16 Channel Constant
current output LED Driver

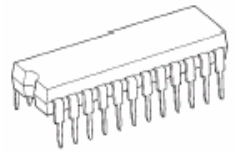
LD71D0016

Data Sheet

2004. 4

DESCRIPTION

The LD71D0016 is specifically designed for LED and LED DISPLAY constant current drivers.
This constant current output circuit is able to set up external resistor (IOUT = 5mA to 90mA).
The devices consist of 16bit shift register, latch, and-gate and constant current driver.



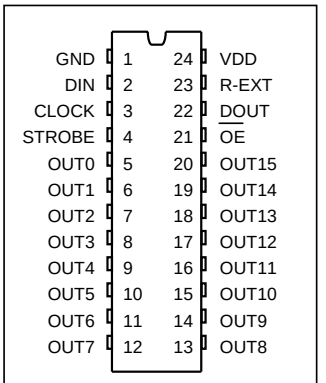
SDIP24-P-300
Weight : 1.20g (Typ.)

FEATURES

- Output current : set-up at 5mA to 90mA with an external resistor
- A little change of output current

OUT-GND VOLTAGE	A LITTLE CHANGE OF CHANNEL	IOUT (mA)
≧ 0.7V	± 6%	5mA ~40mA
≧ 1.0V		5mA ~90mA

- 5V CMOS Compatible Input
- Package : SDIP-24, PDIP-24, SSOP-24, SOP-24
- Maximum Clock Frequency : f_{MAX} = 25MHz

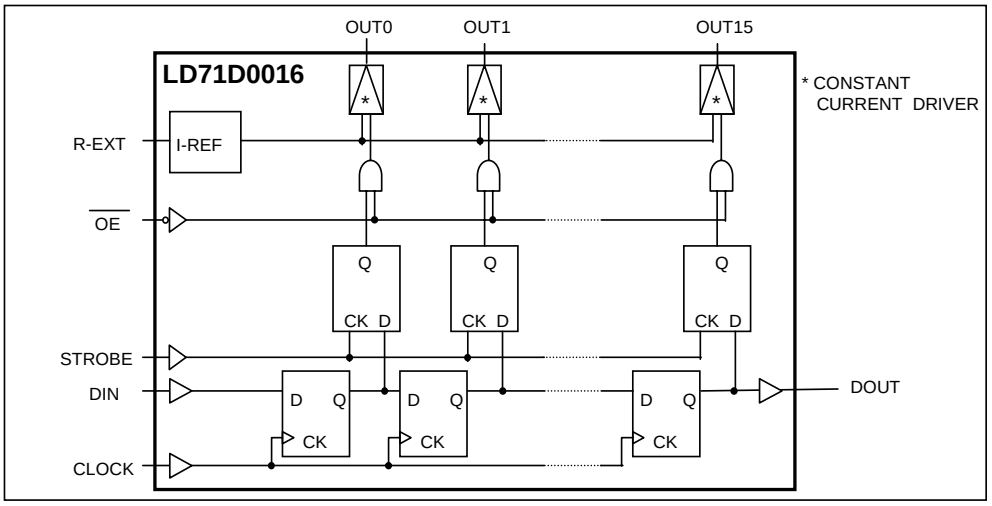


PIN CONNECTIONS (TOP VIEW)

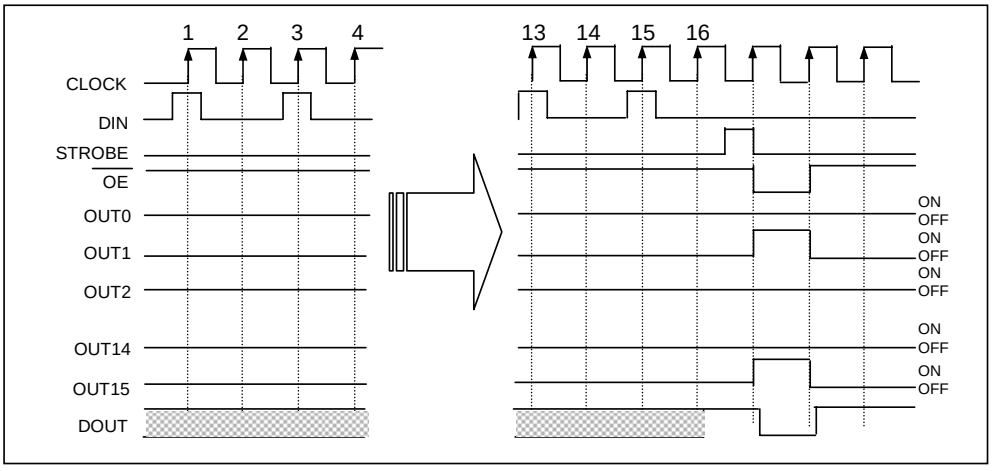
PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	GND	GND terminal for control logic driver
2	DIN	Serial data input terminal for shift register
3	CLOCK	Clock input terminal for data shift to up-edge
4	STROBE	"H" level : data through, "L" level : data hold
24	VDD	Supply voltage terminal
5~12 13~20	OUTn	Output terminals
21	$\overline{OE}$	"H" level output off, "L" level : latch data = "H" level then output on, latch data = "L" level then output off
22	DOUT	Serial data output terminal for shift register
23	R-EXT	The resistor which connects between R-EXT and GND sets the constant output current.

