INTEGRATED CIRCUITS
UNITRODE

UC1832
UC2832/3
UC3832/3

Precision Low Dropout Linear Controllers

FEATURES

- Precision 1% Reference
- Over-Current Sense Threshold Accurate to 5%
- Programmable Duty-Ratio Over-Current Protection
- 4.5 V to 36 V Operation
- 100mA Output Drive, Source, or Sink
- Under-Voltage Lockout

Additional Features of the UC2832 series:

- Adjustable Current Limit to Current Sense Ratio
- Separate +V_{IN} terminal
- Programmable Driver Current Limit
- Access to V_{REF} and E/A(+)
- Logic-Level Disable Input

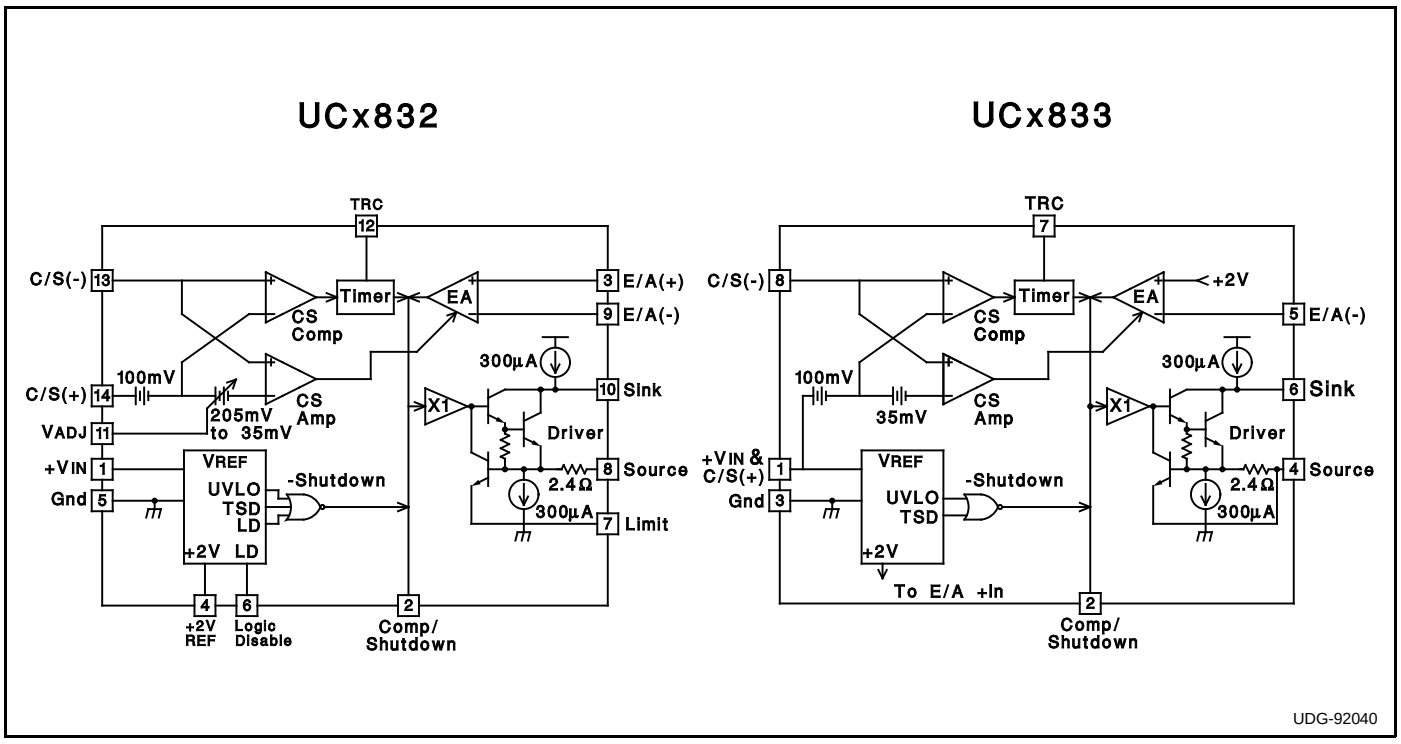
DESCRIPTION

The UC2832 and UC3833 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 UCx832 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.

The UC3833 family includes the basic functions of this design in a low-cost, 8-pin mini-dip package, while the UC2832 series provides added versatility with the availability of 14 pins. Packaging options include plastic (N suffix), or ceramic (J suffix). Specified operating temperature ranges are: commercial (0°C to 70°C), order UC3832/3 (N or J); and industrial (–40°C to 85°C), order UC2832/3 (N or J). Surface mount packaging is also available.

BLOCK DIAGRAMS



UDG-92040

ABSOLUTE MAXIMUM RATINGS

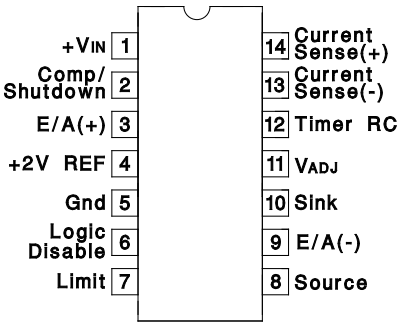
Supply Voltage $+V_{IN}$ 40V
Driver Output Current (Sink or Source) 450mA
Driver Sink to Source Voltage 40V
TRC Pin Voltage . . . . . –0.3V to 3.2V
Other Input Voltages. . . . . –0.3V to $+V_{IN}$
Operating Junction Temperature (note 2) . . . –55°C to +150°C
Storage Temperature . . . . . –65°C to +150°C
Lead Temperature (Soldering, 10 Seconds) . . . . . 300°C

Note 1: Unless otherwise indicated, voltages are referenced to ground and currents are positive into, negative out of, the specified terminals.
Note 2: See Unitrode Integrated Circuits databook for information regarding thermal specifications and limitations of packages.

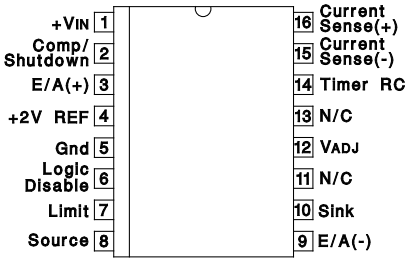
CONNECTION DIAGRAMS

UC2832

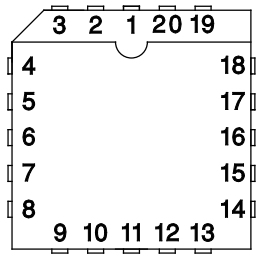
DIL-14 (Top View)
J Or N Package



SOIC-16 (Top View)
DW Package



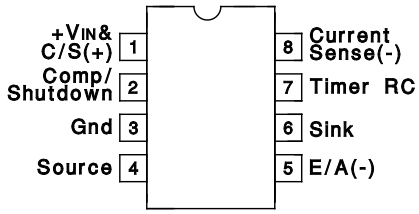
LCC-20 & PLCC-20
L & Q Package
(Top View)



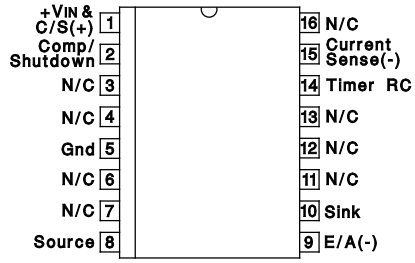
PACKAGE PIN FUNCTION	
FUNCTION	PIN
N/C	1
$+V_{IN}$	2
Comp/Shutdown	3
E/A(+)	4
+2V REF	5
N/C	6
Gnd	7
Logic Disable	8
Limit	9
Source	10
N/C	11
E/A(-)	12
Sink	13
V_{ADJ}	14
N/C	15-17
Timer RC	18
Current Sense(-)	19
Current Sense(+)	20

