

Micropower, Rail-to-Rail Input Current Sense Amplifier with Voltage Output

ISL28005

The ISL28005 is a micropower, uni-directional high-side and low-side current sense amplifier featuring a proprietary rail-to-rail input current sensing amplifier. The ISL28005 is ideal for high-side current sense applications where the sense voltage is usually much higher than the amplifier supply voltage. The device can be used to sense voltages as high as 28V when operating from a supply voltage as low as 2.7V. The micropower ISL28005 consumes only 50µA of supply current when operating from a 2.7V to 28V supply.

The ISL28005 features a common-mode input voltage range from 0V to 28V. The proprietary architecture extends the input voltage sensing range down to 0V, making it an excellent choice for low-side ground sensing applications. The benefit of this architecture is that a high degree of total output accuracy is maintained over the entire 0V to 28V common mode input voltage range.

The ISL28005 is available in fixed (100V/V, 50V/V and 20V/V) gains in the space saving 5 Ld SOT-23 package. The parts operate over the extended temperature range from -40°C to +125°C.

Features

- Low Power Consumption. 50µA,Typ
- Supply Range 2.7V to 28V
- Wide Common Mode Input. 0V to 28V
- Fixed Gain Versions
 - ISL28005-100 100V/V
 - ISL28005-50 50V/V
 - ISL28005-20 20V/V
- Operating Temperature Range. -40°C to +125°C
- Package. 5 Ld SOT-23

Applications

- Power Management/Monitors
- Power Distribution and Safety
- DC/DC, AC/DC Converters
- Battery Management /Charging
- Automotive Power Distribution

Related Literature

- See [AN1531](#) for “ISL28005 Evaluation Board User’s Guide”

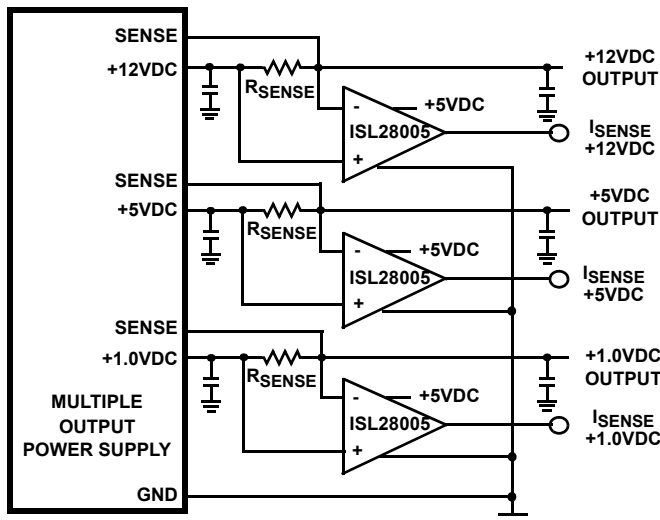


FIGURE 1. TYPICAL APPLICATION

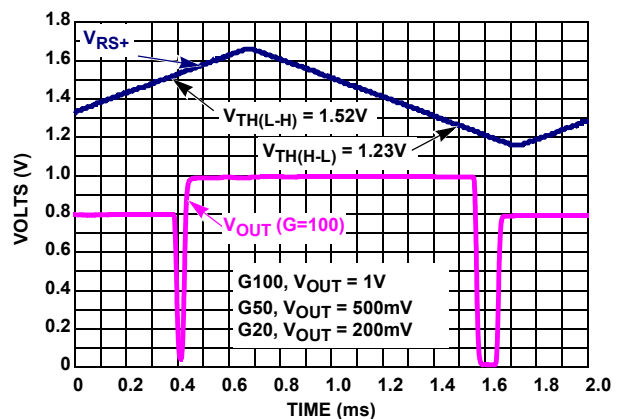
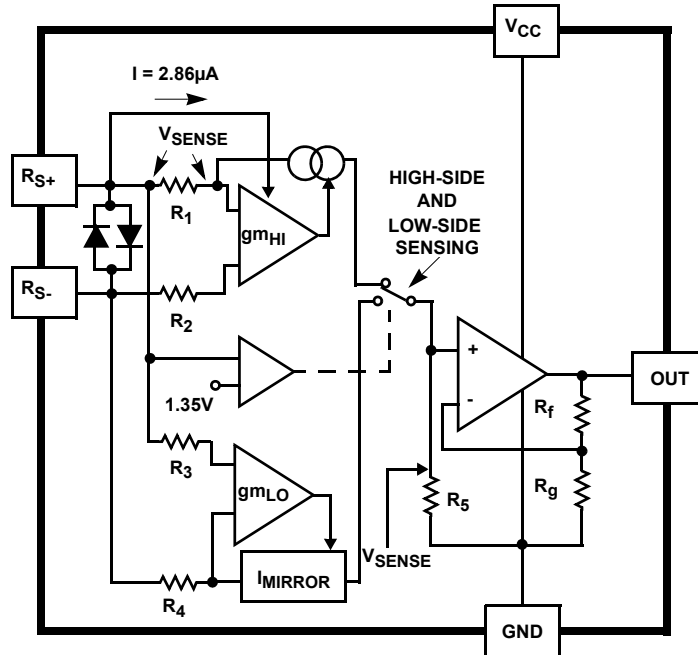


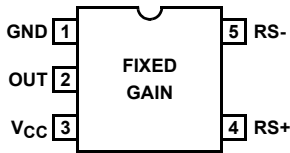
FIGURE 2. HIGH-SIDE AND LOW-SIDE THRESHOLD VOLTAGE

Block Diagram



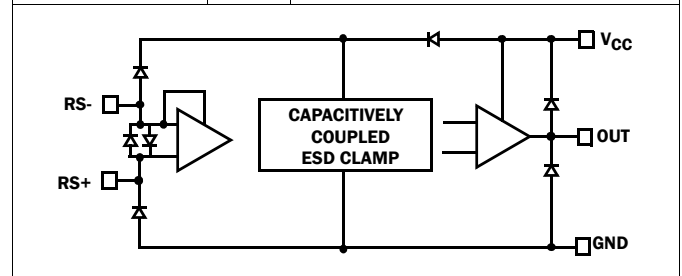
Pin Configuration

ISL28005
(5 LD SOT-23)
TOP VIEW



Pin Descriptions

ISL28005 (5 LD SOT-23)	PIN NAME	DESCRIPTION
1	GND	Power Ground
2	OUT	Amplifier Output
3	VCC	Positive Power Supply
4	RS+	Sense Voltage Non-inverting Input
5	RS-	Sense Voltage Inverting Input



ISL28005

Ordering Information

PART NUMBER (Notes 1, 2, 3)	GAIN	PART MARKING (Note 4)	PACKAGE Tape & Reel (Pb-Free)	PKG. DWG. #
ISL28005FH100Z-T7	100V/V	BDEA	5 Ld SOT-23	P5.064A
ISL28005FH100Z-T7A	100V/V	BDEA	5 Ld SOT-23	P5.064A
ISL28005FH50Z-T7	50V/V	BDDA	5 Ld SOT-23	P5.064A
ISL28005FH50Z-T7A	50V/V	BDDA	5 Ld SOT-23	P5.064A
ISL28005FH20Z-T7	20V/V	BDCA	5 Ld SOT-23	P5.064A
ISL28005FH20Z-T7A	20V/V	BDCA	5 Ld SOT-23	P5.064A
ISL28005FH-100EVAL1Z	100V/V Evaluation Board			
ISL28005FH-50EVAL1Z	50V/V Evaluation Board			
ISL28005FH-20EVAL1Z	20V/V Evaluation Board			

NOTES:

1. Please refer to [TB347](#) for details on reel specifications.
2. These Intersil Pb-free plastic packaged products employ special Pb-free material sets, molding compounds/die attach materials, and 100% matte tin plate plus anneal (e3 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations). Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.
3. For Moisture Sensitivity Level (MSL), please see device information page for [ISL28005](#). For more information on MSL please see techbrief [TB363](#).
4. The part marking is located on the bottom of the part.

