Description

The SX8120/21 is a series of 1 V motor/LED control timers.

The SX8120/21 goes active on the press of a button. The output goes back to sleep on the next button press or after a preset time-out (15 sec or 30 sec on SX8120, 10 minutes or never on the SX8121). The time-out duration and the motor control polarity are pin-selected.

When the SX8120/21 is active, it sets its MOTOR control pin to high or low and sends a burst on its LED pin to control a LED or boost a command voltage.

One output goes low when VDD is higher than the full charge voltage of an NiMH cell to control a minimal charger.

The SX8120/21 controls its IO state starting at 0.6V to facilitate power-up.

Features

- 1 V operation
- 1 button operation
- Pin selection of time-out
- Pin selection of motor polarity
- Boosted LED control (drives bright white and green LEDS)
- NiMH cell charger control (allows USB recharge)

Applications

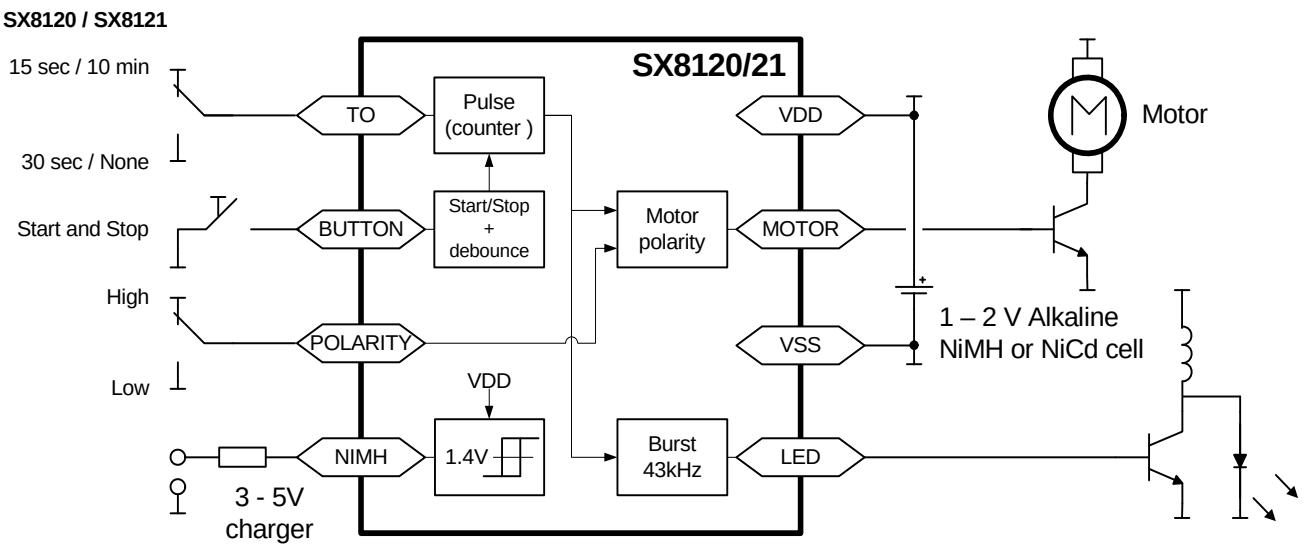
- Electric toothbrushes
- Electric razors
- Toys - LED animation
- LED pointer
- USB rechargeable

Ordering Informations

Part number	Function	Time out
SX8120ISTRT	1V motor controller	15 or 30 second
SX8121ISTRT	1V motor controller	10 minute or none

- Available in tape and reel only
- WEEE/RoHS compliant- Pb-Free and Halogen Free.

Functional Block Diagram



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ELECTRICAL SPECIFICATION

1 Absolute Maximum Ratings

Note The Absolute Maximum Ratings, in table below, are stress ratings only. Functional operation of the device at conditions other than those indicated in the Operating Conditions sections of this specification is not implied.
Exposure to the absolute maximum ratings, where different to the operating conditions, for an extended period may reduce the reliability or useful lifetime of the product.

