IS31AP2036

HIGH EFFICIENCY, CLASS-K AUDIO POWER AMPLIFIER WITH INTEGRATED CHARGE PUMP CONVERTER

Advanced Information

January 2014

GENERAL DESCRIPTION

The IS31AP2036 is a Class-K audio power amplifier with high efficiency and automatic gain control. It drives up to 2.0W (10% THD+N) into an 8Ω speaker from a 4.2V V_{CC} supply.

The IS31AP2036 integrates advanced K-charge pump which increases efficiency up to 92% and whole power amplifier efficiency to 75%. The output power will be maintained in 0.8W, 1.0W and 1.2W.

The IS31AP2036 provides low cost, space saving solution for portable equipments which need audio output with higher power by boosting up supply voltage. Its external components just include a few capacitors and resistors (no inductor).

The IS31AP2036 use fully differential design to reduce RF noise. The IS31AP2036 integrates de-pop circuitry to reduce pop and click noise during power on/off or shutdown enable operation. The IS31AP2036 also integrates thermal and short circuit protection function.

IS31AP2036 is available in FC-16 (2mm × 2mm) package. It operates from 3.0V to 5.0V over the temperature range of -40°C to +85°C.

FEATURES

- Operates from 3.0V to 5.0V
- Advanced K-charge pump technology, efficiency up to 92%
- Low EMI
- -65dB (217Hz) high PSRR
- 0.2% low THD+N
- New AGC function
- Pulse Count Control serial interface
- Output power in 0.8W, 1W and 1.2W levels
- Thermal and short-circuit protection
- Integrated Click-and-Pop suppression circuitry
- Available in FC-16 (2mm × 2mm) package

