# NPN PRE-BIASED SMALL SIGNAL DUAL SURFACE MOUNT TRANSISTOR

## Features

- Epitaxial Planar Die Construction
- Complementary PNP Types Available (DDA)
- Built-In Biasing Resistors
- **"Lead Free", RoHS Compliant (Note 1)**
- **Halogen and Antimony Free "Green" Device (Note 2)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Mechanical Data

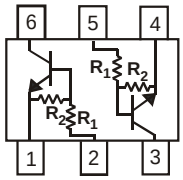
- Case: SOT363
- Case material: Molded Plastic. "Green" Molding Compound.
- Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish
- Weight: 0.006 grams (approximate)

| Part Number | R1 (NOM) | R2 (NOM) |
|---|---|---|
| DDC124EU | 22KΩ | 22KΩ |
| DDC144EU | 47KΩ | 47KΩ |
| DDC114YU | 10KΩ | 47KΩ |
| DDC123JU | 2.2KΩ | 47KΩ |
| DDC114EU | 10KΩ | 10KΩ |

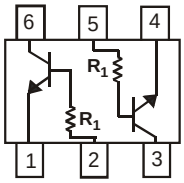
| Part Number | R1 Only |
|---|---|
| DDC113TU | 1KΩ |
| DDC143TU | 4.7KΩ |
| DDC114TU | 10KΩ |

SOT363

Top View




R1, R2




R1 Only

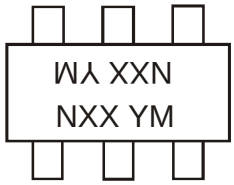
Device Schematic

## Ordering Information (Note 3 & 4)

| Product | Grade | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|---|---|---|---|---|---|
| DDC124EU-7-F | Commercial | N17 | 7 | 8 | 3,000 |
| DDC124EUQ-7-F | Automotive | N17 | 7 | 8 | 3,000 |
| DDC124EUQ-13-F | Automotive | N17 | 13 | 8 | 10,000 |
| DDC144EU-7-F | Commercial | N20 | 7 | 8 | 3,000 |
| DDC114YU-7-F | Commercial | N14 | 7 | 8 | 3,000 |
| DDC114YUQ-7-F | Automotive | N14 | 7 | 8 | 3,000 |
| DDC123JU-7-F | Commercial | N06 | 7 | 8 | 3,000 |
| DDC114EU-7-F | Commercial | N13 | 7 | 8 | 3,000 |
| DDC114EUQ-7-F | Automotive | N13 | 7 | 8 | 3,000 |
| DDC114EUQ-13-F | Automotive | N13 | 13 | 8 | 10,000 |
| DDC113TU-7-F | Commercial | N01 | 7 | 8 | 3,000 |
| DDC143TU-7-F | Commercial | N07 | 7 | 8 | 3,000 |
| DDC114TU-7-F | Commercial | N12 | 7 | 8 | 3,000 |
| DDC114TUQ-7-F | Automotive | N12 | 7 | 8 | 3,000 |

Notes:
1. No purposefully added lead.
2. Diodes Inc's "Green" policy can be found on our website at http://www.diodes.com.
3. For packaging details, go to our website at http://www.diodes.com.
4. Products with Q-suffix are automotive grade. Automotive products are electrical and thermal the same as the commercial, except where specified.

## Marking Information




NXX = Product Type Marking Code
See Page 1 Diagrams
YM = Date Code Marking
Y = Year ex: T = 2006
M = Month ex: 9 = September

Date Code Key

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|
| Code | X | Y | Z | A | B | C | D | E |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |

## Maximum Ratings @$T_A$ = 25°C unless otherwise specified

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Supply Voltage | | $V_{CC}$ | 50 | V |
| Input Voltage | DDC124EU | $V_{IN}$ | -10 to +40 | V |
| | DDC144EU | | -10 to +40 | |
| | DDC114YU | | -6 to +40 | |
| | DDC123JU | | -5 to +12 | |
| | DDC114EU | | -10 to +40 | |
| | DDC113TU | | -5V max | |
| | DDC143TU | | -5V max | |
| | DDC114TU | | -5V max | |
| Output Current | | $I_{C(MAX)}$ | 100 | mA |

