Ver 1.2

Radiation-Hardened SRAM

Datasheet

Part Number： B28F256RH

中国航天 北京微电子技术研究所
Beijing Microelectronics Technology Institute

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Version No.	Publish Time	Revised Chapter	Revise Introduction	Note
1.0	2017.1		Document creation	
1.1	2018.7	7	Recommended Operating Conditions	
1.2	2018.10		Text and wording modifications	

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1. Features

- Asynchronous operation, functionally compatible with Aeroflex UT28F256QLE PROM
- 45 ns maximum access time (-55°C ~ 125°C)
- TTL compatible inputs and TTL/CMOS compatible outputs levels, three-state bidirectional data bus
- Voltage supply: 4.5V ~ 5.5V
- Operational environment:
  Total-dose: 100 K Rad (Si)
  SEL: ≥75 MeV·cm^2/mg
  SEU (Logic): ≥37 MeV·cm^2/mg
  SEU (Memory Cell): ≥75 MeV·cm^2/mg
- Packaging options:
  28-lead FP
  28-lead DIP

2. General Description

The B28F256RH PROM is a high performance, asynchronous, radiation-hardened, 32K x 8 programmable memory device. The B28F256RH PROM features fully asynchronous operation requiring no external clocks or timing strobes and is functionally compatible with Aeroflex UT28F256QLE . B28F256RH needs to be programmed by the special programmer. The combination of radiation-hardness, fast access time, and low power consumption make the B28F256RH ideal for high speed systems designed for operation in radiation environments.

3. Pin Description

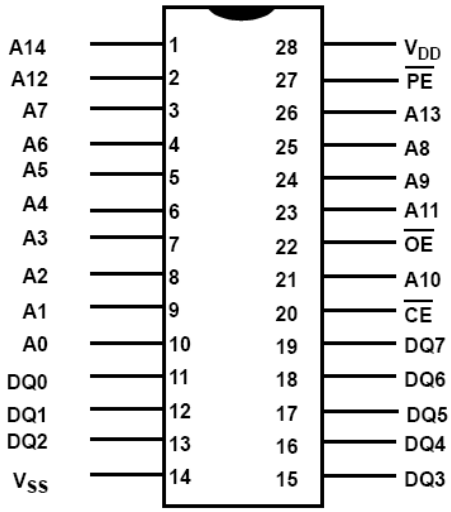


Figure 1 B28F256RH PROM Pin Figuration

Table 1. Pin Names

Pin Names	Functions
A0~A14	Address
DQ0~DQ7	Data Input / Output
$\overline{CE}$	Chip Enable (Active Low)
$\overline{PE}$	Program Enable (Active Low)
$\overline{OE}$	Output Enable (Active Low)
V_{DD}	Power (5 V)
V_{SS}	Ground

4. Pin Configurations（Appendix 1）

5. Product Description

5.1 Function Description

The B28F256RH has three control inputs: Chip Enable ($\overline{CE}$), Program Enable ($\overline{PE}$), and Output Enable ($\overline{OE}$); fifteen address inputs, A(14:0); and eight bidirectional data lines, DQ(7:0). $\overline{CE}$ is the device enable input that controls chip selection, active, and standby modes. Asserting $\overline{CE}$ causes the decode of the fifteen address inputs and one of 32,768 words in the memory is selected. $\overline{PE}$ controls program and read operations. During a read cycle, $\overline{OE}$ must be asserted to enable the outputs.

Table 2. Device Operation Truth Table

Inputs			Outputs	
$\overline{OE}$	$\overline{PE}$	$\overline{CE}$	I/O Mode	Mode
X[1]	1	1	DQ(7:0) 3-State	Standby
0	1	0	DQ(7:0) Data out	Read
1	0	0	DQ(7:0) Data in	Write
1	1	0	DQ(7:0) 3-State	Read

Notes: The other combinations of $\overline{CE}$, $\overline{PE}$, and $\overline{OE}$, which are not listed in the table are not allowed.

1. X = Don't care

◆ **Read Cycle**

A combination of $\overline{PE}$ greater than V_{IH}(min) and $\overline{CE}$ less than V_{IL}(max) defines a read cycle. When $\overline{OE}$ is asserted, the data can be get from DQ(7:0). Read access time is measured from the latter of chip enable, output enable, or valid address to

valid data output.

Read Cycle 1, the Address Access in Figure 2, is initiated by a change in address inputs while the chip is enabled with $\overline{OE}$ asserted and $\overline{PE}$ deasserted. Valid data appears on data outputs DQ (7:0) after the specified t_{AVQV} is satisfied. Outputs remain active throughout the entire cycle. As long as chip enable and output enable are active, the address inputs may change at a rate equal to the minimum read cycle time (t_{AVAV}).

