DATA SHEET
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REV 1-03

MIK384x series

CURRENT MODE PWM CONTROLLER

REPLACEMENT
of **UC384x**

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GENERAL DESCRIPTION

The MIK3842A(AM)(BW)/43A(AM)(BW)/44A(AM)(BW)/45A(AM)(BW) are fixed frequency current mode PWM controller. They are specially designed for OFF-Line and DC to DC converter applications with a minimal external components. Internally implemented circuits include a trimmed oscillator for precise duty cycle control, a temperature compensated reference, high gain error amplifier, current sensing comparator, and a high current totempole output ideally suited for driving a power MOSFET. Protection circuitry includes built undervoltage lockout and current limiting.

The MIK3842A(AM)(BW) and MIK3844A(AM)(BW) have UVLO thresholds of 16V (ON) and 10V (OFF). The corresponding thresholds for the MIK3843A(AM)(BW)/45A(AM)(BW) are 8.4V (ON) and 7.6V (OFF). The MIK3842A(AM)(BW) and MIK3843A(AM)(BW) can operate within 100% duty cycle. The MIK3844A(AM)(BW) and MIK3845A(AM)(BW) can operate within 50% duty cycle.
The MIK384xA(AM)(BW) has Start-Up Current 0.17mA (typ).
The MIK384xA-BW are revised UC384xAM and differ by higher Unity Gain bandwidth of Error Amplifier.

FEATURES

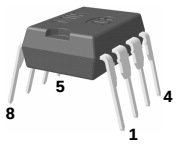
- Low Start-Up and Operating Current
- High Current Totem Pole Output
- Undervoltage Lockout With Hysteresis
- Operating Frequency Up To
  300kHz for 384xA
  500kHz for 384xAM, 384xBW

PIN CONNECTION AND DESCRIPTION

PIN		SYMBOL	DESCRIPTION
8-PIN	14-PIN		
1	1	**COMP**	This pin is the Error Amplifier output and is made for loop compensation.
2	3	**V_{FB}**	This is the inverting input of the Error Amplifier. It is normally connected to the switching power supply output through a resistor divider.
3	5	**V_{SENSE}**	A voltage proportional to inductor current is connected to this input. The PWM uses this information to terminate the output switch conduction.
4	7	**R_T/C_T**	The oscillator frequency and maximum output duty cycle are programmed by connecting resistor **R_T** to **V_{ref}** and capacitor **C_T** to ground.
5	—	**GND**	This pin is the combined control circuitry and power ground.
6	10	**OUT**	This output directly drives the gate of a power MOSFET. Peak currents up to 1A are sourced and sink by this pin.
7	12	**V_{CC}**	This pin is the positive supply of the integrated circuit.
8	14	**V_{REF}**	This is the reference output. It provides charging current for capacitor **C_T** through resistor **R_T** .
—	8	**P_GND**	This pin is a separate power ground return (14–pin package only) that is connected back to the power source. It is used to reduce the effects of switching transient noise on the control circuitry.
—	11	**P_V_C**	The output high state (**V_{OH}**) is set by the voltage applied to this pin (14–pin package only). With a separate power source connection, it can reduce the effects of switching transient noise on the control circuitry.
—	9	**GND**	This pin is the control circuitry ground return (14-pin package only) and is connected back to the power source ground.
—	**2, 4, 6, 13**	NC	No connection (14-pin package only). These pins are not internally connected.

