Welcome to E-XFL.COM

What is "Embedded - Microcontrollers"?

"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, EBI/EMI, I²C, LINbus, UART/USART
Peripherals	DMA, LVD, POR, PWM, WDT
Number of I/O	128
Program Memory Size	256KB (256K x 8)
Program Memory Type	FLASH
EEPROM Size	32K x 8
RAM Size	16K x 8
Voltage - Supply (Vcc/Vdd)	3.3V ~ 5.5V
Data Converters	A/D 24x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	144-LQFP
Supplier Device Package	144-LQFP (20x20)
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/upd70f3378m1gja-gae-ax

Legal Notes

- The information in this document is current as of January 2007. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may appear in this document.
- NEC Electronics does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC Electronics products listed in this document or any other liability arising from the use of such NEC Electronics products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Electronics or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC Electronics assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC Electronics endeavors to enhance the quality, reliability and safety of NEC Electronics products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC Electronics products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.
- NEC Electronics products are classified into the following three quality grades: “Standard”, “Special” and “Specific”.

  The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated “quality assurance program” for a specific application. The recommended applications of NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics product before using it in a particular application.

  "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.

  "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).

  "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

  The quality grade of NEC Electronics products is “Standard” unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact NEC Electronics sales representative in advance to determine NEC Electronics 's willingness to support a given application.

Notes: 1. "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.

2. "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).

3. SuperFlash® is a registered trademark of Silicon Storage Technology, Inc. in several countries including the United States and Japan. This product uses SuperFlash® technology licensed from Silicon Storage Technology, Inc.

Regional Information

Some information contained in this document may vary from country to country. Before using any NEC product in your application, please contact the NEC office in your country to obtain a list of authorized representatives and distributors. They will verify:

- Device availability
- Ordering information
- Product release schedule
- Availability of related technical literature
- Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)
- Network requirements

In addition, trademarks, registered trademarks, export restrictions, and other legal issues may also vary from country to country.

For further information, please contact:

NEC Electronics Corporation
1753, Shimonumabe, Nakahara-ku,
Kawasaki, Kanagawa 211-8668,
Japan
Tel: 044-435-5111
http://www.necel.com/

[America]

NEC Electronics America, Inc.
2880 Scott Blvd.
Santa Clara, CA 95050-2554, U.S.A.
Tel: 408-588-6000
800-366-9782
http://www.am.necel.com/

[Europe]

NEC Electronics (Europe) GmbH
Arcadiastrasse 10
40472 Düsseldorf, Germany
Tel: 0211-65030
http://www.eu.necel.com/

Hanover Office
Podbielski Strasse 166 B
30177 Hanover
Tel: 0 511 33 40 2-0

Munich Office
Werner-Eckert-Strasse 9
81829 München
Tel: 0 89 92 10 03-0

Stuttgart Office
Industriestrasse 3
70565 Stuttgart
Tel: 0 711 99 01 0-0

United Kingdom Branch
Cygnus House, Sunrise Parkway
Linford Wood, Milton Keynes
MK14 6NP, U.K.
Tel: 01908-691-133

Succursale Française
9, rue Paul Dautier, B.P. 52180
78142 Velizy-Villacoublay Cédex
France
Tel: 01-3067-5800

Sucursal en España
Juan Esplandiu, 15
28007 Madrid, Spain
Tel: 091-504-2787

Tyskland Filial
Täby Centrum
Entrance S (7th floor)
18322 Täby, Sweden
Tel: 08 638 72 00

Filiale Italiana
Via Fabio Filzi, 25/A
20124 Milano, Italy
Tel: 02-667541

Branch The Netherlands
Steijgerweg 6
5616 HS Eindhoven
The Netherlands
Tel: 040 265 40 10

[Asia & Oceania]

NEC Electronics (China) Co., Ltd
7th Floor, Quantum Plaza, No. 27 ZhiChunLu Haidian
District, Beijing 100083, P.R.China
TEL: 010-8235-1155
http://www.cn.necel.com/

NEC Electronics Shanghai Ltd.
Room 2509-2510, Bank of China Tower,
200 Yincheng Road Central,
Pudong New Area, Shanghai P.R. China P.C:200120
Tel: 021-5888-5400
http://www.cn.necel.com/

