

# MPS6601, MPS6602 (NPN) MPS6651, MPS6652 (PNP)

MPS6602 and MPS6652 are Preferred Devices

## Amplifier Transistors

### Features

- Voltage and Current are Negative for PNP Transistors
- Pb-Free Packages are Available\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage MPS6601/6651 MPS6602/6652	$V_{CEO}$	25 40	Vdc
Collector–Base Voltage MPS6601/6651 MPS6602/6652	$V_{CBO}$	25 30	Vdc
Emitter–Base Voltage	$V_{EBO}$	4.0	Vdc
Collector Current – Continuous	$I_C$	1000	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625 5.0	W 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 (Note 1)	$R_{\theta JA}$	200	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	83.3	$^\circ\text{C}/\text{W}$

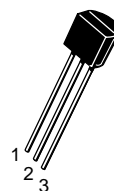
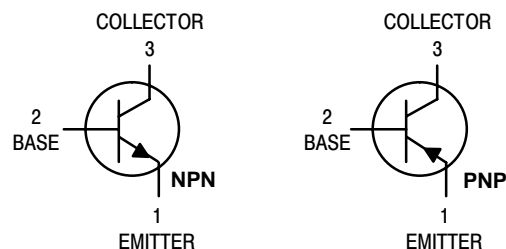
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1.  $R_{\theta JA}$  is measured with the device soldered into a typical printed circuit board.



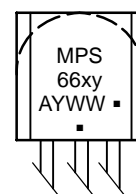
ON Semiconductor®

<http://onsemi.com>



TO-92  
CASE 29-11  
STYLE 1

### MARKING DIAGRAM



MPS66xy = Device Code  
 x = 0 or 5  
 y = 1 or 2  
 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 7 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.

# MPS6601, MPS6602 (NPN) MPS6651, MPS6652 (PNP)

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
----------------	--------	-----	-----	------

### OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage (I <sub>C</sub> = 1.0 mA <sub>dc</sub> , I <sub>B</sub> = 0)	MPS6601/6651 MPS6602/6652	V <sub>(BR)CEO</sub>	25 40	– –	V <sub>dc</sub>
Collector–Base Breakdown Voltage (I <sub>C</sub> = 100 μA <sub>dc</sub> , I <sub>E</sub> = 0)	MPS6601/6651 MPS6602/6652	V <sub>(BR)CBO</sub>	25 40	– –	V <sub>dc</sub>
Emitter–Base Breakdown Voltage (I <sub>E</sub> = 10 μA <sub>dc</sub> , I <sub>C</sub> = 0)		V <sub>(BR)EBO</sub>	4.0	–	V <sub>dc</sub>
Collector Cutoff Current (V <sub>CE</sub> = 25 V <sub>dc</sub> , I <sub>B</sub> = 0) (V <sub>CE</sub> = 30 V <sub>dc</sub> , I <sub>B</sub> = 0)	MPS6601/6651 MPS6602/6652	I <sub>CES</sub>	– –	0.1 0.1	μA <sub>dc</sub>
Collector Cutoff Current (V <sub>CB</sub> = 25 V <sub>dc</sub> , I <sub>E</sub> = 0) (V <sub>CB</sub> = 30 V <sub>dc</sub> , I <sub>E</sub> = 0)	MPS6601/6651 MPS6602/6652	I <sub>CBO</sub>	– –	0.1 0.1	μA <sub>dc</sub>

### ON CHARACTERISTICS

DC Current Gain (I <sub>C</sub> = 100 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 500 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) (I <sub>C</sub> = 1000 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> )		h <sub>FE</sub>	50 50 30	– – –	–
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 1000 mA <sub>dc</sub> , I <sub>B</sub> = 100 mA <sub>dc</sub> )		V <sub>CE(sat)</sub>	–	0.6	V <sub>dc</sub>
Base–Emitter On Voltage (I <sub>C</sub> = 500 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> )		V <sub>BE(on)</sub>	–	1.2	V <sub>dc</sub>

### SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product (I <sub>C</sub> = 50 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 100 MHz)		f <sub>T</sub>	100	–	MHz
Output Capacitance (V <sub>CB</sub> = 10 V <sub>dc</sub> , I <sub>E</sub> = 0, f = 1.0 MHz)		C <sub>obo</sub>	–	30	pF

