



## DESCRIPTION

AP2273 combines a dedicated current mode PWM controller. It is optimized for high performance, low standby power, and cost effective off-line flyback converter applications in 40W~60W range.

AP2273 offers complete protection coverage with automatic self-recovery feature including Cycle-by-Cycle current limiting (OCP), SENSE short protection, SENSE floating protection, over load protection (OLP), and  $V_{DD}$  under voltage lockout (UVLO), over temperature protection (OTP), over voltage (fixed or adjustable) protection (OVP).

The tone energy at below 20kHz is minimized in the design and audio noise is eliminated during operation.

The AP2273 is available in SOT-26 package.

## ORDERING INFORMATION

Package Type	Part Number	
SOT-26	E6	AP2273E6R
		AP2273E6VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products Suffix " V " means Halogen free Package		

## FEATURES

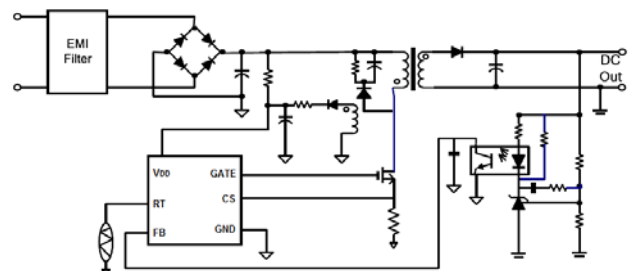
- Power on Soft Start Reducing MOSFET  $V_{DS}$  Stress
- Frequency shuffling for EMI
- Extended Burst Mode Control For Improved Efficiency and Minimum Standby Power Design
- Audio Noise Free Operation
- Fixed 65kHz Switching Frequency
- Internal Synchronized Slope Compensation
- Leading Edge Blanking on Current Sense Input
- Good Protection Coverage With Auto Self Recovery
  - $V_{DD}$  Under Voltage Lockout with Hysteresis(UVLO)
  - Over Temperature Protection (OTP) with auto-recovery
  - Cycle-by-cycle over current threshold setting for constant output power limiting over universal input voltage range
  - Overload Protection (OLP) with auto- recovery
  - Over voltage Protection(OVP) with auto-recovery
  - Adjustable OVP through external Zener
- Available in SOT-26 Package

## APPLICATION

Offline AC/DC flyback converter for

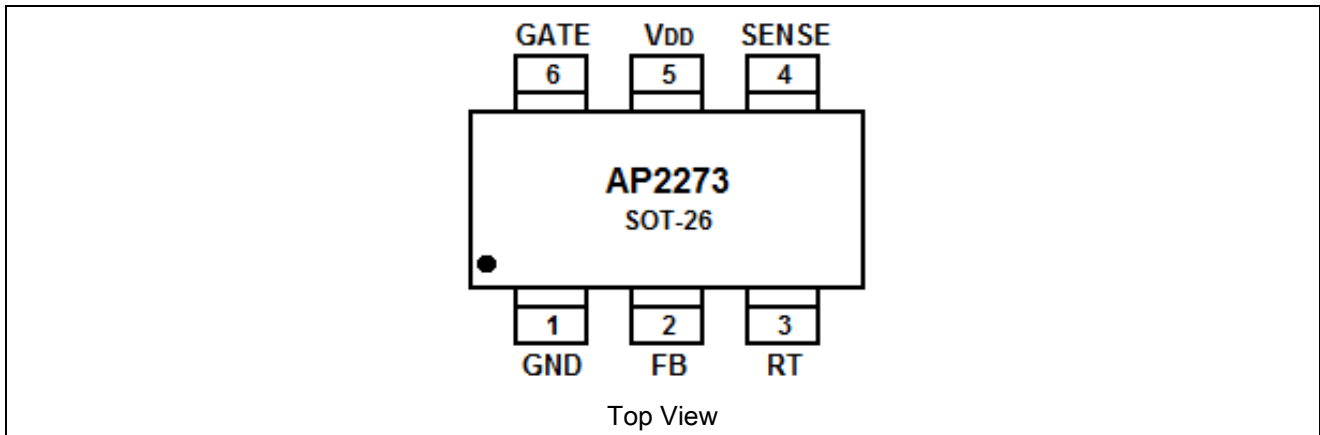
- AC/DC adapter
- PDA power supplies
- Digital Cameras and Camcorder Adapter
- VCR, SVR, STB, DVD&DVCD Player SMPS
- Set-Top Box Power
- Auxiliary Power Supply for PC and Server
- Open-frame SMPS

