LYT3314-3328
LYTSwitch-3 Family

Single-stage LED Driver IC with Combined PFC and Constant Current Output for Outstanding TRIAC Dimming in Isolated and Non-Isolated Topologies

PRELIMINARY

Product Highlights

Combined Single-Stage PFC + Accurate CC Output
- Less than ±3% CC regulation over line and load
- Power Factor >0.9
- Ensures monotonic VA reduction with TRIAC phase angle
- Low THD, 15% typical for dimmable bulbs, as low as 7% in optimized designs

Advanced Integrated TRIAC Dimmer Detection
- Detects leading-edge and trailing-edge TRIAC dimmers
- High-efficiency mode when no dimmer is present
- Selectable dimming profile increases design flexibility
- Fast turn-on (<500 ms) even in deep dimming
- Low pop-on and dead-travel
- Active bleeder drive for widest dimmer compatibility

Design Flexibility
- Supports buck, buck-boost, tapped-buck, boost, isolated and non-isolated flyback
- Up to 20 W output

Highest Reliability
- No electrolytic bulk capacitors or optoisolators for increased lifetime
- Comprehensive protection features
  - Input and output overvoltage
  - Output short-circuit and open-loop protection
- Advanced thermal control
  - Thermal foldback ensures that light continues to be delivered at elevated temperatures
  - End-stop shutdown provides protection during fault conditions

Description

The LYTSwitch™-3 family of ICs are ideal for single-stage power factor corrected constant current LED bulbs and downlighters.

LYTSwitch™-3 devices incorporate a high-voltage power MOSFET and discontinuous mode, variable frequency variable on-time controller. The controller also provides cycle-by-cycle current limit, output OVP, line overvoltage, comprehensive protection features, plus advanced thermal management circuitry.

All LYTSwitch-3 ICs have a built-in TRIAC detector that discriminates between leading-edge and trailing-edge dimmers. This capability together with load monitoring circuitry regulates bleeder current during each switching cycle. The controller disables the bleeder circuit completely if no dimmer is detected, significantly increasing efficiency.

LYTSwitch-3 parts features selectable dimming profiles, allowing the designer to choose a dimming response to match customer needs.

The combination of a low-side switching typology, cooling via electronically quiet SOURCE pins and frequency jitter all ensure extremely low

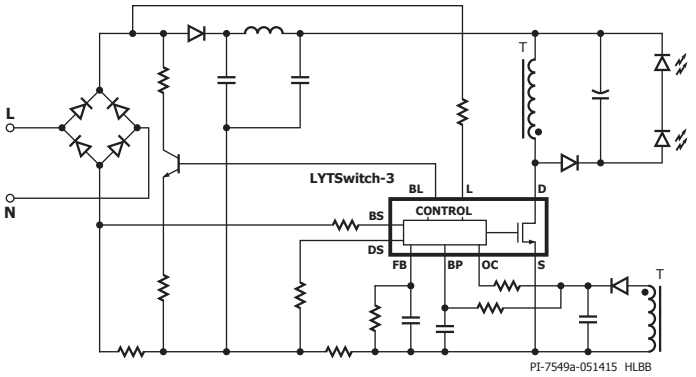


Figure 1. Typical Application/Performance – Simplified Schematic.

Output Power Table

Product[2]	Output Power[1]
	85-132 VAC or 185-265 VAC
LYT33x4D	5.7 W
LYT33x5D	8.8 W
LYT33x6D	12.6 W
LYT33x8D	20.4 W

Table 1. Output Power Table (Buck Topology).
Notes:
1. Maximum practical continuous power in an open frame design with adequate heat sinking, measured at 50°C ambient (see Key Applications Considerations for more information).
2. Package: D: SO-16B.

SO-16B (D Package)

Figure 2. Package.

EMI. This reduces the size of the input filter components - greatly reducing audible noise during dimming.

The LYTSwitch-3 family includes 4 different power levels and two MOSFET voltage options to cost-optimize designs while EcoSmart™ switching technology insures maximum efficiency for each device size and load condition.

