CROCUS TECHNOLOGY
Intelligence in Sensing™

CT300

2D Angular Sensor

Features

- Angular Error < 0.6° Over Full Temperature Range
- Dual Full-Bridge Resistor Network
- Operating Magnetic Field: 20 mT to 80 mT
- Differential Outputs for SIN and COS Axes
- Supply Voltage: 1.0 V to 5.5 V
- Package Options:
  - 8-lead TSSOP
  - 8-lead DFN, 2.00 × 2.00 × 0.35 mm
  - Die Form

Applications

- Angular Measurements
- Rotary and Angular Sensors
- BLDC Motors

Product Description

The CT300 is a 2D angular sensor in a dual full-bridge configuration from Crocus Technology developed on its patented MLU™ technology. The operating magnetic field for this 2D sensor is 20 mT to 80 mT and has an angular error of 0.6° after compensation over the full operating temperature range. It has differential outputs for both sine (SIN) and cosine (COS) axes and operates with a supply voltage range from 1.0 V to 5.5 V.

It is packaged in an 8-lead TSSOP package and for applications where space is critical, a low profile, small form factor 8-lead DFN package that is 2.00 × 2.00 × 0.35 mm in size. The CT300 is also made available in die form where it will be shipped as unsawn wafers (wafer map files will be provided to indicate known good die).

Ordering Information

Part Number	Operating Temperature Range	Output Type	Package	Packing Method
CT300LS-IT8	-40°C to +85°C	Differential	8-lead TSSOP 6.40 x 3.05 x 1.10 mm	Tape & Reel
CT300LS-HT8	-40°C to +125°C			
CT300LS-FT8	-40°C to +150°C			
CT300LS-ID8	-40°C to +85°C	Differential	8-lead DFN 2.00 x 2.00 x 0.35 mm	Tape & Reel
CT300LS-HD8	-40°C to +125°C			
CT300LS-FD8	-40°C to +150°C			
CT300LS-KGD	-40°C to +150°C	Differential	Single Die on Wafer 0.650 x 0.650 mm (80 µm scribe line not included)	Unsawn Wafer