## TYPICAL APPLICATION





## PIN DESCRIPTION



Pin #	Symbol	I/O	Function
1	GND	P	Ground
2	FB	I	Feedback input pin. The PWM duty cycle is determined by voltage level into this pin and the current-sense signal at Pin 3.
3	RT	I	Dual function pin. Either connected through a NTC resistor to ground for over temperature shutdown/latch control or connected through Zener to $V_{DD}$ for adjustable over voltage protection
4	SENSE	I	Current sense input
5	$V_{DD}$	P	Power Supply
6	GATE	O	Totem-pole gate driver output for power MOSFET



## ABSOLUTE MAXIMUM RATINGS

V <sub>DD</sub> DC Supply Voltage	40V
V <sub>DD</sub> Zener Clamp Voltage <sup>NOTE</sup>	V <sub>DD_Clamp</sub> +0.1V
V <sub>DD</sub> DC Clamp Current	10mA
FB Input Voltage	-0.3V ~ 7V
Sense Input Voltage	-0.3V ~ 7V
RT Input Voltage	-0.3V ~ 7V
T <sub>J</sub> , Min/Max Operating Junction Temperature	-20°C ~ 150°C
T <sub>STG</sub> , Min/Max Storage Temperature	-55°C ~ 160°C

Stress beyond above listed "Absolute Maximum Ratings" may lead permanent damage to the device. These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

NOTE: V<sub>DD\_Clamp</sub> has a nominal value of 32V.

## RECOMMENDED OPERATING CONDITION

Parameter	Symbol	Min.	Max.	Unit
V <sub>DD</sub> Supply Voltage	V <sub>DD</sub>	10	30	V
Operating Ambient Temperature	T <sub>A</sub>	-20	85	°C



## ELECTRICAL CHARACTERISTICS

T<sub>A</sub> = 25°C, V<sub>DD</sub> = 16V, unless otherwise noted

Parameter	Symbol	Conditions	Min.	Typ.	Max	Unit
<b>Supply Voltage (V<sub>DD</sub>)</b>						
V <sub>DD</sub> Startup Current	I start up	V <sub>DD</sub> =11V, Measure Leakage current into V <sub>DD</sub>		5	20	μA
Operation Current	I <sub>V<sub>DD</sub></sub> Operation	V <sub>FB</sub> =3V		2		mA
V <sub>DD</sub> Under Voltage Lockout Enter	UVLO(ON)		8	9	10	V
V <sub>DD</sub> Under Voltage Lockout Exit (Recovery)	UVLO(OFF)		14.3	15.3	16.3	V
Pull-up PMOS active	V <sub>pull-up</sub>			13		V
	V <sub>DD</sub> Clamp	I <sub>V<sub>DD</sub></sub> =10mA	30	32	34	V
Over Voltage Protection Voltage	OVP(ON)	SENSE=0V, FB=3V Ramp up V <sub>DD</sub> until gate clock is off	24	26	28	V
Latch Release Voltage	V <sub>latch_release</sub>			5		V
<b>Feedback Input Section (FB Pin)</b>						
V <sub>FB</sub> Open Loop Voltage	V <sub>FB</sub> _Open		3.9	4.2		V
PWM input gain $\Delta V_{FB} / \Delta V_{SENSE}$	A <sub>vsense</sub>			2		V/V
Max duty cycle @ V <sub>DD</sub> =14V, V <sub>FB</sub> =3V, V <sub>SENSE</sub> =0V	Maximum duty cycle		75	80	85	%
The Threshold Enter Green Mode	V <sub>ref_green</sub>			2		V
The Threshold Exit Burst Mode	V <sub>ref_burst_H</sub>			1.275		V
The Threshold Enter Burst Mode	V <sub>ref_burst_L</sub>			1.175		V
FB pin short circuit current	I <sub>FB</sub> _Short	Short FB pin to GND and measure current		0.4		mA
Power Limiting FB Threshold Voltage	V <sub>TH_PL</sub>			3.7		V
Power limiting Debounce Time	T <sub>D_PL</sub>		80	88	96	ms
Input Impedance	Z <sub>FB_IN</sub>			4		kΩ



