DATA SHEET

SA5775A
Differential air core meter driver

Product specification
Supersedes data of 1997 Feb 24

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Philips
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Differential air-core meter driver SA5775A

DESCRIPTION

The SA5775A is a monolithic driver for controlling air-core (or differential) meters typically used in automotive instrument cluster applications. The circuit interfaces with a microprocessor through a serial bus and directly drives the air-core meter. The SA5775A has 10-bit resolution (0.35 degree) and is guaranteed to be monotonic. Data can be shifted through the part, allowing several SA5775As to be cascaded with only one chip-select line. On-chip current shut down logic protects the circuit from external faults.

FEATURES

- 10-Bit resolution (0.35 degrees)
- Exceptional accuracy (0.25 degrees, typical)
- High-torque capability
- Active differential drivers eliminate back-EMF issues
- No RFI/EMI generation issues
- Simple serial interface
- Simple cascading capability for multiple meters
- Internal fault protection
- Only one external component required (bypass capacitor)

APPLICATION

- Instrumentation utilizing air-core meters

PIN CONFIGURATION

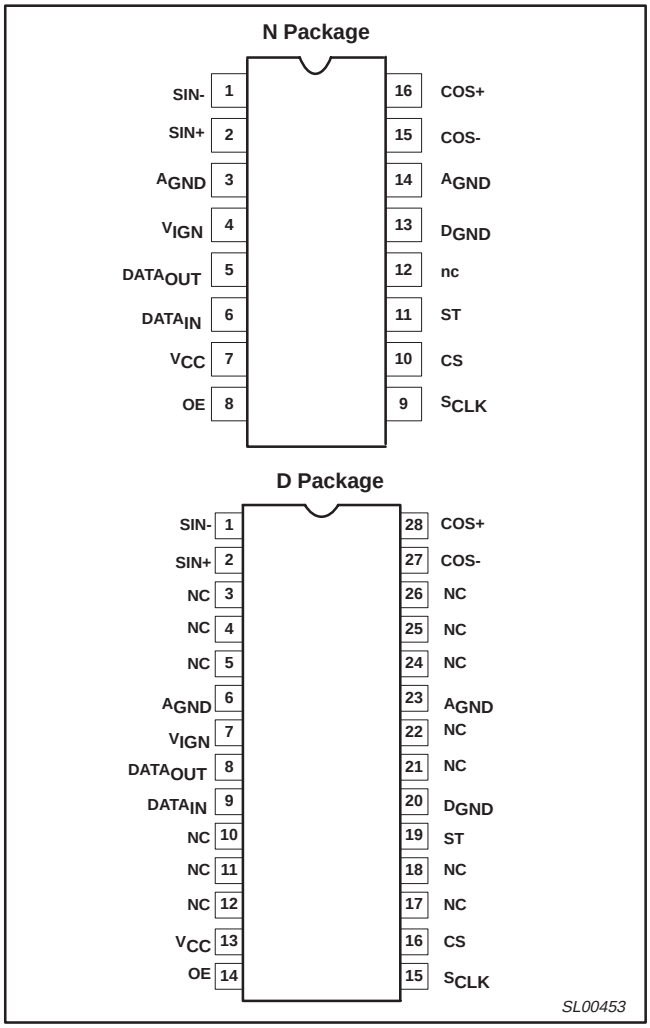


Figure 1. Pin configuration

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
16-Pin Plastic Dual In-Line Package (DIP)	-40 to +85°C	SA5775AN	SOT38-4
28-Pin Small Outline Package (SO)	-40 to +85°C	SA5775AD	SOT136-1

