

AS1119

144-LED Cross-Plexing Driver with 320mA Charge-Pump

1 General Description

The AS1119 is a compact LED driver for 144 (90) single LEDs. The devices can be programmed via an I²C compatible interface.

The AS1119 offers two blocks driving each 72 LEDs (3 blocks each 30LEDs) with 1/9 (1/6) cycle rate. The required lines to drive all 144 (90) LEDs are reduced to 18 by using the cross-plexing feature optimizing space on the PCB. Every block driving 72(30) LEDs can be analog dimmed from 1 to 30mA in 256 steps (8 bit).

Additionally each of the 144 (90) LEDs can be dimmed individually with 8-bit allowing 256 steps of linear dimming. To reduce CPU usage up to 6 frames can be stored with individual time delays between frames to play small animations automatically.

The AS1119 operates from 2.7V to 5.5V and includes a 320mA charge-pump to drive also white LEDs. The charge-pump operates in 2:3 and 1:2 mode.

The AS1119 features very low shutdown and operational current.

The device is available in a ultrasmall 36-pin WL-CSP.

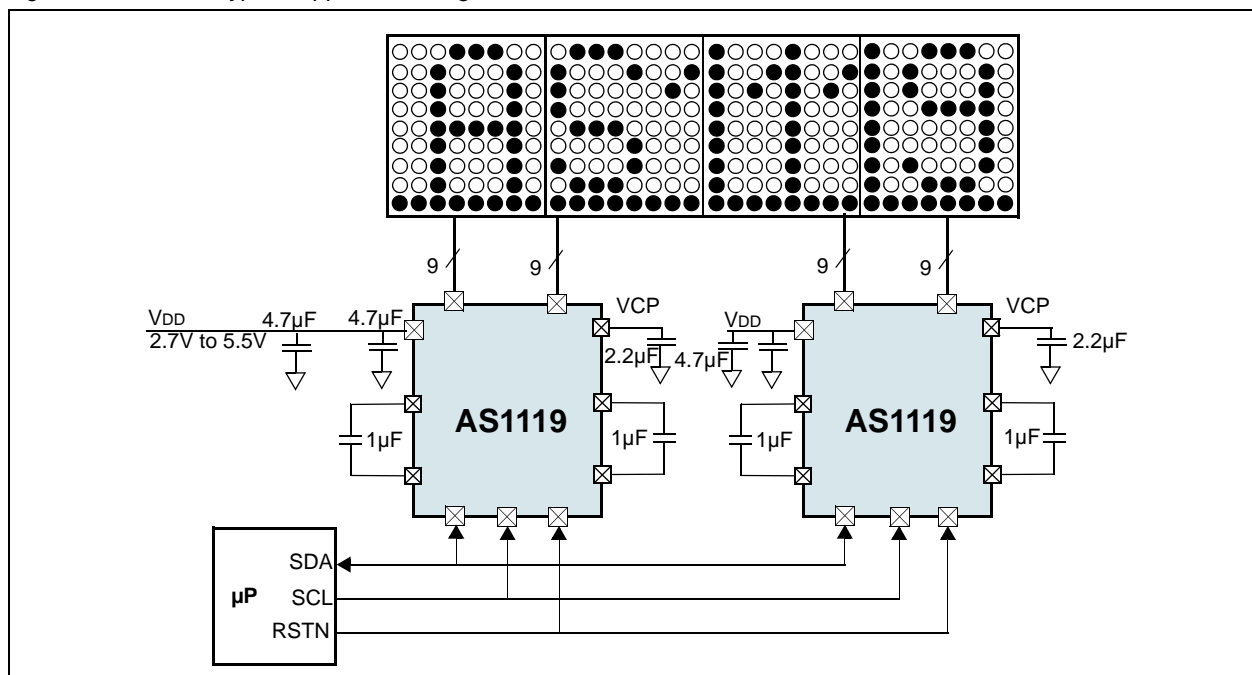
2 Key Features

- 1MHz I²C-Compatible Interface
- Open and Shorted LED Error Detection
 - Global Detection of Shorts
 - Global Detection of Opens
- 144 LEDs in Dot Matrix
- Low-Power Shutdown Current
- Individual 8-bit LED PWM Control
- 8-bit Analog Brightness Control
- (1:1), 2:3, 1:2 320mA Charge Pump
- 6 Frames Memory for Animations
- Supply Voltage Range: 2.7V to 5.5V
- Minimum PCB space required
- 36-pin WL-CSP package

3 Applications

The AS1119 is ideal for dot matrix displays in mobile phones, personal electronic and toys.

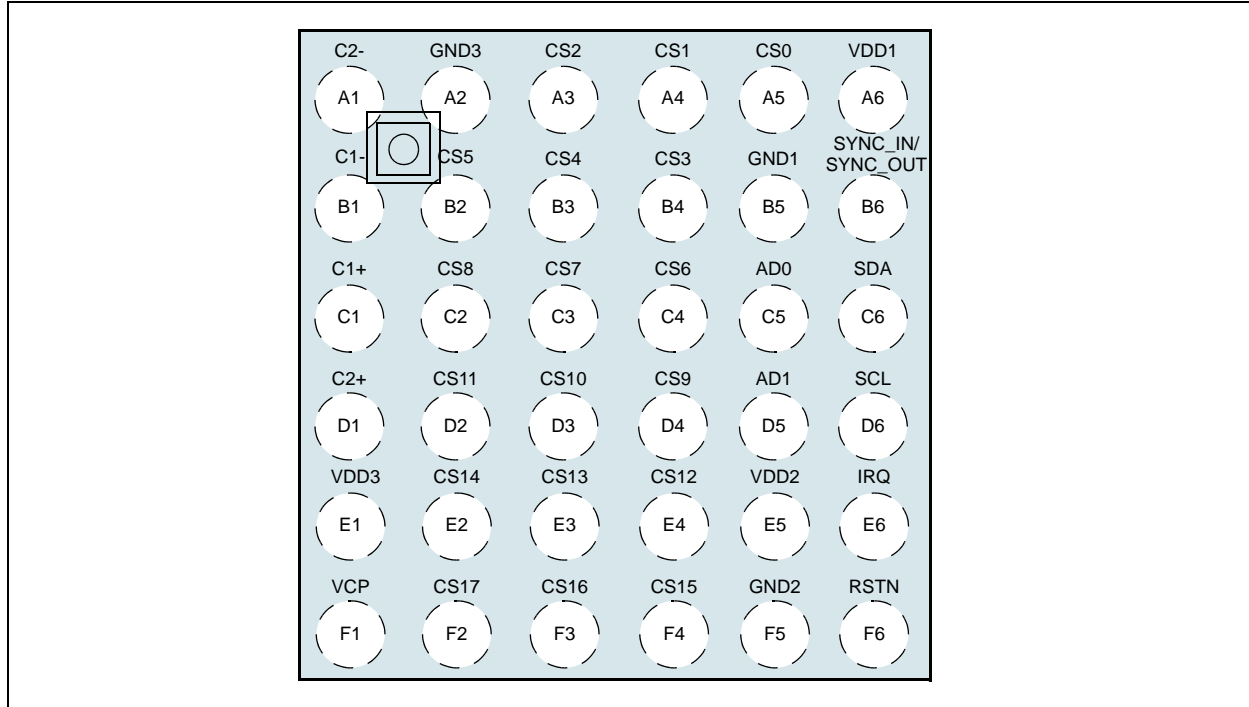
Figure 1. AS1119 - Typical Application Diagram



4 Pinout

Pin Assignments

Figure 2. Pin Assignments (Top View)



Pin Descriptions

Table 1. Pin Descriptions

| Pin Name | Pin Number | Description |
|-------------------|------------|---|
| VDD1, VDD2, VDD3 | A6, E5, E1 | Positive Supply Voltage. Connect to a +2.7V to +5.5V supply. Bypass this pin with 10 μ F capacitance to GND1, GND2, GND3. |
| VCP | F1 | Charge-Pump Output Voltage. Connect a 2.2 μ F capacitor to GND3. |
| C1-, C1+ | B1, C1 | Flying Cap 1. Connect a 1 μ F capacitor. |
| C2-, C2+ | A1, D1 | Flying Cap 2. Connect a 1 μ F capacitor. |
| GND1 | B5 | Ground for VDD1. Used for CS0-CS8 |
| GND2 | F5 | Ground for VDD2. Used for CS9-CS17 |
| GND3 | A2 | Ground for VDD3. Used for Charge-Pump |
| SDA | C6 | Serial-Data I/O. Open drain digital I/O I ² C data pin. |
| SCL | D6 | Serial-Clock Input. |
| AD0 | C5 | I²C Address for bit 0. Put to GND or VDD to set I ² C addresses. |
| AD1 | D5 | I²C Address for bit 1. Put to GND or VDD to set I ² C addresses. |
| RSTN | F6 | Reset Input. Pull this pin to logic low to reset all control registers (set to default values) and to put the device into power-down. For normal operation pull this pin to VDD. |
| SYNC_IN, SYNC_OUT | B6 | Synchronization Clock Input or Output |
| IRQ | E6 | Interrupt Request. Open drain digital Output. |

Table 1. Pin Descriptions

| Pin Name | Pin Number | | Description |
|-------------|-------------------------|------------|---|
| CS0 - CS8 | A5-A3, B4-B2, C4-C2 | 2 Matrixes | Sinks and Sources for 72 LEDs each matrix. |
| CS9 - CS17 | D4-D2, E4- E2, F4-F2 | | |
| CS0 - CS5 | A5-A3, B4-B2 | 3 Matrixes | Sinks and Sources for 30 LEDs each matrix. |
| CS6 - CS11 | C4-C2, D4-D2 | | |
| CS12 - CS17 | E4-E2, F4-F2 | | |

5 Absolute Maximum Ratings

Stresses beyond those listed in [Table 2](#) may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in [Section 6 Electrical Characteristics on page 5](#) is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 2. Absolute Maximum Ratings

| Parameter | | Min | Max | Units | Notes |
|--------------------------|-----------------------|-----------|------------------------|-------|---|
| Input Voltage Range | VDD to GND | -0.3 | 7 | V | |
| | All other pins to GND | -0.3 | 7 or $V_{DD} + 0.3$ | V | |
| Current | Sink Current | | 500 | mA | |
| | Segment Current | | 100 | mA | |
| Humidity | | 5 | 85 | % | Non-condensing |
| Electrostatic Discharge | | 1.5 | | kV | HBM MIL 833 E method 3015 |
| Latch-Up Immunity | | ± 100 | | mA | <i>EIA/JESD78</i> |
| Ambient Temperature | | -40 | +85 | °C | |
| Junction Temperature | | | +125 | °C | |
| Storage Temperature | | -55 | +125 | °C | |
| Package Body Temperature | | | +260 | °C | The reflow peak soldering temperature (body temperature) specified is in accordance with <i>IPC/JEDEC J-STD-020 "Moisture/Reflow Sensitivity Classification for Non-Hermetic Solid State Surface Mount Devices"</i> . |

6 Electrical Characteristics

$V_{DD} = 2.7V$ to $5.5V$, $T_{AMB} = -40^{\circ}C$ to $+85^{\circ}C$, *typ. values are at $T_{AMB} = +25^{\circ}C$ (unless otherwise specified).*

