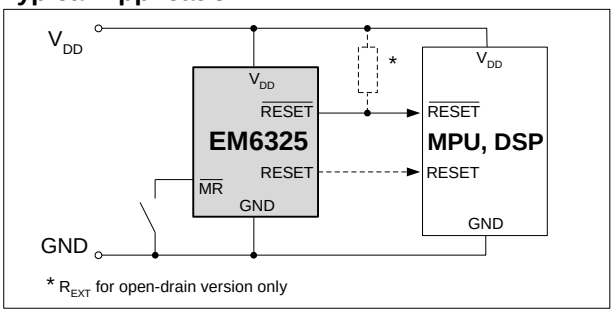
# Reset Circuit with Manual Reset

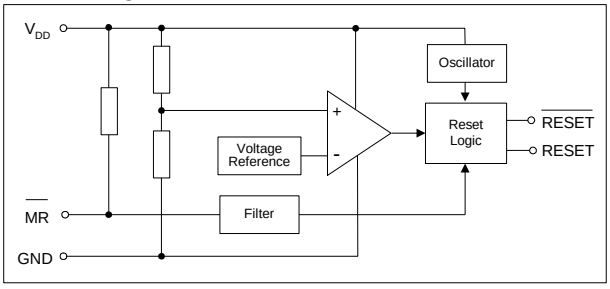
## Description

The EM6325 is an ultra-low current reset circuit available in a large variety of configurations and very small packages for maximum flexibility in all end-applications up to 125°C and using power supplies between 1.5V and 5.5V.
This circuit monitors the supply voltage of any electronic system, and generates the appropriate reset signal after a fixed reset timeout period. The threshold defines the minimum allowed voltage which guarantees the good functionality of the system. When $V_{DD}$ rises above $V_{TH}$, the output remains active for an additional delay time. This allows the system to stabilize before getting fully active.
This circuit features a Manual Reset: an input that asserts reset when pulled low ($\overline{MR}$ with internal pull-up).
Small SOT23-5L package as well as ultra-low supply current of 2.9µA make the EM6325 an ideal choice for portable and battery-operated devices.

## Typical Application




## Block Diagram



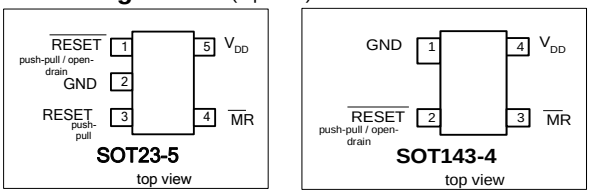

## Features

- Manual reset function
- 200ms reset timeout period (1.6ms, 25ms, 1600ms on request)
- Ultra-low supply current of 2.9µA ($V_{DD}$=3.3V)
- Operating temperature range: -40°C to +125°C
- ±1.5% reset threshold accuracy
- 11 reset threshold voltages $V_{TH}$: 4.63V, 4.4V, 3.08V, 2.93V, 2.63V, 2.2V, 1.8V, 1.66V, 1.57V, 1.38V, 1.31V
- 2 reset output options:
  - Active-low $\overline{RESET}$ push-pull
  - Active-low $\overline{RESET}$ open-drain
- Immune to short negative $V_{DD}$ transients
- Guaranteed Reset valid down to 0.9V
- Threshold hysteresis: 2.1% of $V_{TH}$
- Very small SOT23-5L, SOT143-4L

## Applications

- Computers
- Servers and workstations
- Modems
- Wireless communication
- Metering
- Playstations
- PDA , Webpad

