

Fluxgate system / Voltage-output type

F01P SERIES



RoHS

TAMURA recommends F01P L series as a succession model.

ABSOLUTE MAXIMUM RATINGS

Parameters	Symbol	Unit	Value	Comment
Supply voltage	V _{CC}	V	7	
Primary conductor temperature	—	°C	110	
ESD (HBM: Human Body Model)	—	kV	4	C=100pF, R=1.5kΩ

ISOLATION CHARACTERISTICS

Parameters	Symbol	Unit	Value	Comment
Insulation voltage	V _d	—	AC4200V, for 1minute(Sensing current 0.5mA)	Primary ↔ Secondary
Insulation Resistance	R _{IS}	—	≥ 500MΩ (at DC500V)	Primary ↔ Secondary
Clearance distance	d _{Cl}	—	7.7mm	Primary ↔ Secondary
Creepage distance	d _{Cp}	—	7.7mm	Primary ↔ Secondary
Case material	—	—	UL94 V-0	
Comparative Tracking Index; (CTI)	CTI	V	600	
Application example	—	—	300V, CAT III, PD2	Reinforced isolation, non uniform field according to EN62477-1, EN61010
	—	—	600V, CAT III, PD2	Simple isolation, non uniform field according to EN50178, EN61010

ENVIRONMENTAL AND MECHANICAL CHARACTERISTICS

Parameters	Symbol	Unit	Value			Comment
			MIN	TYP	MAX	
Ambient operating temperature	T _A	°C	−40		+105	
Ambient storage temperature	T _S	°C	−40		+105	
Mass	m	g		12		

SPECIFICATIONS

 $T_A = +25^{\circ}\text{C}$, $N_p = 1\text{T}$, $R_L = 10\text{k}\Omega$, $V_{CC} = +5\text{V}$

Parameters		Symbol	Unit	Value			Comment
				MIN	TYP	MAX	
Primary nominal current	F01P006S05	I_{PN}	A		6		
	F01P015S05				15		
	F01P025S05				25		
	F01P050S05				50		
Primary current, measuring range	F01P006S05	I_{PM}	A	-20		20	
	F01P015S05			-51		51	
	F01P025S05			-85		85	
	F01P050S05			-150		150	
Supply Voltage		V_{CC}	V	4.75	5.00	5.25	
Number of primary turns		N_p	T	1, 2, 3			
Number of secondary turns	F01P006S05	N_s	T		1816		
	F01P015S05				1737		
	F01P025S05				1764		
	F01P050S05				1600		
Consumption current (at I_p)	F01P006S05	I_{CC}	mA		25		$I_{CC} = 15 + I_p(\text{mA}) / N_s$
	F01P015S05				30		
	F01P025S05				35		
	F01P050S05				55		
Output voltage range		V_o	V	0.375		4.625	
Output voltage (at $I_p = 0\text{A}$)		V_o	V		2.5		
Electrical offset voltage *1	F01P006S05	V_{oe}	mV	-10.40		10.40	
	F01P015S05			-7.10		7.10	
	F01P025S05			-6.25		6.25	
	F01P050S05			-5.80		5.80	
Electrical offset current referred to primary*1	F01P006S05	I_{oe}	A	-0.10		0.10	
	F01P015S05			-0.17		0.17	
	F01P025S05			-0.25		0.25	
	F01P050S05			-0.46		0.46	
Temperature coefficient of V_o (at $I_p = 0\text{A}$)	F01P006S05	TCV_o	ppm/K		± 10.0	± 80.0	ppm/K of 2.5V ($-40^{\circ}\text{C} \sim +105^{\circ}\text{C}$)
	F01P015S05				± 7.5	± 70.0	
	F01P025S05				± 6.5	± 60.0	
	F01P050S05				± 6.0	± 60.0	
Theoretical sensitivity	F01P006S05	G_{th}	mV/A		104.2		$625\text{mV}/I_{PN}$
	F01P015S05				41.67		
	F01P025S05				25		
	F01P050S05				12.5		
Sensitivity error		ε_G	%	-0.7		0.7	
Temperature coefficient of Sensitivity (at $T_A = -40^{\circ}\text{C} \sim +105^{\circ}\text{C}$)		TCG	ppm/K			± 40	
Linearity error (at I_p)		ε_L	%	-0.1		0.1	
Magnetic offset current referred to primary (at $10 \times I_p$)		I_{OM}	A	-0.1		0.1	

*1 Offset voltage value is after removal of core hysteresis.

