

# MPS2222, MPS2222A

MPS2222A is a Preferred Device

## General Purpose Transistors

### NPN Silicon

#### Features

- Pb-Free Packages are Available\*

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage MPS2222 MPS2222A	$V_{CEO}$	30 40	Vdc
Collector-Base Voltage MPS2222 MPS2222A	$V_{CBO}$	60 75	Vdc
Emitter-Base Voltage MPS2222 MPS2222A	$V_{EBO}$	5.0 6.0	Vdc
Collector Current - Continuous	$I_C$	600	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	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	W mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$

#### THERMAL CHARACTERISTICS

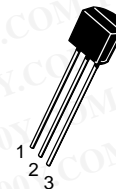
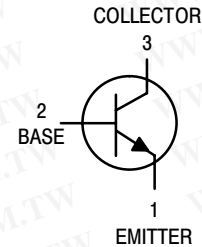
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	200	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	83.3	$^\circ\text{C}/\text{W}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.



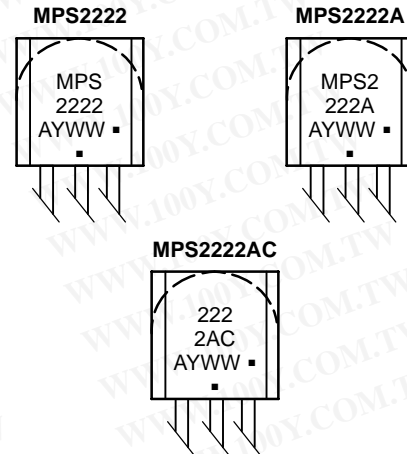
ON Semiconductor®

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TO-92  
CASE 29-11  
STYLE 1

#### MARKING DIAGRAMS



A = Assembly Location  
 Y = Year  
 WW = Work Week  
 ■ = Pb-Free Package  
 (Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

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

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# MPS2222, MPS2222A

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

Characteristic		Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage ( $I_C = 10\text{ mAdc}$ , $I_B = 0$ )	MPS2222 MPS2222A	$V_{(BR)CEO}$	30 40	- -	Vdc
Collector-Base Breakdown Voltage ( $I_C = 10\ \mu\text{Adc}$ , $I_E = 0$ )	MPS2222 MPS2222A	$V_{(BR)CBO}$	60 75	- -	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 10\ \mu\text{Adc}$ , $I_C = 0$ )	MPS2222 MPS2222A	$V_{(BR)EBO}$	5.0 6.0	- -	Vdc
Collector Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 3.0\text{ Vdc}$ )	MPS2222A	$I_{CEX}$	-	10	nAdc
Collector Cutoff Current ( $V_{CB} = 50\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 60\text{ Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 50\text{ Vdc}$ , $I_E = 0$ , $T_A = 125^\circ\text{C}$ ) ( $V_{CB} = 50\text{ Vdc}$ , $I_E = 0$ , $T_A = 125^\circ\text{C}$ )	MPS2222 MPS2222A MPS2222 MPS2222A	$I_{CBO}$	- - - -	0.01 0.01 10 10	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 3.0\text{ Vdc}$ , $I_C = 0$ )	MPS2222A	$I_{EBO}$	-	100	nAdc
Base Cutoff Current ( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 3.0\text{ Vdc}$ )	MPS2222A	$I_{BL}$	-	20	nAdc