## Pin Configuration (top view)




## Pin Description

| Pin | | Name | Function |
|---|---|---|---|
| SOT23-5L | SOT143-4L | | |
| 1 | 2 | $\overline{RESET}$ | Active-low $\overline{RESET}$ output. $\overline{RESET}$ remains low for the reset timeout period and then goes high after all reset conditions are deasserted or after $\overline{MR}$ goes from low to high |
| 2 | 1 | GND | Ground |
| 3 | | RESET | Active-high RESET output. RESET remains high for the reset timeout period and then goes low after all reset conditions are deasserted or after $\overline{MR}$ goes from low to high |
| 4 | 3 | $\overline{MR}$ | Manual Reset input with an internal pull-up 15kΩ resistor. Reset remains active as long as $\overline{MR}$ is low and for $t_{POR}$ after $\overline{MR}$ returns high. $\overline{MR}$ can be driven with a CMOS output or shorted to ground with a switch |
| 5 | 4 | $V_{DD}$ | Supply Voltage (5.5V max.) |

## Ordering Information

EM6325 C X SP5B - 2.9 +

**Delay ($t_{POR}$):**
**C = 200ms** B = 25ms
A = 1.6ms D = 1600ms

**Reset Output Type:**
X = Active-low /RES push-pull
Active-high RES push-pull
Y = Active-low /RES open-drain
Active-high RES push-pull

**Package:**
SP5B = SOT23-5, Tape&Reel 3000 pcs
SK4B = SOT143-4, Tape&Reel 3000 pcs

**RoHS Compliance:**
+ = lead-free/green mold compliant
*[blank]* = leaded

**Reset Threshold Voltage ($V_{TH}$):**

| | |
|---|---|
| 1.3 = 1.31V | 2.6 = 2.63V |
| 1.4 = 1.38V | 2.9 = 2.93V |
| 1.6 = 1.57V | 3.1 = 3.08V |
| 1.7 = 1.66V | 4.4 = 4.40V |
| 1.8 = 1.80V | 4.6 = 4.63V |
| 2.2 = 2.20V | |

## Standard Versions (Top Marking)

| Part Number | Top Marking[1)] | Top Marking[2)] with 4 Characters |
|---|---|---|
| EM6325AXSP5B-2.9+ | CN## | BNAH |
| EM6325AXSP5B-3.1+ | CA## | BNAJ |
| EM6325CXSP5B-1.3+ | CP## | BNCA |
| EM6325CXSP5B-2.6+ | CS## | BNCG |
| EM6325CXSP5B-2.9+ | BZ## | BNCH |
| EM6325CXSP5B-3.1+ | CT## | BNCJ |
| EM6325CXSP5B-4.6+ | C3## | BNCL |
| EM6325CYSP5B-2.9+ | BY## | BNCU |
| EM6325CYSP5B-4.6+ | C0## | BNCX |
| EM6325CXSK4B-2.9+ | CR## | |

1) Top marking is the standard from 2006. No bottom marking exists. Where ## refers to the lot number (EM internal reference only)
2) Top marking with 4 characters is standard from 2003. For lead-free/green mold (RoHS) parts, the first letter of top marking with 4 characters begins with letter “B” instead of letter “A”. Bottom marking indicates the lot number.

## Standard Versions (samples)

| Part Number |
|---|
| EM6325AXSP5B-2.9+ |
| EM6325AXSP5B-3.1+ |
| EM6325CXSP5B-1.3+ |
| EM6325CXSK4B-2.9+ |
| EM6325CXSP5B-2.6+ |

| Part Number |
|---|
| EM6325CXSP5B-2.9+ |
| EM6325CXSP5B-3.1+ |
| EM6325CXSP5B-4.6+ |
| EM6325CYSP5B-2.6+ |
| EM6325CYSP5B-4.6+ |

Sample stock is generally held on **standard versions** only. Please contact factory for other versions not shown here and for availability of non standard versions.

## Absolute Maximum Ratings

| Parameter | Symbol | Conditions |
|---|---|---|
| Voltage at $V_{DD}$ to GND | $V_{DD}$ | -0.3V to +6V |
| Minimum voltage at any signal pin | $V_{MIN}$ | GND - 0.3V |
| Maximum voltage at any signal pin | $V_{MAX}$ | $V_{DD}$ + 0.3V |
| Electrostatic discharge max. to MIL-STD-883C method 3015.7 with ref. to $V_{SS}$ | $V_{ESD}$ | 2000V |
| Max. soldering conditions | $T_{MAX}$ | 250°C x 10s |
| Storage Temperature Range | $T_{STG}$ | -65°C to +150°C |

Stresses above these listed maximum ratings may cause permanent damages to the device. Exposure beyond specified operating conditions may affect device reliability or cause malfunction.

