					4/6/202	20
		ESA8111-179	Rev. 0	page	1/11	
CUSTOMER						
	Residua FC da	l current se S-R05-3A atasheet	ensor			
KEMET Corporation	TOKIN Cor MSABG – Actuator U	poration Magnetics, Sensor and nit				
						$\overline{\ }$

Part	FG-R05-3A	ESA8111-179	page	2/11
			4/6/20	020

1. Scope

This datasheet applies to the specification of Residual current sensor FG-R05-3A

2. Introduction

This sensor FG-R05-3A is a high-sensitivity DC/AC current sensor that can detect leakage current of DC and AC. If DC fault occurs, PIN 4 will change state from low level to high impedance. If AC fault occurs, PIN5 will change state form low level to high impedance.

This sensor has a test coil for testing the operation of the sensor, and by inputting a signal from the outside it is possible to pass a test current to the test coil. It also outputs a digital signal informing that leakage current of DC/AC has been detected.

Features

- For IC-CPD to the standard IEC 62752:2016
- UL2231(CCID20)
- Open-loop, Flux-gate type current sensor
- PCB mounting
- Digital output of fault detection

3. Pin assignment



Pin No.	Symbol	Pin type	Functions
1	VDD	Power	Power supply, 5V
2	GND	Power	Ground
3	AOUT	Analog out.	Analog output. This is for monitoring purposes and is not safety function! Offset voltage is 2.25 V(Typ.). Sensitivity is 40V/A(Typ.)
4	DC Alarm	Digital Out	Active high if DC current is in the range of 3 to 6mA. Pull up to VDD with 1k-ohm resistor.
5	AC Alarm	Digital Out	Active high if AC current is in the range of 15 to 20mA. Pull up to VDD with 1k-ohm resistor IEC62752 & UL2231(CCID20)
6	TEST	Input	Test input. Internal pull-down with 100kohm. When input positive pulse input(>120usec), test sequence is start.

4. Marking



Part	FG-R05-3A	ESA8111-179	page	3/11
			4/6/20)20

5. Absolute maximum ratings

5-1. Environmental characteristics

Parameter	Min	Max	Units
Operating temperature range	-40	+85	°C
Storage temperature range	-40	+85	°C

5-2. Electrical characteristics

Parameter	Min	Max	Units
Supply voltage	-0.3	6.0	V
Primary rated voltage		250	V
Maximum input voltage of digital output		Vdd+0.3	V
Maximum sink current of digital output		10	mA
Input voltage of TEST (LOW)	0	0.6	V
Input voltage of TEST (HIGH)	2.5	Vdd	V

6. Specifications

6-1. Electrical characteristics

Unless otherwise specified, each electrical operating condition is $TA = 25^{\circ}C$, Vdd = 5 V.

Parameter	Symbol	Min.	Тур.	Max.	Units	Comments
Primary nominal current	In			80/40	Α	1phase/3phase
Supply voltage	Vdd	4.75	5.0	5.25	V	
Current consumption	lc		13		mA	lp = 0mA
DC6mA detection current	Idn (DC)	3	4.5	6	mA	-40 to 85°C
AC30mA detection current	Idn (AC)	15	17.5	20	mA	-40 to 85°C, 55Hz
Frequency characteristic		-2	-1		%	@45Hz/55Hz
of Idn(AC)			+1	+2	%	@65Hz/55Hz
Recovery level			ldn/2			
			140	1000	ms	lp = DC6mA
DC Fault response time			12	250	ms	lp = DC60mA
			3	15	ms	lp = DC300mA
			100	250	ms	Ip = AC30mArms
AC Fault response time			40	100	ms	Ip = AC60mArms
AC Fault response time			5	15	ms	Ip = AC150mArms
			3	15	ms	Ip > AC 5Arms
Sensitivity (pin 3)	G		40		V/A	-40 to 85°C
Offset voltage (pin 3)	Vo		2.25		V	-40 to 85°C
Measurement range(pin 3)	lp	-50		50	mA	
Frequency range (pin 3)	fBW	DC		150	Hz	-3dB *Note1

* Parameter without Max or Min values are designed values, are not guaranteed values. Note1: Please refer to Appendix 1 for frequency characteristics of Pin3.

