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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# RD151TS3313ARP, RD151TS3323ARP

## Spread Spectrum Clock for EMI Solution

REJ03D0794-0100

Rev.1.00

May 11, 2006

### Description

RD151TS3313ARP and RD151TS3323ARP is a high-performance Spread Spectrum Clock generator. It is suitable for EMI solution of electric systems.

### Features

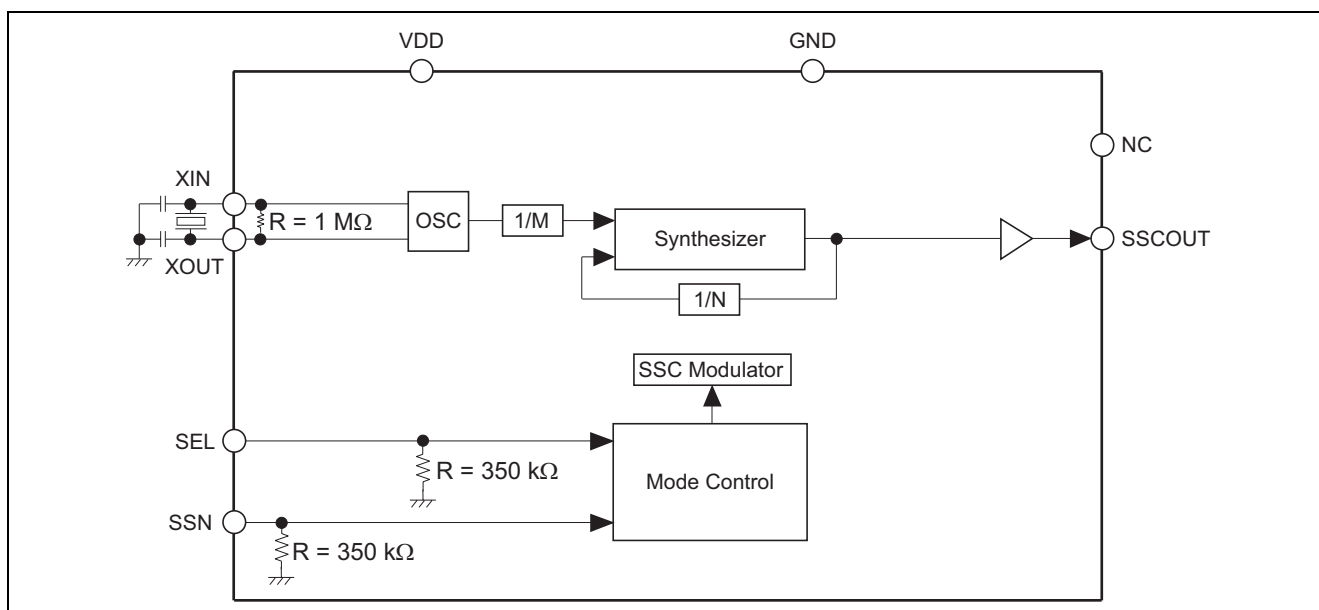
- Supports 20 MHz to 40 MHz operations. Multiple rate (XIN: SSCOUT) = 1: 1  
Input frequency 20 MHz to 40 MHz
- Spread spectrum modulation ; RD151TS3313ARP :  $\pm 1.5\%$ ,  $\pm 0.5\%$  (Central spread modulation)  
RD151TS3323ARP :  $-3.0\%$ ,  $-1.0\%$  (Down spread modulation)

