



CT425

XtremeSense® TMR Ultra-Low Noise, <1% Total Error Current Sensor

Features

- Integrated Contact Current Sensing for Low to Medium Current Ranges:
 - 0 A to +20 A
 - -20 A to +20 A
 - 0 A to +30 A
 - -30 A to +30 A
- Integrated Current Carrying Conductor (CCC)
- Linear Analog Output Voltage
- Total Error Output $\leq \pm 1.0\%$ FS
- 1 MHz Bandwidth
- Response Time: $\sim 0.30 \mu\text{s}$
- Supply Voltage: 4.75 to 5.50 V
- Low Noise: 9 mARMS to 12 mARMS @ $f_{\text{BW}} = 100 \text{ kHz}$
- Filter Function to Reduce Noise on Output Pin
- Immunity to Common Mode Fields: $< 5.0 \text{ mA/mT}$
- 8-Lead SOIC Package

Applications

- Solar/Power Inverters
- UPS, SMPS and Telecom Power Supplies
- Battery Management Systems
- Motor Control
- White Goods
- Consumer and Enterprise Electronics
- Over-Current Fault Protection

Product Description

The CT425 is a high bandwidth and ultra-low noise integrated contact 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 four (4) current ranges where the integrated current carrying conductor (CCC) will handle up to 30 A of current and generates a current measurement as a linear analog output voltage. It achieves a total output error of less than $\pm 1.0\%$ full-scale (FS).

It has about a $0.30 \mu\text{s}$ output response time while the current consumption is about 6.0 mA and is immune to common mode fields. The CT425 has a filter function to reduce the noise on the output pin.

The CT425 is offered in an industry standard 8-lead SOIC package that is "green" and RoHS compliant.

Part Ordering Information

Part Number	Operating Temperature Range	Current Range	Package	Packing Method
CT425-ESN820DR	-40°C to +85°C	0 A to +20 A	8-lead SOIC 4.89 x 6.00 x 1.47 mm	Tape & Reel
CT425-HSN820DR	-40°C to +125°C			
CT425-ESN820MR	-40°C to +85°C	-20 A to +20 A		
CT425-HSN820MR	-40°C to +125°C			
CT425-ESN830DR	-40°C to +85°C	0 A to +30 A		
CT425-HSN830DR	-40°C to +125°C			
CT425-ESN830MR	-40°C to +85°C	-30 A to +30 A		
CT425-HSN830MR	-40°C to +125°C			

Evaluation Board Ordering Information

Part Number	Current Range	Operating Temperature Range
CTD425-20DC	0 A to +20 A	-40°C to +85°C
CTD425-20AC	-20 A to +20 A	
CTD425-30DC	0 A to +30 A	
CTD425-30AC	-30 A to +30 A	

Block Diagram

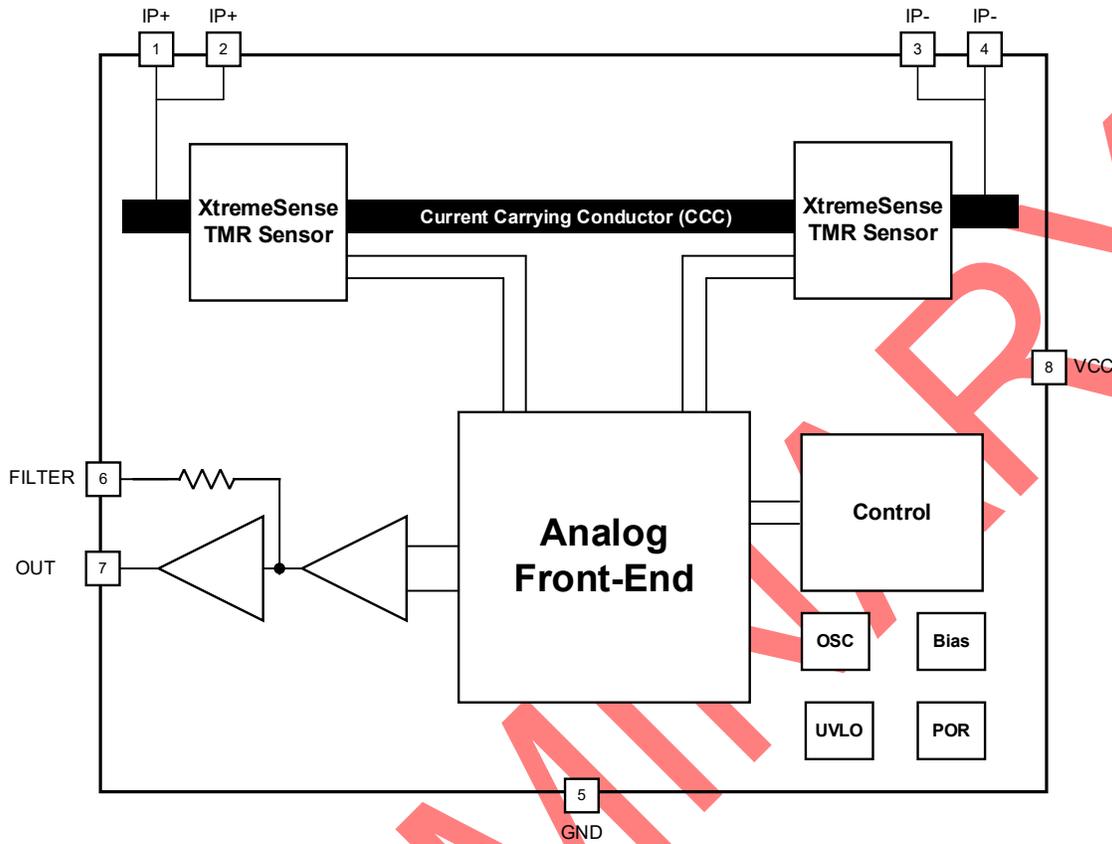


Figure 1. CT425 Functional Block Diagram for 8-lead SOIC Package

Application Diagram

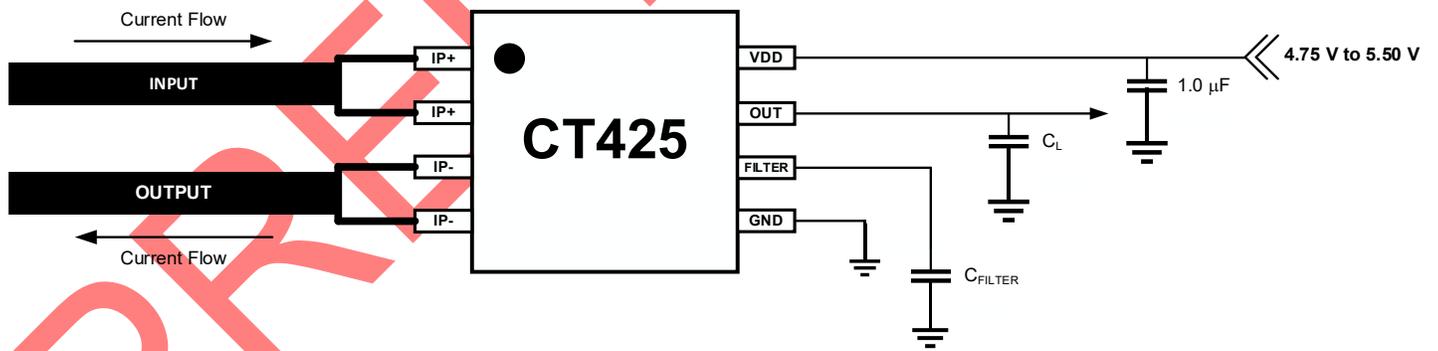


Figure 2. CT425 Application Block Diagram

Table 1. Recommended External Components

Component	Description	Vendor & Part Number	Parameter	Min.	Typ.	Max.	Unit
C _{BY}	1.0 μF, X5R or Better	Murata GRM155C81A105KA12	C		1.0		μF

CT425 Pin Configuration

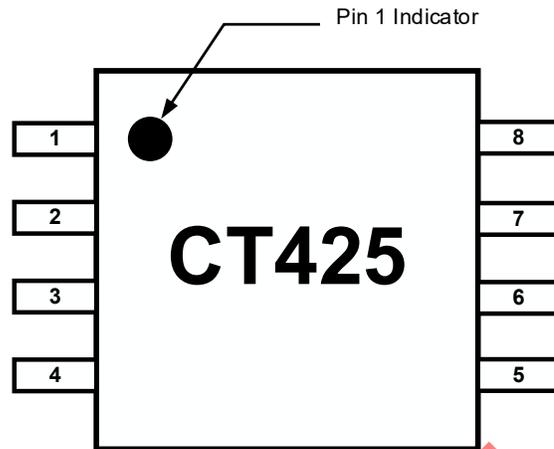


Figure 3. CT425 Pin-out Diagram for 8-lead SOIC Package (Top-Down View)

Pin Definition

Pin #	Pin Name	Pin Description
1	IP+	Input primary conductor (positive).
2		
3	IP-	Output primary conductor (negative).
4		
5	GND	Ground.
6	FILTER	Filter pin to improve noise performance by connecting an external capacitor to set the cut-off frequency.
7	OUT	Analog output voltage that represents the measured current.
8	VDD	Supply voltage.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the CT425 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
I _{CC(MAX)}	Current Carrying Conductor, T _A = +25°C		50	A
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 CT425. 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	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 not to exceed junction temperature T_{J(MAX)} at a given ambient temperature T_A.

