

# ILI2325 Capacitive Touch Sensor Controller

## Specification

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## Revision History

Version	Date	Page	Description
V1.00	2015/06/12		Draft specification released.
V1.01	2015/09/01	8	Modify Pin Definition
V1.02	2015/09/04	15, 16, 17	1. Modify DC Characteristics.
		20	2. Add Capacitors voltage spec.
V1.03	2015/11/17	Title	Remove "Preliminary"

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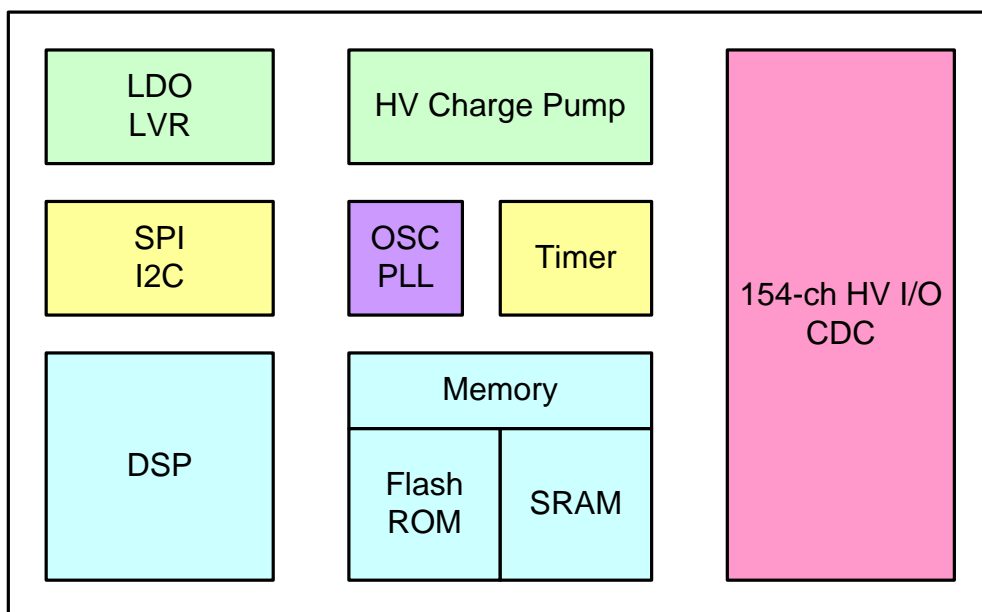
## 1. Description

The ILI2325 is a compact capacitive touch sensor controller optimized for Interactive White-Board (IWB) and All-in-One PC (AIO) capacitive Touch Panel. It integrates high speed Capacitance to Digital Converter (CDC), total 154 channels including high voltage Driving and Sensing channels, high voltage Charge Pump Controller in a 200-ball BGA 9mm\*9mm\*1mm package. It meets all Windows 8.1 and Windows 10 requirements with best user touch performance.

## 2. Features

- 154 channels for capacitive touch panel
- Flexible driving or sensing channel assignment
- Programmable driving voltage for driving channels
- High voltage charge pump controller with programmable high voltage regulator
- High speed 12-bit ADC converter
- Support cascade up to 400 channels
- Support baseline calibration function
- Support mutual-capacitance sensing
- Support self-capacitance sensing
- Built-in noise processing function
- Input voltage low level detection circuit
- Input voltage power on reset circuit
- Driving to Sensing mutual capacitance: 1pF to 4pF

