Device
Engineering
Incorporated

385 East Alamo Drive
Chandler, AZ 85225
Phone: (480) 303-0822
Fax: (480) 303-0824
E-mail: admin@deiaz.com

DEI 1030
Lighting Bus Mapping Circuit

Features

- Reduced part count
- True RMS Conversion
- Small foot print (8L-SOIC-NB)
- Wiring harness programmable
- Reduces multiple bus interfaces
- Stable over temperature
- DO 160C/D Category A3 Lightning Protection
- Works with 5VAC, 5VDC, 14VDC and 28VDC busses

General Description

The DEI1030 is designed to improve lighting bus tracking from unit to unit. Bus voltage is converted to a 0-5VDC signal level output that can be used to control analog drive of incandescent bulbs. It can provide the conditioned input to an ADC/microprocessor for pulse-width modulation, or to the control input of a DEI1090 LED Driver to emulate incandescent lamps using LED's. The need for different bus interface devices for each bus voltage is eliminated.

Bus voltage is selected via two open/ground discrete inputs permitting automatic unit adaptation to the system bus voltage. Lighting bus, common, and gain selection inputs are protected against lightning surges to DO-160C/D category A3 (waveforms 3, 4, and 5). See figures 5, 6, and 7.

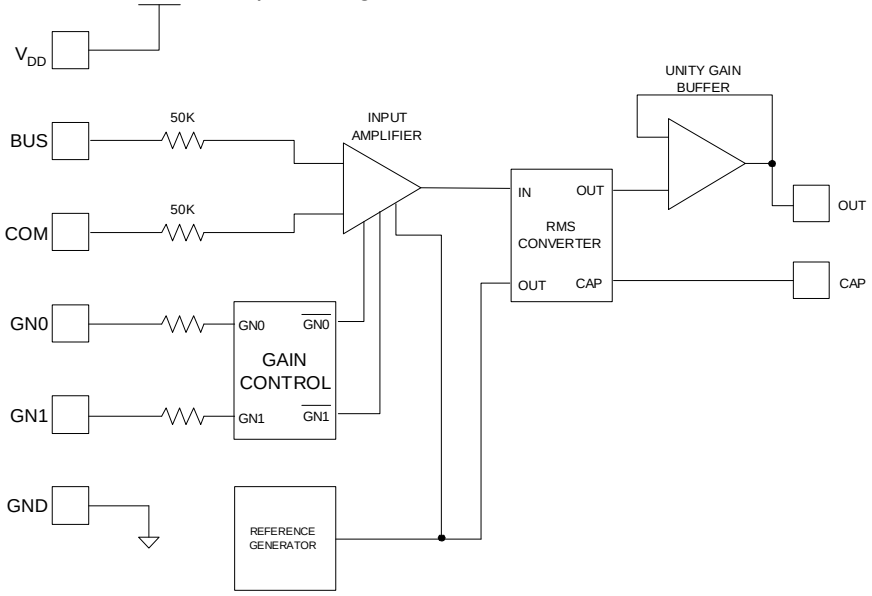


Figure 1: DEI1030 Block Diagram

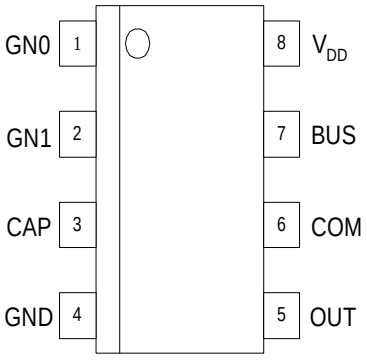
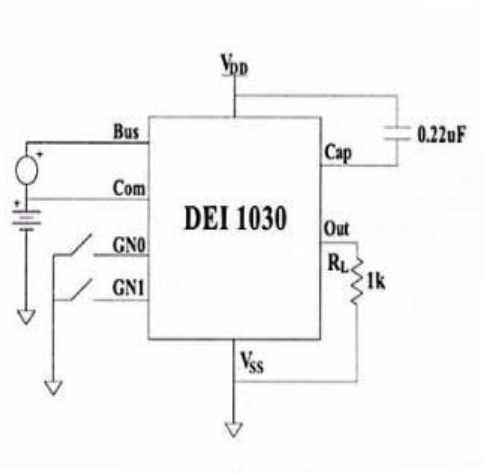


