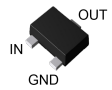
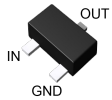
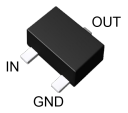
# DTC023E series

NPN 100mA 50V Digital Transistors (Bias Resistor Built-in Transistors) Datasheet

| Parameter | Value |
|---|---|
| $V_{CC}$ | 50V |
| $I_{C(MAX.)}$ | 100mA |
| $R_1$ | 2.2kΩ |
| $R_2$ | 2.2kΩ |

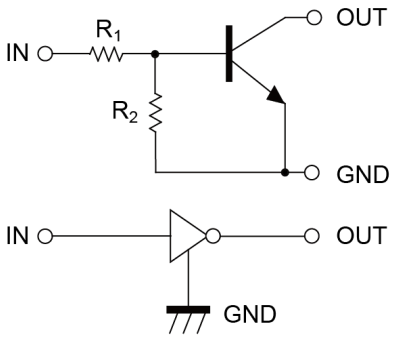
## ●Outline

| | |
|---|---|
| VMT3<br>  <br><br>DTC023EM<br>(SC-105AA) | EMT3F<br>  <br><br>DTC023EEB<br>(SC-89) |
| UMT3F<br>  <br><br>DTC023EUB<br>(SC-85) | |

## ●Features

1) Built-In Biasing Resistors, $R_1 = R_2 = 2.2kΩ$
2) Built-in bias resistors enable the configuration of an inverter circuit without connecting external input resistors (see inner circuit) .
3) The bias resistors consist of thin-film resistors with complete isolation to allow negative biasing of the input. They also have the advantage of completely eliminating parasitic effects.
4) Only the on/off conditions need to be set for operation, making the circuit design easy.
5) Complementary PNP Types: DTA023E series
6) Lead Free/RoHS Compliant.

## ●Inner circuit




## ●Application

Switching circuit, Inverter circuit, Interface circuit, Driver circuit

## ●Packaging specifications

| Part No. | Package | Package size | Taping code | Reel size (mm) | Tape width (mm) | Basic ordering unit.(pcs) | Marking |
|---|---|---|---|---|---|---|---|
| DTC023EM | VMT3 | 1212 | T2L | 180 | 8 | 8000 | 65 |
| DTC023EEB | EMT3F | 1616 | TL | 180 | 8 | 3000 | 65 |
| DTC023EUB | UMT3F | 2021 | TL | 180 | 8 | 3000 | 65 |

## ●Absolute maximum ratings ($T_a$ = 25°C)

| Parameter | | Symbol | Values | Unit |
|---|---|---|---|---|
| Supply voltage | | $V_{CC}$ | 50 | V |
| Input voltage | | $V_{IN}$ | 12 to -10 | V |
| Output current | | $I_O$ | 100 | mA |
| Collector current | | $I_{C(MAX)}$*1 | 100 | mA |
| Power dissipation | DTC023EM | $P_D$*2 | 150 | mW |
| | DTC023EEB | | 150 | |
| | DTC023EUB | | 200 | |
| Junction temperature | | $T_j$ | 150 | ℃ |
| Range of storage temperature | | $T_{stg}$ | -55 to +150 | ℃ |

## ●Electrical characteristics ($T_a$ = 25°C)

| Parameter | Symbol | Conditions | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Input voltage | $V_{I(off)}$ | $V_{CC}$ = 5V, $I_O$ = -0.1mA | - | - | 0.8 | V |
| | $V_{I(on)}$ | $V_O$ = 0.3V, $I_O$ = 5mA | 2.6 | - | - | |
| Output voltage | $V_{O(on)}$ | $I_O$ / $I_I$ = 10mA / 1mA | - | 0.08 | 0.2 | V |
| Input current | $I_I$ | $V_I$ = 5V | - | - | 3.6 | mA |
| Output current | $I_{O(off)}$ | $V_{CC}$ = 50V, $V_I$ = 0V | - | - | 0.5 | μA |
| DC current gain | $G_I$ | $V_O$ = 10V, $I_O$ = 20mA | 20 | - | - | - |
| Input resistance | $R_1$ | - | 1.54 | 2.2 | 2.86 | kΩ |
| Resistance ratio | $R_2/R_1$ | - | 0.8 | 1 | 1.2 | - |
| Transition frequency | $f_T$*1 | $V_{CE}$ = 10V, $I_E$ = -5mA, f = 100MHz | - | 250 | - | MHz |

