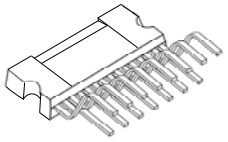
PA7375 *LINEAR INTEGRATED CIRCUIT*

2 x 35W DUAL/QUAD POWER AMPLIFIER FOR CAR RADIO



HZIP-15D

■ DESCRIPTION

The UTC **PA7375** is a class AB car radio amplifier for car radio, it can work either in dual bridge or quad single ended configuration. The exclusive fully complementary structure of the output stage and the internally fixed gain guarantees the highest possible power performances with few external components. The on-board clip detector simplifies gain compression operation. The fault diagnostics makes it possible to detect mistakes during car radio set assembly and wiring in the car.

■ FEATURES

* High output power capability:
  – 2 x 40W Max. / 4Ω
  – 2 x 25W / 4Ω@14.4V, 1KHz, 10%
  – 2 x 35W / 4Ω EIAJ
  – 4 x 7 W / 4Ω@14.4V, 1KHz, 10%
  – 4 x 12W / 2Ω@14.4V, 1KHz, 10%
* Minimum external components:
  – No bootstrap capacitors
  – No Boucherot cells
  – Internally fixed gain (26dB BTL)
* Stand-by function (CMOS compatible)
* No audible pop during st-by operations
* Diagnostics facility for:
  – Clipping
  – Out to GND short
  – Out to V_S short
  – Soft short at turn-on
  – Thermal shutdown proximity

Lead-free: PA7375L
Halogen-free: PA7375G

■ PROTECTIONS

* Output AC/DC short circuit
– to GND
– to V_S
– across the load
* Soft short at turn-on
* Overrating chip temperature with soft thermal limiter
* Load dump voltages urge
* Very inductive loads
* Fortuitous open GND
* Reversed battery
* ESD

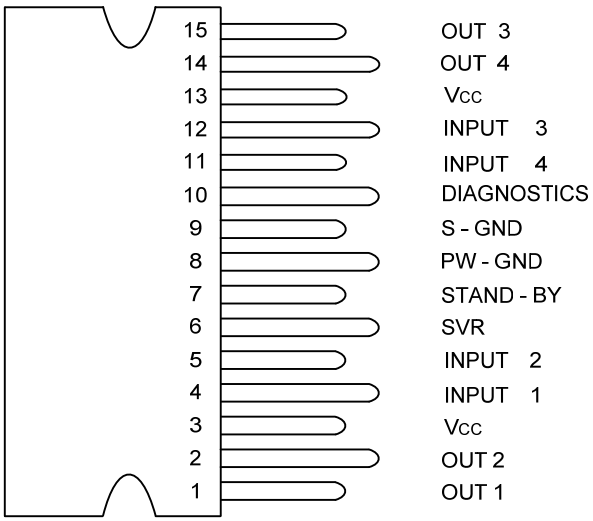
■ ORDERING INFORMATION

Ordering Number			Package	Packing
Normal	Lead Free Plating	Halogen Free		
PA7375-J15-D-T	PA7375L-J15-D-T	PA7375G-J15-D-T	HZIP-15D	Tube

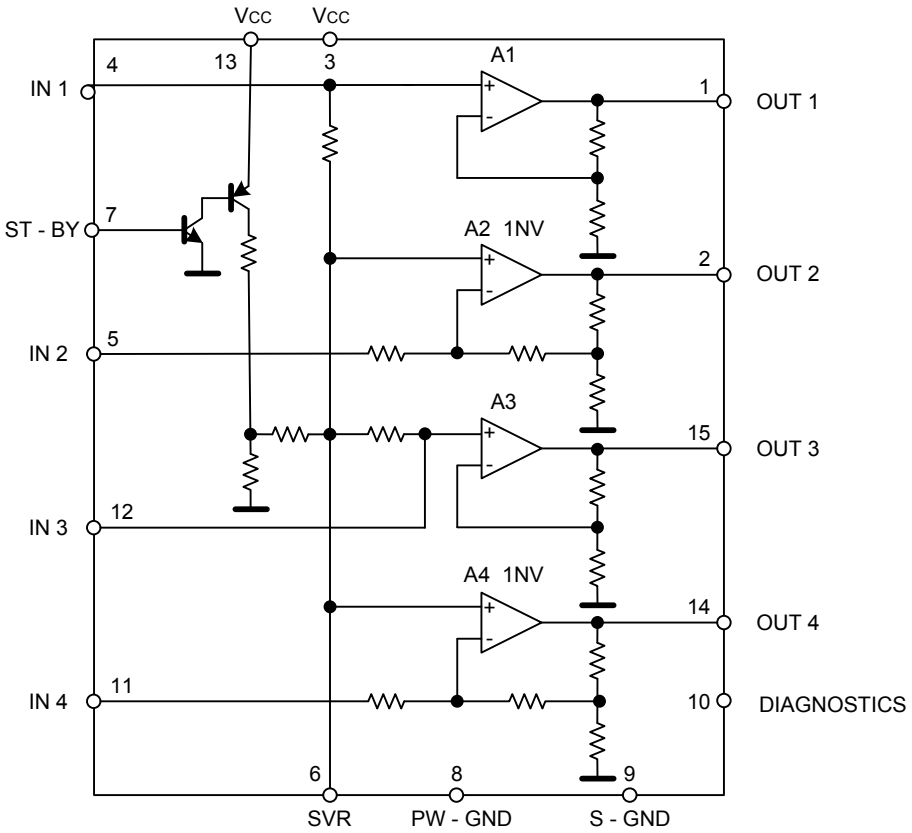
PA7375L-J15-D-T
(1) Packing Type
(2) Package Type
(3) Lead Plating

