# 40V DUAL NPN SMALL SIGNAL TRANSISTOR IN SOT563

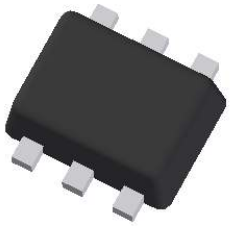
## Features

- $BV_{CEO}$ > 40V
- Ideal for Medium Power Amplification and Switching
- Ultra-Small Surface Mount Package
- Complementary PNP Type: MMDT2907VQ
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The DIODES™ MMDT2222VQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF16949 certified facilities.**
  **https://www.diodes.com/quality/product-definitions/**

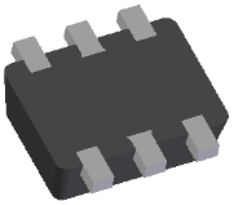
## Mechanical Data

- Package: SOT563
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Finish. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.003 grams (Approximate)

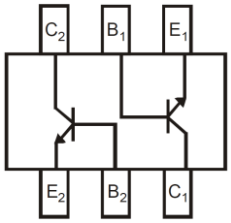
SOT563



Top View



Bottom View




Device Schematic
Top View

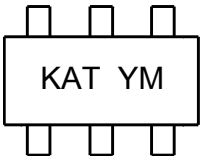
## Ordering Information (Note 4)

| Product | Package | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|---|---|---|---|---|---|
| MMDT2222VQ-7 | SOT563 | KAT | 7 | 8 | 3,000 |

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/

## Marking Information

SOT563




KAT = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: J = 2022)
M = Month (ex: 9 = September)

Date Code Key

| Year | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | J | K | L | M | N | O | P | R | S | T | U | V |

| 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 |

## Absolute Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | 75 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | 40 | V |
| Emitter-Base Voltage | $V_{EBO}$ | 6 | V |
| Collector Current | $I_C$ | 600 | mA |

## Thermal Characteristics

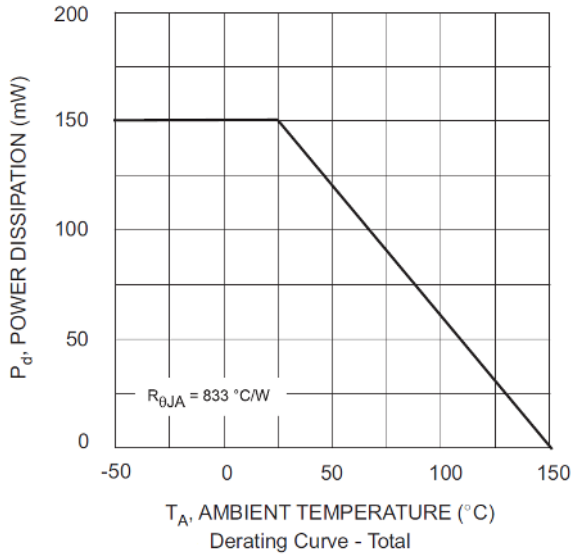
| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Power Dissipation (Note 5) | $P_D$ | 150 | mW |
| Thermal Resistance, Junction to Ambient (Note 5) | $R_{\theta JA}$ | 833 | °C/W |
| Operating and Storage and Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## ESD Ratings (Note 6)

| Characteristic | Symbol | Value | Unit | JEDEC Class |
|---|---|---|---|---|
| Electrostatic Discharge - Human Body Model | ESD HBM | 4,000 | V | 3A |
| Electrostatic Discharge - Machine Model | ESD MM | 400 | V | C |

Notes: 5. For the device mounted on minimum recommended pad layout FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
6. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

