

# SX1501/SX1502/SX1503

# 4/8/16 Channel Low Voltage GPIO with NINT and NRESET

#### **GENERAL DESCRIPTION**

The SX1501, SX1502 and SX1503 are complete ultra low voltage General Purpose parallel Input/Output (GPIO) expanders ideal for low power handheld battery powered equipment. They allow easy serial expansion of I/O through a standard I<sup>2</sup>C interface. GPIO devices can provide additional control and monitoring when the microcontroller or chipset has insufficient I/O ports, or in systems where serial communication and control from a remote location is advantageous.

These devices can also act as a level shifter to connect a microcontroller running at one voltage level to a component running at a different voltage level. The core is operating as low as 1.2V while the I/O banks can operate between 1.2V and 5.5V independent of the core voltage and each other.

Each GPIO is programmable via 8-bit configuration registers. Data registers, direction registers, pull-up/pull-down registers, interrupt mask registers and interrupt registers allow the system master to program and configure 4 or 8 or 16-GPIOs using a standard 400kHz I<sup>2</sup>C interface.

The SX1501, SX1502 and SX1503 offer a unique fully programmable logic functions like a PLD to give more flexibility and reduce external logic gates used for standard applications.

The SX1501, SX1502 and SX1503 have the ability to generate mask-programmable interrupts based on falling/rising edge of any of its GPIO lines. A dedicated pin indicates to a host controller that a state change occurred in one or more of the GPIO lines.

The SX1501, SX1502 and SX1503 each come in a small QFN-UT-20/28 package as well as a TSSOP-20/28 package. All devices are rated from -40 $^{\circ}$  to +85 $^{\circ}$  temperature range.

#### **ORDERING INFORMATION**

Part Number	I/O Channels	Package
SX1501I087TRT	4	QFN-UT-20
SX1502I087TRT	8	QFN-UT-20
SX1503I091TRT	16	QFN-UT-28
SX1501I088TRT <sup>(1)</sup>	4	TSSOP-20
SX1502I088TRT <sup>(1)</sup>	8	TSSOP-20
SX1503I089TRT <sup>(1)</sup>	16	TSSOP-28
SX1502EVK <sup>(2)</sup>	8	Evaluation Kit

<sup>(1)</sup>Future products

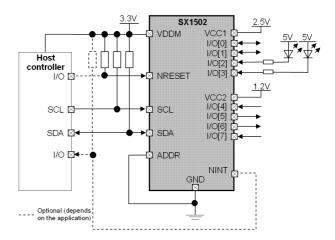
<sup>(2)</sup>SX1502I087TRT based, unique evaluation kit for the three parts.

#### **KEY PRODUCT FEATURES**

- 4/8/16 channel of I/Os
  - True bi-directional style I/O
  - Programmable Pull-up/Pull-down
  - Push/Pull outputs
- 1.2V to 5.5V independent operating voltage for all supply rails (VDDM, VCC1, VCC2)
- 5.5V compatible I/Os, up to 24mA output sink (no total sink current limit)
- Fully programmable logic functions (PLD)
- 400kHz 2-wire I<sup>2</sup>C compatible slave interface
- Open drain active low interrupt output (NINT)
   Bit maskable
  - Programmable edge sensitivity
- Power-On Reset and reset input (NRESET)
- Ultra low current consumption of typ. 1uA
- -40°C to +85°C operating temperature range
- Ultra-Thin 3x3mm QFN-UT-20 and TSSOP-20 packages (SX1501/SX1502)
- Ultra-Thin 4x4mm QFN-UT-28 and TSSOP-28 packages (SX1503)

#### **TYPICAL APPLICATIONS**

- Cell phones, PDAs, MP3 players
- Digital camera
- Portable multimedia player
- Notebooks
- GPS Units
- Industrial, ATE
- Any battery powered equipment





### **Table of Contents**

GEN	IERAL	DESCRIPTION	1
OR	DERIN	G INFORMATION	1
KEY	' Pro	DUCT FEATURES	1
ТҮР		APPLICATIONS	1
1	PIN	DESCRIPTION	4
1	.1	SX1501 4-channel GPIO	4
	.2	SX1502 8-channel GPIO	5
	.3	SX1503 16-channel GPIO	6
2		CTRICAL CHARACTERISTICS	
	.1 .2	Absolute Maximum Ratings Electrical Specifications	7 7
-	2.2.		9
3	TYP	ICAL OPERATING CHARACTERISTICS 1	0
3	.1	IDDM vs. VDDM	0
-	.2		0
	.3		11
	.4	·	12
4			3
-	.1 .2		3  3
-	.2		14
	.4		14
4	.5		15
	4.5. <sup>2</sup> 4.5.2		15 16
	4.5.3		16
-	.6		17
4	<b>.7</b> 4.7.′		17 17
	4.7.2	2 SX1502 1	18
	4.7.3 4.7.4		18 19
5			20
5	.1	SX1501 4-channel GPIO	20
	.2		21
5	.3	SX1503 16-channel GPIO 2	23
6	APF	LICATION INFORMATION	27
6	.1	Typical Application Circuit 2	27
6	.2		27
	6.2. <sup>2</sup> 6.2.2		27 28
6	.3	,	28
6	.4		28
_			



7		PACKAGING INFORMATION	29
	7.1	QFN-UT 20-pin Outline Drawing	29
	7.2	2 QFN-UT 20-pin Land Pattern	29
	7.3	GEN-UT 28-pin Outline Drawing	30
	7.4	QFN-UT 28-pin Land Pattern	30
	7.5	5 TSSOP 20-pin Outline Drawing	31
	7.6	5 TSSOP 20-pin Land Pattern	31
	7.7	TSSOP 28-pin Outline Drawing	32
	7.8	3 TSSOP 28-pin Land Pattern	32
8		SOLDERING PROFILE	33



#### **PIN DESCRIPTION** 1

#### SX1501 4-channel GPIO 1.1

Pin	Symbol	Туре	Description	
1	NRESET	DIO	Active low reset	
2	SDA	DIO	I <sup>2</sup> C serial data line	
3	NC1	-	Leave open, not connected	
4	SCL	DI	I <sup>2</sup> C serial clock line	
5	I/O[0]	DIO <sup>(*1)</sup>	I/O[0], at power-on configured as an input	
6	I/O[1]	DIO (*1)	I/O[1], at power-on configured as an input	
7	VCC1	Р	I/O supply voltage	
8	GND	Р	Ground Pin	
9	I/O[2]	DIO <sup>(*1)</sup>	I/O[2], at power-on configured as an input High sink I/O.	
10	I/O[3]	DIO <sup>(*1)</sup>	I/O[3], at power-on configured as an input High sink I/O.	
11	NINT	DO	Active low interrupt output	
12	ADDR	DI	Address input, connect to VDDM or GND	
13	NC2	-	Leave open, not connected	
14	VDDM	Р	Main supply voltage	
15	NC3	-	Leave open, not connected	
16	NC4	-	Leave open, not connected	
17	NC7	-	Connect to VCC1	
18	GND	Р	Ground Pin	
19	NC5	-	Leave open, not connected	
20	NC6	-	Leave open, not connected	

A: Analog D: Digital

I: Input

O: Output P: Power

(\*1) This pin is programmable through the I<sup>2</sup>C interface

#### Table 1 – SX1501 Pin Description

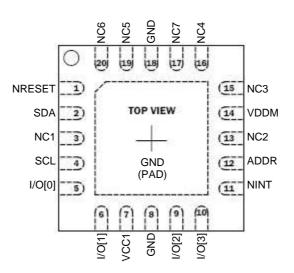


Figure 1 – SX1501 QFN-UT-20 Pinout



#### 1.2 SX1502 8-channel GPIO

Pin	Symbol	Туре	Description	
1	NRESET	DIO	Active low reset	
2	SDA	DIO	I <sup>2</sup> C serial data line	
3	NC1	-	Leave open, not connected	
4	SCL	DI	I <sup>2</sup> C serial clock line	
5	I/O[0]	DIO (*1)	I/O[0], at power-on configured as an input	
6	I/O[1]	DIO (*1)	I/O[1], at power-on configured as an input	
7	VCC1	Р	Supply voltage for Bank A I/O[0-3]	
8	GND	Р	Ground Pin	
9	I/O[2]	DIO <sup>(*1)</sup>	I/O[2], at power-on configured as an input High sink I/O.	
10	I/O[3]	DIO <sup>(*1)</sup>	I/O[3], at power-on configured as an input High sink I/O.	
11	NINT	DO	Active low interrupt output	
12	ADDR	DI	Address input, connect to VDDM or GND	
13	NC2	-	Leave open, not connected	
14	VDDM	Р	Main supply voltage	
15	I/O[4]	DIO (*1)	I/O[4], at power-on configured as an input	
16	I/O[5]	DIO <sup>("1)</sup>	I/O[5], at power-on configured as an input	
17	VCC2	Р	Supply voltage for Bank B I/O[4-7]	
18	GND	Р	Ground Pin	
19	I/O[6]	DIO <sup>(*1)</sup>	I/O[6], at power-on configured as an input	
20	I/O[7]	DIO <sup>(~1)</sup>	I/O[7], at power-on configured as an input	

A: Analog

D: Digital

I: Input O: Output P: Power

(\*1) This pin is programmable through the  $I^2C$  interface

Table 2 – SX1502 Pin Description

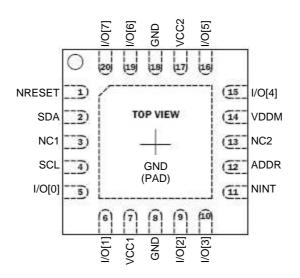


Figure 2 - SX1502 QFN-UT-20 Pinout



#### SX1503 16-channel GPIO 1.3

Pin	Symbol	Туре	Description	
1	GND	Р	Ground Pin	
2	I/O[2]	DIO <sup>(~1)</sup>	I/O[2], at power-on configured as an input	
3	I/O[3]	DIO <sup>(*1)</sup>	I/O[3], at power-on configured as an input	
4	VCC1	Р	I/O supply voltage for Bank A I/O[0-7]	
5	I/O[4]	DIO <sup>(*1)</sup>	I/O[4], at power-on configured as an input	
6	I/O[5]	DIO <sup>("1)</sup>	I/O[5], at power-on configured as an input	
7	GND	Р	Ground Pin	
8	I/O[6]	DIO <sup>(*1)</sup>	I/O[6], at power-on configured as an input High sink I/O.	
9	I/O[7]	DIO <sup>(*1)</sup>	I/O[7], at power-on configured as an input High sink I/O.	
10	NINT	DO	Active low interrupt output	
11	NC	-	Leave open, not connected	
12	VDDM	Р	Main supply voltage	
13	I/O[8]	DIO <sup>(~1)</sup>	I/O[8], at power-on configured as an input	
14	I/O[9]	DIO <sup>(*1)</sup>	I/O[9], at power-on configured as an input	
15	GND	Р	Ground Pin	
16	I/O[10]	DIO <sup>(~1)</sup>	I/O[10], at power-on configured as an input	
17	I/O[11]	DIO <sup>(*1)</sup>	I/O[11], at power-on configured as an input	
18	VCC2	Р	I/O supply voltage for Bank B I/O[8-15]	
19	I/O[12]	DIO <sup>(*1)</sup>	I/O[12], at power-on configured as an input	
20	I/O[13]	DIO <sup>(*1)</sup>	I/O[13], at power-on configured as an input	
21	GND	Р	Ground Pin	
22	I/O[14]	DIO <sup>(*1)</sup>	I/O[14], at power-on configured as an input High sink I/O.	
23	I/O[15]	DIO <sup>(*1)</sup>	I/O[15], at power-on configured as an input High sink I/O.	
24	NRESET	DIO	Active low reset	
25	SDA	DIO	I <sup>2</sup> C serial data line	
26	SCL	DI	I <sup>2</sup> C serial clock line	
27	I/O[0]	DIO <sup>(*1)</sup>	I/O[0], at power-on configured as an input	
28	I/O[1]	DIO <sup>(*1)</sup>	I/O[1], at power-on configured as an input	

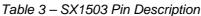
A: Analog D: Digital

I: Input

O: Output

P: Power

(\*1) This pin is programmable through the I<sup>2</sup>C interface



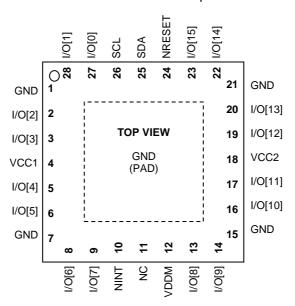


Figure 3 - SX1503 QFN-UT-28 Pinout



#### 2 ELECTRICAL CHARACTERISTICS

#### 2.1 Absolute Maximum Ratings

Stress above the limits listed in the following table may cause permanent failure. Exposure to absolute ratings for extended time periods may affect device reliability. The limiting values are in accordance with the Absolute Maximum Rating System (IEC 134). All voltages are referenced to ground (GND).

Symbol	Description	Min	Max	Unit
<b>VDDM</b> <sub>max</sub>	Main supply voltage	- 0.4	6.0	V
VCC1,2 <sub>max</sub>	I/O banks supply voltage	- 0.4	6.0	V
V <sub>ESD HBM</sub>	Electrostatic handling HBM model <sup>(1)</sup>	-	1500	V
V <sub>ESD CDM</sub>	Electrostatic handling CDM model	-	300	V
V <sub>ESD_MM</sub>	Electrostatic handling MM model	-	200	V
T <sub>A</sub>	Operating Ambient Temperature Range	-40	+85	ĉ
T <sub>c</sub>	Junction Temperature Range	-40	+125	ĉ
T <sub>STG</sub>	Storage Temperature Range	-55	+150	ĉ
l <sub>lat</sub>	Latchup-free input pin current <sup>(2)</sup>	+/-100	-	mA

(1) Tested according to JESD22-A114A

(2) Static latch-up values are valid at maximum temperature according to JEDEC 78 specification

Table 4 - Absolute Maximum Ratings

#### 2.2 Electrical Specifications

Table below applies to default registers values (Boost Mode Off), unless otherwise specified. Typical values are given for  $T_A = +25$ °C, VDDM=VCC1=VCC2=3.3V.

