4-channel Constant Current Driver for LEDs

Features

. Current regulated output channels, constant current range: 20 – 320 mA
. Constant current source invariant to load voltage change
. Fast output current control, the minimum output enable pulse width = 80 ns
. Excellent output current matching
  channel to channel : ± 3%
  chip to chip : ± 6%
. All output current are adjusted through one external resistor
. Dimming control available
. Built-in thermal protection function
. Supply voltage range: 5V
. Package: SOP8 (with/without heat sink pad optional)

Product Description

SCT2004 is a four channels constant current driver for the LED lighting. It can provide the finest PWM control effect with its ability to sink constant current from LED clusters with minimum pulse width only 80 ns. The PWM control is performed by connecting the PWM signal from system control unit to OE pin of SCT2004. The full scale current value of each output is set by an external resistor connected to R_{EXT} pin.

The SCT2004 guarantees to endure maximum DC 17V at each output port. Each output of SCT2004 can sink a constant current up to 320mA. In fields of high power LED lighting applications, we can simply shunt the outputs to get higher current driver-ability.

The excellent current regulation capability let SCT2004 easily drive each output current to a constant stable status nearly without affecting by power supply of LED, loading due to variant V_F of LEDs and operating temperature. Besides, with built-in thermal protection function, the SCT2004 stop driving the output while sense its junction temperature exceeds the 160 ℃ high limit and the output will be turn on again while the junction temperature is below the 130 ℃ low limit. Thus the driver system is protected from damage of overheat.

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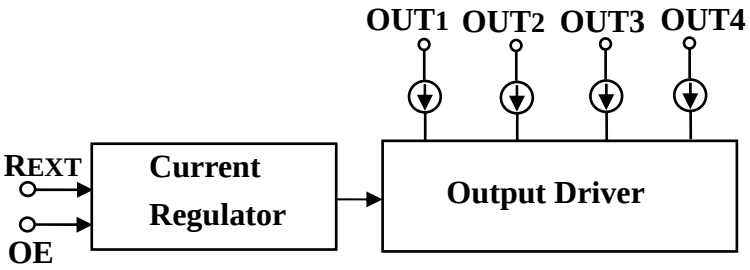
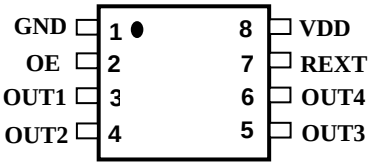
Block Diagram



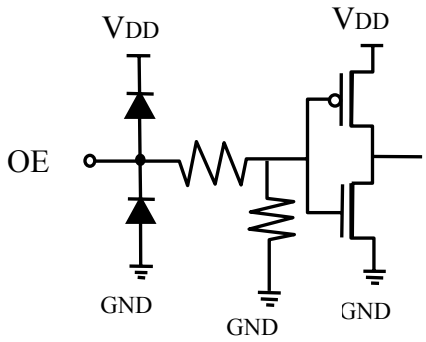
Pin Configuration



Terminal Description

Pin No.	Pin Name	Function
1	GND	Ground terminal.
2	OE	Input terminal of output enable signal. Output is enabled when OE is high.
3~6	$OUT_{1\sim4}$	Output terminals with constant current.
7	R_{EXT}	Input terminal used to connect an external resistor for setting up all output current.
8	V_{DD}	Supply voltage terminal.

Equivalent Circuits of Inputs (1)



Ordering information

Part Number	Marking	Package
SCT2004CSOG	2004CSOG	Pb free SOP8 with thermal pad(TP)
SCT2004CSPG	2004CSPG	Pb free SOP8 without thermal pad(TP)

Maximum Ratings (Ta = 25 °C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{DD}	4.0 ~ 7.0	V
Input voltage	V_{IN}	-0.2 ~ V_{DD}+0.2	V
Output current	I_{OUT}	360	mA/Channel
Output voltage	V_{OUT}	-0.2 ~ 17.0	V
Total GND terminals current	I_{GND}	1500	mA
Power Dissipation(Free Air)	P_D	1.47	W
		2.08(with TP)	W
Thermal Resistance(Free Air)	$R_{TH(j-a)}$	85	°C /W
		60(with TP)	°C /W
Operating temperature	T_{OPR}	-40~+85	°C
Storage temperature	T_{STG}	-55~+150	°C

