



# Technical Note

## Migrating from Micron M29W Devices to MT28EW NOR Flash Devices

### Introduction

This technical note describes the process for converting a system design from the Micron® M29W devices to MT28EW single-level cell NOR Flash devices, including 128Mb and 256Mb densities. The MT28EW higher reliability and performance are ensured through the advanced technology and product design improvements. MT28EW features a large buffer size up to 512 words for advanced program performance. Erase performance is largely improved to meet all variable system design considerations. Moreover, MT28EW supports both x8 and x16 data bus for legacy controllers compatibility. This document was written based on device information available at publication time. In case of inconsistency, information contained in the relevant MT28EW data sheet supersedes the information in this technical note.

This technical note does not provide detailed device information. The standard density-specific device data sheet provides a complete description of device functionality, operating modes, and specifications.



## Comparative Overview

The MT28EW is compatible with the M29W 128Mb, and 256Mb devices, but features superior program and erase performance.

**Table 1: Part Number Comparison**

Density	Package Type	Part Number		Note
		MT28EW	M29W	
256Mb	56-pin TSOP (14mm x 20mm)	MT28EW256ABA1HJS-0SIT	M29W256GH70N6E	
		MT28EW256ABA1LJS-0SIT	M29W256GL70N6E	
	64-ball LBGA (11mm x 13mm)	MT28EW256ABA1HPC-0SIT	M29W256GH70ZS6E	
			M29W256GH70ZS6F	
			M29W256GH70ZA6E	3
	MT28EW256ABA1LPC-0SIT	M29W256GL70ZS6E		
128Mb	56-pin TSOP (14mm x 20mm)	MT28EW128ABA1HJS-0SIT	M29W128GH70N6E	
			M29W128GH70N6F	
		MT28EW128ABA1LJS-0SIT	M29W128GL70N6E	
			M29W128GL70N6F	
	64-ball LBGA (11mm x 13mm)	MT28EW128ABA1HPC-0SIT	M29W128GH60ZA6E	3
			M29W128GH70ZA6E	3
			M29W128GH70ZS6E	
			M29W128GH70ZS6F	
				MT28EW128ABA1LPC-0SIT
			M29W128GL70ZA6F	3
		M29W128GL70ZS6F		

- Notes:
1. For valid combination details, refer to [www.micron.com/products](http://www.micron.com/products), or contact Micron sales representatives.
  2. Unlike M29W, packing types, including tray, and tape and reel, are not indicated in Micron's MT28EW MPN. Contact Micron sales representatives for detail information.
  3. Package TBGA 64-ball 10x13mm will need to convert to LBGA 64-ball 11x13mm. Same ball assignment different package width.



## TN-13-50: Migrating M29W to MT28EW NOR Flash Devices Comparative Overview

**Table 2: Features Comparison**

Feature	MT28EW	M29W	Notes
Process technology	45nm single-level cell (SLC) floating gate	90nm single-level cell (SLC) floating gate	1
Density	128Mb 256Mb	128Mb 256Mb	
Package	64-ball LBGA (11mm x 13mm), 56-pin TSOP (14mm x 20mm)	64-ball LBGA (11mm x 13mm), 64-ball TBGA (10mm x 13mm), 56-pin TSOP (14mm x 20mm)	2
Block architecture	Uniform 128KB	Uniform 128KB	
Data bus	x8/x16	x8/x16	
Page read size	16 words	8 words	3
Extended memory block	128 words (8 + 120)	128 words (8 + 120)	
Program write buffer size	256-byte (x8 mode) 512-word (x16 mode)	64-byte	4
V <sub>CC</sub> range	2.7V to 3.6V	2.7V to 3.6V	
V <sub>CCQ</sub> range	1.65~V <sub>CC</sub>	1.65~V <sub>CC</sub>	
V <sub>PP</sub> accelerated (TYP)	9V	12V	5
CFI version	1.3	1.3	
High voltage auto select (A9)	No	Yes	
Individual block write protection	Yes	Yes	
Hardware protection	Yes	Yes	
Unlock bypass	Yes	Yes	
Chip erase	Yes	Yes	
RY/BY# pin	Yes	Yes	
Blank check	Yes	No	6
Multiblock erase	Yes	Yes	
Data polling	Yes	Yes	
EFI CRC	Yes	No	

- Notes:
1. MT28EW SLC floating-gate technology provides improved performance and optimized quality and reliability. M29W 128M and 256M is also processed with SLC technology.
  2. MT28EW package is RoHS-compliant and halogen-free.
  3. On M29W 128Mb and 256Mb devices, the read page size is 8 words or 16 bytes.
  4. To configure MT28EW device software, query CFI word address 2Ah (x16)/54h (x8) on the buffer size option, in either x8 or x16 mode.
  5. To prevent damaging the device, designs applying V<sub>PP</sub>/WP# voltages higher than 9.5V (MAX) should be modified. V<sub>PP</sub>/WP# should not remain at V<sub>PPH</sub> for more than 80 hours cumulative.
  6. Refer to the data sheet for detailed BLANK CHECK command sets.



