40W-Filter-free Stereo Class-D Audio Power Amplifer

Features

- 40-W/ch into an 8-Ω Loads at 10%THD+N From a 24-V Supply
- 34-W/ch into 8-Ω Loads at 1% THD+N From a 24-V Supply
- 80-W into a 4-Ω Mono Load at 10% THD+N From a 24-V Supply
- 90% Efficient Class-D Operation Eliminates Need for Heat Sinks
- Wide Supply Voltage Range Allows Operation from 5V to 26V
- Filter-Free Operation
- Fixed 24 times
- Differential Inputs

Description

The CS8673E is a 40-W (per channel) efficient, Class-D audio power amplifier for driving bridged-tied stereo speakers. Advanced EMI Suppression Technology enables the use of inexpensive ferrite bead filters at the outputs while meeting EMC requirements. The DC detect circuit measures the frequency and amplitude of the PWM signal and shuts off the output stage if the input capacitors are damaged or shorts exist on the inputs.

The CS8673E can drive stereo speakers as low as 4Ω. The high efficiency of the CS8673E ,92%, eliminates the need for an external heat sink when playing music.

The outputs are also fully protected against shorts to GND, VCC, and output-to-output. The short-circuit protection and thermal protection includes an auto-recoveryfeature.

Applications

- Televisions
- Consumer Audio Equipment

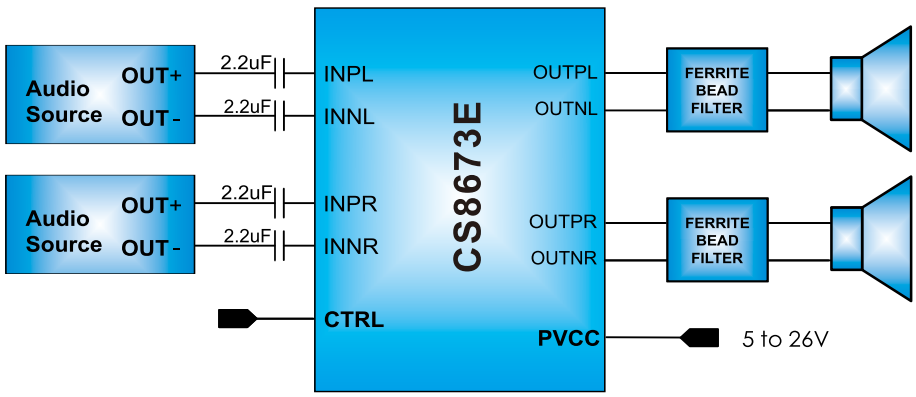
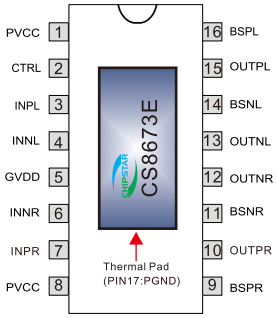


