# PUMH10/ZLH Datasheet

| | |
|---|---|
| DiGi Electronics Part Number | PUMH10/ZLH-DG |
| Manufacturer | Nexperia USA Inc. |
| Manufacturer Product Number | PUMH10/ZLH |
| Description | TRANS PREBIAS |
| Detailed Description | Pre-Biased Bipolar Transistor (BJT) 2 NPN - Pre-Biased (Dual) 50V 100mA 230MHz 300mW Surface Mount 6-TSSOP |

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## Purchase and inquiry

| Manufacturer Product Number: | Manufacturer: |
| --- | --- |
| PUMH10/ZLH | Nexperia USA Inc. |
| Series: | Product Status: |
| - | Obsolete |
| Transistor Type: | Current - Collector (Ic) (Max): |
| 2 NPN - Pre-Biased (Dual) | 100mA |
| Voltage - Collector Emitter Breakdown (Max): | Resistor - Base (R1): |
| 50V | 2.2kOhms |
| Resistor - Emitter Base (R2): | DC Current Gain (hFE) (Min) @ Ic, Vce: |
| 47kOhms | 100 @ 10mA, 5V |
| Vce Saturation (Max) @ Ib, Ic: | Current - Collector Cutoff (Max): |
| 100mV @ 250µA, 5mA | 100nA |
| Frequency - Transition: | Power - Max: |
| 230MHz | 300mW |
| Grade: | Qualification: |
| Automotive | AEC-Q101 |
| Mounting Type: | Package / Case: |
| Surface Mount | 6-TSSOP, SC-88, SOT-363 |
| Supplier Device Package: | Base Product Number: |
| 6-TSSOP | PUMH10 |

## Environmental & Export classification

| RoHS Status: | Moisture Sensitivity Level (MSL): |
| --- | --- |
| ROHS3 Compliant | 1 (Unlimited) |
| REACH Status: | ECCN: |
| REACH Unaffected | OBSOLETE |
| HTSUS: | |
| 0000.00.0000 | |


# PUMH10

## 50 V, 100 mA NPN/NPN resistor-equipped double transistor; R1 = 2.2 kΩ, R2 = 47 kΩ

**1 October 2022** **Product data sheet**

## 1. General description

NPN/NPN double Resistor-Equipped Transistor (RET) in a very small SOT363 (SC-88) Surface-Mounted Device (SMD) plastic package.

NPN/PNP complement: PUMD10

PNP/PNP complement: PUMB10

## 2. Features and benefits

- 100 mA output current capability
- Built-in bias resistors
- Simplifies circuit design
- Reduces component count
- Reduces pick and place costs

## 3. Applications

- Low current peripheral driver
- Control of IC inputs
- Replaces general-purpose transistors in digital applications

## 4. Quick reference data

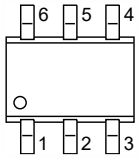
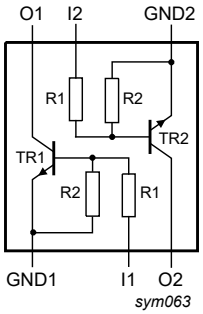
**Table 1. Quick reference data**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | | |
| $V_{CEO}$ | collector-emitter voltage | open base | | - | - | 50 | V |
| $I_O$ | output current | | | - | - | 100 | mA |
| R1 | bias resistor 1 (input) | | [1] | 1.54 | 2.2 | 2.86 | kΩ |
| R2/R1 | bias resistor ratio | | [1] | 17 | 21 | 26 | |

[1] See "Section 11: Test information" for resistor calculation and test conditions.