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Absolute Maximum Ratings

Max Supply Voltage	28V
Max Differential Input Current	20mA
Max Differential Input Voltage	±0.5V
Max Input Voltage (RS+, RS-)	GND-0.5V to 30V
Max Input Current for Input Voltage <GND -0.5V	±20mA
Output Short-Circuit Duration	Indefinite
ESD Rating	
Human Body Model	4kV
Machine Model	200V
Charged Device Model	1.5kV

Thermal Information

Thermal Resistance (Typical)	θ_{JA} (°C/W)	θ_{JC} (°C/W)
5 Ld SOT-23 (Notes 5, 6)	190	90
Maximum Storage Temperature Range	-65°C to +150°C	
Maximum Junction Temperature (T _{JMAX})	+150°C	
Pb-Free Reflow Profile	see link below http://www.intersil.com/pbfree/Pb-FreeReflow.asp	

Recommended Operating Conditions

Ambient Temperature Range (T _A)	-40°C to +125°C
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CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions may adversely impact product reliability and result in failures not covered by warranty.

NOTES:

5. θ_{JA} is measured with the component mounted on a high effective thermal conductivity test board in free air. See Tech Brief [TB379](#) for details.
6. For θ_{JC} , the “case temp” location is taken at the package top center.

Electrical Specification V_{CC} = 12V, V_{RS+} = 0V to 28V, V_{SENSE} = 0V, R_{LOAD} = 1M Ω , T_A = +25°C unless otherwise specified. **Boldface limits apply over the operating temperature range, -40°C to +125°C. Temperature data established by characterization.**

PARAMETER	DESCRIPTION	CONDITIONS	MIN (Note 7)	TYP	MAX (Note 7)	UNIT
V _{OS}	Input Offset Voltage (Notes 8, 9)	V _{CC} = V _{RS+} = 12V, V _S = 20mV to = 100mV	-500 -500	60	500 500	μ V
		V _{CC} = 12V, V _{RS+} = 0.2V, V _S = 20mV, V _S = 100mV	-3 -3.3	-1.2	3 3.3	mV
I _{RS+} , I _{RS-}	Leakage Current	V _{CC} = 0V, V _{RS+} = 28V		0.041	1.2 1.5	μ A
I _{RS+}	Gain = 100 + Input Bias Current	V _{RS+} = 2V, V _{SENSE} = 5mV		4.7	6 7	μ A
		V _{RS+} = 0V, V _{SENSE} = 5mV	-500 -600	-425		nA
	Gain = 50, Gain = 20 + Input Bias Current	V _{RS+} = 2V, V _{SENSE} = 5mV		4.7	6 8	μ A
		V _{RS+} = 0V, V _{SENSE} = 5mV	-700 -840	-432		nA
I _{RS-}	Input Bias Current	V _{RS+} = 2V, V _{SENSE} = 5mV		5	50 75	nA
		V _{RS+} = 0V, V _{SENSE} = 5mV	-125 -130	-45		nA
CMRR	Common Mode Rejection Ratio	V _{RS+} = 2V to 28V	105	115		dB
PSRR	Power Supply Rejection Ratio	V _{CC} = 2.7V to 28V, V _{RS+} = 2V	90	105		dB
V _{FS}	Full-scale Sense Voltage	V _{CC} = 28V, V _{RS+} = 0.2V, 12V	200			mV
G	Gain (Note 8)	ISL28005-100		100		V/V
		ISL28005-50		50		V/V
		ISL28005-20		20		V/V

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Electrical Specification $V_{CC} = 12V$, $V_{RS+} = 0V$ to $28V$, $V_{SENSE} = 0V$, $R_{LOAD} = 1M\Omega$, $T_A = +25^\circ C$ unless otherwise specified. **Boldface limits apply over the operating temperature range, $-40^\circ C$ to $+125^\circ C$. Temperature data established by characterization. (Continued)**

PARAMETER	DESCRIPTION	CONDITIONS	MIN (Note 7)	TYP	MAX (Note 7)	UNIT
G _A	Gain = 100 Gain Accuracy (Note 10)	$V_{CC} = V_{RS+} = 12V$, $V_{SENSE} = 20mV$ to $100mV$	-2 -3		2 3	%
		$V_{CC} = 12V$, $V_{RS+} = 0.1V$, $V_{SENSE} = 20mV$ to $100mV$		-0.25		%
	Gain = 50, Gain = 20 Gain Accuracy (Note 10)	$V_{CC} = V_{RS+} = 12V$, $V_{SENSE} = 20mV$ to $100mV$	-2 -3		2 3	%
		$V_{CC} = 12V$, $V_{RS+} = 0.1V$, $V_{SENSE} = 20mV$ to $100mV$	-3 -4	-0.31	3 4	%
V _{OA}	Gain = 100 Total Output Accuracy (Note 11)	$V_{CC} = V_{RS+} = 12V$, $V_{SENSE} = 100mV$	-2.5 -2.7		2.5 2.7	%
		$V_{CC} = 12V$, $V_{RS+} = 0.1V$, $V_{SENSE} = 100mV$		-1.25		%
	Gain = 50, Gain = 20 Total Output Accuracy (Note 11)	$V_{CC} = V_{RS+} = 12V$, $V_{SENSE} = 100mV$	-2.5 -2.7		2.5 2.7	%
		$V_{CC} = 12V$, $V_{RS+} = 0.1V$, $V_{SENSE} = 100mV$	-6 -7	-1.41	6 7	%
V _{OH}	Output Voltage Swing, High $V_{CC} - V_{OUT}$	$I_O = -500\mu A$, $V_{CC} = 2.7V$ $V_{SENSE} = 100mV$ $V_{RS+} = 2V$		39	50	mV
V _{OL}	Output Voltage Swing, Low V_{OUT}	$I_O = 500\mu A$, $V_{CC} = 2.7V$ $V_{SENSE} = 0V$, $V_{RS+} = 2V$		30	50	mV
R _{OUT}	Output Resistance	$V_{CC} = V_{RS+} = 12V$, $V_{SENSE} = 100mV$ $I_{OUT} = 10\mu A$ to $1mA$		6.5		Ω
I _{SC+}	Short Circuit Sourcing Current	$V_{CC} = V_{RS+} = 5V$, $R_L = 10\Omega$		4.8		mA
I _{SC-}	Short Circuit Sinking Current	$V_{CC} = V_{RS+} = 5V$, $R_L = 10\Omega$		8.7		mA
I _S	Gain = 100 Supply Current	$V_{RS+} > 2V$, $V_{SENSE} = 5mV$		50	59 62	μA
	Gain = 50, 20 Supply Current	$V_{RS+} > 2V$, $V_{SENSE} = 5mV$		50	62 63	μA
V _{CC}	Supply Voltage	Guaranteed by PSRR	2.7		28	V
SR	Gain = 100 Slew Rate	Pulse on RS+ pin, $V_{OUT} = 8V_{P-P}$ (see Figure 17)	0.58	0.76		V/ μs
	Gain = 50 Slew Rate	Pulse on RS+ pin, $V_{OUT} = 8V_{P-P}$ (see Figure 17)	0.58	0.67		V/ μs
	Gain = 20 Slew Rate	Pulse on RS+ pin, $V_{OUT} = 3.5V_{P-P}$ (see Figure 17)	0.50	0.67		V/ μs
BW _{-3dB}	Gain = 100 -3dB Bandwidth	$V_{RS+} = 12V$, $0.1V$, $V_{SENSE} = 100mV$		110		kHz
	Gain = 50 -3dB Bandwidth	$V_{RS+} = 12V$, $0.1V$, $V_{SENSE} = 100mV$		160		kHz
	Gain = 20 -3dB Bandwidth	$V_{RS+} = 12V$, $0.1V$, $V_{SENSE} = 100mV$		180		kHz

