



DL8836

LED Driver IC

DESCRIPTION

DL8836 is an LED Controller driven on a 1/7to 1/8 duty factor. Eleven segment output lines, six grid output lines, 1 segment/grid output lines, one display memory, control circuit , key SGan circuit are all incorporated into a single chip to build a highly reliable peripheral device for a single chip microcomputer. Serial data is fed to DL8836 via a four-line serial interface. Housed in a 32-pin SO Package, DL8836 pin assignments and application circuit are optimized for easy PCB Layout and cost saving advantages.

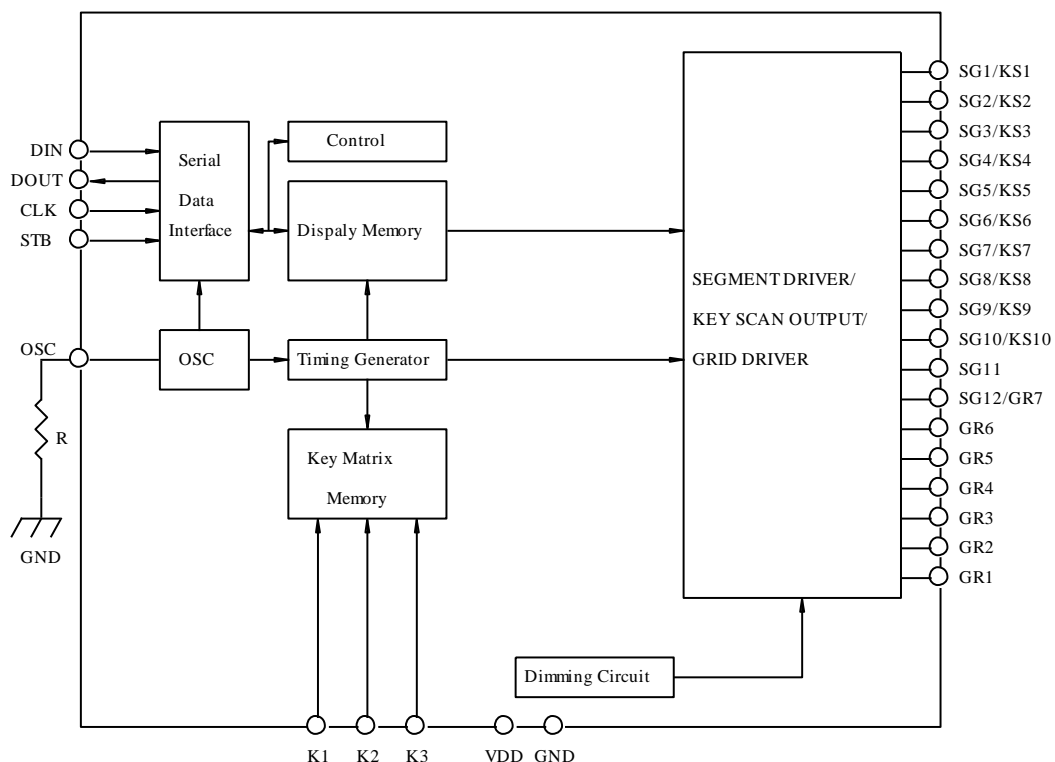
FEATURES

- CMOS Technology
- Low Power Consumption
- Multiple Display Modes (12 segment, 6 Grid to 11 segment, 7 Grid)
- Key SGanning (10x 3 Matrix)
- 8-Step Dimming Circuitry
- Serial Interface for Clock, Data Input, Data Output, Strobe Pins
- Available in 32-Pin, SOP Package

APPLICATION

- Micro-computer Peripheral Device
- VCR set
- Combi set

BLOCK DIAGRAM





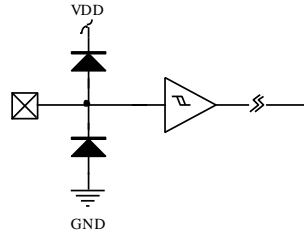
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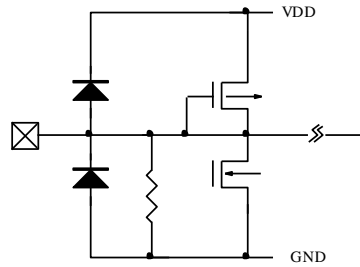
INPUT/OUTPUT CONFIGURATIONS

The Schematic diagrams of the input and output circuits of the logic section are shown below.