## ON CHARACTERISTICS

DC Current Gain ( $I_C = 0.1\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $T_A = -55^\circ\text{C}$ ) ( $I_C = 150\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) (Note 1) ( $I_C = 150\text{ mAdc}$ , $V_{CE} = 1.0\text{ Vdc}$ ) (Note 1) ( $I_C = 500\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ ) (Note 1)	MPS2222A only      MPS2222 MPS2222A	$h_{FE}$	35 50 75 35 100 50 30 40	- - - - 300 - - -	-
Collector-Emitter Saturation Voltage (Note 1) ( $I_C = 150\text{ mAdc}$ , $I_B = 15\text{ mAdc}$ )  ( $I_C = 500\text{ mAdc}$ , $I_B = 50\text{ mAdc}$ )	MPS2222 MPS2222A MPS2222 MPS2222A	$V_{CE(sat)}$	- - - -	0.4 0.3 1.6 1.0	Vdc
Base-Emitter Saturation Voltage (Note 1) ( $I_C = 150\text{ mAdc}$ , $I_B = 15\text{ mAdc}$ )  ( $I_C = 500\text{ mAdc}$ , $I_B = 50\text{ mAdc}$ )	MPS2222 MPS2222A MPS2222 MPS2222A	$V_{BE(sat)}$	- 0.6 - -	1.3 1.2 2.6 2.0	Vdc

## SMALL-SIGNAL CHARACTERISTICS

Current-Gain - Bandwidth Product (Note 2) ( $I_C = 20\text{ mAdc}$ , $V_{CE} = 20\text{ Vdc}$ , $f = 100\text{ MHz}$ )	MPS2222 MPS2222A	$f_T$	250 300	- -	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )		$C_{obo}$	-	8.0	pF
Input Capacitance ( $V_{EB} = 0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )	MPS2222 MPS2222A	$C_{ibo}$	- -	30 25	pF
Input Impedance ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ ) ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	MPS2222A MPS2222A	$h_{ie}$	2.0 0.25	8.0 1.25	$k\Omega$
Voltage Feedback Ratio ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ ) ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	MPS2222A MPS2222A	$h_{re}$	- -	8.0 4.0	$\times 10^{-4}$
Small-Signal Current Gain ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ ) ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	MPS2222A MPS2222A	$h_{fe}$	50 75	300 375	-
Output Admittance ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ ) ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	MPS2222A MPS2222A	$h_{oe}$	5.0 25	35 200	$\mu\text{mhos}$
Collector Base Time Constant ( $I_E = 20\text{ mAdc}$ , $V_{CB} = 20\text{ Vdc}$ , $f = 31.8\text{ MHz}$ )	MPS2222A	$rb'C_c$	-	150	ps
Noise Figure ( $I_C = 100\ \mu\text{Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $R_S = 1.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ )	MPS2222A	NF	-	4.0	dB

1. Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
2.  $f_T$  is defined as the frequency at which  $|h_{fe}|$  extrapolates to unity.

# MPS2222, MPS2222A

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

Characteristic	Symbol	Min	Max	Unit
<b>SWITCHING CHARACTERISTICS MPS2222A only</b>				
Delay Time	$t_d$	-	10	ns
Rise Time				
Storage Time	$t_s$	-	225	ns
Fall Time				