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Electrical Specification $V_{CC} = 12V$, $V_{RS+} = 0V$ to $28V$, $V_{SENSE} = 0V$, $R_{LOAD} = 1M\Omega$, $T_A = +25^\circ C$ unless otherwise specified. **Boldface limits apply over the operating temperature range, $-40^\circ C$ to $+125^\circ C$. Temperature data established by characterization. (Continued)**

PARAMETER	DESCRIPTION	CONDITIONS	MIN (Note 7)	TYP	MAX (Note 7)	UNIT
t_s	Output Settling Time to 1% of Final Value	$V_{CC} = V_{RS+} = 12V$, $V_{OUT} = 10V$ step, $V_{SENSE} > 7mV$		15		μs
		$V_{CC} = V_{RS+} = 0.2V$, $V_{OUT} = 10V$ step, $V_{SENSE} > 7mV$		20		μs
	Capacitive-Load Stability	No sustained oscillations		300		μF
t_s Power-up	Power-Up Time to 1% of Final Value	$V_{CC} = V_{RS+} = 12V$, $V_{SENSE} = 100mV$		15		μs
		$V_{CC} = 12V$, $V_{RS+} = 0.2V$, $V_{SENSE} = 100mV$		50		μs
	Saturation Recovery Time	$V_{CC} = V_{RS+} = 12V$, $V_{SENSE} = 100mV$, overdrive		10		μs

NOTES:

7. Compliance to datasheet limits is assured by one or more methods: production test, characterization and/or design.

8. DEFINITION OF TERMS:

- $V_{SENSE A} = V_{SENSE}$ @100mV
- $V_{SENSE B} = V_{SENSE}$ @20mV
- $V_{OUT A} = V_{OUT}$ @ $V_{SENSE A} = 100mV$
- $V_{OUT B} = V_{OUT}$ @ $V_{SENSE B} = 20mV$

$$G = \text{GAIN} = \left(\frac{V_{OUT A} - V_{OUT B}}{V_{SENSE A} - V_{SENSE B}} \right)$$

9. V_{OS} is extrapolated from the gain measurement. $V_{OS} = V_{SENSE A} - \frac{V_{OUT A}}{G}$

$$10. \% \text{ Gain Accuracy} = G_A = \left(\frac{G_{MEASURED} - G_{EXPECTED}}{G_{EXPECTED}} \right) \times 100$$

$$11. \text{ Output Accuracy } \% V_{OA} = \left(\frac{V_{OUT MEASURED} - V_{OUT EXPECTED}}{V_{OUT EXPECTED}} \right) \times 100 \text{ where } V_{OUT} = V_{SENSE} \times \text{GAIN and } V_{SENSE} = 100mV$$

Typical Performance Curves $V_{CC} = 12V, R_L = 1M$, unless otherwise specified.

