

OTC-047

16-BIT CONSTANT CURRENT LED DRIVER IC

DATE: May 20, 2001

PRELIMINARY

■ FEATURES

- CMOS process
- Low supply voltage: 3V to 5V
- Data transfer rate: up to 20 MHz
- 16 constant current output terminals
- Open-drain NMOS output
- Output sustaining voltage: 7V
- Output “ON” voltage: 0.7V
- Constant current output range: 5mA to 90mA
- Constant current matching ($V_{DD} = 5V$, $T_a = 25^{\circ}C$)
 - Bit-to-Bit: TBD @ $I_{out} = 88mA$
 - Bit-to-Bit: TBD @ $I_{out} = 20mA$
- Package type: PDIP24; SOP24

■ APPLICATIONS

- LED dot matrix driver
- LED back light driver
- LED message indicator driver

■ GENERAL DESCRIPTIONS

The OTC-047 is specially designed as a constant current-sink drive device for LED display applications. The current value at all the constant current outputs is set with an external resistor. The device incorporates with 16-bit shift register and data latch. In addition, there are serial data-input and data-output terminals for being cascaded with other devices.



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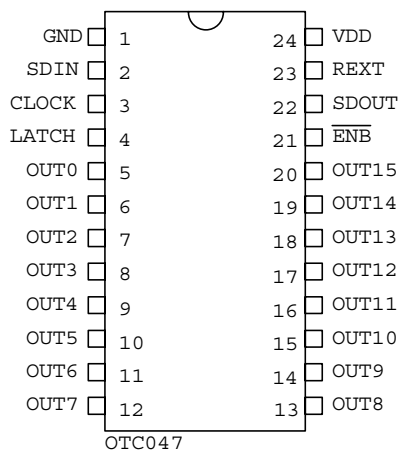
NO.8 INNOVATION ROAD 1,
HSINCHU SCIENCE-BASED INDUSTRIAL PARK,
HSINCHU 30077, TAIWAN, R. O. C.

TEL: 886-3-5777481
FAX: (03)5783636 ; 5783696
URL: <http://www.opto.com.tw/>
EMAIL: 1288@opto.com.tw

ORDERING INFORMATION

PART NO.	PACKAGE	NOTE
OTC-047K	24-Pin P-DIP	SKINNY TYPE
OTC-047S	24-Pin SOP	-

PIN ASSIGNMENT (TOP VIEW)



PIN DESCRIPTIONS

NO.	NAME	TYPE	DESCRIPTION
1	GND	Ground	Ground
2	SDIN	Input	Serial data input
3	CLOCK	Input	Clock input
4	LATCH	Input	Latch input of data strobe
5~20	OUTn	Output	Constant current output terminals
21	$\overline{\text{ENB}}$	Input	Output enable
22	SDOUT	Output	Serial data output
23	REXT	Input	Connection for external resistor
24	VDD	Power	Supply voltage

