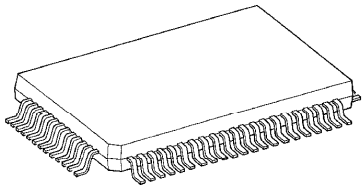
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

T6M19, JT6M19-AS

T6M19, JT6M19-AS SINGLE-CHIP CMOS LSI FOR LCD CALCULATORS

The T6M19, JT6M19-AS is single-chip microcomputer for 10-digit + 2-digit scientific calculation.
T6M19, JT6M19-AS is the complete single-chip CMOS LSI for calculator with 10 digits, 67 functions, 3 expression and hexadecimal, octal and binary, statistic calculation, fractional number calculation, and logic operation with the following features.



QFP67-P-1420-0.80

Weight : 1.20g (Typ.)

FEATURES

- 12-digit display plus 2-digit code at the right margin.
  - Scientific and engineering display.

    Mantissa 10 digits plus exponent 2 digits plus negative code 2 digits.
  - Other than above

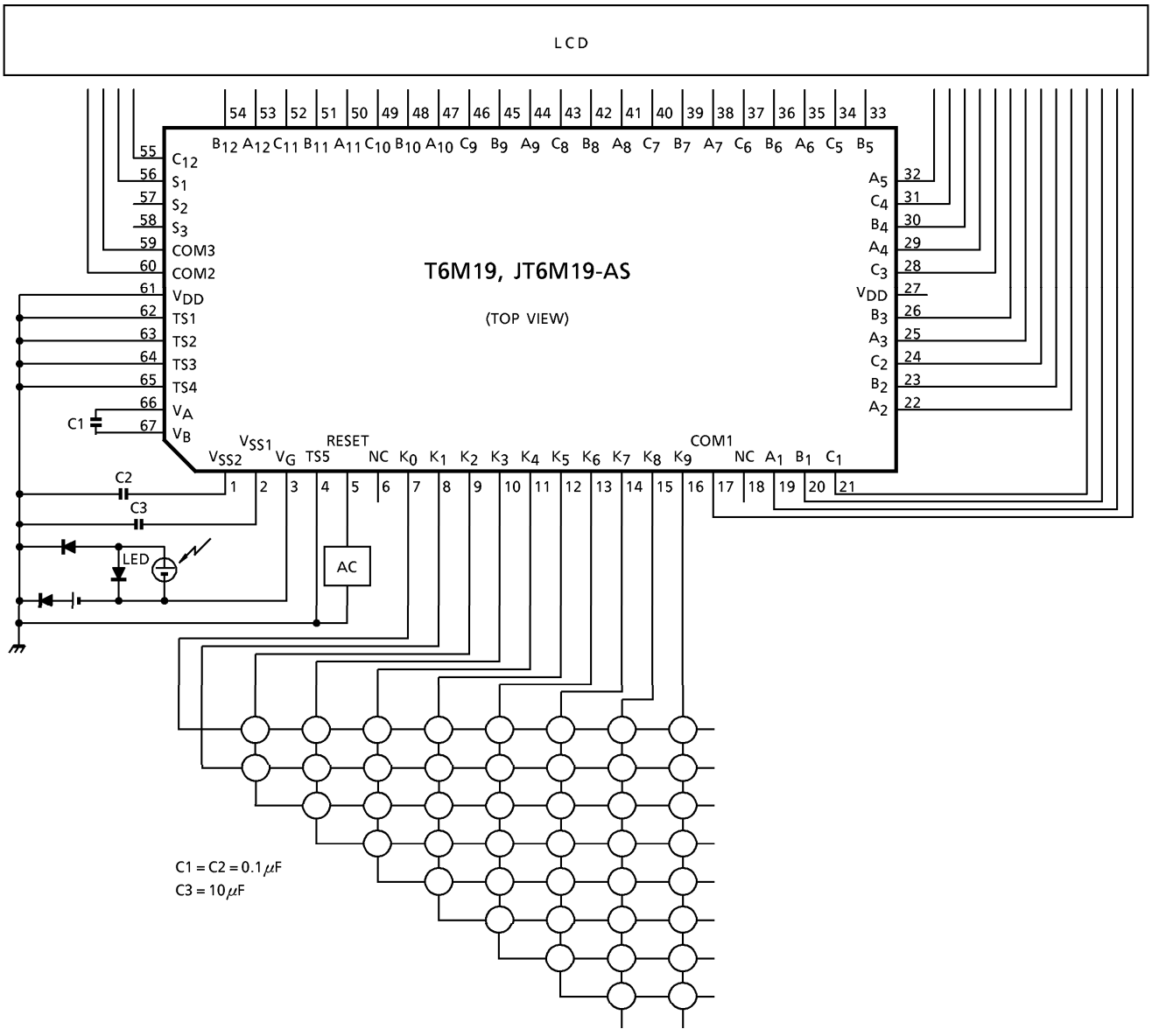
    Mantissa 10 digits plus negative code 1 digit.
- 13 kinds of special display