MIK384x**N**, MIK384x-BW**N**

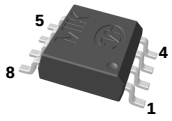
DIP-8



1 — COMP
2 — V_{FB}
3 — V_{SENSE}
4 — R_T/C_T
5 — GND
6 — OUT
7 — V_{CC}
8 — V_{REF}

MIK384x**D1**, MIK384x-BW**D1**

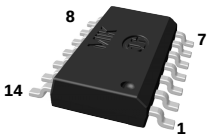
SOP-8



1 — COMP
2 — V_{FB}
3 — V_{SENSE}
4 — R_T/C_T
5 — GND
6 — OUT
7 — V_{CC}
8 — V_{REF}

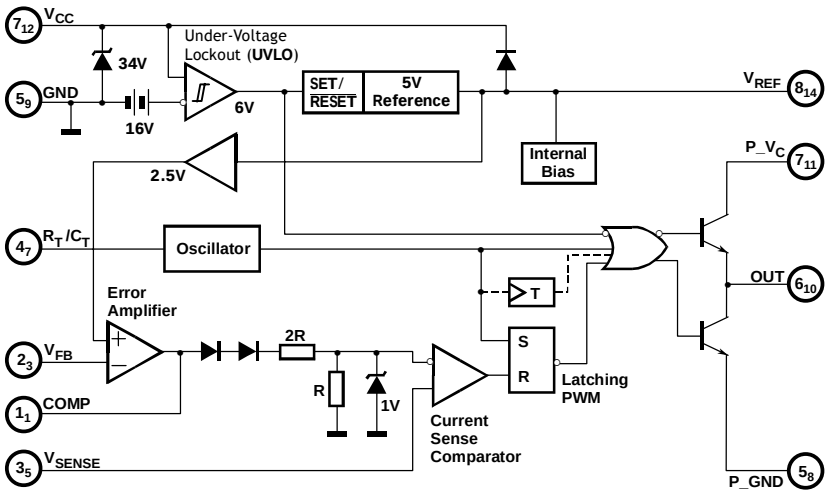
MIK384x**D**, MIK384x-BW**D**

SOP-14



1 — COMP
2 — NC
3 — V_{FB}
4 — NC
5 — V_{SENSE}
6 — NC
7 — R_T/C_T
8 — P_GND
9 — GND
10 — OUT
11 — V_{CC}
12 — V_{CC}
13 — NC
14 — V_{REF}

BLOCK DIAGRAM



NOTES: (A/B)

A = DIP-8 and SOP-8 Pin Number.

B = SOP-14 Pin Number.

Toggle flip flop used only in MIK3844 and MIK3845.

ABSOLUTE MAXIMUM RATINGS

SYMBOL	CHARACTERISTIC	VALUE	UNIT
V_{CC}	Supply Voltage (low impedance source)	30	V
I_O	Output Current	±1	A
V_I	Input Voltage (Analog Inputs pins 2,3)	–0.3 to 5.5	V
$I_{SINK\ (E.A)}$	Error Amp Output Sink Current	10	mA
P_O	Power Dissipation (T_A = 25°C)	1	W
Tstg	Storage Temperature Range	-65 to150	°C
T_L	Lead Temperature (soldering 5 sec.)	260	°C

ELECTRICAL CHARACTERISTICS

(* V_{CC}=15V, R_T = 10KΩ, C_T = 3.3nF, T_A = 0°C TO +70°C, unless otherwise specified)