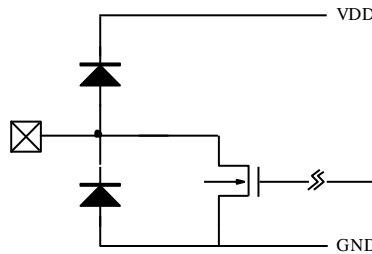
Input Pins: CLK, STB & DIN



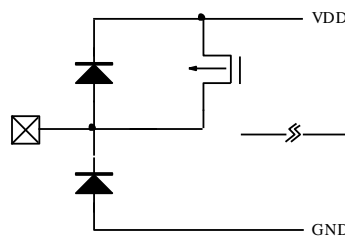
Input Pins: K1 to K3



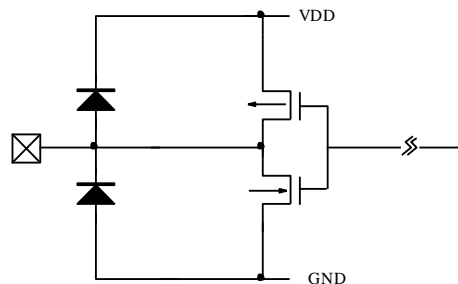
Output Pins: DOUT, GR1 to GR4



Output Pins: SG1 to SG11



Output Pins: GR5, GR6 and SG12/GR7

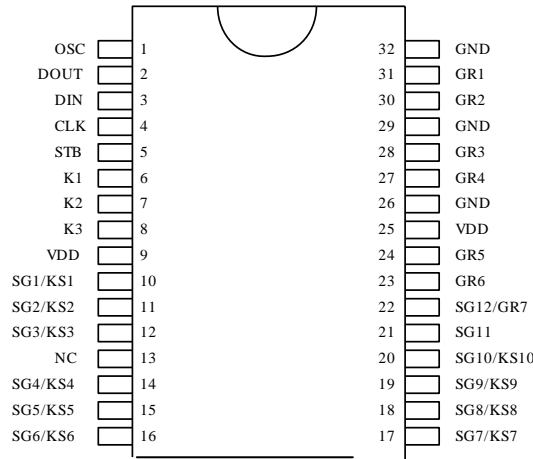




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PIN CONFIGURATION



IC: DL8836

PIN DESCRIPTION

Pin Name	I/O	DeScription	Pin No.
OSG	I	OSGillator Input Pin A resistor is connected to this pin to determine the oSGillation frequency	1
DOUT	O	Data Output Pin (N-Channel, Open-Drain) This pin outputs serial data at the falling edge of the shift clock.	2
DIN	I	Data Input Pin. This Pin inputs serial data at the rising edge of the shift clock (starting from the lower bit)	3
CLK	I	Clock Input Pin This pin reads serial data at the rising edge and outputs data at the falling edge.	4
STB	I	Serial Interface Strobe Pin The data input after the STB has fallen is processed as a command When this pin is "HIGH", CLK is ignored.	5
K1 to K3	I	Key Data Input Pins. The data sent to these pins are latched at the end of the display cycle. (Internal Pull-Low Resistor)	6, 7, 8
GND	-	Ground Pin	26,29,32
SG1/KS1 to SG10/KS10	O	Segment Output Pins (p-channel, open drain) Also acts as the Key Source	10~12 14~20
SG11	O	Segment Output Pins (p-channel, open drain)	21
SG12/GR7	O	Segment/Grid Output Pins	22
VDD	-	Power Supply	9,25
GR6 to GR1	O	Grid Output Pins	23,24,27 28,30,31