BLOCK DIAGRAM



TIMING DIAGRAM



TRUTH TABLE

INPUT				OUTPUT OUTn (t =n)			
CLOCK	STROBE	$\overline{OE}$	DIN	OUT0	OUT7	OUT15	DOUT
↑	H	L	Dn	D_n	D_{n-7}	D_{n-15}	D_{n-15}
↑	L	L	Dn	No change			D_{n-15}
↑	*	H	Dn	OFF	OFF	OFF	D_{n-15}
↓	*	*	Dn	No change			No Change

(Note) Dn~Dn-15 = “H” then OUTn is ON, “L” then OUTn is OFF

ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS (Ta = 25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	0~7.0	V
Output Voltage	V_{OUT}	-0.5~8.0	V
Output current	I_{OUT}	90	mA
Input Voltage	V_{IN}	-0.4~V_{DD}+0.4	V
GND Terminal Current	I_{GND}	1440	mA
Clock Frequency	f_{CK}	25	MHz
Power Dissipation	P_D	1.78	W
Operating Temperature	T_{opr}	-40~85	°C
Storage Temperature	T_{stg}	-55~150	°C

(Note) Ambient temperature delated above 25°C in the proportion of 14.2mW/ °C

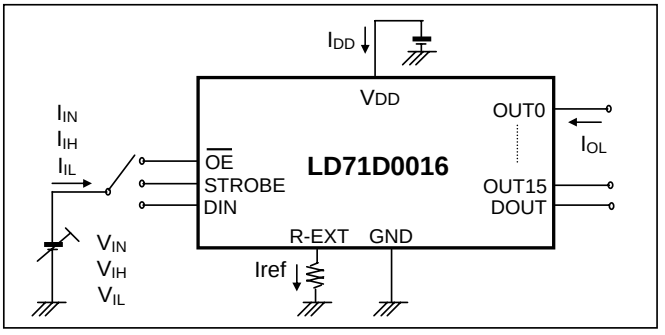
RECOMMENDED OPERATING CONDITION (Ta = 25°C unless otherwise noted)

PARAMETER		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage		V_{DD}	-	4.5	5.0	5.5	V
Output Voltage		V_{OUT}	-	-	-	8.0	-
Output Voltage	OUTn	I_{OUT}	-	-	-	90	mA
	DOUT	I_{OH}	-	-	-	-1.0	
		I_{OL}	-	-	-	1.0	
Input Voltage		V_{IN}	-	0	-	V_{DD}	V
Data Set Up Time		t_{setup} (D)	-	20	-	-	ns
Data Hold Time		t_{hold} (D)	-	20	-	-	ns
STROBE Set UP Time		t_{setup}(S)	-	20	-	-	ns
STROBE Hold Time		t_{hold} (S)	-	20	-	-	ns
Clock Pulse Width		t_w CLK	-	15	-	-	ns
		t_w $\overline{CLK}$	-	15	-	-	
Strobe Pulse Width		t_w STB	-	20	-	-	ns
		t_w $\overline{STB}$	-	20	-	-	
Clock Pulse Width		f_{CK}	Cascade Operation	-	-	25.0	MHz
Power Dissipation		P_D	Ta = 85°C	-	-	0.74	W