(1) T: Tube
(2) J15-D: HZIP-15D
(3) G: Halogen Free, L: Lead Free, Blank: Pb/Sn

■ PIN CONNECTION (Top view)



■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNIT
Operating Supply Voltage		Vop	18	V
DC Supply Voltage		V_S	28	V
Peak Supply Voltage (for t = 50ms)		$V_{S(PEAK)}$	50	V
Output Peak Current	not repetitive t = 100μs	$I_{O(PEAK)}$	4.5	A
	repetitive f > 10Hz		3.5	A
Power Dissipation		P_D	27	W
Junction Temperature		T_J	150	°C
Storage Temperature		T_{STG}	-40~+150	°C

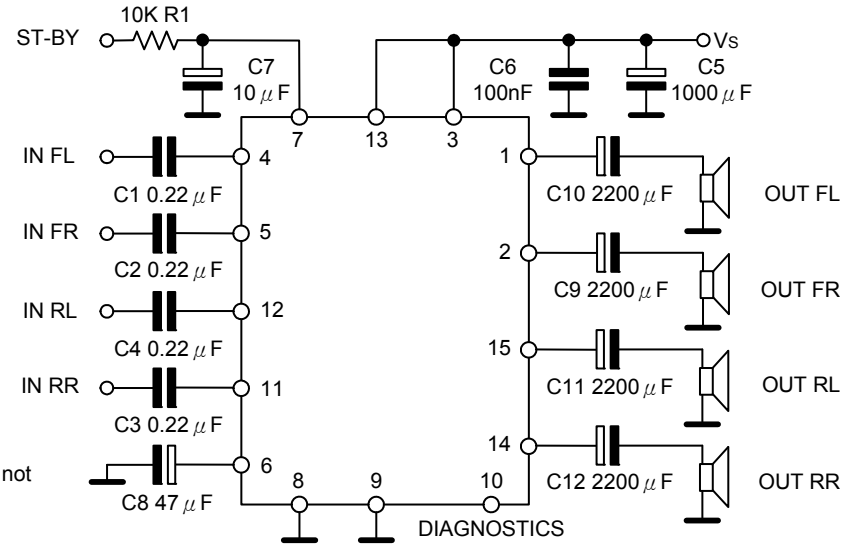
Note Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS (V_S=14.4V, R_L=4Ω, f=1KHz, T_a=25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Supply Voltage Range		V_S			8		18	V
ST-BY Threshold Voltage	IN	$V_{IN(ST-BY)}$					1.5	V
	OUT	$V_{OUT(ST-BY)}$			3.5			
Voltage Saturation on pin 10		V_{SAT}	Sink Current at Pin 10 = 1mA				0.7	V
Output Offset Voltage		$V_{O(OFF)}$					150	mV
Input Noise Voltage		eN	R_G = 0; S.E. ”A” weighted,	Non Inverting Channels		2		μV
				Inverting Channels		5		
			Bridge, R_G = 0; 22Hz ~ 22KHz			3.5		μV
Total Quiescent Drain Current		I_Q	R_L = ∞				200	mA
ST-BY Pin Current(pin 7)		I_{ST-BY}	Max Driving Current Under Fault				5	mA
			Play Mode Vpin7 = 5V				50	μA
ST-BY Current Consumption		I_{ST-BY}	V_{ST-BY} = 0 ~ 1.5V				100	μA
Clipping Detector Output Average Current	OFF	$I_{CD(OFF)}$	d = 1% (Note 2)			90		μA
	ON	$I_{CD(ON)}$	d = 5% (Note 2)			160		μA
Input Impedance		R_{IN}	Single Ended		20	30		KΩ
			Bridge		10	15		
Output Power		P_{OUT}	THD = 10%; R_L = 4Ω	Bridge	23	25		W
				Single Ended	6.5	7		
				Single Ended, R_L = 2Ω		12		
Output Power (Note 3)	Max.	$P_{O(MAX)}$	V_S = 14.4V, Bridge		36	40		W
	EIAJ	$P_{O(EIAJ)}$	V_S = 13.7V, Bridge		32	35		W
Distortion		THD	R_L = 4Ω	Single Ended, P_{OUT}=0.1~4W		0.02		%
				Bridge, P_{OUT} = 0.1 ~ 10W		0.03	0.3	
Cross Talk		CT	f = 1KHz Single Ended			70		dB
			f = 10KHz Single Ended			60		
			f = 1KHz Bridge		55			
			f = 10KHz Bridge			60		
Voltage Gain		G_V	Single Ended		19	20	21	dB
			Bridge		25	26	27	
Voltage Gain Match		G_V					0.5	dB
Supply Voltage Rejection		SVR	R_G = 0, f = 300Hz		50			dB
Stand-by Attenuation		A_{ST-BY}	P_{OUT} = 1W		80	90		dB