## SWITCHING TIME EQUIVALENT TEST CIRCUITS

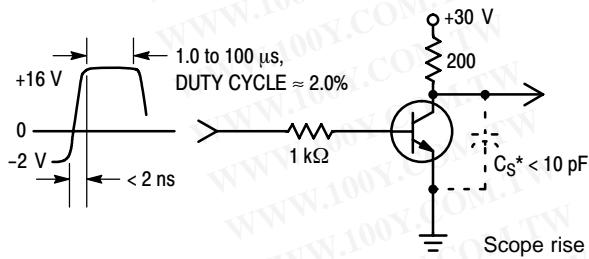


Figure 1. Turn-On Time

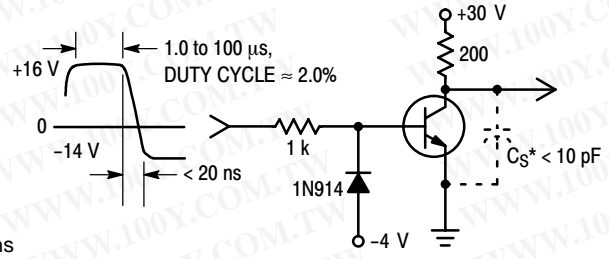


Figure 2. Turn-Off Time

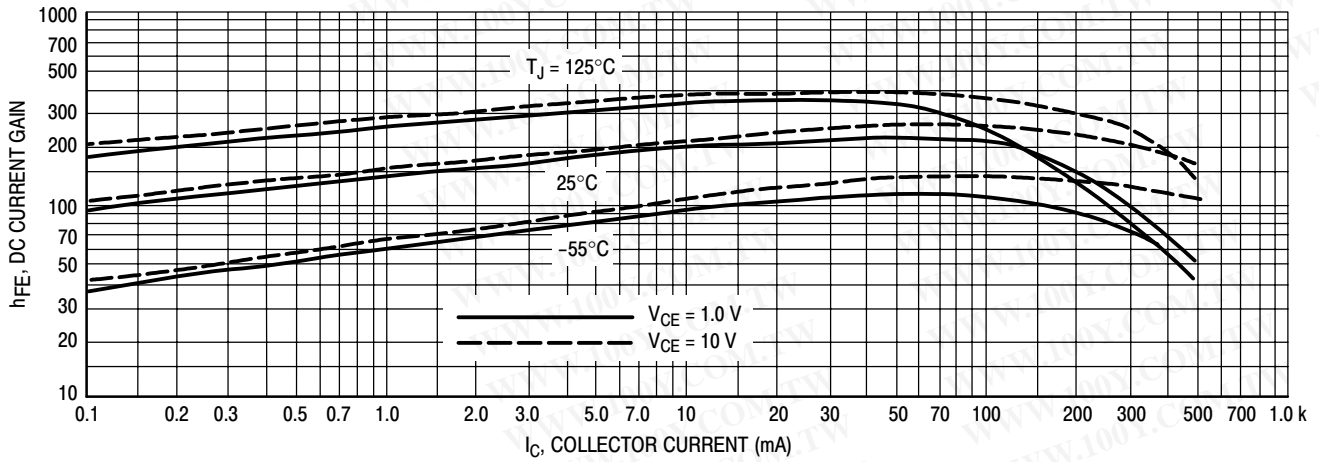


Figure 3. DC Current Gain

# MPS2222, MPS2222A

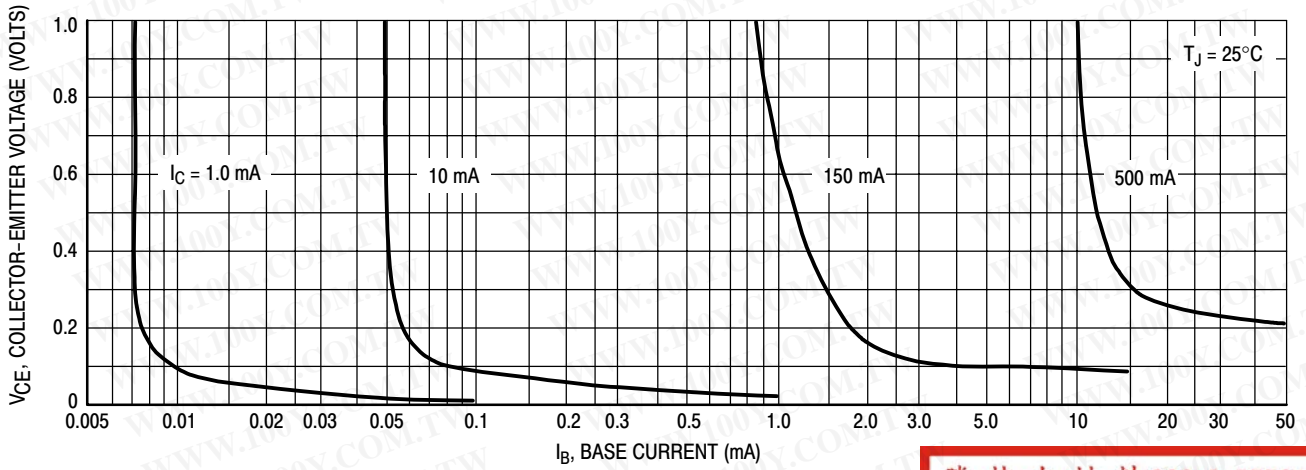


Figure 4. Collector Saturation Region

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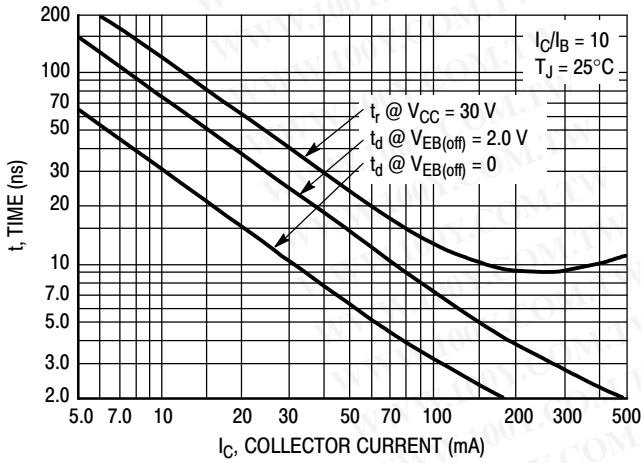


