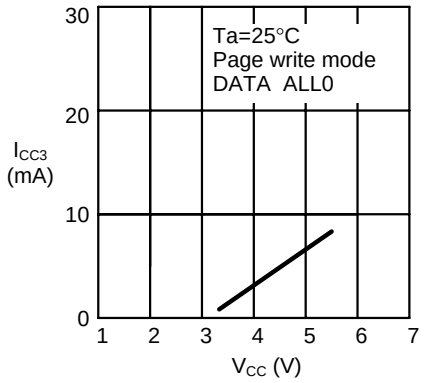
1.9 Current consumption (PROGRAM) I_{CC3} – Ambient temperature Ta



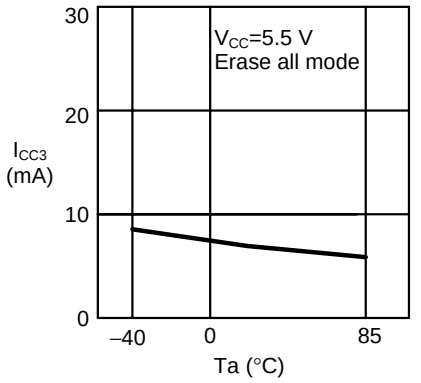
1.10 Current consumption (PROGRAM) I_{CC3} – Ambient temperature Ta



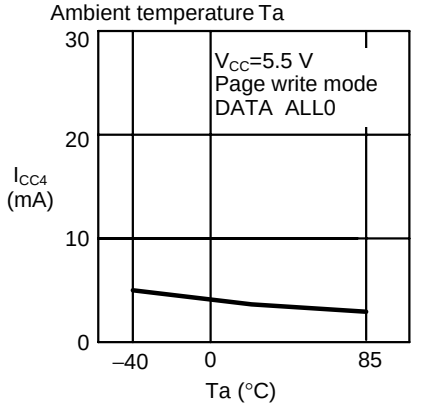
1.11 Current consumption (PROGRAM) I_{CC3} – Power Supply Voltage V_{CC}



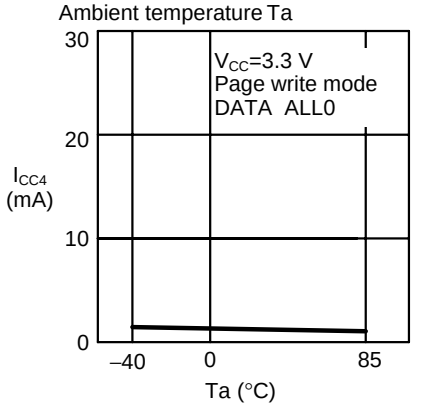
1.12 Current consumption (PROGRAM) I_{CC3} – Ambient temperature Ta



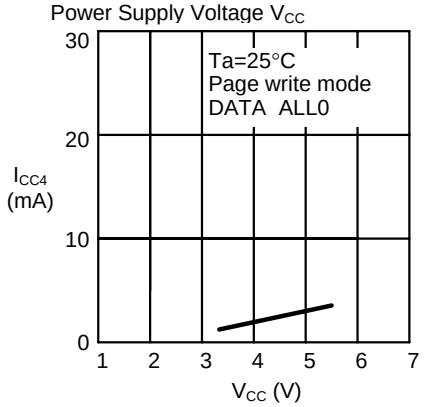
1.13 Current consumption (PROGRAM) I_{CC4} – Ambient temperature Ta



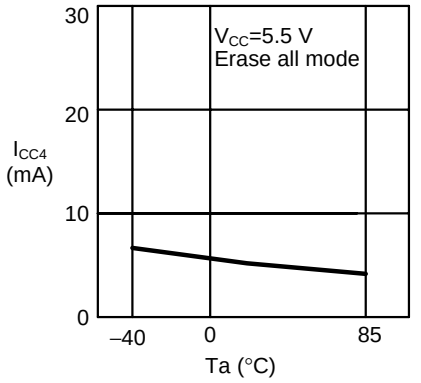
1.14 Current consumption (PROGRAM) I_{CC4} – Ambient temperature Ta



