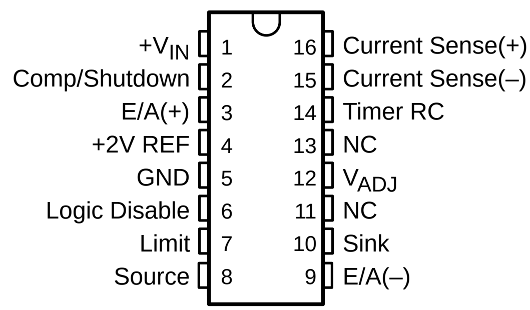
- **Controlled Baseline**
  - **One Assembly/Test Site, One Fabrication Site**
- **Extended Temperature Performance of –40°C to 105°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product Change Notification**
- **Qualification Pedigree†**
- **Precision 1% Reference**
- **Over-Current Sense Threshold Accurate to 5%**
- **Programmable Duty-Ratio Over-Current Protection**

† Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

- **4.5 V to 36 V Operation**
- **100 mA Output Drive, Source or Sink**
- **Under-Voltage Lockout**
- **Adjustable Current Limit to Current Sense Ratio**
- **Separate +V_{IN} terminal**
- **Programmable Driver Current Limit**
- **Access to VREF and E/A(+)**
- **Logic-Level Disable Input**

DW PACKAGE (TOP VIEW)



NC = No Connect

description

The UC2832 series of precision linear regulators include all the control functions required in the design of very low dropout linear regulators. Additionally, they feature an innovative duty-ratio current limiting technique which provides peak load capability while limiting the average power dissipation of the external pass transistor during fault conditions. When the load current reaches an accurately programmed threshold, a gated-astable timer is enabled, which switches the regulator’s pass device off and on at an externally programmable duty-ratio. During the on-time of the pass element, the output current is limited to a value slightly higher than the trip threshold of the duty-ratio timer. The constant-current-limit is programmable on the UC2832 to allow higher peak current during the on-time of the pass device. With duty-ratio control, high initial load demands and short circuit protection may both be accommodated without extra heat sinking or foldback current limiting. Additionally, if the timer pin is grounded, the duty-ratio timer is disabled, and the IC operates in constant-voltage/constant-current regulating mode.

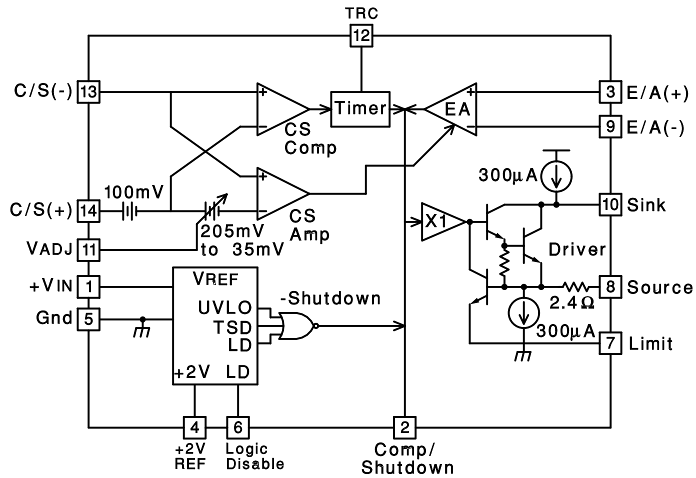
These IC’s include a 2 Volt (±1%) reference, error amplifier, UVLO, and a high current driver that has both source and sink outputs, allowing the use of either NPN or PNP external pass transistors. Safe operation is assured by the inclusion of under-voltage lockout (UVLO) and thermal shutdown.

