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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HA17324A Series

Quad Operational Amplifier

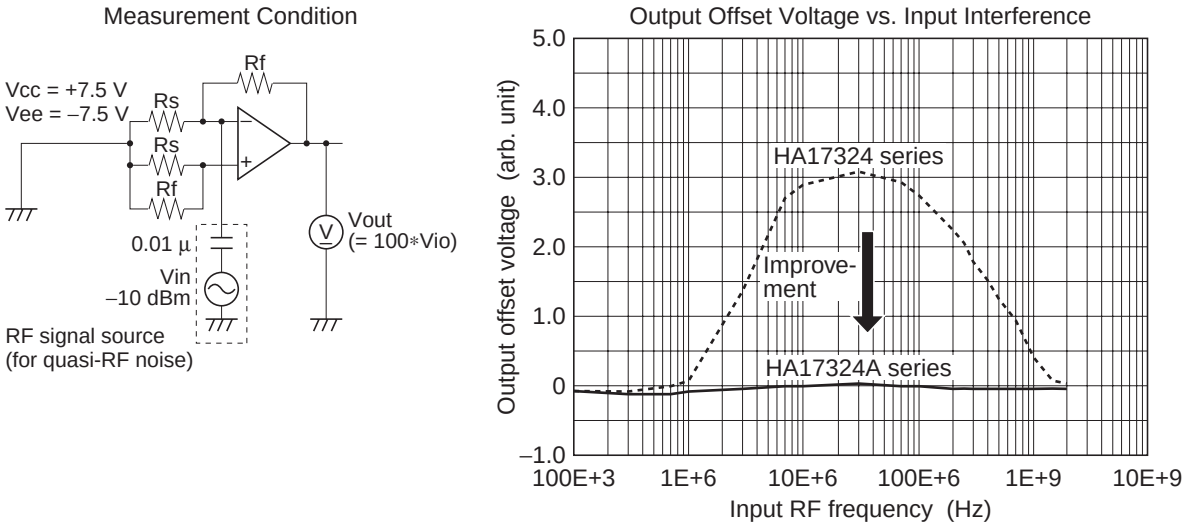
REJ03D0674-0400
Rev.4.00
Mar 10, 2006

Description

HA17324A series are quad operational amplifier that provide high gain and internal phase compensation, with single power supply. They can be widely used to control equipments.

Features

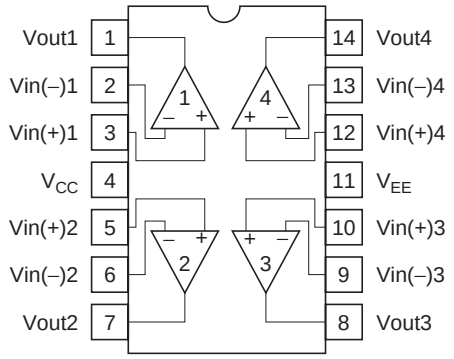
- Wide range of supply voltage, and single power supply used
- Internal phase compensation
- Wide range of common mode voltage, and possible to operate with an input about 0 V
- Low electro-magnetic susceptibility level



Ordering Information

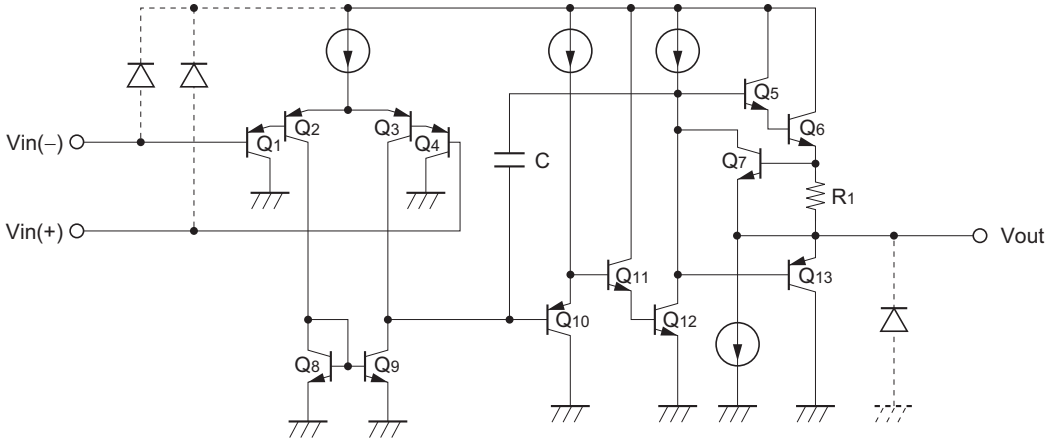
Type No.	Application	Package Name	Package Code
HA17324A	Commercial use	DIP-14 pin	PRDP0014AB-B
HA17324AF		SOP-14 pin (JEITA)	PRSP0014DF-B
HA17324ARP		SOP-14 pin (JEDEC)	PRSP0014DE-A
HA17324AT		TSSOP-14 pin	PTSP0014JA-B

Pin Arrangement



(Top view)

Circuit Schematic (1/4)



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.

