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.

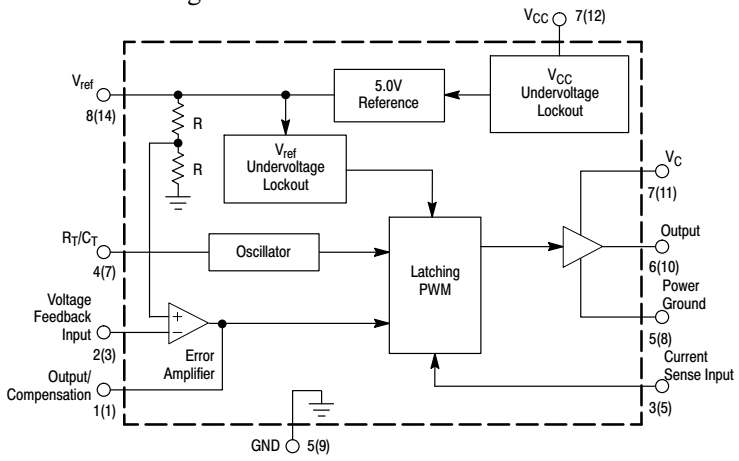
Also included are protective features consisting of input and reference undervoltage lockouts each with hysteresis, cycle–by–cycle current limiting, a latch for single pulse metering, and a flip–flop which blanks the output off every other oscillator cycle, allowing output deadtimes to be programmed 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 UCX844B has UVLO thresholds of 16 V (on) and 10 V (off), ideally suited for off–line converters. The UCX845B is tailored for lower voltage applications having UVLO thresholds of 8.5 V (on) and 7.6 V (off).

Features

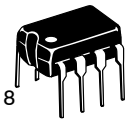
- Trimmed Oscillator for Precise Frequency Control
- Oscillator Frequency Guaranteed at 250 kHz
- Current Mode Operation to 500 kHz Output Switching Frequency
- Output Deadtime Adjustable from 50% to 70%
- Automatic Feed Forward Compensation
- Latching PWM for Cycle–By–Cycle Current Limiting
- Internally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



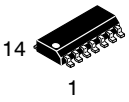
Pin numbers in parenthesis are for the D suffix SOIC–14 package.

Figure 1. Simplified Block Diagram

ON Semiconductor®



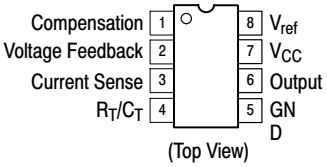
PDIP–8
N SUFFIX
CASE 626



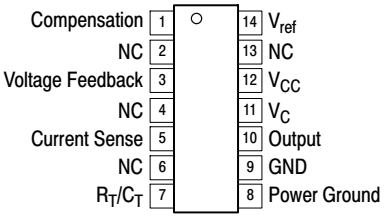
SOIC–14
D SUFFIX
CASE 751A

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.

Publication Order Number:
UC3844B/D

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	μJ
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°C		P_D	862	mW
Thermal Resistance, Junction–to–Air		$R_{\theta JA}$	145	°C/W
D1 Suffix, Plastic Package, SOIC–8 Case 751				
Maximum Power Dissipation @ T_A = 25°C		P_D	702	mW
Thermal Resistance, Junction–to–Air		$R_{\theta JA}$	178	°C/W
N Suffix, Plastic Package, Case 626				
Maximum Power Dissipation @ T_A = 25°C		P_D	1.25	W
Thermal Resistance, Junction–to–Air		$R_{\theta JA}$	100	°C/W
Operating Junction Temperature		T_J	+150	°C
Operating Ambient Temperature	UC3844B, UC3845B UC2844B, UC2845B	T_A	0 to + 70 – 25 to + 85	°C
Storage Temperature Range		T_{stg}	– 65 to +150	°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.

1. 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.
2. Maximum package power dissipation limits must be observed.
3. 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
4. This device contains latch-up protection and exceeds 100 mA per JEDEC Standard JESD78

ELECTRICAL CHARACTERISTICS

(V_{CC} = 15 V [Note 5], R_T = 10 k, C_T = 3.3 nF. For typical values T_A = 25°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 mA, T_J = 25°C)	V_{ref}	4.95	5.0	5.05	4.9	5.0	5.1	V
Line Regulation (V_{CC} = 12 V to 25 V)	Reg_{line}	–	2.0	20	–	2.0	20	mV
Load Regulation (I_O = 1.0 mA to 20 mA)	Reg_{load}	–	3.0	25	–	3.0	25	mV
Temperature Stability	T_S	–	0.2	–	–	0.2	–	mV/°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 Hz to 10 kHz, T_J = 25°C)	V_n	–	50	–	–	50	–	μV
Long Term Stability (T_A = 125°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	f_{OSC}							kHz
T_J = 25°C		49	52	55	49	52	55	
T_A = T_{low} to T_{high}		48	–	56	48	–	56	
T_J = 25°C (R_T = 6.2 k, C_T = 1.0 nF)		225	250	275	225	250	275	
Frequency Change with Voltage (V_{CC} = 12 V to 25 V)	$\Delta f_{OSC}/\Delta V$	–	0.2	1.0	–	0.2	1.0	%
Frequency Change with Temperature (T_A = T_{low} 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