NEC Electronics Hong Kong Ltd.
12/F., Cityplaza 4,
12 Taikoo Wan Road, Hong Kong
Tel: 2886-9318
http://www.hk.necel.com/

Seoul Branch
11F., Samik Lavied'or Bldg., 720-2,
Yeoksam-Dong, Kangnam-Ku,
Seoul, 135-080, Korea
Tel: 02-558-3737

NEC Electronics Taiwan Ltd.
7F, No. 363 Fu Shing North Road
Taipei, Taiwan, R. O. C.
Tel: 02-8175-9600

NEC Electronics Singapore Pte. Ltd.
238A Thomson Road,
#12-08 Novena Square,
Singapore 307684
Tel: 6253-8311
http://www.sg.necel.com/

G06.6-1A

Table of Contents

2. Electrical Specifications of (A)-Grade

This product has to be used only under the conditions of VDD=EVDD. Operation is not ensured at the time of using this product except this condition.

2.1 Absolute Maximum Ratings

Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Conditions		Rating	Unit
Supply voltage	VDD	VDD=EVDD,		-0.5 to +6.5	V
	EVDD	VDD=EVDD		-0.5 to +6.5	V
	AVREF0			-0.5 to +6.5	V
	VSS	VSS=EVSS=AVSS		-0.5 to +0.5	V
	EVSS	VSS=EVSS=AVSS		-0.5 to +0.5	V
	AVSS	VSS=EVSS=AVSS		-0.5 to +0.5	V
Input voltage	VI1	Pin Group 1x, 2x, 6		-0.5 to EVDD+0.5 Note1	V
	VI3	Pin Group 7		-0.5 to VRO+0.5 Note1	V
Analog input voltage	VIAN	Pin Group 4		-0.5 to AVREF0+0.5 Note1	V
High level output current	IOH	Pin Group 1x, 2x	1 pin	-4	mA
			Total	-50	mA
		Pin Group 4	1 pin	-4	mA
			Total	-20 Note2	mA
Low level output current	IOL	Pin Group 1x, 2x	1 pin	4	mA
			Total	50	mA
		Pin Group 4	1 pin	4	mA
			Total	20 Note2	mA
Operating ambient temperature	Ta	Normal operating mode		-40 to +85	°C
		Flash programming mode		-40 to +85	
Storage temperature	Tstg			-40 to +125	°C

Remarks: 1. The characteristics of the dual-function pins are the same as those of the port pins unless otherwise specified

Notes: 1. Be sure not to exceed the absolute maximum ratings (Max. value) of each supply voltage.
2. Excluding ADC IAREF0 current.

2.2 Capacities

(Ta = 25°C, VDD = EVDD = AVREF0 = VSS = EVSS = AVSS = 0V)

Parameter	**Symbol**	Conditions	MIN.	TYP.	MAX.	Unit
Input/output capacitance	CIO	f=1MHz, Not measured pins is 0V.			10	pF

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.

2.6.2 PIN leakage current

(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
High level input leakage current	ILIH1	VI=VDD	Analog pins			0.2	uA
			Other pins Note1			0.5	
Low level input leakage current	ILIL1	VI=0V	Analog pins			-0.2	
			Other pins Note1			-0.5	
High level output leakage current	ILOH1	VO=VDD	Analog pins			0.2	
			Other pins			0.5	
Low level output leakage current	ILOL1	VO=0V	Analog pins			-0.2	
			Other pins			-0.5	

Notes: 1. The input leakage current of FLMD0 is as follows:
High level input leakage current : 2.0uA
Low level input leakage current : -2.0uA

2.6.3 Power supply current (A-grade)

2.6.3.1 FF3 128KB μPD70F3372, FF3 256KB μPD70F3373

(a) Absolute values

(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.	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

(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.

