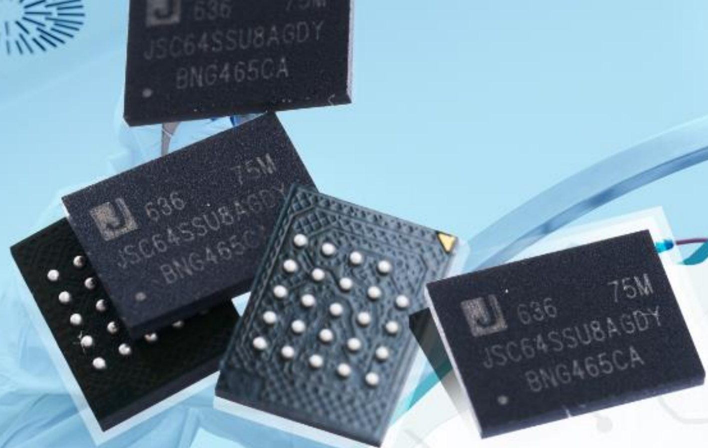
JEJU SEMICONDUCTOR CORP.

PRODUCT ROADMAP

Wherever Low Power Memory is Needed

SOLUTION PROVIDER OWN DESIGN ABILITY STRATEGIC PARTNERSHIP

JSC



CONTENTS

JSC Product Roadmap

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NAND MCP

(NAND Flash + LPDDR4,4X/LPDDR2/LPDDR/SDR)

NAND 1.8V + LPDDR4x MCP

NAND MCP		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
8Gb + 8Gb	NAND : x8, 4bit ECC (1CS, 2stack) LPDDR4x : 1CH, x16/CH (2CS) 1866 / 2133MHz 149B (8.0 x 9.5 mm)	C/S				Mass Production				
8Gb + 8Gb	NAND : x8, 4bit ECC (1CS, 2stack) LPDDR4x : 2CH, x16/CH 1866 / 2133MHz 254B (11.5 x 13.0 mm)	C/S					Mass Production			
8Gb + 4Gb	NAND : x8, 4bit ECC (1CS, 2stack) LPDDR4x : 1CH, x16/CH (2CS) 1866 / 2133MHz 149B (8.0 x 9.5 mm)					Mass Production				
4Gb + 4Gb	NAND : x8, 4bit ECC LPDDR4x : 1CH, x16/CH (2CS) 1866 / 2133MHz 149B (8.0 x 9.5 mm)					Mass Production				
4Gb + 4Gb	NAND : x8, 4bit ECC LPDDR4x : 1CH, x16/CH (1CS) 1866 / 2133MHz 149B (8.0 x 9.5 mm)	C/S				Mass Production				
4Gb + 2Gb	NAND : x8, 4bit ECC LPDDR4x : 1CH, x16/CH (1CS) 1866 / 2133MHz 149B (8.0 x 9.5 mm)					Mass Production				

NAND 1.8V + LPDDR2 MCP(1)

NAND MCP		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
8Gb + 4Gb	Nand : x8 / x16 4bit ECC LPDDR2 : x16 / x32 400 / 533MHz 162B (11.5 x 13.0 mm)	If you have any inquires, please contact us.								
4Gb + 4Gb	Nand : x8 / x16 4bit ECC LPDDR2 : x32 400 / 533MHz 162B (8.0 x 10.5 mm)	Mass Production (1CS, 2ZQ) Mass Production (2CS, 2ZQ)								
4Gb + 2Gb	Nand : x8 / x16 4bit ECC LPDDR2 : x16 / x32 400 / 533MHz 162B (8.0 x 10.5 mm)	Mass Production (1CS, 1stack) Mass Production (2CS, 2stack)								
2Gb + 2Gb	Nand : x8 / x16 4bit ECC LPDDR2 : x16 / x32 400 / 533MHz 162B (8.0 x 10.5 mm)	Mass Production (1CS, 1stack) Mass Production (2CS, 2stack)								

NAND 1.8V + LPDDR2 MCP(2)