Note: 1. See built-in S/C protection description
2. Pin 10 Pulled-up to 5V with 10KΩ; R_L = 4Ω
3. Saturated square wave output.

■ TYPICAL TEST AND APPLICATION CIRCUIT



Note:
C9, C10, C11, C12 could be reduced if the 2Ω operation is not required.

Figure 1: Quad Stereo

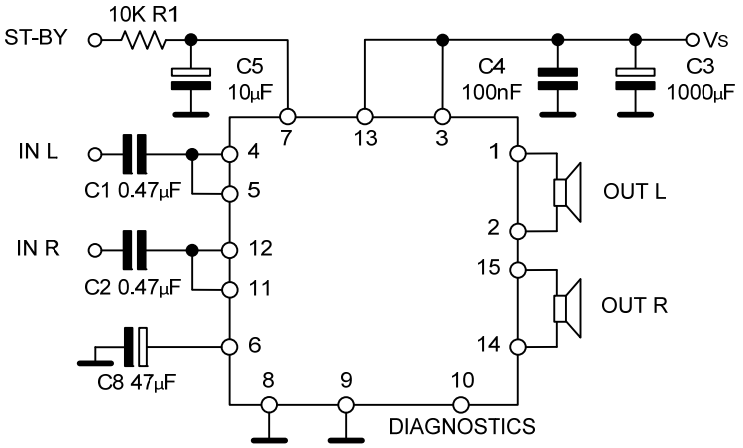


Figure 2: Double Bridge

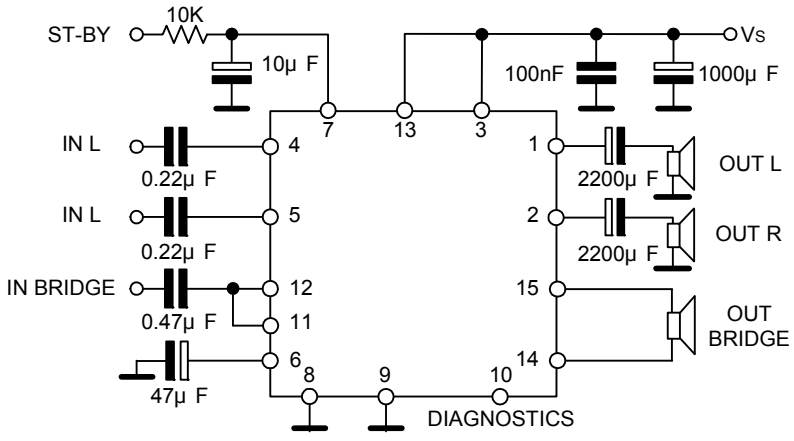


Figure 3: Stereo/Bridge

■ TYPICAL APPLICATION INFORMATION

High Application Flexibility

To avoid phase inconveniences causing sound alterations especially during the reproduction of low frequencies. The polarity of the speakers driven by the inverting amplifier must be reversed respect to those driven by non inverting channels when working in single ended conditions.

Easy Single Ended to Bridge Transition

The change from single ended to bridge configurations is made by a short circuit across the inputs.