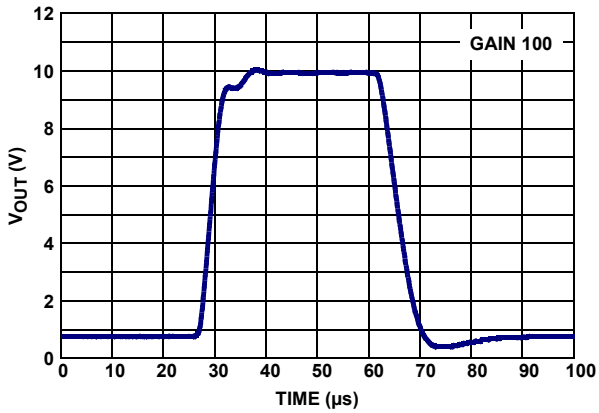


FIGURE 3. LARGE SIGNAL TRANSIENT RESPONSE $V_{RS+} = 0.2V, V_{SENSE} = 100mV$

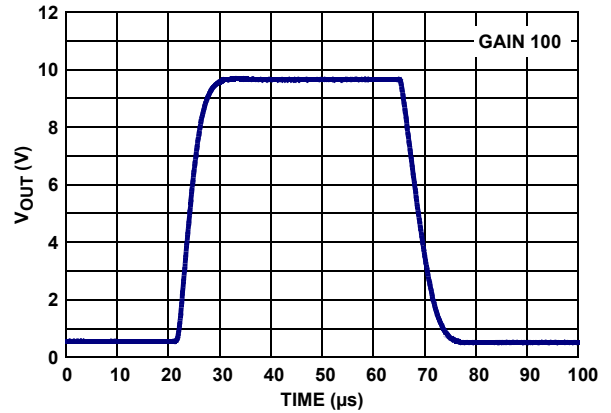


FIGURE 4. LARGE SIGNAL TRANSIENT RESPONSE $V_{RS+} = 12V, V_{SENSE} = 100mV$

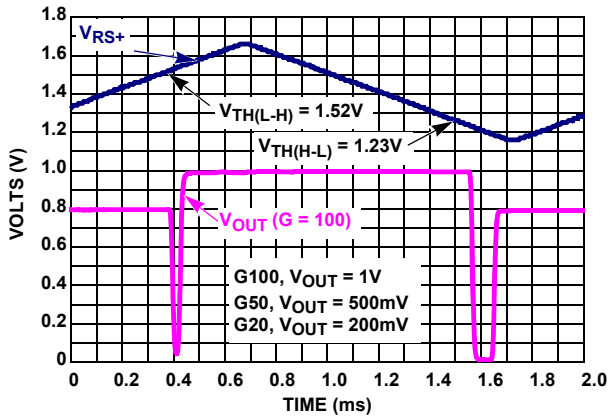


FIGURE 5. HIGH-SIDE and LOW-SIDE THRESHOLD VOLTAGE $V_{RS+(L-H)}$ and $V_{RS+(H-L)}, V_{SENSE} = 10mV$

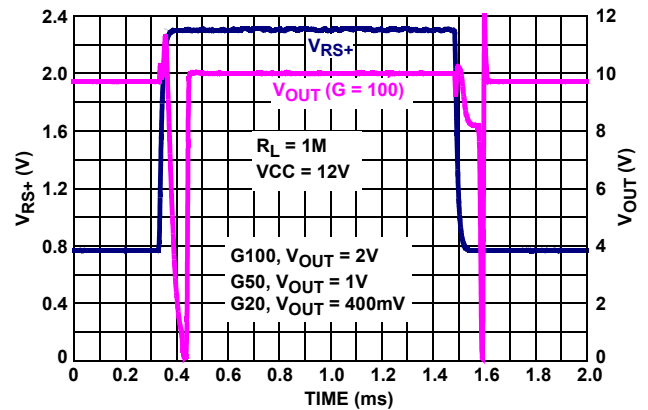


FIGURE 6. V_{OUT} vs $V_{RS+}, V_{SENSE} = 20mV$ TRANSIENT RESPONSE

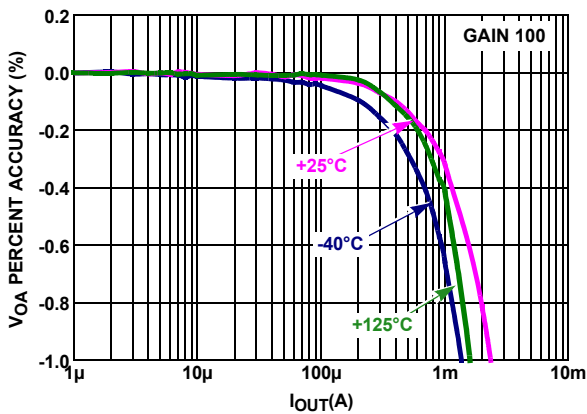


FIGURE 7. NORMALIZED V_{OA} vs I_{OUT}

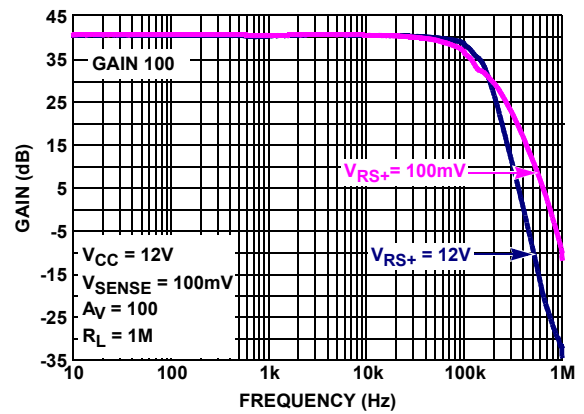


FIGURE 8. GAIN vs FREQUENCY $V_{RS+} = 100mV/12V, V_{SENSE} = 100mV, V_{OUT} = 250mV_{p.p}$

Typical Performance Curves $V_{CC} = 12V$, $R_L = 1M$, unless otherwise specified. (Continued)

