ITE4921

Galvanically Isolated Current Sensor IC

Features

- High operating bandwidth, up to 350kHz
- Background dynamic offset compensation and temperature compensation
- 1.15 mΩ primary conductor resistance for low power loss and high inrush current withstand capability
- High performance sensor frontend guarantees low noise and high resolution
- Zero current output voltage is 50% VCC
- 3500V RMS isolation voltage between pins 1-4 and 5-8
- Wide temperature range: -40℃ to 125℃

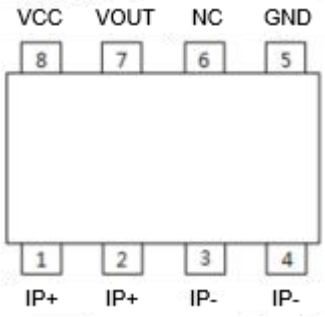
Applications

- Current sensing in high frequency inverters
- Brush-less DC motors
- DC/DC converters
- Other applications requiring current detection

Description

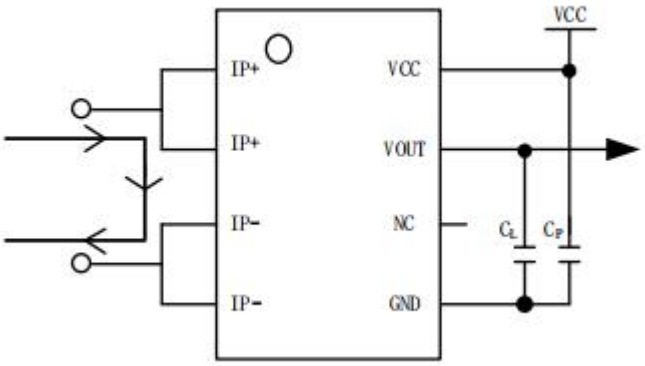
The ITE4921 is a programmable linear Hall-effect sensor IC with on-chip Hall and temperature sensors. It features with temperature stable Hall signal conditioning chains with background dynamic offset and package stress compensation. The sensor offers a high bandwidth up to 350 kHz and a fast response time of 1.0μs. The sensitivity drift is 2.5% over wide temperature range from -40℃ to 125℃.

The on-chip Hall sensor converts the magnetic flux through the chip to Hall signal voltage. The internal signal conditioning chain amplifies the voltage with the predefined gain. The undervoltage detection, overvoltage detection, power-on reset, output clamps and build-in diagnostic test make it suitable for safety-critical automotive applications.



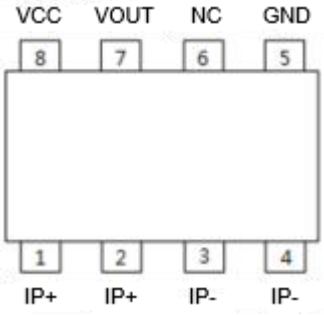
Package Type: SOP-8L

Typical Application



*For hash applications with supply disturbance, a Cp placed close to the IC is recommended (see Fig.3), C_P= 100nF, C_L= 1nF.