Read Cycle 2, the Chip Enable-controlled Access in Figure 3, is initiated by $\overline{CE}$ going active while $\overline{OE}$ remains asserted，$\overline{PE}$ remains deasserted, and the addresses remain stable for the entire cycle. After the specified t_{ETQV} is satisfied, the 8-bit word addressed by A (14:0) is accessed and appears at the data outputs DQ (7:0).

Read Cycle 3, the Output Enable-controlled Access in Figure 4, is initiated by $\overline{OE}$ going active while $\overline{CE}$ is asserted, $\overline{PE}$ is deasserted, and the addresses are stable. Read access time is t_{GLQV} unless t_{AVQV} or t_{ELQV} have not been satisfied.

5.2 Recommended Operating Conditions

Table 3. Recommended Operating Conditions

Symbol	Parameter	Limits
V_{DD}	Positive supply voltage	4.5 V ~ 5.5 V
T_C	Case temperature range	-55℃ ~ +125℃
V_I	DC input voltage	0 V ~ V_{DD}

$\overline{PE}$ should be tied to V_{DD} when the device is used.

6. Electrical Characteristics

6.1 DC Electrical Characteristics

Table 4. DC Parameter Table

Parameter	Symbol	Condition -55°C≤T≤125°C; 4.5V≤V_{DD}≤5.5V	Limits		UNIT
			MIN	MAX	
High-level output voltage	V_{OH1}	V_{DD}=4.5V, I_{OH}= -100μA（CMOS）	V_{DD}-0.1	—	V
	V_{OH2}	V_{DD}=4.5V, I_{OH}= -4mA（TTL）	2.4	—	V
Low-level output voltage	V_{OL1}	V_{DD}=4.5V, I_{OL}= 100μA （CMOS）	—	V_{SS}+0.1	V
	V_{OL2}	V_{DD} =4.5V, I_{OL}= 4mA（TTL）	—	0.4	
High-level input voltage	V_{IH}	TTL	2.4	—	V
Low-level input voltage	V_{IL}	TTL	—	0.8	V
Supply current operating @22.2MHz	$I_{DD(OP)}$	I_{OUT}=0， V_{IL}= V_{SS}+0.2V， V_{IH}= V_{DD} -0.25V， V_{DD} =5.5V， $\overline{P}\,\overline{E}$=5.5V， f=22.2MHz	—	50	mA
Supply current standby	$I_{DD(SB)}$	I_{OUT}=0 ， V_{IL}=V_{SS}+0.25V ， V_{IH}= V_{DD}-0.25V， $\overline{C}\,\overline{E}$ =V_{DD}-0.25V， $\overline{P}\,\overline{E}$ =5.5V ， V_{DD} =5.5V	—	10	mA
Input leakage current	I_{IN}	V_I = 5.5V and 0V, T_A=25°C (all inputs except $\overline{P}\,\overline{E}$)	-0.1	0.1	μA
		V_I= 5.5V， T_A=25°C ($\overline{P}\,\overline{E}$)	—	10	μA
		V_I = 5.5V and 0V, T_A=-55°C and 125°C(all inputs except $\overline{P}\,\overline{E}$)	-1	1	μA
		V_I= 5.5V， T_A=-55°C and 125°C ($\overline{P}\,\overline{E}$)	—	10	μA
Three-state output leakage current	I_{OZ}	V_O = 0V~ V_{DD} ， V_{DD} =5.5V $\overline{O}\,\overline{E}$ =5.5V， T_A=25℃	-0.1	0.1	μA
		V_O = 0V~ V_{DD} ， V_{DD} =5.5V $\overline{O}\,\overline{E}$ =5.5V， T_A=125℃ and -55℃	-1	1	μA
Pin capacitance	C	f =1 MHz，T_A=25°C，open V_{DD}(FP28)	—	15	pF
		f =1 MHz，T_A=25°C，open V_{DD}(DIP28)	—	15	pF

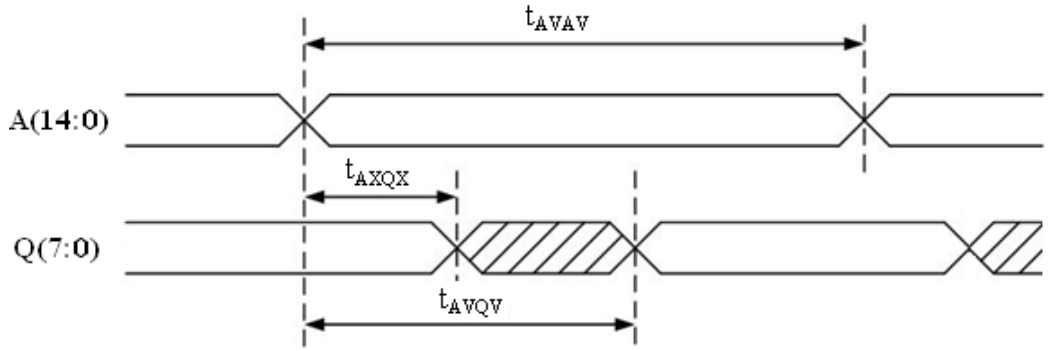
6.2 Read Cycle AC Electrical Characteristics

