

TOSHIBA**TC7MH595FK**

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC7MH595FK

8 - Bit Shift Register / Latch (3 - State)

The TC7MH595 is an advanced high speed 8 - BIT SHIFT REGISTER / LATCH fabricated with silicon gate C²MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schttky TTL while maintaining the CMOS low power dissipation.

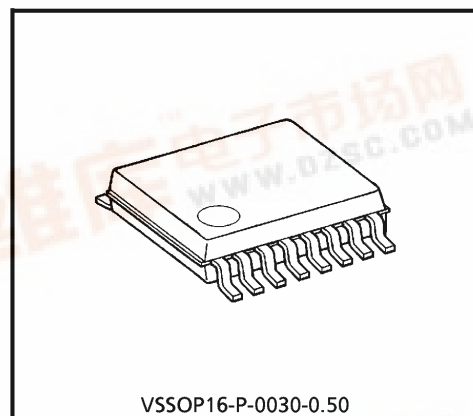
The TC7MH595 contains an 8 - bit static shift register which feeds an 8 - bit storage register.

Shift operation is accomplished on the positive going transition of the SCK input. The output register is loaded with the contents of the shift register on the positive going transition of the RCK input. Since RCK and SCK signal are independent, parallel outputs can be held stable during the shift operation. And, since the parallel outputs are 3 - state, it can be directly connected to 8 - bit bus. This register can be used in serial - to - parallel conversion, data receivers, etc.

An input protection circuit ensures that 0 to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

Features:

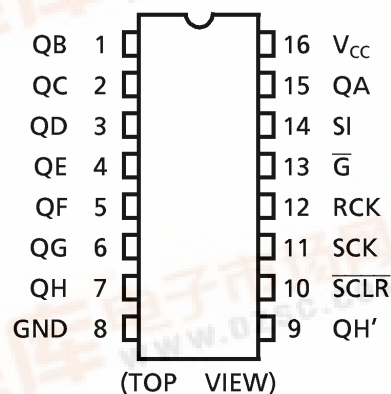
- High Speed..... $f_{\text{MAX}} = 185\text{MHz}(\text{typ.})$
at $V_{\text{CC}} = 5\text{V}$
- Low Power Dissipation..... $I_{\text{CC}} = 4\mu\text{A}(\text{max})$ at $T_a = 25^\circ\text{C}$
- High Noise Immunity..... $V_{\text{NIH}} = V_{\text{NIL}} = 28\% V_{\text{CC}}(\text{min})$
- Power Down Protection is provided on all inputs.
- Balanced Propagation Delays..... $t_{\text{PLH}} \approx t_{\text{PHL}}$
- Wide Operating Voltage Range..... $V_{\text{CC}}(\text{opr.}) = 2\text{V} \sim 5.5\text{V}$
- Low Noise..... $V_{\text{OLP}} = 1.0\text{V}(\text{max})$
- Pin and Function Compatible with 74ALS595



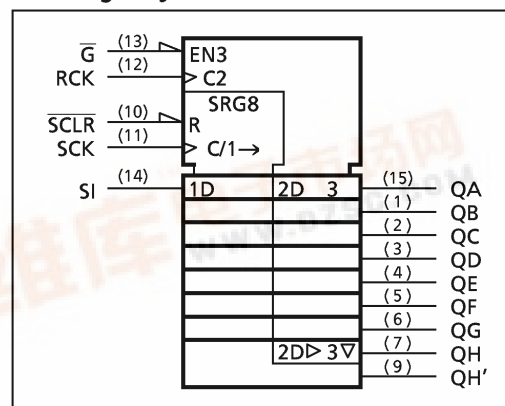
VSSOP16-P-0030-0.50

Weight: 0.02g (Typ.)

