To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

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GRADE A

MAEC TECHNICAL NEWS No. M16C-70-0104

Information of M16C/6N product type name change and restriction on the electrical characteristic.

Classification
Corrections and supplementary explnation of document
✔Notes
Knowhow
Others

Concerned Products
M16C/6N0 Group M306N0FGTFP
M16C/6N1 Group M306N1FGTFP

1. Change of M16C/6N product type name

The Flash MCU of M16C/6N group has been improved about power consumption and radiation noise characteristics.
Thereby, M16C/6N product type name changed as follows.

- M16C/6N Group
  - M16C/6N0 Group (CAN2ch)
    M306N**0**→ M306N**A**
  - M16C/6N1 Group (CAN1ch)
    M306N**1**→ M306N**B**

- M16C/6N Group product type name

OLD	NEW
M306N0FGTFP	M306NAFGTFP
M306N1FCTFP	M306NBFCTFP

2. Restriction on the electrical characteristic

The differences of electrical characteristic between M306N0FGTFP/M306NBFCTFP and M306NAFGTFP/M306NBFCTFP is the following.

(1)Electrical characteristics (refer to 2/4)
(2)A-D conversion characteristics (refer to 3/4)
(3)D-A conversion characteristics (refer to 4/4)

[M16C/6N Group Data Sheet Rev.A1]

Table 21-3. Electr ical characteristics(referenced to VCC=5V,VSS=0V,Ta=-40 to 85˚C, f(XIN)=16MHZ unless otherwise specified)

Symbol	Parameter		Measuring condition		Standard Min.	Standard Typ.	Standard Max.	Unit
V_{OH}	HIGH output voltage	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$, $P7_2$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$, $P9_0$, $P9_2$ to $P9_7$, $P10_0$ to $P10_7$	I_{OH}=-5mA		0.6Vcc			V
V_{OH}	HIGH output voltage	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$, $P7_2$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$, $P9_0$, $P9_2$ to $P9_7$, $P10_0$ to $P10_7$	I_{OH}=-200µA		0.9Vcc			V
V_{OH}	HIGH output voltage	X_{OUT}	HIGHPOWER	I_{OH}=-1mA	3.0			V
			LOWPOWER	I_{OH}=-0.5mA	3.0			
	HIGH output voltage	X_{COUT}	HIGHPOWER	With no load applied		3.0		V
			LOWPOWER	With no load applied		1.6		
V_{OL}	LOW output voltage	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$,$P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$, $P9_0$ to $P9_7$, $P10_0$ to $P10_7$	I_{OL}=5mA				0.4Vcc	V
V_{OL}	LOW output voltage	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$,$P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$, $P9_0$ to $P9_7$, $P10_0$ to $P10_7$	I_{OL}=200µA				0.1Vcc	V
V_{OL}	LOW output voltage	X_{OUT}	HIGHPOWER	I_{OL}=1mA			2.0	V
			LOWPOWER	I_{OL}=0.5mA			2.0	
	LOW output voltage	X_{COUT}	HIGHPOWER	With no load applied		0		V
			LOWPOWER	With no load applied		0		
V_{T+}-V_{T-}	Hysteresis	$\overline{HOLD}$,$\overline{RDY}$,$TA0_{IN}$ to $TA4_{IN}$, $TB0_{IN}$ to $TB2_{IN}$, $\overline{INT0}$ to $\overline{INT5}$, $\overline{ADTRG}$, $\overline{CTS0}$, $\overline{CTS1}$, $CLK0$, $CLK1$,$TA2_{OUT}$ to $TA4_{OUT}$,$\overline{NMI}$ $KI0$ to $KI3$			0.2		0.8	V
V_{T+}-V_{T-}	Hysteresis	$\overline{RESET}$,CNV_{SS},BYTE			0.2		1.8	V
I_{IH}	HIGH input current	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$, $P7_2$ to $P7_7$, $P8_0$ to $P8_7$, $P9_0$, $P9_2$ to $P9_7$, $P10_0$ to $P10_7$, X_{IN}, $\overline{RESET}$, CNVss, BYTE	V_I=5V				5.0	A
I_{IL}	LOW input current	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$,$P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$ to $P7_7$, $P8_0$ to $P8_7$, $P9_0$ to $P9_7$, $P10_0$ to $P10_7$, X_{IN}, $\overline{RESET}$, CNVss, BYTE	V_I=0V				-5.0	A
R_{PULLUP}	Pull-up resistance	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$ $P6_0$ to $P6_7$, $P7_0$,$P7_2$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$, $P9_0$, $P9_2$ to $P9_7$, $P10_0$ to $P10_7$	V_I=0V		30.0	50.0	167.0	k
R_{fXIN}	Feedback resistance X_{IN}					1.0		M
R_{fCXIN}	Feedback resistance X_{CIN}					6.0		M
V_{RAM}	RAM retention voltage		When clock is stopped		2.0			V
Icc	Power supply current		In single-chip mode, the output pins are open and other pins are Vss	f(X_{IN}) = 16MHz Square wave, no division		65.0		mA
				f(X_{CIN}) = 32kHz Square wave		200.0		A
				f(X_{CIN}) = 32kHz When WAIT instruction is executed		4.0		A
				Ta = 25˚C When clock is stopped			1.0	A
				Ta = 85˚C When clock is stopped			20.0	

