Ultra-Small Built-In Delay

High-Precision Voltage Detector

LR8809 Series

■ INTRODUCTION

The LR8809 Series is a series of high-precision voltage detectors with a built-in delay time generator of fixed time. developed using CMOS process.

The detection voltage is fixed internally, with an accuracy of ±2.0%. Internal oscillator and counter timer can delay the release signal without external parts, delay times 200 ms Two output forms, NMOS open-drain and CMOS output are available.

■ APPLICATIONS

- Memory battery back-up circuits
- Power-on reset circuits
- Power failure detection
- Power monitor for portable equipment such as notebook computers, digital cameras, PDA, and cellular phones.
- Constant voltage power monitors for cameras, video equipment and communication devices.
- Power monitor for microcomputers and reset for CPUs.

■ FEATURES

- Ultra-low current consumption: 0.9μA@3.5V(Typ.)
- High-precision detection voltage: ±2.0%
- Hysteresis characteristics: -VDET×5%(Typ.)
- Operating voltage range: 0.95V to 7.0V
- Detection voltage: 1.5V to 6.0V (10mV step)
- Delay time: 210 ms (Typ.)
- Output forms:
  NMOS open-drain output (Active Low)
  CMOS output (Active Low)

■ ORDER INFORMATION

LR8809①②③④⑤

DESIGNATOR	SYMBOL	DESCRIPTION
①	C	CMOS
	N	NMOS open drain
②③④	Integer	Detection Voltage (1.50V~6.00V), "④"elide when it is "0" e.g. 3.0V=②:3, ③:0 2.93V=②:2, ③:9, ④:3
⑤	M/MA/ML	Package：SOT-23-3
	MR	Package：SOT-23-5
	P	Package：SOT-89-3
	T/TA	Package：TO-92
	N/NA	Package：SOT-343（SC-82）
	E	Package：SOT-23-6
	MB/MAB/MLB	Package：SOT-23

LRC
LESHAN RADIO COMPANY, LTD.

■ **BLOCK DIAGRAMS**

NMOS open-drain

CMOS output
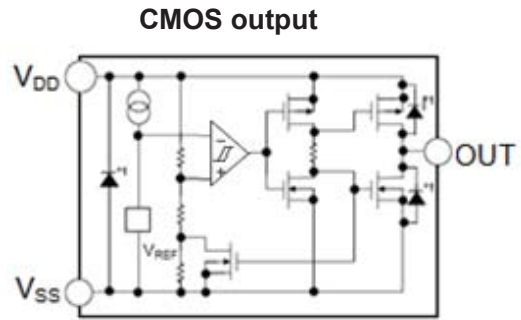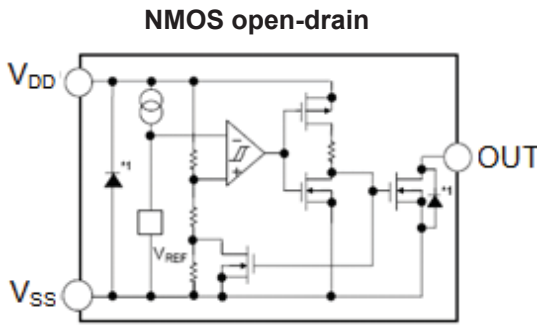
■ **PIN CONFIGURATION**

LR8809 Series（SOT-23-3/SOT-23）
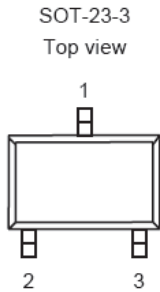
PIN NO.	M/MB	MA/MAB	ML/MLB	FUNCTION
1	V_{DD}	V_{DD}	-	Voltage input pin
	-	-	V_{SS}	Ground
2	V_{OUT}	-	V_{OUT}	Voltage detection output pin
	-	V_{SS}	-	Ground
3	V_{SS}	-	-	Ground
	-	V_{OUT}	-	Voltage detection output pin
	-	-	V_{DD}	Voltage input pin

SOT-23-3
Top view

LR8809 Series（SOT-89-3）

SOT-89-3
Top view

PIN NO.	P	FUNCTION
1	V_{OUT}	Voltage detection output pin
2	V_{DD}	Voltage input pin
3	V_{SS}	Ground
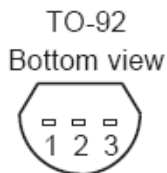
LR8809 Series（TO-92）

