

## XtremeSense™ TMR Current Sensor with Ultra-Low Noise and <0.7% Total Error

### FEATURES AND BENEFITS

- Integrated contact current sensing for low to medium current ranges:
  - 0 to 20 A            □ 0 to 50 A
  - ±20 A              □ ±50 A
  - 0 to 30 A           □ 0 to 65 A
  - ±30 A              □ ±65 A
- Integrated current carrying conductor (CCC)
- Linear analog output voltage
- Total error output  $\leq \pm 1.0\%$  FS,  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- 1 MHz bandwidth
- Response time:  $\sim 300$  ns
- UL/IEC 62368-1 and UL1577 certification
  - Rated isolation voltage:  $5\text{ kV}_{\text{RMS}}$
  - Working voltage for basic isolation:  $1287\text{ V}_{\text{RMS}}$
  - Working voltage for reinforced isolation:  $647\text{ V}_{\text{RMS}}$
- IEC 61000-4-5 certified
- Low noise:  $9$  to  $15\text{ mA}_{\text{RMS}}$  @  $f_{\text{BW}} = 100\text{ kHz}$
- Reference voltage output for AC/DC current measurements
- $V_{\text{OUT}} - V_{\text{REF}} < \pm 1.0\%$  FS,  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- Immunity to common mode fields:  $-54\text{ dB}$
- Supply voltage:  $4.75$  to  $5.50\text{ V}$
- Overcurrent detection
  - Out of range currents
- AEC-Q100 grade 1

### PACKAGE:

Not to scale



16-lead SOICW

### DESCRIPTION

The CT430 is a high bandwidth and ultra-low noise integrated contact current sensor that uses Allegro patented XtremeSense™ TMR technology to enable high accuracy current measurements for many consumer, enterprise, and industrial applications. The device supports eight current ranges where the integrated current carrying conductor (CCC) will handle up to 65 A of current and generates a current measurement as a linear analog output voltage. The device achieves a total output error of less than  $\pm 1.0\%$  full-scale (FS) over voltage and the full temperature range.

The device has a  $\sim 300$  ns output response time while the current consumption is  $\sim 6.0$  mA and is immune to common mode fields. The CT430 has an integrated overcurrent detection (OCD) circuitry to identify out of range currents (OCD) with the result output to the fault-bar ( $\overline{\text{FLT}}$ ) pin. The  $\overline{\text{FLT}}$  is an open drain, active low digital signal that is activated by the CT430 to alert the microcontroller that a fault condition has occurred.

The CT430 is offered in an industry-standard 16-lead SOIC wide package that is green and RoHS compliant.

### APPLICATIONS

- Solar/power inverters
- UPS, SMPS, and telecom power supplies
- Battery management systems
- Motor control
- White goods
- Power utility meter
- Overcurrent fault protection



TÜV Certificate No.:  
R 72226133 0001



UL Certificate No.:  
UL-CA-2201235-0

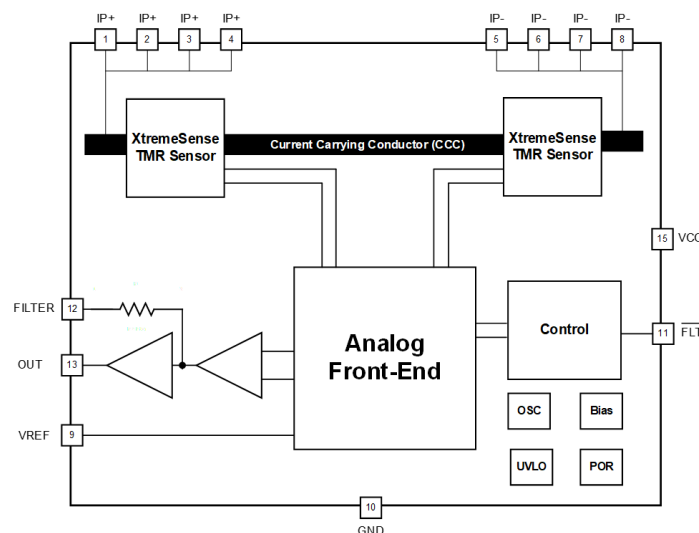


Figure 1: CT430 Functional Block Diagram for 16-lead SOICW Package

# CT430

# XtremeSense™ TMR Current Sensor with Ultra-Low Noise and <0.7% Total Error

## SELECTION GUIDE

Part Number	Current Range (I <sub>PMAX</sub> ) (A)	Sensitivity (mV/A)	Operating Temperature Range (°C)	Package	Packing
CT430-HSWF20MR	±20	100	-40 to 125	16-lead SOICW 10.21 mm × 10.31 mm × 2.54 mm	Tape and Reel
CT430-HSWF30MR	±30	66.7			
CT430-HSWF50MR	±50	40			
CT430-HSWF65MR	±65	30.8			
CT430-HSWF20DR	20	200			
CT430-HSWF30DR	30	133.3			
CT430-HSWF50DR	50	80			
CT430-HSWF65DR	65	61.5			
<b>AEC-Q100 GRADE 1</b>					
CT430-ASWF20MR	±20	100	Grade 1 -40 to 125	16-lead SOICW 10.21 mm × 10.31 mm × 2.54 mm	Tape and Reel
CT430-ASWF30MR	±30	66.7			
CT430-ASWF50MR	±50	40			
CT430-ASWF65MR	±65	30.8			
CT430-ASWF20DR	20	200			
CT430-ASWF30DR	30	133.3			
CT430-ASWF50DR	50	80			
CT430-ASWF65DR	65	61.5			

## EVALUATION BOARD SELECTION GUIDE

Part Number	Current Range (A)	Operating Temperature Range (°C)
CTD430-20DC	0 to 20	-40 to 125
CTD430-20AC	±20	
CTD430-30DC	0 to 30	
CTD430-30AC	±30	
CTD430-50DC	0 to 50	
CTD430-50AC	±50	
CTD430-65DC	0 to 65	
CTD430-65AC	±65	

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## ABSOLUTE MAXIMUM RATINGS [1]

Characteristic	Symbol	Notes	Rating	Unit
Supply Voltage Strength	$V_{CC}$		-0.3 to 6.0	V
Analog Input/Output Pins Maximum Voltage	$V_{I/O}$		-0.3 to $V_{CC} + 0.3$ [2]	V
Current Carrying Conductor Maximum Current	$I_{CCC(MAX)}$	$T_A = 25^\circ\text{C}$	70	A
Dielectric Surge Strength Test Voltage	$V_{SURGE}$	IEC 61000-4-5: Tested $\pm 5$ Pulses at 2/60 seconds, 1.2 $\mu\text{s}$ (rise) and 50 $\mu\text{s}$ (width)	6.0 (min)	kV
Surge Strength Test Current	$I_{SURGE}$	Tested $\pm 5$ Pulses at 3/60 seconds, 8.0 $\mu\text{s}$ (rise) and 20 $\mu\text{s}$ (width)	3.0 (min)	kA
Electrostatic Discharge Protection Level	ESD	Human Body Model (HBM) per JESD22-A114	$\pm 2.0$	kV
		Charged Device Model (CDM) per JESD22-C101	$\pm 0.5$	kV
Junction Temperature	$T_J$		-40 to 150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$		-65 to 155	$^\circ\text{C}$
Lead Soldering Temperature	$T_L$	10 seconds	260	$^\circ\text{C}$

[1] Stresses exceeding the absolute maximum ratings may damage the CT430 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.

[2] The lower of  $V_{CC} + 0.3$  V or 6.0 V.

## RECOMMENDED OPERATING CONDITIONS [1]

Characteristic	Symbol	Notes	Min.	Typ.	Max.	Unit
Supply Voltage Range	$V_{CC}$		4.75	5.00	5.50	V
Output Voltage Range	$V_{OUT}$		0	-	$V_{CC}$	V
Output Current	$I_{OUT}$		-	-	$\pm 1.0$	mA
Operating Ambient Temperature	$T_A$	Industrial	-40	25	85	$^\circ\text{C}$
		Extended Industrial	-40	25	125	$^\circ\text{C}$
		Automotive	-40	25	125	$^\circ\text{C}$

[1] The Recommended Operating Conditions table defines the conditions for actual operation of the CT430. Recommended operating conditions are specified to ensure optimal performance to the specifications. Allegro does not recommend exceeding them or designing to absolute maximum ratings.

## THERMAL CHARACTERISTICS

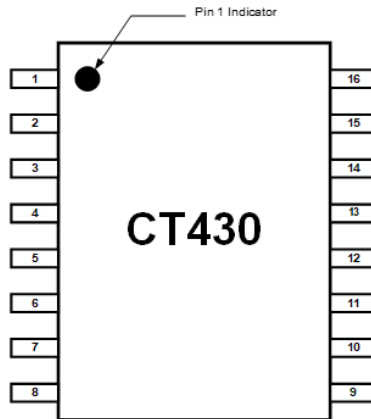
Characteristic	Symbol	Test Conditions	Value	Unit
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$	Junction-to-ambient thermal resistance is a function of application and board layout and is determined in accordance to JEDEC standard JESD51 for a four (4) layer 2s2p FR-4 printed circuit board (PCB) with 4 oz. of copper (Cu). Special attention must be paid not to exceed junction temperature $T_{J(MAX)}$ at a given ambient temperature $T_A$ .	15	$^\circ\text{C}/\text{W}$
Junction-to-Case Thermal Resistance	$R_{\theta JC}$		10	$^\circ\text{C}/\text{W}$

## ISOLATION RATINGS

Characteristic	Symbol	Notes	Rating	Unit
Rated Isolation Voltage	$V_{ISO}$	Agency Tested per IEC 62368 [1] for 60 seconds. Production Tested at $V_{ISO}$ for 1 second per IEC 62368.	5.0	kV <sub>RMS</sub>
		Agency Tested per UL1577 for 60 seconds. Production Tested at $V_{ISO}$ for 1 second per UL1577.	5.0	kV <sub>RMS</sub>
Working Voltage for Basic Isolation	$V_{WORK\_ISO}$	Tested per IEC 62368 [1].	1820	V <sub>PK</sub>
			1287	V <sub>RMS</sub>
Working Voltage for Reinforced Isolation	$V_{WORK\_RI}$	Tested per IEC 62368 [1].	915	V <sub>PK</sub>
			647	V <sub>RMS</sub>
Creepage Distance	$D_{CR}$	Minimum distance along package body from IP pins to I/O pins.	9.21	mm
Clearance Distance	$D_{CL}$	Minimum distance through air from IP pins to I/O pins.	8.79	mm
Distance Through Isolation	$D_{ISO}$	Minimum internal distance through isolation	110	μm
Comparative Tracking Index	CTI	Material Group II	400 to 599	V

[1] 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.

## PINOUT DIAGRAM AND TERMINAL LIST



**Figure 2: CT430 Pinout Diagram for 16-lead SOICW Package (Top-Down View)**

### Terminal List

Number	Name	Function
1, 2, 3, 4	IP+	Terminal for primary conductor (positive).
5, 6, 7, 8	IP-	Terminal for primary conductor (negative).
9	VREF	Reference voltage output. If not used, then do not connect.
10	GND	Ground.
11	$\overline{\text{FLT}}$	Active low output fault signal (open drain output) to indicate that the following parameters are outside of normal operational bounds: <ul style="list-style-type: none"> <li>• Overcurrent Detection</li> <li>• UVLO</li> </ul> If not used, then a 1.0 nF capacitor must be connected from the pin to ground.
12	FILTER	Filter pin to improve noise performance by connecting an external capacitor to set the cut-off frequency. If not used, then do not connect the pin (no connect).
13	OUT	Analog output voltage that represents the measured current.
14	NC	No connect.
15	VCC	Supply voltage.
16	NC	No connect.

**ELECTRICAL CHARACTERISTICS:** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ$ C to  $125^\circ$ C, typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ$ C, unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>POWER SUPPLIES</b>						
Supply Current	$I_{CC}$	$f_{BW} = 1$ MHz, no load, $I_P = 0$ A	–	6.0	9.0	mA
OUT Maximum Drive Capability [1]	$I_{OUT}$	OUT covers 10% to 90% of $V_{CC}$ span	–1.0	–	+1.0	mA
OUT Capacitive Load [1]	$C_{L\_OUT}$		–	–	100	pF
OUT Resistive Load [1]	$R_{L\_OUT}$		–	100	–	k $\Omega$
Internal Filter Resistance	$R_{FILTER}$		–	15	–	k $\Omega$
Primary Conductor Resistance [1]	$R_P$		–	0.5	–	m $\Omega$
Power Supply Rejection Ratio [1]	PSRR		–	35	–	dB
Sensitivity Power Supply Rejection Ratio [1]	SPSRR		–	35	–	dB
Offset Power Supply Rejection Ratio [1]	OPSRR		–	40	–	dB
<b>ANALOG OUTPUT (OUT)</b>						
OUT Voltage Linear Range, Typical	$V_{OUT}$	$V_{SIG\_AC} = \pm 2.00$ V, $V_{SIG\_DC} = +4.00$ V	0.50	–	4.50	V
Output High Saturation Voltage	$V_{OUT\_SAT}$	$V_{OUT}$ , $T_A = 25^\circ$ C	$V_{CC} - 0.30$	$V_{CC} - 0.25$	–	V
Common Mode Field Rejection Ratio [1]	CMFRR		–	–54	–	dB
			–	0.5	–	mA/G
<b>REFERENCE VOLTAGE (VREF)</b>						
Reference Voltage	$V_{REF}$	DC Current (Unipolar)	–	0.50	–	V
		AC Current (Bipolar)	–	2.50	–	V
VREF Capacitive Load [1]	$C_{L\_VREF}$		–	–	10	pF
VREF Resistive Load [1]	$R_{L\_VREF}$		–	10	–	k $\Omega$
VREF Maximum Drive Capability [1]	$I_{VREF}$		–50	–	50	$\mu$ A
<b>FAULT OUTPUT (FLT)</b>						
FLT Voltage Low	$V_{FLT\#\_OL}$	$I_{FLT\#\_OUT} \leq 20$ mA	0	–	0.5	V
High-Impedance Output Leakage Current	$I_{LEAK\_FLT\#}$	$V_{FLT\#\_OH} = V_{CC}$	–	5	–	$\mu$ A
FLT Pull-Up Resistor	$R_{PU}$		–	100	–	k $\Omega$
<b>TIMINGS</b>						
Power-On Time [1]	$t_{ON}$	$V_{CC} \geq 2.50$ V	–	100	200	$\mu$ s
Rise Time [1]	$t_{RISE}$	$I_P = I_{RANGE(MAX)}$ , $T_A = 25^\circ$ C, $C_L = 100$ pF	–	200	–	ns
Response Time [1]	$t_{RESPONSE}$	$I_P = I_{RANGE(MAX)}$ , $T_A = 25^\circ$ C, $C_L = 100$ pF	–	300	–	ns
Propagation Delay [1]	$t_{DELAY}$	$I_P = I_{RANGE(MAX)}$ , $T_A = 25^\circ$ C, $C_L = 100$ pF	–	250	–	ns
FLT Response Time	$t_{FLT\#}$		–	250	–	ns

[1] Guaranteed by design and characterization; not tested in production.

