

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



RELIABILITY REPORT

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B

PART NO. : W25Q16BV
W25X16BV

FUNCTION : 16M FLASH MEMORY

PROCESS : 90nm CMOS (DPTM)

RA ENGINEER : KH. Wang

RA MANAGER : K.F. Chuang

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



~ INTRODUCTION ~

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B and W25X16B, W25X80B, W25X40B, W25X20B, W25X10B are a family of 1M-bit through 16M-bit Serial Flash memories fabricated with 90nm process technology and dual- poly- triple-metal (DPTM) high performance CMOS process.

According to Winbond's product family qualification methodology, the product with larger chip size could be used as the test vehicle for the product family qualification. Besides, W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B and W25X16B, W25X80B, W25X40B, W25X20B, W25X10B are manufactured by same technology. Therefore, we conclude that W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B and W25X16B, W25X80B, W25X40B, W25X20B, W25X10B do pass product qualification.

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



~SUMMARY~

W25Q16BV, W25X16BV for 8 SOP 208 mil passed the qualification tests according to Winbond product qualification requirement. A summary of the test result is as follows:

▣. High Temp. Operating Life test	: 0/231 pcs
▣. Data Retention	: 0/231 pcs
▣. Endurance Cycling Test	: 0/462 pcs
▣. Endurance Cycling with Data Retention	: 0/114 pcs
▣. Pre-Condition Test	: 0/1155 pcs
▣. High Temp. Storage Life Test	: 0/231 pcs
▣. Pressure Cooker Test	: 0/231 pcs
▣. Temperature Cycle Test	: 0/231 pcs
▣. Thermal Shock Test	: 0/231 pcs
▣. Highly Accelerated Stress Test	: 0/231 pcs
▣. ESD-HBM	: 0/36 pcs
▣. ESD-MM	: 0/36 pcs
▣. ESD-CDM	: 0/9 pcs
▣. Latch -Up Test	: 0/18 pcs

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



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1. ESD
2. LATCH-UP

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



I. PRODUCT DESCRIPTION

A. Introduction

The W25Q16BV (16M-bit) Serial Flash memories provide a storage solution for systems with limited space, pins and power. The 25Q series offers flexibility and performance well beyond ordinary Serial Flash devices. They are ideal for code shadowing to RAM, executing code directly from Dual/Quad SPI(XIP) and storing voice, text and data. The devices operate on a single 2.7V to 3.6V power supply with current consumption as low as 5mA active and 1 μ A for power-down. All devices are offered in space-saving packages.

The W25Q16BV array is organized into 8,192 programmable pages of 256-bytes each. Up to 256 bytes can be programmed at a time. Pages can be erased in groups of 16 (sector erase), groups of 128 (32KB block erase), groups of 256 (64KB block erase) or the entire chip (chip erase). The W25Q16BV has 512 erasable sectors and 32 erasable blocks respectively. The small 4KB sectors allow for greater flexibility in applications that require data and parameter storage.

The W25Q16BV supports the standard Serial Peripheral Interface (SPI), and a high performance Dual/Quad output as well as Dual/Quad I/O SPI: Serial Clock, Chip Select, Serial Data I/O0(DI), I/O1(DO), I/O2(/WP), and I/O3(/HOLD). SPI clock frequencies of up to 80MHz are supported allowing equivalent clock rates of 160MHz for Dual Output and 320MHz for Quad Output when using the Fast Read Dual/Quad Output instruction. These transfer rates can outperform standard Asynchronous 8 and 16-bit Parallel Flash memories. The Continuous Read Mode allows for efficient memory access with as few as 8-clocks of instruction-overhead to read a 24-bit address, allowing true XIP (execute in place) operation.

A Hold pin, Write Protect pin and programmable write protection, with top or bottom array control, provides further control flexibility. Additionally, the

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



device supports JEDEC standard manufacturer and device identification with a 64-bit Unique Serial Number.

