BT531

26x16 channels
Capacitive Touch Screen Controller

PRODUCT FEATURES

- 3rd Generation Capacitive touch screen controller
  - 26 x 16 channel
  - Up to 10 fingers
  - Up to 8 keys with TSP or FPC pattern
  - No scan rate degradation in multi touch
- Fast response time (NOTE3)
  - Point detection latency : Down to 10msec
  - Point report rate : Down to 10msec
- High screen resolution
  - Up to 2048x2560
- Supporting LCD size
  - Up to 5.0 inch with 26x16 channel
- TSP sensor type
  - G2(SITO) with/without shield layer
  - GF1 with/without shield layer
  - G1F without shield layer
  - GFF without shield layer
  - On-cell/In-Cell touch
  - Metal Mesh sensor
- Minimum gap between TSP and LCD (NOTE1)
  - Down to 0.1mm UV resin gap
  - Down to 0.1mm AIR gap
- Sensor pattern : FENCE™, New FENCE™
  - Best performance for stylus pen, finger nail
  - 1 layer pattern for GF1, G2(SITO), GG(SITO)
  - 2 layer pattern for G1F, GFF, GG(DITO)
- High SNR
  - Stylus pen : down to 1.8hi tip (NOTE2)
- Window thickness
  - 0.5 ~ 1mm glass
  - 0.5 ~ 1.5mm plastic
- Supporting COB(Chip On Board)
  - Tested up to 150mm FFC/FPC
  - FFC or B2B connector
- I2C interface with BYTE/DMA mode
  - Up to 400KHz/3.4MHz
  - Open drain I/O with 1.62V ~ 3.6V
- DSP technology for the noise reduction
  - Minimizing the cheek/grab noise
  - Minimizing the charger noise
  - Minimizing the LCD noise
  - Various digital filters
- No TSP calibration
  - Real time compensation
  - Fast/Easy mass production
- No RFI issue
  - No interference to FM, NFC, GSM
  - Immune to 2G/3G/4G, WiFi, Bluetooth RF
- Windows software
  - ECM(Extreme CapSensorMon)
  - Demonstration, Evaluation, Debugging
  - Firmware downloading, data monitoring
  - Built in Test Mode for Mass production
- Manufacturing support
  - TSP drawing, FPC schematic, FPC gerber
  - Design guide for Test Machine
- Single power supply
  - 2.5V ~ 3.6V
  - No I2C power supply
- Low power consumption (NOTE4)
  - Full Active : 20mA
  - Normal Active : 12mA
  - Sleep : TBD
- Wide operating temperature
  - Operating : -20°C ~ 85°C
  - Storage : -40°C ~ 125°C
- Small package
  - 56-pin QFN : 6mm x 6mm x 0.45T
- Hazardous Substance
  - Pb-free/Halogen-free, RoHS/REACH compliant

[NOTE]

1. The gap thickness is heavily affected by LCD types, glass thickness, TSP structure
2. Point diameter is affected by TSP performance
3. Response time is related to the channel counts, Cm, charger noise, LCD noise.
   Suggested value may be changed according to the system properties.
4. The power consumption is measured under optimal system condition.
   According to each system condition, the value can be different.
5. To avoid the typo, the table shall always have the correct values.

COPYRIGHT

DISCLAIMER

REVISION HISTORY

REV	DATE	AUTHOR	DESCRIPTION
0.0.1	2012/11/14	Steve Yun	First release
0.0.2	2012/11/26	Jerry So	Fixing package information
0.0.3	2013/01/02	Jerry So	Modifying H/W block diagram