APPLICATIONS

- Smart phones
- Cellular phones
- PDAs
- GPS
- Portable electronics

TYPICAL APPLICATION CIRCUIT

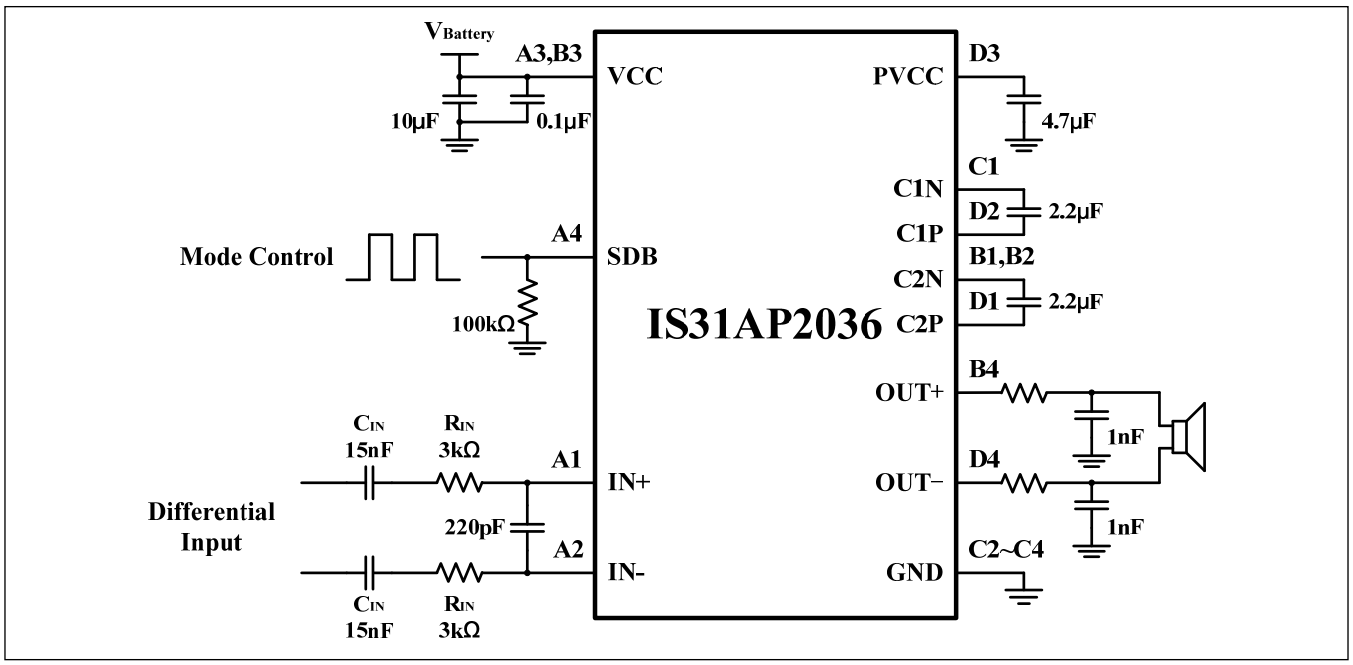


Figure 1 Typical Application Circuit (Differential Input)

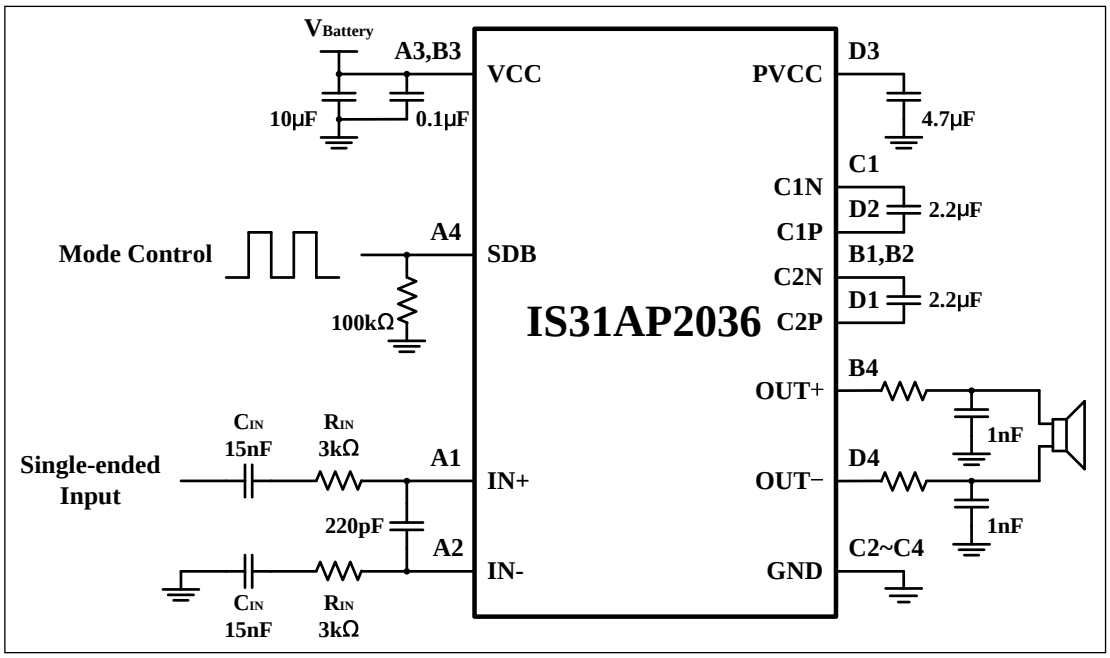
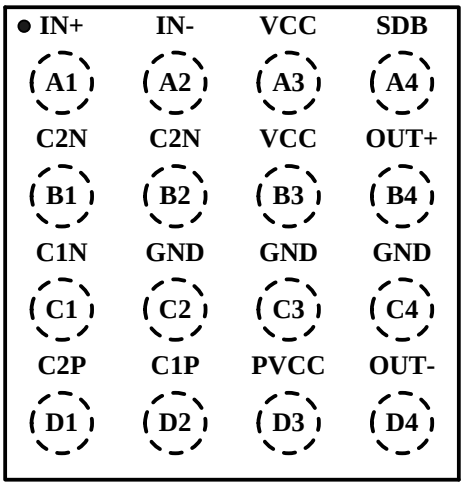


