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Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD

May 2016

FL5150/60
IGBT and MOSFET AC Phase Cut Dimmer Controller

Features

- Selectable Earth Ground or Line-Hot Zero Cross Detection: Complies with UL1472 2015 2nd Edition for Addition of Ground Leakage Current for Flicker Reduction (North America)
- User Programmable Leading or Trailing Edge Dimming Control
- Dynamic Over-Current and Temperature Protection
- Powered from the AC Line
- Symmetric AC Current Control
- IGBT or MOSFET Gate Driver
- Gate Pulse Width Programmable from 0 to 100% t_{ON}
- 8 Bit ADC Input for Dimming Control with an Adjustable Resistor or 0 to 10 V DC Voltage
- 226 Dimming Pulse Widths with 25 s Resolution and Built-in Ramp Up/Down Control for Smooth Dimming
- AutomreWoo o11 0 0 1 90 0 1 17]TJBT1 0 0Wol

Figure 5.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Condition	Min.	Max.	Unit
IS	Supply Current				

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the data sheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings. Unless otherwise specified, refer to Figure 1 to Figure 5. T_A=25°C, I_{SHUNT}=5 mA, and phase=60 Hz.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
FL5150/60 Electrical Parameters (T_A=25°C, I_{shunt}=5 mA, unless otherwise specified)						
VS	Power Supply Shunt Regulator Voltage	VS to GND	16	17	18	V
UVLO	Under-Voltage Lockout					

Table 5. DIM Control Voltage Pulse Width Selection(

Table 5. DIM Control Voltage Pulse Width Selection[1] (Continued)

DIM Mode=0

Table 5. DIM Control Voltage Pulse Width Selection(1) (Continued)

		DIM Mode=0	DIM Mode=0	DIM Mode=1	DIM Mode=1
		Trailing Edge	**Trailing Edge**	**Leading Edge**	**Leading Edge**
DIM_Control Voltage (mV)	**$VOUT_{RMS}$(V)(2)**	**t_{ON} (Rising) s**	**t_{ON} (Falling) s**	**t_{OFF} (Rising) s**	**t_{OFF} (Falling) s**
1080	66.8	3325	3325	4975	4975

Table 5. DIM Control Voltage Pulse Width Selection[1] (Continued)

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		DIM Mode=0	DIM Mode=0	DIM Mode=1	DIM Mode=1
		Trailing Edge	Trailing Edge	Leading Edge	Leading Edge
DIM_Control Voltage (mV)					

Description

(Refer to Figure 1 to Figure 5)

Present AC controls or dimmer switches typically use TRIAC circuits to generate the AC symmetric chopped or phase cut current function. The TRIAC is basically two back to back SCR transistors that allow for symmetric AC operation in both the positive and negative half cycles. The TRIAC dimmer circuit controls the AC voltage pulse width to the load by turning off the TRIAC when its holding current is below the minimum threshold level. This occurs near the AC zero-crossing. The TRIAC is turned on at a selected phase angle during the half cycle. The TRIAC minimum holding current can become an issue for newer low wattage lighting products. In addition, newer lighting products typically have capacitive load impedance so the current and voltage phases are shifted. This can cause problems for the detection of the AC zero-

Figure 4 shows a typical 3 wire application. For a three wire application, the neutral wire is available in addition to the Line Hot and Load Hot connections. External components D1, R1 and C2 provide for the DC bias of the FL5160. During the AC half cycle when Line Neutral is positive, the C2 capacitor will charge positive and be clamped to 17 V by the FL5160's shunt regulator connected to VS. The gate driver circuit is supplied from the VS pin. During the AC half cycle when Line Neutral is negative, the FL5160 is biased by the capacitor C2. Figure 8 shows the VS, DRV Gate and load current waveforms for a LED load. The pulse width can be controlled from 0 to 100% duty cycle with a 3-wire application. The R_{ZC} Monitor resistor detects the AC zero crossing. The typical value for this resistor is 1 M for 120 V_{AC} applications.

Figure 1 shows a typical 120 V_{AC} 2-wire application. This 2-wire application does not have the neutral wire available, which is typical for most switch box applications in North America: only the Line Hot, Load Hot and earth ground wires are available. The FL5160 is powered from the AC line by D1, D2, R1 and C2.

Capacitor C2 charges when the Q1 & Q2 transistors are off. When Q1 and Q2 are on, C2 provides the bias for the FAN5160. Since C2 can only charge when both Q1 and Q2 are off, a 10

Typical Performance Characteristics (Continued)

Unless otherwise specified, T_A=25°C and according to Figure 1 to Figure 5.

