

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

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.

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.

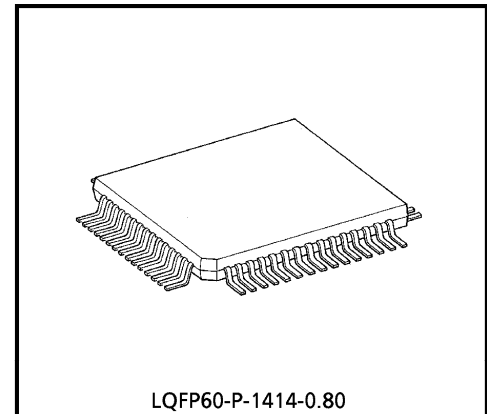
- Other than above

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.



Weight : 0.66g (Typ.)

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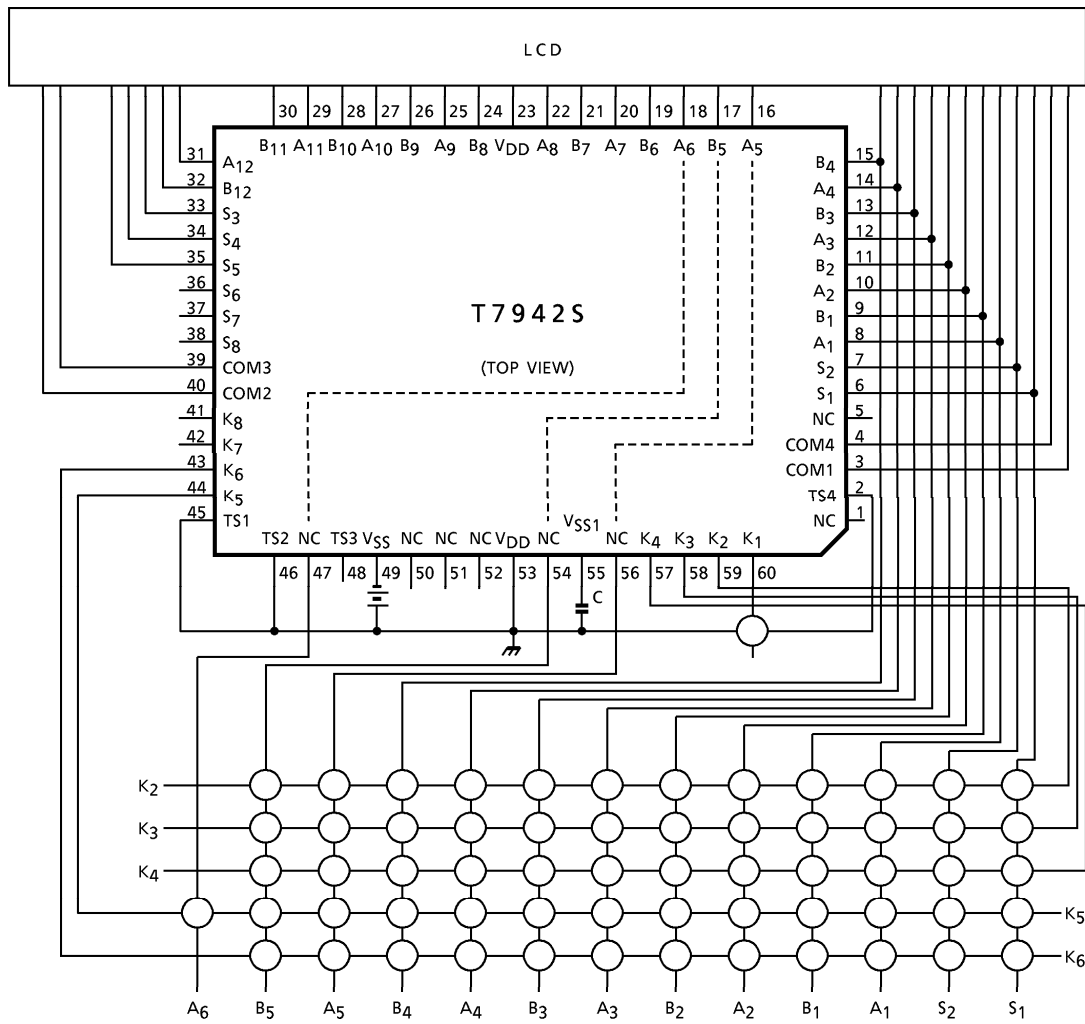
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- Mutual conversion between decimal, binary, octal and hexadecimal, and the 4 operations in arithmetic in binary, octal and hexadecimal are possible.
- Program function
4 formula (LRN1~LRN4) total 128 steps.
 $X > 0$, $X \leq M$ and GO TO judge function (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, °F \leftrightarrow °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. $V_{SS} = -3.0V$ single power supply.
- The 60 pin flat package is used.

