



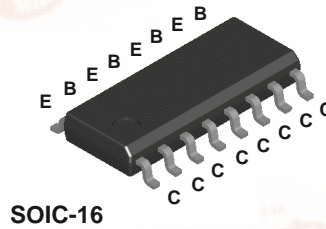
Discrete POWER & Signal Technologies

TN3725A



TO-226

MMPQ3725



SOIC-16

NPN Switching Transistor

This device is designed for high speed core driver applications up to collector currents of 1.0 A. Sourced from Process 25.

Absolute Maximum Ratings

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V <sub>CEO</sub>	Collector-Emitter Voltage	40	V
V <sub>CBO</sub>	Collector-Base Voltage	60	V
V <sub>EBO</sub>	Emitter-Base Voltage	6.0	V
I <sub>C</sub>	Collector Current - Continuous	1.2	A
T <sub>J</sub> , T <sub>stg</sub>	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
		TN3725A	MMPQ3725	
P <sub>D</sub>	Total Device Dissipation	1.0	1.0	W
	Derate above 25°C	8.0	8.0	mW/°C
R <sub>θJC</sub>	Thermal Resistance, Junction to Case	50		°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient	125		°C/W
	Effective 4 Die		125	°C/W
	Each Die		240	°C/W



## NPN Switching Transistor

(continued)

### Electrical Characteristics

TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
<b>OFF CHARACTERISTICS</b>					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	$I_C = 10 \text{ mA}, I_B = 0$	40		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$I_C = 10 \text{ } \mu\text{A}, V_{BE} = 0$	60		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 10 \text{ } \mu\text{A}, I_{CE} = 0$	60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	$I_E = 10 \text{ } \mu\text{A}, I_C = 0$	6.0		V
$I_{CBO}$	Collector Cutoff Current	$V_{CB} = 60 \text{ V}, I_E = 0$ $V_{CB} = 60 \text{ V}, I_E = 0, T_A = 100^\circ\text{C}$		1.7 120	$\mu\text{A}$ $\mu\text{A}$
$I_{CES}$	Collector Cutoff Current	$V_{CE} = 80 \text{ V}, V_{EB} = 0$		10	$\mu\text{A}$

### ON CHARACTERISTICS\*

$h_{FE}$	DC Current Gain	$I_C = 10 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 100 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 100 \text{ mA}, V_{CE} = 1.0 \text{ V}, T_A = -55^\circ\text{C}$ $I_C = 300 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 500 \text{ mA}, V_{CE} = 1.0 \text{ V}$ $I_C = 500 \text{ mA}, V_{CE} = 1.0 \text{ V}, T_A = -55^\circ\text{C}$ $I_C = 800 \text{ mA}, V_{CE} = 2.0 \text{ V}$ $I_C = 1.0 \text{ A}, V_{CE} = 5.0 \text{ V}$	30 60 30 40 35 20 20 25	150	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$ $I_C = 100 \text{ mA}, I_B = 10 \text{ mA}$ $I_C = 300 \text{ mA}, I_B = 30 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ $I_C = 800 \text{ mA}, I_B = 80 \text{ mA}$ $I_C = 1.0 \text{ A}, I_B = 100 \text{ mA}$		0.25 0.26 0.4 0.52 0.8 0.95	V V V V V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$ $I_C = 100 \text{ mA}, I_B = 10 \text{ mA}$ $I_C = 300 \text{ mA}, I_B = 30 \text{ mA}$ $I_C = 500 \text{ mA}, I_B = 50 \text{ mA}$ $I_C = 800 \text{ mA}, I_B = 80 \text{ mA}$ $I_C = 1.0 \text{ A}, I_B = 100 \text{ mA}$		0.76 0.86 1.1 1.2 1.5 1.7	V V V V V V

