FAIRCHILD
SEMICONDUCTOR TM

# MPSW3725


TO-226

## NPN Transistor

This device is designed for high current, low impedance line driver applications. Sourced from Process 26.

### Absolute Maximum Ratings

TA = 25°C unless otherwise noted

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{CEO}$ | Collector-Emitter Voltage | 40 | V |
| $V_{CBO}$ | Collector-Base Voltage | 60 | V |
| $V_{EBO}$ | Emitter-Base Voltage | 6.0 | V |
| $I_C$ | Collector Current - Continuous | 1.2 | A |
| $T_J$, $T_{stg}$ | Operating and Storage Junction Temperature Range | -55 to +150 | °C |

*These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

**NOTES**:
**1)** These ratings are based on a maximum junction temperature of 150 degrees C.
**2)** These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

### Thermal Characteristics

TA = 25°C unless otherwise noted

| Symbol | Characteristic | Max | Units |
|---|---|---|---|
| | | MPSW3725 | |
| $P_D$ | Total Device Dissipation<br>Derate above 25°C | 1.0<br>8.0 | W<br>mW/°C |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 125 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 50 | °C/W |

# NPN Transistor
(continued)

## Electrical Characteristics
TA= 25°C unless otherwise noted

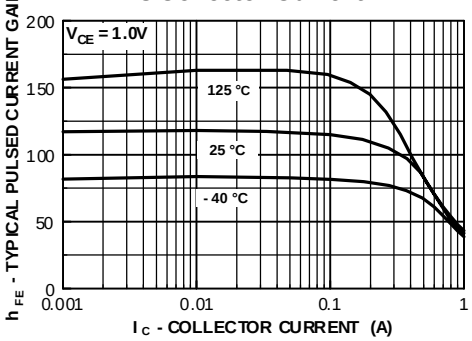
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage* | $I_C$ = 10 mA, $I_B$ = 0 | 40 | | | V |
| $V_{(BR)CES}$ | Collector-Emitter Breakdown Voltage | $I_C$ = 10 µA, $V_{BE}$ = 0 | 60 | | | V |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | $I_C$ = 100 µA, $I_{CE}$ = 0 | 60 | | | V |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | $I_E$ = 10 µA, $I_C$ = 0 | 6.0 | | | V |
| $I_{CBO}$ | Collector Cutoff Current | $V_{CB}$ = 50 V, $I_E$ = 0<br>$V_{CB}$ = 50 V, $I_E$ = 0, $T_A$ = 100°C | | | 100<br>10 | nA<br>µA |
| **ON CHARACTERISTICS*** | | | | | | |
| $h_{FE}$ | DC Current Gain | $I_C$ = 10 mA, $V_{CE}$ = 1.0 V<br>$I_C$ = 100 mA, $V_{CE}$ = 1.0 V<br>$I_C$=100mA,$V_{CE}$=1.0V,$T_A$=-55°C<br>$I_C$ = 300 mA, $V_{CE}$ = 1.0 V<br>$I_C$ = 500 mA, $V_{CE}$ = 1.0 V<br>$I_C$=500mA,$V_{CE}$=1.0V,$T_A$=-55°C<br>$I_C$ = 800 mA, $V_{CE}$ = 2.0 V<br>$I_C$ = 1.0 A, $V_{CE}$ = 5.0 V | 30<br>60<br>30<br>40<br>35<br>20<br>20<br>25 | | <br>180 | |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C$ = 10 mA, $I_B$ = 1.0 mA<br>$I_C$ = 100 mA, $I_B$ = 10 mA<br>$I_C$ = 300 mA, $I_B$ = 30 mA<br>$I_C$ = 500 mA, $I_B$ = 50 mA<br>$I_C$ = 800 mA, $I_B$ = 80 mA<br>$I_C$ = 1.0 A, $I_B$ = 100 mA | | | 0.25<br>0.26<br>0.4<br>0.52<br>0.8<br>0.95 | V<br>V<br>V<br>V<br>V<br>V |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage | $I_C$ = 10 mA, $I_B$ = 1.0 mA<br>$I_C$ = 100 mA, $I_B$ = 10 mA<br>$I_C$ = 300 mA, $I_B$ = 30 mA<br>$I_C$ = 500 mA, $I_B$ = 50 mA<br>$I_C$ = 800 mA, $I_B$ = 80 mA<br>$I_C$ = 1.0 A, $I_B$ = 100 mA | | | 0.76<br>0.86<br>1.1<br>1.2<br>1.5<br>1.7 | V<br>V<br>V<br>V<br>V<br>V |
| **SMALL SIGNAL CHARACTERISTICS** | | | | | | |
| $f_T$ | Current Gain - Bandwidth Product | $I_C$ = 50 mA, $V_{CE}$ = 10 V, f = 100 MHz | 250 | | | MHz |
| $C_{obo}$ | Output Capacitance | $V_{CB}$ = 10 V, $I_E$ = 0, f = 1.0 MHz | | | 25 | pF |
| $C_{ibo}$ | Input Capacitance | $V_{EB}$ = 0.5 V, $I_C$ = 0, f = 1.0 MHz | | | 100 | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{on}$ | Turn-on Time | $V_{CC}$ = 30 V, $V_{BE}$ = 3.8 V, | | 22 | | ns |
| $t_d$ | Delay Time | $I_C$ = 500 mA, $I_{B1}$ = 50 mA | | 10 | | ns |
| $t_r$ | Rise Time | | | 12 | | ns |
| $t_{off}$ | Turn-off Time | $V_{CC}$ = 30 V, $I_C$ = 500mA | | 250 | | ns |
| $t_s$ | Storage Time | $I_{B1}$ = $I_{B2}$ = 50 mA | | 235 | | ns |
| $t_f$ | Fall Time | | | 15 | | ns |

