

## APL5505/6/7

### 500mA Regulator + Reset IC

## Features

- Low Quiescent Current : 120uA (No load)
- Low Dropout Voltage : 300mV ( $V_{OUT}=3.3V@500mA$ )
- Fixed Output Voltage : 1.3V,1.4V,1.5V,1.6V, 1.7V,1.8V,1.9V, 2.0V,2.1V,2.2V,2.3V,2.4V, 2.5V,2.6V,2.7V, 2.8V,2.9V,3.0V,3.1V,3.2V, 3.3V,3.4V.
- Stable with 4.7uF Output Capacitor
- Stable with Aluminum , Tantalum or Ceramic Capacitors .
- Reverse Current Protection
- No Protection Diodes Needed
- Built in Thermal Protection
- Built in Current Limit Protection
- Controlled Short Circuit Current : 50mA
- Fast transient Response
- Short Setting Time
- SOP-8,TSSOP-8 and MSOP-8 Packages.
- Adjustment-free Reset Detection Voltage : 3.9V or 4.2V typ.
- Easy to Set Delay Time from Voltage Detection to Reset Release.
- Reset and  $\overline{\text{RESET}}$  output

## Applications

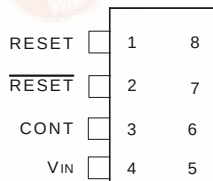
CD-ROM drive.

## General Description

The APL5505/6/7 is micropower, low noise , low drop-out regulators with a reset function (regulator input (APL5505) or specific voltage(APL5506/7) monitoring), and internal delay circuit, set to detect 3.9V or 4.2V. Operate from 3V to 6V input voltage and deliver up to 500mA. Typical output noise is just 180uV<sub>RMS</sub> with an external 0.01uF bypass capacitor connected in BP pin and the typical dropout voltage is only 300mV at 500mA loading. Design with an internal P-channel MOSFET pass transistor, the APL5505/6/7 maintains a low supply current, independent of the load current and dropout voltage. Other features include reverse current protection, thermal-shutdown protection, current limit protection to ensure specified output current and controlled short-circuit current. The APL5505/6/7 regulators come in miniature SOP-8, TSSOP-8 and MSOP-8 packages.

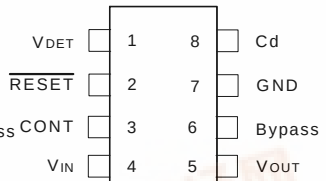
## Pin Configuration

SOP-8 Top View



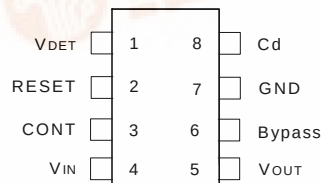
APL5505

SOP-8 Top View



APL5506

SOP-8 Top View



APL5507

# APL5505/6/7

## Ordering and Marking Information

|                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>APL5505/6/7 - □□□□-□□□□</p> <p>Lead Free Code<br/>Handling Code<br/>Temp. Range<br/>Package Code<br/>Voltage Code<br/>Detection Voltage</p> | <p>Package Code<br/>K : SOP-8      O : TSSOP-8<br/>X : MSOP-8<br/>Temp. Range<br/>C : 0 to 70 °C    I : -40 to 85 °C<br/>Handling Code<br/>TR : Tape &amp; Reel<br/>Voltage Code :<br/>13 : 1.3V ~ 34 : 3.4V<br/>Detection Voltage :<br/>A : 3.9V      B : 4.2V<br/>Lead Free Code<br/>L : Lead Free Device      Blank : Original Device</p> |
| <p>APL5505/6/7 :      <span style="border: 1px solid black; padding: 2px;">APL5505/6/7X<br/>XXXXX13</span></p>                                 | <p>X      - Detection Voltage<br/>XXXXX - Date Code , 13 - 1.3V</p>                                                                                                                                                                                                                                                                          |

## Pin Description

| PIN |                    | I/O | Description                                                                                                                                                                                              |
|-----|--------------------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No. | Name               |     |                                                                                                                                                                                                          |
| 1   | RESET(5505)        | O   | Input voltage detection output pin , high = $V_{IN} < V_S$ , low = $V_{IN} > V_S$                                                                                                                        |
|     | $V_{DET}$ (5506/7) | I   | Input pin of voltage detection.                                                                                                                                                                          |
| 2   | RESET(5507)        | O   | Input voltage detection output pin , high = $V_{IN} < V_S$ , low = $V_{IN} > V_S$                                                                                                                        |
|     | RESET(5506)        |     | Input voltage detection output pin , low = $V_{IN} < V_S$ , high = $V_{IN} > V_S$                                                                                                                        |
| 3   | CONT               | I   | Output voltage on/off-control pin, low = off , high = on.                                                                                                                                                |
| 4   | $V_{IN}$           | O   | Voltage supply input pin.                                                                                                                                                                                |
| 5   | $V_{OUT}$          | O   | Regulator output pin.                                                                                                                                                                                    |
| 6   | Bypass             |     | Bypass signal pin, connect a bypass capacitor to reduce output noise.                                                                                                                                    |
| 7   | GND                |     | GND pin                                                                                                                                                                                                  |
| 8   | Cd                 |     | Delay time capacitor pin, RESET pin output delay time can be set by the capacitance connected to the Cd pin. $t_{PLH} = 160000 \cdot C$ , $t_{PLH}$ : transmission delay time (s), C:capacitor value (F) |

