

## Plastic-Encapsulate Transistors

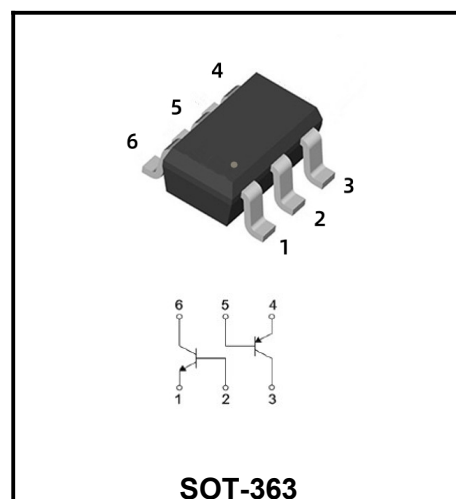
### DUAL TRANSISTOR(NPN+PNP)

#### Features

- ◆Epitaxial Planar Die Construction
- ◆Complementary Pair
- ◆Ideal for low Power Amplification and Switching
- ◆One 4401(NPN), one 4403(PNP)

#### Mechanical Data

- ◆SOT-363 Small Outline Plastic Package
- ◆Epoxy UL: 94V-0
- ◆Mounting Position: Any



#### Marking Code

|            |     |
|------------|-----|
| MMDT4413DW | K13 |
|------------|-----|

#### Maximum Ratings TR1(NPN)4401

Ratings at 25°C ambient temperature unless otherwise specified.

| Parameters                                  | Symbol          | Value    | Unit |
|---------------------------------------------|-----------------|----------|------|
| Collector-Base Voltage                      | $V_{CBO}$       | 60       | V    |
| Collector-Emitter Voltage                   | $V_{CEO}$       | 40       | V    |
| Emitter -Base Voltage                       | $V_{EBO}$       | 6        | V    |
| Collector Current-Continuous                | $I_C$           | 600      | mA   |
| Collector Power Dissipation                 | $P_C$           | 200      | mW   |
| Junction Temperature                        | $T_J$           | 150      | °C   |
| Storage Temperature                         | $T_{stg}$       | -55-+150 | °C   |
| Thermal resistance From junction to ambient | $R_{\theta JA}$ | 625      | °C/W |

**Electrical Characteristics of TR1(NPN)4401**

Ratings at 25°C ambient temperature unless otherwise specified.

| Parameter                            | Symbols       | Test Condition                                    | Limits |     |      | Unit    |
|--------------------------------------|---------------|---------------------------------------------------|--------|-----|------|---------|
|                                      |               |                                                   | Min    | Typ | Max  |         |
| Collector-base breakdown voltage     | $V_{(BR)CBO}$ | $I_C=100\mu A, I_E=0$                             | 60     |     |      | V       |
| Collector-emitter breakdown voltage  | $V_{(BR)CEO}$ | $I_C=1mA, I_B=0$                                  | 40     |     |      | V       |
| Emitter-base breakdown voltage       | $V_{(BR)EBO}$ | $I_E=100\mu A, I_C=0$                             | 6      |     |      | V       |
| Collector cut-off current            | $I_{CBO}$     | $V_{CB}=50V, I_E=0$                               |        |     | 0.1  | $\mu A$ |
| Collector cut-off current            | $I_{CEO}$     | $V_{CE}=35V, I_B=0$                               |        |     | 0.5  | $\mu A$ |
| Emitter cut-off current              | $I_{EBO}$     | $V_{EB}=5V, I_C=0$                                |        |     | 0.1  | $\mu A$ |
| DC current gain                      | $h_{FE1}$     | $V_{CE}=1V, I_C=0.1mA$                            | 20     |     |      |         |
|                                      | $h_{FE2}$     | $V_{CE}=1V, I_C=1mA$                              | 40     |     |      |         |
|                                      | $h_{FE3}$     | $V_{CE}=1V, I_C=10mA$                             | 80     |     |      |         |
|                                      | $h_{FE4}$     | $V_{CE}=1V, I_C=150mA$                            | 100    |     |      |         |
|                                      | $h_{FE5}$     | $V_{CE}=2V, I_C=500mA$                            | 40     |     |      |         |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C=150mA, I_B=15mA$                             |        |     | 0.4  | V       |
|                                      |               | $I_C=500mA, I_B=50mA$                             |        |     | 0.75 | A       |
| Base-emitter saturation voltage      | $V_{BE(sat)}$ | $I_C=150mA, I_B=15mA$                             | 0.75   |     | 0.95 | V       |
|                                      |               | $I_C=500mA, I_B=50mA$                             |        |     | 1.2  | V       |
| Transition frequency                 | $f_T$         | $V_{CE}=10V, I_C=20mA, f=100MHz$                  | 250    |     |      | MHz     |
| Collector output capacitance         | $C_{ob}$      | $V_{CB}=5V, I_E=0, f=1MHz$                        |        |     | 6.5  | pF      |
| Delay time                           | $t_d$         | $V_{CC}=30V, V_{BE}=2.0V, I_C=150mA, I_{B1}=15mA$ |        |     | 15   | ns      |
| Rise time                            | $t_r$         |                                                   |        |     | 20   | ns      |
| Storage time                         | $t_s$         | $V_{CC}=30V, I_C=150mA, I_{B1}=I_{B2}=15mA$       |        |     | 225  | ns      |
| Fall time                            | $t_f$         |                                                   |        |     | 30   | ns      |