## Handling Procedures

This device has built-in protection against high static voltages or electric fields; however, anti-static precautions must be taken as for any other CMOS component. Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the voltage range. Unused inputs must always be tied to a defined logic voltage level.

## Operating Conditions

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Supply voltage | $V_{DD}$ | 0.9 | 5.5 | V |
| Operating Temperature | $T_A$ | -40 | +125 | °C |

## Electrical Characteristics

Unless otherwise specified: $V_{DD}$= 0.9V to 5.5V, $T_A$=-40°C to +125°C (note 1).

| Parameter | Symbol | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Supply current (note 2) | $I_{DD}$ | $V_{DD}$=1.5V | +25°C | - | 2.3 | 4.6 | µA |
| | | | -40°C to +125°C | - | | 7 | |
| | | $V_{DD}$=3.3V | +25°C | - | 2.9 | 5.5 | |
| | | | -40°C to +125°C | - | | 8.3 | |
| | | $V_{DD}$=5.0V | +25°C | - | 3.4 | 6.3 | |
| | | | -40°C to +125°C | - | | 9.6 | |
| Threshold voltage (note 3) | $V_{TH}$ | EM6325 – 1.3 | +25°C | 1.290 | 1.31 | 1.330 | V |
| | | | -40°C to +85°C | 1.245 | | 1.382 | |
| | | | -40°C to +125°C | 1.221 | | 1.387 | |
| | | EM6325 – 1.4 | +25°C | 1.359 | 1.38 | 1.401 | |
| | | | -40°C to +85°C | 1.311 | | 1.456 | |
| | | | -40°C to +125°C | 1.286 | | 1.461 | |
| | | EM6325 – 1.6 | +25°C | 1.546 | 1.57 | 1.594 | |
| | | | -40°C to +85°C | 1.492 | | 1.656 | |
| | | | -40°C to +125°C | 1.463 | | 1.663 | |
| | | EM6325 – 1.7 | +25°C | 1.635 | 1.66 | 1.685 | |
| | | | -40°C to +85°C | 1.577 | | 1.751 | |
| | | | -40°C to +125°C | 1.547 | | 1.758 | |
| | | EM6325 – 1.8 | +25°C | 1.773 | 1.80 | 1.827 | |
| | | | -40°C to +85°C | 1.710 | | 1.899 | |
| | | | -40°C to +125°C | 1.678 | | 1.906 | |
| | | EM6325 – 2.2 | +25°C | 2.167 | 2.20 | 2.233 | |
| | | | -40°C to +85°C | 2.090 | | 2.321 | |
| | | | -40°C to +125°C | 2.050 | | 2.330 | |
| | | EM6325 – 2.6 | +25°C | 2.591 | 2.63 | 2.669 | |
| | | | -40°C to +85°C | 2.499 | | 2.775 | |
| | | | -40°C to +125°C | 2.451 | | 2.785 | |
| | | EM6325 – 2.9 | +25°C | 2.886 | 2.93 | 2.974 | |
| | | | -40°C to +85°C | 2.784 | | 3.091 | |
| | | | -40°C to +125°C | 2.731 | | 3.103 | |
| | | EM6325 – 3.1 | +25°C | 3.034 | 3.08 | 3.126 | |
| | | | -40°C to +85°C | 2.926 | | 3.249 | |
| | | | -40°C to +125°C | 2.871 | | 3.262 | |
| | | EM6325 – 4.4 | +25°C | 4.334 | 4.40 | 4.466 | |
| | | | -40°C to +85°C | 4.180 | | 4.642 | |
| | | | -40°C to +125°C | 4.101 | | 4.660 | |
| | | EM6325 – 4.6 | +25°C | 4.561 | 4.63 | 4.699 | |
| | | | -40°C to +85°C | 4.399 | | 4.885 | |
| | | | -40°C to +125°C | 4.315 | | 4.903 | |
| Threshold hysteresis | $V_{HYS}$ | $T_A$=+25°C | | - | 2.1%•$V_{TH}$ | - | V |

**Note 1:** Production tested at +25°C only. Over temperature limits are guaranteed by design, not production tested.
**Note 3:** Threshold voltage is specified for $V_{DD}$ falling.

