# AS1119

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

## 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.

*Ordering Information and Content Guide appear at end of datasheet.*

### Key Benefits & Features

The benefits and features of the AS1119, 144-LED Cross-Plexing Driver with 320mA Charge-Pump are listed below:

**Figure 1:**
**Added Value of Using AS1119**

| Benefits | Features |
|---|---|
| • Excellent PCB real estate vs LED count | • Up to 144LEDs as 2x 8x9 or 3x 5x6 |
| • 16.7M full color matrix with white balance | • 8bit PWM per LED and current control per matrix |
| • Reduces MCU load and increases battery lifetime | • 6 frames of memory |
| • Extends battery lifetime while reducing BOM and increasing ease of use | • Internal automatic charge pump |

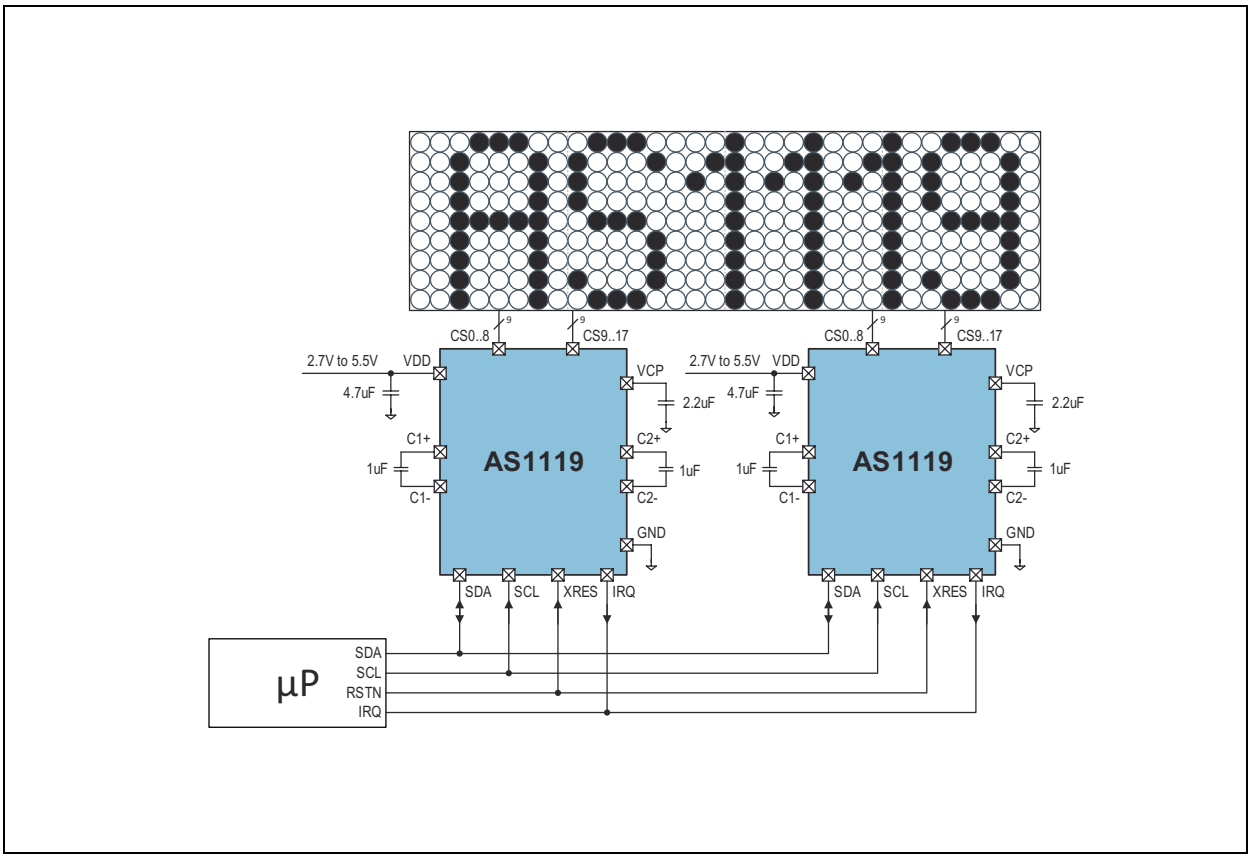
- 1MHz I²C-compatible interface
- Open and shorted LED error detection
- 144 LEDs in dot matrix
- Low-power shutdown current

- 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
- System-clk synchronisation for multiple devices
- Supply voltage range: 2.7V to 5.5V
- Minimum PCB space required
- 36-pin WL-CSP package

## Applications

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

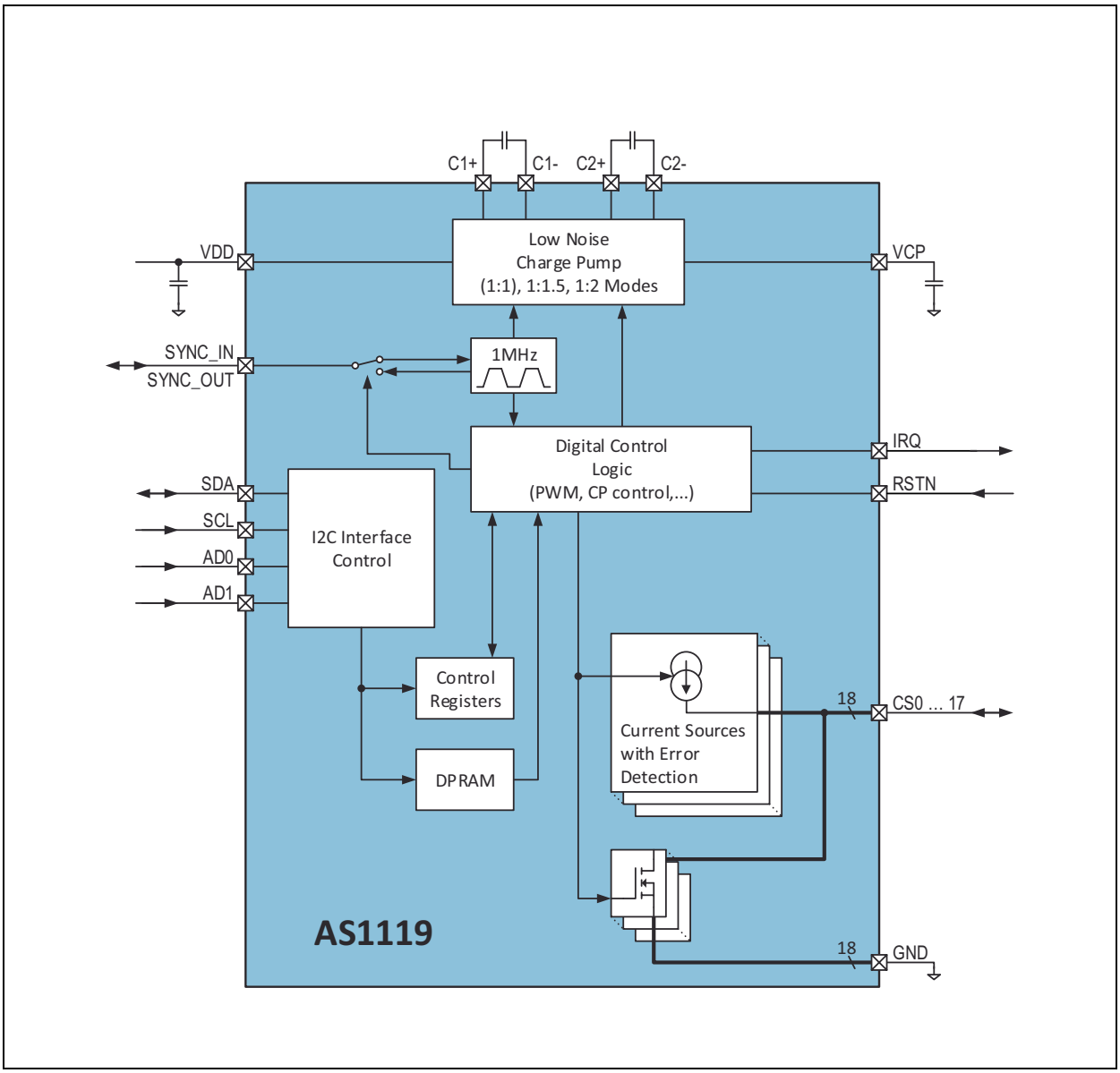
**Figure 2:**
**Typical Application Diagram**



## Block Diagram

The functional blocks of this device are shown below:

**Figure 3:**
**AS1119 Block Diagram**



## Pin Assignments

The AS1119 pin assignments are described below:

