MT7653

5V LDO Linear PWM LED Driver

DESCRIPTION

MT7653 is a high voltage, linear, PWM LED driver, which has high accuracy and customer programmable output current. Thanks to the internal 5V power LDO, the chip can deliver 5mA current to external devices.

MT7653 features over temperature regulation (OTR) function. Once the temperature exceeds the threshold, the chip gradually decreases the output current to ensure system reliability.

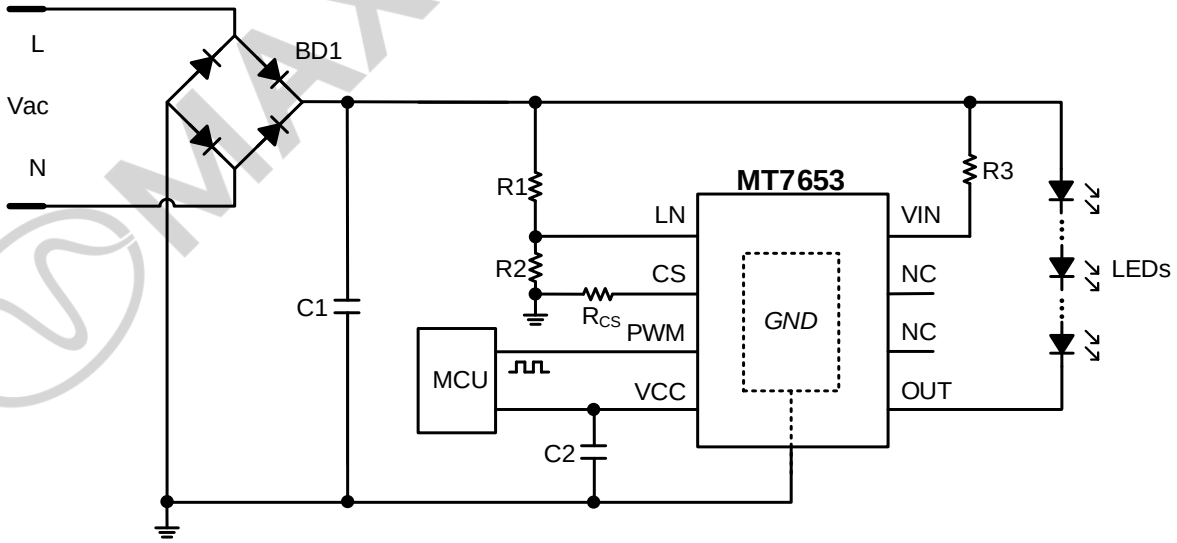
FEATURES

- Adjustable output current: 5mA~100mA
- Support PWM/analog dimming
- Built-in 5V power supply with up to 5mA driving capability
- High constant current accuracy: ±3%
- Features OTR function
- No EMC issue
- Simple peripheral circuit, small size driving circuit, low BOM cost
- Available in ESOP8 package

APPLICATIONS

- Bulb
- Downlight
- Ceiling lamp

TYPICAL APPLICATION CIRCUIT



ABSOLUTE MAXIMUM RATINGS

Test conditions: T_A=25°C, unless otherwise stated.

VIN pin voltage	-0.3 ~ 700V
OUT pin voltage	-0.3 ~ 500V
VCC/PWM/LN/CS pins voltage	-0.3 ~ 6V
OUT pin current	5mA ~ 100mA
Lead temperature (soldering, 10 sec.)	260°C
Maximum power consumption (P_{DMAX})	1.2W
Storage temperature (T_{STG})	-50°C ~ 150°C
Operating junction temperature (T_J)	-40°C ~ 150°C
ESD (HBM)	±2KV

THERMAL RESISTANCE①

Junction to ambient ($R_{\theta JA}$)	70°C/W
Junction to case ($R_{\theta JC}$)	50°C/W

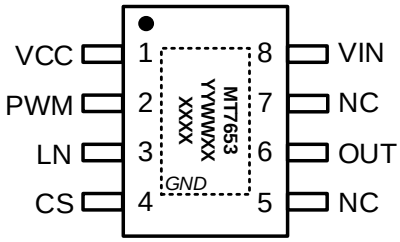
Note:

① *$R_{\theta JA}$, $R_{\theta JC}$ are measured in the natural convection at T_A = 25°C on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard. Test condition: Device mounted on 2" X 2" FR-4 substrate PCB, 2oz copper, with minimum recommended pad on top layer and thermal vias to bottom layer ground plane.*

ORDERING INFORMATION

Part Number	Package	Packing Method	Moisture Sensitivity Level	Chip Mark
MT7653	ESOP8	Tape 4,000pcs/Reel	3	MT7653 YYWWXX XXXX

PIN CONFIGURATION



(ESOP8)

Chip Mark

MT7653: Part Number
Y: Year Code
W: Week Code
X: Manufacture code

PIN DESCRIPTION

Name	Pin No.	Description
VCC	1	Output pin of Built-in 5V LDO.
PWM	2	PWM/analog signal dimming input pin.
LN	3	Linear compensation pin.
CS	4	Output current setting pin.
OUT	6	Constant current output pin. Connects to the cathode of the LED.
NC	5,7	Floating pin.
VIN	8	Chip power supply pin.
Bottom plane		Chip ground.

