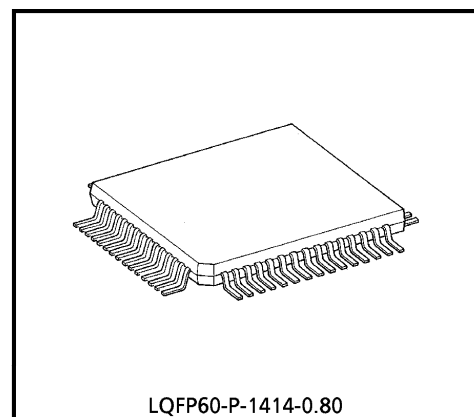


T7942S

T7942S CMOS 1 CHIP LSI FOR LCD ELECTRONIC CALCULATOR

The T7942S is a 1 chip microcomputer for 10-digits + 2-digits electronic scientific calculation.

T7942S is the complete single chip CMOS LSI for electronic programmable scientific calculator with 10 digit, 129 function, max. 4 formula-128 steps program capacity, 3 expression and hexadecimal, octal and binary, 1 variable and 2 variable statistic calculation, complex, fractional number calculation, metric conversion, physical constants and logic operation with the following features.



Weight : 0.66g (Typ.)

FEATURES

- Display 12 display digits plus 2 digits 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.

- 20 kinds of special display

M	Memory	HEX	Hexadecimal mode
-	Mantissa and exponent minus	SD1	1 variable statistic calculation mode
E	Error	SD2	2 variable statistic calculation mode
INV	Inverse	DEG	Degree
HYP	Hyperbolic	RAD	Radian
BIN	Binary mode	GRAD	Gradian
OCT	Octal mode	()	Parenthesis calculation
LRN1	Program write mode 1	LRN2	Program write mode 2
LRN3	Program write mode 3	LRN4	Program write mode 4
HLT	Program HALT	CPLX	Complex number calculation mode

- The minus sign of the mantissa is floating minus.
- The arithmetic key operation in clouding Y^X or $^X\sqrt{Y}$ has same sequence as mathematical equation. 6 pending operations are allowed and () are up to continuous 15 levels.
- Fractional number calculation.

980910EBA2

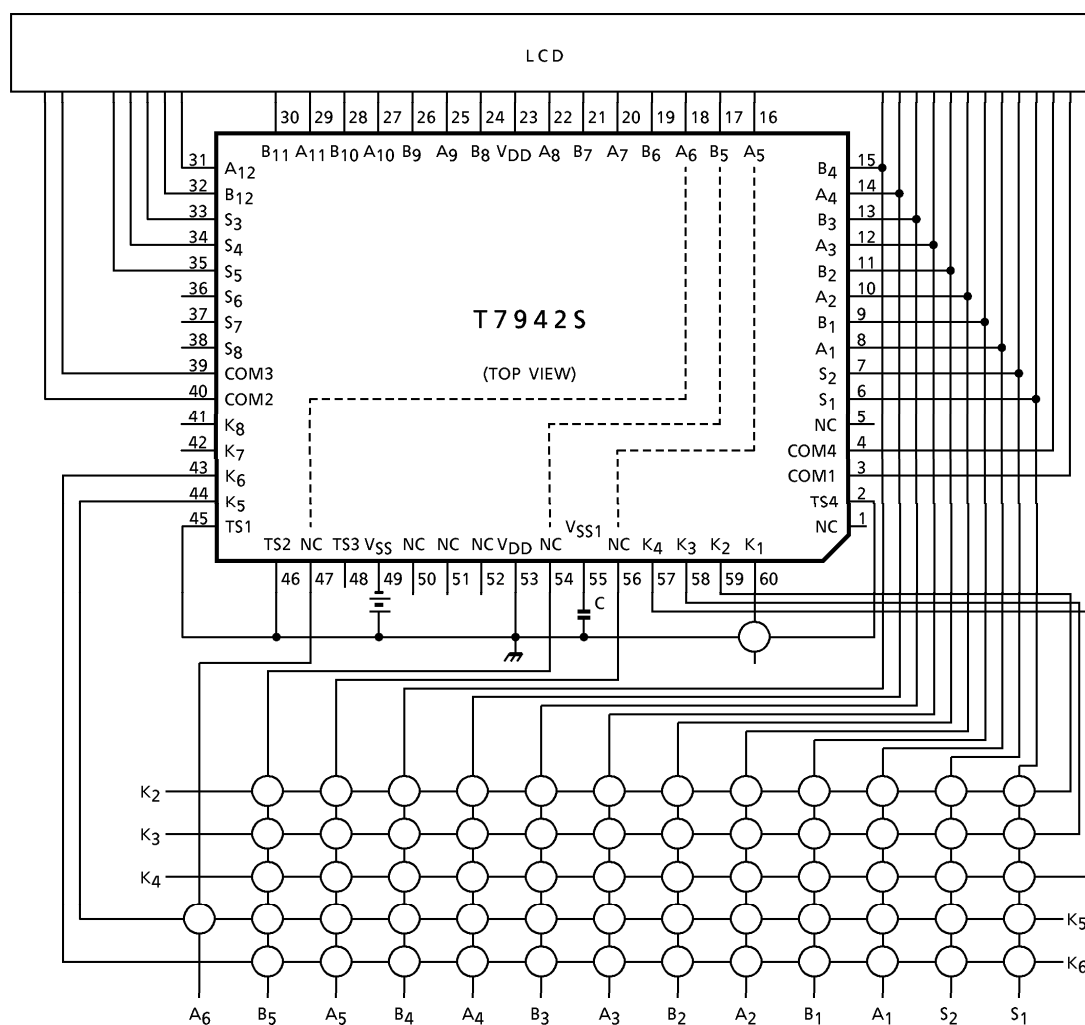
● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing 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.

- Mutual conversion between decimal, binary, octal and hexadecimal, and the 4 operations in arithmetic in binary, octal and hexadecimal are possible.
- Program function
4 formula (LRN1~LRN4) total 128 steps.
 $X > 0$, $X \leq M$ and GO TO judge function (It is possible to jump after and back within 9 steps).
It is possible to display in the middle of result by HLT key.
It is possible to enter the variable by ENT.
- 16 kinds of metric conversion
oz $\leftrightarrow$ g, J $\leftrightarrow$ cal, Lb $\leftrightarrow$ kg, in $\leftrightarrow$ cm, gal $\leftrightarrow$ l, $^{\circ}\text{F} \leftrightarrow ^{\circ}\text{C}$, mmHg $\leftrightarrow$ Kpa, atm $\leftrightarrow$ MPa
- 13 kinds of physical constants
G, g, ϵ_0 , μ_0 , Vm, ch, R, NA, k, me, u, e.
- One independent accumulating memory and 9 storage 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.
- + / - key is possible to enter as first key (According to sequence a mathematical formula).
- Direct drive for FEM LCD (1/3 prebias, 1/4 duty).
- Automatic power on clear and auto power off timer (about 10 minutes).
- Low power consumption. $V_{SS} = -3.0\text{V}$ single power supply.
- The 60 pin flat package is used.

