

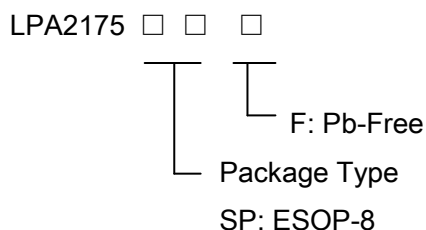


Filterless 8W Class- F Mono Audio Amplifier

General Description

The LPA2175 is a 8W, class-F audio amplifier with a mode pin for switch the work mode. It offers low THD+N, allowing it to achieve high-quality Power Supply sound reproduction. The new filterless architecture allows the device to drive the speaker directly requiring no low-pass output filters, thus to save the system cost and PCB area. The LPA2175 is available in ESOP-8.

Order Information



Applications

- ✧ Portable Bluetooth Speaker
- ✧ Cellular and Smart mobile phone
- ✧ Square Speaker

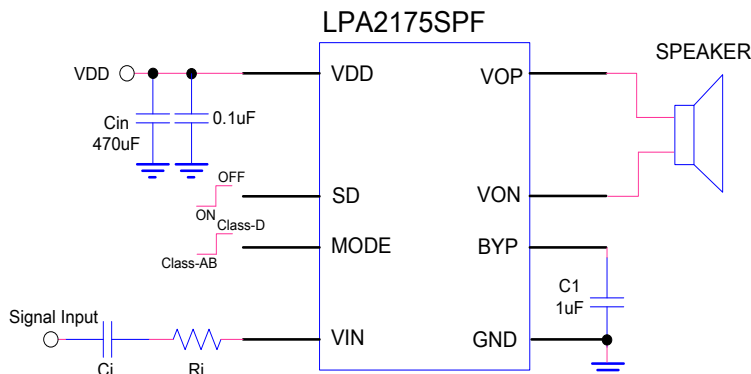
Marking Information

Device	Marking	Package	Shipping
LPA2175		ESOP-8	3K/REEL

Features

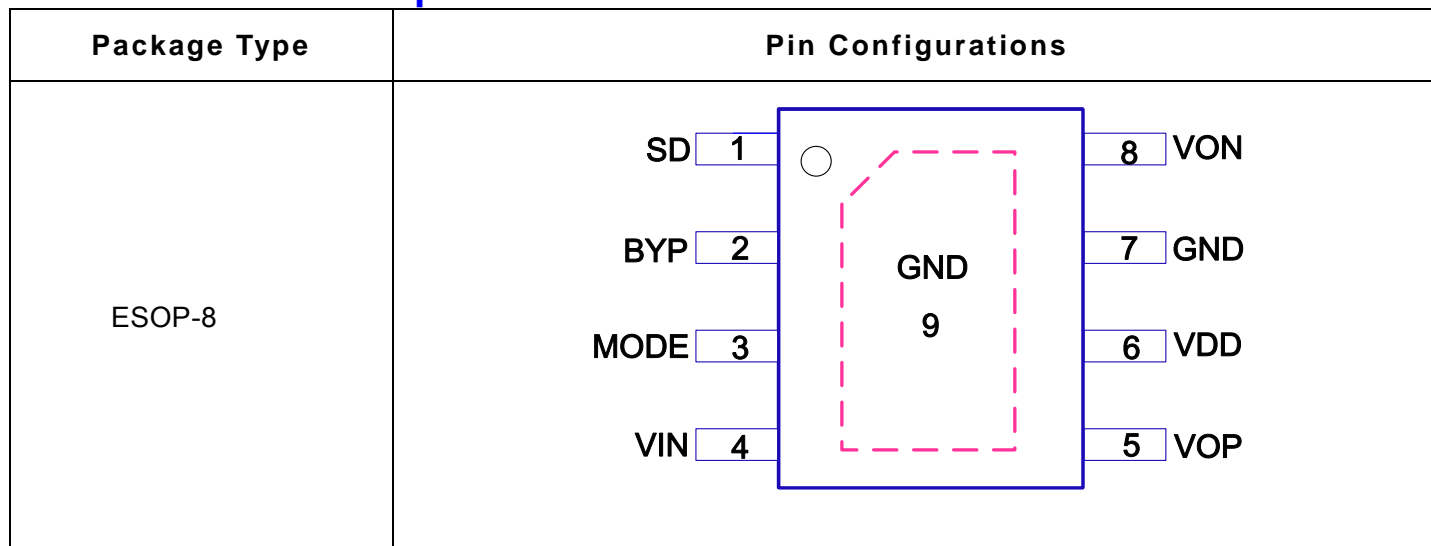
- ◆ Shutdown current:<3uA
- ◆ 480KHz fixed frequency switching for amplifier 8W Output at 10% THD with a 2Ω Load and 6.0V PVDD for amplifier
- ◆ 3.4W Output at 10% THD with a 4Ω Load and 5V PVDD for amplifier
- ◆ 4.6W Output at 1% THD with a 2Ω Load and 5V PVDD for amplifier
- ◆ Filterless, Low Quiescent Current and Low EMI
- ◆ Amplifier Efficiency up to 85%
- ◆ Free LC filter digital modulation, direct-drive speakers
- ◆ Short Circuit Protection
- ◆ Thermal Shutdown
- ◆ Few external components to save the space and cost
- ◆ Pb-Free Package

