LYT1402-1604
LYTSwitch-1 Family

Single-Stage LED Driver IC with Combined PFC and Constant Current Output for Buck Topology

Product Highlights

Single-Stage PFC + Accurate CC Output

- +/- 3% CC regulation in single line input voltage applications
- Power factor > 0.9
- High efficiency > 93%
- Robust 725 V MOSFET for increased line voltage surge performance
- Critical Conduction Mode (CrM) buck
- Low EMI
- Excellent line noise and transient rejection

Design Flexibility

- Supports high- and low-side buck topologies
- Wide input (90 VAC – 308 VAC) and output voltage range operation
- 3 family members cover power range for optimum device selection
- Requires no inductor bias winding

Highest Reliability

- Lowest component count
- Comprehensive protection features with auto-restart
  - Input and output overvoltage protection (OVP)
  - Output short-circuit protection
  - Open-loop protection
- Advanced thermal control
  - Thermal foldback ensures that light continues to be delivered at elevated temperatures
  - Over-temperature shutdown provides protection during fault conditions

Description

The LYTSwitch™-1 family is ideal for single-stage, high PF, constant current LED bulbs and tubes.

The family incorporates a high-voltage MOSFET with a variable on-time CrM controller. Extensive protection features with minimum external components provide industry leading power density and functionality. The devices can be used in high-side or low-side non-isolated buck topology.

The CrM operation results in low turn-on losses and reduces cost of output diode (slower reverse recovery).

LYTSwitch-1 devices are suitable for applications from 2 W to 22 W. See Table 1 for selection guidance.

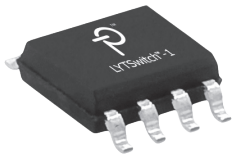


Figure 2. SO-8 D Package.

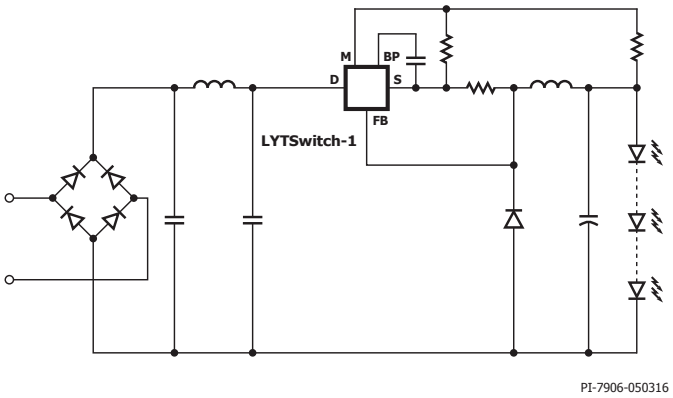


Figure 1a. High-Side Buck – Typical Application Schematic.

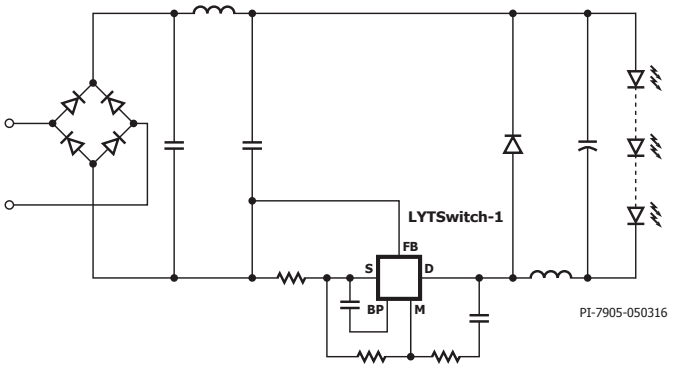


Figure 1b. Low-Side Buck – Typical Application Schematic.