Pin Functional Description

LINE-SENSE (L) Pin
LINE-SENSE pin implements input voltage waveform detection: conduction angle is detected accurately since SOURCE pin is referenced to bulk capacitor ground. Input OVP is activated when LINE-SENSE pin current exceeds the predetermined threshold.

BLEEDER CURRENT SENSE (BS) Pin
BLEEDER CURRENT SENSE pin measures the total input current – active bleeder current plus switch current. This current is sensed in order to keep TRIAC current above its holding level. This is achieved by modulating the bleeder dissipation.

R_{BS} (Ω)	Dim Curve	Load Shut Down (LSD)
6 k	Max. Dim Curve	No
12 k	Min. Dim Curve	No
24 k	Min. Dim Curve	Yes

Table 2. BS Pin Resistor Programming.

DRIVER CURRENT SENSE (DS) Pin
DRIVER CURRENT SENSE pin senses the driver current. This current is used to deduce output current: it is multiplied by the input voltage and the result is then divided by the output voltage to obtain output current.

R_{DS} (Ω)	Topology
6 k	Buck, Buck-Boost, Isolated Flyback
24 k	Non-Isolated Flyback

Table 3. Topology Selection Resistor.

BLEEDER CONTROL (BL) Pin
BLEEDER CONTROL pin drives the external bleeder transistor in order to maintain the driver input current above the holding current of the dimmer TRIAC.

FEEDBACK (FB) Pin
In normal operation and full conduction the preset threshold on the FEEDBACK pin is 300 mV. This threshold gets reduced linearly with conduction angle until a minimum level is reached.

Cycle skipping is triggered when voltage on this pin exceeds 600 mV.

BYPASS (BP) Pin
5.25 V supply rail.

OUTPUT COMPENSATION (OC) Pin
Output OVP for all topologies. Output voltage compensation for indirect output current sense topologies.

DRAIN (D) Pin
High-voltage internal MOSFET (725 V or 650 V).

SOURCE (S) Pin:
Power and signal ground.

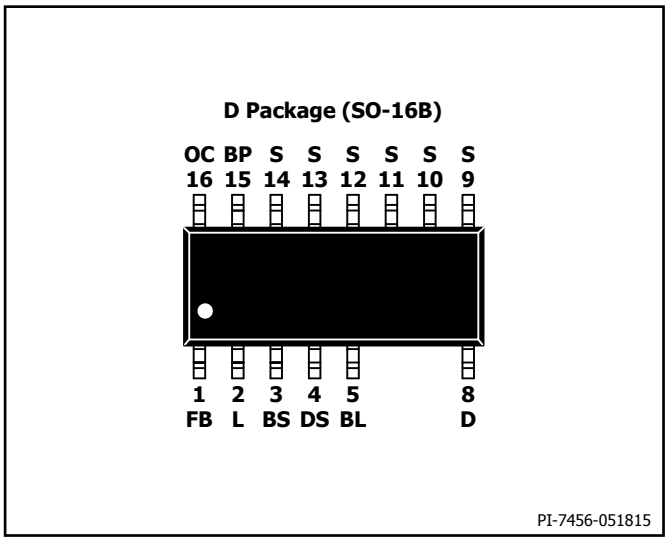


Figure 3. Pin Configuration.

PRELIMINARY

This document contains information on a new product. Specifications and information herein are subject to change without notice.

