Raffar Technology Corp.

RT758

24V Sustaining Voltage 4-channel 350mA RGBW 8bit PWM IC

2019/01

Version : 0.7 (Preliminary)

Description

RT758 is a 4-channel 350mA 8-bit PWM embedded constant current LED sink driver. The accurate constant current outputs can be set from 50 ~ 350mA by individual external resistors. With given 12V/24V supply voltage and output voltage, the RT758 can be adapted with 12V/24V power supply system directly.

With Splitting PWM technology, RT758 can enhance the performance of PWM for higher refresh rate. RT758 has over heat protection to limit the output current to only 50% while the temperature reaches 180 °C.

RT758 provided 4 set individual OE control. User can easily to choose PWM mode or OE mode for LED lighting application.

Features

- Supply voltage：
  VDDL: 3.3V~5.0 V
  VDDH: 9.0 V ~ 24.0 V
- Constant output：50mA ~ 350mA
- Sustaining voltage：24 V
- 4 set individual OE control (OE Mode)
- 8-bit PWM control (PWM Mode)
- Splitting PWM mode
- 1MHz ENI Frequency
- Supporting single layer ALPCB and long cascade connection
- Over heat protection

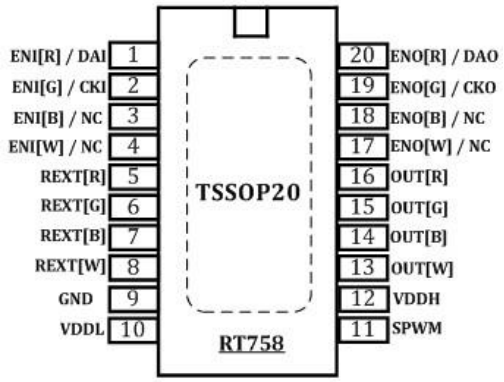
Application

LED decoration

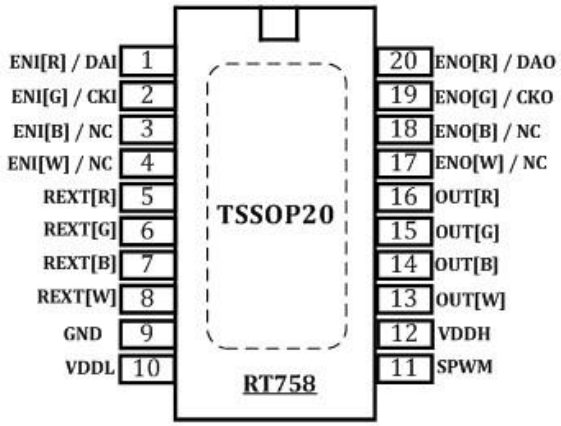
Purchase Information

No.	Part No.	Package
1	RT758ET	TSSOP-20 exposed pad

Pin Assignment

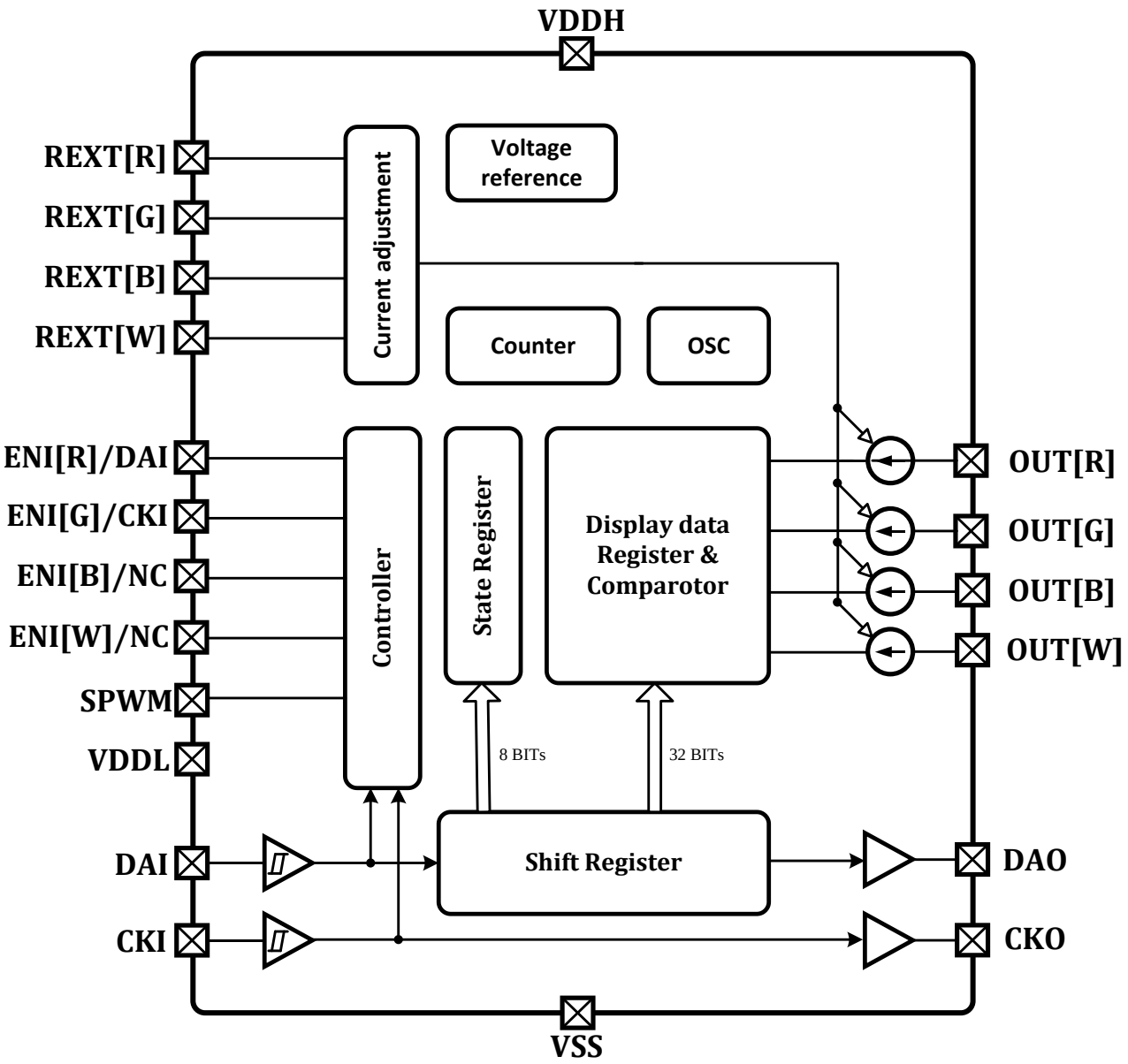


Pin Assignment



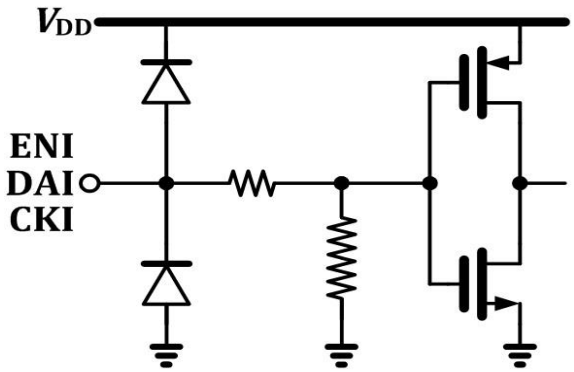
Pin No.	Pin Name	Description
1	ENI[R] / DAI	Enable data input[R] / Serial data input
2	ENI[G] / CKI	Enable data input[G] / Clock signal input
3	ENI[B]	Enable data input[B]
4	ENI[W]	Enable data input[W]
5	REXT[R]	External resistor[R]
6	REXT[G]	External resistor[G]
7	REXT[B]	External resistor[B]
8	RXET[W]	External resistor[W]
9	GND	Ground terminal
10	VDDL	Supply voltage input
11	SPWM	Enable/PWM mode switch “0” : Enable mode “1” : PWM data mode
12	VDDH	Supply voltage input
13	OUT[W]	Constant current output[W]
14	OUT[B]	Constant current output[B]
15	OUT[G]	Constant current output[G]
16	OUT[R]	Constant current output[R]
17	ENO[W]	Enable signal output[W]
18	ENO[B]	Enable signal output[B]
19	ENO[G] / CKO	Enable signal output[G]/ Clock signal output
20	ENO[R] / DAO	Enable signal output[R]/ Serial data output

