LC1628-L
High-Speed USB Flash Disk Controller
Preliminary Data Sheet

Rev. 1.1

Jan. 18, 2007

Revision History

Date	Rev	Owner	Description
Jan 09, 2007	1.0	Iris Chang	
Jan 18, 2007	1.1	Iris Chang	Flash Support List

Data sheet marking

Leadconn uses various markings in the data sheet to designate each document phase as it relates to the product development stage.

Marking	Description
Objective Specification	The objective specification contains data for new product development.
Advance Information	The information is on products in the design phase. Your designs should not be finalized with this information.
Preliminary	This is preliminary information on new products but not yet fully characterized. The specifications in these data sheets are subject to change in any manner without notice.
No Marking	Information contained in the data sheet is on products in full production.

1. Introduction

General description

LC1628-L is a single-chip High-Speed USB flash disk controller which can handle up to two NAND-like flash memory chips. It is compliant with USB 2.0 and also compatible with USB 1.X. The features of USB-boot-up and driver-less make the flash disk very convenient for end-users.

LC1628-L is designed with Leadconn flash interface technology to provide wear-leveling and on-the-fly error-correction coding, which enhance the life time of the disk. The flexibility of the interface design also ensures supporting both SLC NAND and MLC NAND flash. LC1628-L can also support flash with either 16-bit or 8-bit data bus.

For data security, LC1628-L supports multiple protection level. In the non-protection level, data in the disk is fully accessible. In low protection level, disk is read-only to protect from virus and accidental file removal. In high protection level, the disk data cannot be accessed.

User-programmable device name based on USB Mass Storage protocol (SCSI) is also provided.

Features

System Function

- USB 2.0 compliant and USB 1.1 compatible
- USB-ZIP/USB-HDD boot-up
- Support Windows/MacOS Auto-Run
- Support multi-LUN
- Support security
- Compatible with Windows 98/Me/2K/XP, MacOS 9+, and Linux kernel 2.4+
- Configurable Removable or Fixed media
- Support unique serial number for each disk
- Configurable USB vendor/product ID
- Configurable USB vendor/product string
- Single-channel[1] R:10,W:7 Mbyte/s
- Dual-channel[1] R:17,W11 Mbyte/s
- Write protect switch
- Ready/busy LED

Flash Control

- Support 128Mb to 16Gb NAND-type flash
- Dual-channel access boosts data transfer
- Connect up to two flash chips
- Support either x16 or x8 data bus
- Wear-leveling extends product life time
- Defect block concealment and dynamic defect block handling
- On-the-fly ECC enhances reliability

Chip Hardware

- On-chip voltage detector for power-on-reset
- Single 3.3V voltage supply
- 12MHz external clock for low EMI
- 48 pin LQFP package

