



# SSD210 Smart HMI Controller

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Preliminary Product Brief Version 0.1

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## REVISION HISTORY

Revision No.	Description	Date
0.1	<ul style="list-style-type: none"><li>Initial release</li></ul>	10/15/2020

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## FEATURES

- **High Performance Processor Core**
  - ARM Cortex-A7 Dual Core up to 1 GHz
  - 16KB I-Cache/16KB D-Cache/128KB L2-Cache
  - Neon and FPU
  - Memory Management Unit for Linux support
  - DMA Engine
- **Display Subsystem**
  - Built-in contrast, brightness, sharpness, and saturation, 3D NR, Gamma control
  - TTL output up to 1280x800 60fps with RGB565 or RGB666 or RGB888 format
  - BT.656 output up to 720p60
  - Serial RGB up to 800x600 60fps
  - Supports SPI panel, clock frequency up to 54MHz
  - Supports FHD graphic layer with Index 4/8, ARGB1555/ARGB4444/ARGB8888, and RGB565 format
  - Supports UI/OSD layer with max. resolution 1280x800
- **2D Graphics Engine**
  - Line draw
  - Rectangle/gradient rectangle fill
  - Bitblt/Stretch Bitblt/Italic Bitblt
  - Palette mode (1/2/4/8-bit)
  - Format transformation
  - Color space conversion
  - Clipping
  - Alpha blending
  - Rotation/Mirror
  - Dither
- **Audio Processor**
  - Two stereo DMIC inputs
  - I2S TDM 8-channel, RX 2/4/8 channels, TX 2 channels
  - One mono DAC for lineout
  - I2S supports 8K/16K/32K/48K/96KHz sampling rate audio recording
- **NOR/NAND Flash Interface**
  - Supports 1/2/4-bit SPI-NOR / NAND flash with two chip selects
- **SDIO 2.0 Interface**
  - Compatible with SDIO spec. 2.0, data bus 1/4 bit mode
  - Compatible with SD spec. 2.0, data bus 1/4 bit mode
- **USB 2.0 Interface**
  - One USB2.0 configurable host and device
    - Host mode supports EHCI specification
    - Device mode supports 4 end points
- **DRAM Memory**
  - **Embedded** 16-bit 512Mb DDR2 memory with max. 1333Mbps
  - Supports auto-refresh and self-refresh mode
- **Ethernet**
  - Supports one Ethernet port
  - Supports 10/100Mbps half/full-duplex
  - Supports one RMIII to connect external PHY
  - Supports two LEDs for ePHY
- **Security Engines**
  - Supports AES/DES/3DES/RSA/SHA-1/SHA-256
  - Supports secure booting
- **Boot options**
  - ROM
  - SPI NOR
  - SPI NAND with ECC
  - USB

#### ■ Peripherals

- Dedicated GPIOs for system control
- Four PWM outputs
- Three generic UARTs and one fast UART with flow control
- Three generic timers and one watchdog timer
- Two SPI masters
- Two I2C masters

#### ■ Miscellaneous

- Built-in eFuse with 1024-bit to store device ID, AES key, chip configurations, etc.
- Built-in power on reset (POR)
- Built-in SAR ADC with 3-channel analog inputs for different kinds of applications

