



### GENERAL DESCRIPTION

SM16312 is a Vacuum Fluorescent Display (VFD) Controller driven on a 1/8 to 1/16 duty factor. Eleven segment output lines, 6 grid output lines, 5 segment/grid output drive lines, key scan, one display memory, IC control circuit are all incorporated in a single chip. It is pin to pin compatible with uPD16312(NEC). This SM16312 is ideal as a peripheral device of a single chip microcomputer.

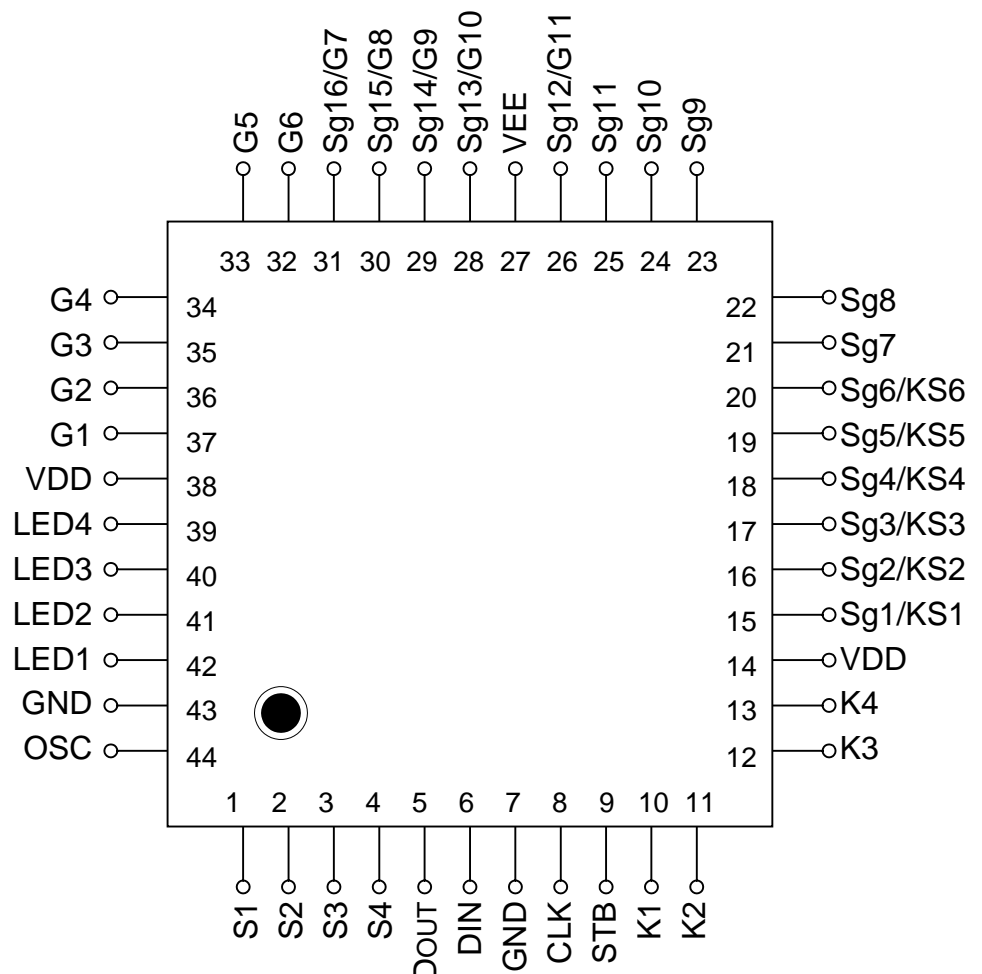
### FEATURES

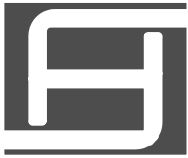
- \* Multiple Display Modes
- \* High Voltage Output
- \* Key Scanning
- \* General Purpose Input Ports (4 bit)
- \* Dimming Circuitry (8 segment)
- \* LED Display Ports(4 outs, 20mA max)
- \* No external Resistors Needed for Driver Outputs
- \* Serial Interface for controller

