

## 16-BIT CONSTANT CURRENT LED DRIVER

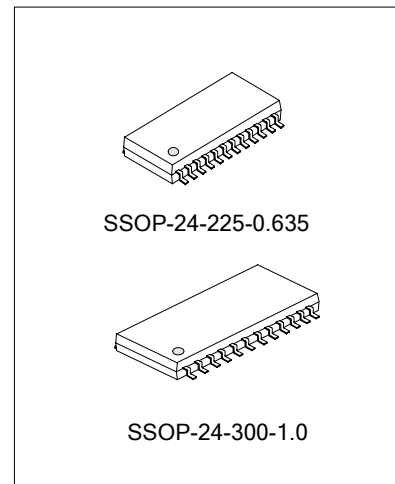
### DESCRIPTION

SD16729 is a constant current LED driver with advanced Bi-CMOS technology, the constant current is determined by external resistor. It includes a 16-bit shift register, latches, the constant current driver and etc. In the output stage, there are 16 current sources which provide a 1-45mA constant current drive for LED through bipolar device.

### FEATURES

- \* Output current adjustable through external resistor
- \* Data serial-in/serial-out
- \* 16-channel constant current output
- \* Output current: 1~45mA
- \* 30MHz clock frequency
- \* Fast output current response, ENABLE min. width:30ns
- \* Current Precision (all output are ON)

Precision		Test Condition
Between bits	Between ICs	
<±2%	<±3%	Output current:1~15mA



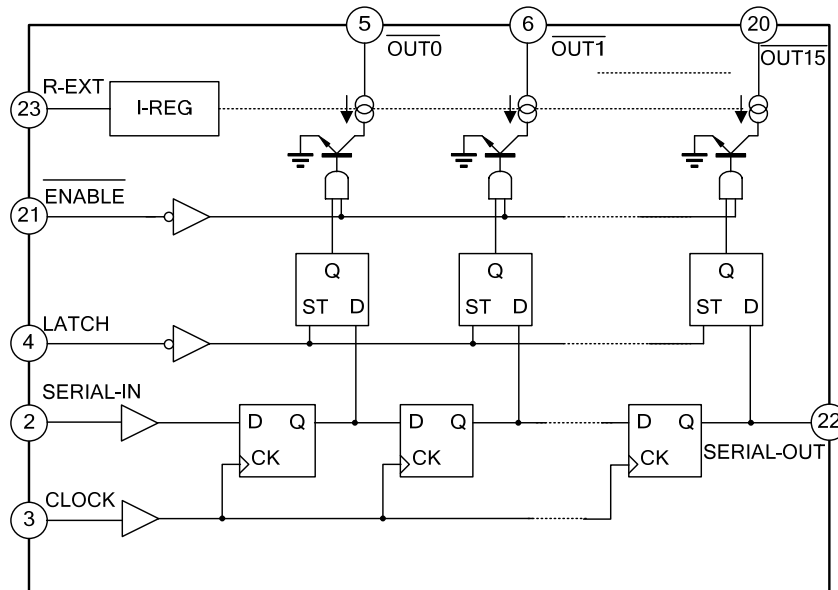
### APPLICATIONS

- \* LED screen

### ORDERING INFORMATION

Device	Package	Marking
SD16729P	SSOP-24-300-1.0	SD16729P
SD16729S	SSOP-24-225-0.635	SD16729S

**BLOCK DIAGRAM**



**ABSOLUTE MAXIMUM RATING (T<sub>amb</sub>=25°C)**

Characteristics		Symbol	Ratings	Unit
Supply Voltage		VDD	6	V
Input Voltage		VIN	-0.2~VDD+0.2	V
Output Current		IOUT	50	mA/ch
Output Voltage		VOUT	-0.2~ 17	V
Power Dissipation	SD16729S	PD1	1.04	W
Power Dissipation	SD16729P	PD2	1.32	W
Thermal Resistance	SD16729S	Rth(j-a)1	120	°C/W
Thermal Resistance	SD16729P	Rth(j-a)2	94	°C/W
Storage Temperature		Tstg	-55~+150	°C
Operating Temperature		Topr	-40 ~ 85	°C

