TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

T6A39

COLUMN DRIVER FOR A DOT MATRIX LCD

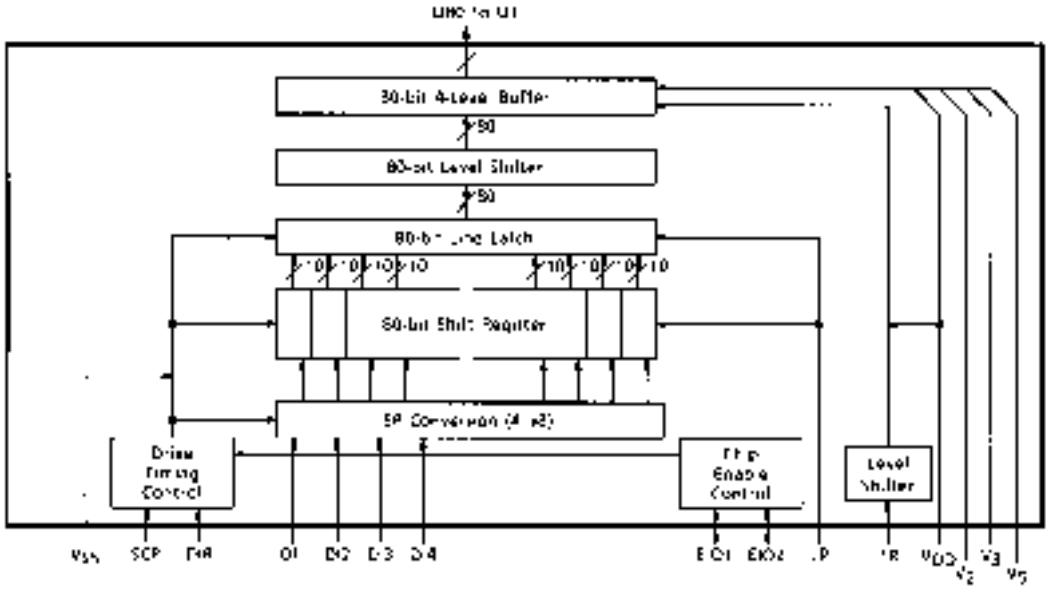
The T6A39 is an 80−channel−output column driver for an STN dot matrix LCD.
The T6A39 features a 28−V LCD drive voltage and a 4−MHz maximum operating frequency. The T6A39 is able to drive LCD panels with a duty ratio of up to 1 / 240. It is recommended for use with the T6A40.

Weight: 1.60 g (typ.)

Features

- Display duty application : to 1 / 240
- LCD drive signal : 80
- Data transfer : 1, 2, 4−bit bidirectional
- Operating frequency : 4 MHz
- LCD drive voltage : 8 to 28 V (max 30 V)
- Power supply voltage : 4.5 to 5.5 V
- Operating temperature : −20 to 75°C
- LCD drive output resistance : 1.5 kΩ (max) (12.8 V, 1 / 9 bias)
- Low power consumption : Cascade connection and auto enable transfer functions are available.