**Maximum Ratings TR2(PNP)4403**

Ratings at 25°C ambient temperature unless otherwise specified.

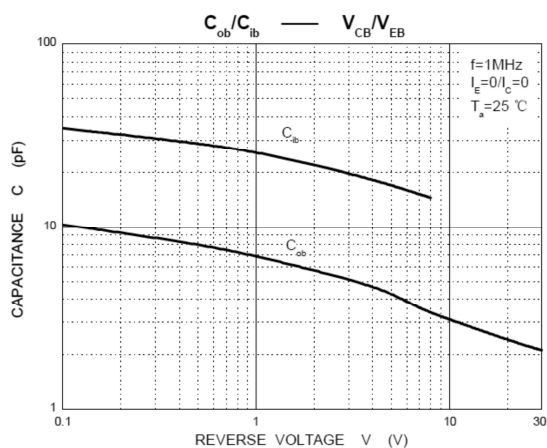
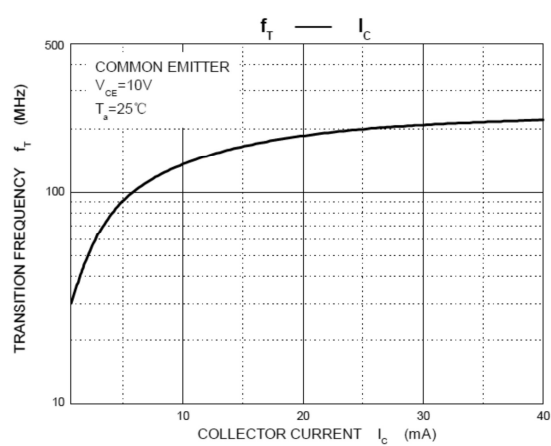
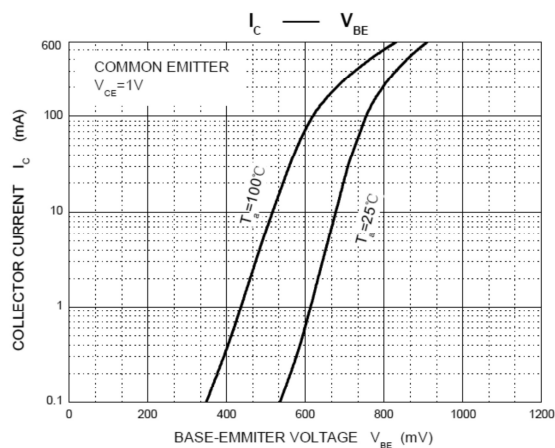
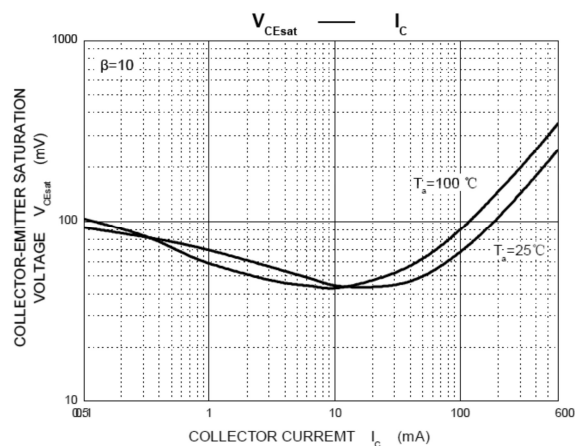
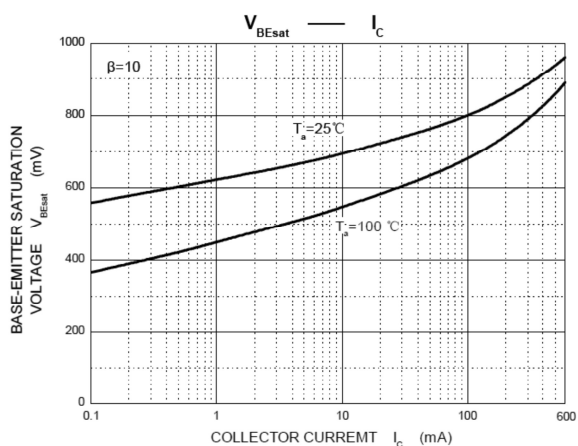
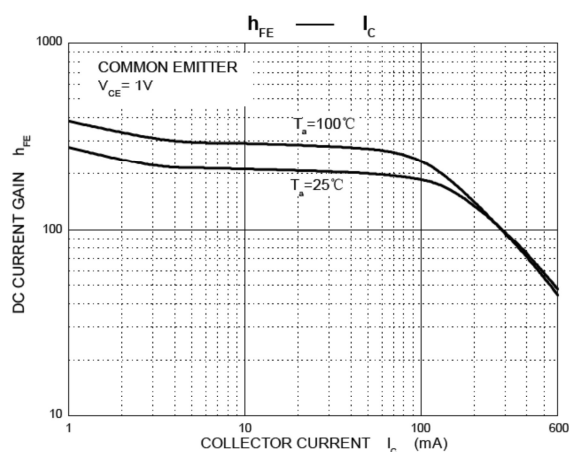
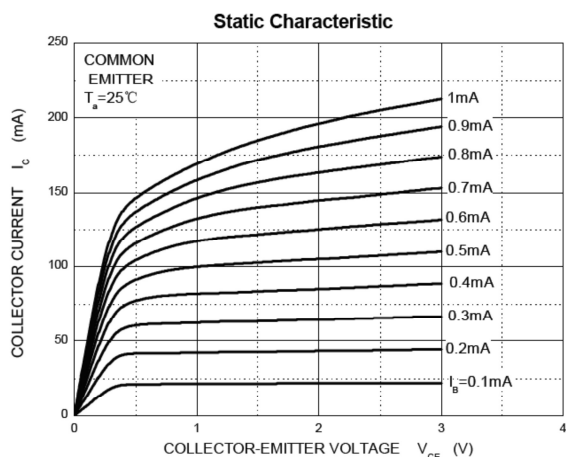
| Parameters                                  | Symbol          | Value    | Unit |
|---------------------------------------------|-----------------|----------|------|
| Collector-Base Voltage                      | $V_{CBO}$       | -40      | V    |
| Collector-Emitter Voltage                   | $V_{CEO}$       | -40      | V    |
| Emitter -Base Voltage                       | $V_{EBO}$       | -5       | V    |
| Collector Current-Continuous                | $I_C$           | -600     | mA   |
| Collector Power Dissipation                 | $P_C$           | 200      | mW   |
| Junction Temperature                        | $T_J$           | 150      | °C   |
| Storage Temperature                         | $T_{stg}$       | -55~+150 | °C   |
| Thermal resistance From junction to ambient | $R_{\theta JA}$ | 625      | °C/W |