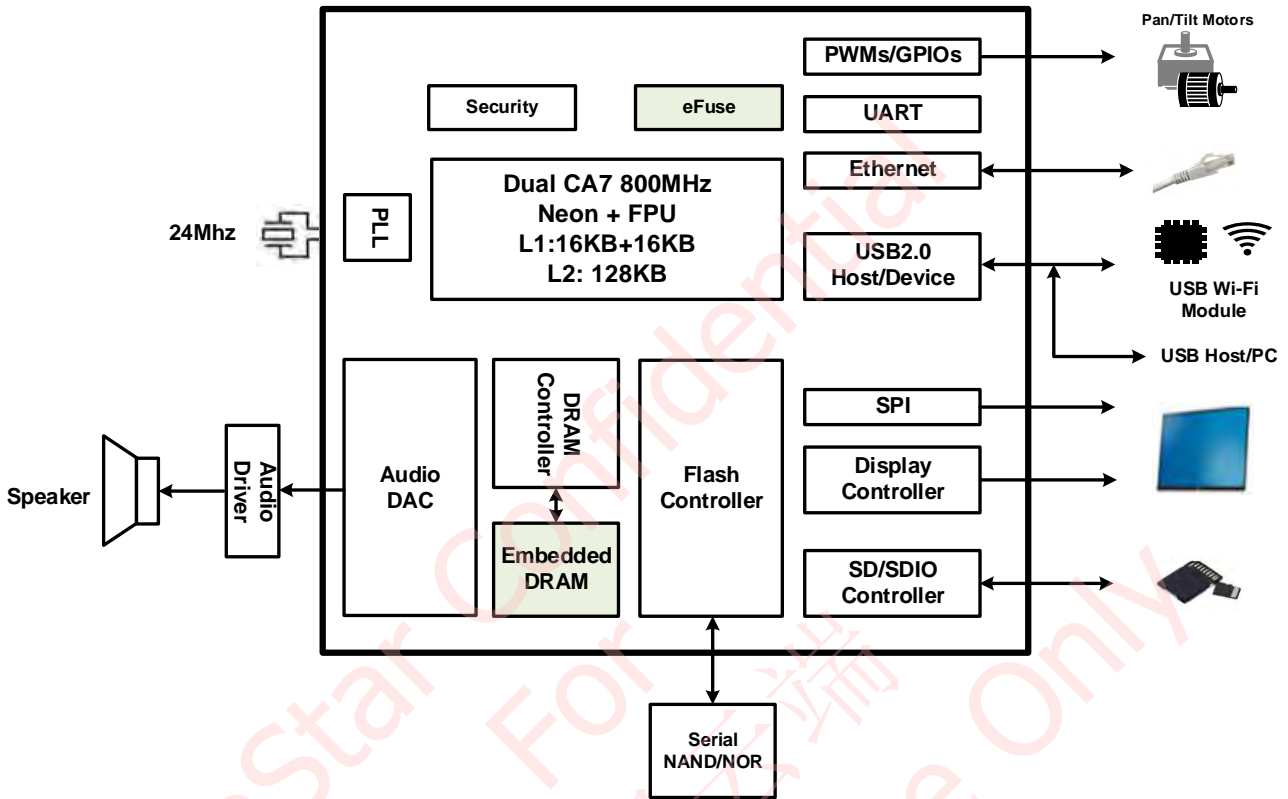
#### ■ Operating Voltage Range

- Core: 0.9V
- I/O: 1.8V ~ 3.3V
- DRAM: 1.8V (DDR2)
- Power Consumption: TBD.
- Operation temperature -20°C ~ 85°C

#### ■ Package

- 68-pin QFN, 7mm x 7mm

## BLOCK DIAGRAM



## GENERAL DESCRIPTION

The SSD210 is a highly integrated SOC product for HMI and smart display applications.

Based on ARM Cortex-A7 dual-core, the SSD210 integrates 2D graphics engine, TTL/serial RGB display with adjustable picture quality engine and other useful peripherals.

