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# Bipolar Power Transistors

## 100 V, 3.0 A, Low $V_{CE(sat)}$ NPN Transistor

### NSV1C301CT

ON Semiconductor's e<sup>2</sup>PowerEdge family of low  $V_{CE(sat)}$  transistors are surface mount devices featuring ultra-low saturation voltage,  $V_{CE(sat)}$ , and high current gain capability. These are designed for use in lower voltage, high speed switching applications where affordable efficient energy control is important.

Housed in an ultra slim LFAK4 5x6 package, typical applications are DC-DC converters and power management in portable and battery powered products such as cellular and cordless phones, digital cameras and MP3 players where PCB space is at a premium. The LFAK4 5x6 package also contains wettable flanks which are a requirement for the automotive industry's optical inspection methods that are implemented in end applications such as air bag deployment, powertrain control units, and instrument clusters.

#### Features

- Complement to NSV1C300CT
- Ultra-slim LFAK4 Package (5 x 6 mm) with Wettable Flanks
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

| Rating  | Symbol         | Value       | Unit             |
|---|----------------|-------------|------------------|
| Collector-Emitter Voltage   | $V_{CEO}$      | 100         | Vdc              |
| Collector-Base Voltage  | $V_{CBO}$      | 140         | Vdc              |
| Emitter-Base Voltage  | $V_{EB}$       | 6.0         | Vdc              |
| Base Current - Continuous   | $I_B$          | 0.5         | Adc              |
| Collector Current - Continuous  | $I_C$          | 3.0         | Adc              |
| Collector Current - Peak  | $I_{CM}$       | 6.0         | A                |
| Total Power Dissipation<br>Total $P_D$ @ $T_A = 25^\circ\text{C}$ (Note 1)<br>Total $P_D$ @ $T_A = 25^\circ\text{C}$ (Note 2) | $P_D$          | 5.0<br>1.0  | W                |
| Operating and Storage Junction Temperature Range  | $T_J, T_{stg}$ | -55 to +150 | $^\circ\text{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

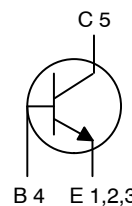
1. Mounted on 1" sq. (645 sq. mm) Collector pad on FR-4 bd material.
2. Mounted on 0.012" sq. (7.6 sq. mm) Collector pad on FR-4 bd material.



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**NPN TRANSISTOR**  
**3.0 AMPERES**  
**100 VOLTS**

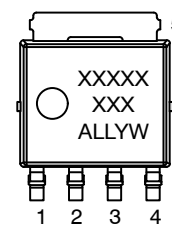


Schematic



LFAK4 5x6  
CASE 760AB

#### MARKING DIAGRAM



(Top View)

XXXXXX = Specific Device Code  
A = Assembly Location  
LL = Wafer Lot  
Y = Year  
W = Work Week

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

# NSV1C301CT

## ORDERING INFORMATION

| Device        | Package                 | Shipping <sup>†</sup> |
|---------------|-------------------------|-----------------------|
| NSS1C301CTWG  | LFP4K4 5x6<br>(Pb-Free) | 3,000 / Tape & Reel   |
| NSV1C301CTWG* | LFP4K4 5x6<br>(Pb-Free) | 3,000 / Tape & Reel   |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable

## THERMAL CHARACTERISTICS

| Characteristic   | Symbol                             | Max       | Unit |
|--|------------------------------------|-----------|------|
| Thermal Resistance, Junction-to-Case<br>Junction-to-Ambient on 1" sq. (645 sq. mm) Collector pad on FR-4 bd material<br>Junction-to-Ambient on 0.012" sq. (7.6 sq. mm) Collector pad on FR-4 bd material | $R_{\theta JA}$<br>$R_{\theta JA}$ | 40<br>120 | °C/W |