## Electrical Characteristics (continued)

Unless otherwise specified: $V_{DD}$= 0.9V to 5.5V, $T_A$=-40°C to +125° C (note 1).

| Parameter | Symbol | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Reset timeout period | $t_{POR}$ | (note 2 and 4) $V_{DD}$ from 0V to $V_{TH\ (typ)}$+15% $T_A$= +25°C | EM6325C | 155 | 200 | 224 | ms |
| | | | EM6325A | 0.7 | 1.6 | 3.8 | |
| | | | EM6325B | 19.4 | 25 | 28 | |
| | | | EM6325D | 1240 | 1600 | 1792 | |
| Propagation delay time $V_{DD}$ to $\overline{\text{RESET}}$ (RESET) delay | $t_P$ | $V_{DD}$ drops from $V_{TH\ (typ)}$+0.2V to $V_{TH\ (typ)}$-0.2V (note 2). $T_A$= +25°C | | 2 | 130 | 255 | µs |
| Open-drain $\overline{\text{RESET}}$ output Voltage | $V_{OL}$ | $V_{DD}$>1V | $I_{OL}$=100µA | - | - | 0.3 | V |
| | | $V_{DD}$>2.5V | $I_{OL}$=1.5mA | - | - | 0.3 | |
| | | $V_{DD}$>5V | $I_{OL}$=3mA | - | - | 0.35 | |
| Push-pull RESET / $\overline{\text{RESET}}$ Output voltage | $V_{OL}$ | $V_{DD}$>1V | $I_{OL}$=100µA | - | - | 0.3 | V |
| | | $V_{DD}$>2.5V | $I_{OL}$=1.5mA | - | - | 0.3 | |
| | | $V_{DD}$>5V | $I_{OL}$=3mA | - | - | 0.35 | |
| | $V_{OH}$ | $V_{DD}$>1V | $I_{OH}$=-30µA | 0.8 | - | - | |
| | | $V_{DD}$>2.5V | $I_{OH}$=-1.5mA | 2 | - | - | |
| | | $V_{DD}$>5V | $I_{OH}$=-3mA | 4 | - | - | |
| Output leakage current | $I_{LEAK}$ | Only for EM6325_Y (open-drain) | | - | - | 0.5 | µA |
| **MANUAL RESET ( $\overline{\text{MR}}$ )** | | | | | | | |
| $\overline{\text{MR}}$ Input low | $V_{MRT}$ low | $T_A$= +25°C | | | | 0.3•$V_{DD}$ | V |
| $\overline{\text{MR}}$ Input high | $V_{MRT}$ high | | | 0.7•$V_{DD}$ | | | V |
| $\overline{\text{MR}}$ to Reset delay | $t_{MD}$ | | | | 0.3 | | µs |
| Pulse width at $\overline{\text{MR}}$ (note 5) | $t_{PMD}$ | | | 1 | | | µs |
| $\overline{\text{MR}}$ Internal Pull-up resistor | $R_{MR}$ | $T_A$=-40°C to +125°C | | 4.8 | 15 | 31 | kΩ |

