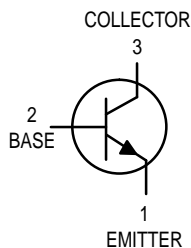


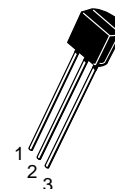
General Purpose Transistors

NPN Silicon



MPS2222
MPS2222A*

*Motorola Preferred Device



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

MAXIMUM RATINGS

Rating	Symbol	MPS2222	MPS2222A	Unit
Collector–Emitter Voltage	V_{CEO}	30	40	Vdc
Collector–Base Voltage	V_{CBO}	60	75	Vdc
Emitter–Base Voltage	V_{EBO}	5.0	6.0	Vdc
Collector Current — Continuous	I_C	600		mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	625 5.0		mW mW/°C
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ 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 ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ($I_C = 10$ mAdc, $I_B = 0$)	MPS2222 MPS2222A	$V_{(BR)CEO}$	30 40	— —	Vdc
Collector–Base Breakdown Voltage ($I_C = 10$ μ Adc, $I_E = 0$)	MPS2222 MPS2222A	$V_{(BR)CBO}$	60 75	— —	Vdc
Emitter–Base Breakdown Voltage ($I_E = 10$ μ Adc, $I_C = 0$)	MPS2222 MPS2222A	$V_{(BR)EBO}$	5.0 6.0	— —	Vdc
Collector Cutoff Current ($V_{CE} = 60$ Vdc, $V_{EB(off)} = 3.0$ Vdc)	MPS2222A	I_{CEX}	—	10	nAdc
Collector Cutoff Current ($V_{CB} = 50$ Vdc, $I_E = 0$) ($V_{CB} = 60$ Vdc, $I_E = 0$) ($V_{CB} = 50$ Vdc, $I_E = 0$, $T_A = 125^\circ\text{C}$) ($V_{CB} = 50$ Vdc, $I_E = 0$, $T_A = 125^\circ\text{C}$)	MPS2222 MPS2222A MPS2222 MPS2222A	I_{CBO}	— — — —	0.01 0.01 10 10	μ Adc
Emitter Cutoff Current ($V_{EB} = 3.0$ Vdc, $I_C = 0$)	MPS2222A	I_{EBO}	—	100	nAdc
Base Cutoff Current ($V_{CE} = 60$ Vdc, $V_{EB(off)} = 3.0$ Vdc)	MPS2222A	I_{BL}	—	20	nAdc

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

MPS2222 MPS2222A

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

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS				
DC Current Gain (I _C = 0.1 mA _{dc} , V _{CE} = 10 V _{dc}) (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc}) (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc}) (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc} , T _A = -55°C) (I _C = 150 mA _{dc} , V _{CE} = 10 V _{dc}) ⁽¹⁾ (I _C = 150 mA _{dc} , V _{CE} = 1.0 V _{dc}) ⁽¹⁾ (I _C = 500 mA _{dc} , V _{CE} = 10 V _{dc}) ⁽¹⁾	h _{FE}	35 50 75 35 100 50 30 40	— — — — 300 — — —	—
Collector–Emitter Saturation Voltage ⁽¹⁾ (I _C = 150 mA _{dc} , I _B = 15 mA _{dc}) (I _C = 500 mA _{dc} , I _B = 50 mA _{dc})	V _{CE(sat)}	— — — —	0.4 0.3 1.6 1.0	V _{dc}
Base–Emitter Saturation Voltage ⁽¹⁾ (I _C = 150 mA _{dc} , I _B = 15 mA _{dc}) (I _C = 500 mA _{dc} , I _B = 50 mA _{dc})	V _{BE(sat)}	— 0.6 — —	1.3 1.2 2.6 2.0	V _{dc}

SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product ⁽²⁾ (I _C = 20 mA _{dc} , V _{CE} = 20 V _{dc} , f = 100 MHz)	f _T	250 300	— —	MHz
Output Capacitance (V _{CB} = 10 V _{dc} , I _E = 0, f = 1.0 MHz)	C _{obo}	—	8.0	pF
Input Capacitance (V _{EB} = 0.5 V _{dc} , I _C = 0, f = 1.0 MHz)	C _{ibo}	— —	30 25	pF
Input Impedance (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz) (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz)	h _{ie}	2.0 0.25	8.0 1.25	kΩ
Voltage Feedback Ratio (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz) (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz)	h _{re}	— —	8.0 4.0	X 10 ⁻⁴
Small–Signal Current Gain (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz) (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz)	h _{fe}	50 75	300 375	—
Output Admittance (I _C = 1.0 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz) (I _C = 10 mA _{dc} , V _{CE} = 10 V _{dc} , f = 1.0 kHz)	h _{oe}	5.0 25	35 200	μmhos
Collector Base Time Constant (I _E = 20 mA _{dc} , V _{CB} = 20 V _{dc} , f = 31.8 MHz)	rb'C _C	—	150	ps
Noise Figure (I _C = 100 μA _{dc} , V _{CE} = 10 V _{dc} , R _S = 1.0 kΩ, f = 1.0 kHz)	NF	—	4.0	dB

SWITCHING CHARACTERISTICS MPS2222A only

Delay Time	(V _{CC} = 30 V _{dc} , V _{BE(off)} = -0.5 V _{dc} , I _C = 150 mA _{dc} , I _{B1} = 15 mA _{dc}) (Figure 1)	t _d	—	10	ns
Rise Time		t _r	—	25	ns
Storage Time	(V _{CC} = 30 V _{dc} , I _C = 150 mA _{dc} , I _{B1} = I _{B2} = 15 mA _{dc}) (Figure 2)	t _s	—	225	ns
Fall Time		t _f	—	60	ns

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

2. f_T is defined as the frequency at which |h_{fe}| extrapolates to unity.

