

Single Output Hall Effect Latch

❖ GENERAL DESCRIPTION

MA7020/B is an integrated Hall effect latched sensor designed for electronic commutation of brush-less DC motor applications. The device is using HV BCD process includes an on-chip Hall voltage generator for magnetic sensing, a comparator that amplifies the Hall voltage, and a Schmitt trigger to provide switching hysteresis for noise rejection, and open-collector output. An internal band-gap regulator is used to provide temperature compensated supply voltage for internal circuits and allows a wide operating supply range.

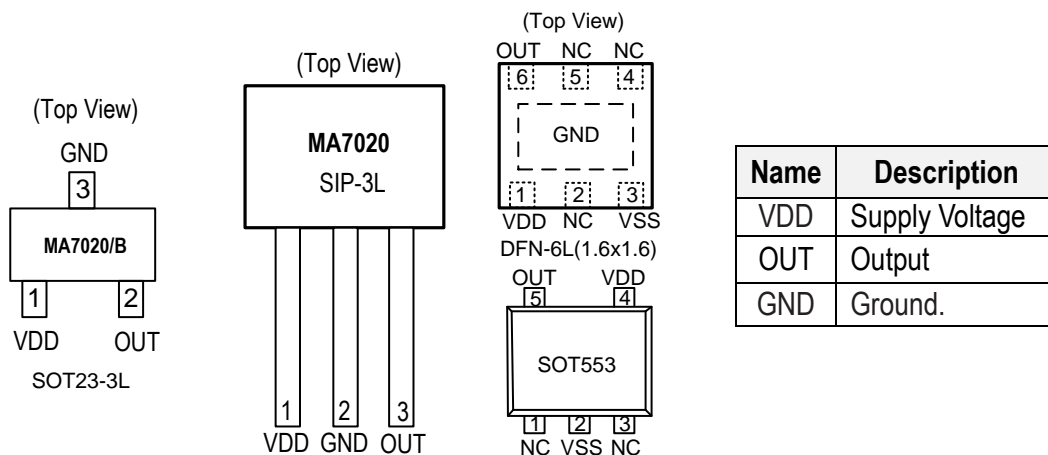
If a magnetic flux density larger than threshold B_{op} , OUT is turned on(low). The output state is held until a magnetic flux density reversal falls below B_{rp} causing OUT to be turned off (high).

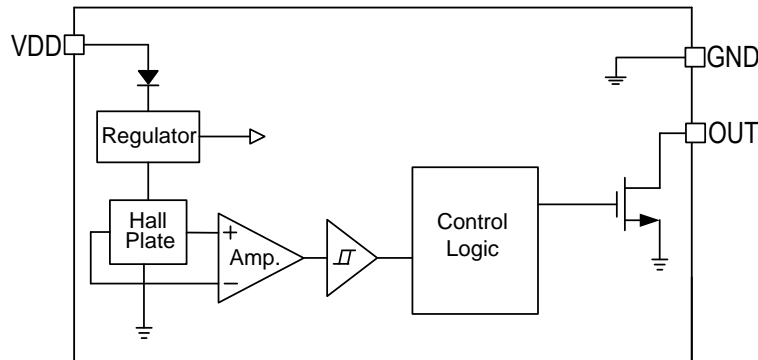
❖ FEATURES

- 2.5V to 26V DC operation voltage
- Temperature compensation
- Wide operating voltage range
- Open-Drain pre-driver
- 25mA maximum sinking output current.
- Packages: SOT23-3L , SIP-3L(TO-92S) , DFN1.6x1.6-6L , SOT553.

❖ PIN ASSIGNMENT

The package of MA7020/B , the pin assignment is given by:



❖ BLOCK DIAGRAM

❖ RDER/MARKING INFORMATION

| Order Information | Top Marking (SIP-3L) |
|--|---|
| MA7020X XXX Blank:MA7020 B: MA7020B Device Name Packing P3: SIP-3L Blank:Bag A :SOT23-3L A : Taping B553:SOT553 D1:DFN1.6x1.6-6L | 7020 → Part number YYWWX → ID code:internal WW:01~52 Year:13=2013 |
| Top Marking (DFN/SOT553) | Top Marking (SOT23-3L) |
| DFN 1.6X1.6 SOT553 X: Internal H 6 H6YW W: 01~26(A~Z) Y WX 27~52(a~z) Y: 9 = 2019 | H X Y W X → ID Code: Internal Week: 01~26(A~Z) 27~52(a~z) Year : 7 = 2017 →H6=MA7020, H7=MA7020B |

