# SHARP

	Date Aug.	8. 2002
Preliminary Dat	TAQUEET	
F NELIMINAN'I DA	DATASHEET	
	64M (x16) Flash Memory	
MODEL NO :	LH28F640BFHE-PBTL80	
	bject to change without notice.	
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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 which demands high reliability, 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.
    - Control and safety devices for airplanes, trains, automobiles, and other transportation equipment
    - 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.

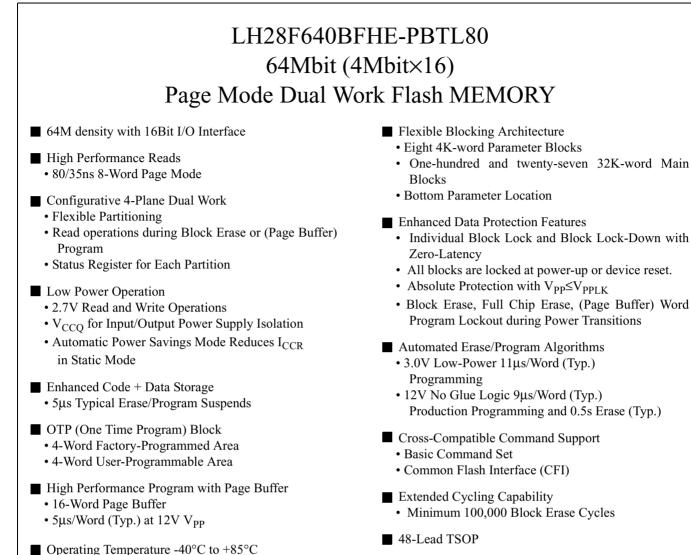
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- CMOS Process (P-type silicon substrate)
- ETOX<sup>TM\*</sup> Flash Technology
- Not designed or rated as radiation hardened

The product, which is 4-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-3.6V and  $V_{PP}$ =1.65V-3.6V or 11.7V-12.3V. 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. Furthermore, its newly configurative partitioning architecture allows flexible dual work operation.

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 a unique number.

\* ETOX is a trademark of Intel Corporation.

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A15       1         A14       2         A13       3         A12       4         A11       5         A10       6         A9       7         A8       8         A20       10         WE#       11         RST#       12         VPP       13         WP#       14         A19       15         A18       16         A17       17         A7       18         A6       19         A5       20         A1       22         A2       23         A1       24	48-LEAD TSOP STANDARD PINOUT 12mm x 20mm TOP VIEW	$\begin{array}{c c c c c c c c c c c c c c c c c c c $

Figure 1. 48-Lead TSOP (Normal Bend) Pinout

Table 1. Pin Descriptions

Symbol	Туре	Name and Function
A <sub>0</sub> -A <sub>21</sub>	INPUT	ADDRESS INPUTS: Inputs for addresses. 64M: A <sub>0</sub> -A <sub>21</sub>
DQ <sub>0</sub> -DQ <sub>15</sub>	INPUT/ OUTPUT	DATA INPUTS/OUTPUTS: Inputs data and commands during CUI (Command Use Interface) write cycles, outputs data during memory array, status register, query code identifier code and partition configuration register code reads. Data pins float to high impedance (High Z) when the chip or outputs are deselected. Data is internally latche 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 operation 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# mu 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#	INPUT	WRITE PROTECT: When WP# is $V_{IL}$ , locked-down blocks cannot be unlocked. Eras or program operation can be executed to the blocks which are not locked and not locked down. When WP# is $V_{IH}$ , lock-down is disabled.
V <sub>PP</sub>	INPUT	MONITORING POWER SUPPLY VOLTAGE: V <sub>PP</sub> is not used for power supply pi With V <sub>PP</sub> $\leq$ V <sub>PPLK</sub> , block erase, full chip erase, (page buffer) program or OTP program cannot be executed and should not be attempted. Applying 12V $\pm$ 0.3V to V <sub>PP</sub> provides fast erasing or fast programming mode. In th mode, V <sub>PP</sub> is power supply pin. Applying 12V $\pm$ 0.3V to V <sub>PP</sub> during erase/program ca only be done for a maximum of 1,000 cycles on each block. V <sub>PP</sub> may be connected to 12V $\pm$ 0.3V for a total of 80 hours maximum. Use of this pin at 12V beyond these limit may reduce block cycling capability or cause permanent damage.
V <sub>CC</sub>	SUPPLY	DEVICE POWER SUPPLY (2.7V-3.6V): With $V_{CC} \leq V_{LKO}$ , all write attempts to the flash memory are inhibited. Device operations at invalid $V_{CC}$ voltage (see D Characteristics) produce spurious results and should not be attempted.
V <sub>CCQ</sub>	SUPPLY	INPUT/OUTPUT POWER SUPPLY (2.7V-3.6V): Power supply for all input/outpup pins.
GND	SUPPLY	GROUND: Do not float any ground pins.
·		

	-		Simunuit	cous ope	number 1910	ues Allow		ur i iune	5		
			THEN 7	THE MO	DES ALL	OWED IN	THE OTI	HER PAI	RTITION I	S:	
IF ONE PARTITION IS:	Read Array	Read ID/OTP	Read Status	Read Query	Word Program	Page Buffer Program	OTP Program	Block Erase	Full Chip Erase	Program Suspend	
Read Array	Х	Х	Х	Х	Х	Х		Х		Х	Х
Read ID/OTP	Х	Х	Х	Х	Х	Х		Х		Х	Х
Read Status	Х	Х	Х	Х	Х	Х	Х	Х	X	Х	Х
Read Query	Х	Х	Х	Х	Х	Х		Х		Х	Х
Word Program	Х	Х	Х	Х							Х
Page Buffer Program	Х	X	Х	Х							Х
OTP Program			Х								
Block Erase	Х	Х	Х	Х							
Full Chip Erase			Х								
Program Suspend	Х	X	Х	Х							Х
Block Erase Suspend	Х	Х	Х	Х	Х	Х				Х	

Table 2. Simultaneous Operation Modes Allowed with Four  $Planes^{(1, 2)}$ 

"X" denotes the operation available.
 Configurative Partition Dual Work Restrictions:

Status register reflects partition state, not WSM (Write State Machine) state - this allows a status register for each partition. Only one partition 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.

### BLOCK NUMBER ADDRESS RANGE

	BL	OCK NUMBI	ER ADDRESS RANGE
	134	32K-WORD	3F8000H - 3FFFFFH
	134	32K-WORD	3F0000H - 3F7FFFH
	132	32K-WORD	3E8000H - 3EFFFFH
	131	32K-WORD	3E0000H - 3E7FFFH
	130	32K-WORD	3D8000H - 3DFFFFH
	129	32K-WORD	3D0000H - 3D7FFFH
	128	32K-WORD	3C8000H - 3CFFFFH
	127 126	32K-WORD	3C0000H - 3C7FFFH 3B8000H - 3BFFFFH
Ē	120	32K-WORD 32K-WORD	3B0000H - 3B7FFFH
PLANE3 (UNIFORM PLANE)	123	32K-WORD	3A8000H - 3AFFFH
	123	32K-WORD	3A0000H - 3A7FFFH
E	122	32K-WORD	398000H - 39FFFFH
Σ	121	32K-WORD	390000H - 397FFFH
1×	120	32K-WORD	388000H - 38FFFFH
L C L	119	32K-WORD	380000H - 387FFFH
E	118	32K-WORD	378000H - 37FFFFH
15	117	32K-WORD	370000H - 377FFFH
	116	32K-WORD	368000H - 36FFFFH
EB-	115 114	32K-WORD 32K-WORD	360000H - 367FFFH 358000H - 35FFFFH
	114	32K-WORD	350000H - 357FFFH
	112	32K-WORD	348000H - 34FFFFH
L I	111	32K-WORD	340000H - 347FFFH
	110	32K-WORD	338000H - 33FFFFH
	109	32K-WORD	330000H - 337FFFH
	108	32K-WORD	328000H - 32FFFFH
	107	32K-WORD	320000H - 327FFFH
	106	32K-WORD	318000H - 31FFFFH
	105 104	32K-WORD	310000H - 317FFFH
	104	32K-WORD 32K-WORD	308000H - 30FFFFH 300000H - 307FFFH
	105	J2K-WORD	50000011 - 507171711
		221/ WORD	26800011 26666611
	102	32K-WORD 32K-WORD	2F8000H - 2FFFFFH 2F0000H - 2F7FFFH
	101 100	32K-WORD	2E8000H - 2EFFFH
	99	32K-WORD	2E0000H - 2E7FFH
	98	32K-WORD	2D8000H - 2DFFFFH
	97	32K-WORD	2D0000H - 2D7FFFH
	96	32K-WORD	2C8000H - 2CFFFFH
	95	32K-WORD	2C0000H - 2C7FFFH
	94	32K-WORD	2B8000H - 2BFFFFH
E	93	32K-WORD	2B0000H - 2B7FFFH
F	92	32K-WORD	2A8000H - 2AFFFFH
RM PLANE)	91 90	32K-WORD 32K-WORD	2A0000H - 2A7FFFH 298000H - 29FFFFH
L L	89	32K-WORD	290000H - 297FFFH
l ≩ l	88	32K-WORD	288000H - 28FFFFH
1Å	87	32K-WORD	280000H - 287FFFH
Ĕ	86	32K-WORD	278000H - 27FFFFH
IZ.	85	32K-WORD	270000H - 277FFFH
Ð	84	32K-WORD	268000H - 26FFFFH
10	83	32K-WORD	260000H - 267FFFH
Η	82	32K-WORD	258000H - 25FFFFH
PLANE2 (UNIFO	81	32K-WORD	250000H - 257FFFH
L	80	32K-WORD	248000H - 24FFFFH
	79 78	32K-WORD	240000H - 247FFFH 238000H - 23FFFFH
	77	32K-WORD 32K-WORD	230000H - 237FFFH
	76	32K-WORD	228000H - 22FFFFH
	75	32K-WORD	220000H - 227FFFH
	74	32K-WORD	218000H - 21FFFFH
	73	32K-WORD	210000H - 217FFFH
	72	32K-WORD	208000H - 20FFFFH
	71	32K-WORD	200000H - 207FFFH