Block Diagram

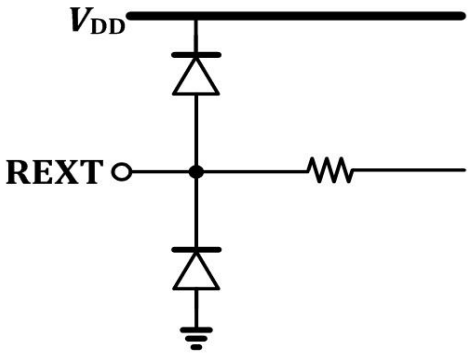


Input/ Output Equivalent Circuits

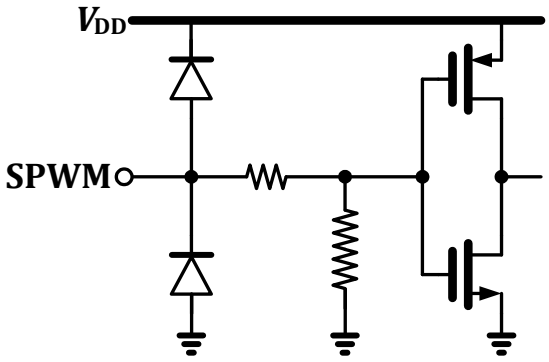
ENI / DAI / CKI Terminal



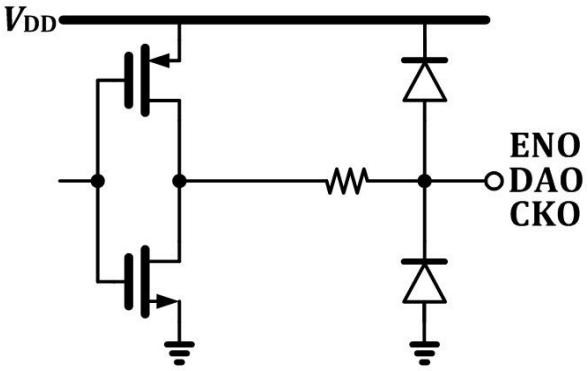
REXT Terminal



SPWM Terminal



ENO / DAO / CKO Terminal



Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply Voltage	V_{DDH}	9.0 ~ 24.0	V
	V_{DDL}	3.3~5.0	
Input Voltage (all pins)	V_{IN}	−0.4 ~ 5.0	V
Output Current (all output pins)	I_{OUT}	385	mA
Output Voltage (all output pins)	V_{OUT}	−0.3 ~ 24	V
Clock Frequency	f_{DCK}	10	MHz
GND Terminal Current	I_{GND}	1700	mA
Power Dissipation (on 4-layer PCB)	P_D	2.51 (TSSOP20 · T_a = 25 °C)	W
Thermal Resistance (on 4-layer PCB)	$R_{th(j-a)}$	49.6 (TSSOP20)	°C/W
Operating Temperature	T_{opr}	−40 ~ 85	°C
Storage Temperature	T_{stg}	−55 ~ 150	°C