## Absolute Maximum Ratings

| Symbol               | Parameter                                 | Rating             | Unit |
|----------------------|-------------------------------------------|--------------------|------|
| $V_{IN}$ , $V_{OUT}$ | Input Voltage or Out Voltage              | 6                  | V    |
| CONT                 | Shutdown Control Pin                      | 6                  | V    |
| $V_{det}$            | RESET pin supply voltage                  | 6                  | V    |
| $R_{TH,JA}$          | Thermal Resistance    Junction to Ambient | 210                | C/W  |
| $P_D$                | Power Dissipation                         | Internally Limited | W    |
| $T_J$                | Operating Junction Temperature            |                    |      |
|                      | Control Section                           | 0 to 125           | C    |
|                      | Power Transistor                          | 0 to 150           |      |
| $T_{STG}$            | Storage Temperature Range                 | -65 to +150        | C    |
| $T_L$                | Lead Temperature (Soldering, 10 second)   | 260                | C    |

## APL5505/6/7

### Electrical Characteristics

Unless otherwise noted these specifications apply over full temperature ,  $V_{IN}=5V$ ,  $C_{IN}=4.7\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $CONT=V_{IN}$ ,  $T_J=0$  to  $125^\circ C$  . Typical values refer to  $T_J=25^\circ C$  .

| Symbol       | Parameter                                                                         | Test Conditions                                            | APL5505/6/7 |           |             | Unit   |
|--------------|-----------------------------------------------------------------------------------|------------------------------------------------------------|-------------|-----------|-------------|--------|
|              |                                                                                   |                                                            | Min.        | Typ.      | Max.        |        |
| $V_{IN}$     | Input Voltage                                                                     |                                                            | 2.7         |           | 6           | V      |
| $V_{OUT}$    | Output Voltage                                                                    | $V_{OUT}+1.0V < V_{CC} < 6.0V$ , $0mA < I_{OUT} < I_{MAX}$ | $V_{OUT}-2$ | $V_{OUT}$ | $V_{OUT}+2$ | V      |
| $I_{LIMIT}$  | Circuit Current Limit                                                             | $V_{IN}=5V$                                                |             | 700       |             | mA     |
| $I_{SHORT}$  | Short Current                                                                     | $V_{OUT}=0V$                                               |             | 50        |             | mA     |
| $I_{OUT}$    | Load Current                                                                      |                                                            | 500         |           |             | mA     |
| $REG_{LINE}$ | Line Regulation                                                                   | $V_{OUT}+0.5V < V_{CC} < 6.0V$ , $0mA < I_{OUT} < I_{MAX}$ |             | 1         | 6           | mV     |
| $REG_{LOAD}$ | Load Regulation                                                                   | $V_{IN}=5V$ , $0mA < I_{OUT} < I_{MAX}$                    |             | 1         | 6           | mV     |
| $V_{DROP}$   | Dropout Voltage <sup>(Note)</sup><br>( $V_{OUT}(\text{Nominal})=3.0V$<br>Version) | $I_{OUT}=500mA$                                            |             | 300       | 450         | mV     |
| PSRR         | Ripple Rejection                                                                  | F 1kHz, 1Vpp at $V_{IN} = V_{OUT}+1.0V$                    | 45          | 55        |             | dB     |
| $I_Q$        | Quiescent Current                                                                 | No load                                                    |             | 120       |             | A      |
|              | Shutdown Supply Current                                                           | $CONT = low$<br>$I_{OUT}=0$ , $V_{CC}=6.0V$                |             | 80        |             | A      |
|              | Noise                                                                             | 100Hz<f<80kHz, typical load,<br>$C_{BP}=0.01 F$            |             | 180       |             | V      |
|              | Shutdown Recovery Delay                                                           | $C_{BP}=0.01 F$ , $C_{OUT}=1 F$ , no load<br>$CONT=L! H$   |             | 400       |             | s      |
| OTS          | Over Temperature                                                                  |                                                            |             | 150       |             | C      |
|              | Over Temperature                                                                  | Hysteresis                                                 |             | 10        |             | C      |
| TC           | Output Voltage Temperature Coefficient                                            |                                                            |             | 50        |             | ppm/ C |
| $C_{OUT}$    | Output Capacitor                                                                  |                                                            |             | 4.7       |             | F      |
|              | ESR                                                                               |                                                            | 0.02        | 0.1       | 1           | Ohm    |
|              | Shutdown Input Threshold                                                          | $V_{OUT}+1.0V < V_{IN} < 6.0V$                             |             | 1.6       |             | V      |
| $I_{CONT}$   | Shutdown input Bias current                                                       | $V_{CONT}=V_{IN}$                                          |             | 0.01      | 100         | nA     |
|              | Reverse Protection Threshold                                                      |                                                            |             | 11        | 50          | mV     |

Note: Dropout voltage definition :  $V_{IN}-V_{OUT}$  when  $V_{OUT}$  is 2% below the value of  $V_{OUT}$  for  $V_{IN} = V_{OUT} + 0.5V$

## APL5505/6/7

### Electrical Characteristics (Cont.)

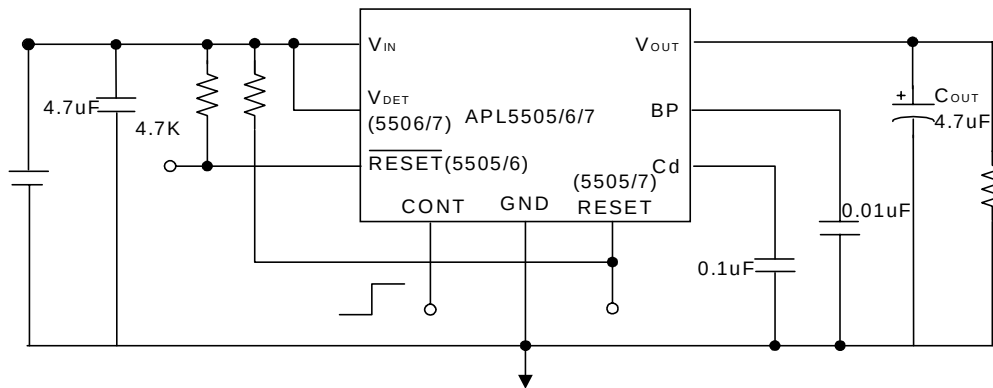
Unless otherwise noted these specifications apply over full temperature ,  $V_{IN}=5V$ ,  $C_{IN}=4.7\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $CONT=V_{IN}$ ,  $T_J=0$  to  $125^\circ C$  . Typical values refer to  $T_J=25^\circ C$  .

