CROCUS TECHNOLOGY
Intelligence in Sensing™

CT452

XtremeSense® TMR Contactless Current Sensor with Common Mode Field Rejection, 1 MHz Bandwidth and <1% Total Error over Full Operating Temperature Range

Features

- Integrated Contactless Current/Field Sensing Ranges:
  - 0 mT to +6 mT
  - -6 mT to +6 mT
  - 0 mT to +12 mT
  - -12 mT to +12 mT
  - 0 mT to +24 mT
  - -24 mT to +24 mT
- Linear Analog Output Voltage
- Common Mode Field Rejection: -50 dB
- Total Error Output ≤ ±1.0%, -40°C to +125°C
- 1 MHz Bandwidth
- Response Time < 300 ns
- VOUT – VREF Error < 1.0% FS (Max.)
- High Signal-to-Noise Ratio (SNR): >65 dB
- Supply Voltage: 4.75 V to 5.50 V
- Filter Pin to Reduce Noise on Output
- AEC-Q100 Grade 1
- Package Options:
  - 8-lead SOIC
  - 8-lead TSSOP Package

Applications

- Solar/Power Inverters
- PFC Systems
- Battery Management Systems
- Smart Fuse Over-Current Detection
- Industrial Equipment
- Power Utility Meters
- Power Conditioner
- DC/DC Converters/Power Supplies

Product Description

The CT452 is a high bandwidth and low noise integrated zero-loss contactless current sensor that uses Crocus Technology's patented XtremeSense TMR technology to enable high accuracy current measurements for many consumer, enterprise, and industrial applications. It supports six (6) field ranges where the CT452 senses and translates the magnetic field into a linear analog output voltage. It achieves a total error output of less than ±1.0% over voltage and temperature.

This coreless current sensor is not only small in size and simple to design but it also provides effective common mode rejection of more than -50 dB. This enables the CT452 to have greater than 90% immunity to stray magnetic fields thus having almost no impact on the accuracy of the current measurement.

It has less than 300 ns output response time while the current consumption is about 6.0 mA. The CT452 is equipped with a filter function to reduce the noise on the output pin.

The CT452 is assembled in an industry standard 8-lead SOIC package and a very low profile, 8-lead TSSOP package that are both "green" and RoHS compliant.

Part Ordering Information

Part Number	Auto Grade	Field Range	Operating Temperature Range	Package	Packing Method
CT452-H06DRSN08	-	0 mT to +6 mT	-40°C to +125°C	8-lead SOIC 4.89 x 6.00 x 1.62 mm	Tape & Reel
CT452-A06DRSN08	Grade 1				
CT452-H06DRTS08	-			8-lead TSSOP 3.00 x 6.40 x 1.10 mm	
CT452-A06DRTS08	Grade 1				
CT452-H06MRSN08	-	-6 mT to +6 mT		8-lead SOIC 4.89 x 6.00 x 1.62 mm	
CT452-A06MRSN08	Grade 1				
CT452-H06MRTS08	-			8-lead TSSOP 3.00 x 6.40 x 1.10 mm	
CT452-A06MRTS08	Grade 1				
CT452-H12DRSN08	-	0 mT to +12 mT		8-lead SOIC 4.89 x 6.00 x 1.62 mm	
CT452-A12DRSN08	Grade 1				
CT452-H12DRTS08	-			8-lead TSSOP 3.00 x 6.40 x 1.10 mm	
CT452-A12DRTS08	Grade 1				
CT452-H12MRSN08	-	-12 mT to +12 mT		8-lead SOIC 4.89 x 6.00 x 1.62 mm	
CT452-A12MRSN08	Grade 1				
CT452-H12MRTS08	-			8-lead TSSOP 3.00 x 6.40 x 1.10 mm	
CT452-A12MRTS08	Grade 1				
CT452-H24DRSN08	-	0 mT to +24 mT		8-lead SOIC 4.89 x 6.00 x 1.62 mm	
CT452-A24DRSN08	Grade 1				
CT452-H24DRTS08	-			8-lead TSSOP 3.00 x 6.40 x 1.10 mm	
CT452-A24DRTS08	Grade 1				
CT452-H24MRSN08	-	-24 mT to +24 mT		8-lead SOIC 4.89 x 6.00 x 1.62 mm	
CT452-A24MRSN08	Grade 1				
CT452-H24MRTS08	-			8-lead TSSOP 3.00 x 6.40 x 1.10 mm	
CT452-A24MRTS08	Grade 1				

Evaluation Board Ordering Information

Part Number	Current Carrying Conductor	Magnetic Field Range	Operating Temperature Range	Package
CTD452-06U	Busbar	0 mT to +6 mT	-40°C to +125°C	8-lead SOIC 4.89 x 6.00 x 1.62 mm
CTD452-06B	Busbar	-6 mT to +6 mT		
CTD452-12U	Busbar	0 mT to +12 mT		
CTD452-12B	Busbar	-12 mT to +12 mT		
CTD452-24U	Busbar	0 mT to +24 mT		
CTD452-24B	Busbar	-24 mT to +24 mT		

Part Number	Current Carrying Conductor	Magnetic Field Range	Operating Temperature Range	Package
CTD452T-06U	PCB Trace	0 mT to +6 mT	-40°C to +125°C	8-lead SOIC 4.89 x 6.00 x 1.62 mm
CTD452T-06B	PCB Trace	-6 mT to +6 mT		
CTD452T-12U	PCB Trace	0 mT to +12 mT		
CTD452T-12B	PCB Trace	-12 mT to +12 mT		
CTD452T-24U	PCB Trace	0 mT to +24 mT		
CTD452T-24B	PCB Trace	-24 mT to +24 mT		

Block Diagram

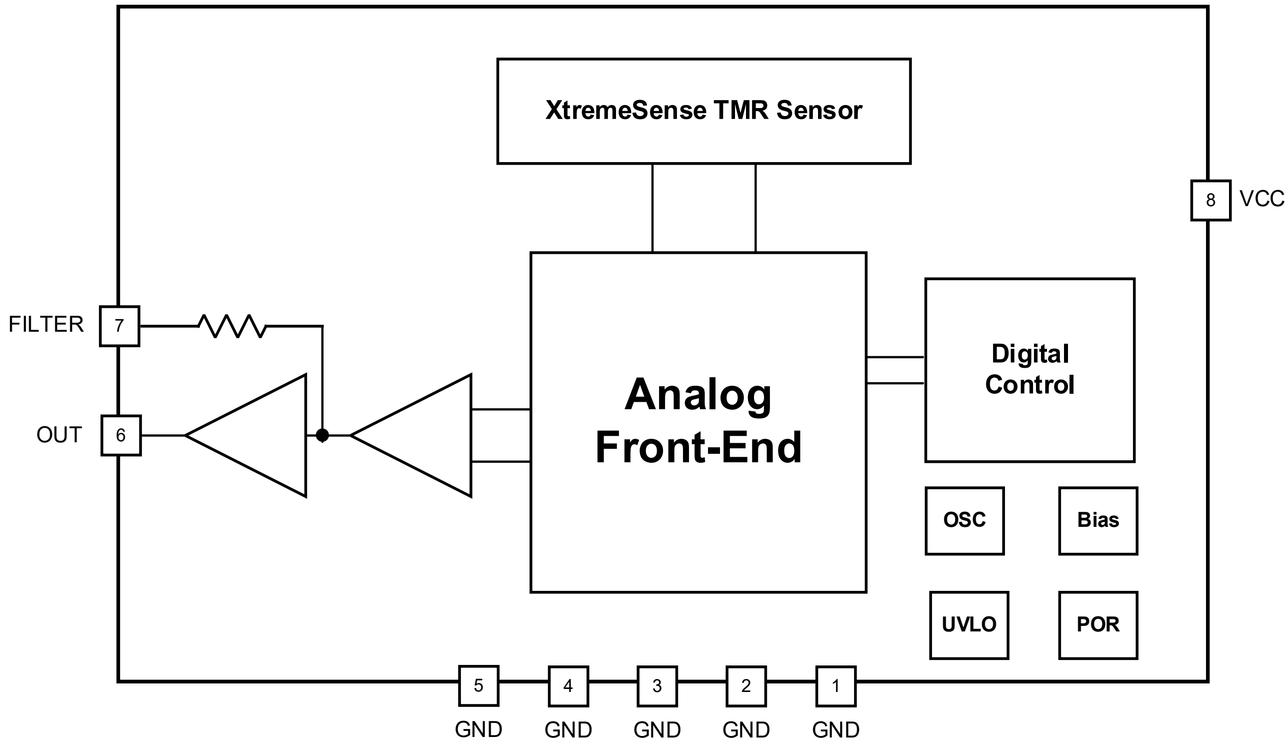


Figure 1. CT452 Functional Block Diagram for SOIC-8

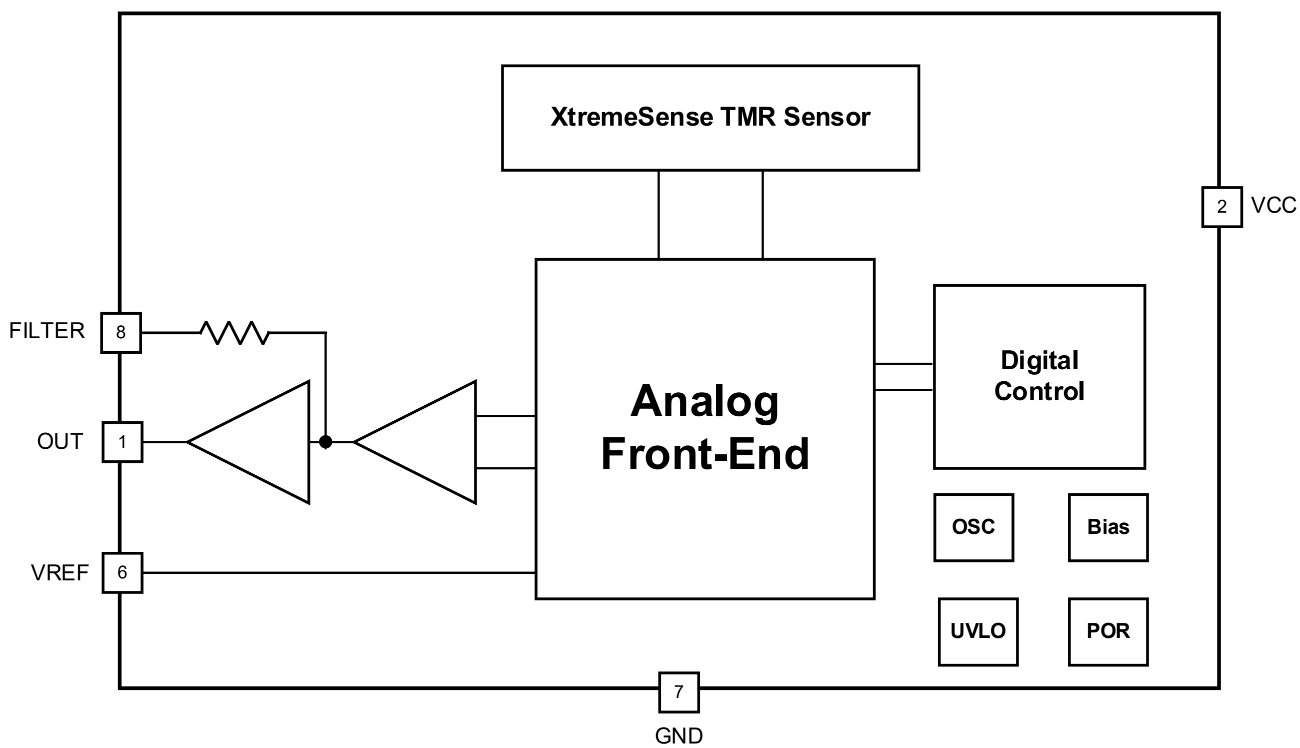


Figure 2. CT452 Functional Block Diagram for TSSOP-8

CT452 Application Diagram

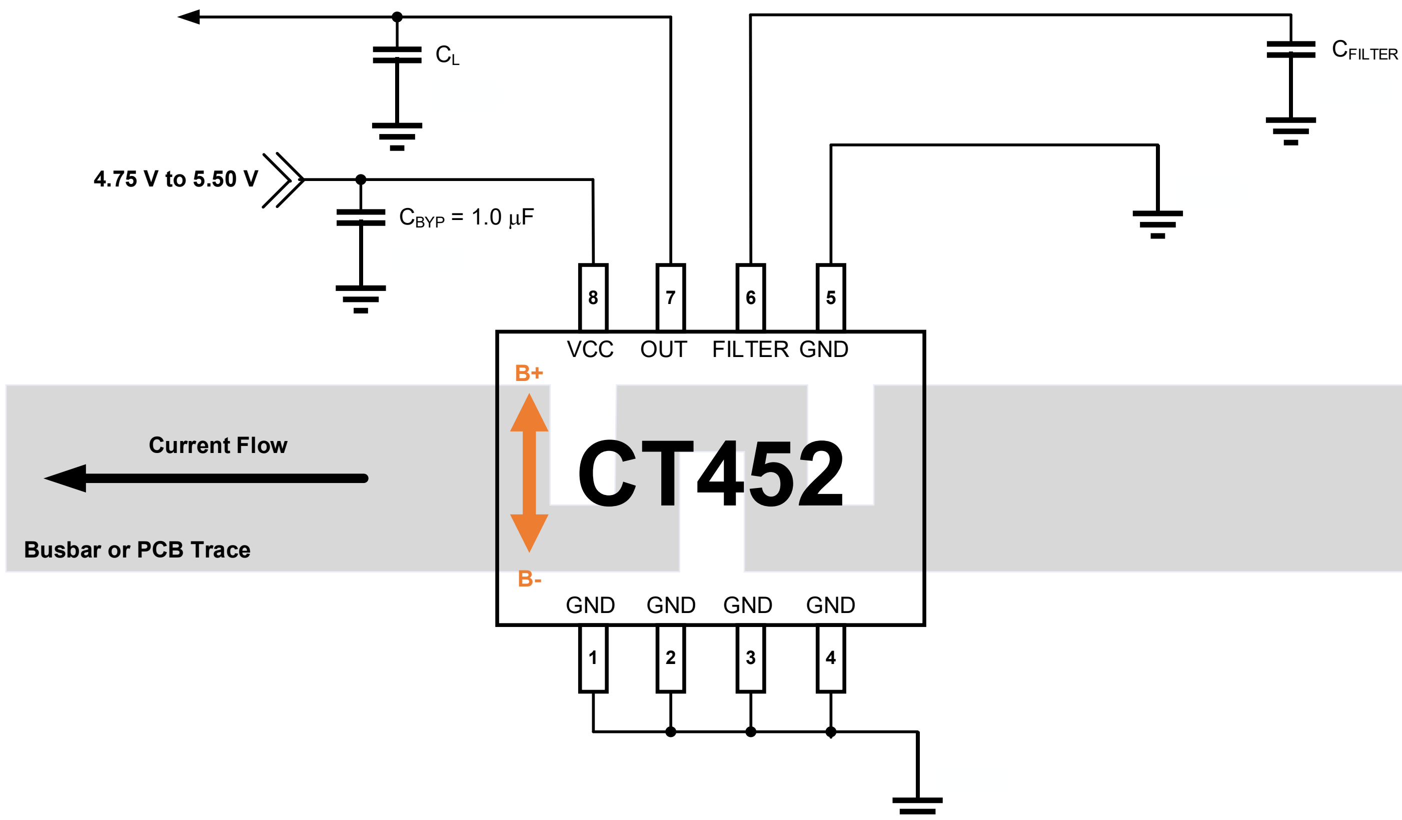


Figure 3. CT452 Application Diagram for SOIC-8

Table 1. Recommended External Components

Component	Description	Vendor & Part Number	Parameter	Min.	Typ.	Max.	Unit
C_{BYP}	1.0 µF, X5R or Better	Murata GRM155C81A105KA12	C1		1.0		µF
C_{FILTER}	Various, X5R or Better	Murata	C2		Table 3		pF