Table 1. Absolute maximum ratings

Parameter		Symbol	Min	Max	Unit
Supply Voltage		V_{AMRVDD}	-0.3	2.5	V
Pin Voltage (non-supply pins)		V_{AMRVIN}	VSS - 0.3	VDD + 0.3	V
Sink or source current on any pin		I_{AMRISS}	-100	100	mA
Storage Temp		T_{STOR}	-50	+150	°C
ESD conditions	HBM	ESD_{HBM}	4000		V
	CDM	ESD_{CDM}	1000		V
	MM	ESD_{MM}	200		V

ESD CAUTION



ESD (electrostatic discharge) sensitive device
Charged devices and circuit boards can discharge without detection. Athough this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therfore, proper ESD precaution should be taken to avoid performance degradation or loss of functionality.

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2 Specifications

2.1 Operating Conditions

Note Circuit operates within the Supply Voltage Range VDD-VSS = VDDOC.
The specification is verified within the Full Spec Voltage Range VDD-VSS = VDDSPEC.

Table 2. Operating range

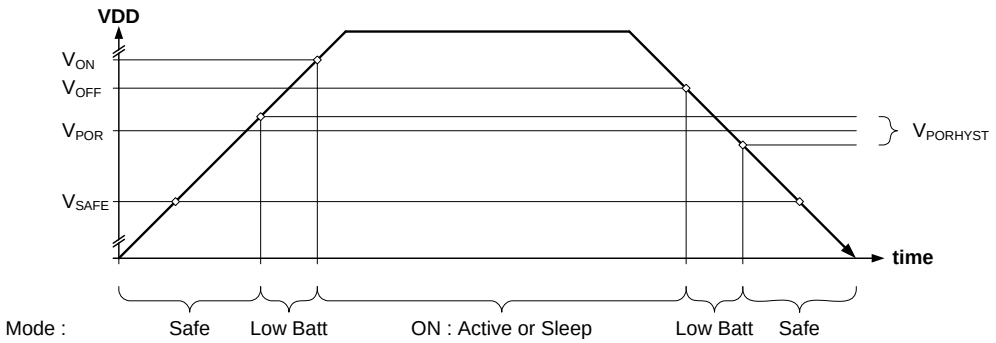
Parameter	Symbol	Min	Max	Unit
Supply Voltage Range	V_{DDOC}	0.9	2.0	V
Full Spec Voltage Range	V_{DDSPEC}	1.0	1.8	V
Ambient Temperature	T_{OC}	-40	+85	°C

2.2 Circuit specification

Note Conditions: Temperature within TOC and VDD-VSS within VDDSPEC, unless otherwise stated.

Table 3. Circuit electrical specification

Parameter		Symbol	Min	Typ	Max	Unit
Safe mode low limit		V_{SAFE}		0.6	0.7	V
POR voltage	Threshold	V_{POR}		0.9		V
	Hysteresis	$V_{PORHYST}$		150		mV
Switch ON level		V_{ON}	0.95	1.07	1.15	V
Switch OFF level	T : 0 to 70°C	V_{OFF}	0.85	0.95	1.00	V
	T : -40 to 85°C		0.85	0.95	1.05	V



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Table 4. Circuit power consumption specifications

Parameter		Symbol	Min	Typ	Max	Unit
Supply current in Active mode (outputs no loaded, Motor pin on, LED pin bursting, counting)	VDD=1.2V	I_{ACTIVE}		20		µA
	VDD=2.0V			30		µA
Supply current in Sleep mode (outputs no loaded, Motor pin off, LED pin tied to ground, not counting)	VDD=1.2V	I_{SLEEP}		10	30	µA
	VDD=2.0V			15	40	µA
Supply current in Low Batt mode		$I_{LOWBATT}$		10	30	µA
Supply current in Safe mode		I_{SAFE}			10	µA

Table 5. Digital IOs specifications

Parameter		Symbol	Min	Typ	Max	Unit
Startup time at power-on		t_{START}		0.1		s
NIMH pin switch voltage	Threshold	V_{NIMH}		1.41		V
	Hysteresis			30		mV
Output High Voltage		V_{OH}	3/4 VDD		VDD	V
Output Low Voltage		V_{OL}	VSS		1/4 VDD	V
Max Source Current at min VOH	VDD = 0.9 V	I_{OH09}	4			mA
	VDD >= 1.2 V	I_{OH12}	10			mA
Max Sink Current at max VOL	VDD = 0.9 V	I_{OL09}	4			mA
	VDD >= 1.2 V	I_{OL12}	10			mA
Input capacitance		C_I			10	pF

