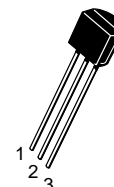
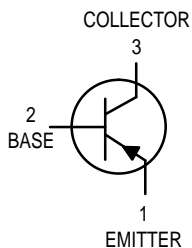


# Switching Transistor

## PNP Silicon

**MPS3640**



CASE 29-04, STYLE 1  
TO-92 (TO-226AA)

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CEO}$	-12	Vdc
Collector–Base Voltage	$V_{CBO}$	-12	Vdc
Emitter–Base Voltage	$V_{EBO}$	-4.0	Vdc
Collector Current — Continuous	$I_C$	-80	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625 5.0	mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 12	Watts 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
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### OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ( $I_C = -100 \mu\text{Adc}, V_{BE} = 0$ )	$V_{(BR)CES}$	-12	—	Vdc
Collector–Emitter Sustaining Voltage <sup>(1)</sup> ( $I_C = -10 \text{mAdc}, I_B = 0$ )	$V_{CEO(sus)}$	-12	—	Vdc
Collector–Base Breakdown Voltage ( $I_C = -100 \mu\text{Adc}, I_E = 0$ )	$V_{(BR)CBO}$	-12	—	Vdc
Emitter–Base Breakdown Voltage ( $I_E = -100 \mu\text{Adc}, I_C = 0$ )	$V_{(BR)EBO}$	-4.0	—	Vdc
Collector Cutoff Current ( $V_{CE} = -6.0 \text{Vdc}, V_{BE} = 0$ ) ( $V_{CE} = -6.0 \text{Vdc}, V_{BE} = 0, T_A = 65^\circ\text{C}$ )	$I_{CES}$	—	-0.01 -1.0	$\mu\text{Adc}$
Base Current ( $V_{CE} = -6.0 \text{Vdc}, V_{EB} = 0$ )	$I_B$	—	-10	nAdc

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

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

Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS(1)</b>				
DC Current Gain ( $I_C = -10\text{ mA dc}$ , $V_{CE} = -0.3\text{ V dc}$ ) ( $I_C = -50\text{ mA dc}$ , $V_{CE} = -1.0\text{ V dc}$ )	$h_{FE}$	30 20	120 —	—
Collector–Emitter Saturation Voltage ( $I_C = -10\text{ mA dc}$ , $I_B = -1.0\text{ mA dc}$ ) ( $I_C = -50\text{ mA dc}$ , $I_B = -5.0\text{ mA dc}$ ) ( $I_C = -10\text{ mA dc}$ , $I_B = -1.0\text{ mA dc}$ , $T_A = 65^\circ\text{C}$ )	$V_{CE(sat)}$	— — —	-0.2 -0.6 -0.25	Vdc
Base–Emitter Saturation Voltage ( $I_C = -10\text{ mA dc}$ , $I_B = -0.5\text{ mA dc}$ ) ( $I_C = -10\text{ mA dc}$ , $I_B = -1.0\text{ mA dc}$ ) ( $I_C = -50\text{ mA dc}$ , $I_B = -5.0\text{ mA dc}$ )	$V_{BE(sat)}$	-0.75 -0.75 —	-0.95 -1.0 -1.5	Vdc

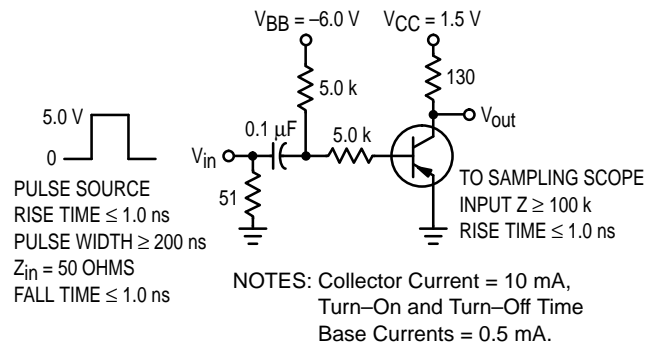
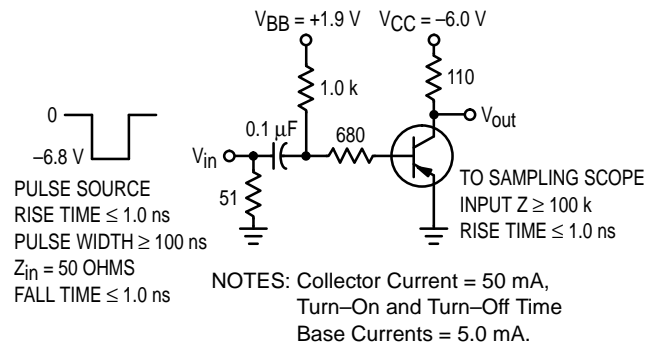
**SMALL–SIGNAL CHARACTERISTICS**

