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PRELIMINARY PRODUCT SPECIFICATION



Integrated Circuits Group

LH28F128BFHT-PBTL75A Flash Memory 16Mbit (8Mbitx16)

(Model Number: LHF12F17)

Spec. Issue Date: June 7, 2004

SPEC No. F M 0 4 6 0 1 2
ISSUE: Jun. 7, 2004
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PRELIMINARY S P E C I F I C A T I O N S
Product Type <u>128 M bit Flash Memory</u>
L H 2 8 F 1 2 8 B F H T — P B T L 7 5 A
Model No. (LHF12F17)
This device specification is subject to change without notice. * This specifications contains <u>32</u> pages including the cover and appendix.
CUSTOMERS ACCEPTANCE
DATE: BY: PRESENTED
BY: Chava M. NAWAKI Dept. General Manager
REVIEWED BY: PREPARED BY:
R. Motsingamin n. troue
Product Development Dept. II System-Flash Division Integrated Circuits Group SHARP CORPORATION

- SHARP
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 - When using the products covered herein, please observe the conditions written herein and the precautions outlined in the following paragraphs. In no event shall the company be liable for any damages resulting from failure to strictly adhere to these conditions and precautions.
 - The products covered herein are designed and manufactured for the following application areas. When using the products covered herein for the equipment listed in Paragraph (2), even for the following application areas, be sure to observe the precautions given in Paragraph (2). Never use the products for the equipment listed in Paragraph (3).
 - Office electronics
 - Instrumentation and measuring equipment
 - Machine tools
 - Audiovisual equipment
 - Home appliance
 - Communication equipment other than for trunk lines
 - (2) Those contemplating using the products covered herein for the following equipment <u>which demands high</u> <u>reliability</u>, should first contact a sales representative of the company and then accept responsibility for incorporating into the design fail-safe operation, redundancy, and other appropriate measures for ensuring reliability and safety of the equipment and the overall system.
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 - Mainframe computers
 - Traffic control systems
 - Gas leak detectors and automatic cutoff devices
 - Rescue and security equipment
 - Other safety devices and safety equipment, etc.
 - (3) Do not use the products covered herein for the following equipment which demands extremely high performance in terms of functionality, reliability, or accuracy.
 - Aerospace equipment
 - Communications equipment for trunk lines
 - Control equipment for the nuclear power industry
 - Medical equipment related to life support, etc.
 - (4) Please direct all queries and comments regarding the interpretation of the above three Paragraphs to a sales representative of the company.

• Please direct all queries regarding the products covered herein to a sales representative of the company.



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LH28F128BFHT-PBTL75A 128Mbit (8Mbit×16) Page Mode Dual Work Flash MEMORY

■ 128-M density with 16-bit I/O Interface

- High Performance Reads
 - 75/25ns 8-Word Page Mode
- 6-Plane Dual Work Operation
 - Read operations are available during Block Erase or (Page Buffer) Program between two different Planes
 Plane Architecture:
 - 16M, 24M, 24M, 24M, 24M, 16M
- Low Power Operation
 - 2.7V Read and Write Operations
 - \bullet V_{CCQ} for Input/Output Power Supply Isolation
 - Automatic Power Savings Mode reduces I_{CCR} in Static Mode
- Enhanced Code + Data Storage
 5µs Typical Erase/Program Suspends
- OTP (One Time Program) Block
 - 4-Word Factory-Programmed Area
 - 4-Word User-Programmable Area
- High Performance Program with Page Buffer
 - 16-Word Page Buffer
 - 5µs/Word (Typ.) at WP#/ACC=9.5V
- Operating Temperature -40° C to $+85^{\circ}$ C
- CMOS Process (P-type silicon substrate)

- Flexible Blocking Architecture
 - Eight 4-Kword Parameter Blocks
 - Two-hundred and fifty-five 32-Kword Main Blocks
 - Bottom Parameter Location
- Enhanced Data Protection Features
 - Individual Block Lock and Block Lock-Down with Zero-Latency
 - All blocks are locked at power-up or device reset.
 - Block Erase, Full Chip Erase, (Page Buffer) Word Program Lockout during Power Transitions
- Automated Erase/Program Algorithms
 - 3.0V Low-Power 11µs/Word (Typ.) Programming
 - 9.5V No Glue Logic 9µs/Word (Typ.) Production Programming and 0.8s Erase (Typ.)
- Cross-Compatible Command Support
 - Basic Command Set
 - Common Flash Interface (CFI)
- Extended Cycling Capability
 Minimum 100,000 Block Erase Cycles
- 56-Lead TSOP (Normal Bend)
- ETOX^{TM*} Flash Technology
- Not designed or rated as radiation hardened

The product, which is 6-Plane Page Mode Dual Work (Simultaneous Read while Erase/Program) Flash memory, is a low power, high density, low cost, nonvolatile read/write storage solution for a wide range of applications. The product can operate at $V_{CC}=2.7V-3.3V$. Its low voltage operation capability greatly extends battery life for portable applications.

The product provides high performance asynchronous page mode. It allows code execution directly from Flash, thus eliminating time consuming wait states.

The memory array block architecture utilizes Enhanced Data Protection features, and provides separate Parameter and Main Blocks that provide maximum flexibility for safe nonvolatile code and data storage.

Fast program capability is provided through the use of high speed Page Buffer Program.

Special OTP (One Time Program) block provides an area to store permanent code such as an unique number.

* ETOX is a trademark of Intel Corporation.



LHF12F17

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Figure 1. 56-Lead TSOP (Normal Bend) Pinout

		Table 1. Pin Descriptions
Symbol	Туре	Name and Function
A ₂₂ -A ₀	INPUT	ADDRESS INPUTS: Inputs for addresses.
DQ ₁₅ -DQ ₀	INPUT/ OUTPUT	DATA INPUTS/OUTPUTS: Inputs data and commands during CUI (Command User Interface) write cycles, outputs data during memory array, status register, query code and identifier code reads. Data pins float to high-impedance (High Z) when the chip or outputs are deselected. Data is internally latched during an erase or program cycle.
CE#	INPUT	CHIP ENABLE: Activates the device's control logic, input buffers, decoders and sense amplifiers. CE#-high (V_{IH}) deselects the device and reduces power consumption to standby levels.
RST#	INPUT	RESET: When low (V_{IL}), RST# resets internal automation and inhibits write operations which provides data protection. RST#-high (V_{IH}) enables normal operation. After power-up or reset mode, the device is automatically set to read array mode. RST# must be low during power-up/down.
OE#	INPUT	OUTPUT ENABLE: Gates the device's outputs during a read cycle.
WE#	INPUT	WRITE ENABLE: Controls writes to the CUI and array blocks. Addresses and data are latched on the rising edge of CE# or WE# (whichever goes high first).
WP#/ACC	INPUT/ SUPPLY	WRITE PROTECT: When WP#/ACC is V_{IL} , locked-down blocks cannot be unlocked. Erase or program operation can be executed to the blocks which are not locked and not locked-down. When WP#/ACC is V_{IH} , lock-down is disabled. Applying 9.5V±0.5V to WP#/ACC provides fast erasing or fast programming mode. In this mode, WP#/ACC is power supply pin. Applying 9.5V±0.5V to WP#/ACC during erase/program can only be done for a maximum of 1,000 cycles on each block. WP#/ ACC may be connected to 9.5V±0.5V for a total of 80 hours maximum. Use of this pin at 9.5V+0.5V beyond these limits may reduce block cycling capability or cause permanent damage.
RY/BY#	OPEN DRAIN OUTPUT	READY/BUSY#: Indicates the status of the internal WSM (Write State Machine). When low, WSM is performing an internal operation (block erase, full chip erase, (page buffer) program or OTP program). RY/BY#-High Z indicates that the WSM is ready for new commands, block erase is suspended and (page buffer) program is inactive, (page buffer) program is suspended, or the device is in reset mode.
V _{CC}	SUPPLY	DEVICE POWER SUPPLY (2.7V-3.3V): With $V_{CC} \leq V_{LKO}$, all write attempts to the flash memory are inhibited. Device operations at invalid V_{CC} voltage (see DC Characteristics) produce spurious results and should not be attempted.
V _{CCQ}	SUPPLY	INPUT/OUTPUT POWER SUPPLY (2.7V-3.3V): Power supply for all input/output pins.
GND	SUPPLY	GROUND: Do not float any ground pins.
NC		NO CONNECT: Lead is not internally connected; it may be driven or floated.