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3 Pinout

3.1 SOIC-8 pinout

Table 6. SX8120/21 pinout

Pin number	Pin name	Pin type	Pin function	Safe mode
1	TO	Digital input	Connect to VDD or VSS to select timout period	High impedance
2	BUTTON	Digital input	Switch to VSS to start/stop motor	High impedance
3	POLARITY	Digital input	- Connect to VDD for MOTOR pin high when on. - Connect to VSS for MOTOR pin low when on.	High impedance
4	NIMH	Digital output	Checks the battery status	High impedance
5	LED	Digital output	Sends bursts to light a LED when the MOTOR is on	High impedance
6	VSS	Power – ground	Negative supply and IC ground	-
7	MOTOR	Digital output	Motor control output (polarity is set by POLARITY)	High impedance
8	VDD	Power – positive	Positive supply	-

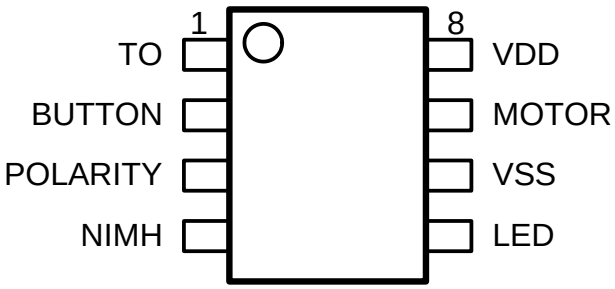


Figure 1. SX8120/21 pinout

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4 System architecture

4.1 SX8120/21 architecture

The system is based on an integrated 5% precise counter. It starts and stops pulses based on the command of a button and times-out after a selectable period of time.

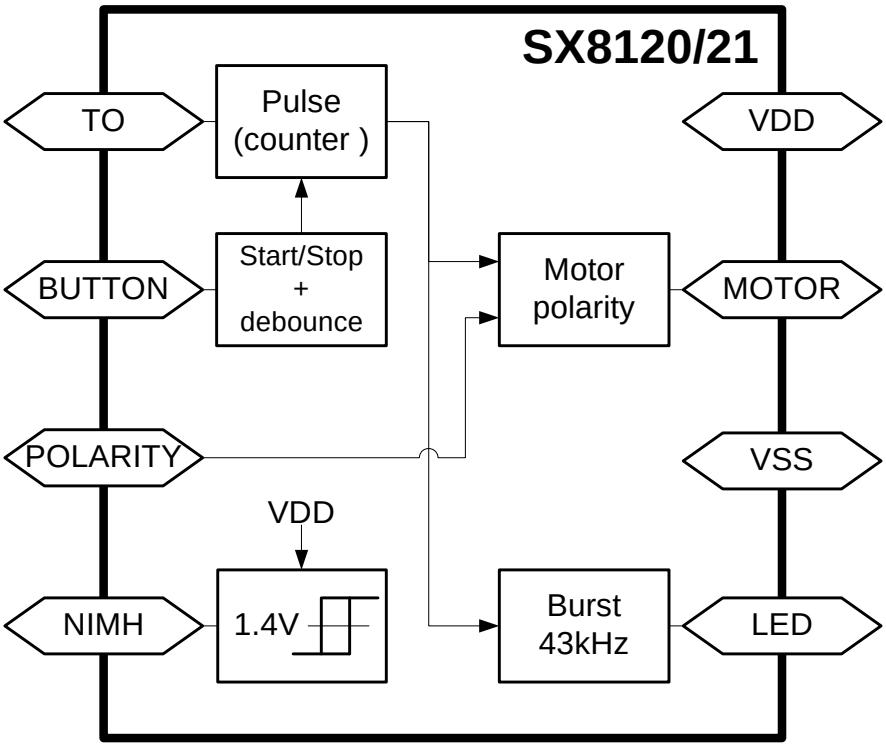


Figure 2. SX8120/21 Architecture

The MOTOR output polarity is controlled by the POLARITY input. If POLARITY is connected the VDD that the MOTOR will be active high, if POLARITY is connected the VSS, the MOTOR will be active low. MOTOR output is usually followed by an NPN transistor to drive the motor, in this case it is active high.