CT452 Application Diagram

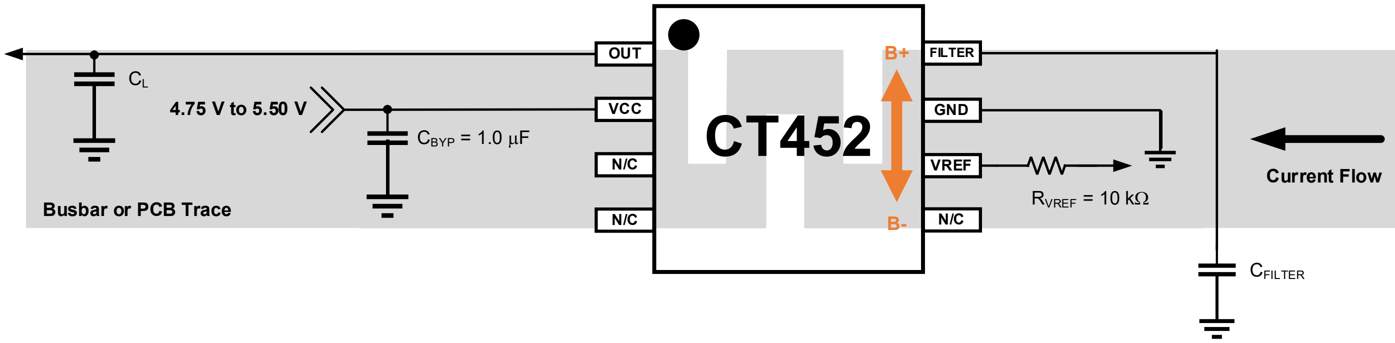


Figure 4. CT452 Application Diagram for TSSOP-8

Table 2. Recommended External Components

Component	Description	Vendor & Part Number	Parameter	Min.	Typ.	Max.	Unit
C_{BYP}	1.0 µF, X5R or Better	Murata GRM155C81A105KA12	C1		1.0		µF
C_{FILTER}	Various, X5R or Better	Murata	C2		Table 3		pF
R_{VREF}	10 kΩ Resistor	Various	R2		10		kΩ

CT452 SOIC-8 Pin Configuration

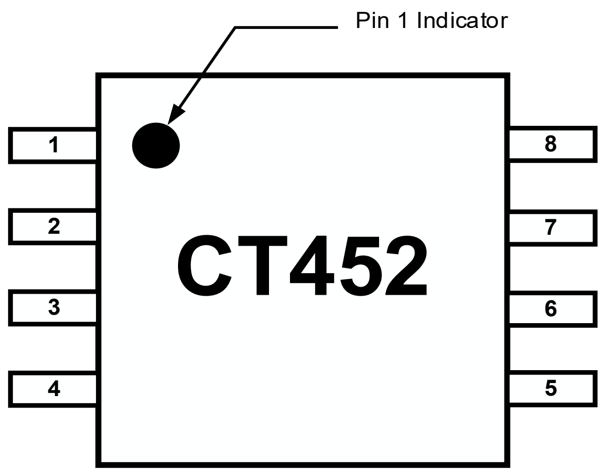


Figure 5. CT452 Pin-out Diagram for 8-lead SOIC Package (Top-Down View)

Pin Definition

Pin #	Pin Name	Pin Description
1	GND	Ground.
2		
3		
4		
5		
6	FILTER	Filter pin to improve noise performance by connecting an external capacitor to set the cut-off frequency. No connect if the FILTER pin is not used.
7	OUT	Analog output voltage that represents the measured current/field.
8	VCC	Supply voltage.

CT452 TSSOP-8 Pin Configuration

Figure 6. CT452 Pin-out Diagram for 8-lead TSSOP Package (Top-Down View)

Pin Definition

<table>
<tr><th>Pin #</th><th>Pin Name</th><th>Pin Description</th></tr>
<tr><td>1</td><td>OUT</td><td>Analog output voltage that represents the measured current/field.</td></tr>
<tr><td>2</td><td>VCC</td><td>Supply voltage.</td></tr>
<tr><td>3</td><td rowspan="3">N/C</td><td rowspan="3">No connect (Do Not Use).</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td><td>VREF</td><td>Reference voltage output. If not used, then do not connect.</td></tr>
<tr><td>7</td><td>GND</td><td>Ground.</td></tr>
<tr><td>8</td><td>FILTER</td><td>Filter pin to improve noise performance by connecting an external capacitor to set the cut-off frequency.
No connect if the FILTER pin is not used.</td></tr>
</table>

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the CT452 and 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.

Symbol	Parameter		Min.	Max.	Unit
V_{CC}	Supply Voltage		-0.3	6.0	V
$V_{I/O}$	Analog Input/Output Pins Maximum Voltage		-0.3	V_{CC} + 0.3*	V
ESD	Electrostatic Discharge Protection Level	Human Body Model (HBM) per JESD22-A114	±2.0		kV
		Charged Device Model (CDM) per JESD22-C101	±0.5		
T_J	Junction Temperature		-40	+150	°C
T_{STG}	Storage Temperature		-65	+155	°C
T_L	Lead Soldering Temperature, 10 Seconds			+260	°C

*The lower of V_{CC} + 0.3 V or 6.0 V.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual operation of the CT452. Recommended operating conditions are specified to ensure optimal performance to the specifications. Crocus Technology does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage Range	4.75	5.00	5.50	V
V_{OUT}	OUT Voltage Range	0		V_{CC}	V
I_{OUT}	OUT Current			±1.0	mA
T_A	Operating Ambient Temperature	-40	+25	+125	°C

Electrical Specifications

General Parameters

Unless otherwise specified: V_{CC} = 4.75 V to 5.50 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF. Typical values are V_{CC} = 5.00 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Power Supplies						
I_{CC}	Supply Current	f_{BW} = 1 MHz No load, B_{OP} = 0 mT		6.0	9.0	mA
I_{OUT}	OUT Maximum Drive Capability	OUT covers 10% to 90% of V_{CC} span.	-1.0		+1.0	mA
C_{L_OUT}	OUT Capacitive Load				100	pF
R_{L_OUT}	OUT Resistive Load			100		kΩ
R_{FILTER}	Internal Filter Resistance (1)			15		kΩ
I_{VREF}	VREF Maximum Drive Capability (TSSOP-8 only)		-50		+50	µA
C_{L_VREF}	VREF Capacitive Load (TSSOP-8 only)				10	pF
R_{L_VREF}	VREF Resistive Load (TSSOP-8 only)			100		kΩ
PSRR	Power Supply Rejection Ratio (1)			35		dB
SPSRR	Sensitivity Power Supply (PS) Rejection Ratio (1)			35		dB
OPSRR	Offset PS Rejection Ratio (1)			40		dB
Analog Output (OUT)						
V_{OUT}	OUT Voltage Linear Range, Typical	V_{SIG_AC} = ±2.00 V V_{SIG_DC} = +4.00 V	0.50		4.50	V
V_{OUT_SAT}	Output High Saturation Voltage	V_{OUT}, T_A = +25°C	V_{CC} – 0.30	V_{CC} – 0.25		V
CMFRR	Common Mode Field Rejection Ratio (1)	CMFR Mode		-50		dB
Reference Voltage (VREF) for TSSOP-8 Only						
V_{REF}	Reference Voltage	Unipolar Field		0.50		V
		Bipolar Field		2.50		
Timings						
t_{ON}	Power-On Time	$V_{CC} \geq 4.0$ V		100	200	µs
t_{RISE}	Rise Time (1)	$B_{OP} = B_{OP(MAX)}$, T_A = +25°C, C_L = 100 pF		200		ns
$t_{RESPONSE}$	Response Time (1)			300		ns
t_{DELAY}	Propagation Delay (1)			250		ns
Protection						
V_{UVLO}	Under-Voltage Lockout	Rising V_{CC}		2.50		V
		Falling V_{CC}		2.45		V
V_{UV_HYS}	UVLO Hysteresis			50		mV

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

Electrical Characteristics

V_{CC} = 5.00 V and T_A = +25°C and C_{BYP} = 1.0 µF (unless otherwise specified)

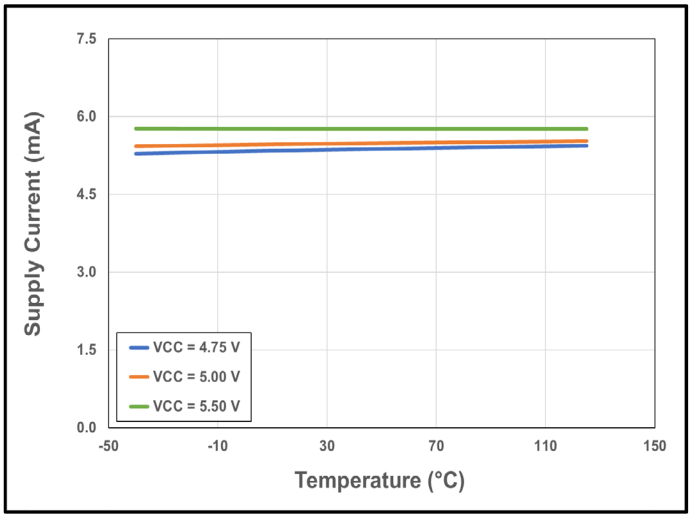


Figure 7. CT452 Supply Current vs. Temperature vs. Supply Voltage

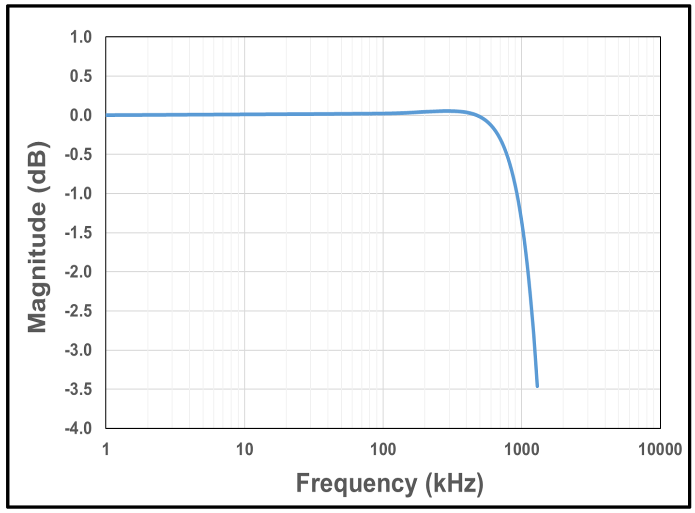


Figure 8. CT452 Bandwidth with C_{FILTER} = 1.0 pF

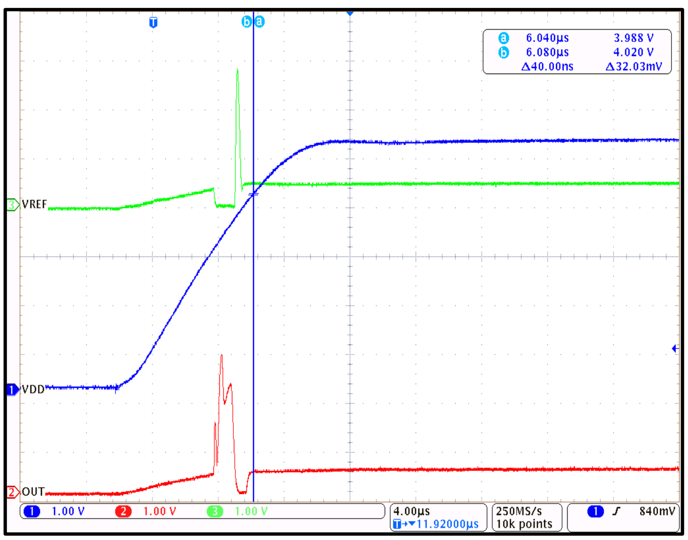


Figure 9. CT452 Startup Waveforms for V_{OQ} = 0.50 V (Unipolar Field)