4

				1		10465 7 1110					
	THEN THE MODES ALLOWED IN THE OTHER PLANE IS:										
IF ONE PLANE IS:	Read Array	Read ID/OTP	Read Status	Read Query	Word Program	Page Buffer Program	OTP Program	Block Erase	Full Chip Erase	Program Suspend	Hrace
Read Array	Х	Х	Х	Х	Х	Х		Х		Х	Х
Read ID/OTP	Х	X	Х	Х	X	Х		Х		Х	Х
Read Status	Х	X	Х	Х	Х	Х	X	Х	X	Х	Х
Read Query	Х	X	Х	Х	Х	Х		Х		Х	Х
Word Program	Х	X	Х	Х							Х
Page Buffer Program	Х	X	Х	Х							X
OTP Program			Х								
Block Erase	Х	Х	Х	Х							
Full Chip Erase			Х								
Program Suspend	Х	X	Х	Х							Х
Block Erase Suspend	Х	X	Х	Х	Х	Х				Х	

Table 2. Simultaneous Operation Modes Allowed with 6 Planes (1, 2)
--

NOTES:

1. "X" denotes the operation available.

2. Dual Work Restrictions:

Status register reflects WSM (Write State Machine) state.

Only one plane can be erased or programmed at a time - no command queuing. Commands must be written to an address within the block targeted by that command.

SHARP)

		[A ₂₂ -A ₀]
	32-Kword Block 86	278000H - 27FFFFH
	32-Kword Block 85	270000H - 277FFFH
	32-Kword Block 84	268000H - 26FFFFH
	32-Kword Block 83	260000H - 267FFFH
	32-Kword Block 82	258000H - 25FFFFH
	32-Kword Block 81	250000H - 257FFFH
	32-Kword Block 80	248000H - 24FFFFH
	32-Kword Block 79	240000H - 247FFFH
	32-Kword Block 78	238000H - 23FFFFH
	32-Kword Block 77	230000H - 237FFFH
	32-Kword Block 76	228000H - 22FFFFH
	32-Kword Block 75	220000H - 227FFFH
	32-Kword Block 74	218000H - 21FFFFH
	32-Kword Block 73	210000H - 217FFFH
	32-Kword Block 72	208000H - 20FFFFH
	32-Kword Block 71	200000H - 207FFFH
	32-Kword Block 70	1F8000H - 1FFFFFH
	32-Kword Block 69	1F0000H - 1F7FFFH
	32-Kword Block 68	1E8000H - 1EFFFFH
	32-Kword Block 67	1E0000H - 1E7FFFH
	32-Kword Block 66	1D8000H - 1DFFFFH
	32-Kword Block 65	1D0000H - 1D7FFFH
	32-Kword Block 64	1C8000H - 1CFFFFH
	32-Kword Block 63	1C0000H - 1C7FFFH
	32-Kword Block 62	1B8000H - 1BFFFFH
	32-Kword Block 61	1B0000H - 1B7FFFH
Ē	32-Kword Block 60	1A8000H - 1AFFFFH
Ē	32-Kword Block 59	1A0000H - 1A7FFFH
PLANE	32-Kword Block 58	198000H - 19FFFFH
Ľ	32-Kword Block 57	190000H - 197FFFH
щ	32-Kword Block 56	188000H - 18FFFFH
	32-Kword Block 55	180000H - 187FFFH
	32-Kword Block 54	178000H - 17FFFFH
	32-Kword Block 53	170000H - 177FFFH
	32-Kword Block 52	168000H - 16FFFFH
	32-Kword Block 51	160000H - 167FFFH
	32-Kword Block 50	158000H - 15FFFFH
-	32-Kword Block 49	150000H - 157FFFH
	32-Kword Block 48	148000H - 14FFFFH
	32-Kword Block 47	140000H - 147FFFH
	32-Kword Block 46	138000H - 13FFFFH
	32-Kword Block 45	130000H - 137FFFH
	32-Kword Block 44	128000H - 12FFFFH
	32-Kword Block 43	120000H - 127FFFH
	32-Kword Block 42	118000H - 11FFFFH
	32-Kword Block 41	110000H - 117FFFH
	32-Kword Block 40	108000H - 10FFFFH
	32-Kword Block 39	100000H - 107FFFH

PLANE1 : 24 Mbit

$[A_{22}-A_0]$	
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		_
	32-Kword Block 38	0F8000H - 0FFFFFH
	32-Kword Block 37	0F0000H - 0F7FFFH
	32-Kword Block 36	0E8000H - 0EFFFFH
	32-Kword Block 35	0E0000H - 0E7FFFH
	32-Kword Block 34	0D8000H - 0DFFFFH
	32-Kword Block 33	0D0000H - 0D7FFFH
	32-Kword Block 32	0C8000H - 0CFFFFH
	32-Kword Block 31	0C0000H - 0C7FFFH
	32-Kword Block 30	0B8000H - 0BFFFFH
	32-Kword Block 29	0B0000H - 0B7FFFH
	32-Kword Block 28	0A8000H - 0AFFFFH
	32-Kword Block 27	0A0000H - 0A7FFFH
	32-Kword Block 26	098000H - 09FFFFH
	32-Kword Block 25	090000H - 097FFFH
	32-Kword Block 24	088000H - 08FFFFH
	32-Kword Block 23	080000H - 087FFFH
	32-Kword Block 22	078000H - 07FFFFH
PLANE0	32-Kword Block 21	070000H - 077FFFH
Ē	32-Kword Block 20	068000H - 06FFFFH
A	32-Kword Block 19	060000H - 067FFFH
Ľ	32-Kword Block 18	058000H - 05FFFFH
Р	32-Kword Block 17	050000H - 057FFFH
	32-Kword Block 16	048000H - 04FFFFH
	32-Kword Block 15	040000H - 047FFFH
	32-Kword Block 14	038000H - 03FFFFH
	32-Kword Block 13	030000H - 037FFFH
	32-Kword Block 12	028000H - 02FFFFH
	32-Kword Block 11	020000H - 027FFFH
	32-Kword Block 10	018000H - 01FFFFH
	32-Kword Block 9	010000H - 017FFFH
	32-Kword Block 8	008000H - 00FFFFH
	4-Kword Block 7	007000H - 007FFFH
	4-Kword Block 6	006000H - 006FFFH
	4-Kword Block 5	005000H - 005FFFH
	4-Kword Block 4	004000H - 004FFFH
	4-Kword Block 3	003000H - 003FFFH
	4-Kword Block 2	002000H - 002FFFH
	4-Kword Block 1	001000H - 001FFFH
	4-Kword Block 0	000000H - 000FFFH

PLANE0 : 16 Mbit

Figure 2.1. Memory Map (Bottom Parameter, Plane 0 and Plane 1)

