TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

T6C72A

ROW DRIVER FOR A DOT MATRIX LCD

The T6C72A is a 120-channel-output row driver for an STN dot matrix LCD. The T6C72A features an 80-V LCD drive voltage. The T6C72A is able to drive LCD panels with a duty ratio of up to 1/480. It is recommended for use with the T6C71.

Unit: mm

T6C72A	LEAD PITCH	
	IN	OUT
(UAN, 3NS)	0.8	0.19
(UDM, 4NS)	0.8	0.26

Please contact Toshiba or an authorized Toshiba dealer for information on package dimensions.

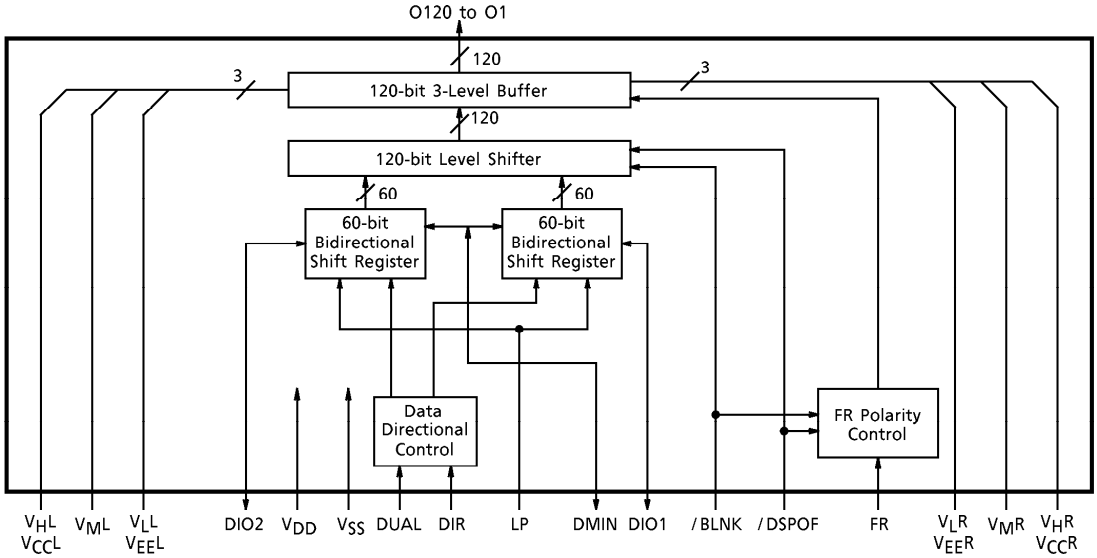
TCP (Tape Carrier Package)