**Figure 4:**
**Pin Diagram (Top View)**

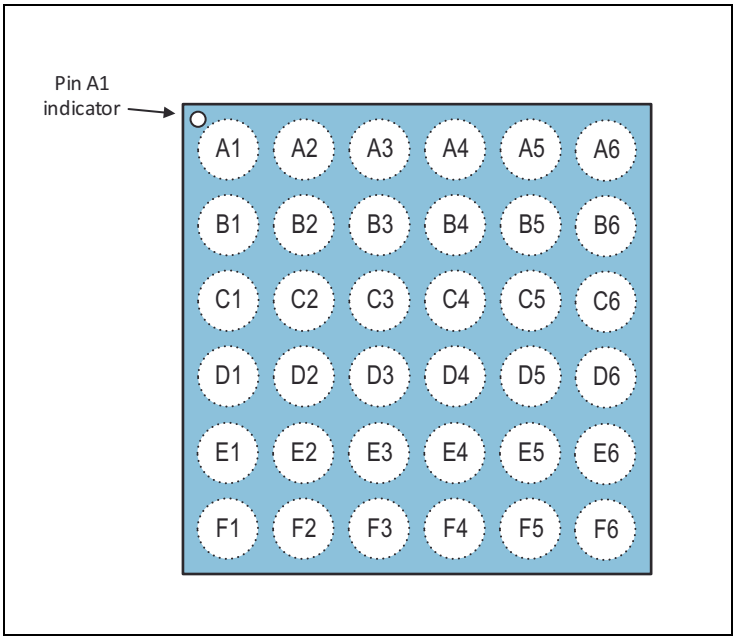



**Figure 5:**
**Pin Description**

| Pin Name | Pin Number | Description |
|---|---|---|
| $V_{DD1}$, $V_{DD2}$, $V_{DD3}$ | A6, E5, E1 | **Positive Supply Voltage**. Connect to a +2.7V to +5.5V supply. Bypass this pin with 10µF capacitance to GND1, GND2, GND3. |
| VCP | F1 | **Charge-Pump Output Voltage**. Connect a 2.2µF capacitor to GND3. |
| C1-, C1+ | B1, C1 | **Flying Cap 1**. Connect a 1µF capacitor. |
| C2-, C2+ | A1, D1 | **Flying Cap 2**. Connect a 1µF 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 $I^2C$ data pin. |
| SCL | D6 | **Serial-Clock Input**. |
| AD0 | C5 | **$I^2C$ Address for bit 0**. Put to GND or VDD to set $I^2C$ addresses. |
| AD1 | D5 | **$I^2C$ Address for bit 1**. Put to GND or VDD to set $I^2C$ addresses. |

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

## Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated under Electrical Characteristics is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**Figure 6:**
**Absolute Maximum Ratings**

| Parameter | Min | Max | Unit | Comments |
|---|---|---|---|---|
| **Electrical Parameters** | | | | |
| $V_{DD}$ to GND | -0.3 | 7 | V | |
| All other pins to GND | -0.3 | 7 or $V_{DD}$ + 0.3 | V | |
| Sink current | | 500 | mA | |
| Segment current | | 100 | mA | |
| Input current (latch-up immunity) | -100 | 100 | mA | JEDEC 78 |
| **Electrostatic Discharge** | | | | |
| Electrostatic discharge HBM | ±1.5 | | kV | MIL 883 E method 3015 |
| **Temperature Ranges and Storage Conditions** | | | | |
| Junction temperature | | 125 | °C | |
| Storage temperature range | -55 | 125 | °C | |
| Package body temperature | | 260 | °C | The reflow peak soldering temperature (body temperature) specified is in accordance with *IPC/ JEDEC J-STD-020 "Moisture/Reflow Sensitivity Classification for Non-Hermetic Solid State Surface Mount Devices".* |
| Relative humidity (non-condensing) | 5 | 85 | % | |
| Moisture sensitivity level | 1 | | | Represents a max. floor life time of unlimited |

## Electrical Characteristics

All limits are guaranteed. The parameters with min and max values are guaranteed with production tests or SQC (Statistical Quality Control) methods.

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

**Figure 7:**
**Electrical Characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $T_{AMB}$ | Operating temperature range | | | -40 | | 85 | °C |
| $V_{DD}$ | Operating supply voltage | | | 2.7 | | 5.5 | V |
| $I_{DDSD}$ | Software shutdown supply current | All digital inputs at $V_{DD}$ or GND, VDD = 5.5V, $T_{AMB}$ = 25°C | | | 7 | | µA |
| $I_{DDFSD}$ | Full shutdown supply current | Pin RSTN = 0V, $T_{AMB}$ = 25°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 | |
| | | | $V_{DD}$ ≥ 3.3V | | | 320 | |
| $I_{SEG}$ | Segment drive source current LED | $V_{OUT}$ = 1.8V to $V_{DD}$ - 400mV | | 28 | 30 | 32 | mA |
| $\Delta I_{SEG}$ | Segment drive current matching LED [3] | | | | 2 | | % |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DSSAT}$ | 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 9 × 8 matrixes | 0.39 | 0.43 | 0.48 | kHz |

**Note(s):**

1. Not all sources are allowed to be fully ON at the same time.
2. guaranteed by design
3. $I_{SEG} = \frac{I_{max} - I_{min}}{I_{max} + I_{min}} \times 100$

**Figure 8:**
**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 |
| $\Delta V_I$ | 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 | |

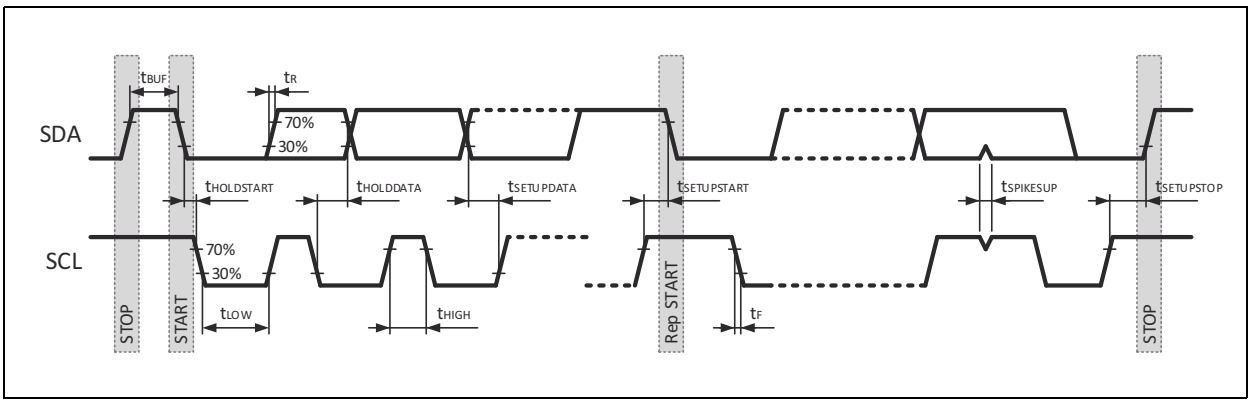
**Figure 9:**
**I²C Timing Characteristics**

