

UC3844B, UC3845B, UC2844B, UC2845B

High Performance Current Mode Controllers

The UC3844B, UC3845B series are high performance fixed frequency current mode controllers. They are specifically designed for Off-Line and dc-dc converter applications offering the designer a cost-effective solution with minimal external components. These integrated circuits feature an oscillator, a temperature compensated reference, high gain error amplifier, current sensing comparator, and a high current totem pole output ideally suited for driving a power MOSFET.

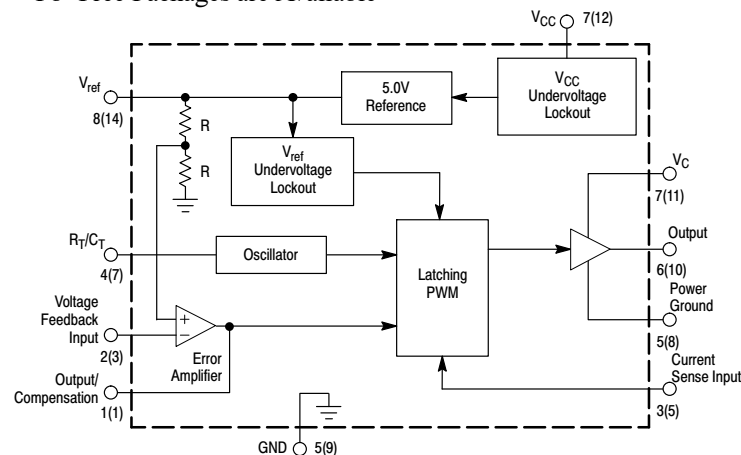
Also included are protective features consisting of input and reference undervoltage lockouts each with hysteresis, cycle-by-cycle current limiting, a latch for single pulse metering, and a flip-flop which blanks the output off every other oscillator cycle, allowing output deadtimes to be programmed from 50% to 70%.

These devices are available in an 8-pin dual-in-line and surface mount (SOIC-8) plastic package as well as the 14-pin plastic surface mount (SOIC-14). The SOIC-14 package has separate power and ground pins for the totem pole output stage.

The UC3844B has UVLO thresholds of 16 V (on) and 10 V (off), ideally suited for off-line converters. The UC3845B is tailored for lower voltage applications having UVLO thresholds of 8.5 V (on) and 7.6 V (off).

Features

- Trimmed Oscillator for Precise Frequency Control
- Oscillator Frequency Guaranteed at 250 kHz
- Current Mode Operation to 500 kHz Output Switching Frequency
- Output Deadtime Adjustable from 50% to 70%
- Automatic Feed Forward Compensation
- Latching PWM for Cycle-By-Cycle Current Limiting
- Internally Trimmed Reference with Undervoltage Lockout
- High Current Totem Pole Output
- Undervoltage Lockout with Hysteresis
- Low Startup and Operating Current
- Pb-Free Packages are Available

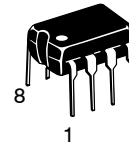


Pin numbers in parenthesis are for the D suffix SOIC-14 package.

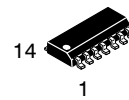
Figure 1. Simplified Block Diagram



ON Semiconductor®



**PDIP-8
N SUFFIX
CASE 626**

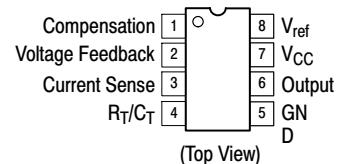


**SOIC-14
D SUFFIX
CASE 751A**

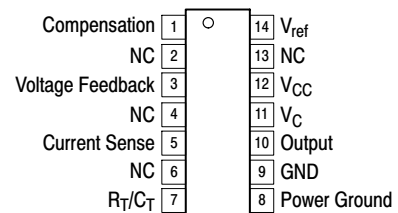


**SOIC-8
D1 SUFFIX
CASE 751**

PIN CONNECTIONS



(Top View)



(Top View)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 15 of this data sheet.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 16 of this data sheet.