M	Memory	HEX	Hexadecimal mode
–	Mantissa and exponent Minus	SD	Statistic calculation mode
E	Error	DEG	Degree
INV	Inverse	RAD	Radian
HYP	Hyperbolic	GRAD	Gradian
BIN	Binary mode	( )	Parenthesis calculation
OCT	Octal mode		

- The minus sign of the mantissa is floating minus.
- The arithmetic key operation in clouding Y^x or $\sqrt[x]{Y}$ has same sequence as mathematical equation. 6 pending operations are allowed and ( ) are up to continuous 15 levels.
- Fractional number calculation.
- It is possible to convert mutually between decimal, binary, octal and hexadecimal, and the 4 operations in arithmetic in binary, octal and hexadecimal.
- One independent accumulating memory.
- It is possible to convert or fix the display number system by FLO (Floating) , SCI (Scientific) or ENG (Engineering) key.

- It is possible to specify decimal part digits (0~9) by FIX key.
- Direct drive for FEM LCD (1 / 2 prebias, 1 / 3 duty).
- Automatic power on clear.
- Low-power consumption. V_G = – 1.5V single power supply.
- The 67-pin flat package is used.
- Automatic power off (A time for about 10 min.).

SYSTEM BLOCK DIAGRAM

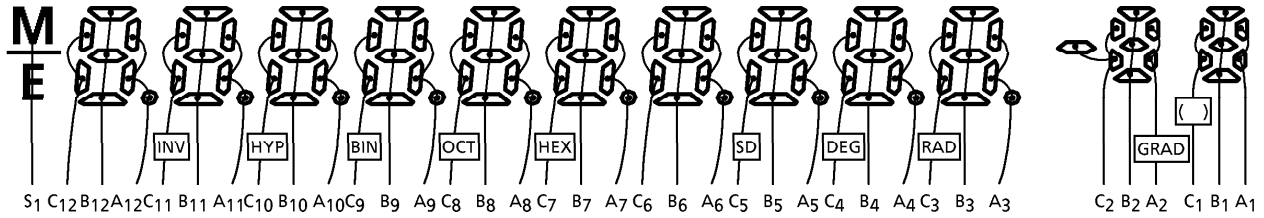


(Note) Key resistance ≦ 5.0kΩ at V_G = – 1.2V

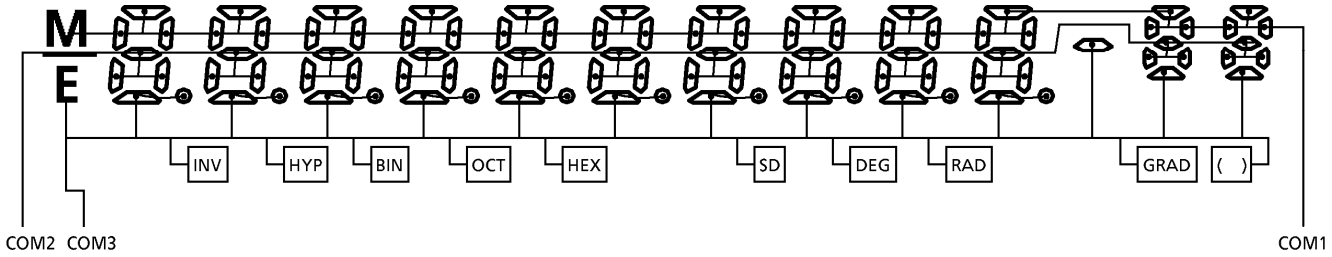
980910EBA2'