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	625 *2	mW
	SOP		625 *3	
	TSSOP		400 *4	
Operating temperature		Topr	–40 to +85	°C
Storage temperature		Tstg	–55 to +125	°C

Notes: 1. HA17324A:
This is the allowable values up to Ta = 50°C. Derate by 8.3 mW/°C.
2. HA17324AF/ARP:
When it is mounted on glass epoxy board of 40 mm × 40 mm × 1.6 mmt with 10% wiring density, value at Ta ≤ 25°C. If Ta > 25°C, derated by 6.25 mW/°C.
When it is mounted on glass epoxy board of 40 mm × 40 mm × 1.6 mmt with 30% wiring density. If Ta > 32°C, derated by 6.70 mW/°C.
3. HA17324AT:
These are the allowable values up to Ta = 25°C. Derate by 4 mW/°C above that temperature.

Electrical Characteristics

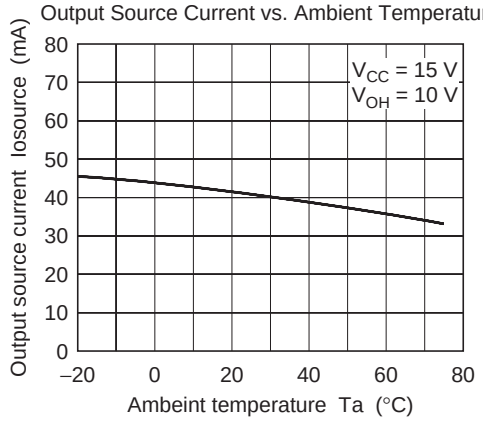
(V_{CC} = +15 V, Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input offset voltage	V_{IO}	—	2	7	mV	V_{CM} = 7.5 V, R_S = 50 Ω, Rf = 50 kΩ
Input offset current	I_{IO}	—	5	50	nA	V_{CM} = 7.5 V, I_{IO} = | $I_{I(-)} - I_{I(+)}$ |
Input bias current	I_{IB}	—	30	500	nA	V_{CM} = 7.5 V
Power source rejection ratio	PSRR	—	93	—	dB	f = 100 Hz, R_S = 1 kΩ, Rj = 100 kΩ
Voltage gain	A_{VD}	75	90	—	dB	R_S = 1 kΩ, Rf = 100 kΩ, R_L = ∞
Common mode rejection ratio	CMR	—	80	—	dB	R_S = 50 Ω, Rf = 5 kΩ
Common mode input voltage range	V_{CM}	–0.3	—	13.5	V	R_S = 1 kΩ, Rf = 100 kΩ, f = 100 Hz
Maximum output voltage	V_{OP-P}	—	13.6	—	V	f = 100 Hz, R_S = 1 kΩ, Rf = 100 kΩ, R_L = 20 kΩ
Output source current	Iosource	20	40	—	mA	V_{IN}^+ = 1 V, V_{IN}^- = 0 V, V_{OH} = 10 V
Output sink current	Iosink	10	20	—	mA	V_{IN} = 0 V, V_{IN} = 1 V, V_{OL} = 2.5 V
Supply current	I_{CC}	—	0.8	2	mA	V_{IN} = GND, R_L = ∞
Slew rate	SR	—	0.19	—	V/µs	f = 1.5 kHz, V_{CM} = 7.5 V, R_L = ∞
Channel separation *1	CS	—	(120)	—	dB	f = 1 kHz
Output sink current	Iosink	15	50	—	µA	V_{IN}^+ = 0 V, V_{IN}^- = 1 V, V_{OL} = 200 mV
		3	9	—	mA	V_{IN}^+ = 0 V, V_{IN}^- = 1 V, V_{OL} = 1 V
Output voltage	V_{OH1}	13.2	13.6	—	V	I_{OH} = –1 mA
	V_{OH2}	12.0	13.3	—	V	I_{OH} = –10 mA
Output voltage	V_{OL1}	—	0.8	1.0	V	I_{OL} = 1 mA
	V_{OL2}	—	1.1	1.8	V	I_{OL} = 10 mA