| Symbol            | Parameter                   | Test Conditions                                                       | APL5505/6/7 |      |      | Unit   |
|-------------------|-----------------------------|-----------------------------------------------------------------------|-------------|------|------|--------|
|                   |                             |                                                                       | Min.        | Typ. | Max. |        |
| RESET/RESET       |                             |                                                                       |             |      |      |        |
| VS                | Detection Voltage           | V <sub>IN</sub> = H! L (APL5505A)                                     |             | 3.90 |      | V      |
|                   |                             | V <sub>DET</sub> =H! L (APL5506A/5507A)                               |             |      |      |        |
|                   |                             | V <sub>IN</sub> = H! L (APL5505B)                                     |             | 4.2  |      |        |
|                   |                             | V <sub>DET</sub> =H! L(APL5506B/5507B)                                |             |      |      |        |
| ! VS/! T          | Vs Temperature Coefficient  | T <sub>J</sub> = -20~+80°C                                            |             | 100  |      | ppm/°C |
| ! VS              | Hysteresis Voltage          | V <sub>IN</sub> = V <sub>DET</sub> = H! L                             | 100         |      | 200  | mV     |
| V <sub>OL</sub>   | Low-level Output Voltage    | V <sub>IN</sub> = V <sub>DET</sub> = 3.9V, R <sub>L</sub> = 4.7k      |             | 30   | 60   | mV     |
| I <sub>OH</sub>   | Output Leakage Current      | V <sub>IN</sub> = V <sub>DET</sub> = 5V                               |             | 0.1  |      | uA     |
| I <sub>OL1</sub>  | Output Current1             | V <sub>IN</sub> = V <sub>DET</sub> =3.9V, R <sub>L</sub> = 0          | 5           |      |      | mA     |
| I <sub>OL2</sub>  | Output Current2             | V <sub>IN</sub> = V <sub>DET</sub> = 3.9V, R <sub>L</sub> = 0         | 3           |      |      | mA     |
| t <sub>PLH</sub>  | “H” Transmission Delay Time | C <sub>d</sub> = 0uF                                                  |             | 40   | 90   | us     |
| t <sub>PLH1</sub> | Reset Delay Time            | V <sub>IN</sub> = V <sub>DET</sub> = 3.7V! 5V, C <sub>d</sub> = 0.1uF |             | 16   |      | ms     |
| t <sub>PHL</sub>  | “L” Transmission Delay Time | C <sub>d</sub> = 0uF                                                  |             | 10   | 90   | us     |
| V <sub>OPL</sub>  | Threshold Operating Voltage | V <sub>OL</sub> = 0.4V                                                |             | 0.9  | 1.1  | V      |