SYMBOL	CHARACTERISTICS	TEST CONDITION	MIN	TYP	MAX	UNIT
	REFERENCE SECTION					
V_{REF}	Reference Output Voltage	T_J = 25°C, I_{REF} = 1 mA	4.9	5.0	5.1	V
ΔV_{REF}	Line Regulation	12V ≤ V_{CC} ≤ 25 V	—	6.0	20	mV
I_{REF}	Load Regulation	1 mA ≤ I_{REF} ≤ 20mA	—	6.0	25	mV
I_{SC}	Short Circuit Output Current	T_A = 25°C	—	-100	-180	mA
	OSCILLATOR SECTION					
f	Oscillation Frequency	T_J = 25°C (MIK384x-A)	47	50	57	kHz
		T_J = 25°C (MIK384x-AM, MIK384x-BW)	47	52	57	kHz
$\Delta f/\Delta V_{CC}$	Frequency Change with Voltage	12V ≤ V_{CC} ≤ 25 V	—	0.05	1.0	%
$V_{(OSC)}$	Oscillator Amplitude	(peak to peak)	—	1.6	—	V
	ERROR AMPLIFIER SECTION					
I_{BIAS}	Input Bias Current	V_{FB}=3V		-0.1	-2	µA
$V_{I(E.A)}$	Input Voltage	$V_{PIN\ 1}$ = 2.5V	2.42	2.5	2.58	V
A_{VOL}	Open Loop Voltage Gain	2V ≤ V_0 ≤ 4V	65	90	—	dB
UGBW	Unity Gain Bandwidth (only for MIK384xA-BW)	T_j=25°C, Note 3	0.5	0.6	—	MHz
PSRR	Power Supply Rejection Ratio	12V ≤ V_{CC} ≤ 25 V	60	70	—	dB
I_{SINK}	Output Sink Current	$V_{PIN\ 2}$ = 2.7V, $V_{PIN\ 1}$ = 1.1V	2	7	—	mA
I_{SOURCE}	Output Source Current	$V_{PIN\ 2}$ = 2.3V, $V_{PIN\ 1}$ = 5V	-0.5	-1.0	—	mA
V_{OH}	High Output Voltage	$V_{PIN\ 2}$ = 2.3V, R_L = 15kΩ to GND	5.0	6.0	—	V
V_{OL}	Low Output Voltage	$V_{PIN\ 2}$ = 2.7V, R_L = 15kΩ to Pin8	—	0.8	1.1	V
	CURRENT SENSE SECTION					
G_V	Gain	(Notes 1, 2)	2.85	3.0	3.15	V/V
$V_{I(MAX)}$	Maximum Input Signal	$V_{PIN\ 1}$ = 5V (Note1)	0.9	1.0	1.1	V
SVR	Supply Voltage Rejection	12V ≤ V_{CC} ≤ 25V (Note 1)	—	70	—	dB
I_{BIAS}	Input Bias Current	$V_{PIN\ 3}$ = 3V	—	-3.0	-10	µA
	OUTPUT SECTION					
V_{OL}	Low Output Voltage	I_{SINK} = 20 mA	—	0.08	0.4	V
		I_{SINK} = 200 mA	—	1.4	2.2	
V_{OH}	High Output Voltage	I_{SINK} = 20 mA	13	13.5	—	V
		I_{SINK} = 200 mA	12	13.0	—	
t_R	Rise Time	T_J = 25°C, C_L = 1nF (Note 3)	—	45	150	ns
t_F	Fall Time	T_J = 25°C, C_L = 1nF (Note 3)	—	35	150	

* Adjust V_{CC} above the start threshold before setting it to 15V.

ELECTRICAL CHARACTERISTICS (CONTINUED)

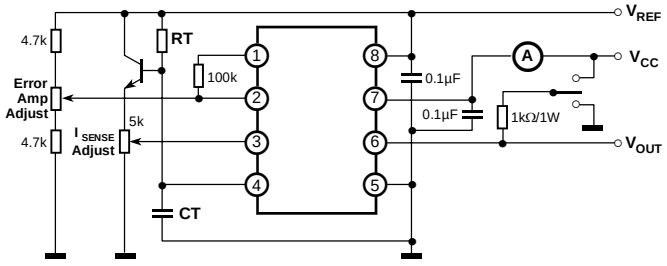
(* V_{CC} = 15V, R_T = 10KΩ, C_T = 3.3nF, T_A = 0^0C TO +70^0C, unless otherwise specified)

SYMBOL	CHARACTERISTICS	TEST CONDITION	MIN	TYP	MAX	UNIT
	UNDERVOLTAGE LOCKOUT SECTION					
$V_{TH(ST)}$	Start Threshold	MIK3842A(AM), MIK3842A-BW	14.5	16.0	17.5	V
		MIK3844A(AM), MIK3844A-BW				
		MIK3843A(AM), MIK3843A-BW	7.8	8.4	9.0	V
		MIK3845A(AM), MIK3845A-BW				
$V_{OPR(min)}$	Min. Operating Voltage (After Turn On)	MIK3842A(AM), MIK3842A-BW	8.5	10	11.5	V
		MIK3844A(AM), MIK3844A-BW				
		MIK3843A(AM), MIK3843A-BW	7.0	7.6	8.2	V
		MIK3845A(AM), MIK3845A-BW				
	PWM SECTION					
$D_{(MAX)}$	Max. Duty Cycle	MIK3842A(AM), MIK3842A-BW	95	97	100	%
		MIK3843A(AM), MIK3843A-BW				
		MIK3844A(AM), MIK3844A-BW	47	48	50	%
		MIK3845A(AM), MIK3845A-BW				
$D_{(MIN)}$	Min. Duty Cycle	–	–	–	0	%
	TOTAL STANDBY CURRENT					
I_{ST}	Start–Up Current	MIK384xA(AM), MIK384xA-BW		0.17	0.3	mA
$I_{CC\ (OPR)}$	Operating Supply Current	V_{pin3} = V_{pin2} = 0V		13	17	
V_Z	Zener Voltage	I_{CC}=25 mA	30	38		V

