To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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HA17904A Series

Dual Operational Amplifier

REJ03D0689-0200
Rev.2.00
Mar 10, 2006

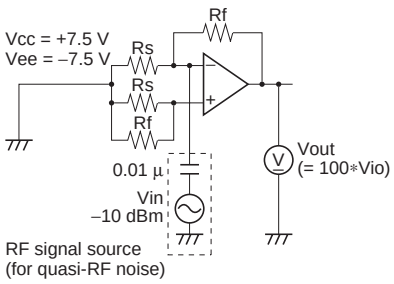
Description

HA17904A series are dual operational amplifier that provide high gain and internal phase compensation, with single power supply. They can be widely applied to control equipments and to general use.

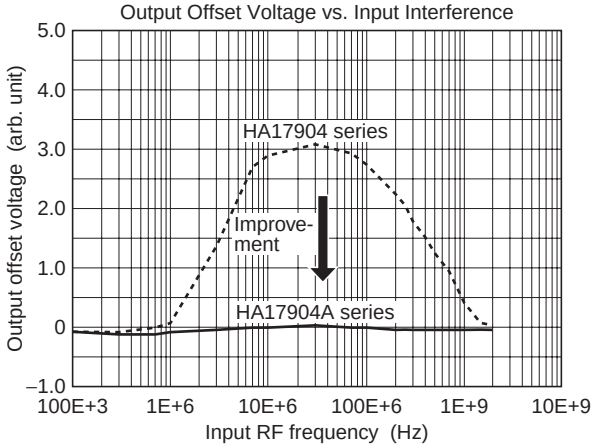
Features

- Wide range of supply voltage, and single power supply used
- Wide range of common mode voltage, and possible to operate with an input about 0 V, and output around 0 V is available
- Frequency characteristics and input bias current are temperature compensated
- Low electro-magnetic susceptibility level

Measurement Condition



Output Offset Voltage vs. Input Interference

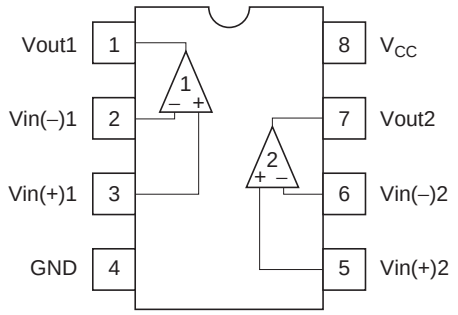


Ordering Information

Type No.	Application	Package Name	Package Code
HA17904APS	Industrial use	DIP-8 pin	PRDP0008AF-B
HA17904AFP		SOP-8 pin (JEITA)	PRSP0008DE-B
HA17904ARP		SOP-8 pin (JEDEC)	PRSP0008DD-C
HA17904AT		TSSOP-8 pin	PTSP0008JC-B

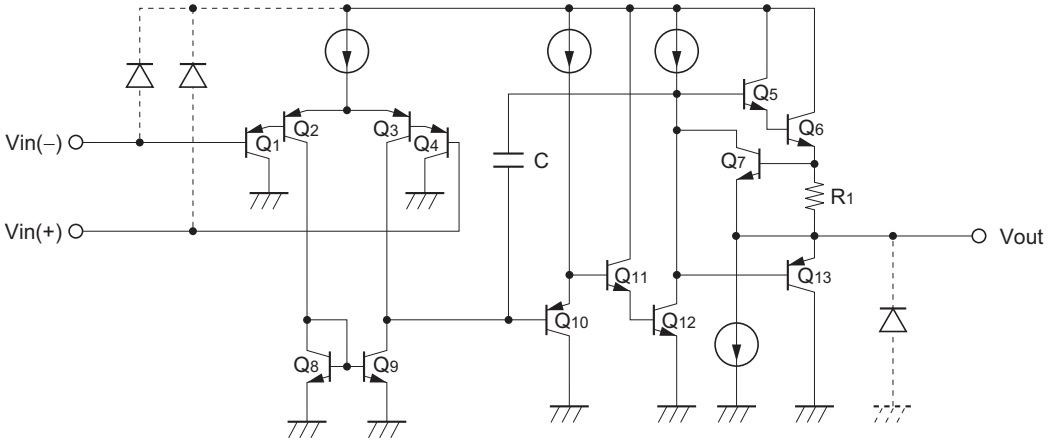
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Pin Arrangement