In parallel with the motor there is a LED output that sends 3 us pulses at 43 kHz that can be used to drive a white or green LED with an NPN transistor and a 40-200 uH coil.

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4.2 SX8120/21 timing and output

The following settings are available on the SX8120/21.

Table 7. SX8120/21 settings

Part number	TO	Polarity	Active motor	Time out after
SX8120	VDD	VDD		15 seconds
		VSS		15 seconds
	VSS	VDD		30 seconds
		VSS		30 seconds
SX8121	VDD	VDD		10 minutes
		VSS		10 minutes
	VSS	VDD		never
		VSS		never

The timeout and polarity values are set at chip startup and at each start/stop command.

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4.3 Digital input levels

Input thresholds levels scale with VDD. Inputs have an hysteresis based on a Schmitt trigger schematics.

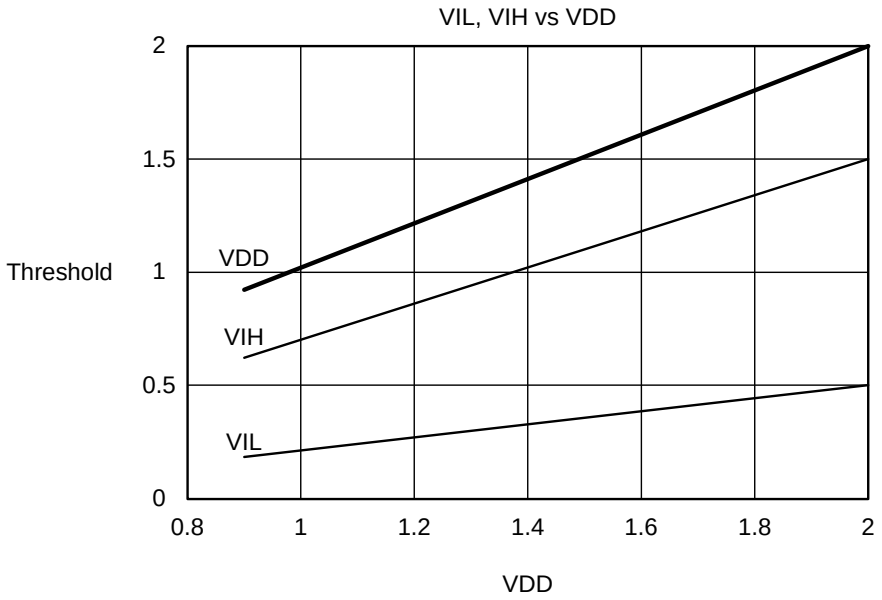


Figure 3. Input level scales with VDD

4.4 Debounce on BUTTON pin

The BUTTON pin is active low. For a start/stop command detection, the voltage on the BUTTON pin must be maintained low during 10ms. Then, a delay of 20ms is necessary before the next start/stop command.

This allow to remove wrong start/stop commands due to oscillations when using of low-cost push buttons.

4.5 NiMH pin

Pin NIMH goes high when VDD is below the NIMH threshold of 1.41V and low when VDD is above the same threshold.

A 30mV hysteresis allow to remove NiMH pin oscillation when the VDD voltage is near the threshold.

The supply voltage on VDD pin is checked at a 1Hz rate, so the NiMH pin can switch with a delay of 1 seconds max.