Symbol	Description	Conditions	Min	Тур	Max	Unit
Supply	· · · ·					
VDDM	Main supply voltage	-	1.2	-	5.5	V
VCC1,2	I/O banks supply voltage	-	1.2	-	5.5	V
IDDM	Main supply current (I <sup>2</sup> C inactive)	-	-	1	5	μA
ICC1,2	I/O banks supply current <sup>(1)</sup>	VCC1,2 >= 2V	-	1	2	μA
· ·		VCC1,2 < 2V	-	0.5	1	μA
I/Os set a	as Input					
VIH	High level input voltage	-	0.7* VCC1,2	-	VCC1,2 +0.3	V
VIL	Low level input voltage	-	-0.4	-	0.3* VCC1,2	V
VHYS	Hysteresis of Schmitt trigger	-	-	0.1* VCC1,2	-	V
ILEAK	Input leakage current	Assuming no active pull-up/down	-1.5	-	1.5	μA
CI	Input capacitance	-	-	-	10	pF
I/Os set a	is Output					
VOH	High level output voltage	-	VCC1,2 - 0.3	-	VCC1,2	V
VOL	Low level output voltage	-	-0.4	-	0.3	V
IOH	High level output source	VCC1,2 >= 2V	-	-	8	mΑ
	current	VCC1,2 < 2V	-	-	0.3 <sup>(2)</sup>	шл
	Low level output sink current	VCC1,2 >= 2V	-	-	24	mA
IOL	for the high sink I/Os	VCC1,2 < 2V	-	-	6 <sup>(2)</sup>	
.01	Low level output sink current	VCC1,2 >= 2V	-	-	12	mΑ
	for the other I/Os.	VCC1,2 < 2V	-	-	6	
t <sub>PV</sub>	Output data valid timing	Cf. Figure 9	-	-	1.5	μs
NINT (Ou			T			
VOL	Low level output voltage	-	-	-	0.3	V
IOLM	Low level output sink current	$VDDM \ge 2V$	-	-	12	mA
	·	VDDM < 2V	-	-	6	
t <sub>IV</sub>	Interrupt valid timing	From input data change	-	-	1	μs



# ADVANCED COMMUNICATIONS & SENSING

Symbol	Description	Conditions	Min	Тур	Max	Unit
t <sub>IR</sub>	Interrupt reset timing	From RegInterruptSource clearing	-	-	2	μs
	(Input/Output)	_	-			
VOL	Low level output voltage	-	-	-	0.3	V
IOLM	Low level output sink current	VDDM >= 2V	-	-	12	mA
		VDDM < 2V	-	-	6	
VIH <sub>MR</sub>	High level input voltage	-	0.7* VDDM	-	5.5	V
VIL <sub>M</sub>	Low level input voltage	-	-0.4	-	0.3* VDDM	V
VHYS <sub>M</sub>	Hysteresis of Schmitt trigger	-	-	0.1* VDDM	-	V
ILEAK	Input leakage current	-	-1.5	-	1.5	μA
CI	Input capacitance	-	-	-	10	pF
VPOR	Power-On-Reset voltage	Cf. Figure 7	0.7	-	0.9	V
	High brown-out voltage	Cf. Figure 7	-	VDDM-1	-	V
VDROPL		Cf. Figure 7	-	0.2	-	V
t <sub>RESET</sub>	Reset time	Cf. Figure 7	-	-	7	ms
t <sub>PULSE</sub>	Reset pulse from host uC	Cf. Figure 7	300	-	-	ns
ADDR (In	put)	1	<b>I</b>			
$VIH_MA$	High level input voltage	-	0.7* VDDM	-	VDDM +0.3	V
VIL <sub>M</sub>	Low level input voltage	-	-0.4	-	0.3* VDDM	V
VHYS <sub>M</sub>	Hysteresis of Schmitt trigger	-	-	0.1* VDDM	-	V
ILEAK	Input leakage current	-	-1.5	-	1.5	μA
CI	Input capacitance	-	-	-	10	pF
SCL (Inpu	ut) and SDA (Input/Output) <sup>(3)</sup>					
Interface	complies with slave F/S mode uary, 2000. Please refer to that c				on version	2.1
SDA t <sub>f</sub> T SCL						-
	S + thD;STA thD;DAT thIGH	t <sub>SU;STA</sub>	t <sub>SU;s</sub>		_s_	-
VOL	Low level output voltage	-	-	-	0.3	V
IOL <sub>M</sub>	Low level output sink current	VDDM >= 2V	-	-	12	mA
IOLM		VDDM < 2V	-	-	6	ШA
$VIH_MR$	High level input voltage	-	0.7* VDDM	-	5.5	V
VIL <sub>M</sub>	Low level input voltage	-	-0.4	-	0.3* VDDM	V
f <sub>SCL</sub>	SCL clock frequency	-	0	-	400	kHz
t <sub>HD;STA</sub>	Hold time (repeated) START condition	-	0.6	-	-	μs
t <sub>LOW</sub>	LOW period of the SCL clock	-	1.3	-	-	μs
t <sub>HIGH</sub>	HIGH period of the SCL clock	VDDM >= 1.3V VDDM < 1.3V	0.6	-	-	μs
t <sub>SU;STA</sub>	Set-up time for a repeated START condition	-	0.6	-	-	μs
t <sub>HD;DAT</sub>	Data hold time	_	0(4)	_	0.9 <sup>(5)</sup>	μs
t <sub>SU;DAT</sub>	Data set-up time	-	100 <sup>(6)</sup>	-	-	μ3
t <sub>r</sub>	Rise time of both SDA and SCL signals	-	20+0.1C <sub>b</sub> <sup>(7)</sup>	-	300	ns



Symbol	Description	Conditions	Min	Тур	Max	Unit		
t <sub>f</sub>	Fall time of both SDA and SCL signals	-	20+0.1C <sub>b</sub> <sup>(7)</sup>	-	300	ns		
t <sub>SU;STO</sub>	Set-up time for STOP condition	-	0.6	-	-	μs		
t <sub>BUF</sub>	Bus free time between a STOP and START condition	-	1.3	-	-	μs		
Cb	Capacitive load for each bus line	-	-	-	400	pF		
V <sub>nL</sub>	Noise margin at the LOW level for each connected device (including hysteresis)	-	0.1*VDDM	-	-	V		
V <sub>nH</sub>	Noise margin at the HIGH level for each connected device (including hysteresis)	-	0.2*VDDM	-	-	V		
Miscellar	Miscellaneous							
RPULL	Programmable pull-up/down resistors for IO[0-7]	-	-	60	-	kΩ		
t <sub>PLD</sub>	PLD propagation delay	VCC1,2 & VDDM = 5V VCC1,2 & VDDM = 1.2V	-	-	25 500	ns		

(1) Assuming no load connected to outputs and inputs fixed to VCC1,2 or GND.

(2) Can be increased in RegAdvanced register. Please refer to §2.2.1 for more details.

(3) All values referred to VIH<sub>MR min</sub> and VIL<sub>M max</sub> levels.

(4) A device must internally provide a hold time of at least 300ns for the SDA signal (referred to VIH<sub>MR min</sub>) to bridge the undefined region of the falling edge of SCL.

(5) The maximum t<sub>HD;DAT</sub> has only to be met if the device does not stretch the LOW period (t<sub>LOW</sub>) of the SCL signal.

(6) A Fast-mode  $l^2$ C-bus device can be used in a Standard-mode  $l^2$ C-bus system, but the requirement  $t_{SU;DAT} \ge 250$  ns must then be met. This will automatically be the case if the device does not stretch the LOW period of the SCL signal.

If such a device does stretch the LOW period of the SCL signal, it must output the next data bit to the SDA line  $t_{r max}$ +  $t_{SU;DAT}$  = 1000 + 250 = 1250 ns (according to the Standard-mode I2C-bus specification) before the SCL line is released.

(7)  $C_b$  = total capacitance of one bus line in pF. If mixed with Hs-mode devices, faster fall-times are allowed.

Table 5 – Electrical Specifications

#### 2.2.1 Increasing I/O Sink and Source Current Capabilities (Boost Mode)

When bit 1 of RegAdvanced register is set, max IOH and IOL spec **when VCC1,2 is below VBOOST** can be increased together with IDDM and ICC1,2 figures as described below.

Symbol	Description	C	Conditions	Min	Тур	Max	Unit
Supply							
VBOOST	Low voltage boost threshold		-	2.0	2.6	-	V
IDDM	Main supply current	VDDM = 5	5.5V (VCC1,2 < 2V)	-	150	250	μA
IDDIVI	(I <sup>2</sup> C inactive)	VDDM = 1.2V (VCC1,2 < 2V)		-	25	50	uA
		SX1501/2	VCC1 = 2V	-	250	550	
ICC1	I/O bank A supply current	3/1001/2	VCC1 = 1.2V	-	100	200	1
1001	NO bank A supply current	SX1503	VCC1 = 2V	-	250	550	μA
		3/1003	VCC1 = 1.2V	-	100	200	1
		SX1502	VCC2 = 2V	-	150	250	μA
ICC2	I/O bank B supply current	371302	VCC2 = 1.2V	-	50	150	
1002		SX1503 —	VCC2 = 2V	-	250	450	
			VCC2 = 1.2V	-	100	200	
/Os set as	Output						
IOH	High level output source	VCC1,2 >= VBOOST		-	-	8	m۸
ЮП	current for all I/Os	VCC1,2 < VBOOST		-	-	4	mA
	Low level output sink current	VCC1,2 >= VBOOST		-	-	24	
IOL	for the high sink I/Os	VCC1,2 < VBOOST		-	-	12	mA
IOL	Low level output sink current	VCC1,2 >= VBOOST		-	-	12	
for the other I/Os		VCC1,2 < VBOOST		-	-	6	mA
NINT, NRE	SET			÷	•		
	Low level output sink current	VDDI	M >= VBOOST	-	-	12	m۸
$IOL_M$	for NINT, NRESET	VDDM < VBOOST		-	-	6	mA
			ations in Deast Made	1			

Table 6 – Electrical Specifications in Boost Mode

Important: RegAdvanced register doesn't affect any spec when VCC1 and VCC2 are above VBOOST.

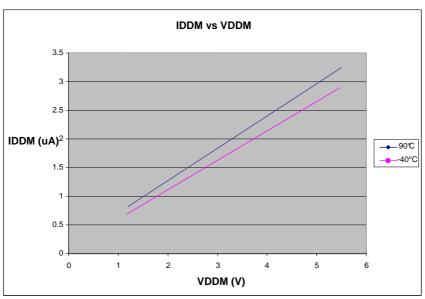
Rev 10 – 28<sup>th</sup> April 2011



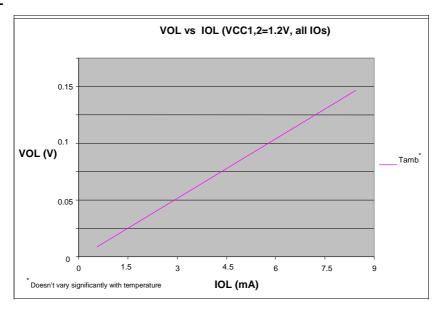
### **3 TYPICAL OPERATING CHARACTERISTICS**

Figures below apply to default registers values (Boost Mode Off), Tamb, unless otherwise specified.

3.1 IDDM vs. VDDM

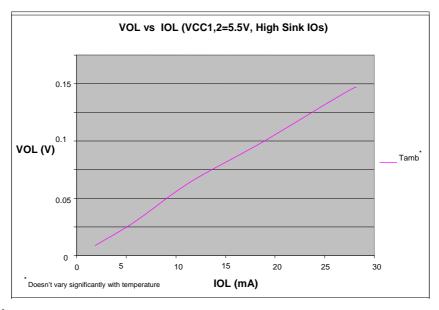


3.2 VOL vs. IOL

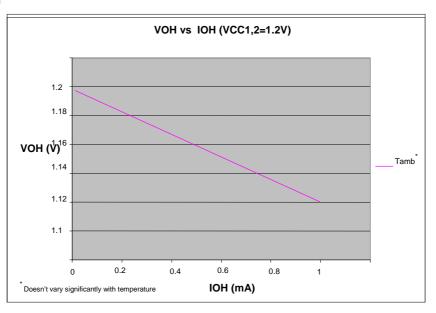


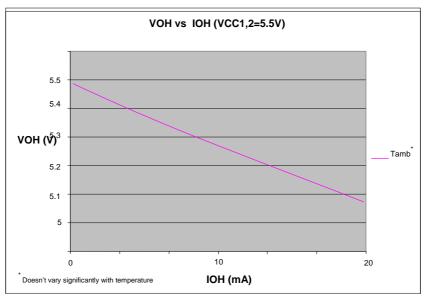


# ADVANCED COMMUNICATIONS & SENSING



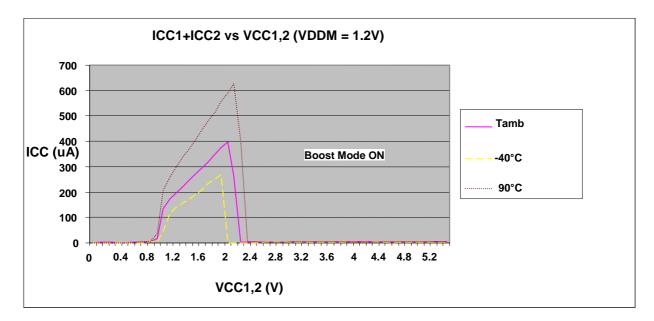
3.3 VOH vs. IOH

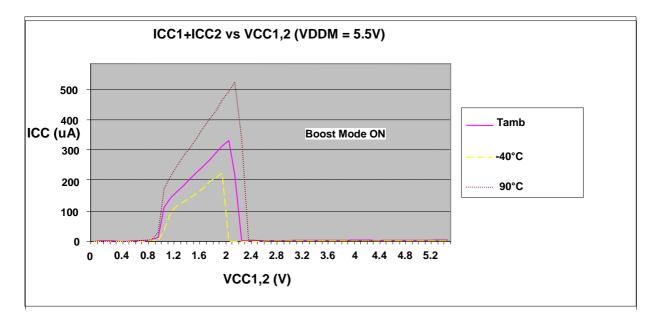






### 3.4 ICC1+ICC2 vs. VCC1,2 when Boost Mode is ON







### 4 BLOCK DETAILED DESCRIPTION

#### 4.1 SX1501 4-channel GPIO

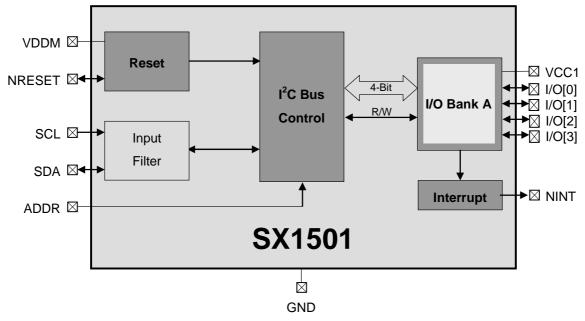


Figure 4 – 4-channel Low Voltage GPIO

#### 4.2 SX1502 8-channel GPIO

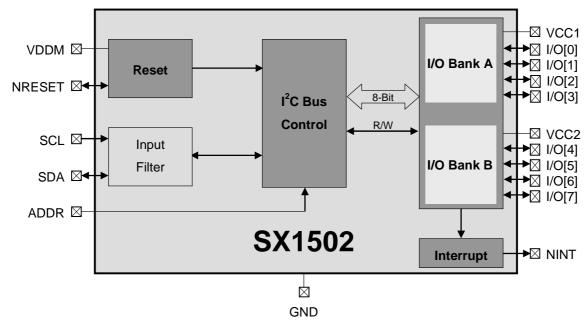
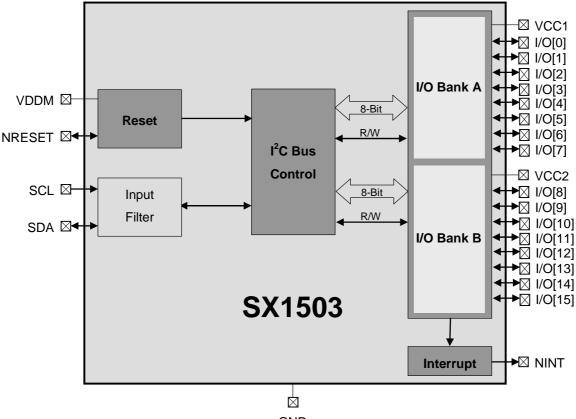


Figure 5 – 8-channel Low Voltage GPIO



#### 4.3 SX1503 16-channel GPIO



GND

Figure 6 – 16-channel Low Voltage GPIO

#### 4.4 Reset (NRESET)

The SX1501, SX1502 and SX1503 generate their own power on reset signal after a power supply is connected to the VDDM pin. The reset signal is made available for the user at the pin NRESET. The rising edge of the NRESET indicates that the startup sequence of the SX1501, SX1502 or SX1503 has finished. NRESET must be connected to VDDM (or greater) either directly, or via a resistor.