### APPLICATIONS

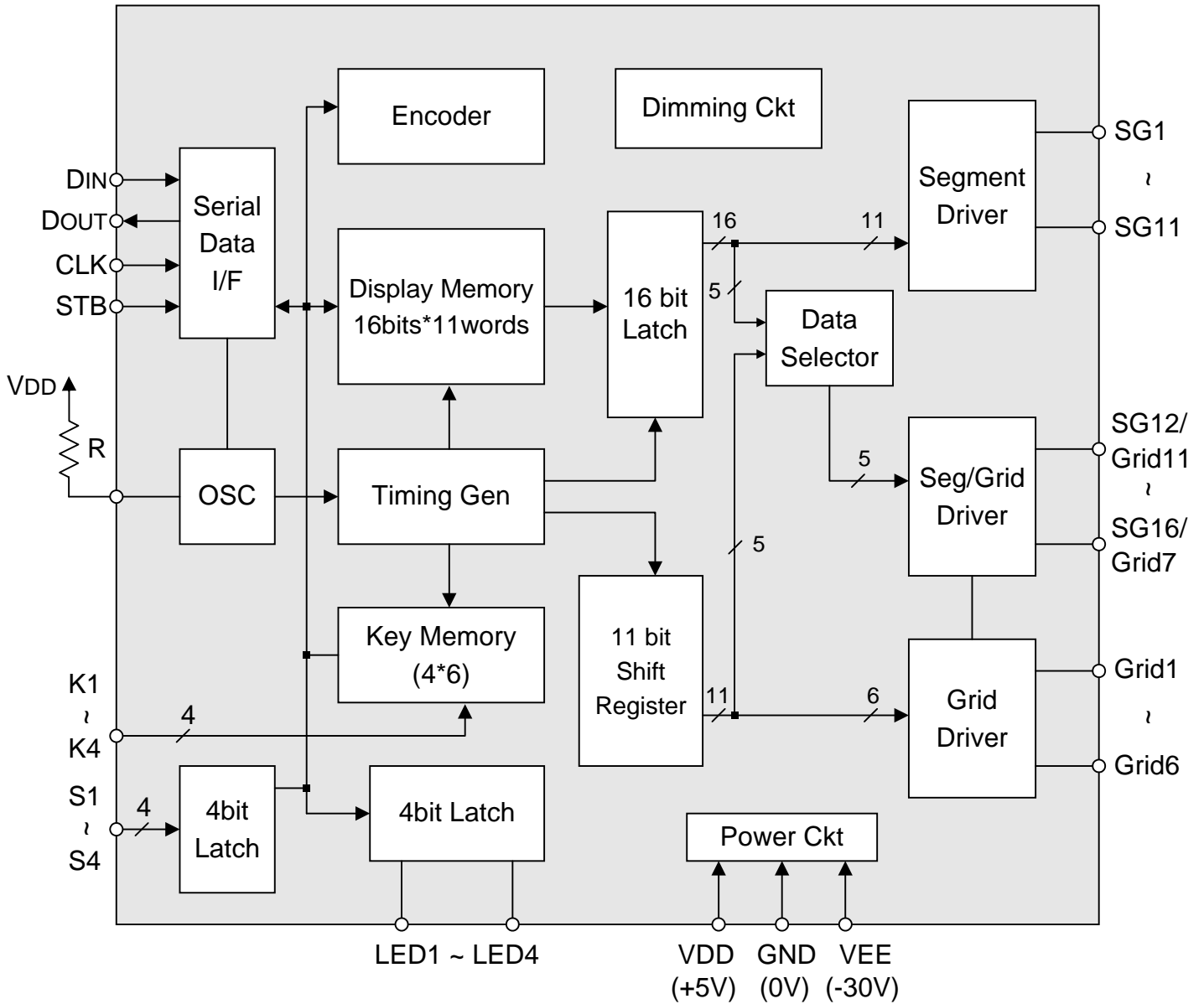
- \* Audio System
- \* Car Stereo
- \* VCD
- \* DVD
- \* VCR
- \* TV

### PIN ASSIGNMENT





**BLOCK DIAGRAM**





## PIN DESCRIPTION

Symbol	Pin Name	Pin No.	Function Description
S1 to S4	Switch Input	1 to 4	4 bit general-purpose input port.
Dout	Data Output	5	Outputs serial data at falling edge of shift clock, starting from lower bit.
Din	Data Input	6	Input serial data at rising edge of shift clock, starting from lower bit.
GND	Logic Ground	7, 43	Connect this pin to GND of system.
CLK	Clock Input	8	Reads serial data at rising edge, and outputs data at falling edge.
STB	Strobe	9	While STB is low, Data is valid; while STB is high, CLK is ignored.
K1 to K4	Key data input	10 to 13	Data input to these pins is latched at end of display cycle.
VDD	Logic Power	14, 38	5V±10%.
Sg1/KS1~Sg6/KS6	Segment/Key	15 to 20	Segment output pins (Dual function as key source).
Sg7~Sg11	Segment	21 to 25	Segment output pins
Sg12/G11~Sg16/G7	Segment/Grid	26,28 to 31	These pins are selectable for segment or grid output.
VEE	Pull Down Level	27	VDD-35V max.
G1~G6	Grid	32 to 37	Grid output pins
LED1~LED4	LED Output	39 to 42	CMOS output. +20 mA max.
OSC	Oscillator Pin	44	Connect resistor for determining oscillation frequency to this pin.