### Key Specifications

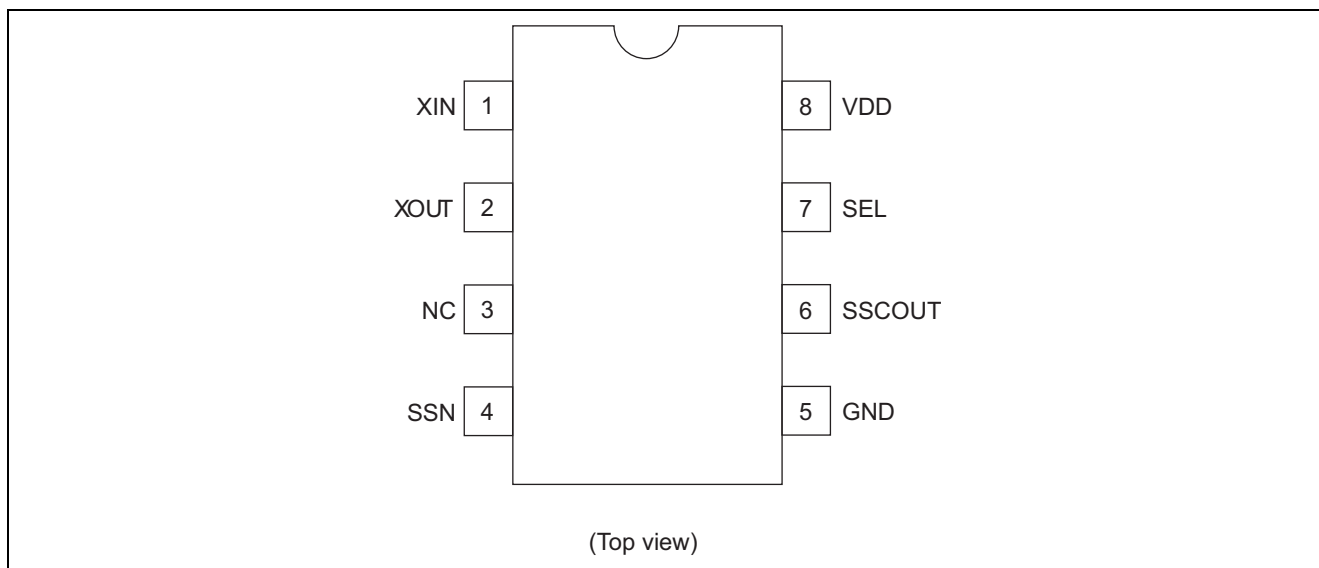
- Supply voltages:  $V_{DD} = 3.3 \text{ V} \pm 0.3 \text{ V}$
- Cycle to cycle jitter =  $\pm 100 \text{ ps}$  typ.
- Clock output duty cycle =  $50 \pm 5\%$
- Output slew rate =  $0.7 \text{ V/ns}$  typ.
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
RD151TS3313ARPH0	SOP-8 pin	PRSP0008DD-C	RP	H (2,500 pcs / Reel)
RD151TS3323ARPH0	(JEDEC)	(FP-8DCV)		

### Block Diagram



## Pin Arrangement



## Pin Descriptions

Pin name	No.	Type	Description
GND	5	Ground	GND pin
VDD	8	Power	Power supply pin.
NC	3	NC	Don't connect any VDD or GND.
SSCOUT	6	Output	Spread spectrum modulated clock output.
XIN	1	Input	Oscillator input.
XOUT	2	Output	Oscillator output.
SEL	7	Input	SSC% mode select pin. LVCMOS level input. Pull-down by internal resistor (350 k $\Omega$ ).
SSN	4	Input	SSC ON/OFF select pin. LVCMOS level input. Pull-down by internal resistor (350 k $\Omega$ ).

## SSC Function Table

STB	SEL	RD151TS3313ARP(Central spread)	RD151TS3323ARP(Down spread)
0	0	$\pm 1.5\%^{*1}$	$-3.0\%^{*1}$
0	1	$\pm 0.5\%$	$-1.0\%$
1	0	OFF	OFF
1	1		

Note: 1.  $\pm 1.5\%$  (TS3313ARP) /  $-3.0\%$ (TS3323ARP) SSC is selected for default by internal pull-down resistors.

## Clock Frequency Table

PRODUCT	XIN(MHz)	SSCOUT(MHz)	Multiply rate (XIN: SSCOUT)
RD151TS3313ARP	20 to 40	20 to 40	1:1
RD151TS3323ARP	20 to 40	20 to 40	1:1

## Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	$V_{DD}$	-0.5 to 4.6	V	
Input voltage	$V_I$	-0.5 to 4.6	V	
Output voltage <sup>*1</sup>	$V_O$	-0.5 to $V_{DD}+0.5$	V	
Input clamp current	$I_{IK}$	-50	mA	$V_I < 0$
Output clamp current	$I_{OK}$	-50	mA	$V_O < 0$
Continuous output current	$I_O$	$\pm 50$	mA	$V_O = 0$ to $V_{DD}$
Maximum power dissipation		0.7	W	$T_a = 55^\circ\text{C}$ (in still air)
Storage temperature	$T_{stg}$	-65 to +150	$^\circ\text{C}$	

Notes: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device.

