

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- SGS-THOMSON PREFERRED SALESTYPE
- HIGH VOLTAGE CAPABILITY
- VERY HIGH SWITCHING SPEED
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- LOW BASE-DRIVE REQUIREMENTS

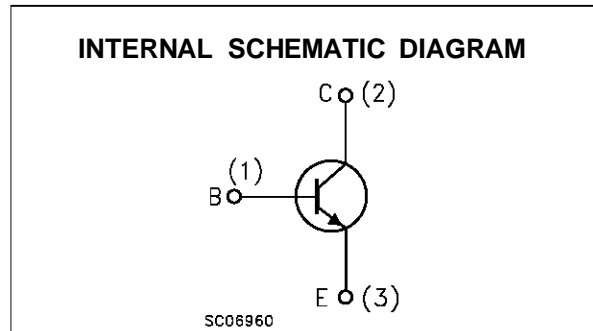
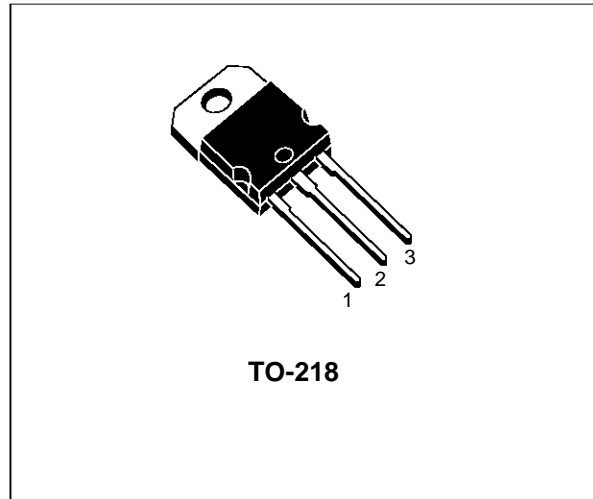
**APPLICATIONS:**

- SWITCH MODE POWER SUPPLIES
- MOTOR CONTROL

**DESCRIPTION**

The BUF420A is manufactured using High Voltage Multi Epitaxial Planar technology for high switching speeds and high voltage capacity. It use a Cellular Emitter structure with planar edge termination to enhance switching speeds while maintaining a wide RBSOA.

The BUF series is designed for use in high-frequency power supplies and motor control applications.


**ABSOLUTE MAXIMUM RATINGS**

| Symbol    | Parameter                                      | Value      | Unit |
|-----------|--|------------|------|
| $V_{CEV}$ | Collector-Emitter Voltage ( $V_{BE} = -1.5$ V) | 1000       | V    |
| $V_{CEO}$ | Collector-Emitter Voltage ( $I_B = 0$ )        | 450        | V    |
| $V_{EBO}$ | Emitter-Base Voltage ( $I_C = 0$ )             | 7          | V    |
| $I_C$     | Collector Current                              | 30         | A    |
| $I_{CM}$  | Collector Peak Current ( $t_p < 5$ ms)         | 60         | A    |
| $I_B$     | Base Current                                   | 6          | A    |
| $I_{BM}$  | Base Peak Current ( $t_p < 5$ ms)              | 9          | A    |
| $P_{tot}$ | Total Dissipation at $T_c = 25$ °C             | 200        | W    |
| $T_{stg}$ | Storage Temperature                            | -65 to 150 | °C   |
| $T_j$     | Max Operation Junction Temperature             | 150        | °C   |

# BUF420A

## THERMAL DATA

|                       |                                  |     |      |      |
|-----------------------|----------------------------------|-----|------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-Case | Max | 0.63 | °C/W |
|-----------------------|----------------------------------|-----|------|------|

