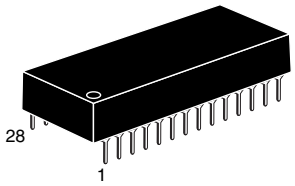
M48Z35
M48Z35Y

256Kbit (32Kbit x 8) ZEROPOWER® SRAM

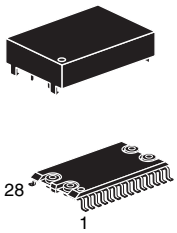
Features

- Integrated, ultra low power SRAM, power-fail control circuit, and battery
- READ cycle time equals WRITE cycle time
- Automatic power-fail chip deselect and WRITE protection
- WRITE protect voltages:
  (V_{PFD} = Power-fail Deselect Voltage)
  - M48Z35: V_{CC} = 4.75 to 5.5V
    $4.5V \leq V_{PFD} \leq 4.75V$
  - M48Z35Y: 4.5 to 5.5V
    $4.2v \leq V_{pfd} \leq 4.5v$
- Self-contained battery in the CAPHAT™ DIP package
- Packaging includes a 28-lead SOIC and SNAPHAT® top (to be ordered separately)
- Pin and function compatible with JEDEC standard 32K x 8 SRAMs
- SOIC package provides direct connection for a SNAPHAT top which contains the battery
- RoHS compliant
  - Lead-free second level interconnect



PCDIP28 (PC)
Battery CAPHAT

SNAPHAT (SH)
Battery



SOH28 (MH)

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1 Description

The M48Z35/Y ZEROPOWER® RAM is a 32K x 8, non-volatile static RAM that integrates power-fail deselect circuitry and battery control logic on a single die. The monolithic chip is available in two special packages to provide a highly integrated battery backed-up memory solution.

The M48Z35/Y is a non-volatile pin and function equivalent to any JEDEC standard 32K x 8 SRAM. It also easily fits into many ROM, EPROM, and EEPROM sockets, providing the non-volatility of PROMs without any requirement for special WRITE timing or limitations on the number of WRITEs that can be performed. The 28-pin 600mil DIP CAPHAT™ houses the M48Z35/Y silicon with a long life lithium button cell in a single package.

The 28-pin 330mil SOIC provides sockets with gold plated contacts at both ends for direct connection to a separate SNAPHAT housing containing the battery. The unique design allows the SNAPHAT battery package to be mounted on top of the SOIC package after the completion of the surface mount process. Insertion of the SNAPHAT housing after reflow prevents potential battery damage due to the high temperatures required for device surface-mounting. The SNAPHAT housing is keyed to prevent reverse insertion.

The SOIC and battery packages are shipped separately in plastic anti-static tubes or in Tape & Reel form.

For the 28-lead SOIC, the battery package (i.e. SNAPHAT) part number is “M4Z28-BR00SH1.”

