



# CT85x Series

## Bipolar Digital TMR Latch for Consumer & Industrial Applications

### Product Description

The CT85x Series of integrated bipolar magnetic latches and analog sensor are designed for consumer and industrial switching applications. It is based on Crocus Technology's patented Magnetic Logic Unit™ (MLU™) technology with integrated CMOS process to provide a monolithic solution for superior sensing performance.



**SOT-23 Package**

These devices are capable of handling large air gap applications with low magnetic fields down to 1.0 mT with best in class high frequency performance. The CT85x is offered in active-low push-pull CMOS and it can also be configured in open drain configuration for design flexibility. The latches are available in a 3-lead SOT-23 packages, providing cost effective and space-saving solutions for high volume manufacturing. Please contact factory for custom solutions.

### Features and Benefits

- High sensitivity,  $B_{OP}$  as low as 1.0 mT
- Resistant to mechanical stress
- Digital CMOS push-pull with option for open drain output
- Low profile and small form factor packaging
- RoHS Compliant

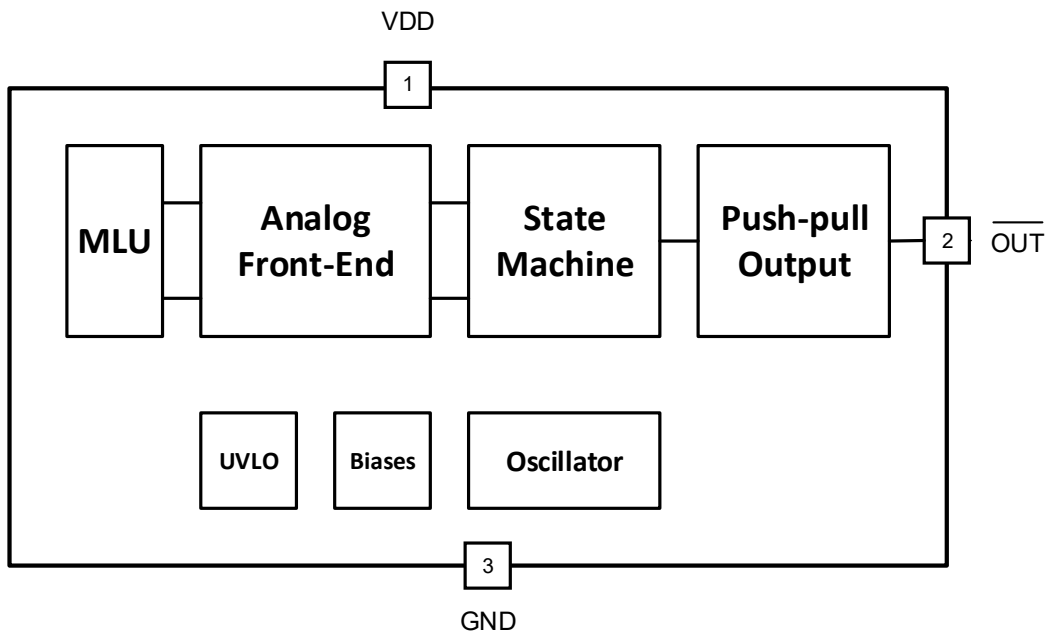
### Application Examples

- IoT devices
- Smartphones, tablets, and laptops
- Door or lid closure detection
- Reed switch replacement
- Motor controllers
- Power switch or open-close detection



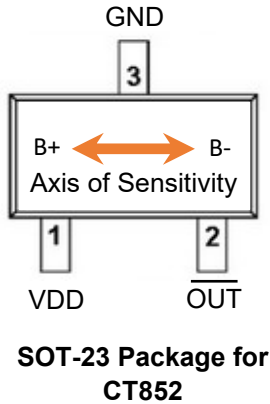
**Figure 1: CT85x Block Diagrams**

**CT852 (SOT23 Package) Block Diagram**





**Figure 2: Package Pin-out with Axis of Sensitivity Diagrams**



**Table 1: Pin-out Information**

| Pin # for SOT23 Package | Pin Name                | Pin Description                       |
|-------------------------|-------------------------|---------------------------------------|
| 1                       | VDD                     | Supply Voltage                        |
| 2                       | $\overline{\text{OUT}}$ | Output Signal (Active LOW) for CT852. |
| 3                       | GND                     | Ground                                |

**Table 2: Absolute Maximum Ratings**

Exceeding the absolute maximum ratings may cause permanent damage. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

| Parameter                                   | Symbol             | Min  | Max            | Unit |
|---------------------------------------------|--------------------|------|----------------|------|
| Supply Voltage                              | $V_{DD}$           | -0.3 | 4.0            | V    |
| Push-pull Output (Active LOW)               | $V_{OUT\_PP}$      | -0.3 | $V_{DD} + 0.3$ | V    |
| Input and Output Current                    | $I_{IN} / I_{OUT}$ | -10  | +10            | mA   |
| Junction temperature                        | $T_J$              | -40  | +125           | °C   |
| Storage temperature                         | $T_{STG}$          | -65  | +150           | °C   |
| Soldering temperature                       | $T_{SOL}$          |      | +260           | °C   |
| ESD Level, Human Body Model per JESD22-A114 | $V_{ESD\_HBM}$     | ±4.0 |                | kV   |

**Table 3: Recommended Operating Conditions**

The Recommended Operating Conditions table defines the conditions for the actual device operation. Recommended operating conditions are specified to ensure optimal performance to the data sheet specifications. Crocus Technology does not recommend exceeding them or designing to absolute maximum ratings.

