



# PRODUCT SELECTION GUIDE

**Displays, Memory and Storage**  
2H 2012

# Samsung Semiconductor, Inc.

Samsung continues to lead the industry with the broadest portfolio of memory products and technology. Its DRAM, flash, mobile, and graphics memory are found in computers—from ultra-mobile notebooks to powerful servers—and in a wide range of handheld devices such as smartphones and tablets. Samsung also delivers the industry's widest line of storage products from the consumer to the enterprise level. These include optical disk drives as well as flash storage, such as Solid State Drives, and a range of embedded and removable flash storage products.

| Markets                       |   | DRAM | SSD | FLASH | ASIC | LOGIC | TFT/LCD | ODD |
|-------------------------------|---|------|-----|-------|------|-------|---------|-----|
| Mobile/Wireless               |    | ●    | N/A | ●     | ●    | ●     | ●       | ●   |
| Notebook PCs/<br>Ultrabooks   |   | ●    | ●   | ●     | ●    | ●     | ●       | ●   |
| Desktop PCs/<br>Workstations  |  | ●    | ●   | ●     | ●    | ●     | ●       | ●   |
| Servers                       |  | ●    | ●   | ●     | ●    | ●     | ●       | ●   |
| Networking/<br>Communications |  | ●    | ●   | ●     | ●    | ●     | N/A     | ●   |
| Consumer<br>Electronics       |  | ●    | N/A | ●     | ●    | ●     | ●       | ●   |

SEMICONDUCTOR  
LARGEST  
INNOVATION  
DDR4  
CUTTING-EDGE  
FLASH  
ENTERPRISE  
DESIGN  
SSD  
DYNAMIC  
LOGIC INNOVATION  
MEMORY  
GREEN  
STORAGE  
ENTERPRISE  
POWER TOGGLE-MODE  
NAND



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## DDR3 SDRAM REGISTERED MODULES

| Density | Voltage | Organization | Part Number                        | Composition          | Compliance                          | Speed (Mbps)        | Ranks | Production |
|---------|---------|--------------|------------------------------------|----------------------|-------------------------------------|---------------------|-------|------------|
| 1GB     | 1.5V    | 128Mx72      | M393B2873GB0-C(F8/H9/K0/MA)(08/09) | 1Gb (128M x8) * 9    | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 1     | Now        |
| 2GB     | 1.5V    | 256Mx72      | M393B5673GB0-C(F8/H9/K0/MA)(08/09) | 1Gb (128M x8) * 18   | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M393B5670GB0-C(F8/H9/K0/MA)(08/09) | 1Gb (256M x4) * 18   | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 1     | Now        |
|         |         |              | M393B5773CH0-C(F8/H9)(04/05)       | 2Gb (256M x8) * 9    | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M393B5773DH0-C(F8/H9/K0/MA)(08/09) | 2Gb (256M x8) * 9    | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
| 4GB     | 1.5V    | 512Mx72      | M393B5170GB0-C(F8/H9/K0/MA)(08/09) | 1Gb (256M x4) * 36   | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M393B5273CH0-C(F8/H9)(04/05)       | 2Gb (256M x8) * 18   | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M393B5273DH0-C(F8/H9/K0/MA)(08/09) | 2Gb (256M x8) * 18   | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M393B5270CH0-C(F8/H9)(04/05)       | 2Gb (512M x4) * 18   | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
| 8GB     | 1.5V    | 1Gx72        | M393B5270DH0-C(F8/H9/K0/MA)(08/09) | 2Gb (512M x4) * 18   | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
|         |         |              | M393B1K73CH0-C(F8/H9)(04/05)       | 2Gb (256M x8) * 36   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M393B1K73DH0-C(F8/H9)(08/09)       | 2Gb (256M x8) * 36   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M393B1K70CH0-C(F8/H9)(04/05)       | 2Gb (512M x4) * 36   | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
| 16GB    | 1.5V    | 2Gx72        | M393B1K70DH0-C(F8/H9/K0/MA)(08/09) | 2Gb (512M x4) * 36   | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M393B2K70CM0-C(F8/H9)(04/05)       | 2Gb DDP (1G x4) * 36 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
| 8GB     | 1.5V    | 1Gx72        | M393B2K70DM0-C(F8/H9)(08/09)       | 2Gb DDP (1G x4) * 36 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M393B1G70BH0-C(F8/H9/K0/MA)(08/09) | 4Gb (1G x4) * 18     | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
| 16GB    | 1.5V    | 2Gx72        | M393B1G73BH0-C(F8/H9/K0/MA)(08/09) | 4Gb (512M x8) * 18   | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M393B2G70AH0-C(F8/H9)(04/05)       | 4Gb (1G x4) * 36     | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
| 32GB    | 1.5V    | 4Gx72        | M393B2G70BH0-C(F8/H9/K0/MA)(08/09) | 4Gb (1G x4) * 36     | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M393B2G73AH0-C(F8/H9)(04/05)       | 4Gb (512M x8) * 36   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
| 8GB     | 1.5V    | 1Gx72        | M393B2G73BH0-C(F8/H9)(08/09)       | 4Gb (512M x8) * 36   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M393B4G70AM0-C(F8/H9)(04/05)       | 4Gb DDP (2G x4) * 36 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
| 32GB    | 1.5V    | 4Gx72        | M393B4G70BM0-C(F8/H9)(08/09)       | 4Gb DDP (2G x4) * 36 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M393B5773CH0-Y(F8/H9)(04/05)       | 2Gb (256M x4) * 9    | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
| 2GB     | 1.35V   | 256Mx72      | M393B5773DH0-Y(F8/H9/K0)(08/09)    | 2Gb (256M x4) * 9    | Lead Free & Halogen Free            | 1066/1333/1600      | 1     | Now        |
|         |         |              | M393B5173GB0-Y(F8/H9)(08/09)       | 1Gb (128M x8) * 36   | Lead Free & Halogen Free, Flip Chip | 1066/1333           | 4     | Now        |
| 4GB     | 1.35V   | 512Mx72      | M393B5170GB0-Y(F8/H9/K0)(08/09)    | 1Gb (256M x4) * 36   | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600      | 2     | Now        |
|         |         |              | M393B5273CH0-Y(F8/H9)(04/05)       | 2Gb (256M x8) * 18   | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
| 8GB     | 1.35V   | 1Gx72        | M393B5273DH0-Y(F8/H9/K0)(08/09)    | 2Gb (256M x8) * 18   | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
|         |         |              | M393B5270CH0-Y(F8/H9)(04/05)       | 2Gb (512M x4) * 18   | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
| 16GB    | 1.35V   | 2Gx72        | M393B5270DH0-Y(F8/H9/K0)(08/09)    | 2Gb (512M x4) * 18   | Lead Free & Halogen Free            | 1066/1333/1600      | 1     | Now        |
|         |         |              | M393B1K73CH0-Y(F8/H9)(04/05)       | 2Gb (256M x8) * 36   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
| 8GB     | 1.35V   | 1Gx72        | M393B1K73DH0-Y(F8/H9)(08/09)       | 2Gb (256M x8) * 36   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M393B1K70CH0-Y(F8/H9)(04/05)       | 2Gb (512M x4) * 36   | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
| 16GB    | 1.35V   | 2Gx72        | M393B1K70DH0-Y(F8/H9/K0)(08/09)    | 2Gb (512M x4) * 36   | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
|         |         |              | M393B2K70CM0-Y(F8/H9)(04/05)       | 2Gb DDP (1G x4) * 36 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
| 8GB     | 1.35V   | 1Gx72        | M393B2K70DM0-Y(F8/H9)(08/09)       | 2Gb DDP (1G x4) * 36 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M393B1G70BH0-Y(F8/H9/K0)(08/09)    | 4Gb (1G x4) * 18     | Lead Free & Halogen Free            | 1066/1333/1600      | 1     | Now        |
| 16GB    | 1.35V   | 2Gx72        | M393B1G73BH0-Y(F8/H9/K0)(08/09)    | 4Gb (512M x8) * 18   | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
|         |         |              | M393B2G70AH0-Y(F8/H9)(04/05)       | 4Gb (1G x4) * 36     | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
| 32GB    | 1.35V   | 4Gx72        | M393B2G70BH0-Y(F8/H9/K0)(08/09)    | 4Gb (1G x4) * 36     | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
|         |         |              | M393B2G73AH0-Y(F8/H9)(04/05)       | 4Gb (512M x8) * 36   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
| 8GB     | 1.35V   | 1Gx72        | M393B2G73BH0-Y(F8/H9)(08/09)       | 4Gb (512M x8) * 36   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M393B4G70AM0-Y(F8/H9)(04/05)       | 4Gb DDP (2G x4) * 36 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
| 32GB    | 1.35V   | 4Gx72        | M393B4G70BM0-Y(F8/H9)(08/09)       | 4Gb DDP (2G x4) * 36 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |

NOTES: 04 = IDT B0 register      F8 = DDR3-1066 (7-7-7)      05 = Inphi C0 register      H9 = DDR3-1333 (9-9-9)      08 = IDT A1      K0 = DDR3-1600 (11-11-11)  
 09 = Inphi UV GS02      MA = DDR3-1866 (13-13-13)  
 \* K0 (1600Mbps) available in ES only

## DDR3 SDRAM LOAD REDUCED REGISTERED MODULES

| Density | Voltage | Organization | Part Number       | Composition          | Compliance               | Speed (Mbps) | Ranks | Production |
|---------|---------|--------------|-------------------|----------------------|--------------------------|--------------|-------|------------|
| 16GB    | 1.35V   | 2Gx72        | M386B2K70DM0-YH90 | 2Gb DDP (1G x4) * 36 | Lead Free & Halogen Free | 1333         | 4     | Now        |
| 32GB    | 1.35V   | 4Gx72        | M386B4G70BM0-YH90 | 4Gb DDP (2G x4) * 36 | Lead Free & Halogen Free | 1333         | 4     | Now        |

