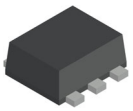
# Bipolar Transistor

## (–)50 V, (–)1 A, Low $V_{CE}$(sat), (PNP)NPN Single MCPH6

# MCH6103, MCH6203



SC–88FL / MCPH6
CASE 419AS

### Features

- Adoption of MBIT Processes
- Low Collector–to–Emitter Voltage
- Ultrasmall Package Facilitates Miniaturization in End Products (Mounting Height: 0.85 mm)
- High Allowable Power Dissipation
- Large Current Capacity
- High–speed Switching
- These Devices are Pb–Free and are RoHS Compliant

### Applications

- Relay Drivers
- Lamp Drivers
- Motor Drivers
- Flash

### Specifications

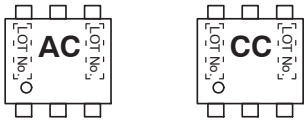
- ( ) : MCH6103

### ABSOLUTE MAXIMUM RATINGS at $T_A$ = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Collector–to–Base Voltage | $V_{CBO}$ | | (–50) 80 | V |
| Collector–to–Emitter Voltage | $V_{CES}$ | | (–50) 80 | V |
| | $V_{CEO}$ | | (–)50 | V |
| Emitter–to–Base Voltage | $V_{EBO}$ | | (–)5 | V |
| Collector Current | $I_C$ | | (–)1.0 | A |
| Collector Current (Pulse) | $I_{CP}$ | | (–)3 | A |
| Base Current | $I_B$ | | 200 | mA |
| Collector Dissipation | $P_C$ | When mounted on ceramic substrate (600 $mm^2$ x 0.8 mm) | 1.0 | W |
| Junction Temperature | $T_J$ | | 150 | °C |
| Storage Temperature | Tstg | | –55 to +150 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

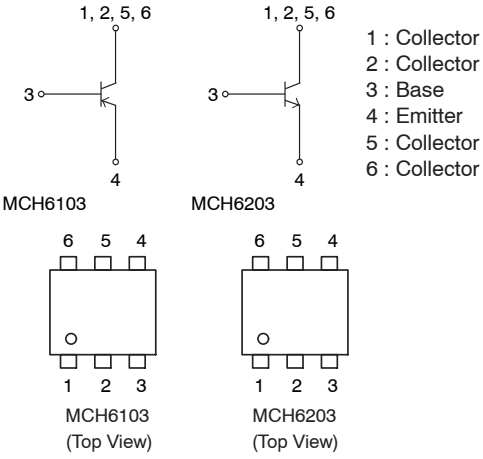
### MARKING DIAGRAM




MCH6103 MCH6203

AC / CC = Specific Device Code

### ELECTRICAL CONNECTION




### ORDERING INFORMATION

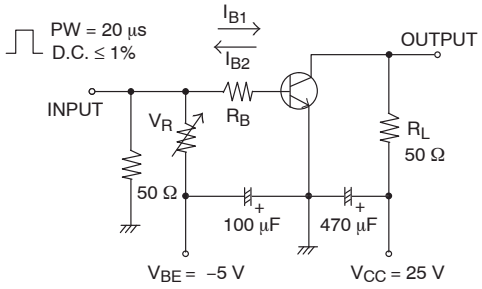
| Device | Package | Shipping† |
|---|---|---|
| MCH6103–TL–E | MCPH6 / SC–88FL (Pb–Free) | 3000 / Tape & Reel |
| MCH6203–TL–E | | |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