70         32K-WORD         1F8000H - IFFFFH           69         32K-WORD         1E8000H - IFFFFH           67         32K-WORD         1E8000H - IEFFFH           66         32K-WORD         1D8000H - IDFFFFH           66         32K-WORD         1D8000H - IDFFFFH           66         32K-WORD         1D0000H - IDFFFFH           64         32K-WORD         1B8000H - IDFFFFH           63         32K-WORD         1B8000H - IDFFFFH           60         32K-WORD         18000H - IDFFFFH           59         32K-WORD         18000H - IBFFFH           59         32K-WORD         18000H - IBFFFH           50         32K-WORD         18000H - IBFFFH           53         32K-WORD         18000H - IBFFFH           53         32K-WORD         18000H - IBFFFH           53         32K-WORD         18000H - ISFFFH           40         32K-WORD         18000H - ISFFFH           41         32K-WORD         18000H - ISFFFH           42         32K-WORD         130000H - ISFFFH           43         32K-WORD         130000H - ISFFFH           43         32K-WORD         130000H - ISFFFH           43         32K-WORD			en en beneret	_
1         1		70	32K-WORD	1F8000H - 1FFFFFH
68         32K-WORD         IE8000H         IEFFFH           67         32K-WORD         ID8000H         IDFFFH           66         32K-WORD         ID8000H         IDFFFH           63         32K-WORD         IC8000H         IDFFFFH           64         32K-WORD         IC8000H         IC7FFFH           63         32K-WORD         IB8000H         IDFFFFH           60         32K-WORD         IA8000H         IAFFFFH           60         32K-WORD         IA8000H         IAFFFFH           57         32K-WORD         IA8000H         IPFFFH           58         32K-WORD         I8000H         IPFFFH           53         32K-WORD         I8000H         IPFFFH           53         32K-WORD         I8000H         IPFFFH           53         32K-WORD         IS000H         IPFFFH           51         32K-WORD         IS000H         IPFFFH           51         32K-WORD         IS000H         IPFFFH           47         32K-WORD         I3000H         IPFFFH           43         32K-WORD         IS000H         IPFFFH           44         32K-WORD         IS000H         IPFFFH </td <td></td> <td>69</td> <td></td> <td>1F0000H - 1F7FFFH</td>		69		1F0000H - 1F7FFFH
67         32K-WORD         IE0000H         IE7FFFH           66         32K-WORD         ID8000H         IDFFFFH           64         32K-WORD         IC0000H         IC7FFFH           63         32K-WORD         IB0000H         IBFFFFH           61         32K-WORD         IB0000H         IBFFFFH           60         32K-WORD         IA0000H         IAFFFFH           59         32K-WORD         IA8000H         IAFFFFH           50         32K-WORD         I98000H         IS7FFFH           54         32K-WORD         I88000H         IS7FFFH           53         32K-WORD         IS8000H         IS7FFFH           50         32K-WORD         IS8000H         IS7FFFH           50         32K-WORD         IS8000H         IS7FFFH           40         32K-WORD         IS8000H         IS7FFFH           41         32K-WORD         I38000H         IAFFFFH           42         32K-WORD         I38000H         IAFFFFH           43         32K-WORD         I30000H         IAFFFFH           43         32K-WORD         I30000H         IAFFFFH           44         32K-WORD         I30000H         <		-		1E8000H - 1EFFFFH
66         32K-WORD         ID8000H - ID7FFFH           65         32K-WORD         ID0000H - ID7FFFH           63         32K-WORD         IC8000H - ICFFFFH           61         32K-WORD         IB8000H - IB7FFFH           61         32K-WORD         IA8000H - IAFFFFH           59         32K-WORD         IA8000H - IAFFFFH           57         32K-WORD         IA8000H - IAFFFFH           56         32K-WORD         I80000H - IAFFFFH           57         32K-WORD         I80000H - IAFFFFH           53         32K-WORD         I80000H - IAFFFFH           54         32K-WORD         I80000H - IAFFFFH           52         32K-WORD         I80000H - IFFFFH           53         32K-WORD         I58000H - IFFFFH           50         32K-WORD         I58000H - IFFFFH           46         32K-WORD         I38000H - IFFFFH           45         32K-WORD         I38000H - IFFFFH           45         32K-WORD         I38000H - IFFFFH           46         32K-WORD         I38000H - IFFFFH           47         32K-WORD         I38000H - IFFFFH           43         32K-WORD         I38000H - IFFFFH           36         32K-WORD <td></td> <td></td> <td></td> <td>1E0000H - 1E7FFFH</td>				1E0000H - 1E7FFFH
65         32K-WORD         1D0000H - 1D7FFH           64         32K-WORD         1C8000H - 1C7FFFH           63         32K-WORD         1B8000H - 1B7FFFH           60         32K-WORD         1B8000H - 1B7FFFH           60         32K-WORD         1A8000H - 1A7FFFH           50         32K-WORD         1A0000H - 1A7FFFH           57         32K-WORD         198000H - 197FFFH           58         32K-WORD         188000H - 187FFFH           53         32K-WORD         188000H - 187FFFH           54         32K-WORD         188000H - 15FFFFH           53         32K-WORD         168000H - 15FFFFH           53         32K-WORD         158000H - 15FFFH           50         32K-WORD         158000H - 15FFFH           43         32K-WORD         138000H - 13FFFH           44         32K-WORD         138000H - 13FFFH           43         32K-WORD         128000H - 17FFFH           44         32K-WORD         128000H - 17FFFH           43         32K-WORD         128000H - 17FFFH           43         32K-WORD         128000H - 17FFFH           44         32K-WORD         128000H - 17FFFH           36         32K-WORD				1D8000H - 1DFFFFH
64         32K-WORD         IC8000H - IC7FFFH           63         32K-WORD         IC8000H - IC7FFFH           63         32K-WORD         IB8000H - IB7FFFH           60         32K-WORD         IB8000H - IB7FFFH           59         32K-WORD         IA8000H - IA7FFFH           57         32K-WORD         I98000H - IP7FFFH           56         32K-WORD         I88000H - I87FFFH           56         32K-WORD         I88000H - I77FFFH           53         32K-WORD         I88000H - I77FFFH           53         32K-WORD         I68000H - I67FFFH           50         32K-WORD         I58000H - I57FFFH           40         32K-WORD         I58000H - I57FFFH           41         32K-WORD         I38000H - I57FFFH           42         32K-WORD         I38000H - 137FFFH           43         32K-WORD         I38000H - 17FFFH           43         32K-WORD         I08000H - 07FFFH           33         32K-WORD         I08000H - 07FFFH           33         32K-WORD<				
63         32K-WORD         1C0000H - 1C7FFFH           62         32K-WORD         1B8000H - 1BFFFFH           61         32K-WORD         1A8000H - 1A7FFFH           59         32K-WORD         1A8000H - 1A7FFFH           59         32K-WORD         198000H - 1A7FFFH           56         32K-WORD         198000H - 17FFFH           56         32K-WORD         188000H - 187FFFH           53         32K-WORD         178000H - 17FFFH           54         32K-WORD         188000H - 17FFFH           52         32K-WORD         168000H - 167FFFH           52         32K-WORD         158000H - 15FFFH           52         32K-WORD         158000H - 15FFFH           43         32K-WORD         138000H - 13FFFH           44         32K-WORD         138000H - 13FFFH           42         32K-WORD         120000H - 17FFFH           43         32K-WORD         120000H - 17FFFH           44         32K-WORD         120000H - 17FFFH           43         32K-WORD         120000H - 17FFFH           43         32K-WORD         108000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD				
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INCUL         IB0000H - IB7FFFH           60         32K-WORD         IA8000H - IA7FFFH           59         32K-WORD         IA8000H - IA7FFFH           59         32K-WORD         I98000H - I97FFFH           56         32K-WORD         I98000H - I97FFFH           56         32K-WORD         I88000H - I87FFFH           53         32K-WORD         I78000H - I77FFFH           53         32K-WORD         I78000H - I77FFFH           52         32K-WORD         I68000H - I57FFFH           50         32K-WORD         I58000H - I57FFFH           50         32K-WORD         I58000H - I57FFFH           50         32K-WORD         I38000H - 157FFFH           48         32K-WORD         I38000H - 157FFFH           43         32K-WORD         I38000H - 157FFFH           42         32K-WORD         I30000H - 177FFH           42         32K-WORD         I28000H - 0F7FFH           43         32K-WORD         I08000H - 0F7FFH           36         32K-WORD         I08000H - 0F7FFH           37         32K-WORD         0F8000H - 0F7FFH           36         32K-WORD         0B8000H - 0F7FFH           33         32K-WORD         0B8000				
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	H			
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	4			
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23				
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	E			
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	7			_
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	2			
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	lÖ			
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	Ĕ		32K-WORD	
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	Ę	54	32K-WORD	178000H - 17FFFFH
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	15	53		170000H - 177FFFH
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	E	52	32K-WORD	168000H - 16FFFFH
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	S	51		160000H - 167FFFH
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	ビザ	50		158000H - 15FFFFH
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	7	49		150000H - 157FFFH
47         32K-WORD         140000H - 147FFH           46         32K-WORD         138000H - 137FFFH           45         32K-WORD         138000H - 137FFFH           43         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           40         32K-WORD         118000H - 107FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           100000H - 107FFFH         332K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           33         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           23	1	48		
46         32K-WORD         138000H - 13FFFFH           45         32K-WORD         130000H - 137FFFH           44         32K-WORD         128000H - 127FFFH           42         32K-WORD         118000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           41         32K-WORD         118000H - 117FFFH           40         32K-WORD         108000H - 0FFFFH           40         32K-WORD         108000H - 0FFFFH           37         32K-WORD         0F8000H - 0FFFFH           36         32K-WORD         0F8000H - 0FFFFH           36         32K-WORD         0E8000H - 0FFFFH           36         32K-WORD         0D8000H - 0FFFFH           33         32K-WORD         0D8000H - 0FFFFH           33         32K-WORD         0C8000H - 0FFFFH           30         32K-WORD         0B8000H - 0FFFFH           30         32K-WORD         0B8000H - 0FFFFH           26         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         08000H - 087FFFH           23         32K-WORD         08000H - 087FFFH           23         32K-WORD         08000H - 07FFFH           23         32K-WORD	Ы			
45         32K-WORD         130000H - 137FFFH           44         32K-WORD         128000H - 127FFFH           43         32K-WORD         120000H - 127FFFH           41         32K-WORD         118000H - 117FFFH           41         32K-WORD         118000H - 117FFFH           40         32K-WORD         100000H - 117FFFH           39         32K-WORD         108000H - 0F7FFFH           36         32K-WORD         068000H - 0F7FFFH           36         32K-WORD         068000H - 0F7FFFH           36         32K-WORD         008000H - 0F7FFFH           37         32K-WORD         008000H - 0F7FFFH           38         32K-WORD         008000H - 0F7FFFH           33         32K-WORD         008000H - 0F7FFFH           30         32K-WORD         008000H - 07FFFH           30         32K-WORD         08000H - 087FFFH           26         32K-WORD         08000H - 087FFFH           27         32K-WORD         08000H - 087FFFH           23         32K-WORD         08000H - 087FFFH           23         32K-WORD         08000H - 087FFFH           23         32K-WORD         08000H - 077FFFH           23         32K-WORD </td <td></td> <td></td> <td></td> <td></td>				
44         32K-WORD         128000H - 12FFFH           43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           41         32K-WORD         118000H - 117FFFH           40         32K-WORD         100000H - 117FFFH           40         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFH           36         32K-WORD         068000H - 0FFFFH           36         32K-WORD         068000H - 0FFFFH           36         32K-WORD         008000H - 0FFFFH           37         32K-WORD         008000H - 0FFFFH           38         32K-WORD         008000H - 0FFFFH           30         32K-WORD         008000H - 07FFFH           31         32K-WORD         008000H - 07FFFH           30         32K-WORD         008000H - 08FFFH           23         32K-WORD         048000H - 04FFFFH           23         32K-WORD         048000H - 08FFFFH           23         32K-WORD         078000H - 07FFFH           23         32K-WORD         078000H - 07FFFH           23         32K-WORD         078000H - 07FFFH           23         32K-WORD				
43         32K-WORD         120000H - 127FFFH           42         32K-WORD         118000H - 117FFFH           41         32K-WORD         110000H - 117FFFH           40         32K-WORD         108000H - 10FFFFH           39         32K-WORD         100000H - 107FFFH           39         32K-WORD         068000H - 0FFFFFH           36         32K-WORD         068000H - 0FFFFFH           36         32K-WORD         060000H - 0F7FFFH           33         32K-WORD         00000H - 0D7FFFH           33         32K-WORD         00000H - 07FFFH           30         32K-WORD         008000H - 087FFFH           23         32K-WORD         048000H - 087FFFH           23         32K-WORD         048000H - 087FFFH           23         32K-WORD         088000H - 067FFFH           23         32K-WORD<				
42         32K-WORD         118000H - 11FFFFH           41         32K-WORD         108000H - 10FFFFH           40         32K-WORD         108000H - 10FFFFH           39         32K-WORD         108000H - 0FFFFH           37         32K-WORD         0F8000H - 0FFFFH           36         32K-WORD         0F8000H - 0FFFFH           36         32K-WORD         0E8000H - 0EFFFH           36         32K-WORD         0E8000H - 0EFFFH           37         32K-WORD         0D8000H - 0EFFFH           38         32K-WORD         0D8000H - 0EFFFH           37         32K-WORD         0D0000H - 0D7FFFH           38         32K-WORD         0D8000H - 0DFFFFH           30         32K-WORD         0B8000H - 0BFFFH           31         32K-WORD         0B8000H - 0FFFFH           26         32K-WORD         0A0000H - 0A7FFFH           27         32K-WORD         088000H - 087FFFH           28         32K-WORD         088000H - 07FFFH           29         32K-WORD         088000H - 07FFFH           21         32K-WORD         088000H - 07FFFH           22         32K-WORD         088000H - 07FFFH           23         32K-WORD				
41         32K-WORD         110000H - 117FFFH           40         32K-WORD         108000H - 10FFFFH           39         32K-WORD         068000H - 0FFFFH           37         32K-WORD         0F8000H - 0FFFFH           36         32K-WORD         0F8000H - 0FFFFH           36         32K-WORD         0F8000H - 0FFFFH           36         32K-WORD         0E8000H - 0FFFFH           33         32K-WORD         0D8000H - 0DFFFFH           33         32K-WORD         0D8000H - 0DFFFFH           31         32K-WORD         0C8000H - 0CFFFFH           30         32K-WORD         0B8000H - 0BFFFFH           23         32K-WORD         0B8000H - 0BFFFFH           20         32K-WORD         0A8000H - 0AFFFFH           26         32K-WORD         098000H - 087FFFH           26         32K-WORD         088000H - 087FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         08000H - 07FFFH           23         32K-WORD         08000H - 07FFFH           20         32K-WORD         068000H - 067FFFH           20         32K-WORD <td></td> <td></td> <td></td> <td></td>				
