Suitable for single and double lithium power supply system, fixed gain 24 times, AB/D switch, power limit, built-in boost module, constant 25W output power mono audio power amplifier

General Description

CS8316C is a class R mono audio power amplifier with four NCN modes,AB/D switching, power limit, built-in BOOST module and adaptive BOOST function for single and double lithium power supply systems.Under the condition of the single section lithium batteries, CS8316C can drive down to 4Ω load, the maximum output of 19W constant power;In the case of double festival li-ion battery series power supply CS8316C can drive down to 3Ωload, the maximum output of 25W constant power. Class AB class D can switch mode design, minimize the audio subsystem of FM interference power amplifier. CS8316C breakthrough the limitations of single \ double lithium batteries, provides a more extreme power output end product, makes the power output end products can match the 12V lead-acid battery power supply power output of the audio system.

CS8316C full differential architecture and very high PSRR effectively improve the ability of RF noise suppression.No filter structure and the built-in PWM BOOST booster module, as well as CS8316C using proprietary AERC ((the Adaptive Edge Rate Control) technology, within the scope of the full bandwidth audio dramatically reduced EMI interference, to 60 cm audio line, under the standard of the FCC has more than 20 db margin, another CS8316C built-in over-current protection, short circuit protection and overheating protection, effective protection chip under abnormal working conditions are not damaged.

CS8316C is available in a compact TSSOP24-PP package with rated operating temperatures ranging from -40 ° C to 85 ° C.