**ELECTRICAL CHARACTERISTICS** at $T_A$ = 25°C

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| Collector Cutoff Current | $I_{CBO}$ | $V_{CB}$ = (−)40 V, $I_E$ = 0 A | – | – | (−)0.1 | μA |
| Emitter Cutoff Current | $I_{EBO}$ | $V_{EB}$ = (−)4 V, $I_C$ = 0 A | – | – | (−)0.1 | μA |
| DC Current Gain | $h_{FE}$ | $V_{CE}$ = (−)2 V, $I_C$ = (−)100 mA | 200 | – | 560 | |
| Gain−Bandwidth Product | $f_T$ | $V_{CE}$ = (−)10 V, $I_C$ = (−)300 mA | – | 420 | – | MHz |
| Output Capacitance | Cob | $V_{CB}$ = (−)10 V, f = 1 MHz | – | (9) 6 | – | pF |
| Collector−to−Emitter Saturation Voltage | $V_{CE}$(sat)1 | $I_C$ = (−)500 mA, $I_B$ = (−)10 mA | – | (−280) 130 | (−430) 190 | mV |
| | $V_{CE}$(sat)2 | $I_C$ = (−)300 mA, $I_B$ = (−)6 mA | – | (−145) 90 | (−220) 135 | mV |
| Base−to−Emitter Saturation Voltage | $V_{BE}$(sat) | $I_C$ = (−)500 mA, $I_B$ = (−)10 mA | – | (−)0.81 | (−)1.2 | V |
| Collector−to−Base Breakdown Voltage | $V_{(BR)CBO}$ | $I_C$ = (−)10 μA, $I_E$ = 0 A | (−50) 80 | – | – | V |
| Collector−to−Emitter Breakdown Voltage | $V_{(BR)CES}$ | $I_C$ = (−)100 μA, $R_{BE}$ = 0 Ω | (−50) 80 | – | – | V |
| | $V_{(BR)CEO}$ | $I_C$ = (−)1 mA, $R_{BE}$ = ∞ | (−)50 | – | – | V |
| Emitter−to−Base Breakdown Voltage | $V_{(BR)EBO}$ | $I_E$ = (−)10 μA, $I_C$ = 0 A | (−)5 | – | – | V |
| Turn−On Time | $t_{on}$ | See specified Test Circuit | – | (36) 38 | – | ns |
| Storage Time | $t_{stg}$ | | – | (173) 332 | – | ns |
| Fall Time | $t_f$ | | – | (28) 40 | – | ns |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.




$I_C$ = 20 $I_{B1}$ = −20 $I_{B2}$ = 500 mA
For PNP, the polarity is reversed.