UC3833

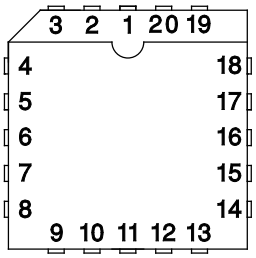
DIL-8 (Top View)
J Or N Package



SOIC-16 (Top View)
DW Package



LCC-20 & PLCC-20
L & Q Package
(Top View)



PACKAGE PIN FUNCTION	
FUNCTION	PIN
$+V_{IN}$ & C/S(+)	1
N/C	2
N/C	3
N/C	4
Comp/Shutdown	5
Gnd	6
N/C	7
N/C	8
N/C	9
Source	10
N/C	11
E/A(-)	12
N/C	13
N/C	14
Sink	15
Timer RC	16
Current Sense(+)	17
N/C	18-20

ELECTRICAL CHARACTERISTICS:

Unless otherwise stated, specifications hold for TA = 0°C to 70°C for the UC3832/3, –40°C to 85°C for the UC2832/3, $+V_{IN}$ = 15V, Driver sink = $+V_{IN}$, C/S(+) voltage = $+V_{IN}$. T_A=T_J.

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	mA
	Logic Disable = 2 V (UCx832 only)		3.3		mA
Reference Section					
Output Voltage (Note 3)	T_J = 25°C, I_{DRIVER} = 10 mA	1.98	2.00	2.02	V
	over temperature, I_{DRIVER} = 10 mA	1.96	2.00	2.04	V
Load Regulation (UCx832 only)	I_O = 0 to 10 m	-10	-5.0		mV
Line Regulation	$+V_{IN}$ = 4.5 V to 36 V, I_{DRIVER} = 10 m		0.033	0.5	mV/V
Under-Voltage Lockout Threshold			3.6	4.5	V
Logic Disable Input (UCx832 only)					
Threshold Voltage		1.3	1.4	1.5	V
Input Bias Current	Logic Disable = 0 V	-5.0	-1.0		µA
Current Sense Section					
Comparator Offset		95	100	105	mV
	Over Temperature	93	100	107	mV
Amplifier Offset (UCx833 only)		110	135	170	mV
Amplifier Offset (UCx832 only)	V_{ADJ} = Open	110	135	170	mV
	V_{ADJ} = 1 V	180	235	290	mV
	V_{ADJ} = 0 V	250	305	360	mV
Input Bias Current	V_{CM} = $+V_{IN}$	65	100	135	µA
Input Offset Current (UCx832 only)	V_{CM} = $+V_{IN}$	-10		10	µA
Amplifier CMRR (UCx832 only)	V_{CM} = 4.1 V to + V_{IN} + 0.3		80		dB
Transconductance	I_{COMP} = ±100 µA		65		mS
V_{ADJ} Input Current (UCx832 only)	V_{ADJ} = 0V	-10	-1		µA
Timer					
Inactive Leakage Current	C/S(+) = C/S(-) = $+V_{IN}$; TRC pin = 2 V		0.25	1.0	µA
Active Pullup Current	C/S(+) = $+V_{IN}$, C/S(-) = $+V_{IN}$ - 0.4V; TRC pin = 0 V	-345	-270	-175	µA
Duty Ratio (note 4)	ontime/period, R_T = 200k, C_T = 0.27µF		4.8		%
Period (notes 4,5)	ontime + offtime, R_T = 200k, C_T = 0.27µF		36		ms
Upper Trip Threshold (Vu)			1.8		V
Lower Trip Threshold (Vl)			0.9		V
Trip Threshold Ratio	Vu/Vl		2.0		V/V
Error Amplifier					
Input Offset Voltage (UCx832 only)	V_{CM} = V_{COMP} = 2 V	-8.0		8.0	mV
Input Bias Current	V_{CM} = V_{COMP} = 2 V	-4.5	-1.1		µA
Input Offset Current (UCx832 only)	V_{CM} = V_{COMP} = 2 V	-1.5		1.5	µA
AVOL	V_{COMP} = 1 V to 13 V	50	70		dB
CMRR (UCx832 only)	V_{CM} = 0V to $+V_{IN}$ - 3 V	60	80		dB
PSRR (UCx832 only)	V_{CM} = 2 V, $+V_{IN}$ = 4.5 V to 36		90		dB
Transconductance	I_{COMP} = ±10 µA		43		mS
VOH	I_{COMP} = 0, Volts below $+V_{IN}$		.95	1.3	V
VOL	I_{COMP} = 0		.45	0.7	V
IOH	V_{COMP} = 2 V	-700	-500	-100	µA

ELECTRICAL CHARACTERISTICS (cont.)

Unless otherwise stated, specifications hold for TA = 0°C to 70°C for the UC3832/3, –40°C to 85°C for the UC2832/3, +VIN = 15 V, Driver sink = +VIN, C/S(+) voltage = +VIN. TA=TJ.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Error Amplifier (cont.)					
IOL	VCOMP = 2 V, C/S(-) = +VIN	100	500	700	µA
	VCOMP = 2 V, C/S(-) = +VIN - 0.4 V	2	6		mA
Driver					
Maximum Current	Driver Limit & Source pins common; TJ = 25°C	200	300	400	mA
	Over Temperature	100	300	450	mA
Limiting Voltage (UCx832 only)	Driver Limit to Source voltage at current limit, ISOURCE = -10 mA; TJ = 25°C (Note 6)		.72		V
Internal Current Sense Resistance	TJ = 25°C (Note 6)		2.4		Ω
Pull-Up Current at Driver Sink	Compensation/Shutdown = 0.4 V; Driver Sink = +VIN - 1V	-800	-300	-100	µA
	Compensation/Shutdown = 0.4 V, +VIN = 36 V; Driver Sink = 35 V	-1000	-300	-75	µA
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 = +VIN, Driver Current = 100 mA Volts below + VIN		3.0		V
UVLO Sink Leakage	+VIN = C/S(+) = C/S(-) = 2.5 V, Driver Sink = 15 V, Driver Source = 0 V, TA = 25°C		25		µA
Maximum Reverse Source Voltage	Compensation/Shutdown = 0 V; ISOURCE = 100 µA, +VIN = 3 V		1.6		V
Thermal Shutdown			160		°C

Note 3: On the UCx833 this voltage is defined as the regulating level at the error amplifier inverting input, with the error amplifier driving VSOURCE to 2 V.

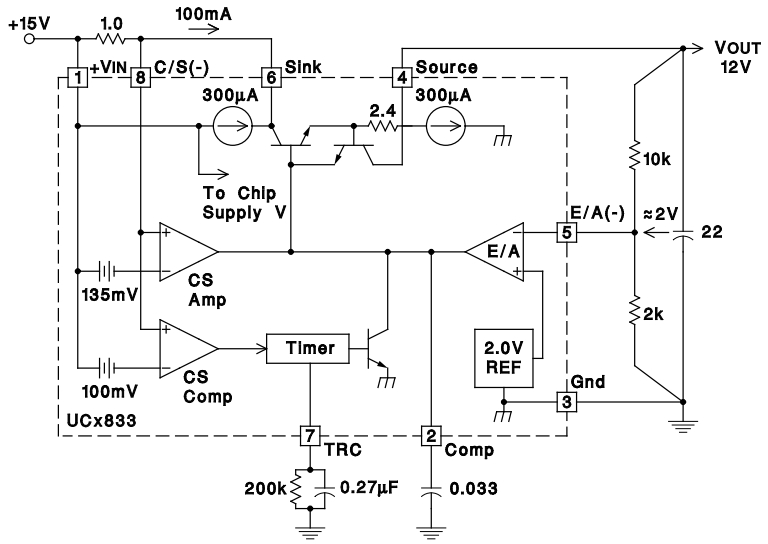
Note 4: These parameters are first-order supply-independent, however both may vary with supply for +VIN less than about 4 V. This supply variation will cause a slight change in the timer period and duty cycle, although a high off-time/on-time ratio will be maintained.

