Renesas Electronics America Inc - UPD70F3370AM1GBA-GAH-AX Datasheet

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"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Obsolete
Core Processor	V850ES
Core Size	32-Bit Single-Core
Speed	32MHz
Connectivity	CANbus, CSI, I²C, LINbus, UART/USART
Peripherals	DMA, LVD, POR, PWM, WDT
Number of I/O	51
Program Memory Size	128KB (128K x 8)
Program Memory Type	FLASH
EEPROM Size	32K x 8
RAM Size	8K x 8
Voltage - Supply (Vcc/Vdd)	3.3V ~ 5.5V
Data Converters	A/D 10x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	64-LQFP
Supplier Device Package	64-LFQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/upd70f3370am1gba-gah-ax

Notes for CMOS Devices

1. **Precaution against ESD for semiconductors**
   Strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred. Environmental control must be adequate. When it is dry, humidifier should be used. It is recommended to avoid using insulators that easily build static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work bench and floor should be grounded. The operator should be grounded using wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with semiconductor devices on it.

2. **Handling of unused input pins for CMOS**
   No connection for CMOS device inputs can be cause of malfunction. If no connection is provided to the input pins, it is possible that an internal input level may be generated due to noise, etc., hence causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using a pull-up or pull-down circuitry. Each unused pin should be connected to VDD or GND with a resistor, if it is considered to have a possibility of being an output pin. All handling related to the unused pins must be judged device by device and related specifications governing the devices.

3. **Status before initialization of MOS devices**
   Power-on does not necessarily define initial status of MOS device. Production process of MOS does not define the initial operation status of the device. Immediately after the power source is turned ON, the devices with reset function have not yet been initialized. Hence, power-on does not guarantee out-pin levels, I/O settings or contents of registers. Device is not initialized until the reset signal is received. Reset operation must be executed immediately after power-on for devices having reset function.

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G06.6-1A

1. Pin Group Information

1.1 Device package information

The V850ES/Fx3 device series comprises several members. An overview with the pin and package information is given in the following table:

Series Member	# Pins	Device package information
μPD70F3370A μPD70F3371	64	FE3
μPD70F3372 μPD70F3373	80	FF3
μPD70F3374 μPD70F3375 μPD70F3376A μPD70F3377A	100	FG3
μPD70F3378 μPD70F3379 μPD70F3380 μPD70F3381 μPD70F3382	144	FJ3
μPD70F3383 μPD70F3384 μPD70F3385	176	FK3

This document describes the specification for the V850ES/FF3.

1.2 Pin Groups 1x: Pins supplied by EVDD

1B: (SHMT1)
- P04, P30-31, P34; P40, P91, P913-915 (FE3)
- P04, P30-31, P34; P38-39, P40, P91, P913-915 (FF3)
- P04, P30-31, P34; P36-39, P40, P91, P911, P913-915 (FG3)
- P04, P30-31, P34; P36-39, P40, P63-69, P614-615, P80-81, P91, P911, P913-915 (FJ3)
- P04, P30-31, P34; P36-39, P40, P63-69, P614-615, P80-81, P91, P911, P913-915, P156-157 (FK3)

1D: (SHMT3)
- P00-03, P05-P06, P32-33, P35, P41-42, P50-55, P90, P96-99 (FE3)
- P00-03, P05-P06, P32-33, P35, P41-42, P50-55, P90, P96-99 (FF3)
- P00-03, P05-P06, P10-11, P32-33, P35, P41-42, P50-55, P90, P92-910, P912 (FG3)
- P00-03, P05-P06, P10-11, P32-33, P35, P41-42, P50-55, P60-62, P610-613, P90, P92-910, P912 (FJ3)
- P00-03, P05-P06, P10-11, P32-33, P35, P41-42, P50-55, P60-62, P610-613, P90, P92-910, P912, P150-155 (FK3)

1.3 Pin Groups 2x: Pins supplied by EVDD

2A: (CMOS)
- PCM0-1 (FE3)
- PCM0-3, PCS0-1, PCT0-1, PCT4, PCT6 (FF3)

2D: (SHMT3)
- PDL0-7 (FE3)
- PDL0-11 (FF3)

2.3 Operating condition

(Ta = -40 to +85°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

Internal System clock frequency (f_{VBCLK})	Supply voltage	Operating Condition

4.0≤f_{xx}≤32MHz Note1	4.0V≤VDD≤5.5V Note2	Operation of functions is usable under following conditions:
		• Peripheral clock frequency
		  • f_{XP1} ≤ 32MHz
		  • f_{XP2} ≤ 32MHz
		• AC characteristics:
		  • Refer to chapter '2.7 AC Characteristics' for details.