| 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 |

**Note(s):**

1. The Min / Max values of the Timing Characteristics are guaranteed by design.

**Figure 10:**
**Timing Diagram**



## Typical Operating Characteristics

Figure 11:
Segment Drive Current vs. Supply Voltage

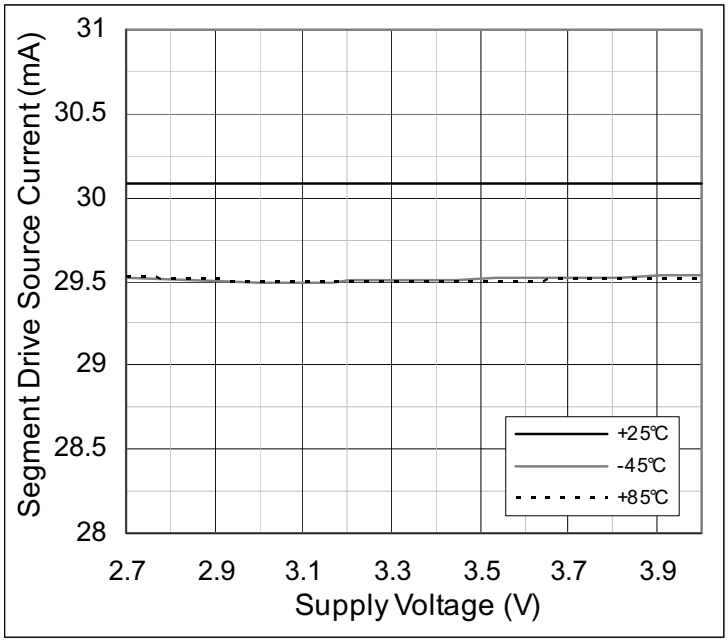



Figure 12:
Segment Drive Current vs. Temperature

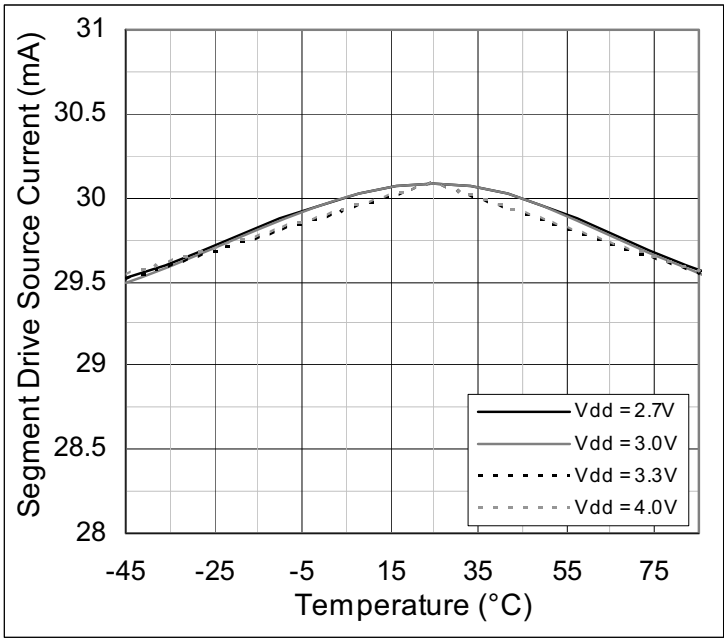


**Figure 13:**
**Segment Drive Current vs. Output Voltage**

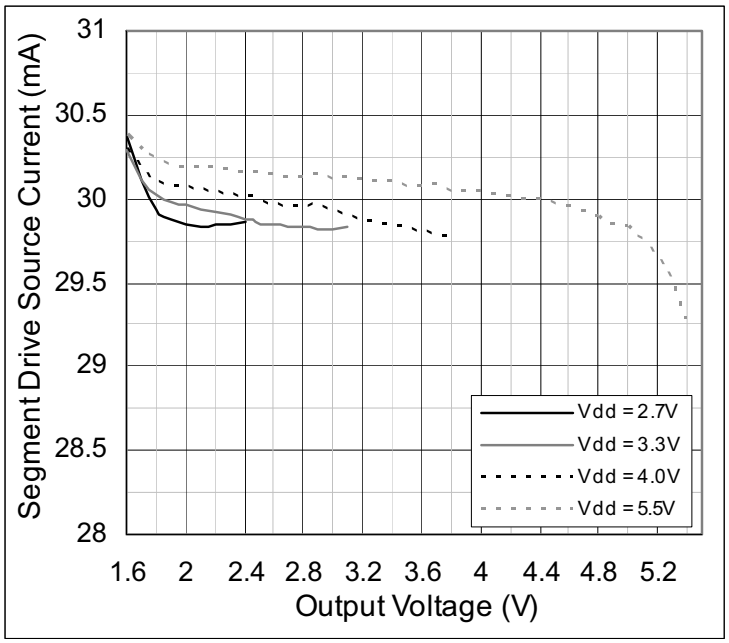



**Figure 14:**
**$R_{ONNMOS}$ vs. Supply Voltage**

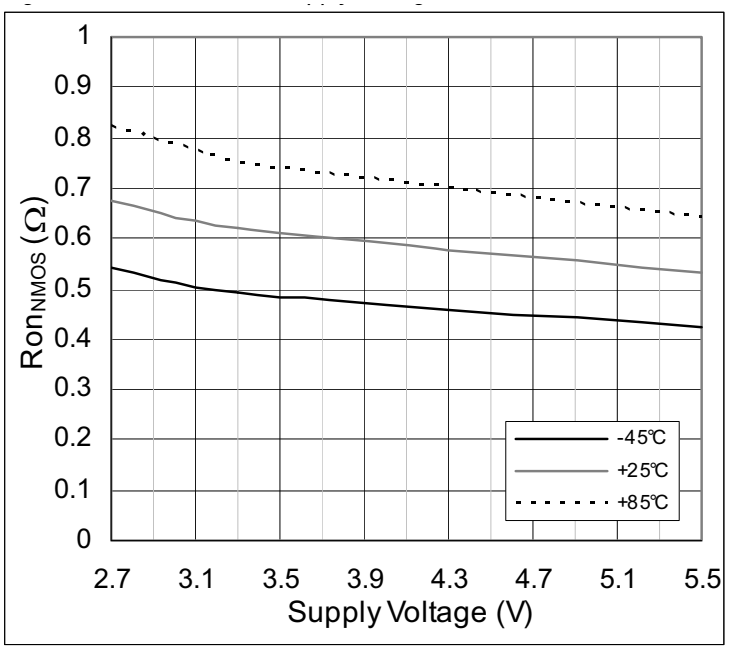


**Figure 15:**
**Open Detection Level vs. Supply Voltage**

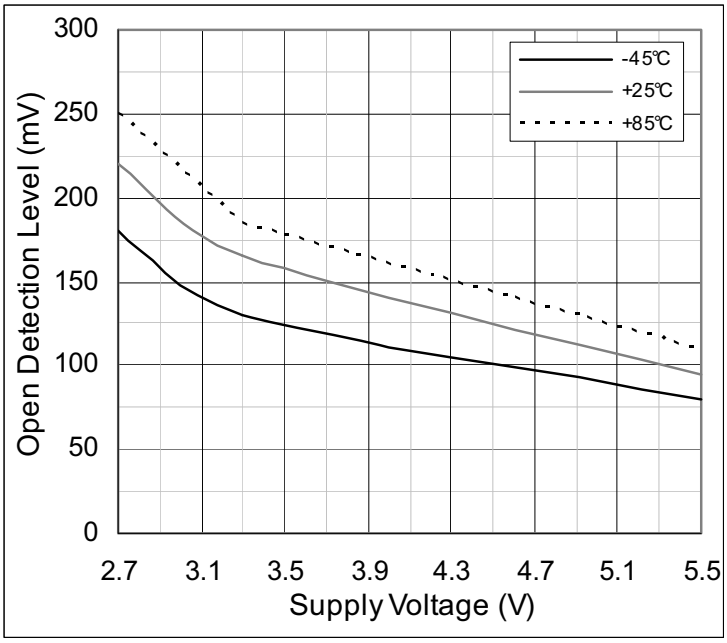



**Figure 16:**
**Short Detection Level vs. Supply Voltage**

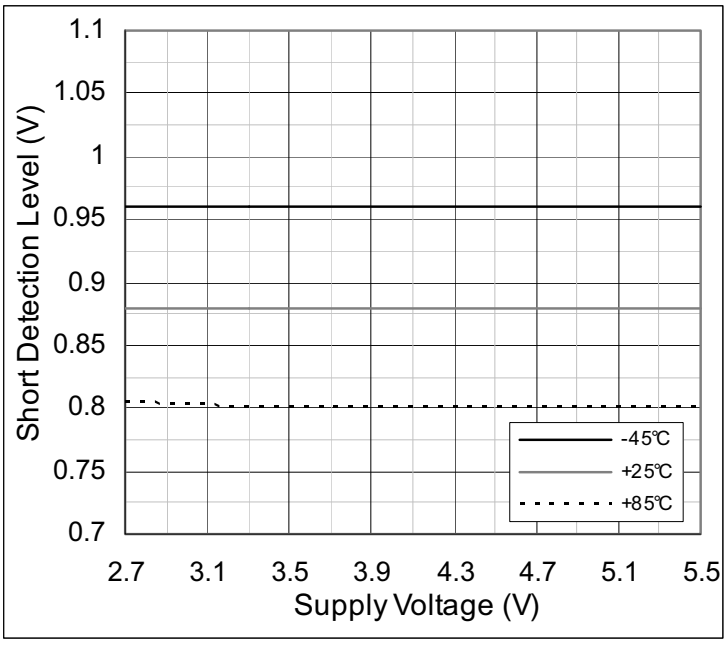


**Figure 17:**
**Efficiency vs. Supply Voltage**

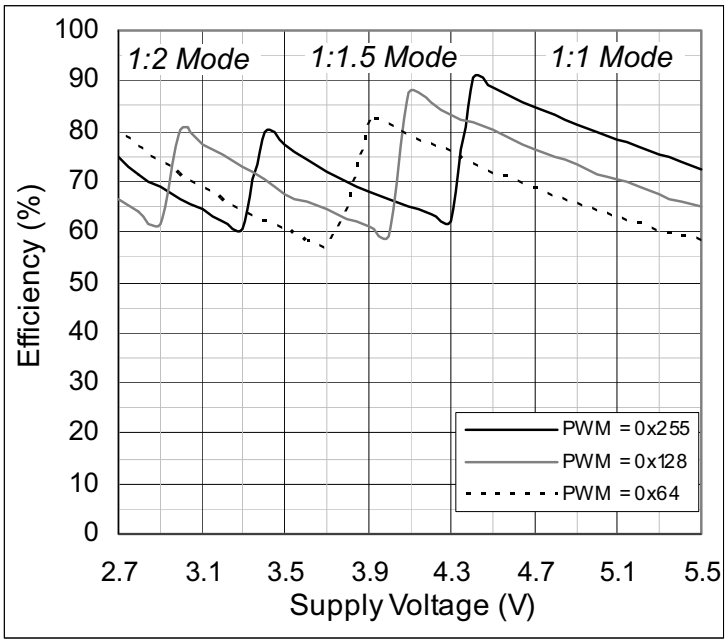



**Figure 18:**
**Logic Input Voltage Levels**

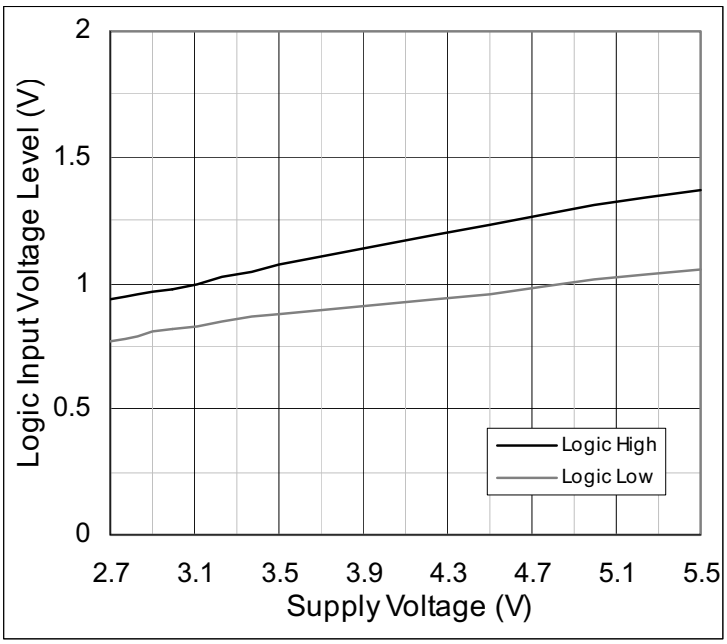
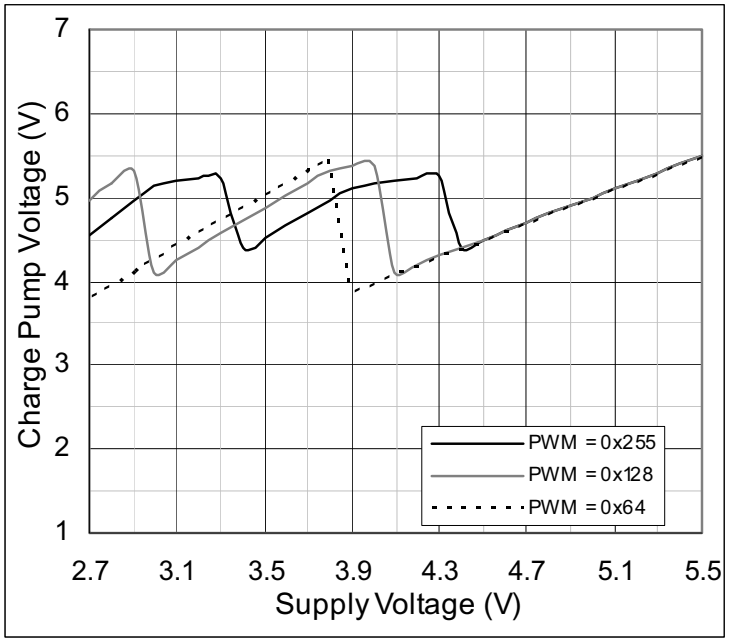


