

TC4S66F, TC4S66FU

1. Functional Description

- Bilateral Switch

2. General

TC4S66F, TC4S66FU contains one circuit of bidirectional switches.

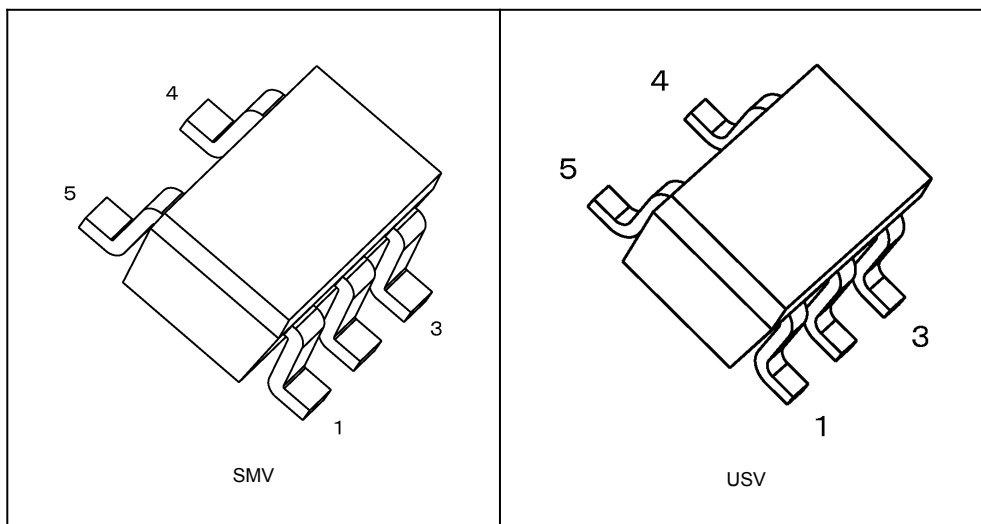
When control input, CONT is set to "H" level, the impedance between input and output of the switch becomes low and when it is set to "L" level, the switch becomes high.

This can be applied for switching of analog signals and digital signals.

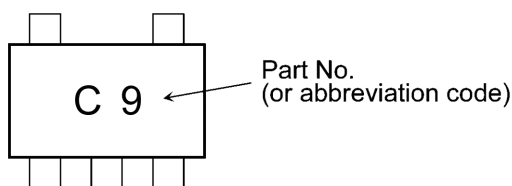
3. Features

- (1) ON resistance: $R_{ON} = 250 \Omega$ (Typ.) at $V_{DD} - V_{SS} = 5 V$
 $R_{ON} = 110 \Omega$ (Typ.) at $V_{DD} - V_{SS} = 10 V$
 $R_{ON} = 70 \Omega$ (Typ.) at $V_{DD} - V_{SS} = 15 V$
- (2) OFF resistance: R_{OFF} (Typ.) $> 10^9 \Omega$

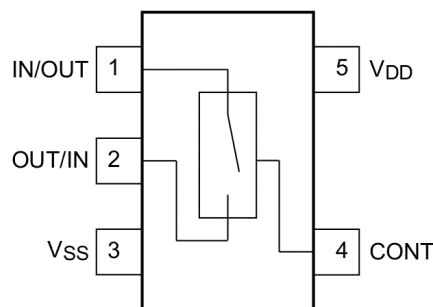
4. Packaging



5. Marking and Pin Assignment



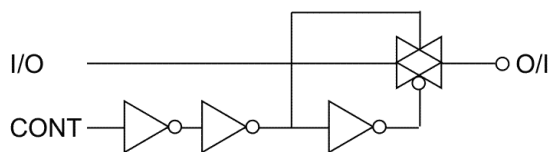
Marking



Pin Assignment (Top view)

Start of commercial production
1988-01

6. Logic Diagram



7. Truth Table

Control	Impedance between IN/OUT-OUT/IN (Note 1)
H	0.5 to 5.0 × 10 ² Ω
L	> 10 ⁹ Ω

