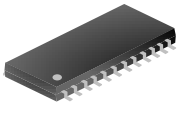
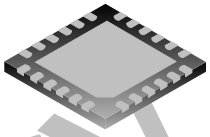
16-BIT CONSTANT CURRENT LED DRIVER

DESCRIPTION

SC16739 is a constant current LED driver. It includes a shift register, data latches, constant current drivers and etc. There are 16-channel constant current output, with 3-45mA current available at each channel. This constant current can be set through an external resistor.



SSOP-24-300-1.0 SSOP-24-225-0.635



QFN-24-4x4x0.75-0.5

FEATURES

* 16-channel CC(constant current) output
* Output current adjustable through external resistor
* Output current: 3-45mA@5V
  3-30mA@3.3V
* Data serial-in/serial-out
* 30MHz DCLK frequency
* Fast output current response, $\overline{OE}$ min. width: 20ns
* Current accuracy

Accuracy	
Between channels	Between ICs
±2%	±3%

APPLICATION

* LED screen

ORDERING INFORMATION

Part No.	Package	Marking	Material	Packing
SC16739P	SSOP-24-300-1.0	SC16739P	Pb free	Tube
SC16739PTR	SSOP-24-300-1.0	SC16739P	Pb free	Tape & Reel
SC16739S	SSOP-24-225-0.635	SC16739S	Pb free	Tube
SC16739STR	SSOP-24-225-0.635	SC16739S	Pb free	Tape & Reel
SC16739QTR	QFN-24-4×4×0.75-0.5	SC16739Q	Pb free	Tape & Reel

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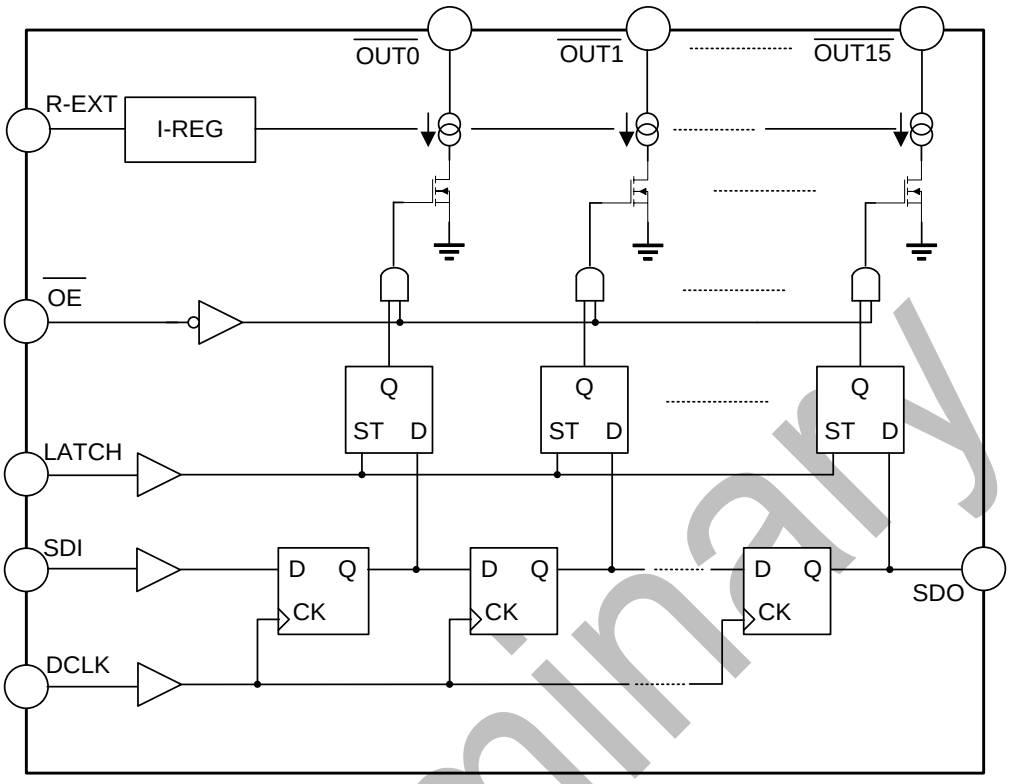
BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Characteristics		Symbol	Ratings	Unit
Supply Voltage		V_{DD}	6	V
Input Voltage		V_{IN}	-0.2~V_{DD}+0.2	V
Output Current		I_{OUT}	45	mA/ch
Output Voltage		V_{DS}	-0.2~ 15	V
Power Dissipation (T_{amb}=25℃)	SC16739S	P_{D1}	1.79	W
	SC16739P	P_{D2}	1.89	W
	SC16739Q	P_{D3}	1.98	W
Thermal Resistance	SC16739S	$R_{th(j-a)1}$	70	°C/W
	SC16739P	$R_{th(j-a)2}$	66	°C/W
	SC16739Q	$R_{th(j-a)3}$	63	°C/W
Storage Temperature		T_{stg}	-55~+150	°C
Operating Temperature		T_{opr}	-40 ~ 85	°C