***** Adjust V_{CC} above the Startup threshold before setting it to 15V.
Note 1: Parameter measured at trip point of latch with V_{pin2} = 0.
Note 2: Gain defined as **A** = $\Delta V_{pin1} / \Delta V_{pin3}$; 0 ≤ V_{pin3} ≤ 0.8V.
Note 3: These parameters, although guaranteed, are not 100% tested in production.

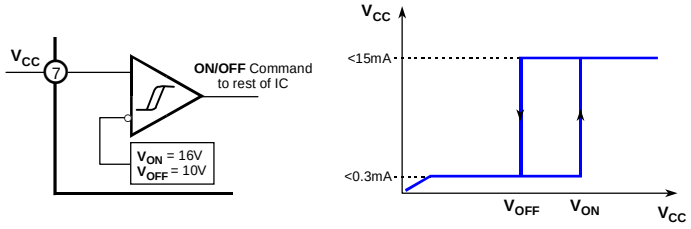
APPLICATION INFORMATION

OPEN-LOOP LABORATORY TEST FIXTURE



High peak currents associated with capacitive loads necessitate careful grounding techniques. Timing and bypass capacitors should be connected close to pin 5 in a single point ground. The transistor and 5kΩ potentiometer are used to sample the oscillator waveform and apply an adjustable ramp to pin 3.

UNDERVOLTAGE LOCKOUT (UVLO)

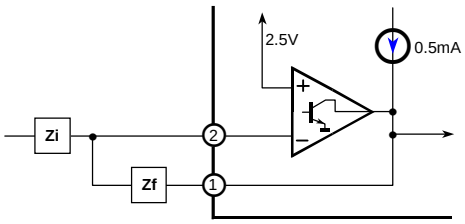


During Under-Voltage Lock-Out, the output driver is biased to a high impedance state. Pin 6 should be shunted to ground with a bleeder resistor to prevent activating the power switch with output leakage current.

APPLICATION INFORMATION (CONTINUED)

ERROR AMPLIFIER CONFIGURATION

Error amplifier can source or sink up to 0.5A.

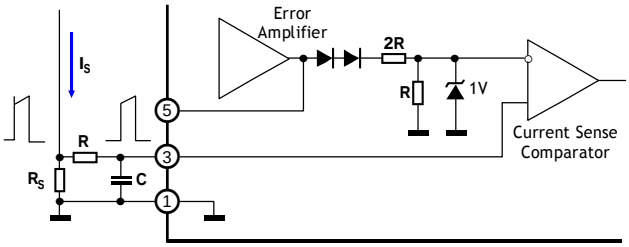


CURRENT SENSE CIRCUIT

Peak current (IS) is determined by the formula:

$$I_S\ (MAX) = 1V\ /\ R_S$$

A small RC filter may be required to suppress switch transients.



