# MZNLN512HMJP-00000

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# PRODUCT SELECTION GUIDE

DISPLAYS, MEMORY AND STORAGE

**1H 2017**

# Samsung Semiconductor, Inc.

Samsung continues to lead the industry with the broadest portfolio of memory products and display technology. Its DRAM, flash, mobile and graphics memory are found in many computers — from ultrabooks to powerful servers — and in a wide range of handheld devices such as smartphones and tablets. Samsung is also a leader in display panels for smartphones, TVs and monitors and public information displays. In addition, Samsung provides the industry's widest line of storage products from the consumer to enterprise levels. These include flash storage, such as Solid State Drives, and a range of embedded flash storage products.

## Markets

| | DRAM | SSD | FLASH | ASIC | LOGIC | LCD/OLED |
|---|---|---|---|---|---|---|
| MOBILE/WIRELESS | ● | N/A | ● | ● | ● | ● |
| NOTEBOOK PCs/ ULTRABOOKS™ | ● | ● | ● | ● | ● | ● |
| DESKTOP PCs/ WORKSTATIONS | ● | ● | ● | ● | ● | ● |
| SERVERS | ● | ● | ● | ● | ● | ● |
| NETWORKING/ COMMUNICATIONS | ● | ● | ● | ● | ● | N/A |
| CONSUMER ELECTRONICS | ● | N/A | ● | ● | ● | ● |

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## DDR4 SDRAM COMPONENTS

| Density | Voltage | Organization | Part Number | # Pins-Package | Compliance | Speed (Mbps) | Dimensions | Production |
|---|---|---|---|---|---|---|---|---|
| 4Gb | 1.2V | 1G x 4 | K4A4G045WD-BCRC/PB | 78 Ball -FBGA | Lead Free & Halogen Free, Flip Chip | 2400/2133 | 7.5x11mm | Now |
| | | 512M x 8 | K4A4G085WD-BCRC/PB | | | | | |
| | | 256M x 16 | K4A4G165WD-BCRC/PB | 96 Ball -FBGA | | | 7.5x13.3mm | |
| | | 1G x 4 | K4A4G045WE-BCRC/PB | 78 Ball -FBGA | | | 7.5x11mm | |
| | | 512M x 8 | K4A4G085WE-BCRC/PB | | | | | |
| | | 256M x 16 | K4A4G165WE-BCRC/PB | 96 Ball -FBGA | | | 7.5x13.3mm | |
| 8Gb | 1.2V | 1G x 8 | K4A8G085WB-BCRC/PB | 78 Ball FBGA | Lead Free & Halogen Free, Flip Chip | 2400/2133 | 7.5x11mm | Now |
| | | 512M x16 | K4A8G165WB-BCRC/PB | 96 Ball -FBGA | | | 7.5x13.3mm | |
| 16Gb (8Gb DDP) | 1.2V | 2Gx8 | K4AAG085WB-MCPB/RC | 78 Ball -FBGA | Lead Free & Halogen Free, Flip Chip | 2133/2400 | 7.5x13.3mm | Now |
| | | | K4AAG165WB-MCPB/RC | | | | | |

## DDR4 SDRAM REGISTERED MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 4GB | 1.2V | 1G x 72 | M393A5143DB0-CPB | 4Gb (512M x8) * 9 | Lead Free & Halogen Free, Flip Chip | 2133 | 1 | Now |
| | | | M393A5143DB0-CRC | | | 2400 | | |
| 8GB | 1.2V | 1G x 72 | M393A1G40DB0-CPB | 4Gb (1G x4) * 18 | Lead Free & Halogen Free, Flip Chip | 2133 | 1 | Now |
| | | | M393A1G40DB1-CRC | | | 2400 | | |
| | | | M393A1G43DB0-CPB | 4Gb (512M x8) * 18 | | 2133 | 2 | |
| | | | M393A1G43DB1-CRC | | | 2400 | | |
| | | | M393A1G40EB1-CPB | 4Gb (1G x4) * 18 | | 2133 | 1 | |
| | | | M393A1G40EB1-CRC | | | 2400 | | |
| | | | M393A1G43EB1-CPB | 4Gb (512M x8) * 18 | | 2133 | 2 | |
| | | | M393A1G43EB1-CRC | | | 2400 | | |
| 16GB | 1.2V | 2G x 72 | M393A2G40DB0-CPB | 4Gb (1G x4) * 36 | Lead Free & Halogen Free, Flip Chip | 2133 | 2 | Now |
| | | | M393A2G40DB1-CRC | | | 2400 | | |
| | | | M393A2G40EB1-CPB | | | 2133 | | |
| | | | M393A2G40EB1-CRC | | | 2400 | | |
| | | | M393A2K40BB0-CPB | 8Gb (2G x4) * 18 | | 2133 | 1 | |
| | | | M393A2K40BB1-CRC | | | 2400 | | |
| | | | M393A2K43BB1-CPB/CRC | 8Gb (1G x8) * 18 | | 2133/2400 | 2 | |
| 32GB | 1.2V | 4G x 72 | M393A4K40BB0-CPB | 8Gb (2G x4) * 36 | Lead Free & Halogen Free, Flip Chip | 2133 | 2 | Now |
| | | | M393A4K40BB1-CRC | | | 2400 | | |
| 64GB TSV | 1.2V | 8G x 72 | M393A8G40D40-CRB | 4Gb 4H TSV (4G x4) * 36 | Lead Free & Halogen Free, 4High TSV | 2133 | 8 | Now |
| | | | M393A8K40B21-CRB | 8Gb 2H TSV (4G x4) * 36 | Lead Free & Halogen Free, 2High TSV | 2133 | 4 | |
| | | | M393A8K40B21-CTC | | | 2400 | | |
| 128GB TSV | 1.2V | 16G x 72 | M393AAK40B41-CTC | 8Gb 4H TSV (8G x4) * 36 | Lead Free & Halogen Free, 4High TSV | 2400 | 8 | Now |

Notes:

| | | | | |
|---|---|---|---|---|
| DDR4 4Gb (D die) based | 0 = IDT | 2 = Montage | 3 = Inphi | PB = DDR4-2133(15-15-15) |
| | 0 = IDT | 4 = Montage | | RC = DDR4-2400(17-17-17) |
| DDR4 4Gb (E die) based | 0 = IDT | 4 = Montage | 3 = Inphi | PB = DDR4-2133(15-15-15) |
| | 0 = IDT | 4 = Montage | 3 = Inphi | RC = DDR4-2400(17-17-17) |
| DDR4 (B Die) 8Gb based | 0 = IDT | 4 = Montage | | PB = DDR4-2133(15-15-15) |
| | 0 = IDT | 4 = Montage | 3 = Inphi | RC = DDR4-2400(17-17-17) |

## DDR4 SDRAM Load Reduced REGISTERED MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 32GB | 1.2V | 4G x 72 | M386A4G40DM0-CPB | 4Gb DDP (2G x4) * 36 | Lead Free & Halogen Free, DDP | 2133 | 4 | Now |
| | | | M386A4G40DM1-CRC | | | 2400 | | |
| | | | M386A4K40BB0-CRC5 | 8G (2Gx4)*36 | Lead Free & Halogen Free, Flip Chip | | 2 | |
| 64GB | 1.2V | 8G x 72 | M386A8K40BM1-CPB/CRC | 8Gb DDP (4G x4) * 36 | Lead Free & Halogen Free, DDP | 2133/2400 | 4 | Now |
| 128GB | 1.2V | 16G x 72 | M386AAK40B40-CUC | 8Gb 4H TSV (8G x4) * 36 | Lead Free & Halogen Free, DDP | 2400 | 8 | Now |

Notes:

| | | | | |
|---|---|---|---|---|
| DDR4 4Gb (D die) based | 0 = IDT | 2 = Montage | | PB = DDR4-2133(15-15-15) |
| | 5 = IDT | 4 = Montage | | RC = DDR4-2400(17-17-17) |
| DDR4 (B Die) 8Gb based | 0 = IDT | 4 = Montage | | PB = DDR4-2133(15-15-15) |
| | 5 = IDT | 4 = Montage | | RC = DDR4-2400(17-17-17) |

## DDR4 SDRAM VLP REGISTERED MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 16GB | 1.2V | 2G x 72 | M392A4K40BM0-CPB/RC | 4Gb DDP (2G x4) * 18 | Lead Free & Halogen Free, DDP | 2133 | 2 | Now |
| | | | M392A2K43BB0-CPB/RC | 8Gb (1G x8) * 18 | Lead Free & Halogen Free, Flip Chip | 2133/2400 | | |
| 32GB | 1.2V | 4G x 72 | M392A4K40BM0-CPB/RC | 8Gb DDP (4G x4) * 18 | Lead Free & Halogen Free, DDP | 2133/2400 | 2 | Now |

## DDR4 SDRAM UNBUFFERED MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 4GB | 1.2V | 512M x 64 | M378A5143DB0-CPB | 4Gb (512M x8) *8 | Lead Free & Halogen Free | 2133 | 1 | Now |
| | | | M378A5143EB1-CPB | | | 2133 | | |
| | | | M378A5143EB2-CRC | | | 2400 | | |
| | | | M378A5244CB0-CPB | | | 2133 | | |
| | | | M378A5244CB0-CRC | | | 2400 | | |
| 8GB | 1.2V | 1G x 64 | M378A1G43DB0-CPB | 4Gb (512M x8) *16 | Lead Free & Halogen Free | 2133 | 2 | Now |
| | | | M378A1G43EB1-CRC | | | 2400 | | |
| | | | M378A1K43BB1-CPB | 8Gb (1G x8) *8 | | 2133 | | |
| | | | M378A1K43BB2-CRC | | | 2400 | | |
| | | 1R x 8 | M378A1K43CB2-CPB | | | 2133 | 1 | |
| | | | M378A1K43CB2-CRC | | | | | |
| 16GB | 1.2V | 2G x 64 | M378A2K43BB1-CPB | 8Gb (1G x8) * 16 | Lead Free & Halogen Free | 2133 | 2 | Now |
| | | | M378A2K43BB1-CRC | | | 2400 | | |
| | | | M378A2K43CB1-CPB | | | 2133 | | |
| | | | M378A2K43CB1-CRC | | | 2400 | | |

