CROCUS TECHNOLOGY
Intelligence in Sensing™

CT400

Integrated Contact Current Sensor

Features

- Contact Current Sensing for Low to Medium Current Ranges:
  - 0 A to +10 A
  - -10 A to +10 A
  - 0 A to +50 A
  - -50 A to +50 A
- Integrated Current Carrying Conductor (CCC)
- Linear Analog Output for Current Measurement
- Continuous Closed Loop Operation
- Immunity to Common Mode Fields
- Over-Field Detection (OFD™)
  - Out of Range Fields
- Tracking Loss Detection (TLD™)
  - Identifies Transients
- Input Under-Voltage Lockout (UVLO)
- Thermal Shutdown Protection (TSD)
- 16-Lead SSOP Package

Applications

- UPS, SMPS and Telecom Power Supplies
- Battery Management Systems
- Motor Control
- White Goods
- Power Utility Meters
- Over-Current Fault Protection

Product Description

The CT400 is an integrated contact current sensor that uses Crocus Technology's patented Magnetic Logic Unit™ (MLU) technology to enable high accuracy current measurements for many consumer, enterprise and industrial applications. It supports 4 current ranges where the integrated current carrying conductor (CCC) will handle up to 50 A of current and generates a current measurement as a linear analog output.

It operates in a continuous closed loop mode and is immune to common mode fields. The CT400 also has built in detection circuitry to identify out of range fields (OFD) and transients (TLD). For safety purposes, the CT400 has thermal shutdown (TSD) protection to prevent overheating of the device. In addition, under-voltage lockout protection is enabled when the power supply falls below 3.3 V.

The CT400 is available in an industry standard 16-lead SSOP package that is "green" and RoHS compliant. This package is designed to not only be able to handle currents up to 50 A but also reduce EMI.

Ordering Information

Part Number	Operating Temperature Range	Current Range	Package	Packing Method
CT400-ESF10DR	-40°C to +85°C	0 A to +10 A	16-lead SSOP 6.20 x 7.80 x 2.00 mm	Tape & Reel
CT400-HSF10DR	-40°C to +125°C			
CT400-ESF10MR	-40°C to +85°C	-10 A to +10 A	16-lead SSOP 6.20 x 7.80 x 2.00 mm	Tape & Reel
CT400-HSF10MR	-40°C to +125°C			
CT400-ESF50DR	-40°C to +85°C	0 A to +50 A	16-lead SSOP 6.20 x 7.80 x 2.00 mm	Tape & Reel
CT400-HSF50DR	-40°C to +125°C			
CT400-ESF50MR	-40°C to +85°C	-50 A to +50 A	16-lead SSOP 6.20 x 7.80 x 2.00 mm	Tape & Reel
CT400-HSF50MR	-40°C to +125°C			

