# DUAL RAIL LED DRIVER PCB 21-406

2-Channel Board For High Brightness and NVIS LED Rails

General Digital's Dual Rail LED Driver PCB is a dual channel, boost-mode LED driver intended to drive Daylight and NVIS combo rails, or two simultaneous Daylight rails.

LED OUTPUTS

In normal (DAY/NVIS) operation, DAY rail is 100 mA/channel (max.) and NVIS is 50 mA/channel (max.), which is a PWM limitation running NVIS at 50% DAY duty cycle. In Synchronized mode, this PWM limitation is removed.
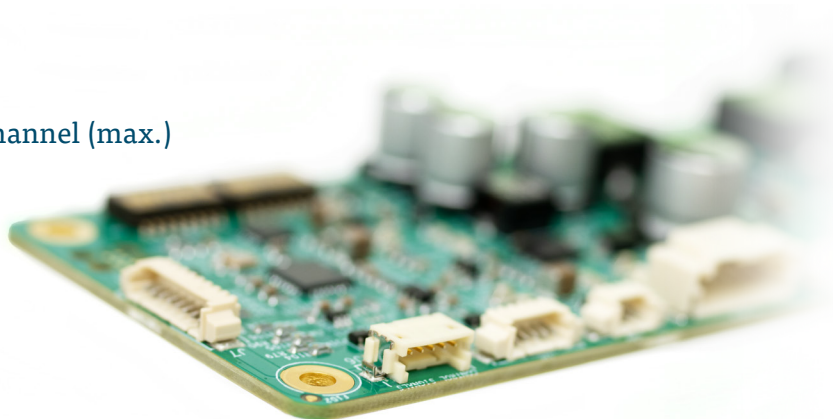
POWER INPUT

Input on power connector is specified to accept 9–13 Vdc, nominal 12 Vdc.

IN-FIELD FIRMWARE PROGRAMMING

The Dual LED Driver PCB is capable of being upgraded via a TTL UART connection. Most behavioral aspects of the controller board can be modified via a firmware update.

THERMAL OVERLOAD PROTECTION

The Dual LED Driver PCB includes one temperature sensor input designed for a Microchip MCP9700A thermal sensor. Thermal sensors should be located as close to the center of the LED rail as possible. The microcontroller will apply a cutback percentage to the dimming PWM signal to reduce temperature in overtemp conditions. To disable sensor, a dummy connector or zero ohm resistor must be used.

Note the standard cutback on the Overtemp Output Correction graph (Figure 2). Overtemp parameters are configured in firmware may be changed for LCD temperature specs.

GENERAL DIGITAL
DISPLAY SYSTEMS

Dual Rail LED Driver PCB 21-406

General Digital's Dual Rail LED Driver Board has many features that offer significant improvements and benefits over standard backlight controllers.

FEATURES	BENEFITS
Ideal for industrial/military requirements	We source components of superior quality and performance
Ideal for extended operating temperature environments	
Up to 3000:1 dimming ratio	
9–13 VDC input	
Small form factor	
Embedded microcontroller	
Dual LED drivers	Each controller is independent. Strings for each are controlled independently of each other, but to a master setpoint for the controller
Short circuit protection	LED outputs are protected against OPEN LED and LED–>VLED shorts
Configuration control	Traceability; repeatability; sustainability; minimal need for costly recertification
Long product life cycle	Sustainability, LTB and EOL announcements; replace obsolete components with like or equivalent to extend life cycle
Designed and manufactured in the USA	Customer confidence working with an established company that has experience serving the industrial and military markets (40+ years)
Support for a wide range of LCDs	Flexibility and compatibility

Embedded Microcontroller/Programmable Performance	Execute Complex Command and Control
Temperature sensors and intelligent over-temperature algorithm	Achieve maximum brightness under varying thermal conditions while protecting expensive electronics from critical failure
Current settings can be independently controlled for each channel	Day and NVIS rails can be calibrated independently
Analog or PWM dimming	Flexible dimming options

Customize Performance	Execute Complex Command and Control
Programming port	Upgrade firmware in the field to minimize expense of downtime, shipping and insurance

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GENERAL

Parameter	Minimum	Maximum	Unit
Operating Temperature	-40	85	°C
LED String Current Matching	-2.0	2.0	%
Dimming Ratio	N/A	3000:1	N/A
Dimming Frequency	180	220	Hz
Efficiency Typical Conditions: +12 Vdc IN, +25 °C	87%	90%	—