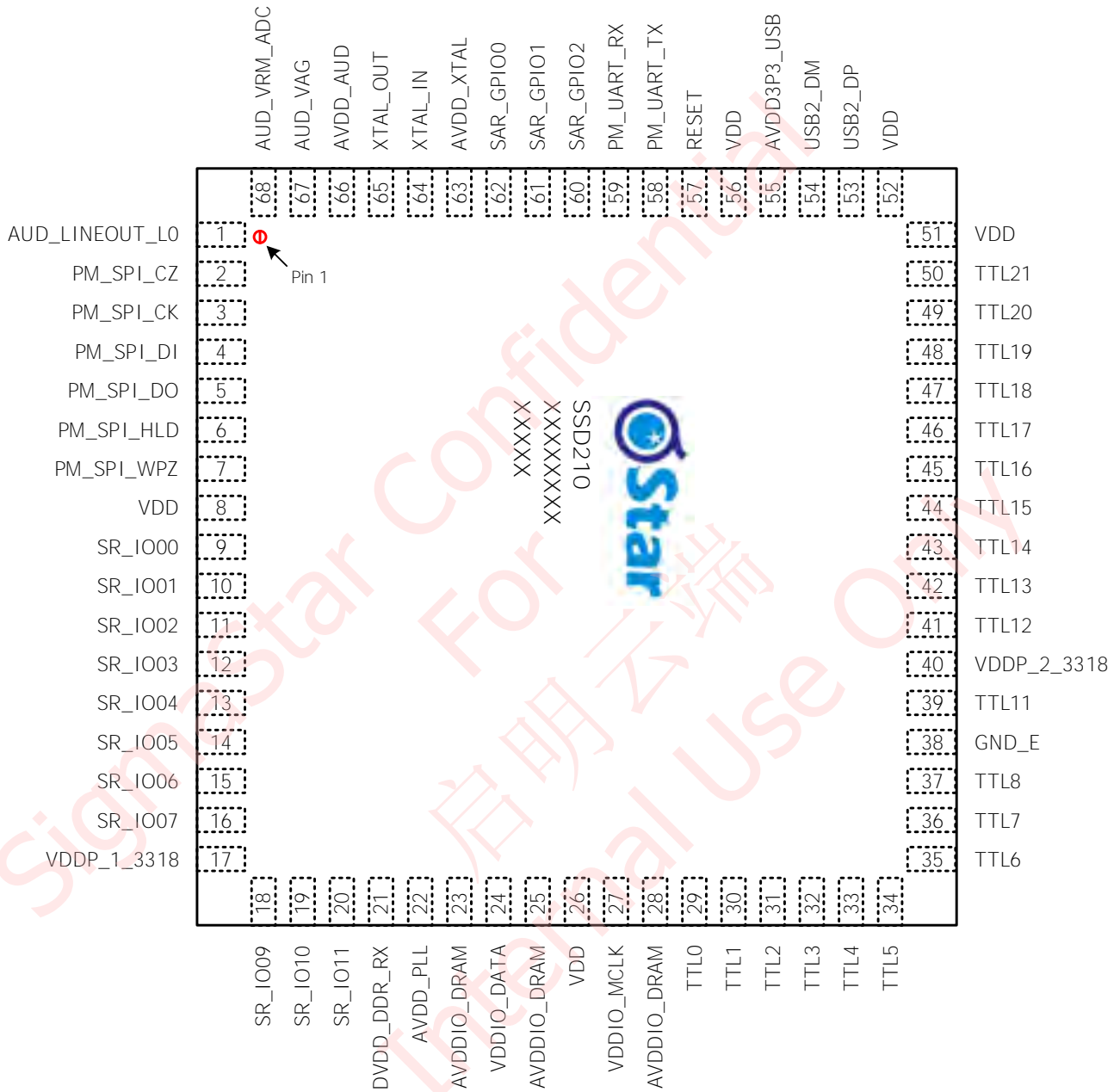
A typical utilization of the SSD210 application processor is demonstrated in the block diagram. The completed system includes NOR/NAND flash, DRAM, SD card, and USB port, and diversified audio connection. Before output to the panel, the images can be enhanced with respect to brightness/contrast/saturation/sharpness to give the best picture quality.

The NOR or NAND flash is usually reserved for operating system and application software. Moreover, other peripherals like SAR ADC, Audio DAC, UARTs, PWMs, GPIOs and SPI are supported to realize applications with maximal flexibility.

The SSD210 supports secure booting and personalization authentication mechanism for securing system. The AES/DES/3DES cipher engines could also help encrypt the compressed video/audio streams for privacy protection.

The SSD210, powered by SigmaStar Technology, comes with a complete hardware platform and software SDK, allowing customers to speed up "Time-to-Market."

