DIODES INCORPORATED

# DCX (xxxx) U

## SMALL SIGNAL COMPLEMENTARY PRE-BIASED DUAL TRANSISTOR

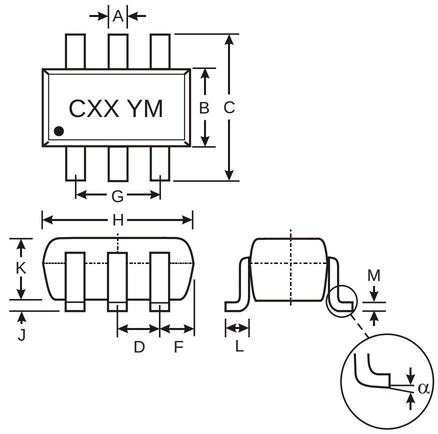
NEW PRODUCT

## Features

- Epitaxial Planar Die Construction
- Built-In Biasing Resistors
- **Lead Free/RoHS Compliant (Note 3)**
- Surface Mount Package Suited for Automated Assembly

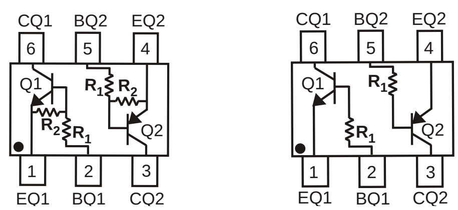
## Mechanical Data

- Case: SOT-363
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020C
- Terminals: Solderable per MIL-STD-202, Method 208
- Lead Free Plating (Matte Tin Finish annealed over Alloy 42 leadframe).
- Terminal Connections: See Diagram
- Marking: Date Code and Marking Code (See Page 4)
- Ordering Information (See Page 4)
- Weight: 0.006 grams (approximate)




| SOT-363 | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | 0.10 | 0.30 |
| **B** | 1.15 | 1.35 |
| **C** | 2.00 | 2.20 |
| **D** | 0.65 Nominal | |
| **F** | 0.30 | 0.40 |
| **H** | 1.80 | 2.20 |
| **J** | ¾ | 0.10 |
| **K** | 0.90 | 1.00 |
| **L** | 0.25 | 0.40 |
| **M** | 0.10 | 0.25 |
| α | 0° | 8° |
| **All Dimensions in mm** | | |

| P/N | R1 | R2 | MARKING |
|---|---|---|---|
| DCX124EU | 22KΩ | 22KΩ | C17 |
| DCX144EU | 47KΩ | 47KΩ | C20 |
| DCX114YU | 10KΩ | 47KΩ | C14 |
| DCX123JU | 2.2KΩ | 47KΩ | C06 |
| DCX114EU | 10KΩ | 10KΩ | C13 |
| DCX143TU | 4.7KΩ | - | C07 |
| DCX143EU | 4.7KΩ | 4.7KΩ | C08 |
| DCX114TU | 10KΩ | - | C12 |




$R_1$, $R_2$ — $R_1$ Only

Q1: NPN Transistor
Q2: PNP Transistor

SCHEMATIC DIAGRAM

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

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Supply Voltage, (6) to (1) and (4) to (3) | | $V_{CC}$ | 50 | V |
| Input Voltage, (2) to (1) and (4) to (5) | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143TU<br>DCX143EU<br>DCX114TU | $V_{IN}$ | -10 to +40<br>-10 to +40<br>-6 to +40<br>-5 to +12<br>-10 to +40<br>-5 Vmax<br>-10 to +30<br>-5 Vmax | V |
| Output Current | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143TU<br>DCX143EU<br>DCX114TU | $I_O$ | 30<br>30<br>70<br>100<br>50<br>100<br>100<br>100 | mA |
| Output Current | All | $I_C$ (Max) | 100 | mA |
| Power Dissipation (Total) | (Note 2) | $P_d$ | 200 | mW |
| Thermal Resistance, Junction to Ambient Air (Note 1) | | $R_{\theta JA}$ | 625 | °C/W |
| Operating and Storage and Temperature Range | | $T_j$, $T_{STG}$ | -55 to +150 | °C |

Note: 1. Mounted on FR4 PC Board with recommended pad layout at http://www.diodes.com/datasheets/ap02001.pdf.
2. 150mW per element must not be exceeded.
3. No purposefully added lead.

NEW PRODUCT

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

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Supply Voltage, (3) to (1) | | $V_{CC}$ | 50 | V |
| Input Voltage, (2) to (1) | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143TU<br>DCX143EU<br>DCX114TU | $V_{IN}$ | +10 to -40<br>+10 to -40<br>+6 to -40<br>+5 to -12<br>+10 to -40<br>+5 Vmax<br>+10 to -30<br>+5 Vmax | V |
| Output Current | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143TU<br>DCX143EU<br>DCX114TU | $I_O$ | -30<br>-30<br>-70<br>-100<br>-50<br>-100<br>-100<br>-100 | mA |
| Output Current | All | $I_C$ (Max) | -100 | mA |
| Power Dissipation (Total) | (Page 1: Note 2) | $P_d$ | 200 | mW |
| Thermal Resistance, Junction to Ambient Air (Page 1: Note 1) | | $R_{\theta JA}$ | 625 | °C/W |
| Operating and Storage and Temperature Range | | $T_j$, $T_{STG}$ | -55 to +150 | °C |

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

| Characteristic (DCX143TU & DCX114TU only) | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | 50 | ¾ | ¾ | V | $I_C$ = 50µA |
| Collector-Emitter Breakdown Voltage | $BV_{CEO}$ | 50 | ¾ | ¾ | V | $I_C$ = 1mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | 5 | ¾ | −− | V | $I_E$ = 50µA |
| Collector Cutoff Current | $I_{CBO}$ | ¾ | ¾ | 0.5 | µA | $V_{CB}$ = 50V |
| Emitter Cutoff Current | $I_{EBO}$ | ¾ | ¾ | 0.5 | µA | $V_{EB}$ = 4V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | ¾ | ¾ | 0.3 | V | $I_C/I_B$ = 2.5mA / 0.25mA DCX143TU<br>$I_C/I_B$ = 1mA / 0.1mA DCX114TU |
| DC Current Transfer Ratio | $h_{FE}$ | 100 | 250 | 600 | ¾ | $I_C$ = 1mA, $V_{CE}$ = 5V |
| Input Resistor ($R_1$) Tolerance | $\Delta R_1$ | -30 | ¾ | +30 | % | ¾ |
| Gain-Bandwidth Product | $f_T$ | ¾ | 250 | ¾ | MHz | $V_{CE}$ = 10V, $I_E$ = -5mA, f = 100MHz |