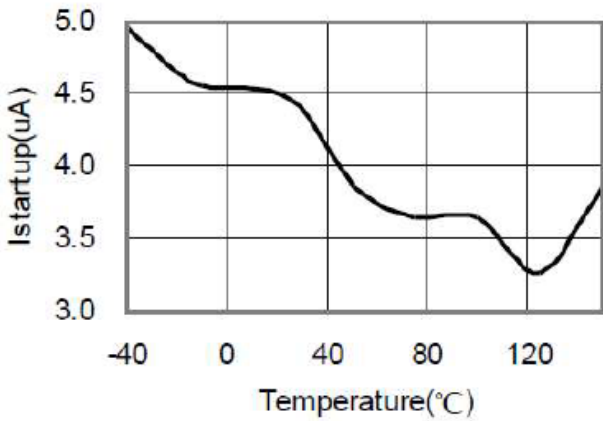
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>Current Sense Input (Sense Pin)</b>						
Soft Start Time				4		ms
Leading Edge Blanking Time	T_ blanking			220		ns
Input Impedance	Z <sub>SENSE_IN</sub>			40		kΩ
Over Current Detection and Control Delay	T <sub>D_OC</sub>	From Over Current occurs till the Gate drive output start to turn off		120		ns
Internal Current Limiting Threshold Voltage	V <sub>TH_OC</sub>	FB=3.3V		0.75		V
SENSE voltage clamper	Vocp_clamper			0.9		V
<b>Oscillator</b>						
Normal Oscillation Frequency	F <sub>osc</sub>	V <sub>DD</sub> =14V, FB=3V, SENSE=0V	60	65	70	kHz
Frequency jittering	Δf <sub>OSC</sub>			+/-4		%
Shuffling frequency	F <sub>shuffling</sub>			32		Hz
Frequency Temperature Stability	Δf <sub>Temp</sub>			1		%
Frequency Voltage Stability	f <sub>VDD</sub>			1		%
Burst Mode Base Frequency	F <sub>Burst</sub>			22		kHz
<b>Gate driver</b>						
Output low level @ V <sub>DD</sub> =14V, I <sub>o</sub> =5mA	V <sub>OL</sub>				1	V
Output high level @ V <sub>DD</sub> =14V, I <sub>o</sub> =20mA	V <sub>OH</sub>		6			V
Output Clamp Voltage	V <sub>clamp</sub>			15		V
Output Rising Time 1V ~ 12V @ C <sub>L</sub> =1000pF	T <sub>r</sub>			175		ns
Output Falling Time 12V ~ 1V @ C <sub>L</sub> =500pF	T <sub>f</sub>			85		ns
<b>Over temperature protection</b>						
Output Current of RT Pin	IRT		95	100	105	uA
Threshold Voltage for OTP	VOTP		0.95	1	1.05	V
OTP Debounce Time	T <sub>d_OTP</sub>			32		Cycle
Float voltage at RT Pin	V <sub>RT_FL</sub>			2.3		V
External OVP Threshold Voltage	V <sub>th_OVP</sub>			4		V



