

# CT813x

## Integrated Omnipolar TMR Digital Latches

### Features

- Sensitivity with  $B_{OP}$  Range: 0.9 mT to 7.0 mT
- Ultra-low Power Consumption:  $\sim 110$  nA @  $V_{DD} = 1.8$  V and  $f_s = 2$  Hz
- Supply Voltage Range: 1.7 V to 5.5 V
- Sensor Polarity: Omnipolar
- Digital CMOS Outputs:
  - Push-pull
  - Open Drain
- Under-Voltage Lockout (UVLO)
- Package Options:
  - 3-Lead SOT23
  - 4-lead LGA,  $1.45 \times 1.45 \times 0.44$  mm

### Applications

- IoT Devices
- Smartphones, Tablets and Laptops
- Door or Lid Closure
- Reed Switch Replacement
- Tamper-proofing for Utility Smart Meters
- Fluid Level Sensing/Detection
- Proximity Detection
- Motor Controllers
- Gimbals for Camera Systems in Drones/UAVs
- Industrial Machinery/Robots
- Medical Devices

### Product Description

The CT813x series of omnipolar Tunnel Magneto-resistance (TMR) digital latches are designed for consumer and industrial applications. They are based on Crocus Technology's patented XtremeSense® TMR technology with integrated CMOS process to provide a monolithic solution for superior sensing performance. The CT813x digital latches offer stable magnetic operation over the operating temperature range.

This product family has very low power consumption as low as 110 nA which is ideal for battery-operated products where minimal current consumption is required. It supports magnetic fields down to 0.9 mT for applications where there is a large air gap requirement.

For applications that require a very small form factor and low profile, the CT813x is assembled in a 4-lead LGA package. It is also available in an industry standard package 3-lead SOT-23 to support high volume manufacturing for industrial markets.

## Ordering Information

Part Number	Operating Temperature Range	Sensor Type	Output	B <sub>OP</sub> (mT)	B <sub>RP</sub> (mT)	f <sub>s</sub>	Package	Packing Method
CT8131BV-IL4	-40°C to +85°C	Omnipolar	Open Drain	±3.0	±2.0	2 Hz	4-lead LGA	Tape & Reel
CT8131BV-HL4	-40°C to +125°C							
CT8131BV-IS3	-40°C to +85°C	Omnipolar	Open Drain	±3.0	±2.0	2 Hz	3-lead SOT23	Tape & Reel
CT8131BV-HS3	-40°C to +125°C							
CT8132BH-IL4	-40°C to +85°C	Omnipolar	Push-pull	±3.0	±2.0	10 kHz	4-lead LGA	Tape & Reel
CT8132BH-HL4	-40°C to +125°C							
CT8132BH-IS3	-40°C to +85°C	Omnipolar	Push-pull	±3.0	±2.0	10 kHz	3-lead SOT23	Tape & Reel
CT8132BH-HS3	-40°C to +125°C							
CT8132BL-IS3	-40°C to +85°C	Omnipolar	Push-pull	±3.0	±2.0	250 Hz	3-lead SOT23	Tape & Reel
CT8132BL-HS3	-40°C to +125°C							
CT8132BV-IL4	-40°C to +85°C	Omnipolar	Push-pull	±3.0	±2.0	2 Hz	4-lead LGA	Tape & Reel
CT8132BV-HL4	-40°C to +125°C							
CT8132BV-IS3	-40°C to +85°C	Omnipolar	Push-pull	±3.0	±2.0	2 Hz	3-lead SOT23	Tape & Reel
CT8132BV-HS3	-40°C to +125°C							
CT8132DM-IS3	-40°C to +85°C	Omnipolar	Push-pull	±1.5	±1.0	2.5 kHz	3-lead SOT23	Tape & Reel
CT8132DM-HS3	-40°C to +125°C							
CT8132EK-IS3	-40°C to +85°C	Omnipolar	Push-pull	±7.0	±5.0	10 Hz	3-lead SOT23	Tape & Reel
CT8132EK-HS3	-40°C to +125°C							
CT8132SK-IL4	-40°C to +85°C	Omnipolar	Push-pull	±0.9	±0.5	10 Hz	4-lead LGA	Tape & Reel
CT8132SK-HL4	-40°C to +125°C							
CT8132SK-IS3	-40°C to +85°C	Omnipolar	Push-pull	±0.9	±0.5	10 Hz	3-lead SOT23	Tape & Reel
CT8132SK-HS3	-40°C to +125°C							
CT8132SL-IS3	-40°C to +85°C	Omnipolar	Push-pull	±0.9	±0.5	250 Hz	3-lead SOT23	Tape & Reel
CT8132SL-HS3	-40°C to +125°C							

Block Diagram

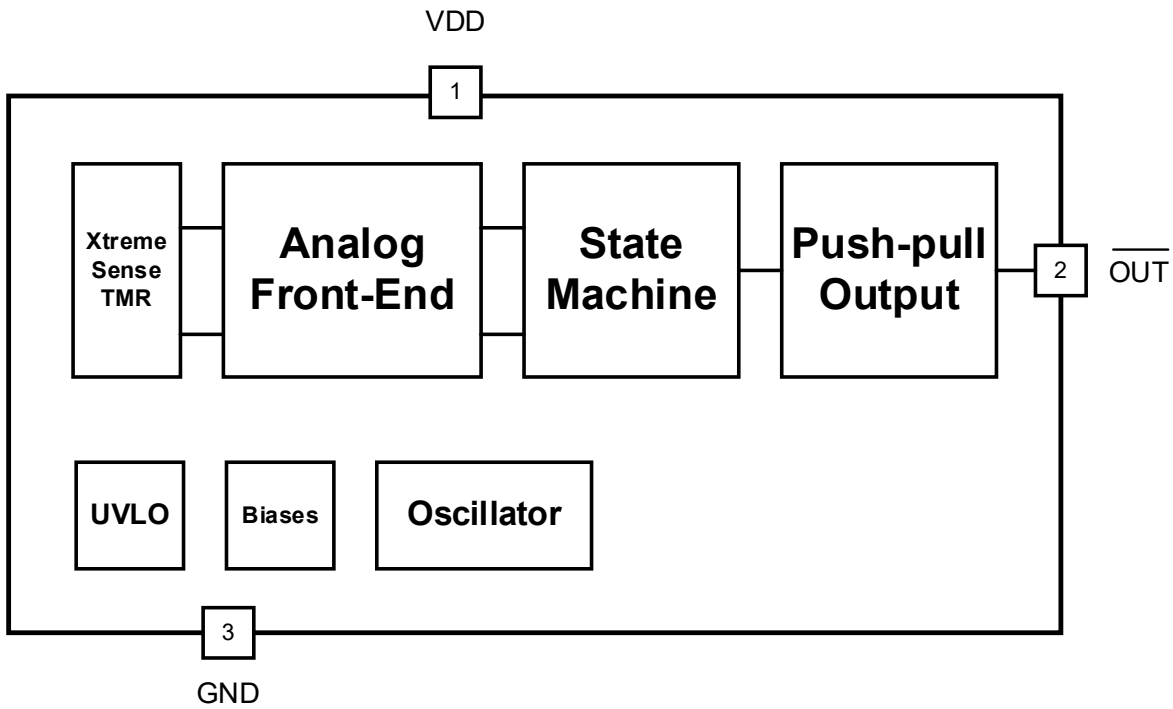


Figure 1. CT8132 with Push-pull Output Block Diagram for 3-lead SOT23 Package

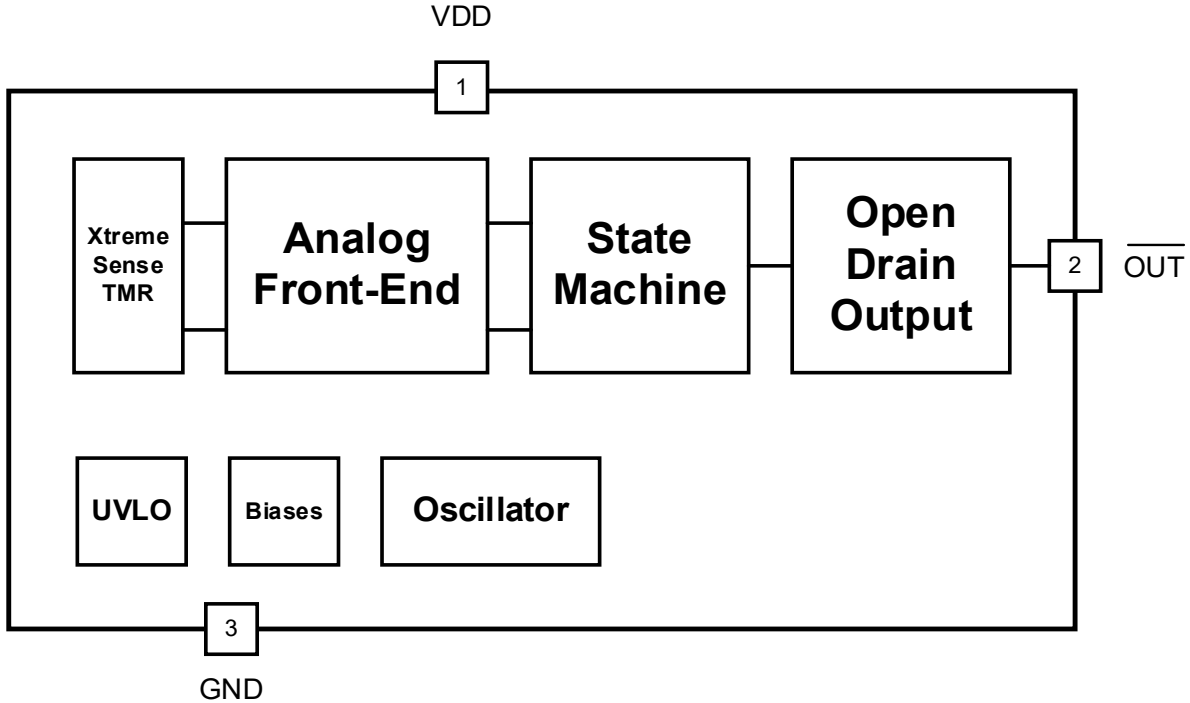


Figure 2. CT8131 with Open Drain Output Block Diagram for 3-lead SOT23 Package

## SOT23 Pin Configuration

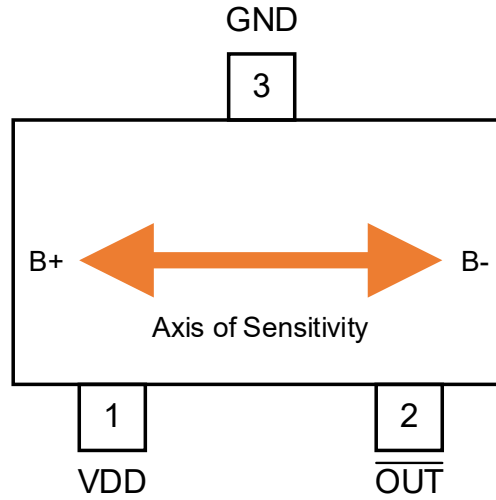


Figure 3. CT813x: 3-Lead SOT23 Package for Digital Output

## Pin Definitions

Pin #	Pin Name	Pin Description
1	VDD	Supply Voltage
2	$\overline{\text{OUT}}$	Output Signal (Active LOW)
3	GND	Ground

LGA Pin Configuration

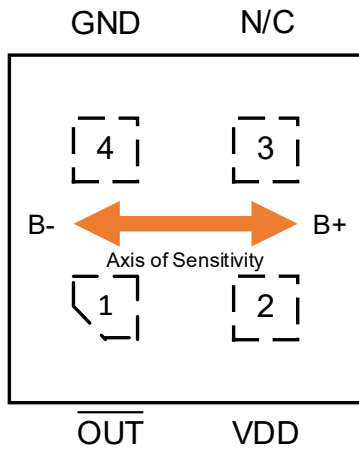


Figure 4. CT8131: 4-Lead LGA Package with Digital Output, Top View

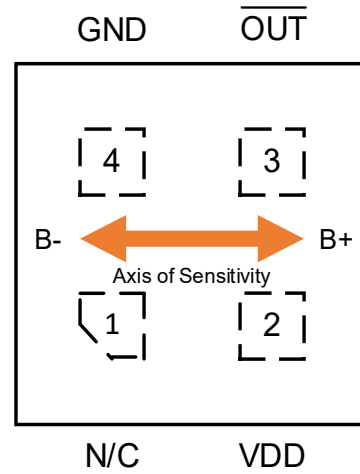


Figure 5. CT8132: 4-Lead LGA Package with Digital Output, Top View

Pin Definitions

Pin #	CT8131	CT8132	Pin Description
1	$\overline{\text{OUT}}$	N/C	Output Signal for Open Drain (Active LOW) N/C – No Connect
2	VDD	VDD	Supply Voltage
3	N/C	$\overline{\text{OUT}}$	N/C – No Connect Output Signal for Push-pull (Active LOW)
4	GND	GND	Ground

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the CT813x. The CT813x products may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Crocus Technology does not recommend exceeding or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	-0.3	6.0	V
V <sub>OUT_PP</sub>	Push-pull Output (Active LOW)	-0.3	V <sub>DD</sub> + 0.3*	V
V <sub>OUT_OD</sub>	Open Drain Output (Active LOW)	-0.3	6.0	V
V <sub>I/O</sub>	Input/Output Pins Maximum Voltage	-0.3	V <sub>DD</sub> + 0.3*	V
I <sub>IN</sub> / I <sub>OUT</sub>	Input and Output Current		±20.0	mA
B <sub>MAX</sub>	Maximum External Magnetic Field @ T <sub>A</sub> = +25°C	CT8132Sx	±60	mT
		CT813xBx, CT8132DM, CT8132EK	±200	
ESD	Electrostatic Discharge Protection Level	Human Body Model (HBM) per JESD22-A114	±4.0	kV
		Charged Device Model (CDM) per JESD22-C101	0.5	
T <sub>J</sub>	Junction Temperature	-40	+150	°C
T <sub>STG</sub>	Storage Temperature	-65	+150	°C
T <sub>L</sub>	Lead Soldering Temperature, 10 Seconds		+260	°C

\*The lower of V<sub>DD</sub> + 0.3 V or 6.0 V.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual operation of the CT813x. Recommended operating conditions are specified to ensure optimal performance to the specifications. Crocus Technology does not recommend exceeding or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Typ.	Max.	Unit	
V <sub>DD</sub>	Supply Voltage Range	1.7	3.3	5.5	V	
V <sub>OUT</sub>	OUT Voltage Range	0		V <sub>DD</sub>	V	
B <sub>OP</sub>	Operating Magnetic Flux			±45	mT	
I <sub>OUT</sub>	OUT Current			±3.0	mA	
C <sub>BYP</sub>	Bypass Capacitor		1.0		µF	
T <sub>A</sub>	Operating Ambient Temperature	Industrial	-40	+25	+85	°C
		Extended Industrial	-40	+25	+125	

## 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) with 2 oz. of copper (Cu). Special attention must be paid to not exceed junction temperature T<sub>J(MAX)</sub> at a given ambient temperature T<sub>A</sub>.