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|   |               |     |   |     |               |
|---|---------------|-----|---|-----|---------------|
| Collector - Emitter Breakdown Voltage<br>( $I_C = 10\text{ mA}$ , $I_B = 0$ ) | $V_{(BR)CEO}$ | 100 | - | -   | V             |
| Collector - Base Breakdown Voltage<br>( $I_C = 0.1\text{ mA}$ , $I_E = 0$ )   | $V_{(BR)CBO}$ | 140 | - | -   | V             |
| Emitter - Base Breakdown Voltage<br>( $I_E = 0.1\text{ mA}$ , $I_C = 0$ )     | $V_{(BR)EBO}$ | 6.0 | - | -   | V             |
| Collector Cutoff Current<br>( $V_{CB} = 140\text{ V}$ , $I_E = 0$ )           | $I_{CBO}$     | -   | - | 0.1 | $\mu\text{A}$ |
| Emitter Cutoff Current<br>( $V_{EB} = 6.0\text{ V}$ )                         | $I_{EBO}$     | -   | - | 0.1 | $\mu\text{A}$ |

### ON CHARACTERISTICS

|   |               |                         |                                  |                                  |     |
|---|---------------|-------------------------|----------------------------------|----------------------------------|-----|
| DC Current Gain (Note 3)<br>( $I_C = 0.1\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )<br>( $I_C = 0.5\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )<br>( $I_C = 1.0\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )<br>( $I_C = 3.0\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )                  | $h_{FE}$      | 200<br>200<br>120<br>80 | -<br>-<br>-<br>-                 | -<br>-<br>500<br>-               | -   |
| Collector - Emitter Saturation Voltage (Note 3)<br>( $I_C = 0.1\text{ A}$ , $I_B = 10\text{ mA}$ )<br>( $I_C = 1.0\text{ A}$ , $I_B = 0.100\text{ A}$ )<br>( $I_C = 2.0\text{ A}$ , $I_B = 0.200\text{ A}$ )<br>( $I_C = 3.0\text{ A}$ , $I_B = 0.300\text{ A}$ ) | $V_{CE(sat)}$ | -<br>-<br>-<br>-        | 0.015<br>0.045<br>0.080<br>0.115 | 0.050<br>0.090<br>0.150<br>0.250 | V   |
| Base - Emitter Saturation Voltage (Note 3)<br>( $I_C = 1.0\text{ A}$ , $I_B = 0.1\text{ A}$ )   | $V_{BE(sat)}$ | -                       | -                                | 1.0                              | V   |
| Base - Emitter Turn-on Voltage (Note 3)<br>( $I_C = 1.0\text{ A}$ , $V_{CE} = 2.0\text{ V}$ )   | $V_{BE(on)}$  | -                       | -                                | 0.90                             | V   |
| Cutoff Frequency<br>( $I_C = 500\text{ mA}$ , $V_{CE} = 10\text{ V}$ , $f = 100\text{ MHz}$ )   | $f_T$         | -                       | 120                              | -                                | MHz |
| Input Capacitance<br>( $V_{EB} = 5.0\text{ V}$ , $f = 1.0\text{ MHz}$ )   | $C_{ibo}$     | -                       | 360                              | -                                | pF  |
| Output Capacitance<br>( $V_{CB} = 10\text{ V}$ , $f = 1.0\text{ MHz}$ )   | $C_{obo}$     | -                       | 30                               | -                                | pF  |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Pulsed Condition: Pulse Width = 300  $\mu\text{sec}$ , Duty Cycle  $\leq 2\%$ .