2. Pin Configuration and Definition.

LC1628-L Pin configuration

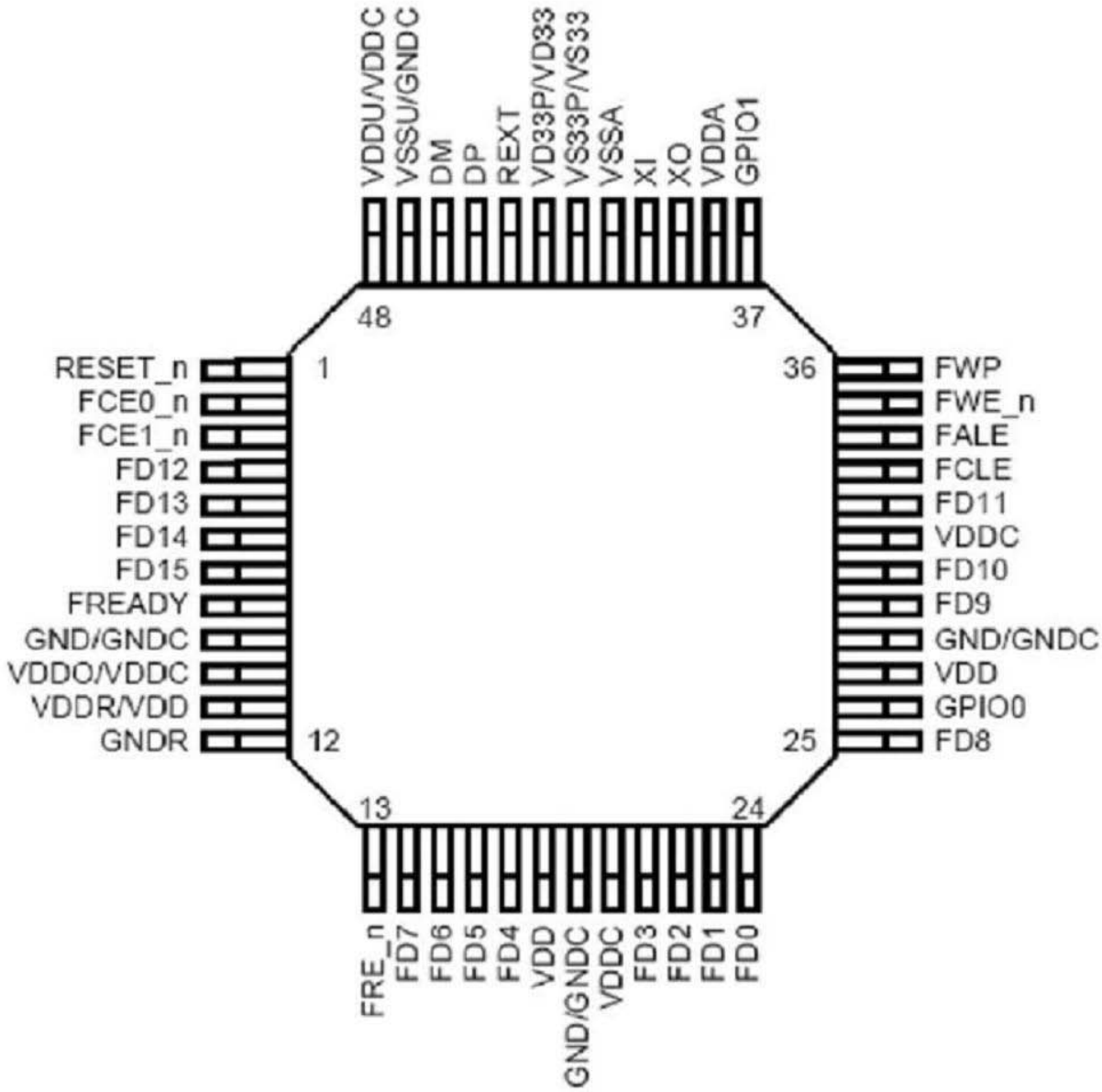


Figure 1. LC1628-L Pin configuration

LC1628-L Pin definition

Pin Number	Name	IO Type	Function
USB Transceiver			
45	DP	Analog	USB bus D+.
46	DM	Analog	USB bus D-.
44	REXT	Analog	Connect to ground through 330Ohm resistor
Clock			
40	XI	Clock In	12MHz crystal input.
39	XO	Clock Out	12MHz crystal output.
Flash			
7, 6, 5, 4, 32, 30, 29, 25	FD15, FD14, FD13, FD12, FD11, FD10, FD9, FD8	IO8	Bi-directional data bus signals to flash, high 8 bits.
14, 15, 16, 17, 21, 22, 23, 24	FD7, FD6, FD5, FD4, FD3, FD2, FD1, FD0	IO8	Bi-directional data bus signals to flash, low 8 bits.
3, 2	FCE1, FCE0	O2	Active-low chip enable signals to flash.
33	FCLE	O8	Command latch enable to flash.
34	FALE	O8	Address latch enable to flash.
13	FRE_n	O8	Active-low read strobe to flash.
35	FWE_n	O8	Active-low write strobe to flash.
8	FREADY	I, ST, PU	Ready/Busy from flash.
36	FWP	O2	Write protect to flash
System Control and Status			
26	GPIO0	I	Write protect switch
37	GPIO1	O8	Ready/busy LED
1	RESET_n	I, ST, PU	Chip reset
Power and Ground			
18, 27	VDD	Power	3.3V Power
10	VDDO/VDDC	Power	1.8V output of built-in regulator
20, 31	VDDC	Power	1.8V Power
11	VDDR/VDD	Power	3.3V Power
9, 19, 28	GND/GNDC	Ground	Ground
12	GNDR	Ground	Ground
38	VDDA	Power	Analog 1.8V Power
41	VSSA	Ground	Ground
43	VD33P/VD33	Power	3.3V Power
42	VS33P/VS33	Ground	Ground
48	VDDU/VDDC	Power	1.8V Power
47	VSSU/GNDC	Ground	Ground

Function of I/O types

