LCD Driver for 160 Display Units BL55077(A)

General Description

The BL55077(A) is a general LCD driver IC for 160 units LCD panel. It features a wide operating supply voltage range, incorporates simple communication interface with microcomputer and is suitable for multiple application.

Features

- Single-chip LCD controller/driver
- Selecable backplane drive configuration: static, 1/2, 1/3 or 1/4 backplane multiplexing.
- Selectable display bias configuration : static, 1/2 or 1/3 bias
- Operation voltage: 2~5.5V
- Serial data interface
- 160(40 SEG x 4 COM) Display Units
- Low power dissipation design: Power saving mode: Idd=14uA @ 5V and Idd=9uA @ 3.3V; Sleeping mode: Idd≈1.5uA
- Maybe cascaded up to 16pcs for large LCD application
- Versatile blinking modes
- VLCD for adjusting LCD operating voltage
- TTL/CMOS compatible
- Excellent EMC immunity
- Compatible with general microcomputer
- LQFP-64 package

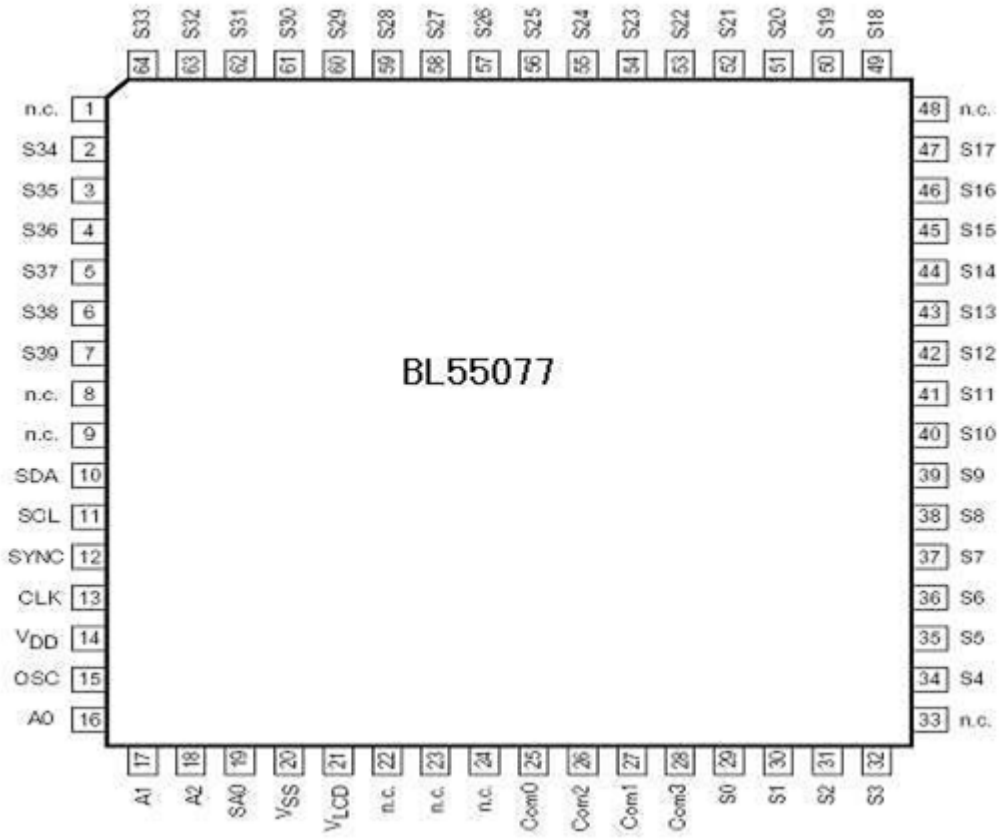
Application

Power Meter, Gas Meter…

Toy, Clock

Industrial instrument

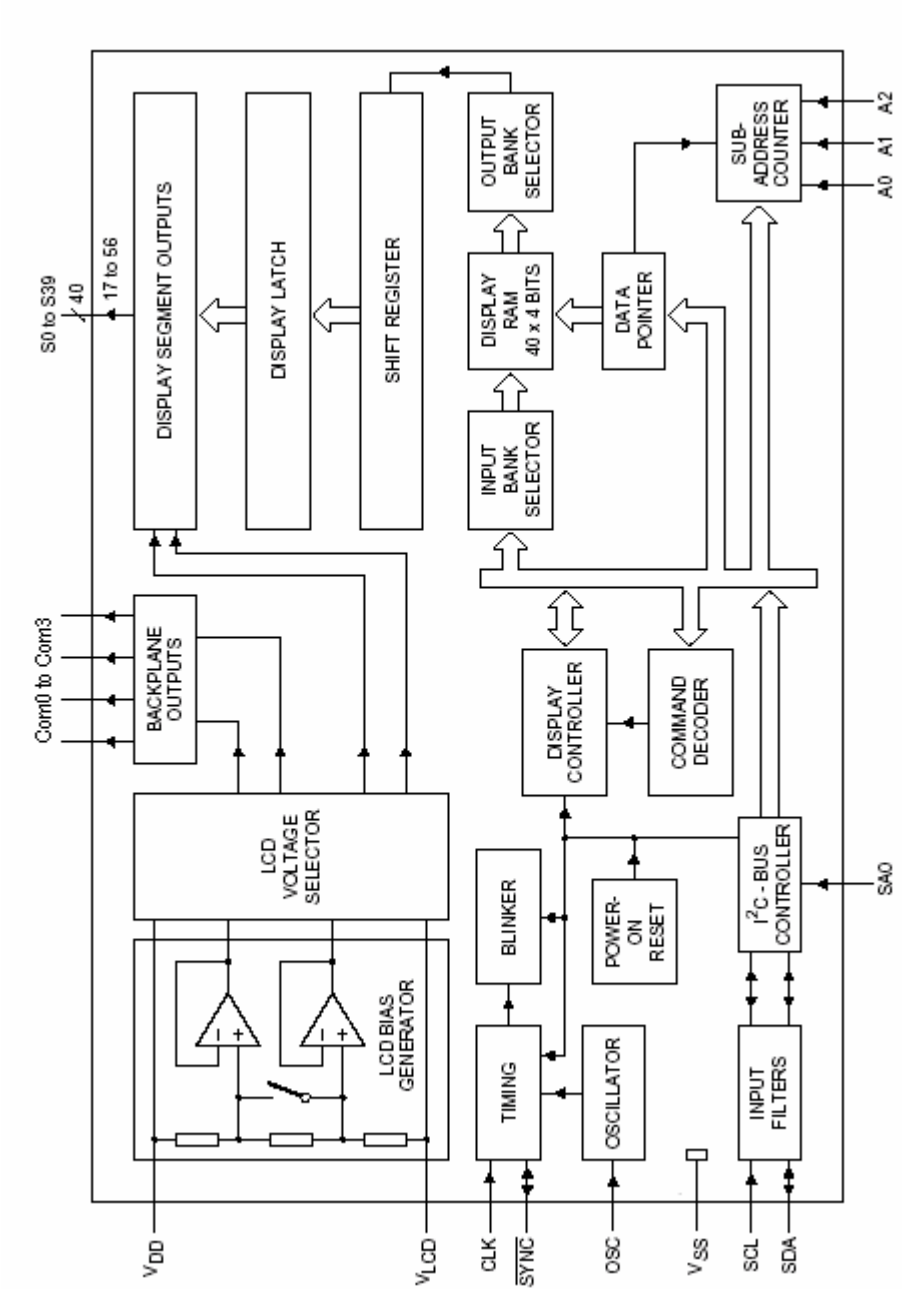
Pin Assignment



Pin Description

Pin No.	SYMBOL	DESCRIPTION
10	SDA	Serial data input/output
11	SCL	Serial clock input
12	SYNC	Cascade synchronization clock
13	CLK	External clock input
14	Vdd	Supply voltage
15	OSC	Oscillator input
16-18	A0、A1、A2	Subaddress inputs
19	SA0	Slave address input;bit0
20	Vss	ground
21	Vlcd	LCD supply voltage
25-28	Com0、Com2、Com1、Com3	Common terminal driving output
29-32、34-37、49-64、2-7	S0——S39	Segment terminal driving output
1、8、9、22、23、24、33、48	NC	Unused