Block Diagram

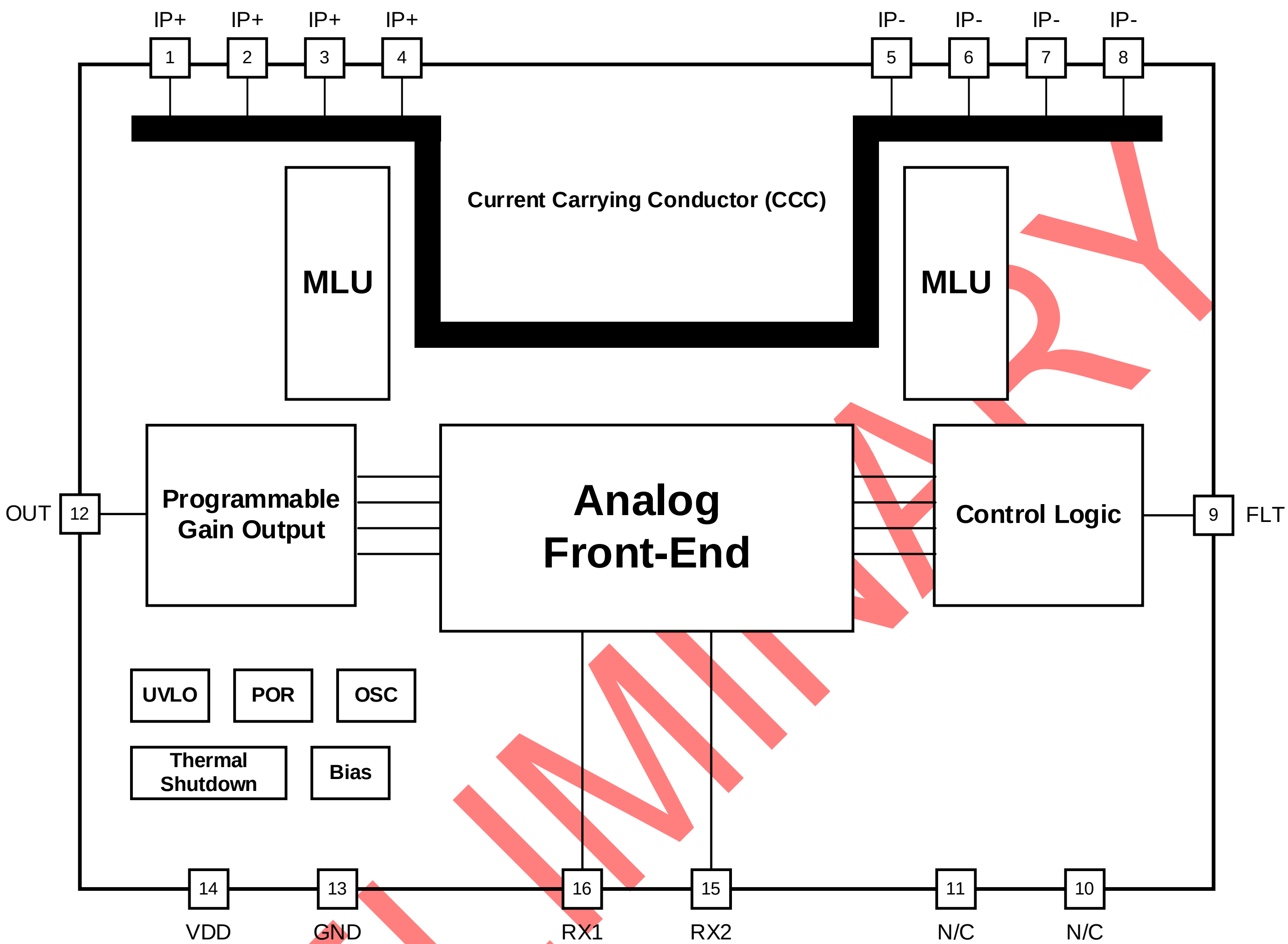

Figure 1. CT400 Functional Block Diagram

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	C		1.0		µF
R_{SENSE}	1% or Better	Various	R		10.0	50.0	Ω

Pin Configuration

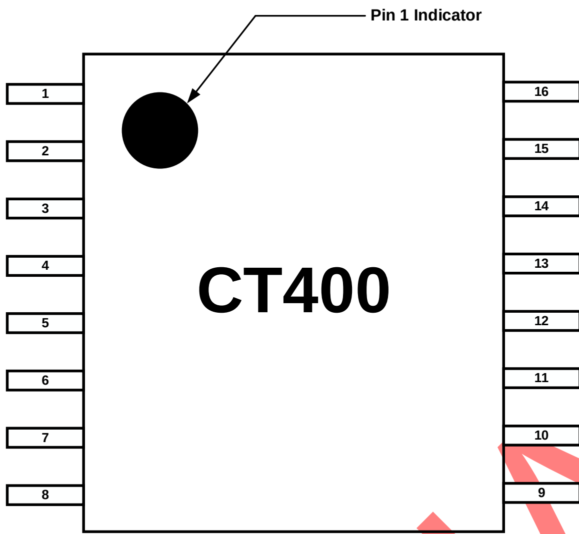

Figure 2. CT400 Pin-out Diagram (Top Down View)

