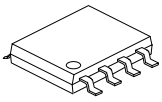
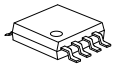
DPA5V3F

CMOS IC

2.8W FILTER-FREE MONO CLASS D AUDIO POWER AMPLIFIER



SOP-8



MSOP-8

■ DESCRIPTION

The UTC **DPA5V3F** is a differential class-D BTL power amplifier. It can drive up to 2.2W into a 4Ω load and 1.4W into an 8Ω load at 5V. It achieves outstanding efficiency (88% typ.) compared to standard AB-class audio amps.

The gain of the device can be controlled via two external gain setting resistors. Pop & click reduction circuitry provides low on/off switch noise while allowing the device to start within 10ms. A standby function (active low) enables the current consumption to be reduced to 10nA typical.

■ FEATURES

* Operating from V_{CC}=2.4V~5.5V
* Standby mode active low
* Low current consumption 2.5mA at 3V
* Adjustable gain via external resistors
* Output power: 2.8W into 4Ω and 1.7W into 8Ω with 10% THD+N maximum and 5 V power supply
* Output power: 2.2W at 5V or 0.7W at 3.0V into 4Ω with 1% THD+N maximum
* Output power: 1.4W at 5V or 0.5W at 3.0V into 8Ω with 1% THD+N maximum
* PWM base frequency: 330kHz
* Efficiency: 88% typical
* Signal to noise ratio: 85dB typical
* PSRR: 63dB typical at 217Hz with 6dB gain
* Low pop & click noise

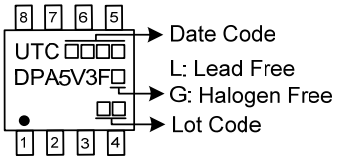
■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
DPA5V3FL-S08-R	DPA5V3FG-S08-R	SOP-8	Tape Reel
DPA5V3FL-SM1-R	DPA5V3FG-SM1-R	MSOP-8	Tape Reel

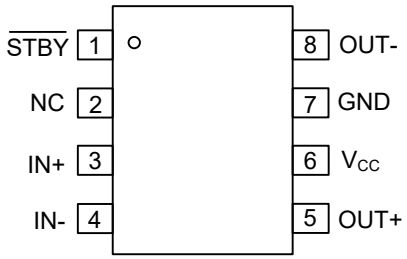
DPA5V3FG-S08-R
- (1)Packing Type
- (2)Packing Type
- (3)Green Package

(1) R: Tape Reel
(2) S08: SOP-8, SM1: MSOP-8
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



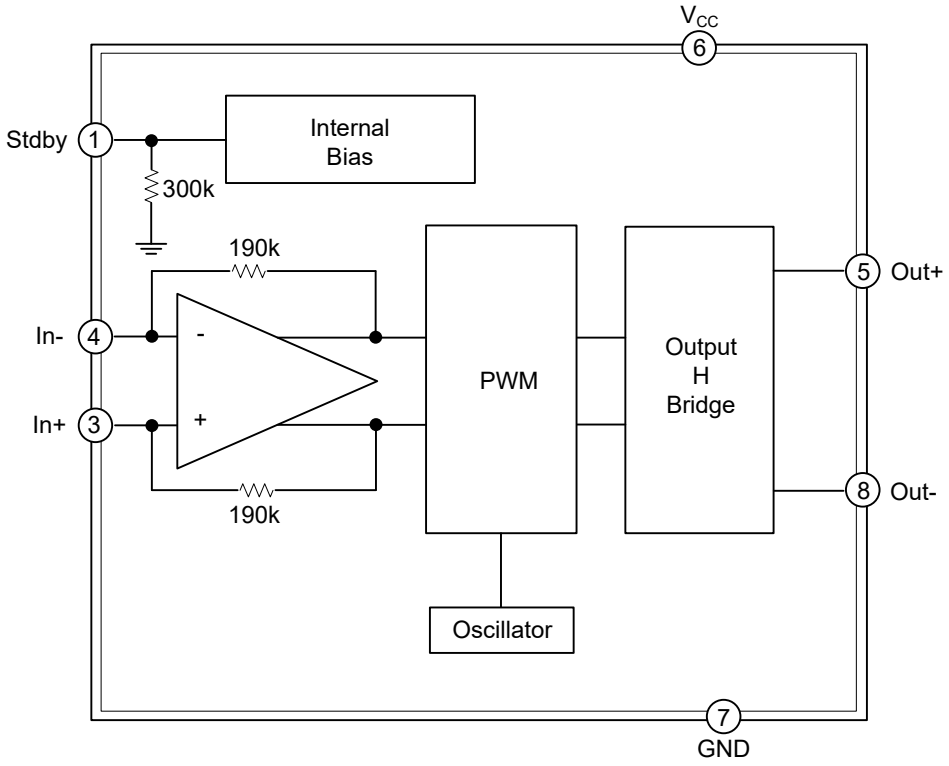
■ PIN CONFIGURATION



■ PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	STBY	Standby input pin (active low)
2	NC	No internal connection pin
3	IN+	Positive input pin
4	IN-	Negative input pin
5	OUT+	Positive output pin
6	V_{CC}	Power supply input pin
7	GND	Ground input pin
8	OUT-	Negative output pin