**Figure 19:**
**Charge Pump Voltage vs. Supply Voltage**



# Detailed Description

## 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 20:**
**I²C Interface Initialization**

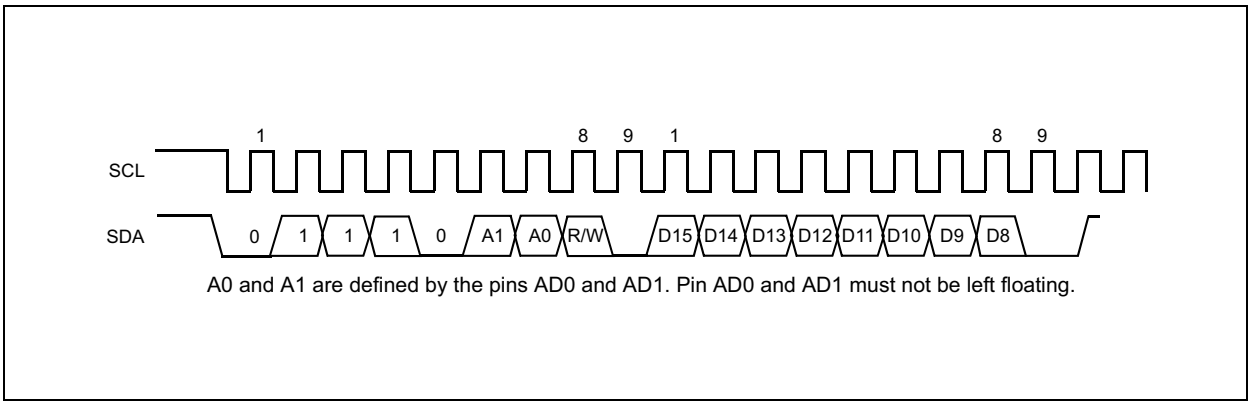
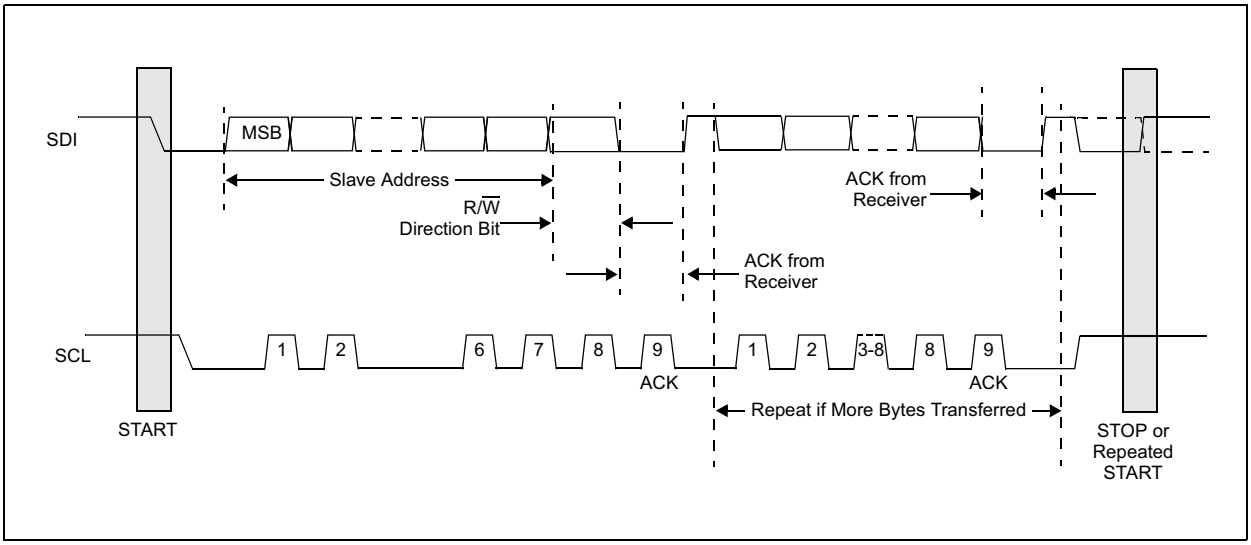



**Figure 21:**
**Bus Protocol**




The bus protocol (as shown in Figure 21) 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 $I^2C$ 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. Ofcourse, 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 21 details how data transfer is accomplished on the $I^2C$ bus. Depending upon the state of the R/$\overline{W}$ 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.

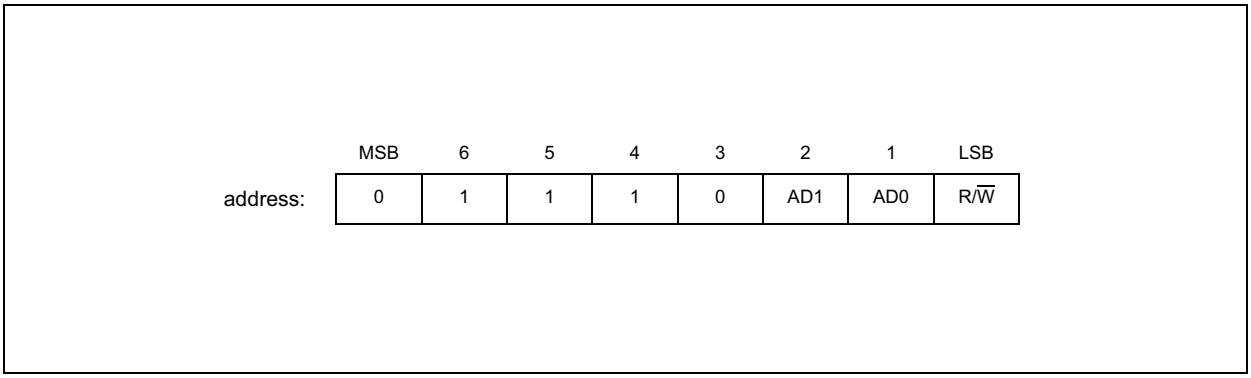
The AS1119 can operate in the following slave modes:

- **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 22) is the first byte received following the START condition from the master device.

**Figure 22:**
**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/$\overline{W}$) 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/$\overline{W}$ bit, the slave device outputs an acknowledge signal on the SDA line.

## Command Byte

The AS1119 operation, (see Figure 21) is determined by a command byte (see Figure 23).

