

# MN657021F

## Low Power 8-Bit, 3-Channel CMOS D/A Converter for Image Processing

### ■ Overview

The MN657021F is a high-speed 8-bit, 3-channel CMOS digital-to-analog converter. (Two channels use serial input.)

It uses both a matrix cell and weighted current technology to achieve both low power consumption and high speed.

It provides independent output amplitude adjustment for the Y (luminance) and C (chroma) synchronization signals. The Y (luminance signal) can be superimposed with an external SYNC signal.

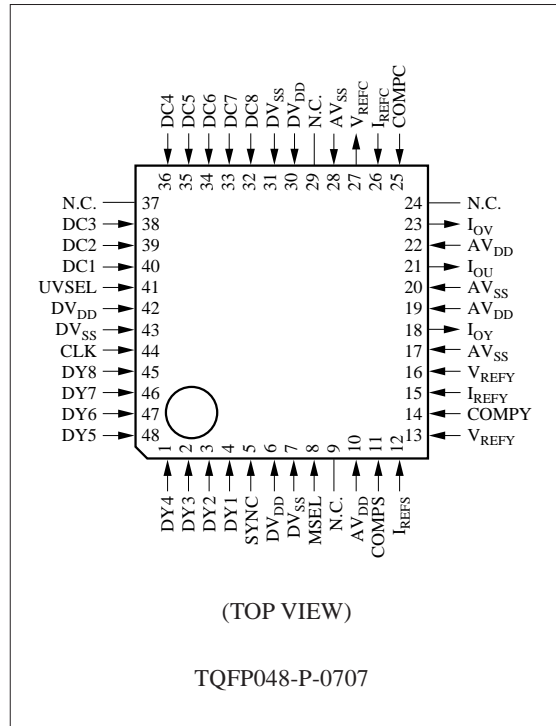
### ■ Features

- Maximum conversion rate: 27 MSPS (min.)
- Linearity error:  $\pm 0.2$  LSB (typ.)
- Differential linearity error:  $\pm 0.2$  LSB (typ.)
- Power supply voltage:  $3.15 \pm 0.3$  V
- Full scale current: 1.75 mA (typ.)
- Power consumption: 54 mW (typ.) ( $f_{CLK}=27$  MHz)