| Parameter               | Symbol    | Conditions | Min | Typ | Max  | Unit |
|-------------------------|-----------|------------|-----|-----|------|------|
| Supply Voltage          | $V_{DD}$  |            | 2.7 | 3.0 | 3.6  | V    |
| Output Voltage          | $V_{OUT}$ |            |     |     | 3.6  | V    |
| Operating Magnetic Flux | B         |            |     |     | 12   | mT   |
| Ambient Temperature     | $T_A$     |            | -40 | +25 | +125 | °C   |
| Junction Temperature    | $T_J$     |            | -40 |     | +125 | °C   |

**Table 4: Thermal Properties**

Junction-to-ambient thermal resistance is a function of application and board layout and is determined in accordance to JEDEC standard JESD51 for a four (4) layer 2s2p FR-4 printed circuit board (PCB). Special attention must be paid not to exceed junction temperature  $T_{J(MAX)}$  at a given ambient temperature.

| Parameter                                                | Symbol               | Min | Typ | Max | Unit |
|----------------------------------------------------------|----------------------|-----|-----|-----|------|
| Junction-to-Ambient Thermal Resistance for SOT23 Package | $\theta_{JA(SOT23)}$ |     | 202 |     | °C/W |



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**Table 5: Electrical Characteristics for CT85x Series**

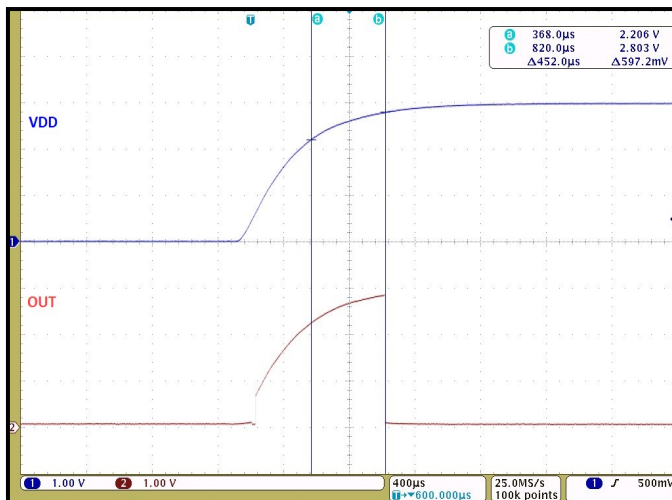
Unless otherwise specified:  $V_{DD} = 2.7 \text{ V}$  to  $3.6 \text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.0 \text{ V}$  and  $T_A = +25^\circ\text{C}$ .

| Parameter                                         | Symbol           | Conditions                | Min                 | Typ     | Max                 | Unit          |
|---------------------------------------------------|------------------|---------------------------|---------------------|---------|---------------------|---------------|
| Power-On Time                                     | $t_{ON}$         | $V_{DD} > 2.7 \text{ V}$  |                     | 500     |                     | $\mu\text{s}$ |
| Under-voltage Lockout Threshold, Rising $V_{DD}$  | $V_{UVLO\_RISE}$ | Rising $V_{DD}$           |                     | 2.20    | 2.60                | V             |
| Under-voltage Lockout Threshold, Falling $V_{DD}$ | $V_{UVLO\_FALL}$ | Falling $V_{DD}$          | 1.90                | 2.15    |                     | V             |
| Under-voltage Lockout Hysteresis                  | $V_{UV\_HYST}$   |                           |                     | 50      |                     | mV            |
| <b>Push-Pull Output</b>                           |                  |                           |                     |         |                     |               |
| Output Voltage High $\overline{OUT}$              | $V_{OH}$         | $I_{OUT} = -2 \text{ mA}$ | $0.9 \times V_{DD}$ |         |                     | V             |
| Output Voltage Low $\overline{OUT}$               | $V_{OL}$         | $I_{OUT} = +2 \text{ mA}$ |                     |         | $0.1 \times V_{DD}$ | V             |
| Current for $\overline{OUT}$                      | $I_{OUT}$        |                           |                     | $\pm 2$ |                     | mA            |

(1) Guaranteed by design and bench characterization.

## Typical Timing Characteristics for CT85x

$V_{DD} = 3.0 \text{ V}$  and  $T_A = +25^\circ\text{C}$ ,  $C_{DD} = 1.0 \mu\text{F}$  (unless otherwise specified).



**Figure 3.** Power-On Time for Push-pull Output ( $V_{DD}$  and  $\overline{OUT}$ )



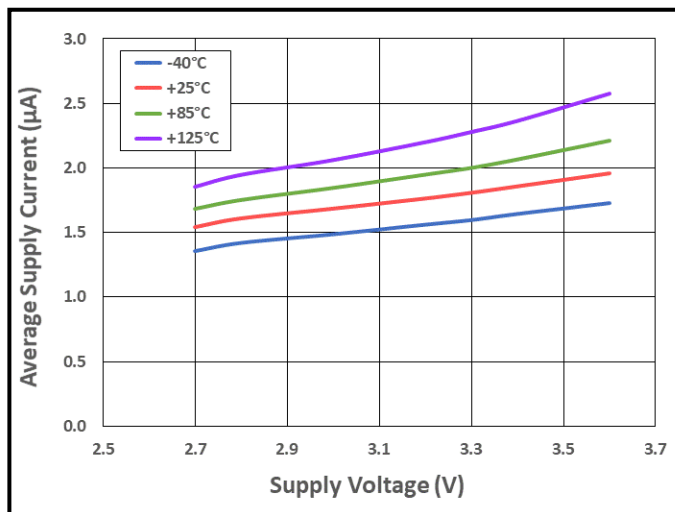
**Table 6: Electrical & Magnetic Characteristics for CT852AN**

Unless otherwise specified:  $V_{DD} = 2.7\text{ V to }3.6\text{ V}$ ,  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