OSCILLATOR WAVEFORMS AND MAXIMUM DUTY CYCLE

Oscillator timing capacitor, C_T, is charged by V_{REF} through R_T and discharged by an internal current source. During the discharge time, the internal clock signal blanks the output to the low state. Selection of R_T and C_T therefore determines both oscillator frequency and maximum duty cycle. Charge and discharge times are determined by the formulas:

$$tc = 0.55\ R_T\ C_T$$

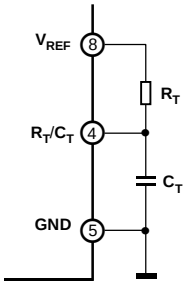
$$td \approx R_T C_T \times \ln\left(\frac{0.0063\ R_T - 2.7}{0.0063\ R_T - 4}\right)$$

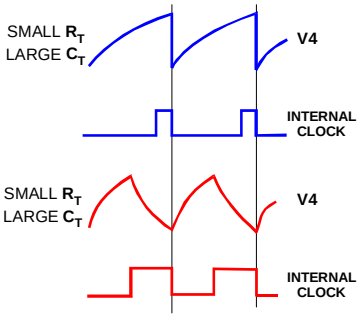
Frequency, then, is

$$f = (tc + td)^{-1}$$

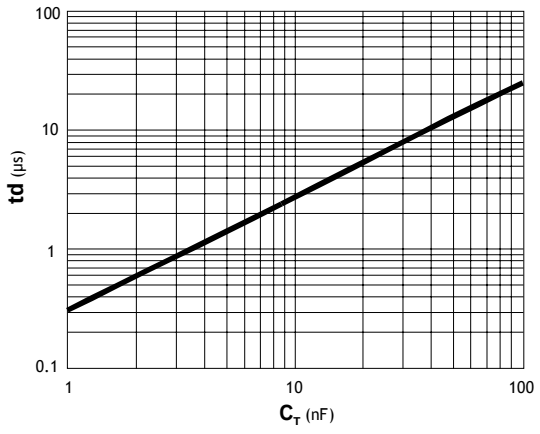
For $R_T > 5k\Omega$

$$f \approx 1.8\ /\ R_T C_T$$

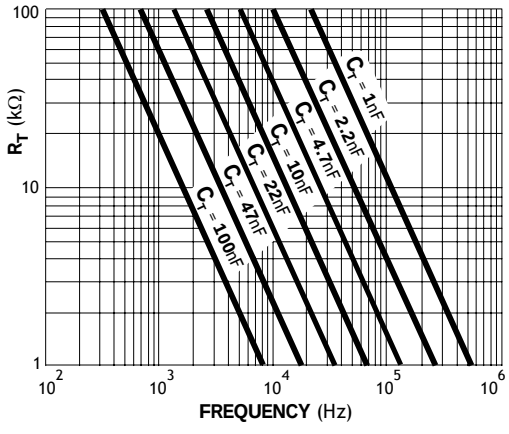




OSCILLATOR DEAD TIME VS. C_T (R_T > 5K)



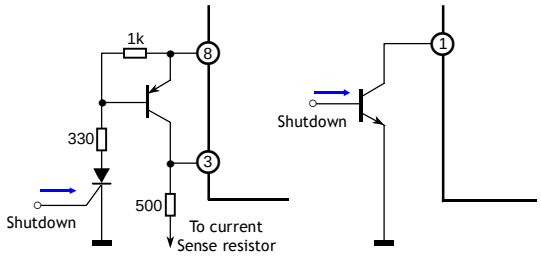
TIMING RESISTANCE VS. FREQUENCY



APPLICATION INFORMATION (CONTINUED)

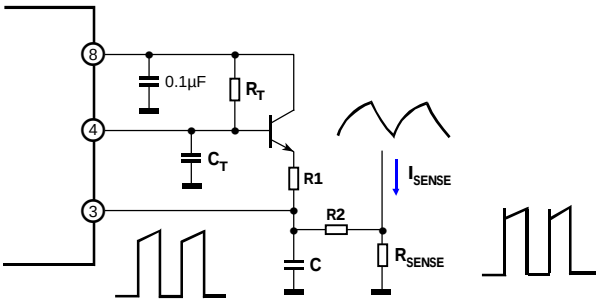
SHUTDOWN TECHNIQUES

Shutdown of the MIK384xx can be accomplished by two methods; either raise Pin 3 above 1V or pull Pin 1 below a voltage two diode drops above ground. Either method caused the output of PWM comparator to be high (refer to block diagram). The PWM latch is reset dominant so that the output will remain low until the next clock cycle after the shutdown condition at pins 1 and/or 3 is removed. In one example, an externally latched shutdown may be accomplished by adding an SCR which be reset by cycling **Vcc** below the lower UVLO threshold.
At this point the reference turns off allowing the SCR to reset.



