
Migration Guide from W29N02GV to W29N02KV

Introduction

This application note details how to migrate designs from Winbond W29N02GV (2G-bit) NAND Flash memory to W29N02KV (2G-bit) NAND Flash memory.

The memory array of W29N02KV totals 285,212,672 bytes, and organized into 2,048 erasable blocks of 139,264 bytes. Each block consists of 64 programmable pages of 2,176-bytes each. Each page consists of 2,048-bytes for the main data storage area and 128-bytes for the spare data area (The spare area is typically used for error management functions).

The W29N02KV supports the standard NAND flash memory interface using the multiplexed 8-bit bus to transfer data, addresses, and command instructions. The five control signals, CLE, ALE, #CE, #RE and #WE handle the bus interface protocol. Also, the device has two other signal pins, the #WP (Write Protect) and the RY/#BY (Ready/Busy) for monitoring the device status.

Note: All the information provided in this guide illustrates only the differences for each section. Please refer to the respective data sheets for more information.

Features Comparison

Most of the features between W29N02GV and W29N02KV are the same, except a few differences that are highlight in Table 2.1. Refer to the respective W29N02GV and W29N02KV data sheets to verify any other features.

Table 2.1 Feature Difference

Command Set	W29N02GV	W29N02KV
Standard NAND command set	V	V
Sequential Cache Read	V	
Random Cache Read	V	
Cache Program	V	
Copy Back	V	V
OTP Data Program/Read/Lock	V	V

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DC Electrical Characteristics

W29N02KV IS THE SAME AS W29N02GV

PARAMETER	SYMBOL	CONDITIONS	SPEC			UNIT
			MIN	TYP	MAX	
Sequential Read current	Icc1	tRC= tRC MIN #CE=VIL IOUT=0mA	-	25	35	mA
Program current	Icc2	-	-	25	35	mA
Erase current	Icc3	-	-	25	35	mA
Standby current (TTL)	ISB1	#CE=VIH #WP=0V/Vcc	-	-	1	mA
Standby current (CMOS)	ISB2	#CE=Vcc - 0.2V #WP=0V/Vcc	-	10	50	μA
Input leakage current	ILI	VIN= 0 V to Vcc	-	-	±10	μA
Output leakage current	ILO	VOUT=0V to Vcc	-	-	±10	μA
Input high voltage	VIH	I/O7~0, #CE,#WE,#RE, #WP,CLE,ALE	0.8 x Vcc	-	Vcc + 0.3	V
Input low voltage	VIL	-	-0.3	-	0.2 x Vcc	V
Output high voltage ⁽¹⁾	VOH	I _{OH} =-400μA	2.4	-	-	V
Output low voltage ⁽¹⁾	VOL	I _{OL} =2.1mA	-	-	0.4	V
Output low current ⁽²⁾	IOL(RY/#BY)	VOL=0.4V	8	10		mA

Table 3.1 DC Electrical Characteristics

Note:

1. VOH and VOL may need to be relaxed if I/O drive strength is not set to full.
2. IOL (RY/#BY) may need to be relaxed if RY/#BY pull-down strength is not set to full

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AC timing characteristics for Operation

W29N02KV IS THE SAME AS W29N02GV

PARAMETER	SYMBOL	SPEC				UNIT
		MIN		MAX		
		GV	KV	GV	KV	
ALE to #RE Delay	tAR	10	10	-	-	ns
#CE Access Time	tCEA	-	-	25	25	ns
#CE HIGH to Output High-Z ⁽¹⁾	tCHZ	-	-	30	30	ns
CLE to #RE Delay	tCLR	10	10	-	-	ns
#CE HIGH to Output Hold	tCOH	15	15	-	-	ns
Output High-Z to #RE LOW	tIR	0	0	-	-	ns
Data Transfer from Cell to Data Register	tR	-	-	25	25	μs
READ Cycle Time	tRC	25	25	-	-	ns
#RE Access Time	tREA	-	-	20	20	ns
#RE HIGH Hold Time	tREH	10	10	-	-	ns
#RE HIGH to Output Hold	tRHOH	15	15	-	-	ns
#RE HIGH to #WE LOW	tRHW	100	100	-	-	ns
#RE HIGH to Output High-Z ⁽¹⁾	tRHZ	-	-	100	100	ns
#RE LOW to output hold	tRLOH	5	5	-	-	ns
#RE Pulse Width	tRP	12	12	-	-	ns
Ready to #RE LOW	tRR	20	20	-	-	ns
Reset Time (READ/PROGRAM/ERASE) ⁽²⁾	tRST	-	-	5/10/500	5/10/500	μs
#WE HIGH to Busy ⁽³⁾	tWB	-	-	100	100	ns
#WE HIGH to #RE LOW	tWHR	60	60	-	-	ns