Block Diagram



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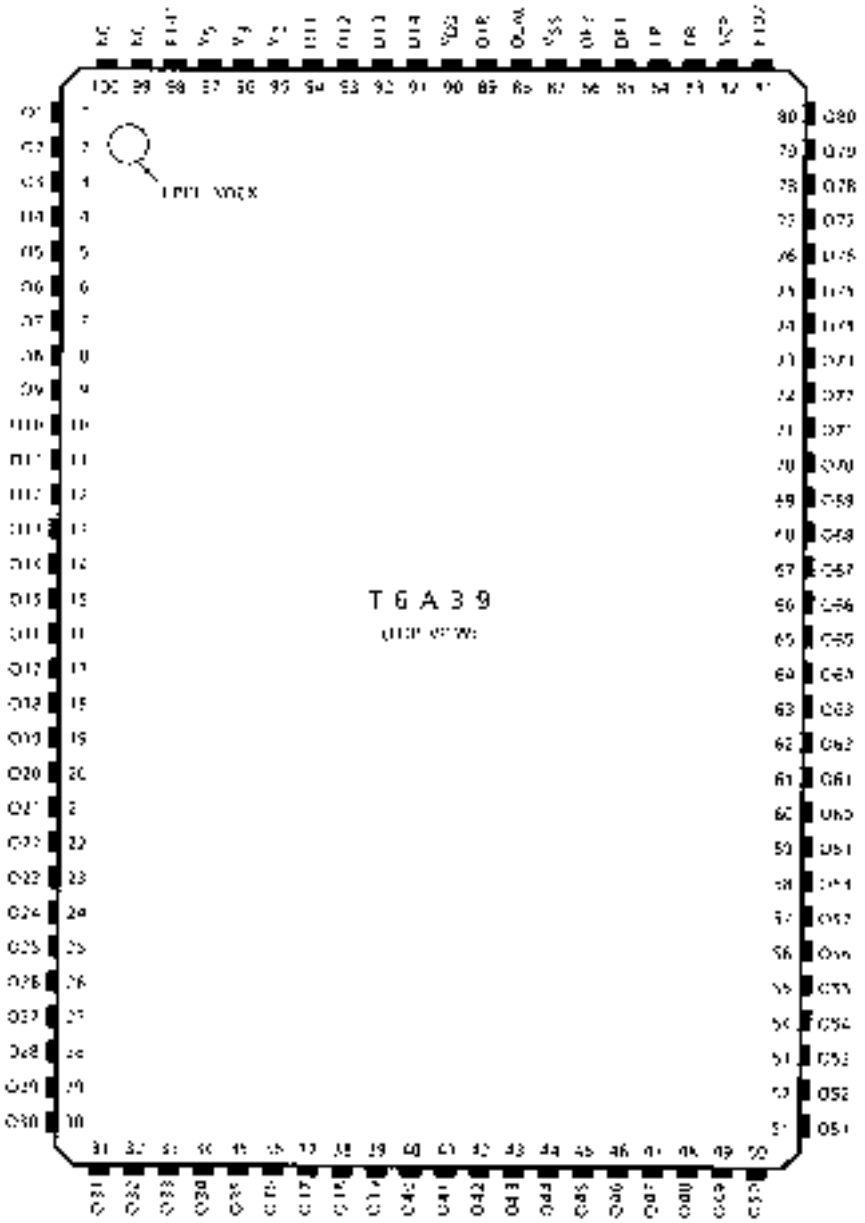
Pin Assignment



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Pin Functions

<table>
<tr><th>Pin Name</th><th>I / O</th><th>Functions</th><th>Level</th></tr>
<tr><td>O1 to O80</td><td>Output</td><td>Output for LCD drive signal</td><td>V_{DD} to V5</td></tr>
<tr><td>DI1 to DI4</td><td>Input</td><td>Input for shift data</td><td rowspan="9">V_{DD} to V_{SS}</td></tr>
<tr><td>SCP</td><td>Input</td><td>(Shift Clock Pulse)
Input for shift clock pulse</td></tr>
<tr><td>FR</td><td>Input</td><td>(Frame)
Input for frame signal</td></tr>
<tr><td>LP</td><td>Input</td><td>(Latch Pulse)
Input for shift clock pulse</td></tr>
<tr><td>DUAL</td><td>Input</td><td>(Dual Mode)
Terminal for dual input mode or single input mode select</td></tr>
<tr><td>DIR</td><td>Input</td><td>(Direction)
Input for data flow direction select</td></tr>
<tr><td>DF1, DF2</td><td>Input</td><td>(Data Format)
Input for selection data format (1−bit, 2−bit, 4−bit)</td></tr>
<tr><td>EIO1, EIO2</td><td>I / O</td><td>Input / output for ENABLE signal
<table>
<tr><th>DUAL</th><th>DIR</th><th>EION1</th><th>EION2</th></tr>
<tr><td>L</td><td>L</td><td>OUT</td><td>IN</td></tr>
<tr><td>L</td><td>H</td><td>IN</td><td>OUT</td></tr>
<tr><td>H</td><td>L</td><td>OUT</td><td>IN</td></tr>
<tr><td>H</td><td>H</td><td>OUT</td><td>IN</td></tr>
</table></td></tr>
<tr><td>V_{DD}</td><td>—</td><td>Power supply for internal logic (+5 V)</td><td rowspan="5">—</td></tr>
<tr><td>V_{SS}</td><td>—</td><td>Power supply for internal logic (0 V)</td></tr>
<tr><td>V2</td><td>—</td><td>Power supply for LCD drive circuit</td></tr>
<tr><td>V3</td><td>—</td><td>Power supply for LCD drive circuit</td></tr>
<tr><td>V5</td><td>—</td><td>Power supply for LCD drive circuit</td></tr>
</table>