SLOPE COMPENSATION

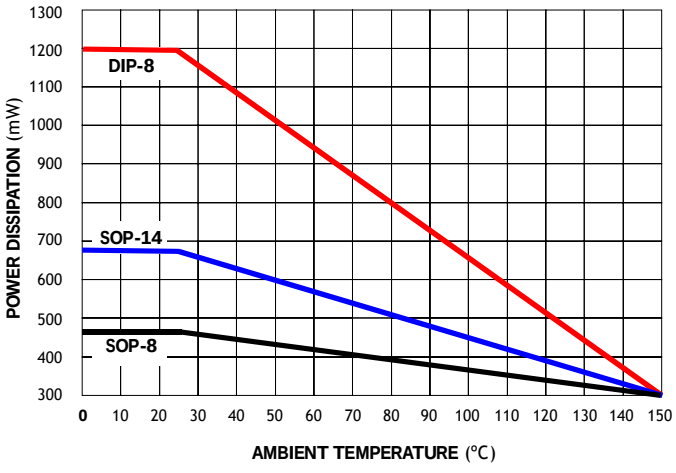
A fraction of the oscillator ramp can be resistively summed with the current sense signal to provide slope compensation for converts requiring duty cycles over 50%. Note that capacitor C_T, forms a filter with R2 to suppress the leading edge switch spikes.



THERMAL DATA

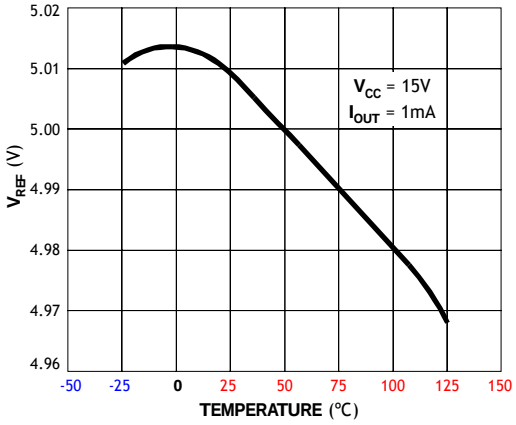
SYMBOL	CHARACTERISTIC	DIP-8	SOP-8	SOP-14	UNIT
$R_{THJ-AMB}$(MAX)	Thermal Resistance Junction-ambient	100	265	180	°C/W