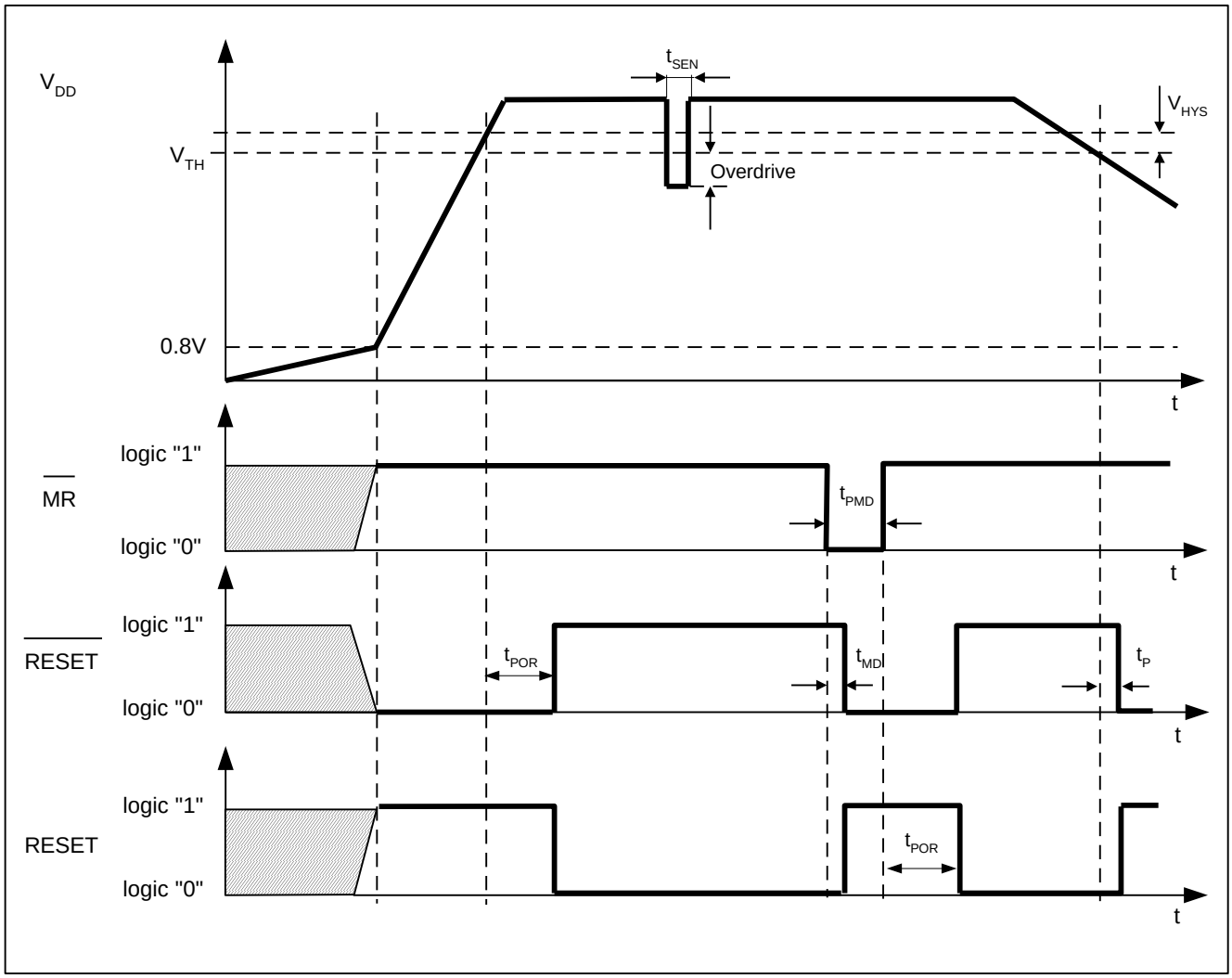
**Note 1:** Production tested at +25°C only. Over temperature limits are guaranteed by design, not production tested.

**Note 2:** $\overline{\text{RESET}}$ (RESET) open.

**Note 4:** Standard version for $t_{POR}$ is 200ms (typ), available at all times. Other option (1.6ms, 25ms, 1600ms) are available by mask option and upon minimum order quantity. Please contact EM sales.

