

PRELIMINARY - August 11, 2000

TEL:805-498-2111 FAX:805-498-3804 WEB:http://www.semtech.com

## DESCRIPTION

The SC1464 is a versatile charge pump designed for use in battery operated power supply applications. A simple, low current charge pump doubler can be implemented without costly inductors or capacitors. Internal MOSFET's and control circuitry eliminate the need for costly board space and design time. The small device footprint allows for compact circuit design.

The SC1464 charge pump can be used for applications that require up to 60mA of output current with  $V_{IN} = 2.85V$  and  $V_{OUT} = 5.2V$ . The small 8 lead MSOP-8 package helps minimize board space.

The TF1 and TF2 pins provide binary control of the oscillator frequency to either 1 MHz, 260kHz, 32kHz or 8kHz. The user can change the frequency during operation with extremely fast settling time.

## FEATURES

- Small size - MSOP-8 package
- Typical efficiency of 90% @ full load
- Designed to work with ceramic or tantalum capacitors
- Soft start functionality
- Short-Circuit and Over-Temperature protection
- $<55\mu A$  input current @ no load (TF1=0;TF2=1)
- $<330\mu A$  input current @ no load (TF1=0;TF2=0)
- Oscillator frequency accurate to  $\pm 5\%$
- Shutdown current  $< 1\mu A$
- All Specifications rated over the full temperature range ( $-40^{\circ}C$  to  $85^{\circ}C$ )

## APPLICATIONS

- Cellular phones
- Handheld devices
- PDA power supplies
- Peripheral card supplies

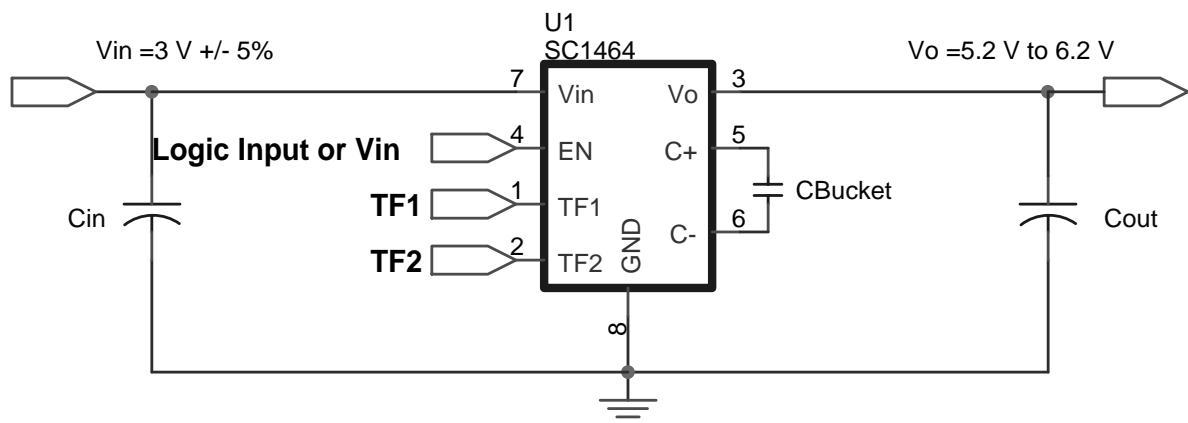
## ORDERING INFORMATION

Part Number <sup>(1)</sup>	Package
SC1464CMS.TR	MSOP-8

Note:

(1) Only available in tape and reel packaging. A reel contains 2500 devices.

## APPLICATION CIRCUIT



Iout	Freq	Cin	Cout	CBucket
60mA	260kHz	3.3uF	3.3uF	2.2uF
20mA	260kHz	1.0uF	1.0uF	0.22uF
60mA	1MHz	1.0uF	1.0uF	0.22uF
20mA	1MHz	0.22uF	0.22uF	0.10uF

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**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Maximum	Units
Input Supply Voltage	$V_{IN}$	-0.3 to +4	V
Output Voltage	$V_O$	-0.3 to +8	V
$V_{OUT}$ Short-Circuit Duration	SC	Indefinite	
Operating Ambient Temperature Range	$T_A$	-40 to +85	°C
Operating Junction Temperature	$T_J$	-40 to +125	°C
Storage Temperature Range	$T_{STG}$	-65 to +150	°C
Lead Temperature (Soldering) 10 Sec	$T_{LEAD}$	300	°C
Thermal Temperature Junction to Ambient	$\theta_{JA}$	185	°C/W
Thermal Impedance Junction to Case	$\theta_{JC}$	47	°C/W

**ELECTRICAL CHARACTERISTICS**

 Unless specified,  $T_A = -40^\circ\text{C}$  to  $85^\circ\text{C}$ ,  $EN = V_{IN}$ ,  $C_{Bucket} = 2.2\mu\text{F}$  (ESR =  $0.1\Omega$ ),  $C_{IN}$ ,  $C_{OUT} = 3.3\mu\text{F}$  (ESR =  $1\Omega$ ),  $V_{IN} = 3V \pm 5\%$ ,  $V_{OUT} = 5.2V$  to  $6.2V$ .