Symbol	Parameter	Min.	Typ.	Max.	Unit
θ _{JA_SOIC}	Junction-to-Ambient Thermal Resistance, SOIC-8		151	176	°C/W
θ _{JC_SOIC}	Junction-to-Case Thermal Resistance, SOIC-8		102	128	°C/W

Isolation Specifications

Symbol	Parameter	Conditions	Rating	Unit
V _{ISO}	Rated Isolation Voltage	Agency Tested per IEC 62368* for 60 seconds. Production Tested at V _{ISO} for 1 second per IEC 62368.	3.0	kV _{RMS}
		Agency Tested per UL1577 for 60 seconds. Production Tested at V _{ISO} for 1 second per UL1577.	3.0	kV _{RMS}
V _{WORK_ISO}	Working Voltage for Basic Isolation	Tested per per IEC 62368*	991	V _{PK}
			701	V _{RMS}
V _{WORK_RI}	Working Voltage for Reinforced Isolation	Tested per IEC 62368*	487	V _{PK}
			344	V _{RMS}
d _{CR}	Creepage Distance	Minimum Distance Along Package Body from IP Pins to I/O Pins	4.96	mm
d _{CL}	Clearance Distance	Minimum Distance Through Air from IP Pins to I/O Pins	4.63	mm
d _{ISO}	Distance Through Isolation	Minimum Internal Distance Through Isolation	40	μm
CTI	Comparative Tracking Index	Material Group II	400 to 599	V

*IEC 62368 is the succeeding standard to IEC 60950-1 (Edition 2) for isolation testing specifications and as such it will be compliant to the latter standard.

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, I _P = 0 A		6.0	9.0	mA
I _{OUT}	OUT Maximum Drive Capability ⁽¹⁾	OUT covers 10% to 90% of V _{CC} span.	-1.0		+1.0	mA
C _{L_OUT}	OUT Capacitive Load ⁽¹⁾				100	pF
R _{L_OUT}	OUT Resistive Load ⁽¹⁾			100		kΩ
R _{FILTER}	Internal Filter Resistance ⁽¹⁾			15		kΩ
R _{IP}	Primary Conductor Resistance ⁽¹⁾			0.5		mΩ
Analog Output (OUT)						
V _{OUT}	OUT Voltage Linear Range	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
CMFR	Common Mode Field Rejection ⁽¹⁾			5.0		mA/mT

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
TCS	Temperature Coefficient of Sensitivity	Absolute Value $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$		10	40	ppm/ $^{\circ}\text{C}$
TCO	Temperature Coefficient of Offset ⁽¹⁾	Absolute Value $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$		0.16		% FS
Timings						
t_{ON}	Power-On Time ⁽¹⁾	$V_{\text{CC}} \geq 2.50 \text{ V}$		100	200	μs
t_{RISE}	Rise Time ⁽¹⁾	$I_P = I_{\text{RANGE(MAX)}}$, $T_A = +25^{\circ}\text{C}$, $C_L = 220 \text{ pF}$		0.20		μs
t_{RESPONSE}	Response Time ⁽¹⁾			0.30		μs
t_{DELAY}	Propagation Delay ⁽¹⁾			0.25		μs
Protection						
V_{UVLO}	Under-Voltage Lockout	Rising V_{CC}		2.50		V
		Falling V_{CC}		2.45		V
$V_{\text{UV_HYS}}$	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)

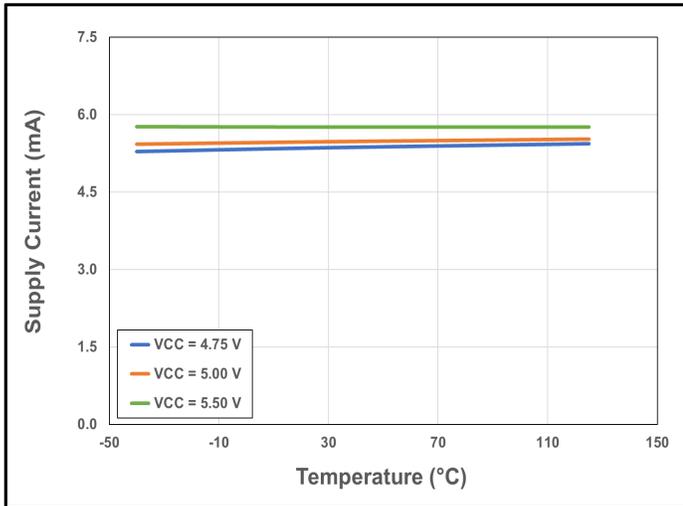


Figure 4. CT425 Supply Current vs. Temperature vs. Supply Voltage

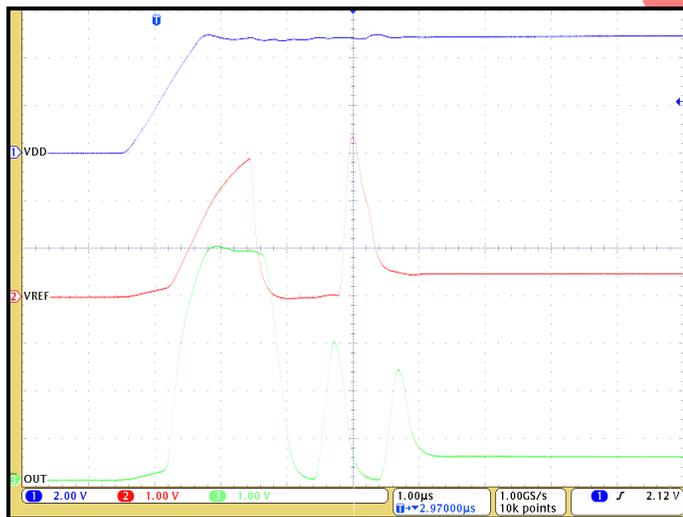


Figure 5. CT425 Startup Waveforms for V_{OQ} = 0.50 V (DC Current)

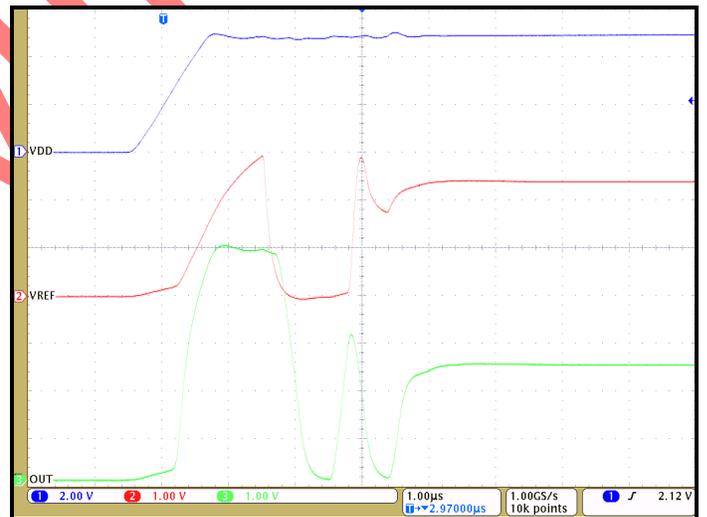


Figure 6. CT425 Startup Waveforms for V_{OQ} = 2.50 V (AC Current)

Electrical Characteristics (continued)

$V_{CC} = 5.00\text{ V}$ and $T_A = +25^\circ\text{C}$ and $C_{BYP} = 1.0\ \mu\text{F}$ (unless otherwise specified)