## Electrical Characteristics NPN Section (Continued) @ $T_A$ = 25°C unless otherwise specified

| Characteristic | | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|---|
| Input Voltage | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $V_{I(off)}$ | 0.5<br>0.5<br>0.3<br>0.5<br>0.5<br>0.5 | 1.1<br>1.1<br>¾<br>¾<br>1.1<br>1.16 | ¾ | V | $V_{CC}$ = 5V, $I_O$ = 100µA |
| | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $V_{I(on)}$ | ¾ | 1.9<br>1.9<br>¾<br>¾<br>1.9<br>1.99 | 3.0<br>3.0<br>1.4<br>1.1<br>3.0<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<br>$V_O$ = 0.3, $I_O$ = 20mA |
| Output Voltage | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $V_{O(on)}$ | ¾ | 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<br>$I_O/I_I$ = 10mA / 0.5mA |
| Input Current | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $I_I$ | ¾ | ¾ | 0.36<br>0.18<br>0.88<br>3.6<br>0.88<br>0.88 | mA | $V_I$ = 5V |
| Output Current | | $I_{O(off)}$ | ¾ | ¾ | 0.5 | µA | $V_{CC}$ = 50V, $V_I$ = 0V |
| DC Current Gain | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $G_I$ | 56<br>68<br>68<br>80<br>30<br>50 | ¾ | ¾ | ¾ | $V_O$ = 5V, $I_O$ = 5mA<br>$V_O$ = 5V, $I_O$ = 5mA<br>$V_O$ = 5V, $I_O$ = 10mA<br>$V_O$ = 5V, $I_O$ = 10mA<br>$V_O$ = 5V, $I_O$ = 5mA<br>$V_O$ = 5V, $I_O$ = 10mA |
| Input Resistor ($R_1$) Tolerance | | $\Delta R_1$ | -30 | ¾ | +30 | % | ¾ |
| Resistance Ratio Tolerance | | $R_2/R_1$ | -20 | ¾ | +20 | % | ¾ |
| Gain-Bandwidth Product | | $f_T$ | ¾ | 250 | ¾ | MHz | $V_{CE}$ = 10V, $I_E$ = 5mA,<br>f = 100MHz |

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

| Characteristic (DCX143TU & DCX114TU only) | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | -50 | ¾ | ¾ | V | $I_C$ = -50µA |
| Collector-Emitter Breakdown Voltage | $BV_{CEO}$ | -50 | ¾ | ¾ | V | $I_C$ = -1mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | -5 | ¾ | ¾ | V | $I_E$ = -50µA |
| Collector Cutoff Current | $I_{CBO}$ | ¾ | ¾ | -0.5 | µA | $V_{CB}$ = -50V |
| Emitter Cutoff Current | $I_{EBO}$ | ¾ | ¾ | -0.5 | µA | $V_{EB}$ = -4V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | ¾ | ¾ | -0.3 | V | $I_C/I_B$ = 2.5mA / 0.25mA DCX143TU<br>$I_C/I_B$ = 1mA / 0.1mA DCX114TU |
| DC Current Transfer Ratio | $h_{FE}$ | 100 | 250 | 600 | ¾ | $I_C$ = -1mA, $V_{CE}$ = -5V |
| Input Resistor ($R_1$) Tolerance | $\Delta R_1$ | -30 | ¾ | +30 | % | ¾ |
| Gain-Bandwidth Product | $f_T$ | ¾ | 250 | ¾ | MHz | $V_{CE}$ = -10V, $I_E$ = 5mA, f = 100MHz |

## Electrical Characteristics PNP Section (Continued) @ $T_A$ = 25°C unless otherwise specified

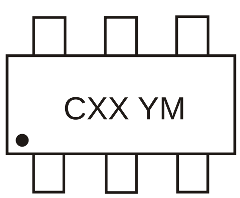
| Characteristic | | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|---|
| Input Voltage | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $V_{I(off)}$ | -0.5<br>-0.5<br>-0.3<br>-0.5<br>-0.5<br>-0.5 | -1.1<br>-1.1<br>¾<br>¾<br>-1.1<br>-1.16 | ¾ | V | $V_{CC}$ = -5V, $I_O$ = -100µA |
| | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $V_{I(on)}$ | ¾ | -1.9<br>-1.9<br>¾<br>¾<br>-1.9<br>-2.5 | -3.0<br>-3.0<br>-1.4<br>-1.1<br>-3.0<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<br>$V_O$ = -0.3, $I_O$ = -20mA |
| Output Voltage | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $V_{O(on)}$ | ¾ | -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<br>$I_O/I_I$ = -10mA /- 0.5mA |
| Input Current | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $I_I$ | ¾ | ¾ | -0.36<br>-0.18<br>-0.88<br>-3.6<br>-0.88<br>-0.88 | mA | $V_I$ = -5V |
| Output Current | | $I_{O(off)}$ | ¾ | ¾ | -0.5 | µA | $V_{CC}$ = 50V, $V_I$ = 0V |
| DC Current Gain | DCX124EU<br>DCX144EU<br>DCX114YU<br>DCX123JU<br>DCX114EU<br>DCX143EU | $G_I$ | 56<br>68<br>68<br>80<br>30<br>40 | ¾ | ¾ | ¾ | $V_O$ = -5V, $I_O$ = -5mA<br>$V_O$ = -5V, $I_O$ = -5mA<br>$V_O$ = -5V, $I_O$ = -10mA<br>$V_O$ = -5V, $I_O$ = -10mA<br>$V_O$ = -5V, $I_O$ = -5mA<br>$V_O$ = -5V, $I_O$ = -10mA |
| Input Resistor ($R_1$) Tolerance | | $\Delta R_1$ | -30 | ¾ | +30 | % | ¾ |
| Resistance Ratio Tolerance | | $R_2/R_1$ | -20 | ¾ | +20 | % | ¾ |
| Gain-Bandwidth Product | | $f_T$ | ¾ | 250 | ¾ | MHz | $V_{CE}$ = -10V, $I_E$ = -5mA,<br>f = 100MHz |

## Ordering Information (Note 4)

| Device | Packaging | Shipping |
|---|---|---|
| DCX124EU-7-F | SOT-363 | 3000/Tape & Reel |
| DCX144EU-7-F | SOT-363 | 3000/Tape & Reel |
| DCX114YU-7-F | SOT-363 | 3000/Tape & Reel |
| DCX123JU-7-F | SOT-363 | 3000/Tape & Reel |
| DCX114EU-7-F | SOT-363 | 3000/Tape & Reel |
| DCX143TU-7-F | SOT-363 | 3000/Tape & Reel |
| DCX143EU-7-F | SOT-363 | 3000/Tape & Reel |
| DCX114TU-7-F | SOT-363 | 3000/Tape & Reel |

Notes: 4. For Packaging Details, go to our website at http://www.diodes.com/datasheets/ap02007.pdf.