CONNECTION OF LCD

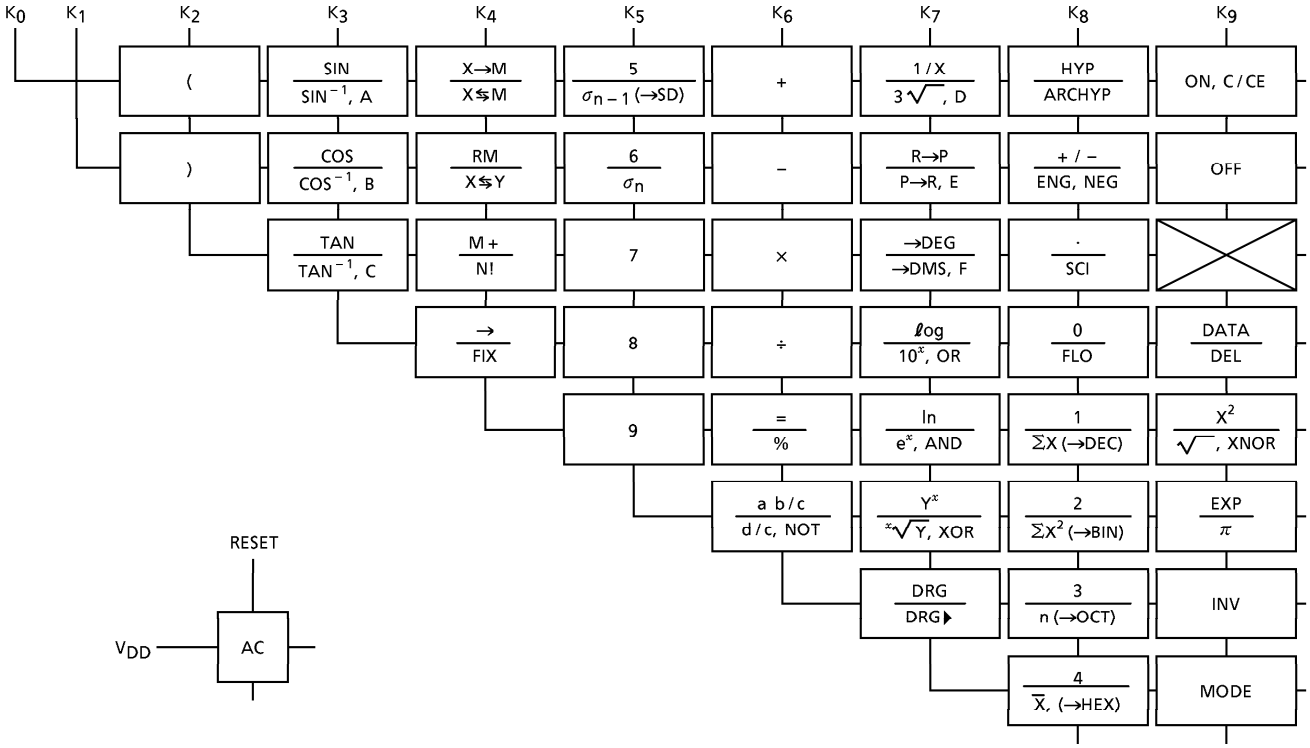
SEGMENT



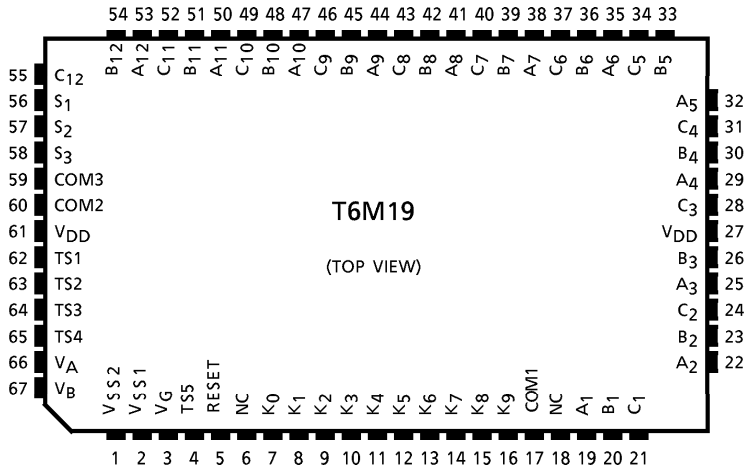
COMMON



KEY CONNECTION



PIN ASSIGNMENT



MAXIMUM RATINGS (Ta = 25°C)