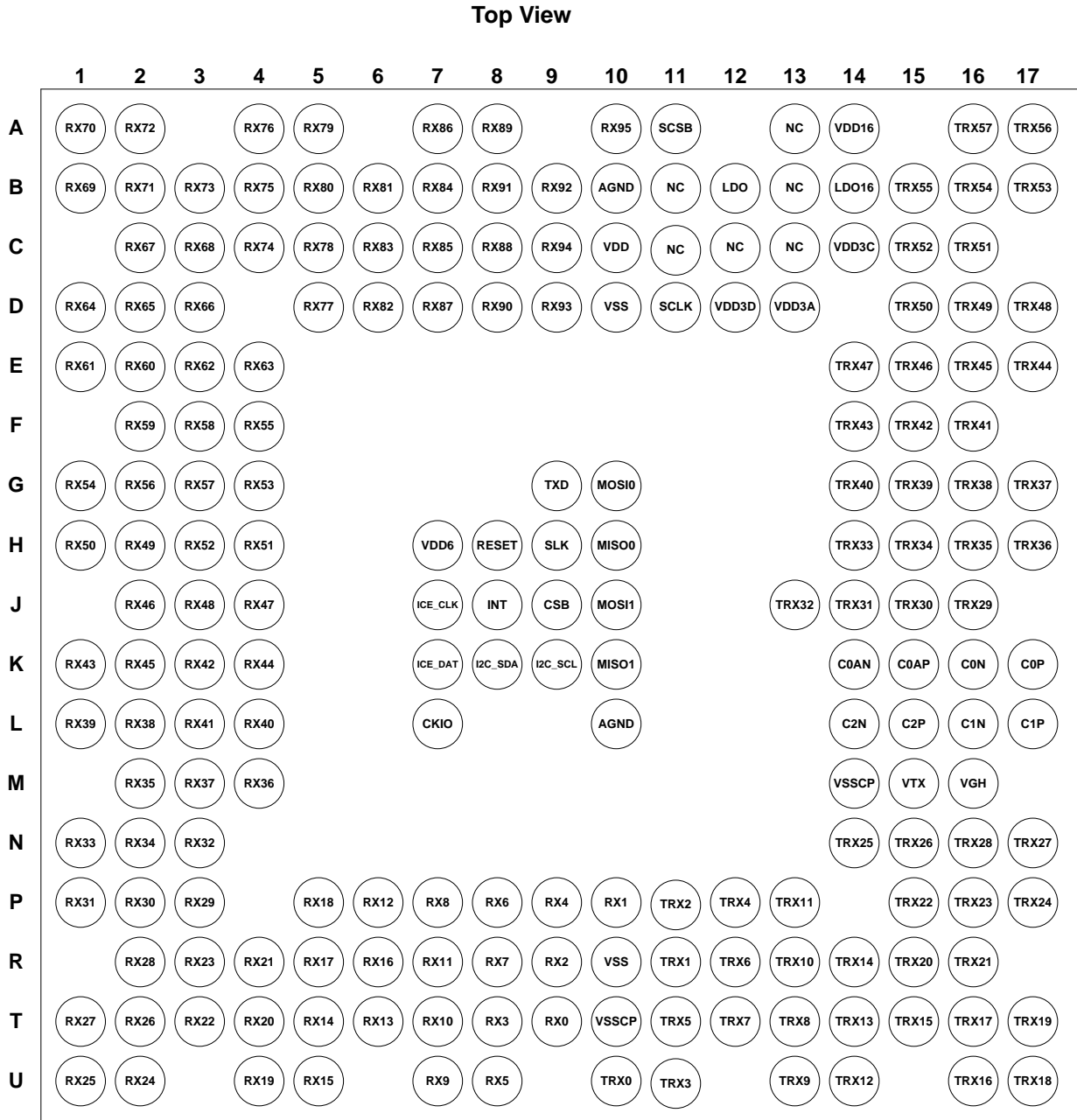
### 3. Block Diagram



**Figure 3-1: ILI2325 Block Diagram**

## 4. Pin Definition

### 4.1 BGA-200 Ball Assignment



**Figure 4-1: ILI2325 BGA-200 Package Diagram**

## 4.2 BGA-200 Pin Description

**Table 4-1: ILI2325 Pin Assignment**

Ball No.	Pin Name	Pin Type	Description
A1	RX70	I/O	HV I/O channel RX70
A2	RX72	I/O	HV I/O channel RX72
A4	RX76	I/O	HV I/O channel RX76
A5	RX79	I/O	HV I/O channel RX79
A7	RX86	I/O	HV I/O channel RX86
A8	RX89	I/O	HV I/O channel RX89
A10	RX95	I/O	HV I/O channel RX95
A11	SCSB	I	Digital input single for cascade chip selection.
A13	NC		No connection.
A14	VDD16	P	Input power supply for digital circuit. Connect to LDO16(B14).
A16	TRX57	I/O	HV I/O channel TRX57
A17	TRX56	I/O	HV I/O channel TRX56
B1	RX69	I/O	HV I/O channel RX69
B2	RX71	I/O	HV I/O channel RX71
B3	RX73	I/O	HV I/O channel RX73
B4	RX75	I/O	HV I/O channel RX75
B5	RX80	I/O	HV I/O channel RX80
B6	RX81	I/O	HV I/O channel RX81
B7	RX84	I/O	HV I/O channel RX84
B8	RX91	I/O	HV I/O channel RX91
B9	RX92	I/O	HV I/O channel RX92
B10	AGND	P	Analog circuit reference ground. Connect to GND.
B11	NC		No connection.
B12	LDO	P	Output power supply of internal LDO. Connect a bypass capacitor 2.2uF to GND.
B13	NC		No connection.
B14	LDO16	P	Output power supply of internal LDO. Connect to V <sub>DD16</sub> (A14) and a bypass capacitor 2.2uF to GND.
B15	TRX55	I/O	HV I/O channel TRX55
B16	TRX54	I/O	HV I/O channel TRX54
B17	TRX53	I/O	HV I/O channel TRX53
C2	RX67	I/O	HV I/O channel RX67