Figure 2 Typical Application Circuit (Single-ended Input)

PIN CONFIGURATION

Package	Pin Configuration (Top View)
FC-16	

PIN DESCRIPTION

No.	Pin	Description
A1	IN+	Positive audio input.
A2	IN-	Negative audio input.
A3, B3	VCC	Power supply.
A4	SDB	Shutdown pin. Active low.
B1, B2	C2N	Negative input for external flying cap 2.
B4	OUT+	Positive audio output.
C1	C1N	Negative input for external flying cap 1.
C2~C4	GND	Amplifier supply voltage.
D1	C2P	Positive input for external flying cap 2.
D2	C1P	Positive input for external flying cap 1.
D3	PVCC	Charge pump output voltage.
D4	OUT-	Negative audio output.

ORDERING INFORMATION (TBD)
INDUSTRIAL RANGE: -40°C TO +85°C

Order Part No.	Package	QTY/Reel
IS31AP2036-xxLS2-TR	FC-16, Lead-free	2500

ABSOLUTE MAXIMUM RATINGS

Supply voltage, V_{CC}	−0.3V ~ +6.0V
Voltage at IN+ and IN- pins	−0.3V ~ V_{CC}+0.3V
Maximum junction temperature, T_{JMAX}	125°C
Storage temperature range, T_{STG}	−65°C ~ +150°C
Operating temperature range, T_A	−40°C ~ +85°C
Thermal resistance, junction to ambient, $R_{\theta JA}$	69°C/W
ESD (HBM) ESD (CDM)	TBD TBD

Note:
Stresses beyond 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 condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC CHARACTERISTICS (TBD)

T_A = 25°C, V_{CC} = 3.0V ~ 5.0V, unless otherwise noted. Typical value are T_A = 25°C, V_{CC} = 3.6V.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage		3.0		5.0	V
I_{CC}	Quiescent current	V_{CC} = 3.6V, no load, no input		9.5		mA
I_{SD}	Shutdown current	V_{CC} =3.6V, V_{SDB} = 0V			1	μA
f_{OSC}	Clock frequency	V_{CC} = 2.5V~4.5V	600	800	1000	kHz
A_V	Output gain	R_{IN} = 3kΩ		16.3		V/V
t_{ON}	Turn on time			40		ms
$\|V_{OS}\|$	Output offset voltage	V_{CC} = 2.5V~4.5V, no input	-30	0	30	mV
R_{INT}	Internal input resistor			16.5		kΩ
V_{IH}	Input logic high voltage		1.3		V_{CC}	V
V_{IL}	Input logic low voltage		0		0.35	V
T_{AGC}	Thermal AGC threshold temperature			150		°C
T_{AGC_HYS}	Thermal AGC hysteresis temperature			20		°C
T_{OTP}	Over temperature protection	*(Note 1)*		160		°C
T_{TOP_HYS}	Hysteresis temperature	*(Note 1)*		30		°C
K-Charge Pump						
PV_{CC}	Charge pump output voltage	V_{CC} = 3.0V~3.8V		1.5V_{CC}		V
		V_{CC} >3.8V		5.8		V
V_{HYS}	OVP hysteresis voltage	V_{CC} >3.8V		50		mV
η	Efficiency	V_{CC} = 4.2V		92		%
t_{ST}	Soft start time	C_{OUT} = 4.7μF, no load	1.0	1.2	1.4	ms
I_L	PVCC short to GND limit current			350		mA

AC CHARACTERISTICS *(Note 1)*

T_A = 25°C, V_{CC} = 3.6V, unless otherwise noted.