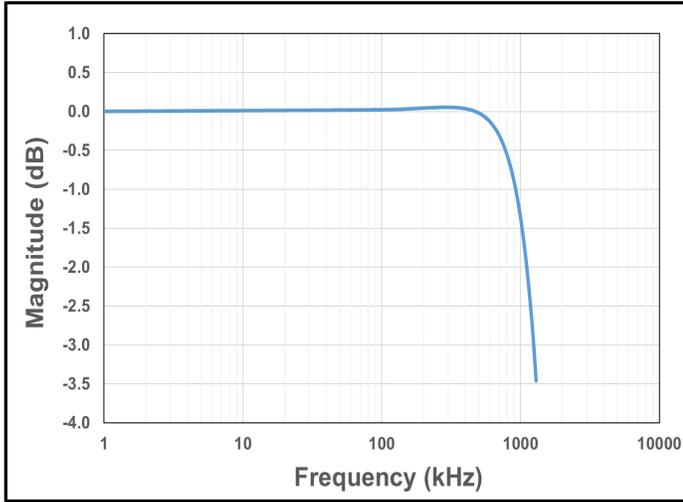


Figure 7. CT425 Bandwidth with $C_{FILTER} = 1.0\ \text{pF}$

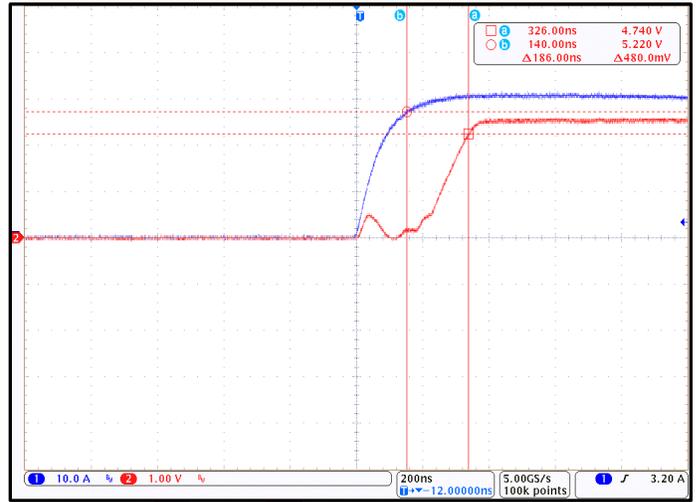


Figure 8. CT425 Response Time; $I_P = 30\ \text{A}_{PK}$ and $C_L = 220\ \text{pF}$ (Blue = I_{CC} , Red = V_{OUT})

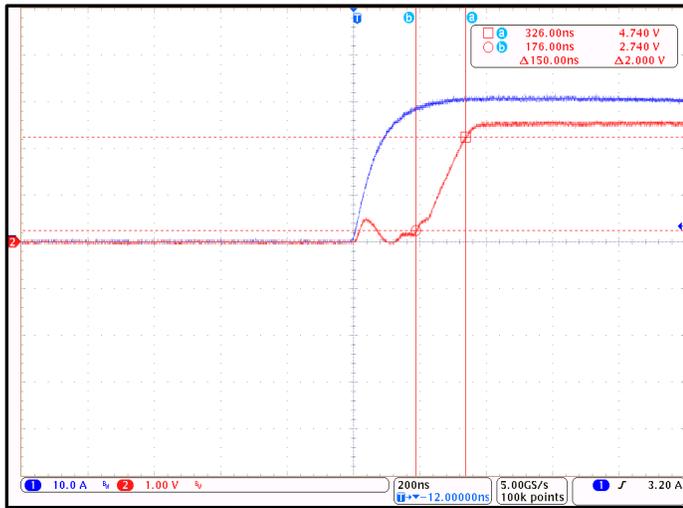


Figure 9. CT425 Rise Time; $I_P = 30\ \text{A}_{PK}$ and $C_L = 220\ \text{pF}$ (Blue = I_{CC} , Red = V_{OUT})

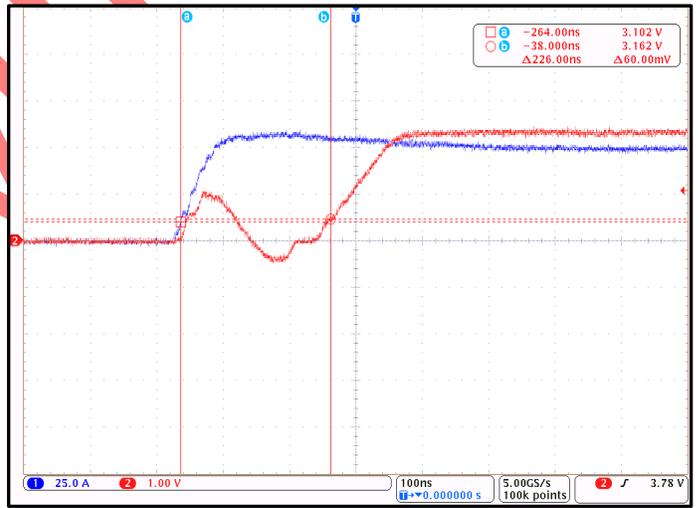


Figure 10. CT425 Propagation Delay; $I_P = 30\ \text{A}_{PK}$ and $C_L = 220\ \text{pF}$ (Blue = I_{CC} , Red = V_{OUT})

CT425-xSN820DR: 0 A to +20 A

Unless otherwise specified: $V_{CC} = 4.75\text{ V to }5.50\text{ V}$, $T_A = -40^\circ\text{C to }+125^\circ\text{C}$, $C_{BYP} = 1.0\ \mu\text{F}$. Typical values are $V_{CC} = 5.00\text{ V}$ and $T_A = +25^\circ\text{C}$.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{RANGE}	Current Range		0		+20	A
V_{OQ}	Voltage Output Quiescent	$T_A = +25^\circ\text{C}$, $I_P = 0\text{ A}$	0.495	0.500	0.505	V
S	Sensitivity	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$		200		mV/A
E_{OUT}	Total Output Error	$I_P = I_{P(MAX)}$		± 1.0		% FS
E_{LIN}	Non-Linearity Error	$I_P = 0\text{ A to }+20\text{ A}$		± 0.3		% FS
f_{BW}	Bandwidth ⁽¹⁾	Small Signal = -3 dB		1.0		MHz
e_N	Noise ⁽¹⁾	$T_A = +25^\circ\text{C}$, $f_{BW} = 100\text{ kHz}$		9		mA _{RMS}
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift ⁽¹⁾	$I_P = I_{P(MAX)}$		± 1.0		% FS

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

Electrical Characteristics for CT425-xSN820DR

$V_{CC} = 5.00\text{ V}$ and $T_A = +25^\circ\text{C}$ and $C_{BYP} = 1.0\ \mu\text{F}$ (unless otherwise specified)