**Figure 1. Switching Time Test Circuit**

## TYPICAL CHARACTERISTICS

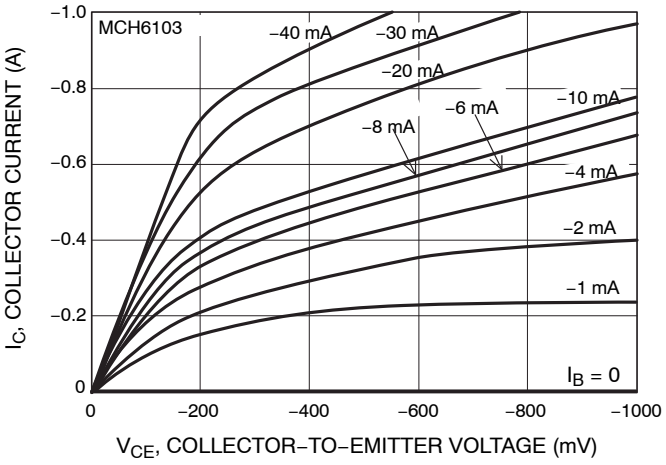



**Figure 2. $I_C$ – $V_{CE}$**

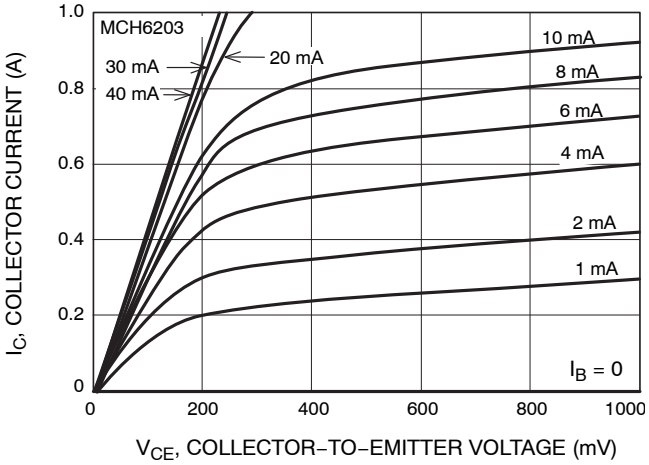



**Figure 3. $I_C$ – $V_{CE}$**

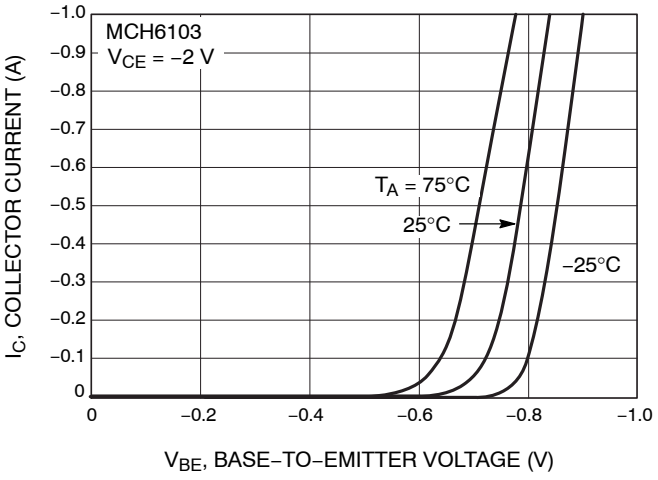



**Figure 4. $I_C$ – $V_{BE}$**

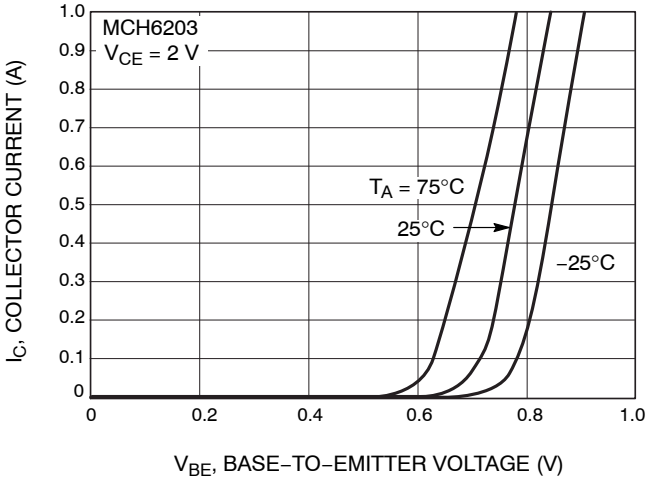



**Figure 5. $I_C$ – $V_{BE}$**

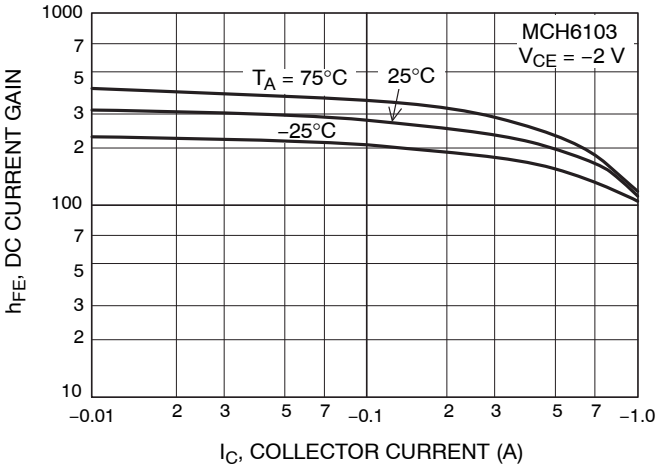



**Figure 6. $h_{FE}$ – $I_C$**

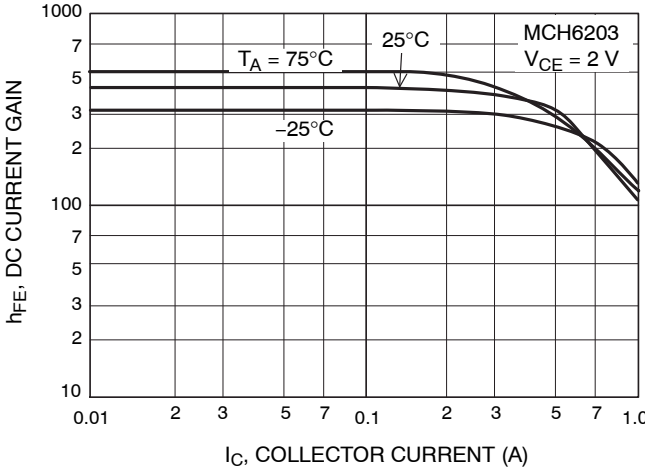



**Figure 7. $h_{FE}$ – $I_C$**

## TYPICAL CHARACTERISTICS (CONTINUED)

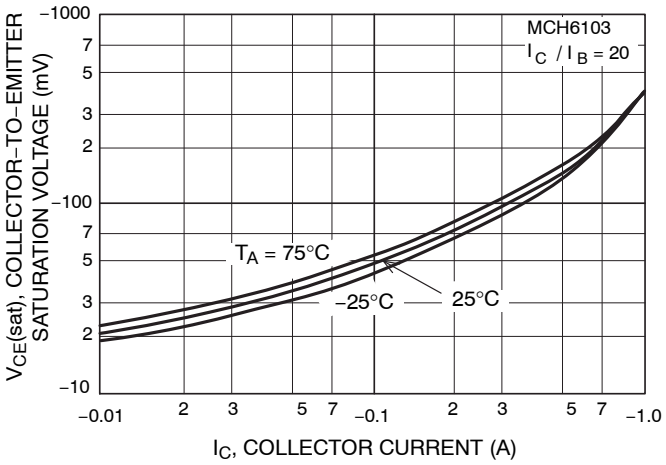