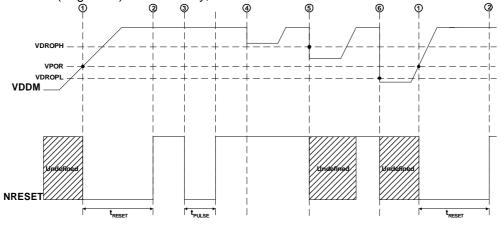


Figure 7 – Power-On / Brown-out Reset Conditions

- 1. Device behavior is undefined until VDDM rises above VPOR, at which point NRESET is driven to GND by the SX1501, SX1502 or SX1503.
- 2. After t<sub>RESET</sub>, NRESET is released (high-impedance) by the SX1501, SX1502 or SX1503 to allow it to be pulled high by an external resistor.
- 3. In operation, the SX1501, SX1502 and SX1503 may be reset at anytime by an external device driving NRESET low during t<sub>PULSE</sub>. Chip can be accessed normally again after NRESET rising edge.



- 4. During a brown-out event, if VDDM drops above VDROPH a reset will not occur.
- 5. During a brown-out event, if VDDM drops between VDROPH and VDROPL a reset may occur.
- 6. During a brown-out event, if VDDM drops below VDROPL a reset will occur next time VPOR is crossed.

Please note that a brown-out event is defined as a transient event on VDDM. If VDDM is attached to a battery, then the gradual decay of the battery voltage will not be interpreted as a brown-out event. Please also note that a sharp rise in VDDM (> 1V/us) may induce a circuit reset.

#### 4.5 2-Wire Interface (I<sup>2</sup>C)

The SX1501, SX1502 and SX1503 2-wire interface (I<sup>2</sup>C compliant) operates only in slave mode. In this configuration, the device has one or two device addresses defined by ADDR pin.

Device	ADDR Pin	I <sup>2</sup> C Address	Description
SX1501 &	0	0x2 <b>0</b> (010000 <b>0</b> )	First address of the 2-wire interface
SX1502	1	0x21 (0100001)	Second address of the 2-wire interface
SX1503		0x20 (0100000)	Fixed address of the 2-wire interface

Table 7 - 2-Wire Interface Address

2 lines are used to exchange data between an external master host and the slave device:

- SCL : Serial CLock •
- SDA : Serial DAta •

The SX1501, SX1502 and SX1503 are read-write slave-mode I<sup>2</sup>C devices and comply with the Philips I<sup>2</sup>C standard Version 2.1 dated January, 2000. The SX1501, SX1502 and SX1503 have respectively 12, 16, and 31 user-accessible internal 8-bit registers. The I<sup>2</sup>C interface has been designed for program flexibility, in that once the slave address has been sent to the SX1501, SX1502 or SX1503 enabling it to be a slave transmitter/receiver, any register can be written or read independently of each other. While there is no auto increment/decrement capability in the SX1501 and SX1502 I<sup>2</sup>C logic, a tight software loop can be designed to access the next register independent of which register you begin accessing. SX1503 implements auto increment capability. The start and stop commands frame the data-packet and the repeat start condition is allowed if necessary.

Seven bit addressing is used and ten bit addressing is not allowed. Any general call address will be ignored by the SX1501, SX1502 and SX1503. The SX1501, SX1502 and SX1503 are not CBUS compatible and can operate in standard mode (100kbit/s) or fast mode (400kbit/s).

#### WRITE 4.5.1

The simplest format for an I<sup>2</sup>C write is given below. After the start condition [S], the slave address is sent, followed by an eighth bit indicating a write. The I<sup>2</sup>C then acknowledges that it is being addressed, and the master responds with an 8 bit data byte consisting of the register address. The slave acknowledges and the master sends the appropriate 8 bit data byte. Once again the slave acknowledges and the master terminates the transfer with the stop condition [P].



S: Start Condition W: Write = '0'

A: Acknowledge (sent by slave)

P: Stop condition

Register Address: 8 bit Data: 8 bit

Slave Address: 7 bit





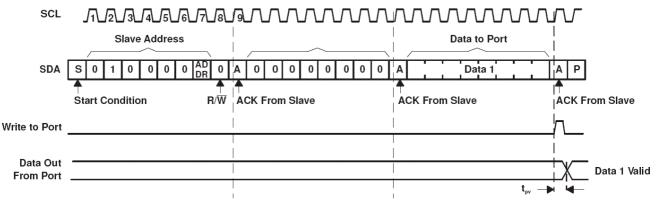


Figure 9 – Write RegData Register

Please note that SX1503 implements register address auto-increment i.e. after the Data ACK from Slave the master can write further bytes and the interface will handle the register address increment automatically. Finally the master terminates the transfer normally the stop condition [P].

#### <u>4.5.2</u> READ

After the start condition [S], the slave address is sent, followed by an eighth bit indicating a write. The I<sup>2</sup>C then acknowledges that it is being addressed, and the master responds with an 8 bit data byte consisting of the register address. The slave acknowledges and the master sends the repeated start condition [Sr]. Once again, the slave address is sent, followed by an eighth bit indicating a read. The slave responds with an acknowledge and the previously addressed 8 bit data byte; the master then sends a non-acknowledge (NACK). Finally, the master terminates the transfer with the stop condition [P].

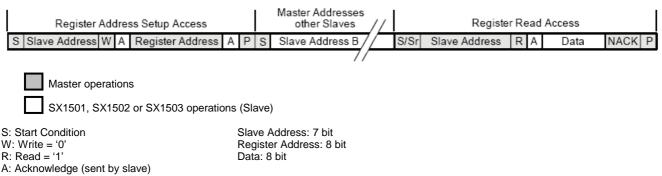
S Slave Address	W	А	Register Address	A Sr	Slave Address	R	А	Data	NACK P	
Master operations										
SX1501, SX1502 or SX1503 operations (Slave)										
S: Start Condition Slave Address: 7 bit W: Write = '0' Register Address: 8 bit R: Read = '1' Data: 8 bit A: Acknowledge (sent by slave) NACK: Non-Acknowledge (sent by master) Sr: Repeated Start Condition P: Stop condition Figure 10 - 2-Wire Serial Interface, Read Register Operation										
Please note that SX1503 implements register address auto-increment i.e. after the Data byte from Slave the master can acknowledge (ACK) to indicate that it wants to read the next byte and the interface will handle the register address increment automatically. Finally the master terminates the transfer normally with a NACK										

#### 4.5.3 READ - STOP separated format (SX1501 and SX1502 only)

When operating SX1501 or SX1502, stop-separated reads can also be used. This format allows a master to set up the register address pointer for a read and return to that slave at a later time to read the data. In this format the slave address followed by a write command are sent after a start [S] condition. The slave then acknowledges it is being addressed, and the master responds with the 8-bit register address. The master sends a Stop or Restart condition and may then address another slave. After performing other tasks, the master can send a start or restart condition to the slave with a read command. The slave acknowledges this request and returns the data from the register location that had previously been set up.

followed by the stop condition [P].





NACK: Non-Acknowledge (sent by master)

Sr: Repeated Start Condition

P: Stop condition

#### Figure 11 - 2-Wire Serial Interface, Read – Stop Separated Mode Operation

#### 4.6 Interrupt (NINT)

At start-up, the transition detection logic is reset, and NINT is released to a high-impedance state. The interrupt mask register is set to 0xFF, disabling the interrupt output for transitions on all I/O ports. The transition flags are cleared to indicate no data changes.

An interrupt NINT can be generated on any programmed combination of I/Os rising and/or falling edges through the RegInterruptMask and RegSense registers.

If needed, the I/Os which triggered the interrupt can then be identified by reading RegInterruptSource register.

When NINT is low (i.e. interrupt occurred), it can be reset back high (i.e. cleared) by writing 0xFF in RegInterruptSource (this will also clear corresponding bits in RegEventStatus register). SX1503 also allows the interrupt to be cleared automatically when reading RegData register (Cf. RegAdvanced)

Example: We want to detect rising edge of I/O[1] on SX1502 (NINT will go low).

- 1. We enable interrupt on I/O[1] in RegInterruptMask
- ⇒ RegInterruptMask = "XXXXXX0X"
- 2. We set edge sense for I/O[1] in RegSense
- ⇒ RegSenseLow ="XXXX**01**XX"

#### 4.7 **Programmable Logic Functions (PLD)**

The SX1501, SX1502 and SX1503 offer a unique fully programmable logic functions like a PLD to give more flexibility and reduce external logic gates used for standard applications.

Since the whole truth table is fully programmable, the SX1501, SX1502, and SX1503 can implement combinatory functions ranging from the basic AND/OR gates to the most complicated ones with up to four 3-to1 PLDs or two 3-to-2 PLDs which can also be externally cascaded if needed.

In all cases, any IO not configured for PLD functionality retains its GPIO functionality while I/Os used by the PLD have their direction automatically set accordingly.

Please note that while RegDir corresponding bits are ignored for PLD operation they may still be set to input to access unused PLD inputs as normal GPI (PLD truth table can define some inputs to have no effect on PLD output) and/or generate interrupt based on any of the PLD inputs or outputs bits.

#### <u>4.7.1</u> SX1501

The SX1501 I/Os can be configured to provide any combinational 2-to-1 logic function using I/O[0-2] whilst retaining GPIO capability on I/O[3] OR provide a combinational 3-to-1 decode function using all 4 I/O ports.

RegPLDMode	SX1501 I/Os							
1:0	3	2	1	0				
00	GPIO	GPIO	GPIO	GPIO				
01	GPIO	PLD OUT	PLD IN	PLD IN				
10	PLD OUT	PLD IN	PLD IN	PLD IN				

Table 8 – SX1501 PLD Modes Settings



### <u>4.7.2</u> SX1502

The SX1502 I/Os can be configured as per the SX1501, and can additionally be configured to provide a 2-to-1 logic function on I/O[4-6], 3-to-1 logic function on I/O[4-7], or 3-to-2 logic decode on I/O[0-4].

RegPL	DMode				SX150	)2 I/Os			
5:4	1:0	7	6	5	4	3	2	1	0
00	00	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO
00	01	GPIO	GPIO	GPIO	GPIO	GPIO	PLD OUT	PLD IN	PLD IN
00	10	GPIO	GPIO	GPIO	GPIO	PLD OUT	PLD IN	PLD IN	PLD IN
00	11	GPIO	GPIO	GPIO	PLD OUT	PLD OUT	PLD IN	PLD IN	PLD IN
01	00	GPIO	PLD OUT	PLD IN	PLD IN	GPIO	GPIO	GPIO	GPIO
01	01	GPIO	PLD OUT	PLD IN	PLD IN	GPIO	PLD OUT	PLD IN	PLD IN
01	10	GPIO	PLD OUT	PLD IN	PLD IN	PLD OUT	PLD IN	PLD IN	PLD IN
01	11	GPIO	GPIO	GPIO	PLD OUT	PLD OUT	PLD IN	PLD IN	PLD IN
10	00	PLD OUT	PLD IN	PLD IN	PLD IN	GPIO	GPIO	GPIO	GPIO
10	01	PLD OUT	PLD IN	PLD IN	PLD IN	GPIO	PLD OUT	PLD IN	PLD IN
10	10	PLD OUT	PLD IN	PLD IN	PLD IN	PLD OUT	PLD IN	PLD IN	PLD IN
10	11	GPIO	GPIO	GPIO	PLD OUT	PLD OUT	PLD IN	PLD IN	PLD IN

Table 9 – SX1502 PLD Modes Settings

#### <u>4.7.3</u> SX1503

Each of the two I/O banks of the SX1503 I/Os can be configured as per the SX1502.

RegPLD	ModeB				SX150	)3 I/Os			
5:4	1:0	15	14	13	12	11	10	9	8
00	00	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO
00	01	GPIO	GPIO	GPIO	GPIO	GPIO	PLD OUT	PLD IN	PLD IN
00	10	GPIO	GPIO	GPIO	GPIO	PLD OUT	PLD IN	PLD IN	PLD IN
00	11	GPIO	GPIO	GPIO	PLD OUT	PLD OUT	PLD IN	PLD IN	PLD IN
01	00	GPIO	PLD OUT	PLD IN	PLD IN	GPIO	GPIO	GPIO	GPIO
01	01	GPIO	PLD OUT	PLD IN	PLD IN	GPIO	PLD OUT	PLD IN	PLD IN
01	10	GPIO	PLD OUT	PLD IN	PLD IN	PLD OUT	PLD IN	PLD IN	PLD IN
01	11	GPIO	GPIO	GPIO	PLD OUT	PLD OUT	PLD IN	PLD IN	PLD IN
10	00	PLD OUT	PLD IN	PLD IN	PLD IN	GPIO	GPIO	GPIO	GPIO
10	01	PLD OUT	PLD IN	PLD IN	PLD IN	GPIO	PLD OUT	PLD IN	PLD IN
10	10	PLD OUT	PLD IN	PLD IN	PLD IN	PLD OUT	PLD IN	PLD IN	PLD IN
10	11	GPIO	GPIO	GPIO	PLD OUT	PLD OUT	PLD IN	PLD IN	PLD IN

Table 10 – SX1503 PLD Modes Settings (Bank B)

RegPLD	OModeA				SX150	)3 I/Os			
5:4	1:0	7	6	5	4	3	2	1	0
00	00	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO
00	01	GPIO	GPIO	GPIO	GPIO	GPIO	PLD OUT	PLD IN	PLD IN
00	10	GPIO	GPIO	GPIO	GPIO	PLD OUT	PLD IN	PLD IN	PLD IN
00	11	GPIO	GPIO	GPIO	PLD OUT	PLD OUT	PLD IN	PLD IN	PLD IN
01	00	GPIO	PLD OUT	PLD IN	PLD IN	GPIO	GPIO	GPIO	GPIO
01	01	GPIO	PLD OUT	PLD IN	PLD IN	GPIO	PLD OUT	PLD IN	PLD IN
01	10	GPIO	PLD OUT	PLD IN	PLD IN	PLD OUT	PLD IN	PLD IN	PLD IN
01	11	GPIO	GPIO	GPIO	PLD OUT	PLD OUT	PLD IN	PLD IN	PLD IN
10	00	PLD OUT	PLD IN	PLD IN	PLD IN	GPIO	GPIO	GPIO	GPIO
10	01	PLD OUT	PLD IN	PLD IN	PLD IN	GPIO	PLD OUT	PLD IN	PLD IN
10	10	PLD OUT	PLD IN	PLD IN	PLD IN	PLD OUT	PLD IN	PLD IN	PLD IN
10	11	GPIO	GPIO	GPIO	PLD OUT	PLD OUT	PLD IN	PLD IN	PLD IN

Table 11 – SX1503 PLD Modes Settings (Bank B)



#### 4.7.4 Tutorial

The generic method described in this paragraph can be applied to any of the SX1501, SX1502 or SX1503. *Example: We want to implement an AND gate between I/O[0] and IO[1] on SX1502* 

- 1. Identify in the tables above the RegPLDMode setting to be programmed. What we need corresponds to the second line of the SX1502 PLD Table => RegPLDMode = "xx00xx01"
- 2. Fill corresponding RegPLDTableX with the wanted truth table. As mentioned in RegPLDMode description, using PLD 2-to-1 mode on I/0[0-2] implies to fill the truth table located in RegPLDTable0(3:0)

I/O[1]	I/O[0]	I/O[2]
0	0	
0	1	0
1	0	0
1	1	1/

=> RegPLDTable0 = "xxxx1000"