❖ ABSOLUTE MAXIMUM RATINGS (at T_A=25°C)

| Characteristics | Symbol | Rating | Unit |
|---|------------------|-------------|-------|
| Supply Voltage | V _{CC} | 28 | V |
| Reverse VCC Polarity Voltage | V _{RCC} | -28 | V |
| Magnetic Flux Density | B | Unlimited | Gauss |
| Output Current | I _O | 25 | mA |
| Power Dissipation(SIP3 /SOT23,DFN,SOT553) | P _D | 550/230 | mW |
| Storage Temperature Range | T _{STG} | -65 to +150 | °C |
| Thermal Resistance from Junction to case (SIP3 /SOT23,DFN) | θ _{JC} | 49/410 | °C/W |
| Thermal Resistance from Junction to ambient (SIP3 /SOT23,DFN) | θ _{JA} | 227/543 | °C/W |
| Junction temperature | T _J | 150 | °C |
| Operating temperature | T _O | -40 to 120 | °C |
| Magnetic signal input frequency(note1) | F _{sw} | 0~3 | kHz |

Note1 : Not subject to production test, verified by design/characterization.

❖ ELECTRICAL CHARACTERISTICS

 ($V_{DD} = 12V$, $T_A = +25^\circ C$, unless otherwise noted.)

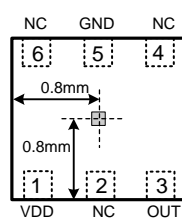
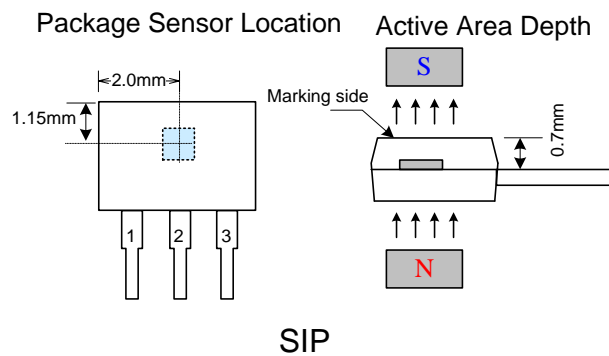
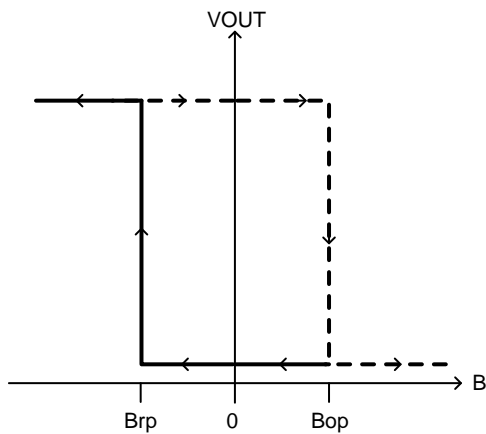
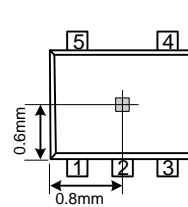
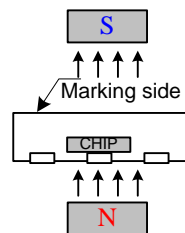
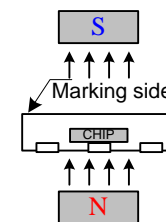
| Characteristics | Symbol | Conditions | Min | Typ | Max | Units |
|---------------------------|---------------|----------------|----------------|-------|-----|---------|
| Supply Voltage | V_{DD} | Operating | 2.5 | - | 26 | V |
| Supply current | I_{DD} | Operating | - | 2.0 | 3.0 | mA |
| Output Leakage Current | I_{OFF} | $V_{OUT}=12V$ | - | < 0.1 | 10 | μA |
| Output Saturation Voltage | $V_{ds(sat)}$ | $I_{OUT}=20mA$ | - | 0.3 | - | V |
| Chopper frequency(note2) | fosc | | | 50 | | kHz |
| Magnetic | | | (1mT=10 Gauss) | | | |
| Operate Point | B_{OP} | | 5 | 28 | 60 | Gauss |
| Release Point | B_{RP} | | -60 | -28 | -5 | Gauss |
| Hysteresis | B_{HYS} | | - | 56 | - | Gauss |