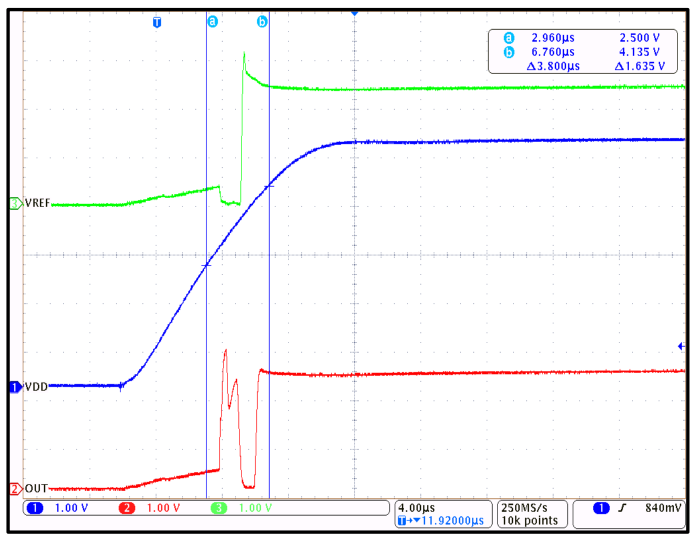


Figure 10. CT452 Startup Waveforms for V_{OQ} = 2.50 V (Bipolar Field)

CT452-x06DR: 0 mT to +6 mT

Unless otherwise specified: V_{CC} = 4.75 V to 5.50 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF. Typical values are V_{CC} = 5.00 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
B_{RNG}	Magnetic Field Range		0		+6	mT
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, B_{OP} = 0 mT	0.495	0.500	0.505	V
S	Sensitivity	$B_{RNG(MIN)} < B_{OP} < B_{RNG(MAX)}$		666.7		mV/mT
f_{BW}	Bandwidth (1)	Small Signal = -3 dB		1.0		MHz
e_N	Noise (1)	T_A = +25°C, f_{BW} = 100 kHz		1.63		mV_{RMS}
				2.45		$µT_{RMS}$
OUT Accuracy Performance						
E_{OUT}	Total Output Error	$B_{OP} = B_{RNG(MAX)}$		±0.7	±1.0	% FS
E_{LIN}	Non-Linearity Error (1)	$B_{OP} = B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.2		% FS
E_{SENS}	Sensitivity Error (1)	$B_{OP} = B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.3		% FS
V_{OFFSET}	Offset Voltage (1)	B_{OP} = 0 mT, T_A = -40°C to +125°C		±10.0		mV
				±0.3		% FS
$V_{OUT} – V_{REF}$ Accuracy Performance (TSSOP-8 only)						
$E_{OUT-VREF}$	VOUT – VREF Error	$B_{OP} = B_{RNG(MAX)}$, V_{CC} = 5.0 V T_A = -40°C to +125°C			±1.0	% FS
$V_{OUT} - V_{REF}$	OUT – VREF Offset Voltage	V_{CC} = 5.0 V T_A = -40°C to +125°C		±5.0		mV
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift (1)	$B_{OP} = B_{OP(MAX)}$		±1.0		% FS

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

Electrical Characteristics for CT452-x06DR

V_{CC} = 5.0 V and T_A = +25°C and C_{BYP} = 1.0 µF (unless otherwise specified)

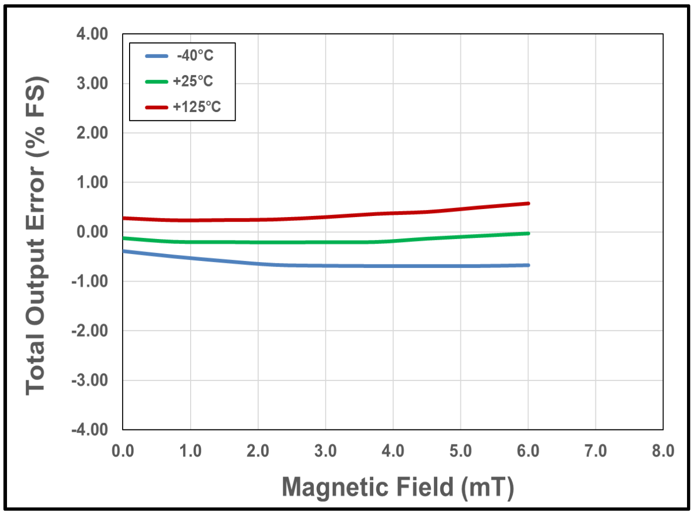


Figure 11. Total Output Error vs. Current vs. Temperature

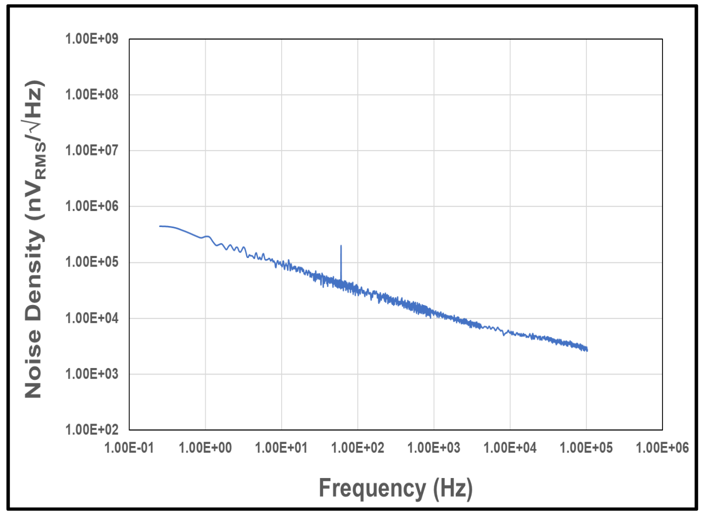


Figure 12. Noise Density vs. Frequency

CT452-x06MR: -6 mT to +6 mT

Unless otherwise specified: V_{CC} = 4.75 V to 5.50 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF. Typical values are V_{CC} = 5.00 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
B_{RNG}	Magnetic Field Range		-6		+6	mT
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, B_{OP} = 0 mT	2.490	2.500	2.510	V
S	Sensitivity	$B_{RNG(MIN)} < B_{OP} < B_{RNG(MAX)}$		333.3		mV/mT
f_{BW}	Bandwidth (1)	Small Signal = -3 dB		1.0		MHz
e_N	Noise (1)	T_A = +25°C, f_{BW} = 100 kHz		0.92		mV_{RMS}
				2.77		$µT_{RMS}$
OUT Accuracy Performance						
E_{OUT}	Total Output Error	$B_{OP} = B_{RNG(MAX)}$		±0.7	±1.0	% FS
E_{LIN}	Non-Linearity Error (1)	$B_{OP} = B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.1		% FS
E_{SENS}	Sensitivity Error (1)	$B_{OP} = B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.3		% FS
V_{OFFSET}	Offset Voltage (1)	B_{OP} = 0 mT, T_A = -40°C to +125°C		±8.0		mV
				±0.2		% FS
$V_{OUT} – V_{REF}$ Accuracy Performance (TSSOP-8 only)						
$E_{OUT-VREF}$	VOUT – VREF Error	$B_{OP} = B_{RNG(MAX)}$, V_{CC} = 5.0 V T_A = -40°C to +125°C			±1.0	% FS
V_{OUT} - V_{REF}	OUT – VREF Offset Voltage	V_{CC} = 5.0 V T_A = -40°C to +125°C		5.0		mV
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift (1)	$B_{OP} = B_{OP(MAX)}$		±1.0		% FS

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

Electrical Characteristics for CT452-x06MR

V_{CC} = 5.0 V and T_A = +25°C and C_{BYP} = 1.0 µF (unless otherwise specified)

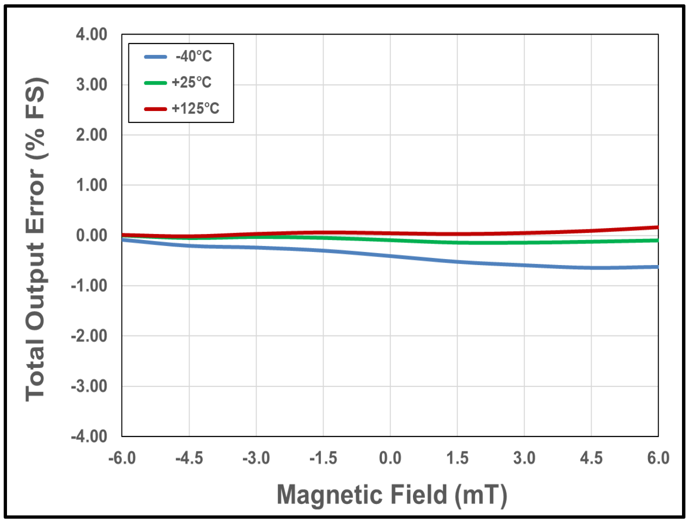


Figure 13. Total Output Error vs. Current vs. Temperature

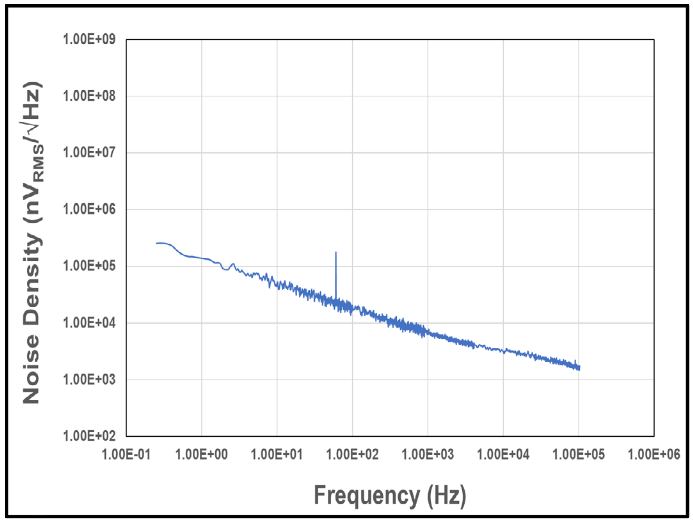


Figure 14. Noise Density vs. Frequency

CT452-x12DR: 0 mT to +12 mT

Unless otherwise specified: V_{CC} = 4.75 V to 5.50 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF. Typical values are V_{CC} = 5.00 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
B_{RNG}	Magnetic Field Range		0		+12	mT
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, B_{OP} = 0 mT	0.495	0.500	0.505	V
S	Sensitivity	$B_{RNG(MIN)} < B_{OP} < B_{RNG(MAX)}$		333.3		mV/mT
f_{BW}	Bandwidth (1)	Small Signal = -3 dB		1.0		MHz
e_N	Noise (1)	T_A = +25°C, f_{BW} = 100 kHz		0.88		mV_{RMS}
				2.64		μT_{RMS}
OUT Accuracy Performance						
E_{OUT}	Total Output Error	B_{OP} = $B_{RNG(MAX)}$		±0.7	±1.0	% FS
E_{LIN}	Non-Linearity Error (1)	B_{OP} = $B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.2		% FS
E_{SENS}	Sensitivity Error (1)	B_{OP} = $B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.3		% FS
V_{OFFSET}	Offset Voltage (1)	B_{OP} = 0 mT, T_A = -40°C to +125°C		±9.0		mV
				±0.2		% FS
V_{OUT} – V_{REF} Accuracy Performance (TSSOP-8 only)						
$E_{OUT-VREF}$	VOUT – VREF Error	B_{OP} = $B_{RNG(MAX)}$, V_{CC} = 5.0 V T_A = -40°C to +125°C			±1.0	% FS
V_{OUT} - V_{REF}	OUT – VREF Offset Voltage	V_{CC} = 5.0 V T_A = -40°C to +125°C		5.0		mV
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift (1)	B_{OP} = $B_{OP(MAX)}$		±1.0		% FS

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

Electrical Characteristics for CT452-x12DR

V_{CC} = 5.0 V and T_A = +25°C and C_{BYP} = 1.0 μF (unless otherwise specified)