Pin Definitions

Pin #	Pin Name	Pin Description
1	IP+	Input primary conductor (positive).
2		
3		
4		
5	IP-	Output primary conductor (negative).
6		
7		
8		
9	FLT	Output fault signal to indicate that the following parameters are outside of normal operational bounds: • Over-Field Detection • Tracking Loss Detection • UVLO • Thermal Shutdown
10	N/C	No connect. (Connect to Ground)
11		
12	OUT	Analog output voltage that represents the measured current.
13	GND	Ground.
14	VDD	Supply voltage.
15	RX2	Sense resistor connection to set the dynamic range of OUT. Negative polarity with respect to OUT. Precision resistor required.
16	RX1	Sense resistor connection to set the dynamic range of OUT. Positive polarity with respect to OUT. Precision resistor required.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the CT400 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_{DD}	Supply Voltage		-0.3	6.0	V
$V_{I/O}$	Analog Input/Output Pins Maximum Voltage		-0.3	V_{DD} + 0.3	V
$I_{CCC(MAX)}$	Current Carrying Conductor, T_A = +25°C			60	A
V_{ISO}	Rated Isolation Voltage per IEC 60950-1:2005 (includes AMD1:2009 and AMD2:2013) and UL1577		2.5		kV_{RMS}
V_{WORK_ISO}	Working Voltage for Basic Isolation per IEC 60950-1:2005 (includes AMD1 :2009 and AMD2 :2013)		TBD		V_{PK}
			TBD		V_{RMS}
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	+150	°C
T_L	Lead Soldering Temperature, 10 Seconds			+260	°C

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual operation of the CT400. 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_{DD}	Supply Voltage Range	4.0	5.0	5.5	V
V_{OUT}	OUT Voltage Range	0		V_{DD}	V
I_{OUT}	OUT Current			±3.0	mA
T_A	Operating Ambient Temperature	-40	+25	+125	°C
T_J	Operating Junction Temperature	-40		+140	°C

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 not to exceed junction temperature $T_{J(MAX)}$ at a given ambient temperature T_A.

Symbol	Parameter	Min.	Typ.	Max.	Unit
θ_{JA}	Junction-to-Ambient Thermal Resistance, SSOP-16		23		°C/W
θ_{JC}	Junction-to-Case Thermal Resistance, SSOP-16		TBD		°C/W

Electrical Specifications

General Parameters

Unless otherwise specified: V_{DD} = 4.0 V to 5.5 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF, and R_{SENSE} = 10 Ω. Typical values are V_{DD} = 5.0 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Power Supplies						
I_Q	Quiescent Current	No load, I_{CCC} = 0 A		3.3	6.0	mA
I_{OUT}	OUT Maximum Drive Capability	OUT covers 10% to 90% of V_{DD} span.	-3.0		+3.0	mA
C_{L_OUT}	OUT Capacitive Load			1.0		nF
R_{L_OUT}	OUT Resistive Load		4.7			kΩ
R_{CCC}	Primary Conductor Resistance (1)			0.7		mΩ
Outputs						
V_{OUT}	OUT Voltage Linear Range		$0.1 \times V_{DD}$		$0.9 \times V_{DD}$	V
E_{OUT}	Total Output Error (1)	$I_P = I_{P(MAX)}$			±0.5	% FS
V_{ORE}	Offset Ratiometric Error (1)	$V_{OQ} = 0.5 \times V_{DD}$ ΔV_{DD} = ±10% of V_{DD}	-0.4		+0.4	% V_{OQ}
V_{OTD}	Offset Thermal Drift	Referenced to T_A = +25°C, IP = 0 A		±0.12	±0.25	A
V_{FLT_L}	FLT Voltage LOW	I_{FLT} = +100 µA			$0.1 \times V_{DD}$	V
V_{FLT_H}	FLT Voltage HIGH	I_{FLT} = -100 µA	$0.9 \times V_{DD}$			V
Timings						
t_{ON}	Power-On Time	$V_{DD} \geq 4.0$ V		100	200	µs
t_{RISE}	Rise Time	$I_P = I_{P(MAX)}$, T_A = +25°C, C_L = 1.0 nF		3		µs
$t_{RESPONSE}$	Response Time (1)			4		µs
t_{DELAY}	Propagation Delay (1)			2		µs
Protection						
T_{TSD}	Thermal Shutdown	Rising Temperature	140	150	160	°C
T_{HYS}	Temperature Hysteresis			10	15	°C
V_{UVLO}	Under-Voltage Lockout	Rising V_{DD}		3.4	3.8	V
		Falling V_{DD}	3.0	3.3		V
V_{UV_HYS}	UVLO Hysteresis			100		mV
$I_{S\text{-}GND}$	Shorted Output to GND			20		mA
$I_{S\text{-}VDD}$	Shorted Output to V_{DD}			22		mA

