MP75L45

Low Voltage CMOS
Buffered Multiplying 12-Bit
Digital-to-Analog Converter

FEATURES

- **3.3 V Operation**
- **Full Four Quadrant Multiplication**
- **12-Bit Resolution**
- **Latch-Up Free**
- **Extremely Low Power CMOS: 0.3 mW (typ.)**

APPLICATIONS

- **Disk Drive Servo Systems**
- **Digital/Synchro Conversion**
- **Programmable Gain Amplifiers**
- **Ratiometric A/D Conversion**
- **Function Generation**
- **Digitally Controlled Filters**

GENERAL DESCRIPTION

The MP75L45 is a 12-bit CMOS multiplying Digital-to-Analog Converter with on-board data latches. It is loaded by a single 12-bit wide word and interfaces directly to most 12- and 16-bit bus systems. Data is loaded into the input latches under the control of the $\overline{CS}$ and $\overline{WR}$ inputs; tying these control inputs low makes the input latches transparent, allowing direct unbuffered operation of the DAC.

The MP75L45 is particularly suitable for single supply operation and applications with wide temperature variations.

Specified for operation over the commercial / industrial (–40 to +85°C) temperature range, the MP75L45 is available in Plastic dual-in-line (PDIP), Surface Mount (SOIC), and Shrunk Small (SSOP) outline packages.
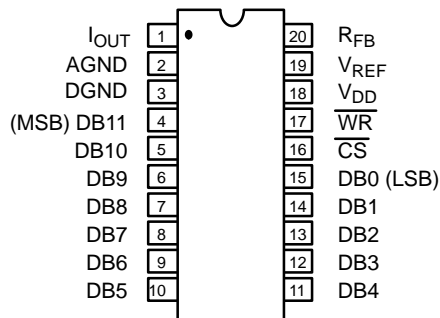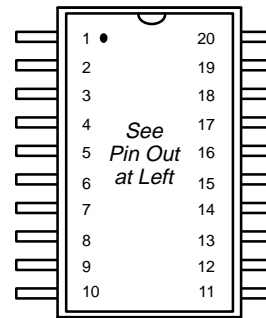
SIMPLIFIED BLOCK DIAGRAM
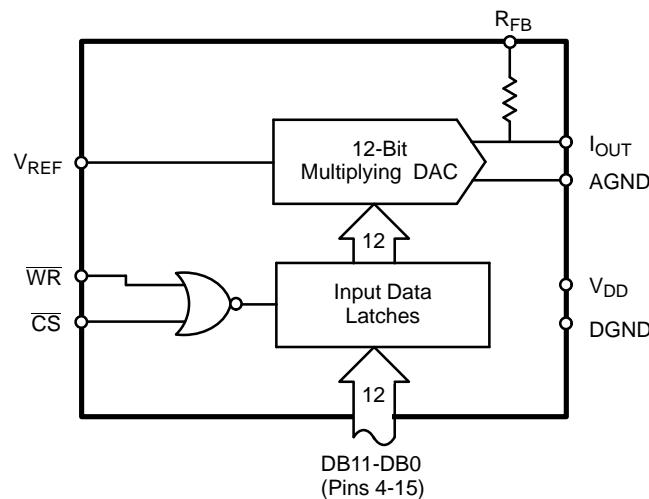
MP75L45

ORDERING INFORMATION

Package Type	Temperature Range	Part No.	INL (LSB)	DNL (LSB)	Gain Error (LSB)
Plastic Dip	−40 to +85°C	MP75L45KN	1	±1	±10
SOIC	−40 to +85°C	MP75L45KS	1	±1	±10
SSOP	−40 to +85°C	MP75L45KQ	1	±1	±10