NOTES: 0 = Inphi iMB GS02A

## DDR3 SDRAM VLP REGISTERED MODULES

| Density | Voltage | Organization | Part Number                        | Composition            | Compliance                          | Speed (Mbps)        | Ranks | Production |
|---------|---------|--------------|------------------------------------|------------------------|-------------------------------------|---------------------|-------|------------|
| 1GB     | 1.5V    | 128Mx72      | M392B2873GB0-C(F8/H9/K0/MA)(08/09) | 1Gb (128M x8) * 9      | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 1     | Now        |
| 2GB     | 1.5V    | 256Mx72      | M392B5673GB0-C(F8/H9/K0/MA)(08/09) | 1Gb (128M x8) * 18     | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M392B5670GB0-C(F8/H9/K0/MA)(08/09) | 1Gb (256M x8) * 18     | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 1     | Now        |
|         |         |              | M392B5773CHO-C(F8/H9)(04/05)       | 2Gb (256M x8) * 9      | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M392B5773DHO-C(F8/H9/K0/MA)(08/09) | 2Gb (256M x8) * 9      | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
| 4GB     | 1.5V    | 512Mx72      | M392B5273CHO-C(F8/H9)(04/05)       | 2Gb (256M x8) * 18     | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M392B5273DHO-C(F8/H9/K0/MA)(08/09) | 2Gb (256M x8) * 18     | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M392B5270CHO-C(F8/H9)(04/05)       | 2Gb (512M x4) * 18     | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M392B5270DHO-C(F8/H9/K0/MA)(08/09) | 2Gb (512M x4) * 18     | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
| 8GB     | 1.5V    | 1Gx72        | M392B1K73CM0-C(F8/H9)(04/05)       | 2Gb DDP (512M x8) * 18 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M392B1K73DM0-C(F8/H9)(08/09)       | 2Gb DDP (512M x8) * 18 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M392B1K70CM0-C(F8/H9)(04/05)       | 2Gb DDP (1G x4) * 18   | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M392B1K70DM0-C(F8/H9/K0/MA)(08/09) | 2Gb DDP (1G x4) * 18   | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M392B1G73BH0-C(F8/H9/K0/MA)(08/09) | 4Gb (512M x8) * 18     | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
|         |         |              | M392B1G70BH0-C(F8/H9/K0/MA)(08/09) | 4Gb (1G x4) * 18       | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
| 16GB    | 1.5V    | 2Gx72        | M392B2G70AM0-C(F8/H9)(04/05)       | 4Gb DDP (2G x4) * 18   | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M392B2G70BM0-C(F8/H9/K0/MA)(08/09) | 4Gb DDP (2G x4) * 18   | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M392B2G73AM0-C(F8/H9)(04/05)       | 4Gb DDP (1G x8) * 18   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M392B2G73BM0-C(F8/H9)(08/09)       | 4Gb DDP (1G x8) * 18   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
| 2GB     | 1.35V   | 256Mx72      | M392B5773CHO-Y(F8/H9)(04/05)       | 2Gb (256M x8) * 9      | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M392B5773DHO-Y(F8/H9/K0)(08/09)    | 2Gb (256M x8) * 9      | Lead Free & Halogen Free            | 1066/1333/1600      | 1     | Now        |
| 4GB     | 1.35V   | 512Mx72      | M392B5273CHO-Y(F8/H9)(04/05)       | 2Gb (256M x8) * 18     | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M392B5273DHO-Y(F8/H9/K0)(08/09)    | 2Gb (256M x8) * 18     | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
|         |         |              | M392B5270CHO-Y(F8/H9)(04/05)       | 2Gb (512M x4) * 18     | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M392B5270DHO-Y(F8/H9/K0)(08/09)    | 2Gb (512M x4) * 18     | Lead Free & Halogen Free            | 1066/1333/1600      | 1     | Now        |
| 8GB     | 1.35V   | 1Gx72        | M392B1K73CM0-Y(F8/H9)(04/05)       | 2Gb DDP (512M x8) * 18 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M392B1K73DM0-Y(F8/H9)(08/09)       | 2Gb DDP (512M x8) * 18 | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M392B1K70CM0-Y(F8/H9)(04/05)       | 2Gb DDP (1G x4) * 18   | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M392B1K70DM0-Y(F8/H9/K0)(08/09)    | 2Gb DDP (1G x4) * 18   | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
|         |         |              | M392B1G73BH0-Y(F8/H9/K0)(08/09)    | 4Gb (512M x8) * 18     | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
|         |         |              | M392B1G70BH0-Y(F8/H9/K0)(08/09)    | 4Gb (1G x4) * 18       | Lead Free & Halogen Free            | 1066/1333/1600      | 1     | Now        |
| 16GB    | 1.35V   | 2Gx72        | M392B2G70AM0-Y(F8/H9)(04/05)       | 4Gb DDP (2G x4) * 18   | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M392B2G70BM0-Y(F8/H9/K0)(08/09)    | 4Gb DDP (2G x4) * 18   | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
|         |         |              | M392B2G70AM0-Y(F8/H9)(04/05)       | 4Gb DDP (1G x8) * 18   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
|         |         |              | M392B2G70BM0-Y(F8/H9)(08/09)       | 4Gb DDP (1G x8) * 18   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |
| 32GB    | 1.35V   | 4Gx72        | M392B4G70BE0-Y(F8/H9)(08)          | 4Gb QDP (4G x4) * 18   | Lead Free & Halogen Free            | 1066/1333           | 4     | Now        |

NOTES: 04 = IDT B0 register      F8 = DDR3-1066 (7-7-7)  
05 = Inphi C0 register      H9 = DDR3-1333 (9-9-9)  
08 = IDT A1                      K0 = DDR3-1600 (11-11-11)  
09 = Inphi UV GS02          MA = DDR3-1866 (13-13-13)

## DDR3 SDRAM UNBUFFERED MODULES

| Density | Voltage | Organization | Part Number                 | Composition        | Compliance                          | Speed (Mbps)        | Ranks | Production |
|---------|---------|--------------|-----------------------------|--------------------|-------------------------------------|---------------------|-------|------------|
| 1GB     | 1.5V    | 128Mx64      | M378B2873GB0-C(F8/H9/K0/MA) | 1Gb (128M x8) * 8  | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 1     | Now        |
|         |         |              | M378B5673GB0-C(F8/H9/K0/MA) | 1Gb (128M x8) * 16 | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 2     | Now        |
| 2GB     | 1.5V    | 256Mx64      | M378B5773CH0-C(F8/H9)       | 2Gb (256M x8) * 8  | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M378B5773DH0-C(F8/H9/K0/MA) | 2Gb (256M x8) * 8  | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
| 4GB     | 1.5V    | 512Mx64      | M378B5273CH0-C(F8/H9)       | 2Gb (256M x8) * 16 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M378B5273DH0-C(F8/H9/K0/MA) | 2Gb (256M x8) * 16 | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
| 8GB     | 1.5V    | 1024Mx64     | M378B1G73AH0-C(F8/H9)       | 4Gb (512M x8) * 16 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M378B1G73BH0-C(F8/H9/K0/MA) | 4Gb (512M x8) * 16 | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |

## DDR3 SDRAM UNBUFFERED MODULES (ECC)

| Density | Voltage | Organization | Part Number                 | Composition        | Compliance                          | Speed (Mbps)        | Ranks | Production |
|---------|---------|--------------|-----------------------------|--------------------|-------------------------------------|---------------------|-------|------------|
| 1GB     | 1.5V    | 128Mx72      | M391B2873GB0-C(F8/H9/K0/MA) | 1Gb (128M x8) * 9  | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 1     | Now        |
| 2GB     | 1.5V    | 256Mx72      | M391B5673GB0-C(F8/H9/K0/MA) | 1Gb (128M x8) * 18 | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M391B5773CH0-C(F8/H9)       | 2Gb (256M x8) * 9  | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M391B5773DH0-C(F8/H9/K0/MA) | 2Gb (256M x8) * 9  | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
| 4GB     | 1.5V    | 512Mx72      | M391B5273CH0-C(F8/H9)       | 2Gb (256M x8) * 18 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M391B5273DH0-C(F8/H9/K0/MA) | 2Gb (256M x8) * 18 | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
| 8GB     | 1.5V    | 1024Mx72     | M391B1G73AH0-C(F8/H9)       | 4Gb (512M x8) * 18 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M391B1G73BH0-C(F8/H9/K0/MA) | 4Gb (512M x8) * 18 | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
| 1GB     | 1.35V   | 128Mx72      | M391B2873GB0-Y(F8/H9/K0)    | 1Gb (128M x8) * 9  | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600      | 1     | Now        |
| 2GB     | 1.35V   | 256Mx72      | M391B5673GB0-Y(F8/H9/K0)    | 1Gb (128M x8) * 18 | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600      | 2     | Now        |
|         |         |              | M391B5773CH0-Y(F8/H9)       | 2Gb (256M x8) * 9  | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M391B5773DH0-Y(F8/H9/K0)    | 2Gb (256M x8) * 9  | Lead Free & Halogen Free            | 1066/1333/1600      | 1     | Now        |
| 4GB     | 1.35V   | 512Mx72      | M391B5273CH0-Y(F8/H9)       | 2Gb (256M x8) * 18 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M391B5273DH0-Y(F8/H9/K0)    | 2Gb (256M x8) * 18 | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
| 8GB     | 1.35V   | 1024Mx72     | M391B1G73AH0-Y(F8/H9)       | 4Gb (512M x8) * 18 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M391B1G73BH0-Y(F8/H9/K0)    | 4Gb (512M x8) * 18 | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |