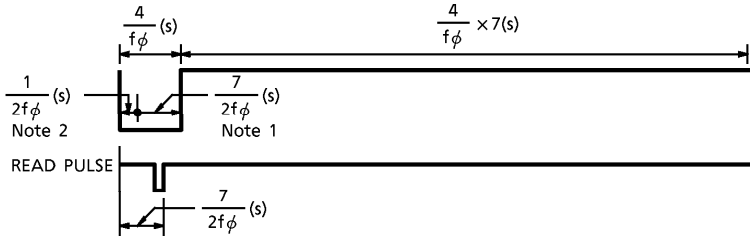
CHARACTERISTICS	SYMBOL	RATING	UNIT
Supply Voltage	V_G	+0.3~−2.2	V
Input Voltage	V_{IN}	+0.3~V_G−0.3	V
Operating Temperature	T_{opr}	0~40	°C
Storage Temperature	T_{stg}	−55~125	°C

ELECTRICAL CHARACTERISTICS (V_G = −1.5V ± 0.2V, V_{SS2} = −3.0 ± 0.4V, V_{DD} = 0V, Ta = 25°C)

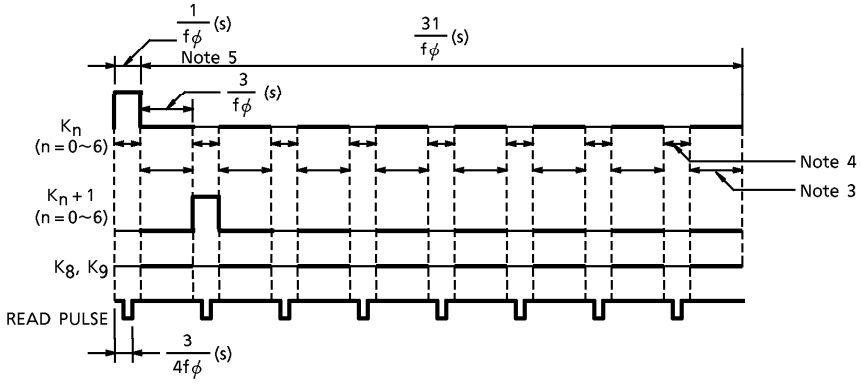
CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	PIN NAME	TEST CONDITION	MIN	TYP.	MAX	UNIT
Operating Voltage	V_G	—	—	—	−1.2	−1.5	−2.0	V
Supply Current (I)	I_{DD} WAIT	—	—	V_G = −1.5V, wait	—	2.0	3.0	μA
Supply Current (II)	I_{DD} OP	—	—	V_G = −1.2V, operate	—	4.5	7.0	μA
Supply Current (III)	I_{DD} OFF	—	—	V_G = −1.5V, off	—	—	2.0	μA
Oscillating Frequency (I)	fϕ WAIT	—	—	V_G = −1.5V, wait	5.4	9.0	12.6	kHz
Oscillating Frequency (II)	fϕ OP	—	—	V_G = −1.5V, operate	14.4	24.0	33.6	kHz
Frame Frequency	f_F	—	—	V_G = −1.5V, wait	56.3	93.8	131.3	Hz
"1" Input Voltage	V_{IH}	—	K_2~K_9 RESET	—	V_G +0.4	—	V_G	V
"0" Input Voltage	V_{IL}	—	K_2~K_9 RESET	—	V_{SS}	—	−0.4	V
"1" Output Voltage	V_{OH} (I)	—	SEGMENT COM1~3	—	V_{SS2} +0.2	—	V_{SS2}	V

