钛地半导体
Tudi Semiconductor

Product Specification

TUDI-ACS712

Fully Integrated, Hall Effect-Based Linear Current Sensor IC with a Low-Resistance Current Conductor

网址 www.sztdbdt.com

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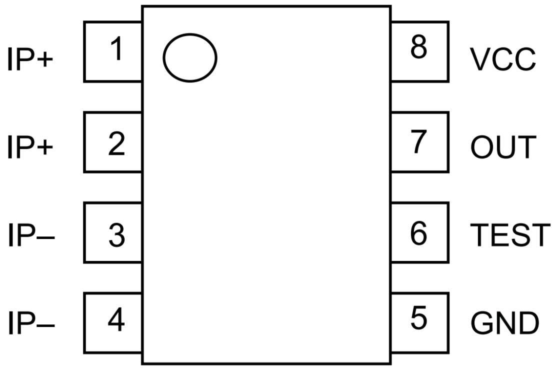
semiconductor device manufacturer

- Design
- research and development
- production
- and sales

Features

- Low-noise analog signal path
- Device bandwidth is set via the new FILTER pin
- 5 μs output rise time in response to step input current
- 120 kHz bandwidth
- Total output error 1.5% at T_A = 25°C
- Small footprint, low-profile SOIC8 package
- 1.2 mΩ internal conductor resistance
- 5.0 V, single supply operation
- 66 to 185 mV/A output sensitivity
- Output voltage proportional to AC or DC currents
- Factory-trimmed for accuracy
- Extremely stable output offset voltage
- Nearly zero magnetic hysteresis
- Ratiometric output from supply voltage



Pin Diagram

Description

The ACS712 provides economical and precise solutions for AC or DC current sensing in industrial, commercial, and communications systems. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, switchmode power supplies, and overcurrent fault protection. The device is not intended for automotive applications.

The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging.

The output of the device has a positive slope (>VIOUT(Q)) when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4), which is the path used for current sampling. The internal resistance of this conductive path is 1.2 mΩ typical, providing low power loss. The thickness of the copper conductor allows survival of the device at up to 5× overcurrent conditions. The terminals of the conductive path are electrically isolated from the signal leads (pins 5 through 8). This allows the ACS712 to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques.

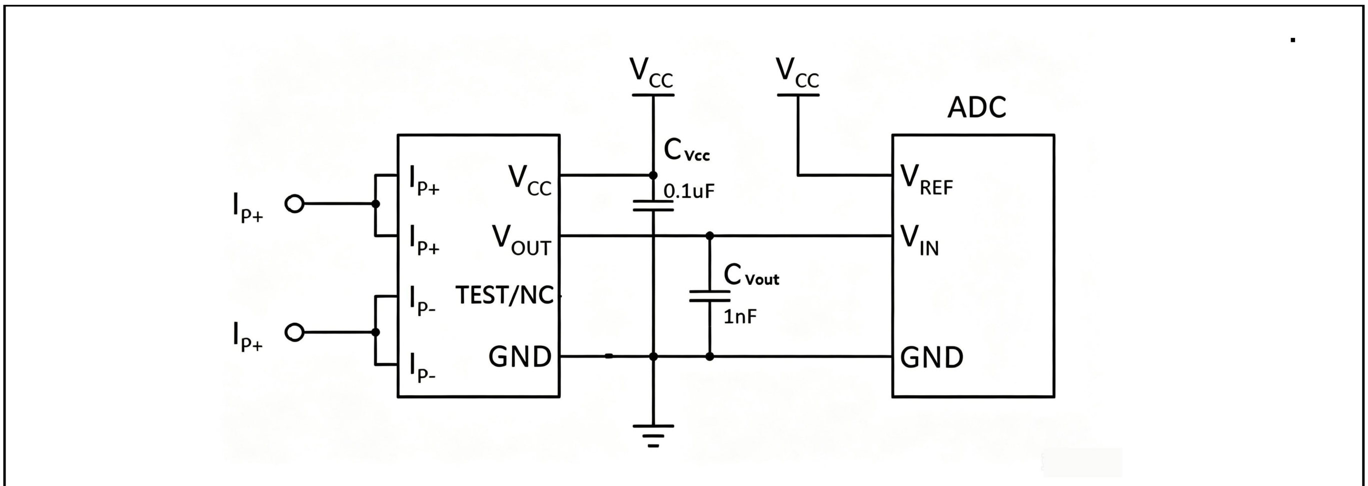
Applications

- Inverter current detection
- Motor phase current detection (motor control)
- Photovoltaic inverter
- Battery Load Testing System
- Current Transformer
- Switching Power Supply
- Overload Protection Device