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

ELECTRICAL CHARACTERISTICS (V_{CC} = 15 V [Note 7], R_T = 10 k, C_T = 3.3 nF. For typical values T_A = 25°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 V)	I_{dischg}							mA
T_J = 25°C		7.8	8.3	8.8	7.8	8.3	8.8	
T_A = T_{low} to T_{high} (UC284XB, UC384XB)		7.5	–	8.8	7.6	–	8.8	
(UC384XBV)		–	–	–	7.2	–	8.8	
ERROR AMPLIFIER SECTION								
Voltage Feedback Input (V_O = 2.5 V)	V_{FB}	2.45	2.5	2.55	2.42	2.5	2.58	V
Input Bias Current (V_{FB} = 5.0 V)	I_{IB}	–	– 0.1	–1.0	–	– 0.1	– 2.0	μA
Open Loop Voltage Gain (V_O = 2.0 V to 4.0 V)	A_{VOL}	65	90	–	65	90	–	dB
Unity Gain Bandwidth (T_J = 25°C)	BW	0.7	1.0	–	0.7	1.0	–	MHz
Power Supply Rejection Ratio (V_{CC} = 12 V to 25 V)	PSRR	60	70	–	60	70	–	dB
Output Current – Sink (V_O = 1.1 V, V_{FB} = 2.7 V)	I_{Sink}	2.0	12	–	2.0	12	–	mA
Source (V_O = 5.0 V, V_{FB} = 2.3 V)	I_{Source}	– 0.5	–1.0	–	– 0.5	–1.0	–	
Output Voltage Swing								V
High State (R_L = 15 k to ground, V_{FB} = 2.3 V)	V_{OH}	5.0	6.2	–	5.0	6.2	–	
Low State (R_L = 15 k to V_{ref}, V_{FB} = 2.7 V)	V_{OL}							
(UC284XB, UC384XB)		–	0.8	1.1	–	0.8	1.1	
(UC384XBV)		–	–	–	–	0.8	1.2	
CURRENT SENSE SECTION								
Current Sense Input Voltage Gain (Notes 9 & 10)	A_V							V/V
(UC284XB, UC384XB)		2.85	3.0	3.15	2.85	3.0	3.15	
(UC384XBV)		–	–	–	2.85	3.0	3.25	
Maximum Current Sense Input Threshold (Note 9)	V_{th}							V
(UC284XB, UC384XB)		0.9	1.0	1.1	0.9	1.0	1.1	
(UC384XBV)		–	–	–	0.85	1.0	1.1	
Power Supply Rejection Ratio (V_{CC} = 12 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								V
Low State (I_{Sink} = 20 mA)	V_{OL}	–	0.1	0.4	–	0.1	0.4	
(I_{Sink} = 200 mA, UC284XB, UC384XB)		–	1.6	2.2	–	1.6	2.2	
(I_{Sink} = 200 mA, UC384XBV)		–	–	–	–	1.6	2.3	
High State (I_{Source} = 20 mA, UC284XB, UC384XB)	V_{OH}	13	13.5	–	13	13.5	–	
(I_{Source} = 20 mA, UC384XBV)		–	–	–	12.9	–	–	
(I_{Source} = 200 mA)		12	13.4	–	12	13.4	–	
Output Voltage with UVLO Activated (V_{CC} = 6.0 V, I_{Sink} = 1.0 mA)	$V_{OL(UVLO)}$	–	0.1	1.1	–	0.1	1.1	V
Output Voltage Rise Time (C_L = 1.0 nF, T_J = 25°C)	t_r	–	50	150	–	50	150	ns
Output Voltage Fall Time (C_L = 1.0 nF, T_J = 25°C)	t_f	–	50	150	–	50	150	ns
UNDERVOLTAGE LOCKOUT SECTION								
Startup Threshold	V_{th}							V
UCX844B, BV		15	16	17	14.5	16	17.5	
UCX845B, BV		7.8	8.4	9.0	7.8	8.4	9.0	
Minimum Operating Voltage After Turn–On	$V_{CC(min)}$							V
UCX844B, BV		9.0	10	11	8.5	10	11.5	
UCX845B, BV		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°C for UC3844B, UC3845B; T_{high} = + 70°C for UC3844B, UC3845B
   = – 25°C for UC2844B, UC2845B; = + 85°C for UC2844B, UC2845B
   = – 40°C for UC3844BV, UC3845BV; = +105°C for UC3844BV, UC3845BV
9. This parameter is measured at the latch trip point with V_{FB} = 0 V.
10. Comparator gain is defined as: $A_V = \frac{\Delta V \text{ Output/Compensation}}{\Delta V \text{ Current Sense Input}}$