$[A_{22}-A_0]$	
----------------	--

32-Kword Block 181 570000H - 577FFFH 32-Kword Block 180 568000H - 56FFFH 32-Kword Block 179 560000H - 567FFFH 32-Kword Block 179 560000H - 557FFFH 32-Kword Block 176 558000H - 557FFFH 32-Kword Block 176 548000H - 557FFFH 32-Kword Block 176 548000H - 547FFFH 32-Kword Block 175 540000H - 547FFFH 32-Kword Block 175 540000H - 547FFFH 32-Kword Block 173 530000H - 537FFFH 32-Kword Block 173 530000H - 537FFFH 32-Kword Block 172 528000H - 527FFFH 32-Kword Block 170 518000H - 527FFFH 32-Kword Block 170 518000H - 517FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 165 508000H - 507FFFH 32-Kword Block 167 500000H - 507FFFH 32-Kword Block 165 4F8000H - 4FFFFFH 32-Kword Block 165 4F0000H - 4FFFFFH 32-Kword Block 164 4E8000H - 4EFFFFH 32-Kword Block 164 4E8000H - 4EFFFFH 32-Kword Block 164 4E8000H - 4EFFFFH 32-Kword Block 164 4E8000H			_
Standard Solution Solution Solution 32-Kword Block 179 Solution Solution Solution Solution 32-Kword Block 178 Solution Solution Solution Solution 32-Kword Block 176 Station Solution Solution Solution 32-Kword Block 175 Solution Solution Solution Solution 32-Kword Block 175 Solution Solution Solution Solution 32-Kword Block 173 Solution Solution Solution Solution 32-Kword Block 170 Solution Solution Solution Solution Solution 32-Kword Block 169 Solution Solution <t< td=""><td></td><td>32-Kword Block 182</td><td>578000H - 57FFFFH</td></t<>		32-Kword Block 182	578000H - 57FFFFH
Section Section Section 32-Kword Block 179 560000H - 567FFFH 32-Kword Block 177 550000H - 557FFFH 32-Kword Block 175 540000H - 547FFFH 32-Kword Block 175 540000H - 547FFFH 32-Kword Block 173 530000H - 537FFFH 32-Kword Block 173 530000H - 537FFFH 32-Kword Block 172 528000H - 527FFFH 32-Kword Block 170 518000H - 517FFFH 32-Kword Block 169 510000H - 527FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 165 508000H - 507FFFH 32-Kword Block 164 458000H - 4FFFFH 32-Kword Block 165 450000H - 4FFFFFH 32-Kword Block 164 458000H - 4EFFFFH 32-Kword Block 164 458000H - 4EFFFFH 32-Kword Block 164 400000H - 4D7FFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 150 4780		32-Kword Block 181	
Stand Stand Stand 32-Kword Block 178 558000H - 55FFFFH 32-Kword Block 177 550000H - 557FFFH 32-Kword Block 175 540000H - 547FFFH 32-Kword Block 173 530000H - 537FFFH 32-Kword Block 171 530000H - 537FFFH 32-Kword Block 172 528000H - 527FFFH 32-Kword Block 170 518000H - 527FFFH 32-Kword Block 170 518000H - 517FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 165 508000H - 507FFFH 32-Kword Block 166 4F8000H - 4F7FFFH 32-Kword Block 165 4F0000H - 4F7FFFH 32-Kword Block 164 4E8000H - 4E7FFFH 32-Kword Block 163 4D0000H - 4D7FFFH 32-Kword Block 164 4D8000H - 4D7FFFH 32-Kword Block 155 4A8000H - 4D7FFFH 32-Kword Block 155 4A8000H - 4A7FFFH 32-Kword Block 150 478000H - 477FFFH 32-Kword Block 151 480000H -		32-Kword Block 180	
Standard Standard 32-Kword Block 177 550000H - 557FFFH 32-Kword Block 175 548000H - 54FFFH 32-Kword Block 175 540000H - 537FFFH 32-Kword Block 173 530000H - 537FFFH 32-Kword Block 172 528000H - 527FFFH 32-Kword Block 171 520000H - 527FFFH 32-Kword Block 170 518000H - 517FFFH 32-Kword Block 168 508000H - 507FFFH 32-Kword Block 166 508000H - 507FFFH 32-Kword Block 166 508000H - 417FFFH 32-Kword Block 166 4F8000H - 4F7FFFH 32-Kword Block 166 4F8000H - 4F7FFFH 32-Kword Block 163 4E0000H - 4E7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 155 4A8000H - 4DFFFFH 32-Kword Block 156 4A8000H - 4AFFFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 154 498000H - 4AFFFFH 32-Kword Block 155 4A8000H - 4AFFFFH 32-Kword Block 151 48000H - 4AFFFFH 32-Kword Block 152 488000H - 4AFFFFH <		32-Kword Block 179	
S2-Kword Block 176 548000H - 54FFFFH 32-Kword Block 174 538000H - 537FFFH 32-Kword Block 172 538000H - 537FFFH 32-Kword Block 172 528000H - 537FFFH 32-Kword Block 172 528000H - 527FFFH 32-Kword Block 170 518000H - 517FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 169 508000H - 507FFFH 32-Kword Block 166 458000H - 4F7FFFH 32-Kword Block 167 508000H - 507FFFH 32-Kword Block 166 458000H - 4F7FFFH 32-Kword Block 164 458000H - 4F7FFFH 32-Kword Block 164 458000H - 4E7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 160 4C8000H - 4D7FFFH 32-Kword Block 157 4B0000H - 4D7FFFH 32-Kword Block 156 4A8000H - 4AFFFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 152 488000H - 48FFFFH 32-Kword Block 152 488000H - 48FFFFH 32-Kword Block 151 480000H - 47FFFH 32-Kword Block 152 488000H - 48FFFFH 32-Kword Block 151 480000H		32-Kword Block 178	558000H - 55FFFFH
Standard Standard Standard 32-Kword Block 175 540000H - 547FFFH 32-Kword Block 173 530000H - 537FFFH 32-Kword Block 173 530000H - 537FFFH 32-Kword Block 171 520000H - 527FFFH 32-Kword Block 170 518000H - 517FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 167 500000H - 507FFFH 32-Kword Block 166 4F8000H - 4F7FFFH 32-Kword Block 165 4F0000H - 4F7FFFH 32-Kword Block 164 4E8000H - 4F7FFFH 32-Kword Block 162 4D8000H - 4F7FFFH 32-Kword Block 160 4C8000H - 4F7FFH 32-Kword Block 159 4C0000H - 4D7FFFH 32-Kword Block 157 4B0000H - 4B7FFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 152 488000H - 487FFFH 32-Kword Block 150 478000H - 477FFFH 3		32-Kword Block 177	550000H - 557FFFH
32-Kword Block 174 538000H - 53FFFFH 32-Kword Block 172 538000H - 537FFFH 32-Kword Block 172 528000H - 527FFFH 32-Kword Block 170 518000H - 527FFFH 32-Kword Block 170 518000H - 517FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 165 50000H - 507FFFH 32-Kword Block 164 458000H - 4F7FFFH 32-Kword Block 165 4F0000H - 4F7FFFH 32-Kword Block 164 4E8000H - 4E7FFFH 32-Kword Block 164 4E8000H - 4E7FFFH 32-Kword Block 164 4D0000H - 4D7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 159 4C0000H - 4C7FFFH 32-Kword Block 156 4A8000H - 4B7FFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 155 4A8000H - 487FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 150 478000H - 477FFFH 32-Kword Block 145 45000H -		32-Kword Block 176	548000H - 54FFFFH
S12-Kword Block 173 530000H - 537FFFH 32-Kword Block 171 528000H - 527FFFH 32-Kword Block 171 520000H - 527FFFH 32-Kword Block 170 518000H - 517FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 164 508000H - 507FFFH 32-Kword Block 165 508000H - 4F7FFFH 32-Kword Block 166 4F8000H - 4F7FFFH 32-Kword Block 164 4E8000H - 4E7FFFH 32-Kword Block 163 4E0000H - 4E7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 162 4D8000H - 4D7FFFH 32-Kword Block 150 4C0000H - 4C7FFFH 32-Kword Block 157 4B0000H - 4D7FFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 154 498000H - 477FFFH 32-Kword Block 154 498000H - 477FFFH 32-Kword Block 154 498000H - 477FFFH 32-Kword Block 154 488000H - 477FFFH 32-Kword Block 142 488000		32-Kword Block 175	540000H - 547FFFH
32-Kword Block 173 530000H - 537FFFH 32-Kword Block 172 528000H - 527FFFH 32-Kword Block 170 518000H - 527FFFH 32-Kword Block 170 518000H - 517FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 165 508000H - 507FFFH 32-Kword Block 166 4F8000H - 4F7FFFH 32-Kword Block 165 4F0000H - 4F7FFFH 32-Kword Block 164 4E8000H - 4E7FFFH 32-Kword Block 164 4E8000H - 4E7FFFH 32-Kword Block 164 4E8000H - 4D7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 159 4C0000H - 4C7FFFH 32-Kword Block 159 4C0000H - 4A7FFFH 32-Kword Block 155 4A8000H - 487FFFH 32-Kword Block 155 4A8000H - 487FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 150 478000H - 477FFFH 32-Kword Block 150 478000H - 487FFFH 32-Kword Block 145 450000H - 487FFFH 32-Kword Block 144 48000H		32-Kword Block 174	538000H - 53FFFFH
S2-Kword Block 171 520000H - 527FFFH 32-Kword Block 170 518000H - 51FFFH 32-Kword Block 169 510000H - 517FFFH 32-Kword Block 169 500000H - 507FFFH 32-Kword Block 167 500000H - 507FFFH 32-Kword Block 166 4F8000H - 4F7FFFH 32-Kword Block 166 4F8000H - 4F7FFFH 32-Kword Block 164 4E8000H - 4E7FFFH 32-Kword Block 164 4E8000H - 4E7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 159 4C0000H - 4D7FFFH 32-Kword Block 157 4B0000H - 4B7FFFH 32-Kword Block 156 4A8000H - 4AFFFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 151 480000H - 487FFFH 32-Kword Block 151 480000H - 487FFFH 32-Kword Block 151 480000H - 487FFFH 32-Kword Block 151 480000H - 477FFFH 32-Kword Block 152 488000H - 487FFFH 32-Kword Block 142 480000H - 477FFFH 32-Kword Block 144 460000H		32-Kword Block 173	530000H - 537FFFH
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32-Kword Block 169 510000H - 517FFFH 32-Kword Block 168 508000H - 507FFFH 32-Kword Block 166 4F8000H - 4FFFFFH 32-Kword Block 165 4F0000H - 4F7FFFH 32-Kword Block 164 4E8000H - 4FFFFH 32-Kword Block 163 4E0000H - 4F7FFFH 32-Kword Block 164 4E8000H - 4E7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 160 4C8000H - 4C7FFFH 32-Kword Block 159 4C0000H - 4D7FFFH 32-Kword Block 159 4C0000H - 4B7FFFH 32-Kword Block 156 4A8000H - 4B7FFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 150 478000H - 487FFFH 32-Kword Block 141 48000H - 487FFFH 32-Kword Block 144 488000H - 487FFFH 32-Kword Block 144 48000H -			518000H - 51FFFFH
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32-Kword Block 165 4F0000H - 4F7FFFH 32-Kword Block 164 4E8000H - 4EFFFFH 32-Kword Block 161 4E0000H - 4E7FFFH 32-Kword Block 162 4D8000H - 4D7FFFH 32-Kword Block 161 4D0000H - 4D7FFFH 32-Kword Block 160 4C8000H - 4D7FFFH 32-Kword Block 159 4C0000H - 4D7FFFH 32-Kword Block 159 4C0000H - 4D7FFFH 32-Kword Block 159 4C0000H - 4D7FFFH 32-Kword Block 157 4B0000H - 4B7FFFH 32-Kword Block 156 4A8000H - 4B7FFFH 32-Kword Block 155 4A0000H - 4A7FFFH 32-Kword Block 154 498000H - 487FFFH 32-Kword Block 152 488000H - 487FFFH 32-Kword Block 152 488000H - 487FFFH 32-Kword Block 150 478000H - 477FFFH 32-Kword Block 150 478000H - 477FFFH 32-Kword Block 142 48000H - 487FFFH 32-Kword Block 144 46000H - 467FFFH 32-Kword Block 144 48000H - 437FFFH 32-Kword Block 144 438000H - 437FFFH 32-Kword Block 144 430000H - 437FFFH 32-Kword Block 142 438000H -			4F8000H - 4FFFFFH
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32-Kword Block 148 468000H - 46FFFFH 32-Kword Block 147 460000H - 467FFFH 32-Kword Block 147 460000H - 467FFFH 32-Kword Block 146 458000H - 457FFFH 32-Kword Block 145 450000H - 457FFFH 32-Kword Block 144 448000H - 447FFFH 32-Kword Block 143 440000H - 447FFFH 32-Kword Block 142 438000H - 437FFFH 32-Kword Block 141 430000H - 437FFFH 32-Kword Block 140 428000H - 427FFFH 32-Kword Block 138 418000H - 427FFFH 32-Kword Block 138 418000H - 417FFFH 32-Kword Block 138 418000H - 417FFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 137 408000H - 407FFFH		32-Kword Block 150	478000H - 47FFFFH
32-Kword Block 147 460000H - 467FFFH 32-Kword Block 146 458000H - 45FFFH 32-Kword Block 145 45000H - 457FFFH 32-Kword Block 145 450000H - 457FFFH 32-Kword Block 144 448000H - 447FFFH 32-Kword Block 143 440000H - 447FFFH 32-Kword Block 142 438000H - 437FFFH 32-Kword Block 141 430000H - 437FFFH 32-Kword Block 140 428000H - 427FFFH 32-Kword Block 138 418000H - 427FFFH 32-Kword Block 138 418000H - 417FFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 407FFFH		32-Kword Block 149	470000H - 477FFFH
32-Kword Block 147 460000H - 467FFFH 32-Kword Block 146 458000H - 457FFFH 32-Kword Block 145 45000H - 457FFFH 32-Kword Block 144 448000H - 447FFFH 32-Kword Block 143 440000H - 447FFFH 32-Kword Block 142 438000H - 437FFFH 32-Kword Block 141 430000H - 437FFFH 32-Kword Block 140 428000H - 437FFFH 32-Kword Block 139 420000H - 427FFFH 32-Kword Block 138 418000H - 417FFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 407FFFH		32-Kword Block 148	468000H - 46FFFFH
32-Kword Block 145 450000H - 457FFFH 32-Kword Block 144 448000H - 44FFFFH 32-Kword Block 143 440000H - 447FFFH 32-Kword Block 142 438000H - 437FFFH 32-Kword Block 141 430000H - 437FFFH 32-Kword Block 140 428000H - 42FFFFH 32-Kword Block 139 420000H - 42FFFFH 32-Kword Block 138 418000H - 41FFFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 40FFFFH		32-Kword Block 147	460000H - 467FFFH
32-Kword Block 145 450000H - 457FFFH 32-Kword Block 144 448000H - 447FFFH 32-Kword Block 143 440000H - 447FFFH 32-Kword Block 142 438000H - 437FFFH 32-Kword Block 141 430000H - 437FFFH 32-Kword Block 140 428000H - 437FFFH 32-Kword Block 139 420000H - 427FFFH 32-Kword Block 139 420000H - 427FFFH 32-Kword Block 137 418000H - 417FFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 407FFFH		32-Kword Block 146	458000H - 45FFFFH
32-Kword Block 143 440000H - 447FFFH 32-Kword Block 142 438000H - 437FFFH 32-Kword Block 141 430000H - 437FFFH 32-Kword Block 140 428000H - 427FFFH 32-Kword Block 139 420000H - 427FFFH 32-Kword Block 138 418000H - 427FFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 407FFFH			450000H - 457FFFH
32-Kword Block 142 438000H - 43FFFFH 32-Kword Block 141 430000H - 437FFFH 32-Kword Block 140 428000H - 427FFFH 32-Kword Block 139 420000H - 427FFFH 32-Kword Block 138 418000H - 417FFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 407FFFH			448000H - 44FFFFH
32-Kword Block 141 430000H - 437FFFH 32-Kword Block 140 428000H - 42FFFH 32-Kword Block 139 420000H - 427FFFH 32-Kword Block 138 418000H - 417FFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 407FFFH		32-Kword Block 143	440000H - 447FFFH
32-Kword Block 140 428000H - 42FFFH 32-Kword Block 139 420000H - 427FFFH 32-Kword Block 138 418000H - 41FFFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 40FFFFH		32-Kword Block 142	438000H - 43FFFFH
32-Kword Block 140 428000H - 42FFFH 32-Kword Block 139 420000H - 427FFFH 32-Kword Block 138 418000H - 41FFFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 40FFFFH			430000H - 437FFFH
32-Kword Block 139 420000H - 427FFFH 32-Kword Block 138 418000H - 41FFFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 40FFFFH			428000H - 42FFFFH
32-Kword Block 138 418000H - 41FFFFH 32-Kword Block 137 410000H - 417FFFH 32-Kword Block 136 408000H - 40FFFFH			420000H - 427FFFH
<u>32-Kword Block 137</u> 32-Kword Block 136 408000H - 40FFFFH			418000H - 41FFFFH
32-Kword Block 136 408000H - 40FFFFH			410000H - 417FFFH
	1		408000H - 40FFFFH
		32-Kword Block 135	400000H - 407FFFH