FEATURES

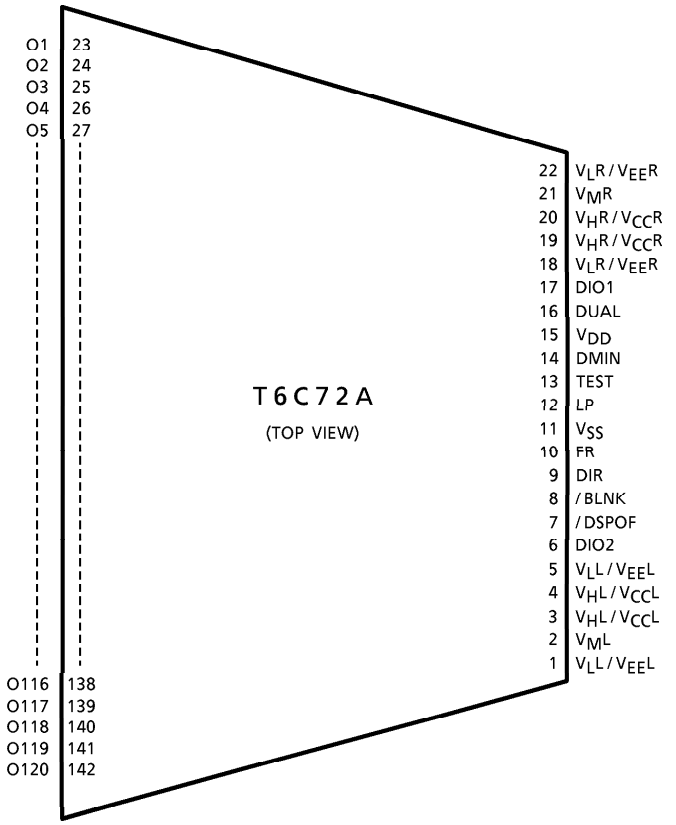
- Display duty application : to 1/480
- LCD drive signal : 120
- Data transfer : 120 bit bidirectional and 60 bit 2 division bidirectional
  ① O1→O120
  ② O1←O120
  ③ O1→O60, O61→O120
  ④ O1←O60, O61←O120
- LCD drive voltage : V_{CC} = 18.5 to 42.5V, V_M = 2.5V, V_{EE} = −13.5 to −37.5V
- Power supply voltage : 2.7 to 5.5V
- Operating temperature : −20 to 75°C
- LCD drive output resistance : 0.4kΩ (typ.) ($V_{CC} = V_H$ = 32.5V, $V_{EE} = V_L$ = −27.5V)
- Display-off function : When /DSPOF is L, all LCD drive outputs (O1 to O120) remain at the V_M level.
- LCD drive output timing : Change on falling edge of LP
- Blanking function : Provision of a blanking interval prevents excessively high voltages being applied to the electrodes of the liquid crystal panel.
  /BLNK = L : Blanking. All LCD drive outputs (O1 to O120) are set to the V_M level.
  /BLNK = H : (O1 to O120) are operational.

970917EBE2

BLOCK DIAGRAM



PIN ASSIGNMENT



* The above diagram shows the pin configuration of the LSI chip, not that of the tape carrier package.

PIN FUNCTIONS

PIN NAME	I/O	FUNCTIONS	LEVEL
O1 to O120	Output	Output for LCD drive signal	V_H / V_M / V_L
DIO1, DIO2	I/O	Input / output for shift data DIR = L : DIO1 is input, DIO2 is output DIR = H : DIO1 is output, DIO2 is input	V_{DD} to V_{SS}
DMIN	Input	Dual Mode (DUAL = H) : data input Single Mode (DUAL = L) : open	
LP	Input	(Shift Clock Pulse) Input for shift clock pulse	
FR	Input	(Frame) Input for frame signal	
DUAL	Input	(Dual Mode) Terminal for dual input mode (H) or single input mode (L) select	
DIR	Input	(Direction) Input for data flow direction select	
/ DSPOF	Input	(Display Off) / DSPOF = L : Display-off mode, (O1 to O120) remain at the V_M level. Latch outputs cleared after release / DSPOF = H : Display-on mode, (O1 to O120) are operational	
/ BLNK	Input	(Blanking Function) Blanking-off mode. (O1 to O120) remain at V_M level. Latch outputs not cleared Blanking-on mode. (O1 to O120) are operational	
TEST	Input	(Test) Test : L or open	
V_{DD}	—	Power supply for internal logic (5V)	—
V_{SS}	—	Power supply for internal logic (0V)	
V_HL/R $V_{CC}L/R$	—	Power supply for LCD drive circuit	
V_ML/R	—	Power supply for LCD drive circuit	
V_LL/R $V_{EE}L/R$	—	Power supply for LCD drive circuit	