Notes: PB = DDR4-2133(15-15-15) RC = DD R4-2400(17-17-17)

## DDR4 SDRAM ECC UNBUFFERED MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 4GB | 1.2V | 512M x72 | M391A5143EB1-CPB/CRC | M391A5143EB1-CPB/CRC | Lead Free & Halogen Free, Flip Chip | 2133/2400 | 1 | Now |
| 8GB | 1.2V | 1G x72 | M391A1G43DB0-CPB/CRC | M391A1G43DB0-CPB/CRC | Lead Free & Halogen Free, Flip Chip | 2133/2400 | 2 | Now |
| | | | M391A1K43BB1-CPB/CRC | M391A1K43BB1-CPB/CRC | | | | |
| 16GB | 1.2V | 2G x72 | M391A2K43BB1-CPB/CRC | M391A2K43BB1-CPB/CRC | Lead Free & Halogen Free, Flip Chip | 2133/2400 | 2 | Now |

Notes: PB = DDR4-2133(15-15-15) RC = DDR4-2400(17-17-17)

## DDR4 SDRAM SODIMM MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 4GB | 1.2V | 512M x 64 | M471A5143DB0-CPB | 4Gb (512M x8) * 8 | Lead Free & Halogen Free | 2133 | 1 | Now |
| | | | M471A5143EB0-CPB/RC | | | 2133/2400 | | |
| | | | M471A5244CB0-CPB/RC | | | | | |
| 8GB | 1.2V | 1G x 64 | M471A1G43DB0-CPB | 4Gb (512M x8) * 16 | Lead Free & Halogen Free | 2133 | 2 | Now |
| | | | M471A1G43EB1-CPB/CRC | | | 2133/2400 | | |
| | | | M471A1K43BB1-CPB/CRC | 8Gb (1Gx8)*8 | | | 1 | |
| | | | M471A1K43CB1-CPB/CRC | | | | | |
| 16GB | 1.2V | 2G x 64 | M471A2K43BB1-CPB/RC | 8Gb (1G x8) * 16 | Lead Free & Halogen Free | 2133/2400 | 2 | Now |
| | | | M471A2K43CB1-CPB/RC | | | | | |

Notes: PB = DDR4-2133(15-15-15) RC = DDR4-2400(17-17-17)

## DDR4 SDRAM ECC SODIMM MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 8GB | 1.2V | 1G x 72 | M474A1G43DB0-CPB | 4Gb (512M x8) * 18 | Lead Free & Halogen Free, Flip Chip | 2133 | 2 | Now |
| | | | M474A1G43DB1-CRC | | | 2400 | | |
| | | | M474A1G43EB1-CPB/CRC | | | 2133/2400 | | |
| 16GB | 1.2V | 2G x 72 | M474A2K43BB1-CPB/RC | 8Gb (1G x8) * 18 | Lead Free & Halogen Free, Flip Chip | 2133/2400 | 2 | Now |

## DDR3 SDRAM REGISTERED MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 8GB | 1.5V | 1G x 72 | M393B1G70EB0-CMA | 4Gb (1G x4) * 18 | Lead Free & Halogen Free, Flip Chip | 1866 | 1 | Now |
| | | | M393B1G73EB0-CMA | 4Gb (512M x8) * 18 | | | 2 | |
| | 1.35V | | M393B1G70EB0-YK0 | 4Gb (1G x4) * 18 | | 1600 | 1 | |
| | | | M393B1G73EB0-YK0 | 4Gb (2R x8) * 18 | | | 2 | |
| 16GB | 1.5V | 2G x 72 | M393B2G70DB0-CMA | 4Gb (1G x4) * 36 | Lead Free & Halogen Free, Flip Chip | 1866 | 2 | Now |
| | | | M393B2G70EB0-CMA | | | | | |
| | 1.35V | | M393B2G70DB0-YK0 | | | 1600 | | |
| | | | M393B2G70EB0-YK0 | | | | | |
| 32GB | 1.35V | 4G x 72 | M393B4G70DM0-YH9 | 4Gb DDP (2G x4) * 36 | Lead Free & Halogen Free. DDP | 1333 | 4 | Now |

Notes: 8 = IDT A1 Evergreen
9 = Inphi UVGS02
2 = IDT (E-die)
3 = Inphi (E-die)
YK = DDR3-1600 (11-11-11)
MA = DDR3-1866 (13-13-13)

## DDR3 SDRAM Load Reduced REGISTERED MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 32GB | 1.35V | 4G x 72 | M386B4G70DM0-YK0 | 4Gb DDP (2G x4) * 36 | Lead Free & Halogen Free, DDP | 1600 | 4 | Now |
| 64GB | 1.35V | 8G x 72 | M386B8G70DE0-YH9(4) | 4Gb QDP (4G x4) * 36 | Lead Free & Halogen Free, QDP | 1333 | 8 | Now |
| | 1.5V | | M386B8G70DE0-CK0(4) | | | 1600 | | |

Notes: 3 = Inphi iMB GS02B
4 = Montage C1

## DDR3 SDRAM VLP REGISTERED MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 8GB | 1.5V | 1G x 72 | M392B1G70DB0-CMA | 4Gb (1Gx4) * 18 | Lead Free & Halogen Free, Flip Chip | 1866 | 1 | Now |
| | | | M392B1G73DB0-CMA | 4Gb (512M x8) * 18 | | | 2 | |
| | 1.35V | | M392B1G70DB0-YK0 | 4Gb (1Gx4) * 18 | | 1600 | 1 | |
| | | | M392B1G73DB0-YK0 | 4Gb (512M x8) * 18 | | | 2 | |
| 16GB | 1.5V | 2G x 72 | M392B2G70DM0-CMA | 4Gb DDP (2G x4) * 18 | Lead Free & Halogen Free, DDP | 1866 | 2 | Now |
| | 1.35V | | M392B2G70DM0-YK0 | | | 1600 | | |
| 32GB | 1.35V | 4G x 72 | M392B4G70DE0-YH9 | 4Gb QDP (4G x4) * 18 | Lead Free & Halogen Free, QDP | 1333 | 4 | Now |

Notes: 2 = IDT 3 = Inphi YK = DDR3-1600 MA = DDR3-1866 (13-13-13)

## DDR3 Non ECC UNBUFFERED MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 4GB | 1.5V | 512M x 64 | M378B5173DB0-CK0/CMA | 4Gb (512M x8) * 8 | Lead Free & Halogen Free. Flip Chip | 1600/1866 | 1 | Now |
| | | | M378B5173EB0-CK0/CMA | | | | | |
| | | | M378B5173EB0-YK0/*CMA | | | | | |
| 8GB | 1.5V | 1G x 64 | M378B1G73DB0-CK0/MA | 4Gb (512M x8) * 16 | Lead Free & Halogen Free. Flip Chip | 1600/1866 | 2 | Now |
| | | | M378B1G73EB0-CK0/CMA | | | | | |
| | 1.35V | | M378B1G73EB0-YK0/*CMA | | | | | |

Notes: YK = DDR3-1600 (11-11-11) MA = DDR3-1866 (13-13-13) * 1.35V is compatible to 1.5V

## DDR3 SDRAM UNBUFFERED MODULES (ECC)

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 4GB | 1.5V | 512Mx72 | M391B5173EB0-CMA | 4Gb (512M x8) * 9 | Lead Free & Halogen Free | 1866 | 1 | Now |
| | 1.35V | | M391B5173EB0-YK0 | | | 1600 | | |
| 8GB | 1.5V | 1G x 72 | M391B1G73EB0-CMA | 4Gb (512M x8) * 18 | Lead Free & Halogen Free | 1866 | 2 | Now |
| | 1.35V | | M391B1G73EB0-YK0 | | | 1600 | | |

Notes: YK0 = DDR3-1600 (11-11-11) MA = DDR3-1866 (13-13-13)

## DDR3 SDRAM SODIMM MODULES

| Density | Voltage | Organization | Part Number | Composition | Compliance | Speed (Mbps) | Ranks | Production |
|---|---|---|---|---|---|---|---|---|
| 4GB | 1.35V | 512M x 72 | M474B5173EB0-YK0 | 4Gb (512M x8) * 9 | Lead Free & Halogen Free, Flip Chip | 1866 | 1 | Now |
| 8GB | 1.5V | 1G x 72 | M474B1G73EB0-CMA | 4Gb (512M x8) * 18 | Lead Free & Halogen Free, Flip Chip | 1866 | 2 | Now |
| | 1.35V | | M474B1G73EB0-YK000 | | | 1600 | | |