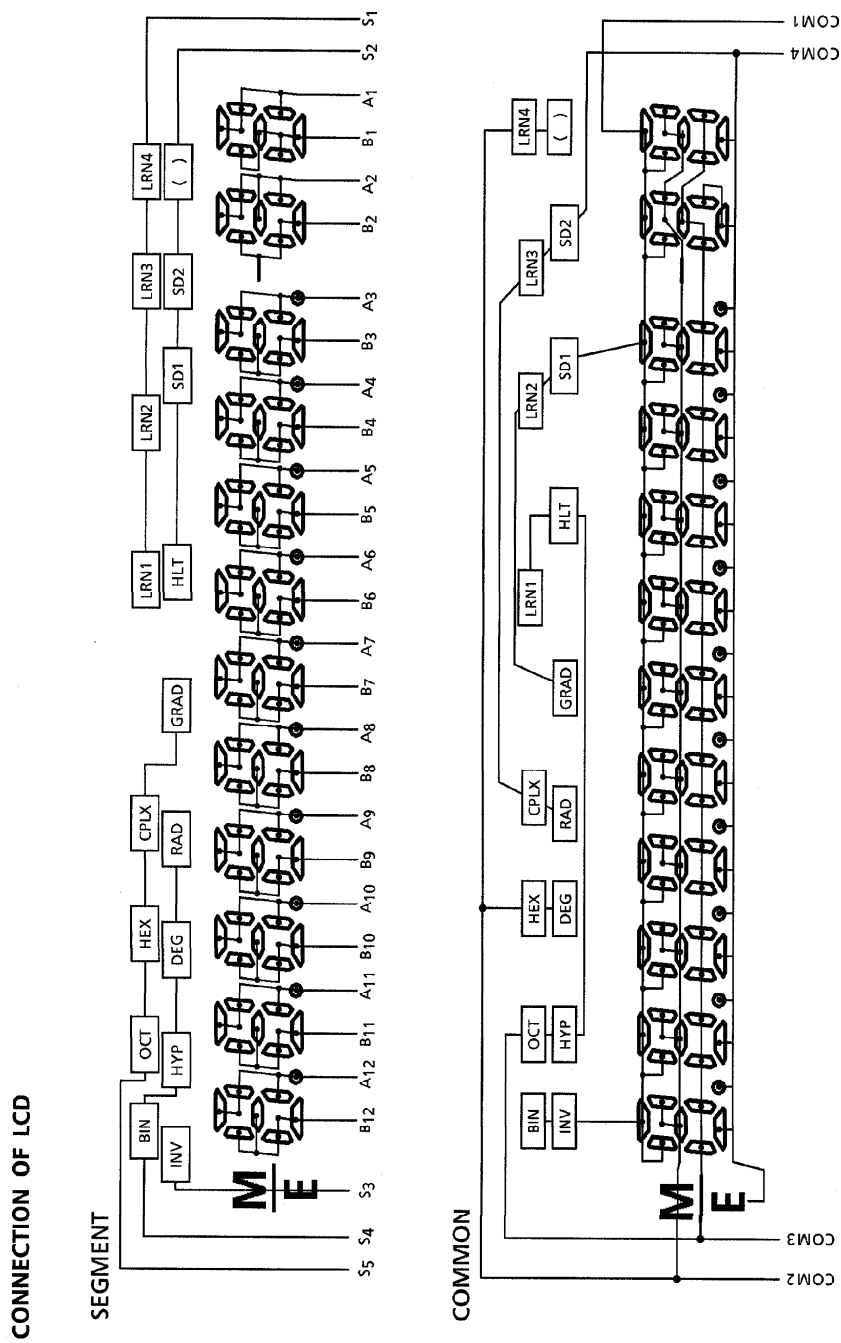
980910EBA2'

- 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 BLOCK DIAGRAM



NOTE : Input capacity ≤ 400 (pF) at $V_{SS} = -3.0$ (V)
 Key resistance ≤ 5.0 (k Ω) at $V_{SS} = -3.0$ (V)



SET KEY LAYOUT (Example)

Used 50 touch Key with all function

INV	HYP		MODE	OFF	ON, C / CE
SIN A	COS B	TAN C	OUT D	x^2 E	CLA F
$\sin^{-1}$	$\cos^{-1}$	$\tan^{-1}$	$\frac{1}{x}$	$\sqrt{x}$	$\sqrt[x]{y}$
$\ln$ AND	$\log$ NAND	$\rightarrow \text{DEG}$ OR	$R \rightarrow P$ NOR	nCr XOR	INT XNOR
e^x	10^x	$\rightarrow \text{DMS}$	$P \rightarrow R$	nPr	FRAC
$a \ b / c$ NOT	% NEG	a	b	π	DRG
d / c	RND	FIX	MDF	N!	DRG
RCL	STO	Mo +	$\rightarrow$ (ENT)	RUN (HLT)	<DATA>
$X \leftrightarrow Y$	$X \leftrightarrow S$	$X \leftrightarrow Mo$	<t>		
7 me LRN2	8 u LRN3	9 e LRN4	(OZ $\leftrightarrow$ g	) J $\leftrightarrow$ cal	
<a> (X>0)	 (X $\leq$ M)	<r> (GOTO)	<x>	<y>	
4 R HEX	5 NA CPLX	6 K LRN1	x Lb $\leftrightarrow$ kg	$\div$ in $\leftrightarrow$ cm	
< Σy >	< Σy^2 >	< Σxy >	< Σy >	< σy >	
1 Vm DEC	2 C BIN	3 h OCT	+ gal $\leftrightarrow$ l	- $^{\circ}\text{F} \leftrightarrow ^{\circ}\text{C}$	
< ΣX >	< Σx^2 >	<n>	< Σx >	< σx >	
0 G SD1	. g SD2	+ / - eo	EXP μO mmHg $\leftrightarrow$ kPa	= atm $\leftrightarrow$ MPa	
FLO <P (t)>	SCI <Q (t)>	ENG <R (t)>	<x'>	<y'>	