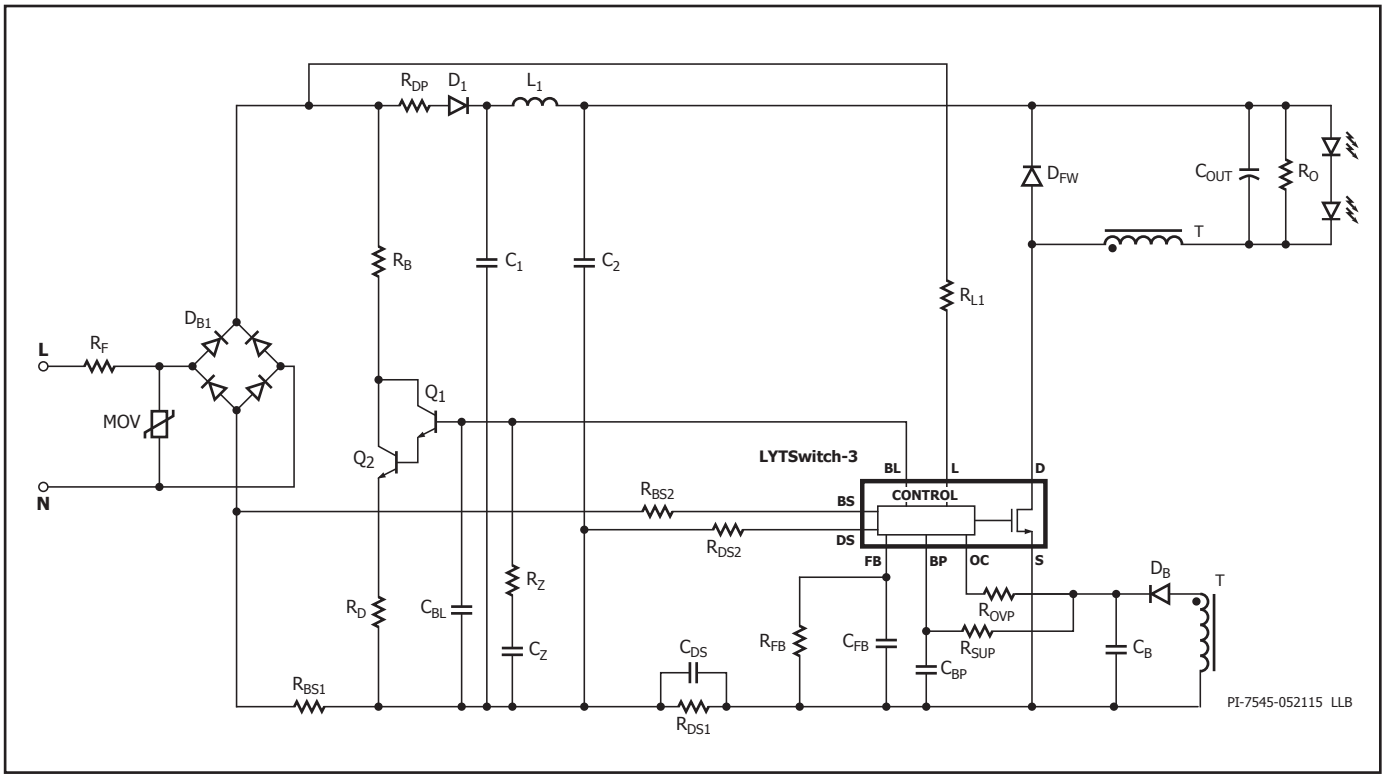


Figure 4. Typical Schematic Buck (Low-Line).