POWER DISSIPATION CURVE

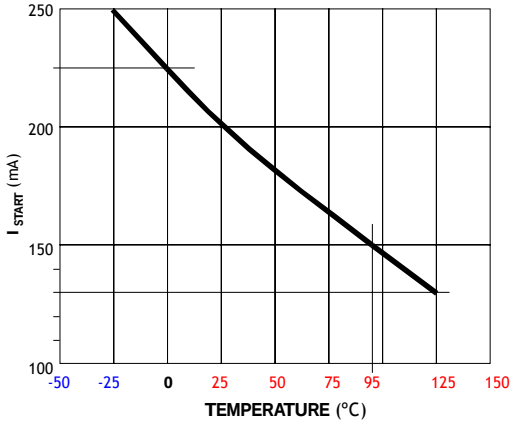


TYPICAL PERFORMANCE CHARACTERISTICS

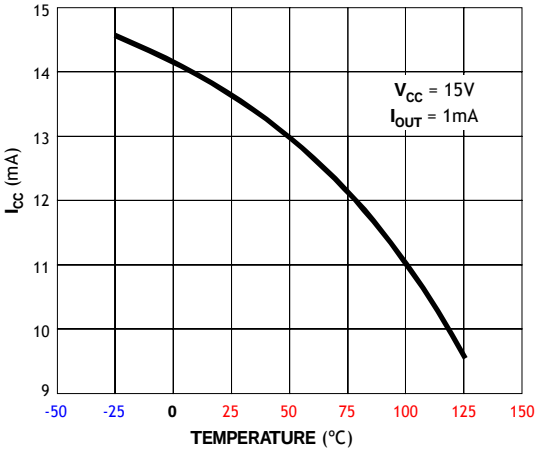
V_{REF} TEMPERATURE DRIFT



I_{START} TEMPERATURE DRIFT

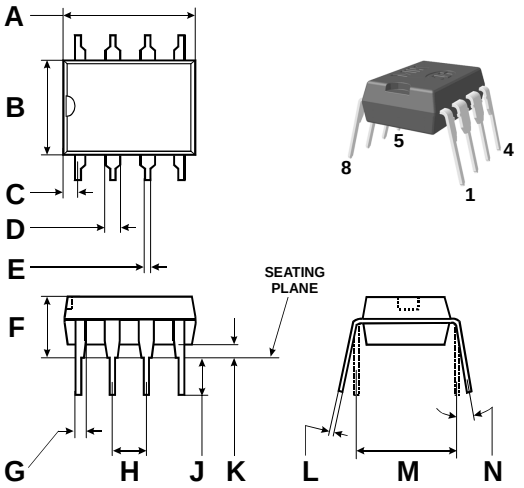


I_{CC} TEMPERATURE DRIFT



PHYSICAL DIMENSIONS AND MARKING DIAGRAMS

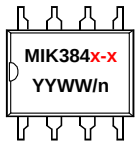
DIP-8 PACKAGE



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9,35	9,45	0,368	0,372
B	6.30	6.40	0,248	0,252
C	0,84	0,94	0,033	0,037
D		1.82		0,072
E	0,41	0,51	0,016	0,020
F	3,75	4,35	0,148	0,171
G	0,94	1,04	0,037	0,041
H	2,49	2,59	0,098	0,102
J	3.00	3.50	0,118	0,138
K	0.50	1.10	0,020	0,043
L	0.20	0.30	0,008	0,012
M	7.57	7.67	0,298	0,302
N		10º		10º

DIP-8

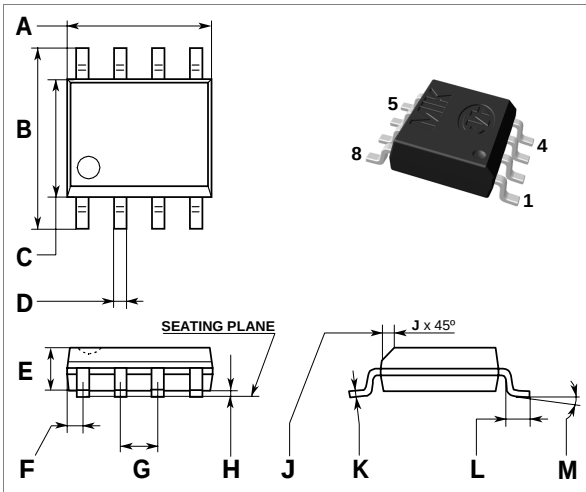
MARKING DIAGRAM



x-x – see page 4, table «ELECTRICAL CHARACTERISTICS»

YY – Year
WW – Work Week
n – assembly location

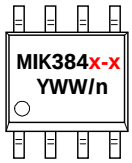
SOP-8 PACKAGE



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.78	4.91	0.188	0.193
B	5.96	6.12	0.235	0.241
C	3.89	3.99	0.153	0.157
D	0.406		0.016	
E	1.40	1.50	0.055	0.059
F	0.49	0.55	0.019	0.022
G	1.27		0.050	
H	0.10	0.25	0.004	0.010
J	0.50	0.25	0.020	0.010
K	0.17	0.23	0.007	0.009
L	0.40	1.25	0.016	0.049
M	0º	7º	0º	7º