Relation Between FR, Data Input and Output Level

F R	Data Input (DI1 to DI4)	Output Level
L	L	V2
L	H	V_{DD}
H	L	V3
H	H	V5

Data Input Format

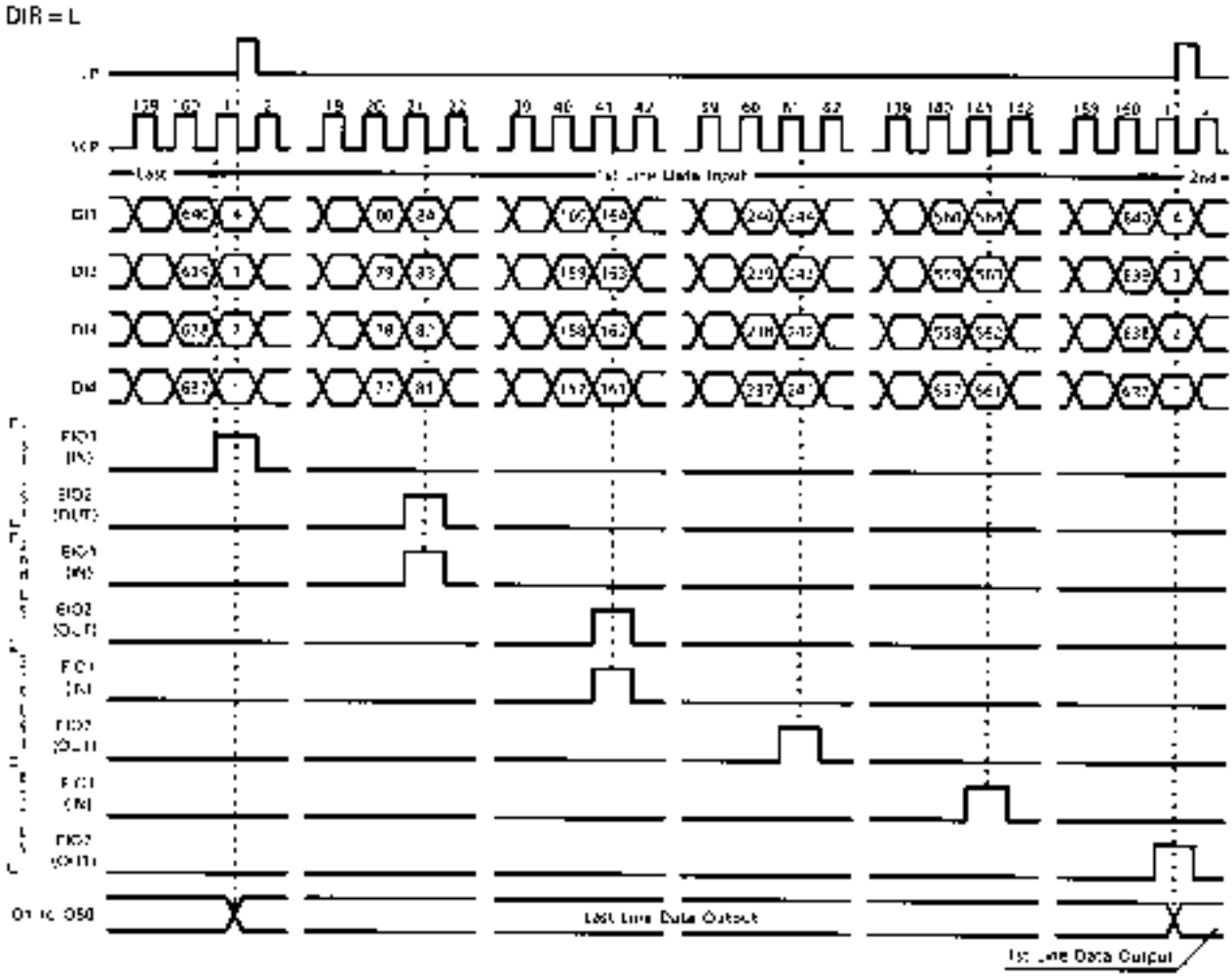
DF1	DF2	DUAL	DIR	bits	DATA INPUT				DATA FORMAT			
					DI1	DI2	DI3	DI4	Ⓛ DI1 Ⓕ	Ⓛ DI2 Ⓕ	Ⓛ DI3 Ⓕ	Ⓛ DI4 Ⓕ
L	L	L	L	1-bit	*	*	*	IN	—	—	—	O80,O79···O2,O1
L	L	L	H		IN	*	*	*	O1,O2···O79,O80	—	—	—
L	L	H	L		*	*	*	IN	—	—	—	O80,O79···O42,O41
L	L	H	H		IN	*	*	IN	O1,O2···O39,O40	—	—	O80,O79···O42,O41
H	L	L	L	2-bit	*	*	IN	IN	—	—	O79,O77···O3,O1	O80,O78···O4,O2
H	L	L	H		IN	IN	*	*	O1,O3···O77,O79	O2,O4···O78,O80	—	—
H	L	H	L		*	*	IN	IN	—	—	O79,O77···O43,O41	O80,O78···O44,O42
H	L	H	H		IN	IN	IN	IN	O1,O3···O37,O39	O2,O4···O38,O40	O79,O77···O43,O41	O80,O78···O44,O42
*	H	L	L	4-bit	IN	IN	IN	IN	O77,O73···O5,O1	O78,O74···O6,O2	O79,O75···O7,O3	O80,O76···O8,O4
*	H	L	H		IN	IN	IN	IN	O1,O5···O73,O77	O2,O6···O74,O78	O3,O7···O75,O79	O4,O8···O76,O80
*	H	H	L		IN	IN	IN	IN	O77,O73···O45,O41	O78,O74···O46,O42	O79,O75···O47,O43	O80,O76···O48,O44
*	H	H	H	DON'T USE								