	3.5V≤VDD<4.0V Note2	Operation of functions is usable under following conditions:
		• Peripheral clock frequency
		  • f_{XP1} ≤ 20MHz
		  • f_{XP2} ≤ 20MHz
		• AC characteristics:
		  • Refer to chapter '2.7 AC Characteristics' for details.

	3.3V≤VDD<3.5V Note2	Only operation of the following functions is assured: • CPU • Flash (include programming) • RAM • IO Buffer • Port • WT • WDT • INT • CLM • POC • LVI

	3.3V≤AVREF0≤5.5V	• A/D Converter
		  • Refer to chapter '2.8 A/D Converter' for details.
		  • stop ADC for AVREF0 < 4.0V (ADA0CE bit =0)

32kHz≤f_{XT}≤35kHz (Crystal)	3.3V≤VDD<5.5V Note2	-
12.5kHz≤f_{XT}≤27.5kHz Note3 (RC)		
f_{RL} (240kHz Internal-OSC)	3.3V≤VDD<5.5V Note2	-

Notes: 1. For using SSCG please refer to '2.5.5 SSCG Characteristics' for details

2. VDD = EVDD

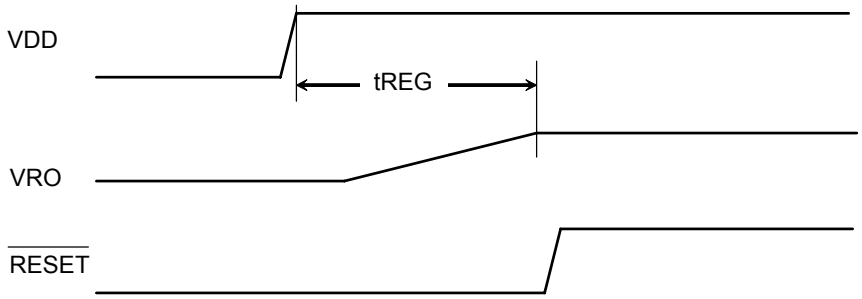
3. RC Oscillation frequency is min. 25kHz max. 55kHz. This clock is divided by 2 internally.

2.4 Voltage Regulator Characteristics

(Ta = -40 to +85°C, C=4.7uF, VDD = EVDD, VSS = EVSS = AVSS = 0V))

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input voltage	VDD		3.5		5.5	V
		Limited function see '2.3 Operating condition'	3.3			V
Output voltage	VRO			2.5		V
Output voltage stabilization time	t_{REG} Note	After VDD reaches voltage range min. 3.3V To connect C=4.7uF on REGC terminal			1	ms

Note: In case of non-POC device, be sure to start VDD in the state of $\overline{\text{RESET}}$=VSS=0V. For POC devices there is no need to control external $\overline{\text{RESET}}$ terminal. For decives with POC function the internal $\overline{\text{RESET}}$ signal will automatically controlled until VRO is stable.



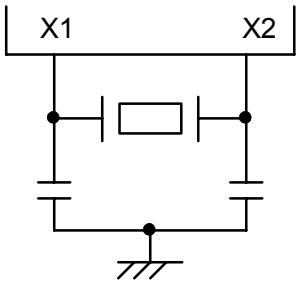
2.5 Clock Generator Circuit

2.5.1 Main System Clock Oscillation Circuit Characteristics

(Ta = -40 to +85°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

Resonator	Recommended Circuit	Parameter	Conditions	MIN.	TYP.	MAX.	Unit
Crystal / Ceramic resonator	Refer to figure below	Oscillator frequency (fx) Note1		4		16	MHz
		Oscillation stabilization time Note2	After STOP mode	64 Note4	Note3		µs
			After IDLE2 mode	54 Note4	Note3		µs

Notes: 1. Indicates only oscillation circuit characteristics. Refer to '2.7 AC Characteristics' for CPU operation clock.
2. Time required to stabilize oscillation after VDD reaches oscillator voltage range MIN. 3.3V
3. Depends on the setting of the oscillation stabilization time select register (OSTS)
4. Minimum time required to stabilize flash. Time has to be secured by setting the oscillation stabilization time select register (OSTS)



2.5.2 Sub System Clock Oscillation Circuit Characteristics

(Ta = -40 to +85°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

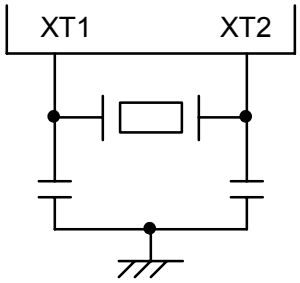
Resonator	Recommended Circuit	Parameter	Conditions	MIN.	TYP.	MAX.	Unit
Crystal resonator	Refer to Figure 1	Oscillator frequency (fxt)Note1		32	32.768	35	kHz
		Oscillation stabilization time Note2				10	s
RC resonator	Refer to Figure 2	Oscillator frequencyNote1,4	R=390KΩ ±5% Note3, C=47pF±10% Note3	25	40	55	kHz
		Oscillation stabilization time Note2				100	μs