### SMALL SIGNAL CHARACTERISTICS

$f_T$	Current Gain - Bandwidth Product	$I_C = 50 \text{ mA}, V_{CE} = 10 \text{ V},$ $f = 100 \text{ MHz}$	300		MHz
$C_{obo}$	Output Capacitance	$V_{CB} = 10 \text{ V}, I_E = 0,$ $f = 1.0 \text{ MHz}$		10	pF
$C_{ibo}$	Input Capacitance	$V_{EB} = 0.5 \text{ V}, I_C = 0,$ $f = 1.0 \text{ MHz}$		55	pF

### SWITCHING CHARACTERISTICS (except MMPQ3725)

$t_{on}$	Turn-on Time	$V_{CC} = 30 \text{ V}, V_{BE(off)} = 3.8 \text{ V},$		35	ns
$t_d$	Delay Time	$I_C = 500 \text{ mA}, I_{B1} = 50 \text{ mA}$		10	ns
$t_r$	Rise Time			30	ns
$t_{off}$	Turn-off Time	$V_{CC} = 30 \text{ V}, I_C = 500 \text{ mA}$		60	ns
$t_s$	Storage Time	$I_{B1} = I_{B2} = 50 \text{ mA}$		50	ns
$t_f$	Fall Time			30	ns

\*Pulse Test: Pulse Width  $\leq 300 \text{ } \mu\text{s}$ , Duty Cycle  $\leq 1.0\%$

TN3725A / MMPQ3725

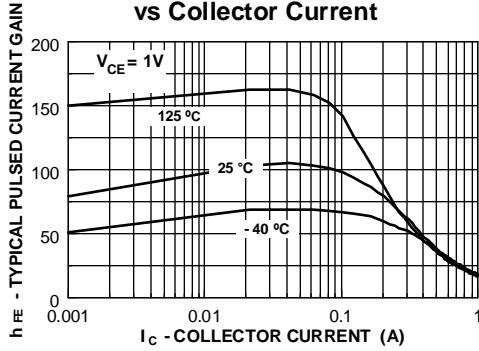
# NPN Switching Transistor

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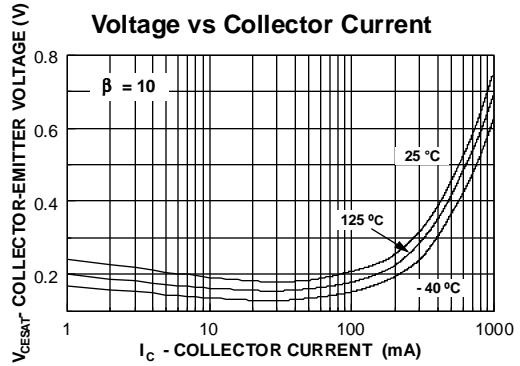
TN3725A / MMPQ3725

## DC Typical Characteristics

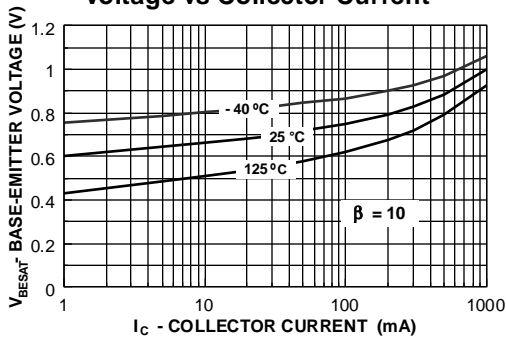
**Typical Pulsed Current Gain vs Collector Current**



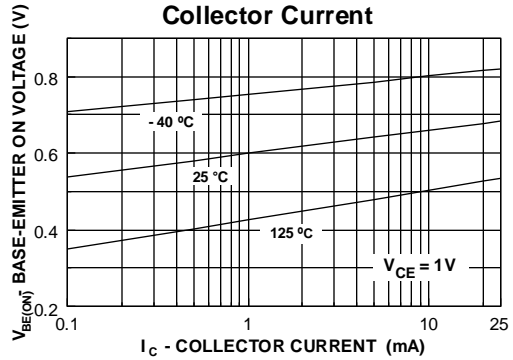
**Collector-Emitter Saturation Voltage vs Collector Current**



