MPR121 Quick Start Guide

INTRODUCTION

The MPR121 is Freescale Semiconductor's top of the line touch sensor and can fit into a wide range of applications. These applications can all be accommodated by having a device a with a very large range of flexibility. While all of these added features can allow for a wide range of flexibility, they can also add an unnecessary layer of complication. For advanced users who want to do more than basic touch detection, additional information can be found in other application notes.

To start, the device is configured through an I^2C serial interface. The following table lists the registers that are initialized. The order they are written in is not significant except that register 0x05E, the Electrode Configuration Register must be written last.

Register Address	Register Name	Value	Application Note	Section
0x2B	MHD Rising	0x01	AN3891	A
0x2C	NHD Amount Rising	0x01	AN3891	A
0x2D	NCL Rising	0x00	AN3891	A
0x2E	FDL Rising	0x00	AN3891	A
0x2F	MHD Falling	0x01	AN3891	B
0x30	NHD Amount Falling	0x01	AN3891	B
0x31	NCL Falling	0xFF	AN3891	B
0x32	FDL Falling	0x02	AN3891	B
0x41	ELE0 Touch Threshold	0x0F	AN3892	C
0x42	ELE0 Release Threshold	0x0A	AN3892	C
0x43	ELE1 Touch Threshold	0x0F	AN3892	C
0x44	ELE1 Release Threshold	0x0A	AN3892	C
0x45	ELE2 Touch Threshold	0x0F	AN3892	C
0x46	ELE2 Release Threshold	0x0A	AN3892	C
0x47	ELE3 Touch Threshold	0x0F	AN3892	C
0x48	ELE3 Release Threshold	0x0A	AN3892	C
0x49	ELE4 Touch Threshold	0x0F	AN3892	C
0x4A	ELE4 Release Threshold	0x0A	AN3892	C
0x4B	ELE5 Touch Threshold	0x0F	AN3892	C
0x4C	ELE5 Release Threshold	0x0A	AN3892	C
0x4D	ELE6 Touch Threshold	0x0F	AN3892	C
0x4E	ELE6 Release Threshold	0x0A	AN3892	C
0x4F	ELE7 Touch Threshold	0x0F	AN3892	C
0x50	ELE7 Release Threshold	0x0A	AN3892	C

Register Address	Register Name	Value	Application Note	Section
0x51	ELE8 Touch Threshold	0x0F	AN3892	C
0x52	ELE8 Release Threshold	0x0A	AN3892	C
0x53	ELE9 Touch Threshold	0x0F	AN3892	C
0x54	ELE9 Release Threshold	0x0A	AN3892	C
0x55	ELE10 Touch Threshold	0x0F	AN3892	C
0x56	ELE10 Release Threshold	0x0A	AN3892	C
0x57	ELE11 Touch Threshold	0x0F	AN3892	C
0x58	ELE11 Release Threshold	0x0A	AN3892	C
0x5D	Filter Configuration	0x04	AN3890	D
0x5E	Electrode Configuration	0x0C	AN3890	E
0x7B	AUTO-CONFIG Control Register 0	0x0B	AN3889	F
0x7D	AUTO-CONFIG USL Register	0x9C	AN3889	F
0x7E	AUTO-CONFIG LSL Register	0x65	AN3889	F
0x7F	AUTO-CONFIG Target Level Register	0x8C	AN3889	F

The following sections describe what each of the defaults do and recommendations for variations.

Section A

Register Address	Register Name	Value	Application Note
0x2B	MHD Rising	0x01	AN3891
0x2C	NHD Amount Rising	0x01	AN3891
0x2D	NCL Rising	0x00	AN3891
0x2E	FDL Rising	0x00	AN3891

Description: This group of setting controls the filtering of the system when the data is greater than the baseline. The setting used allow the filter to act quickly and adjust for environmental changes. Additionally, if calibration happens to take place while a touch occurs, the value will self adjust very quickly. This auto-recovery or snap back prevents repeated false negative for a touch detection.

Variation: As the filter is sensitive to setting changes, it is recommended that users read AN3891 before changing the values. In most cases these default values will work

Section B

Register Address	Register Name	Value	Application Note
0x2F	MHD Falling	0x01	AN3891
0x30	NHD Amount Falling	0x01	AN3891
0x31	NCL Falling	0xFF	AN3891
0x32	FDL Falling	0x02	AN3891

Description: This group of setting controls the filtering of the system, when the data is less than the baseline. The settings slow down the filter as the negative charge is in the same direction as a touch. By slowing down the filter, touch signals are “rejected” by the baseline filter. While at the same time Ion term environmental change that occur slower than at a touch are accepted. This low pass filter both allows for touches to be detected properly while preventing false positive by passing environmental change through the filter.