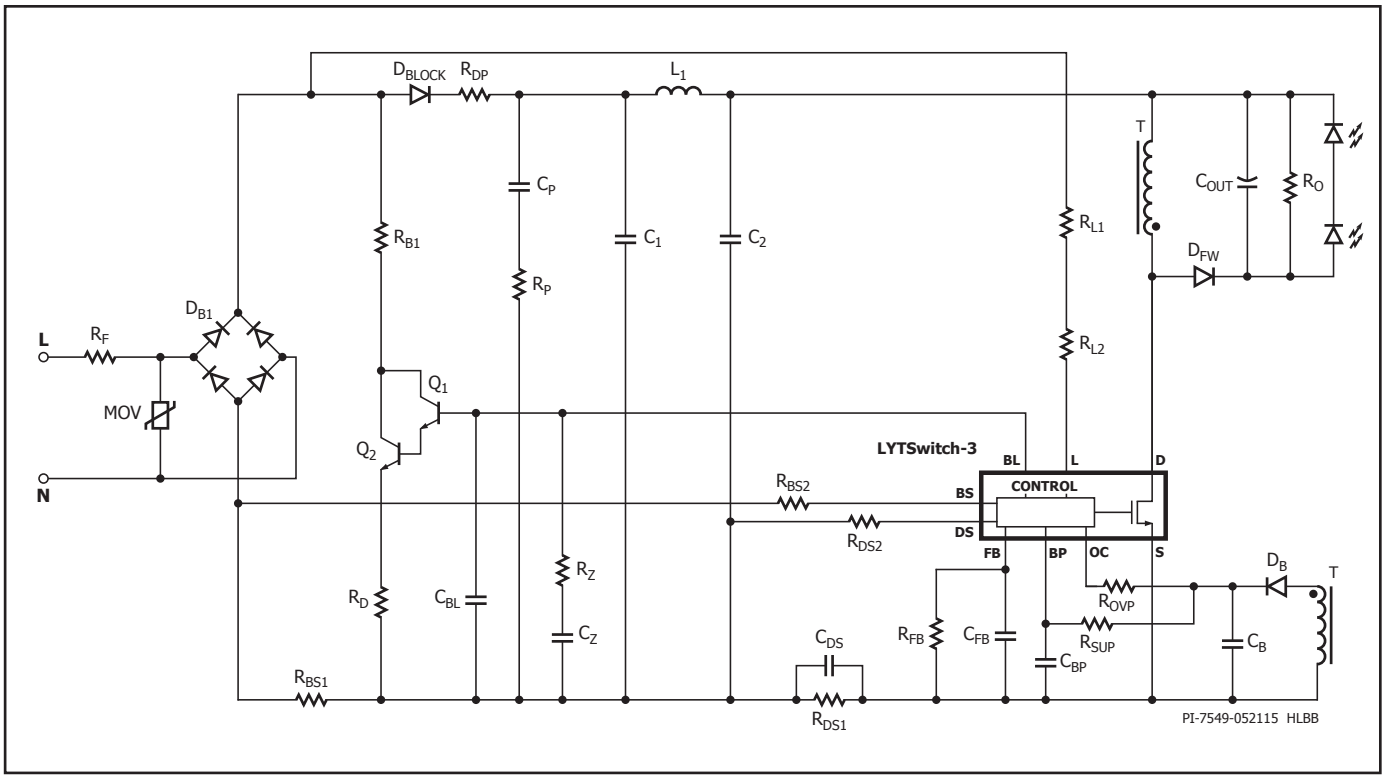


Figure 5. Typical Schematic Buck-Boost (High-Line).

Absolute Maximum Ratings(1,3)

DRAIN Pin Voltage: LNK331x ..... -0.3 V to 650 V
LNK332x ..... -0.3 V to 725 V
DRAIN Pin Peak Current(4) LNK3314 ..... 1.85 A (2.76 A)
LNK3324 ..... 1.44 A (2.33 A)
LNK3315 ..... 2.39 A (3.47 A)
LNK3325 ..... 1.95 A (3.16 A)
LNK3316 ..... 3.67 A (5.46 A)
LNK3326 ..... 2.64 A (4.35 A)
LNK3318 ..... 5.06 A (7.44 A)
LNK3328 ..... 4.16 A (6.86 A)
BP, BS, DS, BL, OC, L DS, FB Pin Voltage ..... -0.3 V to 6.5 V
Lead Temperature(2) ..... 260 °C
Storage Temperature ..... -65 to 150 °C
Operating Junction Temperature ..... -40 to 150 °C

Notes:
1. All voltages referenced to Source, T_A = 25 °C.
2. 1/16 in. from case for 5 seconds.
3. The Absolute Maximum Ratings specified may be applied, one at a time without causing permanent damage to the product. Exposure to Absolute Maximum Ratings for extended periods of time may affect product reliability.
4. The higher peak Drain current (in parentheses) is allowed while the Drain voltage is simultaneously less than 400 V.

Thermal Resistance

Thermal Resistance: SO-16B Package:
(θ_{JA}) ..... 78 °C/W(2)
(θ_{JA}) ..... 68 °C/W(3)
(θ_{JC})(1) ..... TBD °C/W

Notes:
1. Measured on the SOURCE pin close to plastic interface.
2. Soldered to 0.36 sq. inch (232 mm2) 2 oz. (610 g/m2) copper clad, with no external heat sink attached.
3. Soldered to 1 sq. in. (645 mm^2), 2 oz, (610 g/m^2) copper clad.