ORDERING INFORMATION‡

T_A	PACKAGE§		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 105°C	SOP – DW	Tape and reel	UC2832TDWREP	UC2832TEP
–40°C to 105°C	SOP – DW	Tube	UC2832TDWEP	UC2832TEP

‡ Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

block diagram



Ordering Information

UC 283 2 T DW R EP

- EP — **ENHANCED PLASTIC INDICATOR**
- R — **TAPE and REEL INDICATOR**
- DW — **PACKAGE**
  DW = Plastic SOIC
- T — **TEMPERATURE INDICATOR**
  T = –40°C to 105°C
- 2 — **PRODUCT OPTION**

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†‡

V_{IN} supply voltage . . . 40 V
Driver output current (sink or source), I_O . . . 450 mA
Driver sink to source voltage . . . 40 V
TRC pin voltage . . . –0.3 V to 3.2 V
Other input voltages . . . –0.3 V to supply voltage
Operating jucntion temperature range, T_J . . . –55°C to 150°C
Storage temperature range, T_{stg} . . . –65°C to 150°C
Lead temperature soldering 1,6 mm (1/16 inch) from case for 10 seconds . . . 300°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

‡ Unless otherwise indicated, voltages are reference to ground and currents are positive into and negative out of the specified terminals.

electrical characteristics, T_A = –40°C to 105°C for the UC2832T-EP, $+V_{IN}$ = 15 V, Driver sink = $+V_{IN}$, C/S(+) voltage = $+V_{IN}$, and $T_A = T_J$ (unless otherwise stated)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Input Supply						
Supply current	$+V_{IN}$ = 6 V			6.5	10	mA
	$+V_{IN}$ = 36 V			9.5	15	
	Logic Disable = 2 V			3.3	10	
Reference Section						
Output voltage	I_{DRIVER} = 10 mA	T_J = 25°C	1.98	2	2.02	V
		T_J = Full range	1.96	2	2.04	
Load regulation voltage	I_{OUT} = 0 to 10 mA		–10	–5	10	mV
Line regulation	$+V_{IN}$ = 4.5 V to 36 V,	I_{DRIVER} = 10 mA		0.033	0.5	mV/V
Under-voltage lockout threshold				3.6	4.5	V
Logic Disable Input						
Threshold voltage			1.3	1.4	1.5	V
Input bias current	Logic Disable = 0 V		–5	–1	0.1	µA
Current Sense Section						
Comparator offset	T_J = 25°C		95	100	105	mV
	T_J = Full range		93	100	107	
Amplifier offset	V_{ADJ} = Open		110	135	170	mV
	V_{ADJ} = 1 V		180	235	290	
	V_{ADJ} = 0 V		250	305	360	
Input bias current	$V_{CM} = +V_{IN}$		65	100	135	µA
Input offset current	$V_{CM} = +V_{IN}$		–10		10	µA
Amplifier CMRR	V_{CM} = 4.1 V to $+V_{IN}$ + 0.3 V			80		dB
Transconductance	I_{COMP} = ±100 µA			65		ms
V_{ADJ} input current	V_{ADJ} = 0 V		–10	–1		µA

electrical characteristics, T_A = –40°C to 105°C for the UC2832T-EP, $+V_{IN}$ = 15 V, Driver sink = $+V_{IN}$, C/S(+) voltage = $+V_{IN}$, and $T_A = T_J$ (unless otherwise stated)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Timer						
Inactive leakage current	C/S(+) = C/S(–) = $+V_{IN}$, TRC pin = 2 V			0.25	1	µA
Active pull-up current	C/S(+) = $+V_{IN}$, C/S(–) = $+V_{IN}$ – 0.4 V, TRC pin = 0 V		–345	–270	–175	µA
Duty ratio (See Note 1)	ontime/period, R_T = 200 kΩ, C_T = 0.27 µF			4.8		%
Period (See Notes 1 and 2)	ontime + offtime, R_T = 200 kΩ, C_T = 0.27 µF			36		ms
Upper trip threshold (V_u)				1.8		V
Lower trip threshold (V_l)				0.9		V
Trip threshold ratio	V_u / V_l			2.0		V/V
Error Amplifier Section						
Input offset voltage	$V_{CM} = V_{COMP}$ = 2 V		–8		8	mV
Input bias current	$V_{CM} = V_{COMP}$ = 2 V		–4.5	–1.1		µA
Input offset current	$V_{CM} = V_{COMP}$ = 2 V		–1.5		1.5	µA
Open loop voltage gain (A_{VOL})	V_{COMP} = 1 V to 13 V		50	70		dB
Common mode rejection ratio (CMRR)	V_{CM} = 0 V to $+V_{IN}$ – 3 V		60	80		dB
PSRR	V_{CM} = 2 V, $+V_{IN}$ = 4.5 V to 36 V			90		dB
Transconductance	I_{COMP} = ±10 µA			4.3		ms
High-level output voltage (V_{OH})	I_{COMP} = 0, Volts below $+V_{IN}$			0.95	1.3	V
Low-level output voltage (V_{OL})	I_{COMP} = 0			4.5	0.7	V
Output high current (I_{OH})	V_{COMP} = 2 V		–700	–500	–100	µA
Output low current (I_{OL})	V_{COMP} = 2 V	C/S(–) = $+V_{IN}$	100	500	700	µA
		C/S(–) = $+V_{IN}$ – 0.4 V	2	6		mA