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**ELECTRICAL CHARACTERISTICS (continued):** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>PROTECTION</b>						
Undervoltage Lockout	$V_{UVLO}$	Rising $V_{DD}$	–	2.50	–	V
		Falling $V_{DD}$	–	2.45	–	V
UVLO Hysteresis	$V_{UV\_HYS}$		–	50	–	mV
Overcurrent Detection (OCD) for DC Current (Unipolar)	$I_{OCD\_U}$	Rising $I_P$	–	$1.1 \times I_{RANGE(MAX)}$	–	A
		Falling $I_P$	–	$0.9 \times I_{RANGE(MAX)}$	–	A
Overcurrent Detection (OCD) for AC Current (Bipolar)	$I_{OCD\_B}$	Rising $I_P$	–	$1.1 \times I_{RANGE(MAX)}$	–	A
		Falling $I_P$	–	$0.9 \times I_{RANGE(MAX)}$	–	A
Overcurrent Detection Hysteresis	$I_{OCD\_HYS}$		–	$0.2 \times I_{RANGE(MAX)}$	–	A

## ELECTRICAL CHARACTERISTICS

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

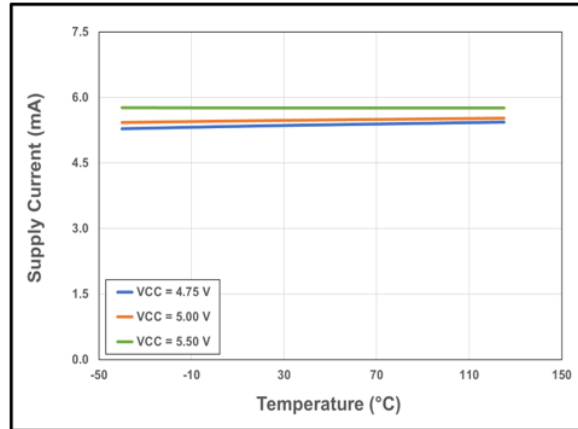


Figure 3: CT430 Supply Current vs. Temperature vs. Supply Voltage

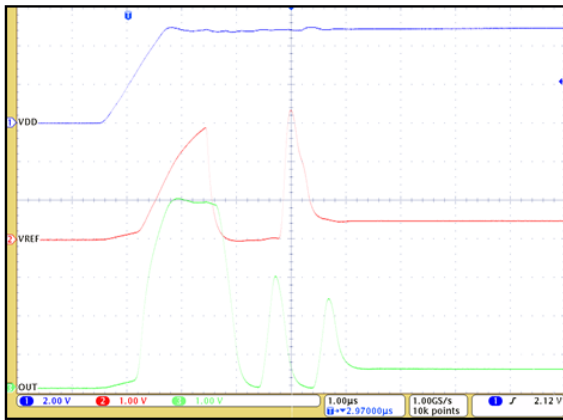


Figure 4: CT430 Startup Waveforms for  $V_{OQ} = 0.50\text{ V}$  (DC Current)

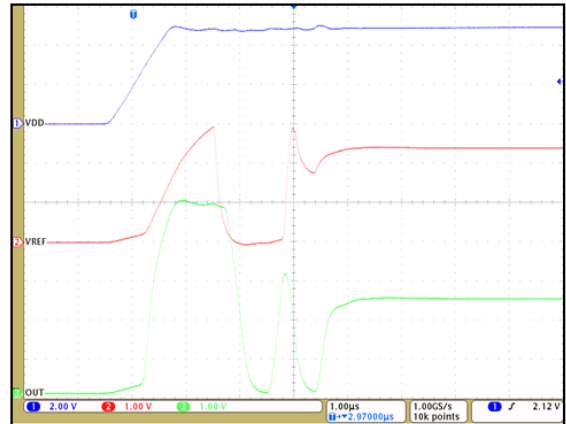


Figure 5: CT430 Startup Waveforms for  $V_{OQ} = 2.50\text{ V}$  (AC Current)



## ELECTRICAL CHARACTERISTICS (continued)

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

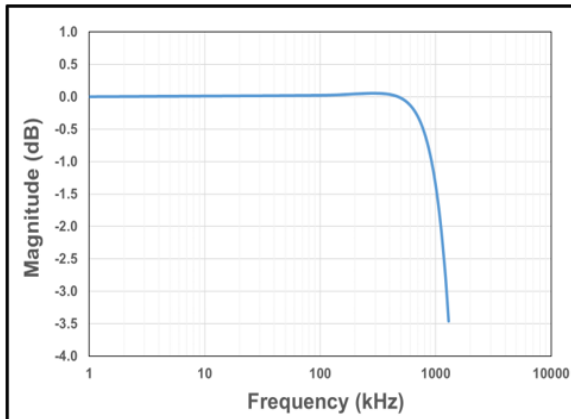


Figure 6: CT430 Bandwidth with  $C_{FILTER} = 1.0\ \text{pF}$

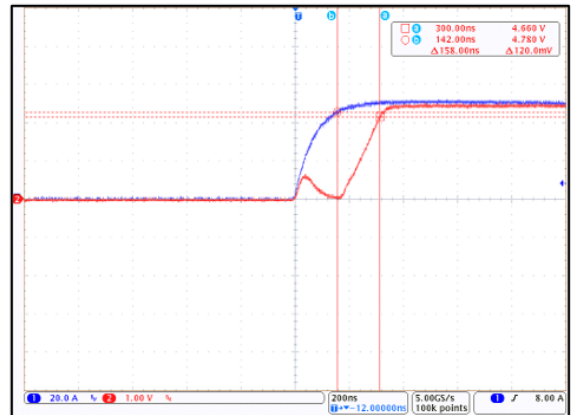


Figure 7: CT430 Response Time;  $I_P = 50\ \text{A}_{PK}$  and  $C_L = 100\ \text{pF}$  (Blue =  $I_{CC}$ , Red =  $V_{OUT}$ )

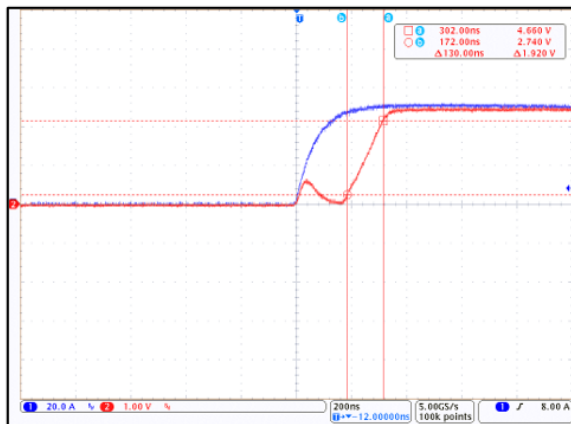


Figure 8: CT430 Rise Time;  $I_P = 50\ \text{A}_{PK}$  and  $C_L = 100\ \text{pF}$  (Blue =  $I_{CC}$ , Red =  $V_{OUT}$ )

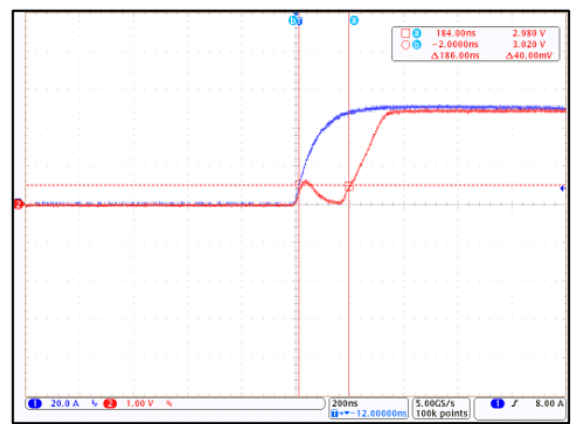


Figure 9: CT430 Propagation Delay;  $I_P = 50\ \text{A}_{PK}$  and  $C_L = 100\ \text{pF}$  (Blue =  $I_{CC}$ , Red =  $V_{OUT}$ )

## ELECTRICAL CHARACTERISTICS (continued)

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

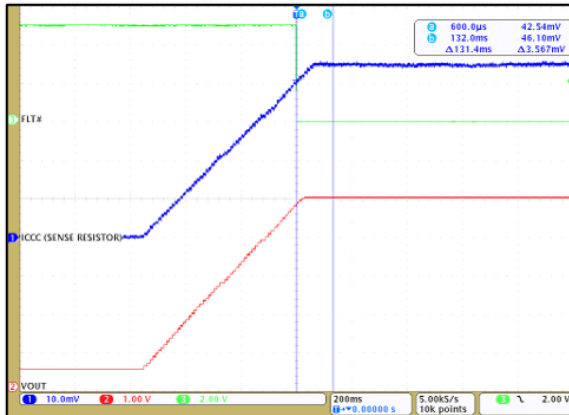


Figure 10: CT430 OCD enabled at 110% of  $50\text{ A}_{DC}$  and  $\overline{\text{FLT}}$  is Low

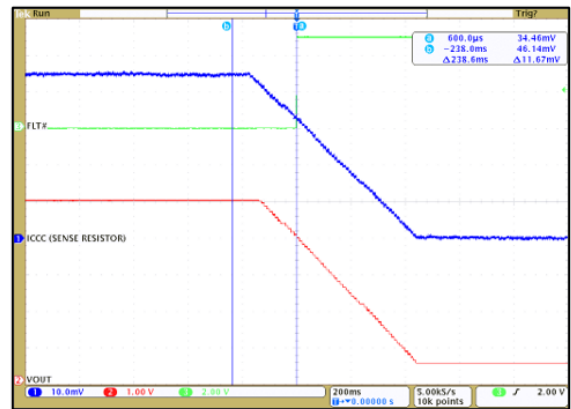


Figure 11: CT430 OCD disabled at 90% of  $50\text{ A}_{DC}$  and  $\overline{\text{FLT}}$  is High

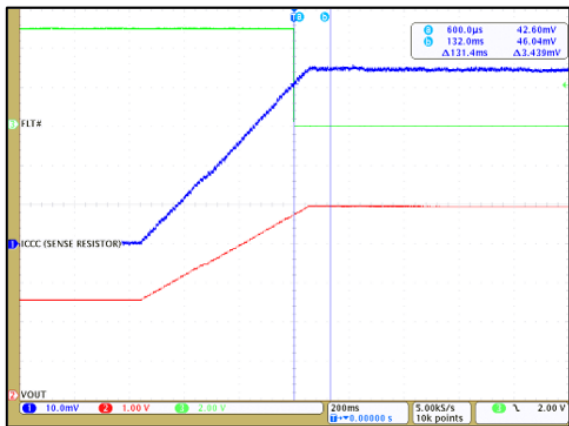


Figure 12: CT430 OCD enabled at 110% of  $50\text{ A}_{PK}$  and  $\overline{\text{FLT}}$  is Low

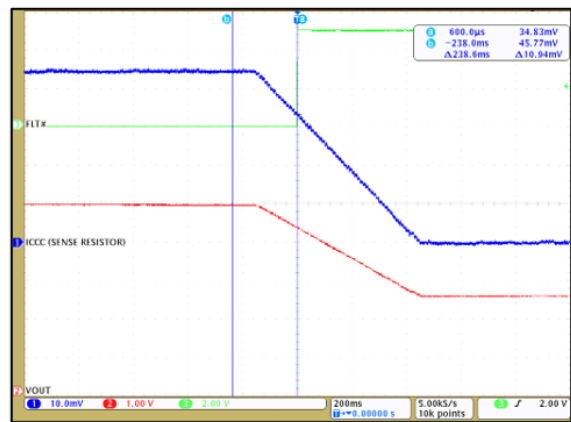


Figure 13: CT430 OCD disabled at 90% of  $50\text{ A}_{PK}$  and  $\overline{\text{FLT}}$  is High

### ELECTRICAL CHARACTERISTICS (continued)

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

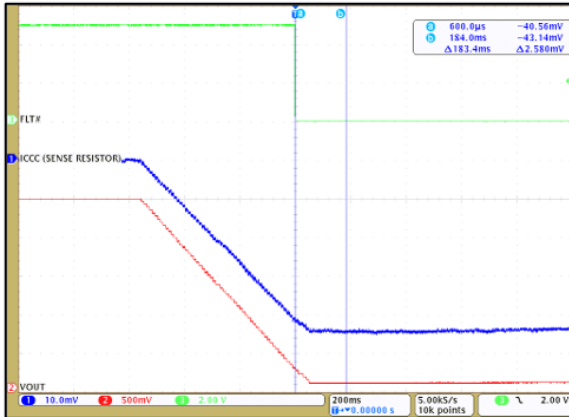


Figure 14: CT430 OCD enabled at  $-110\%$  of  $-50\text{ A}_{PK}$  and  $\overline{\text{FLT}}$  is Low

