Magnetic Proportion System / Through Type, Non ratiometric output, Vref-OUT/IN mode, ΔVout = 800mV@I_{PN}

LA37S S05 SERIES

【STANDARDS】
·UL508
·CSA C22.2 No.14-18
·EN 62477-1

RoHS

ABSOLUTE MAXIMUM RATINGS

Parameters	Symbol	Unit	Value	Comment
Supply voltage	V_{CC}	V	7.2	
Primary conductor temperature	—	℃	120	
ESD (HBM : Human Body Model)	V_{ESD}	kV	2	C=100 pF, R=1.5 kΩ

ISOLATION CHARACTERISTICS

Parameters	Symbol	Unit	Value	Comment
Insulation voltage	Vd	—	AC3300V, for 1minute (Sensing current 0.5mA)	Primary ⇔ Secondary
Impulse withstand voltage	Vw	kV	6.0	Primary ⇔ Secondary Input waveform : · Front time 1.2μs · Time to half value 50μs · single
Insulation resistance	R_{IS}	—	≧ 500MΩ (at DC500V)	Primary ⇔ Secondary
Clearance distance	d_{Cl}	—	5.5 mm (MIN)	Primary ⇔ Secondary
Creepage distance	d_{Cp}	—	5.5 mm (MIN)	Primary ⇔ Secondary
Case material	—	—	UL94 V-0	
Comparative Tracking Index; (CTI)	CTI	V	600 (group Ⅰ)	

ENVIRONMENTAL AND MECHANICAL CHARACTERISTICS

Parameters	Symbol	Unit	Value			Comment
			MIN	TYP	MAX	
Ambient operating temperature * 1	T_A	℃	− 40		+ 105	
Ambient storage temperature	T_S	℃	− 40		+ 105	
Mass	m	g		60		
Internal magnetic core	—	—	Silicon steel			

* 1 Temperature of the connector should not exceed 105℃ because the absolute maximum temperature of the connector is +105℃.

SPECIFICATIONS

T_A = +25℃ RL = 10 kΩ Vcc=+5V

Parameters		Symbol	Unit	Value			Comment
				MIN	TYP	MAX	
Primary nominal current	**LA37S050S05＊**	I_{PN}	A		50		
	LA37S100S05＊				100		
	LA37S200S05＊				200		
	LA37S300S05＊				300		
	LA37S400S05＊				400		
	LA37S500S05＊				500		
	LA37S600S05＊				600		
Primary current, measuring range ＊1	**LA37S050S05＊**	I_{PM}	A	− 125		125	Vcc > 4.8V Ref OUT mode
	LA37S100S05＊			− 250		250	
	LA37S200S05＊			− 500		500	
	LA37S300S05＊			− 750		750	
	LA37S400S05＊			− 1000		1000	
	LA37S500S05＊			− 1200		1200	
	LA37S600S05＊			− 1200		1200	
Supply voltage		Vcc	V	4.5	5.0	5.5	
Consumption current		Icc	mA		16	23	@ Ip = 0A, Icc = 16+ Vout / RL
Load resistance		R_L	kΩ	4.7	10		
Internal reference voltage (output)		Vref1	V	2.48	2.50	2.52	Ref OUT mode
External reference input voltage		Vref2	V	0.50		2.65	Ref IN mode
Reference source current		Iref	mA	0.5	0.7	1.0	Vref to GND. See "support docu..." section.
Reference sink current		Iref	mA		5	10	Vref to Vcc. See "support docu..."section.
Output voltage range (@ I_{PM})		Vout-Vref	V	− 2		2	Ref OUT mode
Internal output resistance of Vref		Rref	Ω	150	200	300	Inside LA37SxxxS05＊.
Internal output resistance of Vout		Rout	Ω		2	5	Inside LA37SxxxS05＊.
Electrical offset voltage (@ I_P=0 A) ＊2		Voe	mV	− 5		5	Vout-Vref at Vref=2.5V
Magnetic offset voltage		V_{OH}	mV	− 3.2		3.2	@ 0A → I_{PN} → 0A
Temperature drift of reference voltage (at I_P=0 A)		$Vref_T$	mV	− 10		10	@T_A = − 40℃～ 105℃
Temperature drift of offset voltage (at I_P=0 A)		Voe_T	mV	− 10		10	@T_A = − 40℃～ 105℃
Theoretical sensitivity	**LA37S050S05＊**	Gth	mV/A		16.00		800mV @ I_{PN} Vout = Vref + Voe + (Gth × I_P)
	LA37S100S05＊				8.00		
	LA37S200S05＊				4.00		
	LA37S300S05＊				2.67		
	LA37S400S05＊				2.00		
	LA37S500S05＊				1.60		
	LA37S600S05＊				1.33		
Sensitivity error ＊3		ε_G	%	− 1.0		1.0	@ I_{PN}
Temperature drift of sensitivity		G_T	%	− 3.0		3.0	@T_A = − 40℃～ 105℃

