

16-Channel Internal Current Sink LED Backlighting Driver for HDR LCD TV/Monitor/Notebook Displays

General Description

The iW7038 is a 16-channel, internal current sink, high precision, LED backlighting driver for high dynamic range (HDR) LCD TVs, monitors and notebook displays.

It combines adaptive DC/DC or AC/DC feedback control together with Dialog's patented **BroadLED™** digital adaptive switch mode technology to enable the best system efficiency and thermal performance.

The iW7038 also offers Dialog's **AnyMode™** comprehensive dimming control, which includes head/tail/center mode PWM alignments to reduce motion blur. Additionally, it supports 13-bit PWM dimming and 11-bit analog dimming to improve contrast ratio in HDR applications.

Full protections are included, including built-in LED open/short detection and protection during both start-up and normal operation.

Key Features

- 16 channel LED driver
- Internal current sink MOSFETs
- External current sense resistors
- Single power supply, 12V (9V to 16V range) 50V max. output voltage
- 200mA x 100% duty x 16ch output current capability, support 2 channel grouping
- 13-bit max PWM dimming
 - range from 0% to 99.9%
 - 1μs min. PWM output pulse
 - Programmable output slew rate for EMI control (0.35μs/0.70μs/1μs)
- Enhanced pure digital **BroadLED™** mode
- 11-bit global or 9 bit independent analog dimming
- LED current and PWM duty update both synchronized to VSYNC
- 46Hz to 32kHz VSYNC input, 46Hz to 32kHz PWM output
- Adaptive external DC/DC or AC/DC feedback control to optimize system power efficiency
- PWM-generator clock
 - HSYNC (up to 22MHz)
 - PLL (20MHz)
 - Internal OSC (10MHz)
- 16MHz Max SPI with Daisy chain
- Optional Key registers write protection with password, and optional data packet CRC/checksum for noisy SPI interface
- Programmable LED open/short detection threshold and protection
- High temperature shutdown and auto recovery
- Fault interrupt output (open drain, need external pull up)
- HBM +/- 2kV JESD22-A114 -20 at all pins
- -20 to +85°C operating ambient temperature range
- 145°C max. operating junction temperature
- Package: 7mm x 7mm QFN48 with EP, 0.5mm pin pitch

