

# HA17324A Series

## Quad Operational Amplifier

REJ03D0674-0400

Rev.4.00

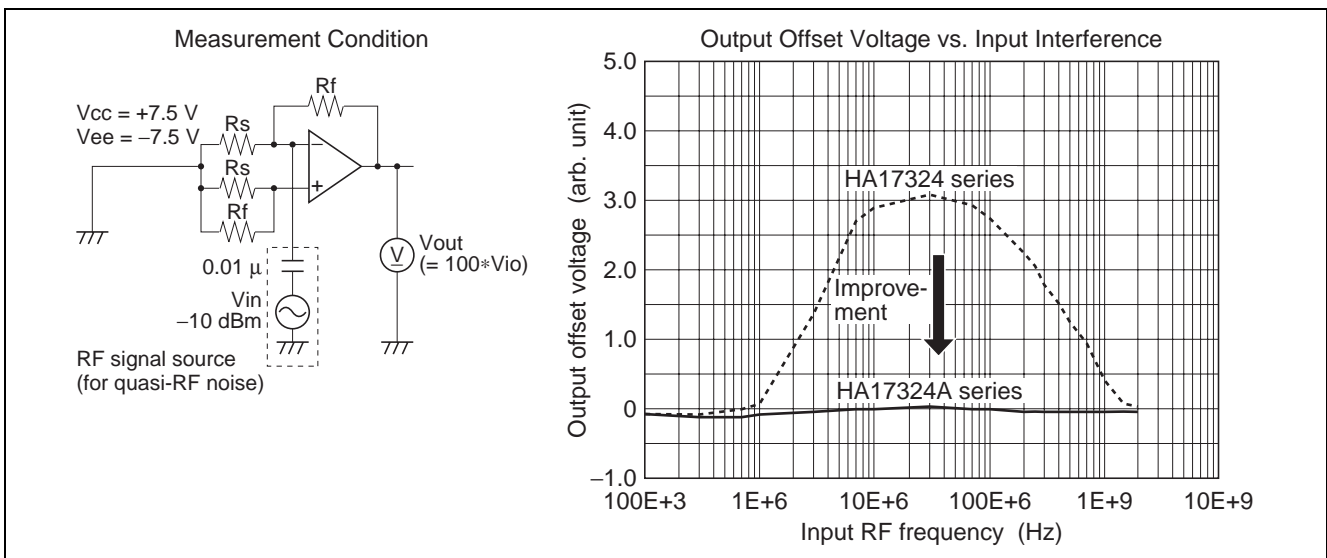
Mar 10, 2006

### 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

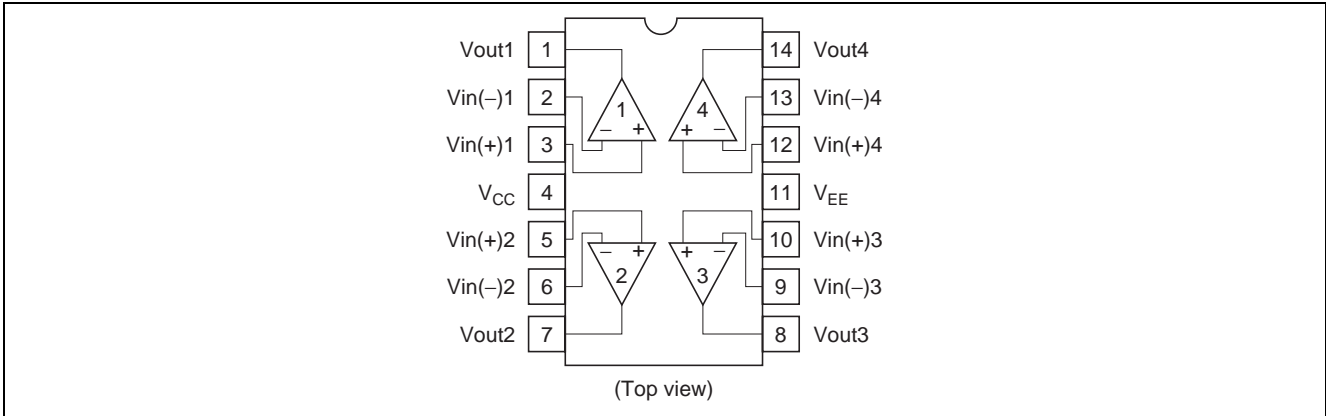
- Wide range of supply voltage, and single power supply used
- Internal phase compensation
- Wide range of common mode voltage, and possible to operate with an input about 0 V
- Low electro-magnetic susceptibility level