### 5 CONFIGURATION REGISTERS

#### 5.1 SX1501 4-channel GPIO

Address	Name	Description	Default
0x00	RegData	Data register	1111 1111
0x01	RegDir	Direction register	1111 1111
0x02	RegPullUp	Pull-up register	0000 0000
0x03	RegPullDown	Pull-down register	0000 0000
0x04	Reserved	Unused	XXXX XXXX
0x05	RegInterruptMask	Interrupt mask register	1111 1111
0x06	RegSenseHigh	Unused	XXXX XXXX
0x07	RegSenseLow	Sense register	0000 0000
0x08	RegInterruptSource	Interrupt source register	0000 0000
0x09	RegEventStatus	Event status register	0000 0000
0x10	RegPLDMode	PLD mode register	0000 0000
0x11	RegPLDTable0	PLD truth table 0	0000 0000
0x12	RegPLDTable1	Unused	XXXX XXXX
0x13	RegPLDTable2	PLD truth table 2	0000 0000
0x14	RegPLDTable3	Unused	XXXX XXXX
0x15	RegPLDTable4	Unused	XXXX XXXX
0xAB	RegAdvanced	Advanced settings register	0000 0000

Addr	Name	Default	Bits	Description					
			7:4	Reserved. Must be set to 1 (default value)					
0x00	RegData 0xFF		3:0	Write: Data to be output to the output-configured IOs Read: Data seen at the IOs, independent of the direction configured.					
			7:4	Reserved. Must be set to 1 (default value)					
0x01	RegDir	0xFF	3:0	Configures direction for each IO. 0 : IO is configured as an output 1 : IO is configured as an input					
			7:4	Reserved. Must be set to 0 (default value)					
0x02	RegPullUp	0x00	3:0	Enables the pull-up for each IO 0 : Pull-up is disabled 1 : Pull-up is enabled					
			7:4	Reserved. Must be set to 0 (default value)					
0x03	0x03 RegPullDown 0x00		3:0	Enables the pull-down for each IO 0 : Pull-down is disabled 1 : Pull-down is enabled					
0x04	Reserved	0xXX	7:0	Unused					
					7:4	Reserved. Must be set to 1 (default value)			
0x05	RegInterruptMask	0xFF	3:0	Configures which [input-configured] IO will trigger an interrupt on NINT pin 0 : An event on this IO will trigger an interrupt 1 : An event on this IO will NOT trigger an interrupt					
0x06	RegSenseHigh	0xXX	7:0	Unused					
			7:6	Edge sensitivity of I/O[3]	00 : None				
0x07	RegSenseLow	0x00	5:4	Edge sensitivity of I/O[2]	01 : Rising				
0/(0/	negoensezow	0,000	3:2	Edge sensitivity of I/O[1]	10 : Falling				
			1:0	Edge sensitivity of I/O[0]	11 : Both				
			7:4	Reserved. Must be set to 0 (default value)					
0x08	3:0 RegSense register occured). Writing '1' clears the bit in RegInterruptSource and in RegEventStatus.		RegEventStatus.						
0x09		0x00	7:4	When all bits are cleared, NINT signal goes back high. Reserved, Must be set to 0 (default value)					
0x09		UXUU	7:4	Reserved. Wust be set to U (default value)					



Addr	Name	Default	Bits	Description			
	RegEventStatus		3:0	Event status of all IOs. 0 : No event has occured on this IO 1 : An event has occured on this IO (an edge as config register occured). Writing '1' clears the bit in RegEventStatus and in RegI If the edge sensitivity of the IO is changed, the bit(s) wi	nterruptSource if relevant.		
			7:2	Reserved. Must be set to 0 (default value)			
0x10	RegPLDMode	0x00	1:0	PLDMode 00 : PLD disabled – Normal GPIO mode for I/O[3:0] 01 : PLD 2-to-1 mode – I/O[2] is a decode of I/O[1:0] as 10 : PLD 3-to-1 mode – I/O[3] is a decode of I/O[2:0] as 11 : Not used	s defined in RegPLDTable0 s defined in RegPLDTable2		
			7:4	Reserved. Must be set to 0 (default value)			
		0x00	3	Value to be output on I/O[2] when I/O[1:0] = 11			
0x11	RegPLDTable0		2	Value to be output on I/O[2] when I/O[1:0] = 10	Applies only when PLDMode is		
			1	Value to be output on I/O[2] when I/O[1:0] = 01	set to PLD 2-to-1 mode		
			0	Value to be output on I/O[2] when I/O[1:0] = 00			
0x12	RegPLDTable1	0xXX	7:0	Unused			
			7	Value to be output on I/O[3] when I/O[2:0] = 111	_		
			6	Value to be output on I/O[3] when I/O[2:0] = 110	_		
			5	Value to be output on I/O[3] when I/O[2:0] = 101	_		
0x13	RegPLDTable2	0x00	4	Value to be output on $I/O[3]$ when $I/O[2:0] = 100$	Applies only when PLDMode is		
	-		3	Value to be output on $I/O[3]$ when $I/O[2:0] = 011$	set to PLD 3-to-1 mode		
			2	Value to be output on $I/O[3]$ when $I/O[2:0] = 010$	-		
			1	Value to be output on $I/O[3]$ when $I/O[2:0] = 001$	-		
0.44	D. DIDTUIA	0.101	0	Value to be output on I/O[3] when I/O[2:0] = 000			
	RegPLDTable3	0xXX	7:0	Unused			
0x15	RegPLDTable4	0xXX	7:0	Unused			
			7.2	Reserved. Must be set to 0 (default value)			
0xAB	RegAdvanced	0x00	1	Boost Mode (Cf. §2.2.1) 0: OFF 1: ON			
			0	Reserved. Must be set to 0 (default value)			

Table 13 – SX1501 Configuration Registers Description

### 5.2 SX1502 8-channel GPIO

Address	Name	Description	Default
0x00	RegData	Data register	1111 1111 <sup>*</sup>
0x01	RegDir	Direction register	1111 1111
0x02	RegPullUp	Pull-up register	0000 0000
0x03	RegPullDown	Pull-down register	0000 0000
0x04	Reserved	Unused	XXXX XXXX
0x05	RegInterruptMask	Interrupt mask register	1111 1111
0x06	RegSenseHigh	Sense register for I/O[7:4]	0000 0000
0x07	RegSenseLow	Sense register for I/O[3:0]	0000 0000
0x08	RegInterruptSource	Interrupt source register	0000 0000
0x09	RegEventStatus	Event status register	0000 0000
0x10	RegPLDMode	PLD mode register	0000 0000
0x11	RegPLDTable0	PLD truth table 0	0000 0000
0x12	RegPLDTable1	PLD truth table 1	0000 0000
0x13	RegPLDTable2	PLD truth table 2	0000 0000
0x14	RegPLDTable3	PLD truth table 3	0000 0000
0x15	RegPLDTable4	PLD truth table 4	0000 0000
0xAB	RegAdvanced	Advanced settings register	0000 0000

#### Table 14 – SX1502 Configuration Registers Overview

Addr	Name	Default	Bits	Description
0x00	RegData	0xFF	7:0	Write: Data to be output to the output-configured IOs Read: Data seen at the IOs, independent of the direction configured.
0x01	RegDir	0xFF	7:0	Configures direction for each IO. 0 : IO is configured as an output 1 : IO is configured as an input