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ELECTRICAL CHARACTERISTICS (Unless otherwise specified, T_{amb}=25°C, V_{DD}=5V)

Characteristics	Symbol	Test Condition		Min.	Typ.	Max.	Unit
Supply Voltage	V_{DD}	-		3.0	-	5.5	V
CC output current	I_{OUT}	V_{DD}=5V		3	-	45	mA/ch
		V_{DD}=3.3V		3	-	30	mA/ch
Port voltage of CC source	V_{DS}	Constant current source is off		-	-	15	V
		Constant current source is on		0.7	1	-	V
Output current	I_{OUT1}	V_{DD}=5V, V_{OUT}=1V	R_{EXT}=470Ω	-	39.8	-	mA
	I_{OUT2}	V_{DD}=3.3V, V_{OUT}=1V	R_{EXT}=1.2KΩ	-	15.9	-	mA
	I_{OUT3}	V_{DD}=5.0V, V_{OUT}=1V		-	15.9	-	mA
Output current difference	Δ I_{OUT}	Between channels	V_{OUT}>0.7V, R_{EXT}=1.2KΩ	-	±2	±3	%
		Between ICs		-	±3	±6	%
R-EXT voltage	V_{R-EXT}			1.23	1.252	1.275	V
Output leakage current	I_{LEAK}	V_{OUT}=15.0V		-	-	1	uA
SDO high output voltage	I_{SDOH}	V_{DD}=3.3V, V_{SDO}=3V		0.8	1.17	-	mA
		V_{DD}=5V, V_{SDO}=4.7V		0.9	1.28	-	mA
SDO low output voltage	I_{SDOL}	V_{DD}=3.3V, V_{SDO}=0.3V		0.75	1.08	-	mA
		V_{DD}=5V, V_{SDO}=0.3V		0.8	1.15	-	mA
Output current regulation	%/V_{DD}	V_{DD}: 3.0V—5.0V		-	0.5	2	%
Pull-down resistance at LATCH	R_{PD}	-		400	500	600	KΩ
Pull-up resistance at $\overline{OE}$	R_{PU}	-		400	500	600	KΩ
Operating current (shutdown)	I_{OFF}	V_{OUT}=15.0V, R_{EXT}=470Ω		6	13.3	8.5	mA
		V_{OUT}=15.0V, R_{EXT}=1.2KΩ		4	5.5	6.3	mA
Operating current (on)	I_{ON}	V_{OUT}=1V, R_{EXT}=470Ω		16.5	19.5	22.5	mA
		V_{OUT}=1V, R_{EXT}=1.2KΩ		15	18	21	mA
SDI high input voltage	V_{IH}	-		0.8V_{DD}	-	V_{DD}+0.15	V
SDI low input voltage	V_{IL}	-		-0.15	-	0.2V_{DD}	V
DCLK frequency	F_{DCLK}	Cascode		-	-	30	MHz
LATCH set-up time	t_{su}(L)	-		10	-	-	nS
LATCH hold time	t_h(L)	-		10	-	-	nS
LATCH pulse width	t_{LATCH}	-		20	-	-	nS
DCLK pulse width	t_{DCLK}	-		15	-	-	nS
$\overline{OE}$ pulse width	t_{OE}	-		20	-	-	nS

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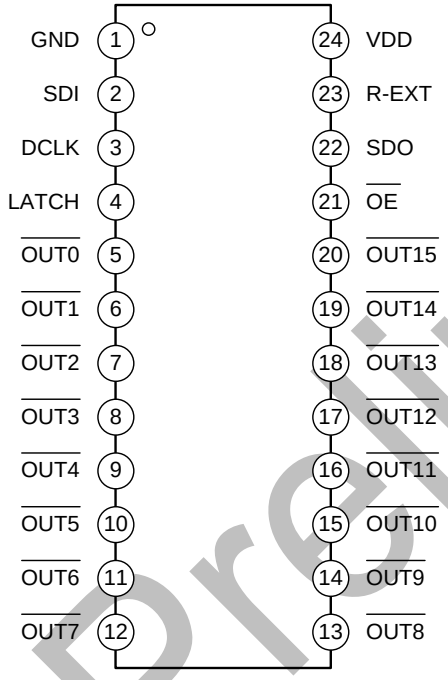
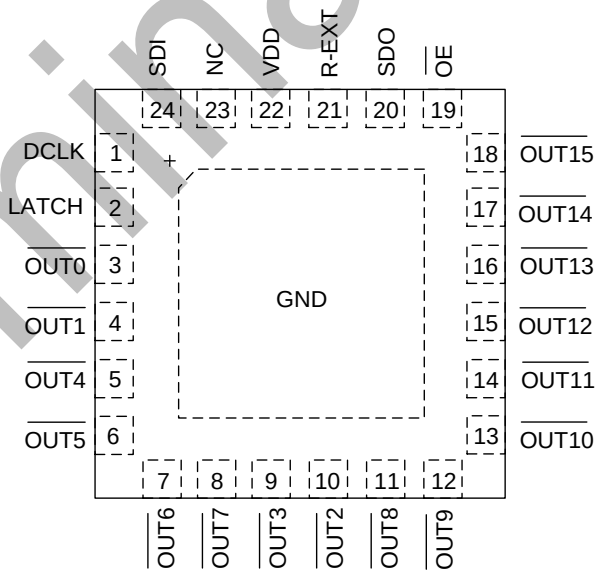
Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
DCLK set-up time	$t_{su}(C)$	-	10	-	-	nS
DCLK hold time	$t_h(C)$	-	10	-	-	nS
Transmission delay time ("L" to "H")	t_{Plh1}	LATCH - $\overline{OUTn}$, $\overline{OE}$ ="L"	35	40	45	ns
	t_{pLH2}	$\overline{OE}$ - $\overline{OUTn}$, LATCH ="H"	35	40	45	ns
	t_{pLH3}	DCLK—SDO	20	25	30	ns
Transmission delay time ("H" to "L")	t_{pHL1}	LATCH - $\overline{OUTn}$, $\overline{OE}$ ="L"	40	45	50	ns
	t_{pHL2}	$\overline{OE}$ - $\overline{OUTn}$, LATCH ="H"	40	45	50	ns
	t_{pHL3}	DCLK—SDO	20	25	30	ns
Max. DCLK rising time	t_r	-	-	-	500	ns
Max. DCLK falling time	t_f	-	-	-	500	ns