Output Power Table[1]

Product[3]	Optimized for Smallest Components	
	V_{OUT} ≤ 30 V[2]	45 V ≤ V_{OUT} ≤ 55 V[2]
LYT1402D	4.0 W	8.0 W
LYT1403D	7.5 W	15 W
LYT1404D	11 W	22 W
Product[3]	**Optimized for Lowest THD**	
	V_{OUT} ≤ 30 V[2]	V_{OUT} ≥ 55 V[2]
LYT1602D	4.0 W	8.0 W
LYT1603D	7.5 W	15 W
LYT1604D	11 W	22 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.
2. Output power scales linearly if VOUT falls in between the specified voltages.
3. Package: SO-8 (D Package).

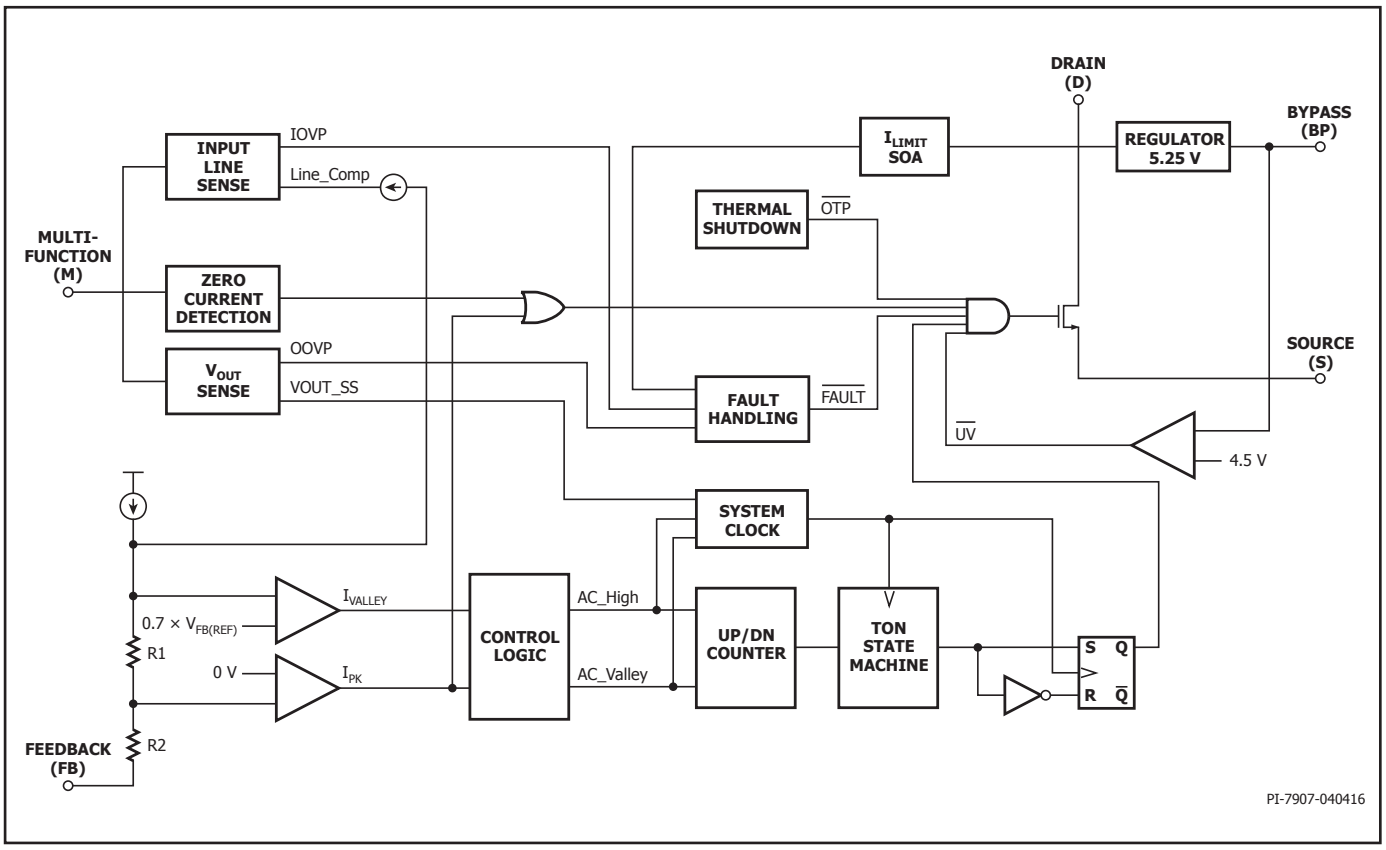


Figure 2. Block Diagram.