*Note 5: With recommended RT value of 200k, TOFF ≈ RT CT * ln(Vu/Vl) ±10%.*

Note 6: 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.

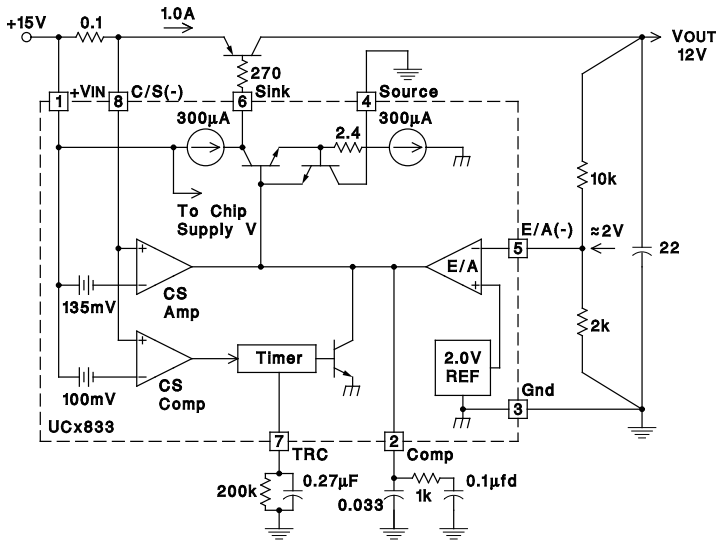
APPLICATION AND OPERATION INFORMATION

NPN Pass (Local 100mA Regulator) (UCx833)



APPLICATION AND OPERATION INFORMATION (cont.)

PNP Pass (Low Drop-Out Regulator) (UCx833)



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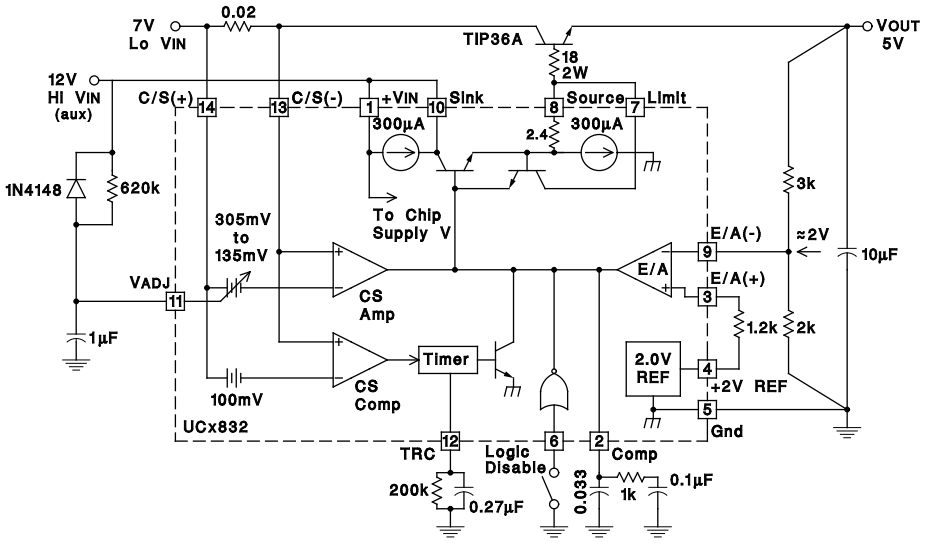
NPN Pass (Medium Power, Low Drop-Out Regulator) (UCx832)



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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 guarantee 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, $T_{ON} = 0.693 \times 10k \times C_T$.

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

≈1.35 for UCx833, and is variable from 1.35 to 3.05 with V_{ADJ} for the UCx832.

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

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

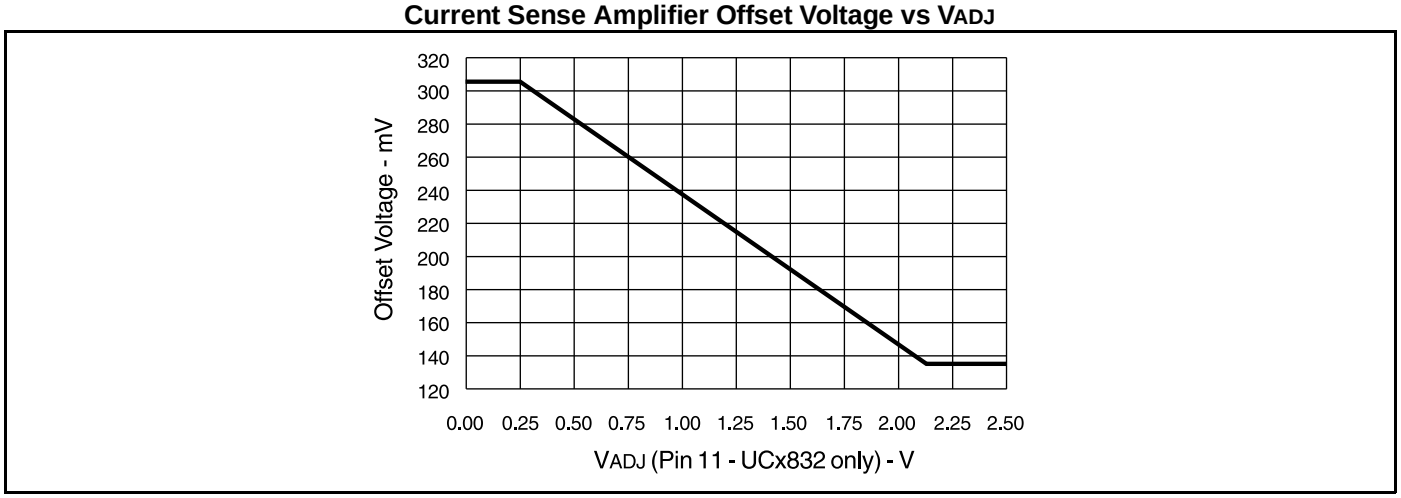
where V_{OUT} is the nominal regulator output voltage.

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

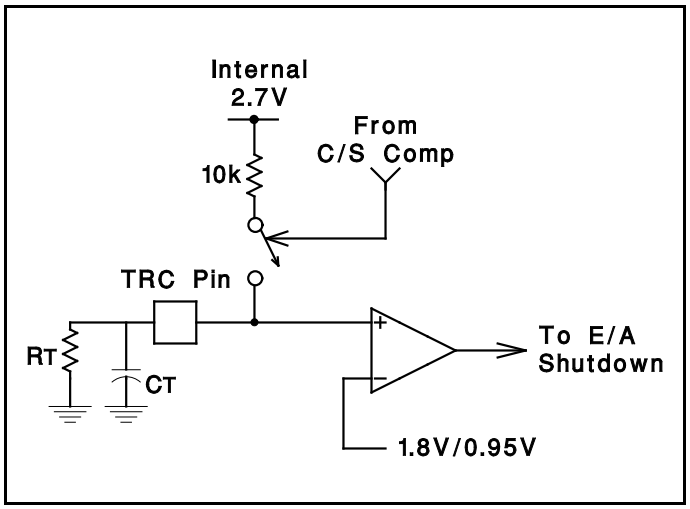
$$C_{MAX} = \frac{T_{ON}}{R_L} \bullet \frac{1}{In\left[\left(1-\frac{V_{OUT}}{K \bullet I_{TH} \bullet R_L}\right)^{-1}\right]}.$$

APPLICATION AND OPERATION INFORMATION (cont.)

