Single Stage Primary Side Regulation PFC Controller For LED Driver AP1682

General Description

The AP1682 is a high performance AC/DC universal input Primary Side Regulation Power Factor Controller for LED driver applications. The device uses Pulse Frequency Modulation (PFM) technology to regulate output current while achieving high power factor and low THD.

The AP1682 provides accurate constant current (CC) regulation while removing the opto-coupler and secondary control circuitry. It also eliminates the need of loop compensation circuitry while maintaining stability. The AP1682 achieves excellent regulation and high efficiency, yet meets the requirement of IEC61000-3-2 harmonic standard.

The AP1682 features low start-up current, low operation current and high efficiency. It also has rich protection features including over voltage, short circuit, over current, over temperature protection etc.

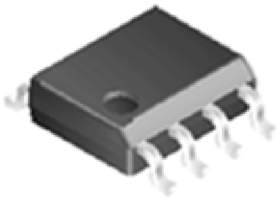
The AP1682 is available in SOIC-8 package.

Features

- Primary Side Control for Output Current Regulation Without Opto-coupler and Secondary CV/CC Control Circuitry
- Low Start-up Current
- High Power Factor and Low THD for Universal Input Range
- Tight CC Regulation Performance for Universal Input Mains Voltage Range
- Eliminates Control Loop Compensation Circuitry
- Built-in Acceleration Start
- Open-load and Reload Detection
- Over Voltage and Short Circuit Protection
- Over Temperature Protection
- Over Current Protection
- Cost Effective Total PFC LED Driver Solution

Applications

- Single Stage Power Factor Correction Power Supply for LED Lighting



SOIC-8

Figure 1. Package Type of AP1682

Pin Configuration

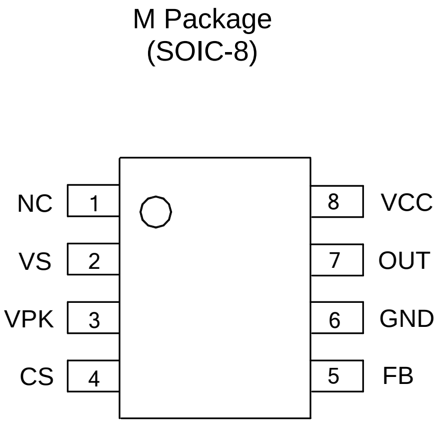


Figure 2. Pin Configuration of AP1682 (Top View)

Pin Description

Pin Number	Pin Name	Function
1	NC	No connection
2	VS	The rectified input voltage sensing pin. The pin is detecting the instantaneous rectified sine waveform of input voltage
3	VPK	The rectified input voltage peak value sensing pin. The pin is detecting the rectified sine waveform peak value of input voltage
4	CS	Primary current sensing
5	FB	This pin captures the feedback voltage from the auxiliary winding. FB voltage is used to control no load output voltage and determine acceleration stop point at start-up phase
6	GND	Ground. Current return for gate driver and control circuits of the IC
7	OUT	Gate driver output
8	VCC	Supply voltage of gate driver and control circuits of the IC