Figure 1. CS8673E Simplified Application Schematic

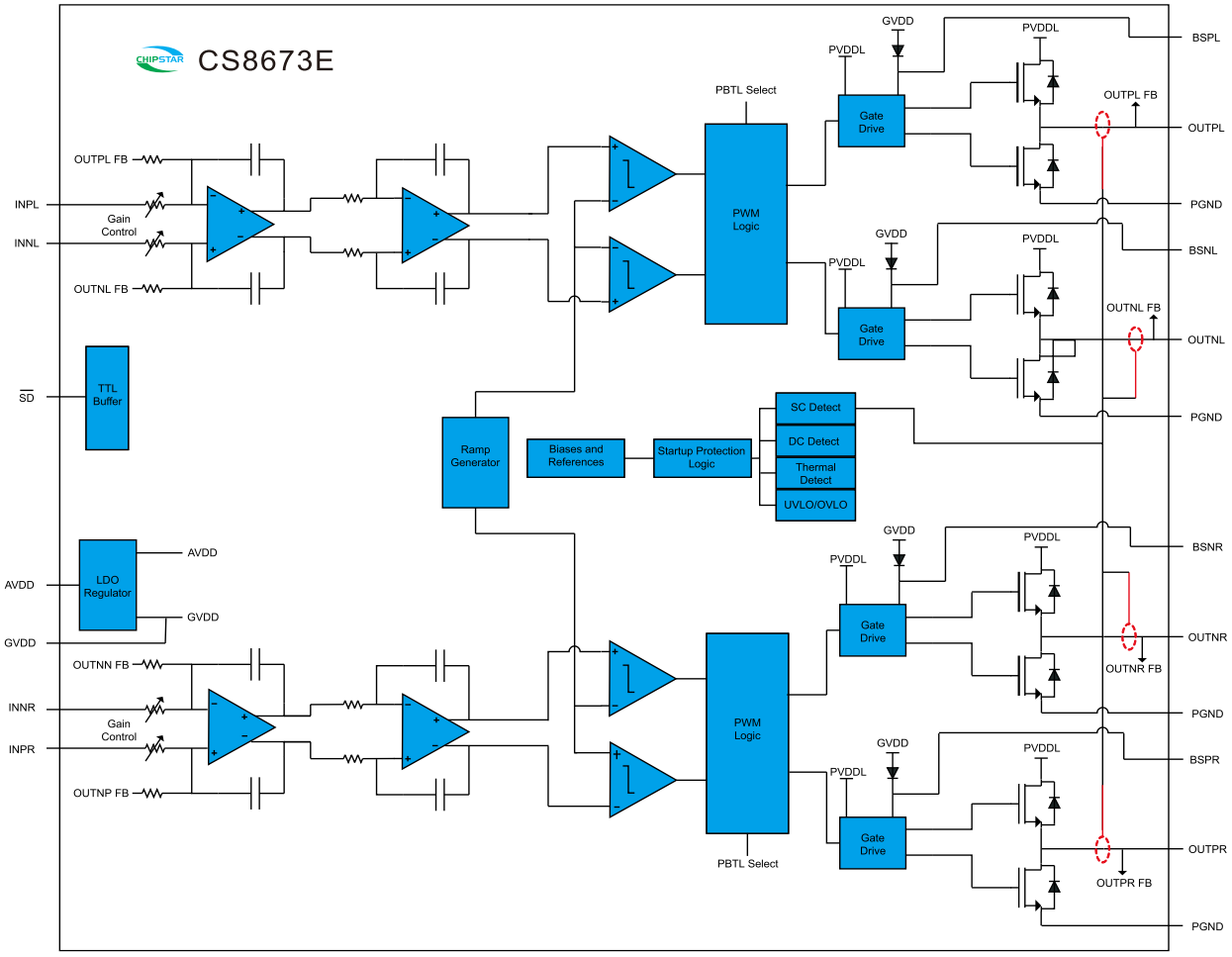
Pin Descriptions



ESOP16L
(Top View)

PIN		I/O/P	DESCRIPTION
NAME	NUMBER		
PVCC	1	P	Power Supply
CTRL	2	I	Standby logic and spread spectrum select control ; TTL logic voltage allowed to AVCC
INPL	3		Positive audio input for left channel. .
INNL	4	I	Negative audio input for left channel.
GVDD	5	O	High-side FET gate drive supply.
INNR	6	I	Negative audio input for right channel.
INPR	7	I	Positive audio input for right channel.
PVCC	8	P	Power Supply
BSPR	9	I	Bootstrap I/O for right channel, positive high-side FET.
OUTPR	10	O	Class-D H-bridge positive output for right channel.
BSNR	11	I	Bootstrap I/O for right channel, negative high-side FET.
OUTNR	12	O	Class-D H-bridge negative output for right channel.
OUTNL	13	O	Class-D H-bridge negative output for left channel.
BSNL	14	I	Bootstrap I/O for left channel, negative high-side FET.
OUTPL	15	O	Class-D H-bridge positive output for left channel.
BSPL	16	I	Bootstrap I/O for left channel, positive high-side FET.
PGND	17	P	Power ground for the H-bridges.

Block Diagram



Typical Application

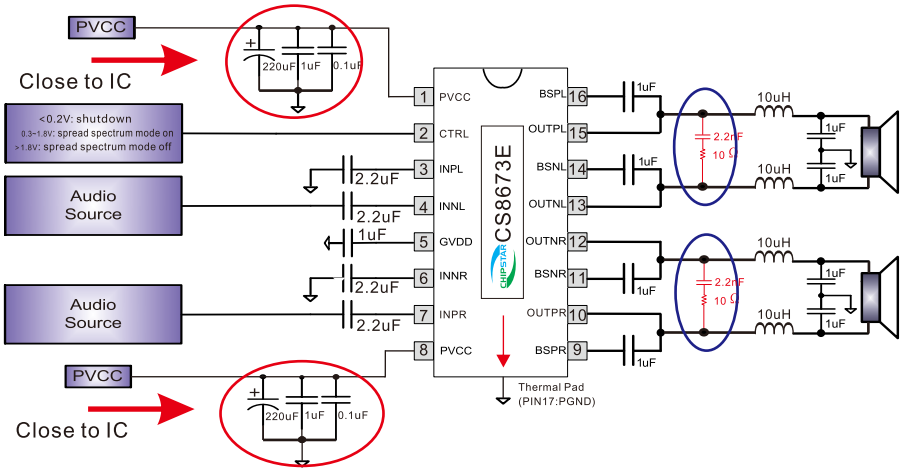


Figure 2. Stereo Class-D Amplifier with BTL Output and Single-Ended Inputs with Power Limiting