Note 1: See electrical characteristics

8. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Rating	Unit
DC Supply voltage	V _{DD}	V _{SS} - 0.5 to V _{SS} + 20	V
Input voltage	V _{IN}	V _{SS} - 0.5 to V _{DD} + 0.5	
Switch I/O voltage.	V _{I/O}	V _{SS} - 0.5 to V _{DD} + 0.5	
Power dissipation	P _D	200	mW
Potential difference across I/O during ON	V _I -V _O	±0.5	V
Input current	I _{IN}	±10	mA
Operation temperature range	T _{opr}	-40 to 85	°C
Storage temperature	T _{stg}	-65 to 150	°C
Lead temperature (10 s)	T _L	260	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

9. Operating Ranges (V_{SS} = 0 V)

Characteristics	Symbol	Min	Typ.	Max	Unit
DC Supply voltage	V _{DD}	3	—	18	V
Switch I/O voltage.	V _{I/O}	0	—	V _{DD}	V

10. Electrical Characteristics

10.1. Electrical Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	V_{DD} (V)	Min	Typ.	Max	Unit
High-level input voltage	V_{IH}	$ I_{IS} = 10\text{ }\mu\text{A}$	5	3.5	2.75	—	V
			10	7.0	5.50	—	
			15	11.0	8.25	—	
Low-level input voltage	V_{IL}	$ I_{IS} = 10\text{ }\mu\text{A}$	5	—	2.25	1.5	
			10	—	4.5	3.0	
			15	—	6.75	4.0	
ON-resistance	R_{ON}	$0 \leq V_{IS} \leq V_{DD}$ $R_L = 10\text{ k}\Omega$	5	—	290	950	Ω
			10	—	120	250	
			15	—	85	160	
Power-OFF leakage current	I_{OFF}	$V_{IN} = 18\text{ V}, V_{OUT} = 0\text{ V}$ $V_{IN} = 0\text{ V}, V_{OUT} = 18\text{ V}$	18	—	± 0.1	± 100	nA
			18	—	± 0.1	± 100	
Quiescent device current	I_{DD}	$V_{IN} = V_{DD}, V_{SS}$	5	—	0.001	0.25	μA
			10	—	0.001	0.5	
			15	—	0.002	1.0	
High level input current	I_{IH}	$V_{IH} = 18\text{ V}$	18	—	10^{-5}	0.1	μA
Low level input current	I_{IL}	$V_{IL} = 0\text{ V}$	18	—	-10^{-5}	-0.1	

10.2. Electrical Characteristics (Unless otherwise specified, $T_a = -40\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	V_{DD} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	$ I_{IS} = 10\text{ }\mu\text{A}$	5	3.5	—	V
			10	7.0	—	
			15	11.0	—	
Low-level input voltage	V_{IL}	$ I_{IS} = 10\text{ }\mu\text{A}$	5	—	1.5	
			10	—	3.0	
			15	—	4.0	
ON-resistance	R_{ON}	$0 \leq V_{IS} \leq V_{DD}$ $R_L = 10\text{ k}\Omega$	5	—	800	Ω
			10	—	210	
			15	—	140	
Power-OFF leakage current	I_{OFF}	$V_{IN} = 18\text{ V}, V_{OUT} = 0\text{ V}$ $V_{IN} = 0\text{ V}, V_{OUT} = 18\text{ V}$	18	—	± 100	nA
			18	—	± 100	
Quiescent device current	I_{DD}	$V_{IN} = V_{DD}, V_{SS}$	5	—	0.25	μA
			10	—	0.5	
			15	—	1.0	
High level input current	I_{IH}	$V_{IH} = 18\text{ V}$	18	—	0.1	μA
Low level input current	I_{IL}	$V_{IL} = 0\text{ V}$	18	—	-0.1	

10.3. Electrical Characteristics (Unless otherwise specified, $T_a = 85\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	V_{DD} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	$ I_{IS} = 10\text{ }\mu\text{A}$	5	3.5	—	V
			10	7.0	—	
			15	11.0	—	
Low-level input voltage	V_{IL}	$ I_{IS} = 10\text{ }\mu\text{A}$	5	—	1.5	
			10	—	3.0	
			15	—	4.0	
ON-resistance	R_{ON}	$0 \leq V_{IS} \leq V_{DD}$ $R_L = 10\text{ k}\Omega$	5	—	1200	Ω
			10	—	300	
			15	—	200	
Power-OFF leakage current	I_{OFF}	$V_{IN} = 18\text{ V}, V_{OUT} = 0\text{ V}$ $V_{IN} = 0\text{ V}, V_{OUT} = 18\text{ V}$	18	—	± 1000	nA
			18	—	± 1000	
Quiescent device current	I_{DD}	$V_{IN} = V_{DD}, V_{SS}$	5	—	7.5	μA
			10	—	15	
			15	—	30	
High level input current	I_{IH}	$V_{IH} = 18\text{ V}$	18	—	1.0	μA
Low level input current	I_{IL}	$V_{IL} = 0\text{ V}$	18	—	-1.0	