Functional Block Diagram

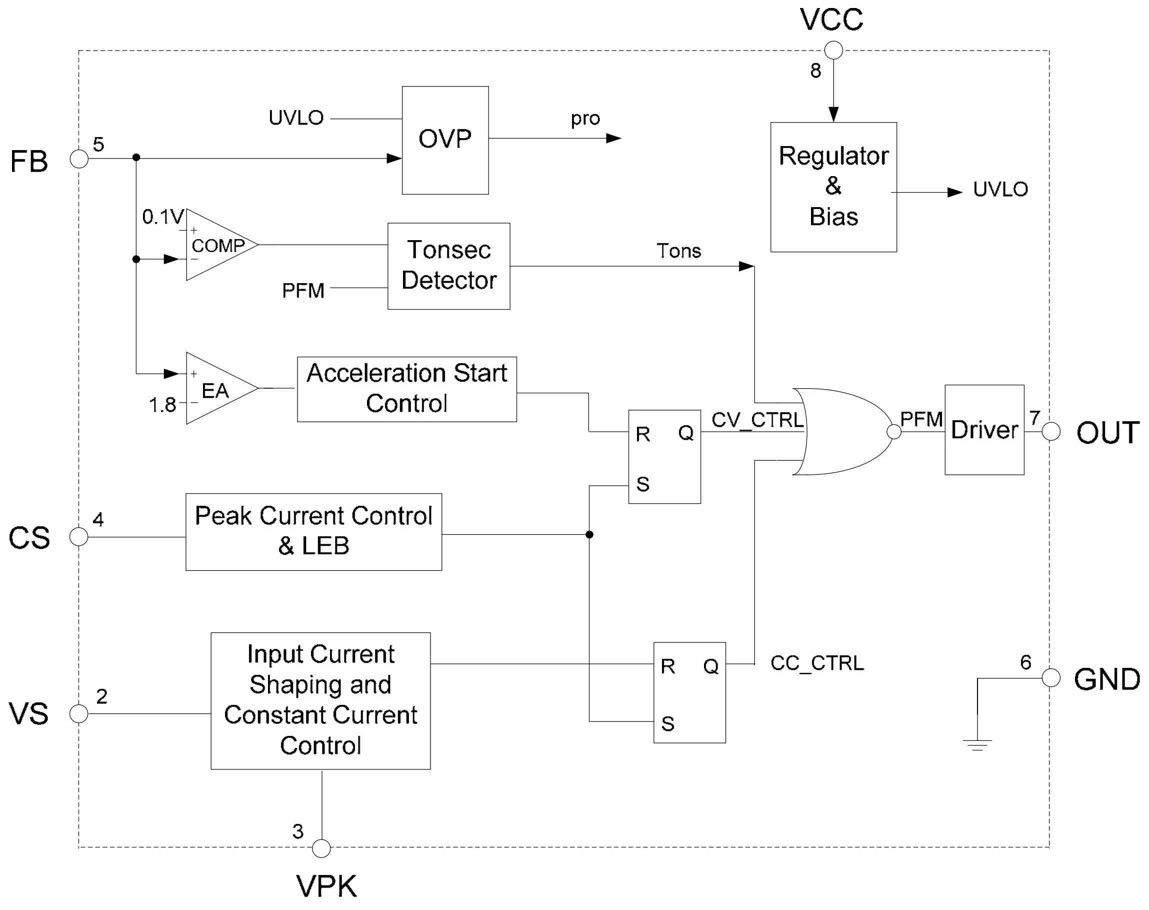
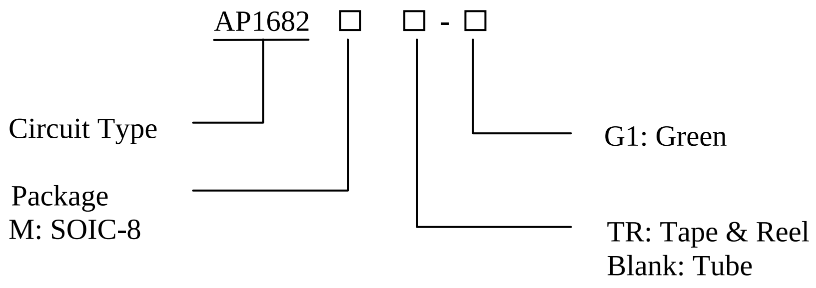


Figure 3. Functional Block Diagram of AP1682

Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOIC-8	-40 to 105°C	AP1682M-G1	1682M-G1	Tube
		AP1682MTR-G1	1682M-G1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	-0.3 to 30	V
Driver Output Current	I_{OUT}	300	mA
Voltage at VS, VPK, CS	V_{VS}, V_{PK}, V_{CS}	-0.3 to 7	V
FB Input Voltage	V_{FB}	-40 to 10	V
Operating Junction Temperature	T_J	150	ºC
Storage Temperature	T_{STG}	-65 to 150	ºC
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	300	ºC
Power Dissipation at T_A=50°C	P_D	0.65	W
Thermal Resistance (Junction-to-Ambient)	θ_{JA}	190	°C/W
ESD (Machine Model)		200	V
ESD (Human Body Model)		3000	V