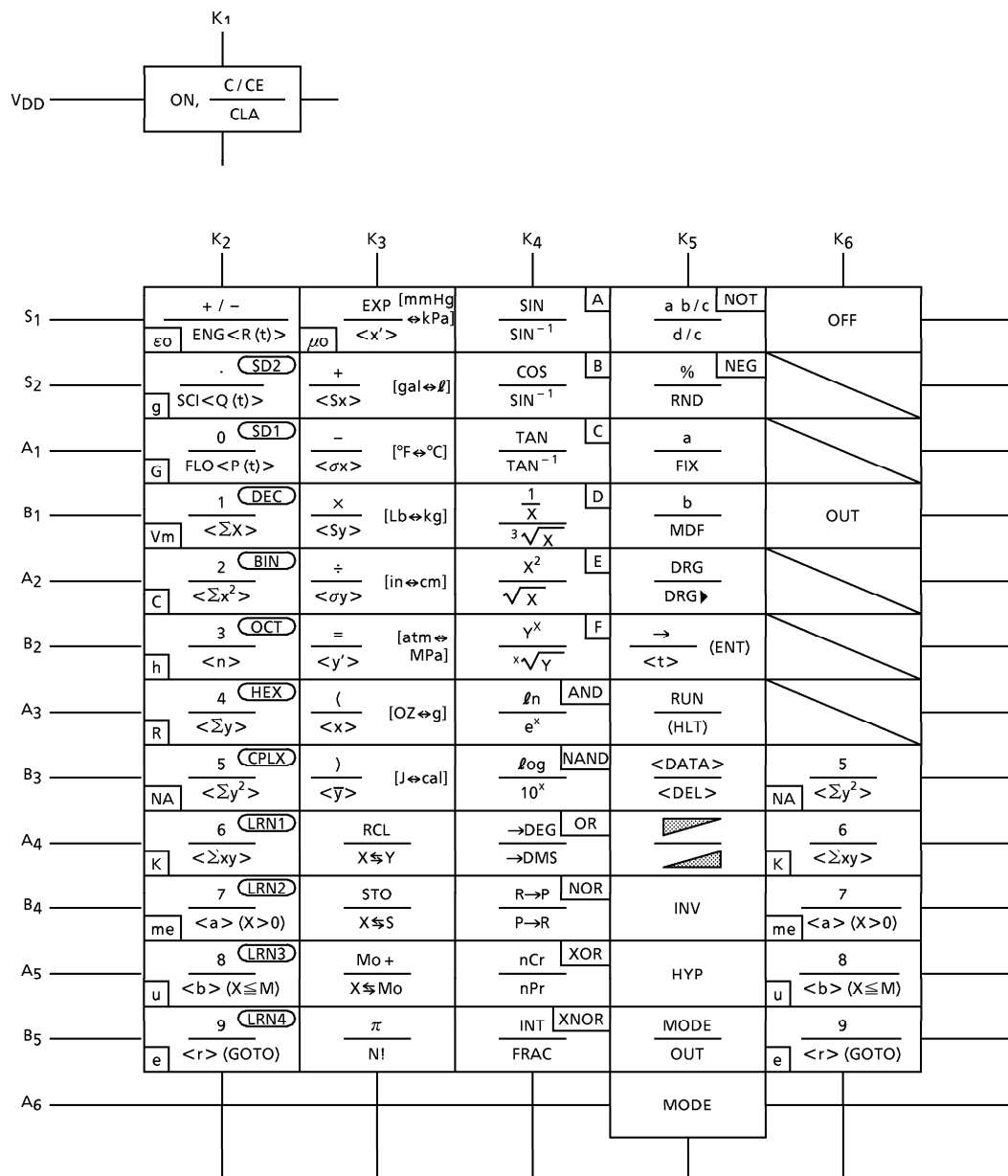
Used 48 touch key without CPLX mode, LRN 1~4 mode, conversion, and scientific constant

INV	HYP			OFF	MODE
SIN A	COS B	TAN C	$\frac{1}{X}$ D	X^2 E	Y^X F
SIN^{-1}	COS^{-1}	TAN^{-1}	$\sqrt[3]{X}$	$\sqrt{X}$	$\sqrt[n]{Y}$
$\ln$ AND	$\log$ NAND	$\rightarrow\text{DEG}$ OR	$R\rightarrow P$ NOR	nCr XOR	INT XNOR
e^x	10^x	$\rightarrow\text{DMS}$	$P\rightarrow R$	nPr	FRAC
$a\ b/c$ NOT	% NEG	a	b	π	DRG
d/c	RND	FIX	MDF	N!	DRG▶
RCL	STO	Mo +	$\rightarrow$	<DATA>	ON C/CE
$X\leftrightarrow Y$	$X\leftrightarrow S$	$X\leftrightarrow\text{Mo}$	<t>		CLA
7	8	9	(	)	
<a>		<r>	< $\bar{x}$ >	< $\bar{y}$ >	
4 HEX	5	6	$\times$	$\div$	
< Σy >	< Σy^2 >	< Σxy >	< Σy >	< σy >	
1 DEC	2 BIN	3 OCT	+	-	
< Σx >	< Σx^2 >	<n>	< Σx >	< σx >	
0 SD1	. SD2	+ / -	EXP	=	
FLO<P (t)>	SCI<Q (t)>	ENG<R (t)>	<x'>	<y'>	