Gain Internally Fixed to 20dB in Single Ended, 26dB in Bridge

The function advantages: save component, PCB space and optimize output noise, supply voltage rejection and distortion

Silent Turn On/Off and Muting/Stand-by Function

At turn-on the device stays in muting condition for a time. The device outputs becomes insensitive to any kinds of signal that may be present at the input terminals while in muting.

STAND-BY DRIVING

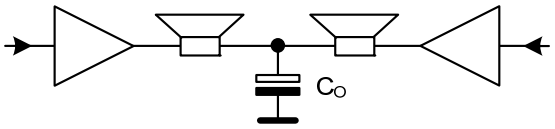
The stand by pin cannot be directly driven by a voltage source whose current capability is higher than 5mA. A series resistance has been inserted to limit the current at this pin and to smooth down the stand-by ON/OFF transitions. To ensure correct turn-on, a capacitor of at least 100nF from pin 7 to S-GND, with no resistance in between.

BUILT–IN SHORTCIRCUIT PROTECTION

To assure correct operation for the device itself and for the loudspeaker, a SOFT SHORT condition is signaled out during the TURN-ON PHASE .

That acts in a way to avoid that the device is turned on (by ST-BY) when a resistive path (less than 16 Ω) is present between the output and GND. When a current higher than 5mA is flowing into the ST-BY pin the involved circuitry is normally disabled.

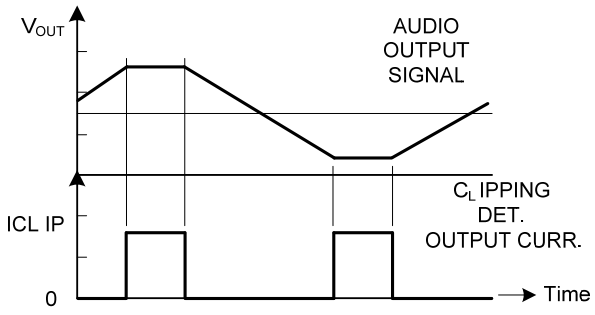
That extra function becomes particularly attractive when, in the single ended configuration



So if the output capacitor C_{OUT} for any reason is shorted, the loudspeaker will not be damaged.

Diagnostics Facility

The IC is equipped with a diagnostic circuitry able to detect the information(clipping in the output signal, thermal shutdown, and output fault including short to GND, short to V_S and soft short at turn on) across an open collector output (pin 10) through a current sinking when the event is detected.



Clipping Detection Waveforms

When a certain distortion level is reached at any of the outputs a current sinking at pin 10 is triggered. Whenever the amplifier is overdriven this function allows gain compression possibility.

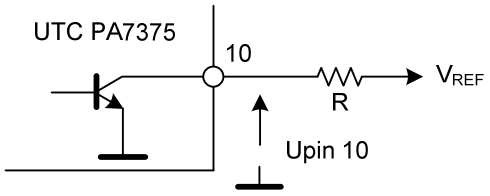
Thermal Shutdown

In this case the output 10 will signal the proximity of the junction temperature to the shutdown threshold. Typically current sinking at pin 10 will start ~10°C before the shutdown threshold is reached.

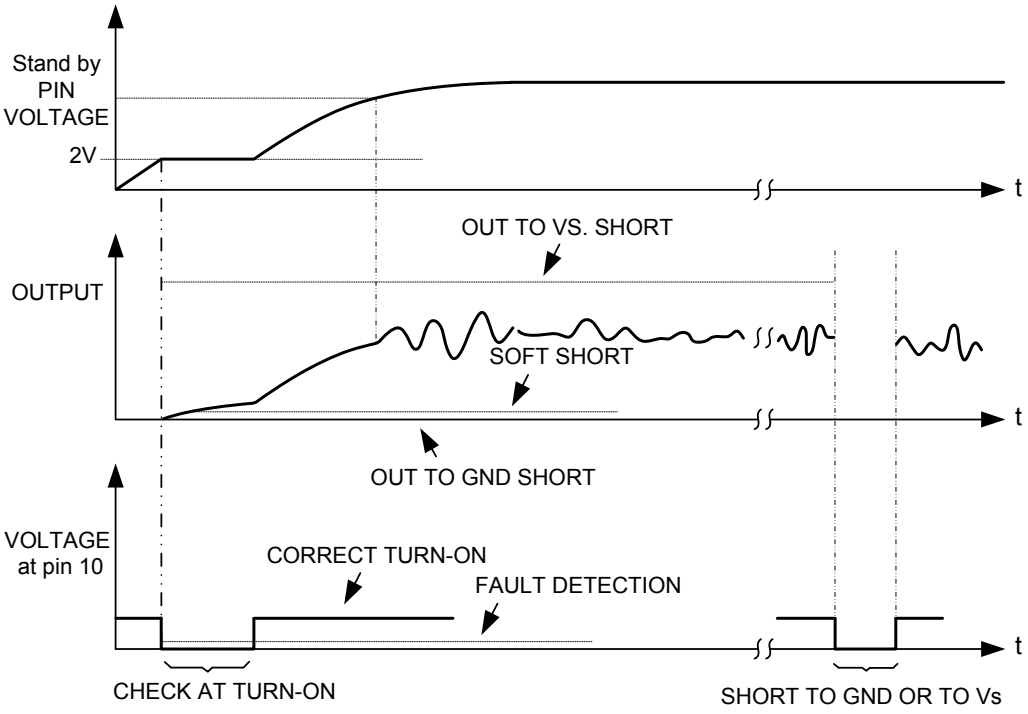
■ TYPICAL APPLICATION INFORMATION (Cont.)

