# Dot Matrix High Duty LCD Driver 

\author{

- 80 Output Segment Driver <br> - Built-in Display RAM $80 \times 200$ bits <br> - Self-refresh Function
}


## DESCRIPTION

The SED1570 is an 80 output segment (column) driver with an internal display RAM. This drive is suitable for driving a dot matrix LCD panel; from a mid-range capacity dot matrix LCD panel to a CGA class dot matrix LCD panel. This device is used with the SED1635.
The display data is stored in the internal display RAM and an LCD panel drive signal is generated. As a result, this device allows configuration of an ultra low power display system since the display data is not transferred unless the display is changed.
In addition, the logic power is low voltage; a wide range of applications is possible.

## FEATURES

- Display duty cycle: 1/64-1/200
- LCD driver output: 80 out
- Internal display RAM: $200 \times 80$ bits
- Slim chip
- Ultra low power consumption
- Power VDD - Vss 2.7 V to 5.5 V

Vdd - Vee 8.0 V to 20 V

- High speed and low power date transfer by the 4-bit bus enables chain method
- Non-bias display off function
- Output shift direction-pin selection
- Adjustable LCD power offset bias for VDd level
- Package: Die form SED1570DoA (Al pad)

SED1570Dob (Au bump)
PAD DIMENSIONS


## SED1570D0A

## PAD COORDINATES

SED1570 Pad Center Coordinates (AI-pad)

| $\begin{aligned} & \text { PAD } \\ & \text { No } \end{aligned}$ | PIN <br> Name | X | Y | $\begin{aligned} & \text { PAD } \\ & \text { No } \end{aligned}$ | PIN <br> Name | X | Y |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | $\times 75$ | 3640 | 1595 | 41 | X 16 | -3862 | -78 |
| 2 | $\times 76$ | 3432 |  | 42 | X 17 |  | -248 |
| 3 | $\times 77$ | 3224 |  | 43 | X 18 |  | -418 |
| 4 | $\times 78$ | 3016 |  | 44 | X 19 |  | -588 |
| 5 | $\times 79$ | 2808 |  | 45 | X 20 |  | -758 |
| 6 | X 80 | 2600 |  | 46 | X 21 |  | -928 |
| 7 | ElO2 | 2340 |  | 47 | X 22 |  | -1098 |
| 8 | Vdd | 2080 |  | 48 | $\times 23$ |  | -1268 |
| 9 | SHL | 1820 |  | 49 | $\times 24$ | $\dagger$ | -1438 |
| 10 | Do | 1560 |  | 50 | $\times 25$ | -3641 | -1595 |
| 11 | D1 | 1300 |  | 51 | $\times 26$ | -3406 |  |
| 12 | D2 | 1040 |  | 52 | $\times 27$ | -3171 |  |
| 13 | D3 | 780 |  | 53 | $\times 28$ | -2936 |  |
| 14 | YD | 520 |  | 54 | X 29 | -2701 |  |
| 15 | Vee | 260 |  | 55 | X 30 | -2466 |  |
| 16 | V5 | 0 |  | 56 | X 31 | -2231 |  |
| 17 | V3 | -260 |  | 57 | X 32 | -1996 |  |
| 18 | V2 | -520 |  | 58 | $\times 33$ | -1761 |  |
| 19 | Vo | -780 |  | 59 | $\times 34$ | -1526 |  |
| 20 | FR | -1040 |  | 60 | $\times 35$ | -1291 |  |
| 21 | XSCL | -1300 |  | 61 | $\times 36$ | -1056 |  |
| 22 | $\overline{\text { DOFF }}$ | -1560 |  | 62 | $\times 37$ | -821 |  |
| 23 | LP | -1820 |  | 63 | $\times 38$ | -586 |  |
| 24 | Vss | -2080 |  | 64 | X 39 | -351 |  |
| 25 | ElO1 | -2340 |  | 65 | X 40 | -116 |  |
| 26 | X 1 | -2600 |  | 66 | X 41 | 119 |  |
| 27 | X 2 | -2808 |  | 67 | X 42 | 354 |  |
| 28 | X 3 | -3016 |  | 68 | X 43 | 589 |  |
| 29 | $\times 4$ | -3224 |  | 69 | $\times 44$ | 824 |  |
| 30 | $\times 5$ | -3432 |  | 70 | X 45 | 1059 |  |
| 31 | $\times 6$ | -3640 | $\dagger$ | 71 | X 46 | 1294 |  |
| 32 | $\times 7$ | -3862 | 1452 | 72 | X 47 | 1530 |  |
| 33 | X 8 |  | 1282 | 73 | X 48 | 1765 |  |
| 34 | X 9 |  | 1112 | 74 | X 49 | 2000 |  |
| 35 | X 10 |  | 942 | 75 | $\times 50$ | 2235 |  |
| 36 | X 11 |  | 772 | 76 | $\times 51$ | 2470 |  |
| 37 | X 12 |  | 602 | 77 | $\times 52$ | 2705 |  |
| 38 | X 13 |  | 432 | 78 | $\times 53$ | 2940 |  |
| 39 | $\times 14$ |  | 262 | 79 | $\times 54$ | 3175 |  |
| 40 | X 15 | $\dagger$ | 92 | 80 | X 55 | 3410 | $\dagger$ |