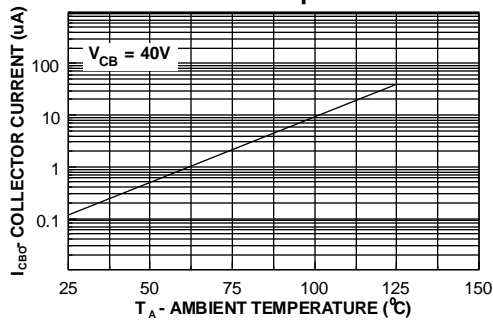
**Base-Emitter Saturation Voltage vs Collector Current**



**Base-Emitter ON Voltage vs Collector Current**



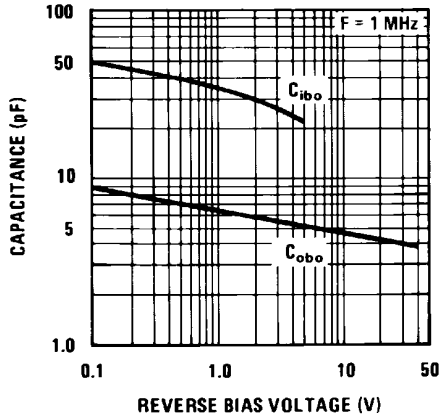
**Collector-Cutoff Current vs Ambient Temperature**



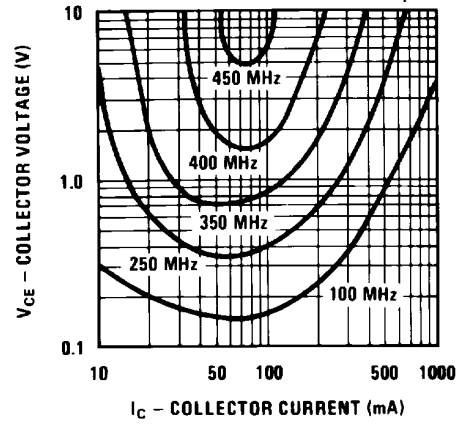
NPN Switching Transistor  
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AC Typical Characteristics

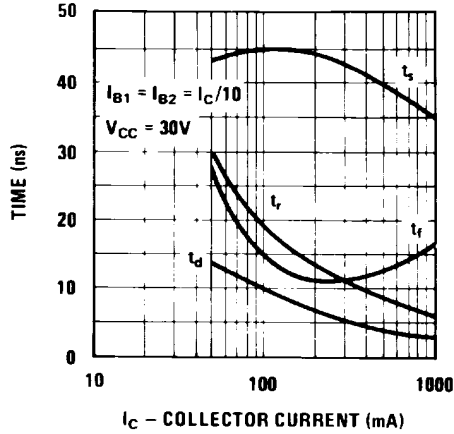
Input/Output Capacitance vs. Reverse Bias



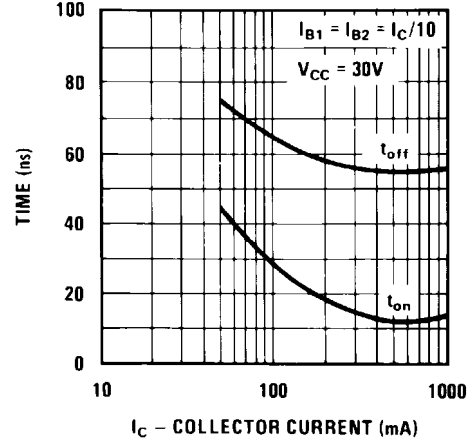
Contours of Constant Bandwidth Product ( $f_T$ )