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

CT400-xSF10DR: 0 A to +10 A

Unless otherwise specified: V_{DD} = 4.0 V to 5.5 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF, and R_{SENSE} = 10 Ω. Typical values are V_{DD} = 5.0 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{RANGE}	Current Range (1)		0		+10	A
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, IP = 0 A	0.098 × V_{DD}	0.100 × V_{DD}	0.102 × V_{DD}	V
S	Sensitivity			400		mV/A
f_{BW}	Bandwidth	Small Signal = -3 dB C_L = 1.0 nF		120		kHz
$N_{DENSITY}$	Noise Density (1)	T_A = +25°C, C_L = 1.0 nF		6.8		µA_{RMS}√Hz
N	Noise (1)	T_A = +25°C, f_{BW} = 100 kHz, C_L = 1.0 nF		2.2		mA

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

CT400-xSF10MR: -10 A to +10 A

Unless otherwise specified: V_{DD} = 4.0 V to 5.5 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF, and R_{SENSE} = 10 Ω. Typical values are V_{DD} = 5.0 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{RANGE}	Current Range (1)		-10		+10	A
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, IP = 0 A	0.498 × V_{DD}	0.500 × V_{DD}	0.502 × V_{DD}	V
S	Sensitivity			200		mV/A
f_{BW}	Bandwidth	Small Signal = -3 dB C_L = 1.0 nF		240		kHz
$N_{DENSITY}$	Noise Density (1)	T_A = +25°C, C_L = 1.0 nF		6.8		µA_{RMS}√Hz
N	Noise (1)	T_A = +25°C, f_{BW} = 100 kHz, C_L = 1.0 nF		2.2		mA

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

CT400-xSF50DR: 0 A to +50 A

Unless otherwise specified: V_{DD} = 4.0 V to 5.5 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF, and R_{SENSE} = 10 Ω. Typical values are V_{DD} = 5.0 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{RANGE}	Current Range (1)		0		+50	A
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, IP = 0 A	0.098 × V_{DD}	0.100 × V_{DD}	0.102 × V_{DD}	V
S	Sensitivity			80		mV/A
f_{BW}	Bandwidth	Small Signal = -3 dB C_L = 1.0 nF		120		kHz
$N_{DENSITY}$	Noise Density (1)	T_A = +25°C, C_L = 1.0 nF		34.0		µA_{RMS}√Hz
N	Noise (1)	T_A = +25°C, f_{BW} = 100 kHz, C_L = 1.0 nF		11.0		mA_{RMS}

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

CT400-xSF50MR: -50 A to +50 A

Unless otherwise specified: V_{DD} = 4.0 V to 5.5 V, T_A = -40°C to +125°C, C_{BYP} = 1.0 µF, and R_{SENSE} = 10 Ω. Typical values are V_{DD} = 5.0 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{RANGE}	Current Range (1)		-50		+50	A
V_{OQ}	Voltage Output Quiescent	T_A = +25°C, IP = 0 A	0.498 × V_{DD}	0.500 × V_{DD}	0.502 × V_{DD}	V
S	Sensitivity			40		mV/A
f_{BW}	Bandwidth	Small Signal = -3 dB C_L = 1.0 nF		240		kHz
$N_{DENSITY}$	Noise Density (1)	T_A = +25°C, C_L = 1.0 nF		34.0		µA_{RMS}√Hz
N	Noise (1)	T_A = +25°C, f_{BW} = 100 kHz, C_L = 1.0 nF		11.0		mA_{RMS}

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

Circuit Description

Overview

The CT400 is an integrated contact current sensor with an integrated current carrying conductor (CCC) that handles up to 50 A. It has very high sensitivity and a wide dynamic range with excellent accuracy across temperature. This current sensor supports four (4) current ranges:

- 0 A to +10 A
- -10 A to +10 A
- 0 A to +50 A
- -50 A to +50 A

When current is flowing through the CCC, the MLU inside the chip senses the field which in turn generates a voltage across the external sense resistor (R_{SENSE}) connected at RX1 and RX2 which is proportional to the current flowing through the CCC. This voltage then goes through its analog frond-end circuit block to output a signal that is representative of the current measured through the OUT pin.

The chip is designed with a closed loop architecture to provide higher level of performance by reducing the output error to no more than ±0.5% of the full scale current, enhancing the robustness against outside disturbances and output consistent performance.