Figure 1. Logic diagram

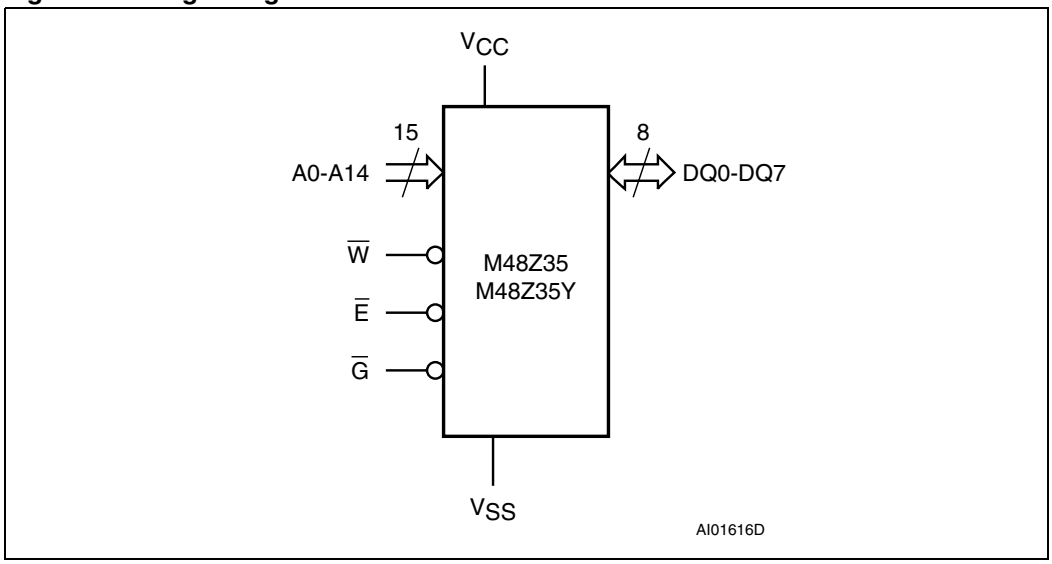

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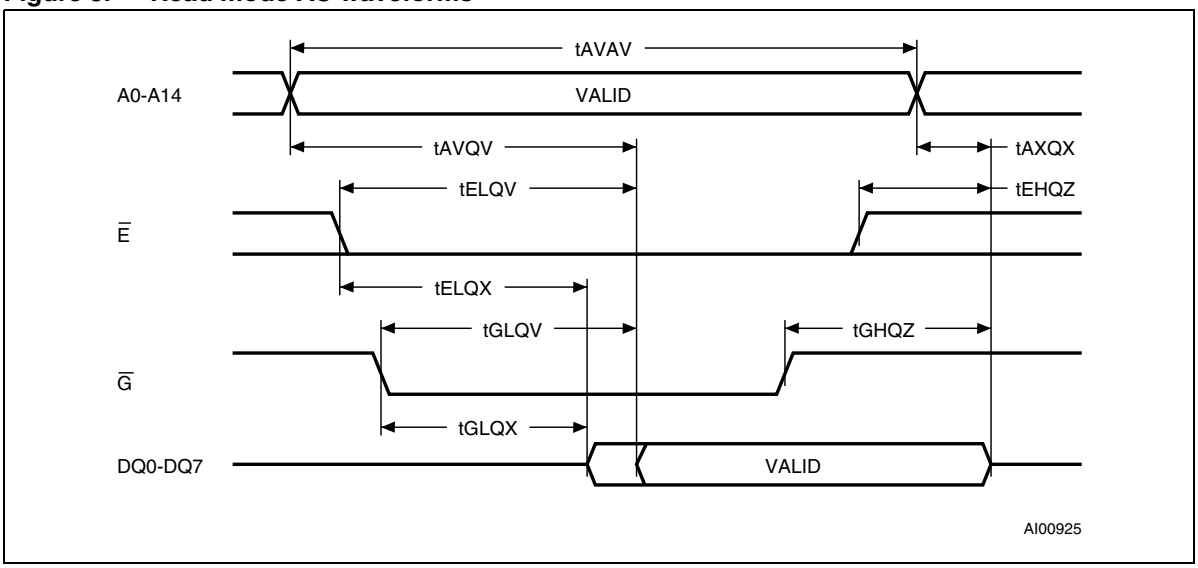
Figure 5. Read mode AC waveforms



Note: WRITE Enable ($\overline{W}$) = High.

Table 3. Read mode AC characteristics

Symbol	Parameter[1]	M48Z35/Y		Unit
		–70		
		Min	Max	
t_{AVAV}	READ cycle time	70		ns
t_{AVQV}[2]	Address valid to output valid		70	ns
t_{ELQV}[2]	Chip enable low to output valid		70	ns
t_{GLQV}[2]	Output enable low to output valid		35	ns
t_{ELQX}[3]	Chip enable low to output transition	5		ns
t_{GLQX}[3]	Output enable low to output transition	5		ns
t_{EHQZ}[3]	Chip enable high to output Hi-Z		25	ns
t_{GHQZ}[3]	Output enable high to output Hi-Z		25	ns
t_{AXQX}[2]	Address transition to output transition	10		ns

1. Valid for ambient operating temperature: T_A = 0 to 70°C; V_{CC} = 4.75 to 5.5V or 4.5 to 5.5V (except where noted).
2. C_L = 100pF.
3. C_L = 5pF.

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Table 4. Write mode AC characteristics

Symbol	Parameter[1]	M48Z35/Y		Unit
		–70		
		Min	Max	
t_{AVAV}	WRITE cycle time	70		ns
t_{AVWL}	Address valid to WRITE enable low	0		ns
t_{AVEL}	Address valid to chip enable low	0		ns
t_{WLWH}	WRITE enable pulse width	50		ns
t_{ELEH}	Chip enable low to chip enable high	55		ns
t_{WHAX}	WRITE enable high to address transition	0		ns
t_{EHAX}	Chip enable high to address transition	0		ns
t_{DVWH}	Input valid to WRITE enable high	30		ns
t_{DVEH}	Input valid to chip enable high	30		ns
t_{WHDX}	WRITE enable high to input transition	5		ns
t_{EHDX}	Chip enable high to input transition	5		ns
t_{WLQZ}[2][3]	WRITE enable low to output Hi-Z		25	ns
t_{AVWH}	Address valid to WRITE enable high	60		ns
t_{AVEH}	Address valid to chip enable high	60		ns
t_{WHQX}[2][3]	WRITE enable high to output transition	5		ns

1. Valid for ambient operating temperature: T_A = 0 to 70°C; V_{CC} = 4.75 to 5.5V or 4.5 to 5.5V (except where noted).
2. C_L = 5pF (see *Figure 10 on page 15*).
3. If $\overline{E}$ goes low simultaneously with $\overline{W}$ going low, the outputs remain in the high impedance state.

