WD3100

200mA Flash/Torch LED Driver

http//:www.sh-willsemi.com

Descriptions

WD3100 is a low cost Flash/Torch LED driver designed for front camera flash and small current rear camera flash application.

WD3100 integrates a current sink to ensure constant LED current when conditions such as V_{BAT} voltage, LED V_F voltage, ambient temperature change.

The LED current can be adjusted by external resistor connected between RSET pin and GND, and also can be set to default 200mA by just simply connect RSET pin to GND.

WD3100 has flash time-out protection function to prevent LED lamp from overheating in abnormal conditions.

Features

- Input voltage range   : 2.7~5.5 V
- Maximum configurable I_{LED} : 200mA
- I_{LED} accuracy   : +/- 20%
- Flash timeout protection
- Over temperature protection
- SOT363 package

Applications

- Front Camera Flash
- Small Current Rear Camera Flash
- LED Torch
- Other small current LED driver

SOT-363
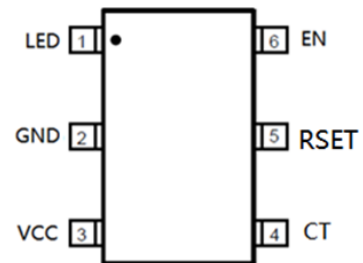
Pin configuration (Top view)
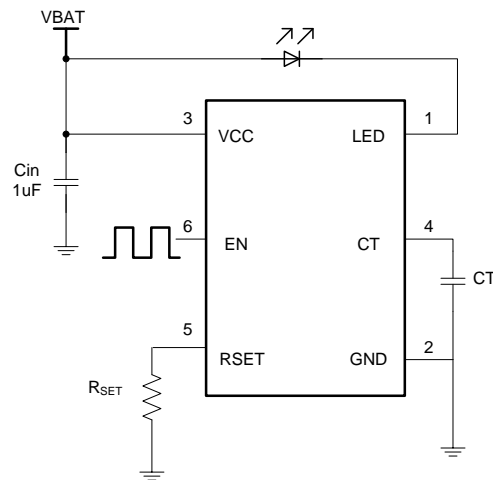

| FA | = Device code |
| * | = Month code |

Order information

| Device	Package	Shipping
WD3100B-6/TR	SOT363	3000/Reel&Tape

Typical Applications

Pin Descriptions

Pin Number	Symbol	Descriptions
1	LED	Open drain current sink pin, connected to LED cathode.
2	GND	Device ground pin.
3	VCC	Device power supply pin.
4	CT	Time-out protection time setting pin. Connect to GND will disable time-out protection function.
5	RSET	LED current setting pin. Connect RSET directly to GND will internally set I_{LED} to default 200mA.
6	EN	Enable pin of the device.