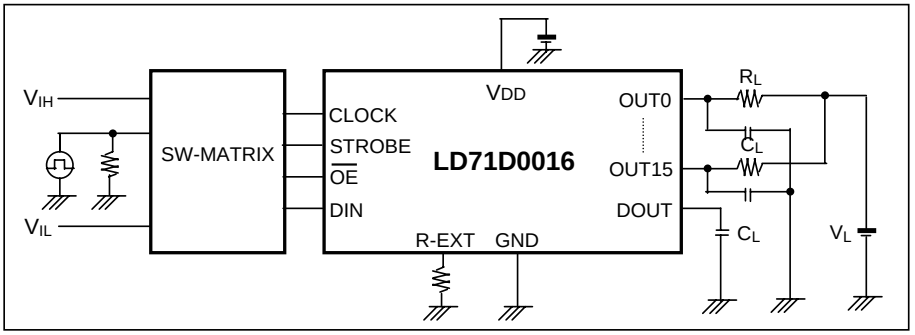
ELECTRICAL CHARACTERISTICS (Ta = 25°C unless otherwise noted) (continued)

PARAMETER		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Voltage	"H" Level	V_{IH}	-	-	$0.7V_{DD}$	-	V_{DD}	V
	"L" Level	V_{IL}	-	-	GND	-	$0.3V_{DD}$	
Output Leakage current		I_{OZ}	-	V_{OH} = 6.0V		-	1	uA
Output Voltage	DOUT	V_{OL}	-	-	-	-	$0.2V_{DD}$	V
		V_{OH}	-	-	$0.8V_{DD}$	-	-	
Output Current1		I_{OL1}	-	REXT = 14kΩ	37	40.0	43.0	mA
	Delta IOUT	ΔI_{OL1}	-	REXT = 14 kΩ IOUT = 40mA, V_{OUT} = 1V	-	± 1.5	± 6.0	%
Output Current2		I_{OL2}	-	REXT = 7.0 kΩ	70.0	75.0	80.0	mA
	Delta IOUT	ΔI_{OL2}	-	R_{EXT} = 7.0 kΩ I_{OUT} = 75mA, V_{OUT} = 1V	-	± 1.5	± 6.0	%
Supply Voltage Regulation		$\%/V_{DD}$	-	R_{EXT}= 14 kΩ	-	1.5	5.0	%/V
Reference Voltage		V_{ref}	-	R_{EXT}=14 kΩ,Ta =-40~85°C	-	1.12	-	V
Pull up resistor		R_{IN}(up)	-	-	100	200	400	kW
Pull down resistor		R_{IN}(down)	-	-	100	200	400	
Supply current		I_{DD} (off) 1	-	R_{EXT} = OPEN, OUTn = OFF	-	0.3	0.6	V
		I_{DD} (off) 2	-	R_{EXT} = 14 kW, OUTn = OFF	0.5	1.0	1.5	mA
		I_{DD} (off) 3	-	R_{EXT} = 7.0 kW, OUTn = OFF	1.0	2.0	3.0	

DC CHARACTERISTIC TEST CIRCUIT



AC CHARACTERISTIC TEST CIRCUIT



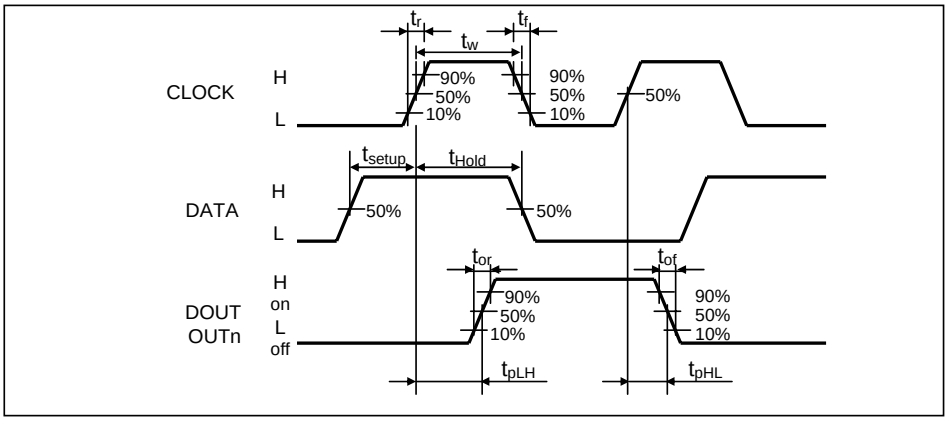
SWITCHING CHARACTERISTICS (Ta = 25°C unless otherwise noted)