B. Features

- Family of Serial Flash Memories
 - W25Q16BV: 16M-bit / 2M -byte (2,097,152)
 - 256-bytes per programmable page
- Standard, Dual or Quad SPI
 - Standard SPI: CLK, /CS, DI, DO, /WP, /Hold
 - Dual SPI: CLK, /CS, IO0, IO1, /WP, /Hold
 - Quad SPI: CLK, /CS, IO0, IO1, IO2, IO3
- Highest Performance Serial Flash
 - Up to 6X that of ordinary Serial Flash
 - 80MHz clock operation
 - 160MHz equivalent Dual SPI
 - 320 MHz equivalent Dual SPI
 - 40MB/S continuous data transfer rate.
- Efficient “Continuous Read Mode”
 - Low Instruction overhead
 - As few as 8 clocks to address memory
 - Allows true XIP(excute in place) operation
 - Outperforms X16 Parallel Flash
- Low Power, Wide Temperature Range
 - Single 2.7 to 3.6V supply
 - 4mA active current, <1μA Power-down (typ.)
 - -40° C to +85°C operating range

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B

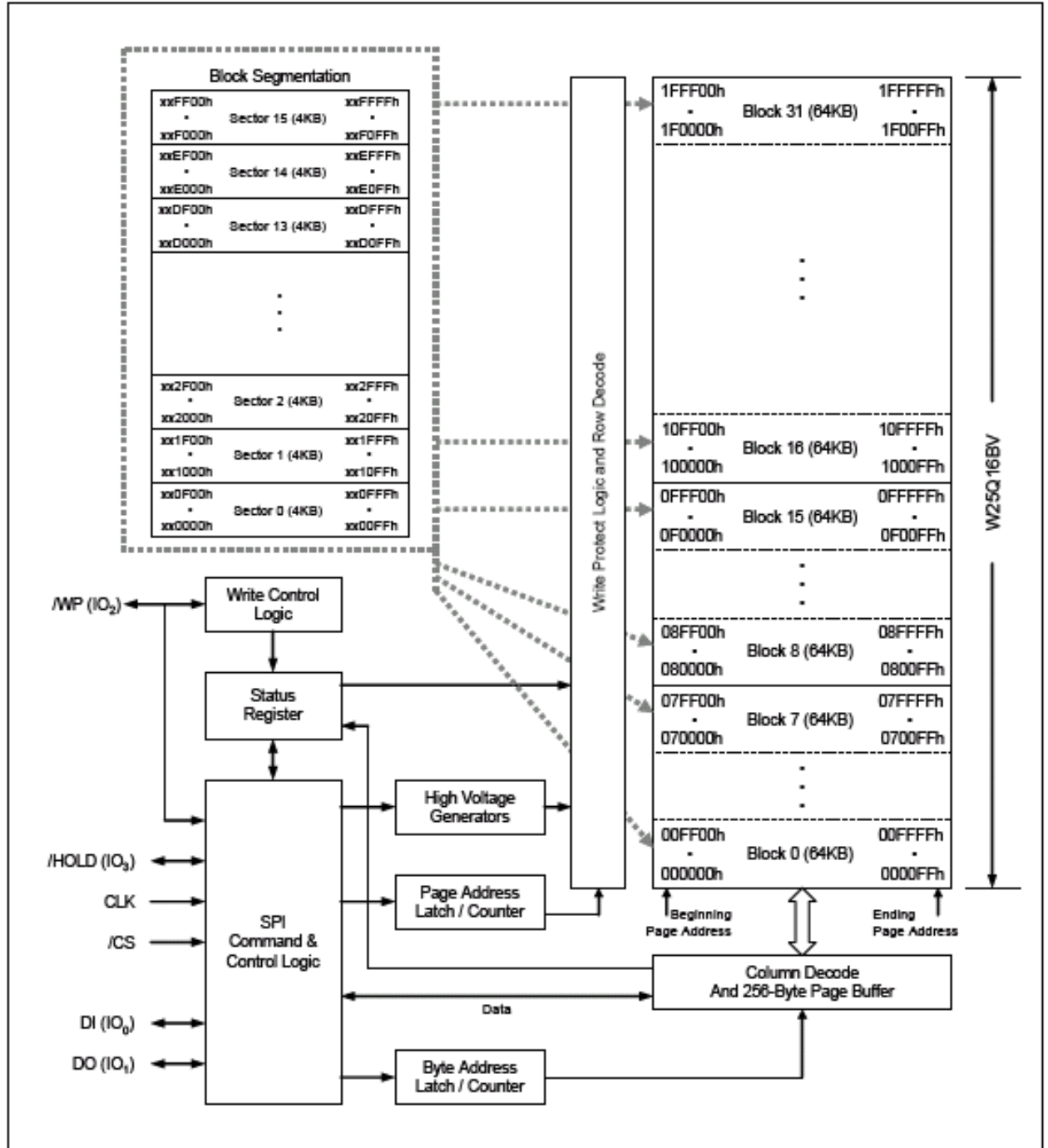


- Flexible Architecture with 4KB sectors
 - Uniform Sector Erase (4K-bytes)
 - Block Erase (32K and 64K-bytes)
 - Program one to 256 bytes
 - More than 100,000 erase/write cycles
 - More than 20-year data retention
- Advanced Security Features
 - Software and Hardware Write-Protect
 - Top or Bottom ,Sector or Block selection
 - Lock-Down and OTP protection
 - 64-Bit Unique ID for each device
- Space Efficient Packaging
 - 8-pin SOIC 150/208-mil
 - 8-pad WSON 6x5-mm
 - 16-pin SOIC 300-mil
 - Contact Winbond for KGD and CSP options