Figure 5. Turn-On Time

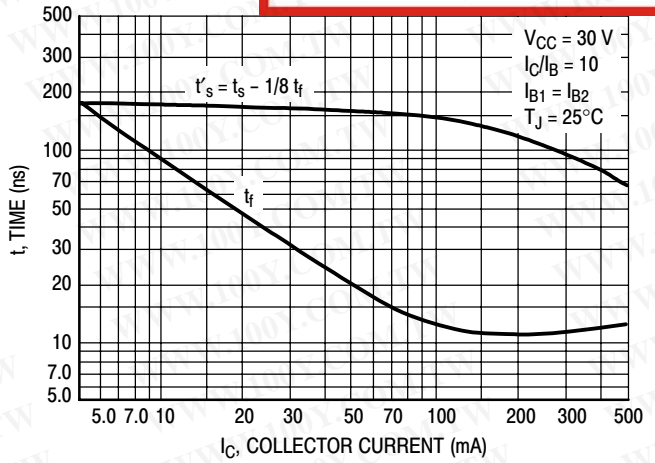


Figure 6. Turn-Off Time

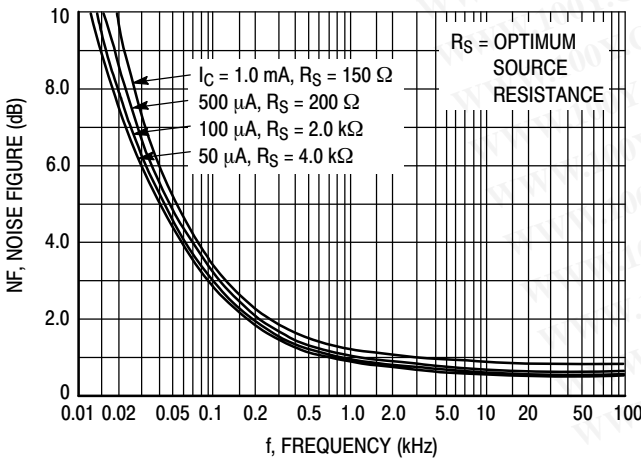


Figure 7. Frequency Effects

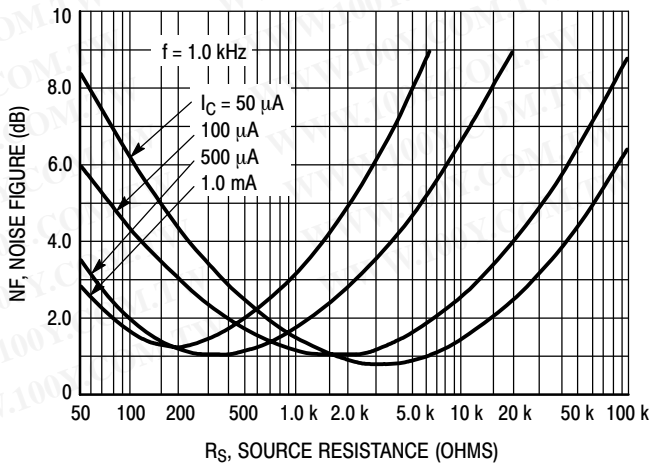


Figure 8. Source Resistance Effects



# MPS2222, MPS2222A

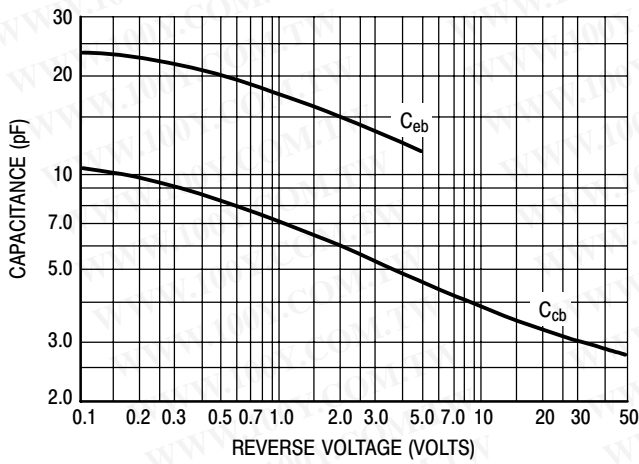


Figure 9. Capacitances

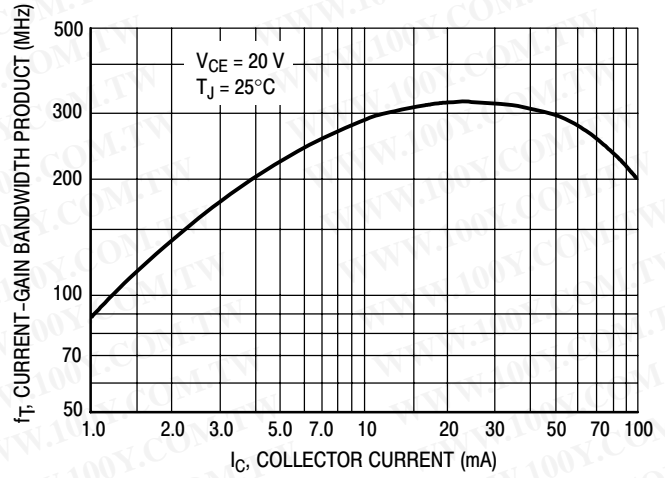


Figure 10. Current-Gain Bandwidth Product

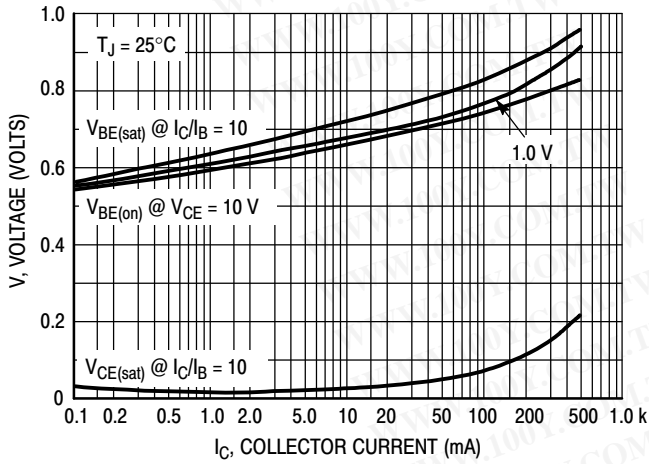


Figure 11. "On" Voltages

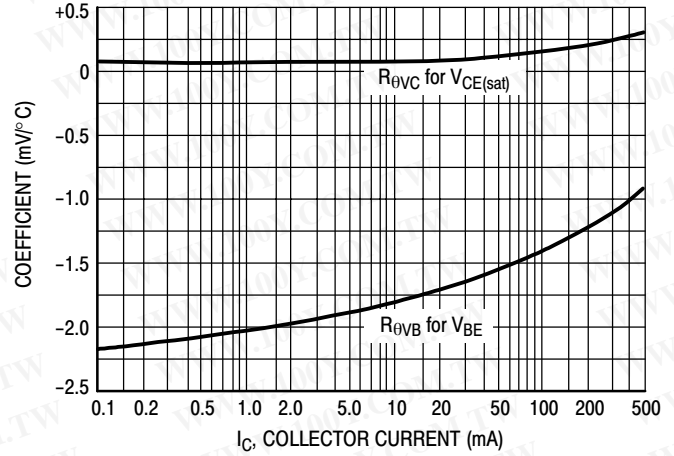


Figure 12. Temperature Coefficients

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## MPS2222, MPS2222A

### ORDERING INFORMATION

Device	Package	Shipping†
MPS2222	TO-92	5000 Units / Bulk