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	PIN NAME	TEST CONDITION	MIN	TYP.	MAX	UNIT
"0" Output Voltage	V_{OL} (I)	—	SEGMENT COM1~3	—	V_{DD}	—	−0.2	V
"M" Output Voltage	V_{OH}	—	COM1~3	—	V_{SS1} +0.2	—	V_{SS1} −0.2	V
"1" Output Voltage	V_{OH} (II)	—	K_0~K_9 RESET	—	V_{SS1} +0.2	—	V_{SS1}	V
"0" Output Voltage	V_{OL} (II)	—	K_0~K_9 RESET	—	V_{DD}	—	−0.2	V
"1" Output Resistance	R_{OH}	—	SEGMENT COM1~3	$V_{OUT} = V_{SS2} + 0.5V$	—	—	70	kΩ
"0" Output Resistance	R_{OL}	—	SEGMENT COM1~3	$V_{OUT} = -0.5V$	—	—	70	kΩ
RESET Pull Up Resistance (I)	R_{RESETH} (I)	—	RESET	$V_{OUT} = 0V$ (Note 1)	156	260	364	kΩ
RESET Pull Up Resistance (II)	R_{RESETH} (II)	—	RESET	$V_{OUT} = 0V$ (Note 2)	18	75	300	kΩ
Key Pull Up Resistance (I)	R_{KEYH} (I)	—	K_0~K_9	$V_{OUT} = V_G + 0.5V$ (Note 3)	—	—	500	kΩ
Key Pull Up Resistance (II)	R_{KEYH}	—	K_0~K_9	$V_{OUT} = 0V$ (Note 4)	60	300	1500	kΩ
Key RESET Pull Down Resistance	R_{KEYL} RESETL	—	K_0~K_9 RESET	$V_{OUT} = -0.5V$ (Note 5)	—	—	25	kΩ