(Top View)

Circuit Schematic (1/2)



Note: If Input/Output terminals voltage over the absolute maximum ratings, there is possibility of mis-operation, characteristics deterioration and destruction, because of the current's flowing to parasitic diode in IC.
The Input/Output terminals are recommended to be protected with the clamp circuit which using the diode with low forward voltage (like schottky barrier diode) when there is a possibility for the Input/Output terminals voltage exceeds the absolute maximum ratings.

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Absolute Maximum Ratings

(Ta = 25°C)

Item		Symbol	Ratings	Unit
Power supply voltage		V_{CC}	32	V
Output sink current		Iosink	50	mA
Common mode input voltage		V_{CM}	–0.3 to +V_{CC}	V
Differential input voltage		Vin(diff)	±V_{CC}	V
Output voltage		Vout	–0.3 to +V_{CC}	V
Allowable power dissipation	DIP	P_T	570 *[1]	mW
	SOP		385 *[2]	
	TSSOP		192 *[3]	
Operating temperature		Topr	–40 to +85	°C
Storage temperature		Tstg	–55 to +125	°C

Notes: 1. HA17904APS:
This is the allowable values up to Ta = 50°C. Derate by 8.3 mW/°C.
2. HA17904AFP/ARP:
These are the allowable values up to Ta = 25°C mounting in air.
When it is mounted on glass epoxy board of 40 mm × 40 mm × 1.5 mmt with 30% wiring density, the allowable value is 570 mW up to Ta = 45°C. If Ta > 45°C, derate by 7.14 mW/°C.
3. HA17904AT:
These are the allowable values up to Ta = 25°C. Derate by 1.92 mW/°C above that temperature.

Electrical Characteristics

(V_{CC} = +15 V, Ta = 25°C)

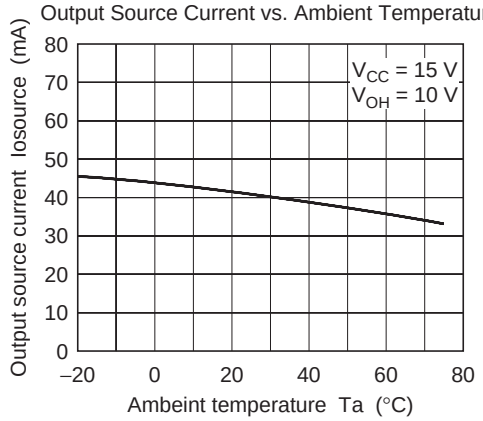
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input offset voltage	V_{IO}	—	3	7	mV	V_{CM} = 7.5V, R_S = 50Ω, Rf = 50kΩ
Input offset current	I_{IO}	—	5	50	nA	V_{CM} = 7.5V, I_{IO} = | $I_{I(+)}$ – $I_{I(–)}$ |
Input bias current	I_{IB}	—	30	250	nA	V_{CM} = 7.5V
Power source rejection ratio	PSRR	—	93	—	dB	R_S = 1kΩ, Rf = 100kΩ
Voltage gain	A_{VD}	75	90	—	dB	R_L = ∞, R_S = 1kΩ, Rf = 100kΩ
Common mode rejection ratio	CMR	—	80	—	dB	R_S = 50Ω, Rf = 5kΩ
Common mode input voltage range	$V_{CM(+)}$	13.5	—	—	V	R_S = 1kΩ, Rf = 100kΩ
	$V_{CM(–)}$	—	—	–0.3	V	R_S = 1kΩ, Rf = 100kΩ
Peak-to-peak output voltage	V_{OP-P}	—	13.6	—	V	f = 100Hz, R_L = 20kΩ, R_S = 1kΩ, Rf = 100kΩ
Output source current	Iosource	20	40	—	mA	V_{IN}^+ = 1V, V_{IN}^- = 0V, V_{OH} = 10V
Output sink current	Iosink	10	20	—	mA	V_{IN}^- = 1V, V_{IN}^+ = 0V, V_{OL} = 2.5V
		15	50	—	µA	V_{IN}^- = 1V, V_{IN}^+ = 0V, Vout = 200mV
Supply current	I_{CC}	—	0.8	2	mA	V_{IN} = GND, R_L = ∞
Slew rate	SR	—	0.2	—	V/µs	R_L = ∞, V_{CM} = 7.5V, f = 1.5kHz
Channel separation *[1]	CS	—	(120)	—	dB	f = 1kHz