PIN CONFIGURATION



SC16739P/SC16739S



SC16739Q

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PIN DESCRIPTION

Pin No.		Pin Name	I/O	Description
SC16739P SC16739S	SC16739Q			
1	0 (heatsink at the bottom)	GND	Ground	Ground
2	24	SDI	I	Serial data input of shift register
3	1	DCLK	I	Clock input of shift register
4	2	LATCH	I	Data latch control pin of shift register
5 ~ 6	3 ~ 4	$\overline{OUT0}$~$\overline{OUT1}$	I/O	CC outputs 0~1
7	10	$\overline{OUT2}$	I/O	CC output 2
8	9	$\overline{OUT3}$	I/O	CC output 3
9~12	5 ~ 8	$\overline{OUT4}$~$\overline{OUT7}$	I/O	CC outputs 4~7
13~20	11 ~ 18	$\overline{OUT8}$~$\overline{OUT15}$	I/O	CC outputs 8~15
21	19	$\overline{OE}$	I	16-channel CC output enable pin (active low)
22	20	SDO	O	Serial data output of shift register
23	21	R-EXT	I/O	The resistor is connected between this pin and ground for 16-channel current setting
24	22	VDD	--	Power supply
/	23	NC	--	NC

FUNCTION DESCRIPTION

For LED display application, the serial data can be shifted from SDI to internal 16-bit shift register via DCLK riding edge and shifted out at SDO. And the SDO of previous SC16739 can be connected to the next SC16739 for cascade connection. The data in shift register can be stored in 16-bit data latch via LATCH falling edge, to control on/off of 16-channel constant current source. The constant current source is controlled by data latch when $\overline{OE}$ is low, and constant current source is off when $\overline{OE}$ is high, with high impedance output. The current of constant current source can be set through an external resistor connected to R-EXT.

Notes: there is only one ground pin shared as analog/digital/power ground. It is recommenced to adopting the routing with minimum inductance to reduce conversion noise caused by input signal and fault caused by output current. The proper output voltage is needed for better constant current output, and the voltage can be obtained the minimum voltage according to the electrical characteristics. The resistor should be placed near pin R-EXT to avoid noise on current.

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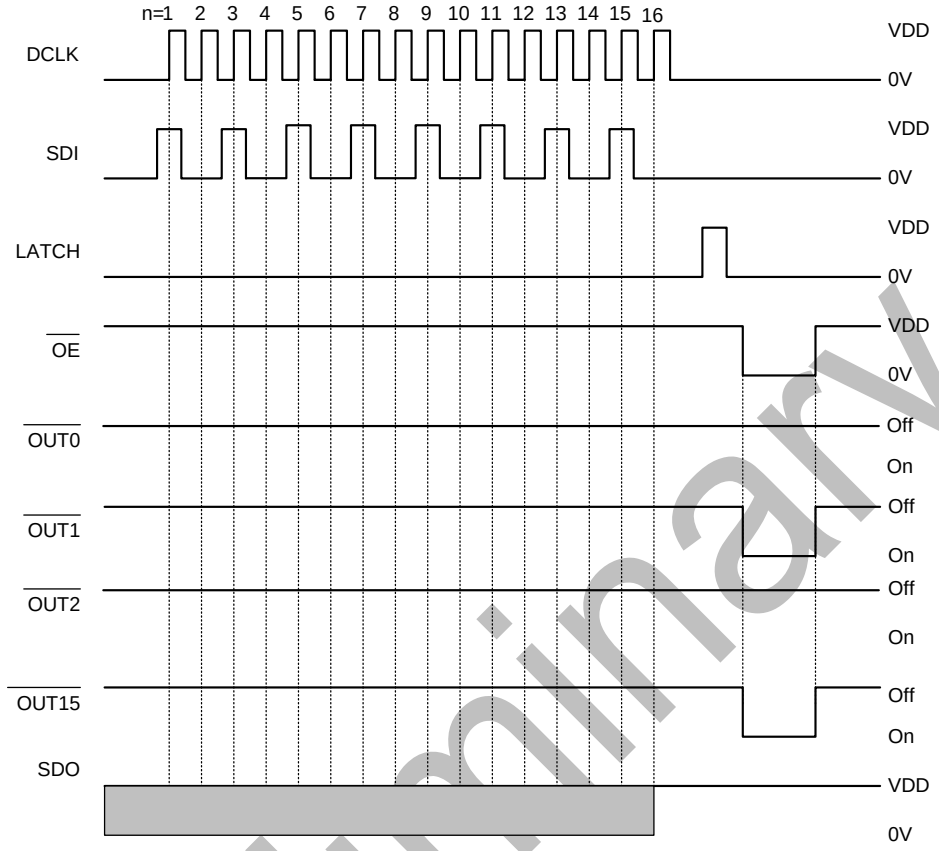
TIME SEQUENCE DIAGRAM