Current–Gain — Bandwidth Product ( $I_C = -10\text{ mA dc}$ , $V_{CE} = -5.0\text{ V dc}$ , $f = 100\text{ MHz}$ )	$f_T$	500	—	MHz
Output Capacitance ( $V_{CB} = -5.0\text{ V dc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$	—	3.5	pF
Input Capacitance ( $V_{EB} = -0.5\text{ V dc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ibo}$	—	3.5	pF

**SWITCHING CHARACTERISTICS**

Delay Time	( $V_{CC} = -6.0\text{ V dc}$ , $I_C = -50\text{ mA dc}$ , $V_{BE(off)} = -1.9\text{ V dc}$ , $I_{B1} = -5.0\text{ mA dc}$ )	$t_d$	—	10	ns
Rise Time		$t_r$	—	30	ns
Storage Time	( $V_{CC} = -6.0\text{ V dc}$ , $I_C = -50\text{ mA dc}$ , $I_{B1} = I_{B2} = -5.0\text{ mA dc}$ )	$t_s$	—	20	ns
Fall Time		$t_f$	—	12	ns
Turn–On Time ( $V_{CC} = -6.0\text{ V dc}$ , $I_C = -50\text{ mA dc}$ , $I_{B1} = -5.0\text{ mA dc}$ ) ( $V_{CC} = -1.5\text{ V dc}$ , $I_C = -10\text{ mA dc}$ , $I_{B1} = -0.5\text{ mA dc}$ )	$t_{on}$	—	—	25	ns
		—	—	60	
Turn–Off Time ( $V_{CC} = -6.0\text{ V dc}$ , $I_C = -50\text{ mA dc}$ , $I_{B1} = I_{B2} = -5.0\text{ mA dc}$ ) ( $V_{CC} = -1.5\text{ V dc}$ , $I_C = -10\text{ mA dc}$ , $I_{B1} = I_{B2} = -0.5\text{ mA dc}$ )	$t_{off}$	—	—	35	ns
		—	—	75	