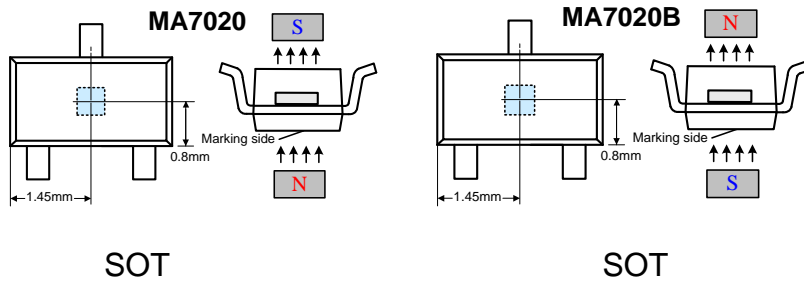
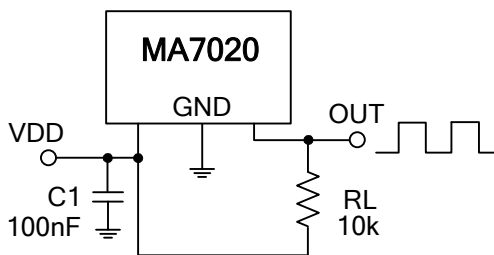
Note2: Not subject to production test, verified by design/characterization.

Driver output vs. magnetic pole(SIP3)

| Characteristics | Test Conditions | OUT |
|-----------------|-----------------|------|
| North pole | $B < B_{rp}$ | High |
| South pole | $B > B_{op}$ | Low |

Note: The magnetic pole is applied facing the branded side of the SIP3 package

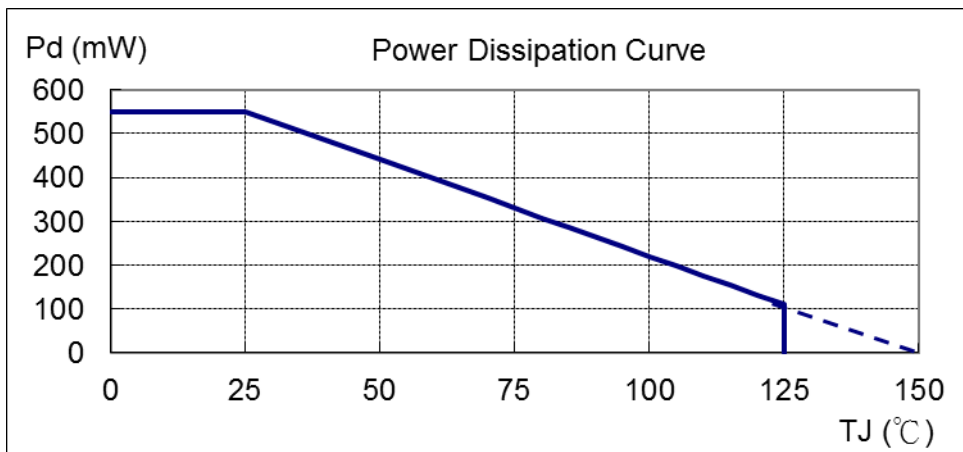

DFN

SOT553



❖ TEST CIRCUIT


Note : C1 is for power stabilization and to strengthen the noise immunity. RL is the pull-up resistor.