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MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Bias and Driver Voltages (Zero Series Impedance, see also Total Device spec) (Note 1)	V_{CC}, V_C	36	V
Total Power Supply and Zener Current	$(I_{CC} + I_Z)$	30	mA
Output Current, Source or Sink (Note 2)	I_O	1.0	A
Output Energy (Capacitive Load per Cycle)	W	5.0	μ J
Current Sense and Voltage Feedback Inputs	V_{in}	- 0.3 to + 5.5	V
Error Amp Output Sink Current	I_O	10	mA
Power Dissipation and Thermal Characteristics D Suffix, Plastic Package, SOIC-14 Case 751A Maximum Power Dissipation @ $T_A = 25^\circ\text{C}$ Thermal Resistance, Junction-to-Air	P_D $R_{\theta JA}$	862 145	mW $^\circ\text{C/W}$
D1 Suffix, Plastic Package, SOIC-8 Case 751 Maximum Power Dissipation @ $T_A = 25^\circ\text{C}$ Thermal Resistance, Junction-to-Air	P_D $R_{\theta JA}$	702 178	mW $^\circ\text{C/W}$
N Suffix, Plastic Package, Case 626 Maximum Power Dissipation @ $T_A = 25^\circ\text{C}$ Thermal Resistance, Junction-to-Air	P_D $R_{\theta JA}$	1.25 100	W $^\circ\text{C/W}$
Operating Junction Temperature	T_J	+150	$^\circ\text{C}$
Operating Ambient Temperature	T_A	UC3844B, UC3845B UC2844B, UC2845B 0 to + 70 - 25 to + 85	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	- 65 to +150	$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

- The voltage is clamped by a zener diode (see page 9 Under Voltage Lockout section). Therefore this voltage may be exceeded as long as the total power supply and zener current is not exceeded.
- Maximum package power dissipation limits must be observed.
- This device series contains ESD protection and exceeds the following tests:
Human Body Model 4000 V per JEDEC Standard JESD22-A114B
Machine Model Method 200 V per JEDEC Standard JESD22-A115-A
- This device contains latch-up protection and exceeds 100 mA per JEDEC Standard JESD78

ELECTRICAL CHARACTERISTICS ($V_{CC} = 15\text{ V}$ [Note 5], $R_T = 10\text{ k}\Omega$, $C_T = 3.3\text{ nF}$. For typical values $T_A = 25^\circ\text{C}$, for min/max values T_A is the operating ambient temperature range that applies [Note 6], unless otherwise noted.)

Characteristic	Symbol	UC284XB			UC384XB, XBV			Unit
		Min	Typ	Max	Min	Typ	Max	

REFERENCE SECTION

Reference Output Voltage ($I_O = 1.0\text{ mA}$, $T_J = 25^\circ\text{C}$)	V_{ref}	4.95	5.0	5.05	4.9	5.0	5.1	V
Line Regulation ($V_{CC} = 12\text{ V to } 25\text{ V}$)	Reg_{line}	-	2.0	20	-	2.0	20	mV
Load Regulation ($I_O = 1.0\text{ mA to } 20\text{ mA}$)	Reg_{load}	-	3.0	25	-	3.0	25	mV
Temperature Stability	T_S	-	0.2	-	-	0.2	-	mV/ $^\circ\text{C}$
Total Output Variation over Line, Load, and Temperature	V_{ref}	4.9	-	5.1	4.82	-	5.18	V
Output Noise Voltage ($f = 10\text{ Hz to } 10\text{ kHz}$, $T_J = 25^\circ\text{C}$)	V_n	-	50	-	-	50	-	μ V
Long Term Stability ($T_A = 125^\circ\text{C}$ for 1000 Hours)	S	-	5.0	-	-	5.0	-	mV
Output Short Circuit Current	I_{SC}	- 30	- 85	-180	- 30	- 85	-180	mA