NOTES: 1. These parameters are first-order supply-independent, however, both may vary with supply for $+V_{IN}$ less than about 4 V. This supply variation will cause a slight change in the timer period and duty cycle, although a high off-time/on-time ratio will be maintained.
2. With recommended R_T value of 200 kΩ, $T_{OFF} \approx R_T\ C_T * \ln(V_u/V_l)$ ±10%.

electrical characteristics, T_A = –40°C to 105°C for the UC2832T-EP, $+V_{IN}$ = 15 V, Driver sink = $+V_{IN}$, C/S(+) voltage = $+V_{IN}$, and T_A = T_J (unless otherwise stated)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Driver Section						
Maximum current	Driver limit and source pins common	T_J = 25°C	200	300	400	mA
		T_J = Full range	100	300	450	
Limiting voltage	Driver limit to source voltage at current limit, I_{SOURCE} = –10 mA, T_J = 25°C, See Note 3			0.72		V
Internal current sense resistance	T_J = 25°C, See Note 3			2.4		Ω
Pull-up current at driver sink	Compensation/Shutdown = 0.4 V	Driver sink = $+V_{IN}$ – 1 V	–800	–300	–100	µA
		$+V_{IN}$ = 36 V, Driver sink = 35 V	–1000	–300	–75	
Pull-down current at driver source	Compensation/Shutdown = 0.4 V, Driver source = 1 V		150	300	700	µA
Saturation voltage sink to source	Driver source = 0 V, Driver current = 100 mA			1.5		V
Maximum source voltage	Driver sink = $+V_{IN}$, Driver current = 100 mA, Volts below $+V_{IN}$			3		V
UVLO sink leakage	$+V_{IN}$ = C/S(+) = C/S(–) = 2.5 V, Driver sink = 15 V, Driver source = 0 V, T_A = 25°C			25		µA
Maximum reverse source voltage	Compensation/Shutdown = 0 V, I_{SOURCE} = 100 µA, $(+)V_{IN}$ = 3 V			1.6		V
Thermal shutdown				160		°C

NOTES: 3. The internal current limiting voltage has a temperature dependence of approximately –2.0 mV/°C, or –2800 ppm/°C. The internal 2.4 Ω sense resistor has a temperature dependance of approximately +1500 ppm/°C.

