8-Channel Constant Current Driver

Product Description

SCT2008 is an eight channels constant current driver for the LED lighting. It provides the finest PWM control effect with its ability to sink constant current from LED clusters with minimum pulse width only 80nS. The PWM control is performed by connecting the PWM signal from system control unit to OE pin of SCT2008. The full scale current value of each output is set by an external resistor connected to REXT pin.

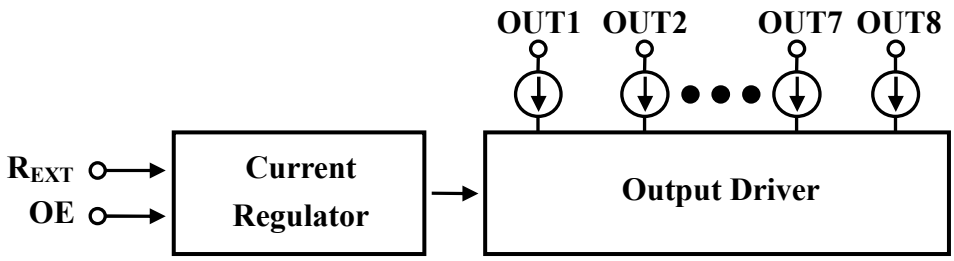
The SCT2008 guarantees to endure maximum DC 24V at each output port. Each output of SCT2008 can sink a constant current up to 160mA. Users can simply shunt the outputs to get higher current driver-ability, especially in the case of high power LED lighting.

The excellent current regulation capability let SCT2008 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. The eight channels IC stops driving the output while junction temperature exceeds 180°C the highest limit and the output will be reactivated while the junction temperature is below the 130°C the low limit of reactivation. Furthermore, with negative temperature coefficient characteristics the driver system and LEDs are protected from damage of thermal runaway or overheated.

Features

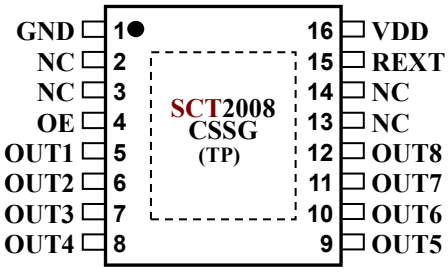
- Eight constant-current outputs rate at 24V
- Constant current range: 10 – 160mA
- Excellent regulation to load, supply voltage and temperature
- Minimum PWM pulse width 80ns
- ±2%(typ) current matching between outputs
- ±4%(typ) current matching between ICs
- Low dropout output 0.4V@40mA
- All output current are adjusted through one external resistor
- Built-in power on reset and thermal protection
- Supply input voltage: 5V
- Dimming control with Schmitt triggered input
- Package: SSOP16 with heat sink pad
- Application: LED lighting, LED backlight, LED lamp

Block Diagram



SCT2008

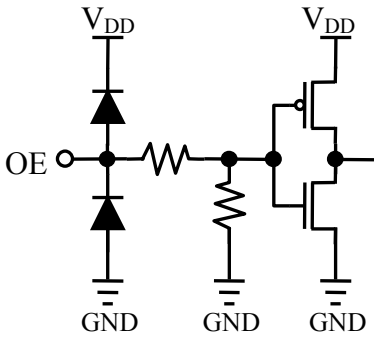
Pin Configuration



Terminal Description

Pin No.	Pin Name	Function
1	GND	Ground terminal
2,3,13,14	NC	No connection
4	OE	Input terminal of output enable signal. Output is enabled when OE is high.
5~12	OUT1~8	Output terminals with constant current
15	REXT	Input terminal connected to an external resistor for setting up all output current
16	VDD	Supply voltage terminal

Equivalent Circuits of Inputs



Ordering information

Part	Package	Unit per reel(pcs)	Marking
SCT2008CSSG	Green SSOP16(150mil) with thermal pad	2500	2008CSSG

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Maximum Ratings (T_A = 25°C)