- The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.

## Recommended Operating Conditions

Item	Symbol	Min	Typ	Max	Unit	Conditions
Supply voltage	$V_{DD}$	3.0	3.3	3.6	V	
DC input signal voltage		-0.3	—	$V_{DD}+0.3$	V	
High level input voltage	$V_{IH}$	$0.7 \times V_{DD}$	—	$V_{DD}+0.3$	V	
Low level input voltage	$V_{IL}$	-0.3	—	$0.3 \times V_{DD}$	V	
Input clock duty cycle		45	50	55	%	
Operating temperature	$T_a$	-20	—	85	$^\circ\text{C}$	

## DC Electrical Characteristics

$T_a = -20$  to  $85^\circ\text{C}$ ,  $V_{DD} = 3.0$  to  $3.6$  V

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input current	$I_i$	—	—	$\pm 20$	$\mu\text{A}$	$V_I = 0$ V or $3.6$ V, $V_{DD} = 3.6$ V, XIN pin
		—	—	$\pm 100$		$V_I = 0$ V or $3.6$ V, $V_{DD} = 3.6$ V, SEL, SSN pins
Input capacitance	$C_i$	—	3	—	pF	SEL, SSN pins

## DC Electrical Characteristics / SSC Clock Output

$T_a = -20$  to  $85^\circ\text{C}$ ,  $V_{DD} = 3.0$  to  $3.6$  V

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	$V_{OH}$	$V_{DD}-0.2$	—	—	V	$I_{OH} = -1$ mA
	$V_{OL}$	—	—	200	mV	$I_{OL} = 1$ mA
Output current	$I_{OH}$	—	-13	—	mA	$V_{OH} = 1.5$ V, $V_{DD} = 3.3$ V
	$I_{OL}$	—	13	—		$V_{OL} = 1.5$ V, $V_{DD} = 3.3$ V
Output impedance		—	40	—	$\Omega$	

Note: Parameters are target of design. Not 100% tested in production.

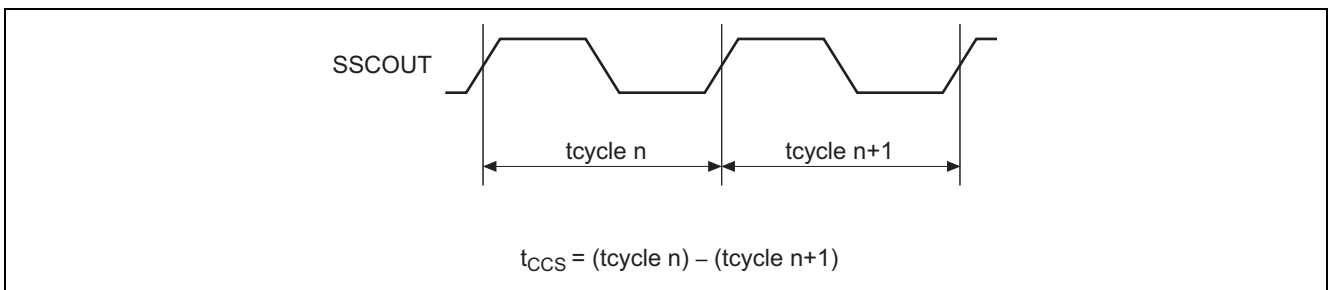
## AC Electrical Characteristics / SSC Clock Output

Ta = 25°C, V<sub>DD</sub> = 3.3 V, C<sub>L</sub> = 15 pF

Item	Symbol	Min	Typ	Max	Unit	Test Conditions	Notes
Operating current	I <sub>DD</sub>	—	14	19	mA	V <sub>DD</sub> = 3.3 V, C <sub>L</sub> = 15 pF, XIN = 40 MHz	
Cycle to cycle jitter *1	t <sub>CCS</sub>	—	100	—	ps	SEL = 0, C <sub>L</sub> = 0 pF SSC = ±1.5% (TS3313ARP) SSC = -3.0% (TS3323ARP)	Figure 1
Slew rate	t <sub>SL</sub>	—	0.7	4.0	V/ns	V <sub>DD</sub> = 3.3 V, 0.2 × V <sub>DD</sub> to 0.8 × V <sub>DD</sub>	
Clock duty cycle		45	50	55	%		
Stabilization time *2		—	—	2	ms		

Notes: Parameters are target of design. Not 100% tested in production.