11. Switching Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Note	Test Condition	V_{SS} (V)	V_{DD} (V)	Min	Typ.	Max	Unit
Propagation delay time(IN-OUT)	t_{PLH}, t_{PHL}		$C_L = 50\text{ pF}$	0	5	—	15	40	ns
				0	10	—	8	20	
				0	15	—	5	15	
Propagation delay time (CONTROL-OUT)	t_{PZL}, t_{PZH}		$R_L = 1\text{ k}\Omega$ $C_L = 50\text{ pF}$	0	5	—	55	120	ns
				0	10	—	25	40	
				0	15	—	20	30	
Propagation delay time (CONTROL-OUT)	t_{PLZ}, t_{PHZ}		$R_L = 1\text{ k}\Omega$ $C_L = 50\text{ pF}$	0	5	—	45	80	ns
				0	10	—	30	70	
				0	15	—	25	60	
Max. Control input repetition rate	$f_{MAX(C)}$		$R_L = 1\text{ k}\Omega$ $C_L = 50\text{ pF}$	0	5	—	10	—	MHz
				0	10	—	12	—	
				0	15	—	12	—	
Maximum frequency response	$f_{MAX(I-O)}$	(Note 1)	$R_L = 1\text{ k}\Omega$ $C_L = 50\text{ pF}$	-5	5	—	30	—	
Total Harmonic Distortion	THD	(Note 2)	$R_L = 10\text{ k}\Omega$ $f = 1\text{ kHz}$	-5	5	—	0.03	—	%
Feed through attenuation (SWITCH OFF)	FTH	(Note 3)	$R_L = 1\text{ k}\Omega$	-5	5	—	600	—	kHz
Crosstalk(CONTROL-OUT)	Xtalk		$R_{IN} = 1\text{ k}\Omega$ $R_{OUT} = 10\text{ k}\Omega$ $C_L = 15\text{ pF}$	0	5	—	200	—	mV
				0	10	—	400	—	
				0	15	—	600	—	
Input capacitance	C_{IN}		Control input	—	5	7.5	pF		
			Switch I/O	—	10	—			
Feedthrough capacitance	C_{IOS}		—	—	0.5	—	pF		

Note 1: The frequency at $20 \log_{10} V_{OS}/V_{IS} = -3\text{ dB}$ shall be $f_{MAX(I-O)}$ using sine wave of $\pm 2.5\text{ Vp-p}$ for V_{IS} .

Note 2: V_{IS} shall be sine wave of $\pm 2.5\text{ V}$.

Note 3: The frequency at $20 \log_{10} V_{OS}/V_{IS} = -50\text{ dB}$ shall be the feed through using of $\pm 2.5\text{ Vp-p}$.

11.1. Switching Test Circuit

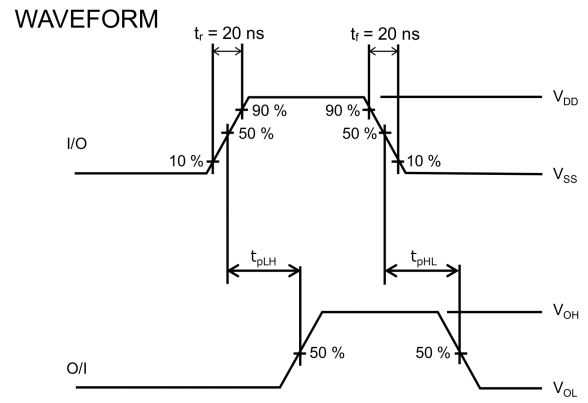
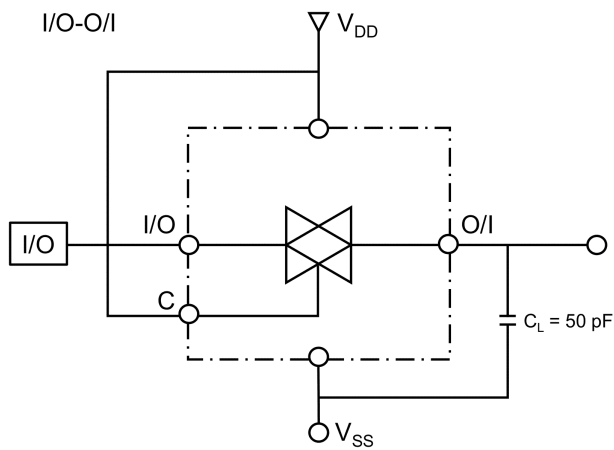