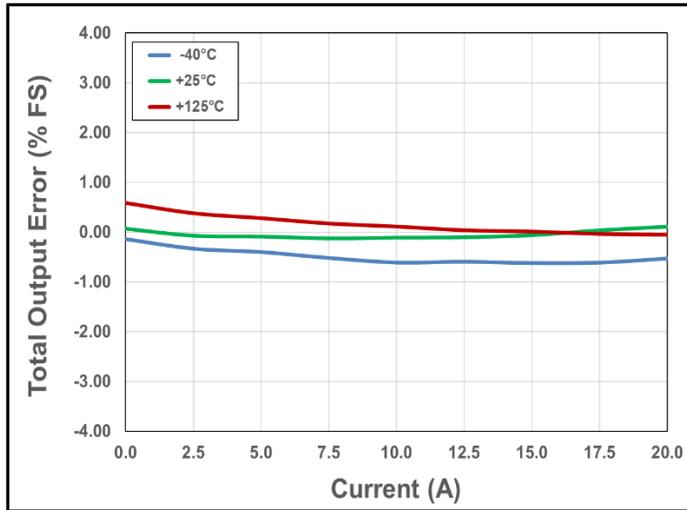


Figure 11. Total Output Error vs. Current vs. Temperature

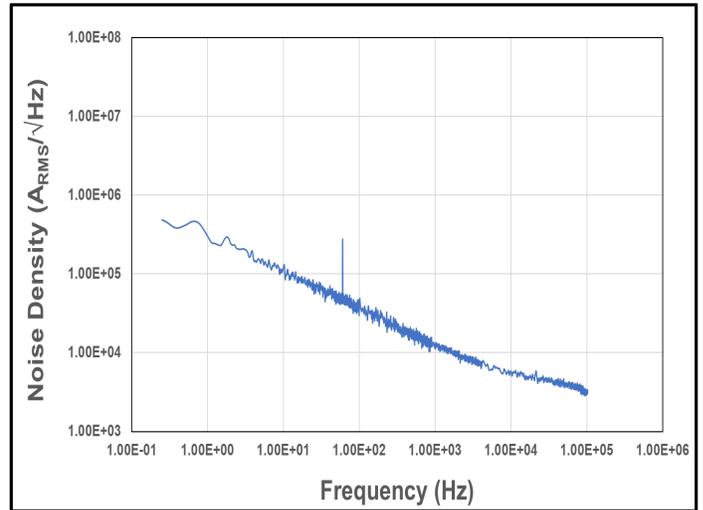


Figure 12. Noise Density vs. Frequency

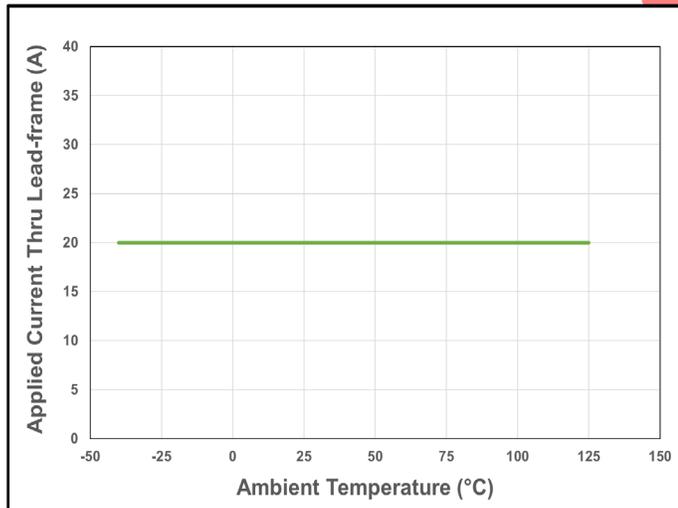


Figure 13. CT425 Current De-rating Curve for 20 A_{DC}

CT425-xSN820MR: -20 A to +20 A

Unless otherwise specified: $V_{CC} = 4.75\text{ V to }5.50\text{ V}$, $T_A = -40^\circ\text{C to }+125^\circ\text{C}$, $C_{BYP} = 1.0\ \mu\text{F}$. Typical values are $V_{CC} = 5.00\text{ V}$ and $T_A = +25^\circ\text{C}$.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{RANGE}	Current Range		-20		+20	A
V_{OQ}	Voltage Output Quiescent	$T_A = +25^\circ\text{C}$, $I_P = 0\text{ A}$	2.495	2.500	2.505	V
S	Sensitivity	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$		100		mV/A
E_{OUT}	Total Output Error	$I_P = I_{P(MAX)}$		± 1.0		% FS
E_{LIN}	Non-Linearity Error	$I_P = -20\text{ A to }+20\text{ A}$		± 0.3		% FS
f_{BW}	Bandwidth ⁽¹⁾	Small Signal = -3 dB		1.0		MHz
e_N	Noise ⁽¹⁾	$T_A = +25^\circ\text{C}$, $f_{BW} = 100\text{ kHz}$		10		mA _{RMS}
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift ⁽¹⁾	$I_P = I_{P(MAX)}$		± 1.0		% FS

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

Electrical Characteristics for CT425-xSN820MR

$V_{CC} = 5.00\text{ V}$ and $T_A = +25^\circ\text{C}$ and $C_{BYP} = 1.0\ \mu\text{F}$ (unless otherwise specified)

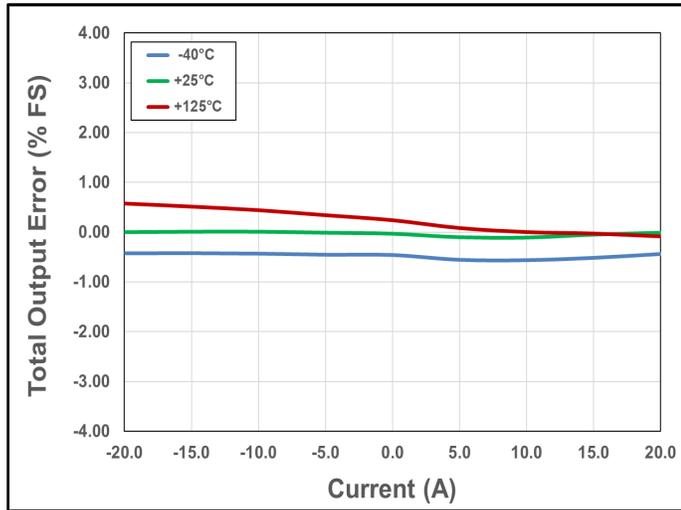


Figure 14. Total Output Error vs. Current vs. Temperature

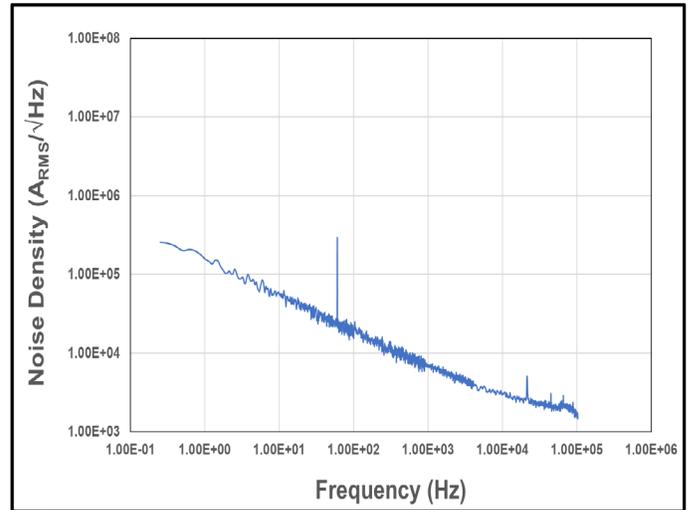


Figure 15. Noise Density vs. Frequency

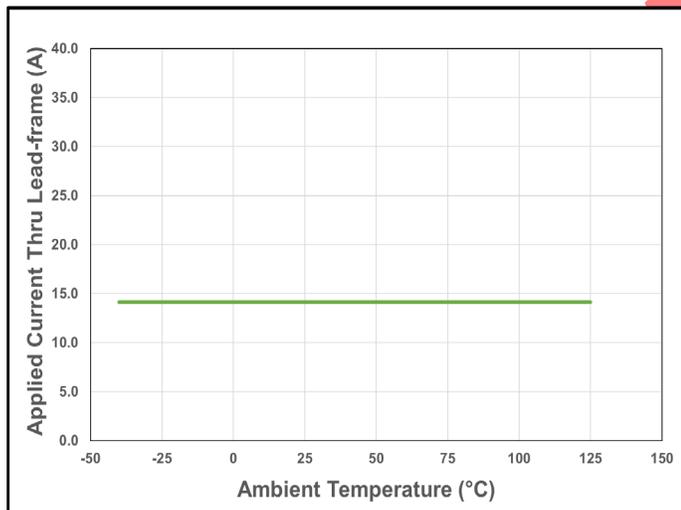


Figure 16. CT425 Current De-rating Curve for 20 A_{PK} (14.1 A_{DC})

CT425-xSN830DR: 0 A to +30 A

Unless otherwise specified: $V_{CC} = 4.75\text{ V to }5.50\text{ V}$, $T_A = -40^\circ\text{C to }+125^\circ\text{C}$, $C_{BYP} = 1.0\ \mu\text{F}$. Typical values are $V_{CC} = 5.00\text{ V}$ and $T_A = +25^\circ\text{C}$.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{RANGE}	Current Range		0		+30	A
V_{OQ}	Voltage Output Quiescent	$T_A = +25^\circ\text{C}$, $I_P = 0\text{ A}$	0.495	0.500	0.505	V
S	Sensitivity	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$		133		mV/A
E_{OUT}	Total Output Error	$I_P = I_{P(MAX)}$		± 1.0		% FS
E_{LIN}	Non-Linearity Error	$I_P = 0\text{ A to }+30\text{ A}$		± 0.3		% FS
f_{BW}	Bandwidth ⁽¹⁾	Small Signal = -3 dB		1.0		MHz
e_N	Noise ⁽¹⁾	$T_A = +25^\circ\text{C}$, $f_{BW} = 100\text{ kHz}$		10		mA _{RMS}
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift ⁽¹⁾	$I_P = I_{P(MAX)}$		± 1.0		% FS