## DDR3 SDRAM COMPONENTS

| Density | Voltage | Organization | Part Number | # Pins- Package | Compliance | Speed (Mbps) | Dimensions | Production |
|---|---|---|---|---|---|---|---|---|
| 1Gb | 1.5V | 128M x 8 | K4B1G0846I-BCK0/MA/NB | 78 Ball -FBGA | Lead Free & Halogen Free, Flip Chip | 1600/1866/2133 | 7.5x11mm | Now |
| | | 128M x 16 | K4B1G1646I-BCK0/MA/NB | 96 Ball -FBGA | | | 7.5x13.3mm | |
| | 1.35V | 128M x 8 | K4B1G0846I-BYK0/MA | 78 Ball -FBGA | | 1600/1800 | 7.5x11mm | |
| | | 128M x 16 | K4B1G1646I-BYK0/MA | 96 Ball -FBGA | | | 7.5x13.3mm | |
| 2Gb | 1.5V | 512M x 8 | K4B2G0846F-BCK0/MA/NB | 78 Ball -FBGA | Lead Free & Halogen Free, Flip Chip | 1600/1866/2133 | 7.5x11mm | Now |
| | | 256M x 16 | K4B2G1646F-BCK0/MA/NB | 96 Ball -FBGA | | | 7.5x13.3mm | |
| | 1.35V | 256M x 8 | K4B2G0846F-BK0/MA | 78 Ball -FBGA | | 1600/1866 | 7.5x11mm | |
| | | 128M x 16 | K4B2G1646F-BK0/MA | 96 Ball -FBGA | | | 7.5x13.3mm | |
| 4Gb | 1.5V | 512M x 8 | K4B4G0846D-BCK0/MA/NB | 78 Ball -FBGA | Lead Free & Halogen Free, Flip Chip | 1600/1866/2133 | 7.5x11mm | Now |
| | | 256M x 16 | K4B4G1646D-BCK0/MA/NB | 96 Ball -FBGA | | | 7.5x13.3mm | |
| | | 512M x 8 | K4B4G0846E-BCK0/MA/NB | 78 Ball -FBGA | | | 7.5x11mm | |
| | | 256M x 16 | K4B4G1646E-BCK0/MA/NB | 96 Ball -FBGA | | | 7.5x13.3mm | |
| | 1.35V | 1G x 4 | K4B4G0446D-BYK0 | 78 Ball -FBGA | Lead Free & Halogen Free, Flip Chip | 1600 | 7.5x11mm | Now |
| | | 512M x 8 | K4B4G0846D-BYK0 | | | | 7.5x11mm | |
| | | 256M x 16 | K4B4G1646D-BYK0/MA | 96 Ball -FBGA | | 1600/1866 | 7.5x13.3mm | |
| | | 1G x 4 | K4B4G0446E-BYK0/MA | 78 Ball -FBGA | | | 7.5x11mm | |
| | | 512M x 8 | K4B4G0846E-BYK0/MA | | | | 7.5x11mm | |
| | | 256M x 16 | K4B4G1646E-BYK0/MA | 96 Ball -FBGA | | | 7.5x13.3mm | |
| 8Gb | 1.5V | 512M x 16 | K4B8G1646Q-MCK0/MA | 96 Ball -FBGA | Lead Free & Halogen Free | 1600/1866 | 11x13.3mm | Now |
| | | | K4G8G1646D-MCK0/MA | | | | | |
| | 1.35V | 512M x 16 | K4G8G1646D-MCK0/MA | | | | | |
| | | | K4G8G1646D-MYK0/ (MA) | | | | | |

Notes: H9 = DDR3-1333 (9-9-9) K0 = DDR3-1600 (11-11-11) MA = DDR3-1866 (13-13-13) NB = DDR3-2133 (14-14-14)

## DDR2 SDRAM COMPONENTS

| Density | Organization | Part Number | # Pins-Package | Dimensions | Package | Speed (Mbps) | Production |
|---|---|---|---|---|---|---|---|
| 512Mb | 64M x 8 | K4T51083QN-BCE7 | 60-FBGA | 7.5x9.5mm | Lead free & Halogen free , Flip chip | 667/800/1066 | Now |
| | 32M x 16 | K4T51163QN-BCE7 | 84-FBGA | 7.5x12.5mm | | | |
| 1Gb | 128M x 8 | K4T1G084QJ-BCE7 | 60-FBGA | 7.5x9.5mm | Lead free & Halogen free , Flip chip | 667/800/1066 | Now |
| | 64M x 16 | K4T1G164QJ-BCE7 | 84-FBGA | 7.5x12.5mm | | | |

Notes: E6 = DDR2-667 (5-5-5) E7 = DDR2-800 (5-5-5) F7 = DDR2-800 (6-6-6) F8 = DDR2-1066 (7-7-7)

## GRAPHICS DRAM COMPONENTS

| Type | Density | Organization | Part Number | Package | VDD/VDDQ | Speed Bin (MHz) | Production |
|---|---|---|---|---|---|---|---|
| GDDR5 | 8Gb | 256M x 32 | K4G80325FB-HC(03/28/25/22) | 170-FCFBGA | 1.5V/1.5V | 6000/7000/8000*/9000* | Now |
| | | | K4G80325FB-HC(03/28/25/22) | | 1.35V/1.35V | 5000/6000/6500/TBD | |
| | 4Gb | 128M x 32 | K4G41325FE-HC2(03/28/25/22) | | 1.5V/1.5V | 6000/7000/8000*/9000* | |
| | | | K4G41325FE-HC2(03/28/25/22) | | 1.35V/1.35V | 5000/6000/6500/TBD | |
| gDDR3 | 4Gb | 256M x 16 | K4W4G1646E-BC(1A/1B) | 96-FCFBGA | 1.5V/1.5V | 2133/2400 | Now |
| | | | K4W4G1646E-BC(1A/1B) | | 1.35V/1.35V | 1866/2133 | |

Notes: Package & Speed Bin Codes

H: FBGA (Halogen Free & Lead Free) (DDR3)
B: FCFBGA (Halogen Free & Lead Free) (DDR3)
H: FCFBGA (Halogen Free & Lead Free) (GDDR5)
F: FBGA (Halogen Free & Lead Free) (GDDR5)
22: 0.22ns (9000Mbps)
25: 0.25ns (8000Mbps)
28: 0.28ns (7000Mbps)
03: 0.3ns (6000Mbps)
04: 0.4ns (5000Mbps)
1B: 8.3ns (2400Mbps gDDR3)
1A: 1.0ns (2133Mbps gDDR3)
11: 1.1ns (1866Mbps)

## MOBILE DRAM COMPONENTS

| Type | Density | Organization | Part Number | Package | Power | Production |
|---|---|---|---|---|---|---|
| LPDDR3 | 8Gb | 1CH x 32 | K4E8E324EB-EGCF | 178-FBGA, 11x11.5, SDP, 1866Mbps | 1.8V/1.2V/1.2V | Now |
| | | | K4E8E324EB-AGCF | 168-FBGA, 12x12, SDP, 1866Mbps | | |
| | 12Gb | 1CH x32 | K4E2E304EA-AGCF | 168-FBGA, 12x12, DDP, 1866Mbps | | |
| | 16Gb | 1CH x 32 | K4E6E304EB-EGCF | 178-FBGA, 11x11.5, DDP, 1866Mbps | | |
| | | | K4E6E304EB-AGCF | 168-FBGA, 12x12, DDP, 1866Mbps | | |
| | | 2CH x 32 | K3QF2F20BM-AGCF | 253-FBGA, 11x11.5, DDP, 1866Mbps | | |
| | | | K3QF3F30BM-FGCF | 256-FBGA, 14x14, DDP, 1866Mbps | | |
| | 24Gb | 1CH x32 | K4EHE304EA-AGCF | 168-FBGA, 12x12, QDP, 1866Mbps | | |
| | | 2CH x32 | K3QF6F60AM-FGCF | 256-FBGA, 14x14, QDP, 1866Mbps | | |
| | 32Gb | 1CH x32 | K4EBE304EB-EGCF | 178-FBGA, 11x11.5, QDP, 1866Mbps | | |
| | | 2CH x32 | K3QF4F40BM-AGCF | 253-FBGA, 11x11.5, QDP, 1866Mbps | | |
| | | | K3QF4F40BM-FGCF | 256-FBGA, 14x14, QDP, 1866Mbps | | |
| LPDDR4 | 8Gb | 2CH x16 | K4F8E304HB-MGCJ | 200-FBGA, 10x15, SDP, 3733Mbps | 1.8V/1.1V/1.1V | Now |
| | 16Gb | | K4F6E304HB-MGCJ | 200-FBGA, 10x15, DDP, 3733Mbps | | |
| | 24Gb | | K4FHE3D4HM-MFCJ | 200-FBGA, 10x15, DDP, 3733Mbps | | |
| | | | K3RG4G40MM-MGCJ | 366-FBGA, 15x15, DDP, 3733Mbps | | |
| | 32Gb | 4CH x16 | K3RG2G20CA-MGCJ | 366-FBGA, 15x15, QDP, 3733Mbps | | CS |
| | | | K3RG2G20CM-FGCJ | 432-FBGA, 15x15, QDP, 3733Mbps | | ES |
| | 48Gb | 4CH x16 | K3RG6G60MM-MGCJ | 366-FBGA, 15x15, QDP, 3733Mbps | | Now |
| LPDDR4X | 32Gb | 4CH x16 | K3UH5H50MM-NGCJ | 366-FBGA, 12x12.7 DDP, 3733Mbps | 1.8V/1.1V/1.1V | CS |
| | 48Gb | | K3UH6H60AM-NGCJ | 366-FBGA, 12x12.7 QDP, 3733Mbps | | |

## COMPONENT DRAM ORDERING INFORMATION

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| K | 4 | T | XX | XX | X | X | X | X | X | XX |

- 1: SAMSUNG Memory
- 2: DRAM
- 3: DRAM Type
- 4: Density
- 5: Bit Organization
- 6: Number of Internal Banks
- 7: Interface (VDD, VDDQ)
- 8: Generation
- 9: Package Type
- 10: Temp & Power
- 11: Speed

### 1. Memory (K)

### 2. DRAM: 4

### 3. DRAM Type

B: DDR3 SDRAM
D: GDDR SDRAM
G: GDDR5 SDRAM
H: DDR SDRAM
J: GDDR3 SDRAM
M: Mobile SDRAM
N: SDDR2 SDRAM
S: SDRAM
T: DDR SDRAM
U: GDDR4 SDRAM
V: Mobile DDR SDRAM Power Efficient Address
W: SDDR3 SDRAM
X: Mobile DDR SDRAM
Y: XDR DRAM
Z: Value Added DRAM