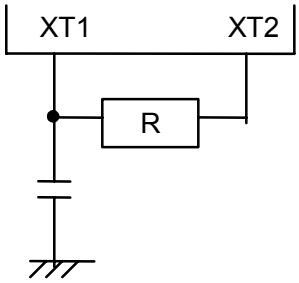
Notes: 1. Indicates only oscillation circuit characteristics. Refer to "AC Characteristic" for cpu operation clock.

2. Time required to stabilize oscillation after VDD reaches oscillator voltage range min. 3.3V

3. In order to avoid the influence of wiring capacity, shorten wiring as much as possible.

4. RC Oscillation frequency is typ. 40kHz. This clock is divided by 2 internally. In case of RC Oscillator, internal system clock frequency (fxt) is min. 12.5kHz, typ. 20kHz, max. 27.5kHz.





2.5.3 Internal-OSC Characteristics

(Ta = -40 to +85°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output frequency	f_{RL}	240kHz Internal-OSC	204	240	276	kHz
	f_{RH}	8MHz Internal-OSC	7.2	8.0	8.8	MHz
Oscillation stabilization time		240kHz Internal-OSC		10	36	μs
		8MHz Internal-OSC	51	92	256	μs

2.5.4 PLL Characteristics

(Ta = -40 to +85°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input frequency	fx		4		16	MHz
	f_{PLLI}	Note1	3		6	MHz
Output frequency	fxx	≤256KB product	12		32	MHz
Lock time	tPLL	After VDD reaches voltage range min. 3.3V			800	μs
Output period jitter Note2	tpj	Peak to peak			2.0	ns

Notes: 1. The input of the PLL (f_{PLLI}) can be set to f_X, $f_X/2$, or $f_X/4$. The divider is set through an option byte in the code flash memory.

2. Not tested in production.

2.5.5 SSCG Characteristics

(Ta = -40 to +85°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input frequency	fx		4		16	MHz
Output frequency	f_{XX}	≤256KB product	12		32	MHz
Lock time	t_{SSCG}	After VDD reaches voltage range min. 3.3V			1000	μs

Remark: The SSCG MAX output frequency indicates the case without modulation. If modulation is enabled the average SSCG frequency has to be set lower. The maximum achievable average operating frequency with modulation is as follows:

SSCG input clock divider selector SFC1[6:4]	Percent modulation		Maximum average operating frequency		Unit
	TYP	MAX	≤256KB product		
000B	± 0.5%	± 2.0%	31.4		MHz
001B	± 1.0%	± 2.5%	31.2		
010B	± 2.0%	± 4.0%	30.7		
011B	± 3.0%	± 6.0%	30.1		
100B	± 4.0%	± 8.0%	29.4		
101B	± 5.0%	± 10.0%	28.8		

2.6 DC Characteristics

2.6.1 Input/Output Level

(Ta = -40 to +85°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

Parameter	Sym-bol	Conditions		MIN.	TYP.	MAX.	Unit
High level input voltage	VIH1	Pin Group 1B		0.7·EVDD		EVDD	V
	VIH2	Pin Group 1D		0.8·EVDD		EVDD	V
		Pin Group 2D		0.8·EVDD		EVDD	V
	VIH3	Pin Group 2A		0.7·EVDD		EVDD	V
	VIH4	Pin Group 4		0.7·AVREF0		AVREF0	V
	VIH5	Pin Group 6		0.8·EVDD		EVDD	V
Low level input voltage	VIL1	Pin Group 1B		EVSS		0.3·EVDD	V
	VIL2	Pin Group 1D		EVSS		0.4·EVDD	V
		Pin Group 2D		EVSS		0.4·EVDD	V
	VIL3	Pin Group 2A		EVSS		0.3·EVDD	V
	VIL4	Pin Group 4		AVSS		0.3·AVREF0	V
	VIL5	Pin Group 6		EVSS		0.2·EVDD	V
Input hysteresis	VHYS1	Pin Group 1B	Center point at 0.5 x EVDD Note3		0.267 x EVDD - 0.51V		V
	VHYS2	Pin Group 1D	Center point at 0.6 x EVDD Note3		0.192 x EVDD - 0.31V		V
		Pin Group 2D	Center point at 0.6 x EVDD Note3		0.192 x EVDD - 0.31V		V
	VHYS5	Pin Group 6	Center point at 0.5 x EVDD Note3		0.535 x EVDD - 0.9V		V
High level output voltage Note2	VOH1	Pin Group 1x, 2x	IOH=-1.0mA	EVDD-1.0		EVDD	V
			IOH=-100uA	EVDD-0.5		EVDD	V
	VOH3	Pin Group 4	IOH=-1.0mA	AVREF0-1.0		AVREF0	V
			IOH=-100uA	AVREF0-0.5		AVREF0	V
Low level output voltage Note2	VOL1	Pin Group 1x, 2x	IOL=1.0mA	0		0.4	V
		P914, 915	IOL=3.0mA				
	VOL3	Pin Group 4	IOL=1.0mA	0		0.4	V
Software pull-up resistor	R1	VI=0V		10	30	100	kΩ
Software Note1 pull-down resistor	R2	VI=VDD		10	30	100	kΩ