Table 4.1 AC timing characteristics for Operation

Notes:

1. Transition is measured $\pm 200\text{mV}$ from steady-state voltage with load. This parameter is sampled and not 100 % tested.
2. The RESET (FFh) command is issued while the device is idle, the device goes busy for a maximum of 5us.
3. Do not issue new command during tWB, even if RY/#BY is ready.

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Program and Erase Characteristics

PARAMETER	SYMBOL	SPEC		UNIT	
		TYP			MAX
		GV	KV		
Number of partial page programs	NoP	-	4	cycles	
Page Program time	tPROG	250	700	μs	
Block Erase Time	tBERS	2	10	ms	

Table 5.1 Program and Erase Characteristics

Device ID

# of Byte/Cycles	1 st Byte/Cycle	2 nd Byte/Cycle	3 rd Byte/Cycle		4 th Byte/Cycle		5 th Byte/Cycle	
			G	K	G	K	G	K
	EFh	DAh	90h	10h	95h	95h	04h	06h
Description	MFR ID	Device ID	ID for Cache Programming supporting or not		Page Size:2KB Spare Area Size:64b BLK Size w/o Spare:128KB Organized:x8	Page Size:2KB Spare Area Size: 128b BLK Size w/o Spare:128KB Organized:x8		

Part number comparison

W29N02GV	W29N02KV
W29N02GVSIAA	W29N02KVSIAF
W29N02GVBIAA	W29N02KVBIAF
W29N02GVDIAA	W29N02KVDIAF

Summary

The difference between W29N02GV (2G-bit) NAND Flash memory and W29N02KV (2G-bit) NAND Flash memory is the features innovation, its respective device ID and the ECC coding requirement. All other standard ONFI command set are the same with each other. Customers can easily migrate from W29N02GV to W29N02KV.

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Comparison Table

DC/AC/Command Set Table

Company		Winbond	Winbond
Parts #		W29N02GV	W29N02KV
Outline			
Process		46nm	32nm
Density		2Gb	2Gb
Vcc		2.7-3.6V	2.7-3.6V
Org.		x8	x8
Memory Cell		SLC	SLC
Page Size		2K+64 bytes	2K+128 bytes
Block Size		128K+4K bytes	128K+8K bytes
Data Retention		10 years	T.B.D
Endurance		100K P/E	T.B.D
ECC Requirements		1bit/528 byte ECC	4bit/544 byte ECC
Command sets			
Read	1st set	00h	00h
	2nd set	30h	30h
Read for Copy back	1st set	00h	00h
	2nd set	35h	35h
Cache Read Sequential	1st set	31h	-
	2nd set	-	-
Cache Read Random	1st set	00h	-
	2nd set	31h	-
Cache Read Last Address	1st set	3Fh	-
	2nd set	-	-
Read ID	1st set	90h	90h
	2nd set	-	-
Reset	1st set	FFh	FFh
	2nd set	-	-
Page Program	1st set	80h	80h
	2nd set	10h	10h
Cache Program	1st set	80h	-
	2nd set	15h	-
Copy-back Program	1st set	85h	85h
	2nd set	10h	10h
Block Erase	1st set	60h	60h
	2nd set	D0h	D0h
Random Data Input	1st set	85h	85h
	2nd set	-	-
Random Data Output	1st set	05h	05h
	2nd set	E0h	E0h