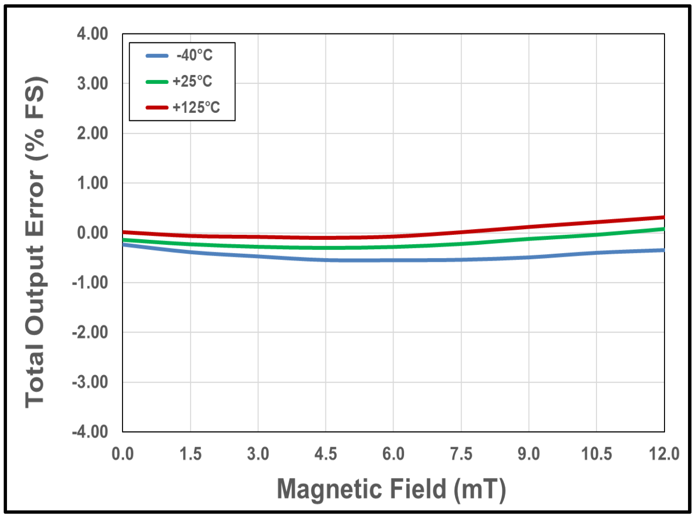


Figure 15. Total Output Error vs. Current vs. Temperature

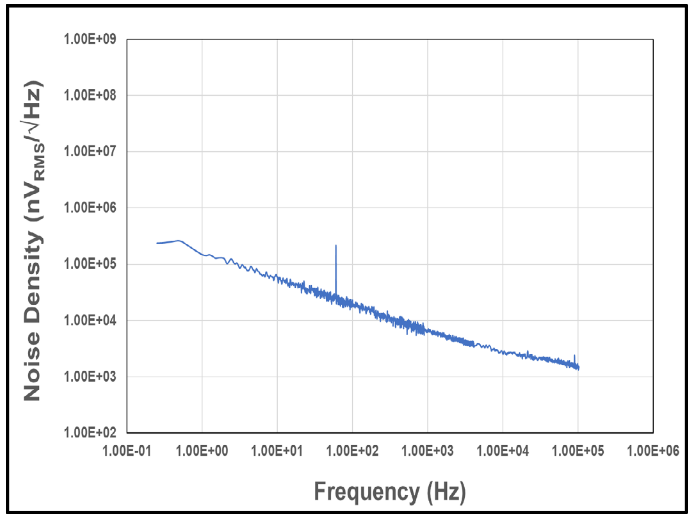


Figure 16. Noise Density vs. Frequency

CT452-x12MR: -12 mT to +12 mT

Unless otherwise specified: V_{CC} = 4.75 V to 5.50 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF. Typical values are V_{CC} = 5.00 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
B_{RNG}	Magnetic Field Range		-12		+12	mT
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, B_{OP} = 0 mT	2.490	2.500	2.510	V
S	Sensitivity	$B_{RNG(MIN)} < B_{OP} < B_{RNG(MAX)}$		166.7		mV/mT
f_{BW}	Bandwidth (1)	Small Signal = -3 dB		1.0		MHz
e_N	Noise (1)	T_A = +25°C, f_{BW} = 100 kHz		0.51		mV_{RMS}
				3.06		μT_{RMS}
OUT Accuracy Performance						
E_{OUT}	Total Output Error	B_{OP} = $B_{RNG(MAX)}$		±0.7	±1.0	% FS
E_{LIN}	Non-Linearity Error (1)	B_{OP} = $B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.1		% FS
E_{SENS}	Sensitivity Error (1)	B_{OP} = $B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.3		% FS
V_{OFFSET}	Offset Voltage (1)	B_{OP} = 0 mT, T_A = -40°C to +125°C		±7.0		mV
				±0.2		% FS
V_{OUT} – V_{REF} Accuracy Performance (TSSOP-8 only)						
$E_{OUT\text{-}VREF}$	VOUT – VREF Error	B_{OP} = $B_{RNG(MAX)}$, V_{CC} = 5.0 V T_A = -40°C to +125°C			±1.0	% FS
V_{OUT} - V_{REF}	OUT – VREF Offset Voltage	V_{CC} = 5.0 V T_A = -40°C to +125°C		5.0		mV
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift (1)	B_{OP} = $B_{OP(MAX)}$		±1.0		% FS

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

Electrical Characteristics for CT452-x12MR

V_{CC} = 5.0 V and T_A = +25°C and C_{BYP} = 1.0 µF (unless otherwise specified)

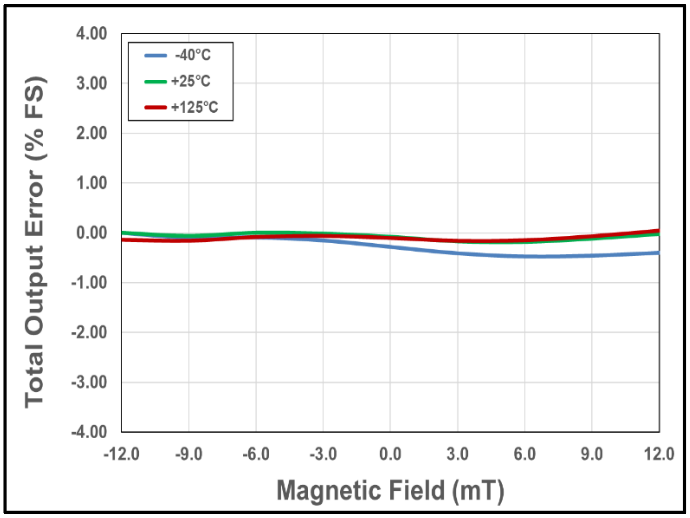


Figure 17. Total Output Error vs. Current vs. Temperature

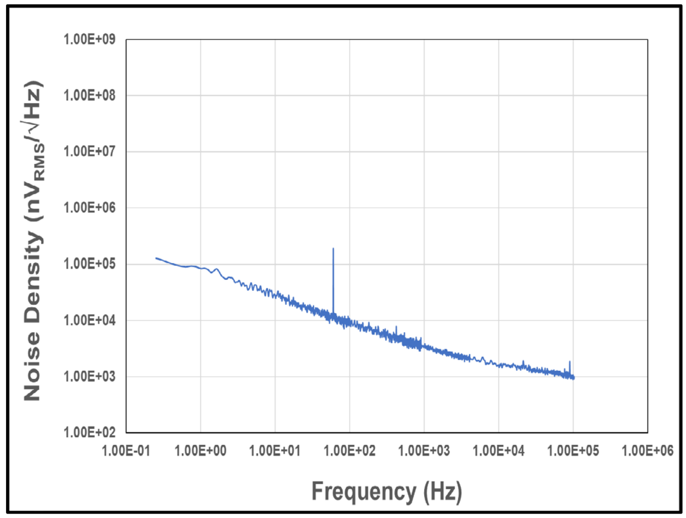


Figure 18. Noise Density vs. Frequency

CT452-x24DR: 0 mT to +24 mT

Unless otherwise specified: V_{CC} = 4.75 V to 5.50 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF. Typical values are V_{CC} = 5.00 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
B_{RNG}	Magnetic Field Range		0		+24	mT
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, B_{OP} = 0 mT	0.495	0.500	0.505	V
S	Sensitivity	$B_{RNG(MIN)} < B_{OP} < B_{RNG(MAX)}$		166.7		mV/mT
f_{BW}	Bandwidth [(1)]	Small Signal = -3 dB		1.0		MHz
e_N	Noise [(1)]	T_A = +25°C, f_{BW} = 100 kHz		0.46		mV_{RMS}
				2.77		μT_{RMS}
OUT Accuracy Performance						
E_{OUT}	Total Output Error	$B_{OP} = B_{RNG(MAX)}$		±0.7	±1.5	% FS
E_{LIN}	Non-Linearity Error [(1)]	$B_{OP} = B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.3		% FS
E_{SENS}	Sensitivity Error [(1)]	$B_{OP} = B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.3		% FS
V_{OFFSET}	Offset Voltage [(1)]	B_{OP} = 0 mT, T_A = -40°C to +125°C		±8.0		mV
				±0.2		% FS
$V_{OUT} – V_{REF}$ Accuracy Performance (TSSOP-8 only)						
$E_{OUT-VREF}$	VOUT – VREF Error	$B_{OP} = B_{RNG(MAX)}$, V_{CC} = 5.0 V T_A = -40°C to +125°C			±1.0	% FS
$V_{OUT} - V_{REF}$	OUT – VREF Offset Voltage	V_{CC} = 5.0 V T_A = -40°C to +125°C		5.0		mV
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift [(1)]	$B_{OP} = B_{OP(MAX)}$		±1.0		% FS

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

Electrical Characteristics for CT452-x24DR

V_{CC} = 5.0 V and T_A = +25°C and C_{BYP} = 1.0 µF (unless otherwise specified)

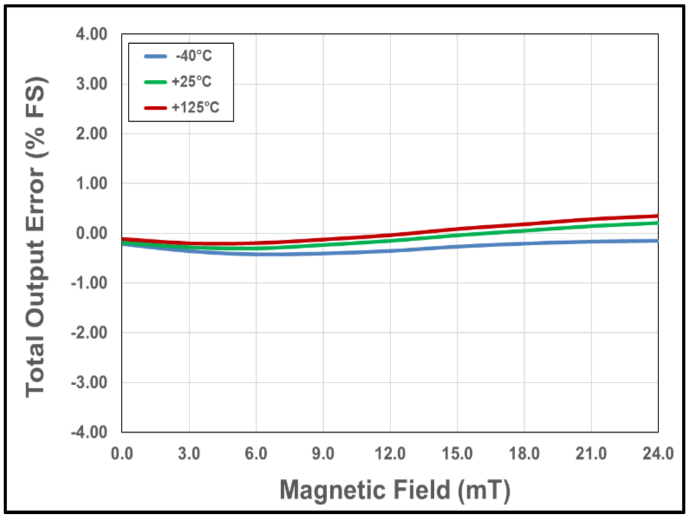


Figure 19. Total Output Error vs. Current vs. Temperature

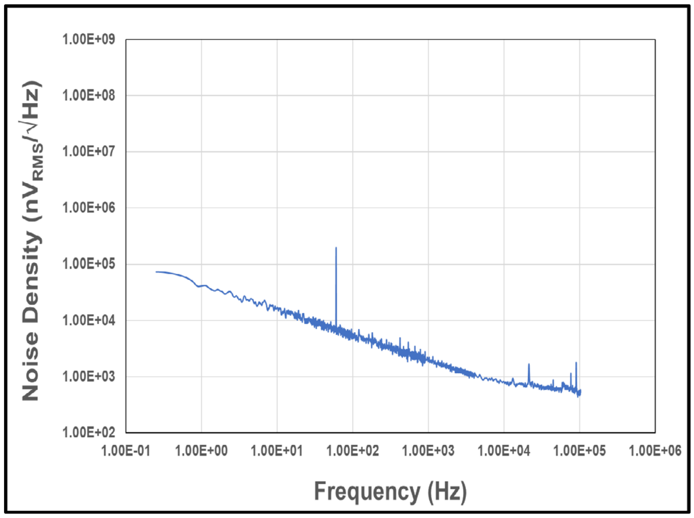


Figure 20. Noise Density vs. Frequency

CT452-x24MR: -24 mT to +24 mT

Unless otherwise specified: V_{CC} = 4.75 V to 5.50 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF. Typical values are V_{CC} = 5.00 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
B_{RNG}	Magnetic Field Range		-24		+24	mT
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, B_{OP} = 0 mT	2.490	2.500	2.510	V
S	Sensitivity	$B_{RNG(MIN)} < B_{OP} < B_{RNG(MAX)}$		83.3		mV/mT
f_{BW}	Bandwidth (1)	Small Signal = -3 dB		1.0		MHz
e_N	Noise (1)	T_A = +25°C, f_{BW} = 100 kHz		0.38		mV_{RMS}
				4.56		μT_{RMS}
OUT Accuracy Performance						
E_{OUT}	Total Output Error	$B_{OP} = B_{RNG(MAX)}$		±0.5	±1.0	% FS
E_{LIN}	Non-Linearity Error (1)	$B_{OP} = B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.2		% FS
E_{SENS}	Sensitivity Error (1)	$B_{OP} = B_{RNG(MAX)}$, T_A = -40°C to +125°C		±0.3		% FS
V_{OFFSET}	Offset Voltage (1)	B_{OP} = 0 mT, T_A = -40°C to +125°C		±7.0		mV
				±0.2		% FS
V_{OUT} – V_{REF} Accuracy Performance (TSSOP-8 only)						
$E_{OUT-VREF}$	VOUT – VREF Error	$B_{OP} = B_{RNG(MAX)}$, V_{CC} = 5.0 V T_A = -40°C to +125°C			±1.0	% FS
V_{OUT} - V_{REF}	OUT – VREF Offset Voltage	V_{CC} = 5.0 V T_A = -40°C to +125°C		5.0		mV
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift (1)	$B_{OP} = B_{OP(MAX)}$		±1.0		% FS

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

Electrical Characteristics for CT452-x24MR

V_{CC} = 5.0 V and T_A = +25°C and C_{BYP} = 1.0 µF (unless otherwise specified)

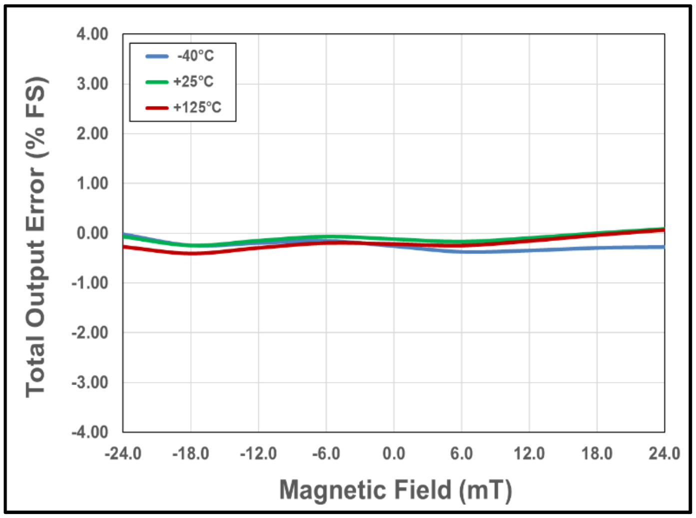


Figure 21. Total Output Error vs. Current vs. Temperature

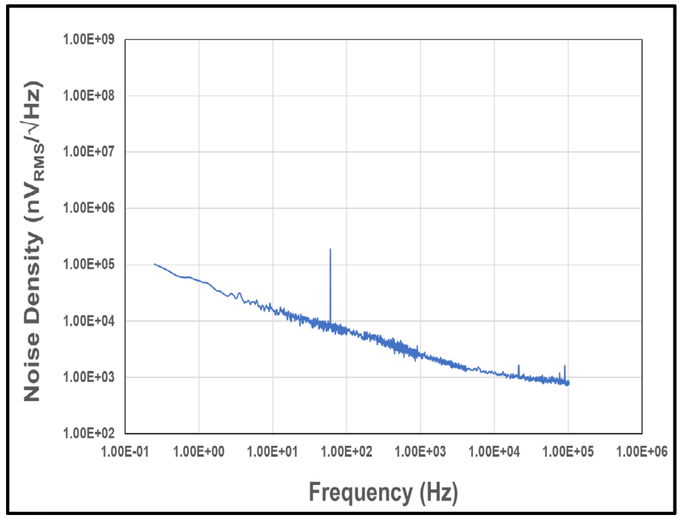


Figure 22. Noise Density vs. Frequency

Circuit Description

Overview

The CT452 is a very high accuracy contactless current sensor that can sense magnetic fields from 6 mT to 24 mT. It has very high sensitivity and a wide dynamic range with excellent accuracy (very low total output error) across temperature. This current sensor supports six (6) field ranges:

- 0 mT to +6 mT
- -6 mT to +6 mT
- 0 mT to +12 mT
- -12 mT to +12 mT
- 0 mT to 24 mT
- -24 mT to +24 mT

When current is flowing through a busbar above or below the CT452, the XtemeSense TMR sensors inside the chip senses the field which in turn generates differential voltage signals that then goes through the Analog Front-End (AFE) to output a current measurement as low as ±1.0% Full-Scale (FS) total output error (E_{OUT}).