**Figure 23:**
**Command Byte**

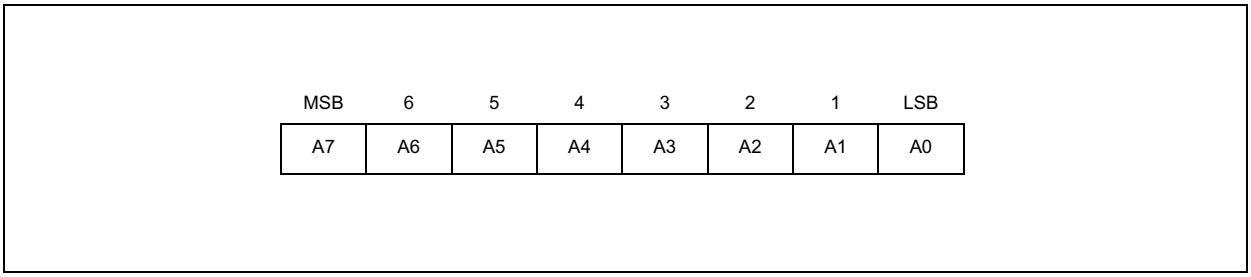



**Figure 24:**
**Command and Single Data Byte Received by AS1119**

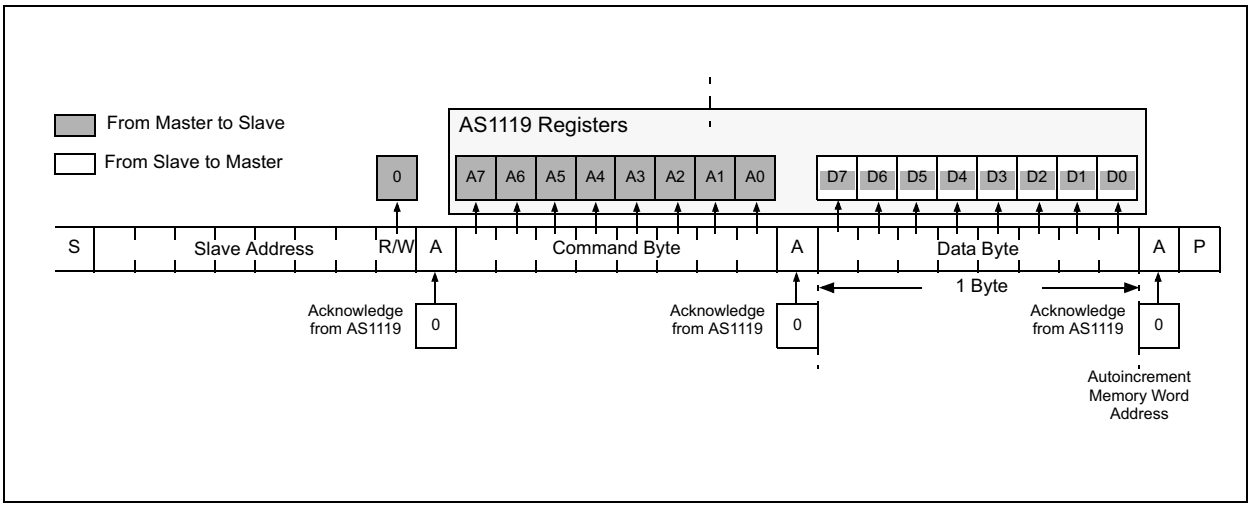



**Figure 25:**
**Setting the Pointer to a Address Register to Select a Data Register for a Read Operation**

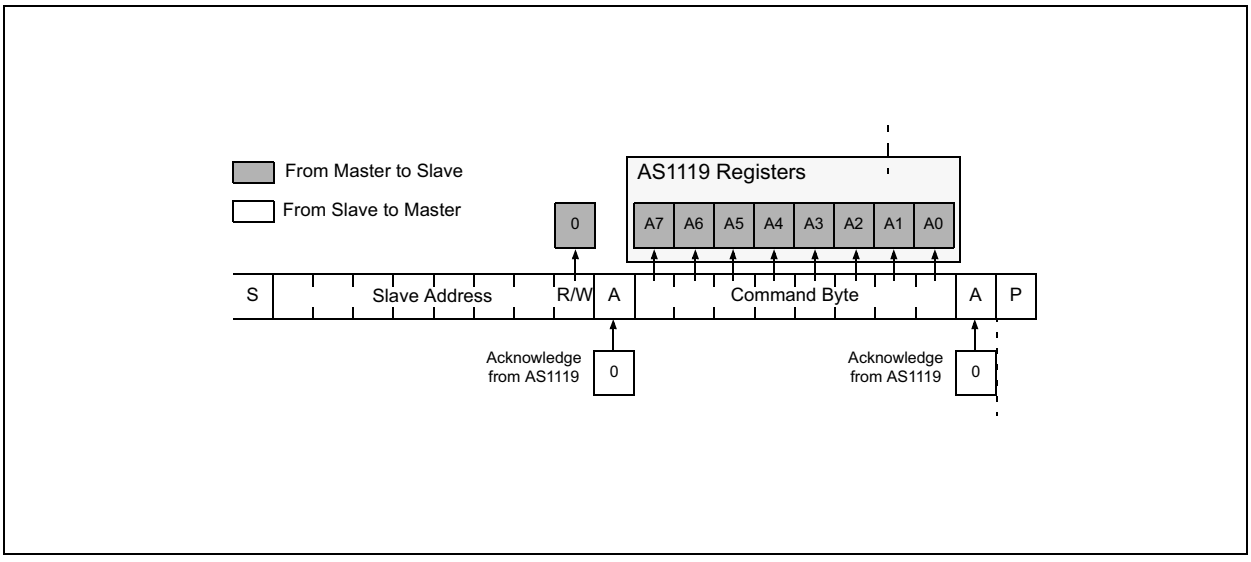
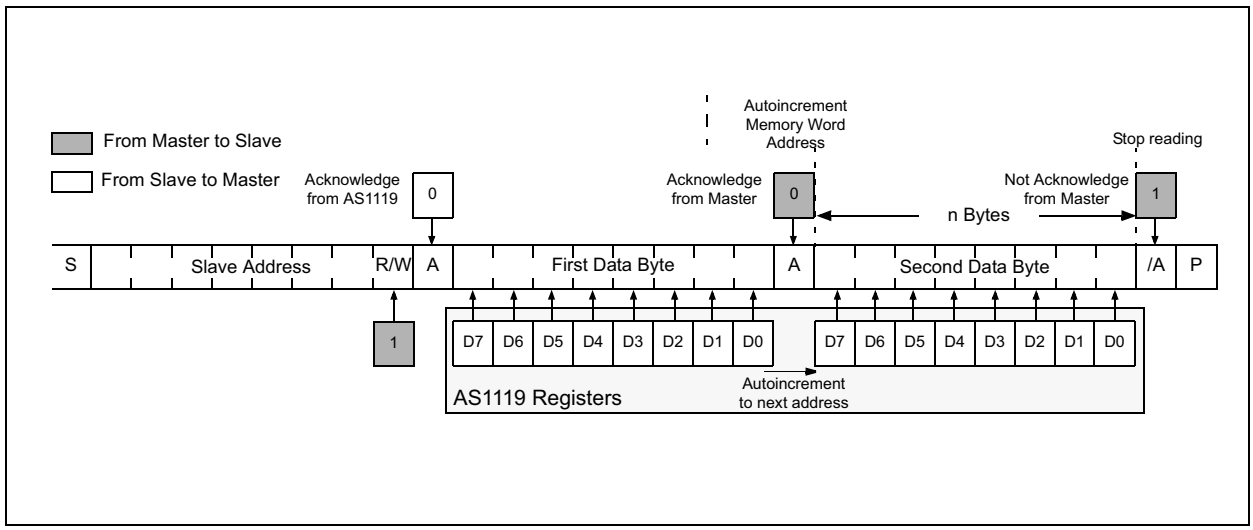


**Figure 26:**
**Reading n Bytes from AS1119**




## 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(s):** The default settings enable only scanning of one digit; the internal decoder is disabled and the Intensity Control Register (see Figure 32) and (see Figure 37) 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)) and a hardware shutdown via the RSTN pin.

The software shutdown disables all LEDs 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.).

# 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.

**Figure 27:**
**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 | 253 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | No operation |
| Data Frame 0 | | | | | | | | | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Selection of RAM section for frame |
| 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 | | | | | | | | | | 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 Single Frames

One frame consists of 2 blocks (a 8 × 9 LED-matrix) or 3 blocks (a 5 × 6 LED-matrix). This configuration is set in the AS1119 config register (see Figure 43).

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

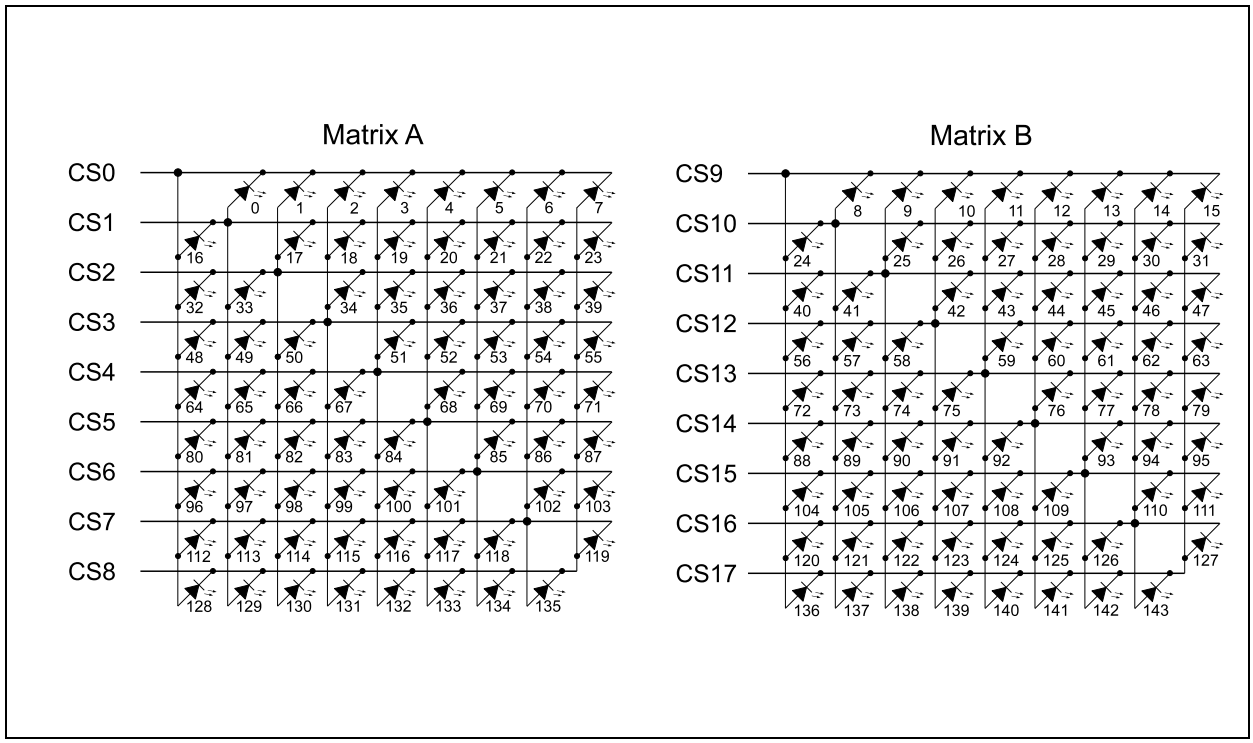
- LED is ON or OFF.
- LED is steady ON or blinking.
- The intensity of every single LED can be set via a 8 bits PWM.