Block Diagram



Function Description

Function Circuit

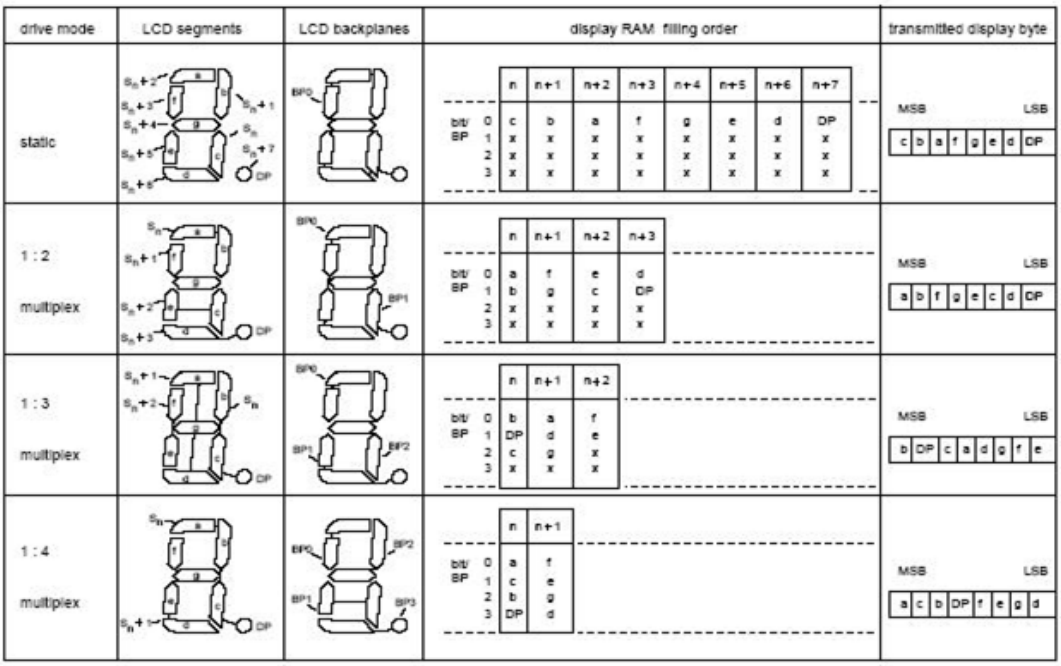
The BL550077(A) has all function circuits that can directly drive any static or multiplexed LCD containing up to four commons and up to 40 segments. The function circuits include:Power-on reset, LCD bias generator, LCD voltage selector, Oscillator, display RAM, Display latch, Shift register, Common/segment outputs, input/output bank selector, Blinker, Data pointer, Subaddress counter,etc.

Display Function Decription

The display RAM is a static 40x 4-bit RAM which stores LCD data. A logic 1 in the RAM bit-map indicates the on state of the corresponding LCD segment; similarly, a logic 0 indicates the off state. There is a one-to-one correspondence between the RAM addresses and the segment outputs, and between the individual bits of a RAM word and the common outputs.

Display RAM address and SEGMENT(S0~S39) output													
COM		0	1	2	3	◦	◦	◦	◦	36	37	38	39
(Com0~	0												
Com3)	1												
outpu	2												
t	3												

When display data is transmitted to the BL55077(A), the display bytes received are stored in the display RAM in accordance with the selected LCD drive mode. To illustrate the filling order, an example of a 7-segment numeric display showing all drive modes is given in Fig.3; the RAM filling organization depicted applies equally to other LCD types.



x = data bit unchanged.