PIN CONFIGURATIONS   *See Packaging Section for Package Dimensions*

20 Pin PDIP (0.300")
N20

20 Pin SOIC (Jedec, 0.300") – S20
20 Pin SSOP – A20

PIN OUT DEFINITIONS

PIN NO.	NAME	DESCRIPTION	PIN NO.	NAME	DESCRIPTION
1	I_{OUT}	Output Current	11	DB4	Data Input Bit 4
2	AGND	Analog Ground	12	DB3	Data Input Bit 3
3	DGND	Digital Ground	13	DB2	Data Input Bit 2
4	DB11	Data Input Bit 11 (MSB)	14	DB1	Data Input Bit 1
5	DB10	Data Input Bit 10	15	DB0	Data Input Bit 0 (LSB)
6	DB9	Data Input Bit 9	16	$\overline{CS}$	Chip Select (Active Low)
7	DB8	Data Input Bit 8	17	$\overline{WR}$	Write (Active Low)
8	DB7	Data Input Bit 7	18	V_{DD}	Digital Supply Voltage
9	DB6	Data Input Bit 6	19	V_{REF}	Reference Input
10	DB5	Data Input Bit 5	20	R_{FB}	Feedback Resistor

ELECTRICAL CHARACTERISTICS
(V_{DD} = + 3 V, V_{REF} = +3 V unless otherwise noted)

Parameter	Symbol	Min	25°C Typ	Max	Units	Test Conditions/Comments
STATIC PERFORMANCE[1]						
Resolution (All Grades)	N	12			Bits	
Integral Non-Linearity (Relative Accuracy)	INL			±1	LSB	Best Fit Straight Line Spec. (Max INL – Min INL) / 2
Differential Non-Linearity	DNL			±1	LSB	
Gain Error	GE		±5	±10	LSB	Using Internal R_{FB}
Gain Temperature Coefficient[2]	TC_{GE}		10		ppm/°C	ΔGain/ΔTemperature
Power Supply Rejection Ratio	PSRR		±50		ppm/%	$|\Delta$Gain$/\Delta V_{DD}| \Delta V_{DD} = \pm$ 5%
Output Leakage Current	I_{OUT}			±10	nA	
REFERENCE INPUT						
Input Resistance	R_{IN}	7		25	KΩ	
DIGITAL INPUTS[3]						
Logical "1" Voltage	V_{IH}	2.5			V	
Logical "0" Voltage	V_{IL}			0.5	V	
Input Leakage Current	I_{LKG}			±1	μA	
Input Capacitance[2]						
Data	C_{IN}			5	pF	
Control	C_{IN}			20	pF	
POWER SUPPLY[5]						
Functional Voltage Range	V_{DD}	3	3.3	3.6	V	
Supply Current	I_{DD}		10	100	μA	All digital inputs = 0 V or V_{DD}
SWITCHING CHARACTERISTICS[4]						
Chip Select to Write Set-Up Time	t_{CS}		200		ns	
Chip Select to Write Hold Time	t_{CH}		10		ns	
Data Valid to Write Set-Up Time	t_{DS}		100		ns	
Data Valid to Write Hold Time	t_{DH}		10		ns	
Write Pulse Width	t_{WR}		175		ns	

NOTES:

1   Full Scale Range (FSR) is 3 V for unipolar mode.
2   Guaranteed but not production tested.
3   Digital input levels should not go below ground or exceed the positive supply voltage, otherwise damage may occur.
4   See timing diagram.
5   Specified values guarantee functionality. Refer to other parameters for accuracy.

Specifications are subject to change without notice

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ABSOLUTE MAXIMUM RATINGS (T$_A$ = +25°C unless otherwise noted)[1, 2, 3]

V_{DD} to GND . . . . 0 to +5 V

Digital Input Voltage to GND . . . . GND –0.5 to V_{DD} +0.5 V

I_{OUT1}, I_{OUT2} to GND . . . . GND –0.5 to V_{DD} +0.5 V

V_{REF} to GND (2) . . . . ±25 V

V_{RFB} to GND (2) . . . . ±25 V

Storage Temperature . . . . –65°C to +150°C

Lead Temperature (Soldering, 10 seconds) . . . . . . +300°C

Package Power Dissipation Rating to 75°C

    PDIP, SOIC, SSOP 900mW

    Derates above 75°C . . . . 12mW/°C

NOTES:

1. Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation at or above this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

2. Any input pin which can see a value outside the absolute maximum ratings should be protected by Schottky diode clamps (HP5082-2835) from input pin to the supplies. *All inputs have protection diodes* which will protect the device from short transients outside the supplies of less than 100mA for less than 100μs.