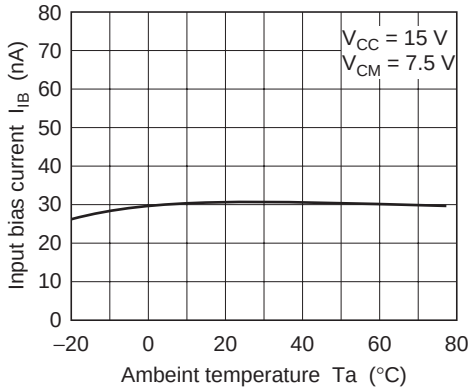
Note: 1. Design spec.

Characteristic Curves

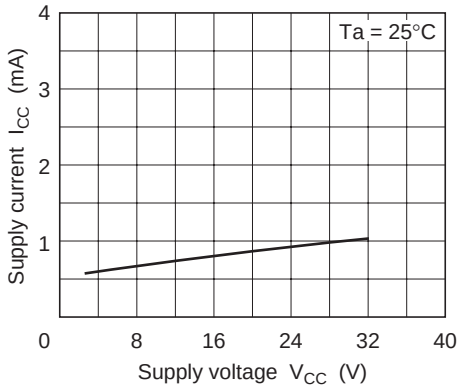
Output Source Current vs. Ambient Temperature



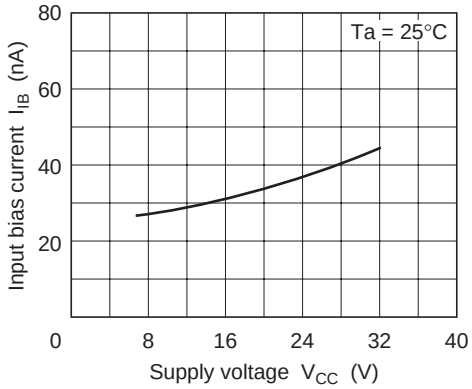
Input Bias Current vs. Ambient Temperature