TO-92
Bottom view

PIN NO.	T	FUNCTION
1	V_{OUT}	Voltage detection output pin
2	V_{DD}	Voltage input pin
3	V_{SS}	Ground

LR8809Series（SOT343）
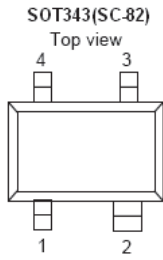
PIN NO.	N	NA	FUNCTION
1	V_{OUT}	-	Voltage detection output pin
	-	V_{DD}	Voltage input pin
2	V_{DD}	-	Voltage input pin
		V_{SS}	Ground
3	NC	-	No Connection
4	V_{SS}	-	Ground
	-	V_{OUT}	Voltage detection output pin
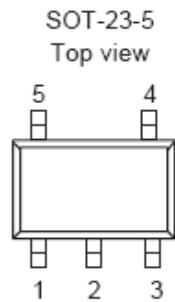
LR8809 Series（SOT23-5）

PIN NO.	MR	FUNCTION
1	V_{OUT}	Voltage detection output pin
2	V_{DD}	Voltage input pin
3	V_{SS}	Ground
4	NC	No connection
5	NC	No connection
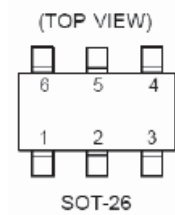
LR8809 Series（SOT23-6）

PIN NO	E	FUNCTION
1	NC	No Connection
2	VSS	Ground
3	VOUT	Voltage detection output pin
4	VDD	Voltage input pin
5	NC	No Connection
6	NC	No Connection

■ **ABSOLUTE MAXIMUM RATINGS**

(Ta=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNITS
Power supply voltage		V_{DD}	$V_{SS}-0.3 \sim V_{SS}+8$	V
Output voltage		V_{OUT}	$V_{SS}-0.3 \sim V_{SS}+8$	V
Power dissipation	SOT-23-3	PD	250	mW
	SOT-89		500	mW
	TO-92		500	mW
	SOT-343		250	mW
Operating ambient temperature		T_{opr}	$-40 \sim +105$	°C
Storage temperature		T_{stg}	$-40 \sim +125$	°C
Soldering Temperature & Time		T_{solder}	260℃, 10s	

■ ELECTRICAL CHARACTERISTICS

(Ta=25°C, unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Detection voltage*1	$-V_{DET}$	—		$-V_{DET(S)}$ ×0.98	$-V_{DET(S)}$	$-V_{DET(S)}$ ×1.02	V
Hysteresis width	V_{HYS}	—		0.02× $-V_{DET(S)}$	0.05× $-V_{DET(S)}$	0.08× $-V_{DET(S)}$	V
Current consumption	I_{SS}	$V_{DD} = -V_{DET}+0.5V$	LR8809 C/N20～26	—	1.0	3.0	uA
			LR8809 C/N 26～39	—	1.2	3.2	uA
			LR8809 C/N 39～60	—	1.5	3.5	uA
Operating voltage	V_{DD}	—		0.95	—	7	V
Output current	I_{OUT}	NMOS：$V_{OUT}=0.5V$ $V_{DD}=-V_{DET}-0.5V$	LR8809 C/N 20～26	3.0	13.0	—	mA
			LR8809 C/N 26～39	3.0	15.0	—	mA
			LR8809 C/N 39～60	3.0	18.0	—	mA
		PMOS：$V_{DD}-V_{OUT}=0.5V$ $V_{DD}=-V_{DET}+0.5V$	LR8809 C/N 20～26	1.5	4.0	—	mA
			LR8809 C/N 26～39	1.5	6.0	—	mA
			LR8809 C/N 39～60	1.5	8.0	—	mA
Leakage current	I_{LEAK}	Only for NMOS open-drain output products, $V_{DD}=8.0V$, $V_{OUT}=8.0V$			—	1.0	uA
temperature coefficient		Ta=−40°C ~+85°C		—	±120	±360	ppm/°C
Delay time	T_{PLH}			130	210	290	ms

*1. −VDET: Actual detection voltage value, −VDET(S): Specified detection voltage value

■ **FUNCTIONAL DESCRIPTION**

1. When a voltage higher than the release voltage ($+V_{DET}$) is applied to the voltage input pin (V_{DD}), the voltage will gradually fall. When a voltage higher than the detect voltage ($-V_{DET}$) is applied to V_{DD}, output (V_{OUT}) will be equal to the input at V_{DD}.