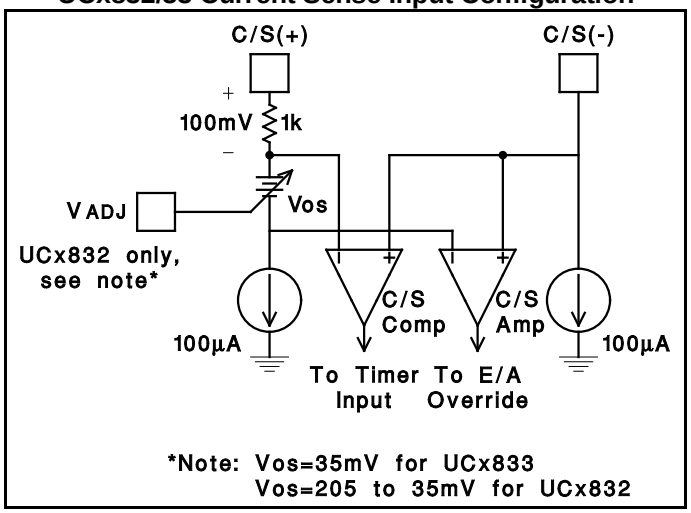
Current Sense Amplifier Offset Voltage vs V_{ADJ}



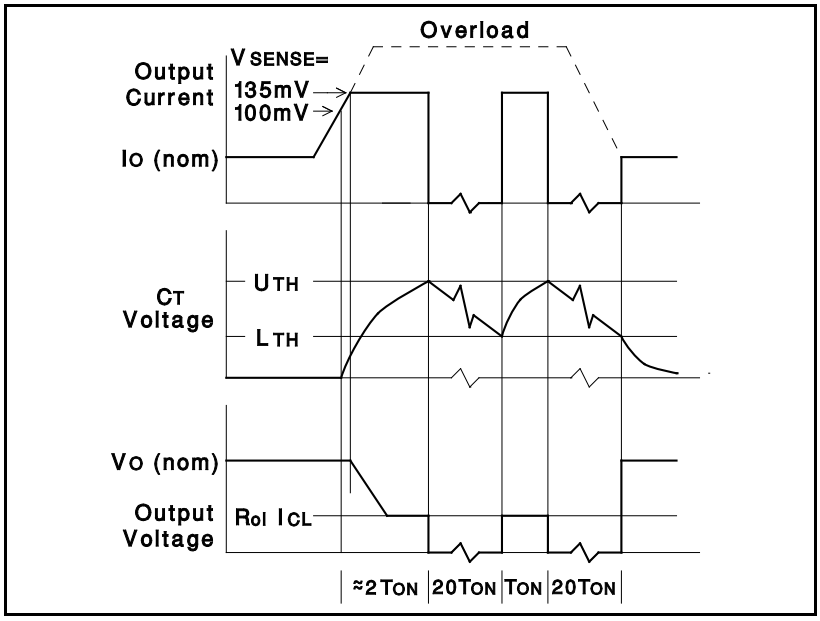
UCx832/33 Timer Function



UCx832/33 Current Sense Input Configuration



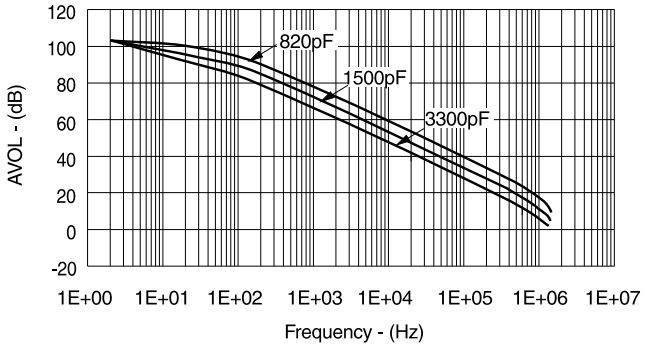
Load current, timing capacitor voltage, and output voltage of the regulator under fault conditions.



APPLICATION AND OPERATION INFORMATION (cont.)

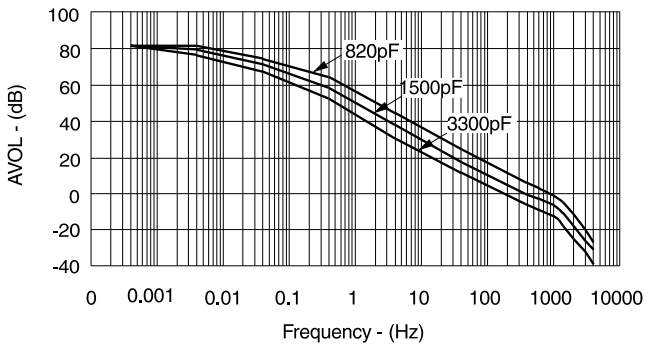
UCx832 Error Amplifier

AVOL vs Frequency and CC



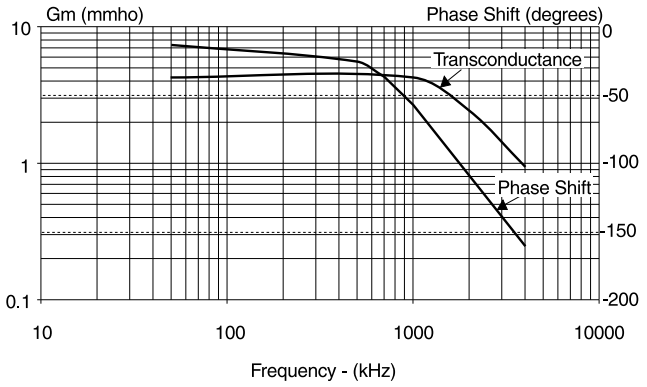
UCx832 Current Sense Amplifier

AVOL vs Frequency and CC



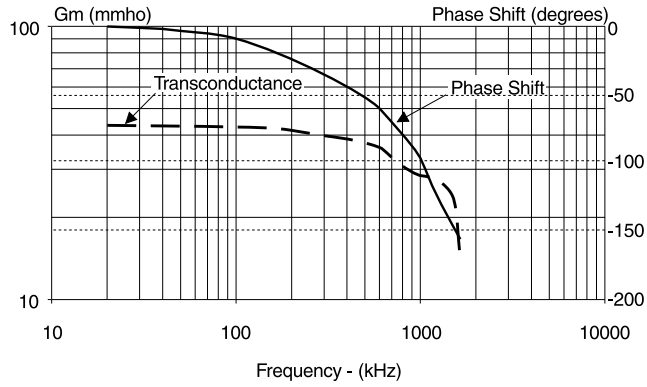
UCx832 Error Amplifier

Transconductance and Phase vs Frequency



UCx832 Current Sense Amplifier

Transconductance and Phase vs Frequency



UNITRODE CORPORATION
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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/ Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
5962-9326501M2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Call TI	
5962-9326501MCA	ACTIVE	CDIP	J	14	1	TBD	Call TI	Call TI	
5962-9326501V2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
5962-9326501VCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	
UC1832J	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	
UC1832J883B	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	
UC1832L883B	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	
UC2832DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC2832DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC2832DWTR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC2832DWTRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC2833DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC2833DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC2833DWTR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC2833DWTRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC2833J	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI	
UC2833N	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	
UC2833NG4	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	
UC3832DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC3832DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/ Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
UC3832DWTR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC3832DWTRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC3832N	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	
UC3832NG4	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	
UC3833DW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC3833DWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC3833DWTR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC3833DWTRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
UC3833J	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI	
UC3833N	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	
UC3833NG4	ACTIVE	PDIP	P	8	50	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

