Low THD High PF and High Efficiency Inductorless Driver with Internal Switch

Features

- Low Quiescent Current
- Need not Inductor Component
- Internal 500V NMOS Switch
- High Power Factor Application
- Low THD Application
- High Efficiency (up to 85%)
- Feed Forward Compensation
- Programmable LED Current
- Over Temperature Protection
- Support Triac Dimming Function
- Suppot Linear Dimming Function
- RoHS Compliant and 100% Lead (Pb)-Free and Green (Halogen Free with Commercial Standard)

Applications

- LED MR16 and general lighting
- LED E17, E26, E27 lighting
- LED Lamp lighting

General Description

The AP1514 is capable of driving multiple series connected LEDs. The AP1514 sense rectified AC input source voltage to modulate LED current which can in phase input voltage to implement high power factor, low THD (Total Harmonic Distortion) and high efficiency. AP1514 is a high voltage process chip with internal regulator to generate bios voltage for IC internal circuit. AP1514 also has internal power switch to minimize external components.

The AP1514 consists of four switches to modulate output LEDs series numbers and adjust current level to fit input sin wave. The AP1514 also has feed-forward compensation to compensate line voltage variation. The AP1514 has LD/SD serve as shut down controlled by external intelligent control box. The LD/SS also has linear dimming controller interface for DALI control dimming.

The package of AP1514 is TSSOP-16. Which suitable for LED lighting like MR-16, E-17, E27...and so on applications.

Patent Pending

Simplified Application Circuit (4-CH with THD Improvement and FF Solution 1)



Simplified Application Circuit (4-CH with THD Improvement and FF Solution 2)







Ordering Information



Pin Description

Part No.			Pin	Symbol	Pin Description
		_	1	1/01	SW Step-1 reference
Ve1 1		16 Vin	I	V31	voltage
		15 NC	2	VS2	SW Step-2 reference
Vs2 2					voltage
			3	Vcc	Internal Voltage Source
Vcc 3		14 SW0	4/EP	GND	Ground/Export PAD
		13 NC	5	lset	LED Current Setting
	5 EP		6	חפ/חו	Initial Pull High.
Iset 5		12 _{SW1}	0	LD/SD	Power Input/Shut down
			7	FF	Feed Forward
LD/SD 6		11 NC	8	SW3	LED String Switch 3
7		10 0.00	10	SW2	LED String Switch 2
		10 SW2	12	SW1	LED String Switch 1
SW3 8	<u> </u>	9 NC	14	SW0	LED String Switch 0
	-		16	Vin	High Voltage Input
	TSSOP16		9,11,13,15	NC	No Connected

Absolute Maximum Ratings

Paramet	er	Symbol	Ratings	Units
High Voltage Input a Switch	nd LED String	V _{IN} / V _{SW1} / V _{SW2} / V _{SW3}	500	V
IC Regulation Vo	ltage input	V _{cc}	36	V
Switch Curren	t Rating	I _{SW}	0.15	A
Other I/O Pin Voltage		V _{IO}	7	V
Junction Temperature		TJ	+150	C
Power Dissipation	wer Dissipation TSSOP-16 P _D		2000	mW
Operating Ambient Temperature		T _{OPR}	-40 ~ +125	C
Storage Temperature		T _{STG}	-55 ~ +150	C
Lead Temperature (soldering, 10sec)			+260	C

Note :

* The power dissipation values are based on the condition that junction temperature T_J and ambient temperature T_A difference is 100°C.

* Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and function operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum -rated conditions for extended periods may affect device reliability. *Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the recommended operating conditions is not implied. Extended exposure to absolute to the device at the device.