BLOCK DIAGRAM

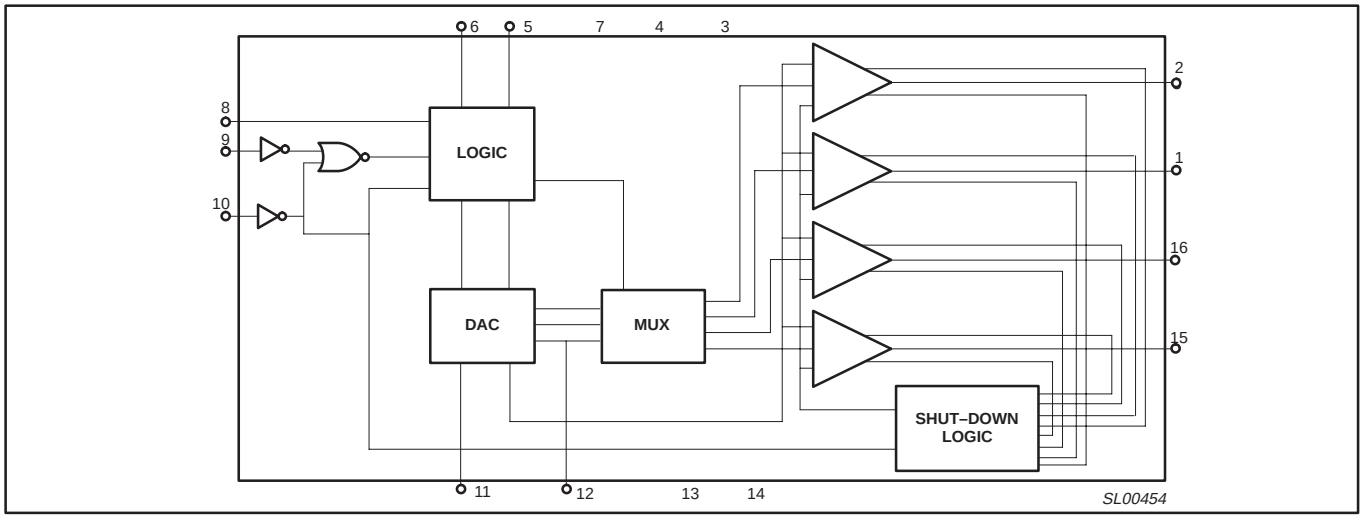


Figure 2. Block diagram

Table 1. SA5775A Pin Descriptions for the N Package (Dual In-Line)

Pin #	Name	Function
1.	SIN–	Negative output connection to the SIN coil of the gauge.
2.	SIN+	Positive output connection to the SIN coil of the gauge.
3.	A_{GND}	Ground for V_{IGN} supply. Pins 3, 13 and 14 connected on the circuit board.
4.	V_{BB}	Analog supply. Nominally 14.0 V.
5.	$DATA_{OUT}$	Serial data output. Output of the internal shift register. When a new data word is shifted in, the old word is shifted out the $DATA_{OUT}$ pin.
6.	$DATA_{IN}$	Serial data input. A new data word is serially shifted into the part on the rising edge of S_{CLK}. The data is shifted in MSB first.
7.	V_{CC}	5 V logic supply. The internal latches and registers are set to zero on the rising edge of this signal.
8.	OE	Output drivers are turned off when this input is low. Current draw is minimized.
9.	S_{CLK}	Serial clock input. Data is loaded into the part on the rising edge of S_{CLK}.
10.	CS	Active high chip select input. When CS is high, the part is enabled to receive a new serial input word. The high-to-low transition of CS loads the new 10-bit word into the DAC registers and updates the output.
11.	ST	Status output from this IC to indicate that the outputs have been disabled. The outputs may be disabled due to shorted outputs, over temperature conditions, power up reset, or output enable control pin .This output is an open drain output .Multiple status outputs may be wire OR'ed together .This output is low when the outputs are disabled due to a fault condition.
12.	nc	Not connected
13.	D_{GND}	Ground for V_{CC} supply. Connect to Pins 3 and 14.
14.	A_{GND}	Ground for V_{BB} supply. Connect to Pins 3 and 13.
15.	COS–	Negative output connection to the COS coil of the gauge.
16.	COS+	Positive output connection to the COS coil of the gauge.