MPS2222G	TO-92 (Pb-Free)	5000 Units / Bulk
MPS2222RLRA	TO-92	2000 / Tape & Reel
MPS2222RLRAG	TO-92 (Pb-Free)	2000 / Tape & Reel
MPS2222RLRM	TO-92	2000 / Tape & Ammo Box
MPS2222RLRMG	TO-92 (Pb-Free)	2000 / Tape & Ammo Box
MPS2222RLRP	TO-92	2000 / Tape & Ammo Box
MPS2222RLRPG	TO-92 (Pb-Free)	2000 / Tape & Ammo Box
MPS2222A	TO-92	5000 Units / Bulk
MPS2222AG	TO-92 (Pb-Free)	5000 Units / Bulk
MPS2222ARL	TO-92	2000 / Tape & Reel
MPS2222ARLG	TO-92 (Pb-Free)	2000 / Tape & Reel
MPS2222ARLRA	TO-92	2000 / Tape & Reel
MPS2222ARLRAG	TO-92 (Pb-Free)	2000 / Tape & Reel
MPS2222ARLRM	TO-92	2000 / Tape & Reel
MPS2222ARLRMG	TO-92 (Pb-Free)	2000 / Tape & Reel
MPS2222ARLRP	TO-92	2000 / Tape & Ammo Box
MPS2222ARLRPG	TO-92 (Pb-Free)	2000 / Tape & Ammo Box