Parameter	Symbol	Test Conditions	MIN	TYP	MAX	Units
Input Supply Voltage	$V_{IN}$		2.5		3.5	V
Input Supply Current	$I_{IN}$	$I_O = 0$ TF1 = 0, TF2 = 1, freq = 8kHz		45	55	$\mu\text{A}$
		$I_O = 0$ TF1 = 0, TF2 = 0, freq = 32kHz		270	330	
		$I_O = 0$ TF1 = 1, TF2 = 0, freq = 260kHz		1.6	2	mA
		$I_O = 0$ TF1 = 1, TF2 = 1, freq = 1MHz		5.8	8	
		EN = GND			1	$\mu\text{A}$
Output Current	$I_O$	$V_I = 2.85$ , TF1 = 0, TF2 = 1. freq = 8kHz	5			mA
		$V_I = 2.85$ , TF1 = 0, TF2 = 0. freq = 32kHz	20			
		$V_I = 2.85$ , TF1 = 1, TF2 = 0. freq = 260kHz	60			
		$V_I = 2.85$ , TF1 = TF2 = 1. freq = 1MHz $C_{bucket} = 220\text{nF}$	45			
Max. Output Voltage <sup>(3)</sup>	$V_{OUT}$	$I_O = 0$			$2 \cdot V_{IN}$	V
Short Circuit Current	$I_{SC}$	$V_O = 0$ to $V_{IN} - 1V$ , $I_O = I_{IN}$			170	mA
Output Ripple (pk-pk) <sup>(1)(3)</sup>	$V_R$	$I_O = 60\text{mA}$ , Frequency = 260kHz		150		mV
Power Efficiency	$\eta$	$I_O = 60\text{mA}$ , TF1 = 1, TF2 = 0	85			%
Oscillator Frequency	OSC	TF1 = 0, TF2 = 1	7.82	8.50	9.18	kHz
		TF1 = 0, TF2 = 0	30.18	32.80	35.42	kHz
		TF1 = 1, TF2 = 0	241.13	262.10	283.07	kHz
		TF1 = TF2 = 1	0.92	1.00	1.08	MHz

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**ELECTRICAL CHARACTERISTICS**

 Unless specified,  $T_A = -40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ ,  $E_N = V_{IN}$ ,  $C_{\text{Bucket}} = 2.2\mu\text{F}$  (ESR =  $0.1\Omega$ ),  $C_{IN}$ ,  $C_{OUT} = 3.3\mu\text{F}$  (ESR =  $1\Omega$ ),  $V_{IN} = 3V \pm 5\%$ ,  $V_{OUT} = 5.2V$  to  $6.2V$ .

Parameter	Symbol	Test Conditions	MIN	TYP	MAX	Units
Time to Regulation at Turn-on <sup>(2)(3)</sup>	$t_{ON}$	$I_O = 0$ to $60\text{ mA}$ freq = $260\text{kHz}$		420	1000	$\mu\text{s}$
Input High Threshold	$V_{ih}$	All input pins	1.3			V
Input Low Threshold	$V_{il}$	All input pins			0.4	V
Inrush Current <sup>(3)</sup>	$I_{INRUSH}$	Upon application of $V_{IN}$ , Maximum average current over 10 periods			750	mA
Over Temperature protection <sup>(3)</sup>	O.T.			170		$^{\circ}\text{C}$
Over Temperature Hysteresis <sup>(3)</sup>	O.T.H			10		$^{\circ}\text{C}$