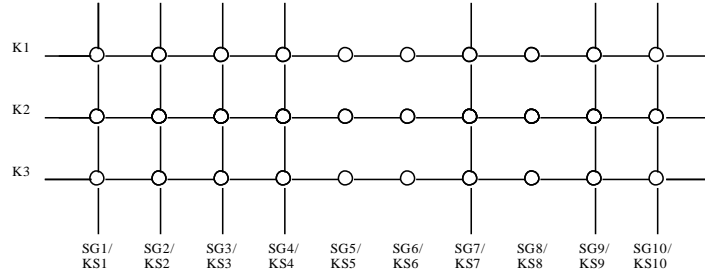


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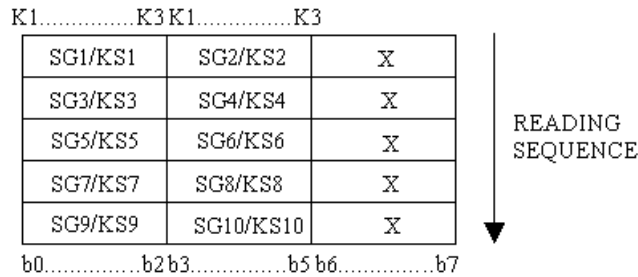
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DL8836 KEYS MATRIX & KEY INPUT DATA STORAGE RAM

DL8836 Key Matrix consists of 10 x 3 array as shown below:



Each data entered by each key is stored as follows and read by a READ Command, starting from the last significant bit. When the most significant bit of the data (b0) has been read, the least significant bit of the next data (b7) is read.

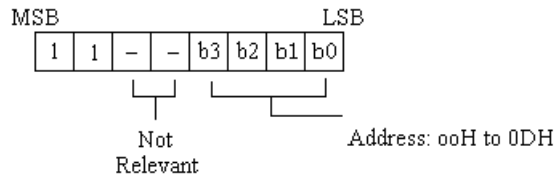


Note: b6 and b7 do not care

Command 3: Address Setting Commands

Address Setting Commands are used to set the address of the display memory. The address is considered valid if it has a value of 00H to 0DH. If the address is set to 0EH or higher, the data is ignored until a valid address is set. When power is turned ON, the address is set at 00H.

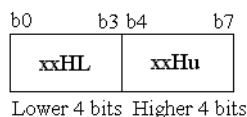
Please refer to the diagram below.



DISPALYMODE AND RAMADDRESS

Data transmitted from an external device to DL8836 via the serial interface are stored in the Display RAM and are assigned addresses. The RAM addresses of DL8836 are given below in 8 bits unit.

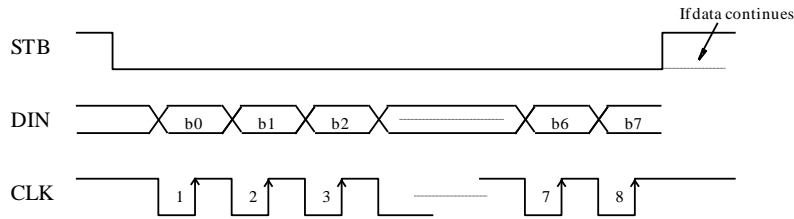
SG1	SG4 SG5	SG8 SG9	SG12
00HL	00Hu	01HL	DIG1
02HL	02Hu	03HL	DIG2
04HL	04Hu	05HL	DIG3
06HL	06Hu	07HL	DIG4
08HL	08Hu	09HL	DIG5
0AHL	0AHu	0BHL	DIG6
0CHL	0CHu	0DHL	DIG7



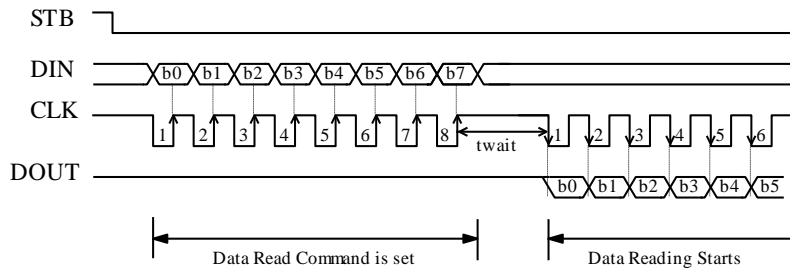


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TRANSMISSION (Data Read)