Pin description

Number	Name	Description
1	IP+	Terminals for current being sampled;fused internally
2		
3	IP-	Terminals for current being sampled;fused internally
4		
5	GND	Signal ground terminal
6	TEST	Terminal for external capacitor that sets bandwidth
7	OUT	Analog output signal
8	VCC	Device power supply terminal

The typical application circuit of ACS712includes a filter capacitor CVcc between VCC and ground, aswell as an optional filter capacitor CVout between the output and ground. At the input end of themeasured current, pins 1 and 2 are shorted together to serve as the input end of the measured current, while pins 3 and 4 are shorted together to serve as the output end of the measured current. The analog output signal of the sensor is perfectly proportional to the AC/DC current being measured.



Typical application circuit

Electrical Parameters

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
V_{cc}	Operating voltage	-	4.5	5	5.5	V
I_{cc}	Operating current	TA=25℃,Output No Load	9	11.18	13	mA
B_W	Built-in bandwidth	Smallsignal:-3dB,CL=1nF, TA=25℃	-	120	-	KHz
T_{PO}	Power-on time	TA=25℃,CL=1nF,Sensitivity 2mV/G,Constant Magnetic Field: 400Gs		100		us
T_{TC}	Temperature-compensated power-on time	TA=150℃,CL=1nF,Sensitivity 2mV/G,Constant Magnetic Field: 400Gs	-	300	-	us
V_{UVLOH}	Undervoltage lockout threshold	TA=25℃,Voltage rises,Device starts operating.		4.1		V
V_{UVLOL}		TA=25℃,Voltage drops,Device stops operating.		3.8		V
V_{PORH}	Reset voltage	TA=25℃,VCC rises.	-	4.1	-	V
V_{PORL}		TA=25℃,VCC drops.	-	3.8	-	V
t_{PORR}	Power-on reset release time	TA=25℃,VCC rises.	-	10	-	us
I_{sCLP}	Maximum current source			80		mA
I_{sCLN}	Maximum sink current		-	40	-	mA
V_{oL}	Analog output saturation low level	RL>=4.7KΩ		0.5		V
V_{oH}	Analog output saturation high level	RL>=4.7KQ	VCC-0.3	-	4.97	V
C_L	Output load capacitance	VOUT to GND	-	0.5	1	nF
R_L	Output load resistance	VOUT to GND		10	-	KQ
		VOUT to VCC		10		KQ
R_{oUT}	Output resistance			9		Ω
t_R	Rise time	TA=25℃,constant magnetic field 400Gs,CL=1nF,sensitivity 2mV/Gs.	-	5.5	-	us
T_{PD}	Transmission delay	TA=25℃,constant magnetic field 400Gs,CL=1nF,sensitivity 2mV/Gs.		4.5		us
T_{RESP}	Response time	TA=25℃,constant magnetic field 400Gs,CL=1nF,sensitivity 2mV/Gs.	-	4	5	us
V_N	Noise	TA=25℃,CL=1nF,sensitivity 2mV/Gs, BWf=Bwi.	-	14.1	-	mVp-p
R_P	Main Current End Resistance			1.5	1.8	mΩ
E_{lin}	Linear Error	TA=25℃,CL=1nF,sensitivity 2mV/Gs, BWf=Bwi.	-	0.4		%
V_{oq}	Quiescent Point	TA=25℃,CL=1nF,sensitivity 2mV/Gs, BWf=Bwi.	2.485	2.500	2.515	V