*1 Characteristics of built-in transistor

*2 Each terminal mounted on a reference footprint

## ●Electrical characteristic curves ($T_a$ =25°C)

Fig.1 Input voltage vs. output current (ON characteristics)

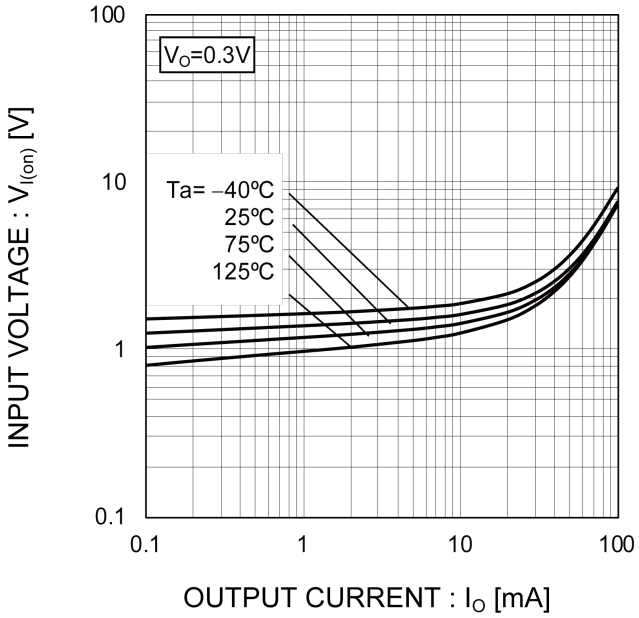



Fig.2 Output current vs. input voltage (OFF characteristics)