# 5. Pinning information

**Table 2. Pinning information**

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|---|---|---|---|---|
| 1 | GND1 | GND (emitter) TR1 |  TSSOP6 (SOT363) |  |
| 2 | I1 | input (base) TR1 | | |
| 3 | O2 | output (collector) TR2 | | |
| 4 | GND2 | GND (emitter) TR2 | | |
| 5 | I2 | input (base) TR2 | | |
| 6 | O1 | output (collector) TR1 | | |

# 6. Ordering information

**Table 3. Ordering information**

| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PUMH10 | TSSOP6 | plastic, surface-mounted package; 6 leads; 0.65 mm pitch; 2.1 mm x 1.25 mm x 0.95 mm body | SOT363 |

# 7. Marking

**Table 4. Marking codes**

| Type number | Marking code[1] |
|---|---|
| PUMH10 | H%0 |

[1] % = placeholder for manufacturing site code

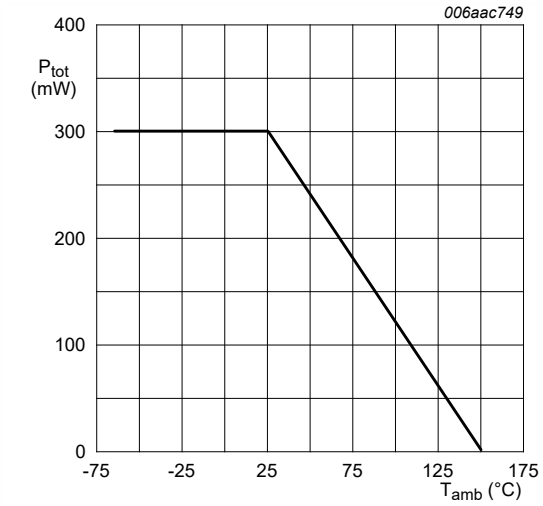
# 8. Limiting values

**Table 5. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | | Min | Max | Unit |
|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | |
| $V_{CBO}$ | collector-base voltage | open emitter | | - | 50 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | | - | 50 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | | - | 5 | V |
| $V_I$ | input voltage | positive | | - | 12 | V |
| | | negative | | - | -5 | V |
| $I_O$ | output current | | | - | 100 | mA |
| $P_{tot}$ | total power dissipation | $T_{amb} \leq 25$ °C | [1] | - | 200 | mW |
| **Per device** | | | | | | |
| $P_{tot}$ | total power dissipation | $T_{amb} = 25$ °C | [1] | - | 300 | mW |
| $T_j$ | junction temperature | | | - | 150 | °C |
| $T_{amb}$ | ambient temperature | | | -65 | 150 | °C |
| $T_{stg}$ | storage temperature | | | -65 | 150 | °C |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided, 35 µm copper, tin-plated and standard footprint.




FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint

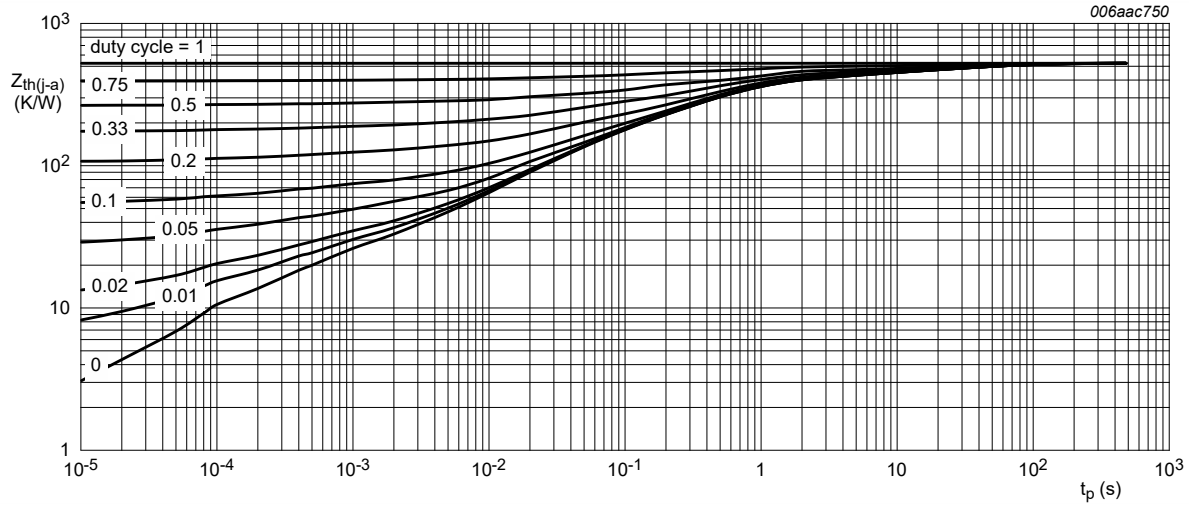
**Fig. 1. Per device: Power derating curve**