### SWITCHING CHARACTERISTICS

Delay Time	(V <sub>CC</sub> = 40 V <sub>dc</sub> , I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B1</sub> = 50 mA <sub>dc</sub> , t <sub>p</sub> ≥ 300 ns Duty Cycle)	t <sub>d</sub>	–	25	ns
Rise Time		t <sub>r</sub>	–	30	ns
Storage Time		t <sub>s</sub>	–	250	ns
Fall Time		t <sub>f</sub>	–	50	ns

MPS6601, MPS6602 (NPN) MPS6651, MPS6652 (PNP)

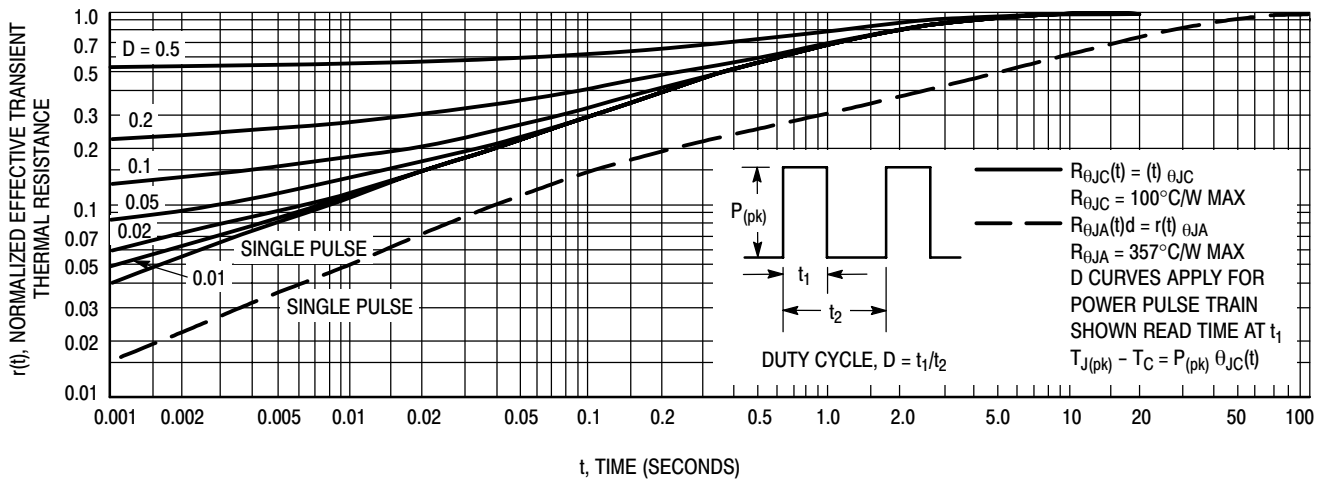
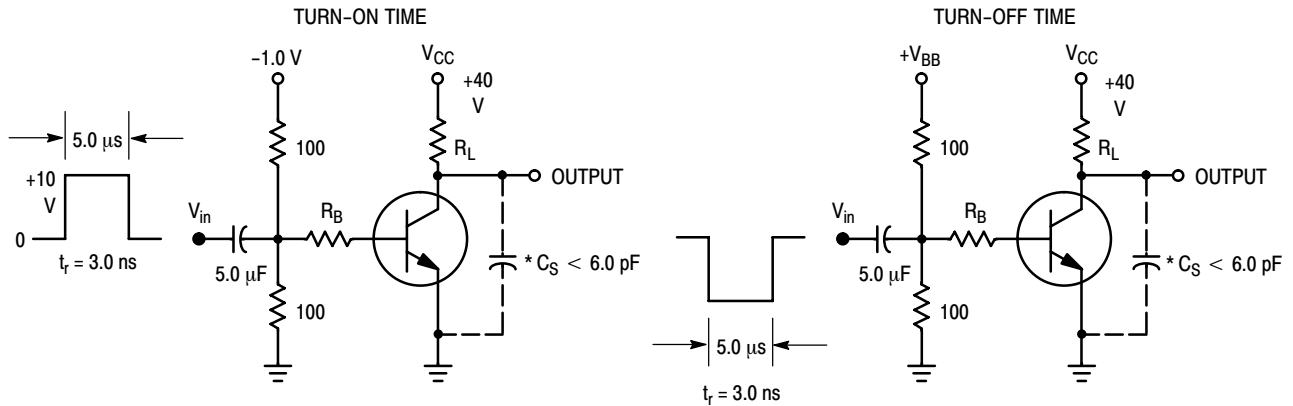