Note: 1. Design spec.

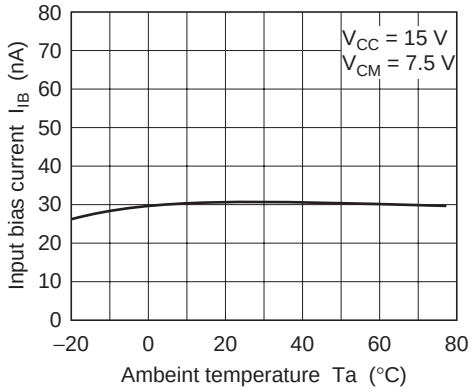
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Characteristic Curves

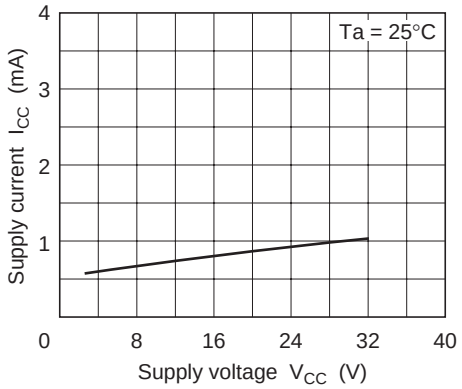
Output Source Current vs. Ambient Temperature



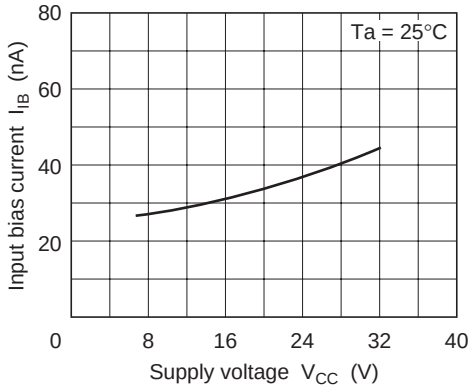
Input Bias Current vs. Ambient Temperature