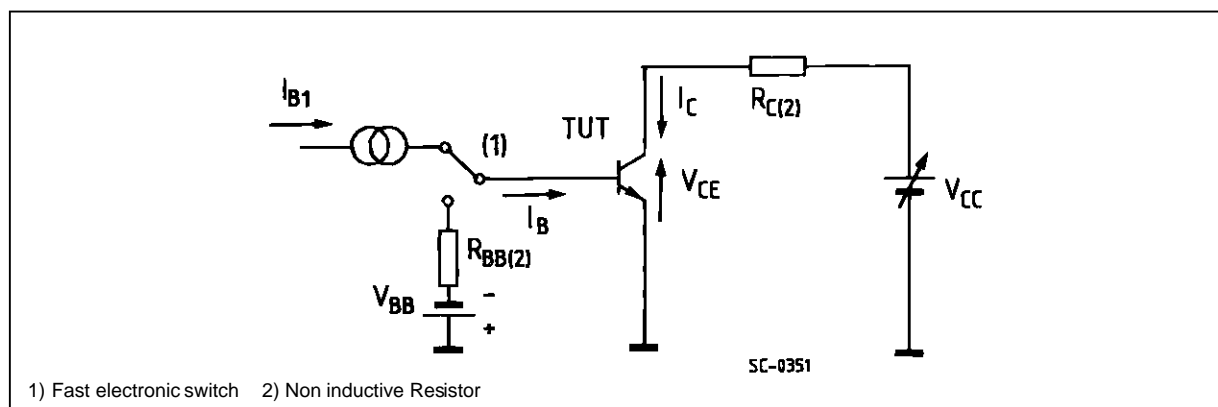
## ELECTRICAL CHARACTERISTICS (T<sub>case</sub> = 25 °C unless otherwise specified)

| Symbol   | Parameter   | Test Conditions  | Min.      | Typ.                | Max.             | Unit                 |
|--|---|--|-----------|---------------------|------------------|----------------------|
| I <sub>CER</sub>                                   | Collector Cut-off Current (R <sub>BE</sub> = 5 Ω) | V <sub>CE</sub> = V <sub>CEV</sub><br>V <sub>CE</sub> = V <sub>CEV</sub> T <sub>c</sub> = 100 °C   |           |                     | 0.2<br>1         | mA<br>mA             |
| I <sub>CEV</sub>                                   | Collector Cut-off Current (I <sub>B</sub> = 0)    | V <sub>CE</sub> = V <sub>CEV</sub> V <sub>BE</sub> = -1.5 V<br>V <sub>CE</sub> = V <sub>CEV</sub> V <sub>BE</sub> = -1.5 V T <sub>c</sub> = 100 °C   |           |                     | 0.2<br>1         | mA<br>mA             |
| I <sub>EBO</sub>                                   | Emitter Cut-off Current (I <sub>C</sub> = 0)      | V <sub>BE</sub> = 5 V  |           |                     | 1                | mA                   |
| V <sub>CEO(sus)*</sub>                             | Collector-Emitter Sustaining Voltage              | I <sub>C</sub> = 200 mA L = 25 mH  | 450       |                     |                  | V                    |
| V <sub>EBO</sub>                                   | Emitter Base Voltage (I <sub>C</sub> = 0)         | I <sub>E</sub> = 50 mA   | 7         |                     |                  | V                    |
| V <sub>CE(sat)*</sub>                              | Collector-Emitter Saturation Voltage              | I <sub>C</sub> = 10 A I <sub>B</sub> = 1 A<br>I <sub>C</sub> = 10 A I <sub>B</sub> = 1 A T <sub>c</sub> = 100 °C<br>I <sub>C</sub> = 20 A I <sub>B</sub> = 2 A<br>I <sub>C</sub> = 20 A I <sub>B</sub> = 2 A T <sub>c</sub> = 100 °C |           | 0.8<br>0.5          | 2.8<br>2         | V<br>V<br>V<br>V     |
| V <sub>BE(sat)*</sub>                              | Base-Emitter Saturation Voltage                   | I <sub>C</sub> = 10 A I <sub>B</sub> = 1 A<br>I <sub>C</sub> = 10 A I <sub>B</sub> = 1 A T <sub>c</sub> = 100 °C<br>I <sub>C</sub> = 20 A I <sub>B</sub> = 2 A<br>I <sub>C</sub> = 20 A I <sub>B</sub> = 2 A T <sub>c</sub> = 100 °C |           | 0.9<br>1.1          | 1.5<br>1.5       | V<br>V<br>V<br>V     |
| di <sub>c</sub> /dt                                | Rate of rise on-state Collector Current           | V <sub>CC</sub> = 300 V R <sub>C</sub> = 0 t <sub>p</sub> = 3 μs<br>I <sub>B1</sub> = 1.5 A T <sub>j</sub> = 25 °C<br>I <sub>B1</sub> = 1.5 A T <sub>j</sub> = 100 °C<br>I <sub>B1</sub> = 6 A T <sub>j</sub> = 100 °C               | 70<br>150 | 100                 |                  | A/μs<br>A/μs<br>A/μs |
| V <sub>CE(3μs)</sub>                               | Collector-Emitter Dynamic Voltage                 | V <sub>CC</sub> = 300 V R <sub>C</sub> = 60 Ω<br>I <sub>B1</sub> = 1.5 A T <sub>j</sub> = 25 °C<br>I <sub>B1</sub> = 1.5 A T <sub>j</sub> = 100 °C   |           | 2.1                 | 8                | V<br>V               |
| V <sub>CE(5μs)</sub>                               | Collector-Emitter Dynamic Voltage                 | V <sub>CC</sub> = 300 V R <sub>C</sub> = 60 Ω<br>I <sub>B1</sub> = 1.5 A T <sub>j</sub> = 25 °C<br>I <sub>B1</sub> = 1.5 A T <sub>j</sub> = 100 °C   |           | 1.1                 | 4                | V<br>V               |
| t <sub>s</sub><br>t <sub>f</sub><br>t <sub>c</sub> | Storage Time<br>Fall Time<br>Cross Over Time      | I <sub>C</sub> = 10 A V <sub>CC</sub> = 50 V<br>V <sub>BB</sub> = -5 V R <sub>BB</sub> = 0.6 Ω<br>V <sub>clamp</sub> = 400 V I <sub>B1</sub> = 0.5 A<br>L = 0.25 mH  |           | 1<br>0.05<br>0.08   |                  | μs<br>μs<br>μs       |
| t <sub>s</sub><br>t <sub>f</sub><br>t <sub>c</sub> | Storage Time<br>Fall Time<br>Cross Over Time      | I <sub>C</sub> = 10 A V <sub>CC</sub> = 50 V<br>V <sub>BB</sub> = -5 V R <sub>BB</sub> = 0.6 Ω<br>V <sub>clamp</sub> = 400 V I <sub>B1</sub> = 1 A<br>L = 0.25 mH T <sub>j</sub> = 100 °C  |           |                     | 2<br>0.1<br>0.18 | μs<br>μs<br>μs       |
| V <sub>CEW</sub>                                   | Maximum Collector Emitter Voltage without Snubber | I <sub>C</sub> = 10 A V <sub>CC</sub> = 50 V<br>V <sub>BB</sub> = -5 V R <sub>BB</sub> = 0.6 Ω<br>V <sub>clamp</sub> = 400 V I <sub>B1</sub> = 1 A<br>L = 0.25 mH T <sub>j</sub> = 125 °C  | 500       |                     |                  | V                    |
| t <sub>s</sub><br>t <sub>f</sub><br>t <sub>c</sub> | Storage Time<br>Fall Time<br>Cross Over Time      | I <sub>C</sub> = 10 A V <sub>CC</sub> = 50 V<br>V <sub>BB</sub> = 0 R <sub>BB</sub> = 0.15 Ω<br>V <sub>clamp</sub> = 400 V I <sub>B1</sub> = 1 A<br>L = 0.25 mH  |           | 1.5<br>0.04<br>0.07 |                  | μs<br>μs<br>μs       |