Applications

- HDR LCD TV
- HDR LCD Monitor
- HDR NB display
- Automobile Display

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System Diagram

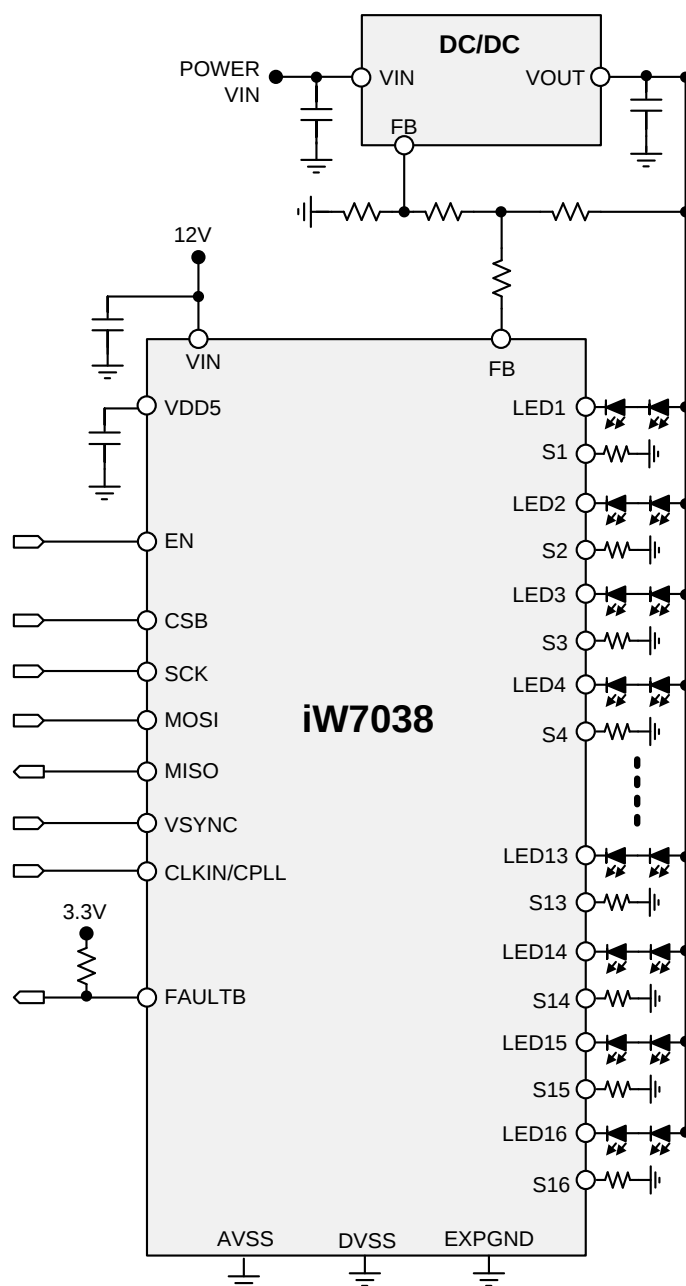


Figure 1.1: System Diagram

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Pinout

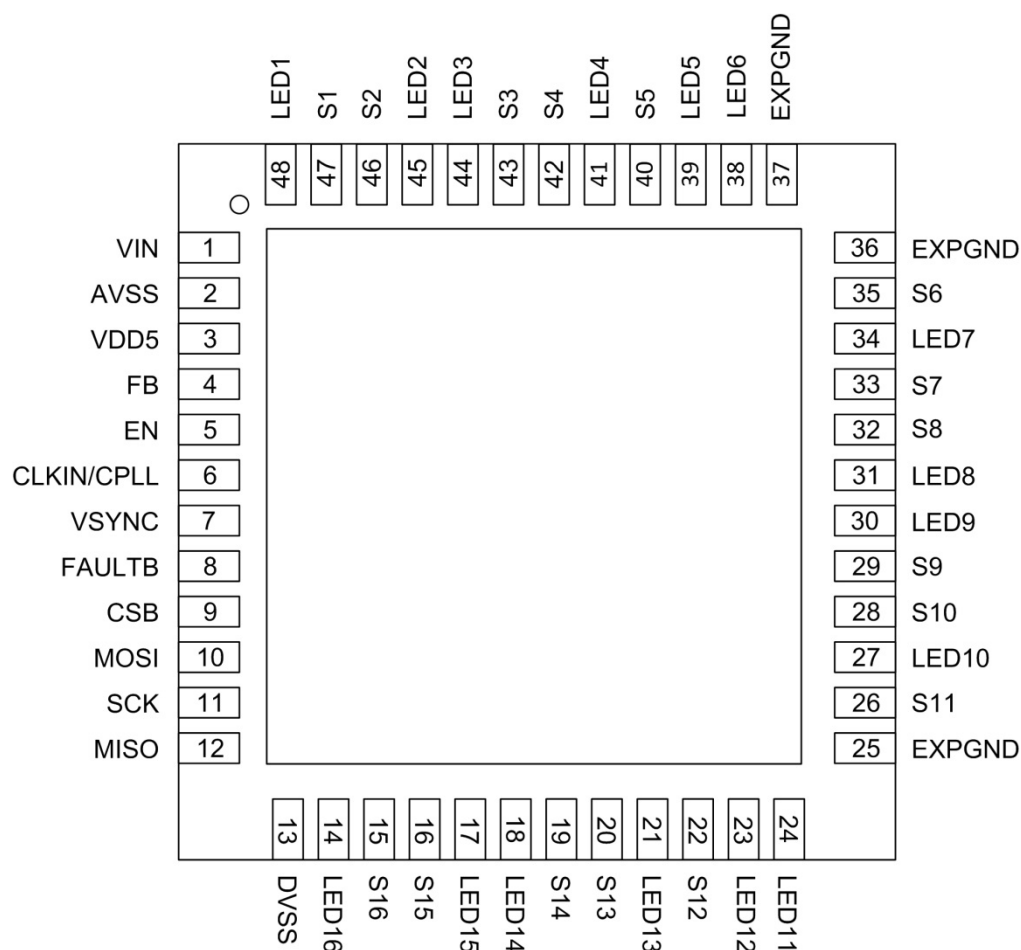


Figure 1.2: Connection Diagram

Table 1: Pin Description

Pin #	Pin Name	Type (Table 2)	Description
1	VIN	AI	Power supply. Connect 4.7 μ F capacitor to AVSS.
2	AVSS	GND	GND.
3	VDD5	AIO	5V LDO compensation Pin. Need a $\geq 4.7\mu\text{F}$ ceramic cap for decoupling. Recommended ESR range of 50m Ω to 350m Ω .
4	FB	AIO	Analog DAC output interface with external AC/DC or DC/DC converter for LED strings.
5	EN	DI	Chip enable.
6	CLKIN/CPLL	DI/AI	PLL compensation input/External clock in.
7	VSYNC	DI	VSYNC clock input in SPI dimming mode
8	FAULTB	DO	Fault status (Active Low) - Open drain.
9	CSB	DI	chip select input for SPI slave . Active LOW.