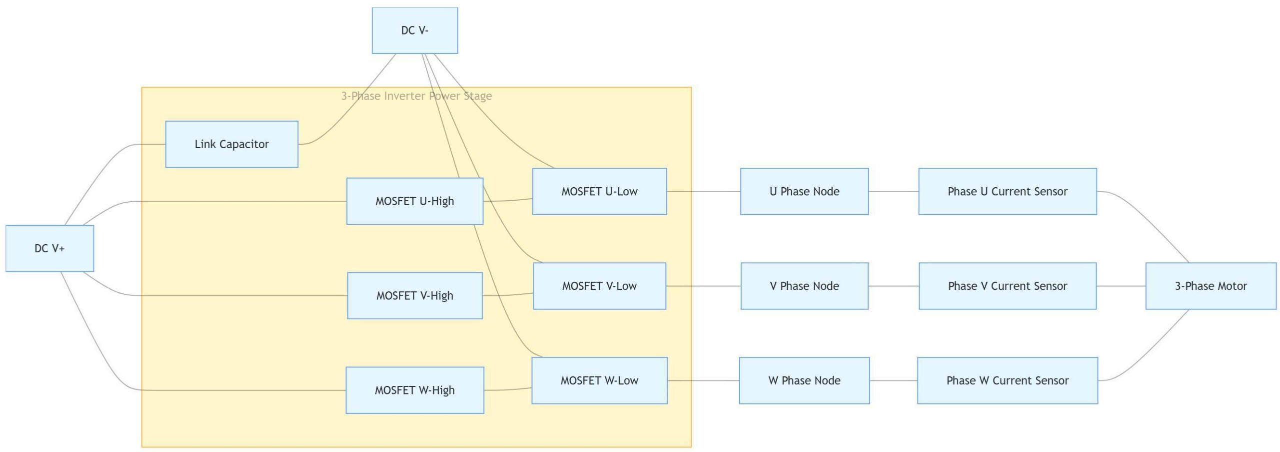
Absolute Maximum Ratings

Using the device beyond its limiting parameters may cause instability of the chip's functions, and prolonged exposure to such conditions may damage the chip .

Symbol	Parameter	Min	Max	Unit
T_A	Working Environment Temperature	-40	150	℃
T_s	Storage Temperature	-65	170	℃
T_J	Maximum Junction Temperature	-	165	℃
V_{cc}	Power supply voltage	-	6	V
V_{OUT}	Output voltage		VCC-0.5	V
$I_{OUT(source)}$	Output current source	-	80	mA
$I_{OUT(sink)}$	Output current sink	-	40	mA
Endurance	EEPROM Programming cycle number	200	-	cycle
Transient surge current at current sampling terminal	IPlpulse100ms		100	A