## Thermal Characteristics @$T_A$ = 25°C unless otherwise specified

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Power Dissipation (Note 5) | $P_D$ | 200 | mW |
| Thermal Resistance, Junction to Ambient Air (Note 5) | $R_{\theta JA}$ | 625 | °C/W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | °C |

Notes: 5. Mounted on FR4 PC Board with minimum recommended pad layout

## Electrical Characteristics @$T_A$ = 25°C unless otherwise specified

| Characteristic (DDC113TU & DDC143TU & DDC114TU only) | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | 50 | — | — | V | $I_C$ = 50μA |
| Collector-Emitter Breakdown Voltage | $BV_{CEO}$ | 50 | — | — | V | $I_C$ = 1mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | 5 | — | — | V | $I_E$ = 50μA |
| Collector Cutoff Current | $I_{CBO}$ | — | — | 0.5 | μA | $V_{CB}$ = 50V |
| Emitter Cutoff Current | $I_{EBO}$ | — | — | 0.5 | μA | $V_{EB}$ = 4V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | — | — | 0.3 | V | $I_C/I_B$ = 2.5mA / 0.25mA DDC143TU<br>$I_C/I_B$ = 1mA / 0.1mA DDC114TU<br>$I_C/I_B$ = 10mA / 1mA DDC113TU |
| DC Current Transfer Ratio | $h_{FE}$ | 100 | 250 | 600 | — | $I_C$ = 1mA, $V_{CE}$ = 5V |
| Input Resistor ($R_1$) Tolerance | $\Delta R_1$ | -30 | — | +30 | % | — |
| Gain-Bandwidth Product (Note 6) | $f_T$ | — | 250 | — | MHz | $V_{CE}$ = 10V, $I_E$ = -5mA, f = 100MHz |

| Characteristic | | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|---|
| Input Voltage | DDC124EU<br>DDC144EU<br>DDC114YU<br>DDC123JU<br>DDC114EU | $V_{I(off)}$ | 0.5<br>0.5<br>0.3<br>0.5<br>0.5 | 1.1<br>1.1<br>—<br>—<br>1.1 | — | V | $V_{CC}$ = 5V, $I_O$ = 100μA |
| | DDC124EU<br>DDC144EU<br>DDC114YU<br>DDC123JU<br>DDC114EU | $V_{I(on)}$ | — | 1.9<br>1.9<br>—<br>—<br>1.9 | 3.0<br>3.0<br>1.4<br>1.1<br>3.0 | | $V_O$ = 0.3, $I_O$ = 5mA<br>$V_O$ = 0.3, $I_O$ = 2mA<br>$V_O$ = 0.3, $I_O$ = 1mA<br>$V_O$ = 0.3, $I_O$ = 5mA<br>$V_O$ = 0.3, $I_O$ = 10mA |
| Output Voltage | DDC124EU<br>DDC144EU<br>DDC114YU<br>DDC123JU<br>DDC114EU | $V_{O(on)}$ | — | 0.1 | 0.3 | V | $I_O/I_I$ = 10mA / 0.5mA<br>$I_O/I_I$ = 10mA / 0.5mA<br>$I_O/I_I$ = 5mA / 0.25mA<br>$I_O/I_I$ = 5mA / 0.25mA<br>$I_O/I_I$ = 10mA / 0.5mA |
| Input Current | DDC124EU<br>DDC144EU<br>DDC114YU<br>DDC123JU<br>DDC114EU | $I_I$ | — | — | 0.36<br>0.18<br>0.88<br>3.6<br>0.88 | mA | $V_I$ = 5V |
| Output Current | | $I_{O(off)}$ | — | — | 0.5 | μA | $V_{CC}$ = 50V, $V_I$ = 0V |
| DC Current Gain | DDC124EU<br>DDC144EU<br>DDC114YU<br>DDC114YUQ<br>DDC123JU<br>DDC114EU | $G_I$ | 56<br>68<br>68<br>80<br>80<br>30 | — | — | — | $V_O$ = 5V, $I_O$ = 5mA<br>$V_O$ = 5V, $I_O$ = 5mA<br>$V_O$ = 5V, $I_O$ = 10mA<br>$V_O$ = 5V, $I_O$ = 5mA<br>$V_O$ = 5V, $I_O$ = 10mA<br>$V_O$ = 5V, $I_O$ = 5mA |
| Input Resistor ($R_1$) Tolerance | | $\Delta R_1$ | -30 | — | +30 | % | — |
| Resistance Ratio Tolerance | | $R_2/R_1$ | -20 | — | +20 | % | — |
| Gain-Bandwidth Product (Note 6) | | $f_T$ | — | 250 | — | MHz | $V_{CE}$ = 10V, $I_E$ = 5mA, f = 100MHz |