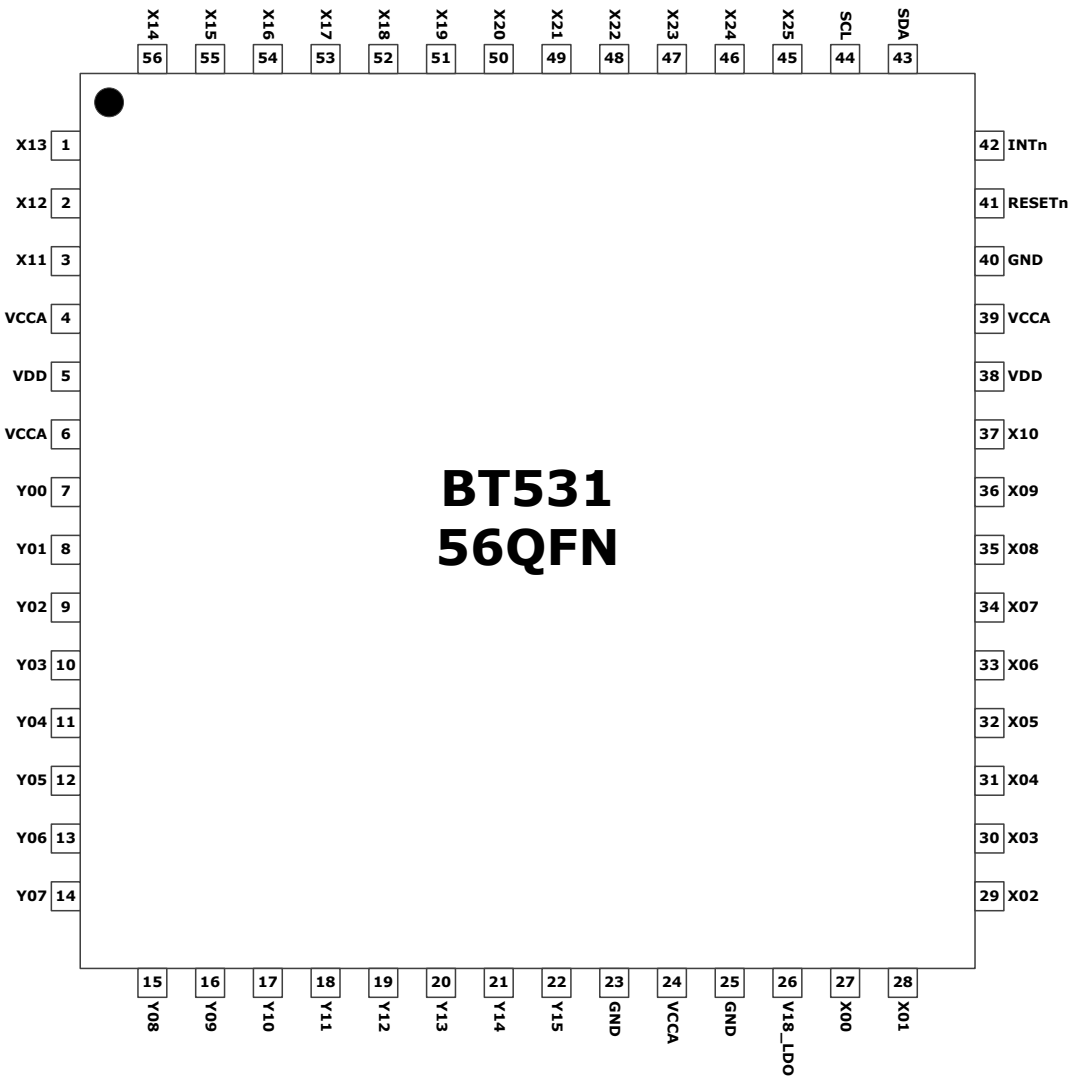
1. GENERAL DESCRIPTION

BT431 is 3rd generation mutual capacitive touch screen controller using the transparent capacitive touch screen panel. This controller includes all signal processing algorithm to provide the versatile filters like User usage scenarios, various LCD types, charger noise.

The controller supports the wide I/O voltage which can accept the various voltage level of I/O in HOST CPU, thus can be compatible with almost HOST CPU for the mobile applications.

