WD35-S28A

2+2 Channel AC Direct LED Driver IC with Analog Dimming

Rev1.2 – 12 May 2020

1. General Description

The WD35-S28A is an AC Direct LED Driving IC with internal 2 channels and external 2 channels. It can drive several series LEDs from rectified AC voltage. It will give much convenience to the design because it requires a small number of external components. The WD35-S28A has higher LED current drive capability and the current can be adjustable with external resistors. The WD35-S28A will help engineers to produce excellent products in LED lightings for energy efficiency, design efficiency, cost efficiency, and so on.

2. Features

- LEDs direct driver form AC line
- Wide input range : AC 90~305V
- Constant current driving with internal 2 channels and external 2 channels
- Adjustable channel driving current
- Compatible with Analog dimming
- Excellent power factor > 0.9
- Lower total harmonic distortion < 15%
- Over temperature protection
- EMI safe operation
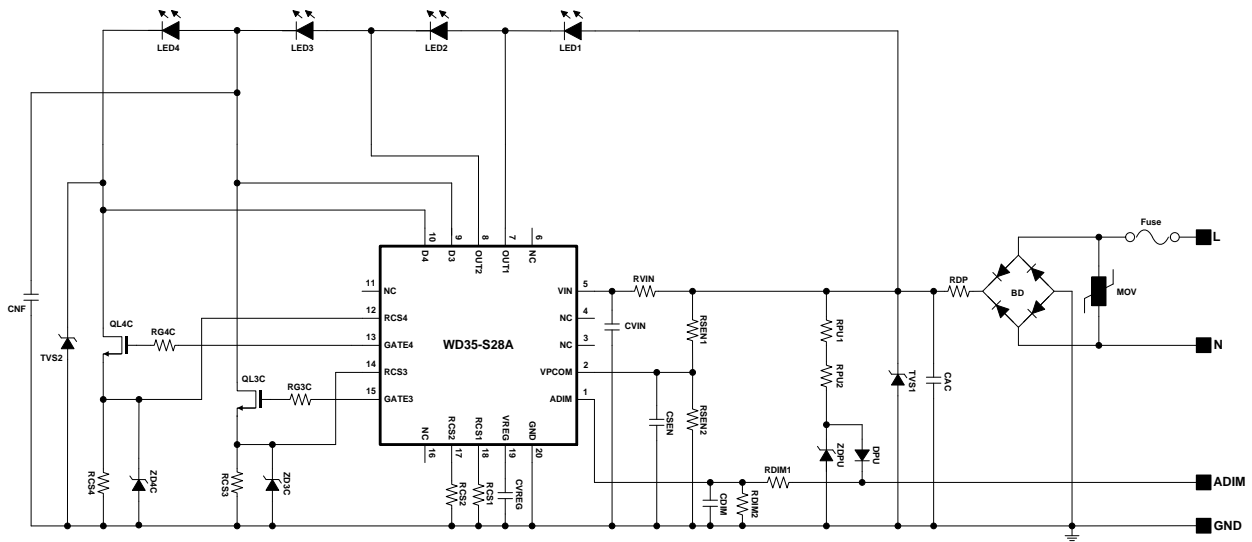- Thermally enhanced QFN 20pin

3. Applications

- AC direct LED light Applications
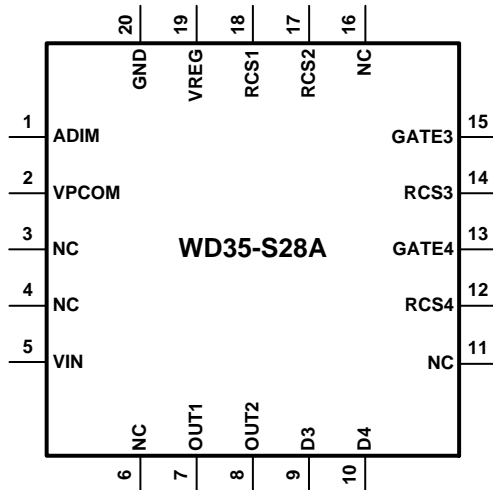- Down Light
- High Bay
- Street Light

4. Package Information

| *Type number* | *Package* | | |
	Name	*Description*	*Marking*
WD35-S28A	20 QFN	20 QFN 6mm x 6mm	WD35-S28A