APPLICATION AND OPERATION INFORMATION

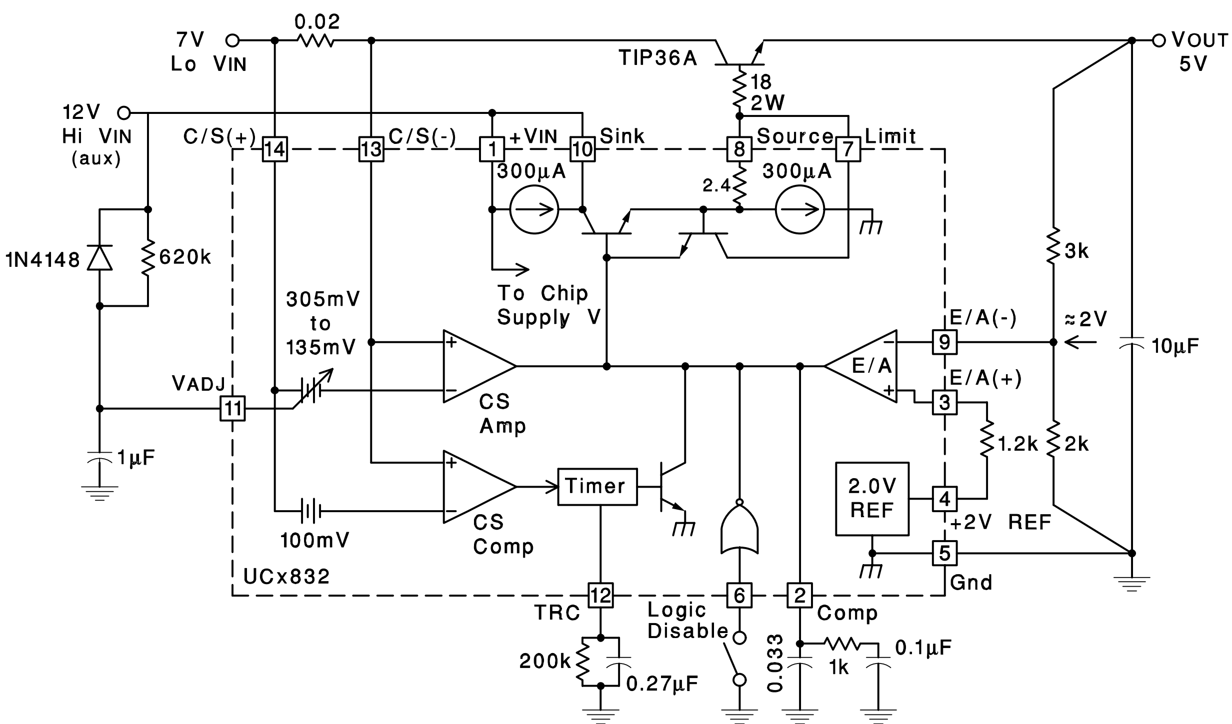


Figure 1. NPN Pass (Medium Power, Low Drop-Out Regulator)

APPLICATION AND OPERATION INFORMATION

Estimating Maximum Load Capacitance

For any power supply, the rate at which the total output capacitance can be charged depends on the maximum output current available and on the nature of the load. For a constant-current current-limited power supply, the output will come up if the load asks for less than the maximum available short-circuit limit current.

To ensure recovery of a duty-ratio current-limited power supply from a short-circuited load condition, there is a maximum total output capacitance which can be charged for a given unit ON time. The design value of ON time can be adjusted by changing the timing capacitor. Nominally, $T_{ON} = 0.693 \times 10\ k\Omega \times C_T$.

Typically, the IC regulates output current to a maximum of $I_{MAX} = K \times I_{TH}$, where I_{TH} is the timer trip-point current, and

$$K = \frac{\text{Current Sense Amplifier Offset Voltage}}{100\ \text{mA}}$$

and is variable from 1.35 to 3.05 with V_{ADJ}.

For a worst-case constant-current load of value just less than I_{TH}, C_{MAX} can be estimated from:

$$C_{MAX} = \left(\frac{K - 1}{TH}\right) \times \left(\frac{T_{ON}}{V_{OUT}}\right)$$

where V_{OUT} is the nominal regulator output voltage.

For a resistive load of value R_L, the value of C_{MAX} can be estimated from:

$$C_{MAX} = \frac{T_{ON}}{R_L} \times \frac{1}{\ln\left[\left(1 - \frac{V_{OUT}}{K \times I_{TH} \times R_L}\right)^{-1}\right]}$$