Typical Application Circuit





Functional Pin Description



Functional Pin Description

PIN NAME	PIN No.	DESCRIPTION
SD	1	Shutdown pin.
BYP	2	Bypass pin. Connect a 1uF capacitor between this pin and GND.
MODE	3	Mode control pin. High voltage with Class_D mode and low voltage with Class_AB mode.
VIN	4	Input of amplifier.
VOP	5	Positive output of signal.
VDD	6	Voltage supply pin.
GND	7	Ground pin.
VON	8	Negative output of signal.

Absolute Maximum Ratings

Supply Input Voltage range	-----	2.1V to 7.5V
Input voltage	-----	-0.3V to VDD+0.3V
Lead Temperature (Soldering, 10 sec.)	-----	260°C
Storage Temperature Range	-----	-65°C to 150°C
Operation Junction Temperature Range	-----	-40°C to 125°C
Operation Ambient Temperature Range	-----	-40°C to 85°C
Maximum Junction Temperature Range	-----	150°C
Maximum Power Dissipation (PD,TA<40°C)	-----	2.6W
Thermal resistance (junction to ambient)	-----	45°C/W

**Electrical Characteristics For Amplifier**

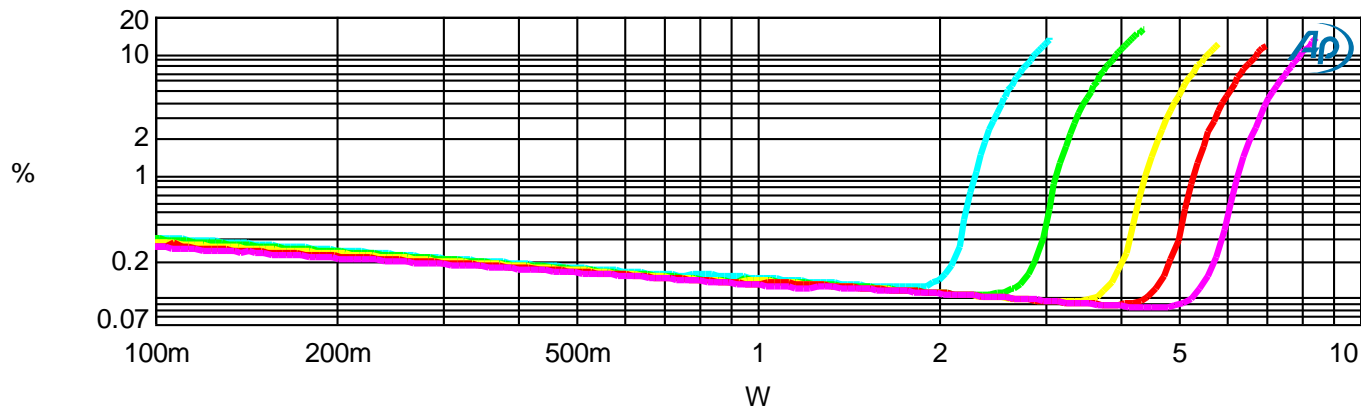
(VDD = 5V, RL=4Ω , TA = 25° C, unless otherwise specified)