5. Typical Application

6. Pin Information

Top View

Pin	Symbol	I/O	Description
1	ADIM	I	Analog Dimming Input
2	VPCOM	I	Voltage Input for Power Compensation
3	NC	-	No Connection
4	NC	-	No Connection
5	VIN	P	Supply Input
6	NC	-	No Connection
7	OUT1	O	Internal LED Driver Output 1
8	OUT2	O	Internal LED Driver Output 2
9	D3	I	Voltage Sensing Input of External FET Drain 3
10	D4	I	Voltage Sensing Input of External FET Drain 4
11	NC	-	No Connection
12	RCS4	I/O	LED Current Setting for Output 4
13	GATE4	O	Gate Signal Output for External FET 4
14	RCS3	I/O	LED Current Setting for Output 3
15	GATE3	O	Gate Signal Output for External FET 3
16	NC	-	No Connection
17	RCS2	I/O	LED Current Setting for Output 2
18	RCS1	I/O	LED Current Setting for Output 1
19	VREG	O	Internal Reference Voltage
20	GND	P	Ground

7. Block Diagram
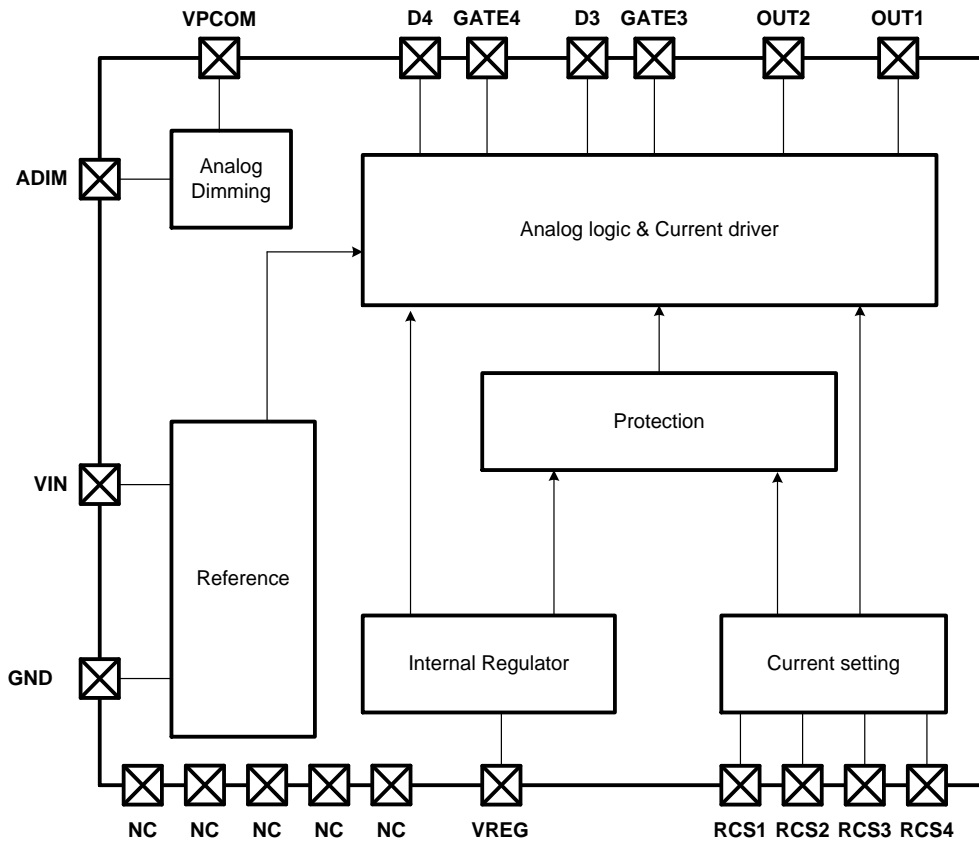
8. Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
VIN, OUT1, OUT2, D3, D4	V_{HV1}	-0.3 ~ +700	V
GATE3, GATE4	V_{LV1}	-0.3 ~ +16	V
VREG	V_{LV2}	-0.3 ~ +9	V
Other Pins	V_{LV3}	-0.3 ~ +7.5	V
Storage Temperature	T_{STG}	-65 ~ +150	°C

9. Package Thermal Characteristics

Parameter	Symbol	Value	Unit
Junction to ambient thermal resistance	θ_{JA}	33.8	°C/W
Junction to case thermal resistance	θ_{JC}	7.5	°C/W

*Test conditions

- θ_{JA} : The package thermal impedance is calculated in accordance with JESD 51-7

- θ_{JC} : The package thermal impedance is calculated in accordance with JESD 51-14

10. Recommended Operating Conditions

Parameter	Symbol	Min	Typ.	Max	Unit
Supply Voltage	V_{IN}	90		305	VAC
Ambient Temperature	T_A	-25		85	°C
Junction Temperature	T_J			125	°C