SPECIFICATIONS

$T_A=+25^{\circ}\text{C}$, $N_p=1\text{T}$, $R_L=10\text{k}\Omega$, $V_{CC}=+5\text{V}$

Parameters	Symbol	Unit	Value			Comment
			MIN	TYP	MAX	
Peak to peak output ripple at oscillator frequency($f_{\text{typ}}=450\text{kHz}$)	F01P006S05	—	mV	40	160	$R_L=1\text{k}\Omega$
	F01P015S05			15	60	
	F01P025S05			10	40	
	F01P050S05			5	20	
Reaction time(at 10% of I_{PN})	F01P006S05	t_{ra}	μs		0.3	$R_L=1\text{k}\Omega$, $di/dt=18\text{A}/\mu\text{s}$
	F01P015S05				0.3	$R_L=1\text{k}\Omega$, $di/dt=44\text{A}/\mu\text{s}$
	F01P025S05				0.3	$R_L=1\text{k}\Omega$, $di/dt=68\text{A}/\mu\text{s}$
	F01P050S05				0.3	$R_L=1\text{k}\Omega$, $di/dt=100\text{A}/\mu\text{s}$
Response time (at 90% of I_{PN})	F01P006S05	t_r	μs		0.3	$R_L=1\text{k}\Omega$, $di/dt=18\text{A}/\mu\text{s}$
	F01P015S05				0.3	$R_L=1\text{k}\Omega$, $di/dt=44\text{A}/\mu\text{s}$
	F01P025S05				0.3	$R_L=1\text{k}\Omega$, $di/dt=68\text{A}/\mu\text{s}$
	F01P050S05				0.3	$R_L=1\text{k}\Omega$, $di/dt=100\text{A}/\mu\text{s}$
Frequency bandwidth($\pm 1\text{dB}$)	BW	kHz	200			$R_L=1\text{k}\Omega$
Frequency bandwidth($\pm 3\text{dB}$)	BW	kHz	300			$R_L=1\text{k}\Omega$
Overall Accuracy (at $T_A=25^{\circ}\text{C}$)	F01P006S05	X_G	%		2.5	$X_G=(100 \times V_{0e}/625) + \epsilon_G + \epsilon_L$
	F01P015S05				1.9	
	F01P025S05				1.8	
	F01P050S05				1.7	

STANDARDS

EN50178, EN62477-1, EN61010-1, EN62368-1, UL508(file No.E243511)

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

Characteristic curve (TYP)

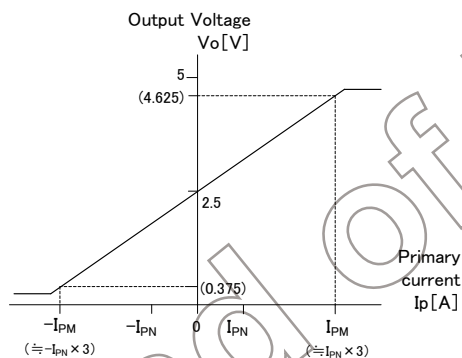


Figure 1: Linearity curve

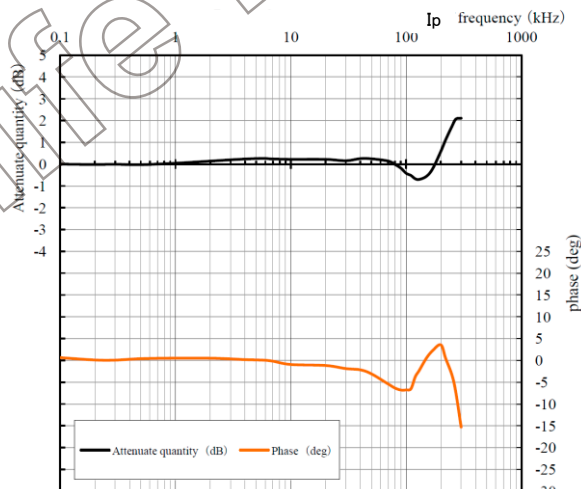


Figure 2: Frequency response curve

ex) F01P025S05

Measurement condition $T_A=+25^{\circ}\text{C}$, $R_L=1\text{k}\Omega$, $I_p=3\text{A}$, $V_{CC}=+5\text{V}$