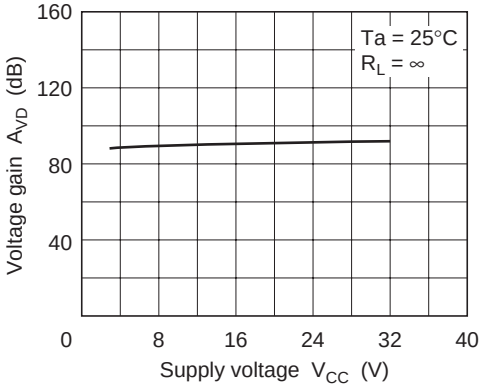
Supply Current vs. Supply Voltage



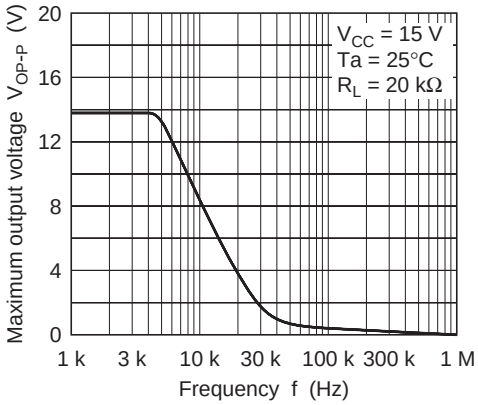
Input Bias Current vs. Supply Voltage



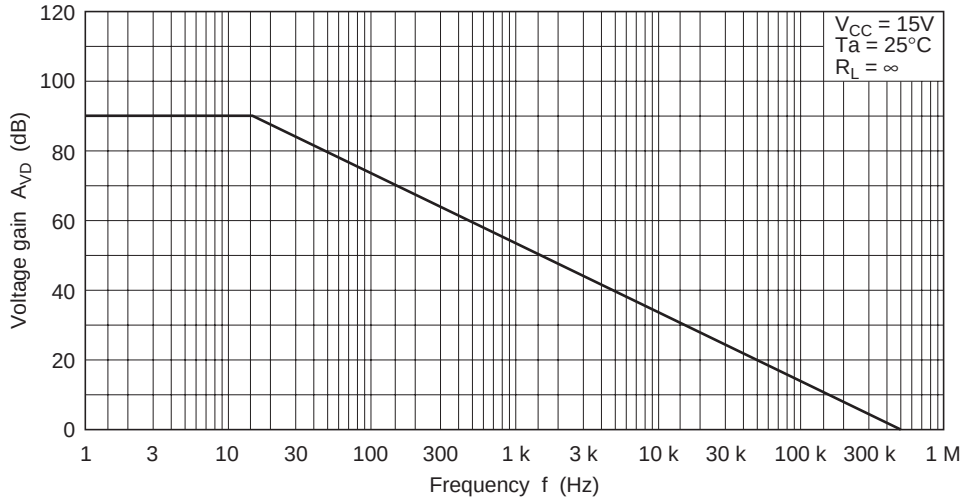
Voltage Gain vs. Supply Voltage



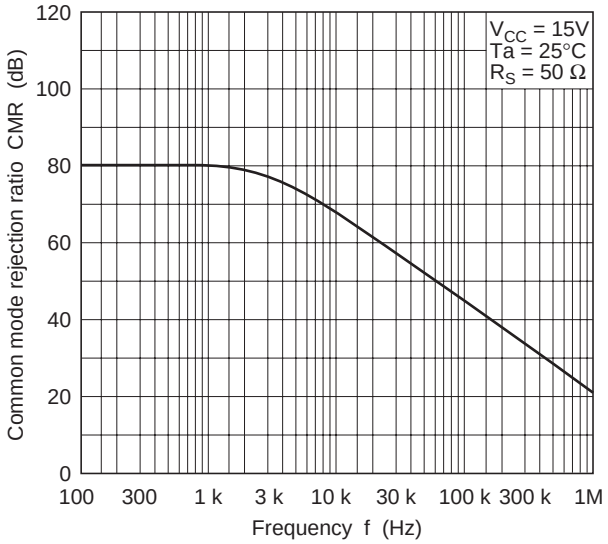
MaxImum Output Voltage vs. Frequency



Voltage Gain vs. Frequency

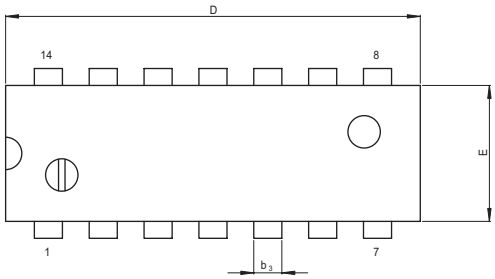


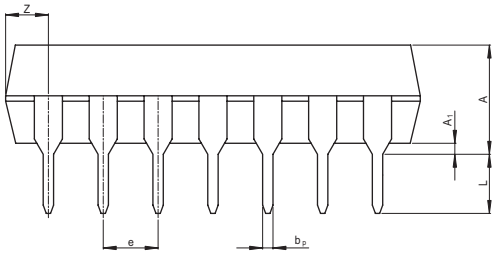
Common Mode Rejection Ratio vs. Frequency

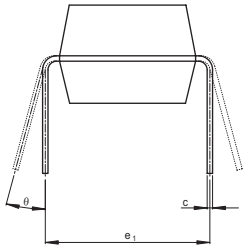


Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP14-6.3x19.2-2.54	PRDP0014AB-B	DP-14AV	0.97g



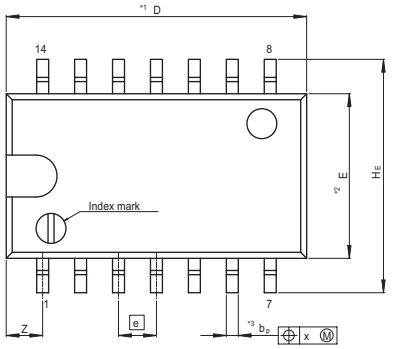


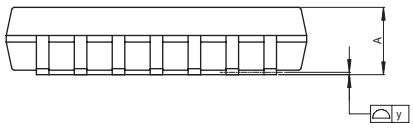


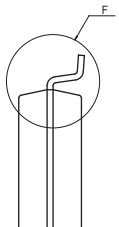
(Ni/Pd/Au plating)

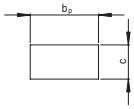
Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e_1	—	7.62	—
D	—	19.2	20.32
E	—	6.3	7.4
A	—	—	5.06
A_1	0.51	—	—
b_p	0.40	0.48	0.56
b_3	—	1.30	—
c	0.19	0.25	0.31
θ	0°	—	15°
e	2.29	2.54	2.79
Z	—	—	2.39
L	2.54	—	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP14-5.5x10.06-1.27	PRSP0014DF-B	FP-14DAV	0.23g