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5 Operating Modes

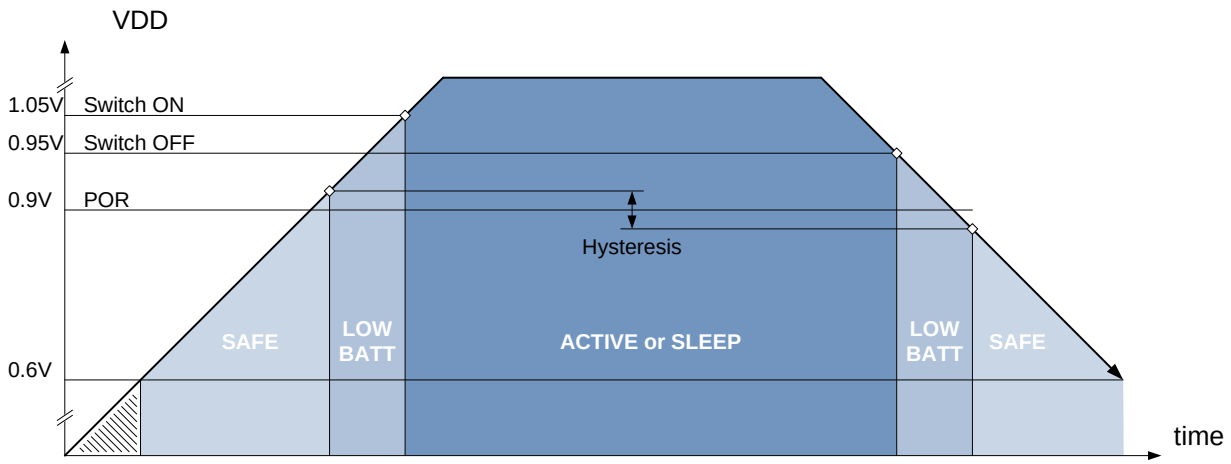


Figure 4. Operating modes vs battery voltage [1]

1. Typical values.

5.1 Safe Mode

The internal system goes in Safe mode as soon as the battery voltage is above 0.6-0.7V. In this mode all pins are set in high impedance and are inactive. This guarantees a safe start-up when a battery is inserted. The power consumption is 10uA max and prevents the battery from leaking when it is empty.

5.2 Low Batt mode

The device is in Low Batt mode as soon as the battery voltage reaches the 0.9V POR threshold. In this mode, each output pin is in a static state. The device will not react to the BUTTON pin. The LED pin is set to ground. The MOTOR pin is off according to POLARITY pin, meaning at VSS if POLARITY was set to '1' or at VDD if POLARITY was set to '0'. The chip internally checks the VDD voltage each seconds and wakes up to Sleep mode when VDD > VON (1.05V typical). NIMH pin is forced high until the VDD voltage goes below 0.9V (back to Safe mode), or above 1.41V (battery full).

5.3 Sleep mode

The MOTOR pin is off according to POLARITY pin, meaning at VSS if POLARITY was set to '1' or at VDD if POLARITY was set to '0'. LED pin is tied to ground. The chip reacts to the BUTTON pin and if a low pulse occurs, the device switch to Active mode. NIMH pin is set according to VDD voltage (see **4.5. NiMH pin**).

5.4 Active Mode

The MOTOR pin is on according to the POLARITY pin, meaning at VDD if POLARITY was set to '0' or at VSS if POLARITY was set to '1'. The LED pin send 43kHz burst. The internal system is in Active mode until the timeout occurs or the button is pulsed again and then goes back to the Sleep mode. NIMH pin is set according to VDD voltage (see **4.5. NiMH pin**).

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APPLICATION EXAMPLES

6 Motor and LED timer

6.1 Start/stop a motor with a 30 seconds time-out.

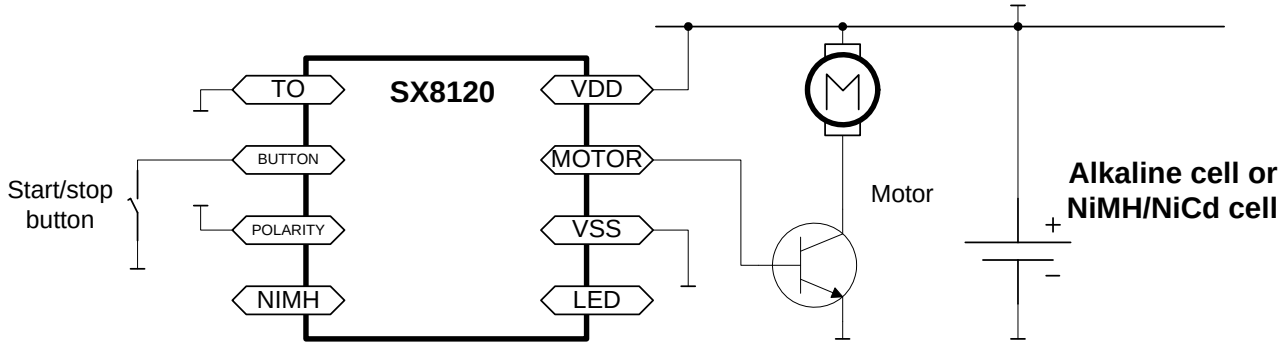


Figure 5. Pressing the button will start the motor for 30 seconds or until the button is pressed again.