NOTES: F8 = DDR3-1066 (7-7-7) H9 = DDR3-1333 (9-9-9) K0 = 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 |
|---------|---------|--------------|-----------------------------|--------------------|-------------------------------------|---------------------|-------|------------|
| 1GB     | 1.5V    | 128Mx64      | M471B2873GB0-C(F8/H9/K0/MA) | 1Gb (128M x8) * 8  | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 1     | Now        |
|         |         |              | M471B5673GB0-C(F8/H9/K0/MA) | 1Gb (128M x8) * 16 | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 2     | Now        |
| 2GB     | 1.5V    | 256Mx64      | M471B5773CHS-C(F8/H9)       | 2Gb (256M x8) * 8  | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M471B5773DHO-C(F8/H9/K0/MA) | 2Gb (256M x8) * 8  | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
| 4GB     | 1.5V    | 512Mx64      | M471B5273CHO-C(F8/H9)       | 2Gb (256M x8) * 16 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M471B5273DHO-C(F8/H9/K0/MA) | 2Gb (256M x8) * 16 | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
|         |         |              | M471B5173BHO-C(F8/H9/K0/MA) | 4Gb (512M x8) * 8  | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 1     | Now        |
| 8GB     | 1.5V    | 1024Mx64     | M471B1G73AHO-C(F8/H9/K0)    | 4Gb (512M x8) * 16 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M471B1G73BHO-C(F8/H9/K0/MA) | 4Gb (512M x8) * 16 | Lead Free & Halogen Free            | 1066/1333/1600/1866 | 2     | Now        |
| 1GB     | 1.35V   | 128Mx64      | M471B2873GB0-Y(F8/H9/K0)    | 1Gb (128M x8) * 8  | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600/1866 | 1     | Now        |
| 2GB     | 1.35V   | 256Mx64      | M471B5673GB0-Y(F8/H9/K0)    | 1Gb (128M x8) * 16 | Lead Free & Halogen Free, Flip Chip | 1066/1333/1600      | 2     | Now        |
|         |         |              | M471B5773CHS-Y(F8/H9)       | 2Gb (256M x8) * 8  | Lead Free & Halogen Free            | 1066/1333           | 1     | Now        |
|         |         |              | M471B5773DHO-Y(F8/H9/K0)    | 2Gb (256M x8) * 8  | Lead Free & Halogen Free            | 1066/1333/1600      | 1     | Now        |
| 4GB     | 1.35V   | 512Mx64      | M471B5273CHO-Y(F8/H9)       | 2Gb (256M x8) * 16 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M471B5273DHO-Y(F8/H9/K0)    | 2Gb (256M x8) * 16 | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |
|         |         |              | M471B5173BHO-Y(F8/H9/K0)    | 4Gb (512M x8) * 8  | Lead Free & Halogen Free            | 1066/1333/1600      | 1     | Now        |
| 8GB     | 1.35V   | 1024Mx64     | M471B1G73AHO-Y(F8/H9)       | 4Gb (512M x8) * 16 | Lead Free & Halogen Free            | 1066/1333           | 2     | Now        |
|         |         |              | M471B1G73BHO-Y(F8/H9/K0)    | 4Gb (512M x8) * 16 | Lead Free & Halogen Free            | 1066/1333/1600      | 2     | Now        |

NOTES: F8 = DDR3-1066 (7-7-7) H9 = DDR3-1333 (9-9-9) K0 = DDR3-1600 (11-11-11) MA = DDR3-1866 (13-13-13)

## DDR2 SDRAM UNBUFFERED MODULES (ECC)

| Density | Organization | Part Number           | Composition | Compliance | Speed (Mbps) | Rank | Production |
|---------|--------------|-----------------------|-------------|------------|--------------|------|------------|
| 1GB     | 128Mx72      | M391T2863FB3-C(E6/F7) | (128Mx8)*9  | Lead free  | 667/800      | 1    | Now        |
| 2GB     | 256Mx64      | M391T5663FB3-C(E6/F7) | (128Mx8)*18 | Lead free  | 667/800      | 2    | Now        |

NOTES: E6 = PC2-5300 (DDR2-667 @ CL=5) E7 = PC2-6400 (DDR2-800 @ CL=5)  
F7 = PC2-6400 (DDR2-800 @ CL=6) Voltage = 1.8V

## DDR2 SDRAM SODIMM MODULES

| Density | Organization | Part Number              | Composition | Compliance | Speed (Mbps) | Rank | Production |
|---------|--------------|--------------------------|-------------|------------|--------------|------|------------|
| 1GB     | 128Mx64      | M470T2863FB3-C(E6/F7/E7) | (64Mx16)*8  | Lead free  | 667/800      | 2    | Now        |
| 2GB     | 256Mx64      | M470T5663FB3-C(E6/F7/E7) | (128M x8)*8 | Lead free  | 667/800      | 2    | Now        |

NOTES: E6 = PC2-5300 (DDR2-667 @ CL=5) E7 = PC2-6400 (DDR2-800 @ CL=5)  
F7 = PC2-6400 (DDR2-800 @ CL=6) Voltage = 1.8V

## DDR2 SDRAM COMPONENTS

| Density | Organization | Part Number                | # Pins-Package | Dimensions | Package                  | Speed (Mbps) | Production |
|---------|--------------|----------------------------|----------------|------------|--------------------------|--------------|------------|
| 256Mb   | 16Mx16       | K4T56163QN-HC(E6/F7/E7/F8) | 84-FBGA        | 7.5x12.5mm | Lead free & Halogen free | 667/800/1066 | Now        |
| 512Mb   | 128M x4      | K4T51043QJ-HC(E6/F7/E7)    | 60-FBGA        | 7.5x9.5mm  | Lead free & Halogen free | 667/800      | Now        |
|         | 64M x8       | K4T51083QJ-HC(E6/F7/E7/F8) | 60-FBGA        | 7.5x9.5mm  | Lead free & Halogen free | 667/800/1066 | Now        |
|         | 32M x16      | K4T51163QJ-HC(E6/F7/E7/F8) | 84-FBGA        | 7.5x12.5mm | Lead free & Halogen free | 667/800/1066 | Now        |
| 1Gb     | 256M x4      | K4T1G044QF-BC(E6/F7/E7)    | 60-FBGA        | 7.5x9.5mm  | Lead free & Halogen free | 667/800      | Now        |
|         | 128M x8      | K4T1G084QF-BC(E6/F7/E7/F8) | 60-FBGA        | 7.5x9.5mm  | Lead free & Halogen free | 667/800/1066 | Now        |
|         | 64M x16      | K4T1G164QF-BC(E6/F7/E7/F8) | 84-FBGA        | 7.5x12.5mm | Lead free & Halogen free | 667/800/1066 | Now        |

## DDR SDRAM COMPONENTS

| Density | Organization | Part Number        | # Pins - Package | Speed (Mbps) |
|---------|--------------|--------------------|------------------|--------------|
| 512Mb   | 128Mx4       | K4H510438J-LCB3/B0 | 66-TSOP          | 266/333      |
|         |              | K4H510438J-BCCC/B3 | 60-FBGA          | 333/400      |
|         | 64Mx8        | K4H510838J-LCCC/B3 | 66-TSOP          | 333/400      |
|         |              | K4H510838J-BCCC/B3 | 60-FBGA          | 333/400      |
|         | 32Mx16       | K4H511638J-LCCC/B3 | 66-TSOP          | 333/400      |
| 256Mb   | 64Mx4        | K4H560438N-LCB3/B0 | 66-TSOP          | 266/333      |
|         | 32Mx8        | K4H560838N-LCCC/B3 | 66-TSOP          | 333/400      |
|         | 16Mx16       | K4H561638N-LCCC/B3 | 66-TSOP          | 333/400      |
| 128Mb   | 8Mx16        | K4H2816380-LCCC    | 66-TSOP          | 400          |

NOTES: B0 = DDR266 (133MHz @ CL=2.5)    A2 = DDR266 (133MHz @ Cl=2)    B3 = DDR333 (166MHz @ CL=2.5)    CC = DDR400 (200MHz @ CL=3)

## MOBILE DRAM COMPONENTS

| Density | Type       | Organization     | Part Number                        | Package                             | Power | Production |
|---------|------------|------------------|------------------------------------|-------------------------------------|-------|------------|
| 512Mb   | MDDR       | 32Mx16           | K4X51163PK-FGD8                    | 60-FBGA, 800MHz                     | 1.8V  | Now        |
|         |            | 16Mx32           | K4X51323PK-8GD8                    | 90-FBGA, 800MHz                     | 1.8V  | Now        |
| 1Gb     |            | 32Mx32           | K4X1G323PF-8GD8                    | 90-FBGA, 800MHz                     | 1.8V  | Now        |
| 2Gb     |            | 64Mx32           | K4X2G323PD-8GD8                    | 90-FBGA, 800MHz                     | 1.8V  | Now        |
| 4Gb     |            | x32 (2CS, 2CKE)  | K4X4G303PD-AGD8                    | 168-FBGA, 12x12 PoP, DDP, . 800MHz  | 1.8V  | Now        |
| 2Gb     |            | 1CH x32          | K4P2G324ED-AG(1)                   | 168-FBGA, 12x12 PoP, MONO,          | 1.2V  | Now        |
| 4Gb     |            | 1CH x32          | K4P4G324EB-AG(1,2)                 | 168-FBGA, 12x12 PoP, MONO, 128Mx32  | 1.2V  | Now        |
|         |            | 1CH x32          | K4P4G324EC-AG(2)                   | 168-FBGA, 12x12 PoP, MONO, 128Mx32  | 1.2V  | ES         |
|         |            | 2CH x32/ch       | K3PE4E400P-XG(2)                   | 216FBGA, 12x12 PoP, DDP, 64Mx32*2   | 1.2V  | Now        |
|         |            | 2CH x32/ch       | K3PE4E400D-XG(2)                   | 220FBGA, 14x14 PoP, DDP, 64Mx32*2   | 1.2V  | CS         |
|         | 2CH x32/ch | K3PE4E400K-XG(2) | 240-FBGA, 14x14 PoP, DDP, 64Mx32*2 | 1.2V                                | Now   |            |
|         | 2CH x32/ch | K3PE4E400L-XG(2) | 240-FBGA, 14x14 PoP, DDP, 64Mx32*2 | 1.2V                                | ES    |            |
| 8Gb     | LPDDR2     | 1CH x32          | K4P8G304EB-FG(1,2)                 | 134-FBGA, 11x11.5 , DDP, 128x16*4   | 1.2V  | Now        |
|         |            | 1CH x32          | K4P8G304EB-AG(1)                   | 168-FBGA, 12x12 PoP, DDP, 128x16*4  | 1.2V  | Now        |
|         |            | 1CH x32          | K4P8G304EB-GG(2)                   | 216FBGA, 12x12 PoP, DDP, 128x16*4   | 1.2V  | CS         |
|         |            | 1CH x32          | K4P8G304EC-FG(2)                   | 134-FBGA, 11x11.5 , DDP, 128x16*4   | 1.2V  | ES         |
|         |            | 1CH x32          | K4P8G304EC-AG(2)                   | 168-FBGA, 12x12 PoP, DDP, 128x16*4  | 1.2V  | ES         |
|         |            | 2CH x32/ch       | K3PE7E700M-XG(2)                   | 216-FBGA, 12x12 PoP, DDP, 128Mx32*2 | 1.2V  | Now        |
|         |            | 2CH x32/ch       | K3PE7E700D-XG(2)                   | 220-FBGA, 14x14 PoP, DDP, 128Mx32*2 | 1.2V  | Now        |
|         |            | 2CH x32/ch       | K3PE7E700A-XG(2)                   | 240-FBGA, 14x14 PoP, DDP, 128Mx32*2 | 1.2V  | Now        |
|         |            | 2CH x32/ch       | K3PE7E700P-XG(2)                   | 220-FBGA, 14x14 PoP, DDP, 128Mx32*2 | 1.2V  | CS         |
|         |            | 2CH x32/ch       | K3PE7E700L-XG(2)                   | 216-FBGA, 12x12 PoP, DDP, 128Mx32*2 | 1.2V  | CS         |
| 16Gb    | LPDDR2     | 2CH x32/ch       | K3PE7E700N-XG(2)                   | 240-FBGA, 14x14 PoP, DDP, 128Mx32*2 | 1.2V  | ES         |
|         |            | 1CH x32          | K4PAG304EB-FG(2)                   | 134-FBGA, 11x11.5 , QDP             | 1.2V  | Now        |
|         |            | 1CH x32          | K4PAG304EC-FG(2)                   | 134-FBGA, 11x11.5 , QDP             | 1.2V  | ES         |
|         |            | 2CH x32/ch       | K3PE0E000M-XG(2)                   | 216-FBGA, 12x12 PoP, QDP, 128Mx32*4 | 1.2V  | Now        |
|         |            | 2CH x32/ch       | K3PE0E000A-XG(2)                   | 220-FBGA, 14x14 PoP, QDP, 128Mx32*4 | 1.2V  | Now        |
|         |            | 2CH x32/ch       | K3PE0E000B-XG(2)                   | 240-FBGA, 14x14 PoP, QDP, 128Mx32*4 | 1.2V  | Now        |
|         |            | 2CH x32/ch       | K3PE0E000E-XG(2)                   | 220-FBGA, 14x14 PoP, QDP, 128Mx32*4 | 1.2V  | ES         |
|         |            | 2CH x32/ch       | K3PE0E000C-XG(2)                   | 216-FBGA, 12x12 PoP, QDP, 128Mx32*4 | 1.2V  | ES         |
| 4Gb     | LPDDR3     | 2CH x32/ch       | K3PE0E000D-XG(2)                   | 240-FBGA, 14x14 PoP, QDP, 128Mx32*4 | 1.2V  | ES         |
|         |            | 1CH x32          | K4E4E324EB-EGCE                    | 178-FBGA, 11x11.5 , MONO , 1066 MHz | 1.2V  | ES         |
|         |            | 1CH x32          | K4E8E304EB-EGCE                    | 178-FBGA, 11x11.5 , DDP, 1066 MHz   | 1.2V  | ES         |
|         |            | 2CH x32/ch       | K3QF1F100B-PGCE                    | 253-FBGA, 11x11.5 , DDP, 1066 MHz   | 1.2V  | ES         |
|         |            | 2CH x32/ch       | K3QF1F100G-XGCE                    | 216-FBGA, 15x15 PoP , DDP, 1066 MHz | 1.2V  | ES         |
|         |            | 1CH x32          | K4E6E304EB-EGCE                    | 178-FBGA, 11x11.5 , QDP, 1066 MHz   | 1.2V  | ES         |
|         |            | 2CH x32/ch       | K3QF2F200A-XGCE                    | 253-FBGA, 11x11.5 , QDP, 1066 MHz   | 1.2V  | ES         |
|         |            | 2CH x32/ch       | K3QF2F200B-XGCE                    | 216-FBGA, 15x15 PoP , QDP, 1066 MHz | 1.2V  | ES         |