Table 3. Electrical Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit | |
|----------------------|---|--|--------------------|------|------|----------|----|
| V_{DD} | Operating Supply Voltage | | 2.7 | | 5.5 | V | |
| I_{DDSD} | Software Shutdown Supply Current | All digital inputs at V_{DD} or GND, $V_{DD} = 5.5V$, $T_{AMB} = +25^{\circ}C$ | | 7 | | μA | |
| I_{DDFSD} | Full Shutdown Supply Current | Pin RSTN = 0V, $T_{AMB} = +25^{\circ}C$ | | 0.1 | 1 | μA | |
| I_{DD} | Operating Supply Current (all current sources turned off) | CP disabled @ $V_{DD} = 5.5V$ | | 1.4 | | mA | |
| | | With CP in 2:3 mode @ $V_{DD} = 2.7V$ | | 3 | | | |
| | | With CP in 1:2 mode @ $V_{DD} = 2.7V$ | | 4 | | | |
| I_{START} | max. Peak Inrush Current | | | 1.5 | | A | |
| | max. DC Current | | | 700 | | mA | |
| I_{DIGIT} | Digit Drive Sink Current (Drive capability of all sources of one digit ^{1,2}) | CP disabled | | | | 500 | mA |
| | | CP enabled | $V_{DD} < 3.3V$ | | | 160 | |
| | | | $V_{DD} \geq 3.3V$ | | | 320 | |
| I_{SEG} | Segment Drive Source Current LED | $V_{OUT} = 1.8V$ to $V_{DD}-400mV$ | 28 | 30 | 32 | mA | |
| ΔI_{SEG} | Segment Drive Current Matching LED ³ | | | 2 | | % | |
| V_{DSSAT} | Saturation Voltage | Current = 30mA, $V_{DD} = 5V$ | | 100 | | mV | |
| $R_{DSON(N)}$ | Resistance for NMOS | | | 0.5 | 1 | Ω | |
| f _{OSC} | Oscillator Frequency | | 0.9 | 1 | 1.1 | MHz | |
| f _{REFRESH} | Display Scan Rate | 2 time 9x8 matrixes | 0.39 | 0.43 | 0.48 | kHz | |

- Not all sources are allowed to be fully on at the same time.
- guaranteed by design

$$3. I_{SEG} = \frac{I_{max} - I_{min}}{I_{max} + I_{min}} \times 100$$

Table 4. Logic Inputs/Outputs Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------|-----------------------------------|---------------------------|--------------|--------------|--------------|---------|
| I_{IH}, I_{IL} | Logic Input Current | $V_{IN} = 0V$ or V_{DD} | -1 | | 1 | μA |
| V_{IH} | Logic High Input Voltage | | 1.6 | | | V |
| V_{IL} | Logic Low Input Voltage | | | | 0.6 | V |
| ΔV_I | Hysteresis Voltage | | | 0.1 | | V |
| $V_{OL(SDA)}$ | SDA Output Low Voltage | $I_{SINK} = 3mA$ | | | 0.4 | V |
| $V_{OL(IRQ)}$ | IRQ Output Low Voltage | $I_{SINK} = 3mA$ | | | 0.4 | V |
| $V_{OL(SYNC_OUT)}$ | Sync Clock Output Low Voltage | $I_{SINK} = 1mA$ | | | 0.4 | V |
| $V_{OH(SYNC_OUT)}$ | Sync Clock Output High Voltage | $I_{SOURCE} = 1mA$ | | | $V_{DD}-0.4$ | V |
| | Open Detection Level Threshold | | $V_{DD}-0.4$ | $V_{DD}-0.1$ | | V |
| | Short Detection Level Threshold | | | 0.9 | 1.2 | V |
| | Capacitive Load for Each Bus Line | SCL Frequency = 400kHz | | | 400 | pF |
| | | SCL Frequency = 1000kHz | | | 100 | |

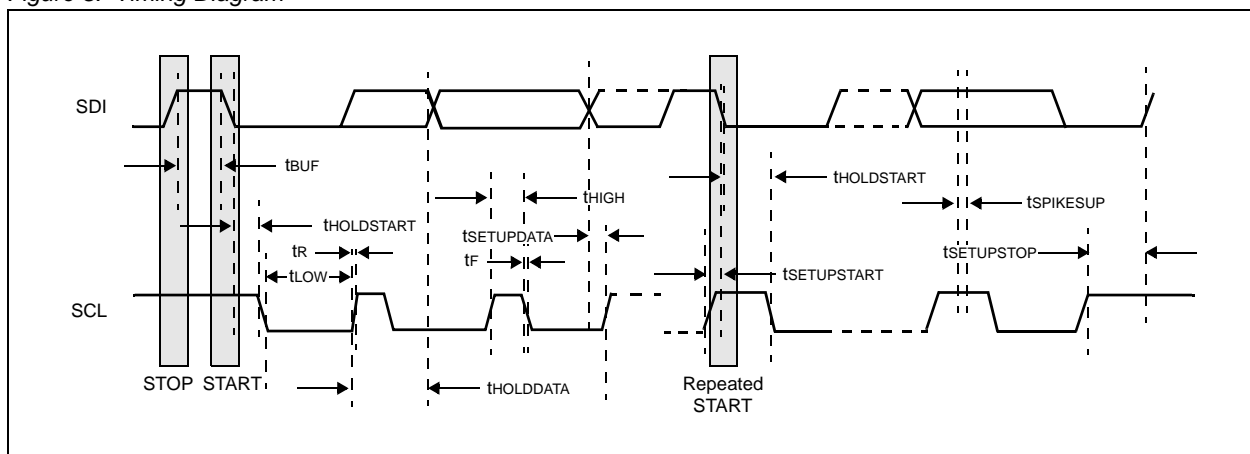
Table 5. I²C Timing Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------|---|------------|-----|-----|------|------|
| f _{SCL} | SCL Frequency | | 100 | | 1000 | kHz |
| t _{BUF} | Bus Free Time Between STOP and START Conditions | | 1.3 | | | μs |
| t _{HOLDSTART} | Hold Time for Repeated START Condition | | 160 | | | ns |
| t _{LOW} | SCL Low Period | | 50 | | 75 | ns |
| t _{HIGH} | SCL High Period | | 50 | | 75 | ns |
| t _{SETUPSTART} | Setup Time for Repeated START Condition | | 100 | | | ns |
| t _{SETUPDATA} | Data Setup Time | | 10 | | | ns |
| t _{HOLDDATA} | Data Hold Time | | | | 70 | ns |
| t _{RISE(SCL)} | SCL Rise Time | | 10 | | 40 | ns |
| t _{RISE(SCL1)} | SCL Rise Time after Repeated START Condition and After an ACK Bit | | 10 | | 80 | ns |
| t _{FALL(SCL)} | SCL Fall Time | | 10 | | 40 | ns |
| t _{RISE(SDA)} | SDA Rise Time | | 20 | | 80 | ns |
| t _{FALL(SDA)} | SDA Fall Time | | 20 | | 80 | ns |
| t _{SETUPSTOP} | STOP Condition Setup Time | | 160 | | | ns |
| t _{SPIKESUP} | Pulse Width of Spike Suppressed | | | 50 | | ns |

Notes:

1. The Min / Max values of the Timing Characteristics are guaranteed by design.
2. All limits are guaranteed. The parameters with min and max values are guaranteed with production tests or SQC (Statistical Quality Control) methods.