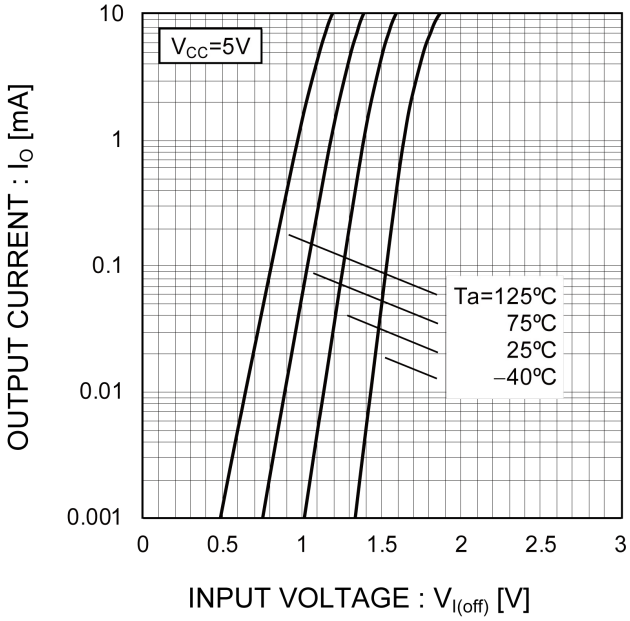



Fig.3 Output current vs. output voltage

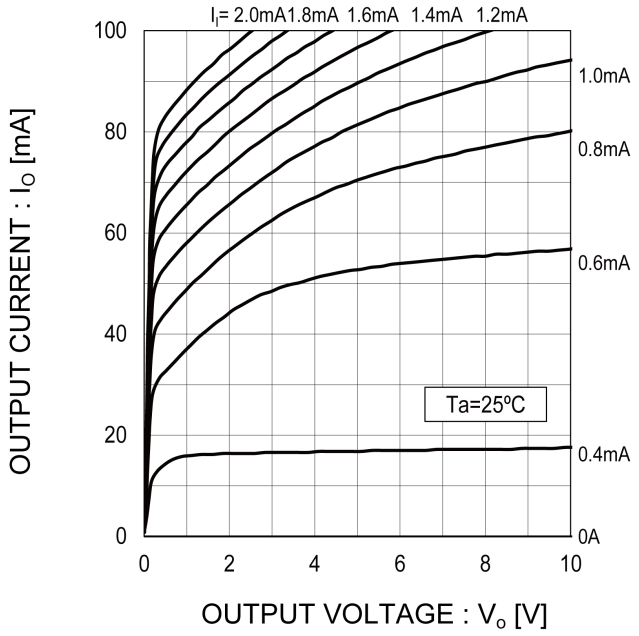
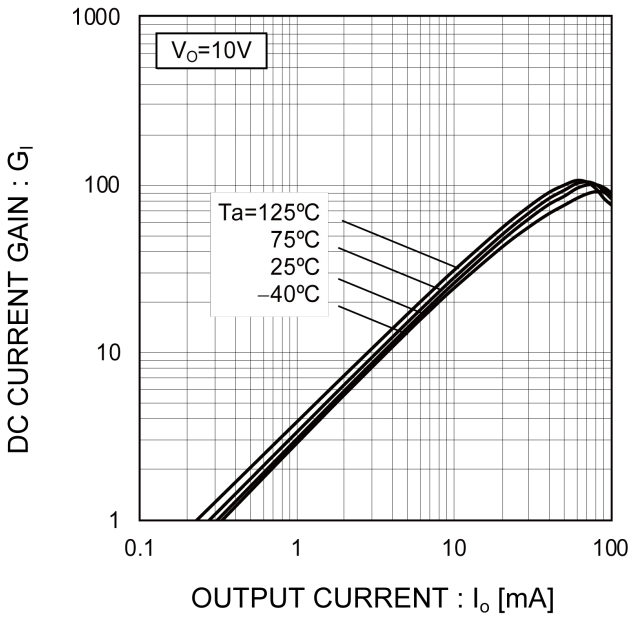
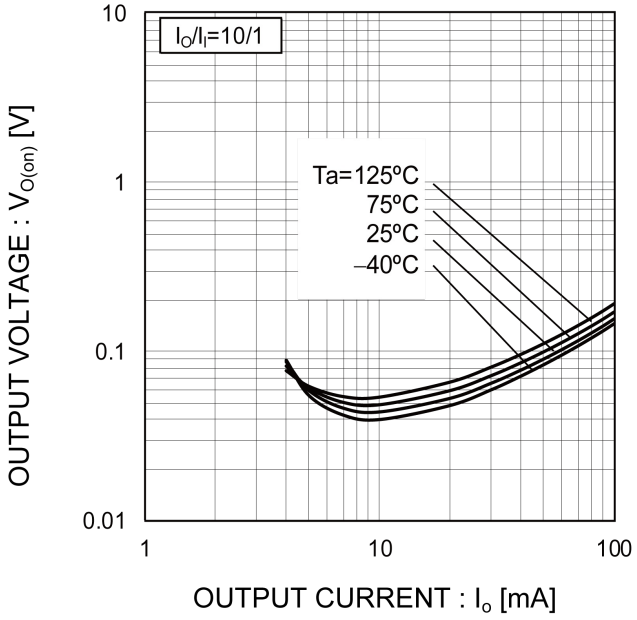