## Marking Information




CXX = Product Type Marking Code
YM = Date Code Marking
Y = Year ex: T = 2006
M = Month ex: 9 = September

Date Code Key

| Year | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|
| Code | T | U | V | W | X | Y | Z |

| 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 |

NEW PRODUCT

# TYPICAL CURVES - DCX123JU
## PNP SECTION



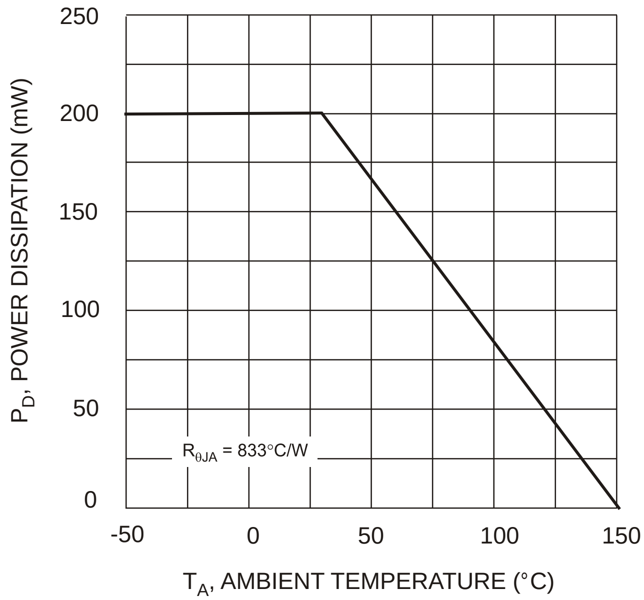



Fig. 1 Derating Curve

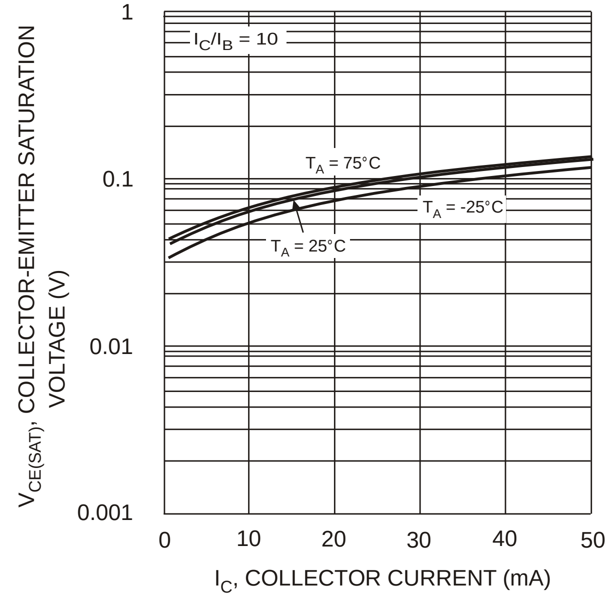



Fig. 2 $V_{CE(SAT)}$ vs. $I_C$

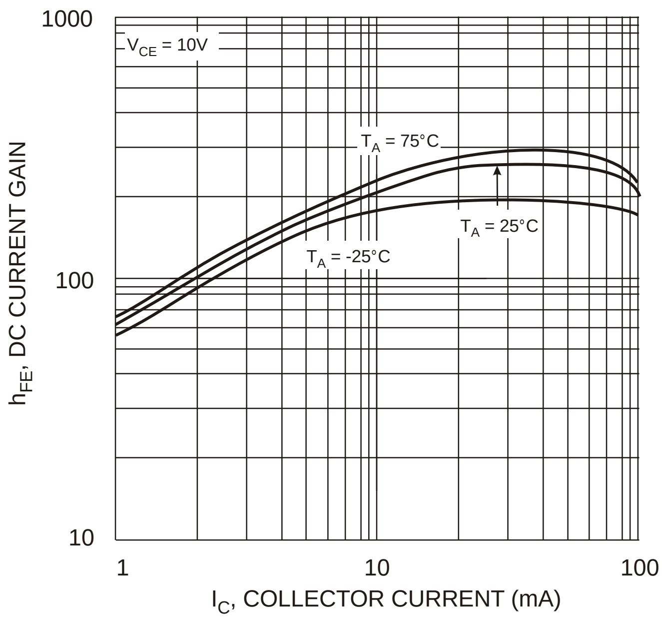



Fig. 3 DC Current Gain

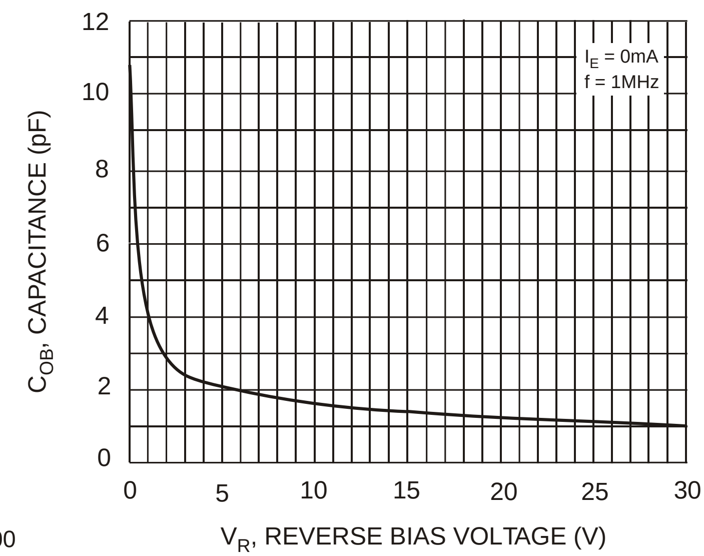