[Restriction on the characteristic of M306N0FGTFP]

Table 21-3. Electr ical characteristics(referenced to VCC=5V,VSS=0V,Ta=-40 to 85˚C, f(XIN)=16MHZ unless otherwise specified)

Symbol	Parameter		Measuring condition		Standard Min.	Standard Typ.	Standard Max.	Unit
V_{OH}	HIGH output voltage	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$ $P6_0$ to $P6_7$, $P7_0$, $P7_2$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$, $P9_0$, $P9_2$ to $P9_7$, $P10_0$ to $P10_7$	I_{OH}=-5mA		0.6Vcc			V
V_{OH}	HIGH output voltage	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$ $P6_0$ to $P6_7$, $P7_0$, $P7_2$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$, $P9_0$, $P9_2$ to $P9_7$, $P10_0$ to $P10_7$	I_{OH}=-200µA		0.9Vcc			V
V_{OH}	HIGH output voltage	X_{OUT}	HIGHPOWER	I_{OH}=-1mA	3.0			V
			LOWPOWER	I_{OH}=-0.5mA	3.0			
	HIGH output voltage	X_{COUT}	HIGHPOWER	With no load applied		3.0		V
			LOWPOWER	With no load applied		1.6		
V_{OL}	LOW output voltage	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$, $P9_0$ to $P9_7$, $P10_0$ to $P10_7$	I_{OL}=5mA				0.4Vcc	V
V_{OL}	LOW output voltage	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$, $P9_0$ to $P9_7$, $P10_0$ to $P10_7$	I_{OL}=200µA				0.1Vcc	V
V_{OL}	LOW output voltage	X_{OUT}	HIGHPOWER	I_{OL}=1mA			2.0	V
			LOWPOWER	I_{OL}=0.5mA			2.0	
	LOW output voltage	X_{COUT}	HIGHPOWER	With no load applied		0		V
			LOWPOWER	With no load applied		0		
V_{T+}-V_{T-}	Hysteresis	$\overline{HOLD}$,$\overline{RDY}$,$TA0_{IN}$ to $TA4_{IN}$, $TB0_{IN}$ to $TB2_{IN}$, $\overline{INT0}$ to $\overline{INT5}$, $\overline{ADTRG}$, $\overline{CTS0}$, $\overline{CTS1}$, $CLK0$, $CLK1$,$TA2_{OUT}$ to $TA4_{OUT}$,$\overline{NMI}$ $KI0$ to $KI3$			0.2		0.8	V
V_{T+}-V_{T-}	Hysteresis	$\overline{RESET}$,CNV_{SS},BYTE			0.2		1.8	V
I_{IH}	HIGH input current	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$,$P7_2$ to $P7_7$, $P8_0$ to $P8_7$, $P9_0$, $P9_2$ to $P9_7$, $P10_0$ to $P10_7$ X_{IN}, $\overline{RESET}$, CNVss, BYTE	V_I=5V,When BCLK is 10MHz or less				5.0	A
I_{IL}	LOW input current	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$, $P6_0$ to $P6_7$, $P7_0$ to $P7_7$, $P8_0$ to $P8_7$, $P9_0$ to $P9_7$, $P10_0$ to $P10_7$, X_{IN}, $\overline{RESET}$, CNVss, BYTE	V_I=0V,When BCLK is 10MHz or less				- 5.0	A
R_{PULLUP}	Pull-up resistance	$P0_0$ to $P0_7$, $P1_0$ to $P1_7$, $P2_0$ to $P2_7$, $P3_0$ to $P3_7$, $P4_0$ to $P4_7$, $P5_0$ to $P5_7$ $P6_0$ to $P6_7$, $P7_0$, $P7_2$ to $P7_7$, $P8_0$ to $P8_4$, $P8_6$, $P8_7$,$P9_0$, $P9_2$ to $P9_7$, $P10_0$ to $P10_7$	V_I=0V		30.0	50.0	167.0	k
R_{fXIN}	Feedback resistance X_{IN}					1.0		M
R_{fCXIN}	Feedback resistance X_{CIN}					6.0		M
V_{RAM}	RAM retention voltage		When clock is stopped		2.0			V
Icc	Power supply current		In single-chip mode, the output pins are open and other pins are Vss	f(X_{IN}) = 16MHz Square wave, no division		65.0	105.0	mA
				f(X_{CIN}) = 32kHz Square wave, no division		200.0		A
				f(X_{CIN}) = 32kHz When WAIT instruction is executed		4.0		A
				Ta = 25˚C When clock is stopped			1.0	A
				Ta = 85˚C When clock is stopped			20.0	