Fig.4 DC current gain vs. output current



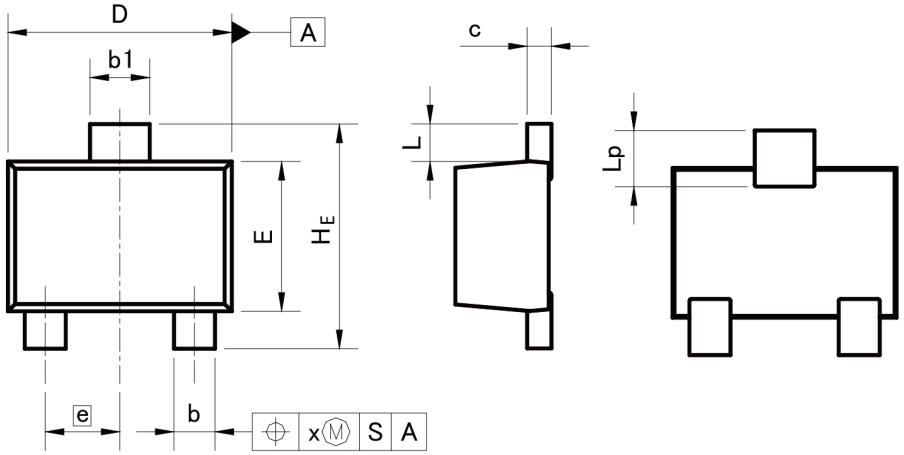
## ●Electrical characteristic curves ($T_a$ =25°C)

