

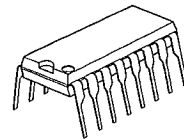
## 8-BIT HIGH SPEED MULTIPLYING D/A CONVERTER

## ■ GENERAL DESCRIPTION

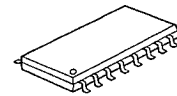
NJMDAC-08C series are 8-bit monolithic multiplying digital to analog converters with very highspeed performance. Open collector output provides dual complementary current outputs increasing versatility in application.

Adjustable threshold logic input voltage through  $V_{LC}$  pin, can be connected to various type of digital IC products.

## ■ PACKAGE OUTLINE



NJMDAC-08DC

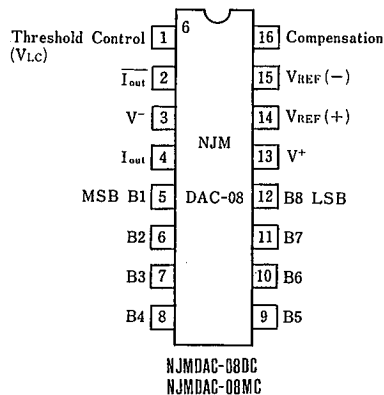


NJMDAC-08MC

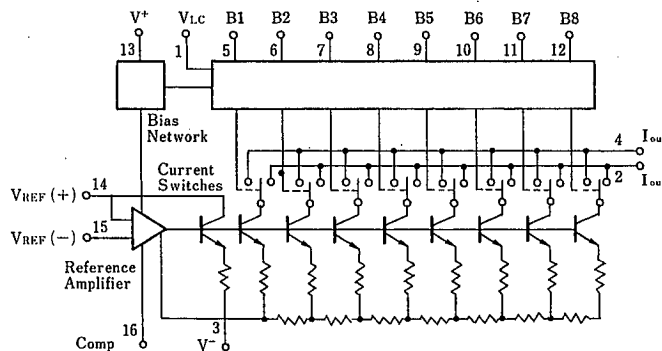
## ■ FEATURES

- Resolution (8bit)
- Settling Time (85ns)
- Linearity Error ( $\pm 0.1\%FS$  MAX (NJM DAC-08H))
- Full Scale Current Temperature Drift (50ppm/ $^{\circ}C$  MAX (NJM DAC-08H/E))
- Wide Operating Voltage ( $\pm 5V \sim \pm 18V$ )
- Wide Output Voltage Range ( $-10V \sim +18V$ )
- Wide Range Adjustable Threshold Logic Input ( $-10V \sim +13.5V(V/V = \pm 15V)$ )
- Multiplying operations can be performed
- Package Outline DIP16, DMP16
- Bipolar Technology

## ■ PIN CONFIGURATION



## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply voltage	$V^+ - V^-$	36	V
Logic Input Voltage Range	$V_i$	$V^- \sim V^- + 36$	V
Threshold Control Input Voltage	$V_{LC}$	$V^- \sim V^+$	V
Analog Current Outputs	$I_o$	4.2	mA
Reference Input Voltage Range	$V_{REF}$	$V^- \sim V^+$	V
Reference Input Differential Voltage	$V_{REF(+)} - V_{REF(-)}$	$\pm 18$	V
Reference Input Current	$I_{REF}$	5.0	mA
Power Dissipation	$P_d$	(DIP16) 500	mW
		(DMP16) 300	mW
Operating Temperature Range	$T_{opr}$	$-20 \sim +75$	°C
Storage Temperature Range	$T_{stg}$	$-40 \sim +125$	°C