NOTES: (1,2) SPEED: MOBILE LPDDR2 (1) C1: 800MHZ (2) C2: 1066MHZ

## GRAPHICS DRAM COMPONENTS

| Type  | Density | Organization | Part Number                | Package  | VDD/VDDQ    | Speed Bin (MHz)  | Production |
|-------|---------|--------------|----------------------------|----------|-------------|------------------|------------|
| GDDR5 | 2Gb     | 64Mx32       | K4G20325FD-FC(04/03/28)    | 170-FBGA | 1.5V/1.5V   | 1250/1500/1750   | Now        |
|       |         |              | K4G20325FD-FC(04/03)       | 170-FBGA | 1.35V/1.35V | 1000/1250        | Now        |
|       | 1Gb     | 32Mx32       | K4G10325FG-HC03            | 170-FBGA | 1.6V/1.6V   | 1500             | Now        |
|       |         |              | K4G10325FG-HC(05/04)       | 170-FBGA | 1.5V/1.5V   | 1000/1250        | Now        |
|       |         |              | K4G10325FG-HC(04/03)       | 170-FBGA | 1.35V/1.35V | 900/1050         | Now        |
| GDDR3 | 1Gb     | 32Mx32       | K4J10324KG-HC(14/1A)       | 136-FBGA | 1.8V/1.8V   | 700/1000         | Now        |
| gDDR3 | 4Gb     | 256Mx16      | K4W4G1646B-HC(12/11/1A)    | 96-FBGA  | 1.5V/1.5V   | 800/933/1066     | Now        |
|       | 2Gb     | 128Mx16      | K4W2G1646E-BC(15/12/11/1A) | 96-FBGA  | 1.5V/1.5V   | 667/800/933/1066 | Now        |
|       | 1Gb     | 64Mx16       | K4W1G1646G-BC(15/12/11/1A) | 96-FBGA  | 1.5V/1.5V   | 667/800/933/1066 | Now        |

NOTES: **Package**

H: FBGA (Halogen Free & Lead Free)  
B: FBGA (Halogen Free & Lead Free)

**(1) Speeds (clock cycle - speed bin)**

03: 0.3ns (3000MHz) 08: 0.83ns (1200MHz) 14: 1.429ns (700MHz)  
04: 0.4ns (2500MHz) 1A: 1ns (1000MHz GDDR3) 20: 2.0ns (500MHz)  
05: 0.5ns (2000MHz) 1A: 1ns (1066MHz gDDR3) 25: 2.5ns (400MHz)  
5C: 0.555 (1800MHz) 11: 1.1ns (933MHz)  
12: 1.25ns (800MHz)

# 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                       |
| SAMSUNG Memory   |   |   |   |    |    |   |   |   |   |    | Speed                    |
| DRAM             |   |   |   |    |    |   |   |   |   |    | Temp & Power             |
| DRAM Type        |   |   |   |    |    |   |   |   |   |    | Package Type             |
| Density          |   |   |   |    |    |   |   |   |   |    | Revision                 |
| Bit Organization |   |   |   |    |    |   |   |   |   |    | Interface (VDD, VDDQ)    |
|                  |   |   |   |    |    |   |   |   |   |    | Number of Internal Banks |

## 1. Memory (K)

08: x8

## 2. DRAM: 4

15: x16 (2CS)

## 3. DRAM Type

B: DDR3 SDRAM  
D: GDDR SDRAM  
G: GDDR5 SDRAM

16: x16

26: x4 Stack (JEDEC Standard)

27: x8 Stack (JEDEC Standard)

30: x32 (2CS, 2CKE)

31: x32 (2CS)

32: x32

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

## 6. # of Internal Banks

2: 2 Banks

3: 4 Banks

4: 8 Banks

5: 16 Banks

## 7. Interface ( VDD, VDDQ)

2: LVTTTL, 3.3V, 3.3V

4: LVTTTL, 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: LVTTTL, 1.8V, 1.5V

N: LVTTTL, 1.5V, 1.5V

P: LVTTTL, 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. Revision

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)

## 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: x2

04: x4

06: x4 Stack (Flexframe)

07: x8 Stack (Flexframe)

## 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                       |
| SAMSUNG Memory   |   |   |   |    |    |   |   |   |   |    | Speed                    |
| DRAM             |   |   |   |    |    |   |   |   |   |    | Temp & Power             |
| DRAM Type        |   |   |   |    |    |   |   |   |   |    | Package Type             |
| Density          |   |   |   |    |    |   |   |   |   |    | Revision                 |
| Bit Organization |   |   |   |    |    |   |   |   |   |    | Interface (VDD, VDDQ)    |
|                  |   |   |   |    |    |   |   |   |   |    | Number of Internal Banks |

### 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

### 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 of Lead-free or Halogen-free product are in compliance with RoHS

## 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"

# 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                  |
| SAMSUNG Memory      |   |   |    |   |    |   |   |   |   |    |    |    | AMB Vendor         |
| DIMM                |   |   |    |   |    |   |   |   |   |    |    |    | Speed              |
| Data bits           |   |   |    |   |    |   |   |   |   |    |    |    | Temp & Power       |
| DRAM Component Type |   |   |    |   |    |   |   |   |   |    |    |    | PCB Revision       |
| Depth               |   |   |    |   |    |   |   |   |   |    |    |    | Package            |
| Number of Banks     |   |   |    |   |    |   |   |   |   |    |    |    | Component Revision |
| Bit Organization    |   |   |    |   |    |   |   |   |   |    |    |    |                    |

## 1. Memory Module: M

### 2. DIMM Type

- 3: DIMM
- 4: SODIMM

### 3. Data bits

- 12: x72 184pin Low Profile Registered DIMM
- 63: x63 PC100/PC133 μSODIMM with SPD for 144pin
- 64: x64 PC100/PC133 SODIMM with SPD for 144pin (Intel/JEDEC)
- 66: x64 Unbuffered DIMM with SPD for 144pin/168pin (Intel/JEDEC)
- 68: x64 184pin Unbuffered DIMM
- 70: x64 200pin Unbuffered SODIMM
- 71: x64 204pin Unbuffered SODIMM
- 74: x72/ECC Unbuffered DIMM with SPD for 168pin (Intel/JEDEC)
- 77: x72/ECC PLL + Register DIMM with SPD for 168pin (Intel PC100)
- 78: x64 240pin Unbuffered DIMM
- 81: x72 184pin ECC unbuffered DIMM
- 83: x72 184pin Registered DIMM
- 90: x72/ECC PLL + Register DIMM
- 91: x72 240pin ECC unbuffered DIMM
- 92: x72 240pin VLP Registered DIMM
- 93: x72 240pin Registered DIMM
- 95: x72 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 & LVTTT (SDR Only)
- 5: 8K/64ms Ref., 4Banks & LVTTT (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. Component Revision

- 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 of Lead-free or Halogen-free product are in compliance with RoHS