| $\begin{aligned} & \text { PAD } \\ & \text { No } \end{aligned}$ | PIN <br> Name | X | Y |
| :---: | :---: | :---: | :---: |
| 81 | X 56 | 3645 | -1595 |
| 82 | $\times 57$ | 3862 | -1438 |
| 83 | X 58 |  | -1268 |
| 84 | X 59 |  | -1098 |
| 85 | X 60 |  | -928 |
| 86 | X 61 |  | -758 |
| 87 | X 62 |  | -588 |
| 88 | X 63 |  | -418 |
| 89 | X 64 |  | -248 |
| 90 | X 65 |  | -78 |
| 91 | X 66 |  | 92 |
| 92 | X 67 |  | 262 |
| 93 | X 68 |  | 432 |
| 94 | X 69 |  | 602 |
| 95 | $\times 70$ |  | 772 |
| 96 | $\times 71$ |  | 942 |
| 97 | $\times 72$ |  | 1112 |
| 98 | $\times 73$ |  | 1282 |
| 99 | $\times 74$ | $\nabla$ | 1452 |

(Au-bump)

| $\begin{aligned} & \text { PAD } \\ & \text { No } \end{aligned}$ | PIN Name | X | Y |
| :---: | :---: | :---: | :---: |
| 1 | $\times 75$ | 3640 | 1601 |
| 2 | $\times 76$ | 3432 |  |
| 3 | $\times 77$ | 3224 |  |
| 4 | $\times 78$ | 3016 |  |
| 5 | $\times 79$ | 2808 |  |
| 6 | X 80 | 2600 |  |
| 7 | EIO2 | 2340 |  |
| 8 | VDD | 2080 |  |
| 9 | SHL | 1820 |  |
| 10 | Do | 1560 |  |
| 11 | D1 | 1300 |  |
| 12 | D2 | 1040 |  |
| 13 | D3 | 780 |  |
| 14 | YD | 520 |  |
| 15 | Vee | 260 |  |
| 16 | V5 | 0 |  |
| 17 | $V_{3}$ | -260 |  |
| 18 | V2 | -520 |  |
| 19 | Vo | -780 |  |
| 20 | FR | -1040 |  |
| 21 | XSCL | -1300 |  |
| 22 | $\overline{\text { DOFF }}$ | -1560 |  |
| 23 | LP | -1820 |  |
| 24 | Vss | -2080 |  |
| 25 | EIO1 | -2340 |  |
| 26 | X1 | -2600 |  |
| 27 | X 2 | -2808 |  |
| 28 | X 3 | -3016 |  |
| 29 | $\times 4$ | -3224 |  |
| 30 | $\times 5$ | -3432 |  |
| 31 | $\times 6$ | -3640 | $\dagger$ |
| 32 | $\times 7$ | -3868 | 1452 |
| 33 | X 8 |  | 1282 |
| 34 | X 9 |  | 1112 |
| 35 | X 10 |  | 942 |
| 36 | X 11 |  | 772 |
| 37 | X 12 |  | 602 |
| 38 | X 13 |  | 432 |
| 39 | X 14 |  | 262 |
| 40 | X 15 | $\nabla$ | 92 |