### 4. Density

10: 1G, 8K/32ms
16: 16M, 4K/64ms
26: 128M, 4K/32ms
28: 128M, 4K/64ms
32: 32M, 2K/32ms
50: 512M, 32K/16ms
51: 512M, 8K/64ms
52: 512M, 8K/32ms
54: 256M, 16K/16ms
55: 256M, 4K/32ms
56: 256M, 8K/64ms
62: 64M, 2K/16ms
64: 64M, 4K/64ms
68: 768M, 8K/64ms
1G: 1G, 8K/64ms
2G: 2G, 8K/64ms
4G: 4G, 8K/64ms

### 5. Bit Organization

02: x 2
04: x 4
06: x 4 Stack (Flexframe)
07: x 8 Stack (Flexframe)
08: x 8
15: x 16 (2CS)
16: x 16
26: x 4 Stack (JEDEC Standard)
27: x 8 Stack (JEDEC Standard)
30: x 32 (2CS, 2CKE)
31: x 32 (2CS)
32: x 32

### 6. # of Internal Banks

2: 2 Banks
3: 4 Banks
4: 8 Banks
5: 16 Banks

### 7. Interface ( VDD, VDDQ)

2: LVTTL, 3.3V, 3.3V
4: LVTTL, 2.5V, 2.5V
5: SSTL-2 1.8V, 1.8V
6: SSTL-15 1.5V, 1.5V
8: SSTL-2, 2.5V, 2.5V
A: SSTL, 2.5V, 1.8V
F: POD-15 (1.5V,1.5V)
H: SSTL_2 DLL, 3.3V, 2.5V
M: LVTTL, 1.8V, 1.5V
N: LVTTL, 1.5V, 1.5V
P: LVTTL, 1.8V, 1.8V
Q: SSTL-2 1.8V, 1.8V
R: SSTL-2, 2.8V, 2.8V
U: DRSL, 1.8V, 1.2V

### 8. Generation

A: 2nd Generation
B: 3rd Generation
C: 4th Generation
D: 5th Generation
E: 6th Generation
F: 7th Generation
G: 8th Generation
H: 9th Generation
I: 10th Generation
J: 11th Generation
K: 12th Generation
M: 1st Generation
N: 14th Generation
Q: 17th Generation

### 9. Package Type

**DDR2 DRAM**

L: TSOP II (Lead-free & Halogen-free)
H: FBGA (Lead-free & Halogen-free)
F: FBGA for 64Mb DDR (Lead-free & Halogen-free)
6: sTSOP II (Lead-free & Halogen-free)
T: TSOP II
N: sTSOP II
G: FBGA
U: TSOP II (Lead-free)
V: sTSOP II (Lead-free)
Z: FBGA (Lead-free)

**DDR2 SDRAM**

Z: FBGA (Lead-free)
J: FBGA DDP (Lead-free)
Q: FBGA QDP (Lead-free)
H: FBGA (Lead-free & Halogen-free)
M: FBGA DDP (Lead-free & Halogen-free)
E: FBGA QDP (Lead-free & Halogen-free)
T: FBGA DSP (Lead-free & Halogen-free, Thin)

**DDR3 SDRAM**

Z: FBGA (Lead-free)
H: FBGA (Halogen-free & Lead-free)

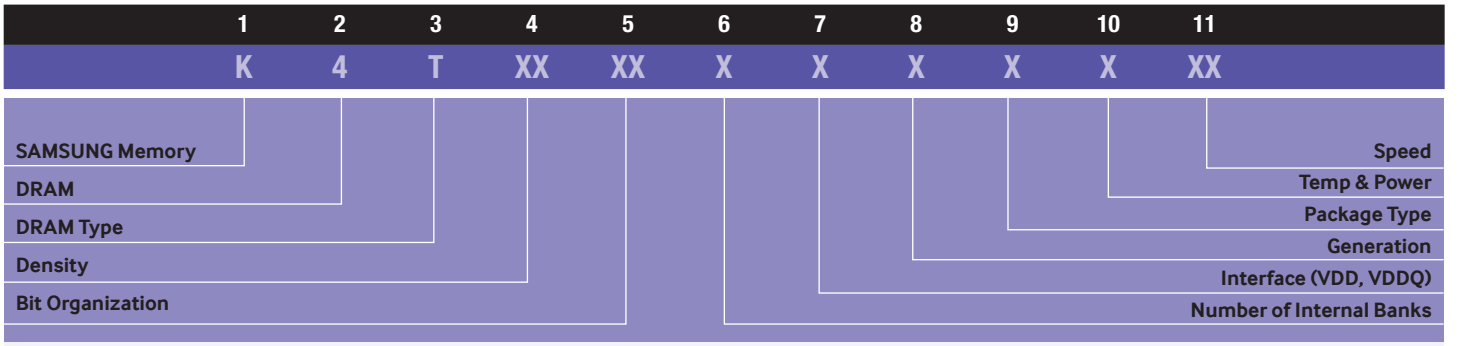
**Graphics Memory**

Q: TQFP
U: TQFP (Lead Free)
G: 84/144 FBGA
V: 144 FBGA (Lead Free)
Z: 84 FBGA (Lead Free)
T: TSOP
L: TSOP (Lead Free)
A: 136 FBGA
B: 136 FBGA (Lead Free)
H: FBGA (Hologen Free & Lead Free)
E: 100 FBGA (Hologen Free & Lead Free)

**SDRAM**

L TSOP II (Lead-free & Halogen-free)
N: STSOP II
T: TSOP II
U: TSOP II (Lead-free)
V: sTSOP II (Lead-free)

## COMPONENT DRAM ORDERING INFORMATION




**XDR DRAM**

J: BOC(LF) P: BOC

**Mobile DRAM**

**Leaded/Lead Free**

G/A: 52balls FBGA Mono
R/B: 54balls FBGA Mono
X/Z: 54balls BOC Mono
J/V: 60(72)balls FBGA Mono 0.5pitch
L /F: 60balls FBGA Mono 0.8pitch
S/D: 90balls FBGA

**Monolithic (11mm x 13mm)**

F/H: Smaller 90balls FBGA Mono
Y/P: 54balls CSP DDP
M/E: 90balls FBGA DDP

### 10. Temp & Power - COMMON (Temp, Power)

C: Commercial, Normal (0'C – 95'C) & Normal Power
C: (Mobile Only) Commercial (-25 ~ 70'C), Normal Power
J: Commercial, Medium
L: Commercial, Low (0'C – 95'C) & Low Power
L: (Mobile Only) Commercial, Low, i-TCSR
F: Commercial, Low, i-TCSR & PASR & DS
E: Extended (-25~85'C), Normal
N: Extended, Low, i-TCSR
G: Extended, Low, i-TCSR & PASR & DS
I: Industrial, Normal (-40'C – 85'C) & Normal Power
P: Industrial, Low (-40'C – 85'C) & Low Power
H: Industrial, Low, i-TCSR & PASR & DS

### 11. Speed (Wafer/Chip Biz/BGD: 00)

**DDR SDRAM**

CC: DDR400 (200MHz @ CL=3, tRCD=3, tRP=3)
B3: DDR333 (166MHz @ CL=2.5, tRCD=3, tRP=3) *1
A2: DDR266 (133MHz @ CL=2 , tRCD=3, tRP=3)
B0: DDR266 (133MHz @ CL=2.5, tRCD=3, tRP=3)

Note 1: "B3" has compatibility with "A2" and "B0"

**DDR2 SDRAM**

CC: DDR2-400 (200MHz @ CL=3, tRCD=3, tRP=3)
D5: DDR2-533 (266MHz @ CL=4, tRCD=4, tRP=4)
E6: DDR2-667 (333MHz @ CL=5, tRCD=5, tRP=5)
F7: DDR2-800 (400MHz @ CL=6, tRCD=6, tRP=6)
E7: DDR2-800 (400MHz @ CL=5, tRCD=5, tRP=5)

**DDR3 SDRAM**

F7: DDR3-800 (400MHz @ CL=6, tRCD=6, tRP=6)
F8: DDR3-1066 (533MHz @ CL=7, tRCD=7, tRP=7)
G8: DDR3-1066 (533MHz @ CL=8, tRCD=8, tRP=8)
H9: DDR3-1333 (667MHz @ CL=9, tRCD=9, tRP=9)
K0: DDR3-1600 (800MHz @ CL=11, tRCD=11, tRP=11)
MA: DDR3-1866 (933MHz @ CL=13, tRCD=13, tRP=13)
NB: DDR3-2133 (1067MHz @ CL=14, tRCD=14, tRP=14)

**Graphics Memory**

18: 1.8ns (550MHz)
04: 0.4ns (2500MHz)
20: 2.0ns (500MHz)
05: 0.5ns (2000MHz)
22: 2.2ns (450MHz)
5C: 0.56ns (1800MHz)
25: 2.5ns (400MHz)
06: 0.62ns (1600MHz)
2C: 2.66ns (375MHz)
6A: 0.66ns (1500MHz)
2A: 2.86ns (350MHz)
07: 0.71ns (1400MHz)
33: 3.3ns (300MHz)
7A: 0.77ns (1300MHz)
36: 3.6ns (275MHz)
08: 0.8ns (1200MHz)
40: 4.0ns (250MHz)
09: 0.9ns (1100MHz)
45: 4.5ns (222MHz)
1 : 1.0ns (1000MHz)
50/5A: 5.0ns (200MHz)
1 : 1.1ns (900MHz)
55: 5.5ns (183MHz)
12: 1.25ns (800MHz)
60: 6.0ns (166MHz)
14: 1.4ns (700MHz)
16: 1.6ns (600MHz)

**SDRAM (Default CL=3)**

50: 5.0ns (200MHz CL=3)
60: 6.0ns (166MHz CL=3)
67: 6.7ns
75: 7.5ns PC133 (133MHz CL=3)

**XDR DRAM**

A2: 2.4Gbps, 36ns, 16Cycles
B3: 3.2Gbps, 35ns, 20Cycles
C3: 3.2Gbps, 35ns, 24Cycles
C4: 4.0Gbps, 28ns, 24Cycles
DS: Daisychain Sample