Pin Assignment



IEC Logic Symbol



980910EBA2

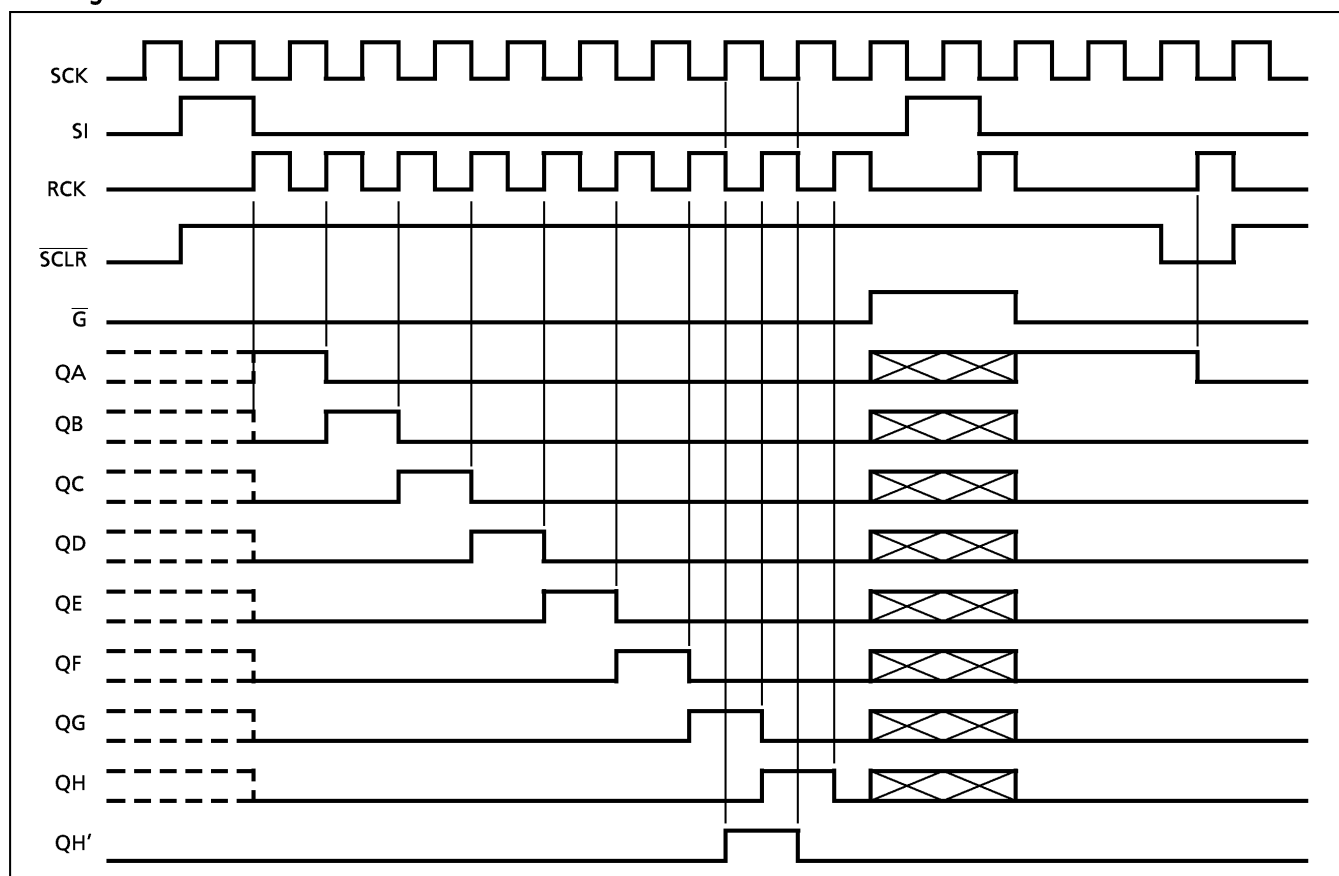
● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

Truth Table

INPUTS					FUNCTION
SI	SCK	$\overline{\text{SCLR}}$	RCK	$\overline{\text{G}}$	
X	X	X	X	H	QA thru QH outputs disable
X	X	X	X	L	QA thru QH outputs enable
X	X	L	X	X	Shift register is cleared.
L		H	X	X	First stage of S. R. becomes "L". Other stages store the data of previous stage, respectively.
H		H	X	X	First stage of S. R. becomes "H". Other stages store the data of previous stage, respectively.
X		H	X	X	State of S. R. is not changed.
X	X	X		X	S.R. data is stored into storage register.
X	X	X		X	Storage register stage is not changed.