6.2 Start/stop a LED with a 15 seconds time-out

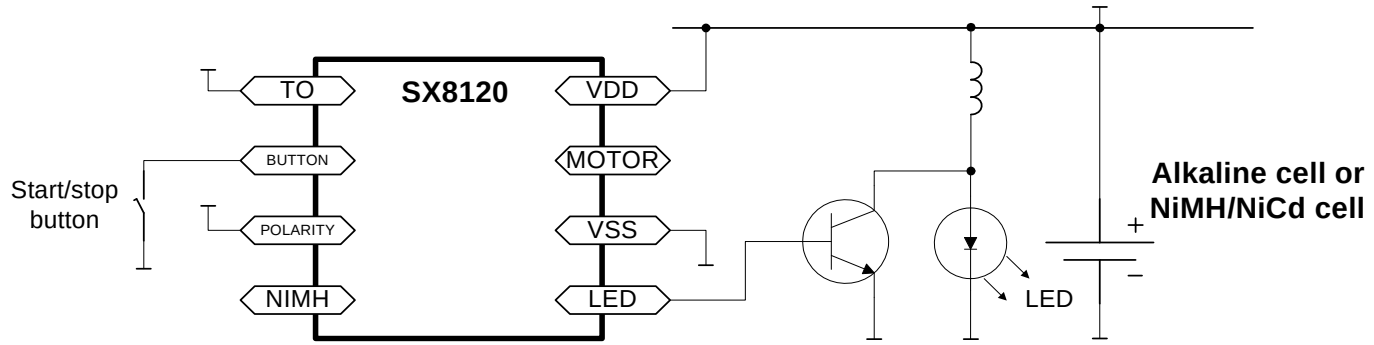


Figure 6. Pressing the button will light up the LED for 15 seconds or until the button is pressed again.

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6.3 Start/stop a high current motor with 10 minutes time-out

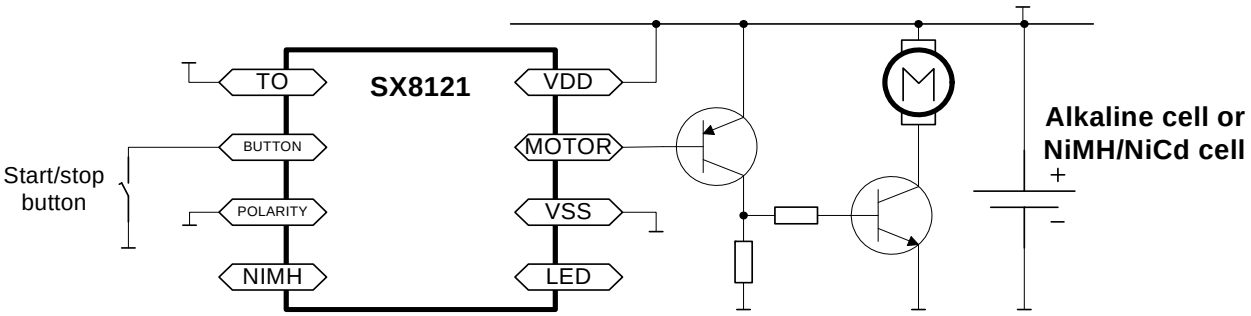


Figure 7. Pressing the button will start the motor for 10 minutes or until the button is pressed again.