2.8 A/D Converter

(Ta = -40 to +85°C, C=4.7uF, VDD = EVDD = 3.5 to 5.5V, AVREF0 = 4.0 to 5.5V, VSS = EVSS = AVSS = 0V)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Resolution					10	bit
Overall error[Note1]		4.0V≤AVREF0<5.5V		±0.15	±0.3	%FSR
Conversion time	tCONV		3.10		16	μs
Stabilization time	tSTA	After ADA0PS bit = 0 -> 1	2			μs
Recovery time for power down mode	tDPU		1			μs
Zero-scale error[Note1]	ZSE				±0.3	%FSR
Full-scale error[Note1]	FSE				±0.3	%FSR
Integral non-liniearity error[Note2]	INL				±2.5	LSB
Differential non-liniearity error[Note2]	DNL				±1.5	LSB
Analog input voltage	VIAN		AVSS		AVREF0	V
Analog input equivalent circuit capacitance [Note3,4]	CINA				6.19	pF
Analog input equivalent circuit resistance [Note3]	RINA				2.55	kΩ
AVREF0 current	IAREF0	A/D operating		4	7	mA
		A/D operation stop		1	10	uA
Conversion rusult when using Diagnostic function		AVREF0 conversion	3FC		3FF	HEX
		AVSS conversion	000		003	HEX

Notes: 1. Overall error excluding quantization error (±0.05%FSE). It is indicated as a ratio to the full-scale value.

2. Excluding quantization error (±1/2 LSB)

3. Not tested in production.

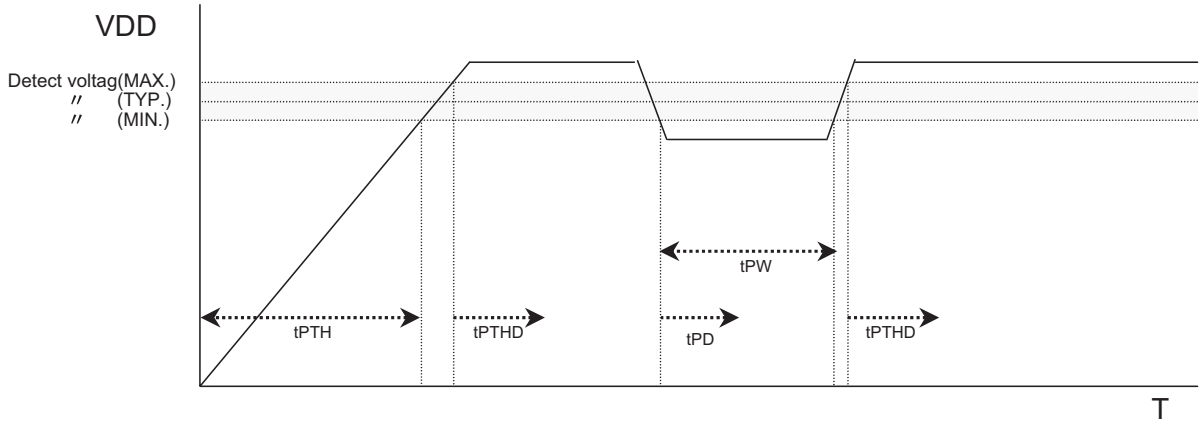
4. Does not include input/output capacitance CIO

2.9 POC

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

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Detect voltage	VPOC0		3.3	3.5	3.7	V
Supply voltage rise time	tPTH	From VDD=0V to VDD=3.3V	0.002			ms
Response time1 Note1	tPTHD	In case of power on. After VDD reaches 3.7V.			2.0	ms
Response time2 Note2	tPD	In case of power off. After VDD drop 3.3V.		0.2	1.0	ms
VDD minimum width	tPW		0.2			ms

Notes: 1. From detect voltage to release reset signal
2. From detect voltage to occurrence of reset signal



Note: POC is available only in M2 devices. Refer to 'Ordering information' in the V850ES/Fx3 User's Manual.

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)

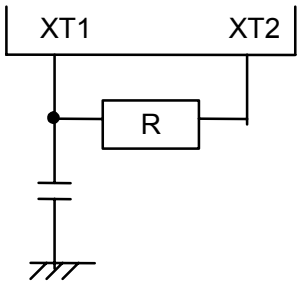
Resonator	Recommended Circuit	Parameter	Conditions	MIN.	TYP.	MAX.	Unit
RC resonator	Refer to Figure 2	Oscillator frequency Note1,4	R=390KΩ ±5% Note3, C=47pF±10% Note3	25	40	55	kHz
		Oscillation stabilization time Note2				100	μs

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.