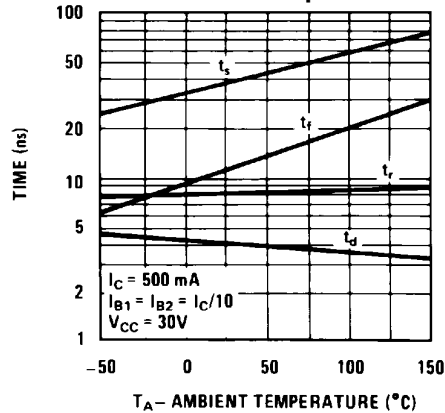
Switching Time vs. Collector Current



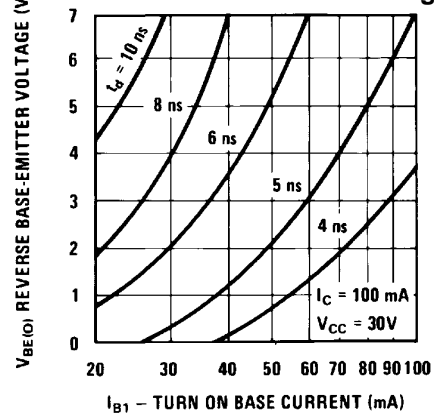
Turn On / Turn Off Times vs. Collector Current



Switching Times vs. Ambient Temperature



Delay Time vs. Turn On Base Current and Reverse Base-Emitter Voltage

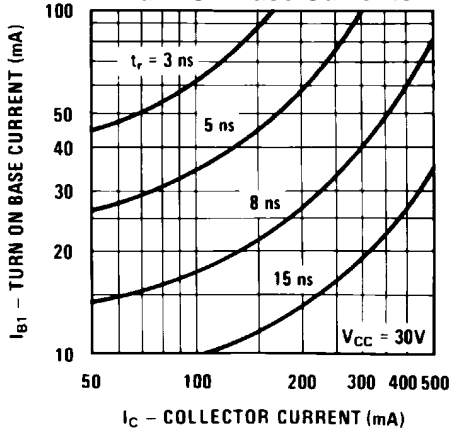


NPN Switching Transistor

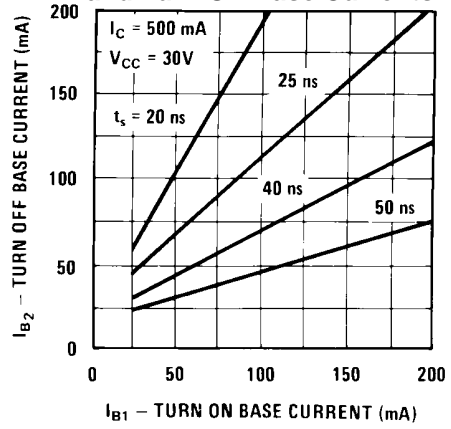
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AC Typical Characteristics (continued)

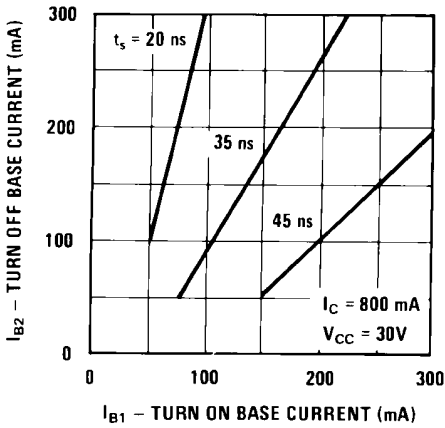
Rise Time vs. Collector and Turn On Base Currents



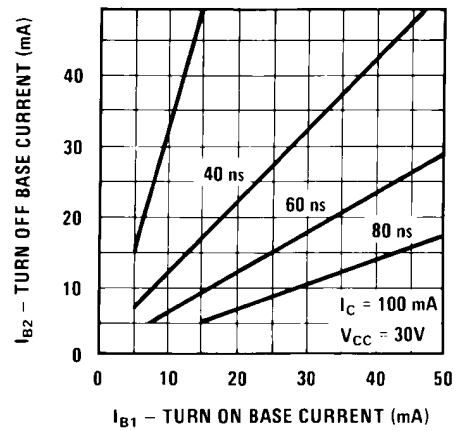
Storage Time vs. Turn On and Turn Off Base Currents