Figure 1. Thermal Response



\*Total Shunt Capacitance of Test Jig and Connectors  
For PNP Test Circuits, Reverse All Voltage Polarities

Figure 2. Switching Time Test Circuits

MPS6601, MPS6602 (NPN) MPS6651, MPS6652 (PNP)

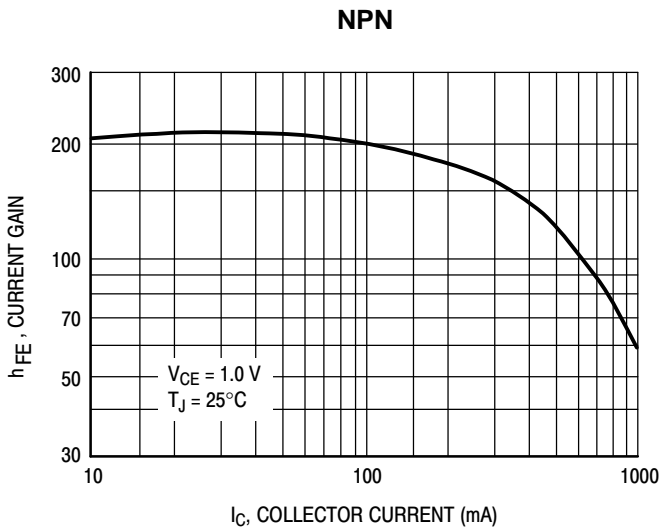


Figure 3. MPS6601/6602 DC Current Gain

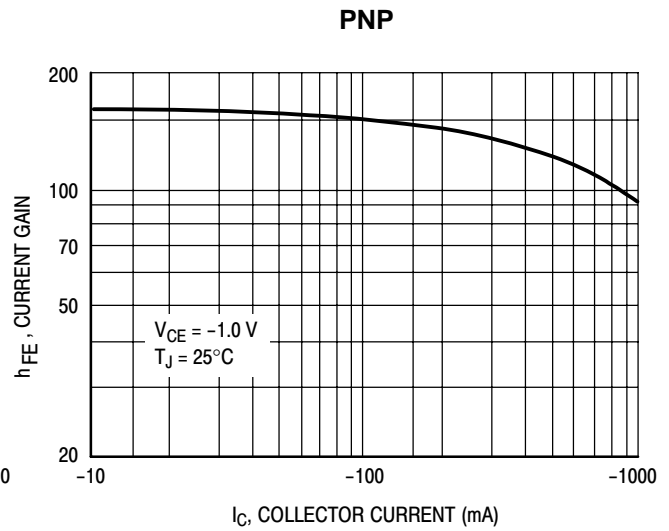


Figure 4. MPS6651/6652 DC Current Gain

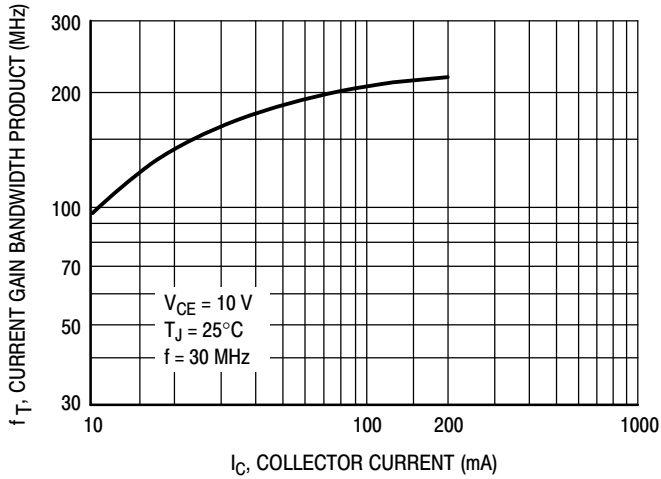


Figure 5. Current Gain Bandwidth Product