2.3 Data retention mode

With valid V_{CC} applied, the M48Z35/Y operates as a conventional BYTEWIDE™ static RAM. Should the supply voltage decay, the RAM will automatically power-fail deselect, write protecting itself when V_{CC} falls within the V_{PFD}(max), V_{PFD}(min) window. All outputs become high impedance, and all inputs are treated as “don't care.”

Note: A power failure during a WRITE cycle may corrupt data at the currently addressed location, but does not jeopardize the rest of the RAM's content. At voltages below V_{PFD}(min), the user can be assured the memory will be in a write protected state, provided the V_{CC} fall time is not less than t_F. The M48Z35/Y may respond to transient noise spikes on V_{CC} that reach into the deselect window during the time the device is sampling V_{CC}. Therefore, decoupling of the power supply lines is recommended.

When V_{CC} drops below V_{SO}, the control circuit switches power to the internal battery which preserves data. The internal button cell will maintain data in the M48Z35/Y for an accumulated period of at least 10 years (at 25°C) when V_{CC} is less than V_{SO}.

As system power returns and V_{CC} rises above V_{SO}, the battery is disconnected, and the power supply is switched to external V_{CC}. Write protection continues until V_{CC} reaches V_{PFD}(min) plus t_{REC}(min). Normal RAM operation can resume t_{REC} after V_{CC} exceeds V_{PFD}(max).

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For more information on Battery Storage Life refer to the Application Note AN1012.

Figure 8. Power down/up mode AC waveforms

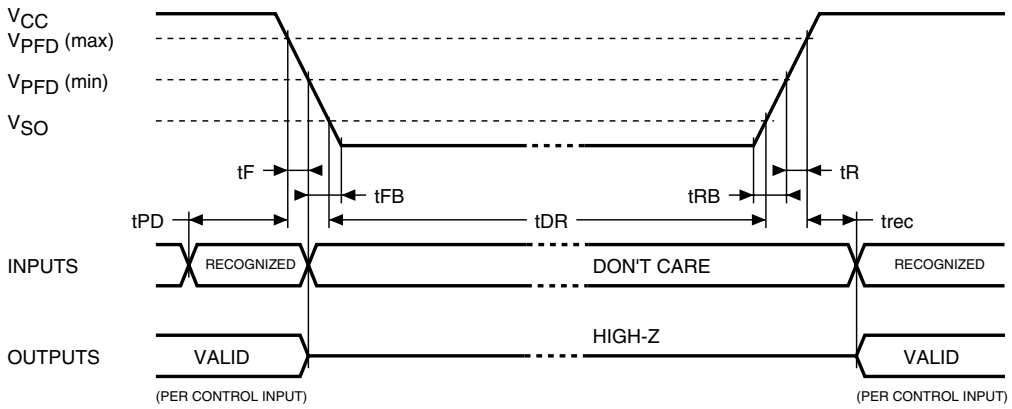

Table 5. Power down/up AC characteristics

Symbol	Parameter(1)	Min	Max	Unit
t_{PD}	$\overline{E}$ or $\overline{W}$ at V_{IH} before power down	0		µs
t_F(2)	V_{PFD} (max) to V_{PFD} (min) V_{CC} fall time	300		µs
t_{FB}(3)	V_{PFD} (min) to V_{SS} V_{CC} fall time	10		µs
t_R	V_{PFD} (min) to V_{PFD} (max) V_{CC} rise time	10		µs
t_{RB}	V_{SS} to V_{PFD} (min) V_{CC} rise time	1		µs
t_{rec}	V_{PFD} (max) to inputs recognized	40	200	ms

1. Valid for ambient operating temperature: T_A = 0 to 70°C; V_{CC} = 4.75 to 5.5V or 4.5 to 5.5V (except where noted).
2. V_{PFD} (max) to V_{PFD} (min) fall time of less than t_F may result in deselection/write protection not occurring until 200µs after V_{CC} passes V_{PFD} (min).
3. V_{PFD} (min) to V_{SS} fall time of less than t_{FB} may cause corruption of RAM data.