40         32K-WORD         108000H - 10FFFFH           39         32K-WORD         100000H - 107FFFH           37         32K-WORD         0F8000H - 0F7FFFH           36         32K-WORD         0F8000H - 0F7FFFH           35         32K-WORD         0E8000H - 0E7FFFH           34         32K-WORD         0E8000H - 0E7FFFH           33         32K-WORD         0D8000H - 0D7FFFH           34         32K-WORD         0C8000H - 0D7FFFH           33         32K-WORD         0C8000H - 0D7FFFH           30         32K-WORD         0C8000H - 0D7FFFH           30         32K-WORD         0B8000H - 0B7FFFH           29         32K-WORD         0B0000H - 0A7FFFH           26         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         08000H - 08FFFFH           23         32K-WORD         08000H - 087FFFH           23         32K-WORD         08000H - 087FFFH           23         32K-WORD         078000H - 07FFFH           23         32K-WORD         078000H - 07FFFH           23         32K-WORD         058000H - 057FFFH           20         32K-WORD         058000H - 057FFFH           13         32K-WORD				
39         32K-WORD         100000H - 107FFFH           38         32K-WORD         0F8000H - 0FFFFFH           37         32K-WORD         0F8000H - 0FFFFH           36         32K-WORD         0E8000H - 0E7FFFH           34         32K-WORD         0E8000H - 0E7FFFH           34         32K-WORD         0D8000H - 0D7FFFH           33         32K-WORD         0D8000H - 0D7FFFH           33         32K-WORD         0C8000H - 0D7FFFH           30         32K-WORD         0C8000H - 0D7FFFH           30         32K-WORD         0C8000H - 0A7FFFH           29         32K-WORD         0A8000H - 0A7FFFH           29         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 0A7FFFH           25         32K-WORD         098000H - 087FFFH           23         32K-WORD         078000H - 077FFFH           23         32K-WORD         078000H - 077FFFH           23         32K-WORD         078000H - 057FFFH           23         32K-WORD         058000H - 06FFFFH           20         32K-WORD         058000H - 057FFFH           18         32K-WORD         058000H - 057FFFH           16         32K-				
38         32K-WORD         0F8000H - 0FFFFH           37         32K-WORD         0F0000H - 0F7FFH           36         32K-WORD         0E8000H - 0EFFFH           35         32K-WORD         0E0000H - 0E7FFH           33         32K-WORD         0D0000H - 0D7FFFH           33         32K-WORD         0D0000H - 0D7FFFH           33         32K-WORD         0C8000H - 0C7FFFH           31         32K-WORD         0C8000H - 0C7FFFH           30         32K-WORD         0B0000H - 0D7FFFH           23         32K-WORD         0B0000H - 0B7FFFH           29         32K-WORD         0B0000H - 0B7FFFH           26         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 087FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         088000H - 07FFFH           23         32K-WORD         088000H - 07FFFH           23         32K-WORD         088000H - 07FFFH           23         32K-WORD         068000H - 067FFFH           20         32K-WORD         058000H - 05FFFH           20         32K-WORD         058000H - 05FFFH           10         32K-WORD <td></td> <td>-</td> <td></td> <td></td>		-		
37         32K-WORD         0F0000H - 0F7FFFH           36         32K-WORD         0E8000H - 0EFFFFH           35         32K-WORD         0E0000H - 0E7FFFH           33         32K-WORD         0D8000H - 0D7FFFH           33         32K-WORD         0D8000H - 0D7FFFH           33         32K-WORD         0D0000H - 0D7FFFH           31         32K-WORD         0C8000H - 0C7FFFH           30         32K-WORD         0B0000H - 0D7FFFH           23         32K-WORD         0B0000H - 0B7FFFH           23         32K-WORD         0B0000H - 0B7FFFH           23         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 087FFFH           26         32K-WORD         098000H - 087FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         088000H - 07FFFH           23         32K-WORD         088000H - 07FFFH           23         32K-WORD         068000H - 067FFFH           20         32K-WORD         068000H - 067FFFH           21         32K-WORD         058000H - 05FFFH           23         32K-WORD         058000H - 05FFFH           16         32K-WOR		39	32K-WORD	100000H - 107FFFH
37         32K-WORD         0F0000H - 0F7FFFH           36         32K-WORD         0E8000H - 0EFFFFH           35         32K-WORD         0E0000H - 0E7FFFH           33         32K-WORD         0D8000H - 0D7FFFH           33         32K-WORD         0D8000H - 0D7FFFH           33         32K-WORD         0D0000H - 0D7FFFH           31         32K-WORD         0C8000H - 0C7FFFH           30         32K-WORD         0B0000H - 0D7FFFH           23         32K-WORD         0B0000H - 0B7FFFH           23         32K-WORD         0B0000H - 0B7FFFH           23         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 087FFFH           26         32K-WORD         098000H - 087FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         088000H - 07FFFH           23         32K-WORD         088000H - 07FFFH           23         32K-WORD         068000H - 067FFFH           20         32K-WORD         068000H - 067FFFH           21         32K-WORD         058000H - 05FFFH           23         32K-WORD         058000H - 05FFFH           16         32K-WOR				
37         32K-WORD         0F0000H - 0F7FFFH           36         32K-WORD         0E8000H - 0EFFFFH           35         32K-WORD         0E0000H - 0E7FFFH           33         32K-WORD         0D8000H - 0D7FFFH           33         32K-WORD         0D8000H - 0D7FFFH           33         32K-WORD         0D0000H - 0D7FFFH           31         32K-WORD         0C8000H - 0C7FFFH           30         32K-WORD         0B0000H - 0D7FFFH           23         32K-WORD         0B0000H - 0B7FFFH           23         32K-WORD         0B0000H - 0B7FFFH           23         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 087FFFH           26         32K-WORD         098000H - 087FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         088000H - 07FFFH           23         32K-WORD         088000H - 07FFFH           23         32K-WORD         068000H - 067FFFH           20         32K-WORD         068000H - 067FFFH           21         32K-WORD         058000H - 05FFFH           23         32K-WORD         058000H - 05FFFH           16         32K-WOR		38	32K-WORD	0F8000H - 0FFFFFH
36         32K-WORD         0E8000H - 0EFFFH           35         32K-WORD         0E0000H - 0E7FFFH           34         32K-WORD         0D0000H - 0DFFFFH           33         32K-WORD         0D0000H - 0D7FFFH           31         32K-WORD         0C8000H - 0C7FFFH           30         32K-WORD         0C8000H - 0C7FFFH           30         32K-WORD         0B0000H - 0S7FFFH           29         32K-WORD         0B0000H - 0B7FFFH           29         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         0A8000H - 0A7FFFH           26         32K-WORD         08000H - 087FFFH           23         32K-WORD         08000H - 087FFFH           23         32K-WORD         08000H - 07FFFH           23         32K-WORD         08000H - 07FFFH           21         32K-WORD         068000H - 07FFFH           20         32K-WORD         068000H - 05FFFFH           19         32K-WORD         058000H - 05FFFFH           10         32K-WORD         058000H - 05FFFH           11         32K-WORD         038000H - 037FFFH           12         32K-WORD <td></td> <td>-</td> <td></td> <td></td>		-		
35         32K-WORD         0E0000H - 0E7FFFH           34         32K-WORD         0D8000H - 0D7FFFH           33         32K-WORD         0D0000H - 0D7FFFH           33         32K-WORD         0C8000H - 0C7FFFH           31         32K-WORD         0C8000H - 0C7FFFH           30         32K-WORD         0B8000H - 0B7FFFH           29         32K-WORD         0B8000H - 0B7FFFH           29         32K-WORD         0A8000H - 0A7FFFH           26         32K-WORD         0A8000H - 0A7FFFH           26         32K-WORD         098000H - 0A7FFFH           26         32K-WORD         088000H - 087FFFH           26         32K-WORD         088000H - 087FFFH           26         32K-WORD         088000H - 087FFFH           23         32K-WORD         08000H - 07FFFH           23         32K-WORD         078000H - 07FFFH           20         32K-WORD         068000H - 067FFFH           20         32K-WORD         058000H - 05FFFH           20         32K-WORD         058000H - 03FFFFH           21         32K-WORD         038000H - 03FFFFH           23         32K-WORD         038000H - 03FFFFH           13         32K-WOR				
34         32K-WORD         0D8000H - 0DFFFH           33         32K-WORD         0D0000H - 0D7FFFH           32         32K-WORD         0C8000H - 0D7FFFH           33         32K-WORD         0C0000H - 0C7FFFH           30         32K-WORD         0C0000H - 0C7FFFH           30         32K-WORD         0B8000H - 0BFFFFH           29         32K-WORD         0B8000H - 0AFFFFH           29         32K-WORD         0A0000H - 0A7FFFH           27         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 0AFFFFH           27         32K-WORD         098000H - 0A7FFFH           26         32K-WORD         098000H - 0A7FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         078000H - 07FFFH           20         32K-WORD         078000H - 07FFFH           20         32K-WORD         058000H - 067FFFH           18         32K-WORD         058000H - 057FFFH           16         32K-WORD         038000H - 047FFFH           13         32K-WORD         038000H - 037FFFH           13         32K-WORD         038000H - 037FFFH           13         32K-WO				
Image: Signer				
32         32K-WORD         0C8000H - 0CFFFFH           31         32K-WORD         0B000H - 0BFFFFH           30         32K-WORD         0B0000H - 0BFFFFH           29         32K-WORD         0B0000H - 0BFFFFH           29         32K-WORD         0B0000H - 0AFFFFH           29         32K-WORD         0A0000H - 0AFFFFH           27         32K-WORD         0A0000H - 0AFFFFH           26         32K-WORD         098000H - 09FFFFH           26         32K-WORD         098000H - 08FFFFH           23         32K-WORD         088000H - 08FFFFH           23         32K-WORD         088000H - 08FFFFH           23         32K-WORD         088000H - 08FFFFH           23         32K-WORD         068000H - 08FFFFH           20         32K-WORD         068000H - 07FFFH           21         32K-WORD         068000H - 06FFFFH           20         32K-WORD         058000H - 05FFFH           17         32K-WORD         058000H - 05FFFH           16         32K-WORD         038000H - 03FFFFH           13         32K-WORD         038000H - 03FFFFH           13         32K-WORD         028000H - 02FFFFH           13         32K-WOR		-		
31         32K-WORD         0C0000H - 0C7FFFH           30         32K-WORD         0B8000H - 0BFFFH           29         32K-WORD         0B0000H - 0B7FFFH           29         32K-WORD         0A8000H - 0AFFFFH           29         32K-WORD         0A8000H - 0AFFFFH           29         32K-WORD         0A8000H - 0AFFFFH           27         32K-WORD         0A8000H - 0AFFFFH           26         32K-WORD         098000H - 097FFFH           26         32K-WORD         088000H - 08FFFFH           23         32K-WORD         080000H - 087FFFH           23         32K-WORD         080000H - 07FFFH           21         32K-WORD         078000H - 07FFFH           22         32K-WORD         068000H - 067FFFH           20         32K-WORD         068000H - 05FFFH           20         32K-WORD         058000H - 05FFFH           17         32K-WORD         058000H - 05FFFH           16         32K-WORD         038000H - 037FFFH           12         32K-WORD         038000H - 037FFFH           13         32K-WORD         018000H - 037FFFH           12         32K-WORD         018000H - 017FFFH           13         32K-WORD<				
30         32K-WORD         0B8000H - 0BFFFH           29         32K-WORD         0B0000H - 0B7FFFH           29         32K-WORD         0A0000H - 0A7FFFH           27         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 09FFFFH           26         32K-WORD         098000H - 09FFFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         08000H - 087FFFH           23         32K-WORD         078000H - 077FFFH           21         32K-WORD         078000H - 077FFFH           20         32K-WORD         068000H - 067FFFH           20         32K-WORD         068000H - 067FFFH           20         32K-WORD         058000H - 057FFFH           21         32K-WORD         058000H - 047FFFH           16         32K-WORD         038000H - 037FFFH           13         32K-WORD         028000H - 037FFFH           13         32K-WORD         018000H - 017FFFH           13         32K-WORD         018000H - 017FFFH           13         32K-WORD         018000H - 017FFFH           13         32K-W				
29         32K-WORD         0B0000H - 0B7FFH           28         32K-WORD         0A8000H - 0A7FFFH           27         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 097FFFH           26         32K-WORD         098000H - 097FFFH           25         32K-WORD         098000H - 087FFFH           23         32K-WORD         080000H - 087FFFH           23         32K-WORD         080000H - 087FFFH           23         32K-WORD         078000H - 07FFFH           23         32K-WORD         078000H - 07FFFH           20         32K-WORD         068000H - 067FFFH           20         32K-WORD         068000H - 067FFFH           18         32K-WORD         05000H - 057FFFH           16         32K-WORD         05000H - 047FFFH           13         32K-WORD         038000H - 037FFFH           13         32K-WORD         028000H - 027FFFH           13         32K-WORD         010000H - 07FFFH           13         32K-WORD         018000H - 017FFFH           13         32K-WORD         010000H - 007FFFH           13         32K-WORD<				
28         32K-WORD         0A8000H - 0AFFFFH           27         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 087FFFH           25         32K-WORD         090000H - 097FFFH           23         32K-WORD         090000H - 087FFFH           23         32K-WORD         088000H - 08FFFH           23         32K-WORD         080000H - 087FFFH           23         32K-WORD         078000H - 077FFFH           21         32K-WORD         078000H - 077FFFH           23         32K-WORD         068000H - 067FFFH           23         32K-WORD         068000H - 057FFFH           20         32K-WORD         058000H - 057FFFH           21         32K-WORD         058000H - 057FFFH           23         32K-WORD         050000H - 037FFFH           16         32K-WORD         040000H - 047FFFH           13         32K-WORD         038000H - 037FFFH           13         32K-WORD         028000H - 037FFFH           13         32K-WORD         018000H - 017FFFH           13         32K-WORD         018000H - 017FFFH           13         32K-WORD         018000H - 017FFFH           13         32K-				
27         32K-WORD         0A0000H - 0A7FFFH           26         32K-WORD         098000H - 097FFFH           25         32K-WORD         090000H - 087FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         088000H - 087FFFH           23         32K-WORD         078000H - 07FFFH           21         32K-WORD         078000H - 07FFFH           20         32K-WORD         068000H - 067FFFH           20         32K-WORD         068000H - 067FFFH           20         32K-WORD         060000H - 067FFFH           10         32K-WORD         050000H - 057FFFH           16         32K-WORD         050000H - 057FFFH           16         32K-WORD         040000H - 047FFFH           13         32K-WORD         038000H - 03FFFH           13         32K-WORD         038000H - 027FFFH           13         32K-WORD         018000H - 017FFFH           13         32K-WORD         018000H - 017FFFH           13         32K-WORD         018000H - 007FFFH           13         32K-WORD         008000H - 007FFFH           13         32K-WO				
20         32K-WORD         068800H         06FFFH           19         32K-WORD         060000H         067FFFH           18         32K-WORD         058000H         057FFFH           17         32K-WORD         05000H         057FFFH           16         32K-WORD         048000H         047FFFH           16         32K-WORD         040000H         047FFFH           13         32K-WORD         038000H         037FFFH           13         32K-WORD         038000H         037FFFH           12         32K-WORD         028000H         027FFFH           10         32K-WORD         018000H         027FFFH           10         32K-WORD         018000H         017FFFH           9         32K-WORD         018000H         007FFFH           9         32K-WORD         018000H         007FFFH           10         32K-WORD         008000H         007FFFH           9         32K-WORD         008000H         007FFFH           10         32K-WORD         0008000H         007FFFH           14         4K-WORD         007000H         007FFFH           14         4K-WORD         005000H         005	1 m	-		