Ball No.	Pin Name	Pin Type	Description
C3	RX68	I/O	HV I/O channel RX68
C4	RX74	I/O	HV I/O channel RX74
C5	RX78	I/O	HV I/O channel RX78
C6	RX83	I/O	HV I/O channel RX83
C7	RX85	I/O	HV I/O channel RX85
C8	RX88	I/O	HV I/O channel RX88
C9	RX94	I/O	HV I/O channel RX94
C10	VDD	P	Input power supply. Connect a bypass capacitor 2.2uF to GND.
C11	NC		No connection.
C12	NC		No connection.
C13	NC		No connection.
C14	VDD3C	P	Input power supply for charge pump circuit. Connect a bypass capacitor 2.2uF to GND.
C15	TRX52	I/O	HV I/O channel TRX52
C16	TRX51	I/O	HV I/O channel TRX51
D1	RX64	I/O	HV I/O channel RX64
D2	RX65	I/O	HV I/O channel RX65
D3	RX66	I/O	HV I/O channel RX66
D5	RX77	I/O	HV I/O channel RX77
D6	RX82	I/O	HV I/O channel RX82
D7	RX87	I/O	HV I/O channel RX87
D8	RX90	I/O	HV I/O channel RX90
D9	RX93	I/O	HV I/O channel RX93
D10	VSS	P	Digital circuit reference ground. Connect to GND.
D11	SCLK	I	Digital input single for cascade clock single.
D12	VDD3D	P	Input power supply. Connect a bypass capacitor 2.2uF to GND.
D13	VDD3A	P	Input power supply. Connect a bypass capacitor 2.2uF to GND.
D15	TRX50	I/O	HV I/O channel TRX50
D16	TRX49	I/O	HV I/O channel TRX49
D17	TRX48	I/O	HV I/O channel TRX48
E1	RX61	I/O	HV I/O channel RX61
E2	RX60	I/O	HV I/O channel RX60
E3	RX62	I/O	HV I/O channel RX62

Ball No.	Pin Name	Pin Type	Description
E4	RX63	I/O	HV I/O channel RX63
E14	TRX47	I/O	HV I/O channel TRX47
E15	TRX46	I/O	HV I/O channel TRX46
E16	TRX45	I/O	HV I/O channel TRX45
E17	TRX44	I/O	HV I/O channel TRX44
F2	RX59	I/O	HV I/O channel RX59
F3	RX58	I/O	HV I/O channel RX58
F4	RX55	I/O	HV I/O channel RX55
F14	TRX43	I/O	HV I/O channel TRX43
F15	TRX42	I/O	HV I/O channel TRX42
F16	TRX41	I/O	HV I/O channel TRX41
G1	RX54	I/O	HV I/O channel RX54
G2	RX56	I/O	HV I/O channel RX56
G3	RX57	I/O	HV I/O channel RX57
G4	RX53	I/O	HV I/O channel RX53
G9	TXD	O	Output data signal for test.
G10	MOSI0	I/O	Input data signal A of SPI.
G14	TRX40	I/O	HV I/O channel TRX40
G15	TRX39	I/O	HV I/O channel TRX39
G16	TRX38	I/O	HV I/O channel TRX38
G17	TRX37	I/O	HV I/O channel TRX37
H1	RX50	I/O	HV I/O channel RX50
H2	RX49	I/O	HV I/O channel RX49
H3	RX52	I/O	HV I/O channel RX52
H4	RX51	I/O	HV I/O channel RX51
H7	VDD6F	P	Digital input single for cascade chip selection.
H8	RESET	I	Input reset signal of chip. Low active reset.
H9	SLK	I/O	Clock signal of SPI.
H10	MISO0	O	Output data signal A of SPI.
H14	TRX33	I/O	HV I/O channel TRX33
H15	TRX34	I/O	HV I/O channel TRX34
H16	TRX35	I/O	HV I/O channel TRX35
H17	TRX36	I/O	HV I/O channel TRX36

