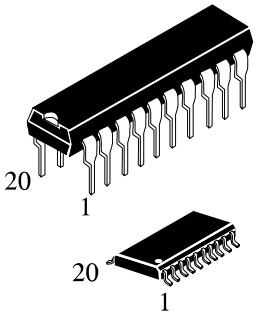
Liquid Crystal Display Controller

KK472

The KK472 Liquid Crystal Display (LDC) Controller is a perpheral member of the COPS™ family, fabricated using CMOS technology. The KK472 drives a multiplexed liquid crystal directly. Data is loaded serially and is held in internal latches. The KK472 contains an on-chip oscillator and generates all the multi-level waveforms for back-planes and segment outputs on a triplex display. One KK472 can drive 36 segments multiplexed as 3 x 12 ($4^1/_2$ digit display). Two KK472 devices can be used together to drive 72 segments (3 x 24) which could be an $8^1/_2$ digit display.

- Direct interface to TRIPLEX LCD
- Low power dissipation (100 μW typ.)
- Low cost
- Compatible with all COP400 processors
- Needs no refresh from processor
- On-chip oscillator and latches
- Expandable to longer displays
- Software compatible with COP470 V.F.Display Driver Chip
- Operates from display voltage
- MICROWIRE™ compatible serial I/O
- 20-pin Dual-In-Line package



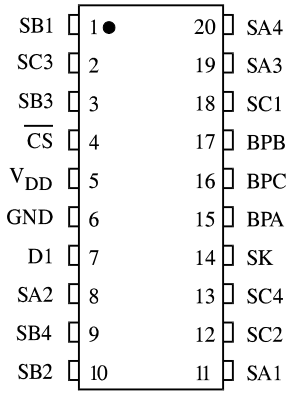
N SUFFIX
PLASTIC

DW SUFFIX
SOIC

ORDERING INFORMATION

KK472N Plastic
KK472DW SOIC
T_A = 0° to 70° C for all packages

PIN ASSIGNMENT



Pin Description

Pin	Description
CS	Chip select
V_{DD}	Power supply (display voltage)
GND	Ground
DI	Serial data input
SK	Serial clock input
BP_A	Display backplane A (or oscillator in)
BP_B	Display backplane B
BP_C	Display backplane C (or oscillator out)
SA1~SA4	12 multiplexed outputs

DC ELECTRICAL CHARACTERISTICS (GND=0 V, V_{DD}=3.0 V to 5.5 V, T_A= 0°C to 70°C (depends on display characteristics)

Symbol	Parameter	Test Conditions	Guaranteed Limit		Unit
			Min	Max	
V_{DD}	Power Supply Voltage		3.0	5.5	V
I_{DD}	Power Supply Current (Note 1)	V_{DD} =5.5 V		250	µA
V_{IL}	Input Levels DI, SK, CS			0.8	V
V_{IH}			0.7 V_{DD}	V_{DD}	
V_{IL}	BPA (as Osc. in)			0.6	V
V_{IH}			V_{DD}-0.6	V_{DD}	
V_{OL}	Output Levels, BPC (as Osc. Out)			0.4	V
V_{OH}			V_{DD}-0.4	V_{DD}	
$V_{BPA,BPB,BPC}$ ON	Backplane Outputs (BPA,BPB,BPC)	During	V_{DD} -ΔV	V_{DD}	V
$V_{BPA,BPB,BPC}$ OFF		BP + Time	1/3V_{DD} -ΔV	1/3V_{DD} +ΔV	
$V_{BPA,BPB,BPC}$ ON	Backplane Outputs (BPA,BPB,BPC)	During	0	ΔV	V
$V_{BPA,BPB,BPC}$ OFF		BP - Time	2/3V_{DD} -ΔV	2/3V_{DD} +ΔV	
V_{SEG} ON	Segment Outputs (SA_1 ~ SA_4)	During	0	ΔV	V
V_{SEG} OFF		BP + Time	2/3V_{DD} -ΔV	2/3V_{DD} +ΔV	
V_{SEG} ON	Segment Outputs (SA_1 ~ SA_4)	During	V_{DD} -ΔV	V_{DD}	V
V_{SEG} OFF		BP - Time	1/3V_{DD} -ΔV	1/3V_{DD} +ΔV	
	Internal Oscillator Frequency		15	80	kHz
	Frame Time (Int. Osc. ÷ 192)		2.4	12.8	ms
1/T_{SCAN}	Scan Frequency		39	208	Hz
	SK Clock Frequency		4	250	kHz
	SK Width		1.7		µs
t_{SETUP}	DI Data Stup		1.0		µs
t_{HOLD}	DI Data Hold		100		ns
t_{SETUP}	CS		1.0		µs
t_{HOLD}			1.0		
	Output Loading Capacitance			100	pF