Pin Functional Description

BYPASS (BP) Pin:
5.25 V supply rail.

MULTIFUNCTION (M) Pin:
Mode 1: FET OFF
- Detection of inductor de-magnetization (ZCD) to ensure CrM.
- Output OVP Sensing (120 % of V_{OUT} nominal).
- Steady-state operation voltage range is [1 V – 2.4 V].

Mode 2: FET ON
- Line OVP.

FEEDBACK (FB) Pin:
- FET current sensing using external current sense resistor.
- Normal operation voltage range is [$V_{FB(REF)}$ – 0 V].

DRAIN (D) Pin:
High-voltage internal MOSFET.

SOURCE (S) Pin:
Power and signal ground.

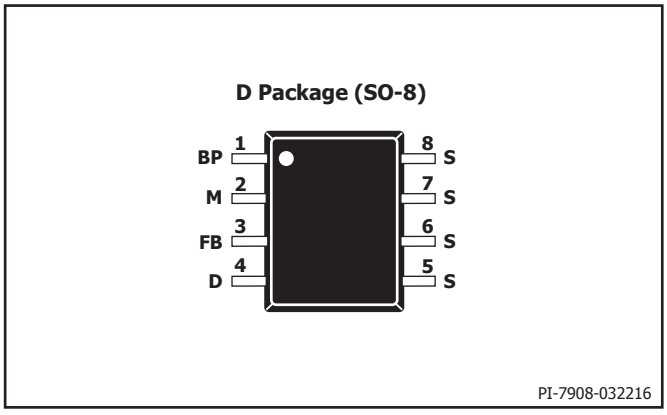


Figure 3. Pin Configuration.

Absolute Maximum Ratings[1,3]

DRAIN Pin Voltage: LYT1x0x ..... -0.3 V to 725 V
DRAIN Pin Peak Current: LYT1x02 ..... 1.05 A (1.3 A)[1]
LYT1x03 ..... 2.1 A (2.6 A)[1]
LYT1x04 ..... 2.8 A (3.5 A)[1]
BYPASS Pin Voltage ..... -0.3 V to 6.0 V
MULTIFUNCTION, FEEDBACK Pin Voltage..... -0.45 V to 7.0 V[2]
Lead Temperature ..... 260 °C
Storage Temperature ..... -65 to 150 °C
Operating Junction Temperature..... -40 to 150 °C[4]

Notes:
1. The higher peak Drain current (in parentheses) is allowed while the Drain voltage is simultaneously less than 400 V for 725 V integrated MOSFET.
2. In case SOURCE pin is open, -0.7 V between FEEDBACK pin and SOURCE pin is observed with no degradation in performance.
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. Normally limited by internal circuitry.

Thermal Resistance

Thermal Resistance: SO-8 Package:
(θ_{JA})..... 100 °C/W[2], 80 °C/W[3]
(θ_{JC})[1] ..... 30 °C/W

Notes:
1. Measured on the SOURCE pin close to plastic interface.
2. Soldered to 0.36 sq. inch (232 mm^2) 2 oz. (610 g/m^2) 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 (Unless Otherwise Specified)		Min	Typ	Max	Units
Control Functions							
Minimum Switching Frequency	f_{MIN}			18	20	22	kHz
Maximum Switch ON-Time	$T_{ON(MAX)}$			37.5	40	45	µs
Minimum Switch ON-Time	$T_{ON(MIN)}$			1.012	1.1	1.25	µs
FEEDBACK Pin Reference Voltage	$V_{FB(REF)}$	T_J = 25 °C		-283	-280	-277	mV
Dead Zone Detect Threshold	$V_{TH(DZ)}$				0.3 × $V_{FB(REF)}$		V
Maximum Constant Current Zone	$T_{CC(MAX)}$				6		ms
Forced Minimum Constant Current Zone	$T_{CC(MIN)}$				1.2		ms
BYPASS Pin Supply Current	I_{SBY}	Standby (MOSFET not switching)			180		µA
	I_{DSS}	MOSFET Switching	LYT1x02		680		µA
			LYT1x03		785		
			LYT1x04		850		
BYPASS Pin Charge Current	I_{CH1}	V_{BP} = 0.0 V, V_{DS} ≥ 36 V		-10	-4.5		mA
	I_{CH2}	V_{BP} = 5.0 V, V_{DS} ≥ 36 V		-6	-2		mA
BYPASS Pin Voltage	V_{BP}			5.075	5.22	5.35	V