3.6.2 PIN leakage current

(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)

Parameter	Symbol	Conditions	MIN.		TYP.	MAX.	Unit
High level input leakage current	ILIH1	VI=VDD	Analog pins			0.4	uA
			Other pins Note1			0.8	
Low level input leakage current	ILIL1	VI=0V	Analog pins			-0.4	
			Other pins Note1			-0.8	
High level output leakage current	ILOH1	VO=VDD	Analog pins			0.4	
			Other pins			0.8	
Low level output leakage current	ILOL1	VO=0V	Analog pins			-0.4	
			Other pins			-0.8	

Notes: 1. The input leakage current of FLMD0 is as follows:
High level input leakage current : 4.0uA
Low level input leakage current : -4.0uA

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	2.5	mA
				f_{xx}=12MHz f_x=12MHz	2.0	3.4	mA
				f_{xx}=16MHz f_x=16MHz	2.4	3.9	mA
			fxx=8MHz, 8MHz Internal-OSC Note3		1.5	2.6	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	0.9	mA
				f_{xx}=12MHz f_x=12MHz	0.7	1.2	mA
				f_{xx}=16MHz f_x=16MHz	0.8	1.4	mA
		fxx=8MHz, 8MHz Internal-OSC Note3			0.2	0.7	mA
SUB operating mode Note5	IDD5	RC resonator (fxt=20kHz) Note6			80	600	μA
		240 kHz Internal-OSC (SubOSC stopped)			220	1200	μA
SubIDLE mode Note3,	IDD6	RC resonator (fxt=20kHz) Note6			40	420	μA
		240kHz Internal-OSC (SubOSC stopped)			25	380	μA
STOP mode Note3,4	IDD7	POC stop	240kHz Internal-OSC stop		7.5	280	μA
			240kHz Internal-OSC working		15.5	295	μA
		POC work	240kHz Internal-OSC stop		10.5	285	μA
			240kHz Internal-OSC working		18.5	300	μA

(b) Calculation formulas

(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. [Note9]	MAX. [Note3]	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}+ 1.82	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}+ 0.63	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.

(b) Calculation formulas

(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[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}≤24MHz	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}≤24MHz	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}≤24MHz	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}≤24MHz	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}≤24MHz	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}≤24MHz	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}≤24MHz	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}≤24MHz	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}+ 2.12	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}+ 0.88	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:

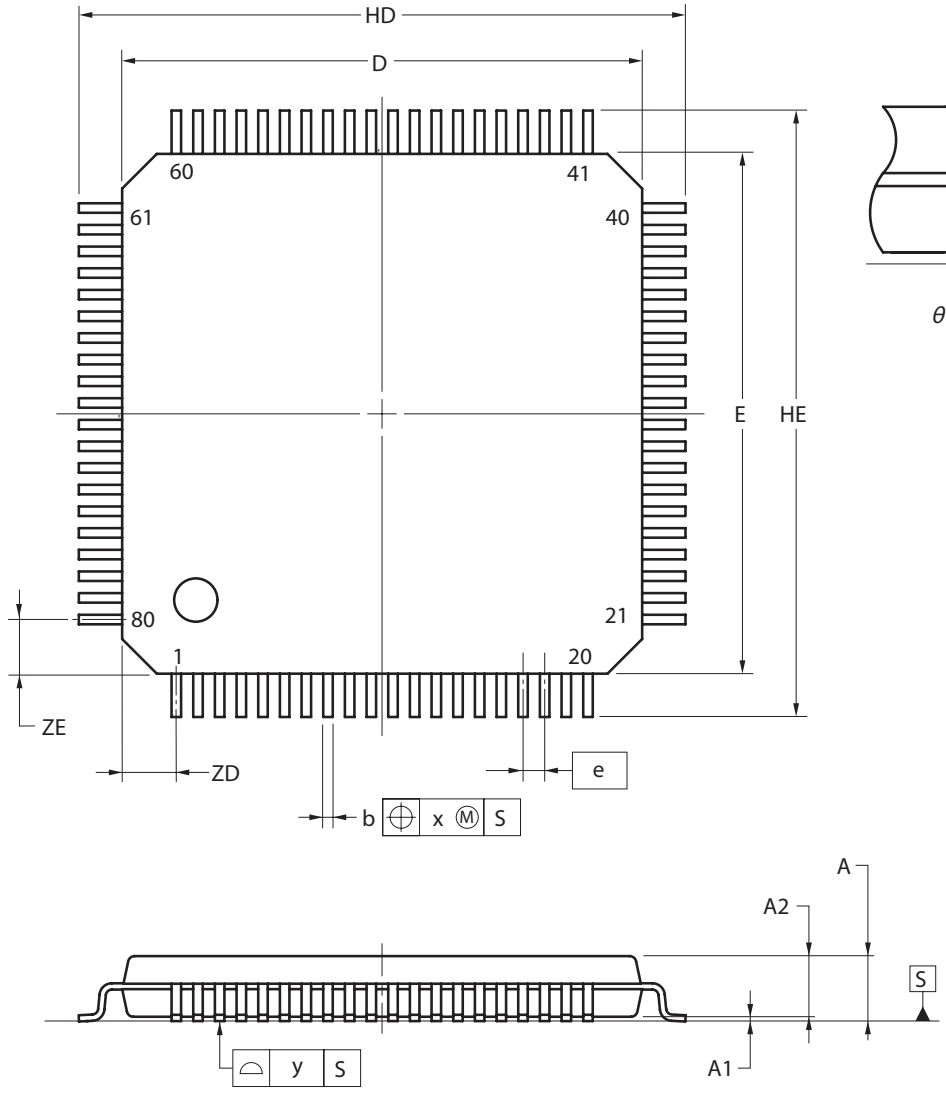
- Self-programming mode:
  + In case of PLL OFF: 7-(0.33*fxx+0.1) [mA]
  + In case of PLL ON: 7-(0.18*fxx+3.0) [mA]
- Data flash programming mode:
  + 7-(0.18*fxx/4+3.0) [mA]