Fig. 4 Output Capacitance

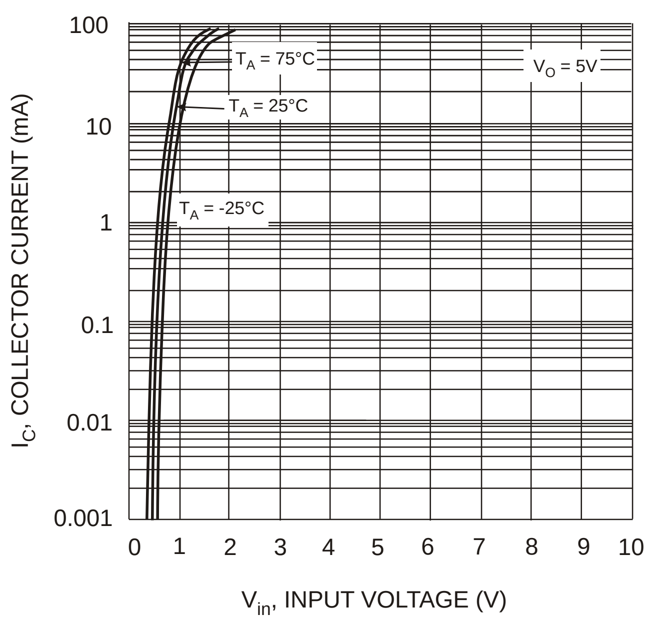



Fig. 5 Collector Current Vs. Input Voltage

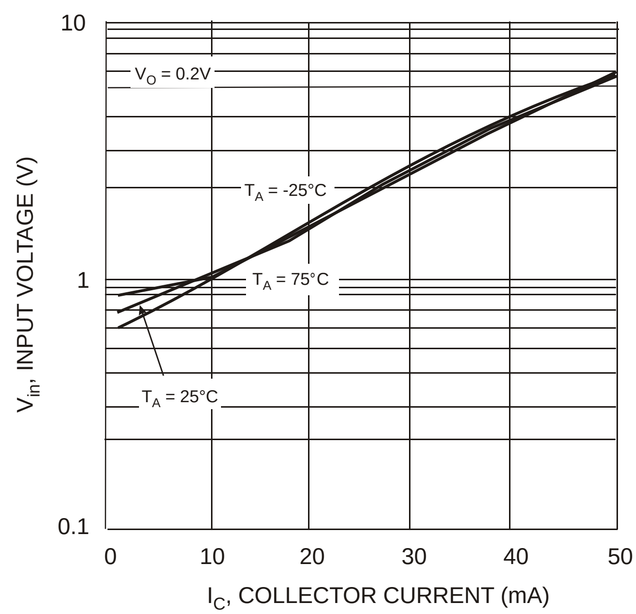



Fig. 6 Input Voltage vs. Collector Current

# TYPICAL CURVES - DCX123JU
## NPN SECTION

NEW PRODUCT

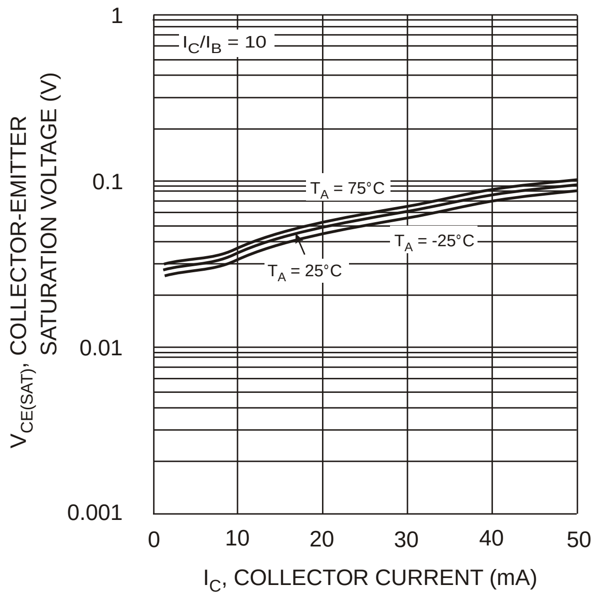



Fig. 7 $V_{CE(SAT)}$ vs. $I_C$

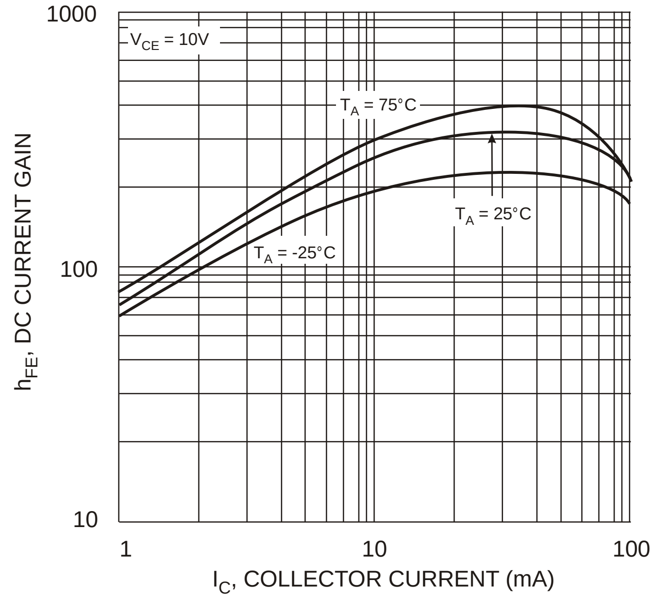



Fig. 8 DC Current Gain

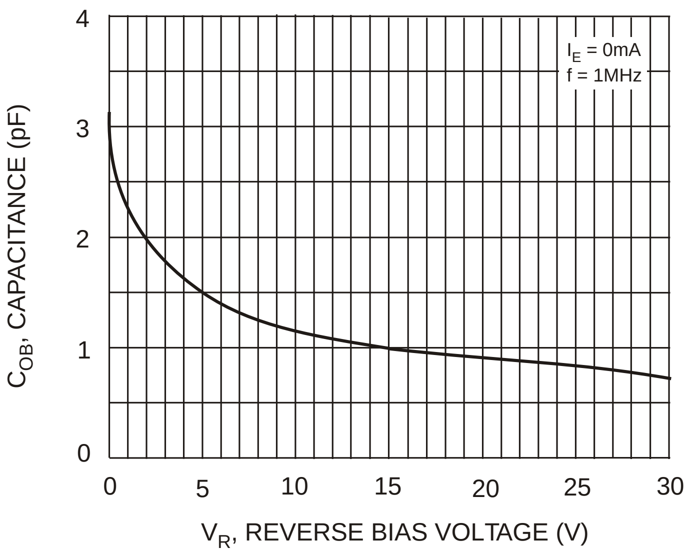



Fig. 9 Output Capacitance

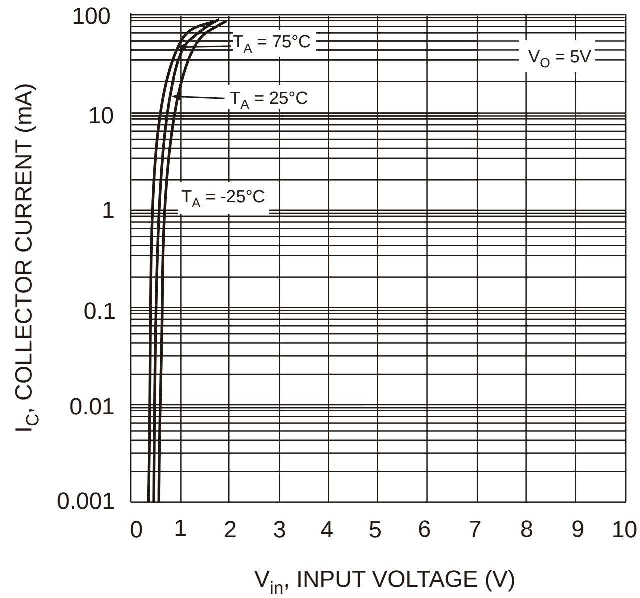



Fig. 10 Collector Current Vs. Input Voltage

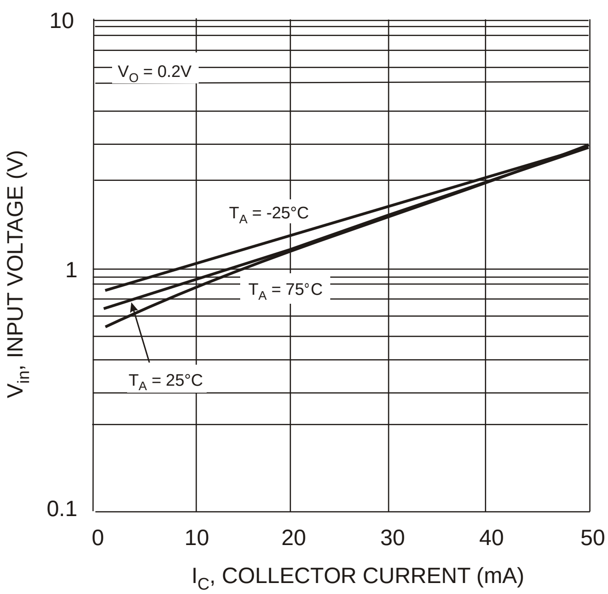



Fig. 11 Input Voltage vs. Collector Current