| $\begin{aligned} & \text { PAD } \\ & \text { No } \end{aligned}$ | PIN Name | X | Y |
| :---: | :---: | :---: | :---: |
| 41 | X 16 | -3868 | -78 |
| 42 | X 17 |  | -248 |
| 43 | X 18 |  | -418 |
| 44 | X 19 |  | -588 |
| 45 | X 20 |  | -758 |
| 46 | X 21 |  | -928 |
| 47 | X 22 |  | -1098 |
| 48 | $\times 23$ |  | -1268 |
| 49 | $\times 24$ | $\dagger$ | -1438 |
| 50 | X 25 | -3641 | -1601 |
| 51 | $\times 26$ | -3406 |  |
| 52 | X 27 | -3171 |  |
| 53 | X 28 | -2936 |  |
| 54 | X 29 | -2701 |  |
| 55 | X 30 | -2466 |  |
| 56 | X 31 | -2231 |  |
| 57 | X 32 | -1996 |  |
| 58 | X 33 | -1761 |  |
| 59 | $\times 34$ | -1526 |  |
| 60 | X 35 | -1291 |  |
| 61 | $\times 36$ | -1056 |  |
| 62 | X 37 | -821 |  |
| 63 | $\times 38$ | -586 |  |
| 64 | X 39 | -351 |  |
| 65 | $\times 40$ | -116 |  |
| 66 | $\times 41$ | 119 |  |
| 67 | X 42 | 354 |  |
| 68 | X 43 | 589 |  |
| 69 | $\times 44$ | 824 |  |
| 70 | X 45 | 1059 |  |
| 71 | X 46 | 1294 |  |
| 72 | X 47 | 1530 |  |
| 73 | X 48 | 1765 |  |
| 74 | X 49 | 2000 |  |
| 75 | $\times 50$ | 2235 |  |
| 76 | $\times 51$ | 2470 |  |
| 77 | X 52 | 2705 |  |
| 78 | X 53 | 2940 |  |
| 79 | $\times 54$ | 3175 |  |
| 80 | $\times 55$ | 3410 | V |

Unit: $\mu \mathrm{m}$

| $\begin{aligned} & \hline \text { PAD } \\ & \text { No } \end{aligned}$ | PIN Name | X | Y |
| :---: | :---: | :---: | :---: |
| 81 | $\times 56$ | 3645 | -1601 |
| 82 | X 57 | 3868 | -1438 |
| 83 | $\times 58$ |  | -1268 |
| 84 | X 59 |  | -1098 |
| 85 | X 60 |  | -928 |
| 86 | X61 |  | -758 |
| 87 | X 62 |  | -588 |
| 88 | $\times 63$ |  | -418 |
| 89 | X64 |  | -248 |
| 90 | X 65 |  | -78 |
| 91 | X66 |  | 92 |
| 92 | X 67 |  | 262 |
| 93 | X 68 |  | 432 |
| 94 | X69 |  | 602 |
| 95 | $\times 70$ |  | 772 |
| 96 | $\times 71$ |  | 942 |
| 97 | $\times 72$ |  | 1112 |
| 98 | $\times 73$ |  | 1282 |
| 99 | $\times 74$ | V | 1452 |

## SED1570D0A

BLOCK DIAGRAM


## - ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
| :---: | :---: | :---: | :---: |
| Supply voltage 1 | Vss | -7.0 to +0.3 | V |
| Supply voltage 2 | Vee | -22.0 to +0.3 | V |
| Supply voltage 3 | V0, V2, V3, V5 | Vee -0.3 to Vdd +0.3 | V |
| Input voltage | VI | Vss -0.3 to VdD +0.3 | V |
| Output voltage | Vo | Vss -0.3 to VdD +0.3 | V |
| EIO output current | 101 | 20 | mA |
| Operating temperature | Topr | -40 to +85 | ${ }^{\circ} \mathrm{C}$ |
| Storage temperature 1 | Tstg1 | -65 to +150 | ${ }^{\circ} \mathrm{C}$ |
| Storage temperature 2 | Tstg2 | -55 to +100 | ${ }^{\circ} \mathrm{C}$ |