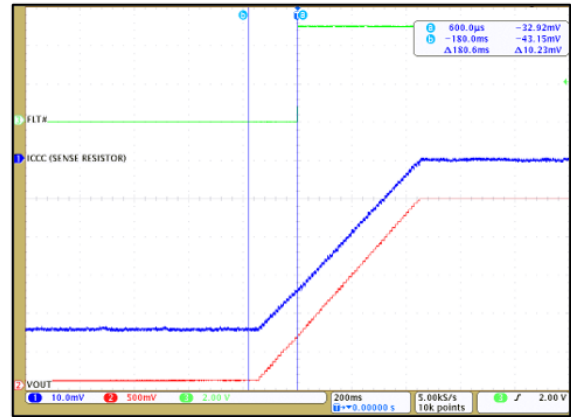


Figure 15: CT430 OCD disabled at  $-90\%$  of  $-50\text{ A}_{PK}$  and  $\overline{\text{FLT}}$  is High

**CT430-xSWF20DR: 0 to 20 A – ELECTRICAL CHARACTERISTICS:** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Current Range	$I_{RANGE}$		0	–	20	A
Voltage Output Quiescent	$V_{OQ}$	$T_A = 25^\circ\text{C}$ , $I_P = 0$ A	0.495	0.500	0.505	V
Sensitivity	S	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$	–	200	–	mV/A
Bandwidth [1]	$f_{BW}$	Small Signal = –3 dB	–	1.0	–	MHz
Noise [1]	$e_N$	$T_A = 25^\circ\text{C}$ , $f_{BW} = 100$ kHz	–	9.0	–	$\text{mA}_{RMS}$
<b>OUT ACCURACY PERFORMANCE</b>						
Total Output Error	$E_{OUT}$	$I_P = I_{P(MAX)}$	–	$\pm 0.7$	$\pm 1.0$	% FS
Non-Linearity Error [1]	$E_{LIN}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 0.1$	–	% FS
Sensitivity Error [1]	$E_{SENS}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 0.7$	–	% FS
Offset Voltage [1]	$V_{OFFSET}$	$I_P = 0$ A, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 12.5$	–	mV
			–	$\pm 0.3$	–	% FS
<b><math>V_{OUT} - V_{REF}</math> ACCURACY PERFORMANCE</b>						
$V_{OUT} - V_{REF}$ Error	$E_{OUT-VREF}$	$I_P = I_{P(MAX)}$ , $V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	–	$\pm 1.0$	% FS
$V_{OUT} - V_{REF}$ Offset Voltage	$V_{OUT-VREF}$	$V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 5.0$	–	mV
<b>LIFETIME DRIFT</b>						
Total Output Error Lifetime Drift [1]	$E_{TOT\_DRIFT}$	$I_P = I_{P(MAX)}$	–	$\pm 1.0$	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

## ELECTRICAL CHARACTERISTICS FOR CT430-xSWF20DR

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

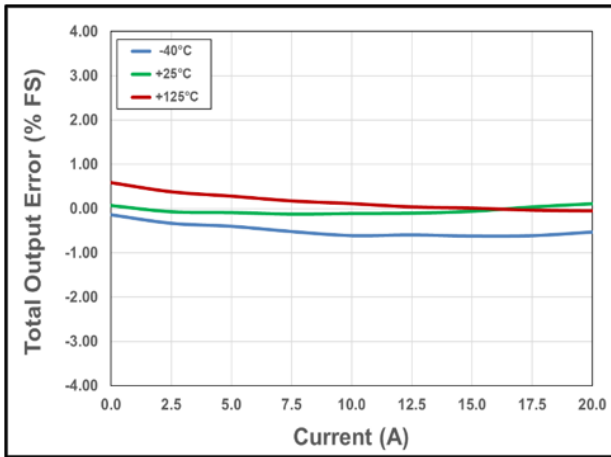


Figure 16: Total Output Error vs. Current vs. Temperature

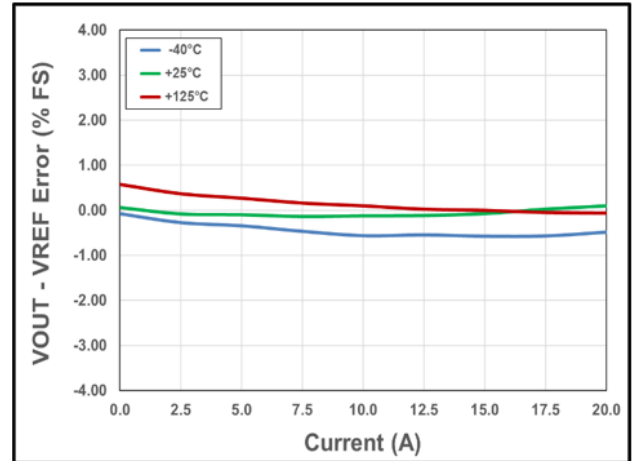


Figure 17:  $V_{OUT} - V_{REF}$  Error vs. Current vs. Temperature

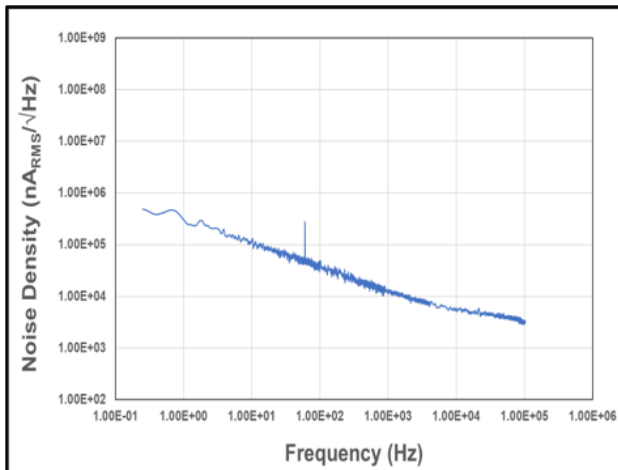


Figure 18: Noise Density vs. Frequency

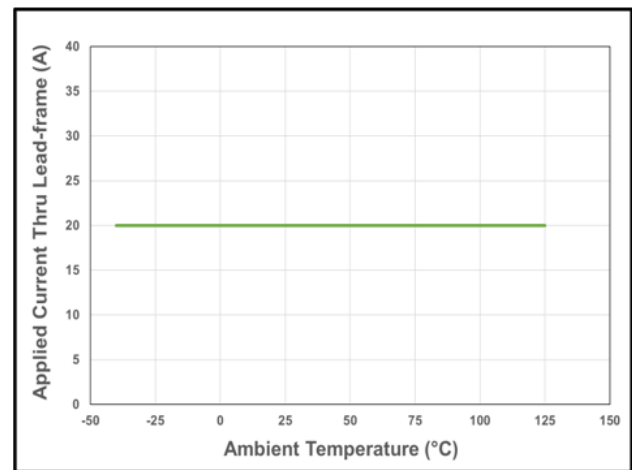


Figure 19: CT430 Current Derating Curve for  $20\text{ A}_{DC}$

**CT430-xSWF20MR: ±20 A – ELECTRICAL CHARACTERISTICS:** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Current Range	$I_{RANGE}$		-20	-	20	A
Voltage Output Quiescent	$V_{OQ}$	$T_A = 25^\circ\text{C}$ , $I_P = 0$ A	2.495	2.500	2.505	V
Sensitivity	S	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$	-	100	-	mV/A
Bandwidth [1]	$f_{BW}$	Small Signal = -3 dB	-	1.0	-	MHz
Noise [1]	$e_N$	$T_A = 25^\circ\text{C}$ , $f_{BW} = 100$ kHz	-	10.0	-	$\text{mA}_{RMS}$
<b>OUT ACCURACY PERFORMANCE</b>						
Total Output Error	$E_{OUT}$	$I_P = I_{P(MAX)}$	-	$\pm 0.5$	$\pm 1.0$	% FS
Non-Linearity Error [1]	$E_{LIN}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 0.1$	-	% FS
Sensitivity Error [1]	$E_{SENS}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 0.5$	-	% FS
Offset Voltage [1]	$V_{OFFSET}$	$I_P = 0$ A, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 7.0$	-	mV
			-	$\pm 0.2$	-	% FS
<b><math>V_{OUT} - V_{REF}</math> ACCURACY PERFORMANCE</b>						
$V_{OUT} - V_{REF}$ Error	$E_{OUT-VREF}$	$I_P = I_{P(MAX)}$ , $V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	-	$\pm 1.0$	% FS
$V_{OUT} - V_{REF}$ Offset Voltage	$V_{OUT-VREF}$	$V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 5.0$	-	mV
<b>LIFETIME DRIFT</b>						
Total Output Error Lifetime Drift [1]	$E_{TOT\_DRIFT}$	$I_P = I_{P(MAX)}$	-	$\pm 1.0$	-	% FS

[1] Guaranteed by design and characterization; not tested in production.

## ELECTRICAL CHARACTERISTICS FOR CT430-xSWF20MR

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

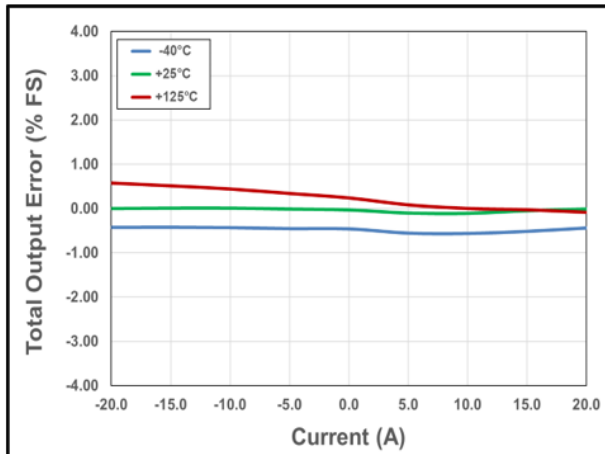


Figure 20: Total Output Error vs. Current vs. Temperature

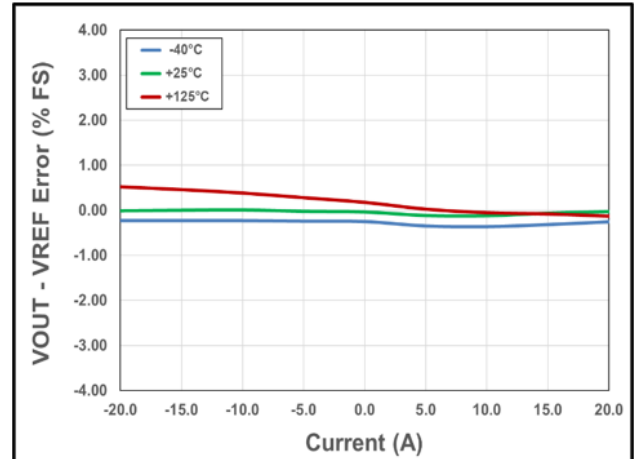


Figure 21:  $V_{OUT} - V_{REF}$  Error vs. Current vs. Temperature

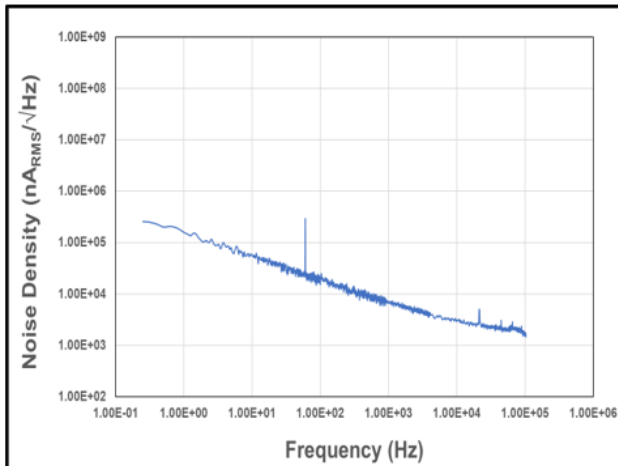


Figure 22: Noise Density vs. Frequency

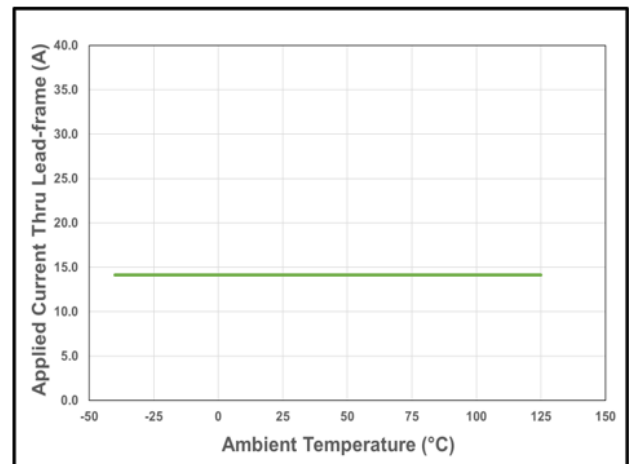


Figure 23: CT430 Current Derating Curve for  $20\text{ A}_{PK}$  ( $14.1\text{ A}_{DC}$ )

**CT430-xSWF30DR: 0 to 30 A – ELECTRICAL CHARACTERISTICS:** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Current Range	$I_{RANGE}$		0	–	30	A
Voltage Output Quiescent	$V_{OQ}$	$T_A = 25^\circ\text{C}$ , $I_P = 0$ A	0.495	0.500	0.505	V
Sensitivity	S	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$	–	133.3	–	mV/A
Bandwidth [1]	$f_{BW}$	Small Signal = $-3$ dB, $C_{FILTER} = 5$ pF	–	1.0	–	MHz
Noise [1]	$e_N$	$T_A = 25^\circ\text{C}$ , $f_{BW} = 100$ kHz	–	10.0	–	$\text{mA}_{RMS}$
<b>OUT ACCURACY PERFORMANCE</b>						
Total Output Error	$E_{OUT}$	$I_P = I_{P(MAX)}$	–	$\pm 0.7$	$\pm 1.0$	% FS
Non-Linearity Error [1]	$E_{LIN}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 0.1$	–	% FS
Sensitivity Error [1]	$E_{SENS}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 0.6$	–	% FS
Offset Voltage [1]	$V_{OFFSET}$	$I_P = 0$ A, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 13.5$	–	mV
			–	$\pm 0.3$	–	% FS
<b><math>V_{OUT} - V_{REF}</math> ACCURACY PERFORMANCE</b>						
$V_{OUT} - V_{REF}$ Error	$E_{OUT-VREF}$	$I_P = I_{P(MAX)}$ , $V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	–	$\pm 1.0$	% FS
$V_{OUT} - V_{REF}$ Offset Voltage	$V_{OUT-VREF}$	$V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 5.0$	–	mV
<b>LIFETIME DRIFT</b>						
Total Output Error Lifetime Drift [1]	$E_{TOT\_DRIFT}$	$I_P = I_{P(MAX)}$	–	$\pm 1.0$	–	% FS

[1] Guaranteed by design and characterization; not tested in production.