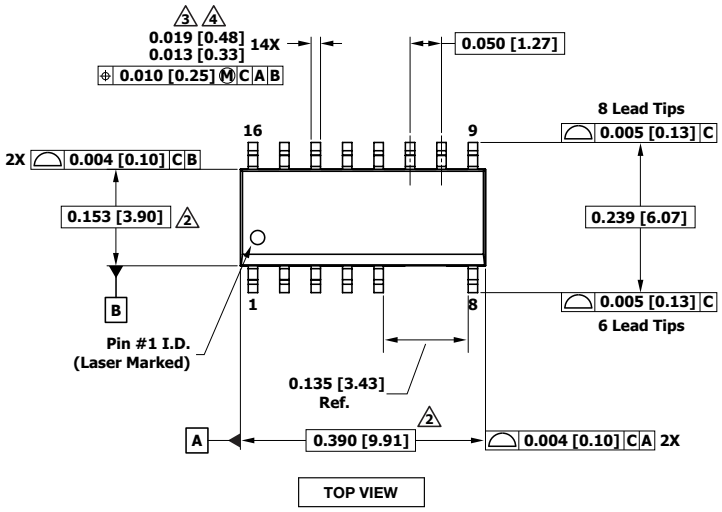
Parameter	Symbol	Conditions SOURCE = 0 V T_J = -40 °C to +125 °C (Note C) (Unless Otherwise Specified)		Min	Typ	Max	Units
Control Functions							
Maximum Output Frequency	f_{MAX}	T_J = 25 °C	Average	115.3	124	132.7	kHz
			Peak-to-Peak Jitter		8		%
Minimum Output Frequency	f_{MIN}	T_J = 0 °C to 125 °C	Average		40		kHz
			Peak-to-Peak Jitter		8		%
Frequency Jitter Modulation Rate	f_M				1.76		kHz
Maximum Duty Cycle	$T_{ON(MAX)}$			TBD	6.2	TBD	µs
FEEDBACK Pin Voltage	V_{FB}	T_J = 25 °C		297	300	303	mV
FEEDBACK Pin Voltage Triggering Cycle Skipping	$V_{FB(SK)}$				600		mV
FEEDBACK Pin Overvoltage Threshold	$V_{FB(OV)}$				2000		mV
FEEDBACK Pin Undervoltage Threshold	$V_{FB(UV)}$			19.3	21.5	23.7	mV
Feedback Pull-up Current	I_{FB}			-1.3	-1.0	-0.7	µA

Parameter	Symbol	Conditions SOURCE = 0 V T_J = -40 °C to +125 °C (Unless Otherwise Specified)		Min	Typ	Max	Units
Control Functions (cont.)							
DRAIN Supply Current	I_{S1}	$V_{FB(ON)} > V_{FB} > V_{FB(SK)}$ (MOSFET not switching)			450	TBD	µA
	I_{S2}	MOSFET Switching at f_{MAX}	LYT3314		580	TBD	µA
			LYT3324		630	TBD	
			LYT3315		615	TBD	
			LYT3325		700	TBD	
			LYT3316		700	TBD	
			LYT3326		775	TBD	
			LYT3318		815	TBD	
			LYT3328		970	TBD	
BYPASS Pin Charge Current	I_{CH1}	V_{BP} = 0 V, T_J = 25 °C	33x4-5	TBD	-7.1	TBD	mA
			33x6-8	TBD	-9.1	TBD	
BYPASS Pin Charge Current	I_{CH2}	V_{BP} = 4 V, T_J = 25 °C	33x4-5	TBD	-4.9	TBD	mA
			33x6-8	TBD	-6.3	TBD	
BYPASS Pin Voltage	V_{BP}			4.75	5.00	5.25	V
BYPASS Pin Shunt Voltage	V_{SHUNT}	I_{BP} = 5 mA		TBD	5.30	TBD	
BYPASS Pin Power-Up Reset Threshold Voltage	$V_{BP(RESET)}$			TBD	4.6	TBD	V
Circuit Protection							
Current Limit	I_{LIMIT}	di/dt = 662 mA/µs T_J = 25 °C	LYT33x4	TBD	907	TBD	mA
		di/dt = 974 mA/µs T_J = 25 °C	LYT33x5	TBD	1325	TBD	
		di/dt = 1403 mA/µs T_J = 25 °C	LYT33x6	TBD	1901	TBD	
		di/dt = 2239 mA/µs T_J = 25 °C	LYT33x8	TBD	3074	TBD	
Leading Edge Blanking Time	t_{LEB}	T_J = 25 °C		TBD	165		ns
Current Limit Delay	T_{ILD}	T_J = 25 °C			160		ns
Thermal Foldback Temperature	T_{FB}			128	135	142	°C
Thermal Shutdown Temperature	T_{SD}			150	160	170	°C
Thermal Shutdown Hysteresis	$T_{SD(H)}$				75		°C
SOA Switch ON-Time	$T_{ON(SOA)}$				350	TBD	ns

