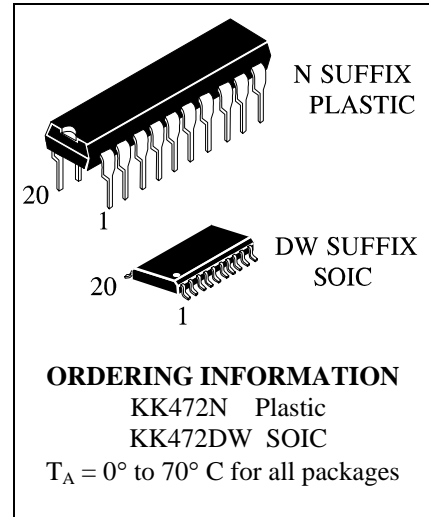


# Liquid Crystal Display Controller

## KK472

The KK472 Liquid Crystal Display (LDC) Controller is a peripheral 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 (4½ digit display). Two KK472 devices can be used together to drive 72 segments (3 x 24) which could be an 8½ digit display.

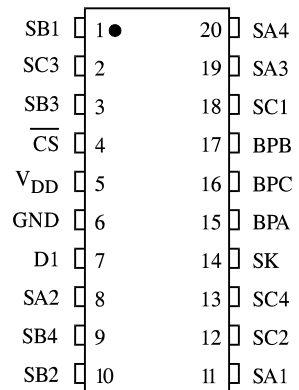
- Direct interface to TRIPLEX LCD
- Low power dissipation (100 µW typ.)
- Low cost
- Compatible with all COP400 processors
- Needs no refresh from processor
- On-chip oscillator and latches
- Expandable to longer displays
- Software compatible with COP470 V.F.Display Driver Chip
- Operates from display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



### Pin Description

Pin	Description
CS	Chip select
V <sub>DD</sub>	Power supply (display voltage)
GND	Ground
DI	Serial data input
SK	Serial clock input
BP <sub>A</sub>	Display backplane A (or oscillator in)
BP <sub>B</sub>	Display backplane B
BP <sub>C</sub>	Display backplane C (or oscillator out)
SA1~SA4	12 multiplexed outputs

### PIN ASSIGNMENT

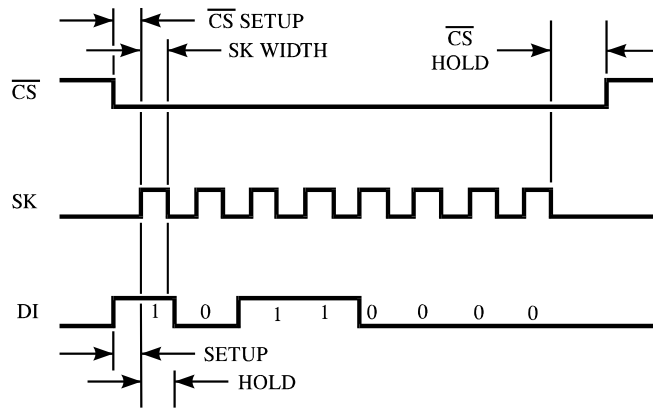


**DC ELECTRICAL CHARACTERISTICS** (GND=0 V,  $V_{DD}$ =3.0 V to 5.5 V,  $T_A$ = 0°C to 70°C (depends on display characteristics))