I Input
ST Input with Schmitt trigger
PU Input with internal pull-up
O2 Output buffer with 2mA driving capability
O8 Output buffer with 8mA driving capability
IO8 I/O buffer with 8mA driving capability

3. Electrical Specifications

Maximum Ratings

Parameter	Min	Typ	Max	Units
LC1628-L Lead Temperature Range (soldering, 10 seconds)			+235°C V	
LC1628-LG Lead Temperature Range (soldering, 10 seconds)			+260°C V	

Recommended Operating Condition

Symbol	Parameter	Min	Typ	Max	Units
V_{33}	3.3V Voltage	3.0	3.3	3.6	V
T_{OPR}	Operating temperature	0		70	°C

Symbol	Parameter	Min	Typ	Max	Units
V_{18}	1.8V Voltage	1.65	1.8	1.95	V
T_{OPR}	Operating temperature	0		70	°C

DC Characteristics of Flash Interface and System Pins.

Symbol	Parameter	Min	Typ	Max	Units
V_{IL}	Input LOW voltage			$0.3*V_{33}$	V
V_{IH}	Input HIGH voltage	2.0			V
V_{OL}	Output LOW voltage			0.4	V
V_{OH}	Output HIGH voltage	2.4			V

DC and Operating Characteristics

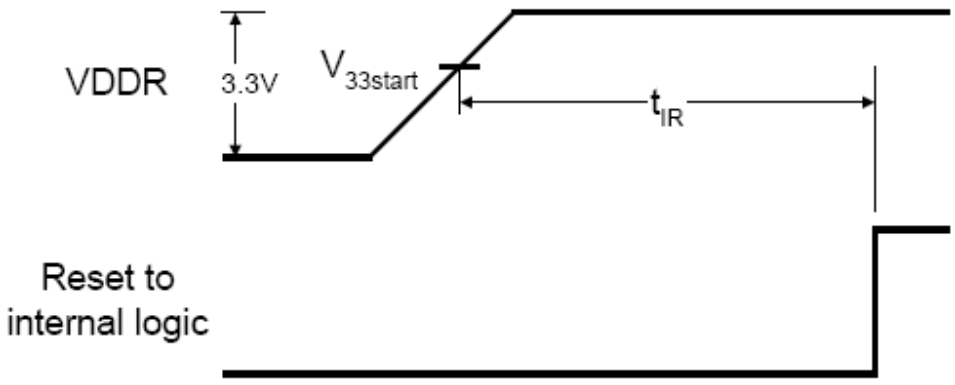
Symbol	Parameter	Min	Typ	Max	Units
$I_{IDLE-HS}$	High-Speed Idle current (no access, no suspend)		63		mA
I_{RD-HS}	High-Speed Read current		78		mA
I_{WR-HS}	High-Speed Write current		85		mA
I_{SP-HS}	High-Speed Suspend current		550		uA
$I_{IDLE-FS}$	Full-Speed Idle current (no access, no suspend)		45		mA
I_{RD-FS}	Full-Speed Read current		51		mA
I_{WR-FS}	Full-Speed Write current		50		mA
I_{SP-FS}	Full-Speed Suspend current		550		uA

NOTE: We measure the overall current of a reference module with one Samsung K9F1G08U0M.