■ ELECTRICAL CHARACTERISTICS (V<sup>+</sup>=±15V, I<sub>REF</sub>=2.0mA, T<sub>a</sub>=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Resolution			8	8	8	Bit
Monotonicity			8	8	8	Bit
Nonlinearity	NL				±0.39	%FS
*1 Settling Time	t <sub>s</sub>	To ±1/2LSB, all bits switched ON or OFF		85	150	ns
*1 Propagation Delay	t <sub>PLH</sub> t <sub>PHL</sub>	All bits switched		35	60	ns
*1 Full Scale Temperature Coefficient	TCI <sub>FS</sub>			±10	±80	ppm/°C
Output Voltage Compliance	V <sub>OC</sub>	ΔI <sub>FS</sub> <1/2LSB R <sub>OUT</sub> >20MΩ typ.	-10		+18	V
Full Scale Current	I <sub>FS4</sub>	V <sub>REF</sub> =10.000V R <sub>14</sub> , R <sub>15</sub> =5.000kΩ	1.94	1.99	2.04	mA
Full Scale Symmetry	I <sub>FS5</sub>	I <sub>FS4</sub> -I <sub>FS2</sub>		±2.0	±16.0	μA
Zero Scale Current	I <sub>ZS</sub>			0.2	4.0	μA
Output Current Range	I <sub>OR1</sub>	V <sub>REF</sub> =15V, V <sup>-</sup> =10V <sup>R<sub>14,15</sub>=15.000kΩ</sup>	2.1			mA
	I <sub>OR2</sub>	V <sub>REF</sub> =25V, V <sup>-</sup> =12V <sup>15.000kΩ</sup>	4.2			mA
Logic Input Level "0"	V <sub>IL</sub>	V <sub>LC</sub> =0V			0.8	V
"1"	V <sub>IH</sub>	V <sub>LC</sub> =0V	2.0			V
Logic Input Current "0"	I <sub>IL</sub>	V <sub>LC</sub> =0V, V <sub>IN</sub> =-10V~+0.8V		-2.0	-10	μA
"1"	I <sub>IH</sub>	V <sub>LC</sub> =0V, V <sub>IN</sub> =2V~18V		0.002	10	μA
Logic Input Swing	V <sub>IS</sub>		-10		+18	V
Logic Threshold Range	V <sub>TH2</sub>		-10		+13.5	V
Reference Bias Current	I <sub>IS</sub>			-1.0	-3.0	μA
*1 Reference Input Slew Rate	dI/dt		4.0	8.0		mA/μs
*2 Power Supply Sensitivity	PSSI <sub>FS</sub>	V <sup>+</sup> =4.5V~18V, I <sub>REF</sub> =1.0mA		±0.0003	±0.01	%/%
	PSSI <sub>FS</sub>	V <sup>-</sup> =-4.5V~18V, I <sub>REF</sub> =1.0mA		±0.002	±0.01	
*3 Operating Current	I <sup>+</sup>	V <sup>+</sup> =±5V, I <sub>REF</sub> =1.0mA		2.3	3.8	mA
	I <sup>-</sup>	"		-4.3	-5.8	
	I <sup>+</sup>	V <sup>+</sup> =5V, V <sup>-</sup> =-15V		2.4	3.8	
	I <sup>-</sup>	"		-6.4	-7.8	
	I <sup>+</sup>			2.5	3.8	
	I <sup>-</sup>			-6.5	-7.8	

\*1 Guaranteed by design

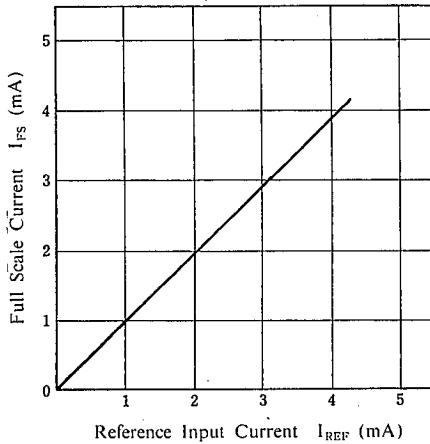
\*2 Calculation formula  $PSSI_{FS} = \left( \frac{|\Delta I_{FS}|}{I_{FS}} \times 100 \right) \div \left( \frac{18-4.5}{15} \right) \times 100$

\*3 Calculation formula  $P_D = I^+ \times (V^+ - V^-) + 2I_{REF} \times |V^-|$

## ■ TYPICAL CHARACTERISTICS

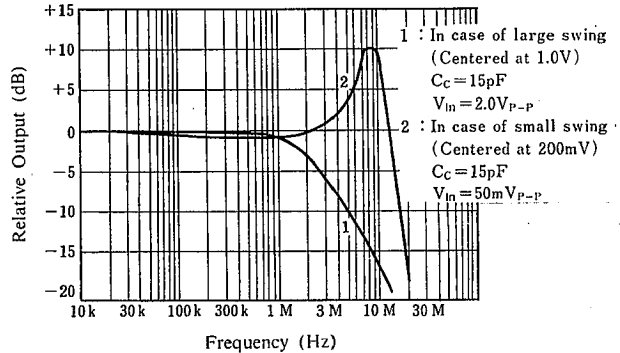
**Full Scale Current vs. Reference Input Current**

(All bits on,  $V^- = -15V$ )