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

Electrical Characteristics for CT425-xSN830DR

$V_{CC} = 5.00\text{ V}$ and $T_A = +25^\circ\text{C}$ and $C_{BYP} = 1.0\ \mu\text{F}$ (unless otherwise specified)

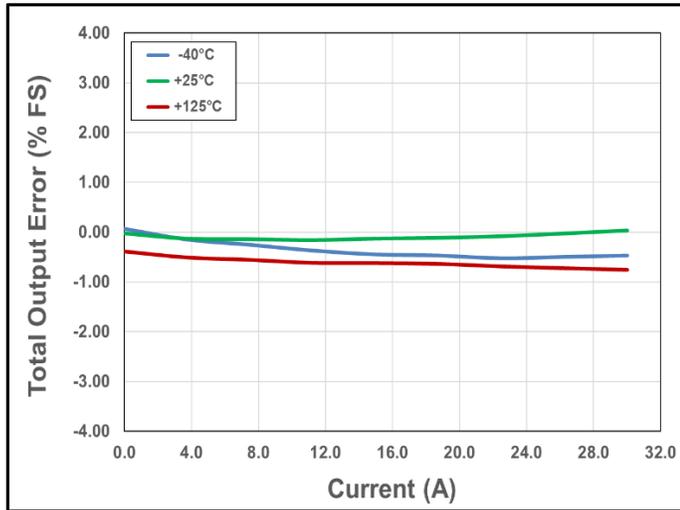


Figure 17. Total Output Error vs. Current vs. Temperature

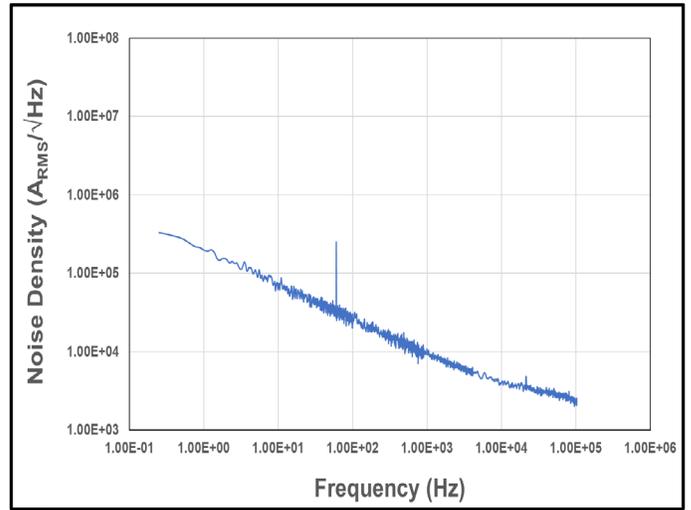


Figure 18. Noise Density vs. Frequency

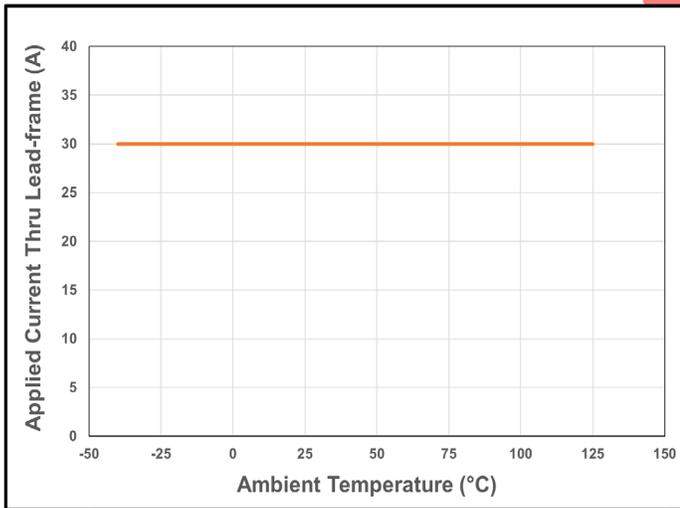


Figure 19. CT425 Current De-rating Curve for 30 A_{DC}

CT425-xSN830MR: -30 A to +30 A

Unless otherwise specified: $V_{CC} = 4.75\text{ V to }5.50\text{ V}$, $T_A = -40^\circ\text{C to }+125^\circ\text{C}$, $C_{BYP} = 1.0\ \mu\text{F}$. Typical values are $V_{CC} = 5.00\text{ V}$ and $T_A = +25^\circ\text{C}$.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{RANGE}	Current Range		-30		+30	A
V_{OQ}	Voltage Output Quiescent	$T_A = +25^\circ\text{C}$, $I_P = 0\text{ A}$	2.495	2.500	2.505	V
S	Sensitivity	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$		67		mV/A
E_{OUT}	Total Output Error	$I_P = I_{P(MAX)}$		± 1.0		% FS
E_{LIN}	Non-Linearity Error	$I_P = -30\text{ A to }+30\text{ A}$		± 0.3		% FS
f_{BW}	Bandwidth ⁽¹⁾	Small Signal = -3 dB		1.0		MHz
e_N	Noise ⁽¹⁾	$T_A = +25^\circ\text{C}$, $f_{BW} = 100\text{ kHz}$		12		mA _{RMS}
Lifetime Drift						
E_{TOT_DRIFT}	Total Output Error Lifetime Drift ⁽¹⁾	$I_P = I_{P(MAX)}$		± 1.0		% FS

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

Electrical Characteristics for CT425-xSN830MR

$V_{CC} = 5.00\text{ V}$ and $T_A = +25^\circ\text{C}$ and $C_{BYP} = 1.0\ \mu\text{F}$ (unless otherwise specified)

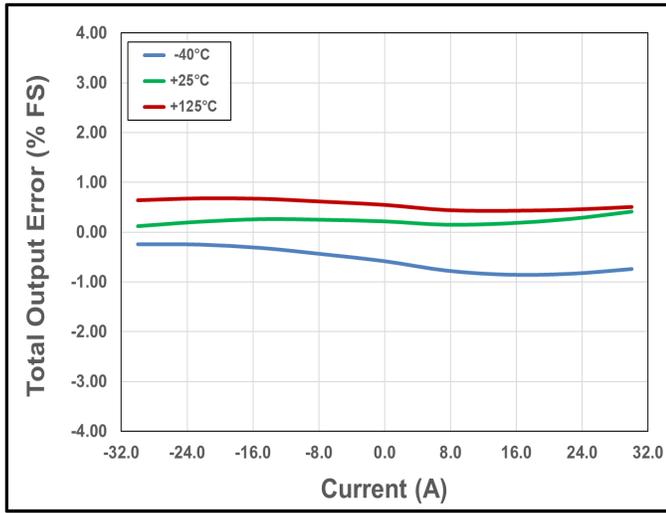


Figure 20. Total Output Error vs. Current vs. Temperature

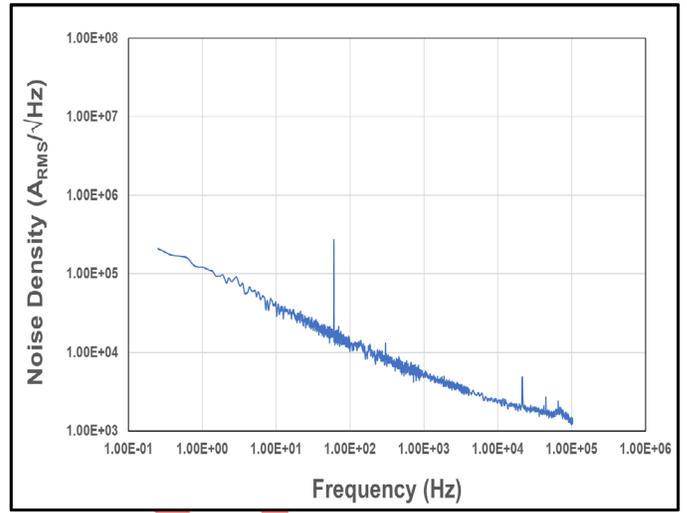


Figure 21. Noise Density vs. Frequency

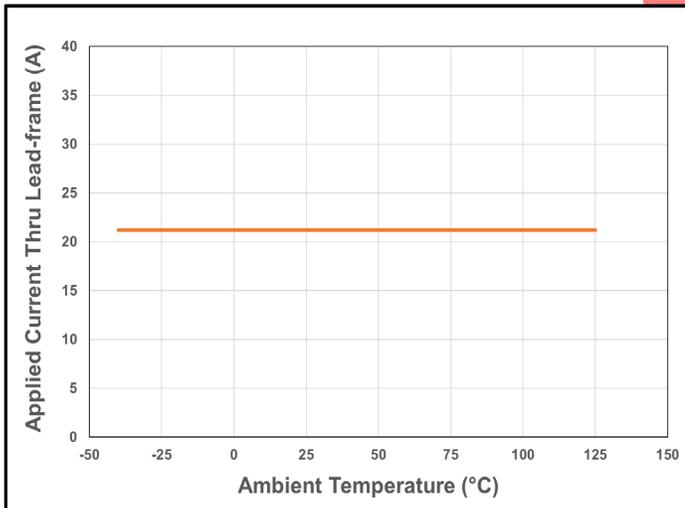


Figure 22. CT425 Current De-rating Curve for 30 A_{PK} (21.2 A_{DC})