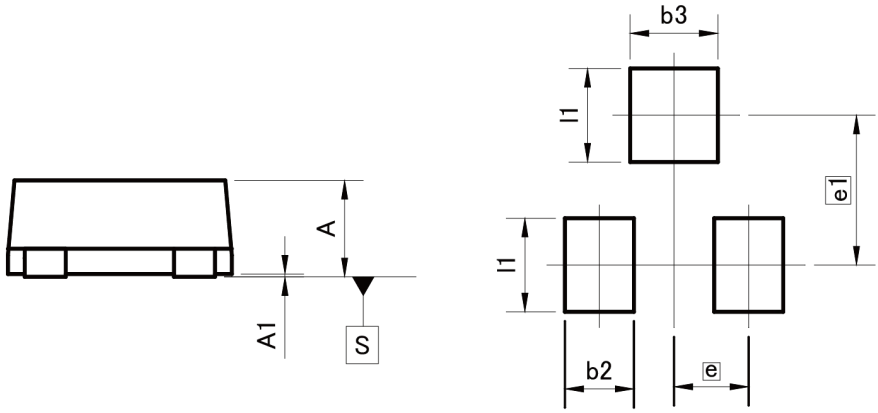
Fig.5 Output voltage vs. output current



## ●Dimensions

VMT3




Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

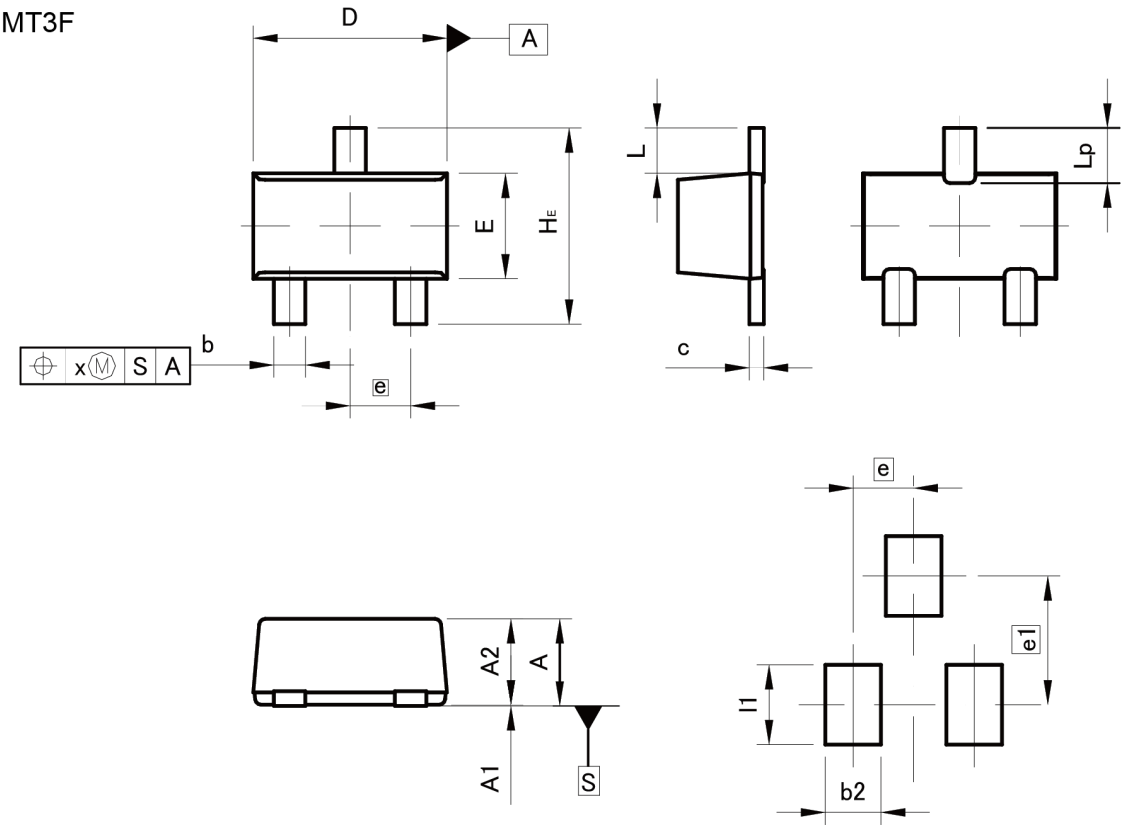
| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.45 | 0.55 | 0.018 | 0.022 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| b | 0.17 | 0.27 | 0.007 | 0.011 |
| b1 | 0.27 | 0.37 | 0.011 | 0.015 |
| c | 0.08 | 0.18 | 0.003 | 0.007 |
| D | 1.10 | 1.30 | 0.043 | 0.051 |
| E | 0.70 | 0.90 | 0.028 | 0.035 |
| e | 0.40 | | 0.02 | |
| HE | 1.10 | 1.30 | 0.043 | 0.051 |
| L | 0.10 | 0.30 | 0.004 | 0.012 |
| Lp | 0.20 | 0.40 | 0.008 | 0.016 |
| x | − | 0.10 | − | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| b2 | − | 0.37 | − | 0.015 |
| b3 | − | 0.47 | − | 0.019 |
| e1 | 0.80 | | 0.031 | |
| l1 | − | 0.50 | − | 0.020 |