NAND MCP		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2Gb + 1Gb	Nand : x8 / x16, 4bit ECC LPDDR2 : x16 / x32 400MHz 121B (8.0 x 8.0 mm) 162B (11.5 x 13.0 mm) 162BS (8.0 x 10.5 mm)					Mass Production				B−version
						Mass Production				C−version
1Gb + 1Gb	Nand : x8 / x16, 4bit ECC LPDDR2 : x16 / x32 400MHz 121B (8.0 x 8.0 mm) 162B (11.5 x 13.0 mm) 162BS (8.0 x 10.5 mm)					Mass Production				B−version
						Mass Production				C−version
1Gb + 512Mb	Nand : x8 / x16, 4bit ECC LPDDR2 : x16 / x32 400MHz 121B (8.0 x 8.0 mm) 162B (11.5 x 13.0 mm) 162BS (8.0 x 10.5 mm)					Mass Production				B−version
						Mass Production				C−version

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NAND 1.8V + LPDDR1 MCP

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NAND MCP		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
4Gb + 2Gb	Nand : x8 / x16, 4bit ECC LPDDR1 : x32 200MHz 137B (10.5 x 13.0mm) 130B (8.0 x 9.0mm)	Mass Production								
2Gb + 1Gb	Nand : x8 / x16, 4bit ECC LPDDR1 : x16 / x32 200MHz 137B (10.5 x 13.0mm) 107B (10.5 x 13.0mm) 130B (8.0 x 9.0mm)	Mass Production								
1Gb + 512Mb	Nand : x8 / x16, 4bit ECC LPDDR1 : x16 / x32 200MHz 137B (10.5 x 13.0mm) 107B (10.5 x 13.0mm) 130B (8.0 x 9.0mm)	Mass Production								
1Gb + 512Mb	Nand : x8, 4bit ECC LPSDR : x16 / x32 200MHz 137B (10.5 x 13.0mm) 107B (10.5 x 13.0mm)	Mass Production								
1Gb + 256Mb	Nand : x8 / x16 4bit ECC LPDDR1 : x16 200MHz 107B (10.5 x 13.0mm) 130B (8.0 x 9.0mm)	Mass Production								
1Gb + 256Mb	Nand : x8 / x16, 4bit ECC LPSDR : x16 / x32 200MHz 137B (10.5 x 13.0mm) 107B (10.5 x 13.0mm) 130B (8.0 x 9.0mm)	Mass Production								

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eMMC

eMMC

eMMC		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
4GB	153B (11.5 x 13.0mm) eMMC 5.1, MLC	Mass Production								
8GB	153B (11.5 x 13.0mm) eMMC 5.1, MLC	Mass Production								

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eMCP

eMMC + LPDDR4x eMCP

eMCP		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
4GB + 4Gb	eMMC : Version 5.1 Supported 32Gb MLC NAND LPDDR4x : 1CH, x16/CH (1CS) 1866 / 2133MHz 149B (8.0 x 9.5 mm)					Under Consideration				
4GB + 8Gb	eMMC : Version 5.1 Supported 32Gb MLC NAND LPDDR4x : 1CH, x16/CH (2CS) 1866 / 2133MHz 149B (8.0 x 9.5 mm)			C/S			Mass Production			
8GB + 8Gb	eMMC : Version 5.1 Supported 64Gb MLC NAND LPDDR4x : 2CH, x32 1866 / 2133MHz 254B (11.5 x 13.0 mm)					Under Consideration				

eMMC + LPDDR2 eMCP

eMCP		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
4GB + 4Gb	MLC/LPDDR2 162Bs, eMMC 5.1 (11.5 x 13.0mm)	Mass Production								

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NOR MCP

(NOR Flash + pSRAM/CRAM)

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NOR Flash + CRAM/pSRAM MCP 1.8V

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NOR MCP		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
256Mb + 256Mb	A/D Mux, Sync Burst 16–Bank, Top Boot 56B (6.2 x 7.7mm)					If you have any inquires, please contact us.				
256Mb + 128Mb	A/D Mux, Sync Burst 16–Bank, Top Boot 56B (6.2 x 7.7mm)					Mass Production				A–version
256Mb + 64Mb	A/D Mux, Sync Burst 16–Bank, Top Boot 56B (6.2 x 7.7mm)					If you have any inquires, please contact us.				
128Mb + 64Mb	A/D Mux, Sync Burst 8–Bank, Top Boot 56B (6.0 x 6.0mm)					If you have any inquires, please contact us.				
128Mb + 32Mb	A/D Mux, Sync Burst 8–Bank, Top Boot 56B (6.0 x 6.0mm)					Mass Production		56B (6mm X 6mm) A–version		
64Mb + 32Mb	A/D Mux, Sync Burst 16–Bank, Top Boot 56B (6.0 x 6.0mm) 52B (6.0 x 4.0mm)					Mass Production Mass Production		56B (6mm X 6mm) A–version 52B (6mm X 4mm) B–version		
64Mb + 32Mb	A/D Mux, Sync Burst 4–Bank, Top Boot 56B (6.0 x 6.0mm) 52B (6.0 x 4.0mm)					Mass Production Mass Production		56B (6mm X 6mm) A–version 52B (6mm X 4mm) B–version		