**Figure 8. $V_{CE}$(sat) − $I_C$**

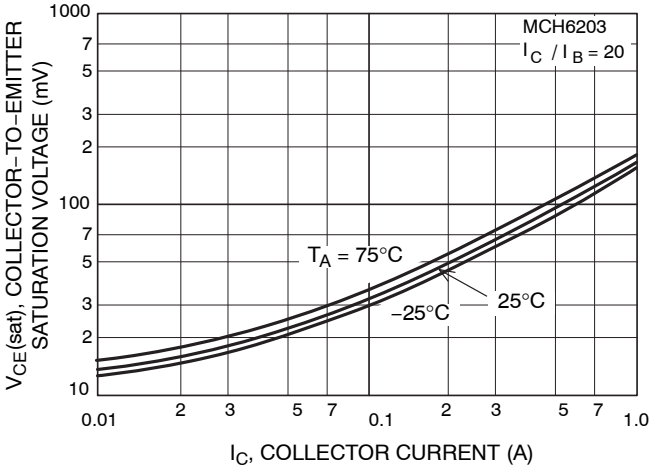



**Figure 9. $V_{CE}$(sat) − $I_C$**

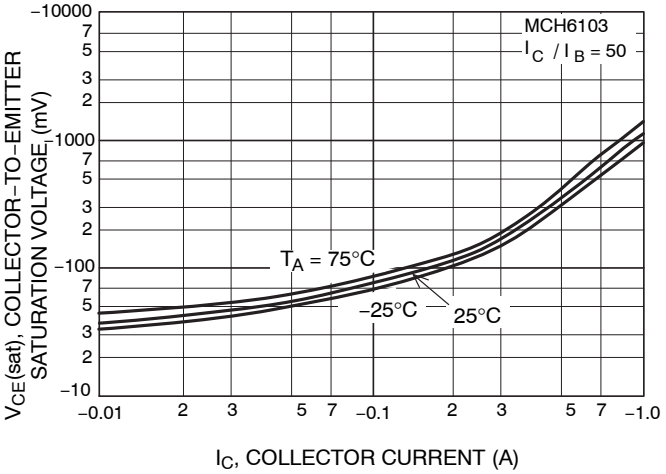



**Figure 10. $V_{CE}$(sat) − $I_C$**

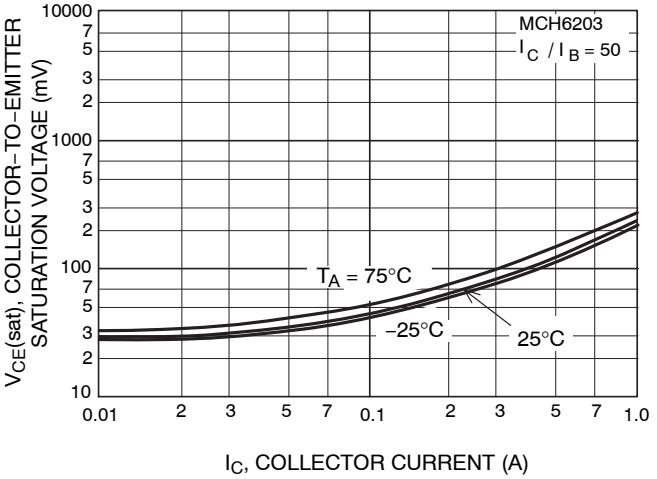



**Figure 11. $V_{CE}$(sat) − $I_C$**

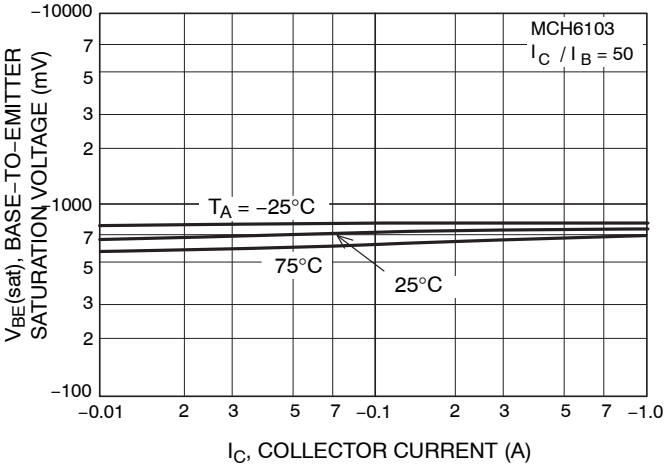



**Figure 12. $V_{BE}$(sat) − $I_C$**

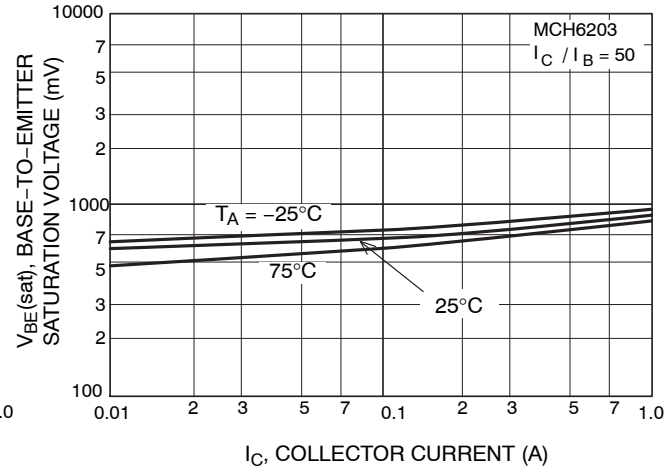



**Figure 13. $V_{BE}$(sat) − $I_C$**

## TYPICAL CHARACTERISTICS (CONTINUED)

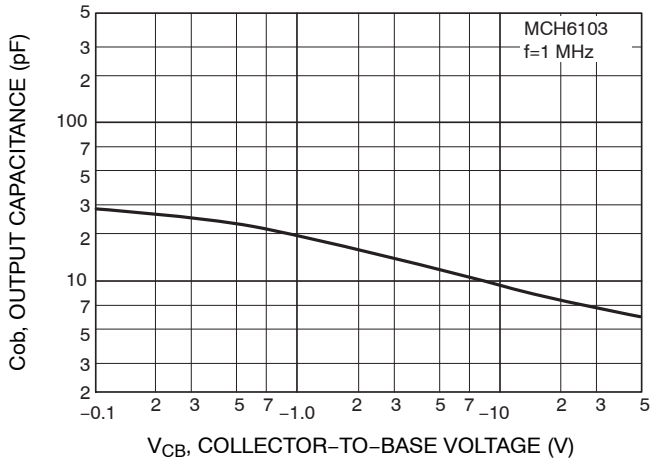