Dimension in mm/inches

## ●Dimensions

EMT3F




Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

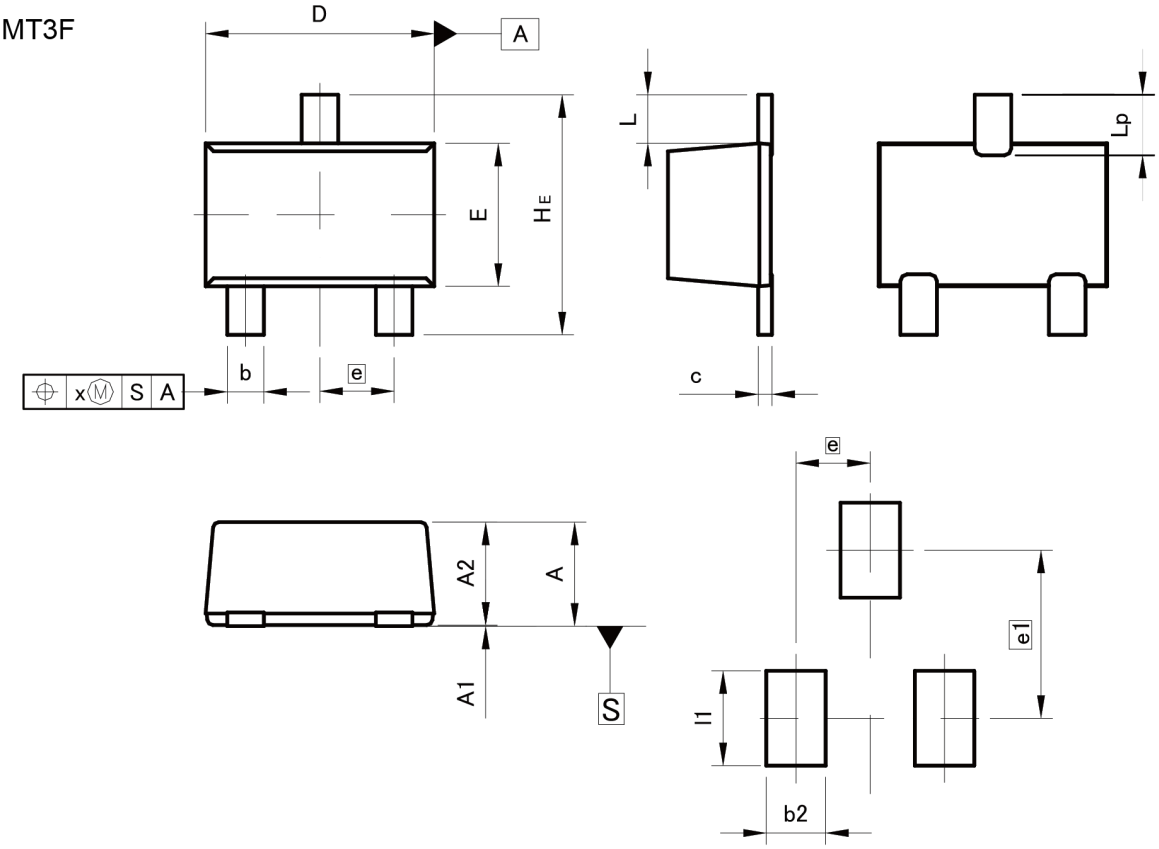
| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.65 | 0.85 | 0.026 | 0.033 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.60 | 0.80 | 0.024 | 0.031 |
| b | 0.21 | 0.36 | 0.008 | 0.014 |
| c | 0.08 | 0.18 | 0.003 | 0.007 |
| D | 1.50 | 1.70 | 0.059 | 0.067 |
| E | 0.76 | 0.96 | 0.030 | 0.038 |
| e | 0.50 | | 0.020 | |
| HE | 1.50 | 1.70 | 0.059 | 0.067 |
| L | 0.37 | | 0.015 | |
| Lp | 0.35 | 0.55 | 0.014 | 0.022 |
| x | − | 0.10 | − | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| b2 | − | 0.46 | − | 0.018 |
| e1 | − | 1.05 | − | 0.041 |
| l1 | − | 0.65 | − | 0.026 |

Dimension in mm/inches

## ●Dimensions

UMT3F




Pattern of terminal position areas
[Not a recommended pattern of soldering pads]

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.85 | 1.05 | 0.033 | 0.041 |
| A1 | 0.00 | 0.10 | 0.000 | 0.004 |
| A2 | 0.80 | 1.00 | 0.031 | 0.039 |
| b | 0.27 | 0.42 | 0.011 | 0.017 |
| c | 0.08 | 0.18 | 0.003 | 0.007 |
| D | 1.90 | 2.10 | 0.075 | 0.083 |
| E | 1.15 | 1.35 | 0.045 | 0.053 |
| e | 0.65 | | 0.026 | |
| HE | 2.00 | 2.20 | 0.079 | 0.087 |
| L | 0.43 | | 0.017 | |
| Lp | 0.43 | 0.63 | 0.017 | 0.025 |
| x | − | 0.10 | − | 0.004 |

| DIM | MILIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| b2 | − | 0.52 | − | 0.020 |
| e1 | 1.47 | | 0.058 | |
| l1 | − | 0.83 | − | 0.033 |

Dimension in mm/inches

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