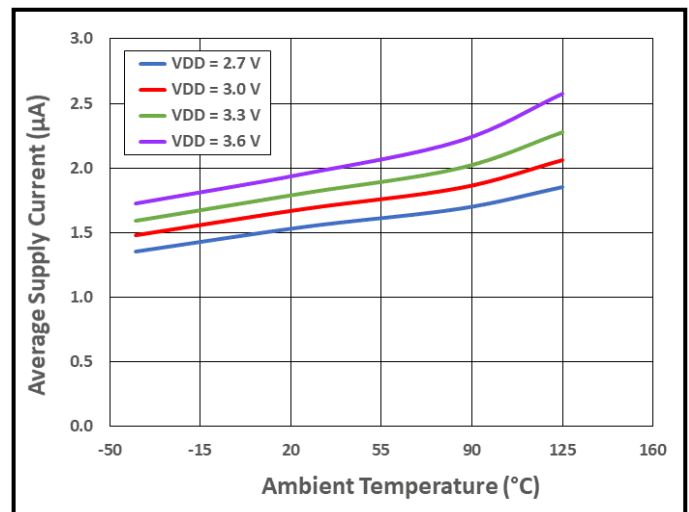
| Parameter              | Symbol        | Conditions           | Min  | Typ  | Max  | Unit          |
|------------------------|---------------|----------------------|------|------|------|---------------|
| Average Supply Current | $I_{DD(AVG)}$ | $t \geq 10\text{ s}$ |      | 1.7  | 3.3  | $\mu\text{A}$ |
| Sampling Frequency     | $f_S$         |                      | 325  | 500  | 600  | Hz            |
| Active Mode Time       | $t_{ACT}$     |                      |      | 1.4  |      | $\mu\text{s}$ |
| Idle Mode Time         | $t_{IDLE}$    |                      | 1.6  | 2.0  | 3.1  | ms            |
| Operate Point          | $B_{OPS}$     |                      | 0.8  | 1.0  | 1.4  | mT            |
| Release point          | $B_{RPN}$     |                      | -1.4 | -1.0 | -0.8 | mT            |

## Typical Electrical Characteristics for CT852AN

$V_{DD} = 3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ ,  $C_{DD} = 1.0\text{ }\mu\text{F}$  (unless otherwise specified).



**Figure 4.** Average Supply Current vs. Supply Voltage vs. Temperature

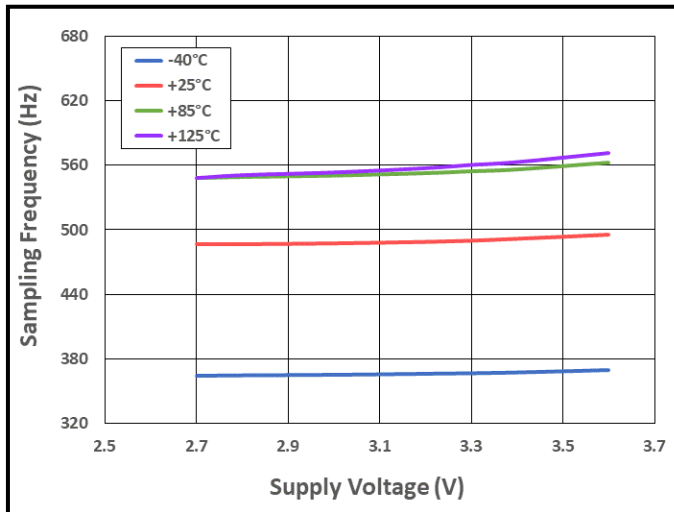


**Figure 5.** Average Supply Current vs. Temperature vs. Supply Voltage



## Typical Electrical Characteristics for CT852AN

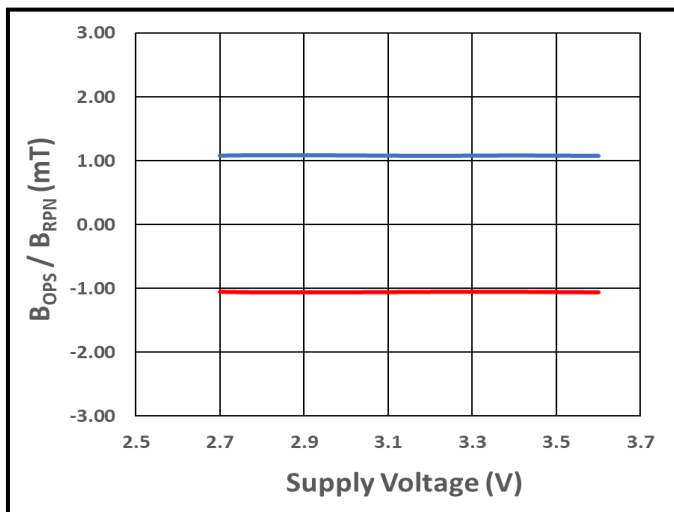
$V_{DD} = 3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ ,  $C_{DD} = 1.0\text{ }\mu\text{F}$  (unless otherwise specified).



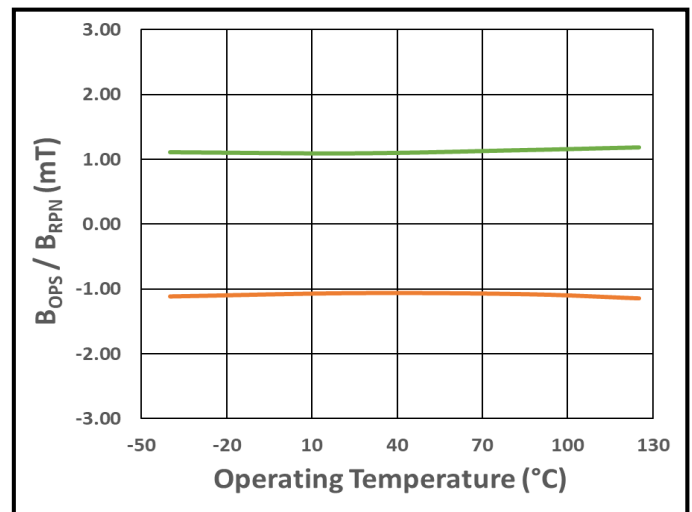
**Figure 6.** Sampling Frequency vs. Supply Voltage vs. Temperature

## Typical Magnetic Characteristics for CT852AN

$V_{DD} = 3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ ,  $C_{DD} = 1.0\text{ }\mu\text{F}$  (unless otherwise specified).