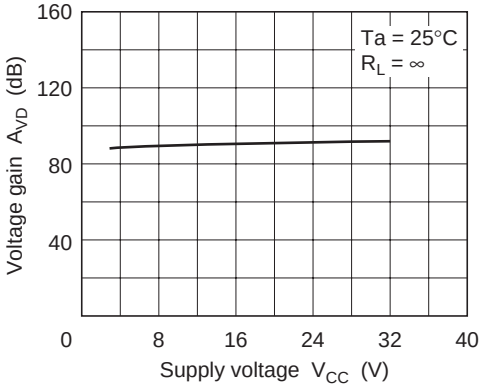
Supply Current vs. Supply Voltage



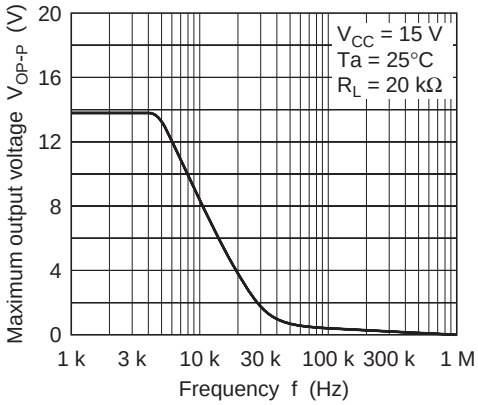
Input Bias Current vs. Supply Voltage



Voltage Gain vs. Supply Voltage

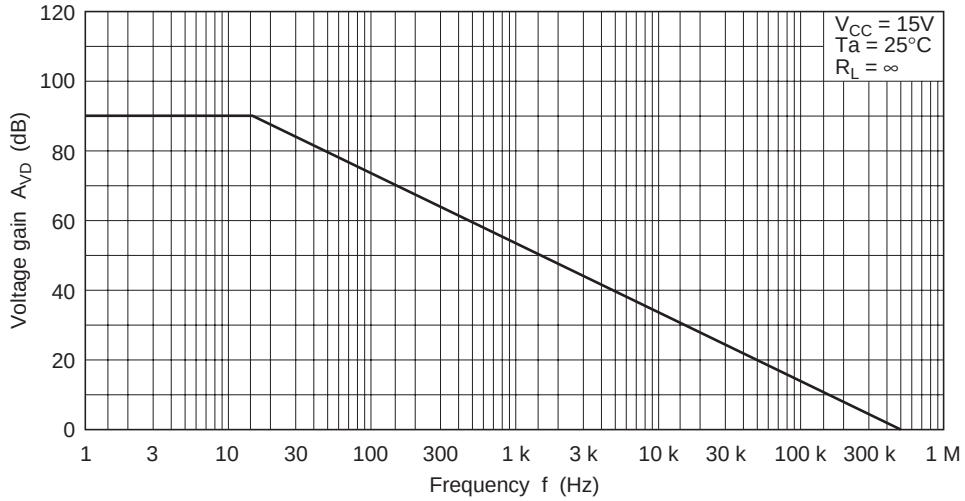


MaxImum Output Voltage vs. Frequency

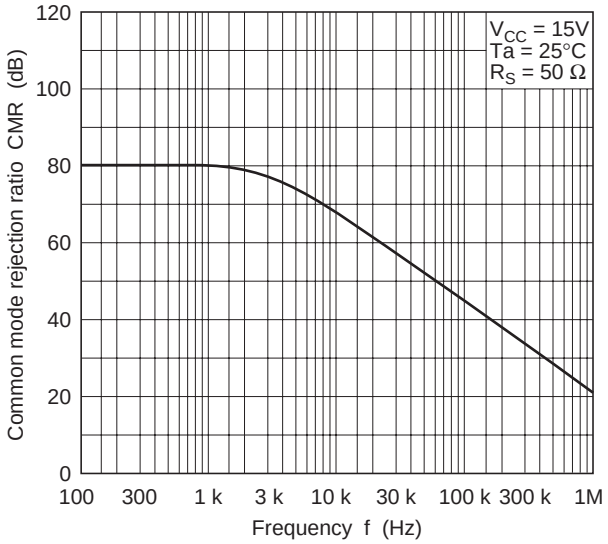


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Voltage Gain vs. Frequency



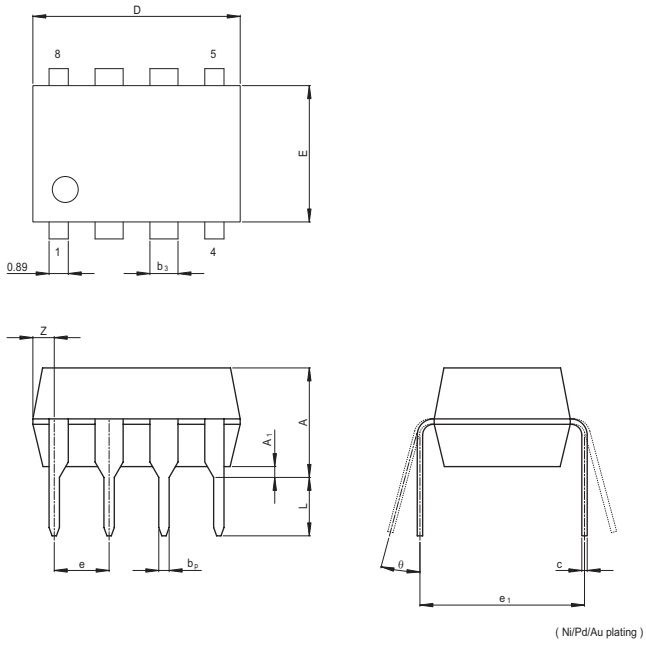
Common Mode Rejection Ratio vs. Frequency