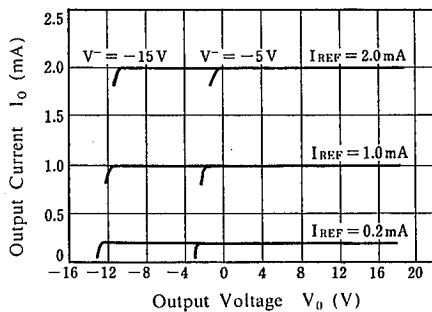


**Reference Input Frequency Respons**

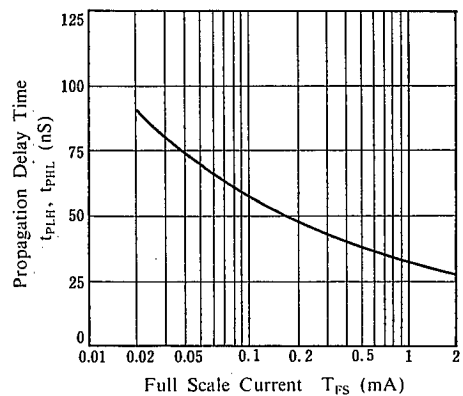
( $R_{14}=R_{15}=1k\Omega$ ,  $R_L=100\Omega$ , ALL BITS "ON")



**Output Current vs. Output Voltage**

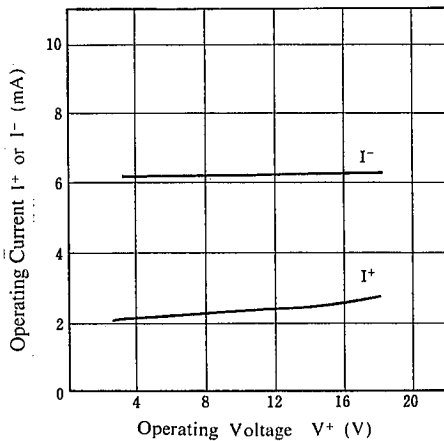


**Propagation Delay Time vs. Full Scale Current**



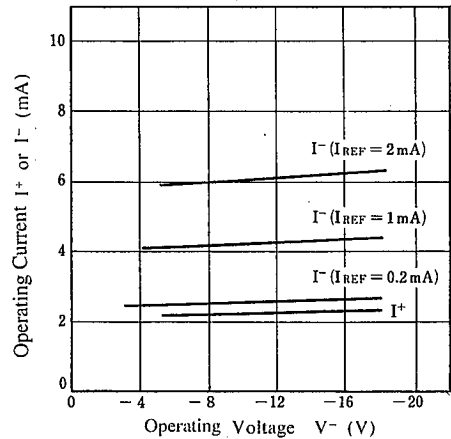
**Operating Current vs. Operating Voltage**

(ALL BITS "HIGH", OR "LOW")

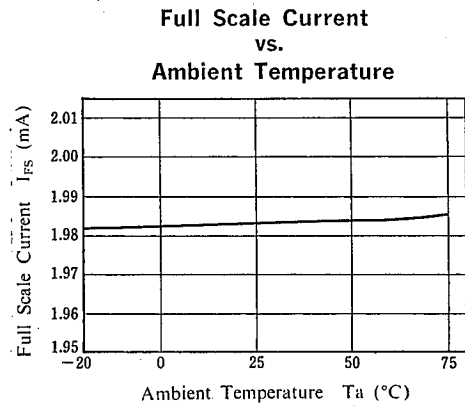
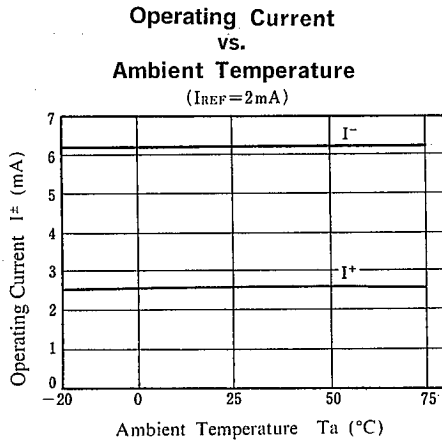


**Operating Current vs. Operating Voltage**

(BITS MAY BE "HIGH" OR "LOW")