Notes: 6. Transistor - For Reference Only

## Typical Curves – DDC123TK One Section

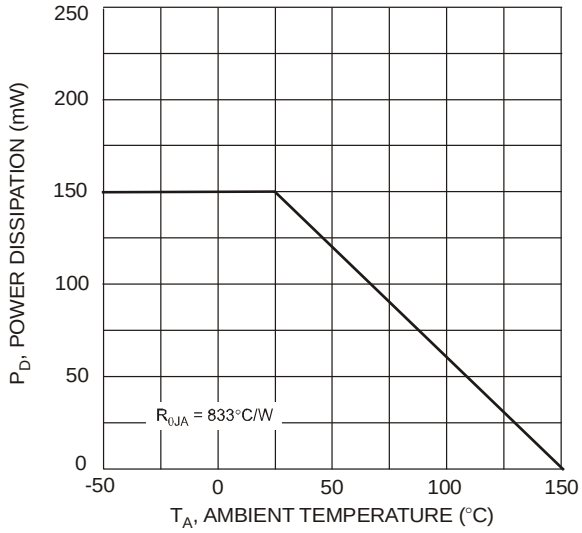


Fig. 1 Derating Curve

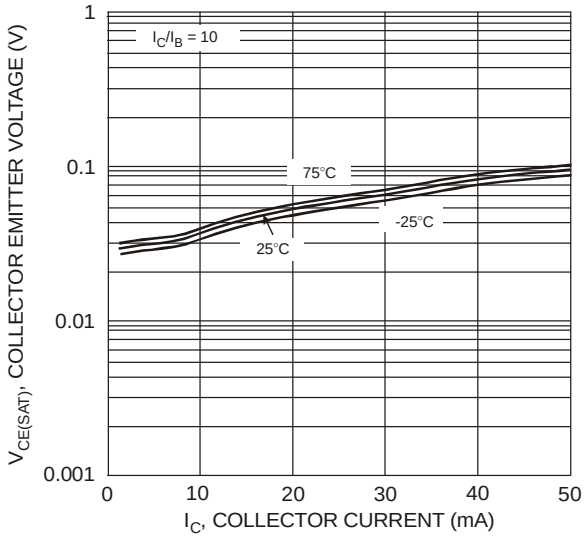


Fig. 2 $V_{CE(SAT)}$ vs. $I_C$

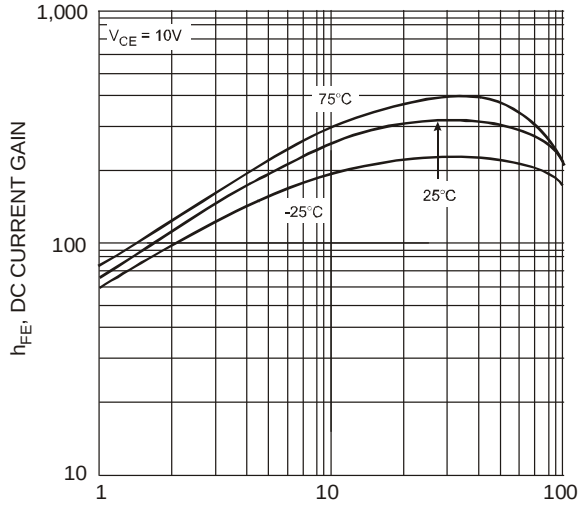


Fig. 3 DC Current Gain

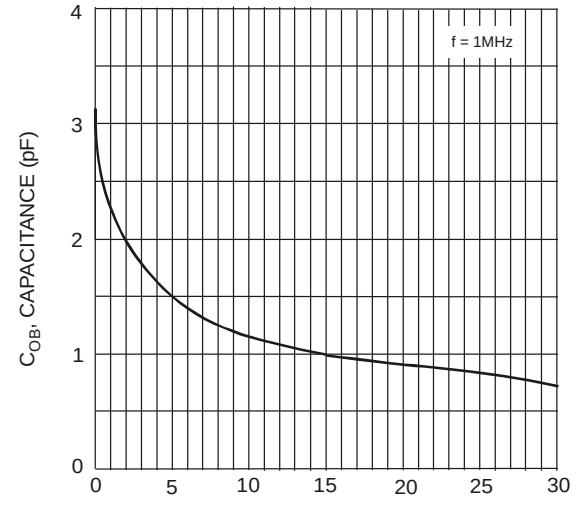


Fig. 4 Output Capacitance

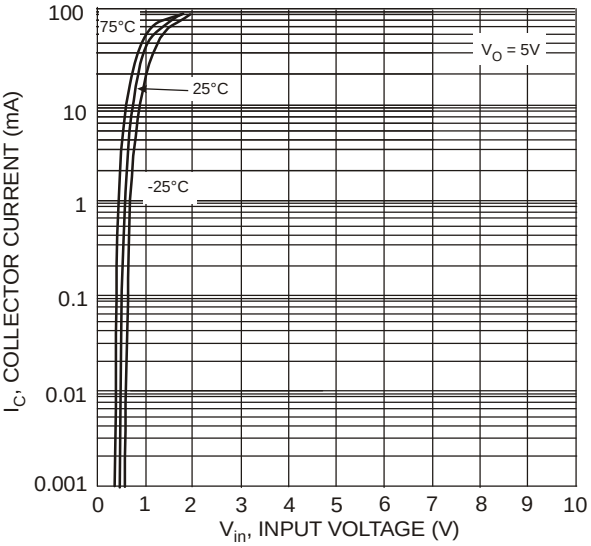


Fig. 5 Collector Current vs. Input Voltage