0x02         RegPuilty         0x00         7:0         Enables the puil-up for each 1/0           0x03         RegPuilDown         0x00         7:0         Enables the puil-up for each 1/0           0x04         Feederation         Enables the puil-up for each 1/0         Enables the puil-up for each 1/0           0x04         Feederation         Enables the puil-up for each 1/0         Enables the puil-up for each 1/0           0x06         Regeneration         Construction         Enables the puil-up for each 1/0         Willinger an interrupt           0x06         Regeneration         Construction         Edge sensitivity of 10/01         0: Name           0x07         Regeneration         Construction         Edge sensitivity of 10/01         0: Name           0x08         Regeneration         Construction         Construction         0: Name           0x07         Regeneration         Construction         0: Name         0: Name           0x08         Regeneration         Construction         Distruction         Distruction         Distruction           0x09         Regeneration         Construction         Regeneration         Distruction         Distruction         Distruction           0x09         Regeneration         Distructin         Distructin         Distructi	Addr	Name	Default	Bits	Description		
0x03         RegPulDown         0x00         7:0         0: Pul-down is disabled 1: Pul-down is enabled           0x06         RegInterruptMask         0x7:7         7:0         0: A new rest on this (D will ingger an interrupt on NINT pin 0: A new rest on this (D will ingger an interrupt)         0: None 0: None None None None None Non 0: None None None Non Non None None None	0x02	RegPullUp	0x00	7:0	0 : Pull-up is disabled		
0x05         ReginteruptMask         0xFF         7:0         Configures which input-configured [10 will trigger an interrupt 1: An event on this [0 will trigger an interrupt 1: An event on this [0 will trigger an interrupt 1: An event on this [0 will trigger an interrupt 1: An event on this [0 will trigger an interrupt 1: An event on this [0 will trigger an interrupt 1: An event on this [0 will trigger an interrupt 1: An event on this [0 will trigger an interrupt 1: Bohn 1: Bohn	0x03	RegPullDown	0x00	7:0	0 : Pull-down is disabled 1 : Pull-down is enabled		
0x05         ReginterruptMask         0xFF         7:0         0: An event on this IO will trigger an interrupt 1: An event on this IO will trigger an interrupt 1: An event on this IO will trigger an interrupt 0: None         0: None           0x06         RegSenseHigh         0x00         7:6         Edge sensitivity of I/O(1)         0: None           0x07         RegSenseLow         0x00         7:8         Edge sensitivity of I/O(2)         0: None           0x08         RegInterruptSource         0x00         7:8         Edge sensitivity of I/O(2)         0: None           0x09         RegInterruptSource         0x00         7:8         Edge sensitivity of I/O(2)         0: None           0x08         RegInterruptSource         0x00         7:0         Edge sensitivity of I/O(2)         0: None           0x09         RegEventStatus         0x00         7:0         RegRevent on this IO         None         None           0x09         RegEventStatus         0x00         7:0         RegRevent on this Clarable on the Dile NID is clarable on	0x04	Reserved	0xXX	7:0			
0x06         RegSenseHigh         0x00         5:4         Edge sensitivity of IVO(s)         0:1         1:8ing 1::5         1:8ing 1::5           0x07         RegSenseLow         0x00         2::5         Edge sensitivity of IVO(s)         0:None 0::5         0:None 0::0         0:None 0::5	0x05	RegInterruptMask	0xFF	7:0	0 : An event on this IO will trigger an interrupt	terrupt on NINT pin	
00.00         RegSenseLow         0.00         3.2         Edge sensitivity of I/O[5]         10 : Falling 11 : Both           0x07         RegSenseLow         0x00         7.6         Edge sensitivity of I/O[2]         00 : None 01 : Ring 10 : Raing 11 : Both           0x08         RegInterruptSource         0x00         7.6         Edge sensitivity of I/O[2]         01 : Ring 10 : Raing 11 : Both           0x08         RegInterruptSource         0x00         7.0         Edge sensitivity of I/O[2]         01 : Ring 11 : Both           0x08         RegInterruptSource         0x00         7.0         Edge sensitivity of I/O[2]         01 : Ring 11 : Both           0x09         RegEventStatus         0x00         7.0         Event status of all I/Os. 1 : An interrupt has been triggered by this IO (an event as configured in relevant RegSense register occured).         Writing '1 clears the bit in RegInterruptSource and in RegEventStatus When all bits are cleared, NINT signal goes back high.           0x09         RegEventStatus         0x00         7.0         Regenet this I RegEventStatus and in RegInterruptSource if relevant. If the edge sensitivity of the IO is changed, the bit(s) will be cleared automatically the edges ensitivity of IO(7.4) 0 : PLD 24:0 + mode = I/O[1] is a decede of I/O[7.4] 5.4         File edge sensitivity of RegInterruptSource if relevant. If the edge sensitivity of ID (2] is a decede of I/O[7.4] 5.4         File edge sensitivity of RegInteruptSource if relevant. If the edge sensitivity of ReGIN				7:6	Edge sensitivity of I/O[7]	00 : None	
0x07         RegSenseLow         3.2         Edge sensitivity of I/O[6]         11: Both           0x07         RegSenseLow         0x00         7.6         Edge sensitivity of I/O[2]         01: None           0x08         RegInterruptSource         0x00         3.2         Edge sensitivity of I/O[2]         01: Rising           0x08         RegInterruptSource         0x00         3.2         Edge sensitivity of I/O[2]         01: Rising           0x08         RegInterruptSource         0x00         7.0         1: An interrupt has been triggered by this IO         1: Both           0x09         RegEventStatus         0x00         7.0         Viting '1' clears the bit in RegInterruptSource and in RegEventStatus           0x09         RegEventStatus         0x00         7.0         Viting '1' clears the bit in RegInterruptSource and in RegEventStatus           0x09         RegEventStatus         0x00         7.0         Viting '1' clears the bit in RegInterruptSource and in RegEventStatus           0x10         RegPLDMode         0x00         7.0         PLModeUnder Intervant RegRemet Intervant Re	0x06	ReaSenseHigh	0x00	5:4			
0x07         RegSenseLow         0x00         7:6         Edge sensitivity of I/O3         00 : None           0x07         RegSenseLow         0x00         2: Edge sensitivity of I/O3         00 : None           0x08         RegInterruptSource         0x00         2: Edge sensitivity of I/O3         10: Rising           0x08         RegInterruptSource         0x00         1: A interrupt has been triggered by this IO (an event as configured in relevant RegSense register occured).           0x09         RegInterruptSource         0x00         7:0         RegSense register occured).           0x09         RegEventStatus         0x00         7:0         RegSense register occured).           0x09         RegEventStatus         0x00         7:0         RegEventStatus of all IO: 1: An interrupt has been triggered by this IO (an event as configured in relevant RegSense register occured).           0x09         RegEventStatus         0x00         7:0         RegEventStatus and I RegEventStatus and I RegEventStatus and I RegEventStatus and I RegPuteruptSource if relevant. If the edge sensitivity of I/O1(2) is a decode of I/O1(2) and the relevant. If the edge sensitivity of I/O1(2) is a decode of I/O1(2) as defined in RegPLDTable0           0x10         RegPLDMode         0x00         7:0         PLDModeHigh (applies to I/O1(2) is a decode of I/O1(2) as defined in RegPLDTable0           0x11         RegPLDTable0         0x00	ence e		0,100				
0x07         RegBenseLow         0x00         5.4         Edge sensitivity of I/O[2]         01         11         Baing 11         Baing 12         Edge sensitivity of I/O[1]         01         11         An interrupt has been intiggered by this IO         01         01         11 <th1< td=""><td></td><td></td><td></td><td></td><td></td><td></td></th1<>							
0x07         Regeneration         0x00         3:2         Egge sensitivity of LO(1)         10: Falling           0x08         ReginterruptSource         1:0         Edge sensitivity of LO(1)         11: Both           0:x08         ReginterruptSource         0:x00         7:0         Edge sensitivity of LO(2)         11: Both           0:x09         Regeneration         0:x00         7:0         Regeneration         0:x00         1: An interrupt has been triggered by this IO (an event as configured in relevant RegSense register occured).           0x09         RegEventStatus         0:x00         7:0         Event status of all IOs.         0: No event has occured on this IO (an edge as configured in relevant RegSense register occured).           0x09         RegPLDMode         0:x00         7:0         Freestreat Mail for action of RegPLOT addition and the edge sensitivity of the O is charged, the bits) will be cleared automatically.           0x10         RegPLDMode         0:x00         7:0         Freestreat Mail for action of RPIO mode for I/07:4)         0: PLDModeHgi (applied to to I/06041 value)           0x11         RegPLDMode         0:x00         7:0         Freestreat Mail for action of RPIO mode for I/07:4)         0: PLDModeHgi (applied to I/02:4)         0: PLDModeHgi (applied to I/02:4)           0x11         RegPLDMode         0:x00         7:0         Value to be output on I/							
Ox08         ReginterruptSource         0x00         Edge sensitivity of iO(0)         11 : Both         11 : Both           0x08         ReginterruptSource         0x00         7.0         Edge sensitivity of iO(0)         11 : Both         11 : Both           0x08         ReginterruptSource         0x00         7.0         Interrupt source (from IOs set in ReginterruptSource and in RegEventStatus Writing '1' clears the bit in RegInterruptSource and in RegEventStatus           0x09         RegEventStatus         0x00         7.0         Event status of all IOs. 0 : No wern thas occured on this IO 1 : An event has occured on this IO (an edge as configured in relevant RegSense register occured).           0x10         RegPLDMode         7.0         Regeree register occured).         Writing '1' clears the bit in RegEventStatus and in RegInterruptSource if relevant. If the dge sensitivity of the IO is changed, the bit(s) will be cleared automatically 0 the ID stabel mode round (SC4) as defined in RegPLDTable0 0 1: PLD 24-01 mode - IO(2) is a decode of IO(2):4] as defined in RegPLDTable0 0 10 : PLD 24-01 mode - IO(2) is a decode of IO(2):4] as defined in RegPLDTable0 0 10 : PLD 24-01 mode - IO(2) is a decode of IO(2):0] as defined in RegPLDTable0 10 : PLD 24-01 mode - IO(2) is a decode of IO(2):0] as defined in RegPLDTable0 10 : PLD 24-01 mode - IO(2) is a decode of IO(2):0] as defined in RegPLDTable0 10 : PLD 24-01 mode - IO(2) is a decode of IO(2):0] as defined in RegPLDTable2 11 : PLD 24-01 mode - IO(2) is a decode of IO(2):0] as defined in RegPLDTable0 10 : PLD 24-01 mode - IO	0x07	RegSenseLow	0x00		· · · ·		
0x08         ReginteruptSource         0x00         FilteruptSource         Filterup							
Ox08         ReginterruptSource         0x00         7.0         0: No interrupt has been triggered by this IO (an event as configured in relevant RegSense register occured).           0x09         RegEventStatus         0x00         7.0         Writing '1' clears the bit in RegInterruptSource and in RegEventStatus When all bits are cleared, NNIT signal goes back high.           0x09         RegEventStatus         0x00         7.0         0: No event has occured on this IO (an edge as configured in relevant RegSense register occured).           0x09         RegEventStatus         0x00         7.0         0: No event has occured on this IO (an edge as configured in relevant RegSense register occured).           0x10         RegPLDMode         0x00         7.0         Regeres the bit in RegEventStatus and in RegInterruptSource if relevant. If the edge as restituity of the IO is changed, the bits) will be cleared automatically if the OS is changed, the Dis changed, the bits) will be cleared automatically if 0: PLDModeHigh (applies to I/O(7.4))         0: PLDModeHigh (applies to I/O(7.4))         0: PLDModeHigh (applies to I/O(7.4))         0: PLDModeHigh (applies to I/O(3.0))           0x10         RegPLDMode         0x00         3.2         Reserved. Mult be set to 0 (default value)         PLDModeHigh (applies to I/O(3.0))         0: PLDModeHigh (applies to I/O(2.0))         PLDModeHig				1.0			
0x09         RegEventStatus         0x00         7:0         When all lbs: are cleared, NINT signal goes back high.            0x09         RegEventStatus         0x00         7:0         :No event has occured on this IO            0:No event has occured on this IO <td< td=""><td>0x08</td><td>ReginterruptSource</td><td>0x00</td><td>7:0</td><td>0 : No interrupt has been triggered by this IO 1 : An interrupt has been triggered by this IO (an event RegSense register occured).</td><td>-</td></td<>	0x08	ReginterruptSource	0x00	7:0	0 : No interrupt has been triggered by this IO 1 : An interrupt has been triggered by this IO (an event RegSense register occured).	-	
0x09         RegEventStatus         0x00         7:0         Event status of all IOs. 0: No event has occured on this IO 1: An event has occured on this IO 1: PLD 24-01 mode - IVO[61] is changed, the bit(s) will be cleared automatically PLDModeH of publics to I/O[7:4] 0: PLD 24-01 mode - IVO[71] is a decode of I/O[7:4] 0: PLD 24-01 mode - IVO[71] is a decode of I/O[7:4] as defined in RegPLDTable0 10: PLD 24-01 mode - IVO[71] is a decode of I/O[7:0] as defined in RegPLDTable0 10: PLD 24-01 mode - IVO[71] is a decode of I/O[7:0] as defined in RegPLDTable0 10: PLD 24-01 mode - IVO[71] is a decode of I/O[7:0] as defined in RegPLDTable0 10: PLD 24-01 mode - IVO[71] is a decode of I/O[7:0] as defined in RegPLDTable0 10: PLD 24-01 mode - IVO[71] is a decode of I/O[7:0] as defined in RegPLDTable3 and RegPLDTable4 0 Value to be output on I/O[6] when I/O[5:4] = 01 PLDModeLow is set to PLD 2- to-1 mode           0x11         RegPLDTable0 0         0x00         7         Value to be output on I/O[6] when I/O[5:4] = 01 PLDModeLow is set to PLD 2- to-1 mode           0x12         RegPLDTable0 0         0x00         7         Value to be output on I/O[2] when I/O[5:4] = 01 PLDModeLow is set to PLD 3- to-1 mode           0x12						egevenisialus	
0x10         RegPLDMode         0x00         7.6         Reserved. Must be set to 0 (default valua) PLDModeHigh (applies to 1/0[7:4] 00 : PLD disabled - Normal GPIO mode for 1/0[7:4] 01 : PLD 2-to - 1 mode - 1/0[6] is a decode of 1/0[5:4] as defined in RegPLDTable0 10 : PLD 3-to -1 mode - 1/0[6] is a decode of 1/0[5:4] as defined in RegPLDTable1 11 : Reserved           0x10         0x00         3:2         Reserved. Must be set to 0 (default valua) 0 : PLD disabled - Normal GPIO mode for 1/0[3:0] 00 : PLD disabled - Normal GPIO mode for 1/0[3:0] 00 : PLD disabled - Normal GPIO mode for 1/0[3:0] 00 : PLD disabled - Normal GPIO mode for 1/0[3:0] 00 : PLD disabled - Normal GPIO mode for 1/0[3:0] 00 : PLD disabled - Normal GPIO mode for 1/0[3:0] 00 : PLD 3-to -1 mode - 1/0[2] is a decode of 1/0[2:0] as defined in RegPLDTable2 11 : PLD 3-to-2 mode - 1/0[4:3] are decode of 1/0[2:0] as defined in RegPLDTable2 11 : PLD 3-to-2 mode - 1/0[4:4] = 10           0x11         RegPLDTable0         0x00         7         Value to be output on 1/0[6] when 1/0[6:4] = 10 - 1 mode         Applies only when PLDModeHigh is set to PLD 2- to 1 mode           0x12         RegPLDTable1         7         Value to be output on 1/0[6] when 1/0[6:4] = 101 - 1 walue to be output on 1/0[2] when 1/0[6:4] = 101 - 1 walue to be output on 1/0[2] when 1/0[6:4] = 101 - 1 mode         Applies only when PLDModeHigh is set to PLD 2- to-1 mode           0x12         RegPLDTable1         0x00         7         Value to be output on 1/0[2] when 1/0[6:4] = 101 - 1 walue to be output on 1/0[2] when 1/0[6:4] = 101 - 1 mode         Applies only when PLDModeHigh is set to PLD 3- to-1 mode           0x13         RegP	0x09	RegEventStatus	0x00	7:0	Event status of all IOs. 0 : No event has occured on this IO 1 : An event has occured on this IO (an edge as configured in relevant RegSense register occured).		
0x10         RegPLDMode         0x00         7:6         Penervoid. Must be sist to 0:(draft value)           0x10         RegPLDMode         0x00         PLDModeHigh (applies to I/0[7:4])         00: PLD disabled – Normal GPIO mode for I/0[7:4] as defined in RegPLDTable0           0x10         PLDModeHigh (applies to I/0[7:4])         01: PLD 2-to-1 mode – I/0[7] is a decode of I/0[5:4] as defined in RegPLDTable1           11: Reserved         3:2         Penervoid. Must be solt to 0:(default value)           PLDModeLow (applies to I/0[3:0])         00: PLD disable1 – Normal GPIO mode for I/0[3:0] as defined in RegPLDTable0           10: PLD 3-to-1 mode – I/0[2] is a decode of I/0[2:0] as defined in RegPLDTable1         11: PLD 3-to-1 mode – I/0[2] is a decode of I/0[2:0] as defined in RegPLDTable2           10: PLD 3-to-1 mode – I/0[2] is a decode of I/0[2:0] as defined in RegPLDTable2         11: PLD 3-to-2 mode – I/0[2] is a decode of I/0[2:0] as defined in RegPLDTable3           and RegPLDTable4         7         Value to be output on I/0[6] when I/0[5:4] = 01         Applies only when PLDModeHigh is set to PLD 2-to-1 mode – I/0[4:3] are decode of I/0[1:0] = 11           2         Value to be output on I/0[6] when I/0[5:4] = 01         Applies only when PLDModeHigh is set to PLD 2-to-1 mode – I/0[2] when I/0[1:0] = 11           4         Value to be output on I/0[2] when I/0[1:0] = 11         Applies only when PLDModeHigh is set to PLD 3-to-1 mode – I/0[2] when I/0[1:0] = 01           0x12         RegPLDTable1 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td></t<>							
0x10         RegPLDMode         0x00         5:4         0: PLD disabled - Normal GPU mode for I/O[7:4] 0: PLD 3:to-1 mode - I/O[6] is a decode of U/O[5:4] as defined in RegPLDTable0 10: PLD 3:to-1 mode - I/O[7] is a decode of U/O[5:4] as defined in RegPLDTable1 11: Reserved           0x10         0x00         2: Reserved. Must be set to 0 (default value) 0: PLD disabled - Normal GPU mode for I/O[3:0] 0: PLD 3:to-1 mode - I/O[2] is a decode of U/O[2:0] as defined in RegPLDTable0 10: PLD 3:to-1 mode - I/O[2] is a decode of U/O[2:0] as defined in RegPLDTable0 10: PLD 3:to-1 mode - I/O[2] is a decode of U/O[2:0] as defined in RegPLDTable3 and RegPLDTable4           0x11         RegPLDTable0         0x00         7         Value to be output on I/O[6] when I/O[5:4] = 11 PLDModeHigh is set to PLD 2: 10: PLD 3:to-2 mode - I/O[2] when I/O[5:4] = 10 PLDModeHigh is set to PLD 2: 10: PLD 3:to-2 mode - I/O[2] when I/O[5:4] = 10 PLDModeHigh is set to PLD 2: 10: PLD 3:to-2 mode - I/O[2] when I/O[5:4] = 01 PLDModeLigh is set to PLD 2: 10: PLD 3:to-2 mode - I/O[2] when I/O[5:4] = 01 PLDModeLigh is set to PLD 2: 10: PLD 3:to-2 mode - I/O[2] when I/O[1:0] = 10 PLDModeLigh is set to PLD 2: 10: PLD 3:to-2 mode - I/O[2] when I/O[1:0] = 10 PLDModeLigh is set to PLD 2: 10: PLD 3:to 2: PLD 3: 10: PLD 3:to 2: 10: PLD 3:to 2: 10: PLD 3:to 2: PLD 3: 10: PLD 3:to 2: PLD 3: 10: PLD 3:to 2: 10: PLD 3:to 2: PLD 3: 10: PLD 3:to 2: PLD 3:to 2: PLD 3: 10: PLD 3:to 2: PLD 3:to 2: PLD 3: 10: PLD 3:to 2: PLD 3: 10: PLD 3:to				7:6			
Ox1         PicDModeLow (applies to I/O[3:0]) 00 : PLD disabled - Normal GPIO mode or I/O[2:0] as defined in RegPLDTable0 10 : PLD 2+to-1 mode - I/O[2] is a decode of I/O[2:0] as defined in RegPLDTable0 10 : PLD 2+to-1 mode - I/O[3] is a decode of I/O[2:0] as defined in RegPLDTable3 and RegPLDTable4           0x11         RegPLDTable0         0x00         7         Value to be output on I/O[6] when I/O[5:4] = 11 6         Applies only when PLDModeLow (applies to I/O[2:0] as defined in RegPLDTable3 and RegPLDTable4           0x11         RegPLDTable0         0x00         3         Value to be output on I/O[6] when I/O[5:4] = 11 6         Applies only when PLDModeHigh is set to PLD 2- to-1 mode           0x11         RegPLDTable0         0x00         3         Value to be output on I/O[2] when I/O[5:4] = 01 7         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x12         RegPLDTable1         0x00         7         Value to be output on I/O[2] when I/O[1:0] = 10 7         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x12         RegPLDTable1         0x00         7         Value to be output on I/O[2] when I/O[1:0] = 10 7         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 101 7         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[3] whe		00 : PLD disabled – Normal GPIO mode for I/O[7:4]         5:4       01 : PLD 2-to-1 mode – I/O[6] is a decode of I/O[5:4] as defined in RegPI         10 : PLD 3-to-1 mode – I/O[7] is a decode of I/O[6:4] as defined in RegPI					
0x11         RegPLDTable0         0x00         1:0         0: PLD disabled - Nomal GPIO mode for I/O[3:0] 01: PLD 2:to-1 mode - I/O[2] is a decode of I/O[2:0] as defined in RegPLDTable0 10: PLD 3:to-2 mode - I/O[2] is a decode of I/O[2:0] as defined in RegPLDTable2 11: PLD 3:to-2 mode - I/O[3] is a decode of I/O[2:0] as defined in RegPLDTable3 and RegPLDTable4           0x11         RegPLDTable0         7         Value to be output on I/O[6] when I/O[5:4] = 11 4         Applies only when PLDModeHigh is set to PLD 2- to-1 mode           0x12         RegPLDTable1         7         Value to be output on I/O[0] when I/O[5:4] = 00         Applies only when PLDModeHigh is set to PLD 2- to-1 mode           0x12         RegPLDTable1         7         Value to be output on I/O[2] when I/O[1:0] = 11         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x13         RegPLDTable1         7         Value to be output on I/O[2] when I/O[1:0] = 00         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x13         RegPLDTable2         7         Value to be output on I/O[7] when I/O[6:4] = 101         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 000         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 000         Applies only when PLDModeLow is s	0x10	RegPLDMode	0x00	3:2			
0x11         RegPLDTable0         0x00         6         Value to be output on I/O[6] when I/O[5:4] = 10 5         Value to be output on I/O[6] when I/O[5:4] = 01 to 1 mode         Applies only when PLDModeHigh is set to PLD 2- to 1 mode           0x11         RegPLDTable0         0x00         3         Value to be output on I/O[2] when I/O[1:0] = 11 2         Applies only when PLDModeLigh is set to PLD 2- to 1 mode           0x12         RegPLDTable1         0         Value to be output on I/O[2] when I/O[1:0] = 00 1         Value to be output on I/O[2] when I/O[1:0] = 00         Applies only when PLDModeLow is set to PLD 2- to 1 mode           0x12         RegPLDTable1         7         Value to be output on I/O[7] when I/O[6:4] = 111 6         Value to be output on I/O[7] when I/O[6:4] = 101 5         Applies only when PLDModeHigh is set to PLD 3- to 1 mode           0x12         RegPLDTable1         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 101 1         Applies only when PLDModeHigh is set to PLD 3- to 1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 000 1         Applies only when PLDModeLow is set to PLD 3- to 1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 110 1         Applies only when PLDModeLow is set to PLD 3- to 1 mode           0x13         RegPLDTable2         0x00         7				1:0	00 : PLD disabled – Normal GPIO mode for I/O[3:0] 01 : PLD 2-to-1 mode – I/O[2] is a decode of I/O[1:0] as 10 : PLD 3-to-1 mode – I/O[3] is a decode of I/O[2:0] as 11 : PLD 3-to-2 mode – I/O[4:3] are decodes of I/O[2:0]	s defined in RegPLDTable2	
0x11         RegPLDTable0         0x00         0x10         0x10 to be output on I/O[6] when I/O[5:4] = 10 4         PLDModeHigh is set to PLD 2- to-1 mode           0x11         RegPLDTable0         0x00         3         Value to be output on I/O[2] when I/O[1:0] = 11 2         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x12         RegPLDTable1         0x00         7         Value to be output on I/O[2] when I/O[1:0] = 00 0         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x12         RegPLDTable1         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 110 5         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x13         RegPLDTable1         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 101 5         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 000         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 111 0         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         Xalue to be output on I/O[3] when I/O[2:0] = 110 0         Xalue to be output on I/O[3] when I/O[2:0] = 110 0         Applies only when PLDModeLow is set to PLD 3- to-1 mode				7	Value to be output on I/O[6] when I/O[5:4] = 11	Applies only when	
0x11         RegPLDTable0         0x00         5         Value to be output on I/O[6] when I/O[5:4] = 01         to-1 mode           0x11         4         Value to be output on I/O[6] when I/O[5:4] = 00         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x10         7         Value to be output on I/O[2] when I/O[1:0] = 01         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x12         RegPLDTable1         7         Value to be output on I/O[7] when I/O[6:4] = 111         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x12         RegPLDTable1         7         Value to be output on I/O[7] when I/O[6:4] = 101         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 001         Applies only when PLDModeHigh is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 001         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 110         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 110         Applies only when PLDModeLow is set to PLD 3- to-1 m							
0x11         RegPLDTable1         0x00         3         Value to be output on I/O[2] when I/O[1:0] = 11         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x12         RegPLDTable1         7         Value to be output on I/O[2] when I/O[1:0] = 00         Applies only when PLDModeLow is set to PLD 2- to-1 mode           0x12         RegPLDTable1         7         Value to be output on I/O[7] when I/O[6:4] = 101         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 001         Applies only when PLDModeHigh is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 010         Applies only when PLDModeHigh is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 010         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 111         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         Value to be output on I/O[3] when I/O[2:0] = 100         Applies only when PLDModeLow is set to PLD 3- to-1 mode         Applies only when PLDModeLow is set to PLD 3- to-1 mode							
0x12         RegPLDTable1         0x00         7         Value to be output on I/O[2] when I/O[1:0] = 10         Applies only when PLDModeLow is set to PLD 2-to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 101         Applies only when PLDModeLow is set to PLD 2-to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 001         Applies only when PLDModeLow is set to PLD 3-to-1 mode	0x11	RegPLDTable0	0x00				
No.         No. <td></td> <td></td> <td></td> <td></td> <td></td> <td>Applies only when</td>						Applies only when	
0         Value to be output on I/O[2] when I/O[1:0] = 00         In the optimization           0x12         RegPLDTable1         7         Value to be output on I/O[7] when I/O[6:4] = 111         Applies only when           0x12         0x00         4         Value to be output on I/O[7] when I/O[6:4] = 100         Applies only when           0x12         0x00         4         Value to be output on I/O[7] when I/O[6:4] = 101         Applies only when           0x12         0x00         4         Value to be output on I/O[7] when I/O[6:4] = 101         Applies only when           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 001         to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 111         Applies only when           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 110         Applies only when           0x13         Value         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 110         Applies only when           0x13         Z         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 101         Applies only when           0x13         Z         0x00         7         Value to be output on						PLDModeLow is set to PLD 2-	
0x12         RegPLDTable1         7         Value to be output on I/O[7] when I/O[6:4] = 111         Applies only when PLDModeHigh is set to PLD 3- to-1 mode           0x12         0x00         4         Value to be output on I/O[7] when I/O[6:4] = 101         Applies only when PLDModeHigh is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 001         Applies only when PLDModeHigh is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[7] when I/O[6:4] = 000         Applies only when PLDModeHigh is set to PLD 3- to-1 mode           0x13         RegPLDTable2         0x00         7         Value to be output on I/O[3] when I/O[2:0] = 111         Applies only when PLDModeLow is set to PLD 3- to-1 mode           0x13         Value to be output on I/O[3] when I/O[2:0] = 100         3         Value to be output on I/O[3] when I/O[2:0] = 101         Applies only when PLDModeLow is set to PLD 3- to-1 mode						to-1 mode	
0x12RegPLDTable10x006Value to be output on I/O[7] when I/O[6:4] = 110 5Value to be output on I/O[7] when I/O[6:4] = 101 4Applies only when PLDModeHigh is set to PLD 3- to-1 mode0x120x004Value to be output on I/O[7] when I/O[6:4] = 010 2Value to be output on I/O[7] when I/O[6:4] = 010 1Value to be output on I/O[7] when I/O[6:4] = 010 1Applies only when PLDModeHigh is set to PLD 3- to-1 mode0x13RegPLDTable20x007Value to be output on I/O[7] when I/O[2:0] = 111 6Value to be output on I/O[3] when I/O[2:0] = 110 5Applies only when PLDModeLow is set to PLD 3- to-1 mode0x13RegPLDTable20x007Value to be output on I/O[3] when I/O[2:0] = 110 5Applies only when PLDModeLow is set to PLD 3- to-1 mode0x13Value to be output on I/O[3] when I/O[2:0] = 101 4Value to be output on I/O[3] when I/O[2:0] = 101 4Applies only when PLDModeLow is set to PLD 3- to-1 mode				-			
0x12RegPLDTable15Value to be output on I/O[7] when I/O[6:4] = 101 4Applies only when PLDModeHigh is set to PLD 3- to-1 mode0x120x004Value to be output on I/O[7] when I/O[6:4] = 100 3Value to be output on I/O[7] when I/O[6:4] = 011 1Value to be output on I/O[7] when I/O[6:4] = 010 1Value to be output on I/O[7] when I/O[6:4] = 010 0Value to be output on I/O[7] when I/O[6:4] = 010 0Value to be output on I/O[7] when I/O[6:4] = 001Applies only when PLDModeHigh is set to PLD 3- to-1 mode0x13RegPLDTable20x007Value to be output on I/O[3] when I/O[2:0] = 111 5Applies only when PLDModeLow is set to PLD 3- to-1 mode0x13Nalue to be output on I/O[3] when I/O[2:0] = 100 3Value to be output on I/O[3] when I/O[2:0] = 101 4Applies only when PLDModeLow is set to PLD 3- to-1 mode						1	
0x12       RegPLDTable1       0x00          4         Value to be output on I/O[7] when I/O[6:4] = 100         3         Value to be output on I/O[7] when I/O[6:4] = 011         2         Value to be output on I/O[7] when I/O[6:4] = 010         1         Value to be output on I/O[7] when I/O[6:4] = 010         1         Value to be output on I/O[7] when I/O[6:4] = 010         0         Value to be output on I/O[7] when I/O[6:4] = 001         0         Value to be output on I/O[7] when I/O[6:4] = 000         Value to be output on I/O[7] when I/O[6:4] = 000         Value to be output on I/O[7] when I/O[6:4] = 000         Value to be output on I/O[3] when I/O[2:0] = 111         Applies only when         PLDModelAight         Applies only when         PLDModelAight         Applies         Applies only when         PLDModelAig						1	
0X12       KegPLDTable1       0X00       3       Value to be output on I/O[7] when I/O[6:4] = 011 2       Value to be output on I/O[7] when I/O[6:4] = 010 1       Value to be output on I/O[7] when I/O[6:4] = 010 0       Value to be output on I/O[7] when I/O[6:4] = 001 0       Value to be output on I/O[7] when I/O[6:4] = 001 0       Value to be output on I/O[7] when I/O[6:4] = 000       Value to be output on I/O[7] when I/O[6:4] = 000       Value to be output on I/O[3] when I/O[2:0] = 111       Applies only when PLDModeLow is set to PLD 3- to-1 mode         0x13       RegPLDTable2       0x00       7       Value to be output on I/O[3] when I/O[2:0] = 110       Applies only when PLDModeLow is set to PLD 3- to-1 mode         0x13       Value to be output on I/O[3] when I/O[2:0] = 101       4       Value to be output on I/O[3] when I/O[2:0] = 011       Applies only when PLDModeLow is set to PLD 3- to-1 mode         0x13       Value to be output on I/O[3] when I/O[2:0] = 010       3       Value to be output on I/O[3] when I/O[2:0] = 010       Applies only when PLDModeLow is set to PLD 3- to-1 mode	0×10		0,000				
2         Value to be output on I/O[7] when I/O[6:4] = 010           1         Value to be output on I/O[7] when I/O[6:4] = 001           0         Value to be output on I/O[7] when I/O[6:4] = 000           0x13         RegPLDTable2           0x00         7         Value to be output on I/O[3] when I/O[2:0] = 111           6         Value to be output on I/O[3] when I/O[2:0] = 110           5         Value to be output on I/O[3] when I/O[2:0] = 101           4         Value to be output on I/O[3] when I/O[2:0] = 100           3         Value to be output on I/O[3] when I/O[2:0] = 011           2         Value to be output on I/O[3] when I/O[2:0] = 010	UX12	Regrediable	000	3			
0       Value to be output on I/O[7] when I/O[6:4] = 000         0x13       RegPLDTable2       0x00       7       Value to be output on I/O[3] when I/O[2:0] = 111       Applies only when         6       Value to be output on I/O[3] when I/O[2:0] = 110       FLDModeLow is set to PLD 3-         5       Value to be output on I/O[3] when I/O[2:0] = 101       Applies only when         4       Value to be output on I/O[3] when I/O[2:0] = 100       Aoplies only when         3       Value to be output on I/O[3] when I/O[2:0] = 011       Aoplies only when         2       Value to be output on I/O[3] when I/O[2:0] = 010       Aoplies only when				2			
0x13       RegPLDTable2       0x00       7       Value to be output on I/O[3] when I/O[2:0] = 111       Applies only when         6       Value to be output on I/O[3] when I/O[2:0] = 110       5       Value to be output on I/O[3] when I/O[2:0] = 101       Applies only when         5       Value to be output on I/O[3] when I/O[2:0] = 101       4       Value to be output on I/O[3] when I/O[2:0] = 100       Applies only when         3       Value to be output on I/O[3] when I/O[2:0] = 011       2       Value to be output on I/O[3] when I/O[2:0] = 010       Applies only when						4	
6Value to be output on I/O[3] when I/O[2:0] = 110PLDModeLow is set to PLD 3-5Value to be output on I/O[3] when I/O[2:0] = 101to-1 mode4Value to be output on I/O[3] when I/O[2:0] = 100to-1 mode3Value to be output on I/O[3] when I/O[2:0] = 011value to be output on I/O[3] when I/O[2:0] = 0102Value to be output on I/O[3] when I/O[2:0] = 010value to be output on I/O[3] when I/O[2:0] = 010				-			
5Value to be output on $I/O[3]$ when $I/O[2:0] = 101$ to-1 mode4Value to be output on $I/O[3]$ when $I/O[2:0] = 100$ 33Value to be output on $I/O[3]$ when $I/O[2:0] = 011$ 22Value to be output on $I/O[3]$ when $I/O[2:0] = 010$	0x13	RegPLDTable2	0x00				
4Value to be output on I/O[3] when I/O[2:0] = 1013Value to be output on I/O[3] when I/O[2:0] = 0112Value to be output on I/O[3] when I/O[2:0] = 010				-			
3         Value to be output on I/O[3] when I/O[2:0] = 011           2         Value to be output on I/O[3] when I/O[2:0] = 010							
2 Value to be output on I/O[3] when I/O[2:0] = 010						4	
						1	
				1	Value to be output on $I/O[3]$ when $I/O[2:0] = 0.01$	1	