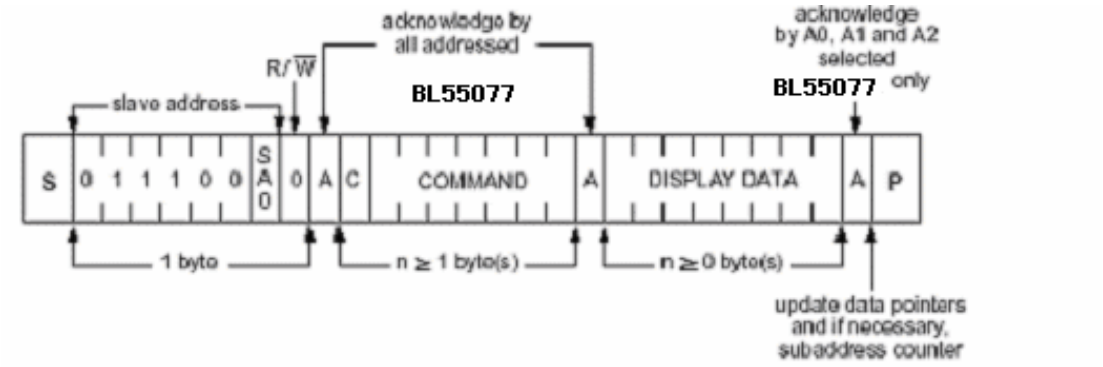
I²C-bus protocol

Two I2C-bus slave addresses (0111000 and 0111001) are reserved for the BL55077(A). The least significant bit of the slave address that a BL55077(A) will

respond to is defined by the level tied at its input SA0. Therefore, two types of BL55077(A) can be distinguished on the same I2C-bus which allows:

1) Up to 16 BL55077(A) on the same I2C-bus for very large LCD applications.
2) The use of two types of LCD multiplex on the same I2C-bus.

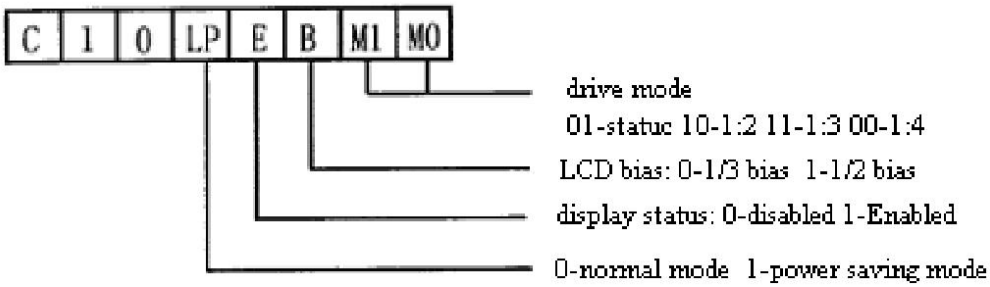
The I2C-bus protocol is shown in Fig.4. The sequence is initiated with a START condition (S) from the I2C-bus master which is followed by one of the two BL55077(A) slave addresses available. All BL55077(A)s with the corresponding SA0 level acknowledge in parallel with the slave address but all BL55077(A)s with the alternative SA0 level ignore the whole I2C-bus transfer. After acknowledgement, one or more command bytes (m) follow which define the status of the addressed BL55077(A)s. The last command byte is tagged with a cleared most significant bit, the continuation bit C. The command bytes are also acknowledged by all addressed BL55077(A)s on the bus. After the last command byte, a series of display data bytes(n) may follow. These display bytes are stored in the display RAM at the address specified by the data pointer and the subaddress counter. Both data pointer and subaddress counter are automatically updated and the data is directed to the intended BL55077(A) device. The acknowledgement after each byte is made only by the (A0, A1 and A2) addressed BL55077(A). After the last display byte, the I2C-bus master issues a STOP condition (P).



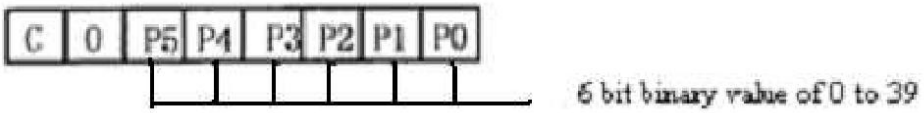
Command Decoder

The command decoder identifies command bytes that arrive on the I^2C-bus. All available commands carry a continuation bit C in their most significant bit position. The five commands available to the BL55077(A) are defined.