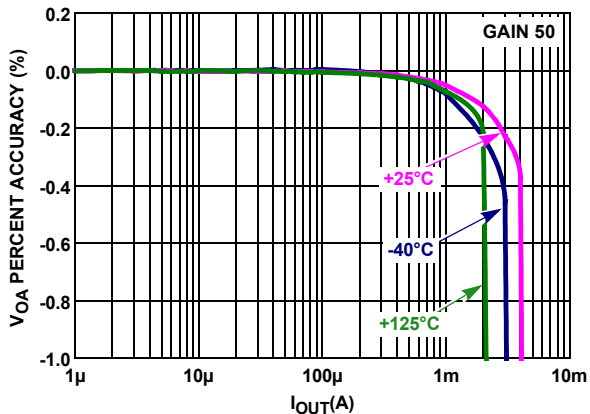


FIGURE 9. NORMALIZED V_{OA} vs I_{OUT}

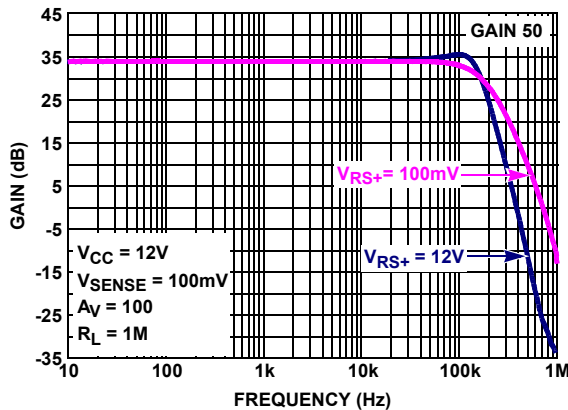


FIGURE 10. GAIN vs FREQUENCY $V_{RS+} = 100mV/12V$, $V_{SENSE} = 100mV$, $V_{OUT} = 250mV_{p.p}$

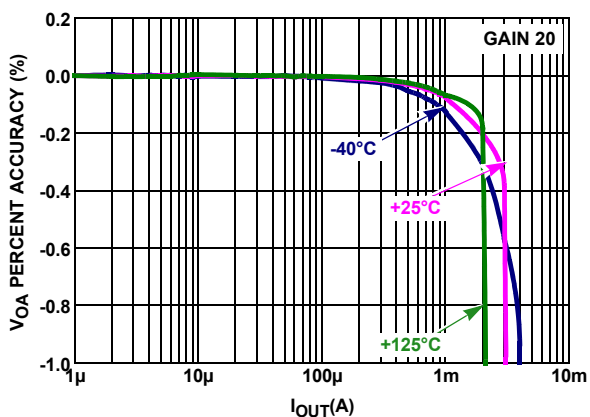


FIGURE 11. NORMALIZED V_{OA} vs I_{OUT}

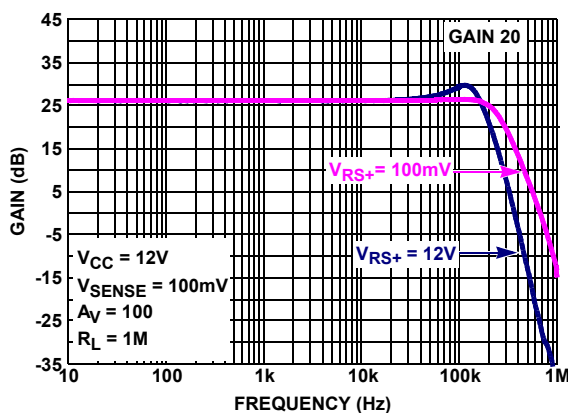


FIGURE 12. GAIN vs FREQUENCY $V_{RS+} = 100mV/12V$, $V_{SENSE} = 100mV$, $V_{OUT} = 250mV_{p.p}$

Test Circuits and Waveforms

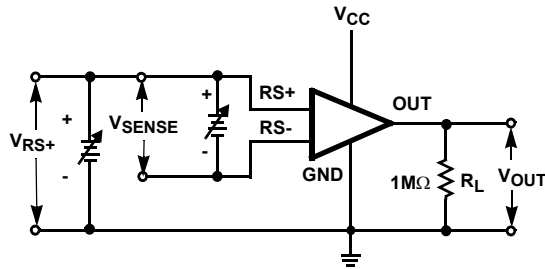


FIGURE 13. I_S , V_{OS} , V_{OA} , CMRR, PSRR, GAIN ACCURACY

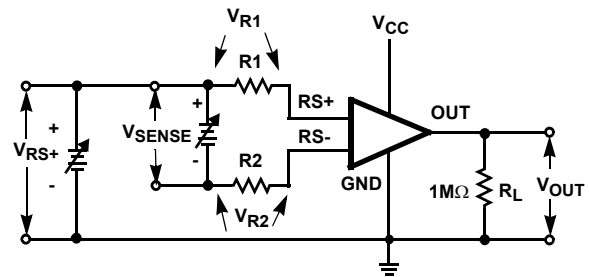


FIGURE 14. INPUT BIAS CURRENT, LEAKAGE CURRENT

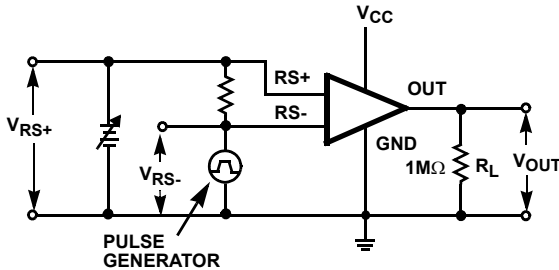


FIGURE 15. SLEW RATE, t_s , SATURATION RECOVERY TIME

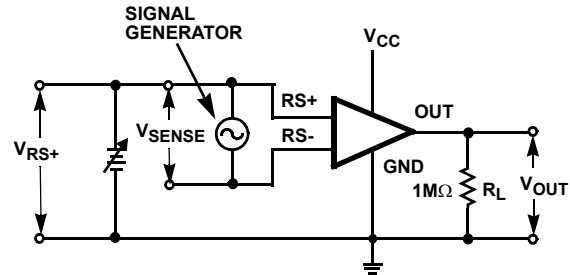


FIGURE 16. GAIN vs FREQUENCY

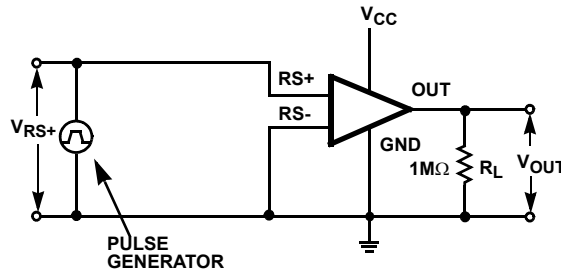


FIGURE 17. SLEW RATE

Applications Information

Functional Description

The ISL28005-20, ISL28005-50 and ISL28005-100 are single supply, uni-directional current sense amplifiers with fixed gains of 20V/V, 50V/V and 100V/V respectively.

The ISL28005 is a 2-stage amplifier. Figure 18 shows the active circuitry for high-side current sense applications where the sense voltage is between 1.35V to 28V. Figure 19 shows the active circuitry for ground sense applications where the sense voltage is between 0V to 1.35V.

The first stage is a bi-level trans-conductance amp and level translator. The g_m stage converts the low voltage drop (V_{SENSE}) sensed across an external milli-ohm sense resistor, to a current (@ $g_m = 21.3\mu A/V$). The trans-conductance amplifier forces a current through R_1 resulting to a voltage drop across R_1 that is equal to the sense voltage (V_{SENSE}). The current through R_1 is mirrored across R_5 creating a ground-referenced voltage at the input of the second amplifier equal to V_{SENSE} .

The second stage is responsible for the overall gain and frequency response performance of the device. The fixed gains (20, 50, 100) are set with internal resistors R_f and R_g . The only external component needed is a current sense resistor (typically 0.001Ω to 0.01Ω , 1W to 2W).

The transfer function is given in Equation 1.

$$V_{OUT} = GAIN \times (I_S R_S + V_{OS}) \quad (EQ. 1)$$

The input g_m stage derives its $\sim 2.86\mu A$ supply current from the input source through the $RS+$ terminal as long as the sensed voltage at the $RS+$ pin is $>1.35V$ and the gm_{HI} amplifier is selected. When the sense voltage at $RS+$ drops below the 1.35V threshold, the gm_{LO} amplifier kicks in and the gm_{LO} output current reverses, flowing out of the $RS-$ pin.

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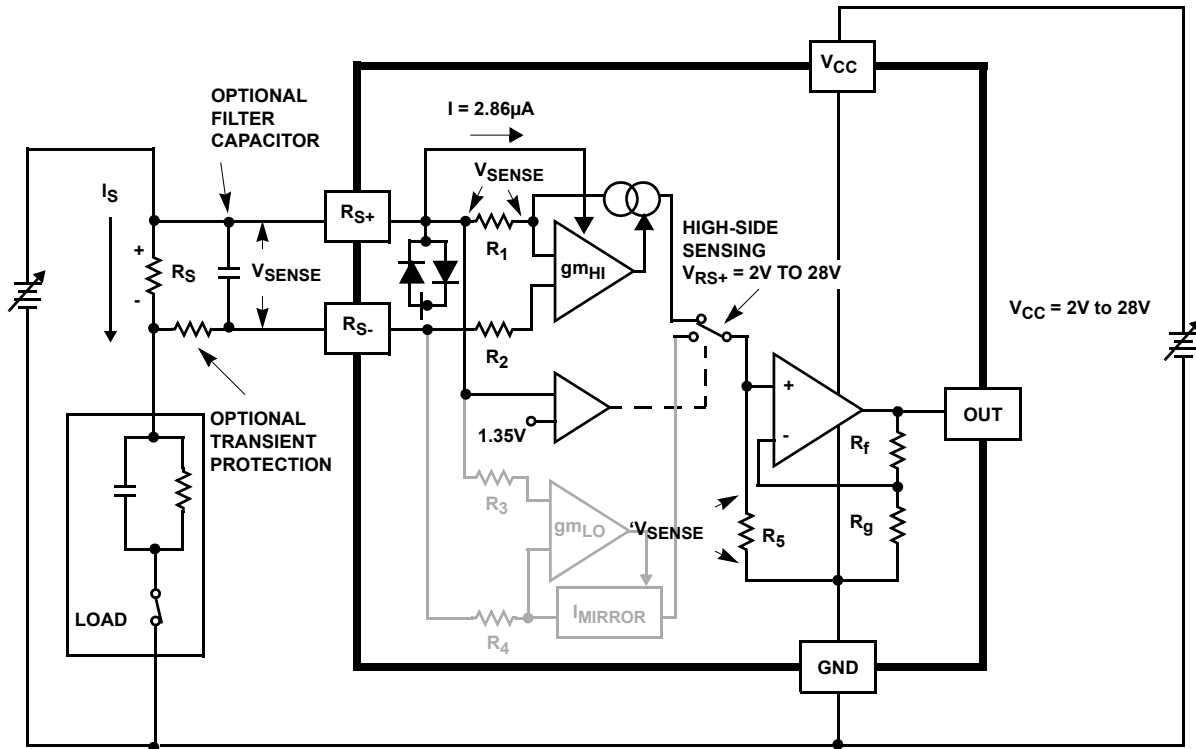