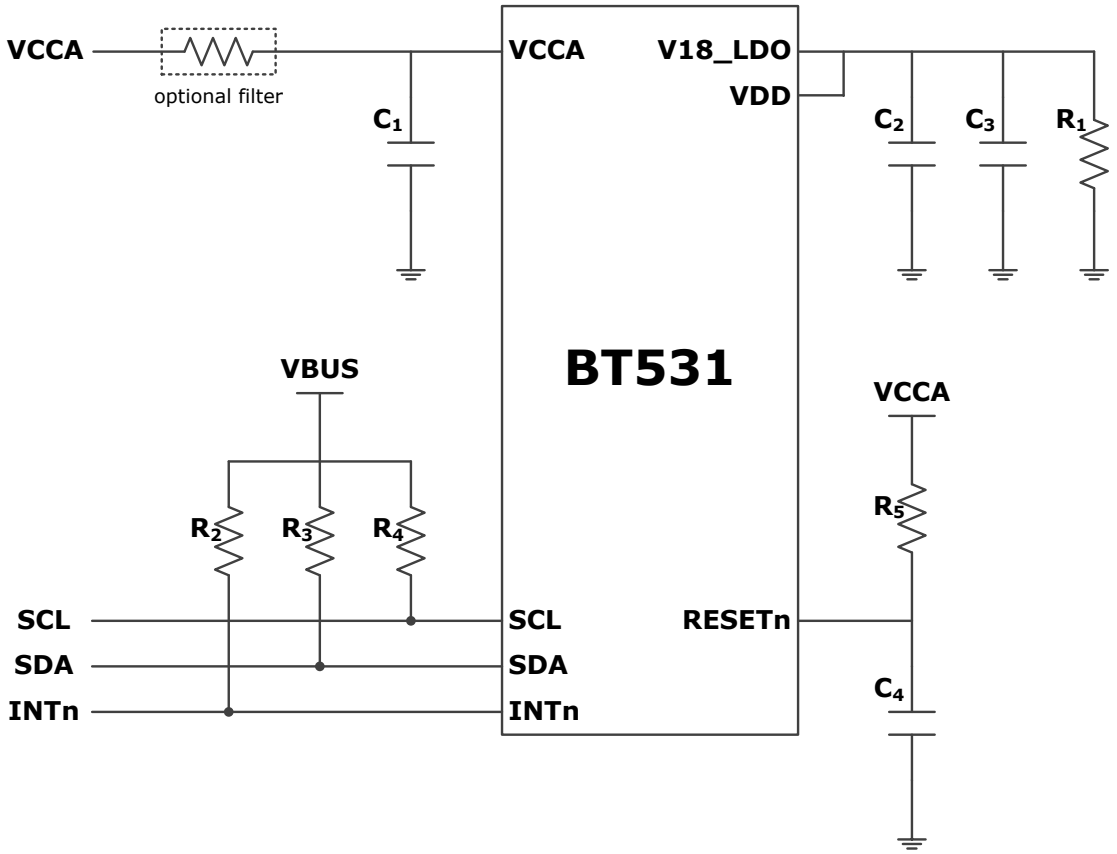
The controller can receive the I2C clock speed ranging from 400KHz up to 3.4MHz which is fastest in I2C specification.

QFN package is adopted to provide the stable soldering on FPC (Flexible Printed Circuit) module. No external components except the bypass filter capacitors for the power supply is needed.



2. HARDWARE DESCRIPTIONS

2.1 BLOCK DIAGRAM



C1	C2	C3	C4	R1	R2	R3	R4	R5
1uF	1uF	-	1uF	-	2.2KΩ	2.2KΩ	2.2KΩ	1KΩ

2.2 PIN ASSIGNMENT

(NOTES)
Suffix 'n' in "XXXn" means the low level assertion. Negation value for suffix 'n' signals shall be the logic 'HIGH'.