*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 1.0%

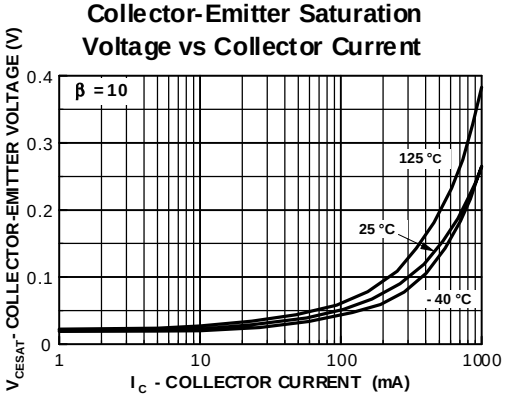
## NPN Transistor
(continued)

## Typical Characteristics

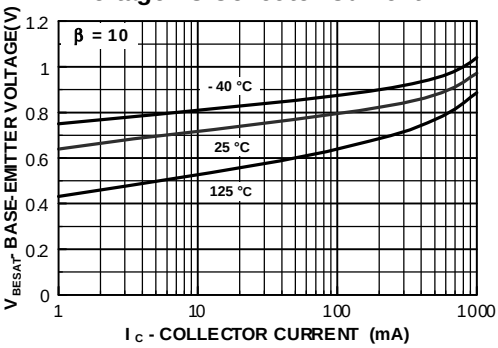
### Typical Pulsed Current Gain vs Collector Current