Remark: The characteristics of the dual-function pins are the same as those of the port pins unless otherwise specified.

Notes: 1. $\overline{\text{DRST}}$ terminal only. (Control register is OCDM)

2. Total IOH/IOL max is 20mA/-20mA each power supply line (EVDD and AVREF0). AVREF0 IOH/IOL current is excluding ADC0 current IAREF0.

3. Typical value. Not tested and guaranteed

Mode	Symbol	Condition			TYP.	MAX.	Unit
IDLE1 mode	IDD3	Peripheral (TAA, UARTD) running	PLL: OFF 4MHz≤f_{xx}≤16MHz Note7	f_{xx}=5MHz f_X=5MHz	1.4	2.2	mA
				f_{xx}=12MHz f_X=12MHz	2.0	3.1	mA
				f_{xx}=16MHz f_X=16MHz	2.4	3.6	mA
			fxx=8MHz, 8MHz Internal-OSC Note3		1.5	2.3	mA
		All peripherals stopped	PLL: OFF 4MHz≤f_{xx}≤16MHz Note7	f_{xx}=5MHz f_X=5MHz	1.2		mA
				f_{xx}=12MHz f_X=12MHz	1.4		mA
				f_{xx}=16MHz f_X=16MHz	1.6		mA
			fxx=8MHz, 8MHz Internal-OSC Note3		1.1		mA
IDLE2 mode	IDD4	PLL: OFF 4MHz≤f_{xx}≤16MHz Note7		f_{xx}=5MHz f_X=5MHz	0.4	0.7	mA
				f_{xx}=12MHz f_X=12MHz	0.7	1.0	mA
				f_{xx}=16MHz f_X=16MHz	0.8	1.2	mA
		fxx=8MHz, 8MHz Internal-OSC Note3			0.2	0.5	mA
SUB operating mode Note5	IDD5	Crystal resonator (fxt = 32,768kHz)			80	400	μA
		RC resonator (fxt=20kHz) Note6			80	400	μA
		240 kHz Internal-OSC (SubOSC stopped)			220	1000	μA
SubIDLE mode Note3,5	IDD6	Crystal resonator (fxt = 32,768kHz)			20	190	μA
		RC resonator (fxt=20kHz) Note6			40	220	μA
		240kHz Internal-OSC (SubOSC stopped)			25	180	μA
STOP mode Note3,4	IDD7	POC stop	240kHz Internal-OSC stop		7.5	80	μA
			240kHz Internal-OSC working		15.5	95	μA
		POC work	240kHz Internal-OSC stop		10.5	85	μA
			240kHz Internal-OSC working		18.5	100	μA

(b) Calculation formulas

(Ta = -40 to +85°C, C=4.7uF,
VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V[Note1])