## Hardware and Mechanical Considerations

### Packages and Ballouts

The MT28EW device is available in 56-pin TSOP and 64-ball LPGA packages, both lead-free. The pin and ball assignments and the physical dimensions are compatible with the M29W.

### Signals

**Table 3: Signal Comparison**

MT28EW and M29W	Type	Description	Notes
A[MAX:0]	Input	Address inputs	
BYTE#	Input	Byte/Word organization select cannot be floated	
CE#	Input	Chip enable	
OE#	Input	Output enable	
RST#	Input	Reset	
WE#	Input	Write enable	
V <sub>pp</sub> /WP#	Input	Acceleration power/write protect input	1
DQ15/A-1	I/O or Input	Data input/output or address input	
DQ[14:8]	I/O	Data inputs/outputs	
DQ[7:0]	I/O	Data inputs/outputs	
RY/BY#	Output	Ready/Busy	
V <sub>CC</sub>	Supply	Supply voltage	
V <sub>CCQ</sub>	Supply	Input/Output buffer supply voltage	
V <sub>SS</sub>	–	Ground	
NC	–	No connect	

Note: 1. V<sub>pp</sub>/WP# could be tied to V<sub>CCQ</sub> or left floating on MT28EW device if it is not used on system design.

### Input/Output Capacitance

**Table 4: Input/Output Capacitance Comparison**

Parameter	MT28EW		M29W		Unit
	Min	Max	Min	Max	
C <sub>IN</sub>	3	11	-	6	pF
C <sub>OUT</sub>	3	7	-	12	pF

Note: 1. This is a comparison table taking an example of 1Gb density.

### Power Supply Decoupling

Flash memory devices require careful power supply decoupling to prevent external transient noise from affecting device operations, and to prevent internally generated transient noise from affecting other devices in the system.

Ceramic chip capacitors of 0.01 $\mu$ F to 0.1 $\mu$ F should be used between each  $V_{CC}$ ,  $V_{CCQ}$ , and  $V_{PP}$  supply connection or system ground pin. These high-frequency, inherently low-inductance capacitors should be placed as close as possible to the device package, or on the opposite side of the printed circuit board close to the center of the device package footprint.

Larger electrolytic or tantalum bulk capacitors (4.7 $\mu$ F to 33.0 $\mu$ F) should also be distributed as needed throughout the system to compensate for voltage sags and surges caused by circuit trace inductance.

Transient current magnitudes depend on the capacitive and inductive loading on the device's outputs. For best signal integrity and device performance, high-speed design rules should be used when designing the printed-circuit board. Final signal reflections (overshoot and undershoot) may vary by each system.



## Software Considerations

### Command Set

The MT28EW command set is fully compatible with M29W; therefore, no command change in the software is required. MT28EW provides some unique commands to support enhanced features such as EFI CRC functions.

### Manufacturer ID and Auto Select Comparison

The auto select information of MT28EW is fully compatible with M29W. There should be no any software modification on the system design.

To obtain the device ID of the secure version of MT28EW and M29W devices, contact your local Micron sales offices for the Security Addendum.

**Table 5: Auto Select Comparison – Word Mode**

Address	Description	MT28EW	M29W
(Base) + 00h	<b>Manufacturer ID</b>		
	–	0089h	0020h
(Base) + 01h	<b>Device ID (cycle 1)</b>		
	–	227Eh	227Eh
(Base) + 0Eh	<b>Device ID (cycle 2)</b>		
	128Mb	2221h	2221h
	256Mb	2222h	2222h
(Base) + 0Fh	<b>Device ID (cycle 3)</b>		
	–	2201h	2201h
(Base) + 03h	<b>Protection register indicator – V<sub>pp</sub>/WP# locks highest block</b>		
	Factory locked	0099h	0099h
	Factory unlocked	0019h	0019h
	<b>Protection register indicator – V<sub>pp</sub>/WP# locks lowest block</b>		
	Factory locked	0089h	0089h
	Factory unlocked	0009h	0009h
(Block) + 02h	<b>Block protection</b>		
	Protected	0001h	0001h
	Unprotected	0000h	0000h

### CFI Comparison

M29W and MT28EW CFI differences exist because of the different device performance characteristics. MT28EW supports asynchronous single-word and page mode READ operations while M29W supports only asynchronous single-word mode on CFI storage area.