## ELECTRICAL CHARACTERISTICS FOR CT430-xSWF30DR

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

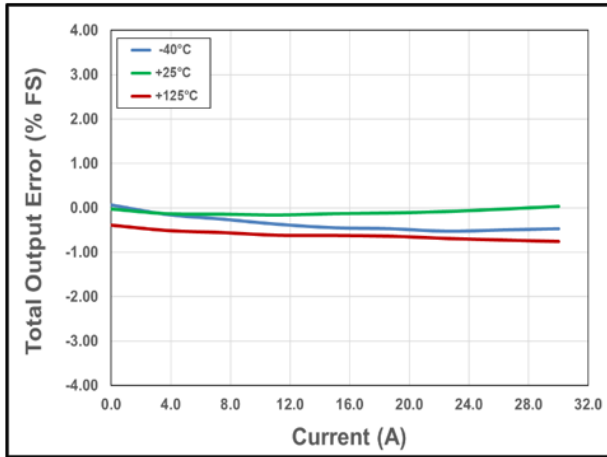


Figure 24: Total Output Error vs. Current vs. Temperature

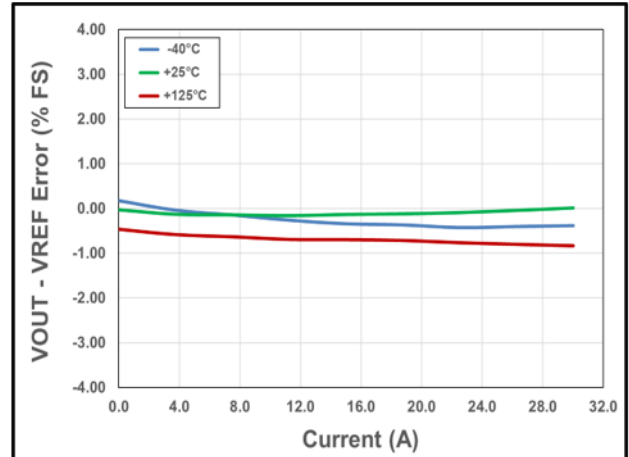


Figure 25:  $V_{OUT} - V_{REF}$  Error vs. Current vs. Temperature

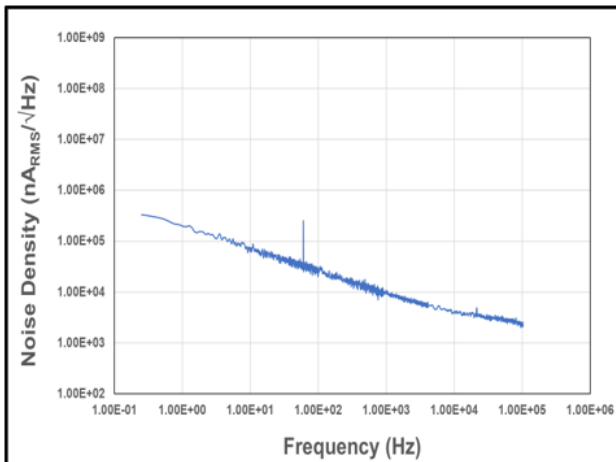


Figure 26: Noise Density vs. Frequency

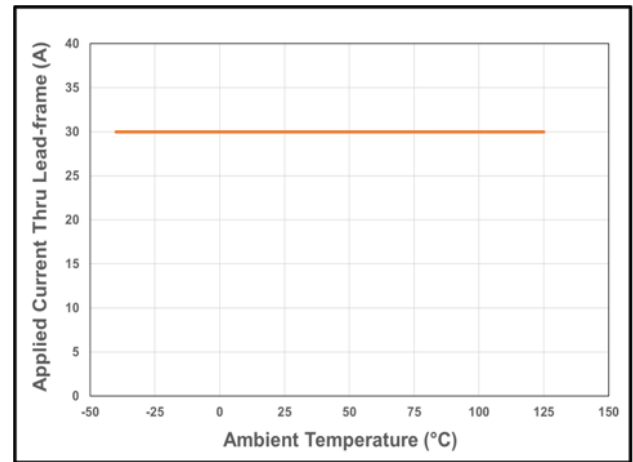


Figure 27: CT430 Current Derating Curve for  $30\text{ A}_{DC}$

**CT430-xSWF30MR: ±30 A – ELECTRICAL CHARACTERISTICS:** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Current Range	$I_{RANGE}$		-30	-	30	A
Voltage Output Quiescent	$V_{OQ}$	$T_A = 25^\circ\text{C}$ , $I_P = 0$ A	2.495	2.500	2.505	V
Sensitivity	S	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$	-	66.7	-	mV/A
Bandwidth [1]	$f_{BW}$	Small Signal = -3 dB, $C_{FILTER} = 5$ pF	-	1.0	-	MHz
Noise [1]	$e_N$	$T_A = 25^\circ\text{C}$ , $f_{BW} = 100$ kHz	-	11.5	-	mA <sub>RMS</sub>
<b>OUT ACCURACY PERFORMANCE</b>						
Total Output Error	$E_{OUT}$	$I_P = I_{P(MAX)}$	-	±0.5	±1.0	% FS
Non-Linearity Error [1]	$E_{LIN}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	±0.1	-	% FS
Sensitivity Error [1]	$E_{SENS}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	±0.4	-	% FS
Offset Voltage [1]	$V_{OFFSET}$	$I_P = 0$ A, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	±9.0	-	mV
			-	±0.2	-	% FS
<b><math>V_{OUT} - V_{REF}</math> ACCURACY PERFORMANCE</b>						
$V_{OUT} - V_{REF}$ Error	$E_{OUT-VREF}$	$I_P = I_{P(MAX)}$ , $V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	-	±1.0	% FS
$V_{OUT} - V_{REF}$ Offset Voltage	$V_{OUT-VREF}$	$V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	±5.0	-	mV
<b>LIFETIME DRIFT</b>						
Total Output Error Lifetime Drift [1]	$E_{TOT\_DRIFT}$	$I_P = I_{P(MAX)}$	-	±1.0	-	% FS

[1] Guaranteed by design and characterization; not tested in production.

## ELECTRICAL CHARACTERISTICS FOR CT430-xSWF30MR

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

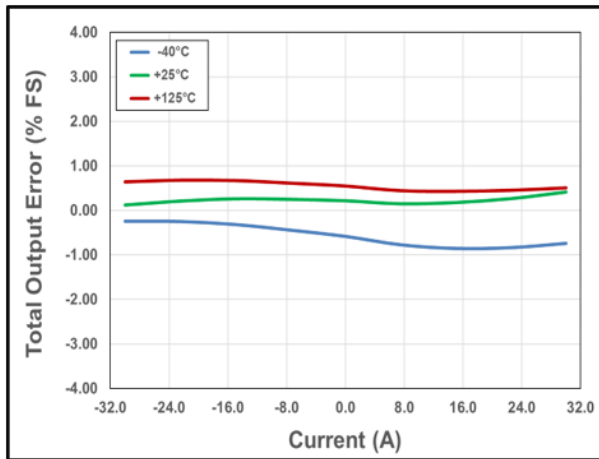


Figure 28: Total Output Error vs. Current vs. Temperature

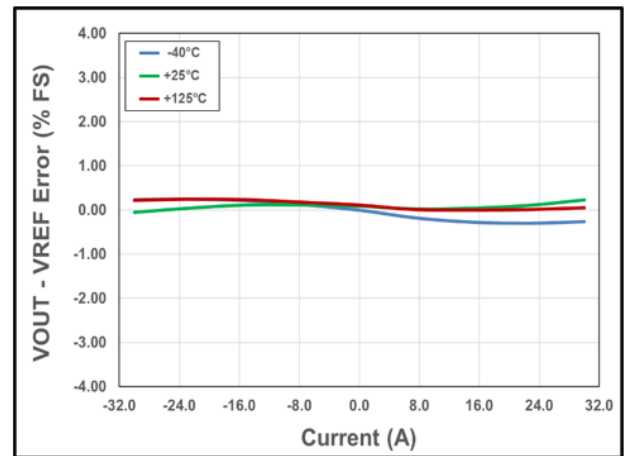


Figure 29:  $V_{OUT} - V_{REF}$  Error vs. Current vs. Temperature

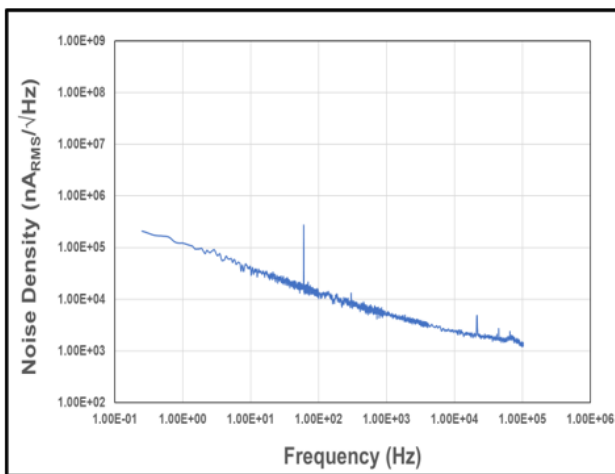


Figure 30: Noise Density vs. Frequency

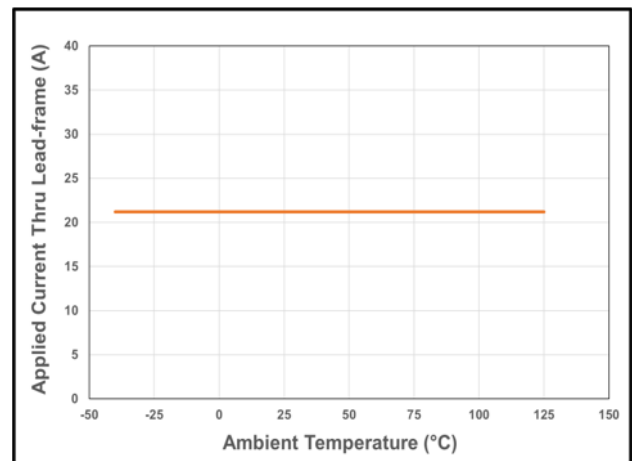


Figure 31: CT430 Current Derating Curve for  $30\text{ A}_{PK}$  ( $21.2\text{ A}_{DC}$ )

**CT430-xSWF50DR: 0 to 50 A – ELECTRICAL CHARACTERISTICS:** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Current Range	$I_{RANGE}$		0	–	50	A
Voltage Output Quiescent	$V_{OQ}$	$T_A = 25^\circ\text{C}$ , $I_P = 0$ A	0.495	0.500	0.505	V
Sensitivity	S	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$	–	80	–	mV/A
Bandwidth [1]	$f_{BW}$	Small Signal = –3 dB	–	1.0	–	MHz
Noise [1]	$e_N$	$T_A = 25^\circ\text{C}$ , $f_{BW} = 100$ kHz	–	10.0	–	mA <sub>RMS</sub>
<b>OUT ACCURACY PERFORMANCE</b>						
Total Output Error	$E_{OUT}$	$I_P = I_{P(MAX)}$	–	$\pm 0.7$	$\pm 1.5$	% FS
Non-Linearity Error [1]	$E_{LIN}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 0.2$	–	% FS
Sensitivity Error [1]	$E_{SENS}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 0.6$	–	% FS
Offset Voltage [1]	$V_{OFFSET}$	$I_P = 0$ A, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 12.9$	–	mV
			–	$\pm 0.3$	–	% FS
<b><math>V_{OUT} - V_{REF}</math> ACCURACY PERFORMANCE</b>						
$V_{OUT} - V_{REF}$ Error	$E_{OUT-VREF}$	$I_P = I_{P(MAX)}$ , $V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	–	$\pm 1.0$	% FS
$V_{OUT} - V_{REF}$ Offset Voltage	$V_{OUT-VREF}$	$V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 5.0$	–	mV
<b>LIFETIME DRIFT</b>						
Total Output Error Lifetime Drift [1]	$E_{TOT\_DRIFT}$	$I_P = I_{P(MAX)}$	–	$\pm 1.0$	–	% FS

[1] Guaranteed by design and characterization; not tested in production.