Ball No.	Pin Name	Pin Type	Description
J2	RX46	I/O	HV I/O channel RX46
J3	RX48	I/O	HV I/O channel RX48
J4	RX47	I/O	HV I/O channel RX47
J7	ICE_CLK	I/O	Input clock signal of ICE.
J8	INT	I/O	Output interrupt signal for host controller.
J9	CSB	I/O	Chip selection signal of SPI.
J10	MOSI1	I	Input data signal B of SPI.
J13	TRX32	I/O	HV I/O channel TRX32
J14	TRX31	I/O	HV I/O channel TRX31
J15	TRX30	I/O	HV I/O channel TRX30
J16	TRX29	I/O	HV I/O channel TRX29
K1	RX43	I/O	HV I/O channel RX43
K2	RX45	I/O	HV I/O channel RX45
K3	RX42	I/O	HV I/O channel RX42
K4	RX44	I/O	HV I/O channel RX44
K7	ICE_DAT	I/O	Input data signal of ICE.
K8	I2C_SDA	I/O	Output/Input data signal of I2C. Connect a resistor 4.7kΩ to V <sub>DD</sub> .
K9	I2C_SCL	I	Input clock signal of I2C. Connect a resistor 4.7kΩ to V <sub>DD</sub> .
K10	MISO1	O	Output data signal B of SPI.
K14	C0AN	P	Output clock signal of charge pump. Connect a fly capacitor 1uF to C0AP.
K15	C0AP	P	Output clock signal of charge pump. Connect a fly capacitor 1uF to C0AN.
K16	C0N	P	Output clock signal of charge pump. Connect a fly capacitor 1uF to C0P.
K17	C0P	P	Output clock signal of charge pump. Connect a fly capacitor 1uF to C0P.
L1	RX39	I/O	HV I/O channel RX39
L2	RX38	I/O	HV I/O channel RX38
L3	RX41	I/O	HV I/O channel RX41
L4	RX40	I/O	HV I/O channel RX40
L7	CKIO	CLK	Clock input single.
L10	AGND	P	Analog circuit reference ground. Connect to GND.
L14	C2N	P	Output clock signal of charge pump. Connect a fly capacitor 1uF to C2P.
L15	C2P	P	Output clock signal of charge pump. Connect a fly capacitor 1uF to C2N.
L16	C1N	P	Output clock signal of charge pump. Connect a fly capacitor 1uF to C1P.

Ball No.	Pin Name	Pin Type	Description
L17	C1P	P	Output clock signal of charge pump. Connect a fly capacitor 1uF to C1N.
M2	RX35	I/O	HV I/O channel RX35
M3	RX37	I/O	HV I/O channel RX37
M4	RX36	I/O	HV I/O channel RX36
M14	VSSCP	P	Charge pump circuit reference ground. Connect to GND.
M15	VTX	P	Output power supply of charge pump. Connect a bypass capacitor 1uF to GND.
M16	VGH	P	Output power supply of charge pump. Connect a bypass capacitor 1uF to GND.
N1	RX33	I/O	HV I/O channel RX33
N2	RX34	I/O	HV I/O channel RX34
N3	RX32	I/O	HV I/O channel RX32
N14	TRX25	I/O	HV I/O channel TRX25
N15	TRX26	I/O	HV I/O channel TRX26
N16	TRX28	I/O	HV I/O channel TRX28
N17	TRX27	I/O	HV I/O channel TRX27
P1	RX31	I/O	HV I/O channel RX31
P2	RX30	I/O	HV I/O channel RX30
P3	RX29	I/O	HV I/O channel RX29
P5	RX18	I/O	HV I/O channel RX18
P6	RX12	I/O	HV I/O channel RX12
P7	RX8	I/O	HV I/O channel RX8
P8	RX6	I/O	HV I/O channel RX6
P9	RX4	I/O	HV I/O channel RX4
P10	RX1	I/O	HV I/O channel RX1
P11	TRX2	I/O	HV I/O channel TRX2
P12	TRX4	I/O	HV I/O channel TRX4
P13	TRX11	I/O	HV I/O channel TRX11
P15	TRX22	I/O	HV I/O channel TRX22
P16	TRX23	I/O	HV I/O channel TRX23
P17	TRX24	I/O	HV I/O channel TRX24
R2	RX28	I/O	HV I/O channel RX28
R3	RX23	I/O	HV I/O channel RX23
R4	RX21	I/O	HV I/O channel RX21
R5	RX17	I/O	HV I/O channel RX17