SOP-8

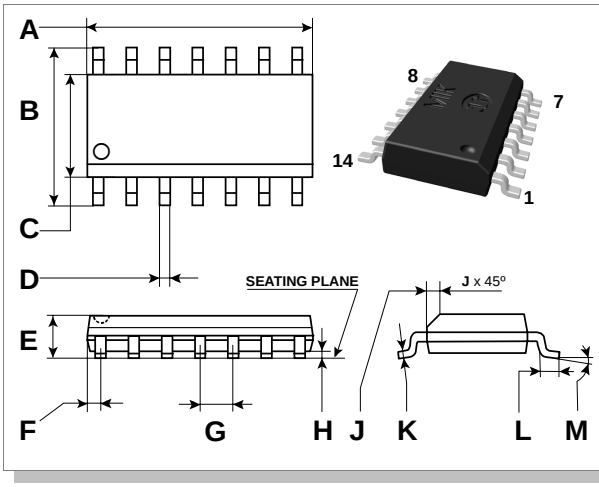
MARKING DIAGRAM



x-x – see page 4, table «ELECTRICAL CHARACTERISTICS»

Y – Year
WW – Work Week
n – assembly location

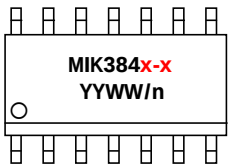
SOP-14 PACKAGE



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.55	8.75	0.340	0.350
B	5.80	6.20	0.228	0.244
C	3.80	4.00	0.150	0.160
D	0.36	0.49	0.014	0.019
E	1.25	1.75	0.049	0.069
F	0.49	0.55	0.019	0.022
G	1.27		0.050	
H	0.10	0.25	0.004	0.010
J	0.50	0.25	0.020	0.010
K	0.17	0.23	0.007	0.009
L	0.40	1.25	0.016	0.049
M	0º	7º	0º	7º

SOP-14

MARKING DIAGRAM



x-x – see page 4, table «ELECTRICAL CHARACTERISTICS»

YY – Year
WW – Work Week
n – assembly location

ORDERING INFORMATION

(THE FORM OF PACKING IS STIPULATED IN THE CONTRACT)

ODERING NUMBER	OPERATING TEMPERATURE RANGE	PACKAGE	SHIPPING
MIK3842A N	T_A = 0°C to +70°C	DIP-8	50 Units/Rail
MIK3843A N		DIP-8	50 Units/Rail
MIK3844A N		DIP-8	50 Units/Rail
MIK3845A N		DIP-8	50 Units/Rail
MIK3842AM N		DIP-8	50 Units/Rail
MIK3843AM N		DIP-8	50 Units/Rail
MIK3844AM N		DIP-8	50 Units/Rail
MIK3845AM N		DIP-8	50 Units/Rail
MIK3842A-BW N		DIP-8	50 Units/Rail
MIK3843A-BW N		DIP-8	50 Units/Rail
MIK3844A-BW N		DIP-8	50 Units/Rail
MIK3845A-BW N		DIP-8	50 Units/Rail
MIK3842A D1	T_A = 0°C to +70°C	SOP-8	98 Units/Rail
MIK3843A D1		SOP-8	98 Units/Rail
MIK3844A D1		SOP-8	98 Units/Rail
MIK3845A D1		SOP-8	98 Units/Rail
MIK3842AM D1		SOP-8	98 Units/Rail
MIK3843AM D1		SOP-8	98 Units/Rail
MIK3844AM D1		SOP-8	98 Units/Rail
MIK3845AM D1		SOP-8	98 Units/Rail
MIK3842A-BW D1		SOP-8	98 Units/Rail
MIK3843A-BW D1		SOP-8	98 Units/Rail
MIK3844A-BW D1		SOP-8	98 Units/Rail
MIK3845A-BW D1		SOP-8	98 Units/Rail
MIK3842A D	T_A = 0°C to +70°C	SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3843A D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3844A D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3845A D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3842AM D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3843AM D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3844AM D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3845AM D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3842A-BW D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3843A-BW D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3844A-BW D		SOP-14	55 Units/Rail _ 2500 Tape & Reel
MIK3845A-BW D		SOP-14	55 Units/Rail _ 2500 Tape & Reel

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