# ADVANCED COMMUNICATIONS & SENSING

Addr	Name	Default	Bits	Description	
			0	Value to be output on I/O[3] when I/O[2:0] = 000	
		7	Value to be output on I/O[4] when I/O[2:0] = 111		
			6	Value to be output on I/O[4] when I/O[2:0] = 110	
			5	Value to be output on I/O[4] when I/O[2:0] = 101	Applies estructure
0x14	RegPLDTable3	0x00	4	Value to be output on I/O[4] when I/O[2:0] = 100	Applies only when PLDModeLow is set to PLD 3-
0714	Regi ED Tables	0,00	3	Value to be output on I/O[4] when I/O[2:0] = 011	to-2 mode
			2	Value to be output on I/O[4] when I/O[2:0] = 010	
			1	Value to be output on I/O[4] when I/O[2:0] = 001	
			0	Value to be output on I/O[4] when I/O[2:0] = 000	
			7	Value to be output on I/O[3] when I/O[2:0] = 111	
			6	Value to be output on I/O[3] when I/O[2:0] = 110	
			5	Value to be output on I/O[3] when I/O[2:0] = 101	Analise enhanter
0x15	RegPLDTable4	0x00	4	Value to be output on I/O[3] when I/O[2:0] = 100	Applies only when PLDModeLow is set to PLD 3-
0.15	Regred Table4	0,000	3	Value to be output on I/O[3] when I/O[2:0] = 011	to-2 mode
			2	Value to be output on I/O[3] when I/O[2:0] = 010	
			1	Value to be output on I/O[3] when I/O[2:0] = 001	
			0	Value to be output on I/O[3] when I/O[2:0] = 000	
			7:2	Reserved. Must be set to 0 (default value)	
0xAB	RegAdvanced	0x00	1	Boost Mode (Cf. §2.2.1) 0: OFF 1: ON	
			0	Reserved. Must be set to 0 (default value)	

Table 15 – SX1502 Configuration Registers Description

#### 5.3 SX1503 16-channel GPIO

Address	Name	Description	Default	
0x00	RegDataB	Data register for Bank B I/O[15:8]	1111 1111	
0x01	RegDataA	Data register for Bank A I/O[7:0]	1111 1111	
0x02	RegDirB	Direction register for Bank B I/O[15:8]	1111 1111	
0x03	RegDirA	Direction register for Bank A I/O[7:0]	1111 1111	
0x04	RegPullUpB	Pull-up register for Bank B I/O[15:8]	0000 0000	
0x05	RegPullUpA	Pull-up register for Bank A I/O[7:0]	0000 0000	
0x06	RegPullDownB	Pull-down register for Bank B I/O[15:8]	0000 0000	
0x07	RegPullDownA	Pull-down register for Bank A I/O[7:0]	0000 0000	
0x08	RegInterruptMaskB	Interrupt mask register for Bank B I/O[15:8]	1111 1111	
0x09	RegInterruptMaskA	Interrupt mask register for Bank A I/O[7:0]	1111 1111	
0x0A	RegSenseHighB	Sense register for I/O[15:12]	0000 0000	
0x0B	RegSenseHighA	Sense register for I/O[7:4]	0000 0000	
0x0C	RegSenseLowB	Sense register for I/O[11:8]	0000 0000	
0x0D	RegSenseLowA	Sense register for I/O[3:0]	0000 0000	
0x0E	RegInterruptSourceB	Interrupt source register for Bank B I/O[15:8]	0000 0000	
0x0F	RegInterruptSourceA	Interrupt source register for Bank A I/O[7:0]	0000 0000	
0x10	RegEventStatusB	Event status register for Bank B I/O[15:8]	0000 0000	
0x11	RegEventStatusA	Event status register for Bank A I/O[7:0]	0000 0000	
0x20	RegPLDModeB	PLD mode register for Bank B I/O[15:8]	0000 0000	
0x21	RegPLDModeA	PLD mode register for Bank A I/O[7:0]	0000 0000	
0x22	RegPLDTable0B	PLD truth table 0 for Bank B I/O[15:8]	0000 0000	
0x23	RegPLDTable0A	PLD truth table 0 for Bank A I/O[7:0]	0000 0000	
0x24	RegPLDTable1B	PLD truth table 1 for Bank B I/O[15:8]	0000 0000	
0x25	RegPLDTable1A	PLD truth table 1 for Bank A I/O[7:0]	0000 0000	
0x26	RegPLDTable2B	PLD truth table 2 for Bank B I/O[15:8]	0000 0000	
0x27	RegPLDTable2A	PLD truth table 2 for Bank A I/O[7:0]	0000 0000	
0x28	RegPLDTable3B	PLD truth table 3 for Bank B I/O[15:8]	0000 0000	
0x29	RegPLDTable3A	PLD truth table 3 for Bank A I/O[7:0]	0000 0000	
0x2A	RegPLDTable4B	PLD truth table 4 for Bank B I/O[15:8]	0000 0000	
0x2B	RegPLDTable4A	PLD truth table 4 for Bank A I/O[7:0]	0000 0000	
0xAD	RegAdvanced	Advanced settings register	0000 0000	