* Don't Care

Ⓛ→LAST DATA

Ⓕ→FIRST DATA

Timing Diagram



Absolute Maximum Ratings (Ensure that the Following Conditions are Maintained, $V_{CC} \geq V_0 \geq V_2 \geq V_3 \geq V_5 \geq V_{SS}$, $V_{SS} = 0$ V)

Item	Symbol	Pin Name	Rating	Unit
Supply Voltage 1	V_{DD}	V_{DD}	−0.3 to 7.0	V
Supply Voltage 2	V2	V2	V_{DD} − 30 to V_{DD} + 0.3	V
Supply Voltage 3	V3	V3	V_{DD} − 30 to V_{DD} + 0.3	V
Supply Voltage 4	V5	V5	V_{DD} − 30 to V_{DD} + 0.3	V
Input Voltage	V_{IN}	(Note 1)	−0.3 to V_{DD} + 0.3	V
Operating Temperature	T_{opr}	—	−20 to 75	°C
Storage Temperature	T_{stg}	—	−55 to 125	°C

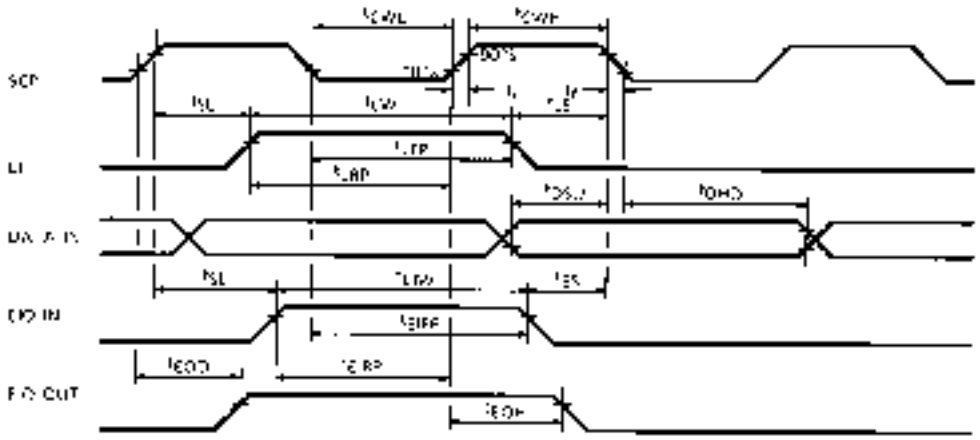
Note 1: SCP, FR, LP, DIR, DF1, DF2, DUAL, DI1 to DI4