Note 1: Power supply current as measured in stand-alone mode with all outputs open and all inputs at V_{DD}.

Note 2: ΔV - 0.05V_{DD}.

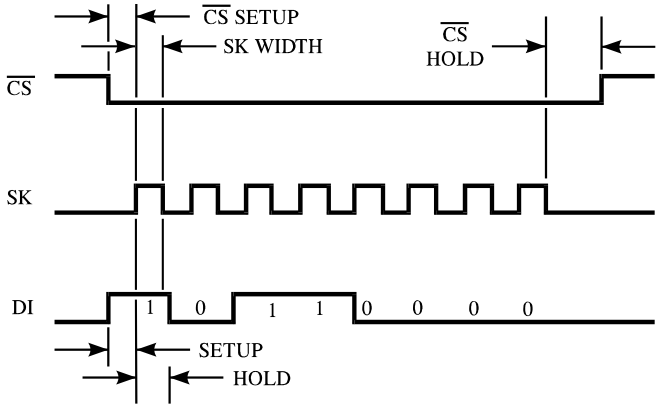


Figure 1. Serial Load Timing Diagram

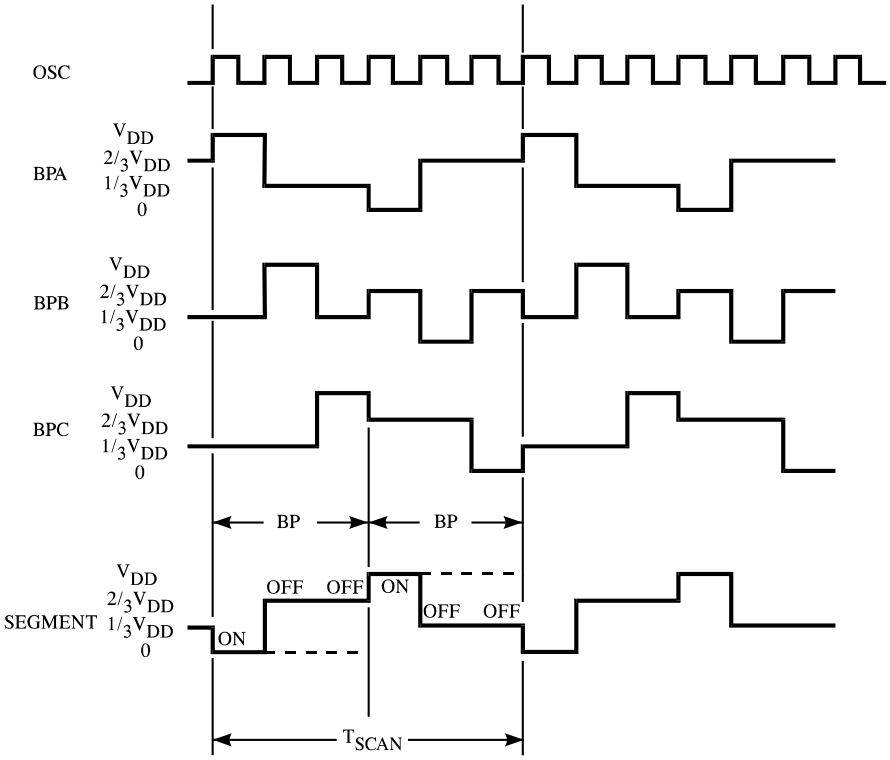
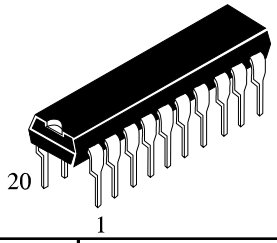
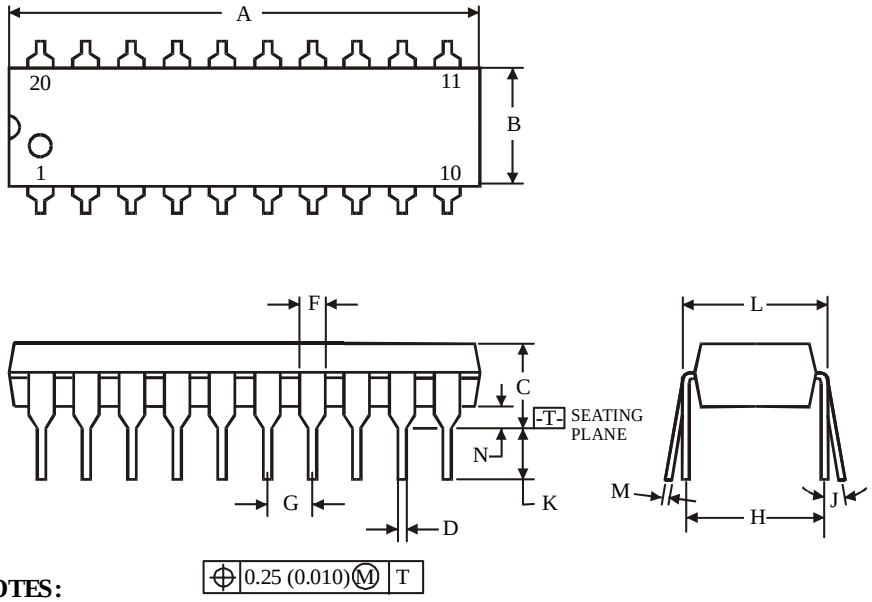