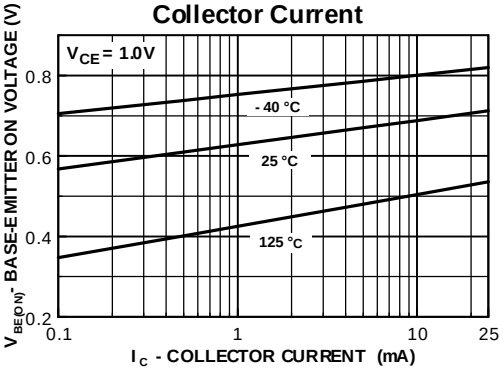

### Collector-Emitter Saturation Voltage vs Collector Current



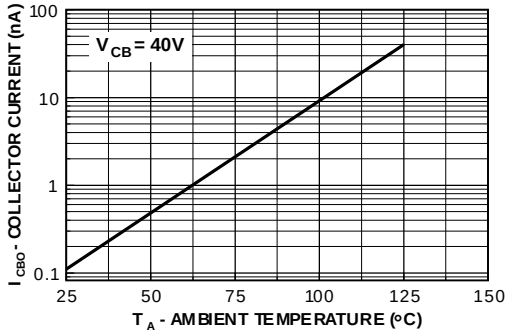

### Base-Emitter Saturation Voltage vs Collector Current



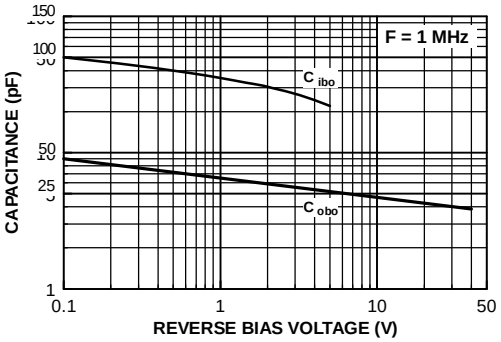

### Base-Emitter ON Voltage vs Collector Current




### Collector-Cutoff Current vs Ambient Temperature

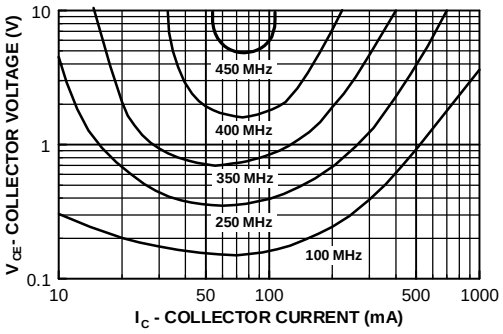



### Input / Output Capacitance vs Reverse Bias

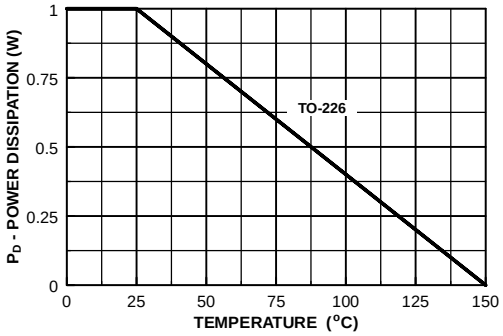


## Typical Characteristics (continued)

**Contours of Constant Bandwidth Product ($f_T$)**

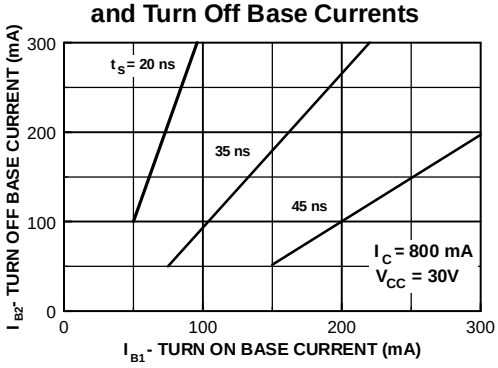



**Power Dissipation vs Ambient Temperature**

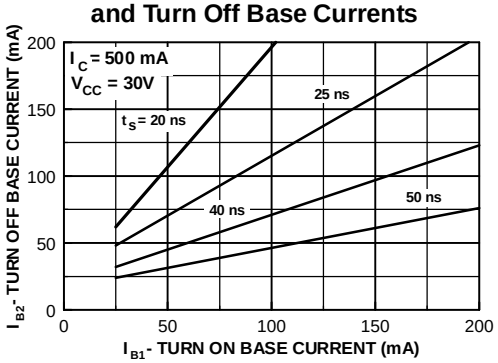


## Typical Characteristics (continued)

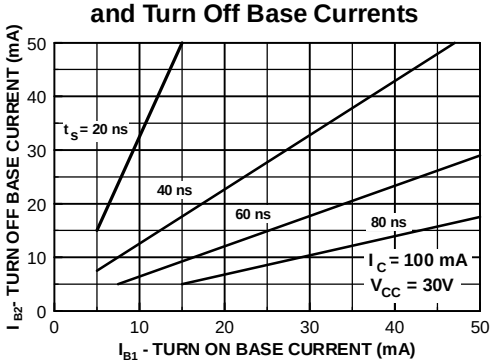
**Storage Time vs. Turn On and Turn Off Base Currents**