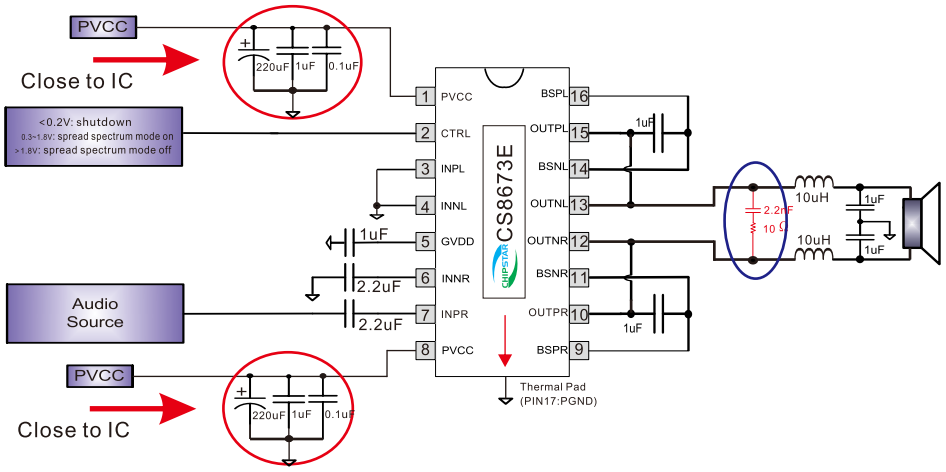


Figure 3. Stereo Class-D Amplifier with PBTL Output and Single-Ended

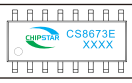
over operating free-air temperature range(unless otherwise noted)(1)

			UNIT
V_{CC}	Supply voltage	PVCC	**0.3**Vto28V
V_I	Interface pin voltage	**CRTL**	0.3VtoV_{CC}+0.3V
T_A	Operating free-air temperature range		-40℃ to 85℃
T_J	Operating junction temperature range		-40℃to150℃
T_{stg}	Storage temperature range		-65℃ to150℃

Thermal information[2]

Symbol	Parameter	Value	Unit
θ_{JA}	Junction-to-ambient thermal resistance	45	℃/W
θ_{JC}	Junction-to-case (top) thermal resistance	10	℃/W
θ_{JB}	Junction-to-board thermal resistance	17.5	℃/W

Order Information

Device	Package	Making	Reel Size	Tape Width	Quantity
CS8673E	ESOP16L		Tube		50

ESD Range

ESD HBM mode ---------- ±2kV
ESD MM mode ----------±400V

1,The ThermalPad on the bottom of the IC should soldered directly to the PCB's ThermalPad area that with several thermal vias connect to the ground plan,and the PCB is a 2-layer,5-inch square area with 2oz copper thickness.
2,Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device.Functional operation at conditions other than the operating conditions specified is not implied.Only one Absolute Maximum Rating should be applied at one time.

Recommended Operating Conditions

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
V_{CC}	Supplyvoltage	PVCC	5	26.0	V
V_{IH}	High-levelinput voltage	CTRL	2		V
V_{IL}	Low-levelinput voltage	CTRL		0.8	V
V_{OL}	Low-leveloutput voltage	$R_{PULL-UP}$ =100k,V_{CC} =15V		0.8	V
I_{IH}	High-levelinput current	CTRL,V_I =2V,V_{CC}=15V		50	uA
I_{IL}	Low-levelinput current	CTRL,V_I=0.8V,V_{CC}=15V		5	uA
OVP				30.0	V

DC Characteristics

T_A=25°C,Vcc =12 V, RL = 8 Ω (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$\|V_{OS}\|$	Output offset voltage	V_I =0V			1.5	15	mV
I_{CC}	Quiescent supply current	CTRL=1V,no load ,PV_{CC} =12V			6.5	9	mA
$I_{CC(SD)}$	Shutdowm current	CTRL=0.2V,no load ,PV_{CC} =12V			20	50	uA
$r_{DS(on)}$	Drain-sourceon-state resistance	V_{CC} =12V,I_O =500mA, T_J =25°C	HighSide		80		mΩ
			Lowside		80		
t_{on}	Turn-ontime	CTRL=2V			100		ms
t_{OFF}	Turn-offtime	CTRL=0V			2		us
GVDD	GateDriveSupply	I_{GVDD} =100 mA		4.0	4.5	5.0	V

T_A=25°C,Vcc = 16 V, RL = 8 Ω (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$\|V_{OS}\|$	Output offset voltage	V_I =0V			1.5	15	mV
I_{CC}	Quiescent supply current	CTRL=1V,no load ,PV_{CC} =16V			10	15	mA
$I_{CC(SD)}$	Shutdowm current	CTRL=0.2V,no load,PV_{CC} =16V			50		uA
$r_{DS(on)}$	Drain-sourceon-state resistance	V_{CC} =16V,I_O =500mA, T_J =25°C	HighSide		80		mΩ
			Lowside		80		
t_{on}	Turn-ontime	CTRL=2V			110		ms
t_{OFF}	Turn-offtime	CTRL=0V			2		us
GVDD	GateDriveSupply	I_{GVDD} =2mA		4.0	4.5	5.0	V