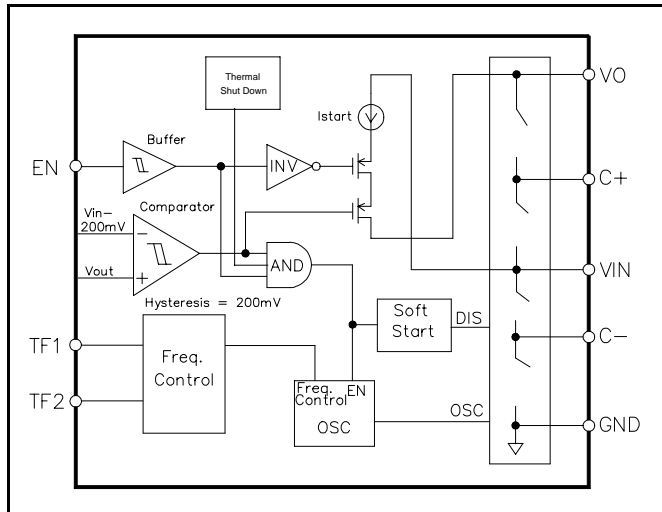
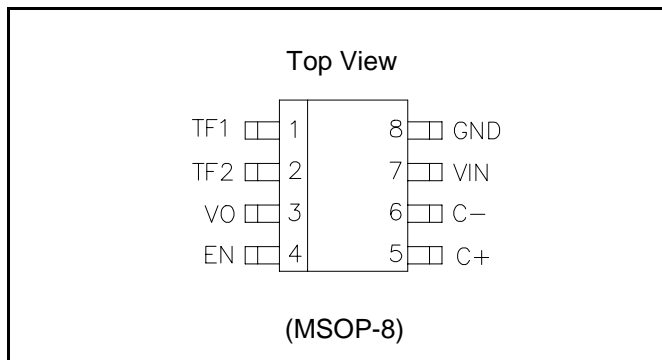
**NOTES:**

(1) All electrical characteristics are for the application circuit on page 2.

 (2) Soft start functionality is performed along with short circuit protection. If  $V_{OUT}$  is less than  $V_{IN} - 200\text{mV}$ , then all switches are turned off and  $V_{OUT}$  is charged with a  $70\text{mA}$  current source from  $V_{IN}$ . When  $V_{OUT}$  reaches  $V_{IN} - 200\text{mV}$ , then a current limit version of the switches are turned on until  $V_{OUT}$  reaches  $V_{IN} +$  a PMOS threshold, at which point all switches are enabled.