**Figure 7.**  $B_{OPS}$  (Blue) and  $B_{RPN}$  (Red) vs. Supply Voltage at  $+25^\circ\text{C}$



**Figure 8.**  $B_{OPS}$  (Green) and  $B_{RPN}$  (Orange) vs. Operating Temperature at  $V_{DD} = 3.0\text{ V}$



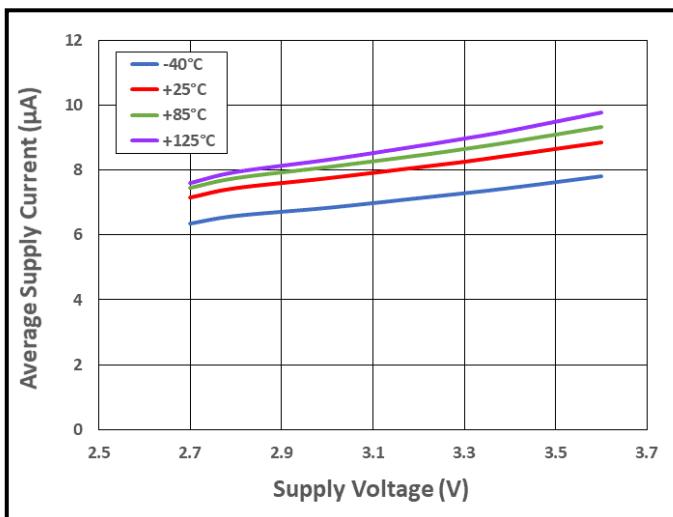
**Table 7: Electrical & Magnetic Characteristics for CT852AM**

Unless otherwise specified:  $V_{DD} = 2.7\text{ V to }3.6\text{ V}$ ,  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

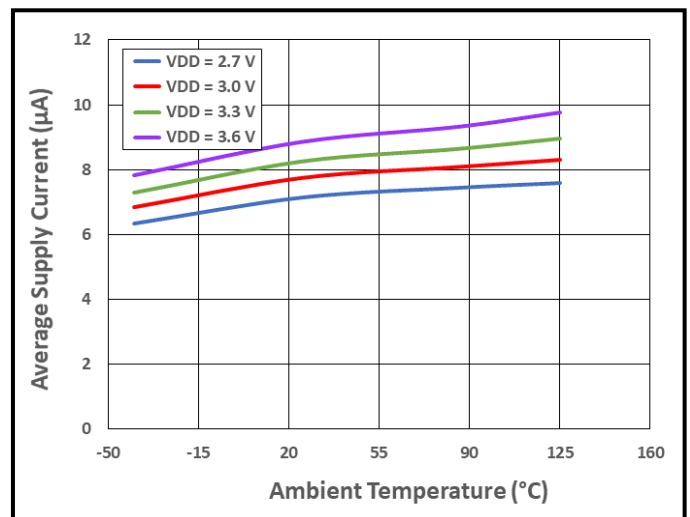
| Parameter              | Symbol        | Conditions           | Min  | Typ  | Max  | Unit          |
|------------------------|---------------|----------------------|------|------|------|---------------|
| Average Supply Current | $I_{DD(AVG)}$ | $t \geq 10\text{ s}$ |      | 8.0  | 13.0 | $\mu\text{A}$ |
| Sampling Frequency     | $f_S$         |                      | 1.63 | 2.50 | 3.25 | kHz           |
| Active Mode Time       | $t_{ACT}$     |                      |      | 1.4  |      | $\mu\text{s}$ |
| Idle Mode Time         | $t_{IDLE}$    |                      | 308  | 400  | 614  | ms            |
| Operate Point          | $B_{OPS}$     |                      | 0.8  | 1.0  | 1.4  | mT            |
| Release point          | $B_{RPN}$     |                      | -1.4 | -1.0 | -0.8 | mT            |

## Typical Electrical Characteristics for CT852AM

$V_{DD} = 3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ ,  $C_{DD} = 1.0\text{ }\mu\text{F}$  (unless otherwise specified).