# TYPICAL CURVES - DCX143EU
## PNP SECTION

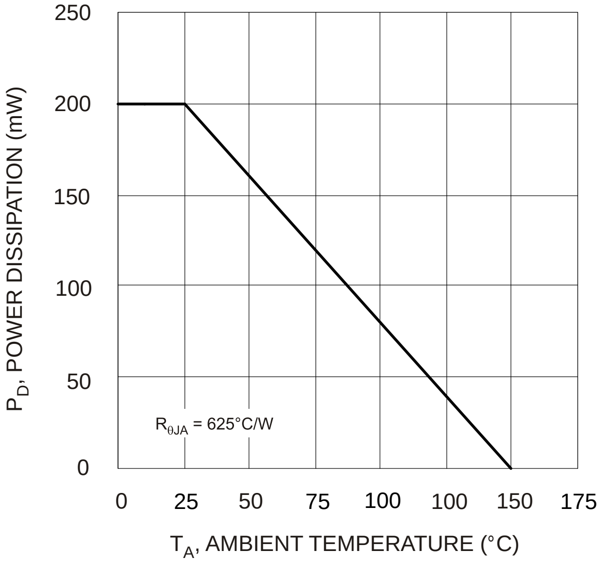


Fig. 12 Power Derating Curve

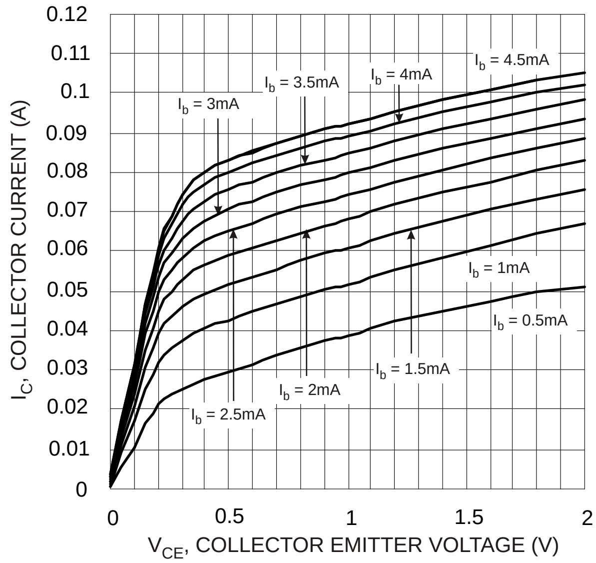


Fig. 13 $V_{CE}$ vs $I_C$

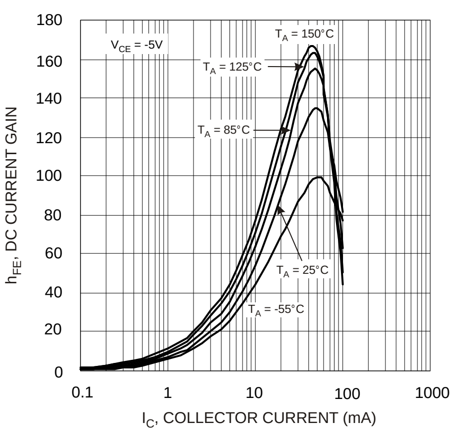


Fig. 14 DC Current Gain

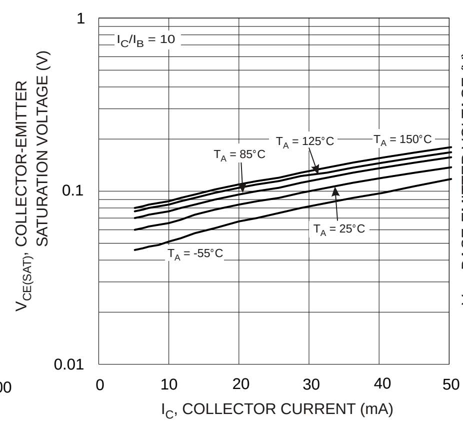


Fig. 15 $V_{CE(SAT)}$ vs $I_C$

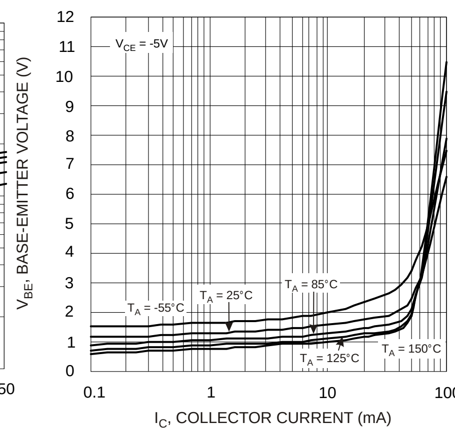


Fig. 16 $V_{BE}$ vs $I_C$

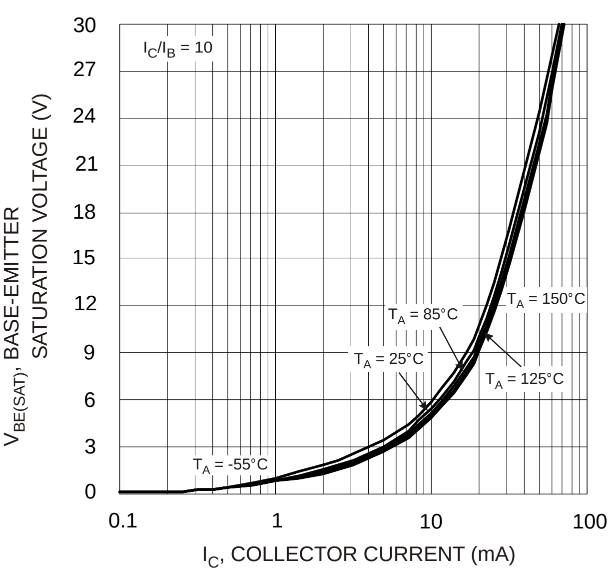


Fig. 17 $V_{BE(SAT)}$ vs $I_C$

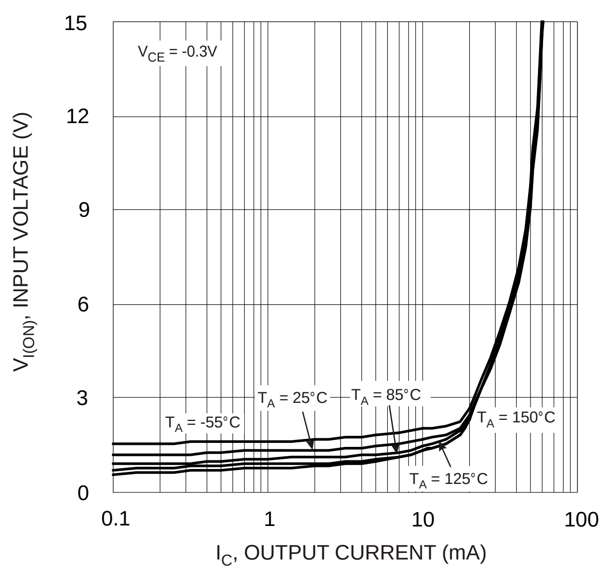


Fig. 18 $V_{I(ON)}$ vs $I_C$

NEW PRODUCT

# TYPICAL CURVES - DCX143EU
## NPN SECTION

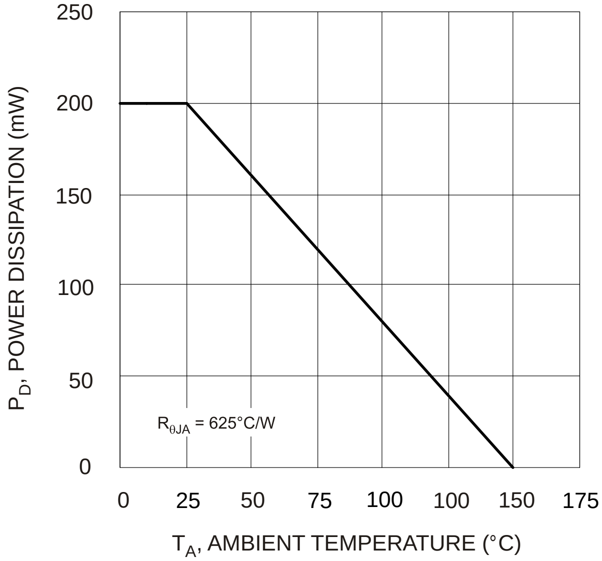