Electrical Characteristics
Dc Characteristics
Test Conditions (Unless Otherwise Noted, V_{SS} = 0 V, V_{DD} = 4.5 to 5.5 V, V5 = (V_{DD} − 23) V ± 10%, Ta = −20 to 75°C)

Item		Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit	Pin Name
Supply Voltage 1		—	—	—		4.5	5.0	5.5	V	V_{DD}
Supply Voltage 2		V5	—	—		V_{DD} − 28	V_{DD} − 23	V_{DD} − 8.0	V	V5
Input Voltage	H Level	V_{IH}	—	T_{opr} = −10 to 75 °C (Note2)		V_{DD} − 0.8 (Note 3)	—	V_{DD}	V	SCP, FR, LP, DIR, EIO1, EIO2, DI1 to DI4, DF1, DF2, DUAL
	L Level	V_{IL}		T_{opr} = −10 to 75 °C (Note2)		0	—	0.8 (Note 4)		
Output Voltage	H Level	V_{OH}	—	—		V_{DD} − 0.3	—	V_{DD}	V	EIO1, EIO2
	L Level	V_{OL}		—		0	—	0.3		
Output Resistance (1)	H Level	R_{OH}	—	V_{OUT} = V_{DD} − 0.5 V		—	—	1.0	kΩ	EIO1, EIO2
	L Level	R_{OL}	—	V_{OUT} = V_{SS} + 0.5 V		—	—	1.0		
Output Resistance (2)	H Level	R_{OH}	—	V_{OUT} = V_{DD} − 0.5 V (Note 5)		—	—	1.5	kΩ	O1 to O80
	M Level	R_{OM}	—	V_{OUT} = V2 ± 0.5 V (Note 5)		—	—	1.5		
		R_{OM}	—	V_{OUT} = V3 ± 0.5 V (Note 5)		—	—	1.5		
	L Level	R_{OL}	—	V_{OUT} = V5 + 0.5 V (Note 5)		—	—	1.5		
Current Consumption (1) (Note 5)		I_{SS}	—	V_{DD} = 5.5 V, V5 = −22.5 V, f_{FR} = 35 Hz, f_{SCP} = 2.5 MHz, O1 to O80 : No Load (Note 7)	Input Data: every bit inverted	—	1050	1400	µA	VSS
					Input Data: low	—	770	1000		
Current Consumption (2) (Note 6)		I_{SS}	—	As mentioned above (Note 7)	Input Data: every bit inverted	—	260	350	µA	VSS

Note 2: R_L = 3 kΩ, C_L = 500 pF
Note 3: V_{DD} − 0.7 (T_{opr} = −20 to −10°C)
Note 4: 0.7 (T_{opr} = −20 to −10°C)
Note 5: Internal data receiver operating
Note 6: Internal data receiver sleeping
Note 7: V_{DD} = 5.0 V, V_5 = −7.8 V, V_2 = V_{DD} − 2 / 9 (V_{DD} − V_5), V_3 = V_{DD} − 7 / 9 (V_{DD} − V_5)