**Mobile-SDRAM**

60: 166MHz, CL 3
75: 133MHz, CL 3
80: 125MHz, CL 3
1H: 105MHz, CL 2
1L: 105MHz, CL 3
15: 66MHz, CL 2 & 3

**Mobile-DDR**

C3: 133MHz, CL 3
C2: 100MHz, CL 3
C0: 66MHz, CL 3

Note: All Lead-free and Halogen-free products are in compliance with RoHS

## MODULE DRAM ORDERING INFORMATION

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M | X | XX | T | XX | X | X | X | X | X | X | XX | X |

- 1: SAMSUNG Memory
- 2: DIMM
- 3: Data bits
- 4: DRAM Component Type
- 5: Depth
- 6: Number of Banks
- 7: Bit Organization
- 8: Generation
- 9: Package
- 10: PCB Revision
- 11: Temp & Power
- 12: Speed
- 13: AMB Vendor

### 1. Memory Module: M

### 2. DIMM Type

3: DIMM
4: SODIMM

### 3. Data bits

12: x 72 184pin Low Profile Registered DIMM
63: x 63 PC100/PC133 µSODIMM with SPD for 144pin
64: x 64 PC100/PC133 SODIMM with SPD for 144pin (Intel/JEDEC)
66: x 64 Unbuffered DIMM with SPD for 144pin/168pin (Intel/JEDEC)
68: x 64 184pin Unbuffered DIMM
70: x 64 200pin Unbuffered SODIMM
71: x 64 204pin Unbuffered SODIMM
74: x 72/ECC Unbuffered DIMM with SPD for 168pin (Intel/JEDEC)
77: x 72/ECC PLL + Register DIMM with SPD for 168pin (Intel PC100)
78: x 64 240pin Unbuffered DIMM
81: x 72 184pin ECC unbuffered DIMM
83: x 72 184pin Registered DIMM
90: x 72/ECC PLL + Register DIMM
91: x 72 240pin ECC unbuffered DIMM
92: x 72 240pin VLP Registered DIMM
93: x 72 240pin Registered DIMM
95: x 72 240pin Fully Buffered DIMM with SPD for 168pin (JEDEC PC133)

### 4. DRAM Component Type

B: DDR3 SDRAM (1.5V VDD)
L: DDR SDRAM (2.5V VDD)
S: SDRAM
T: DDR2 SDRAM (1.8V VDD)

### 5. Depth

09: 8M (for 128Mb/512Mb)
17: 16M (for 128Mb/512Mb)
16: 16M
28: 128M
29: 128M (for 128Mb/512Mb)
32: 32M
33: 32M (for 128Mb/512Mb)
51: 512M
52: 512M (for 512Mb/2Gb)
56: 256M
57: 256M (for 512Mb/2Gb)
59: 256M (for 128Mb/512Mb)
64: 64M
65: 64M (for 128Mb/512Mb)
1G: 1G
1K: 1G (for 2Gb)

### 6. # of Banks in Comp. & Interface

1: 4K/64mxRef., 4Banks & SSTL-2
2 : 8K/64ms Ref., 4Banks & SSTL-2
2: 4K/64ms Ref., 4Banks & LVTTL (SDR Only)
5: 8K/64ms Ref., 4Banks & LVTTL (SDR Only)
5: 4Banks & SSTL-1.8V
6: 8Banks & SSTL-1.8V

### 7. Bit Organization

0: x 4
3: x 8
4: x16
6: x 4 Stack (JEDEC Standard)
7: x 8 Stack (JEDEC Standard)
8: x 4 Stack
9: x 8 Stack

### 8. Generation

A: 2nd Gen.
B: 3rd Gen.
C: 4th Gen.
D: 5th Gen.
E: 6th Gen.
F: 7th Gen.
G: 8th Gen.
M: 1st Gen.
Q: 17th Gen.

### 9. Package

E: FBGA QDP (Lead-free & Halogen-free)
G: FBGA
H: FBGA (Lead-free & Halogen-free)
J: FBGA DDP (Lead-free)
M: FBGA DDP (Lead-free & Halogen-free)
N: sTSOP
Q: FBGA QDP (Lead-free)
T: TSOP II (400mil)
U: TSOP II (Lead-Free)
V: sTSOP II (Lead-Free)
Z: FBGA (Lead-free)

### 10. PCB Revision

0: Mother PCB
1: 1st Rev
2: 2nd Rev.
3: 3rd Rev.
4: 4th Rev.
A: Parity DIMM
S: Reduced PCB
U: Low Profile DIMM

### 11. Temp & Power

C: Commercial Temp. (0°C ~ 95°C) & Normal Power
L: Commercial Temp. (0°C ~ 95°C) & Low Power

### 12. Speed

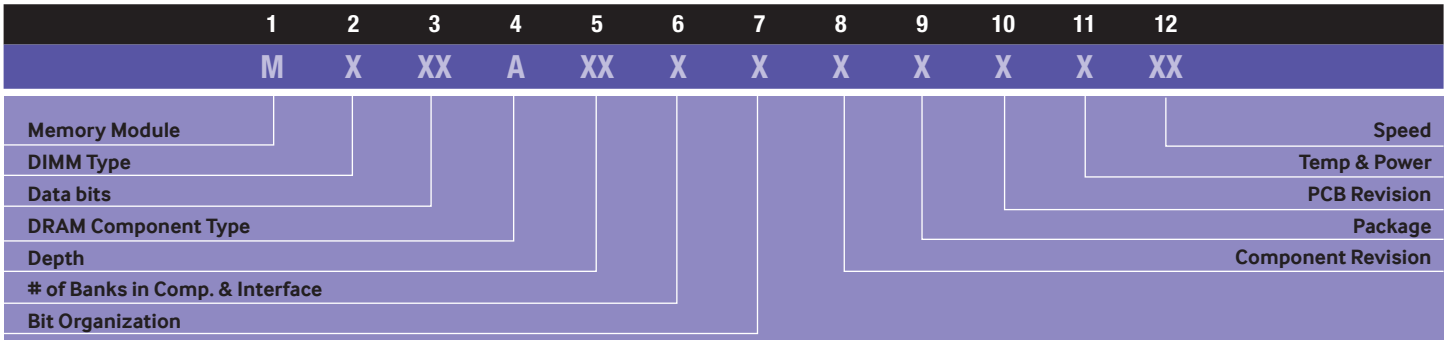
CC: (200MHz @ CL=3, tRCD=3, tRP=3)
D5: (266MHz @ CL=4, tRCD=4, tRP=4)
E6: (333MHz @ CL=5, tRCD=5, tRP=5)
F7: (400MHz @ CL=6, tRCD=6, tRP=6)
E7: (400MHz @ CL=5, tRCD=5, tRP=5)
F8: (533MHz @ CL=7, tRCD=7, tRP=7)
G8: (533MHz @ CL=8, tRCD=8, tRP=8)
H9: (667MHz @ CL=9, tRCD=9, tRP=9)
K0: (800MHz @ CL=10, tRCD=10, tRP=10)
7A: (133MHz CL=3/PC100 CL2)

### 13. AMB Vendor for FBDIMM

0, 5: Intel
1, 6, 8: IDT
9: Montage

Note: All Lead-free and Halogen-free products are in compliance with RoHS

## DDR4 SDRAM MODULE ORDERING INFORMATION




### 1. Memory Module: M

### 2. DIMM Type

3: R/LRDIMM
4: SODIMM

### 3. Data bits

74: x 72 260pin SODIMM
86: x 72 288pin Load Reduced DIMM
93: x 72 288pin Registered DIMM

### 4. DRAM Component Type

A: DDR4 SDRAM (1.2V VDD)

### 5. Depth

1G: 1G
2G: 2G
4G: 4G
8G: 8G
1K: 1G (for 8Gb)
2K: 2G (for 8Gb)

### 6. # of Banks in Comp. & Interface

4: 16Banks & POD-1.2V

### 7. Bit Organization

0: x 4
3: x 8

### 8. Component Revision

M: 1st Gen.
A: 2nd Gen.
B: 3rd Gen.
C: 4th Gen.
D: 5th Gen.
E: 6th Gen.
F: 7th Gen.
G: 8th Gen.

### 9. Package

B: FBGA (Halogen-free & Lead-free, Flip Chip)
M: FBGA (Halogen-free & Lead-free, DDP)

### 10. PCB Revision

0: None
1: 1st Rev.
2: 2nd Rev.
3: 3rd Rev.
4: 4th Rev.