**Electrical Characteristics of TR2 (PNP)4403**

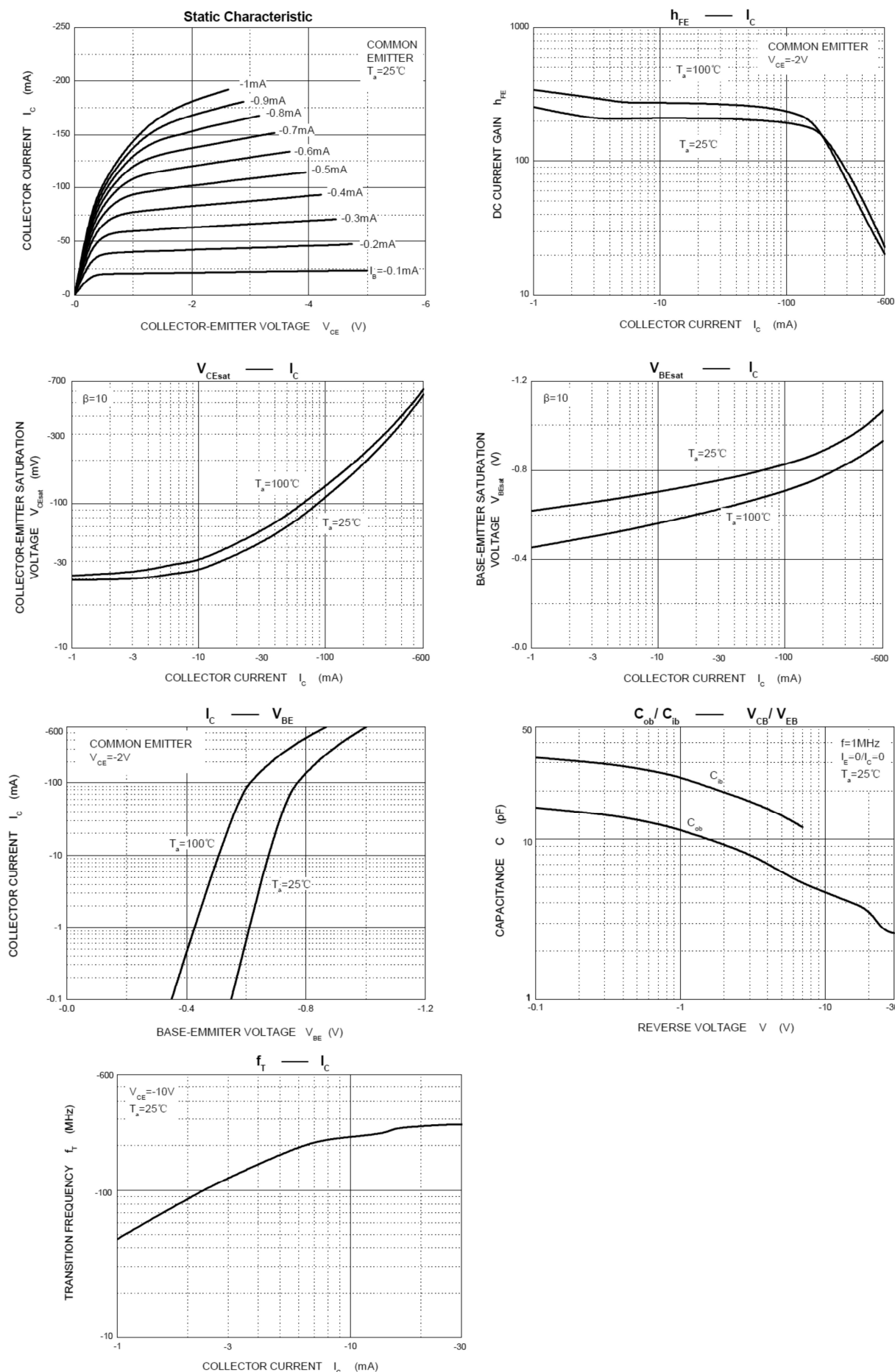
Ratings at 25°C ambient temperature unless otherwise specified.