OSCILLATOR SECTION

Frequency $T_J = 25^\circ\text{C}$ $T_A = T_{low}\text{ to } T_{high}$ $T_J = 25^\circ\text{C}$ ($R_T = 6.2\text{ k}\Omega$, $C_T = 1.0\text{ nF}$)	f_{osc}	49 48 225	52 - 250	55 56 275	49 48 225	52 - 250	55 56 275	kHz
Frequency Change with Voltage ($V_{CC} = 12\text{ V to } 25\text{ V}$)	$\Delta f_{osc}/\Delta V$	-	0.2	1.0	-	0.2	1.0	%
Frequency Change with Temperature ($T_A = T_{low}\text{ to } T_{high}$)	$\Delta f_{osc}/\Delta T$	-	1.0	-	-	0.5	-	%
Oscillator Voltage Swing (Peak-to-Peak)	V_{osc}	-	1.6	-	-	1.6	-	V

- Adjust V_{CC} above the Startup threshold before setting to 15 V.
- Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.
 $T_{low} = 0^\circ\text{C}$ for UC3844B, UC3845B
 $T_{low} = -25^\circ\text{C}$ for UC2844B, UC2845B
 $T_{low} = -40^\circ\text{C}$ for UC3844BV, UC3845BV
 $T_{high} = +70^\circ\text{C}$ for UC3844B, UC3845B
 $T_{high} = +85^\circ\text{C}$ for UC2844B, UC2845B
 $T_{high} = +105^\circ\text{C}$ for UC3844BV, UC3845BV

UC3844B, UC3845B, UC2844B, UC2845B

ELECTRICAL CHARACTERISTICS ($V_{CC} = 15\text{ V}$ [Note 7], $R_T = 10\text{ k}$, $C_T = 3.3\text{ nF}$. For typical values $T_A = 25^\circ\text{C}$, for min/max values T_A is the operating ambient temperature range that applies [Note 8], unless otherwise noted.)

Characteristic	Symbol	UC284XB			UC384XB, XBV			Unit
		Min	Typ	Max	Min	Typ	Max	
OSCILLATOR SECTION								
Discharge Current ($V_{OSC} = 2.0\text{ V}$) $T_J = 25^\circ\text{C}$ $T_A = T_{low}$ to T_{high} (UC284XB, UC384XB) (UC384XBV)	I_{dischg}	7.8	8.3	8.8	7.8	8.3	8.8	mA
		7.5	–	8.8	7.6	–	8.8	
		–	–	–	7.2	–	8.8	

ERROR AMPLIFIER SECTION

Voltage Feedback Input ($V_O = 2.5\text{ V}$)	V_{FB}	2.45	2.5	2.55	2.42	2.5	2.58	V
Input Bias Current ($V_{FB} = 5.0\text{ V}$)	I_{IB}	–	–0.1	–1.0	–	–0.1	–2.0	μA
Open Loop Voltage Gain ($V_O = 2.0\text{ V}$ to 4.0 V)	A_{VOL}	65	90	–	65	90	–	dB
Unity Gain Bandwidth ($T_J = 25^\circ\text{C}$)	BW	0.7	1.0	–	0.7	1.0	–	MHz
Power Supply Rejection Ratio ($V_{CC} = 12\text{ V}$ to 25 V)	PSRR	60	70	–	60	70	–	dB
Output Current – Sink ($V_O = 1.1\text{ V}$, $V_{FB} = 2.7\text{ V}$) Source ($V_O = 5.0\text{ V}$, $V_{FB} = 2.3\text{ V}$)	I_{Sink}	2.0	12	–	2.0	12	–	mA
	I_{Source}	–0.5	–1.0	–	–0.5	–1.0	–	
Output Voltage Swing High State ($R_L = 15\text{ k}$ to ground, $V_{FB} = 2.3\text{ V}$) Low State ($R_L = 15\text{ k}$ to V_{ref} , $V_{FB} = 2.7\text{ V}$) (UC284XB, UC384XB) (UC384XBV)	V_{OH}	5.0	6.2	–	5.0	6.2	–	V
	V_{OL}	–	0.8	1.1	–	0.8	1.1	
		–	–	–	–	0.8	1.2	