Block Diagram
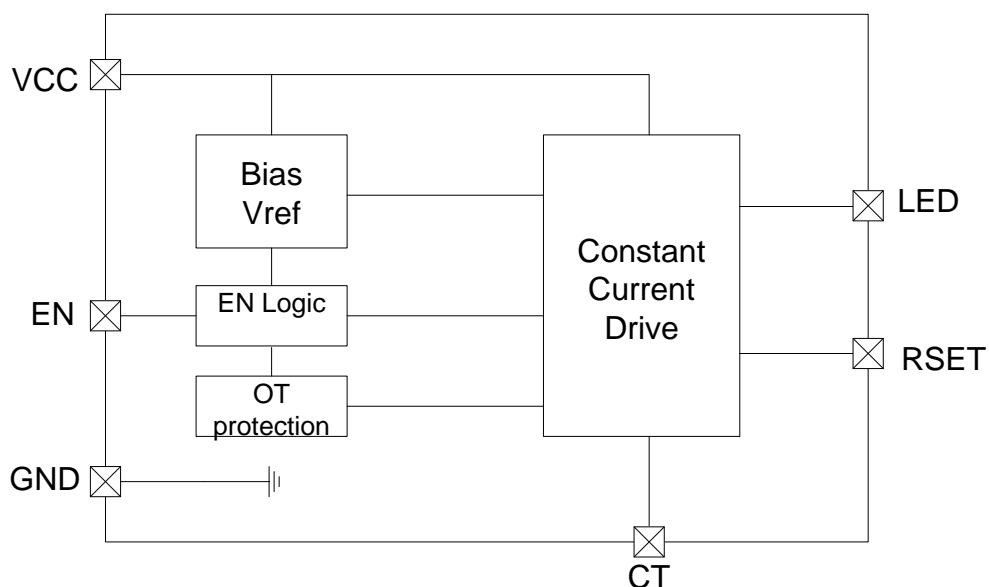
Absolute maximum ratings

Parameter	Symbol	Value	Unit
VCC pin voltage range	V_{CC}	-0.3～6.5	V
EN pin voltage range	V_{EN}	-0.3~6.5	V
Junction temperature	T_J	-40~150	^{o}C
Lead temperature(Soldering, 10s)	T_L	260	^{o}C
Storage temperature	Tstg	-55 ~ 150	^{o}C
ESD Ratings	HBM	2000	V
	MM	200	V
	CDM	1500	V

These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Value	Unit
VCC supply input voltage range	V_{CC}	2.7～4.5	V
Operating ambient temperature	T_A	-40～85	^{o}C
Thermal Resistance	$R_{\theta JA}$	250	$^{o}C/W$

Electrical Characteristics

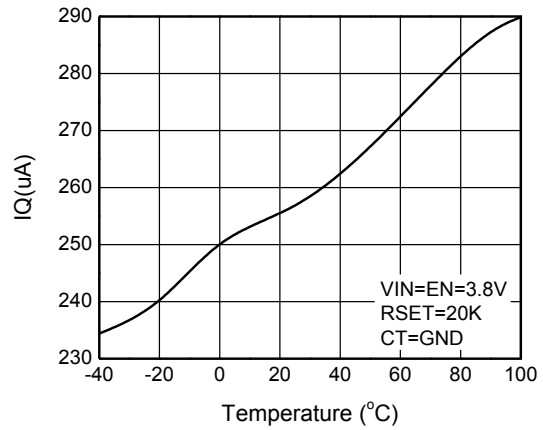**(Ta=25°C, V_CC=3.8V, C_IN=1uF, unless otherwise noted)**

| Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Quiescent supply current	I_Q	V_{EN}=3.8V, ILED=200mA		220		uA
Shutdown current	I_{SD}	V_{EN}=0V			1	uA
External set LED current	I_{LED_RSET}	V_{EN}=3.8V, R_{SET}=24K	170	210	250	mA
Internal set default LED current	I_{LED_INT}	V_{EN}=3.8V, R_{SET}=0	160	200	240	mA
EN logic high	VIH		1.6			V
EN logic low	VIL				0.4	V
Turn on time	t_{ON}	I_{LED}=200mA, from EN rising edge to 90% I_{LED}		12		uS
Turn off time	t_{OFF}	I_{LED}=200mA, from EN falling edge to 10% I_{LED}		6		uS
Dropout voltage	V_{DROP}	V_{EN}=3.8V, I_{LED}=160mA		100	150	mV
		V_{EN}=3.8V, I_{LED}=80mA		50	80	mV
Timeout protection time	$t_{TIMEOUT}$	V_{EN}=3.8V, CT=0.1uF		600		mS
Over-temperature shutdown threshold	T_{SD}			155		°C
Over-temperature threshold hysteresis	T_{HYS}			20		°C

Typical Characteristics
（**V$_{CC}$=3.8V, V$_{BAT}$=3.8V, Ta=25℃, unless otherwise noted**）
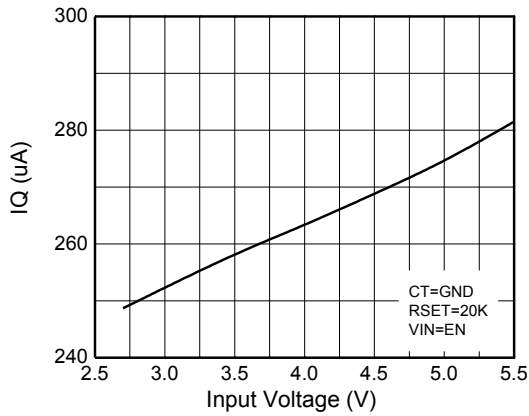
Quiescent Current vs. Input Voltage