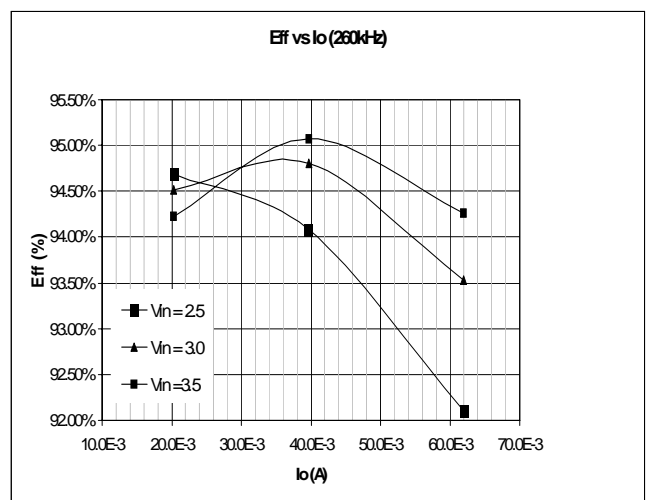
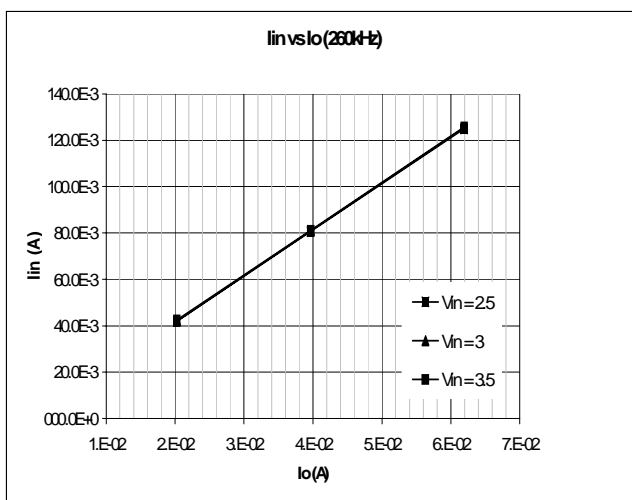
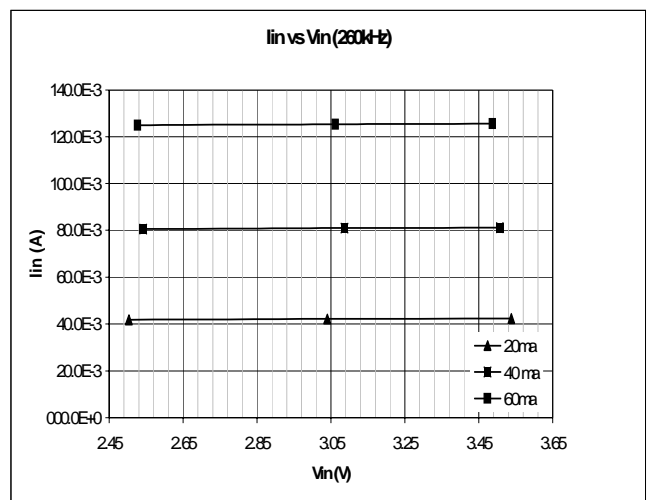
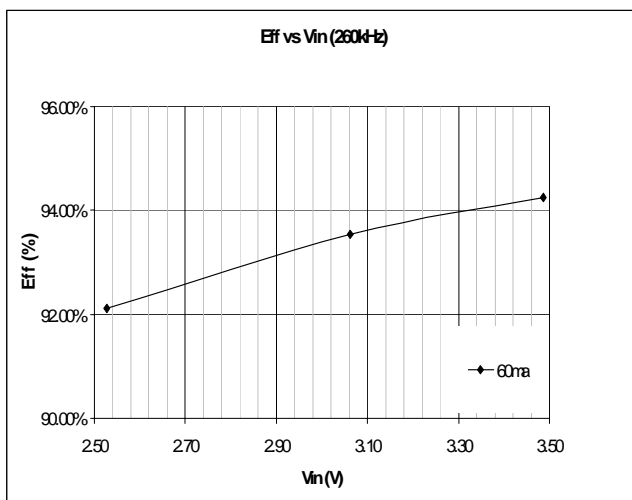
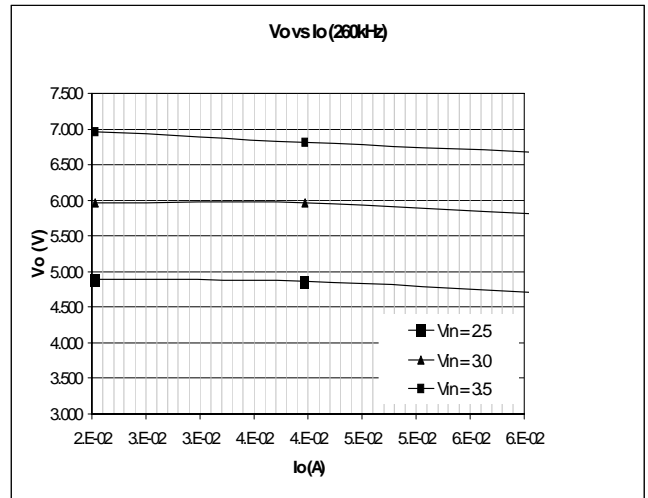
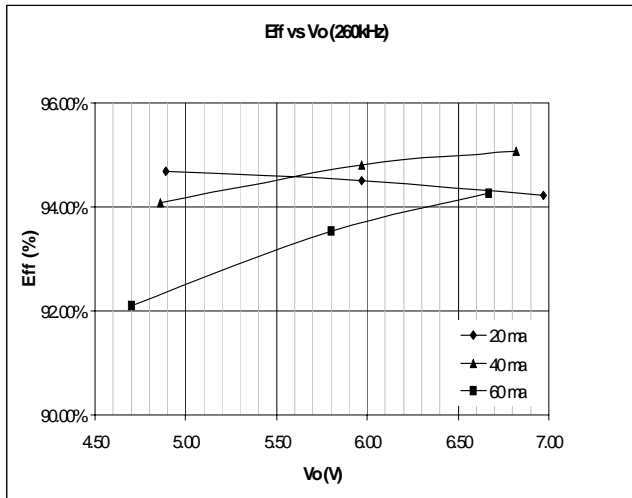
(3) Guaranteed by design.

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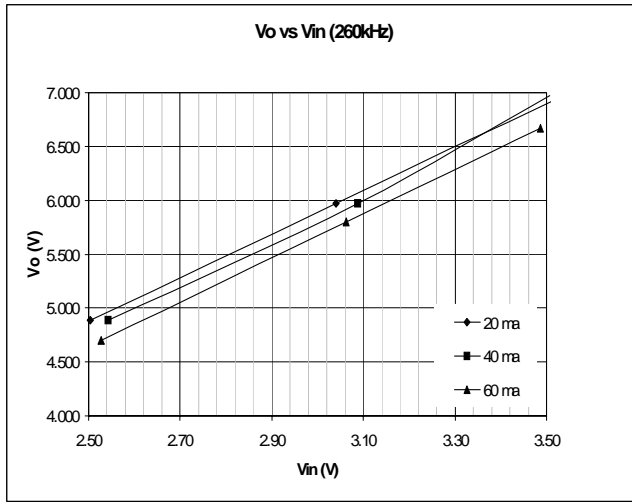
**BLOCK DIAGRAM**