CURRENT SENSE SECTION

Current Sense Input Voltage Gain (Notes 9 & 10) (UC284XB, UC384XB) (UC384XBV)	A_V	2.85	3.0	3.15	2.85	3.0	3.15	V/V
		–	–	–	2.85	3.0	3.25	
Maximum Current Sense Input Threshold (Note 9) (UC284XB, UC384XB) (UC384XBV)	V_{th}	0.9	1.0	1.1	0.9	1.0	1.1	V
		–	–	–	0.85	1.0	1.1	
Power Supply Rejection Ratio ($V_{CC} = 12\text{ V}$ to 25 V) (Note 9)	PSRR	–	70	–	–	70	–	dB
Input Bias Current	I_{IB}	–	–2.0	–10	–	–2.0	–10	μA
Propagation Delay (Current Sense Input to Output)	$t_{PLH(In/Out)}$	–	150	300	–	150	300	ns

OUTPUT SECTION

Output Voltage Low State ($I_{Sink} = 20\text{ mA}$) ($I_{Sink} = 200\text{ mA}$, UC284XB, UC384XB) ($I_{Sink} = 200\text{ mA}$, UC384XBV)	V_{OL}	–	0.1	0.4	–	0.1	0.4	V
		–	1.6	2.2	–	1.6	2.2	
		–	–	–	–	1.6	2.3	
High State ($I_{Source} = 20\text{ mA}$, UC284XB, UC384XB) ($I_{Source} = 20\text{ mA}$, UC384XBV) ($I_{Source} = 200\text{ mA}$)	V_{OH}	13	13.5	–	13	13.5	–	
		–	–	–	12.9	–	–	
		12	13.4	–	12	13.4	–	
Output Voltage with UVLO Activated ($V_{CC} = 6.0\text{ V}$, $I_{Sink} = 1.0\text{ mA}$)	$V_{OL(UVLO)}$	–	0.1	1.1	–	0.1	1.1	V
Output Voltage Rise Time ($C_L = 1.0\text{ nF}$, $T_J = 25^\circ\text{C}$)	t_r	–	50	150	–	50	150	ns
Output Voltage Fall Time ($C_L = 1.0\text{ nF}$, $T_J = 25^\circ\text{C}$)	t_f	–	50	150	–	50	150	ns

UNDERVOLTAGE LOCKOUT SECTION

Startup Threshold UCX844B, BV UCX845B, BV	V_{th}	15	16	17	14.5	16	17.5	V
		7.8	8.4	9.0	7.8	8.4	9.0	
Minimum Operating Voltage After Turn-On UCX844B, BV UCX845B, BV	$V_{CC(min)}$	9.0	10	11	8.5	10	11.5	V
		7.0	7.6	8.2	7.0	7.6	8.2	

7. Adjust V_{CC} above the Startup threshold before setting to 15 V .

8. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

$T_{low} = 0^\circ\text{C}$ for UC3844B, UC3845B $T_{high} = +70^\circ\text{C}$ for UC3844B, UC3845B
 = -25°C for UC2844B, UC2845B = $+85^\circ\text{C}$ for UC2844B, UC2845B
 = -40°C for UC3844BV, UC3845BV = $+105^\circ\text{C}$ for UC3844BV, UC3845BV

9. This parameter is measured at the latch trip point with $V_{FB} = 0\text{ V}$.

10. Comparator gain is defined as: $A_V = \frac{\Delta V_{Output/Compensation}}{\Delta V_{Current\ Sense\ Input}}$

UC3844B, UC3845B, UC2844B, UC2845B

ELECTRICAL CHARACTERISTICS ($V_{CC} = 15\text{ V}$ [Note 11], $R_T = 10\text{ k}$, $C_T = 3.3\text{ nF}$. For typical values $T_A = 25^\circ\text{C}$, for min/max values T_A is the operating ambient temperature range that applies [Note 12], unless otherwise noted.)