Figure 2. Backplane and Segment Waveforms

N SUFFIX PLASTIC DIP
(MS - 001AD)





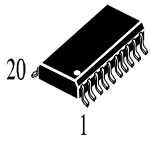
	Dimension, mm	
Symbol	MIN	MAX
A	24.89	26.92
B	6.1	7.11
C		5.33
D	0.36	0.56
F	1.14	1.78
G	2.54	
H	7.62	
J	0°	10°
K	2.92	3.81
L	7.62	8.26
M	0.2	0.36
N	0.38	

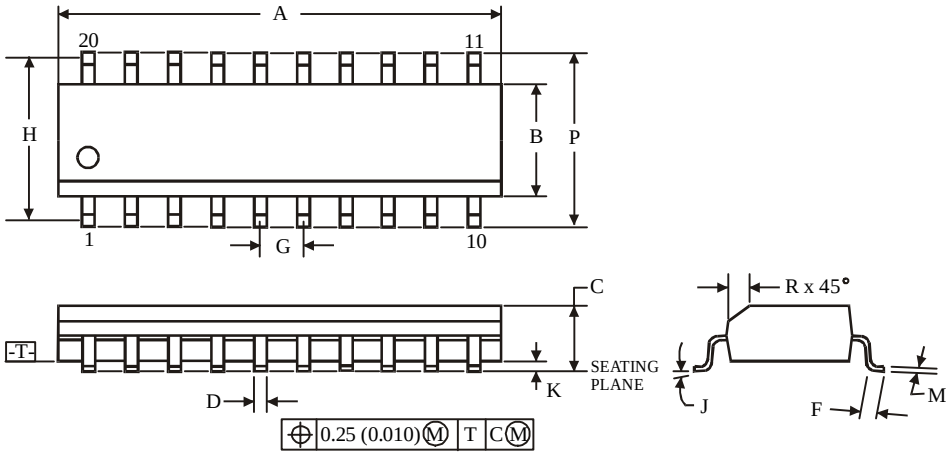
NOTES:

1. Dimensions “A”, “B” do not include mold flash or protrusions.

   Maximum mold flash or protrusions 0.25 mm (0.010) per side.

D SUFFIX SOIC
(MS - 013AC)





	Dimension, mm	
Symbol	MIN	MAX
A	12.6	13
B	7.4	7.6
C	2.35	2.65
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	9.53	
J	0°	8°
K	0.1	0.3
M	0.23	0.32
P	10	10.65
R	0.25	0.75

NOTES:

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B – 0.25 mm (0.010) per side.