

QT113 (#604-00038)

General Description

The QT113 touch sensor is a self-contained digital IC with optional latching and momentary functions. The chip can project a proximity sense field through air, via almost any dielectric material, such as glass, plastic or ceramic. The user can also use an object with metal in it to create a sensor, responsive to touch.

Features

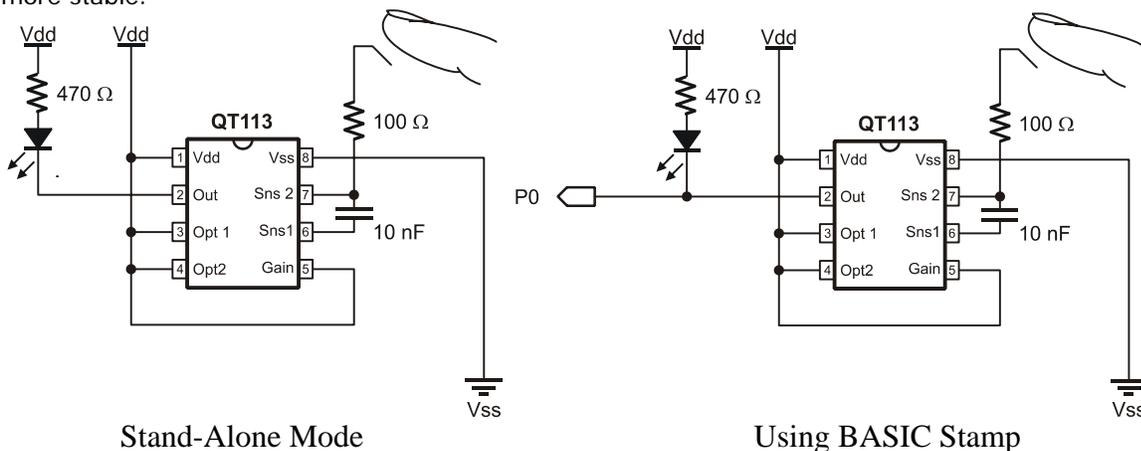
- Projects a proximity field through the air
- Less expensive than many mechanical switches
- Only one external part required – a capacitor
- 8 pin DIP package
- Compatible with all BASIC Stamp® & SX Microcontrollers

Application Ideas

- Light Switches
- Security Systems
- Prox Sensors
- Toys & games

Connecting and Testing

The example circuits below show the QT113 in both Stand-Alone Mode as well as using the BASIC Stamp to read the output. In both cases the LED lights when the sensor is activated. The output of the QT113 is active low. When using the BASIC Stamp, removing the LED will make the output to the Stamp Module more stable.



Calibration

The QT113 is 100% auto-calibrating.

Sensitivity

The sensitivity of the QT113 is adjusted by a single capacitor, and can be set to one of two gain levels by setting pin 5 high or low. Sensitivity can also be increased by using a larger electrode or reducing panel thickness. Please see the datasheet for more information on adjusting the sensitivity.

Resources and Downloads

Check out the QT113 product page for the manufacturer datasheet and more:

http://www.parallax.com/detail.asp?product_id=604-00038

Theory of Operation

The QT113 relies on Kirchoff's Current Law to detect the change in capacitance of the electrode. This law as applied to capacitive sensing requires that the sensor's field current must create a loop, returning back to its source in order for the capacitance to be sensed. This requires that the signal ground and the target object must both be coupled together in some manner for the sensor to operate correctly. There is no need to provide actual hardwired ground connections. Capacitive coupling to ground is always sufficient, even if the coupling might seem to be very tenuous. For example, powering the sensor via an isolated transformer will provide ample ground coupling, since there is capacitance between the windings and/or the transformer core, and from the power wiring itself directly to 'local earth'. Even when battery powered, just the physical size of the PCB and the object into which the electronics is embedded will generally be enough to couple a few picofarads back to local earth.

When detecting human contact, such as a fingertip, grounding of the person is never required. The human body naturally has several hundred picofarads of 'free space' capacitance to the local environment, which is more than two orders of magnitude greater than that required to create a return path to the QT113 via earth.

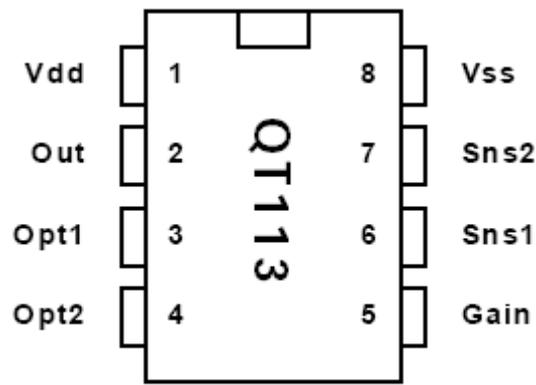
Specifications [†]

Symbol	Quantity	Minimum	Typical	Maximum	Units
Vdd	Supply Voltage	2.5	5.0	5.5	V
Idd	Supply Current		600	1500	μA
Vdds	Supply turn-on slope	100			V/s
Vil	Low input logic level			0.8	V
Vhl	High input logic level	2.2			V
Vol	Low output voltage			0.6	V
Voh	High output voltage	Vdd-0.7			V
Iil	Input leakage current			+/-1	μA
Cx	Load capacitance range	0		100	pF
S	Sensitivity range *	1000		28	fF

[†] Obtained from QProx™ datasheet * Sensitivity depends on value of Cx and Cs

Pin Definitions

Pin	Name	Function
1	Vdd	Supply Voltage
2	Out	Output
3	Opt1	Optional Register 1
4	Opt2	Optional Register 2
5	Gain	Gain
6	Sns1	Sensor Input 1
7	Sns2	Sensor Input 2
8	Vss	Ground



Output Mode Strap Options

The output of the QT113 can respond in DC mode, where the output is active-low for the duration of the detection, or until the Max On-Duration expires (if not infinite), whichever occurs first. If a max on-duration timeout occurs first, the sensor performs a full recalibration and the output becomes inactive until the next detection.

In this mode, three Max On-Duration timeouts are available: 10 seconds, 60 seconds, and infinite.

	Tie Pin 3 to:	Tie Pin 4 to:	Max On-Duration
DC Out	Vdd	Vdd	10s
DC Out	Vdd	Gnd	60s
Toggle	Gnd	Gnd	10s
DC Out	Gnd	Vdd	infinite

Source Code

The following code example demonstrates how to read the output of the QT113 into a variable. From there the program can act based on the input. In this example the value is displayed on the DEBUG window. Code for the BASIC Stamp 1 or for the SX could be derived from the example below.

BASIC Stamp® 2 Program

```
' =====
' File..... QT113.bs2
' Purpose... Monitor QT113 Touch Sensor
' Author.... Parallax, Inc.
' E-mail.... support@parallax.com
' Started...
' Updated... 08-29-2005
'
'   {$STAMP BS2}
'   {$PBASIC 2.5}
' =====
' -----[ Program Description ]-----
'
' This program monitors the output of the QT113 and displays it on the
' DEBUG window.
'
' -----[ I/O Definitions ]-----
QT113          PIN      0          ' QT113 Output Pin
'
' -----[ Variables ]-----
Trigger        VAR      Bit        ' Trigger
'
' -----[ Program Code ]-----
Main:
DO
  Trigger = QT113
  DEBUG HOME, "QT113 = ", BIN Trigger
  PAUSE 15
LOOP
```