RELATION BETWEEN FR, DATA INPUT AND OUTPUT LEVEL FORMAT

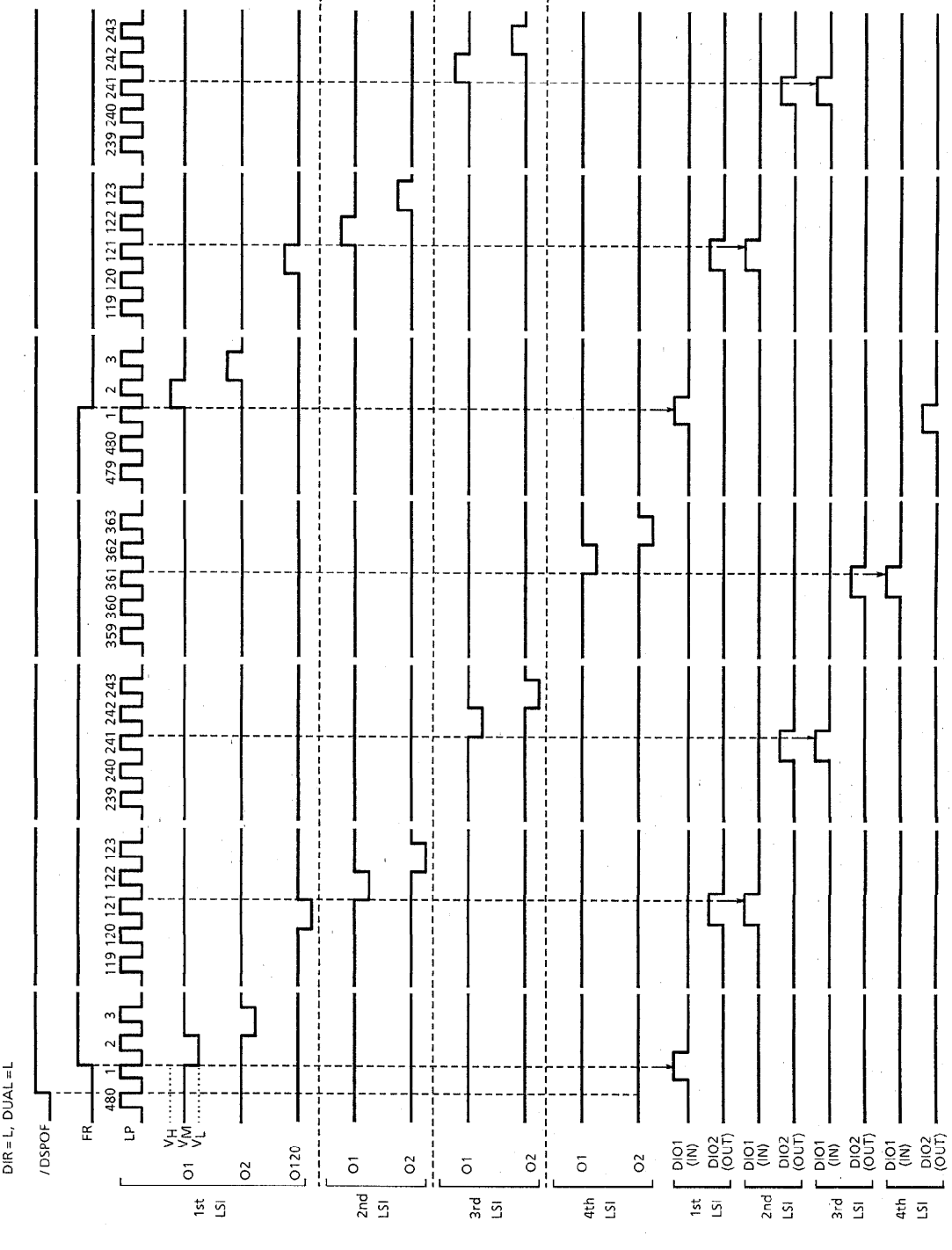
FR	DATA INPUT	/DSPOF OR /BLNK	OUTPUT LEVEL
L	L	H	V_M
L	H	H	V_H
H	L	H	V_M
H	H	H	V_L
*	*	L	V_M