**Note 5:** Pulse width must be greater than 1µs to ensure the $\overline{\text{RESET}}$ (RESET) to go active.

## Timing Waveforms



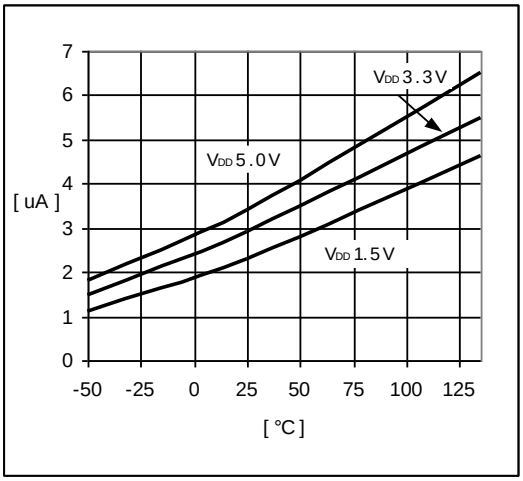

**Note 6:** $t_{SEN}$ = Maximum Transient Duration. Please refer to figure on the next page.
**Note 7:** Overdrive = $V_{TH}$ -$V_{DD}$. Please refer to figure on the next page.

### Manual Reset Input

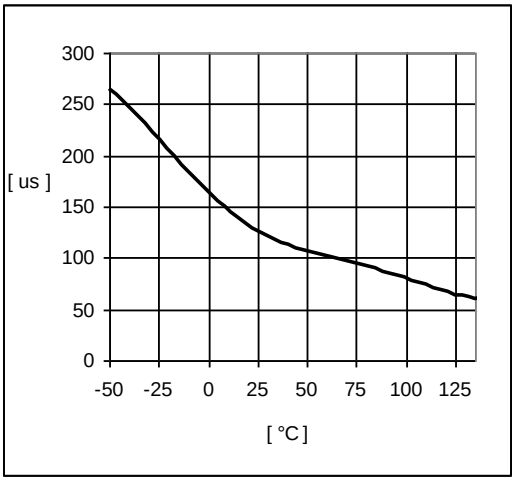
A logic low on $\overline{MR}$ asserts a reset. Reset remains asserted while $\overline{MR}$ is low, and for $t_{POR}$ (200ms nominal for EM6325C) after it returns high. $\overline{MR}$ has an internal 15kΩ pull-up resistor, so it can be left open if unused. This input can be driven with CMOS logic levels or with open-drain outputs. Connect a normally open momentary switch from $\overline{MR}$ to $V_{SS}$ to create a manual-reset function; debounce circuitry is integrated. If $\overline{MR}$ is driven from long cable or the device is used in a noisy environment, connect a 0.1µF capacitor from $\overline{MR}$ to $V_{SS}$ to provide additional noise immunity (stronger external additional pull-up resistor can also be added).

## Typical Operating Characteristics

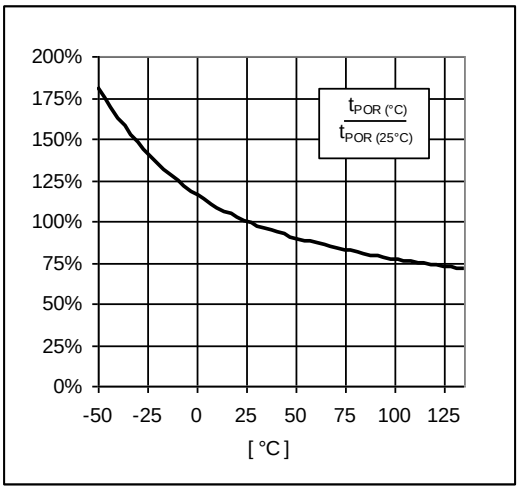
(Typical values are at $T_A$=+25°C unless otherwise noted, $\overline{MR}$ , $\overline{RESET}$ and RESET open.)