SHARP

3E8000H - 3EFFFFH 32-Kword Block 132 32-Kword Block 131 3E0000H - 3E7FFFH 32-Kword Block 130 3D8000H - 3DFFFFH 32-Kword Block 129 3D0000H - 3D7FFFH 32-Kword Block 128 3C8000H - 3CFFFFH 32-Kword Block 127 3C0000H - 3C7FFFH 32-Kword Block 126 3B8000H - 3BFFFFH 3B0000H - 3B7FFFH 32-Kword Block 125 3A8000H - 3AFFFFH 32-Kword Block 124 32-Kword Block 123 3A0000H - 3A7FFFH 32-Kword Block 122 398000H - 39FFFFH 32-Kword Block 121 390000H - 397FFFH 32-Kword Block 120 388000H - 38FFFFH 32-Kword Block 119 380000H - 387FFFH 378000H - 37FFFFH 32-Kword Block 118 370000H - 377FFFH 32-Kword Block 117 32-Kword Block 116 368000H - 36FFFFH 32-Kword Block 115 360000H - 367FFFH 32-Kword Block 114 358000H - 35FFFFH 350000H - 357FFFH 32-Kword Block 113 348000H - 34FFFFH 32-Kword Block 112 32-Kword Block 111 340000H - 347FFFH 338000H - 33FFFFH 32-Kword Block 110 330000H - 337FFFH 32-Kword Block 109 32-Kword Block 108 328000H - 32FFFFH **PLANE2** 32-Kword Block 107 320000H - 327FFFH 318000H - 31FFFFH 32-Kword Block 106 32-Kword Block 105 310000H - 317FFFH 32-Kword Block 104 308000H - 30FFFFH 300000H - 307FFFH 32-Kword Block 103 32-Kword Block 102 2F8000H - 2FFFFFH 32-Kword Block 101 2F0000H - 2F7FFFH 32-Kword Block 100 2E8000H - 2EFFFFH 32-Kword Block 99 2E0000H - 2E7FFFH 32-Kword Block 98 2D8000H - 2DFFFFH 32-Kword Block 97 2D0000H - 2D7FFFH 2C8000H - 2CFFFFH 32-Kword Block 96 2C0000H - 2C7FFFH 32-Kword Block 95 32-Kword Block 94 2B8000H - 2BFFFFH 32-Kword Block 93 2B0000H - 2B7FFFH 32-Kword Block 92 2A8000H - 2AFFFFH 32-Kword Block 91 2A0000H - 2A7FFFH 298000H - 29FFFFH 32-Kword Block 90 32-Kword Block 89 290000H - 297FFFH 32-Kword Block 88 288000H - 28FFFFH 32-Kword Block 87 280000H - 287FFFH