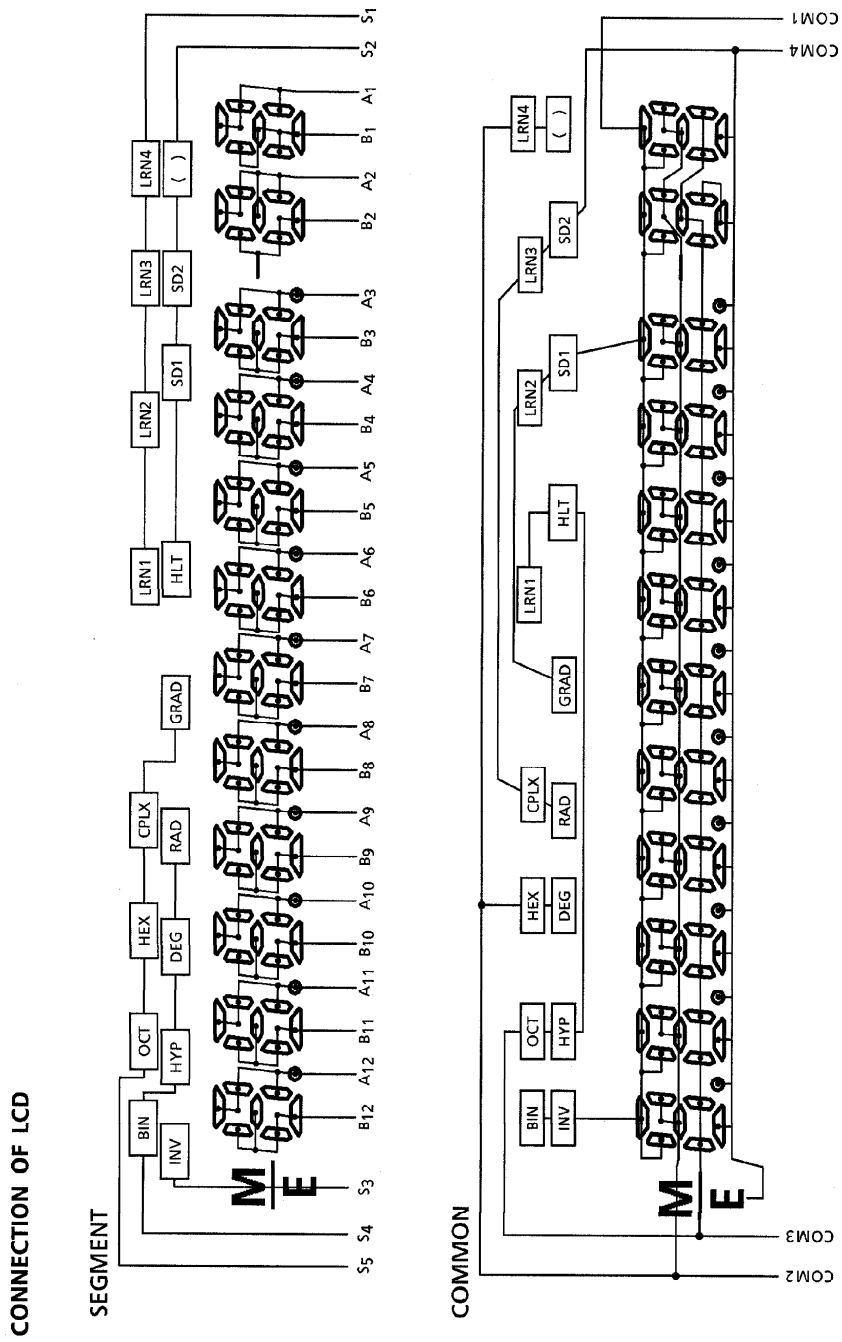
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SYSTEM BLOCK DIAGRAM