SWITCHING TIME EQUIVALENT TEST CIRCUITS

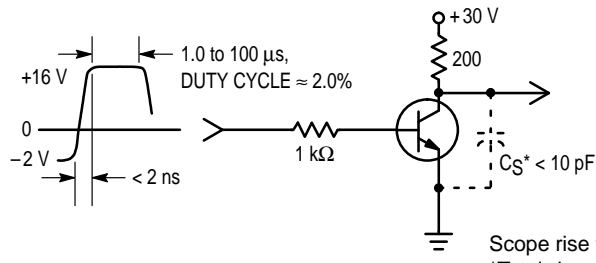


Figure 1. Turn-On Time

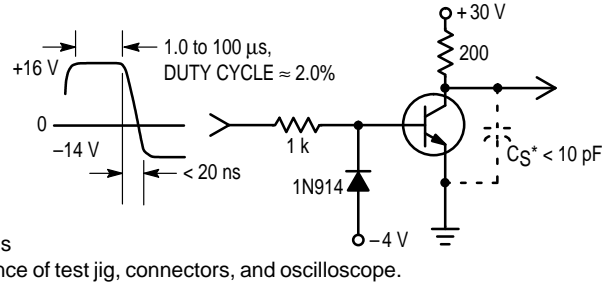


Figure 2. Turn-Off Time

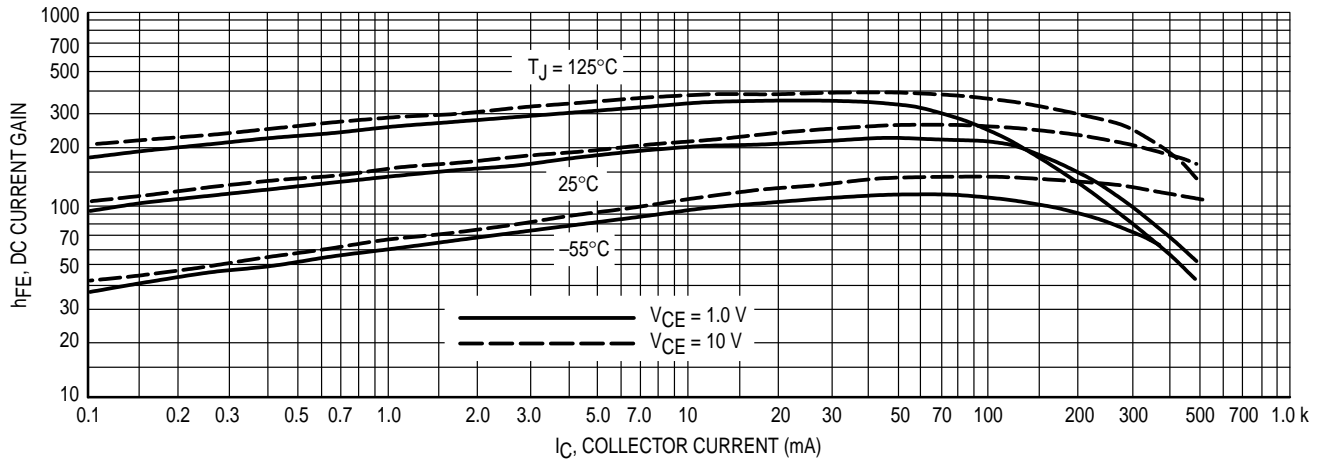


Figure 3. DC Current Gain

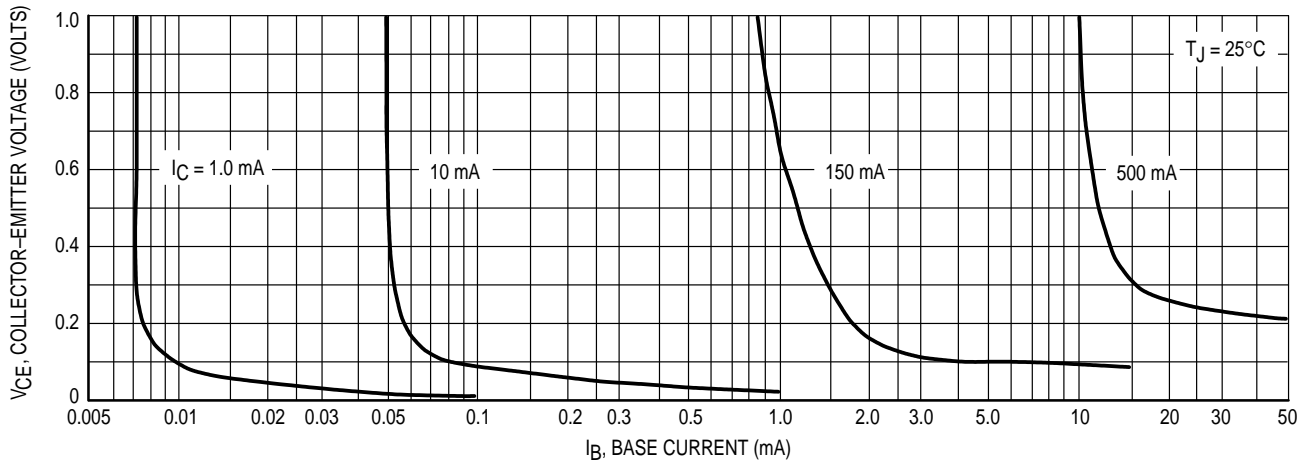


Figure 4. Collector Saturation Region

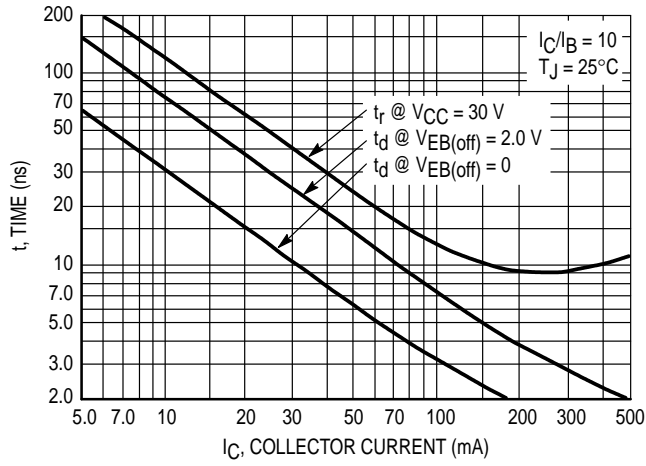


Figure 5. Turn-On Time

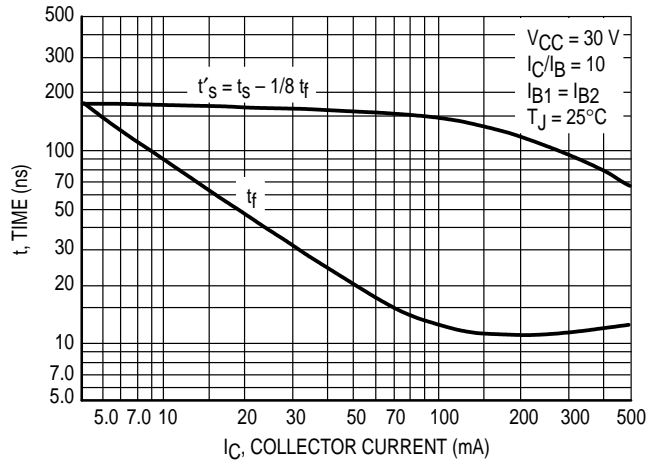


Figure 6. Turn-Off Time

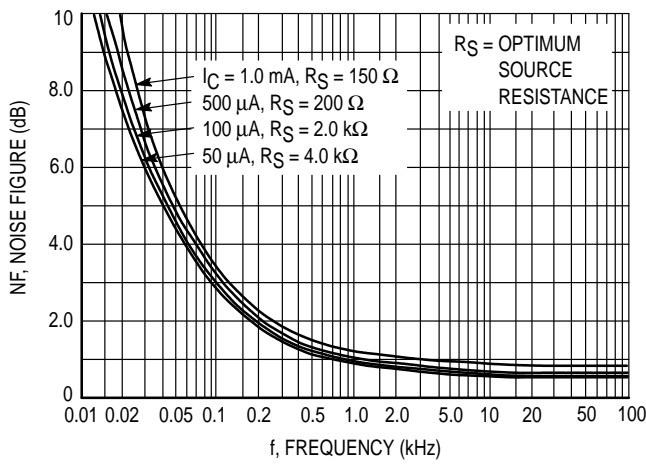