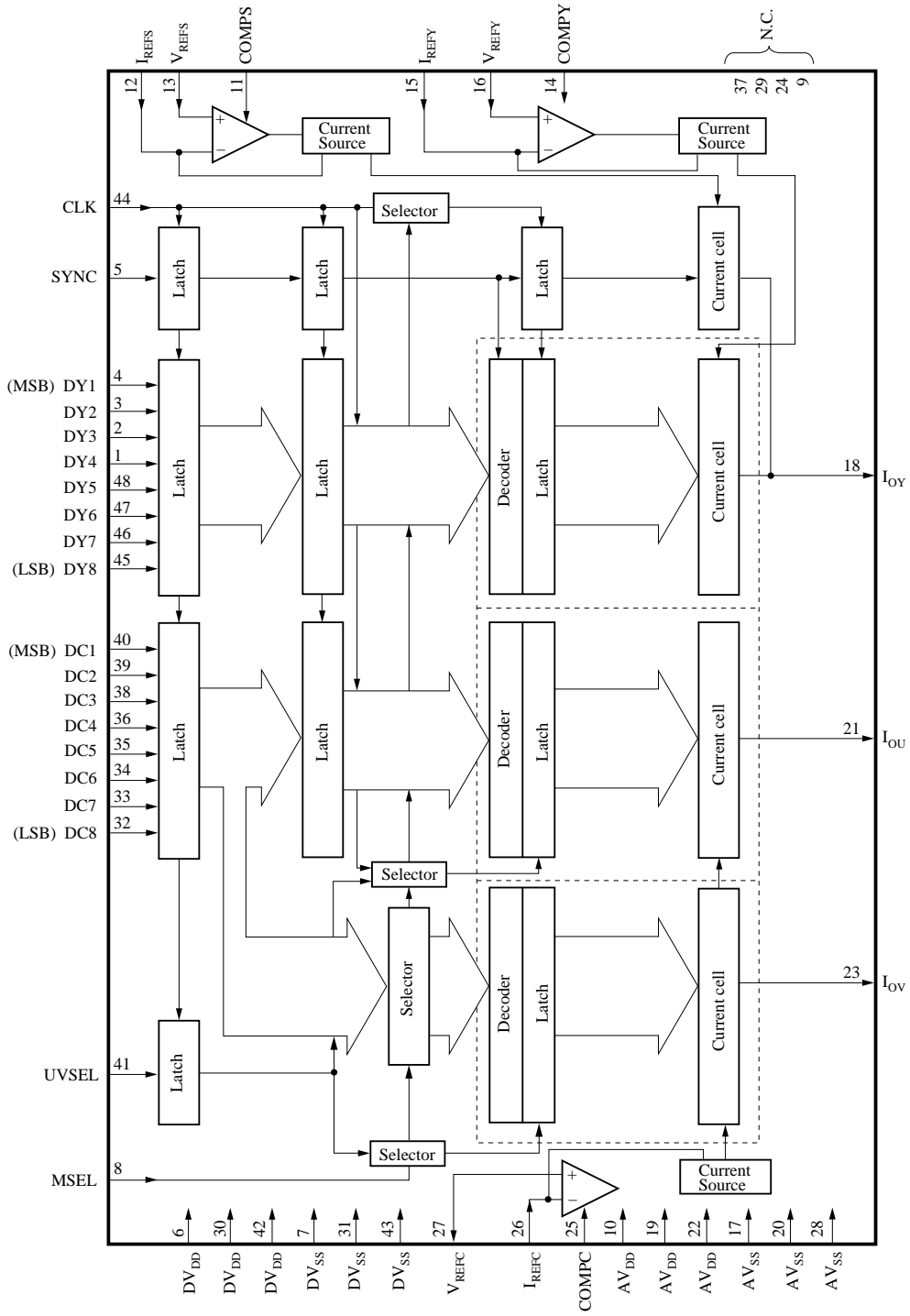
### ■ Applications

- Digital television
- Digital video equipment
- Digital image processing equipment

### ■ Pin Assignment



■ Block Diagram



### ■ Pin Descriptions

Pin No.	Symbol	Function Description
1	DY4	Y (luminance) digital input
2	DY3	Y (luminance) digital input
3	DY2	Y (luminance) digital input
4	DY1	Y (luminance) digital input (MSB)
5	SYNC	SYNC signal judgment signal
6	DV <sub>DD</sub>	Power supply for digital circuits
7	DV <sub>SS</sub>	Ground for digital circuits
8	MSEL	Y, C/Y, R-Y, B-Y discrimination signal
9	N.C.	No connection
10	AV <sub>DD</sub>	Power supply for analog circuits
11	COMPS	Phase compensation
12	I <sub>REFS</sub>	Full scale adjustment resistor
13	V <sub>REFS</sub>	SYNC reference voltage input
14	COMPY	Phase compensation
15	I <sub>REFY</sub>	Full scale adjustment resistor
16	V <sub>REFY</sub>	Luminance reference voltage input
17	AV <sub>SS</sub>	Ground for analog circuits
18	I <sub>OY</sub>	Y signal analog current output
19	AV <sub>DD</sub>	Power supply for analog circuits
20	AV <sub>SS</sub>	Ground for analog circuits
21	I <sub>OU</sub>	U signal analog current output
22	AV <sub>DD</sub>	Ground for analog circuits
23	I <sub>OV</sub>	V signal analog current output
24	N.C.	No connection
25	COMPC	Phase compensation
26	I <sub>REFC</sub>	Full scale adjustment resistor
27	V <sub>REFC</sub>	Chroma reference voltage input
28	AV <sub>SS</sub>	Ground for analog circuits
29	N.C.	No connection
30	DV <sub>DD</sub>	Power supply for digital circuits
31	DV <sub>SS</sub>	Ground for digital circuits
32	DC8	C (chroma) digital input (LSB)
33	DC7	C (chroma) digital input
34	DC6	C (chroma) digital input
35	DC5	C (chroma) digital input
36	DC4	C (chroma) digital input
37	N.C.	No connection
38	DC3	C (chroma) digital input
39	DC2	C (chroma) digital input
40	DC1	C (chroma) digital input (MSB)
41	UVSEL	U/V signal discrimination for C (chroma) signal
42	DV <sub>DD</sub>	Power supply for digital circuits

### ■ Pin Descriptions (continued)

Pin No.	Symbol	Function Description
43	DV <sub>SS</sub>	Ground for digital circuits
44	CLK	Sampling clock
45	DY8	Y (luminance) digital input (LSB)
46	DY7	Y (luminance) digital input
47	DY6	Y (luminance) digital input
48	DY5	Y (luminance) digital input

### ■ Absolute Maximum Ratings $T_a=25^\circ\text{C}$

Parameter	Symbol	Rating	Unit
Power supply voltage for digital circuits	DV <sub>DD</sub>	- 0.3 to +7.0	V
Power supply voltage for analog circuits	AV <sub>DD</sub>	- 0.3 to +7.0	V
Input voltage	V <sub>I</sub>	- 0.3 to DV <sub>DD</sub> +0.3	V
Output voltage	V <sub>O</sub>	- 0.3 to AV <sub>DD</sub> +0.3	V
Operating ambient temperature	T <sub>opr</sub>	-20 to +70	°C
Storage temperature	T <sub>stg</sub>	-55 to +125	°C