**Note(s):** 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 Figure 43).

**Figure 28:**
**8x9 LED Matrix with Two Blocks**



The address structure (as shown in Figure 29) within on frame is always the same independent which frame was selected via the register selection (Register Selection Address Map).

**Figure 29:**
**Dataframe Address 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 | 0x23 | 0xA4-0xAB | 0xAC-0xB3 |

In Figure 30 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.

**Figure 30:**
**LEDs ON/OFF Register Format for 2 Matrices 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 | LED7 | LED6 | LED5 | LED4 | LED3 | LED2 | LED1 | LED0 |
| B | CS9 | 0x01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | LED15 | LED14 | LED13 | LED12 | LED11 | LED10 | LED9 | LED8 |
| A | CS1 | 0x02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | LED23 | LED22 | LED21 | LED20 | LED19 | LED18 | LED17 | LED16 |
| B | CS10 | 0x03 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | LED31 | LED30 | LED29 | LED28 | LED27 | LED26 | LED25 | LED24 |
| A | CS2 | 0x04 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | LED39 | LED38 | LED37 | LED36 | LED35 | LED34 | LED33 | LED32 |
| B | CS11 | 0x05 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | LED47 | LED46 | LED45 | LED44 | LED43 | LED42 | LED41 | LED40 |
| A | CS3 | 0x06 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | LED55 | LED54 | LED53 | LED52 | LED51 | LED50 | LED49 | LED48 |
| B | CS12 | 0x07 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | LED63 | LED62 | LED61 | LED60 | LED59 | LED58 | LED57 | LED56 |
| A | CS4 | 0x08 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | LED71 | LED70 | LED69 | LED68 | LED67 | LED66 | LED65 | LED64 |
| B | CS13 | 0x09 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | LED79 | LED78 | LED77 | LED76 | LED75 | LED74 | LED73 | LED72 |
| A | CS5 | 0x0A | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | LED87 | LED86 | LED85 | LED84 | LED83 | LED82 | LED81 | LED80 |
| B | CS14 | 0x0B | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | LED95 | LED94 | LED93 | LED92 | LED91 | LED90 | LED89 | LED88 |
| A | CS6 | 0x0C | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | LED103 | LED102 | LED101 | LED100 | LED99 | LED98 | LED97 | LED96 |
| B | CS15 | 0x0D | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | LED111 | LED110 | LED109 | LED108 | LED107 | LED106 | LED105 | LED104 |
| A | CS7 | 0x0E | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | LED119 | LED118 | LED117 | LED116 | LED115 | LED114 | LED113 | LED112 |

| Matrix | Current Source | Address | | | | | | | | Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| B | CS16 | 0x0F | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | LED127 | LED126 | LED125 | LED124 | LED123 | LED122 | LED121 | LED120 |
| A | CS8 | 0x10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | LED135 | LED134 | LED133 | LED132 | LED131 | LED130 | LED129 | LED128 |
| B | CS17 | 0x11 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | LED143 | LED142 | LED141 | LED140 | LED139 | LED138 | LED137 | LED136 |

In the blink register (see Figure 31) every single LED can be set to blink. The blink period is set in the display option register (see Display Option Register (0x03)).

**Figure 31:**
**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 | LED7 | LED6 | LED5 | LED4 | LED3 | LED2 | LED1 | LED0 |
| B | CS9 | 0x13 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | LED15 | LED14 | LED13 | LED12 | LED11 | LED10 | LED9 | LED8 |
| A | CS1 | 0x14 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | LED23 | LED22 | LED21 | LED20 | LED19 | LED18 | LED17 | LED16 |
| B | CS10 | 0x15 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | LED31 | LED30 | LED29 | LED28 | LED27 | LED26 | LED25 | LED24 |
| A | CS2 | 0x16 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | LED39 | LED38 | LED37 | LED36 | LED35 | LED34 | LED33 | LED32 |
| B | CS11 | 0x17 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | LED47 | LED46 | LED45 | LED44 | LED43 | LED42 | LED41 | LED40 |
| A | CS3 | 0x18 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | LED55 | LED54 | LED53 | LED52 | LED51 | LED50 | LED49 | LED48 |
| B | CS12 | 0x19 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | LED63 | LED62 | LED61 | LED60 | LED59 | LED58 | LED57 | LED56 |
| A | CS4 | 0x1A | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | LED71 | LED70 | LED69 | LED68 | LED67 | LED66 | LED65 | LED64 |

| Matrix | Current Source | Address | | | | | | | | | Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| B | CS13 | 0x1B | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | LED79 | LED78 | LED77 | LED76 | LED75 | LED74 | LED73 | LED72 |
| A | CS5 | 0x1C | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | LED87 | LED86 | LED85 | LED84 | LED83 | LED82 | LED81 | LED80 |
| B | CS14 | 0x1D | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | LED95 | LED94 | LED93 | LED92 | LED91 | LED90 | LED89 | LED88 |
| A | CS6 | 0x1E | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | LED103 | LED102 | LED101 | LED100 | LED99 | LED98 | LED97 | LED96 |
| B | CS15 | 0x1F | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | LED111 | LED110 | LED109 | LED108 | LED107 | LED106 | LED105 | LED104 |
| A | CS7 | 0x20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | LED119 | LED118 | LED117 | LED116 | LED115 | LED114 | LED113 | LED112 |
| B | CS16 | 0x21 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | LED127 | LED126 | LED125 | LED124 | LED123 | LED122 | LED121 | LED120 |
| A | CS8 | 0x22 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | LED135 | LED134 | LED133 | LED132 | LED131 | LED130 | LED129 | LED128 |
| B | CS17 | 0x23 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | LED143 | LED142 | LED141 | LED140 | LED139 | LED138 | LED137 | LED136 |

In the intensity register (see Figure 32) the brightness of every single LED can be set via a 8bit PWM (255 steps).

**Figure 32:**
**LEDs Intensity Register Format for 2 Matrices 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 | | | | | | | | |
| | | LED7 | 0x2B | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 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 | | | | | | | | |

| Matrix | Current Source | | Address | | | | | | | | | Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 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 | | | | | | | | |

| Matrix | Current Source | | Address | | | | | | | | 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 | | | | | | | | |
| ..... | | | | | | | | | | | | | | | | | | | |

| Matrix | Current Source | | Address | | | | | | | | Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 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 5×6 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)).

**Figure 33:**
**5x6 LED Matrix with 3 Matrixes**

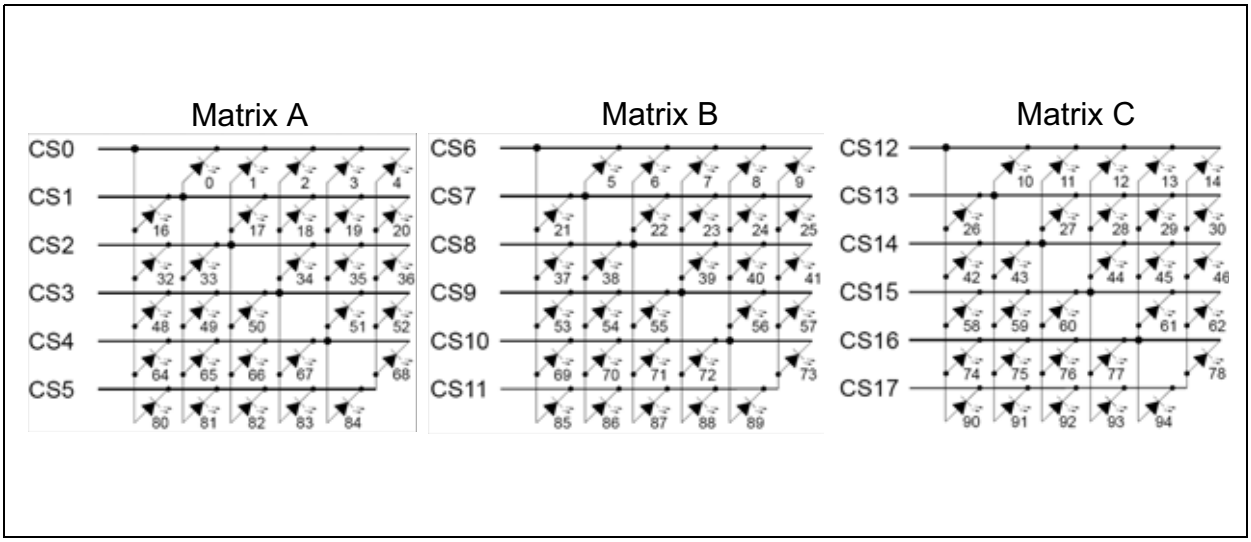



**Figure 34:**
**Dataframe Address Structure for 3 Matrices**

| | | | Addresses Within Frame (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 Figure 35 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(s):** 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.

**Figure 35:**
**LEDs ON/OFF Register Format for 3 Matrices 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 | LED7 | LED6 | LED5 | LED4 | LED3 | LED2 | LED1 | LED0 |
| | 0x01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | LED14 | LED13 | LED12 | LED11 | LED10 | LED9 | LED8 |
| CS1, CS7, CS13 | 0x02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | LED23 | LED22 | LED21 | LED20 | LED19 | LED18 | LED17 | LED16 |
| | 0x03 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | X | LED30 | LED29 | LED28 | LED27 | LED26 | LED25 | LED24 |
| CS2, CS8, CS14 | 0x04 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | LED39 | LED38 | LED37 | LED36 | LED35 | LED34 | LED33 | LED32 |
| | 0x05 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | X | LED46 | LED45 | LED44 | LED43 | LED42 | LED41 | LED40 |
| CS3, CS9, CS15 | 0x06 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | LED55 | LED54 | LED53 | LED52 | LED51 | LED50 | LED49 | LED48 |
| | 0x07 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | X | LED62 | LED61 | LED60 | LED59 | LED58 | LED57 | LED56 |
| CS4, CS10, CS16 | 0x08 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | LED71 | LED70 | LED69 | LED68 | LED67 | LED66 | LED65 | LED64 |
| | 0x09 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | X | LED78 | LED77 | LED76 | LED75 | LED74 | LED73 | LED72 |
| CS5, CS11, CS17 | 0x0A | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | LED87 | LED86 | LED85 | LED84 | LED83 | LED82 | LED81 | LED80 |
| | 0x0B | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | X | LED94 | LED93 | LED92 | LED91 | LED90 | LED89 | LED88 |

In the blink register (see Figure 36) every single LED can be set to blink. The blink period is set in the display option register (see Display Option Register (0x03)).