Symbol	Parameter	Min.	Typ.	Max.	Unit
θ <sub>JA</sub>	Junction-to-Ambient Thermal Resistance, SOT23-3		202		°C/W
θ <sub>JA</sub>	Junction-to-Ambient Thermal Resistance, LGA-4		165		°C/W

## Electrical Specifications

### General Parameters

Unless otherwise specified:  $V_{DD} = 1.7\text{ V to }5.5\text{ V}$ ,  $C_{BYP} = 1.0\ \mu\text{F}$  and  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.3\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>Push-pull Output</b>						
$V_{OH}$	Output Voltage High $\overline{O\overline{U\overline{T}}}$ <sup>(1)</sup>	$I_{OUT} = -2\text{ mA}$	$0.9 \times V_{DD}$			V
$V_{OL}$	Output Voltage Low $\overline{O\overline{U\overline{T}}}$ <sup>(1)</sup>	$I_{OUT} = +2\text{ mA}$			$0.1 \times V_{DD}$	V
<b>Open Drain Output</b>						
$V_{OH}$	Output Voltage High <sup>(1)</sup>				5.5	V
$V_{OL}$	Output Voltage Low	$I_{OUT} \leq 20\text{ mA}$	0		0.5	V
$I_{LEAK}$	High Output Leakage Current <sup>(1)</sup>	$V_{OH} = 5.5\text{ V}$ , $B_{OP} = 0$		20		pA
<b>Timings</b>						
$t_{ON}$	Power-On Time <sup>(1)</sup>	$V_{DD} \geq 1.7\text{ V}$		50	75	$\mu\text{s}$
$t_{ACTIVE}$	Active Mode Time <sup>(1)</sup>			2.6		$\mu\text{s}$
<b>Protection</b>						
$V_{UVLO}$	Under-Voltage Lockout <sup>(1)</sup>	Rising $V_{DD}$		1.60	1.64	V
		Falling $V_{DD}$	1.44	1.53		V
$V_{UV\_HYS}$	UVLO Hysteresis <sup>(1)</sup>			70		mV

(1) Guaranteed by design and characterization; not tested in production.

### Typical Timing Characteristics

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

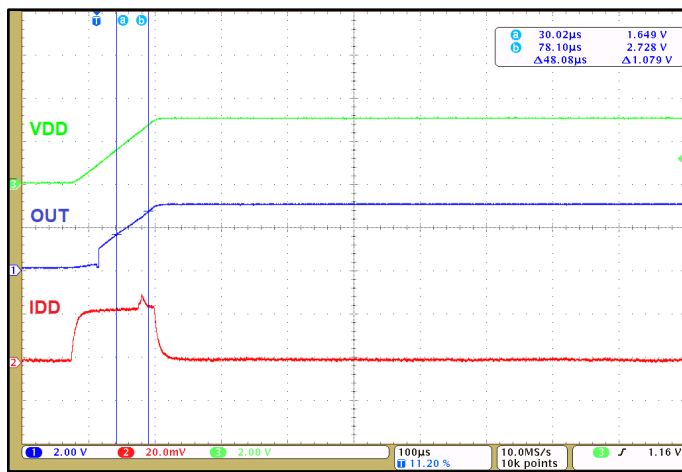


Figure 6. Power-On Time for Push-pull Output

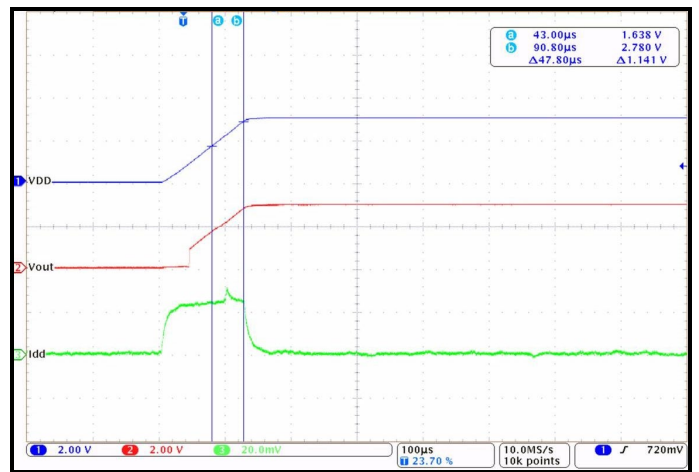


Figure 7. Power-On Time for Open Drain Output

**CT8131BV Electrical & Magnetic Specifications**

Unless otherwise specified:  $V_{DD} = 1.7\text{ V to }5.5\text{ V}$ ,  $C_{BYP} = 1.0\ \mu\text{F}$  and  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.3\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{DD(AVG)}$	Average Supply Current	$t \geq 10\text{ s}$		140	900	nA
$I_{DD(AVG)_1.8V}$	Average Supply Current @ $V_{DD} = 1.8\text{ V}$	$t \geq 10\text{ s}, V_{DD} = 1.8\text{ V}$		110	900	nA
$f_{S1}$	Sampling Frequency		1	2	4	Hz
$t_{IDLE1}$	Idle Mode Time	$f_S = 2\text{ Hz}$	250	500	1000	ms
B <sub>OPN</sub>	Operate Point, B-		+2.3	+3.0	+3.8	mT
B <sub>OPS</sub>	Operate Point, B+		-3.8	-3.0	-2.3	mT
B <sub>RPN</sub>	Release Point, B-		+1.4	+2.0	+2.7	mT
B <sub>RPS</sub>	Release Point, B+		-2.7	-2.0	-1.4	mT
B <sub>HYST</sub>	Hysteresis		0.5	1.0		mT

**CT8132BH Electrical & Magnetic Specifications**

Unless otherwise specified:  $V_{DD} = 1.7\text{ V to }5.5\text{ V}$ ,  $C_{BYP} = 1.0\ \mu\text{F}$  and  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.3\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{DD(AVG)}$	Average Supply Current	$t \geq 10\text{ s}$		45	57	$\mu\text{A}$
$I_{DD(AVG)_1.8V}$	Average Supply Current @ $V_{DD} = 1.8\text{ V}$	$t \geq 10\text{ s}, V_{DD} = 1.8\text{ V}$		41	47	$\mu\text{A}$
$f_S$	Sampling Frequency		6	10	14	kHz
$t_{IDLE}$	Idle Mode Time	$f_S = 10\text{ kHz}$	71	100	167	$\mu\text{s}$
B <sub>OPN</sub>	Operate Point, B-		+2.3	+3.0	+3.8	mT
B <sub>OPS</sub>	Operate Point, B+		-3.8	-3.0	-2.3	mT
B <sub>RPN</sub>	Release Point, B-		+1.4	+2.0	+2.7	mT
B <sub>RPS</sub>	Release Point, B+		-2.7	-2.0	-1.4	mT
B <sub>HYST</sub>	Hysteresis		0.5	1.0		mT



**CT8132BL Electrical & Magnetic Specifications**

Unless otherwise specified:  $V_{DD} = 1.7\text{ V}$  to  $5.5\text{ V}$ ,  $C_{BYP} = 1.0\ \mu\text{F}$  and  $T_A = -40^\circ\text{C}$  to  $+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.3\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{DD(AVG)}$	Average Supply Current	$t \geq 10\text{ s}$		1.3	3.0	$\mu\text{A}$
$I_{DD(AVG)_1.8V}$	Average Supply Current @ $V_{DD} = 1.8\text{ V}$	$t \geq 10\text{ s}$ , $V_{DD} = 1.8\text{ V}$		1.1	2.0	$\mu\text{A}$
$f_s$	Sampling Frequency		150	250	350	Hz
$t_{IDLE}$	Idle Mode Time	$f_s = 250\text{ Hz}$	2.8	4.0	6.7	ms
$B_{OPN}$	Operate Point, B-		+2.3	+3.0	+3.8	mT
$B_{OPS}$	Operate Point, B+		-3.8	-3.0	-2.3	mT
$B_{RPN}$	Release Point, B-		+1.4	+2.0	+2.7	mT
$B_{RPS}$	Release Point, B+		-2.7	-2.0	-1.4	mT
$B_{HYST}$	Hysteresis		0.5	1.0		mT

**CT8132BV Electrical & Magnetic Specifications**

Unless otherwise specified:  $V_{DD} = 1.7\text{ V}$  to  $5.5\text{ V}$ ,  $C_{BYP} = 1.0\ \mu\text{F}$  and  $T_A = -40^\circ\text{C}$  to  $+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.3\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{DD(AVG)}$	Average Supply Current	$t \geq 10\text{ s}$		140	900	nA
$I_{DD(AVG)_1.8V}$	Average Supply Current @ $V_{DD} = 1.8\text{ V}$	$t \geq 10\text{ s}$ , $V_{DD} = 1.8\text{ V}$		110	700	nA
$f_s$	Sampling Frequency		1	2	4	Hz
$t_{IDLE}$	Idle Mode Time	$f_s = 2\text{ Hz}$	250	500	1000	ms
$B_{OPN}$	Operate Point, B-		+2.3	+3.0	+3.8	mT
$B_{OPS}$	Operate Point, B+		-3.8	-3.0	-2.3	mT
$B_{RPN}$	Release Point, B-		+1.4	+2.0	+2.7	mT
$B_{RPS}$	Release Point, B+		-2.7	-2.0	-1.4	mT
$B_{HYST}$	Hysteresis		0.5	1.0		mT

Typical Magnetic Characteristics for CT813xBV, CT8132BH and CT8132BL

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

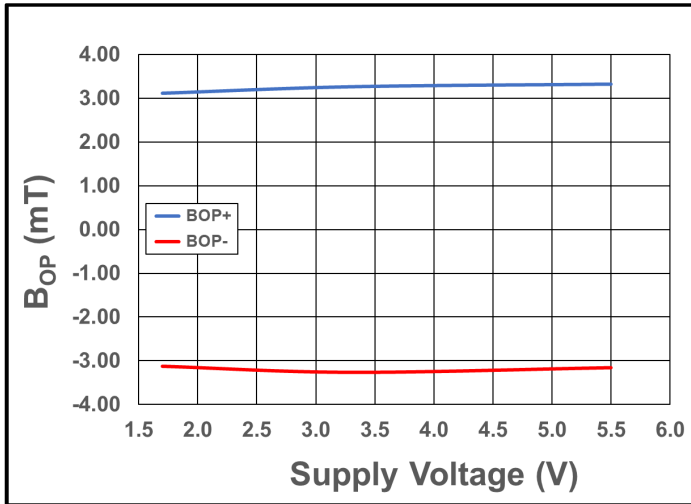


Figure 8.  $B_{OP}$ . (Red) and  $B_{OP+}$  (Blue) vs. Supply Voltage at  $T_A = +25^\circ\text{C}$