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage (Note 2, 3)	V_{CC}	6	V
Input Voltage (Note 4)	V_{IN}	GND ~ V_{CC}	V
Power Dissipation	P_D	Internally Limited (Note 4)	
Standby Pin Maximum Voltage (Note 6)	V_{STBY}	GND ~ V_{CC}	V
Maximum Junction Temperature	T_J	150	°C
Operating Free Air Temperature Range	T_{OPR}	-40 ~ +85	°C
Storage Temperature	T_{STG}	-65 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Caution: this device is not protected in the event of abnormal operating conditions such as short-circuiting between any one output pin and ground or between any one output pin and V_{CC}, and between individual output pins.
3. All voltage values are measured with respect to the ground pin.
4. The magnitude of the input signal must never exceed V_{CC} + 0.3V/GND - 0.3V.
5. Exceeding the power derating curves during a long period will provoke abnormal operation.
6. The magnitude of the standby signal must never exceed V_{CC}+ 0.3V/GND -0.3V.

■ OPERATING CONDITIONS

PARAMETER		SYMBOL	VALUE	UNIT
Supply Voltage (Note 1)		V_{CC}	2.4 ~ 5.5	V
Common Mode Input Voltage Range (Note 2)		V_{IC}	0.5 ~ V_{CC}-0.8	V
Standby Voltage Input (Note 3)	Device ON	V_{STBY}	1.4 ≤ V_{STBY} ≤ V_{CC}	V
	Device OFF		GND ≤ V_{STBY} ≤ 0.4 (Note 4)	V
Load Resistor		R_L	≥ 4	Ω

Notes: 1. For V_{CC} between 2.4V and 2.5V, the operating temperature range is reduced to 0°C ≤ T_A ≤70°C.
2. For V_{CC} between 2.4V and 2.5V, the common mode input range must be set at V_{CC}/2.
3. Without any signal on V_{STBY}, the device will be in standby.
4. Minimum current consumption is obtained when V_{STBY}=GND.

■ ELECTRICAL CHARACTERISTICS

(V_{CC}=+5V, with GND=0V, V_{icm}=2.5V, and T_A=25°C unless otherwise specified)