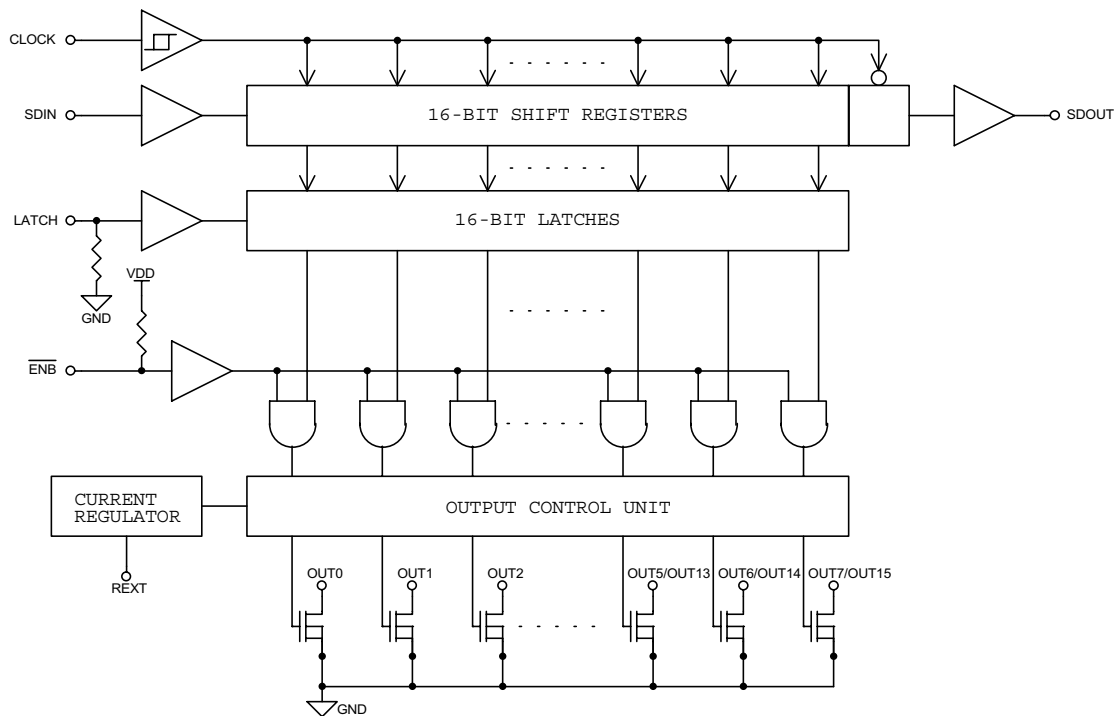


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■ FUNCTION BLOCK DIAGRAM



■ FUNCTION DESCRIPTIONS

The OTC-047 incorporates 16-bit shift register and data latch. Data at the serial data input terminal, SDIN, are transferred into shift registers and shift stage by stage on the rising edge of CLOCK and finally shift out via SDOUT port. The data in shift registers go through the data latch if LATCH holds high state. Once LATCH goes from high to low the data are latched in the data latch.

All constant current outputs are disabled when $\overline{\text{ENB}}=1$. While $\overline{\text{ENB}}$ goes low and holds low state, the constant current output turn ON if the data latch content is high and turn OFF if the data latch content is low.

The REXT terminal is with fixed voltage and a resistor externally connected with this terminal provides a reference current. The current value at each constant current output is about 14 times greater than reference current.



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■ ABSOLUTE MAXIMUM RATINGS

VDD=+5V, Ta=+25°C, UNLESS OTHERWISE SPECIFIED			
CHARACTERISTICS	SYMBOL	RATING	UNIT
Supply Voltage	VDD	2.5 ~ 5.5	V
Input Voltage	VIN	-0.4 ~ VDD+0.4	V
Clock Frequency	FCLK	20M	Hz
Output Sustaining Voltage	VOUT	7	V
Continuous Constant Current Output	IOUT	90	mA
GND Terminal Current	IGND	1440	mA
Power Dissipation, each Output	PDISS	90 (PDIP)	mW
		70 (SOP)	mW
Operating Temperature	TOPR	-40 ~ +85	°C
Storage Temperature	TSTR	-50 ~ +150	°C

■ RECOMMENDED OPERATING CONDITIONS

VDD=+5V, Ta=+25°C, UNLESS OTHERWISE SPECIFIED						
CHARACTERISTIC	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	VDD	-	4.5	-	5.5	V
Output Voltage	VOUT	OUTn ON or OFF	-	-	7	V
Output Current	IOUT	single OUTn ON	5	-	90	mA
	IOH	SDOUT	-	-	-1	
	IOL	SDOUT	-	-	1	
Input Voltage	VIH	-	0.7VDD	-	VDD+0.3	V
	VIL	-	-0.3	-	0.3VDD	
CLOCK Frequency	FCLK	-	-	-	10	MHz
Power Dissipation	PDISS	Ta=85°C (PDIP)	-	-	1.37	W
		Ta=85°C (SOP)	-	-	0.69	



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■ DC ELECTRICAL CHARACTERISTICS