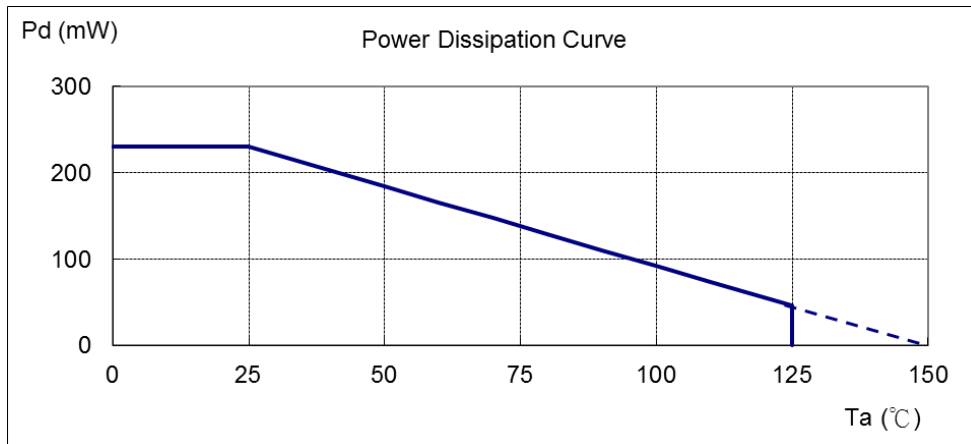
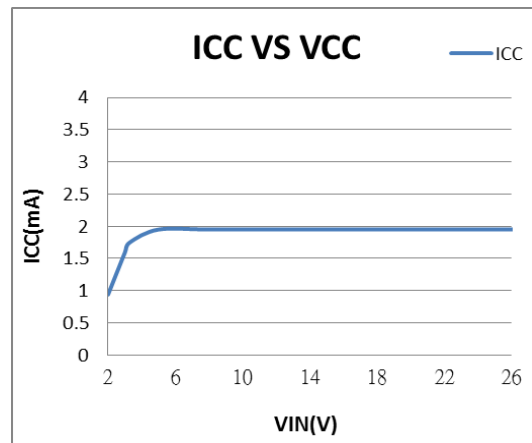
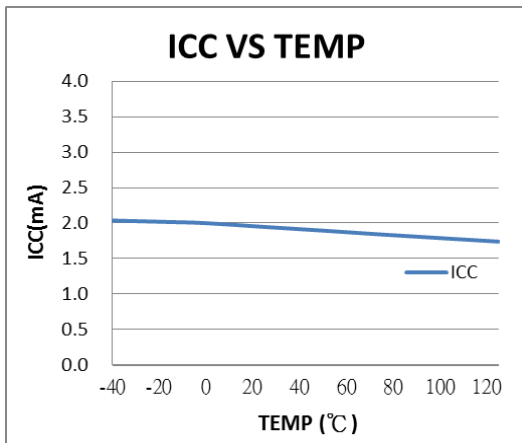
❖ PERFORMANCE CHARACTERISTICS
SIP-3L

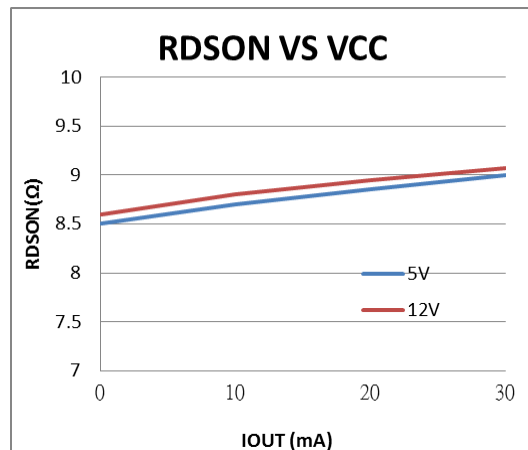
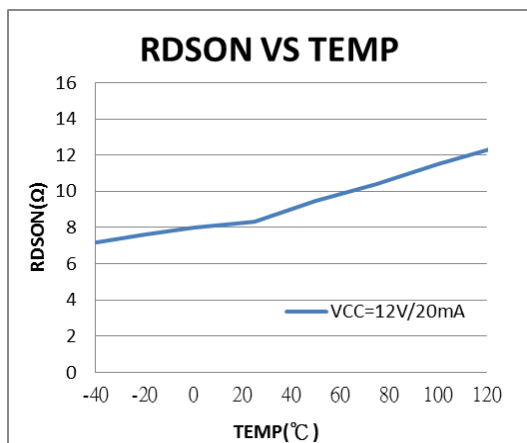
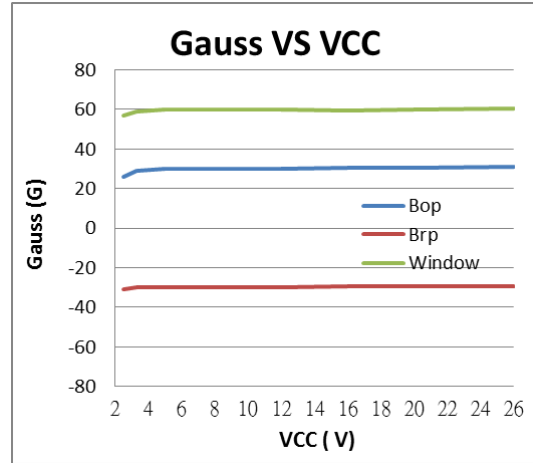
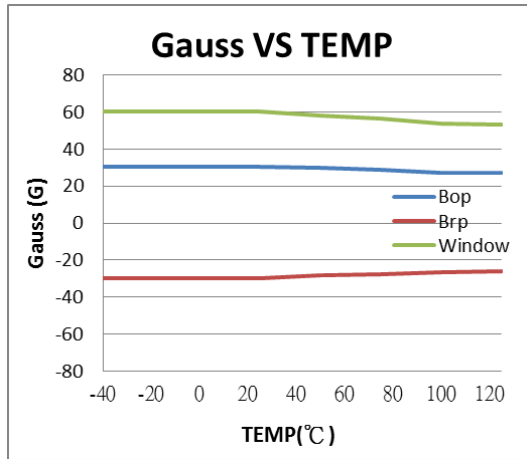
| | | | | | | | | | |
|---------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| T_A (°C) | 25 | 50 | 60 | 70 | 80 | 85 | 90 | 95 | 100 |
| Pd (mW) | 550 | 440 | 396 | 352 | 308 | 286 | 264 | 242 | 220 |
| T_A (°C) | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 150 |
| Pd (mW) | 198 | 176 | 154 | 132 | 110 | 88 | 66 | 44 | 0 |