Mode	Symbol	Condition			TYP. [Note9]	MAX. [Note9]	Unit
Operating mode [Note2,8]	IDD1	All peripherals running	Peripheral: f_{xx} PRSI option: 0	PLL: ON 12MHz≤f_{xx}≤32MHz	0.98·f_{xx}+7.1	1.18·f_{xx}+13.6	mA
				PLL: OFF 4MHz≤f_{xx}≤16MHz	0.98·f_{xx}+5.5	1.18·f_{xx}+10.6	mA
			Peripheral: f_{xx}/2 PRSI option: 1	PLL: ON 12MHz≤f_{xx}≤32MHz	0.90·f_{xx}+6.0	1.08·f_{xx}+12.2	mA
		All peripherals stopped	Peripheral: ff_{xx}- PRSI option: 0	PLL: ON 12MHz≤f_{xx}≤32MHz	0.81·f_{xx}+6.2		mA
				PLL: OFF 4MHz≤f_{xx}≤16MHz	0.83·f_{xx}+5.7		mA
			Peripheral: f_{xx}/2 PRSI option: 1	PLL: ON 12MHz≤f_{xx}≤32MHz	0.79·f_{xx}+6.2		mA
HALT mode [Note8]	IDD2	All peripherals running	Peripheral: ff_{xx}- PRSI option: 0	PLL: ON 16MHz≤f_{xx}≤32MHz	0.67·f_{xx}+3.0	0.90*f_{xx}+5.4	mA
				PLL: OFF 4MHz≤f_{xx}≤16MHz	0.70·f_{xx}+1.9	1.00*f_{xx}+4.0	mA
			Peripheral: f_{xx}/2 PRSI option: 1	PLL: ON 16MHz≤f_{xx}≤32MHz	0.55·f_{xx}+2.8	0.64*f_{xx}+7.0	mA
		All peripherals stopped	Peripheral: f_{xx} PRSI option: 0	PLL: ON 16MHz≤f_{xx}≤32MHz	0.46·f_{xx}+2.8		mA
				PLL: OFF 4MHz≤f_{xx}≤16MHz	0.44·f_{xx}+1.6		mA
			Peripheral: f_{xx}/2 PRSI option: 1	PLL: ON 16MHz≤f_{xx}≤32MHz	0.46·f_{xx}+1.8		mA
IDLE1 mode	IDD3	Peripheral (TAA, UARTD) running		PLL: OFF 4MHz≤f_{xx}≤16MHz [Note7]	0.092·f_{xx}+0.90	0.128·f_{xx}+ 1.35	mA
		All peripherals stopped			0.035·f_{xx}+1.01		mA
IDLE2 mode	IDD4	PLL: OFF 4MHz ≤f_{xx}≤16MHz [Note7]			0.037·f_{xx}+0.21	0.049·f_{xx}+ 0.43	mA

Notes: 1. VDD and EVDD total current. (Ports are stopped).
AVREF0 current, port buffer current (including a current flowing in the on-chip pull-up/pull-down resistor) are not included.

2. The code flash and the data flash are in read mode.
When the device is in programming mode (Self-programming mode or data flash programming mode), the current value (MAX. value) adds by the following value:

- Self-programming mode:
  + In case of PLL OFF: 7-(0.33*fxx+0.1) [mA]
  + In case of PLL ON: 7-(0.18*fxx+3.0) [mA]
- Data flash programming mode:
  + 7-(0.18*fxx/4+3.0) [mA]

3. Main OSC is stopped.
4. Do not use SubOSC.
5. POC is working. 240kHz Internal-OSC is working. 8MHz Internal-OSC is stopped.
6. RC Oscillation frequency is typ.40kHz. This clock is divided by 2 internally.
7. 8MHz Internal-OSC is stopped
8. When the SSCG is running, the current value adds typ +2.5mA, max +4mA.
9. The formulas are for reference only. Not all possible values for f_{xx} are tested in the outgoing device inspection.

3.5.2 Sub System Clock Oscillation Circuit Characteristics

(Ta = -40 to +110°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

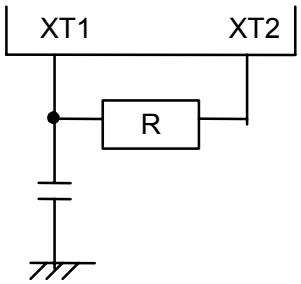
Resonator	Recommended Circuit	Parameter	Conditions	MIN.	TYP.	MAX.	Unit
RC resonator	Refer to Figure 2	Oscillator frequency Note1,4	R=390KΩ ±5% Note3, C=47pF±10% Note3	25	40	55	kHz
		Oscillation stabilization time Note2				100	μs

Notes: 1. Indicates only oscillation circuit characteristics. Refer to "AC Characteristic" for cpu operation clock.

2. Time required to stabilize oscillation after VDD reaches oscillator voltage range min. 3.3V

3. In order to avoid the influence of wiring capacity, shorten wiring as much as possible.

4. RC Oscillation frequency is typ. 40kHz. This clock is divided by 2 internally. In case of RC Oscillator, internal system clock frequency(fxt) is min. 12.5kHz, typ. 20kHz, max. 27.5kHz.