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Company		Winbond		Winbond
Parts #		W29N02GV		W29N02KV
	Read Status	1st set	70h	70h
		2nd set	-	-
	Two Plane Page Read	1st-2nd set	00h-00h	00h-00h
		3rd set	30h	30h
	Two Plane Copy Back Read	1st-2nd set	00h-00h	00h-00h
		3rd set	35h	35h
	Two Plane Random Data Read	1st set	06h	06h
		2nd set	E0h	E0h
	Two Plane Program (Tradi)	1st-2nd set	80h-11h	80h-11h
		3rd-4th set	81h-10h	81h-10h
	Two Plane Program (ONFI)	1st-2nd set	80h-11h	80h-11h
		3rd-4th set	80h-10h	80h-10h
	Two Plane Cache Program (Tradi)	1st-2nd set	80h-11h	-
		3rd-4th set	81h-15h	-
	Two Plane Cache Program (ONFI)	1st-2nd set	80h-11h	-
		3rd-4th set	80h-15h	-
	Two Plane Cache Program End (Tradi)	1st-2nd set	80h-11h	-
		3rd-4th set	81h-10h	-
	Two Plane Cache Program End (ONFI)	1st-2nd set	80h-11h	-
		3rd-4th set	81h-10h	-
	Two Plane Copy Back Program (Tradi)	1st-2nd set	85h-11h	85h-11h
		3rd-4th set	81h-10h	81h-10h
	Two Plane Copy Back Program (ONFI)	1st-2nd set	85h-11h	85h-11h
		3rd-4th set	85h-10h	85h-10h
	Two Plane Block Erase (Tradi)	1st-2nd set	60h-60h	60h-60h
		3rd set	D0h	D0h
Two Plane Block Erase (ONFI)	1st-2nd set	60h-D1h	60h-D1h	
	3rd-4th set	60h-D0h	60h-D0h	
Read Unique ID	1st set	EDh	EDh	
	2nd set	-	-	
Read Parameter Page	1st set	ECh	ECh	
	2nd set	-	-	
Set Features	1st set	EFh	EFh	
	2nd set	-	-	
Get Features	1st set	EEh	EEh	
	2nd set	-	-	
ONFI OTP	DATA Lock by Page	1st set	(80h)*	(80h)*
		2nd set	(10h)*	(10h)*
	OTP DATA PROGRAM	1st set	(80h)*	(80h)*
		2nd set	(10h)*	(10h)*
OTP DATA READ	1st set	(00h)*	(00h)*	
	2nd set	(30h)*	(30h)*	

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Company			Winbond	Winbond	
Parts #			W29N02GV	W29N02KV	
Block Lock	BLOCK UNLOCK	1st set	(23h)*	(23h)*	
		2nd set	(24h)*	(24h)*	
	BLOCK LOCK	1st set	(2Ah)*	(2Ah)*	
		2nd set	-	-	
	BLOCK LOCK TIGHT	1st set	(2Ch)*	(2Ch)*	
		2nd set	--	--	
	BLOCK LOCK READ STATUS	1st set	(7Ah)*	(7Ah)*	
		2nd set	-	-	
				(*) :Optional	
	AC spec				
tR	Max	Data transfer from Cell to array	25 us	25 us	
tAR	Min	ALE to #RE delay	10 ns	10 ns	
tCLR	Min	CLE to #RE delay	10 ns	10 ns	
tRR	Min	Ready to #RE low	20 ns	20 ns	
tRP	Min	#RE pulse width	12 ns	12 ns	
tWB	Max	#WE high to Busy	100 ns	100 ns	
tWW	Min	#WP high to #WE low	100 ns	100 ns	
tRC	Min	Read cycle time	25 ns	25 ns	
tREA	Max	#RE access time	20 ns	20 ns	
tCEA	Max	#CE access time	25 ns	25 ns	
tRHZ	Max	#RE high to output hi-z	100 ns	100 ns	
tCHZ	Max	#CE high to output Hi-z	30 ns	30 ns	
tRHOH	Min	#RE high to output hold	15 ns	15 ns	
tRLOH	Min	#RE low to output hold	5ns	5ns	
tCOH	Min	#CE high to output hold	15 ns	15 ns	
tREH	Min	#RE high hold time	10 ns	10 ns	
tIR	Min	Output hi-z to #RE low	0 ns	0 ns	
tRHW	Min	#RE high to #WE low	100 ns	100 ns	
tWHR	Min	#WE high to #RE low	60 ns	60 ns	
tRST (R/P/E)	Max	device resetting time	5/10/500 us	5/10/500 us	
tRCBSY (tCBSYR)	Max	Cache busy in cache read mode	25 us	-	
tPROG	Max (typ)	Page program time	700 (250) us	700 (250) us	
tCBSY	Max (typ)	Dummy busy time for cache program	700 (3) us	-	
NOP	Max	Number of Partial program cycles in the same page	4 cycles	4 cycles	
tBERS	Max (typ)	Block erase time	10 (2) ms	10 (2) ms	
tCLS	Min	CLE setup time	10 ns	10 ns	
tCLH	Min	CLE Hold time	5 ns	5 ns	