HANDLING OF THE DIAGNOSTICS SIGNAL

Because of kinds of information(clipping detection, output fault, thermal proximity) is available at the same pin, this signal must be handled to discriminate each event which could be done by taking into account the different timing of the diagnostic output during each case.

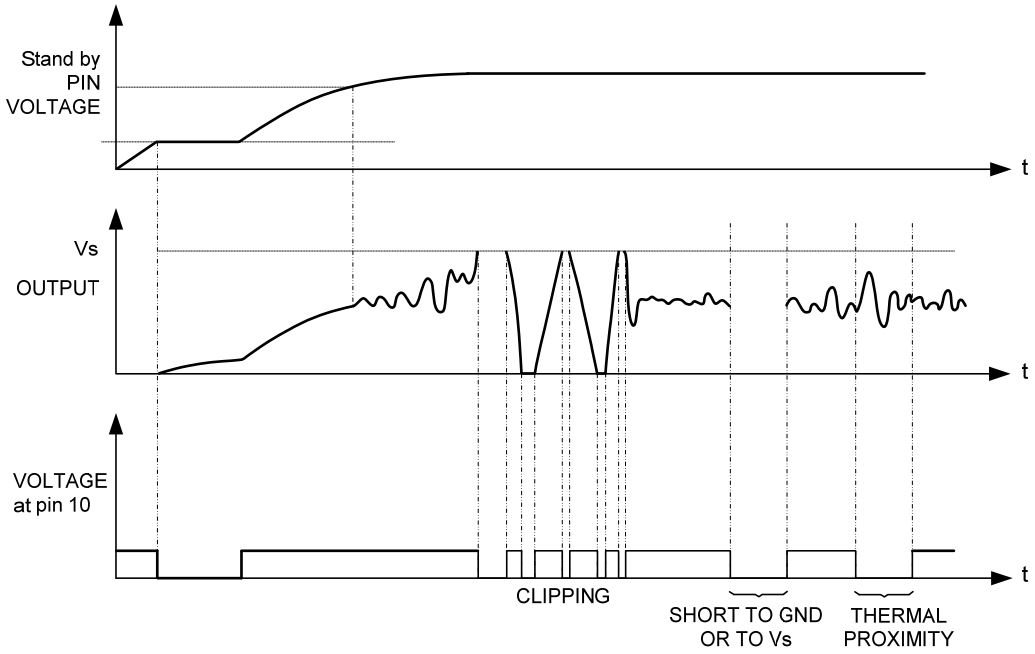


Output Fault Waveforms



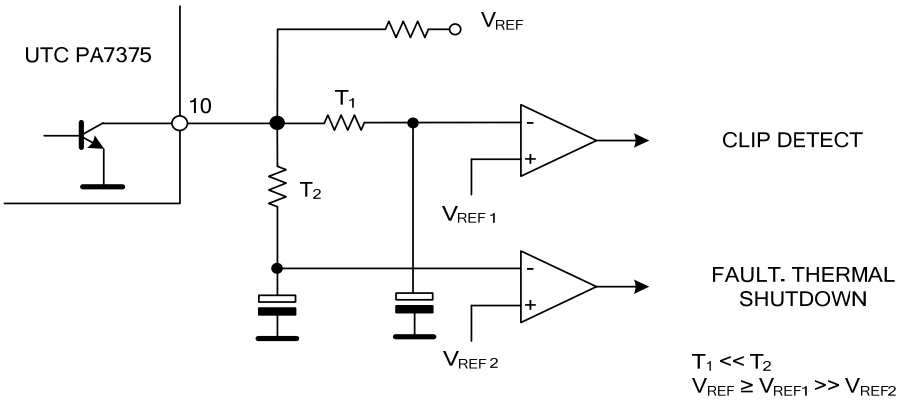
Fault Waveforms

■ TYPICAL APPLICATION INFORMATION (Cont.)