**Figure 9.** Average Supply Current vs. Supply Voltage vs. Temperature

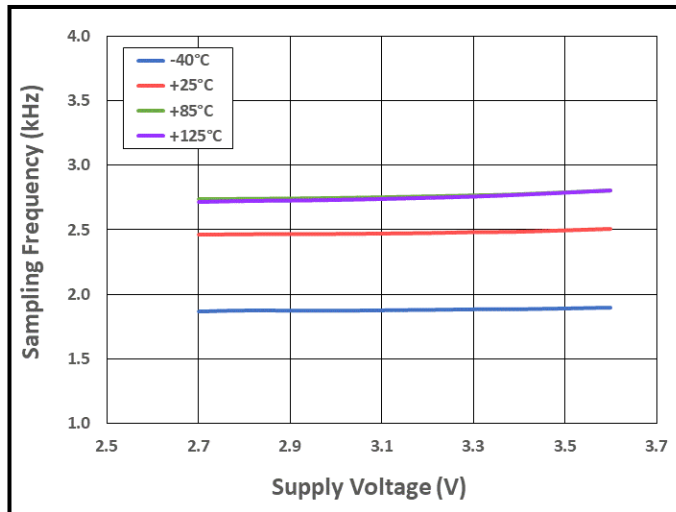


**Figure 10.** Average Supply Current vs. Temperature vs. Supply Voltage



## Typical Electrical Characteristics for CT852AM

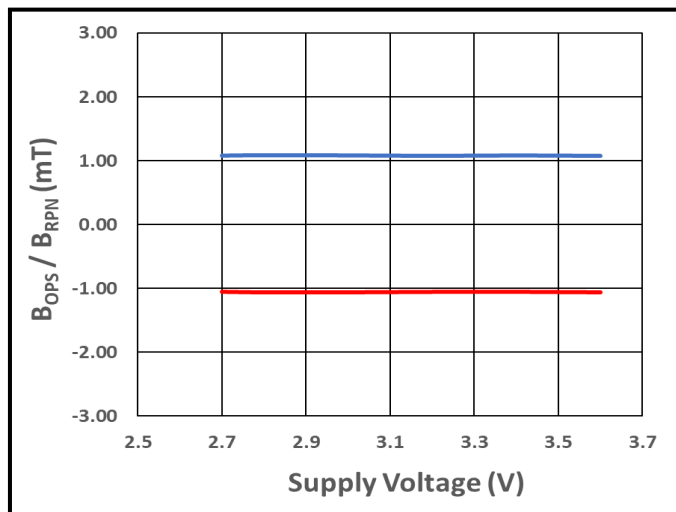
$V_{DD} = 3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ ,  $C_{DD} = 1.0\text{ }\mu\text{F}$  (unless otherwise specified).



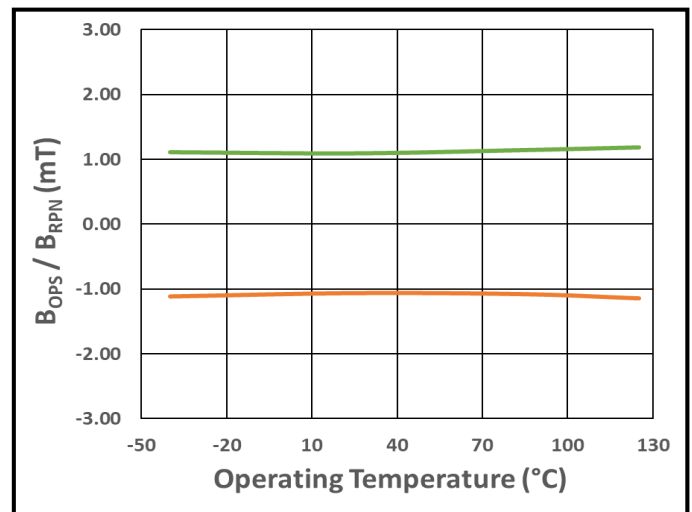
**Figure 11.** Sampling Frequency vs. Supply Voltage vs. Temperature

## Typical Magnetic Characteristics for CT852AM

$V_{DD} = 3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ ,  $C_{DD} = 1.0\text{ }\mu\text{F}$  (unless otherwise specified).



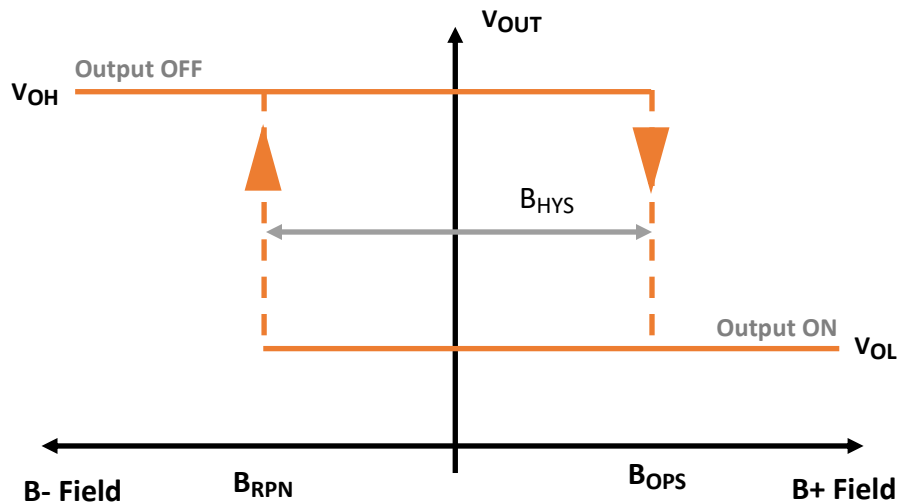
**Figure 12.**  $B_{OPS}$  (Blue) and  $B_{RPN}$  (Red) vs. Supply Voltage at  $+25^\circ\text{C}$



**Figure 13.**  $B_{OPS}$  (Green) and  $B_{RPN}$  (Orange) vs. Operating Temperature at  $V_{DD} = 3.0\text{ V}$



**Figure 14: Bipolar Magnetic Flux**



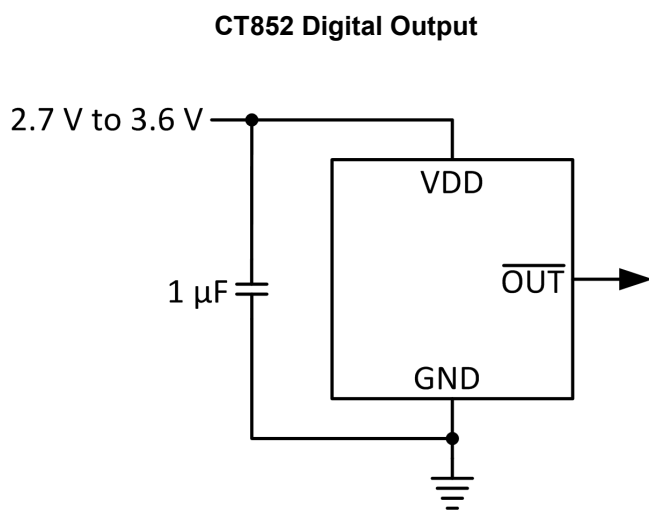
**Output Behavior vs. Magnetic Field**

| Characteristic | Conditions   | Output     |
|----------------|--------------|------------|
| Positive Field | $B > B_{OP}$ | Low (ON)   |
| Negative Field | $B < B_{RP}$ | High (OFF) |