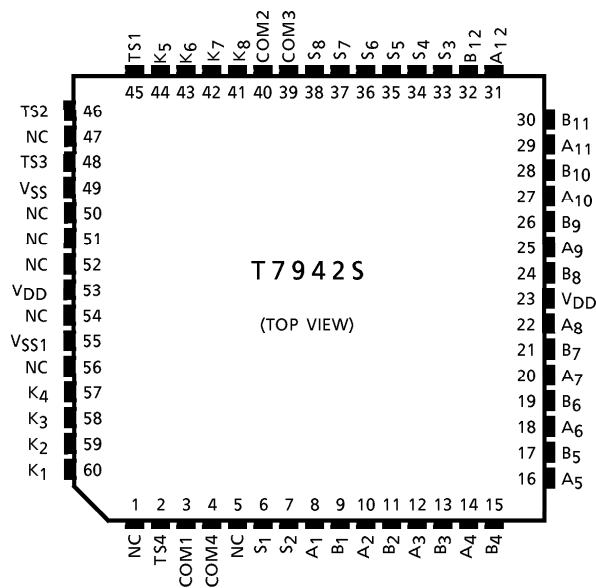
Used 50 touch key with all function

MODE		SIN	A	COS	B	TAN	C	LN2	7	LN3	8	LN4	9	(	OZ ↔ g	)	↔ cal	OFF
OUT		SIN ⁻¹	D	COS ⁻¹	E	TAN ⁻¹	F	<a> (X>0)	me	 (X≤M)	u	<c> (GOTO)	e	<x>	OZ ↔ g	<y>		
INV	HYP	$\frac{1}{X}$	1/X	X ²	E	Y ^X	F	<Σy>	R	<Σy ² >	NA	<Σxy>	K	X	Lb ↔ kg	÷	in ↔ cm	ON, C/CE
DRG	π	$\sqrt[n]{X}$	AND	$\sqrt{X}$	NAND	$\sqrt[n]{Y}$	OR	<Σy>	4	HEX	5	CPLX	6	+	Lb ↔ kg	<ny>	RCL	CLA
DRG	N!	e ^X	NOR	10 ^X	XOR	→DMS	INT	<ΣX>	1	DEC	2	BIN	3	+	gal ↔ l	°F ↔ °C	X ↔ Y	STO
a	b	R→P	P→R	nCr	nPr	FRAC	%	FLO<P (t)>	G	SDI	0	SD2	h	EXP	mmHg ↔ kPa	=	X ↔ S	Mo+
FIX	MDF	<DATA>		a b/c	d/c	RND	NEG	SCI<Q (t)>	g	SDI	g	SD2	ENG<R (t)>	/10	atm ↔ MPa	<y>	X ↔ Mo	
→ (ENT)	RUN (HLT)																	
<1>																		

KEY LAYOUT



PIN LAYOUT



SPECIFICATION OF CALCULATOR

Speed of calculation

Key on 5.3ms

Key off 36.8ms

$f_{\phi} \text{ WAIT} = 15\text{kHz}$, $f_{\phi} \text{ op} = 190\text{kHz}$

The calculation speed doesn't include the key on or off time.

ITEM	OPERATION			CALCULATION SPEED (ms)
Number	DEC		5	8.
		5	5	8.
	HEX		A	5.
		A	A	5.
Function	DEC	5	+	10.
		5	x	11.
	HEX	A	-	31.
		A	÷	32.
4 operation	DEC	1 + 2	+	14.
		1 0 0 0 0 0 0 0 0 - 1	-	15.
		5 x 9	x	15.
		5 5 5 5 5 x 9 9 9 9 9	x	17.
		5 ÷ 9	÷	22.
		5 5 5 5 5 ÷ 9 9 9 9 9	÷	26.
	HEX	A B C + D E F	+	45.
		A B C - D E F	-	70.
		A B C x D E F	x	49.
		A B C ÷ D E F	÷	53.
Y^x , $x\sqrt{Y}$	3 Y^x 4		=	110.
	3 $x \sqrt{Y}$ 4		=	113.

ITEM	OPERATION			CALCULATION SPEED (ms)
SIN	DEG	3 0	SIN	102.
	RAD	$\pi \div 6 =$	SIN	98.
	GRAD	$1\ 0\ 0 \div 3 =$	SIN	148.
COS	DEG	6 0	COS	103.
	RAD	$\pi \div 3 =$	COS	131.
	GRAD	$200 \div 3 =$	COS	150.
TAN	DEG	4 5	TAN	51.
	RAD	$\pi \div 4 =$	TAN	20.
	GRAD	5 0	TAN	22.
SIN ⁻¹	DEG	0. 5	SIN ⁻¹	106.
	RAD	0. 5	SIN ⁻¹	84.
	GRAD	0. 5	SIN ⁻¹	105.
COS ⁻¹	DEG	0. 5	COS ⁻¹	136.
	RAD	0. 5	COS ⁻¹	97.
	GRAD	0. 5	COS ⁻¹	134.
TAN ⁻¹	DEG	1	TAN ⁻¹	32.
	RAD	1	TAN ⁻¹	21.
	GRAD	1	TAN ⁻¹	32.
Ln		2 0	ln	24.
Log		2 0	log	46.
e ^x		2 0	e ^x	44.
10 ^x		1. 2 3	10 ^x	52.
		1 0	10 ^x	22.
X!		6 9	N!	129.
HYP		3 hyp	SIN	80.
		3 hyp	COS	81.
		3 hyp	TAN	99.
ARC HYP		3 hyp ⁻¹	SIN	78.
		3 hyp ⁻¹	COS	87.
		0.5 hyp ⁻¹	TAN	75.
X ²		2 0	X ²	11.
$\sqrt{\quad}$		2 0	$\sqrt{\quad}$	30.
1/X		2 0	1/X	13.
$\sqrt[3]{\quad}$		2 0	$\sqrt[3]{\quad}$	80.
→DEG		1.2 3 4 5	→DEG	37.
→DMS		1.2 3 4 5	→DMS	41.
→RAD	DEG	3 6 0	DRG▶	20.
→GRAD	RAD	$2 \times \pi =$	DRG▶	14.
→DEG	GRAD	4 0 0	DRG▶	11.
Random number		C / C E	RND	164.
INT FRAC		1.2 3	INT	13.
		1.2 3	FRAC	14.