Note: the data in shift register is shifted by DCLK rising edge.

The data in shift register is stored in data latch by LATCH falling edge.

The output is enabled when $\overline{OE}$ is low.

When $\overline{OE}$ is high, output is off, and the status is high impedance.

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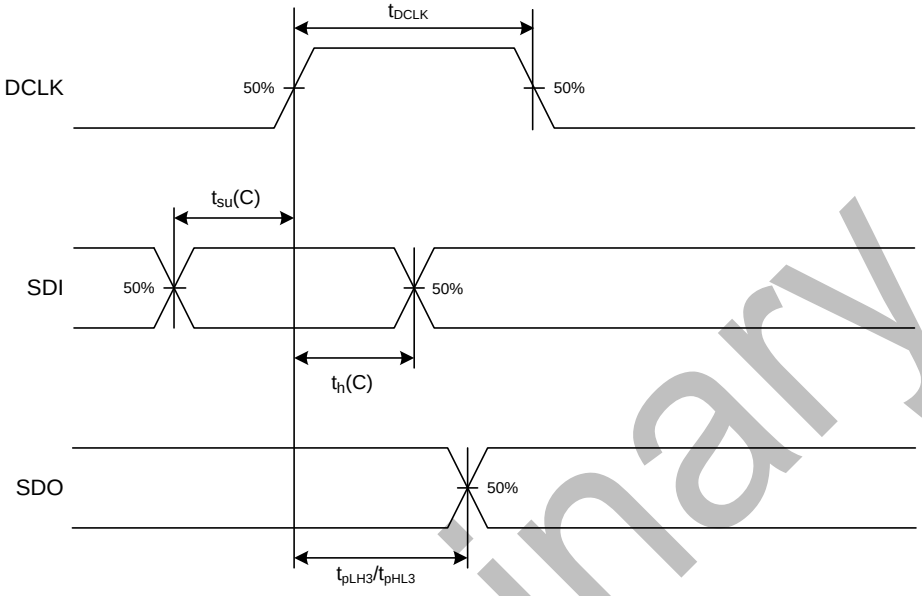
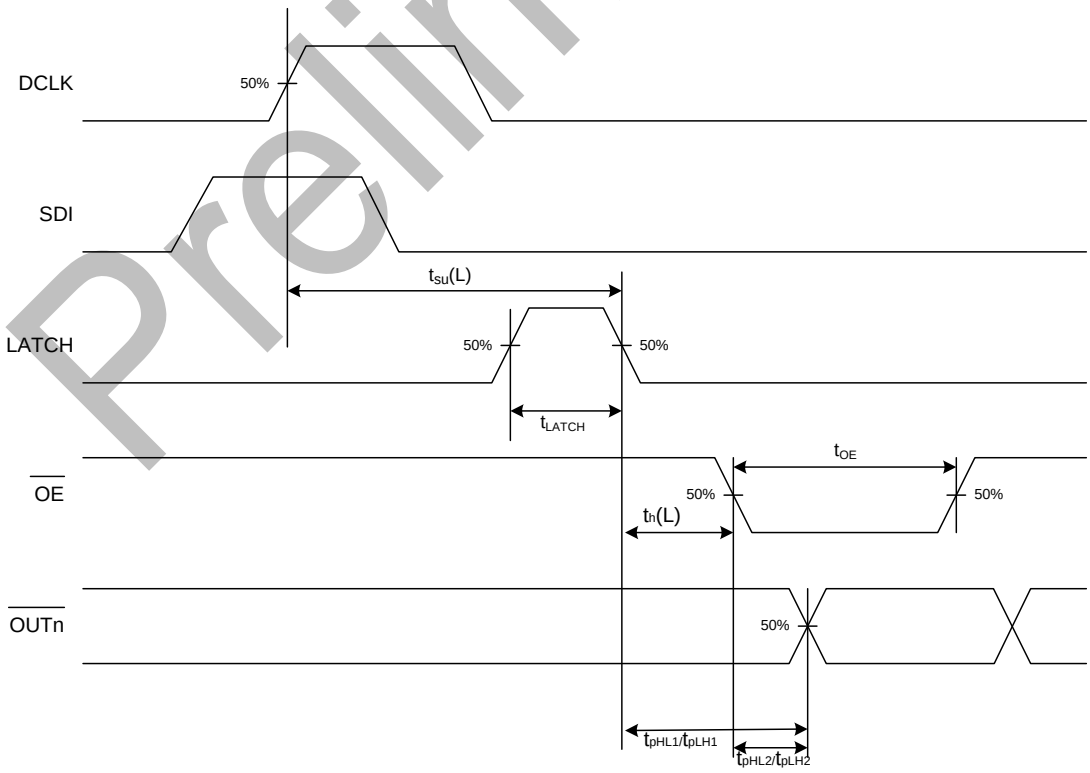
TIME SEQUENCE WAVEFORM