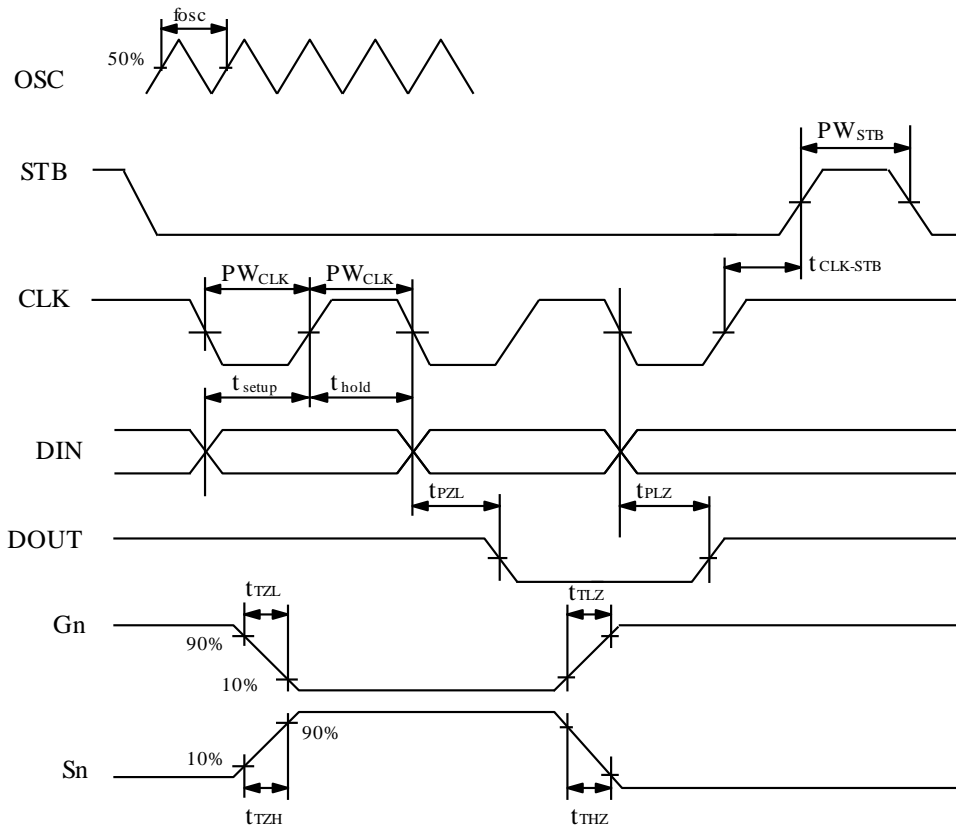


where: t_{wait} (waiting time) $\geq 1\mu s$

It must be noted that when the data is read, the waiting time (t_{wait}) between the rising of the eighth clock that has set the command and the falling of the first clock that has read the data is greater or equal to $1\mu s$.

SWITCHING CHARACTERISTIC WAVEFORM

DL8836 Switching Characteristics Waveform is given below.



where: PW_{CLK} (Clock Pulse Width) $\geq 400nS$ PW_{STB} (Strobe Pulse Width) $\geq 1\mu s$