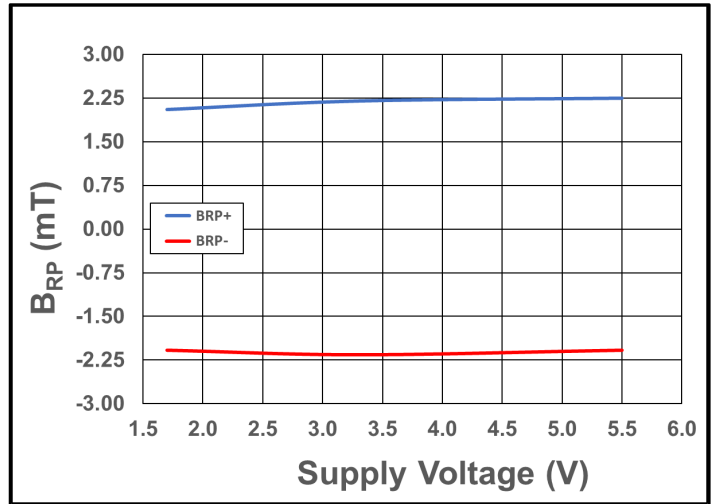


Figure 9.  $B_{RP}$ . (Red) and  $B_{RP+}$  (Blue) vs. Supply Voltage at  $T_A = +25^\circ\text{C}$

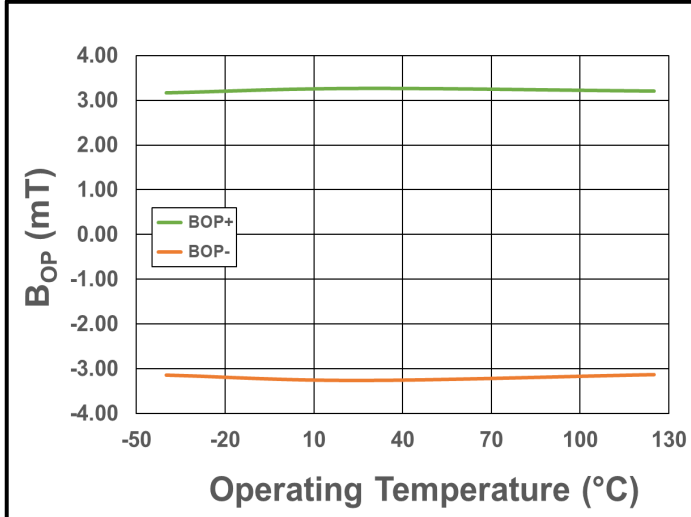


Figure 10.  $B_{OP}$ . (Orange) and  $B_{OP+}$  (Green) vs. Temperature at  $V_{DD} = 3.3\text{ V}$

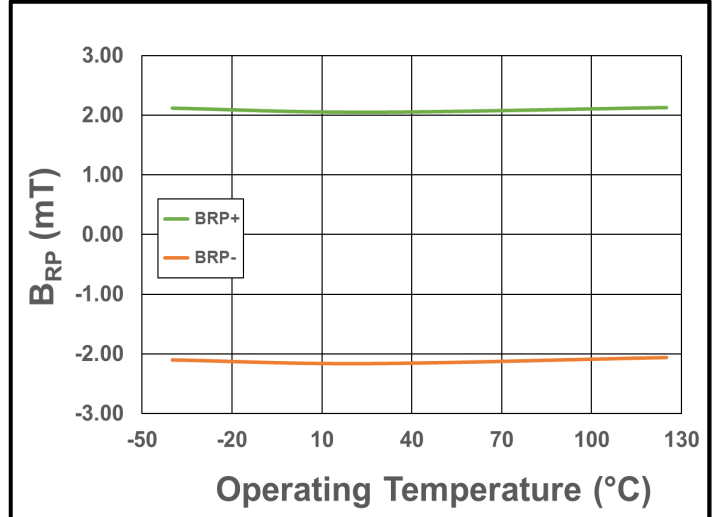


Figure 11.  $B_{RP}$ . (Orange) and  $B_{RP+}$  (Green) vs. Temperature at  $V_{DD} = 3.3\text{ V}$