**OPERATING CONDITION RECOMMENDED**

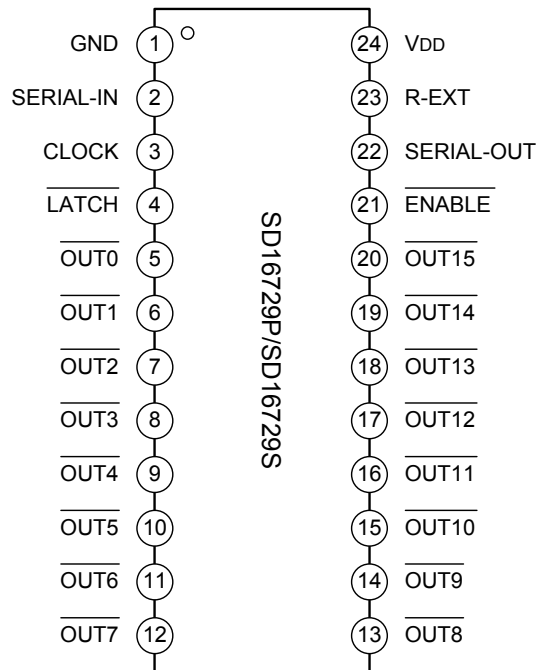
Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Supply Voltage	VDD	-	3.0	-	5.5	V
Output Voltage	VOUT	-	0.5	1	17	V
Output Current	IOUT	-	1	-	45	mA/ch
	IOH	SERIAL-OUT	-	-	1	mA
	IOL	SERIAL-OUT	-	-	-1	mA
Input Voltage	VIH	-	0.76VDD	-	VDD+ 0.15	V
Input Voltage	VIL	-	-0.15	-	0.26VDD	V
CLOCK Frequency	Fclk	Cascaded	-	-	30	MHz
LATCH Setup Time	tsu(L)	-	5	-	-	nS
LATCH Hold Time	th(L)	-	30	-	-	nS
CLOCK Pulse Width	tCLK	-	20	-	-	nS
ENABLE Pulse Width	tENA	IOUT = 20 mA, connected to LED for test	30	-	-	nS
CLOCK Setup Time	tsu(C)	-	10	-	-	nS
CLOCK Hold Time	th(C)	-	10	-	-	nS

**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified, Tamb=25°C, VDD=3.0V-5.5V)

Characteristics	Symbol	Test conditions		Min.	Typ.	Max.	Unit
Supply Voltage	VDD	-		3.0	-	5.5	V
Output Current	IOUT1	VDD=3.3V VOUT=1V	REXT=470Ω	38.53	39.55	40.61	mA
	IOUT2	VDD=5.0V VOUT=1V		38.53	39.55	40.61	mA
	IOUT3	VDD=3.3V VOUT=1V	REXT=1.2kΩ	14.81	15.25	15.69	mA
	IOUT4	VDD=5.0V VOUT=1V		14.81	15.25	15.69	mA
	IOUT5	VDD=3.3V VOUT=1V	REXT = 12kΩ	1.5	1.55	1.6	mA
	IOUT6	VDD=5.0V VOUT=1V		1.5	1.55	1.6	mA
Output Leakage Current	Iok	VOUT=15.0V		-	-	1	uA
Output Current Precision (Bit To Bit)	△ IOUT1	VOUT>0.7V	REXT=1.2kΩ	-	±1	±2	%
	△ IOUT2	VOUT>0.7V	REXT=12kΩ				

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Output Voltage (SOUT)	VOH	I <sub>OH</sub> =-1.0 mA, V <sub>DD</sub> =3.3 V	3	-	-	V
		I <sub>OH</sub> =-1.0 mA, V <sub>DD</sub> =5.0 V	4.7	-	-	V
Output Voltage (SOUT)	VOL	I <sub>OL</sub> =1.0 mA, V <sub>DD</sub> =3.3 V	-	-	0.3	V
		I <sub>OL</sub> =1.0 mA, V <sub>DD</sub> =5.0 V	-	-	0.3	V
Output Current Regulation	%/V <sub>DD</sub>	V <sub>DD</sub> : 3.0V – 5.0V	-	1	2	%
Pull-Down Resistance	R <sub>IN(down)</sub>	-	115	250	460	kΩ
Pull-Up Resistance	R <sub>IN(up)</sub>	-	115	250	460	kΩ
Supply Current OFF	I <sub>OFF</sub>	V <sub>OUT</sub> =15.0V, R <sub>EXT</sub> =470Ω	11.5	13.14	15	mA
		V <sub>OUT</sub> =15.0V, R <sub>EXT</sub> =1.2kΩ	4.5	5.2	6	mA
		V <sub>OUT</sub> =15.0V, R <sub>EXT</sub> =12kΩ	0.57	0.72	0.86	mA
Supply Current ON	I <sub>ON</sub>	V <sub>OUT</sub> =1V, R <sub>EXT</sub> =470Ω	18	20	23	mA
		V <sub>OUT</sub> =1V, R <sub>EXT</sub> =1.2kΩ	6.5	7.95	9.5	mA
		V <sub>OUT</sub> =1V, R <sub>EXT</sub> =12kΩ	0.83	1.04	1.24	mA
	I <sub>ON</sub>	V <sub>OUT</sub> =1V, T <sub>amb</sub> =-40°C, R <sub>EXT</sub> =470Ω	-	-	30	mA
		V <sub>OUT</sub> =1V, T <sub>amb</sub> = -40°C, R <sub>EXT</sub> =1.2kΩ	-	-	13	mA
		V <sub>OUT</sub> =1V, T <sub>amb</sub> = -40°C, R <sub>EXT</sub> =12kΩ	-	-	1.5	mA
Propagation Delay ("L" To "H")	t <sub>pLH1</sub>	CLK-OUT <sub>n</sub> , LATCH = "H" ENABLE = "L"	-	50	70	ns
		LATCH - OUT <sub>n</sub> , ENABLE = "L"	-	50	70	ns
		ENABLE - OUT <sub>n</sub> , LATCH = "H"	-	50	70	ns
		CLK – SERIAL OUT	3	10	15	ns
Propagation Delay ("H" To "L")	t <sub>pHL1</sub>	CLK-OUT <sub>n</sub> , LATCH = "H" ENABLE = "L"	-	20	50	ns
		LATCH - OUT <sub>n</sub> , ENABLE = "L"	-	20	50	ns
		ENABLE - OUT <sub>n</sub> , LATCH = "H"	-	20	50	ns
		CLK – SERIAL OUT	4	10	15	ns
Max. CLOCK Rise Time	t <sub>r</sub>	-	-	-	500	ns
Max. CLOCK Fall Time	t <sub>f</sub>	-	-	-	500	ns