Note 1: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Power Supply Voltage	V_{CC}	9	21	V
Ambient Temperature	T_A	-40	105	ºC

Electrical Characteristics

V_{CC} =15V, T_A=25°C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
UVLO Section						
Start-up Threshold	V_{TH} (ST)		18	19	20	V
Minimal Operating Voltage	V_{OPR} (Min)	After turn on	7	8	9	
VCC OVP Voltage	V_{CC_OVP}		28	32	36	
Standby Current Section						
Start-up Current	I_{ST}	V_{CC}=V_{TH} (ST)-0.5V, Before start up			20	μA
Maximum Operating Current	I_{CC} (Max)	V_{VS}=V_{PK}=3V		1000	1300	
Drive Output Section						
Output High Level Voltage	V_{OH}	$I_{GD\text{-}SOURCE}$=20mA V_{CC}=12V	10			V
Output Low Level Voltage	V_{OL}	$I_{GD\text{-}SINK}$=20mA V_{CC}=12V			1	V
Output Voltage Rise Time	t_R	C_L=1nF	100	140	190	ns
Output Voltage Fall Time	t_F	C_L=1nF	30	60	90	ns
Output Clamp Voltage	$V_{O\text{-}CLAMP}$	$I_{GD\text{-}SOURCE}$=5mA V_{CC}=20V	12	13.5	15	V
UVLO Saturation Voltage	V_{UVLO}	V_{CC}=0 to $V_{CC\text{-}ON}$ I_{SINK}=10mA			1.1	V
VS Input Section						
Maximum Ratio	V_{VS}/V_{PK} (Max)	V_{VS}=V_{PK}=3V	0.8	1	1.2	V
Minimum Ratio	V_{VS}/V_{PK} (Min)	V_{VS}=0V, V_{PK}=3V			0.2	V
Current Sense Section						
Minimum On Time	t_{ON} (Min)		500	750	1000	ns
Short Circuit Protection Voltage	V_{SOCP}		3	4		V
Feedback Input Section						
FB Pin Input Leakage Current	I_{FB}	V_{FB}=4V		2	8	μA
Acceleration Start Threshold	V_{FB} (ACC)		1.4	1.8	2.2	V
CV Threshold	V_{FB} (CV)		3.2	4.2	5.2	V
Over Voltage Protection	V_{FB} (OVP)		4.5	6	7.5	V
Over Temperature Protection Section						
Shutdown Temperature				140		°C
Temperature Hysteresis				20		°C