AC CHARACTERISTICS

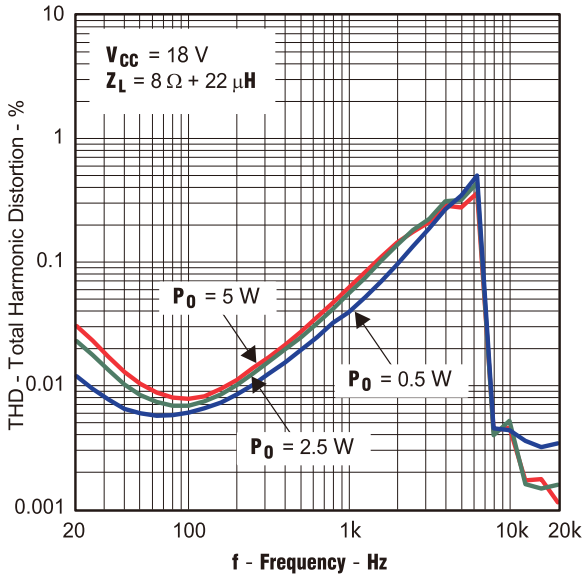
T_A=25°C,Vcc = 14 V, RL = 4 Ω (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
K_{SVR}		Power Supply ripple rejection	1kHz, 200mVpp ripple Gain=20dB, Inputs ac-coupled to AGND		70		dB
THD+N		Total harmonic distortion+noise	VCC=14V, f=1kHz Po=12W (half-power)		0.1		%
V_n		Output integrated noise	20~22kHz, A-weighted filter Gain=20dB		90		uV
					-80		dBV
		Crosstalk	Vo=1Vrms,Gain=20dB,f=1kHz		-90		dB
SNR		Signal-to-noiseratio	Gain=20dB ,Maximum output THD+N < 1%, f=1kHz		102		dB
f_{OSC}		Oscillator frequency			300		kHz
		Thermal trip point			170		℃
		Thermal hysteresis			15		℃
Po	STERO OUTPUT	Continuous output power	PO at 10% THD+N, VDD = 12V@RL = 4 Ω		20		W
			PO at 1% THD+N, VDD = 12V@RL = 4 Ω		16		
			PO at 10% THD+N, VDD = 16V@RL = 4 Ω		33.5		
			PO at 1% THD+N, VDD = 16V@RL = 4 Ω		27.5		
			PO at 10% THD+N, VDD = 18V@RL = 8 Ω		24.5		
			PO at 1% THD+N, VDD = 18V@RL = 8 Ω		20		
			PO at 10% THD+N, VDD = 21V@RL = 8 Ω		33		
			PO at 1% THD+N, VDD = 21V@RL = 8 Ω		27.5		
			PO at 10% THD+N, VDD = 24V@RL = 8 Ω		42.5		
			PO at 1% THD+N, VDD = 24V@RL =8 Ω		34.5		
	PBTL MODE,MONO OUTPUT	Continuous output power	PO at 10% THD+N, VDD = 12V@RL = 4 Ω		22		
			PO at 1% THD+N, VDD = 12V@RL = 4 Ω		17.6		
			PO at 10% THD+N, VDD = 18V@RL = 4 Ω		47.6		
			PO at 1% THD+N, VDD = 18V@RL = 4 Ω		38.5		
			PO at 10% THD+N, VDD = 21V@RL = 4 Ω		64		
			PO at 1% THD+N, VDD = 21V@RL = 4 Ω		51.5		
			PO at 10% THD+N, VDD = 24V@RL = 4 Ω		82.2		
			PO at 1% THD+N, VDD = 24V@RL = 4 Ω		65.2		

Typical Operating Characteristics

(All Measurements taken at 1kHz,unless otherwise noted.)

TOTALHARMONICDISTORTION vs FREQUENCY(BTL)



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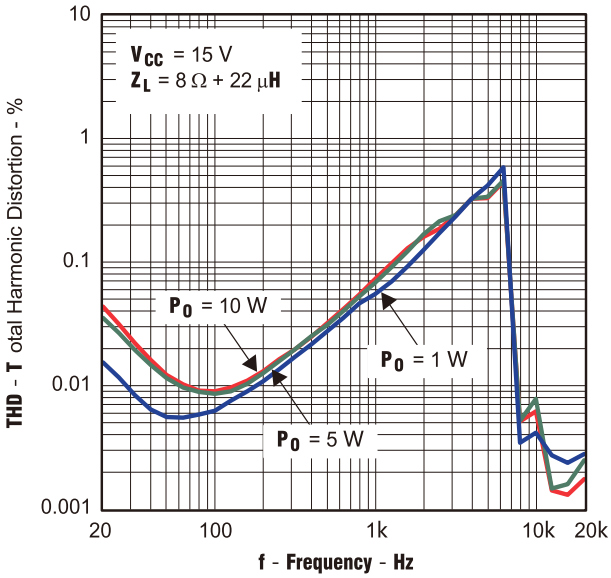