OTHER QUALIFIED VERSIONS OF UC1832, UC1832-SP, UC2832, UC3832, UC3833 :

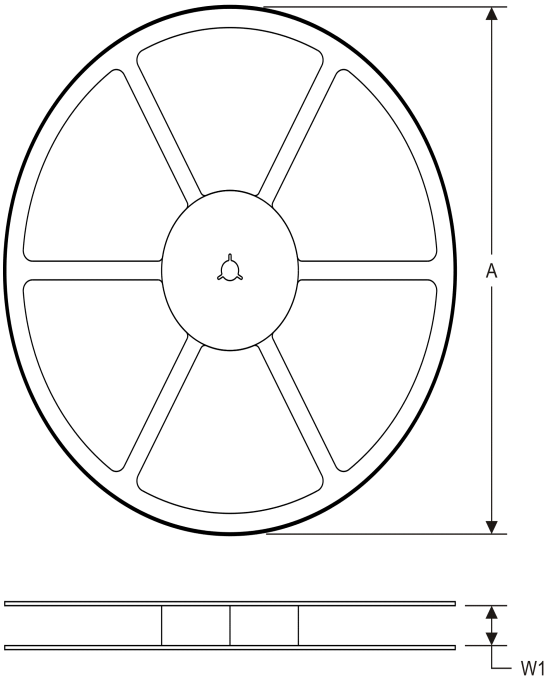
- Catalog: UC3832, UC1832
- Enhanced Product: UC2832-EP
- Military: UC1832, UC1833
- Space: UC1832-SP

NOTE: Qualified Version Definitions:

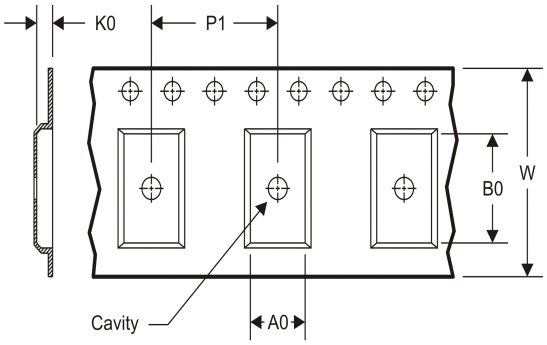
- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



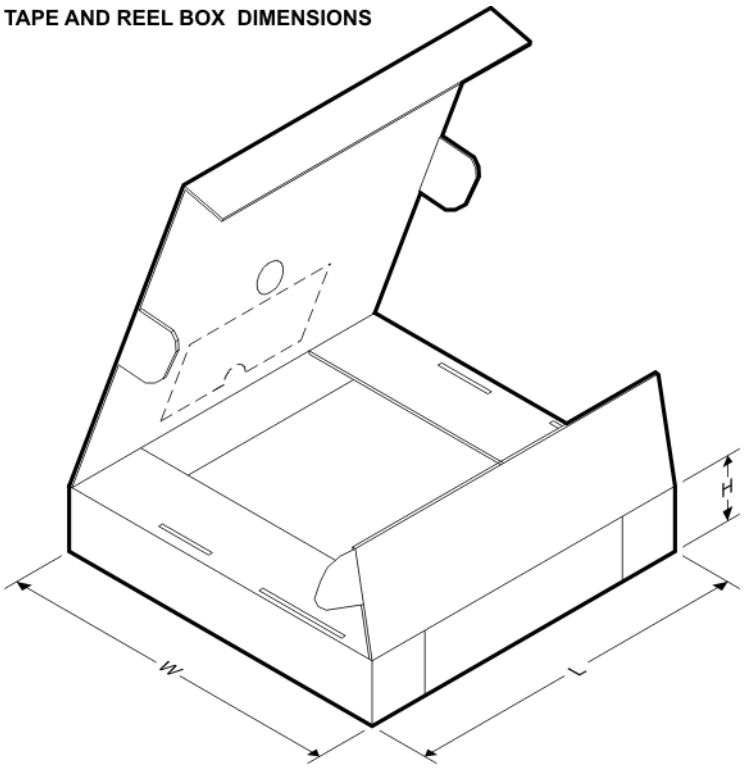
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
UC2832DWTR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
UC2833DWTR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
UC3832DWTR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
UC3833DWTR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