1. Cycle to cycle jitter is included spread spectrum modulation.
2. Stabilization time is the time required for the integrated circuit to obtain phase lock of its input signal after power up.



**Figure 1** Cycle to cycle jitter

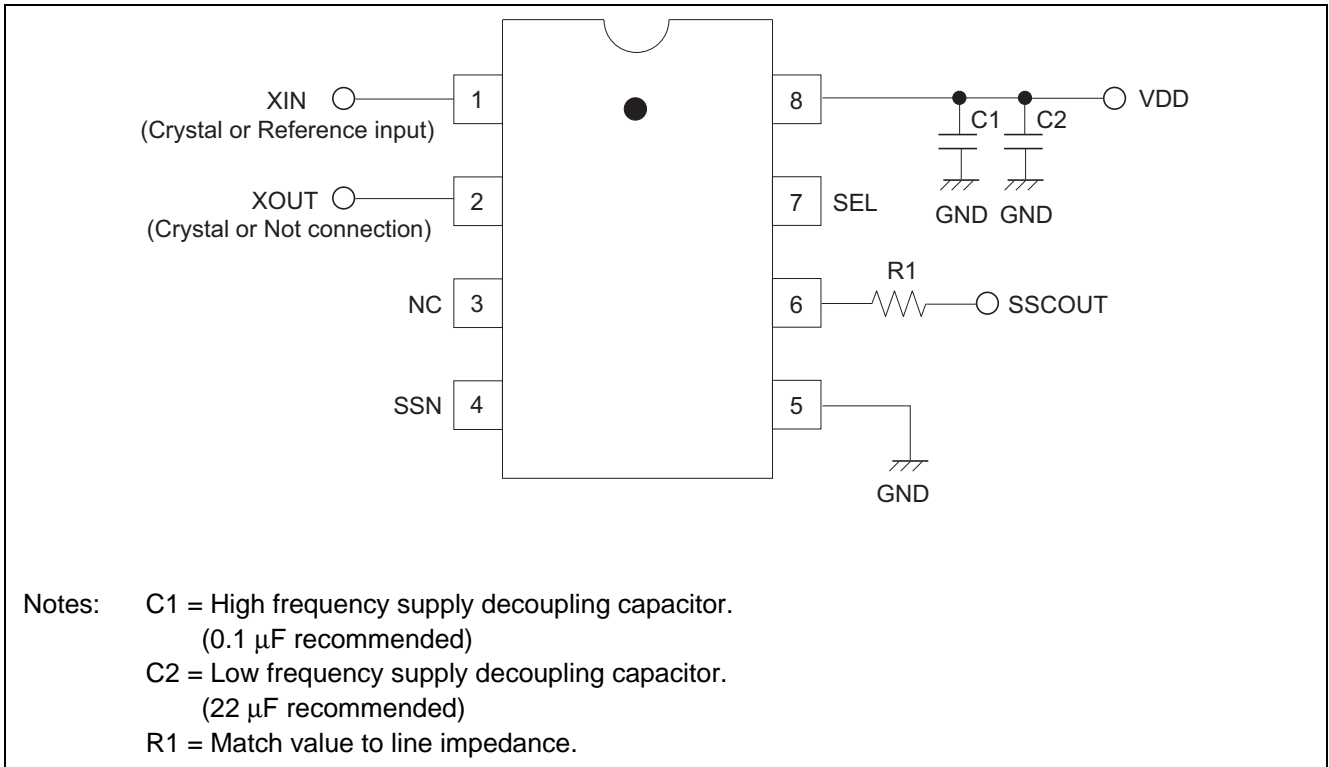
## Application Information

### 1. Recommended Circuit Configuration

The power supply circuit of the optimal performance on the application of a system should refer to Figure 2.

VDD decoupling is important to both reduce Jitter and EMI radiation.

The C1 decoupling capacitor should be placed as close to the VDD pin as possible, otherwise the increased trace inductance will negate its decoupling capability.