## PIN CONFIGURATION



## PIN DESCRIPTION

Pin No.	Pin Name	I/O	Pin Function
1	GND	--	Ground
2	SERIAL-IN	I	Shift register input pin
3	CLOCK	I	Clock input pin for shift register
4	LATCH	I	Data strobe pin for the latch
5 ~ 20	OUT0 ~ OUT15	I/O	Output pins
21	ENABLE	I	Output enable pin (active low)
22	SERIAL-OUT	O	Shift register output pin
23	R-EXT	I/O	External resistor connecting pin
24	VDD	--	Power supply

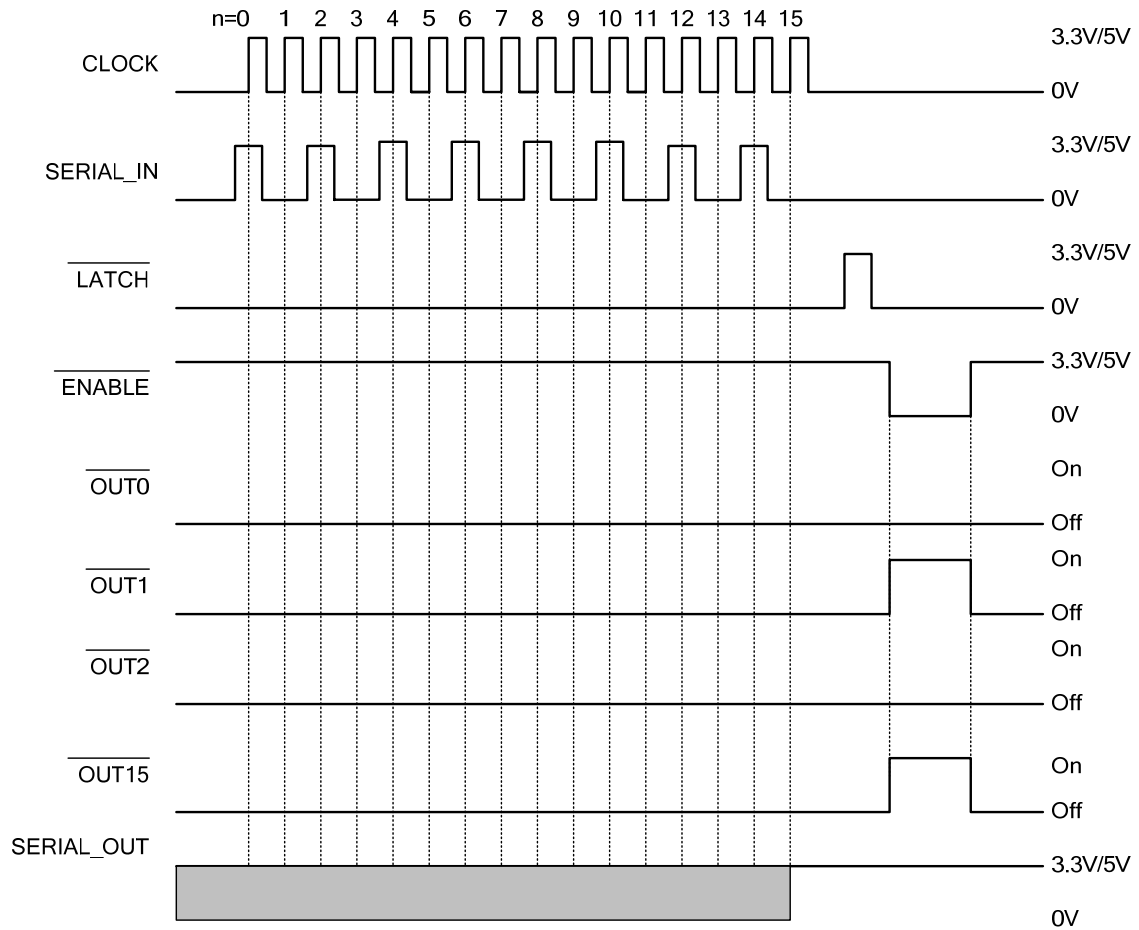
## FUNCTION DESCRIPTION

In the LED display applications, SD16729 can maintain almost no change in different channels or between the different chips. In the different channels, the current changes less than  $\pm 2\%$ , while between the different chips, the current changes less than  $\pm 3\%$ .