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Pin #	Pin Name	Type (Table 2)	Description
10	MOSI	DI	Master output, slave input for SPI.
11	SCK	DI	Serial clock input for SPI.
12	MISO	DO	Master input, slave output for SPI.
13	DVSS	GND	GND.
14	LED16	AI	LED cathode connection for string 16.
15	S16	AO	Source of internal MOSFET, connect to sense resistor.
16	S15	AO	Source of internal MOSFET, connect to sense resistor.
17	LED15	AI	LED cathode connection for string 15.
18	LED14	AI	LED cathode connection for string 14.
19	S14	AO	Source of internal MOSFET, connect to sense resistor.
20	S13	AO	Source of internal MOSFET, connect to sense resistor.
21	LED13	AI	LED cathode connection for string 13.
22	S12	AO	Source of internal MOSFET, connect to sense resistor.
23	LED12	AI	LED cathode connection for string 12.
24	LED11	AI	LED cathode connection for string 11.
25	EXPGND	GND	Exposed PAD for LED driver, connect to GND.
26	S11	AO	Source of internal MOSFET, connect to sense resistor.
27	LED10	AI	LED cathode connection for string 10.
28	S10	AO	Source of internal MOSFET, connect to sense resistor.
29	S9	AO	Source of internal MOSFET, connect to sense resistor.
30	LED9	AI	LED cathode connection for string 9.
31	LED8	AI	LED cathode connection for string 8.
32	S8	AO	Source of internal MOSFET, connect to sense resistor.
33	S7	AO	Source of internal MOSFET, connect to sense resistor.
34	LED7	AI	LED cathode connection for string 7.
35	S6	AO	Source of internal MOSFET, connect to sense resistor.
36	EXPGND	GND	Exposed PAD for LED driver, connect to GND.
37	EXPGND	GND	Exposed PAD for LED driver, connect to GND.
38	LED6	AI	LED cathode connection for string 6.
39	LED5	AI	LED cathode connection for string 5.
40	S5	AO	Source of internal MOSFET, connect to sense resistor.
41	LED4	AI	LED cathode connection for string 4.
42	S4	AO	Source of internal MOSFET, connect to sense resistor.
43	S3	AO	Source of internal MOSFET, connect to sense resistor.
44	LED3	AI	LED cathode connection for string 3.
45	LED2	AI	LED cathode connection for string 2.
46	S2	AO	Source of internal MOSFET, connect to sense resistor.
47	S1	AO	Source of internal MOSFET, connect to sense resistor.
48	LED1	AI	LED cathode connection for string 1.

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Table 2: Pin Type Definition

Pin type	Description	Pin type	Description
DI	Digital Input	AI	Analog Input
DO	Digital Output	AO	Analog Output
DIO	Digital Input/Output	AIO	Analog Input/Output