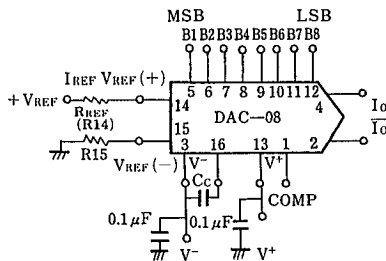


## TYPICAL CHARACTERISTICS

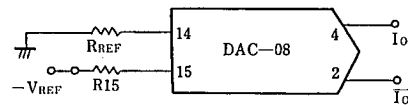


## TYPICAL APPLICATION

### ① Connecting Reference Voltage

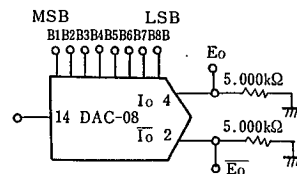
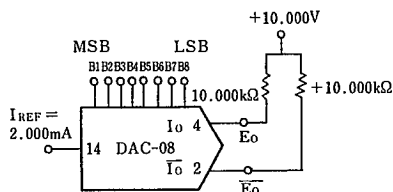


- ① Positive Reference Voltage  
Minimum Compensation Capacitance  
 $C_C = R_{REF}(\text{k}\Omega) \times 15(\text{pF})$



- ② Negative Reference Voltage  
Recommended  $C_C$  Value  
(When  $V_{REF}$  is DC)

### ② Connecting Output Circuit



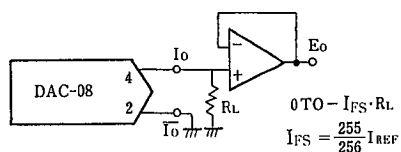
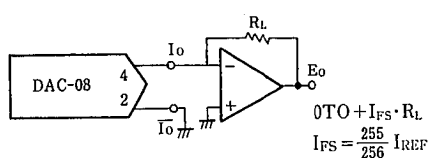
	B1	B2	B3	B4	B5	B6	B7	B8	$I_{REF}$	$I_{REF}$	$E_o$	$\bar{E}_o$
POS FULL RANGE	1	1	1	1	1	1	1	1	-9.920	÷10.000		
POS FULL RANGE-LSB	1	1	1	1	1	1	1	0	-9.840	÷9.920		
ZERO SCALE÷LSB	1	0	0	0	0	0	0	1	-0.050	÷0.160		
ZERO SCALE	1	0	0	0	0	0	0	0	0.000	÷0.050		
ZERO SCALE-LSB	0	1	1	1	1	1	1	1	÷0.080	0.000		
NEG FULL SCALE÷LSB	0	0	0	0	0	0	0	1	÷9.920	-9.840		
NEG FULL SCALE	0	0	0	0	0	0	0	0	÷10.000	-9.920		

	B1	B2	B3	B4	B5	B6	B7	B8	$I_{REF}$	$I_{REF}$	$E_o$	$\bar{E}_o$
FULL RANGE	1	1	1	1	1	1	1	1	1.992	0.000	-9.960	-0.000
HALF SCALE÷LSB	1	0	0	0	0	0	0	1	1.008	0.984	-5.040	-4.920
HALF SCALE	1	0	0	0	0	0	0	0	1.000	0.992	-5.000	-4.960
HALF SCALE-LSB	0	1	1	1	1	1	1	1	0.992	1.000	-4.960	-5.000
ZERO SCALE÷LSB	0	0	0	0	0	0	0	1	0.008	1.984	-0.040	-9.920
ZERO SCALE	0	0	0	0	0	0	0	0	0.000	1.992	-0.000	-9.950

(1) Basic Bipolar Output Operation

(2) Basic Unipolar Negative Operation

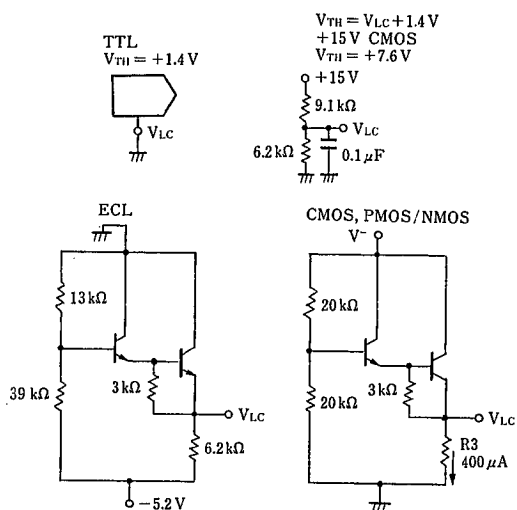
## ③ Connecting Output Buffer Amp.



(1) Positive Low Impedance Output Operation

(2) Negative Low Impedance Output Operation

## ④ Connecting to various type logic IC products



$V_{TH}$  temperature compensation is considered in the above circuit

## MEMO

**[CAUTION]**

The specifications on this databook are only given for information , without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.