PARAMETER		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Propagation Delay Time ("L" to "H")	CK-DOUT	t_{PLH}	-	V_{DD} = 5.0V V_{OUT} = 1.0V V_{IH} = VDD V_{IL} = GND f_{CK} = 10MHz R_{EXT} = 10 kΩ I_{OUT} = 40mA V_L = 3.0V C_L = 10.0pF R_L = 65Ω	-	30	70	ns
	CK-OUTn				-	600	1500	
	STROBE-OUTn				-	600	1500	
	$\overline{OE}$-OUTn				-	600	1500	
Propagation Delay Time ("H" to "L")	CK-DOUT	t_{PHL}	-		-	30	70	ns
	CK-OUTn				-	350	1000	
	STROBE-OUTn				-	350	1000	
	$\overline{OE}$-OUTn				-	350	1000	
Maximum Clock Frequency		f_{CKMAX} (*1)	-		-	10	25	MHz
Propagation Delay Time ("H" to "L")	Clock	t_{WCK}	-		-	20	50	ns
	STROBE	t_W STB	-		-	10	40	
Data Set Up Time		$t_{setup\ (D)}$	-		-	10	30	ns
Data Hold Time		$t_{hold\ (D)}$	-		-	10	30	
STROBE Set up Time	LH	t_{STB} setup	-		-	10	20	ns
	HL				-	0	20	
STROBE Hold Time	LH	t_{STB} hold	-		-	10	20	ns
	HL				-	0	20	
Maximum Clock Rise Time		t_r	-		-	-	10	ns
Maximum Clock Fall Time		t_f			-	-	10	
Minimum Output Rise Time		t_{or}	-		-	300	1000	ns
Minimum Output Rise Time		t_{of}			-	150	600	