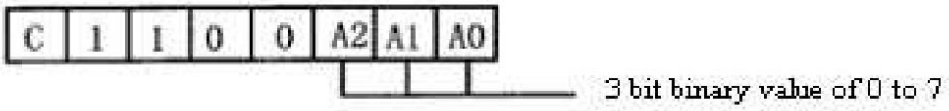
A. Mode set



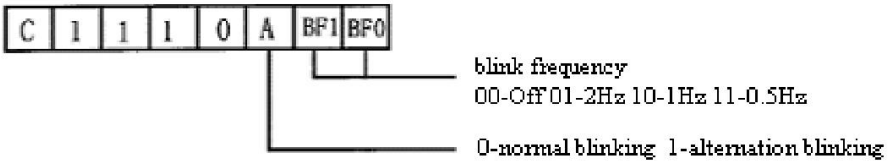
B. Load data pointer



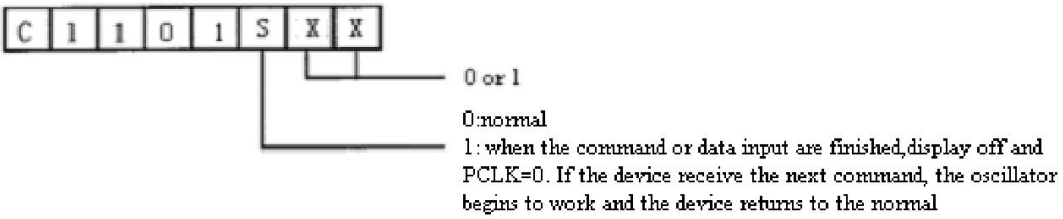
C. Device select



D. Blink control

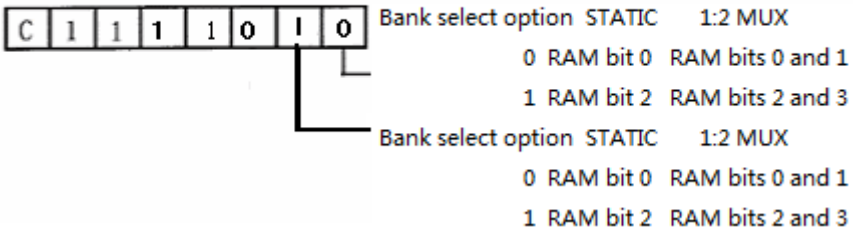


E. Sleep control



F. BANK

The BANK SELECT command has no effect in 1:3 and 1:4 multiplex drive modes.



Absolute Maximum Rating

Parameter	Symbol	Rating	Unit
Supply voltage	Vdd	-0.5～+6.0	V
LCD operating voltage	Vlcd	0～ Vdd	V
Input voltage	Vi	Vss-0.5～Vdd+0.5	V
Output voltage	Vo	Vlcd-0.5～Vdd+0.5	V
Vdd,Vss,Vlcd current	Idd,Iss,Ilcd	-50～+50	mA
Maximum power consumption	Ptot	400	mW
Operating temperature	Topr	-40～ +75	℃
Storage temperature	Tstg	-65～ +150	℃

DC Characteristic(Ta=25 ℃)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
Vdd	IC Operating voltage		2.5	-	5.5	V
Vlcd	LCD operating voltage		0	-	Vdd-2	V
Idd1	Supply current	Vdd=5V,VLCD=0V,Normal mode,internal oscillator	-	25	50	uA
Idd2	Supply current	Vdd=5V,VLCD=0V,power saving mode,internal oscillator	-	14	30	uA
Idd3	Supply current	Vdd=3.3V,VLCD=0V,Normalmode,internal oscillator	-	16	30	uA
Idd4	Supply current	Vdd=3.3V,VLCD=0V,power saving mode,internal oscillator	-	9	15	uA
I_{SL}	Sleep current	Vdd=5V,VLCD=0V	-	1.5		uA
ViL	Low voltage input	SDA,SCL	Vss	-	0.3Vdd	V
ViH	High voltage input	SDA,SCL	0.7Vdd	-	Vdd	V
Rph	Pull high resister	SYNC	30	50	100	kΩ
V_C	DC voltage component	C_{COM}=32nF, COM0~COM3	-40		40	mV
V_S	DC voltage component	C_S=4.7nF, SEG0~SEG39	-40		40	mV