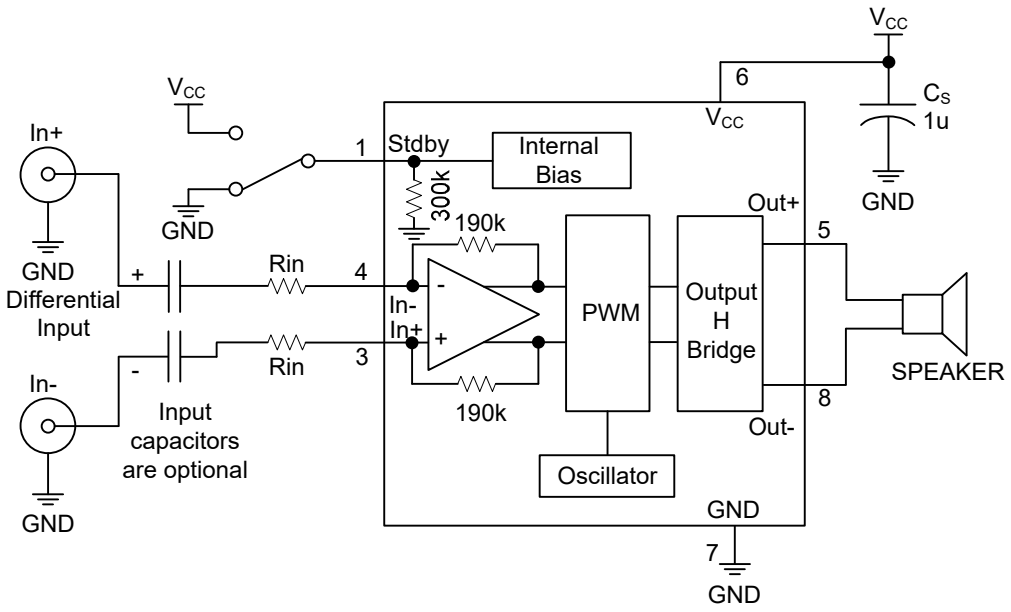
PARAMETER	SYMBOL	TEST CONDITIONS			MIN	TYP	MAX	UNIT
Supply Current	I_{CC}	No Input Signal, No Load		+5V		3.5	5.4	mA
				+4.2V		3.1	5.2	mA
				+3.6V		2.9	5.0	mA
				+3.0V		2.5	4.8	mA
				+2.5V		2.1	4.6	mA
				+2.4V		2.1		mA
Standby Current (Note 1)	I_{STBY}	No Input Signal, V_{STBY}=GND				10	1000	nA
Output Offset Voltage	V_{OO}	No Input Signal, R_L=8Ω				3		mV
Output Power	P_{OUT}	THD=1% max, G=6dB f =1kHz, R_L=4Ω		V_{CC}=5V		2.2		W
				V_{CC}=4.2V		1.5		W
				V_{CC}=3.6V		1.1		W
				V_{CC}=3.0V		0.7		W
				V_{CC}=2.5V		0.5		W
				V_{CC}=2.4V		0.42		W
		THD=10% max, G=6dB f=1kHz, R_L=4Ω		V_{CC}=5V		2.8		W
				V_{CC}=4.2V		1.95		W
				V_{CC}=3.6V		1.4		W
				V_{CC}=3.0V		1		W
				V_{CC}=2.5V		0.65		W
				V_{CC}=2.4V		0.61		W
		THD=1% max, G=6dB, f =1kHz, R_L=8Ω		V_{CC}=5V		1.4		W
				V_{CC}=4.2V		0.9		W
				V_{CC}=3.6V		0.7		W
				V_{CC}=3.0V		0.5		W
				V_{CC}=2.5V		0.33		W
				V_{CC}=2.4V		0.3		W
		THD=10% max, f=1kHz, R_L=8Ω		V_{CC}=5V		1.7		W
				V_{CC}=4.2V		1.1		W
				V_{CC}=3.6V		0.85		W
				V_{CC}=3.0V		0.6		W
				V_{CC}=2.5V		0.41		W
				V_{CC}=2.4V		0.38		W
Total Harmonic Distortion + Noise	THD+N	G=6dB, 20Hz<f<20kHz R_L=8Ω+15μH, BW<30kHz	P_{OUT}=850mW_{RMS}	V_{CC}=5V		2		%
			P_{OUT}=600mW_{RMS}	V_{CC}=4.2V		2		%
			P_{OUT}=450mW_{RMS}	V_{CC}=3.6V		2		%
			P_{OUT}=300mW_{RMS}	V_{CC}=3.0V		2		%
			P_{OUT}=180mW_{RMS}	V_{CC}=2.5V		1		%
			P_{OUT}=150mW_{RMS}	V_{CC}=2.4V		1		%
		G=6dB, f=1kHz R_L=8Ω+15μH, BW<30kHz	P_{OUT}=1W_{RMS}	V_{CC}=5V		0.4		%
			P_{OUT}=700mW_{RMS}	V_{CC}=4.2V		0.35		%
			P_{OUT}=500mW_{RMS}	V_{CC}=3.6V		0.1		%
			P_{OUT}=350mW_{RMS}	V_{CC}=3.0V		0.1		%
			P_{OUT}=200mW_{RMS}	V_{CC}=2.5V		0.05		%
Efficiency	η	P_{OUT}=2W_{RMS}, R_L=4Ω+≥15μH				78		%
		P_{OUT}=1.2W_{RMS}, R_L=8Ω+≥15μH				88		%