1. DCLK, SDI, SDO



2. DCLK, SDI, LATCH, $\overline{OE}$, $\overline{OUTn}$



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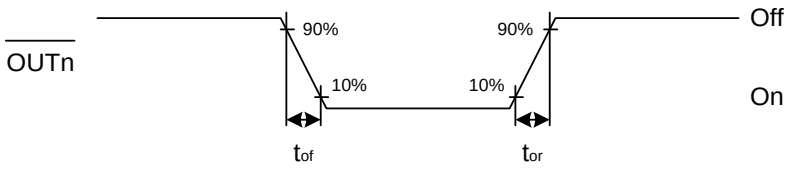
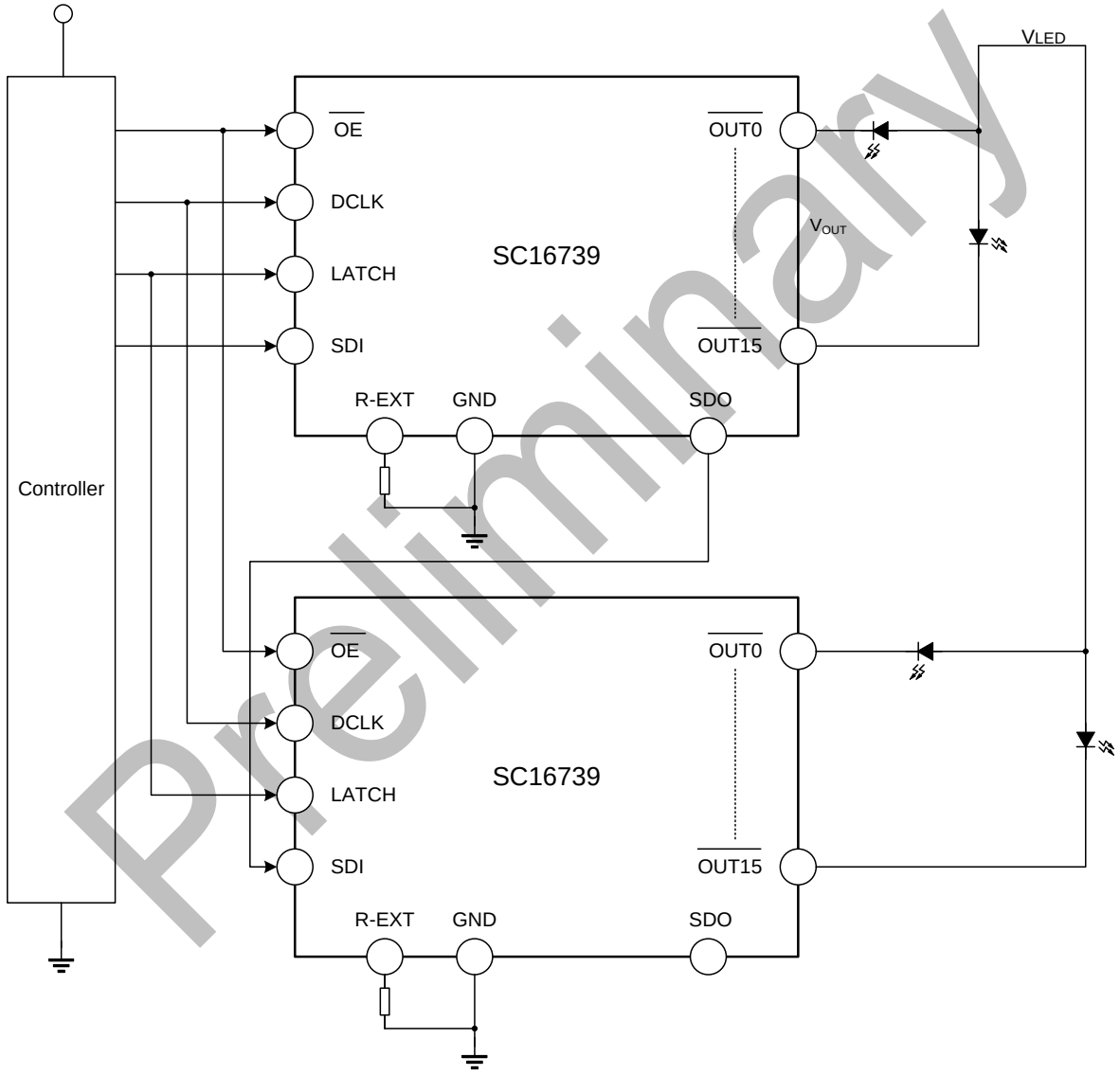
3. $\overline{OUTn}$