Figure 2: DEI1030 Pinout

Table 1: Pin Definitions			
PIN #	**NAME**	**SYMBOL**	**DEFINITION**
1	Gain Select 0	GN0	Lightning protected* gain select input
2	Gain Select 1	GN1	Lightning protected* gain select input
3	Capacitor	CAP	Capacitor connection to V_{DD} for 5VRMS to DC conversion.
4	Ground	GND	Circuit ground reference
5	Output	OUT	Circuit output to lamp driver.
6	Common	COM	Lightning protected* reference input from lighting bus.
7	Bus Input	BUS	Lightning protected* circuit input from lighting bus.
8	Supply Voltage	V_{DD}	Circuit input voltage.
*Protected from lightning surges to DO160C/D category A3. See figures 5, 6, and 7.			

The DEI 1030 input stage is a differential to single-ended converter with variable gain. The GN0 and GN1 inputs control the gain of this circuit. Following the differential input stage is an RMS-to-DC converter, which provides a DC output voltage proportional to the RMS value of its input. The circuit is intended to interface various lighting systems to a 0 ~ 5 volt internal standard.



Three gain settings are provided. If both gain pins are grounded (GN0 = GN1 = 0), the circuit will output a DC voltage that is equal to the RMS value of the input. Because of the RMS conversion, either polarity of input DC voltage results in the same output. A true sine waveform will give a DC output that is equal to the RMS value of the input. A distorted sine, or any other waveform (at low enough frequency) will give a DC output voltage that is approximately equal to the RMS value of the input. Thus in this gain mode, either a zero-to-5 V DC or 400Hz sinusoidal input will result in a zero-to-5 V DC output.

A filter capacitor is used in the RMS-to-DC conversion. A value of at least 0.22 µF is recommended. A larger value will reduce the ripple (at 2x the input frequency) at the output.

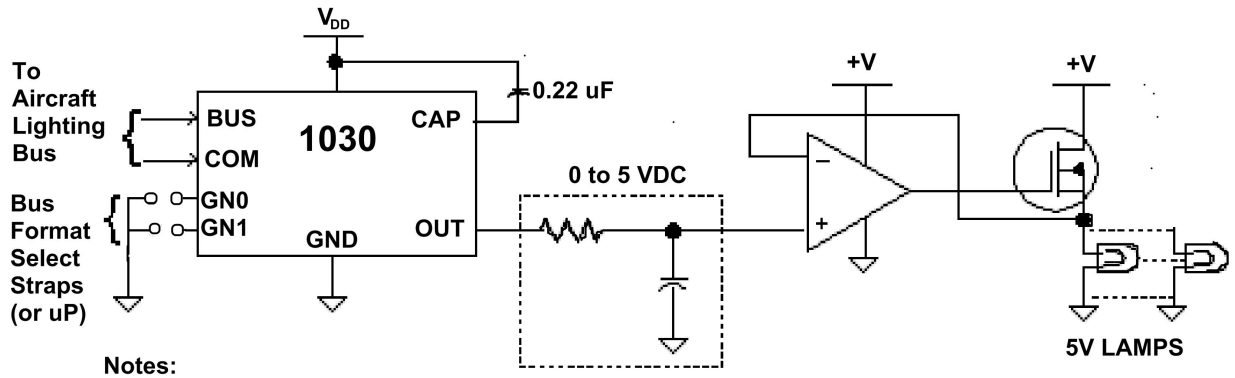
FUNCTION TABLE			
GN1	**GN0**	**INPUT FORMAT**	**DC GAIN**
0 (Gnd)	0 (Gnd)	5V	5V
0 (Gnd)	1 (Open)	14V	0.357
1 (Open)	0 (Gnd)	19V (not used)	0.263
1 (Open)	1 (Open)	28V	0.179