# NSV1C301CT

## TYPICAL CHARACTERISTICS

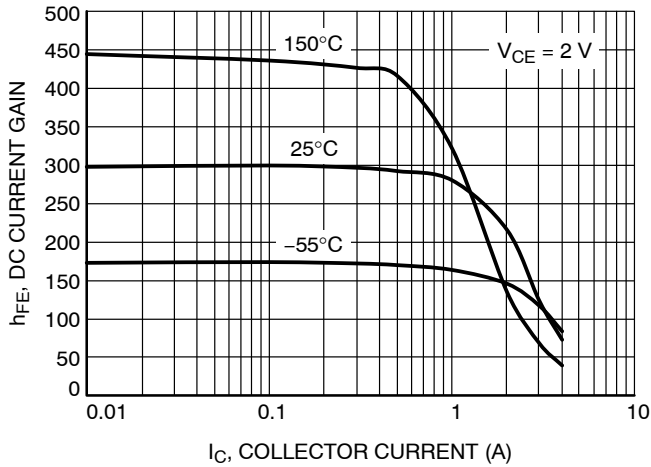


Figure 1. DC Current Gain

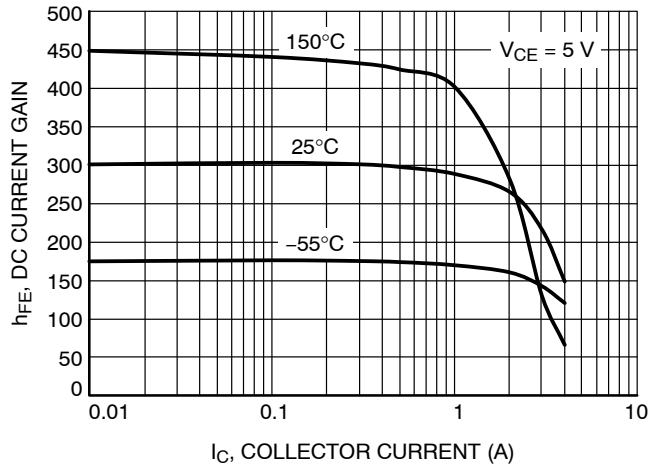


Figure 2. DC Current Gain

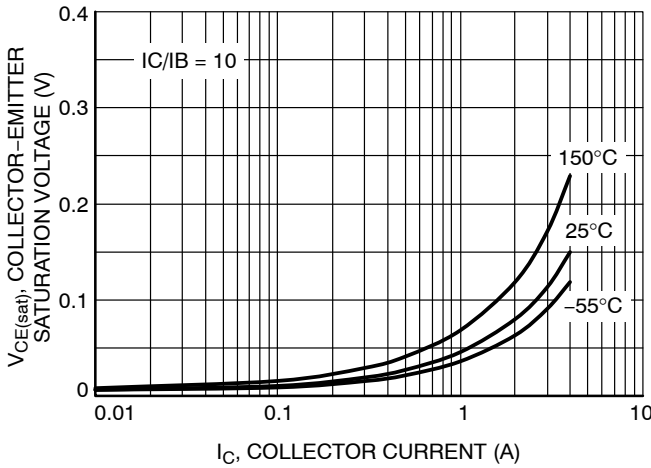


Figure 3. Collector-Emitter Saturation Voltage

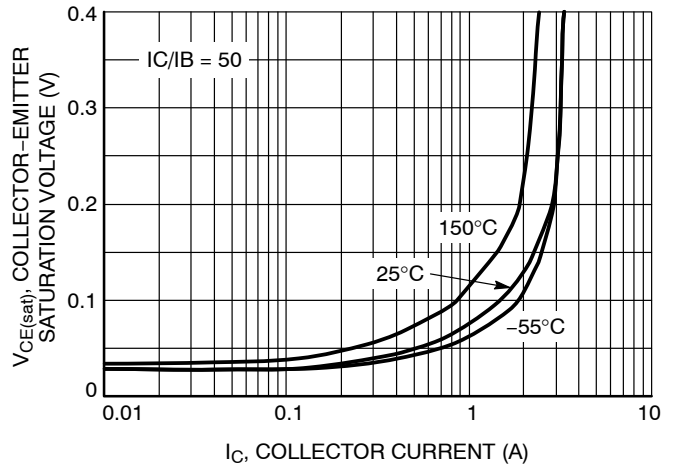


Figure 4. Collector-Emitter Saturation Voltage

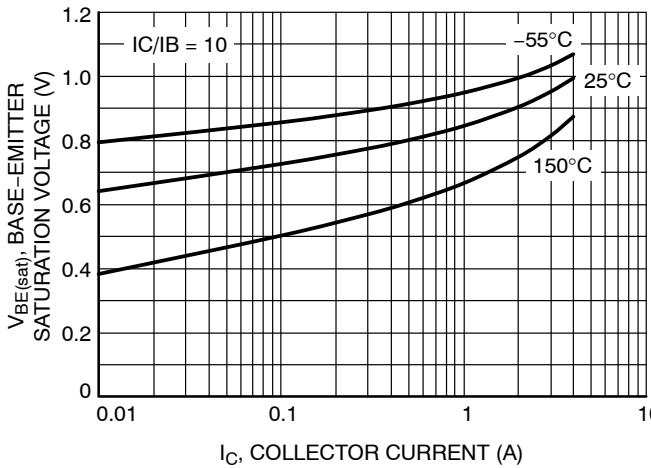


Figure 5. Base-Emitter Saturation Voltage

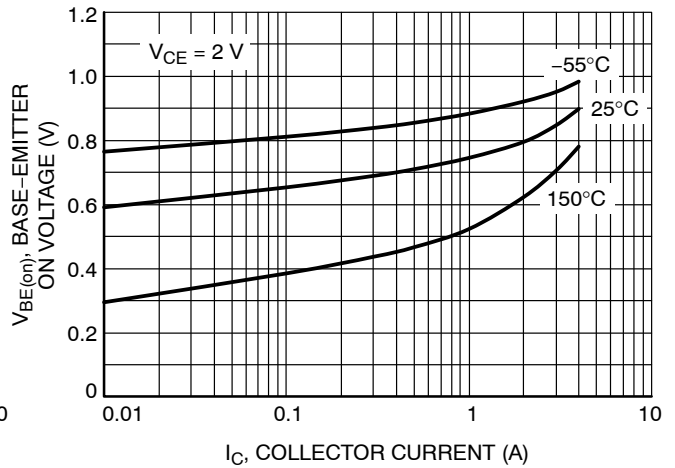


Figure 6. Base-Emitter "On" Voltage

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## TYPICAL CHARACTERISTICS

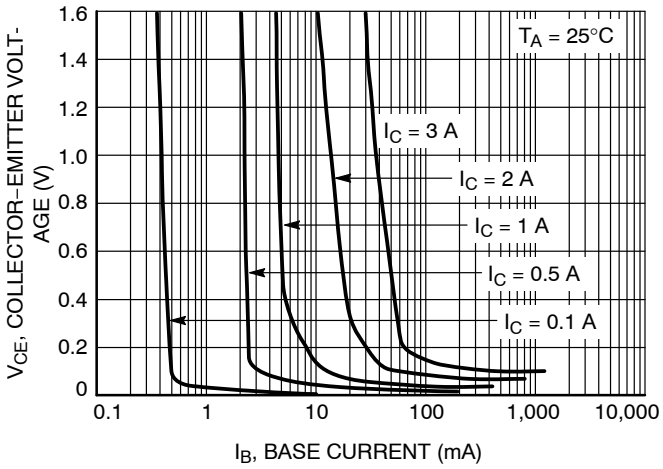


Figure 7. Collector Saturation Region

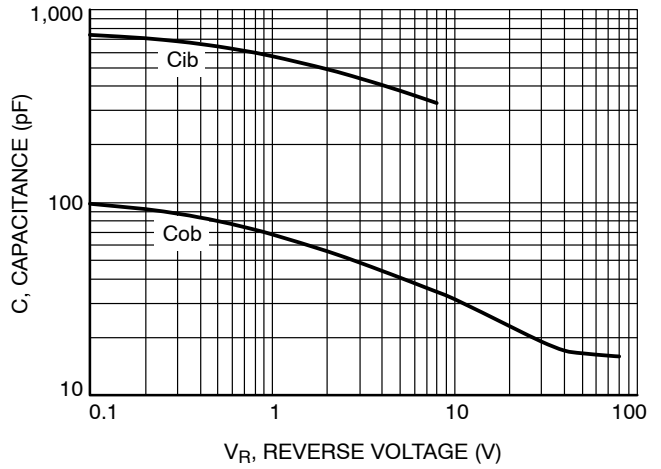


Figure 8. Capacitance

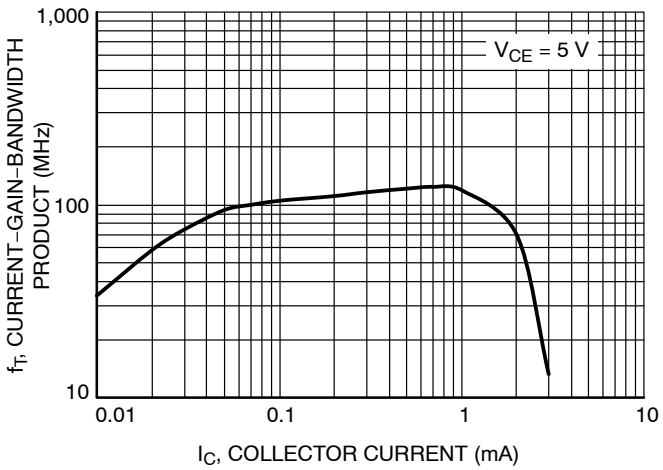