Block Diagram

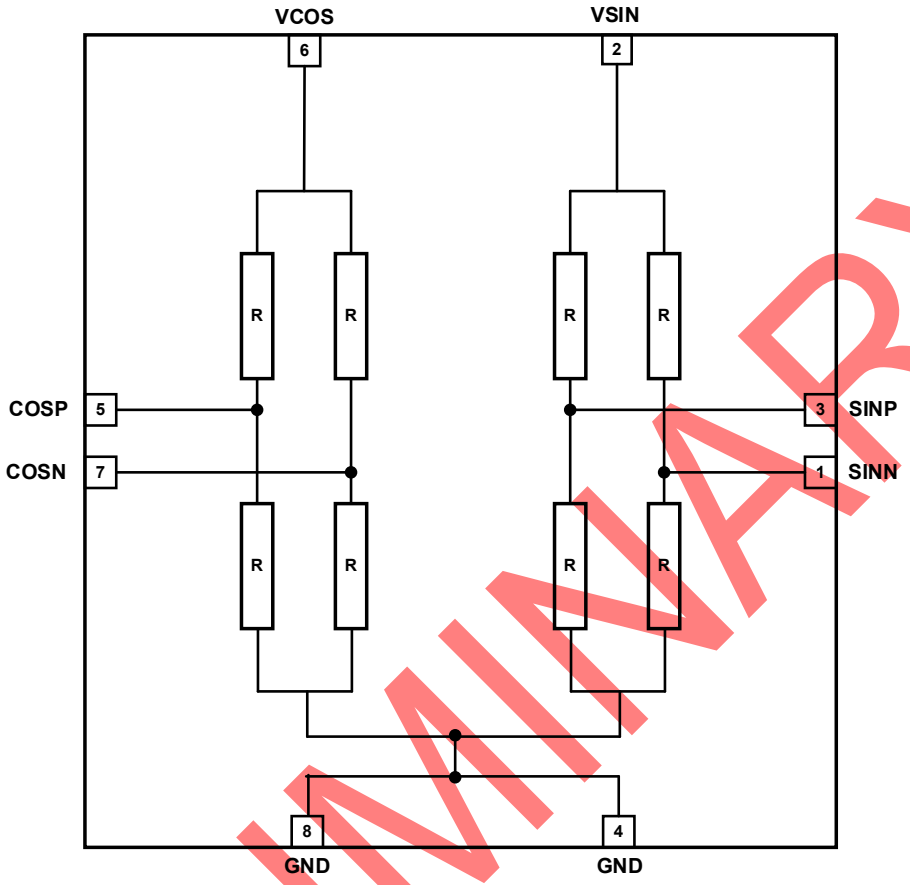


Figure 1. CT300 Functional Block Diagram

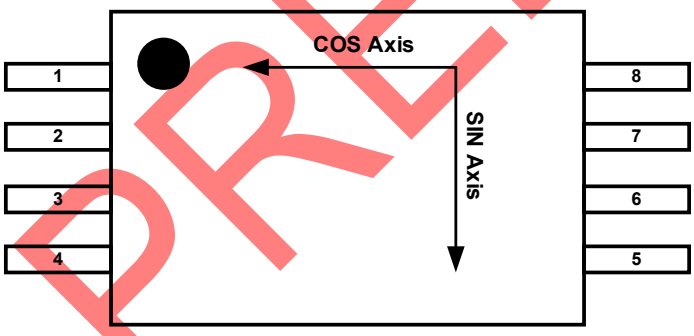


Figure 2. CT300 Axes of Sensitivity for TSSOP-8

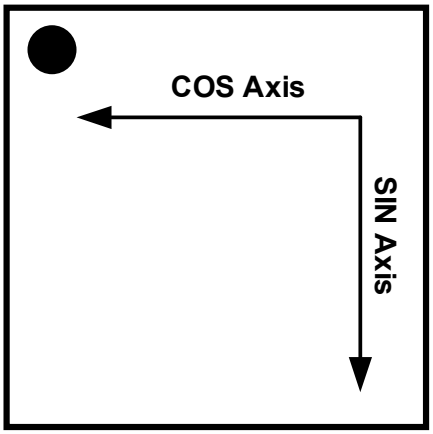
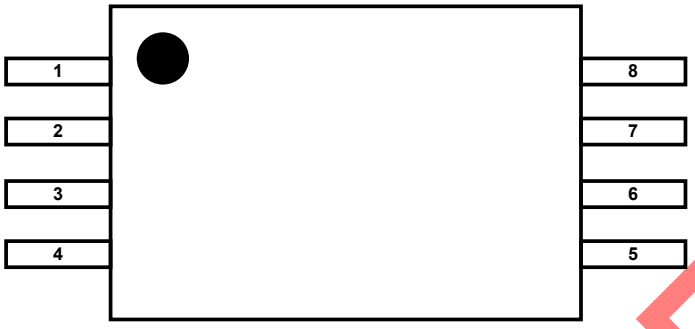
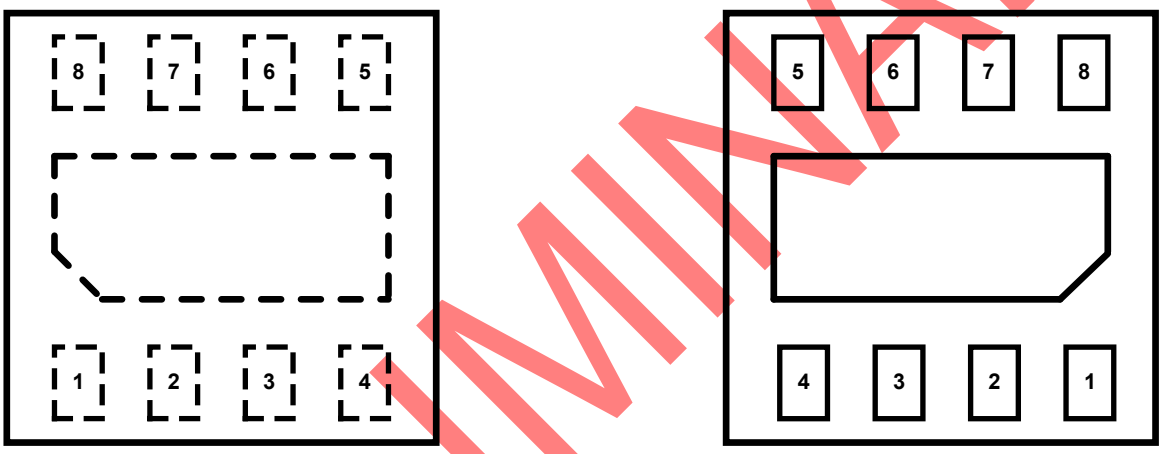