## PIN DIAGRAM





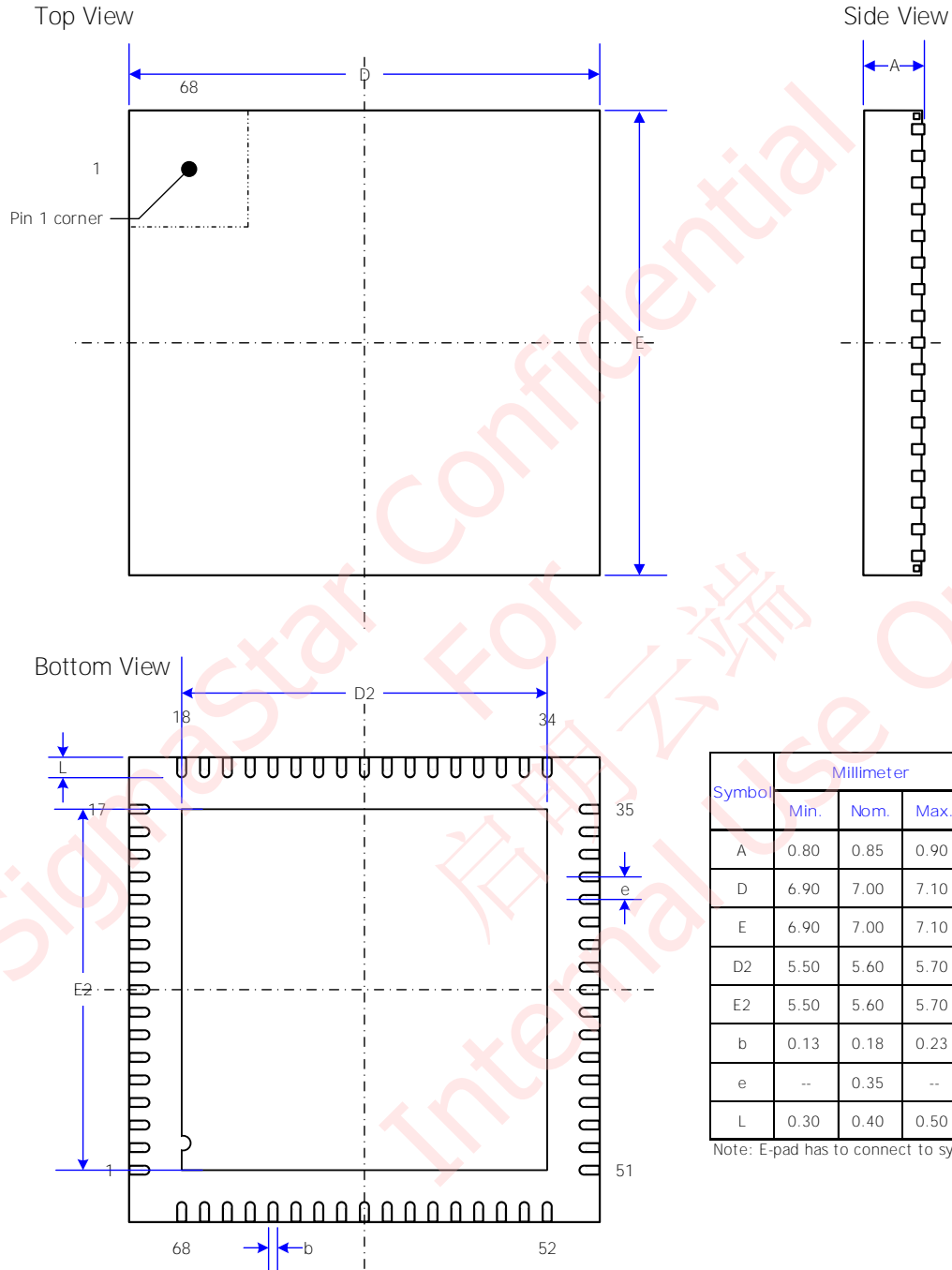
## SIGNAL DESCRIPTION

Signal Name	Signal Type	Function	Pin Location
System Reset Interface			
RESET	I	System Reset (Active High)	57
Debug UART Interface			
PM_UART_RX	I	Debug UART Receive Data Input with Pull Up Resistor / Slave I2C Serial Clock	59
PM_UART_TX	O	Debug UART Transmit Data Output with Pull Up Resistor / Slave I2C Serial Data	58
System Interface			
XTAL_IN	I	24MHz Crystal Input	64
XTAL_OUT	O	24MHz Crystal Output	65
SPI Flash Interface			
PM_SPI_CZ	O	SPI Flash Chip Select (Active Low)	2
PM_SPI_CK	O	SPI Flash Clock	3
PM_SPI_DI	O	SPI Flash Serial Data To Device (MOSI)	4
PM_SPI_DO	I	SPI Flash Serial Data From Device (MISO)	5
PM_SPI_WPZ	O	SPI Flash Write Protect	7
PM_SPI_HLD	O	SPI Flash Hold	6
SAR_GPIO0	I	General Purpose Input/Output or Muxed to SARADC Input Channel 0	62
SAR_GPIO1	I	General Purpose Input/Output or Muxed to SARADC Input Channel 1	61
SAR_GPIO2	I	General Purpose Input/Output or Muxed to SARADC Input Channel 2	60
Image Sensor Interface			
SR_IO00	I/O	Sensor General Purpose Input/Output 0	9
SR_IO01	I/O	Sensor General Purpose Input/Output 1	10
SR_IO02	I/O	Sensor General Purpose Input/Output 2	11
SR_IO03	I/O	Sensor General Purpose Input/Output 3	12
SR_IO04	I/O	Sensor General Purpose Input/Output 4	13
SR_IO05	I/O	Sensor General Purpose Input/Output 5	14
SR_IO06	I/O	Sensor General Purpose Input/Output 6	15
SR_IO07	I/O	Sensor General Purpose Input/Output 7	16
SR_IO09	I/O	Sensor General Purpose Input/Output 9	18

Signal Name	Signal Type	Function	Pin Location
SR_IO10	I/O	Sensor General Purpose Input/Output 10	19
SR_IO11	I/O	Sensor General Purpose Input/Output 11	20
