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1. OVERVIEW

The SME-08A1x is a 3-channel optical encoder IC with digital output.

The SME-08A1x consists of an LED and an OEIC (Opto-Electric Integrated Circuit) in a single package.

The light emitted from the LED is projected onto the code wheel, and the reflected light is received by a photodiode to detect the relative movement between the SME-08A1x and the code wheel. In addition, Z-phase, the origin signal, is output by setting a pattern on the code wheel for origin detection.

The resolution can be adjusted with a built-in interpolation circuit.

2. FEATURES

- Compact clear molded package (L=3.95mm W=3.4mm H=1.0 mm)
- 80µm resolution (When interpolation factor is 1)
- LED and OEIC fabricated in a single package
- 3-channel digital output
- Bult-in interpolation circuit (Interpolation factor can be selected from 1, 2, 4)
- 4.5 to 5.5 V supply voltage
- 27mA current consumption
- LED wavelength: 850nm

3. BLOCK DIAGRAM



4. PIN LAYOUT



5. PIN DESCRIPTION

No.	Name	I/O	Function				
1	CHA	0	A-phase digital incremental signal				
2	CHB	0	B-phase digital incremental signal				
3	CHZ	0	se digital origin signal				
4	SEL2	Ι	polation setting input 2				
5	SEL1	Ι	olation setting input 2				
6	VSS_A	-	Ground				
7	VDD_A	-	Supply voltage				
8	VDD_D	-	Supply voltage				
9	VSS_D	-	Ground				

I/O type I: Input O: Output

6. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Rating	Unit	note
Supply voltage	V_{DD}	VDD_A, VDD_D pins	-0.3 to 7.0	V	*1
Input voltage	V _{IN}	SEL1, SEL2 pins	-0.3 to V _{DD} +0.3	V	*1
Output voltage	V _{OUT}	CHA, CHB, CHZ pins	-0.3 to V _{DD} +0.3	V	*1,*2
Storage temperature	T _{STG}		-40 to 85	°C	*3

*1: Parameters must not exceed ratings, not even momentarily. If a rating is exceeded, there is a risk of IC failure, deterioration in characteristics, and decrease in reliability.

*2: VDD in absolute value ratings refers to the recommended operating voltage VDD value.

*3: Stored separately in Nitrogen (N2) atmosphere or vacuum.

7. RECOMMENDED OPERATING CONDITIONS

V _{SS} =UV codewneel R _{OP} :11mm								
Parameter	Symbol	Conditions	MIN	ТҮР	MAX	Unit		
Supply voltage	V_{DD}	Between VDD and VSS terminals VDD_A=VDD_D VSS_A=VSS_D	4.5	5	5.5	V		
Operating temperature	Ta	-	-20	-	85	°C		
Code wheel radial misalignment	E _R		-0.2	0	+0.2	mm		
Code wheel tangential misalignment	\mathbf{E}_{T}		-0.2	0	+0.2	mm		
Code wheel Gap	G		0.5	0.75	1.0	mm		

* Operation outside the recommended operating conditions may adversely affect reliability. Use only within specified ratings

8. ELECTRIC CHARACTERISTIC

8.1. DC Characteristics

					V _{SS} =0V、	T _a =25°C
Parameter	Symbol	Condition	MIN	ТҮР	MAX	Unit
Current consumption	I _{DD1}	Include LED load current At no output load	-	27	40	mA
High-level output voltage	V _{OH}	I _{OH} =1.5mA	V_{DD} -0.4		\mathbf{V}_{DD}	V
Low-level output voltage	V _{OL}	I _{OL} =-1.5mA	V _{ss}		0.4	V

*Under our installation conditions and typical recommended operating conditions

8.2. AC Characteristics

$V_{SS}=0V$, $T_a=25^{\circ}$							°C
Parameter	Symbol	Condition	MIN	ТҮР	MAX	Unit	
Output frequency	F _{OUT}	SEL1 = H, SEL2 = H Interpolation factor: 1	-	-	60		
		SEL1 = L, SEL2 = L Interpolation factor: 2	-	-	120	KHz	
		SEL1 = H , SEL2 = L Interpolation factor: 4	-	-	240		
Output signal rise time	t _r	$C_L \leq 50 pF$	-	-	100	ns	
Output signal fall time	t_{f}	$C_L \leq 50 pF$		-	100	ns	
Output stable latency	t _{wait}		1	-	-	ms	

*Under our installation conditions and typical recommended operating conditions

9. FUNCTIONAL DESCRIPTION

The light emitted from the LED is projected onto the code wheel, and the reflected light is received by a photodiode to detect the relative movement between the SME-08A1x and the code wheel. In addition, Z-phase, the origin signal, is output by setting a pattern on the code wheel for origin detection.

The SME-08A1x also has a built-in interpolation circuit, which can be set using the SEL1 and SEL2 pins.

9.1. Interporation Function

The interpolation factors can be set by the SEL1 and SEL2 pins.