AC Characteristics



Test Conditions

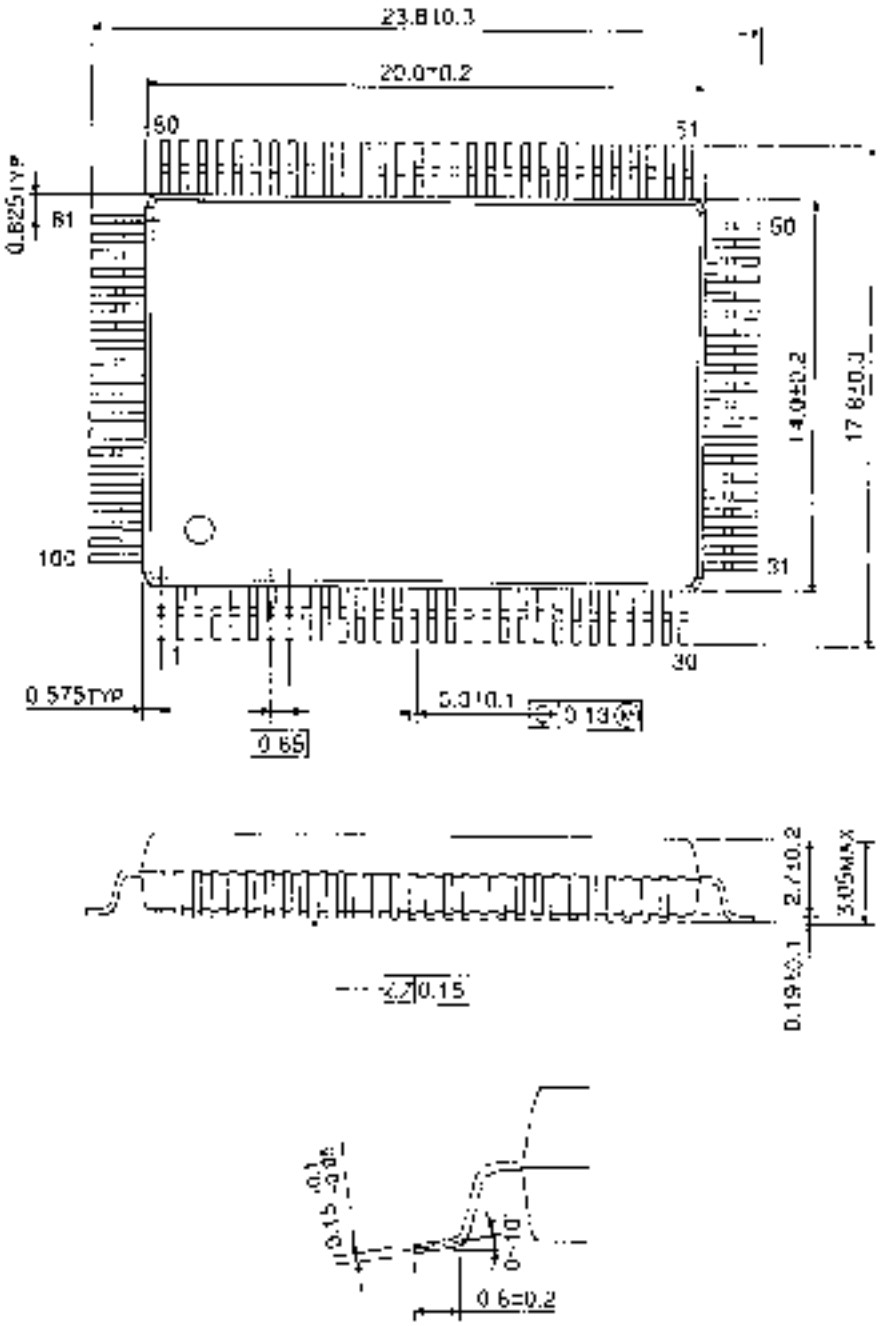
(V_{SS} = 0 V, V_{DD} = 4.5 to 5.5 V, V_0 = V_{DD}, V_5 = (V_{DD} − 23) V ± 10%, Ta = −20 to 75°C)

Item	Symbol	Test Condition	Min	Max	Unit
Operating Frequency	t_{SCP}	—	—	4.0	MHz
SCP Pulse Width	t_{CWH}	—	95	—	ns
SCP Pulse Width	t_{CWL}	—	95	—	
Data Set−up Time	t_{DSU}	—	20	—	
Data Hold Time	t_{DHD}	—	40	—	
SCP Rise / Fall Time	t_r, t_f	—	—	30	
LP Set−up Time	t_{LRP}	—	20	—	
LP Hold Time	t_{LFP}	—	40	—	
LP Pulse Width	t_{LW}	—	40	—	
SCP−Rise−to−LP−Rise Time	t_{SL}	—	10	—	
LP−Fall−to−SCP−Fall Time	t_{LS}	—	10	—	
EIO IN Set−up Time	t_{EIRP}	—	20	—	
EIO IN Hold Time	t_{EIFP}	—	40	—	
EIO IN Pulse Width	t_{EIW}	—	40	—	
SCP−Rise−to−EIO−Rise Time	t_{SE}	(Note 8)	10	—	
EIO−Fall−to−SCP−Fall Time	t_{ES}	(Note 8)	10	—	
EIO OUT Data Delay Time	t_{EOD}	—	—	100	
EIO OUT Hold Time	t_{EOH}	—	—	95	

Note 8: C_L = 10 pF

Package Dimensions

QFP100-P-1420-0.65A Unit: mm



Weight : 1.60g (typ.)