ELECTRICAL

Connector J3: Power			Molex/502352-0600 Mate (Molex/502351-0600)				
Pin	Signal	Notes	Typical Range		Absolute Rating		Units
			Minimum	Maximum	Minimum	Maximum	
1	Vin	Power Input	9	13	-0.3	13.2	V
2							
3							
4	GND	Power Return	GND	GND	GND	GND	V
5							
6							

Connector J6: Discrete Controls			Hirose DF13A-5P-1.25H(51) [Mate: Hirose DF13-5S-1.25C]				
Pin	Signal	Notes	Typical Range		Absolute Rating		Units
			Minimum	Maximum	Minimum	Maximum	
1	3V3	+3.3V Output, Brightness Pot	3.2	3.4*	-0.3	3.6	V
2	Enable	High Active, 100K Pull-Up to 3V3	0	5	-0.3	5.5	V
		Enable Input Low	—	0.7	—	—	V
		Enable Input High	2.6	—	—	—	V
3	DIM	Analog or PWM Dimming Signal, 100K Pull Down to GND	—	—	-0.3	5.5	V
		Analog Dimming Range – SW2.1 On	0	5	—	—	V
		Analog Dimming Range – SW2.1 Off	0	3.3	—	—	V
		PWM Input Low	—	0.7	—	—	V
		PWM Input High	2.6	—	—	—	V
		PWM Dimming Frequency	180	220	—	—	Hz
4	NVG_En	Low Active NVG Enable, 100K Pull-Up to 3V3	0	5	-0.3	5.5	V
		NVG Mode Input Low	—	0.7	—	—	V
		Enable Input High	2.6	—	—	—	V
5	GND	Electrical Ground	GND	GND	GND	GND	V

*470 Ohm Impedance

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ELECTRICAL

Pin	Signal	Notes (refer to Figure 1)	Typical Range		Absolute Rating		Units
Connector J1 - LED Driver Channel 1 (DAY)			**Molex/53261-1171 (Mate: Molex/51021-1100)**				
			Minimum	Maximum	Minimum	Maximum	
1	DAY_CA	Day Common Anode	Vin	45	-0.3	50	V
2	DAY_CA	Day Common Anode	Vin	45	-0.3	50	V
3	DAY_CA	Day Common Anode	Vin	45	-0.3	50	V
4	DAY_C1	Day Cathode 1	100	100	—	—	mA
5	DAY_C2	Day Cathode 2	100	100	—	—	mA
6	DAY_C3	Day Cathode 3	100	100	—	—	mA
7	DAY_C4	Day Cathode 4	100	100	—	—	mA
8	DAY_C5	Day Cathode 5	100	100	—	—	mA
9	DAY_C6	Day Cathode 6	100	100	—	—	mA
10	DAY_C7	Day Cathode 7	100	100	—	—	mA
11	DAY_C8	Day Cathode 8	100	100	—	—	mA

Pin	Signal	Notes (refer to Figure 1)	Typical Range		Absolute Rating		Units
Connector J2 - LED Driver Channel 2 (NVG)			**Molex/53261-1071 (Mate: Molex/51021-1000)**				
			Minimum	Maximum	Minimum	Maximum	
1	NVG_CA	NVG Common Anode	Vin	45	-0.3	50	V
2	NVG_CA	NVG Common Anode	Vin	45	-0.3	50	V
3	NVG_C1	NVG Cathode 1	100	50	—	—	mA
4	NVG_C2	NVG Cathode 2	100	50	—	—	mA
5	NVG_C3	NVG Cathode 3	100	50	—	—	mA
6	NVG_C4	NVG Cathode 4	100	50	—	—	mA
7	NVG_C5	NVG Cathode 5	100	50	—	—	mA
8	NVG_C6	NVG Cathode 6	100	50	—	—	mA
9	NVG_C7	NVG Cathode 7	100	50	—	—	mA
10	NVG_C8	NVG Cathode 8	100	50	—	—	mA