11. Electrical Characteristics

T_A = 80°C, V_{AC} = 100/120/220V, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
General						
Bias Current	I_{BIAS}		0.6	1.1	1.6	mA
Standby Current	I_{STBY}			0.33		mA
Power Factor	PF		0.9			-
Total Harmonic Distortion	I_{THD}				15	%
VREG Voltage	V_{REG}	No load	6.8	7.8	8.8	V
GATE3, GATE4 Output	V_{GATE}				15	V
Thermal Shutdown	T_{SHDN}			160		°C
Driver Stage Current						
Max. Driver Current[Note 1]	I_{OUT1}				180	mA
	I_{OUT2}				210	mA

Note 1)

- The maximum drive current means the guaranteed operating current.
- The maximum drive current is not the DC current. It is the maximum peak current of the four stage for guaranteeing normal operation in AC direct drive method.
- The operating drive current must be determined within the maximum drive current with margin.

12. Functional Description

Driver Current and Power Setting

The WD35-S28A is (2+2) Ch LED lighting driver IC that controls constant LED current regulation in order to control brightness at the LED lighting system by internal 2 channels consist of high voltage FETs and external 2 channels consist of drivers for external High Voltage MOSFET. The constant LED current regulation value can be controlled by 4 external resistors. The LED current can be set by using RCS1, RCS2, RCS3, RCS4 pin and the equations are as below.

$$\text{Channel 1 Current} = \frac{1.85V}{R_{CS1}}$$

$$\text{Channel 2 Current} = \frac{1.90V}{R_{CS2}}$$

$$\text{Channel 3 Current} = \frac{2.00V}{R_{CS3}}$$

$$\text{Channel 4 Current} = \frac{2.00V}{R_{CS4}}$$

RCS Open

When RCSn Pin is opened, the outputs from step 1 to step n of WD35-S28A become deactivated.

For examples,
If RCS2 is opened, output1 and output2 become deactivated, and output3 and output4 become activated.
If RCS3 is opened, output1, output2 and output3 become deactivated, and output4 becomes activated.

### Over Temperature Protection

The junction temperature of WD35-S28A should not exceed the maximum limit. The WD35-S28A becomes LED off when the silicon temperature is higher than 160°C. The WD35-S28A will restart the operation when the silicon temperature is lower than temperature hysteresis.

12. Functional Description (Continued)

Analog Dimming Function

The WD35-S28A can be used with analog dimming. To use analog dimming properly, a resister network must be a connection between external analog dimming signal, ADIM and GND. Please refer the typical application circuit.

When ADIM is < 0.436V, all LEDs are turned off. And it has a hysteresis of 40mV.
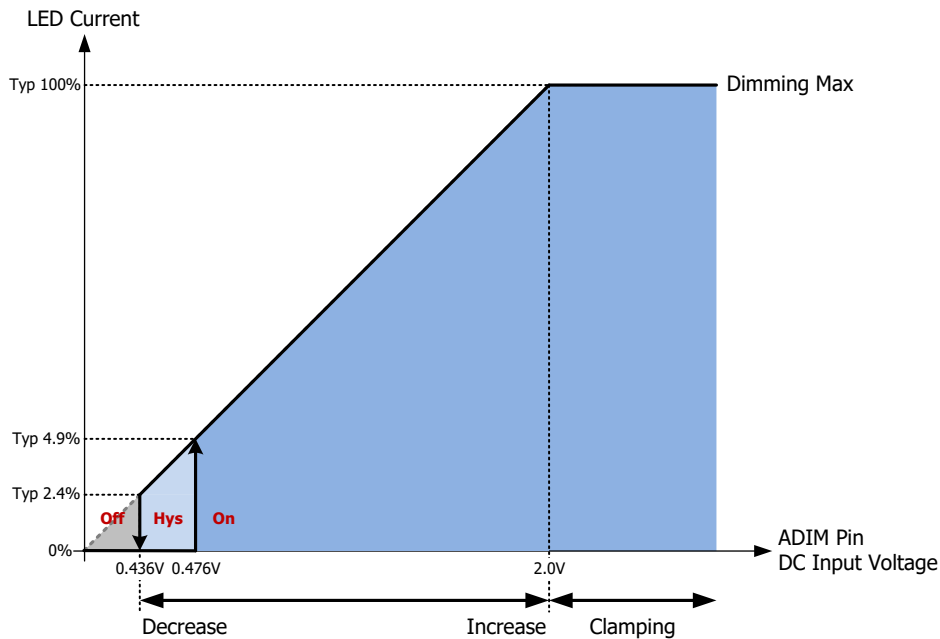
Power Compensation Function

The WD35-S28A can adjust LED currents according to AC input voltage to maintain a total power consumption constant. VPCOM pin is an input to sense AC input voltage.