Note that high impedance exists at V_{OUT} with the N-channel open drain configuration. If the pin is pulled up, V_{OUT} T will be equal to the pull up voltage.

2. When V_{DD} falls below $-V_{DET}$, V_{OUT} will be equal to the ground voltage (V_{SS}) level (detect state).

Note that this also applies to N-channel open drain configurations.

3. When V_{DD} falls to a level below that of the minimum operating voltage (V_{MIN}) output will become unstable.

Because the output pin is generally pulled up with N-channel open drain configurations, output will be equal to pull up voltage.

4. When V_{DD} rises above the V_{SS} level (excepting levels lower than minimum operating voltage), V_{OUT} will be equal to V_{SS} until V_{DD} reaches the $+V_{DET}$ level.

5 . Although V_{DD} will rise to a level higher than $+V_{DET}$, V_{OUT} maintains ground voltage level via the delay circuit.

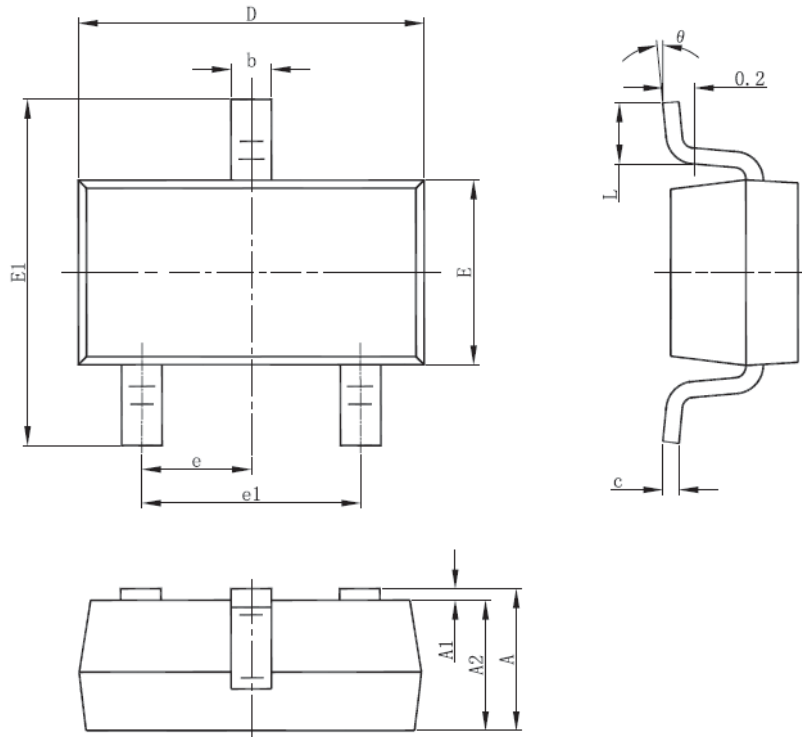6. Following transient delay time, V_{DD} will be output at V_{OUT}.

Note that high impedance exists with the N-channel open drain configuration and that voltage will be dependent on pull up
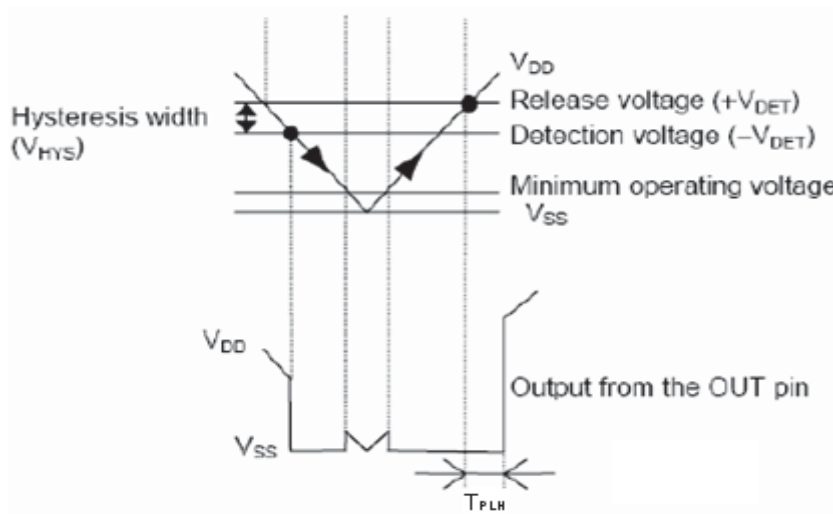
■ TYPICAL APPLICATION CIRCUITS