Typical Electrical Characteristics for CT813xBV

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

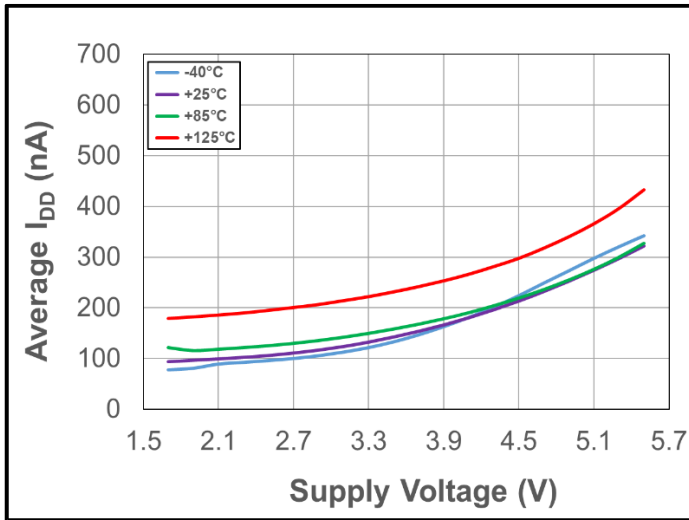


Figure 12. Average Supply Current vs. Supply Voltage vs. Temperature

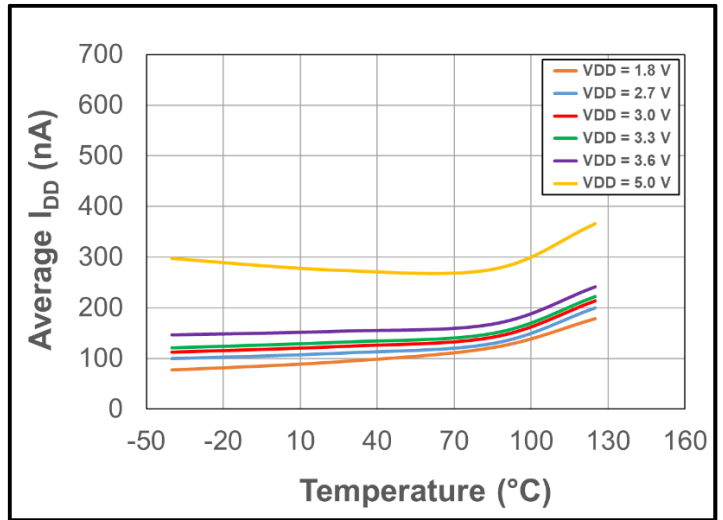


Figure 13. Average Supply Current vs. Temperature vs. Supply Voltage

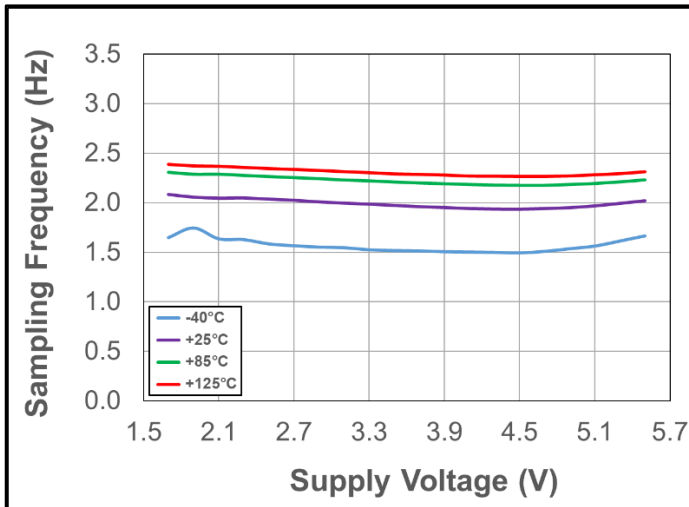


Figure 14. Sampling Frequency vs. Supply Voltage vs. Temperature

Typical Electrical Characteristics for CT8132BH

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

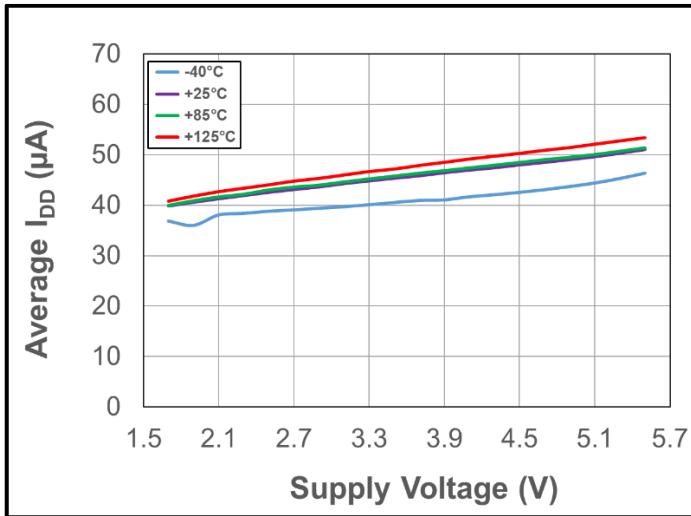


Figure 15. Average Supply Current vs. Supply Voltage vs. Temperature

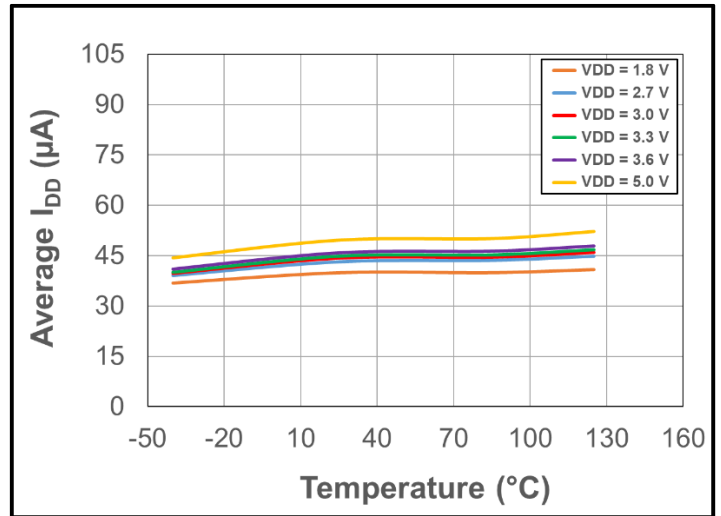


Figure 16. Average Supply Current vs. Temperature vs. Supply Voltage

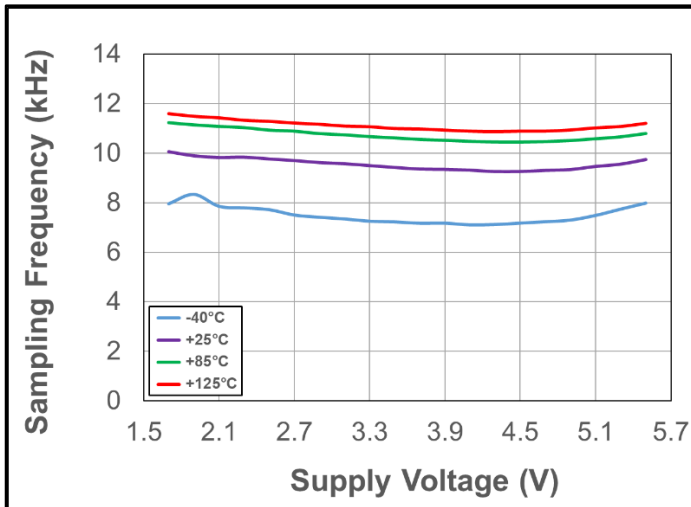


Figure 17. Sampling Frequency vs. Supply Voltage vs. Temperature

Typical Electrical Characteristics for CT8132BL

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

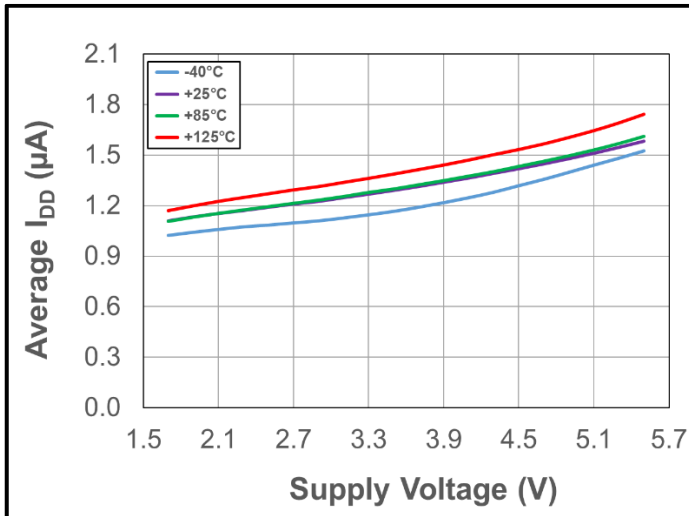


Figure 18. Average Supply Current vs. Supply Voltage vs. Temperature

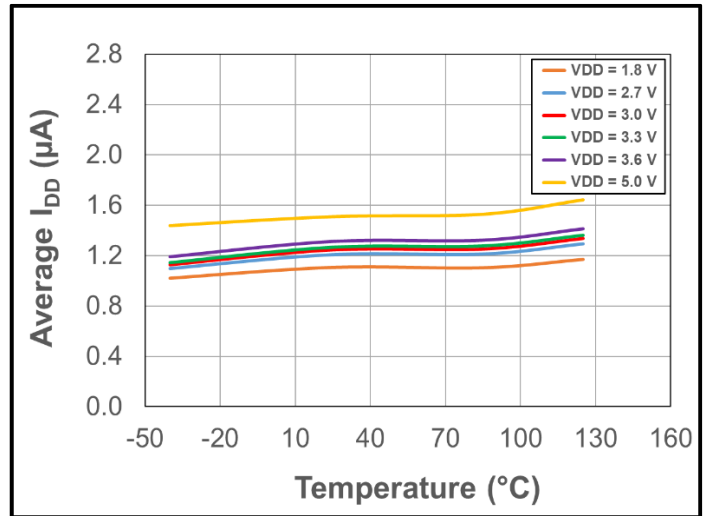


Figure 19. Average Supply Current vs. Temperature vs. Supply Voltage

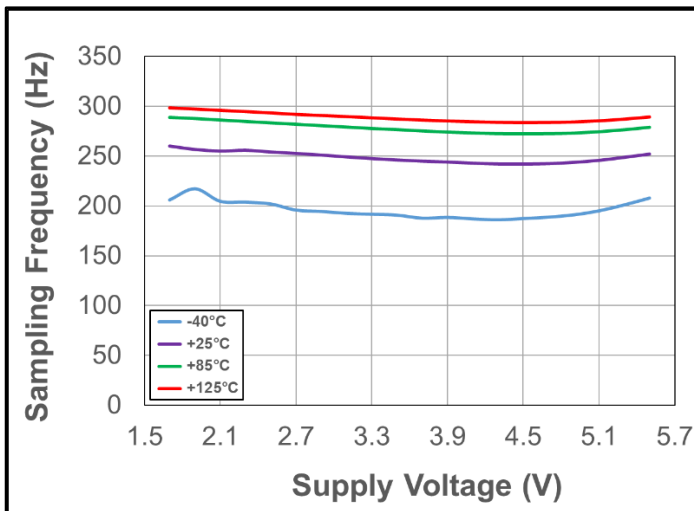


Figure 20. Sampling Frequency vs. Supply Voltage vs. Temperature

**CT8132DM Electrical & Magnetic Specifications**

Unless otherwise specified:  $V_{DD} = 1.7\text{ V to }5.5\text{ V}$ ,  $C_{BYP} = 1.0\ \mu\text{F}$  and  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.3\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{DD(AVG)}$	Average Supply Current	$t \geq 10\text{ s}$		11.5	15.0	$\mu\text{A}$
$I_{DD(AVG\_1.8V)}$	Average Supply Current @ $V_{DD} = 1.8\text{ V}$	$t \geq 10\text{ s}$ , $V_{DD} = 1.8\text{ V}$		10.5	12.0	$\mu\text{A}$
$f_s$	Sampling Frequency		1.5	2.5	3.5	kHz
$t_{IDLE}$	Idle Mode Time	$f_s = 2.5\text{ kHz}$	285	400	667	$\mu\text{s}$
B <sub>OPN</sub>	Operate Point, B-		+1.1	+1.5	+1.9	mT
B <sub>OPS</sub>	Operate Point, B+		-1.9	-1.5	-1.1	mT
B <sub>RPN</sub>	Release Point, B-		+0.6	+1.0	+1.4	mT
B <sub>RPS</sub>	Release Point, B+		-1.4	-1.0	-0.6	mT
B <sub>HYST</sub>	Hysteresis		0.3	0.5		mT

Typical Magnetic Characteristics for CT8132DM

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

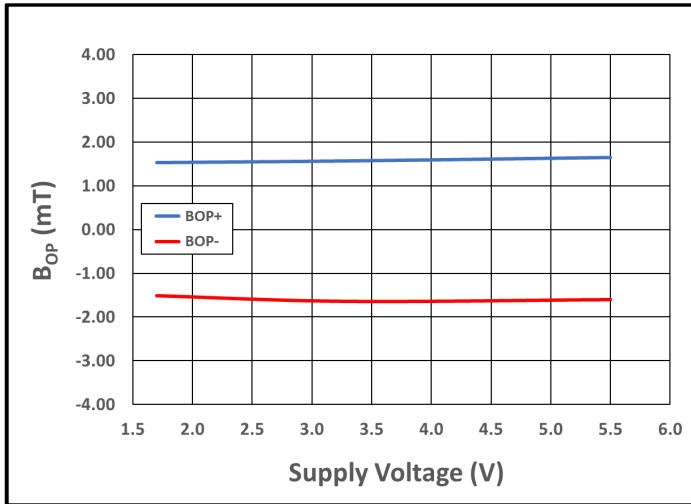


Figure 21.  $B_{OP}$ . (Red) and  $B_{OP+}$  (Blue) vs. Supply Voltage at  $T_A = +25^\circ\text{C}$

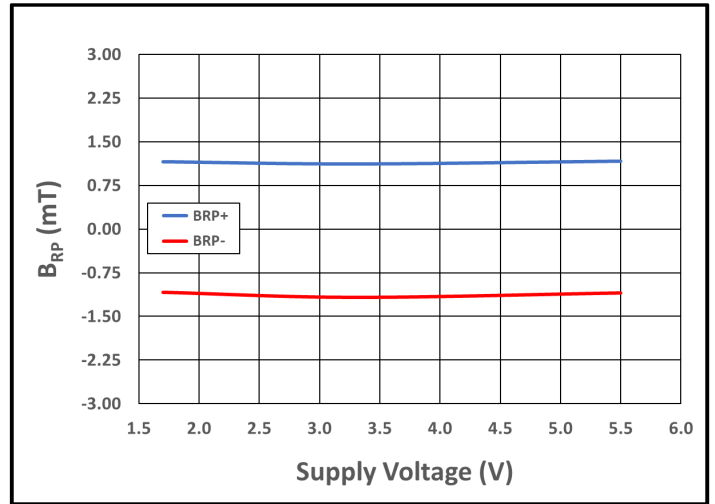


Figure 22.  $B_{RP}$ . (Red) and  $B_{RP+}$  (Blue) vs. Supply Voltage at  $T_A = +25^\circ\text{C}$

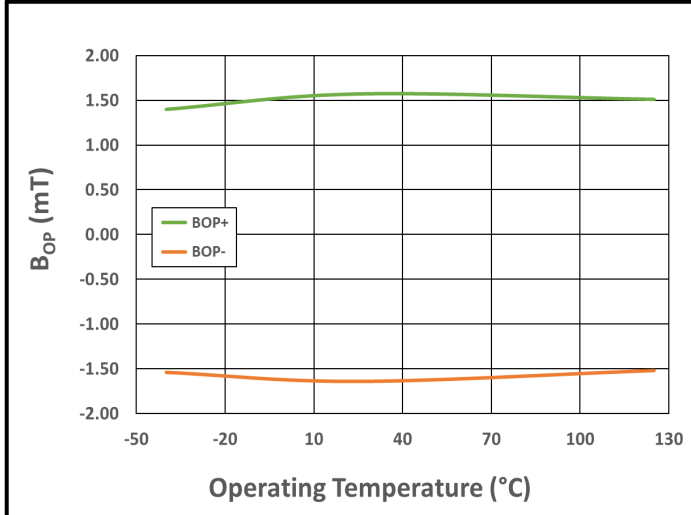


Figure 23.  $B_{OP}$ . (Orange) and  $B_{OP+}$  (Green) vs. Temperature at  $V_{DD} = 3.3\text{ V}$

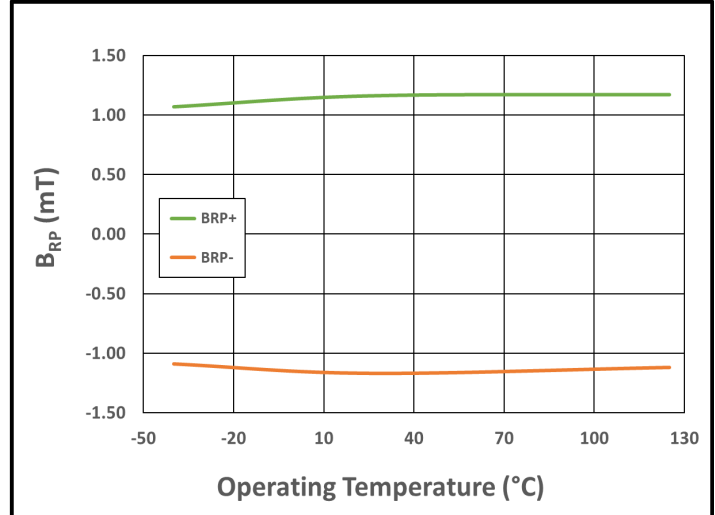


Figure 24.  $B_{RP}$ . (Orange) and  $B_{RP+}$  (Green) vs. Temperature at  $V_{DD} = 3.3\text{ V}$

Typical Electrical Characteristics for CT8132DM

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

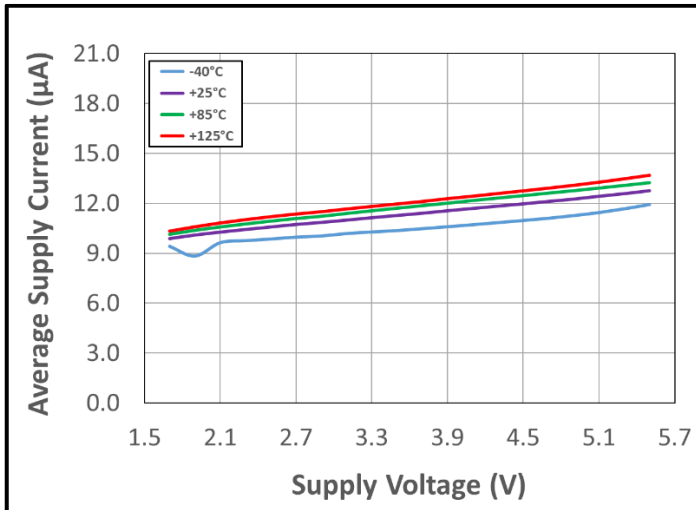


Figure 25. Average Supply Current vs. Supply Voltage vs. Temperature

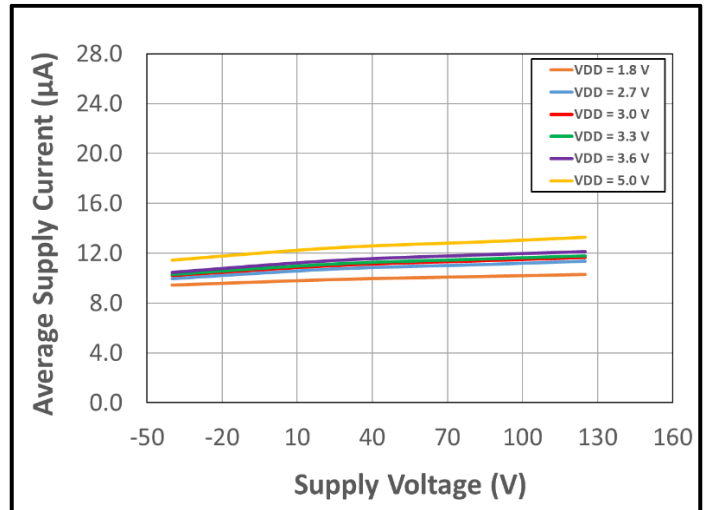


Figure 26. Average Supply Current vs. Temperature vs. Supply Voltage

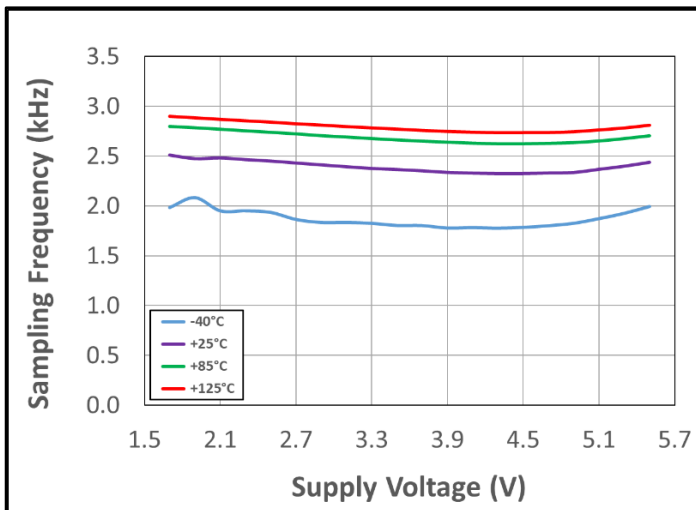


Figure 27. Sampling Frequency vs. Supply Voltage vs. Temperature



**CT8132EK Electrical & Magnetic Specifications**

Unless otherwise specified:  $V_{DD} = 1.7\text{ V to }5.5\text{ V}$ ,  $C_{BYP} = 1.0\ \mu\text{F}$  and  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.3\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{DD(AVG)}$	Average Supply Current	$t \geq 10\text{ s}$		190	900	nA
$I_{DD(AVG\_1.8V)}$	Average Supply Current @ $V_{DD} = 1.8\text{ V}$	$t \geq 10\text{ s}, V_{DD} = 1.8\text{ V}$		145	700	nA
$f_s$	Sampling Frequency		6	10	14	Hz
$t_{IDLE}$	Idle Mode Time	$f_s = 10\text{ Hz}$	71	100	166	ms
B <sub>OPN</sub>	Operate Point, B-		+6.2	+7.0	+7.8	mT
B <sub>OPS</sub>	Operate Point, B+		-7.8	-7.0	-6.2	mT
B <sub>RPN</sub>	Release Point, B-		+4.2	+5.0	+6.0	mT
B <sub>RPS</sub>	Release Point, B+		-6.0	-5.0	-4.2	mT
B <sub>HYST</sub>	Hysteresis		1.2	2.0		mT