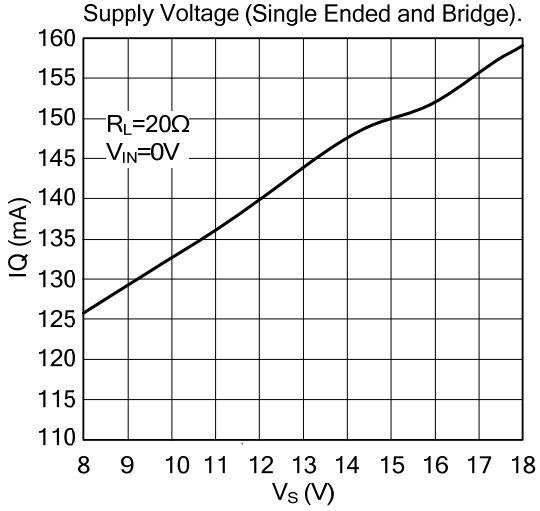
Waveforms

The clip detector signaling produces a low level at pin 10 normally; based on this an interface circuitry to differentiate the information is necessary in the schematic below

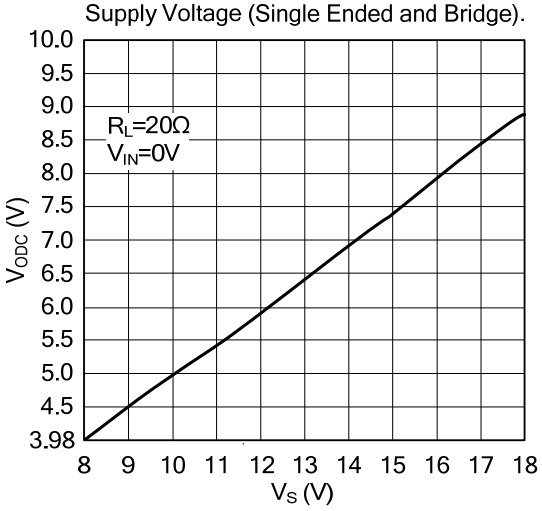


■ TYPICAL CHARACTERISTICS

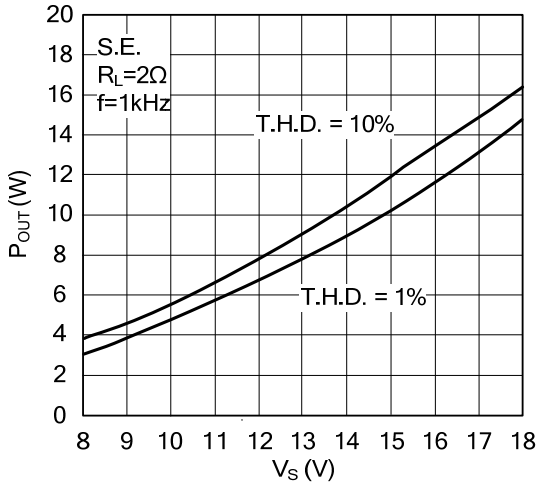
Quiescent Drain Current vs. Supply Voltage (Single Ended and Bridge).



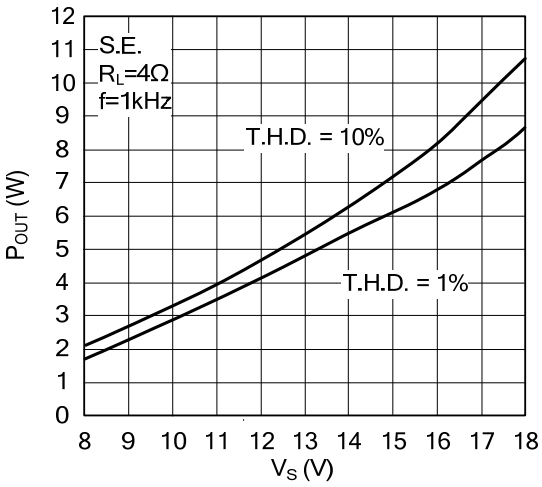
Quiescent Output Voltage vs. Supply Voltage (Single Ended and Bridge).