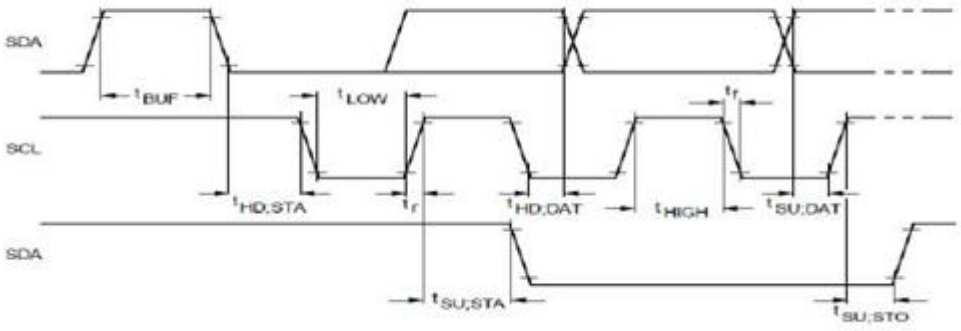
NOTE: the voltage of DC voltage component test: VDD=3.3 V , VLCD=0V

AC Characteristics

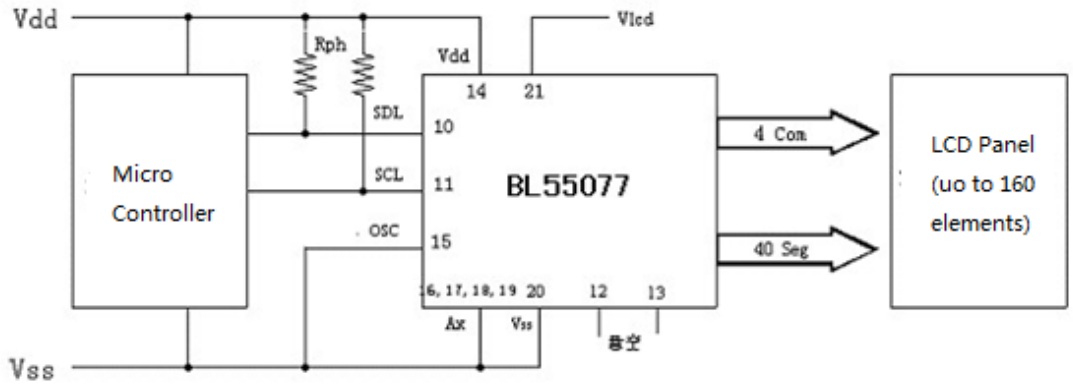
Symbol	Parameter	Conditions	MIN.	TYP.	MAX.	UNIT.
Fclk	Oscillator frequency	Vdd=5V,normal mode	125	180	300	KHz
Fclklp	Oscillator frequency	Vdd=3.3V,power-save	21	31	48	KHz

		mode				
Tclkh	CLK High time		1	-	-	us
Tclkl	CLK Low time		1	-	-	us
IIC-bus						
tBUF	bus free time		4.7	-	-	us
tHD;STA	START condition hold time		4	-	-	us
tLOW	SCL Low time		4.7	-	-	us
tHIGH	SCL High time		4	-	-	us
tSU;STA	set-up time for a repeated START condition		4.7	-	-	us
tHD;DAT	Data hold time		0	-	-	us
tSU;DAT	Data set-up time		250	-	-	ns
Tr	SCL and SDA rise time		-	-	1	us
Tf	SCL and SDA fall time		-	-	300	us
tSU;STO	Set-up time for STOP condition		4.7	-	-	us

