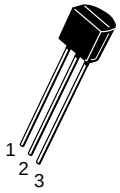
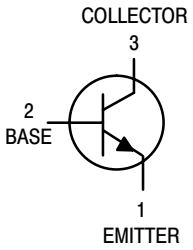
Switching Transistor
NPN Silicon

MPS3646

ON Semiconductor Preferred Device



CASE 29−11, STYLE 1
TO−92 (TO−226AA)



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 — 10 μs Pulse	I_C	300 500	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	625 5.0	mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.5 12	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

THERMAL CHARACTERISTICS

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

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector−Emitter Breakdown Voltage	(I_C = 100 μAdc, V_{BE} = 0)	$V_{(BR)CES}$	40	—	Vdc
Collector−Emitter Sustaining Voltage(1)	(I_C = 10 mAdc, I_B = 0)	$V_{CEO(sus)}$	15	—	Vdc
Collector−Base Breakdown Voltage	(I_C = 100 μAdc, I_E = 0)	$V_{(BR)CBO}$	40	—	Vdc
Emitter−Base Breakdown Voltage	(I_E = 100 μAdc, I_C = 0)	$V_{(BR)EBO}$	5.0	—	Vdc
Collector Cutoff Current (V_{CE} = 20 Vdc, V_{BE} = 0) (V_{CE} = 20 Vdc, V_{BE} = 0, T_A = 65°C)		I_{CES}	 — —	 0.5 3.0	μAdc
ON CHARACTERISTICS(1)					
DC Current Gain	(I_C = 30 mAdc, V_{CE} = 0.4 Vdc) (I_C = 100 mAdc, V_{CE} = 0.5 Vdc) (I_C = 300 mA, V_{CE} = 1.0 Vdc)	h_{FE}	30 25 15	120 — —	—
Collector−Emitter Saturation Voltage	(I_C = 30 mAdc, I_B = 3.0 mAdc) (I_C = 100 mAdc, I_B = 10 mAdc) (I_C = 300 mAdc, I_B = 30 mAdc) (I_C = 30 mA, I_B = 3.0 mA, T_A = 65°C)	$V_{CE(sat)}$	— — — —	0.2 0.28 0.5 0.3	Vdc
Base−Emitter Saturation Voltage	(I_C = 30 mAdc, I_B = 3.0 mAdc) (I_C = 100 mAdc, I_B = 10 mAdc) (I_C = 300 mAdc, I_B = 30 mA)	$V_{BE(sat)}$	0.73 — —	0.95 1.2 1.7	Vdc

1. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.

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

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic		Symbol	Min	Max	Unit
SMALL−SIGNAL CHARACTERISTICS					
Current−Gain — Bandwidth Product (I_C = 30 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)		f_T	350	—	MHz
Output Capacitance (V_{CB} = 5.0 Vdc, I_E = 0, f = 1.0 MHz)		C_{obo}	—	5.0	pF
Input Capacitance (V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)		C_{ibo}	—	9.0	pF
SWITCHING CHARACTERISTICS					
Turn−On Time	(V_{CC} = 10 Vdc, I_C = 300 mAdc, I_{B1} = 30 mAdc) (Figure 1)	t_{on}	—	18	ns
Delay Time		t_d	—	10	ns
Rise Time		t_r	—	15	ns
Turn−Off Time	(V_{CC} = 10 Vdc, I_C = 300 mAdc, I_{B1} = I_{B2} = 30 mAdc) (Figure 1)	t_{off}	—	28	ns
Fall Time		t_f	—	15	ns
Storage Time (V_{CC} = 10 Vdc, I_C = 10 mAdc, I_{B1} = I_{B2} = 10 mAdc) (Figure 2)		t_s	—	18	ns