Notes: 1. All voltages are given relative to VDD $=0 \mathrm{~V}$.
2. For storage temperature 1 - Plastic package

For storage temperature 2 - TAB mounted
3. $\mathrm{V}_{0}, \mathrm{~V}_{2}, \mathrm{~V}_{3}$, and $\mathrm{V}_{5}$ must satisfy the condition
$V_{D D} \geq V_{0} \geq V_{2} \geq V_{3} \geq V_{5} \geq V_{E E}$

4. If the logic power is being floated or if the Vss voltage exceeds -2.5 Vdc during LCD power-on, the LSI chips may be damaged permanently. Take care not to damage the chips especially in the system power on/off sequence.

## SED1570D0A

## ELECTRICAL CHARACTERISTICS

- DC Characteristics
$\left(\mathrm{VDD}=\mathrm{V} 0=0 \mathrm{~V}, \mathrm{Vss}=-5.0 \mathrm{~V} \pm 10 \%, \mathrm{Ta}=-40\right.$ to $85^{\circ} \mathrm{C}$ )

| Characteristic |  | Symbol |  | dition | Min. | Typ. | Max. | Unit | Pin |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Supply voltage (1) |  | Vss |  |  | -5.5 | -5.0 | -2.7 | V | Vss |
| Recommended operation voltage |  | Vee | Vss $=-2.7$ | -5.5V | -20.0 |  | -8.0 | V | Vee |
| Supply voltage (2) |  | Vo | Recommen | d value | VDD -2.5 |  | VDD | V | Vo |
| Supply voltage (3) |  | $\mathrm{V}_{2}$ | Recommen | d value | 2/9 Vee |  |  | V | $\mathrm{V}_{2}$ |
| Supply voltage (4) |  | V3 | Recommen | d value |  |  | 7/9 Vee | V | V3 |
| Supply voltage (5) |  | $\mathrm{V}_{5}$ | Recommen | d value | Vee |  | VEE +2.5 | V | V5 |
| Input high voltage |  | VIH | $\mathrm{Vss}=-2.7$ to -5.5 V |  | $0.2 \cdot \mathrm{Vss}$ |  |  | V | EIO1, EIO2, |
| Input low voltage |  | VIL |  |  |  |  | $0.8 \cdot \mathrm{Vss}$ | V | FR, D0 to D3, YD, LP, SHL, DOFF, XSCL |
| Output high voltage |  | VOH | $\mathrm{VSS}=-2.7$ | $\mathrm{IOH}=-0.6 \mathrm{~mA}$ | VDD -0.4 |  |  | V | ElO1, ElO2 |
| Output low voltage |  | Vol | to -5.5V | $\mathrm{IOL}=0.6 \mathrm{~mA}$ |  |  | VDD +0.4 | V |  |
| Input leakage current |  | ILI | $\mathrm{Vss} \leq \mathrm{VIN} \leq$ |  |  |  | 2.0 | $\mu \mathrm{A}$ | $\begin{aligned} & \text { Do to D3, LP, } \\ & \text { FR, YD, XSCL, } \\ & \text { SHL, } \overline{\text { DOFF }} \\ & \hline \end{aligned}$ |
| I/O leakage current |  | ILI/O | $\mathrm{Vss} \leq \mathrm{VIN} \leq$ |  |  |  | 5.0 | $\mu \mathrm{A}$ | ElO1, EIO2 |
| Static current |  | Iss | $\begin{aligned} & \mathrm{V}_{5}=-20.0 \\ & \mathrm{~V}_{\mathrm{H}}=\mathrm{VDD}, \end{aligned}$ | $\begin{aligned} & -10.0 \mathrm{~V} \\ & =\mathrm{Vss} \end{aligned}$ |  |  | 25 | $\mu \mathrm{A}$ | Vss |
| On resistance |  | Rseg | $\begin{aligned} & \Delta V O N=0.5 \\ & V_{3}=7 / 9 \cdot V_{E} \\ & V_{E E}=V_{5}= \end{aligned}$ | $\begin{aligned} & \mathrm{V}_{0}=\mathrm{VDD}, \\ & \mathrm{~V}_{2}=2 / 9 \cdot \mathrm{VEE}^{2} \\ & 4.0 \mathrm{~V} \\ & \hline \end{aligned}$ |  | 1.0 | 1.4 | $\mathrm{K} \Omega$ | X1 to X80 |
| Average current consump tion (1) | Data transfer mode | IDDT | $\begin{aligned} & \mathrm{VSS}=-5.0 \\ & \mathrm{VIL}=\mathrm{VSS}, \mathrm{f} \\ & \mathrm{fLP}=14 \mathrm{kH} \\ & \text { Checkered } \\ & \text { non-burden } \\ & \mathrm{VDD}=\mathrm{V}_{0}= \\ & \mathrm{V}_{3}=-16 \mathrm{~V}, \end{aligned}$ | $\begin{aligned} & \mathrm{VIH}=\mathrm{VDD} \\ & \mathrm{~L}=4.0 \mathrm{MHz} \\ & \mathrm{FR}=70 \mathrm{~Hz} \end{aligned}$ <br> tern, $\begin{aligned} & V_{2}=-4 \mathrm{~V} \\ & E=V_{5}=-20 \mathrm{~V} \end{aligned}$ |  | 0.3 | 0.8 | mA | VDD |
|  | Selfrefresh mode | IDDS | $\mathrm{fxSCL}=0 \mathrm{H}$ <br> Another pla IDDT item | Vss is same as |  | 70 | 200 | $\mu \mathrm{A}$ |  |
| Average current consumption (2) |  | Iee | $\begin{aligned} & \mathrm{VSS}=-5.0 \\ & \mathrm{~V} 2=-4 \mathrm{~V}, \\ & \mathrm{IEE}=\mathrm{V}_{5}=- \end{aligned}$ <br> Another pla IDDT item | $\begin{aligned} & \mathrm{V}_{0}=0.0 \mathrm{~V} \\ & =-16 \mathrm{~V} \\ & .0 \mathrm{~V} \end{aligned}$ <br> is same as |  | 25 | 70 | $\mu \mathrm{A}$ | Vee |
| Input capacitance |  | Cl | $\text { Freq. }=1 \mathrm{MHz}, \mathrm{Ta}=25^{\circ} \mathrm{C}$ <br> Simple substance of CHIP |  |  |  | 8 | pF | $\begin{aligned} & \text { Do to D3, LP, } \\ & \text { FR, YD, XSCL, } \\ & \text { SHL, DOFF } \end{aligned}$ |
| I/O capacitance |  | CI/o |  |  |  |  | 15 | pF | ElO1, ElO2 |