Recommended Operating Conditions (Ta = -40 to 85 °C unless otherwise noted)

Characteristic	**Symbol**	**Condition**	**Min.**	**Typ.**	**Max.**	**Unit**
Supply voltage	V_{DD}	-	4.5	-	5.5	V
Output voltage	V_{OUT}	OUT1 ~ OUT4	1.0	-	17	V
Output current	I_{OUT}	DC test circuit	20	-	320	mA
Input voltage	V_{IH}	-	2	-	V_{DD}	V
	V_{IL}	-	0	-	0.4	V
OE pulse width	t_W	V_{DD}=4.5~5.5V	80	-	-	ns

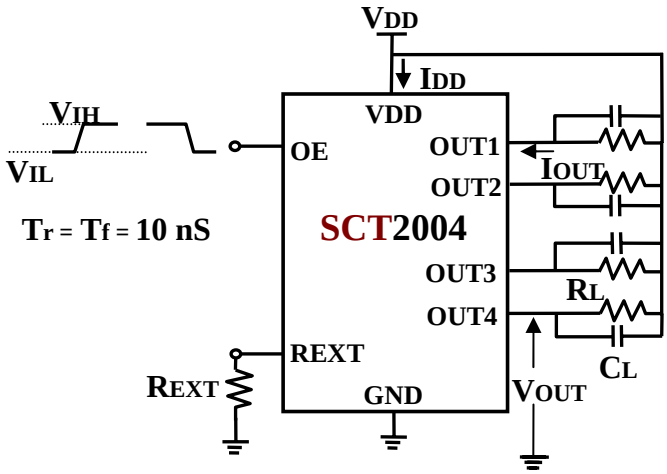
Electrical Characteristics (V_{DD}=5.0V, Ta=25ºC unless otherwise noted)

Characteristic		Symbol	Condition		Min.	Typ.	Max.	Unit
Input voltage		V_{IH}	-		2	-	V_{DD}	V
		V_{IL}	-		0	-	0.4	V
Output leakage current		I_{OL}	V_{OUT} = 17V		-	-	0.5	µA
Output current		I_{OUT}	V_{OUT}=1.0V	R_{EXT}=900 Ω	-	84	-	mA
Current bit skew		dI_{OUT}	I_{OUT}=84mA V_{OUT}=1.0V	R_{EXT}=900 Ω	-	±1	±3	%
I_{OUT} vs. supply voltage regulation		$\%/dV_{DD}$	4.5V <V_{DD} < 5.5V V_{OUT} > 1.0 V		-	-	±2	%/V
I_{OUT} vs. output voltage regulation		%/dVOUT	1V < V_{OUT} < 5V R_{EXT}=900 Ω, V_{DD} = 5V		-	-	±2	%/V
Supply current	OFF	$I_{DD(off)\ 1}$	R_{EXT} = Open ,V_{DD} = 5V OUT1~OUT4=Off		-	6	15	mA
		$I_{DD(off)\ 2}$	R_{EXT} = 900 Ω,V_{DD} = 5V OUT1~OUT4=Off		-	9	15	
	ON	$I_{DD(on)}$	R_{EXT} = 900 Ω,V_{DD} = 5V OUT1~OUT4=On		-	10	15	