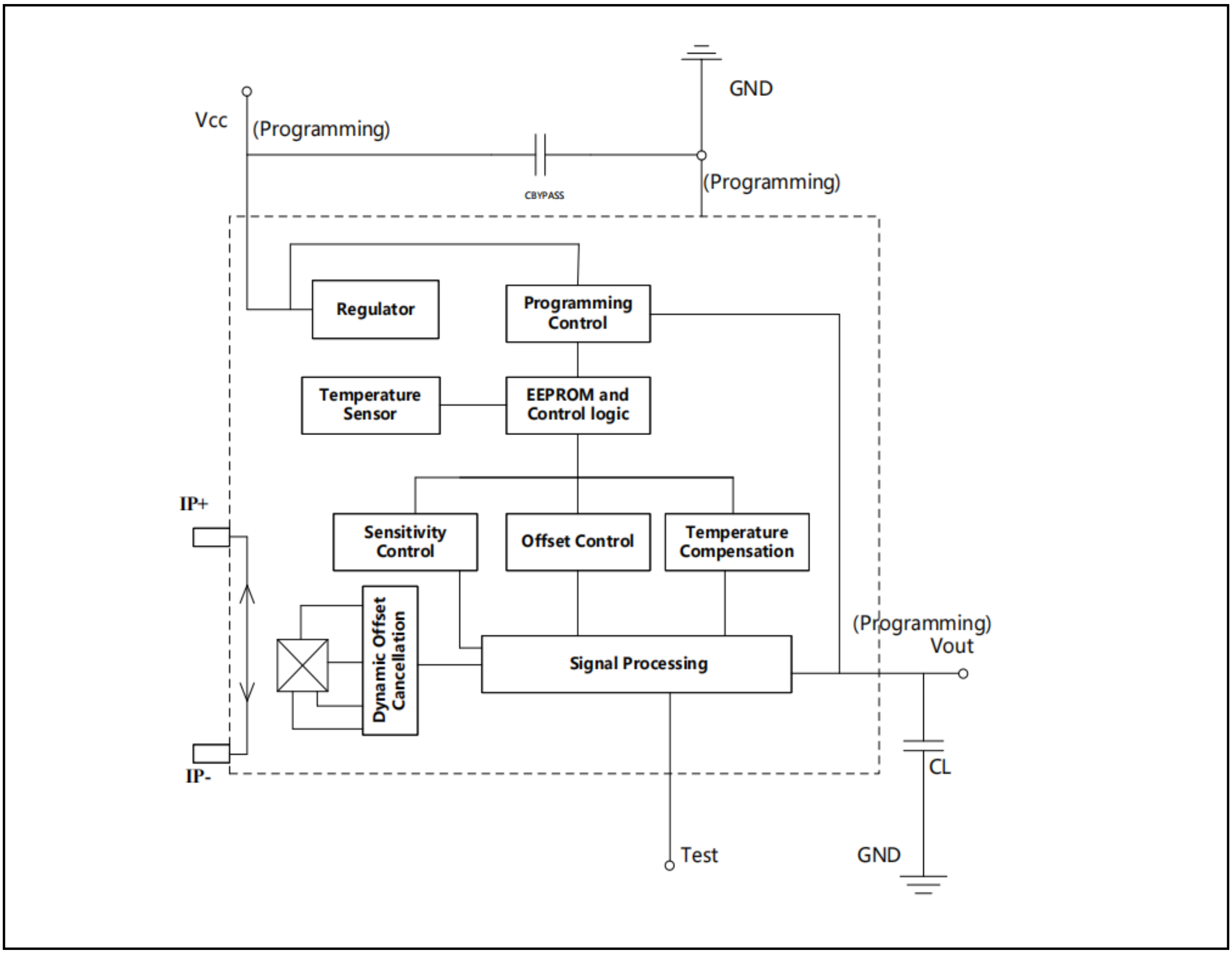
Electrostatic Discharge (ESD) Parameters

Symbol		Execution Standard	Max	Unit
VESD	Human Body Model(HBM)	JEDECJS-001-2017	5	kV



3-Phase Motor Control Application Circuit

Functional Block Diagra



Accuracy Parameter

ACS712ELCTR-05B-T

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Total Output Error	ETOT		-3.0		3.0	%
Output Noise	VNOISE(PP)			46		mV
Sensitivity	Sens	Full Current Range	180	185	190	mV/A
Sensitivity Temperature Coefficient	△Sens	TA=150℃,TA=-40℃ relative to 25℃		0		%/℃
current range	IP			± 5		A
Zero Current Output Temperature Coefficient	△VOUT(Q)			0.26		mV/℃

ACS712ELCTR-20A-T

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Noise	VNOISE(PP)			30		mV
Sensitivity	Sens	Full Current Range	96	100	104	mV/A
Sensitivity Temperature Coefficient	△Sens	TA=150℃,TA=-40℃ relative to 25℃		0		%/℃
Current Range	IP		-20		20	A
Zero Current Output Temperature Coefficient	△VOUT(Q)			0.26		mV/℃
Total Output Error	ETOT		-3.0		3.0	%

ACS712ELCTR-30A-T

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Current Range	IP		-30		30	A
Zero Current Output Temperature Coefficient	△VOUT(Q)			0.26		mV/℃
Total Output Error	ETOT		-3.0		3.0	%
Sensitivity	Sens	FullCurrent Range	64	66.6	69	mV/A
Thermal coefficient of sensitivity	△Sens	TA=150℃,TA=-40℃ ,relative to 25℃		0		%/℃
Output Noise	VNOISE(PP)			20		mV

Feature Definition

1.Power-on Time - TPO

Power-on time: The time taken for the power supply to reach thePower-on time: The time taken for the power supply to reach the minimum operating voltage VCCM IN is t1; the time taken for the output to reach 90% of its steady value under an external magnetic field is t2. The difference between these two times is the power-on time.