Table 6. Power down/up trip points DC characteristics

Symbol	Parameter(1)		Min	Typ	Max	Unit
V_{PFD}	Power-fail deselect voltage	M48Z35	4.5	4.6	4.75	V
		M48Z35Y	4.2	4.35	4.5	V
V_{SO}	Battery back-up switchover voltage	M48Z35/Y		3.0		V
t_{DR}(2)	Expected data retention time		10			YEARS

1. Valid for ambient operating temperature: T_A = 0 to 70°C; V_{CC} = 4.75 to 5.5V or 4.5 to 5.5V (except where noted).
2. At 25°C, V_{CC} = 0V.

Note: All voltages referenced to V_{SS}.

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3 Maximum rating

Stressing the device above the rating listed in the “Absolute Maximum Ratings” table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the Operating sections of this specification is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

Table 7. Absolute maximum ratings

Symbol	Parameter		Value	Unit
T_A	Ambient operating temperature		0 to 70	°C
T_{STG}	Storage temperature (V_{CC} off, oscillator off)	SNAPHAT® top	–40 to 85	°C
		CAPHAT® DIP	–40 to 85	°C
		SOIC	–55 to 125	°C
T_{SLD}(1)(2)	Lead solder temperature for 10 seconds		260	°C
V_{IO}	Input or output voltages		–0.3 to 7.0	V
V_{CC}	Supply voltage		–0.3 to 7.0	V
I_O	Output current		20	mA
P_D	Power dissipation		1	W

1. For DIP package: Soldering temperature not to exceed 260°C for 10 seconds (total thermal budget not to exceed 150°C for longer than 30 seconds).
2. For SO package, Lead-free (Pb-free) lead finish: Reflow at peak temperature of 260°C (total thermal budget not to exceed 245°C for greater than 30 seconds).

Caution: *Negative undershoots below –0.3V are not allowed on any pin while in the Battery Back-up mode.*

Caution: *Do NOT wave solder SOIC to avoid damaging SNAPHAT sockets.*

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4 DC and AC parameters

This section summarizes the operating and measurement conditions, as well as the DC and AC characteristics of the device. The parameters in the following DC and AC Characteristic tables are derived from tests performed under the Measurement Conditions listed in *Table 8: Operating and AC measurement conditions*. Designers should check that the operating conditions in their projects match the measurement conditions when using the quoted parameters.

Table 8. Operating and AC measurement conditions

Parameter	M48Z35	M48Z35Y	Unit
Supply voltage (V_{CC})	4.75 to 5.5V	4.5 to 5.5	V
Ambient operating temperature (T_A)	0 to 70	0 to 70	°C
Load capacitance (C_L)	100	100	pF
Input rise and fall times	≤ 5	≤ 5	ns
Input pulse voltages	0 to 3	0 to 3	V
Input and output timing ref. voltages	1.5	1.5	V

Note: Output Hi-Z is defined as the point where data is no longer driven.

Figure 10. AC measurement load circuit

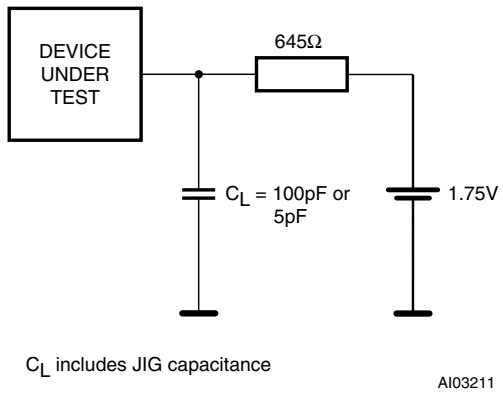

Table 9. Capacitance

Symbol	Parameter[1][2]	Min	Max	Unit
C_{IN}	**Input capacitance**		10	pF
C_{IO}[3]	**Input / output capacitance**		10	pF

1. Effective capacitance measured with power supply at 5V. Sampled only, not 100% tested.
2. Outputs deselected.
3. At 25°C.