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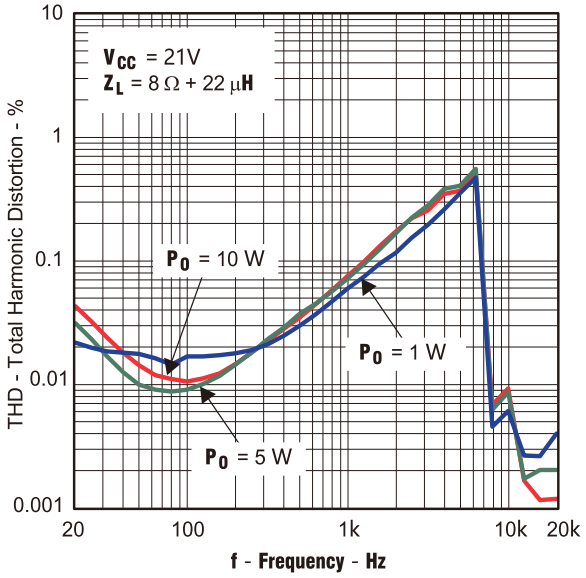

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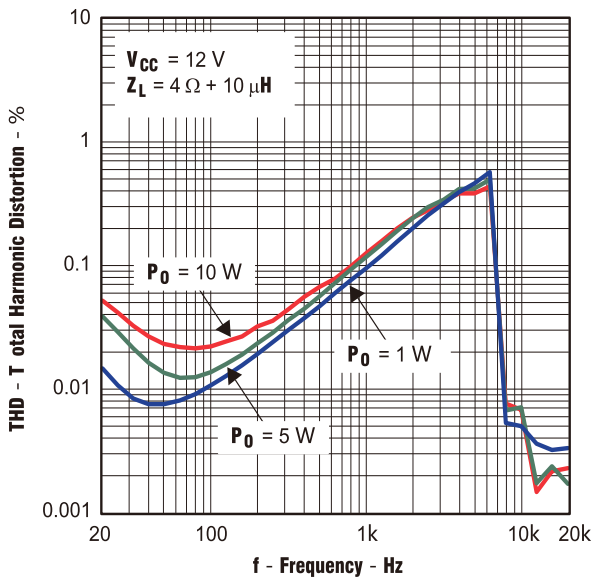

Typical Operating Characteristics

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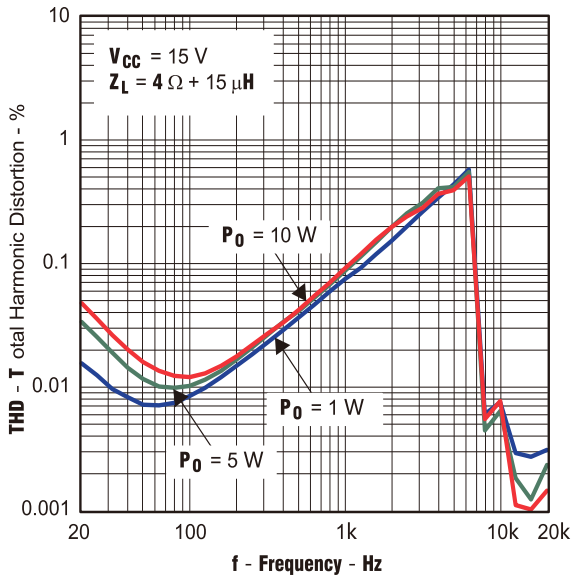
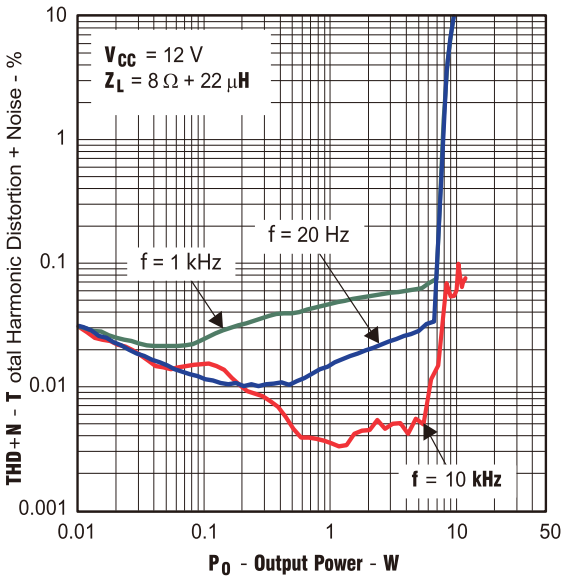
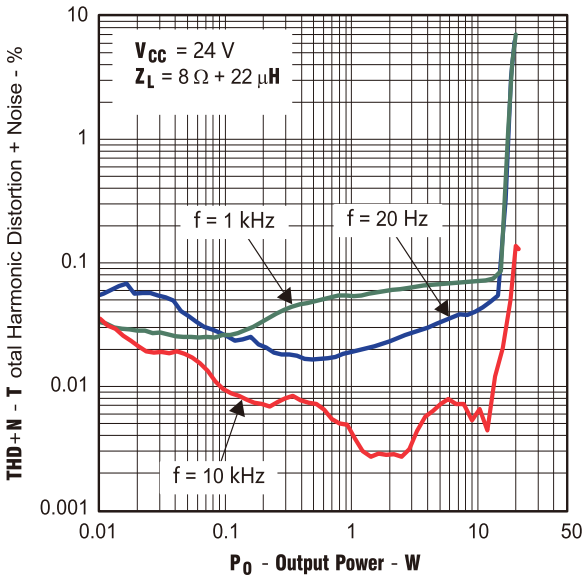