# 9. Thermal characteristics

**Table 6. Thermal characteristics**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 625 | K/W |
| **Per device** | | | | | | | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air | [1] | - | - | 417 | K/W |

[1] Device mounted on an FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint.




FR4 PCB, single-sided, 35 µm copper, tin-plated and standard footprint

**Fig. 2. Per transistor: Transient thermal impedance from junction to ambient as a function of pulse duration; typical values**

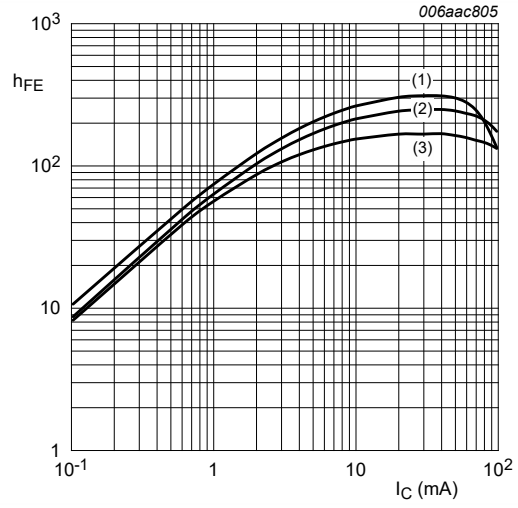
# 10. Characteristics

**Table 7. Characteristics**

*$T_{amb}$ = 25 °C unless otherwise specified.*

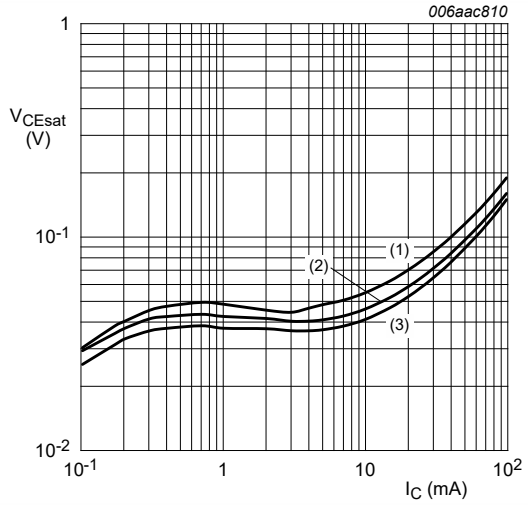
| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Per transistor** | | | | | | | |
| $V_{(BR)CBO}$ | collector-base breakdown voltage | $I_C$ = 100 µA; $I_E$ = 0 A; $T_{amb}$ = 25 °C | | 50 | - | - | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | $I_C$ = 2 mA; $I_B$ = 0 A; $T_{amb}$ = 25 °C | | 50 | - | - | V |
| $I_{CBO}$ | collector-base cut-off current | $V_{CB}$ = 50 V; $I_E$ = 0 A | | - | - | 100 | nA |
| $I_{CEO}$ | collector-emitter cut-off current | $V_{CE}$ = 30 V; $I_B$ = 0 A | | - | - | 100 | nA |
| | | $V_{CE}$ = 30 V; $I_B$ = 0 A; $T_j$ = 150 °C | | - | - | 5 | µA |
| $I_{EBO}$ | emitter-base cut-off current | $V_{EB}$ = 5 V; $I_C$ = 0 A | | - | - | 180 | µA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 10 mA | | 100 | - | - | |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 5 mA; $I_B$ = 0.25 mA | | - | - | 100 | mV |
| $V_{I(off)}$ | off-state input voltage | $V_{CE}$ = 5 V; $I_C$ = 100 µA | | - | 0.6 | 0.5 | V |
| $V_{I(on)}$ | on-state input voltage | $V_{CE}$ = 0.3 V; $I_C$ = 5 mA | | 1.1 | 0.75 | - | V |
| R1 | bias resistor 1 (input) | | [1] | 1.54 | 2.2 | 2.86 | kΩ |
| R2/R1 | bias resistor ratio | | [1] | 17 | 21 | 26 | |
| $C_c$ | collector capacitance | $V_{CB}$ = 10 V; $I_E$ = 0 A; $i_e$ = 0 A; f = 1 MHz | | - | - | 2.5 | pF |
| $f_T$ | transition frequency | $V_{CE}$ = 5 V; $I_C$ = 10 mA; f = 100 MHz | [2] | - | 230 | - | MHz |