FIGURE 18. HIGH-SIDE CURRENT DETECTION

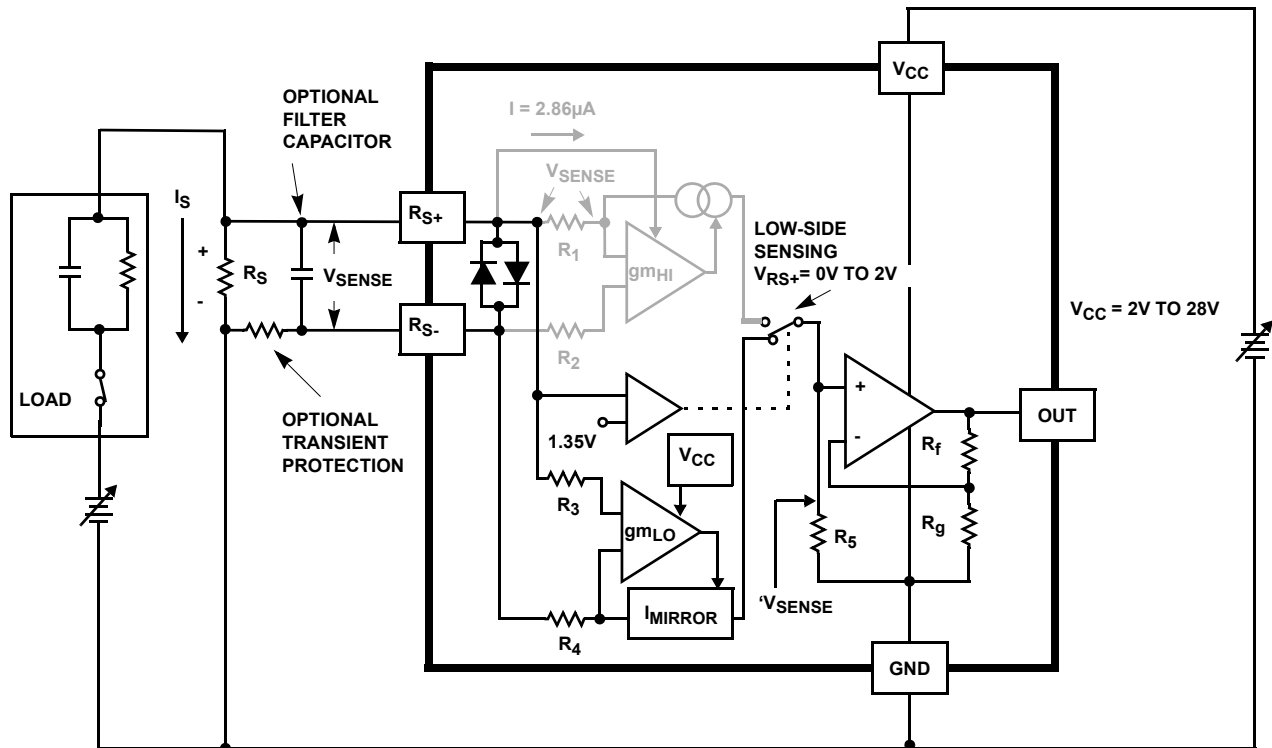


FIGURE 19. LOW-SIDE CURRENT DETECTION

Hysteretic Comparator

The input trans-conductance amps are under control of a hysteretic comparator operating from the incoming source voltage on the RS+ pin (see Figure 20). The comparator monitors the voltage on RS+ and switches the sense amplifier from the low-side gm amp to the high-side gm amplifier whenever the input voltage at RS+ increases above the 1.35V threshold. Conversely, a decreasing voltage on the RS+ pin, causes the hysteric comparator to switch from the high-side gm amp to the low-side gm amp as the voltage decreases below 1.35V. It is that low-side sense gm amplifier that gives the ISL28005 the proprietary ability to sense current all the way to 0V. Negative voltages on the RS+ or RS- are beyond the sensing voltage range of this amplifier.

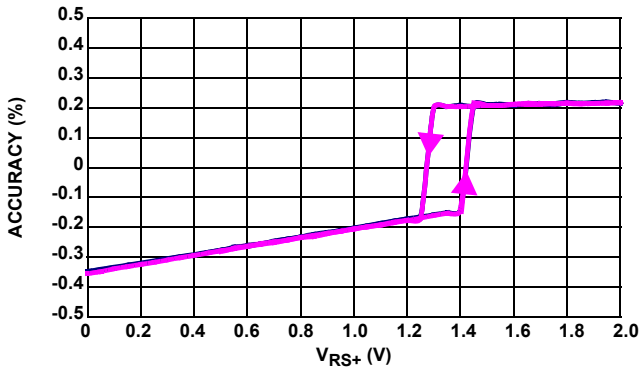


FIGURE 20. GAIN ACCURACY vs $V_{RS+} = 0V$ TO $2V$

Typical Application Circuit

Figure 22 shows the basic application circuit and optional protection components for switched-load applications. For applications where the load and the power source is permanently connected, only an external sense resistor is needed. For applications where fast transients are caused by hot plugging the source or load, external protection components may be needed. The external current limiting resistor (R_P) in Figure 22 may be required to limit the peak current through the internal ESD diodes to $< 20mA$. This condition can occur in applications that experience high levels of in-rush current causing high peak voltages that can damage the internal ESD diodes. An R_P resistor value of 100Ω will provide protection for a $2V$ transient with the

maximum of $20mA$ flowing through the input while adding only an additional $13\mu V$ (worse case over-temperature) of V_{OS} . Refer to the following formula:

$$((R_P \times I_{RS-}) = (100\Omega \times 130nA) = 13\mu V)$$

Switching applications can generate voltage spikes that can overdrive the amplifier input and drive the output of the amplifier into the rails, resulting in a long overload recovery time. Capacitors C_M and C_D filter the common mode and differential voltage spikes.

Error Sources

There are 3 dominant error sources: gain error, input offset voltage error and Kelvin voltage error (see Figure 21). The gain error is dominated by the internal resistance matching tolerances. The remaining errors appear as sense voltage errors at the input to the amplifier. They are V_{OS} of the amplifier and Kelvin voltage errors. If the transient protection resistor is added, an additional V_{OS} error can result from the $I \times R$ voltage due to input bias current. The limiting resistor should only be added to the R_S- input, due to the high-side gm amplifier (gm_{HI}) sinking several micro amps of current through the $RS+$ pin.