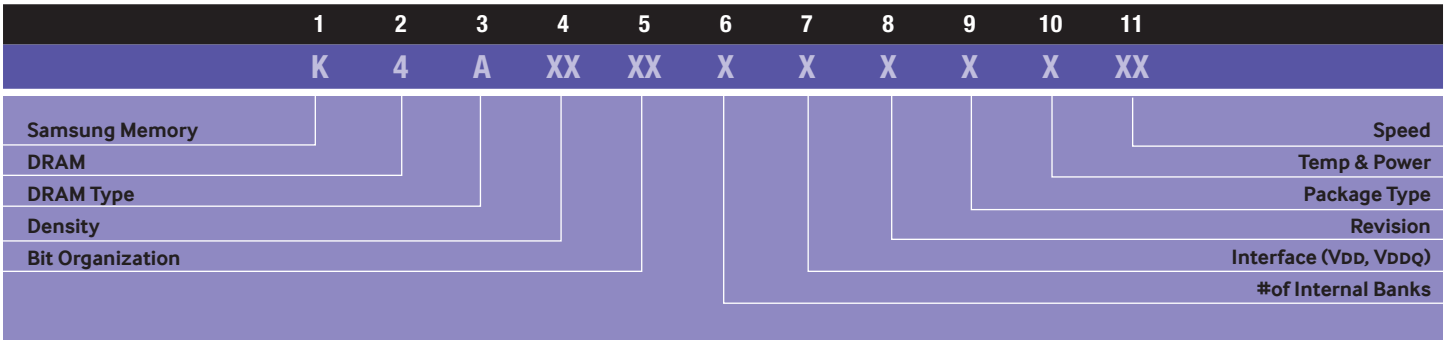
### 11. Temp & Power

C: Commercial Temp. (0°C ~ 85°C) &
Normal Power

### 12. Speed

PB: DDR4-2133
(1066MHz @ CL=15, tRCD=15, tRP=15)

## DDR4 SDRAM MEMORY ORDERING INFORMATION




### 1. Samsung Memory: K

### 2. DRAM: 4

### 3. DRAM Type

A: DDR4 SDRAM

### 4. Density

4G: 4Gb
8G: 8Gb

### 5. Bit Organization

04: x 4
08: x 8

### 6. # of Internal Banks

5: 16Banks

### 7. Interface ($V_{DD}$, $V_{DDQ}$)

W: POD (1.2V, 1.2V)

### 8. Revision

M: 1st Gen.
A: 2nd Gen.
B: 3rd Gen.
C: 4th Gen.
D: 5th Gen.
E: 6th Gen.
F: 7th Gen.
G: 8th Gen.
H: 9th Gen.

### 9. Package Type

B: FBGA (Halogen-free & Lead-free, Flip Chip)
M: FBGA (Halogen-free & Lead-free, DDP)

### 10. Temp & Power

C: Commercial Temp. (0°C ~ 85°C) &
Normal Power

### 11. Speed

PB: DDR4-2133
(1066MHz @ CL=15, tRCD=15, tRP=15)

RC: DDR4-2400
(1200MHz @ CL=17, tRCD=17, tRP=17)

## MOBILE STORAGE

| Application | Product | Density | Org | Type | Flash Die | Part Number | Seq R/W MB/s | Random R/W IOPS | mm Pkg Size (X,Y,Z) | Status |
|---|---|---|---|---|---|---|---|---|---|---|
| High-End | UFS v2.1 (Gear 3 x 2 lanes) | 256GB | 256Gb*8 | TLC | M-die | KLUEG8U1EM-B0C10** | 890/260 | 48K / 42K | 11.5 x 13.0 x 1.0 | CS |
| | | 128GB | 128Gb*8 | | E-die | KLUDG8V1EE-B0C10** | 880/230 | 40K / 33K | | |
| | | 64GB | 128Gb*4 | MLC | D-die | KLUCG4J1ED-B0C10** | 880/200 | 48K / 35K | | |
| | UFS v2.0 (Gear 3 x 2 lanes) | 256GB | 256Gb*8 | TLC | M-die | KLUEG8U1EM-B0B10** | 850/260 | 45K / 40K | 11.5 x 13.0 x 1.2 | MP |
| Mainstream | UFS 2.0 (Gear 3 x 1 lane) | 128GB | 128Gb*8 | MLC | B-die | KLUDG8J1CB-B0B10** | 460/160 | 20K / 14K | 11.5 x 13.0 x 1.2 | MP |
| | | 64GB | 128Gb*4 | | | KLUCG4J1CB-B0B10** | | | 11.5 x 13.0 x 1.0 | |
| | | 32GB | 64Gb*4 | | E-die | KLUBG4G1CE-B0B10** | | | | |
| | eMMC v5.1 (Gear 3 x 1 lane) | 256GB | 256Gb*8 | TLC | M-die | KLMEG8UERM-C0410** | 320/150 | 22K / 18K | | CS |
| | | 128GB | 256Gb*4 | | | KLMDG4UERM-B0410** | | | | CS in Dec / Jan |
| | | 64GB | 128Gb*4 | MLC | D-die | KLMCG4JETD-B0410** | | | | |
| | | 32GB | 128Gb*2 | | | KLMBG2JETD-B0410** | | | 11.5 x 13.0 x 0.8 | |
| | | 16GB | 128Gb*1 | | | KLMAG1JETD-B0410** | | | | |
| | | 8GB | 64Gb*1 | | F-die | KLM8G1GETF-B0410** | | | | |

MMC5.1 is backwards compatible with 5.0 & 4.5
*Denotes bucket code for latest firmware patch

## eMCP: eMMC + LPDDR3

| Memory | eMMC Density | DRAM Density/Organization | Voltage (eMMC-DRAM) | Package |
|---|---|---|---|---|
| eMMC & MDRAM | 8GB | 8Gb (x32) | 3.3V/1.8V - 1.8V/1.2V | 221FBGA 11.5 x 13mm |
| | 16GB | 8Gb (x32) | 3.3V/1.8V - 1.8V/1.2V | 221FBGA 11.5 x 13mm |
| | | 8Gb*2 (x32) | | |
| | | 6Gb*4 (x32) | | |
| | 32GB | 8Gb*2 (x32) | 3.3V/1.8V - 1.8V/1.2V | 221FBGA 11.5 x 13mm |
| | | 6Gb*4 (x32) | | |
| | | 8Gb*4 (x32) | | |
| | 64GB | 6Gb*4 (x32) | 3.3V/1.8V - 1.8V/1.2V | 221FBGA 11.5 x 13mm |
| | | 8Gb*4 (x32) | | |
| | 128GB | 8Gb*4 (x32) | 3.3V/1.8V - 1.8V/1.2V | 221FBGA 11.5 x 13mm |

## eMCP: eMMC + LPDDR4X

| Memory | eMMC Density | DRAM Density/Organization | Voltage (eMMC-DRAM) | Package |
|---|---|---|---|---|
| eMMC & MDRAM | 32GB | 12Gb*2 (x32) | 3.3V/1.8V - 1.8V/1.2V/0.6V | 254FBGA 11.5 x 13mm |
| | | 8Gb*4 (x32) | | |
| | 64GB | 12Gb*2 (x32) | 3.3V/1.8V - 1.8V/1.2V/0.6V | 254FBGA 11.5 x 13mm |
| | | 8Gb*4 (x32) | | |
| | | 12Gb*4 (x32) | | |
| | 128GB | 12Gb*4 (x32) | 3.3V/1.8V - 1.8V/1.2V/0.6V | 254FBGA 12 x 15mm |

## ePoP: eMMC + LPDDR3

| Memory | eMMC Density | DRAM Density/Organization | Voltage (eMMC-DRAM) | Package |
|---|---|---|---|---|
| eMMC & MDRAM | 4GB | 4Gb (x32) | 3.3V/1.8V - 1.8V/1.2V | 168FBGA 12x12mm |
| | | 6Gb (x32) | | |
| | 4GB | 4Gb (x32) | 3.3V/1.8V - 1.8V/1.2V | 136FBGA 10x10mm |
| | | 6Gb (x32) | | |
| | 8GB | 8Gb (x32) | 3.3V/1.8V - 1.8V/1.2V | 136FBGA 10x10mm |

# Solid State Drives (SSDs)

| | Server & Cloud Datacenter | | Enterprise | | |
|---|---|---|---|---|---|
| | LEGACY SERVERS | HIGH-DENSITY SERVERS | ALL FLASH PRIMARY STORAGE<br>Hard Disk Drive Replacement | LOW LATENCY PRIMARY STORAGE<br>Next-Generation All Flash Array | EXTREME PERFORMANCE SERIES<br>Server-side Caching |
| | **PM863a** | **PM963** | **PM1633a** | **PM1725a** | **PM1725a** |
| **Host Interface** | SATA 3.0 @ 6 Gbit/s | PCIe Gen 3 x4 @ 32Gbit/s (NVMe) | SAS 3.0 @ 12 Gbit/s | PCIe Gen 3 x4 @ 32Gbit/s (NVMe) | PCIe Gen 3 x8 @ 64Gbit/s (NVMe) |
| **Form Factor** | 2.5" | M.2 (22x110mm) | 2.5" | 2.5" / U.2 | Add-in Card (HHHL) |
| **Capacity (GB)** | 240/480/960/ 1920/3840 | 960/1920 | 480/960/1920/ 3840/7680/15360 | 3840/7680/15360 | 1600/3200/6400 |
| **Endurance (up to)** | 1.3 DWPD for 3 Years | 1.3 DWPD for 3 Years | 1-3 DWPD for 5 Years | 5 DWPD for 5 Years | 5 DWPD for 5 Years |
| **Power Consumption (Active)** | 4 W | 7.5 W | 13 W | 25 W | 23 W |
| **Power Consumption (Idle)** | 1.3 W | 2.5 W | 7 W | 7 W | 7.7 W |
| **Random Reads (up to)** | 99,000 IOPS | 430,000 IOPS | 205,000 IOPS | 740,000 IOPS | 1,080,000 IOPS |
| **Random Writes (up to)** | 18,000 IOPS | 40,000 IOPS | 39,000 IOPS | 70,000 IOPS | 170,000 IOPS |
| **Sequential Reads (up to)** | 520 MB/s | 2,000 MB/s | 1,300 MB/s | 3,100 MB/s | 6,400 MB/s |
| **Sequential Writes (up to)** | 480 MB/s | 1,800 MB/s | 1,400 MB/s | 3,000 MB/s | 3,000 MB/s |
| **MTBF** | 2.0 Million Hours | 2.0 Million Hours | 2.0 Million Hours | 2.0 Million Hours | 2.0 Million Hours |
| **Uncorrectable Bit Error Rate (UBER)** | 1 in $10^{17}$ | 1 in $10^{17}$ | 1 in $10^{17}$ | 1 in $10^{17}$ | 1 in $10^{17}$ |
| **Physical Dimensions** | 100 x 70 x 7mm | 22 x 110 x 4.15 mm | 100 x 70 x 15 mm | 100 x 70 x 15 mm | 168 x 70 x 19 mm (HHHL) |
| **Weight** | 55 g | 20 g | 160 g | 160 g | 330 g |