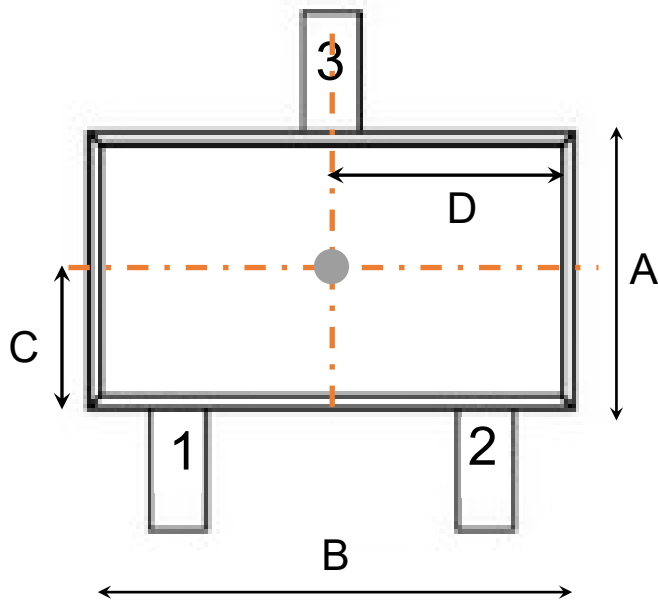
## Figure 15: Application Circuit

A decoupling capacitor ( $C_{DD}$ ) between the supply voltage and ground is required with placement close to the magnetic switch. A typical capacitor value of  $1\ \mu\text{F}$  (Ceramic) will suffice.





**Figure 16: MLU Sensor Location**



**SOT23 Package**

| Symbols | Nominal Dimensions (mm) |
|---------|-------------------------|
| A       | 1.60                    |
| B       | 2.90                    |
| C       | 0.80                    |
| D       | 1.45                    |



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**Table 8: Order Guide for Bipolar TMR Digital Latches**

| Part Number                | Polarity | Output Type | B <sub>OP</sub> | B <sub>RP</sub> | I <sub>DD(AVG)</sub> | f <sub>S</sub> | Description                                                     |
|----------------------------|----------|-------------|-----------------|-----------------|----------------------|----------------|-----------------------------------------------------------------|
| CT852AN-HS3<br>CT852AN-IS3 | Bipolar  | Push-Pull   | +1.0 mT         | -1.0 mT         | 1.7 $\mu$ A          | 500 Hz         | Bipolar Magnetic Latch<br>SOT-23 Package, Tape & Reel Packaging |
| CT852AM-HS3<br>CT852AM-IS3 | Bipolar  | Push-Pull   | +1.0 mT         | -1.0 mT         | 8.0 $\mu$ A          | 2.5 kHz        | Bipolar Magnetic Latch<br>SOT-23 Package, Tape & Reel Packaging |



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**Table 9. Packaging Information**

| Orderable Part Number | Package Type | Pins | Package Quantity | Lead Finish | Eco Plan <sup>(1)</sup> | MSL Rating <sup>(2)</sup> | Operating Temperature | Device Marking <sup>(3)</sup> |
|-----------------------|--------------|------|------------------|-------------|-------------------------|---------------------------|-----------------------|-------------------------------|
| CT852AN-HS3           | SOT-23       | 3    | 3,000            | Sn          | Green & RoHS            | 1                         | -40°C to +125°C       | HS YWWS                       |
| CT852AN-IS3           | SOT-23       | 3    | 3,000            | Sn          | Green & RoHS            | 1                         | -40°C to +85°C        | HS YWWS                       |
| CT852AM-HS3           | SOT-23       | 3    | 3,000            | Sn          | Green & RoHS            | 1                         | -40°C to +125°C       | HR YWWS                       |
| CT852AM-IS3           | SOT-23       | 3    | 3,000            | Sn          | Green & RoHS            | 1                         | -40°C to +85°C        | HR YWWS                       |