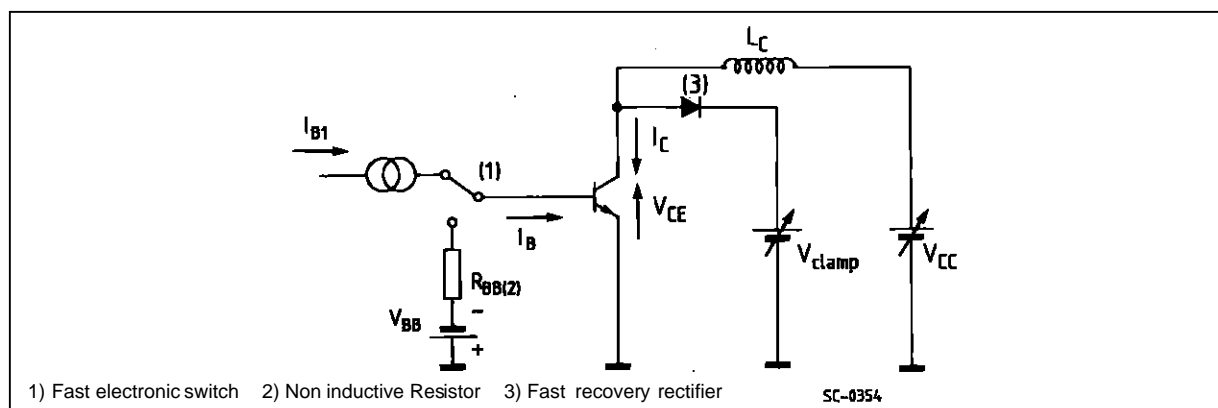
**ELECTRICAL CHARACTERISTICS** (continued)