Table 6: CFI Comparison

Address (x16)	Description	MT28EW	M29W		Notes
		128Mb-1Gb	128Mb	256Mb	
1Dh	<b>V<sub>PPH</sub> (programming) supply minimum</b>				
	Bits[7:4] hex value in volts	0085	00B5	00B5	-
	Bits[3:0] BCD value in 100mV				
1Eh	<b>V<sub>PPH</sub> (programming) supply maximum PROGRAM/ERASE voltage</b>				
	Bits[7:4] hex value in volts	0095	00C5	00C5	-
	Bits[3:0] BCD value in 100mV				
1Fh	<b>Typical timeout for single byte/word PROGRAM = 2<sup>n</sup>µs</b>				
	-	0005	0004	0004	-
20h	<b>Typical timeout for maximum size BUFFER PROGRAM = 2<sup>n</sup>µs</b>				
	-	0009	0004	0004	-
21h	<b>Typical timeout for individual BLOCK ERASE = 2<sup>n</sup>ms</b>				
	-	0008	0009	0009	-
22h	<b>Typical timeout for full-chip ERASE = 2<sup>n</sup>ms</b>				
	128Mb	000F	0010	-	-
	256Mb	0010	-	0011	
23h	<b>Maximum timeout for byte/word PROGRAM = 2<sup>n</sup> times typical timeout</b>				
	-	0003	0001	0004	-
24h	<b>Maximum timeout for BUFFER PROGRAM = 2<sup>n</sup> times typical timeout</b>				
	-	0002	0004	0004	-
25h	<b>Maximum timeout per individual BLOCK ERASE = 2<sup>n</sup> times typical timeout</b>				
	-	0003	0002	0003	-
26h	<b>Maximum timeout for chip ERASE = 2<sup>n</sup> times typical timeout</b>				
	-	0003	0004	0004	-
2Ah	<b>Maximum number of bytes in multiple-byte write = 2<sup>n</sup></b>				
	x8 mode	08	0006	0006	1
	x16 mode	000A			
45h	<b>Address-sensitive unlock (bits[1:0])</b>				
	0 = required, 1 = not required	0018	000D	0010	-
	Silicon revision number (bits[7:2])				
4Ch	<b>Page mode</b>				
	00 = not supported	0003	0002	0002	-
	01 = 4-word page				
	02 = 8-word page				
	03 = 16-word page				
4Dh	<b>V<sub>PPH</sub> supply minimum PROGRAM/ERASE voltage</b>				
	Bits[7:4] hex value in volts	0085h	00B5h	00B5h	-
	Bits[3:0] BCD value in 100mV				



Table 6: CFI Comparison (Continued)

Address (x16)	Description	MT28EW	M29W		Notes
		128Mb-1Gb	128Mb	256Mb	
4Eh	<b>V<sub>PPH</sub> supply maximum PROGRAM/ERASE voltage</b>				
	Bits[7:4] hex value in volts	0095h	00C5h	00C5h	-
	Bits[3:0] BCD value in 100mV				

Note: 1. On MT28EW, the query result from 2Ah is modulated by BYTE# status for x8 and x16 modes, and designs can query the address to get the proper maximum buffer size.

## Performance Comparison

The MT28EW features significantly improved program and erase performance.

Table 7: Program and Erase Performance Comparison (Word Mode)

Parameter	MT28EW		M29W				Unit
			128Mb		256Mb		
	Typ	Max	Typ	Max	Typ	Max	
<b>Block Erase</b>							
Block erase	200	1100	500	2000	500	2000	ms
<b>Chip Erase</b>							
128Mb	26	-	40	400	-	-	s
256Mb	52	-	-	-	145	400	
<b>Program/Erase Suspend</b>							
Erase suspend latency time	-	20	25	45	25	45	μs
Program suspend latency time	-	15	5	15	5	15	
Erase/Program or suspend to next resume (tRES *1)	100	-	500	-	500	-	
<b>Program, x16</b>							
Single word	25	200	16	200	16	200	μs
Write-to-buffer (32 words)	92 (0.7 MB/s)	460	51 (1.3 MB/s)	200	50 (1.3 MB/s)	200	
Write-to-buffer (64 words)	117 (1.1 MB/s)	600	-	-	-	-	
Write-to-buffer (128 words)	171 (1.5 MB/s)	900	-	-	-	-	
Write-to-buffer (256 words)	285 (1.8 MB/s)	1500	-	-	-	-	
Write-to-buffer (512 words)	512 (2.0 MB/s)	2000	-	-	-	-	
Accelerated full buffered program	410 (2.5 MB/s)	-	-	-	-	-	
<b>Set Nonvolatile Protection Bit Time</b>							