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Electrical Characteristics

Symbol	Parameter	Test Conditions	Min	Тур	Max	Unit
V _{IN}	High voltage input	Vin rising			500	V
V _{cc}	Internal regulation voltage	Vin rising measure V_{CC}		10		V
I _{SET0}	First stan surrant	SW1 turn on; LD/SD>1.02V;		2970/Rset		
	First step current	VS1 < 0.51V				ma
	First stan surrant	SW1 turn on; LD/SD>1.02V;	2070/Dee			m 4
ISET1	First step current	VS1 > 0.51V; VS2<1.02V		2970/RSet		ШA
	Cocord aton ourrent	SW2 turn on; LD/SD>1.02V;	0070/D t			m 4
ISET2	Second step current	VS1 > 1.02V and VS2<1.02V		2970/RSet		ША
	Third stop ourrant	SW2 turn on; LD/SD>1.02V;		0070/D		mA
ISET3		VS1 > 1.02V and VS2>1.02V	2970/Rset			
V ₁	SW1 turn on select level	VS rising measure SW1		0.51		V
V ₂	SW2 turn on select level	VS rising measure SW2		1.02		V
V _{LD(0%)}	0% Linear dimming	V_{LD} falling from 1V to 0V		0.27		V
V _{LD(100%)}	100% Linear dimming	V_{LD} rising from 0.5V to 1.5V		1.02		V
V _{SD}	LD pin shut down voltage	V_{IN} = 12V, V_{SD} rising			0.27	V
V _{FF(5%)}	5% Feed Forward Voltage			0.27		V
V _{FF(10%)}	10% Feed Forward Voltage			0.51		V
V _{FF(15%)}	15% Feed Forward Voltage			0.78		V
V _{FF(20%)}	20% Feed Forward Voltage			1.02		V
T _{TST}	Thermal Shutdown Temperature			150		ĉ
T _{TSH}	Thermal Shutdown Hysteresis			40		C

AP1514 Function Block Diagram



Package Outline

A) TSSOP-16

Case Dimensions

Dimension	mm			Inches		
Dimension	Min	Nom	Max	Min	Nom	Max
Α	4.30	4.40	4.50	0.169	0.173	0.177
В	4.90	5.00	5.10	0.193	0.197	0.201
С	6.40 BSC.		0.252 BSC.			
D	0.19		0.30	0.007		0.012
E		0.65 BSC		0.026 BSC.		
F	0.80	0.90	1.05	0.031	0.035	0.041
G			1.20			0.047
L	0.50	0.60	0.75	0.020	0.024	0.030
L1	1.00 REF.		0.39 REF.			
R	0.09			0.004		
R1	0.09			0.004		
01	0		8	0		8
02	12 REF.		12 REF.			
03	12 REF.		12 REF.			



Detail

Reflow Condition (IR/Convection or VPR Reflow)



Classification Reflow Profiles

Profile Feature	Pb-Free / Green Assembly		
Average ramp-up rate $(T_L \text{ to } T_P)$	3℃/second max		
Preheat	150°C		
- Temperature Min (Tsmin) - Temperature Max (Tsmax)	200℃		
- Time (min to max) (ts)	60-180 seconds		
Time maintained above:	217℃		
- Temperature (T _L) - Time (t _L)	60-150 seconds		
Peak/Classification Temperature (Tp)	See table 1		
Time within 5℃ of actual			
Peak Temperature (tp)	20-40 seconas		
Ramp-down Rate	6℃/second max		
Time 25℃ to Peak Temperature	8 minutes max		

Notes :

1) All temperatures refer to topside of the package.

2) Measured on the body surface.

Classification Reflow Profiles (Continued)

Package Thickness	Volume mm³ <350	Volume mm ³ 350~2000	Volume mm³ ≧2000	
<2.5 mm	260 +0℃*	260 +0℃*	260 +0℃*	
1.6-2.5 mm	260 +0℃*	250 +0℃*	245 +0℃*	
≧2.5 mm	250 +0℃*	245 +0℃*	245 + 0℃*	

Table 1. Pb-free / Green Process – Package Classification Reflow Temperatures

Notes :

* Tolerance: The device manufacturer/supplier shall assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rat ed MSL level.