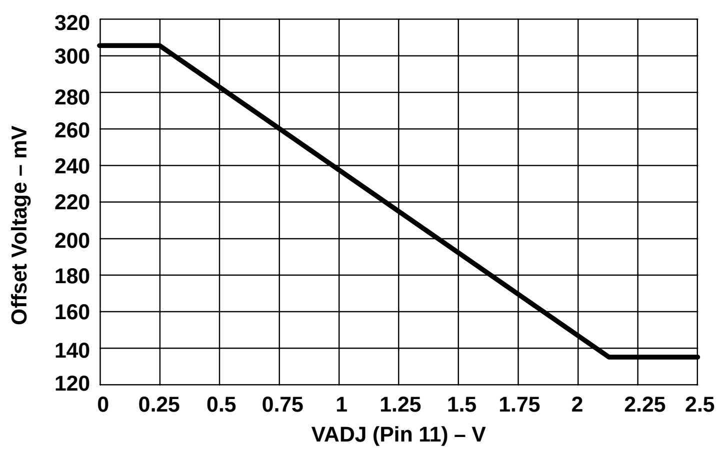


Figure 2. Current Sense Amplifier Offset Voltage vs V_{ADJ}

APPLICATION AND OPERATION INFORMATION

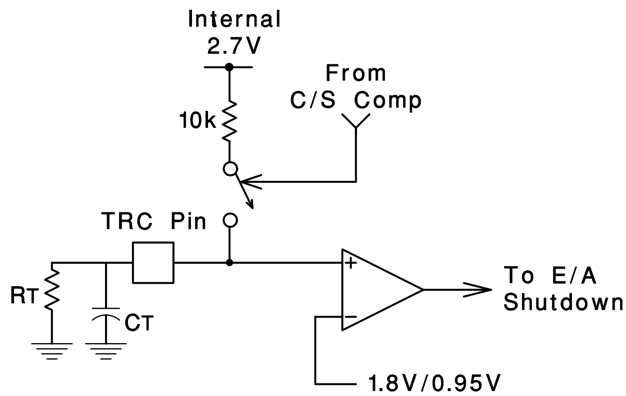
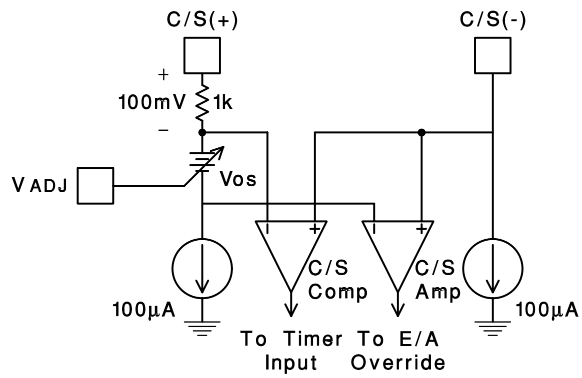


Figure 3. Timer Function



NOTE A: V_{OS} = 205 mV to 35 mV

Figure 4. Current Sense Input Configuration

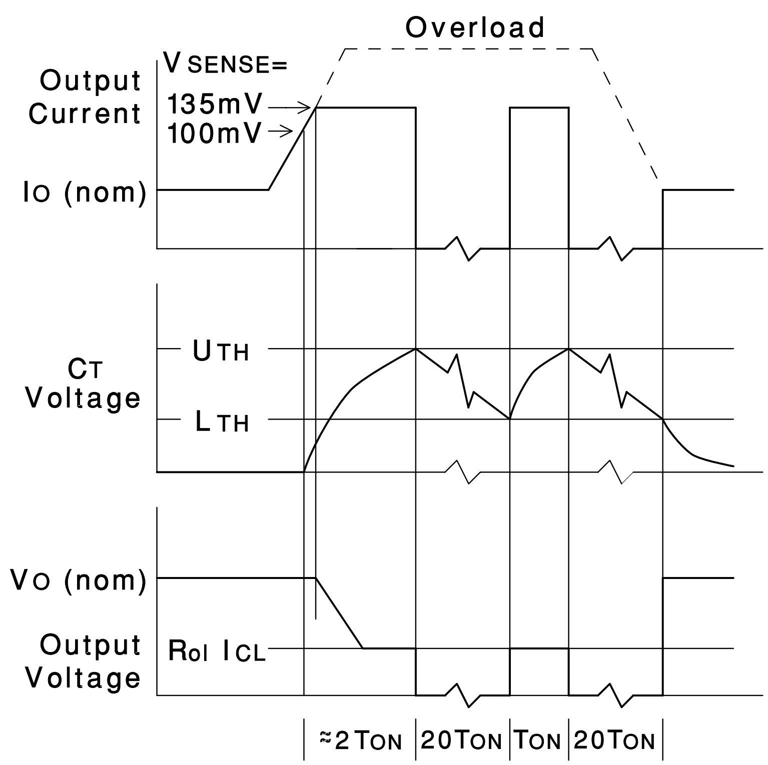


Figure 5. Load Current, Timing Capacitor Voltage, and Output Voltage of the Regulator Under Fault Conditions