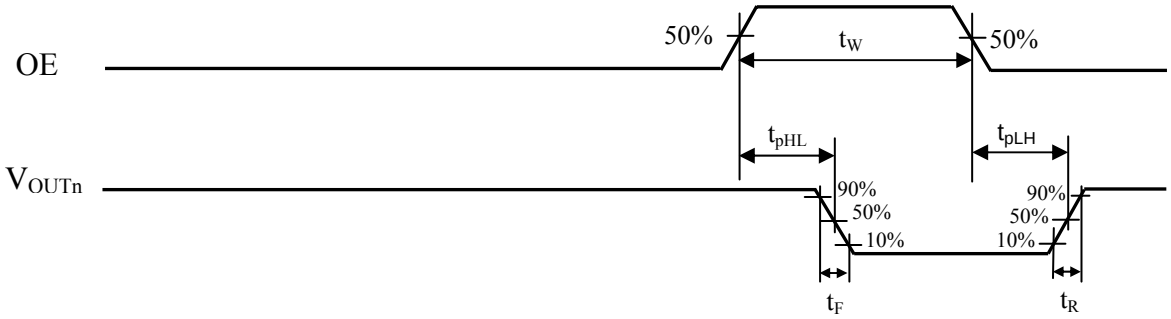
Switching Characteristics (V_{DD}=5.0V, Ta=25ºC unless otherwise noted)

Characteristic		Symbol	Condition	Min.	Typ.	Max.	Unit
Propagation Delay Time (“L” to “H”)	OE - OUTn	t_{pLH}	V_{DD} = 5.0 V V_{LED} = V_{DD} V_{IH} = V_{DD} V_{IL}= GND R_{EXT} = 900 Ω R_L = 47 Ω C_L = 10 pF	-	50	100	ns
Propagation Delay Time (“H” to “L”)	OE - OUTn	t_{pHL}		-	30	60	ns
Pulse Width	OE	t_w		80			ns
Output Rise Time of Iout		t_R		-	10	25	ns
Output Fall Time of Iout		t_F		-	10	25	ns