Table 2: ABSOLUTE MAXIMUM RATINGS			
PARAMETER	**SYMBOL**	**RATING**	**UNITS**
Supply Voltage	V_{DD}	16.5	V
Input Voltage (Pins BUS, COM, GN0, GN1)	V_{in}	V_{SS} -10 to V_{DD} +40	V
Lightning Protection (BUS, COM, GN0, GN1; DO160C/D, Waveforms 3, 4* and 5*; Level 3)	V_{LTG}	± 600 ± 300*	V
Output Current (Pin OUT)	I_{out}	50	mA
Peak Body Temperature -G Package		260	°C
Storage Temperature	T_{STG}	-65 to 125	°C
Note: The DEI1030 contains circuitry to protect inputs against damage due to high voltage static discharge. Normal precautions must be used in handling these devices.			

Table 3: Operating Range					
PARAMETER	**SYMBOL**	**MIN**	**TYP**	**MAX**	**UNITS**
Supply Voltage	V_{DD}	10.8	12	13.2	V
Supply Current (V_{DD} = 13.2V, V_{BUS} – V_{COM} = 0)	I_{DD}			9	mA
Operating Temperature	T_O	-55		85	°C

Table 4: Electrical Characteristics						
Unless noted, operating connections: V_{DD} = 12V ± 10%, V_{COM} = 0V, T = -55°C to +85°C, GN0 = "low", GN1 = "low"						
PARAMETER	**SYMBOL**	**CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNITS**
OUTPUT CHARACTERISTICS						
DC Output voltage	V_{O1}	V_{BUS} - V_{COM} = 0 GN0 = GN1 = "low" T = -55°C	0 0		50 60	mV
DC Output voltage	V_{O2}	V_{BUS} - V_{COM} = 2.5 V DC GN0 = GN1 = "low" T = -55°C	2.4 2.33		2.6 2.6	V
DC Output voltage	V_{O3}	V_{BUS} - V_{COM} = 5.0 V DC GN0 = GN1 = "low" T = -55°C	4.8 4.75		5.2 5.2	V
DC Output voltage	V_{O4}	V_{BUS} - V_{COM} = 5.0Vrms, 400Hz GN0 = GN1 = "low"	4.8		5.2	V
DC Output voltage	V_{O5}	V_{BUS} - V_{COM} = 14.0 V DC GN0 = "high ", GN1 = "low "	4.8		5.2	V
DC Output voltage	V_{O6}	V_{BUS} - V_{COM} = 28.0 V DC GN0 = "high ", GN1 = "high" T = -55°C	4.8 4.75		5.2 5.2	V
INPUT CHARACTERISTICS						
Signal input resistance	R_I	Single-ended input resistance: BUS or COM (1)	30		80	kΩ
Common-mode input range	V_{COM}	Voltage on COM pin for less than 1% change in output voltage (1)	-2		2	V
GAIN CONTROL INPUT CHARACTERISTICS						
Gain select low level voltage	V_{IL}	GN0, GN1 input voltage to guarantee "low" input			3.0	V
Gain select high level voltage	V_{IH}	GN0, GN1 input voltage to guarantee "high" input	3.5			V
Gain select low level resistance (GND)	R_{IL}	GN0, GN1 input resistor to ground to guarantee "low" input			100	Ω
Gain select high level resistance (OPEN)	R_{IH}	GN0, GN1 input resistor to ground to guarantee "high" input	100k			Ω
Gain select source current	I_G	Input voltage = 0			-100	μA

Notes:
1. Guaranteed by design and not production tested.