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)

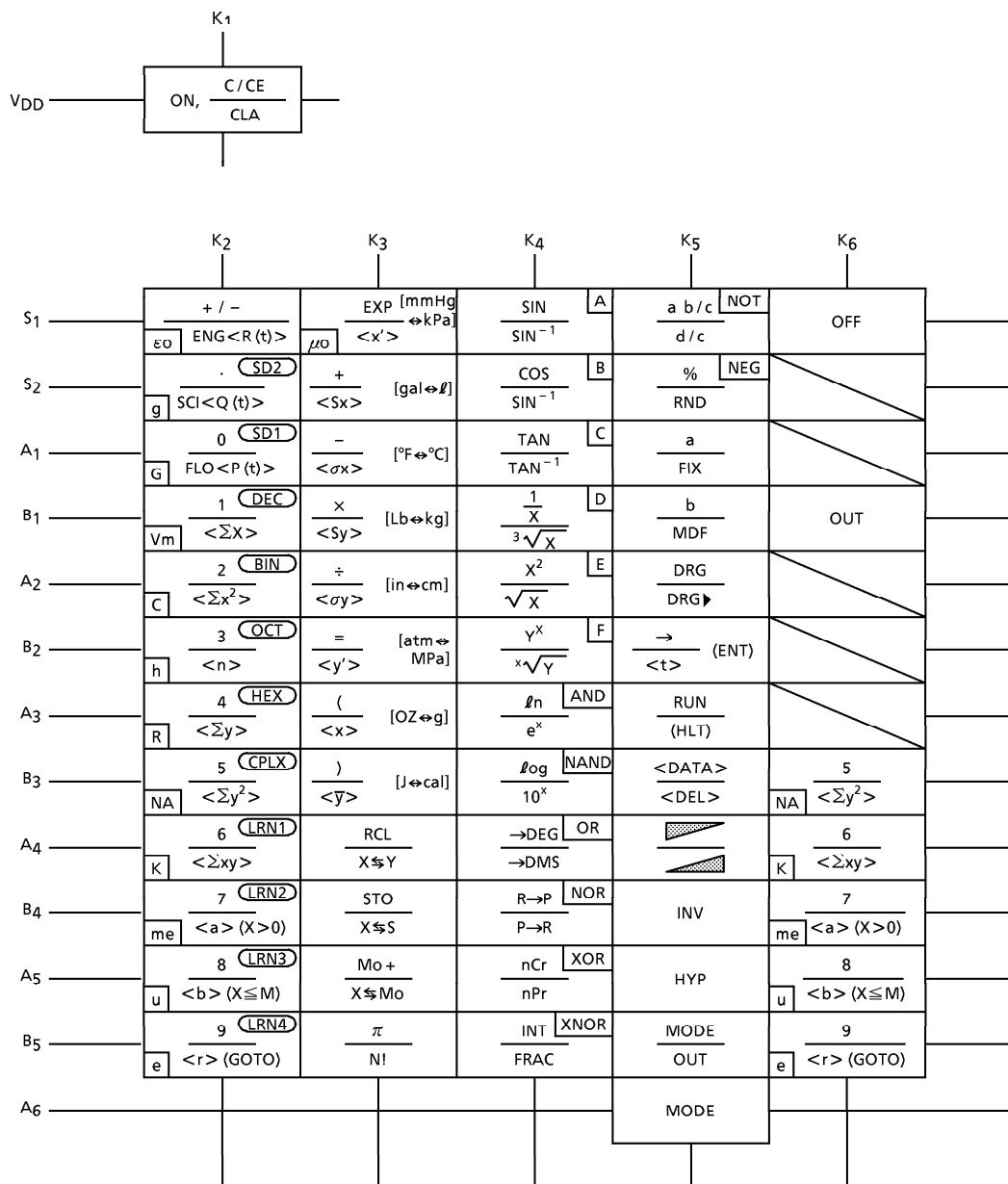
Used 50 touch Key with all function

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 \blacktriangleright
RCL	STO	Mo +	\rightarrow (ENT)	RUN (HLT)	<DATA>
$X \S Y$	$X \S S$	$X \S Mo$	<t>		
7 LRN2	8 LRN3	9 LRN4	(OZ \leftrightarrow g) J \leftrightarrow cal	
$\langle a \rangle (X > 0)$	$\langle b \rangle (X \leq M)$	$\langle r \rangle$ (GOTO)	$\langle \bar{x} \rangle$	$\langle \bar{y} \rangle$	
4 HEX	5 CPLX	6 LRN1	\times Lb \leftrightarrow kg	\div in \leftrightarrow cm	
$\langle \Sigma y \rangle$	$\langle \Sigma y^2 \rangle$	$\langle \Sigma xy \rangle$	$\langle S y \rangle$	$\langle \sigma y \rangle$	
1 DEC	2 BIN	3 OCT	+ gal \leftrightarrow l	- °F \leftrightarrow °C	
$\langle \Sigma X \rangle$	$\langle \Sigma x^2 \rangle$	$\langle n \rangle$	$\langle S x \rangle$	$\langle \sigma x \rangle$	