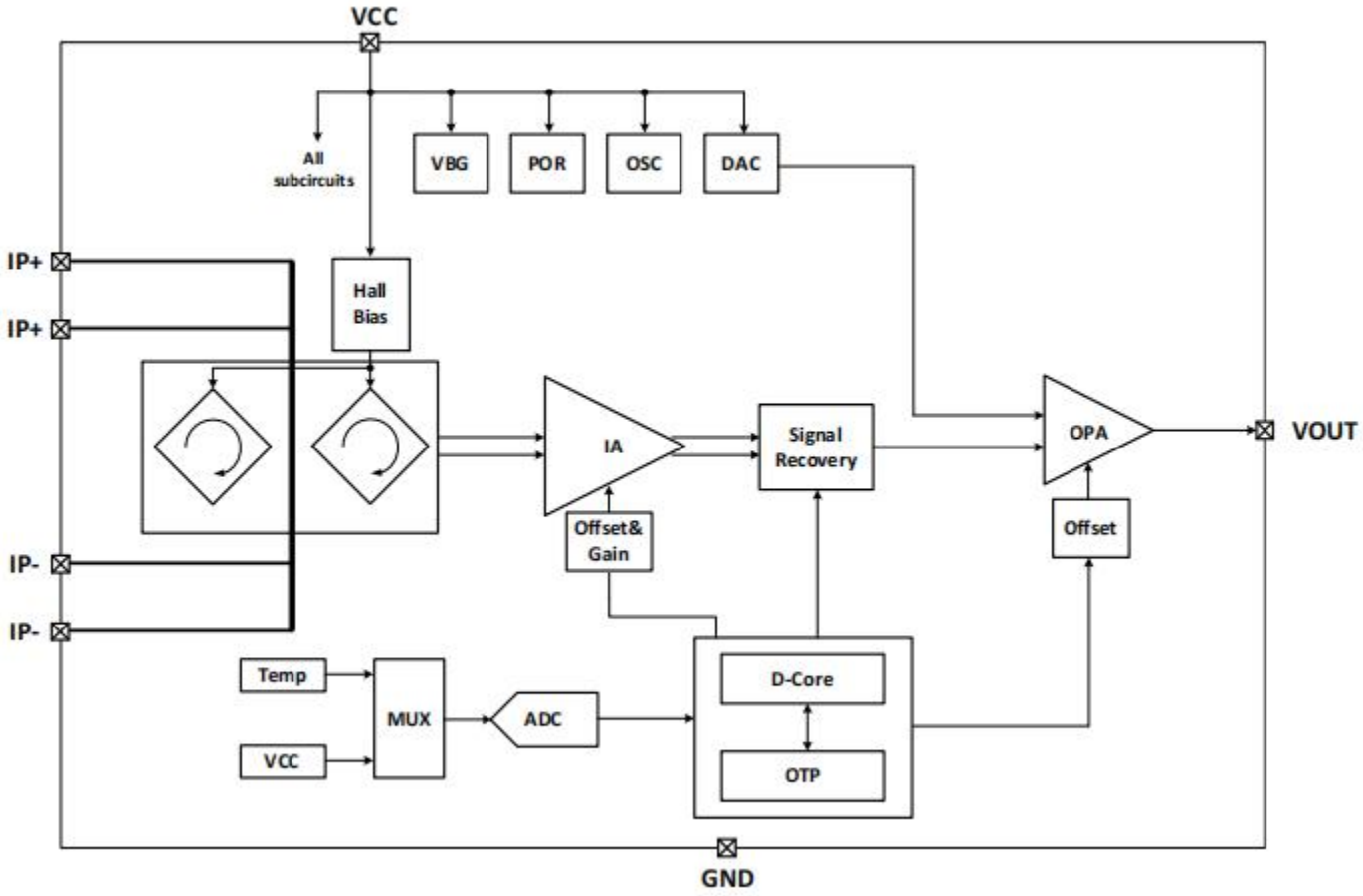
Pin Description



PIN NO.	NAME	DESCRIPTION
1	IP+	Positive power rail
2	IP+	Positive power rail
3	IP-	Negative power rail
4	IP-	Negative power rail
5	GND	Ground
6	NC	Not connected
7	VOUT	Output voltage
8	VCC	Supply voltage

PART NUMBER	I_{PR} (A)	SENSITIVITY (mV/A)
ITE4921SEA-5P0	±5	400mV/A
ITE4921SEA-10P	±10	200mV/A
ITE4921SEA-20P	±20	100mV/A
ITE4921SEA-25P	±25	80mV/A
ITE4921SEA-30P	±30	67mV/A
ITE4921SEA-40P	±40	50mV/A
ITE4921SEA-50P	±50	40mV/A
ITE4921SEA-5P03	±5	400mV/A
ITE4921SEA-10P3	±10	200mV/A
ITE4921SEA-20P3	±20	100mV/A
ITE4921SEA-25P3	±25	80mV/A
ITE4921SEA-30P3	±30	67mV/A
ITE4921SEA-40P3	±40	50mV/A
ITE4921SEA-50P3	±50	40mV/A

Functional Block Diagram



Absolute Maximum Ratings

T_A=25℃, all voltages are referenced to GND unless otherwise specified.(1)

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{CC}	Supply voltage	-	7	V
V_{RCC}	Reverse supply voltage	-	-0.5	V
V_{OUT}	Output voltage	-	7	V
V_{REF}	Reference voltage	-	5.5	V
V_{ROUT}	Output reverse voltage	-	-0.5	V
I_O	Output current	-	20	mA
T_J	Junction temperature range	-	150	℃
T_S	Storage temperature	-55	150	℃
$R_{thJA(2)}$	Package thermal resistance (junction to ambient)	-	24	℃/W
R_{thJL}	Package thermal resistance (junction to lead)	-	5	℃/W

Note:

1. Exceeding these ratings may cause permanent damage to the device. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.
2. Mounted on the board with 1500 mm2 of 4 oz. copper on each side, connected to pins 1 and 2, and to pins 3 and with thermal vias connecting the layers. Performance values include the power consumed by the PCB.