TOTALHARMONICDISTORTION+NOISE vs OUTPUTPOWER(BTL)



TOTALHARMONICDISTORTION+NOISE vs OUTPUTPOWER(BTL)



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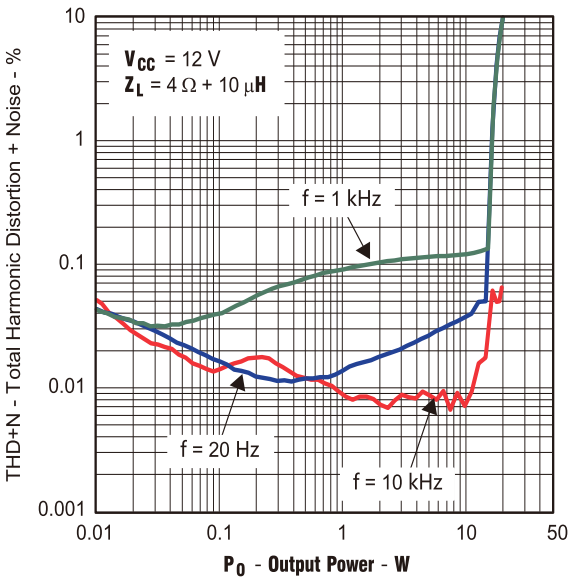
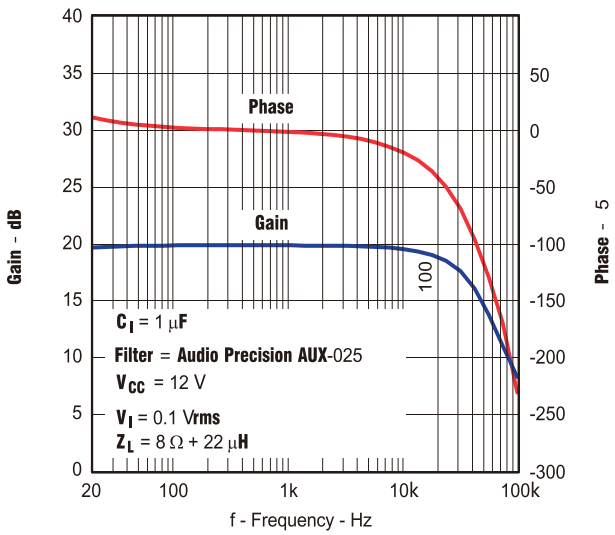


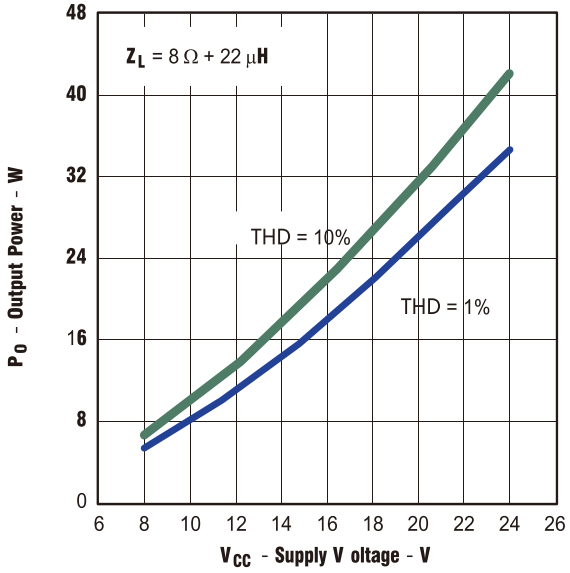
Typical Operating Characteristics

(All Measurements taken at 1kHz,unless otherwise noted.)

