

SED1230 Series

Dot Matrix LCD Controller Driver

- 12 Character × 4 Line (5 × 7 dot)
- Built-in Character Generator ROM and RAM
- Built-in Power Supply Circuit for LCD

■ DESCRIPTION

The SED1230 Series is a dot matrix LCD controller driver for character display, and can display a maximum of 48 characters, 4 user-defined characters, and a maximum of 64 symbols by means of 4-bit, 8-bit or serial data sent from a microcomputer.

A built-in character generator ROM is prepared for 256 character types, and each character font consists of 5 × 7 dots. A user-defined character RAM for four characters of 5 × 7 dots are incorporated, and a symbol register is also incorporated. With these, it is possible to apply this Series to display with a high degree of freedom. This Series can operate handy units with a minimum power consumption by means of its low power consumption and standby mode.

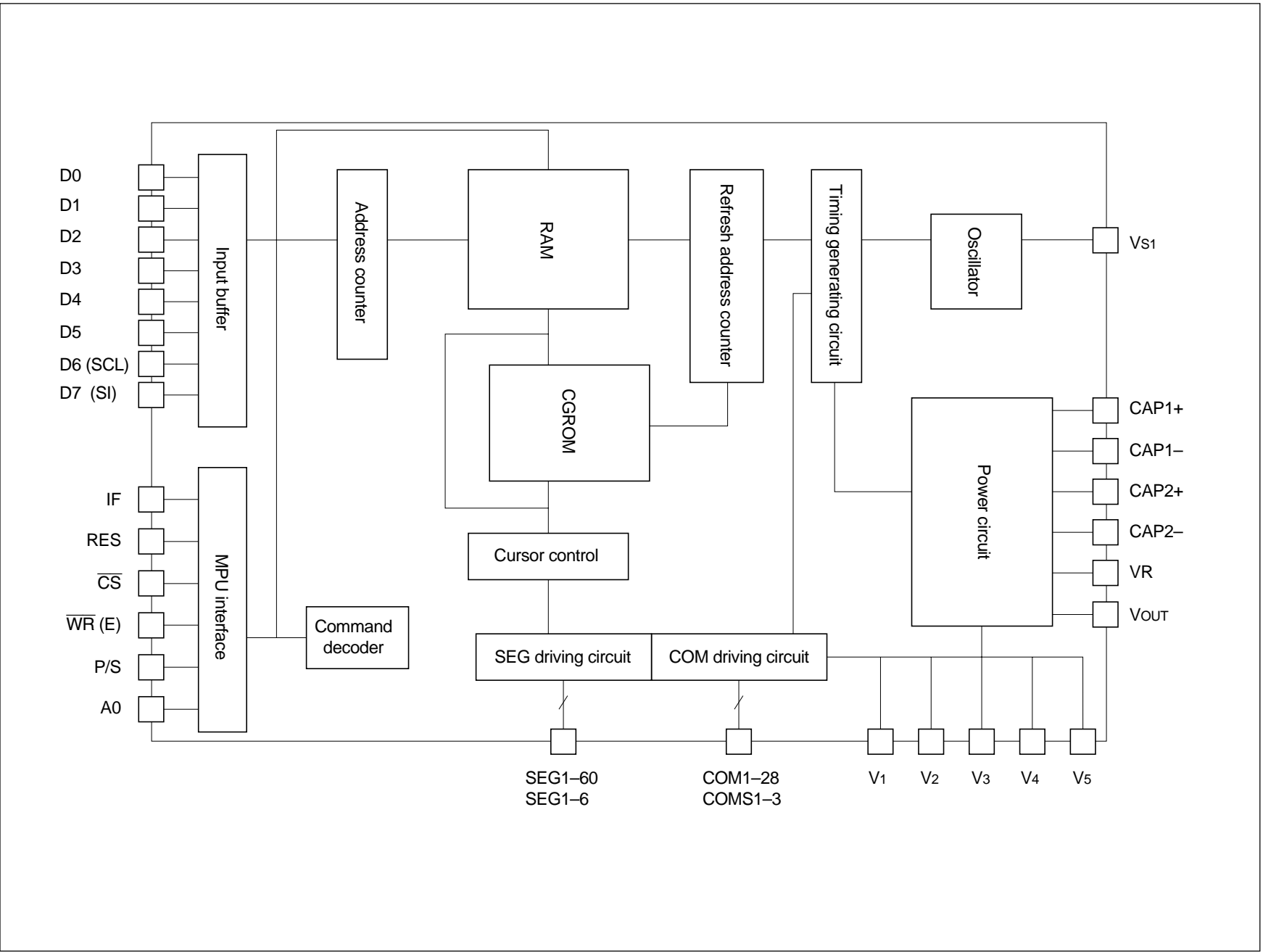
The SED1230 Series are classified into SED1230, SED1231, SED1232, and SED1233 depending on the duty of use and the number of display columns.