Notes:

1. **Use modern rail-to-rail op amp to avoid oscillation.**
2. **Use low R_{DSON} logic level FET.**
3. **Adjust RC filter to set ramp time, if desired.**

Figure 4. Typical Application

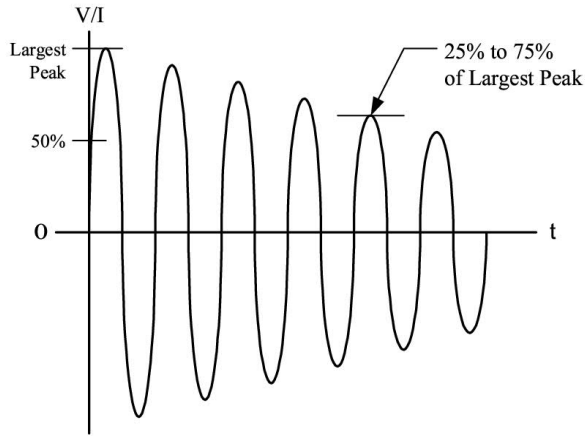


Figure 5: DO160C/D Voltage Waveform #3

V_{OC} = 600V, I_{SC} = 24A, Frequency = 1.0MHZ ±20%

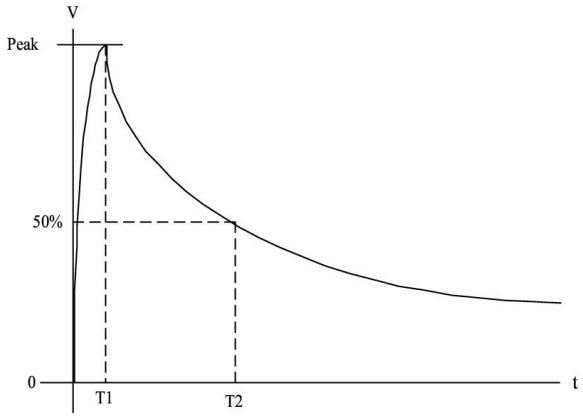


Figure 6: DO160C/D Voltage Waveform #4

V_{OC} = 300V, I_{SC} = 60A

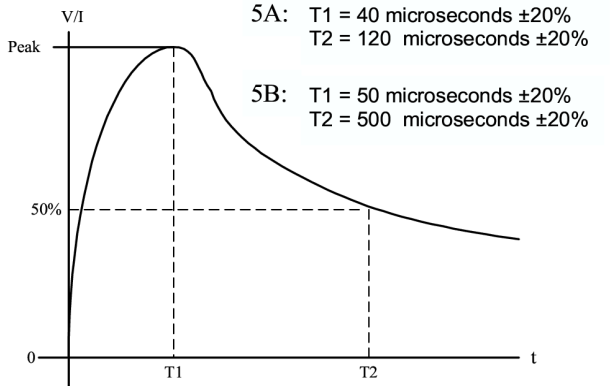


Figure 7: DO160C/D Voltage Waveform #5

V_{OC} = 300V, I_{SC} = 300A

Notes:

1. V_{OC} = Peak Open Circuit Voltage available at the calibration point.
2. I_{SC} = Peak Short Circuit Current available at the calibration point.
3. Amplitude tolerances: +10%, -0%
4. The ratio of V_{OC} to I_{SC} is the generator source impedance to be used for generator calibration purposes.

Ordering Information

Table 5: Ordering Information			
DEI PART NUMBER	**MARKING**	**PACKAGE**	**TEMP RANGE**
DEI1030-G	DEI1030 E4	8L NB SOIC G	-55 / +85 °C

Package Information

Table 6: Package Characteristics	
PACKAGE TYPE	**8 Lead SOIC Narrow Body, Green**
REFERENCE	8L NB SOIC G
THERMAL RESISTANCE: θ_{JA} (4 layer PCB with Power Planes) θ_{JC}	 135 °C/W 40 °C/W
JEDEC MOISTURE SENSITIVITY LEVEL (MSL)	MSL 1 / 260°C
LEAD FINISH MATERIAL / JEDEC Pb-free CODE	NiPdAu e4
Pb-Free DESIGNATION	RoHS Compliant
JEDEC REFERENCE	MS-012-AC