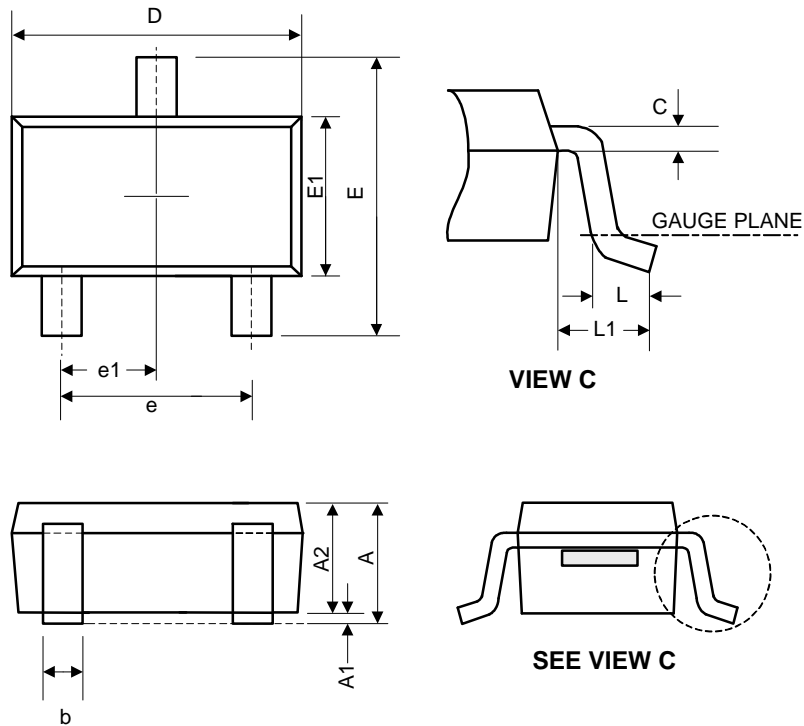


SOT/DFN

| | | | | | | | | | |
|---------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| T_A (°C) | 25 | 50 | 60 | 70 | 80 | 85 | 90 | 95 | 100 |
| Pd (mW) | 230 | 230 | 184 | 166 | 147 | 129 | 120 | 110 | 101 |
| T_A (°C) | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 150 |
| Pd (mW) | 83 | 74 | 64 | 55 | 46 | 37 | 27 | 18 | 0 |