Recommended Operating Condition

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	V_{DDH}	—	9.0	—	24.0	V
	V_{DDL}		3.3	—	5.0	
Output Voltage (all output pins)	V_{OUT}	Output turned off	—	—	24	V
		Output turned on*1	1.0	—	2.5	V
Output Current	I_{OUT}	All current output pins	50	—	350	mA
	I_{OH_1}	V_{OH} = 4.6 – 0.2 V @ V_{DDH}	—	−2.0	—	
	I_{OL_1}	V_{OL} = 0.2 V @ V_{DDH}	—	2.0	—	
	I_{OH_2}	V_{OH} = VDDL – 0.2 V @ V_{DDL}	—	−2.0	—	
	I_{OL_2}	V_{OL} = 0.2 V @ V_{DDL}	—	2.0	—	
Input Voltage (DAI/ CKI/ DAO/ CKO)	V_{IH}	V_{DDH}= 9.0 V ~ 24.0 V	3.5	—	5.0	V
	V_{IL}	V_{DDL}= 3.3 V ~ 5.0 V	0	—	1.5	

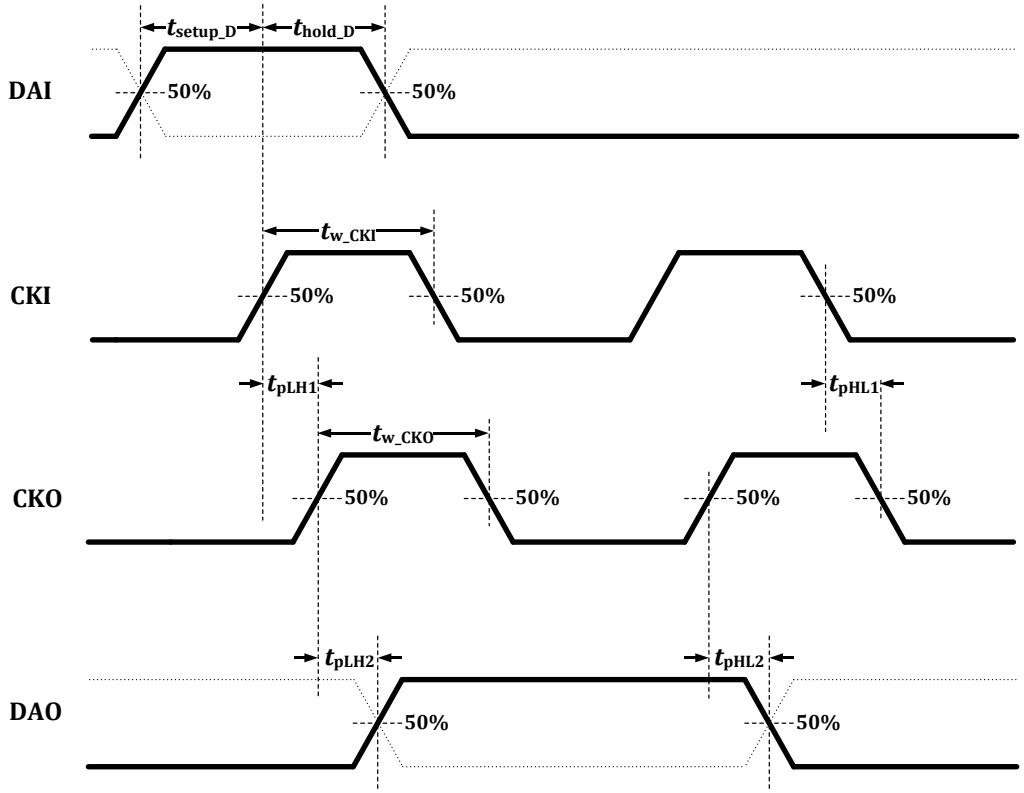
*1Note: power dissipation is limited by package type and the temperature of the operating environment.

DC Electrical Characteristics (VDD = 12.0 V)