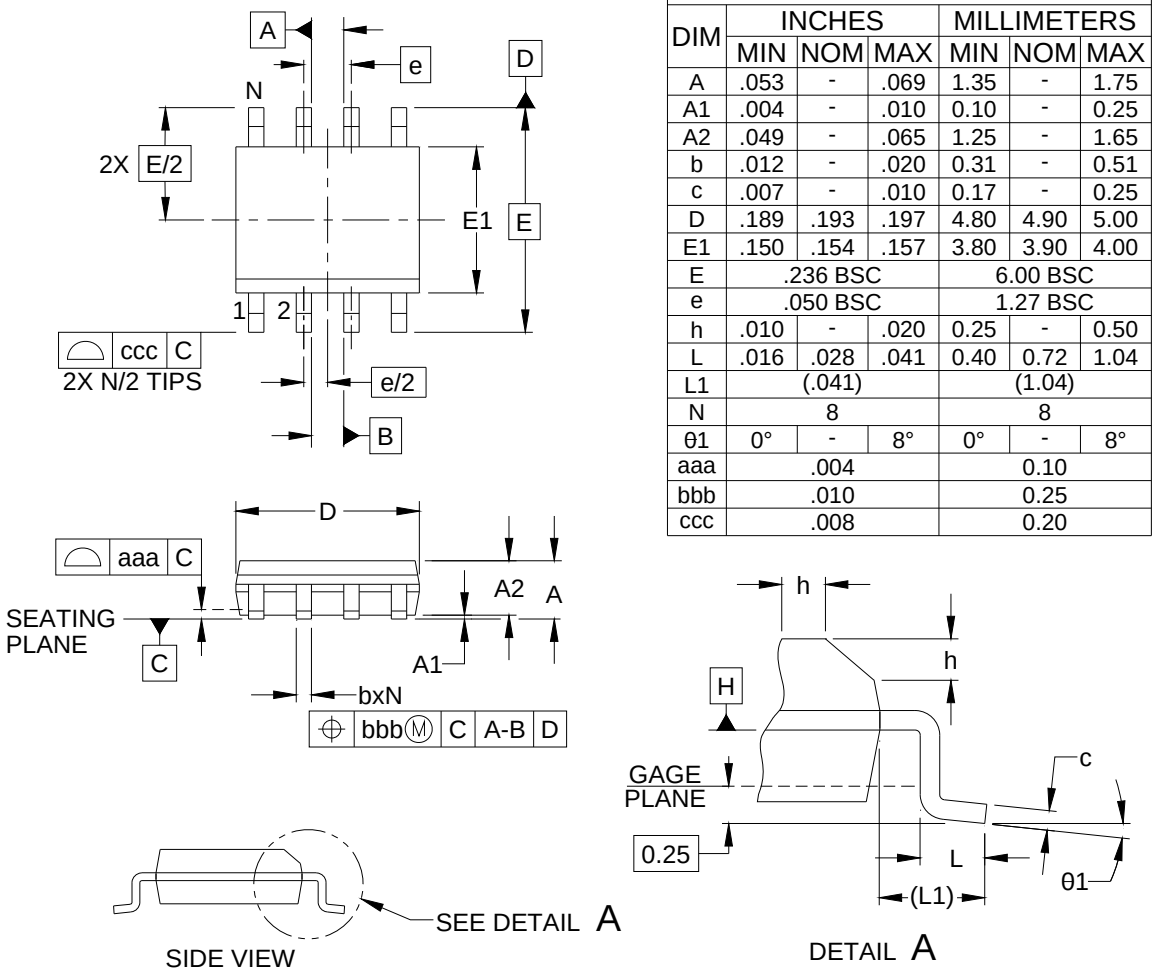
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MECHANICAL SPECIFICATION

7 Packages

7.1 SOIC-8

7.1.1 Outline drawing



DIM	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	.053	-	.069	1.35	-	1.75
A1	.004	-	.010	0.10	-	0.25
A2	.049	-	.065	1.25	-	1.65
b	.012	-	.020	0.31	-	0.51
c	.007	-	.010	0.17	-	0.25
D	.189	.193	.197	4.80	4.90	5.00
E1	.150	.154	.157	3.80	3.90	4.00
E	.236 BSC			6.00 BSC		
e	.050 BSC			1.27 BSC		
h	.010	-	.020	0.25	-	0.50
L	.016	.028	.041	0.40	0.72	1.04
L1	(.041)			(1.04)		
N	8			8		
θ1	0°	-	8°	0°	-	8°
aaa	.004			0.10		
bbb	.010			0.25		
ccc	.008			0.20		