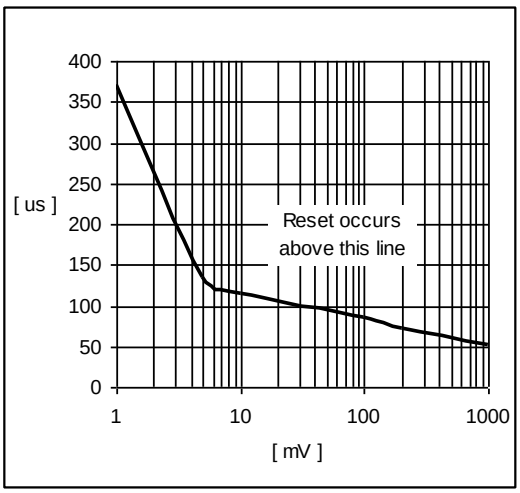

**$I_{DD}$ vs. Temperature**



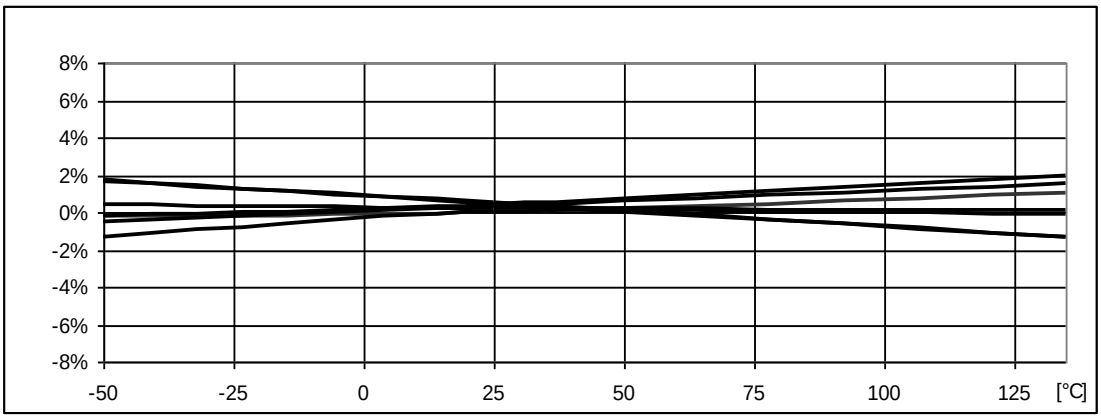

**Propagation Time $t_P$ vs. Temperature**




**Reset Timeout Period $t_{POR}$ vs. Temperature (normalized with respect to $t_{POR\ 25°C}$)**



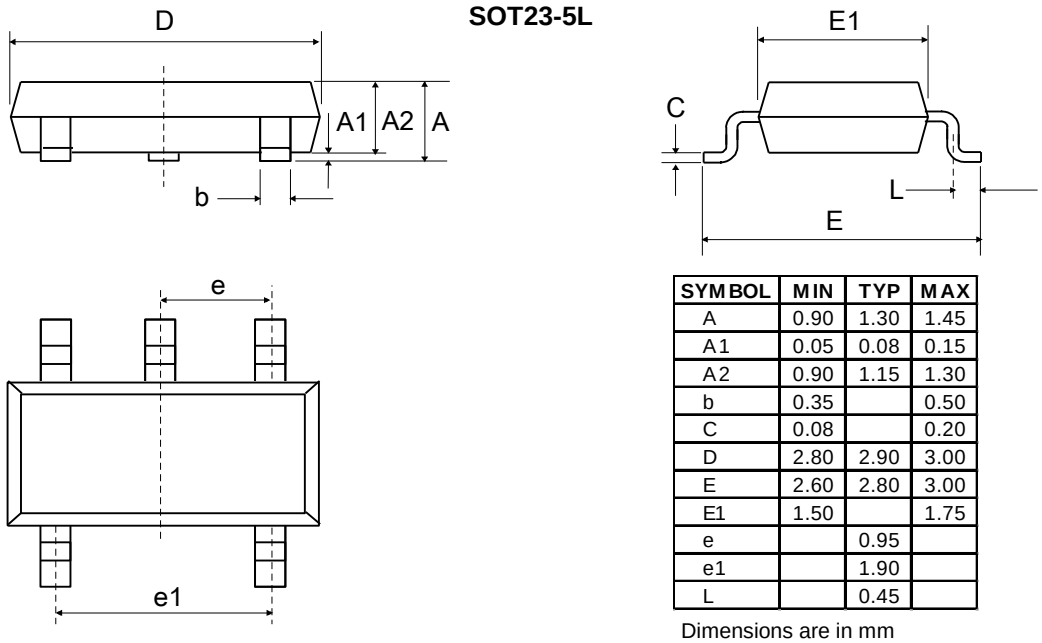

**Maximum Transient Duration $t_{SEN}$ vs. Overdrive $V_{TH}$-$V_{DD}$**




**Threshold Voltage Variation vs. Temperature (normalized)**

## Package Information

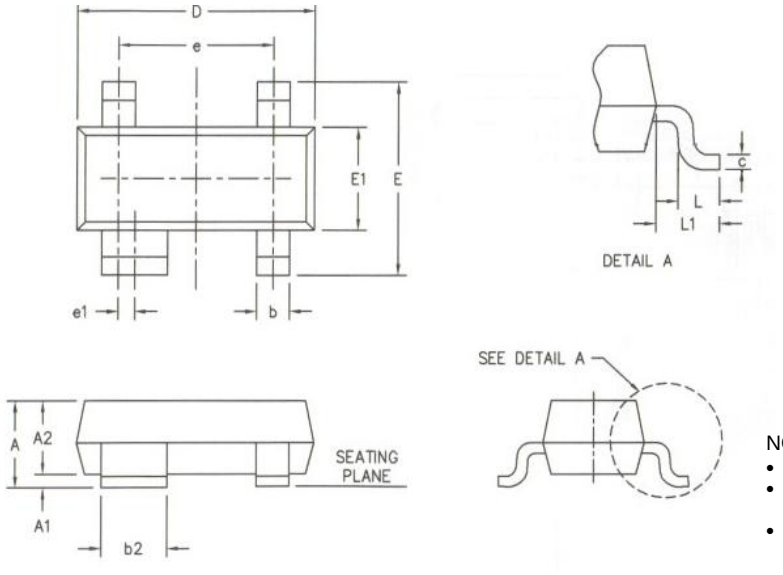
### SOT23-5L




| SYMBOL | MIN | TYP | MAX |
|---|---|---|---|
| A | 0.90 | 1.30 | 1.45 |
| A1 | 0.05 | 0.08 | 0.15 |
| A2 | 0.90 | 1.15 | 1.30 |
| b | 0.35 | | 0.50 |
| C | 0.08 | | 0.20 |
| D | 2.80 | 2.90 | 3.00 |
| E | 2.60 | 2.80 | 3.00 |
| E1 | 1.50 | | 1.75 |
| e | | 0.95 | |
| e1 | | 1.90 | |
| L | | 0.45 | |

Dimensions are in mm

### SOT143-4L




| SYMBOL | MIN | TYP | MAX |
|---|---|---|---|
| A | 0.97 | 1.04 | 1.12 |
| A1 | 0.05 | 0.10 | 0.15 |
| A2 | 0.89 | 0.94 | 0.99 |
| b | 0.36 | 0.41 | 0.46 |
| b2 | 0.76 | 0.79 | 0.84 |
| c | 0.08 | 0.10 | 0.20 |
| D | 2.79 | 2.82 | 2.87 |
| E1 | 1.22 | 1.27 | 1.32 |
| E | 2.11 | 2.44 | 2.64 |
| e | | 1.92 | |
| e1 | | 0.20 | |
| L | 0.41 | 0.43 | 0.48 |
| L1 | 0.53 | 0.58 | 0.64 |

NOTE:

- All dimensions are in millimeters
- Dimensions are exclusive of mold flash & metal burr
- Based from JEDEC TO-253

**Traceability for small packages**

Due to the limited space on the package surface, the bottom marking contains a limited number of characters that provide only partial information for lot traceability. Full information for complete traceability is however provided on the packing labels of the product at delivery from EM. It is highly recommended that the customer insures full lot traceability of EM product in his final product.