APPLICATION AND OPERATION INFORMATION

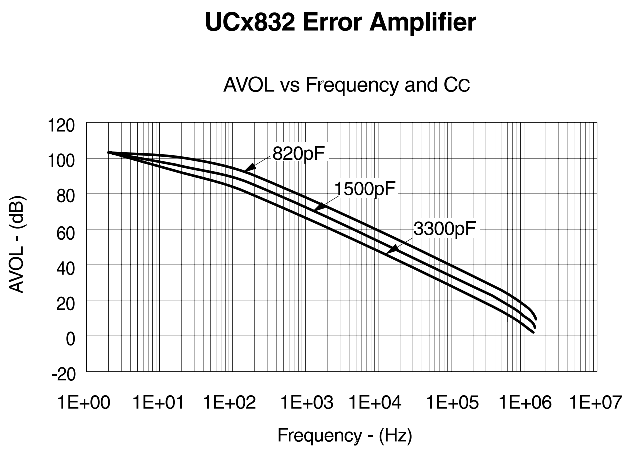


Figure 6. UCx832 Error Amplifier

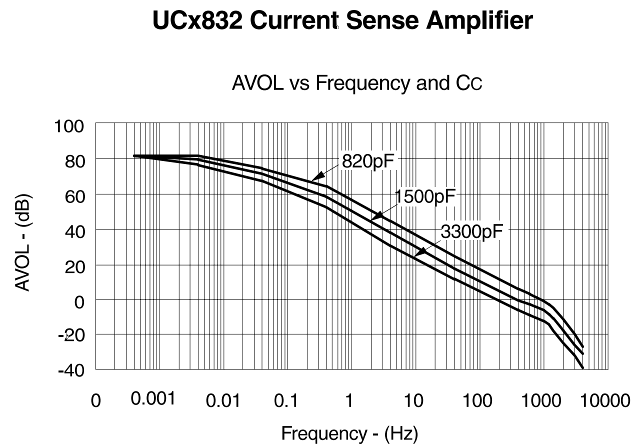


Figure 7. UCx832 Current Sense Amplifier

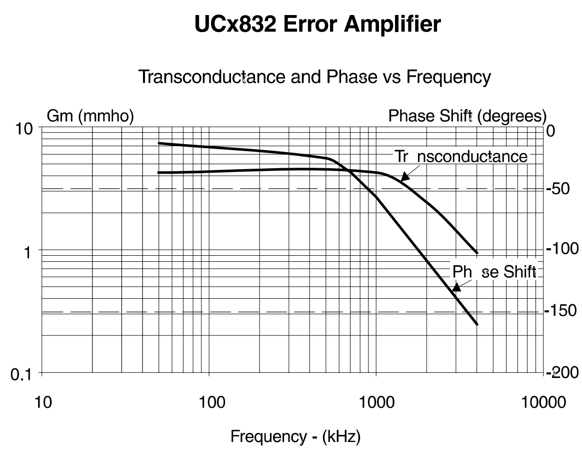


Figure 8. UCx832 Error Amplifier

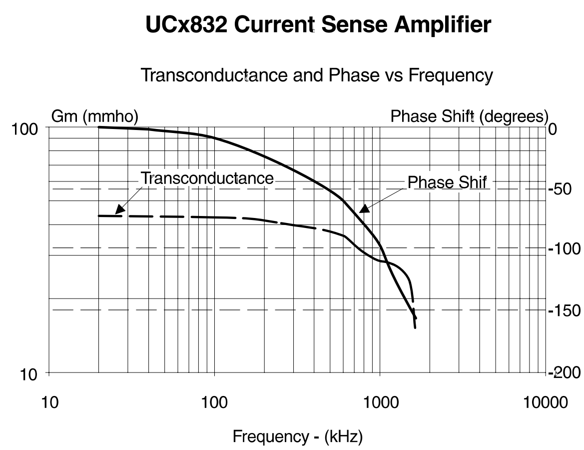


Figure 9. UCx832 Current Sense Amplifier

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
UC2832TDWEP	ACTIVE	SOIC	DW	16	40	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 105	UC2832TEP	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF UC2832-EP :

- Catalog: UC2832

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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