## SOLID STATE DRIVES (SSD)

| Drive Type | Power-loss Protection | Form Factor | Interface | Connector | Product Family | Write Endurance | Capacity (GB) | Part Number |
|---|---|---|---|---|---|---|---|---|
| Client PC/ Embedded | No | M.2 22 x 80 mm | SATA 3.0 @ 6 Gbit/s | M.2 | PM871a | PC Workload | 256 | MZNLN256HMHQ-00000 |
| | | | | | | | 512 | MZNLN512HMJP-00000 |
| | | | | | | | 1024 | MZNLN1T0HMLH-00000 |
| | | | PCIe Gen 3 x4 @ 32Gbit/s (NVMe) | | PM951 | | 128 | MZVLV128HCGR-00000 |
| | | | | | | | 256 | MZVLV256HCHP-00000 |
| | | | | | | | 512 | MZVLV512HCJH-00000 |
| Datacenter | Yes | 2.5" 7mmT | SATA 3.0 @ 6 Gbit/s | SFF-8223 | PM863a | 0.8 DWPD for 5 Years | 240 | MZ7LM240HMHQ-00005 |
| | | | | | | | 480 | MZ7LM480HMHQ-00005 |
| | | | | | | | 960 | MZ7LM960HMJP-00005 |
| | | | | | | | 1920 | MZ7LM1T9HMJP-00005 |
| | | | | | | | 3840 | MZ7LM3T8HMLP-00005 |
| | | | | | SM863 | 3.6 DWPD for 5 Years | 120 | MZ7KM120HAFD-00005 |
| | | | | | | | 240 | MZ7KM240HAGR-00005 |
| | | | | | | | 480 | MZ7KM480HAHP-00005 |
| | | | | | | | 960 | MZ7KM960HAHP-00005 |
| | | | | | | | 1920 | MZ7KM1T9HAJM-00005 |
| | | | | | | 10 DWPD for 5 Years | 100 | MZ7KM120HAFD-00005 |
| | | | | | | | 200 | MZ7KM240HAGR-00005 |
| | | | | | | | 400 | MZ7KM480HAHP-00005 |
| | | | | | | | 800 | MZ7KM960HAHP-00005 |
| | | | | | | | 1600 | MZ7KM1T9HAJM-00005 |
| | | | PCIe Gen 3x4 @ 32Gbit/s (NVMe) | U.2 (SFF-8639) | PM963 | 0.8 DWPD for 5 Years | 480 | MZQLW480HMHQ-00003 |
| | | | | | | | 960 | MZQLW960HMJP-00003 |
| | | | | | | | 1920 | MZQLW1T9HMJP-00003 |
| | | | | | | | 3840 | MZQLW3T8HMLP-00003 |
| | | | | | SM963 | 3.6 DWPD for 5 Years | 960 | MZQKW960HMJP-00003 |
| | | | | | | | 1920 | MZQKW1T9HMJP-00003 |
| | | | | | | | 3840 | MZQKW3T8HMLH-00003 |
| | | | | | | 10 DWPD for 5 Years | 800 | MZQKW960HMJP-00003 |
| | | | | | | | 1600 | MZQKW1T9HMJP-00003 |
| | | | | | | | 3200 | MZQKW3T8HMLH-00003 |
| | | M.2 22 x 110 mm | | M.2 | PM963 | 0.8 DWPD for 5 Years | 480 | MZ1LW480HMHQ-00003 |
| | | | | | | | 960 | MZ1LW960HMJP-00003 |
| | | | | | | | 1920 | MZ1LW1T9HMLS-00003 |
| | | | | | SM963 | 3.6 DWPD for 5 Years | 960 | MZ1KW960HMJP-00003 |
| | | | | | | | 1920 | MZ1KW1T9HMJP-00003 |
| | | | | | | 10 DWPD for 5 Years | 800 | MZ1KW960HMJP-00003 |
| | | | | | | | 1600 | MZ1KW1T9HMJP-00003 |

## SOLID STATE DRIVES (SSD) *continued*

| Drive Type | Power-loss Protection | Form Factor | Interface | Connector | Product Family | Write Endurance | Capacity (GB) | Part Number |
|---|---|---|---|---|---|---|---|---|
| Enterprise | Yes | 2.5" 15mmT | SAS 3.0 @ 12 Gbit/s | SFF-8680 | PM1633 | 1 DWPD for 5 Years | 480 | MZILS480HCGR-00003 |
| | | | | | | | 960 | MZILS960HCHP-00003 |
| | | | | | | | 1920 | MZILS1T9HCHP-00003 |
| | | | | | | | 3840 | MZILS3T8HCJM-00003 |
| | | | | | | 3 DWPD for 5 Years | 400 | MZILS480HCGR-00003 |
| | | | | | | | 800 | MZILS960HCHP-00003 |
| | | | | | | | 1600 | MZILS1T9HCHP-00003 |
| | | | | | | | 3200 | MZILS3T8HCJM-00003 |
| | | | | | PM1633a | 1 DWPD for 5 Years | 480 | MZILS480HEGR-00007 |
| | | | | | | | 960 | MZILS960HEHP-00007 |
| | | | | | | | 1920 | MZILS1T9HEJH-00007 |
| | | | | | | | 3840 | MZILS3T8HMLH-00007 |
| | | | | | | | 7680 | MZILS7T6HMLS-00007 |
| | | | | | | | 15360 | MZILS15THMLS-00007 |
| | | | PCIe Gen 3x4 @ 32Gbit/s (NVMe) | U.2 (SFF-8639) | PM1725a | 5 DWPD for 5 Years | 800 | MZWLL800HEHP-00003 |
| | | | | | | | 1600 | MZWLL1T6HEHP-00003 |
| | | | | | | | 3200 | MZWLL3T2HMJP-00003 |
| | | | | | | | 6400 | MZWLL6T4HMLS-00003 |
| | | Add-in Card (HHHL) | PCIe Gen 3 x8 @ 64Gbit/s (NVMe) | Edge Connector | | | 1600 | MZPLL1T6HEHP-00003 |
| | | | | | | | 3200 | MZPLL3T2HMJP-00003 |
| | | | | | | | 6400 | MZPLL6T4HMLT-00003 |

# Public Information Display (PID) Product Classification

| | | | |
|---|---|---|---|
| **Super Narrow Bezel (SNB)/ Ultra Narrow Bezel (UNB)** | » Video Wall | » SNB: 5.9mm A-to-A | » UNB: 3.9mm A-to-A |
| **Indoor PID** | » Narrow Bezel | » 40"/46"/55"/75" | » 700 nits Brightness |
| **E-Board PID** | » Landscape Orientation | » 55"/70"/82" Edge LED | » AGAR Surface Treatment |
| **Outdoor PID** | » High Brightness | » Full High Definition | » 110°C Clearing Point |

## Why PID instead of TV?

| | COMMERCIAL (PID) | CONSUMER (TV) |
|---|---|---|
| **WARRANTY** | 18 months to 2 years | 90 days to 1 year |
| **RELIABILITY** | Public environments<br>20+ hours daily duty cycle<br>Variety of temperatures & location | 5-8 hour daily duty cycle<br>Designed for in-home use in controlled environment<br>In-home living room |
| **PRODUCTION LIFECYCLE** | 24-36 months | 12-15 months |
| **PICTURE QUALITY** | Designed to resist image retention<br>LCD backlight covers a wider color spectrum necessary for PC source integration, giving better picture quality<br>AGAR coating for public viewing | 120Hz / 240Hz for full-motion video<br>Designed for TV signals<br>Gloss surface treatment |
| **LOCATION** | Most models portrait capable | Can only be oriented in landscape mode |

# Product Segmentation

HEAVY USE

LIGHT USE

**SNB / UNB**

| Professional | Indoor Events | Billboard |
|---|---|---|
| • Control Room<br>• Simulation | • Scoreboard<br>• Sports Broadcasting | • Dynamic Signage |

**Indoor PID**

| Entertainment | Transportation | Communication |
|---|---|---|
| • Casino<br>• Theatre<br>• Menu | • Airport<br>• Train/Bus Station | • Conference Room |

**E-Board PID**

| Commercial | Education | Hospitality |
|---|---|---|
| • Kiosk<br>• Conference Systems | • Interactive FPD | • Hotel Signage |

**Outdoor PID**

| Commercial | Education | Hospitality |
|---|---|---|
| • Kiosk<br>• Conference Systems | • Interactive FPD | • Hotel Signage |

## Product Segmentation

| Type | Class | Warranty | Bezel | Suggested Run Time | Brightness | Usage | Applications | Value Tier |
|---|---|---|---|---|---|---|---|---|
| ENB / UNB / SNB | Ultra / Super Narrow Bezel | 2 years | 1.9mm - 5.9mm A-to-A | 20+ hours | 500-700 nits | Heavy | Video Walls | Premium commercial range |
| Indoor PID | Indoor Commercial Panels | 2 years | Narrow | 20+ hours | 600/700 nits | Medium | Semi-Outdoor | Mid-price range |
| E-Board | Value, Large Format | 18 months | Normal | 12 hours | 450 nits | Daily | Indoor, e-Board | High-value commercial range |
| Outdoor PID | High Bright, Wide Temp | 2 years | Normal | 20+ hours | 2500-5000 nits | Heavy | Outdoor | Premium commercial range |
| Specialty | Value, Large Format | 2 years | Narrow | 20+ hours | 500/ 1500 nits | Medium | specialty | |