Symbol	Parameter	Condition		Min.	Typ.	Max.	Unit
Po	Output power, Mode 4	THD+N = 10%, f = 1kHz R_L = 8Ω+33μH	V_{CC} = 3.6V		1.5		W
			V_{CC} = 4.2V		2.0		
		THD+N = 1%, f = 1kHz R_L = 8Ω+33μH	V_{CC} = 3.6V		1.23		
			V_{CC} = 4.2V		1.65		
P_{NCN}	NCN output power	V_{CC} = 4.2V, R_L = 8Ω+33μH, THD+N = 0.25%	Mode 1		1.2		W
			Mode 2		1.0		
			Mode 3		0.8		
THD+N	Total harmonic distortion plus noise	V_{CC} = 4.2V, P_O = 1W, R_L = 8Ω+33μH f = 1kHz, Mode 1			0.2		%
		V_{CC} = 4.2V, P_O = 1.2W, R_L = 8Ω+33μH f = 1kHz, Mode 4			0.2		
t_{WU}	Wake-up time from shutdown				40		ms
η	Efficiency	V_{CC} = 4.2V, P_O = 1.2W, R_L = 8Ω			75		%
PSRR	Power supply rejection ratio	V_{CC} = 4.2V, V_{P-P} = 200mV, R_L = 8Ω, f = 217Hz		-53	-65		dB
		V_{CC} = 4.2V, V_{P-P} = 200mV, R_L = 8Ω, f = 1kHz		-53	-65		
NCN							
t_{AT}	Attack time				40		ms
t_{RL}	Release time				1.2		s
A_{max}	Max attenuation gain				-13.5		dB
Pulse Count Control							
t_L	Mode control low time	V_{CC} = 2.5V~4.5V		0.75	2	10	μs
t_H	Mode control high time	V_{CC} = 2.5V~4.5V		0.75	2	10	μs
t_{LAT}	Mode latch up time	V_{CC} = 2.5V~4.5V		150		500	μs
t_{OFF}	Shutdown time	V_{CC} = 2.5V~4.5V		150		500	μs

Note 1: Guaranteed by design.

CLASSIFICATION REFLOW PROFILES

Profile Feature	Pb-Free Assembly
Preheat & Soak Temperature min (Tsmin) Temperature max (Tsmax) Time (Tsmin to Tsmax) (ts)	150°C 200°C 60-120 seconds
Average ramp-up rate (Tsmax to Tp)	3°C/second max.
Liquidous temperature (TL) Time at liquidous (tL)	217°C 60-150 seconds
Peak package body temperature (Tp)*	Max 260°C
Time (tp)** within 5°C of the specified classification temperature (Tc)	Max 30 seconds
Average ramp-down rate (Tp to Tsmax)	6°C/second max.
Time 25°C to peak temperature	8 minutes max.