Characteristic		Symbol	Rating	Unit
Supply voltage		V_{DD}	7	V
Input voltage		V_{IN}	-0.2 ~ V_{DD}+0.2	V
Output current		I_{OUT}	180	mA/Ch
Output voltage		V_{OUT}	24	V
Total GND terminals current		I_{GND}	1500	mA
Power dissipation	SSOP16TP	P_D	2.08	W
Thermal resistance	SSOP16TP	$R_{TH(j-a)}$	60	°C /W
Operating temperature		T_{OPR}	-40~+85	°C
Storage temperature		T_{STG}	-55~+150	°C

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

Characteristic	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}	-	4.5	-	5.5	V
Output voltage	V_{OUT}	Output OFF	-	-	24	V
		Output ON	-	1	4	V
Output current	I_{OUT}	DC test condition	10	-	160	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}=5V, T_A =25°C unless otherwise noted)

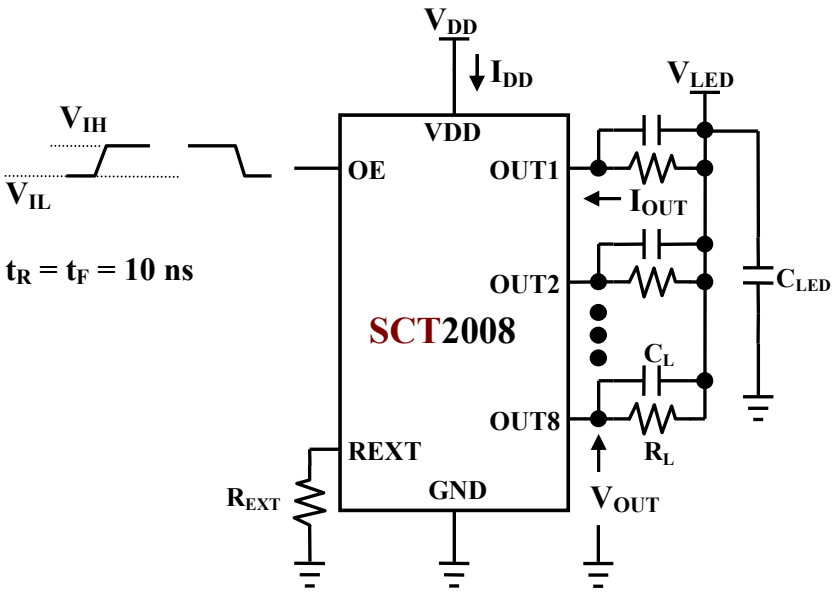
Characteristic		Symbol	Conditions		Min.	Typ.	Max.	Unit
Input voltage		V_{IH}	-		2	-	V_{DD}	V
		V_{IL}	-		0	-	0.4	V
Output leakage current		I_{OL}	V_{OUT} = 24V		-	-	0.5	uA
Output current		I_{OUT}	V_{OUT}=1V	R_{EXT}=900Ω	-	42	-	mA
Current channel skew*		dI_{OUT1}	V_{OUT}=1V	R_{EXT}=900Ω	-	±2	±3	%
Current chip skew*		dI_{OUT2}	V_{OUT}=1V	R_{EXT}=900Ω	-	±4	±6	%
Line regulation I_{OUT} vs. V_{DD}		$\%/dV_{DD}$	4.5V < V_{DD} < 5.5V, R_{EXT}=900Ω, V_{OUT} > 1V		-	-	±1	%/V
Load regulation I_{OUT} vs. V_{OUT}		$\%/dV_{OUT}$	1V < V_{OUT} < 4V, R_{EXT}=900Ω, V_{DD}=5V		-	-	±1	%/V
Pull-down resistor		R_{DOWN}	OE		-	500	-	KΩ
Thermal shutdown		T_H	Junction Temperature		-	180	-	°C
		T_L			-	130	-	°C
Supply current	OFF	$I_{DD(OFF)1}$	R_{EXT} = Open, OUT_1~OUT_4=OFF		-	6	15	mA
		$I_{DD(OFF)2}$	R_{EXT} = 900Ω, OUT_1~OUT_4=OFF		-	9	15	
	ON	$I_{DD(ON)}$	R_{EXT} = 900Ω, OUT_1~OUT_4=ON		-	10	15	

