

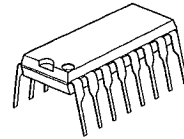
## 8-BIT HIGH SPEED MULTIPLYING D/A CONVERTER

### ■ GENERAL DESCRIPTION

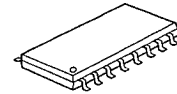
NJMDAC-08C series are 8-bit monolithic multiplying digital to analog converters with very highspeed performance. Open collector output provides dual complementary current outputs increasing versatility in application.

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

### ■ PACKAGE OUTLINE



NJMDAC-08DC

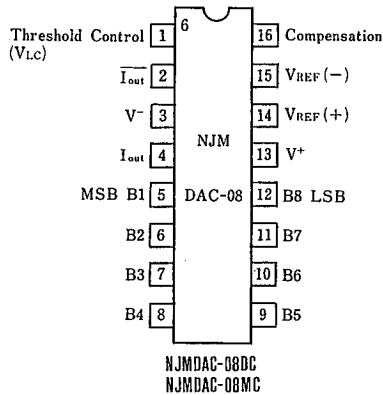


NJMDAC-08MC

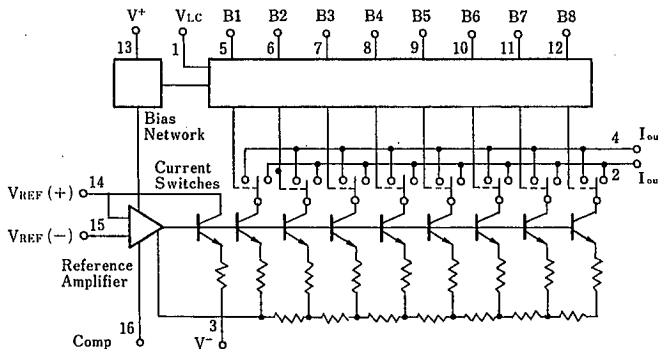
### ■ FEATURES

- 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	TC <sub>IFS</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 $\frac{R_{14,15}}{R_{14,15}+15.000k\Omega}$	2.1			mA
	I <sub>OR2</sub>	V <sub>REF</sub> =25V, V <sup>-</sup> =12V $\frac{R_{14,15}}{R_{14,15}+15.000k\Omega}$	4.2			mA
Logic Input Level	"0" "1"	V <sub>IL</sub> V <sub>IH</sub>	V <sub>LC</sub> =0V V <sub>LC</sub> =0V		0.8	V
Logic Input Current	"0" "1"	I <sub>IL</sub> I <sub>IH</sub>	V <sub>LC</sub> =0V, V <sub>IN</sub> =-10V~+0.8V V <sub>LC</sub> =0V, V <sub>IN</sub> =2V~18V	-2.0 0.002	-10 10	μA
Logic Input Swing	V <sub>IS</sub>		-10		+18	V
Logic Threshold Range	V <sub>THZ</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	

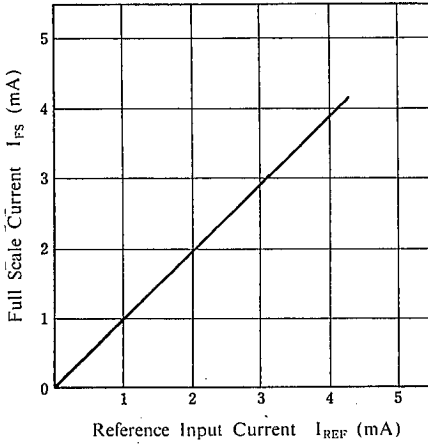
\*1 Guaranteed by design

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

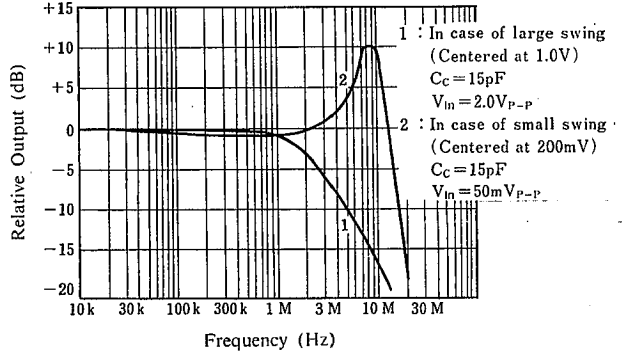
\*3 Calculation formula  $P_D = I^+ \times (V^+ - V^-) + 2I_{REF} \times |V^-|$