Ball No.	Pin Name	Pin Type	Description
R6	RX16	I/O	HV I/O channel RX16
R7	RX11	I/O	HV I/O channel RX11
R8	RX7	I/O	HV I/O channel RX7
R9	RX2	I/O	HV I/O channel RX2
R10	VSS	P	Digital circuit reference ground. Connect to GND.
R11	TRX1	I/O	HV I/O channel TRX1
R12	TRX6	I/O	HV I/O channel TRX6
R13	TRX10	I/O	HV I/O channel TRX10
R14	TRX14	I/O	HV I/O channel TRX14
R15	TRX20	I/O	HV I/O channel TRX20
R16	TRX21	I/O	HV I/O channel TRX21
T1	RX27	I/O	HV I/O channel RX27
T2	RX26	I/O	HV I/O channel RX26
T3	RX22	I/O	HV I/O channel RX22
T4	RX20	I/O	HV I/O channel RX20
T5	RX14	I/O	HV I/O channel RX14
T6	RX13	I/O	HV I/O channel RX13
T7	RX10	I/O	HV I/O channel RX10
T8	RX3	I/O	HV I/O channel RX3
T9	RX0	I/O	HV I/O channel RX0
T10	VSSCP	P	Charge pump circuit reference ground. Connect to GND.
T11	TRX5	I/O	HV I/O channel TRX5
T12	TRX7	I/O	HV I/O channel TRX7
T13	TRX8	I/O	HV I/O channel TRX8
T14	TRX13	I/O	HV I/O channel TRX13
T15	TRX15	I/O	HV I/O channel TRX15
T16	TRX17	I/O	HV I/O channel TRX17
T17	TRX19	I/O	HV I/O channel TRX19
U1	RX25	I/O	HV I/O channel RX25
U2	RX24	I/O	HV I/O channel RX24
U4	RX19	I/O	HV I/O channel RX19
U5	RX15	I/O	HV I/O channel RX15
U7	RX9	I/O	HV I/O channel RX9

Ball No.	Pin Name	Pin Type	Description
U8	RX5	I/O	HV I/O channel RX5
U10	TRX0	I/O	HV I/O channel TRX0
U11	TRX3	I/O	HV I/O channel TRX3
U13	TRX9	I/O	HV I/O channel TRX9
U14	TRX12	I/O	HV I/O channel TRX12
U16	TRX16	I/O	HV I/O channel TRX16
U17	TRX18	I/O	HV I/O channel TRX18

**Table 4-2: Pin Type Define**

Symbol	Description
P	Power pad
CLK	Clock
I	Input only
O	Output only (Push-pull)
I/O	input / output pad

## 5. Electrical Characteristics

### 5.1 Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.

**Table 5-1: Absolute Maximum Ratings**

Parameter	Symbol	Min	Max	Unit
$V_{DD}$ to GND	$V_{DD}$	-0.3	3.6	V
$AV_{DD}$ to GND	$AV_{DD}$	-0.3	3.6	V
$V_{DD3A}$	$V_{DD3A}$	-0.3	3.6	V
$V_{DD3C}$	$V_{DD3C}$	-0.3	3.6	V
$V_{DD3D}$	$V_{DD3D}$	-0.3	3.6	
$V_{DD16}$ to GND	$V_{DD16}$	-0.3	1.65	V
$V_{TX}$ to GND	$V_{TX}$	-0.3	35	V
ESD Susceptibility HBM (Human Body Mode) <b>(Note 1)</b>	HBM		2000	V
ESD Susceptibility MM (Machine Mode)	MM		200	V