Parameter	Symbol	Test Conditions		Min	Typ		Max	Units
					Class-D	Class-AB		
Supply power	VIN			2.3			6.5	V
Output power	Po	THD+N=10%, f=1KHz,RL=4Ω	VDD=6.0V		4.9	4.9		W
			VDD=5.5V		4.1	4.1		
			VDD=5.0V		3.4	3.4		
			VDD=4.2V		2.4	2.4		
			VDD=3.6V		1.8	1.8		
		THD+N=1%, f=1KHz,RL=4Ω	VDD=6.0V		3.9	3.9		
			VDD=5.5V		3.3	3.3		
			VDD=5.0V		2.7	2.7		
			VDD=4.2V		1.9	1.9		
		THD+N=10%, f=1KHz,RL=2Ω	VDD=6.0V		8	8		
			VDD=5.5V		6.8	6.75		
			VDD=5.0V		5.64	5.6		
			VDD=4.2V		3.3	3.9		
			VDD=3.6V		2.3	2.9		
		Power supply ripple rejection	PSRR	INPUT ac-grounded with CIN=0.47uF, VDD=6.0V	f=100HZ		75	
f=1KHz					50			
Signal-to-noise ratio	SNR	VDD=5V,Class_AB	f=1KHz		88		dB	
		VDD=5V,Class_D	f=1KHz		88			
Output noise	VN	INPUT ac-grounded with CIN=0.47uF, VDD=6.0V			140		μV	
Efficiency	η	RL=4Ω, Po=3.2W	f=1KHz		84		%	
Vos		VDD=5.0V, VSD =0V			1.7	5	mV	
Shutdown current	I _{LEAK}	VSD =VDD=5.0V			2		uA	
Quiescent current	I _Q	VDD=5.0V	No load		4.5	4	mA	



Typical Operating Characteristic

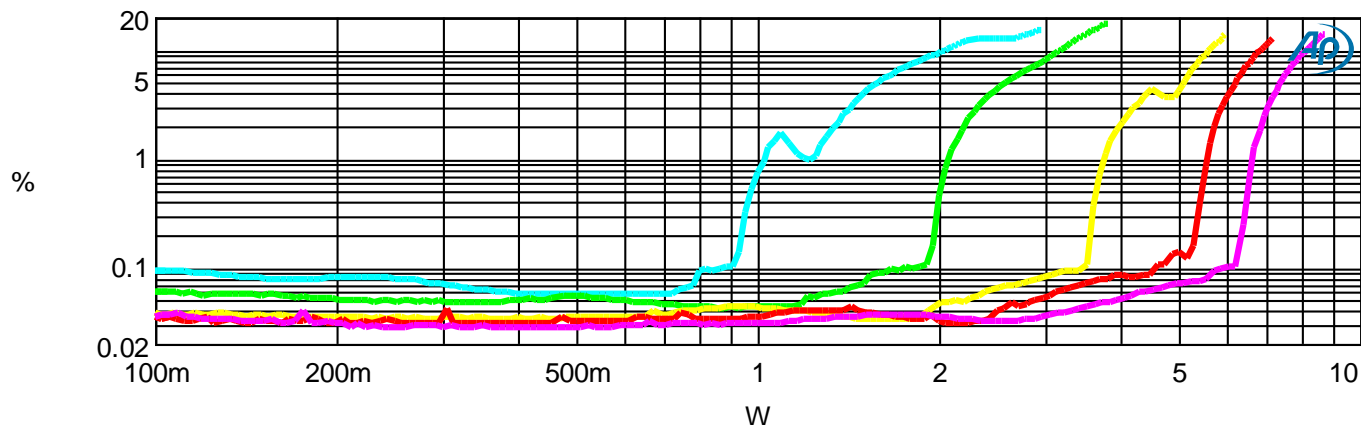
Audio Precision



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Cyan	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=3.6V Class AB
2	1	Green	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=4.2V Class AB
3	1	Yellow	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=5.0V Class AB
4	1	Red	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=5.5V Class AB
5	1	Magenta	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=6.0V Class AB