NOR Flash + CRAM/pSRAM MCP 3.0V

NOR MCP		2020Y	2021Y				2022Y			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
128Mb + 32Mb	De−Mux, Async, Single−Bank Uniform Sector 56B (7.0 x 9.0mm)	Mass Production								
64Mb + 32Mb	De−Mux, Async Single−Bank Uniform Sector Bottom Boot 56B (7.0 x 9.0mm)	Mass Production								
64Mb + 32Mb	Async, Demux Single−Bank Top Boot 56B (7.0 x 9.0mm)	Mass Production								

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NAND Flash Components

NAND Flash 1.8V Components(1)

NAND Flash		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1Gb	x8, 4bit ECC 67B FBGA (8.0 x 6.5mm)	Mass Production								
1Gb	x8 / x16, 4bit ECC 48 TSOP (12.0 x 20.0mm) 63B FBGA (9.0 x 11.0mm)	Mass Production								
2Gb	x8 / x16, 4bit ECC 48 TSOP (12.0 x 20.0mm) 63B FBGA (9.0 x 11.0mm)	Mass Production								
4Gb	x8 / x16, 4bit ECC 48 TSOP (12.0 x 20.0mm) 63B FBGA (9.0 x 11.0mm)	Mass Production								
8Gb	x8 / x16, 4bit ECC 48 TSOP (12.0 x 20.0mm) 63B FBGA (9.0 x 11.0mm)	Mass Production								

NAND Flash 3.3V Components(2)

<table>
<tr><th colspan="2">NAND Flash</th><th>Y2020</th><th colspan="4">Y2021</th><th colspan="4">Y2022</th></tr>
<tr><th>Density</th><th>Description</th><th>Q4</th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th></tr>
<tr><td>1Gb</td><td>x8 / x16, 4bit ECC
48 TSOP (12.0 x 20.0mm)
63B FBGA (9.0 x 11.0mm)</td><td colspan="9">Mass Production</td></tr>
<tr><td>2Gb</td><td>x8 / x16, 4bit ECC
48 TSOP (12.0 x 20.0mm)
63B FBGA (9.0 x 11.0mm)</td><td colspan="9">Mass Production</td></tr>
<tr><td rowspan="2">4Gb</td><td>x8, On-die ECC
48 TSOP (12.0 x 20.0mm)
63B FBGA (9.0 x 11.0mm)</td><td colspan="9">Mass Production</td></tr>
<tr><td>x8 / x16, 4bit ECC
48 TSOP (12.0 x 20.0mm)
63B FBGA (9.0 x 11.0mm)</td><td colspan="9">Mass Production</td></tr>
<tr><td>8Gb</td><td>x8 / x16, 4bit ECC
48 TSOP (12.0 x 20.0mm)
63B FBGA (9.0 x 11.0mm)</td><td colspan="9">Mass Production</td></tr>
</table>

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SPI NAND

SPI NAND

<table>
<tr><th colspan="2">SPI NAND</th><th>Y2020</th><th colspan="4">Y2021</th><th colspan="4">Y2022</th></tr>
<tr><th>Density</th><th>Description</th><th>Q4</th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th><th>Q1</th><th>Q2</th><th>Q3</th><th>Q4</th></tr>
<tr><td>1Gb</td><td>3.3V / 1.8V
120MHz
8–LGA (8.0 x 6.0mm)</td><td colspan="9">Mass Production</td></tr>
<tr><td>2Gb</td><td>3.3V / 1.8V
120MHz
8–LGA (8.0 x 6.0mm)</td><td colspan="9">Mass Production</td></tr>
<tr><td rowspan="2">4Gb</td><td>3.3V
120MHz
8–LGA (8.0 x 6.0mm)</td><td colspan="9">Mass Production</td></tr>
<tr><td>1.8V
120MHz
8–LGA (8.0 x 6.0mm)</td><td colspan="9">If you have any inquires, please contact us.</td></tr>
<tr><td>8Gb</td><td>3.3V / 1.8V
120MHz
8–LGA (8.0 x 6.0mm)</td><td colspan="9">If you have any inquires, please contact us.</td></tr>
</table>