TTL Interface			
TTL0	I/O	Parallel LCDGeneral Purpose Input/Output 0	29
TTL1	I/O	Parallel LCDGeneral Purpose Input/Output 1	30
TTL2	I/O	Parallel LCDGeneral Purpose Input/Output 2	31
TTL3	I/O	Parallel LCDGeneral Purpose Input/Output 3	32
TTL4	I/O	Parallel LCDGeneral Purpose Input/Output 4	33
TTL5	I/O	Parallel LCDGeneral Purpose Input/Output 5	34
TTL6	I/O	Parallel LCDGeneral Purpose Input/Output 6	35
TTL7	I/O	Parallel LCDGeneral Purpose Input/Output 7	36
TTL8	I/O	Parallel LCDGeneral Purpose Input/Output 8	37
TTL11	I/O	Parallel LCDGeneral Purpose Input/Output 11	39
TTL12	I/O	Parallel LCDGeneral Purpose Input/Output 12	41
TTL13	I/O	Parallel LCDGeneral Purpose Input/Output 13	42
TTL14	I/O	Parallel LCDGeneral Purpose Input/Output 14	43
TTL15	I/O	Parallel LCDGeneral Purpose Input/Output 15	44
TTL16	I/O	Parallel LCDGeneral Purpose Input/Output 16	45
TTL17	I/O	Parallel LCDGeneral Purpose Input/Output 17	46
TTL18	I/O	Parallel LCDGeneral Purpose Input/Output 18	47
TTL19	I/O	Parallel LCDGeneral Purpose Input/Output 19	48
TTL20	I/O	Parallel LCDGeneral Purpose Input/Output 20	49
TTL21	I/O	Parallel LCDGeneral Purpose Input/Output 21	50
Audio Line Out Interface			
AUD_LINEOUT_LO	O	Audio Left Channel Line Output	1
AUD_VAG	O	Audio Reference Voltage from 1/2 AVDD_AUD	67
AUD_VRM_ADC	I	Audio Reference Voltage for ADC	68
USB 2.0 Interface			
USB2_DM	I/O	USB 2.0 Differential Pair, Negative	54
USB2_DP	I/O	USB 2.0 Differential Pair, Positive	53
Power pins			
VDD	Core Power	Digital Core Power	8, 26, 51, 52, 56
DVDD_DDR_RX	Core Power	Digital Power for DDR RX LDO (0.1uF CAP to GND)	21
VDDIO_DATA	DDR Power	IO Power for DDR Data	24