Parameter	Symbol	Conditions SOURCE = 0 V T_J = -40 °C to 125 °C (Unless Otherwise Specified)		Min	Typ	Max	Units
Control Functions (cont.)							
BYPASS Pin Shunt Voltage	$V_{BP(SHUNT)}$			5.2	5.39	5.55	V
BYPASS Pin Power-Up Reset Threshold Voltage	$V_{BP(RESET)}$			4.35	4.5	4.65	V
Circuit Protection							
Current Limit for Auto-Restart	$I_{LIMIT(AR)}$	di/dt = 277 mA/µs T_J = 25 °C	LYT1x02	0.59	0.65	0.70	A
		di/dt = 446 mA/µs T_J = 25 °C	LYT1x03	1.06	1.15	1.24	
		di/dt = 662 mA/µs T_J = 25 °C	LYT1x04	1.61	1.75	1.88	
Fault Minimum Switch ON-Time	$T_{FAULT(MIN)}$				250	400	ns
Auto-Restart	$T_{AR(OFF)1}$	T_J = 25 °C			100		ms
	$T_{AR(OFF)2}$				1000		
Input Overvoltage Threshold	I_{IOV}	T_J = 25 °C		0.9	1.0	1.1	mA
MULTIFUNCTIONAL Pin Auto-Restart Threshold Voltage (Output OVP)	V_{OOV}	T_J = 25 °C		2.3	2.4	2.48	V
MULTIFUNCTIONAL Pin Undervoltage Threshold (Output Short)	V_{OUV}	T_J = 25 °C See Note B		0.91	0.95	0.99	V
Junction Temperature at Fold-Back	T_{FB}	See Note B		138	145	152	°C
Thermal Shutdown Temperature	T_{SD}	See Note A			160		°C
Thermal Shutdown Hysteresis	$T_{SD(H)}$	See Note A			75		°C

Parameter	Symbol	Conditions SOURCE = 0 V T_J = -40 °C to 125 °C (Unless Otherwise Specified)		Min	Typ	Max	Units
Output							
ON-State Resistance	$R_{DS(ON)}$	LYT1x02 I_D = 91 mA	T_J = 25 °C		9.2	10.6	Ω
			T_J = 100 °C		14.0	16.1	
		LYT1x03 I_D = 139 mA	T_J = 25 °C		4.5	5.2	
			T_J = 100 °C		6.8	7.8	
		LYT1x04 I_D = 182 mA	T_J = 25 °C		3.4	3.9	
			T_J = 100 °C		5.1	5.8	
OFF-State Leakage	I_{DSS1}	V_{BP} = 5.25 V, V_{DS} = 580 V T_J = 125 °C	LYT1x02			40	µA
			LYT1x03			55	
			LYT1x04			70	
Breakdown Voltage	BV_{DSS}	LYT1x0x		725			V

NOTES:
A. Guaranteed by design.
B. This parameter is derived from characterization. Non-production test.

Typical Performance Characteristics

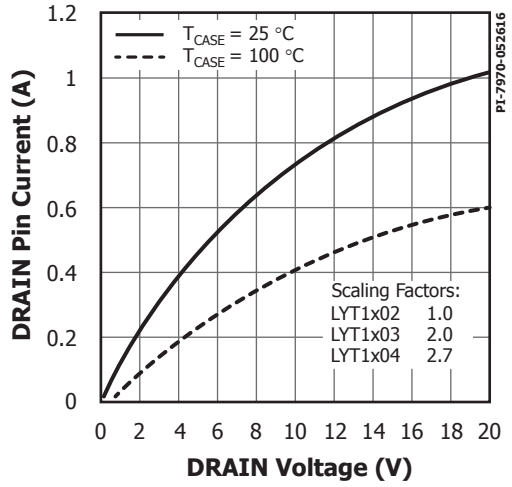


Figure 1. DRAIN Pin Current vs. Drain Pin Voltage.