## Thermal Characteristic and Derating Information

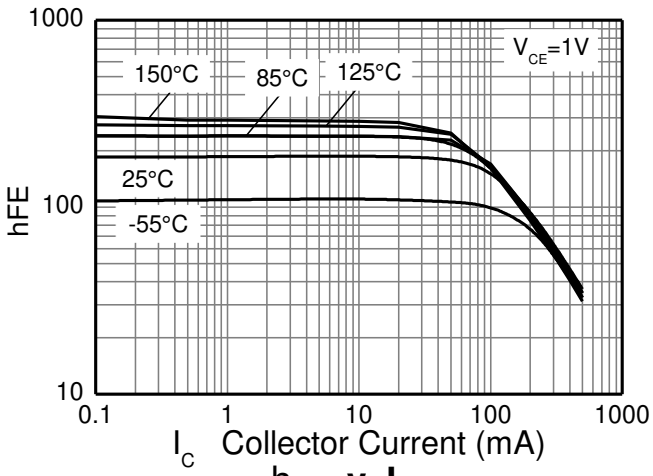


## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

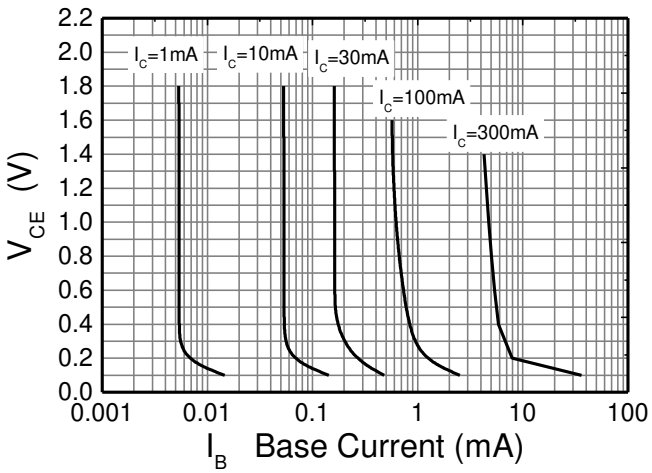
| Characteristic | Symbol | Min | Max | Unit | Test Condition |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Base Breakdown Voltage | $BV_{CBO}$ | 75 | — | V | $I_C$ = 100µA |
| Collector-Emitter Breakdown Voltage (Note 7) | $BV_{CEO}$ | 40 | — | V | $I_C$ = 10mA |
| Emitter-Base Breakdown Voltage | $BV_{EBO}$ | 6 | — | V | $I_E$ = 100µA |
| Collector-Base Cut-Off Current | $I_{CBO}$ | — | 10<br>10 | nA<br>µA | $V_{CB}$ = 60V<br>$V_{CB}$ = 60V, $T_A$ = +150°C |
| Collector Cut-Off Current | $I_{CEX}$ | — | 10 | nA | $V_{CE}$ = 60V, $V_{BE(off)}$ = 3V |
| Emitter-Base Cut-Off Current | $I_{EBO}$ | — | 10 | nA | $V_{EB}$ = 5V |
| Base Cut-Off Current | $I_{BL}$ | — | 20 | nA | $V_{CE}$ = 60V, $V_{BE(off)}$ = 0V |
| **ON CHARACTERISTICS** (Note 7) | | | | | |
| DC Current Gain | $h_{FE}$ | 35<br>50<br>75<br>100<br>40<br>50<br>35 | —<br>—<br>—<br>300<br>—<br>—<br>— | — | $I_C$ = 100µA, $V_{CE}$ = 10V<br>$I_C$ = 1mA, $V_{CE}$ = 10V<br>$I_C$ = 10mA, $V_{CE}$ = 10V<br>$I_C$ = 150mA, $V_{CE}$ = 10V<br>$I_C$ = 500mA, $V_{CE}$ = 10V<br>$I_C$ = 10mA, $V_{CE}$ = 10V, $T_A$ = -55°C<br>$I_C$ = 150mA, $V_{CE}$ = 1V |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | — | 0.3<br>1.0 | V | $I_C$ = 150mA, $I_B$ = 15mA<br>$I_C$ = 500mA, $I_B$ = 50mA |
| Base-Emitter Saturation Voltage | $V_{BE(sat)}$ | 0.6<br>— | 1.2<br>2.0 | V | $I_C$ = 150mA, $I_B$ = 15mA<br>$I_C$ = 500mA, $I_B$ = 50mA |
| **SMALL SIGNAL CHARACTERISTICS** | | | | | |
| Output Capacitance | $C_{obo}$ | — | 8.0 | pF | $V_{CB}$ = 10V, f = 1MHz, $I_E$ = 0 |
| Input Capacitance | $C_{ibo}$ | — | 25 | pF | $V_{EB}$ = 0.5V, f = 1MHz, $I_C$ = 0 |
| Current Gain-Bandwidth Product | $f_T$ | 300 | — | MHz | $V_{CE}$ = 20V, $I_C$ = 20mA, f = 100MHz |
| Noise Figure | NF | — | 4 | dB | $V_{CE}$ = 10V, $I_C$ = 100µA, $R_S$ = 1kΩ, f = 1.0kHz |
| **SWITCHING CHARACTERISTICS** | | | | | |
| Delay Time | $t_d$ | — | 10 | ns | $V_{CC}$ = 30V, $I_C$ = 150mA, $V_{BE(off)}$ = - 0.5V, $I_{B1}$ = 15mA |
| Rise Time | $t_r$ | — | 25 | ns | |
| Storage Time | $t_s$ | — | 225 | ns | $V_{CC}$ = 30V, $I_C$ = 150mA, $I_{B1}$ =-$I_{B2}$ = 15mA |
| Fall Time | $t_f$ | — | 60 | ns | |