20         32K-WORD         068800H         06FFFH           19         32K-WORD         060000H         067FFFH           18         32K-WORD         058000H         057FFFH           17         32K-WORD         05000H         057FFFH           16         32K-WORD         048000H         047FFFH           16         32K-WORD         040000H         047FFFH           13         32K-WORD         038000H         037FFFH           13         32K-WORD         038000H         037FFFH           12         32K-WORD         028000H         027FFFH           10         32K-WORD         018000H         027FFFH           10         32K-WORD         018000H         017FFFH           9         32K-WORD         018000H         007FFFH           9         32K-WORD         018000H         007FFFH           10         32K-WORD         008000H         007FFFH           9         32K-WORD         008000H         007FFFH           10         32K-WORD         0008000H         007FFFH           14         4K-WORD         007000H         007FFFH           14         4K-WORD         005000H         005	IE.			
20         32K-WORD         068800H         06FFFH           19         32K-WORD         060000H         067FFFH           18         32K-WORD         058000H         057FFFH           17         32K-WORD         05000H         057FFFH           16         32K-WORD         048000H         047FFFH           16         32K-WORD         040000H         047FFFH           13         32K-WORD         038000H         037FFFH           13         32K-WORD         038000H         037FFFH           12         32K-WORD         028000H         027FFFH           10         32K-WORD         018000H         027FFFH           10         32K-WORD         018000H         017FFFH           9         32K-WORD         018000H         007FFFH           9         32K-WORD         018000H         007FFFH           10         32K-WORD         008000H         007FFFH           9         32K-WORD         008000H         007FFFH           10         32K-WORD         0008000H         007FFFH           14         4K-WORD         007000H         007FFFH           14         4K-WORD         005000H         005	2			
20         32K-WORD         068800H         06FFFH           19         32K-WORD         060000H         067FFFH           18         32K-WORD         058000H         057FFFH           17         32K-WORD         05000H         057FFFH           16         32K-WORD         048000H         047FFFH           16         32K-WORD         040000H         047FFFH           13         32K-WORD         038000H         037FFFH           13         32K-WORD         038000H         037FFFH           12         32K-WORD         028000H         027FFFH           10         32K-WORD         018000H         027FFFH           10         32K-WORD         018000H         017FFFH           9         32K-WORD         018000H         007FFFH           9         32K-WORD         018000H         007FFFH           10         32K-WORD         008000H         007FFFH           9         32K-WORD         008000H         007FFFH           10         32K-WORD         0008000H         007FFFH           14         4K-WORD         007000H         007FFFH           14         4K-WORD         005000H         005	1	25	32K-WORD	
20         32K-WORD         068800H         06FFFH           19         32K-WORD         060000H         067FFFH           18         32K-WORD         058000H         057FFFH           17         32K-WORD         05000H         057FFFH           16         32K-WORD         048000H         047FFFH           16         32K-WORD         040000H         047FFFH           13         32K-WORD         038000H         037FFFH           13         32K-WORD         038000H         037FFFH           12         32K-WORD         028000H         027FFFH           10         32K-WORD         018000H         027FFFH           10         32K-WORD         018000H         017FFFH           9         32K-WORD         018000H         007FFFH           9         32K-WORD         018000H         007FFFH           10         32K-WORD         008000H         007FFFH           9         32K-WORD         008000H         007FFFH           10         32K-WORD         0008000H         007FFFH           14         4K-WORD         007000H         007FFFH           14         4K-WORD         005000H         005	6	24	32K-WORD	
20         32K-WORD         068800H         06FFFH           19         32K-WORD         060000H         067FFFH           18         32K-WORD         058000H         057FFFH           17         32K-WORD         05000H         057FFFH           16         32K-WORD         048000H         047FFFH           16         32K-WORD         040000H         047FFFH           13         32K-WORD         038000H         037FFFH           13         32K-WORD         038000H         037FFFH           12         32K-WORD         028000H         027FFFH           10         32K-WORD         018000H         027FFFH           10         32K-WORD         018000H         017FFFH           9         32K-WORD         018000H         007FFFH           9         32K-WORD         018000H         007FFFH           10         32K-WORD         008000H         007FFFH           9         32K-WORD         008000H         007FFFH           10         32K-WORD         0008000H         007FFFH           14         4K-WORD         007000H         007FFFH           14         4K-WORD         005000H         005	1 K	23	32K-WORD	080000H - 087FFFH
20         32K-WORD         068800H         06FFFH           19         32K-WORD         060000H         067FFFH           18         32K-WORD         058000H         057FFFH           17         32K-WORD         05000H         057FFFH           16         32K-WORD         048000H         047FFFH           16         32K-WORD         040000H         047FFFH           13         32K-WORD         038000H         037FFFH           13         32K-WORD         038000H         037FFFH           12         32K-WORD         028000H         027FFFH           10         32K-WORD         018000H         027FFFH           10         32K-WORD         018000H         017FFFH           9         32K-WORD         018000H         007FFFH           9         32K-WORD         018000H         007FFFH           10         32K-WORD         008000H         007FFFH           9         32K-WORD         008000H         007FFFH           10         32K-WORD         0008000H         007FFFH           14         4K-WORD         007000H         007FFFH           14         4K-WORD         005000H         005	Ë	22	32K-WORD	078000H - 07FFFFH
20         32K-WORD         068800H         06FFFH           19         32K-WORD         060000H         067FFFH           18         32K-WORD         058000H         057FFFH           17         32K-WORD         05000H         057FFFH           16         32K-WORD         048000H         047FFFH           16         32K-WORD         040000H         047FFFH           13         32K-WORD         038000H         037FFFH           13         32K-WORD         038000H         037FFFH           12         32K-WORD         028000H         027FFFH           10         32K-WORD         018000H         027FFFH           10         32K-WORD         018000H         017FFFH           9         32K-WORD         018000H         007FFFH           9         32K-WORD         018000H         007FFFH           10         32K-WORD         008000H         007FFFH           9         32K-WORD         008000H         007FFFH           10         32K-WORD         0008000H         007FFFH           14         4K-WORD         007000H         007FFFH           14         4K-WORD         005000H         005	Ξ	21	32K-WORD	070000H - 077FFFH
19         32K-WORD         060000H - 067FFFH           18         32K-WORD         058000H - 05FFFH           17         32K-WORD         050000H - 057FFFH           16         32K-WORD         048000H - 047FFFH           15         32K-WORD         048000H - 047FFFH           13         32K-WORD         038000H - 037FFFH           12         32K-WORD         030000H - 037FFFH           13         32K-WORD         028000H - 027FFFH           11         32K-WORD         020000H - 027FFFH           12         32K-WORD         018000H - 017FFFH           13         32K-WORD         018000H - 017FFFH           9         32K-WORD         008000H - 007FFFH           9         32K-WORD         008000H - 007FFFH           18         32K-WORD         008000H - 007FFFH           6         4K-WORD         005000H - 007FFFH           5         4K-WORD         005000H - 003FFFH           3         4K-WORD         003000H - 003FFFH           2         4K-WORD         002000H - 002FFFH           1         4K-WORD         002000H - 002FFFH	17			068000H - 06FFFFH
11         32K WORD         018000H         01FFFFH           9         32K-WORD         018000H         01FFFFH           9         32K-WORD         010000H         017FFFH           8         32K-WORD         008000H         00FFFFH           7         4K-WORD         007000H         007FFFH           6         4K-WORD         006000H         005FFFH           5         4K-WORD         005000H         005FFFH           4         4K-WORD         004000H         004FFFH           3         4K-WORD         003000H         003FFFH           2         4K-WORD         002000H         002FFFH           1         4K-WORD         001000H         001FFFH	2			060000H - 067FFFH
11         32K WORD         018000H         01FFFFH           9         32K-WORD         018000H         01FFFFH           9         32K-WORD         010000H         017FFFH           8         32K-WORD         008000H         00FFFFH           7         4K-WORD         007000H         007FFFH           6         4K-WORD         006000H         005FFFH           5         4K-WORD         005000H         005FFFH           4         4K-WORD         004000H         004FFFH           3         4K-WORD         003000H         003FFFH           2         4K-WORD         002000H         002FFFH           1         4K-WORD         001000H         001FFFH		-		058000H - 05FFFFH
11         32K WORD         018000H         01FFFFH           9         32K-WORD         018000H         01FFFFH           9         32K-WORD         010000H         017FFFH           8         32K-WORD         008000H         00FFFFH           7         4K-WORD         007000H         007FFFH           6         4K-WORD         006000H         005FFFH           5         4K-WORD         005000H         005FFFH           4         4K-WORD         004000H         004FFFH           3         4K-WORD         003000H         003FFFH           2         4K-WORD         002000H         002FFFH           1         4K-WORD         001000H         001FFFH	$\mathbf{P}$			
11         32K WORD         018000H         01FFFFH           9         32K-WORD         018000H         01FFFFH           9         32K-WORD         010000H         017FFFH           8         32K-WORD         008000H         00FFFFH           7         4K-WORD         007000H         007FFFH           6         4K-WORD         006000H         005FFFH           5         4K-WORD         005000H         005FFFH           3         4K-WORD         004000H         004FFFH           2         4K-WORD         003000H         003FFFH           1         4K-WORD         002000H         002FFFH	E.			
11         32K WORD         018000H         01FFFFH           9         32K-WORD         018000H         01FFFFH           9         32K-WORD         010000H         017FFFH           8         32K-WORD         008000H         00FFFFH           7         4K-WORD         007000H         007FFFH           6         4K-WORD         006000H         005FFFH           5         4K-WORD         005000H         005FFFH           3         4K-WORD         004000H         004FFFH           2         4K-WORD         003000H         003FFFH           1         4K-WORD         002000H         002FFFH	$\widetilde{\mathbf{C}}$			
11         32K WORD         018000H         01FFFFH           9         32K-WORD         018000H         01FFFFH           9         32K-WORD         010000H         017FFFH           8         32K-WORD         008000H         00FFFFH           7         4K-WORD         007000H         007FFFH           6         4K-WORD         006000H         005FFFH           5         4K-WORD         005000H         005FFFH           3         4K-WORD         004000H         004FFFH           2         4K-WORD         003000H         003FFFH           1         4K-WORD         002000H         002FFFH	Ē			
11         32K WORD         018000H         01FFFFH           9         32K-WORD         018000H         01FFFFH           9         32K-WORD         010000H         017FFFH           8         32K-WORD         008000H         00FFFFH           7         4K-WORD         007000H         007FFFH           6         4K-WORD         006000H         005FFFH           5         4K-WORD         005000H         005FFFH           3         4K-WORD         004000H         004FFFH           2         4K-WORD         003000H         003FFFH           1         4K-WORD         002000H         002FFFH		-		
11         32K WORD         018000H         01FFFFH           9         32K-WORD         018000H         01FFFFH           9         32K-WORD         010000H         017FFFH           8         32K-WORD         008000H         00FFFFH           7         4K-WORD         007000H         007FFFH           6         4K-WORD         006000H         005FFFH           5         4K-WORD         005000H         005FFFH           3         4K-WORD         004000H         004FFFH           2         4K-WORD         003000H         003FFFH           1         4K-WORD         002000H         002FFFH	Į٩			
11         32K WORD         018000H         01FFFFH           9         32K-WORD         018000H         01FFFFH           9         32K-WORD         010000H         017FFFH           8         32K-WORD         008000H         00FFFFH           7         4K-WORD         007000H         007FFFH           6         4K-WORD         006000H         005FFFH           5         4K-WORD         005000H         005FFFH           3         4K-WORD         004000H         004FFFH           2         4K-WORD         003000H         003FFFH           1         4K-WORD         002000H         002FFFH				
9         32K-WORD         010000H - 017FFFH           8         32K-WORD         008000H - 00FFFFH           7         4K-WORD         007000H - 007FFFH           6         4K-WORD         006000H - 006FFFH           5         4K-WORD         005000H - 005FFFH           4         4K-WORD         004000H - 004FFFH           3         4K-WORD         003000H - 003FFFH           2         4K-WORD         002000H - 002FFFH           1         4K-WORD         001000H - 001FFFH	1			
8         32K-WORD         008000H - 00FFFFH           7         4K-WORD         007000H - 007FFFH           6         4K-WORD         006000H - 006FFFH           5         4K-WORD         005000H - 005FFFH           4         4K-WORD         004000H - 004FFFH           3         4K-WORD         003000H - 003FFFH           2         4K-WORD         002000H - 002FFFH           1         4K-WORD         001000H - 001FFFH				
7         4K-WORD         007000H - 007FFFH           6         4K-WORD         006000H - 006FFFH           5         4K-WORD         005000H - 005FFFH           4         4K-WORD         004000H - 004FFFH           3         4K-WORD         003000H - 003FFFH           2         4K-WORD         002000H - 002FFFH           1         4K-WORD         001000H - 001FFFH				
6         4K-WORD         006000H - 006FFFH           5         4K-WORD         005000H - 005FFFH           4         4K-WORD         004000H - 004FFFH           3         4K-WORD         003000H - 003FFFH           2         4K-WORD         002000H - 002FFFH           1         4K-WORD         001000H - 001FFFH	1			
5         4K-WORD         005000H - 005FFFH           4         4K-WORD         004000H - 004FFFH           3         4K-WORD         003000H - 003FFFH           2         4K-WORD         002000H - 002FFFH           1         4K-WORD         001000H - 001FFFH				
4         4K-WORD         004000H - 004FFFH           3         4K-WORD         003000H - 003FFFH           2         4K-WORD         002000H - 002FFFH           1         4K-WORD         001000H - 001FFFH				
3         4K-WORD         003000H - 003FFFH           2         4K-WORD         002000H - 002FFFH           1         4K-WORD         001000H - 001FFFH	1	5	4K-WORD	
3         4K-WORD         003000H - 003FFFH           2         4K-WORD         002000H - 002FFFH           1         4K-WORD         001000H - 001FFFH		4	4K-WORD	004000H - 004FFFH
2         4K-WORD         002000H - 002FFFH           1         4K-WORD         001000H - 001FFFH		3		003000H - 003FFFH
1 4K-WORD 001000H - 001FFFH	1			
	•	•		

