



**THE DATASHEET OF
MPS3646**



Switching Transistor

NPN Silicon

- This device is available in Pb-free package(s). Specifications herein apply to both standard and Pb-free devices. Please see our website at www.onsemi.com for specific Pb-free orderable part numbers, or contact your local ON Semiconductor sales office or representative.

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|----------------|-------------|----------------------|
| Collector–Emitter Voltage | V_{CEO} | 15 | Vdc |
| Collector–Emitter Voltage | V_{CES} | 40 | Vdc |
| Collector–Base Voltage | V_{CBO} | 40 | Vdc |
| Emitter–Base Voltage | V_{EBO} | 5.0 | Vdc |
| Collector Current — Continuous | I_C | 300 | mAdc |
| — 10 μ s Pulse | | 500 | |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$ | P_D | 625 | mW |
| Derate above 25°C | | 5.0 | mW/ $^\circ\text{C}$ |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ | P_D | 1.5 | Watts |
| Derate above 25°C | | 12 | mW/ $^\circ\text{C}$ |
| Operating and Storage Junction Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|-----------------|------|---------------------------|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 200 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 83.3 | $^\circ\text{C}/\text{W}$ |

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|----------------|--------|-----|-----|------|
|----------------|--------|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|---|---|----------------|-----|-----|-----------------|
| Collector–Emitter Breakdown Voltage | ($I_C = 100 \mu\text{Adc}, V_{BE} = 0$) | $V_{(BR)CES}$ | 40 | — | Vdc |
| Collector–Emitter Sustaining Voltage ⁽¹⁾ | ($I_C = 10 \text{ mAdc}, I_B = 0$) | $V_{CEO(sus)}$ | 15 | — | Vdc |
| Collector–Base Breakdown Voltage | ($I_C = 100 \mu\text{Adc}, I_E = 0$) | $V_{(BR)CBO}$ | 40 | — | Vdc |
| Emitter–Base Breakdown Voltage | ($I_E = 100 \mu\text{Adc}, I_C = 0$) | $V_{(BR)EBO}$ | 5.0 | — | Vdc |
| Collector Cutoff Current | ($V_{CE} = 20 \text{ Vdc}, V_{BE} = 0$) | I_{CES} | — | 0.5 | μAdc |
| ($V_{CE} = 20 \text{ Vdc}, V_{BE} = 0, T_A = 65^\circ\text{C}$) | | | — | 3.0 | |

ON CHARACTERISTICS⁽¹⁾

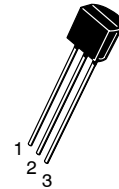
| | | | | | |
|--------------------------------------|--|---------------|------------------|---------------------------|-----|
| DC Current Gain | ($I_C = 30 \text{ mAdc}, V_{CE} = 0.4 \text{ Vdc}$) ($I_C = 100 \text{ mAdc}, V_{CE} = 0.5 \text{ Vdc}$) ($I_C = 300 \text{ mA}, V_{CE} = 1.0 \text{ Vdc}$) | h_{FE} | 30 25 15 | 120 — — | — |
| Collector–Emitter Saturation Voltage | ($I_C = 30 \text{ mAdc}, I_B = 3.0 \text{ mAdc}$) ($I_C = 100 \text{ mAdc}, I_B = 10 \text{ mAdc}$) ($I_C = 300 \text{ mAdc}, I_B = 30 \text{ mAdc}$) ($I_C = 30 \text{ mA}, I_B = 3.0 \text{ mA}, T_A = 65^\circ\text{C}$) | $V_{CE(sat)}$ | — — — — | 0.2 0.28 0.5 0.3 | Vdc |
| Base–Emitter Saturation Voltage | ($I_C = 30 \text{ mAdc}, I_B = 3.0 \text{ mAdc}$) ($I_C = 100 \text{ mAdc}, I_B = 10 \text{ mAdc}$) ($I_C = 300 \text{ mAdc}, I_B = 30 \text{ mA}$) | $V_{BE(sat)}$ | 0.73 — — | 0.95 1.2 1.7 | Vdc |

1. Pulse Test: Pulse Width $\leq 300 \mu\text{s}$; Duty Cycle $\leq 2.0\%$.

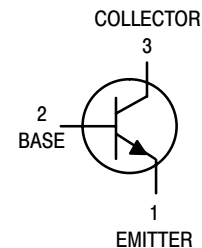
Preferred devices are ON Semiconductor recommended choices for future use and best overall value.