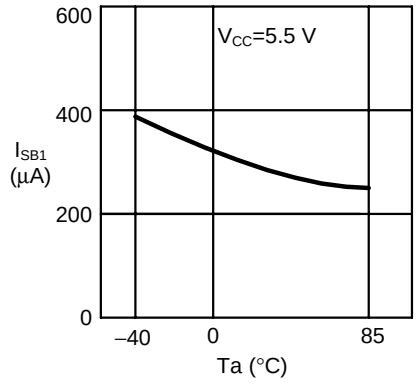
1.15 Current consumption (PROGRAM) I_{CC4} – Power Supply Voltage V_{CC}



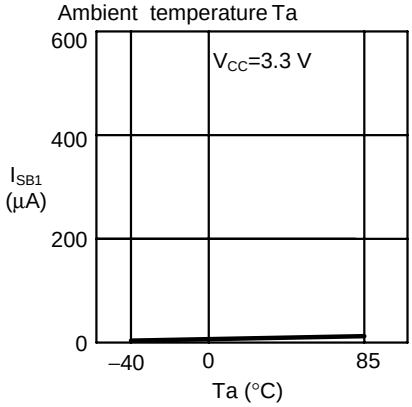
1.16 Current consumption (PROGRAM) I_{CC4} – Ambient temperature Ta



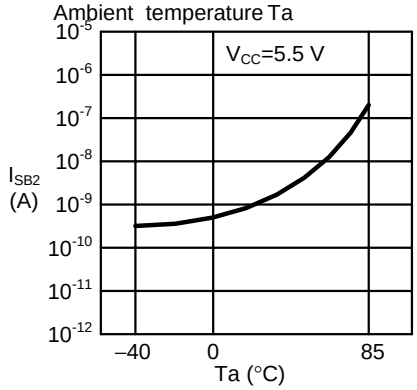
1.17 Standby current I_{SB1} – Ambient temperature Ta



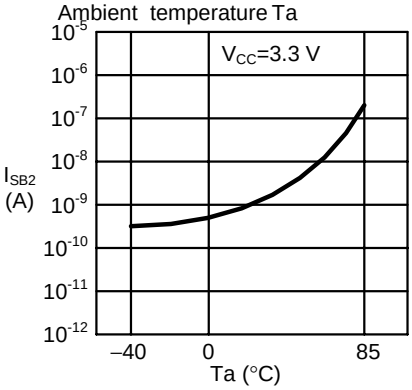
1.18 Standby current I_{SB1} – Ambient temperature Ta



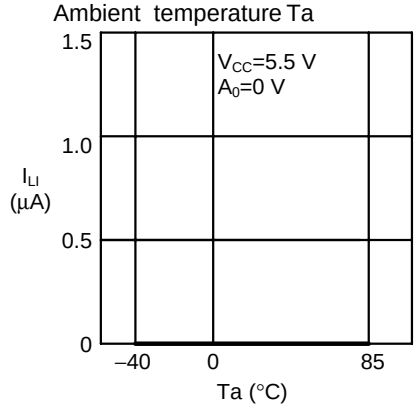
1.19 Standby current I_{SB2} – Ambient temperature Ta



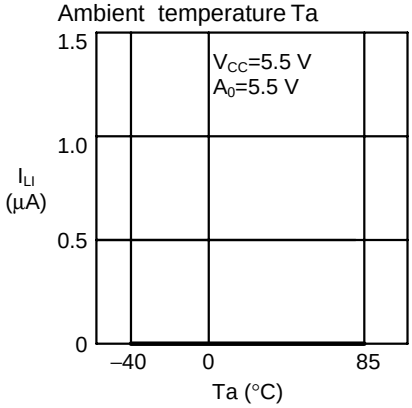
1.20 Standby current I_{SB2} – Ambient temperature Ta