The chip is designed to enable a very fast response time of 300 ns for the current measurement from the OUT pin as the bandwidth for the CT452 is 1.0 MHz. Even with a high bandwidth, the chip consumes a minimal amount of power.

Linear Output Magnetic Field Measurement

The CT452 provides a continuous linear analog output voltage which represents the magnetic field generated by the current flowing through the busbar. The output voltage range of OUT is from 0.50 V to 4.50 V with a V_{OQ} of 0.50 V and 2.50 V for unidirectional and bidirectional fields, respectively. Figure 23 illustrates the output voltage range of the OUT pin as a function of the measured field.

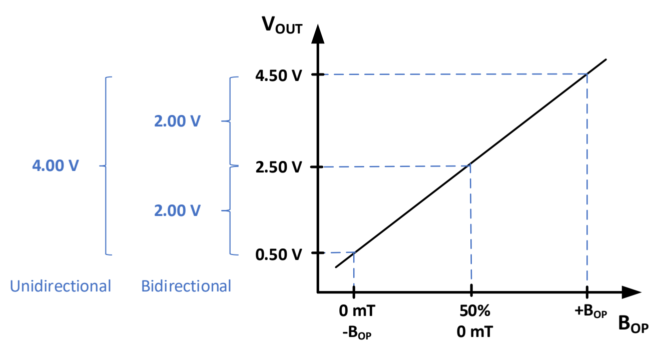


Figure 23. Linear Output Voltage Range (OUT) vs. Measured Magnetic Field (B_{OP})

Common Mode Field Rejection (CMFR) Mode

The CT452 has a built-in CMFR mode that combines the design ease of contactless current sensing with excellent common mode field rejection. This is achieved by placing notches in the current carrying busbar or PCB trace to generate a differential magnetic field in the vicinity of the CT452 sensor. The current sensor utilizes two full-bridge XtremeSense TMR sensors to achieve differential magnetic sensing capability, which allows the CT452 to greatly attenuate external magnetic fields and only capture the magnetic field generated by the current flowing in the busbar. Using this technique achieves better than -50 dB of CMFR without compromising the accuracy or the Signal-to-Noise Ratio (SNR) of the CT452.

Figure 24 (and Figure 25) shows an example of a 2-layer Printed Circuit Board (PCB) where the CT452 is placed on the top layer of the PCB and the bottom layer is designed to generate differential magnetic fields as the current flows through this trace. The “snake like” shape of the PCB trace produces the differential magnetic fields that almost completely eliminates the effects of stray magnetic fields to the CT452. This ensures that the CT452 outputs an accurate output voltage/current measurement to the host system.

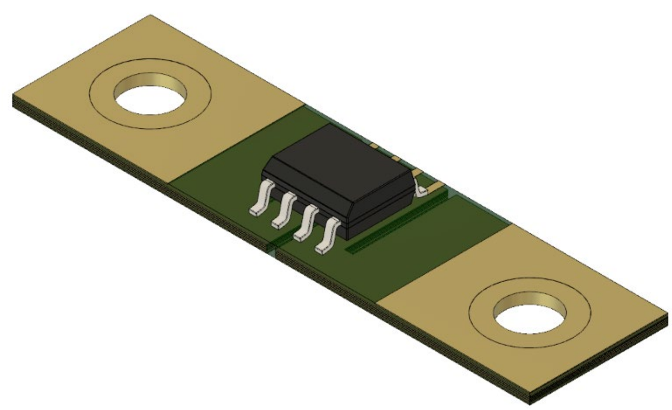


Figure 24. 3D View of CT452 and PCB Trace Design

Figure 25. PCB Trace Design to Generate Differential Magnetic Field for CT452 to Measure

An exploded view of the differential magnetic field generated by the PCB trace is illustrated in Figure 26. It demonstrates the IP+ current generating a clockwise field and goes around the bend or corner of the trace and coming out is IP- with a counter-clockwise field.

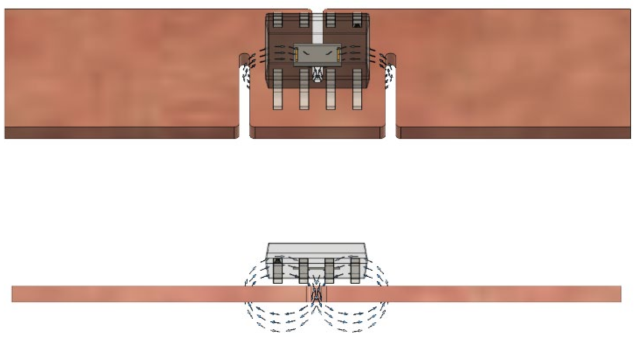


Figure 26. Differential Magnetic Fields Generated Current Through the Busbar (or PCB Trace) and Measured by the CT452

This concept is not restricted to PCB layers and can be extended to busbars carrying current in the hundreds to thousands of Amperes. Figure 27 shows a graphic of the CT452 placed over a busbar that generates differential magnetic fields when 300 A or greater steady-state current through it which will also give CMFR ratio of -50 dB or greater than 90% immunity.

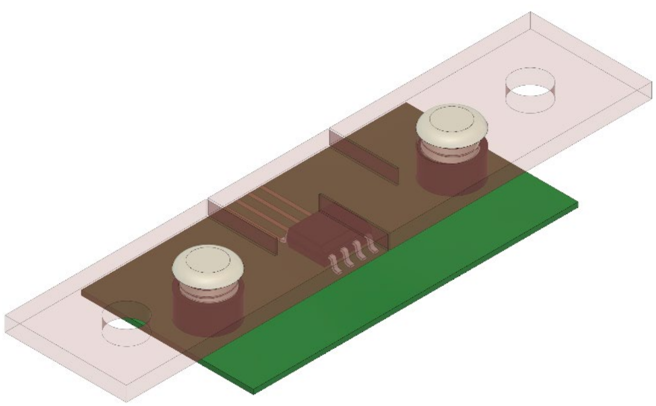


Figure 27. CT452 for Contactless Current Sensing Using Busbar

For more information on how to design the PCB trace and busbar to achieve this CMFR performance, please see the application note AN134, The CT452/CT453 Reference Design Guide for Contactless Current Sensing.

Voltage Reference Function (VREF)

The CT452 in the TSSOP-8 package has a reference voltage (VREF) pin that may be used as an output voltage reference for bipolar or unipolar field/AC or DC current measurements. The VREF pin should be connected to a buffer circuit. This is a stable output that provides an error of the difference between the output voltage (V_{OUT}) and the reference voltage (V_{REF}) less than ±1.0% FS over temperature

If the VREF is not used, then it should be left unconnected.

Filter Function (FILTER)

The CT452 has a pin for the FILTER function which will enable it to improve the noise performance by changing the cut-off frequency. The bandwidth of the CT452 is 1.0 MHz, however by adding a capacitor to the FILTER pin which, will be in series with an internal resistance of approximately 15 kΩ, will set the cut-off frequency to reduce the noise. Table 3 shows the capacitor values required to achieve four (4) cut-off frequencies.

Table 3. R-C Filter Options for FILTER Pin

Cut-off Frequency	C_{FILTER} (pF)	Capacitor Part Number
100 kHz	91	GRM0225C1C910JA02
250 kHz	33	GRM0225C1C330JA02
500 kHz	16	GRM0225C1C160JA03
1.0 MHz	5	GRM0225C1C5R0CA03

If the FILTER pin is not used, then it should be left unconnected (No Connect).

Total Output Error

The Total Output Error is the difference between the magnetic field measured by CT452 and the actual field, relative to the actual field. It is equivalent to the ratio between the difference of the ideal and actual voltage to the ideal sensitivity multiplied by the magnetic field due to current flowing through the busbar. The equation below defines the Total Output Error (E_{OUT}) for the CT452:

$$E_{OUT} = \frac{V_{OUT\_IDEAL}(B_{OP}) - V_{OUT}(B_{OP})}{S_{IDEAL}(B_{OP}) \times B_{OP}}$$

The E_{OUT} incorporates all sources of error and is a function of the sensed magnetic field (B_{OP}) from CT452. At high field levels, the E_{OUT} will be dominated by the sensitivity error whereas at low fields, the dominant characteristic is the offset voltage. Figure 28 shows the behavior of E_{OUT} versus B_{OP}. When B_{OP} goes 0 from both directions, the curves exhibit asymptotic behavior i.e., E_{OUT} approaches infinity.

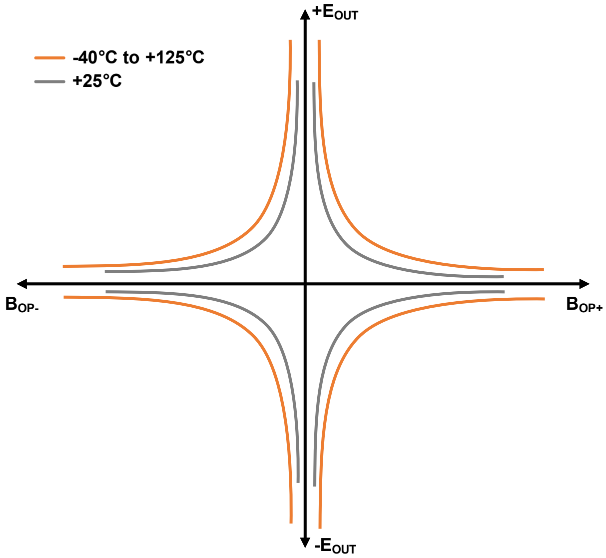


Figure 28. Total Output Error (E_{OUT}) vs. Field (B_{OP})

The CT452 achieves a total output error (E_{OUT}) that is less than ±1.0% of Full-Scale (FS) over supply voltage and temperature. It is designed with innovative and proprietary TMR sensors and circuit blocks to provide very accurate magnetic field measurements regardless of the operating conditions.

Sensitivity Error

The sensitivity error (E_{SENS}) is the sensitivity temperature drift error for unipolar field or DC current. It is calculated using the equation below:

$$E_{SENS} = \left(\frac{S_{MEASURED}}{S} - 1\right) \times 100\%$$

For bipolar field or AC current, the E_{SENS} is calculated by dividing the equation by 2.

Power-On Time (t_{ON})

The Power-On Time (t_{ON}) of 100 µs is the amount of time required by CT452 to start up, fully power the chip and becoming fully operational from the moment the supply voltage is greater than the UVLO voltage. 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_{CC}.

Response Time ($t_{RESPONSE}$)

The Response Time ($t_{RESPONSE}$) of 300 ns for the CT452 is the time interval between the following terms:

1. When the primary field/current signal reaches 90% of its final value,
2. When the chip reaches 90% of its output corresponding to the applied field/current.

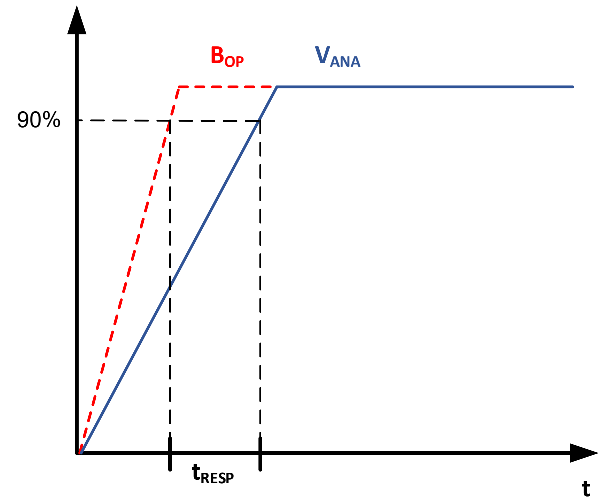


Figure 29. CT452 Response Time Curve

Rise Time (t_{RISE})

The CT452's rise time, t_{RISE}, is the time interval of when it reaches 10% and 90% of the full-scale output voltage. The t_{RISE} of the CT452 is 200 ns.

Propagation Delay (t_{DELAY})

The Propagation Delay (t_{DELAY}) is the time difference between these two events:

1. When the primary current reaches 20% of its final value
2. When the chip reaches 20% of its output corresponding to the applied field/current.

The CT452 has a propagation delay of 250 ns.

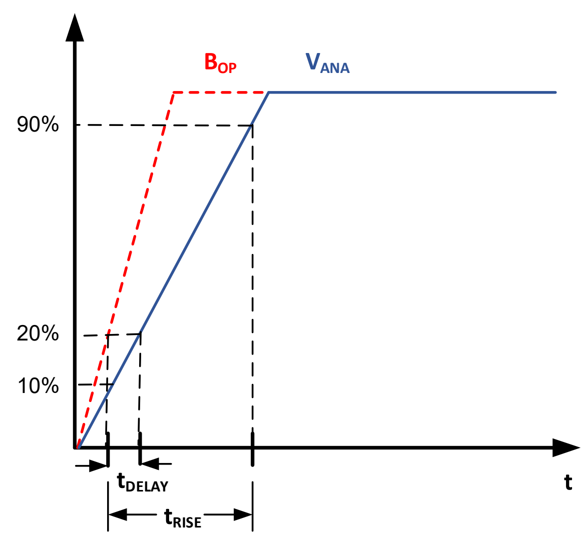


Figure 30. CT452 Propagation Delay and Rise Time Curve

Under-Voltage Lockout (UVLO)

The Under-Voltage Lock-out protection circuitry of the CT452 is activated when the supply voltage (V_{CC}) falls below 2.45 V. The CT452 remains in a low quiescent state until V_{CC} rises above the UVLO threshold (2.50 V). In this condition where the V_{CC} is less than 2.45 V and UVLO is triggered, the output from the CT452 is not valid and the FLT pin will go LOW. Once the V_{CC} rises above 4.0 V then the UVLO is cleared, and the $\overline{FLT}$ pin will be HIGH.