Package

- TSSOP24-PP

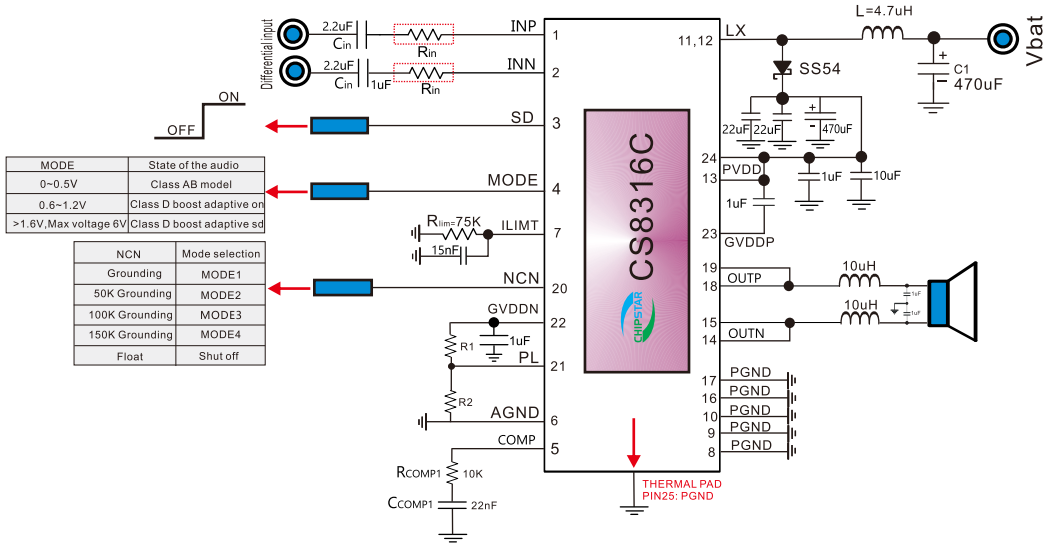
Features

- Built-in BOOST module class R structure, integrated ClassAB and class D
- Power output
  - PO at 10% THD+N, VIN = 3.7V
    RL = 4 Ω+22uH 19W(D MODE NCN OFF)
  - PO at 1% THD+N, VIN = 3.7V
    RL = 4 Ω+22uH 16W(D MODE NCN OFF)
  - PO at 10% THD+N, VIN = 7.4V
    RL = 4 Ω+22uH 21W(D MODE NCN OFF)
  - PO at 10% THD+N, VIN = 7.4V
    RL = 3 Ω+22uH 25W(D MODE NCN OFF)
- Excellent "pop-noise" noise suppression
- Operating voltage range: 2.7V to 9V
- Adaptive boost function
- Built-in 4 kinds of NCN mode
- Built-in power-limit
- Class-D structure without filtering
- Maximum 84% efficiency (Vbat=8.4V)
- High power suppression ratio (PSRR) : 70dB at 217Hz
- Startup time (200ms)
- Static current (10mA)
- Low turn-off current (50uA)
- Overcurrent protection, short circuit protection and overheat protection
- Rohs compliant lead-free package

Applications

- Portable Bluetooth speaker

Typical Application



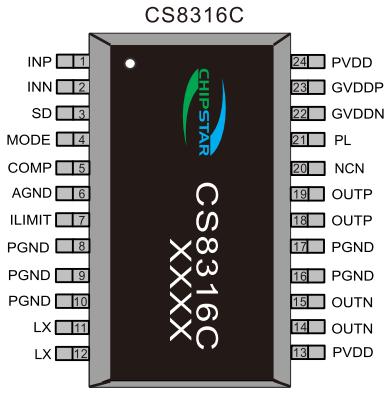
MODE	State of the audio
0~0.5V	Class AB model
0.6~1.2V	Class D boost adaptive on
>1.6V,Max voltage 6V	Class D boost adaptive sd

NCN	Mode selection
Grounding	MODE1
50K Grounding	MODE2
100K Grounding	MODE3
150K Grounding	MODE4
Float	Shut off

Note:

- L1 is 4.7uh, saturation current is inductance above 5A;When supplying a single lithium battery,L1 should select the inductor with saturation current above 8A, and the selected inductor DCR should be small enough.
- When the power supply system is a single lithium battery, turn off the adaptive boost function of CS8316C.
- SD pin high level up to 20V voltage
- RIN in the red box in the figure is the reserved position of input resistance,CS8316C has a built-in 24x gain, the internal integrated input resistance is 8.5K, the feedback resistance is 204K, and the gain less than 24 times is calculated as：Gain=204K/(8.5K+RIN)
- CS8316C bottom fin is defined as PGND pin.

Pin Configuration and Pin Descriptions



TSSOP24-PP
TOP VIEW

PIN	Symbol	I/O	Function	PIN	Symbol	I/O	Function
1	INP	I	Audio signal input positive end	13	PVDD	P	Power supply end
2	INN	I	Audio signal input negative end	14	OUTN	O	Negative end of audio signal output
3	SD	I	Chip off PIN, low level shutdown, High voltage can be connected	15	OUTN	O	Negative end of audio signal output
4	MODE	I	ABD switch and adaptive booster switch control pin	16	PGND	GND	GOUND
5	COMP	I	External compensation pin	17	PGND	GND	GOUND
6	AGND	GND	Analog ground	18	OUTP	O	Positive end of audio signal output
7	ILIMIT	I	Peak current limiting pin of inductance	19	OUTP	O	Positive end of audio signal output
8	PGND	GND	GOUND	20	NCN	I	NCN control pin
9	PGND	GND	GOUND	21	PL	I	Power limit pin
10	PGND	GND	GOUND	22	GVDDN	P	5V voltage source
11	LX	I	Switch to pin and connect external inductor	23	GVDDP	P	Upper grid drive voltage
12	LX	I		24	PVDD	P	The power supply
				25	PGND	GND	GOUND

Absolute Maximum Ratings*1

Item	Value	Unit
Supply Voltage	12	V
Input Voltage	-0.3 to V_{DD}+0.3	V
Operation Temperature Range	-40 to 85	℃
Maximum Junction Temperature	150	℃
Storage Temperature Range	-65 to150	℃
Operation Junction Temperature	-40 to125	℃
Soldering Temperature	300,5sec	℃