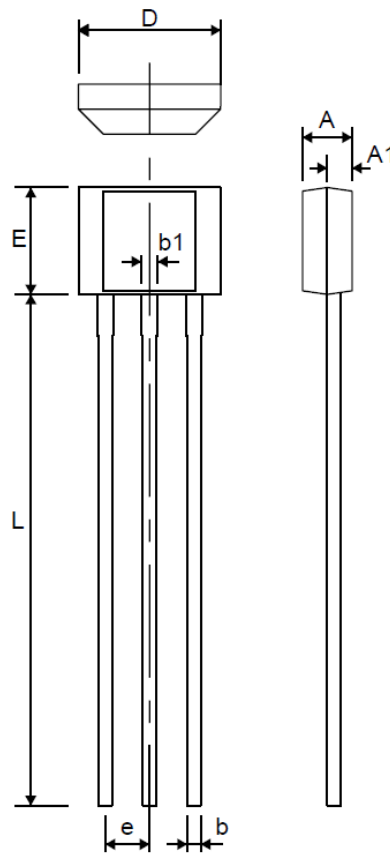

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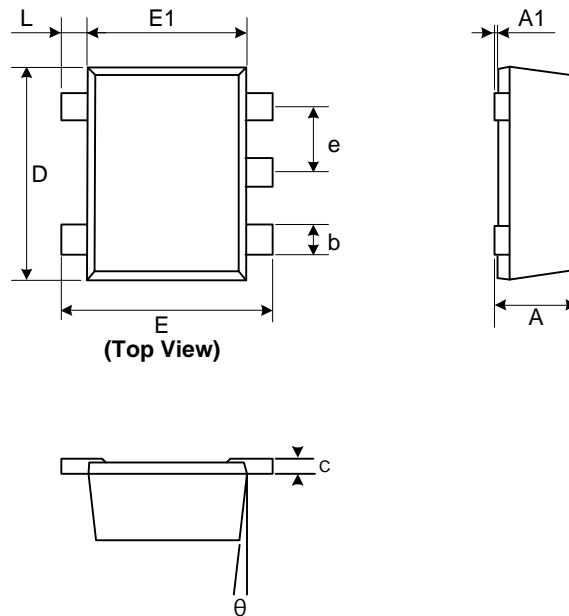
❖ PACKAGE OUTLINES
(1) SOT-23-3L


| Symbol | Dimensions in Millimeters | | | Dimensions in Inches | | |
|--------|---------------------------|------|------|----------------------|-------|-------|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | - | - | 1.45 | - | - | 0.057 |
| A1 | 0 | 0.08 | 0.15 | - | - | 0.006 |
| A2 | 0.9 | 1.1 | 1.3 | 0.035 | 0.043 | 0.051 |
| b | 0.3 | 0.4 | 0.5 | 0.012 | 0.016 | 0.02 |
| C | 0.08 | 0.15 | 0.22 | 0.003 | 0.006 | 0.009 |
| D | 2.7 | 2.9 | 3.1 | 0.106 | 0.114 | 0.122 |
| E | 2.6 | 2.8 | 3 | 0.102 | 0.11 | 0.118 |
| E1 | 1.4 | 1.6 | 1.8 | 0.055 | 0.063 | 0.071 |
| L | 0.3 | 0.45 | 0.6 | 0.012 | 0.018 | 0.024 |
| L1 | 0.5 | 0.6 | 0.7 | 0.02 | 0.024 | 0.028 |
| e | 1.9 BSC | | | 0.075 BSC | | |
| e1 | 0.95 BSC | | | 0.037 BSC | | |