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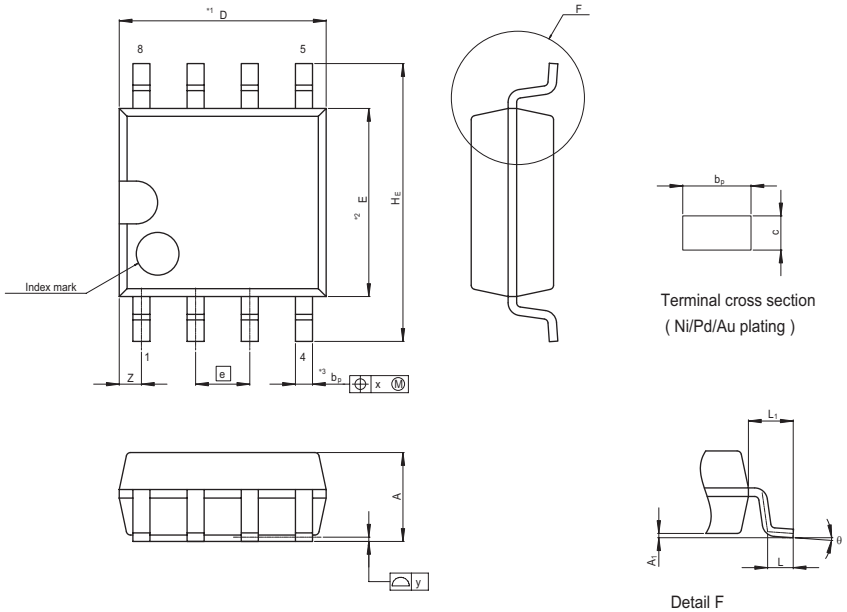
Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP8-6.3x9.6-2.54	PRDP0008AF-B	DP-8FV	0.54g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e_1	—	7.62	—
D	—	9.60	10.6
E	—	6.30	7.4
A	—	—	5.06
A_1	0.5	—	—
b_p	0.40	0.48	0.56
b_3	—	1.30	—
c	0.19	0.25	0.31
θ	0°	—	15°
e	2.29	2.54	2.79
Z	—	—	1.27
L	2.54	—	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP8-4.4x4.85-1.27	PRSP0008DE-B	FP-8DGV	0.1g