Figure 3. Timing Diagram



7 Typical Operating Characteristics

Figure 4. Segment Drive Current vs. Supply Voltage

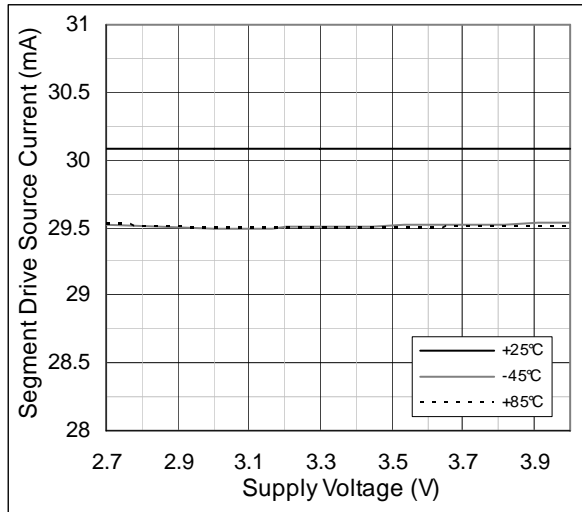


Figure 5. Segment Drive Current vs. Temperature

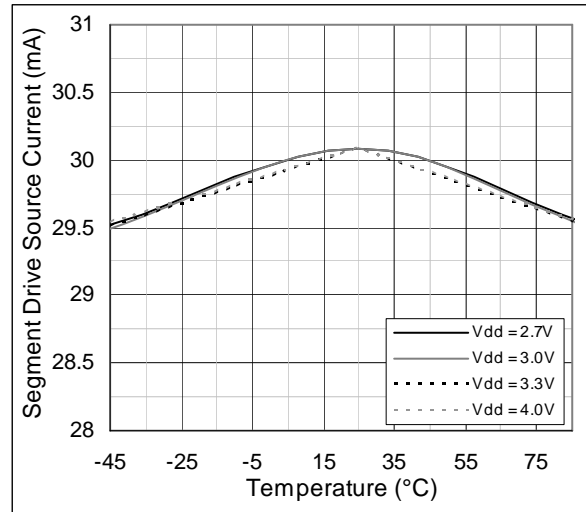


Figure 6. Segment Drive Current vs. Output Voltage

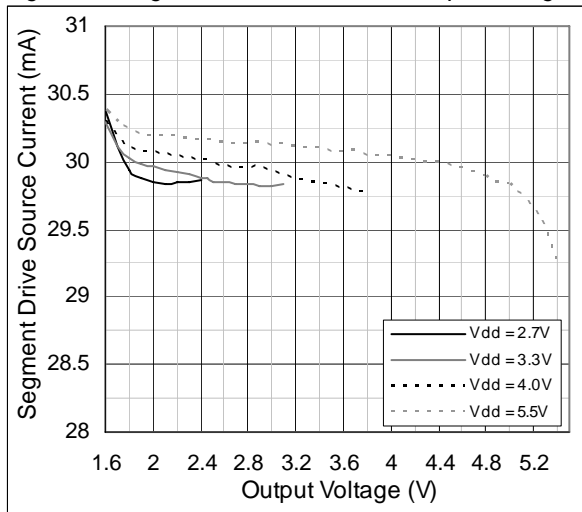


Figure 7. RonNmos vs. Supply Voltage

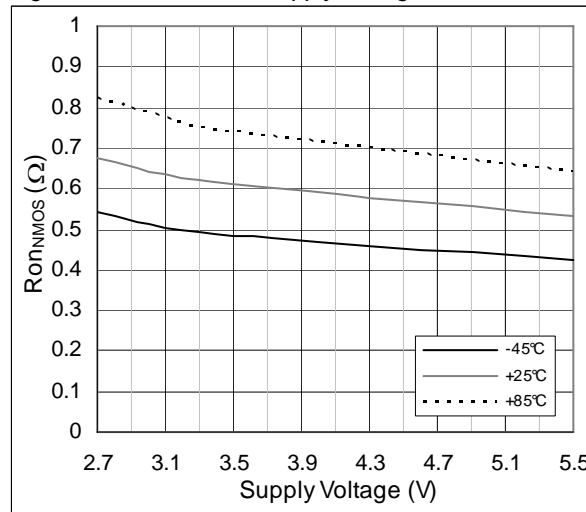


Figure 8. Open Detection Level vs. Supply Voltage

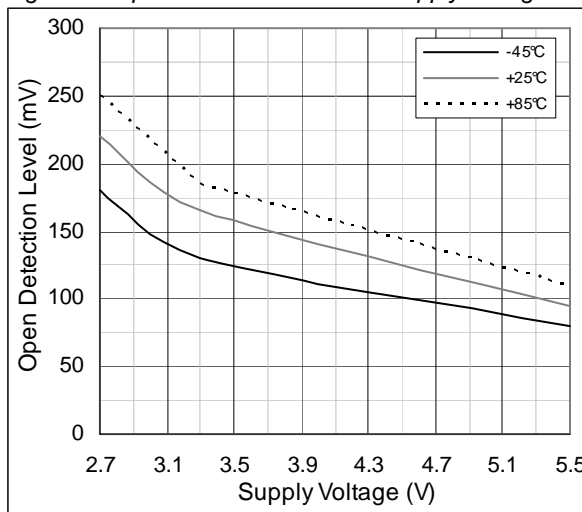


Figure 9. Short Detection Level vs. Supply Voltage

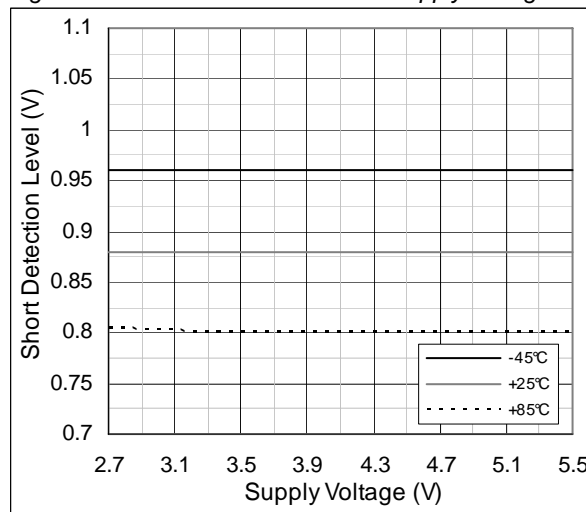


Figure 10. Efficiency vs. Supply Voltage

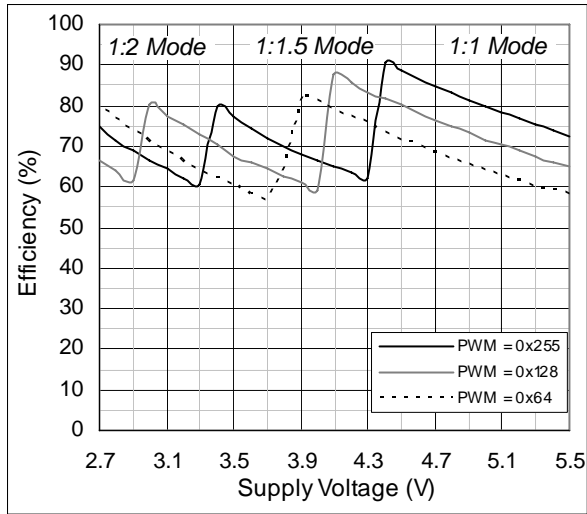


Figure 11. Logic Input Voltage Levels

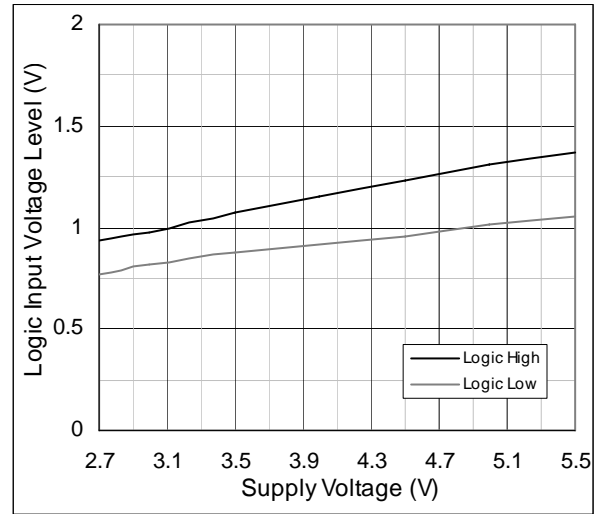
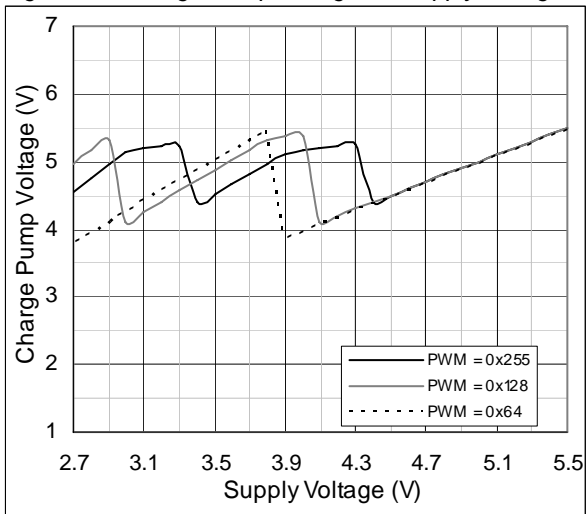


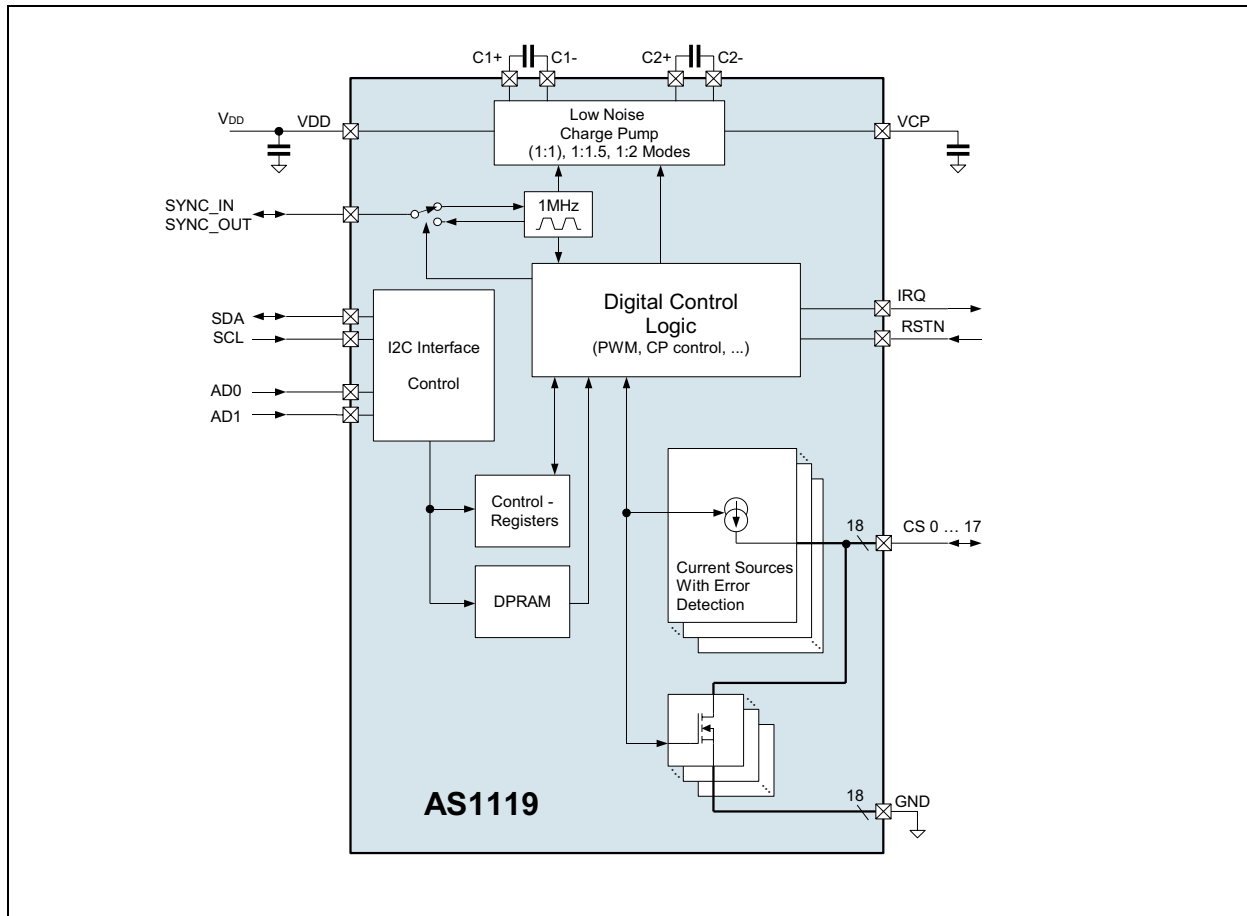
Figure 12. Charge Pump Voltage vs. Supply Voltage



8 Detailed Description

Block Diagram

Figure 13. AS1119 - Block Diagram



I²C Interface

The AS1119 supports the I²C serial bus and data transmission protocol in fast mode at 1MHz. The AS1119 operates as a slave on the I²C bus. The bus must be controlled by a master device that generates the serial clock (SCL), controls the bus access, and generates the START and STOP conditions. Connections to the bus are made via the open-drain I/O pins SCL and SDA.

Figure 14. I²C Interface Initialisation

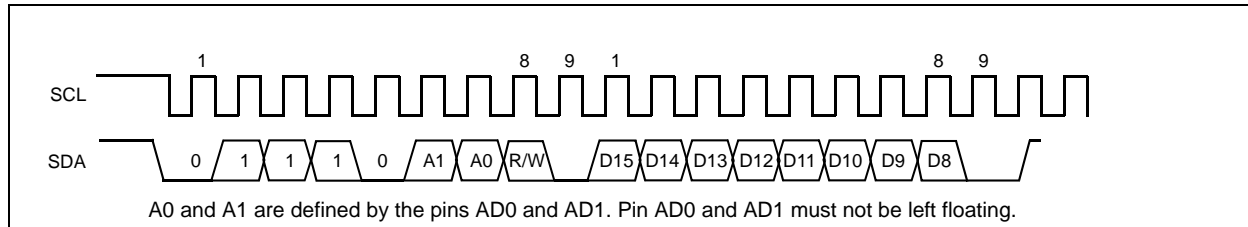
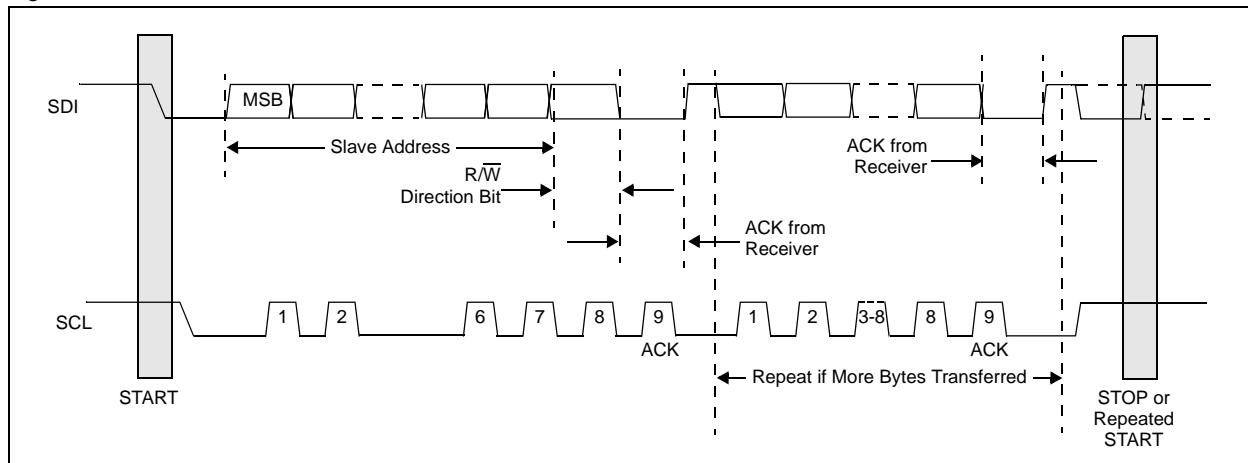


Figure 15. Bus Protocol



The bus protocol (as shown in [Figure 15](#)) is defined as:

- Data transfer may be initiated only when the bus is not busy.
- During data transfer, the data line must remain stable whenever the clock line is HIGH. Changes in the data line while the clock line is HIGH will be interpreted as control signals.