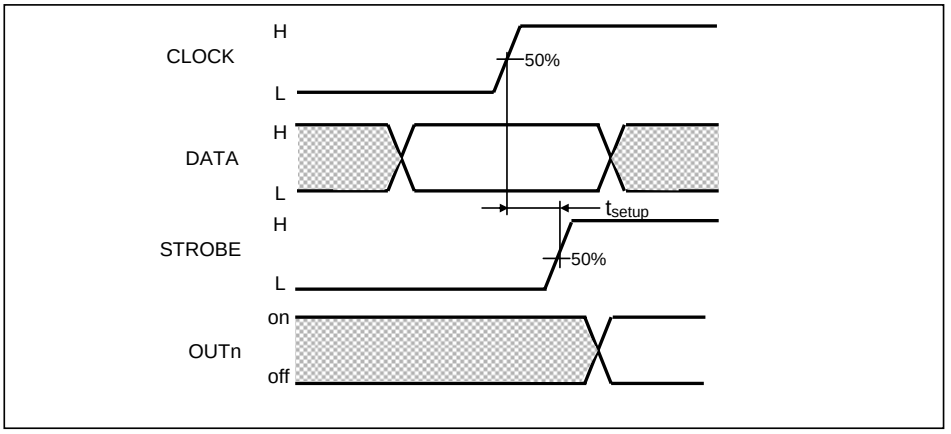
*1 : Cascade Operation

TIMING WAVE FORM

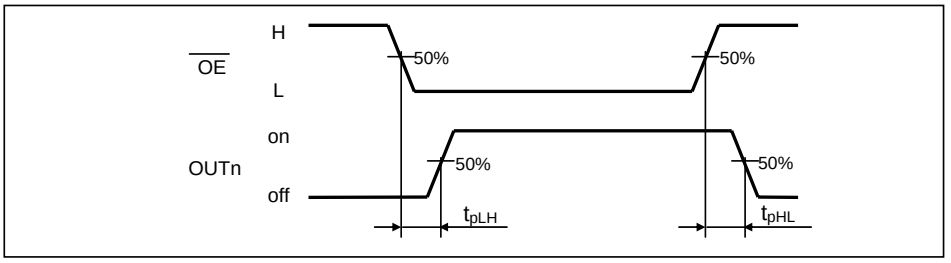
CLOCK-DOUT, OUTn



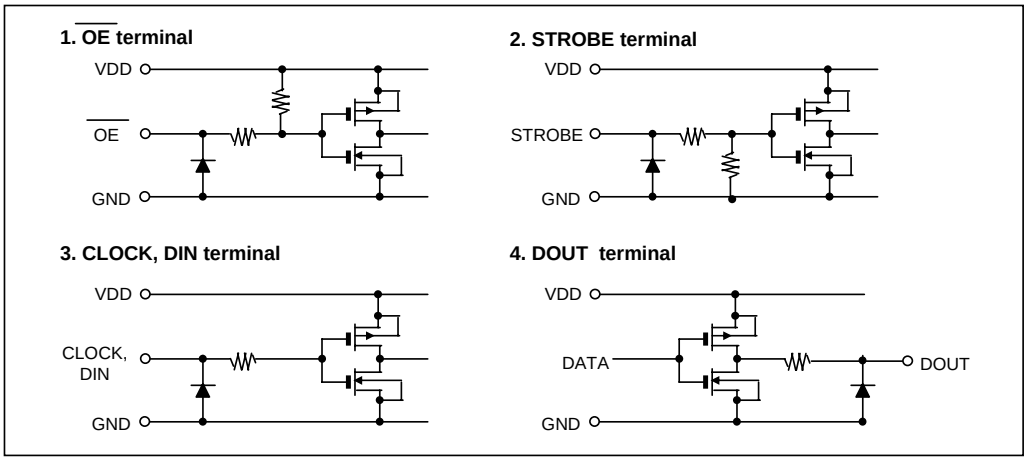
CLOCK-STROBE



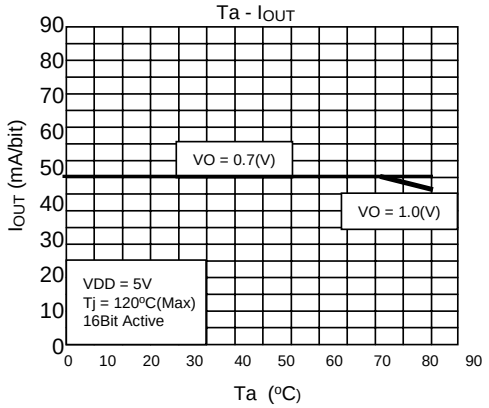
$\overline{OE}$

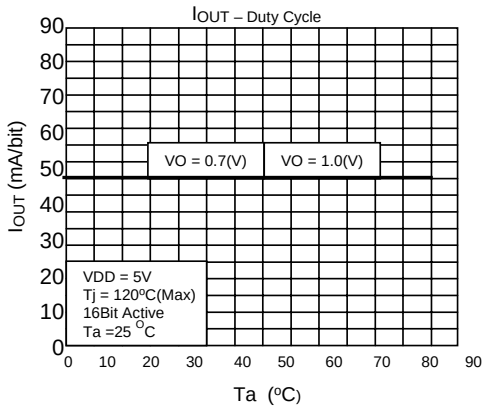


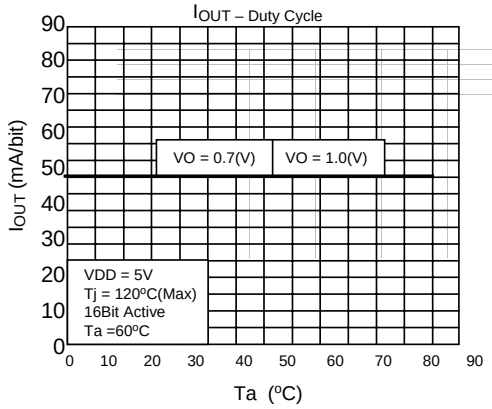
EQUIVALENT CIRCUIT OF INPUTS AND OUTPUTS