Characteristics		Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage		V_{DD}	—	11.4	12.0	12.6	V
Output Voltage		V_{OUT}	All output pins	—	—	24	V
Output Leakage Current		I_{LEAK}	V_{OUT} = 24 V	—	—	1	μA
Input Voltage	High Level	V_{IH}	Logic Signal	3.5	—	5.0	V
	Low Level	V_{-IL}		0	—	1.5	
Output Voltage (DAO/CKO)		V_{OH}	I_{OH} = −2.0 mA	—	4.4	—	V
		V_{OL}	I_{OL} = 2.0 mA	—	0.2	—	
Output Current Skew	Chip-to-Chip	I_{OSC}	V_{OUT} = 1.0 V Iout[R],[G],[B],[W] = 201.6mA R_{EXT} = 2658 Ω	—	±5.0	±10.0	%
Output Current Regulation	Output Voltage	%/ΔV_{OUT}	R_{EXT} = 2658 Ω V_{OUT} = 1 V ~ 3 V	—	—	±0.1	%/V
	Supply Voltage	%/ΔV_{DD}	R_{EXT} = 2658 Ω V_{DD} = 11.4 ~ 12.6 V	—	—	±1	
Supply Voltage Current		I_{DD_OFF1}	R_{EXT} open All output pins off	—	1.9	2.9	mA
		I_{DD_OFF2}	R_{EXT} = 2063 Ω All output pins off	—	8.9	9.9	
		I_{DD_OFF3}	R_{EXT} = 5865 Ω All output pins off	—	4.1	5.1	
		I_{DD_ON1}	R_{EXT} = 2063 Ω All output pins on	—	9.6	10.6	
		I_{DD_ON2}	R_{EXT} = 5865 Ω All output pins on	—	4.8	5.8	

Timing Waveforms

CKI, CKO, DAI, DAO



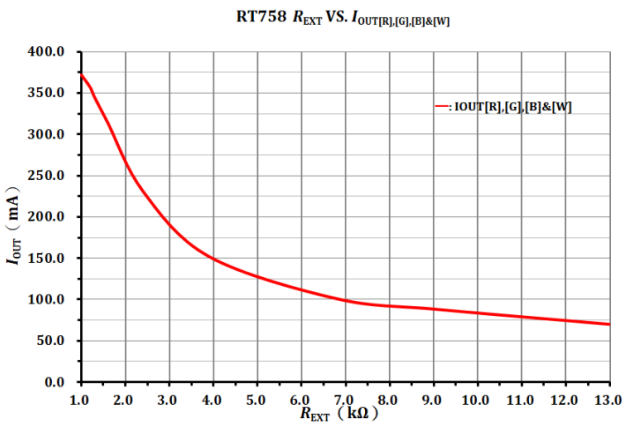
Operation Principle

1. To set up the external resistors of R,G,B,W respectively for the max. current of each channel.
2. Set SPWM=0 for OE mode or set SPWM=1 for PWM mode.
3. In OE mode, output pins OUT[R] OUT[G], OUT[B], OUT[W] are controlled directly by ENI[R],ENI[G],ENI[B] and ENI[W] .
4. In PWM mode, the commmand data and image data shoulc comply with 3-CH operation and global PWM control.
5. There are golabal PWM mode(SERIAL=0) and serial PWM mode(SERIAL=1) for different application.
6. The format of command data depneds on “SERIAL” and “CH[1:0]”

External Resistor
(Adjusting output current)

The output current of each channel of RT758 can be set respectively. The external resistor is put on between GND pin and REXT pin.

The output current can be set from 50mA to 350mA by using different resistors as shown below.



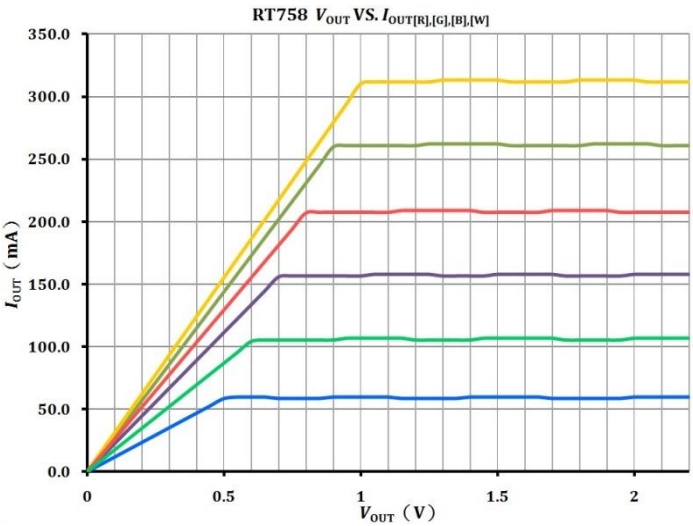
For example, When R_{EXT} is 1600Ω, the output current of OUT[R]~[W] is 314 mA.