Variation: As the filter is sensitive to setting changes, it is recommended that users read AN3891 before changing the values. In most cases these default values will work

Section C

Register Address	Register Name	Value	Application Note
0x41	ELE0 Touch Threshold	0x0F	AN3892
0x42	ELE0 Release Threshold	0x0A	AN3892
0x43	ELE1 Touch Threshold	0x0F	AN3892
0x44	ELE1 Release Threshold	0x0A	AN3892
0x45	ELE2 Touch Threshold	0x0F	AN3892
0x46	ELE2 Release Threshold	0x0A	AN3892
0x47	ELE3 Touch Threshold	0x0F	AN3892
0x48	ELE3 Release Threshold	0x0A	AN3892
0x49	ELE4 Touch Threshold	0x0F	AN3892
0x4A	ELE4 Release Threshold	0x0A	AN3892
0x4B	ELE5 Touch Threshold	0x0F	AN3892
0x4C	ELE5 Release Threshold	0x0A	AN3892
0x4D	ELE6 Touch Threshold	0x0F	AN3892
0x4E	ELE6 Release Threshold	0x0A	AN3892
0x4F	ELE7 Touch Threshold	0x0F	AN3892
0x50	ELE7 Release Threshold	0x0A	AN3892
0x51	ELE8 Touch Threshold	0x0F	AN3892
0x52	ELE8 Release Threshold	0x0A	AN3892
0x53	ELE9 Touch Threshold	0x0F	AN3892
0x54	ELE9 Release Threshold	0x0A	AN3892
0x55	ELE10 Touch Threshold	0x0F	AN3892
0x56	ELE10 Release Threshold	0x0A	AN3892
0x57	ELE11 Touch Threshold	0x0F	AN3892
0x58	ELE11 Release Threshold	0x0A	AN3892

Description: The touch threshold registers set the minimum delta from the baseline when a touch is detected 0x0F or 15 in decimal is an estimate of the minimum value for touch. Most electrodes will work with this value even if they vary greatly in size and shape. The value of 0x0A or 10 is the release threshold register allowed for hysteresis in the touch detection.

Variation: For very small electrodes, smaller values can be used and for very large electrodes the reverse is true. One easy method is to view the deltas actually seen in a system and set the touch at 80% and release at 70% of delta for good performance.

Section D

Register Address	Register Name	Value	Application Note
0x5D	Filter Configuration	0x04	AN3890

Description: There are three settings embedded in this register so it is only necessary to pay attention to one. The ESI controls the sample rate of the device. In the default, the setting used is 0x00 for 1 ms sample rate. Since the SFI is set to 00, resulting in 4 samples averaged, the response time will be 4 ms.

Variation: To save power, the 1 ms can be increased to 128 ms by increasing the setting to 0x07. The values are base 2 exponential thus 0x01 = 2 ms; 0x02 = 4 ms; and so on to 0x07 = 128 ms. Most of the time, 0x04 results in the best compromise between power consumption and response time.

Section E

Register Address	Register Name	Value	Application Note
0x5E	Electrode Configuration	0x0C	AN3890

Description: This register controls the number of electrodes being enabled and the mode the device is in. There are only two modes, Standby (when the value is 0x00) and Run (when the value of the lower bit is non-zero). The default value shown enables all 12 electrodes by writing decimal 12 or hex 0x0C to the register. Typically other registers cannot be changed while the part is running so this register should always be written last.

Variation: During debug of a system, this register will change between the number of electrodes and 0x00 every time a register needs to change. In a production system, this register will only need to be written when the mode is changed from Standby to Run or vise versa.

Section F

Register Address	Register Name	Value	Application Note
0x7B	AUTO-CONFIG Control Register 0	0x0B	AN3889
0x7D	AUTO-CONFIG USL Register	0x9C	AN3889
0x7E	AUTO-CONFIG LSL Register	0x65	AN3889
0x7F	AUTO-CONFIG Target Level Register	0x8C	AN3889

Description: These are the settings used for the Auto Configuration. They enable AUTO-CONFIG and AUTO_RECONFIG. In addition they set the target range for the baseline. The upper limit is set to 190, the target is set to 180 and the lower limit is set to 140.

Variation: In most cases these values will never need to be change, but if a case arises, a full description is found in application note AN3889.

CONCLUSION

In many applications for the MPR121, the default settings presented in this document will be sufficient for both design time activities as well as in the production implementation.

How to Reach Us:

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http://www.freescale.com/support

USA/Europe or Locations Not Listed:
Freescale Semiconductor, Inc.
Technical Information Center, EL516
2100 East Elliot Road
Tempe, Arizona 85284
+1-800-521-6274 or +1-480-768-2130
www.freescale.com/support

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
www.freescale.com/support

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
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