MPS3646

ON Semiconductor Preferred Device



CASE 29-11, STYLE 1
TO-92 (TO-226AA)



MPS3646

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) (Continued)

| Characteristic | Symbol | Min | Max | Unit |
|--|-----------|-----|-----|------|
| SMALL-SIGNAL CHARACTERISTICS | | | | |
| Current-Gain — Bandwidth Product ($I_C = 30\text{ mA}$, $V_{CE} = 10\text{ V}$, $f = 100\text{ MHz}$) | f_T | 350 | — | MHz |
| Output Capacitance ($V_{CB} = 5.0\text{ V}$, $I_E = 0$, $f = 1.0\text{ MHz}$) | C_{obo} | — | 5.0 | pF |
| Input Capacitance ($V_{EB} = 0.5\text{ V}$, $I_C = 0$, $f = 1.0\text{ MHz}$) | C_{ibo} | — | 9.0 | pF |

SWITCHING CHARACTERISTICS

| | | | | | |
|---|--|-----------|---|----|----|
| Turn-On Time | $(V_{CC} = 10\text{ Vdc}$, $I_C = 300\text{ mA}$, $I_{B1} = 30\text{ mA}$) (Figure 1) | t_{on} | — | 18 | ns |
| Delay Time | | t_d | — | 10 | ns |
| Rise Time | | t_r | — | 15 | ns |
| Turn-Off Time | $(V_{CC} = 10\text{ Vdc}$, $I_C = 300\text{ mA}$, $I_{B1} = I_{B2} = 30\text{ mA}$) (Figure 1) | t_{off} | — | 28 | ns |
| Fall Time | | t_f | — | 15 | ns |
| Storage Time ($V_{CC} = 10\text{ Vdc}$, $I_C = 10\text{ mA}$, $I_{B1} = I_{B2} = 10\text{ mA}$) (Figure 2) | | t_s | — | 18 | ns |

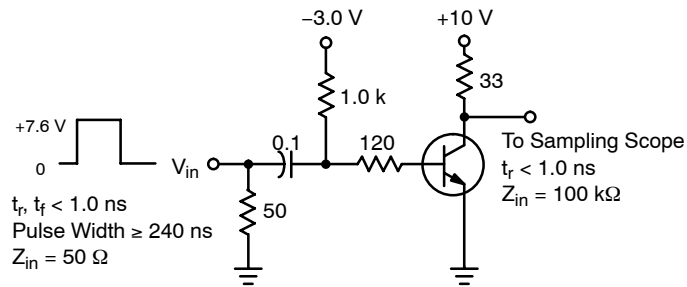


Figure 1. Switching Time Test Circuit

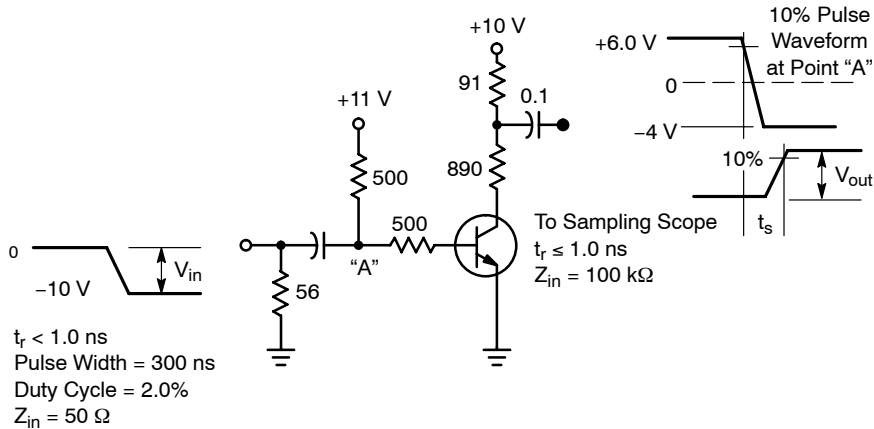


Figure 2. Charge Storage Time Test Circuit

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CURRENT GAIN CHARACTERISTICS