Fig. 19 Power Derating Curve

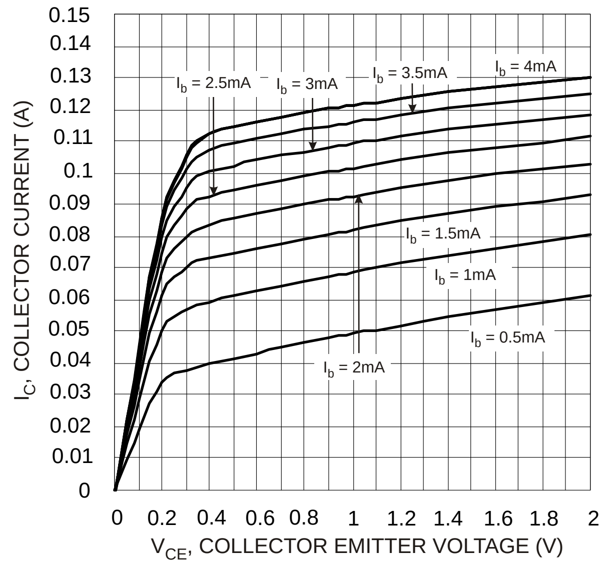



Fig. 20 $V_{CE}$ vs $I_C$

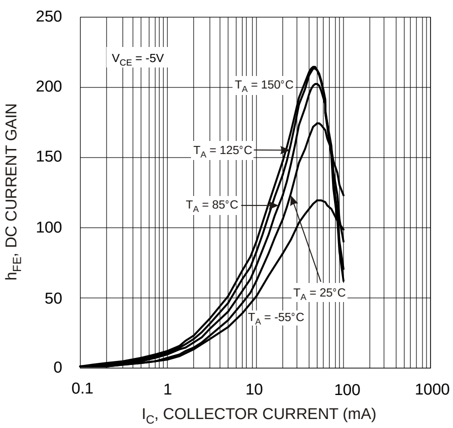



Fig. 21 DC Current Gain

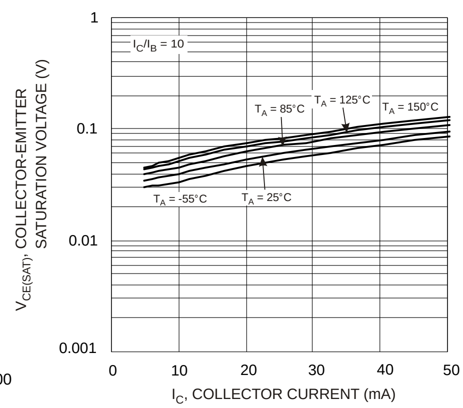



Fig. 22 $V_{CE(SAT)}$ vs $I_C$

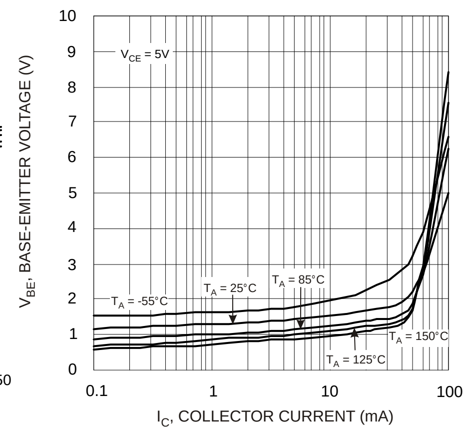



Fig. 23 $V_{BE}$ vs $I_C$

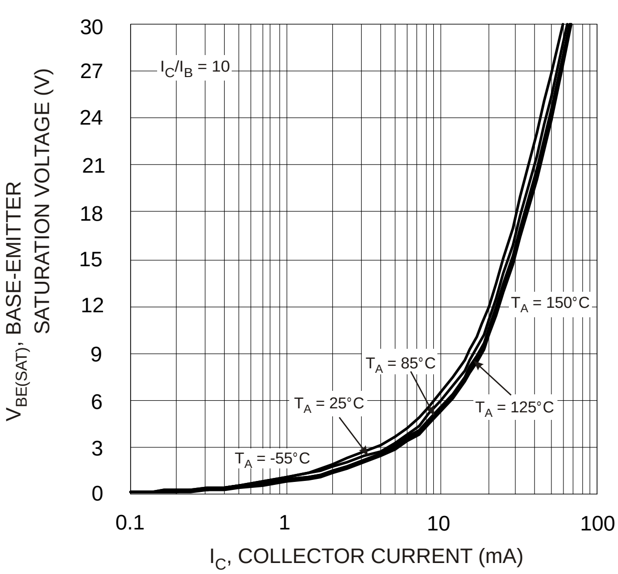



Fig. 24 $V_{BE(SAT)}$ vs $I_C$

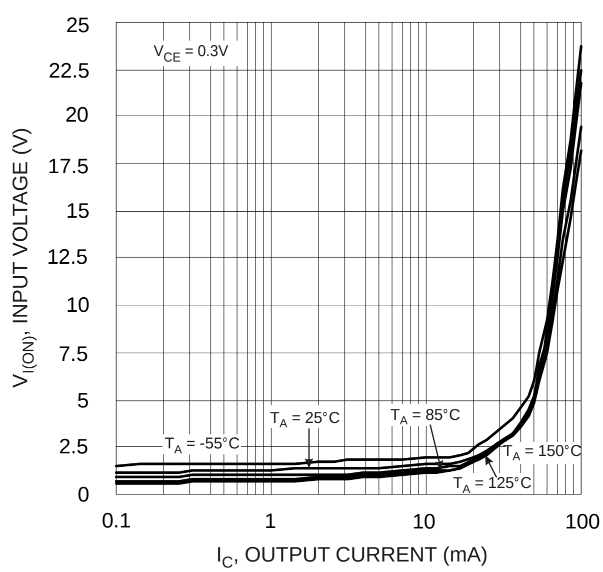



Fig. 25 $V_{I(ON)}$ vs $I_C$

# TYPICAL CURVES - DCX114TU
## PNP SECTION

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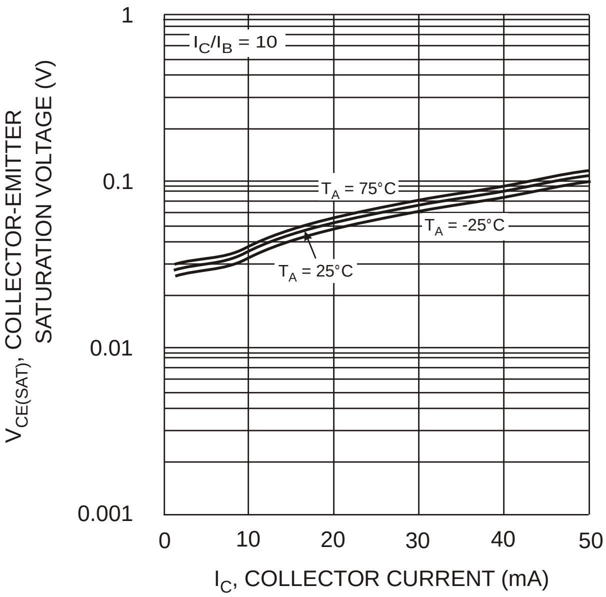