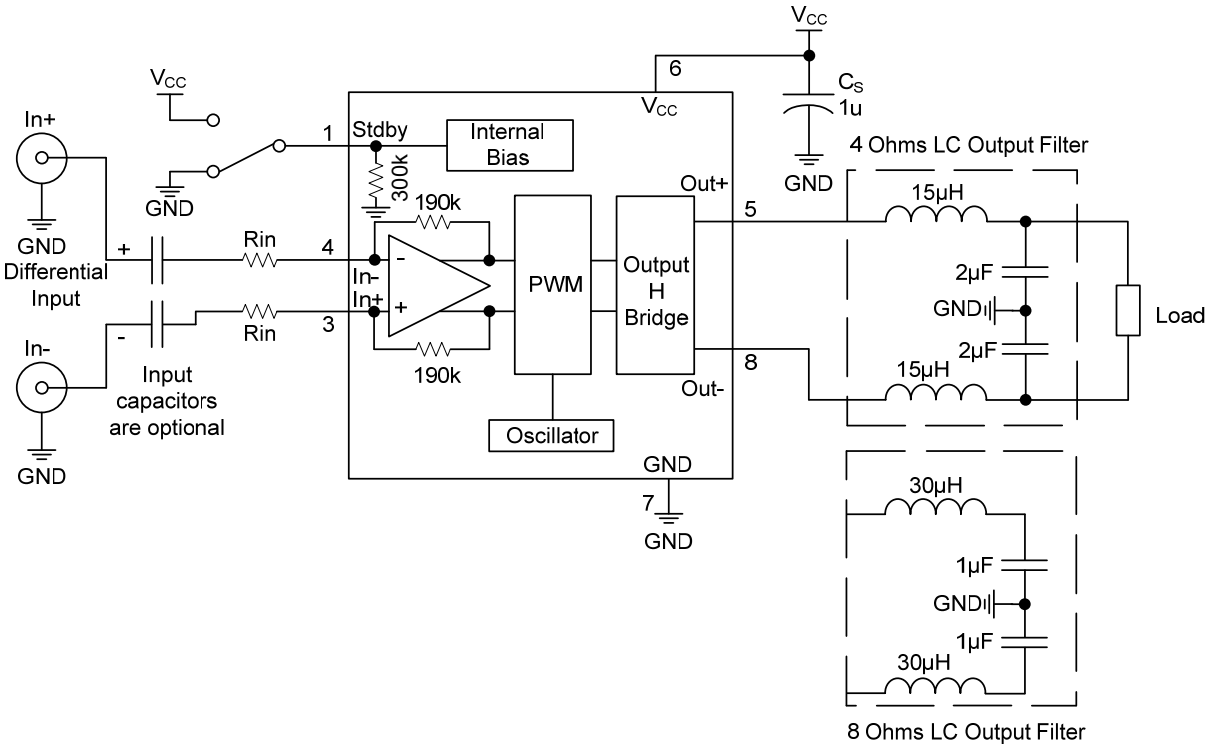
■ ELECTRICAL CHARACTERISTICS (Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Power Supply Rejection Ratio with Inputs Grounded (Note 2)	PSRR	f=217Hz, R_L=8Ω, G=6dB, V_{ripple}=200mV_{pp}			63		dB
Common Mode Rejection Ratio	CMRR	f=217Hz, R_L=8Ω, G=6dB, ΔV_{ic}=200mV_{pp}			57		dB
Gain Value (R_{in} in kΩ)	Gain	Gain value (Rin in kΩ)		$\frac{273k\Omega}{R_{in}}$	$\frac{380k\Omega}{R_{in}}$	$\frac{477k\Omega}{R_{in}}$	V/V
Internal Resistance from Standby to GND	R_{STBY}	Internal resistance from standby to GND		273	300	327	kΩ
Pulse Width Modulator Base Frequency	F_{PWM}	Pulse width modulator base frequency		200	330	460	kHz
Signal to Noise Ratio (A Weighting)	SNR	P_{OUT}=1.2W, R_L=8Ω			85		dB
Wake-Up Time	t_{WU}	Wake-up time			1	10	ms
Standby Time	t_{STBY}	Standby time			1	10	ms
Output Voltage Noise	V_N	f=20Hz~20kHz, G=6dB	Unweighted R_L=4Ω		85		μV_{RMS}
			A-weighted R_L=4Ω		60		μV_{RMS}
			Unweighted R_L=8Ω		86		μV_{RMS}
			A-weighted R_L=8Ω		62		μV_{RMS}
			Unweighted R_L=4Ω+15μH		83		μV_{RMS}
			A-weighted R_L=4Ω+15μH		60		μV_{RMS}
			Unweighted R_L=4Ω+30μH		88		μV_{RMS}
			A-weighted R_L=4Ω+30μH		64		μV_{RMS}
			Unweighted R_L=8Ω+30μH		78		μV_{RMS}
			A-weighted R_L=8Ω+30μH		57		μV_{RMS}
			Unweighted R_L=4Ω+filter		87		μV_{RMS}
			A-weighted R_L=4Ω+filter		65		μV_{RMS}
			Unweighted R_L=4Ω+filter		82		μV_{RMS}
			A-weighted R_L=4Ω+filter		59		μV_{RMS}

Notes: 1. Standby mode is active when V_{STBY} is tied to GND.
2. Dynamic measurements -20×log ($R_{MS}(V_{OUT})$ / R_{MS} (V_{ripple})). V_{ripple} is the superimposed sinusoidal signal to V_{CC} at f=217Hz.

■ TYPICAL APPLICATION CIRCUIT (See Table 1)





■ TYPICAL APPLICATION CIRCUIT (Cont.)

Table 1. External Component Information

COMPONENT	FUNCTIONAL DESCRIPTION
C_S	Bypass supply capacitor. Install as close as possible to the DPA5V3F to minimize high-frequency ripple. A 100 nF ceramic capacitor should be added to enhance the power supply filtering at high frequencies.
R_{IN}	Input resistor used to program the DPA5V3F's differential gain (gain = 380 kΩ/ R_{IN} with R_{IN} in kΩ).
Input Capacitor	Because of common-mode feedback, these input capacitors are optional. However, they can be added to form with Rin a 1st order high-pass filter with -3 dB cut-off frequency = $1/(2\times \pi \times R_{IN}\times C_{IN})$.