## SLC FLASH

| Density   | Technology | Part Number      | Package Type          | Org. | Vol(V)  | Status     |
|-----------|------------|------------------|-----------------------|------|---------|------------|
| 512Gb HDP | 21nm DDR   | K9WDGY8S5M-CCK*  | 316FBGA               | x8   | 3.3/1.8 | CS Q2 2012 |
| 256Gb ODP | 21nm DDR   | K9QFGY8S7M-CCK*  | 316FBGA               | x8   | 3.3/1.8 | CS Q2 2012 |
| 128Gb QDP | 21nm DDR   | K9VHGY8SCM-CCK*  | 316FBGA               | x8   | 3.3/1.8 | CS Q2 2012 |
| 16Gb QDP  | 42nm SDR   | K9WAG08U1D-SCB0* | TSOP1                 | x8   | 3.3     | MP         |
|           |            | K9WAG08U1D-SIB0* | TSOP1                 | x8   | 3.3     | MP         |
| 8Gb DDP   | 42nm SDR   | K9K8G08U0D-SCB0* | TSOP-LF/HF            | x8   | 3.3     | MP         |
|           |            | K9K8G08U0D-SIB0* | TSOP-LF/HF, i-temp    | x8   | 3.3     | MP         |
| 4Gb       | 42nm SDR   | K9F4G08U0D-SCB0* | TSOP1 HF & LF         | x8   | 3.3     | MP         |
|           |            | K9F4G08U0D-SIB0* | TSOP1 HF & LF, i-temp | x8   | 3.3     | MP         |
| 2Gb       | 42nm SDR   | K9F2G08U0C-SCB0* | TSOP-LF/HF            | x8   | 3.3     | MP         |
|           |            | K9F2G08U0C-SIB0* | TSOP-LF/HF, i-temp    | x8   | 3.3     | MP         |
| 1Gb       | 42nm SDR   | K9F1G08U0D-SCB0* | TSOP-LF/HF            | x8   | 3.3     | MP         |
|           |            | K9F1G08U0D-SIB0* | TSOP-LF/HF, i-temp    | x8   | 3.3     | MP         |

Please contact your local Samsung sales representative for latest product offerings.

Note: All parts are lead free

## MLC FLASH

| Type      | Density   | Technology | Part Number        | Package Type       | Org.   | Vol(V)  | Status |    |
|-----------|-----------|------------|--------------------|--------------------|--------|---------|--------|----|
| 2bit      | 512Gb ODP | 21nm DDR   | K9PHGY8S5A-HCK0000 | 132BGA             | x8     | 3.3/1.8 | MP     |    |
|           | 256Gb QDP | 21nm DDR   | K9HFGY8S5A-HCK0000 | 132BGA             | x8     | 3.3/1.8 | MP     |    |
|           | 128Gb QDP | 21nm DDR   | 27nm DDR           | K9HDG08U1A-SCB0000 | 48TSOP | x8      | 3.3    | MP |
|           |           |            | 21nm DDR           | K9HDGY8U5B-HCK0000 | 132BGA | x8      | 3.3    | MP |
|           |           |            | 21nm DDR           | K9HDGY8U5B-HCK0000 | 132BGA | x8      | 3.3    | MP |
|           | 128Gb DDP | 21nm DDR   | K9LDGY8S1A-HCK0000 | 132BGA             | x8     | 3.3/1.8 | MP     |    |
|           | 64Gb DDP  | 21nm DDR   | K9LCG08U0B-SCB0000 | 48TSOP             | x8     | 3.3     | MP     |    |
|           |           | 21nm SDR   | K9LCGY8U1B-HCK0000 | 132BGA             | x8     | 3.3     | MP     |    |
|           | 64Gb mono | 21nm DDR   | K9GCGY8S0A-HCK0000 | 132BGA             | x8     | 3.3     | MP     |    |
|           | 32Gb mono | 21nm SDR   | K9GBG08U0A-SCB0000 | 48TSOP             | x8     | 3.3     | MP     |    |
|           |           | 21nm DDR   | K9GBGY8U0B-HCK0000 | 60LGA              | x9     | 3.3/1.8 | MP     |    |
|           | 16Gb mono | 27nm SDR   | K9GAG08U0F-SCB0000 | 48TSOP             | x8     | 3.3     | MP     |    |
|           |           | 27nm DDR   | K9GAGD8U0F-MCB0000 | 60LGA              | x8     | 3.3     | MP     |    |
|           | 3bit      | 256Gb QDP  | 21nm DDR           | K9CFGD8U1A-SCB0000 | TSOP   | x8      | 3.3    | MP |
| 128Gb DDP |           | 21nm DDR   | K9BDGD8U0A-SCB0000 | TSOP               | x8     | 3.3     | MP     |    |
| 64Gb mono |           | 21nm DDR   | K9ACGD8U0A-SCB0000 | TSOP               | x8     | 3.3     | MP     |    |
| 32Gb mono |           | 21nm DDR   | K9ABGD8U0C-SCB0000 | TSOP               | x8     | 3.3     | MP     |    |

Please contact your local Samsung sales representative for latest product offerings.

Note: All parts are lead-free & halogen-free

## SD and MicroSD FLASH CARDS

| Application | Density | Part Number        |
|-------------|---------|--------------------|
| SD Cards    | 2GB     | MMAGF02GWFCA-2MN00 |
|             | 4GB     | MMBTF04GWBCA-QME00 |
|             | 8GB     | MMBTF08GWBCA-RME00 |
|             | 16GB    | MMBTF16GWBCA-RME00 |
| uSD Cards   | 2GB     | MMAUR02G3ACA-QMP00 |
|             | 4GB     | MMBTR04GUBCA-2ME00 |
|             | 8GB     | MMBTR08GUBCA-2ME00 |
|             | 16GB    | MMBTR16GUBCA-2ME00 |
|             | 32GB    | MMBTR32GUBCA-2AB00 |

Please contact your local Samsung sales representative for part numbers and latest product offerings.

## eMMC

| Density | Flash  | Part Number        | Class (Random W IOPS) | MMC Version | Package Type | Org. | Vol (V) | Status |
|---------|--------|--------------------|-----------------------|-------------|--------------|------|---------|--------|
| 4GB     | 32Gb*1 | KLM4G1FE3B-B001xxx | 50                    | v4.41       | 11.5x13 BGA  | x8   | 1.8/3.3 | MP     |
|         | 32Gb*1 | KLM4G1YE4C-B001xxx | 100                   | v4.41       | 11.5x13 BGA  | x8   | 1.8/3.3 | MP     |
| 8GB     | 32Gb*1 | KLM4G1FE3B-B001xxx | 50                    | v4.41       | 11.5x13 BGA  | x8   | 1.8/3.3 | MP     |
|         | 32Gb*1 | KLM4G1YE4C-B001xxx | 100                   | v4.41       | 11.5x13 BGA  | x8   | 1.8/3.3 | MP     |
| 16GB    | 64Gb*2 | KLMAG2WE4A-A001xxx | 250                   | v4.41       | 12x16 BGA    | x8   | 1.8/3.3 | MP     |
|         | 64Gb*2 | KLMAG2GE4A-A001xxx | 400                   | v4.41       | 12x16 BGA    | x8   | 1.8/3.3 | MP     |
|         | 64Gb*2 | KLMAG2GE2A-A001xxx | 1500                  | v4.5        | 12x16 BGA    | x8   | 1.8/3.3 | MP     |
| 32GB    | 64Gb*4 | KLMBG4WE4A-A001xxx | 400                   | v4.41       | 12x16 BGA    | x8   | 1.8/3.3 | MP     |
|         | 64Gb*4 | KLMBG4GE2A-A001xxx | 1500                  | v4.5        | 12x16 BGA    | x8   | 1.8/3.3 | MP     |
| 64GB    | 64Gb*8 | KLMCG8GE4A-A001xxx | 400                   | v4.41       | 12x16 BGA    | x8   | 1.8/3.3 | MP     |
|         | 64Gb*8 | KLMCG8GE2A-A001xxx | 1500                  | v4.5        | 12x16 BGA    | x8   | 1.8/3.3 | MP     |

Please contact your local Samsung sales representative for part numbers and latest product offerings.

## SOLID STATE DRIVES (SSD)

| Interface        | Size       | Connector | Controller | Component       | Density | Part Number        | Comments        |
|------------------|------------|-----------|------------|-----------------|---------|--------------------|-----------------|
| SATA III - 6Gb/s | 2.5" 7mmT  | Thin SATA | PM830      | 27nm 32Gb MLC   | 64GB    | MZ7PC064HADR-00000 | Mass production |
|                  |            |           |            |                 | 128GB   | MZ7PC128HAFU-00000 | Mass production |
|                  |            |           |            |                 | 256GB   | MZ7PC256HAFU-00000 | Mass production |
|                  |            |           |            |                 | 512GB   | MZ7PC512HAGH-00000 | Mass production |
|                  | mSATA      | PCIe      | PM830      | 21nm 32Gb MLC   | 32GB    | MZMPC032HBGD-00000 | Mass production |
|                  |            |           |            |                 | 64GB    | MZMPC064HBDR-00000 | Mass production |
|                  |            |           |            |                 | 128GB   | MZMPC128HBFU-00000 | Mass production |
|                  |            |           |            |                 | 256GB   | MZMPC256HBGJ-00000 | Mass production |
| SATA II - 3Gb/s  | 2.5" 15mmT | Thin SATA | SM825      | 32nm 32Gb E-MLC | 100GB   | MZ5EA100HMDR-00003 | Mass production |
|                  |            |           |            |                 | 200GB   | MZ5EA200HMDR-00003 | Mass production |
|                  |            |           |            |                 | 400GB   | MZ5EA400HMFP-00003 | Mass production |

Please contact your local Samsung sales representative for latest product offerings.

