EPSON

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

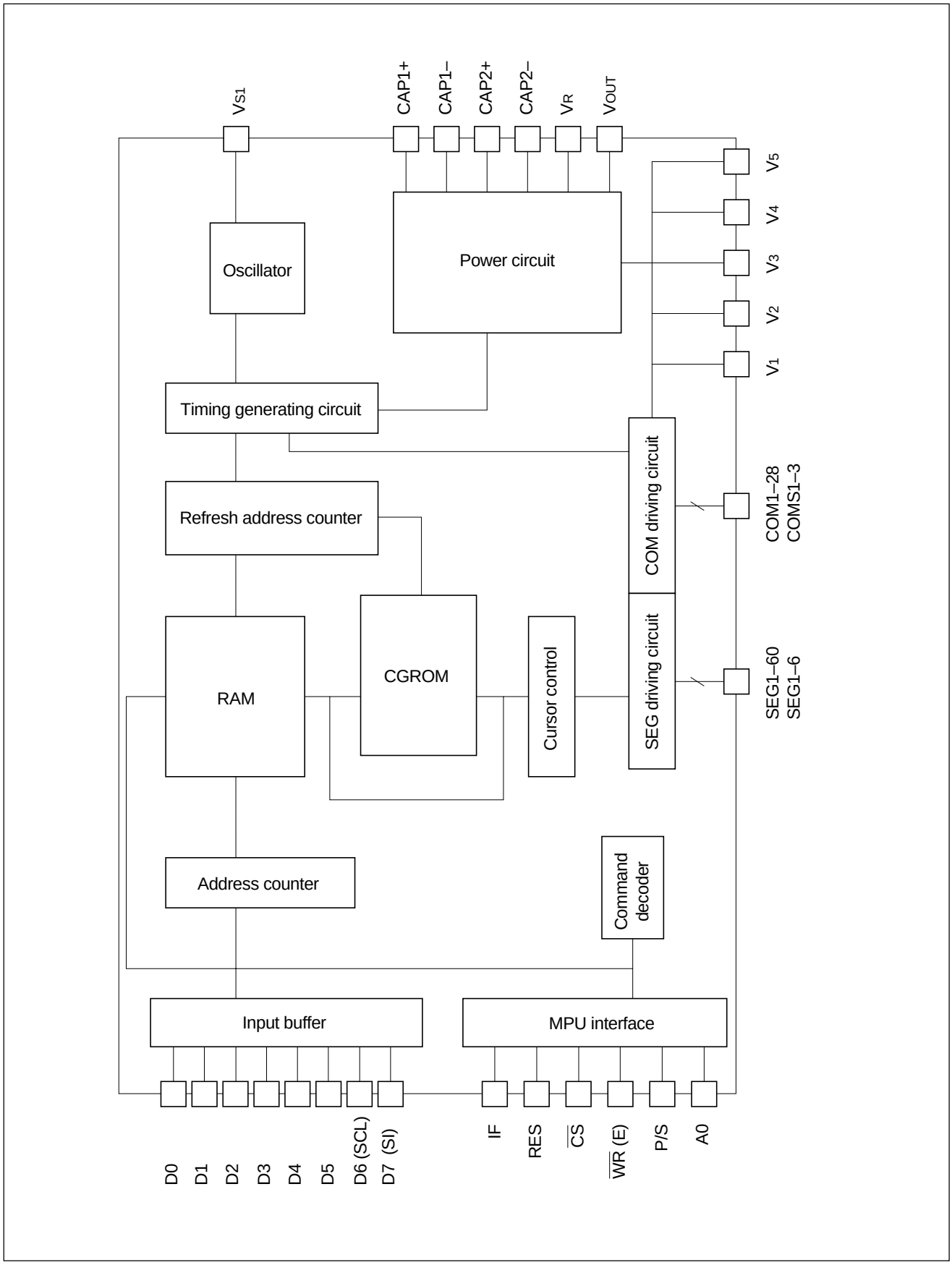
■ DESCRIPTION

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.

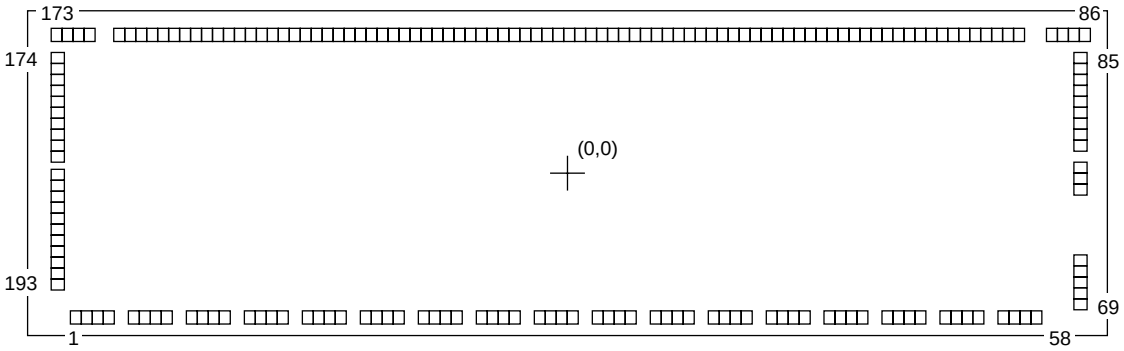
■ FEATURES

- 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} - V_5 (liquid crystal drive section): –5.0 V to –11.0 V (In the case of external power supply)
- Wide operating temperature range
  Ta = -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.