## APL5505/6/7

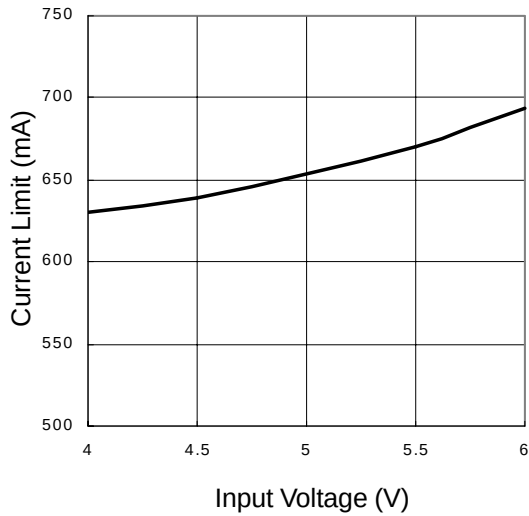
---

### Application Circuit

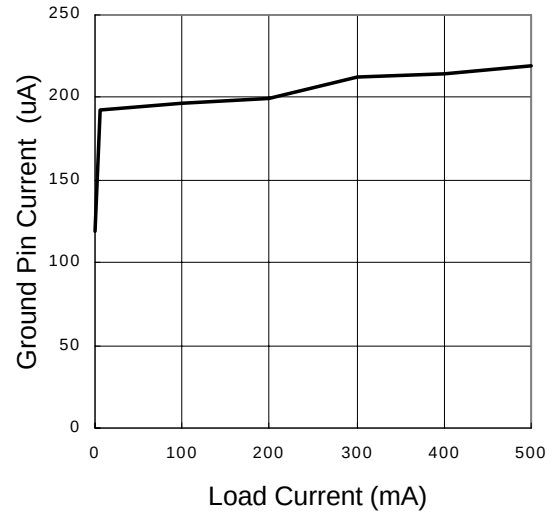


## Typical Characteristics

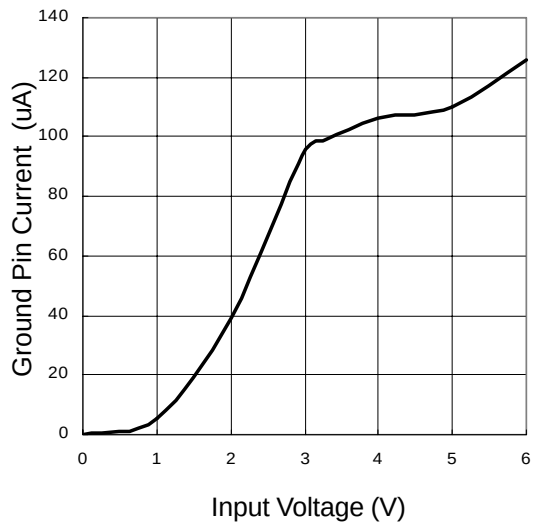
Current Limit vs. Input Voltage



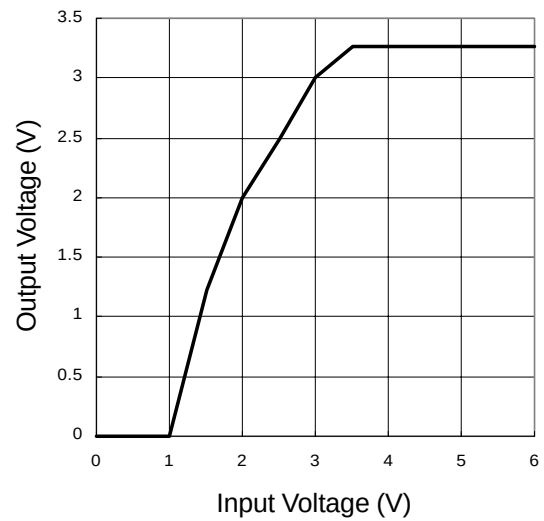
Ground Pin Current vs. Load Current



Ground Pin Current vs. Input Voltage

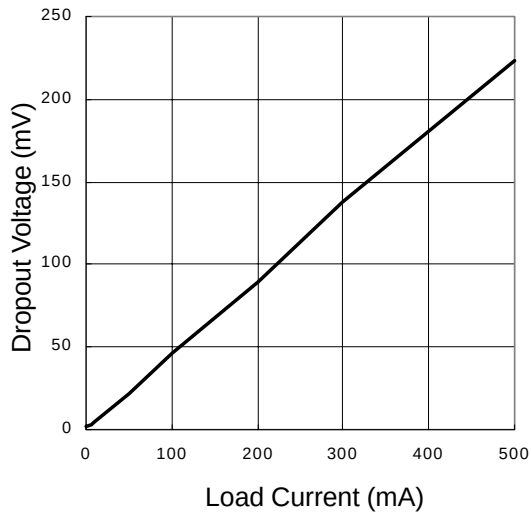


Input Voltage vs. Output Voltage

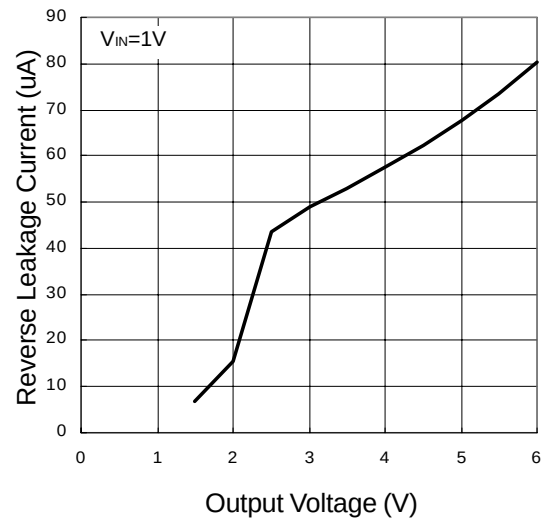


## Typical Characteristics

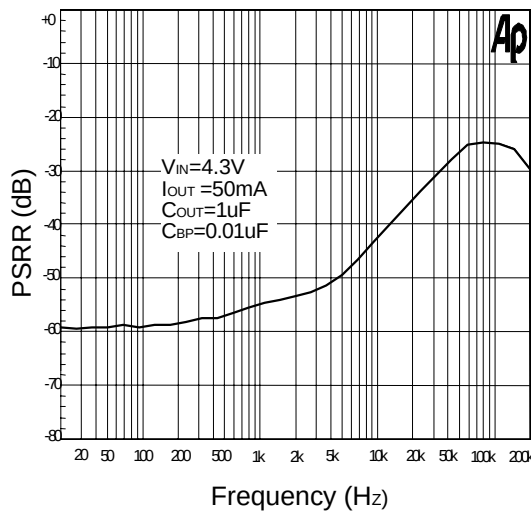
Dropout Voltage vs. Load Current



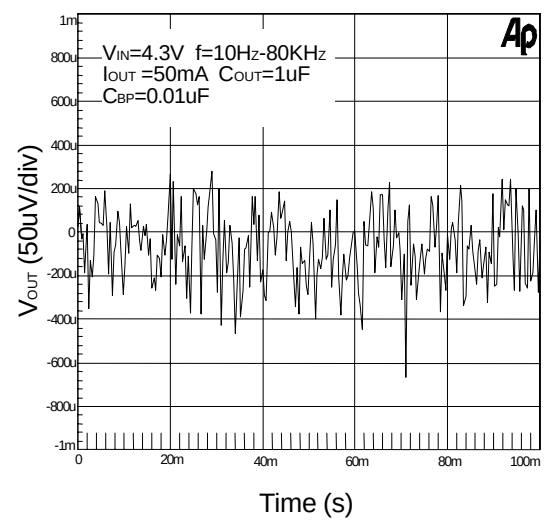
Reverse Leakage Current vs. Output Voltage