Recommended Operating Condition

Item	Min	Max	Unit
Supply Voltage	2.7	9.0	V
Operation Temperature Range	-40	85	℃
Junction Temperature Range	-40	125	℃

Thermal information[2]

Symbol	Parameter	Value	Unit
θ_{JA}	Junction-to-ambient thermal resistance	55.0	℃/W
θ_{JC}	Junction-to-case (top) thermal resistance	33.5	℃/W
Ψ_{JB}	Junction-to-board characterization parameter	17.5	℃/W
Ψ_{JT}	Junction-to-top characterization parameter	0.8	℃/W

Order Information

Device	Package	Making	Reel Size	Tape Width	Quantity
CS8316C	TSSOP24L-PP		13''	16mm	3000 units

ESD Range

ESD HBM mode ----------±2kV
ESD MM mode ----------±200V

Electrical Characteristics T_A= 25°C (unless otherwise noted)

Symbol	Parameter	Conditions	MIN	Typ	MAX	Units
$\|V_{OO}\|$	Output offset voltage	VIN=0V, Av=2V/V VIN=5.0V to 9.0V		5	25	mV
PSRR	Power supply rejection ratio	VIN=5V to 9V,217Hz		-70		dB
CMRR	Common mode rejection ratio	V_{DD} = 5V to 9V		-72		dB
I_{DD}	Quiescent current	VIN=7.4V,No load		10		mA
I_{SD}	Shutdown current			50		μA
$r_{DS(ON)}$	Static Drain- source On-state Resistance(D mode)	VIN= 3.7V		110		mΩ
		VIN=7.4V		100		
$f_{(SW)}$	Switching frequency	VIN=5V to 9V		330		KHz
R_{in}	Input resistance			8.5		KΩ
R_f	Feedback resistance			204		KΩ
V_{IH}	High-level input current				6.0	V
V_{IL}	Low-level inpu t current		0.2			V

BOOSTodule electrical parameters (TA = +25°C, VDD = VEN = 3.7V, unless otherwise noted.)

Symbol	Parameter	MIN	Typ	MAX	Units
Input voltage		2.7		9.0	V
Undervoltage protection threshold	V_{IN} Rising		2.0		V
Switching frequency			330		KHZ
Maximum duty cycle		85			%
Switch tube conducts a current	V_{DD}= 3.7V,Duty cycle= 70%		7.0		A
Switching tube conduction impedance			12		mΩ
Switch tube conducts leakage current	V_{LX} = 12.5V, EN = 0			15	uA
Thermal temperature			160		°C
Thermal hysteresis			40		°C

OPERATING CHARACTERISTICS T_A=25°C, RL = 4 Ω+33uH

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
P_O	NCNOFF Output power (D MODE)	Vbat=3.7V,THD=10%,f=1KHz,RL=4 Ω+33uH		19.0		W
		Vbat=3.7V,THD=1%,f=1KHz,,RL=4 Ω+33uH		15.9		
		Vbat=7.4V,THD=10%,f=1KHz,RL=4 Ω+33uH		21.0		
		Vbat=7.4V,THD=1%,f=1KHz,RL=4 Ω+33uH		16.0		
		Vbat=7.4V,THD=1%,f=1KHz,,RL=3 Ω+33uH		21.6		
		Vbat=7.4V,THD=10%,f=1KHz,RL=3 Ω+33uH		25.0		
THD+N	Total harmonic distortion plus noise	Vbat=7.4V,Po=5W, f=1KHz		0.08		%
η	Efficiency	Vbat=8.4V, f=1KHz,Po=20W,RL=4 Ω+33uH		84		%
		Vbat=3.7V,f=1KHz,Po=10W,RL=4 Ω+33uH		74		
t_{ST}	Wake up time			200		ms
Vn	Output noise	Differential input floating,f=20~20K,A-Weighted		70		uV
SNR		VIN=3.7V , Po=5W		90		dB