Figure 3. CT300 Axes of Sensitivity for DFN-8

Pin Configurations



TSSOP-8 – Top Down View



DFN-8 – Top Down View

DFN-8 – Bottoms Up View

Figure 4. CT300 Pin-out Diagrams

Pin Definitions

TSSOP-8 Pin #	DFN-8 Pin #	Pin Name	Pin Description
1	1	SINN	Differential negative output for sine.
2	2	VSIN	Supply voltage for sine
3	3	SINP	Differential positive output for sine.
4	4	GND	Ground for sine.
5	5	COSP	Differential positive output for cosine.
6	6	VCOS	Supply voltage for cosine
7	7	COSN	Differential negative output for cosine.
8	8	GND	Ground for cosine.

Pad Configuration

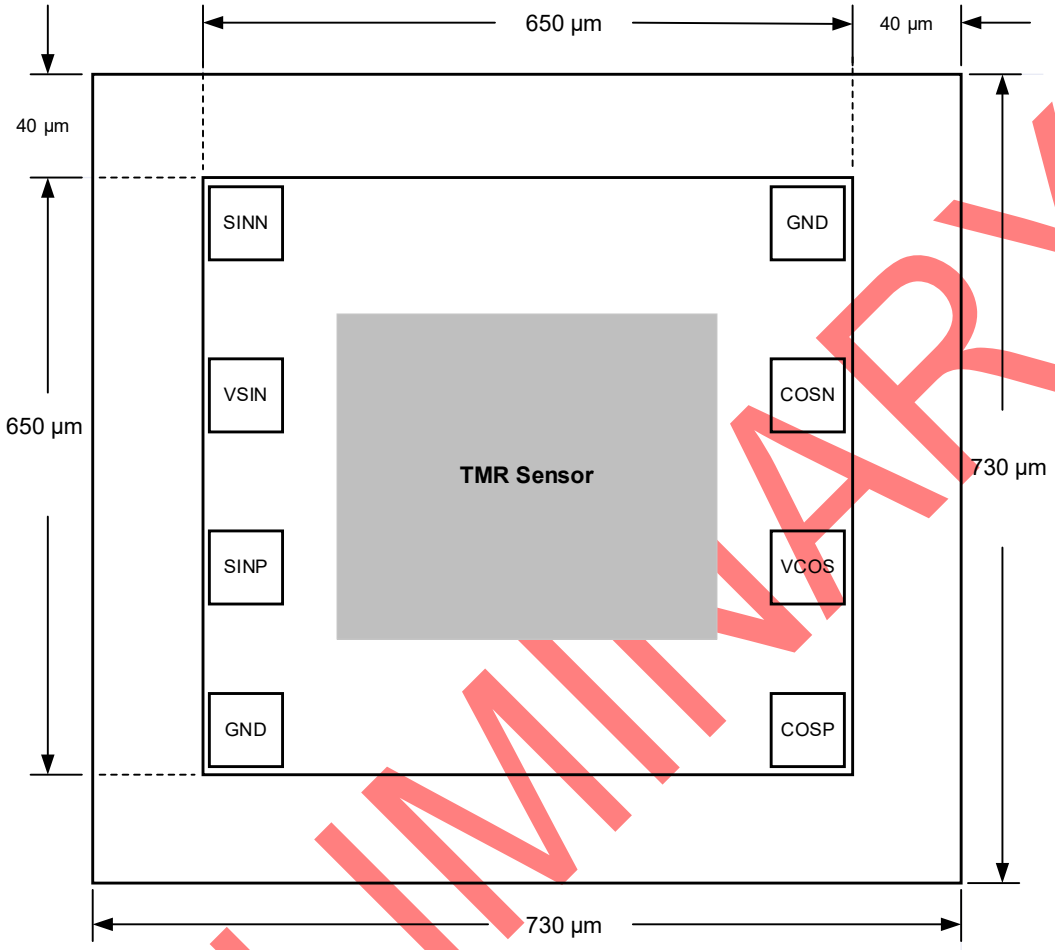


Figure 5. CT300 Pad Diagram

Pad Definitions

Pad #	Pad Name	Pad Description
1	SINN	Differential negative output for sine.
2	VSIN	Supply voltage for sine
3	SINP	Differential positive output for sine.
4	GND	Ground for sine.
5	COSP	Differential positive output for cosine.
6	VCOS	Supply voltage for cosine
7	COSN	Differential negative output for cosine.
8	GND	Ground for cosine.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the CT300 and may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
V_{DD}	Supply Voltage		-0.3	6.0	V
$V_{I/O}$	Analog Input/Output Pins Maximum Voltage		-0.3	V_{DD} + 0.3	V
ESD	Electrostatic Discharge Protection Level	Human Body Model (HBM) per JESD22-A114	±2.0		kV
		Charged Device Model (CDM) per JESD22-C101	±1.0		
B_{MAX}	Maximum Magnetic Field			200	mT
T_{STG}	Storage Temperature		-65	+165	°C
T_L	Lead Soldering Temperature, 10 Seconds			+260	°C

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual operation of the CT300. Recommended operating conditions are specified to ensure optimal performance to the specifications. Crocus Technology does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter		Min.	Typ.	Max.	Unit