ITEM	OPERATION			CALCULATION SPEED (ms)
MDF	FIX2	$1 \div 3 =$	MDF	15.
Exchange		$1\ 2\ 3 + 4\ 5\ 6$	$X \leftrightarrow Y$	11.
Shift		$1\ 2\ 3$	$\rightarrow$	7.
Fractions	Function	$2\ ab/c\ 3\ 6\ ab/c\ 2\ 3\ 4$	$-$	33.
		$2\ ab/c\ 3\ 6\ ab/c\ 2\ 3\ 4$	$\div$	33.
	4-operation	$2\ _ 36J\ 234 + 3\ _ 45\ J\ 345$	$=$	68.
		$2\ _ 36J\ 234 - 3\ _ 45\ J\ 345$	$=$	65.
		$2\ _ 36J\ 234 \times 3\ _ 45\ J\ 345$	$=$	65.
		$2\ _ 36J\ 234 \div 3\ _ 45\ J\ 345$	$=$	73.
%		$1\ 2\ 3 + 4\ 5\ 6$	%	11.
		$1\ 2\ 3 - 4\ 5\ 6$	%	11.
		$1\ 2\ 3 \times 4\ 5\ 6$	%	9.
		$1\ 2\ 3 \div 4\ 5\ 6$	%	8.
R→P	DEG	$\sqrt[3]{\quad} a\ 1\ b$	R→P	117.
	RAD	$\sqrt[3]{\quad} a\ 1\ b$	R→P	92.
	GRAD	$\sqrt[3]{\quad} a\ 1\ b$	R→P	117.
P→R	DEG	$2\ a\ 3\ 0\ b$	P→R	195.
	RAD	$2\ a\ 30\ DRG\ b$	P→R	185.
	GRAD	$2\ a\ 30\ DRG\ DRG\ b$	P→R	264.
Permutation combination		$6\ 9\ a\ 3\ 5\ b$	nPr	221.
		$7\ 0\ a\ 3\ 0\ b$	nCr	218.
Memory		$1\ 2\ 3\ S\ T\ 0$	0	36.
		$1\ 2\ 3\ S\ T\ 0\ 0$	Mo +	40.
		$1\ 2\ 3\ S\ T\ 0\ 0\ R\ C\ L$	0	8.
		$1\ 2\ 3\ S\ T\ 0\ 0\ X \leftrightarrow S$	0	37.
		$1\ 2\ 3\ S\ T\ 0\ 0\ 4\ 5\ 6\ S\ T\ 0\ +$	0	38.
		$1\ 2\ 3\ S\ T\ 0\ 0\ 4\ 5\ 6\ S\ T\ 0\ -$	0	38.
		$1\ 2\ 3\ S\ T\ 0\ 0\ 4\ 5\ 6\ S\ T\ 0\ \times$	0	39.
		$1\ 2\ 3\ S\ T\ 0\ 0\ 4\ 5\ 6\ S\ T\ 0\ \div$	0	47.
Mutual Conversion	DEC	$1\ 2\ 3$	→BIN	22.
		$1\ 2\ 3\ 4\ 5$	→OCT	24.
		$1\ 2\ 3\ 4\ 5$	→HEX	26.
	BIN	$1\ 0\ 1\ 0\ 1$	→DEC	15.
	OCT	$1\ 2\ 3\ 4\ 5$	→DEC	17.
	HEX	$A\ B\ C\ D\ E$	→DEC	25.
Logical operation	HEX	$A\ B\ C\ AND\ D\ E\ F$	$=$	99.
		$A\ B\ C\ NAND\ D\ E\ F$	$=$	139.
		$A\ B\ C\ OR\ D\ E\ F$	$=$	105.
		$A\ B\ C\ NOR\ D\ E\ F$	$=$	132.
		$A\ B\ C\ XOR\ D\ E\ F$	$=$	92.
		$A\ B\ C\ XNOR\ D\ E\ F$	$=$	145.
		$A\ B\ C$	NOT	55.
NEG	HEX	$A\ B\ C$	NEG	54.

ITEM	OPERATION			CALCULATION SPEED (ms)
Complex Calculation	ADD	(12 + 34 i) + (56 + 78 i)		= 13.
	SUB	(12 + 34 i) − (56 + 78 i)		= 14.
	MLT	(12 + 34 i) × (56 + 78 i)		= 23.
	DIV	(12 + 34 i) ÷ (56 + 78 i)		= 47.
Statistic calculation	1 a DATA 2 a DATA ~ 9 a 1.1 b 2.2 b 9.9 b			DATA 43.
	The above-mentioned data			n 9.
				X 13.
				Y 14.
				ΣX 8.
				ΣY 9.
				ΣX² 9.
				ΣY² 9.
				Sx 39.
				Sy 41.
				σx 45.
				σy 46.
				a 38.
	b 33.			
	r 59.			
	5. 5	x'	39.	
	5. 5	y'	39.	
5. 5	t	74.		
Normal distributions	1 P (t) 121.			
	1 Q (t) 120.			
	1 R (t) 118.			
Program operation	LRN1	continue	1 + 12.	
			2 + 16.	
			3 + 15.	
			4 + 15.	
			5 + 16.	
			6 + 16.	
			7 + 16.	
			8 + 15.	
			9 + 16.	
			10 = 14.	
	DEC	above program	RUN	LRN1 156.

OPERATION RANGE AND ACCURACY

FUNCTION	ANGLE UNIT	OPERATION RANGE	UNDER FLOW AREA	NORMAL ACCURACY
SIN X	DEG	$0 \leq X \leq 4.499999999 \times 10^{10}$	$0 \leq X \leq 5.729577951 \times 10^{-98}$	10 digits ± 1
	RAD	$0 \leq X \leq 785398163.3$	—	
	GRAD	$0 \leq X \leq 4.999999999 \times 10^{10}$	$0 \leq X \leq 6.366197723 \times 10^{-98}$	
COS X	DEG	$0 \leq X \leq 4.500000008 \times 10^{10}$	—	
	RAD	$0 \leq X \leq 785398164.9$	—	
	GRAD	$0 \leq X \leq 5.000000009 \times 10^{10}$	—	
TAN X	DEG	SAME AS SIN X except $ X = (2n - 1) \cdot 90$	SAME AS SIN X	
	RAD	SAME AS SIN X except $ X = (2n - 1) \cdot \pi / 2$	SAME AS SIN X	
	GRAD	SAME AS SIN X except $ X = (2n - 1) \cdot 100$	SAME AS SIN X	
SIN ⁻¹ X	DEG	$0 \leq X \leq 1$	$0 \leq X \leq 1.570796326 \times 10^{-99}$	
	RAD	$0 \leq X \leq 1$	—	
	GRAD	$0 \leq X \leq 1$	$0 \leq X \leq 1.570796326 \times 10^{-99}$	
COS ⁻¹ X	DEG	SAME AS SIN ⁻¹ X	—	
	RAD	SAME AS SIN ⁻¹ X	—	
	GRAD	SAME AS SIN ⁻¹ X	—	
TAN ⁻¹ X	DEG	$0 \leq X \leq 9.999999999 \times 10^{99}$	SAME AS SIN ⁻¹ X	
	RAD	$0 \leq X \leq 9.999999999 \times 10^{99}$	—	
	GRAD	$0 \leq X \leq 9.999999999 \times 10^{99}$	SAME AS SIN ⁻¹ X	