■ BLOCK DIAGRAM



■ PAD SPECIFICATION



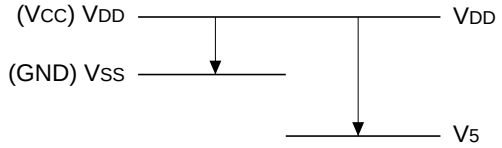
SED1230D** 1/30 duty 12 columns + 1 signal column
SED1231D** 1/23 duty 12 columns + 1 signal column
SED1232D** 1/16 duty 12 columns + 1 signal column
SED1233D** 1/16 duty 16 columns
↑
#1 Column for CGROM pattern change

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 size A 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}	–55 to +100	°C
	Bare chip		–75 to +125	



Notes: 1. All the voltage values are based on V_{DD} = 0 V.
2. For voltages of V_1, V_2, V_3 and V_4, keep the condition of $V_{DD} \geq V_1 \geq V_2 \geq V_3 \geq V_4 \geq V_5$ 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.

■ DC CHARACTERISTICS

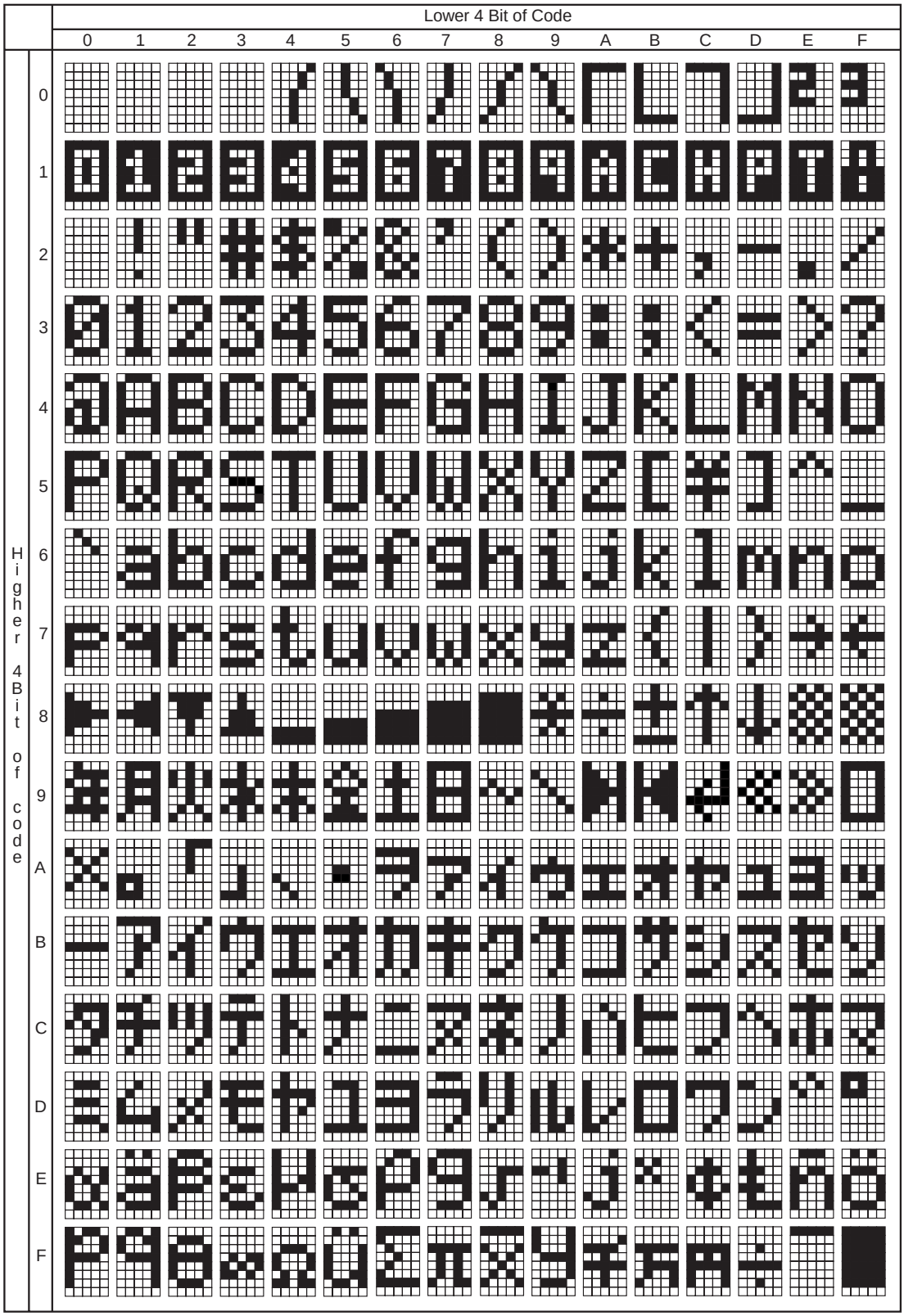
(V_{DD} = 0 V, V_{SS} = –3.6 V to –2.4 V, Ta = –30 to 85°C unless otherwise specified.)