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Company			Winbond	Winbond
Parts #			W29N02GV	W29N02KV
tCS	Min	#CE setup time	15 ns	15 ns
tCH	Min	#CE hold time	5 ns	5 ns
tWP	Min	#WE pulse width	12 ns	12 ns
tALS	Min	ALE setup time	10 ns	10 ns
tALH	Min	ALE hold time	5 ns	5 ns
tDS	Min	Data setup time	10 ns	10 ns
tDH	Min	Data hold time	5 ns	5 ns
tWC	Min	Write cycle time	25 ns	25 ns
tWH	Min	#WE high hold time	10 ns	10 ns
tADL	Min	Address to Data loading time	70 ns	70 ns
tFEAT	Max	Busy time for SET/GET Features ope.	1 us	1 us
tLBSY	Max	Busy time for PRG/ERS on locked blk	3 us	3 us
tOBSY	Max	Busy Time for OTP program when OTP is protected	30 us	30 us
tDBSY	Max (typ)	Busy Time for 2 Plane Program and Erase	1 (0.5) us	1 (0.5) us
DC spec				
Icc1	Max (typ)	Page read with serial access	35 (25) mA	35 (25) mA
Icc2	Max (typ)	Program operating current	35 (25) mA	35 (25) mA
Icc3	Max (typ)	Erase operating current	35 (25) mA	35 (25) mA
Isb (CMOS)	Max (typ)	Standby Current (CMOS)	50 (10) uA	50 (10) uA
ILI	Max	Input leakage current	+ - 10 uA	+ - 10 uA
ILO	Max	Output leakage current	+ - 10 uA	+ - 10 uA
VIH	Min to Max	Input high voltage	0.8*Vcc to Vcc+0.3	0.8*Vcc to Vcc+0.3
VIL	Min to Max	Input low voltage	-0.3 to 0.2*Vcc	-0.3 to 0.2*Vcc
VOH	Min	output high voltage level	2.4V	2.4V
VOL	Max	output low voltage level	0.4V	0.4V
IOL	Min (typ)	output low current	8 (10) mA	8 (10) mA

Parameter Page Table

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Parameter Page (Byte#)	Description	W29N02GVxIAA	W29N02KVxIAF
8-9	Optional commands support	37h,00h	10h,00h
44-63	Device Model	57h, 32h, 39h, 4Eh, 30h, 32h, 47h, 56h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h	57h, 32h, 39h, 4Eh, 30h, 32h, 4Bh, 56h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h, 20h
84-85	# of spare bytes per page	40h, 00h	80h, 00h
90-91	# of spare bytes per partial page	10h, 00h	20h, 00h
112	# of ECC bits	01h	04h
131-132	Program Cache Timing	1Fh, 00h	00h, 00h

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Revision History

Version	Date	Page	Description
1.0	01/22/2019	NA	Original

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