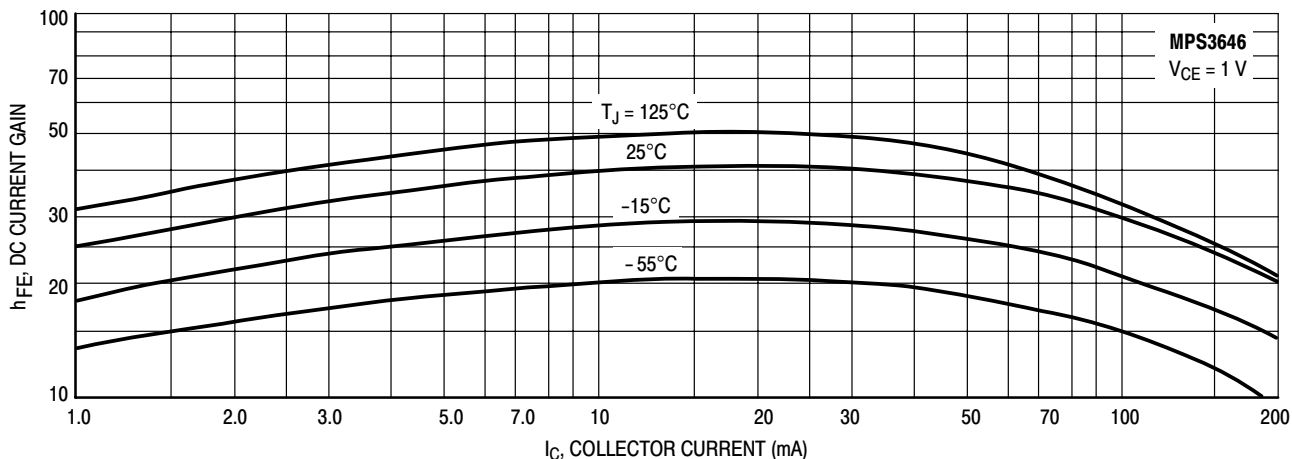


Figure 3. Minimum Current Gain

“ON” CONDITION CHARACTERISTICS

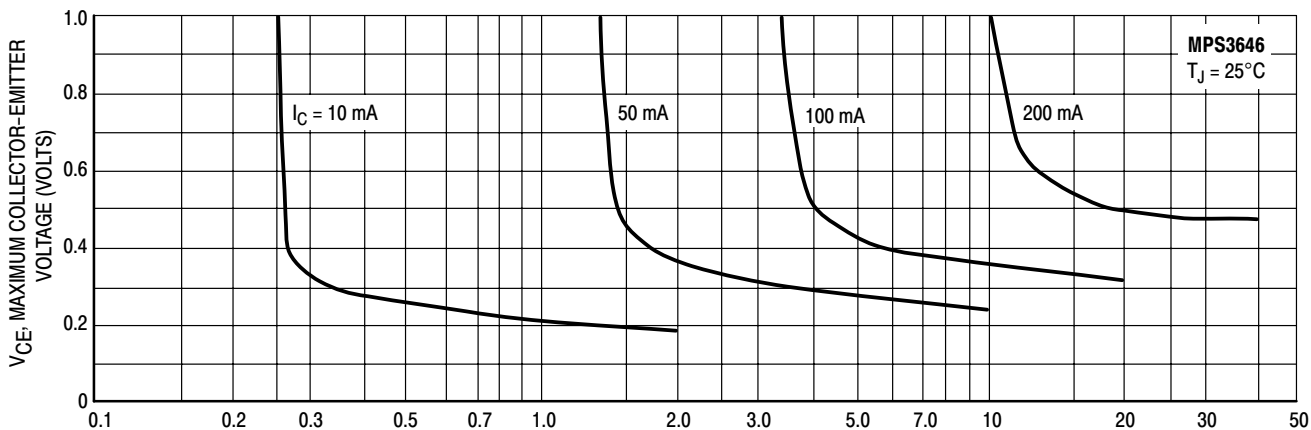


Figure 4. Collector Saturation Region

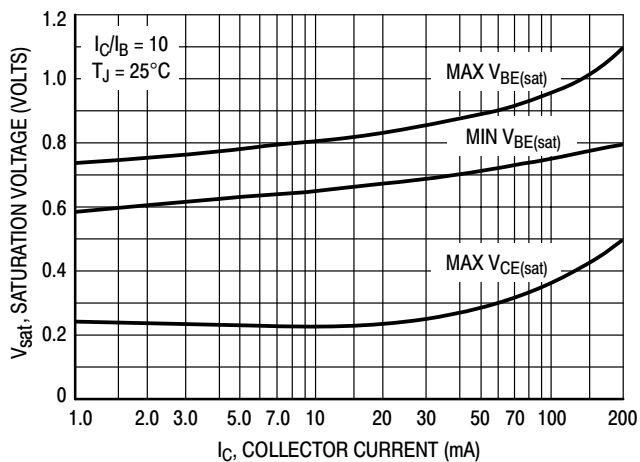


Figure 5. Saturation Voltage Limits

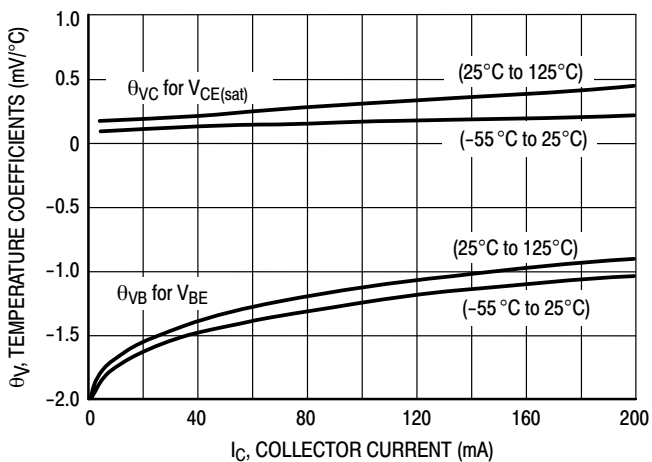


Figure 6. Temperature Coefficients

DYNAMIC CHARACTERISTICS

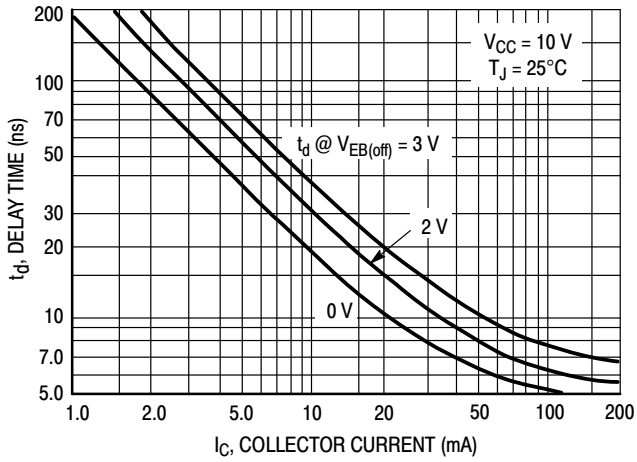


Figure 7. Delay Time

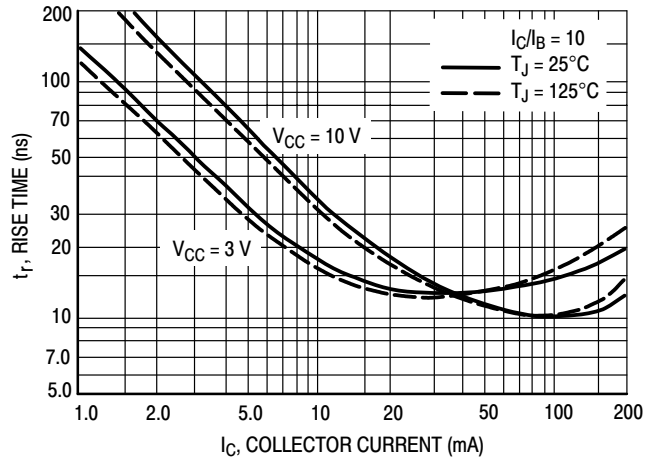


Figure 8. Rise Time