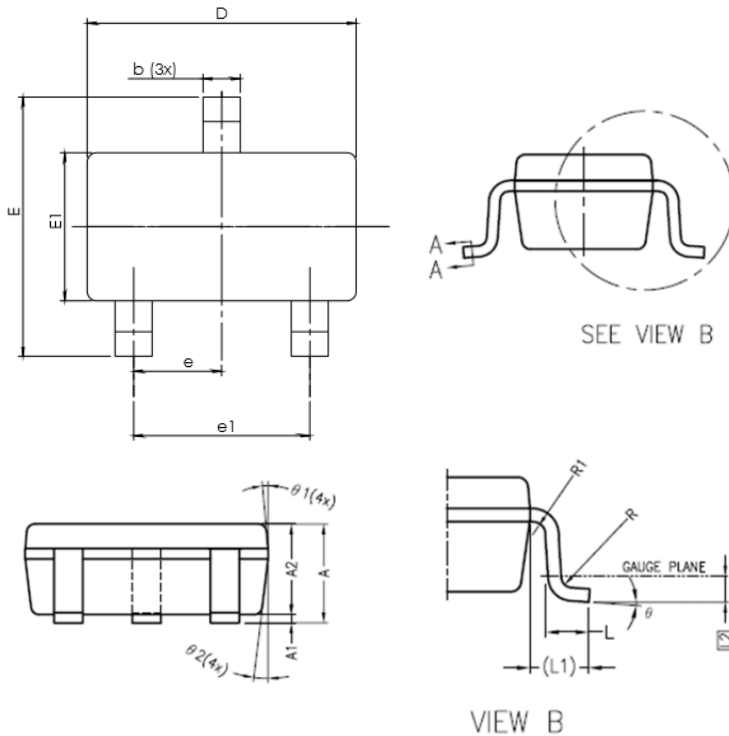
- (1) RoHS is defined as semiconductor products that are compliant to the current EU RoHS requirements. It also will meet the requirement that RoHS substances do not exceed 0.1% by weight in homogeneous materials. Green is defined as the content of Chlorine (Cl), Bromine (Br) and Antimony Trioxide based flame retardants satisfy JS709B low halogen requirements of  $\leq 1,000$  ppm.
- (2) MSL Rating = Moisture Sensitivity Level Rating as defined by JEDEC industry standard classifications.
- (3) Device Marking for SOT23 is defined as XZ YWWS where XZ = part number, Y = year, WW = work week and S = sequential number.



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**Figure 17: 3-Lead SOT-23 Package Dimensions**



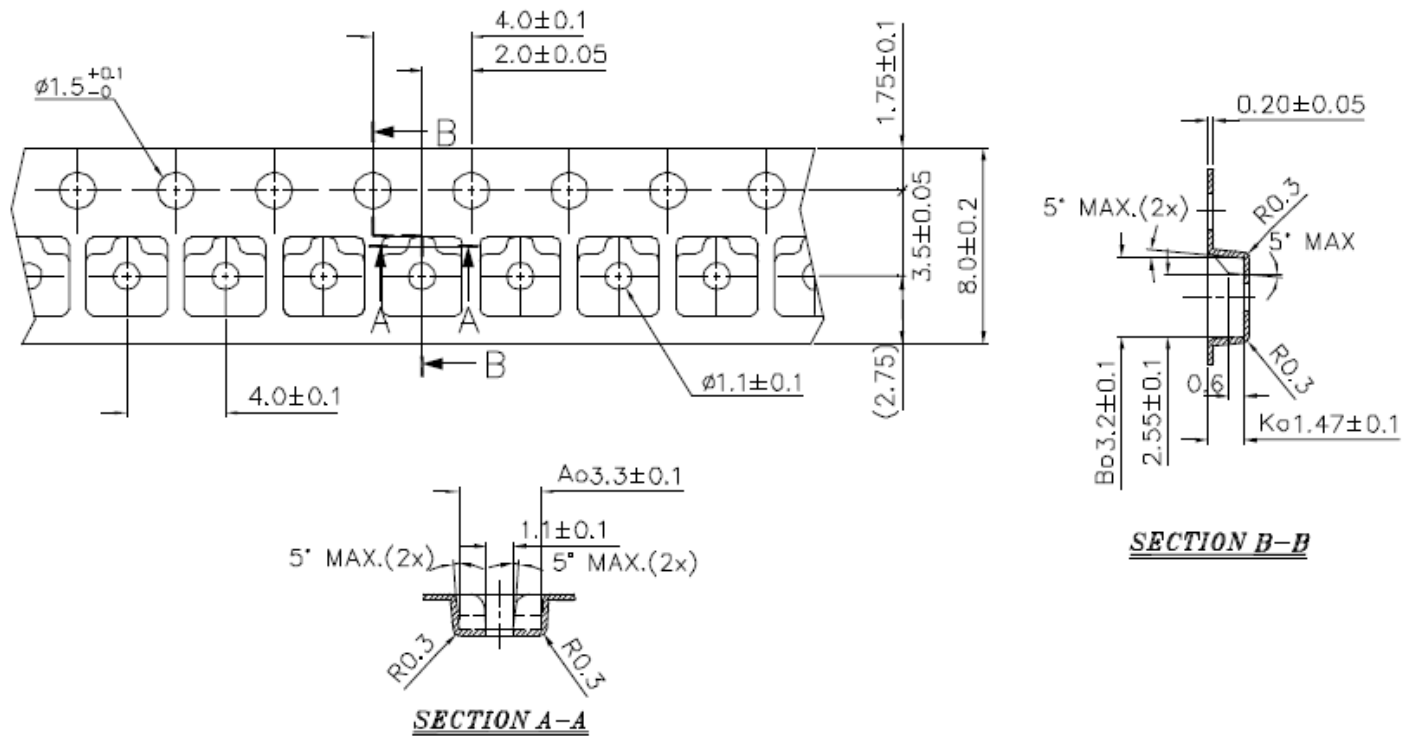
| SYMBOLS | DIMENSIONS IN MILLIMETERS |      |      |
|---------|---------------------------|------|------|
|         | MIN                       | NOM  | MAX  |
| A       | 1.05                      | 1.20 | 1.35 |
| A1      | 0.00                      | 0.10 | 0.15 |
| A2      | 1.00                      | 1.10 | 1.20 |
| b       | 0.30                      |      | 0.50 |
| b1      | 0.30                      | 0.35 | 0.45 |
| c       | 0.08                      |      | 0.22 |
| c1      | 0.08                      | 0.13 | 0.20 |
| D       | 2.80                      | 2.90 | 3.00 |
| E       | 2.60                      | 2.80 | 3.00 |
| E1      | 1.50                      | 1.60 | 1.70 |
| e       | 0.95 BSC                  |      |      |
| e1      | 1.90 BSC                  |      |      |
| L       | 0.35                      | 0.43 | 0.60 |
| L1      | 0.60 REF                  |      |      |
| L2      | 0.25 BSC.                 |      |      |
| R       | 0.10                      |      |      |
| R1      | 0.10                      |      | 0.25 |
| θ       | 0°                        | 4°   | 8°   |
| θ1      | 5°                        | 6°   | 15°  |
| θ2      | 5°                        | 8°   | 15°  |