ESD and Latch-up

SYMBOL	PARAMETER	VALUE	UNIT
I_{LU}	Latch-up current, JESD78F.02-2023	±200	mA
$V_{HBM\_}$	Electrostatic discharge-Human body Model (HBM), JS-001-2017	±4	kV
$V_{CDM\_}$	Electrostatic discharge- Charged Device Model (CDM), JS-002-2018	±1	kV

Isolation Characteristics

SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT
V_{ISO}	Dielectric strength test voltage	Tested at VISO for 60 second and 1.2VISO for 1 second in accordance with IEC 62368-1	3500	V_{RMS}
		t=1s (100%production)	3500	VAC
V_{WVBI}	Working voltage for basic isolation	Maximum approved working voltage for basic (single) isolation according to UL 62368-1:2014	600	V_{PK} or VDC
			424	V_{RMS}
V_{IORM}	Maximum repetitive peak isolation voltage	AC voltage(bipolar)	600	V_{PK}
V_{IOWM}	Maximum working isolation voltage	DC voltage	600	V_{DC}
		AC voltage (sinewave)	424	V_{RMS}
V_{IOTM}	Maximum transient isolation voltage	t=60s (qualification)	4949	V_{PK}
V_{TEST}		t=1s (100%production)	5515	V_{PK}
D_{CL}	Clearance	Minimum distance through air from IP leads to signal leads	4	mm
D_{CR}	Creepage	Minimum distance along package body from IP leads to signal leads	4	mm

Operating Range

All voltages are absolute voltages referenced to GND unless otherwise specified. (T_A=25℃)

SYMBOL	PARAMETER	VALUES			UNIT
		MIN	TYP	MAX	
VIN	Input voltage(1)	-600	-	600	V
VCC	Supply voltage	3	3.3	3.6	V
V_{REF}	Reference voltage	-	0.5*VCC	-	V
I_O	Output current(2)	-	11	-	mA
I_{O+_REF}	Reference current(2)	-	10	-	mA
I_{O-_REF}	Reference current(2)	-	1	-	mA
T_A	Operating ambient temperature	-40	-	125	℃

Note:

1. VIN is the voltage of the current rail relative to GND (pin5).
2. The output current includes sink current and source current, which is guaranteed by R &D.

Electrical Characteristics

All voltages are absolute voltages referenced to GND-potential, T_A=25℃ (unless otherwise specified).

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES			UNIT
			MIN	TYP	MAX	
VCC Supply						
Supply current	I_{CC}	VCC=3.3V, output open	-	14	20	mA
Power-on time	t_{PO}	CP=open, CL=1nF, Output rising from 0 to 90% of steady-state	-	15	-	μs
Power on reset	V_{PORH}	VCC=3.3V, VCC rising	-	2.7	-	V
	V_{PORL}	VCC=3.3V, VCC falling	-	2.3	-	V
Input stage						
Current rail resistance	R_{IP}	IIP=2A	-	1.15	-	mΩ
Common mode field rejection ratio	CMFRR	Common Mode Field Rejection Ratio	-	38	-	dB
Output stage						
Output saturation voltage	V_{OH}	VCC=3.3V,R_L=4.7K	-	3	-	V
	V_{OL}	VCC=3.3V,R_L=4.7K	-	0.3	-	V
Zero-current output Voltage	V_{OQ}	I_P=0A	-	0.5*VCC	-	V
Reference output voltage	V_{REF}	VCC=3.3V	1.64	1.65	1.66	V
Output capacitance Load	C_L	VOUT to GND	-	1	10	nF
Output resistive load	R_L	VOUT to GND	4.7	-	-	kΩ
Propagation time	t_{pd}	C_L=1nF, I_{IP}=2A	-	0.5	-	μs
Rise time	t_r	C_L=1nF, I_{IP}=2A	-	1	-	μs
Response time	$t_{RESPONSE}$	C_L=1nF, I_{IP}=2A	-	1	-	μs
Output slew rate	SR	C_L=1nF, I_{IP}=2A	-	1.5	-	V/μs
Accuracy and Frequency						
Bandwidth	BW	Small signal, -3dB, C_L =1nF		350		kHz
Nonlinearity	E_{LIN}	Through full range of IP	-1.5	-	1.5	%
Symmetry	E_{SYM}	Through full range of IP	-1.5	0.5	1.5	%