## ELECTRICAL CHARACTERISTICS FOR CT430-xSWF50DR

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

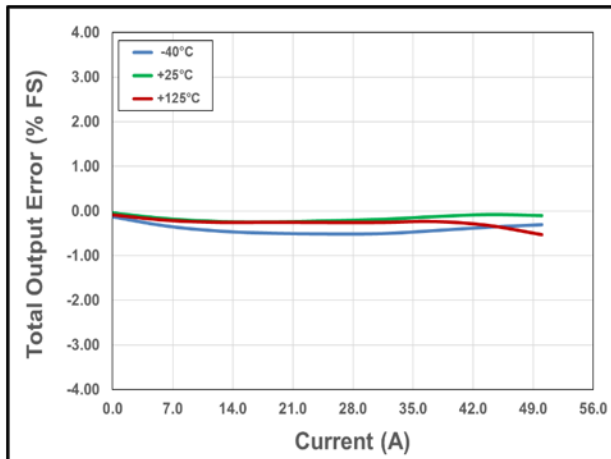


Figure 32: Total Output Error vs. Current vs. Temperature

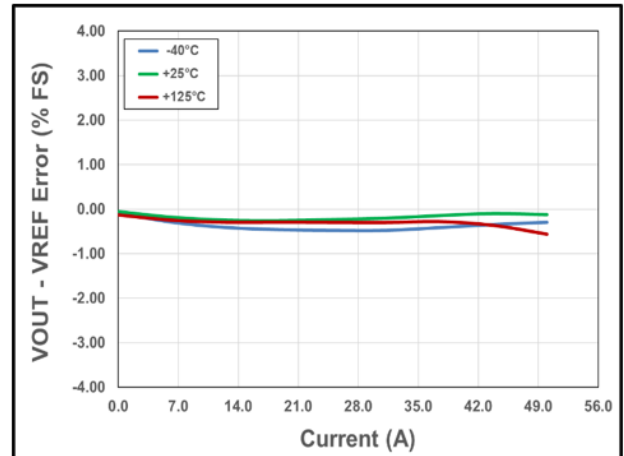


Figure 33:  $V_{OUT} - V_{REF}$  Error vs. Current vs. Temperature

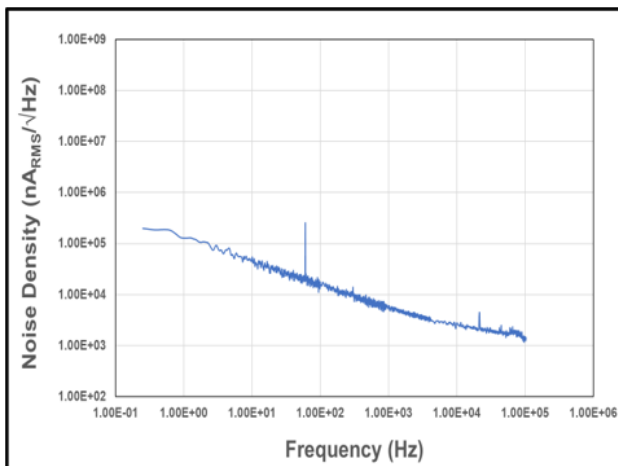


Figure 34: Noise Density vs. Frequency

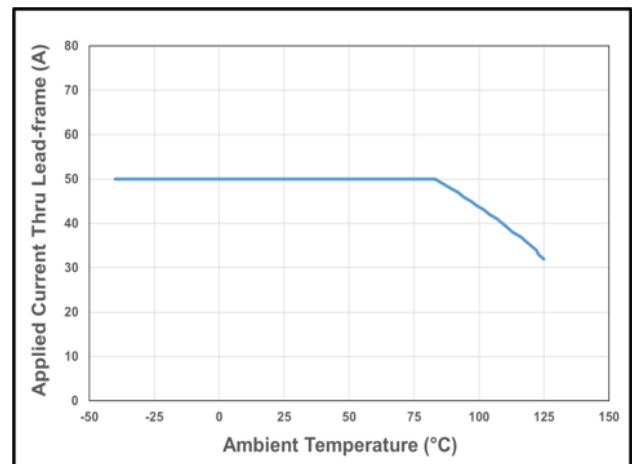


Figure 35: CT430 Current Derating Curve for  $50\text{ A}_{DC}$

**CT430-xSWF50MR: ±50 A – ELECTRICAL CHARACTERISTICS:** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Current Range	$I_{RANGE}$		-50	-	50	A
Voltage Output Quiescent	$V_{OQ}$	$T_A = 25^\circ\text{C}$ , $I_P = 0$ A	2.495	2.500	2.505	V
Sensitivity	S	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$	-	40	-	mV/A
Bandwidth [1]	$f_{BW}$	Small Signal = -3 dB	-	1.0	-	MHz
Noise [1]	$e_N$	$T_A = 25^\circ\text{C}$ , $f_{BW} = 100$ kHz	-	14.0	-	$\text{mA}_{RMS}$
<b>OUT ACCURACY PERFORMANCE</b>						
Total Output Error	$E_{OUT}$	$I_P = I_{P(MAX)}$	-	$\pm 0.5$	$\pm 1.0$	% FS
Non-Linearity Error [1]	$E_{LIN}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 0.1$	-	% FS
Sensitivity Error [1]	$E_{SENS}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 0.5$	-	% FS
Offset Voltage [1]	$V_{OFFSET}$	$I_P = 0$ A, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 10.9$	-	mV
			-	$\pm 0.3$	-	% FS
<b><math>V_{OUT} - V_{REF}</math> ACCURACY PERFORMANCE</b>						
$V_{OUT} - V_{REF}$ Error	$E_{OUT-VREF}$	$I_P = I_{P(MAX)}$ , $V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	-	$\pm 1.0$	% FS
$V_{OUT} - V_{REF}$ Offset Voltage	$V_{OUT-VREF}$	$V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 5.0$	-	mV
<b>LIFETIME DRIFT</b>						
Total Output Error Lifetime Drift [1]	$E_{TOT\_DRIFT}$	$I_P = I_{P(MAX)}$	-	$\pm 1.0$	-	% FS

[1] Guaranteed by design and characterization; not tested in production.

**ELECTRICAL CHARACTERISTICS FOR CT430-xSWF50MR**

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

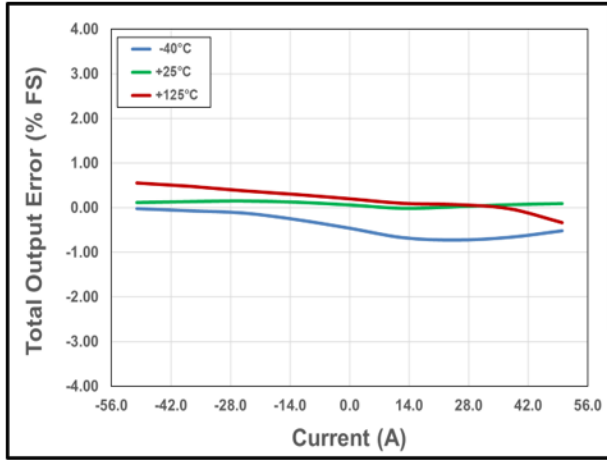


Figure 36: Total Output Error vs. Current vs. Temperature

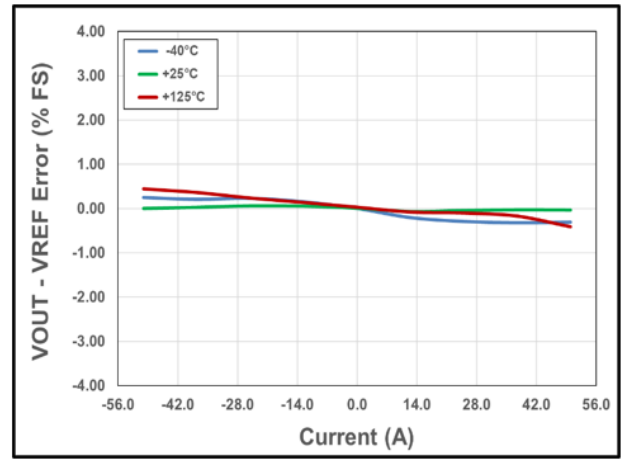


Figure 37:  $V_{OUT} - V_{REF}$  Error vs. Current vs. Temperature

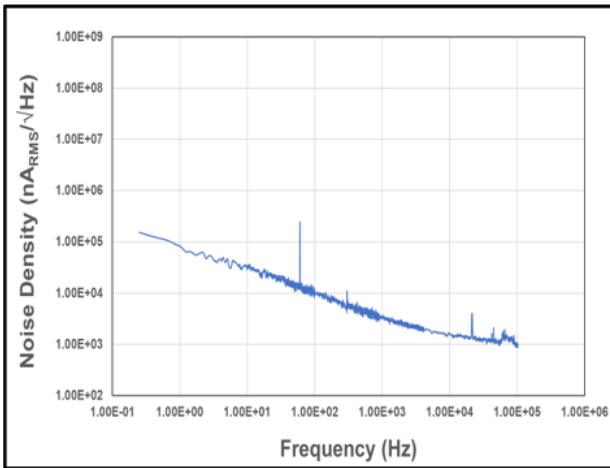


Figure 38: Noise Density vs. Frequency

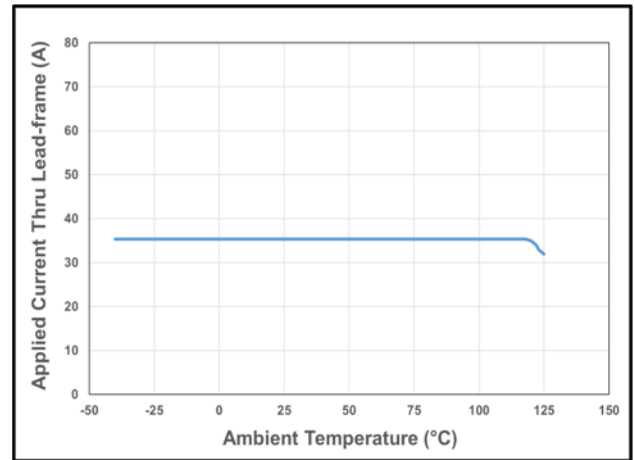


Figure 39: CT430 Current Derating Curve for  $50\text{ A}_{PK}$  ( $35.4\text{ A}_{DC}$ )

**CT430-xSWF65DR: 0 to 65 A – ELECTRICAL CHARACTERISTICS:** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Current Range	$I_{RANGE}$		0	–	65	A
Voltage Output Quiescent	$V_{OQ}$	$T_A = 25^\circ\text{C}$ , $I_P = 0$ A	0.495	0.500	0.505	V
Sensitivity	S	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$	–	61.5	–	mV/A
Bandwidth [1]	$f_{BW}$	Small Signal = –3 dB	–	1.0	–	MHz
Noise [1]	$e_N$	$T_A = 25^\circ\text{C}$ , $f_{BW} = 100$ kHz	–	10.0	–	$\text{mA}_{RMS}$
<b>OUT ACCURACY PERFORMANCE</b>						
Total Output Error	$E_{OUT}$	$I_P = I_{P(MAX)}$	–	$\pm 0.7$	$\pm 1.5$	% FS
Non-Linearity Error [1]	$E_{LIN}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 0.2$	–	% FS
Sensitivity Error [1]	$E_{SENS}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 0.4$	–	% FS
Offset Voltage [1]	$V_{OFFSET}$	$I_P = 0$ A, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 3.0$	–	mV
			–	$\pm 0.1$	–	% FS
<b><math>V_{OUT} - V_{REF}</math> ACCURACY PERFORMANCE</b>						
$V_{OUT} - V_{REF}$ Error	$E_{OUT-VREF}$	$I_P = I_{P(MAX)}$ , $V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	–	$\pm 1.0$	% FS
$V_{OUT} - V_{REF}$ Offset Voltage	$V_{OUT-VREF}$	$V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	–	$\pm 5.0$	–	mV
<b>LIFETIME DRIFT</b>						
Total Output Error Lifetime Drift [1]	$E_{TOT\_DRIFT}$	$I_P = I_{P(MAX)}$	–	$\pm 1.0$	–	% FS

[1] Guaranteed by design and characterization; not tested in production.