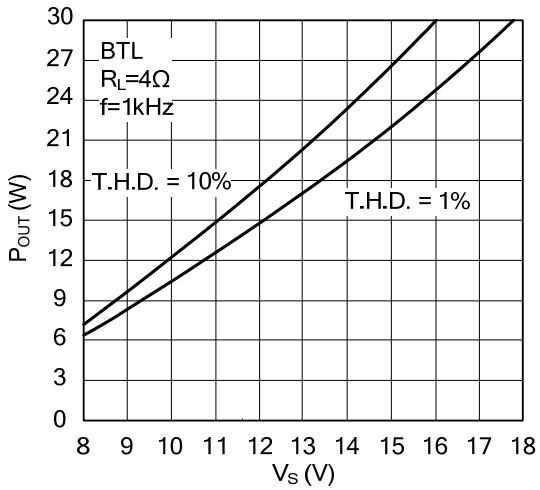
Output Power vs. Supply Voltage



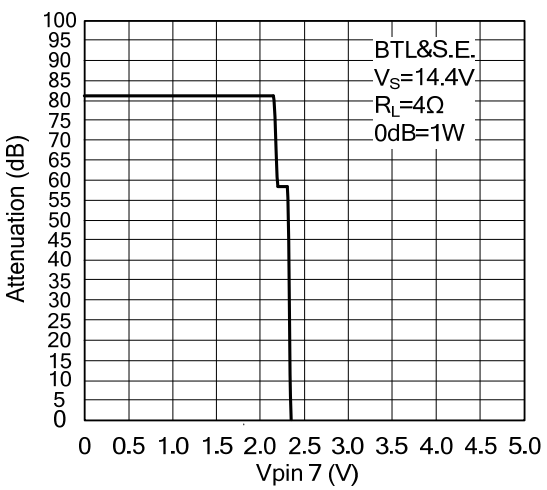
Output Power vs. Supply Voltage



Output Power vs. Supply Voltage

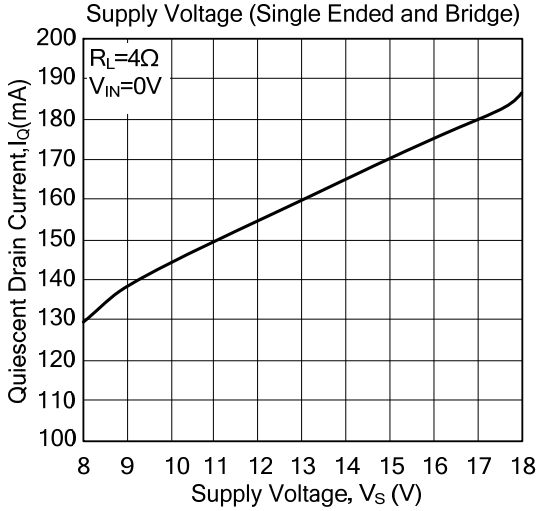


Stand-by Attenuation vs. Threshold Voltage

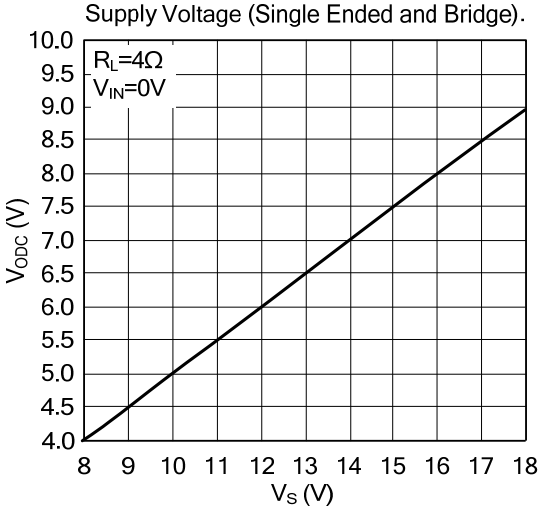


■ TYPICAL CHARACTERISTICS (Cont.)