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



C. Function Block





II. LIFE TEST

A. Introduction

1. High-Temperature Operating Life Test (HTOL)

1.1 SCOPE

HTOL test is performed to accelerate failure mechanisms which are thermally activated. This can be achieved by stressing the devices with bias at high temperature.

1.2 TEST CONDITION

Temp ambient = 125°C , Vdd = 3.6V, dynamic stressing, Td = 1000 hrs.
(MIL-STD-883E, Method 1005)

2. Data Retention Test (DR)

2.1 SCOPE

DR test is to determine the stability of data stored in the device under high temperature environment.

2.2 TEST CONDITION

Temp = 150°C , Td = 1000 hrs. (MIL-STD-883E, Method 1008,
Condition "C")

3. Endurance Cycling Test

3.1 SCOPE

Endurance cycling test is to measure the capability of program/erase cycle.

3.2 TEST CONDITION

Temp=25°C, Td=100K Cycles with Single Block, Td=10K Cycles with
Whole Chip, pattern=CKBD and CKBD\,

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



4. Non-Volatile Memory Cycling Endurance (NVCE)

4.1 SCOPE

Test product's capability to the number of Program and Erase.

4.2 TEST CONDITION

JEDEC-STD-JESD 47F

Room Temp cycling test:

TD (Duration) = 1K, 10K, 100K cycles on 100:10:1 memory size.

Vcc = 3.3V.

Pattern = 00, FF, CHKBD, CHKBD\

Low temp data retention (LTDR):

Dynamic operation life test at room temp.

TD (Duration) = 168, 500 hrs

Apply dynamic pattern.