* Skew=(I_{OUT}-I_{AVG})/I_{AVG}, where I_{AVG}=(I_{max}+ I_{min})/2

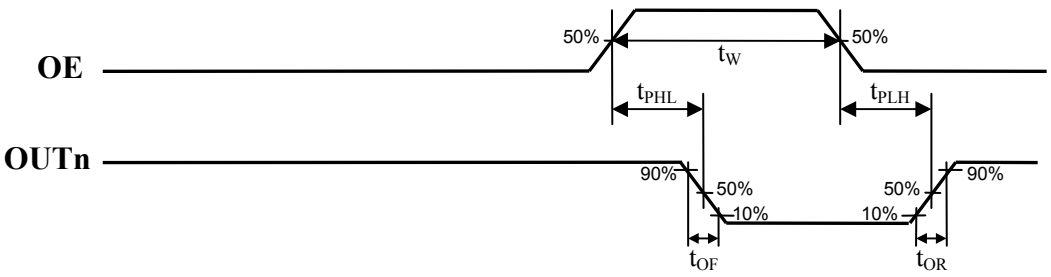
Switching Characteristics (V_{DD}=5V, T_A=25°C unless otherwise noted)

Characteristic		Symbol	Condition	Min.	Typ.	Max.	Unit
Propagation delay time (“L” to “H”)	OE - OUTn	t_{PLH}	V_{DD} = 5V V_{LED} = 5V C_{LED} = 100uF V_{IH} = V_{DD} V_{IL}= GND R_{EXT} = 900Ω R_L = 90Ω C_L = 10pF	-	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 I_{OUT}		t_{OR}		-	10	25	ns
Output fall time of I_{OUT}		t_{OF}		-	10	25	ns