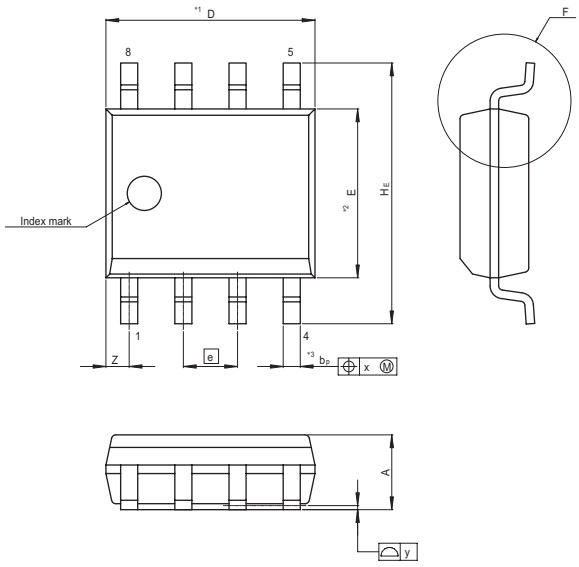


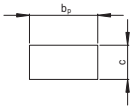
NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	4.85	5.25
E	—	4.4	—
A_2	—	—	—
A_1	0.00	0.1	0.20
A	—	—	2.03
b_p	0.35	0.4	0.45
b_1	—	—	—
c	0.15	0.20	0.25
c_1	—	—	—
θ	0°	—	8°
H_E	6.35	6.5	6.75
e	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	0.75
L	0.42	0.60	0.85
L_1	—	1.05	—

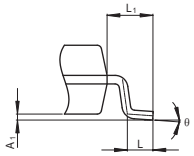
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JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP8-3.95x4.9-1.27	PRSP0008DD-C	FP-8DCV	0.085g





Terminal cross section
(Ni/Pd/Au plating)

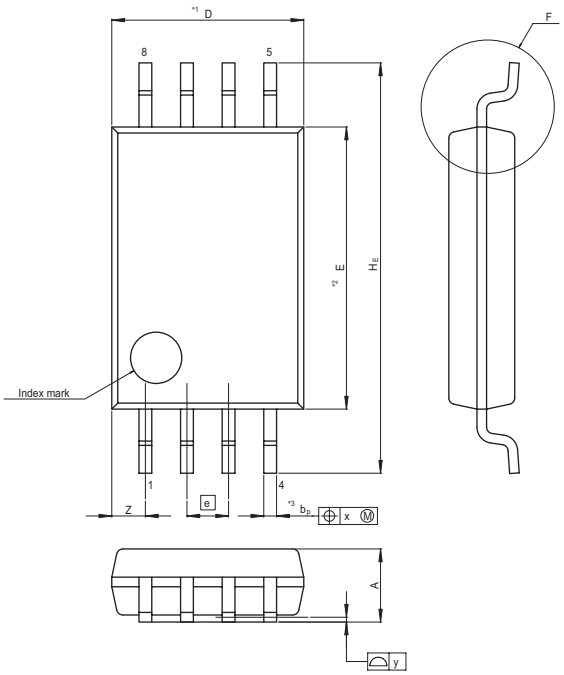


Detail F

NOTE)
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2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.

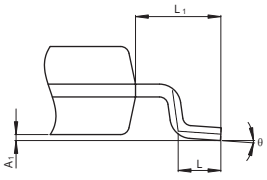
Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	4.90	5.30
E	—	3.95	—
A_2	—	—	—
A_1	0.10	0.14	0.25
A	—	—	1.75
b_p	0.34	0.40	0.46
b_1	—	—	—
c	0.15	0.20	0.25
c_1	—	—	—
θ	0°	—	8°
H_E	5.80	6.10	6.20
e	—	1.27	—
x	—	—	0.25
y	—	—	0.10
Z	—	—	0.75
L	0.40	0.60	1.27
L_1	—	1.08	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-TSSOP8-4.4x3-0.65	PTSP0008JC-B	TTP-8DAV	0.034g





Terminal cross section
(Ni/Pd/Au plating)



Detail F

NOTE)
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2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	3.00	3.30
E	—	4.40	—
A_2	—	—	—
A_1	0.03	0.07	0.10
A	—	—	1.10
b_p	0.15	0.20	0.25
b_1	—	—	—
c	0.10	0.15	0.20
c_1	—	—	—
θ	0°	—	8°
H_E	6.20	6.40	6.60
e	—	0.65	—
x	—	—	0.13
y	—	—	0.10
Z	—	—	0.805
L	0.40	0.50	0.60
L_1	—	1.00	—

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