Figure 2. Memory Map (Bottom Parameter)

Table 3.	Identifier	Codes and	OTP A	Address	for Read	Operation
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		1		
	Code	Address $[A_{15}-A_0]^{(1)}$	Data [DQ <sub>15</sub> -DQ <sub>0</sub> ]	Notes
Manufacturer Code	Manufacturer Code	0000H	00B0H	
Device Code	Bottom Parameter Device Code	0001H	00B1H	2
Block Lock Configuration	Block is Unlocked		$DQ_0 = 0$	3
Code	Block is Locked	Block	$DQ_0 = 1$	3
	Block is not Locked-Down	Address + 2	$DQ_1 = 0$	3
	Block is Locked-Down		$DQ_1 = 1$	3
Device Configuration Code	Partition Configuration Register	0006Н	PCRC	4
OTP	OTP Lock	0080H	OTP-LK	5
	OTP	0081-0088H	OTP	6

1. The address A<sub>21</sub>-A<sub>16</sub> are shown in below table for reading the manufacturer, device, lock configuration,

device configuration code and OTP data.

2. Bottom parameter device has its parameter blocks in the plane0 (The lowest address).

3. DQ<sub>15</sub>-DQ<sub>2</sub> are reserved for future implementation.
 4. PCRC=Partition Configuration Register Code.

5. OTP-LK=OTP Block Lock configuration.

6. OTP=OTP Block data.

Partition C	Configuration 1	Register <sup>(2)</sup>	Address (64M-bit device)
PCR.10	PCR.9	PCR.8	[A <sub>21</sub> -A <sub>16</sub> ]
0	0	0	00H
0	0	1	00H or 10H
0	1	0	00H or 20H
1	0	0	00H or 30H
0	1	1	00H or 10H or 20H
1	1	0	00H or 20H or 30H
1	0	1	00H or 10H or 30H
1	1	1	00H or 10H or 20H or 30H

Table 4. Identifier Codes and OTP Address for Read Operation on Partition Configuration<sup>(1)</sup> (64M-bit device)

NOTES:

1. The address to read the identifier codes or OTP data is dependent on the partition which is selected when writing the Read Identifier Codes/OTP command (90H).

2. Refer to Table 12 for the partition configuration register.

000088H	
	Customer Programmable Area
000085H	
000084H	
	Factory Programmed Area
000081H	
000080H	Reserved for Future Implementation (DO15-DO2)

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

Mode	Notes	RST#	CE#	OE#	WE#	Address	V <sub>PP</sub>	DQ <sub>0-15</sub>			
Read Array	6	V <sub>IH</sub>	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	Х	Х	D <sub>OUT</sub>			
Output Disable		V <sub>IH</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IH</sub>	Х	Х	High Z			
Standby		V <sub>IH</sub>	V <sub>IH</sub>	Х	Х	Х	Х	High Z			
Reset	3	V <sub>IL</sub>	Х	Х	Х	Х	Х	High Z			
Read Identifier Codes/OTP	6	V <sub>IH</sub>	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	See Table 3 and Table 4	Х	See Table 3 and Table 4			
Read Query	6,7	V <sub>IH</sub>	V <sub>IL</sub>	V <sub>IL</sub>	V <sub>IH</sub>	See Appendix	Х	See Appendix			
Write	4,5,6	V <sub>IH</sub>	V <sub>IL</sub>	V <sub>IH</sub>	V <sub>IL</sub>	Х	Х	D <sub>IN</sub>			

Table 5. Bus  $Operation^{(1,2)}$ 

Refer to DC Characteristics. When V<sub>PP</sub>≤V<sub>PPLK</sub>, memory contents can be read, but cannot be altered.
 X can be V<sub>IL</sub> or V<sub>IH</sub> for control pins and addresses, and V<sub>PPLK</sub> or V<sub>PPH1/2</sub> for V<sub>PP</sub>. See DC Characteristics for V<sub>PPLK</sub> and V<sub>PPH1/2</sub> voltages.
 RST# at GND±0.2V ensures the lowest power consumption.

4. Command writes involving block erase, (page buffer) program or OTP program are reliably executed when V<sub>PP</sub>=V<sub>PPH1/2</sub> and V<sub>CC</sub>=2.7V-3.6V.
 Command writes involving full chip erase are reliably executed when V<sub>PP</sub>=V<sub>PPH1</sub> and V<sub>CC</sub>=2.7V-3.6V.
 Refer to Table 6 for valid D<sub>IN</sub> during a write operation.

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

7. Refer to Appendix of LH28F640BF series for more information about query code.

	Т	able 6. C	Command	Definitions <sup>(1</sup>	1)			
	Bus		1	First Bus Cyc	ele	Se	econd Bus C	ycle
Command	Cycles Req'd	Notes	Oper <sup>(1)</sup>	Addr <sup>(2)</sup>	Data	Oper <sup>(1)</sup>	Addr <sup>(2)</sup>	Data <sup>(3)</sup>
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	С0Н	Write	OA	OD
Set Partition Configuration Register	2		Write	PCRC	60H	Write	PCRC	04H

1. Bus operations are defined in Table 5.

2. The address which is written at the first bus cycle should be the same as the address which is written at the second bus cvcle.

X=Any valid address within the device.

PA=Address within the selected partition.

IA=Identifier codes address (See Table 3 and Table 4).

QA=Query codes address. Refer to Appendix of LH28F640BF series for details.

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).

PCRC=Partition configuration register code presented on the address A<sub>0</sub>-A<sub>15</sub>.

3. ID=Data read from identifier codes. (See Table 3 and Table 4).

QD=Data read from query database. Refer to Appendix of LH28F640BF series for details.

SRD=Data read from status register. See Table 10 and Table 11 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, partition configuration register code and the data within OTP block (See Table 3 and Table 4). 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<sub>IH</sub>.

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

7. Following the third bus cycle, inputs the program sequential address and write data of "N" times. Finally, input the any valid address within the target partition to be programmed and the confirm command (D0H). Refer to Appendix of LH28F640BF series for details.

- 8. If the program operation in one partition is suspended and the erase operation in other partition is also suspended, the suspended program operation should be resumed first, and then the suspended erase operation should be resumed next.
- 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# is V<sub>IL</sub>. When WP# is V<sub>IH</sub>, 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.

		Cu	rrent State		(2)	
State	WP#	DQ1 <sup>(1)</sup>	DQ <sub>0</sub> <sup>(1)</sup>	State Name	Erase/Program Allowed <sup>(2)</sup>	
[000]	0	0	0	Unlocked	Yes	
[001] <sup>(3)</sup>	0	0	1	Locked	No	
[011]	0	1	1	Locked-down	No	
[100]	1	0	0	Unlocked	Yes	
[101] <sup>(3)</sup>	1	0	1	Locked	No	
[110] <sup>(4)</sup>	1	1	0	Lock-down Disable	Yes	
[111]	1	1	1	Lock-down Disable	No	

Table 7. Functions of Block Lock<sup>(5)</sup> and Block Lock-Down

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#=0) or [101] (WP#=1), regardless of the states before power-off or reset operation. 4. When WP# 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.

	Curren	t State		Result after L	ock Command Writte	n (Next State)
State	WP#	DQ <sub>1</sub>	DQ <sub>0</sub>	Set Lock <sup>(1)</sup>	Clear Lock <sup>(1)</sup>	Set Lock-down <sup>(1)</sup>
[000]	0	0	0	[001]	No Change	[011] <sup>(2)</sup>
[001]	0	0	1	No Change <sup>(3)</sup>	[000]	[011]
[011]	0	1	1	No Change	No Change	No Change
[100]	1	0	0	[101]	No Change	[111] <sup>(2)</sup>
[101]	1	0	1	No Change	[100]	[111]
[110]	1	1	0	[111]	No Change	[111] <sup>(2)</sup>
[111]	1	1	1	No Change	[110]	No Change

Table 8. Block Locking State Transitions upon Command Write<sup>(4)</sup>

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# is not changed and fixed  $V_{IL}$  or  $V_{IH}$ .

Due is a Chata		Current S	State		Result after WP# Transition (Next State)			
Previous State	State	WP#	DQ <sub>1</sub>	DQ <sub>0</sub>	WP#= $0 \rightarrow 1^{(1)}$	WP#= $1 \rightarrow 0^{(1)}$		
-	[000]	0	0	0	[100]	-		
-	[001]	0	0	1	[101]	-		
[110] <sup>(2)</sup>	[011]	0	1	1	[110]	-		
Other than $[110]^{(2)}$	[011]	0			[111]	-		
-	[100]	1	0	0	-	[000]		
-	[101]	1	0	1	-	[001]		
-	[110]	1	1	0	-	[011] <sup>(3)</sup>		
-	[111]	1	1	1	-	[011]		

Table 9. Block Locking State Transitions upon WP# Transition<sup>(4)</sup>

1. "WP#=0 $\rightarrow$ 1" means that WP# is driven to V<sub>IH</sub> and "WP#=1 $\rightarrow$ 0" means that WP# is driven to V<sub>IL</sub>.