Quiescent Current vs. Temperature
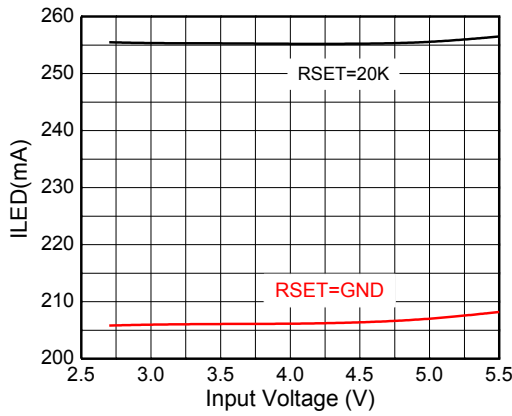
I$_{LED}$ vs. Input Voltage
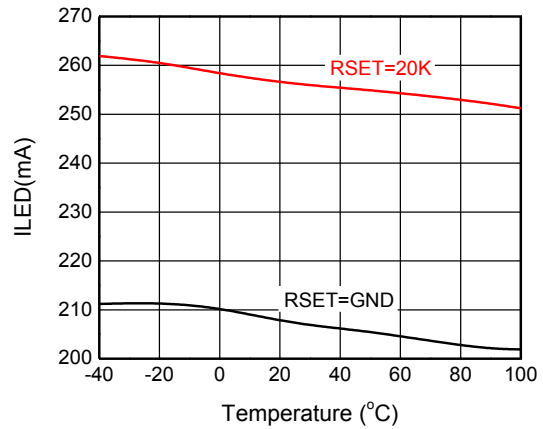
I$_{LED}$ vs. Temperature
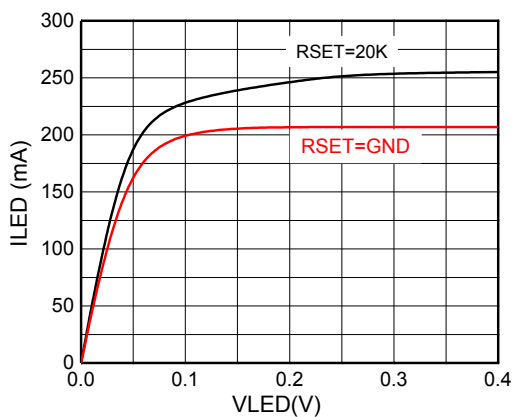
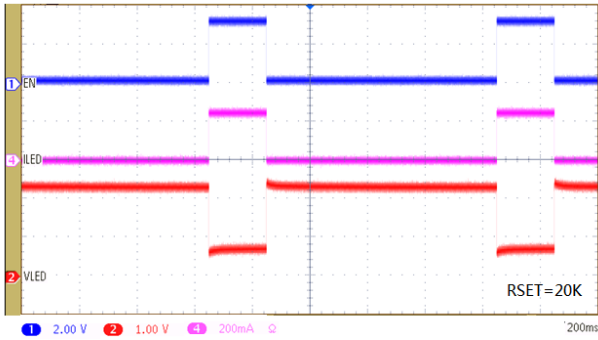I$_{LED}$ vs. V$_{LED}$
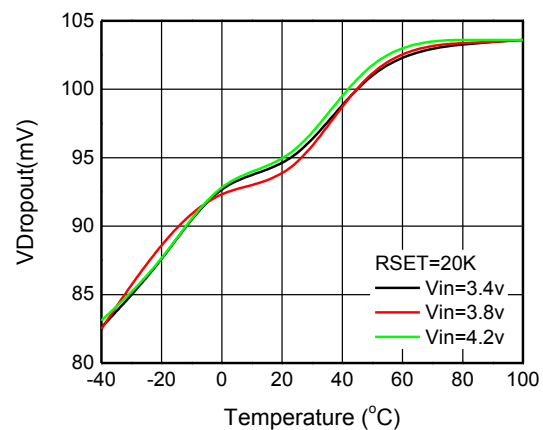
Dropout voltage vs. Temperature