( ) = Changed part

[M16C/6N Group Data Sheet Rev.A1]

Table 21-4. A-Dconversion characteristics (referenced to V_{CC}=AV_{CC}=V_{REF}=5V, V_{SS}=AV_{SS}=0V Ta=25˚C, f(X_{IN})=16MHz unless otherwrise specified)

Symbol	Parameter		Measuring condition		Standard Min.	Standard Typ.	Standard Max.	Unit
-	Resolution		V_{REF}=V_{CC}				10	Bits
-	Absolute accuracy	Sample & hold function disabled	V_{REF} =V_{CC}=5V				± 3	LSB
		Sample & hold function enabled (10bit)	V_{REF} = V_{CC}=5V	AN_0 to AN_7 input			± 3	LSB
				A00 to A07 input AN20 to AN27 input			± 3	LSB
				ANEX0, ANEX1 input, External op-amp connection mode			± 7	LSB
		Sample & hold function enabled (8bit)	V_{REF} = V_{CC} = 5V				± 2	LSB
R_{LADDER}	Ladder resistance		V_{REF} = V_{CC}		10		40	k
t_{CONV}	Conversion time (10bit)				3.3			s
t_{CONV}	Conversion time (8bit)				2.8			s
t_{SAMP}	Sampling time				0.3			s
V_{REF}	Reference voltage				2		V_{CC}	V
V_{IA}	Analog input voltage				0		V_{REF}	V

Note. Divide the frequency if f(Xin) exceeds10MHz, and make øAD equal to or lower than 10MHz.

[Restriction on the characteristic of M306N0FGTFP]

Table 21-4. A-Dconversion characteristics (referenced to V_{CC}=AV_{CC}=V_{REF}=5V, V_{SS}=AV_{SS}=0V Ta=40 to 85˚C, f(X_{IN})=16MHZ, f_{2AD}=8MHZ unless otherwrise specified)

Symbol	Parameter		Measuring condition (Note1)			Standard Min.	Standard Typ.	Standard Max.	Unit
-	Resolution		V_{REF} =V					10	Bits
-	Absolute accuracy	Sample & hold function enabled (10bit)	V_{REF} = V_{CC}=5V	AN_0 to AN_7 input	0 to 0.5V			± 10	LSB
				AN_{00} to AN_{07} input	0.5 to 1.25V			± 8	
				AN_{20} to AN_{27} input	1.25 to 3.85V			± 4	
					3.85 to 4.5V			± 8	
				ANEX0, 1 in put	4.5 to 5V			No guarantee value	
R_{LADDER}	Ladder resistance		V_{REF} =V_{CC}			10		40	k
t_{CONV}	Conversion time (10bit)					3.3			s
t_{SAMP}	Sampling time					0.3			s
V_{REF}	Reference voltage					4.2		V_{CC}	V
V_{IA}	Analog input voltage					0		5	V

Note 1. Assumed output impdance of 100 at test.