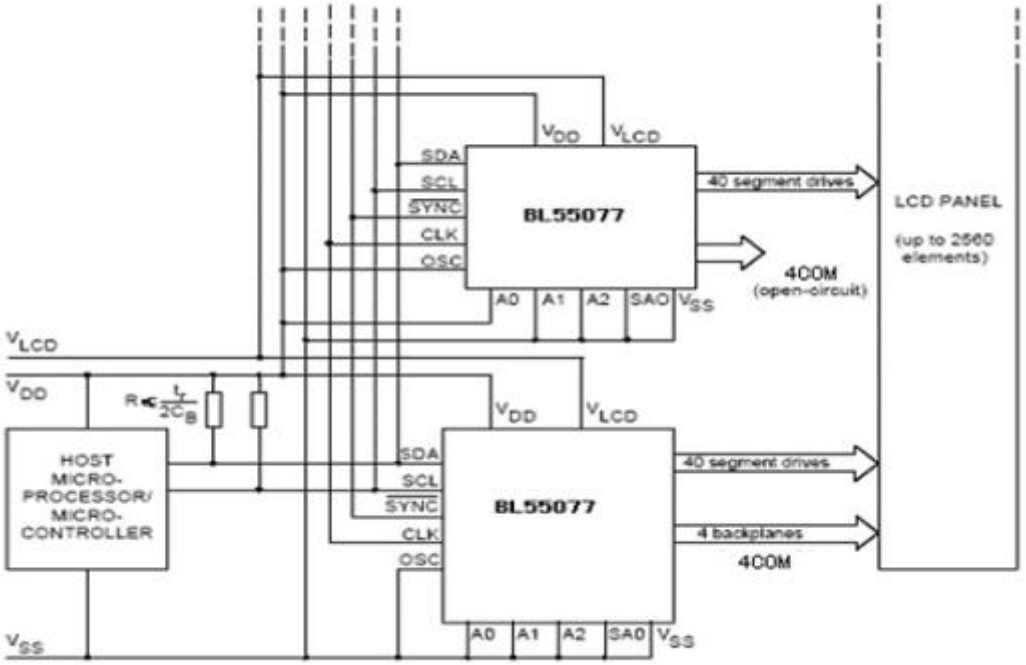
I^2C-bus timing waveforms



Typical Application

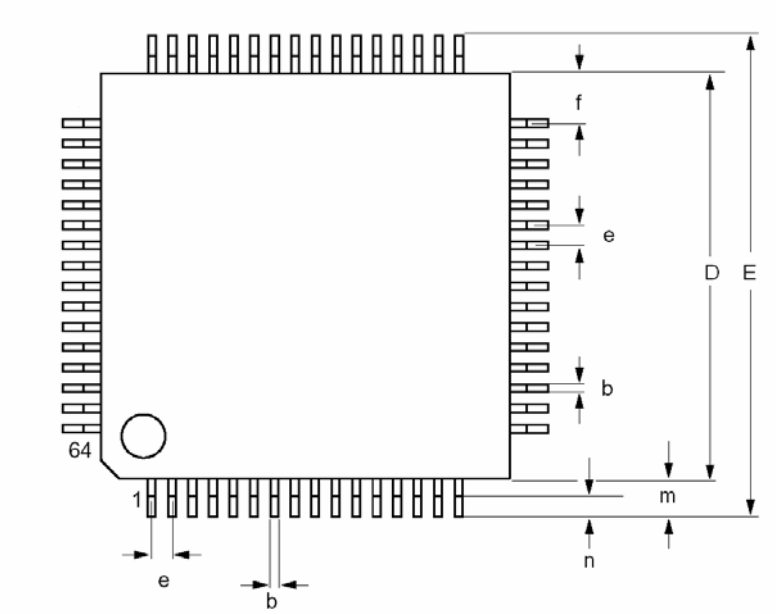


Typical cascaded Application



Package Outlines

LQFP64



Unit	D	E	e	b	f	m	n
mm	10.0(0.1)	12.0(0.15)	0.5	0.22(0.05)	1.25(0.2)	1.0	0.6(0.15)