**Figure 14. Cob – $V_{CB}$**

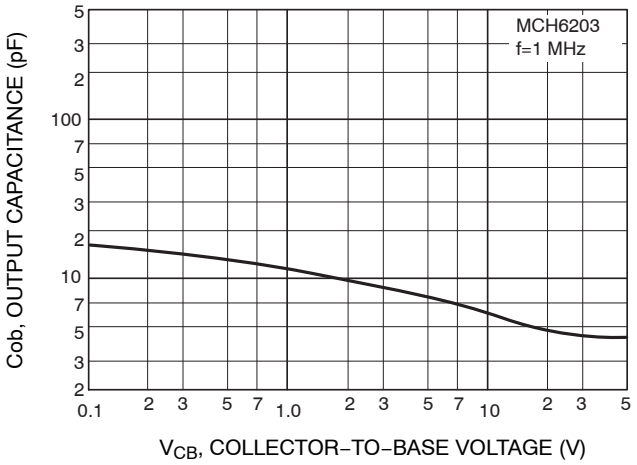



**Figure 15. Cob – $V_{CB}$**

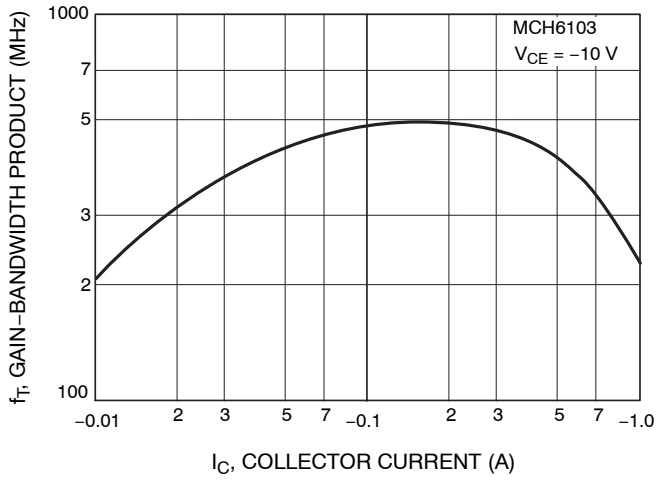



**Figure 16. $f_T$ – $I_C$**

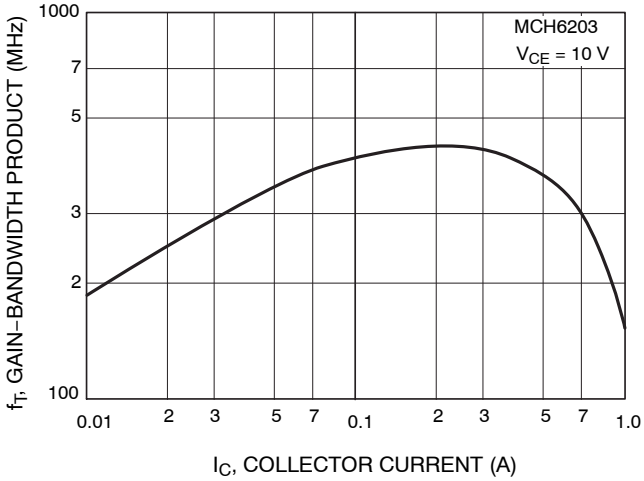



**Figure 17. $f_T$ – $I_C$**

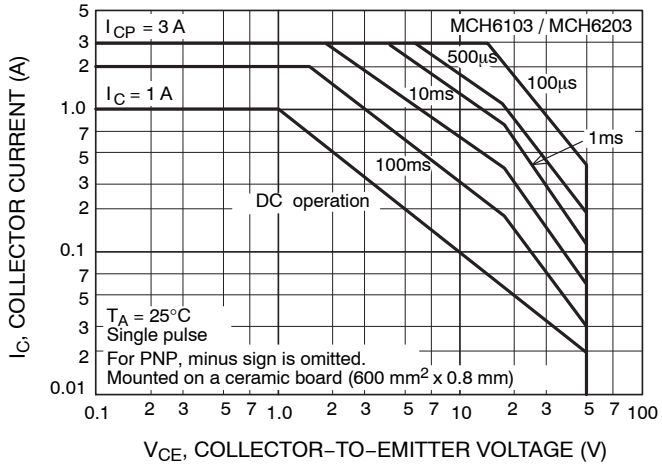



**Figure 18. ASO**

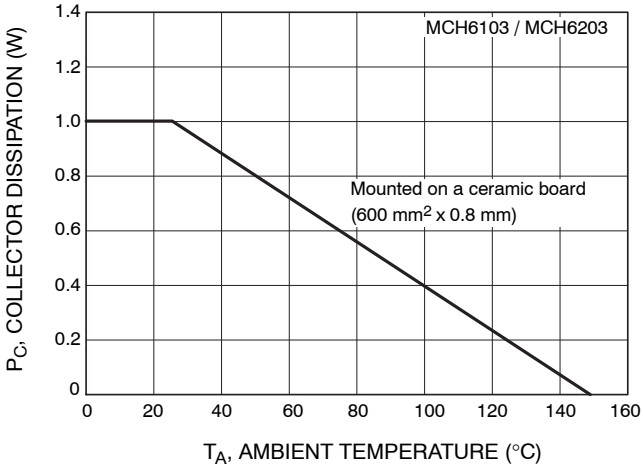



**Figure 19. $P_C$ – $T_A$**

## LAND PATTERN EXAMPLE

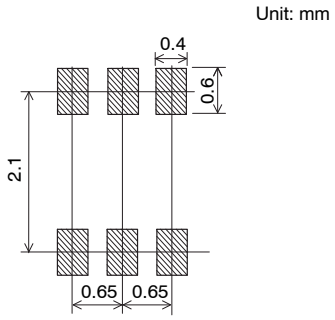
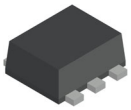