3. V_{DD} refers to AV_{DD} and DV_{DD}. GND refers to AGND and DGND.
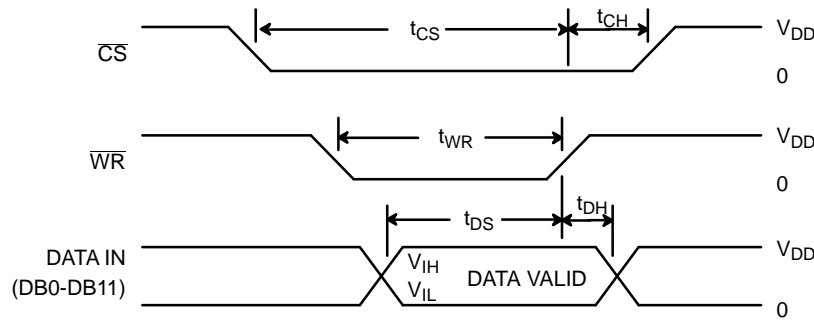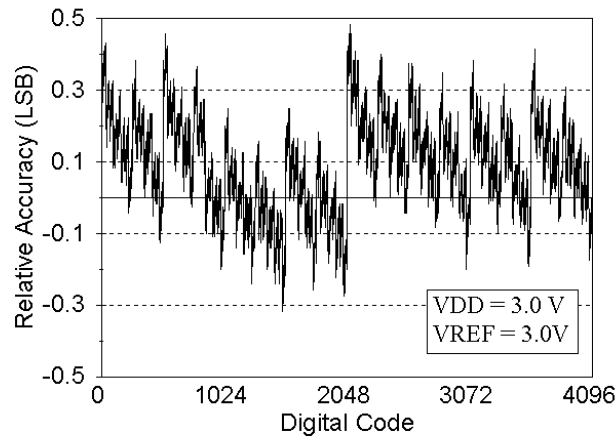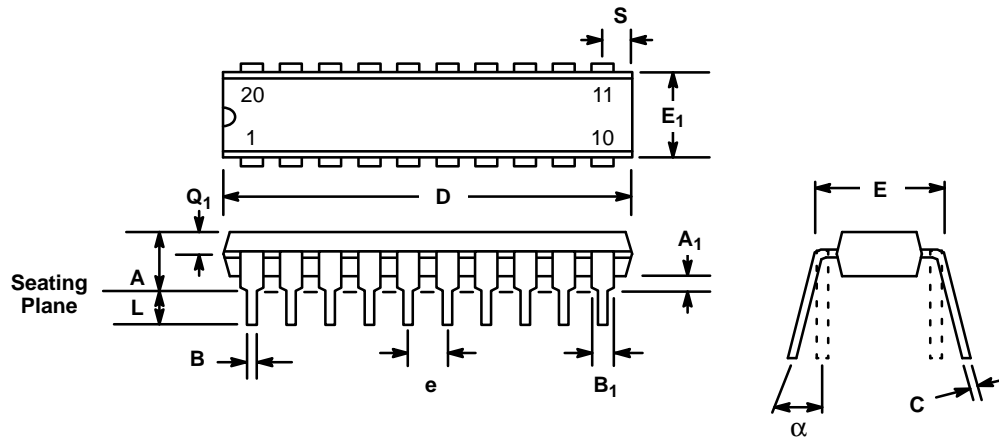