### ■ Recommended Operating Conditions $V_{DD}=AV_{DD}=DV_{DD}=3.0\text{V}$ , $V_{SS}=AV_{SS}=DV_{SS}=0\text{V}$ , $T_a=25^\circ\text{C}$

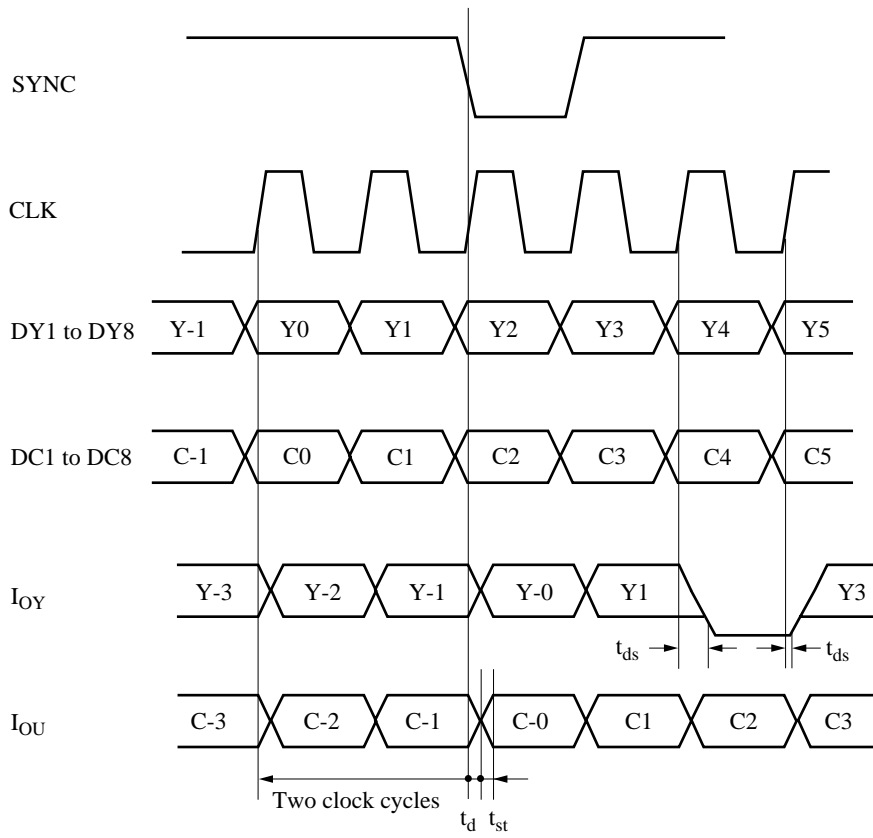
Parameter	Symbol	min	typ	max	Unit
Power supply voltage	V <sub>DD</sub>	2.85	3.0	3.45	V
Reference voltage	V <sub>REFS/Y,C</sub>	1.0	1.85/1.63	2.3	V
Reference resistance	R <sub>REFS/Y,C</sub>	2.0/0.58	5.0/2.5	8.0/5.0	kΩ
External compensation capacitor	C <sub>COMPS, Y, C</sub>	0.33	1.0	3.3	μF
Output load resistance	R <sub>OUT</sub>	75	400	500	Ω
Digital input voltage	"H" level	V <sub>IH</sub>	V <sub>DD</sub> × 0.75	V <sub>DD</sub>	V
	"L" level	V <sub>IL</sub>	V <sub>SS</sub>	V <sub>DD</sub> × 0.25	V
Clock	"H" level pulse width	t <sub>WH</sub>	16		ns
	"L" level pulse width	t <sub>WL</sub>	16		ns

### ■ Electrical Characteristics $DV_{DD}=AV_{DD}=3.0\text{V}$ , $DV_{SS}=AV_{SS}=0\text{V}$ , $T_a=25^\circ\text{C}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Power supply current	I <sub>DD</sub>	F <sub>CLK</sub> =30MHz, MSEL="H", Output amplitude=0.7 V, R <sub>OUT</sub> =400Ω		18	28	mA
Resolution	RES			8		bit
Linearity error	E <sub>L</sub>	V <sub>DD</sub> =3.0V, Y output amplitude=0.7V		±0.2	±0.5	LSB
Differential linearity error	E <sub>D</sub>	UV output amplitude=0.7V		±0.2	±0.5	LSB
Full scale current	I <sub>FS</sub>	R <sub>OUT</sub> =400Ω R <sub>REFY</sub> =2.5kΩ, R <sub>REFC</sub> =2.5kΩ		1.75		mA
Setup time	t <sub>S</sub>		12			ns
Hold time	t <sub>H</sub>		10			ns
Settling time	t <sub>ST</sub>	V <sub>DD</sub> =3.0V, Y output amplitude=0.7V,		25	37	ns
Maximum conversion speed	F <sub>C(max.)</sub>	UV output amplitude=0.7V R <sub>OUT</sub> =400Ω, R <sub>REF</sub> =2.5kΩ	27			MSPS
Analog output delay time	t <sub>d</sub>	V <sub>DD</sub> =3.0V, Y output amplitude=0.7V, UV output amplitude=0.7V		10		ns