Fig. 26 $V_{CE(SAT)}$ vs. $I_C$

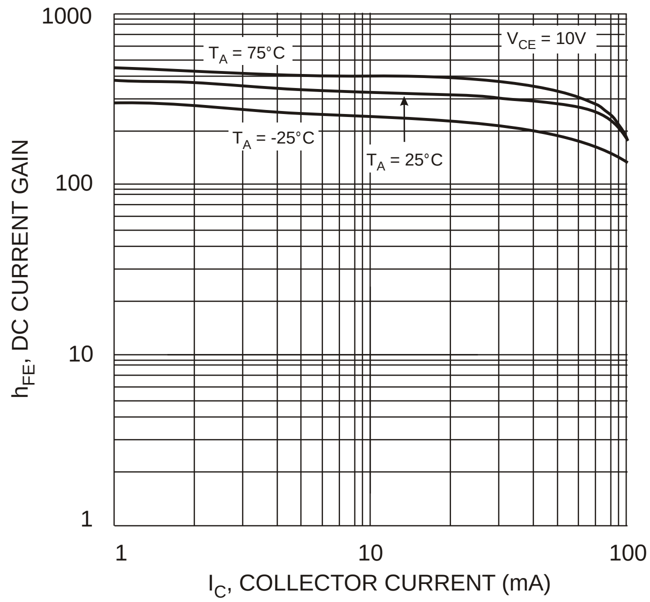


Fig. 27 DC Current Gain

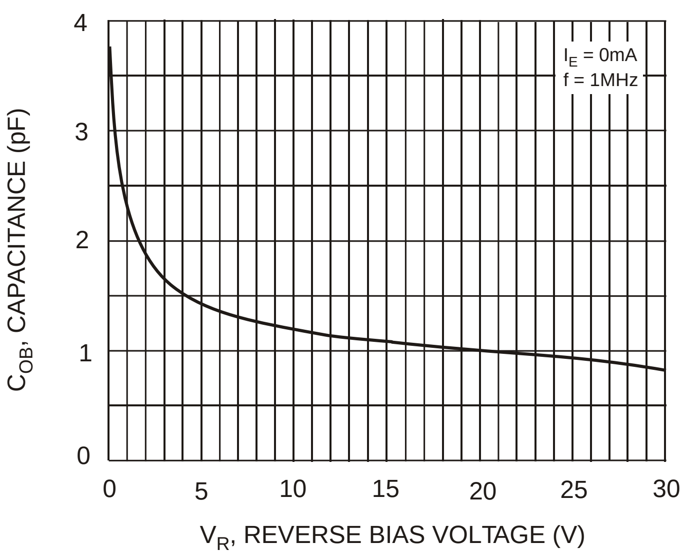


Fig. 28 Output Capacitance

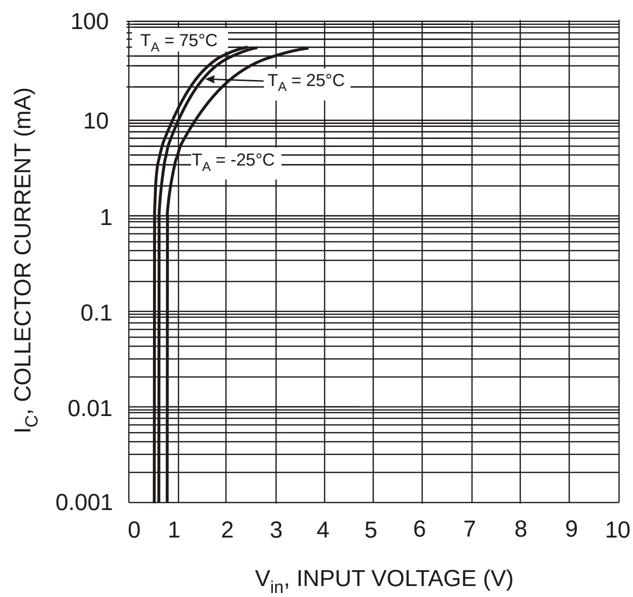


Fig. 29 Collector Current Vs. Input Voltage

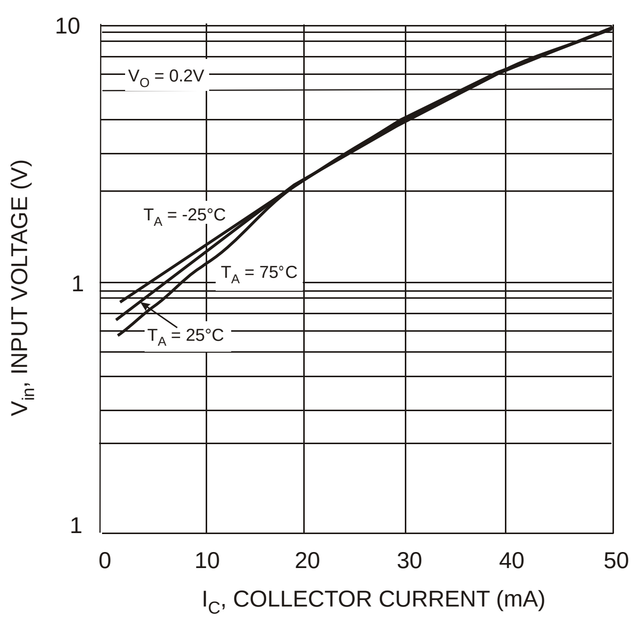


Fig. 30 Input Voltage vs. Collector Current

# TYPICAL CURVES - DCX114TU
## NPN SECTION

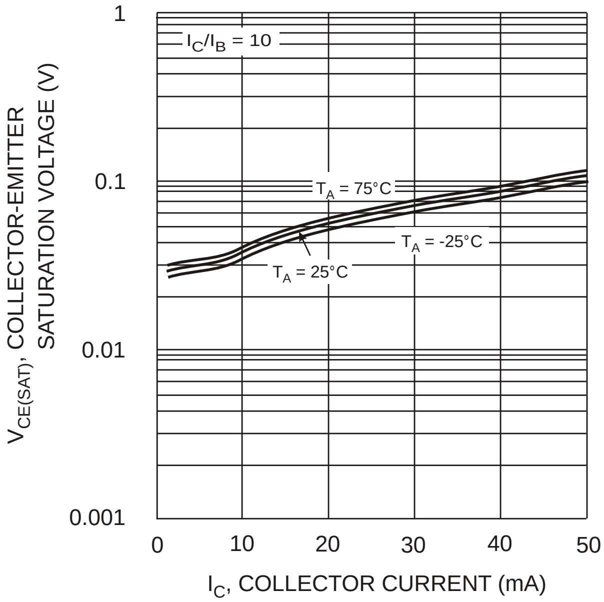