Table 2. SA5775A Pin Descriptions for the D Package (Small Outline)

Pin #	Name	Function
1.	SIN–	Negative output connection to the SIN coil of the gauge.
2.	SIN+	Positive output connection to the SIN coil of the gauge.
3.	NC	No connect
4.	NC	No connect
5.	NC	No connect
6.	A_{GND}	Ground for V_{IGN} supply. Pins 6, 20 and 23 connected on the circuit board.
7.	V_{IGN}	Analog supply. Nominally 14.0V.
8.	$DATA_{OUT}$	Serial data output. Output of the internal shift register. When a new data word is shifted in, the old word is shifted out the $DATA_{OUT}$ pin.
9.	$DATA_{IN}$	Serial data input. A new data word is serially shifted into the part on the rising edge of S_{CLK}. The data is shifted in MSB first.
10.	NC	No connect
11.	NC	No connect
12.	NC	No connect
13.	V_{CC}	5 V logic supply. The internal latches and registers are set to zero on the rising edge of this signal.
14.	OE	Output drivers are turned off when this input is low. Current draw is minimized.
15.	S_{CLK}	Serial clock input. Data is loaded into the part on the rising edge of S_{CLK}.
16.	CS	Active high chip select input. When CS is high, the part is enabled to receive a new serial input word. The high-to-low transition of CS loads the new 10-bit word into the DAC registers and updates the output.
17.	NC	No connect
18.	NC	No connect
19.	ST	Status output from this IC to indicate that the outputs have been disabled. The outputs may be disabled due to shorted outputs, over temperature conditions, power up reset, or output enable control pin. This output is an open drain output. Multiple status outputs may be wire OR'ed together. This output is low when the outputs are disabled due to a fault condition.
20.	D_{GND}	Ground for V_{CC} supply. Connect to Pins 6 and 23.
21.	NC	No connect
22.	NC	No connect
23.	A_{GND}	Ground for V_{BB} supply. Connect to Pins 6 and 20.
24.	NC	No connect
25.	NC	No connect
26.	NC	No connect
27.	COS–	Negative output connection to the COS coil of the gauge.
28.	COS+	Positive output connection to the COS coil of the gauge.

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNIT
V_{IGN}	Analog supply	-1 to +23	V
V_{CC}	Digital supply	-1 to +6	V
D_{GND} to A_{GND}	Ground difference	-0.3 to +0.3	V
V_{IN}	Digital input voltage, Data In, OE, CS, S_{CLK}	-1 to +7	V
P_D	Power dissipation (T_A = 25°C)[1] D and N packages	1500	mW
T_A	Ambient operating temperature	–40 to +85	°C
T_J	Junction temperature	150	°C
θ_{JA}	DIP and SO packages	90	°C/W

NOTE:
1. For power dissipation ratings in still air, derate above 25°C at the following rates:
D and N packages at 12mW/°C

DC ELECTRICAL CHARACTERISTICS

V_{IGN} = 7.5 to 18 V; V_{CC} = 4.5 to 5.5 V; T_A = –40 to +85°C.

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX	
V_{IGN}	Ignition supply voltage		7.5		18	V
I_{IGN}	Ignition supply current	V_{IGN} = 18 V no load V_{BB} = 18 V with load R_{LC}, R_{LS} = R_{LMIN}[1,2]			25 160	mA
I_{CC}	Logic supply current	V_{CC} = 5.5 V			1	mA
V_{OH}	Output high voltage	Data out I_{OH} = 300 µA	V_{CC} – 0.8			
V_{OL}	Output low voltage	Data out I_{OL} = 1.5 mA			0.4	V
V_{OL} Status		I_{OL} = 2.8 mA			0.8	V
I_{OH} Status		ST, V_{CC} = 5 V			25	µA
V_{IH}	Input high voltage	CS, S_{CLK}, $DATA_{IN}$	0.7 x V_{CC}			V
V_{IL}	Input low voltage	CS, S_{CLK}, $DATA_{IN}$			0.3 x V_{CC}	V
I_{IH}	Input high current	CS, S_{CLK}, $DATA_{IN}$, V_{IN} = 0.7 x V_{CC}			10	µA
I_{IL}	Input low current	CS, S_{CLK}, $DATA_{IN}$, V_{IN} = 0.3 x V_{CC}			10	µA
A_{CC}	Output function accuracy[3]	R_{LC}, R_{LS} = R_{LMIN}	–0.5		0.5	Degree
I_{SD}	Output shut-down current	COS+, COS–, SIN+, SIN– I_{SINK} V_{IGN} = $V_{IGN\ (MAX)}$ V_{IGN} = $V_{IGN\ (MIN)}$ I_{SOURCE} V_{IGN} = $V_{IGN\ (MAX)}$ V_{IGN} = $V_{IGN\ (MIN)}$	 97 43 85 43		 500 300 500 300	 mA mA mA mA
V_{DRIVE}	Coil drive voltage	V_{IGN} = $V_{IGN\ (MAX)}$ V_{IGN} = $V_{IGN\ (MIN)}$	68		78	%V_{IGN}
R_{LMIN}	Minimum load resistance	T_A = 85°C T_A = 25°C T_A = –40°C	215 171 138			Ω Ω Ω