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



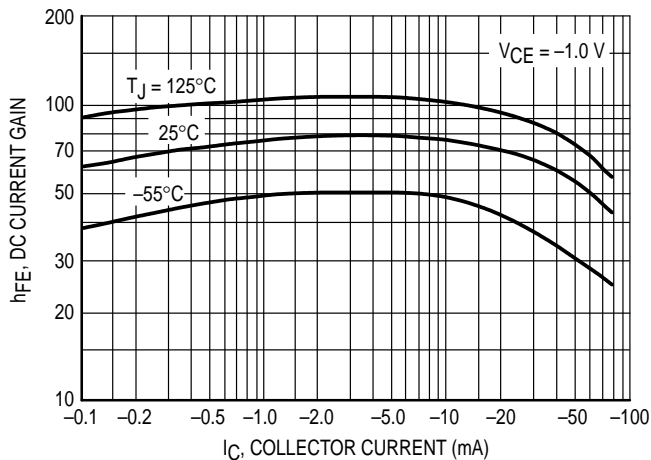


Figure 3. DC Current Gain

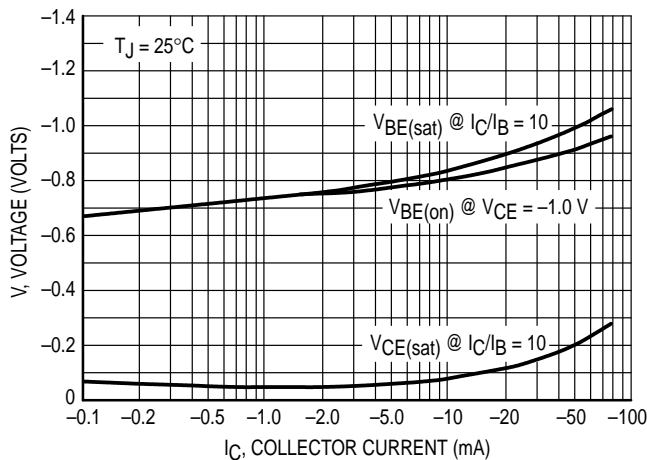


Figure 4. "On" Voltages

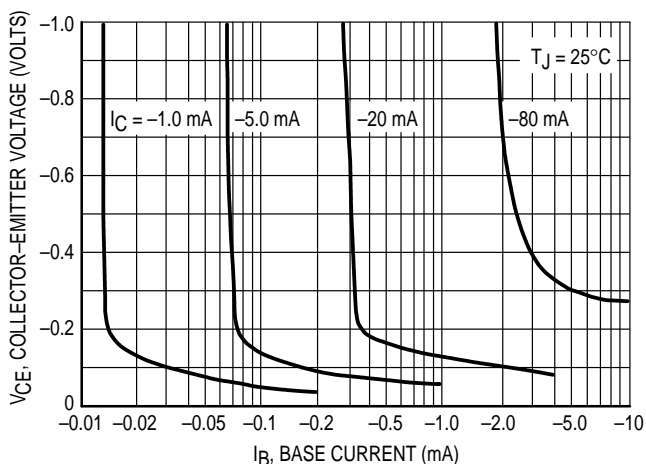


Figure 5. Collector Saturation Region

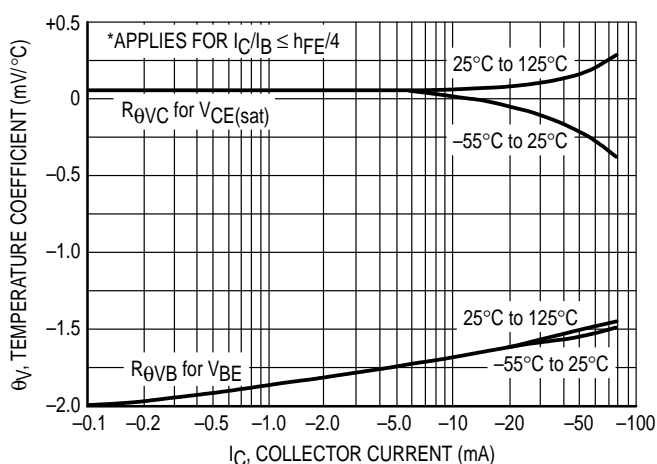


Figure 6. Temperature Coefficients

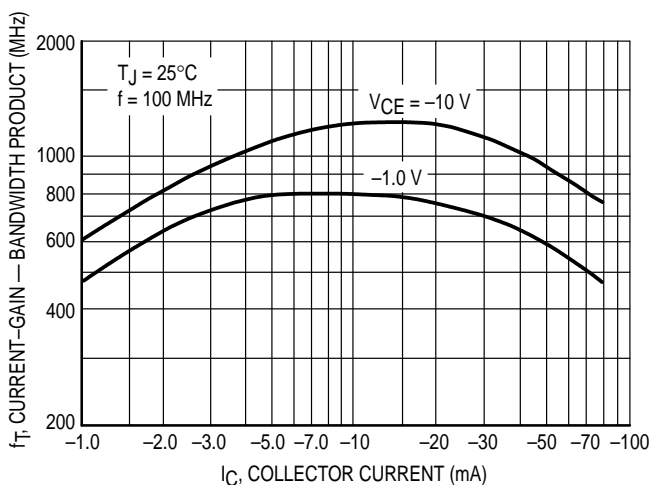


Figure 7. Current-Gain — Bandwidth Product

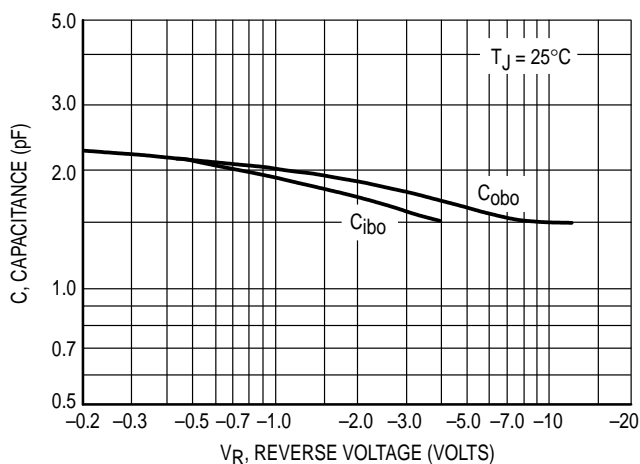


Figure 8. Capacitance

PACKAGE DIMENSIONS



**CASE 029-04  
(TO-226AA)  
ISSUE AD**

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. DIMENSION 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	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.022	0.41	0.55
F	0.016	0.019	0.41	0.48
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
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	0.115	—	2.93	—
V	0.135	—	3.43	—

STYLE 1:

1. EMITTER
2. BASE
3. COLLECTOR

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