The bus conditions are defined as:

- **Bus Not Busy.** Data and clock lines remain HIGH.
- **Start Data Transfer.** A change in the state of the data line, from HIGH to LOW, while the clock is HIGH, defines a START condition.
- **Stop Data Transfer.** A change in the state of the data line, from LOW to HIGH, while the clock line is HIGH, defines the STOP condition.
- **Data Valid.** The state of the data line represents valid data, when, after a START condition, the data line is stable for the duration of the HIGH period of the clock signal. There is one clock pulse per bit of data. Each data transfer is initiated with a START condition and terminated with a STOP condition. The number of data bytes transferred between START and STOP conditions is not limited and is determined by the master device. The information is transferred byte-wise and each receiver acknowledges with a ninth-bit. Within the I²C bus specifications a high-speed mode (3.4MHz clock rate) is defined.
- **Acknowledge:** Each receiving device, when addressed, is obliged to generate an acknowledge after the reception of each byte. The master device must generate an extra clock pulse that is associated with this acknowledge bit. A device that acknowledges must pull down the SDA line during the acknowledge clock pulse in such a way that the SDA line is stable LOW during the HIGH period of the acknowledge clock pulse. Of course, setup and hold times must be taken into account. A master must signal an end of data to the slave by not generating an

acknowledge bit on the last byte that has been clocked out of the slave. In this case, the slave must leave the data line HIGH to enable the master to generate the STOP condition.

- [Figure 15 on page 10](#) details how data transfer is accomplished on the I²C bus. Depending upon the state of the R/W bit, two types of data transfer are possible:
- **Master Transmitter to Slave Receiver.** The first byte transmitted by the master is the slave address, followed by a number of data bytes. The slave returns an acknowledge bit after the slave address and each received byte.
- **Slave Transmitter to Master Receiver.** The first byte, the slave address, is transmitted by the master. The slave then returns an acknowledge bit. Next, a number of data bytes are transmitted by the slave to the master. The master returns an acknowledge bit after all received bytes other than the last byte. At the end of the last received byte, a not-acknowledge is returned. The master device generates all of the serial clock pulses and the START and STOP conditions. A transfer is ended with a STOP condition or a repeated START condition. Since a repeated START condition is also the beginning of the next serial transfer, the bus will not be released.

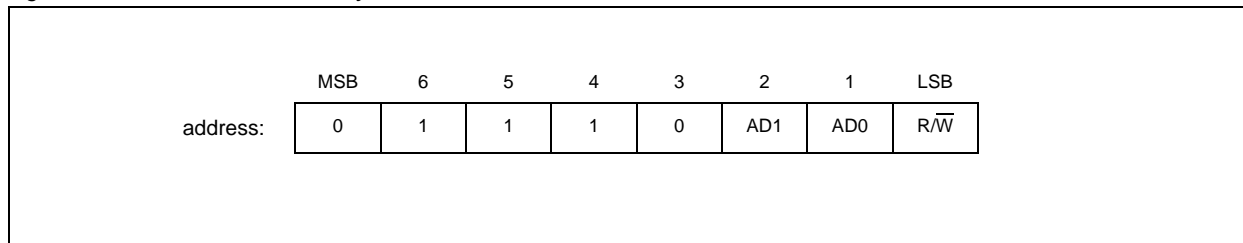
The AS1119 can operate in the following slave modes:

- **Slave Receiver Mode.** Serial data and clock are received through SDA and SCL. After each byte is received, an acknowledge bit is transmitted. START and STOP conditions are recognized as the beginning and end of a serial transfer. Address recognition is performed by hardware after reception of the slave address and direction bit.
- **Slave Transmitter Mode.** The first byte (the slave address) is received and handled as in the slave receiver mode. However, in this mode the direction bit will indicate that the transfer direction is reversed. Serial data is transmitted on SDA by the AS1119 while the serial clock is input on SCL. START and STOP conditions are recognized as the beginning and end of a serial transfer.

I²C Device Address Byte

The address byte (see [Figure 16](#)) is the first byte received following the START condition from the master device.

Figure 16. I²C Device Address Byte



- The bit 1 and bit 2 of the address byte are the device select pins AD0 and AD1, which must be set to V_{DD} or to GND. A maximum of four devices with the same pre-set code can therefore be connected on the same bus at one time.
- The last bit of the address byte (R/W) define the operation to be performed. When set to a 1 a read operation is selected; when set to a 0 a write operation is selected.

Following the START condition, the AS1119 monitors the I²C bus, checking the device type identifier being transmitted. Upon receiving the address code, and the R/W bit, the slave device outputs an acknowledge signal on the SDA line.

Command Byte

The AS1119 operation, (see Table 15 on page 22) is determined by a command byte (see Table 17).

Figure 17. Command Byte

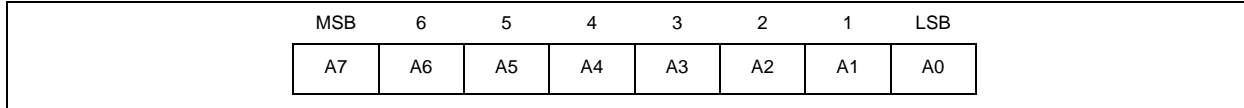


Figure 18. Command and Single Data Byte received by AS1119

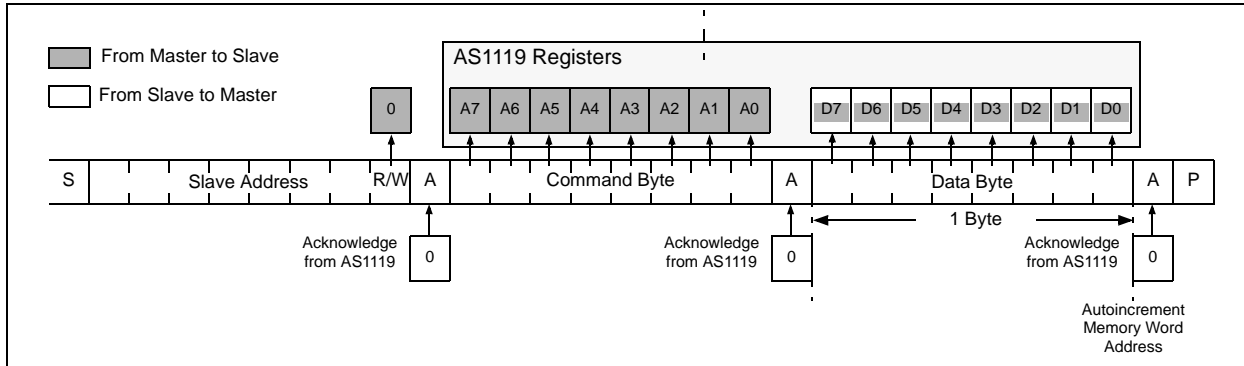


Figure 19. Setting the Pointer to a Address Register to select a Data Register for a Read Operation

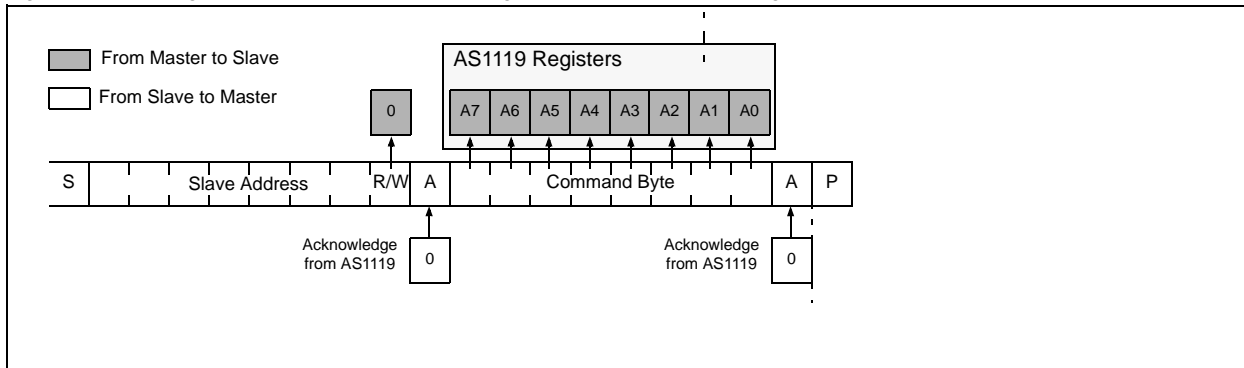
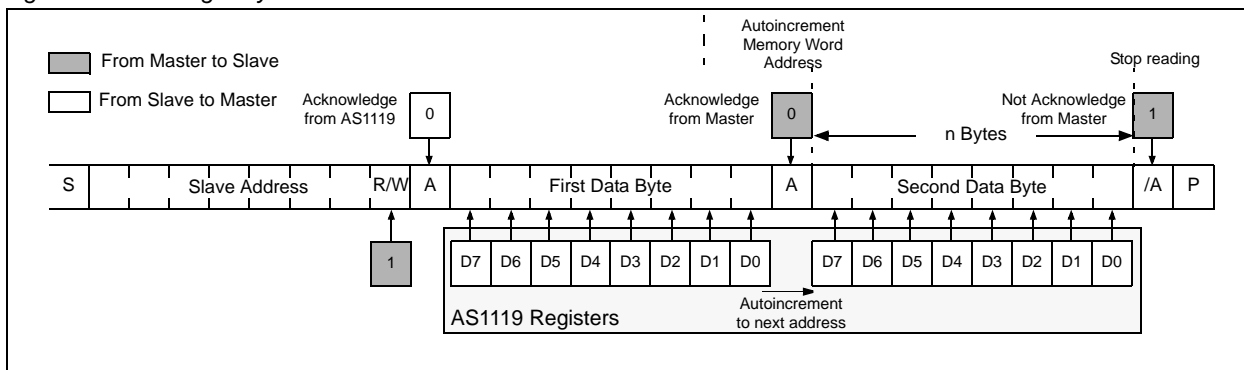


Figure 20. Reading n Bytes from AS1119



Initial Power-Up

On initial power-up, the AS1119 registers are reset to their default values, the display is blanked, and the device goes into shutdown mode. At this time, all registers should be programmed for normal operation.

Note: The default settings enable only scanning of one digit; the internal decoder is disabled and the Intensity Control Register ([see page 17](#)) and ([see page 21](#)) is set to the minimum values.

Shutdown Mode

The AS1119 device features two different shutdown modes. A software shutdown via shutdown register ([see Shutdown Register \(0x0A\) on page 27](#)) and a hardware shutdown via the RSTN pin.

The software shutdown disables all LED's and stops the internal operation of the logic. A shutdown mode via the RSTN pin additionally powers down the power-on-reset (PO) of the device. In this shutdown mode the AS1119 consumes only 100nA (typ.).