NOTE:
1. See Test Circuit.
2. Maximum current is when output is 45 degrees; T_A = –40°C, and R_L = 138 Ω.
3. See Table “Output function accuracy”

Table 3. Output function accuracy

Ideal	Nominal	Input Code
0	0.176	0
45	45.176	128
90	90.176	256
135	135.176	384
180	180.176	512
225	225.176	640
270	270.176	768
360	359.820	1023
N = Binary Input Code **Equation for Output Angle (θ) vs Output Voltage**		
Quadrant	**Equation**	
I	$\theta = \tan^{-1} \lvert [(SIN+) – (SIN–)] / [(COS+) – (COS–)] \rvert$	
II	$\theta = 180° + \tan^{-1} \lvert [(SIN+) – (SIN–)] / [(COS+) – (COS–)] \rvert$	
III	$\theta = 180° + \tan^{-1} \lvert [(SIN+) – (SIN–)] / [(COS+) – (COS–)] \rvert$	
IV	$\theta = 360° + \tan^{-1} \lvert [(SIN+) – (SIN–)] / [(COS+) – (COS–)] \rvert$	

AC ELECTRICAL CHARACTERISTICS

V_{DD} = 7.5 to 18 V; V_{CC} = 4.5 to 5.5 V; T_A = –40 to +85°C

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			MIN	TYP	MAX	
FS_{CLK}	Input frequency				1.6	MHz
TS_{CLKH}	S_{CLK} high time		175			ns
TS_{CLKL}	S_{CLK} low time	V_{CC} = 5.5 V	175			ns
TRO	Output rise time DO	0.75 to V_{CC} –1.2 V, C_L = 90 pF			75	ns
TFO	Output fall time DO	V_{CC} –1.2 V to 0.75, C_L = 90 pF			75	ns
TSU	DI set-up time		75			ns
THI	DI hold time		75			ns