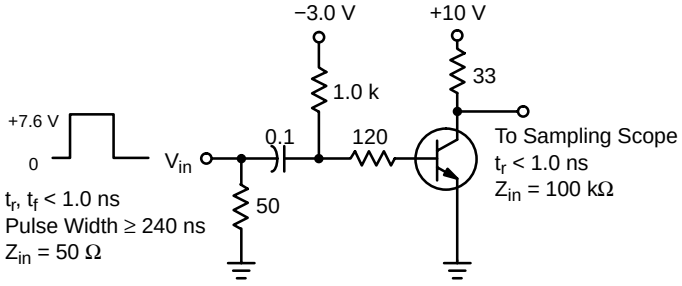


Figure 1. Switching Time Test Circuit

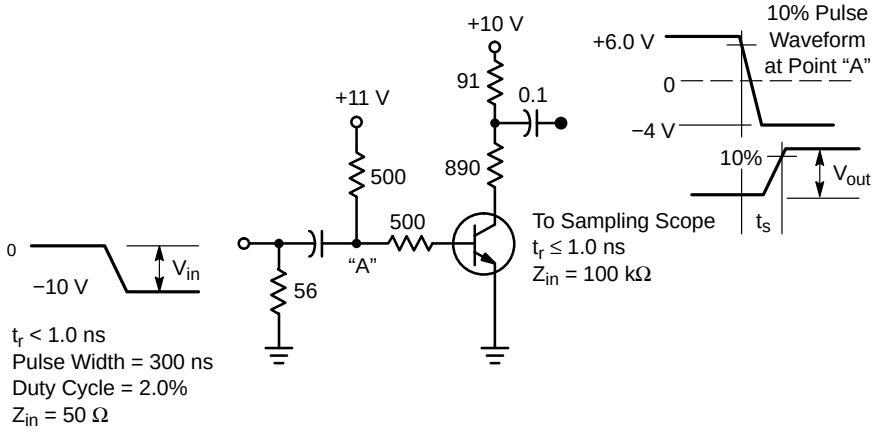


Figure 2. Charge Storage Time Test Circuit

CURRENT GAIN CHARACTERISTICS

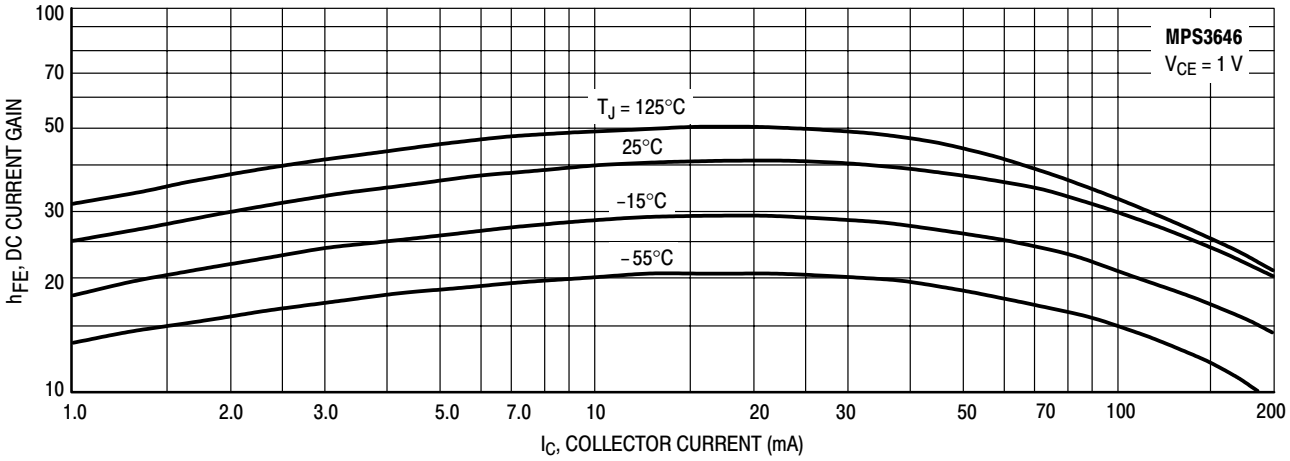


Figure 3. Minimum Current Gain

"ON" CONDITION CHARACTERISTICS

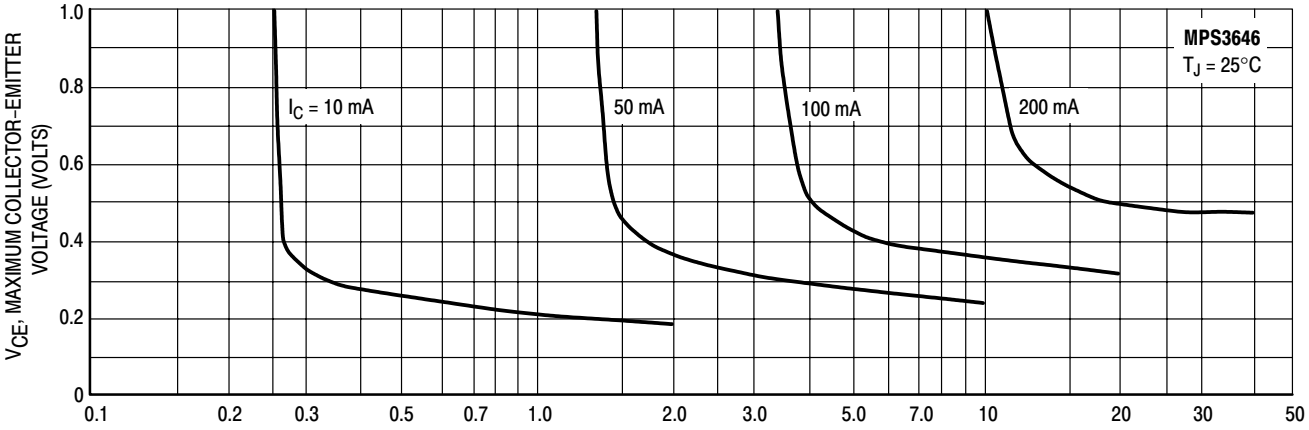


Figure 4. Collector Saturation Region

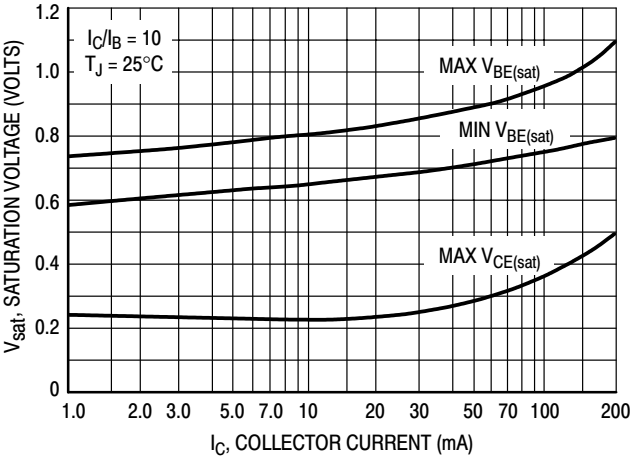


Figure 5. Saturation Voltage Limits