ELECTRICAL CHARACTERISTICS (V_{CC} = 15 V [Note 11], R_T = 10 k, C_T = 3.3 nF. For typical values T_A = 25°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	
(UC384XBV)		–	–	–	46	48	50	
Minimum	$DC_{(min)}$	–	–	0	–	–	0	
TOTAL DEVICE								
Power Supply Current	I_{CC}							mA
Startup (V_{CC} = 6.5 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 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°C for UC3844B, UC3845B; T_{high} = + 70°C for UC3844B, UC3845B
= – 25°C for UC2844B, UC2845B; = + 85°C for UC2844B, UC2845B
= – 40°C for UC3844BV, UC3845BV; = +105°C for UC3844BV, UC3845BV

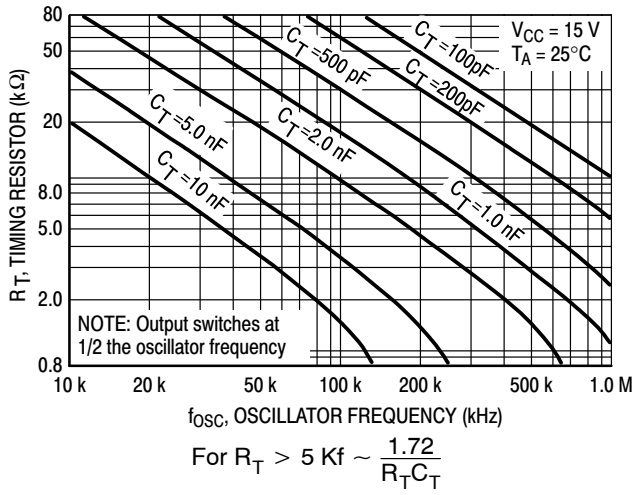


Figure 2. Timing Resistor versus Oscillator Frequency

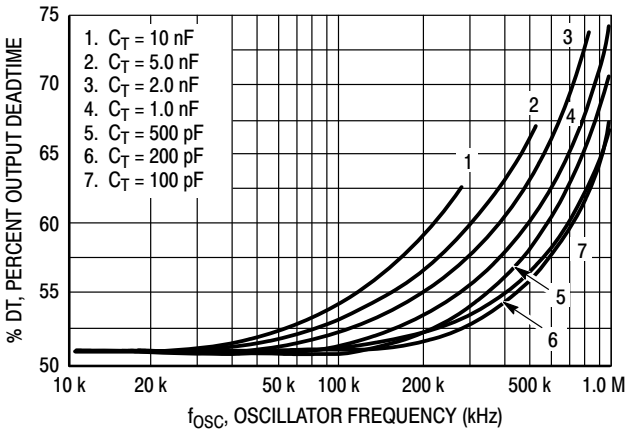


Figure 3. Output Deadtime versus Oscillator Frequency

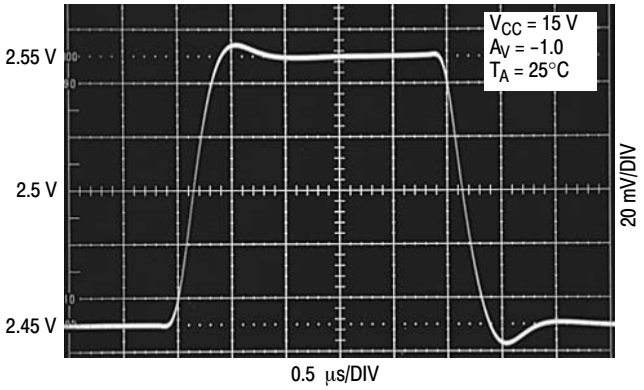


Figure 4. Error Amp Small Signal Transient Response

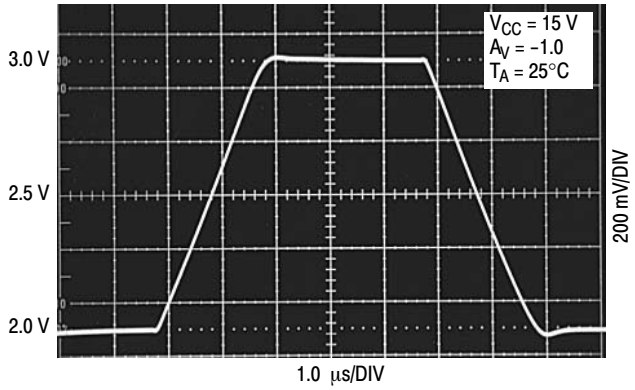