＊1 Measurement condition : Primary conductor cross sectional area is as same as through hole, and penetration with 1turn in through hole.
＊2 Electrical offset voltage value is after removal of magnetic offset voltage (core hysteresis).
＊3 Sensitivity error is factory inspection value. MAX and MIN are values of ± 3 σ .

SPECIFICATIONS

T_A = +25℃ RL = 10 kΩ Vcc=+5V

Parameters		Symbol	Unit	Value			Comment
				MIN	TYP	MAX	
Linearity error	@0A ~ I_{PN}	ε_L	%	− 0.5		0.5	
	@0A ~ I_{PM}			− 1.0		1.0	
Reaction time (@ 10 % of I_{PN}) * 1		t_{ra}	μs			3.0	di/dt=100A / μs
Response time (@ 90 % of I_{PN}) * 1	**LA37S050S05***	tr	μs			4.0	di/dt=100A / μs
	Others					3.5	
Frequency bandwidth		BW	kHz		100		@ − 3dB
Output voltage noise	**LA37S050S05***	Vno	mVpp		30		DC..20MHz
	LA37S100S05*				25		
	LA37S200S05*				20		
	LA37S300S05*				20		
	LA37S400S05*				25		
	LA37S500S05*				20		
	LA37S600S05*				20		
Accuracy * 4	T_A=25℃	X1	% of I_{PN}	− 1.50		1.50	@ I_{PN}
	T_A=105℃	X2	% of I_{PN}	− 5.75		5.75	

* 1 Measurement condition : Primary conductor cross sectional area is as same as through hole, and penetration with 1turn in through hole.
* 4 Accuracy formula is following Accuracy X1 = $\varepsilon_G + \varepsilon_L$
Accuracy X2 = X1 + (Voe_T / 800 × 100) + G_T

STANDARDS

EN62477-1:2012, EN62477-1:2012/A1:2017 and EN62477-1:2012/A11:2014
Rated voltage 300V, CAT Ⅲ, PD2, Reinforced isolation, non uniform field

UL508, CSA C22.2 No.14-18（UL FILE No. E243511）
Rated voltage 600V, PD2

※ Please refer to the another sheet about conditions of UL Recognition.

SUPPORT DOCUMENTATION

Reference voltage

The Ref pin can be used as Ref OUT mode and/or Ref IN mode.

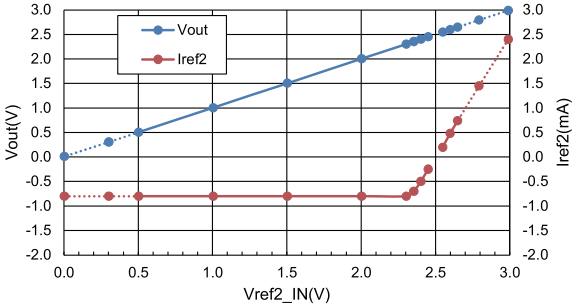
<Ref OUT mode>

The 2.5 V internal reference is used by the transducer as the reference point for bipolar measurements.

<Ref IN mode>

An external reference voltage is connected to the Ref pin. This voltage is specified in the range 0.5 to 2.65 V, its voltage is used as the offset voltage at the measurement.