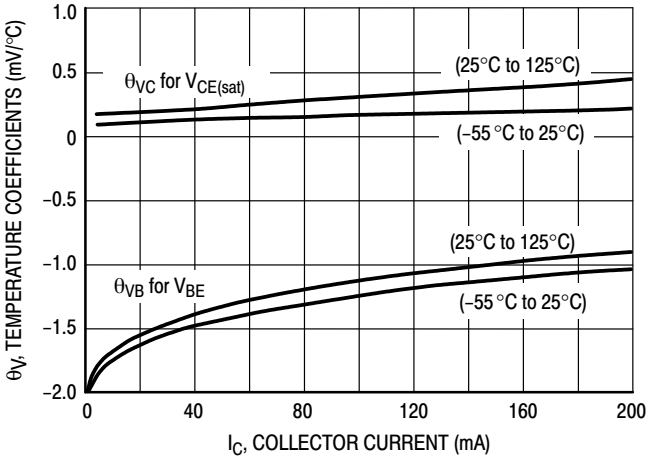


Figure 6. Temperature Coefficients

DYNAMIC CHARACTERISTICS

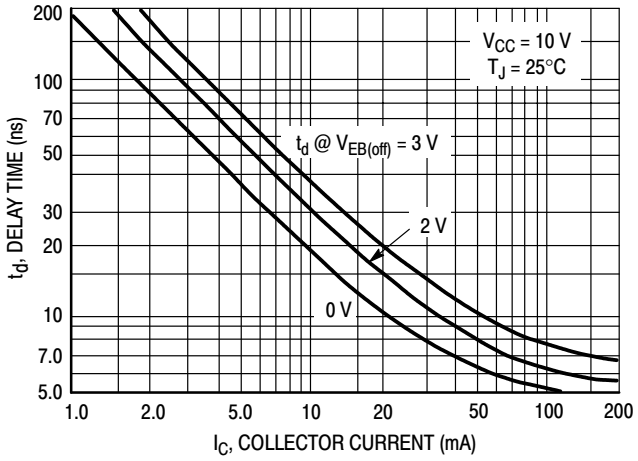


Figure 7. Delay Time

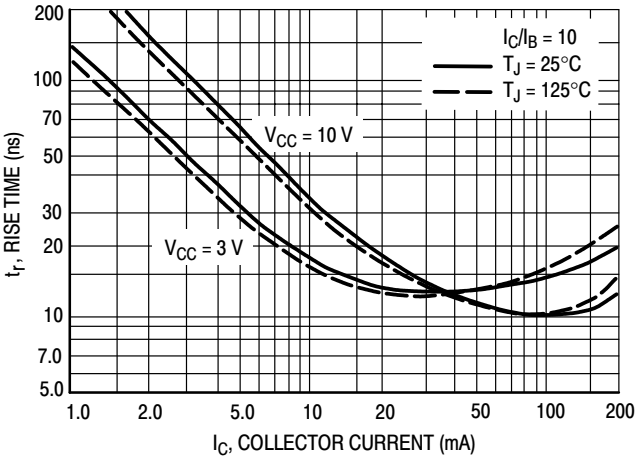


Figure 8. Rise Time

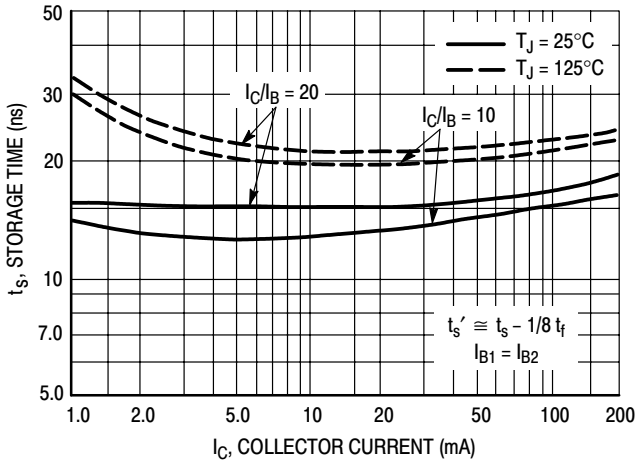


Figure 9. Storage Time

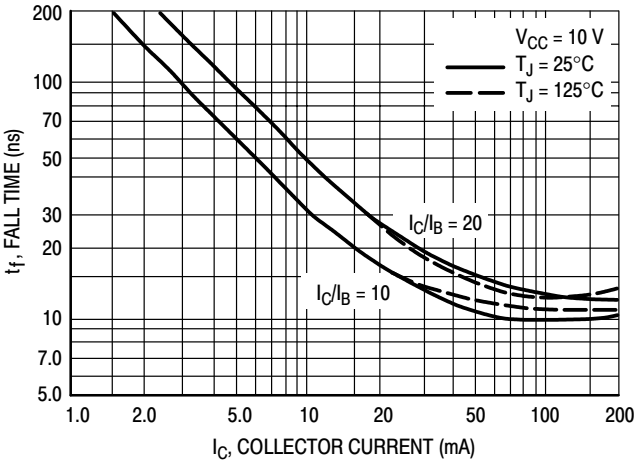


Figure 10. Fall Time

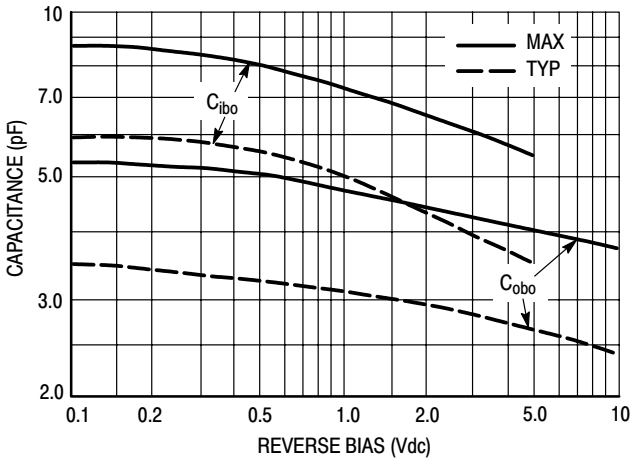


Figure 11. Junction Capacitance