Test Circuit for Switching Characteristics

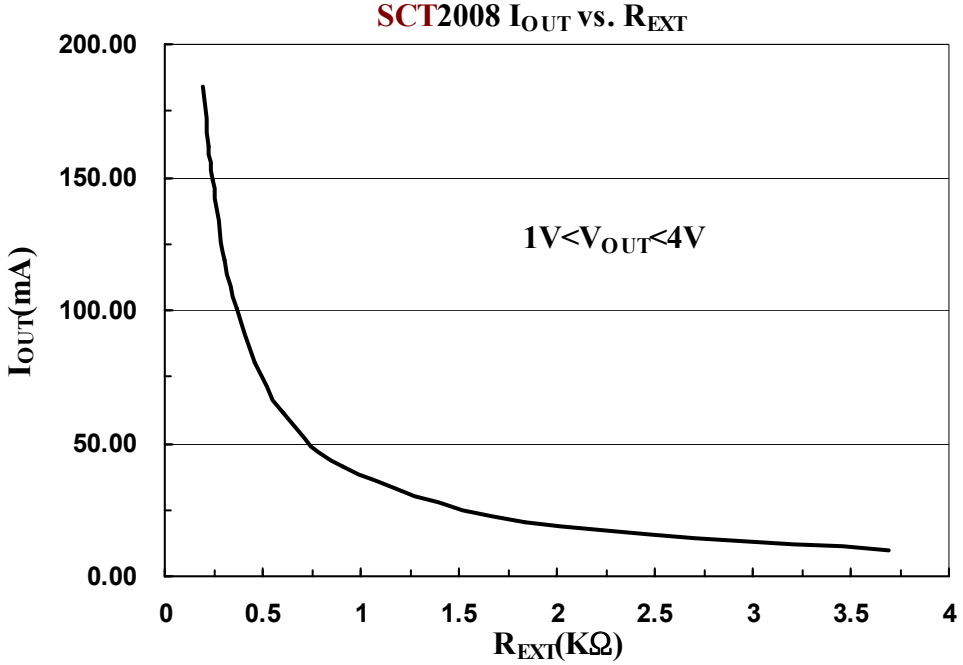


Timing Waveform



Adjusting Output Current

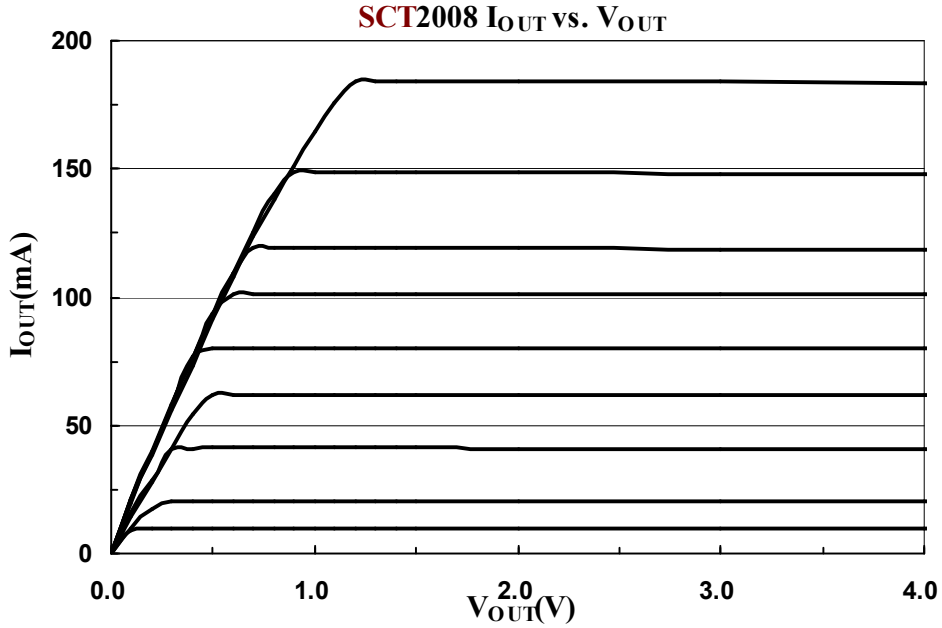
All SCT2008's output current (I_{OUT}) are set by one external resistor at pin REXT. The relationship between I_{OUT} and resistance R_{EXT} is shown as the following figure.



When the SCT2008's output voltage is set between 1 Volt and 4 Volt, the output current can be estimated approximately by: I_{OUT} = 60 (630 / R_{EXT}) (mA) (chip skew < ±6%). Thus the output current are all set to be about 42mA at R_{EXT} = 900Ω.

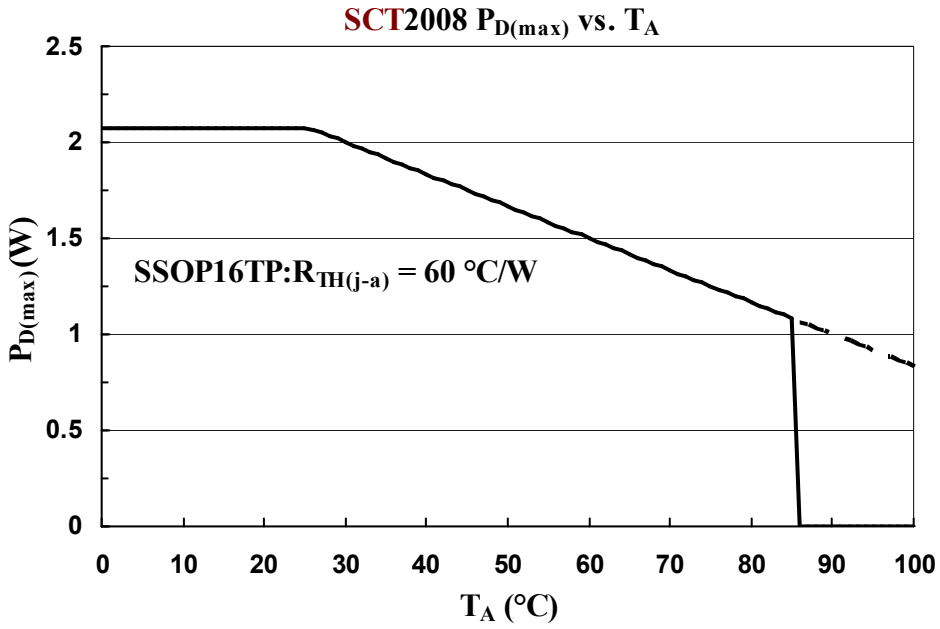
Output Characteristics

The current characteristic of output curve is flat. The output current can kept constant regardless of the variations of LED forward voltage when V_{OUT} > 1V. The relationship between I_{OUT} and V_{OUT} is shown below:



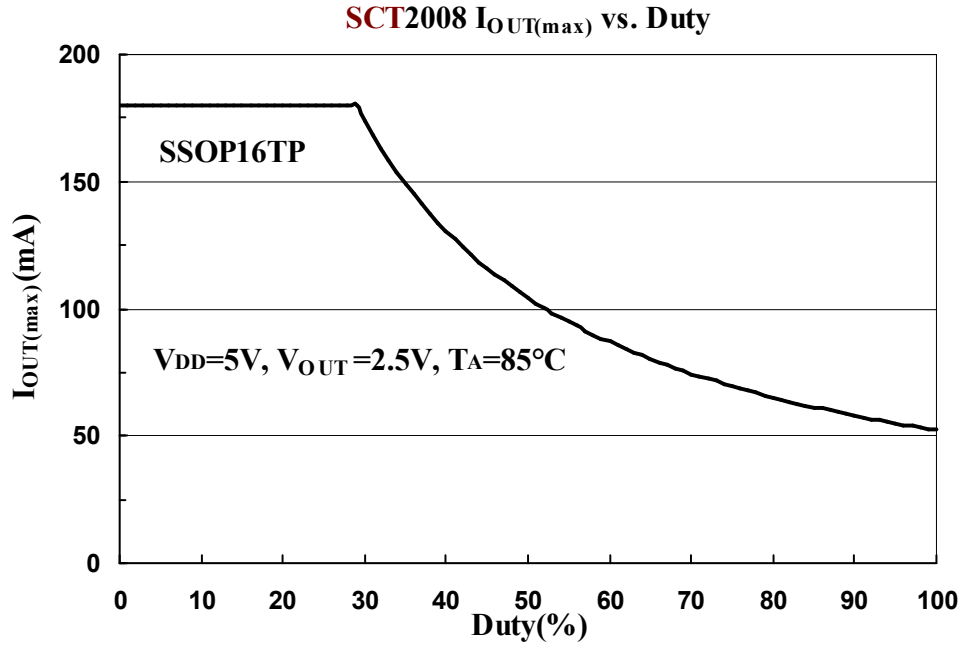
Power Dissipation

The maximum power dissipation ($P_{D(max)}$) of a semiconductor chip varied to different package and ambient temperature. It's determined as $P_{D(max)}=(T_{J(max)} - T_A)/R_{TH(j-a)}$ where $T_{J(max)}$: maximum chip junction temperature usually considered as 150°C, T_A: ambient temperature, $R_{TH(j-a)}$: thermal resistance. Since P=IV, for sink larger I_{OUT}, users are encouraged to add proper voltage reducers on output to reduce the heat generated from the SCT2008.