When R_{EXT} is 6800Ω, the output current of OUT[R]~[W] is 101 mA.

I_{OUT} (mA)	R_{EXT} (Ω)
357	**1200**
345	**1300**
314	**1600**
231	**2400**
152	**3900**
101	**6800**
88	**9100**
70	**13000**

Constant current output

RT758 supports "Constant Current "output as below and it would not be influenced by V_{LED}.



For ideal constant current output, it is necessary to consider the I_{OUT} and the minimum V_{OUT} at the same time.

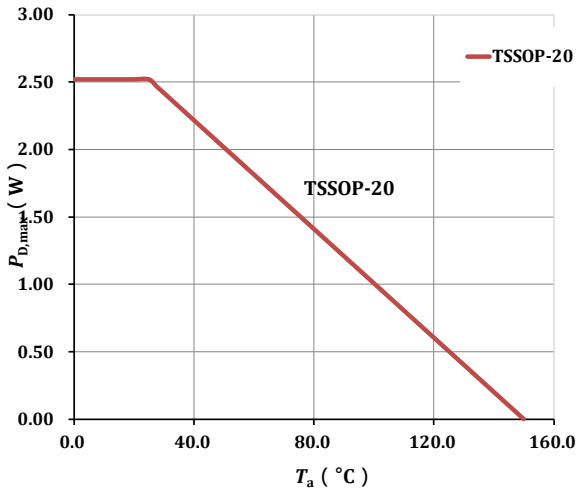
Power Dissipation

The maximum power dissipation ($P_{D,max}$) of IC is subject to the package and environment temperature. The formula is as below:

$$P_{D,max}\,(\,W\,)=\frac{T_j\,(°C\,)-T_a(°C\,)}{R_{th(j-a)}\,(°C/W\,)}$$

T_j is the temperature of junction, T_a is environment temperature, $R_{th(j-a)}$ is thermal resistance.

The relationship of $P_{D,max}$ and T_a is as below (@T_j is 150 °C) .



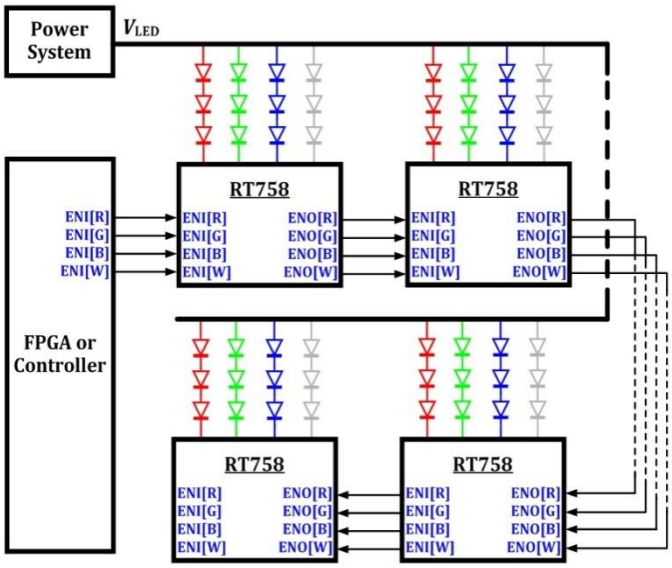
The real power dissipation of a working IC can be calculated by