OPERATING CHARACTERISTICS T_A=25°C, RL = 4 Ω,AB mode

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
P_O	RL = 4 Ω,AB mode	Vbat=9.0V,THD=10%,f=1KHz		10.2		W
		Vbat=9.0,THD=1%,f=1KHz		7.4		
		Vbat=8.4V,THD=10%,f=1KHz		8.7		
		Vbat=8.4V,THD=1%,f=1KHz		6.5		
		Vbat=7.4V,THD=10%,f=1KHz		6.8		
		Vbat=7.4V,THD=1%,f=1KHz		5.0		
P_O	RL = 3 Ω,AB mode	Vbat=9.0V,THD=10%,f=1KHz		12.3		W
		Vbat=9.0,THD=1%,f=1KHz		8.9		
		Vbat=8.4V,THD=10%,f=1KHz		10.8		
		Vbat=8.4V,THD=1%,f=1KHz		7.8		
		Vbat=7.0V,THD=10%,f=1KHz		7.4		
		Vbat=7.0V,THD=1%,f=1KHz		5.4		
THD+N	Total harmonic distortion plus noise	Vbat=8.0V,Po=1.0W, f=1KHz		0.20		%
		Vbat=6.6V,Po=0.5W, f=1KHz		0.20		

T_A=25°C, RL = 4 Ω+47uH,D mode,NCN=GND

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
P_O	Output power	Vbat=7.2V,NCN MODE1		16.0		W
		Vbat=3.6V,NCN MODE1		16.0		
THD+N	Total harmonic distortion	Vbat=7.2V,NCN MODE1		1.0		%
		Vbat=3.6V,NCN MODE1		1.0		
T_{at}	NCN wake up			50		ms
T_{rl}	NCN wake off			300		ms

T_A=25°C, RL = 4 Ω+47uH,D mode,NCN+51KΩ=GND

Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
P_O	Output power	Vbat=7.2V,NCN MODE2		11.0		W
		Vbat=3.6V,NCN MODE2		10.5		
THD+N	Total harmonic distortion	Vbat=7.2V,NCN MODE2		0.60		%
		Vbat=3.6V,NCN MODE2		0.60		
T_{at}	NCN wake up			4		ms
T_{rl}	NCN wake off			2		s

T_A=25°C, RL = 4 Ω+47uH,D mode,NCN+100KΩ=GND

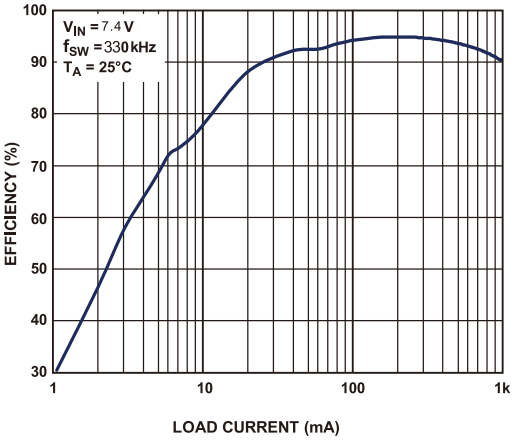
Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
P_O	Output power	Vbat=7.2V,NCN MODE3		11.5		W
		Vbat=3.6V,NCN MODE3		11.0		
THD+N	Total harmonic distortion	Vbat=7.2V,NCN MODE3		0.9		%
		Vbat=3.6V,NCN MODE3		0.9		
T_{at}	NCN wake up			50		ms
T_{rl}	NCN wake off			600		ms