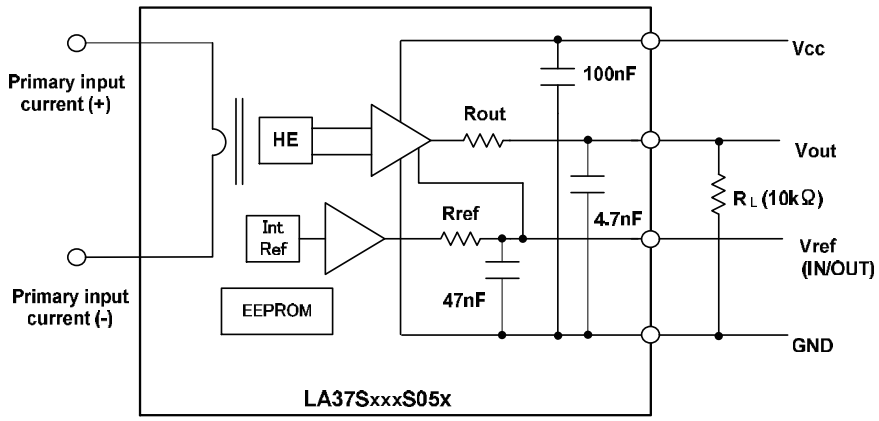
The following graphs (Fig 1) show the output voltage (@ Ip = 0A) and the reference input / output current due to the external reference voltage value Vref2.



T_A = +25 ℃
Vcc = +5.0 V
RL = 10 kΩ

Fig 1 : Vref2 input voltage vs Output voltage and Iref2 (= Vref2 current)
(Typical performance)

CONNECTION

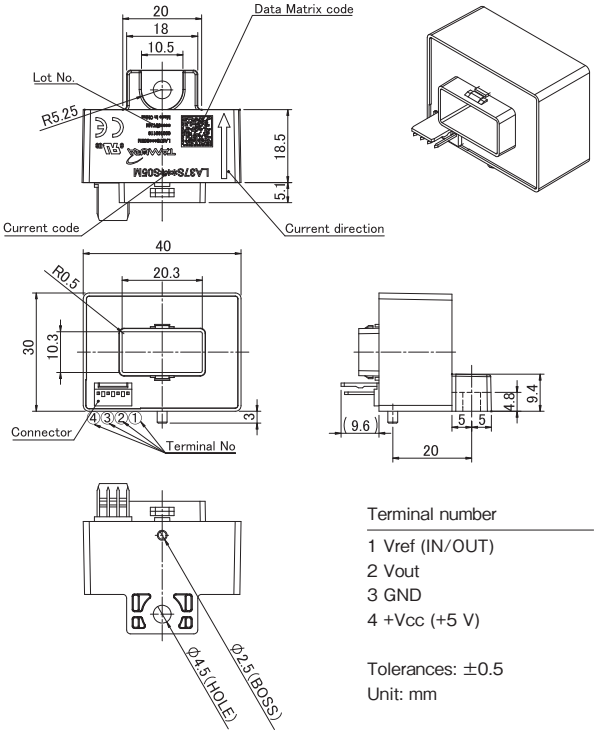


< Notice >

Sufficient capacitors are built into the product for the purpose of reducing output noise. Do not attach external capacitors to the Vout and Vref terminals.

DIMENSIONS (mm)