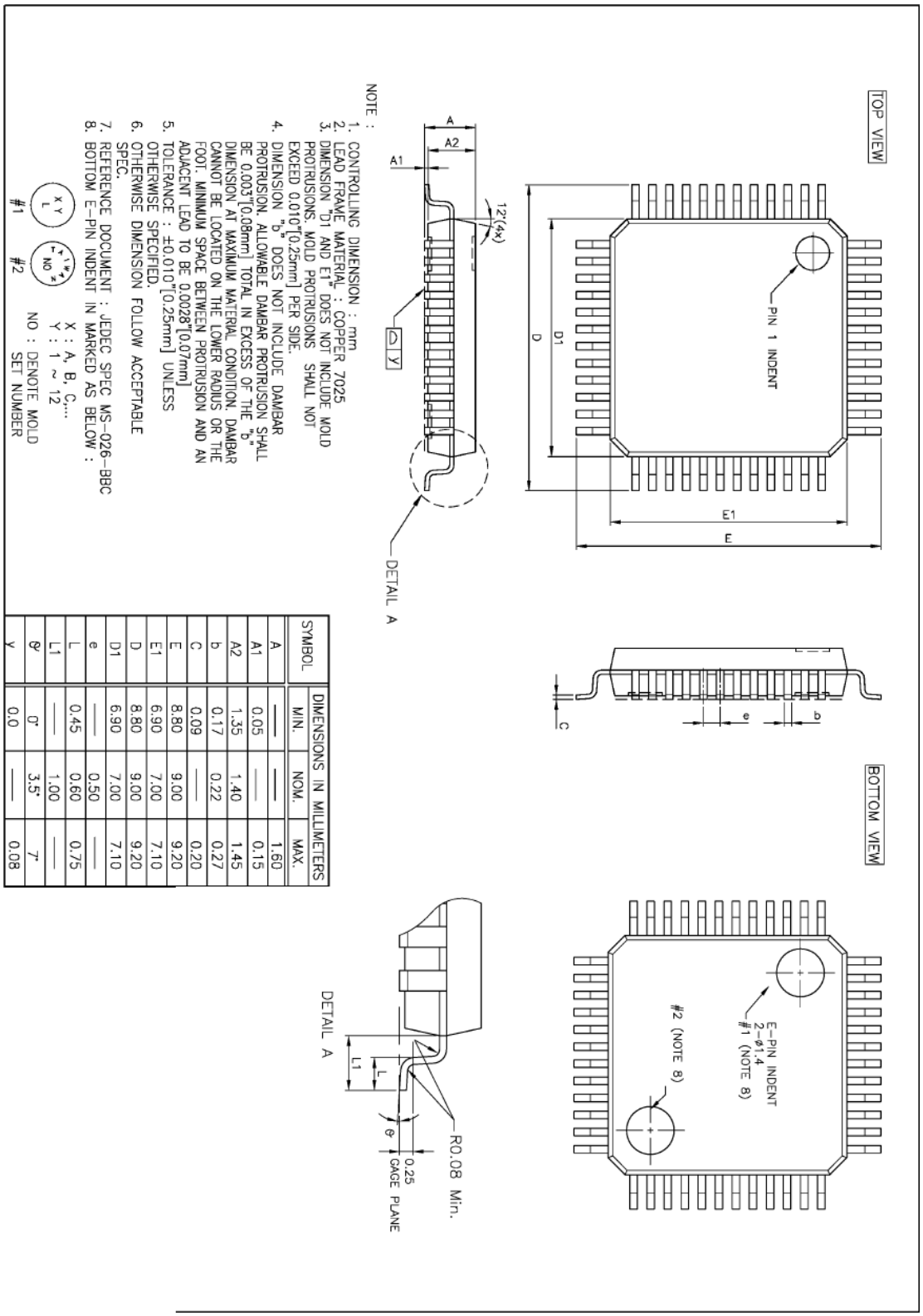
DC Characteristics of Built-in Power-On-Reset