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SD NAND

SD NAND

<table>
<tr><th colspan="2">SD NAND</th><th>Y2020</th><th colspan="4">Y2021</th><th colspan="4">Y2022</th></tr>
<tr><td>Density</td><td>Description</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td><td>Q1</td><td>Q2</td><td>Q3</td><td>Q4</td></tr>
<tr><td>1Gb</td><td>3.3V
50MHz
8–LGA (8.0 x 6.0mm)</td><td colspan="9">Mass Production</td></tr>
<tr><td>4Gb</td><td>3.3V
50MHz
8–LGA (8.0 x 6.0mm)</td><td colspan="9">Mass Production</td></tr>
</table>

Low Power DRAM

(LPSDR/LPDDR1/LPDDR2/LPDDR4)

Low Power DDR1/SDR_KGD

Low Power DRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
128Mb	SDR/DDR, x16 200MHz					Mass Production				(256Mb Half)
256Mb	SDR/DDR, x16 200MHz					Mass Production				
	SDR/DDR, x32 200MHz					Mass Production				(512Mb Half)
512Mb	SDR/DDR, x16 200MHz					Mass Production				
	SDR/DDR, x32 200MHz					Mass Production				
1Gb	SDR/DDR, x16 200MHz					Mass Production				
	SDR/DDR, x32 200MHz					Mass Production				

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Low Power DDR1/SDR_PKG

Low Power DRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
128Mb	SDR/DDR, x16 200MHz 60B (8.0 x 9.0mm)					Mass Production				(256Mb Half)
256Mb	DDR, x16 166MHz 60B (8.0 x 9.0mm)					Mass Production				
256Mb	SDR/DDR, x32 166MHz 90B (8.0 x 13.0mm)					Mass Production				(512Mb Half)
512Mb	SDR/DDR, x16 200MHz 60B (8.0 x 9.0mm)					Mass Production				C–version
512Mb	SDR/DDR, x32 200MHz 90B (8.0 x 13.0mm)					Mass Production				
512Mb	DDR, x32 200MHz WLCSP (Contact us)					Mass Production				
1Gb	DDR, x16 200MHz 60B (8.0 x 9.0mm)					Mass Production				
1Gb	DDR, x32 200MHz 90B (8.0 x 13.0mm)					Mass Production				

Low Power DDR2_KGD

Low Power DRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
512Mb	LPDDR2 x16 / x32 400MHz / 533MHz					Mass Production				
1Gb	LPDDR2 x16 / x32 400MHz / 533MHz	C/S				Mass Production				
2Gb	LPDDR2 x16 / x32 400MHz					Mass Production				
2Gb	LPDDR2 x16 / x32 533MHz				C/S			Mass Production		

Low Power DDR2_PKG

Low Power DRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1Gb	LPDDR2 x16 / x32 400MHz 134B (10.0 x 11.5mm)	Mass Production								
2Gb	LPDDR2 x16 / x32 400MHz/533MHz 134B (10.0 x 11.5mm)	Mass Production								
4Gb DDP*	LPDDR2 x32 400MHz/533MHz 134B (10.0 x 11.5mm)	Mass Production								

*DDP : Double Die Package

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Low Power DDR4

Low Power DRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
4Gb	LPDDR4/4x 1CH, x16/CH 1600 / 1866MHz			C/S	Mass Production					
8Gb	LPDDR4/4x 1CH, x16/CH 1600 / 1866MHz				C/S	Mass Production				

Low Power CRAM/pSRAM

Low Power CRAM/pSRAM_KGD

Low Power CRAM/pSRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
16Mb	1.8V, x16 (A/D Mux) 133MHz	Mass Production								
	3.0V, x16 (pSRAM) 133MHz	Mass Production								
32Mb	1.8V, x16 (A/D Mux) 133MHz	Mass Production								
	3.0V, x16 (pSRAM) 133MHz	Mass Production								
64Mb	1.8V, x16 (A/D Mux) 133MHz	Mass Production								