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t_{setup} (Data Setup Time) $\geq 100nS$

t_{hold} (Data Hold Time) $\geq 100nS$

$t_{CLK-STB}$ (Clock-Strobe Time) $\geq 1\mu s$

t_{THZ} (Fall Time) $\leq 10\mu s$

t_{TZH} (Rise Time) $\leq 1\mu s$

t_{PZL} (Propagation Delay Time) $\leq 100nS$

f_{oSG} =OSGillation Frequency

t_{PLZ} (Propagation Delay Time) $\leq 300uS$

$t_{TZL} < 1\mu s$

$t_{TLZ} < 10\mu s$

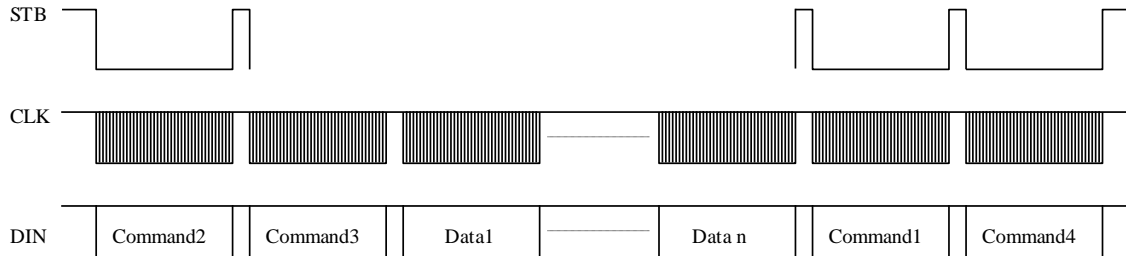
Note: Test condition under

t_{THZ} (Pull low risistor=100k ohms, Loading capacitor =300pf)

t_{TLZ} (Pull high risistor =100k ohms, Loading capacitor=300pf)

APPLICATIONS

Display memory is updated by incrementing addresses. Please refer to the following diagram.



where: Command 1: Display Mode Setting Command

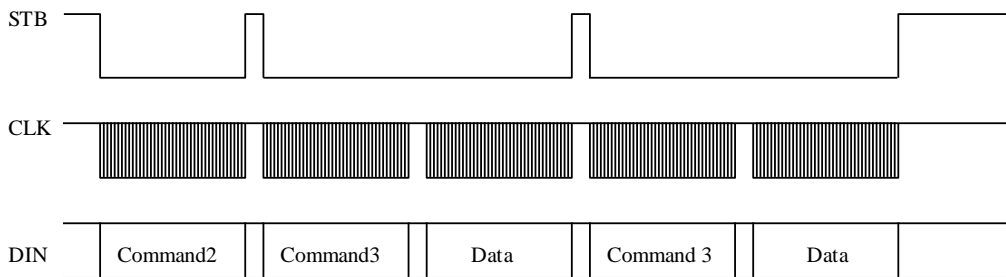
Command 2: Data Setting Command

Command 3: Address Setting Command

Data 1 to n : Transfer Display Data (14 Bytes max.)

Command 4: Display Control Command

The following diagram shows the waveforms when updating specific addresses.



