2/4/8-Mbit SmartVoltage Boot Block Flash Memory Family Overview

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1.0 INTRODUCTION

This document includes a feature overview, pinouts, and memory maps for Intel's SmartVoltage boot block family, including 2/4/8-Mbit densities. These products offer feature and function compatibility, including the SmartVoltage technology (SVT) outlined below. Follow the design steps in Section 5.0 to upgrade 12V $V_{PP}$ designs to SVT.

2.0 BOOT BLOCK ARCHITECTURE

Intel's boot block architecture products offer the familiar features that optimize it for updateable firmware storage. These features include:

- Hardware-lockable boot block for secure kernel code storage
- Parameter blocks for parameter storage
- Main blocks for modular code updates, facilitating updateable firmware
- x8 or x16 user-selectable I/O operation
- RP# for reset and write protection
- PSOP and TSOP packages

Intel has integrated its SmartVoltage technology into the boot block family in order to increase the voltage flexibility of these components.

3.0 PINOUT COMPATIBLE DENSITY UPGRADES

In addition, Intel is providing density upgrades with pinout compatibility for the 2-Mbit, 4-Mbit, and 8-Mbit densities. The pinouts in Figures 2, 3, and 4 illustrate these compatible upgrade paths.

4.0 NEW SmartVoltage TECHNOLOGY FEATURES

SmartVoltage offers the following new features:

1. Voltage Flexibility
   - $V_{CC} = 2.7-3.6V, 3.3V \pm 0.3V$ or $5V \pm 10\%$ with enhanced circuits to optimize low-voltage performance when low power consumption is critical.
   - Program/Erase operation with $V_{PP} = 5V$ for convenient in-system writes without a DC–DC converter or $V_{PP} = 12V$ when write/erase performance is a concern, such as during production.

2. Write Protection
   - WP# pin replaces a DU pin and is used in conjunction with the $V_{PP}$ and RP# pins, as detailed in the table below, to control write protection of the boot block. (WP# pin not available on 8-Mbit 44-lead PSOP. In this package, treat as if the WP# pin is internally tied low, effectively eliminating the last row of the table below.)

<table>
<thead>
<tr>
<th>$V_{PP}$</th>
<th>RP#</th>
<th>WP#</th>
<th>Write Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{IL}$</td>
<td>X</td>
<td>X</td>
<td>All Blocks Locked</td>
</tr>
<tr>
<td>$\geq V_{PPLK}$</td>
<td>$V_{IL}$</td>
<td>X</td>
<td>All Blocks Locked (Reset)</td>
</tr>
<tr>
<td>$\geq V_{PPLK}$</td>
<td>$V_{HH}$</td>
<td>X</td>
<td>All Blocks Unlocked</td>
</tr>
<tr>
<td>$\geq V_{PPLK}$</td>
<td>$V_{IH}$</td>
<td>$V_{IL}$</td>
<td>Boot Block Locked</td>
</tr>
<tr>
<td>$\geq V_{PPLK}$</td>
<td>$V_{IH}$</td>
<td>$V_{IH}$</td>
<td>All Blocks Unlocked</td>
</tr>
</tbody>
</table>

5.0 UPGRADING FROM 12V TO SVT

If you have designs using 12V $V_{PP}$ boot block products, you must adhere to the following design steps to ensure you can upgrade to SVT:

1. If using 5V program/erase, allow for connecting $V_{PP}$ to 5V and disconnecting $V_{PP}$ from 12V.
2. If adding a switch on $V_{PP}$ for write protection, switch to GND instead of $V_{CC}$.
3. Connect WP# (DU on existing products) to $V_{CC}$, GND, or a control signal. This pin should not be left floating. The DU pin on BX/BX products can be driven to a logic-level in order to provide upgrade compatibility.
### 6.0 PACKAGE PINOUTS

![Diagram of package pinouts](image)

**NOTE:** The 28F008B pinout shown is for the 8-Mbit boot block, and not the 28F008SA FlashFile™ memory.

**Figure 2.** The 40-Lead TSOP Offers the Smallest Form Factor for Space-Constrained Applications

**NOTE:** For the 8-Mbit device, pin 2 has been changed to A18 (WP# on 2/4-Mbit). Designers planning to upgrade to the 8-Mbit density from the 2/4-Mbit density in this package should design pin 2 to control WP# functionality at the 2/4-Mbit level and allow for pin 2 to control A18 after upgrading to the 8-Mbit density.

**Figure 3.** The 44-Lead PSOP Offers a Convenient Upgrade from JEDEC ROM Standards
Figure 4. The 48-Lead TSOP Offers the Smallest Form Factor for x16 Operation

Figure 5. The 56-Lead TSOP Offers Compatibility between 2 and 4 Mbits
7.0 MEMORY MAPS

NOTE: These memory maps apply to the 28F002/004/008-T components, or the 28F200/400/800-T components in byte-wide (x8) mode.

Figure 6. Byte-Wide x8-Mode Memory Maps (Top Boot)

NOTE: These memory maps apply to the 28F002/004/008-B components, or the 28F200/400/800-B components in byte-wide (x8) mode.

Figure 7. Byte-Wide x8-Mode Memory Maps (Bottom Boot)
(Word addresses shown)

NOTE: These memory maps apply to the denoted 28F200/400/800-T components in word-wide (x16) mode.

Figure 8. Word-Wide x16-Mode Memory Maps (Top Boot)

(Word addresses shown)

NOTE: These memory maps apply to the denoted 28F200/400/800-B components in word-wide (x16) mode.