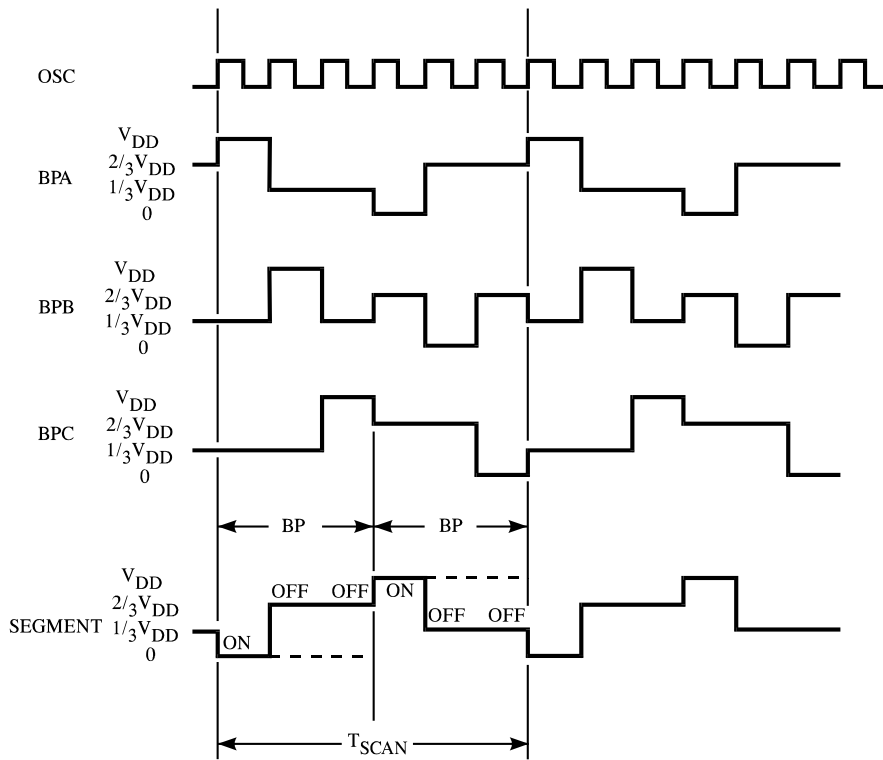
Symbol	Parameter	Test Conditions	Guaranteed Limit		Unit
			Min	Max	
$V_{DD}$	Power Supply Voltage		3.0	5.5	V
$I_{DD}$	Power Supply Current (Note 1)	$V_{DD} = 5.5$ V		250	$\mu$ A
$V_{IL}$	Input Levels DI, SK, CS			0.8	V
$V_{IH}$			$0.7 V_{DD}$	$V_{DD}$	
$V_{IL}$	BPA (as Osc. in)			0.6	V
$V_{IH}$			$V_{DD}-0.6$	$V_{DD}$	
$V_{OL}$	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 BP + Time	$V_{DD} - \Delta V$	$V_{DD}$	V
$V_{BPA,BPB,BPC}$ OFF			$1/3V_{DD} - \Delta V$	$1/3V_{DD} + \Delta V$	
$V_{BPA,BPB,BPC}$ ON	Backplane Outputs (BPA,BPB,BPC)	During BP - Time	0	$\Delta V$	V
$V_{BPA,BPB,BPC}$ OFF			$2/3V_{DD} - \Delta V$	$2/3V_{DD} + \Delta V$	
$V_{SEG}$ ON	Segment Outputs ( $SA_1 \sim SA_4$ )	During BP + Time	0	$\Delta V$	V
$V_{SEG}$ OFF			$2/3V_{DD} - \Delta V$	$2/3V_{DD} + \Delta V$	
$V_{SEG}$ ON	Segment Outputs ( $SA_1 \sim SA_4$ )	During BP - Time	$V_{DD} - \Delta V$	$V_{DD}$	V
$V_{SEG}$ OFF			$1/3V_{DD} - \Delta V$	$1/3V_{DD} + \Delta V$	
	Internal Oscillator Frequency		15	80	kHz
	Frame Time (Int. Osc. $\div$ 192)		2.4	12.8	ms
$1/T_{SCAN}$	Scan Frequency		39	208	Hz
	SK Clock Frequency		4	250	kHz
	SK Width		1.7		$\mu$ s
$t_{SETUP}$	DI Data Stup		1.0		$\mu$ s
$t_{HOLD}$	DI Data Hold		100		ns
$t_{SETUP}$	CS		1.0		$\mu$ s
$t_{HOLD}$			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:  $\Delta V = 0.05V_{DD}$ .

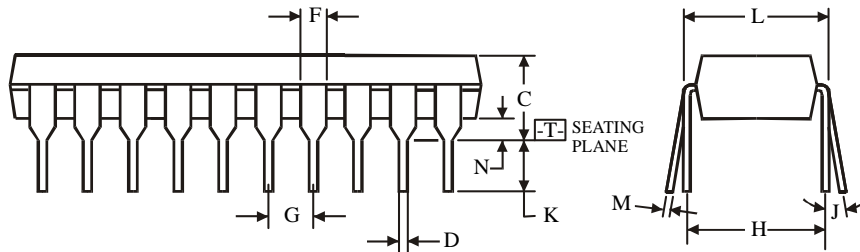
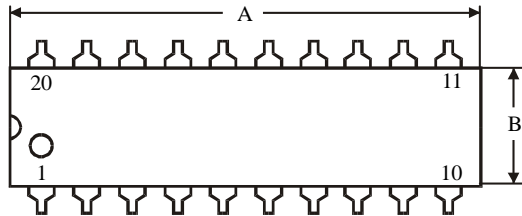
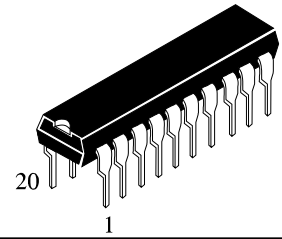


**Figure 1. Serial Load Timing Diagram**



**Figure 2. Backplane and Segment Waveforms**

**N SUFFIX PLASTIC DIP  
(MS - 001AD)**



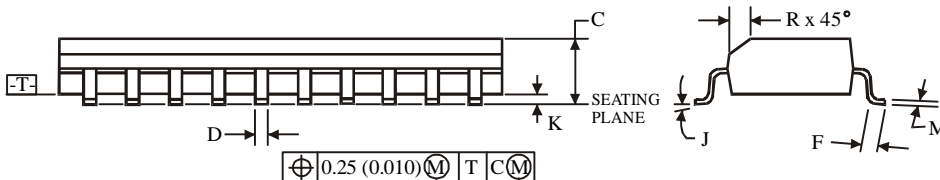
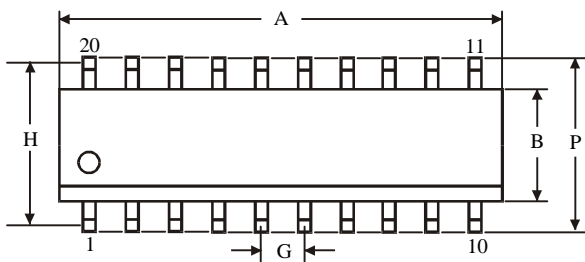
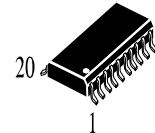
$\oplus 0.25 (0.010) \text{ (M) T}$

**NOTES:**

- Dimensions "A", "B" do not include mold flash or protrusions.  
Maximum mold flash or protrusions 0.25 mm (0.010) per side.

Symbol	Dimension, mm	
	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	

**D SUFFIX SOIC  
(MS - 013AC)**



$\oplus 0.25 (0.010) \text{ (M) T CM}$

**NOTES:**

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

Symbol	Dimension, mm	
	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