32-Kword Block 134

32-Kword Block 133

PLANE3 : 24 Mbit

PLANE2: 24 Mbit

Figure 2.2. Memory Map (Bottom Parameter, Plane 2 and Plane 3)

Rev. 0.04

[A₂₂-A₀]

3F8000H - 3FFFFFH 3F0000H - 3F7FFFH

	32-Kword Block 230	6F8000H - 6FFFFFH
	32-Kword Block 229	6F0000H - 6F7FFFH
	32-Kword Block 229 32-Kword Block 228	6E8000H - 6EFFFFH
	32-Kword Block 228	6E0000H - 6E7FFFH
		6D8000H - 6DFFFFH
	32-Kword Block 226	6D0000H - 6D7FFFH
	32-Kword Block 225	6C8000H - 6CFFFFH
	32-Kword Block 224	6C0000H - 6C7FFFH
	32-Kword Block 223	6B8000H - 6BFFFFH
	32-Kword Block 222	6B0000H - 6B7FFFH
	32-Kword Block 221	6A8000H - 6AFFFFH
	32-Kword Block 220	6A8000H - 6A7FFFH
	32-Kword Block 219	
	32-Kword Block 218	698000H - 69FFFFH
	32-Kword Block 217	690000H - 697FFFH
	32-Kword Block 216	688000H - 68FFFFH
	32-Kword Block 215	680000H - 687FFFH
	32-Kword Block 214	678000H - 67FFFFH
	32-Kword Block 213	670000H - 677FFFH
	32-Kword Block 212	668000H - 66FFFFH
	32-Kword Block 211	660000H - 667FFFH
	32-Kword Block 210	658000H - 65FFFFH
	32-Kword Block 209	650000H - 657FFFH
	32-Kword Block 208	648000H - 64FFFFH
	32-Kword Block 207	640000H - 647FFFH
	32-Kword Block 206	638000H - 63FFFFH
	32-Kword Block 205	630000H - 637FFFH
	32-Kword Block 204	628000H - 62FFFFH
	32-Kword Block 203	620000H - 627FFFH
	32-Kword Block 202	618000H - 61FFFFH
4	32-Kword Block 201	610000H - 617FFFH
PLANE4	32-Kword Block 200	608000H - 60FFFFH
7	32-Kword Block 199	600000H - 607FFFH
Ľ	32-Kword Block 198	5F8000H - 5FFFFFH
Р	32-Kword Block 197	5F0000H - 5F7FFFH
	32-Kword Block 196	5E8000H - 5EFFFFH
	32-Kword Block 195	5E0000H - 5E7FFFH
	32-Kword Block 194	5D8000H - 5DFFFFH
	32-Kword Block 193	5D0000H - 5D7FFFH
	32-Kword Block 192	5C8000H - 5CFFFFH
	32-Kword Block 191	5C0000H - 5C7FFFH
	32-Kword Block 190	5B8000H - 5BFFFFH
	32-Kword Block 189	5B0000H - 5B7FFFH
	32-Kword Block 188	5A8000H - 5AFFFFH
-	32-Kword Block 187	5A0000H - 5A7FFFH
	32-Kword Block 186	598000H - 59FFFFH
	32-Kword Block 185	590000H - 597FFFH
	32-Kword Block 184	588000H - 58FFFFH
	32-Kword Block 183	580000H - 587FFFH

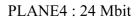
[A₂₂-A₀]

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LHF12F17

		-
	32-Kword Block 262	7F8000H - 7FFFFFH
	32-Kword Block 261	7F0000H - 7F7FFFH
	32-Kword Block 260	7E8000H - 7EFFFFH
	32-Kword Block 259	7E0000H - 7E7FFFH
	32-Kword Block 258	7D8000H - 7DFFFFH
	32-Kword Block 257	7D0000H - 7D7FFFH
	32-Kword Block 256	7C8000H - 7CFFFFH
	32-Kword Block 255	7C0000H - 7C7FFFH
	32-Kword Block 254	7B8000H - 7BFFFFH
	32-Kword Block 253	7B0000H - 7B7FFFH
	32-Kword Block 252	7A8000H - 7AFFFFH
	32-Kword Block 251	7A0000H - 7A7FFFH
	32-Kword Block 250	798000H - 79FFFFH
S	32-Kword Block 249	790000H - 797FFFH
町	32-Kword Block 248	788000H - 78FFFFH
PLANE5	32-Kword Block 247	780000H - 787FFFH
Ľ	32-Kword Block 246	778000H - 77FFFFH
P	32-Kword Block 245	770000H - 777FFFH
	32-Kword Block 244	768000H - 76FFFFH
	32-Kword Block 243	760000H - 767FFFH
	32-Kword Block 242	758000H - 75FFFFH
	32-Kword Block 241	750000H - 757FFFH
	32-Kword Block 240	748000H - 74FFFFH
	32-Kword Block 239	740000H - 747FFFH
	32-Kword Block 238	738000H - 73FFFFH
	32-Kword Block 237	730000H - 737FFFH
	32-Kword Block 236	728000H - 72FFFFH
	32-Kword Block 235	720000H - 727FFFH
	32-Kword Block 234	718000H - 71FFFFH
	32-Kword Block 233	710000H - 717FFFH
	32-Kword Block 232	708000H - 70FFFFH
	32-Kword Block 231	700000H - 707FFFH

PLANE5 : 16 Mbit



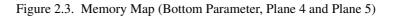


Table 3. Identifier Codes and OTP Address for Read Operation							
	Code	Address [A ₁₅ -A ₀]	Data [DQ ₁₅ -DQ ₀]	Notes			
Manufacturer Code	Manufacturer Code	0000H	00B0H	1			
Device Code	Device Code	0001H	0011H	1			
Block Lock Configuration	Block is Unlocked		$DQ_0 = 0$	2, 3			
Code	Block is Locked	$DQ_0 = 1$	2, 3				
	Block is not Locked-Down	Address + 2	$DQ_1 = 0$	2, 3			
	Block is Locked-Down		DQ ₁ = 1	2, 3			
OTP	OTP Lock	0080H	OTP-LK	1, 4			
	OTP	0081-0088H	OTP	1, 5			

NOTES:

1. A_{22} - A_{16} must be the address within the plane to which the Read Identifier Codes/OTP command (90H) has been written. 2. Block Address = The beginning location of a block address within the plane to which the Read Identifier Codes/OTP command (90H) has been written.

3. DQ_{15} - DQ_2 are reserved for future implementation.

4. OTP-LK=OTP Block Lock configuration.

5. OTP=OTP Block data.

[A ₂₂ -A ₀]	
000088H	
	Customer Programmable Area
000085H	
000084H	
	Factory Programmed Area
000081H	
000080H	Reserved for Future Implementation (DQ15-DQ2)
U	mmable Area Lock Bit (DQ1)

Figure 3. OTP Block Address Map for OTP Program (The area outside 80H~88H cannot be used.)

HARP

			Table 4	. bus Op	eration	*		
Mode	Notes	RST#	CE#	OE#	WE#	Address	DQ ₁₅₋₀	RY/BY# ⁽⁸⁾
Read Array	6	V _{IH}	V _{IL}	V _{IL}	V _{IH}	Х	D _{OUT}	High Z
Output Disable		V _{IH}	V _{IL}	V _{IH}	V _{IH}	Х	High Z	X
Standby		V _{IH}	V _{IH}	Х	Х	Х	High Z	Х
Reset	3	V _{IL}	Х	X	X	Х	High Z	High Z
Read Identifier Codes/OTP	6	V _{IH}	V _{IL}	V _{IL}	V _{IH}	See Table 3	See Table 3	High Z
Read Query	6,7	V _{IH}	V _{IL}	V _{IL}	V _{IH}	Х	D _{OUT}	High Z
Read Status Register	6	V _{IH}	V _{IL}	V _{IL}	V _{IH}	Х	D _{OUT}	X
Write	4,5,6	V _{IH}	V _{IL}	V _{IH}	V _{IL}	Х	D _{IN}	X

Table 4. Bus $Operation^{(1,2)}$

NOTES:

1. Refer to DC Characteristics for V_{IL} or V_{IH} voltages.

2. X can be V_{IL} or V_{IH} for control pins and addresses. 3. RST# at GND±0.2V ensures the lowest power consumption.

4. Command writes involving block erase, full chip erase, (page buffer) program or OTP program are reliably executed when $V_{CC}=2.7V-3.3V$.