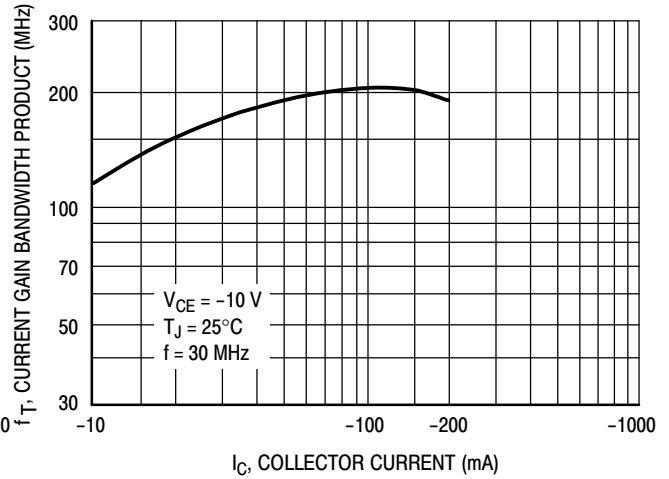


Figure 6. Current Gain Bandwidth Product

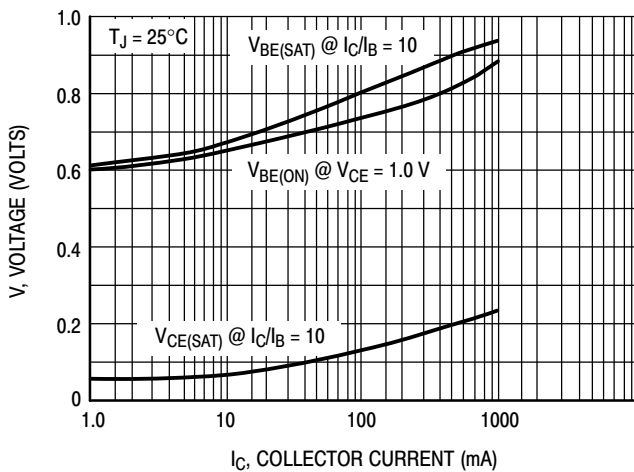


Figure 7. On Voltages

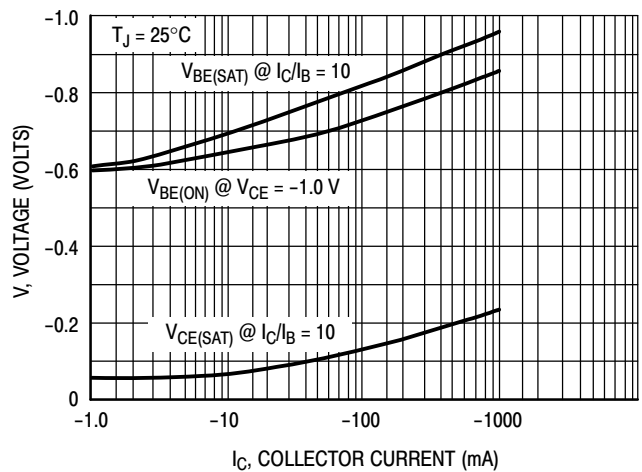
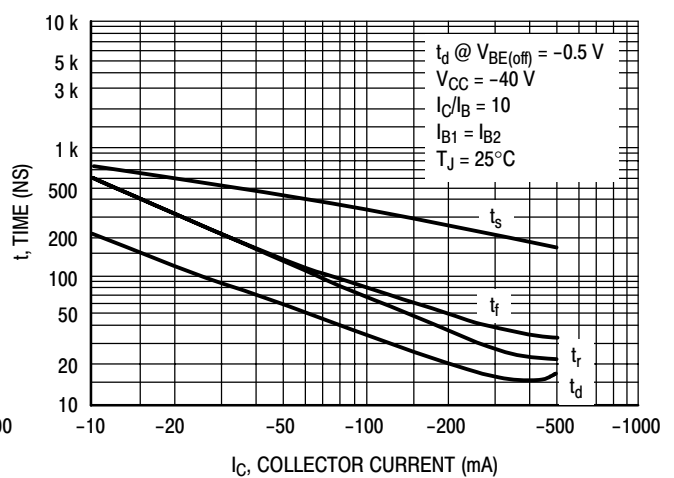