LC1628-L builds in voltage detector to detect power ramp-up and then generates reset singal to internal logic, thus external POR device can be eliminated.

Symbol	Parameter	Min	Typ	Max	Units
$V_{33start}$	3.3V threshold of built-in voltage detector		2.1		V
t_{IR}	De-assert time of internal reset		30		ms



4. Package Dimensions



NOTE :
1. CONTROLLING DIMENSION : mm
2. LEAD FRAME MATERIAL : COPPER 7025
3. DIMENSION "D1 AND E1" DOES NOT INCLUDE MOLD PROTRUSIONS. MOLD PROTRUSIONS SHALL NOT EXCEED 0.010"[0.25mm] PER SIDE.
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.003"[0.08mm] TOTAL IN EXCESS OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSION AND AN ADJACENT LEAD TO BE 0.0028"[0.07mm]
5. TOLERANCE : ±0.010"[0.25mm] UNLESS OTHERWISE SPECIFIED.
6. OTHERWISE DIMENSION FOLLOW ACCEPTABLE SPEC.
7. REFERENCE DOCUMENT : JEDEC SPEC MS-026-BBC
8. BOTTOM E-PIN INDENT IN MARKED AS BELOW :

X : A, B, C,...
Y : 1 ~ 12
NO : DENOTE MOLD SET NUMBER

SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN.	NOM.	MAX.
A	——	——	1.60
A1	0.05	——	0.15
A2	1.35	1.40	1.45
b	0.17	0.22	0.27
C	0.09	——	0.20
E	8.80	9.00	9.20
E1	6.90	7.00	7.10
D	8.80	9.00	9.20
D1	6.90	7.00	7.10
e	——	0.50	——
L	0.45	0.60	0.75
L1	——	1.00	——
θ	0°	3.5°	7°
y	0.0	——	0.08

5. Flash Support List

Flash Support List – 8bit

Actrans	
512Mbit (64MByte)	AC79LV512B
Fujitsu	
32Mbite (4MByte)	MBM30LV0032
128Mbit (16MByte)	MBM30LV0128
Hynix	
256Mbit (32MByte)	HY27US08561
512Mbit (64MByte)	HY27US08121
1Gbit (128MByte)	HY27UA081G1, HY27UA081G4
2Gbit (256MByte)	HY27UB082G4
1Gbit (128MByte) Large Block	HY27UF081G2
2Gbit (256MByte) Large Block	HY27UG082G2, HY27UF082G2
4Gbit (512MByte) Large Block	HY27UH084G2, HY27UG084G2, HY27UF084G2, HY27UG084GD
8Gbit (1GByte) Large Block	HY27UH088G2, HY27UH088GD, HY27UG088G2, HY27UG088G5, HY27UG088GD
4Gbit (512MByte) 4LC Large Block	HY27UT084G2
8Gbit (1GByte) 4LC Large Block	HY27UU088G2
Qimonda	
512Mbit (64MByte)	HYF33DS512800AT, HYF31DS512805BT
1Gbit (128MByte)	HYF33DS1G800CT
Micron	
2Gbit (256MByte) Large Block	MT29F2G08AA
4Gbit (512MByte) Large Block	MT29F4G08BA
8Gbit (1GByte) Large Block	MT29F8G08FA
PFC	
512Mbit (64MByte)	PF79BL1208
Renesas	
256Mbit (32MByte)	HN29V25691BT
1Gbit (128Mbyte)	HN29V1G91T
2Gbit (256Mbyte)	HN29V2G74WT
4Gbit (512Mbyte)	R1FV04G13R
Samsung	
128Mbit (16MByte)	KM29U128, K9K2808U, K9F2808U
256Mbit (32MByte)	K9K5608U, K9F5608U
512Mbit (64MByte)	K9K1208U, K9F1208U
1Gbit (128MByte)	K9K1G08U, K9T1G08U
2Gbit (256MByte)	K9E2G08U
1Gbit (128MByte) Large Block	K9F1G08U
2Gbit (256MByte) Large Block	K9K2G08U, K9F2G08U
4Gbit (512MByte) Large Block	K9K4G08U, K9W4G08U, K9F4G08U
8Gbit (1GByte) Large Block	K9W8G08U, K9K8G08U
16Gbit (2GByte) Large Block	K9WAG08U1