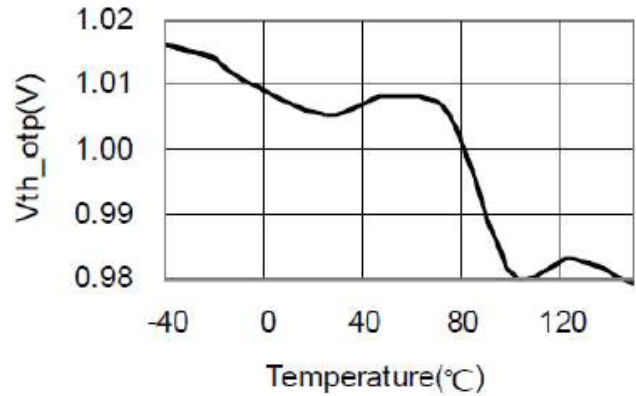
## TYPICAL PERFORMANCE CHARACTERISTICS

$V_{DD} = 18V$ ,  $T_A = 25^\circ C$  condition applies if not otherwise noted.

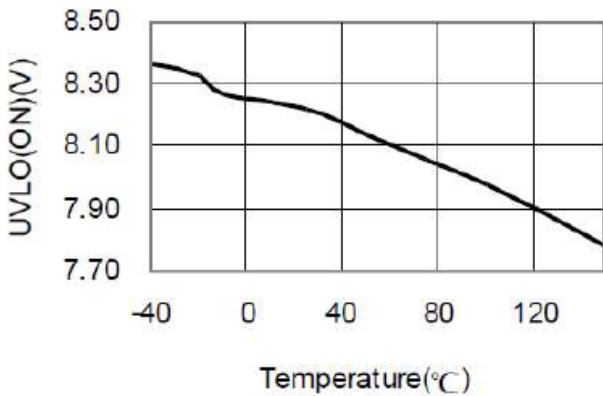
1.  $I_{startup}(uA)$  vs. Temperature( $^\circ C$ )



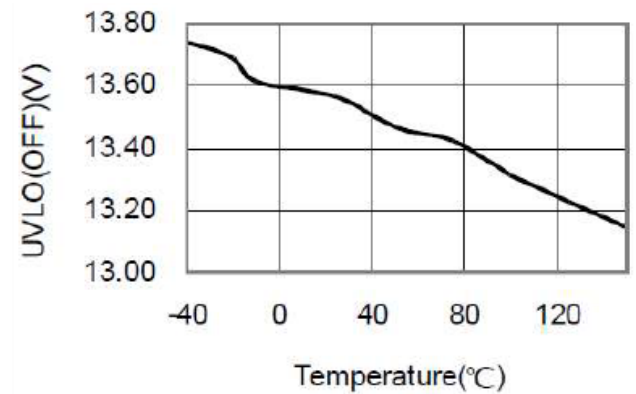
2.  $V_{th\_otp}(V)$  vs. Temperature( $^\circ C$ )



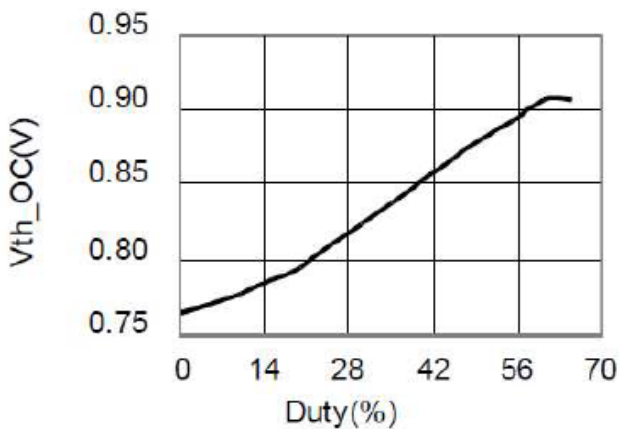
3.  $UVLO(ON)(V)$  vs. Temperature( $^\circ C$ )