## ELECTRICAL CHARACTERISTICS FOR CT430-xSWF65DR

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

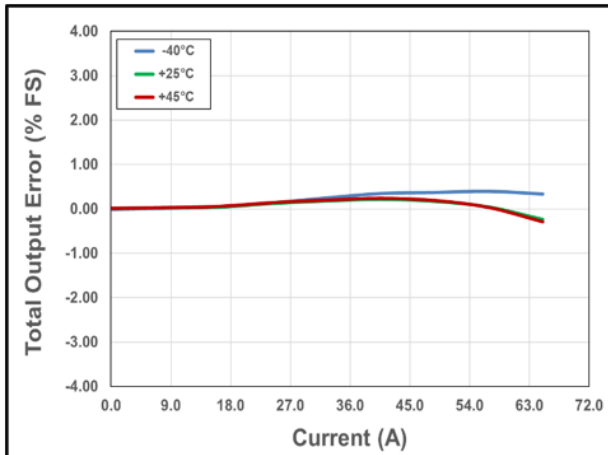


Figure 40: Total Output Error vs. Current vs. Temperature

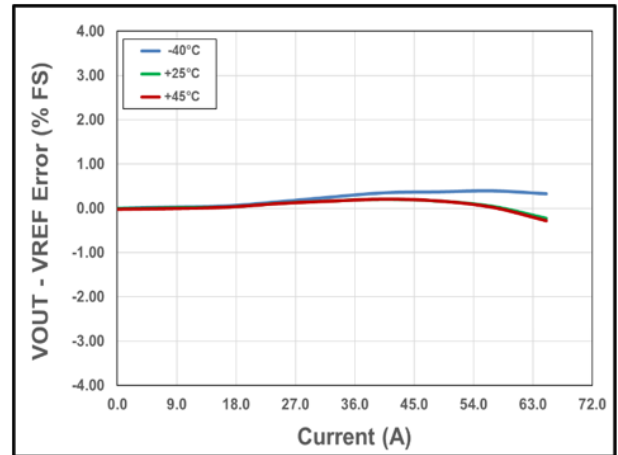


Figure 41:  $V_{OUT} - V_{REF}$  Error vs. Current vs. Temperature

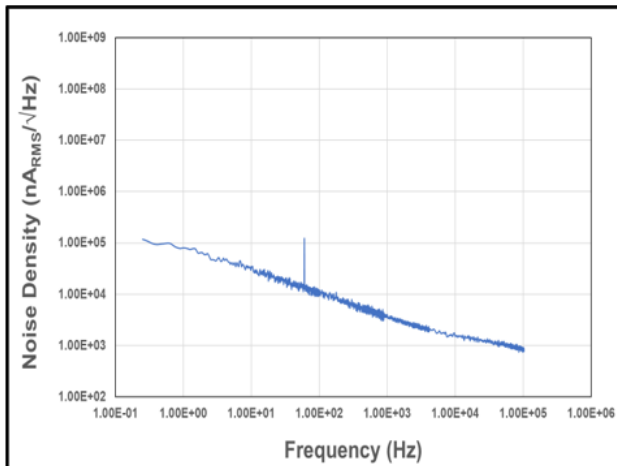


Figure 42: Noise Density vs. Frequency

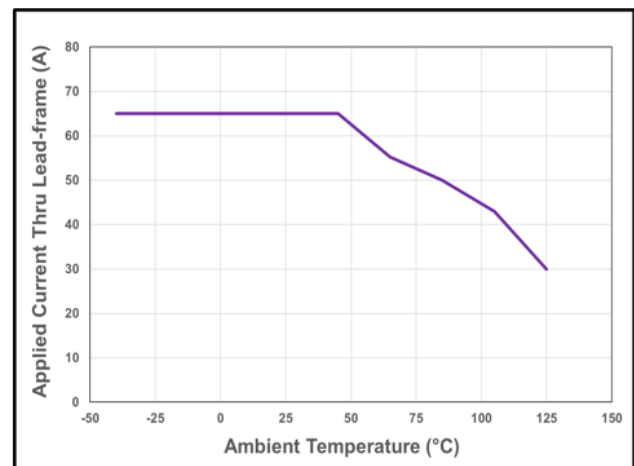


Figure 43: CT430 Current Derating Curve for 65  $A_{DC}$

**CT430-xSWF65MR: ±65 A – ELECTRICAL CHARACTERISTICS:** Valid for  $V_{CC} = 4.75$  to  $5.50$  V,  $C_{BYP} = 1.0$   $\mu$ F, and  $T_A = -40^\circ\text{C}$  to  $125^\circ\text{C}$ , typical values are  $V_{CC} = 5.00$  V and  $T_A = 25^\circ\text{C}$ , unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Current Range	$I_{RANGE}$		-65	-	65	A
Voltage Output Quiescent	$V_{OQ}$	$T_A = 25^\circ\text{C}$ , $I_P = 0$ A	2.495	2.500	2.505	V
Sensitivity	S	$I_{RANGE(MIN)} < I_P < I_{RANGE(MAX)}$	-	30.8	-	mV/A
Bandwidth [1]	$f_{BW}$	Small Signal = -3 dB	-	1.0	-	MHz
Noise [1]	$e_N$	$T_A = 25^\circ\text{C}$ , $f_{BW} = 100$ kHz	-	13.5	-	$\text{mA}_{RMS}$
<b>OUT ACCURACY PERFORMANCE</b>						
Total Output Error	$E_{OUT}$	$I_P = I_{P(MAX)}$	-	$\pm 0.5$	$\pm 1.0$	% FS
Non-Linearity Error [1]	$E_{LIN}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 0.2$	-	% FS
Sensitivity Error [1]	$E_{SENS}$	$I_P = I_{P(MAX)}$ , $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 0.3$	-	% FS
Offset Voltage [1]	$V_{OFFSET}$	$I_P = 0$ A, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 3.0$	-	mV
			-	$\pm 0.1$	-	% FS
<b><math>V_{OUT} - V_{REF}</math> ACCURACY PERFORMANCE</b>						
$V_{OUT} - V_{REF}$ Error	$E_{OUT-VREF}$	$I_P = I_{P(MAX)}$ , $V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	-	$\pm 1.0$	% FS
$V_{OUT} - V_{REF}$ Offset Voltage	$V_{OUT-VREF}$	$V_{CC} = 5.0$ V, $T_A = -40^\circ\text{C}$ to $125^\circ\text{C}$	-	$\pm 5.0$	-	mV
<b>LIFETIME DRIFT</b>						
Total Output Error Lifetime Drift [1]	$E_{TOT\_DRIFT}$	$I_P = I_{P(MAX)}$	-	$\pm 1.0$	-	% FS

[1] Guaranteed by design and characterization; not tested in production.

## ELECTRICAL CHARACTERISTICS FOR CT430-xSWF65MR

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

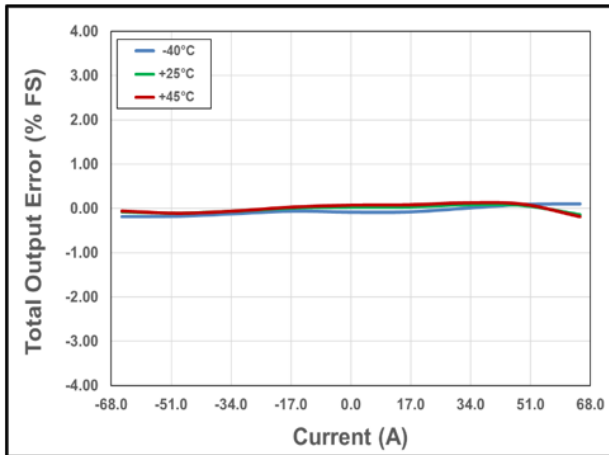


Figure 44: Total Output Error vs. Current vs. Temperature

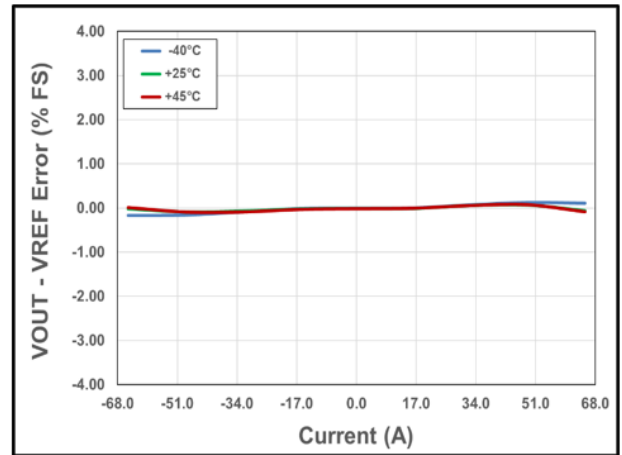


Figure 45:  $V_{OUT} - V_{REF}$  Error vs. Current vs. Temperature

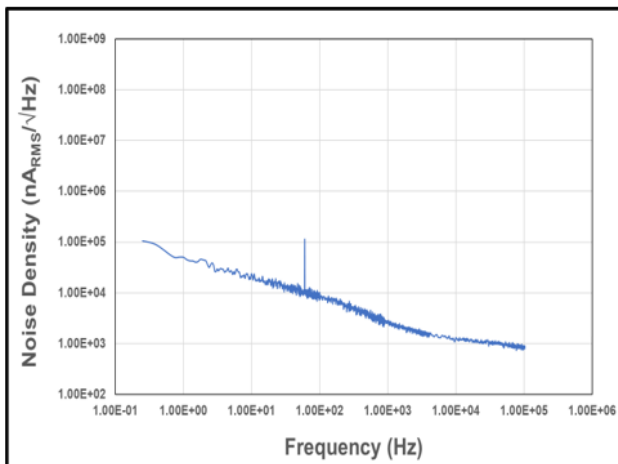


Figure 46: Noise Density vs. Frequency

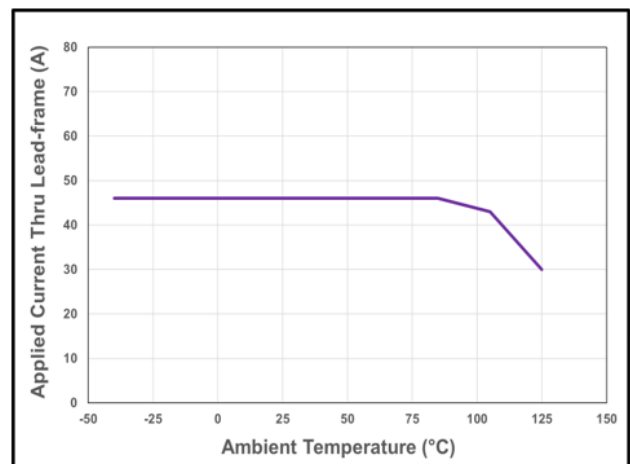


Figure 47: CT430 Current Derating Curve for  $65\text{ A}_{DC}$  ( $46.0\text{ A}_{DC}$ )

## FUNCTIONAL DESCRIPTION

### Overview

The CT430 is a high accuracy contact current sensor with an integrated current-carrying conductor that handles up to 65 A. It has high sensitivity and a wide dynamic range with excellent accuracy (low total output error) across temperature. This current sensor supports eight current ranges:

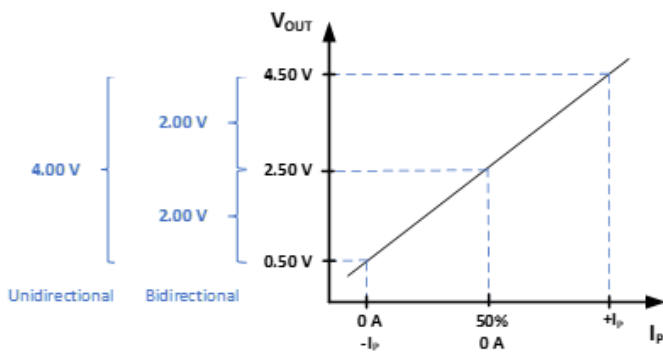
- 0 to 20 A
- ±20 A
- 0 to 30 A
- ±30 A
- 0 to 50 A
- ±50 A
- 0 to 65 A
- ±65 A

When current is flowing through the current-carrying conductor, the XtremeSense 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 with less than ±1.0% full-scale total output error ( $E_{OUT}$ ).

The chip is designed to enable a fast response time of 300 ns for the current measurement from the OUT pin as the bandwidth for the CT430 is 1.0 MHz. Even with a high bandwidth, the chip consumes a minimal amount of power.

### Linear Output Current Measurement

The CT430 provides a continuous linear analog output voltage which represents the current measurement. The output voltage range of OUT is from 0.50 to 4.50 V with a  $V_{OQ}$  of 0.50 V and 2.50 V for unidirectional and bidirectional currents, respectively. Figure 48 illustrates the output voltage range of the OUT pin as a function of the measured current.

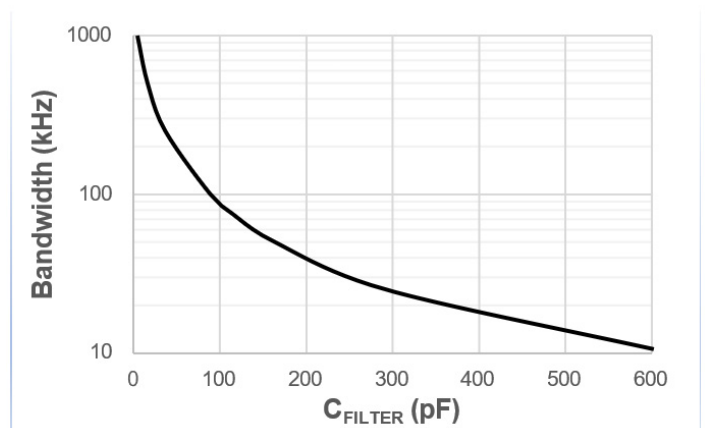


**Figure 48: Linear Output Voltage Range (OUT) vs. Measured Current (IP)**

### Filter Function (FILTER)

The CT430 has a pin for the FILTER function which will enable it to improve the noise performance by changing the cutoff frequency. The bandwidth of the CT430 is 1.0 MHz; however, adding a capacitor to the FILTER pin—which will be in-series with an internal resistance of approximately 15 kΩ—will set the cutoff frequency to reduce noise.

Experimentally measured Bandwidth does not necessarily match the calculated bandwidth value obtained by using the equation  $f_{BW} = 1/2\pi RC$  because of the parasitic capacitances due to PCB manufacturing and layout. This is further impacted by the small, picofarad level  $C_{FILTER}$  recommendations.



**Figure 49: Experimental Bandwidth vs.  $C_{FILTER}$**

### Voltage Reference Function (VREF)

The CT430 has a reference voltage (VREF) pin that may be used as an output voltage reference for AC or DC current measurements. The VREF pin should be connected to a buffer circuit.

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

### Sensitivity

Sensitivity (S) is a change in the CT430 output in response to a change in 1 A of current flowing through the current-carrying conductor. It is defined by the product of the magnetic circuit sensitivity (G/A, where 1.0 G = 0.1 mT) and the chip linear amplifier gain (mV/G). Therefore, the result of this gives a sensitivity unit of mV/A. The CT430 is factory-calibrated to optimize the sensitivity for the full scale of the device dynamic range.

## Total Output Error

The Total Output Error ( $E_{OUT}$ ) is the maximum deviation of the sensor output from the ideal sensor transfer curve over the full temperature range relative to the sensor full scale.

