

# AX34063AP / AX34063AS

DC-to-DC Converter Integrate Circuit Devices

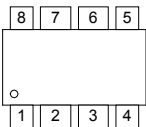
## Description

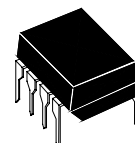
The AX34063A Series is a monolithic control circuit containing the primary functions required for DC-to-DC converters. These devices consist of an internal temperature compensated reference, comparator, controlled duty cycle oscillator with an active current limit circuit, driver and high current output switch. This series was specifically by Avantics Microelectronics Corp.

## Features

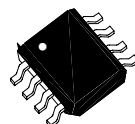
- 3V to 40V Input Voltage Operation
- Internal 1.6A Peak Current Switch
- Internal  $\pm 1.8\%$  Reference
- Low Quiescent Current at 1.6mA
- Frequency Operation from 100Hz~100KHz
- Output Voltage Adjustable
- Active Current Limiting
- Step-Up, Step-Down or Inverting Switching Regulators

## Pin Connections

|                                                                                     |                              |                                       |
|-------------------------------------------------------------------------------------|------------------------------|---------------------------------------|
|  | Pin1: Switch Collector (SWC) | Pin5: Comparator Inverting Input (FB) |
|                                                                                     | Pin2: Switch Emitter (SWE)   | Pin6: Voltage Supply (Vcc)            |
|                                                                                     | Pin3: Timing Capacitor (TC)  | Pin7: Ipk Sense (Ipk)                 |
|                                                                                     | Pin4: Ground (GND)           | Pin8: Voltage Driver Collector (DRC)  |