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}	Ta=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}	Ta=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}	Ta = 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, $\overline{CS}$, $\overline{WR}$ (E), P/S, IF
*4: This is a resistance value when a voltage of 0.1 V is applied between output pin SEGn, SEGSn, COMn or COMSn, and each power pin (V_1, V_2, V_3 or V_4). It is specified in the range of operating voltage (2).
RON = 0.1 V / ΔI
(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 fcyc.
The current consumption in the access state is almost proportional to the access frequency (fcyc).
When no access is made, only IDD (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.

■ CHARACTOR FONT (JIS TYPE STANDARD)

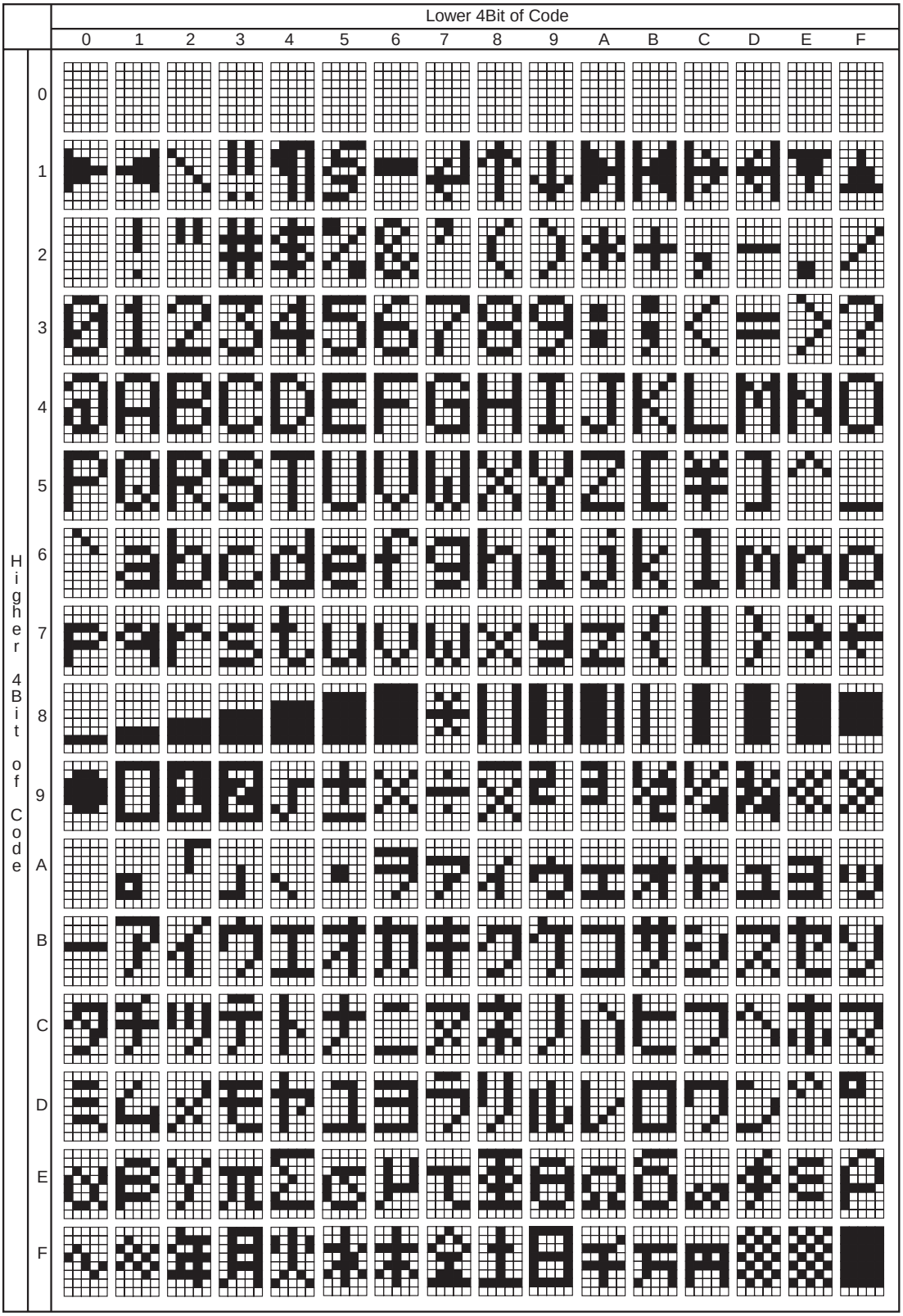
● SED123*DA*



● **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 1 2 3 4 5 6 7 8 9 A B C D E F

● **SED123*D$_{G}$***


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

NOTICE

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