## TYPICAL CHARACTERISTICS

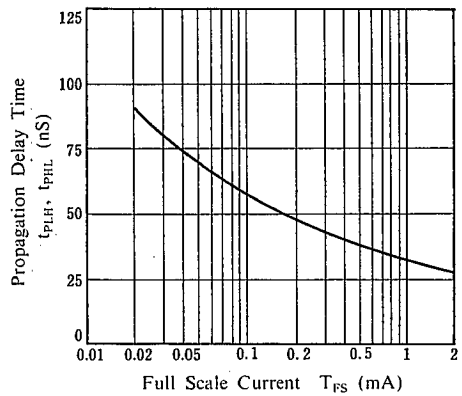
**Full Scale Current vs. Reference Input Current**  
(All bits on,  $V^- = -15V$ )



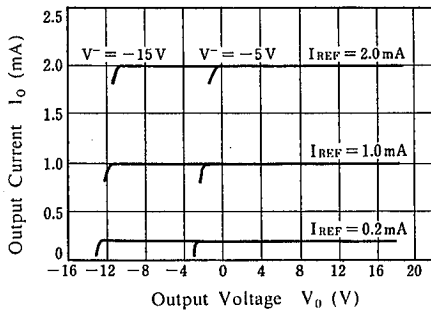
**Reference Input Frequency Respons**  
( $R_{14}=R_{15}=1k\Omega$ ,  $R_L=100\Omega$ , ALL BITS "ON")



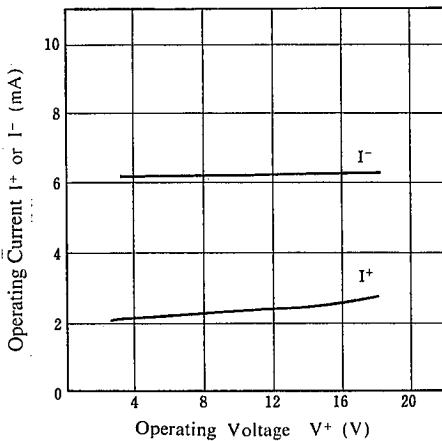
**Propagation Delay Time vs. Full Scale Current**



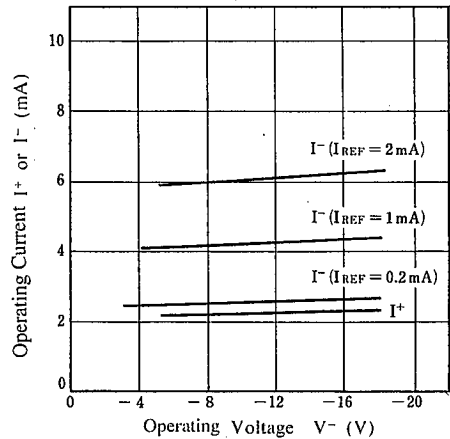
**Output Current vs. Output Voltage**



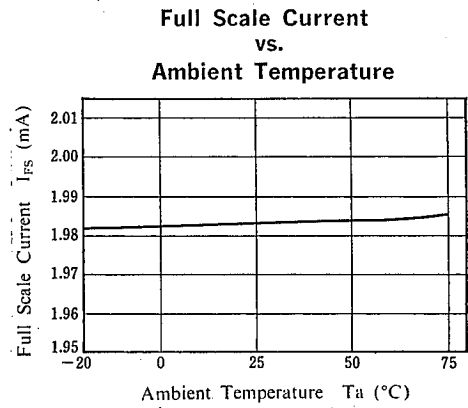
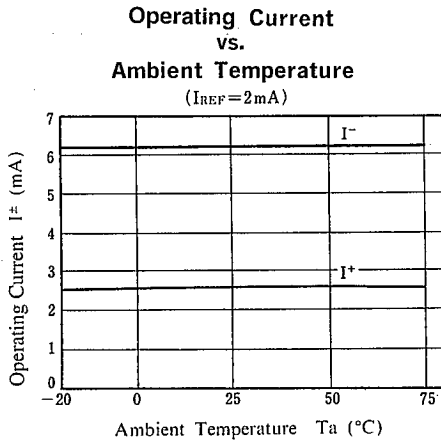
**Operating Current vs. Operating Voltage**  
(ALL BITS "HIGH", OR "LOW")