TYPICAL APPLICATION CIRCUIT



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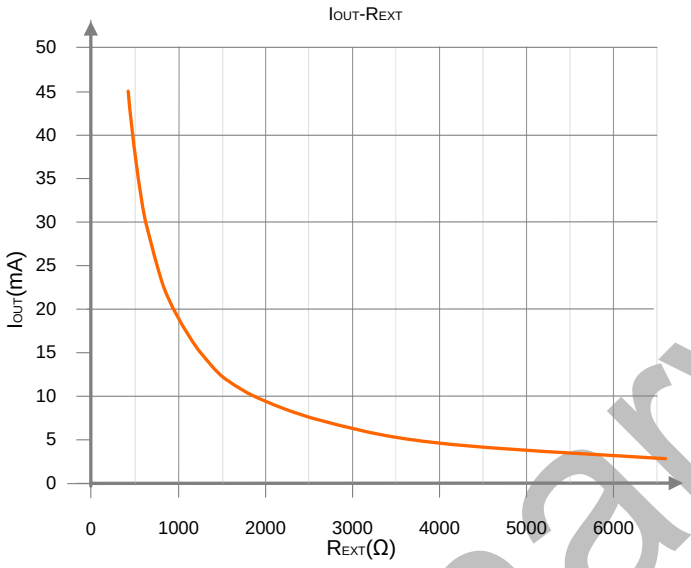
Note: the circuit and parameter above are only for reference, please set the parameter according to practical circuit.

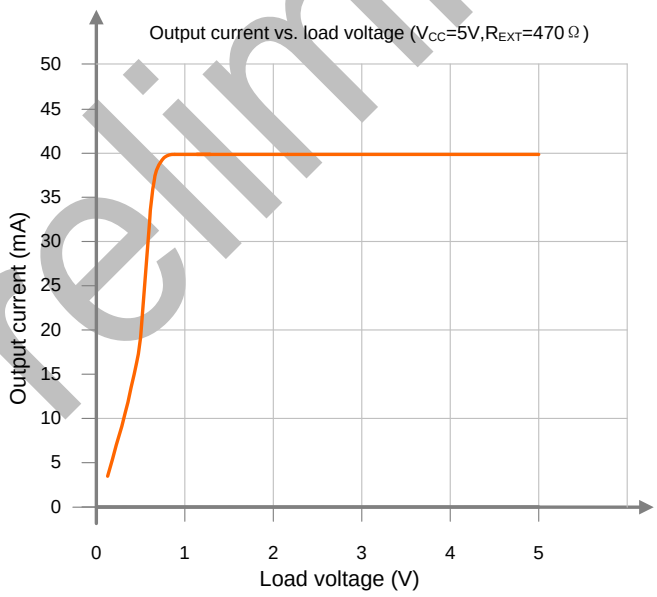
CHARACTERISTIC CURVE



Formula:

$I_{OUT} = (V_{R\text{-}EXT} / R_{EXT}) \times 15$; $V_{R\text{-}EXT} = 1.252V$

Where, $V_{R\text{-}EXT}$ is voltage at R-EXT, R_{EXT} is external resistance connected to R-EXT.



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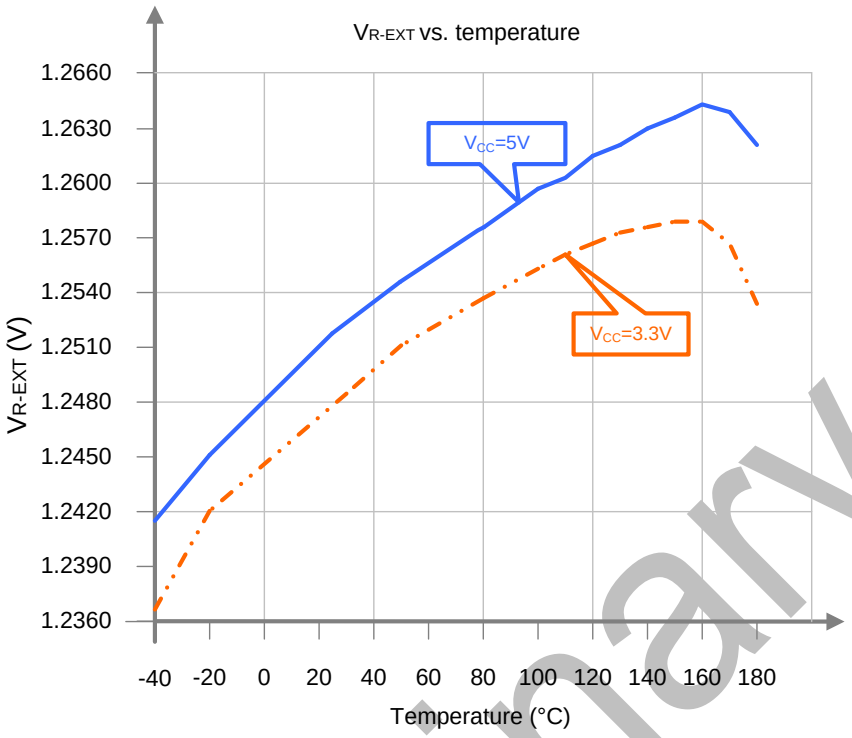