■ FEATURES

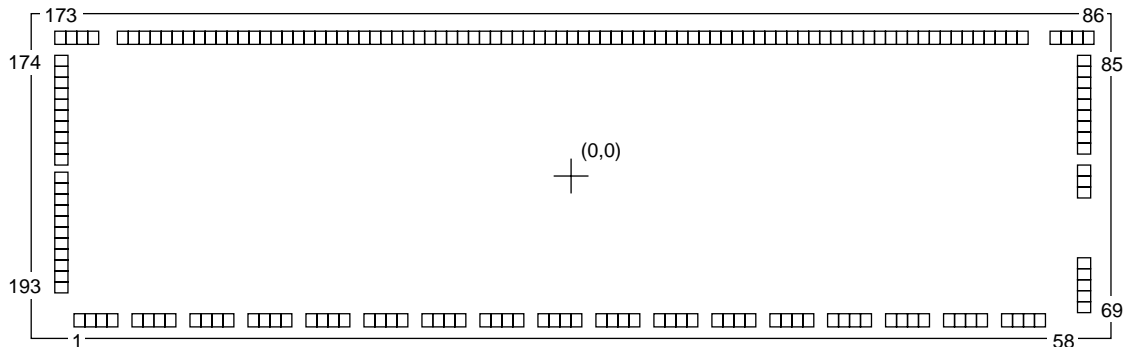
- Built-in display RAM
48 characters + 4 user-defined characters + 64 symbols
- CGROM (for up to 256 characters), CGRAM (4 characters), and symbol register (64 symbols)
- Number of display columns × number of lines
 (12 columns + 1 column for signal) × 4 lines + 52 symbols: SED1230
 (12 columns + 1 column for signal) × 3 lines + 52 symbols: SED1231
 (12 columns + 1 column for signal) × 2 lines + 52 symbols: SED1232
 16 columns × 2 lines + 64 symbols: SED1233
- CR oscillating circuit (incorporating C and R)
- High-speed MPU interface
Interfacing with both 68 series and 80 series MPU
Interfacing in 4 bits/8 bits
- Serial interface
- Character font 5 × 7 dots
- Duty ratio 1/16 (SED1232, SED1233)
1/23 (SED1231)
1/30 (SED1230)
- Simple command setting
- Built-in liquid crystal driving power circuit
Voltage boosting circuit, voltage regulating circuit, voltage follower × 4
- Built-in electronic volume function
- Low power consumption
100 μA Max. (In normal operation mode:
Including the operating current of the built-in power supply)
20 μA Max. (In standby display mode)
- Power supply
V_{DD} - V_{SS} (logic section): -2.4 V to -3.6 V
V_{DD} - V₅ (liquid crystal drive section): -5.0 V to -11.0 V (In the case of external power supply)
- Wide operating temperature range
T_a = -30 to 85°C
- CMOS process
- Package: Die form SED123*D*B, SED123*D*E (Au bump)
SED123*D*A, SED123*D*C (Al pad)
TCP SED123*T**
- This IC is not designed with a protection against radioactive rays.

SED1230 Series

■ BLOCK DIAGRAM



■ PAD SPECIFICATION



SED1230D** 1/30 duty 12 columns + 1 signal column
 SED1231D** 1/23 duty 12 columns + 1 signal column
 SED1232D** 1/16 duty 12 columns + 1 signal column
 SED1233D** 1/16 duty 16 columns

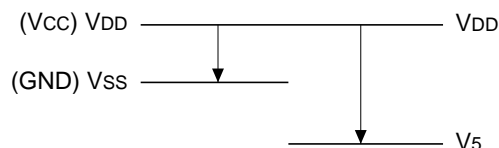
↑
#1 Column for CGROM pattern change

Chip size: 10.23 × 3.11 mm
 Pad pitch: 110 μm (Min.)
 Chip thickness: 625 ± 25 μm (SED123*D*A, SED123*D*B)
 525 ± 25 μm (SED123*D*C, SED123*D*E)

- 1) A1 pad specification (SED123*D*A)
 Pad size: A 86 μm × 135 μm
 B 135 μm × 86 μm
- 2) Au bump specification (SED123*D*B*)
 For reference:
 Bump sizeA 80 μm × 129 μm
 B 129 μm × 80 μm
 Bump height 22.5 μm ± 5.5 μm

■ ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Power supply voltage (1)	V _{SS}	-6.0 to +0.3	V
Power supply voltage (2)	V ₅	-16.0 to +0.3	V
Power supply voltage (3)	V ₁ , V ₂ , V ₃ , V ₄	V ₅ to +0.3	V
Input voltage	V _{IN}	V _{SS} -0.3 to +0.3	V
Output voltage	V _O	V _{SS} -0.3 to +0.3	V
Operating temperature	T _{opr}	-30 to +85	°C
Storage temperature	TCP	T _{str}	°C
	Bare chip		



- Notes:
1. All the voltage values are based on V_{DD} = 0 V.
 2. For voltages of V₁, V₂, V₃ and V₄, keep the condition of V_{DD} ≥ V₁ ≥ V₂ ≥ V₃ ≥ V₄ ≥ V₅ at all times.
 3. If the LSI is used exceeding the absolute maximum ratings, it may lead to permanent destruction.
 In ordinary operation, it is desirable to use the LSI in the condition of electrical characteristics. If the LSI is used out of this condition, it may cause a malfunction of the LSI and have a bad effect on the reliability of the LSI.