Typical Magnetic Characteristics for CT8132EK

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

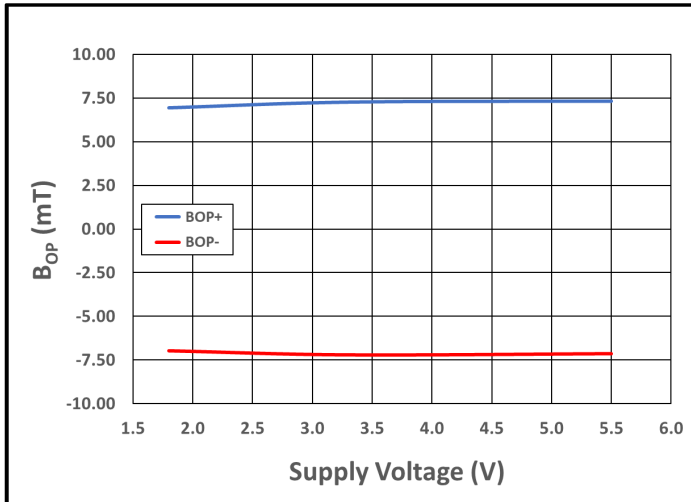


Figure 28. B<sub>OP</sub>. (Red) and B<sub>OP+</sub> (Blue) vs. Supply Voltage at  $T_A = +25^\circ\text{C}$

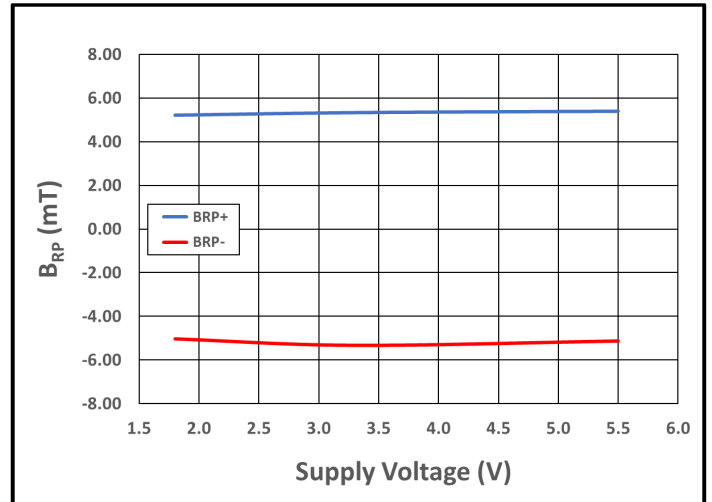


Figure 29. B<sub>RP</sub>. (Red) and B<sub>RP+</sub> (Blue) vs. Supply Voltage at  $T_A = +25^\circ\text{C}$

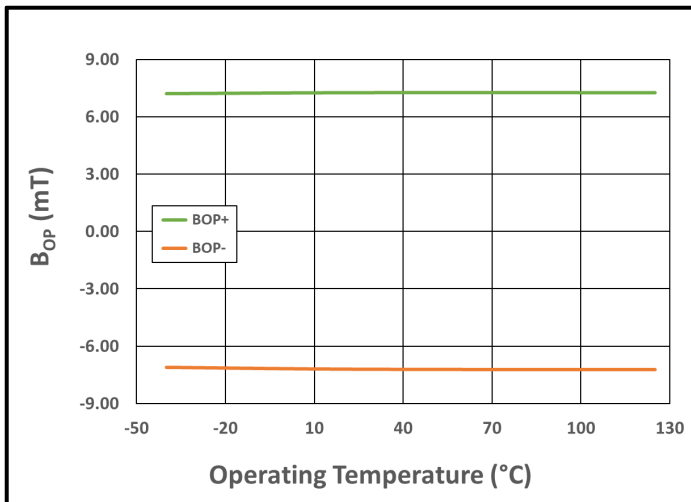


Figure 30. B<sub>OP</sub>. (Orange) and B<sub>OP+</sub> (Green) vs. Temperature at  $V_{DD} = 3.3\text{ V}$

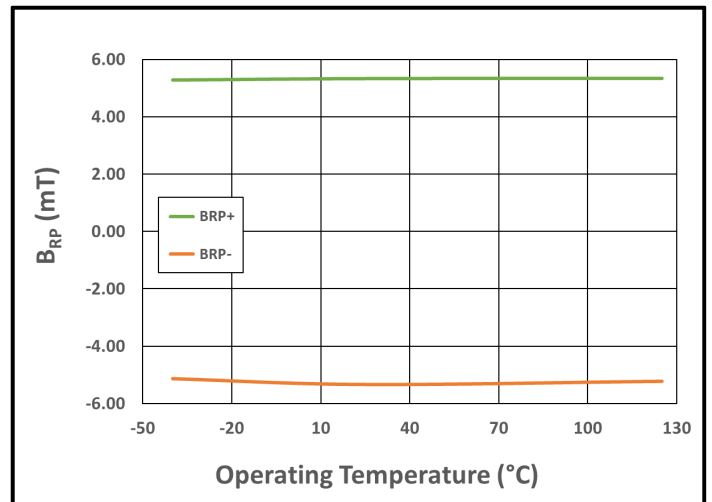


Figure 31. B<sub>RP</sub>. (Orange) and B<sub>RP+</sub> (Green) vs. Temperature at  $V_{DD} = 3.3\text{ V}$

Typical Electrical Characteristics for CT8132EK

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

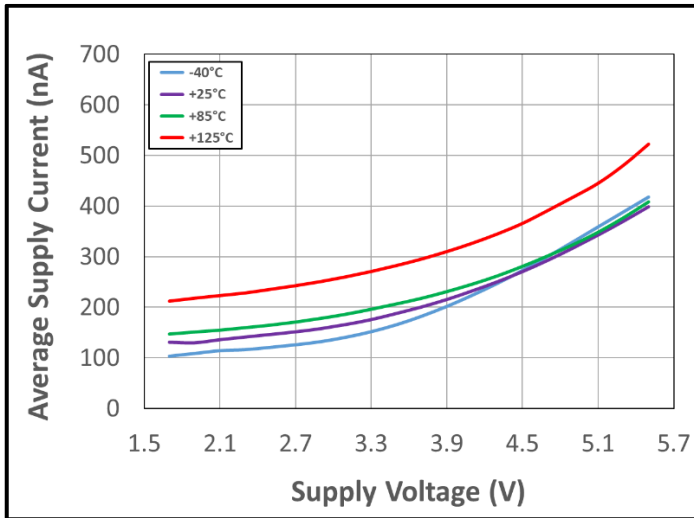


Figure 32. Average Supply Current vs. Supply Voltage vs. Temperature

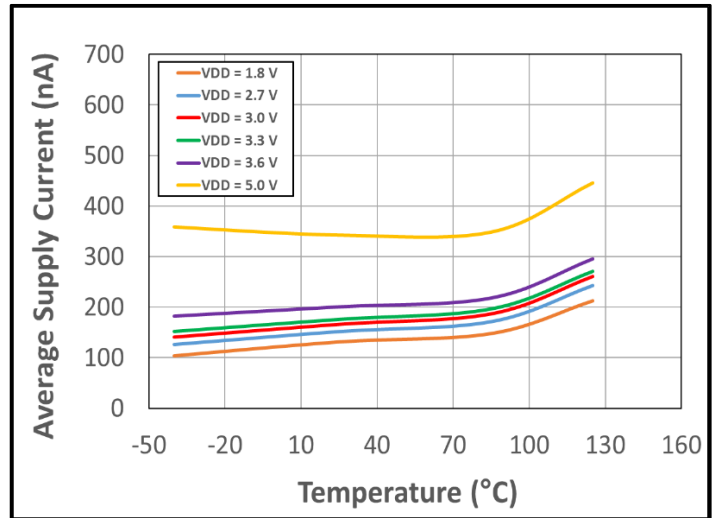


Figure 33. Average Supply Current vs. Temperature vs. Supply Voltage

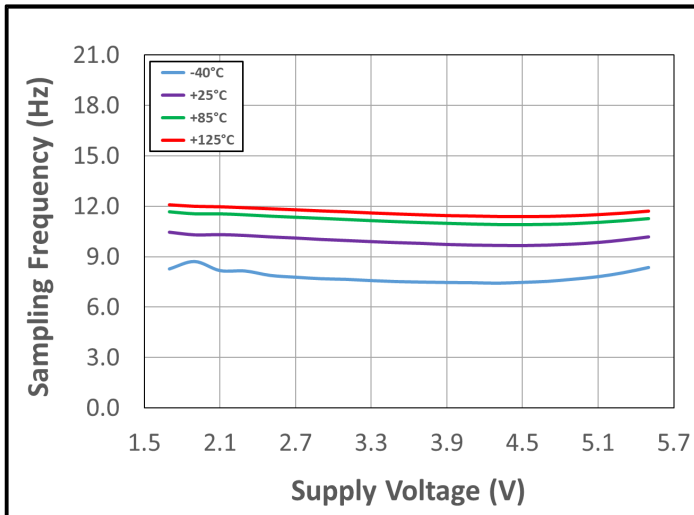


Figure 34. Sampling Frequency vs. Supply Voltage vs. Temperature

**CT8132SK Electrical & Magnetic Specifications**

Unless otherwise specified:  $V_{DD} = 1.7\text{ V to }5.5\text{ V}$ ,  $C_{BYP} = 1.0\ \mu\text{F}$  and  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.3\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{DD(AVG)}$	Average Supply Current	$t \geq 10\text{ s}$		190	900	nA
$I_{DD(AVG)\_1.8V}$	Average Supply Current @ $V_{DD} = 1.8\text{ V}$	$t \geq 10\text{ s}, V_{DD} = 1.8\text{ V}$		145	700	nA
$f_s$	Sampling Frequency		6	10	14	Hz
$t_{IDLE}$	Idle Mode Time	$f_s = 10\text{ Hz}$	71	100	166	ms
B <sub>OPN</sub>	Operate Point, B-		+0.7	+0.9	+1.2	mT
B <sub>OPS</sub>	Operate Point, B+		-1.2	-0.9	-0.7	mT
B <sub>RPN</sub>	Release Point, B-		+0.3	+0.5	+0.7	mT
B <sub>RPS</sub>	Release Point, B+		-0.7	-0.5	-0.3	mT
B <sub>HYST</sub>	Hysteresis		0.3	0.4		mT

**CT8132SL Electrical & Magnetic Specifications**

Unless otherwise specified:  $V_{DD} = 1.7\text{ V to }5.5\text{ V}$ ,  $C_{BYP} = 1.0\ \mu\text{F}$  and  $T_A = -40^\circ\text{C to }+125^\circ\text{C}$ . Typical values are  $V_{DD} = 3.3\text{ V}$  and  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_{DD(AVG)}$	Average Supply Current	$t \geq 10\text{ s}$		1.3	3.0	$\mu\text{A}$
$I_{DD(AVG)\_1.8V}$	Average Supply Current @ $V_{DD} = 1.8\text{ V}$	$t \geq 10\text{ s}, V_{DD} = 1.8\text{ V}$		1.1	2.0	$\mu\text{A}$
$f_s$	Sampling Frequency		150	250	350	Hz
$t_{IDLE}$	Idle Mode Time	$f_s = 250\text{ Hz}$	2.8	4.0	6.7	ms
B <sub>OPN</sub>	Operate Point, B-		+0.7	+0.9	+1.2	mT
B <sub>OPS</sub>	Operate Point, B+		-1.2	-0.9	-0.7	mT
B <sub>RPN</sub>	Release Point, B-		+0.3	+0.5	+0.7	mT
B <sub>RPS</sub>	Release Point, B+		-0.7	-0.5	-0.3	mT
B <sub>HYST</sub>	Hysteresis		0.3	0.4		mT

Typical Magnetic Characteristics for CT8132SK and CT8132SL

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

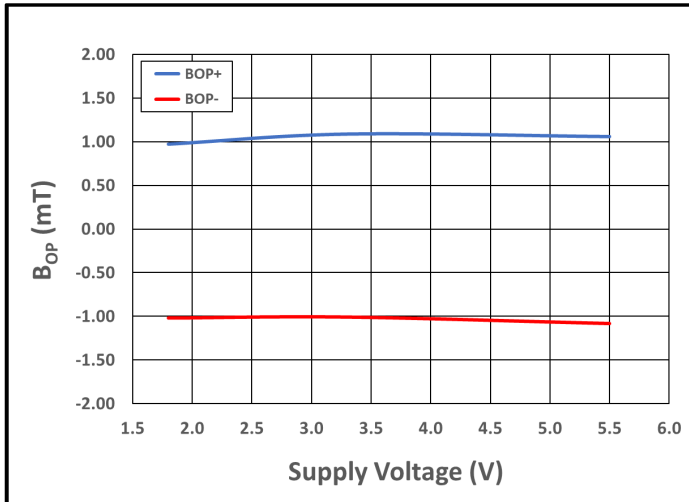


Figure 35.  $B_{OP}$ . (Red) and  $B_{OP+}$  (Blue) vs. Supply Voltage at  $T_A = +25^\circ\text{C}$