2. State transition from the current state [011] to the next state depends on the previous state.

3. When WP# 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.

R	R	R	R	R	R	R	R	
15	14	13	12	11	10	9	8	
WSMS	BESS	BEFCES	PBPOPS	VPPS	PBPSS	DPS	R	
7	6	5	4	3	2	1	0	
ENHANCE	= RESERVED F MENTS (R) E STATE MACH		(WSMS)	Status Register	NOT		tion not WS	
1 = Ready 0 = Busy SR.6 = BLOC	K ERASE SUS	PEND STATUS	S (BESS)	(Write State Ma be occupied by 3 or 4 partitions	achine). Even if the other partit	the SR.7 is "1", ion when the de	the WSM ma	
1 = Block	Erase Suspende Erase in Progres	d		Check SR.7 to buffer) program invalid while S	n or OTP progra			
<ul> <li>SR.5 = BLOCK ERASE AND FULL CHIP ERASE STATUS (BEFCES)</li> <li>1 = Error in Block Erase or Full Chip Erase</li> <li>0 = Successful Block Erase or Full Chip Erase</li> </ul>				If both SR.5 and SR.4 are "1"s after a block erase, full chip erase, (page buffer) program, set/clear block lock bit, set block lock-down bit, set partition configuration register attempt, an improper command sequence was entered.				
OTP $1 = Error is$ $0 = Succes$	BUFFER) PRO PROGRAM ST n (Page Buffer) sful (Page Buffe	ATUS (PBPOP Program or OT	P Program	SR.3 does not provide a continuous indication of $V_{PP}$ level The WSM interrogates and indicates the $V_{PP}$ level only after Block Erase, Full Chip Erase, (Page Buffer) Program or OT Program command sequences. SR.3 is not guaranteed				
	TATUS (VPPS) DW Detect, Ope K	eration Abort		SR.1 does not p bit. The WSM i	provide a continue of the arron of the provide a continue of the provi	nuous indication block lock bit o	n of block loo nly after Bloo	
STAT $1 = (Page I)$	BUFFER) PRO US (PBPSS) Buffer) Program Buffer) Program	n Suspended		Erase, Full Cl Program comm depending on th set. Reading the the Read Iden lock bit status.	mand sequence he attempted op block lock co	es. It informs beration, if the b nfiguration cod	s the syster block lock bit es after writir	
1 = Erase of	CE PROTECT S or Program Atte d Block, Operat ced	mpted on a		SR.15 - SR.8 and SR.0 are reserved for future use and shou be masked out when polling the status register.				

		Table 1	1. Extended Sta	atus Register De	efinition		
R	R	R	R	R	R	R	R
15	14	13	12	11	9	8	
SMS	R	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			NOTES: After issue a Page Buffer Program command (E8H) XSR.7="1" indicates that the entered command is accepted If XSR.7 is "0", the command is not accepted and a next Page Buffer Program command (E8H) should be issued again to check if page buffer is available or not. XSR.15-8 and XSR.6-0 are reserved for future use and				
XSR.6-0 = RES	SERVED FOR FU	JTURE ENHAN	CEMENTS (R)	should be ma register.	sked out when	polling the e	extended status

		Table 12. I	Partition Config	guration Regis	ter Definition		
R	R	R	R	R	PC2	PC1	PC0
15	14	13	12	11	10	9	8
R	R	R	R	R	R	R	R
7	6	5	4	3	2	1	0
PCR.15-11 = RPCR.10-8 = PA000 = No001 = Plan(defau010 = Plan(defau011 = Planthreeoperat101 = Planthreeoperat101 = Planthreeoperat000<	RESERVED FOR ENHANCEME ARTITION COM partitioning. Du ne1-3 are merge It in a bottom param ne 0-1 and Plane on respectively. ne 0-2 are merge partitions in the ion is available ne 0-1 are merge partitions in the ion is available ne 1-2 are merge partitions in the ion is available ne 1-2 are merge partitions in the ion is available ne 1-2 are merge partitions in the ion is available PARTITION PARTITION PARTITION	R FUTURE ENTS (R) IFIGURATION al Work is not a d into one partin arameter device e2-3 are merged ed into one part is configuratic between any tw ed into one part is configuratic is configura	(PC2-0) allowed. tion. i into one ition. There are on. Dual work o partitions. ition. There are on. Dual work o partitions. ition. There are on. Dual work o partitions. Ition. There are on. Dual work o partitions. IL WORK	111 = Th Each tivel two PCR.7-0 = R After power- "001" in a parameter de See Figure 4 PCR.15-11 a should be configuration PC2 PC1PC0 0 1 1 1 1 0 1 0 1 1 1 1 1	PARTITION2 PARTITION3 PARTITIA PARTITION3 PARTITIA PARTITION3 PARTITIA PARTITION3 PARTITIA PARTITIA PARTITION3 PARTITIA P	tions in this comods to each peration is available FUTURE JTS (R) TES: Set, PCR10-8 (If partition config partition config partition config NING FOR DU N2 PARTITION EAU N2 PARTITION EAU N12 PARTITION EAU PARTITION1 PAR EAU PARTITION1 PAR	AL WORK 1 PARTITIONO AL WORK 1 PARTITIONO PARTITIONO PARTITIONO PARTITIONO PARTITIONO PARTITIONO
		F	igure 4. Partiti	on Configurat	1011		
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Rev. 2.42

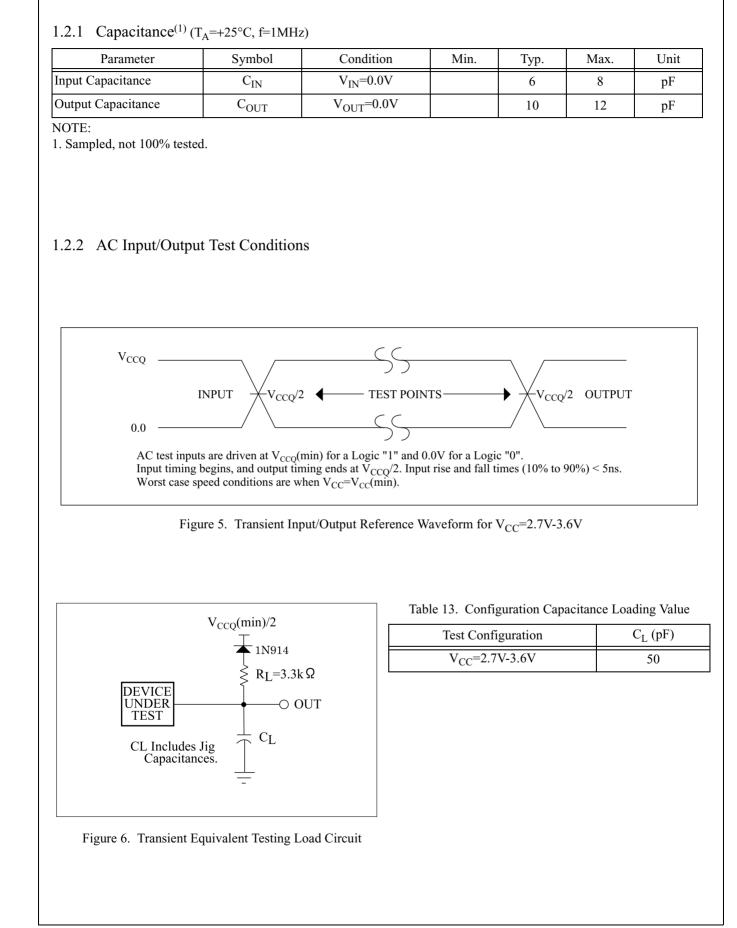
<ol> <li>Electrical Specifications</li> <li>Absolute Maximum Ratings*</li> <li>Operating Temperature During Read, Erase and Program40°C to +85°C <sup>(1)</sup></li> </ol>	*WARNING: Stressing the device beyond the "Absolute Maximum Ratings" may cause permanent damage. These are stress ratings only. Operation beyond the "Operating Conditions" is not recommended and extended exposure beyond the "Operating Conditions" may affect device reliability.
	NOTES:
Storage Temperature During under Bias40°C to +85°C During non Bias65°C to +125°C	<ol> <li>Operating temperature is for extended temperature product defined by this specification.</li> <li>All specified voltages are with respect to GND. Minimum DC voltage is -0.5V on input/output pins and -0.2V on V<sub>CC</sub> and V<sub>PP</sub> pins. During transitions,</li> </ol>
Voltage On Any Pin (except $V_{CC}$ and $V_{PP}$ )0.5V to $V_{CC}$ +0.5V $^{(2)}$	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.
$V_{CC}$ and $V_{CCQ}$ Supply Voltage0.2V to +3.9V $^{(2)}$	<ol> <li>Maximum DC voltage on V<sub>PP</sub> may overshoot to +13.0V for periods &lt;20ns.</li> <li>V<sub>PP</sub> erase/program voltage is normally 2.7V-3.6V. Applying 11.7V-12.3V to V<sub>PP</sub> during erase/program</li> </ol>
$V_{PP}$ Supply Voltage0.2V to +12.6V <sup>(2, 3, 4)</sup>	can be done for a maximum of 1,000 cycles on the main blocks and 1,000 cycles on the parameter blocks. $V_{PP}$ may be connected to 11.7V-12.3V for a total of 80
Output Short Circuit Current 100mA <sup>(5)</sup>	<ul><li>hours maximum.</li><li>5. Output shorted for no more than one second. No more than one output shorted at a time.</li></ul>

## 1.2 Operating Conditions

Parameter	Symbol	Min.	Тур.	Max.	Unit	Notes
Operating Temperature	T <sub>A</sub>	-40	+25	+85	°C	
V <sub>CC</sub> Supply Voltage	V <sub>CC</sub>	2.7	3.0	3.6	V	1
I/O Supply Voltage	V <sub>CCQ</sub>	2.7	3.0	3.6	V	1
V <sub>PP</sub> Voltage when Used as a Logic Control	V <sub>PPH1</sub>	1.65	3.0	3.6	V	1
V <sub>PP</sub> Supply Voltage	V <sub>PPH2</sub>	11.7	12	12.3	V	1, 2
Main Block Erase Cycling: V <sub>PP</sub> =3.0V		100,000			Cycles	
Parameter Block Erase Cycling: V <sub>PP</sub> =3.0V		100,000			Cycles	
Main Block Erase Cycling: V <sub>PP</sub> =12V, 80 hrs.				1,000	Cycles	
Parameter Block Erase Cycling: V <sub>PP</sub> =12V, 80 hrs.				1,000	Cycles	
Maximum V <sub>PP</sub> hours at 12V				80	Hours	

NOTES:

See DC Characteristics tables for voltage range-specific specification.
 Applying V<sub>PP</sub>=11.7V-12.3V 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 V<sub>PP</sub>=11.7V-12.3V is not allowed and can cause damage to the device.



## 1.2.3 DC Characteristics

V<sub>CC</sub>=2.7V-3.6V

Symbol	Paran	neter	Notes	Min.	Тур.	Max.	Unit	Test Conditions
I <sub>LI</sub>	Input Load Current		1	-1.0		+1.0	μΑ	V <sub>CC</sub> =V <sub>CC</sub> Max.,
I <sub>LO</sub>	Output Leakage Cur	rent	1	-1.0		+1.0	μΑ	V <sub>CCQ</sub> =V <sub>CCQ</sub> Max., V <sub>IN</sub> /V <sub>OUT</sub> =V <sub>CCQ</sub> or GND
I <sub>CCS</sub>	V <sub>CC</sub> Standby Curren	t	1		4	20	μΑ	$V_{CC}=V_{CC}Max.,$ $CE\#=RST\#=$ $V_{CCQ}\pm0.2V,$ $WP\#=V_{CCQ} \text{ or } GND$
I <sub>CCAS</sub>	V <sub>CC</sub> Automatic Pow	1,4		4	20	μΑ	V <sub>CC</sub> =V <sub>CC</sub> Max., CE#=GND±0.2V, WP#=V <sub>CCQ</sub> or GND	
I <sub>CCD</sub>	V <sub>CC</sub> Reset Power-D	1		4	20	μΑ	RST#=GND±0.2V	
I	Average V <sub>CC</sub> Read Current Normal Mode		1,7		15	25	mA	V <sub>CC</sub> =V <sub>CC</sub> Max., CE#=V <sub>IL</sub> ,
I <sub>CCR</sub>	Average V <sub>CC</sub> Read Current Page Mode	8 Word Read	1,7		5	10	mA	OE#=V <sub>IH</sub> , f=5MHz
т	V (De ce Duffer) D	no anome Cumuont	1,5,7		20	60	mA	V <sub>PP</sub> =V <sub>PPH1</sub>
I <sub>CCW</sub>	V <sub>CC</sub> (Page Buffer) P	Togram Current	1,5,7		10	20	mA	V <sub>PP</sub> =V <sub>PPH2</sub>
т	V <sub>CC</sub> Block Erase, Fu	ıll Chip	1,5,7		10	30	mA	V <sub>PP</sub> =V <sub>PPH1</sub>
I <sub>CCE</sub>	Erase Current		1,5,7		10	30	mA	V <sub>PP</sub> =V <sub>PPH2</sub>
I <sub>CCWS</sub> I <sub>CCES</sub>	V <sub>CC</sub> (Page Buffer) P Block Erase Suspend	-	1,2,7		10	200	μA	CE#=V <sub>IH</sub>
I <sub>PPS</sub> I <sub>PPR</sub>	V <sub>PP</sub> Standby or Read	d Current	1,6,7		2	5	μΑ	V <sub>PP</sub> ≤V <sub>CC</sub>
I	V <sub>PP</sub> (Page Buffer) P	rogram Current	1,5,6,7		2	5	μA	V <sub>PP</sub> =V <sub>PPH1</sub>
I <sub>PPW</sub>	· pp (1 age Duilet) I		1,5,6,7		10	30	mA	V <sub>PP</sub> =V <sub>PPH2</sub>
I	V <sub>PP</sub> Block Erase, Fu	ıll Chip	1,5,6,7		2	5	μΑ	V <sub>PP</sub> =V <sub>PPH1</sub>
I <sub>PPE</sub>	Erase Current		1,5,6,7		5	15	mA	V <sub>PP</sub> =V <sub>PPH2</sub>
Innura	V <sub>PP</sub> (Page Buffer) P	rogram	1,6,7		2	5	μA	V <sub>PP</sub> =V <sub>PPH1</sub>
I <sub>PPWS</sub>	Suspend Current		1,6,7		10	200	μA	V <sub>PP</sub> =V <sub>PPH2</sub>
Innec	V <sub>PP</sub> Block Erase Sus	spend Current	1,6,7		2	5	μA	V <sub>PP</sub> =V <sub>PPH1</sub>
I <sub>PPES</sub>	v pp block Elase Su	spena Current	1,6,7		10	200	μA	V <sub>PP</sub> =V <sub>PPH2</sub>