| Symbol    | Parameter   | Test Conditions   |   | Min. | Typ. | Max. | Unit          |
|-----------|---|---|---|------|------|------|---------------|
| $t_s$     | Storage Time                                      | $I_C = 10\text{ A}$   | $V_{CC} = 50\text{ V}$  |      |      | 3    | $\mu\text{s}$ |
| $t_f$     | Fall Time   | $V_{BB} = 0$  | $R_{BB} = 0.15\ \Omega$   |      |      | 0.15 | $\mu\text{s}$ |
| $t_c$     | Cross Over Time                                   | $V_{clamp} = 400\text{ V}$<br>$L = 0.25\text{ mH}$  | $I_{B1} = 1\text{ A}$<br>$T_j = 100^\circ\text{C}$  |      |      | 0.25 | $\mu\text{s}$ |
| $V_{CEW}$ | Maximum Collector Emitter Voltage without Snubber | $I_C = 10\text{ A}$<br>$V_{BB} = 0$<br>$V_{clamp} = 400\text{ V}$<br>$L = 0.25\text{ mH}$                       | $V_{CC} = 50\text{ V}$<br>$R_{BB} = 0.15\ \Omega$<br>$I_{B1} = 1\text{ A}$<br>$T_j = 125^\circ\text{C}$ | 500  |      |      | V             |
| $t_s$     | Storage Time                                      | $I_C = 20\text{ A}$   | $V_{CC} = 50\text{ V}$  |      | 2.2  |      | $\mu\text{s}$ |
| $t_f$     | Fall Time   | $V_{BB} = -5\text{ V}$  | $R_{BB} = 0.6\ \Omega$  |      | 0.06 |      | $\mu\text{s}$ |
| $t_c$     | Cross Over Time                                   | $V_{clamp} = 400\text{ V}$<br>$L = 0.12\text{ mH}$  | $I_{B1} = 4\text{ A}$   |      | 0.12 |      | $\mu\text{s}$ |
| $t_s$     | Storage Time                                      | $I_C = 20\text{ A}$   | $V_{CC} = 50\text{ V}$  |      |      | 3.5  | $\mu\text{s}$ |
| $t_f$     | Fall Time   | $V_{BB} = -5\text{ V}$  | $R_{BB} = 0.6\ \Omega$  |      |      | 0.12 | $\mu\text{s}$ |
| $t_c$     | Cross Over Time                                   | $V_{clamp} = 400\text{ V}$<br>$L = 0.12\text{ mH}$  | $I_{B1} = 4\text{ A}$<br>$T_j = 125^\circ\text{C}$  |      |      | 0.3  | $\mu\text{s}$ |
| $V_{CEW}$ | Maximum Collector Emitter Voltage without Snubber | $I_{C\text{Woff}} = 30\text{ A}$<br>$V_{BB} = -5\text{ V}$<br>$L = 0.08\text{ mH}$<br>$T_j = 125^\circ\text{C}$ | $V_{CC} = 50\text{ V}$<br>$R_{BB} = 0.6\ \Omega$<br>$I_{B1} = 6\text{ A}$                               | 400  |      |      | V             |