Figure 5. Error Amp Large Signal Transient Response

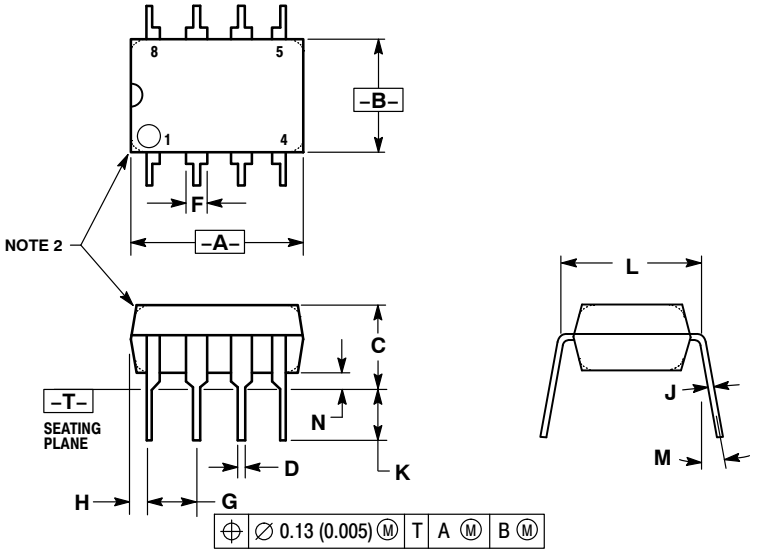
ORDERING INFORMATION

Device	Operating Temperature Range	Package	Shipping†
UC384xBD	T_A = 0° to +70°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° to +85°C	SOIC−14	55 Units/Rail
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° to +105°C	SOIC−14	55 Units/Rail
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.

PACKAGE DIMENSIONS

PDIP−8
N SUFFIX
CASE 626−05
ISSUE L

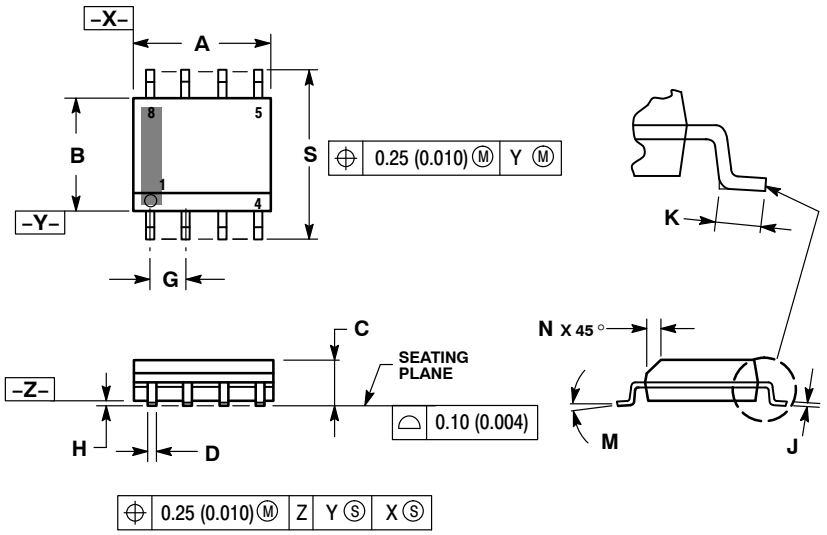


NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	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

PACKAGE DIMENSIONS

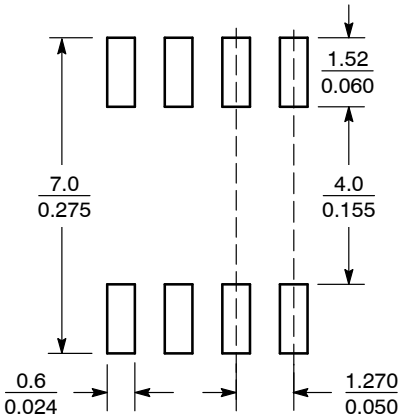
SOIC−8 NB
CASE 751−07
ISSUE AH



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.

	MILLIMETERS		INCHES	
DIM	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*



SCALE 6:1 (mm / inches)

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