9 Register Description

Register Selection

Within this register the access to one of the RAM sections or to the Control register is selected. After one section is selected this section is valid as long as an other section is selected.

Table 6. Register Selection Address Map

| Register Section | Address | | | | | | | | | Data | | | | | | | | Description | | |
|------------------|---------|----|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|-------------|-------------------------------|------------------------------------|
| | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | HEX | D7 | D6 | D5 | D4 | D3 | D2 | D1 | | D0 | |
| NOP | | | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Selection of RAM section for frame |
| Data Frame 0 | | | | | | | | | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | |
| Data Frame 1 | | | | | | | | | | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | | |
| Data Frame 2 | | | | | | | | | | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | | |
| Data Frame 3 | 253 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | | |
| Data Frame 4 | | | | | | | | | | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | | |
| Data Frame 5 | | | | | | | | | | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | | |
| Control Register | | | | | | | | | | 11 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | Selection of Control Register | |

Data Definition of the single frames

One frame consists of 2 blocks (à 8x9 LED-matrix) or 3 blocks (à 5x6 LED-matrix). This configuration is set in the AS1119 config register (see Table 20 on page 25).

In the internal DPRAM of the device 6 frames can be stored. For each frame the following parameters have to be stored.

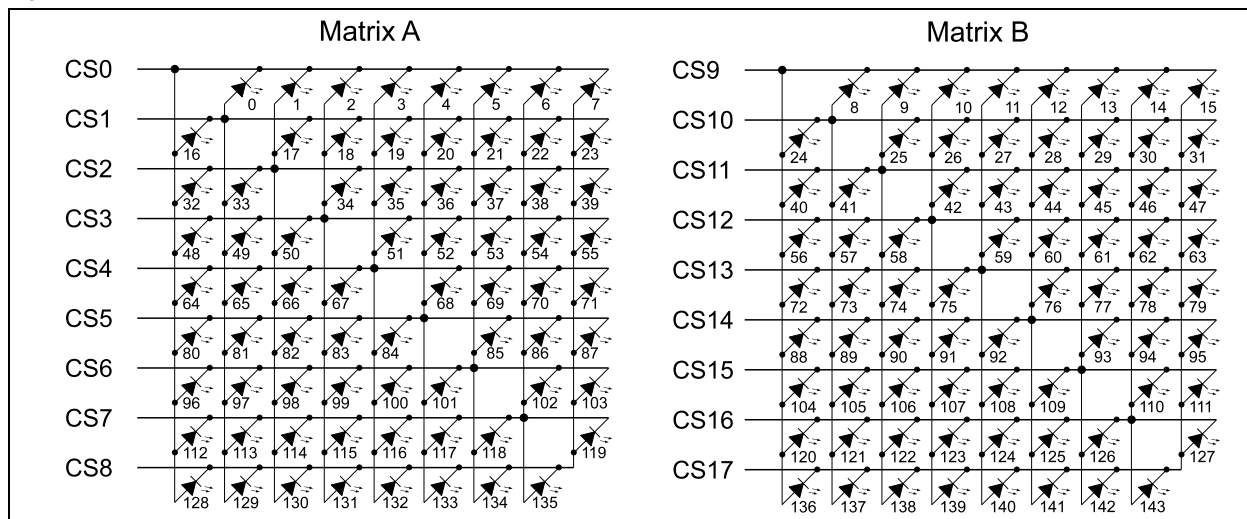
- LED is ON or OFF.
- LED is steady ON or blinking.
- The intensity of every single LED can be set via a 8 bits PWM.

Note: After power-up the data in the DPRAM is undefined (either '0' or '1').

2 Blocks with 8x9 LED Matrix

The AS1119 can be configured to control two separated blocks of LEDs matrixes. This must be set via the bit D0 in the AS1119 config register (see AS1119 Config Register (0x04) on page 25).

Figure 21. 8x9 LED Matrix with two blocks



The address structure (as shown in Table 7) within on frame is always the same independent which frame was selected via the register selection (see Table 6 on page 14).

Table 7. Dataframe Adress Structure for 2 Matrixes

| | | Addresses within frame (HEX code) | | | | | |
|----------------|----------|-----------------------------------|----------|----------|----------|-----------|-----------|
| Current Source | | On / Off | | Blink | | Intensity | |
| Matrix A | Matrix B | Matrix A | Matrix B | Matrix A | Matrix B | Matrix A | Matrix B |
| CS0 | CS9 | 0x00 | 0x01 | 0x12 | 0x13 | 0x24-0x2B | 0x2C-0x33 |
| CS1 | CS10 | 0x02 | 0x03 | 0x14 | 0x15 | 0x34-0x3B | 0x3C-0x43 |
| CS2 | CS11 | 0x04 | 0x05 | 0x16 | 0x17 | 0x44-0x4B | 0x4C-0x53 |
| CS3 | CS12 | 0x06 | 0x07 | 0x18 | 0x19 | 0x54-0x5B | 0x5C-0x63 |
| CS4 | CS13 | 0x08 | 0x09 | 0x1A | 0x1B | 0x64-0x6B | 0x6C-0x73 |
| CS5 | CS14 | 0x0A | 0x0B | 0x1C | 0x1D | 0x74-0x7B | 0x7C-0x83 |
| CS6 | CS15 | 0x0C | 0x0D | 0x1E | 0x1F | 0x84-0x8B | 0x8C-0x93 |
| CS7 | CS16 | 0x0E | 0x0F | 0x20 | 0x21 | 0x94-0x9B | 0x9C-0xA3 |
| CS8 | CS17 | 0x10 | 0x11 | 0x22 | 0x22 | 0xA4-0xAB | 0xAC-0xB3 |

In Table 8 it's described which databit represents which LED in the matrix. Per default all databits are '0', meaning no LED is on. A '1' puts the LED on.

Table 8. LEDs ON/OFF Register Format for 2 Matrixes Setup

| Matrix | Current Source | Address | | | | | | | | | Data | | | | | | | |
|--------|----------------|---------|----|----|----|----|----|----|----|----|---------|---------|---------|---------|---------|---------|---------|---------|
| | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| A | CS0 | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | LED 7 | LED 6 | LED 5 | LED 4 | LED 3 | LED 2 | LED 1 | LED 0 |
| B | CS9 | 0x01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | LED 15 | LED 14 | LED 13 | LED 12 | LED 11 | LED 10 | LED 9 | LED 8 |
| A | CS1 | 0x02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | LED 23 | LED 22 | LED 21 | LED 20 | LED 19 | LED 18 | LED 17 | LED 16 |
| B | CS10 | 0x03 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | LED 31 | LED 30 | LED 29 | LED 28 | LED 27 | LED 26 | LED 25 | LED 24 |
| A | CS2 | 0x04 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | LED 39 | LED 38 | LED 37 | LED 36 | LED 35 | LED 34 | LED 33 | LED 32 |
| B | CS11 | 0x05 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | LED 47 | LED 46 | LED 45 | LED 44 | LED 43 | LED 42 | LED 41 | LED 40 |
| A | CS3 | 0x06 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | LED 55 | LED 54 | LED 53 | LED 52 | LED 51 | LED 50 | LED 49 | LED 48 |
| B | CS12 | 0x07 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | LED 63 | LED 62 | LED 61 | LED 60 | LED 59 | LED 58 | LED 57 | LED 56 |
| A | CS4 | 0x08 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | LED 71 | LED 70 | LED 69 | LED 68 | LED 67 | LED 66 | LED 65 | LED 64 |
| B | CS13 | 0x09 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | LED 79 | LED 78 | LED 77 | LED 76 | LED 75 | LED 74 | LED 73 | LED 72 |
| A | CS5 | 0x0A | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | LED 87 | LED 86 | LED 85 | LED 84 | LED 83 | LED 82 | LED 81 | LED 80 |
| B | CS14 | 0x0B | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | LED 95 | LED 94 | LED 93 | LED 92 | LED 91 | LED 90 | LED 89 | LED 88 |
| A | CS6 | 0x0C | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | LED 103 | LED 102 | LED 101 | LED 100 | LED 99 | LED 98 | LED 97 | LED 96 |
| B | CS15 | 0x0D | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | LED 111 | LED 110 | LED 109 | LED 108 | LED 107 | LED 106 | LED 105 | LED 104 |
| A | CS7 | 0x0E | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | LED 119 | LED 118 | LED 117 | LED 116 | LED 115 | LED 114 | LED 113 | LED 112 |
| B | CS16 | 0x0F | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | LED 127 | LED 126 | LED 125 | LED 124 | LED 123 | LED 122 | LED 121 | LED 120 |

Table 8. LEDs ON/OFF Register Format for 2 Matrixes Setup

| Matrix | Current Source | Address | | | | | | | | | Data | | | | | | | |
|--------|----------------|---------|----|----|----|----|----|----|----|----|---------|---------|---------|---------|---------|---------|---------|---------|
| | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| A | CS8 | 0x10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | LED 135 | LED 134 | LED 133 | LED 132 | LED 131 | LED 130 | LED 129 | LED 128 |
| B | CS17 | 0x11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | LED 143 | LED 142 | LED 141 | LED 140 | LED 139 | LED 138 | LED 137 | LED 136 |

In the blink register (see Table 9) every single LED can be set to blink. The blink period is set in the display option register (see Display Option Register (0x03) on page 24).

Table 9. LEDs Blink Register Format for 2 Matrixes Setup

| Matrix | Current Source | Address | | | | | | | | | Data | | | | | | | |
|--------|----------------|---------|----|----|----|----|----|----|----|----|---------|---------|---------|---------|---------|---------|---------|---------|
| | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| A | CS0 | 0x12 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | LED 7 | LED 6 | LED 5 | LED 4 | LED 3 | LED 2 | LED 1 | LED 0 |
| B | CS9 | 0x13 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | LED 15 | LED 14 | LED 13 | LED 12 | LED 11 | LED 10 | LED 9 | LED 8 |
| A | CS1 | 0x14 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | LED 23 | LED 22 | LED 21 | LED 20 | LED 19 | LED 18 | LED 17 | LED 16 |
| B | CS10 | 0x15 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | LED 31 | LED 30 | LED 29 | LED 28 | LED 27 | LED 26 | LED 25 | LED 24 |
| A | CS2 | 0x16 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | LED 39 | LED 38 | LED 37 | LED 36 | LED 35 | LED 34 | LED 33 | LED 32 |
| B | CS11 | 0x17 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | LED 47 | LED 46 | LED 45 | LED 44 | LED 43 | LED 42 | LED 41 | LED 40 |
| A | CS3 | 0x18 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | LED 55 | LED 54 | LED 53 | LED 52 | LED 51 | LED 50 | LED 49 | LED 48 |
| B | CS12 | 0x19 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | LED 63 | LED 62 | LED 61 | LED 60 | LED 59 | LED 58 | LED 57 | LED 56 |
| A | CS4 | 0x1A | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | LED 71 | LED 70 | LED 69 | LED 68 | LED 67 | LED 66 | LED 65 | LED 64 |
| B | CS13 | 0x1B | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | LED 79 | LED 78 | LED 77 | LED 76 | LED 75 | LED 74 | LED 73 | LED 72 |
| A | CS5 | 0x1C | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | LED 87 | LED 86 | LED 85 | LED 84 | LED 83 | LED 82 | LED 81 | LED 80 |
| B | CS14 | 0x1D | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | LED 95 | LED 94 | LED 93 | LED 92 | LED 91 | LED 90 | LED 89 | LED 88 |
| A | CS6 | 0x1E | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | LED 103 | LED 102 | LED 101 | LED 100 | LED 99 | LED 98 | LED 97 | LED 96 |
| B | CS15 | 0x1F | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | LED 111 | LED 110 | LED 109 | LED 108 | LED 107 | LED 106 | LED 105 | LED 104 |
| A | CS7 | 0x20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | LED 119 | LED 118 | LED 117 | LED 116 | LED 115 | LED 114 | LED 113 | LED 112 |
| B | CS16 | 0x21 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | LED 127 | LED 126 | LED 125 | LED 124 | LED 123 | LED 122 | LED 121 | LED 120 |
| A | CS8 | 0x22 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | LED 135 | LED 134 | LED 133 | LED 132 | LED 131 | LED 130 | LED 129 | LED 128 |
| B | CS17 | 0x23 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | LED 143 | LED 142 | LED 141 | LED 140 | LED 139 | LED 138 | LED 137 | LED 136 |

In the intensity register (see Table 10) the brightness of every single LED can be set via a 8bit PWM (255 steps).