X: Don't Care

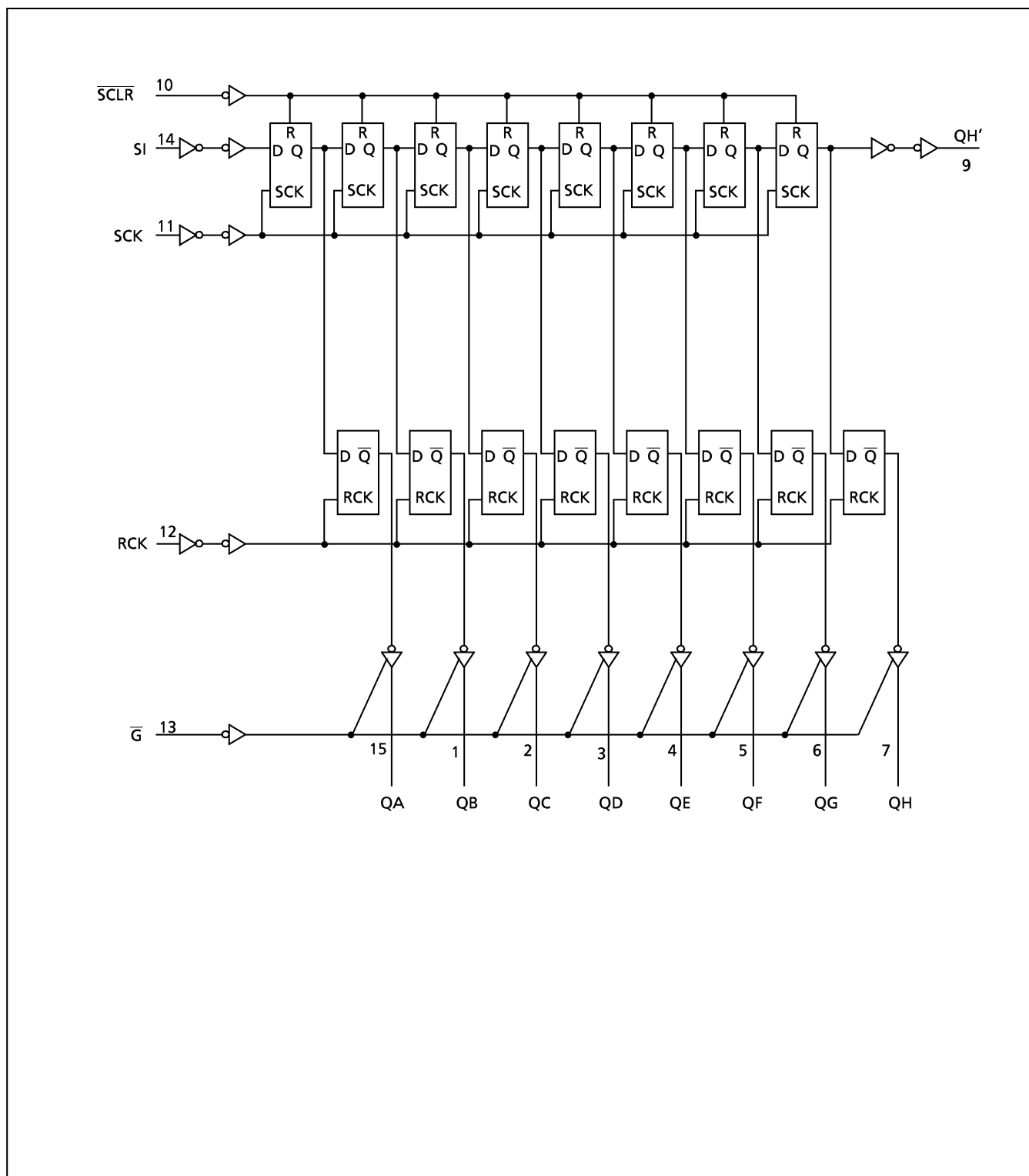
Timing Chart



980910EBA2'

- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

System Diagram



Absolute Maximum Ratings

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7.0$	V
DC Input Voltage	V_{IN}	$-0.5 \sim 7.0$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC} + 0.5$	V
Input Diode Current	I_{IK}	-20	mA
Output Diode Current	I_{OK}	± 20	mA
DC Output Current	I_{OUT}	± 25	mA
DC V_{CC} /Ground Current	I_{CC}	± 75	mA
Power Dissipation	P_D	180	mW
Storage Temperature	T_{stg}	$-65 \sim 150$	$^{\circ}\text{C}$

Recommended Operating Conditions

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	$2.0 \sim 5.5$	V
Input Voltage	V_{IN}	$0 \sim 5.5$	V
Output Voltage	V_{OUT}	$0 \sim V_{CC}$	V
Operating Temperature	T_{opr}	$-40 \sim 85$	$^{\circ}\text{C}$
Input Rise and Fall Time	dt/dv	0~100 ($V_{CC} = 3.3 \pm 0.3\text{V}$) 0~20 ($V_{CC} = 5 \pm 0.5\text{V}$)	ns/V

DC Electrical Characteristics

PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	$T_a = 25^{\circ}\text{C}$			$T_a = -40 \sim 85^{\circ}\text{C}$		UNIT
				Min	Typ.	Max	Min	Max	
High - Level Input Voltage	V_{IH}		2.0 3.0~5.5	1.50 $V_{CC} \times 0.7$	— —	— —	1.50 $V_{CC} \times 0.7$	— —	V
Low - Level Input Voltage	V_{IL}		2.0 3.0~5.5	— —	— —	0.50 $V_{CC} \times 0.3$	— $V_{CC} \times 0.3$	0.50 $V_{CC} \times 0.3$	V
High - Level Output Voltage	V_{OH}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -50 \mu\text{A}$	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	— — —	1.9 2.9 4.4	V
			$I_{OH} = -4\text{mA}$ $I_{OH} = -8\text{mA}$	3.0 4.5	2.58 3.94	— —	— —	2.48 3.80	
Low - Level Output Voltage	V_{OL}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 50 \mu\text{A}$	2.0 3.0 4.5	— — —	0.0 0.0 0.0	— — —	0.1 0.1 0.1	V
			$I_{OL} = 4\text{mA}$ $I_{OL} = 8\text{mA}$	3.0 4.5	— —	0.36 0.36	— —	0.44 0.44	
3 - State Output Off - State Current	I_{OZ}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = V_{CC} \text{ or GND}$	5.5	—	—	± 0.25	—	± 2.50	μA
Input Leakage Current	I_{IN}	$V_{IN} = 5.5\text{V or GND}$	0~5.5	—	—	± 0.1	—	± 1.0	
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC} \text{ or GND}$	5.5	—	—	4.0	—	40.0	

Timing Requirements (Input $t_r = t_f = 3\text{ns}$)

PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}(V)$	$T_a = 25^\circ\text{C}$		$T_a = -40 \sim 85^\circ\text{C}$	UNIT
				Typ.	Limit	Limit	
Minimum Pulse Width (SCK, RCK)	$t_{W(H)}$ $t_{W(L)}$		3.3 ± 0.3	—	5.0	5.0	ns
			5.0 ± 0.5	—	5.0	5.0	
Minimum Pulse Width (SCLR)	$t_{W(L)}$		3.3 ± 0.3 5.0 ± 0.5	— —	5.0 5.0	5.0 5.0	
Minimum Set-up Time (SI—SCK)	t_s		3.3 ± 0.3 5.0 ± 0.5	— —	3.5 3.0	3.5 3.0	
Minimum Set-up Time (SCK—RCK)	t_s		3.3 ± 0.3 5.0 ± 0.5	— —	8.0 5.0	8.5 5.0	
Minimum Set-up Time (SCLR—RCK)	t_s		3.3 ± 0.3 5.0 ± 0.5	— —	8.0 5.0	9.0 5.0	
Minimum Hold Time (SI—SCK)	t_h		3.3 ± 0.3 5.0 ± 0.5	— —	1.5 2.0	1.5 2.0	
Minimum Hold Time (SCK—RCK)	t_h		3.3 ± 0.3 5.0 ± 0.5	— —	0 0	0 0	
Minimum Hold Time (SCLR—RCK)	t_h		3.3 ± 0.3 5.0 ± 0.5	— —	0 0	0 0	
Minimum Removal Time (SCLR)	t_{rem}		3.3 ± 0.3 5.0 ± 0.5	— —	3.0 2.5	3.0 2.5	

AC Electrical Characteristics (Input $t_r = t_f = 3\text{ns}$)

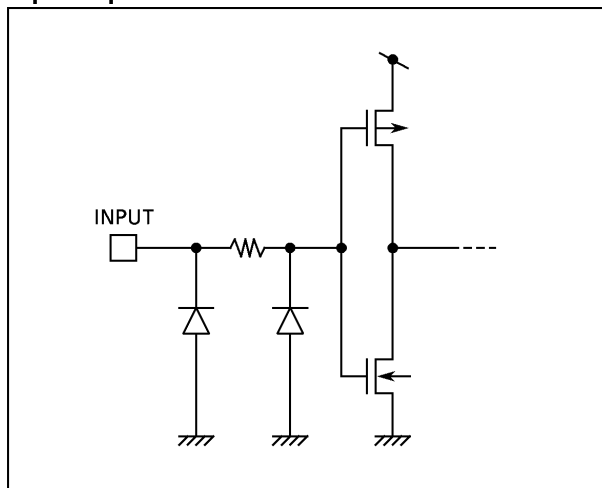
PARAMETER	SYMBOL	TEST CONDITION			Ta = 25°C			Ta = - 40~85°C		UNIT
			V _{CC} (V)	CL (pF)	Min	Typ.	Max	Min	Max	
Propagation Delay Time (SCK—QH’)	t _{pLH} t _{pHL}		3.3 ± 0.3	15	—	8.8	13.0	1.0	15.0	ns
				50	—	11.3	16.5	1.0	18.5	
			5.0 ± 0.5	15	—	6.2	8.2	1.0	9.4	
				50	—	7.7	10.2	1.0	11.4	
Propagation Delay Time ($\overline{\text{SCLR}}$ —QH’)	t _{pHL}		3.3 ± 0.3	15	—	8.4	12.8	1.0	13.7	
				50	—	10.9	16.3	1.0	17.2	
			5.0 ± 0.5	15	—	5.9	8.0	1.0	9.1	
				50	—	7.4	10.0	1.0	11.1	
Propagation Delay Time (RCK—Q _n)	t _{pLH} t _{pHL}		3.3 ± 0.3	15	—	7.7	11.9	1.0	13.5	
				50	—	10.2	15.4	1.0	17.0	
			5.0 ± 0.5	15	—	5.4	7.4	1.0	8.5	
				50	—	6.9	9.4	1.0	10.5	
Output Enable time	t _{pZL} t _{pZH}	R _L = 1kΩ	3.3 ± 0.3	15	—	7.5	11.5	1.0	13.5	
				50	—	9.0	15.0	1.0	17.0	
			5.0 ± 0.5	15	—	4.8	8.6	1.0	10.0	
				50	—	8.3	10.6	1.0	12.0	
Output Disable time	t _{pLZ} t _{pHZ}	R _L = 1kΩ	3.3 ± 0.3	50	—	12.1	15.7	1.0	16.2	
			5.0 ± 0.5	50	—	7.6	10.3	1.0	11.0	
Maximum Clock Frequency	f _{MAX}		3.3 ± 0.3	15	80	150	—	70	—	MHz
				50	55	130	—	50	—	
			5.0 ± 0.5	15	135	185	—	115	—	
				50	95	155	—	85	—	
Input Capacitance	C _{IN}				—	4	10	—	10	pF
Output Capacitance	C _{OUT}				—	6	—	—	10	
Power Dissipation Capacitance	C _{PD}	Note(1)			—	87	—	—	—	