GAIN/PHASE vs FREQUENCY(BTL)

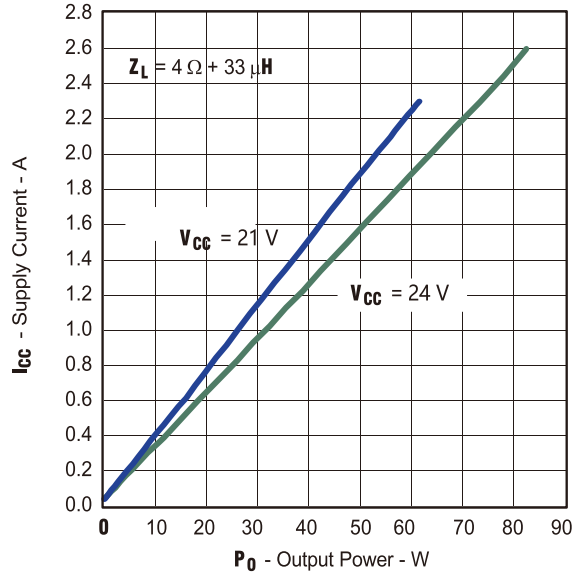


OUTPUTPOWER vs SUPPLYVOLTAGE(STERO)

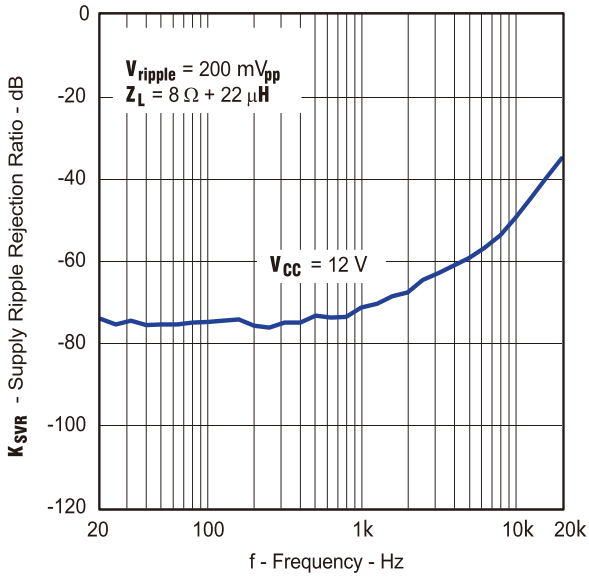


Note:DashedLinesrepresentthermallylimitedregions.

SUPPLYCURRENT vs OUTPUTPOWER(PBTL)



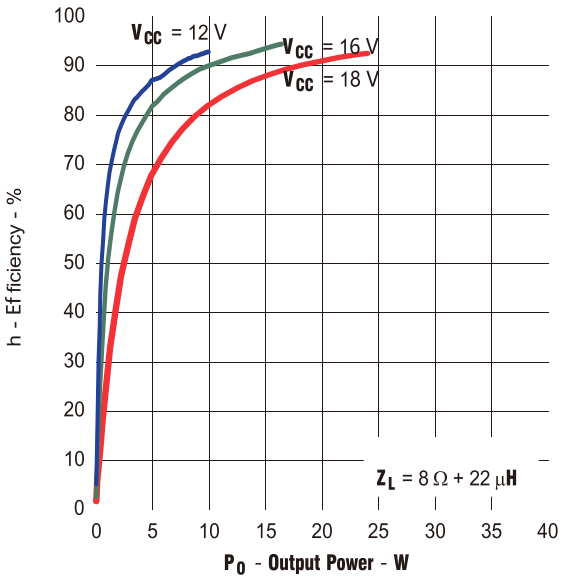
SUPPLYRIPPLEREJECTIONRATIO vs FREQUENCY(PBTL)



Typical Operating Characteristics

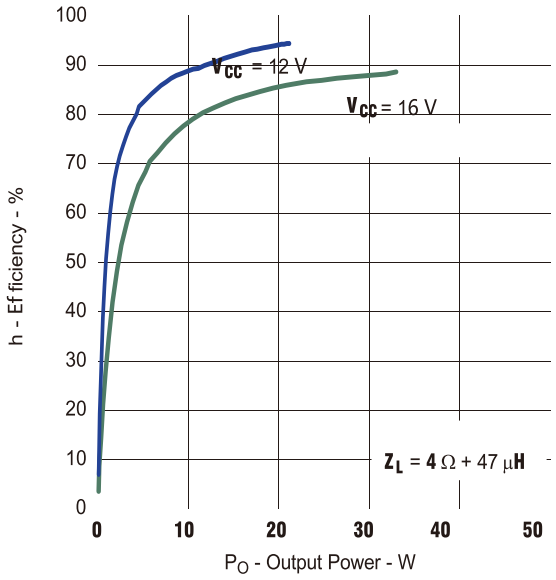
(All Measurements taken at 1kHz,unless otherwise noted.)