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.

5. Package

5.1 Package Dimension

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



(UNIT:mm)

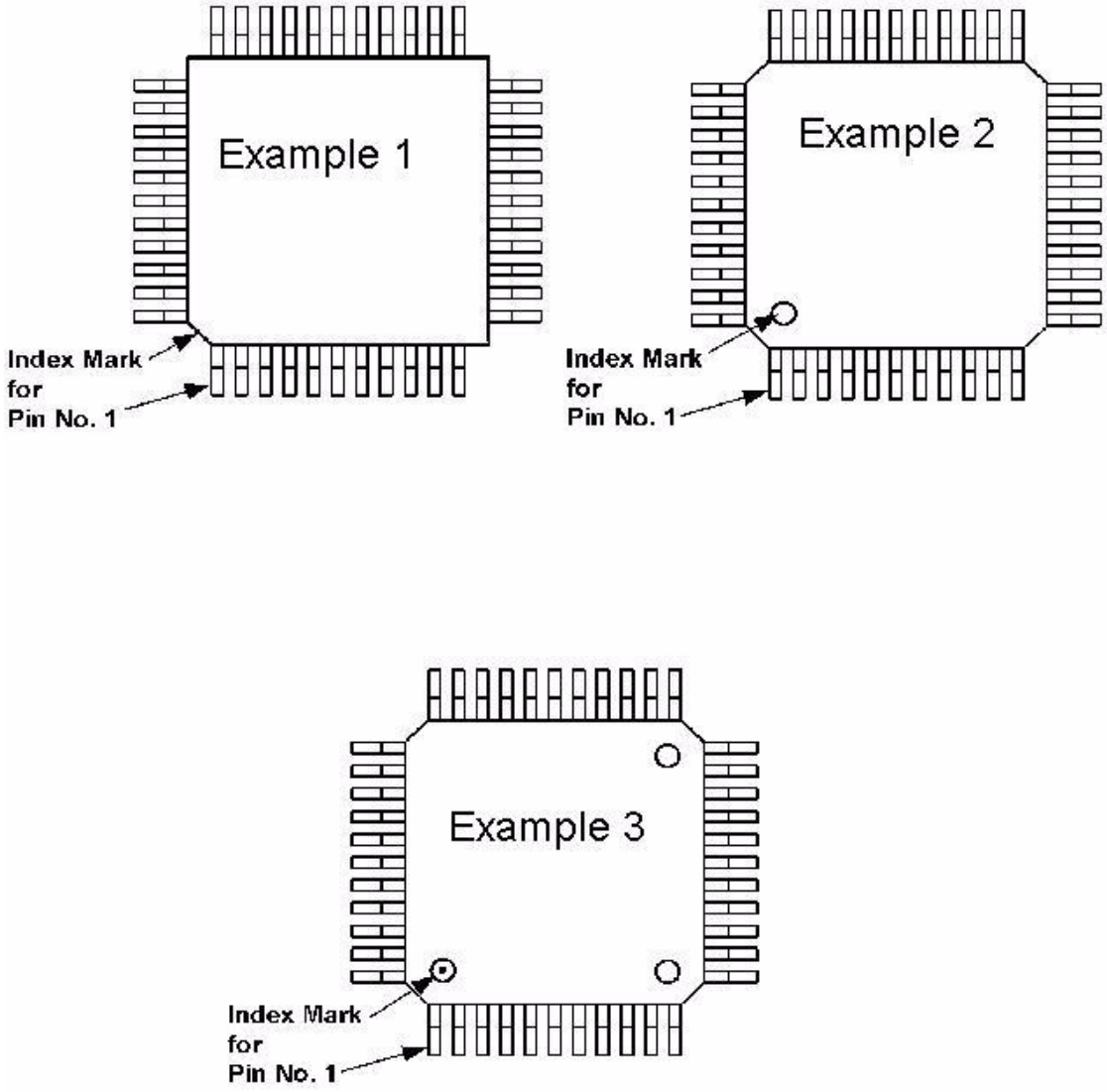
ITEM	DIMENSIONS
D	12.00 ±0.20
E	12.00 ±0.20
HD	14.00 ±0.20
HE	14.00 ±0.20
A	1.60 MAX.
A1	0.10 ±0.05
A2	1.40 ±0.05
A3	0.25
b	$0.20^{+0.07}_{-0.03}$
c	$0.125^{+0.075}_{-0.025}$
L	0.50
Lp	0.60 ±0.15
L1	1.00 ±0.20
θ	$3^{\circ}{}^{+5^{\circ}}_{-3^{\circ}}$
e	0.50
x	0.08
y	0.08
ZD	1.25
ZE	1.25