There is only one pin connected to ground which is shared as analog ground, digital ground and power ground. It is recommended to route with min. inductance against switching noise and output current noise-induced IC faults. In order to obtain a good current output, the chip needs an appropriate output voltage. According to the electrical characteristics table, users can get minimum output voltage and other related information. Even in the same output current conditions, the minimum output voltage of every part is different.

In order to avoid noise interference, the resistance should be placed close to the pin R-EXT.

**TIME SEQUENCE**



NOTE: When  $\overline{\text{LATCH}}$  is low, latch the data;

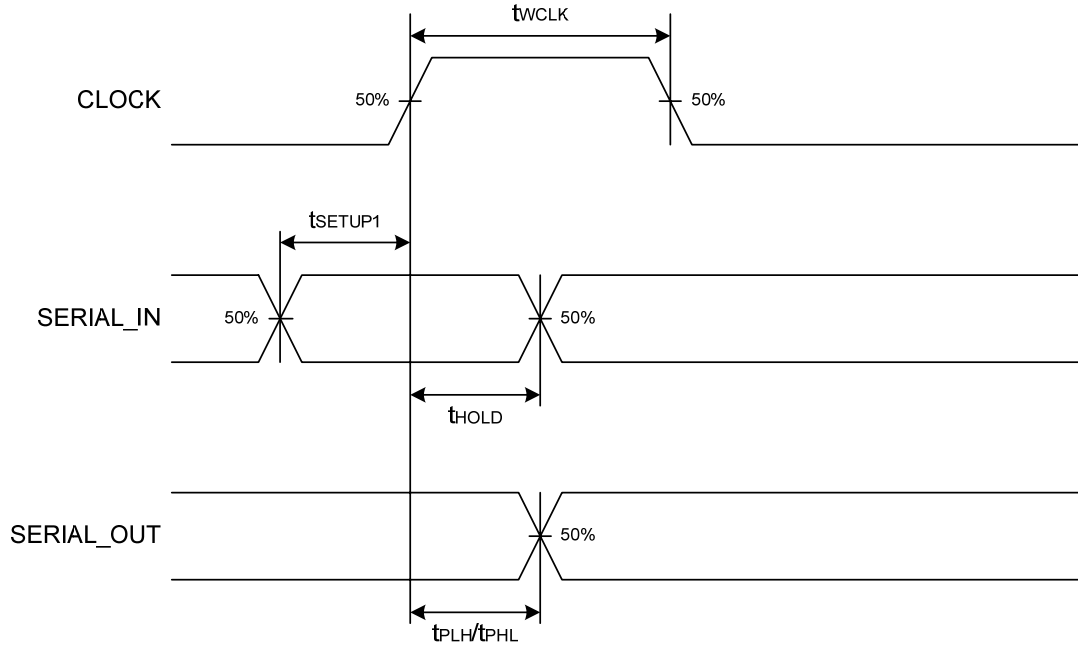
When  $\overline{\text{LATCH}}$  high, data is is transmitted from input to output of register;

When  $\overline{\text{ENABLE}}$  is low, normal response output;