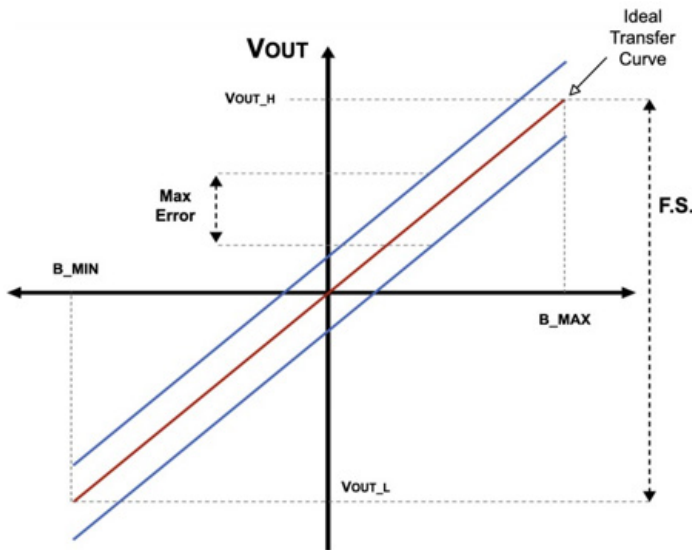
The Total Output Error is measured by performing a full-scale primary current ( $I_P$ ) sweep and measuring  $V_{OUT}$  at multiple points.

$$E_{OUT} = 100 * \frac{\max(V_{OUT_{IDEAL}}(I) - V_{OUT}(I))}{F.S.}$$

The Ideal Transfer Curve is calculated based on datasheet parameters as described below.

$$V_{OUT_{IDEAL}}(I_P) = V_{OQ} + S * I_P$$

$E_{OUT}$  incorporates all sources of error and is a function of the sensed current ( $I_P$ ) from the current sensor.



**Figure 50: Total Output Error ( $E_{OUT}$ ) vs. Sensed Current ( $I_P$ )**

The CT430 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.

## Sensitivity Error

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

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

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

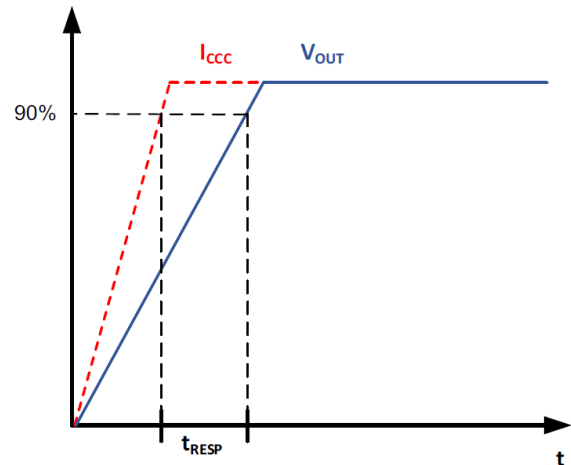
## Power-On Time ( $t_{ON}$ )

Power-On Time ( $t_{ON}$ ) of 100  $\mu s$  is the amount of time required by CT430 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 has reached the minimum  $V_{CC}$ .

## Response Time ( $t_{RESPONSE}$ )

Response Time ( $t_{RESPONSE}$ ) of 300 ns for the CT430 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 51: CT430 Response Time Curve**

## Rise Time ( $t_{RISE}$ )

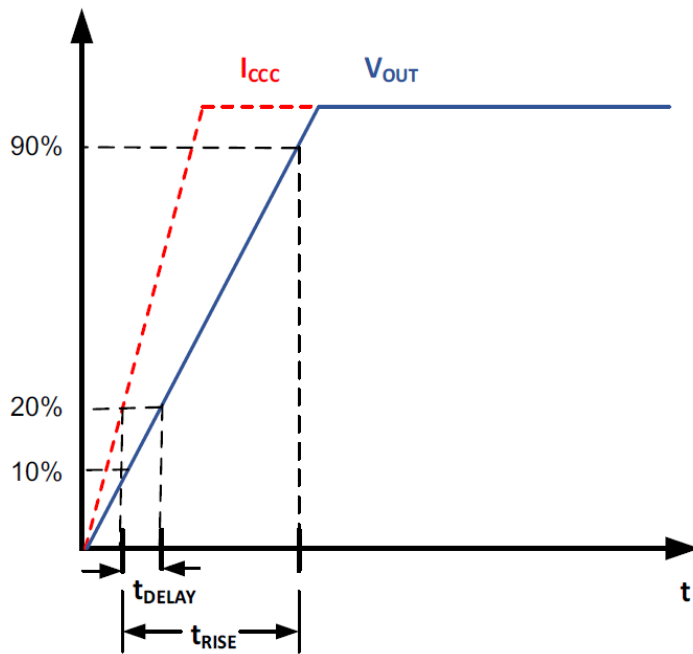
Rise Time ( $t_{RISE}$ ) is the time interval of when it reaches 10% and 90% of the full-scale output voltage. The  $t_{RISE}$  of the CT430 is 200 ns.

## Propagation Delay ( $t_{DELAY}$ )

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 CT430 has a propagation delay of 250 ns.



**Figure 52: CT430 Propagation Delay and Rise Time Curve**

## Overcurrent Detection (OCD)

The Overcurrent Detection (OCD) circuitry detects measured current values that are 110% above the maximum current range value of the CT430 for the unipolar (DC current) variant. For the bipolar (AC current) variant of the CT430 it is greater than  $\pm 110\%$  of the maximum current range. This will generate a fault signal via the Fault# Interrupt ( $\overline{\text{FLT}}$ ) pin (low) to the host system's microcontroller. Once the measured current falls to 90% of the maximum current range for the DC current variant or  $\pm 90\%$  for the AC current version then the fault will be cleared, and the  $\overline{\text{FLT}}$  pin will go high.

## Undervoltage Lockout (UVLO)

The Undervoltage Lockout protection circuitry of the CT430 is activated when the supply voltage ( $V_{CC}$ ) falls below 2.45 V. The CT430 remains in a low quiescent state until  $V_{CC}$  rises above the UVLO threshold (2.50 V). In this condition where  $V_{CC}$  is less than 2.45 V and UVLO is triggered, the output from the CT430 is not valid, and the  $\overline{\text{FLT}}$  pin will go low. Once  $V_{CC}$  rises above

2.50 V then the UVLO is cleared, and the  $\overline{\text{FLT}}$  pin will be high.

## Fault# Interrupt ( $\overline{\text{FLT}}$ )

The CT430 generates an active LOW digital fault signal via the  $\overline{\text{FLT}}$  pin to interrupt the microcontroller to indicate a fault event has been triggered. It is an open drain output and requires a pull-up resistor with a value of 100 k $\Omega$  tied to  $V_{CC}$  and a 1.0 nF capacitor is connected to ground. A fault signal will interrupt the host system for these events:

- OCD
- UVLO

The  $\overline{\text{FLT}}$  signal will be asserted low whenever one of the above fault events occur. In the case of an UVLO event, the  $\overline{\text{FLT}}$  pin will stay low until the fault is cleared and then go high.

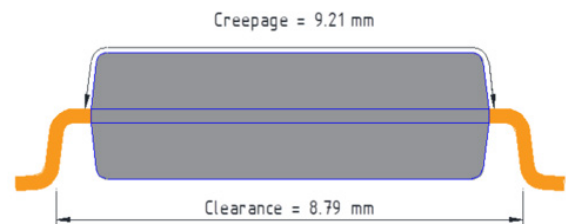
If the  $\overline{\text{FLT}}$  is not used, then a 1.0 nF capacitor must be connected from the pin to ground.

## Immunity to Common Mode Fields

The CT430 is housed in custom plastic package that uses a U-shaped leadframe to reduce the common mode fields generated by external stray magnetic fields. With the U-shaped leadframe, the stray fields cancel one another thus reducing electro-magnetic interference (EMI). The CT430 is able to achieve -54 dB of Common Mode Rejection Ratio (CMFRR). Also, good PCB layout of the CT430 will optimize performance and reduce EMI. See the Applications Information section in this datasheet 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 53 illustrates the creepage and clearance for the SOICW-16 package of the CT430.



**Figure 53: The Creepage and Clearance for the CT430 SOICW-16 package**

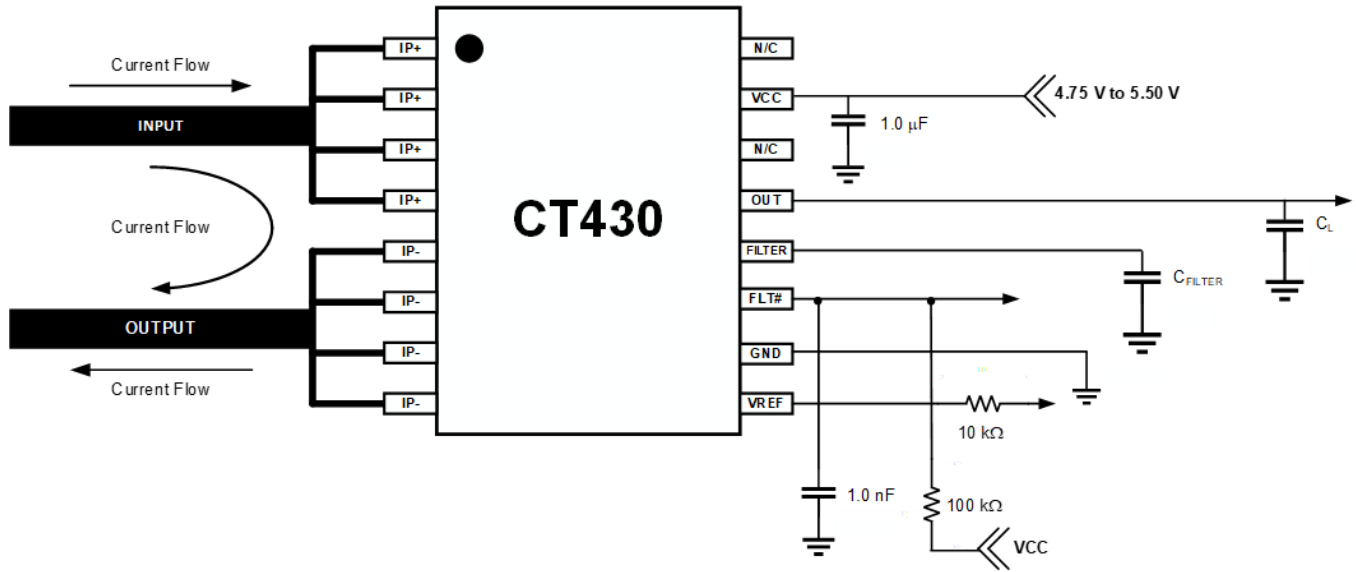


Figure 54: CT430 Application Block Diagram

## Application

The CT430 is an integrated contact current sensor that can be used in many applications from measuring current in power supplies to motor control to overcurrent 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  $\overline{\text{FLT}} \#$  alerts the host system to any fault event that may occur in the CT430. Figure 54 is an application diagram of how CT430 would be implemented in a system. The third output is the VREF which provides the output reference voltage of the CT430.

The device 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  $\mu\text{F}$  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 CT430 to minimize inductance and resistance between the two devices.

## Filter Capacitor

A capacitor may be added to the FILTER pin of the CT430 if there is a requirement to improve the noise performance. The capacitor will be connected to an internal resistor of 15 k $\Omega$  inside

the chip to form an R-C filter. This R-C filter produces a cutoff frequency that will reduce the noise over this lower bandwidth.

If the FILTER pin is not used, then it should not be connected (no connect).

## $\overline{\text{FLT}} \#$ and VREF Resistors and Capacitors

For the CT430, the  $\overline{\text{FLT}} \#$  pin is an open drain output. It requires a pull-up resistor value of 100 k $\Omega$  to be connected from the pin to VCC and also a 1.0 nF capacitor to be connected from the pin to ground.

In designs where the VREF pin is used, a 10 k $\Omega$  resistor must be connected as close to the pin as possible in series with a load.

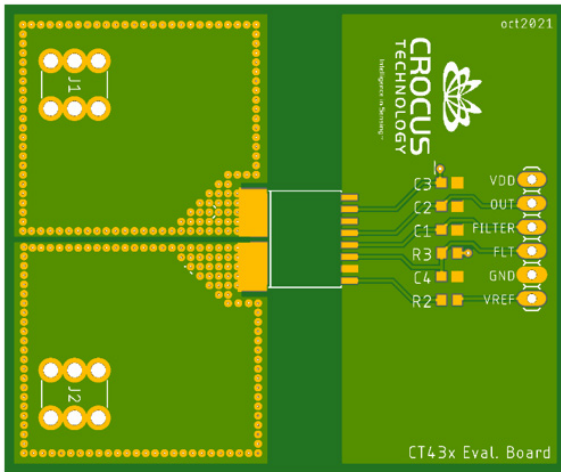
If the VREF pin is not needed in the application, then this pin should not be connected and be left floating.

Also, if the  $\overline{\text{FLT}} \#$  pin function is not required in the application, then a 1.0 nF capacitor must be connected from this pin to ground.

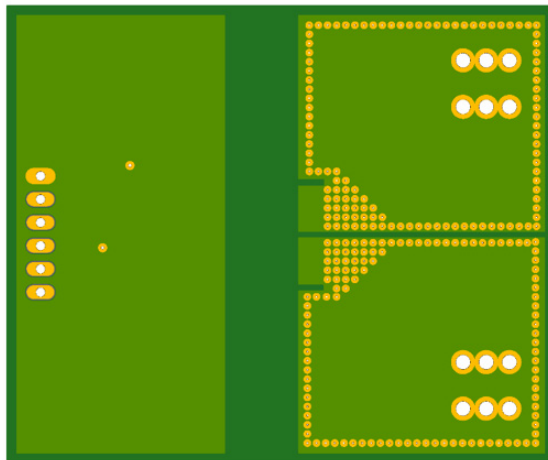
## Recommended PCB Layout

Since the CT430 can measure up to 65 A of current, special care must be taken in the printed circuit board (PCB) layout of the CT430 and the surrounding circuitry. It is recommended that the CCC pins be connected to as much copper area as possible. For up to 30 A of current, 2 oz (or heavier) of copper can be used for the PCB traces. It is also recommended that 4 oz. or heavier cop-

per be used for PCB traces when the CT430 is used to measure 50 A and 65 A of current. Additional layers of the PCB should also be used to carry current and be connected using the arrangement of vias. Figure 55 and Figure 56 show the recommended the PCB layout for the 20 A, 30 A, 50 A, and 65 A variants of the CT430. Note that the traces connected to the IP+ and IP- pins of the CT430 are very wide with multiple vias such that it can handle the high current.