TYPICAL APPLICATION

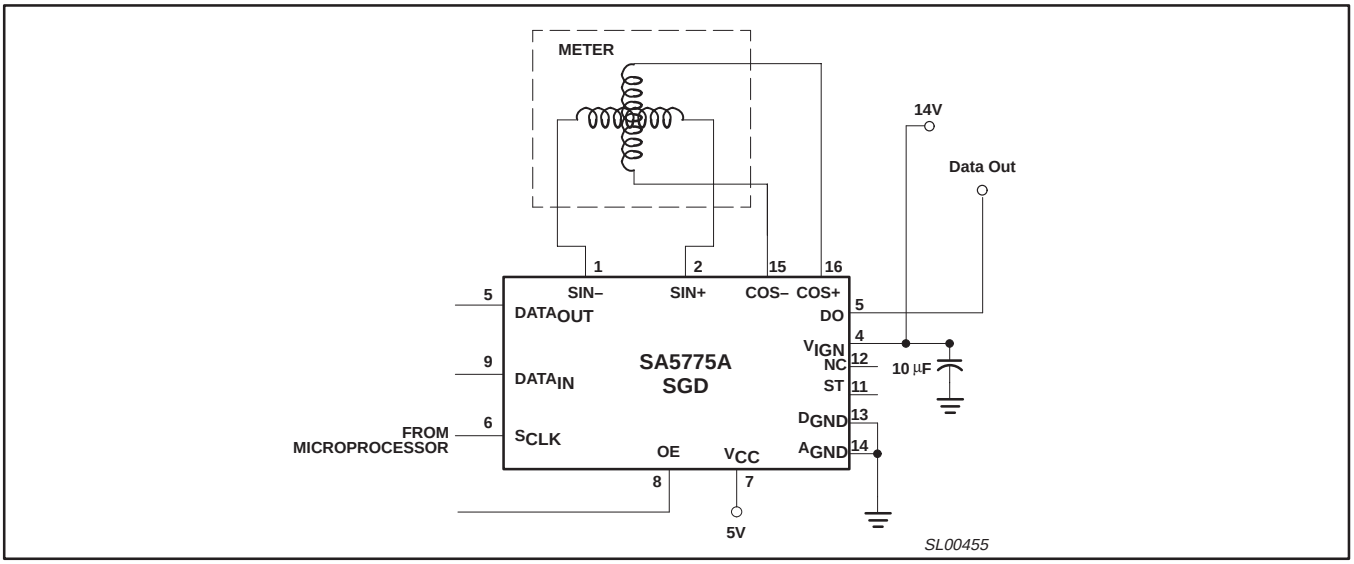


Figure 3. Typical application

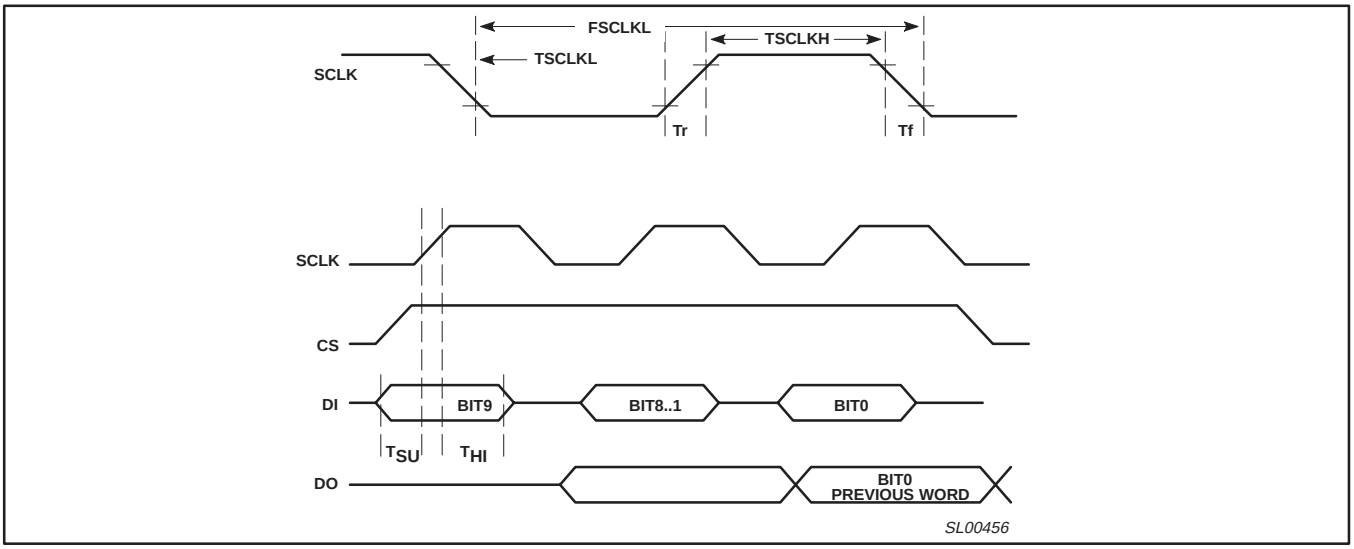


Figure 4. Serial interface timing