Test Circuit for Switching Characteristics

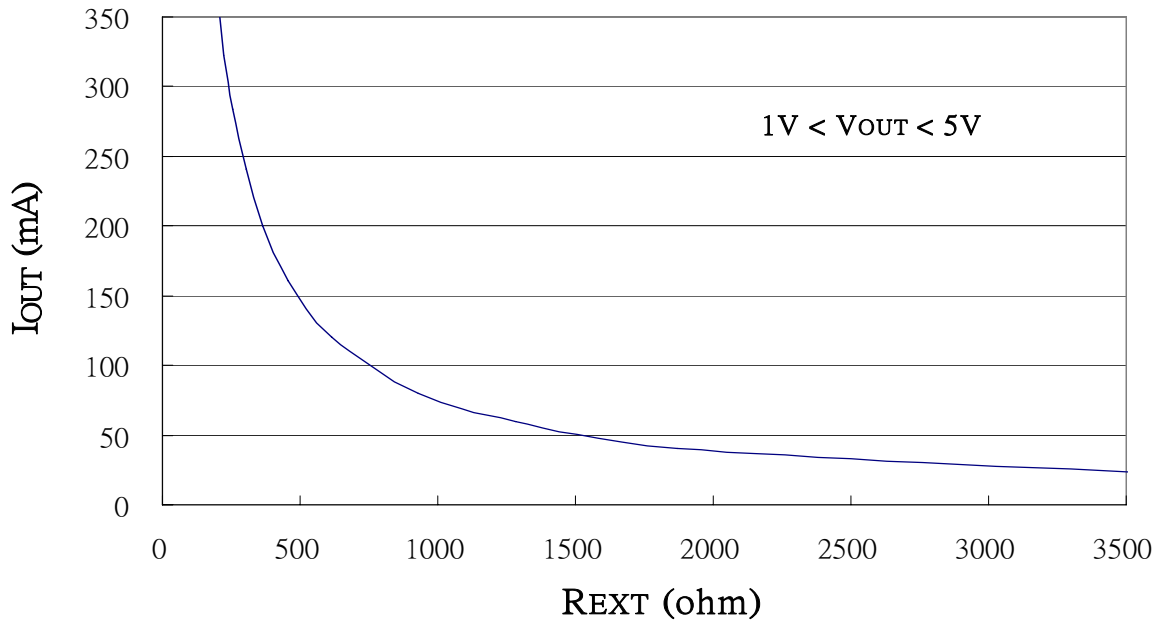


Timing Waveform



Adjusting Output Current

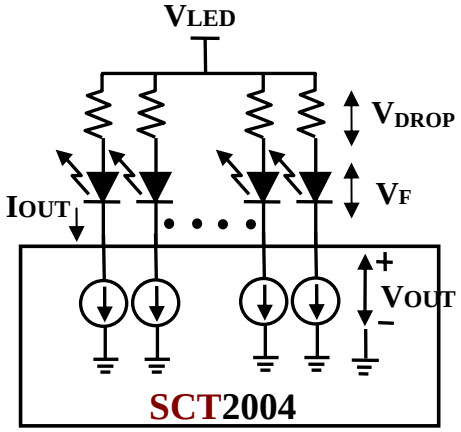
All SCT2004's output current (I_{OUT}) are set by one external resistor at pin REXT. The relationship between I_{OUT} and resistance R_{EXT} is shown as the following figure.

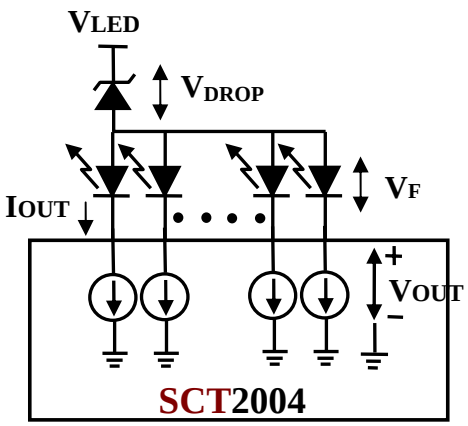


Also, when SCT2004's output voltage is set between 1 Volt and 5 Volt, the output current can be estimated approximately by: $I_{OUT} = 122(620 / R_{EXT})$ (mA)
Thus the output current are all set to be about 84 mA at $R_{EXT} = 900\ \Omega$.

Load Supply Voltage (V_{LED})

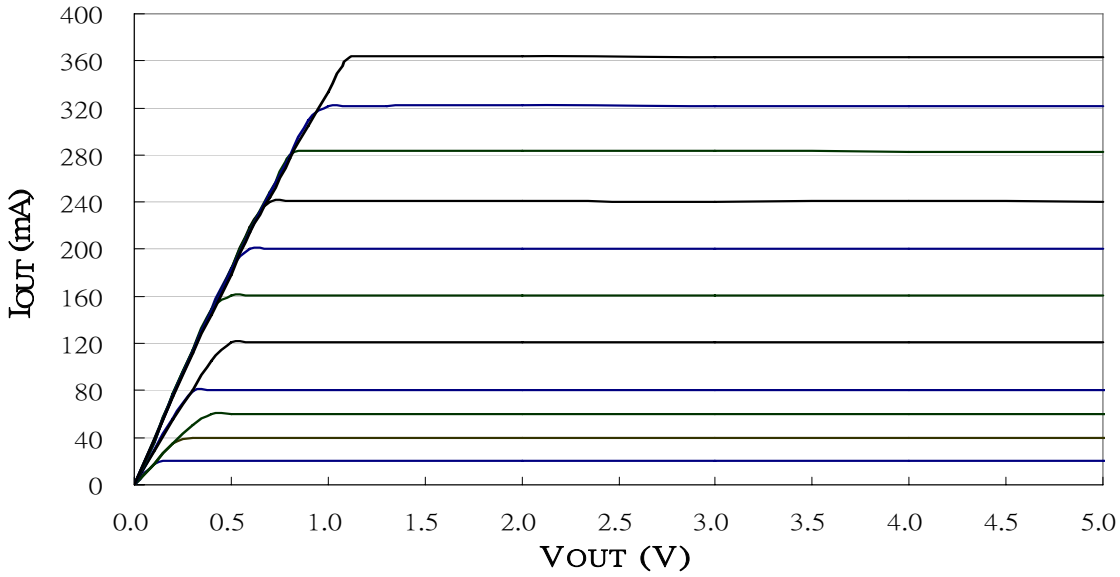
SCT2004 can operate very well when V_{OUT} ranging from 1V to 5V. So it is recommended to use the lowest possible supply voltage or set a voltage reducer to reduce the V_{OUT} voltage. A voltage reducer lets $V_{OUT} = V_{LED} - V_{DROP} - V_F$. Resistors or Zener diode can be used in the applications as shown in the following figures.