**Figure 55: Recommended PCB Layout (Top Layer) for the 20 A to 65 A variants of the CT430**

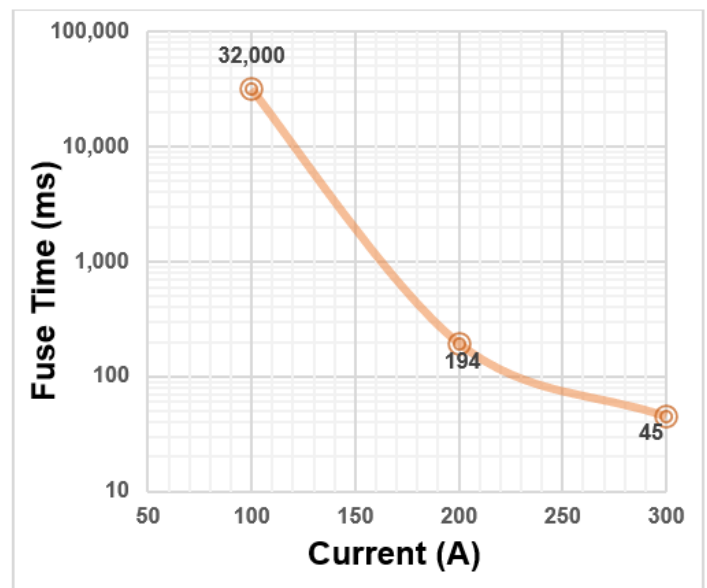


**Figure 56: Recommended PCB Layout (Bottom Layer) for the 20 A to 65 A variants of the CT430**

### Fuse Time vs. Current

Since the CT430 is a contact current sensor, it dissipates heat as current is conducted through its leadframe, this limits the current it can measure which is 65 A. The CT430 leadframe has ~0.5 mΩ resistance which results in very low power dissipation during normal operation.

However, when the current surges above the rated nominal values of the CT430 due to short circuit or transient current spikes for a specific duration of time, the leadframe will be permanently damaged.



**Figure 57: CT430 Fuse Time vs. Current**

Figure 57 illustrates the CT430 fuse time for 100 A, 200 A, and 300 A current levels. The CT430 tolerates 100 A for 32 seconds while, at 200 A and 300 A, the fuse times are 194 ms and 45 ms, respectively.



## PACKAGE OUTLINE DRAWING

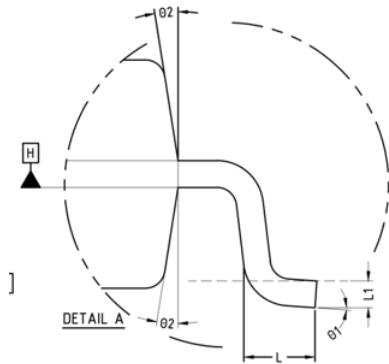
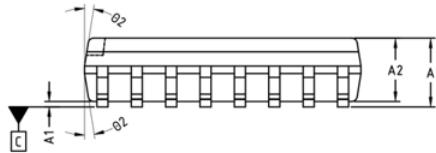
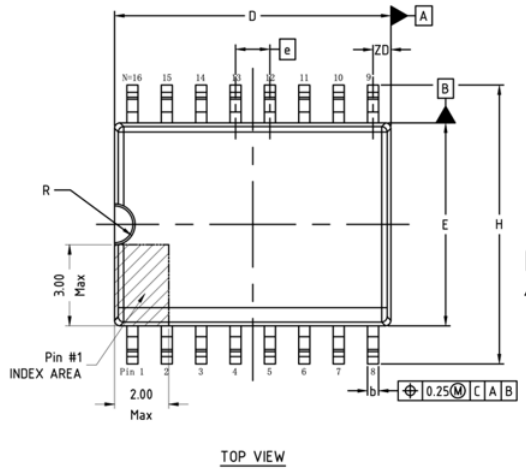


Table 1: CT430 SOICW-16 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
A	2.44	2.54	2.64
A1	0.10	0.20	0.30
A2	2.24	2.34	2.44
b	0.36	0.41	0.46
C	0.23	–	0.32
D	10.11	10.21	10.31
E	7.40	7.50	7.60
e	1.27 BSC		
H	10.11	10.31	10.51
h	0.31	0.51	0.71
L	0.51	0.76	1.01
L1	0.25 BSC		
R	0.76 REF		
θ1	0.25 BSC	0.25 BSC	0.25 BSC
θ2	0.76 REF	0.76 REF	0.76 REF
ZD	0.66 REF		
N	16		

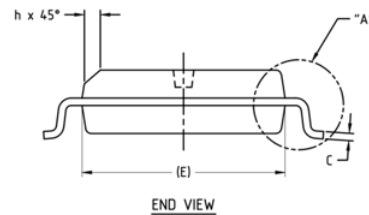
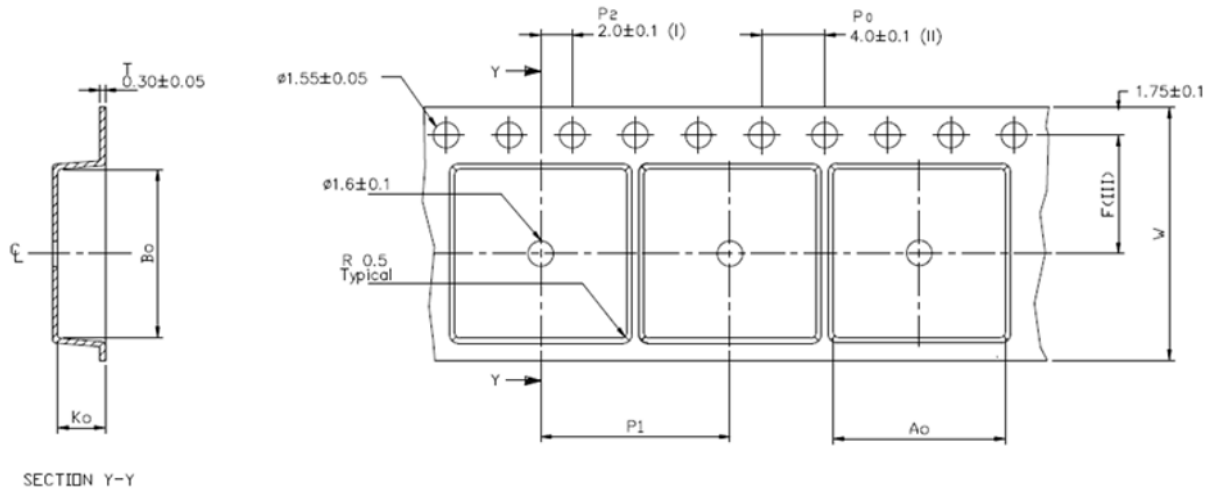


Figure 58: SOICW-16 Package Drawing and Dimensions

TAPE AND REEL POCKET DRAWING AND DIMENSIONS



Ao	10.90 +/- 0.1
Bo	10.70 +/- 0.1
Ko	3.00 +/- 0.1
F	7.50 +/- 0.1
P1	12.00 +/- 0.1
W	16.00 +/- 0.3

- (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) Typical SR of form tape Max 10<sup>8</sup> OHM/SQ
- ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

Figure 59: Tape and Pocket Drawing for SOICW-16 Package

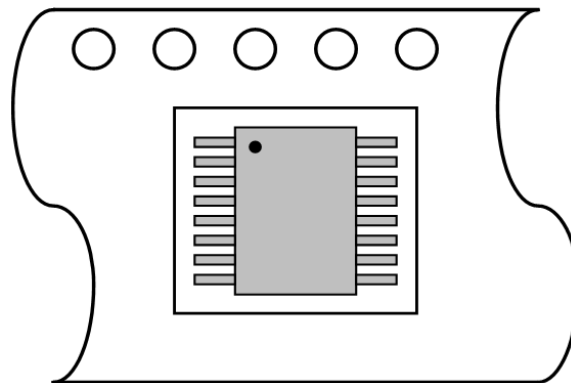


Figure 60: SOICW-16 Orientation in Tape Pocket

## PACKAGE INFORMATION

Table 2: CT430 Package Information

Part Number	Package Type	# of Leads	Package Quantity	Lead Finish	MSL Rating [2]	Operating Temperature (°C) [3]	Device Marking [4]
CT430-HSWF20DR	SOICW	16	1000	Sn	3	-40 to 125	CT430 SWF20DR YYWWLL
CT430-ASWF20DR	SOICW	16	1000	Sn	3	-40 to 125	CT430A SWF20DR YYWWLL
CT430-HSWF20MR	SOICW	16	1000	Sn	3	-40 to 125	CT430 SWF20MR YYWWLL
CT430-ASWF20MR	SOICW	16	1000	Sn	3	-40 to 125	CT430A SWF20MR YYWWLL
CT430-HSWF30DR	SOICW	16	1000	Sn	3	-40 to 125	CT430 SWF30DR YYWWLL
CT430-ASWF30DR	SOICW	16	1000	Sn	3	-40 to 125	CT430A SWF30DR YYWWLL
CT430-HSWF30MR	SOICW	16	1000	Sn	3	-40 to 125	CT430 SWF30MR YYWWLL
CT430-ASWF30MR	SOICW	16	1000	Sn	3	-40 to 125	CT430A SWF30MR YYWWLL
CT430-HSWF50DR	SOICW	16	1000	Sn	3	-40 to 125	CT430 SWF50DR YYWWLL
CT430-ASWF50DR	SOICW	16	1000	Sn	3	-40 to 125	CT430A SWF50DR YYWWLL
CT430-HSWF50MR	SOICW	16	1000	Sn	3	-40 to 125	CT430 SWF50MR YYWWLL
CT430-ASWF50MR	SOICW	16	1000	Sn	3	-40 to 125	CT430A SWF50MR YYWWLL
CT430-HSWF65DR	SOICW	16	1000	Sn	3	-40 to 125	CT430 SWF65DR YYWWLL
CT430-ASWF65DR	SOICW	16	1000	Sn	3	-40 to 125	CT430A SWF65DR YYWWLL
CT430-HSWF65MR	SOICW	16	1000	Sn	3	-40 to 125	CT430 SWF65MR YYWWLL
CT430-ASWF65MR	SOICW	16	1000	Sn	3	-40 to 125	CT430A SWF65MR 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  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  and storage temperature range of  $-65^{\circ}\text{C}$  to  $150^{\circ}\text{C}$ .

[4] Device Marking for CT430 is defined as CT430 SWFxxZR YYWWLL where the first 2 lines = part number, YY = year, WW = work week, and LL = lot code.

## DEVICE MARKING

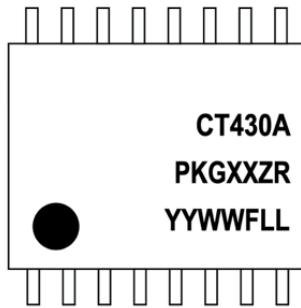
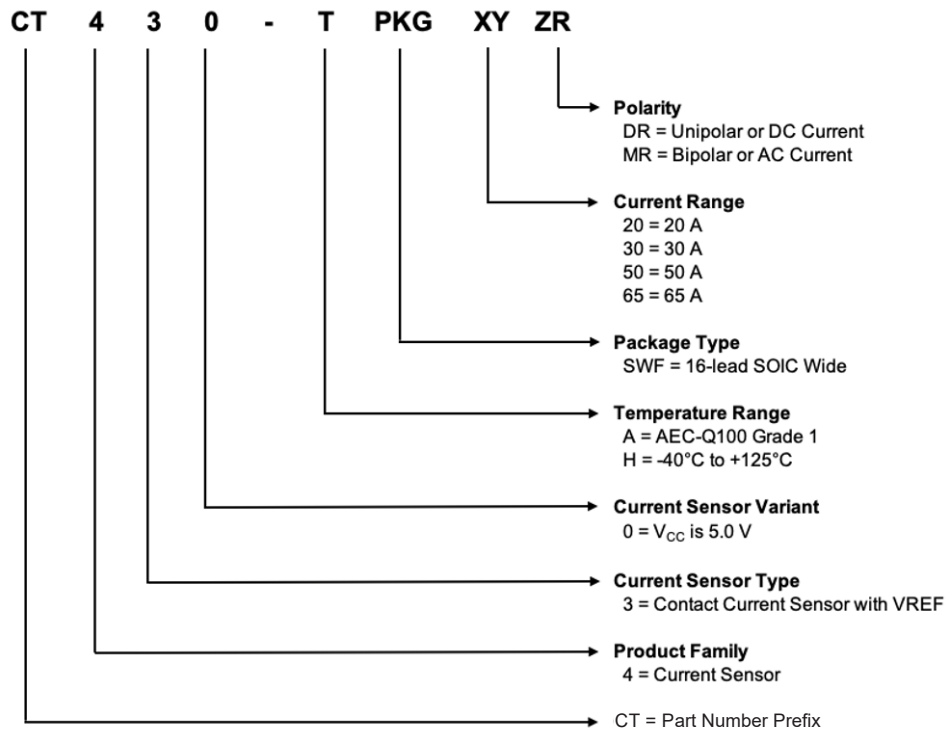


Table 3: CT430 Device Marking Definition for 16-lead SOICW Package

Row No.	Code	Definition
3	•	Pin 1 Indicator
1	CT430	Allegro Part Number
1	A	AEC-Q100 Qualified
2	PKG	Package Type
2	XX	Maximum Current Rating
2	ZR	Polarity
3	YY	Calendar Year
3	WW	Work Week
3	LL	Lot Code

Figure 61: CT430 Device Marking for 16-lead Package

## PART ORDERING NUMBER LEGEND



## Revision History

Number	Date	Description
3	November 2, 2023	Document rebranded and minor editorial updates

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