Characteristic	Symbol	UC284XB			UC384XB, XBV			Unit
		Min	Typ	Max	Min	Typ	Max	
PWM SECTION								
Duty Cycle								
Maximum (UC284XB, UC384XB)	$DC_{(max)}$	47	48	50	47	48	50	%
Minimum (UC384XBV)	$DC_{(min)}$	–	–	0	46	48	50	
TOTAL DEVICE								
Power Supply Current	I_{CC}							mA
Startup ($V_{CC} = 6.5\text{ V}$ for UCX845B, 14 V for UCX844B, BV)		–	0.3	0.5	–	0.3	0.5	
Operating (Note 11)		–	12	17	–	12	17	
Power Supply Zener Voltage ($I_{CC} = 25\text{ mA}$)	V_Z	30	36	–	30	36	–	V

11. Adjust V_{CC} above the Startup threshold before setting to 15 V.
 12. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.
- | | |
|--|---|
| $T_{low} = 0^\circ\text{C}$ for UC3844B, UC3845B | $T_{high} = +70^\circ\text{C}$ for UC3844B, UC3845B |
| = -25°C for UC2844B, UC2845B | = $+85^\circ\text{C}$ for UC2844B, UC2845B |
| = -40°C for UC3844BV, UC3845BV | = $+105^\circ\text{C}$ for UC3844BV, UC3845BV |