Note: All parts are lead free

# FLASH PRODUCT ORDERING INFORMATION

|                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15                  |
|----------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|---------------------|
|                      | K | 9 | X | X | X | X | X | X | X | X  | -  | X  | X  | X  | X                   |
| SAMSUNG Memory       |   |   |   |   |   |   |   |   |   |    |    |    |    |    | Pre-Program Version |
| NAND Flash           |   |   |   |   |   |   |   |   |   |    |    |    |    |    | Customer Bad Block  |
| Small Classification |   |   |   |   |   |   |   |   |   |    |    |    |    |    | Temp                |
| Density              |   |   |   |   |   |   |   |   |   |    |    |    |    |    | Package             |
| Density              |   |   |   |   |   |   |   |   |   |    |    |    |    |    | ---                 |
| Organization         |   |   |   |   |   |   |   |   |   |    |    |    |    |    | Generation          |
| Organization         |   |   |   |   |   |   |   |   |   |    |    |    |    |    | Mode                |
| Vcc                  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |                     |

## 1. Memory (K)

## 2. NAND Flash : 9

## 3. Small Classification

(SLC : Single Level Cell, MLC : Multi Level Cell)

- 7 : SLC eMMC
- 8 : MLC eMMC
- F : SLC Normal
- G : MLC Normal
- H : MLC QDP
- K : SLC DDP
- L : MLC DDP
- M : MLC DSP
- N : SLC DSP
- P : MLC 8 Die Stack
- Q : SLC 8 Die Stack
- S : SLC Single SM
- T : SLC SINGLE (S/B)
- U : 2 Stack MSP
- W : SLC 4 Die Stack

## 4~5. Density

- 12 : 512M
- 56 : 256M
- 1G : 1G
- 2G : 2G
- 4G : 4G
- 8G : 8G
- AG: 16G
- BG: 32G
- CG: 64G
- DG : 128G
- EG : 256G
- LG : 24G
- NG : 96G
- ZG : 48G
- 00 : NONE

## 6~7. Organization

- 00 : NONE
- 08 : x8
- 16 : x16

## 8. Vcc

- A : 1.65V~3.6V
- B : 2.7V (2.5V~2.9V)
- C : 5.0V (4.5V~5.5V)
- D : 2.65V (2.4V~2.9V)
- E : 2.3V~3.6V
- R : 1.8V (1.65V~1.95V)
- Q : 1.8V (1.7V~1.95V)
- T : 2.4V~3.0V
- U : 2.7V~3.6V
- V : 3.3V (3.0V~3.6V)
- W : 2.7V~5.5V, 3.0V~5.5V
- 0 : NONE

## 9. Mode

- 0 : Normal
- 1 : Dual nCE & Dual R/nB
- 3 : Tri/CE & Tri R/B
- 4 : Quad nCE & Single R/nB
- 5 : Quad nCE & Quad R/nB
- 9 : 1st block OTP
- A : Mask Option 1
- L : Low grade

## 10. Generation

- M : 1st Generation
- A : 2nd Generation
- B : 3rd Generation
- C : 4th Generation
- D : 5th Generation

## 11. ----

## 12. Package

- A : COB
- B : FBGA (Halogen-Free, Lead-Free)
- C : CHIP BIZ D : 63-TBGA
- F : WSOP (Lead-Free) G : FBGA
- H : TBGA (Lead-Free)
- I : ULGA (Lead-Free) (12\*17)
- J : FBGA (Lead-Free)
- L : ULGA (Lead-Free) (14\*18)
- M : TLGA N : TLGA2
- P : TSOP1 (Lead-Free)
- Q : TSOP2 (Lead-Free)
- S : TSOP1 (Halogen-Free, Lead-Free)
- T : TSOP2 U : COB (MMC)
- V : WSOP W : Wafer
- Y : TSOP1 Z : WELP (Lead-Free)

## 13. Temp

- C : Commercial I : Industrial
- 0 : NONE (Containing Wafer, CHIP, BIZ, Exception handling code)

## 14. Customer Bad Block

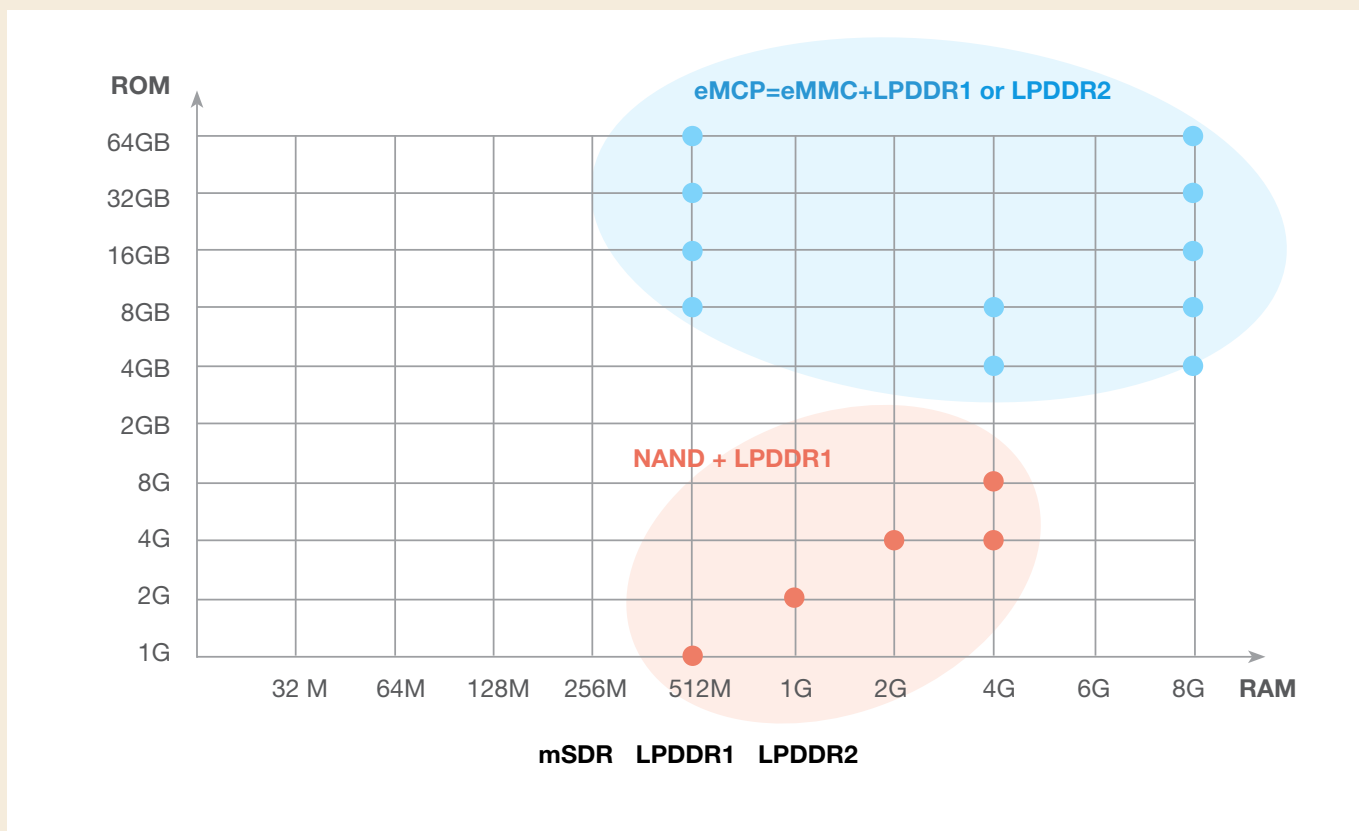
- B : Include Bad Block
- D : Daisychain Sample
- L : 1~5 Bad Block
- N : ini. 0 blk, add. 10 blk
- S : All Good Block
- 0 : NONE (Containing Wafer, CHIP, BIZ, Exception handling code)

## 15. Pre-Program Version

- 0 : None
- Serial (1~9, A~Z)

Samsung has a vast portfolio of MCP products for a variety of solutions, such as mobile phones, PMPs, and tablet computers. The following illustration shows Samsung's lineup of MCP memory solutions, which can be deployed in almost any application.

### Samsung MCP products' suite with different values and types of RAM and ROM



## MCP: NAND + MDDR

| Memory       | NAND Density | DRAM Density/Organization | Voltage (NAND-DRAM) | Package |
|--------------|--------------|---------------------------|---------------------|---------|
| NAND & MDRAM | 1Gb (x16)    | 256Mb (x16)               | 1.8V - 1.8V         | 130FBGA |
|              |              | 512Mb (x16)               | 1.8V - 1.8V         | 130FBGA |
|              | 2Gb (x8)     | 1Gb (x32)                 | 1.8V - 1.8V         | 130FBGA |
|              | 2Gb (x16)    | 1Gb (x16)                 | 1.8V - 1.8V         | 130FBGA |
|              | 4Gb (x16)    | 2Gb (x32)                 | 1.8V - 1.8V         | 137FBGA |
|              |              | 2Gb*2 (x32, 2CS/2CKE)     | 1.8V - 1.8V         | 137FBGA |

## eMCP: eMMC + LPDDR2

| Memory       | eMMC Density | DRAM Density/Organization | Voltage (eMMC-DRAM)   | Package |
|--------------|--------------|---------------------------|-----------------------|---------|
| eMMC & MDRAM | 4GB          | 4Gb                       | 3.3V/1.8V - 1.8V/1.2V | 162FBGA |
|              |              | 4Gb*2 (x32, 1ch, 2CS)     | 3.3V/1.8V - 1.8V/1.2V | 162FBGA |
|              | 8GB          | 4Gb*2 (x32, 1ch, 2CS)     | 3.3V/1.8V - 1.8V/1.2V | 162FBGA |
|              | 16GB         | 4Gb*2 (x32, 1ch, 2CS)     | 3.3V/1.8V - 1.8V/1.2V | 186FBGA |
|              | 32GB         | 4Gb*2 (x32, 1ch, 2CS)     | 3.3V/1.8V - 1.8V/1.2V | 186FBGA |
|              | 64GB         | 4Gb*2 (x32, 1ch, 2CS)     | 3.3V/1.8V - 1.8V/1.2V | 186FBGA |

## eMCP: eMMC + MDDR

| Memory       | eMMC Density | DRAM Density/Organization | Voltage (eMMC-DRAM) | Package |
|--------------|--------------|---------------------------|---------------------|---------|
| eMMC & MDRAM | 4GB          | 2Gb*2 (x32, 2CS/CKE)      | 3.3V/1.8V - 1.8V    | 153FBGA |
|              | 8GB          | 512Mb (x16)               | 3.3V/1.8V - 1.8V    | 169FBGA |
|              | 16GB         | 512Mb (x16)               | 3.3V/1.8V - 1.8V    | 169FBGA |
|              | 32GB         | 512Mb (x16)               | 3.3V/1.8V - 1.8V    | 169FBGA |
|              | 64GB         | 512Mb (x16)               | 3.3V/1.8V - 1.8V    | 169FBGA |