Figure 9. Current-Gain-Bandwidth Product

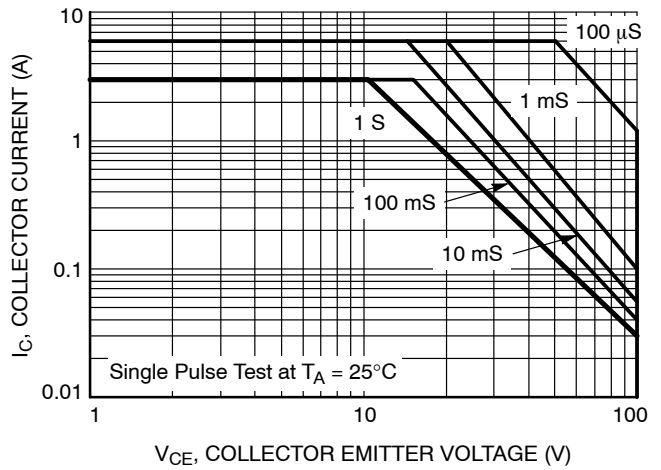


Figure 10. Safe Operating Area

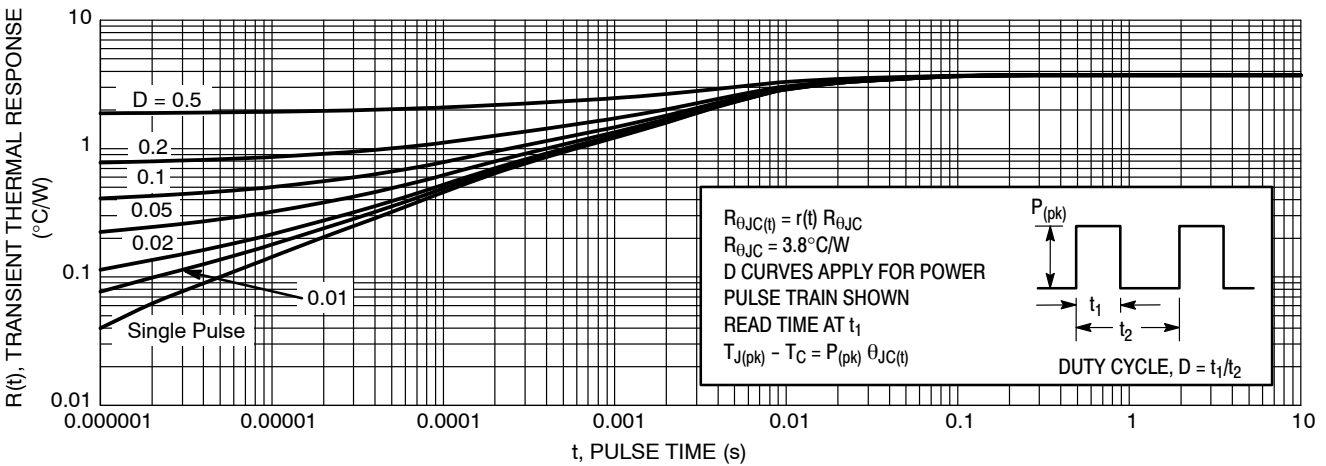


Figure 11. Typical Transient Thermal Response, Junction-to-Case

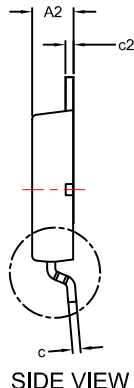
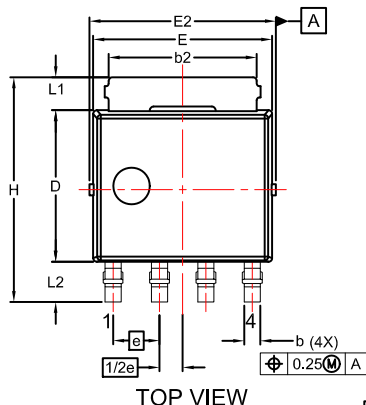
# NSV1C301CT

## PACKAGE DIMENSIONS

### LFPAK4 5x6 CASE 760AB ISSUE C

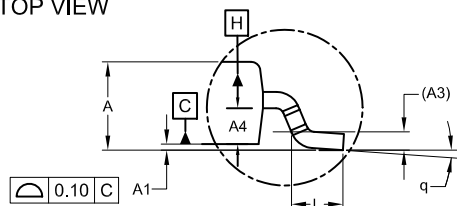
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.150mm PER SIDE.
4. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

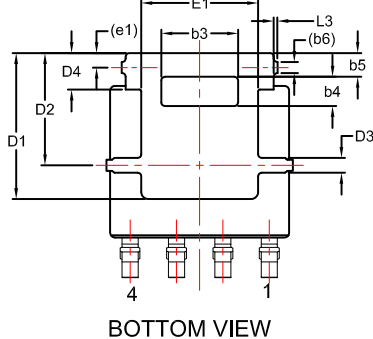


TOP VIEW

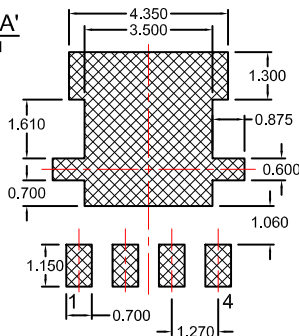
SIDE VIEW



DETAIL 'A'  
SCALE: 2:1



BOTTOM VIEW



RECOMMENDED LAND PATTERN

\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

| UNIT IN MILLIMETER |           |      |      |