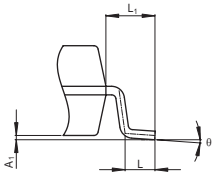








Terminal cross section
(Ni/Pd/Au plating)

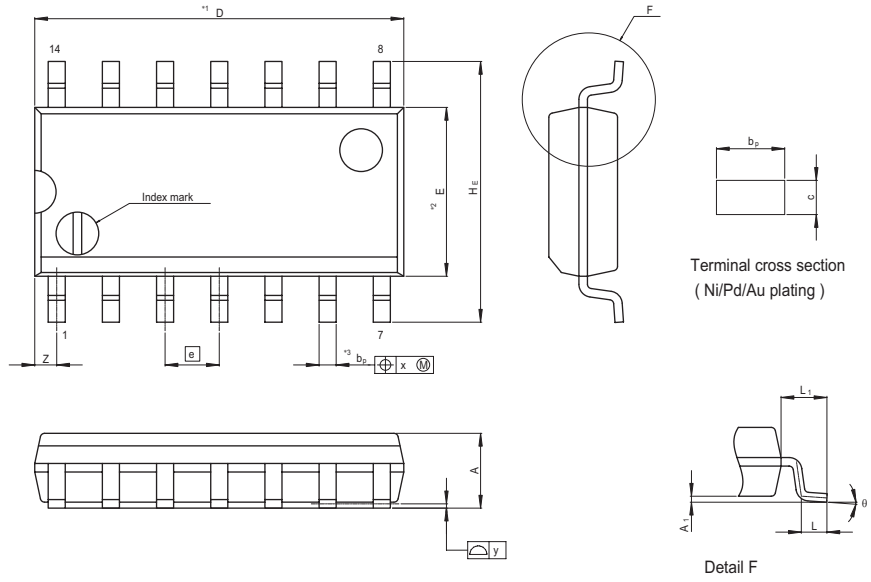


Detail F

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	—	10.06	10.5
E	—	5.50	—
A_2	—	—	—
A_1	0.00	0.10	0.20
A	—	—	2.20
b_p	0.34	0.40	0.46
b_1	—	—	—
c	0.15	0.20	0.25
c_1	—	—	—
θ	0°	—	8°
H_E	7.50	7.80	8.00
e	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	1.42
L	0.50	0.70	0.90
L_1	—	1.15	—

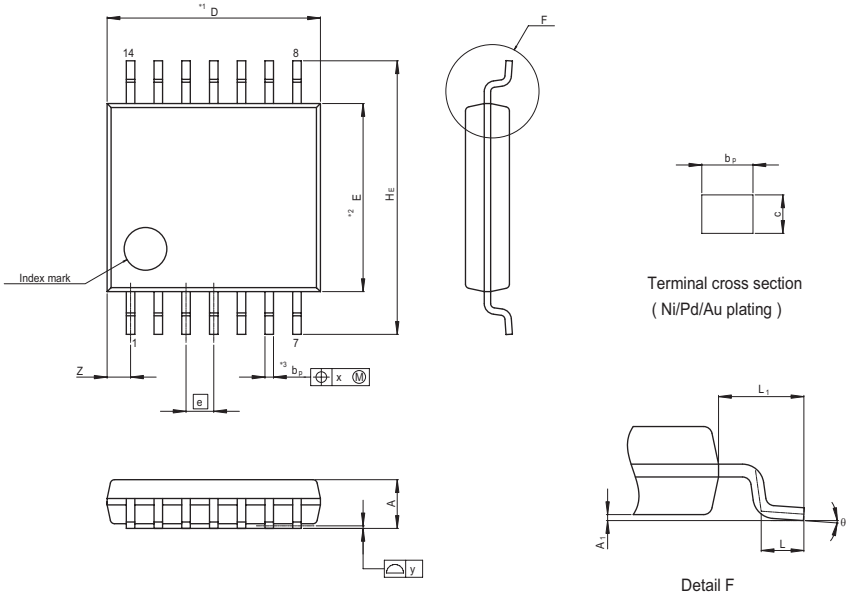
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP14-3.95x8.65-1.27	PRSP0014DE-A	FP-14DNV	0.13g



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	—	8.65	9.05
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	—	—	0.15
Z	—	—	0.635
L	0.40	0.60	1.27
L_1	—	1.08	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-TSSOP14-4.4x5-0.65	PTSP0014JA-B	TTP-14DV	0.05g



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	—	5.00	5.30
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	—	—	0.83
L	0.4	0.5	0.6
L_1	—	1.0	—

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