[1] See "Section 11: Test information" for resistor calculation and test conditions.
[2] Characteristics of built-in transistor



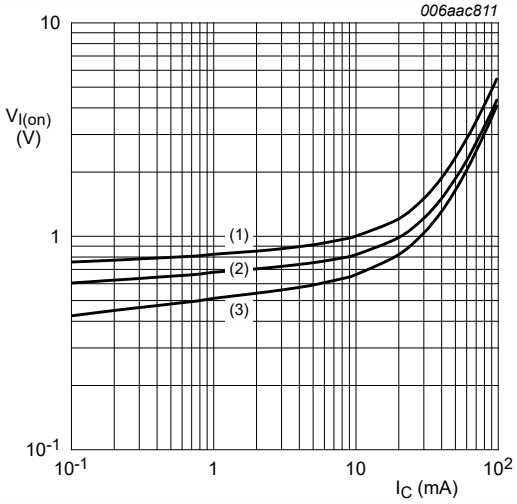

$V_{CE}$ = 5 V
(1) $T_{amb}$ = 100 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = -40 °C

**Fig. 3. DC current gain as a function of collector current; typical values**



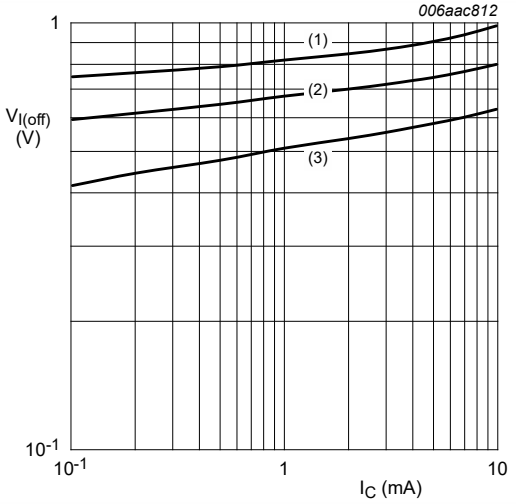

$I_C/I_B$ = 20
(1) $T_{amb}$ = 100 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = -40 °C

**Fig. 4. Collector-emitter saturation voltage as a function of collector current; typical values**



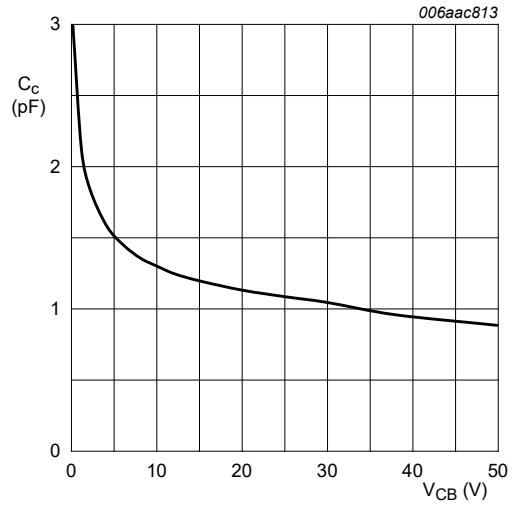

$V_{CE}$ = 0.3 V
(1) $T_{amb}$ = -40 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 100 °C