Fig. 11.1.1 t_{pLH} , t_{pHL}

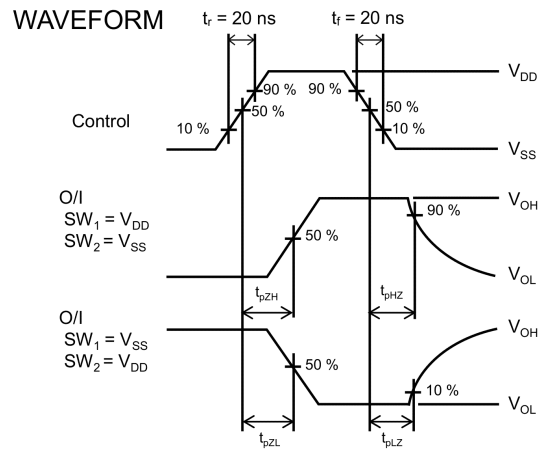
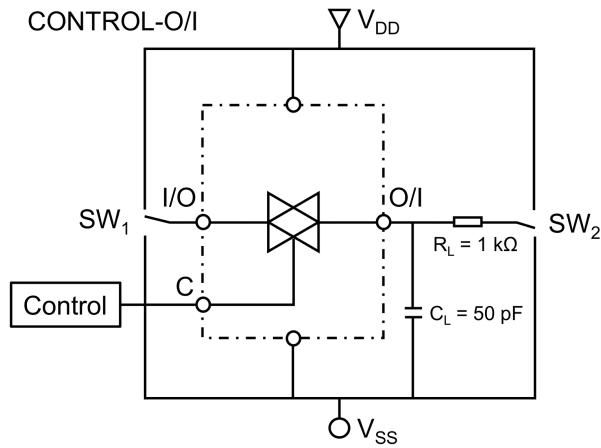