Circuit Description

Overview

The CT425 is a very high accuracy contact current sensor with an integrated current carrying conductor (CCC) that handles up to 30 A. It has very high sensitivity and a wide dynamic range with excellent accuracy (very low total output error) across temperature. This current sensor supports four (4) current ranges:

- 0 A to +20 A
- -20 A to +20 A
- 0 A to +30 A
- -30 A to +30 A

When current is flowing through the CCC, the XtemeSense TMR sensors inside the chip senses the field which in turn generates a differential voltage signals that then goes through the Analog Front-End (AFE) to output a current measurement with less than $\pm 1.0\%$ full-scale (FS) total output error (E_{OUT}).

The chip is designed to enable a very fast response time of $0.35 \mu\text{s}$ for the current measurement from the OUT pin as the bandwidth for the CT425 is 1.0 MHz. Even with a high bandwidth, the chip consumes a minimal amount of power.

Linear Output Current Measurement

The CT425 provides a continuous linear analog output voltage which represents the current measurement. 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 currents, respectively. Figure 23 illustrates the output voltage range of the OUT pin as a function of the measured current.

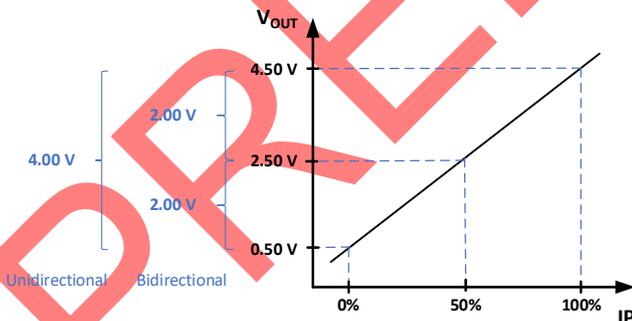


Figure 23. Linear Output Voltage Range (OUT) vs. Measured Current (IP)

Filter Function (FILTER)

The CT425 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 CT425 is 1.0 MHz however by adding a capacitor to the FILTER pin which will be in series with an internal resistance of approximately $15 \text{ k}\Omega$ will set the cut-off frequency to reduce the noise.

Table 2 shows the capacitor values required to achieve four (4) cut-off frequencies.

$$f_{cut-off} = \frac{1}{2\pi RC}$$

Table 2. R-C Filter Options for FILTER Pin

Cut-off Frequency	C_{FILTER} (pF)	Capacitor Part Number
100 kHz	47	GRM0225C1C470JA02
250 kHz	20	GRM0225C1C200JA02
500 kHz	10	GRM0225C1C100JA03
1.0 MHz	5 or lower	GRM0225C1C5R0CA03

Sensitivity

The Sensitivity (S) is a change in CT425'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 $1.0 \text{ G} = 0.1 \text{ mT}$) and the chip's linear amplifier gain (mV/G). Therefore, the result of this gives a sensitivity unit of mV/A. The CT425 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 CT425 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 following equation defines the Total Output Error (E_{OUT}) for the CT425:

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

The E_{OUT} incorporates all sources of error and is a function of the sensed current (I_P) from CT425. 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 24 shows the behavior of E_{OUT} versus I_P . When I_P goes to 0 from both directions, the curves exhibit asymptotic behavior i.e. E_{OUT} approaches infinity.

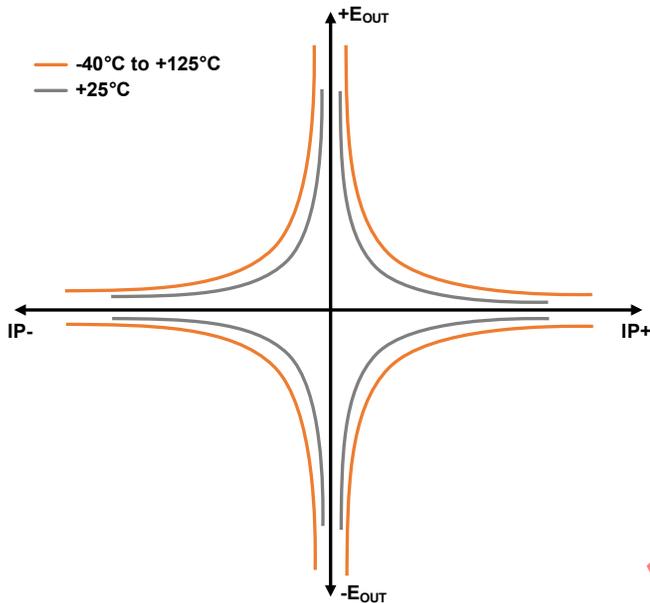


Figure 24. Total Output Error (E_{OUT}) vs. Sensed Current (I_P)

The CT425 achieves a total output error (E_{OUT}) that is less than $\pm 1.0\%$ 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 current measurements regardless of the operating conditions.

Power-On Time (t_{ON})

The Power-On Time (t_{ON}) of $100 \mu s$ is the amount of time required by CT425 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 has reached the minimum V_{CC} .

Response Time ($t_{RESPONSE}$)

The Response Time ($t_{RESPONSE}$) of $0.30 \mu s$ for the CT425 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.

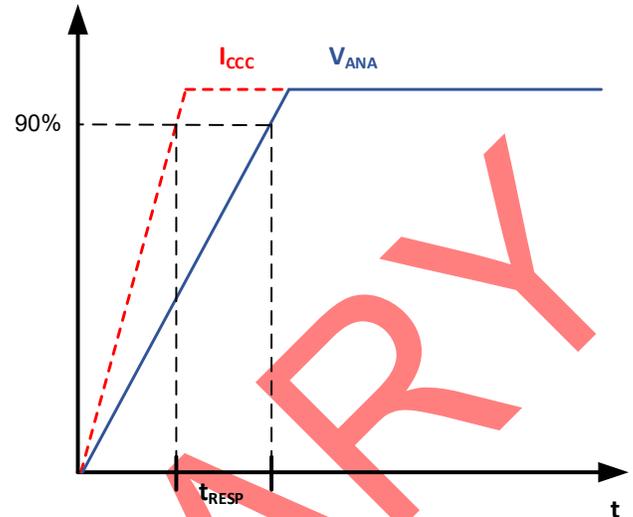


Figure 25. CT425 Response Time Curve

Rise Time (t_{RISE})

The CT425'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 CT425 is $0.20 \mu s$.

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.

The CT425 has a propagation delay of $0.25 \mu s$.

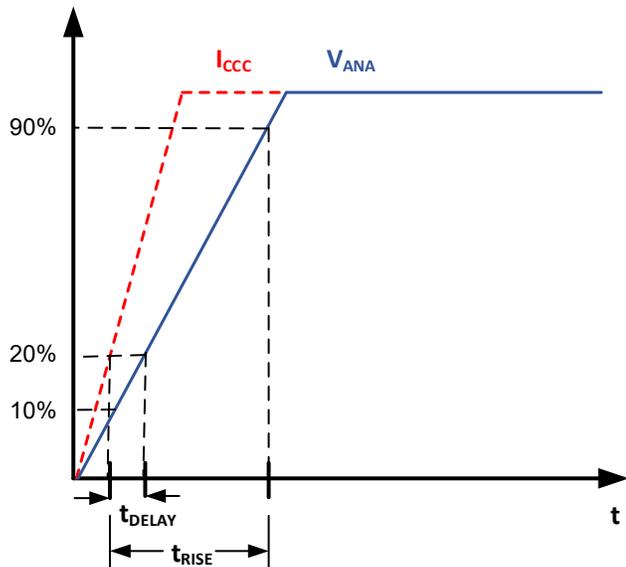


Figure 26. CT425 Propagation Delay and Rise Time Curve

Under-Voltage Lockout (UVLO)

The Under-Voltage Lock-out protection circuitry of the CT425 is activated when the supply voltage (V_{CC}) falls below 2.45 V. The CT425 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 CT425 is not valid and the \overline{FLT} pin will go LOW. Once the V_{CC} rises above 2.50 V then the UVLO is cleared and the \overline{FLT} pin will be HIGH.