1、CMOS output:
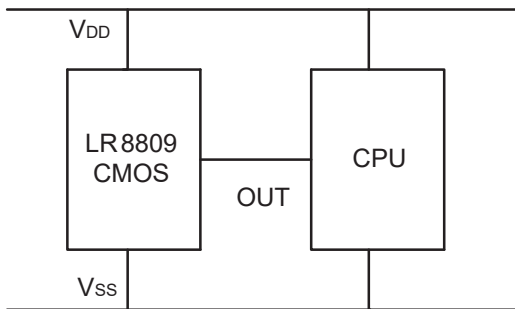
2、NMOS open-drain
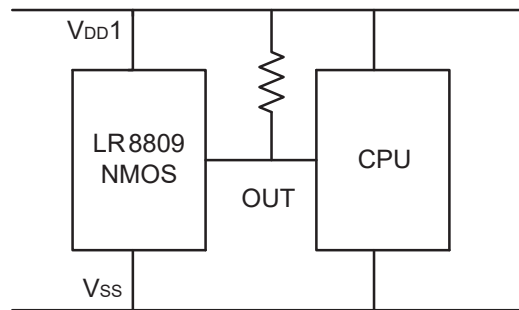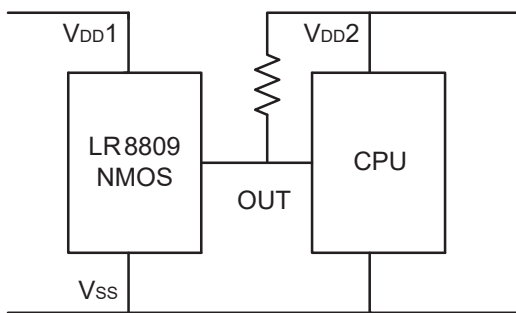
3．Forbidden Circuits
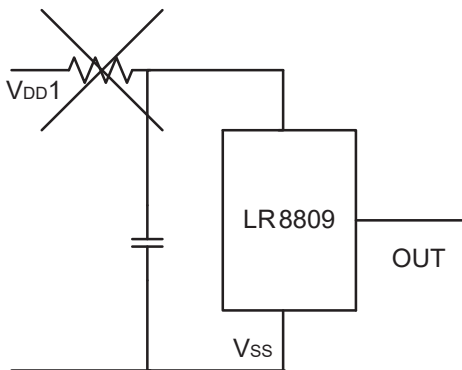
■ PACKAGING INFORMATION

● **SOT-23**
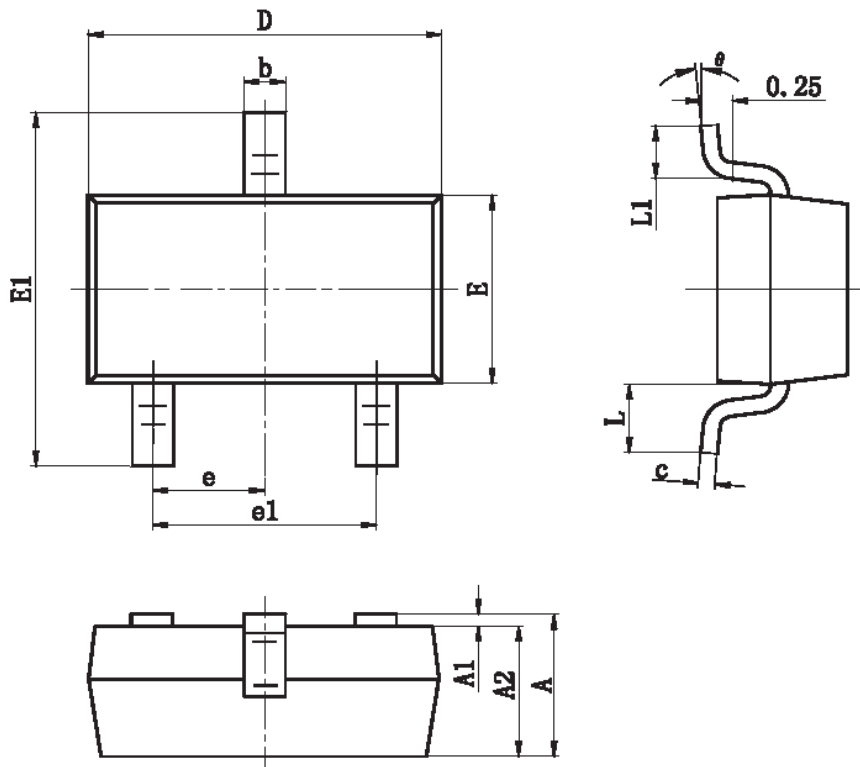
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	6°