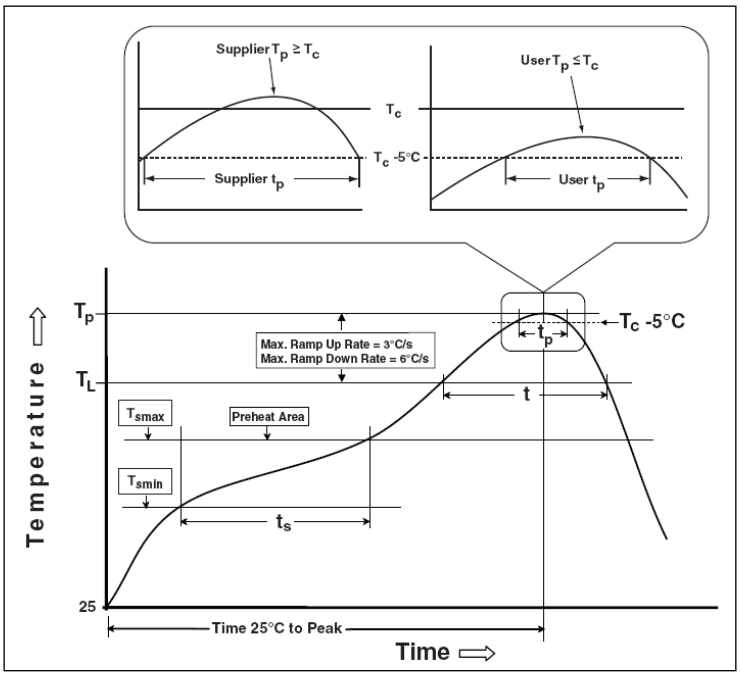
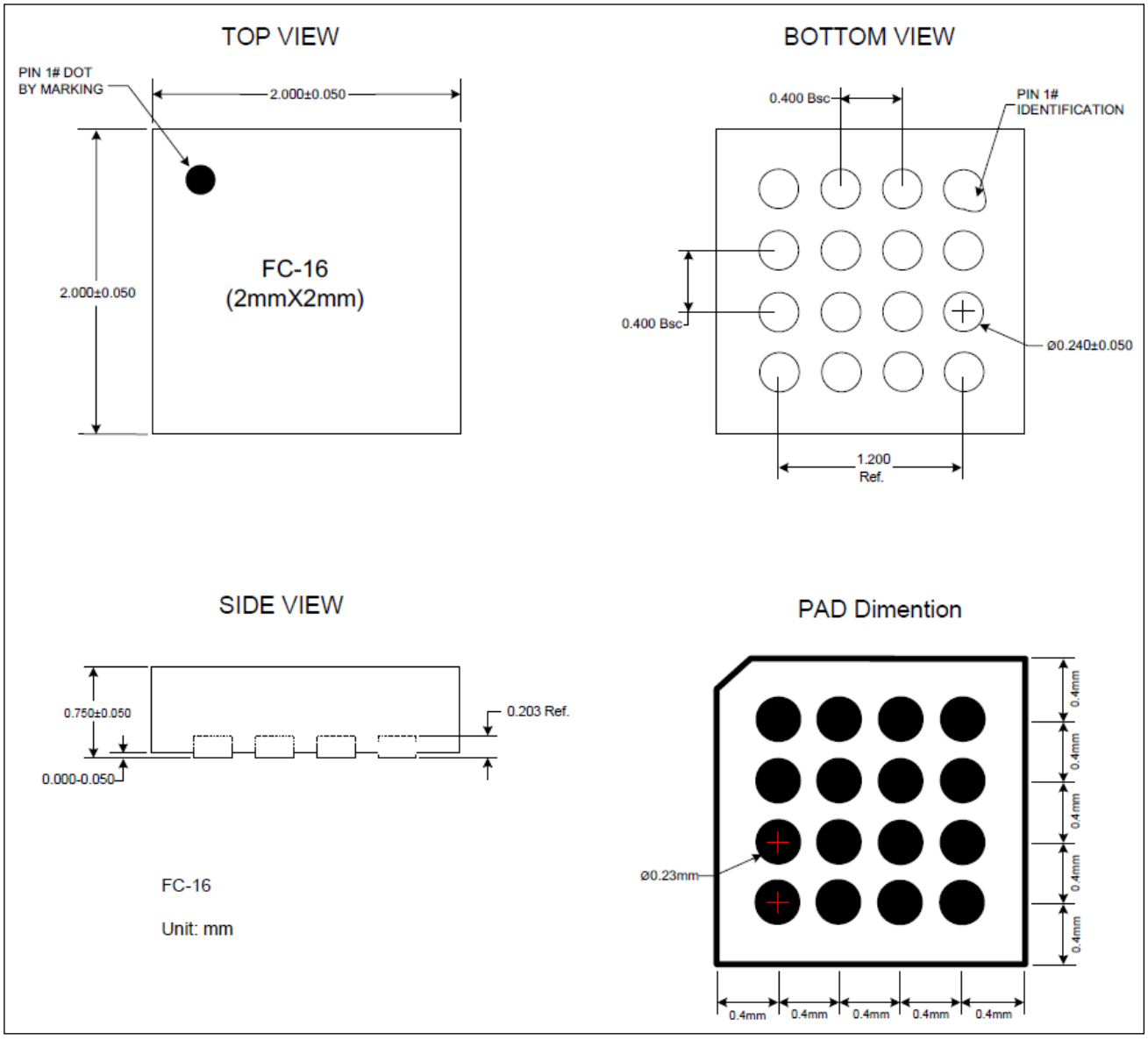


Figure 13 Classification Profile

PACKAGE INFORMATION

FC-16 (TBD)



Note: All dimensions in millimeters unless otherwise stated.