Table 16 – SX1503 Configuration Registers Overview

Addr	Name	Default Bits	Description

SEMTECH

# SX1501/SX1502/SX1503 4/8/16 Channel Low Voltage GPIO

# ADVANCED COMMUNICATIONS & SENSING

Addr	Name	Default	Bits	Description	
0x00	RegDataB	0xFF	7:0	Write: Data to be output to the output-configured IOs	
		<b>0</b> /4 1		Read: Data seen at the IOs, independent of the direction Write: Data to be output to the output-configured IOs	n configured.
0x01	RegDataA	0xFF	7:0	Read: Data seen at the IOs, independent of the direction	n configured.
				Configures direction for each IO.	
0x02	RegDirB	RegDirB 0xFF 7:0		0 : IO is configured as an output	
				1 : IO is configured as an input Configures direction for each IO.	
0x03	RegDirA	0xFF	7:0	0 : IO is configured as an output	
				1 : IO is configured as an input	
0x04	RegPullUpB	0x00	7:0	Enables the pull-up for each IO 0 : Pull-up is disabled	
0,04	Regi unope	0,00	7.0	1 : Pull-up is enabled	
0.05		0.00	7.0	Enables the pull-up for each IO	
0x05	RegPullUpA	0x00	7:0	0 : Pull-up is disabled 1 : Pull-up is enabled	
				Enables the pull-down for each IO	
0x06	RegPullDownB	0x00	7:0	0 : Pull-down is disabled	
				1 : Pull-down is enabled Enables the pull-down for each IO	
0x07	RegPullDownA	0x00	7:0	0 : Pull-down is disabled	
				1 : Pull-down is enabled	
0x08	RegInterruptMaskB	0xFF	7:0	Configures which [input-configured] IO will trigger an inter 0 : An event on this IO will trigger an interrupt	errupt on NIN1 pin
0,000	Roginion aptiliaons	0, 1 T	1.0	1 : An event on this IO will NOT trigger an interrupt	
0.00		0	7.0	Configures which [input-configured] IO will trigger an inte	errupt on NINT pin
0x09	RegInterruptMaskA	0xFF	7:0	0 : An event on this IO will trigger an interrupt 1 : An event on this IO will NOT trigger an interrupt	
			7:6	Edge sensitivity of I/O[15]	00 : None
0x0A	RegSenseHighB	0x00	5:4	Edge sensitivity of I/O[14]	01 : Rising
0,0,7	Regoenseringind	0,000	3:2	Edge sensitivity of I/O[13]	10 : Falling 11 : Both
			1:0	Edge sensitivity of I/O[12]	
			7:6	Edge sensitivity of I/O[7]	00 : None
0x0B	RegSenseHighA	0x00	5:4 3:2	Edge sensitivity of I/O[6] Edge sensitivity of I/O[5]	01 : Rising 10 : Falling
				Edge sensitivity of I/O[4]	11 : Both
			1:0 7:6	Edge sensitivity of I/O[11]	00 : None
0x0C	RegSenseLowB	0x00	5:4	Edge sensitivity of I/O[10]	01 : Rising
0,00	Reguenselowb		3:2	Edge sensitivity of I/O[9]	10 : Falling 11 : Both
			1:0	Edge sensitivity of I/O[8]	
			7:6 5:4	Edge sensitivity of I/O[3] Edge sensitivity of I/O[2]	00 : None 01 : Rising
0x0D	RegSenseLowA	0x00	3:2	Edge sensitivity of I/O[1]	10 : Falling
			1:0	Edge sensitivity of I/O[0]	11 : Both
				Interrupt source (from IOs set in RegInterruptMaskB)	
				<ul><li>0 : No interrupt has been triggered by this IO</li><li>1 : An interrupt has been triggered by this IO (an event a</li></ul>	as configured in relevant
0x0E	RegInterruptSourceB	0x00	7:0	RegSense register occured).	ao oo mgaroa in roiovant
				Writing '1' clears the bit in RegInterruptSourceB and in I	DogEvontStatusP
				When all bits of both RegInterruptSourceA/B are cleared	
				Interrupt source (from IOs set in RegInterruptMaskA)	
				0 : No interrupt has been triggered by this IO 1 : An interrupt has been triggered by this IO (an event a	as configured in relevant
0x0F	RegInterruptSourceA	0x00	7:0	RegSense register occured).	as configured in relevant
				Writing '1' clears the bit in RegInterruptSourceA and in I When all bits of both RegInterruptSourceA/B are cleared	
				Event status of all IOs.	
				0 : No event has occured on this IO	und in valeurent D = 0
0x10	RegEventStatusB	0x00	7:0	1 : An event has occured on this IO (an edge as configuregister occured).	irea in relevant RegSense
				Writing '1' clears the bit in RegEventStatusB and in Reg If the edge sensitivity of the IO is changed, the bit(s) wil	
				I in the edge sensitivity of the IO is changed, the bit(s) will	i de diedieu autornatically



# ADVANCED COMMUNICATIONS & SENSING

Addr	Name	Default	Bits	Description		
0x11	RegEventStatusA	0x00	7:0	Event status of all IOs. 0 : No event has occured on this IO 1 : An event has occured on this IO (an edge as configured in relevant RegSense register occured).		
				Writing '1' clears the bit in RegEventStatusA and in Reg If the edge sensitivity of the IO is changed, the bit(s) wi	gInterruptSourceA if relevant. Il be cleared automatically	
			7:6	Reserved. Must be set to 0 (default value) PLDModeHighB (applies to I/O[15:12])		
			5:4	00 : PLD disabled – Normal GPIO mode for I/O[15:12] 01 : PLD 2-to-1 mode – I/O[14] is a decode of I/O[13:12 10 : PLD 3-to-1 mode – I/O[15] is a decode of I/O[14:12 11 : Reserved		
0x20	RegPLDModeB	0x00	3:2	Reserved. Must be set to 0 (default value)		
			1:0	PLDModeLowB (applies to I/O[11:8]) 00 : PLD disabled – Normal GPIO mode for I/O[11:8] 01 : PLD 2-to-1 mode – I/O[10] is a decode of I/O[9:8] a 10 : PLD 3-to-1 mode – I/O[11] is a decode of I/O[10:8] 11 : PLD 3-to-2 mode – I/O[12:11] are decodes of I/O[1 RegPLDTable3B and RegPLDTable4B	as defined in RegPLDTable2B	
			7:6	Reserved. Must be set to 0 (default value)		
			5:4	PLDModeHighA (applies to I/O[7:4]) 00 : PLD disabled – Normal GPIO mode for I/O[7:4] 01 : PLD 2-to-1 mode – I/O[6] is a decode of I/O[5:4] as 10 : PLD 3-to-1 mode – I/O[7] is a decode of I/O[6:4] as 11 : Reserved		
0x21	RegPLDModeA	0x00	3:2	Reserved. Must be set to 0 (default value)		
			1:0	PLDModeLowA (applies to I/O[3:0]) 00 : PLD disabled – Normal GPIO mode for I/O[3:0] 01 : PLD 2-to-1 mode – I/O[2] is a decode of I/O[1:0] as 10 : PLD 3-to-1 mode – I/O[3] is a decode of I/O[2:0] as 11 : PLD 3-to-2 mode – I/O[4:3] are decodes of I/O[2:0] and RegPLDTable4A	s defined in RegPLDTable2A	
			7	Value to be output on I/O[14] when I/O[13:12] = 11		
			6	Value to be output on I/O[14] when I/O[13:12] = 10	Applies only when PLDModeHighB is set to PLD	
			5	Value to be output on $I/O[14]$ when $I/O[13:12] = 01$	2-to-1 mode	
0x22	RegPLDTable0B	0x00	4	Value to be output on $I/O[14]$ when $I/O[13:12] = 00$ Value to be output on $I/O[10]$ when $I/O[9:8] = 11$		
			2	Value to be output on $I/O[10]$ when $I/O[9:8] = 10$	Applies only when	
			1	Value to be output on $I/O[10]$ when $I/O[9:8] = 01$	PLDModeLowB is set to PLD 2-to-1 mode	
			0	Value to be output on $I/O[10]$ when $I/O[9:8] = 00$		
			7 6	Value to be output on $I/O[6]$ when $I/O[5:4] = 11$	Applies only when	
			5	Value to be output on I/O[6] when I/O[5:4] = 10 Value to be output on I/O[6] when I/O[5:4] = 01	PLDModeHighA is set to PLD	
0x23	RegPLDTable0A	0x00	4	Value to be output on $I/O[6]$ when $I/O[5:4] = 00$	2-to-1 mode	
0x23	Regrid TableuA	0x00	3	Value to be output on I/O[2] when I/O[1:0] = 11	Applies only when	
			2	Value to be output on $I/O[2]$ when $I/O[1:0] = 10$	PLDModeLowA is set to PLD	
			1 0	Value to be output on $I/O[2]$ when $I/O[1:0] = 01$ Value to be output on $I/O[2]$ when $I/O[1:0] = 00$	2-to-1 mode	
			7	Value to be output on $I/O[15]$ when $I/O[14:12] = 111$		
			6	Value to be output on I/O[15] when I/O[14:12] = 110		
			5	Value to be output on $I/O[15]$ when $I/O[14:12] = 101$	Applies only when	
0x24	RegPLDTable1B	0x00	4	Value to be output on $I/O[15]$ when $I/O[14:12] = 100$ Value to be output on $I/O[15]$ when $I/O[14:12] = 011$	PLDModeHighB is set to PLD	
			2	Value to be output on $I/O[15]$ when $I/O[14:12] = 010$	3-to-1 mode	
			1	Value to be output on I/O[15] when I/O[14:12] = 001	1	
			0	Value to be output on $I/O[15]$ when $I/O[14:12] = 000$		
			7 6	Value to be output on $I/O[7]$ when $I/O[6:4] = 111$ Value to be output on $I/O[7]$ when $I/O[6:4] = 110$	-	
			5	Value to be output on $I/O[7]$ when $I/O[6:4] = 110$	1	
0x25	RegPLDTable1A	0x00	4	Value to be output on I/O[7] when I/O[6:4] = 100	Applies only when PLDModeHighA is set to PLD	
0,25	Regi LotableTA	0,00	3	Value to be output on $I/O[7]$ when $I/O[6:4] = 011$	3-to-1 mode	
			2	Value to be output on I/O[7] when I/O[6:4] = 010 Value to be output on I/O[7] when I/O[6:4] = 001	4	
			0	Value to be output on $I/O[7]$ when $I/O[6:4] = 001$ Value to be output on $I/O[7]$ when $I/O[6:4] = 000$	-	
0x26	RegPLDTable2B	0x00	7	Value to be output on $I/O[11]$ when $I/O[10:8] = 111$	Applies only when	
	-		6	Value to be output on I/O[11] when I/O[10:8] = 110	PLDModeLowB is set to PLD	

www.semtech.com



# ADVANCED COMMUNICATIONS & SENSING

Addr	Name	Default	Bits	Description	
			5	Value to be output on I/O[11] when I/O[10:8] = 101	3-to-1 mode
			4	Value to be output on I/O[11] when I/O[10:8] = 100	-
			3	Value to be output on I/O[11] when I/O[10:8] = 011	
			2	Value to be output on I/O[11] when I/O[10:8] = 010	
			1	Value to be output on I/O[11] when I/O[10:8] = 001	
			0	Value to be output on I/O[11] when I/O[10:8] = 000	
			7	Value to be output on I/O[3] when I/O[2:0] = 111	
			6	Value to be output on I/O[3] when I/O[2:0] = 110	
			5	Value to be output on I/O[3] when I/O[2:0] = 101	Analian anhuuhan
0x27	RegPLDTable2A	0x00	4	Value to be output on I/O[3] when I/O[2:0] = 100	Applies only when PLDModeLowA is set to PLD
0/21	Regi ED TablezA	0,000	3	Value to be output on I/O[3] when I/O[2:0] = 011	3-to-1 mode
			2	Value to be output on I/O[3] when I/O[2:0] = 010	
			1	Value to be output on I/O[3] when I/O[2:0] = 001	
			0	Value to be output on I/O[3] when I/O[2:0] = 000	
			7	Value to be output on I/O[11] when I/O[10:8] = 111	
			6	Value to be output on I/O[11] when I/O[10:8] = 110	
			5	Value to be output on I/O[11] when I/O[10:8] = 101	Applies only when
0x28	RegPLDTable3B	0x00	4	Value to be output on I/O[11] when I/O[10:8] = 100	PLDModeLowB is set to PLD
0//20	Regi ED Tableob	0,000	3	Value to be output on I/O[11] when I/O[10:8] = 011	3-to-2 mode
			2	Value to be output on I/O[11] when I/O[10:8] = 010	
			1	Value to be output on I/O[11] when I/O[10:8] = 001	
			0	Value to be output on I/O[11] when I/O[10:8] = 000	
			7	Value to be output on I/O[3] when I/O[2:0] = 111	
			6	Value to be output on I/O[3] when I/O[2:0] = 110	
			5	Value to be output on I/O[3] when I/O[2:0] = 101	Applies only when PLDModeLowA is set to PLD 3-to-2 mode
0x29	RegPLDTable3A	0x00	4	Value to be output on I/O[3] when I/O[2:0] = 100	
	···· <b>j</b> · · ·····		3	Value to be output on I/O[3] when I/O[2:0] = 011	
			2	Value to be output on I/O[3] when I/O[2:0] = 010	_
			1	Value to be output on I/O[3] when I/O[2:0] = 001	_
			0	Value to be output on I/O[3] when I/O[2:0] = 000	
			7	Value to be output on $I/O[12]$ when $I/O[10:8] = 111$	
			6	Value to be output on $I/O[12]$ when $I/O[10:8] = 110$	-
			5	Value to be output on $I/O[12]$ when $I/O[10:8] = 101$	Applies only when
0x2A	RegPLDTable4B	0x00	4	Value to be output on $I/O[12]$ when $I/O[10:8] = 100$	PLDModeLowB is set to PLD
	-		3	Value to be output on $I/O[12]$ when $I/O[10:8] = 011$	3-to-2 mode
			2	Value to be output on $I/O[12]$ when $I/O[10:8] = 010$	4
			1	Value to be output on $I/O[12]$ when $I/O[10:8] = 001$	4
			0 7	Value to be output on $I/O[12]$ when $I/O[10:8] = 000$	
			6	Value to be output on $I/O[4]$ when $I/O[2:0] = 111$ Value to be output on $I/O[4]$ when $I/O[2:0] = 110$	4
			5	Value to be output on $I/O[4]$ when $I/O[2:0] = 110$ Value to be output on $I/O[4]$ when $I/O[2:0] = 101$	-
			4	Value to be output on $I/O[4]$ when $I/O[2:0] = 100$	Applies only when
0x2B	RegPLDTable4A	0x00	3	Value to be output on $I/O[4]$ when $I/O[2:0] = 100$ Value to be output on $I/O[4]$ when $I/O[2:0] = 011$	PLDModeLowA is set to PLD
			2	Value to be output on $I/O[4]$ when $I/O[2:0] = 010$	3-to-2 mode
			1	Value to be output on $I/O[4]$ when $I/O[2:0] = 010$	1
			0	Value to be output on $I/O[4]$ when $I/O[2:0] = 000$	1
			7:3	Reserved. Must be set to 0 (default value)	
0xAD	RegAdvanced	0x00	2	Autoclear NINT on RegData read (Cf. §4.6) 0: OFF.RegInterruptSource must be manually cleared of 1: ON.RegInterruptSource is automatically cleared whe	
			1	Boost Mode (Cf. §2.2.1) 0: OFF 1: ON	
			0	Reserved. Must be set to 0 (default value)	

Table 17 – SX1503 Configuration Registers Description



## ADVANCED COMMUNICATIONS & SENSING

#### 6 APPLICATION INFORMATION

#### 6.1 Typical Application Circuit

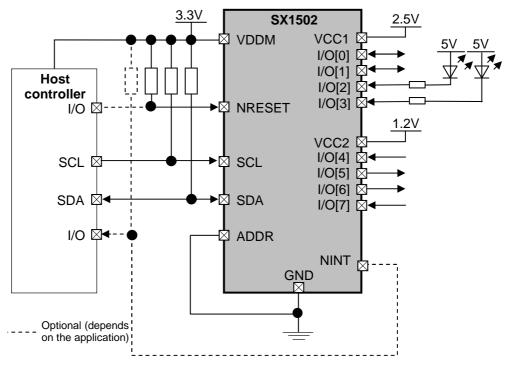
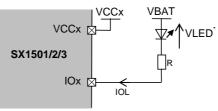


Figure 12 - Typical Application Schematic

#### 6.2 Typical LED Operation

Typical LED operation is described below. The LED is usually connected to a high voltage (VBAT) to take advantage of the high sink current of the I/O and to accommodate high LED threshold voltages (VLED).