Turn-on Switching Test Circuit

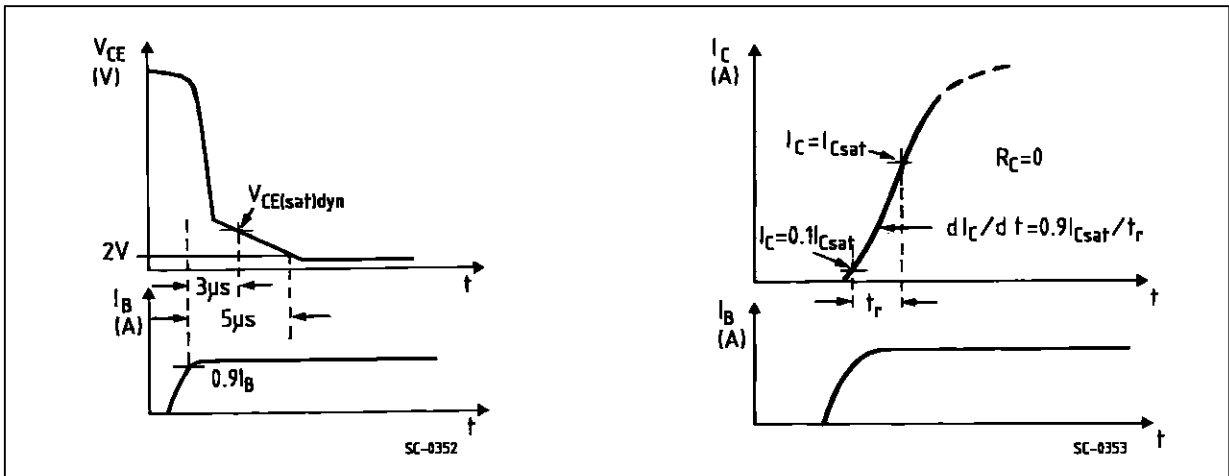


Turn-off Switching Test Circuit

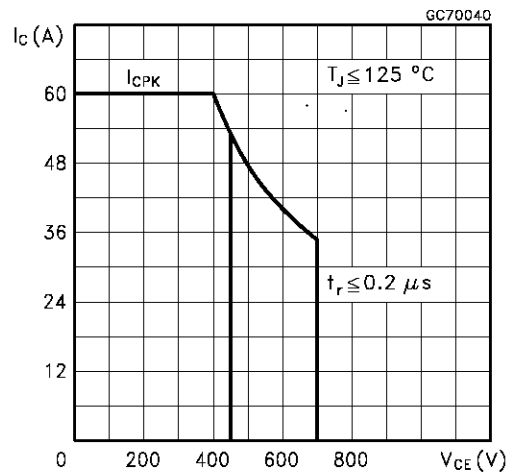
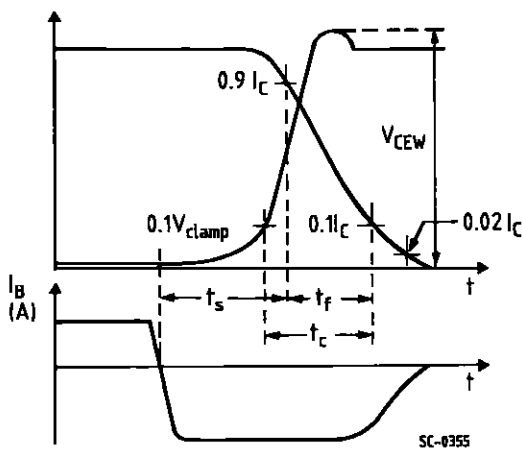


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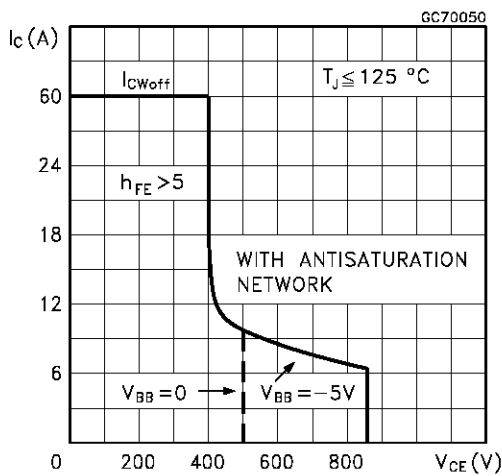
Turn-on Switching Test Waveforms.



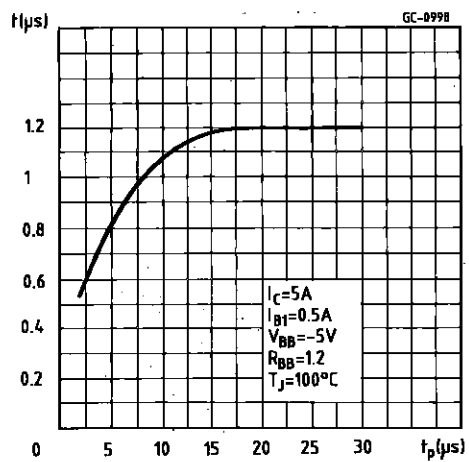
Turn-off Switching Test Waveforms (inductive load). Forward Biased Safe Operating Areas.