0 SD1	. SD2	+ / -	EXP mmHg \leftrightarrow kPa	= atm \leftrightarrow MPa	
FLO <P (t)>	SCI <Q (t)>	ENG <R (t)>	$\langle x' \rangle$	$\langle y' \rangle$	

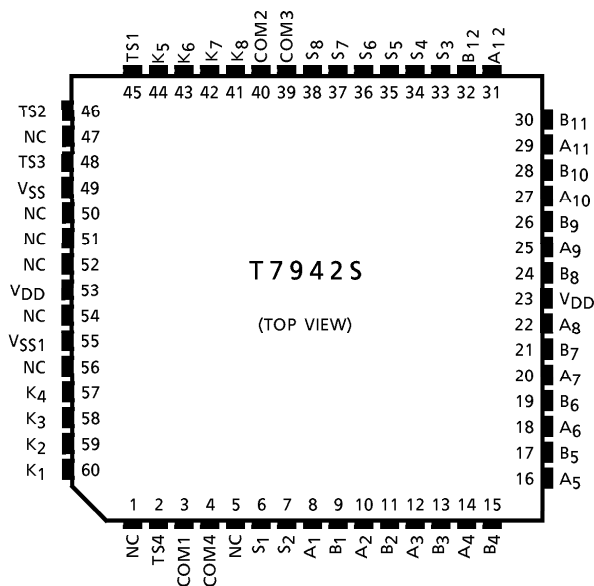
Used 48 touch key without CPLX mode, LRN 1~4 mode, conversion, and scientific constant

INV	HYP		OFF	MODE
SIN A	COS B	TAN C	$\frac{1}{X}$ D	X^2 E
SIN^{-1}	COS^{-1}	TAN^{-1}	$\sqrt[3]{X}$	\sqrt{X}
\ln AND	\log NAND	$\rightarrow DEG$ OR	$R \rightarrow P$ NOR	nCr XOR
e^x	10^x	$\rightarrow DMS$	$P \rightarrow R$	nPr
$a \ b / c$ NOT	$\%$ NEG	a	b	π
d / c	RND	FIX	MDF	N!
RCL	STO	Mo +	\rightarrow	<DATA>
$X \leftrightarrow Y$	$X \leftrightarrow S$	$X \leftrightarrow Mo$	<t>	
7	8	9	()
<a>		<r>	< \bar{x} >	< \bar{y} >
4 HEX	5	6	x	\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'>