Part	FG-R05-3A	ESA8111-179	page	4/11
			4/6/20)20

6-2. ESD

Judgment: Idn (DC) within Specification of 6-1 items after ESD test

Parameter	Judge
Electrostatic Discharge Voltage Human-body model (HBM) R=1.5kΩ, C=100pF, U=+/-2kV	Passed
Electrostatic Discharge Voltage Charged-device model (CDM) U=+/-800V	Passed

6-3. EMC

Judgment: DC Alarm and AC Alarm do not malfunction during noise stimulation

Parameter	Conditions	Judge
IEC 61000-4-3 Radiated, radio-frequency, electromagnetic field immunity	30V/m, 80MHz – 1GHz 80%AM 1kHz	Passed
ISO 11452-2 (ALSE) electrical disturbances from narrowband radiated electromagnetic energy	50V/m 200MHz – 800MHz 80%AM 1kHz, 800MHz – 2GHz PM	Passed
ISO 11452-4 (BCI) Electrical disturbances from narrowband radiated electromagnetic energy	100mA 20MHz – 200MHz 80% AM 1kHz	Passed

6-4. Dielectric strength

Parameter	Conditions	Value
Uw, prim-sec	Impulse(1.2us/50us), PIN1-6 vs insulated primary wire, 5 pulse -> polarity +, 5 pulse -> polarity -	5.5kVrms
Ud	Test voltage, 60s PIN1-6 vs insulated primary wire	1.5kVrms
UPDx1.5	Partial discharge voltage, PIN1-6 vs insulated primary wire *acc. to table 24	1.2kVrms
UPDx1.875	Partial discharge voltage, PIN1-6 vs insulated primary wire *acc. to table 24	1.5kVrms

* IEC 61800-5-1:2007

Note2:

The case is Insulation material group III.

When designing the primary wire, be careful of clearance and creepage distance from the input/output terminal.

Note3: Please See Appendix2 for recommended wire configuration



*This characteristic is indicated only for reference, and are not guaranteed.

6-6. Digital Output state

DC Alarm	AC Alarm	State
GND	GND	Normal condition
High impedance	GND	ldn > 6mA(DC)
GND	High impedance	ldn > 20mA(AC)
High impedance	High impedance	Idn > 6mA(DC) & Idn > 20mA(AC)

Other instructions:

- Temperature of primary wire should not exceed 105°C.
- The rise time of Vdd is 50us to 100 ms.
- UL2231 Recognized component expected

Part	FG-R05-3A		ESA811	1-179	page	6/11
					4/6/20)20
6-7 Self-te	est operation					
		FG-R05-3A	,			
	Prim	ary conductor	\frown			
		Vdd				
	ACA	4arm 1k 5 74k 4		5 0	v	
	0				——— Test_in	
Con	nect to MCU etc.	Vdd 74				
	DC		→ 3	Analog out (Co	nnect to ADC etc.)
	₀ ـــــــ		✓ 2 1	∆ Vdd (4.	75 to 5.25)	
			Ϋ́ς			
		Tin (>120us)				
	Tost in	$\overset{\leftrightarrow}{\square}$				
	Test_III					
		о (Тур. 0.8s)	(Typ. 0.8s)	, , ,		
	Test curre	nt				
	(Internal)	DC test		1		
		0		ų —		
	DC Alarm					
		0	<u>}</u>			
		t3		÷		
	AC Alarm	· ·	t4			
		0				
				[sec]		
		Parameter Min	Typ N	lax		
		t2 0.7	1.0 1	1.3		
		t3 0.7	1.0 1	1.2		
		ι 4 1.4	1.0 2	1		

Part	FG-R05-3A	ESA8111-179	page	7/11
			4/6/2020	
6-8 Recover	y level			
	Input current			
Idn(DC) Idn(AC) Recovery	, level	t		
DC Alaı AC Alar	rm, 1 m Low Hi-Z Lov	V		
		•		

When the residual current exceeds the threshold level (Idn(DC) or Idn(AC)), PIN 4(DC Alarm) or PIN 5(AC Alarm) will change from low level(GND) to high impedance. Each output goes back from high impedance to low level when residual current falls below recovery level.

Part	FG-R05-3A	ESA8111-179	page	8/11
_		1	4/6/20	020
7. PCB foot	tprint (Top view)			
<u>2x</u> ∅ 1.8TH		6x Ø 0.9TH 2.4 € 0:6		
	< 28.45	< 16.85	3.1	
1.5	≤33.0	3	8.5	
	40.0		~>	



Part	FG-R05-3A	ESA8111-179	page	10/11
			4/6/20	020
9. Packing The produc The tray w	ct is packed in a special tray and carton bo ould be an antistatic type.	x as shown below.		
	cardboard pad			
	MAX 30pc MAX 10lay (MAX 300)	er ocs)		

Appendix 1 Frequency characteristics of Analog output



*This characteristic is indicated only for reference, and are not guaranteed.

Appendix 2

Recommended wire configuration



*Reinforced insulation, Insulation material group III, Pollution degree 2, altitude<5000m and overvoltage category II *Please take enough creepage distance between each pin