Linear Output Current Measurement

The CT400 provides a continuous linear analog output voltage which represents the current measurement. The output voltage range of OUT is 10% of V_{DD} to 90% of V_{DD} which represents the current from the low end (-50 A, -10 A or 0 A) to the maximum current (+10 A or +50 A) respectively. A resistor-capacitor (R-C) filter may be implemented on the OUT pin to further lower the noise. Figure 3 illustrates the output voltage range of the OUT pin as a function of the measured current.

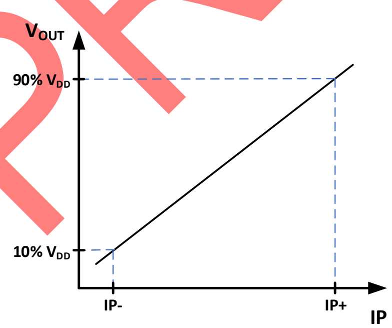

Figure 3. Linear Output Voltage Range vs. Measured Current

The recommended resistor and capacitor for the R-C filter are outlined in the following table. If maximum bandwidth is desired, a R-C filter is not needed and the signal from OUT can be directly connected to the microcontroller.

Table 2. R-C Filter Options for OUT Pin

R (Ω)	C (µF)	Bandwidth (kHz)
-	-	100
100	0.15	10
1,000	0.15	1

Sensitivity

The Sensitivity (S) is a change in CT400's output in response to a change in 1 A of current flowing through the CCC. It is defined by the product of the magnetic circuit sensitivity (G/A, where 1.0 G = 0.1 mT) and the chip's linear amplifier gain (mV/G). Therefore, the result of this gives a sensitivity unit of mV/A. The CT400 is factory calibrated to optimize the sensitivity for the full scale of the device's dynamic range.

Total Output Error

The Total Output Error is the difference between the current measured by CT400 and the actual current, relative to the actual current. It is equivalent to the ratio between the difference of the ideal and actual voltage to the ideal sensitivity multiplied by the current flowing through the primary conductor (CCC). The equation below defines the Total Output Error (E_{OUT}) for CT400:

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

The E_{OUT} incorporates all sources of error and is a function of the sensed current (I_P) from CT400. At high current levels, the E_{OUT} will be dominated by the sensitivity error whereas at low current, the dominant characteristic is the offset voltage. Figure 4 shows the behavior of E_{OUT} versus I_P. When I_P goes 0 from both directions, the curves exhibit asymptotic behavior i.e. E_{TOT} approaches infinity.

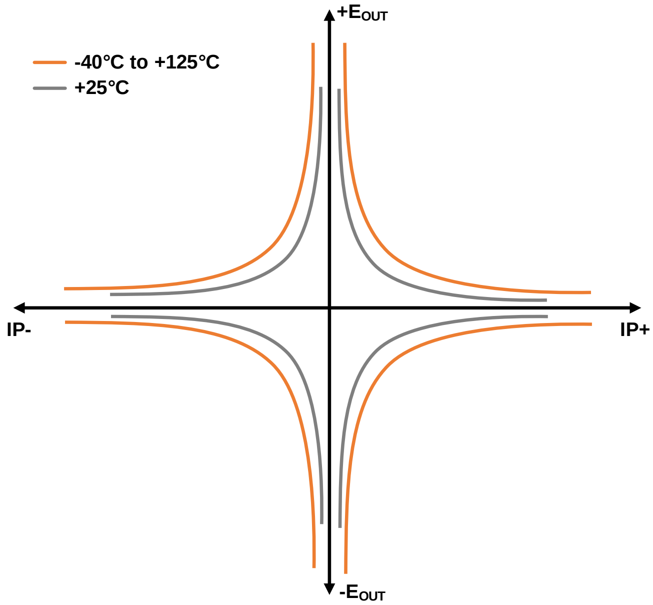

Figure 4. Total Output Error vs. Sensed Current

Power-On Time (t_{ON})

The Power-On Time (t_{ON}) is the amount of time required by CT400 to start up, fully power the chip and becoming fully operational from the moment the supply voltage is applied to it. 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}.

Response Time ($t_{RESPONSE}$)

The Response Time ($t_{RESPONSE}$) is the time interval between the following terms:

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

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 current.