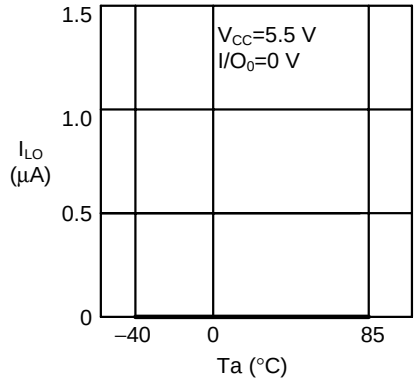
1.21 Input leakage current I_{LI} – Ambient temperature Ta



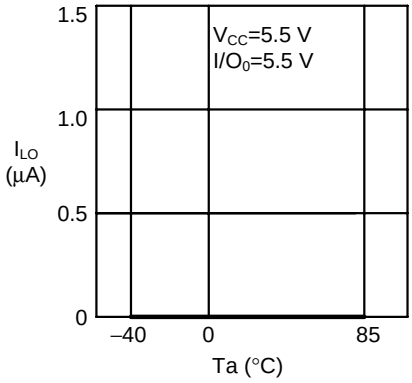
1.22 Input leakage current I_{LI} – Ambient temperature Ta



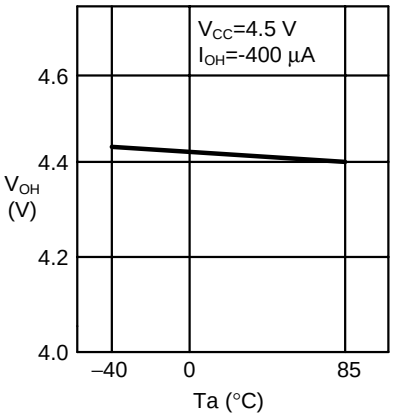
1.23 Output leakage current I_{LO} – Ambient temperature Ta



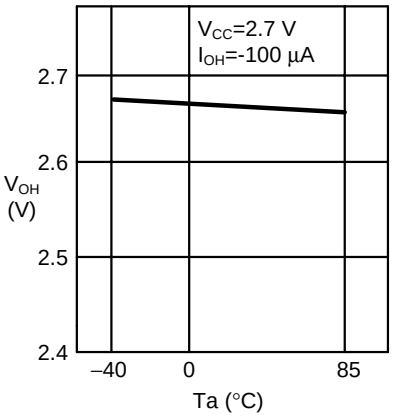
1.24 Output leakage current I_{LO} – Ambient temperature Ta



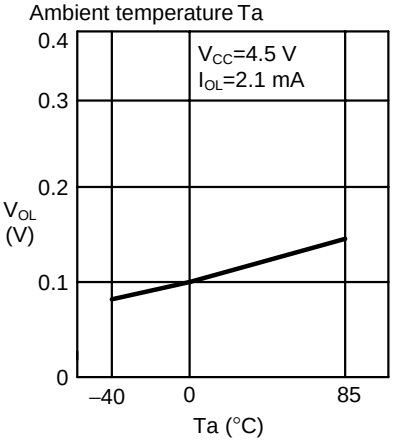
1.25 High level output voltage V_{OH} – Ambient temperature Ta



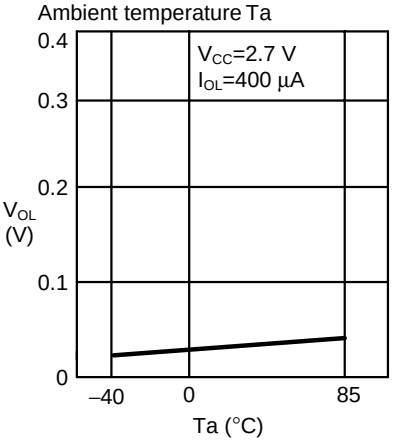
1.26 High level output voltage V_{OH} – Ambient temperature Ta