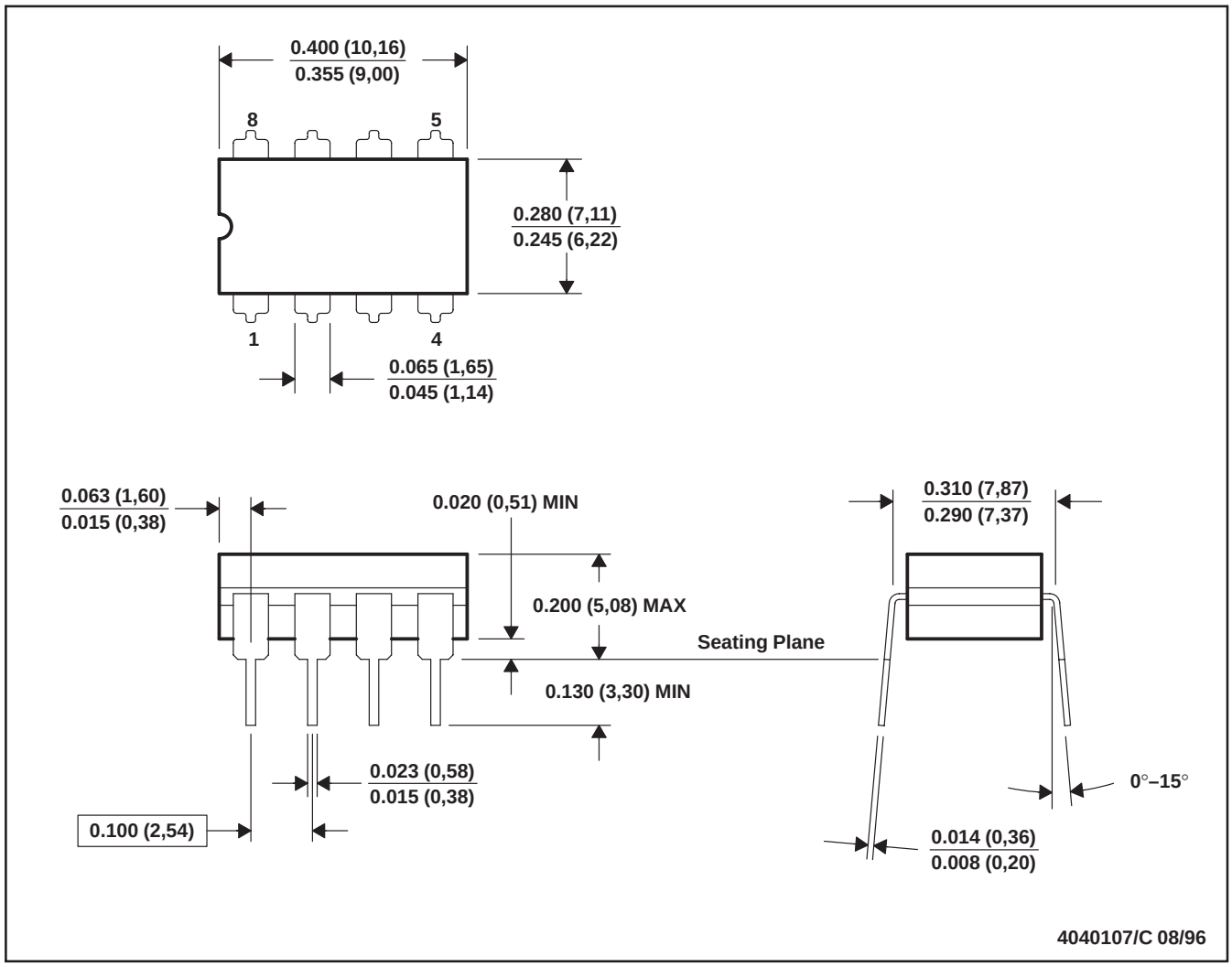


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
UC2832DWTR	SOIC	DW	16	2000	367.0	367.0	38.0
UC2833DWTR	SOIC	DW	16	2000	367.0	367.0	38.0
UC3832DWTR	SOIC	DW	16	2000	367.0	367.0	38.0
UC3833DWTR	SOIC	DW	16	2000	367.0	367.0	38.0

MCER001A – JANUARY 1995 – REVISED JANUARY 1997

JG (R-GDIP-T8) **CERAMIC DUAL-IN-LINE**

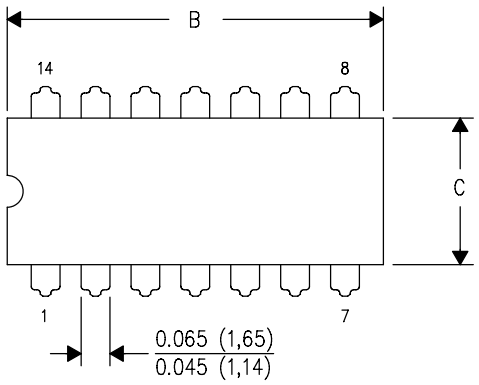


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification.
E. Falls within MIL STD 1835 GDIP1-T8

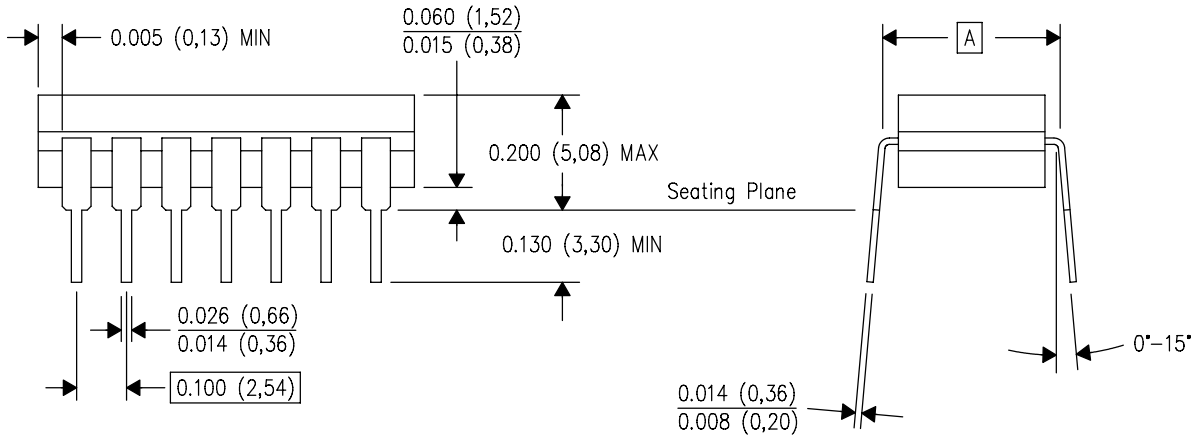
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

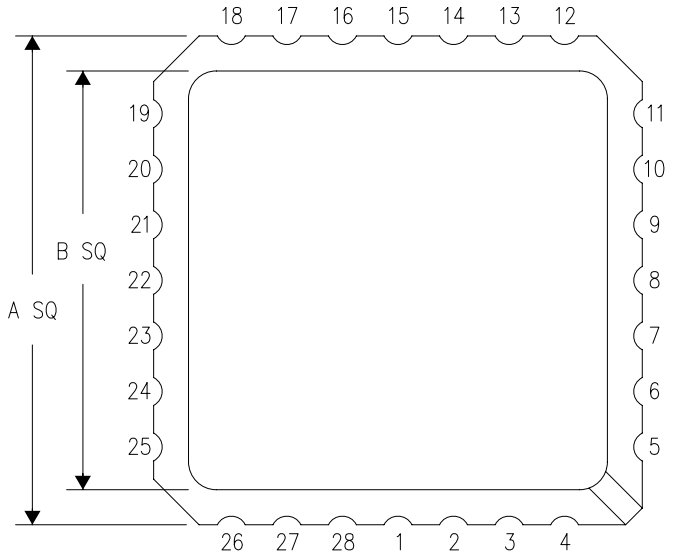


4040083/F 03/03

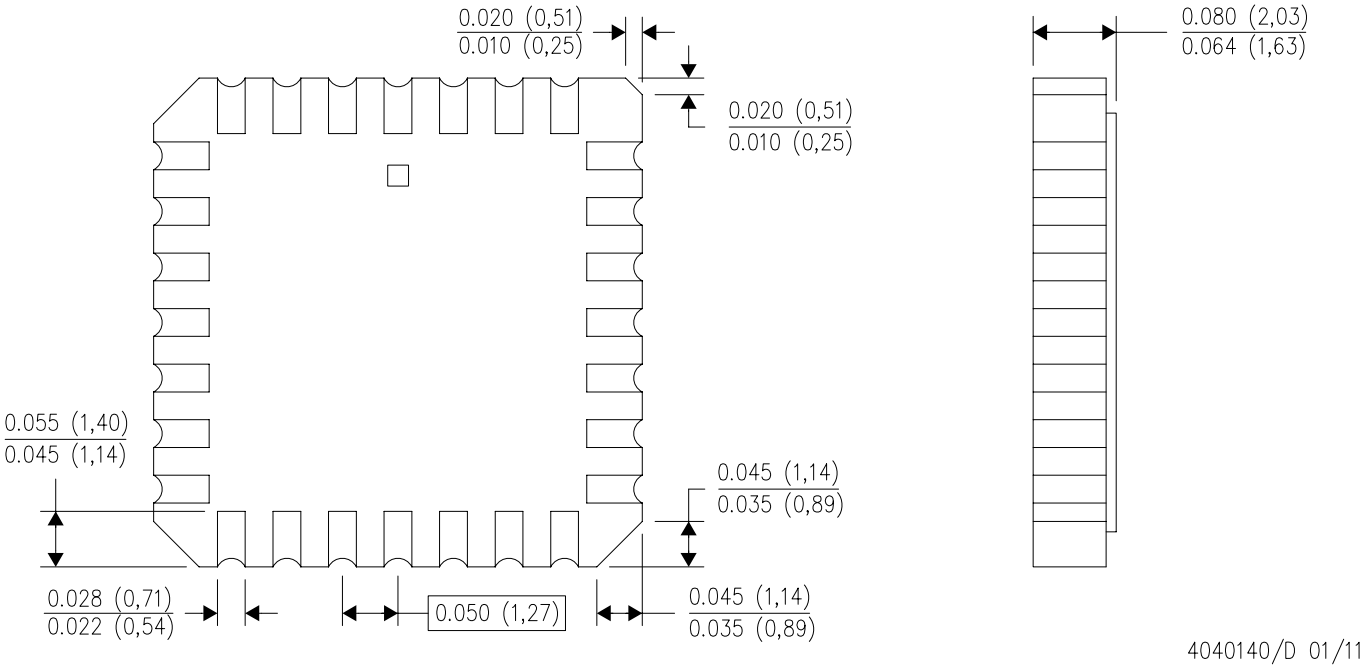
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1–T14, GDIP1–T16, GDIP1–T18 and GDIP1–T20.