Low Power CRAM/pSRAM_PKG

Low Power CRAM/pSRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
8Mb	3.0V, x16 (pSRAM) 70ns 48B FBGA (6.0 x 7.0mm)	Mass Production								
16Mb	3.0V, x16 (pSRAM)70ns 48B FBGA (6.0 x 7.0mm)	Mass Production								
32Mb	3.0V, x16 (pSRAM) 70ns 48B FBGA (6.0 x 7.0mm)	Mass Production								
64Mb	1.8V, x16 (4.0 x 4.0mm) 108MHz 49B FBGA (4.0 x 4.0mm) 54B FBGA (6.0 x 8.0mm)	Mass Production								
128Mb	49B FBGA (4.0 x 4.0mm) 2CS	Mass Production								

OctaRAM

OctaRAM

OctaRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
64Mb	3.0V, x8 DDR CRAM 133MHz					Mass Production				
	1.8V, x8 DDR CRAM 200MHz					Mass Production				
128Mb	3.0V, x8 DDR CRAM 133MHz					Mass Production				
	1.8V, x8 DDR CRAM 200MHz					Mass Production				

OctaRAM_PKG

OctaRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
64Mb	3.0V, x8 DDR CRAM 133MHz 24B (6.0 x 8.0mm) 49B (4.0 x 4.0mm)	Mass Production								
	1.8V, x8 DDR CRAM 200MHz 24B (6.0 x 8.0mm) 49B (4.0 x 4.0mm)	Mass Production								
128Mb	3.0V, x8 DDR CRAM 133MHz 24B (6.0 x 8.0mm) 49B (4.0 x 4.0mm)	Mass Production								
	1.8V, x8 DDR CRAM 200MHz 24B (6.0 x 8.0mm) 49B (4.0 x 4.0mm)	Mass Production								

Customized Memory

Customized Memory

Customized DRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
64Mb	Over 15 Gbps For Mobile Display	Mass Production								
128Mb	Over 30 Gbps For Large Size Display	Mass Production								
128Mb	Over 3.2 Gbps For Mobile Display	Mass Production								

• Customized High–Speed Memory

Consumer DRAM

Consumer DRAM_DDR3

Consumer DRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
2/4Gb	DDR3 x8(78B) / x16(96B) 933 / 1066MHz 1.5V	Mass Production								
2/4Gb	DDR3L x8(78B) / x16(96B) 933 / 1066MHz 78B / 96B 1.35V	Mass Production								

Consumer DRAM_DDR4

Consumer DRAM		Y2020	Y2021				Y2022			
Density	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
4Gb	DDR4 x8 / x16 1200 / 1333 / 1600MHz 78B / 96B 1.2V		C/S	Mass Production						

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Automotive Product

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Automotive Product

Automotive Product		Y2020				Y2021				Y2022	Y2023	Y2024	Y2025	Y2026
Density	Description	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4					
4Gb + 4Gb NAND MCP	LPDDR4x x8, 4bit ECC, 1Ch, x16, 2133MHz 149B (8.0 x 9.5 mm)				In Progress			Completion of AEC−Q100 Grade2 Certification						
4Gb + 4Gb NAND MCP	LPDDR2 x8 / x32, 1.8V, 4bit ECC, 533MHz 162B (8.0 x 10.5 mm)			In Progress			Completion of AEC−Q100 Grade2 Certification							
4Gb + 2Gb NAND MCP	LPDDR2 x8 / x32, 1.8V, 4bit ECC, 533MHz 162B (8.0 x 10.5 mm)	Completion of AEC−Q100 Grade2 Certification												
8Gb NAND Flash	x8, 1.8V, 4bit ECC 63B FBGA (9.0 x 11.0mm)	Completion of AEC−Q100 Grade2 Certification												
4Gb NAND Flash	x8, 1.8V, 4bit ECC 63B FBGA (9.0 x 11.0mm)	Completion of AEC−Q100 Grade2 Certification												
4Gb LPDDR2	x32, 1.8V, 533MHz 134B (10.0 x 11.5mm)	Completion of AEC−Q100 Grade2 Certification												
2Gb LPDDR2	x32, 1.8V, 533MHz 134B (10.0 x 11.5mm)	Completion of AEC−Q100 Grade2 Certification												
128Mb OctaRAM	x8, 1.8V, 133/200 MHz 24B BGA (6.0 x 8.0 mm)	Completion of AEC−Q100 Grade2 Certification												
64Mb OctaRAM	x8, 1.8V, 133 MHz 24B BGA (6.0 x 8.0 mm)	Completion of AEC−Q100 Grade2 Certification												

* Automotive Products might be changed by market situation

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It's our value to increase customer value.

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