32Gbit (4GByte) Large Block	K9NBG08U5 (i5129 only)
4Gbit (512MByte) 4LC Large Block	K9G4G08U0
8Gbit (1GByte) 4LC Large Block	K9L8G08U0, K9G8G08U0
16Gbit (2GByte) 4LC Large Block	K9HAG08U1, K9LAG08U0,
32Gbit (4GByte) 4LC Large Block	K9MBG08U5 (i5129 only), K9HBG08U1
64Gbit (8GByte) 4LC Large Block	K9MCG08U5
Sandisk	
128Mbit (16MByte)	SDTNFAH-128, SDTNGAHE0-128
256Mbit (32MByte)	SDTNFAH-256, SDTNGAHE0-256
512Mbit (64MByte)	SDTNFAH-512, SDTNGAHE0-512
1Gbit (128MByte)	SDTNFBH-1024, SDTNGBHE0-1024
2Gbit (256MByte)	SDTNGBHE0-2048
512Mbit (64MByte) 4LC	SDTNFCH-512, SDTNGCHE0-512
1Gbit (128MByte) 4LC	SDTNFCH-1024, SDTNGCHE0-1024
2Gbit (256MByte) 4LC	SDTNFDH-2048, SDTNGDHE0-2048, SDTNGCHE0-2048
4Gbit (512MByte) 4LC	SDTNGDHE0-4096
1Gbit (128MByte) Big Block	SDTNGEHE0-1024
2Gbit (256MByte) Big Block	SDTNGFHE0-2048
2Gbit (256MByte) 4LC Big Block	SDTNIGHE0-2048
4Gbit (512MByte) 4LC Big Block	SDTNIGHE0-4096
8Gbit (1GByte) 4LC Big Block	SDTNIHHE0-8192, SDTNKGHE0-8192
16Gbit (2GByte) 4LC Big Block	SDTNKHHE0-16384
ST	
128Mbit (16MByte)	NAND128W3A
256Mbit (32MByte)	NAND256W3A
512Mbit (64MByte)	NAND512W3A
1Gbit (128MByte)	NAND1GW3A
512MBite (64MByte) Big Block	NAND512W3B
1Gbit (128MByte) Big Block	NAND01GW3B
2Gbit (256MByte) Big Block	NAND02GW3B
4Gbit (512MByte) Big Block	NAND04GW3B
8Gbit (1GByte) Big Block	NAND08GW3B
4Gbit (512MByte) 4LC Large Block	NAND04GW3C2
8Gbit (1GByte) 4LC Large Block	NAND08GW3C2
Toshiba	
128Mbit (16MByte)	TC58128FT, TC58DVM72A1FT
256Mbit (32MByte)	TC58256FT, TC58DVM82A1FT
512Mbit (64MByte)	TH58512FT, TC58512FT, TC58512TG, TC58DVM92A1FT
1Gbit (128MByte)	TH58100FT, TC58DVG02A1FT
2GBit (256MByte)	TH58DVG12A1TGK0
512Mbit (64MByte) 4LC	TC58005FT, TC58DVM94B1FT
1Gbit (128MByte) 4LC	TC58010FT, TC58DVG04B1FT
2Gbit (256MByte) 4LC	TH58020FT, TC58DVG14B1FT , TH58DVG14B1FT
4Gbit (512MByte) 4LC	TH58DVG24B1FT
1Gbit (128MByte) Big Block	TC58NVG0S3AFT
2Gbit (256MByte) Big Block	TH58NVG1S3AFT
2Gbit (256MByte) 4LC Big Block	TC58NVG1D4BFT
4Gbit (512MByte) 4LC Big Block	TC58NVG2D4BFT
8Gbit (1GByte) 4LC Big Block	TH58NVG3D4BFT, TC58NVG3D4CFT
16Gbit (2GByte) 4LC Big Block	TH58NVG4D4CFT