MPS2222AZL1	TO-92	2000 / Tape & Ammo Box
MPS2222AZL1G	TO-92 (Pb-Free)	2000 / Tape & Ammo Box
MPS2222ACLRP	TO-92	2000 / Tape & Ammo Box
MPS2222ACLRPG	TO-92 (Pb-Free)	2000 / Tape & Ammo Box

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

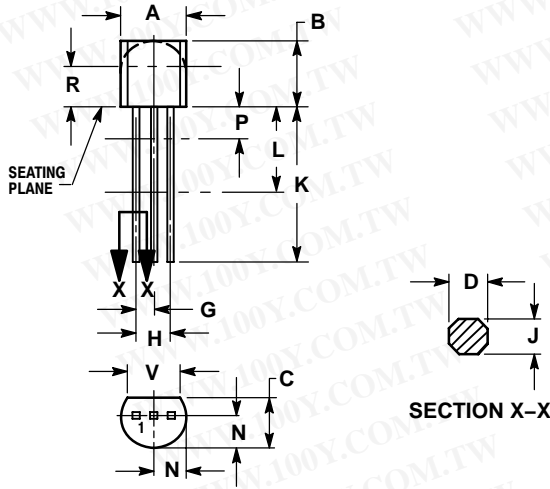
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# MPS2222, MPS2222A

## PACKAGE DIMENSIONS

TO-92 (TO-226)  
CASE 29-11  
ISSUE AL

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### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. 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	0.021	0.407	0.533
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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