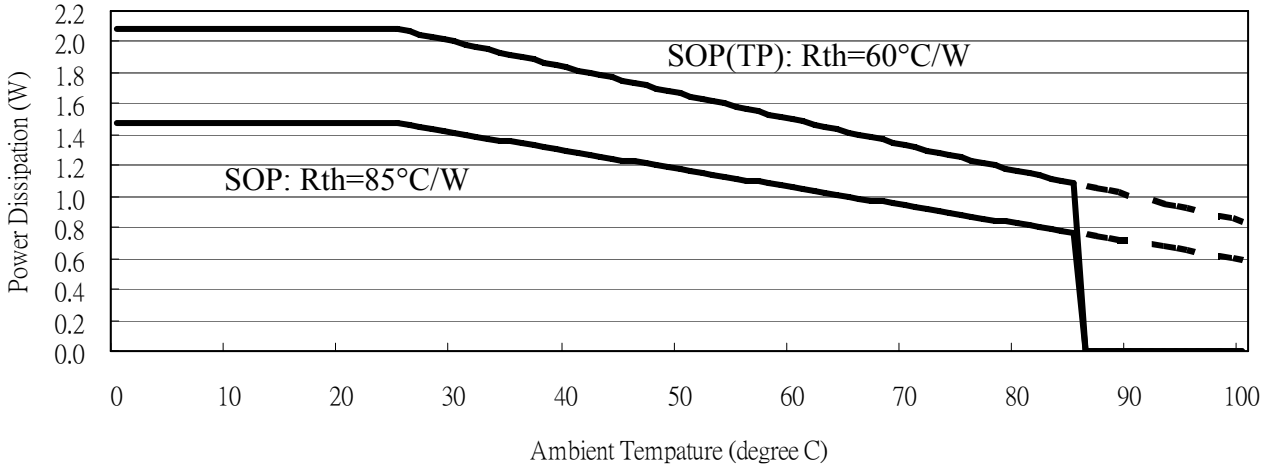
Constant Current

The current characteristic of output stage is flat. The output current can kept constant regardless of the variations of LED forward voltage when V_{OUT} > 1.0V. The relationship between I_{OUT} and V_{OUT} is shown below:



Power Dissipation

The power dissipation (P_D) of a semiconductor chip is limited by its package and ambient temperature. The maximum allowable power dissipation (P_D) is determined as $P_D(max)=(Tj - Ta)/R_{th(j-a)}$ where Tj: the chip junction temperature, Ta: ambient temperature, $R_{th(j-a)}$: thermal resistance. For SOP packages, the relationship between P_D and Ta is shown as the following figure. Since P=IV, for sink larger I_{OUT}, user had better to properly select resistors as the voltage reducers of output channels to reduce the heat in body of SCT2004.



Layout Guide

Use the following general guide-line when designing printed circuit boards (PCB**) :**

Decoupling Capacitor
Place a 0.1uF decoupling capacitor between VDD and GND pins of SCT2004. Locate the capacitor as close to the pins as possible.