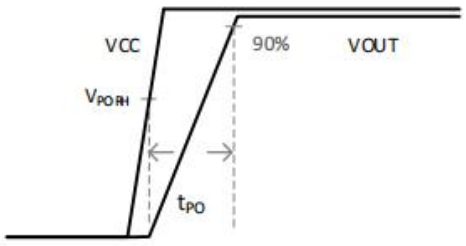
Note:
1. The parameter values are obtained under the corresponding test conditions mentioned above.
2. Ensured by design.
3. The sensor IC will continue to respond to currents exceeding the IP range until the high or low saturation voltage is reached; however, the nonlinearity in this region will be worse than in the rest of the measurement range.

Performance Characteristics

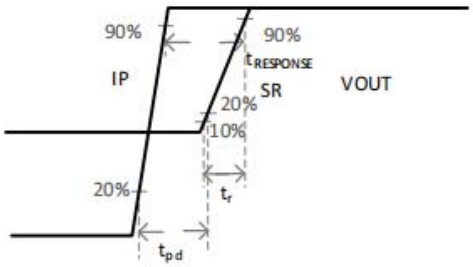
V_{CC}=3.3V, T_A=-25℃, C_P=0.1μF(unless otherwise specified).

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES			UNIT
			MIN	TYP	MAX	
20A performance characteristics						
Current-sensing range	I_P	-	-20	-	20	A
Sensitivity	Sens	Through full range of IP	64	66	68	mV/A
Zero current differential output error	V_{OE}		-10	-	10	mV
Zero current output slope	$\Delta_{VOUT(Q)}$	T_A=-40℃~125℃	-	0.2	-	mV/℃
Sensitivity slope	Δ_{SENS}	T_A=-40℃~125℃	-	0.016	-	mV/A/℃
Noise	$V_{N(RMS)}$		-	11	-	mV
Total output error	E_{TOT}	I_P=$I_{PR(max)}$, T_A= 25°C to 125°C	-4	-	4	%
		I_P=$I_{PR(max)}$, T_A= -40°C to 25°C	-3.5	-	3.5	%

Timing Section

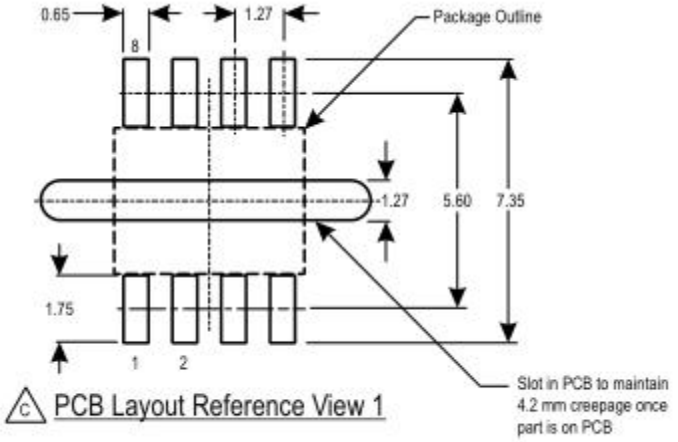


Power on time

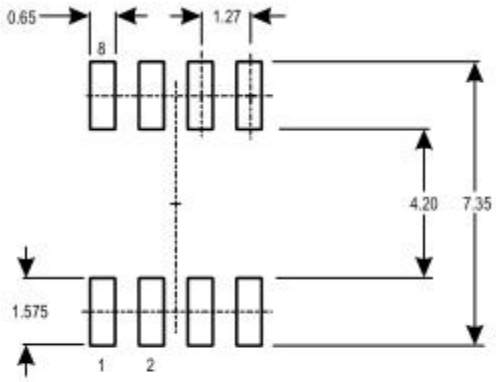


Response time& Response Time& Rise Time& SR

Package Outline: SOP-8L



C PCB Layout Reference View 1



C PCB Layout Reference View 2

For PCB assemblies that cannot support a slotted design, the above stretched footprint may be used.