2.Temperature Compensated Power-on Time - TTC

After power-on, temperature trimming time is required before valid temperature compensation output.

3.Transmission Delay - TPD

The time difference between the output reaching 20% of its final value when the external magnetic field reaches 20% of its final value.

4.Rise time - TR

The time difference between the rise of the chip output level from 10% to 90%.

5. Response Time - TRESP

The time difference between when the external magnetic field applied to the chip reaches 80% of its final value and when the corresponding output value also reaches 80%

6. Static Voltage Output - VOQ

When the power supply voltage and ambient temperature of the chip are within the working range and the measured current is 0, the output of the chip.
Note: Prolonged operation at the maximum rated value may affect the reliability of the device. Exceeding the maximum rated value may damage the device.

7. Static Voltage Output Error - VOE

The difference between the actual output voltage of the sensor and the ideal output voltage power supply when the measured current value is zero. In proportional output mode with power supply, the static voltage output error is the difference between the actual output error and VCC / 2.

8. Sensitivity

Sensitivity indicates the change value of sensor output per 1A change of measured current, with the unit of mV/A. The calculation method is to pass through the positive full-scale current and negative full- scale current, and divide the difference between the output voltage at 2 points of the sensor by the difference between the positive full-scale current and negative full-scale current, which is the sensitivity of the sensor. The specific calculation formula is as follows:

$$SENS = (Vout(IPma0) - Vout(Inma0))/(IPma0 - Inma0)$$

Here, IPma0 and Inma0 are the positive full-scale current and negative full-scale current respectively, Vout(IPma0) and Vout(Inma0) are the analog output voltages of the sensor when passing through the positive full-scale current and negative full-scale current respectively.

9. Global Error Budget - ETOT

This error value represents the maximum error of the sensor under various environmental conditions, which is equal to the absolute value of the measurement error within each temperature range, divided by the maximum output dynamic range of the sensor, over the full current measurement range. It can be expressed as follows:

ETOT(IP)=Ma0(Vout –Vout_ idea)/(Vout(IPma0)-Voq)

Here, Ma0 (Vout – Vout _ idea) represents the maximum error within the measurementHere, Ma0 (Vout – Vout _ idea) represents the maximum error within the measurement range and (Vout (IPma0) -Voq) represents the maximum output dynamic range of the sensor.

10. Non-linearity error - ELIN

Due to the non-ideal characteristics of the sensor, the output voltageDue to the non-ideal characteristics of the sensor, the output voltage is not completely linear with the measured current in practical applications. After linear fitting by least squares method, the linearity error of the sensor can be obtained by dividing the maximum output error of the sensor by its dynamic range, i.e. ELIN (IP) = ∆Vout / (Vout (IPma0) -Voq). Here, ∆Vout is the maximum linearity error within the measuring range of the sensor.