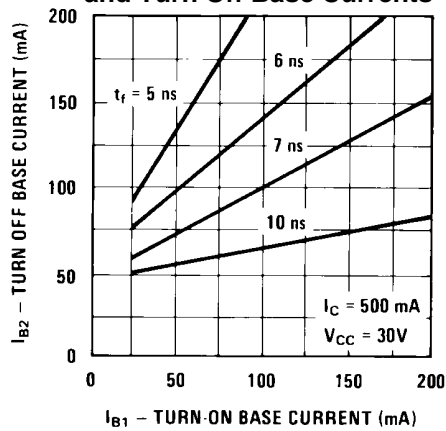
Storage Time vs. Turn On and Turn Off Base Currents



Storage Time vs. Turn On and Turn Off Base Currents



Fall Time vs. Turn On and Turn Off Base Currents

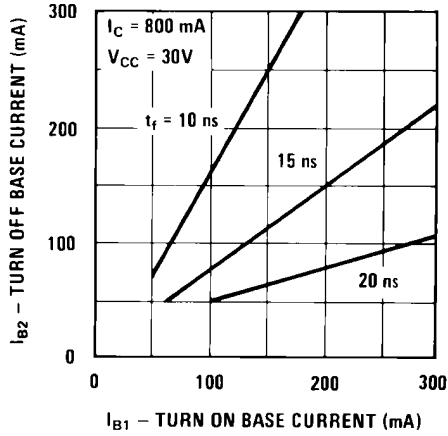


**NPN Switching Transistor**

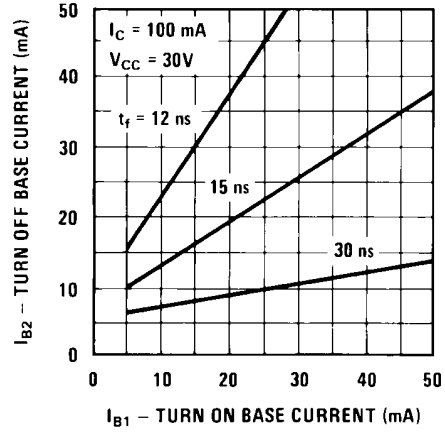
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**AC Typical Characteristics** (continued)

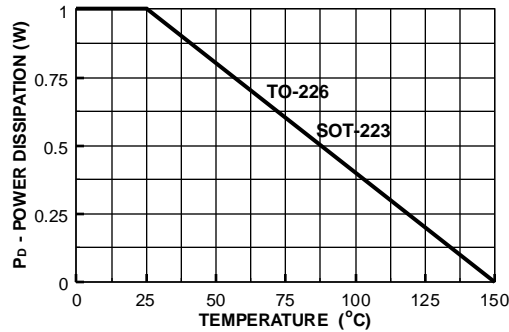
**Fall Time vs. Turn On and Turn Off Base Currents**



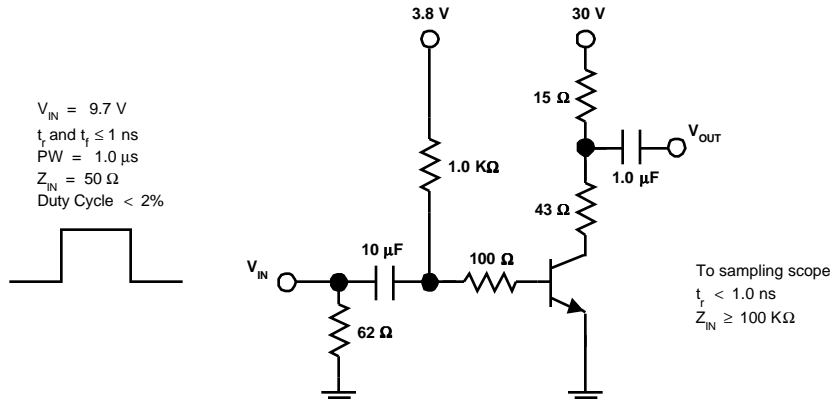
**Fall Time vs. Turn On and Turn Off Base Currents**



**POWER DISSIPATION vs AMBIENT TEMPERATURE**



**Test Circuit**



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