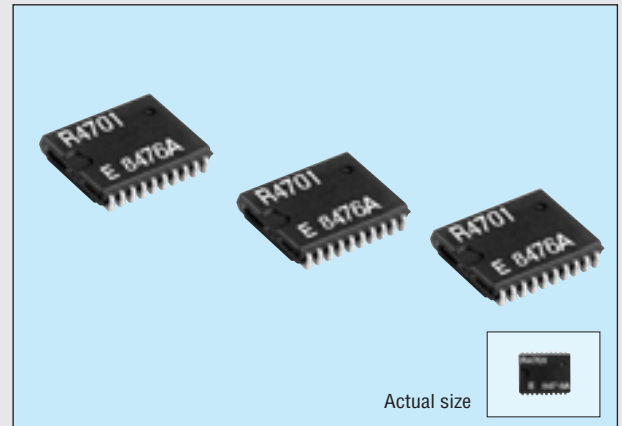


SERIAL RTC MODULE WITH ALARM AND TIMER FUNCTIONS

RTC-4701JE

- Built-in crystal unit allows adjustment-free efficient operation.
- Serial interface which can be controlled by three signal lines.
- Alarm interrupt function for day of week, day, hour, and minute.
- Regular cycle interrupt function which can be set up between 1/4096 second and 255 minutes.
- OVF interrupt function based on 12-bit additional counter.
- Ability to detect stopping of oscillation and time update.
- Automatic adjustment for leap year.
- Built-in temperature sensor.(voltage output :-7.6 mV/ °C Typ.)
- Wide range of interface voltage between 1.6 and 5.5 V.
- Wide range of clock voltage between 1.6 and 5.5 V.
- Low power consumption at 0.5 μA/3 V. (Typ.)



Specifications (characteristics)

Absolute Max. rating

Item	Symbol	Condition	Min.	Max.	Unit
Supply voltage	V _{DD}	—	-0.3	+7.0	V
Input voltage	V _{IN}	Input Pin	GND-0.3	V _{DD} +0.3 V	
Output voltage	V _{OUT1}	TIRQ, AIRQ		+8.0	
	V _{OUT2}	FOUT, DATA		V _{DD} +0.3 V	
Storage temperature	T _{STG}	—	-55	+125	°C

Operating range

Item	Symbol	Condition	Min.	Max.	Unit
Power voltage	V _{DD}	—	1.6	5.5	V
Clock voltage	V _{CLK}				
Operating temperature	V _{OPR}				
			-40	+85	°C

Frequency characteristics

Item	Symbol	Condition	Range	Unit
Frequency tolerance	Δf/fo	T _a =+25 °C, V _{DD} =3 V	5±23	x 10 ⁻⁶
Frequency temperature characteristics	T _{op}	T _a =-10 to +70 °C, Reference at +25 °C	+10 -120	
Frequency voltage characteristics	f _v	T _a =+25 °C, V _{DD} =1.6 to 5.5 V	±2	x 10 ⁻⁶ /V
Oscillation start up time	t _{STA}	T _a =+25 °C, V _{DD} =3.0 V	3	s
Aging	f _a	T _a =+25 °C, V _{DD} =3 V	±5	x 10 ⁹ /year

*Equivalent to 1 minute of monthly deviation

DC characteristics (V_{DD}=1.6 to 5.5 V, T_a=-40 to +85 °C)