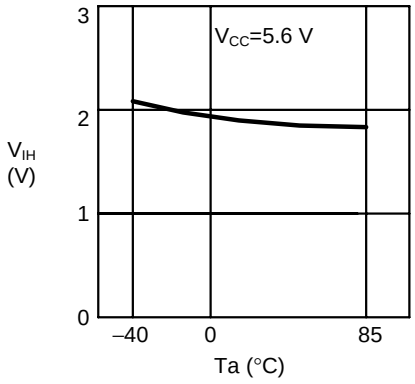
1.27 Low level output voltage V_{OL} – Ambient temperature Ta



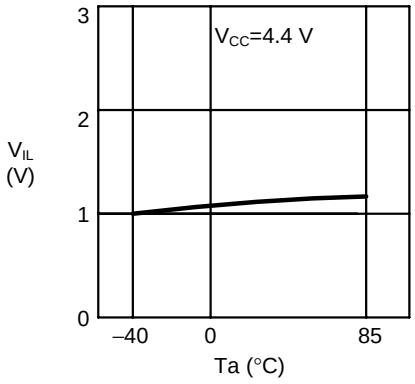
1.28 Low level output voltage V_{OL} – Ambient temperature Ta



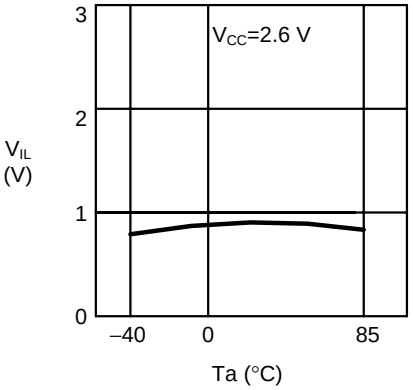
1.29 High level input voltage V_{IH} – Ambient temperature Ta



1.30 Low level input voltage V_{IL} – Ambient temperature Ta

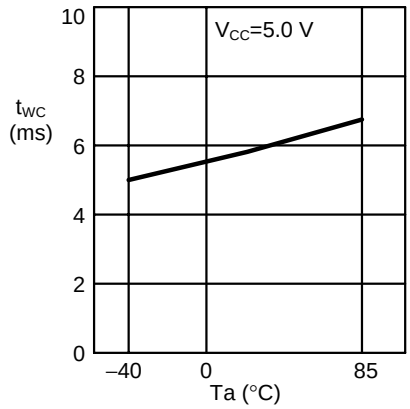


1.31 Low level input voltage V_{IL} – Ambient temperature Ta

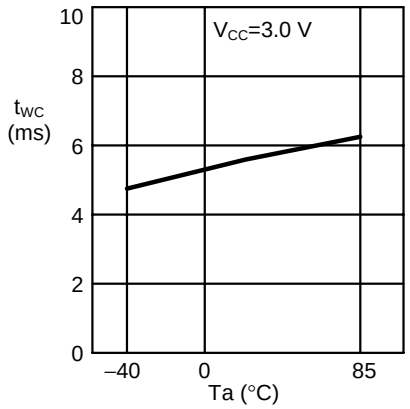


2. AC characteristics

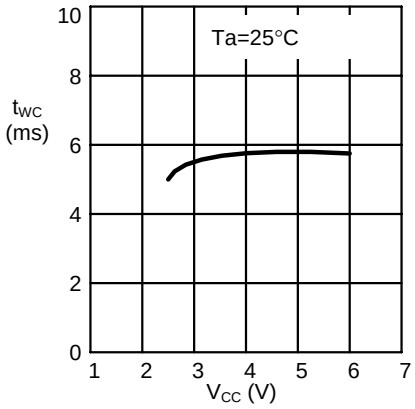
2.1 Write cycle time t_{WC} – Ambient temperature Ta