VDD=+5V, Ta=+25°C, UNLESS OTHERWISE SPECIFIED						
CHARACTERISTIC	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	VDD	-	3	5	5.5	V
Digital Input Voltage	V _{IH}	-	0.7VDD	-	VDD	V
	V _{IL}	-	GND	-	0.3VDD	V
Digital Output Voltage	V _{OH}	I _{OH} =-1.0mA	4.6	-	-	V
	V _{OL}	I _{OL} =1.0mA	-	-	0.4	V
Voltage Reference	V _{REXT}	REXT=300Ω, Ta=-40~85°C	-	1.23	-	V
Supply Voltage Regulation	%/VDD	REXT=300Ω, Ta=-40~85°C	-	1.5	5.0	%/V
Supply Current	I _{DD(off)}	REXT=OPEN, all OUTn OFF	-	0.3	-	mA
		REXT=910Ω, all OUTn OFF	-	2.84	-	mA
		REXT=200Ω, all OUTn OFF	-	12.6	-	mA
	I _{DD(on)}	REXT=910Ω, all OUTn ON	-	2.84	-	mA
		REXT=200Ω, all OUTn ON	-	12.6	-	mA
Output Current	I _{OUT(on)}	REXT=910Ω, all OUTn ON	-	19.7	-	mA
		REXT=300Ω, all OUTn ON	-	59.3	-	mA
		REXT=200Ω, all OUTn ON	-	88.0	-	mA
Output Current Matching (Bit to Bit)	I _{OM}	REXT=910Ω, all OUTn ON	-	-	TBD	%
		REXT=200Ω, all OUTn ON	-	-	TBD	%
Input Resistance	R _{IN}	ENABLE input, Pull up	150	300	600	KΩ
		LATCH input, Pull down	100	200	400	
CLOCK Frequency	FCLK	-	-	10	20	MHz
Output Leakage Current	I _{OUT(OFF)}	V _{OUT} = 5V, all OUTn OFF	-	-	1	μA
Output Sustaining Voltage	V _{OUT(BK)}	all OUTn ON/OFF	-	-	7	V



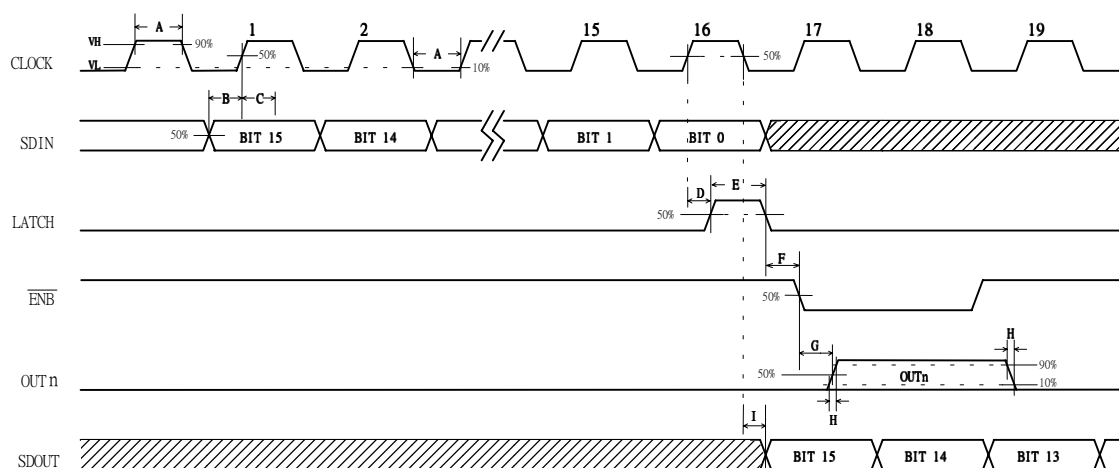
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■ TIMING CHART AND TIMING CONDITIONS

— TIMING CHART



— TIMING CONDITIONS

VDD=+5V, Ta=25°C, REXT=300Ω; CL=13PF@SDOUT					
ITEM	DESCRIPTION	MIN	TYP	MAX	UNIT
A	Clock pulse width	25	50	-	nS
B	Serial data setup time	30	-	-	nS
C	Serial data hold time	30	-	-	nS
D	Time between clock activation and data latch enable	50	-	-	nS
E	Data latch pulse width	50	-	-	nS
F	Time between data latch and output enable	50	-	-	nS
G	Time between output enable and output transition	30	-	-	ns
H	Output current rise/fall time	-	30	35	μs
I	Output delay time of serial data	-	20	25	nS