P0 VS THD(2ohm AB).ats2

Audio Precision



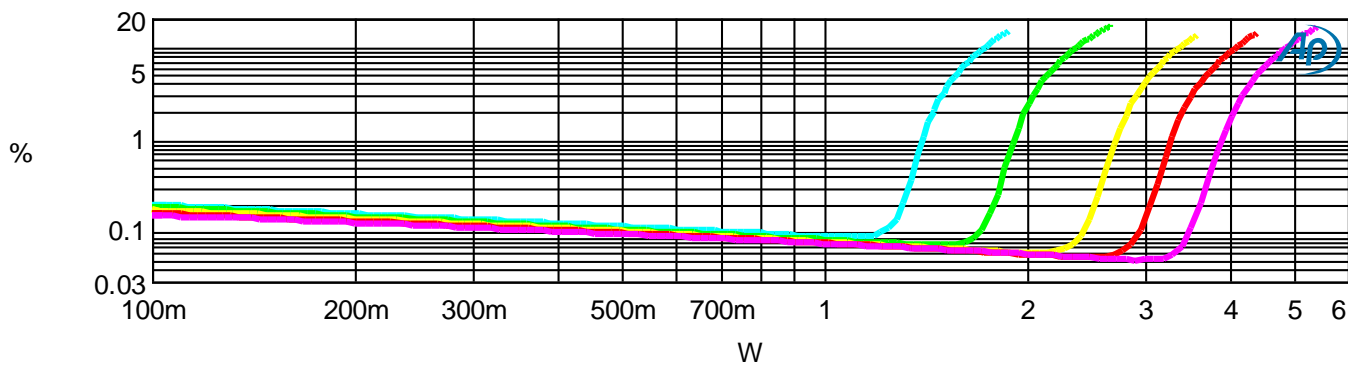
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Cyan	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=3.6V Class D
2	1	Green	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=4.2V Class D
3	1	Yellow	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=5.0V Class D
4	1	Red	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=5.5V Class D
5	1	Magenta	Solid	3	Analyzer.TH _D +N Ratio A	Left	VDD=6.0V Class D

P0 VS THD(2ohm D).ats2



Audio Precision

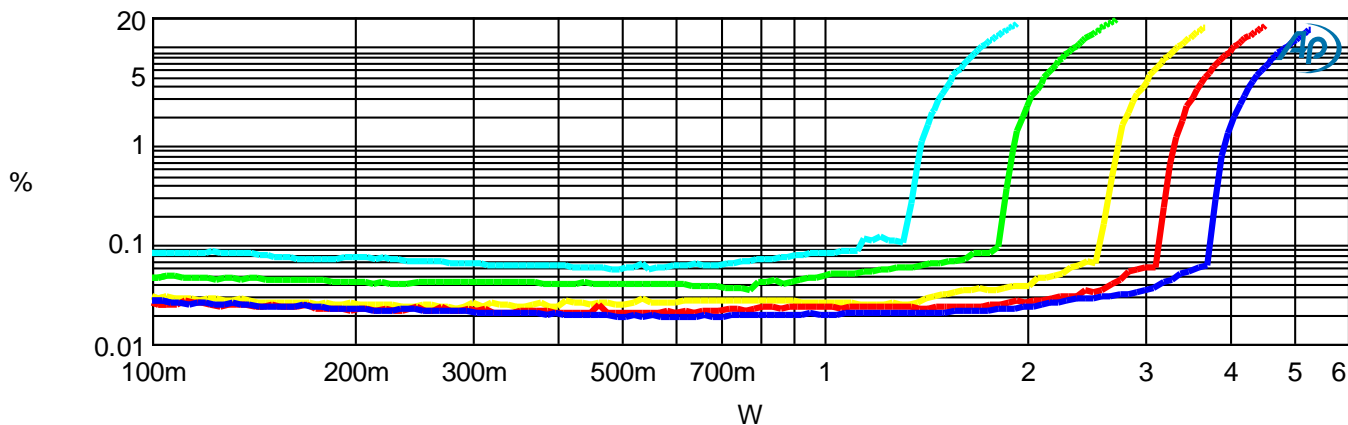
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Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Cyan	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=3.6V Class AB
2	1	Green	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=4.2V Class AB
3	1	Yellow	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=5.0V Class AB
4	1	Red	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=5.5V Class AB
5	1	Magenta	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=6.0V Class AB