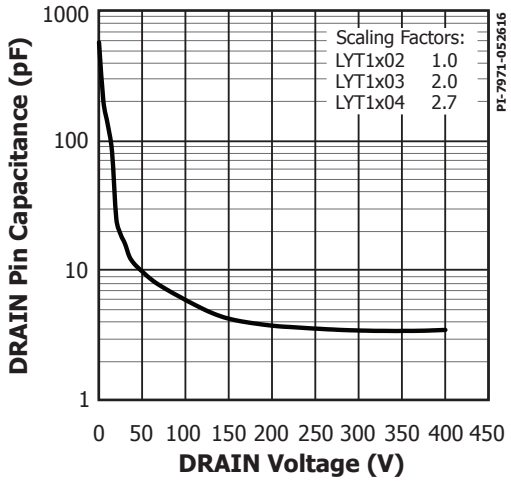


Figure 2. DRAIN Pin Capacitance vs. DRAIN Pin Voltage.

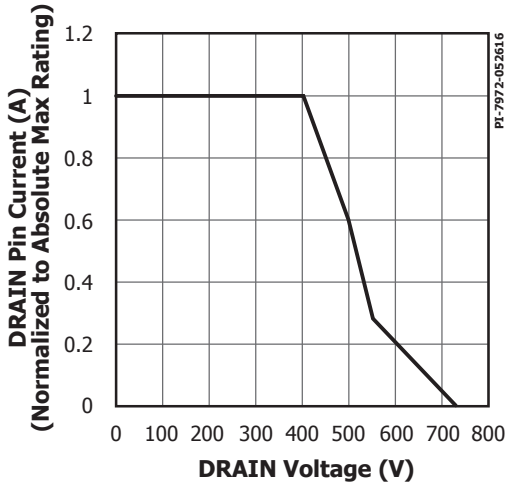
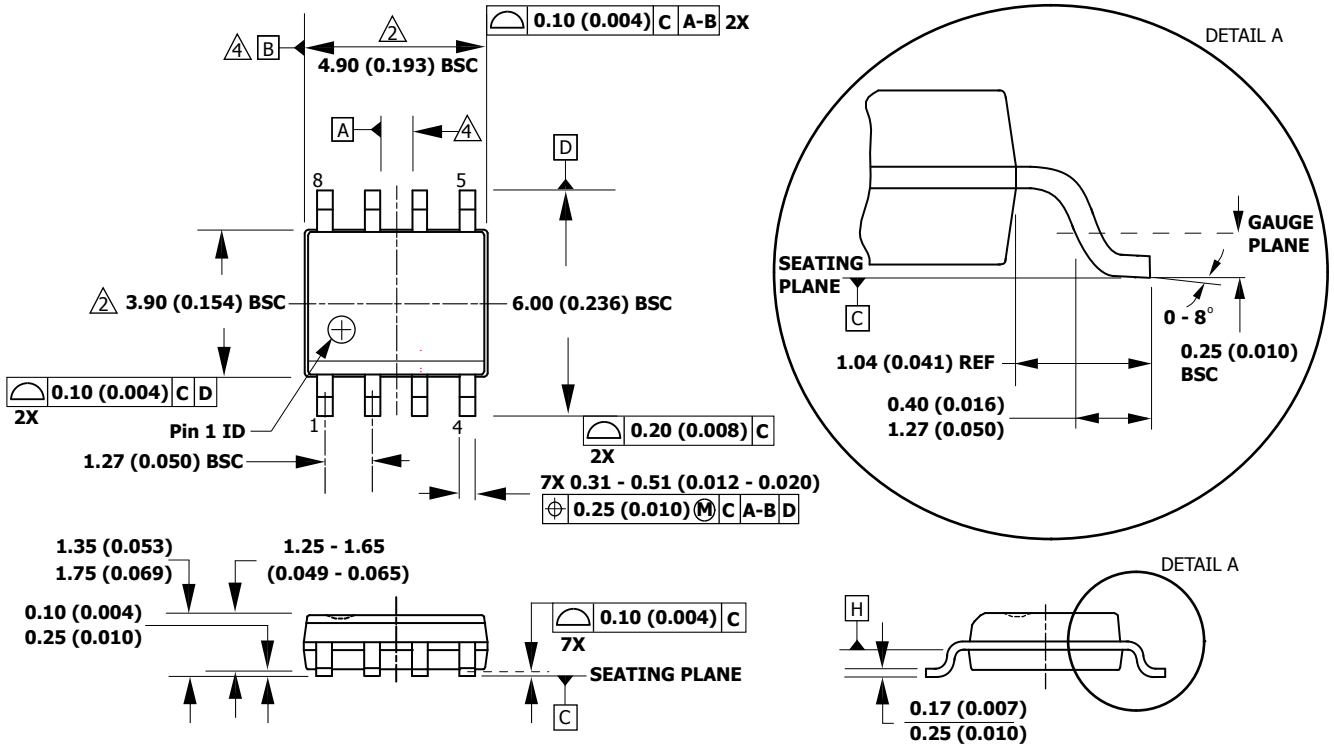
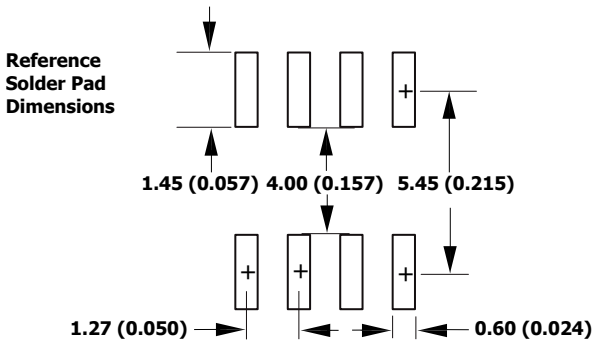