CT452 Calibration Guide

Introduction

All current sensors, no matter how expensive they are, or what materials they use, or even if they were factory calibrated, are susceptible to deviations from their Ideal Transfer Line.

To extract the absolute best performance from any current sensing system, calibration is required.

Ideal Transfer Line

Ideally, the sensor output follows a straight line, has a fixed slope, and crosses a fix offset point. This allows the user to apply a straightforward linear equation to extract the "physical" value being measured. In the case of a current sensor:

$$Current = \frac{Voltage - b}{a}$$

where a: slope and b: offset of the ideal curve. In a perfect sensor, both a and b coefficients can be simply looked up on the datasheet.

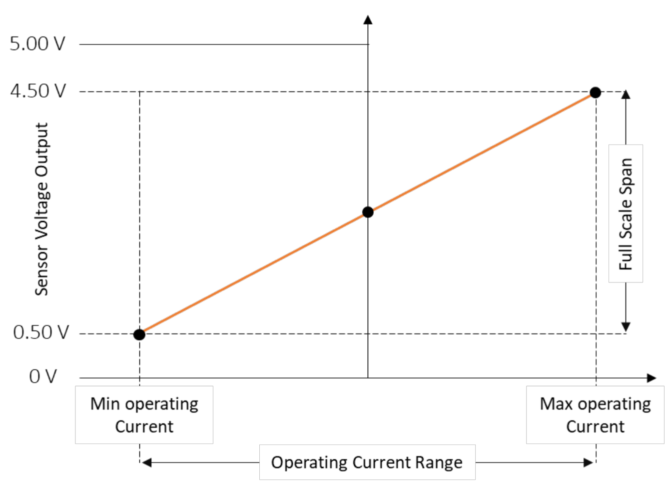


Figure 31. Ideal Transfer Line

Any deviation from this Ideal Line are considered sensor errors. More specifically Accuracy Errors as they related in the case of Crocus Technology's sensors to Gain and Offset errors.

Offset Error

Based on the Ideal Transfer Line, when no current is applied, the voltage output of the sensor should be equal to 2.50 V. On the datasheet, the user can find the spread (i.e., min-max) values of offsets of Crocus Technology's products.

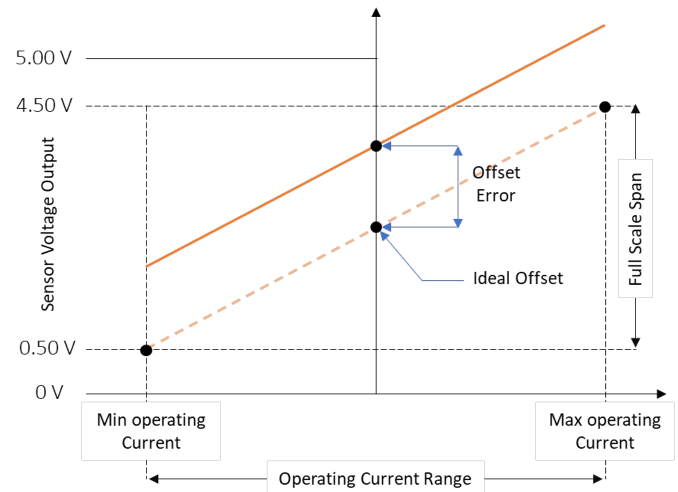


Figure 32. Exaggerated Offset Error

Gain Error

The Ideal Transfer Line shows a line that reaches 4.50 V at the maximum operating current and 0.50 V at the minimum. The datasheet also shows the spread of the gain found on the sensors.

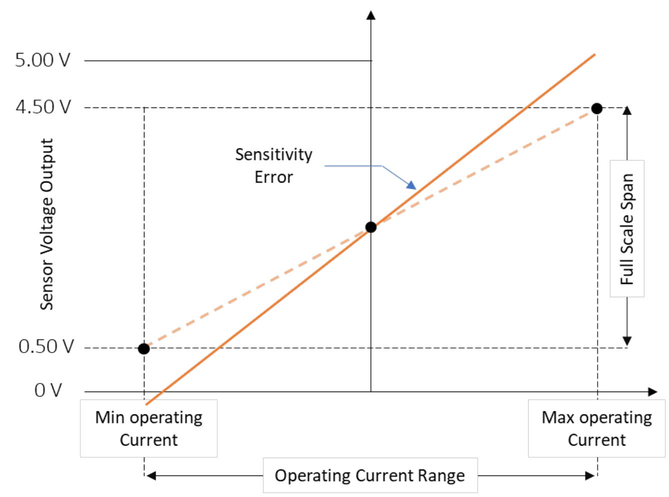


Figure 33. Exaggerated Gain Error

Calibration

Different methods can be applied for offset and/or gain correction. The complexity of these methods lead to different calibration results. The higher the complexity the better the error correction is.

Simple Offset Correction

Offset calibration is achieved simply by storing the voltage output of the sensor at zero flowing current.

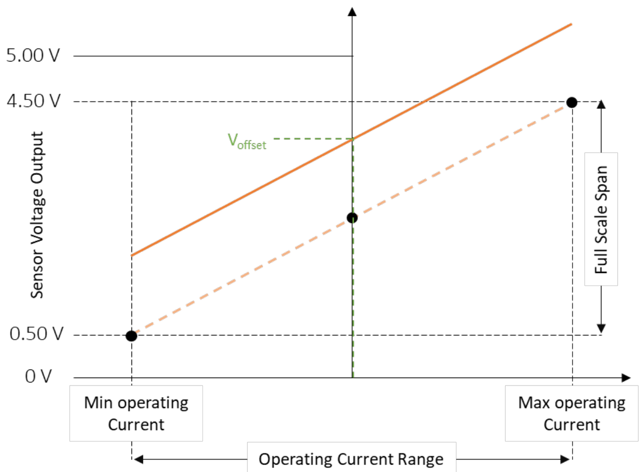


Figure 34. Simple Offset Calibration

This stored value V_{OFFSET} becomes the coefficient "b" in the linear transfer function:

$$Current = \frac{Voltage - b}{a}$$

Simple Gain Correction

Basic Gain calibration can be achieved by applying a known current value (A_1) and measure the sensor output voltage value (V_1)

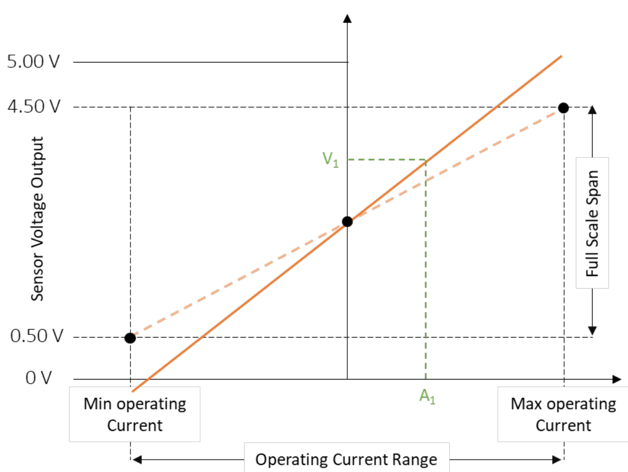


Figure 35. Simple Gain Calibration

The following equation is used to calculate the slope coefficient "a":

$$a = \frac{V_1 - V_{OFFSET}}{A_1}$$

Recommended Offset and Gain Correction

For bi-directional current applications, the steps below are recommended for users trying to perform the best error correction of gain and offset.

1. Apply a known current value (A_1) and measure voltage output (V_1)
2. Apply a "second current value" (A_2) and measure the voltage output (V_2)
3. Calculate the slope using the following equation.

It is recommended that the applied currents A_1 and A_2 are the absolute maximum and minimum operating current the sensor will see during its normal operations.

Also, $A_1 = -A_2$ for bi-directional current sensing.

$$a = \frac{V_1 - V_2}{A_1 - A_2} \qquad b = \frac{V_1 + V_2}{2}$$

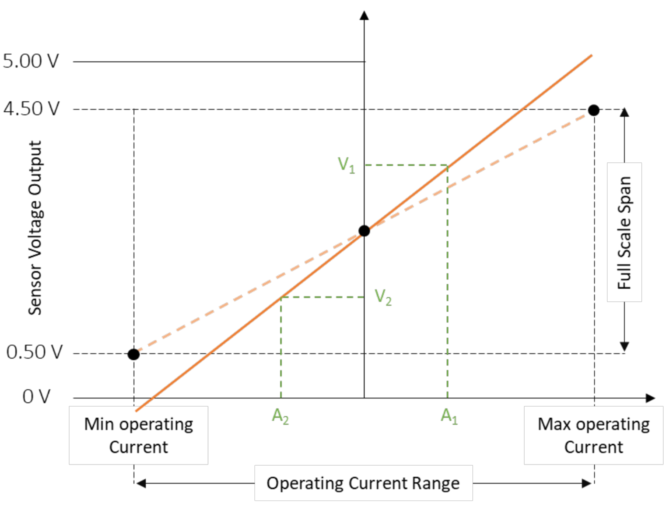


Figure 36. Gain Calibration

Both calculated coefficients "a" and "b" are then used to calculate the current:

$$Current = \frac{Voltage - b}{a}$$

Applications Information

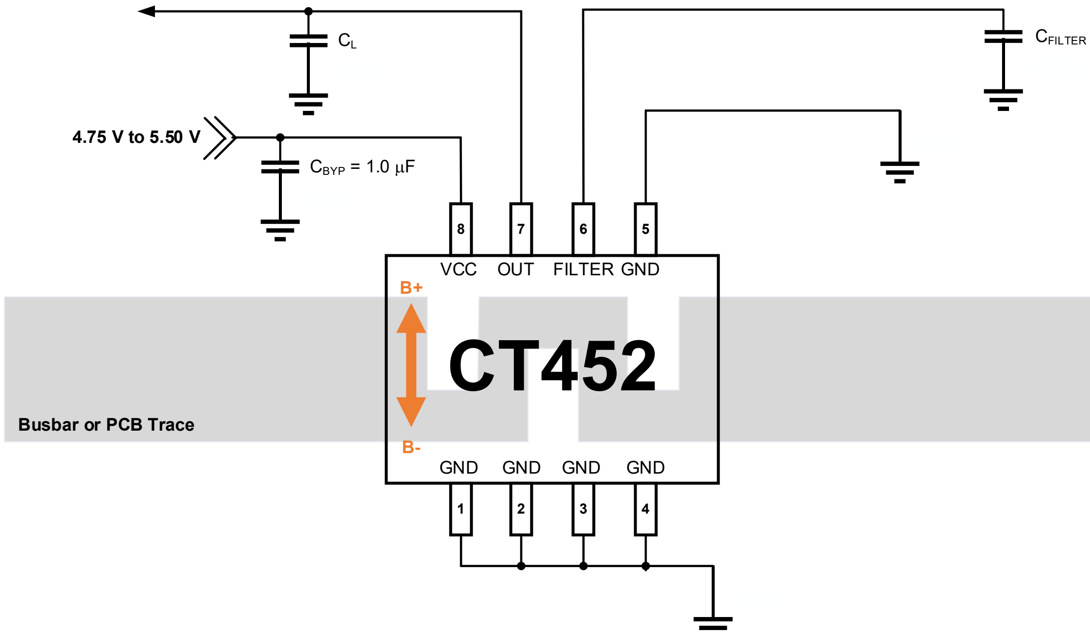


Figure 37. Application Diagram of CT452 Sensing Current of Busbar or PCB Trace Underneath It

Application

The CT452 is an integrated contactless current sensor that can be used in many applications from measuring current in solar inverters and other high-current applications. The chip outputs to a microcontroller a simple linear analog output voltage which corresponds to a magnetic field (current) measurement value. A second output called FLT# alerts the host system to any fault event that may occur in the CT452. Figure 37 is an application diagram of how CT452 would be implemented in a system.

It is designed to support an operating voltage range of 4.75 V to 5.50 V, but it is ideal to use a 5.00 V power supply where the output tolerance is less than ±5%.

Current Sensing

The CT452 can sense and therefore measure the current by either placing a current-carrying busbar above or under the device. The busbar should be placed across the package for the CT452 to measure the current. The chip is also sensitive enough to measure the current from a PCB trace that is routed underneath it.

Bypass Capacitor

A single 1.0 µF capacitor is needed for the VCC pin to reduce the noise from the power supply and other circuits. This capacitor should be placed as close as possible to the CT452 to minimize inductance and resistance between the two devices.

VREF Resistors (TSSOP-8)

In designs where the VREF pin of the CT452 in TSSOP-8 is used, a 10 kΩ resistor must be connected as close to the pin as possible in series with a load.

If the VREF pin is not needed in the application, then this pin should not be connected and be left floating.

Recommended PCB Trace Design

The CT452 requires a different PCB trace or busbar design than the standard current trace or busbar to enable common mode field rejection. Figure 37 and Figure 39 show the shape and design of a PCB trace or busbar.

Other considerations in the PCB layout include the thickness of the trace and the amount of copper to support the current. Also placing the PCB trace on the bottom layer of the board will increase the isolation voltage. The greater distance between the CT452 and the current trace will result in a higher isolation voltage.

For more information on how to design the current-carrying busbar or PCB trace, please see the AN135 application note.