Figure 7. Frequency Effects

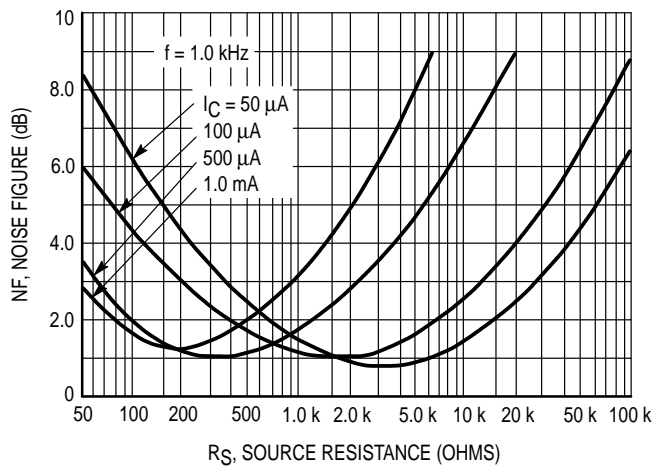


Figure 8. Source Resistance Effects

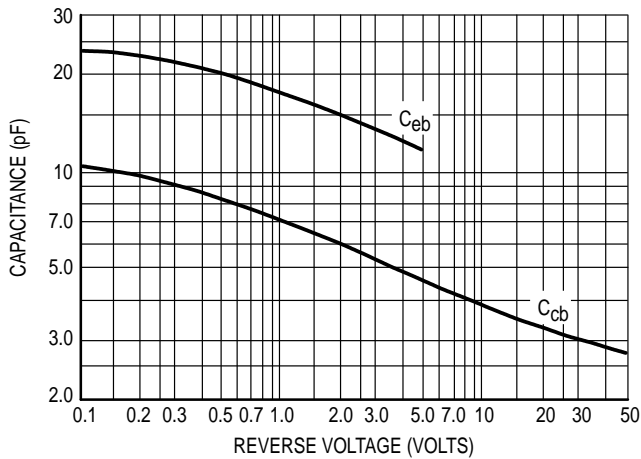


Figure 9. Capacitances

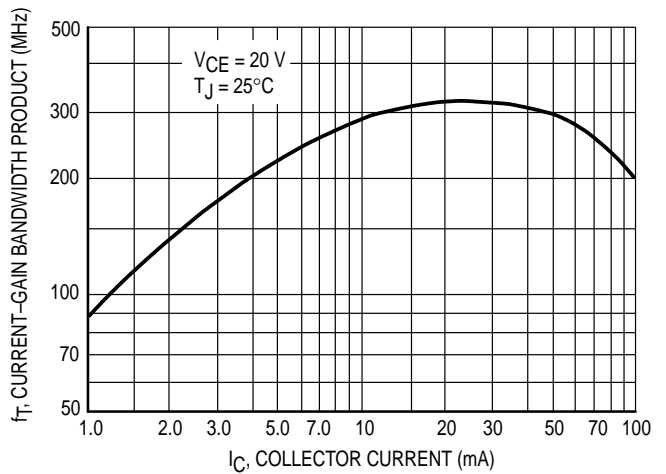


Figure 10. Current-Gain Bandwidth Product

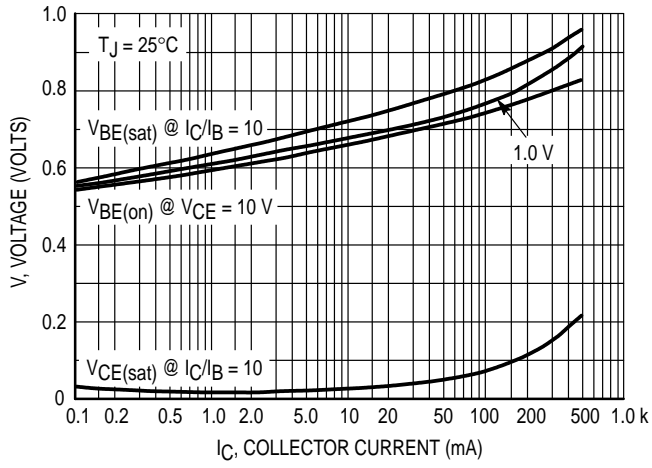


Figure 11. "On" Voltages

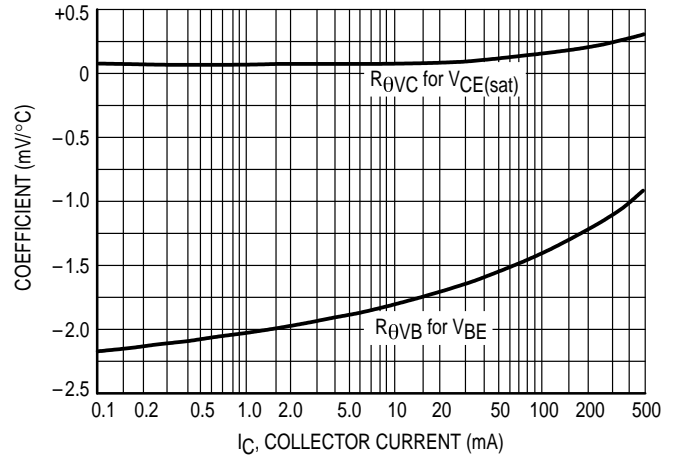
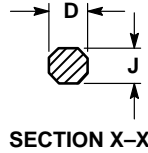
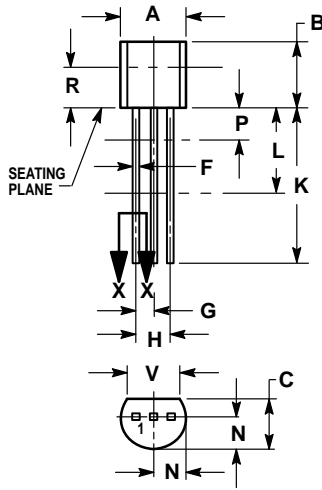


Figure 12. Temperature Coefficients

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. PIN 1. EMITTER
 2. BASE
 3. COLLECTOR

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How to reach us:
USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
 P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447 or 602-303-5454

JAPAN: Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,
 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-81-3521-8315

MFAX: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
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