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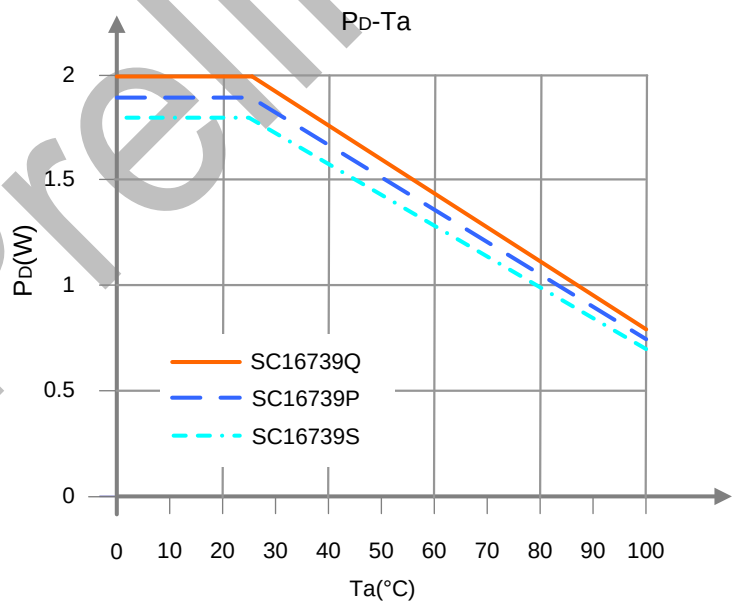
Power dissipation (PD)

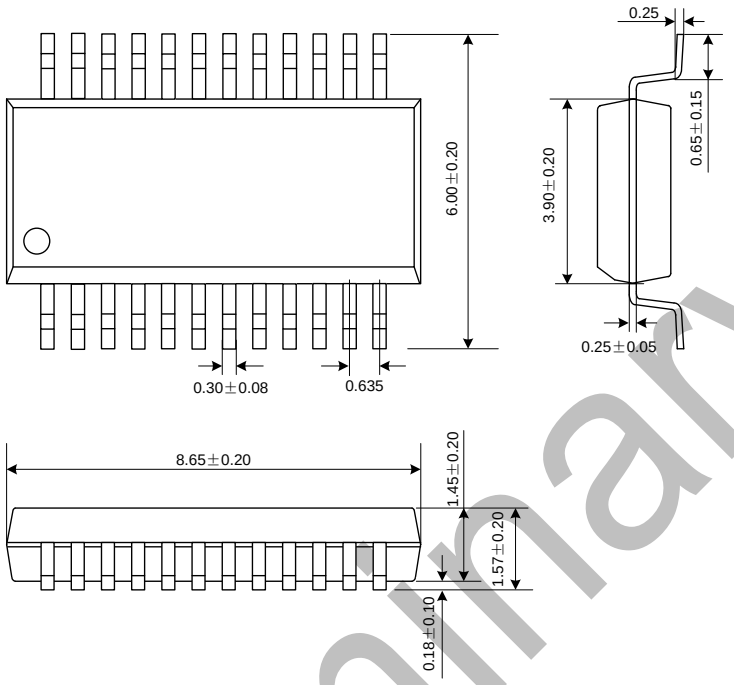
The maximum power dissipation is given by: $P_{D(max)}=(T_j-T_a)/R_{th(j-a)}$. When 16-channel are all on, the actual power dissipation is given by: $P_{D(act)}=(I_{DD} \times V_{DD})+(I_{OUT} \times V_{CE} \times 16)$.