PSRR vs. Frequency

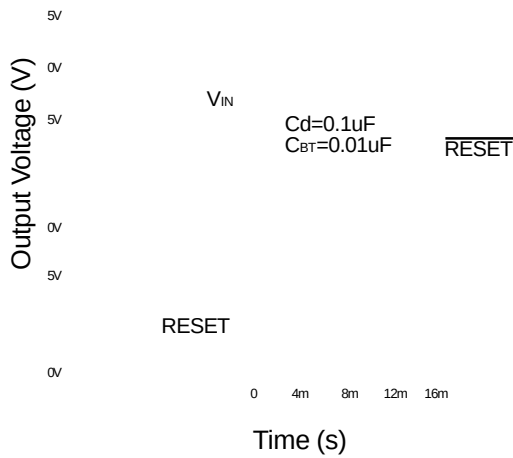


Output Noise

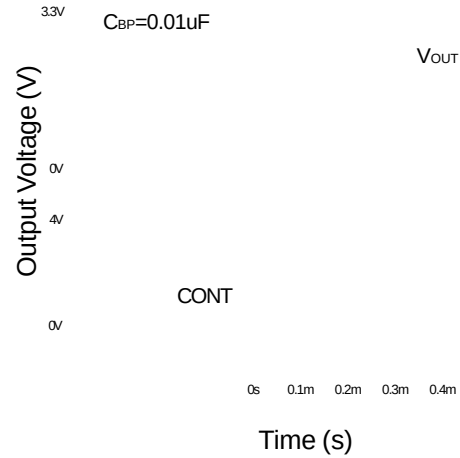


## Typical Characteristics

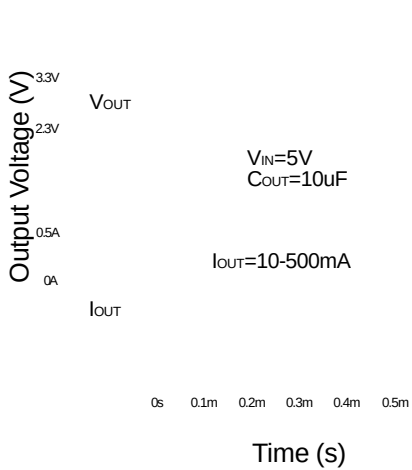
RESET and  $\overline{\text{RESET}}$  Delay Time



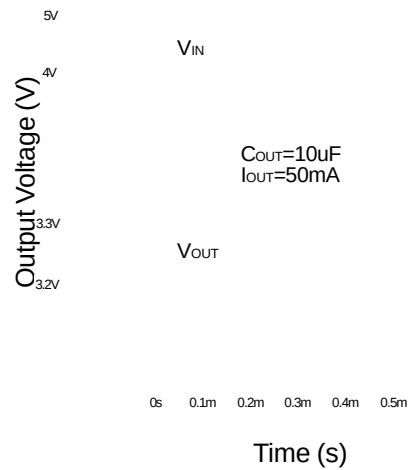
Shutdown Recovery Delay



Load-Transient Response

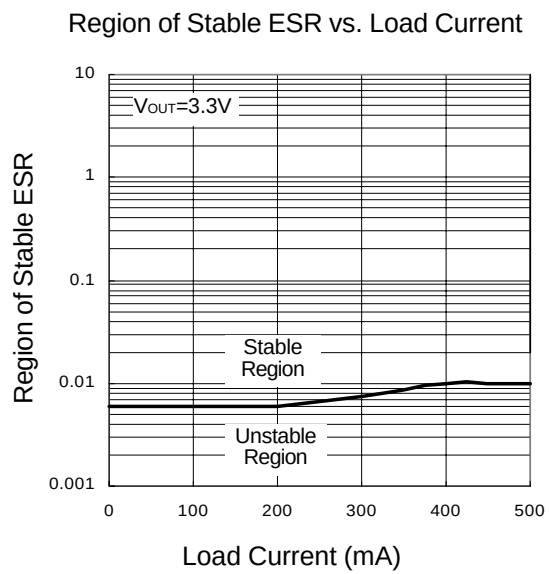


Line-Transient Response



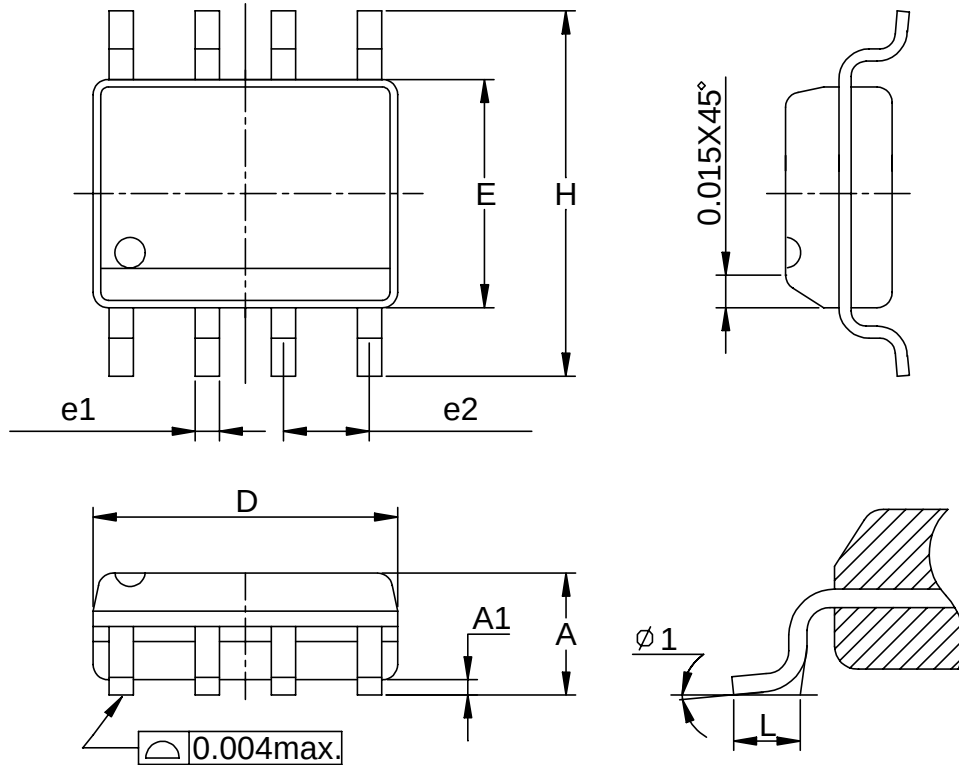


## Typical Characteristics



## Packaging Information

SOP-8 pin ( Reference JEDEC Registration MS-012)