V_{DD}	Supply Voltage Range		1.0		5.5	V
V_{OUT}	OUT Voltage Range		0		V_{DD}	V
$B_{OPERATING}$	Operating Magnetic Field		20		80	mT
T_A	Operating Ambient Temperature	Industrial	-40	+25	+85	°C
		Extended Industrial	-40	+25	+125	
		Full	-40	+25	+150	

Thermal Properties

Junction-to-ambient thermal resistance is a function of application and board layout and is determined in accordance to JEDEC standard JESD51-7 for a four (4) layer 2s2p FR-4 printed circuit board (PCB) with 2 oz. of copper (Cu). Special attention must be paid to not exceed junction temperature $T_{J(MAX)}$ at a given ambient temperature T_A.

Symbol	Parameter	Min.	Typ.	Max.	Unit
θ_{JA}	Junction-to-Ambient Thermal Resistance, DFN-8		81		°C/W
θ_{JA}	Junction-to-Ambient Thermal Resistance, TSSOP-8		124		°C/W

Electrical & Magnetic Specifications

Unless otherwise specified: V_{DD} = 1.0 V to 5.5 V, C_{BYP} = 1.0 µF and T_A = -40°C to +125°C. Typical values are V_{DD} = 3.0 V and T_A = +25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Magnetic						
$B_{OPERATING}$	Operating Magnetic Field		20		80	mT
Electrical						
R_{BRIDGE}	Bridge Resistance		36	40	44	kΩ
Differential Outputs						
θ_{ERR}	Angular Error (1)	After Compensation at T_A = +25°C.			0.6	°
θ_{ERR_HYST}	Angle Error due to Hysteresis		No Hysteresis			°
V_{SIN_D}, V_{COS_D}	SIN, COS Differential Output Voltage Peak-to-Peak		0.38	0.40	0.44	V/V
V_{OFF_SIN}, V_{OFF_COS}	SIN, COS Voltage Offset			±1	±2	mV/V
k	SIN, COS Amplitude Synchronism Ratio		98	100	102	%
OE_{SIN}, OE_{COS}	SIN, COS Orthogonality Error		89	90	91	°
$t_{RESPONSE}$	SIN, COS Response Time	C_L = 37 pF		1.0		µs

(1) Hysteresis error and output noise are included in the Angular Error specification.

Electrical Characteristics

V_{DD} = 3.0 V and T_A = +25°C, C_{BYP} = 1.0 µF.