LED colour/technology dependent

Figure 13 – Typical LED Operation

#### Important:

- VCCx must exceed VBAT-VLED (VCCx = VBAT is recommended) else the LED will never be completely OFF
- R must be calculated for IOL not to exceed its max spec (Cf. Table 5)

#### 6.2.1 LED ON/OFF Control

	RegDir[x]	RegData[x]
LED ON	"0" (Output)	" <b>O</b> "
LED OFF	o (Output)	"1"

Table 18 – LED ON/OFF Control



#### 6.2.2 LED Intensity Control

When the max IOL spec is not enough it is possible to drive simultaneously multiple I/Os connected together hence increasing the total sink capability.

Example: on an SX1502, by driving an LED with both IO[2] and IO[3] one can sink up to 24+24 =48mA.

Driving an LED with multiple I/Os can also be used to implement more intensity steps for the LED. Example: with two I/Os capable of sinking each 24mA the LED can sink a total of 0mA (no I/O set to "0"), 24mA (one I/O set to "0") or 48mA (both I/Os set to "0") => 3 LED intensity steps ( 4 steps with 3 I/Os, 5 steps with 4 I/Os, etc)

#### 6.3 Keypad Implementation

SX1501, SX1502, and SX1503 can be used to implement keypad applications up to 8x8 matrix (i.e. 64 keys)

Example: We want to implement a 4x4matrix keypad on SX1502

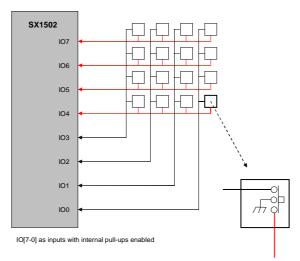


Figure 14 – 4x4 keypad connection to SX1502

- 1. Set all I/Os as inputs with internal pull-up (RegDir = 0xFF, RegPullUp = 0xFF)
- 2. Set NINT to be triggered on any IO's falling edge (RegInterruptMask = 0x00, RegSenseHigh = 0xAA, RegSenseLow = 0xAA)
- 3. When NINT goes low read RegData (or RegInterruptSource) to know the X:Y coordinates of the button which has been pressed.
- 4. Clear NINT (RegInterruptSource = 0xFF, can be done automatically on SX1503 depending on RegAdvanced setting)
- 5. Restart from point 3

#### 6.4 Level Shifter Implementation Hints

Because of their I/O banks with independent supply voltages between 1.2V and 5.5V, the SX1502 and SX1503 can be easily used to perform level shifting of signals from one I/O bank to an other (uC reads I/O from one I/O bank and sends it back to the other I/O bank)

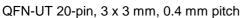
This can save significant BOM cost in a final application where only a few slow signals need to be level-shifted.

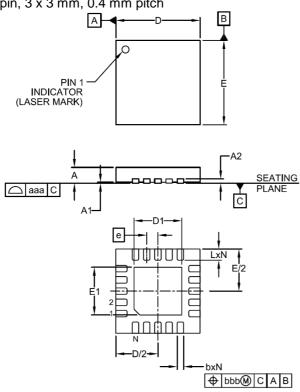


## **ADVANCED COMMUNICATIONS & SENSING**

#### 7 PACKAGING INFORMATION

#### 7.1 QFN-UT 20-pin Outline Drawing





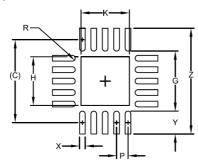
	DIMENSIONS								
אום	11	NCHE	s	MILL	<b>I</b> MET	ERS			
DIM	MN	NOM	MAX	MIN	NOM	MAX			
Α	.020	-	.024	0.50	-	0.60			
A1	.000	-	.002	0.00	-	0.05			
A2		(.006)			(0.152)				
b	.006	.008	.010	0.15	0.20	0.25			
D	.114	.118	.122	2.90	3.00	3.10			
D1	.061	.067	.071	1.55	1.70	1.80			
Е	.114	.118	.122	2.90	3.00	3.10			
E1	.061	.067	.071	1.55	1.70	1.80			
е		016 BS	C	0	.40 BS	С			
L	.012	.016	.020	0.30	0.40	0.50			
Ν		20			20				
aaa		.003			0.08				
bbb		.004			0.10				

#### NOTES:

- 1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
- 2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
- 3. DAP IS 1.90 x 1.90mm.

Figure 15 - Packaging Information – QFN-UT 20-pin Outline Drawing

#### 7.2 QFN-UT 20-pin Land Pattern



	DIMENSIONS						
DIM	INCHES	MILLIMETERS					
С	(.114)	(2.90)					
G	.083	2.10					
Н	.067	1.70					
K	.067	1.70					
Р	.016	0.40					
R	.004	0.10					
Х	.008	0.20					
Y	.031	0.80					
Z	.146	3.70					

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).

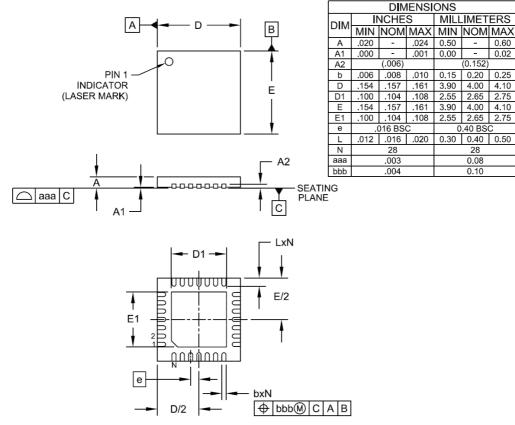
- 2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.
- 3. THERMAL VIAS IN THE LAND PATTERN OF THE EXPOSED PAD SHALL BE CONNECTED TO A SYSTEM GROUND PLANE. FAILURE TO DO SO MAY COMPROMISE THE THERMAL AND/OR FUNCTIONAL PERFORMANCE OF THE DEVICE.

Figure 16 - Packaging Information – QFN-UT 20-pin Land Pattern



### 7.3 QFN-UT 28-pin Outline Drawing

QFN-UT 28-pin, 4 x 4 mm, 0.4 mm pitch



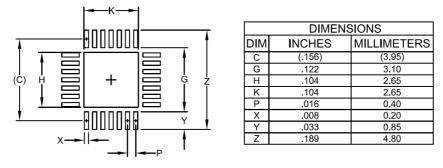
NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).

2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

Figure 17 - Packaging Information – QFN-UT 28-pin Outline Drawing

#### 7.4 QFN-UT 28-pin Land Pattern



NOTES:

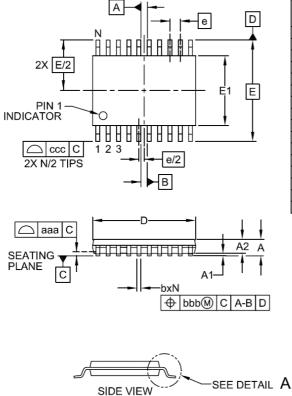
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).

- 2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.
- THERMAL VIAS IN THE LAND PATTERN OF THE EXPOSED PAD SHALL BE CONNECTED TO A SYSTEM GROUND PLANE. FAILURE TO DO SO MAY COMPROMISE THE THERMAL AND/OR FUNCTIONAL PERFORMANCE OF THE DEVICE.
   SQUARE PACKAGE-DIMENSIONS APPLY IN BOTH X AND Y DIRECTIONS.

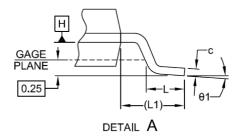




### 7.5 TSSOP 20-pin Outline Drawing



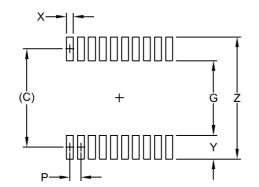
DIMENSIONS							
	DIMENSIONS						
DIM	1	<b>NCHE</b>	S	MILL	IMET	ERS	
	MIN	NOM	MAX	MIN	NOM	MAX	
Α	-	-	.047	-	-	1.20	
A1	.002	-	.006	0.05	-	0.15	
A2	.031	-	.042	0.80	-	1.05	
b	.007	-	.012	0.19	-	0.30	
С	.003	-	.007	0.09	-	0.20	
D	.251	.255	.259	6.40	6.50	6.60	
E1	.169	.173	.177	4.30	4.40	4.50	
Е		252 BS	C	6.40 BSC			
е		)26 BS	С	0.65 BSC			
L	.018	.024	.030	0.45	0.60	0.75	
L1		(.039)			(1.0)		
Ν		20			20		
<del>0</del> 1	0° - 8°			0°	-	8°	
aaa		.004			0.10		
bbb		.004			0.10		
CCC		.008			0.20		



NOTES:

- 1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
- 2. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-
- 3. DIMENSIONS "E1" AND "D" DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
- 4. REFERENCE JEDEC STD MO-153, VARIATION AC. *Figure 19 - Packaging Information – TSSOP 20-pin Outline Drawing*

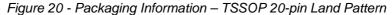
#### 7.6 TSSOP 20-pin Land Pattern



DIMENSIONS					
DIM	INCHES	MILLIMETERS			
С	(.222)	(5.65)			
G	.161	4.10			
Р	.026	0.65			
Х	.016	0.40			
Y	.061	1.55			
Ζ	.283	7.20			

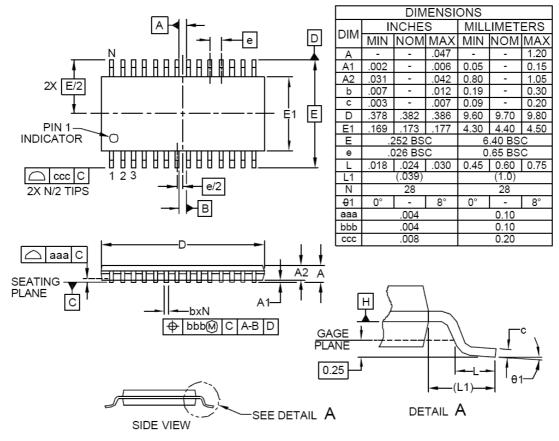
NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.





### 7.7 TSSOP 28-pin Outline Drawing

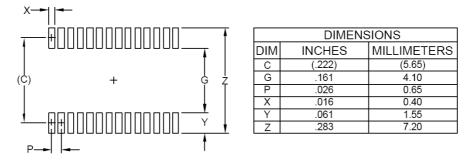


NOTES:

- 1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
- 2. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-
- 3. DIMENSIONS "E1" AND "D" DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
- 4. REFERENCE JEDEC STD MO-153, VARIATION AE.

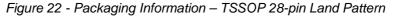
#### Figure 21 - Packaging Information – TSSOP 28-pin Outline Drawing

#### 7.8 TSSOP 28-pin Land Pattern



NOTES

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.





### 8 SOLDERING PROFILE

The soldering reflow profile for the SX1501, SX1502 and SX1503 is described in the standard IPC/JEDEC J-STD-020C. For detailed information please go to <u>http://www.jedec.org/download/search/jstd020c.pdf</u>

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average Ramp-Up Rate (Ts <sub>max</sub> to Tp)	3 °C/second max.	3° C/second max.
Preheat – Temperature Min (Ts <sub>min</sub> ) – Temperature Max (Ts <sub>max</sub> ) – Time (ts <sub>min</sub> to ts <sub>max</sub> )	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-180 seconds
Time maintained above: – Temperature (T <sub>L</sub> ) – Time (t <sub>L</sub> )	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak/Classification Temperature (Tp)	See Table 4.1	See Table 4.2
Time within 5 °C of actual Peak Temperature (tp)	10-30 seconds	20-40 seconds
Ramp-Down Rate	6 °C/second max.	6 °C/second max.
Time 25 °C to Peak Temperature	6 minutes max.	8 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.

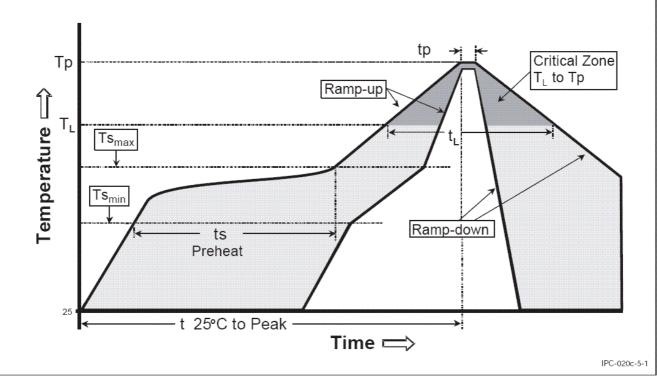


Figure 23 - Classification Reflow Profile (IPC/JEDEC J-STD-020C)



#### © Semtech 2011

All rights reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent or other industrial or intellectual property rights. Semtech assumes no responsibility or liability whatsoever for any failure or unexpected operation resulting from misuse, neglect improper installation, repair or improper handling or unusual physical or electrical stress including, but not limited to, exposure to parameters beyond the specified maximum ratings or operation outside the specified range.

SEMTECH PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF SEMTECH PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE UNDERTAKEN SOLELY AT THE CUSTOMER'S OWN RISK. Should a customer purchase or use Semtech products for any such unauthorized application, the customer shall indemnify and hold Semtech and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs damages and attorney fees which could arise.

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

#### **Contact Information**

Semtech Corporation Advanced Communications and Sensing Products Division 200 Flynn Road, Camarillo, CA 93012 Phone: (805) 498-2111 Fax: (805) 498-3804