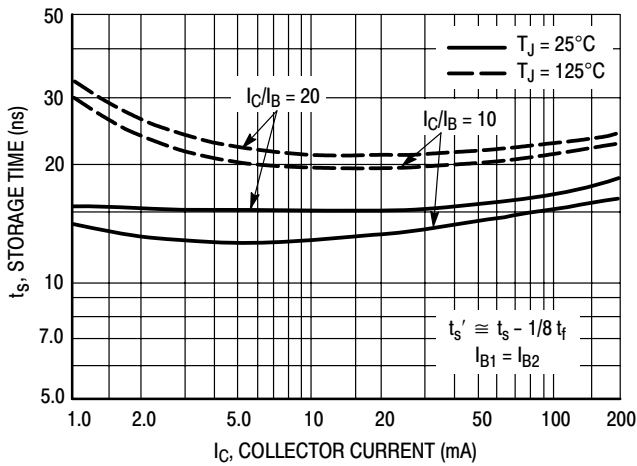


Figure 9. Storage Time

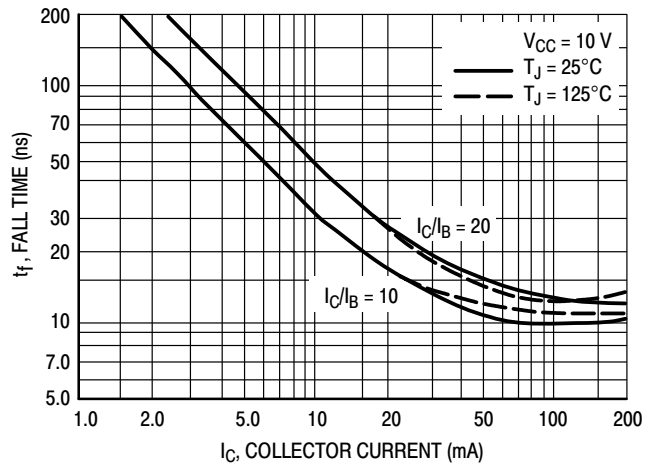


Figure 10. Fall Time

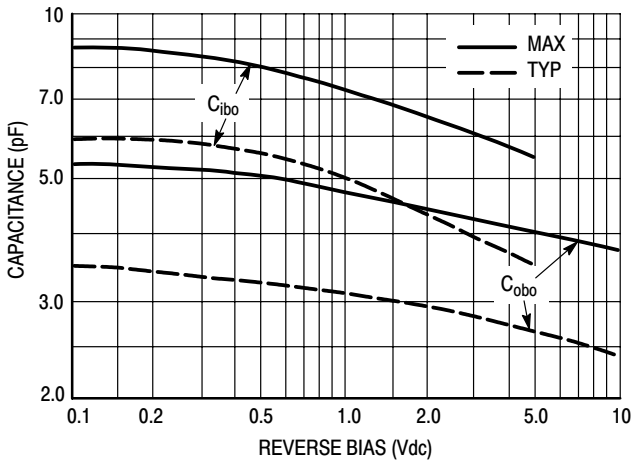


Figure 11. Junction Capacitance

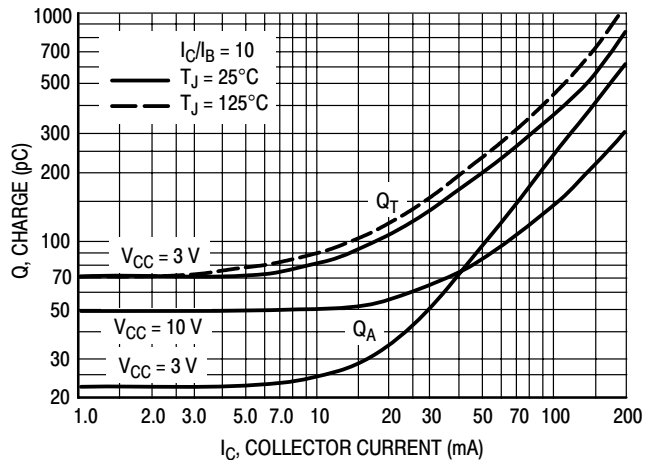
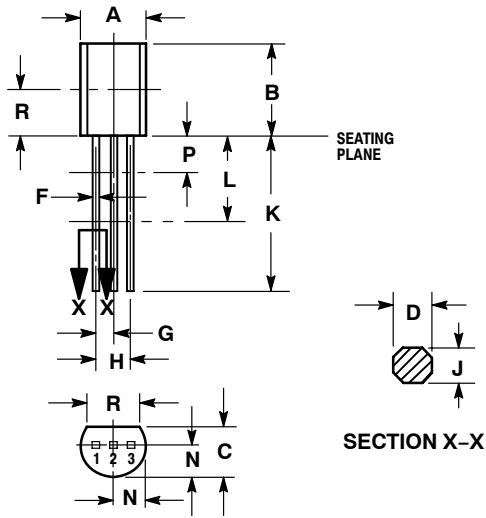


Figure 12. Maximum Charge Data

MPS3646

PACKAGE DIMENSIONS

CASE 029-11 (TO-226AA) ISSUE AD



STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSIONS D AND J APPLY BETWEEN L AND K MINIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.175 | 0.205 | 4.44 | 5.21 |
| B | 0.290 | 0.310 | 7.37 | 7.87 |
| C | 0.125 | 0.165 | 3.18 | 4.19 |
| D | 0.018 | 0.021 | 0.457 | 0.533 |
| F | 0.016 | 0.019 | 0.407 | 0.482 |
| G | 0.045 | 0.055 | 1.15 | 1.39 |
| H | 0.095 | 0.105 | 2.42 | 2.66 |
| J | 0.018 | 0.024 | 0.46 | 0.61 |
| K | 0.500 | --- | 12.70 | --- |
| L | 0.250 | --- | 6.35 | --- |
| N | 0.080 | 0.105 | 2.04 | 2.66 |
| P | --- | 0.100 | --- | 2.54 |
| R | 0.135 | --- | 3.43 | --- |

Notes

Notes

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