# SAMSUNG SOLID STATE DRIVES

|  | DATA CENTER EDITION<br>High-Write Environments | CLIENT/MOBILE EDITION<br>High-Read Environments |                    |
|--|--|---|--------------------|
|  | Samsung SM825                                  | Samsung PM830                                   |                    |
| <b>Form Factor</b>                         | 2.5 inches                                     | 2.5 inches                                      | mSATA              |
| <b>Capacity (GB)</b>                       | 100, 200, 400                                  | 64, 128, 256, 512                               | 32, 64, 128, 256   |
| <b>Host Interface</b>                      | SATA Gen 2.0–3Gb/s                             | SATA Gen 3.0–6Gb/s                              |                    |
| <b>Flash</b>                               | E-MLC 30nm-class                               | MLC 20nm-class                                  |                    |
| <b>Encryption</b>                          | AES-256  | AES-256   |                    |
| <b>MTBF</b>                                | 2mm hours                                      | 1.5 mm hours                                    | 1 mm hours         |
| <b>Uncorrectable Bit Error Rate (UBER)</b> | 1 in 10 <sup>17</sup>                          | 1 in 10 <sup>15</sup>                           |                    |
| <b>Power Consumption</b>                   | Active: 1.8W<br>Idle: 1.3W                     | Active: 0.127W<br>Idle: 0.078W                  |                    |
| <b>Write Endurance (Terabytes Written)</b> | Up to 7,000TBW                                 | Up to 60–1250TBW                                | Up to 30–60TBW     |
| <b>Cache Power Protection</b>              | Yes  | No  |                    |
| <b>Sequential R/W (MB/s)</b>               | 250/220  | 500/400   | 500/400            |
| <b>Random R/W (IOPs)</b>                   | 43K/11K  | 80K/36K   | 50K/29K            |
| <b>Physical Dimensions</b>                 | 100 x 69.85 x 15mm                             | 100 x 69.85 x 7mm                               | 50.95 x 30 x 3.8mm |
| <b>Weight</b>                              | 140–146g                                       | 61g–62.5g                                       | 9–10g              |

Which SSD is right for you?

For more information, email: [SSD@ssi.samsung.com](mailto:SSD@ssi.samsung.com)

## SOLID STATE DRIVES (SSD)

| Interface        | Size       | Connector | Controller | Component       | Density | Part Number        | Comments        |
|------------------|------------|-----------|------------|-----------------|---------|--------------------|-----------------|
| SATA III - 6Gb/s | 2.5" 7mmT  | Thin SATA | PM830      | 27nm 32Gb MLC   | 64GB    | MZ7PC064HADR-00000 | Mass production |
|                  |            |           |            |                 | 128GB   | MZ7PC128HAFU-00000 | Mass production |
|                  |            |           |            |                 | 256GB   | MZ7PC256HAFU-00000 | Mass production |
|                  |            |           |            |                 | 512GB   | MZ7PC512HAGH-00000 | Mass production |
|                  | mSATA      | PCIe      | PM830      | 21nm 32Gb MLC   | 32GB    | MZMPC032HBCD-00000 | Mass production |
|                  |            |           |            |                 | 64GB    | MZMPC064HBDR-00000 | Mass production |
|                  |            |           |            |                 | 128GB   | MZMPC128HBFU-00000 | Mass production |
|                  |            |           |            |                 | 256GB   | MZMPC256HBGJ-00000 | Mass production |
| SATA II - 3Gb/s  | 2.5" 15mmT | Thin SATA | SM825      | 32nm 32Gb E-MLC | 100GB   | MZ5EA100HMDR-00003 | Mass production |
|                  |            |           |            |                 | 200GB   | MZ5EA200HMDR-00003 | Mass production |
|                  |            |           |            |                 | 400GB   | MZ5EA400HMFP-00003 | Mass production |

Please contact your local Samsung sales representative for latest product offerings.  
Note: All parts are lead free

## OPTICAL SMARTHUB

| Interface | Speed        | Type | Loading | Lightscribe | Model    |
|-----------|--------------|------|---------|-------------|----------|
| Wi-Fi     | DVD Write 8X | Slim | Tray    | X           | SE-208BW |

## BLU-RAY SLIM

| Interface | Speed        | Type | Loading | Lightscribe | Model    |
|-----------|--------------|------|---------|-------------|----------|
| SATA      | BD Combo 6X  | Slim | Tray    | X           | SN-406AB |
|           | BD Writer 6X | Slim | Tray    | X           | SN-506BB |

## BLU-RAY WRITER SLIM EXTERNAL

| Interface | Speed        | Type | Loading | Lightscribe | Model    |
|-----------|--------------|------|---------|-------------|----------|
| USB 2.0   | BD Writer 6X | Slim | Tray    | X           | SE-506AB |
|           |              |      |         |             | SE-506BB |

## DVD-W H/H

| Interface | Speed         | Type | Loading | Lightscribe | Model    |
|-----------|---------------|------|---------|-------------|----------|
| SATA      | DVD Write 24X | H/H  | Tray    | X           | SH-224BB |

## DVD-W SLIM

| Interface | Speed        | Type | Loading | Lightscribe | Model    |
|-----------|--------------|------|---------|-------------|----------|
| SATA      | DVD Write 8X | Slim | Tray    | X           | SN-208BB |
|           |              |      |         |             | SN-208DB |

## DVD-W SLIM EXTERNAL

| Interface | Speed        | Type       | Loading | Lightscribe | Model    |
|-----------|--------------|------------|---------|-------------|----------|
| USB 2.0   | DVD Write 8X | Ultra Slim | Tray    | X           | SE-218BB |
|           |              | Slim       | Tray    | X           | SE-208DB |

# DID Product Classification

|                               |  |   |
|-------------------------------|--|---|
| <b>E-DID: Exclusive DID</b>   | <b>SUPER NARROW</b>                        | <b>OUTDOOR: HIGH LUMINANCE</b><br>» 1500 – 2000nit  |
| <b>P-DID: Performance DID</b> | <b>NARROW</b><br>» Narrow<br>» Black Bezel | <b>WALL-MOUNTED</b><br>» Thin/Light<br>» (Edge LED) |
| <b>B-DID: Basic DID</b>       | <b>LANDSCAPE/PORTRAIT CONVERTIBLE</b>      |   |

## Why DID Instead of TV?

|                        | <b>Commercial (DID)</b>  | <b>Consumer (TV)</b>   |
|------------------------|--|--|
| <b>Warranty</b>        | 18 months to 2 years   | 90 days to 1 year  |
| <b>Reliability</b>     | Designed for continuous use in different environments<br>Turned on for 20 hours +<br>Variety of temperatures & location                  | Designed for in-home use in controlled environment<br>Turned on for 6-8 hours<br>In-home living room |
| <b>Picture Quality</b> | Designed for PC signals<br>LCD backlight covers a wider color spectrum necessary for PC source integration giving better picture quality | Designed for TV signals  |
| <b>Location</b>        | Can be oriented in either portrait or landscape mode   | Can only be oriented in landscape mode   |

# Product Segmentation

**HEAVY USE**

↑

**E-DID: Exclusive**

- » All features of P-DID plus
- » Specialty: SNB, High Brightness
- » Robust design

**P-DID: Performance**

- » All features of B-DID plus
- » Narrow & Black Bezel
- » Typ. Brightness: 700 (cd/m2)

**B-DID: Basic**

- » Landscape/Portrait
- » High reliability
- » Pol. (Haze 44%)
- » Long lifetime: more than 2 years

↓

**LIGHT USE**

|   |   |   |   |
|---|---|---|---|
| <b>Professional</b>   | <b>Outdoor Events</b>   | <b>Billboard</b>  |   |
| <ul style="list-style-type: none"> <li>• Control Room</li> <li>• Simulation</li> </ul>                          | <ul style="list-style-type: none"> <li>• Scoreboard</li> <li>• Sports Broadcasting</li> </ul> | <ul style="list-style-type: none"> <li>• Billboard</li> </ul>       |   |
| <b>Entertainment</b>  | <b>Transportation</b>   | <b>Communication</b>  | <b>Rental</b>   |
| <ul style="list-style-type: none"> <li>• Casino</li> <li>• Theatre</li> <li>• Poster</li> <li>• Menu</li> </ul> | <ul style="list-style-type: none"> <li>• Airport</li> <li>• Train/Bus Station</li> </ul>      | <ul style="list-style-type: none"> <li>• Conference Room</li> </ul> | <ul style="list-style-type: none"> <li>• Rental</li> <li>• Staging</li> </ul> |
| <b>Commercial</b>   | <b>Education</b>  |   |   |
| <ul style="list-style-type: none"> <li>• Kiosk</li> <li>• Mart Board</li> </ul>                                 | <ul style="list-style-type: none"> <li>• E-Board</li> </ul>                                   |   |   |

## Product Segmentation

| Type  | Abbr        | Warranty  | Bezel                   | Suggested Run Time | Brightness       | Usage  | Applications         | Pricing  |
|-------|-------------|-----------|-------------------------|--------------------|------------------|--------|----------------------|--|
| E-DID | Exclusive   | 2 years   | Narrow and Super Narrow | 20 hours +         | 450 to 2000 nits | Heavy  | Outdoor, Video Walls | High-price range                               |
| P-DID | Performance | 2 years   | Narrow                  | 20 hours +         | 600/700 nits     | Medium | Semi-Outdoor         | Mid-price range                                |
| B-DID | Basic       | 18 months | Normal                  | 12 hours           | 450 nits         | Light  | Indoor, e-Board      | Low-price range; comparable to consumer panels |