Over-Field Detection (OFD)

The Over-Field Detection (OFD) circuitry detects out of range fields where the voltage from the OUT pin is below 5% of V_{DD} or above 95% of V_{DD}. This will generate a fault signal via the FLT pin to the host system's microcontroller.

Tracking Loss Detection (TLD)

Implemented in the CT400 is the Tracking Loss Detection (TLD) feature which will identify if there is a transient spike or a large field is encountered. This TLD event will cause a refresh cycle for 100 µs whereby a pulse will be initiated to clear the circuitry and return it to a normal state. It will hold the last known good voltage during this refresh cycle.

Under-Voltage Lockout (UVLO)

The Under-Voltage Lockout protection circuitry turns off all the MOSFETs and CT400 remains in a low quiescent state until V_{DD} rises above the UVLO threshold.

Thermal Shutdown (TSD)

When the junction temperature of the CT400 exceeds the maximum specified temperature, +150°C, it will reset and go into power down mode (except the thermal shutdown circuitry). The CT400 will remain in this state until the device cools down to +125°C at which time it will re-start.

Fault Interrupt (FLT)

The CT400 generates a digital fault signal via the FLT pin to interrupt the microcontroller to indicate a fault event has been triggered. A fault signal will interrupt the host system for these events:

- OFD
- TLD
- UVLO
- TSD

Immunity to Common Mode Fields

The CT400 is housed in a custom 16-lead SSOP package that utilizes a "U-shaped" lead-frame to reduce the common mode fields generated as current flows through the CCC. With the "U-shaped" lead-frame, the stray fields cancel one another thus reducing electro-magnetic interference (EMI).

Also, good PCB layout of the CT400 will optimize performance and reduce EMI. Please see the Applications Information section in this data sheet for recommendations on PCB layout.

Applications Information

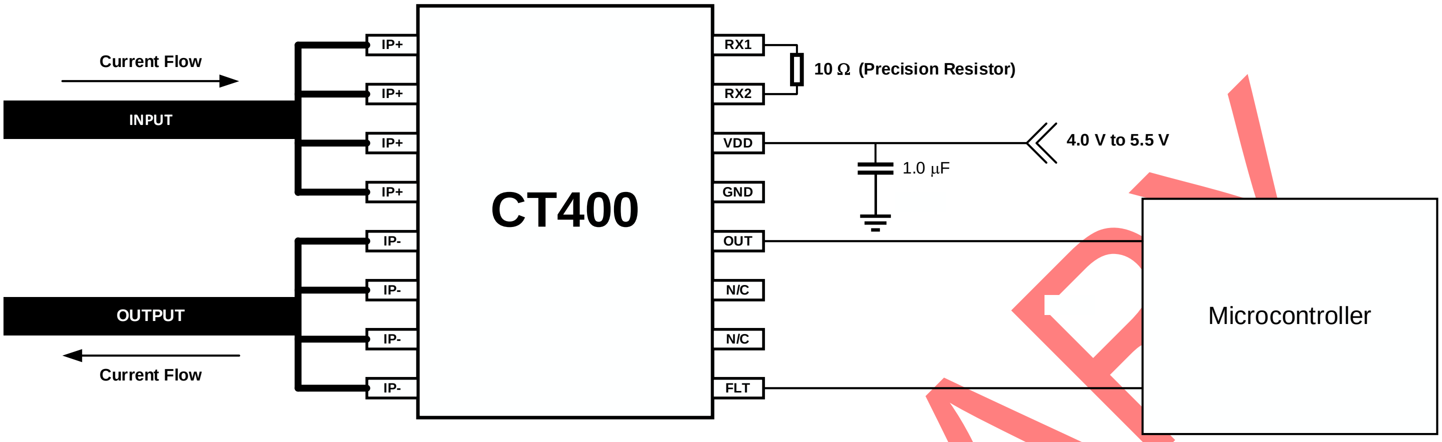

Figure 5. CT400 Application Block Diagram

Application

The CT400 is an integrated contact current sensor that can be used in many applications from measuring current in power supplies to motor control to over-current fault protection. It is a plug-and-play solution in that no calibration is required and it outputs to a microcontroller a simple linear analog output voltage which corresponds to a current measurement value. A second output called FLT alerts the host system to any fault event that may occur in the CT400. Figure 5 is an application diagram of how CT400 would be implemented in a system.