Layout Guidelines

Kelvin Connected Sense Resistor

The source of Kelvin voltage errors is illustrated in Figure 21. The resistance of $1/2$ oz. copper is $\sim 1m\Omega$ per square with a TC of $\sim 3900ppm/^{\circ}C$ ($0.39\%/^{\circ}C$). When you compare this unwanted parasitic resistance with the total of $1m\Omega$ to $10m\Omega$ resistance of the sense resistor, it is easy to see why the sense connection must be chosen very carefully. For example, consider a maximum current of $20A$ through a 0.005Ω sense resistor, generating a $V_{SENSE} = 0.1$ and a full scale output voltage of $10V$ ($G = 100$). Two side contacts of only 0.25 square per contact puts the V_{SENSE} input about $0.5 \times 1m\Omega$ away from the resistor end capacitor. If only $10A$ the $20A$ total current flows through the kelvin path to the resistor, you get an error voltage of $10mV$ ($10A \times 0.5sq \times 0.001\Omega/sq. = 10mV$) added to the $100mV$ sense voltage for a sense voltage error of 10% $(0.110V - 0.1)/0.1V \times 100$.

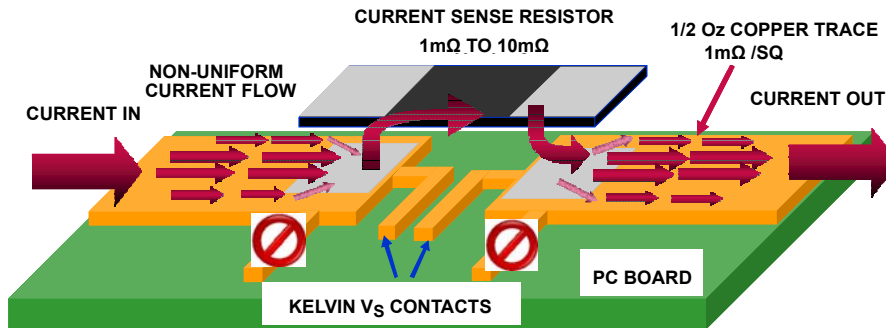


FIGURE 21. PC BOARD CURRENT SENSE KELVIN CONNECTION

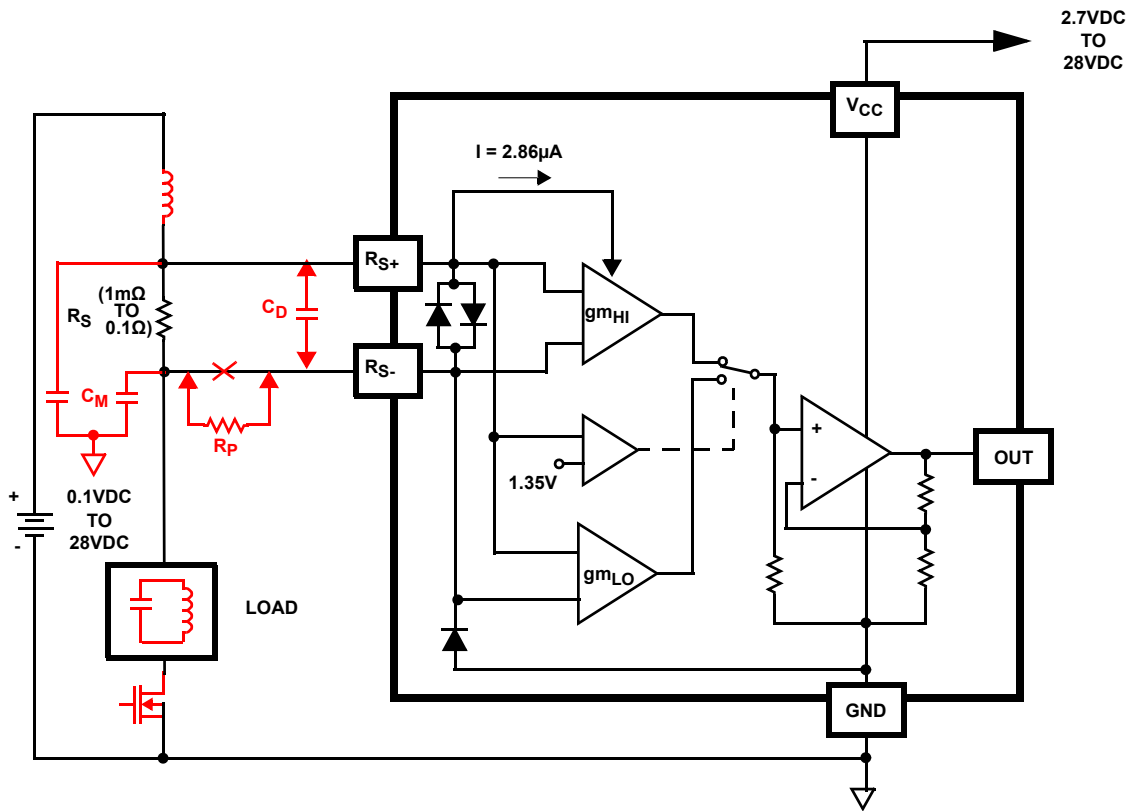


FIGURE 22. TYPICAL APPLICATION CIRCUIT

Overall Accuracy (V_{OA} %)

V_{OA} is defined as the total output accuracy Referred-to-Output (RTO). The output accuracy contains all offset and gain errors, at a single output voltage. Equation 2 is used to calculate the % total output accuracy.

$$V_{OA} = 100 \times \left(\frac{V_{OUT\text{actual}} - V_{OUT\text{expected}}}{V_{OUT\text{expected}}} \right) \quad (\text{EQ. 2})$$

where

$$V_{OUT\text{Actual}} = V_{SENSE} \times \text{GAIN}$$

Example: Gain = 100, For 100mV V_{SENSE} input we measure 10.1V. The overall accuracy (V_{OA}) is 1% as shown in Equation 3.

$$V_{OA} = 100 \times \left(\frac{10.1 - 10}{10} \right) = 1\text{percent} \quad (\text{EQ. 3})$$

Power Dissipation

It is possible to exceed the +150°C maximum junction temperatures under certain load and power supply conditions. It is therefore important to calculate the maximum junction temperature (T_{JMAX}) for all applications to determine if power supply voltages, load conditions, or package type need to be modified to remain in the safe operating area. These parameters are related using Equation 4:

$$T_{JMAX} = T_{MAX} + \theta_{JA} \times PD_{MAXTOTAL} \quad (\text{EQ. 4})$$

where:

- $PD_{MAXTOTAL}$ is the sum of the maximum power dissipation of each amplifier in the package (PD_{MAX})
- PD_{MAX} for each amplifier can be calculated using Equation 5:

$$PD_{MAX} = V_S \times I_{qMAX} + (V_S - V_{OUTMAX}) \times \frac{V_{OUTMAX}}{R_L} \quad (\text{EQ. 5})$$

where:

- T_{MAX} = Maximum ambient temperature
- θ_{JA} = Thermal resistance of the package
- PD_{MAX} = Maximum power dissipation of 1 amplifier
- V_{CC} = Total supply voltage
- I_{qMAX} = Maximum quiescent supply current of 1 amplifier
- V_{OUTMAX} = Maximum output voltage swing of the application
- R_L = Load resistance

ISL28005

Revision History

The revision history provided is for informational purposes only and is believed to be accurate, but not warranted. Please go to web to make sure you have the latest Rev.