8-Lead Plastic **DIP-8**  
Package Code: P



8-Lead Plastic **SO-8**  
Package Code: S

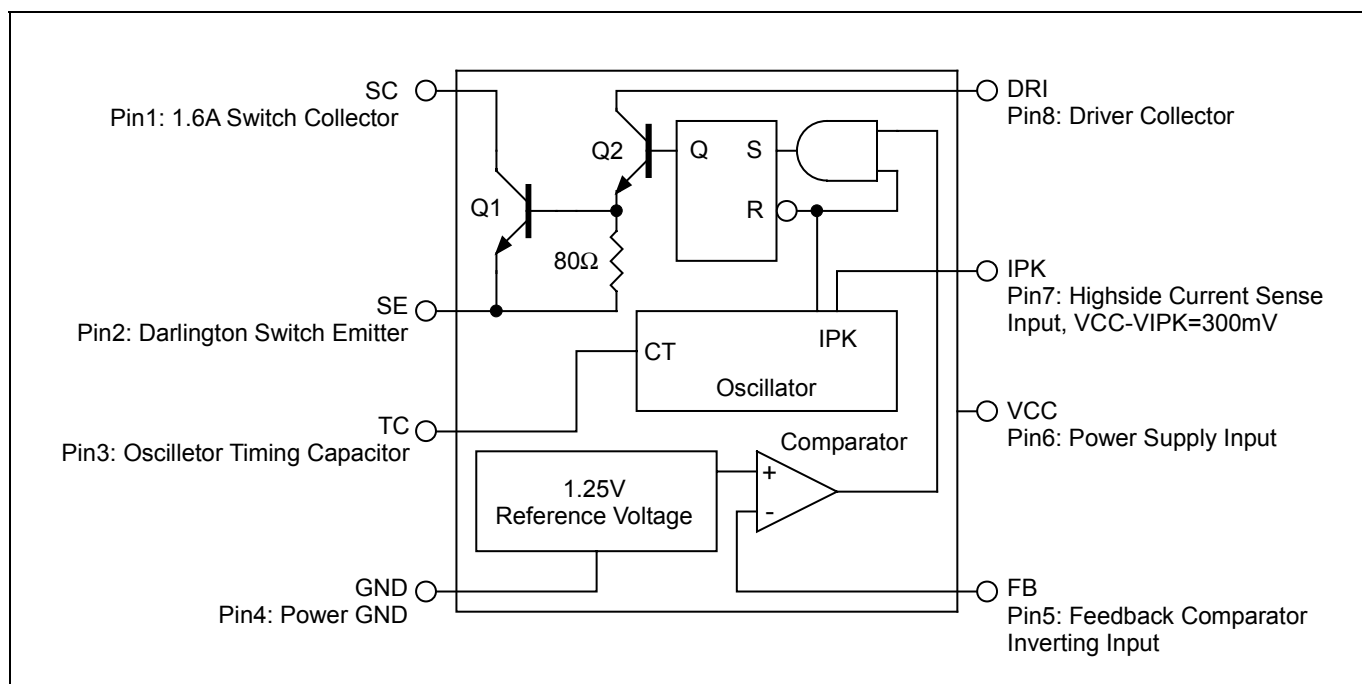
## Absolute Maxium Rating

| Parameter                              | Symbol        | Value    |       | Unit          |
|----------------------------------------|---------------|----------|-------|---------------|
| Power Supply Voltage                   | $V_{CC}$      | 40       |       | V             |
| Comparator Input Voltage Range         | $V_{ir}$      | -0.3~+40 |       | V             |
| Switch Collector Voltage               | $V_{C(SW)}$   | 40       |       | V             |
| Switch Emitter Voltage                 | $V_{SWE}$     | 40       |       | V             |
| Switch Emitter to Collector Voltage    | $V_{CE}$      | 40       |       | V             |
| Driver Collector Voltage               | $V_{C(DR)}$   | 40       |       | V             |
| Switch Current                         | $I_{SW}$      | 1.5      |       | A             |
| Power Dissipation at $T_J=20^{\circ}C$ | $P_D$         | DIP-8    | 1.25  | W             |
|                                        |               | SO-8     | 0.625 |               |
| Operating Ambient Temperature Range    | $T_{opr}$     | 0~+70    |       | $^{\circ}C$   |
| Storage Temperature Range              | $T_{stg}$     | -65~+150 |       | $^{\circ}C$   |
| Operating Junction Temperature         | $T_{opj}$     | 120      |       | $^{\circ}C$   |
| Thermal Resistance Junction-ambient    | $\theta_{JA}$ | 125      |       | $^{\circ}C/W$ |

## Electrical Characteristics ( $V_{CC}=5V, T_A=0\sim70^{\circ}C$ , unless otherwise specified)

| Parameter                                    | Symbol               | Test Condition                                                                                     | Min. | Typ. | Max. | Unit    |
|----------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------|------|------|------|---------|
| <b>Oscillator</b>                            |                      |                                                                                                    |      |      |      |         |
| Charging Current                             | $I_{chg}$            | $V_{CC}=5\sim40V, T_a=25^{\circ}C$                                                                 | 10   | 25   | 40   | $\mu A$ |
| Discharge Current                            | $I_{dischg}$         | $V_{CC}=5\sim40V, T_a=25^{\circ}C$                                                                 | 140  | 190  | 240  | $\mu A$ |
| Frequency                                    | $f_{OSC}$            | $V_{PIN5}=0, C_T=1nF, T_a=25^{\circ}C$                                                             | 28   | 33   | 40   | KHz     |
| Discharge to Charge Current Ratio            | $I_{dischg}/I_{chg}$ | $V_{PIN7}=V_{CC}, T_a=25^{\circ}C$                                                                 | 5.2  | 6    | 7.5  |         |
| Current Limit Sense Voltage                  | $V_{IPK}$            | $I_{dischg}=I_{chg}, T_a=25^{\circ}C$                                                              | 250  | 300  | 350  | mV      |
| <b>Output Switch</b>                         |                      |                                                                                                    |      |      |      |         |
| Saturation Voltage,<br>Darlington Connection | $V_{CE(sat)} 1$      | $I_{SW}=1A, V_{C(SW)}=V_{C(DR)}$                                                                   | -    | 1    | 1.3  | V       |
| Saturation Voltage                           | $V_{CE(sat)} 2$      | $I_{SW}=1A, I_{C(DR)}=50mA$                                                                        | -    | 0.4  | 0.7  | V       |
| DC Current Gain                              | $h_{FE}$             | $I_{SW}=1A, V_{CE}=5V$                                                                             | 35   | 120  | -    |         |
| Collector Off-State Current                  | $I_{CC(off)}$        | $V_{CE}=40V, T_a=25^{\circ}C$                                                                      | -    | 10   | 100  | $\mu A$ |
| <b>Comparator</b>                            |                      |                                                                                                    |      |      |      |         |
| Threshold Voltage                            | $V_{FB}$             |                                                                                                    | 1.23 | 1.25 | 1.27 | V       |
| Threshold Voltage Line Regulation            | $\Delta V_{FB}$      | $V_{CC}=5\sim40V$                                                                                  | -    | 1.5  | 6    | mV      |
| Input Bias Current                           | $I_{IB}$             | $V_{IN}=0V$                                                                                        | -    | 40   | 400  | nA      |
| <b>Total Device</b>                          |                      |                                                                                                    |      |      |      |         |
| Supply Current                               | $I_{CC}$             | $V_{CC}=5\sim40V, V_{PIN7}=V_{CC}, V_{PIN5}>V_{FB}, C_T=0.001\mu F, Pin7=GND, Remaining pins open$ | -    | 1.6  | 3    | mA      |