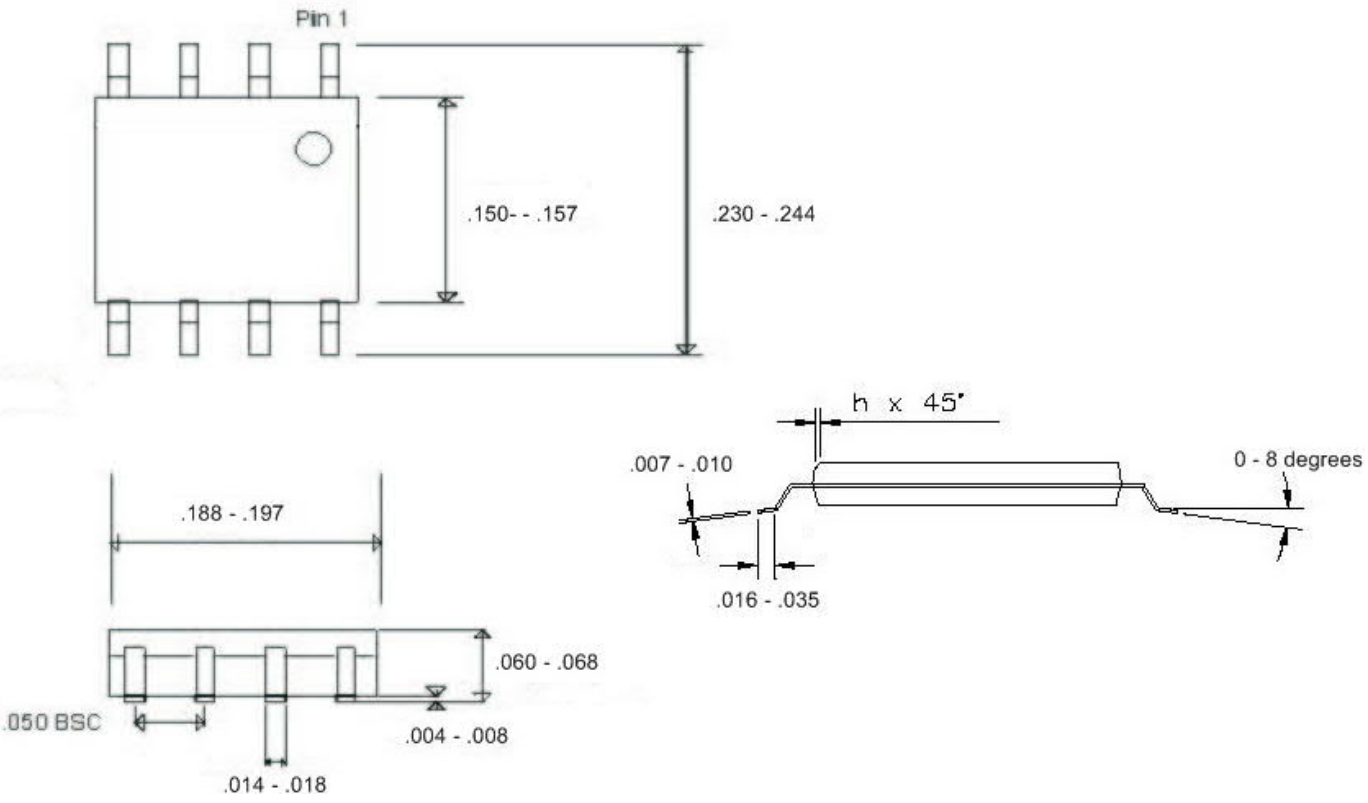


Figure 8: Mechanical Outline 8 Lead NB SOIC – G Package