**PIN CONFIGURATION**

**PIN DESCRIPTION**

Pin#	Pin Name	Pin Function																
1	TF1	Binary frequency select pins. The frequency is set according to the following table.																
2	TF2																	
		<table style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td colspan="2"></td> <td colspan="2" style="text-align: center;">TF1</td> </tr> <tr> <td colspan="2"></td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">TF2</td> <td style="text-align: center;">0</td> <td style="text-align: center;">32kHz</td> <td style="text-align: center;">260kHz</td> </tr> <tr> <td style="text-align: center;">TF2</td> <td style="text-align: center;">1</td> <td style="text-align: center;">8kHz</td> <td style="text-align: center;">1MHz</td> </tr> </table>			TF1				0	1	TF2	0	32kHz	260kHz	TF2	1	8kHz	1MHz
		TF1																
		0	1															
TF2	0	32kHz	260kHz															
TF2	1	8kHz	1MHz															
3	VO	Voltage output																
4	EN	Enable. Pull EN low to reduce the current on VIN to less than 1μA.																
5	C+	This pin should be connected to the positive terminal of the external charging capacitor.																
6	C-	This pin should be connected to the negative terminal of the external charging capacitor.																
7	VIN	Supply voltage input.																
8	GND	Ground.																

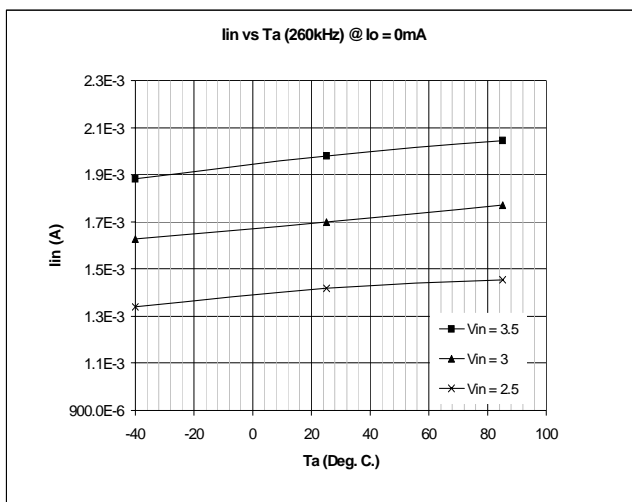
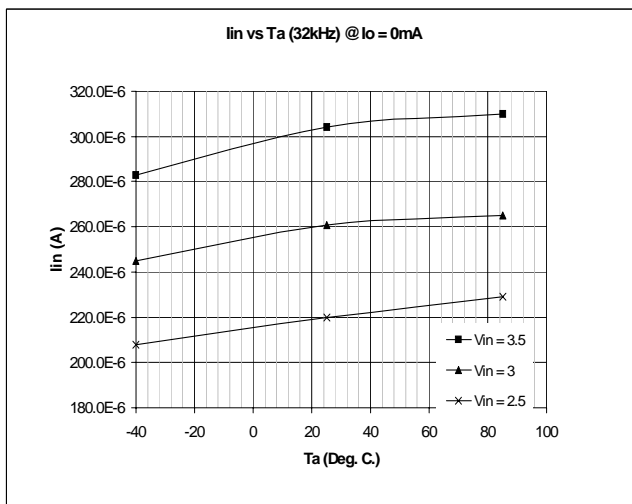
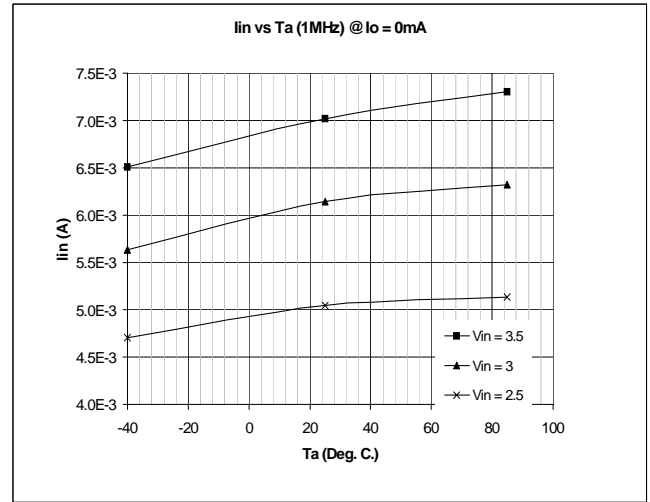
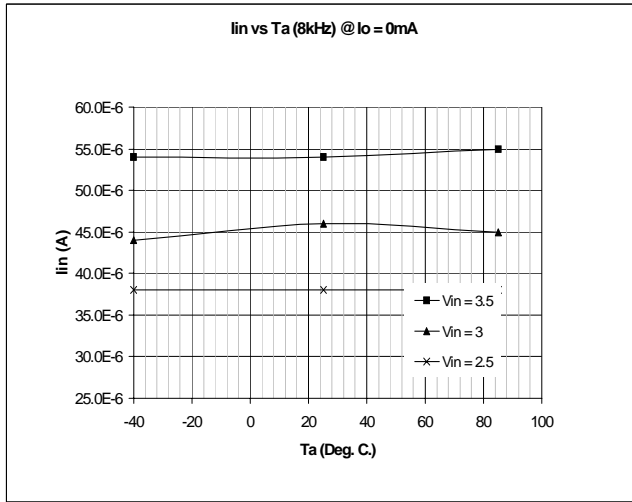
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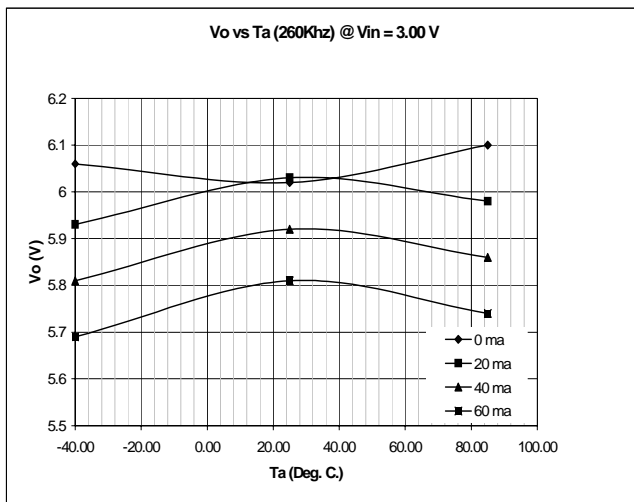
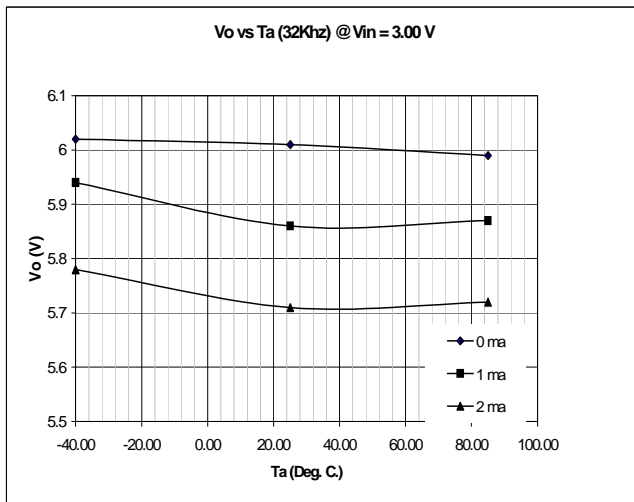
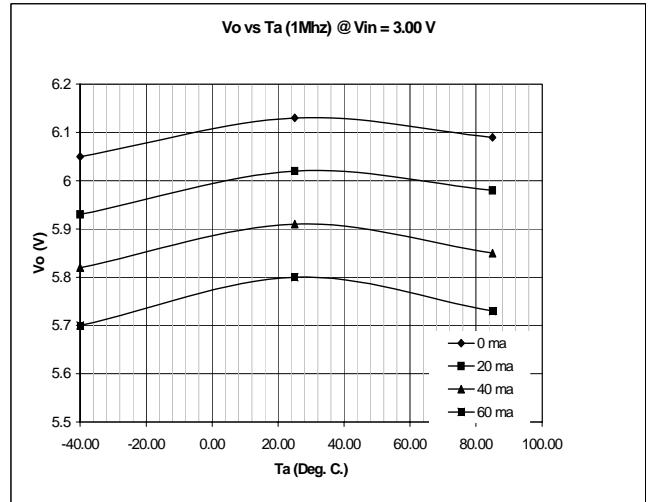
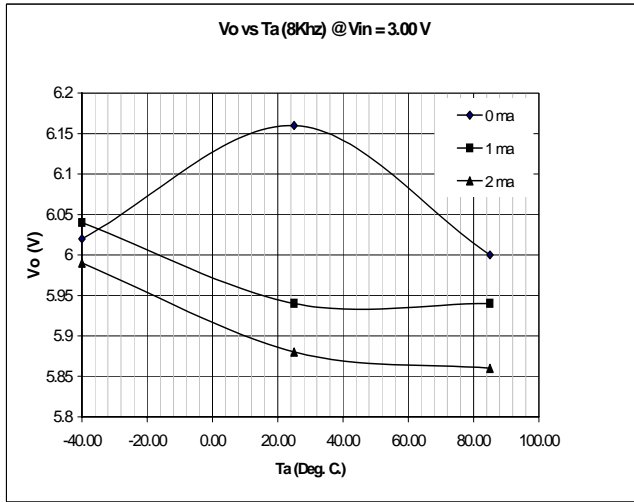
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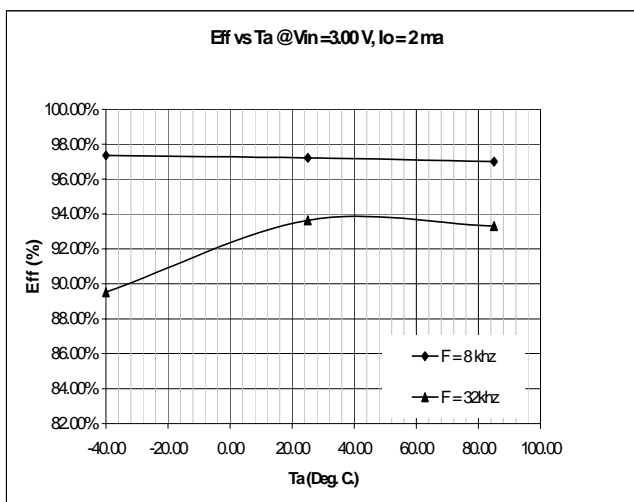
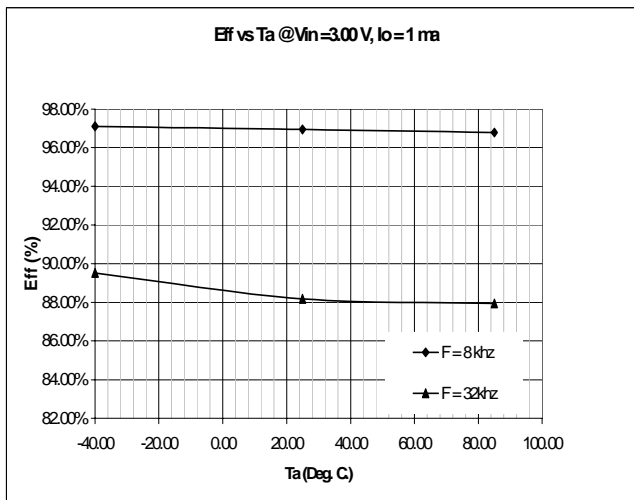
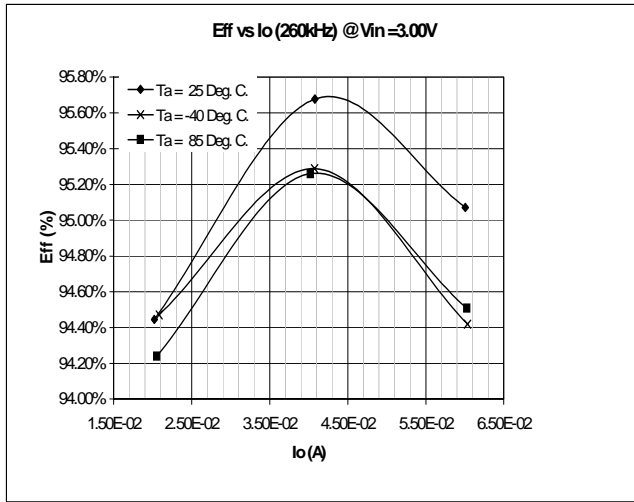