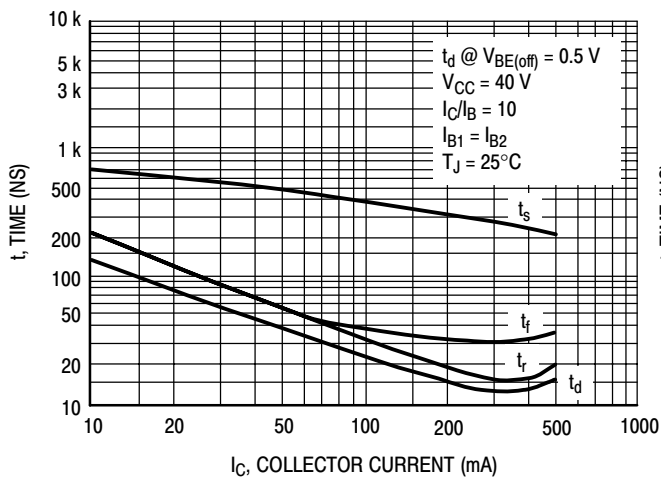
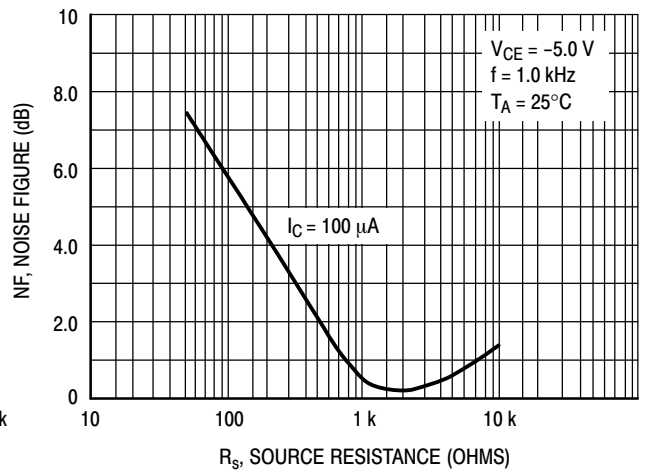
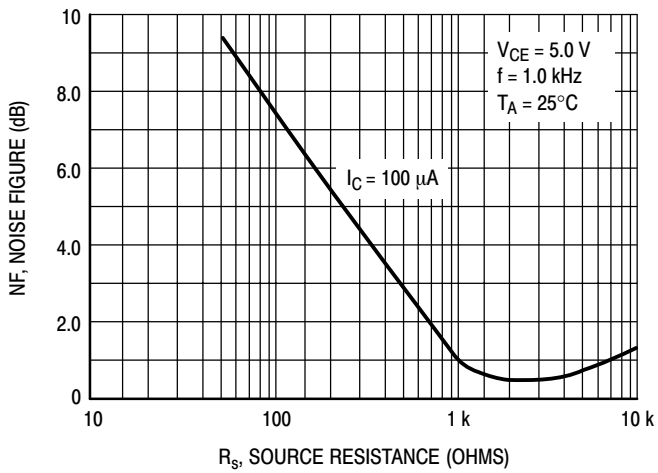
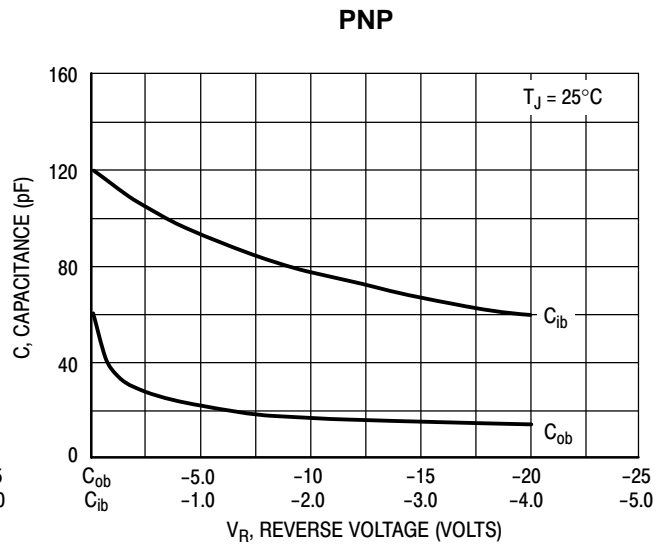
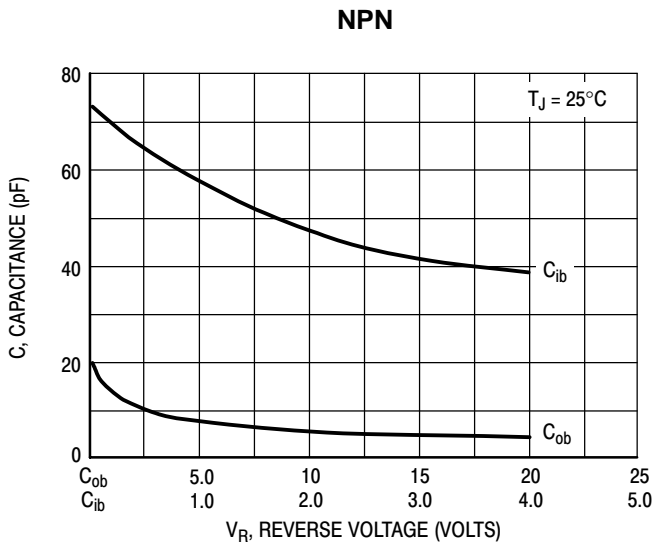
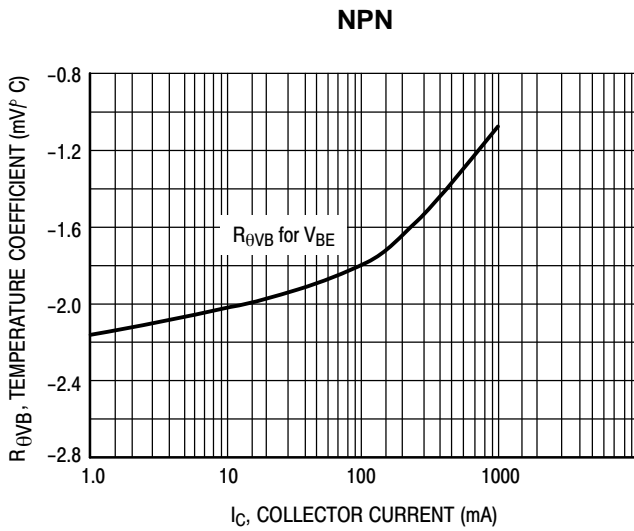