**Table 7: Program and Erase Performance Comparison (Word Mode) (Continued)**

Parameter	MT28EW		M29W				Unit
			128Mb		256Mb		
	Typ	Max	Typ	Max	Typ	Max	
Set nonvolatile protection bit time	25	200	16	200	16	200	µs
Clear nonvolatile protection bit time	80	1100	500	2000	500	2000	ms
<b>Blank Check</b>							
Blank check: main block	3.2	–	3.2	–	3.2	–	ms

Note: 1. This typical value allows an ERASE operation to progress to completion. It is important to note that the algorithm might never finish if the ERASE operation is always suspended less than this specification.

**Table 8: Read AC Performance Comparison – 3V**

Parameter	Symbol		MT28EW		M29W				Unit	Notes
					128Mb		256Mb			
	Legacy	JEDEC	Min	Max	Min	Max	Min	Max		
Address valid to output valid	<sup>t</sup> ACC	<sup>t</sup> AVQV	–	95/70	–	60-80	–	60-80	ns	1
Page address access	<sup>t</sup> APA	–	–	20	–	25/30	–	25/30	ns	
OE# LOW to output valid	<sup>t</sup> OE	<sup>t</sup> GLQV	–	25	–	25/30	–	25/30	ns	

Note: 1. For MT28EW, 70ns spec is available only for 128Mb/256Mb.



**Table 9: Power Consumption Comparison**

Parameter	Symbol	MT28EW		M29W				Unit	
				128Mb		256Mb			
		Typ	Max	Typ	Max	Typ	Max		
<b>Read</b>									
V <sub>CC</sub> random read current	I <sub>CC1</sub>	26	31	–	10	–	10	mA	
V <sub>CC</sub> page read current	I <sub>CC1</sub>	12	16	–	1	–	1		
<b>Standby</b>									
V <sub>CC</sub> standby current	1Gb	I <sub>CC2</sub>	75	165	–	–	–	–	μA
	512Mb		70	150	–	–	–	–	
	256Mb		65	135	–	–	–	100	
	128Mb		50	120	–	100	–	–	
<b>Program/Erase</b>									
V <sub>CC</sub> erase current	I <sub>CC3</sub>	35	50	–	20	–	20	mA	
V <sub>CC</sub> program current	I <sub>CC3</sub>	35	50	–	20	–	20		

## Power-on and Reset Timings

Because many of the more common processors support the MT28EW timings, there should be no adverse effect from timing differences.

**Table 10: Reset Timing Comparison**

Condition/Parameter	Symbol		MT28EW		M29W				Unit
					128Mb		256Mb		
	Legacy	JEDEC	Min	Max	Min	Max	Min	Max	
V <sub>CC</sub> power valid to RST# HIGH	t <sup>VCS</sup>	t <sup>VCHPH</sup>	300	–	55	–	55	–	μs
RST# LOW to read mode during program or erase	t <sup>READY</sup>	t <sup>PLRH</sup>	–	25	–	50	–	55	μs
RST# pulse width	t <sup>RP</sup>	t <sup>PLPH</sup>	100	–	10000	–	20000	–	ns
RST# HIGH to CE# LOW, OE# LOW	t <sup>RH</sup>	t <sup>PHEL</sup> , t <sup>PHGL</sup>	50	–	50	–	55	–	ns
RY# BY# HIGH to CE# LOW, OE# LOW	t <sup>RB</sup>	t <sup>RHEL</sup> , t <sup>RHGL</sup>	0	–	0	–	0	–	ns
RST# HIGH to WE# LOW	–	t <sup>PHWL</sup>	150	–	50	–	55	–	ns
Low V <sub>CC</sub> lock-out voltage	V <sub>LKO</sub>	–	2.0	–	1.8	–	1.8	–	V

Note: 1. A complete initialization (t<sup>VCS</sup>) is needed on MT28EW device when the device is powered up from a voltage below the normal operating range.

## Related Information

**Table 11: Document List**

Document/Tool
Parallel NOR Flash Embedded Memory MT28EW datasheet (all densities)
TN-13-14: Software Device Drivers for Micron M29W256 NOR Flash Memory
Application Note 309046: Power Loss Recovery for NOR Flash Memory
TN-13-30: System Design Considerations with Micron Flash Memory
TN-13-07: Patching the Linux Kernel and U-Boot for Micron M29 Flash Memory

- Notes:
1. Contact your local Micron or distribution sales office to request additional documentation.
  2. Visit [www.micron.com](http://www.micron.com) for technical documentation.



## **Revision History**

### **Rev. A – 2/17**

- Initial release

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