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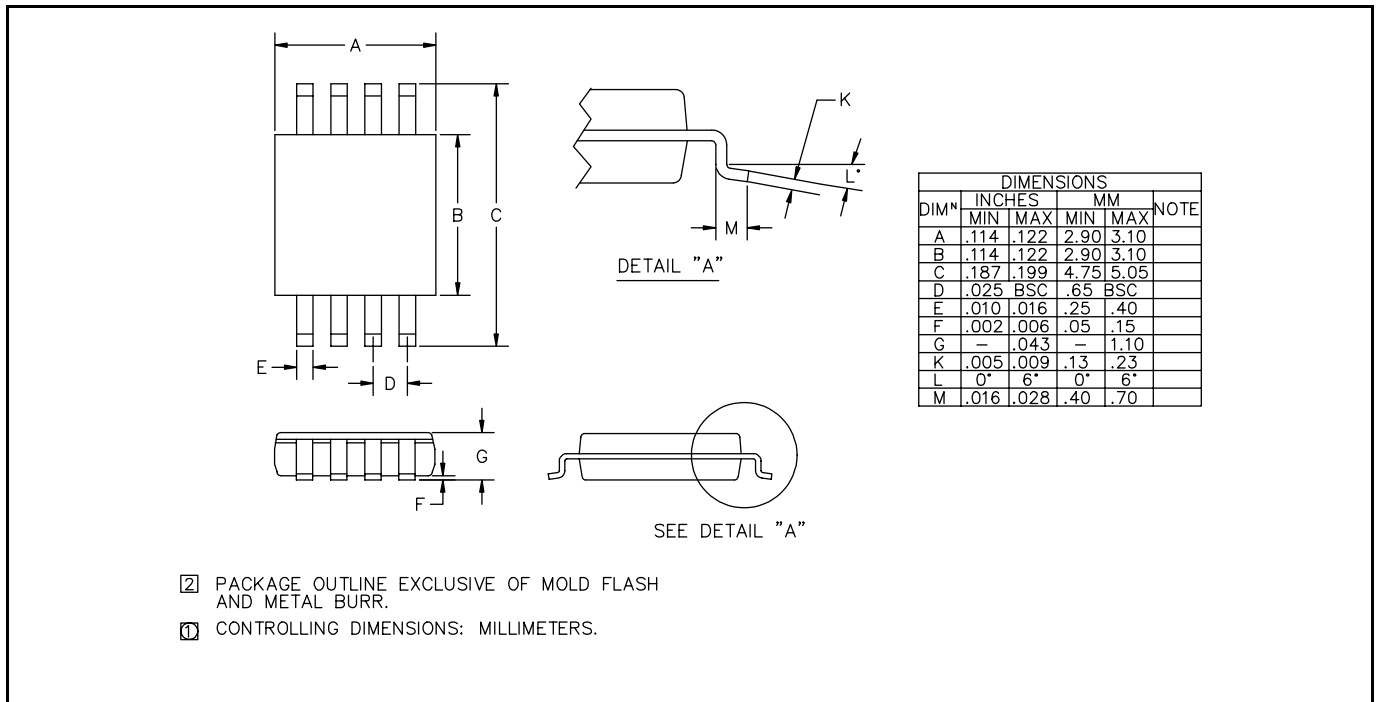
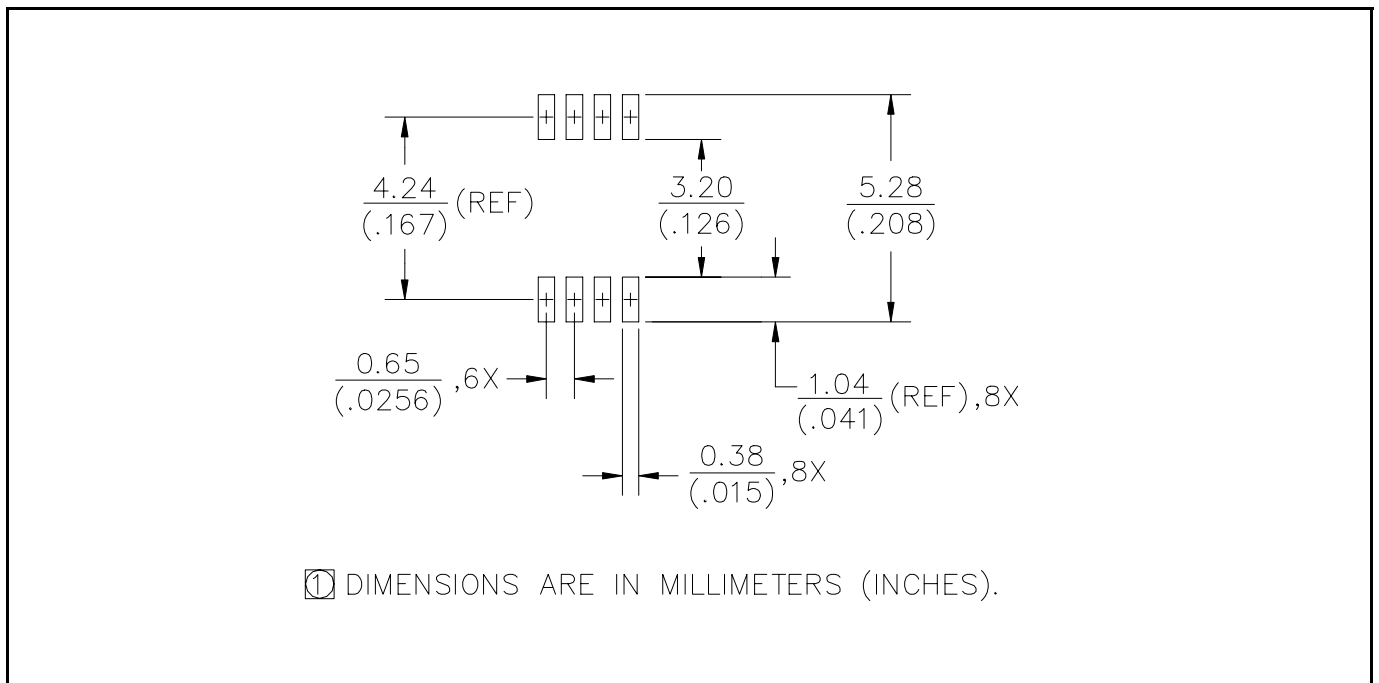




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**OUTLINE DRAWING - MSOP-8**

**LAND PATTERN - MSOP-8**


ECN 00-1246