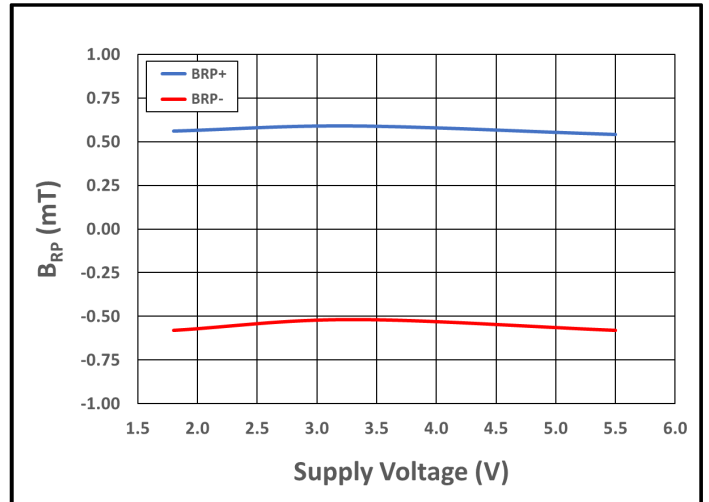


Figure 36.  $B_{RP}$ . (Red) and  $B_{RP+}$  (Blue) vs. Supply Voltage at  $T_A = +25^\circ\text{C}$

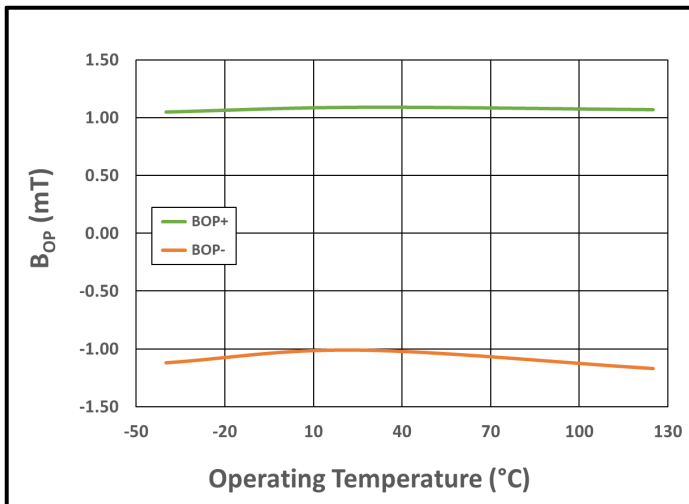


Figure 37.  $B_{OP}$ . (Orange) and  $B_{OP+}$  (Green) vs. Temperature at  $V_{DD} = 3.3\text{ V}$

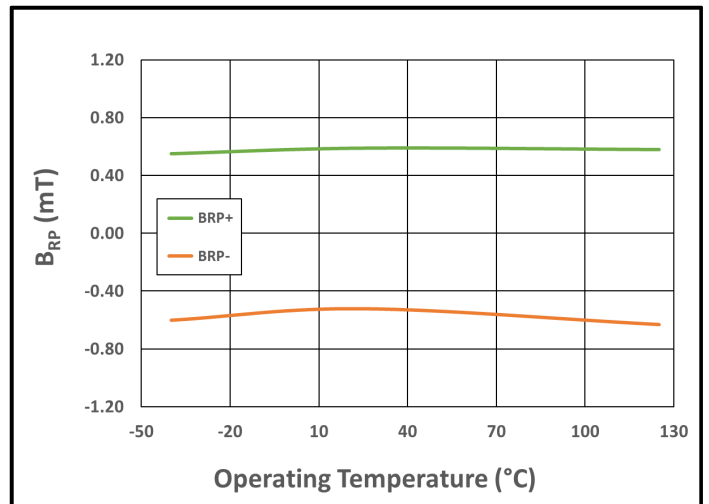


Figure 38.  $B_{RP}$ . (Orange) and  $B_{RP+}$  (Green) vs. Temperature at  $V_{DD} = 3.3\text{ V}$

Typical Electrical Characteristics for CT8132SK

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

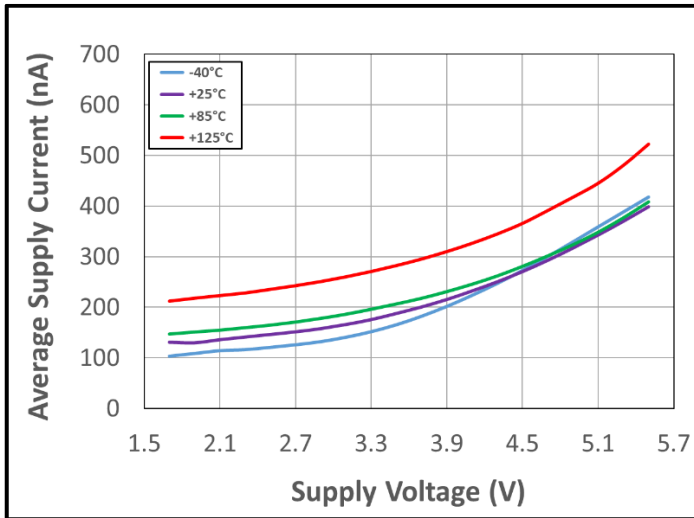


Figure 39. Average Supply Current vs. Supply Voltage vs. Temperature

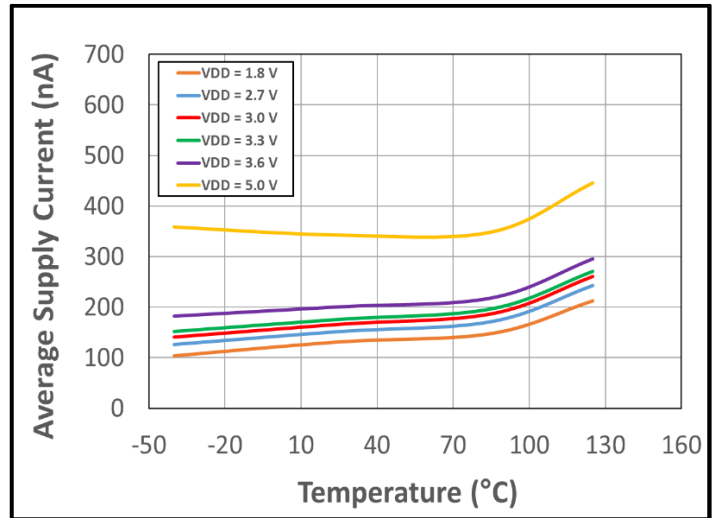


Figure 40. Average Supply Current vs. Temperature vs. Supply Voltage

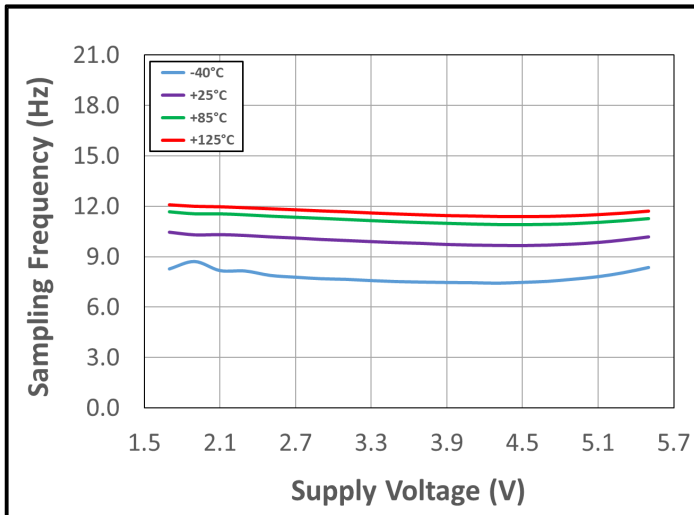


Figure 41. Sampling Frequency vs. Supply Voltage vs. Temperature

Typical Electrical Characteristics for CT8132SL

$V_{DD} = 3.3\text{ V}$ ,  $T_A = +25^\circ\text{C}$  and  $C_{BYP} = 1.0\ \mu\text{F}$  (unless otherwise specified)

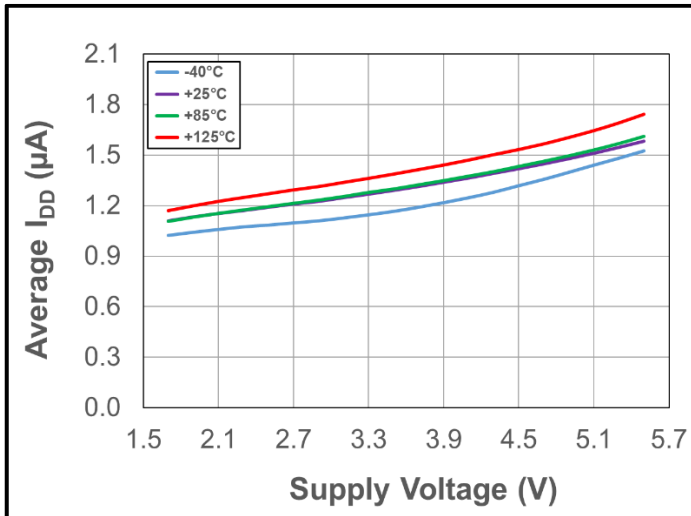


Figure 42. Average Supply Current vs. Supply Voltage vs. Temperature

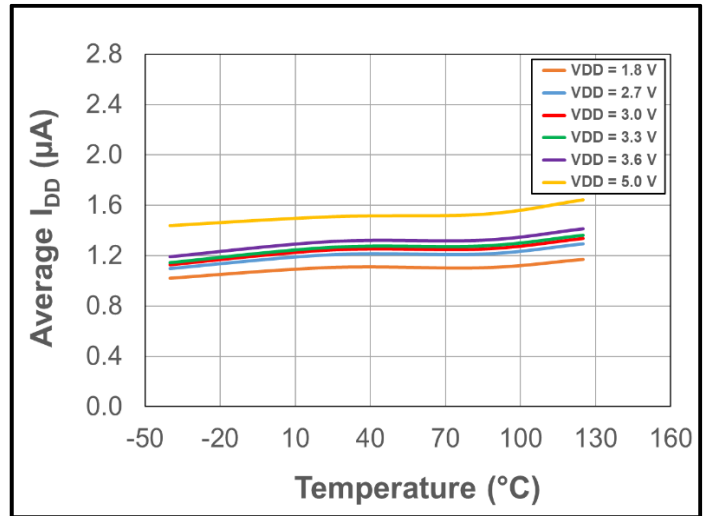


Figure 43. Average Supply Current vs. Temperature vs. Supply Voltage

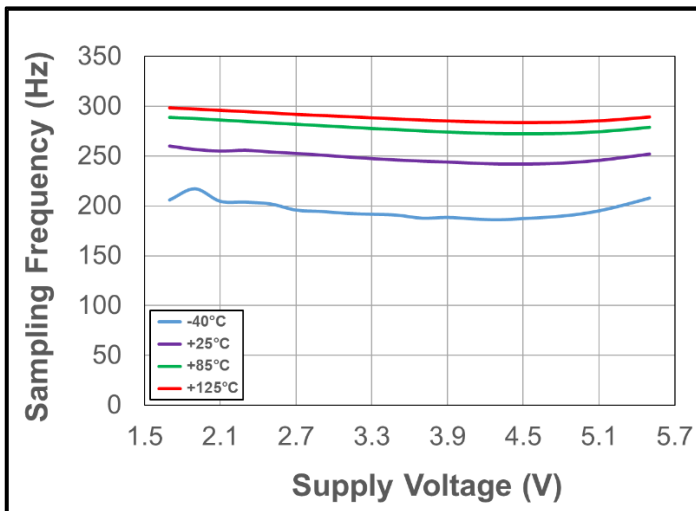


Figure 44. Sampling Frequency vs. Supply Voltage vs. Temperature

## Circuit Description

### Overview

The CT813x is a product family of omnipolar TMR magnetic latches that supports a wide operating voltage range of 1.7 V to 5.5 V and is capable of providing two (2) digital output configurations: open drain or push-pull. These omnipolar TMR digital latches are designed to consume a minimal amount of current which is ideal for battery-operated products. It also supports a wide range of sensitivity levels for various applications.

### Under-Voltage Lockout (UVLO)

The Under-Voltage Lock-out protection circuitry of the CT813x is activated when the supply voltage ( $V_{DD}$ ) falls below 1.53 V. The CT813x remains in a low quiescent state and the  $\overline{OUT}$  output is not valid until  $V_{DD}$  rises above the UVLO threshold (1.60 V).

### Power-On Time ( $t_{ON}$ )

The Power-On Time ( $t_{ON}$ ) of 50  $\mu s$  is the amount of time required by the CT813x to start up, power-on and acquire the first sample. The chip is fully powered up and operational from the moment the supply voltage passes the rising UVLO point (1.60 V). This time includes the ramp up time and the settling time (within 10% of steady-state voltage under an applied magnetic field) after the power supply have reach the minimum  $V_{DD}$ .