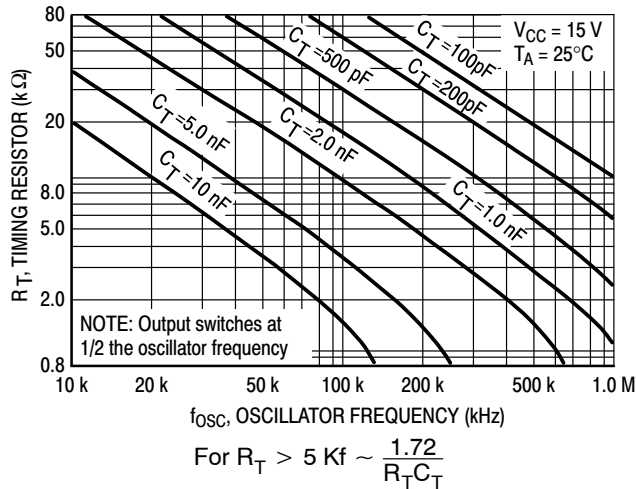


Figure 2. Timing Resistor versus Oscillator Frequency

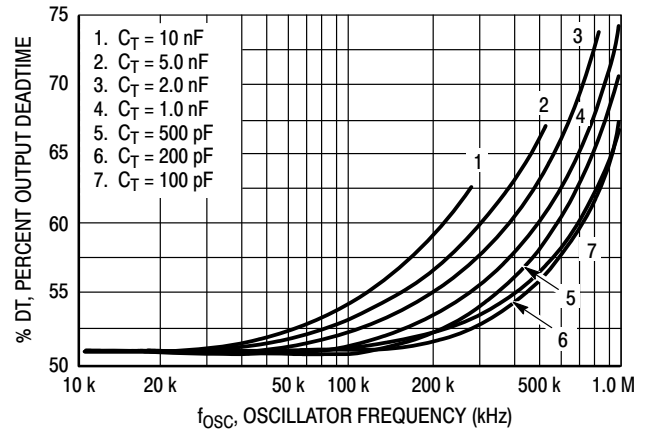


Figure 3. Output Deadtime versus Oscillator Frequency

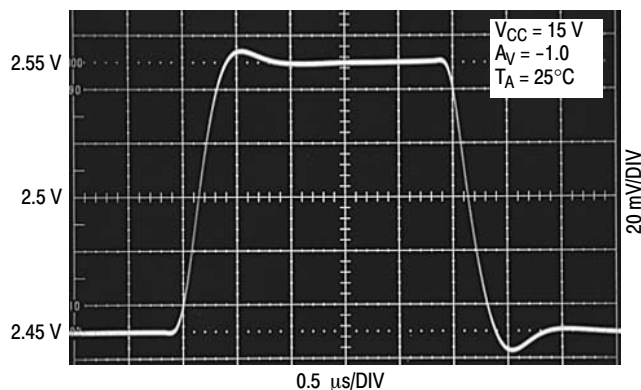


Figure 4. Error Amp Small Signal Transient Response

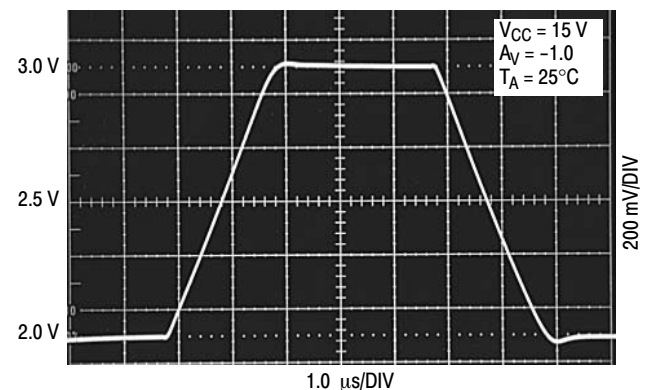


Figure 5. Error Amp Large Signal Transient Response

UC3844B, UC3845B, UC2844B, UC2845B

ORDERING INFORMATION

Device	Operating Temperature Range	Package	Shipping†
UC384xBD	$T_A = 0^\circ \text{ to } +70^\circ\text{C}$	SOIC-14	55 Units/Rail
UC384xBDG		SOIC-14 (Pb-Free)	55 Units/Rail
UC384xBDR2		SOIC-14	2500 Tape & Reel
UC384xBDR2G		SOIC-14 (Pb-Free)	2500 Tape & Reel
UC384xBD1		SOIC-8	98 Units/Rail
UC384xBD1G		SOIC-8 (Pb-Free)	98 Units/Rail
UC384xBD1R2		SOIC-8	2500 Tape & Reel
UC384xBD1R2G		SOIC-8 (Pb-Free)	2500 Tape & Reel
UC384xBN		PDIP-8	50 Units/Rail
UC384xBNG		PDIP-8 (Pb-Free)	50 Units/Rail
UC284xBD		$T_A = -25^\circ \text{ to } +85^\circ\text{C}$	SOIC-14
UC284xBDG	SOIC-14 (Pb-Free)		55 Units/Rail
UC284xBDR2	SOIC-14		2500 Tape & Reel
UC284xBDR2G	SOIC-14 (Pb-Free)		2500 Tape & Reel
UC284xBD1	SOIC-8		98 Units/Rail
UC284xBD1G	SOIC-8 (Pb-Free)		98 Units/Rail
UC284xBD1R2	SOIC-8		2500 Tape & Reel
UC284xBD1R2G	SOIC-8 (Pb-Free)		2500 Tape & Reel
UC284xBN	PDIP-8		50 Units/Rail
UC284xBNG	PDIP-8 (Pb-Free)		50 Units/Rail
UC384xBVD	$T_A = -40^\circ \text{ to } +105^\circ\text{C}$		SOIC-14
UC384xBVDG		SOIC-14 (Pb-Free)	55 Units/Rail
UC384xBVDR2		SOIC-14	2500 Tape & Reel
UC384xBVDR2G		SOIC-14 (Pb-Free)	2500 Tape & Reel
UC384xBVD1		SOIC-8	98 Units/Rail
UC384xBVD1G		SOIC-8 (Pb-Free)	98 Units/Rail
UC384xBVD1R2		SOIC-8	2500 Tape & Reel
UC384xBVD1R2G		SOIC-8 (Pb-Free)	2500 Tape & Reel
UC384xBVN		PDIP-8	50 Units/Rail
UC384xBVNG		PDIP-8 (Pb-Free)	50 Units/Rail