3.5.3 Internal-OSC Characteristics

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.5.4 PLL Characteristics

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.5.5 SSCG Characteristics

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.6.3 Power supply current (A1-grade)

3.6.3.1 FF3 128KB μPD70F3372, FF3 256KB μPD70F3373

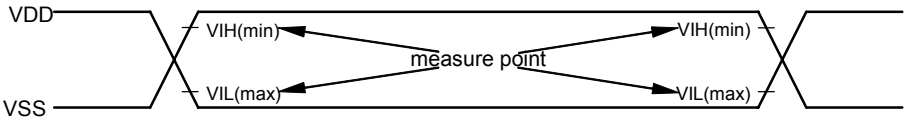
(a) Absolute values

(Ta = -40 to +110°C, C=4.7uF,
VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V[Note1])

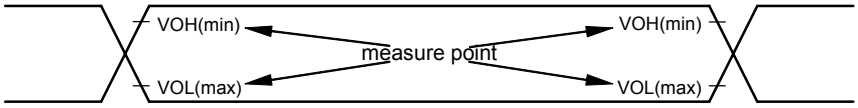
Mode	Symbol	Condition				TYP.	MAX.	Unit
Operating mode Note2,8	IDD1	All peripherals running	Peripheral: f_{xx} PRSI option: 0	PLL: ON 12MHz≤f_{xx}≤32MHz	f_{xx}=20MHz f_X=5MHz	27	37	mA
					f_{xx}=32MHz f_X=16MHz	39	51	mA
				PLL: OFF 4MHz≤f_{xx}≤16MHz	f_{xx}=8MHz 8MHz Internal-OSC Note3	13	20	mA
					f_{xx}=16MHz f_X=16MHz	21	30	mA
			Peripheral: f_{xx}/2 PRSI option: 1	PLL: ON 12MHz≤f_{xx}≤32MHz	f_{xx}=32MHz f_X=16MHz	35	47	mA
		All peripherals stopped	Peripheral: f_{xx} PRSI option: 0	PLL: ON 12MHz≤f_{xx}≤32MHz	f_{xx}=20MHz f_X=5MHz	22		mA
					f_{xx}=32MHz f_X=16MHz	32		mA
				PLL: OFF 4MHz≤f_{xx}≤16MHz	f_{xx}=8MHz 8MHz Internal-OSC Note3	12		mA
					f_{xx}=16MHz f_X=16MHz	19		mA
			Peripheral: f_{xx}/2 PRSI option: 1	PLL: ON 12MHz≤f_{xx}≤32MHz	f_{xx}=32MHz f_X=16MHz	31		mA
HALT mode Note8	IDD2	All peripherals running	Peripheral: f_{xx} PRSI option: 0	PLL: ON 12MHz≤f_{xx}≤32MHz	f_{xx}=20MHz f_X=5MHz	16	23	mA
					f_{xx}=32MHz f_X=16MHz	24	34	mA
				PLL: OFF 4MHz≤f_{xx}≤16MHz	f_{xx}=8MHz 8MHz Internal-OSC Note3	8	12	mA
					f_{xx}=16MHz f_X=16MHz	13	20	mA
			Peripheral: f_{xx}/2 PRSI option: 1	PLL: ON 12MHz≤f_{xx}≤32MHz	f_{xx}=32MHz f_X=16MHz	20	27	mA
		All peripherals stopped	Peripheral: f_{xx} PRSI option: 0	PLL: ON 12MHz≤f_{xx}≤32MHz	f_{xx}=20MHz f_X=5MHz	12		mA
					f_{xx}=32MHz f_X=16MHz	18		mA
				PLL: OFF 4MHz≤f_{xx}≤16MHz	f_{xx}=8MHz 8MHz Internal-OSC Note3	5		mA
					f_{xx}=16MHz f_X=16MHz	9		mA
			Peripheral: f_{xx}/2 PRSI option: 1	PLL: ON 12MHz≤f_{xx}≤32MHz	f_{xx}=32MHz f_X=16MHz	17		mA

3.7 AC Characteristics

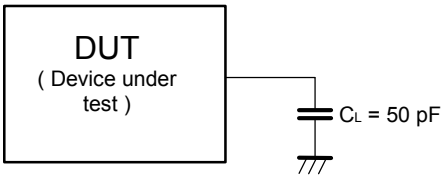
AC test Input measurement points (VDD, AVREF0, EVDD)



AC test output measurement points



Load conditions



Caution: If the load capacitance exceeds 50pF due to the circuit configuration, reduce the load capacitance of the device to 50pF or less by inserting a buffer or by some other means.