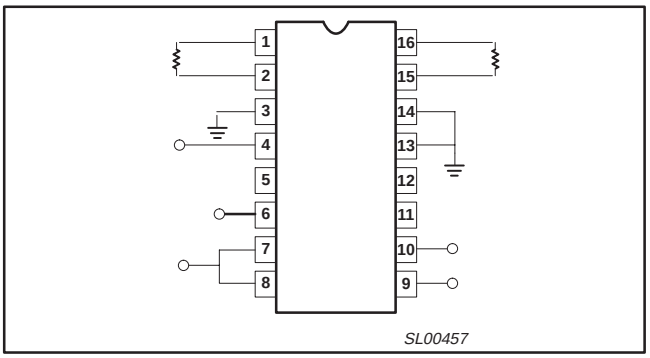


Figure 5. SA5775A Test circuit, N package

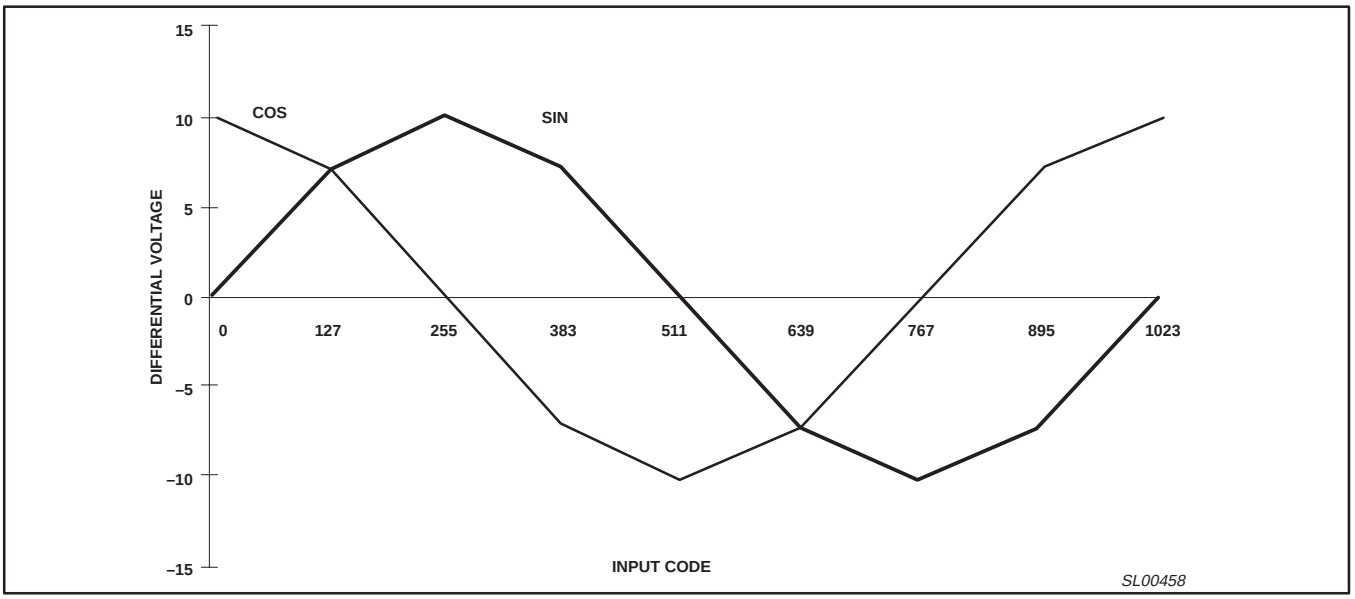


Figure 6. SA5775A output voltages (V_{IGN} = 14 V)