5. Refer to Table 5 for valid D_{IN} during a write operation.

6. Never hold OE# low and WE# low at the same timing.

7. Query code = Common Flash Interface (CFI) code.

8. RY/BY# is VOL when the WSM (Write State Machine) is executing internal block erase, full chip erase, (page buffer) program or OTP program algorithms. It is High Z during when the WSM is not busy, in block erase suspend mode (with program and page buffer program inactive), (page buffer) program suspend mode, or reset mode.

	Bus		First Bus Cycle			Second Bus Cycle		
Command	Cycles Req'd	Notes	Oper ⁽¹⁾	Addr ⁽²⁾	Data	Oper ⁽¹⁾	Addr ⁽²⁾	Data ⁽³⁾
Read Array	1		Write	PA	FFH			
Read Identifier Codes/OTP	≥2	4	Write	PA	90H	Read	IA or OA	ID or OD
Read Query	≥2	4	Write	PA	98H	Read	QA	QD
Read Status Register	2		Write	PA	70H	Read	PA	SRD
Clear Status Register	1		Write	PA	50H			
Block Erase	2	5	Write	BA	20H	Write	BA	D0H
Full Chip Erase	2	5,9	Write	Х	30H	Write	Х	D0H
Program	2	5,6	Write	WA	40H or 10H	Write	WA	WD
Page Buffer Program	≥4	5,7	Write	WA	E8H	Write	WA	N-1
Block Erase and (Page Buffer) Program Suspend	1	8,9	Write	PA	B0H			
Block Erase and (Page Buffer) Program Resume	1	8,9	Write	PA	D0H			
Set Block Lock Bit	2		Write	BA	60H	Write	BA	01H
Clear Block Lock Bit	2	10	Write	BA	60H	Write	BA	D0H
Set Block Lock-down Bit	2		Write	BA	60H	Write	BA	2FH
OTP Program	2	9	Write	OA	СОН	Write	OA	OD

Table 5. Command $Definitions^{(11)}$

NOTES:

1. Bus operations are defined in Table 4.

2. All addresses which are written at the first bus cycle should be the same as the addresses which are written at the second bus cycle.

X=Any valid address within the device.

PA=Address within the selected plane.

IA=Identifier codes address (See Table 3).

QA=Query codes address.

BA=Address within the block being erased, set/cleared block lock bit or set block lock-down bit.

WA=Address of memory location for the Program command or the first address for the Page Buffer Program command. OA=Address of OTP block to be read or programmed (See Figure 3).

3. ID=Data read from identifier codes. (See Table 3).

QD=Data read from query database.

SRD=Data read from status register. See Table 9.1, Table 9.2 for a description of the status register bits.WD=Data to be programmed at location WA. Data is latched on the rising edge of WE# or CE# (whichever goes high first) during command write cycles.

OD=Data within OTP block. Data is latched on the rising edge of WE# or CE# (whichever goes high first) during command write cycles.

N-1=N is the number of the words to be loaded into a page buffer.

4. Following the Read Identifier Codes/OTP command, read operations access manufacturer code, device code, block lock configuration code and the data within OTP block (See Table 3).

The Read Query command is available for reading CFI (Common Flash Interface) information.

5. Block erase, full chip erase or (page buffer) program cannot be executed when the selected block is locked. Unlocked block can be erased or programmed when RST# is V_{IH}.

6. Either 40H or 10H are recognized by the CUI (Command User Interface) as the program setup.



- 7. Following the third bus cycle, input the program sequential address and write data of "N" times. Finally, input the any valid address within the target block to be programmed and the confirm command (D0H).
- 8. If the program operation in one plane is suspended and the erase operation in other plane is also suspended, the suspended program operation will be resumed first.
- 9. Full chip erase and OTP program operations can not be suspended. The OTP Program command can not be accepted while the block erase operation is being suspended.
- 10. Following the Clear Block Lock Bit command, block which is not locked-down is unlocked when WP#/ACC is V_{IL}. When WP#/ACC is V_{IH}, lock-down bit is disabled and the selected block is unlocked regardless of lock-down configuration.
- 11. Commands other than those shown above are reserved by SHARP for future device implementations and should not be used.

		(2)			
State	WP#/ACC	$DQ_1^{(1)}$	$\mathrm{DQ}_{0}^{(1)}$	State Name	Erase/Program Allowed ⁽²⁾
[000]	0	0	0	Unlocked	Yes
[001] ⁽³⁾	0	0	1	Locked	No
[011]	0	1	1	Locked-down	No
[100]	1	0	0	Unlocked	Yes
[101] ⁽³⁾	1	0	1	Locked	No
[110] ⁽⁴⁾	1	1	0	Lock-down Disable	Yes
[111]	1	1	1	Lock-down Disable	No

Table 6. Functions of Block Loo	ck ⁽⁵⁾ and Block Lock-Down
---------------------------------	---------------------------------------

NOTES:

1. $DQ_0=1$: a block is locked; $DQ_0=0$: a block is unlocked.

- $DQ_1=1$: a block is locked-down; $DQ_1=0$: a block is not locked-down.
- 2. Erase and program are general terms, respectively, to express: block erase, full chip erase and (page buffer) program operations.
- 3. At power-up or device reset, all blocks default to locked state and are not locked-down, that is, [001] (WP#/ACC=0) or [101] (WP#/ACC=1), regardless of the states before power-off or reset operation.
- 4. When WP#/ACC is driven to V_{IL} in [110] state, the state changes to [011] and the blocks are automatically locked.
- 5. OTP (One Time Program) block has the lock function which is different from those described above.

	Current State Result after Lock Command Written (Next State)					n (Next State)
State	WP#/ACC	DQ_1	DQ ₀	Set Lock ⁽¹⁾	Clear Lock ⁽¹⁾	Set Lock-down ⁽¹⁾
[000]	0	0	0	[001]	No Change	[011] ⁽²⁾
[001]	0	0	1	No Change ⁽³⁾	[000]	[011]
[011]	0	1	1	No Change	No Change	No Change
[100]	1	0	0	[101]	No Change	[111] ⁽²⁾
[101]	1	0	1	No Change	[100]	[111]
[110]	1	1	0	[111]	No Change	[111] ⁽²⁾
[111]	1	1	1	No Change	[110]	No Change

Table 7. Block Locking State Transitions upon Command Write⁽⁴⁾

NOTES:

- 1. "Set Lock" means Set Block Lock Bit command, "Clear Lock" means Clear Block Lock Bit command and "Set Lock-down" means Set Block Lock-Down Bit command.
- 2. When the Set Block Lock-Down Bit command is written to the unlocked block ($DQ_0=0$), the corresponding block is locked-down and automatically locked at the same time.
- 3. "No Change" means that the state remains unchanged after the command written.
- 4. In this state transitions table, assumes that WP#/ACC is not changed and fixed V_{IL} or V_{IH} .

Due in State		Current Sta	te		Result after WP#/ACC Transition (Next State)		
Previous State	State	WP#/ACC	DQ_1	DQ ₀	WP#/ACC= $0 \rightarrow 1^{(1)}$	WP#/ACC= $1 \rightarrow 0^{(1)}$	
-	[000]	0	0	0	[100]	-	
-	[001]	0	0	1	[101]	-	
[110] ⁽²⁾					[110]	-	
Other than [110] ⁽²⁾	[011]	0	1	1	[111]	-	
-	[100]	1	0	0	-	[000]	
-	[101]	1	0	1	-	[001]	
-	[110]	1	1	0	-	[011] ⁽³⁾	
-	[111]	1	1	1	-	[011]	

Table 8.	Block Locking	State Transitions up	on WP#/ACC Transition ⁽⁴⁾
rubie 0.	DIOCK LOCKING	State Hunshions up	

NOTES:

1. "WP#/ACC=0 \rightarrow 1" means that WP#/ACC is driven to V_{IH} and "WP#/ACC=1 \rightarrow 0" means that WP#/ACC is driven to V_{IL}.
State transition from the current state [011] to the next state depends on the previous state.
When WP#/ACC is driven to V_{IL} in [110] state, the state changes to [011] and the blocks are

automatically locked.

4. In this state transitions table, assumes that lock configuration commands are not written in previous, current and next state.