Fig. 31 $V_{CE(SAT)}$ vs. $I_C$

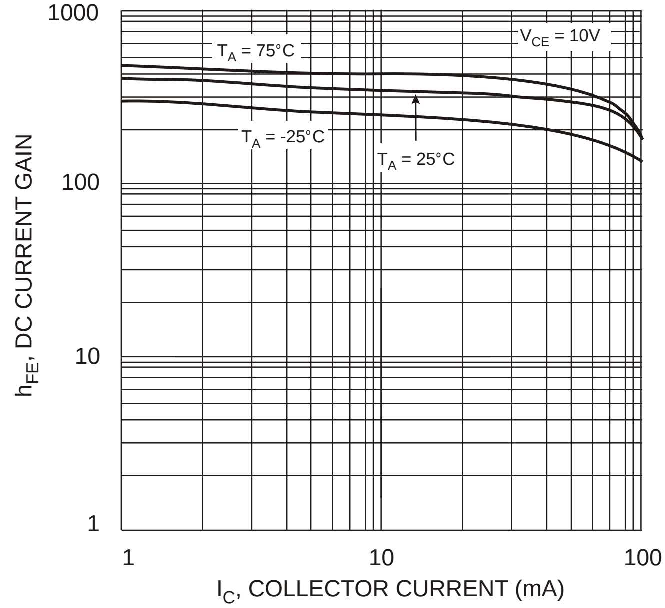


Fig. 32 DC Current Gain

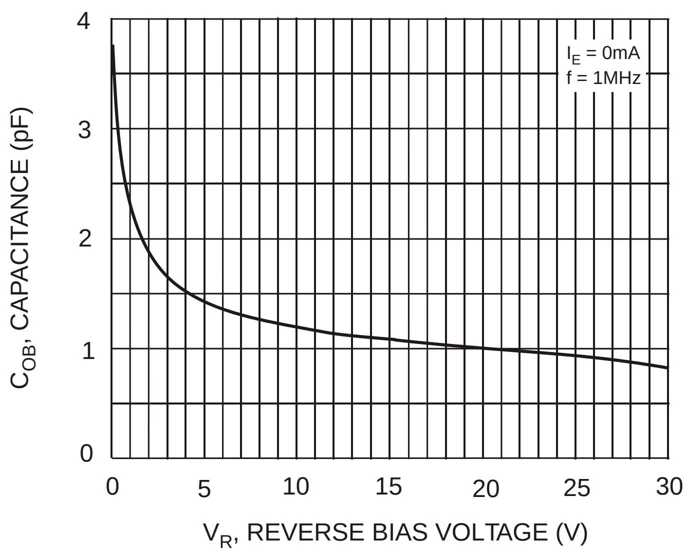


Fig. 33 Output Capacitance

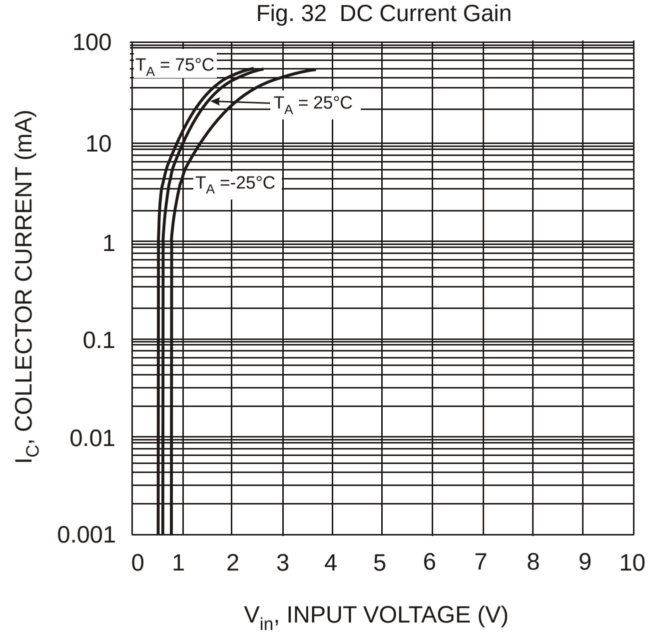


Fig. 34 Collector Current Vs. Input Voltage

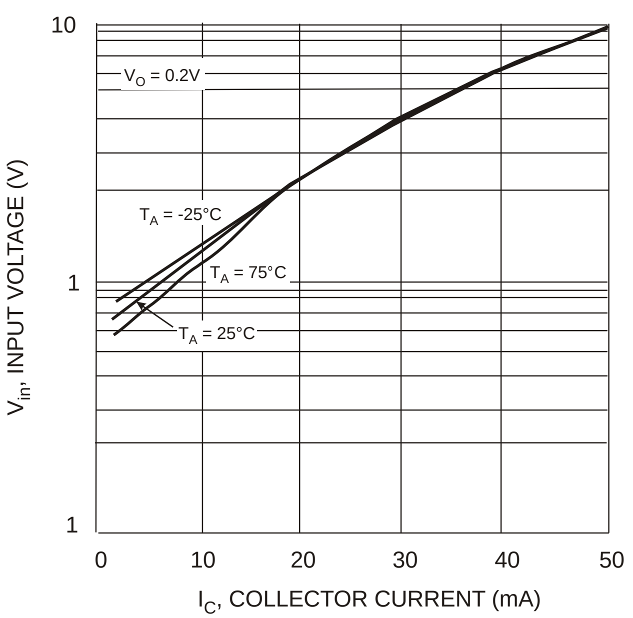


Fig. 35 Input Voltage vs. Collector Current

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## IMPORTANT NOTICE



## LIFE SUPPORT