Typical Temperature Characteristics

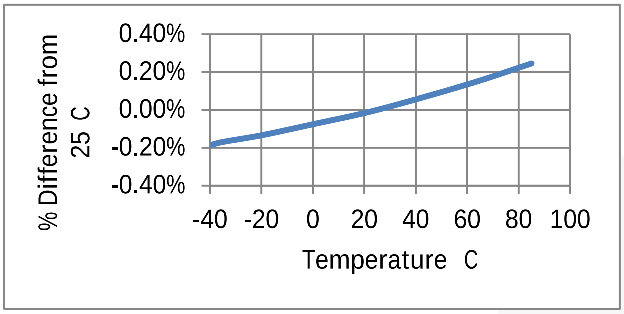


Figure 13. Shunt Regulator Voltage vs. Temperature

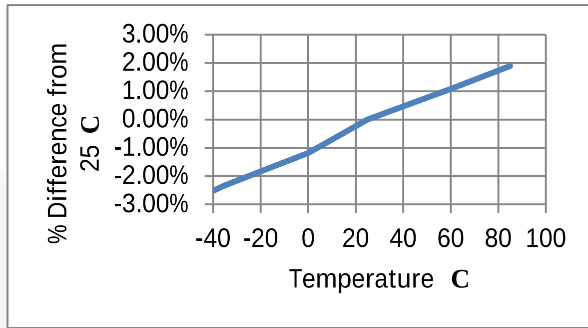


Figure 14. Quiescent Current vs. Temperature

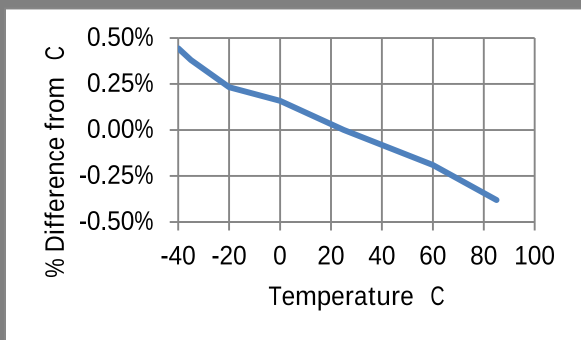


Figure 15. Under-Voltage Lockout Rising vs. Temperature

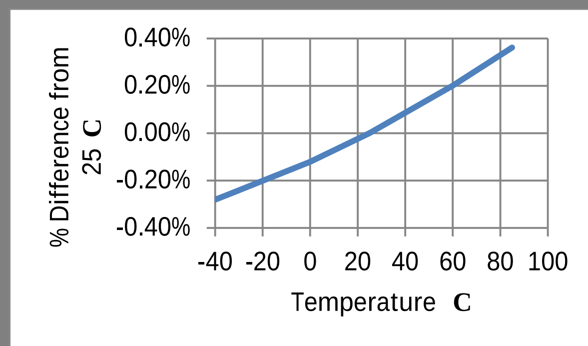


Figure 16. VDD vs. Temperature

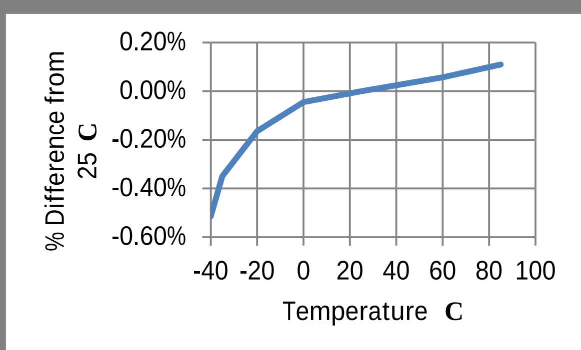


Figure 17. Oscillator Frequency vs. Temperature

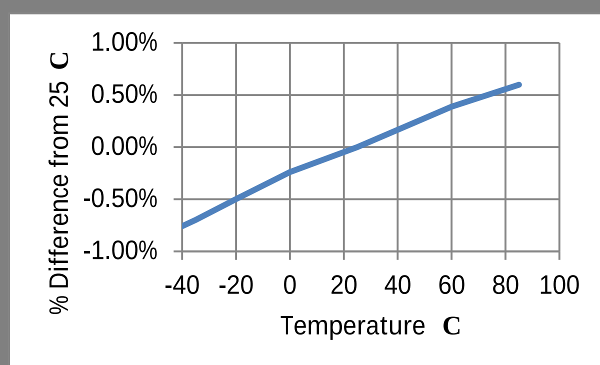
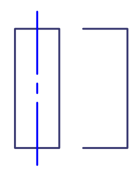


Figure 18. DIM Control Source Current vs. Temperature



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