EFFICIENCY vs OUTPUTPOWER(BTL)



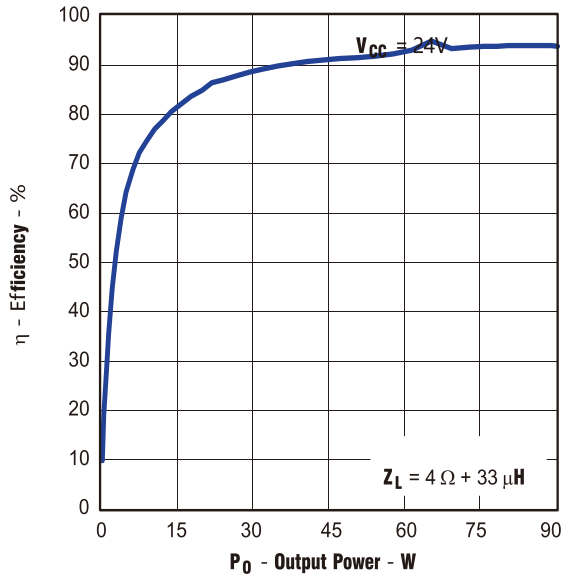
Note:DashedLinesrepresentthermallylimitedregions.

EFFICIENCY vs OUTPUTPOWER(BTL)

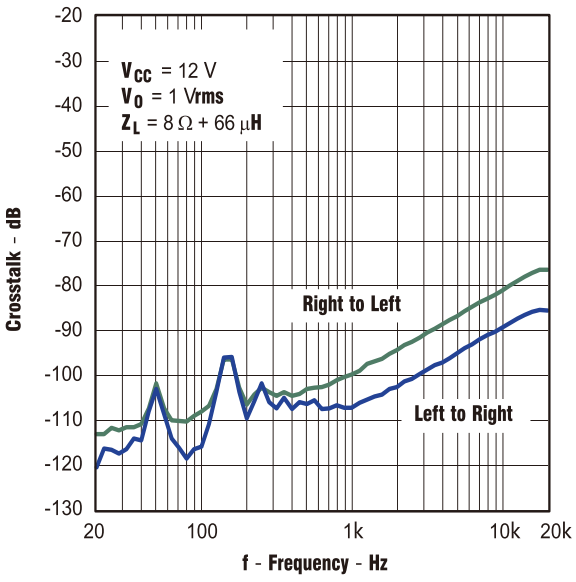


Note:DashedLinesrepresentthermallylimitedregions.

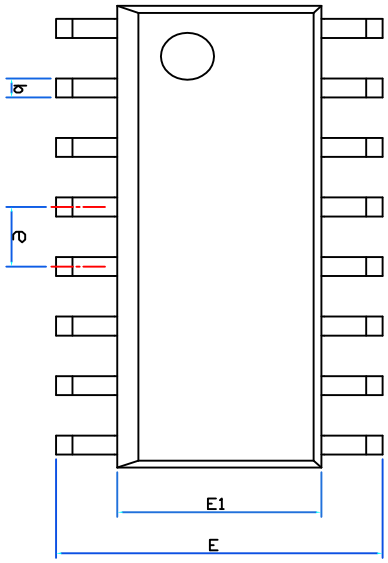
EFFICIENCY vs OUTPUTPOWER(BTL)

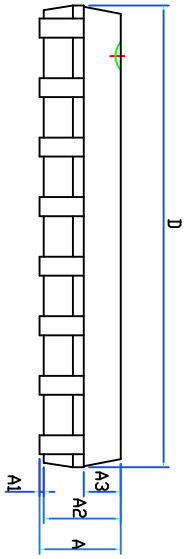


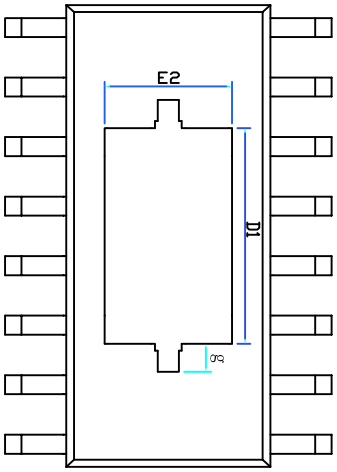
CROSSTALK vs FREQUENCY(BTL)

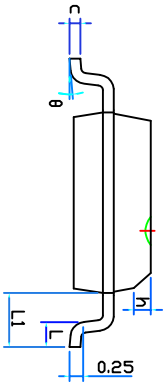


Package Information
CS8673E ESOP16L









SYMBOL	MILLMETER		
	MIN	NOM	MAX
A	—	—	1.55
A1	0.02	0.05	0.08
A2	1.40	1.45	1.50
A3	0.70	0.75	0.80
b	0.35	—	0.45
c	0.20	—	0.24
D	9.70	9.80	9.90
D1	4.60REF		
e	1.27BSC		
E	6.25	6.35	6.45
E1	3.70	3.80	3.90
E2	2.40REF		
L	0.50	—	0.70
L1	1.25REF		
h	0.25	0.35	0.45
θ	0	—	8°
g	0.60REF		