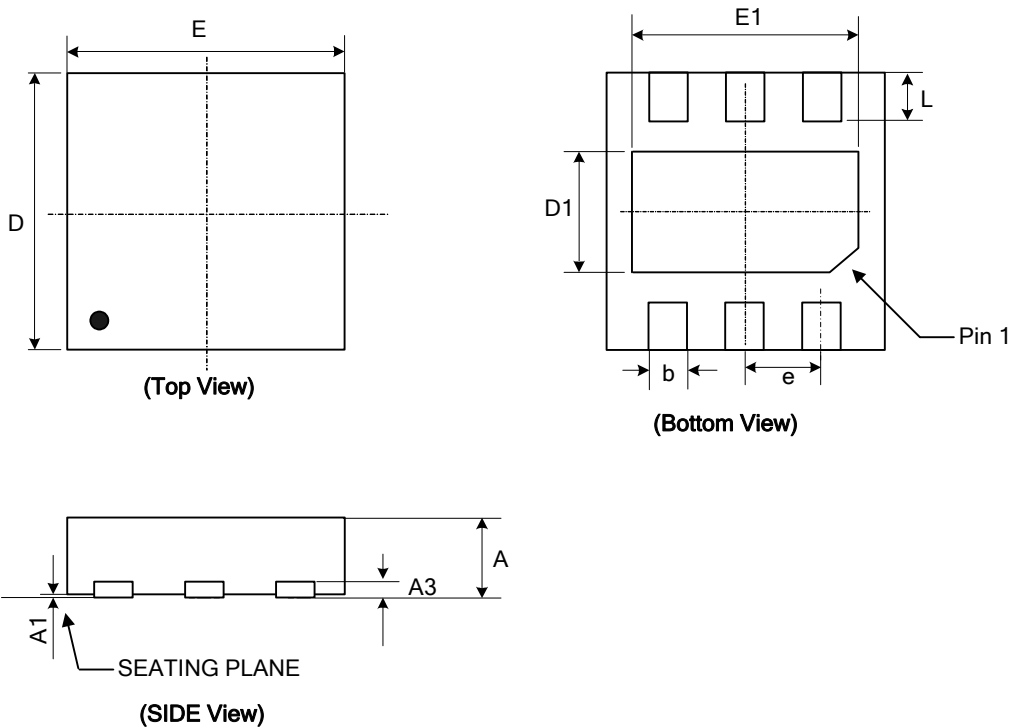
JEDEC outline: NA

2. SIP-3L


| Symbol | Dimensions in Millimeters | | | Dimensions in Inches | | |
|--------|---------------------------|-------|-------|----------------------|-------|-------|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | 1.20 | 1.48 | 1.76 | 0.047 | 0.058 | 0.069 |
| A1 | 0.75 REF. | | | 0.030 REF. | | |
| b | 0.33 | 0.38 | 0.43 | 0.013 | 0.015 | 0.017 |
| b1 | 0.40 | 0.45 | 0.50 | 0.016 | 0.018 | 0.020 |
| D | 3.90 | 4.10 | 4.30 | 0.154 | 0.161 | 0.169 |
| e1 | 1.27 BSC | | | 0.050 BSC | | |
| E | 2.80 | 3.00 | 3.20 | 0.110 | 0.118 | 0.126 |
| L | 13.60 | 14.60 | 15.60 | 0.535 | 0.575 | 0.614 |

3. SOT553


| Symbol | Dimensions in Millimeters | | | Dimensions in Inches | | |
|--------|---------------------------|-------|-------|----------------------|-------|-------|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | 0.525 | 0.563 | 0.600 | 0.021 | 0.022 | 0.024 |
| A1 | 0.000 | 0.025 | 0.050 | 0.000 | 0.001 | 0.002 |
| e | 0.450 | 0.500 | 0.550 | 0.018 | 0.020 | 0.022 |
| c | 0.090 | 0.125 | 0.160 | 0.004 | 0.005 | 0.006 |
| D | 1.500 | 1.600 | 1.700 | 0.059 | 0.063 | 0.067 |
| b | 0.170 | 0.220 | 0.270 | 0.007 | 0.009 | 0.011 |
| E1 | 1.100 | 1.200 | 1.300 | 0.043 | 0.047 | 0.051 |
| E | 1.500 | 1.600 | 1.700 | 0.059 | 0.063 | 0.067 |
| L | 0.100 | 0.200 | 0.300 | 0.004 | 0.008 | 0.012 |
| θ | 7° REF. | | | 7° REF. | | |

4. DFN1.6X1.6-6L


| Symbol | Dimensions in Millimeters | | | Dimensions in Inches | | |
|--------|---------------------------|------|------|----------------------|-------|-------|
| | Min. | Nom. | Max. | Min. | Nom. | Max. |
| A | 0.4 | 0.45 | 0.5 | 0.016 | 0.018 | 0.020 |
| A1 | 0 | 0.02 | 0.05 | 0.000 | 0.001 | 0.002 |
| A3 | 0.15 REF. | | | 0.006 REF. | | |
| b | 0.15 | 0.2 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 1.55 | 1.6 | 1.65 | 0.061 | 0.063 | 0.065 |
| D1 | 0.65 | 0.7 | 0.75 | 0.026 | 0.028 | 0.030 |
| E | 1.55 | 1.6 | 1.65 | 0.061 | 0.063 | 0.065 |
| E1 | 1.25 | 1.3 | 1.35 | 0.049 | 0.051 | 0.053 |
| e | 0.5 BSC. | | | 0.020 BSC. | | |
| L | 0.2 | 0.25 | 0.3 | 0.008 | 0.010 | 0.012 |