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	8.
	HEX		A	5.
			A	5.
Function	DEC		5 +	10.
			5 ×	11.
	HEX		A -	31.
			A ÷	32.
4 operation	DEC		1 + 2	14.
			1 0 0 0 0 0 0 0 0 - 1	15.
			5 × 9	15.
			5 5 5 5 5 × 9 9 9 9 9	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 × D E F	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 × $\pi =$	DRG▶	14.
→DEG	GRAD		4 0 0	DRG▶	11.
Random number			C / C E	RND	164.
INT			1.2 3	INT	13.
FRAC			1.2 3	FRAC	14.

ITEM	OPERATION			CALCULATION SPEED (ms)
MDF	FIX2		1 ÷ 3 =	MDF 15.
Exchange			1 2 3 + 4 5 6	X↔Y 11.
Shift			1 2 3	→ 7.
Fractions	Function		2 ab/c 3 6 ab/c 2 3 4	- 33.
			2 ab/c 3 6 ab/c 2 3 4	÷ 33.
	4-operation		2 _ 36J 234 + 3 _ 45 J 345	= 68.
			2 _ 36J 234 - 3 _ 45 J 345	= 65.
			2 _ 36J 234 × 3 _ 45 J 345	= 65.
		2 _ 36J 234 ÷ 3 _ 45 J 345	= 73.	
%			1 2 3 + 4 5 6	% 11.
			1 2 3 - 4 5 6	% 11.
			1 2 3 × 4 5 6	% 9.
			1 2 3 ÷ 4 5 6	% 8.
R→P	DEG		$\sqrt[3]{a}$ 1 b	R→P 117.
	RAD		$\sqrt[3]{a}$ 1 b	R→P 92.
	GRAD		$\sqrt[3]{a}$ 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 ↔ 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 ×	0 39.
	1 2 3 S T 0 0	4 5 6 S T 0 ÷	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	$(12 + 34 i) \times (56 + 78 i)$		= 23.	
	DIV	$(12 + 34 i) \div (56 + 78 i)$		= 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.
				ΣX^2	9.
				ΣY^2	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		NORMAL ACCURACY
		UNDER FLOW AREA	
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	$-9.999999999 \times 10^{99}$ $\leq X \cdot \text{LN } Y \leq 230.2585092$	$-9.999999999 \times 10^{99}$ $\leq X \cdot \text{LN } Y \leq -227.9559243$	
	$Y > 0 \cdots$ The above-mentioned operation range. $Y < 0 \cdots X$ (Integer) or, $1/X$ (Odd, $X \neq 0$) \cdots The above-mentioned operation range. $Y = 0 \cdots 0 < X$		
$x\sqrt{Y}$	$-9.999999999 \times 10^{99}$ $\leq \frac{1}{X} \cdot \text{LN } Y \leq 230.2585092$	$-9.999999999 \times 10^{99}$ $\leq \frac{1}{X} \cdot \text{LN } Y \leq -227.9559243$	
	$Y > 0 \cdots$ The above-mentioned operation range. $Y < 0 \cdots X$ (Odd) or, $1/X$ (Integer, $X \neq 0$) \cdots The above-mentioned operation range. $Y = 0 \cdots 0 < X$		
R→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→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	$0 \leq n \leq 99, r \leq n, r = \text{Integer}$ $1 \leq (n! / (n - r)!) \leq 9.999999999 \times 10^{99}$		
nCr	$0 \leq n \leq 99, r \leq n, r = \text{Integer}$		