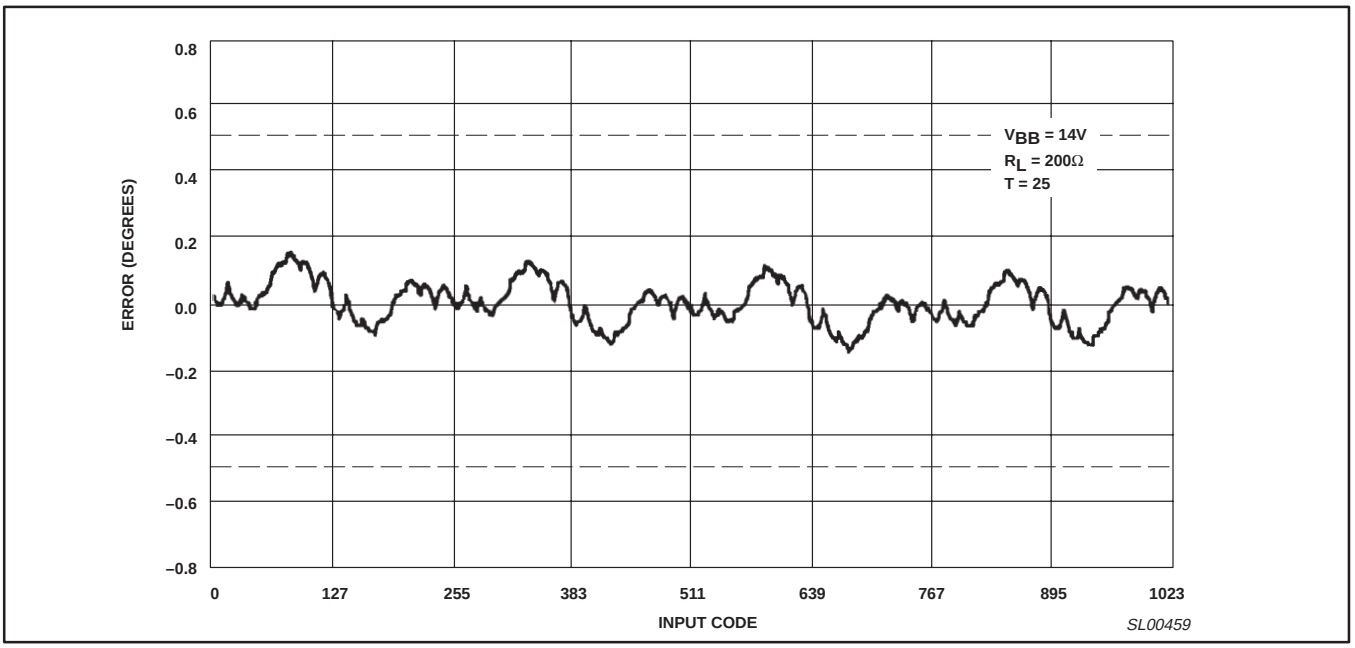
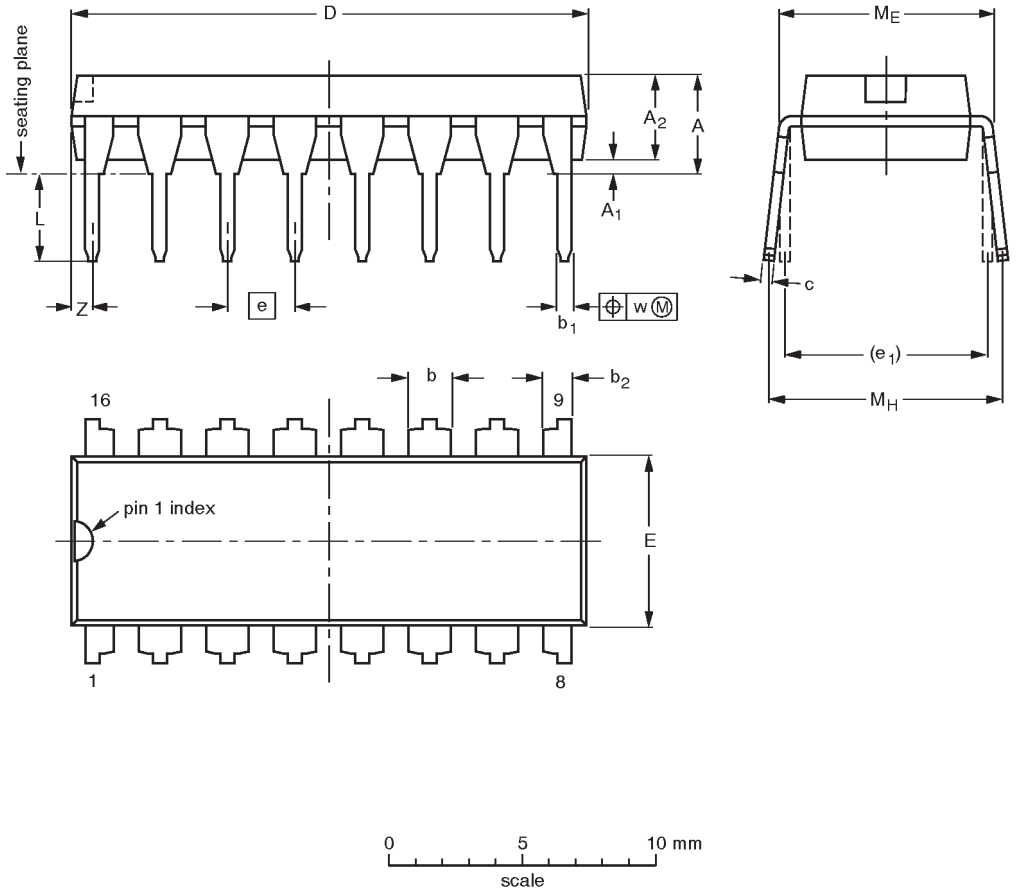