FK (S–CQCC–N**) LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



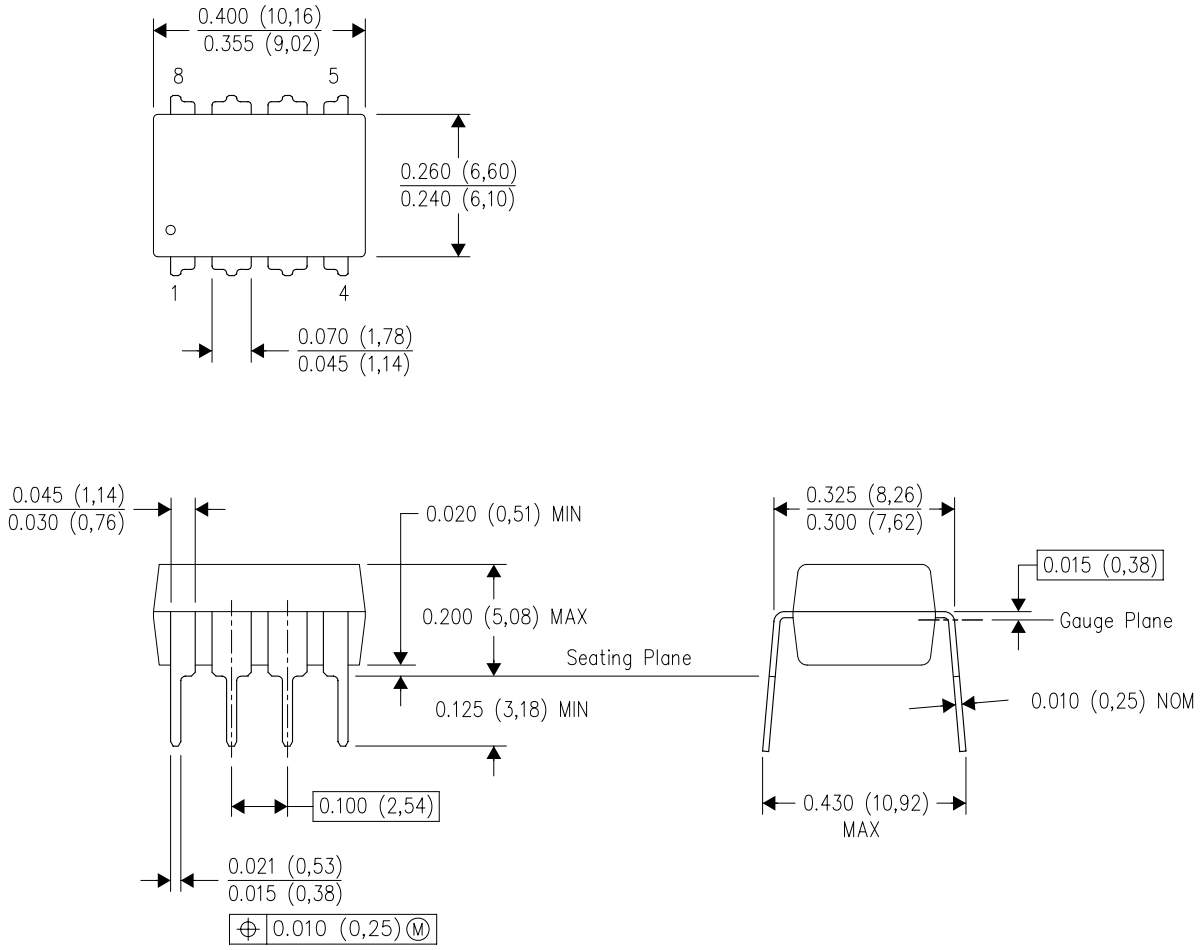
NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. Falls within JEDEC MS–004

P (R–PDIP–T8) PLASTIC DUAL–IN–LINE PACKAGE

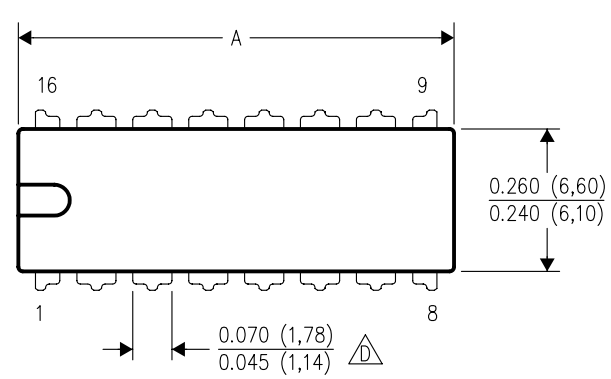


NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001 variation BA.

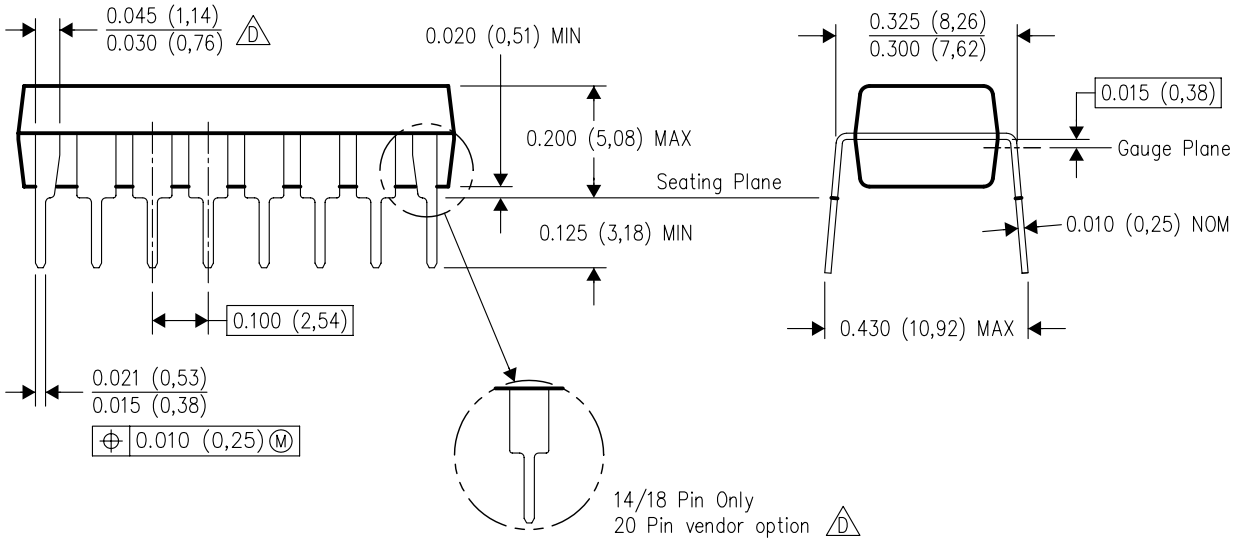
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