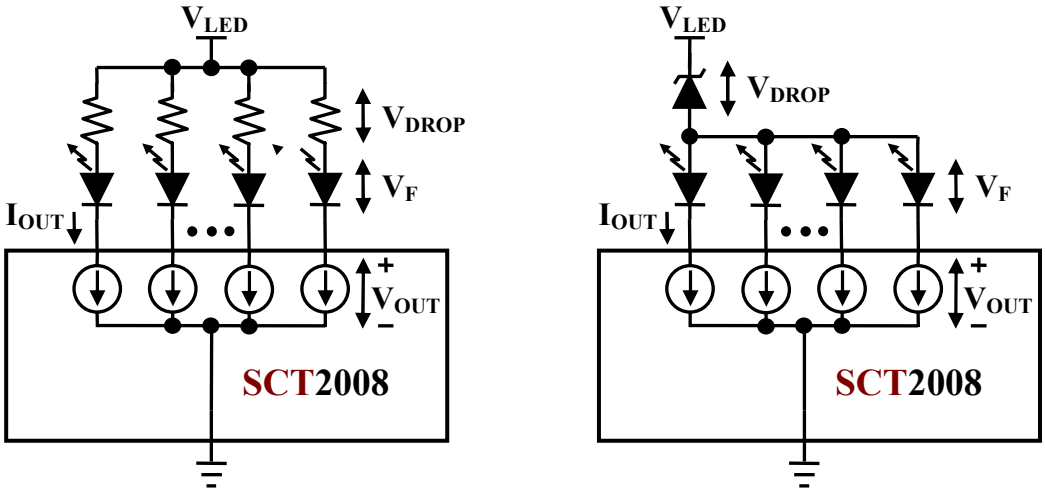
Limitation on Maximum Output Current

The maximum output current vs. duty cycle is estimated by:
$I_{OUT(max)}=(((T_{J(max)}-T_A)/R_{TH(j-a)})-(V_{DD}*I_{DD}))/V_{OUT}/Duty/N$, where $T_{J(max)}$=150°C, N=8(all ON)



Load Supply Voltage (V_{LED})

The SCT2008 can be operated very well when V_{OUT} ranging from 1V to 4V. It is recommended to use the lowest possible supply voltage or set a voltage reducer to reduce the V_{OUT} voltage, at the same time reduce the power dissipation of the SCT2008. Follow the diagram instructions shown below to lower down the output voltage. This can be done by adding additional resistor or Zener diode, thus $V_{OUT}=V_{LED}-V_{DROP}-V_F$.

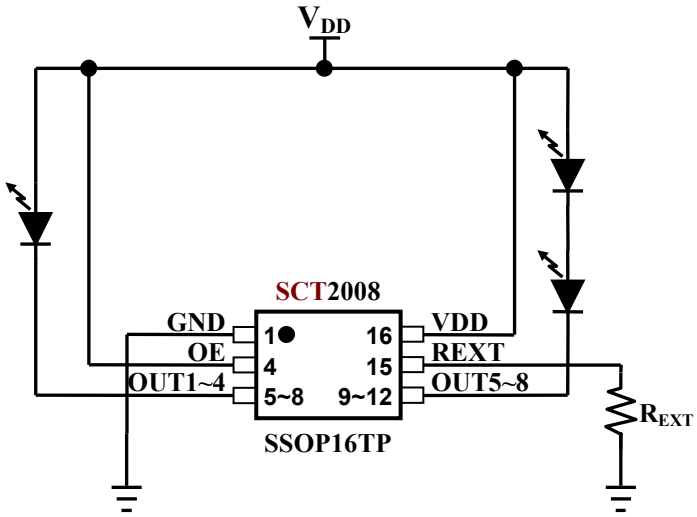


Over Temperature Shutdown

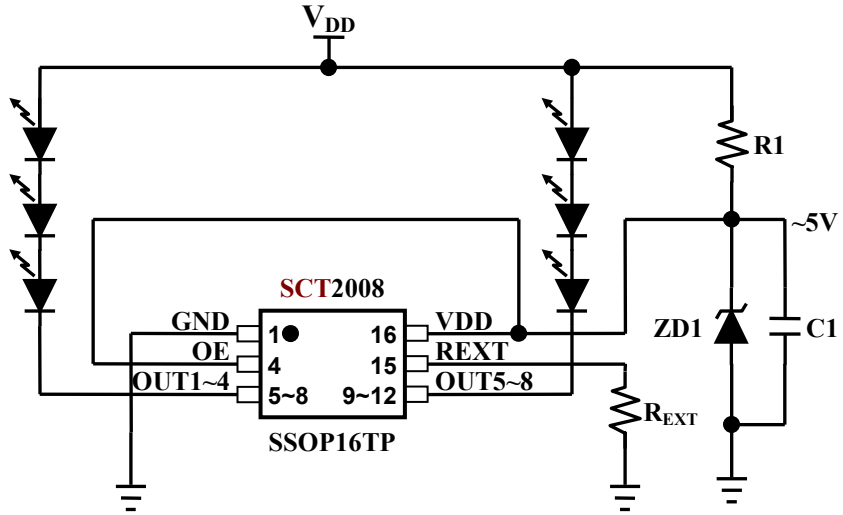
The SCT2008 contains thermal shutdown scheme to prevent damage from over heated. The internal thermal sensor turns off all outputs when the die temperature exceeds ~ +180°C. The outputs are enabled again when the die temperature drops below ~ +130°C.