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	$(x_1 \times_2 - y_1 \times_2) \leq 9.999999999 \times 10^{99}$ $(y_1 \times_2 + x_1 \times_2) \leq 9.999999999 \times 10^{99}$ $(x_1 \times_2), (y_1 \times_2), (y_1 \times_2), (x_1 \times_2) \leq 9.999999999 \times 10^{99}$	
	Division	$\frac{x_1 \times_2 + y_1 \times_2}{x_2^2 + y_2^2}, \frac{y_1 \times_2 - x_1 \times_2}{x_2^2 + y_2^2} \leq 9.999999999 \times 10^{99}$ $x_2^2 + y_2^2, x_2^2, y_2^2, x_1 \times_2 + y_1 \times_2, y_1 \times_2 - x_1 \times_2, x_1 \times_2, y_1 \times_2, y_1 \times_2, x_1 \times_2,$ $\leq 9.999999999 \times 10^{99}$	
→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 ≠ 0	
	\bar{y}	n ≠ 0	
	Sx	n ≠ 1, n ≠ 0 $0 \leq \frac{\sum X^2 - \{(\sum X)^2 / n\}}{n - 1} \leq 9.999999999 \times 10^{99}$	
	Sy	n ≠ 1, n ≠ 0 $0 \leq \frac{\sum Y^2 - \{(\sum Y)^2 / n\}}{n - 1} \leq 9.999999999 \times 10^{99}$	
	σ_x	n ≠ 0 $0 \leq \frac{\sum X^2 - \{(\sum X)^2 / n\}}{n} \leq 9.999999999 \times 10^{99}$	
	σ_y	n ≠ 0 $0 \leq \frac{\sum Y^2 - \{(\sum Y)^2 / n\}}{n} \leq 9.999999999 \times 10^{99}$	
	t	n ≠ 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}	

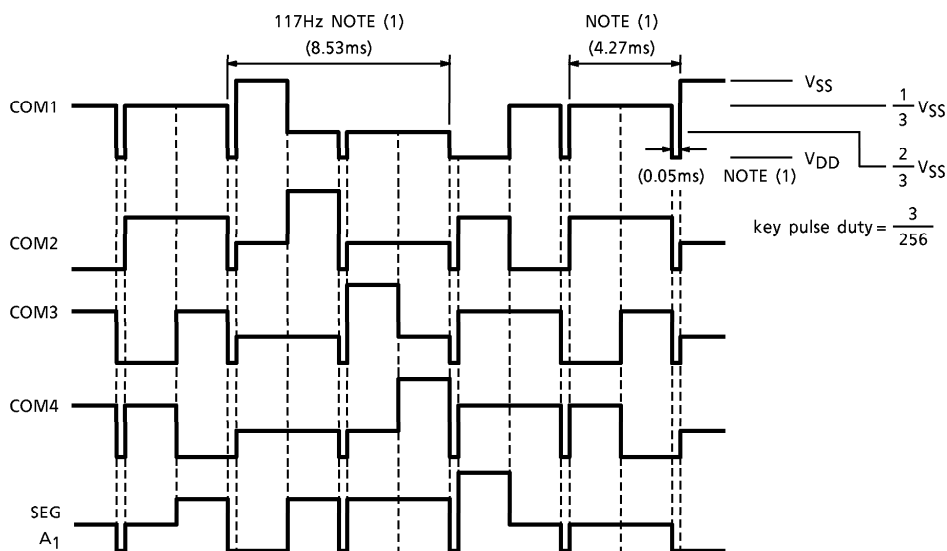
ELECTRICAL CHARACTERISTICS ($V_{DD} = -3.0 \pm 0.2V$, $V_{SS} = 0V$, $T_a = 25 \pm 1.5^\circ C$)

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}	$V_{DD} - 0.2$	

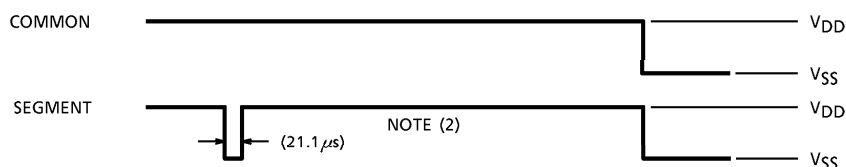
(Note 1) The key buffer is high impedance at keystrobe.