= Changed part

[M16C/6N Group Data Sheet Rev.A1]

Table 21-5. D-A con version characteristics (referenced to V_{CC}=5V, V_{SS}=AV_{SS}=0V, V_{REF}=5V, Ta=25˚C, f(X_{IN})=16MHZ unless otherwise specified)

Symbol	Parameter	Measuring condition	Standard			Unit
			Min.	Typ.	Max.	
-	Resolution				8	Bits
-	Absolute accuracy				1.0	%
t_{su}	Setup time				3	s
R_O	Output resistance		4	10	20	k
I_{VREF}	Reference power supply input current	(Note 1)			1.5	mA

Note 1. This applies when using one D-A converter,with the D-A register for the unused D-A converter set to "00 $_{16}$". The A-D converter's ladder resistance is not included. Also, when the V_{REF} is unconnected at the A-D control register,I_{VREF} is sent.

[Restriction on the characteristic of M306N0FGTFP]

Table 21-5. D-A conversion characteristics (referenced to V_{CC}=5V, V_{SS}=AV_{SS}=0V, V_{REF}=5V, Ta=40 to 85˚C, f(X_{IN})=16MHZ, f_{2AD}=8MHZ unless otherwise specified)

Symbol	Parameter	Measuring condition	Standard			Unit
			Min.	Typ.	Max.	
-	Resolution				8	Bits
-	Absolute accuracy (Note 1)				3.0	%
t_{su}	Setup time				3	s
R_O	Output resistance		4	10	20	k
I_{VREF}	Reference power supply input current	(Note 2)			1.5	mA

Note 1. Guarantee for absolute accuracy is up to maximum of ±3.0% (±150m [V]) according to analog output voltage characteristic shown in the shown below. Analog output voltage characteristic Y is set to

$Y=0.96 \quad X+0.13$ [V].

However, X sets D-A input code value to n(n-256) and is set to

$X=5[V] \cdot \frac{n}{256}$.

Maximum error on plus side: $Y = 0.96X+0.28$,

Maximum error on minus side: $Y = 0.96X-0.02$.

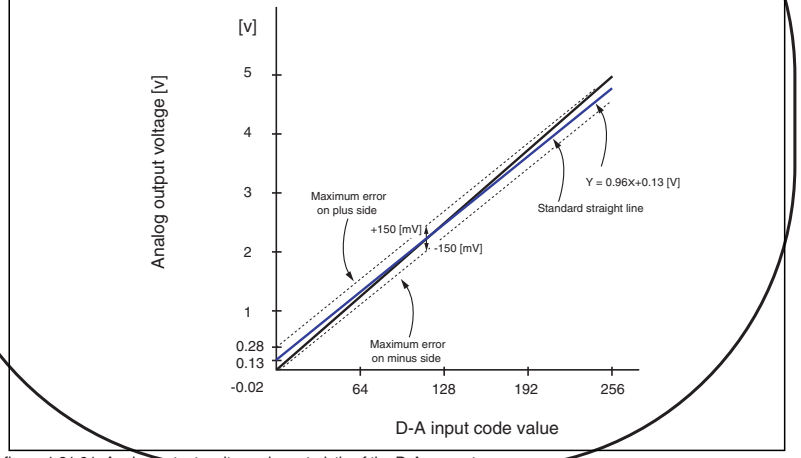

figure 1.21.01. Analog output voltage characteristic of the D-A converter.

Note 2. In case one D-A converter is used and the value of the D-Aregister of the unused D-A converter is "FF$_{16}$". Registance of ladder register of the A-D convcerter is not included I flows even when the A-D control register is configured as not connected to V_{REF}.

( ) = Changed part