**Figure 20. Land Pattern Example**



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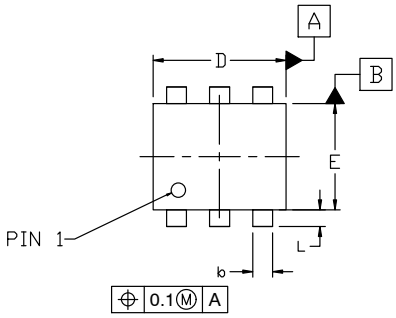
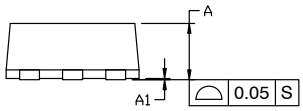
ISSUE A

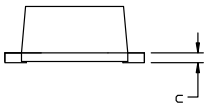
DATE 28 SEP 2022



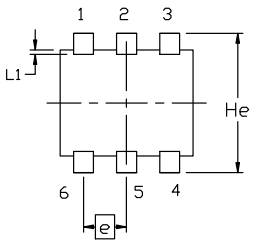

TOP VIEW




SIDE VIEW




FRONT VIEW



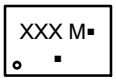

BOTTOM VIEW

NOTES:

1. NO INDUSTRY STANDARD APPLIES TO THIS PACKAGE.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND THE BAR PROTRUSIONS.

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 0.80 | 0.85 | 0.90 |
| A1 | 0.00 | --- | 0.02 |
| b | 0.25 | 0.30 | 0.40 |
| c | 0.12 | 0.15 | 0.25 |
| D | 1.94 | 2.00 | 2.06 |
| E | 1.54 | 1.60 | 1.66 |
| He | 2.05 | 2.10 | 2.15 |
| L | 0.19 | 0.25 | 0.31 |
| L1 | 0.00 | 0.07 | 0.12 |
| e | 0.65 BSC | | |

**GENERIC MARKING DIAGRAM***




XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

| DOCUMENT NUMBER: | 98AON65646E | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
|---|---|---|
| DESCRIPTION: | SC−88FL / MCPH6 | PAGE 1 OF 1 |

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