**Fig. 5. On-state input voltage as a function of collector current; typical values**



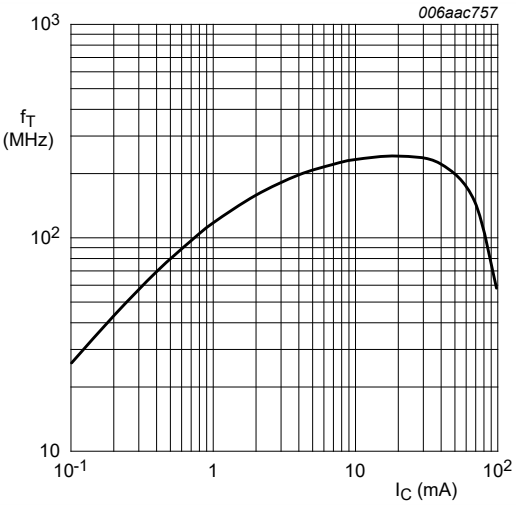

$V_{CE}$ = 5 V
(1) $T_{amb}$ = -40 °C
(2) $T_{amb}$ = 25 °C
(3) $T_{amb}$ = 100 °C

**Fig. 6. Off-state input voltage as a function of collector current; typical values**




f = 1 MHz; $T_{amb}$ = 25 °C

**Fig. 7. Collector capacitance as a function of collector-base voltage; typical values**




f = 100 MHz
$T_{amb}$ = 25 °C
$V_{CE}$ = 5 V

**Fig. 8. Transition frequency as a function of collector current; typical values of built-in transistor**

# 11. Test information

## Resistor calculation

- Calculation of bias resistor 1 (R1)

$$R_1 = \frac{V(I_2) - V(I_1)}{I_2 - I_1}$$

- Calculation of bias resistor ratio (R2/R1)

$$\frac{R2}{R1} = \frac{V(I_4) - V(I_3)}{R1 \cdot (I_4 - I_3)} - 1$$

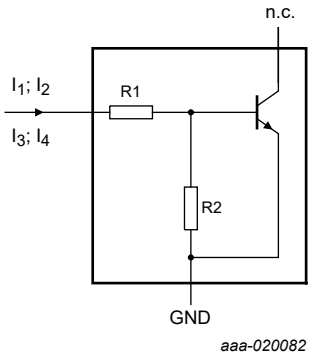



**Fig. 9. NPN transistor: Resistor test circuit**

## Resistor test conditions

**Table 8. Resistor test conditions**

| PUMH10 | R1 (kΩ) | R2 (kΩ) | Test conditions | | | |
|---|---|---|---|---|---|---|
| | | | $I_1$ | $I_2$ | $I_3$ | $I_4$ |
| TR1 (NPN) | 2.2 | 47 | 90 µA | 140 µA | -55 µA | -105 µA |
| TR2 (NPN) | 2.2 | 47 | 90 µA | 140 µA | -55 µA | -105 µA |