P0 VS THD(4ohm AB).ats2

Audio Precision



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Cyan	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=3.6V Class D
2	1	Green	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=4.2V Class D
3	1	Yellow	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=5.0V Class D
4	1	Red	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=5.5V Class D
5	1	Magenta	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=6.0V Class D
6	1	Blue	Solid	3	Analyzer.THD+N Ratio A	Left	VDD=6.0V Class D

P0 VS THD(4ohm D).ats2



Applications Information

Maximum Gain

The LPA2175 has two internal amplifier stages. The first stage's gain is externally configurable, while the second stage's is internally fixed. The closed-loop gain of the first stage is set by selecting the ratio of Rf to Ri while the second stage's gain is fixed at 2x. The output of amplifier serves as the input to amplifier 2, thus the two amplifiers produce signals identical in magnitude, but different in phase by 180°. Consequently, the differential gain for the IC is

$$A_v = 20 \cdot \log [2 \cdot (R_f/R_i)]$$

The LPA2175 sets maximum:

Rf= 150 k Ω±10%	Class-AB
Rf= 150 k Ω±10%	Class-D

Shutdown operation

In order to reduce power consumption while not in use, the LPA2175 contains shutdown circuitry to turn off the amplifier's bias circuitry. This shutdown feature turns the amplifier off when logic High is applied to the SD pin. By switching the SD pin connected to logic High, the LPA2175 supply current draw will be minimized in idle mode. The SD pin can not be left floating in normal application.

Power supply decoupling

The LPA2175 is a high performance CMOS audio amplifier that requires adequate power supply decoupling to ensure the output THD and PSRR a low as possible. Power supply decoupling affects low frequency response. Optimum decoupling is achieved by using two capacitors of different types targeting to different types of noise on the power supply leads. For higher frequency transients, spikes, or digital hash on the line, a good low equivalent-series-resistance (ESR) ceramic capacitor, typically 1.0µF, works best, placing it as close as possible to the device VDD terminal. For

filtering lower- frequency noise signals, a large capacitor of 20µF (ceramic) or greater is recommended, placing it near the audio power amplifier.

Short Circuit Protection (SCP)

The LPA2175 has short circuit protection circuitry on the outputs to prevent damage to the device when output-to-output or output-to-GND short occurs. When a short circuit is detected on the outputs, the outputs are disabled immediately. If the short was removed, the device activates again.

Over Temperature Protection

Thermal protection on the LPA2175 prevents the device from damage when the internal die temperature exceeds 150°C. There is a 15 degree tolerance on this trip point from device to device. Once the die temperature exceeds the thermal set point, the device outputs are disabled. This is not a latched fault. The thermal fault is cleared once the temperature of the die is reduced by 30°C. This large hysteresis will prevent motor boating sound well and the device begins normal operation at this point without external system intervention.

Analog Reference Bypass Capacitor (C_{BYP})

In addition to system cost and size, click and pop performance is affected by the size of the input coupling capacitor, C_{BYP}. A larger input coupling capacitor requires more charge to reach its quiescent DC voltage (nominally 1/2 VDD). This charge comes from the internal circuit via the feedback and is apt to create pops upon device enable. Thus, by minimizing the capacitor size based on necessary low frequency response, turn-on pops can be minimized.