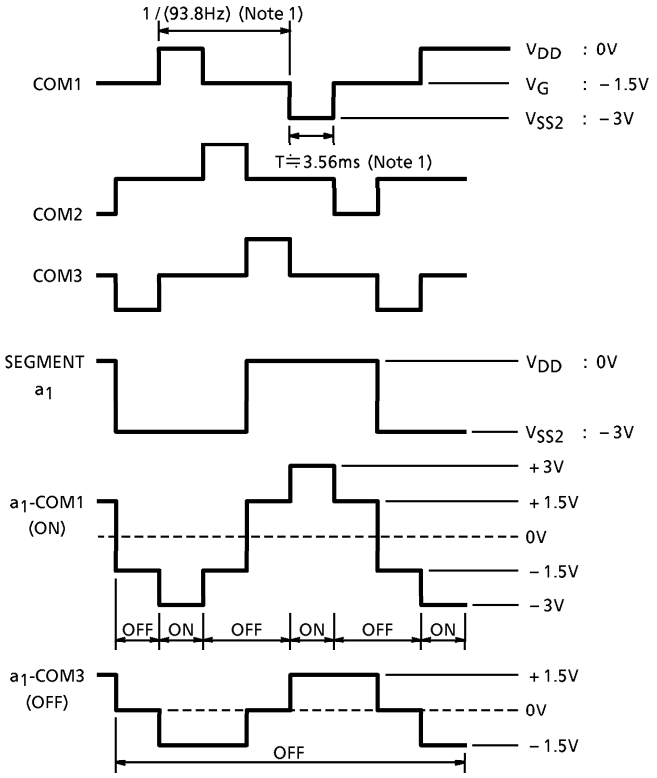
(Note 1, 2, 5) RESET Waveform, 1-cycle



(Note 3, 4, 5) KEY Waveform, 1-cycle



WAVEFORMS FOR DISPLAY



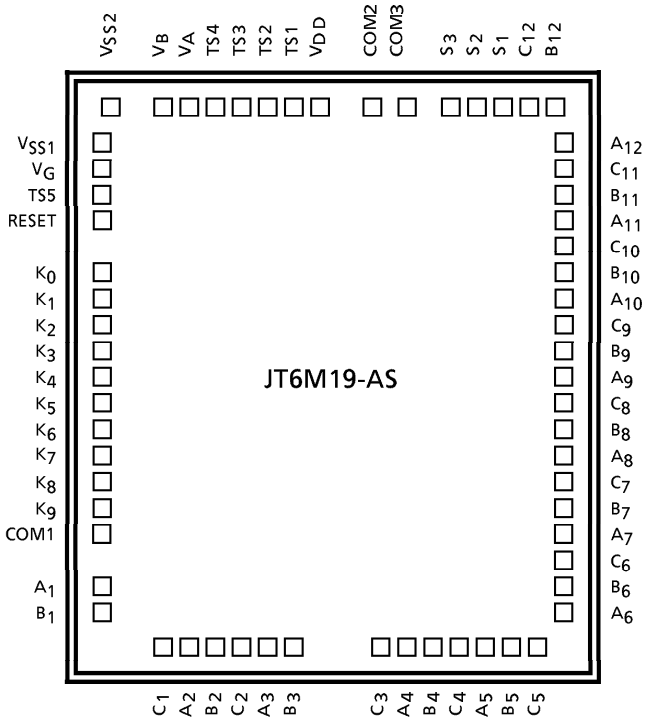
(Note 1) f_ϕ WAIT = 9kHz

PAD LOCATION TABLE (μm)

NAME	X POINT	Y POINT
V_{SS2}	– 1783	2330
V_{SS1}	– 1894	2102
V_G	– 1894	1901
TS5	– 1894	1690
RESET	– 1894	1469
K_0	– 1894	1070
K_1	– 1894	789
K_2	– 1894	547
K_3	– 1894	265
K_4	– 1894	23
K_5	– 1894	– 259
K_6	– 1894	– 501
K_7	– 1894	– 782
K_8	– 1894	– 1024
K_9	– 1894	– 1306
COM1	– 1894	– 1602
A_1	– 1894	– 2023
B_1	– 1894	– 2258
C_1	– 1513	– 2330
A_2	– 1277	– 2330
B_2	– 1042	– 2330
C_2	– 806	– 2330
A_3	– 571	– 2330
B_3	– 336	– 2330
C_3	118	– 2330
A_4	353	– 2330
B_4	589	– 2330
C_4	824	– 2330
A_5	1059	– 2330
B_5	1295	– 2330
C_5	1530	– 2330
A_6	1894	– 2234

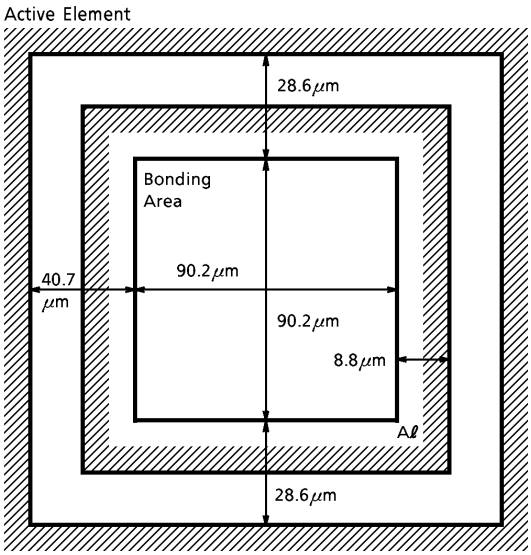
NAME	X POINT	Y POINT
B_6	1894	– 1937
C_6	1894	– 1709
A_7	1894	– 1482
B_7	1894	– 1254
C_7	1894	– 1026
A_8	1894	– 799
B_8	1894	– 571
C_8	1894	– 343
A_9	1894	– 116
B_9	1894	112
C_9	1894	332
A_{10}	1894	557
B_{10}	1894	784
C_{10}	1894	1012
A_{11}	1894	1240
B_{11}	1894	1467
C_{11}	1894	1695
A_{12}	1894	1920
B_{12}	1839	2330
C_{12}	1606	2330
S_1	1373	2330
S_2	1140	2330
S_3	902	2330
COM3	565	2330
COM2	295	2330
V_{DD}	– 51	2330
TS1	– 263	2330
TS2	– 484	2330
TS3	– 681	2330
TS4	– 888	2330
V_A	– 1124	2330
V_B	– 1371	2330