If VPCOM < 2V, LED Current of each step is 100%. In this section, a power compensation is deactivated.

If VPCOM > 2V, LED Current of each step is getting down according to VPCOM. In this section, a power compensation is activated.
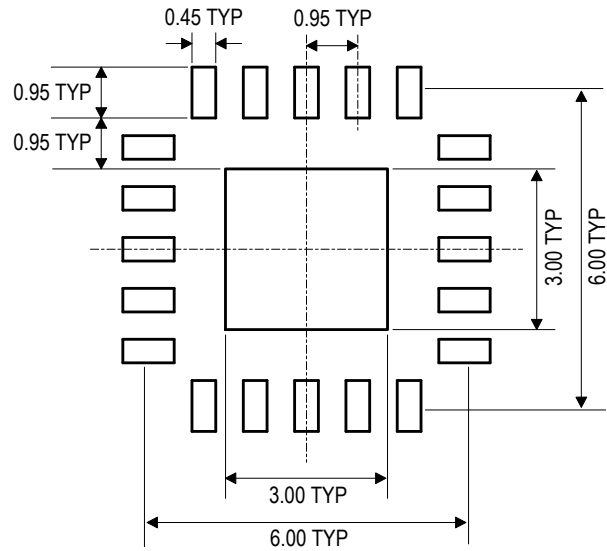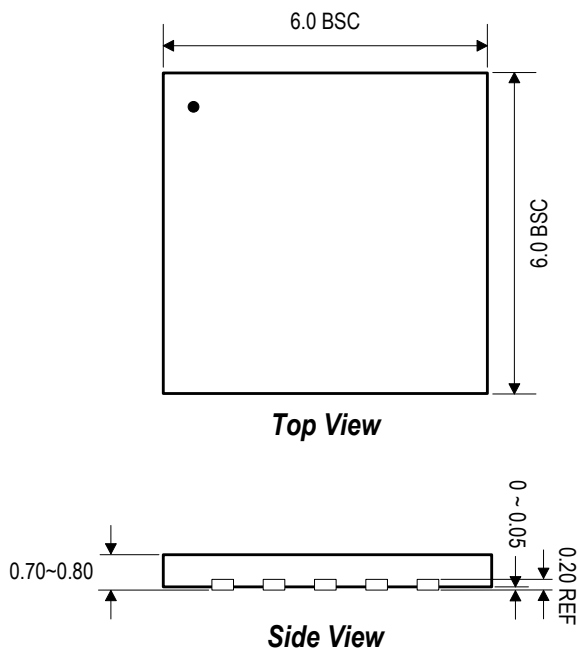
For example,

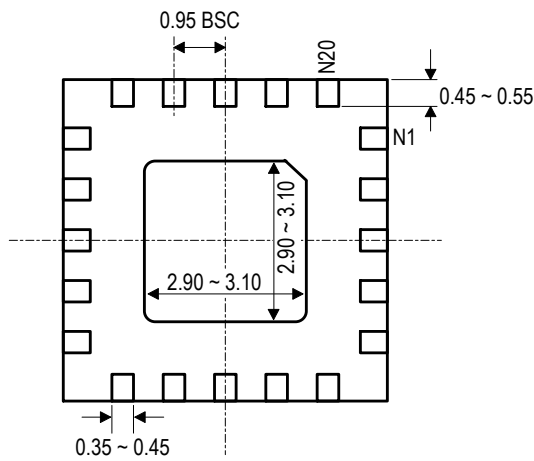To set a power compensation mode between from 200V to 260V, set RSEN2 value to become VPCOM=2V at 200V AC input.

To disable a power compensation mode, let VPCOM open or tied to GND.

13. Package Outline Dimensions

QFN 12Pin

6.0 BSC

6.0 BSC

Top View

0.70~0.80

0 ~ 0.05

0.20 REF

Side View

0.45 TYP　**0.95 TYP**

0.95 TYP

0.95 TYP

3.00 TYP

6.00 TYP

3.00 TYP

6.00 TYP

Recommend solder PAD

0.95 BSC

N20

0.45 ~ 0.55

N1

2.90 ~ 3.10

2.90 ~ 3.10

0.35 ~ 0.45

Bottom View

Note
1. Dimensions are in millimeters
2. Dimensions are exclusive of mold flash and interlead flash

14. Important notices

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15. Contact information

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