It is designed to support an operating voltage range of 4.0 V to 5.5V but it is ideal to use a 5.0 V power supply where the output tolerance is less than ±10%.

Sense Resistor

As described in the Circuit Description section, the CT400 uses an external sense resistor to measure the voltage generated by the MLU when current is flowing through the CCC. The recommended sense resistor value for the CT400 is 10 Ω for the four variants (to realize the maximum current range, I_{RANGE}) however depending upon design requirements, the current sensor can be scaled to support different current measurement ranges. The range of values for R_{SENSE} are 10 Ω to 50 Ω. The tolerance and temperature coefficient of the sense resistor should be less than ±1.0% and ±100 ppm/°C respectively.

To determine the resistor value for a current range measurement that is different from the maximum current range rating of the CT400, the equations below will be used for the calculation depending upon the device.

1. CT400-xSF10 can be scaled from 2 A to 10 A:

$$R_{SENSE} = \frac{100}{I_{RANGE}}$$

2. CT400-xSF50 can be scaled from 10 A to 50 A:

$$R_{SENSE} = \frac{500}{I_{RANGE}}$$

Recommended PCB Layout

Since the CT400 can measure up to 50 A of current, special care must be taken in the printed circuit board (PCB) layout of the CT400 and the surrounding circuitry. It is recommended that the CCC pins be connected to as much copper area as possible. It is also recommended that 2 oz. or heavier copper be used for PCB traces when the CT400 is used to measure 50 A of current. Additional layers of the PCB should also be used to carry current and be connected using the arrangement of vias. Figure 6 shows the recommended PCB layout for CT400 where the traces that are connected to IP+ and IP- pins are very wide with multiple vias. An example of the PCB layout for CT400 is shown in Figure 6.

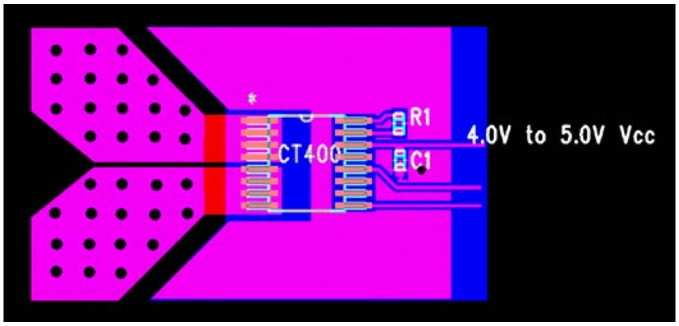

Figure 6. Recommended PCB Layout for CT400.