Figure 9. Word-Wide x16-Mode Memory Maps (Bottom Boot)
## 8.0 PRODUCT OFFERINGS

### 12V Program/Erase Boot Block Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Density x Org.</th>
<th>Pkg.</th>
<th>Speed (ns) ( V_{CC} = 5V )</th>
<th>Speed (ns) ( V_{CC} = 3.3V )</th>
<th>Extended Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>28F001BX</td>
<td>1 Mb, 128Kx8</td>
<td>P, N, E</td>
<td>70, 90, 120, 150</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F200BX</td>
<td>2 Mb, 256Kx8/128Kx16</td>
<td>PA, E</td>
<td>60, 80, 120</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F002BX</td>
<td>2 Mb, 256Kx8</td>
<td>E</td>
<td>60, 80, 120</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F200BL</td>
<td>2 Mb, 256Kx8/128Kx16</td>
<td>PA, E</td>
<td>(1) 150</td>
<td></td>
<td>(2)</td>
</tr>
<tr>
<td>28F002BL</td>
<td>2 Mb, 256Kx8</td>
<td>E</td>
<td>(1) 150</td>
<td></td>
<td>(2)</td>
</tr>
<tr>
<td>28F400BX</td>
<td>4 Mb, 512Kx8/256Kx16</td>
<td>PA, E</td>
<td>60, 80, 120</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F004BX</td>
<td>4 Mb, 512Kx8</td>
<td>E</td>
<td>60, 80, 120</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F400BL</td>
<td>4 Mb, 512Kx8/256Kx16</td>
<td>PA, E</td>
<td>(1) 150</td>
<td></td>
<td>(2)</td>
</tr>
<tr>
<td>28F004BL</td>
<td>4 Mb, 512Kx8</td>
<td>E</td>
<td>(1) 150</td>
<td></td>
<td>(2)</td>
</tr>
</tbody>
</table>

### NOTICES:
1. The BL products also operate at 5V \( V_{CC} \) for programmer compatibility.
2. \(-20°C - +70°C\) operating range for Read; \(-0°C - +70°C\) for program and erase.

### SmartVoltage Boot Block Products

<table>
<thead>
<tr>
<th>Product</th>
<th>Density x Org.</th>
<th>Pkg</th>
<th>Speed (ns) ( V_{CC} = 5V )</th>
<th>Speed (ns) ( V_{CC} = 3.3V )</th>
<th>Speed (ns) ( V_{CC} = 2.7V )</th>
<th>Extended Temp.</th>
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</thead>
<tbody>
<tr>
<td>28F200BV</td>
<td>2 Mb, 256Kx8/128Kx16</td>
<td>44, 56</td>
<td>60, 80, 120</td>
<td>110, 150, 180</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F200CV</td>
<td>2 Mb, 256Kx8/128Kx16</td>
<td>48</td>
<td>60, 80, 120</td>
<td>110, 150, 180</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F002BV</td>
<td>2 Mb, 256Kx8</td>
<td>40</td>
<td>60, 80, 120</td>
<td>110, 150, 180</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F400BV</td>
<td>4 Mb, 512Kx8/256Kx16</td>
<td>44, 56</td>
<td>60, 80, 120</td>
<td>110, 150, 180</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F400CV</td>
<td>4 Mb, 512Kx8/256Kx16</td>
<td>48</td>
<td>60, 80, 120</td>
<td>110, 150, 180</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F004BV</td>
<td>4 Mb, 512Kx8</td>
<td>40</td>
<td>60, 80, 120</td>
<td>110, 150, 180</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F800BV</td>
<td>8 Mb, 1024Kx8/512Kx16</td>
<td>44</td>
<td>70,120</td>
<td>120,150</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F800CV</td>
<td>8 Mb, 1024Kx8/512Kx16</td>
<td>48</td>
<td>70,120</td>
<td>120,150</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F008BV</td>
<td>8 Mb, 1024Kx8</td>
<td>40</td>
<td>70,120</td>
<td>120,150</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F800CE</td>
<td>8 Mb, 1024Kx8/512Kx16</td>
<td>48</td>
<td>90</td>
<td>120</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>28F008BE</td>
<td>8 Mb, 1024Kx8/512Kx16</td>
<td>40</td>
<td>90</td>
<td>120</td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>

### NOTE:
1. BV products also operate at \( V_{CC} = 5V \) for high-performance.
2. BE/CE products operate over the \( V_{CC} \) ranges 2.7–3.6V and 5V ±10%.
9.0 ORDERING INFORMATION

Operating Temperature
T = Extended Temp
Blank = Commercial Temp

Package
E = TSOP
PA = 44-Lead PSOP
TB = Ext. Temp 44-Lead PSOP

Product line designator
for all Intel Flash products

Density / Organization
00X = x8-only (X = 1, 2, 4, 8)
X00 = x8/x16 Selectable (X = 2, 4, 8)

Access Speed
ns, BE: $V_{CC} = 2.7V$
BV: $V_{CC} = 5V$

Voltage Options ($V_{PP}$ / $V_{CC}$)
V = (5 or 12 / 3.3 or 5)
E = (5 or 12 / 2.7 or 5)
X = (12 / 5)
L = (12 / 3.3 or 5)

Architecture
B = Boot Block
C = Compact 48-Lead TSOP
Boot Block

Figure 10. Decoding the Product Names

10.0 ADDITIONAL INFORMATION

10.1 Revision History

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-001</td>
<td>Original Version</td>
</tr>
<tr>
<td>-002</td>
<td>Text updated. DU and WP# pin usage clarified. Note and &quot;B&quot; suffixes added to Figure 2. SmartVoltage Boot Block Products table: Speeds added to 28F800 and 28F008, 2.7V products added. Figure 10 updated.</td>
</tr>
</tbody>
</table>
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