3.7.1 CLKOUT Output Timing

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.7.2 RESET, Interrupt, ADTRG Timing

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.7.3 Key Return Timing

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.7.4 Timer Timing

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.7.5 CSI Timing

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.7.6 UART Timing

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.7.7 IIC Timing

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.7.8 CAN Timing

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.8 A/D Converter

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.9 POC

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.10 LVI

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.11 RAM Retention Flag

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.12 Data Retention Characteristics

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

3.13 Flash Memory Programming Characteristics

(a) Basic Characteristics

(C=4.7uF, VDD = EVDD, AVREF0 = 3.5 to 5.5V, VSS = EVSS = AVSS = 0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Operation frequency	fCPU		4		32	MHz
Supply voltage	VDD		3.3		5.5	V
Number of rewrites	CWRT1	Code Flash	1000			count
		Data Flash				
	CWRT2		10000			
High level input voltage	VIH	FLMD0	0.8EVDD		EVDD	V
Low level input voltage	VIL	FLMD0	EVSS		0.2EVDD	V
Programming temperature	tPRG		-40		+110	°C
Data retention		Code Flash			15[Note1]	year
		Data Flash				
					5[Note2]	

Notes: 1. Under the condition of CWRT1
2. Under the condition of CWRT2

Remark: The initial write when the product is shipped, any erase → write set of operations, or any programming operation is counted as one rewrite.
Example: P: Program(write) E: Erase
Product is shipped → P → E → P → E → P : Rewrite count: 3
Product is shipped → E → P → E → P → E → P : Rewrite count: 3

(b) Serial Writing Operation Characteristics

Specification is identical to that from (A)-Grade except Ta=-40 to +110°C.

4.5.2 Sub System Clock Oscillation Circuit Characteristics

Specification is identical to that from (A1)-Grade except Ta=-40 to +125°C.

4.5.3 Internal-OSC Characteristics

Specification is identical to that from (A)-Grade except Ta=-40 to +125°C.

4.5.4 PLL Characteristics

(Ta = -40 to +125°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input frequency	fx		4		16	MHz
	f_{PLLI}	Note	3		6	MHz
Output frequency	fxx	≤256KB product	12		24	MHz
Lock time	tPLL	After VDD reaches voltage range min. 3.3V			800	μs
Output period jitter Note2	tpj	Peak to peak			2.0	ns

Notes: 1. The input of the PLL (f_{PLLI}) can be set to f_X, $f_X/2$, or $f_X/4$. The divider is set through an option byte in the code flash memory.

2. Not tested in production.

4.5.5 SSCG Characteristics

(Ta = -40 to +125°C, C=4.7uF, VDD = EVDD = 3.3 to 5.5V, AVREF0 = 3.3 to 5.5V, VSS = EVSS = AVSS = 0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input frequency	fx		4		16	MHz
Output frequency	fxx	≤256KB product	12		24	MHz
Lock time	t_{SSCG}	After VDD reaches voltage range min. 3.3V			1000	μs

Remark: The SSCG MAX output frequency indicates the case without modulation. If modulation is enabled the average SSCG frequency has to be set lower. The maximum achievable average operating frequency with modulation is as follows:

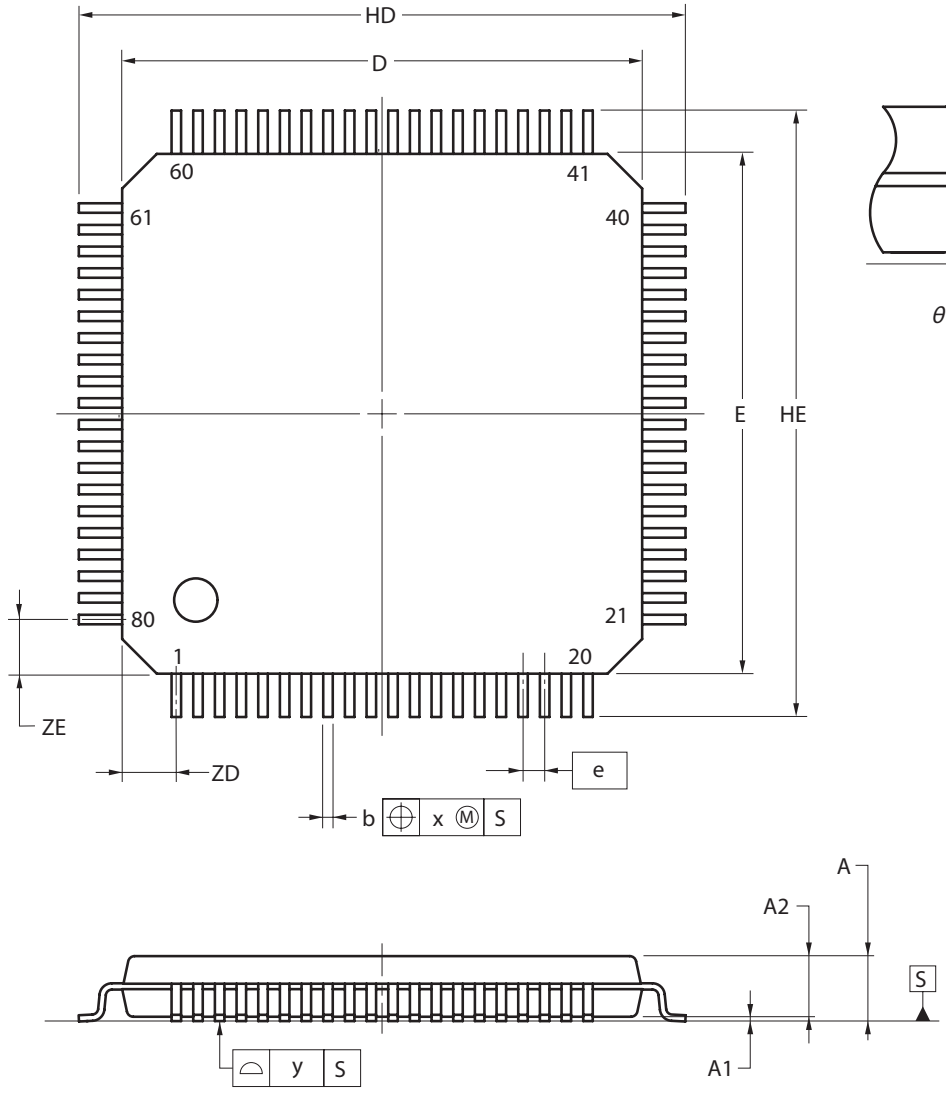
SSCG input clock divider selector SFC1[6:4]	Percent modulation		Maximum average operating frequency		Unit
	TYP	MAX	≤256KB product		
000B	± 0.5%	± 2.0%	23.5		MHz
001B	± 1.0%	± 2.5%	23.4		
010B	± 2.0%	± 4.0%	23.0		
011B	± 3.0%	± 6.0%	22.6		
100B	± 4.0%	± 8.0%	22.1		
101B	± 5.0%	± 10.0%	21.6		

Mode	Symbol	Condition		TYP.	MAX.	Unit
IDLE2 mode	IDD4	PLL: OFF 4MHz≤f_{xx}≤16MHz Note7	f_{xx}=5MHz f_X=5MHz	0.4	1.1	mA
			f_{xx}=12MHz f_X=12MHz	0.7	1.5	mA
			f_{xx}=16MHz f_X=16MHz	0.8	1.7	mA
		fxx=8MHz, 8MHz Internal-OSC Note3		0.2	1.0	mA
SUB operating mode Note5	IDD5	RC resonator (fxt=20kHz) Note6		80	850	μA
		240 kHz Internal-OSC (SubOSC stopped)		220	1450	μA
SubIDLE mode Note3,5	IDD6	RC resonator (fxt=20kHz) Note6		40	670	μA
		240kHz Internal-OSC (SubOSC stopped)		25	630	μA
STOP mode Note3,4	IDD7	POC stop	240kHz Internal-OSC stop	7.5	530	μA
			240kHz Internal-OSC working	15.5	545	μA
		POC work	240kHz Internal-OSC stop	10.5	535	μA
			240kHz Internal-OSC working	18.5	550	μA

5. Package

5.1 Package Dimension

80-PIN PLASTIC LQFP (FINE PITCH) (12x12)



(UNIT:mm)

ITEM	DIMENSIONS
D	12.00 ±0.20
E	12.00 ±0.20
HD	14.00 ±0.20
HE	14.00 ±0.20
A	1.60 MAX.
A1	0.10 ±0.05
A2	1.40 ±0.05
A3	0.25
b	$0.20^{+0.07}_{-0.03}$
c	$0.125^{+0.075}_{-0.025}$
L	0.50
Lp	0.60 ±0.15
L1	1.00 ±0.20
θ	$3^{\circ}{}^{+5^{\circ}}_{-3^{\circ}}$
e	0.50
x	0.08
y	0.08
ZD	1.25
ZE	1.25

P80GK-50-GAK

NOTE
Each lead centerline is located within 0.08 mm of its true position at maximum material condition.

6. Change History

The following revision list shows all major changes of the different datasheet versions.

Version	Chapter	Comment
V1.0		Initial release
V1.1	2.13 3.13	Removed ’Target Specification’ for (A)- and (A1)-Grade Devices in the Flash Programming specifications.
		Changed specification of ’Number of rewrites’ from MAX. to MIN.
	2.8 4.8	Remove Caution (Described in User’s Manual)
V1.2		Changed document status from ’Preliminary Datasheet’ to ’Datasheet’.
	4.13	Removed ’Target Specification’ for (A2)-Grade Devices in the Flash Programming specifications.

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