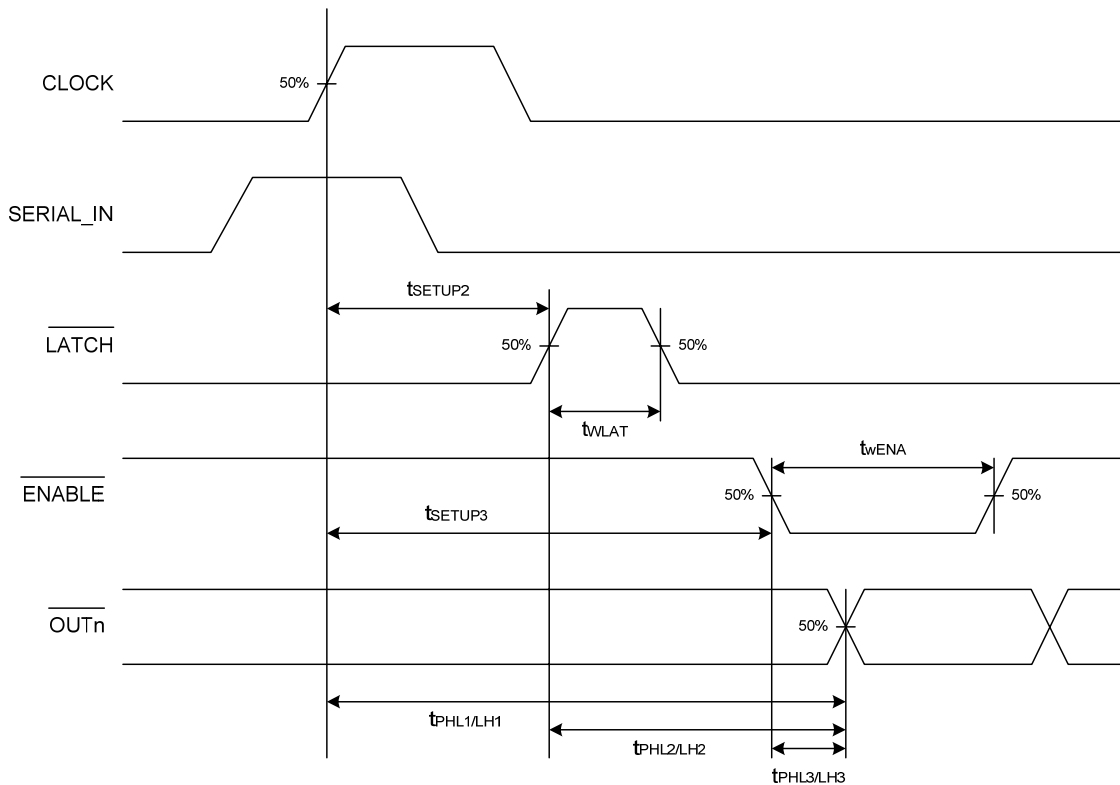
When  $\overline{\text{ENABLE}}$  is high, output is not available.

SEQUENCE WAVEFORM

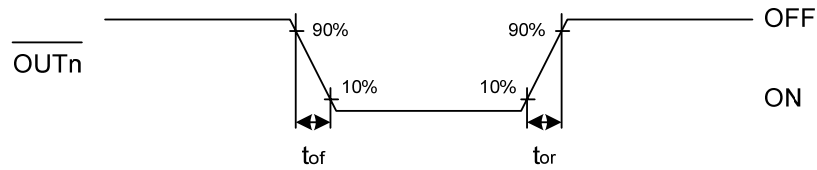
1. Clock, serial-in, serial-out



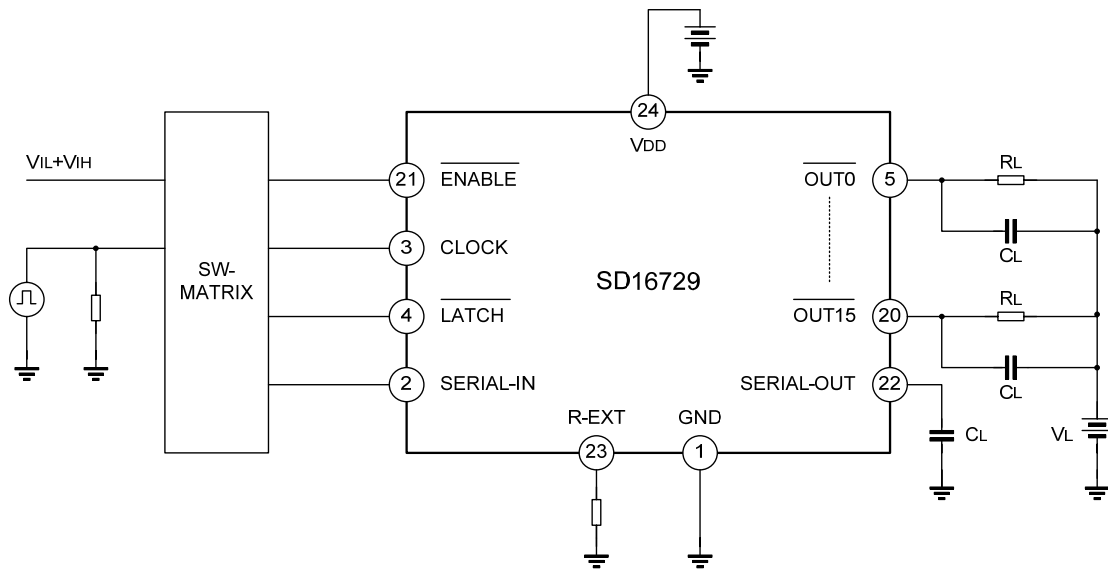
2. Clock, serial-in, LATCH, ENABLE, OUTn