where: Command 2 — Data Setting Command

Command 3 — Address Setting Command

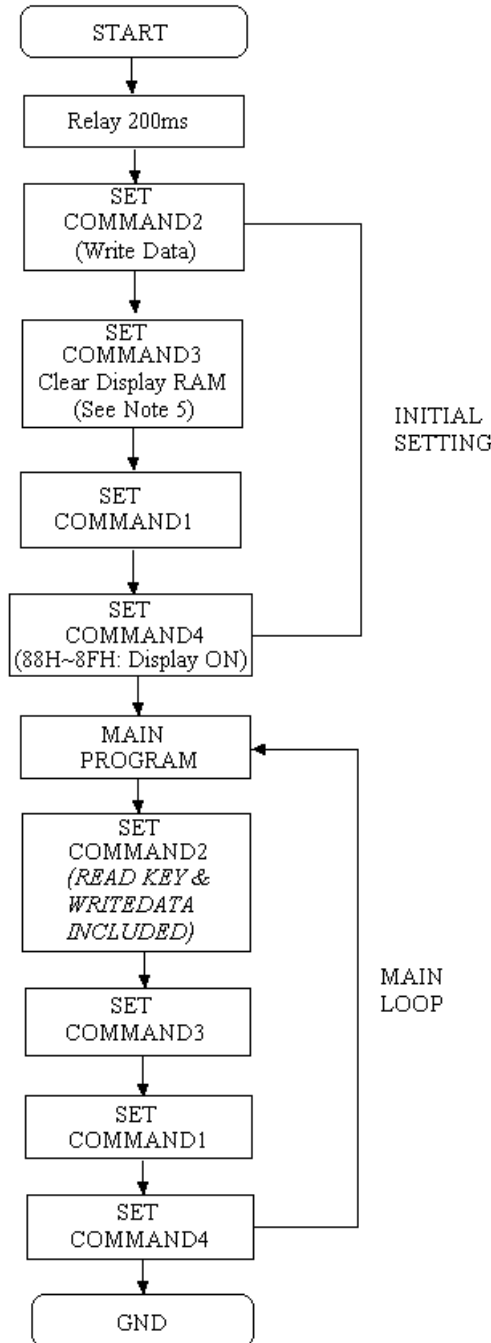
Data — Display Data



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RECOMMENDED SOFTWARE PROGRAMMING FLOWCHART



Note: 1. Command 1: Display Mode Commands

2. Command 2: Data Setting Commands

3. Command 3: Address Setting Commands

4. Command 4: Display Control Commands

5. When IC power is applied for the first time, the contents of the Display RAM is not defined; thus, it is strongly suggested that the contents of the Display RAM must be cleared during the initial setting.



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ABSOLUTE MAXIMUM RATINGS

(Unless otherwise stated, Ta=25°C, GND=0V)

Parameter	Symbol	Ratings	Unit
Supply Voltage	V _{DD}	-0.5 to +7	Volts
Logic Input Voltage	V _I	-0.5 to V _{DD} +0.5	Volts
Driver Output Current	I _{OLGR}	+250	mA
	I _{OHS}	-50	mA
Maximum Driver Output Current/Total	I _{TOTAL}	400	mA

RECOMMENDED OPERATING RANGE

(Unless otherwise stated, Ta=-20 to +70°C, GND=0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V _{DD}	4.5	5	5.5	V
Dynamic Current (see Note)	I _{DDdyn}	-	-	10	mA
High-Level Input Voltage	V _{IH}	0.8V _{DD}	-	V _{DD}	V
Low-Level Input Voltage	V _{IL}	0	-	0.3V _{DD}	V

Note: Test Condition: Set Display Control Commands = 80H (Display Turn OFF State & under no load)

ELECTRICAL CHARACTERISTICS

(Unless otherwise stated, V_{DD}=5V, GND=0V, Ta=25°C)