**Note 1:** Devices are ESD sensitive. Handling precaution is recommended.

## 5.2 Recommended Operating Conditions

**Table 5-2: Recommended Operating Conditions**

Parameter	Symbol	Min	Max	Unit
$V_{DD}$ to GND	$V_{DD}$	2.7	3.6	V
$AV_{DD}$ to GND	$AV_{DD}$	2.7	3.6	V
$V_{DD3A}$	$V_{DD3A}$	2.7	3.6	V
$V_{DD3C}$	$V_{DD3C}$	2.7	3.6	V
$V_{DD3D}$	$V_{DD3D}$	2.7	3.6	V
Operating Ambient Temperature Range	$T_A$	-40	85	°C
Operating Junction Temperature Range	$T_J$	-40	125	°C
Storage Ambient Temperature Range	$T_{ST}$	-40	150	°C

**Note:** The device is not guaranteed to function outside its operating conditions.



### 5.3 DC Characteristics

**Table 5-3: Input Power Supply and LDO**

 (GND = 0V, T<sub>opr</sub> = 25°C)

Item	Symbol	Min	Typ.	Max	Unit	Condition
Digital input power supply voltage	V <sub>DD</sub>	2.7	3	3.4	V	
Analog input power supply voltage	AV <sub>DD</sub>	2.7	3	3.4	V	
1.8V LDO output voltage	LDO	-10%	1.8	+10%	V	
1.6V LDO output voltage	LDO16		1.6		V	

