ON Semiconductor

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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 — 10 μs Pulse	IC	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

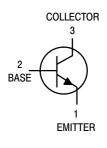
THERMAL CHARACTERISTICS

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

MPS3646

ON Semiconductor Preferred Device





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

Character	istic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS					
Collector - Emitter Breakdown Voltage	$(I_C = 100 \mu Adc, V_{BE} = 0)$	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 $(V_{CE} = 20 \text{ Vdc}, V_{BE} = 0)$ $(V_{CE} = 20 \text{ Vdc}, V_{BE} = 0, T_A = 65^{\circ}\text{C})$		I _{CES}		0.5 3.0	μAdc
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	$ \begin{array}{l} (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}) \end{array} $	V _{CE(sat)}	_ _ _ _	0.2 0.28 0.5 0.3	Vdc
Base – Emitter Saturation Voltage	$(I_{\rm C}=30~{\rm mAdc},~I_{\rm B}=3.0~{\rm mAdc})$ $(I_{\rm C}=100~{\rm mAdc},~I_{\rm B}=10~{\rm mAdc})$ $(I_{\rm C}=300~{\rm mAdc},~I_{\rm B}=30~{\rm mA})$	V _{BE(sat)}	0.73 — —	0.95 1.2 1.7	Vdc

^{1.} Pulse Test: Pulse Width \leq 300 μ s; Duty Cycle \leq 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)

 $(V_{CC}$ = 10 Vdc, I_{C} = 10 mAdc, I_{B1} = I_{B2} = 10 mAdc) (Figure 2)

	Characteristic	Symbol	Min	Max	Unit
SMALL-SIGNA	L CHARACTERISTICS			•	I.
Current – Gain — (I _C = 30 mAdc,	f _T	350	_	MHz	
Output Capacitan (V _{CB} = 5.0 Vdc	C _{obo}	_	5.0	pF	
Input Capacitance (V _{EB} = 0.5 Vdc,	C _{ibo}	_	9.0	pF	
SWITCHING CH	ARACTERISTICS	•			
Turn-On Time		t _{on}	_	18	ns
Delay Time	(V _{CC} = 10 Vdc, I _C = 300 mAdc, I _{B1} = 30 mAdc) (Figure 1)	t _d	_	10	ns
Rise Time	(1.92.12.1)	t _r	_	15	ns
Turn-Off Time	(V _{CC} = 10 Vdc, I _C = 300 mAdc, I _{B1} = I _{B2} = 30 mAdc)	t _{off}	_	28	ns
Fall Time	(Figure 1)	t _f	_	15	ns
Storage Time		t _s	_	18	ns