P80GK-50-GAK

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

5.2 Product Marking

5.2.1 Marking of pin 1 at a QFP (Quad Flat Package)



Example 1: The index mark for pin 1 is the beveled edge of the package

Example 2: The index mark for pin 1 is a round notch at one of the 4 edges. In this case, the shape of all edges is identical (usually beveled).

Example 3: For production reasons, two or more similar notches may be located at the top of the package. In such a case the index marker for pin 1 is a round notch with an additional mark in it.

Note: RoHS compliant devices have an additional dot at the top side. Do not mix it up with the marking for pin 1. For details see 5.2.2 "Identification of Lead-Free Products" on page 53.

NEC

Facsimile Message

From:

Name

Company

Tel. FAX

Address

Although NEC has taken all possible steps to ensure that the documentation supplied to our customers is complete, bug free and up-to-date, we readily accept that errors may occur. Despite all the care and precautions we've taken, you may encounter problems in the documentation. Please complete this form whenever you'd like to report errors or suggest improvements to us.

Thank you for your kind support.

North America
NEC Electronics America Inc.
Corporate Communications Dept.
Fax: 1-800-729-9288
1-408-588-6130

Europe
NEC Electronics (Europe) GmbH
Market Communication Dept.
Fax: +49(0)-211-6503-1344

Hong Kong, Philippines, Oceania
NEC Electronics Hong Kong Ltd.
Fax: +852-2886-9022/9044

Korea
NEC Electronics Hong Kong Ltd.
Seoul Branch
Fax: 02-528-4411

Taiwan
NEC Electronics Taiwan Ltd.
Fax: 02-2719-5951

Asian Nations except Philippines
NEC Electronics Singapore Pte. Ltd.
Fax: +65-6250-3583

Japan
NEC Semiconductor Technical Hotline
Fax: +81- 44-435-9608

I would like to report the following error/make the following suggestion:

Document title: _____

Document number: _____ Page number: _____

If possible, please fax the referenced page or drawing.

Document Rating	Excellent	Good	Acceptable	Poor
Clarity	☐	☐	☐	☐
Technical Accuracy	☐	☐	☐	☐
Organization	☐	☐	☐	☐

[MEMO]