Figure 7. Error graph

DIP16: plastic dual in-line package; 16 leads (300 mil) **SOT38-4**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

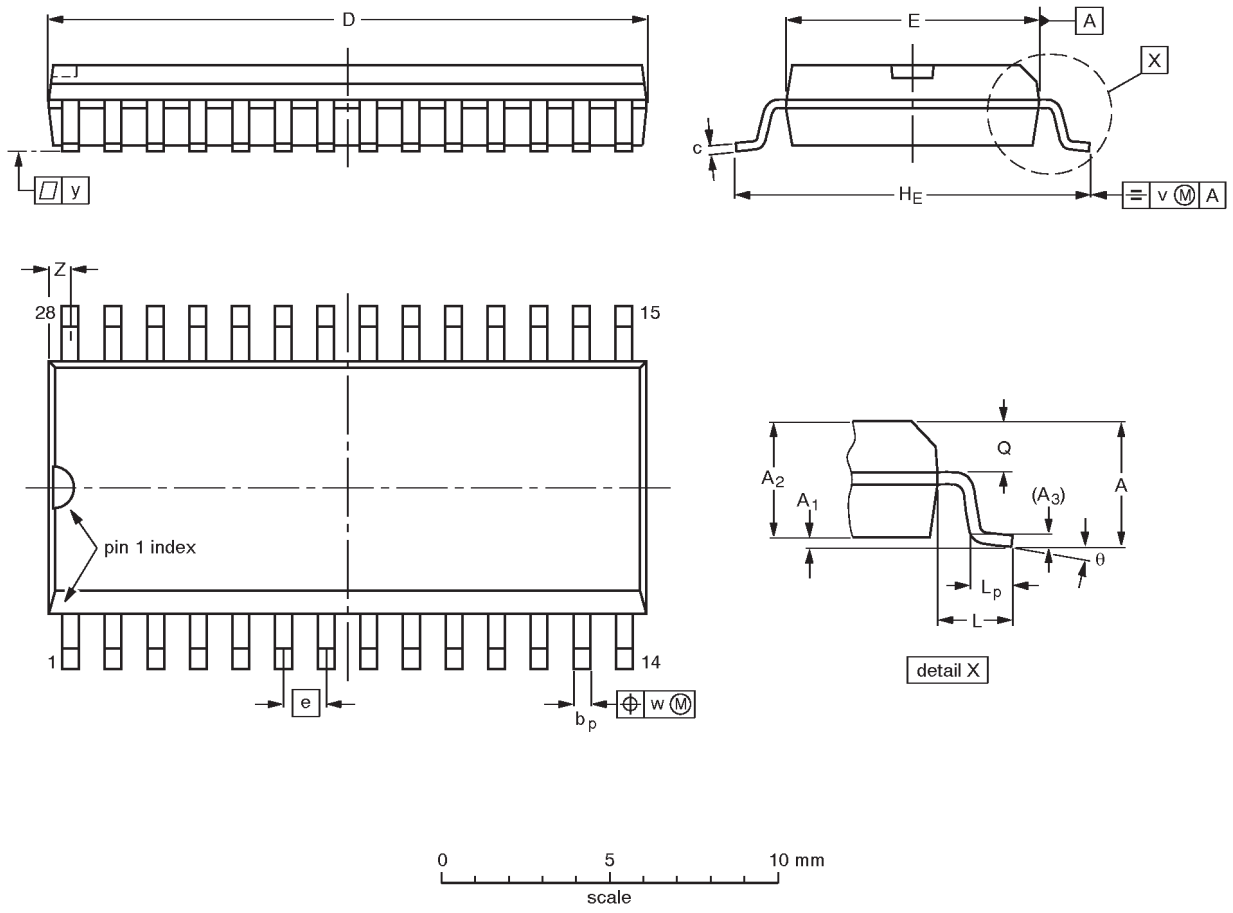
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	b_2	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.030

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-4						~~92-11-17~~ 95-01-14

SO28: plastic small outline package; 28 leads; body width 7.5mm **SOT136-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	18.1 17.7	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.71 0.69	0.30 0.29	0.050	0.42 0.39	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT136-1	075E06	MS-013AE				~~91-08-13~~ 95-01-24

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Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
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[1] Please consult the most recently issued datasheet before initiating or completing a design.

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