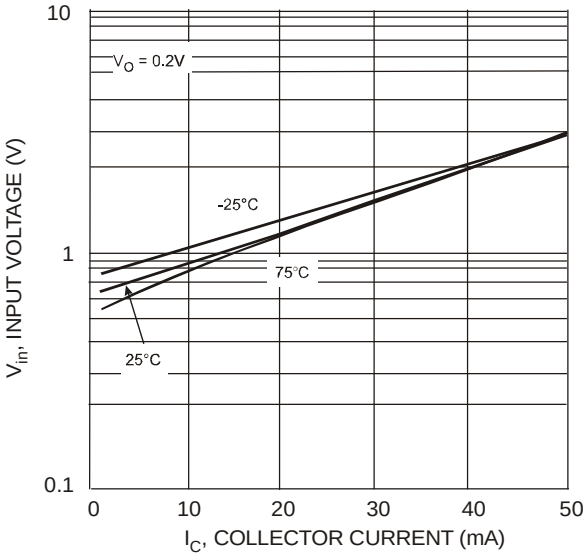


Fig. 6 Input Voltage vs. Collector Current

## Typical Curves – DDC114TK One Section

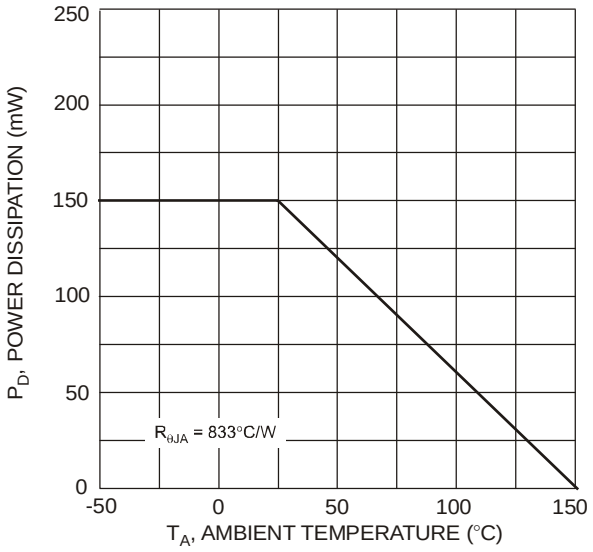



Fig. 1 Derating Curve

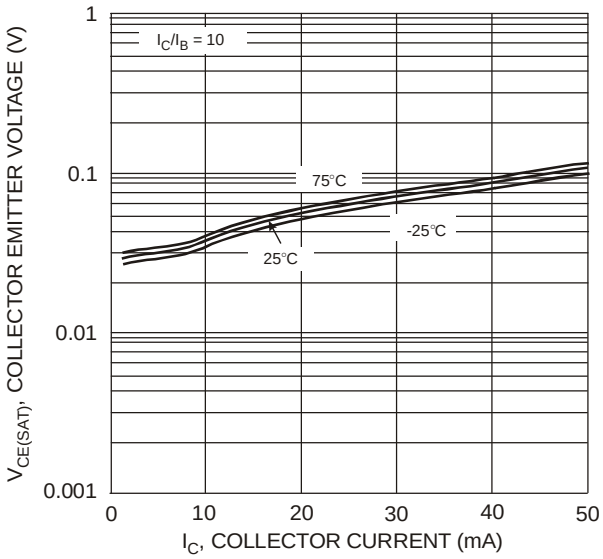



Fig. 2 $V_{CE(SAT)}$ vs. $I_C$

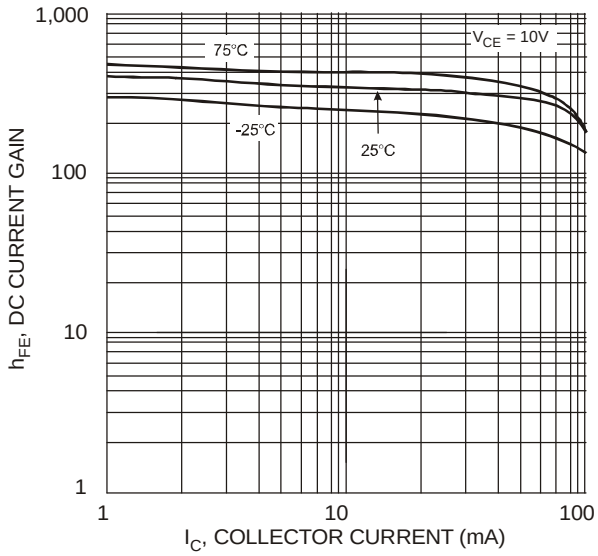



Fig. 3 DC Current Gain

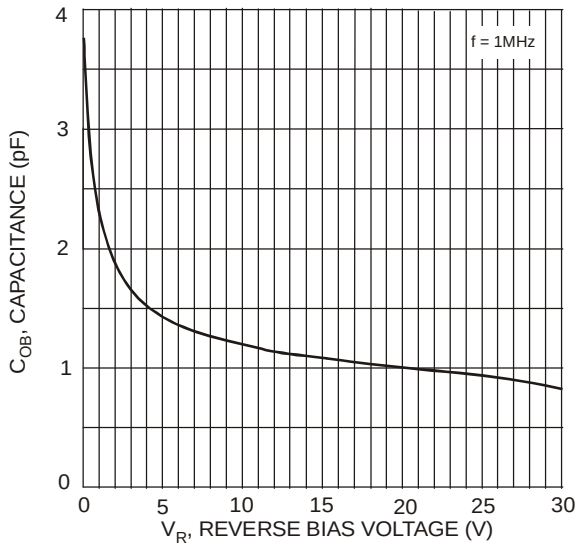



Fig. 4 Output Capacitance