		V <sub>CC</sub> =2	2.7V-3.6V	7			
Symbol	Parameter	Notes	Min.	Тур.	Max.	Unit	Test Conditions
V <sub>IL</sub>	Input Low Voltage	5	-0.4		0.4	V	
V <sub>IH</sub>	Input High Voltage	5	2.4		V <sub>CCQ</sub> + 0.4	V	
V <sub>OL</sub>	Output Low Voltage	5			0.2	V	$\begin{array}{l} V_{CC} = V_{CC} Min., \\ V_{CCQ} = V_{CCQ} Min., \\ I_{OL} = 100 \mu A \end{array}$
V <sub>OH</sub>	Output High Voltage	5	V <sub>CCQ</sub> -0.2			V	V <sub>CC</sub> =V <sub>CC</sub> Min., V <sub>CCQ</sub> =V <sub>CCQ</sub> Min., I <sub>OH</sub> =-100µA
V <sub>PPLK</sub>	V <sub>PP</sub> Lockout during Normal Operations	3,5,6			0.4	V	
V <sub>PPH1</sub>	V <sub>PP</sub> during Block Erase, Full Chip Erase, (Page Buffer) Program or OTP Program Operations	6	1.65	3.0	3.6	V	
V <sub>PPH2</sub>	V <sub>PP</sub> during Block Erase, (Page Buffer) Program or OTP Program Operations	6	11.7	12	12.3	V	
V <sub>LKO</sub>	V <sub>CC</sub> Lockout Voltage		1.5			V	

#### DC Characteristics (Continued)

NOTES:

1. All currents are in RMS unless otherwise noted. Typical values are the reference values at V<sub>CC</sub>=3.0V and T<sub>A</sub>=+25°C unless V<sub>CC</sub> is specified.

2. I<sub>CCWS</sub> and I<sub>CCES</sub> 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<sub>CCES</sub> and I<sub>CCR</sub> or I<sub>CCW</sub>. 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. Block erase, full chip erase, (page buffer) program and OTP program are inhibited when  $V_{PP} \leq V_{PPLK}$ , and not guaranteed

in the range between V<sub>PPLK</sub>(max.) and V<sub>PPH1</sub>(min.), between V<sub>PPH1</sub>(max.) and V<sub>PPH2</sub>(min.) and above V<sub>PPH2</sub>(max.).

4. 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.

5. Sampled, not 100% tested.

6. V<sub>PP</sub> is not used for power supply pin. With V<sub>PP</sub>≤V<sub>PPLK</sub>, block erase, full chip erase, (page buffer) program and OTP program cannot be executed and should not be attempted.

Applying 12V±0.3V to V<sub>PP</sub> provides fast erasing or fast programming mode. In this mode, V<sub>PP</sub> 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 12V±0.3V to V<sub>PP</sub> during erase/program can only be done for a maximum of 1,000 cycles on each block. V<sub>PP</sub> may be connected to  $12V\pm0.3V$  for a total of 80 hours maximum.

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

# 1.2.4 AC Characteristics - Read-Only Operations<sup>(1)</sup>

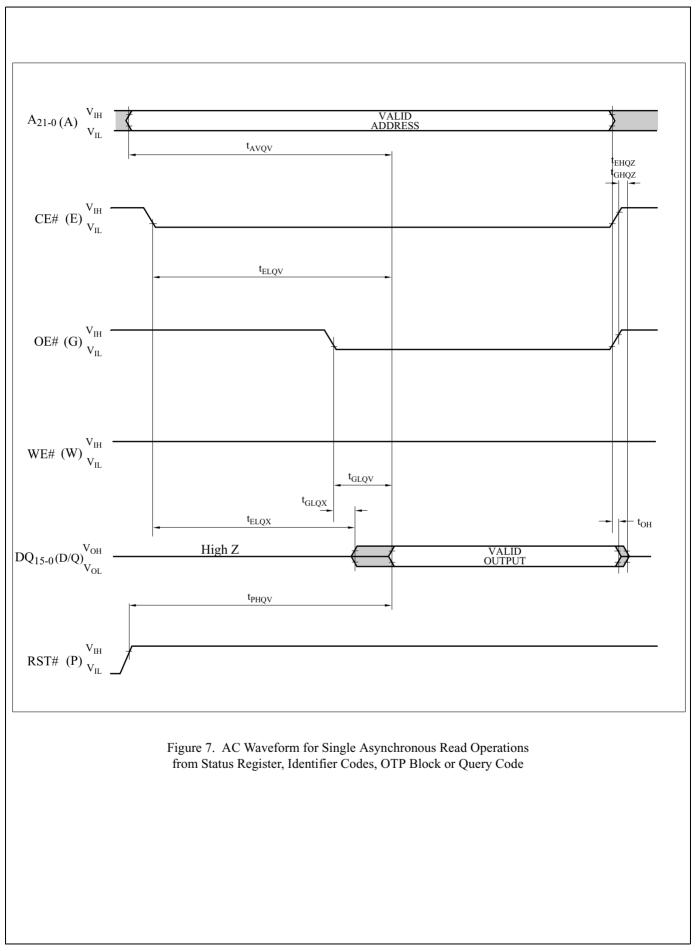
$V_{CC}=2.7V-3.6V$	$T_A = -40^{\circ}C$ to $+85^{\circ}C$
CC 2.7 = 5.0	$I_{A} = 0 C 10 + 05 C$

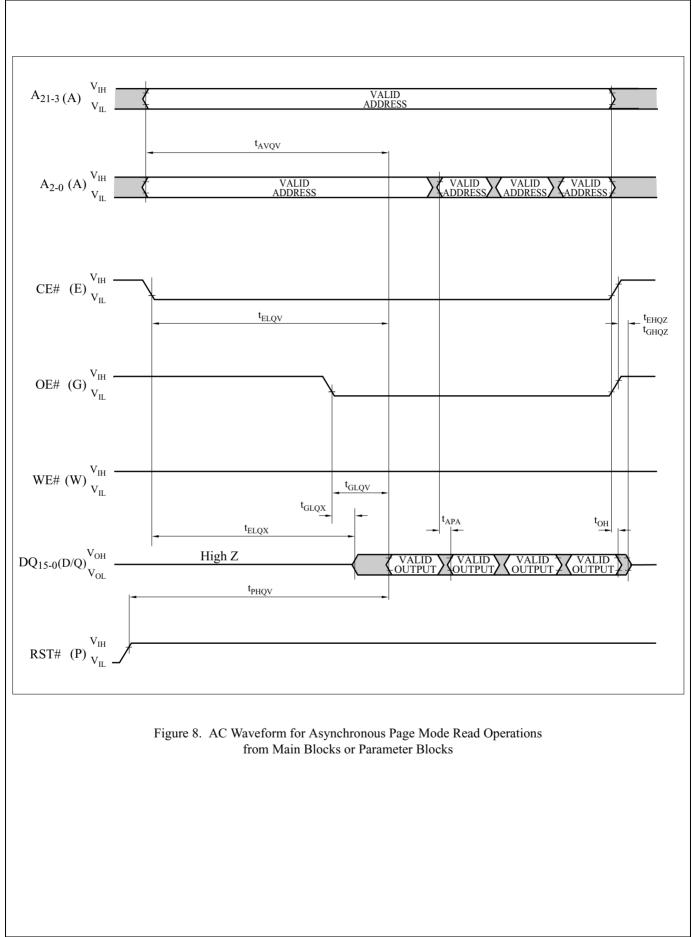
Symbol	Parameter	Notes	Min.	Max.	Unit
t <sub>AVAV</sub>	Read Cycle Time		80		ns
t <sub>AVQV</sub>	Address to Output Delay			80	ns
t <sub>ELQV</sub>	CE# to Output Delay	3		80	ns
t <sub>APA</sub>	Page Address Access Time			35	ns
t <sub>GLQV</sub>	OE# to Output Delay	3		20	ns
t <sub>PHQV</sub>	RST# High to Output Delay			150	ns
t <sub>EHQZ</sub> , t <sub>GHQZ</sub>	CE# or OE# to Output in High Z, Whichever Occurs First	2		20	ns
t <sub>ELQX</sub>	CE# to Output in Low Z	2	0		ns
t <sub>GLQX</sub>	OE# to Output in Low Z	2	0		ns
t <sub>OH</sub>	Output Hold from First Occurring Address, CE# or OE# change	2	0		ns

NOTES:

1. See AC input/output reference waveform for timing measurements and maximum allowable input slew rate.

2. Sampled, not 100% tested. 3. OE# may be delayed up to  $t_{ELQV}$  —  $t_{GLQV}$  after the falling edge of CE# without impact to  $t_{ELQV}$ .





## 1.2.5 AC Characteristics - Write Operations<sup>(1), (2)</sup>

$V_{CC}=2.7V-3.6V, T_{A}=-40^{\circ}C \text{ to }+85^{\circ}C$	$V_{CC}$	~=2.7V-3	.6V, T	$=-40^{\circ}$ C to	o +85°C
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Symbol	Parameter	Notes	Min.	Max.	Unit
t <sub>AVAV</sub>	Write Cycle Time		80		ns
t <sub>PHWL</sub> (t <sub>PHEL</sub> )	RST# High Recovery to WE# (CE#) Going Low	3	150		ns
$t_{\rm ELWL} \left( t_{\rm WLEL} \right)$	CE# (WE#) Setup to WE# (CE#) Going Low	4	0		ns
t <sub>WLWH</sub> (t <sub>ELEH</sub> )	WE# (CE#) Pulse Width	4	50		ns
t <sub>DVWH</sub> (t <sub>DVEH</sub> )	Data Setup to WE# (CE#) Going High	8	40		ns
$t_{AVWH} (t_{AVEH})$	Address Setup to WE# (CE#) Going High	8	50		ns
t <sub>WHEH</sub> (t <sub>EHWH</sub> )	CE# (WE#) Hold from WE# (CE#) High		0		ns
t <sub>WHDX</sub> (t <sub>EHDX</sub> )	DX) Data Hold from WE# (CE#) High		0		ns
$t_{WHAX} (t_{EHAX})$	X (t <sub>EHAX</sub> ) Address Hold from WE# (CE#) High		0		ns
t <sub>WHWL</sub> (t <sub>EHEL</sub> )	HEL) WE# (CE#) Pulse Width High 5 30			ns	
$t_{\rm SHWH} \left( t_{\rm SHEH}  ight)$	WP# High Setup to WE# (CE#) Going High	3	0		ns
t <sub>VVWH</sub> (t <sub>VVEH</sub> )	V <sub>PP</sub> Setup to WE# (CE#) Going High	3	200		ns
t <sub>WHGL</sub> (t <sub>EHGL</sub> )	Write Recovery before Read		30		ns
t <sub>QVSL</sub>	WP# High Hold from Valid SRD	3, 6	0		ns
t <sub>QVVL</sub>	V <sub>PP</sub> Hold from Valid SRD	3, 6	0		ns
$t_{WHR0} (t_{EHR0})$	WE# (CE#) High to SR.7 Going "0"	3, 7		$t_{AVQV}^+$ 50	ns

NOTES:

1. The timing characteristics for reading the status register during block erase, full chip erase, (page buffer) program and OTP program operations are the same as during read-only operations. Refer to AC Characteristics for read-only operations.