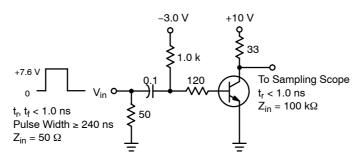


Figure 1. Switching Time Test Circuit

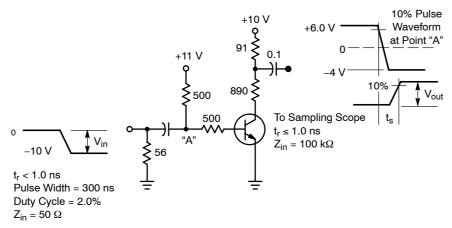


Figure 2. Charge Storage Time Test Circuit

CURRENT GAIN CHARACTERISTICS

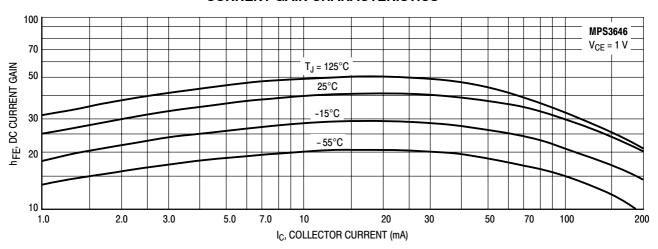


Figure 3. Minimum Current Gain

"ON" CONDITION CHARACTERISTICS

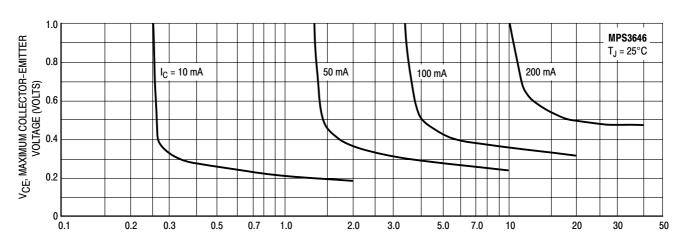


Figure 4. Collector Saturation Region

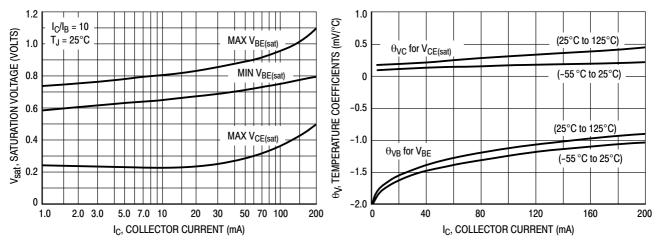
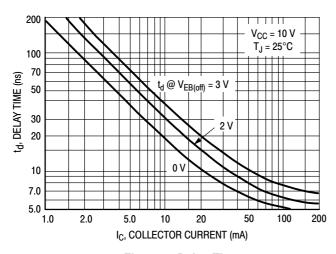


Figure 5. Saturation Voltage Limits

Figure 6. Temperature Coefficients

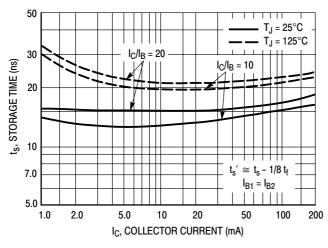
DYNAMIC CHARACTERISTICS



200 $I_C/I_B = 10$ $T_J = 25^{\circ}C$ 100 $T_{J} = 125^{\circ}C$ V_{CC} = 10 V t_r, RISE TIME (ns) 50 30 20 $V_{CC} = 3 V$ 10 7.0 5.0 1.0 2.0 5.0 20 50 100 200 IC, COLLECTOR CURRENT (mA)

Figure 7. Delay Time

Figure 8. Rise Time



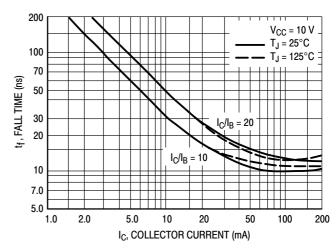
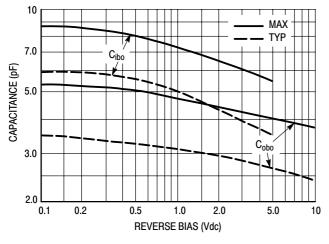


Figure 9. Storage Time

Figure 10. Fall Time



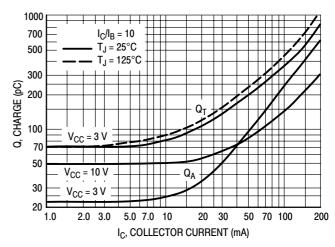
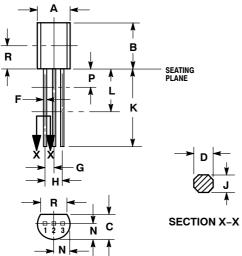


Figure 11. Junction Capacitance

Figure 12. Maximum Charge Data

PACKAGE DIMENSIONS

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



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

	INCHES		MILLIM	ETERS
DIM	MIN	MAX	MIN	MAX
Α	0.175	0.205	4.44	5.21
В	0.290	0.310	7.37	7.87
С	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
Н	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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