#	PIN NAME	TYPE	FUNCTION
1	X13	O	TX driver
2	X12	O	TX driver
3	X11	O	TX driver
4	VCCA	PWR	Analog power supply
5	VDD	PWR	Digital power supply
6	VCCA	PWR	Analog power supply
7	Y00	I	RX input
8	Y01	I	RX input
9	Y02	I	RX input
10	Y03	I	RX input
11	Y04	I	RX input
12	Y05	I	RX input
13	Y06	I	RX input
14	Y07	I	RX input
15	Y08	I	RX input
16	Y09	I	RX input
17	Y10	I	RX input
18	Y11	I	RX input
19	Y12	I	RX input
20	Y13	I	RX input
21	Y14	I	RX input
22	Y15	I	RX input
23	GND	PWR	Ground
24	VCCA	PWR	Analog power supply
25	GND	PWR	Ground
26	V18_LDO	PWR	LDO 1.8V output
27	X00	O	TX driver
28	X01	O	TX driver
29	X02	O	TX driver
30	X03	O	TX driver
31	X04	O	TX driver
32	X05	O	TX driver
33	X06	O	TX driver
34	X07	O	TX driver
35	X08	O	TX driver
36	X09	O	TX driver
37	X10	O	TX driver
38	VDD	PWR	Digital power supply
39	VCCA	PWR	Analog power supply
40	GND	PWR	Ground
41	RESETn	OD	Reset
42	INTn	OD	Interrupt to HOST
43	SDA	OD	I2C data
44	SCL	OD	I2C clock
45	X25	O	TX driver
46	X24	O	TX driver
47	X23	O	TX driver
48	X22	O	TX driver
49	X21	O	TX driver
50	X20	O	TX driver
51	X19	O	TX driver
52	X18	O	TX driver
53	X17	O	TX driver

54	X16	O	TX driver
55	X15	O	TX driver
56	X14	O	TX driver

3. ELECTRICAL CHARACTERISTICS

3.1 ABSOLUTE MAXIMUM RATINGS

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
VCCA	Analog power supply voltage (1)	-0.5	-	4.6	V
V_{IN}	Input voltage for I/O bus (1)	-0.5	-	4.6	V
I_{IN}	DC input current (1)	-	-	50	mA
I_{OUT}	Output short circuit current (1)	-	-	50	mA
T_{STG}	Storage temperature (6)	-65	-	+150	°C
V_{ESD1}	Electrostatic handling HBM (3)	-4000	-	+4000	V
V_{ESD2}	Electrostatic handling (4)	-250	-	+250	V

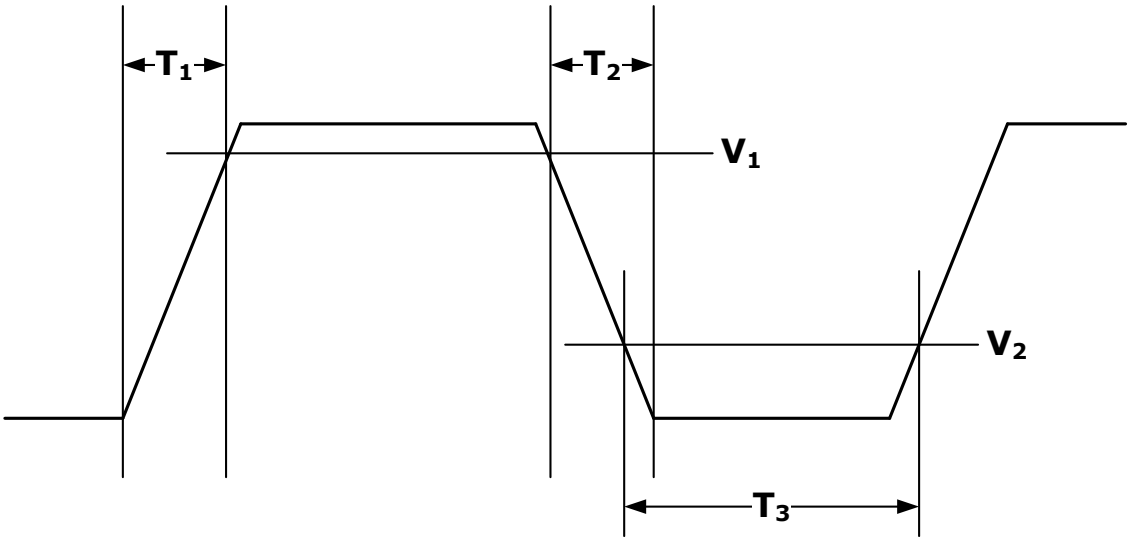
(NOTES)