Figure 3. Maximum Allowable DRAIN Pin Current vs. DRAIN Pin Voltage.

SO-8 (D Package)





Notes:

1. JEDEC reference: MS-012.
2. Package outline exclusive of mold flash and metal burr.
3. Package outline inclusive of plating thickness.
4. Datums A and B to be determined at datum plane H.
5. Controlling dimensions are in millimeters. Inch dimensions are shown in parenthesis. Angles in degrees.

D08A

PI-5615-020515

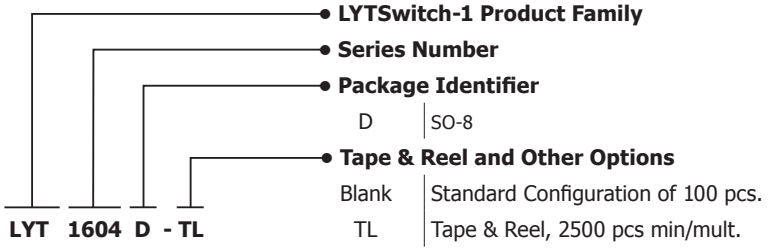
MSL Table

Part Number	MSL Rating
LYT1402D	1
LYT1403D	1
LYT1404D	1
LYT1602D	1
LYT1603D	1
LYT1604D	1

ESD and Latch-Up Table

Test	Conditions	Results
Latch-up at 125 °C	JESD78D	> ±100 mA or > 1.5 × V(max) on all pins
Human Body Model ESD	ANSI/ESDA/JEDEC JS-001-2012	> ±2000 V on all pins
Machine Model ESD	JESD22-A115CA	> ±200 V on all pins
Charged Device Model ESD	JESD22-C101	> ±500 V on all pins

Part Ordering Information



Notes

Revision	Notes	Date
A	Code A.	06/16

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