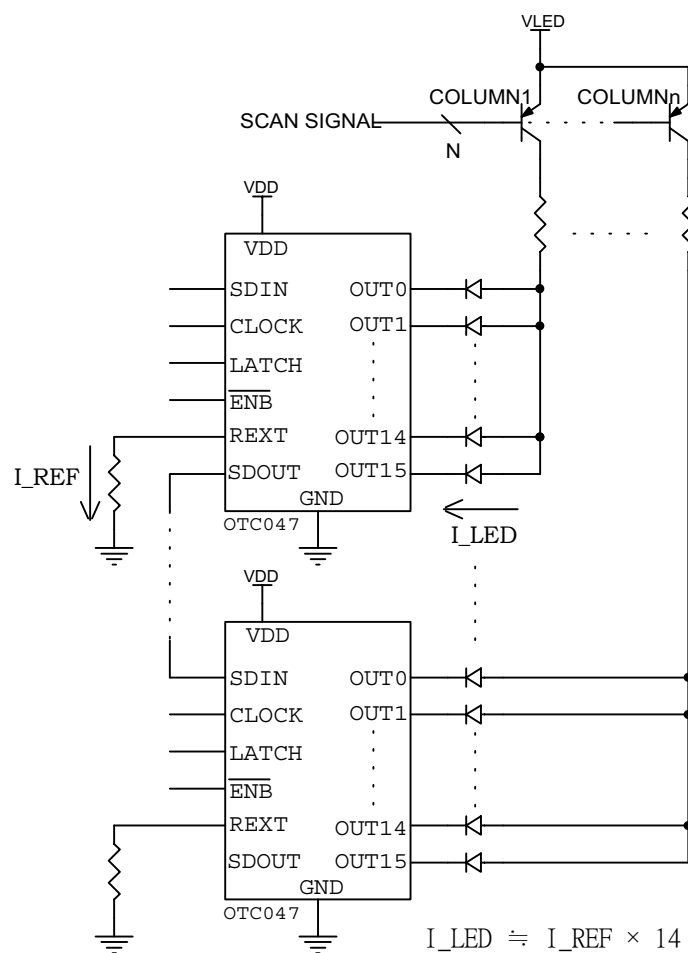


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■ TYPICAL APPLICATION CIRCUIT



■ TRUTH TABLE

SERIAL	CLOCK	SHIFT REGISTER CONTENTS					SERIAL	LATCH	LATCH CONTENTS					OUTPUT	OUTPUT CONTENTS				
DATA	INPUT						DATA	INPUT						ENABLE					
INPUT		I1	I2	I3.....IN-1	IN		OUTPUT		I1	I2	I3.....IN-1	IN		INPUT	I1	I2	I3.....IN-1	IN	
H		f _H	R1	R2.....RN-2	RN-1			RN-1											
L		f _L	R1	R2.....RN-2	RN-1			RN-1											
X			R1	R2 R3.....RN-1	RN			RN											
		X	X	XX	X		X		R1	R2	R3.....RN-1	RN							
		P1	P2	P3.....PN-1	PN		PN		P1	P2	P3.....PN-1	PN	L		P1	P2	P3.....PN-1	PN	
									X	X	XX	X	H		L	L	LL	L	

L=LOW LOGIC LEVEL H=HIGH LOGIC LEVEL X=IRRELEVANT P=PRESENT STATE R=PREVIOUS STATE



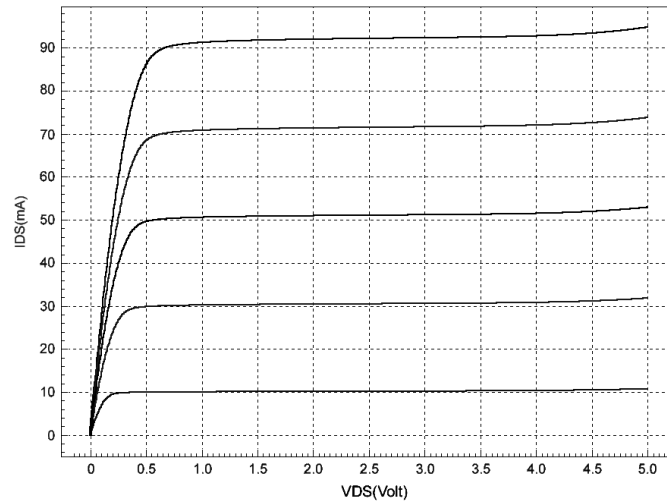
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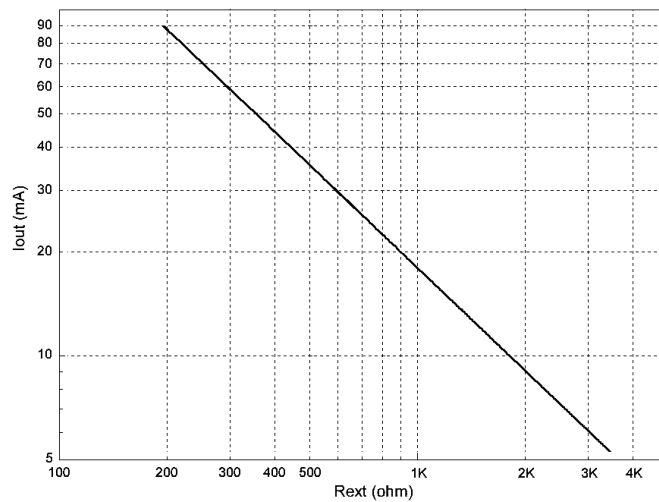
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■ TYPICAL CHARACTERISTIC CURVES