	1		1	Register Definiti		1	1
GWSMS	GBESS	GBEFCES	GPBPOPS	GWPACCS	GPBPSS	GDPS	R
15	14	13	12	11	10	9	8
PWSMS	GBESS	GBEFCES	GPBPOPS	GWPACCS	GPBPSS	GDPS	R
7	6	5	4	3	2	1	0
(PWS) $1 = Ready$ $0 = Busy$ $SR.6 = GLOB$ (GBE) $1 = Block$	AL BLOCK EF	RASE SUSPEN d		Status Register Machine). How each plane. Ev occupied by the In the plane to RY/BY# to de buffer) program invalid while Sl	vever, SR.7 ind ven if the SR. other plane. which the com- termine block or OTP progra	tatus of the WS dicates the stat 7 is "1", the mand is issued, erase, full chi	us of WSM WSM may Check SR.7 p erase, (pag
FULI 1 = Error i 0 = Succes SR.4 = GLOB OTI 1 = Error i	AL BLOCK EF CHIP ERASE n Block Erase o ssful Block Eras AL (PAGE BUI P PROGRAM S n (Page Buffer) ssful (Page Buff	STATUS (GBE r Full Chip Eras e or Full Chip E FFER) PROGR TATUS (GPBP Program or OT	se Erase AM AND OPS) P Program	If both SR.5 an erase, (page bi block lock-do sequence was e	uffer) program wn bit atterr	, set/clear bloc	k lock bit, s
SR.3 = GLOBAL WP#/ACC STATUS (GWPACCS) 1 = V _{CCQ} +0.4V < WP#/ACC < 9.0V Detect, Operation Abort 0 = WP#/ACC OK				SR.3 does not p level. The WS level only after Program or OT guaranteed to ACC≠V _{ACCH} .	M interrogates Block Erase, I P Program cor	and indicates Full Chip Erase nmand sequenc	the WP#/AC , (Page Buffe es. SR.3 is n
SUSI 1 = (Page 0 = (Page	AL (PAGE BU PEND STATUS Buffer) Program Buffer) Program	(GPBPSS) n Suspended n in Progress/Co	ompleted	SR.1 does not p bit. The WSM i Erase, Full Ch Program com	nterrogates the nip Erase, (Pa	block lock bit o ge Buffer) Pro	only after Bloo ogram or OT
SR.1 = GLOBAL DEVICE PROTECT STATUS (GDPS) 1 = Erase or Program Attempted on a Locked Block, Operation Abort 0 = Unlocked				Program comm depending on the set. Reading the the Read Ident lock bit status.	ne attempted op e block lock co	peration, if the b nfiguration cod	lock lock bit es after writii
SR.0 = RESE	RVED FOR FU	ΓURE ENHAN	CEMENTS (R)	SR.0 is reserve when polling th	ed for future u e status registe	se and should r.	be masked o

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Table 9.2. S	Status Register Definition (Continued)
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	NOTES:
SR.15 = GLOBAL WRITE STATE MACHINE STATUS (GWSMS)	Status Register SR.15-SR.9 indicates the status of the WSM.
1 = Ready $0 = Busy$	Check SR.15 or RY/BY# to determine block erase, full chip erase, (page buffer) program or OTP program completion. SR.14 - SR.9 are invalid while SR.15="0".
SR.14 = GLOBAL BLOCK ERASE SUSPEND STATUS (GBESS) 1 = Block Erase Suspended	
0 = Block Erase in Progress/Completed	
 SR.13 = GLOBAL BLOCK ERASE AND FULL CHIP ERASE STATUS (GBEFCES) 1 = Error in Block Erase or Full Chip Erase 0 = Successful Block Erase or Full Chip Erase 	If both SR.13 and SR.12 are "1"s after a block erase, full chip erase, (page buffer) program, set/clear block lock bit, set block lock-down bit attempt, an improper command sequence was entered.
SR.12 = GLOBAL (PAGE BUFFER) PROGRAM AND OTP PROGRAM STATUS (GPBPOPS) 1 = Error in (Page Buffer) Program or OTP Program	
0 = Successful (Page Buffer) Program or OTP Program	
SR.11 = GLOBAL WP#/ACC STATUS (GWPACCS) $1 = V_{CCQ}+0.4V < WPP#/ACC < 9.0V$ Detect, Operation Abort 0 = WP#/ACC OK	SR.11 does not provide a continuous indication of WP#/ACC level. The WSM interrogates and indicates the WP#/ACC level only after Block Erase, Full Chip Erase, (Page Buffer) Program or OTP Program command sequences. SR.11 is not guaranteed to report accurate feedback when WP#/ ACC \neq V _{ACCH} .
SR.10 = GLOBAL (PAGE BUFFER) PROGRAM SUSPEND STATUS (GPBPSS)	
1 = (Page Buffer) Program Suspended 0 = (Page Buffer) Program in Progress/Completed	SR.9 does not provide a continuous indication of block lock bit. The WSM interrogates the block lock bit only after Block Erase, Full Chip Erase, (Page Buffer) Program or OTP
SR.9 = GLOBAL DEVICE PROTECT STATUS (GDPS) 1 = Erase or Program Attempted on a Locked Block, Operation Abort	Program command sequences. It informs the system, depending on the attempted operation, if the block lock bit is set. Reading the block lock configuration codes after writing the Read Identifier Codes/OTP command indicates block
0 = Unlocked	lock bit status.
SR.8 = RESERVED FOR FUTURE ENHANCEMENTS (R)	SR.8 is reserved for future use and should be masked out when polling the status register.



Table 10. Extended Status Register Definition									
R	R R R R R R R R								
15	14	13	12	11	10	9	8		
SMS	R	R	R	R R R					
7	6	5	4	3	2	1	0		
 XSR.15-8 = RESERVED FOR FUTURE ENHANCEMENTS (R) XSR.7 = STATE MACHINE STATUS (SMS) 1 = Page Buffer Program available 0 = Page Buffer Program not available 				XSR.7="1" ind If XSR.7 is "0' Buffer Program	NOT a Page Buffer dicates that the the command is m command (E8 puffer is availabl	Program cor entered comma is not accepted BH) should be	and is accepted.		
XSR.6-0 = RESERVED FOR FUTURE ENHANCEMENTS (R)					1 XSR.6-0 are usked out when				

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1	9
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1 Electrical Specifications	*W
1.1 Absolute Maximum Ratings [*]	
Operating Temperature During Read, Erase and Program40°C to +85°C ⁽¹⁾	
Storage Temperature During under Bias40°C to +85°C During non Bias65°C to +125°C	NC 1. 2.
Voltage On Any Pin (except V_{CC} , V_{CCQ} and WP#/ACC) 0.5V to V_{CCQ} +0.5V ⁽²⁾	r - t F
V_{CC} and V_{CCQ} Supply Voltage0.2V to +3.7V $^{(2)}$	3. N 4. 2
WP#/ACC Supply Voltage0.2V to +10.3V $^{(2, 3, 4)}$	F C L
Output Short Circuit Current 100mA ⁽⁵⁾	a 5. (t

*WARNING: Stressing the device beyond the "Absolute Maximum Ratings" may cause permanent damage. These are stress ratings only. Operation beyond the "Operating Conditions" is not recommended and extended exposure beyond the "Operating Conditions" may affect device reliability.

NOTES:

- 1. Operating temperature is for extended temperature product defined by this specification.
- 2. All specified voltages are with respect to GND. Minimum DC voltage is -0.5V on input/output pins and -0.2V on V_{CC} , V_{CCQ} and WP#/ACC pins. During transitions, this level may undershoot to -2.0V for periods <20ns. Maximum DC voltage on input/output pins is V_{CC} +0.5V which, during transitions, may overshoot to V_{CC} +2.0V for periods <20ns.
- 3. Maximum DC voltage on WP#/ACC may overshoot to +11.0V for periods <20ns.
- 4. WP#/ACC erase/program voltage is normally 2.7V-3.3V. Applying 9.0V-10.0V to WP#/ACC during erase/ program can be done for a maximum of 1,000 cycles on the main blocks and 1,000 cycles on the parameter blocks. WP#/ACC may be connected to 9.0V-10.0V for a total of 80 hours maximum.
- 5. Output shorted for no more than one second. No more than one output shorted at a time.