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ELECTRICAL

Connector J4 – Temperature Sensor			Molex/53261-0371 (Mate: Molex/51021-0300)				
Pin	Signal	Notes	Typical Range		Absolute Rating		Units
			Minimum	Maximum	Minimum	Maximum	
1	3V3	+3.3V output for MCP9700A sensor, 100 Ohm impedance, 10 mA MAX	3.2	3.4	-0.3	3.6	V
2	DAY_TEMP	Analog Temperature Sensor Input	0.05	1.5	-0.3	3.6	V
		MCP9700A Temperature Sense Range	-40	125	—	—	°C
3	GND	Power Return for MCP9700A Sensor	GND	GND	GND	GND	V
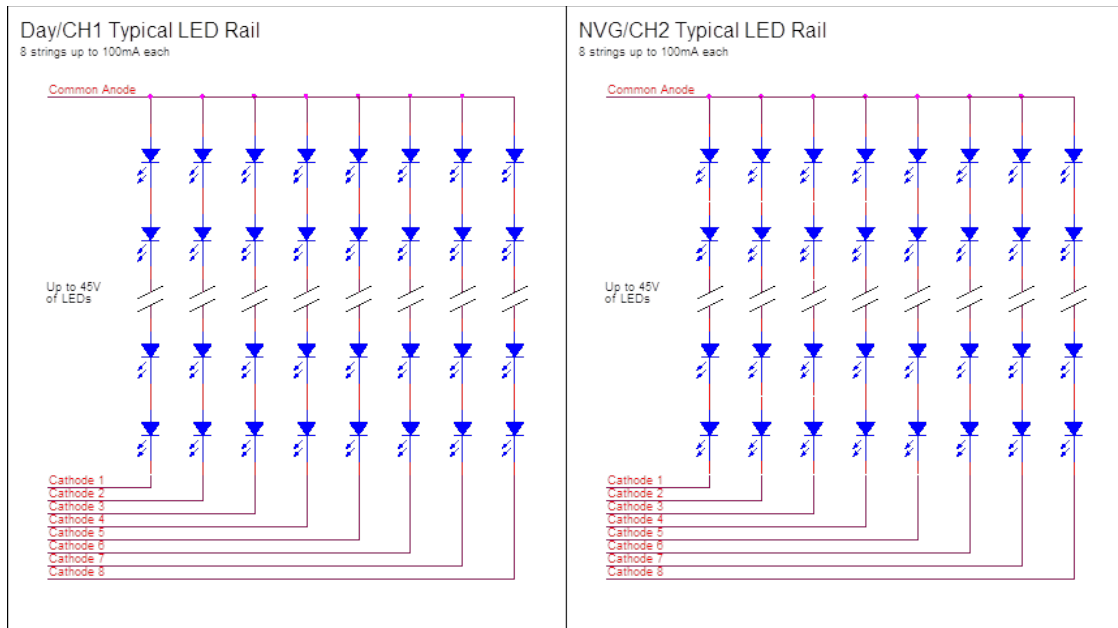
Figure 1
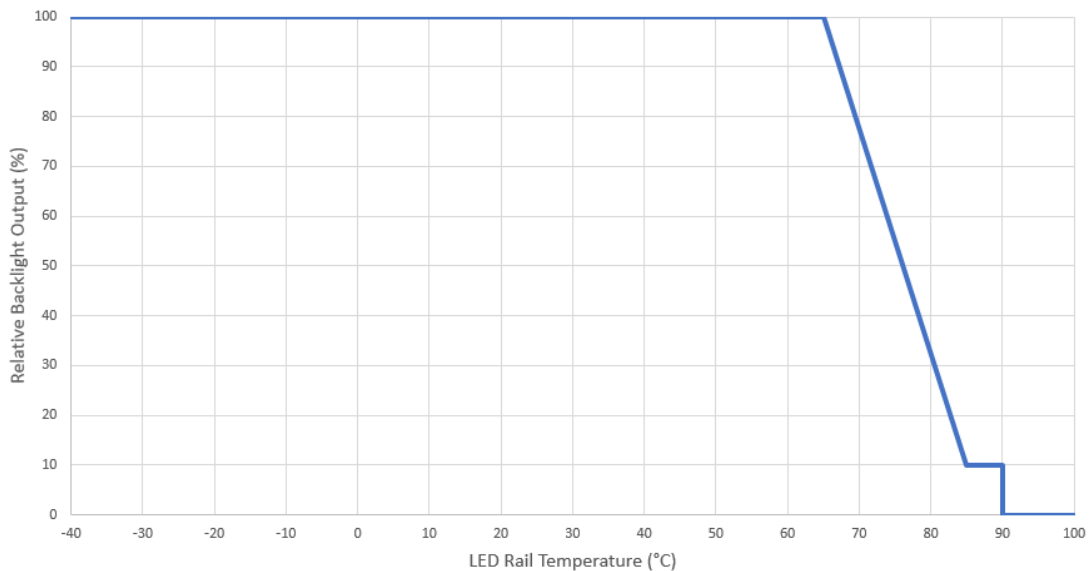
Figure 2