FUNCTION	OPERATION RANGE	UNDER FLOW AREA	NORMAL ACCURACY
SINH X	$0 \leq X \leq 230.2585092$	—	10 digits ± 1
COSH X	$0 \leq X \leq 230.2585092$	—	
TANH X	$0 \leq X \leq 9.999999999 \times 10^{99}$	—	
SINH ⁻¹ X	$0 \leq X \leq 4.999999999 \times 10^{99}$	—	
COSH ⁻¹ X	$1 \leq X \leq 4.999999999 \times 10^{99}$	—	
TANH ⁻¹ X	$0 \leq X \leq 9.999999999 \times 10^{-1}$	—	
LN X	$0 < X$	—	
LOG X	$0 < X$	—	
e ^x	$-9.999999999 \times 10^{99} \leq X \leq 230.2585092$	$-9.999999999 \times 10^{99} \leq X \leq -227.9559243$	
10 ^x	$-9.999999999 \times 10^{99} \leq X \leq 99.99999999$	$-9.999999999 \times 10^{99} \leq X \leq -99.00000001$	
X!	$0 \leq X \leq 69$ (INTEGER)	—	
$\frac{1}{X}$	$1 \times 10^{-99} \leq X \leq 9.999999999 \times 10^{99}$	$1.000000001 \times 10^{99} \leq X \leq 9.999999999 \times 10^{99}$	

FUNCTION	OPERATION RANGE	UNDER FLOW AREA	NORMAL ACCURACY
X^2	$0 \leq X \leq 9.999999999 \times 10^{49}$	$0 \leq X \leq 3.162277660 \times 10^{-50}$	10 digits ± 1
$\sqrt{X}$	$0 \leq X \leq 9.999999999 \times 10^{99}$	—	
$\sqrt[3]{X}$	$0 \leq X \leq 9.999999999 \times 10^{99}$	—	
DMS→DEG	$0 \leq X \leq 9999999999.$	—	
DEG→DMS	$0 \leq X \leq 9999999.999$	$0 \leq X \leq 1.388888888 \times 10^{-6}$	lowest digits ± 1
DEG→RAD	$0 \leq X \leq 9.999999999 \times 10^{99}$	$0 \leq X \leq 5.729577951 \times 10^{-98}$	10 digits ± 1
RAD→GRAD	$0 \leq X \leq 1.570796326 \times 10^{98}$	—	
GRAD→DEG	$0 \leq X \leq 9.999999999 \times 10^{99}$	$0 \leq X \leq 1.111111111 \times 10^{-99}$	
MDF	$0 \leq X \leq 9.999999999 \times 10^{99}$	—	
INT	$0 \leq X \leq 9.999999999 \times 10^{99}$	—	
FRAC	$0 \leq X \leq 9.999999999 \times 10^{99}$	—	
Y^X	$-9.999999999 \times 10^{99}$ $\leq X \cdot \text{LN } Y \leq 230.2585092$	$-9.999999999 \times 10^{99}$ $\leq X \cdot \text{LN } Y \leq -227.9559243$	
	Y>0...The above-mentioned operation range. Y<0...X (Integer) or, 1/X (Odd, X≠0) ...The above-mentioned operation range. Y = 0...0<X		
$x\sqrt{Y}$	$-9.999999999 \times 10^{99}$ $\leq \frac{1}{X} \cdot \text{LN } Y \leq 230.2585092$	$-9.999999999 \times 10^{99}$ $\leq \frac{1}{X} \cdot \text{LN } Y \leq -227.9559243$	
	Y>0...The above-mentioned operation range. Y<0...X (Odd) or, 1/X (Integer, X≠0) ...The above-mentioned operation range. Y = 0...0<X		
$R \rightarrow P$ ($xy \rightarrow \gamma\theta$)	$x, y \leq 9.999999999 \times 10^{49}$ $(x^2 + y^2) \leq 9.999999999 \times 10^{99}$ $\frac{y}{x}$; SAME AS $\text{TAN}^{-1}X$	$\frac{y}{x}$; SAME AS $\text{TAN}^{-1}X$	
$P \rightarrow R$ ($\gamma\theta \rightarrow xy$)	$0 \leq \gamma \leq 9.999999999 \times 10^{99}$ θ ; SAME AS $\text{SIN } X, \text{COS } X$	θ ; SAME AS $\text{SIN } X, \text{COS } X$	
nPr	$0 \leq n \leq 99, r \leq n$ n, r = Integer $1 \leq (n! / (n - \gamma) !\} \leq 9.999999999 \times 10^{99}$		
nCr	$0 \leq n \leq 99$ r≤n n, r = Integer		

FUNCTION		OPERATION RANGE	NORMAL ACCURACY
Complex number calculation	$(x_1 + y_1 i) \begin{matrix} + \\ - \\ \times \\ \div \end{matrix} (x_2 + y_2 i)$		10 digits ± 1
	Addition Subtraction	$ x_1 + x_2 \leq 9.999999999 \times 10^{99}$ $ y_1 + y_2 \leq 9.999999999 \times 10^{99}$	
	Multiplication	$(x_1 x_2 - y_1 y_2) \leq 9.999999999 \times 10^{99}$ $(y_1 x_2 + x_1 y_2) \leq 9.999999999 \times 10^{99}$ $(x_1 x_2), (y_1 y_2), (y_1 x_2), (x_1 y_2) \leq 9.999999999 \times 10^{99}$	
	Division	$\frac{x_1 x_2 + y_1 y_2}{x_2^2 + y_2^2}, \frac{y_1 x_2 - x_1 y_2}{x_2^2 + y_2^2} \leq 9.999999999 \times 10^{99}$ $x_2^2 + y_2^2, x_2^2, y_2^2, x_1 x_2 + y_1 y_2, y_1 x_2 - x_1 y_2, x_1 x_2, y_1 y_2, y_1 x_2, x_1 y_2,$ $\leq 9.999999999 \times 10^{99}$	
→DEC		The following operation range after the conversion. $0 \leq X \leq 9999999999.$	—
→BIN		The following operation range after the conversion. $1000000000 \leq X \leq 1111111111$ $0 \leq X \leq 1111111111$	—
→OCT		The following operation range after the conversion. $4000000000 \leq X \leq 7777777777$ $0 \leq X \leq 3777777777$	—
→HEX		The following operation range after the conversion. $FDABF41C01 \leq X \leq FFFFFFFF$ $0 \leq X \leq 2540BE3FF$	—
AND NAND OR NOR XOR XNOR		BIN ; $1000000000 \leq X \leq 1111111111$ $0 \leq X \leq 1111111111$ OCT ; $4000000000 \leq X \leq 7777777777$ $0 \leq X \leq 3777777777$ HEX ; The following operation range after the operation. $FDABF41C01 \leq X \leq FFFFFFFF$ $0 \leq X \leq 2540BE3FF$	—
NOT		BIN ; SAME AS AND OCT ; SAME AS AND HEX ; $FDABF41C01 \leq X \leq FFFFFFFF$ $0 \leq X \leq 2540BE3FE$	—
NEG		BIN ; $1000000001 \leq X \leq 1111111111$ $0 \leq X \leq 1111111111$ OCT ; $4000000001 \leq X \leq 7777777777$ $0 \leq X \leq 3777777777$ HEX ; $FDABF41C01 \leq X \leq FFFFFFFF$ $0 \leq X \leq 2540BE3FF$	—