## Block Diagram



## Application Information

Design Formula Table

| Calculation              | Step-Down                                            | Step-Up                                           | Voltage-Inverting                              |
|--------------------------|------------------------------------------------------|---------------------------------------------------|------------------------------------------------|
| $t_{on}/t_{off}$         | $(V_{out}+V_F)/(V_{in(min)}-V_{sat}-V_{out})$        | $(V_{out}+V_F-V_{in(min)})/(V_{in(min)}-V_{sat})$ | $( V_{out} +V_F)/(V_{in(max)}-V_{sat})$        |
| $(t_{on}+t_{off})_{max}$ | $1/F_{min}$                                          | $1/F_{min}$                                       | $1/F_{min}$                                    |
| $C_T$                    | $4*10^{-5}t_{on}$                                    | $4*10^{-5}t_{on}$                                 | $4*10^{-5}t_{on}$                              |
| $I_{C(sw)}$              | $2*I_{out(max)}$                                     | $2*I_{out(max)}(t_{on}+t_{off}/t_{off})$          | $2*I_{out(max)}(t_{on}+t_{off}/t_{off})$       |
| $R_S$                    | $0.3/I_{C(sw)}$                                      | $0.3/I_{C(sw)}$                                   | $0.3/I_{C(sw)}$                                |
| $L_{(min)}$              | $(V_{in(min)}-V_{sat}/I_{pk(sw)})*t_{on(max)}$       | $(V_{in(min)}-V_{sat}/I_{pk(sw)})*t_{on(max)}$    | $(V_{in(min)}-V_{sat}/I_{pk(sw)})*t_{on(max)}$ |
| $C_O$                    | $(I_{pk(sw)}*(t_{on}+t_{off}))/((8*V_{ripple(P-P)})$ | $I_{out}*t_{on}/V_{ripple(P-P)}$                  | $I_{out}*t_{on}/V_{ripple(P-P)}$               |

$V_{sat}$ : Saturation voltage of the output switch.

$V_F$ : Forward voltage drop of the ringback rectifier.

The following power supply characteristics must be chosen:

$V_{in}$ : Nominal input voltage.

$V_{out}$ : Desired output voltage.  $|V_{out}|=1.25*(1+R_B/R_A)$

$I_{out}$ : Desired output current

$F_{min}$ : Minimum desired output switching frequency at the selected values for  $V_{in}$  and  $I_{out}$ .

$V_{ripple(P-P)}$ : Desired peak to peak output ripple voltage in practice, the calculated value will need to be increased due to the capacitor equivalent series resistance and board layout. The ripple voltage should be kept to a low value since it will directly effect the line and load regulation.