Reverse Biased Safe Operating Area

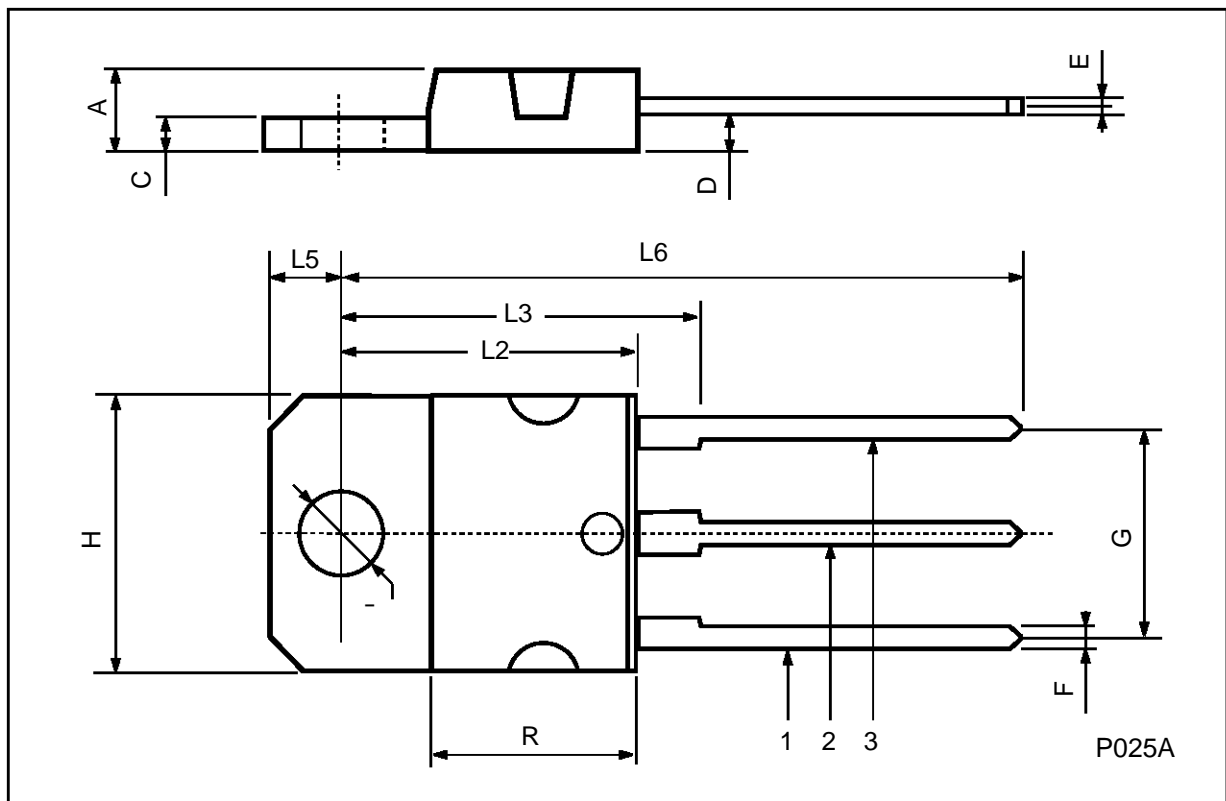


Storage Time Versus Pulse Time.



**TO-218 (SOT-93) MECHANICAL DATA**

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 4.7  |      | 4.9  | 0.185 |       | 0.193 |
| C    | 1.17 |      | 1.37 | 0.046 |       | 0.054 |
| D    |      | 2.5  |      |       | 0.098 |       |
| E    | 0.5  |      | 0.78 | 0.019 |       | 0.030 |
| F    | 1.1  |      | 1.3  | 0.043 |       | 0.051 |
| G    | 10.8 |      | 11.1 | 0.425 |       | 0.437 |
| H    | 14.7 |      | 15.2 | 0.578 |       | 0.598 |
| L2   | -    |      | 16.2 | -     |       | 0.637 |
| L3   |      | 18   |      |       | 0.708 |       |
| L5   | 3.95 |      | 4.15 | 0.155 |       | 0.163 |
| L6   |      | 31   |      |       | 1.220 |       |
| R    | -    |      | 12.2 | -     |       | 0.480 |
| Ø    | 4    |      | 4.1  | 0.157 |       | 0.161 |



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