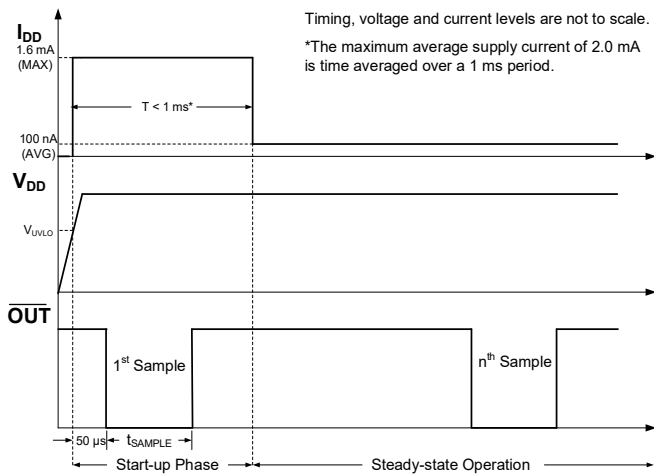


Figure 45. CT813x Power-On Timing Diagram

### Omnipolar Magnetic Flux

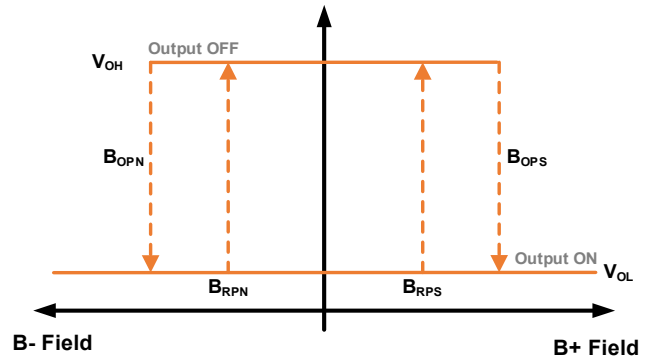


Figure 46. CT813x Output Behavior vs. Magnetic Field

Table 1. CT8131 Open Drain Output Behavior

Magnetic Field	Condition	Output
Positive Field	$B > B_{OPS}$	Low (ON)
	$0 < B < B_{RRPS}$	High-Z (OFF)
Negative Field	$B < B_{OPN}$	Low (ON)
	$0 > B > B_{RRPN}$	High-Z (OFF)

Table 2. CT8132 Push-pull Output Behavior

Magnetic Field	Condition	Output
Positive Field	$B > B_{OPS}$	Low (ON)
	$0 < B < B_{RRPS}$	High (OFF)
Negative Field	$B < B_{OPN}$	Low (ON)
	$0 > B > B_{RRPN}$	High (OFF)



## Applications Information

A decoupling capacitor,  $C_{BYP}$ , between the supply voltage (VDD) and ground (GND) is required to lower the noise going into the CT8131 as well as providing isolation from the other circuits. The decoupling capacitor should be placed close to the TMR digital latch. A typical capacitor value of  $1.0 \mu\text{F}$  (ceramic) will be sufficient. A pull-up resistor of  $47 \text{ k}\Omega$  connected from the  $\overline{\text{OUT}}$  to the system voltage ( $V_{\text{SYS}}$ ) is required for the CT8131.

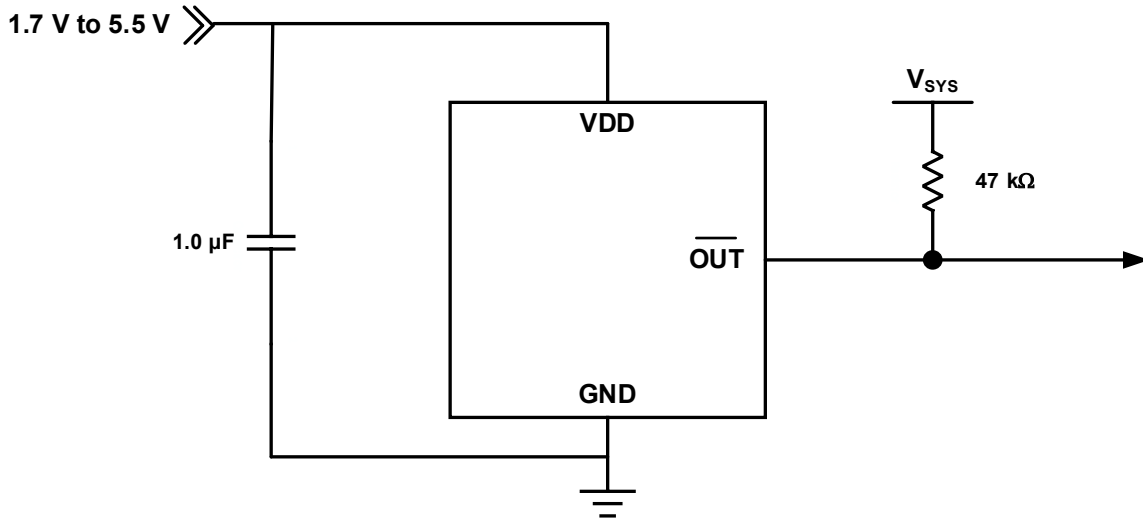


Figure 47. CT8131 Application Block Diagram

Similar to the CT8131, the CT8132 products require a  $1.0 \mu\text{F}$  (ceramic) bypass capacitor to be connected between the supply voltage and ground.

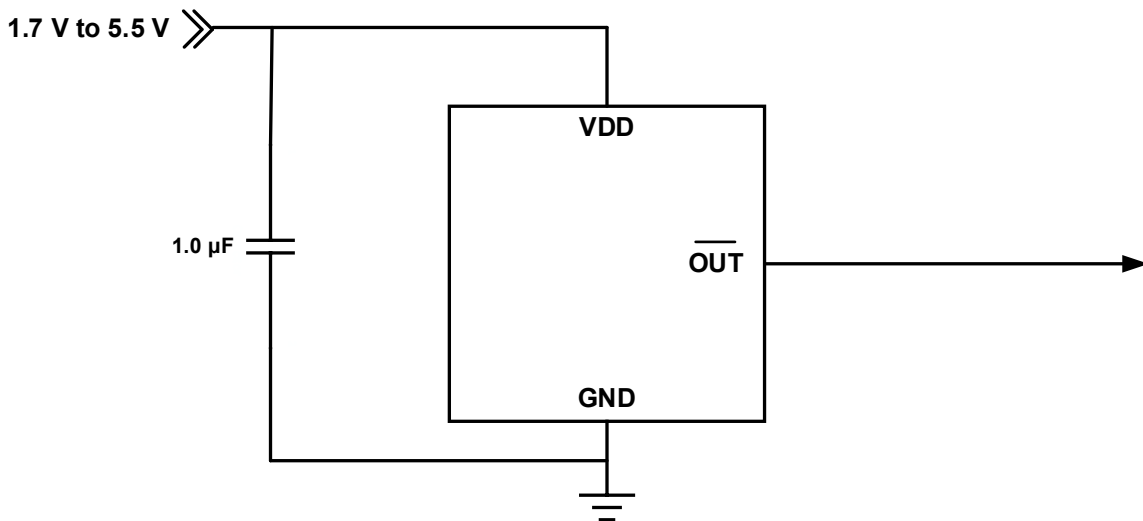
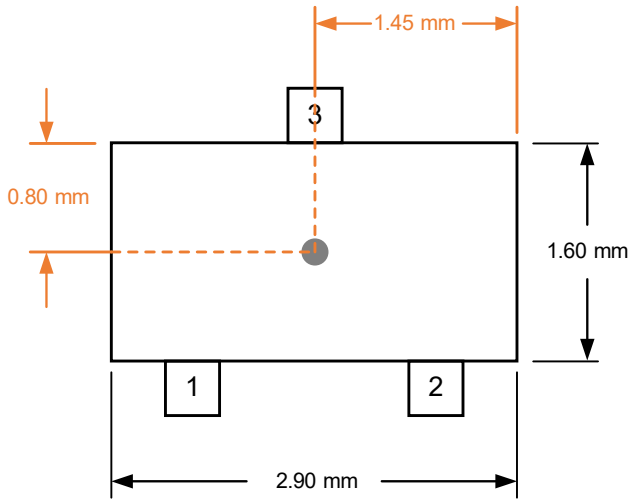


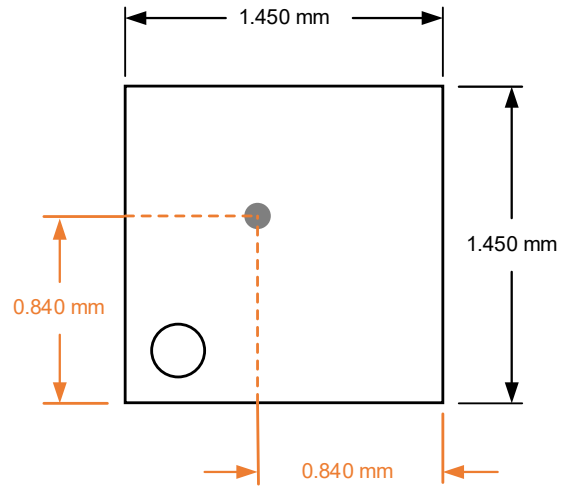
Figure 48. CT8132 Application Block Diagram

**Applications Information**

The XtremeSense TMR sensor location for the CT813x products are shown in Figure 49 and Figure 50. The dimensions shown in both figures are typical values.