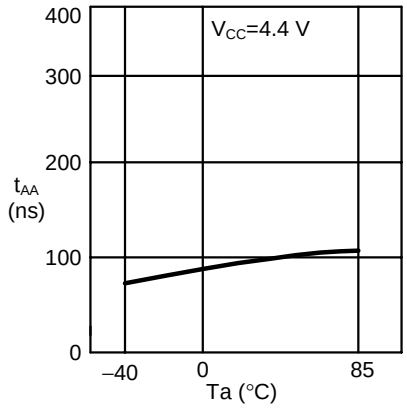
2.2 Write cycle time t_{WC} – Ambient temperature Ta



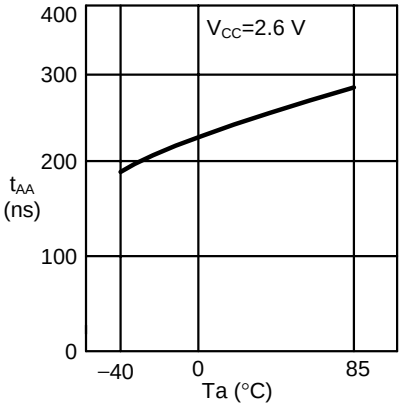
2.3 Write cycle time t_{WC} – Power supply voltage V_{CC}



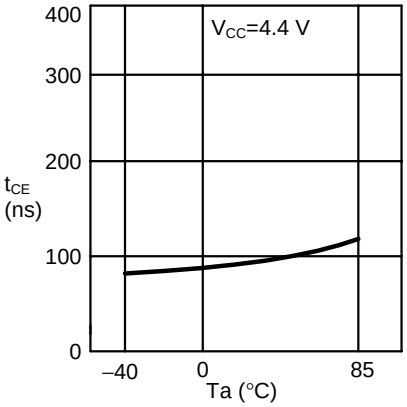
2.4 Address access time t_{AA} – Ambient temperature Ta



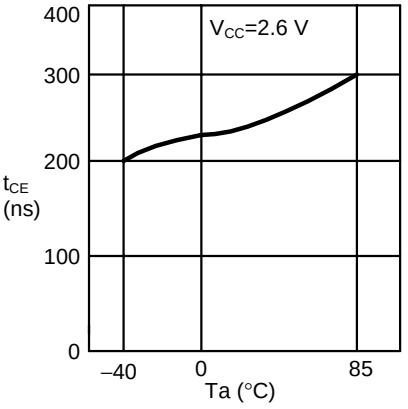
2.5 Address access time t_{AA} – Ambient temperature Ta



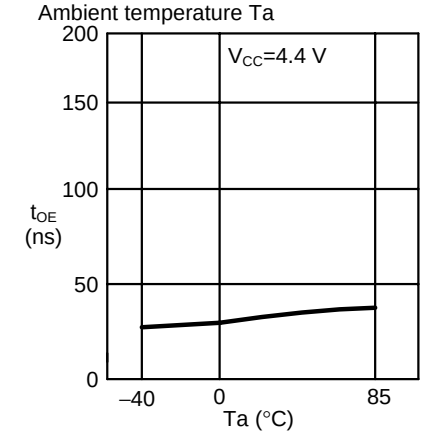
2.6 $\overline{CE}$ access time t_{CE} – Ambient temperature Ta



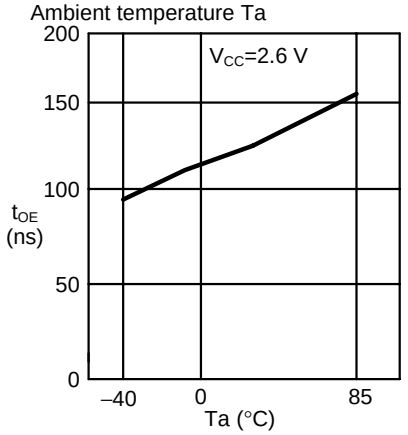
2.7 $\overline{CE}$ access time t_{CE} – Ambient temperature Ta