Table 10. LEDs Intensity Register Format for 2 Matrixes Setup

| Matrix | Current Source | | Address | | | | | | | | | Data | | | | | | | | | |
|--------|----------------|-------|---------|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|--|--|
| | | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | |
| A | CS0 | LED0 | 0x24 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 255 steps for intensity each single LED | | | | | | | | | |
| | | LED1 | 0x25 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | | | | | | | | | | |
| | | LED2 | 0x26 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | | | | | | | | | | |
| | | LED3 | 0x27 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | | | | | | | | | | |
| | | LED4 | 0x28 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | | | | | | | | | | |
| | | LED5 | 0x29 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | | | | | | | | | | |
| | | LED6 | 0x2A | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | | 1 | | | | | | | | |
| | | LED7 | 0x2B | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | | 1 | | | | | | | | |
| B | CS9 | LED8 | 0x2C | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | | | | | | | | | | |
| | | LED9 | 0x2D | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | | | | | | | | | | |
| | | LED10 | 0x2E | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | | | | | | | | | | |
| | | LED11 | 0x2F | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | | | | | | | | | | |
| | | LED12 | 0x30 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | | | | | | | | | | |
| | | LED13 | 0x31 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | | | | | | | | | | |
| | | LED14 | 0x32 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | | | | | | | | | | |
| | | LED15 | 0x33 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | | | | | | | | | | |
| A | CS1 | LED16 | 0x34 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 255 steps for intensity each single LED | | | | | | | | | |
| | | LED17 | 0x35 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | | | | | | | | | | |
| | | LED18 | 0x36 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | | | | | | | | | | |
| | | LED19 | 0x37 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | | | | | | | | | | |
| | | LED20 | 0x38 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | | | | | | | | | | |
| | | LED21 | 0x39 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | | | | | | | | | | |
| | | LED22 | 0x3A | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | | | | | | | | | | |
| | | LED23 | 0x3B | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | | | | | | | | | | |
| B | CS10 | LED24 | 0x3C | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | | | | | | | | | | |
| | | LED25 | 0x3D | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | | | | | | | | | | |
| | | LED26 | 0x3E | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | | | | | | | | | | |
| | | LED27 | 0x3F | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | |
| | | LED28 | 0x40 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | |
| | | LED29 | 0x41 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | | | | | | | | | | |
| | | LED30 | 0x42 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | | | | | | | | | | |
| | | LED31 | 0x43 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | | | | | | | | | | |

Table 10. LEDs Intensity Register Format for 2 Matrixes Setup

| Matrix | Current Source | | Adress | | | | | | | | | Data | | | | | | | |
|--------|----------------|--------|--------|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|
| | | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| A | CS2 | LED32 | 0x44 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 255 steps for intensity each single LED | | | | | | | |
| | | LED33 | 0x45 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | | | | | | | | |
| | | LED34 | 0x46 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | | | | | | | | |
| | | LED35 | 0x47 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | | | | | | | | |
| | | LED36 | 0x48 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | | | | | | | | |
| | | LED37 | 0x49 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | | | | | | | | |
| | | LED38 | 0x4A | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | | | | | | | | |
| | | LED39 | 0x4B | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | | | | | | | | |
| B | CS11 | LED40 | 0x4C | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | | | | | | | | |
| | | LED41 | 0x4D | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | | | | | | | | |
| | | LED42 | 0x4E | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | | | | | | | | |
| | | LED43 | 0x4F | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | | | | | | | | |
| | | LED44 | 0x50 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | | | | | | | | |
| | | LED45 | 0x51 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | | | | | | | | |
| | | LED46 | 0x52 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | | | | | | | | |
| | | LED47 | 0x53 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| A | CS8 | LED128 | 0xA4 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 255 steps for intensity each single LED | | | | | | | |
| | | LED129 | 0xA5 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | | | | | | | | |
| | | LED130 | 0xA6 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | | | | | | | | |
| | | LED131 | 0xA7 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | | | | | | | | |
| | | LED132 | 0xA8 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | | | | | | | | |
| | | LED133 | 0xA9 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | | | | | | | | |
| | | LED134 | 0xAA | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | | | | | | | | |
| | | LED135 | 0xAB | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | | | | | | | | |
| B | CS17 | LED136 | 0xAC | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | | | | | | | | |
| | | LED137 | 0xAD | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | | | | | | | | |
| | | LED138 | 0xAE | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | | | | | | | | |
| | | LED139 | 0xAF | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | | | | | | | | |
| | | LED140 | 0xB0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | | | | | | | | |
| | | LED141 | 0xB1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | | | | | | | | |
| | | LED142 | 0xB2 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | | | | | | | | |
| | | LED143 | 0xB3 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | | | | | | | | |

3 Blocks with 5x6 LED Matrix

The AS1119 can be configured to control three separated blocks of LEDs matrixes. This must be set via the bit D0 in the AS1119 config register (see AS1119 Config Register (0x04) on page 25).

Figure 22. 5x6 LED Matrix with 3 Matrixes

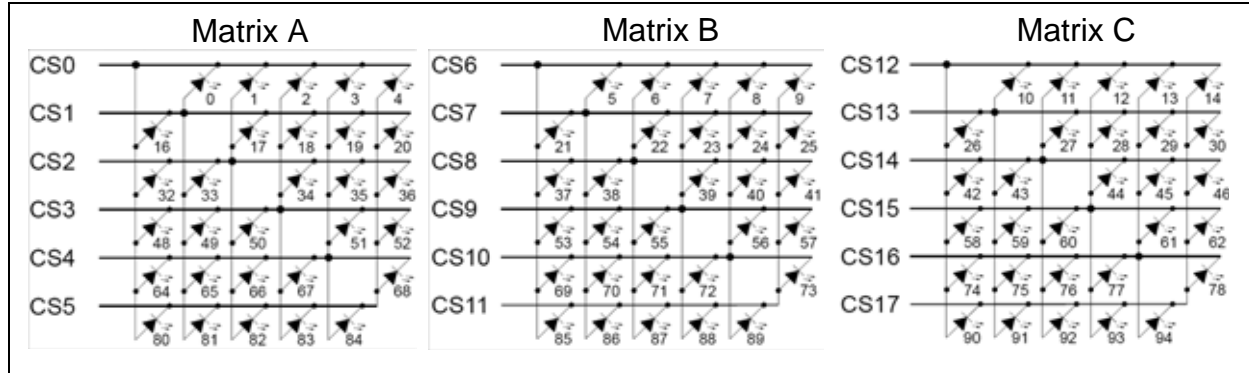


Table 11. Dataframe Adress Structure for 3 Matrixes

| | | | Adresses (HEX code) | | | | | | | | |
|----------------|------|------|---------------------|---|------|--------|---|------|-----------|---|-----------|
| Current Source | | | On / Off | | | Blink | | | Intensity | | |
| Matrix | | | Matrix | | | Matrix | | | Matrix | | |
| A | B | C | A | B | C | A | B | C | A | B | C |
| CS0 | CS6 | CS12 | 0x00 | | 0x01 | 0x12 | | 0x13 | 0x24-0x2B | | 0x2C-0x33 |
| CS1 | CS7 | CS13 | 0x02 | | 0x03 | 0x14 | | 0x15 | 0x34-0x3B | | 0x3C-0x43 |
| CS2 | CS8 | CS14 | 0x04 | | 0x05 | 0x16 | | 0x17 | 0x44-0x4B | | 0x4C-0x53 |
| CS3 | CS9 | CS15 | 0x06 | | 0x07 | 0x18 | | 0x19 | 0x54-0x5B | | 0x5C-0x63 |
| CS4 | CS10 | CS16 | 0x08 | | 0x09 | 0x1A | | 0x1B | 0x64-0x6B | | 0x6C-0x73 |
| CS5 | CS11 | CS17 | 0x0A | | 0x0B | 0x1C | | 0x1D | 0x74-0x7B | | 0x7C-0x83 |

In Table 12 it's described which databit represents which LED in the matrix. Per default all databits are '0', meaning no LED is on. A '1' puts the LED on.

Note: LED A01 is the first LED of the Current Source 0 in the Matrix A. LED B01 is the first LED of the Current Source 6 in the Matrix B. and so on.

Table 12. LEDs ON/OFF Register Format for 3 Matrixes Setup

| Current Source | Address | | | | | | | | | Data | | | | | | | |
|----------------------|---------|----|----|----|----|----|----|----|----|--------|--------|--------|--------|--------|--------|--------|--------|
| | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| CS0, CS6, CS12 | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | LED 7 | LED 6 | LED 5 | LED 4 | LED 3 | LED 2 | LED 1 | LED 0 |
| | 0x01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | LED 14 | LED 13 | LED 12 | LED 11 | LED 10 | LED 9 | LED 8 |
| CS1, CS7, CS13 | 0x02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | LED 23 | LED 22 | LED 21 | LED 20 | LED 19 | LED 18 | LED 17 | LED 16 |
| | 0x03 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | X | LED 30 | LED 29 | LED 28 | LED 27 | LED 26 | LED 25 | LED 24 |
| CS2, CS8, CS14 | 0x04 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | LED 39 | LED 38 | LED 37 | LED 36 | LED 35 | LED 34 | LED 33 | LED 32 |
| | 0x05 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | X | LED 46 | LED 45 | LED 44 | LED 43 | LED 42 | LED 41 | LED 40 |

Table 12. LEDs ON/OFF Register Format for 3 Matrixes Setup

| Current Source | Address | | | | | | | | | Data | | | | | | | |
|-----------------------|---------|----|----|----|----|----|----|----|----|--------|--------|--------|--------|--------|--------|--------|--------|
| | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| CS3, CS9, CS15 | 0x06 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | LED 55 | LED 54 | LED 53 | LED 52 | LED 51 | LED 50 | LED 49 | LED 48 |
| | 0x07 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | X | LED 62 | LED 61 | LED 60 | LED 59 | LED 58 | LED 57 | LED 56 |
| CS4, CS10, CS16 | 0x08 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | LED 71 | LED 70 | LED 69 | LED 68 | LED 67 | LED 66 | LED 65 | LED 64 |
| | 0x09 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | X | LED 78 | LED 77 | LED 76 | LED 75 | LED 74 | LED 73 | LED 72 |
| CS5, CS11, CS17 | 0x0A | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | LED 87 | LED 86 | LED 85 | LED 84 | LED 83 | LED 82 | LED 81 | LED 80 |
| | 0x0B | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | X | LED 94 | LED 93 | LED 92 | LED 91 | LED 90 | LED 89 | LED 88 |

In the blink register (see Table 13) every single LED can be set to blink. The blink period is set in the display option register (see Display Option Register (0x03) on page 24).