Parameter	Symbol	Min.	Тур.	Max.	Unit	Notes
Operating Temperature	T _A	-40	+25	+85	°C	
V _{CC} Supply Voltage	V _{CC}	2.7	3.0	3.3	V	1
I/O Supply Voltage	V _{CCQ}	2.7	3.0	3.3	V	1
		-0.2		0.4	V	
WP#/ACC Voltage when Used as a Logic Control	V _{IH}	2.4		V _{CCQ} + 0.4	V	1
WP#/ACC Supply Voltage	V _{ACCH}	9.0	9.5	10.0	V	1, 2
Main Block Erase Cycling: WP#/ACC=V _{IL} or V _{IH}		100,000			Cycles	
Parameter Block Erase Cycling: WP#/ACC=V _{IL} or V _{IH}		100,000			Cycles	
Main Block Erase Cycling: WP#/ACC=V _{ACCH} , 80 hrs.				1,000	Cycles	
Parameter Block Erase Cycling: WP#/ACC=V _{ACCH} , 80 hrs.				1,000	Cycles	
Maximum WP#/ACC hours at V _{ACCH}				80	Hours	

1.2 Operating Conditions

NOTES:

1. See DC Characteristics tables for voltage range-specific specification.

2. Applying WP#/ACC=9.0V-10.0V during a erase or program can be done for a maximum of 1,000 cycles on the main blocks and 1,000 cycles on the parameter blocks. A permanent connection to WP#/ACC=9.0V-10.0V is not allowed and can cause damage to the device.

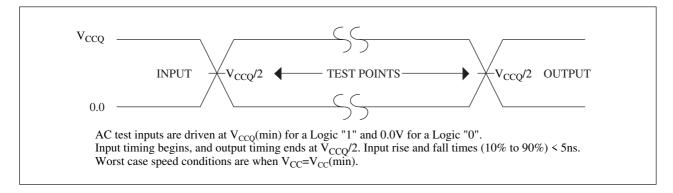
1.2.1 Capacitance ⁽¹⁾ (T_A =+25°C, f=1MHz)

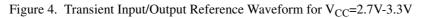
Parameter	Symbol	Condition	Min.	Тур.	Max.	Unit
Input Capacitance	C _{IN}	V _{IN} =0.0V		4	7	pF
WP#/ACC Input Capacitance	C _{IN}	V _{IN} =0.0V		18	22	pF
Output Capacitance	C _{OUT}	V _{OUT} =0.0V		6	10	pF

NOTE:

1. Sampled, not 100% tested.

1.2.2 AC Input/Output Test Conditions





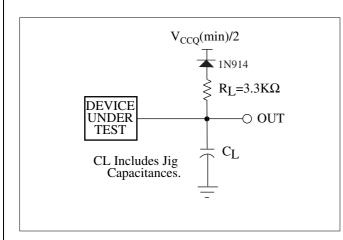


Figure 5. Transient Equivalent Testing Load Circuit

Table 11. Test Configuration Capacitance Loading Value

Test Configuration	C _L (pF)
V _{CC} =2.7V-3.3V	50

1.2.3 DC Characteristics

			• CC-2	2.7 8-3.3 1				
Symbol	Param	eter	Notes	Min.	Тур.	Max.	Unit	Test Conditions
I _{LI}	Input Load Current		1	-1.0		+1.0	μΑ	V _{CC} =V _{CC} Max.,
I _{LO}	Output Leakage Current		1	-1.0		+1.0	μΑ	V _{CCQ} =V _{CCQ} Max., V _{IN} /V _{OUT} =V _{CCQ} or GND
I _{CCS}	V _{CC} Standby Current		1,7,8		9	40	μΑ	V _{CC} =V _{CC} Max., CE#=RST#= V _{CCQ} ±0.2V, WP#/ACC=V _{CCQ} or GND
I _{CCAS}	V _{CC} Automatic Current	Power Savings	1,3,7		9	40	μΑ	V _{CC} =V _{CC} Max., CE#=GND±0.2V, WP#/ACC=V _{CCQ} or GND
I _{CCD}	V _{CC} Reset Current		1,7		9	40	μΑ	RST#=GND±0.2V
I	Average V _{CC} Read Current Normal Mode		1,6,7		20	30	mA	V _{CC} =V _{CC} Max., CE#=V _{IL} ,
I _{CCR}	Average V _{CC} Read Current Page Mode	8 Word Read	1,6,7		5	10	mA	OE#=V _{IH} , f=5MHz
т	V (Daga Puffer) D	rogram Current	1,4,6,7		20	60	mA	WP#/ACC=V _{IL} or V _{IH}
I _{CCW}	V _{CC} (Page Buffer) P		1,4,6,7		10	20	mA	WP#/ACC=V _{ACCH}
I	V _{CC} Block Erase,		1,4,6,7		10	30	mA	WP#/ACC=V _{IL} or V _{IH}
I _{CCE}	Full Chip Erase Curr	rent	1,4,6,7		4	10	mA	WP#/ACC=V _{ACCH}
I _{CCWS} I _{CCES}	V _{CC} (Page Buffer) P Block Erase Suspend		1,2,6,7		10	200	μΑ	CE#=V _{IH}
I _{ACCS} I _{ACCR}	WP#/ACC Standby of	or Read Current	1,5,6,7		2	5	μΑ	WP#/ACC≤V _{CC}
I _{ACCW}	WP#/ACC (Page	Buffer) Program	1,4,5,6,7		2	5	μΑ	WP#/ACC=V _{IL} or V _{IH}
ACCW	Current		1,4,5,6,7		10	30	mA	WP#/ACC=V _{ACCH}
I _{ACCE}	WP#/ACC Block Er		1,4,5,6,7		2	5	μΑ	WP#/ACC=V _{IL} or V _{IH}
ACCE	Full Chip Erase Curr	rent	1,4,5,6,7		5	15	mA	WP#/ACC=V _{ACCH}
I _{ACCWS}	WP#/ACC (Page Bu	ffer) Program	1,5,6,7		2	5	μA	WP#/ACC=V _{IL} or V _{IH}
ACCWS	Suspend Current		1,5,6,7		10	200	μA	WP#/ACC=V _{ACCH}
I _{ACCES}	WP#/ACC Block	Erase Suspend	1,5,6,7		2	5	μΑ	WP#/ACC=V _{IL} or V _{IH}
-ACCES	Current		1,5,6,7		10	200	μΑ	WP#/ACC=V _{ACCH}

V_{CC}=2.7V-3.3V

DC Characteristics (Continued)

	-
V = -2.7 V - 2.3 V	1
$V_{CC}=2.7V-3.3V$	v

Symbol	Parameter	Notes	Min.	Тур.	Max.	Unit	Test Conditions
V _{IL}	Input Low Voltage	5	-0.4		0.4	V	
V _{IH}	Input High Voltage	4	2.4		V _{CCQ} + 0.4	V	
V _{OL}	Output Low Voltage	4,8			0.2	V	$\label{eq:V_CC} \begin{split} V_{CC} = & V_{CC} Min., \\ V_{CCQ} = & V_{CCQ} Min., \\ & I_{OL} = & 100 \mu A \end{split}$
V _{OH}	Output High Voltage	4	V _{CCQ} -0.2			V	$\label{eq:V_CC} \begin{split} V_{CC} = & V_{CC} Min., \\ V_{CCQ} = & V_{CCQ} Min., \\ & I_{OH} = -100 \mu A \end{split}$
V _{ACCH}	WP#/ACC during Block Erase, Full Chip Erase, (Page Buffer) Program or OTP Program Operations		9.0	9.5	10.0	V	
V _{LKO}	V _{CC} Lockout Voltage		1.5			V	

NOTES:

HARP

1. All currents are in RMS unless otherwise noted. Typical values are the reference values at V_{CC} =3.0V, V_{CCO} =3.0V and

 T_A =+25°C unless V_{CC} is specified. 2. I_{CCWS} and I_{CCES} are specified with the device de-selected. If read or (page buffer) program is executed while in block erase suspend mode, the device's current draw is the sum of I_{CCES} and I_{CCR} or I_{CCW}. If read is executed while in (page buffer) program suspend mode, the device's current draw is the sum of I_{CCWS} and I_{CCR}.

3. The Automatic Power Savings (APS) feature automatically places the device in power save mode after read cycle completion. Standard address access timings (t_{AVOV}) provide new data when addresses are changed.

4. Sampled, not 100% tested.

5. Applying 9.5V±0.5V to WP#/ACC provides fast erasing or fast programming mode. In this mode, WP#/ACC is power supply pin and supplies the memory cell current for block erasing and (page buffer) programming. Use similar power supply trace widths and layout considerations given to the V_{CC} power bus.

Applying 9.5V±0.5V to WP#/ACC during erase/program can only be done for a maximum of 1,000 cycles on each block. WP#/ACC may be connected to 9.5V±0.5V for a total of 80 hours maximum.

6. The operating current in dual work is the sum of the operating current (read, erase, program) in each plane.

7. For all pins other than those shown in test conditions, input level is V_{CCO} or GND.

8. Includes RY/BY#.