Typical Performance Characteristics

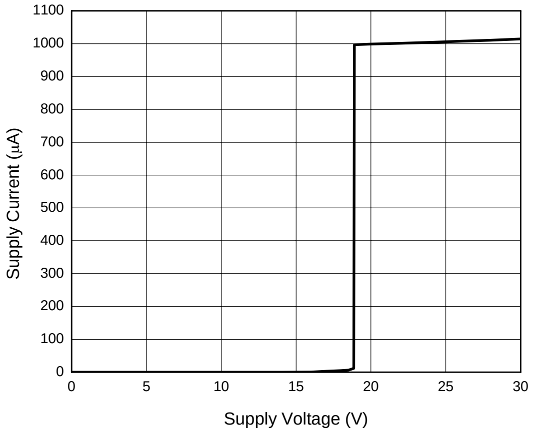


Figure 4. Supply Current vs. Supply Voltage

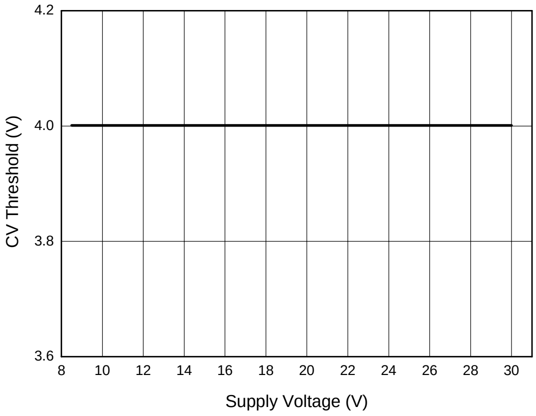


Figure 5. CV Threshold Vs. Supply Voltage

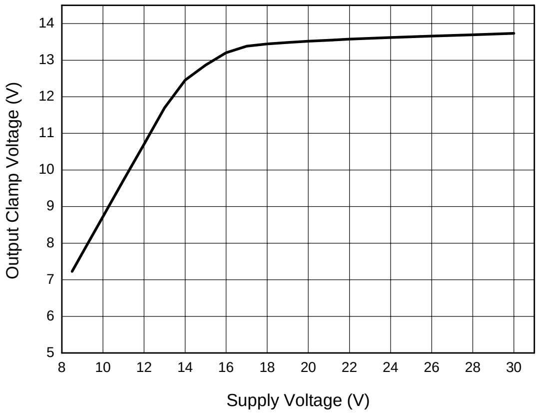


Figure 6. Output Clamp Voltage vs.
Supply Voltage

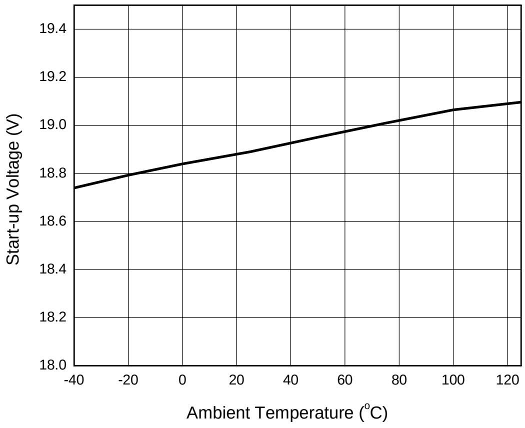


Figure 7. Start-up Voltage vs.
Ambient Temperature

Typical Performance Characteristics (Continued)