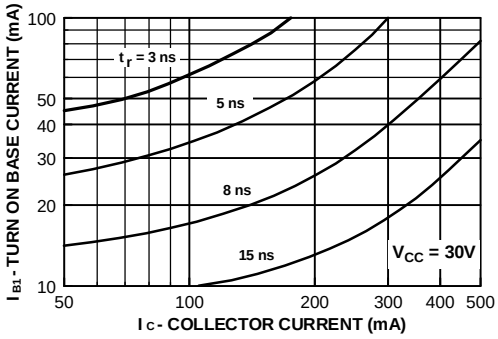

**Storage Time vs. Turn On and Turn Off Base Currents**




**Storage Time vs. Turn On and Turn Off Base Currents**

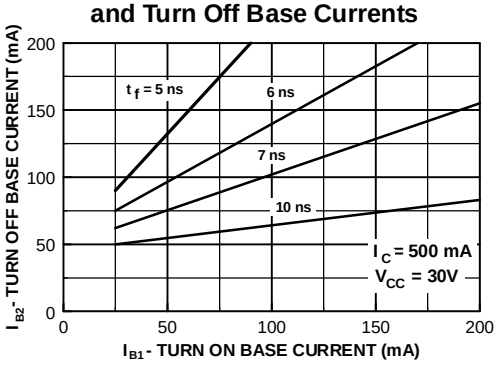



**Rise Time vs. Collector and Turn On Base Currents**

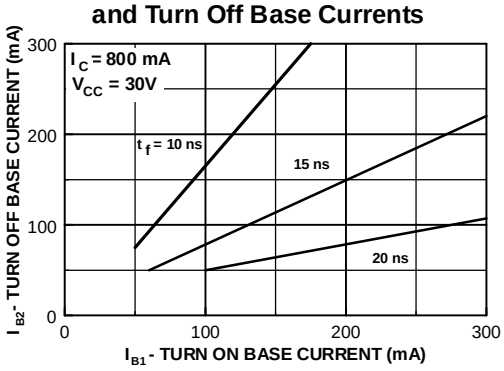


## Typical Characteristics (continued)

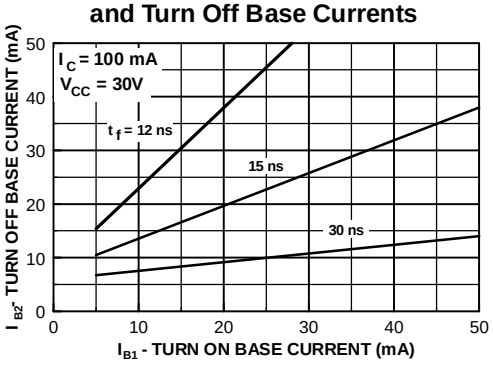
**Fall Time vs. Turn On and Turn Off Base Currents**




**Fall Time vs. Turn On and Turn Off Base Currents**




**Fall Time vs. Turn On and Turn Off Base Currents**



## Test Circuit

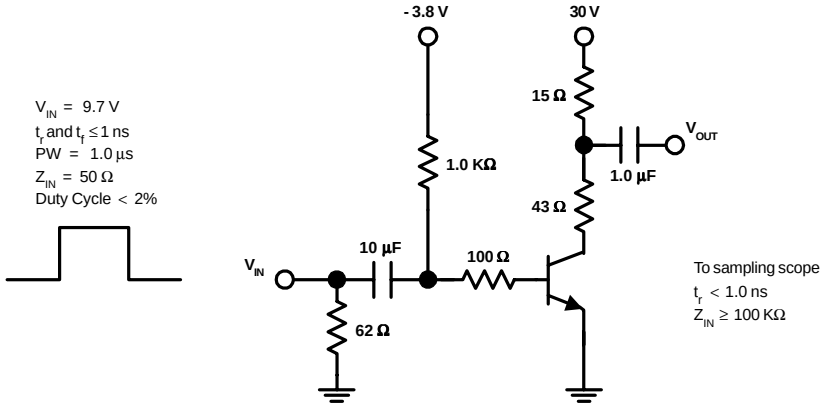



**FIGURE 1: Switching Time Test Circuit**
**($I_C$ = 500 mA, $I_{B1}$ = 50 mA, $I_{B2}$ = 50 mA)**

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