Typical Application Circuits

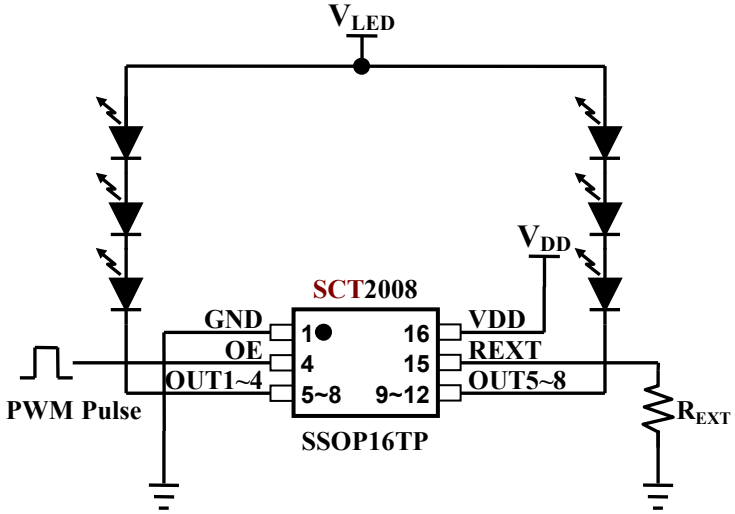
(1) Lighting with recommended V_{DD}=5V



(2) Lighting with V_{DD} > 5V, e.g. V_{DD}=12V/24V



(3) Lighting with dimming control

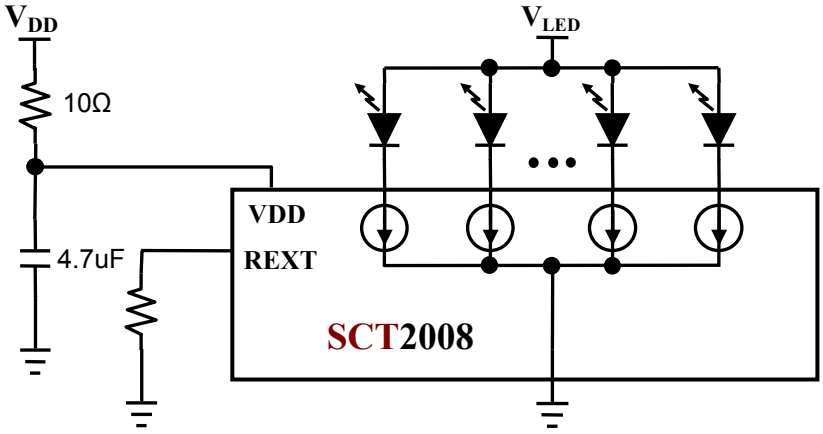


PCB Design Considerations

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

Decoupling Capacitor

Place a decoupling capacitor e.g. 4.7uF between VDD and GND pins of the SCT2008. Locate the capacitor as close to the SCT2008 as possible. The necessary capacitance depends on the LED load current and dimming frequency.



External Resistor (R_{EXT})