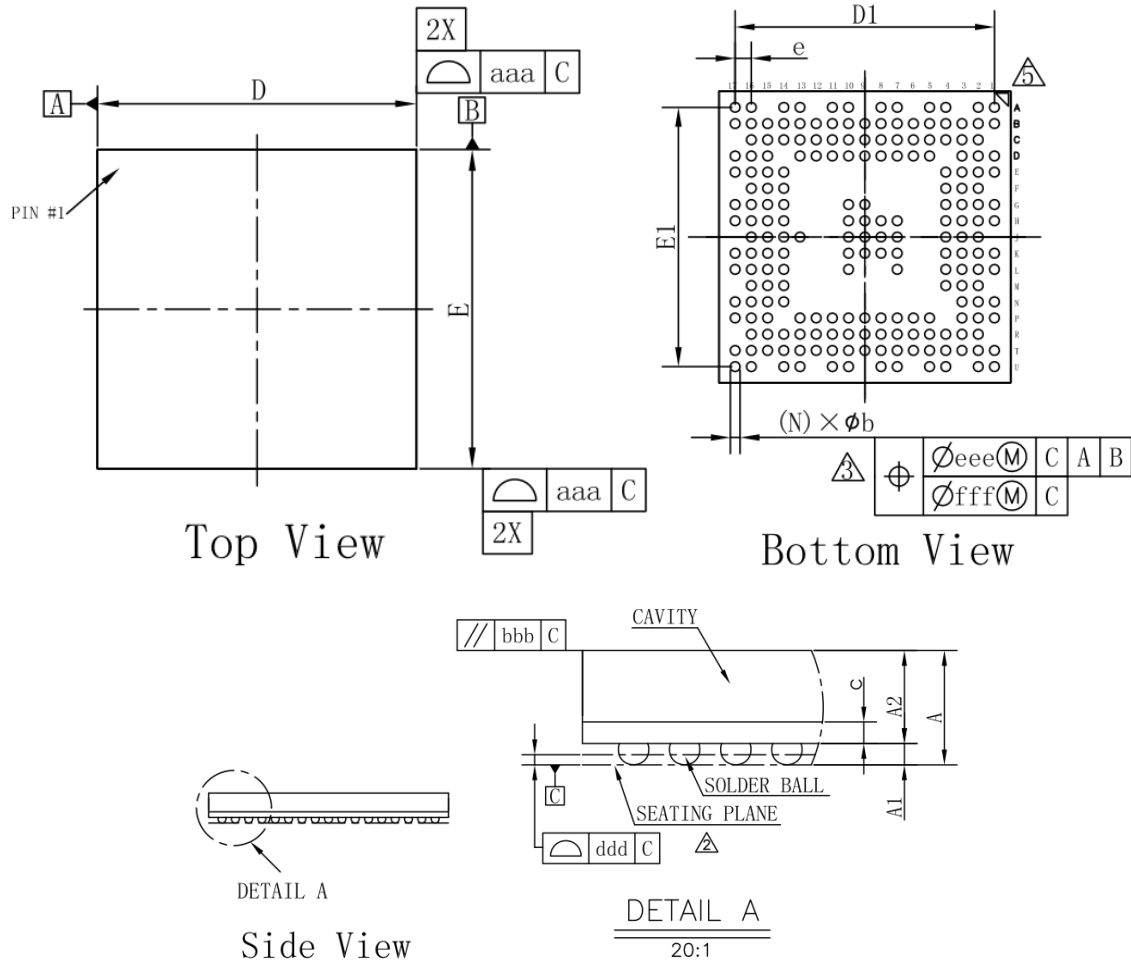
**Table 5-4: DC Characteristics**

 (V<sub>DD</sub> = 3.3, GND = 0V, T<sub>opr</sub> = 25°C)

Item	Symbol	Min	Typ.	Max	Unit	Condition
Power Ground	V <sub>SS</sub>	-0.3			V	
Operation current	I <sub>op</sub>		TBD		mA	
Input Low Voltage	V <sub>IL</sub>	-0.5		0.3V <sub>DD</sub>	V	
Input High Voltage	V <sub>IH</sub>	0.65V <sub>DD</sub>		V <sub>DD</sub> +0.5	V	
Hysteresis voltage	V <sub>HY</sub>		0.2V <sub>DD</sub>		V	
Negative going threshold, /Reset	V <sub>ILS</sub>	-0.5		0.2V <sub>DD</sub>	V	
Positive going threshold, /Reset	V <sub>IHS</sub>	0.6V <sub>DD</sub>		V <sub>DD</sub> +0.5	V	
Output High Voltage	V <sub>OH</sub>	0.7V <sub>DD</sub>			V	V <sub>DD</sub> =3.3V, I <sub>OH</sub> =8mA
Output Low Voltage	V <sub>OL</sub>			0.3V <sub>DD</sub>	V	V <sub>DD</sub> =3.3V, I <sub>OL</sub> =10mA

## 6. Package Information

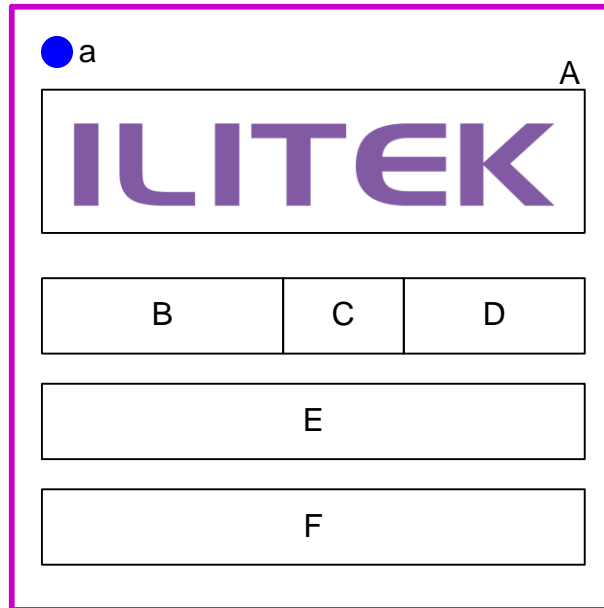
### 6.1 BGA-200 Package Dimension



symbol	Dimension in mm			Dimension in inch		
	MIN	NOM	MAX	MIN	NOM	MAX
A	---	---	1.220	---	---	0.048
A1	0.160	0.210	0.260	0.006	0.008	0.010
A2	0.860	0.910	0.960	0.034	0.036	0.038
c	0.170	0.210	0.250	0.007	0.008	0.010
D	8.900	9.000	9.100	0.350	0.354	0.358
E	8.900	9.000	9.100	0.350	0.354	0.358
D1	---	8.000	---	---	0.315	---
E1	---	8.000	---	---	0.315	---
e	---	0.500	---	---	0.020	---
b	0.250	0.300	0.350	0.010	0.012	0.014
aaa	0.150			0.006		
bbb	0.200			0.008		
ddd	0.080			0.003		
eee	0.150			0.006		
fff	0.080			0.003		
N	200			200		
MD/ME	17/17			17/17		

**Figure 6-1: Package Information of BGA-200**

## 6.2 Marking Description



**Figure 6-2: BGA-200 package top view**

a – PIN1 Ref.