## ABSOLUTE MAXIMUM RATINGS

(Ta=25°C, GND=0V)

Parameter	Symbol	Rating	Unit
Logic Supply Voltage	VDD	-0.5 to +7	V
Driver Supply Voltage	VEE	VDD+0.5 to VDD-40	V
Logic Input Voltage	VI	-0.5 to VDD+0.5	V
VFD Driver Output Voltage	VO	VEE-0.5 to VDD+0.5	V
LED Driver Output Current	IOLED	+25	mA
VFD Driver Output Current	IOVFD	-40(grid) / -15(segment)	mA

## RECOMMENDED OPERATING CONDITIONS

(Ta=-20 to +70°C, GND=0V)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Logic Supply Voltage	VDD	4.5	5	5.5	V
High-Level Input Voltage	VIH	0.7 VDD		VDD	V
Low-Level Input Voltage	VIL	0		0.3 VDD	V
Driver Supply Voltage	VEE	0		VDD-35	V



## DC/AC ELECTRICAL CHARACTERISTIC

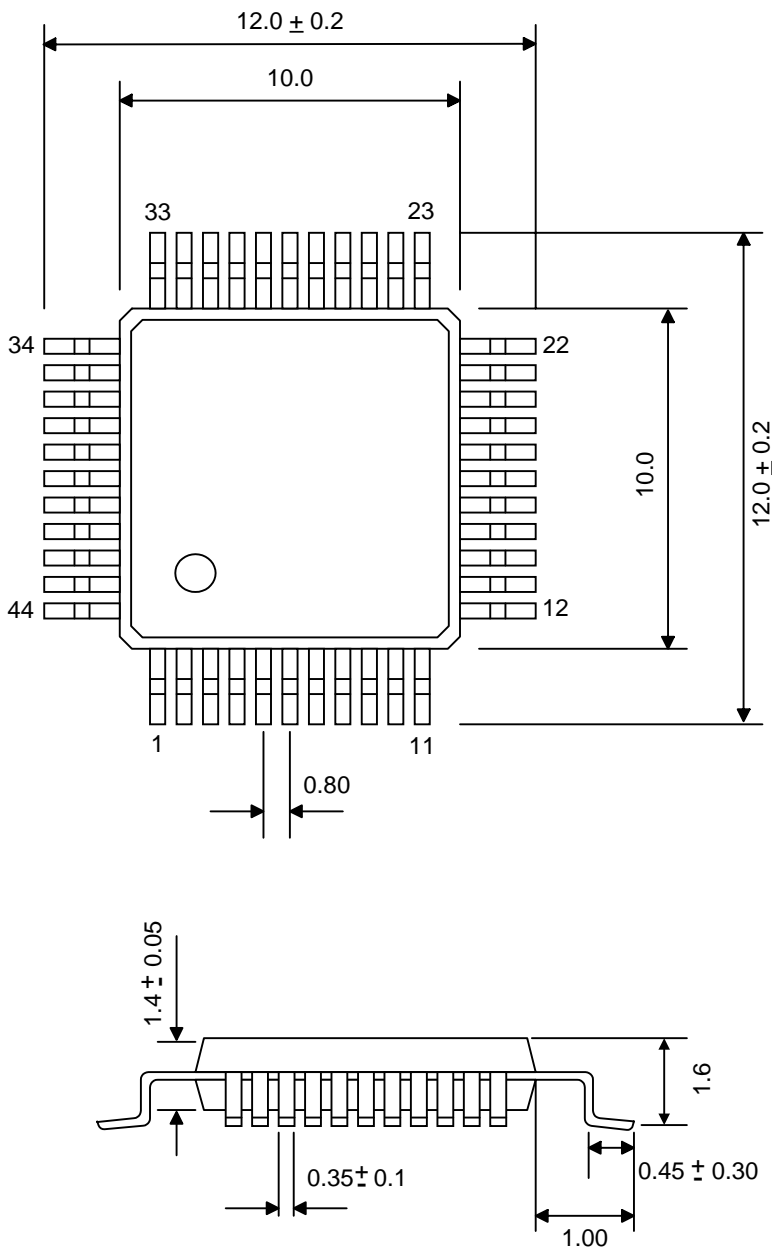
(VDD=5V, GND=0V, VEE=VDD-35V, TA=25°C, unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
High-Level Output Voltage	VOHLED	IOHLED=-1mA LED1 to LED4	0.9VDD			V
Low-Level Output Voltage	VOLLED	IOLLED=+20mA LED1 TO LED4			1	V
Low-Level Output Voltage	VOLDout	Dout, IOLDout=4mA			0.4	V
High-Level Output Current	IOHSg	Vo=VDD-2V Sg1 to Sg11	-3			mA
High-Level Output Current	VOHGr	Vo=VDD-2V G1 to G6 Sg12/G11 to Sg16/G7	-15			mA
High-Level Input Voltage	VIH		0.7VDD			V
Low-Level Input Voltage	VIL				0.3VDD	V
Oscillation Frequency	fosc	R=68K	350	350	650	KHz