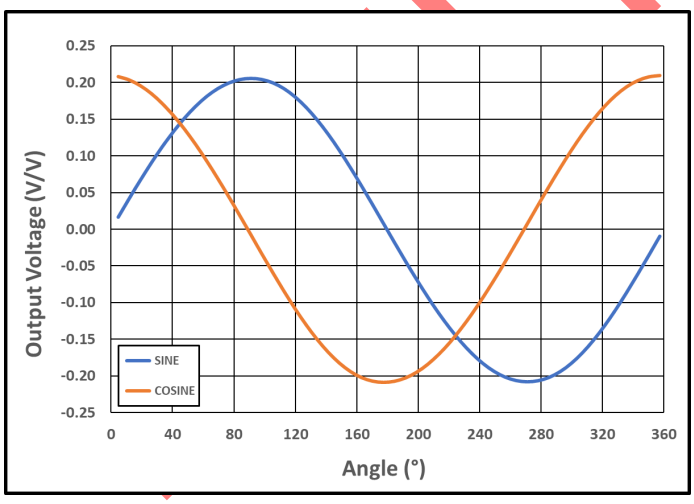


Figure 6. Output Voltage vs. Angle

Recommended Application Circuit

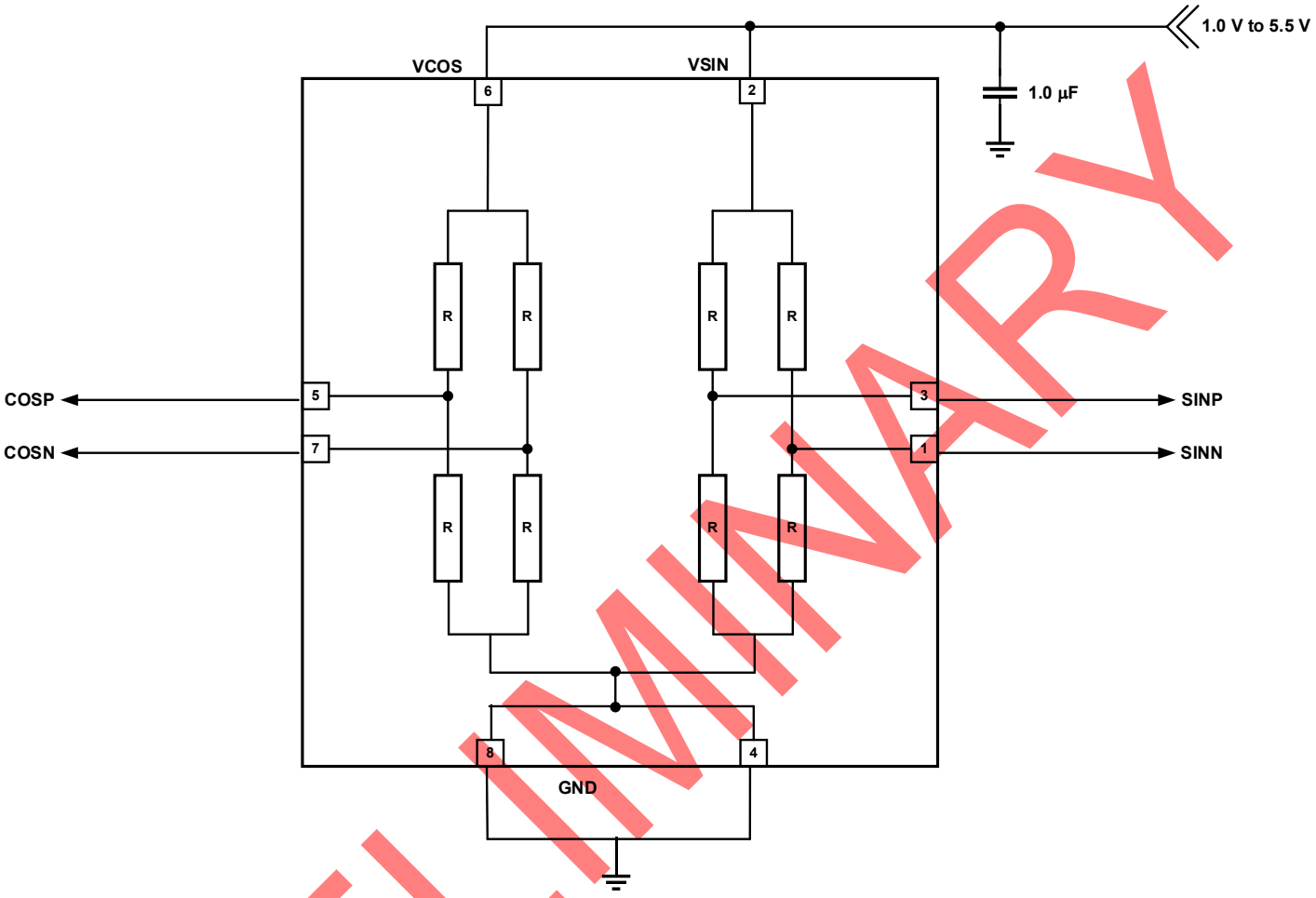


Figure 7. CT300 Application Diagram

Table 1. Recommended External Components

Component	Description	Vendor & Part Number	Parameter	Min.	Typ.	Max.	Unit
C_{BYP}	1.0 µF, X7R	Murata GRM155R70J105MA12	C		1.0		µF