3.  $\overline{\text{OUTn}}$



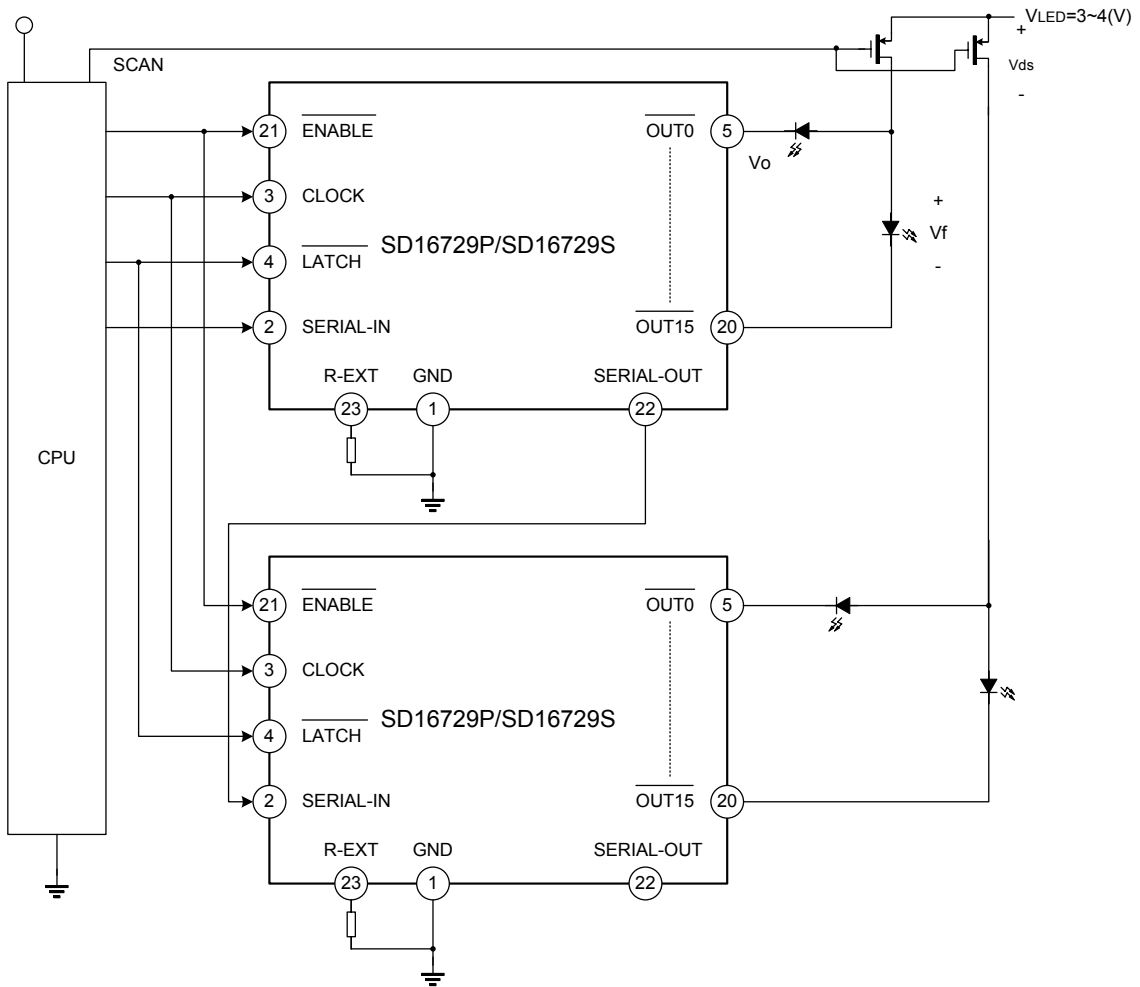
TEST CIRCUIT



For this test circuit,  $T_{opr}=25^{\circ}\text{C}$ ,  $V_{DD}=V_{IH}=3.3\text{V}/5\text{V}$ ,  $V_{OUT}=0.7\text{V}$ ,  $V_{IL}=0\text{V}$ ,  $R_{EXT}=490\Omega$ ,  $V_L=3.0\text{V}$ ,  $R_L=60\Omega$ ,  $C_L=10.5\text{pF}$ .

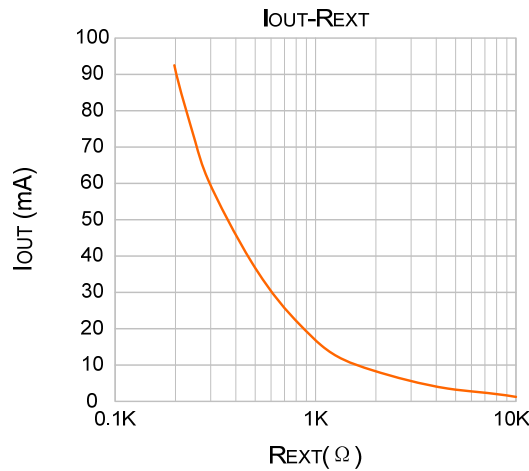


TYPICAL APPLICATION CIRCUIT



Note: this circuit and corresponding parameters are just for reference, please set the parameter according to practical circuit.