WAVEFORMS FOR DISPLAY

Display



Key pulse output

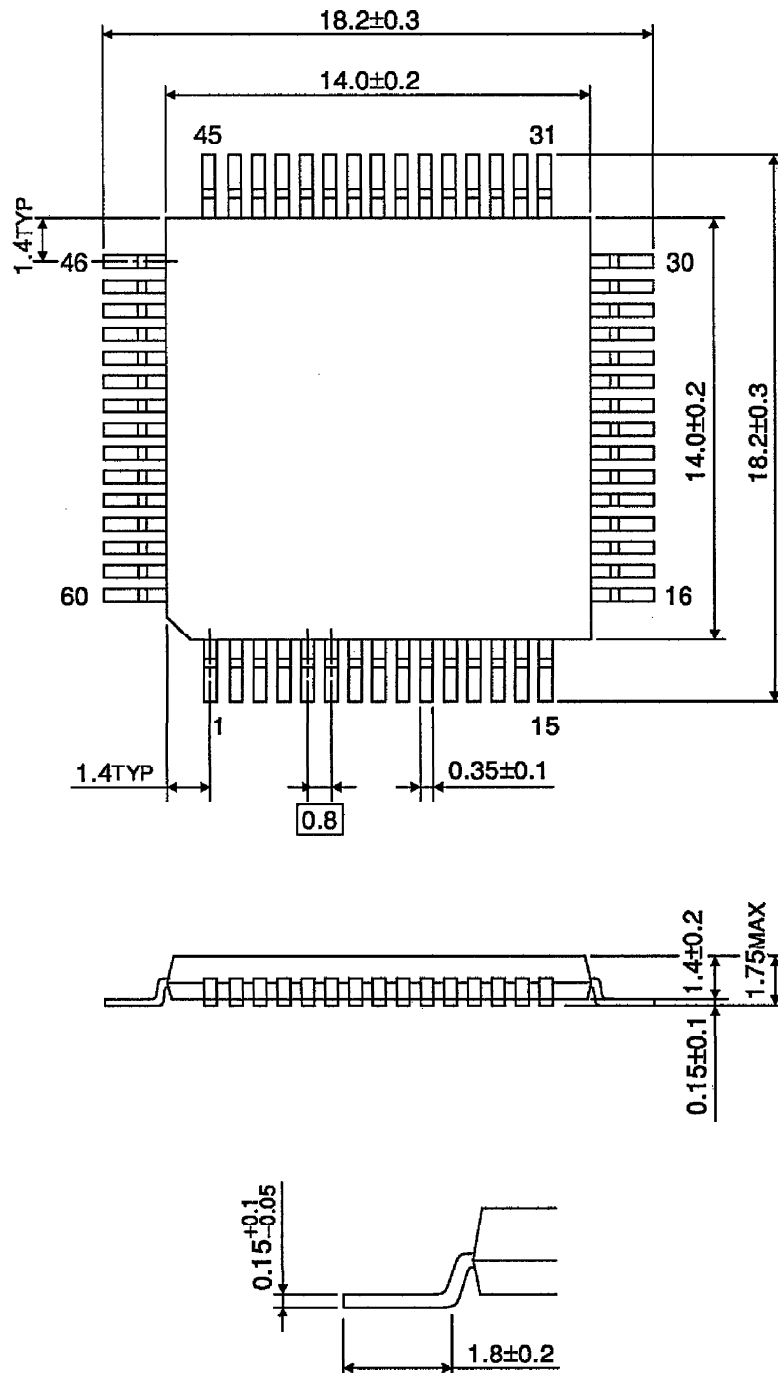


NOTE (1) $F_{\phi} \text{ WAIT} = 15\text{kHz}$

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

OUTLINE DRAWING
LQFP60-P-1414-0.80

Unit : mm



Weight : 0.66g (Typ.)