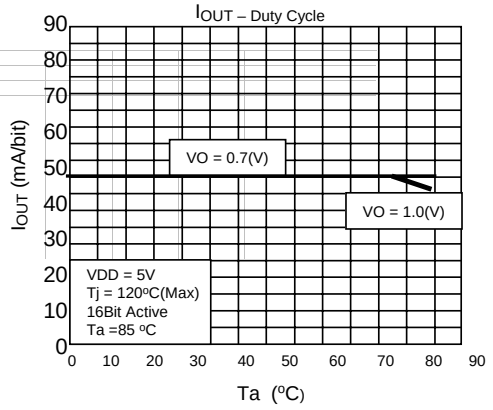


OUTPUT CURRENT vs. AMBIENT TEMPERATURE

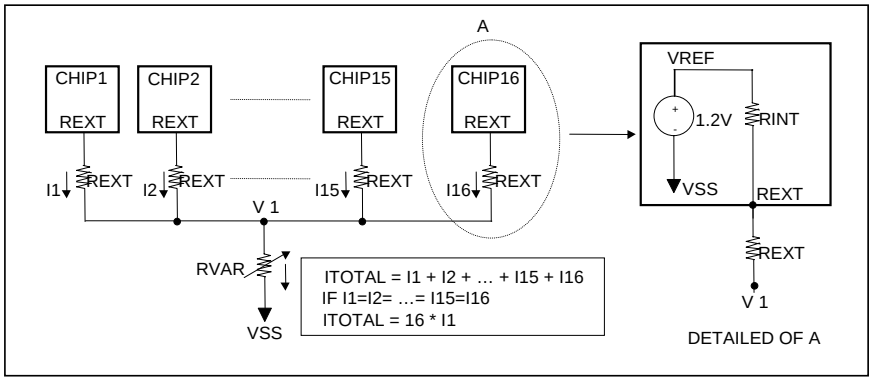








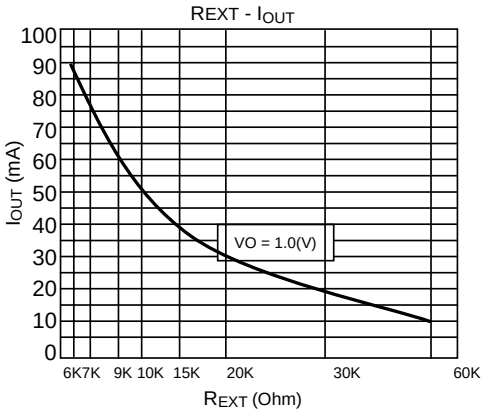
OUTPUT CURRENT AND REXT



When RVAR is closing to 0 Ohm, the current through LED(ILED) reaches to maximum value then the Maximum Current Limitation(ILED_MAX) value can be determined with REXT resistor. The LD71D0016 has RINT resistor(1 kOhm) internally to protect device from excessive current and RINT is connected to REXT port serially.

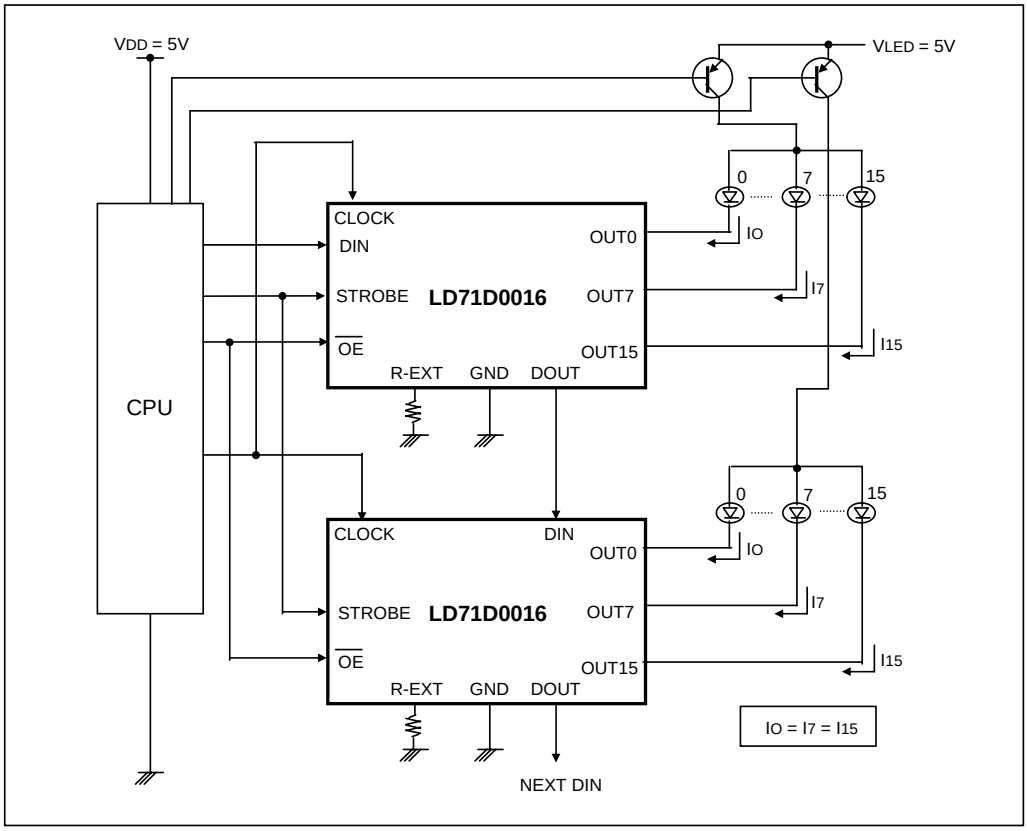
I1 = (VREF - V1) / (RINT + REXT)
V1 = 16 * I1 * RVAR = 16 * [(VREF- V1) / (RINT+ REXT)] * RVAR
ILED = 500 * I1 = 500 * (VREF - V1) / (RINT + REXT)

At RVAR is 0 Ohm(V1 voltage is 0 V), the ILED_MAX value can be measured. Knowing the ILED_MAX and ILED_MIN, the REXT and the RVAR value are calculated using above formula and determined with taking the operating tolerance into considerations.