B. Test Results

1. High-Temperature Operating Life Test (HTOL)

1.1 SUMMARY TABLE

RUN	Lot No	168 Hrs	500 Hrs	1000 Hrs	Remark
#1	68349H700	0/77	0/77	0/77	
#2	68319C0AP	0/77	0/77	0/77	
#3	68349B500	0/77	0/77	0/77	

*Criteria : Acc/Rej = 0/1

1.2 FAILURE RATE CALCULATION

$$F.R.(T) = \frac{X^2(1-CL, 2N+2)}{2EDH}$$

WHERE X^2 : CHI-SQUARE Function CL : Confidence Level

N : No of Failures

EDH : Equivalent Device Hour

Test Item	Dev. Hours at Tj=126.21°C	Equiv. Dev. Hours at Tj=55°C	No. of Failure	Failure Rate at 55°C
HTOL	228000	35550630.05	0	25.74 FIT

Based on CL = 60% and Activation Energy = 0.8 eV

$$T_j = T_a + P_d \cdot \theta_{ja}$$

where :Tj= junction temp ,Ta=125°C (ambient temp)

Pd=17.31mW (power dissipated on the device)

Θja=70.12°C/W (thermal resistance from junction to ambient)



2. Data Retention Test (DR)

RUN	Lot No	168 Hrs	500 Hrs	1000 Hrs	Remark
#1	68349H700	0/77	0/77	0/77	
#2	68319C0AP	0/77	0/77	0/77	
#3	68349B500	0/77	0/77	0/77	

*Criteria : Acc/Rej = 0/1.

3. Endurance Cycling Test

3.1 Single block

RUN	Lot No	50K CYC	100K CYC	Remark
#1	68349H700	0/77	0/77	
#2	68319C0AP	0/77	0/77	
#3	68349B500	0/77	0/77	

*Criteria: Acc/Rej = 0/1.

3.2 Whole Chip

Run	Lot No	10K CYC	Remark
#1	68349H700	0/77	
#2	68319C0AP	0/77	
#3	68349B500	0/77	

*Criteria: Acc/Rej = 0/1.

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



4. Non-Volatile Memory Cycling Endurance (NVCE)

4.1 Room temp 1k~100k cycling with Data Retention

RUN	Lot No	RT cycling: 1K~100K	LTDR- 168 HRs	LTDR- 500 HRs	Remark
#1	68450M600	0/38	0/38	0/38	
#2	68450M6AC	0/38	0/38	0/38	
#3	685079500	0/38	0/38	0/38	

*Criteria: Acc/Rej = 0/1.



III. ENVIRONMENTAL TESTS

A. Introduction

1. Pre-condition Test

1.1 SCOPE

Pre-condition Test is to measure the resistance of SMD(Surface Mount Devices) to the storage environment at the customer site and to thermal stress created by IR reflow or Vapor Phase Reflow.

1.2 TEST CONDITION

- Step 1 : TCT (-65°C/150°C, 5 cycles)
- Step 2 : Bake (125°C, 20 hours)
- Step 3 : Soak (30°C/60%RH, 192 hours)
- Step 4 : IR , 3 passes (JEDEC 020 C).

2. High Temperature Storage Life Test (HTSL)

2.1 SCOPE

HTSL test is to determine the stability of the device in high temperature environment.

2.2 TEST CONDITION

Temp = 150°C , Td = 1000 hrs. (MIL-STD-883E, Method 1008, Condition "C")

3. Pressure Cooker Test (PCT)

3.1 SCOPE

PCT is to evaluate the device resistance to moisture penetration.

3.2 TEST CONDITION

Ta = 121°C, RH = 100%, P = 2 atm, Td = 168 Hrs. (JESD22-A102-A)

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



4. Highly Accelerated Stress Testing (HAST)

4.1 SCOPE

HAST is to evaluate the reliability of non hermetic packaged solid-state device in humid environments.

4.2 TEST CONDITION

Ta = 130°C, Vdd=3.6V, RH% = 85%, P = 2 atm, Td = 168 Hrs.
(JESD22-A1100)

5. Temperature Cycle Test (TCT)

5.1 SCOPE

TCT is to evaluate the resistance of device to environmental temperature change.

5.2 TEST CONDITION

-65°C / 15min, transfer time 1min, +150 °C/15min, 500 cycles.
MIL-STD-883E, Method 1010, Condition "C".

6. Thermal Shock Test (TST)

6.1 SCOPE

TST test is also to evaluate the resistance of device to the extremely environmental change.