Package Drawing and Dimensions

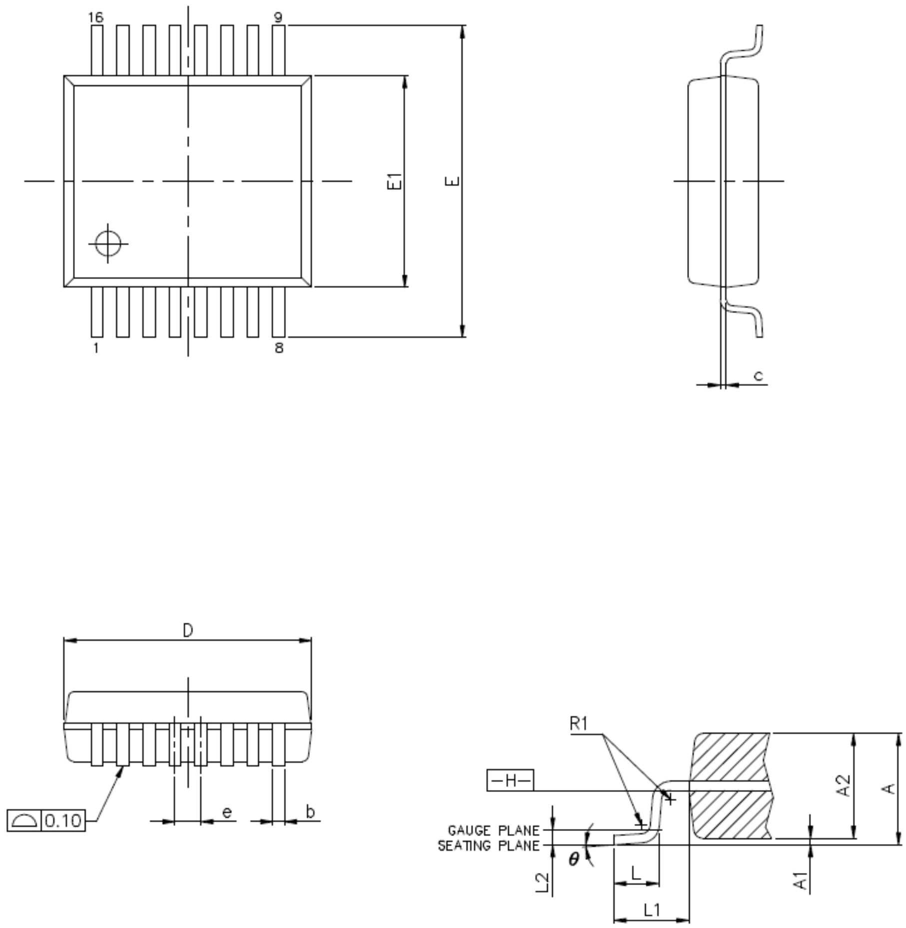

Figure 7. SSOP-16 Package Drawing

Table 3. CT400 SSOP-16 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
A	-	-	2.00
A1	0.05	-	-
A2	1.65	1.75	1.85
b	0.22	-	0.38
c	0.09	-	0.25
D	5.90	6.20	6.50
E	7.40	7.80	8.20
E1	5.00	5.30	5.60
e	0.65 REF		
L	0.55	0.75	0.95
L1	1.25 REF		
L2	0.25 BSC		
R1	0.09	-	-
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.

Package Information

Table 4. CT400 Package Information

Part Number	Package Type	# of Leads	Package Quantity	Lead Finish	Eco Plan (1)	MSL Rating (2)	Operating Temperature (3)	Device Marking
CT400-ESF10DR	SSOP	16	1,500	Sn	Green & RoHS	1	-40°C to +85°C	CT400 ESF10DR
CT400-HSF10DR	SSOP	16	1,500	Sn	Green & RoHS	1	-40°C to +125°C	CT400 HSF10DR
CT400-ESF10MR	SSOP	16	1,500	Sn	Green & RoHS	1	-40°C to +85°C	CT400 ESF10MR
CT400-HSF10MR	SSOP	16	1,500	Sn	Green & RoHS	1	-40°C to +125°C	CT400 HSF10MR
CT400-ESF50DR	SSOP	16	1,500	Sn	Green & RoHS	1	-40°C to +85°C	CT400 ESF50DR
CT400-HSF50DR	SSOP	16	1,500	Sn	Green & RoHS	1	-40°C to +125°C	CT400 HSF50DR
CT400-ESF50MR	SSOP	16	1,500	Sn	Green & RoHS	1	-40°C to +85°C	CT400 ESF50MR
CT400-HSF50MR	SSOP	16	1,500	Sn	Green & RoHS	1	-40°C to +125°C	CT400 HSF50MR

(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.

Device Marking

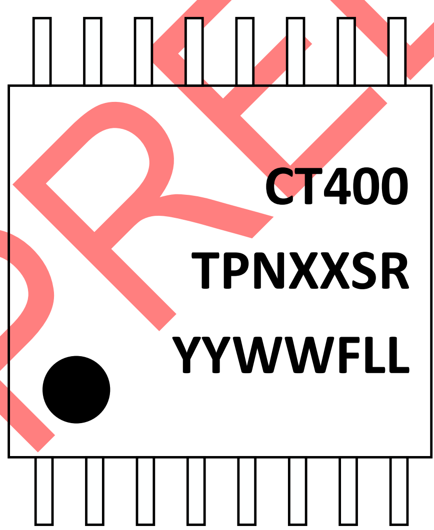

Figure 8. CT400 Device Marking

Row No.	Code	Definition
3	•	Pin 1 Indicator
1	CT400	Crocus Part Number
2	T	Temperature
2	PN	Package Type
2	XX	Maximum Current Rating
2	SR	Current Range
3	YY	Calendar Year
3	WW	Work Week
3	F	Factory Code
3	LL	Lot Code

Table 5. CT400 Device Marking Definition

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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.