Typical Waveform

（V$_{CC}$=3.8V, V$_{BAT}$=3.8V, Ta=25℃, unless otherwise noted）

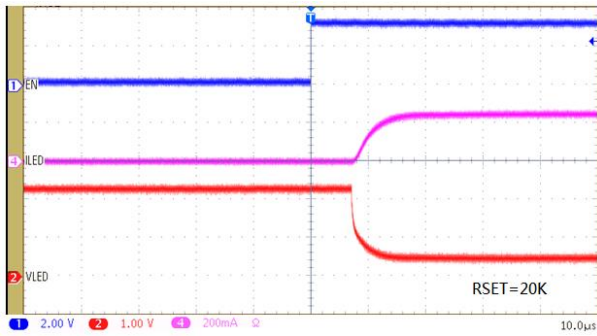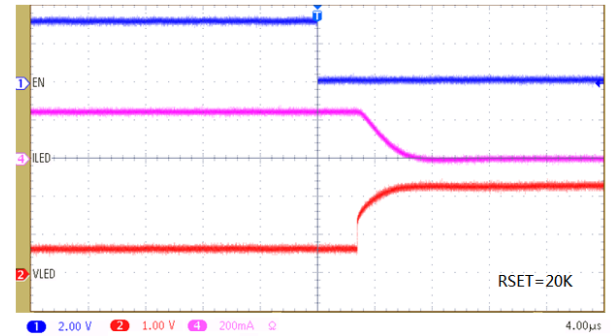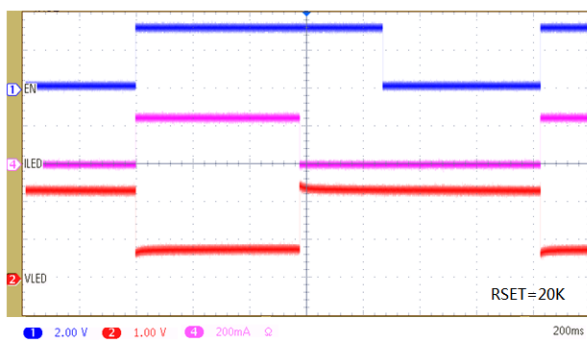Figure1. Flash mode I$_{LED}$

Figure2. Torch mode I$_{LED}$

Figure3. I$_{LED}$ turn on transient

Figure4. I$_{LED}$ turn off transient

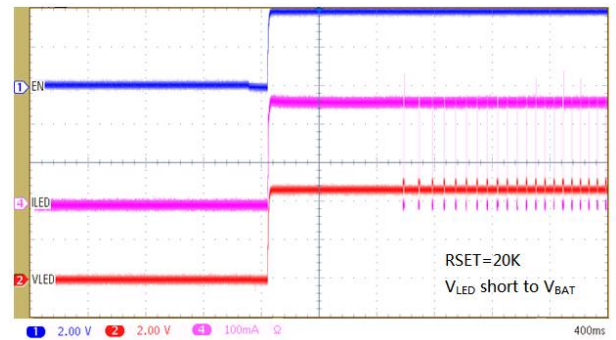Figure5. Flash mode time out protection

Figure6. LED short thermal protection

Application Information

Flash Mode LED Current

The LED current can be set either by an external resistor R_{SET} connected between RSET pin and GND, or by just directly connecting RSET pin to GND. When WD3100 is turned on, the device will automatically detect RSET pin status: if there is a resistor R_{SET} connected between RSET pin and GND, I_{LED} will be set by R_{SET} value following below equation, and if RSET pin is directly short to GND, I_{LED} will be internally set to default 200mA.

The relationship between R_{SET} and I_{LED} is:

$$I_{LED} = 4.8K / R_{SET}$$

Torch Mode LED Current

In torch mode, the average LED current can be adjusted by PWM control signal applied to the EN pin. Recommended PWM frequency range is 100-4KHz. The maximum PWM frequency depends on the total turn on and turn off time. The duty cycle of the PWM signal is proportional to average LED current. The LED current during PWM on status is the same as in the flash mode.

Flash Time-out Protection

WD3100 has flash time-out protection function. When continuous on time exceeds certain value, the LED current will be shut off to prevent LED lamp from overheating. After protection, the LED current will remain zero, and can be restarted only by turning off and on the device again.

The time-out time value can be set by a capacitor connected between CT pin and GND. The relationship between time-out time and CT value is:

$$t_{TIMEOUT} = 5.5M * CT$$

This time-out protection function can be disabled by connecting CT pin directly to GND.

Over Temperature Protection

WD3100 has over temperature protection function. In abnormal status, such as LED short, when junction temperature of WD3100 exceeds 150℃, internal blocks will be shut off to protect the device, and it will recover automatically when junction temperature decreased to below 130℃.

Power Consumption Calculation

The maximum allowable power dissipation of the device is determined by the following relationship:

$$P_{dis\_max} = \frac{T_{OT} - T_A}{\theta_{JA}}$$

In which: θ_{JA} is the thermal resistance between junction to ambient temperature, T_{OT} is the over temperature protection threshold, and T_A is the ambient temperature.