## LCD PANLE CONNECTION EXAMPLE



NOTICE:
No part of this material may be reproduced or duplicated in any form or by any means without the written permission of Seiko Epson. Seiko Epson reserves the right to make changes to this material without notice. Seiko Epson does not assume any liability of any kind arising out of any inaccuracies contained in this material or due to its application or use in any product or circuit and, further, there is no representation that this material is applicable to products requiring high level reliability, such as, medical products. Morever, no license to any intellectual property rights is granted by implication or otherwise, and there is no representation or warranty that anything made in accordance with this material will be free from any patent or copyright infringement of a third party. This material or portions thereof may contain technology or the subject relating to strategic products under the control of the Foreign Exchange and Foreign Trade Control Law of Japan and may require an export license from the Ministry of International Trade and Industry or other approval from another government agency.

IBM is registered trademark of International Business Machines Corporation, U.S.A.
© Seiko Epson Corporation 1994 All right reserved.

## SEIKO EPSON CORPORATION

DEVICE MARKETING DEPARTMENT

## IC Marketing \& Engineering Group

421-8 Hino, Hino-shi, Tokyo 191, JAPAN
Phone: 0425-87-5816 FAX: 0425-87-5624
International Marketing Department I (Europe, U.S.A.)
421-8 Hino, Hino-shi, Tokyo 191, JAPAN
Phone: 0425-87-5812 FAX: 0425-87-5564
International Marketing Department II (ASIA)
421-8 Hino, Hino-shi, Tokyo 191, JAPAN
First issue December, 1994 (S)
Phone: 0425-87-5814 FAX: 0425-87-5110