1. Either voltage limit or current limit is sufficient to protect inputs.
2. Maximum ratings are defined based on the wide voltage
3. Equivalent to discharging a 100pF capacitor through a 1.5 kΩ series resistor.
4. Equivalent to discharging a 200pF capacitor through a 0 kΩ series resistor.
5. Permanent device damage may occur if the absolute maximum ratings are exceeded. These are stress rating only, and functional operation should be restricted to within the recommended conditions
6. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability.

3.2 RECOMMENDED OPERATING CONDITIONS

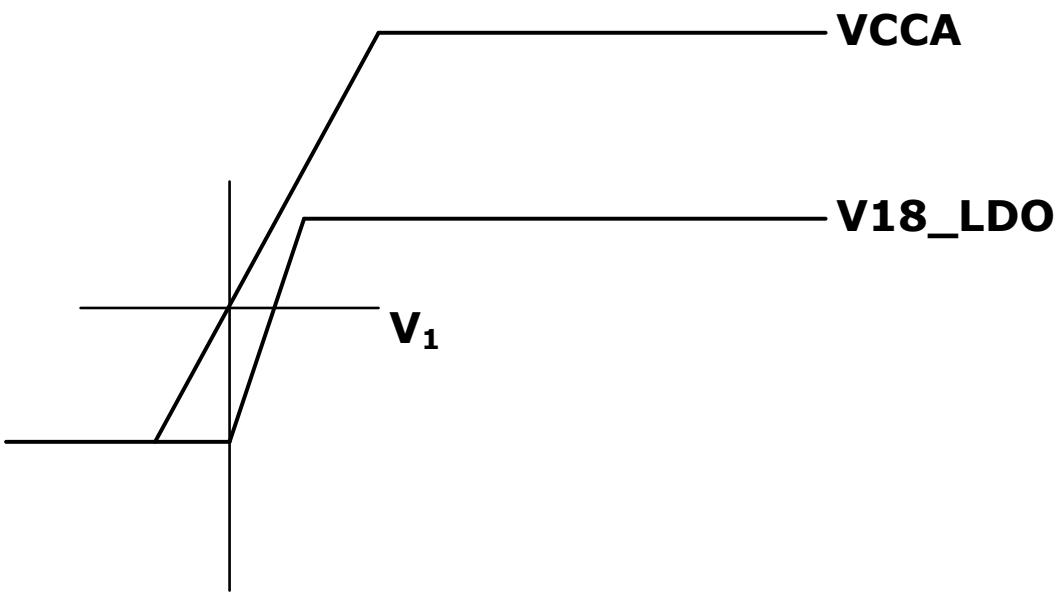
SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
VCCA	Analog power supply voltage	2.5	3.3	3.6	V
T_{OPT}	Operation environment temperature	-20	-	85	°C
T_J	Junction temperature	-40		125	°C

3.3 POWER UP CONDITION



SYMBOL	PARAMETER	MIN	MAX	UNIT
T_1	Power-on time	-	10ms@V_1=2.5V	ms
T_2	Power-off time	-	10ms@V_2=0.3V	ms
T_3	From power-off to power-on time	20	-	ms