CHIP LAYOUT



Chip size : 4.04×4.98 (mm)
Chip thickness : 450±20μm
Substrate : V_{DD}

PAD LAYOUT

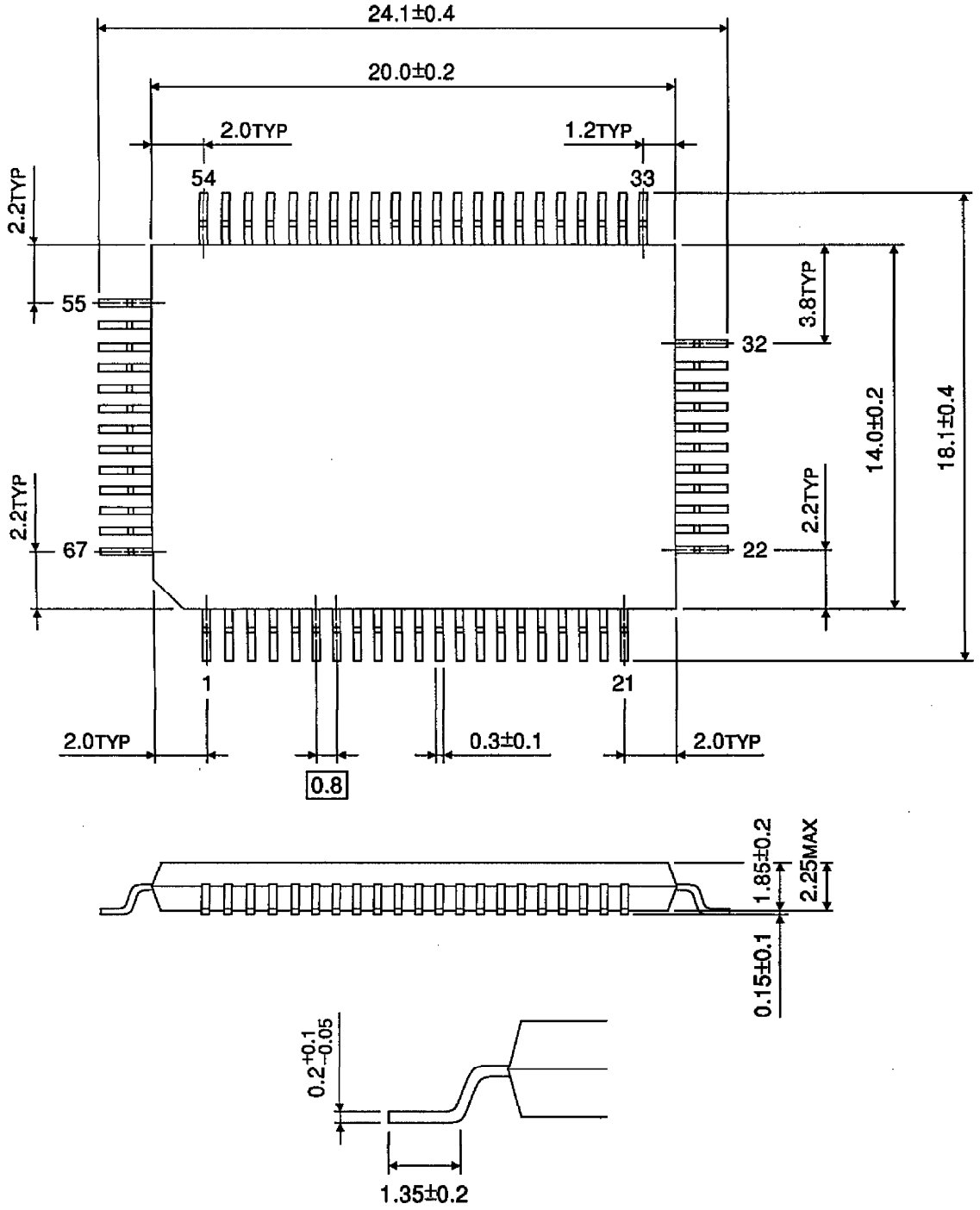


Scribe Line

PAD Pitch 201.3μm

PACKAGE DIMENSIONS

QFP67-P-1420-0.80 Unit : mm



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