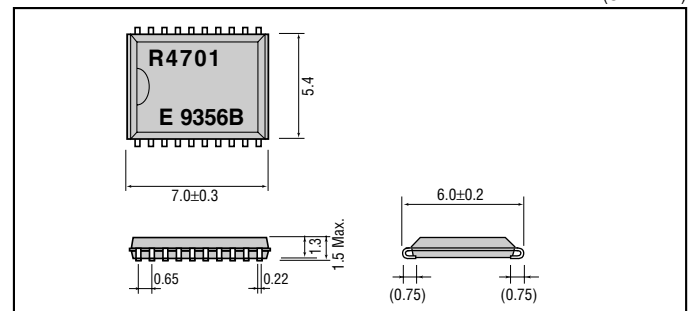
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Input voltage	V _{IH}	CE, CLK, DATA, FOUT, SOFF	0.8V _{DD}	—	V _{DD} +0.3	V
	V _{IL}	FOE, SOFF	GND-0.3		0.2V _{DD}	
Input leakage current	I _{LK}	CLK, DATA, FOE, SOFF V _{IN} =V _{DD} or GND	-0.5		0.5	μA
Pulldown R1	R _{DWN1}	V _{DD} =5 V	75	150	300	kΩ
	R _{DWN2}	V _{DD} =3 V	150	300	600	
Output voltage 1	V _{OH1}	V _{DD} =5 V	I _{OH} =-1 mA	4.5	5.0	V
	V _{OH2}	V _{DD} =3 V	DATA, FOUT pins	2.0	3.0	
	V _{OH3}		I _{OH} =-100 μA DATA, FOUT pins	2.9		
Output voltage 2	V _{OL1}	V _{DD} =5 V	I _{OL} =1 mA	—	GND+0.5	V
	V _{OL2}	V _{DD} =3 V	DATA, FOUT pins		GND+0.8	
	V _{OL3}		I _{OL} =100 μA DATA, FOUT pins		GND+0.1	
	V _{OL4}	V _{DD} =5 V	I _{OL} =1 mA		GND+0.25	
	V _{OL5}	V _{DD} =3 V	AIRQ, TIRQ pins		GND+0.4	
Leakage current	I _{OZ}	V _O =GND or V _{DD} , FOUT, DATA, AIRQ, TIRQ pins	-0.5		0.5	μA
Standby current 1	I _{DD1}	V _{DD} =5 V	CE, FOE, SOFF-GND AIRQ, TIRQ-V _{DD} 32.768kHz output is OFF. Sensor output is OFF.	1.0	2.0	μA
Standby current 2	I _{DD2}	V _{DD} =3 V		0.5	1.0	μA

Terminal connection

No.	Pin terminal
1	V _{DD}
2	FOUT
3	CE
4	AIRQ
5	TIRQ
6	CLK
7	DATA
8	FOE
9	VTEMP
10	SOFF
11	GND
12	N.C
13	N.C
14	N.C
15	N.C
16	N.C
17	N.C
18	N.C
19	N.C
20	N.C

External dimensions

(Unit: mm)



Temperature sensor characteristics

GND=0 V, T_a=-40 °C to +85 °C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Temperature output voltage	Vtemp	T _a =+25 °C, GND based output voltage VTEMP pin, V _{DD} =2.7 to 5.5 V		1.48		V
Output precision	T _{ACR}	T _a =+25 °C, V _{DD} =2.7 to 5.5 V			±5.0	°C
Temperature sensitivity	V _{SE}	-40 °C ≤ T _a ≤ +85 °C, V _{DD} =2.7 to 5.5 V	-7.1	-7.6	-8.1	mV/°C
Linearity	ΔNL	-40 °C ≤ T _a ≤ +85 °C, V _{DD} =2.7 to 5.5 V			±2.0	%
Output resistance	R _O	T _a =+25 °C, VTEMP pin, V _{DD} =2.7 to 5.5 V GND standard and V _{DD} standard		1.0	3.0	kΩ