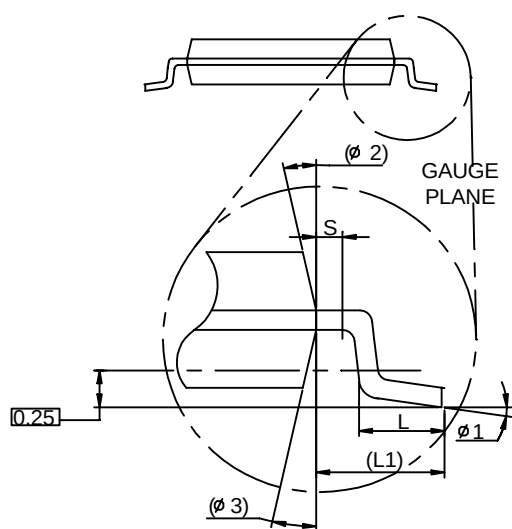
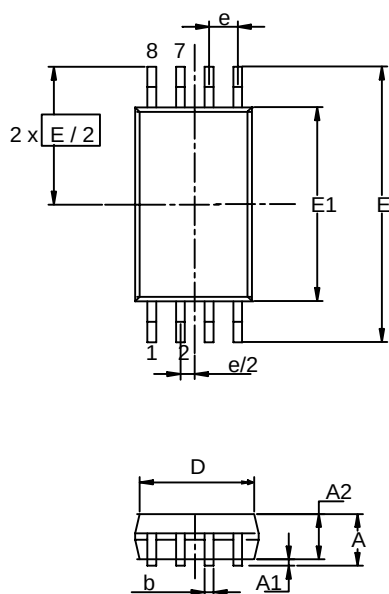


| Dim | Millimeters |      | Inches  |       |
|-----|-------------|------|---------|-------|
|     | Min.        | Max. | Min.    | Max.  |
| A   | 1.35        | 1.75 | 0.053   | 0.069 |
| A1  | 0.10        | 0.25 | 0.004   | 0.010 |
| D   | 4.80        | 5.00 | 0.189   | 0.197 |
| E   | 3.80        | 4.00 | 0.150   | 0.157 |
| H   | 5.80        | 6.20 | 0.228   | 0.244 |
| L   | 0.40        | 1.27 | 0.016   | 0.050 |
| e1  | 0.33        | 0.51 | 0.013   | 0.020 |
| e2  | 1.27BSC     |      | 0.50BSC |       |
| 1   | 8           |      | 8       |       |

# APL5505/6/7

## Packaging Information

TSSOP

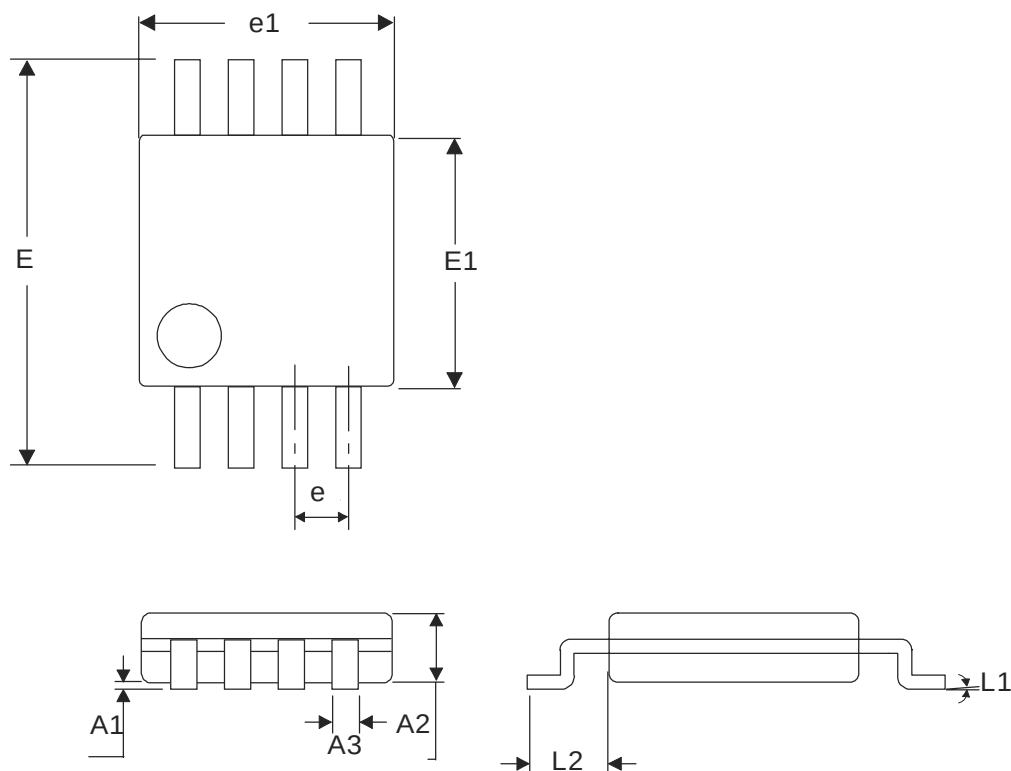


| Dim | Millimeters |      | Inches    |       |
|-----|-------------|------|-----------|-------|
|     | Min.        | Max. | Min.      | Max.  |
| A   |             | 1.2  |           | 0.047 |
| A1  | 0.00        | 0.15 | 0.000     | 0.006 |
| A2  | 0.80        | 1.05 | 0.031     | 0.041 |
| b   | 0.19        | 0.30 | 0.007     | 0.012 |
| D   | 2.9         | 3.1  | 0.114     | 0.122 |
| e   | 0.65 BSC    |      | 0.026 BSC |       |
| E   | 6.40 BSC    |      | 0.252 BSC |       |
| E1  | 4.30        | 4.50 | 0.169     | 0.177 |
| L   | 0.45        | 0.75 | 0.018     | 0.030 |
| L1  | 1.0 REF     |      | 0.039 REF |       |
| R   | 0.09        |      | 0.004     |       |
| R1  | 0.09        |      | 0.004     |       |
| S   | 0.2         |      | 0.008     |       |
| 1   | 0           | 8    | 0         | 8     |
| 2   | 12 REF      |      | 12 REF    |       |
| 3   | 12 REF      |      | 12 REF    |       |