Signal Name	Signal Type	Function	Pin Location
VDDIO_MCLK	DDR Power	IO Power for DDR Clock	27
AVDDIO_DRAM	DDR Power	IO Power for embedded DRAM	23, 25, 28
VDDP_1_3318	1.8V/3.3V Power	Digital Input/Output Power for Domain 1	17
VDDP_2_3318	1.8V/3.3V Power	Digital Input/Output Power for Domain 2	40
AVDD_PLL	3.3V Power	Analog Power for PLL	22
AVDD_XTAL	3.3V Power	Analog Power for XTAL	63
AVDD3P3_USB	3.3V Power	Analog Power for USB2.0	55
AVDD_AUD	3.3V Power	Analog Power for Audio	66
GND_E	GND	Ground	38

## MECHANICAL DIMENSIONS



## ELECTRICAL SPECIFICATIONS

### Interface Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
<b>DIGITAL INPUTS</b>					
Input Voltage, High	$V_{IH}$	$V_{DDP} * 0.7$ <small>Note</small>			V
Input Voltage, Low	$V_{IL}$			0.8	V
Input Current, High	$I_{IH}$			-1.0	uA
Input Current, Low	$I_{IL}$			1.0	uA
Input Capacitance			5		pF
<b>DIGITAL OUTPUTS</b>					
Output Voltage, High	$V_{OH}$	$V_{DDP} - 0.1$ <small>Note</small>			V
Output Voltage, Low	$V_{OL}$			0.1	V
SAR ADC Input		0		$V_{VDD\_33}$	V
<b>AUDIO OUTPUTS</b>					
Line-Out			2.54		Vp-p
<b>XTAL Specifications</b>					
Input Voltage, High	$V_{IH}$	2.0		3.6	V
Input Voltage, Low	$V_{IL}$	-0.3		0.8	V
Clock frequency			24		MHz
Crystal accuracy			+/-30		ppm
Long-term jitter			+/-500		ps

Note: VDDP typical voltage is 3.3V or 1.8V

### Recommended Operating Conditions

Parameter	Symbol	Min	Typ.	Max.	Unit
3.3V Supply Voltage	$V_{VDD\_33}$	3.14	3.3	3.46	V
1.8V Supply Voltage (DDR II)	$V_{VDD\_18}$	1.71	1.8	1.89	V
Core Power Supply Voltage (Core)	$V_{VDD\_core}$	0.87	0.9	0.93	V
Ambient Operation Temperature	$T_A$	-20		85	°C
Junction Temperature	$T_J$			125	°C

## Absolute Maximum Ratings

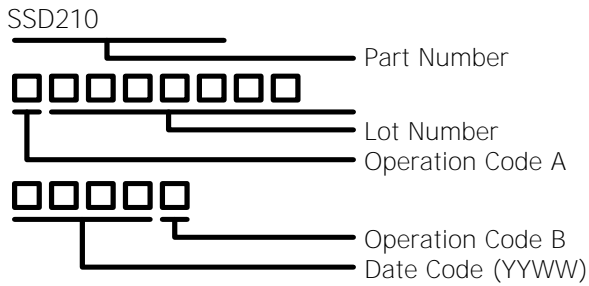
Parameter	Symbol	Min	Typ.	Max.	Unit
3.3V Supply Voltage	V <sub>VDD_33</sub>	2.97	3.3	3.63	V
1.8V Supply Voltage (DDR II)	V <sub>VDD_18</sub>			1.98	V
Core Power Supply Voltage (Core)	V <sub>VDD_core</sub>			1.1	V
Storage Temperature	T <sub>STG</sub>	-40		150	°C

Note: Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and does not imply functional operation of device. Exposure to absolute maximum ratings for extended periods may affect device reliability.

## ORDERING GUIDE

Part Number	Temperature Range	Package Description	Package Option
SSD210	-20°C to +85°C	QFN	68-pin

## MARKING INFORMATION



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Electrostatic charges accumulate on both test equipment and human body and can discharge without detection. SSD210 comes with ESD protection circuitry; however, the device may be permanently damaged when subjected to high energy discharges. The device should be handled with proper ESD precautions to prevent malfunction and performance degradation.