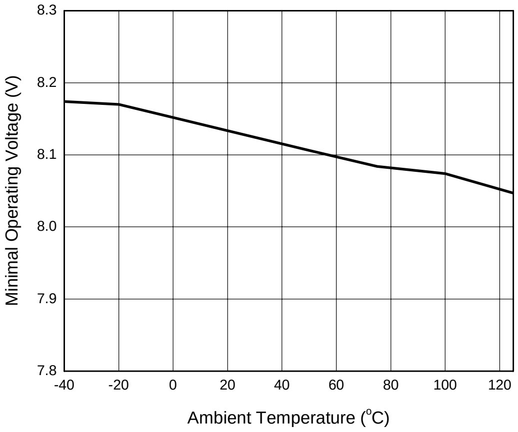


Figure 8. Minimal Operating Voltage vs. Ambient Temperature

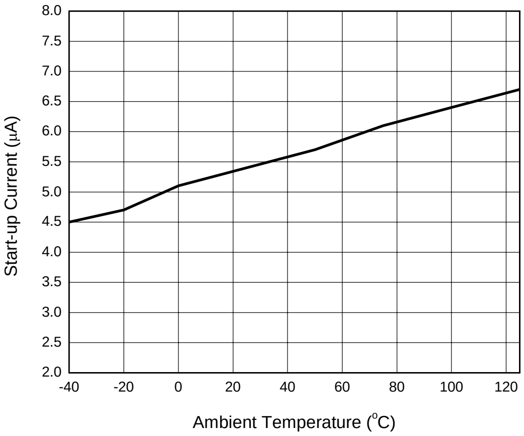


Figure 9. Start-up Current vs. Ambient Temperature

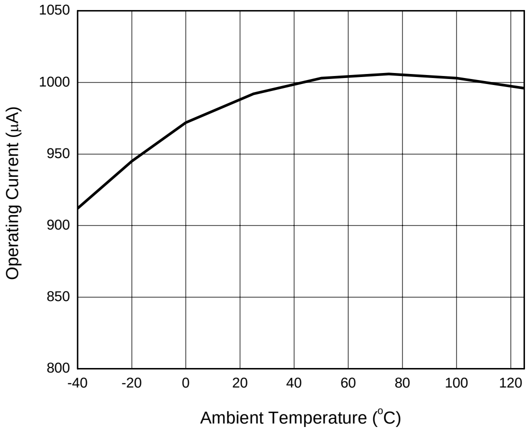


Figure 10. Operating Current vs. Ambient Temperature

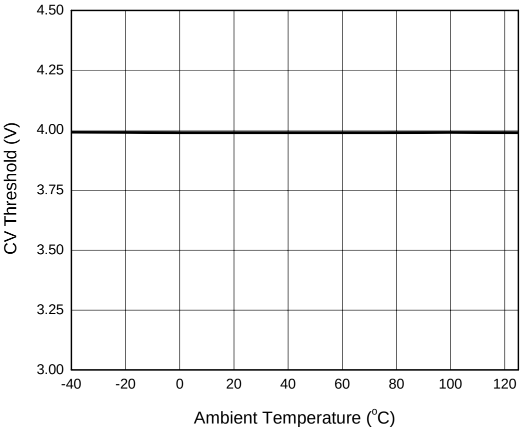


Figure 11. CV Threshold Vs. Ambient Temperature

Typical Performance Characteristics (Continued)