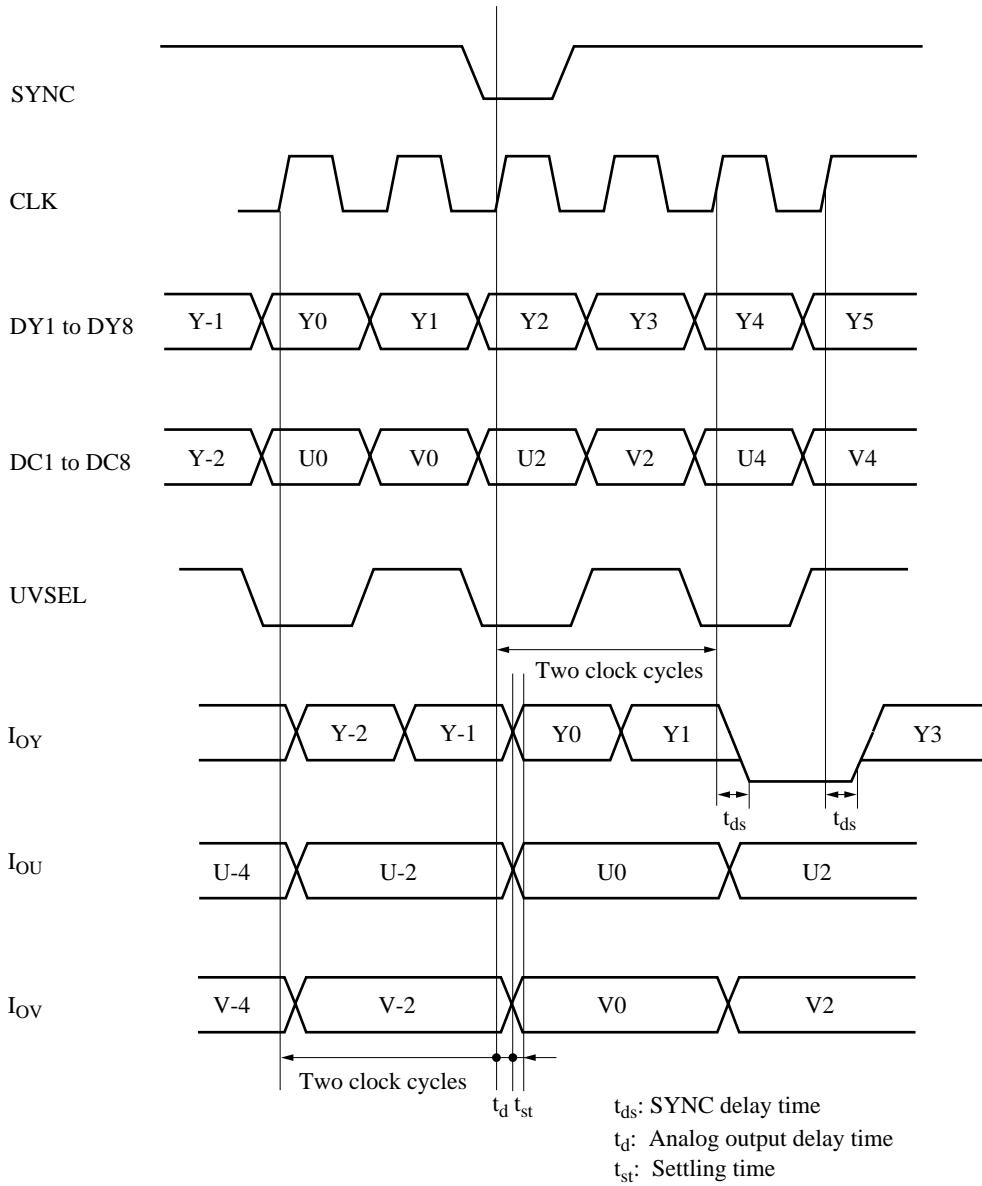
■ Timing Chart

M SELECT = "L," Y and U(C), 2-channel output



$t_{ds}$ : SYNC delay time  
 $t_d$ : Analog output delay time  
 $t_{st}$ : Settling time

M SELECT = "H," Y and U(C), 3-channel output



■ Package Dimensions (Unit:mm)

TQFP048-P-0707