A – ILITEK Logo

B – Product Name : 2325

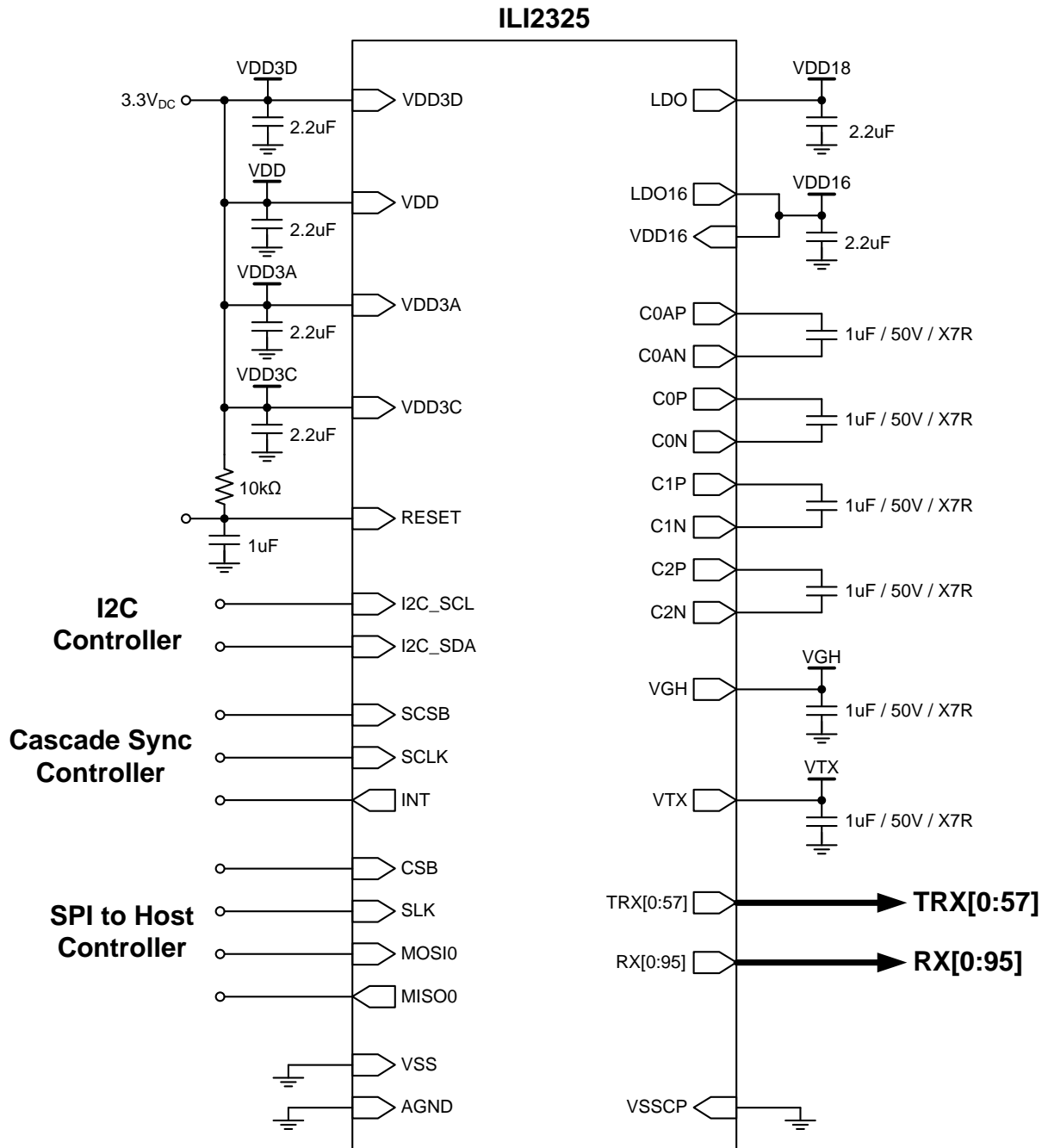
C – Package Type : BJ (BGA)

D – Control Code : The code will be updated by production control.

E – Assembly Lot No. : The code will be updated by production control.

F – Wafer Lot No. : The code will be updated by production control.

## 7. Typical Application Circuit



**Figure 7-1: ILI2325 Typical Application Circuit**