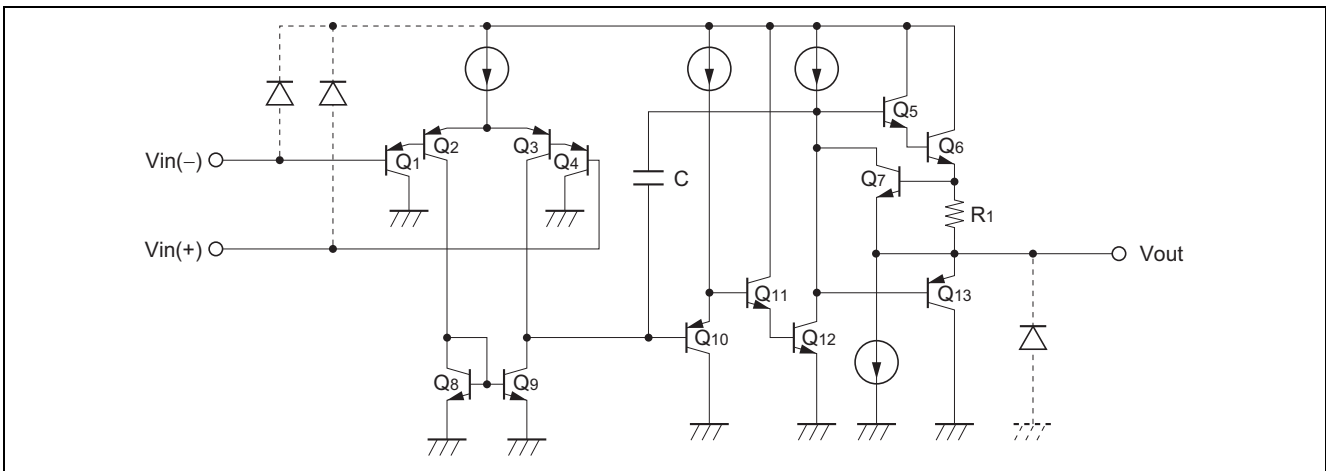
### Ordering Information

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



### 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 <sub>CC</sub>	32	V
Output sink current	I <sub>osink</sub>	50	mA
Common mode input voltage	V <sub>CM</sub>	-0.3 to +V <sub>CC</sub>	V
Differential input voltage	V <sub>in(diff)</sub>	±V <sub>CC</sub>	V
Output voltage	V <sub>out</sub>	-0.3 to +V <sub>CC</sub>	V
Allowable power dissipation	DIP	P <sub>T</sub>	mW
	SOP		
	TSSOP		
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 mm with 10% wiring density, value at Ta ≤ 25°C. If Ta &gt; 25°C, derated by 6.25 mW/°C.

When it is mounted on glass epoxy board of 40 mm × 40 mm × 1.6 mm with 30% wiring density. If Ta &gt; 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.