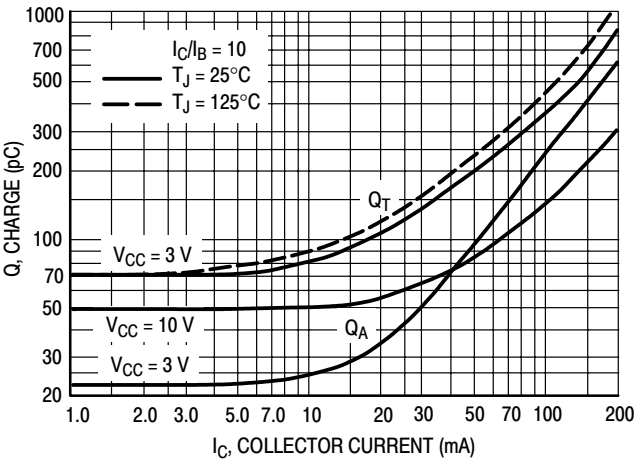
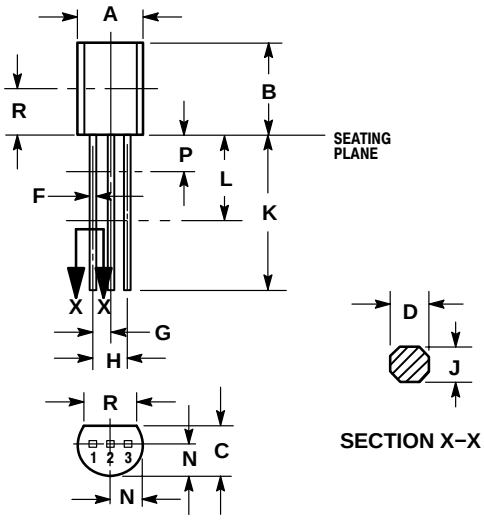


Figure 12. Maximum Charge Data

PACKAGE DIMENSIONS

CASE 029−11
(TO−226AA)
ISSUE AD



SECTION X−X

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 MIMIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	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	---

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

Notes

Notes

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