* Don't Care

DATA INPUT FORMAT

DUAL	DIR	DATA FLOW	DATA INPUT TERMINALS		
			DIO1	DIO2	DMIN
L	L	O1→O120	IN	OUT	OPEN
L	H	O120→O1	OUT	IN	OPEN
H	L	O1→O60	IN	—	—
		O61→O120	—	OUT	IN
H	H	O60→O1	OUT	—	IN
		O120→O61	—	IN	—

TIMING DIAGRAM 1



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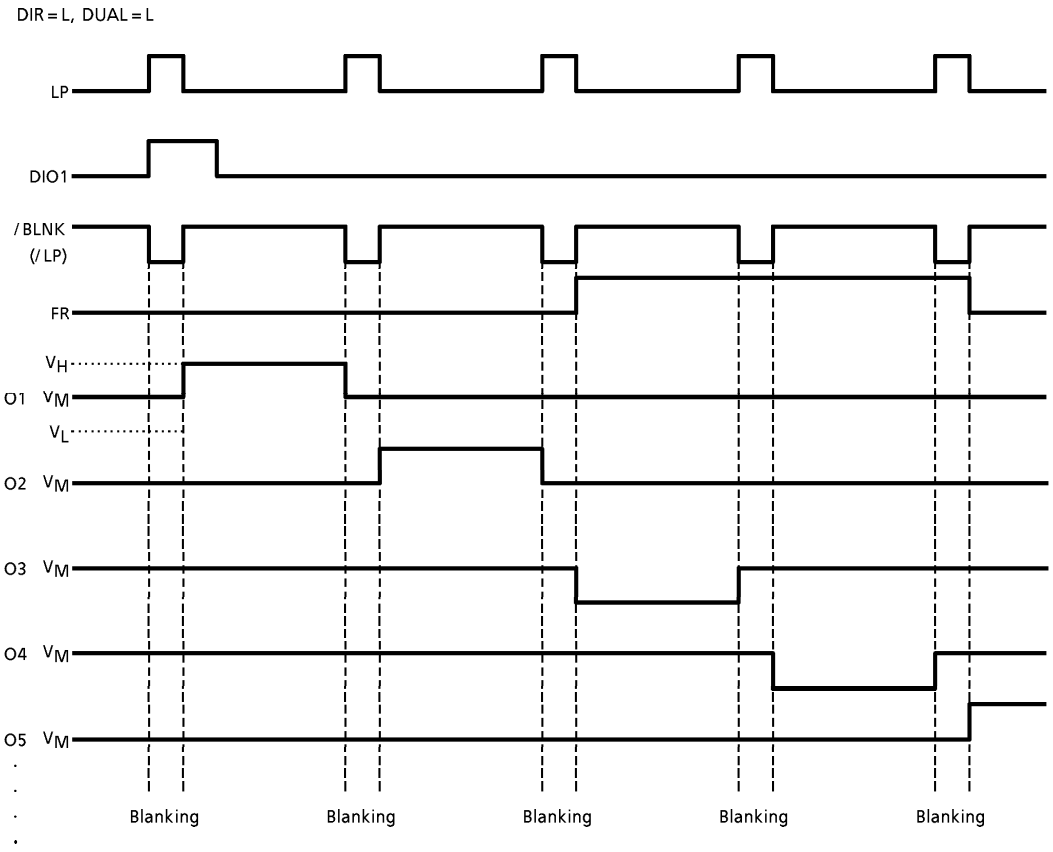
TIMING DIAGRAM 2 (Blanking function)



ABSOLUTE MAXIMUM RATINGS

(Ensure that the following conditions are maintained, $V_{CC} \geqq V_H \geqq V_{DD} \geqq V_M \geqq V_{SS} \geqq V_L \geqq V_{EE}$) (*1)