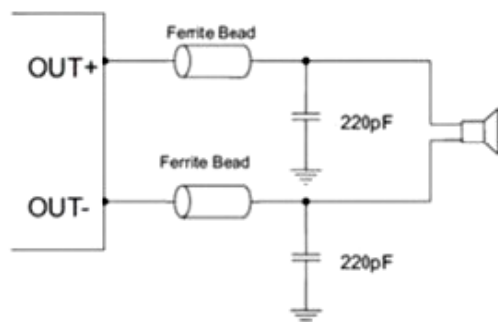
The Analog Reference Bypass Capacitor (C_{BYP}) is the most critical capacitor and serves several important functions. During start-up or recovery from shutdown mode, C_{BYP} determines the rate at which the amplifier starts up. The second function is to



reduce noise caused by the power supply coupling into the output drive signal. This noise is from the internal analog reference to the amplifier, which appears as degraded PSRR and THD+N.

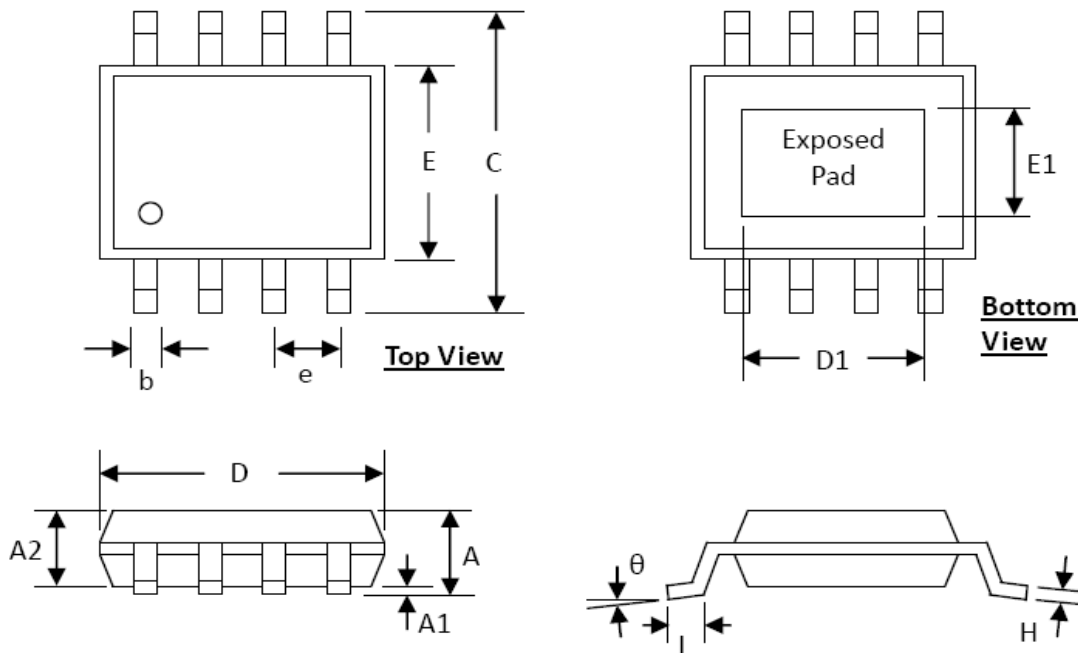
How to reduce EMI

A simple solution is to put an additional capacitor 220pF at power supply terminal for power line. The traces from amplifier to speakers should design as short as we can.



Packaging Information

ESOP-8



SYMBOLS	DIMENSION (MM)		DIMENSION (INCH)	
	MIN	MAX	MIN	MAX
A	1.30	1.70	0.051	0.067
A1	0.00	0.15	0.000	0.006
A2	1.25	1.52	0.049	0.060
b	0.33	0.51	0.013	0.020
C	5.80	6.20	0.228	0.244
D	4.80	5.00	0.189	0.197
D1	3.15	3.45	0.124	0.136
E	3.80	4.00	0.150	0.157
E1	2.26	2.56	0.089	0.101
e	1.27 BSC		0.050 BSC	
H	0.19	0.25	0.0075	0.0098
L	0.41	1.27	0.016	0.050
θ	0°	8°	0°	8°

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