ELECTRICAL

SW1.1	SW1.2	SW1.3	SW1.4	SW1.5	SW1.6	SW1.7	SW1.8	Description	Value	Units
						Switch SW1				
ON	ON	ON	ON	X	X	X	X	Day Cathode Current	100	mA
OFF	ON	ON	ON	X	X	X	X	Day Cathode Current	95	mA
ON	OFF	ON	ON	X	X	X	X	Day Cathode Current	90	mA
OFF	OFF	ON	ON	X	X	X	X	Day Cathode Current	85	mA
ON	ON	OFF	ON	X	X	X	X	Day Cathode Current	80	mA
OFF	ON	OFF	ON	X	X	X	X	Day Cathode Current	75	mA
ON	OFF	OFF	ON	X	X	X	X	Day Cathode Current	70	mA
OFF	OFF	OFF	ON	X	X	X	X	Day Cathode Current	65	mA
ON	ON	ON	OFF	X	X	X	X	Day Cathode Current	60	mA
OFF	ON	ON	OFF	X	X	X	X	Day Cathode Current	55	mA
ON	OFF	ON	OFF	X	X	X	X	Day Cathode Current	50	mA
OFF	OFF	ON	OFF	X	X	X	X	Day Cathode Current	45	mA
ON	ON	OFF	OFF	X	X	X	X	Day Cathode Current	40	mA
OFF	ON	OFF	OFF	X	X	X	X	Day Cathode Current	35	mA
ON	OFF	OFF	OFF	X	X	X	X	Day Cathode Current	30	mA
OFF	OFF	OFF	OFF	X	X	X	X	Day Cathode Current	25	mA
X	X	X	X	ON	ON	ON	ON	NVG Cathode Current	50	mA
X	X	X	X	OFF	ON	ON	ON	NVG Cathode Current	47.5	mA
X	X	X	X	ON	OFF	ON	ON	NVG Cathode Current	45	mA
X	X	X	X	OFF	OFF	ON	ON	NVG Cathode Current	42.5	mA
X	X	X	X	ON	ON	OFF	ON	NVG Cathode Current	40	mA
X	X	X	X	OFF	ON	OFF	ON	NVG Cathode Current	37.5	mA
X	X	X	X	ON	OFF	OFF	ON	NVG Cathode Current	35	mA
X	X	X	X	OFF	OFF	OFF	ON	NVG Cathode Current	32.5	mA
X	X	X	X	ON	ON	ON	OFF	NVG Cathode Current	30	mA
X	X	X	X	OFF	ON	ON	OFF	NVG Cathode Current	27.5	mA
X	X	X	X	ON	OFF	ON	OFF	NVG Cathode Current	25	mA
X	X	X	X	OFF	OFF	ON	OFF	NVG Cathode Current	22.5	mA
X	X	X	X	ON	ON	OFF	OFF	NVG Cathode Current	20	mA
X	X	X	X	OFF	ON	OFF	OFF	NVG Cathode Current	17.5	mA
X	X	X	X	ON	OFF	OFF	OFF	NVG Cathode Current	15	mA
X	X	X	X	OFF	OFF	OFF	OFF	NVG Cathode Current	12.5	mA

Switch SW2		
Switch	Signal	Description
1	Dimming Voltage	Off ➜ 3.3 V On ➜ 5.0 V
2	Non-Linear Dimming	Off ➜ Linear On ➜ Non-Linear
3	Factory Set	—
4	Factory Set	—
5	BL Enable	Off ➜ Enable High (3.3 V) On ➜ Enable Low (0 V)
6	Factory Set	—
7	Bright CTRL1	Reference Brightness Control Table
8	Bright CTRL2	Reference Brightness Control Table

Note: SW2.1 through SW2.6 are Factory Set. Do not change. Changing settings may cause damage or render board inoperable.