**Figure 36:**
**LEDs Blink Register Format for 3 Matrices 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 | LED7 | LED6 | LED5 | LED4 | LED3 | LED2 | LED1 | LED0 |
| | 0x13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | LED14 | LED13 | LED12 | LED11 | LED10 | LED9 | LED8 |
| CS1, CS7, CS13 | 0x14 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | LED23 | LED22 | LED21 | LED20 | LED19 | LED18 | LED17 | LED16 |
| | 0x15 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | X | LED30 | LED29 | LED28 | LED27 | LED26 | LED25 | LED24 |
| CS2, CS8, CS14 | 0x16 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | LED39 | LED38 | LED37 | LED36 | LED35 | LED34 | LED33 | LED32 |
| | 0x17 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | X | LED46 | LED45 | LED44 | LED43 | LED42 | LED41 | LED40 |
| CS3, CS9, CS15 | 0x18 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | LED55 | LED54 | LED53 | LED52 | LED51 | LED50 | LED49 | LED48 |
| | 0x19 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | X | LED62 | LED61 | LED60 | LED59 | LED58 | LED57 | LED56 |
| CS4, CS10, CS16 | 0x1A | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | LED71 | LED70 | LED69 | LED68 | LED67 | LED66 | LED65 | LED64 |
| | 0x1B | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | X | LED78 | LED77 | LED76 | LED75 | LED74 | LED73 | LED72 |
| CS5, CS11, CS17 | 0x1C | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | LED87 | LED86 | LED85 | LED84 | LED83 | LED82 | LED81 | LED80 |
| | 0x1D | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | X | LED94 | LED93 | LED92 | LED91 | LED90 | LED89 | LED88 |

In the intensity register (see Figure 37) the brightness of every single LED can be set via a 8bit PWM (255 steps).

**Figure 37:**
**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 | | | | | | | | |
| | | 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 | | | | | | | | |
| | | 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 | | | | | | | | |

| Matrix | Current Source | | Address | | | | | | | | Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 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 | 0 | 0 | 0 | 0 | | | | | | | | |
| B | CS7 | 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 | | | | | | | | |
| | | 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 | | | | | | | | |
| | | 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 | | | | | | | | |

| Matrix | Current Source | | Address | | | | | | | | 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 | | | | | | | | |
| B | CS8 | 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 | | | | | | | | |
| | | 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 | | | | | | | | |
| | | 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 | | | | | | | | |
| ..... | | | | | | | | | | | | | | | | | | | |

| Matrix | Current Source | | Address | | | | | | | | Data | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HEX | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 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 Figure 38. 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 Figure 27).

**Figure 38:**
**Control Register Address Map**

| Register Name | HEX | 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 Figure 39) |
| Frame play | 0x01 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | (see Figure 40) |
| Frame time | 0x02 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | (see Figure 41) |
| Display option | 0x03 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | (see Figure 42) |
| AS1119 config | 0x04 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | (see Figure 43) |
| Current source matrix A | 0x05 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | (see Figure 44) |
| 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 Figure 45) |
| Open/short test | 0x09 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | (see Figure 46) |
| Shutdown | 0x0A | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | (see Figure 47) |
| $I^2C$ Interface monitoring | 0x0B | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | (see Figure 48) |
| Open/Short status | 0x0C | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | (see Figure 49) |
| AS1119 status | 0x0D | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | (see Figure 50) |

## 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 movie or the picture which should be displayed must be set within this register. The default setting of this register is 0x00.

**Figure 39:**
**Frame Address Register Format**

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

**Note(s):**

1. 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.

**Figure 40:**
**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<br>001: 1 loop<br>010: 2 loops<br>011: 3 loops<br>100: 4 loops<br>101: 5 loops<br>110: 6 loops<br>111: Play endless |
| 2:0 | Number of frames to played in a movie | 000 | R/W | 000: 1 frame<br>001: 2 frames<br>010: 3 frames<br>011: 4 frames<br>100: 5 frames<br>101: 6 frames |

**Note(s):**

1. To stop a movie in *play endless mode*, bits D5:D3 have to be set to a value between 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 Figure 41 are typical values. Per default this register is set to 0x00.

**Figure 41:**
**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<br>0001: 32.5ms<br>0010: 65ms<br>0011: 97.5ms<br>0100: 130ms<br>0101: 162.5ms<br>0110: 195ms<br>0111: 227.5ms<br>1000: 260ms<br>1001: 292.5ms<br>1010: 325ms<br>1011:357.5ms<br>1100: 390ms<br>1101: 422.5ms<br>1110: 455ms<br>1111: 487.5ms |

## Display Option Register (0x03)

With the scan-limit it can be controlled how many digits are displayed in each matrix. When all 18 digits in the 2 matrix configuration are displayed, the display scan rate is 430Hz (typ.). If the number of digits to display is reduced, the update frequency is increased. Per default this register is set to 0x07.

**Figure 42:**
**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<br>1: Set the intensity of each frame independently | | |
| 5 | Start with blink | 0 | R/W | 0: Start blinking with LED On<br>1: Start blinking with LED Off | | |
| 4 | Blink period | 0 | R/W | 0: 1.5s<br>1: 3s | | |
| 3:0 | Number of displayed current sources in one frame (scan-limit) | 0111 | R/W | 2 Matrix setting | | |
| | | | | Matrix A | Matrix B | |
| | | | | 0000: CS0<br>0001: CS0 to CS1<br>0010: CS0 to CS2<br>0011: CS0 to CS3<br>0100: CS0 to CS4<br>0101: CS0 to CS5<br>0110: CS0 to CS6<br>0111: CS0 to CS7<br>1000: CS0 to CS8 | 0000: CS9<br>0001: CS9 to CS10<br>0010: CS9 to CS11<br>0011: CS9 to CS12<br>0100: CS9 to CS13<br>0101: CS9 to CS14<br>0110: CS9 to CS15<br>0111: CS9 to CS16<br>1000: CS9 to CS17 | |
| | | | | 3 Matrixes setting | | |
| | | | | Matrix A | Matrix B | Matrix C |
| | | | | 0000: CS0<br>0001: CS0 to CS1<br>0010: CS0 to CS2<br>0011: CS0 to CS3<br>0100: CS0 to CS4<br>0101: CS0 to CS5 | 0000: CS6<br>0001: CS6 to CS7<br>0010: CS6 to CS8<br>0011: CS6 to CS9<br>0100: CS6 to CS10<br>0101: CS6 to CS11 | 0000: CS12<br>0001: CS12 to CS13<br>0010: CS12 to CS14<br>0011: CS12 to CS15<br>0100: CS12 to CS16<br>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_IN/SYNC_OUT pin (input or output) is also set. Per default this register is set to 0x00.

**Figure 43:**
**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: Internal oscillator is system-clk. No synchronisation on pin B6. Tie pin to high or low.<br>01: Internal oscillator is system-clk. System-clk is available on pin B6 for synchronization. (output)<br>10: Internal oscillator is disabled. Pin B6 is used as clk input for system-clk.<br>11: Do not use |
| 0 | Matrix configuration | 0 | R/W | 0: 3 matrixes (a 5x6 LED-Matrix)<br>1: 2 matrixes (a 8x9 LED-Matrix) |

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

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

**Figure 44:**
**Current Source 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<br>.....<br>11111111: 31mA |
| **Address 0x06** | | | | |
| 7:0 | Analog Current Matrix B | 0000000 | R/W | 00000000: 0mA<br>.....<br>11111111: 31mA |
| **Address 0x07** | | | | |
| 7:0 | Analog Current Matrix C | 0000000 | R/W | 00000000: 0mA<br>.....<br>11111111: 31mA |

## Charge Pump Config Register (0x08)

In this register the characteristics of the Charge Pump can be set. By the use of the charge pump (bit 0) the supply voltage for the LEDs can be boosted to 1.5- or 2-times of the device supply (VDD), if required. Additionally bit1 offers the option to check periodically if the LED supply can be reduced again during operation. This period is defined by bit 4:2.

Alternatively, the LED supply can be (re)set to $V_{DD}$ by disabling the charge pump for a short time. In this case the period can be defined by user (application). Per default this register is set to 0x1E.

**Figure 45:**
**AS1119 Charge Pump 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<br>001: 0.5s<br>010: 0.8s<br>011: 1.0s<br>100: 1.3s<br>101: 1.6s<br>110: 1.8s<br>111: 2.1s |
| 1 | Reduce supply option | 1 | R/W | 0: Reduce supply option Off<br>1: Reduce supply option On |
| 0 | Charge Pump | 0 | R/W | 0: Charge Pump disable<br>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 startup register (see Figure 46). The default setting of this register is 0x00.