**Operating Current vs. Operating Voltage**  
(BITS MAY BE "HIGH" OR "LOW")

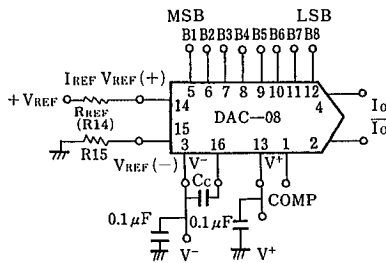


## ■ TYPICAL CHARACTERISTICS

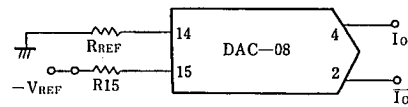


## ■ TYPICAL APPLICATION

### ① Connecting Reference Voltage

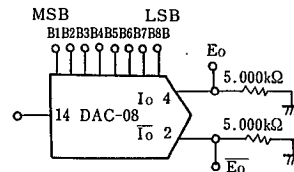
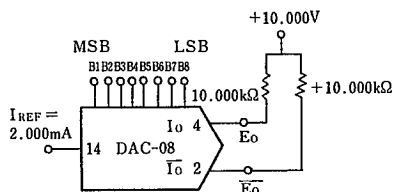


- ① Positive Reference Voltage  
Minimum Compensation Capacitance  
 $C_C = R_{REF}(k\Omega) \times 15(pF)$



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

### ② Connecting Output Circuit



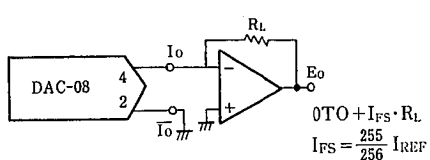
	B1	B2	B3	B4	B5	B6	B7	B8	$E_o$	$\bar{E}_o$
POS FULL RANGE	1	1	1	1	1	1	1	1	-9.920	÷10.000
POS FULL RANGE-LSB	1	1	1	1	1	1	1	0	-9.840	÷9.920
ZERO SCALE÷LSB	1	0	0	0	0	0	0	1	-0.050	÷0.160
ZERO SCALE	1	0	0	0	0	0	0	0	0.000	÷0.050
ZERO SCALE-LSB	0	1	1	1	1	1	1	1	÷0.080	0.000
NEG FULL SCALE÷LSB	0	0	0	0	0	0	0	1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

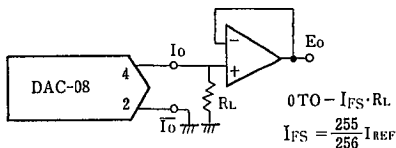
(1) Basic Bipolar Output Operation

(2) Basic Unipolar Negative Operation

### ③ Connecting Output Buffer Amp.

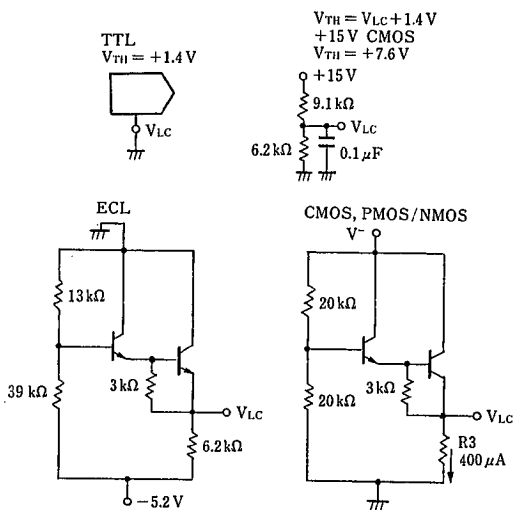


(1) Positive Low Impedance Output Operation



(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]

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