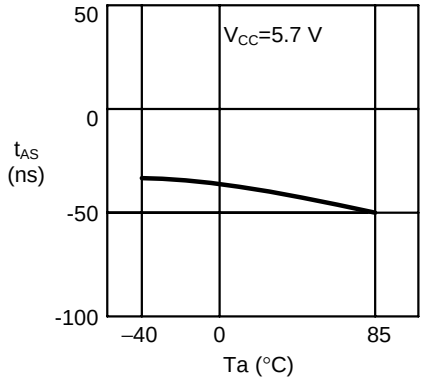
2.8 $\overline{OE}$ access time t_{OE} – Ambient temperature Ta



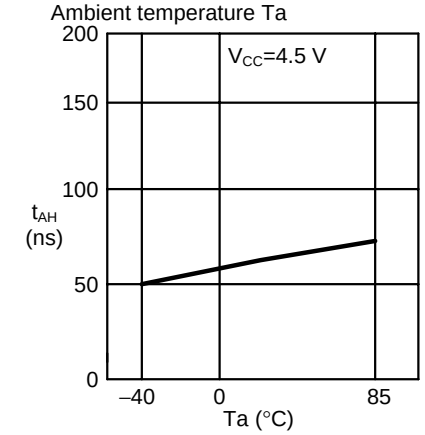
2.9 $\overline{OE}$ access time t_{OE} – Ambient temperature Ta



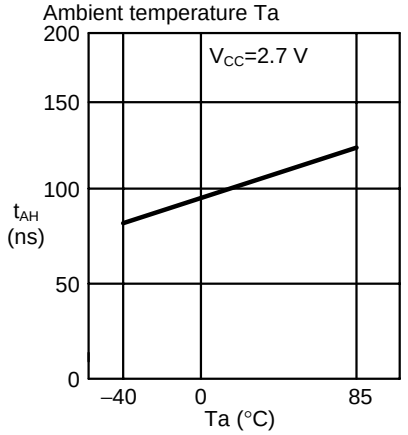
2.10 Address setup time t_{AS} – Ambient temperature Ta



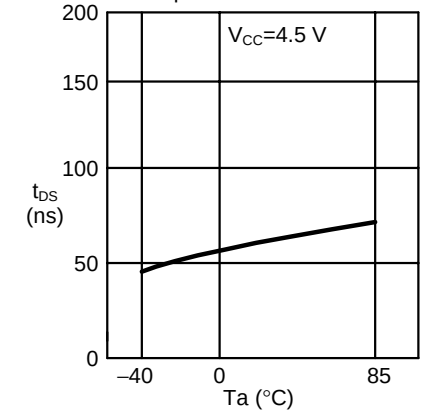
2.11 Address hold time t_{AH} – Ambient temperature Ta



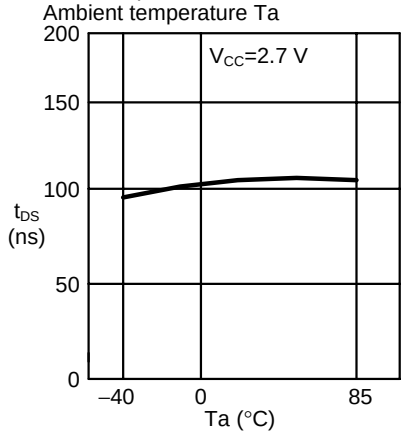
2.12 Address hold time t_{AH} – Ambient temperature Ta



2.13 Data setup time t_{DS} – Ambient temperature Ta



2.14 Data setup time t_{DS} – Ambient temperature Ta



2.15 Data hold time t_{DH} – Ambient temperature Ta