# APL5505/6/7

## Packaging Information

MSOP

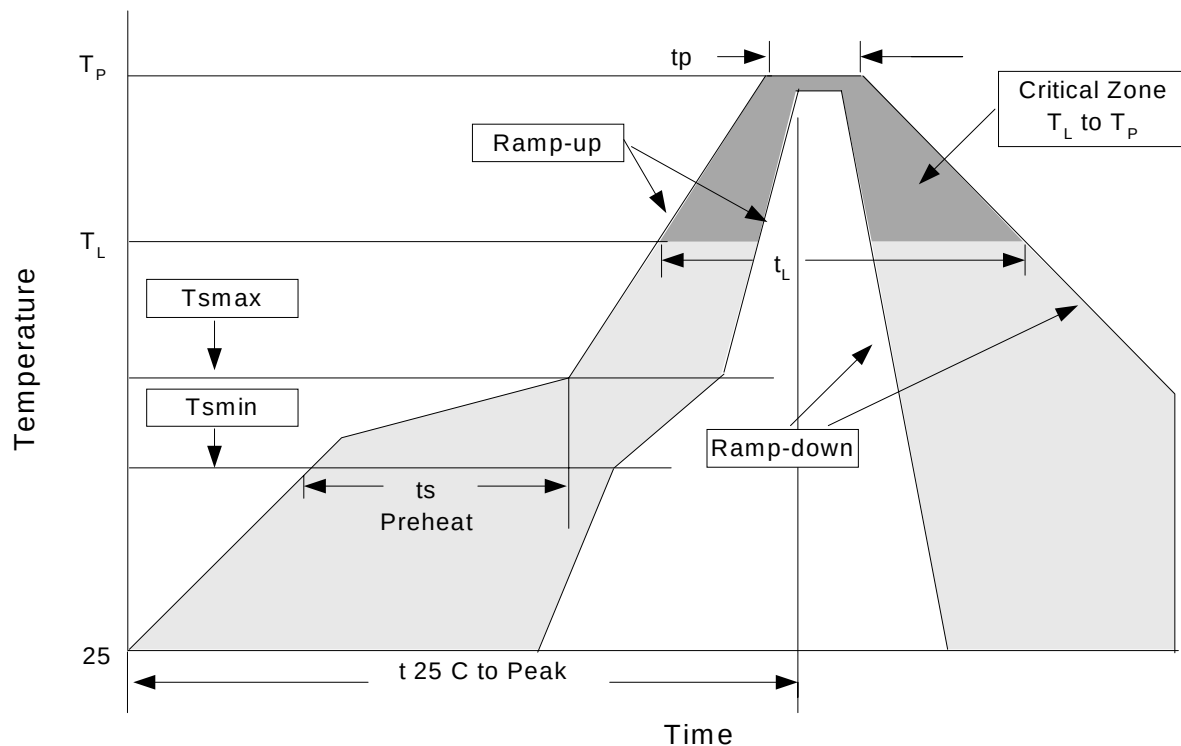


| Dim | Millimeters |      | Inches     |        |
|-----|-------------|------|------------|--------|
|     | Min.        | Max. | Min.       | Max.   |
| A1  | 0.06        | 0.15 | 0.002      | 0.006  |
| A2  | 0.86 TYP    |      | 0.34 TYP   |        |
| A3  | 0.25        | 0.4  | 0.01       | 0.0126 |
| e   | 0.65 TYP    |      | 0.0256 TYP |        |
| e1  | 2.90        | 3.1  | 0.114      | 0.124  |
| E   | 4.8         | 5.0  | 0.189      | 0.197  |
| E1  | 2.90        | 3.1  | 0.169      | 0.177  |
| L1  | 0.25 REF    |      | 0.039 REF  |        |
| L2  | 0.0375 REF  |      | 0.953 REF  |        |

## Physical Specifications

|                    |                                                                      |
|--------------------|----------------------------------------------------------------------|
| Terminal Material  | Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn |
| Lead Solderability | Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.         |

## Reflow Condition (IR/Convection or VPR Reflow)



## Classification Reflow Profiles

| Profile Feature                                     | Sn-Pb Eutectic Assembly |               | Pb-Free Assembly |               |
|-----------------------------------------------------|-------------------------|---------------|------------------|---------------|
|                                                     | Large Body              | Small Body    | Large Body       | Small Body    |
| Average ramp-up rate ( $T_L$ to $T_P$ )             | 3 C/second max.         |               | 3 C/second max.  |               |
| Preheat                                             |                         |               |                  |               |
| - Temperature Min ( $T_{min}$ )                     | 100 C                   |               | 150 C            |               |
| - Temperature Max ( $T_{max}$ )                     | 150 C                   |               | 200 C            |               |
| - Time (min to max)( $t_s$ )                        | 60-120 seconds          |               | 60-180 seconds   |               |
| $T_{max}$ to $T_L$                                  |                         |               | 3 C/second max   |               |
| - Ramp-up Rate                                      |                         |               |                  |               |
| $T_{max}$ to $T_L$                                  |                         |               |                  |               |
| - Temperature( $T_L$ )                              | 183 C                   |               | 217 C            |               |
| - Time ( $t_L$ )                                    | 60-150 seconds          |               | 60-150 seconds   |               |
| Peak Temperature( $T_P$ )                           | 225 +0/-5 C             | 240 +0/-5 C   | 245 +0/-5 C      | 250 +0/-5 C   |
| Time within 5 C of actual Peak Temperature( $t_p$ ) | 10-30 seconds           | 10-30 seconds | 10-30 seconds    | 20-40 seconds |
| Ramp-down Rate                                      | 6 C/second max.         |               | 6 C/second max.  |               |
| Time 25 C to Peak Temperature                       | 6 minutes max.          |               | 8 minutes max.   |               |