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Table 10. DC characteristics

Symbol	Parameter	Test condition(1)	Min	Max	Unit
I_{LI}(2)	Input leakage current	$0V \le V_{IN} \le V_{CC}$		±1	µA
I_{LO}(2)	Output leakage current	$0V \le V_{OUT} \le V_{CC}$		±5	µA
I_{CC}	Supply current	Outputs open		50	mA
I_{CC1}	Supply current (standby) TTL	$\overline{E} = V_{IH}$		3	mA
I_{CC2}	Supply current (standby) CMOS	$\overline{E} = V_{CC} - 0.2V$		3	mA
V_{IL}	Input low voltage		–0.3	0.8	V
V_{IH}	Input high voltage		2.2	V_{CC} + 0.3	V
V_{OL}	Output low voltage	I_{OL} = 2.1mA		0.4	V
V_{OH}	Output high voltage	I_{OH} = –1mA	2.4		V

1. Valid for ambient operating temperature: T_A = 0 to 70°C; V_{CC} = 4.75 to 5.5V or 4.5 to 5.5V (except where noted).
2. Outputs deselected.

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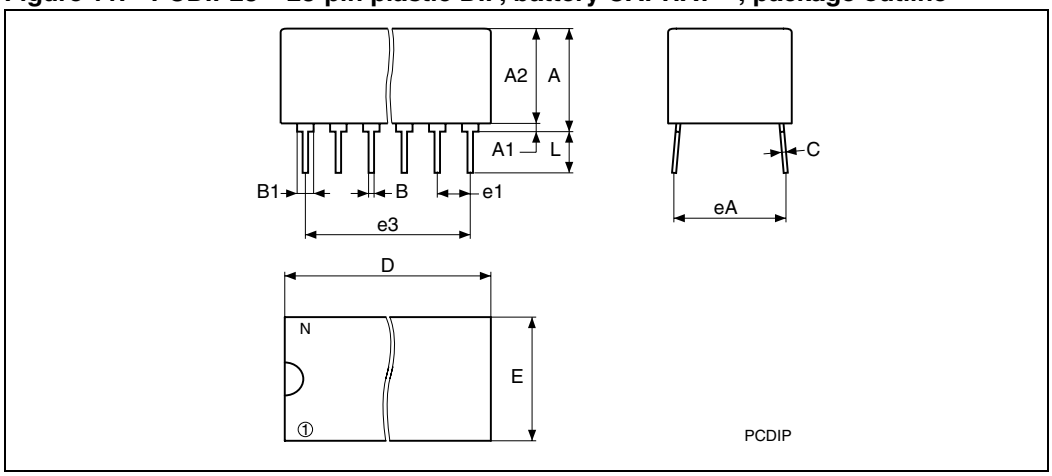
5 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

Figure 11. PCDIP28 – 28-pin plastic DIP, battery CAPHAT™, package outline



Note: Drawing is not to scale.

Table 11. PMDIP28 – 28-pin plastic DIP, battery CAPHAT™, pack. mech. data

Symbol	mm			inches		
	Typ	Min	Max	Typ	Min	Max
A		8.89	9.65		0.350	0.380
A1		0.38	0.76		0.015	0.030
A2		8.38	8.89		0.330	0.350
B		0.38	0.53		0.015	0.021
B1		1.14	1.78		0.045	0.070
C		0.20	0.31		0.008	0.012
D		39.37	39.88		1.550	1.570
E		17.83	18.34		0.702	0.722
e1		2.29	2.79		0.090	0.110
e3		29.72	36.32		1.170	1.430
eA		15.24	16.00		0.600	0.630
L		3.05	3.81		0.120	0.150
N	28			28		

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6 Part numbering

Table 15. Ordering information scheme

Example: M48Z 35Y –70 MH 1 E

Device type

M48Z

Supply voltage and write protect voltage

35[1] = V_{CC} = 4.75 to 5.5V; V_{PFD} = 4.5 to 4.75V

35Y = V_{CC} = 4.5 to 5.5V; V_{PFD} = 4.2 to 4.5V

Speed

–70 = 70ns

Package

PC = PCDIP28

MH[2] = SOH28

Temperature range

1 = 0 to 70°C

Shipping method

For SOH28:

E = Lead-free Package, Tubes

F = Lead-free Package, Tape & Reel

For PCDIP28:

blank = Tubes

1. The M48Z35 part is offered with the PCDIP28 (CAPHAT) package only.
2. The SOIC package (SOH28) requires the SNAPHAT® battery package which is ordered separately under the part number “M4Zxx-BR00SH1” in plastic tubes (see *Table 16*).

Caution: Do not place the SNAPHAT battery package “M4Zxx-BR00SH1” in conductive foam as it will drain the lithium button-cell battery.

For other options, or for more information on any aspect of this device, please contact the ST sales office nearest you.

Table 16. SNAPHAT battery table

Part Number	Description	Package
M4Z28-BR00SH1	Lithium Battery (48mAh) SNAPHAT	SH
M4Z32-BR00SH1	Lithium Battery (120mAh) SNAPHAT	SH

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