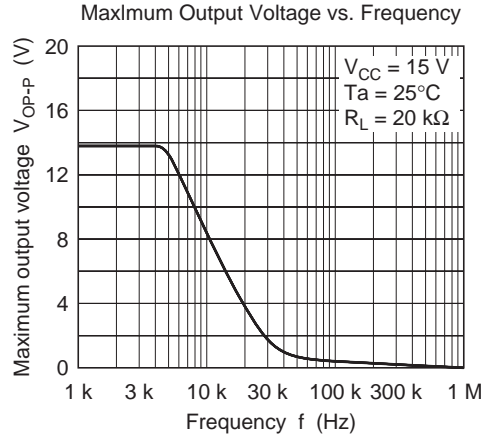
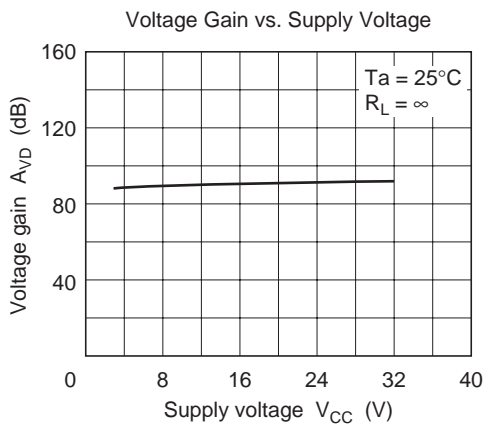
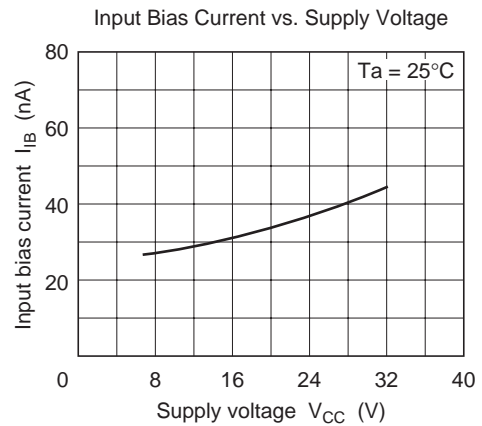
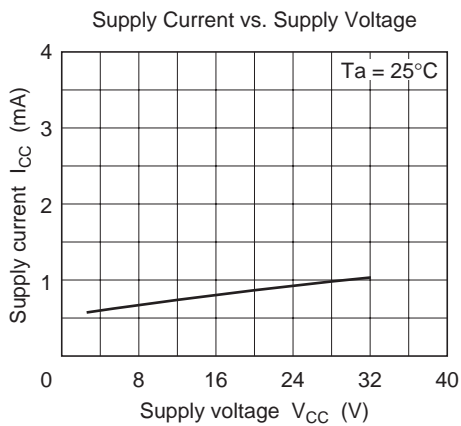
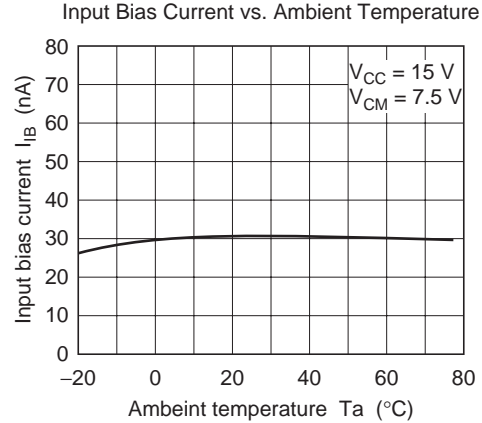
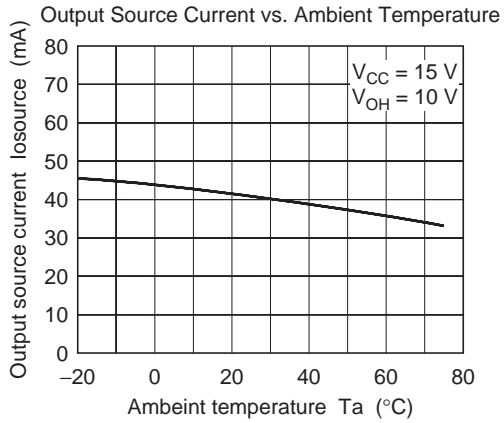
## Electrical Characteristics

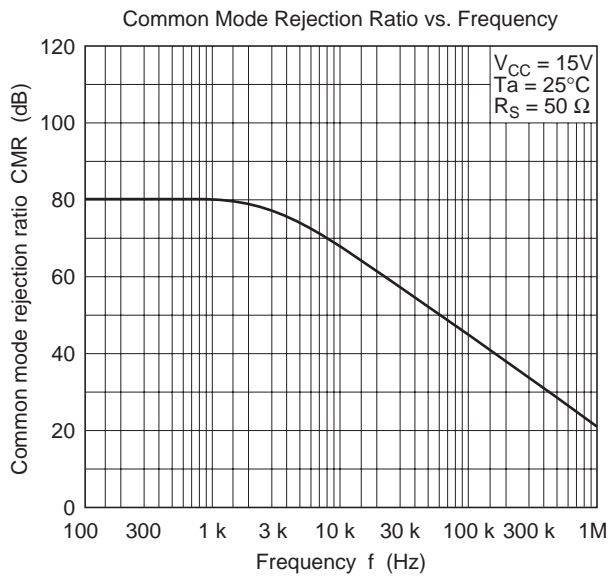
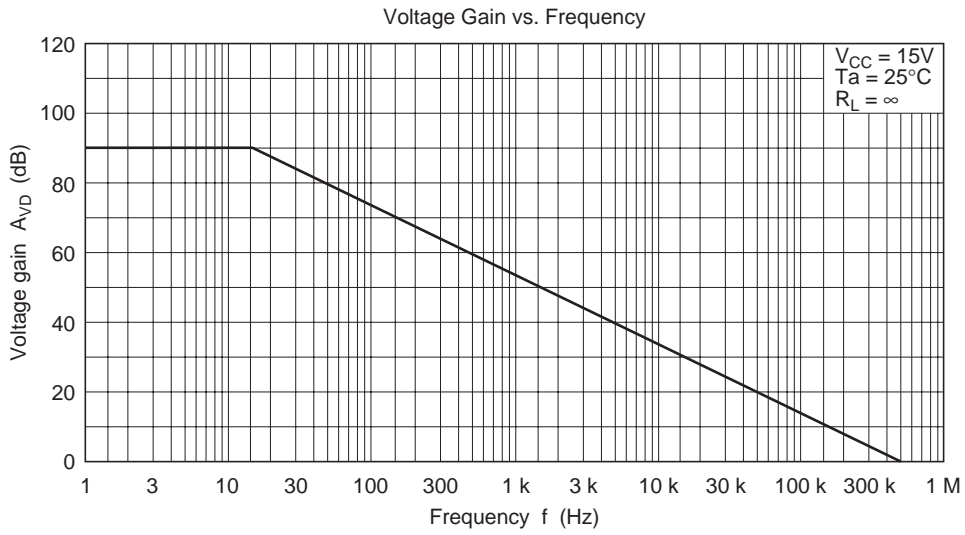
(V<sub>CC</sub> = +15 V, Ta = 25°C)