TSSOP-8 Package Drawing and Dimensions

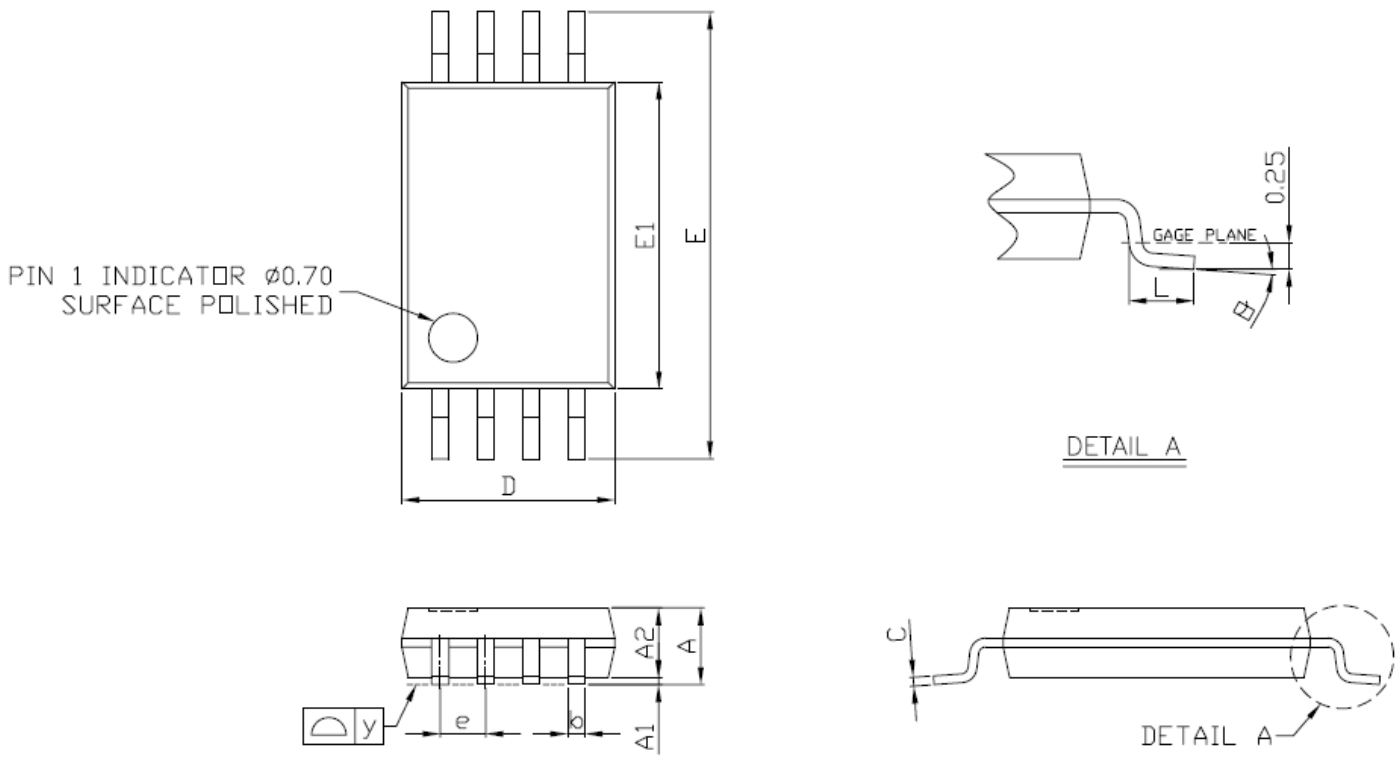


Figure 8. TSSOP-8 Package Drawing

Table 2. CT300 TSSOP-8 Package Dimensions

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

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DFN-8 Package Drawing and Dimensions