6.2 TEST CONDITION

-65°C / 5min, transfer time <10sec, +150 °C / 5min, 100 cycles.
MIL-STD-883E, Method 1011, Condition "C".



B. Test Result

1. Pre-condition Test

Run	Lot No	Result	Remark
#1	68349H700	0/385	
#2	68319C0AP	0/385	
#3	68349B500	0/385	

*Criteria : Acc/Rej = 0/1.

2. High Temperature Storage Life Test (HTSL)

RUN	Lot No	168 Hrs	500 Hrs	1000 Hrs	Remark
#1	68349H700	0/77	0/77	0/77	
#2	68319C0AP	0/77	0/77	0/77	
#3	68349B500	0/77	0/77	0/77	

*Criteria : Acc/Rej = 0/1

3. Pressure Cooker Test (PCT)

Run	Lot No	168 Hrs	Remark
#1	68349H700	0/77	
#2	68319C0AP	0/77	
#3	68349B500	0/77	

*Criteria : Acc/Rej = 0/1.



4. Highly Accelerated Stress Testing (HAST)

Run	Lot No	168 Hrs	Remark
#1	68349H700	0/77	
#2	68319C0AP	0/77	
#3	68349B500	0/77	

*Criteria : Acc/Rej = 0/1.

5. Temperature Cycle Test (TCT)

Run	Lot No	500 Cycles	Remark
#1	68349H700	0/77	
#2	68319C0AP	0/77	
#3	68349B500	0/77	

*Criteria : Acc/Rej = 0/1.

6. Thermal Shock Test (TST)

Run	Lot No	100 Cycles	Remark
#1	68349H700	0/77	
#2	68319C0AP	0/77	
#3	68349B500	0/77	

*Criteria : Acc/Rej = 0/1.



IV. ESD AND LATCH-UP

A. Introduction

1. ESD

1.1 SCOPE

ESD test is to evaluate the immunity of device to electrostatic discharge.

1.2 TEST CONDITION

Human Body Model (HBM): JESD22-A114C.01

Machine Model (MM): EIA/JESD22-A115-A.

Charge Device Model (CDM): JESD22-C101-C.

2. Latch-Up

2.1 SCOPE

Latch-Up test is to evaluate the immunity of the devices to latch-up.

2.2 TEST CONDITION

JEDEC STD 78, Temp = 25 °C, VDD = Max. Operating Voltage.



B. Test Results

1. ESD

1.1 Human Body Model

Run	LOT#	POSITIVE	NEGATIVE	Remark
#1	68349H700	0/6	0/6	
#2	68319C0AP	0/6	0/6	
#3	68349B500	0/6	0/6	

*Criteria : Acc/Rej = 0/1.

*| SPEC | : >2KV

1.2. Machine Model

Run	LOT#	POSITIVE	NEGATIVE	Remark
#1	68349H700	0/6	0/6	
#2	68319C0AP	0/6	0/6	
#3	68349B500	0/6	0/6	

*Criteria : Acc/Rej = 0/1.

*| SPEC | : >200 V

1.3. Charge Device Model

Run	LOT#	POSITIVE / NEGATIVE	Remark
#1	68349H700	0/3	
#2	68319C0AP	0/3	
#3	68349B500	0/3	

*Criteria : Acc/Rej = 0/1.

*| SPEC | : >750V

W25Q16B, W25Q80B, W25Q40B, W25Q20B, W25Q10B,
W25X16B, W25X80B, W25X40B, W25X20B, W25X10B



2. Latch-Up

Run	LOT#	POSITIVE	NEGATIVE	Remark
#1	68349H700	0/3	0/3	
#2	68319C0AP	0/3	0/3	
#3	68349B500	0/3	0/3	

*Criteria : Acc/Rej = 0/1.

*I SPEC. I : I-Test > 100mA

Vsupply over voltage Test>1.5x max supply voltage

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Note: All data and specifications are subject to change without notice.