LA37SxxxS05M(M-A) Series



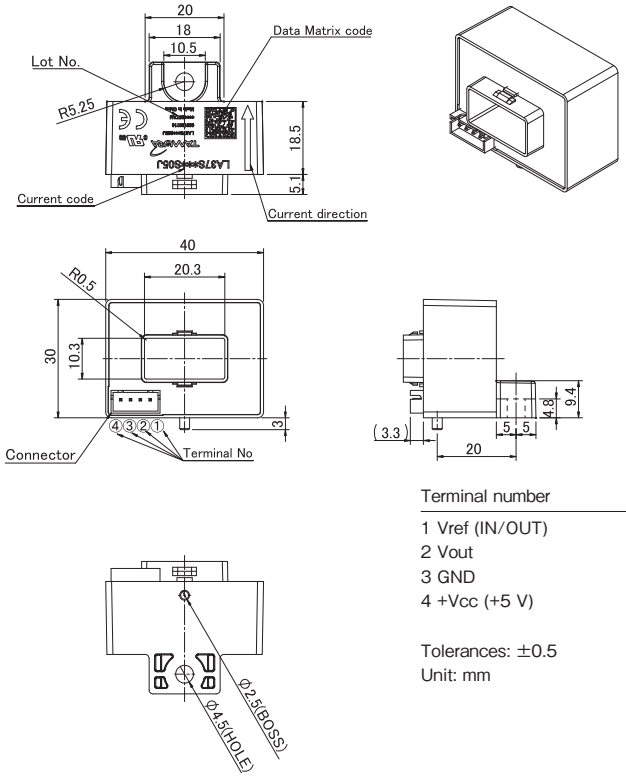
Terminal number

1 Vref (IN/OUT)
2 Vout
3 GND
4 +Vcc (+5 V)

Tolerances: ±0.5
Unit: mm

・Recommended fastening screw type : M4 with flat washer and spring washer
・Recommended fastening torque : < 1.5 N・m

LA37SxxxS05J Series



Terminal number

1 Vref (IN/OUT)
2 Vout
3 GND
4 +Vcc (+5 V)

Tolerances: ±0.5
Unit: mm

Note

It is different from how to put the pin numbering of connector manufacturer (JST). It is matched to the Molex type.

Order number and Connector number (terminal plating)

Types		Connector			
		Manufacturer	Part Number	Old Part Number	Plating of terminal
LA37SxxxS05J	Standard	JST	B4B-XH-A-G	—	Au
LA37SxxxS05M	Standard	Molex	22-04-1041	5045-04A	Sn
LA37SxxxS05M-A	Build to Order		22-11-1041	5045-04AG	Au

∗ Rated current (3 figures)
∗ As for the LA37SxxxS05M series of a gold-plated connector, ' -A' attaches to the end of the product name.
∗ The pin numbers of LA37SxxxD15J are different from those of the connector maker (JST). It is matched to the Molex type.

Important Notice

1. The content of this information is subject to change without prior notice for the purpose of improvements, etc. Ensure that you are in possession of the most up-to-date information when using this product.

2. This product is intended to be used in general electronics applications (electric home appliances, business equipment, information equipment, communication terminal equipment, measuring devices, industrial equipment, and so on). This product is neither intended nor warranted for use in following equipment or devices:

   Special application (such as for medical devices, transportation equipment, traffic signal control equipment, fire and crime prevention equipment, aeronautics and space devices, nuclear power control, fuel control, in-vehicle equipment, safety devices, and so on) in which extremely high quality and high reliability is required, or if the malfunction or failures of product could be cause loss of human life, bodily injury.

   Tamura Corporation shall not be held responsible for any damage incurred by customers or any third party when products are used in special application, unless specifically permitted in this document.

3. Tamura Corporation constantly strives to improve quality and reliability, but malfunction or failures are bound to occur with some probability in current sensor. To ensure that failures do not cause accidents resulting in injury or death, fire accidents, social damage, and so on, users are to thoroughly verify the safety of their designs in devices and/or systems.

4. The operation examples and circuit examples shown in this information are for reference purposes only, and Tamura Corporation disclaims all responsibility for any violations of industrial property rights, intellectual property rights and any other rights owned by Tamura Corporation or third parties that these may entail.

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6. The products are designed for use in environments where consumer electronics are commonly used. It is not designed for use in special environments such as listed below, and if such use is considered, the user is to perform thorough safety and reliability checks under his/her responsibility.