## 12. Package outline

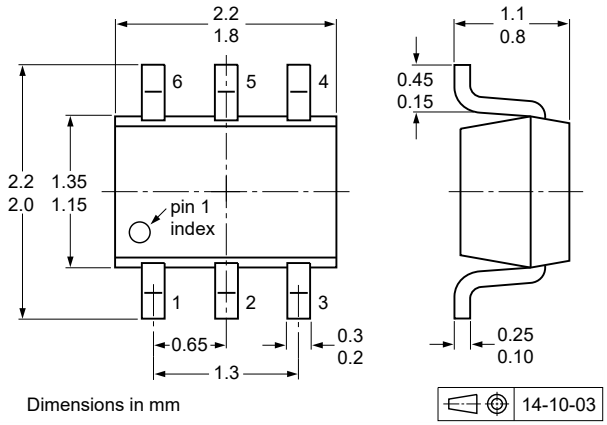



**Fig. 10. Package outline TSSOP6 (SOT363)**

## 13. Soldering

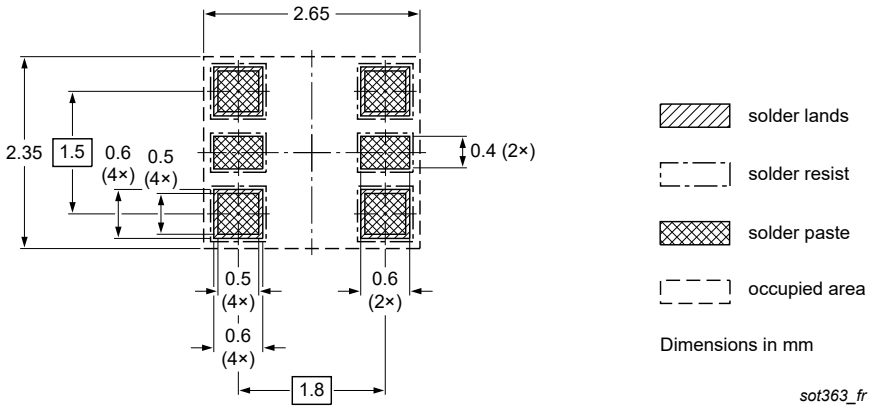



**Fig. 11. Reflow soldering footprint for TSSOP6 (SOT363)**

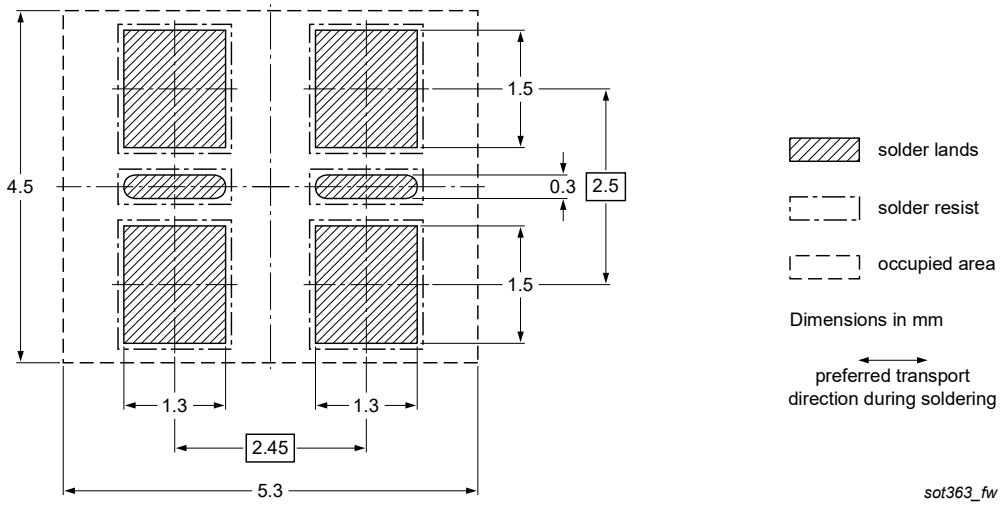



**Fig. 12. Wave soldering footprint for TSSOP6 (SOT363)**

# 14. Revision history

**Table 9. Revision history**

| Data sheet ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| PUMH10 v.5 | 20221001 | Product data sheet | - | PEMH10_ PUMH10 v.4 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Family data sheet reduced to single type data sheet.<br>• Product changed to non-automotive qualification. Please refer to nexperia.com for automotive (-Q) product alternative(s). | | | |
| PEMH10_ PUMH10 v.4 | 20111220 | Product data sheet | - | PEMH10_ PUMH10 v.3 |
| PEMH10_ PUMH10 v.3 | 20031020 | Product data sheet | - | PUMH10 v.2 |
| PUMH10 v.2 | 20011022 | Preliminary specification | - | PUMH10 v.1 |
| PUMH10 v.1 | 20000801 | Product specification | - | - |

# 15. Legal information

## Data sheet status

| Document status [1][2] | Product status [3] | Definition |
|---|---|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
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50 V, 100 mA NPN/NPN resistor-equipped double transistor; R1 = 2.2 kΩ, R2 = 47 kΩ

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**Date of release: 1 October 2022**

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