Immunity to Common Mode Fields

The CT425 is housed in custom plastic packages that utilize 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 CT425 will optimize performance and reduce EMI. Please see the Applications Information section in this data sheet for recommendations on PCB layout.

Creepage and Clearance

Two important terms as it relates to isolation provided by the package are: creepage and clearance. Creepage is defined as the shortest distance across the surface of the package from one side the leads to the other side of the leads. The definition for clearance is the shortest distance between the leads of opposite side through the air. Figure

27 illustrates the creepage and clearance for the SOIC-8 package of the CT425.

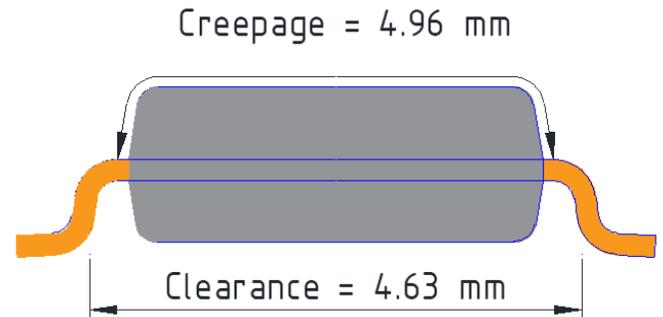


Figure 27. The Creepage and Clearance for the CT425's SOIC-8 package

Applications Information

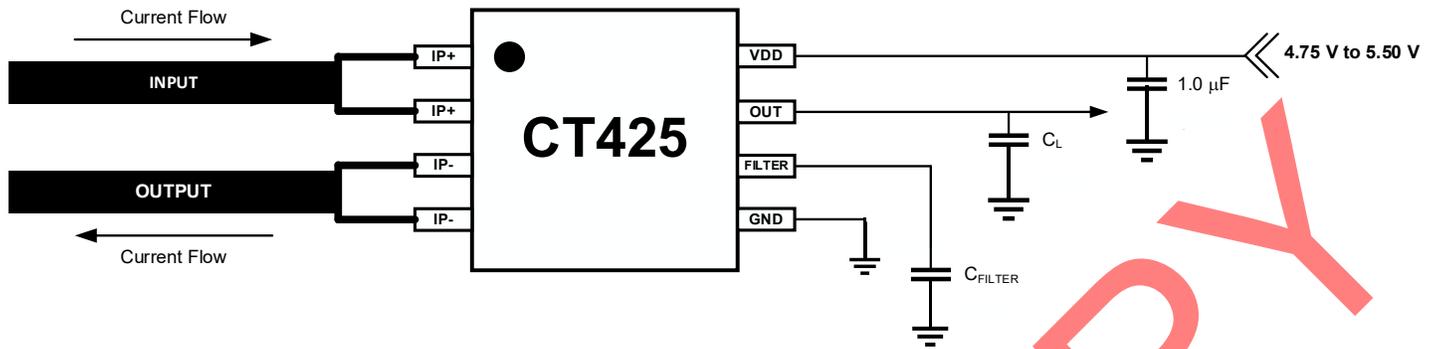


Figure 28. CT425 Application Block Diagram

Application

The CT425 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.

It is designed to support an operating voltage range of 4.75 V to 5.50 V, but it is ideal to use a 5.0 V power supply where the output tolerance is less than $\pm 5\%$.

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 CT425 to minimize inductance and resistance between the two devices.

Filter Capacitor

A capacitor may be added to the FILTER pin of the CT425 if there is a requirement to improve the noise performance. The capacitor will be connected to an internal resistor of 15 k Ω inside the chip to form a R-C filter. This R-C filter produces a cut-off frequency that will reduce the noise over this lower bandwidth.

Recommended PCB Layout

Since the CT425 can measure up to 30 A of current, special care must be taken in the printed circuit board (PCB) layout of the CT425 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 CT425 is used to measure 30 A of current. Additional layers of the PCB should also be used to carry current and be connected using the arrangement of vias.