— NMOS Driver I-V Characteristics



— I_{OUT} vs. R_{EXT}

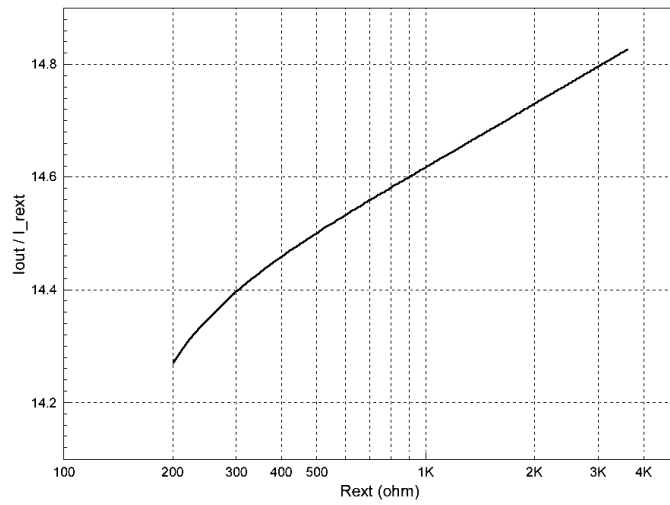


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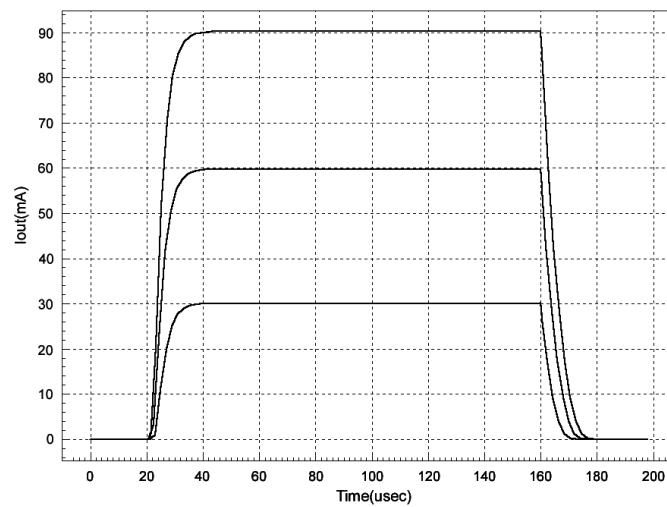
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— I_{OUT} / I_{REXT} vs. R_{EXT}



— Output Current Waveforms



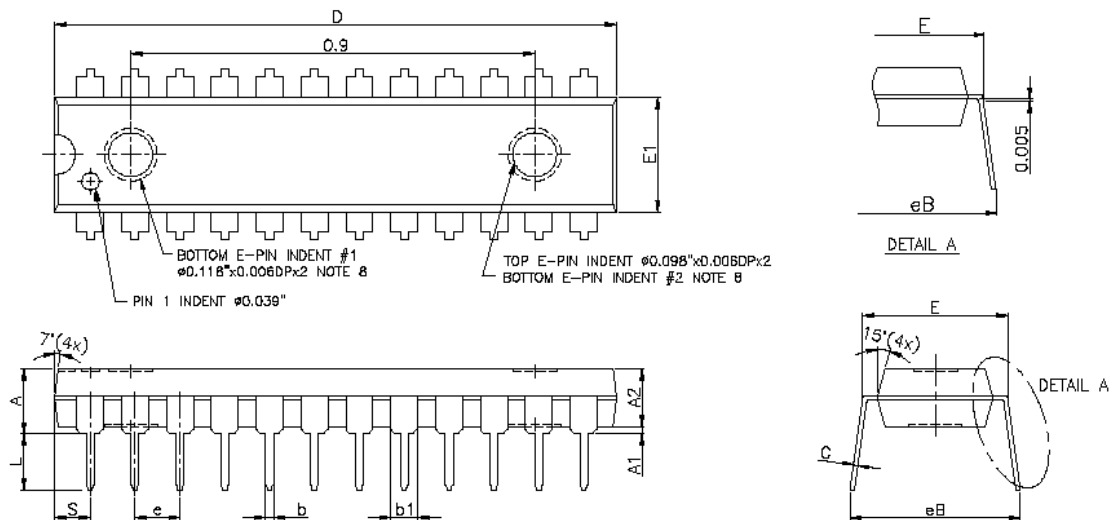
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■ PACKAGE INFORMATION