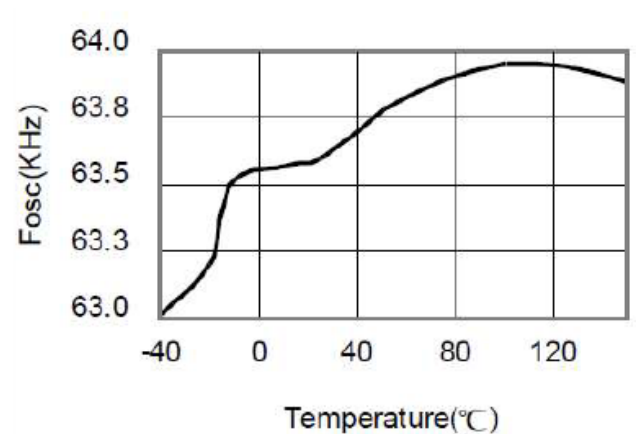
4.  $UVLO(OFF)(V)$  vs. Temperature( $^\circ C$ )



5.  $V_{th\_OC}(V)$  vs. Duty(%)

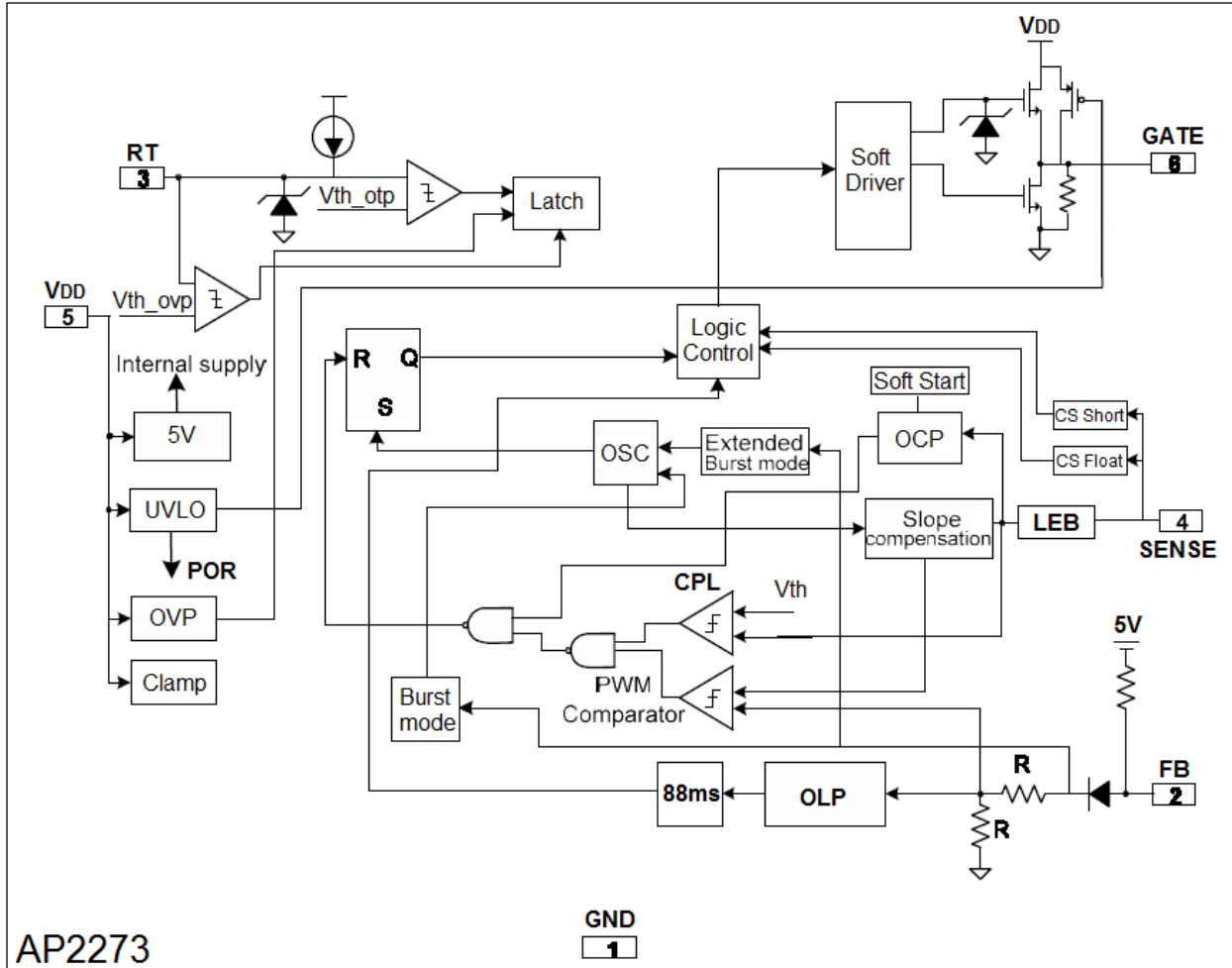


6.  $F_{osc}(kHz)$  vs. Temperature( $^\circ C$ )