| Parameter                            | Symbols       | Test Condition                                        | Limits |     |       | Unit |
|--------------------------------------|---------------|-------------------------------------------------------|--------|-----|-------|------|
|                                      |               |                                                       | Min    | Typ | Max   |      |
| Collector-base breakdown voltage     | $V_{(BR)CBO}$ | $I_C=-100\mu A, I_E=0$                                | -40    |     |       | V    |
| Collector-emitter breakdown voltage  | $V_{(BR)CEO}$ | $I_C=-1mA, I_B=0$                                     | -40    |     |       | V    |
| Emitter-base breakdown voltage       | $V_{(BR)EBO}$ | $I_E=-100\mu A, I_C=0$                                | -5     |     |       | V    |
| Collector cut-off current            | $I_{CBO}$     | $V_{CB}=-50V, I_E=0$                                  |        |     | -0.1  | uA   |
| Collector cut-off current            | $I_{CEO}$     | $V_{CE}=-35V, I_B=0$                                  |        |     | -0.5  | uA   |
| Emitter cut-off current              | $I_{EBO}$     | $V_{EB}=-5V, I_C=0$                                   |        |     | -0.1  | uA   |
| DC current gain                      | $h_{FE1}$     | $V_{CE}=-1V, I_C=-0.1mA$                              | 30     |     |       |      |
|                                      | $h_{FE2}$     | $V_{CE}=-1V, I_C=-1mA$                                | 60     |     |       |      |
|                                      | $h_{FE3}$     | $V_{CE}=-1V, I_C=-10mA$                               | 100    |     |       |      |
|                                      | $h_{FE4}$     | $V_{CE}=-2V, I_C=-150mA$                              | 100    |     | 300   |      |
|                                      | $h_{FE5}$     | $V_{CE}=-2V, I_C=-500mA$                              | 20     |     |       |      |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $I_C=-150mA, I_B=-15mA$                               |        |     | -0.4  | V    |
|                                      |               | $I_C=-500mA, I_B=-50mA$                               |        |     | -0.75 | A    |
| Base-emitter saturation voltage      | $V_{BE(sat)}$ | $I_C=-150mA, I_B=-15mA$                               | -0.75  |     | -0.95 | V    |
|                                      |               | $I_C=-500mA, I_B=-50mA$                               |        |     | -1.3  | V    |
| Transition frequency                 | $f_T$         | $V_{CE}=-10V, I_C=-20mA, f=100MHz$                    | 200    |     |       | MHz  |
| Collector output capacitance         | $C_{ob}$      | $V_{CB}=-5V, I_E=0, f=1MHz$                           |        |     | 8.5   | pF   |
| Delay time                           | $t_d$         | $V_{CC}=-30V, V_{BE}=-2.0V, I_C=-150mA, I_{B1}=-15mA$ |        |     | 15    | ns   |
| Rise time                            | $t_r$         |                                                       |        |     | 20    | ns   |
| Storage time                         | $t_s$         | $V_{CC}=-30V, I_C=-150mA, I_{B1}=-I_{B2}=-15mA$       |        |     | 225   | ns   |
| Fall time                            | $t_f$         |                                                       |        |     | 30    | ns   |

Typical characteristics NPN



Typical characteristics PNP



## Ordering information

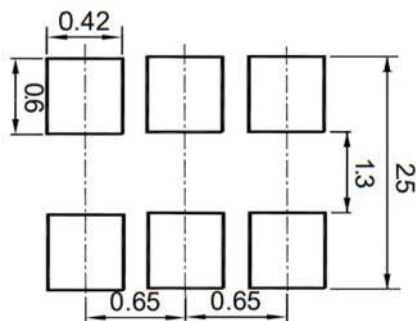
| Package | Packing Description | Packing Quantity              |
|---------|---------------------|-------------------------------|
| SOT-363 | Tape/Reel, 7" reel  | 3000PCS/Reel 120000PCS/Carton |

## Package Dimensions

### SOT-363

| Dim. | Millimeter(mm) |      | mil   |       |
|------|----------------|------|-------|-------|
|      | Min.           | Max. | Min.  | Max.  |
| A    | 0.8            | 1.1  | 32    | 43    |
| A1   | -              | 0.1  | -     | 3.94  |
| bp   | 0.20           | 0.30 | 7.87  | 11.81 |
| c    | 0.10           | 0.25 | 3.94  | 9.84  |
| D    | 1.8            | 2.2  | 70.87 | 86.61 |
| E    | 1.15           | 1.35 | 45.28 | 53.15 |
| e    | 1.3            |      | 51.18 |       |
| e1   | 0.65           |      | 25.6  |       |
| HE   | 2.0            | 2.2  | 78.74 | 86.6  |
| Lp   | 0.15           | 0.45 | 5.90  | 17.71 |
| Q    | 0.15           | 0.25 | 5.90  | 9.84  |
| v    | 0.2            |      | 7.78  |       |
| w    | 0.2            |      | 7.78  |       |
| y    | 0.1            |      | 3.94  |       |

### The recommended mounting pad size



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