SOIC-8 Package Drawing and Dimensions

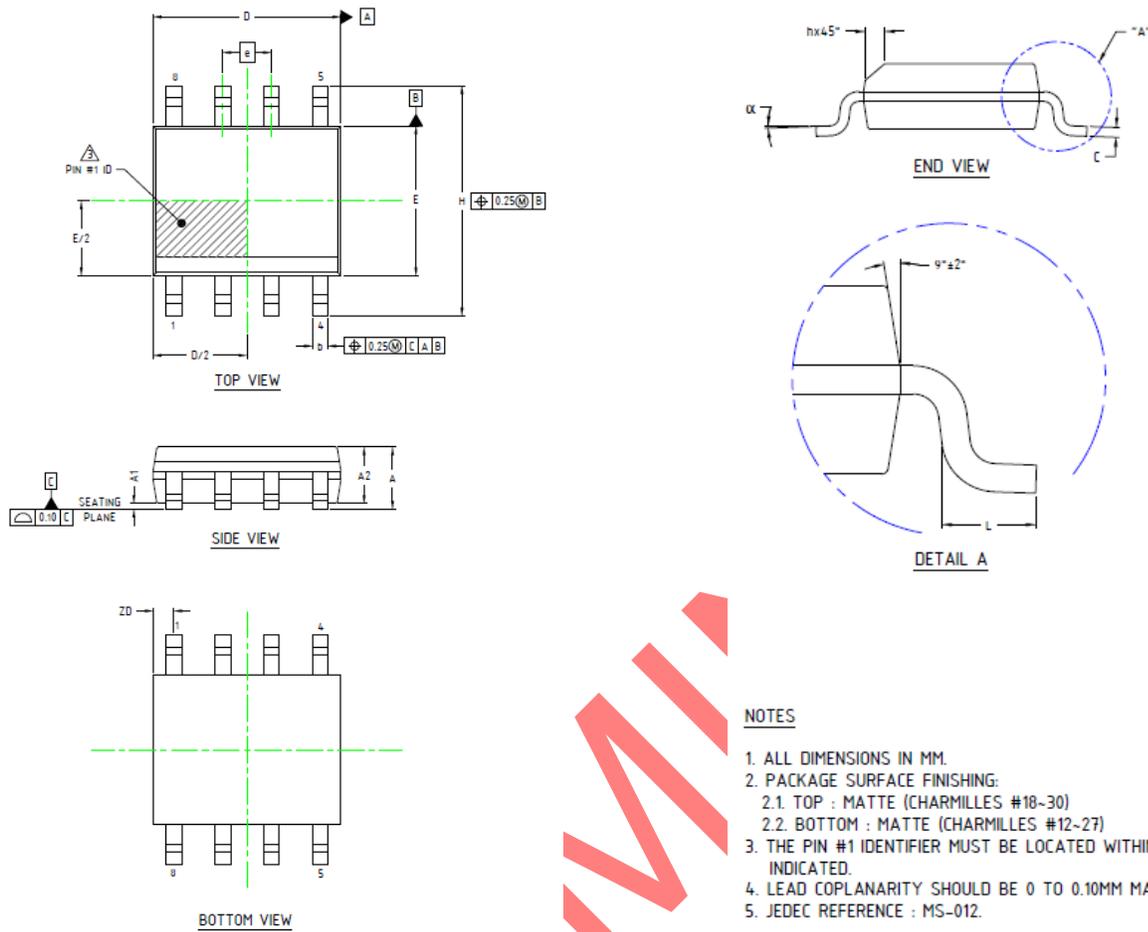


Figure 29. SOIC-8 Package Drawing

Table 3. CT425 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

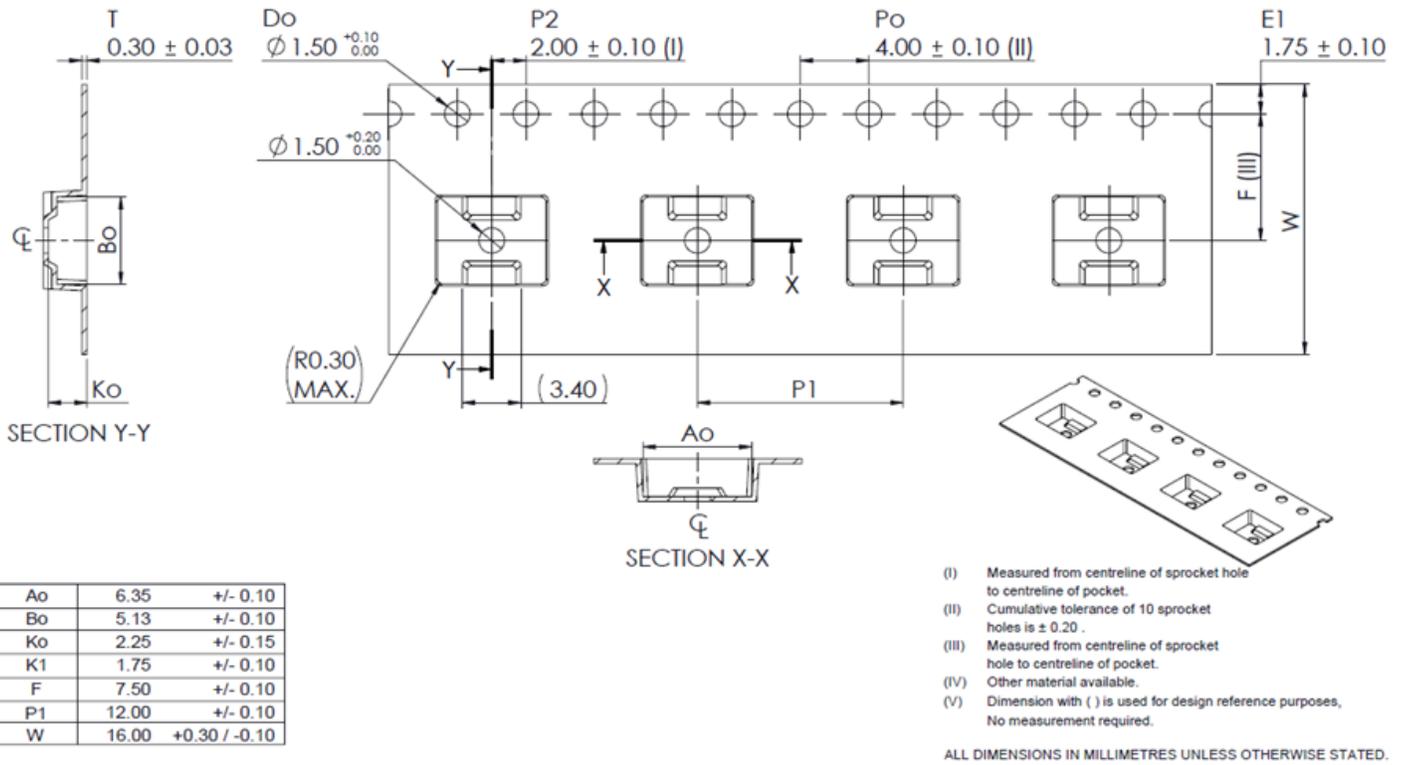


Figure 30. SOIC-8 Package Drawing

Package Information

Table 4. CT425 Package Information

Part Number	Package Type	# of Leads	Quantity per Reel	Lead Finish	MSL Rating ⁽²⁾	Operating Temperature ⁽³⁾	Device Marking ⁽⁴⁾
CT425-ESN820DR	SOIC	8	2,000	Sn	3	-40°C to +85°C	CT425 S820DR YYWWLL
CT425-HSN820DR	SOIC	8	2,000	Sn	3	-40°C to +125°C	CT425 S820DR YYWWLL
CT425-ESN820MR	SOIC	8	2,000	Sn	3	-40°C to +85°C	CT425 S820MR YYWWLL
CT425-HSN820MR	SOIC	8	2,000	Sn	3	-40°C to +125°C	CT425 S820MR YYWWLL
CT425-ESN830DR	SOIC	8	2,000	Sn	3	-40°C to +85°C	CT425 S830DR YYWWLL
CT425-HSN830DR	SOIC	8	2,000	Sn	3	-40°C to +125°C	CT425 S830DR YYWWLL
CT425-ESN830MR	SOIC	8	2,000	Sn	3	-40°C to +85°C	CT425 S830MR YYWWLL
CT425-HSN830MR	SOIC	8	2,000	Sn	3	-40°C to +125°C	CT425 S830MR 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 $\leq 1,000$ 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 +125°C and storage temperature range of -65°C to +150°C.
- (4) Device Marking for CT425 is defined as CT425 S8xxZR YYWWLL where the first 2 lines = part number, YY = year, WW = work week and LL = lot code.

Device Marking

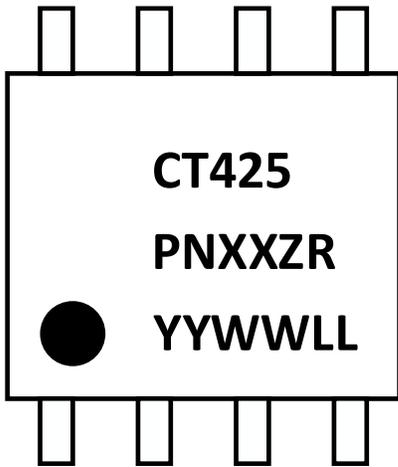
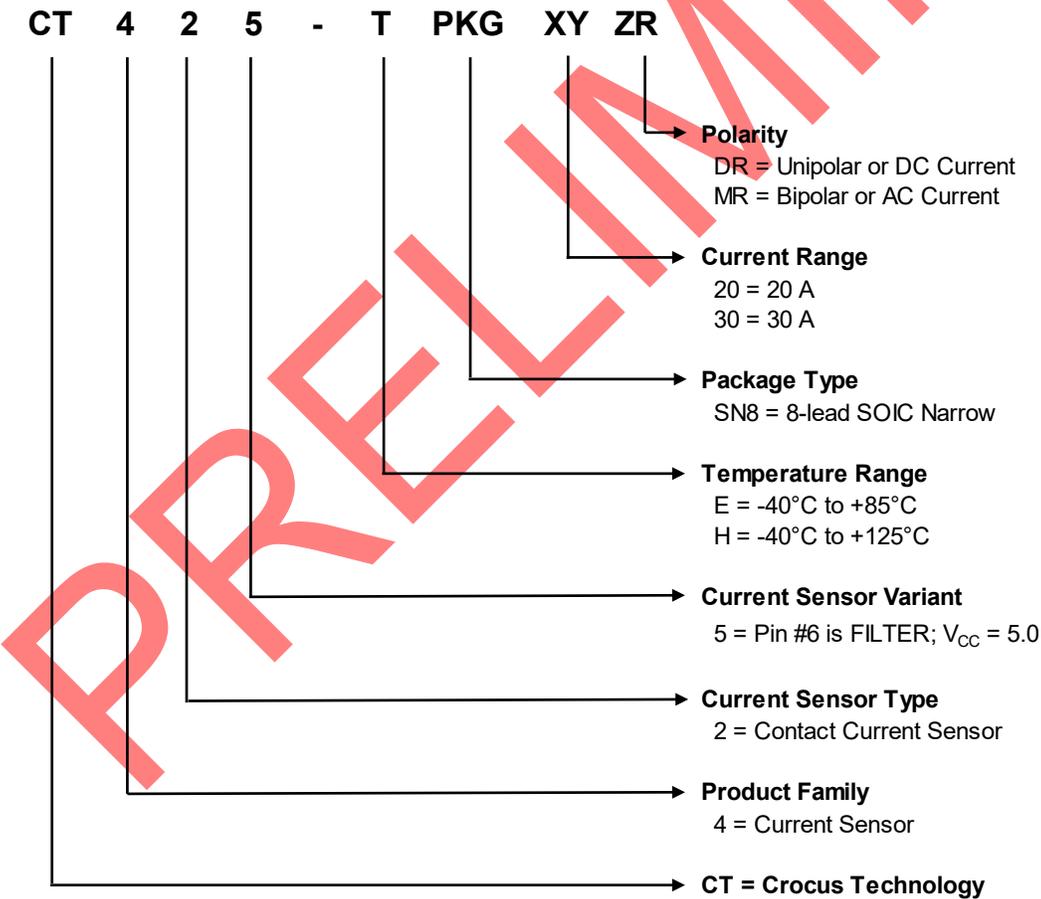


Figure 31. CT425 Device Marking for 8-lead Package

Row No.	Code	Definition
3	•	Pin 1 Indicator
1	CT425	Crocus Part Number
2	P	Package Type
2	N	Number of Pins
2	XX	Maximum Current Rating
2	ZR	Current Range
3	YY	Calendar Year
3	WW	Work Week
3	LL	Lot Code

Table 5. CT425 Device Marking Definition for 8-lead SOIC Package

Part Ordering Number Legend



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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.