Fig. 11.1.2 t_{pZL} , t_{pZH} , t_{pLZ} , t_{pHZ}

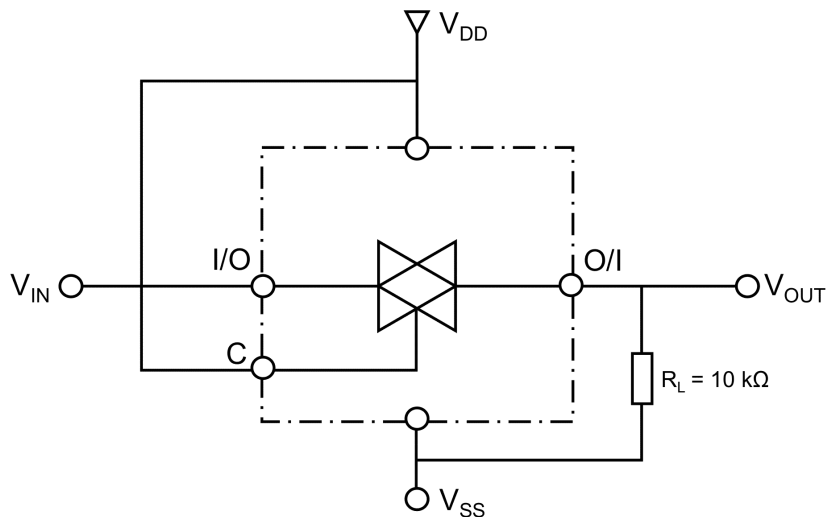


Fig. 11.1.3 R_{ON}

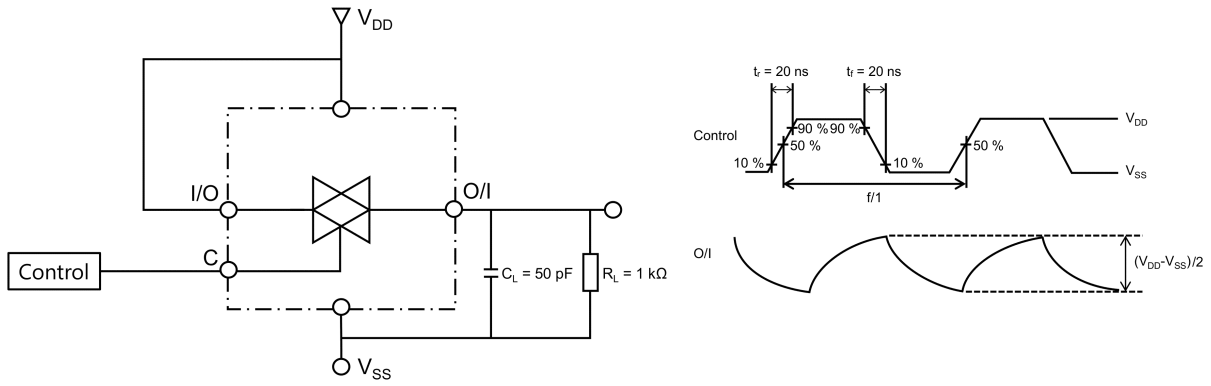


Fig. 11.1.4 $f_{MAX}(C)$

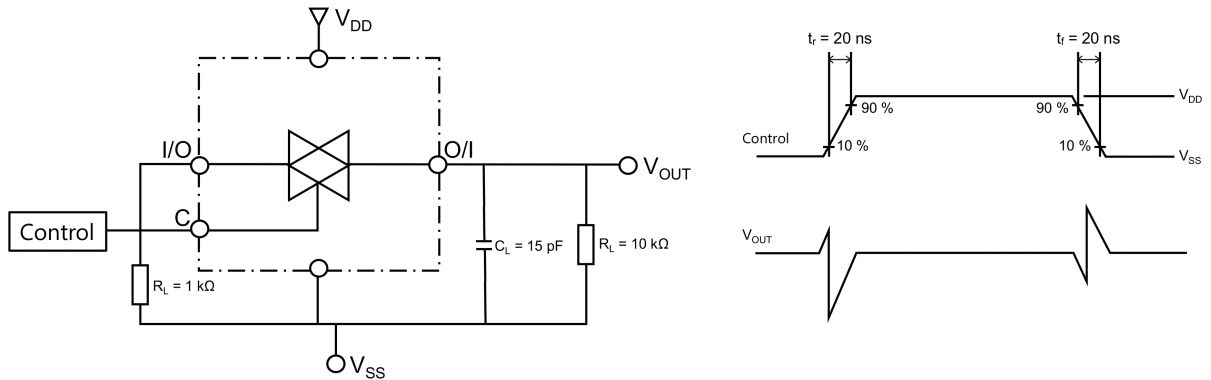
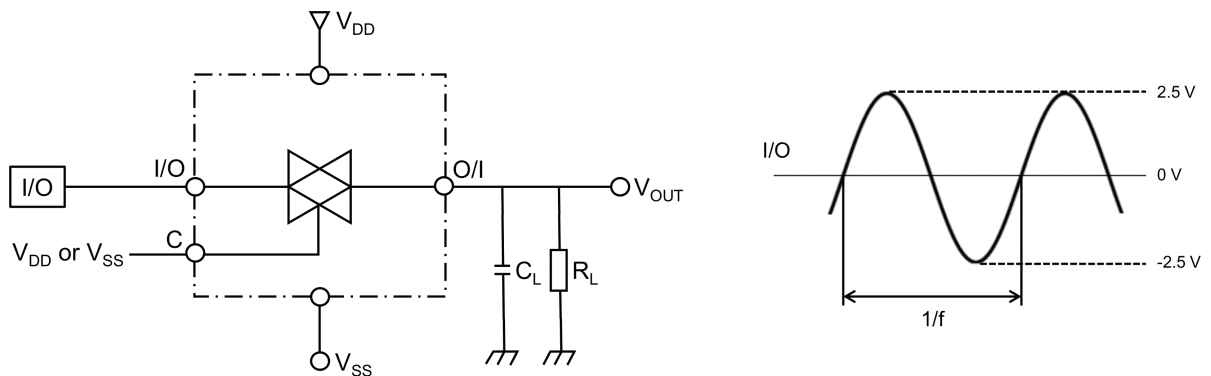