Table 5. Read Cycle AC Parameters

Parameter	Symbol	Condition ($4.5V \leq V_{DD} \leq 5.5$ V, $-55\ °C \leq T_A \leq 125\ °C$)	Limits		Unit
			MIN	MAX	
Read cycle time1	t_{AVAV}	Figure 2	45	—	ns
Read access time23	t_{AVQV}		—	45	ns
Output hold time	t_{AXQX}		0		ns
$\overline{OE}$-controlled output 1enable time	t_{GLQX}	Figure 3	0	—	ns
$\overline{OE}$-controlled output enable time3	t_{GLQV}		—	15	ns
$\overline{OE}$-controlled output three-state time4	t_{GHQZ}		—	15	ns
$\overline{CE}$-controlled output enable time1	t_{ELQX}	Figure 4	0	—	ns
$\overline{CE}$-controlled access time3	t_{ELQV}		—	35	ns
$\overline{CE}$-controlled output three-state time4	t_{EHQZ}		—	15	ns

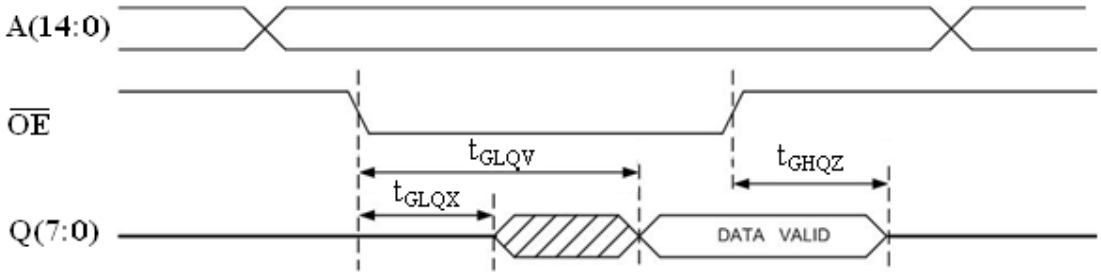
Notes:

1. t_{AVAV} is guaranteed by the test condition, t_{GLQX} and t_{ELQX} are design guaranteed but not tested.
2. The item is not tested for the blank device.
3. Measurement of data output occurs at the low to high or high to low transition mid-point.
4. Three-state is defined as a 500mV change from steady-state output voltage.



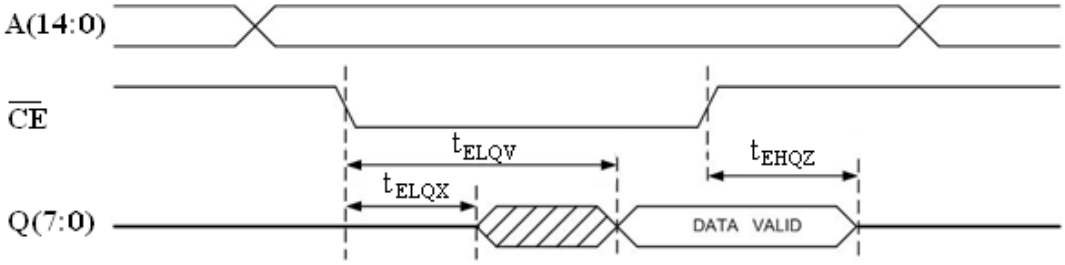
Assumptions: $\overline{CE}$ ≤V_{IL}(max), $\overline{OE}$≤V_{IL}(max), $\overline{PE}$≥V_{IH}(min)

Figure 2. Read Cycle 1: Address Access



Assumptions: $\overline{CE}$ ≤V_{IL}(max), $\overline{PE}$≥V_{IH}(min)