## SAMSUNG DIGITAL INFORMATION DISPLAY (DID) PANEL LINEUP

| Category | Model | Size | Model Resolution | Bezel | Backlight | Brightness (typical) | Contrast Ratio | Response Time | Frequency | MP* | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SNB / UNB / ENB | LTI460HN09-0 | 46" | FHD | Super narrow | D-LED | 500 nits | 3,000:1 | 8ms | 60Hz | Now | 5.9mm Active to Active, LED |
| | LTI460HN11-A | | | Ultra narrow | | 500 nits | | | | | 3.9mm Active to Active, LED |
| | LTI460HN12-V | | | | | 700 nits | | | | | |
| | LTI460HN13-V | | | Extreme narrow | | 700 nits | | | | Feb., '17 | 2.0mm Active to Active, LED |
| | LTI460HN14-V | | | | | 500 nits | | | | Q2, '17 | |
| | LTI550HN11-V | 55" | | Ultra narrow | | 500 nits | | | | Now | 3.9mm Active to Active, LED |
| | LTI550HN12-V | | | | | 700 nits | | | | | |
| Indoor PID | LTI550HN13-V (Broadcast) | 55" | FHD | Ultra narrow | D-LED | 700 nits | 3,000:1 | 8ms | 60Hz | Now | 3.9mm Active to Active, LED |
| | LTI550HN14-V | | | | 55" | | | | | | |
| | LTI550HN17-V | | | | | 55" | | | | | |
| | LTI460HN08 | 46" | | | eLED | 700 nits | 4,000:1 | | | | Slim eLED,Landscape / Portrait |
| | LTI480HN01-0 | 48" | | | Slim eLED | | | | | | |
| | LTI480HN02-0 | | | | | 500 nits | | | | | |
| | LTI550HN06 | 55" | | | eLED | 700 nits | | | | | eLED, Landscape / Portrait |
| | LTI550HN07-0 | | | | | 450 nits | | | | | E-Board; Landscape/Portrait |
| | LTI550FN01-N | | UHD | | Slim eLED | 500 nits | | | | | Slim eLED, Landscape / Portrait |
| | LTI750HF02-0 | 75" | FHD | Normal | D-LED | 400 nits | 3,500:1 | | 120Hz | | Landscape / Portrait |
| | LTI750FJ01-N | | UHD | | | 500 nits | 5,000:1 | | | | |
| | LTI750FN01-V | | | | eLED | 600 nits | 4,000:1 | | 60Hz | 16. Q2 | eLED Landscape / Portrait |
| | LTI980FN01-V | 98" | | | | 500 nits | | | | Jan., '17 | |
| E-Board | LTI550HN15-0 | 55" | FHD | Narrow | eLED | 380 nits | 4,000:1 | 8ms | 60Hz | Now | Value PID |
| | LTI700HA02-0 | 70" | | Normal | | 350 nits | | | | | E-Board; Landscape mode only |
| | LTI750HF02-0 | 75" | | | D-LED | 450 nits | | | | | |
| | LTI750FN02-N | | | | eLED | 350 nits | | | | | E-Board; Landscape mode only |
| Outdoor | LTI460HZ01-V | 46" | FHD | Narrow | D-LED | 5,000 nits | 4,000:1 | 8ms | 60Hz | Now | High Bright, Hi Temp LC, 1/4λ Pol. |
| | LTI460HF01-V | | | | | 2,500 nits | 3,000:1 | | 120Hz | | |
| | LTH550HF04-V(A) | 55" | | | | | | | | | |
| | LTI750HF01-V | 75" | | | | 3,500 nits | | | | | |
| Specialty | LTI290LN01-0 | 29" | Half FHD | Narrow | eLED | 500 nits | 4,000:1 | 16ms | 60Hz | Now | Stretched, 40"/2, Hi Temp LC |
| | LTI290LN02-0 | | | | | 700 nits | | | | | |
| | LTI370LN03-V | 37" | | | | | | | | | Stretched, 46"/2, Hi Temp LC |
| | LTI370LN02-V | | | | | 1500 nits | | | | Q1, '17 | |

# Contacts

Feel free to contact your local distributor or sales representative with any Samsung sales inquiries.

## Adelsa | www.adetronics.com.mx

| PRODUCTS | ADDRESS | | MAIN PHONE | FAX |
|---|---|---|---|---|
| Memory, SLSI, LCD | **MEXICO** | Hacienda Corralejo #80,<br>Bosque de Echegaray,<br>Naucalpan, Mexico 53310 | 52-555-560-5002 | |
| | **GUADALAJARA OFFICE** | | 52-333-122-3054 | |
| | **MONTERREY OFFICE** | | 52-818-214-0011 | |
| | **CD. JUAREZ OFFICE** | | 52-656-613-3517 | |
| | **REYNOSA OFFICE** | | 52-899-922-5540 | |

## ATMI Sales | www.atmisales.com

| PRODUCTS | ADDRESS | | MAIN PHONE | FAX |
|---|---|---|---|---|
| Memory, SLSI, LCD | **OREGON** | 4900 S.W. Griffith Drive, Suite 253<br>Beaverton, OR 97005 | 1-800-898-2446,<br>503-643-8307 | 503-643-4364 |
| | **WASHINGTON** | 8581 154th Avenue NE<br>Redmond WA 98052 | 425-869-7636 | 425-869-9841 |

## Bear VAI Technology | www.bearvai.com

| PRODUCTS | ADRRESS | | MAIN PHONE | FAX |
|---|---|---|---|---|
| Memory, SLSI, LCD | **MAIN OFFICE - BRECKSVILLE, OHIO** | 6910 Treeline Drive, Unit H<br>Brecksville, OH 44141 | 440-526-1991 | 440-526-5426 |
| | **MAIN OFFICE - INDIANA** | 11451 Overlook Drive<br>Fishers, IN 46037 | 440-832-7637 | 317-845-8650 |
| | **MICHIGAN** | 5506 Alpine Ridge<br>Stevensville, MI 49127 | 440-526-1991 | 440-526-5426 |

## Crestone Technology Group | www.crestonegroup.com

| PRODUCTS | ADDRESS | | MAIN PHONE | FAX |
|---|---|---|---|---|
| Memory, SLSI, LCD | **COLORADO** | 7108 S. Alton Way, Building L, Suite A<br>Centennial, CO 80112 | 303-280-7202 | 720-482-2220 |
| | **UTAH** | | 801-973-8909 | |

## Customer 1st | www.customer1st.com

| PRODUCTS | ADDRESS | | MAIN PHONE | FAX |
|---|---|---|---|---|
| Memory, SLSI, LCD | **MINNESOTA** | 2950 Metro Drive, Suite 101<br>Bloomington, MN 55425 | 952-851-7909 | 952-851-7907 |
| | **KANSAS** | 2111 E. Crossroad Lane, #202<br>Olathe, KS 66062 | | |

→ For all product information please visit: **www.samsung.com/us/samsungsemiconductor**

## InTELaTECH | www.intelatech.com

| PRODUCTS | ADDRESS | MAIN PHONE | FAX |
|---|---|---|---|
| Memory, SLSI | 2113 St. Regis, Suite 240, Dollard Des Ormeaux, QC Canada H9B 2M9 | 905-629-0082 | 905-629-1795 |
| | 5225 Orbitor Drive, Mississauga, Ont, Canada L4W 4Y8 | 905-629-0082 | 905-624-6909 |

## I-Squared Incorporated | www.isquared.com

| PRODUCTS | ADDRESS | MAIN PHONE | FAX |
|---|---|---|---|
| Memory, SLSI, LCD | 2635 N. 1st Street, Suite 128, San Jose, CA 95134 | 408-988-3400 | 408-988-2079 |
| | 1250 B Street, Petaluma, CA 94952 | 707-773-3108 | |

## IRI Rep | www.irirep.com

| PRODUCTS | ADDRESS | MAIN PHONE | FAX |
|---|---|---|---|
| Memory, SLSI, LCD | 320 W. Frontage Rd, Northfield, IL 60093 | 847-967-8430 | 847-967-5903 |

## IRI WEST | www.iriwest.com

| PRODUCTS | ADDRESS | | MAIN PHONE | FAX |
|---|---|---|---|---|
| Memory, SLSI, LCD | **AUSTIN** | 810 Hesters Crossing Rd, Suite 200<br>Round Rock, TX 78681 | 512-343-1199 | 512-343-1922 |
| | **DALLAS** | 2745 Dallas Pkwy, Suite 460<br>Plano, TX 75093 | 972-680-2800 | 972-699-0330 |
| | **HOUSTON** | 24624 Interstate 45 North, Suite 200<br>Spring, TX 77386 | 832-940-9600 | 512-343-1922 |

## Neptune Electronics (necco) | www.neccoelect.com

| PRODUCTS | ADDRESS | MAIN PHONE | FAX |
|---|---|---|---|
| Memory, SLSI, LCD | 11 Oval Drive, Suite 169, Islandia, NY 11749 | 631-234-2525 | 631-234-2707 |

## New Tech Solutions

| PRODUCTS | ADDRESS | MAIN PHONE | FAX |
|---|---|---|---|
| Memory, SLSI, LCD | 26 Ray Avenue, Burlington, MA 01803 | 781-229-8888 | 781-229-1614 |

## Rep One Associates, Inc. | www.repone.com

| PRODUCTS | ADDRESS | | MAIN PHONE | FAX |
|---|---|---|---|---|
| Memory, SLSI, LCD | **ALABAMA** | 403 Madison St.<br>Huntsville, AL 3580 | 256-539-7371 | 256-533-4509 |
| | **FLORIDA** | | 704 516-0242 | |
| | **GEORGIA** | 3000 Langford Road, Building 300<br>Norcross, GA 30071 | 770-209-9242<br>678-591-6753 | 770-209-9245 |
| | **NORTH & SOUTH CAROLINA** | 912 Oleander Lane<br>Waxhaw, NC 28173 | 704 516-0242 | |

## Tech Coast Sales | www.tc-sales.com

| PRODUCTS | ADDRESS | MAIN PHONE | EMAIL |
|---|---|---|---|
| Memory, SLSI, LCD | 23121 Verdugo Drive, Suite 101, Laguna Hills, CA 92653 | 949-305-6869 | sales@tc-sales.com |

## Notes

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