Fig. 11.1.5 CROSSTALK(CONTROL INPUT)

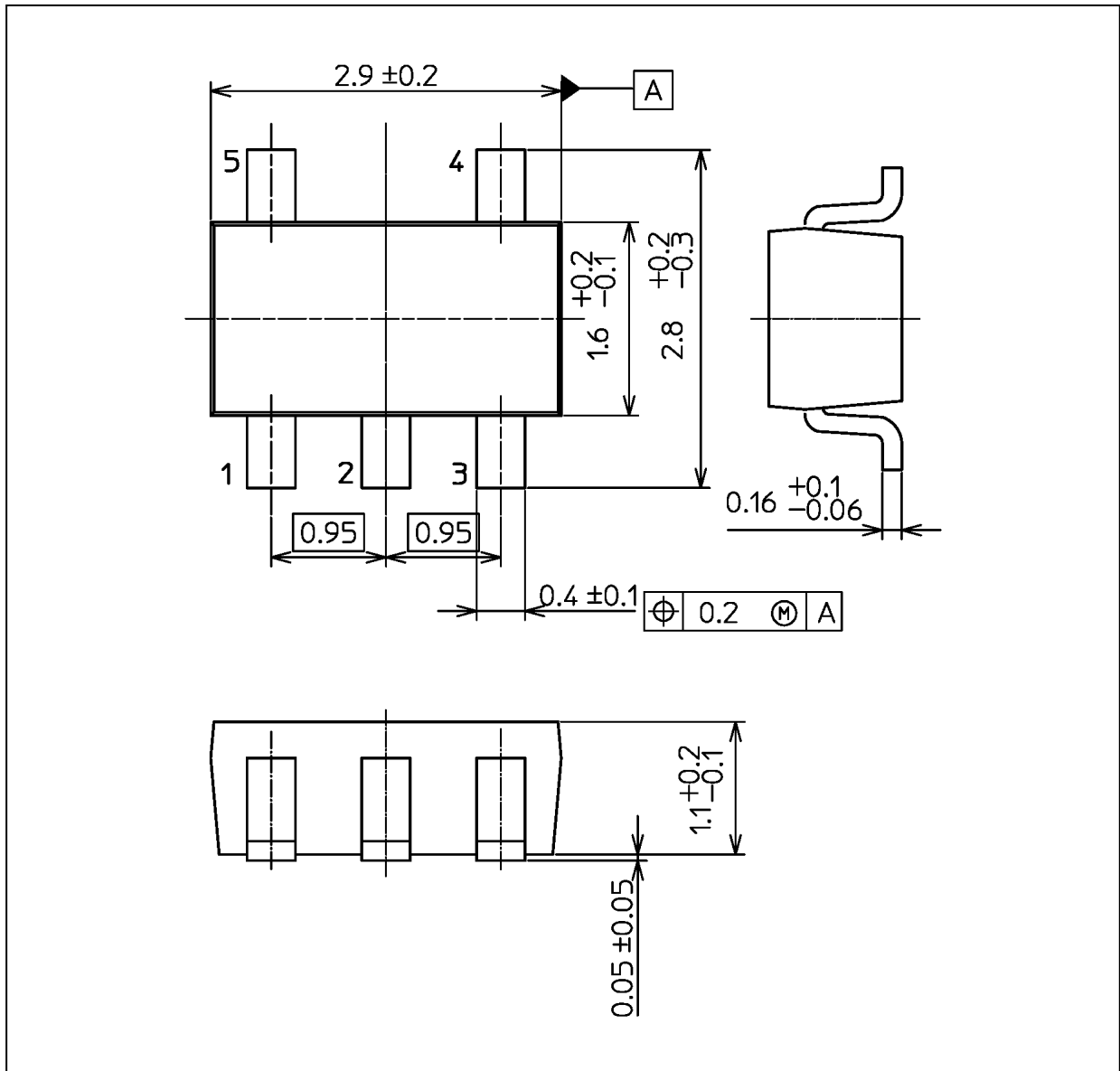


C_L, R_L : Reference to Test Condition

Fig. 11.1.6 TOTAL HARMONIC DISTORTION, $f_{MAX}(I/O-O/I)$, FEEDTHRU(SWITCH OFF)