— P-DIP24



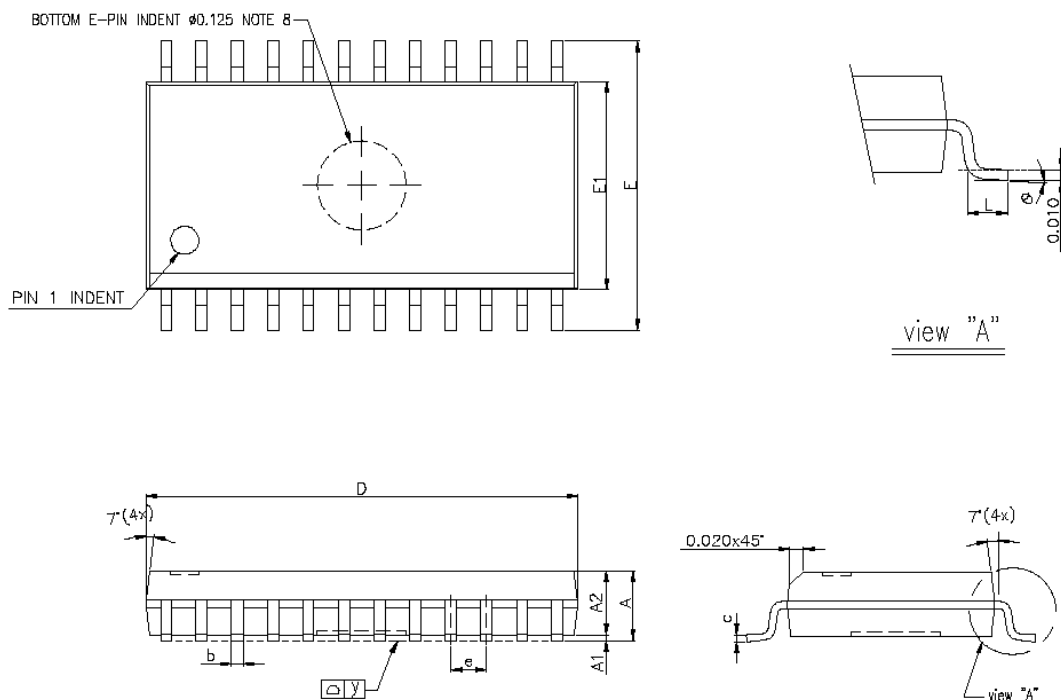
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	4.57	—	—	0.180
A1	0.38	—	—	0.015	—	—
A2	3.25	3.30	3.45	0.128	0.130	0.136
b	0.36	0.46	0.56	0.014	0.018	0.022
b1	1.27	1.52	1.78	0.050	0.060	0.070
C	0.20	0.25	0.33	0.008	0.010	0.013
D	31.70	31.75	31.90	1.248	1.250	1.256
E	7.62	—	8.26	0.300	—	0.325
E1	6.43	6.48	6.68	0.253	0.255	0.263
e	—	2.54	—	—	0.100	—
eB	8.64	—	9.65	0.340	—	0.380
L	3.18	3.30	3.81	0.125	0.130	0.150
S	1.88	1.98	2.16	0.074	0.078	0.085



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SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	2.36	2.49	2.64	0.093	0.098	0.104
A1	0.10	—	0.30	0.004	—	0.012
A2	—	2.34	—	—	0.092	—
b	0.33	0.41	0.51	0.013	0.016	0.020
C	0.23	0.25	0.30	0.009	0.010	0.012
D	15.19	15.39	15.49	0.598	0.606	0.610
E	10.01	10.31	10.64	0.394	0.406	0.419
E1	7.39	7.49	7.59	0.291	0.295	0.299
e	—	1.27	—	—	0.050	—
L	0.38	0.81	1.27	0.015	0.032	0.050
y	—	—	0.076	—	—	0.003
Ø	0°	—	8°	0°	—	8°



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