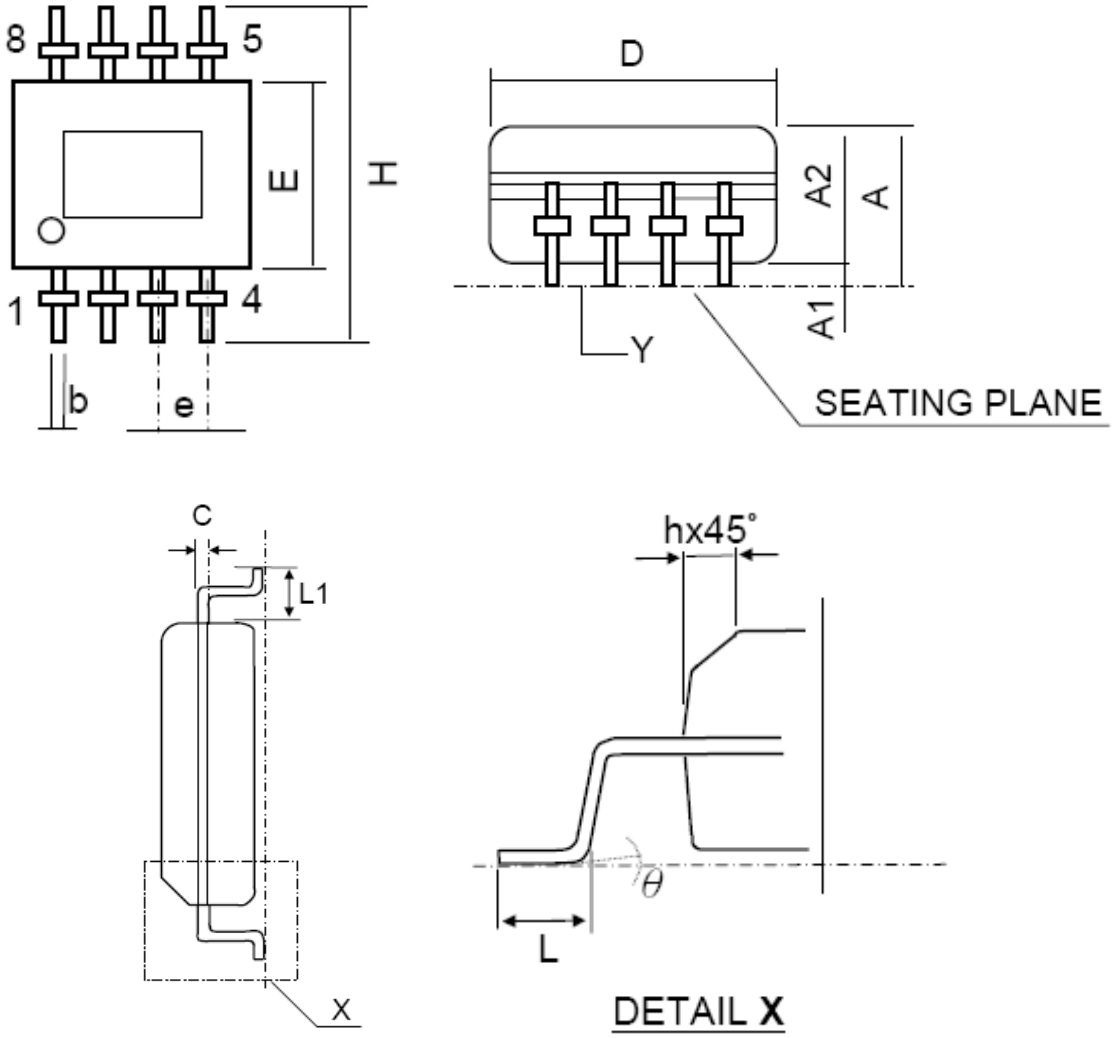
External Resistor (REXT)
Locate the external resistor as close to the REXT pin as possible to avoid the noise influence.

Current-limited Resistor
It is recommended to use 22/33 Ohm series resistors in the power connections of offending SCT2004s in conjunction with decoupling capacitors shunting the ICs.

Ground
Maximizing the width and minimizing the length of GND trace improve efficiency and ground bouncing by effect of reducing both ground parasitic resistance and inductance.

Package Dimension

SOP8



SYMBOL	DIMENSION (mm)			DIMENSION (mil)		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.40	1.50	1.60	55	59	63
A1	0.00	-	0.10	0	-	4
A2	-	1.45	-	-	57	-
b	0.33	-	0.51	13	-	20
c	0.19	-	0.25	7.0	-	10
D	4.80	-	5.00	189	-	197
E	3.80	3.90	4.00	150	153	157
e	1.27 BSC			50 BSC		
H	5.80	6.00	6.20	228	236	244
L	0.40	-	1.27	16	-	50
L1	0.95	1.05	1.15	37	41	45
Y	-	-	0.10			4
θ	0°		8°	0°		8°

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