## Application Information (Continuos)

Fig.2 Step-Up Converter

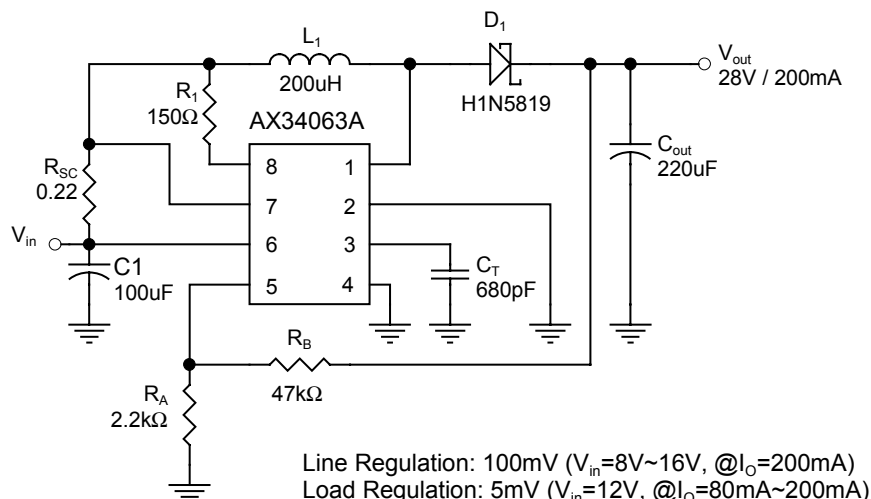


Fig.3 Step-Up Converter With External NPN Switch

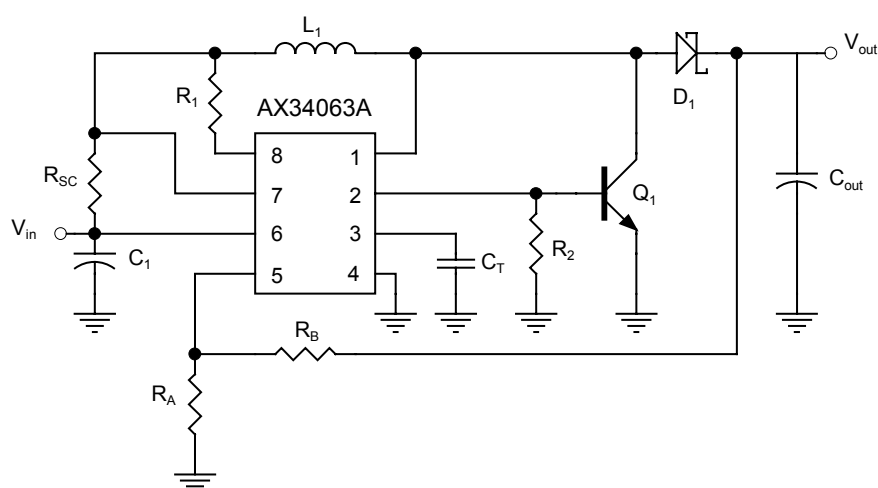


Fig.4 Step-Down Converter

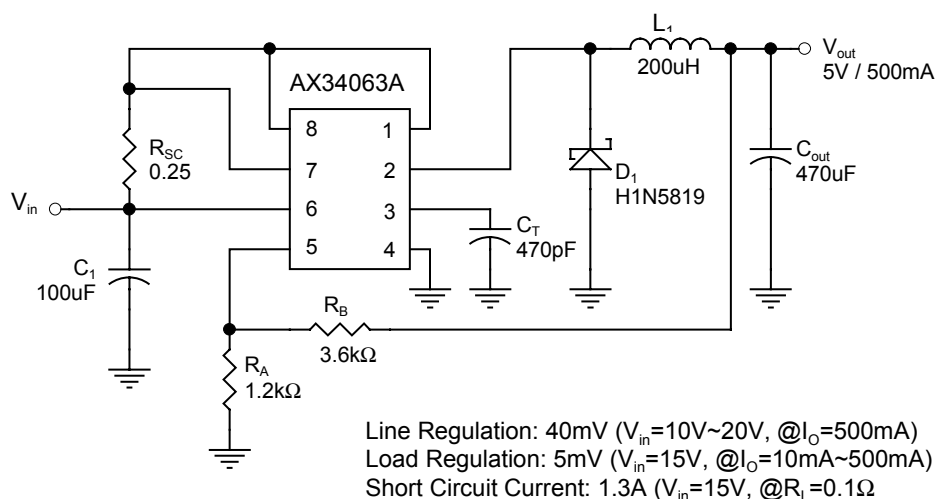