**Figure 49. XtremeSense TMR Sensor Location for CT813x products in 3-lead SOT23 Package**



**Figure 50. XtremeSense TMR Sensor Location for CT813x products in 4-lead LGA Package**

SOT23-3 Package Drawing and Dimensions

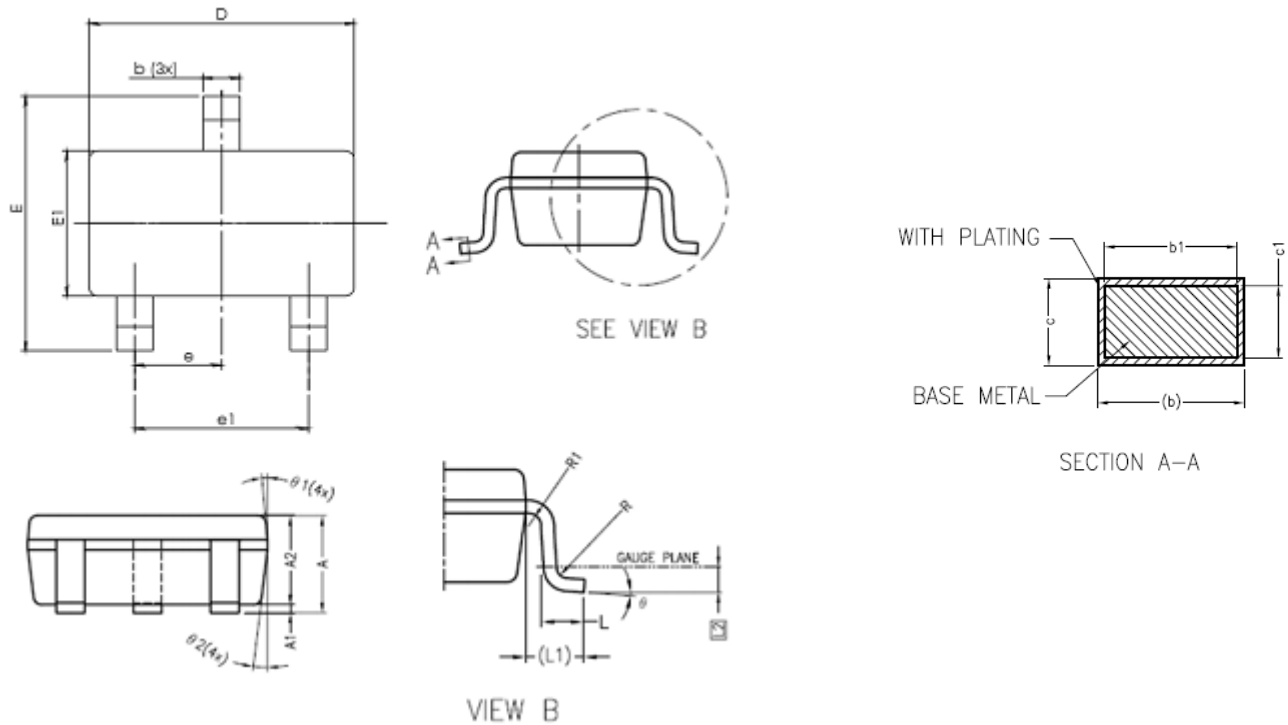


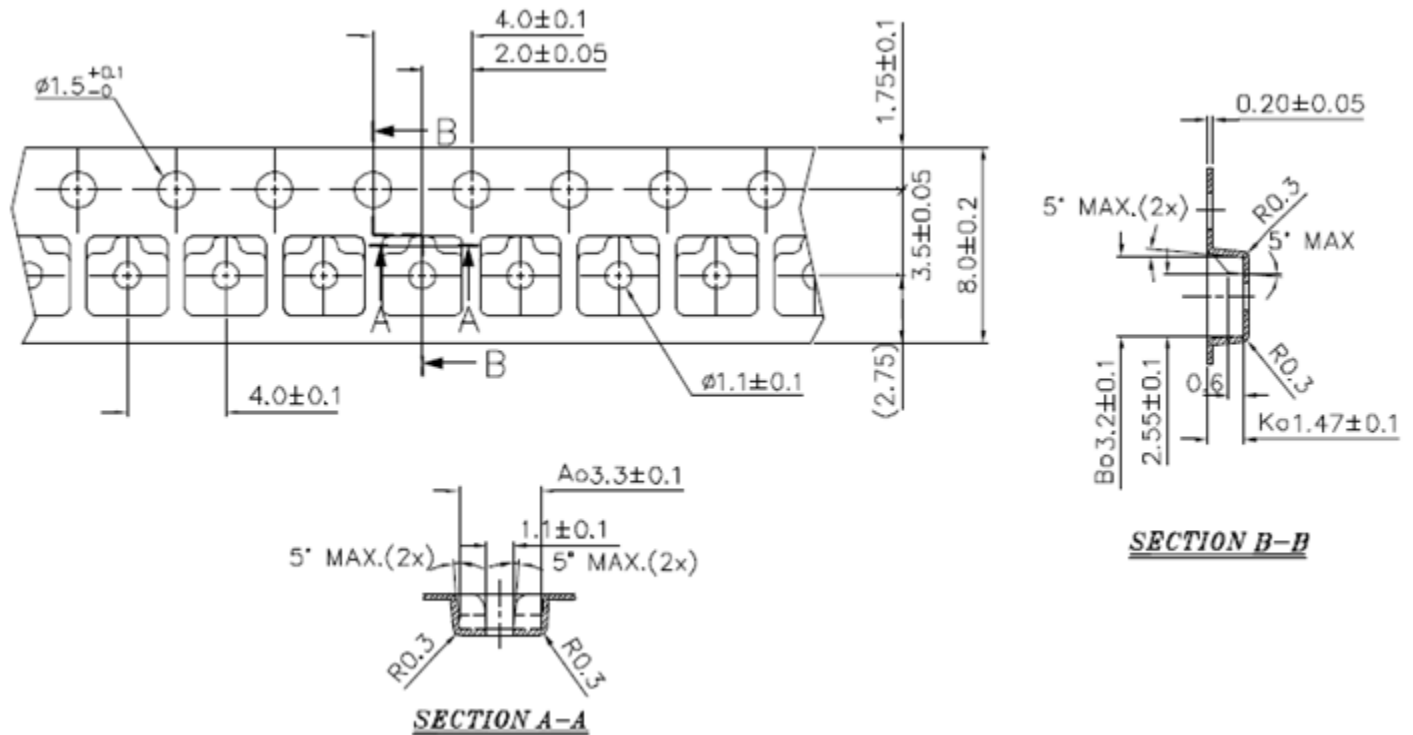
Figure 51. 3-Lead SOT23 Package Drawing

Table 3. CT813x 3-Lead SOT23 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	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	0.50 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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SOT23 Tape & Pocket Drawing and Dimensions

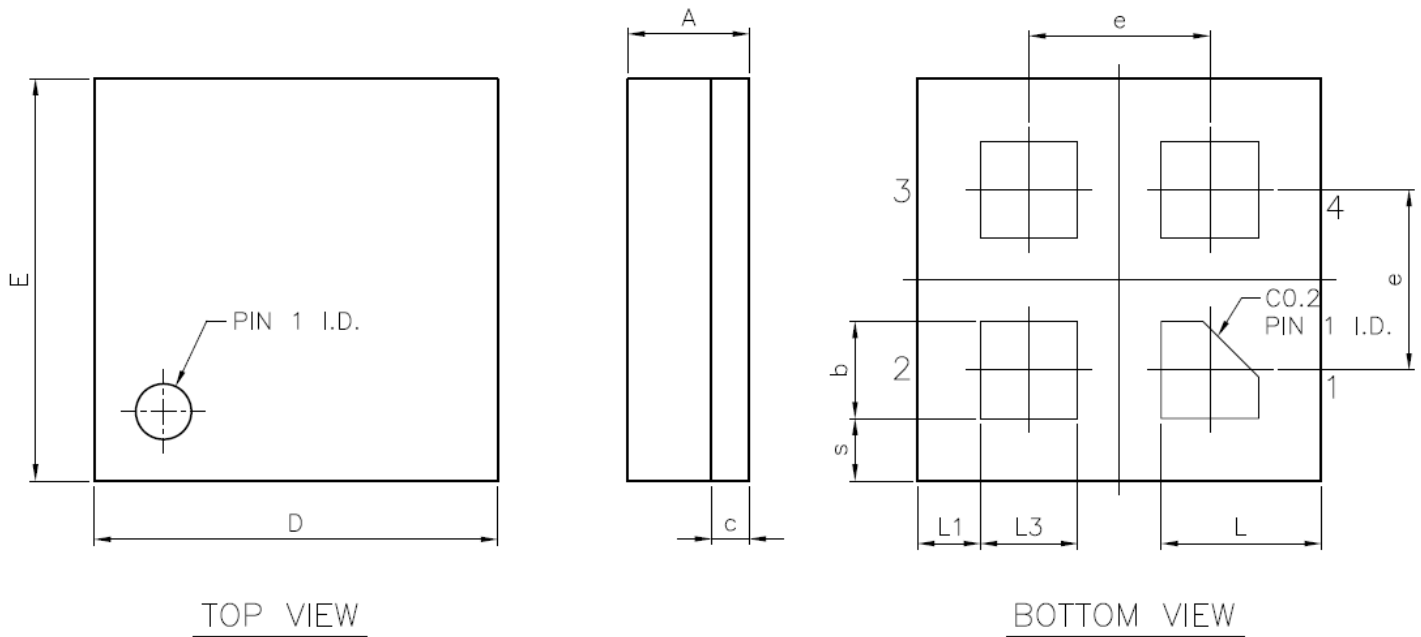


NOTES:

1. Material: Conductive Polystyrene
2. Dimensions in mm.
3. 10 sprocket hole pitch cumulative tolerance  $\pm 0.20$  mm.
4. Camber bot to exceed 1 mm in 100 mm.
5. Pocket position relative to sprocket hole measured as true position of pocket and not pocket hole.
6. (S.R.  $\Omega/\text{sq}$ ) means surface electric resistivity of the carrier tape.

Figure 52. Tape and Pocket Drawing for SOT23 Package

LGA-4 Package Drawing and Dimensions



NOTES:

1. All dimensions are in millimeters.
2. Pin A1 ID is marked by ink or laser.

Figure 53. 4-Lead LGA Package Drawing

Table 4. CT813x 4-Lead LGA Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
A	0.386	0.436	0.486
b	0.300	0.350	0.400
c	-	0.136 REF	-
D	1.400	1.450	1.500
E	1.400	1.450	1.500
e	-	0.650	-
L	0.525	0.575	0.625
L1	0.175	0.225	0.275
L3	0.300	0.350	0.400
s	0.175	0.225	0.275

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LGA-4 Tape & Pocket Drawing and Dimensions

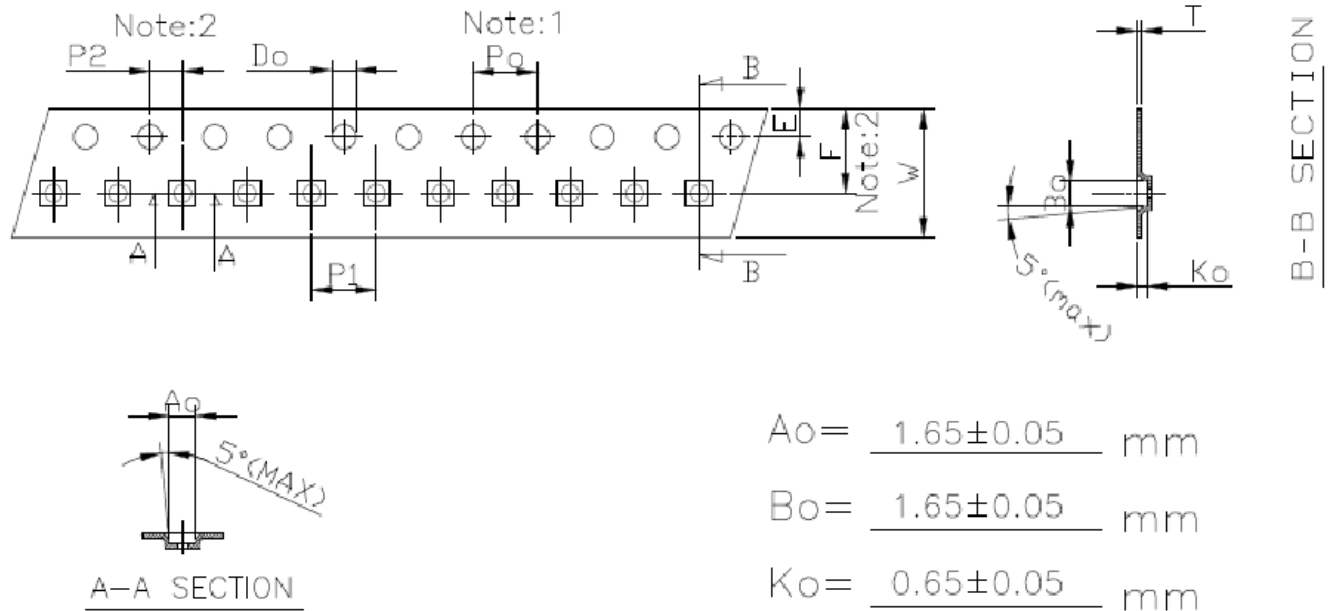


Figure 54. Tape and Pocket Drawing for LGA-4 Package

Table 5. LGA-4 Tape and Pocket Dimensions

Symbol	Specification
Po	4.00 mm ± 0.10 mm
P1	4.00 mm ± 0.10 mm
P2	2.00 mm ± 0.05 mm
Do	1.50 mm ± 0.10 mm
D1	1.10 mm ± 0.05 mm
E	1.75 mm ± 0.10 mm
F	3.50 mm ± 0.05 mm
10Po	40.00 mm ± 0.10 mm
W	8.00 mm ± 0.20 mm
T	0.25 mm ± 0.02 mm

Notes:

1. 10 Sprocket hole pitch cumulative tolerance is ±0.10 mm.
2. Pocket position is relative to sprocket hole measured as true position of pocket and not pocket hole.
3. Ao and Bo measured on a plane of 0.3 mm above the bottom of the pocket to top surface of the carrier.
4. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
5. Carrier camber shall not more than 1 mm per 100 mm through a length of 250 mm.

## Package Information

Table 6. CT813x Package Information

Part Number	Package Type	# of Leads	Package Quantity	Lead Finish	Eco Plan <sup>(1)</sup>	MSL Rating <sup>(2)</sup>	Operating Temperature <sup>(3)</sup>	Device Marking
CT8131BV-IL4	LGA	4	3,000	Sn	Green & RoHS	3	-40°C to +85°C	L YZ
CT8131BV-HL4	LGA	4	3,000	Sn	Green & RoHS	3	-40°C to +125°C	L YZ
CT8131BV-IS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	JD YWWS
CT8131BV-HS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +125°C	JD YWWS
CT8132BH-IL4	LGA	4	3,000	Sn	Green & RoHS	3	-40°C to +85°C	YZ
CT8132BH-HL4	LGA	4	3,000	Sn	Green & RoHS	3	-40°C to +125°C	YZ
CT8132BH-IS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	MG YWWS
CT8132BH-HS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +125°C	MG YWWS
CT8132BL-IS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	MB YWWS
CT8132BL-HS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +125°C	MB YWWS
CT8132BV-IL4	LGA	4	3,000	Sn	Green & RoHS	3	-40°C to +85°C	M YZ
CT8132BV-HL4	LGA	4	3,000	Sn	Green & RoHS	3	-40°C to +125°C	M YZ
CT8132BV-IS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	MA YWWS
CT8132BV-HS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +125°C	MA YWWS
CT8132DM-IS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	MD YWWS
CT8132DM-HS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +125°C	MD YWWS
CT8132EK-IS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	MF YWWS
CT8132EK-HS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +125°C	MF YWWS
CT8132SK-IL4	LGA	4	3,000	Au	Green & RoHS	3	-40°C to +85°C	P YZ
CT8132SK-HL4	LGA	4	3,000	Au	Green & RoHS	3	-40°C to +125°C	P YZ
CT8132SK-IS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	MC YWWS
CT8132SK-HS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +125°C	MC YWWS
CT8132SL-IS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +85°C	ME YWWS
CT8132SL-HS3	SOT23	3	3,000	Sn	Green & RoHS	1	-40°C to +125°C	ME 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 standard classifications.
- (3) Package will withstand ambient temperature range of -40°C to +150°C and storage temperature range of -65°C to +150°C.
- (4) Device Marking for SOT23 is defined as XZ YWWS where XZ = part number, Y = year, WW = work week and S = sequential number. LGA is defined as X where X = part number and YZ = date code information.

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## Product Status Definition

Data Sheet Identification	Product Status	Definition
Objective	Proposed New Product Idea or In Development	Data sheet contains design target specifications and are subject to change without notice at any time.
Preliminary	First Production	Data sheet contains preliminary specifications obtained by measurements of early samples. Follow-on data will be published at a later date as more test data is acquired. Crocus reserves the right to make changes to the data sheet at any time.
None	Full Production	Data sheet contains final specifications for all parameters. Crocus reserves the right to make changes to the data sheet at any time.
Obsolete	Not in Production	Data sheet for a product that is no longer in production at Crocus. It is for reference only.