T_A=25°C, RL = 4 Ω+47uH,D mode,NCN+150KΩ=GND

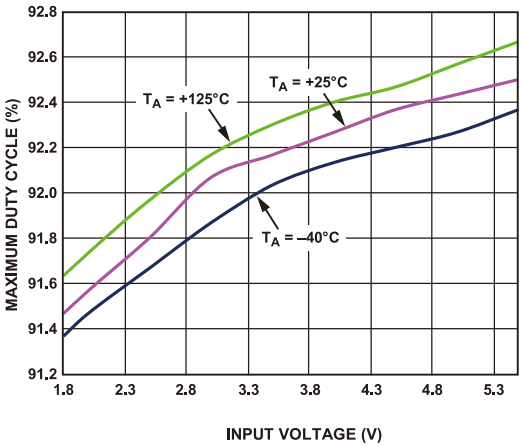
Symbol	Parameter	Conditions	MIN	TYP	MAX	Unit
P_O	Output power	Vbat=7.2V,NCN MODE4		18.0		W
		Vbat=3.6V,NCN MODE4		18.0		
THD+N	Total harmonic distortion	Vbat=7.2V,NCN MODE4		4.0		%
		Vbat=3.6V,NCN MODE4		4.0		
T_{at}	NCN wake up			50		ms
T_{rl}	NCN wake off			75		ms

BOOST Characteristic curve

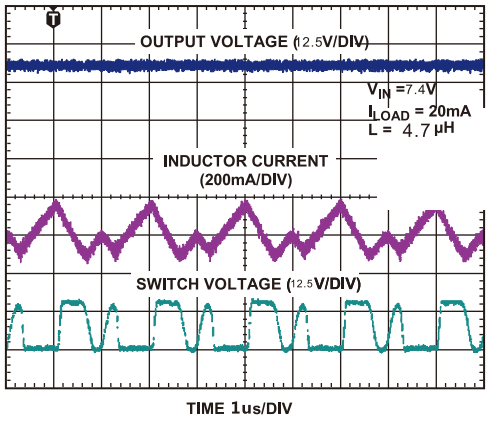
T_A=25°C, RL = 4 Ω



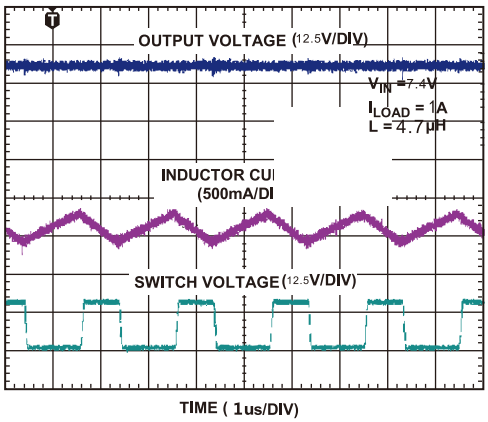
Efficiency vs. Load Current, V_{IN} =7.4 V, f_{SW} = 330KHz



Maximum Duty Cycle vs. Input Voltage, f_{SW} = 330KHz



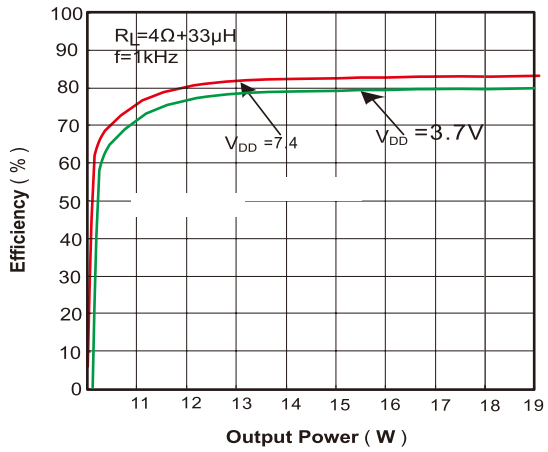
Switching Waveform in Discontinuous Conduction Mode



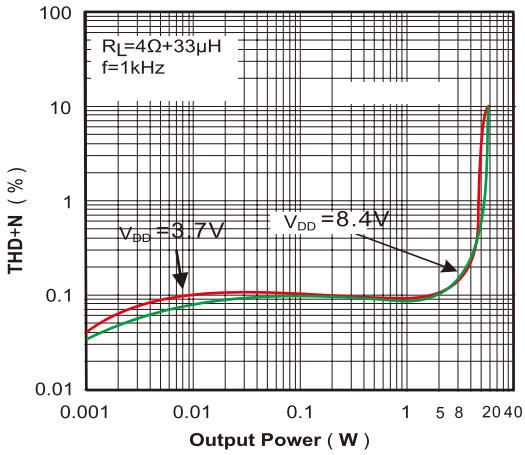
Switching Waveform in Continuous Conduction Mode