**PACKAGE SPEC.**

44 PINS TQFP DIMENSION

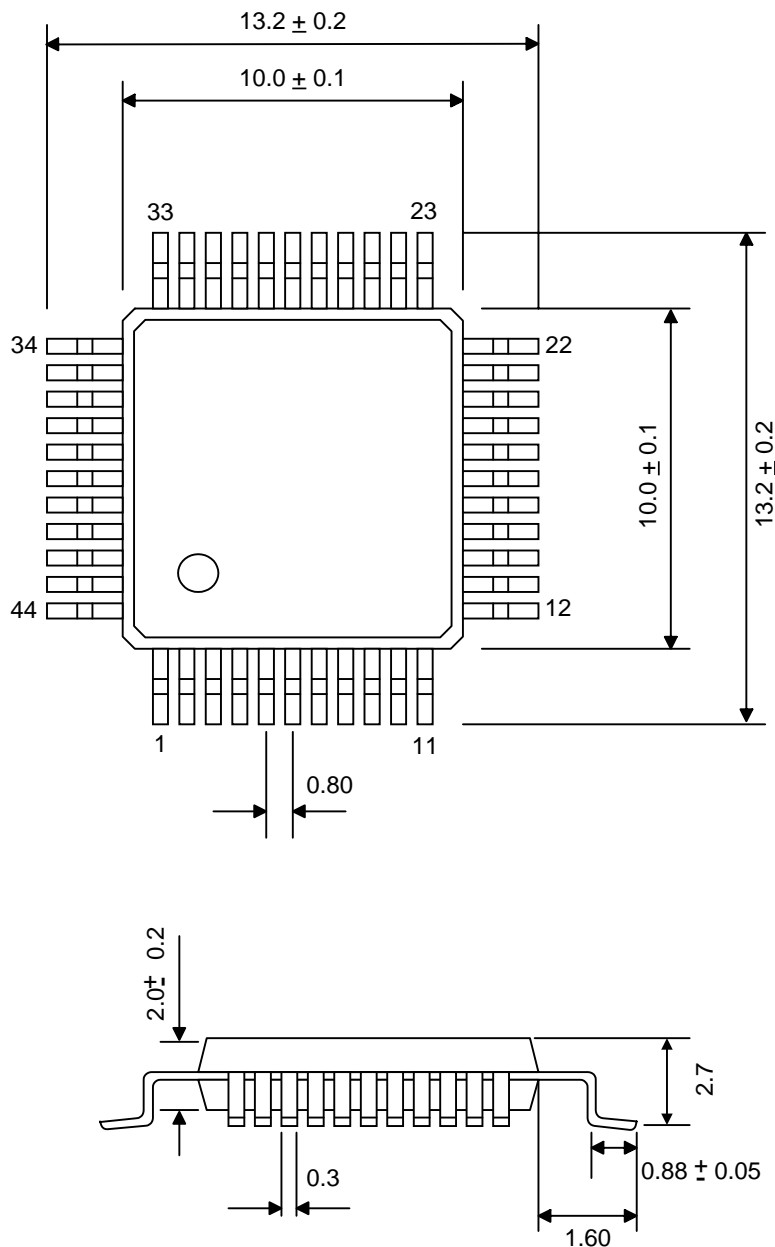


Note: Controlling dimensions are in millimeters (MM).



**PACKAGE SPEC.**

44 PINS QFP DIMENSION



Note: Controlling dimensions are in millimeters (MM).