Note: 7. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.

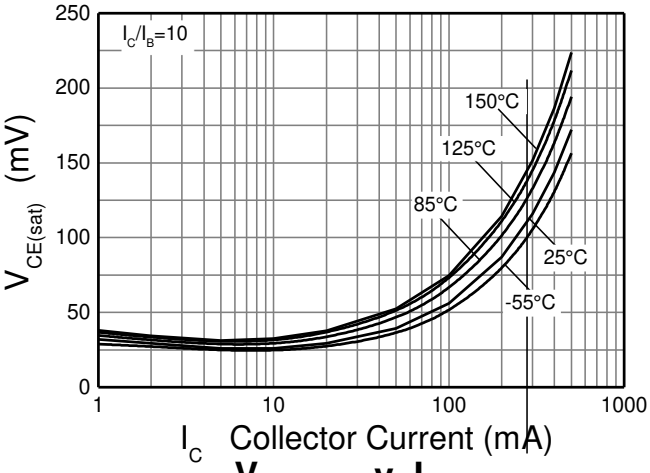
## Typical Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)



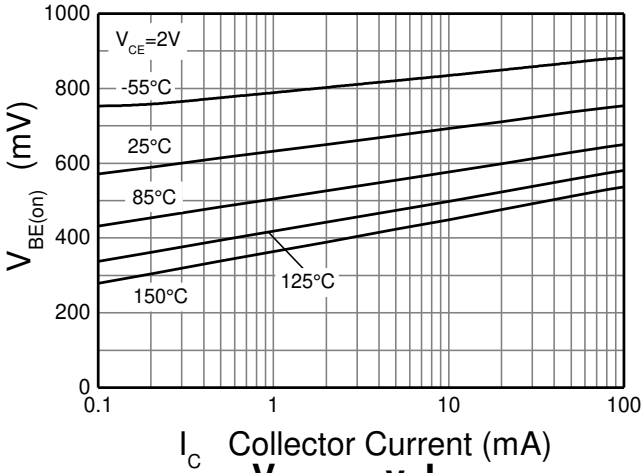

$h_{FE}$ v $I_C$



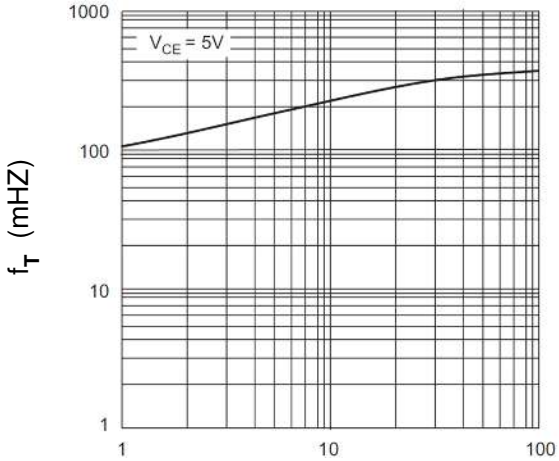

$V_{CE}$ v $I_B$



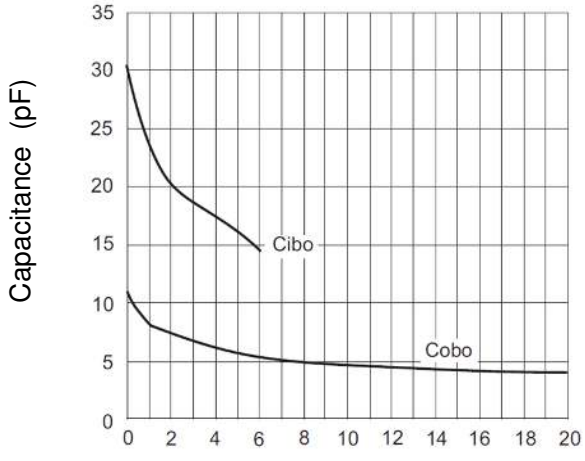

$V_{CE(sat)}$ v $I_C$




$V_{BE(on)}$ v $I_C$




$f_T$ v $I_C$

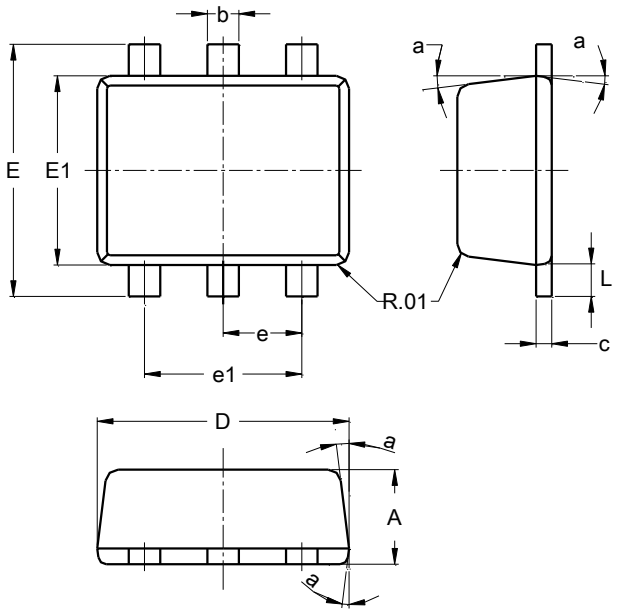



Capacitance v $V_R$

## Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

**SOT563**

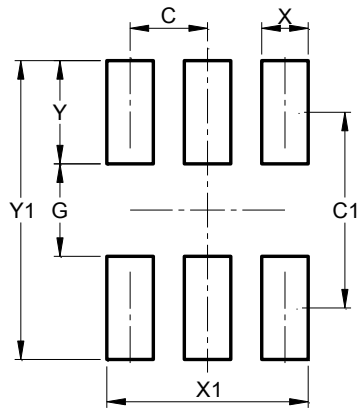



| SOT563 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.55 | 0.60 | -- |
| **b** | 0.15 | 0.30 | 0.20 |
| **c** | 0.10 | 0.18 | 0.11 |
| **D** | 1.50 | 1.70 | 1.60 |
| **E** | 1.55 | 1.70 | 1.60 |
| **E1** | 1.10 | 1.25 | 1.20 |
| **e** | -- | -- | 0.50 |
| **e1** | 0.90 | 1.10 | 1.00 |
| **L** | 0.10 | 0.30 | 0.20 |
| **a** | 8° | 9° | 7° |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

**SOT563**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 0.500 |
| **C1** | 1.270 |
| **G** | 0.600 |
| **X** | 0.300 |
| **X1** | 1.300 |
| **Y** | 0.670 |
| **Y1** | 1.940 |

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