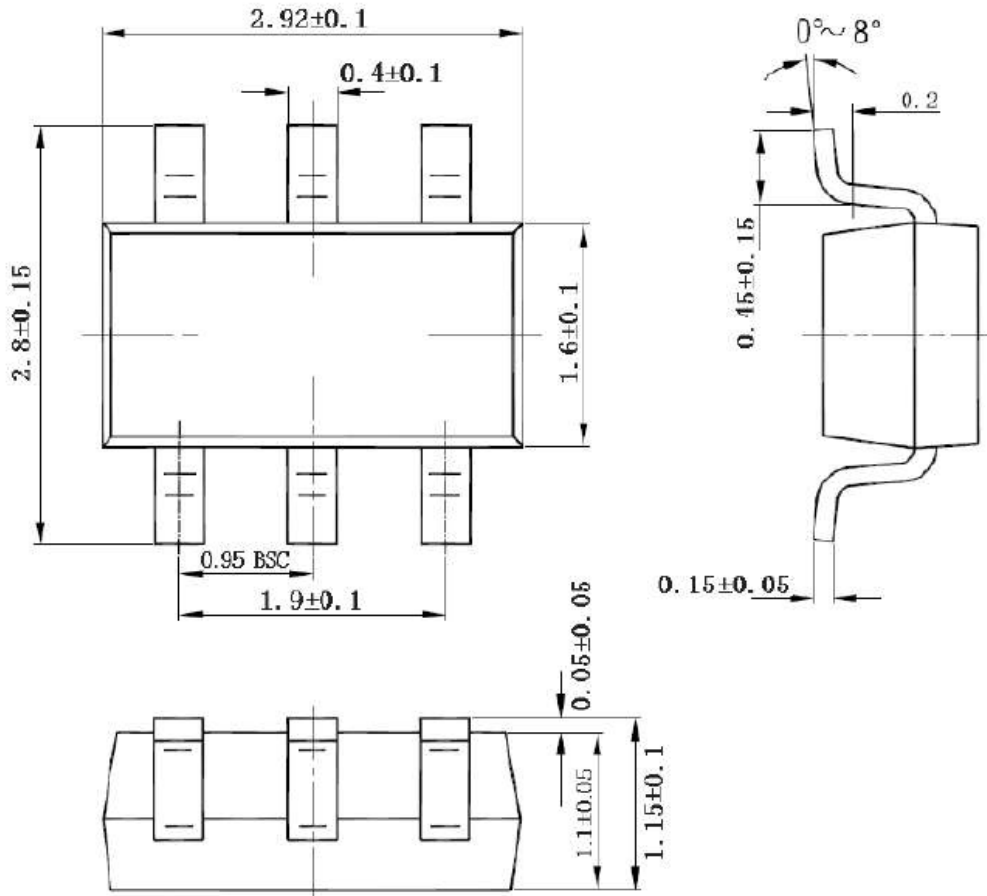
**BLOCK DIAGRAM**





## PACKAGE INFORMATION

Dimension in SOT-26 (Unit: mm)







## IMPORTANT NOTICE

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