Flash Support List – 16bit

Actrans	
512Mbit (64MByte)	AC79LV512W
Hynix	
256Mbit (32MByte)	HY27US16561
512Mbit (64MByte)	HY27US16121
1Gbit (128MByte)	HY27UA161G1, HY27UA161G4
2Gbit (256MByte)	HY27UB162G4
1Gbit (128MByte) Large Block	HY27UF161G2
2Gbit (256MByte) Large Block	HY27UG162G2, HY27UF162G2
4Gbit (512MByte) Large Block	HY27UH164G2
Micron	
2Gbit (256MByte) Large Block	MT29F2G16AA
4Gbit (512MByte) Large Block	MT29F4G16BA
PFC	
512Mbit (64MByte)	PF79BL1216
Renesas	
4Gbit (512Mbyte)	R1FV04G14R
Samsung	
128Mbit (16MByte)	K9K2816U, K9F2816U
256Mbit (32MByte)	K9K5616U, K9F5616U
512Mbit (64MByte)	K9K1216U, K9F1216U
1Gbit (128MByte)	K9K1G16U, K9T1G16U
2Gbit (256MByte)	K9E2G16U
1Gbit (128MByte) Large Block	K9F1G16U
2Gbit (256MByte) Large Block	K9K2G16U, K9F2G16U
4Gbit (512MByte) Large Block	K9K4G16U, K9W4G16U, K9F4G16U
8Gbit (1GByte) Large Block	K9W8G16U, K9K8G16U
Sandisk	
2Gbit (256MByte) 4LC Big Block	SDTNIGHS0-2048
4Gbit (512MByte) 4LC Big Block	SDTNIGHS0-4096
8Gbit (1GByte) 4LC Big Block	SDTNIHHS0-8192, SDTNKGHS0-8192
16Gbit (2GByte) 4LC Big Block	SDTNKHHS0-16384
ST	
128Mbit (16MByte)	NAND128W4A
256Mbit (32MByte)	NAND256W4A
512Mbit (64MByte)	NAND512W4A
1Gbit (128MByte)	NAND1GW4A
512MBite (64MByte) Big Block	NAND512W4B
1Gbit (128MByte) Big Block	NAND01GW4B
2Gbit (256MByte) Big Block	NAND02GW4B
4Gbit (512MByte) Big Block	NAND04GW4B
8Gbit (1GByte) Big Block	NAND08GW4B
Toshiba	
128Mbit (16MByte)	TC58DVM72F1FT
256Mbit (32MByte)	TC58DVM82F1FT
512Mbit (64MByte)	TC58DVM92F1FT
1Gbit (128MByte)	TC58DVG02F1FT
2Gbit (256MByte) 4LC Big Block	TC58NVG1D9BFT
4Gbit (512MByte) 4LC Big Block	TC58NVG2D9BFT
8Gbit (1GByte) 4LC Big Block	TH58NVG3D9BFT, TC58NVG3D9CFT
16Gbit (2GByte) 4LC Big Block	TH58NVG4D9CFT