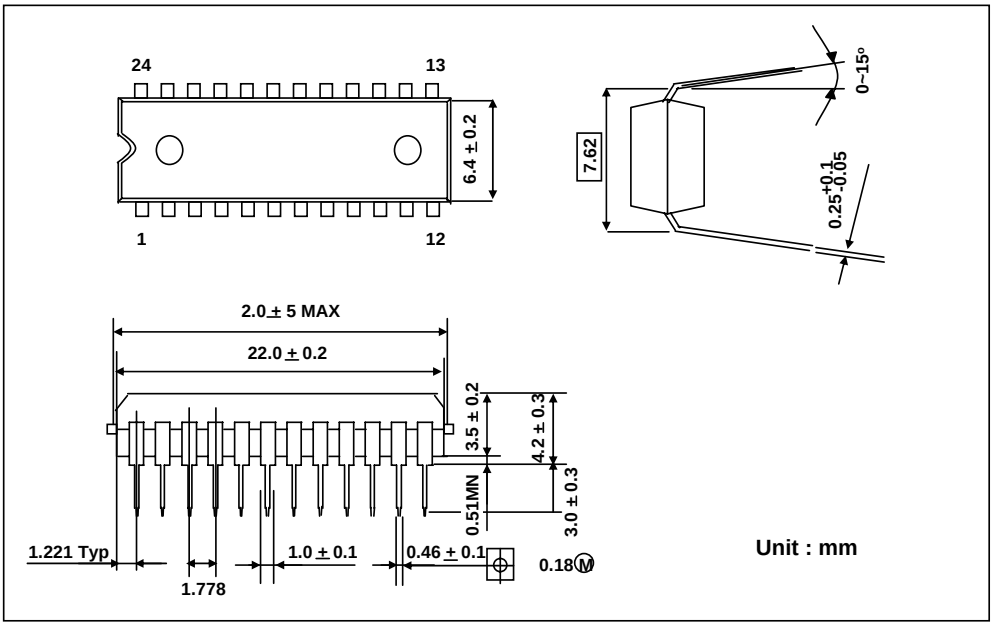
REXT	IOUT
6 kOhm	85mA
7 kOhm	75mA
9 kOhm	60mA
11 kOhm	50mA
14 kOhm	40mA
19 kOhm	30mA
29 kOhm	20mA
59 kOhm	10mA