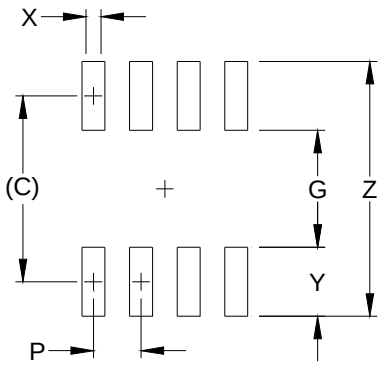
NOTES:

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 MS-012, VARIATION AA.

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7.1.2 Land pattern

This land pattern is for reference purposes only. Consult your manufacturing group to ensure your company's manufacturing guidelines are met.



DIMENSIONS		
DIM	INCHES	MILLIMETERS
C	(.205)	(5.20)
G	.118	3.00
P	.050	1.27
X	.024	0.60
Y	.087	2.20
Z	.291	7.40

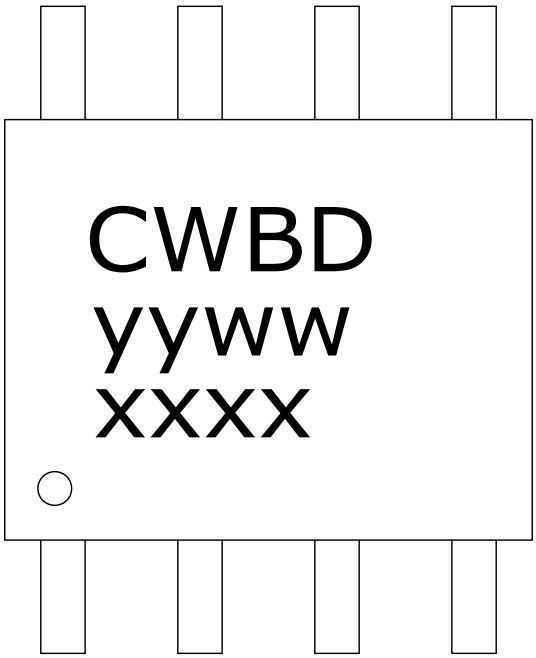
NOTES:

1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.
2. REFERENCE IPC-SM-782A, RLP NO. 300A.

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7.1.3 SX8120 marking information

Top Mark



TOP MARK	
CHAR	ROWS
7/7/5	3

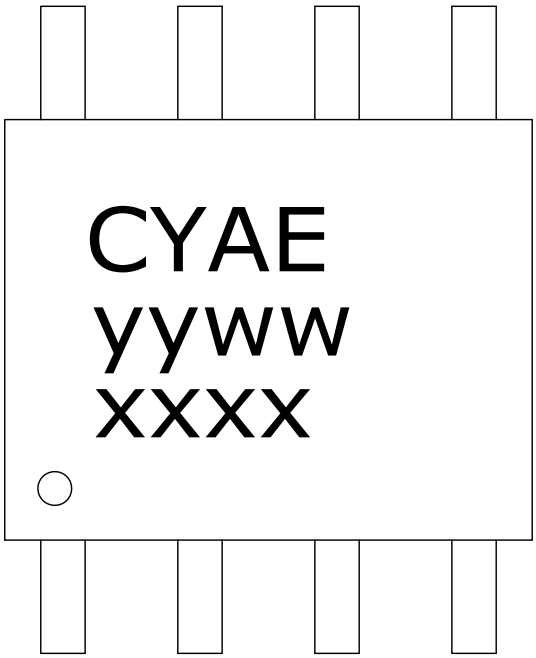
Marking for the SOIC 8 Lead package:

nnnn = Part Number (Example : CWBD)
yyww = Date Code (Example : 1012)
xxxx = Semtech Lot No. (Example : E9010)

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7.1.4 SX8121 marking information

Top Mark



TOP MARK	
CHAR	ROWS
7/7/5	3

Marking for the SOIC 8 Lead package:

nnnn = Part Number (Example : CYAE)
yyww = Date Code (Example : 1012)
xxxx = Semtech Lot No. (Example : E9010)

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