## SAMSUNG DIGITAL INFORMATION DISPLAY (DID) PANEL LINEUP

| Type        | Current Model | Size  | Model resolution | Bezel          | Backlight           | Brightness (typical) | Contrast Ratio | Response Time | Frequency | MP*        | Comment                           | High TN1 85°C |
|-------------|---------------|-------|------------------|----------------|---------------------|----------------------|----------------|---------------|-----------|------------|-----------------------------------|---------------|
| E-DID       | LT1216XM01    | 21.6" | 960x960          | Super narrow   | D-LED               | 450 nits             | 4000:1         | 8ms           | 60Hz      | Aug. 2012  |                                   |               |
|             | LT1460HN03    | 46"   | FHD              | Narrow + Black | CCFL                | 1500 nits            | 3,000:1        | 8ms           | 60Hz      | Now        | High Bright, Hi Temp LC, 1/4 Pol. | Yes           |
|             | LT1460HN01    | 46"   | FHD              | Super narrow   | D-LED               | 700 nits             | 3,000:1        | 8ms           | 60Hz      | Now        | 5.7mm Active to Active            | Yes           |
|             | LT1460HN07    | 46"   | FHD              | Super narrow   | D-LED               | 450 nits             | 3,000:1        | 8ms           | 60Hz      | Q3, 2012   |                                   |               |
|             | LT1460AA05    | 46"   | HD               | Super narrow   | CCFL                | 450 nits             | 4,000:1        | 8ms           | 60Hz      | Ltd Avail. | 7.3mm Active to Active            |               |
|             | LT1550HN01    | 55"   | FHD              | Super narrow   | D-LED               | 700 nits             | 3,000:1        | 8ms           | 60Hz      | Now        | 5.7mm Active to Active            | Yes           |
|             | LT1550HN04    | 55"   | FHD              | Super narrow   | D-LED               | 450 nits             | 3,000:1        | 8ms           | 60Hz      | Now        | 5.7mm Active to Active            |               |
|             | LT1700HD02    | 70"   | FHD              | Normal         | D-LED               | 2000 nits            | 2,500:1        | 8ms           | 60Hz      | Now        | High Bright                       |               |
| P-DID       | LT1400HA02    | 40"   | FHD              | Narrow         | CCFL                | 700 nits             | 3,000:1        | 8ms           | 60Hz      | Now        |                                   |               |
|             | LT1400HA08    | 40"   | FHD              | Narrow         | CCFL                | 700 nits             | 3,000:1        | 8ms           | 60Hz      | Now        |                                   | Yes           |
|             | LT1400HA08    | 40"   | FHD              | Narrow + Black | CCFL                | 700 nits             | 3,000:1        | 8ms           | 60Hz      | Now        |                                   | Yes           |
|             | LT1400HA10    | 40"   | FHD              | Narrow         | E-LED               | 700 nits             | 3500:1         | 8ms           | 60Hz      | Oct. 2012  |                                   |               |
|             | LT1460HN05    | 46"   | FHD              | Narrow + Black | CCFL                | 700 nits             | 3,500:1        | 8ms           | 60Hz      | Now        |                                   | Yes           |
|             | LT1550HN03    | 55"   | FHD              | Narrow         | CCFL                | 700 nits             | 4,000:1        | 8ms           | 60Hz      | Now        |                                   | Yes           |
|             | LT1700HD01    | 70"   | FHD              | Normal         | CCFL                | 600 nits             | 2,000:1        | 8ms           | 60Hz      | Now        |                                   |               |
|             | LT1820HT-L01  | 82"   | FHD              | Normal         | CCFL                | 600 nits             | 2,000:1        | 8ms           | 60Hz      | Now        |                                   |               |
| B-DID       | LT1320AP02    | 32"   | HD               | Normal         | CCFL                | 450 nits             | 3,500:1        | 8ms           | 60Hz      | Now        |                                   |               |
|             | LT1400HA07    | 40"   | FHD              | Normal         | CCFL                | 450 nits             | 4,000:1        | 8ms           | 60Hz      | Now        |                                   | Yes           |
|             | LT1460HN04    | 46"   | FHD              | Normal         | CCFL                | 450 nits             | 3,000:1        | 8ms           | 60Hz      | Now        |                                   | Yes           |
|             | LT1550HN02    | 55"   | FHD              | Normal         | CCFL                | 450 nits             | 3,500:1        | 8ms           | 60Hz      | Now        |                                   | Yes           |
|             | LT1700HA01    | 70"   | FHD              | Normal         | CCFL                | 450 nits             | 2,000:1        | 8ms           | 60Hz      | Now        | E-Board; Landscape mode only      |               |
|             | LT1700HA02    | 70"   | FHD              | Normal         | E-LED               | 400 nits             | 4,000:1        | 8ms           | 60Hz      | Now        | E-Board; Landscape mode only      |               |
|             | LT1820HD03    | 82"   | FHD              | Normal         | CCFL                | 450 nits             | 2,000:1        | 8ms           | 60Hz      | Now        | E-Board; Landscape mode only      |               |
| Transparent | LT1460AP01    | 46"   | HD               | Narrow         | Transparent/ No BLU |                      | 4,500:1        | 8ms           | 60Hz      | Now        |                                   |               |
|             | LT1220MT02    | 46"   | WSXGA+           | Narrow         | Transparent/ No BLU |                      | 500:1          | 5ms           | 60Hz      | Now        | LVDS Input                        |               |

## TABLETS

| Size  | PN         | Mode | Resolution | H(RGB) | V   | Aspect Ratio | PPI | Brightness (nits) | MP  |
|-------|------------|------|------------|--------|-----|--------------|-----|-------------------|-----|
| 7"    | LTN070AL01 | PLS  | WXGA       | 1280   | 800 | 16:10        | 216 | 400               | Now |
| 10.1" | LTL101AL02 | PLS  | WXGA       | 1280   | 800 | 16:10        | 149 | 400               | Now |

## MONITORS

| Size  | PN         | Mode | Resolution | H(RGB) | V    | Aspect Ratio | PPI | Brightness (nits) | MP         |
|-------|------------|------|------------|--------|------|--------------|-----|-------------------|------------|
| 19"   | LTM190BT07 | TN   | WXGA+      | 1440   | 900  | 16:9         | 96  | 250               | Ltd Avail. |
| 20"   | LTM200KT03 | TN   | HD+        | 1600   | 900  | 16:09        | 92  | 250               | Ltd Avail. |
|       | LTM200KT10 | TN   | HD+        | 1600   | 900  | 16:09        | 92  | 250               | Now        |
| 21.5" | LTM215HT04 | TN   | FHD        | 1920   | 1080 | 16:9         | 103 | 250               | Ltd Avail. |
| 22"   | LTM220MT05 | TN   | WSXGA+     | 1680   | 1050 | 16:10        | 90  | 250               | Ltd Avail. |
|       | LTM220MT09 | TN   | WSXGA+     | 1680   | 1050 | 16:10        | 90  | 250               | Now        |
| 23"   | LTM230HT10 | TN   | FHD        | 1920   | 1080 | 16:9         | 96  | 300               | Now        |
|       | LTM230HL01 | PLS  | FHD        | 1920   | 1080 | 16:9         | 96  | 300               | Now        |
| 24"   | LTM240CT06 | TN   | WUXGA      | 1920   | 1200 | 16:10        | 94  | 250               | Now        |
|       | LTM240CL01 | PLS  | WUXGA      | 1920   | 1200 | 16:10        | 94  | 300               | Now        |
| 27"   | LTM270HT03 | TN   | FHD        | 1920   | 1080 | 16:9         | 82  | 300               | Now        |
|       | LTM270DL02 | PLS  | QHD        | 2560   | 1440 | 16:9         | 109 | 300               | Now        |

## CONTACTS

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

### Representatives

| Name             | Location          | Phone           |
|------------------|-------------------|-----------------|
| Adelsa           | Ciudad Juarez     | 52-656-613-3517 |
| Adelsa           | Monterrey         | 52-818-214-0011 |
| Adelsa           | Mexico City (HQ)  | 52-555-560-5002 |
| Adelsa           | Guadalajara       | 52-333-122-3054 |
| ATMI             | Washington        | 425-869-7636    |
| ATMI             | Oregon            | 503-643-8307    |
| Bear/VAI         | Ohio              | 440-526-1991    |
| Bear/VAI         | Western PA        | 440-526-1991    |
| Bear/VAI         | Indiana/Kentucky  | 440-832-7637    |
| Bear/VAI         | Michigan          | 440-526-1991    |
| Bestronics       | San Diego         | 858-673-4300    |
| Core             | Illinois          | 847-843-8888    |
| Core             | Wisconsin         | 414-791-1666    |
| Crestone         | Colorado          | 303-280-7202    |
| Crestone         | Utah              | 303-280-7202    |
| Customer 1st     | Iowa              | 319-393-1351    |
| Customer 1st     | Kansas            | 913-390-9119    |
| Customer 1st     | Minnesota         | 952-851-7909    |
| Digit-Tech Sales | Sao Paulo, Brazil | 5511-3165-2218  |
| Digit-Tech Sales | Puerto Rico       | 787-892-4260    |
| Digit-Tech Sales | Miami (export)    | 305-591-2400    |

| Name                    | Location        | Phone        |
|-------------------------|-----------------|--------------|
| Infinity Sales          | Los Angeles     | 818-880-6480 |
| Infinity Sales          | Orange County   | 714-669-8520 |
| InTELaTECH              | Calgary         | 905-629-0082 |
| InTELaTECH              | Montreal        | 905-629-0082 |
| InTELaTECH              | Ottawa          | 905-629-0082 |
| InTELaTECH              | Toronto         | 905-629-0082 |
| I-Squared               | San Jose        | 408-988-3400 |
| I-Squared               | Petaluma        | 707-773-3108 |
| Neptune Electr. (NECCO) | NY, PA, MD      | 631-234-2525 |
| New Elpis (LCD)         | Ontario         | 905-275-3516 |
| New Tech Solutions      | Massachusetts   | 781-229-8888 |
| New Tech Solutions      | CT/NY           | 585-204-2183 |
| Rep One Associates      | Alabama         | 256-539-7371 |
| Rep One Associates      | Charlotte, NC   | 704-846-5744 |
| Rep One Associates      | Georgia         | 770-209-9242 |
| Rep One Associates      | Raleigh, NC     | 919-424-3804 |
| Rep One Associates      | Florida         | 256-539-7371 |
| Summit Sales            | Phoenix/El Paso | 480-998-4850 |
| West Associates         | Dallas          | 972-680-2800 |
| West Associates         | Austin          | 512-343-1199 |
| West Associates         | Houston         | 512-538-2810 |

### Distributors

| Company Name                                      | Location  | Contact   |
|---|---|---|
| Edge Electronics, Inc.<br>Headquarters            | 75 Orville Dr., Unit 2<br>Bohemia, NY 11716                               | Phone: 800.647.EDGE (3343)<br>Fax: 631.471.3405<br>www.edgeelectronics.com<br>Email: edge@edgeelectronics.com                   |
| Avnet, Inc.<br>Phoenix, Arizona Headquarters      | 2211 South 47th Street<br>Phoenix, AZ 85034                               | www.avnet.com<br>For sales inquiries: (800) 332-8638 www.avnetexpress.com   |
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