Register table

BANK0

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	Second	fos	S 40	S 20	S 10	S 8	S 4	S 2	S 1
1	Minute	fr	Min 40	Min 20	Min 10	Min 8	Min4	Min 2	Min 1
2	Hour	fr	0	Hour 20	Hour 10	Hour 8	Hour4	Hour 2	Hour 1
3	Day of Week	fr	W 6	W 5	W 4	W 3	W 2	W 1	W 0
4	Day	fr	0	Day 20	Day 10	Day 8	Day 4	Day 2	Day 1
5	Month	fr	c	0	Month 10	Month 8	Month 4	Month 2	Month 1
6	Year	Year 80	Year 40	Year 20	Year 10	Year 8	Year 4	Year 2	Year 1
7	Minutes Alarm	AE	A-Min 40	A-Min 20	A-Min 10	A-Min 8	A-Min 4	A-Min 2	A-Min 1
8	Hours Alarm	AE	*	A-Hr 20	A-Hr 10	A-Hr 8	A-Hr 4	A-Hr 2	A-Hr 1
9	Day of week Alarm	AE	A-W 6	A-W 5	A-W 4	A-W 3	A-W 2	A-W 1	A-W 0
A	Day Alarm	AE	*	A-Day 20	A-Day 10	A-Day 8	A-Day 4	A-Day 2	A-Day 1
B	-	-	-	-	-	-	-	-	-
C	Timer setup	TE	*	TD ₁	TD ₀	*	*	*	*
D	Timer Couner	128	64	32	16	8	4	2	1
E	Control 1	0	0	0	TI/TP	AF	TF	AIE	TIE
F	Control 2	0	TEST	STOP	RESET	HOLD	0	0	0

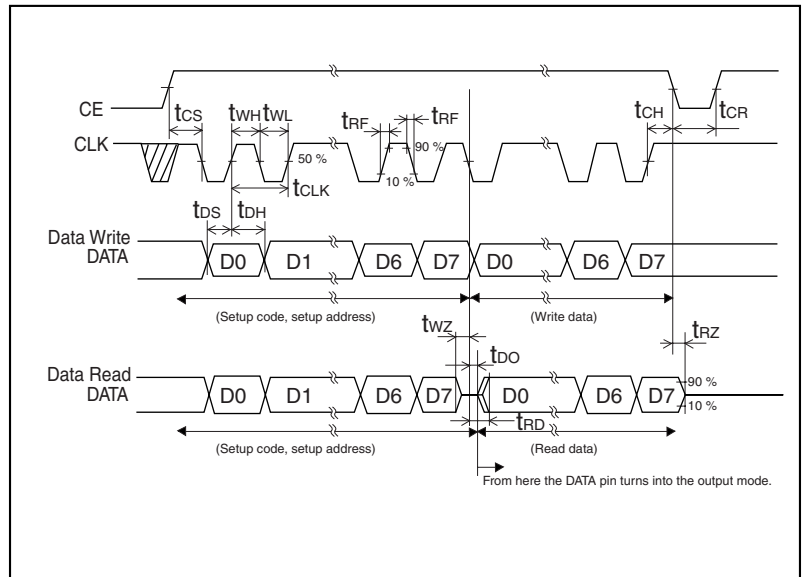
BANK1

Address	Register symbol	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
B	additional counter 1	128	64	32	16	8	4	2	1
C	additional counter 2	fr	AC1	AC0	OVF	2048	1024	512	256
D	-	-	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-	-	-
F	control 3	FOES	TEST	-	-	-	ACIE	ACE	SON

0 : Always set this bit to "0".

Switching characteristics (GND=0V, Ta=-40 °C to +85 °C) Timing chart

Item	Symbol	Control	V _{DD} =3.0±10%		V _{DD} =5.0±10%		Unit
			Min.	Max.	Min.	Max.	
CLK clock cycle	t _{CLK}		600		350		ns
CLK H Pulse Width	t _{WH}						
CLK L Pulse Width	t _{WL}						
CE setup time	t _{CS}		300		175		
CE hold time	t _{CH}	-					
CE recovery time	t _{CR}		400		300		
Write data setup time	t _{DS}		75		50		
Write data hold time	t _{DH}						
Write data disable delay time	t _{DZ}		0		0		
Output mode switching time	t _{DO}						
Read data delay time	t _{RD}	C _L =50 pF		300		120	ns
Output disable time	t _{rz}	C _L =50 pF R _L =10 kΩ		200		100	
Rise and fall time	t _{RF}			100		50	ns
FOUT duty ratio (32.768kHz output)	Duty		40	60	40	60	
Oscillation stop defection time	t _{osc}		10		10		ms



Block diagram