Fig.5 Step-Down Converter With External PNP Saturation Switch

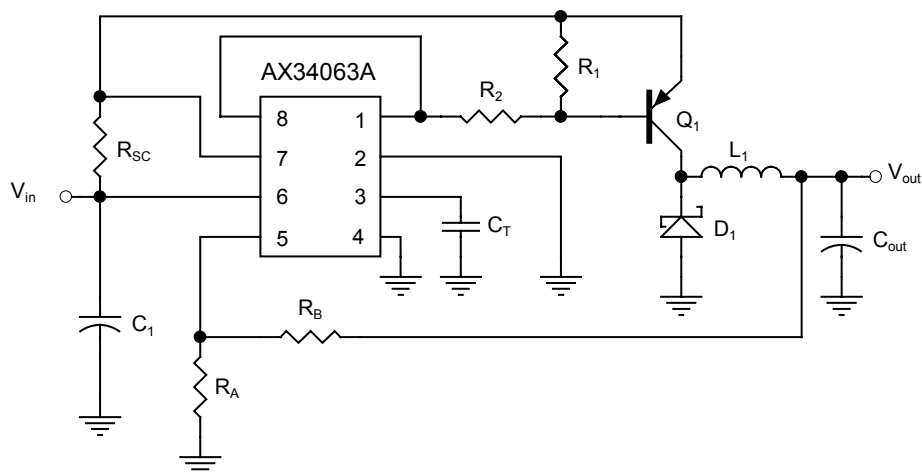


Fig.6 Voltage Inverting Converter

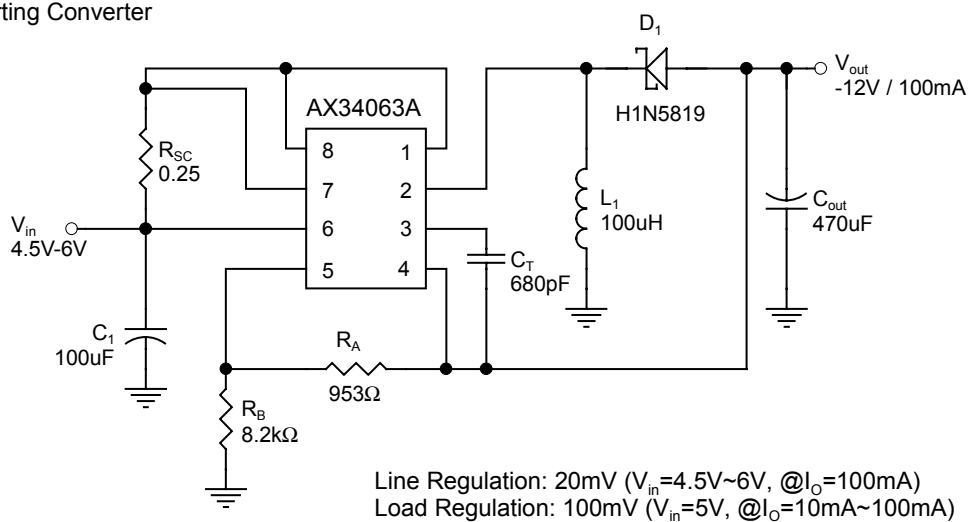
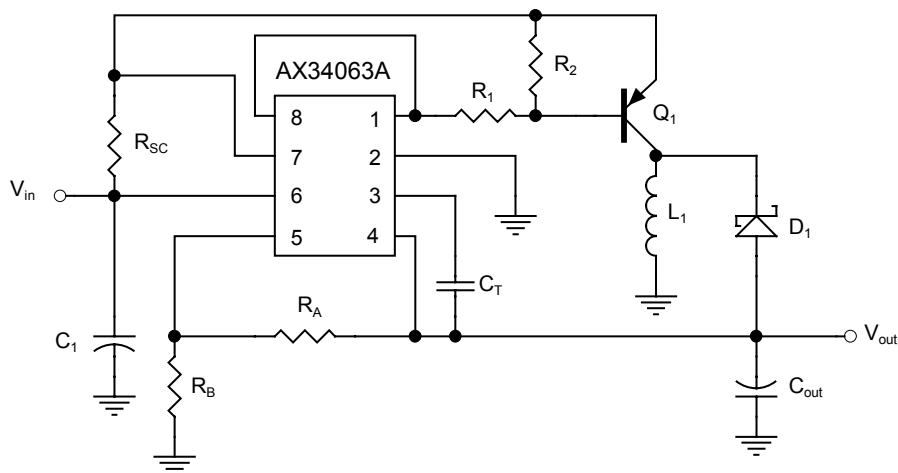
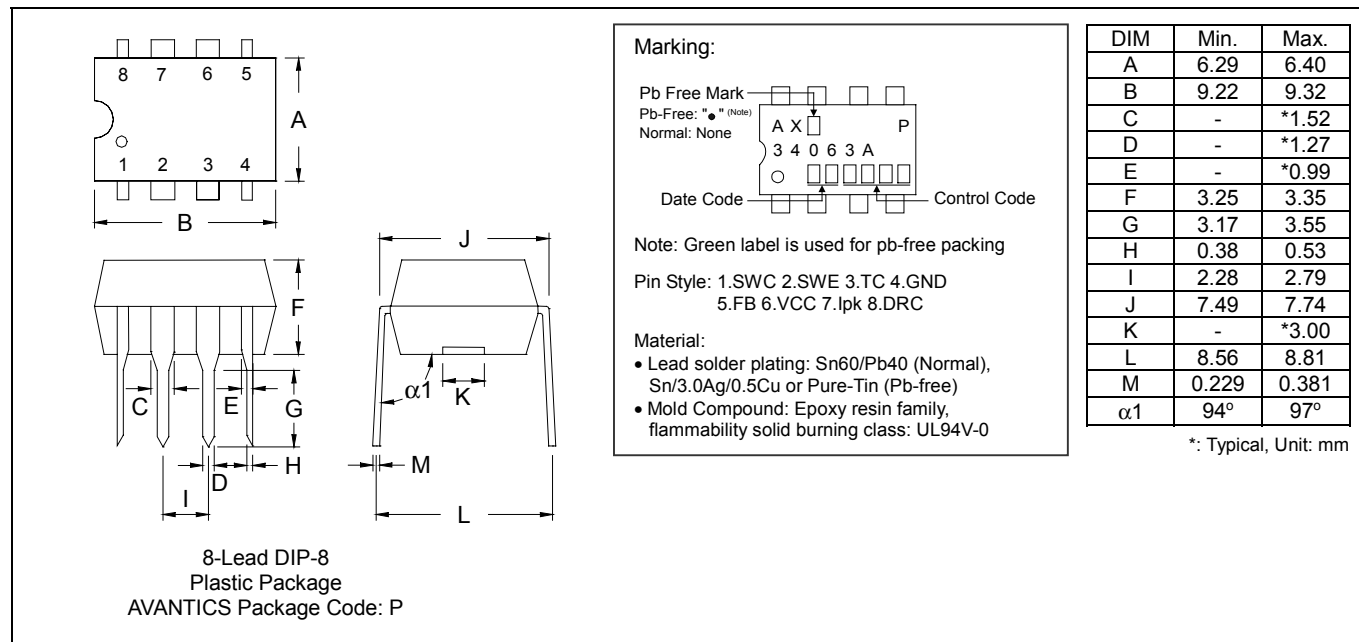