The power dissipation of the device can be calculated by the following equation:

$$P_{dis} = V_{LED} * I_{LED}$$

In which: V_{LED} is LED pin voltage, I_{LED} is LED current

PCB Layout Consideration

- The VCC decoupling capacitor C_{IN} should be placed as near as possible to V_{CC} pin on PCB.
- The external resistor R_{SET} should be placed as near as possible to RSET pin on PCB.
- The PCB route connected to GND pin should be as wide as possible.
- The PCB route from LED pin to the cathode of LED lamp should be as short as possible, and as wide as possible.

Package outline dimensions

COMMON DIMENSIONS (UNIT: MM)　　　　　　　　　　　　　　　**SOT-363**

SYMBOL	MIN	NOM	MAX
A	0.85	-	1.05
A1	0	-	0.10
A2	0.80	0.90	1.00
A3	0.47	0.52	0.57
b	0.22	-	0.29
b1	0.22	0.25	0.28
c	0.115	-	0.15
c1	0.115	0.13	0.14
D	2.02	2.07	2.12
E	2.20	2.30	2.40
E1	1.25	1.30	1.35
e	0.65BSC		
e1	1.30BSC		
L	0.28	0.33	0.38
L1	0.50REF		
L2	0.15BSC		
R	0.10	-	-
R1	0.10	-	0.25
θ	$0°$	-	$8°$
θ1	$6°$	$9°$	$12°$
θ2	$6°$	$9°$	$12°$
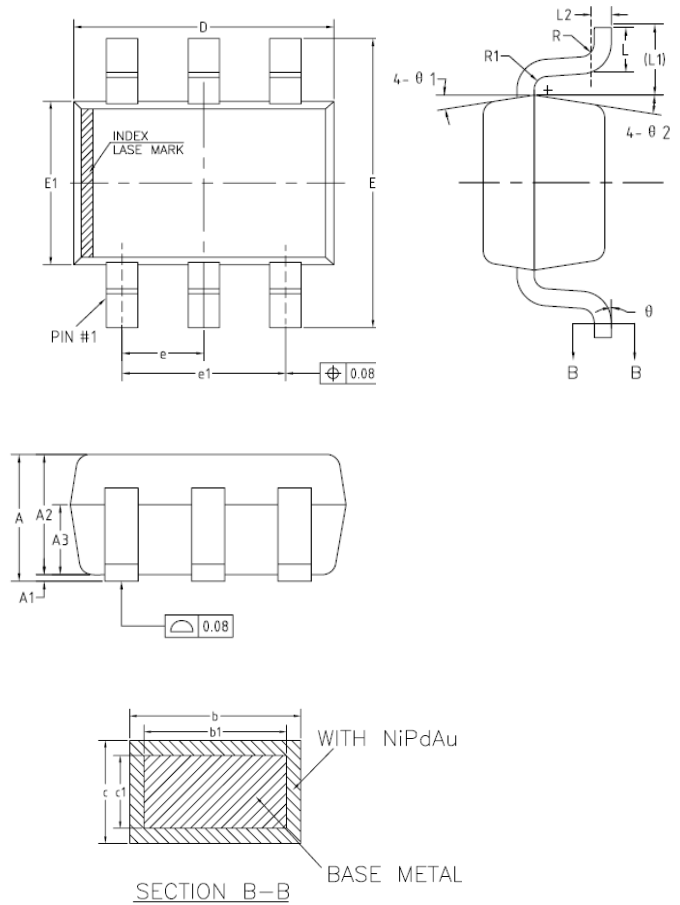
NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD MO-203 AB
DO NOT INCLUDE MOLD FLASH , PROTRUSIONS OR GATE BURRS.
MOLD FLASH , PROTRUSIONS OR GATE BURRS WILL NOT EXCEED 0.15mm PER SIDE.

Recommended Land Pattern (Unit: mm)
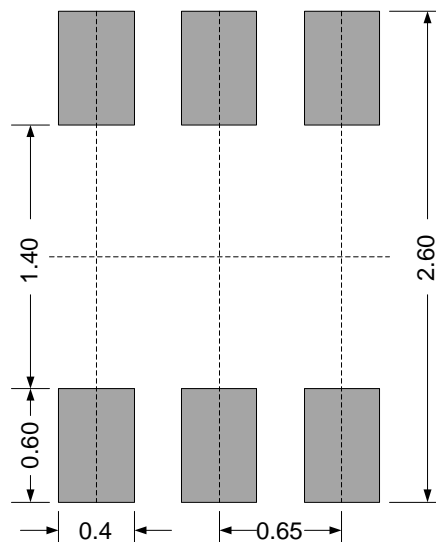
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