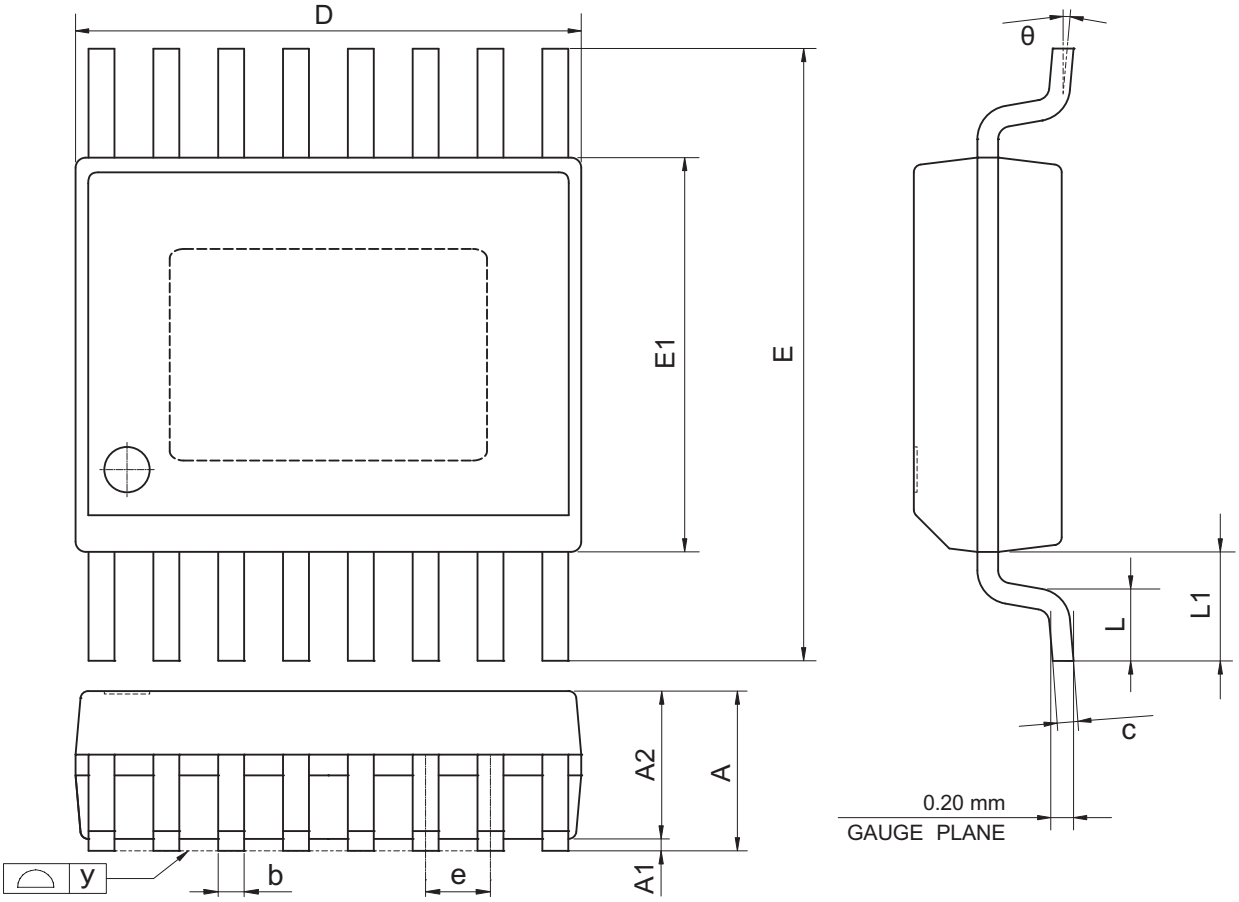
Locate the external resistor as close to the REXT pin in as possible to avoid noise.

Power and Ground

Maximizing the width and minimizing the length of V_{DD} and GND trace improve efficiency and ground bouncing by effect of reducing both power and ground parasitic resistance and inductance. A small value of resistor e.g. 10Ω series in power input of the SCT2008 in conjunction with decoupling capacitor shunting the ICs is recommended. Separating and feeding the LED power from another stable supply terminal V_{LED} is strongly recommended.

Package Dimension

SSOP16TP(check up-to-date version)



Symbol	Dimension (mm)			Dimension (mil)		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	1.35	1.50	1.65	53.1	59.1	65.0
A1	0.00	-	010	0.0	-	3.9
A2	-	1.45	-	-	57.1	-
b	0.20	0.25	0.30	7.9	9.8	11.8
c	0.19	-	0.25	7.5	-	9.8
D	4.80	-	5.00	189.0	-	196.9
E	5.80	6.00	6.20	228.3	236.2	244.1
E1	3.80	3.90	4.00	149.6	153.5	157.5
e	-	0.64	-	-	25.2	-
L	0.40	-	1.27	15.7	-	50.0
L1	0.95	1.05	1.15	37.4	41.3	45.3
y	-	-	0.10	-	-	3.9
θ	0°	-	8°	0°	-	8°

Revision History (check up-to-date version)

Data Sheet Version	Remark
V02_01	Description added

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