FUNCTION		OPERATION RANGE	NORMAL ACCURACY
NORMAL DISTRIBUTIONS-STATISTIC CALCULATION	DATA DEL	$ x \leq 9.999999999 \times 10^{49}$ $ \sum x \leq 9.999999999 \times 10^{99}$ $\sum x^2 \leq 9.999999999 \times 10^{99}$ $0 \leq n \leq 9999999999$. n = Integer	10 digits ± 1
	$\bar{x}$	$n \neq 0$	
	$\bar{y}$	$n \neq 0$	
	Sx	$n \neq 1, n \neq 0$ $0 \leq \frac{\sum X^2 - \{(\sum X)^2 / n\}}{n - 1} \leq 9.999999999 \times 10^{99}$	
	Sy	$n \neq 1, n \neq 0$ $0 \leq \frac{\sum Y^2 - \{(\sum Y)^2 / n\}}{n - 1} \leq 9.999999999 \times 10^{99}$	
	σx	$n \neq 0$ $0 \leq \frac{\sum X^2 - \{(\sum X)^2 / n\}}{n} \leq 9.999999999 \times 10^{99}$	
	σy	$n \neq 0$ $0 \leq \frac{\sum Y^2 - \{(\sum Y)^2 / n\}}{n} \leq 9.999999999 \times 10^{99}$	
	t	$n \neq 0, \sigma x \neq 0$ $0 \leq \left \frac{x - \bar{x}}{\sigma x} \right \leq 9.999999999 \times 10^{99}$	
	P (t)	$0 \leq X \leq 9.999999999 \times 10^{99}$	6 digits ± 1
	Q (t)	$0 \leq X \leq 9.999999999 \times 10^{99}$	
	R (t)	$0 \leq X \leq 9.999999999 \times 10^{99}$	

MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V_{SS}	+ 0.3 ~ - 3.5	V
Input Voltage	V_{IN}	+ 0.3 ~ V_{SS} - 0.3	V
Operating Temperature	T_{opr}	0 ~ 40	°C
Storage Temperature	T_{stg}	- 55 ~ 125	°C

ELECTRICAL CHARACTERISTICS ($V_{SS} = -3.0 \pm 0.2V$, $V_{DD} = 0V$, $T_a = 25 \pm 1.5^\circ C$)

PARAMETER	SYMBOL	TEST CIRCUIT	PIN NAME	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage	—	—	—	—	-2.5	-3.0	-3.4	V
Supply Current (I)	I_{DD} WAIT	—	—	$V_{SS} = -3.0V$, wait	—	-18	-32	μA
Supply Current (II)	I_{DD} OP	—	—	$V_{SS} = -3.0V$, operate	—	-135	-200	
Supply Current (III)	I_{DD} OFF	—	—	$V_{SS} = -3.0V$, OFF	—	—	-2	
Oscillating Frequency (I)	$F\phi$ WAIT	—	—	$V_{SS} = -3.0V$, WAIT	9	15	21	kHz
Oscillating Frequency (II)	$F\phi$ OP	—	—	$V_{SS} = -3.0V$, operate	114	190	266	
Fram Frequency	f_F	—	—	$V_{SS} = -3.0V$, WAIT	70	117	164	Hz
Timer	T timer	—	—	$V_{SS} = -3.0V$	430	603	1005	s
"1" Input Voltage	V_{IH}	—	$K_1 \sim K_8$	—	$\frac{3}{4} V_{SS}$	—	V_{SS}	V
"0" Input Voltage	V_{IL}	—	$K_1 \sim K_8$	—	V_{SS}	—	$\frac{1}{4} V_{SS}$	
"1" Output Resistance	R_{KEY}	—	SEG	$V_{OUT} = V_{SS} + 0.5V$: KEY STROBE	—	—	1	k Ω
"0" Output Resistance	$R_{SEG(L)}$	—	SEG	$V_{OUT} = V_{DD} - 0.5V$	—	—	90	
"1" Output Resistance	$R_{SEG(H)}$	—	SEG	$V_{OUT} = V_{SS} + 0.5V$: KEY STROBE	—	—	90	
"0" Output Resistance	$R_{COM(L)}$	—	COM	$V_{OUT} = V_{DD} - 0.5V$	—	—	25	
"1" Output Resistance	$R_{COM(H)}$	—	COM	$V_{OUT} = V_{SS} + 0.5V$	—	—	25	
KEY PULL UP Resistance	$R_{PULL UP}$	—	K_1	$V_{OUT} = 0V$ (Note 1)	28.8	48	67.2	
KEY PULL DOWN Resistance	$R_{PULL DOWN}$	—	$K_2 \sim K_8$	$V_{OUT} = V_{SS}$ (Note 1)	28.8	48	67.2	
"M" Output Resistance	R_{OM}	—	SEG	$V_{OUT} = \frac{2}{3} V_{SS} + 0.5V$	—	90	—	
"M" Output Resistance	R_{OM}	—	SEG	$V_{OUT} = \frac{2}{3} V_{SS} + 0.5V$	—	90	—	
"M" Output Resistance	R_{OM}	—	COM	$V_{OUT} = \frac{1}{3} V_{SS} - 0.5V$	—	90	—	
"M" Output Resistance	R_{OM}	—	COM	$V_{OUT} = \frac{2}{3} V_{SS} + 0.5V$	—	90	—	
"1" Output Voltage	V_{OH}	—	K_1	(Note 1)	$V_{SS} + 0.2$	V_{SS}	V_{SS}	