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

Note: 1. Design spec.

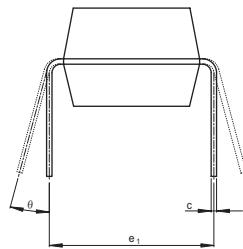
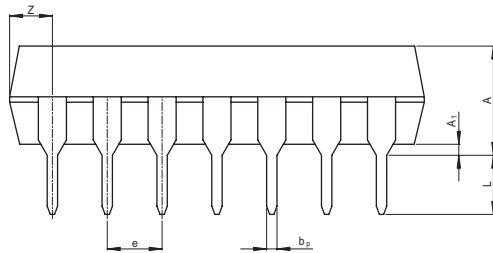
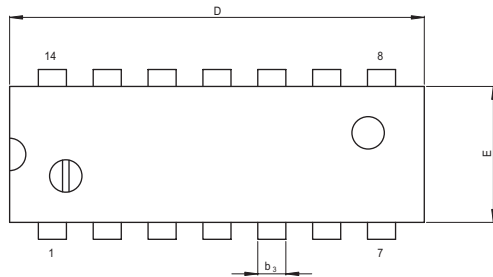
Characteristic Curves





Package Dimensions

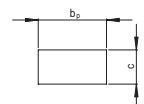
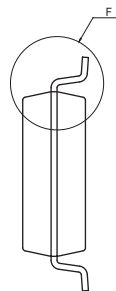
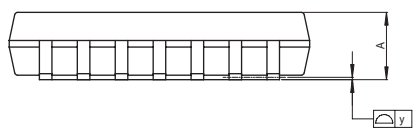
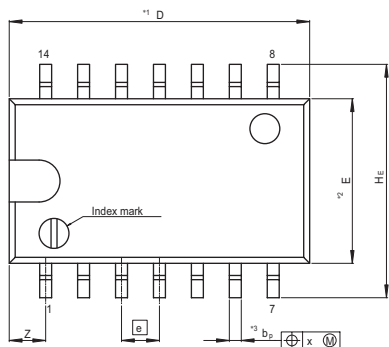
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP14-6.3x19.2-2.54	PRDP0014AB-B	DP-14AV	0.97g



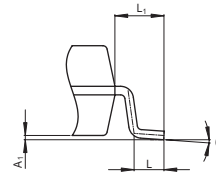
(Ni/Pd/Au plating)

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e <sub>1</sub>	—	7.62	—
D	—	19.2	20.32
E	—	6.3	7.4
A	—	—	5.06
A <sub>1</sub>	0.51	—	—
b <sub>p</sub>	0.40	0.48	0.56
b <sub>3</sub>	—	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)