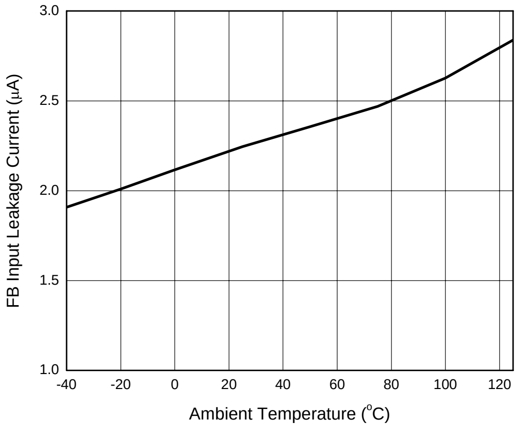


Figure 12. FB Input Leakage Current vs. Ambient Temperature

Typical Application

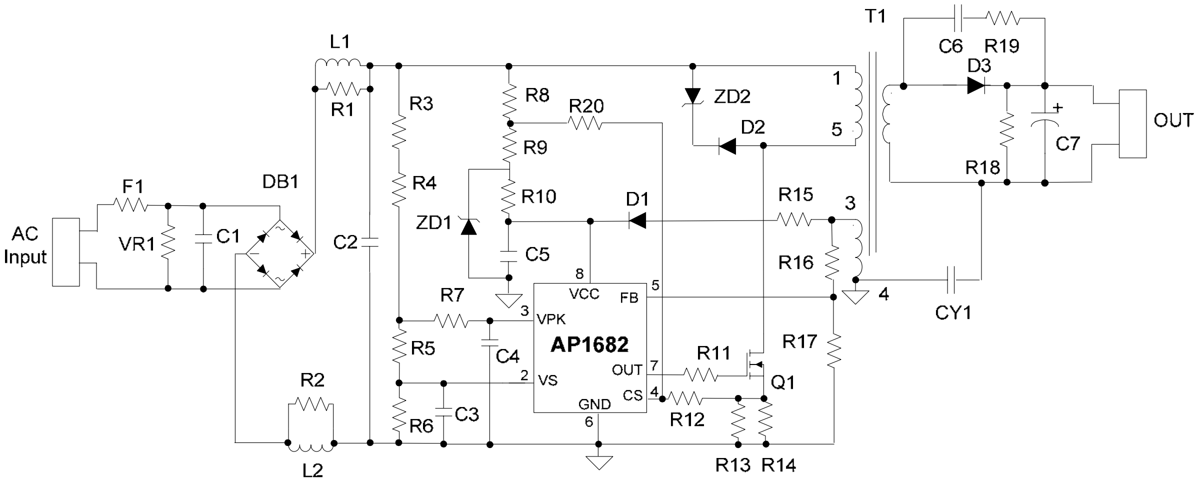
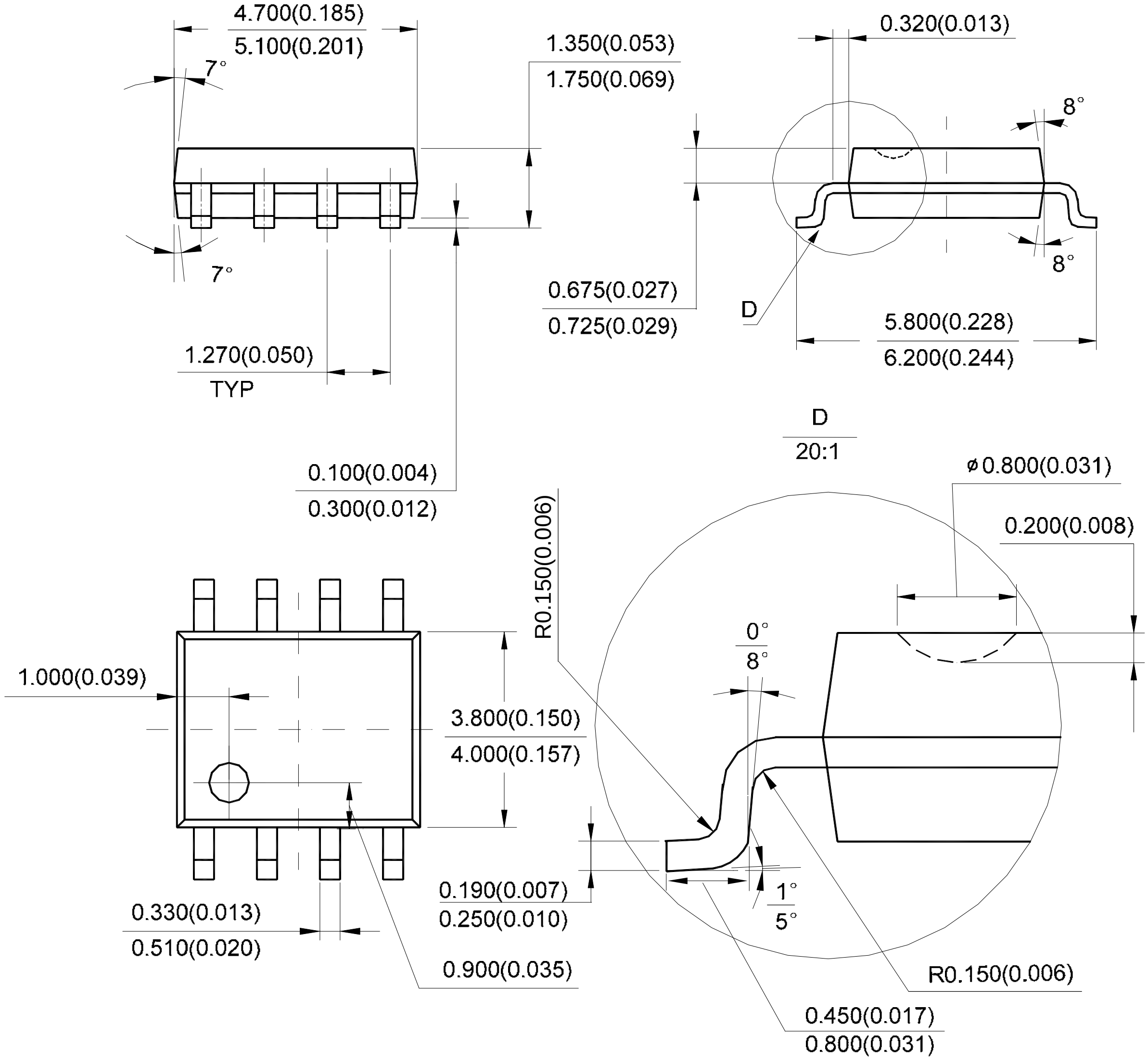


Figure 13. Typical Application of AP1682

Mechanical Dimensions

SOIC-8 **Unit: mm(inch)**



Note: Eject hole, oriented hole and mold mark is optional.

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