SUPPORT DOCUMENTATION

Maximum continuous DC primary current

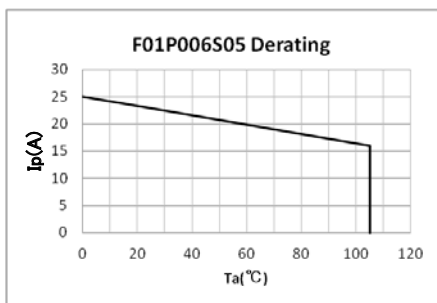


Figure 3: Ip vs Ta for F01P006S05

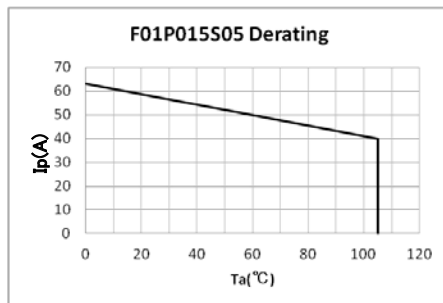


Figure 4: Ip vs Ta for F01P015S05

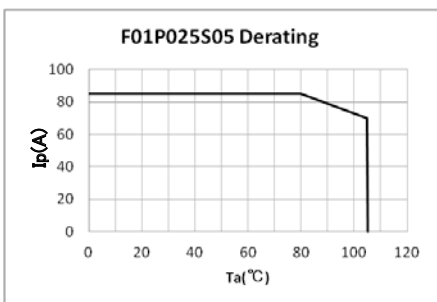


Figure 5: Ip vs Ta for F01P025S05

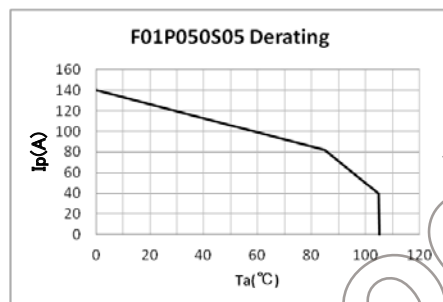


Figure 6: Ip vs Ta for F01P050S05

According to which the following conditions are true the maximum continuous DC primary current plot shows the boundary of the area.

- ① $I_p < I_{pmax}$
- ② Junction temperature $T_j < 125^\circ\text{C}$
- ③ Resistor power dissipation $< 0.5 \times \text{rated power}$