Characteristic curve T_A=25°C, RL = 4 Ω ,D mode

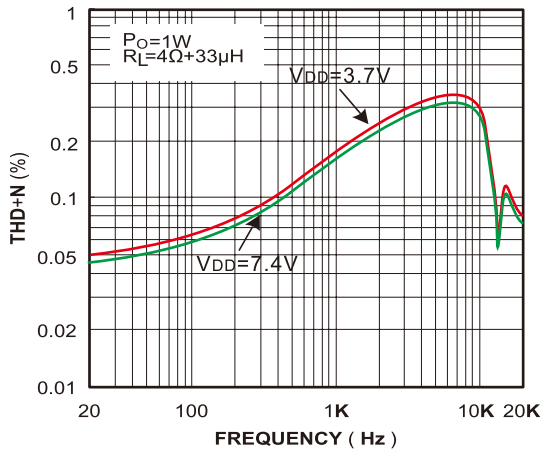
EFFICIENCY vs OUTPUT POWER



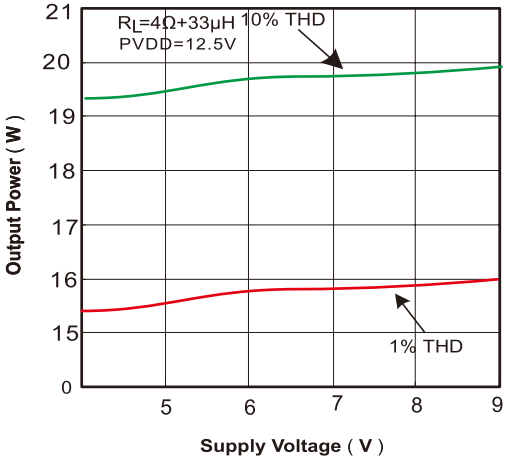
THD+N vs OUTPUT POWER



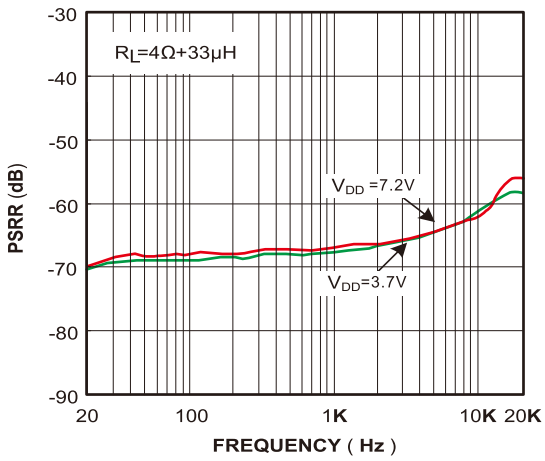
THD+N vs FREQUENCY



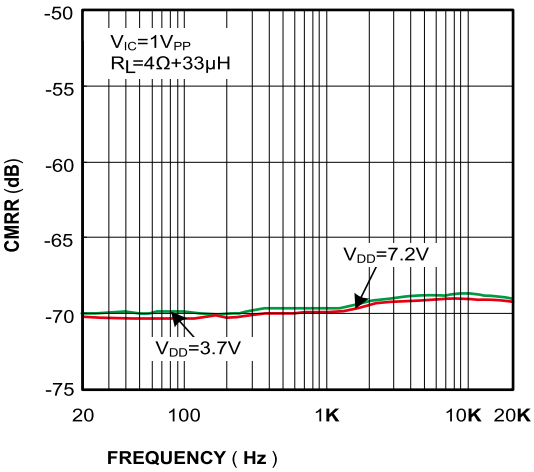
OUTPUT POWER vs SUPPLY VOLTAGE



PSRR vs FREQUENCY

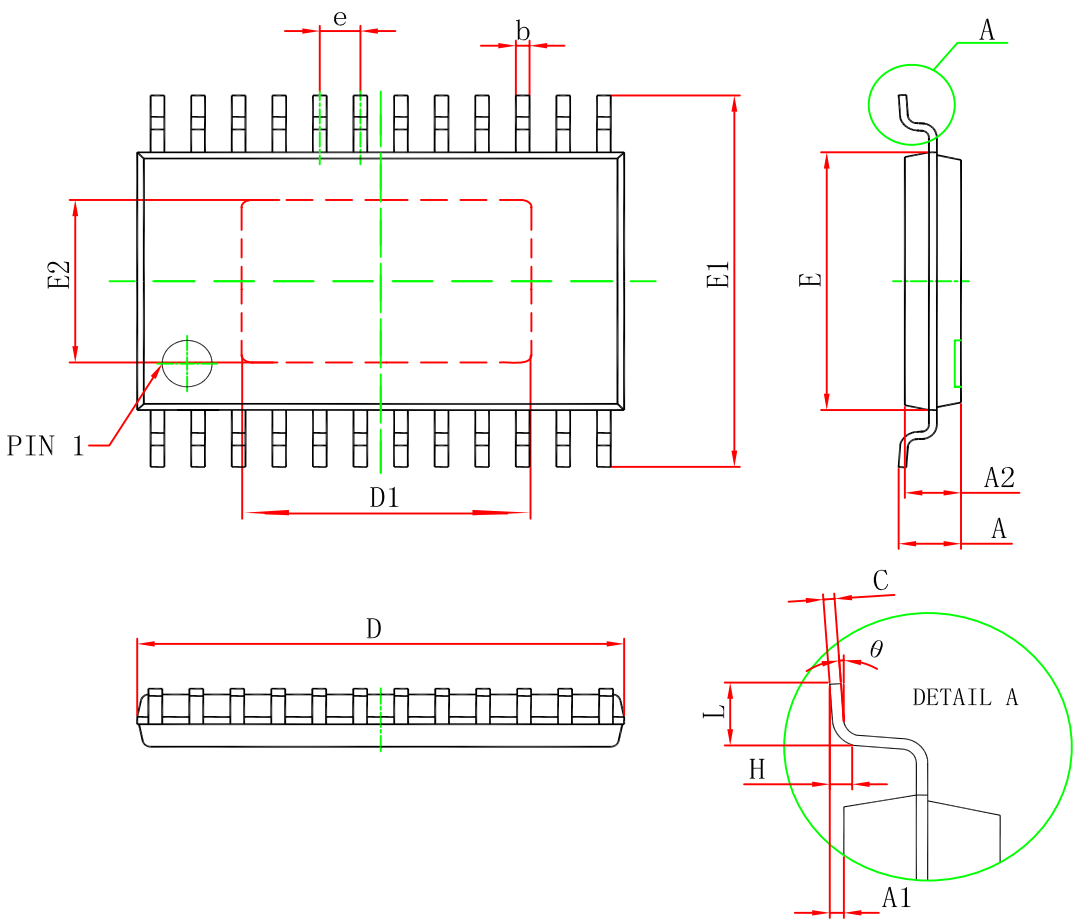


CMRR vs FREQUENCY



Package information

CS8316C TSSOP24-PP



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	7.700	7.900	0.303	0.311
D1	3.950	4.150	0.185	0.188
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
E2	2.700	2.900	0.106	0.122
A		1.100		0.043
A2	0.800	1.000	0.031	0.039
A1	0.020	0.150	0.001	0.006
e	0.600	0.700	0.023	0.029
L	0.500	0.700	0.02	0.028
H	0.230	0.270	0.000	0.001

Notes:

(1) All dimensions are in millimeters