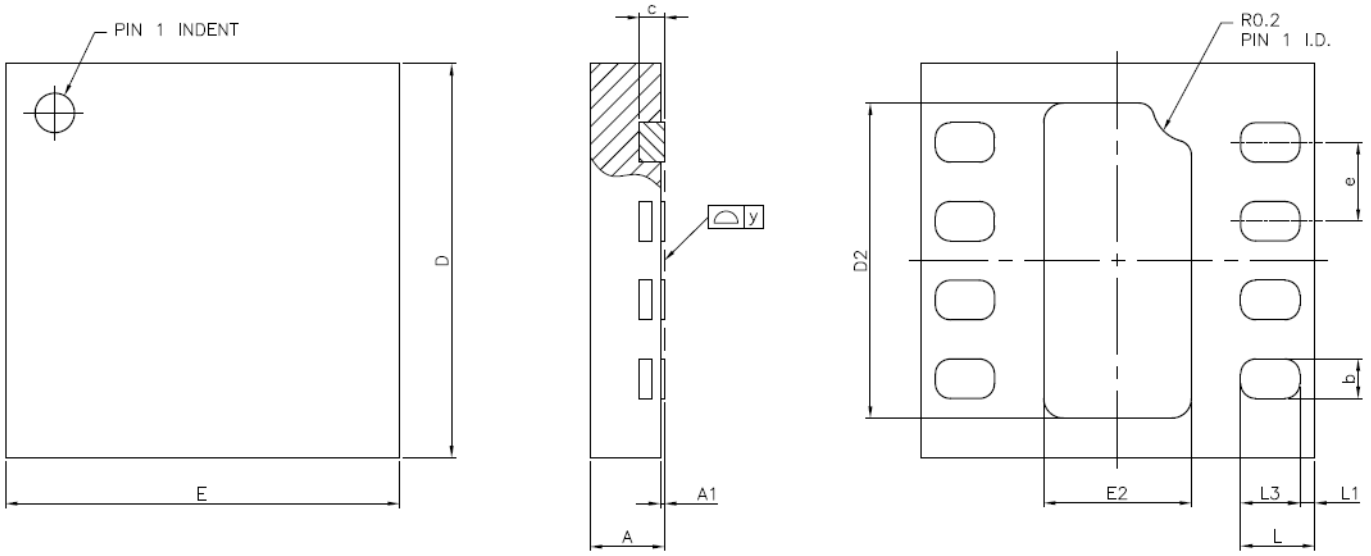

Figure 9. DFN-8 Package Drawing

Table 3. CT300 DFN-8 Package Dimensions

Symbol	Dimensions in Millimeters (mm)		
	Min.	Typ.	Max.
A	0.30	0.35	0.40
A1	0.00	0.02	0.05
b	0.15	0.20	0.25
c	-	0.127 REF	-
D	1.95	2.00	2.05
D2	1.55	1.60	1.65
E	1.95	2.00	2.05
E2	0.70	0.75	0.80
e	-	0.40	-
L	0.325	0.375	0.425
L1	-	0.075	-
L3	0.25	0.30	0.35
y	0.000	-	0.075

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Package Information

Table 4. CT300 Package Information

Part Number	Package Type	# of Leads	Package Quantity	Lead Finish	Eco Plan (1)	MSL Rating (2)	Operating Temperature (3)	Device Marking
CT300LS-IT8	TSSOP	8	3,000	Sn	Green & RoHS	1	-40°C to +85°C	TBD
CT300LS-HT8	TSSOP	8	3,000	Sn	Green & RoHS	1	-40°C to +125°C	TBD
CT300LS-FT8	TSSOP	8	3,000	Sn	Green & RoHS	1	-40°C to +150°C	TBD
CT300LS-ID8	DFN	8	3,000	Sn	Green & RoHS	1	-40°C to +85°C	TBD
CT300LS-HD8	DFN	8	3,000	Sn	Green & RoHS	1	-40°C to +125°C	TBD
CT300LS-FD8	DFN	8	3,000	Sn	Green & RoHS	1	-40°C to +150°C	TBD

(1) RoHS is defined as semiconductor products that are compliant to the current EU RoHS requirements. It also will meet the requirement that RoHS substances do not exceed 0.1% by weight in homogeneous materials. Green is defined as the content of Chlorine (Cl), Bromine (Br) and Antimony Trioxide based flame retardants satisfy JS709B low halogen requirements of ≤ 1,000 ppm.

(2) MSL Rating = Moisture Sensitivity Level Rating as defined by JEDEC standard classifications.

(3) Package will withstand ambient temperature range of -40°C to +150°C and storage temperature range of -65°C to +165°C.

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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.