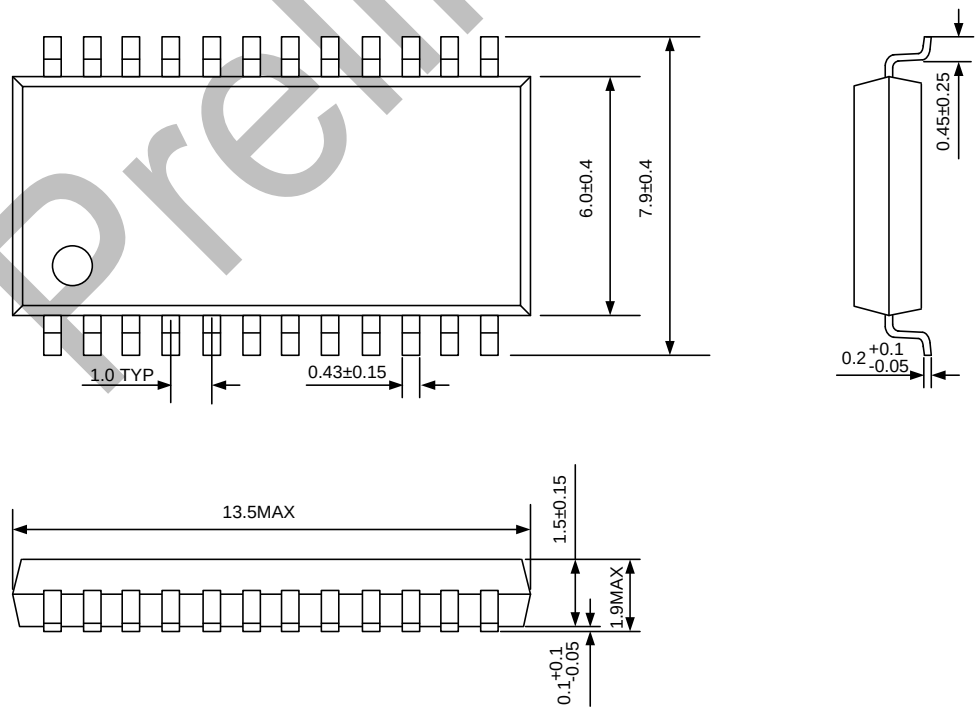
The maximum power is affected by various factors, such as ambient environment, humidity. The data above is tested the limit in special environment, and it is only for reference. The margin will be considered during mass production and the data will be tested.

PACKAGE OUTLINE

SSOP-24-225-0.635 UNIT: mm



SSOP-24-300-1.0 UNIT: mm



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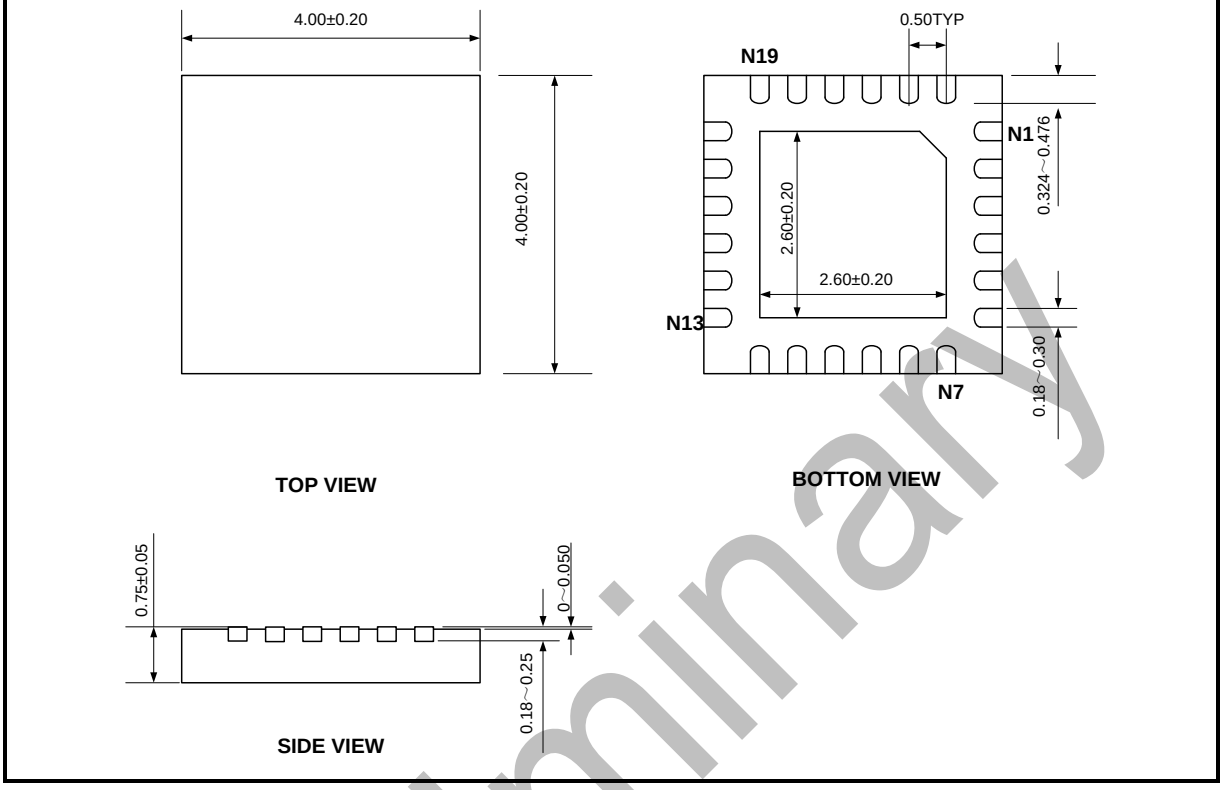
PACKAGE OUTLINE (CONTINUED)

QFN-24-4×4×0.75-0.5 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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