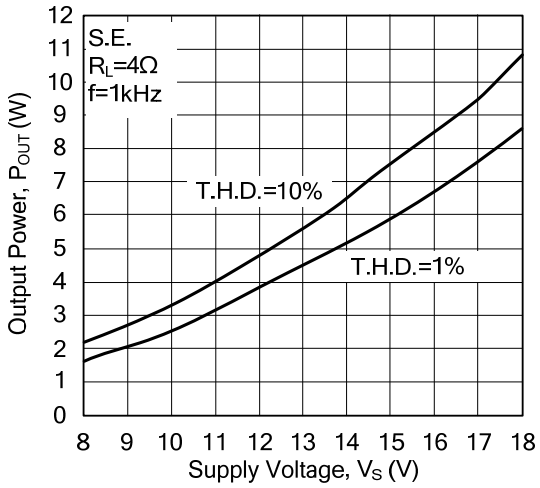
Quiescent Drain Current vs. Supply Voltage (Single Ended and Bridge)



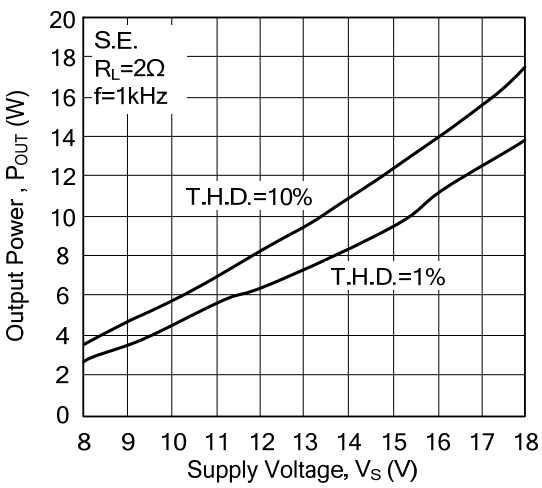
Quiescent Output Voltage vs. Supply Voltage (Single Ended and Bridge).



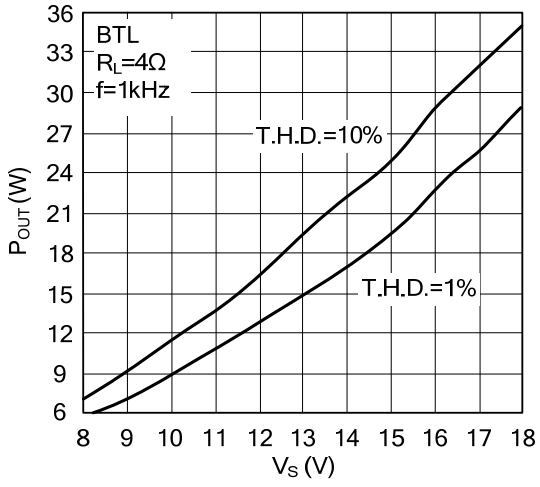
Output Power vs. Supply Voltage



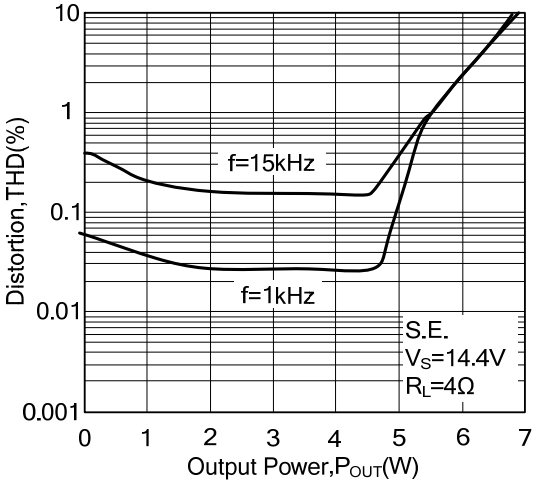
Output Power vs. Supply Voltage



Output Power vs. Supply Voltage

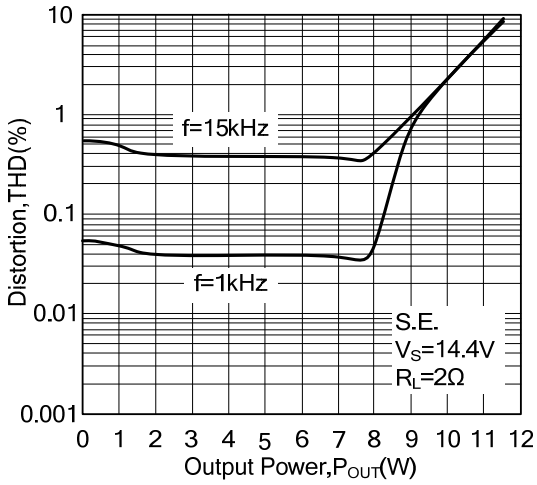


Distortion vs. Output Power



■ TYPICAL CHARACTERISTICS (Cont.)

Distortion vs. Output Power



Distortion vs. Output Power