ITEM	SYMBOL	PIN NAME	RATING	UNIT
Supply Voltage 1	V_{DD}	V_{DD}	−0.3 to 7.0	V
Supply Voltage 2	V_{CC}-V_{EE}	V_{CC}L/R, V_{EE}L/R	−0.3 to 85	V
	V_H-V_{EE}	V_HL/R, V_{EE}L/R	−0.3 to 85	
Supply Voltage 3	V_M-V_{EE}	V_ML/R, V_{EE}L/R	−0.3 to 85	V
Supply Voltage 4	V_L-V_{EE}	V_LL/R, V_{EE}L/R	−0.3 to 85	V
Input Voltage	V_{in}	(*2)	−0.3 to V_{DD} + 0.3	V
Operating Temperature	T_{opr}	—	−20 to 75	°C
Storage Temperature	T_{stg}	—	−40 to 125	°C

(*1) Input voltage : $V_{SS} \rightarrow V_{DD} \rightarrow V_{EE}/V_L \rightarrow V_{CC}/V_H \rightarrow V_M$

(*2) LP, FR, DIR, DUAL, DIO1, DIO2, DMIN, /DSPOF, /BLNK, TEST

ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS (Unless otherwise noted, V_{SS} = 0V, V_{DD} = 2.7 to 5.5V, Ta = −20 to 75°C)

(Ensure that the following conditions are maintained, $V_{CC} \geqq V_H \geqq V_{DD} \geqq V_M \geqq V_{SS} \geqq V_L \geqq V_{EE}$)

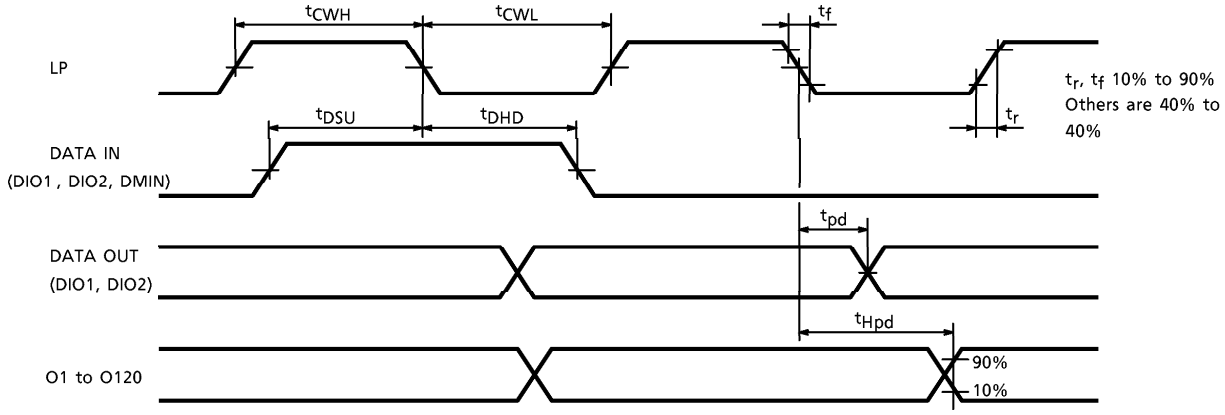
ITEM		SYMBOL	TEST CIR-CUIT	TEST CONDITION			MIN	TYP.	MAX	UNIT	PIN NAME
Supply Voltage 1		V_{DD}	—	—			2.7	5.0	5.5	V	V_{DD}
Supply Voltage 2		V_{CC}-V_M V_M-V_{EE}	—	—			16	—	40	V	V_{CC}L/R V_{EE}L/R
Input Voltage	H Level	V_{IH}	—	(*3)			0.6 V_{DD}	—	V_{DD}	V	(*2)
	L Level	V_{IL}		(*3)			0	—	0.2 V_{DD}		
Output Voltage	H Level	V_{OH}	—	I_{OH} = −0.5mA			V_{DD} −0.5	—	V_{DD}	V	DIO1 DIO2
	L Level	V_{OL}		I_{OL} = 0.5mA			0	—	0.5		
Output Resistance	H Level	R_{OH}	—	$V_{OUT} = V_H - 0.5V$	(*4)		—	0.4	1.0	kΩ	O1 to O120
	M Level	R_{OM}		$V_{OUT} = V_M + 0.5V$	(*4)		—	0.4	1.0		
		R_{OM}		$V_{OUT} = V_M - 0.5V$	(*4)		—	0.4	1.0		
	L Level	R_{OL}		$V_{OUT} = V_L + 0.5V$	(*4)		—	0.4	1.0		
Current Consumption		I_{DD} Ope	—	V_{DD} = 5.5V	V_{CC} − V_{EE} = 80V	Function	—	—	60	μA	V_{DD}
				V_{DD} = 2.7V		(*5)	—	—	30		
		I_{CC} Ope		V_{DD} = 5.5V		Function	—	—	200		V_{CC}L/R
				V_{DD} = 2.7V		(*5)	—	—	200		
		I_{CC} Leak		V_{DD} = 5.5V		Standby	−10	—	10		V_{CC}L/R