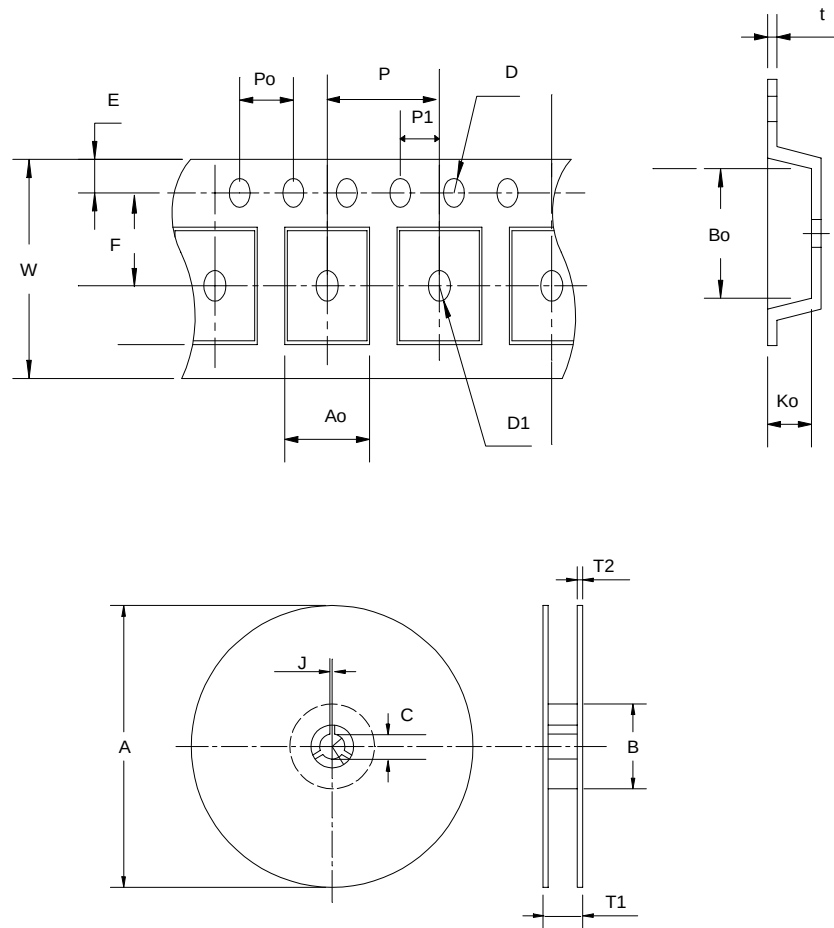
Note: All temperatures refer to topside of the package. Measured on the body surface.

## APL5505/6/7

### Reliability test program

| Test item     | Method              | Description                |
|---------------|---------------------|----------------------------|
| SOLDERABILITY | MIL-STD-883D-2003   | 245 C , 5 SEC              |
| HOLT          | MIL-STD-883D-1005.7 | 1000 Hrs Bias @ 125 C      |
| PCT           | JESD-22-B, A102     | 168 Hrs, 100 % RH , 121 C  |
| TST           | MIL-STD-883D-1011.9 | -65 C ~ 150 C , 200 Cycles |
| ESD           | MIL-STD-883D-3015.7 | VHBM > 2KV, VMM > 200V     |
| Latch-Up      | JESD 78             | 10ms , $I_{tr}$ > 100mA    |

### Carrier Tape



## Reel Dimensions

| Application | A       | B         | C              | J       | T1       | T2      | W       | P       | E         |
|-------------|---------|-----------|----------------|---------|----------|---------|---------|---------|-----------|
| SOP- 8      | 330 1   | 62 +1.5   | 12.75+<br>0.15 | 2 0.5   | 12.4 0.2 | 2 0.2   | 12 0.3  | 8 0.1   | 1.75 0.1  |
|             | F       | D         | D1             | Po      | P1       | Ao      | Bo      | Ko      | t         |
|             | 5.5 1   | 1.55 +0.1 | 1.55+ 0.25     | 4.0 0.1 | 2.0 0.1  | 6.4 0.1 | 5.2 0.1 | 2.1 0.1 | 0.3 0.013 |
| Application | A       | B         | C              | J       | T1       | T2      | W       | P       | E         |
| TSSOP-8     | 330 1   | 62 +1.5   | 12.75+<br>0.15 | 2 + 0.5 | 12.4 0.2 | 2 0.2   | 12 0.3  | 8 0.1   | 1.75 0.1  |
|             | F       | D         | D1             | Po      | P1       | Ao      | Bo      | Ko      | t         |
|             | 5.5 0.1 | 1.5 + 0.1 | 1.5 + 0.1      | 4.0 0.1 | 2.0 0.1  | 7.0 0.1 | 3.6 0.3 | 1.6 0.1 | 0.3 0.013 |

(mm)

## Cover Tape Dimensions

| Application | Carrier Width | Cover Tape Width | Devices Per Reel |
|-------------|---------------|------------------|------------------|
| SOP- 8      | 12            | 9.3              | 2500             |
| TSSOP- 8    | 12            | 9.3              | 2500             |

## Customer Service

Anpec Electronics Corp.

Head Office :

5F, No. 2 Li-Hsin Road, SBIP,

Hsin-Chu, Taiwan, R.O.C.

Tel : 886-3-5642000

Fax : 886-3-5642050

Taipei Branch :

7F, No. 137, Lane 235, Pac Chiao Rd.,

Hsin Tien City, Taipei Hsien, Taiwan, R. O. C.

Tel : 886-2-89191368

Fax : 886-2-89191369