**Figure 2 Recommended circuit configuration**

2. Example Board Layout Configuration

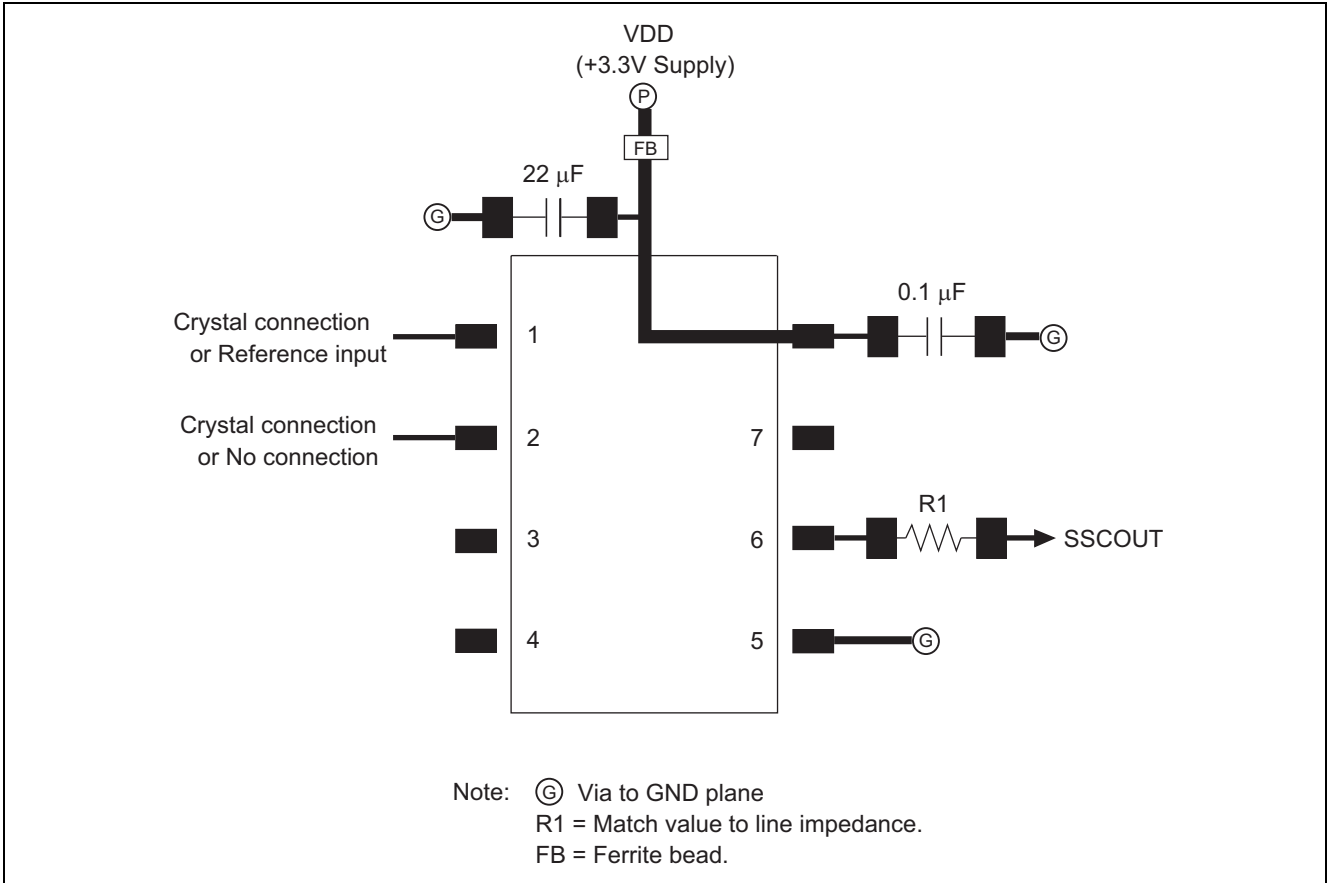


Figure 3 Example Board Layout



### 3. Example of TS33XX EMI Solution IC's Application

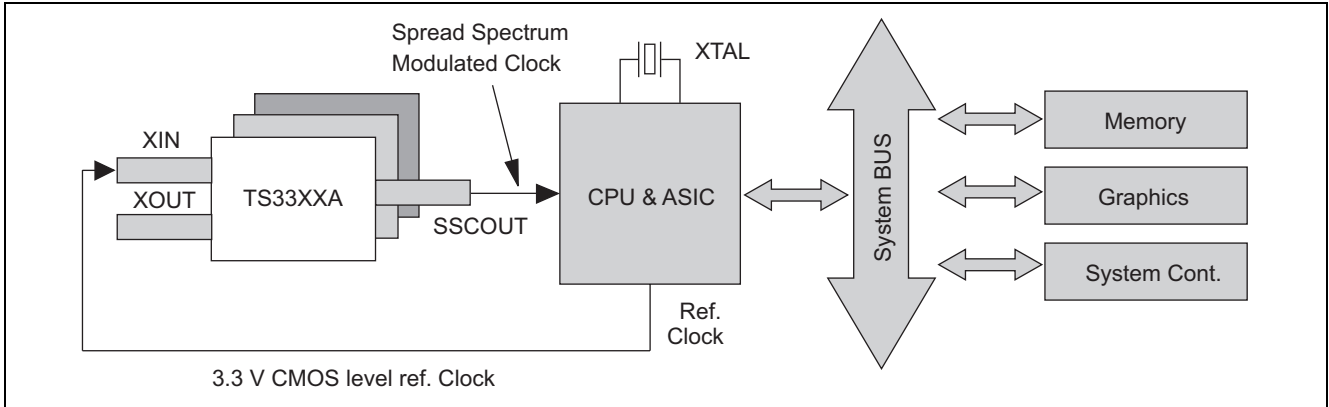


Figure 4 Ref. Clock Input Example

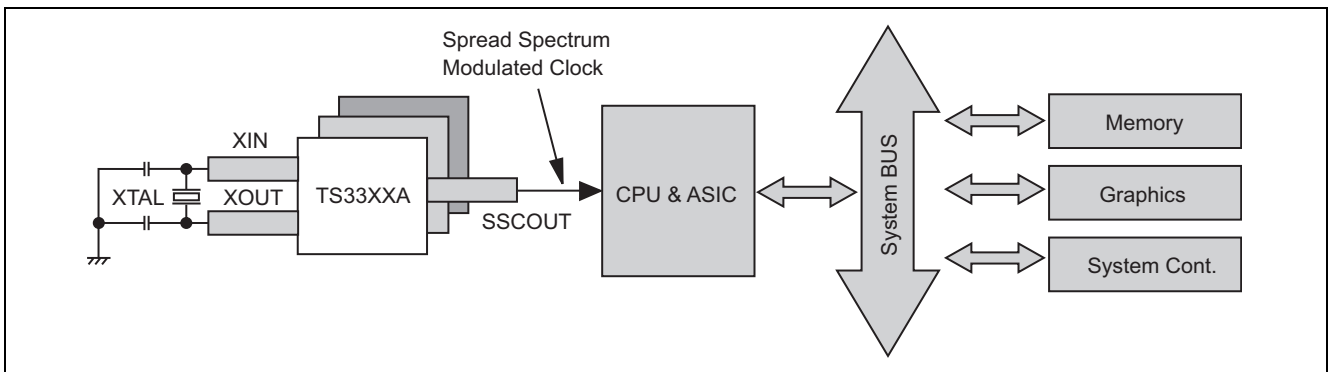
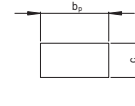
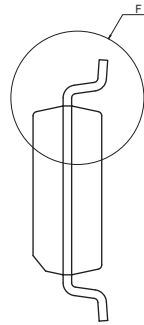
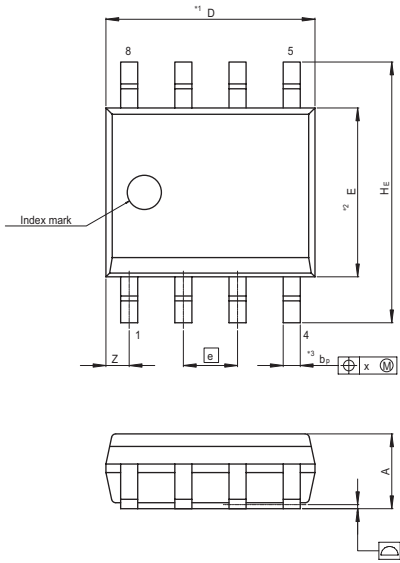


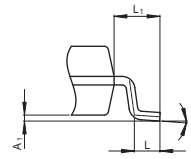
Figure 5 XTAL Ref. Clock Input Example

Package Dimensions

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)  
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	—	4.90	5.30
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	—	—	0.10
Z	—	—	0.75
L	0.40	0.60	1.27
L <sub>1</sub>	—	1.08	—

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