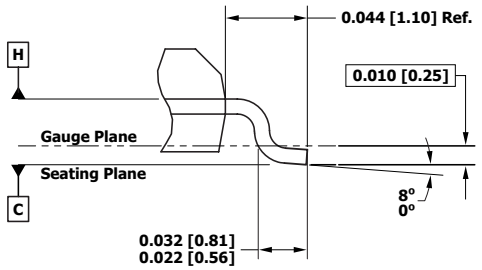
Parameter	Symbol	Conditions SOURCE = 0 V T_J = -40 °C to +125 °C (Unless Otherwise Specified)		Min	Typ	Max	Units
Output							
ON-State Resistance	$R_{DS(ON)}$	LYT33x4 I_D = 150 mA	T_J = 25 °C		5.61	6.45	
			T_J = 100 °C		8.52	TBD	
		LYT33x5 I_D = 200 mA	T_J = 25 °C		4.06	4.67	
			T_J = 100 °C		6.16	TBD	
		LYT33x6 I_D = 300 mA	T_J = 25 °C		2.83	3.25	
			T_J = 100 °C		4.30	TBD	
		LYT33x8 I_D = 500 mA	T_J = 25 °C		1.75	2.01	
			T_J = 100 °C		2.64	TBD	
OFF-State Leakage	I_{DSS}	V_{BP} = 5.3 V, V_{FB} > $V_{FB(SK)}$, V_{DS} = 580 V T_J = 125 °C				200	µA
Breakdown Voltage	BV_{DSS}	V_{BP} = 5.3 V, V_{FB} > $V_{FB(SK)}$ T_J = 25 °C	LYT331x	650			V
			LYT332x	725			

NOTES:

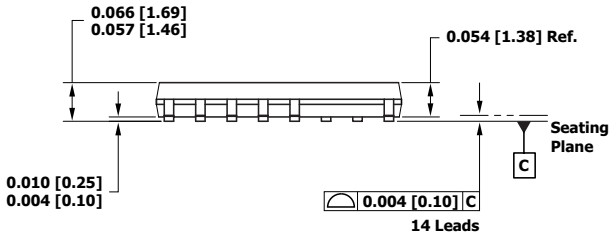
SO-16B



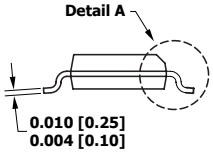
TOP VIEW



DETAIL A



SIDE VIEW



END VIEW

Notes:
1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions noted are determined at the outermost extremes of the plastic body exclusive of mold flash, tie bar burrs, gate burrs, and inter-lead flash, but including any mismatch between the top and bottom of the plastic body. Maximum mold protrusion is 0.25 mm per side.
3. Dimensions noted are inclusive of plating thickness.
4. Does not include inter-lead flash or protrusions.
5. Dimensions in Inches [mm].
6. Datums A and B to be determined in Datum H.
7. JEDEC reference: MS – 012.

PI-7473-061515
POD-SO-16B Rev A

Revision	Notes	Date
A	Code S.	08/15

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