DATE	REVISION	CHANGE
4/11/11	FN6973.4	Corrected location of the load in Figure 19. Moved Load from the ground side of the input sense circuit to the high side of the voltage source Updated note in Min Max column of spec table from "Parameters with MIN and/or MAX limits are 100% tested at +25 °C, unless otherwise specified. Temperature limits established by characterization and are not production tested." to "Compliance to datasheet limits is assured by one or more methods: production test, characterization and/or design."
9/2/10	FN6973.3	Added -7TA tape and reel package options to Ordering Information Table for all packages.
5/12/10	FN6973.2	Added Note 4 to Part Marking Column in "Ordering Information" on page 3. Corrected hyperlinks in Notes 1 and 3 in "Ordering Information" on page 3. Corrected ISL28005 hyperlink in "Products" on page 13.
4/12/10		Added Eval boards to ordering info.
4/7/10		Added "Related Literature" on page 1 Updated Package Drawing Number in the "Ordering Information" on page 3 from MDP0038 to P50.64A. Revised package outline drawing from MDP0038 to P5.064A on page 14. MDP0038 package contained 2 packages for both the 5 and 6 Ld SOT-23. MDP0038 was obsoleted and the packages were separated and made into 2 separate package outline drawings; P5.064A and P6.064A. Changes to the 5 Ld SOT-23 were to move dimensions from table onto drawing, add land pattern and add JEDEC reference number.
2/3/10	FN6973.1	-Page1: Edited last sentence of paragraph 2. Moved order of GAIN listings from 20, 50, 100 to 100, 50, 20 in the 3rd paragraph. Under Featuresremoved "Low Input Offset Voltage 250µV,max" Under Features moved order of parts listing from 20, 50, 100 (from top to bottom) to 100, 50, 20. -Page 3: Removed coming soon on ISL28005FH50Z and ISL28005FH20Z and changes the order or listing them to 100, 50, 20. -Page 5: VOA test. Under conditions column ...deleted "20mV to". It now reads ... Vsense = 100mV SR test. Under conditions column ..deleted what was there. It now reads ... Pulse on RS+pin, See Figure 17 -Page 6: ts test. Removed Gain = 100 and Gain = 100V/V in both description and conditions columns respectively. -Page 9 Added Figure 17 and adjusted figure numbers to account for the added figure.
12/14/09	FN6973.0	Initial Release

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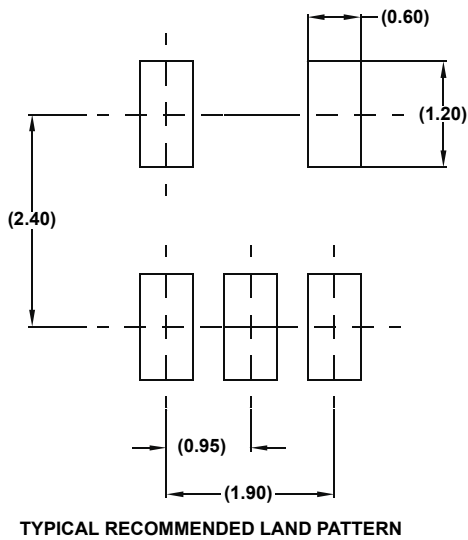
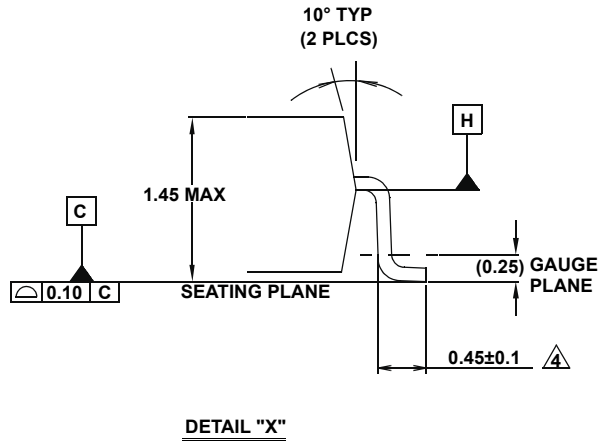
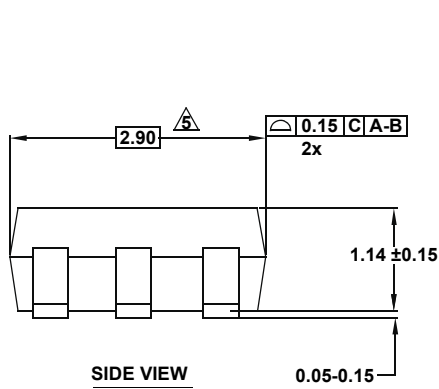
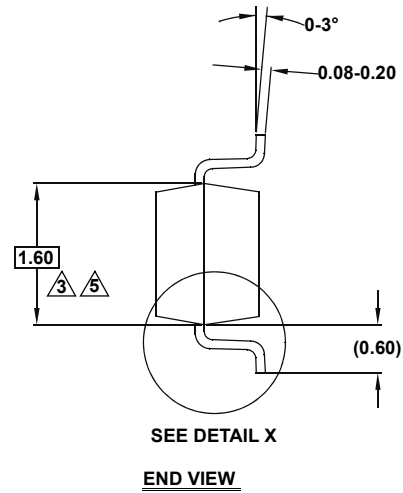
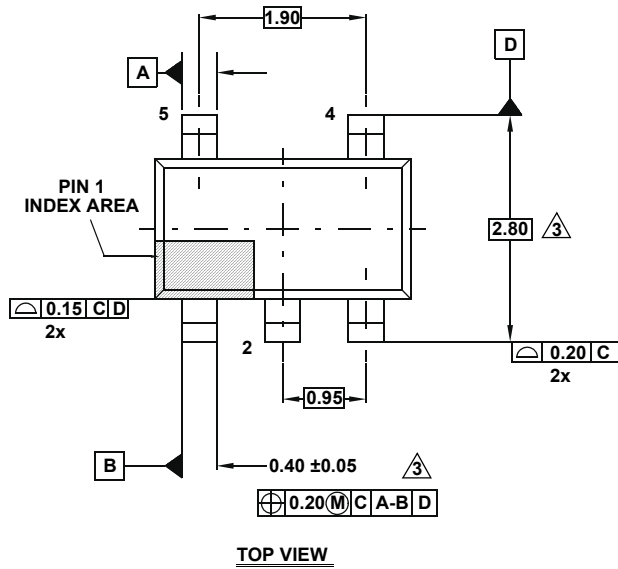
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Package Outline Drawing

P5.064A

5 LEAD SMALL OUTLINE TRANSISTOR PLASTIC PACKAGE

Rev 0, 2/10



NOTES:

- Dimensions are in millimeters.
Dimensions in () for Reference Only.
- Dimensioning and tolerancing conform to ASME Y14.5M-1994.
- Dimension is exclusive of mold flash, protrusions or gate burrs.
- Foot length is measured at reference to gauge plane.
- This dimension is measured at Datum "H".
- Package conforms to JEDEC MO-178AA.