● **SOT-23-3**

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

● SOT-23-5

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

● **SOT-23-6**

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

● **SOT-343**

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	**Max.**	**Min.**	**Max.**
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.250	0.400	0.010	0.016
b1	0.350	0.500	0.014	0.020
c	0.080	0.150	0.003	0.006
d	0.050 TYP.		0.002 TYP.	
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP.		0.026 TYP.	
e1	1.200	1.400	0.047	0.055
L	0.525 REF.		0.021 REF.	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

● SOT-89-3
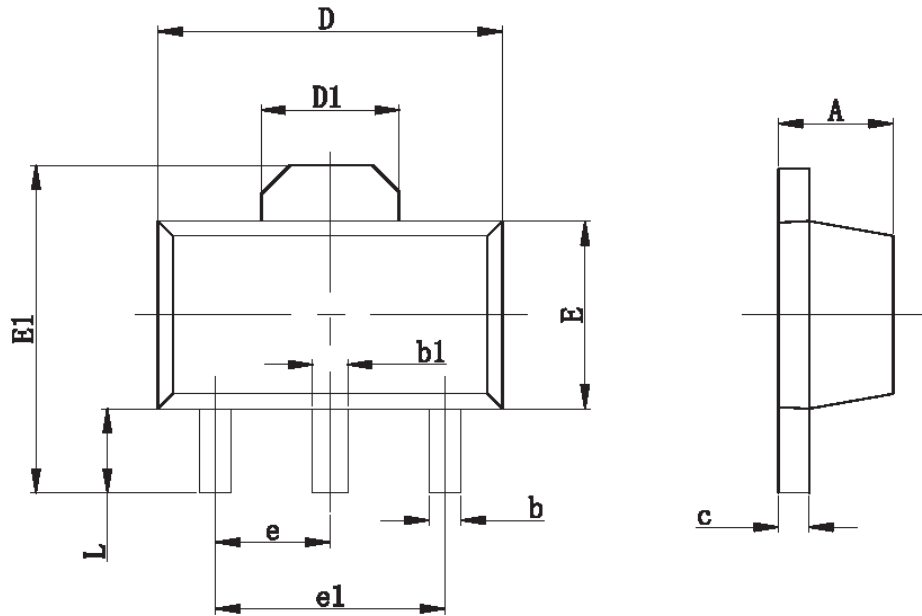
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.197
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060TYP	
e1	3.000 TYP		0.118TYP	
L	0.900	1.200	0.035	0.047

● TO-92
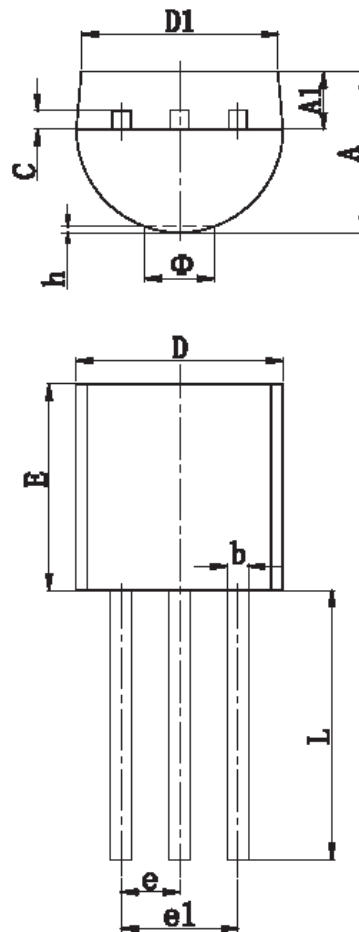
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.400	4.700	0.173	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270 TYP		0.050 TYP	
e1	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.571
Φ		1.600		0.063
h	0.000	0.380	0.000	0.015