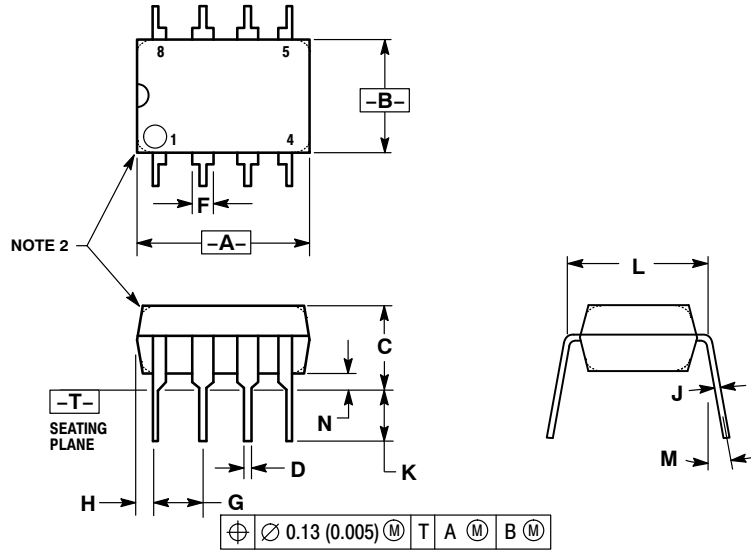
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

x indicates either a 4 or 5 to define specific device part numbers.

UC3844B, UC3845B, UC2844B, UC2845B

PACKAGE DIMENSIONS

PDIP-8
N SUFFIX
CASE 626-05
ISSUE L



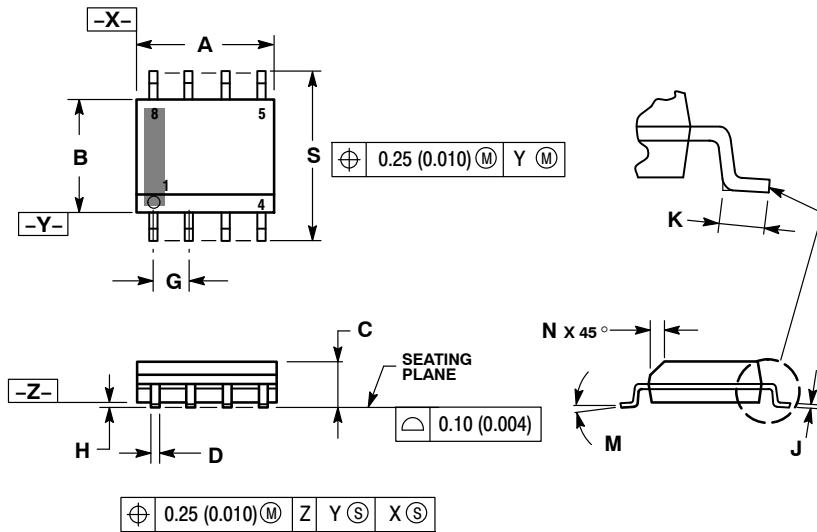
- NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
 2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
 3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	---	10°	---	10°
N	0.76	1.01	0.030	0.040

UC3844B, UC3845B, UC2844B, UC2845B

PACKAGE DIMENSIONS

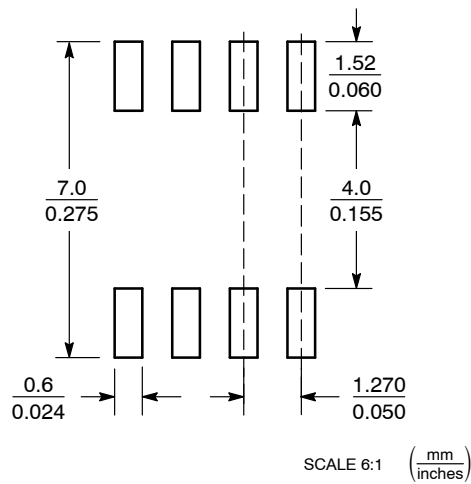
SOIC-8 NB
CASE 751-07
ISSUE AH



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: MILLIMETER.
 3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
 4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
 5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
 6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.