Figure 3. Read Cycle 2: Output Enable Access



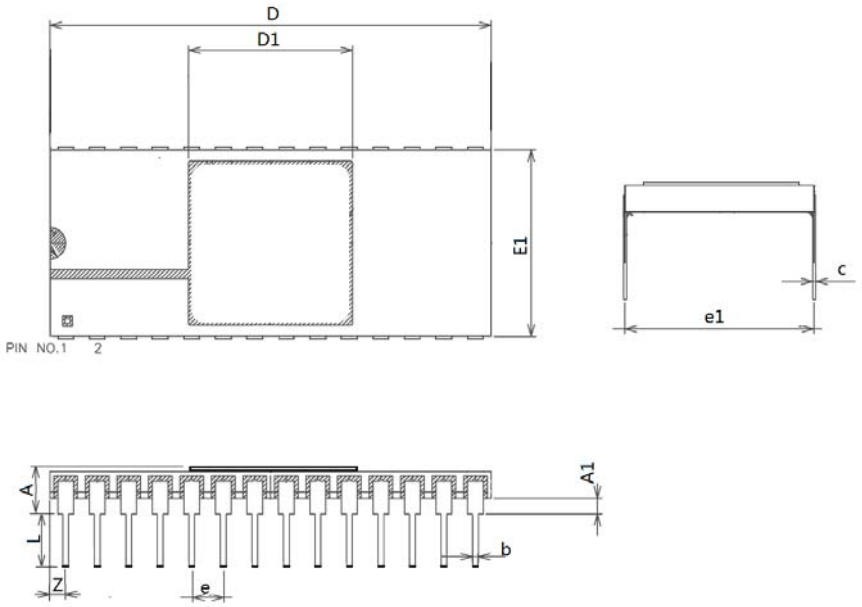
Assumptions：$\overline{OE}$≤V_{IL}(max), $\overline{PE}$≥V_{IH}(min)

Figure 4. Read Cycle 3: Chip Enable Access

7. Packaging

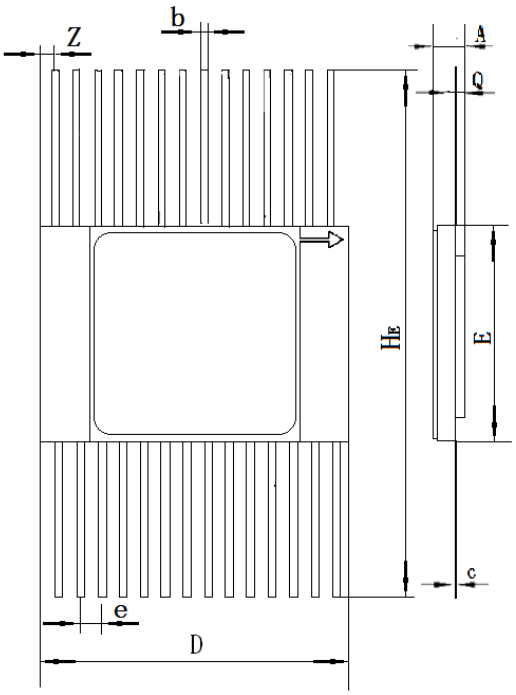
The PROM B28F256RH utilizes DIP28 and FP28 packs as shown in Figure 5

and 6.



Symbols	Size (unit: mm)		
	Min	BSC	Max
A	2.83	——	4.03
A1	0.72	——	1.82
b	0.20	——	0.70
c	0.10	——	0.40
e	——	2.54	——
e1	14.70	——	16.00
D	34.90	——	36.22
D1	12.70	——	13.70
E1	14.50	——	16.00
Z	0.59	——	1.95
L	2.54	——	4.74

Figure 5 Packging (DIP28)



Symbols	Size (unit: mm)		
	Min	BSC	Min
A	2.10	——	2.90
b	0.25	——	0.55
c	0.07	——	0.20
e	——	1.27	——
E	12.20	——	13.20
D	17.60	——	18.80
H_E	17.10	——	33.55
Q	0.30	——	1.20
Z	0.63	——	1.27

Figure 5 Packging (FP28)

Appendix 1

Pin Descriptions are listed in Table 6:

Table 6. Pin Symbols and Functions

Pin No.	Symbol	Functions	Pin No.	Symbol	Functions
1	A14	Address Input	15	Q3	bidirectional data
2	A12	Address Input	16	Q4	Bidirectional data
3	A7	Address Input	17	Q5	Bidirectional data
4	A6	Address Input	18	Q6	bidirectional data
5	A5	Address Input	19	Q7	Bidirectional data
6	A4	Address Input	20	CE	Chip Enable
7	A3	Address Input	21	A10	Address Input
8	A2	Address Input	22	OE	Output Enable
9	A1	Address Input	23	A11	Address Input
10	A0	Address Input	24	A9	Address Input
11	DQ0	bidirectional data	25	A8	Address Input
12	DQ1	Bidirectional data	26	A13	Address Input
13	DQ2	Bidirectional data	27	PE	Program Enable
14	V_{SS}	Ground	28	V_{DD}	5V Power Supply

Service & Supply

Address: No.2. Siyingmen N.Rd. Donggaodi Fengtai District,BeiJing,China
Department: Department of international cooperation
Telephone: +86(0)10-67968115-6751
Email：gjhz@mxtronics.com
Fax: +86(0)10-68757706
Zip code: 100076