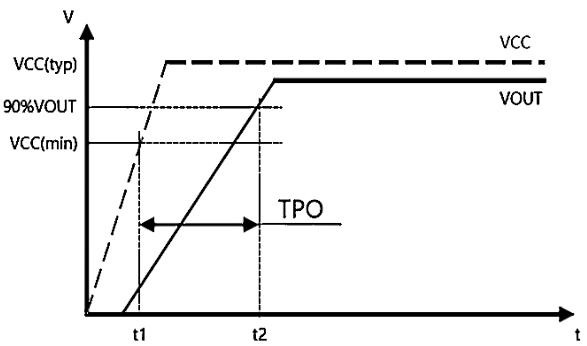


Figure 1: Definition of Power-on Time

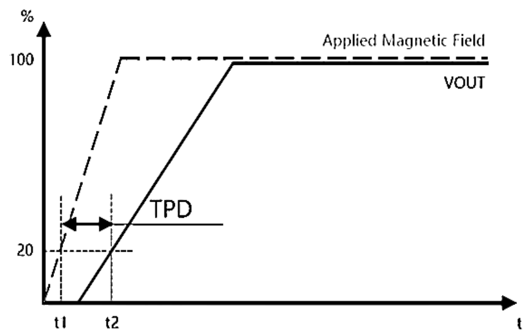


Figure 2: Definition of transmission delay

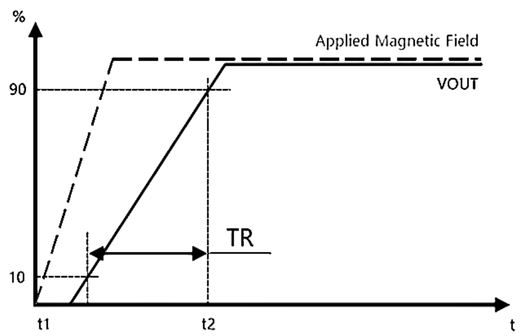


Figure 3: Definition of Rise Time

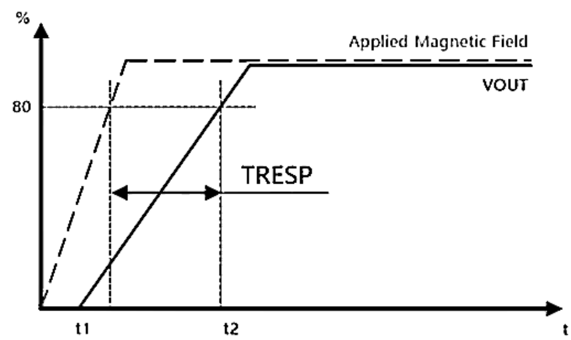
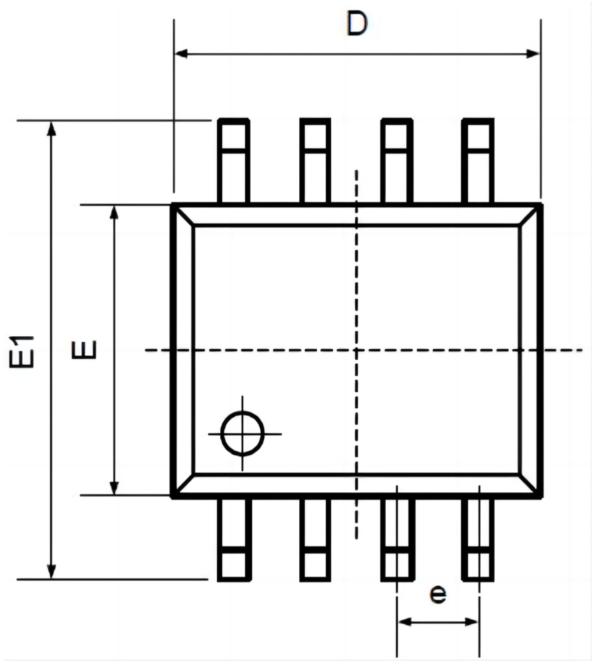
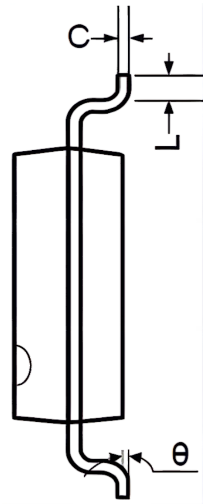
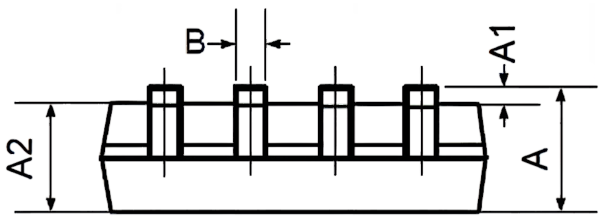


Figure 4 : Definition of Response Time

Package SOP8







Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Order information

Order Number	Package	Package Quantity	Marking On The park	Temperature
ACS712ELCTR-05B-T-TUDI	SOP8	Tape,Reel,3000	ACS712-05B	-40℃ to +150℃
ACS712ELCTR-20A-T-TUDI	SOP8	Tape,Reel,3000	ACS712-20A	
ACS712ELCTR-30A-T-TUDI	SOP8	Tape,Reel,3000	ACS712-30A	

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