Figure 1. Write Cycle Timing Diagram

Graph 1. Relative Accuracy vs. Digital Code

20 LEAD PLASTIC DUAL-IN-LINE
(300 MIL PDIP)
N20

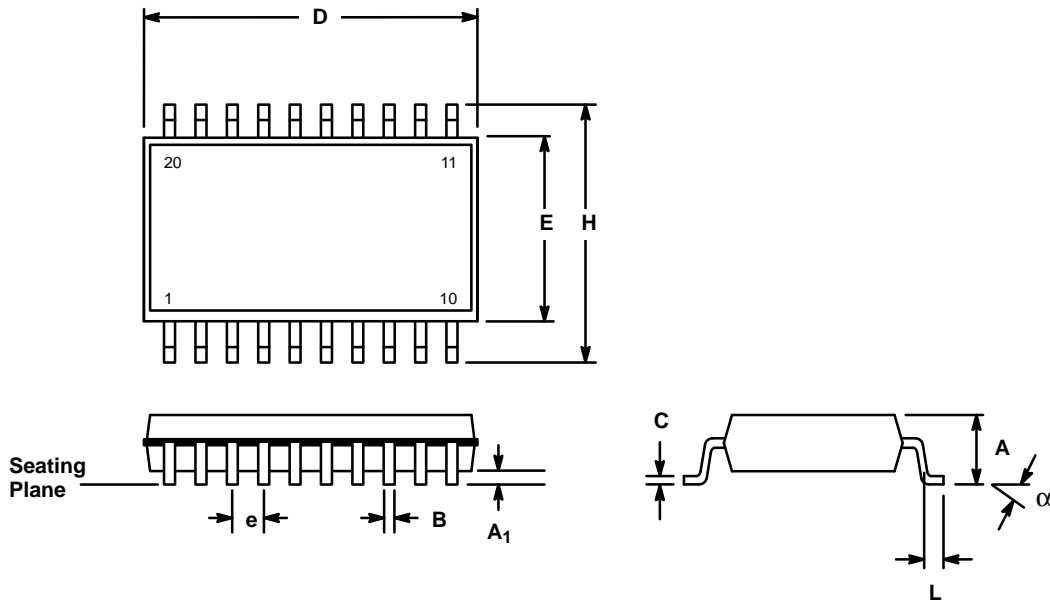| SYMBOL	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	—	0.200	—	5.08
A_1	0.015	—	0.38	—
B	0.014	0.023	0.356	0.584
B_1 (1)	0.038	0.065	0.965	1.65
C	0.008	0.015	0.203	0.381
D	0.945	1.060	24.0	26.92
E	0.295	0.325	7.49	8.26
E_1	0.220	0.310	5.59	7.87
e	0.100 BSC		2.54 BSC	
L	0.115	0.150	2.92	3.81
α	$0°$	$15°$	$0°$	$15°$
Q_1	0.055	0.070	1.40	1.78
S	0.040	0.080	1.02	2.03

Note: (1) The minimum limit for dimensions B1 may be 0.023"
(0.58 mm) for all four corner leads only.

20 LEAD SMALL OUTLINE
(300 MIL JEDEC SOIC)
S20

	INCHES		MILLIMETERS	
SYMBOL	MIN	MAX	MIN	MAX
A	0.097	0.104	2.464	2.642
A_1	0.0050	0.0115	0.127	0.292
B	0.014	0.019	0.356	0.483
C	0.0091	0.0125	0.231	0.318
D	0.500	0.510	12.70	12.95
E	0.292	0.299	7.42	7.59
e	0.050 BSC		1.27 BSC	
H	0.400	0.410	10.16	10.41
h	0.010	0.016	0.254	0.406
L	0.016	0.035	0.406	0.889
α	0°	8°	0°	8°

20 LEAD SHRINK SMALL OUTLINE PACKAGE
(SSOP)
A20

SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.73	2.05	0.068	0.081
A_1	0.05	0.21	0.002	0.008
B	0.20	0.40	0.008	0.016
C	0.13	0.25	0.005	0.010
D	7.07	7.40	0.278	0.291
E	5.20	5.38	0.205	0.212
e	0.65 BSC		0.0256 BSC	
H	7.65	8.1	0.301	0.319
L	0.45	0.95	0.018	0.037
α	0°	8°	0°	8°

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Rev. 1.00