$$P_{D,opr}=I_{DD}\times V_{DD}+4\times I_{OUT}\times V_{OUT}\times Duty$$

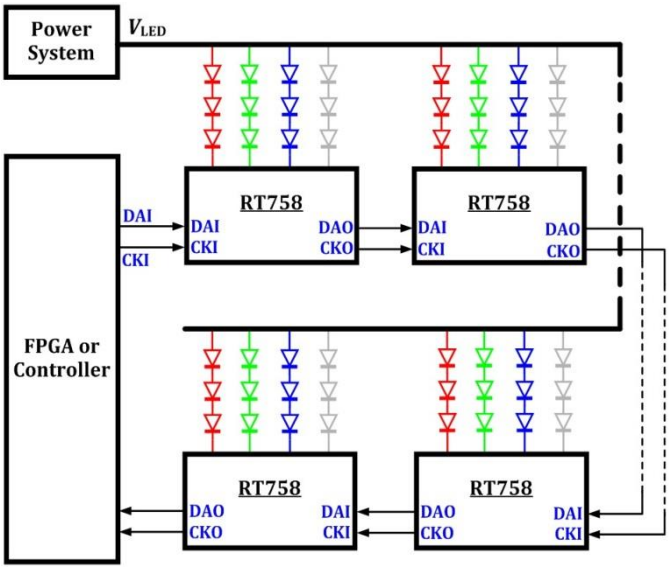
Duty means the proportion of the turn-on time comparing to the total time. It is necessary to keep $P_{D,opr} < P_{D,max}$ for package reliability.

Application Circuit

OE mode

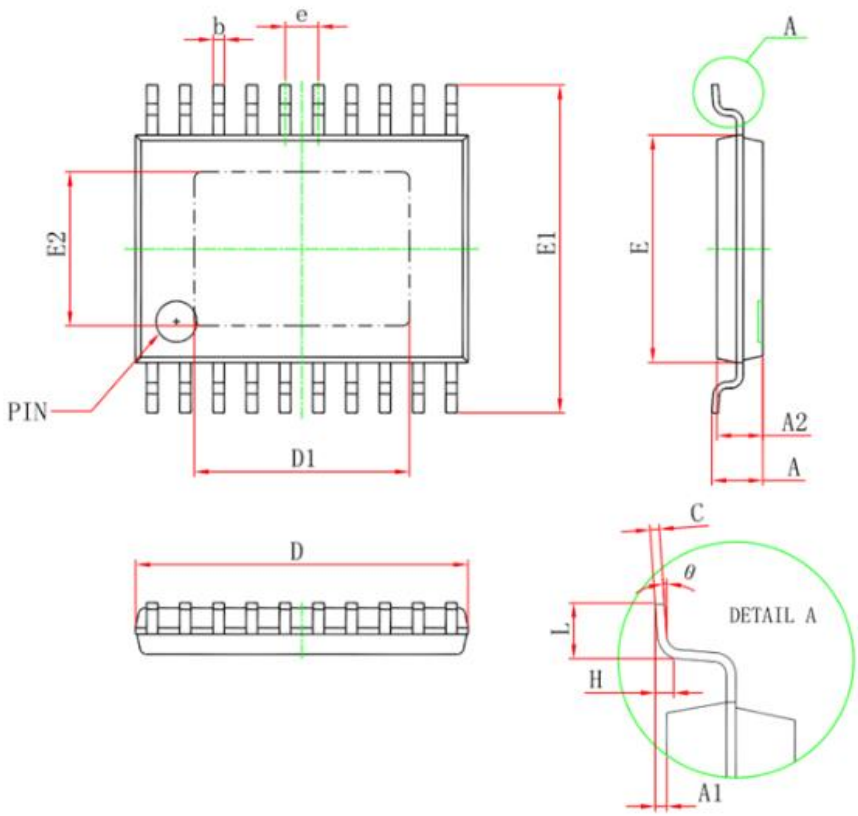


PWM mode



Package Outline Dimension

TSSOP-20 Dimension (165 mil 0.65mm with Exposed Pad)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	6.400	6.600	0.252	0.259
D1	4.100	4.300	0.165	0.169
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
E2	2.900	3.100	0.114	0.122
A		1.100		0.043
A2	0.800	1.000	0.031	0.039
A1	0.020	0.150	0.001	0.006
e	0.65 (BSC)		0.026(BSC)	
L	0.500	0.700	0.02	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°	7°	1°	7°

Note

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