SEL1	SEL2	Interpolation factor
Н	Н	1
L	L	2
Н	L	4

9.2. LED Auto Power Control (APC) Brightness Adjustment Function

The SME-08A1x has a built-in automatic LED brightness adjustment function (Auto Power Control) to compensate for LED brightness variations and temperature fluctuations.

10. TIMING DIAGLAM



Direction of code wheel rotation: CCW

* The Z-phase pulse width is determined by each product.

Product name	Z-phase pulse width					
SME-08A11	90°e					
SME-08A12	180°e					
SME-08A13	360°e *When interpolation setting is 1: 430°e (Ungated)					



counter clock wise

Parameter Definition		
Parameter	Symbol	
Output cycle	С	Phase A and B output 1 cycle 360°e
Output cycle error	ΔC	Output cycle deviation
Pulse width (Duty)	Р	Output signal duty ratio
Pulse width (Duty) error	ΔP	Deviation of the pulse width from the ideal value of 180°e
Stata	c	Phase A/B rising (falling) edge interval.
State	3	4 states per output cycle, ideal value is 90°e
State error	ΔS	Deviation of each state width from 90°e
Dhasa difference	(2)	The distance between the center of the High state of phase A and the center of
Fliase difference	φ	the High state of phase B. Ideal value 90°e
Phase error	Δφ	Deviation from the ideal phase value of 90°e
Ontional Dadius	р	Distance from the center of rotation of the code wheel to the optical center of the
Optical Radius	KOP	encoder IC
Z-phase pulse width	Pz	Z-phase pulse width

Code wheel: $R_{OP} = 11mm$

Demomentar	Sumbal	In	terpolation fac	I Init	
Parameter	Symbol	1	2	4	Unit
Output cycle error	ΔC	18	22	36	°e
Pulse width (Duty) error	ΔP	15	20	30	°e
Phase error	Δφ	9	15	18	°e
State error	ΔS	10	15	25	°e
Z-phase pulse width (Gated 90°)	Pz	90	90	90	°e
Z-phase pulse width (Gated 180°)	Pz	180	180	180	°e
Z-phase pulse width (Gated 360°)	Pz	430 Ungated	360	360	°e

*Under our installation conditions and typical recommended operating conditions

11. RECOMMENDED CODE WHEEL CONDITIONS

Parameter	Symbol	Min	Тур	Max	Unit	Note
Pattern width ratio (reflective/non-reflective)	W _W /W _B	0.9	1	1.1		
Incremental pattern cycle	P _P		80		μm	
Incremental pattern width	W _W ,W _B		40		μm	
Pattern length	Lw	1.8	-	-	mm	
Reflectance (reflective part)	р	60	-	-	%	
Reflectance (non-reflective part)	ĸ _F	-	-	10	%	

 $R_{OP}=(PPR*P_P)/2p$



For multiple origin (index) pattern placement



11.1. Reference Drawings (500 pulse/revolution)

 $R_{OP}=(PPR*P_P)/2p=6.366mm$



12. CODE WHEEL MOUNTING CONDITIONS

The optical center of the encoder IC should be aligned with the ROP. Please evaluate the mounting conditions thoroughly before setting the encoder IC.



13. TYPICAL APPLICATIONS



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14. PACKAGING DIMENSIONS



Bottomview



15. USAGE AND PRECAUTIONS

This product is designed and manufactured to the generally accepted standards of reliability as expected for use in general electronic and electrical equipment, such as personal equipment, machine tools, and measurement equipment. This product is not designed and manufactured to be used in any other special equipment requiring extremely high level of reliability and safety, such as aerospace equipment, nuclear power control equipment, medical equipment, transportation equipment, disaster prevention equipment, security equipment.

If you wish to use this product in equipment requiring extremely high level of reliability, please contact our sales department or representative in advance.

In the event that this product is used in such equipment, please take scrupulous care and apply fail-safe techniques including redundancy and malfunction prevention in order to prevent damage to life, health, property, or infrastructure etc. in case there is some malfunction in the product.

Please pay your attention to the following points at time of using the products shown in this document.

1. The products shown in this document (hereinafter "Products") are designed and manufactured to the generally accepted standards of reliability as expected for use in general electronic and electrical equipment, such as personal equipment, machine tools and measurement equipment. The Products are not designed and manufactured to be used in any other special equipment requiring extremely high level of reliability and safety, such as aerospace equipment, nuclear power control equipment, medical equipment, transportation equipment, disaster prevention equipment, security equipment. The Products are not designed and manufactured to be used for the apparatus that exerts harmful influence on the human lives due to the defects, failure or malfunction of the Products.

If you wish to use the Products in that apparatus, please contact our sales section in advance.

In the event that the Products are used in such apparatus without our prior approval, we assume no responsibility whatsoever for any damages resulting from the use of that apparatus.

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DE230310E 2023.10