(*3) V_{DD} = 4.5 to 5.5V, V_{DD} = 2.7V : $V_{IH} = 0.7V_{DD}$ (min), $V_{IL} = 0.2V_{DD}$ (max)

(*4) V_{DD} = 2.7V, V_H = 32.5V, V_M = 2.5V, V_L = −27.5V

(*5) No load, f_{LP} = 48kHz, f_{FR} = 2.4kHz, f_{DIO} = 400Hz, $V_{IH} = V_{DD}$, $V_{IL} = V_{SS}$

AC CHARACTERISTICS



TEST CONDITIONS (1) (V_{DD} = 4.5 to 5.5V)

ITEM	SYMBOL	TEST CONDITION	MIN	MAX	UNIT
LP Pulse Width H	t_{CWH}	LP	30	—	ns
LP Pulse Width L	t_{CWL}	LP	195	—	ns
Input Rise / Fall Time	t_r, t_f	LP, FR, DIO1, DIO2, DMIN	—	50	ns
Data Set-up Time	t_{DSU}	DIO1, DIO2, DMIN	30	—	ns
Data Hold Time	t_{DHD}	DIO1, DIO2, DMIN	30	—	ns
Output Data Delay Time (*6)	t_{pd}	DIO1, DIO2, DMIN	40	150	ns
LCD Drive Data Delay Time (*7)	t_{Hpd}	O1 to O120	—	1.0	μs

(*6) C_L = 30pF
(*7) No load, V_{SS} = 0V, V_M = 2.5V, V_H = 42.5V, V_L = −37.5V

TEST CONDITIONS (2) (V_{DD} = 2.7 to 4.5V)

ITEM	SYMBOL	TEST CONDITION	MIN	MAX	UNIT
LP Pulse Width H	t_{CWH}	LP	100	—	ns
LP Pulse Width L	t_{CWL}	LP	400	—	ns
Input Rise / Fall Time	t_r, t_f	LP, FR, DIO1, DIO2, DMIN	—	50	ns
Data Set-up Time	t_{DSU}	DIO1, DIO2, DMIN	60	—	ns
Data Hold Time	t_{DHD}	DIO1, DIO2, DMIN	30	—	ns
Output Data Delay Time (*8)	t_{pd}	DIO1, DIO2, DMIN	40	400	ns
LCD Drive Data Delay Time (*9)	t_{Hpd}	O1 to O120	—	1.2	μs

(*8) C_L = 30pF
(*9) No load, V_{SS} = 0V, V_M = 2.5V, V_H = 42.5V, V_L = −37.5V

NOTE

Insert the bypass capacitor (0.1μF) between V_{DD} and V_{SS} to decrease power supply noise. Position the bypass capacitor as close to the LSI as possible.