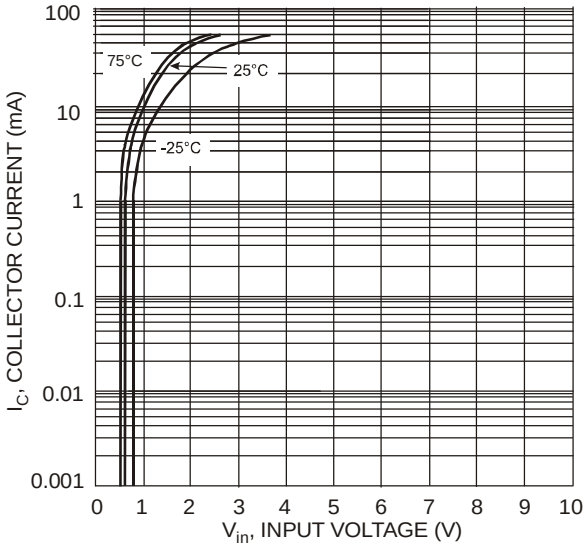



Fig. 5 Collector Current vs. Input Voltage

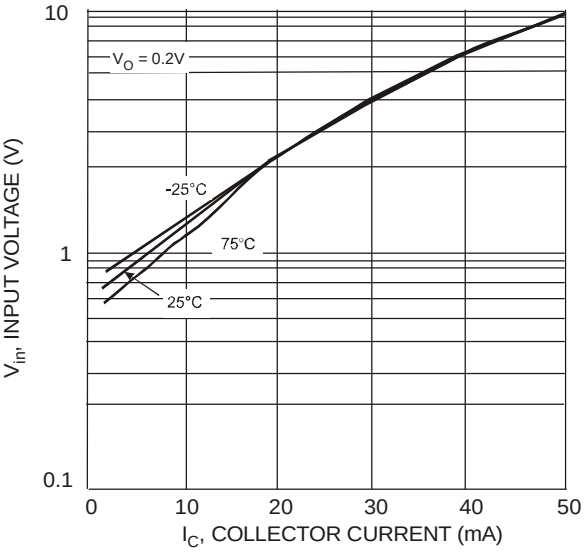
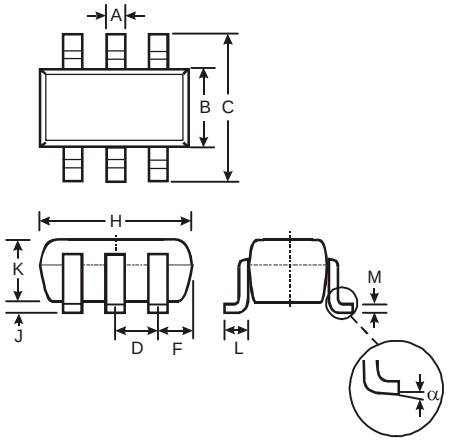


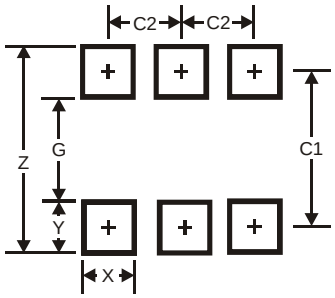

Fig. 6 Input Voltage vs. Collector Current

## Package Outline Dimensions




| SOT363 | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | 0.10 | 0.30 |
| **B** | 1.15 | 1.35 |
| **C** | 2.00 | 2.20 |
| **D** | 0.65 Typ | |
| **F** | 0.40 | 0.45 |
| **H** | 1.80 | 2.20 |
| **J** | 0 | 0.10 |
| **K** | 0.90 | 1.00 |
| **L** | 0.25 | 0.40 |
| **M** | 0.10 | 0.22 |
| **α** | 0° | 8° |
| **All Dimensions in mm** | | |

## Suggested Pad Layout




| Dimensions | Value (in mm) |
|---|---|
| **Z** | 2.5 |
| **G** | 1.3 |
| **X** | 0.42 |
| **Y** | 0.6 |
| **C1** | 1.9 |
| **C2** | 0.65 |

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