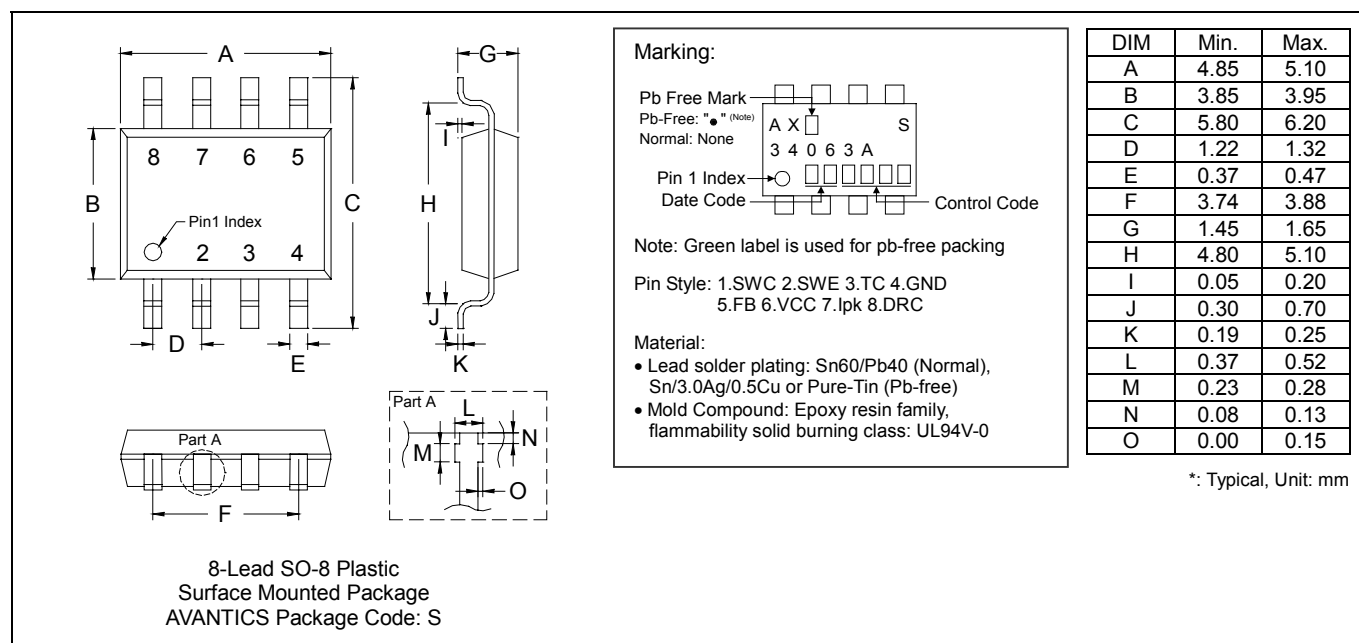
Fig.7 Voltage Inverting Converter With External PNP Saturation Switch