Brightness Control Table		
SW2-7	SW2-8	Description
On	On	Reserved
Off	On	Reserved
On	Off	PWM
Off	Off	Analog

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MECHANICAL
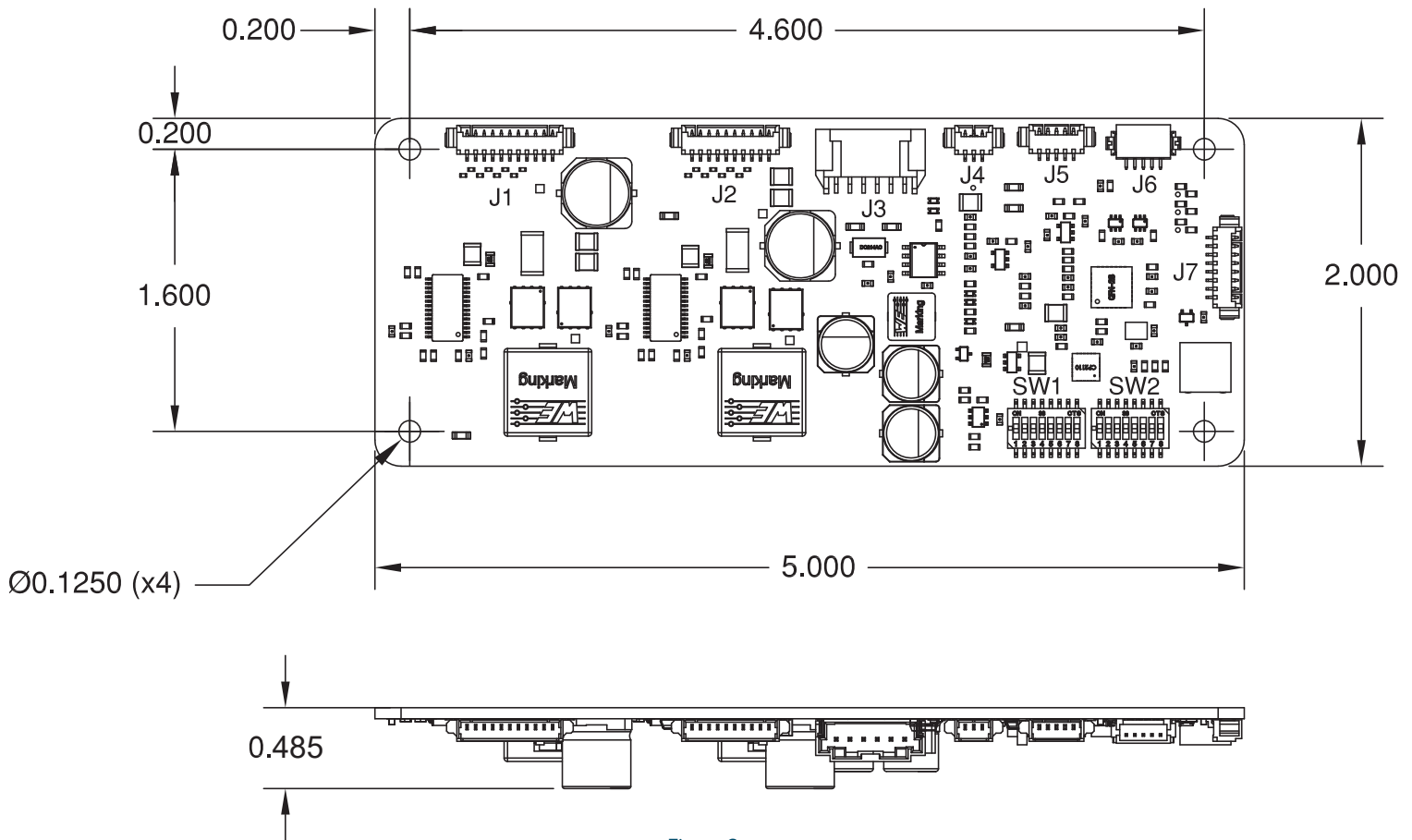
Figure 3
Note: J5 is for factory use only. Do not use.

REVISION HISTORY

Rev. No.	ECN No.	Date	Description	Initial
0	—	3 April 2017	Created data sheet	JDG
1	E005371	4 October 2018	PCB updated, requiring multiple detail changes	JDG
2	E005537	25 March 2019	More completely defined switch settings; added Brightness Control Table	JDG
3	E005717	8 July 2021	PCB updated; various specifications updated	JDG

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