Table 13. LEDs Blink Register Format for 3 Matrixes Setup

| Current Source | Address | | | | | | | | | Data | | | | | | | |
|-----------------------|---------|----|----|----|----|----|----|----|----|--------|--------|--------|--------|--------|--------|--------|--------|
| | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| CS0, CS6, CS12 | 0x12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | LED 7 | LED 6 | LED 5 | LED 4 | LED 3 | LED 2 | LED 1 | LED 0 |
| | 0x13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | LED 14 | LED 13 | LED 12 | LED 11 | LED 10 | LED 9 | LED 8 |
| CS1, CS7, CS13 | 0x14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | LED 23 | LED 22 | LED 21 | LED 20 | LED 19 | LED 18 | LED 17 | LED 16 |
| | 0x15 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | X | LED 30 | LED 29 | LED 28 | LED 27 | LED 26 | LED 25 | LED 24 |
| CS2, CS8, CS14 | 0x16 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | LED 39 | LED 38 | LED 37 | LED 36 | LED 35 | LED 34 | LED 33 | LED 32 |
| | 0x17 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | X | LED 46 | LED 45 | LED 44 | LED 43 | LED 42 | LED 41 | LED 40 |
| CS3, CS9, CS15 | 0x18 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | LED 55 | LED 54 | LED 53 | LED 52 | LED 51 | LED 50 | LED 49 | LED 48 |
| | 0x19 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | X | LED 62 | LED 61 | LED 60 | LED 59 | LED 58 | LED 57 | LED 56 |
| CS4, CS10, CS16 | 0x1A | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | LED 71 | LED 70 | LED 69 | LED 68 | LED 67 | LED 66 | LED 65 | LED 64 |
| | 0x1B | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | X | LED 78 | LED 77 | LED 76 | LED 75 | LED 74 | LED 73 | LED 72 |
| CS5, CS11, CS17 | 0x1C | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | LED 87 | LED 86 | LED 85 | LED 84 | LED 83 | LED 82 | LED 81 | LED 80 |
| | 0x1D | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | X | LED 94 | LED 93 | LED 92 | LED 91 | LED 90 | LED 89 | LED 88 |

In the intensity register (see Table 14) the brightness of every single LED can be set via a 8bit PWM (255 steps).

Table 14. LEDs Intensity Register Format for 3 Matrixes Setup

| Matrix | Current Source | | Address | | | | | | | | | Data | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--------|----------------|-------|---------|----|----|----|----|----|----|----|----|---|----|----|----|----|----|----|----|---|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|---|--|--|--|--|--|--|--|
| | | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A | CS0 | LED0 | 0x24 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 255 steps for intensity each single LED | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED1 | 0x25 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED2 | 0x26 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED3 | 0x27 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED4 | 0x28 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B | CS6 | LED5 | 0x29 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | | | | | | | | | 255 steps for intensity each single LED | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED6 | 0x2A | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED7 | 0x2B | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED8 | 0x2C | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED9 | 0x2D | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | CS12 | LED10 | 0x2E | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | | | | | | | | | | | | | | | | | 255 steps for intensity each single LED | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED11 | 0x2F | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED12 | 0x30 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED13 | 0x31 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED14 | 0x32 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A | CS1 | LED16 | 0x34 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | 255 steps for intensity each single LED | | | | | | | | | | | | | | | |
| | | LED17 | 0x35 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED18 | 0x36 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED19 | 0x37 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED20 | 0x38 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B | CS7 | LED21 | 0x39 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 255 steps for intensity each single LED | | | | | | | |
| | | LED22 | 0x3A | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED23 | 0x3B | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED24 | 0x3C | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED25 | 0x3D | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | CS13 | LED26 | 0x3E | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 255 steps for intensity each single LED | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED27 | 0x3F | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED28 | 0x40 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED29 | 0x41 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED30 | 0x42 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A | CS2 | LED32 | 0x44 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | | | | | | | | | 255 steps for intensity each single LED | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED33 | 0x45 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED34 | 0x46 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED35 | 0x47 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED36 | 0x48 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B | CS8 | LED37 | 0x49 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | | | | | | | | | | | | | | | | | 255 steps for intensity each single LED | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED38 | 0x4A | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED39 | 0x4B | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED40 | 0x4C | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED41 | 0x4D | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| C | CS14 | LED42 | 0x4E | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | 255 steps for intensity each single LED | | | | | | | | | | | | | | | |
| | | LED43 | 0x4F | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED44 | 0x50 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED45 | 0x51 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | LED46 | 0x52 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 14. LEDs Intensity Register Format for 3 Matrixes Setup

| Matrix | Current Source | | Address | | | | | | | | Data | | | | | | | |
|--------|----------------|-------|---------|----|----|----|----|----|----|----|------|---|----|----|----|----|----|----|
| | | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 |
| | | | | | | | | | | | | | | | | | | |
| A | CS5 | LED80 | 0xA4 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 255 steps for intensity each single LED | | | | | | |
| | | LED81 | 0xA5 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | | | | | | | |
| | | LED82 | 0xA6 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | | | | | | | |
| | | LED83 | 0xA7 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | | | | | | | |
| | | LED84 | 0xA8 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | | | | | | | |
| B | CS11 | LED85 | 0xA9 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | | | | | | | |
| | | LED86 | 0xAA | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | | | | | | | |
| | | LED87 | 0xAB | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | | | | | | | |
| | | LED88 | 0xAC | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | | | | | | | |
| | | LED89 | 0xAD | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | | | | | | | |
| C | CS17 | LED90 | 0xAE | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | | | | | | | |
| | | LED91 | 0xAF | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | | | | | | | |
| | | LED92 | 0xB0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | | | | | | | |
| | | LED93 | 0xB1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | | | | | | | |
| | | LED94 | 0xB2 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | | | | | | | |

Control-Registers

The AS1119 devices contain 13 control-registers which are listed in [Table 15](#). All registers are selected using a 8-bit address word, and communication is done via the serial interface. Select the Control Register via the Register Selection (see [Table 6](#) on page 14).

Table 15. Control Register Address Map

| Register Name | HEX | Register Address | | | | | | | | Register Data |
|---------------------------------------|------|------------------|----|----|----|----|----|----|----|---|
| | | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7:D0 |
| Frame Address | 0x00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (see Table 16 on page 23) |
| Frame Play | 0x01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | (see Table 17 on page 23) |
| Frame Time | 0x02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | (see Table 18 on page 24) |
| Display Option | 0x03 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | (see Table 19 on page 24) |
| AS1119 Config | 0x04 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | (see Table 20 on page 25) |
| Current Source Matrix A | 0x05 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | (see Table 21 on page 25) |
| Current Source Matrix B | 0x06 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | |
| Current Source Matrix C | 0x07 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | |
| Chare Pump Config | 0x08 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | (see Table 22 on page 26) |
| Open/Short Test | 0x09 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | (see Table 23 on page 26) |
| Shutdown | 0x0A | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | (see Table 24 on page 27) |
| I ² C Interface Monitoring | 0x0B | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | (see Table 25 on page 27) |
| Open/Short Status | 0x0C | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | (see Table 26 on page 27) |
| AS1119 Status | 0x0D | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | (see Table 27 on page 28) |

Frame Address Register (0x00)

In this register it must be set if a picture or a movie is to display on the LED matrix. Also the start address of the the movie or the picture which should be displayed must be set within this register. The default setting of this register is 0x00.

Table 16. Frame Address Register Format

| 0x00 Frame Address Register | | | | |
|-----------------------------|-------------------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| 7 | Play Movie | 0 | R/W | 0: no movie 1: play movie |
| 6 | Display Picture | 0 | R/W | 0: no picture 1: display picture |
| 5:3 | Start Address for movie | 000 | R/W | 000: Frame 0 001: Frame 1 010: Frame 2 011: Frame 3 100: Frame 4 101: Frame 5 |
| 2:0 | Address of Picture | 000 | R/W | 000: Frame 0 001: Frame 1 010: Frame 2 011: Frame 3 100: Frame 4 101: Frame 5 |

Note: If bit 6 and 7 are set to '1' the AS1119 will play the movie first and than the picture will be displayed.

Frame Play Register (0x01)

Within this register two movie play options can be set. Per default this register is set to 0x00.

- The number of frames which are displayed in one movie.
- The number of loops to play in a movie.

Table 17. Frame Play Register Format

| 0x01 Frame Play Register | | | | |
|--------------------------|---------------------------------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| 7:6 | - | 00 | n/a | |
| 5:3 | Number of loops played in one movie | 000 | R/W | 000: no loop 001: 1 loop 010: 2 loops 011: 3 loops 100: 4 loops 101: 5 loops 110: 6 loops 111: play endless |
| 2:0 | Number of frames to played in a movie | 000 | R/W | 000: 1 frame 001: 2 frames 010: 3 frames 011: 4 frames 100: 5 frames 101: 6 frames |

Note: To display a picture again after the *play endless* function D5:D3 has to be set to D5:D3 = 000 to 110.

Frame Time Register (0x02)

Every single frame in a movie is displayed for a certain time before the next frame is displayed. This time can be set within this register with 4 bits. The stated values in Table 18 are typical values. Per default this register is set to 0x00.

Table 18. Frame Time Register Format

| 0x02 Frame Time Register | | | | |
|--------------------------|---------------------------------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| 7:4 | - | 00 | n/a | |
| 3:0 | Delay between frame change in a movie | 000 | R/W | 0000: play frame only one time 0001: 32.5ms 0010: 65ms 0011: 97.5ms 0100: 130ms 0101: 162.5ms 0110: 195ms 0111: 227.5ms 1000: 260ms 1001: 292.5ms 1010: 325ms 1011: 357.5ms 1100: 390ms 1101: 422.5ms 1110: 455ms 1111: 487.5ms |

Display Option Register (0x03)

With the scan-limit it can be controled how many digits should be displayed. When all 18 digits are to display, the update frequency is typically 430Hz (typ). If the number of digits to display is reduced, the update frequency is increased. Per default this register is set to 0x07.

Table 19. Display Option Register Format

| 0x03 Display Option Register | | | | |
|------------------------------|-------------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| 7 | - | 0 | n/a | |
| 6 | intensity setting | 0 | R/W | 0: use intensity setting of frame 0 for all other frames 1: set the intensity of each frame independently |
| 5 | start with blink | 0 | R/W | 0: start blinking with LED on 1: start blinking with LED off |
| 4 | blink period | 0 | R/W | 0: 1.5s 1: 3s |

Table 19. Display Option Register Format

| 0x03 Display Option Register | | | | | | |
|------------------------------|---|---------|--------|---|---|--|
| Bit | Bit Name | Default | Access | Bit Description | | |
| 3:0 | number of displayed current sources in one frame (scan-limit) | 0111 | R/W | 2 Matrix setting | | |
| | | | | Matrix A | Matrix B | |
| | | | | 0000: CS0 0001: CS0 to CS1 0010: CS0 to CS2 0011: CS0 to CS3 0100: CS0 to CS4 0101: CS0 to CS5 0110: CS0 to CS6 0111: CS0 to CS7 1000: CS0 to CS8 | 0000: CS0 0001: CS0 to CS1 0010: CS0 to CS2 0011: CS0 to CS3 0100: CS0 to CS4 0101: CS0 to CS5 0110: CS0 to CS6 0111: CS0 to CS7 1000: CS0 to CS8 | |
| | | | | 3 Matrixes setting | | |
| | | | | Matrix A | Matrix B | Matrix C |
| | | | | 0000: CS0 0001: CS0 to CS1 0010: CS0 to CS2 0011: CS0 to CS3 0100: CS0 to CS4 0101: CS0 to CS5 | 0000: CS6 0001: CS6 to CS7 0010: CS6 to CS8 0011: CS6 to CS9 0100: CS6 to CS10 0101: CS6 to CS11 | 0000: CS12 0001: CS12 to CS13 0010: CS12 to CS14 0011: CS12 to CS15 0100: CS12 to CS16 0101: CS12 to CS17 |

AS1119 Config Register (0x04)

In this register the configuration of the charge pumps is set to 2 or 3 blocks. The direction of the SYNC_XXX pin (input or output) is also set. Per default this register is set to 0x00.