(Note1): C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: $I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

Noise Characteristics (Input $t_r = t_f = 3\text{ns}$)

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C		UNIT
			V _{CC} (V)	Typ.	Limit	
Quiet Output Maximum Dynamic V _{OL}	V _{OLP}	C _L = 50pF	5.0	0.8	1.0	V
Quiet Output Minimum Dynamic V _{OL}	V _{OLV}	C _L = 50pF	5.0	- 0.8	- 1.0	V
Minimum High Level Dynamic Input Voltage	V _{IHD}	C _L = 50pF	5.0	—	3.5	V
Maximum Low Level Dynamic Input Voltage	V _{ILD}	C _L = 50pF	5.0	—	1.5	V

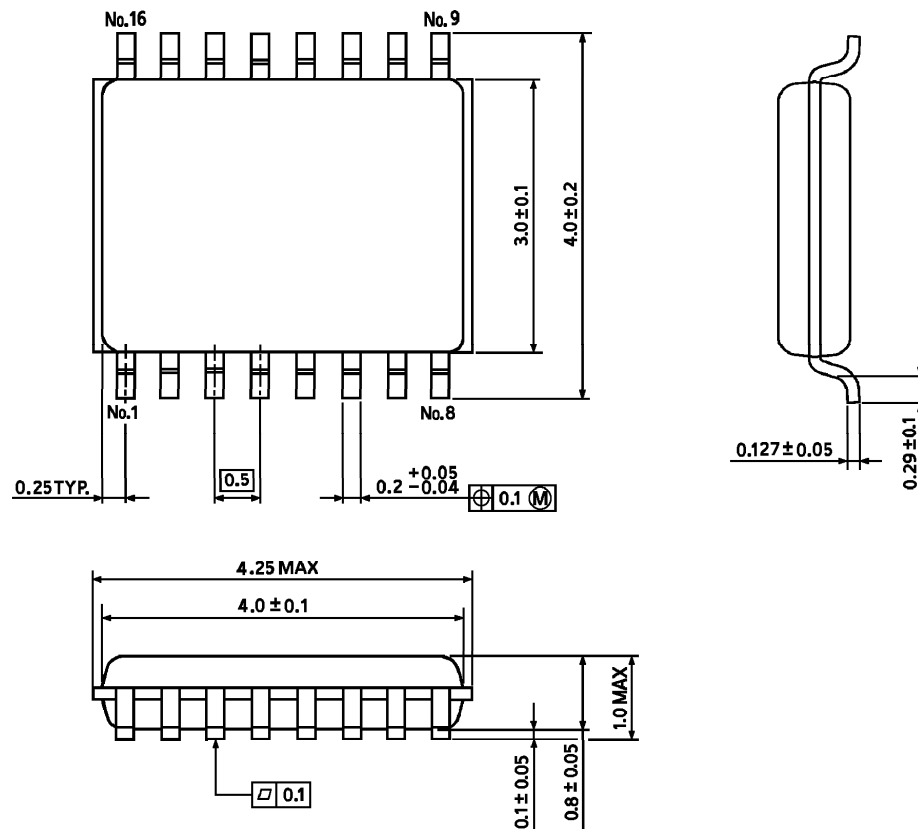
Input Equivalent Circuit



Outline Drawing

VSSOP16-P-0030-0.50

Unit: mm



Weight: 0.02g (Typ.)