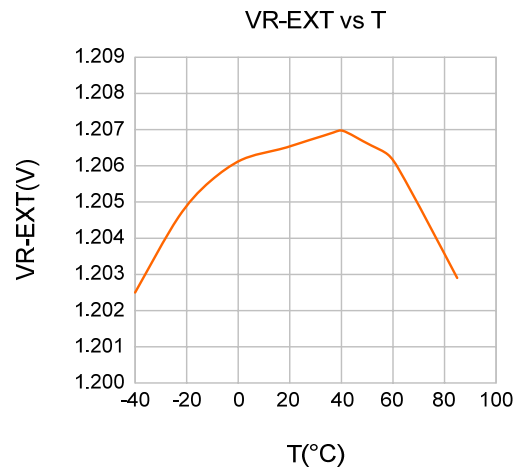
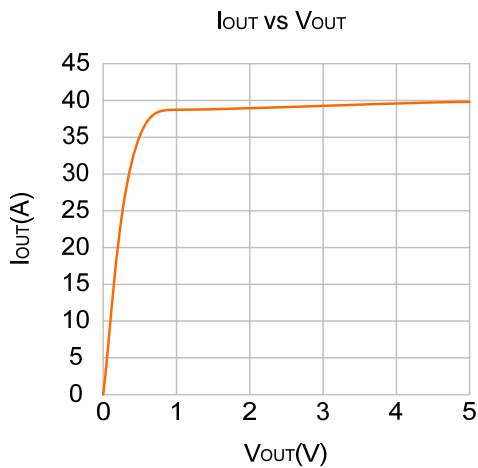
**ELECTRICAL CHARACTERISTIC CURVE**



IOUT is given by:

$$I_{OUT} = (V_{R-EXT} / R_{EXT}) \times 15.2; V_{R-EXT} = 1.202V$$

Where, VR-EXT is voltage of R-EXT, and REXT is the resistance of resistor connected to R-EXT.

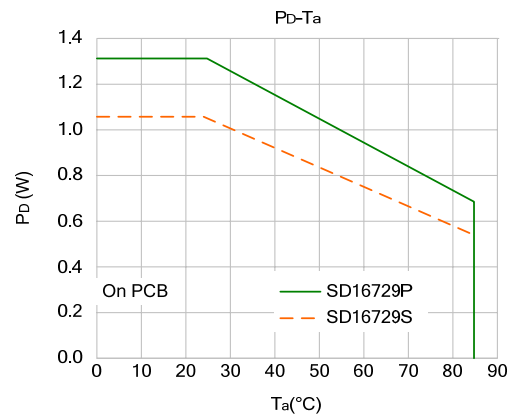
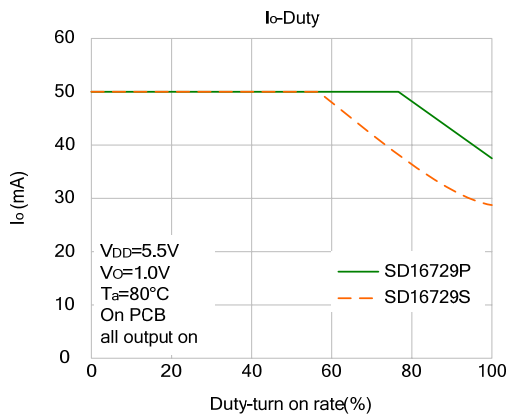
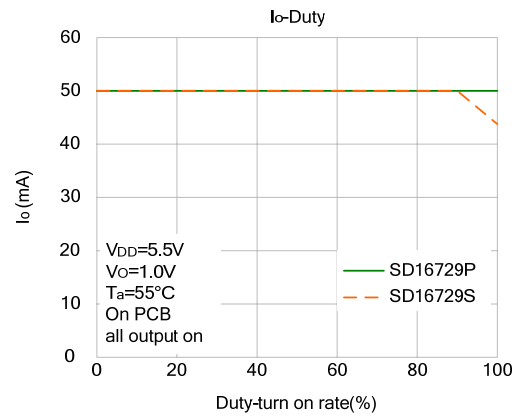
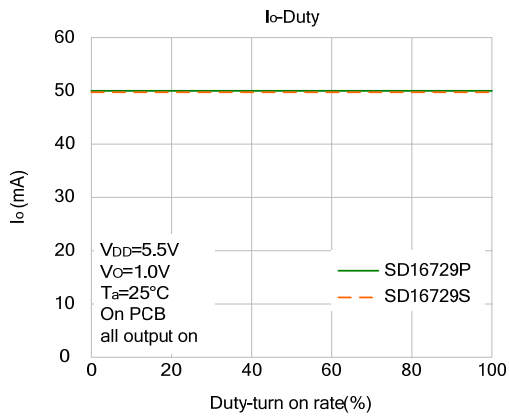


**Power dissipation (PD)**

Max. power dissipation is given by:  $PD_{(max)} = (T_j - T_a) / R_{th(j-a)}$  and actual power dissipation when 16 channel are all ON is expressed as:  $PD_{(act)} = (I_{DD} \times V_{DD}) + (I_{OUT} \times Duty \times V_{CE} \times 16)$ .