Package Dimensions

Unit: mm

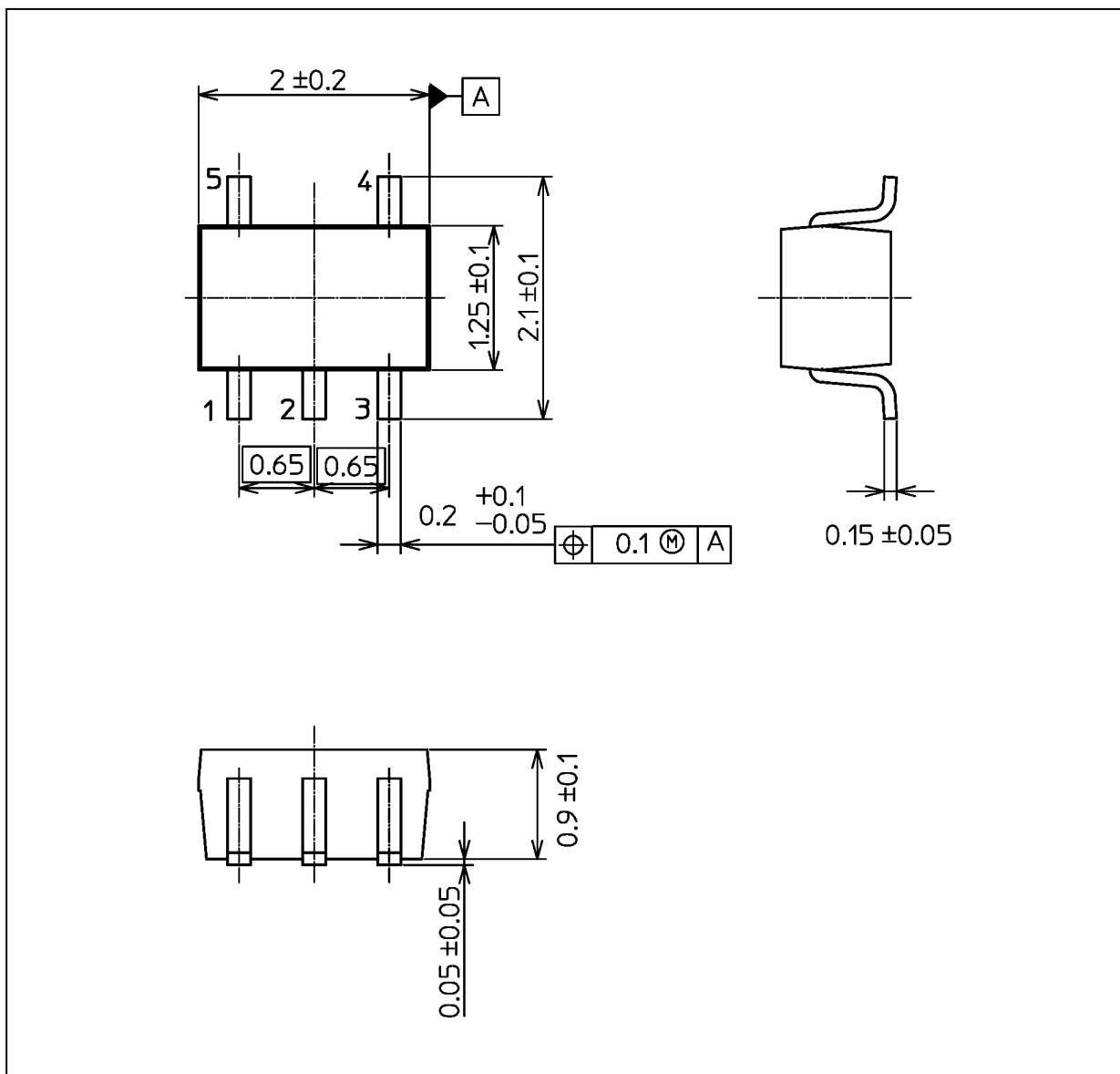


Weight: 14 mg (typ.)

Package Name(s)
JEDEC: SOT-25
Nickname: SMV

Package Dimensions

Unit: mm



Weight: 0.006 g (typ.)

Package Name(s)
JEDEC: SOT-353
Nickname: USV

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