7. This product is not designed to resist radiation.
   - *Use in liquids such as water, oil, chemical solutions, or organic solvents, and use in locations where the product will be exposed to such liquids.*
   - *Use that involves exposure to direct sunlight, outdoor exposure, or dusty conditions.*
   - *Use in locations where corrosive gases such as sea winds, Cl2, H2S, NH3, SO2, or NO2, are present. (Some product improves durability)*
   - *Use in environments with strong static electricity or electromagnetic radiation.*
   - *Use that involves placing inflammable material next to the product.*
   - *Use of this product either sealed with a resin filling or coated with resin.*
   - *Use of water or a water soluble detergent for flux cleaning.*
   - *Use in locations where condensation is liable to occur.*

8. Do not use or otherwise make available the TAMUTA products or the technology described in this document for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of mass destruction weapons (e.g. nuclear, chemical, or biological weapons or missile technology products). When exporting and re-exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations including, without limitation, Japan -Foreign Exchange and Foreign Trade Control Law and U.S.-Export Administration Regulations. The TAMURA products and related technology should not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.

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Application notes

<General Considerations>

1. The sensor uses polar electronic components. When the polarity of the power supply is mistaken, the sensor is damaged.
2. Static electricity or excessive voltage can increase an offset voltage in the Hall element, and cause offset voltage to change. Please exercise care in handling and application.
3. In order to prevent the influence of noise, the use of twisted cable or shielded cable for the output line is recommended
4. If using this device within a magnetic field generated by other devices, the specified accuracy may not be obtainable.
5. Our products (several models are excluded) are adjusted with the trimming method by the measurement condition (Load resistance, Power supply voltage) of specification sheets. Therefore, characteristics (Offset, Output, etc.) and its deviation may be changed in different circuit conditions from the measurement condition. All change characteristic items are not indicated on specification sheets.
6. The performance of current sensors with through-hole (aperture) is dependent on the position of the primary conductor. Tamura specifications are based on a primary conductor completely filling the through-hole (aperture) area.
7. The current sensor rated current in DC Amps.
8. Please use mating connector with equivalent terminal plating material to insure proper operation and avoid possibility of 'galvanic corrosion' .
9. Please do not store in high-temperature and high-humidity storage environment. Please use it after confirming soldering when it is kept for six months or more. (product soldered with substrate)
10. We recommend performing a zero offset adjustment by measuring the offset voltage at startup. In continuously operation for a few months, or at change of ambient temperature or humidity is large, we recommend regularly performing a zero offset adjustment at being idling (it is clear that the current is not apply) .
11. The current sensor doesn't have built-in protection circuit (devices and fuses, etc.). As a failure mode of the sensor, there is a short circuit and open state. In the case of a short-circuit state, the abnor-mal temperature rise of the internal parts is assumed, and there is a possibility to smoke and to ignite. If it is used in safety critical circuit blocks, please take appropriate measures by protection devices, protection circuits, etc. For closed loop –type sensors and flux gate (closed loop type) sensors, the consumption current of the secondary power supply varies in proportion to the measurement current.

<Open loop>

1. High frequency primary current may result in excessive heating in iron magnetic core and cause damage to internal circuitry; for high frequency applications select current sensor with ferrite core material.
2. If the measured current exceeds the rated current, magnetic core saturation will occur and the output voltage signal will not be linearly proportional to the measured current.

<Closed Loop>

1. For closed loop current sensors please insure the power supply voltage is balanced, symmetrical, and, applied simultaneously to avoid potential increase in DC offset error.
2. Maximum rated current measurement duration is timedependent. Maximum rated current applied in excess of the time limit can result in damage to internal electronic circuitry; please consult Tamura for assistance.
3. When using a measurement resistor to convert current output to voltage output select a resistor with stable temperature characteristic to insure accuracy of the output voltage.
4. Compensation current supplied to the secondary winding varies in proportion to the measured current based on the conversion ratio. (If/KN; KN = secondary turns) Please insure the PSU has required current capacity to supply compensation current to the secondary winding.

<Flux-Gate>

1. Compensation current supplied to the secondary winding varies in proportion to the measured current. Please insure the PSU has required current capacity to supply compensation current to the secondary winding.
2. There is 450kHz ripple voltage present on the output and reference output voltage signals . An external capacitor maybe added if necessary.