TYPICAL APPLICATION

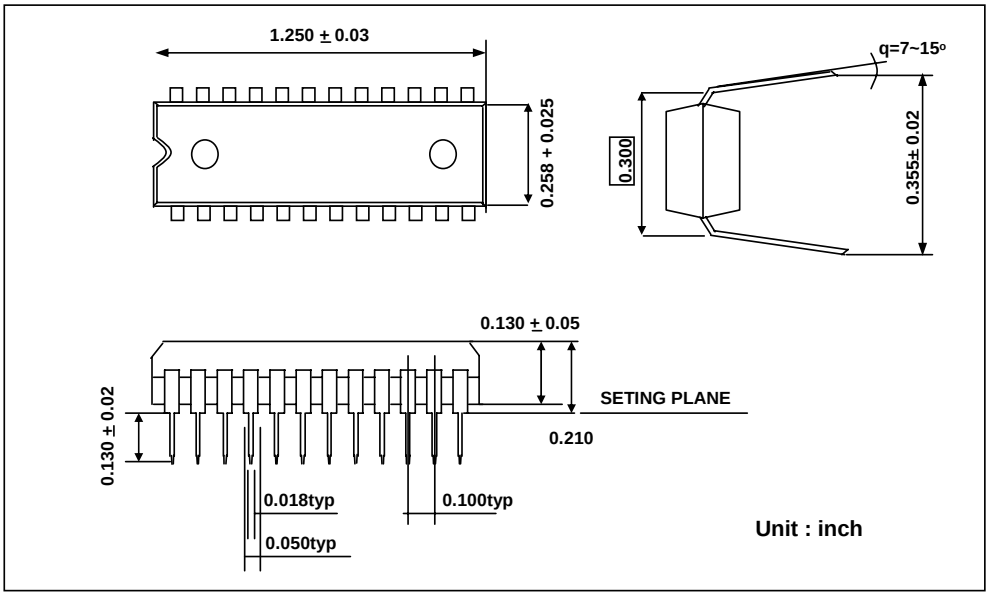


PACKAGE INFORMATION

SDIP24-P-300-1.78

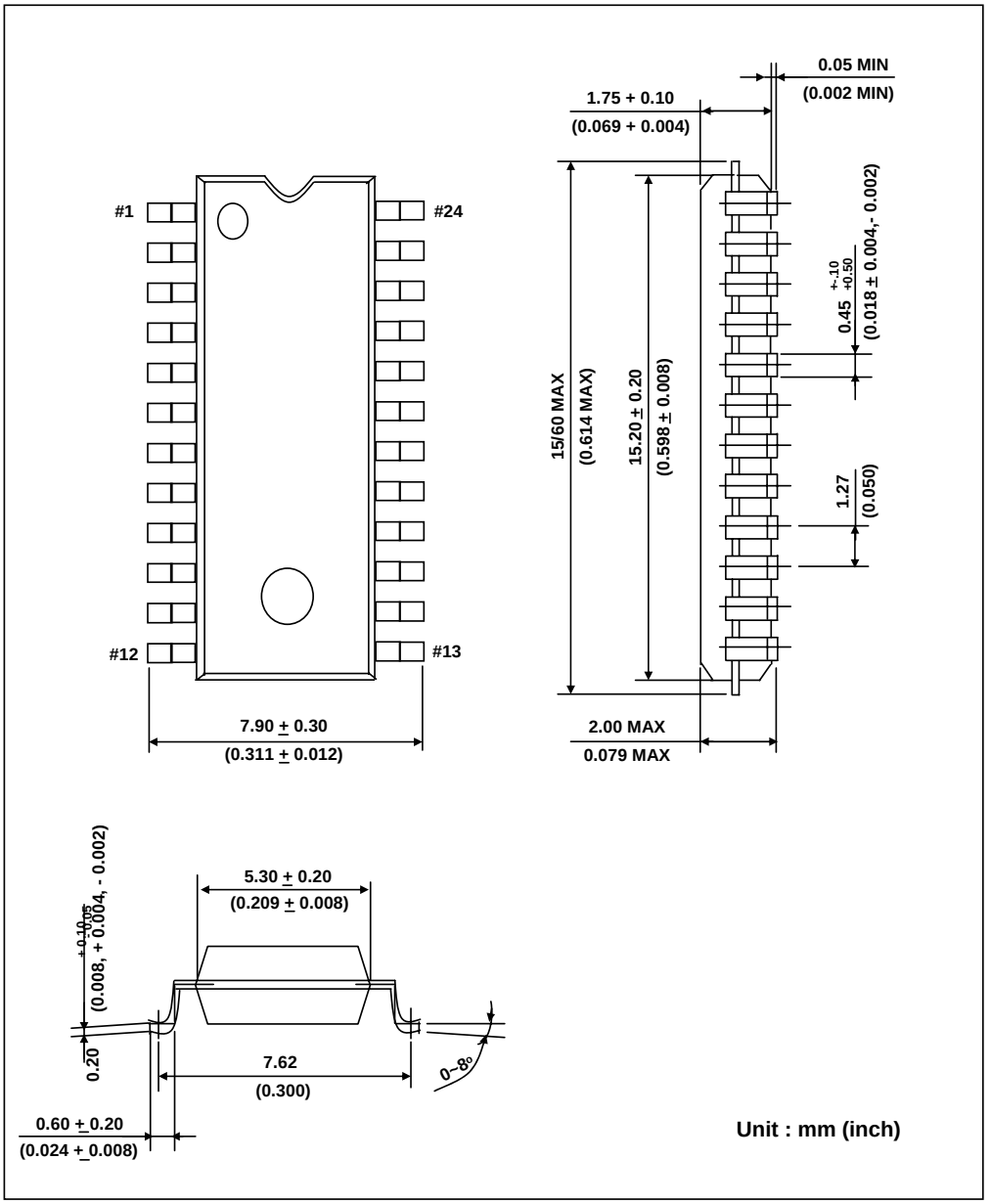


P-DIP 24



PACKAGE INFORMATION (continued)

SSOP 24 - 300



PACKAGE INFORMATION (continued)

SOP 24