Frequency derating

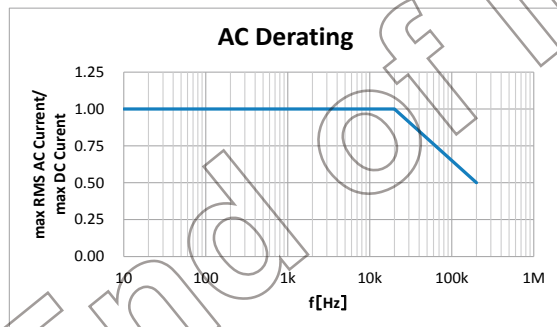
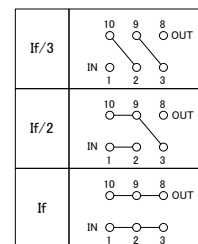
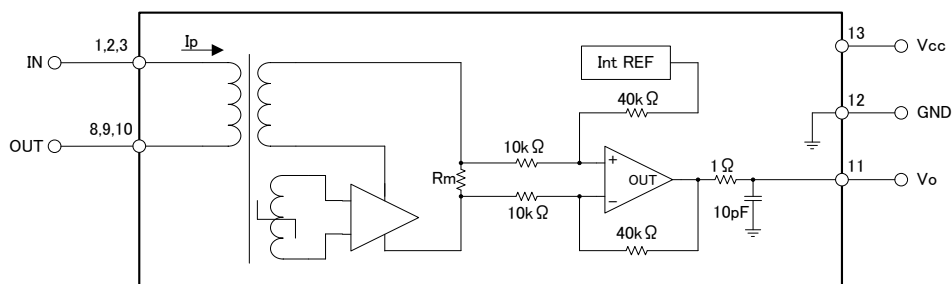
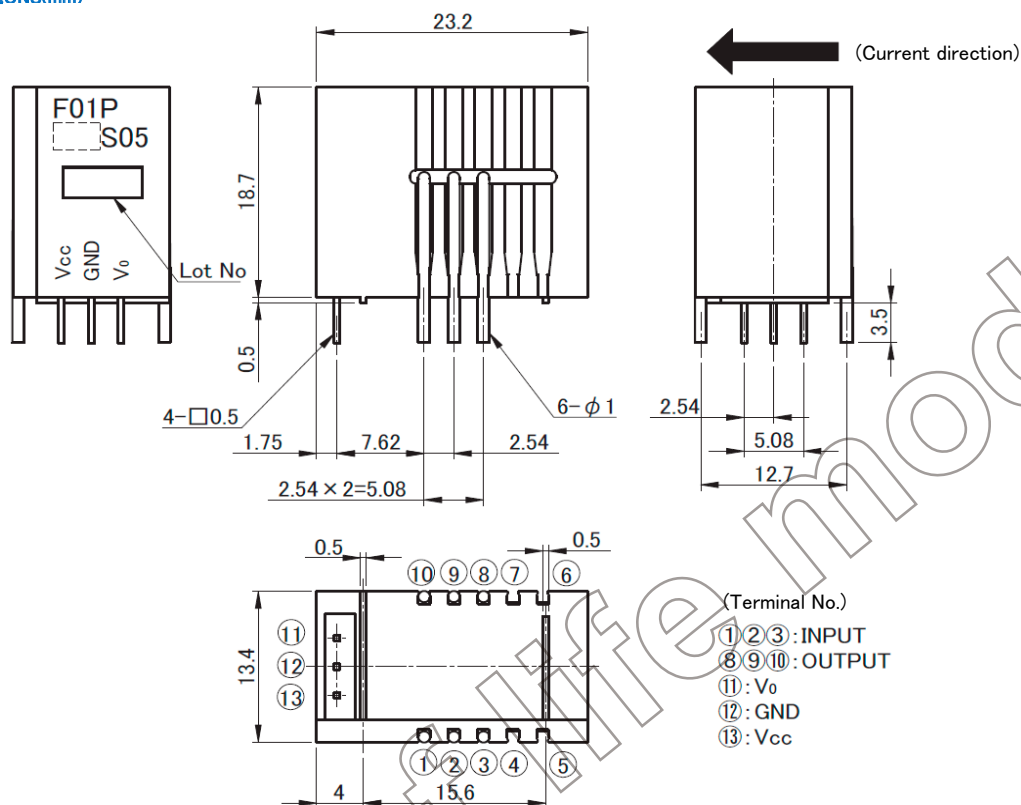


Figure 7: Maximum RMS AC primary current/maximum DC primary current vs frequency

CONNECTION

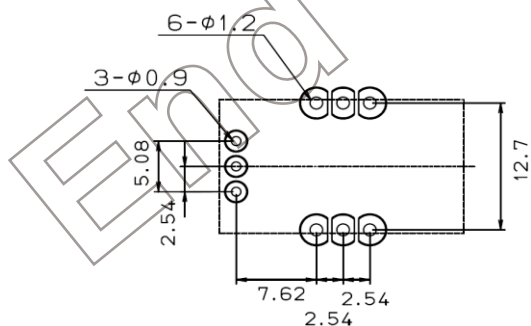


DIMENSIONS(mm)



※ (Unless otherwise specified tolerances shall be ± 0.5)

RECOMMENDED HOLE DIAMETER(mm)



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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 abnormal 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 time dependent. 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 I/K_N ; K_N = 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.

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