Table 20. AS1119 Config Register Format

| 0x04 AS1119 Config Register | | | | | |
|-----------------------------|----------------------|---------|--------|---|--|
| Bit | Bit Name | Default | Access | Bit Description | |
| 7:3 | - | 00000 | n/a | | |
| 2:1 | Sync | 00 | R/W | 00: do not use 01: pin B6 is used as clk output for synchronization 10: pin B6 is used as clk input for synchronization 11: do not use | |
| 0 | Matrix Configuration | 0 | R/W | 0: 3 matrixes (à 5x6 LED-Matrix) 1: 2 matrixes (à 8x9 LED-Matrix) | |

Current Source Block A, B, C Registers (0x05, 0x06, 0x07)

Within this registers the current for one block of LEDs can be set from 0mA to 31mA in 255 steps (8 bits). Per default this register is set to 0x00.

Table 21. Current Sourcer Register Format

| Current Source Registers | | | | | |
|--------------------------|-------------------------|---------|--------|--|--|
| Bit | Bit Name | Default | Access | Bit Description | |
| Address 0x05 | | | | | |
| 7:0 | Analog Current Matrix A | 0000000 | R/W | 00000000: 0mA 11111111: 31mA | |
| Address 0x06 | | | | | |
| 7:0 | Analog Current Matrix B | 0000000 | R/W | 00000000: 0mA 11111111: 31mA | |

Table 21. Current Sourcer Register Format

| Current Source Registers | | | | |
|--------------------------|-------------------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| Address 0x07 | | | | |
| 7:0 | Analog Current Matrix C | 0000000 | R/W | 00000000: 0mA 11111111: 31mA |

Charge Pump Config Register (0x08)

In this register the characteristics of the Charge Pump can be set. If the supply of the AS1119 is strong enough the charge pump is turning off automatically. This option and also the timeframe for it can be set. The timeframe defines the period in which the control logic tries to switch off the charge pump. Per default this register is set to 0x1E.

Table 22. AS1119 Config Register Format

| 0x08 Charge Pump Config Register | | | | |
|----------------------------------|----------------------------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| 7:5 | - | 000 | n/a | |
| 4:2 | Timeframe for reduce supply test | 111 | R/W | 000: 0.3s 001: 0.5s 010: 0.8s 011: 1.0s 100: 1.3s 101: 1.6s 110: 1.8s 111: 2.1s |
| 1 | Reduce supply option | 1 | R/W | 0: reduce supply option off 1: reduce supply option on |
| 0 | Charge Pump | 0 | R/W | 0: Charge Pump disable 1: Charge Pump enable |

Open/Short Test Register (0x09)

The AS1119 can detect open and shorted LEDs. To start this test the according bits have to be set. The result of the open/short test is written in the Open/Short status register (see Table 26). The default setting of this register is 0x00.

Table 23. Open/Short Test Register Format

| 0x09 Open/Short Test Register | | | | |
|-------------------------------|-----------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| 7:2 | - | 000000 | n/a | |
| 1 | Full Matrix | 0 | R/W | 0: all LED's are available in the matrixes 1: not all LED's are available in the matrixes |
| 0 | Error detection | 0 | R/W | 0: start test 1: no test |

The Open/Short test is only checking LEDs which are defined as ON in the Data Frame Registers Table 8 on page 15 or Table 12 on page 19. With the bit1 (Full Matrix) all 144 LEDs will be defined as available and will be tested. If bit1 is set to '1', no LED will be turned ON.

Shutdown Register (0x0A)

The default setting of this register is 0x00. To get the AS1119 operational the bit D0 has to be set to '1'.

Table 24. Shutdown Register Format

| 0x0A Shutdown Register | | | | |
|------------------------|----------|---------|--------|------------------------------------|
| Bit | Bit Name | Default | Access | Bit Description |
| 7:1 | - | 0000000 | n/a | |
| 0 | shutdown | 0 | R/W | 0: shutdown 1: normal operation |

I²C Interface Monitoring Register (0x0B)

This register is used to monitor the activity on the I²C bus. If a deadlock situation occurs (e.g. the bus SDA pin is pulled to low and no communication is possible) the chip will reset the I²C interface and the master is able to start the communication again.

The time window for the reset of the interface of the AS1119 can be set via 7 bits from 256µs to 33ms. The default setting of this register is 0xFF.

Table 25. I²C Interface Monitoring Register Format

| 0x0B I ² C Interface Monitoring Register | | | | |
|---|--------------------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| 7:2 | Time out window | 1111111 | R/W | 0 to 127 => 1 to 128x256µs 0000000: 256µs 1111111: 32.7ms |
| 0 | I ² C Monitor | 1 | R/W | 0: I ² C monitoring off 1: I ² C monitoring on |

Open/Short Status Register (0x0C)

This is a read only register. Within this register the result of the open/short test can be read out. It's also stated if the test is completed or still running. The default setting of this register is 0x00.

Table 26. Open/Short Status Register Format

| 0x0C Open/Short Status Register | | | | |
|---------------------------------|----------------------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| 7 | - | 0 | n/a | |
| 6 | status | 0 | R | 0: no test 1: test ongoing |
| 5 | short test result Matrix C | 0 | R | 0: no error detected 1: short in Matrix C |
| 4 | short test result Matrix B | 0 | R | 0: no error detected 1: short in Matrix B |
| 3 | short test result Matrix A | 0 | R | 0: no error detected 1: short in Matrix A |
| 2 | open test result Matrix C | 0 | R | 0: no error detected 1: open in Matrix C |
| 1 | open test result Matrix B | 0 | R | 0: no error detected 1: open in Matrix B |
| 0 | open test result Matrix A | 0 | R | 0: no error detected 1: open in Matrix A |

AS1119 Status Register (0x0D)

This is a read only register. From this register the actual status of the AS1119 can be read out. The default setting of this register is 0x00. After an read command the bits are set to '0' again automatically.

Table 27. AS1119 Status Register Register Format

| 0x0D AS1119 Status Register | | | | |
|-----------------------------|------------------------|---------|--------|--|
| Bit | Bit Name | Default | Access | Bit Description |
| 7 | - | 0 | n/a | |
| 6 | Movie status | | R | 0: no movie is playing 1: one movie is playing |
| 5:4 | Interrupt | 00 | R | 00: no Interrupt triggered 01: POR triggered an interrupt ¹ 10: I ² C monitor triggered an interrupt 11: both (I ² C and POR) triggered an interrupt |
| 3:0 | actual displayed frame | 000 | R | 000: frame 0 001: frame 1 010: frame 2 011: frame 3 100: frame 4 101: frame 5 |

1. The power-on reset is part of the start sequence, hence after start-up this bit is also set.

10 Package Drawings and Markings

Figure 23. 36-pin WL-CSP Marking

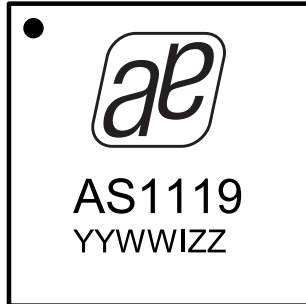
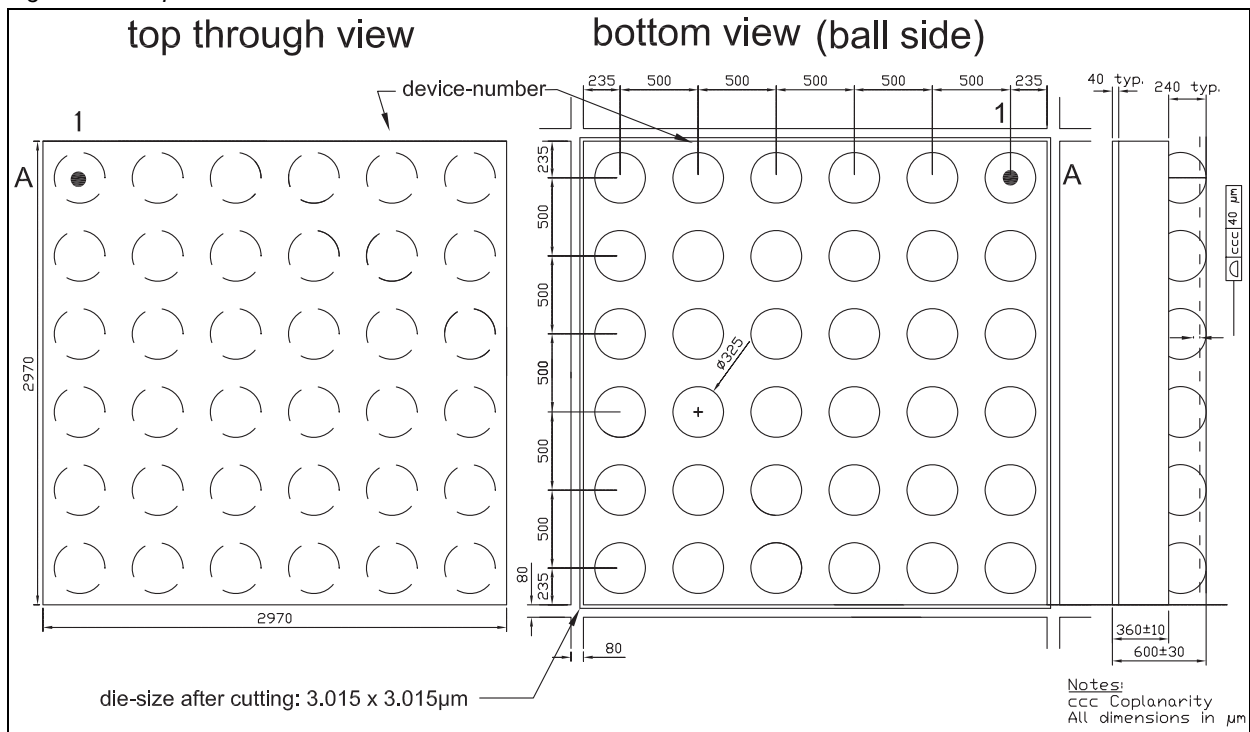


Table 28. Packaging Code YYWWIZZ

| YY | WW | I | ZZ |
|-------------------------------------|--------------------|------------------|---------------------------------|
| last two digits of the current year | manufacturing week | plant identifier | free choice / traceability code |

Figure 24. 36-pin WL-CSP



11 Ordering Information

The devices are available as the standard products shown in [Table 29](#).

Table 29. Ordering Information

| Ordering Code | Marking | Description | Delivery Form | Package |
|---------------|---------|---|---------------|---------------|
| AS1119-BWLT | AS1119 | 144-LED Cross-Plexing Driver with 320mA Charge-Pump | Tape and Reel | 36-pin WL-CSP |

Note: All products are RoHS compliant.

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