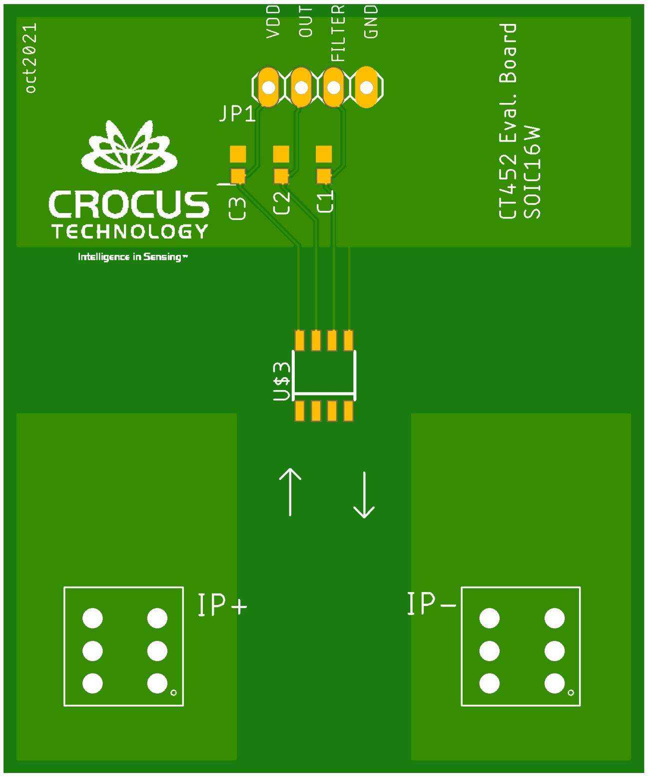


Figure 38. Recommended PCB Layout (Top Layer) for CT452

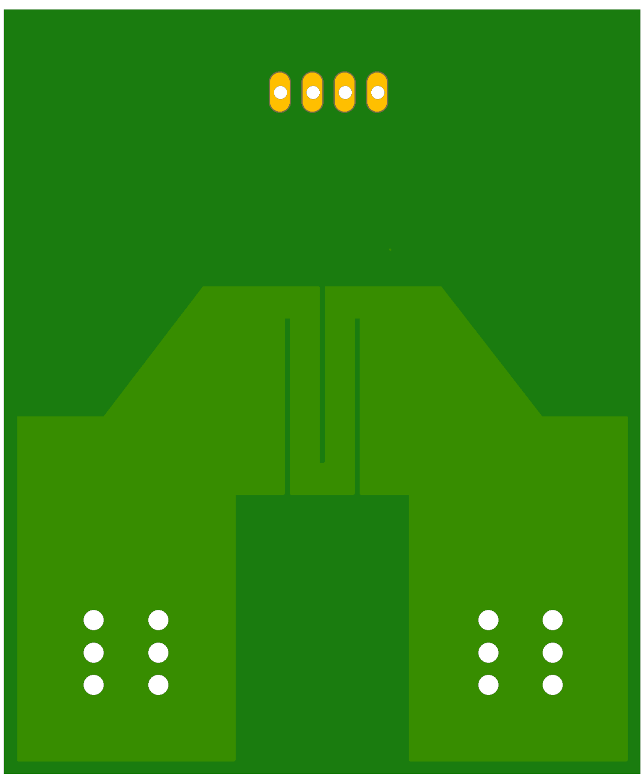


Figure 39. Recommended PCB Layout (Bottom Layer) for CT452

XtremeSense TMR Current Sensor Location

The XtremeSense TMR current sensor location of the CT452 for the x and y dimensions are shown in Figure 40 and z dimension in Figure 41 for the SOIC-8 package.

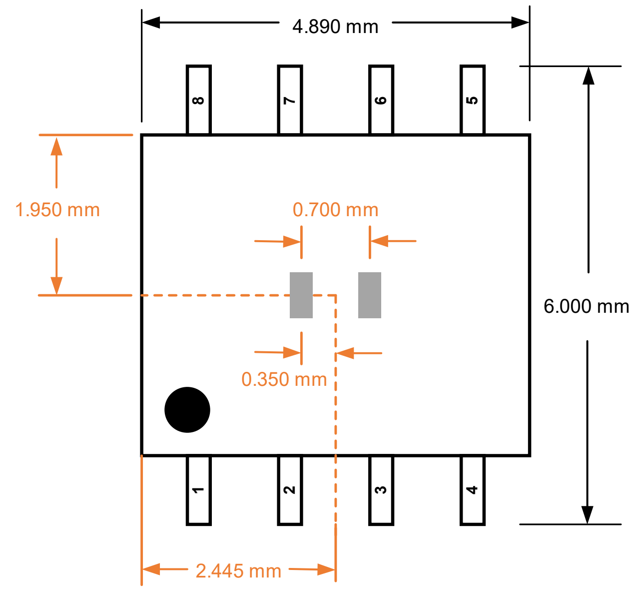


Figure 40. XtremeSense TMR Current Sensor Location in x-y Plane for CT452 in SOIC-8 Package

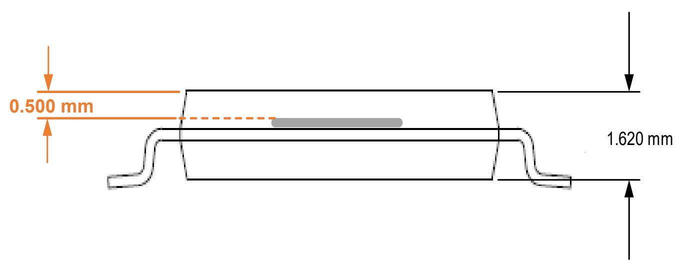


Figure 41. XtremeSense TMR Current Sensor Location in z Dimension for CT452 in SOIC-8 Package

Similarly, Figure 42 and Figure 43 for the TSSOP-8 package. All dimensions in the figures below are nominal.

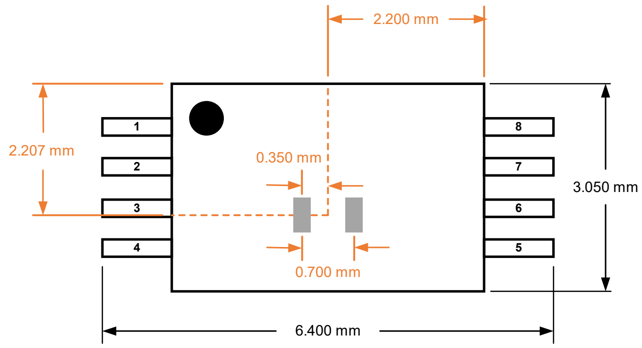


Figure 42. XtremeSense TMR Current Sensor Location in x-y Plane for CT452 in TSSOP-8 Package

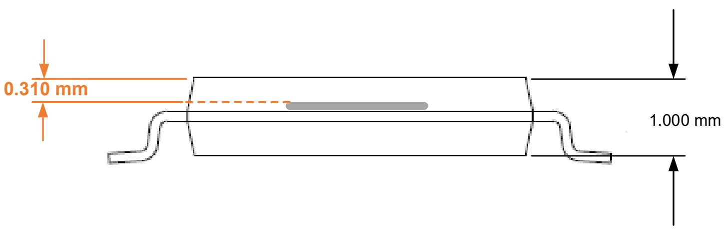


Figure 43. XtremeSense TMR Current Sensor Location in z Dimension for CT452 in TSSOP-8 Package

SOIC-8 Package Drawing and Dimensions

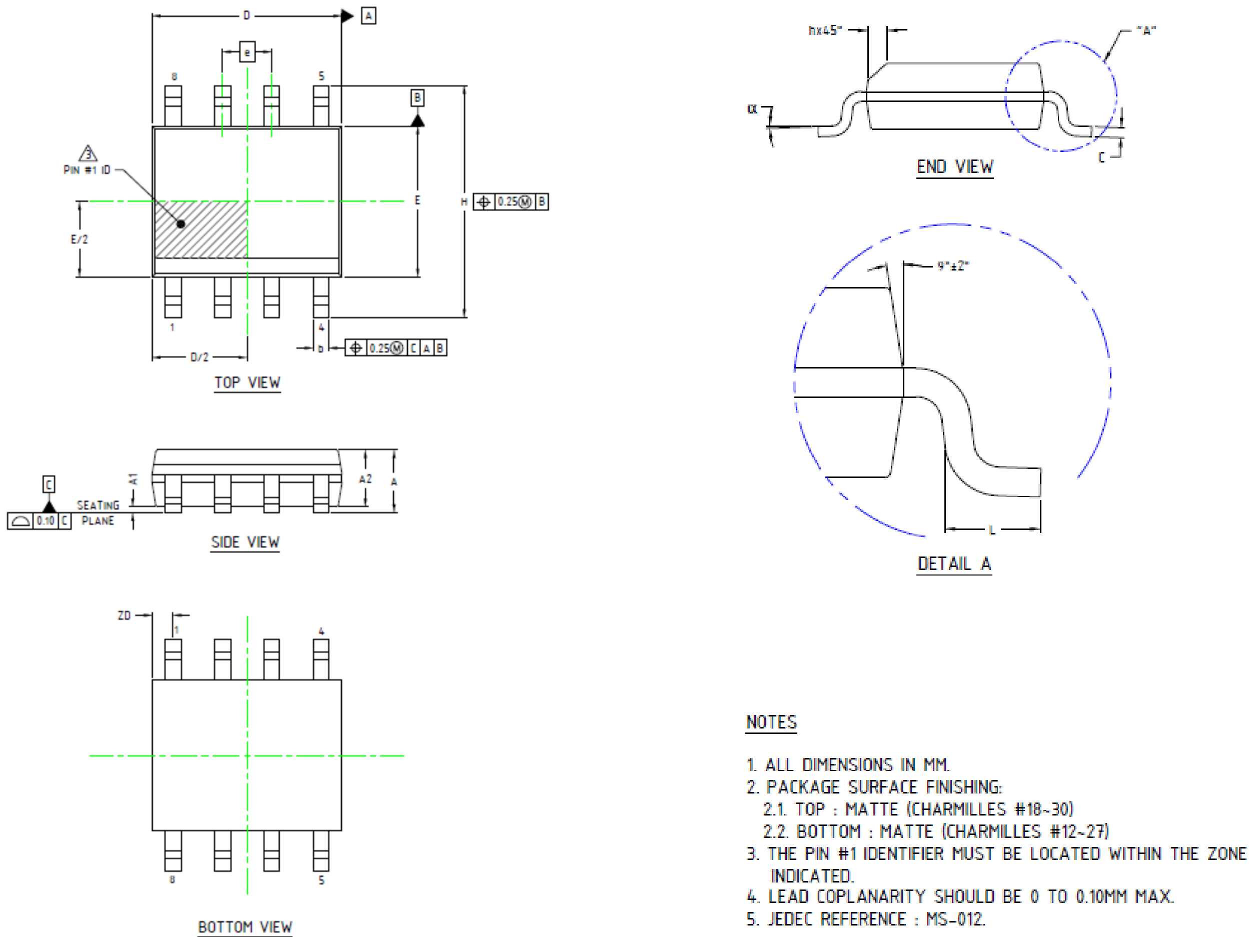


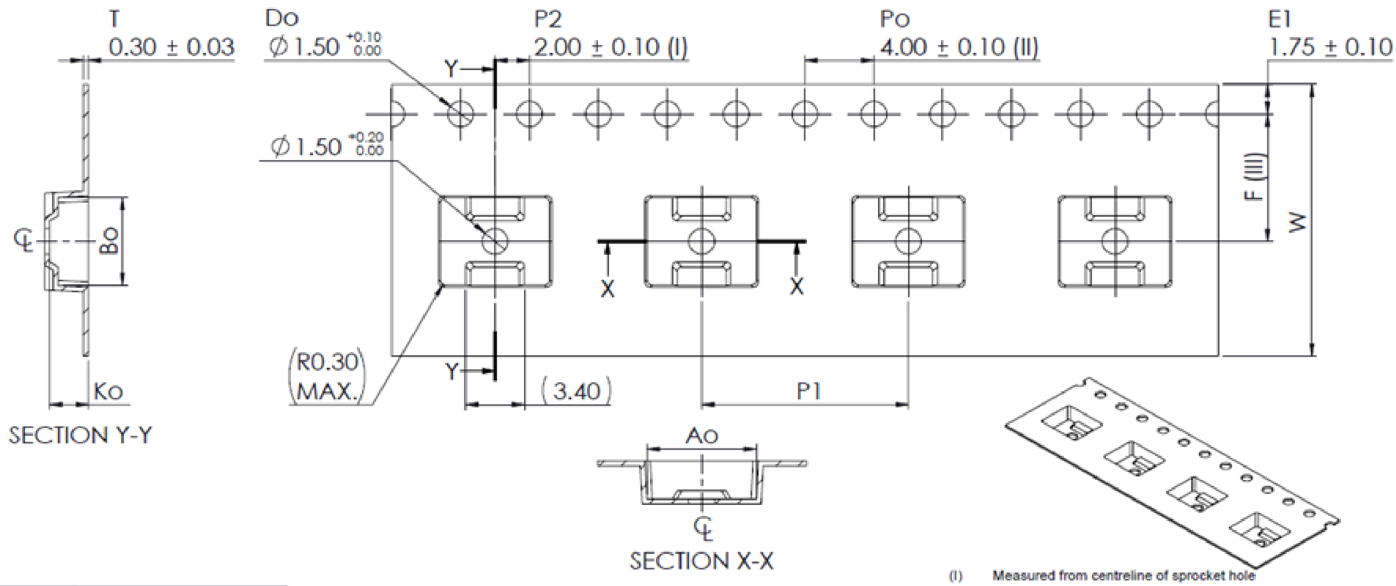
Figure 44. SOIC-8 Package Drawing

Table 4. CT452 SOIC-8 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
A1	0.10	0.18	0.25
b	0.36	0.41	0.46
C	0.19	0.22	0.25
D	4.80	4.89	4.98
E	3.81	3.90	3.99
e	1.27 BSC		
H	5.80	6.00	6.20
h	0.25	0.37	0.50
L	0.41	-	1.27
A	1.52	1.62	1.72
α	0°	-	8°
ZD	0.53 REF		
A2	1.37	1.47	1.57

Crocus Technology provides package drawings as a service to customers considering or planning to use Crocus products in their designs. Drawings may change without notice. Please note the revision and date of the data sheet and contact a Crocus Technology representative to verify or obtain the most recent version. The package specifications do not expand the terms of Crocus Technology's worldwide terms and conditions, specifically the warranty therein, which covers Crocus Technology's products.