1. Absolute Maximum Ratings

Table 3: Absolute Maximum Ratings

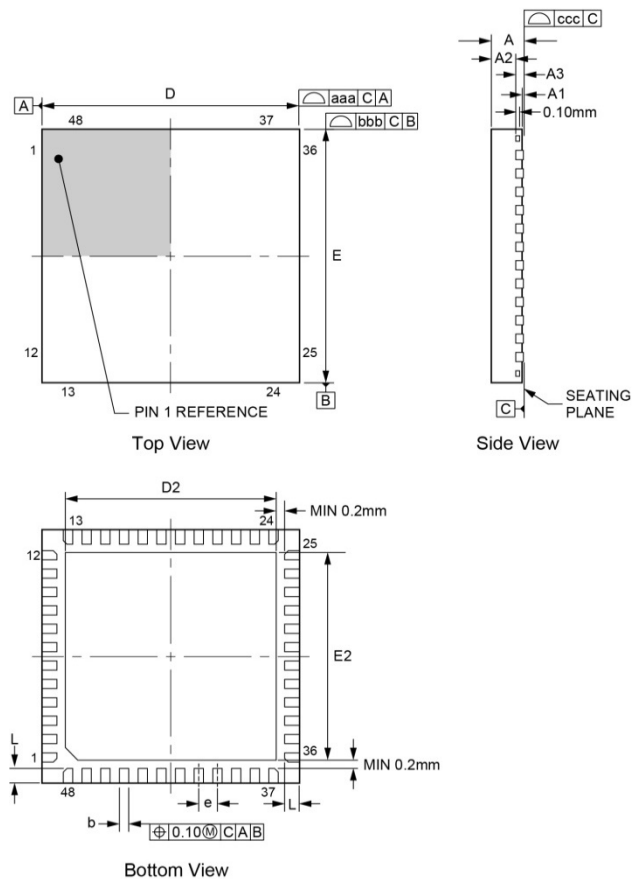
Symbol	Parameter	Min	Max	Unit
VIN	VIN supply voltage	-0.3	20	V
VDD5	5V LDO output	-0.3	7	V
GND pins (AVSS, DVSS, EXPGND)	Ground pins	-0.3	0.3	V
LEDn(LED1~LED16)	LEDn pin voltage	-0.3	50	V
Sn(S1~S16)	Internal MOSFET source pins	-0.3	7	V
Other low voltage pins (CSB, SCK, MISO, MOSI, VSYNC, CLKIN/CPLL, EN, FAULTB, FB)	Digital logic I/O pins and voltage feedback pins	-0.3	7	V
Maximum Operating Junction temperature		-40	150	°C
Storage temperature		-40	150	°C
Latch-up current	JESD78D	-100	+100	mA
ESD level	JEDEC JESD22-A114 - HBM	-2000	+2000	V

Note 1 Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, so functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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2. Package Information

48-Lead QFN Package (7mm x 7mm)



	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.80	0.85	0.90	0.031	0.033	0.035
A1	0.00	0.035	0.05	0.000	0.001	0.002
A2	0.60	0.65	0.67	0.024	0.026	0.026
A3	0.203 REF			0.008 RE		
b	0.20	0.25	0.30	0.008	0.010	0.012
D	6.90	7.00	7.10	0.272	0.276	0.280
D2	5.60	5.75	5.90	0.220	0.026	0.232
E	6.90	7.00	7.10	0.272	0.276	0.280
E2	5.60	5.75	5.90	0.220	0.226	0.232
e	0.50 BSC			0.020 BSC		
L	0.30	0.40	0.50	0.012	0.016	0.020
Tolerances of Form and Position						
aaa	0.10			0.004		
bbb	0.10			0.004		
ccc	0.08			0.003		

Controlling dimensions are in millimeters; inch dimensions are for reference only.

Package warpage max. 0.08mm.

Package is IPC/JEDEC Std 020D Moisture Sensitivity Level 3.

This product is RoHS compliant and Halide free.

Compliant to JEDEC Standard MO-220.

Figure 2.1: 48-Lead 7mm x 7mm QFN Package Outline Drawing

3. Ordering Information

Part Number	Package	Description
iW7038-00-QFN4	QFN-7mm x 7mm 48L	Tape & Reel ¹

Note 1 Tape & Reel packing quantity is 4,000/reel. Minimum ordering quantity is 4,000.

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Contacting Dialog Semiconductor

United Kingdom (Headquarters)
Dialog Semiconductor (UK) LTD
Phone: +44 1793 757700

Germany
Dialog Semiconductor GmbH
Phone: +49 7021 805-0

The Netherlands
Dialog Semiconductor B.V.
Phone: +31 73 640 8822

North America
Dialog Semiconductor Inc.
Phone: +1 408 845 8500

Japan
Dialog Semiconductor K. K.
Phone: +81 3 5769 5100

Taiwan
Dialog Semiconductor Taiwan
Phone: +886 281 786 222

Hong Kong
Dialog Semiconductor Hong Kong
Phone: +852 2607 4271

Korea
Dialog Semiconductor Korea
Phone: +82 2 3469 8200

China (Shenzhen)
Dialog Semiconductor China
Phone: +86 755 2981 3669

China (Shanghai)
Dialog Semiconductor China
Phone: +86 21 5424 9058