## DIP-8 Dimension



## SO-8 Dimension



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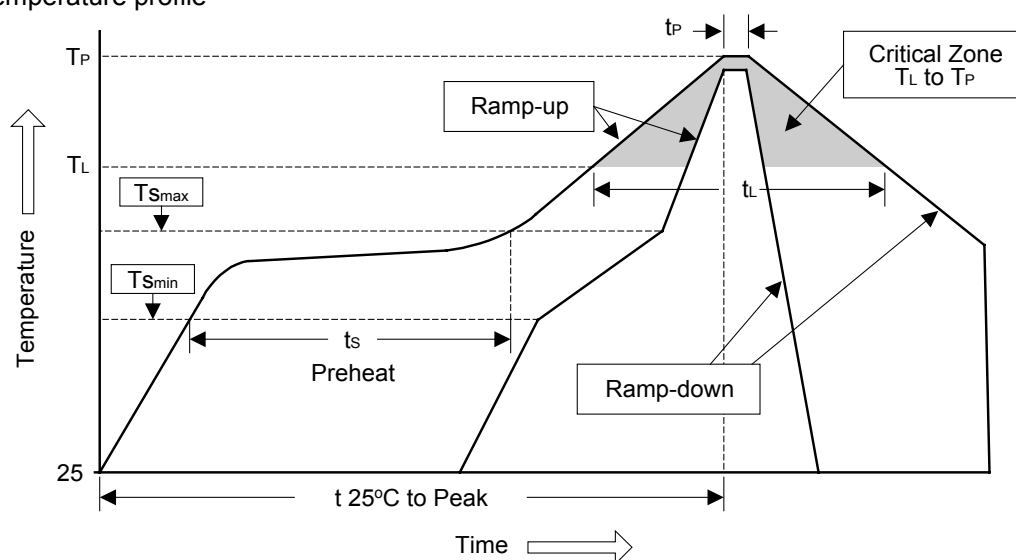
- AVANTICS Microelectronics Corp: No. 255, Cai Lun Rd. Zhangjiang Technology Industrial Park Pudong, Shanghai, China  
 Tel: 86-021-58955599 Fax: 86-021-58558038

## Soldering Methods for AVANTICS's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%

2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



| Profile Feature                                      | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|------------------------------------------------------|-------------------------|------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )              | <3°C/sec                | <3°C/sec         |
| Preheat                                              |                         |                  |
| - Temperature Min ( $T_{smin}$ )                     | 100°C                   | 150°C            |
| - Temperature Max ( $T_{smax}$ )                     | 150°C                   | 200°C            |
| - Time (min to max) ( $t_s$ )                        | 60~120 sec              | 60~180 sec       |
| $T_{smax}$ to $T_L$                                  |                         |                  |
| - Ramp-up Rate                                       | <3°C/sec                | <3°C/sec         |
| Time maintained above:                               |                         |                  |
| - Temperature ( $T_L$ )                              | 183°C                   | 217°C            |
| - Time ( $t_L$ )                                     | 60~150 sec              | 60~150 sec       |
| Peak Temperature ( $T_P$ )                           | 240°C +0/-5°C           | 260°C +0/-5°C    |
| Time within 5°C of actual Peak Temperature ( $t_P$ ) | 10~30 sec               | 20~40 sec        |
| Ramp-down Rate                                       | <6°C/sec                | <6°C/sec         |
| Time 25°C to Peak Temperature                        | <6 minutes              | <8 minutes       |

3. Flow (wave) soldering (solder dipping)

| Products         | Peak temperature | Dipping time |
|------------------|------------------|--------------|
| Pb devices.      | 245°C ±5°C       | 5sec ±1sec   |
| Pb-Free devices. | 260°C +0/-5°C    | 5sec ±1sec   |