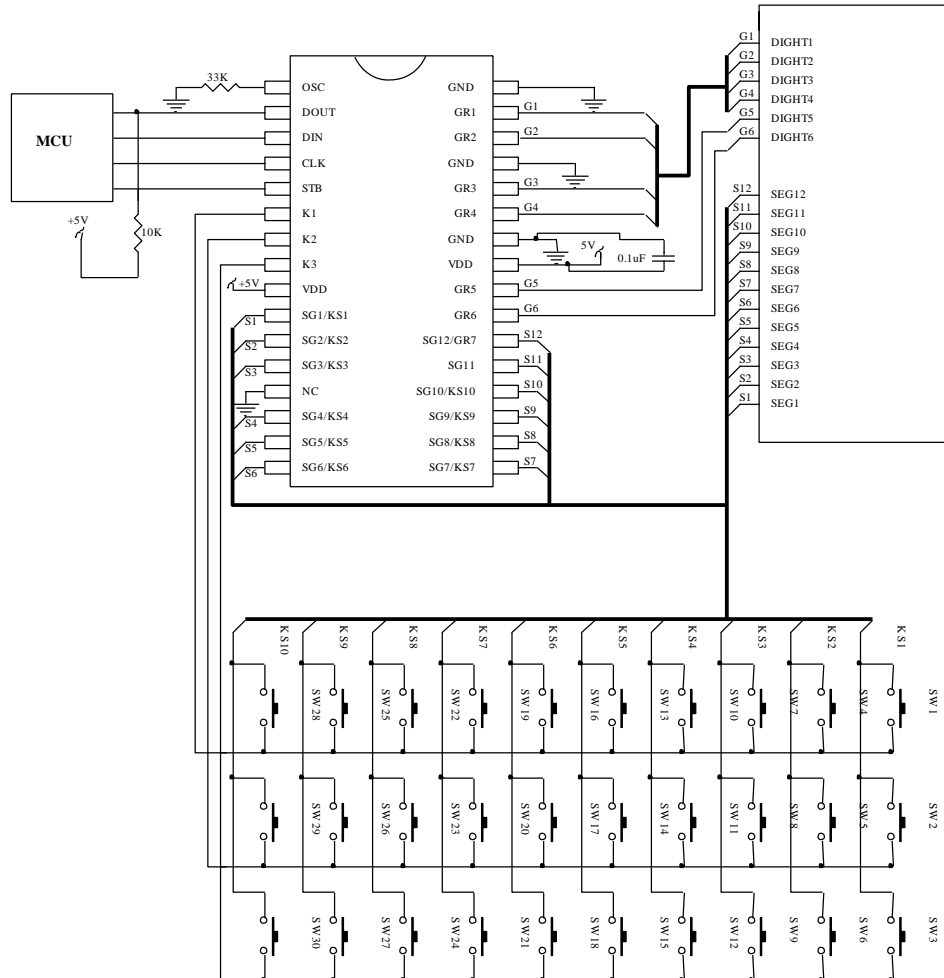
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
High-Level Output Current	IOHSG1	V _o =V _{DD} -2V SG1 to SG11, SG12/GR7	-20	-25	-40	mA
	IOHSG2	V _o =V _{DD} -3V SG1 to SG12, SG12/GR7	-25	-30	-50	mA
Low-Level Output Current	IOLGR	V _o =0.3V GR1 to GR6, SG12/GR7	100	140	-	mA
Low-Level Output Current	IOLDOUT	V _o =0.4V	4	-	-	mA
Segment High-Level Output Current Tolerance	ITOLSG	V _o =V _{DD} -3V SG1 to SG11, SG12/GR7	-	-	±5	mA
High-Level Input Voltage	VIH	-	0.8 V _{DD}	-	5	V
Low-Level Input Voltage	VIL	-	0	-	0.3V _{DD}	V
OSGillation Frequency	foSG	R=33 KOhms	350	500	650	KHz
K1 to K3 Pull Down Resistor	RKN	K1 to K3 V _{DD} =5V	40	-	100	KOhms



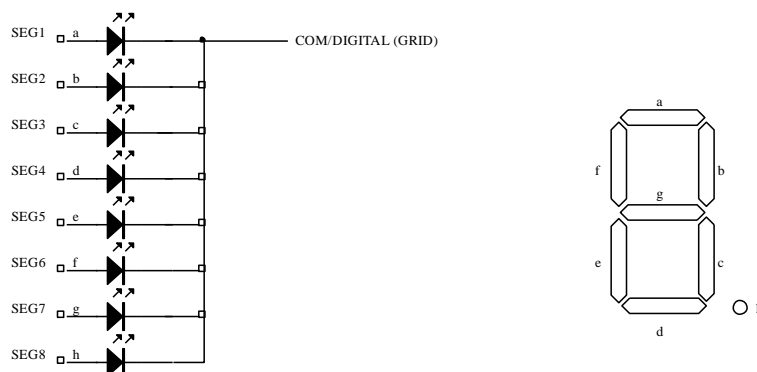
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APPLICATION CIRCUIT



COMMON CATHODE TYPE LED PANEL:



- Note: 1、 The capacitor (0.1uF) connected between the GND and the VDD pins must be located as close as possible to the DL8836 chip.
- 2、 It is strongly suggested that the NC Pin(pins 13) be connected to the GND.
- 3、 The DL8836 power supply is separate from the application system power supply.



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Pad Assignment (Chip size: 1380um x 1390um)