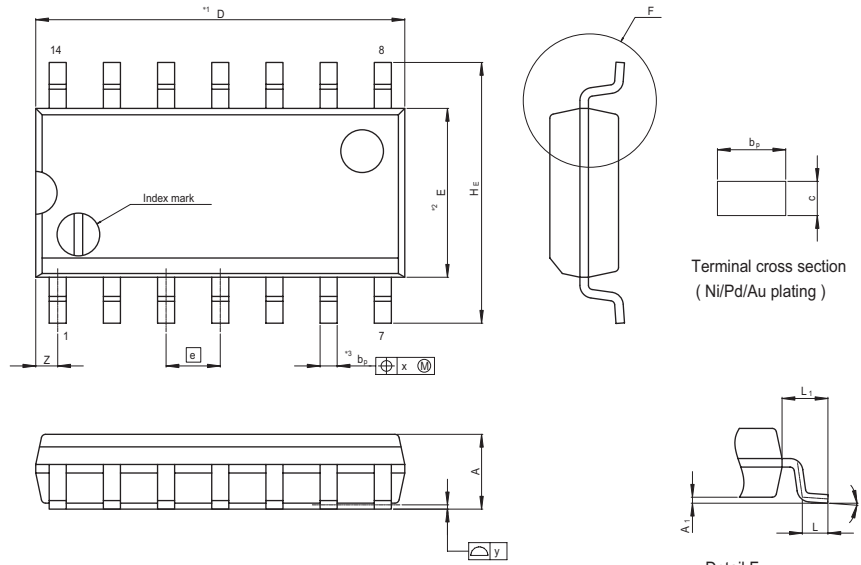
Detail F

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 <sub>2</sub>	—	—	—
A <sub>1</sub>	0.00	0.10	0.20
A	—	—	2.20
b <sub>p</sub>	0.34	0.40	0.46
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	7.50	7.80	8.00
Ⓧ	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	1.42
L	0.50	0.70	0.90
L <sub>1</sub>	—	1.15	—

# HA17324A Series

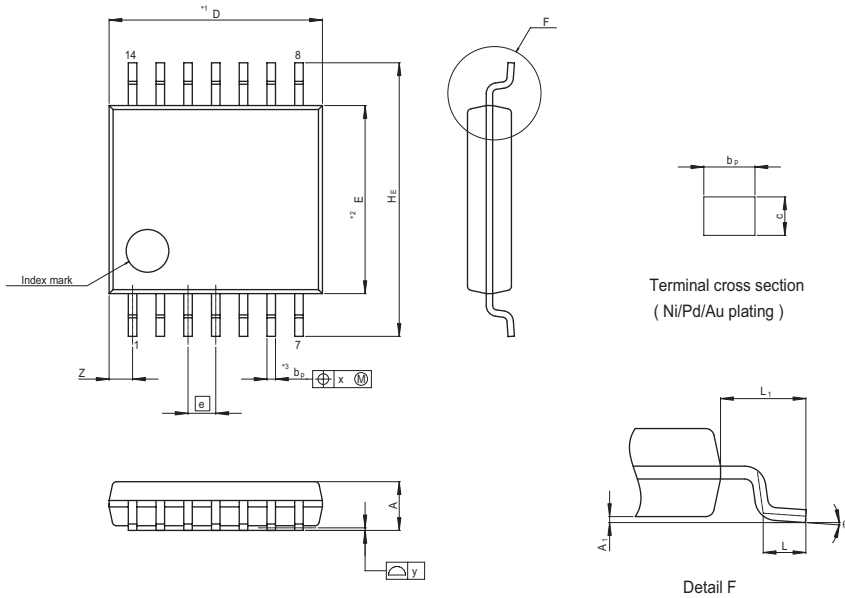
JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP14-3.95x8.65-1.27	PRSP0014DE-A	FP-14DNV	0.13g



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 <sub>2</sub>	—	—	—
A <sub>1</sub>	0.10	0.14	0.25
A	—	—	1.75
b <sub>p</sub>	0.34	0.40	0.46
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	5.80	6.10	6.20
Ⓜ	—	1.27	—
x	—	—	0.25
y	—	—	0.15
Z	—	—	0.635
L	0.40	0.60	1.27
L <sub>1</sub>	—	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 <sub>2</sub>	—	—	—
A <sub>1</sub>	0.03	0.07	0.10
A	—	—	1.10
b <sub>p</sub>	0.15	0.20	0.25
b <sub>1</sub>	—	—	—
c	0.10	0.15	0.20
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	6.20	6.40	6.60
Ⓜ	—	0.65	—
x	—	—	0.13
y	—	—	0.10
Z	—	—	0.83
L	0.4	0.5	0.6
L <sub>1</sub>	—	1.0	—

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