3.4 LDO



SYMBOL	PARAMETER	MIN	MAX	UNIT
V_1	LDO start-up threshold	0.4	1.25	V

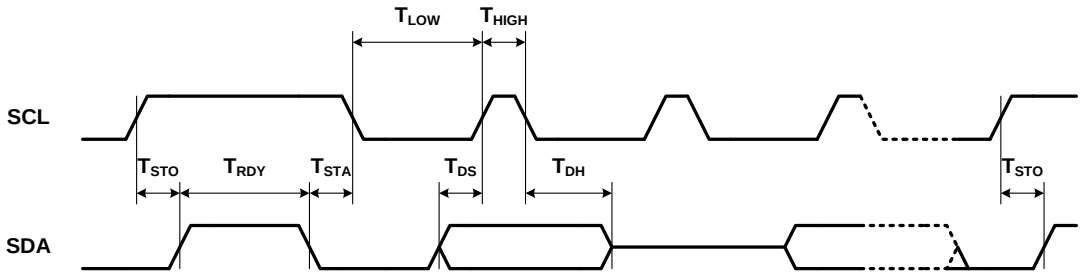
3.5 HOST INTERFACE I/O CHARACTERISTICS

3.5.1 I2C INTERFACE

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
V_{IN}	Input voltage range	0	-	3.6	V
V_{OUT}	Output voltage range	0	-	VBUS	V
V_{IH}	Input threshold voltage for logic HIGH	1.25	-	-	V
V_{IL}	Input threshold voltage for logic LOW	-	-	0.5	V
V_{OL}	Output voltage for logic LOW	-	-	0.4	V
C_{IN}	Input capacitance	-	2.3	-	pF
RPU	Input pull-up resistance	none	none	none	KΩ

(NOTE)
1. I_O = 4mA
2. VBUS is defined by the pull-up voltage

3.5.2 I2C INTERFACE TIMING



SYMBOL	PARAMETER	FAST-MODE		HS-MODE		UNIT
		MIN	MAX	MIN	MAX	
F_{SCL}	SCL clock frequency	0	400	0	3400	KHz
T_{LOW}	LOW period of SCL	1300	-	160	-	ns
T_{HIGH}	HIGH period of SCL	600	-	60	-	ns
T_{STA}	Hold time for START condition	600	-	160	-	ns
T_{STO}	Setup time for STOP condition	600	-	160	-	ns
T_{DH}	Data hold time	0	90	0	70	ns
T_{DS}	Data set-up time	100	-	10	-	ns
T_{rC}	Rise time of SCL	20	300	10	40	ns
T_{fC}	Fall time of SCL	20	300	10	40	ns
T_{rD}	Rise Time of SDA	20	300	10	80	ns
T_{fD}	Fall time of SDA	20	300	10	80	ns
T_{RDY}	Ready time between STOP and START condition	20	-	20	-	us

3.5.3 INTERRUPT

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
V_{IN}	Input voltage range	0	-	3.6	V
V_{OUT}	Output voltage range	0	-	VBUS	V
V_{IH}	Input threshold voltage for logic HIGH	1.25	-	-	V
V_{IL}	Input threshold voltage for logic LOW	-	-	0.5	V
V_{OL}	Output voltage for logic LOW	-	-	0.4	V
C_{IN}	Input capacitance	-	2.3	-	pF
RPU	Input pull-up resistance	none	none	none	KΩ

(NOTE)
1. I_O = 4mA
2. VBUS is defined by the pull-up voltage

3.6 TX

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
V_{OUT}	Output voltage range	0	-	VCCA	V
C_{OUT}	Output capacitance capacitance	-	3.5	-	pF
F_{CLK}	TX clock frequency	1.7	-	9000	KHz
T_{rise}	Rising time	5	-	90	ns
T_{fall}	Falling time	5	-	60	ns

3.7 RX

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNIT
V_{IN}	Input voltage range	0	-	3.6	V
C_{OUT}	Output capacitance capacitance	-	3.5	-	pF