2. A write operation can be initiated and terminated with either CE# or WE#.

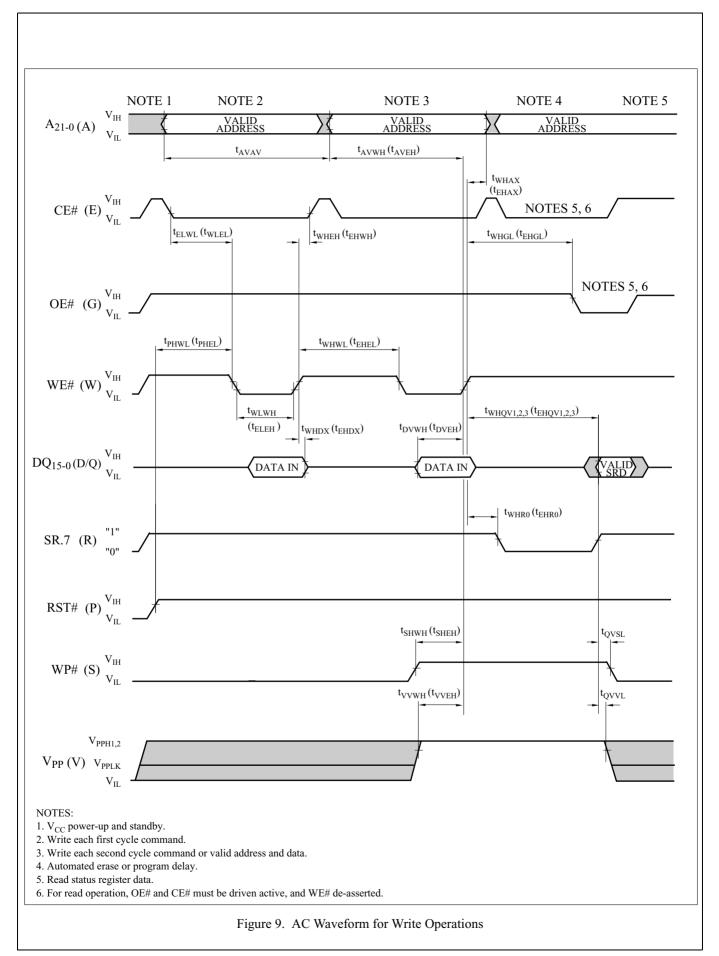
3. Sampled, not 100% tested.

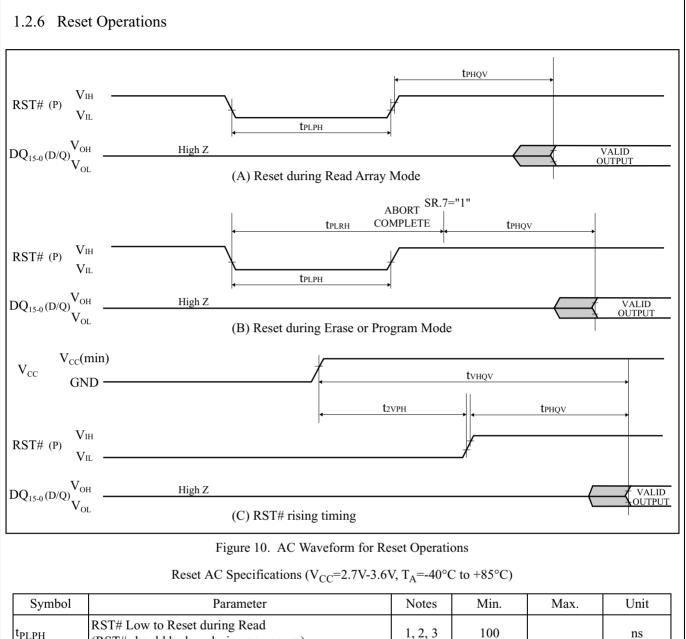
4. Write pulse width (t<sub>WP</sub>) is defined from the falling edge of CE# or WE# (whichever goes low last) to the rising edge of

CE# or WE# (whichever goes high first). Hence,  $t_{WP}=t_{WLWH}=t_{ELEH}=t_{WLEH}=t_{ELWH}$ . 5. Write pulse width high ( $t_{WPH}$ ) is defined from the rising edge of CE# or WE# (whichever goes high first) to the falling

6. V<sub>PP</sub> should be held at V<sub>PP</sub>=V<sub>PPH1/2</sub> until determination of block erase, (page buffer) program or OTP program success (SR.1/3/4/5=0) and held at V<sub>PP</sub>=V<sub>PPH1</sub> until determination of full chip erase success (SR.1/3/5=0).
7. t<sub>WHR0</sub> (t<sub>EHR0</sub>) after the Read Query or Read Identifier Codes/OTP command=t<sub>AVQV</sub>+100ns.

8. Refer to Table 6 for valid address and data for block erase, full chip erase, (page buffer) program, OTP program or lock bit configuration.





Symbol	Parameter		Min.	Max.	Unit
t <sub>PLPH</sub>	RST# Low to Reset during Read (RST# should be low during power-up.)		100		ns
t <sub>PLRH</sub>	RST# Low to Reset during Erase or Program	1, 3, 4		22	μs
t <sub>2VPH</sub>	VPH V <sub>CC</sub> 2.7V to RST# High		100		ns
t <sub>VHQV</sub>	<sub>QV</sub> V <sub>CC</sub> 2.7V to Output Delay			1	ms
NOTES					

1. A reset time, t<sub>PHQV</sub>, is required from the later of SR.7 going "1" or RST# going high until outputs are valid. Refer to AC Characteristics - Read-Only Operations for t<sub>PHQV</sub>.

2.  $t_{PLPH}$  is <100ns the device may still reset but this is not guaranteed.

3. Sampled, not 100% tested.

4. If RST# asserted while a block erase, full chip erase, (page buffer) program or OTP program operation is not executing, the reset will complete within 100ns.

5. When the device power-up, holding RST# low minimum 100ns is required after  $V_{CC}$  has been in predefined range and also has been in stable there.

	·	<u> </u>	-5.0 v, 1 <sub>A</sub> 40			,				<del></del>
Symbol	Parameter	Notes	Page Buffer Command is Used or not	V <sub>PP</sub> =V <sub>PPH1</sub> (In System)			V <sub>PP</sub> =V <sub>PPH2</sub> (In Manufacturing)			Unit
			Used	Min.	Тур. <sup>(1)</sup>	Max. <sup>(2)</sup>	Min.	Тур. <sup>(1)</sup>	Max. <sup>(2)</sup>	
t <sub>WPB</sub>	4K-Word Parameter Block	2	Not Used		0.05	0.3		0.04	0.12	S
WPB	Program Time	2	Used		0.03	0.12		0.02	0.06	s
t <sub>WMB</sub>	32K-Word Main Block	2	Not Used		0.38	2.4		0.31	1.0	s
ч	Program Time	2	Used		0.24	1.0		0.17	0.5	S
t <sub>WHQV1</sub> /	Word Program Time	2	Not Used		11	200		9	185	μs
t <sub>EHQV1</sub>	word Program Time	2	Used		7	100		5	90	μs
t <sub>WHOV1</sub> / t <sub>EHOV1</sub>	OTP Program Time	2	Not Used		36	400		27	185	μs
t <sub>WHQV2</sub> / t <sub>EHQV2</sub>	4K-Word Parameter Block Erase Time	2	-		0.3	4		0.2	4	s
t <sub>WHQV3</sub> / t <sub>EHQV3</sub>	32K-Word Main Block Erase Time	2	-		0.6	5		0.5	5	s
	Full Chip Erase Time	2	ĺ		80	700				s
t <sub>WHRH1</sub> / t <sub>EHRH1</sub>	(Page Buffer) Program Suspend Latency Time to Read	4	-		5	10		5	10	μs
t <sub>WHRH2</sub> / t <sub>EHRH2</sub>	Block Erase Suspend Latency Time to Read	4	-		5	20		5	20	μs
t <sub>ERES</sub>	Latency Time from Block Erase Resume Command to Block Erase Suspend Command	5	-	500			500			μs

 $V_{CC}=2.7V-3.6V$ ,  $T_{A}=-40^{\circ}C$  to  $+85^{\circ}C$ 

NOTES:

1. Typical values measured at  $V_{CC}$ =3.0V,  $V_{PP}$ =3.0V or 12V, and  $T_A$ =+25°C. Assumes corresponding lock bits are not set. Subject to change based on device characterization.

2. Excludes external system-level overhead.

3. Sampled, but not 100% tested.

4. A latency time is required from writing suspend command (WE# or CE# going high) until SR.7 going "1".

5. If the interval time from a Block Erase Resume command to a subsequent Block Erase Suspend command is shorter than t<sub>ERES</sub> and its sequence is repeated, the block erase operation may not be finished.

## 2 Related Document Information<sup>(1)</sup>

Document No.	Document Name
FUM00701	LH28F640BF series Appendix

NOTE:

1. International customers should contact their local SHARP or distribution sales offices.

### A-1 RECOMMENDED OPERATING CONDITIONS

### A-1.1 At Device Power-Up

AC timing illustrated in Figure A-1 is recommended for the supply voltages and the control signals at device power-up. If the timing in the figure is ignored, the device may not operate correctly.

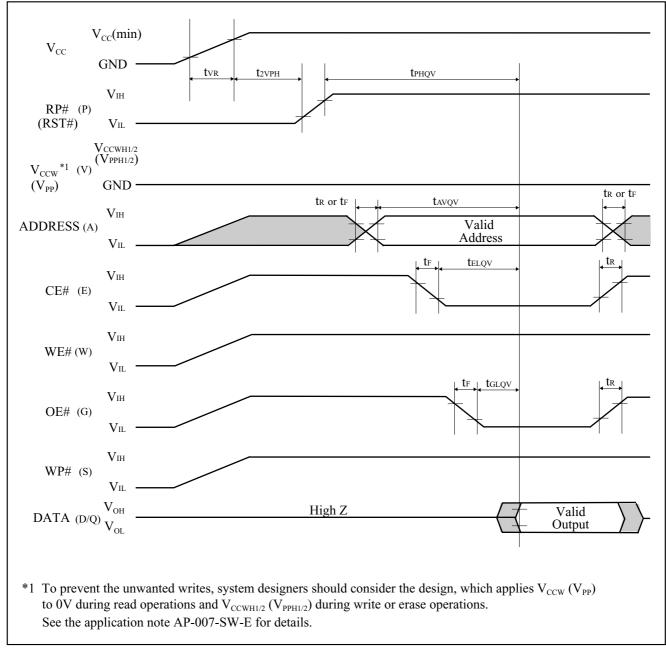


Figure A-1. AC Timing at Device Power-Up

For the AC specifications  $t_{VR}$ ,  $t_R$ ,  $t_F$  in the figure, refer to the next page. See the "ELECTRICAL SPECIFICATIONS" described in specifications for the supply voltage range, the operating temperature and the AC specifications not shown in the next page.

## A-1.1.1 Rise and Fall Time

Symbol	Parameter	Notes	Min.	Max.	Unit
t <sub>VR</sub>	V <sub>CC</sub> Rise Time		0.5	30000	μs/V
t <sub>R</sub>	Input Signal Rise Time			1	μs/V
t <sub>F</sub>	Input Signal Fall Time	1, 2		1	µs/V

NOTES:

1. Sampled, not 100% tested.

2. This specification is applied for not only the device power-up but also the normal operations.

## A-1.2 Glitch Noises

Do not input the glitch noises which are below  $V_{IH}$  (Min.) or above  $V_{IL}$  (Max.) on address, data, reset, and control signals, as shown in Figure A-2 (b). The acceptable glitch noises are illustrated in Figure A-2 (a).

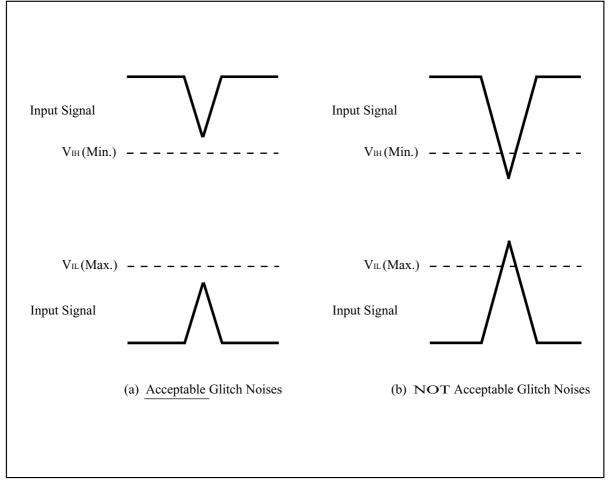


Figure A-2. Waveform for Glitch Noises

See the "DC CHARACTERISTICS" described in specifications for  $V_{IH}$  (Min.) and  $V_{IL}$  (Max.).

## A-2 RELATED DOCUMENT INFORMATION<sup>(1)</sup>

Document No.	Document Name	
AP-001-SD-E	Flash Memory Family Software Drivers	
AP-006-PT-E	Data Protection Method of SHARP Flash Memory	
AP-007-SW-E	RP#, V <sub>PP</sub> Electric Potential Switching Circuit	

NOTE:

1. International customers should contact their local SHARP or distribution sales office.