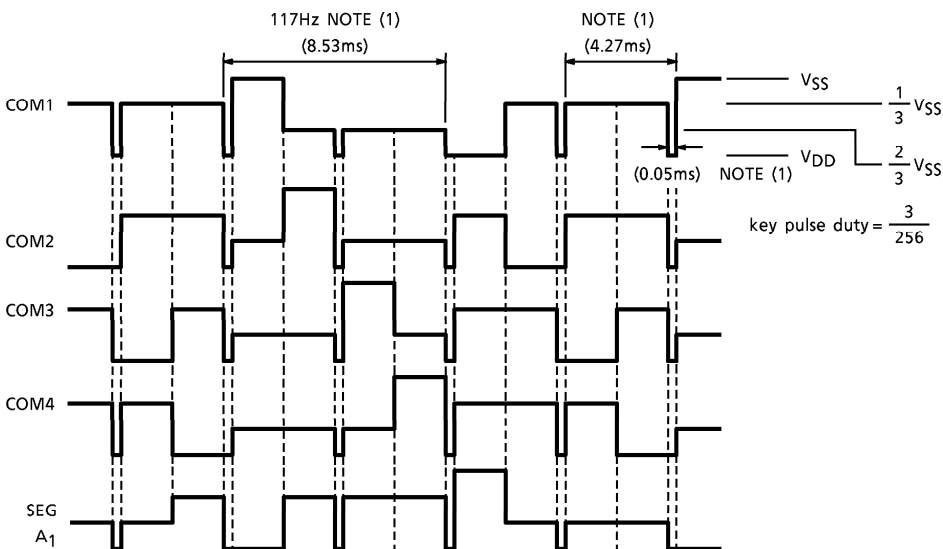
ELECTRICAL CHARACTERISTICS ($V_{DD} = -3.0 \pm 0.2V$, $V_{SS} = 0V$, $T_a = 25 \pm 1.5^\circ C$)

PARAMETER	SYMBOL	TEST CIR- CUIT	PIN NAME	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
"0" Output Voltage	V_{OL}	—	$K_2 \sim K_8$	(Note 1)	V_{DD}	V_{DD}	$V_{DD} - 0.2$	V
"1" Output Voltage	V_{OH}	—	SEG COM	—	$V_{SS} + 0.2$	V_{SS}	V_{SS}	
"M" Output Voltage	V_{OM}	—	SEG COM	—	$\frac{2}{3} V_{SS} + 0.2$	$\frac{2}{3} V_{SS}$	$\frac{2}{3} V_{SS} - 0.2$	
"M" Output Voltage	V_{OM}	—	SEG COM	—	$\frac{1}{3} V_{SS} + 0.2$	$\frac{1}{3} V_{SS}$	$\frac{1}{3} V_{SS} - 0.2$	
"0" Output Voltage	V_{OL}	—	SEG COM	—	V_{DD}	V_{DD}	$V_{DD} - 0.2$	

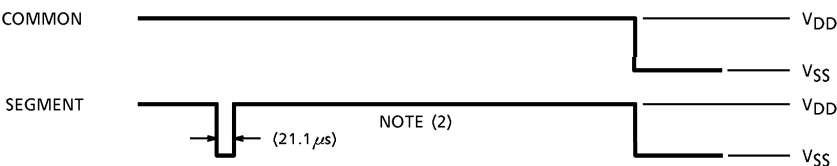
(Note 1) The key buffer is high impedance at keystrobe.

WAVEFORMS FOR DISPLAY

Display



Key pulse output



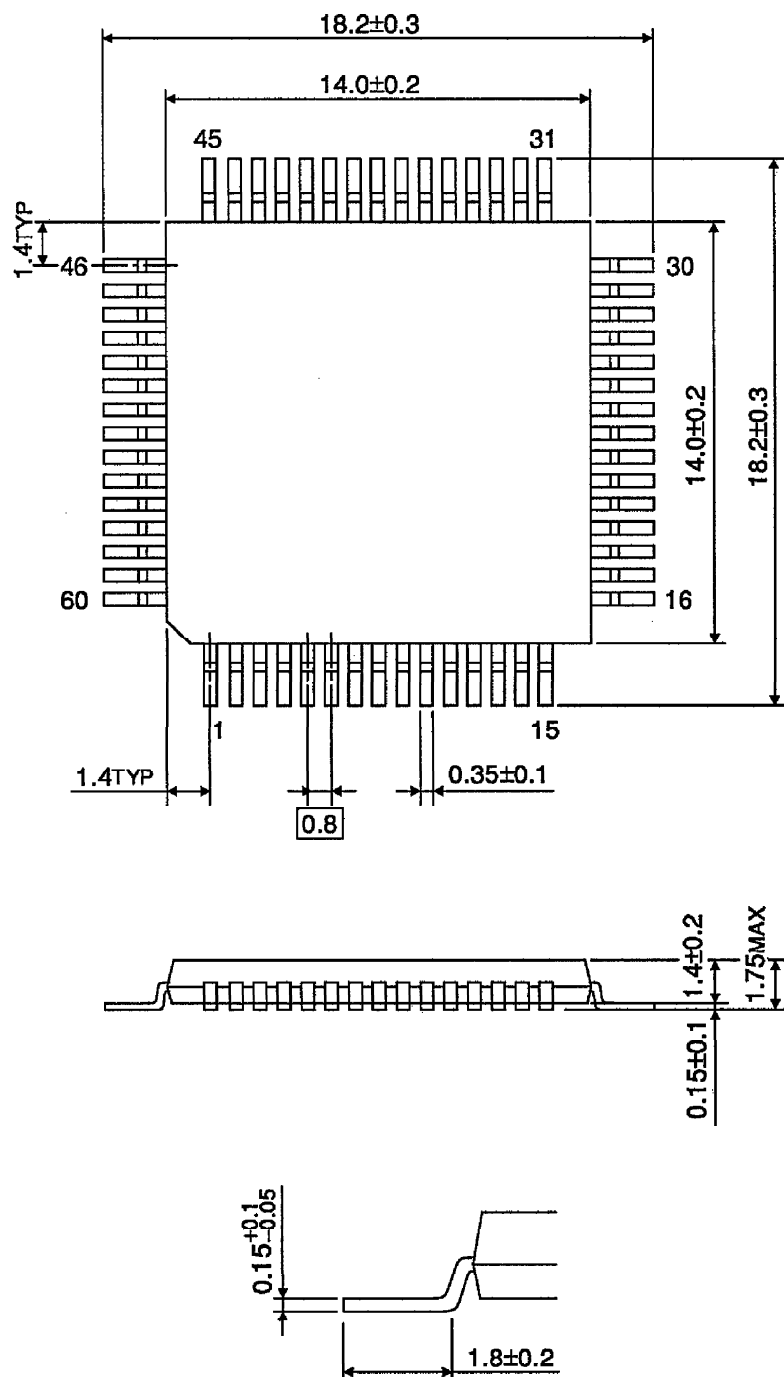
NOTE (1) $F_{\phi WAIT} = 15kHz$

NOTE (2) $F_{\phi OP} = 190kHz$

OUTLINE DRAWING

LQFP60-P-1414-0.80

Unit : mm



Weight : 0.66g (Typ.)