SED1230 Series

■ DC CHARACTERISTICS

(V_{DD} = 0 V, V_{SS} = -3.6 V to -2.4 V, T_a = -30 to 85°C unless otherwise specified.)

Characteristic		Symbol	Condition	Min.	Typ.	Max.	Unit	Applicable pin
Power supply voltage (1)	Recommended operation	V _{SS}		-3.6	-3.0	-2.4	V	V _{SS}
	Operable			-5.5	-3.0	-2.0		*1
Power supply voltage (2)	Recommended operation	V ₅		-11.0		-5.0	V	V ₅
	Operable			-11.0		-4.5		*2
	Operable	V ₁ , V ₂		0.6×V ₅		V _{DD}	V	V ₁ , V ₂
	Operable	V ₃ , V ₄		V _{DD}		0.8×V ₅	V	V ₃ , V ₄
High-level input voltage		V _{IHC}		0.2×V _{SS}		V _{DD}	V	*3
Low-level input voltage		V _{ILC}		V _{SS}		0.8×V _{SS}	V	*3
Input leakage current		I _{LI}	V _{IN} = V _{DD} or V _{SS}	-1.0		1.0	μA	*3
LC driver ON resistance		R _{ON}	T _a =25°C V ₅ =-7.0V ΔV=0.1V		20	40	KΩ	COM, SEG *4
Static current consumption		I _{DDQ}			0.1	5.0	μA	V _{DD}
Dynamic current consumption	I _{DD}	Display State	V ₅ = -7 V without load			100	μA	V _{DD} *5
		Standby state	Oscillation ON, Power OFF			20	μA	V _{DD} *6
		Sleep state	Oscillation OFF, Power OFF			5	μA	V _{DD}
		Access state	f _{cyc} =200KHz			500	μA	V _{DD} *7
Input pin capacity		C _{IN}	T _a =25°C f=1MHz		5.0	8.0	pF	*3
Reset time		t _R		1.0			μs	*8
Reset pulse width		t _{RW}		10			μs	*9
Built-in power supply	Input voltage	V _{SS}		-3.6		-2.4	V	*10
	Booster output voltage	V _{OUT}	Double boosting state	-7.2			V	V _{OUT}
			Triple boosting state	-10.8				
	Voltage follower operating voltage	V ₅		-11.0		-4.5	V	
	Reference voltage	V _{REG}	T _a = 25°C	-3.5	-3.1	-2.7	V	

*1: A wide operating voltage range is guaranteed but an abrupt voltage variation in the access status of the MPU is not guaranteed.


*2: The operating voltage range is applicable to the case where an external power supply is used.

*3: D0 - D5, D6 (SCL), D7 (SI), A0, RES, CS WR (E), P/S, IF

*4: This is a resistance value when a voltage of 0.1 V is applied between output pin SEG_n, SEG_S_n, COM_n or COM_S_n, and each power pin (V₁, V₂, V₃ or V₄). It is specified in the range of operating voltage (2).

$$R_{ON} = 0.1 \text{ V} / \Delta I$$

(ΔI: Current flowing when 0.1 V is applied between the power and output)

*5: Character “” display. This is applicable to the case where no access is made from the MPU and the built-in power circuit and oscillating circuit are in operation.

*6: This is applicable to the case where the built-in power circuit is OFF and the oscillating circuit is in operation in the standby mode.

*7: Current consumption when data is always written by f_{cyc}.

The current consumption in the access state is almost proportional to the access frequency (f_{cyc}).

When no access is made, only I_{DD} (I) occurs.

8: t_R (reset time) indicates the internal circuit reset completion time from the edge of the RES signal. Accordingly, the SED123 usually enters the operating state after t_R.

*9: The minimum pulse width of the RES signal is specified.

To cause a reset operation, it is necessary to input a pulse width exceeding t_{RW}.

*10: When operating the boosting circuit, the power supply V_{SS} must be used within the input voltage range.

■ CHARACTER FONT (JIS TYPE STANDARD)

● SED123*DA*

		Lower 4 Bit of Code															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Higher 4 Bit of Code	0																
	1																
	2																
	3																
	4																
	5																
	6																
	7																
	8																
	9																
	A																
	B																
	C																
	D																
	E																
	F																

SED1230 Series

● SED123*DB*

		Lower 4 Bit of Code															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Higher 4 Bit of Code	0	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]
	1	士	≡	∩	△	∇	∧	∨	∞	∞	∞	∞	∞	∞	∞	∞	∞
	2	[Grid]	!	"	#	\$	%	&	'	()	*	+	,	-	.	/
	3	0	1	2	3	4	5	6	7	8	9	*	+	<	=	>	?
	4	P	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	5	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	_	[
	6	^	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	7	P	Q	R	S	T	U	V	W	X	Y	Z	[\]	_	^
	8	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	9	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	A	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	B	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]
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● SED123*DG*

		Lower 4 Bit of Code															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Higher 4 Bit of Code	0	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]	[Grid]
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First issue February, 1999
Printed in February, 2000 Japan Ⓟ