**Figure 46:**
**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<br>1: Not all LED's are available in the matrixes |
| 0 | Error detection | 0 | R/W | 0: Start test<br>1: No test |

The Open/Short test is only checking LEDs which are defined as ON in the Data Frame Registers Figure 30 or Figure 35. With the bit1 (Full Matrix) all LEDs of the matrixes will be defined as ON and will be tested independently from the content of the Data Frame Register. The function of bit1 is only available during the open/short test and not during normal operation.

### 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'.

**Figure 47:**
**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<br>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 bes set via 7 bits from 256µs to 33ms. The default setting of this register is 0xFF.

**Figure 48:**
**I²C Interface Monitoring Register Format**

| 0x0B I²C Interface Monitoring Register | | | | |
|---|---|---|---|---|
| **Bit** | **Bit Name** | **Default** | **Access** | **Bit Description** |
| 7:2 | Time out window | 1111111 | R/W | 0 to 127 => 1 to 128 × 256µs<br>0000000: 256µs<br>.....<br>1111111: 32.7ms |
| 0 | I²C Monitor | 1 | R/W | 0: I²C monitoring Off<br>1: I²C 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.

**Figure 49:**
**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<br>1: Test ongoing |
| 5 | short test result Matrix C | 0 | R | 0: No error detected<br>1: Short in Matrix C |
| 4 | short test result Matrix B | 0 | R | 0: No error detected<br>1: Short in Matrix B |
| 3 | short test result Matrix A | 0 | R | 0: No error detected<br>1: Short in Matrix A |
| 2 | open test result Matrix C | 0 | R | 0: No error detected<br>1: Open in Matrix C |

| 0x0C Open/Short Status Register | | | | |
|---|---|---|---|---|
| Bit | Bit Name | Default | Access | Bit Description |
| 1 | open test result Matrix B | 0 | R | 0: No error detected<br>1: Open in Matrix B |
| 0 | open test result Matrix A | 0 | R | 0: No error detected<br>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 a read command the bits 5:4 are set to '0' again automatically.

**Figure 50:**
**AS1119 Status 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<br>1: One movie is playing |
| 5:4 | Interrupt | 00 | R | 00: No Interrupt triggered<br>01: POR triggered an interrupt (1)<br>10: $I^2C$ monitor triggered an interrupt<br>11: Both ($I^2C$ and POR) triggered an interrupt |
| 3:0 | actual displayed frame | 000 | R | 000: Frame 0<br>001: Frame 1<br>010: Frame 2<br>011: Frame 3<br>100: Frame 4<br>101: Frame 5 |

**Note(s):**

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

## Package Drawings & Markings

**Figure 51:**
**36-Pin WL-CSP**

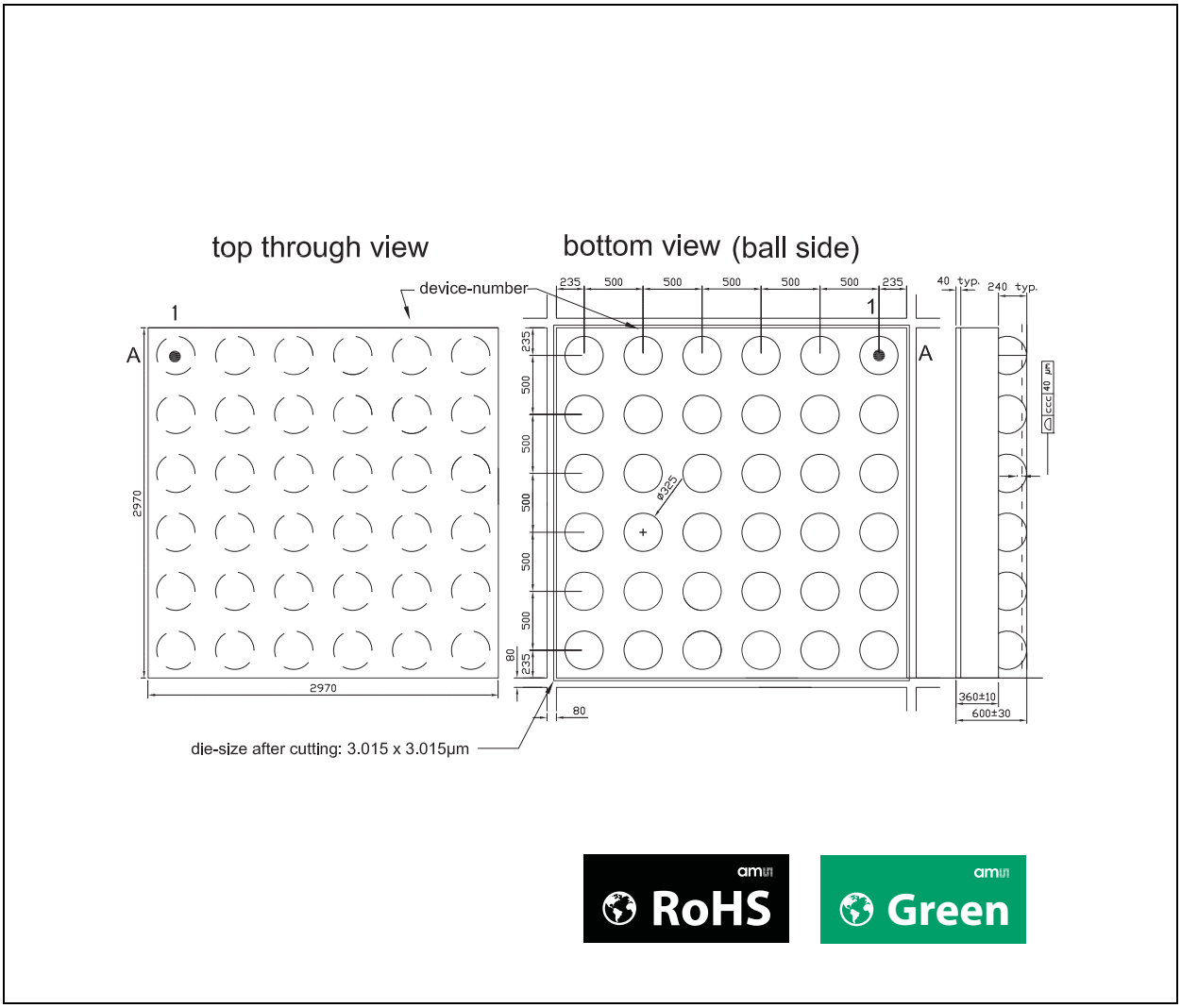


**Figure 52:**
**36-Pin WL-CSP Marking**

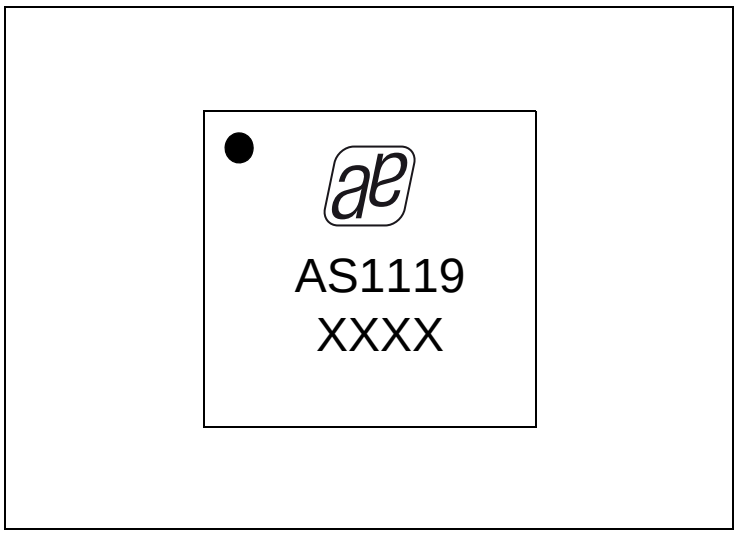



**Figure 53:**
**Packaging Code**

| XXXX |
| --- |
| Tracecode |

## Ordering & Contact Information

The devices are available as the standard products shown in Figure 54.

**Figure 54:**
**Ordering Information**

| Ordering Code | Package | Marking | Description | Delivery Form | Delivery Quantity |
|---|---|---|---|---|---|
| AS1119-BWLT | 36-Pin WL-CSP | AS1119 | 144-LED Cross-Plexing Driver with 320mA Charge-Pump | Tape & Reel | 1000 pcs/reel |

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**Headquarters**
ams AG
Tobelbader Strasse 30
8141 Premstaetten
Austria, Europe

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## Document Status

| Document Status | Product Status | Definition |
|---|---|---|
| Product Preview | Pre-Development | Information in this datasheet is based on product ideas in the planning phase of development. All specifications are design goals without any warranty and are subject to change without notice |
| Preliminary Datasheet | Pre-Production | Information in this datasheet is based on products in the design, validation or qualification phase of development. The performance and parameters shown in this document are preliminary without any warranty and are subject to change without notice |
| Datasheet | Production | Information in this datasheet is based on products in ramp-up to full production or full production which conform to specifications in accordance with the terms of ams AG standard warranty as given in the General Terms of Trade |
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# Revision Information

| Changes from 1.04 to current revision 2-00 (2016-Sep-21) | Page |
|---|---|
| Content of austriamicrosystems datasheet was converted to latest **ams** design | |
| Added Figure 1 | 1 |
| Updated Figure 2 | 2 |
| Updated Figure 3 | 3 |
| Updated Figure 4 | 4 |
| Updated Figure 10 | 9 |
| Updated Figure 42 | 41 |
| Updated Figure 52 | 49 |
| Updated Figure 53 | 49 |

**Note(s):**

1. Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
2. Correction of typographical errors is not explicitly mentioned.

## Content Guide