SOIC-8 Tape & Pocket Drawing and Dimensions



Ao	6.35	+/- 0.10
Bo	5.13	+/- 0.10
Ko	2.25	+/- 0.15
K1	1.75	+/- 0.10
F	7.50	+/- 0.10
P1	12.00	+/- 0.10
W	16.00	+0.30 / -0.10

(I) Measured from centreline of sprocket hole to centreline of pocket.
(II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
(III) Measured from centreline of sprocket hole to centreline of pocket.
(IV) Other material available.
(V) Dimension with ( ) is used for design reference purposes, No measurement required.

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

Figure 45. SOIC-8 Package Drawing

TSSOP-8 Package Drawing and Dimensions

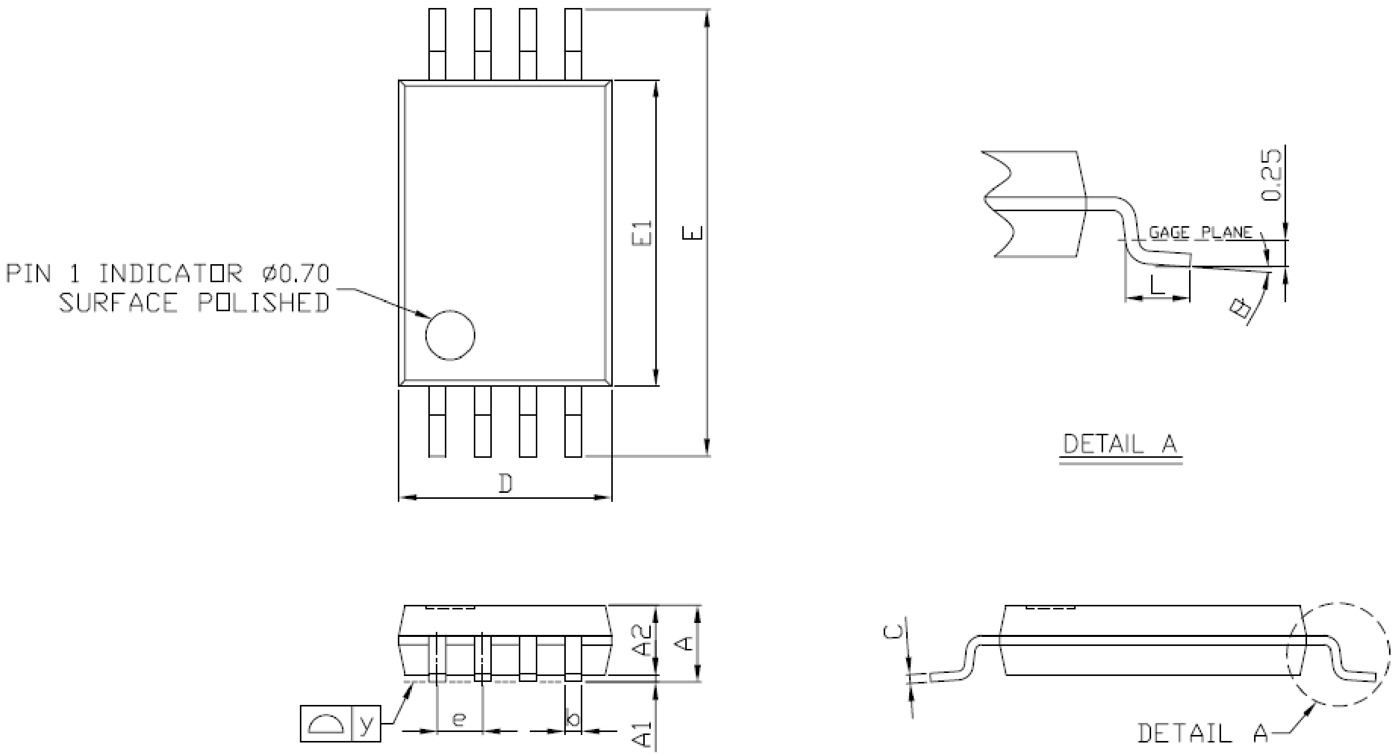


Figure 46. TSSOP-8 Package Drawing

Table 5. CT452 TSSOP-8 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
A	1.05	1.10	1.20
A1	0.05	0.10	0.15
A2	-	1.00	1.05
b	0.25	-	0.30
C	-	0.127	-
D	2.90	3.05	3.10
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	-	0.65	-
L	0.50	0.60	0.70
y	-	-	0.076
θ	0°	4°	8°

Crocus Technology provides package drawings as a service to customers considering or planning to use Crocus products in their designs. Drawings may change without notice. Please note the revision and date of the data sheet and contact a Crocus Technology representative to verify or obtain the most recent version. The package specifications do not expand the terms of Crocus Technology's worldwide terms and conditions, specifically the warranty therein, which covers Crocus Technology's products.

TSSOP-8 Tape & Pocket Drawing and Dimensions

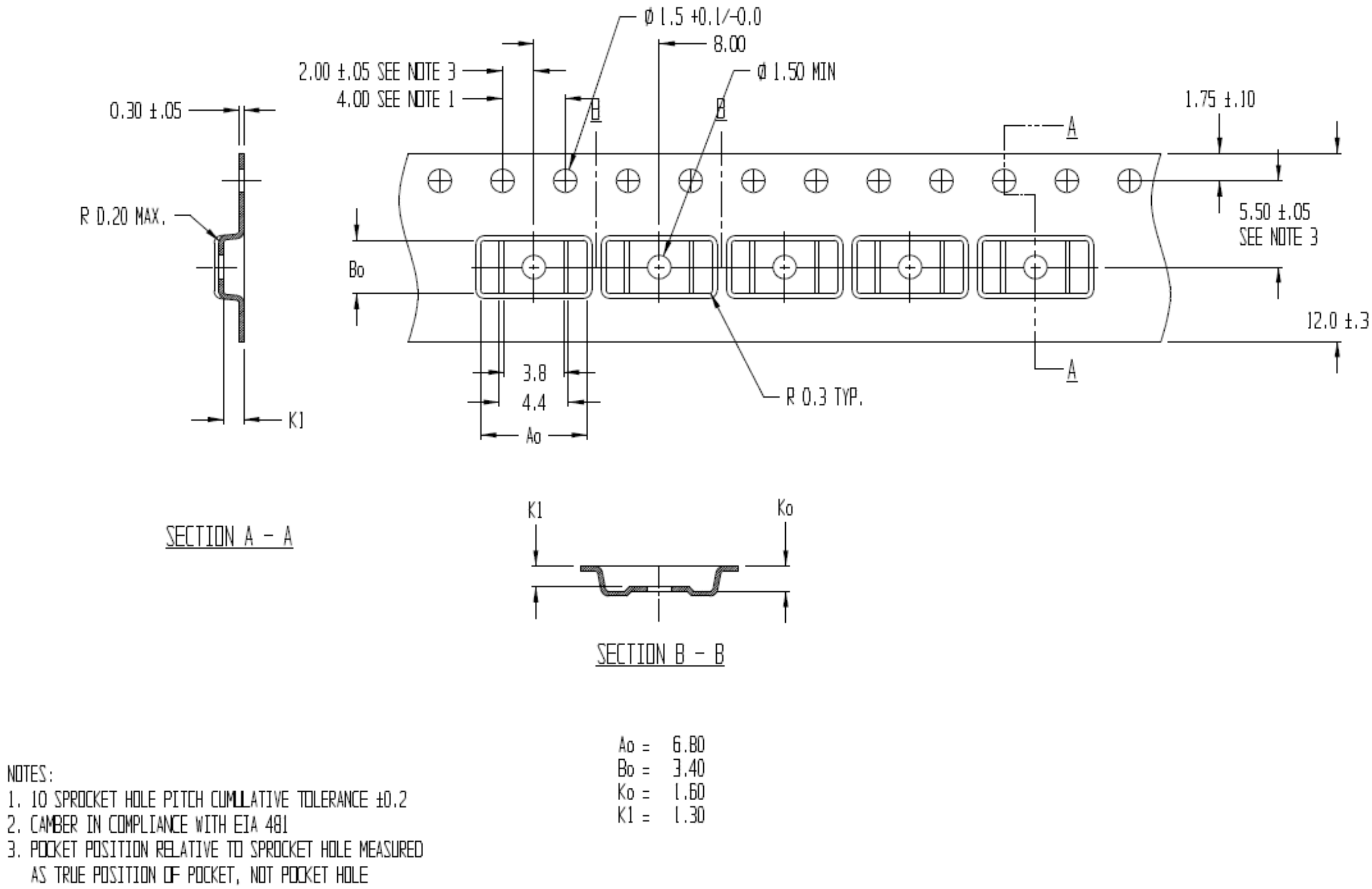


Figure 47. TSSOP-8 Tape and Pocket Drawings

Package Information

Table 6. CT452 Package Information

Part Number	Package Type	# of Leads	Quantity per Reel	Lead Finish	MSL Rating (2)	Operating Temperature (3)	Device Marking (4)
CT452-H06DRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 06DR YYWWLL
CT452-A06DRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 A06DR YYWWLL
CT452-H06DRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-06DR YYWWLL
CT452-A06DRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-A06DR YYWWLL
CT452-H06MRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 06MR YYWWLL
CT452-A06MRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 A06MR YYWWLL
CT452-H06MRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-06MR YYWWLL
CT452-A06MRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-A06MR YYWWLL
CT452-H12DRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 12DR YYWWLL
CT452-A12DRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 A12DR YYWWLL
CT452-H12DRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-12DR YYWWLL
CT452-A12DRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-A12DR YYWWLL
CT452-H12MRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 12MR YYWWLL
CT452-A12MRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 A12MR YYWWLL
CT452-H12MRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-12MR YYWWLL
CT452-A12MRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-A12MR YYWWLL
CT452-H24DRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 24DR YYWWLL
CT452-A24DRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 A24DR YYWWLL

Part Number	Package Type	# of Leads	Quantity per Reel	Lead Finish	MSL Rating (2)	Operating Temperature (3)	Device Marking (4)
CT452-H24DRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-24DR YYWWLL
CT452-A24DRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-A24DR YYWWLL
CT452-H24MRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 24MR YYWWLL
CT452-A24MRSN08	SOIC	8	3,000	Sn	3	-40°C to +125°C	CT452 A24MR YYWWLL
CT452-H24MRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-24MR YYWWLL
CT452-A24MRTS08	TSSOP	8	3,000	Sn	1	-40°C to +125°C	CT452-A24MR YYWWLL

(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 ≤ 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 +125°C and storage temperature range of -65°C to +150°C.

(4) Device Marking for CT452 in SOIC-8 is defined as CT452 xxZR YYWWLL where the first 2 lines = part number, and third line is YY = year, WW = work week and LL = lot code. In TSSOP-8 is defined as CT452 xxZR YYWWLL where the first line = part number, and second line is YY = year, WW = work week and LL = lot code.

Device Marking

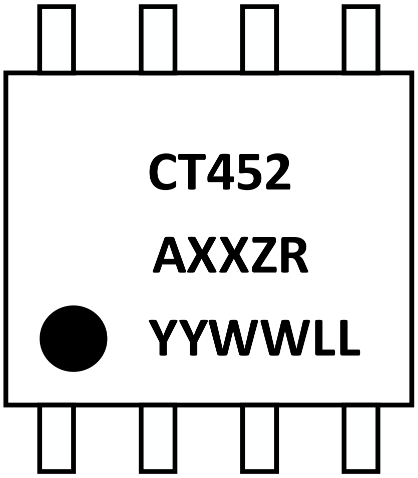


Figure 48. CT452 Device Marking for 8-lead SOIC Package

Row No.	Code	Definition
3	•	Pin 1 Indicator
1	CT452	Crocus Part Number
2	A	Automotive Identifier
2	XX	Maximum Field Rating
2	ZR	Polarity
3	YY	Calendar Year
3	WW	Work Week
3	LL	Lot Code

Table 7. CT452 Device Marking Definition for 8-lead SOIC Package

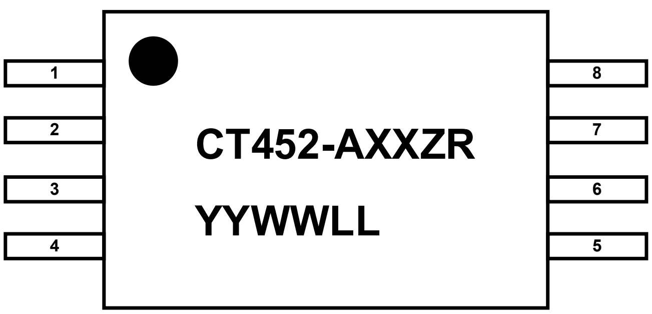


Figure 49. CT452 Device Marking for 8-lead TSSOP Package

Row No.	Code	Definition
1	•	Pin 1 Indicator
2	CT452	Crocus Part Number
2	A	Automotive Identifier
2	XX	Maximum Magnetic Field Rating
2	ZR	Magnetic Field Range
3	YY	Calendar Year
3	WW	Work Week
3	LL	Lot Code

Table 8. CT452 Device Marking Definition for 8-lead TSSOP Package

Part Ordering Number Legend

CT 4 5 2 - T FR XY PCKG

Package Type (PCKG)
- SN08 = 8-lead SOIC
- TS08 = 8-lead TSSOP

Polarity (XY)
- DR = Unipolar Magnetic Field
- MR = Bipolar Magnetic Field

Field Range (FR)
- 06 = 6 mT
- 12 = 12 mT
- 24 = 24 mT

Temperature Range (T)
- A = AEC-Q100 Grade 1
- H = -40°C to +125°C

Current Sensor Variant (2)
- 2 = V_{CC} is 5.0 V; CMFR Mode Enabled

Current Sensor Type (5)
- 5 = Contactless Current Sensor

Product Family (4)
- 4 = Current Sensor

CT = Crocus Technology