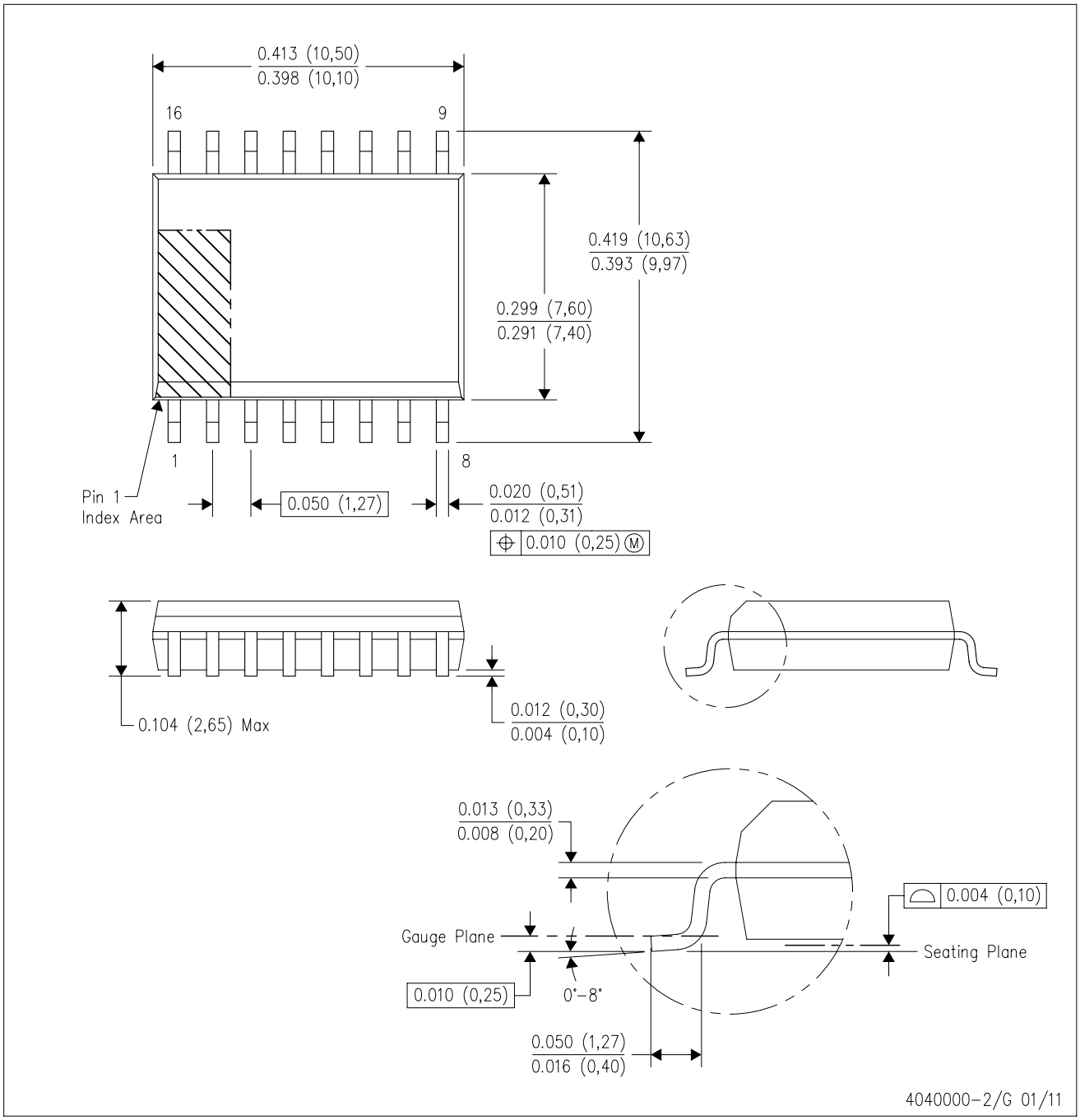
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

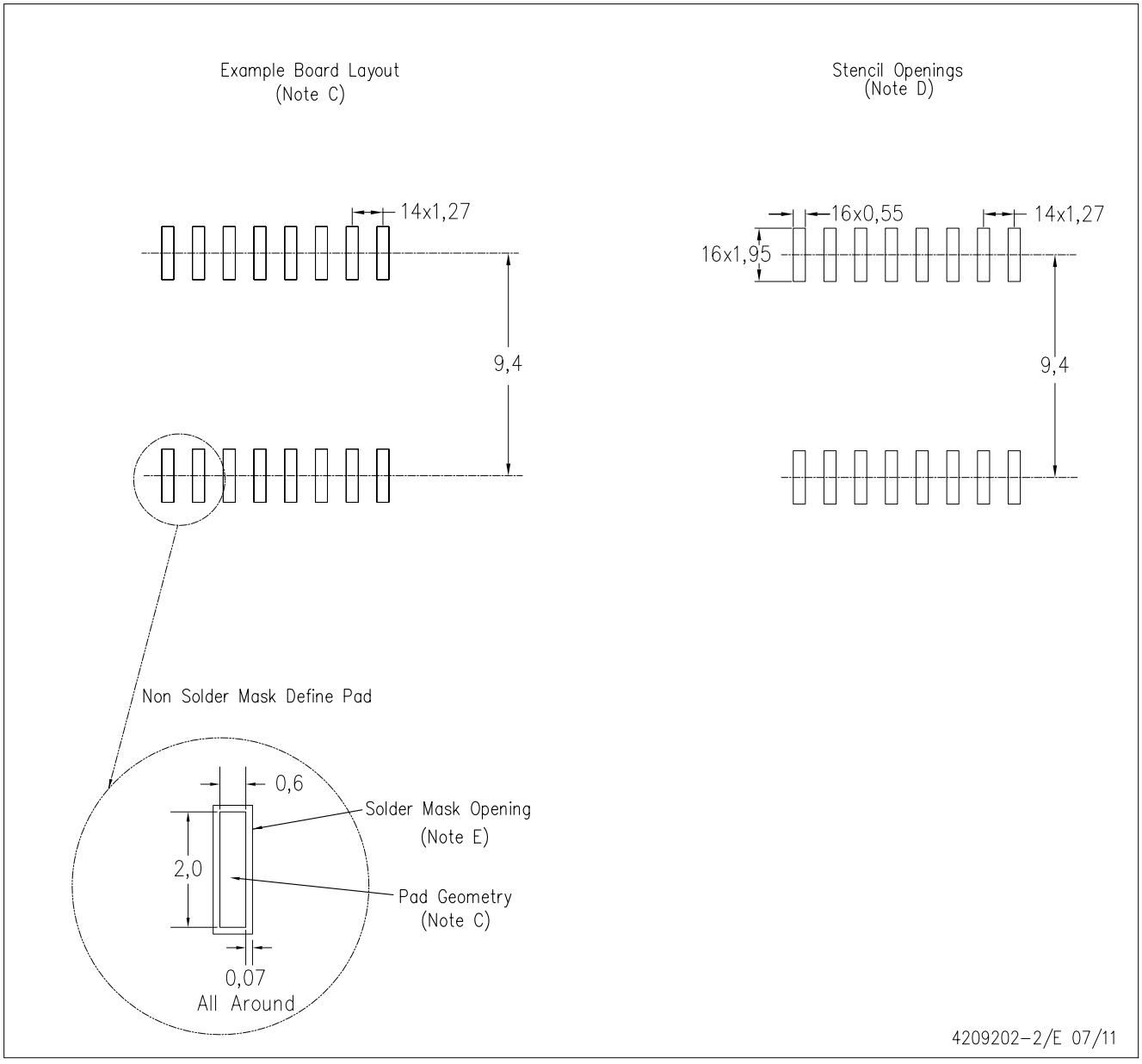
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

DW (R–PDSO–G16) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS–013 variation AA.

DW (R–PDSO–G16) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Refer to IPC7351 for alternate board design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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