|--------------------|-----------|------|------|
| DIM                | MIN       | NOM  | MAX  |
| A                  | 1.10      | 1.20 | 1.30 |
| A1                 | 0.00      | 0.08 | 0.15 |
| A2                 | 1.10      | 1.15 | 1.20 |
| A3                 | 0.25 REF  |      |      |
| A4                 | 0.45      | 0.50 | 0.55 |
| b                  | 0.40      | 0.45 | 0.50 |
| b2                 | 3.80      | 4.10 | 4.40 |
| b3                 | 2.00      | 2.10 | 2.20 |
| b4                 | 0.70      | 0.80 | 0.90 |
| b5                 | 0.55      | 0.65 | 0.75 |
| b6                 | 0.31 REF  |      |      |
| c                  | 0.19      | 0.22 | 0.25 |
| c2                 | 0.19      | 0.22 | 0.25 |
| D                  | 4.05      | 4.15 | 4.25 |
| D1                 | 3.80      | 4.00 | 4.20 |
| D2                 | 3.00      | 3.10 | 3.20 |
| D3                 | 0.30      | 0.40 | 0.50 |
| D4                 | 0.90      | 1.00 | 1.10 |
| E                  | 4.80      | 4.90 | 5.00 |
| E1                 | 3.10      | 3.20 | 3.30 |
| E2                 | 5.00      | 5.15 | 5.30 |
| e                  | 1.27 BSC  |      |      |
| 1/2e               | 0.635 BSC |      |      |
| e1                 | 0.40 REF  |      |      |
| H                  | 6.00      | 6.15 | 6.30 |
| L                  | 0.40      | 0.65 | 0.85 |
| L1                 | 0.80      | 0.90 | 1.00 |
| L2                 | 0.90      | 1.10 | 1.30 |
| L3                 | 0.00      | 0.10 | 0.20 |
| q                  | 0°        | 4°   | 8°   |

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