ELECTRICAL CHARACTERISTICS

Test conditions: T_A=25°C, unless otherwise stated.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{OUT_DROP}	Min operating voltage for OUT pin to reach rated current	I_{OUT}=30mA		5.6	6.0	V
I_Q	Quiescent current	V_{IN}=30V, OUT, PWM, CS, LN pins floating		150		μA
V_{REF_CS}	CS pin reference voltage	V_{IN}=V_{OUT}=30V, R_{CS}=1kΩ, PWM, LN pins floating	0.57	0.6	0.63	V
V_{PWM_H}	PWM pin high level	PWM pin voltage ramps up			2.8	V
V_{PWM_L}	PWM pin low level	PWM pin voltage ramps down	0.4			V
V_{PWM_DC}	Start point of DC voltage dimming	V_{PWM} > V_{PWM-DC}, the output current rise from 0		0.4		V
V_{REF_LN}	Internal reference voltage for Line voltage compensation			1.2		V
S_{LN}	slope line voltage compensation			1400		mV/V
I_{VCC}	Max output current of VCC pin	V_{CC}=5V		5		mA
T_{OTR}	OTR threshold			150		°C

APPLICATION INFORMATION

MT7653 is a high voltage, linear, PWM LED driver with built-in 5V power supply, which has high accuracy and customer programmable constant current.

Constant Current Control

MT7653 accurately adjusts LED current by the CS pin external resistor.
The calculation equation is shown below:

$$I_{LED}=\frac{V_{REF\_CS}}{R_{CS}}$$

Where V_{REF_CS} (=600mV) is the CS pin internal reference voltage and R_{CS} is the external current sense resistor at CS pin.

PWM Pin Dimming

PWM pin supports two kinds of dimming signal: PWM dimming signal and analog dimming signal.

When PWM signal inputs, the pin is enabled at high level and disables at low level.

For DC voltage input, PWM pin operates at 0.4V ~ 2.4V input. Once V_{PWM}>2.4V, the chip outputs 100% rated current.

If PWM dimming function is not required, it is recommended to connect PWM pin with VCC pin.

Line Voltage Compensation

MT7653 detects line voltage through LN pin and adjusts the internal reference voltage V_{REF_CS} through the resistor at LN pin so as to ensure the input power does not change with the line. The relationship between the input AC voltage and the sampling resistors R1 and R2 can be calculated by the below equation:

$$\frac{R2}{R1+R2}\times V_{AC}\times 1.414=1.2V$$

The relationship between the CS pin voltage and the LN pin voltage is given by the below equations:

- V_{REF_LN} ≥1.2V,

  $V_{REF\_CS}=600-[(V_{REF\_LN}-1.2)\times 1400]$

- V_{REF_LN}<1.2V,

  $V_{REF\_CS}=600mV$

Where, V_{REF_LN} is in V, and V_{REF_CS} is in mV.

If the line voltage compensation function is not required, it is recommended to connect LN pin to the ground.

VCC Pin Drive Current

VCC pin is used to supply power to MCU and other modules. It is built-in 5V LDO with 5mA output current capability. It is recommended to connect a 1μF capacitor or above in parallel to the VCC pin.

PCB Layout Consideration

1. R_{CS} Ground

The trace between the current sense resistor and the ground should be as short and thick as possible to enhance heat sinking capacity.

2. VCC capacitor

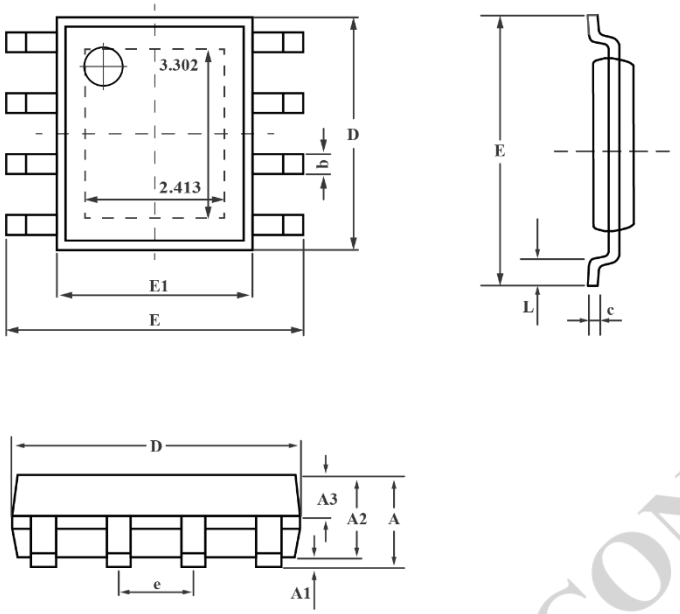
The SMD capacitor at VCC pin should be as close as possible to the VCC pin.

3. Heat sinking

The bottom plane, internally connected to the ground, is the main heat sinking area of the chip. While layout, there should be a heat sinking pad below the bottom plane, and it's should be connected to the ground. Moreover, its copper area should be as large as possible to enhance the heat sinking capacity.

PACKAGE OUTLINE AND DIMESION

ESOP8 PACKAGE OUTLINE AND DIMENSIONS



SYMBOL	MILIMETER		
	MIN	NOM	MAX
A	1.35	-	1.75
A1	0.10	-	0.25
A2	1.30	1.40	1.50
A3	0.55	0.65	0.70
b	0.33	-	0.51
c	0.17	-	0.25
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
L	0.40	0.60	0.80

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