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**Figure 18: Tape & Pocket Dimensions for SOT23 Package**



**Notes:**

1. Material: Conductive Polystyrene
2. Dimensions in mm.
3. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$ .
4. Camber not to exceed 1 mm in 100 mm.
5. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.
6. (S.R.  $\Omega/\text{sq}$ ) means surface electric resistivity of the carrier tape.



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# CT85x Series

## Bipolar Digital TMR Latch for Consumer & Industrial Applications

| Revision Number | Revision Date | Summary of Changes                                                                                                                                                                                                                                                                                            |
|-----------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.1             | 5/12/17       | Datasheet Initiated                                                                                                                                                                                                                                                                                           |
| 0.2             | 6/2/17        | Updated electrical characteristics, application circuit, and disclaimer clause.                                                                                                                                                                                                                               |
| 0.3             | 6/21/17       | Increased operating temperature to 125°C.                                                                                                                                                                                                                                                                     |
| 0.4             | 6/28/17       | Changed Switch product name to Latch.                                                                                                                                                                                                                                                                         |
| 0.5             | 7/7/17        | Updated Part Number Ordering Guide.                                                                                                                                                                                                                                                                           |
| 0.6             | 7/14/17       | Added SK, BL option offering.                                                                                                                                                                                                                                                                                 |
| 0.7             | 7/20/17       | Added new part numbers.                                                                                                                                                                                                                                                                                       |
| 0.8             | 8/15/17       | Updated CT832SK from Bop = 0.7 mT to Bop = 0.9 mT. Updated axis of sensitivity                                                                                                                                                                                                                                |
| 0.81            | 8/16/17       | Updated available part numbers.                                                                                                                                                                                                                                                                               |
| 0.82            | 8/17/17       | Updated datasheet formatting.                                                                                                                                                                                                                                                                                 |
| 0.83            | 8/28/17       | Updated 250 Hz to 500 Hz device offering.                                                                                                                                                                                                                                                                     |
| 0.84            | 8/29/17       | Added new part number CT832SL.                                                                                                                                                                                                                                                                                |
| 0.85            | 9/26/17       | Updated part numbers and added 250 Hz option.                                                                                                                                                                                                                                                                 |
| 0.86            | 10/16/17      | Added part numbers for Industrial variants in Ordering Guide.                                                                                                                                                                                                                                                 |
| 0.87            | 10/20/17      | Added Packaging Information Table and changed operating conditions for each Electrical Table. Changed formatting in document.                                                                                                                                                                                 |
| 0.88            | 11/10/17      | Updated all tables and figures.                                                                                                                                                                                                                                                                               |
| 0.89            | 11/15/17      | Changed CT833BH to CT832BH; added CT834; updated specifications and application diagrams.                                                                                                                                                                                                                     |
| 0.90            | 11/21/17      | Added Min/Max specs for switching frequency, average supply current and B <sub>OP</sub> plus B <sub>RP</sub> and Min/Typ hysteresis specs for B <sub>OP</sub> -B <sub>RP</sub> .                                                                                                                              |
| 0.91            | 12/18/17      | Added Average Supply Current curves and Tables for Recommending Operating Conditions and Thermal Properties. Formatted entire data sheet to use Arial font.<br>Changed Min/Max specs for Table 14 from 0.2 x V <sub>DD</sub> and 0.8 x V <sub>DD</sub> to 0.19 x V <sub>DD</sub> and 0.81 x V <sub>DD</sub> . |
| 0.92            | 12/19/17      | Removed page for Part Legend and corrected device marking for CT832BH-IL1.                                                                                                                                                                                                                                    |

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## Bipolar Digital TMR Latch for Consumer & Industrial Applications

| Revision Number | Revision Date | Summary of Changes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.93            | 2/2/18        | Removed Output Voltage High spec and renamed output leakage current spec.<br>Changed CT832BL and CT832SL supply current from 1.4 $\mu$ A to 1.2 $\mu$ A.<br>Added B <sub>OP</sub> and B <sub>RP</sub> and Sensitivity curves.<br>Added Min/Max Idle Times for all ETs since these values correspond to Min/Max Sampling Frequencies.<br>Added Block Diagrams on page 2.<br>Added T&R diagram on page 31.<br>Corrected Average Supply Current for CT832BH to 36 $\mu$ A from 1.6 mA.<br>Added curves for CT834DR.<br>Moved Open Drain specs from Table 6 to Table 5.. |
| 0.94            | 2/19/18       | Changed all references from North and South poles to Negative and Positive fields.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 0.95            | 10/10/18      | Corrected Average Supply Current value for CT832BH in Table 16 on page 28.<br>Added Figures 33 to 36 and 51 to 52 on pages 18 and 24 respectively.<br>Added Figures 37 and 38 on page 20.<br>Added CT852AM section on pages 25 and 26.<br>Updated Table 18 on page 32.                                                                                                                                                                                                                                                                                               |
| 1.0             | 10/23/2018    | Converted to CT85x data sheet and removed all CT83x parts.<br>Updated Figure and Table numbers.<br>Changed title of Figure 18 from Tape & Reel to Tape & Pocket on page 16.                                                                                                                                                                                                                                                                                                                                                                                          |
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