Hence, to make  $PD_{(act)} \leq PD_{(max)}$ , output current and duty cycle should be:

$$I_{OUT} = \{ [(T_j - T_a) / R_{th(j-a)}] - (I_{DD} \times V_{DD}) \} / V_{CE} / Duty / 16, \text{ where } T_j = 150^\circ C.$$

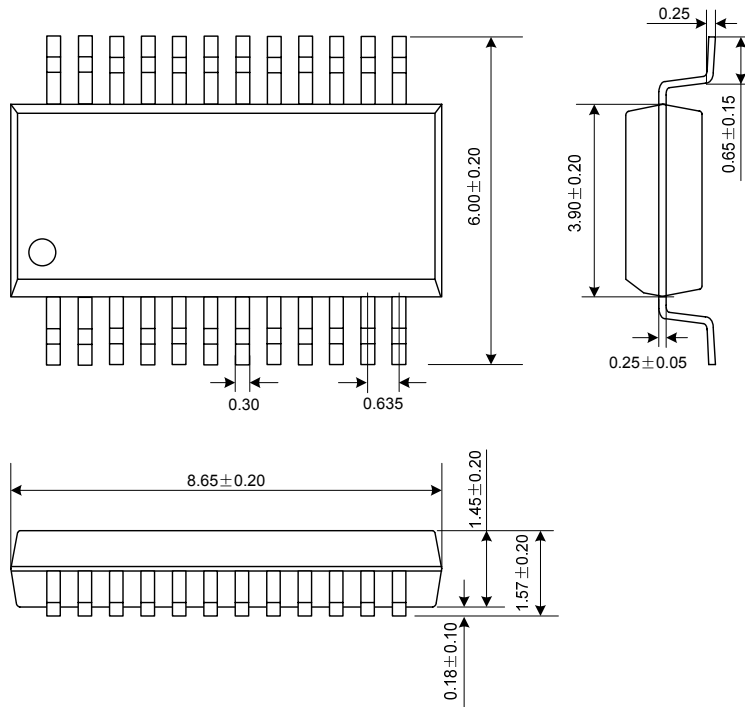


All the parameters are just for reference, please test for your design.

PACKAGE OUTLINE

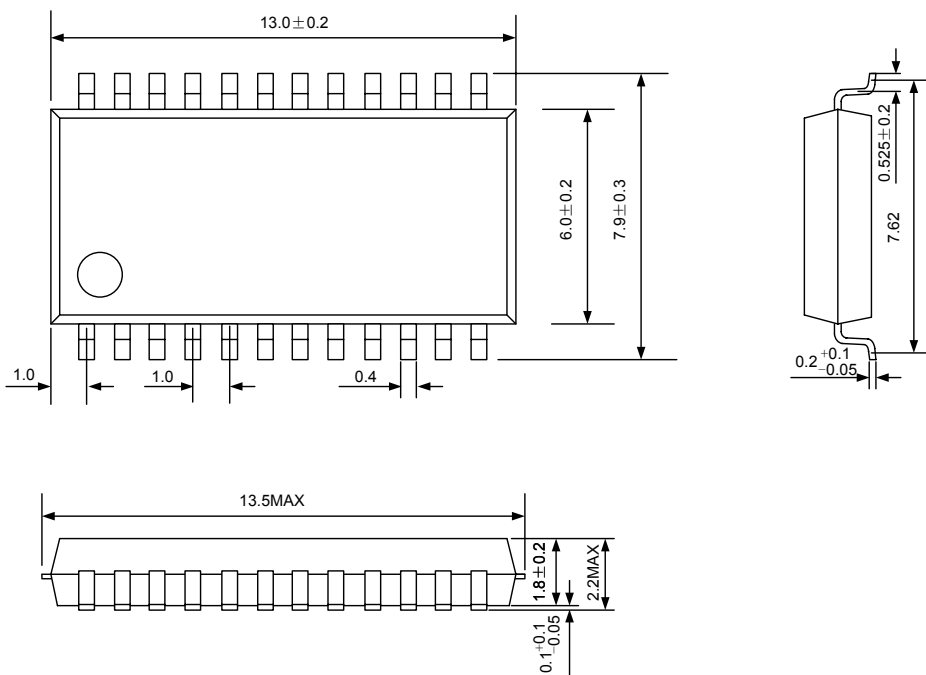
SSOP-24-225-0.635

UNIT: mm



SSOP-24-300-1.0

UNIT: mm





#### MOS DEVICES OPERATE NOTES:

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.

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