Figure 8. On Voltages

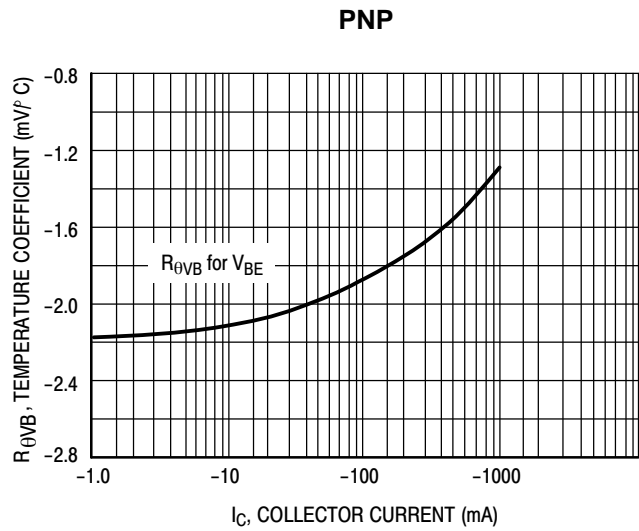
# MPS6601, MPS6602 (NPN) MPS6651, MPS6652 (PNP)



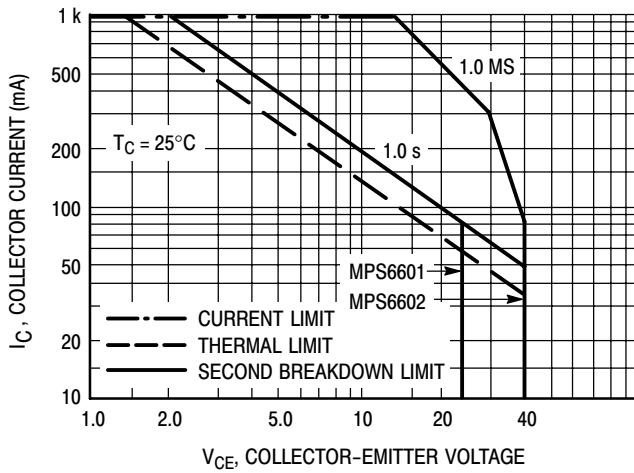
MPS6601, MPS6602 (NPN) MPS6651, MPS6652 (PNP)



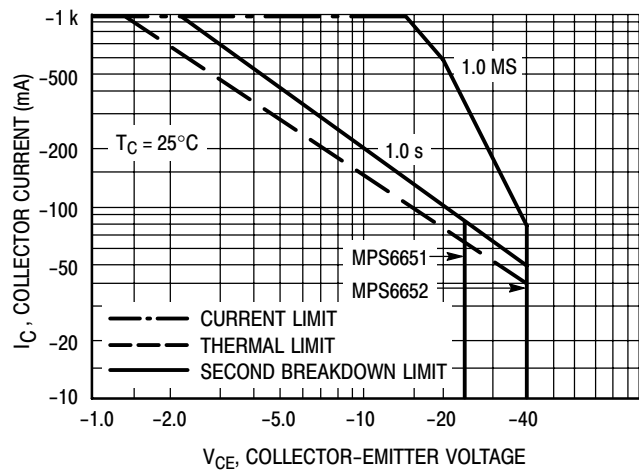
**Figure 15. Base-Emitter Temperature Coefficient**



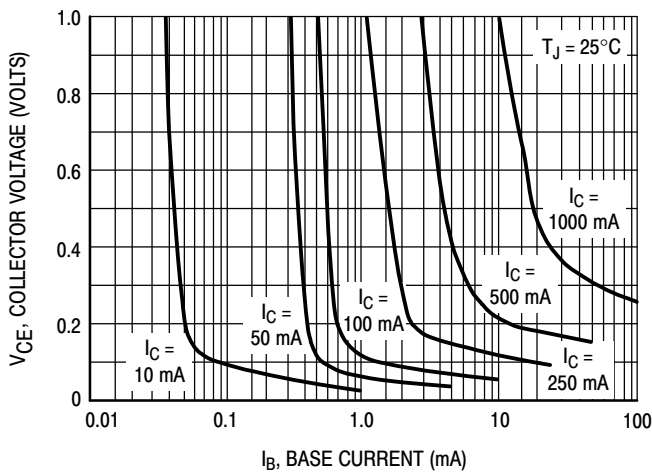
**Figure 16. Base-Emitter Temperature Coefficient**



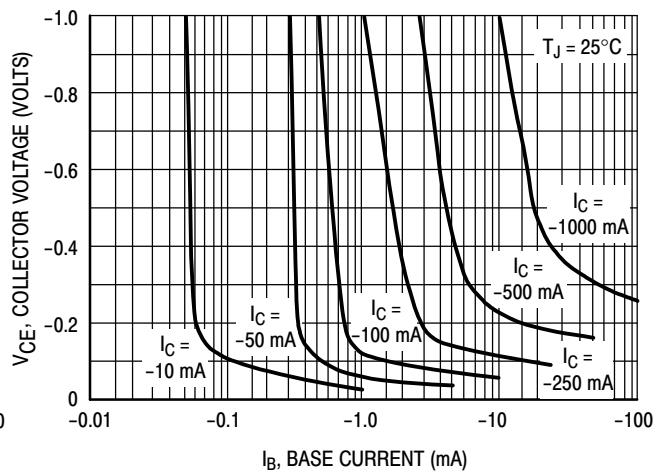
**Figure 17. Safe Operating Area**



**Figure 18. Safe Operating Area**



**Figure 19. MPS6601/6602 Saturation Region**



**Figure 20. MPS6651/6652 Saturation Region**

## MPS6601, MPS6602 (NPN) MPS6651, MPS6652 (PNP)

### ORDERING INFORMATION

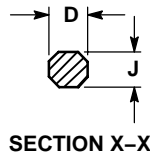
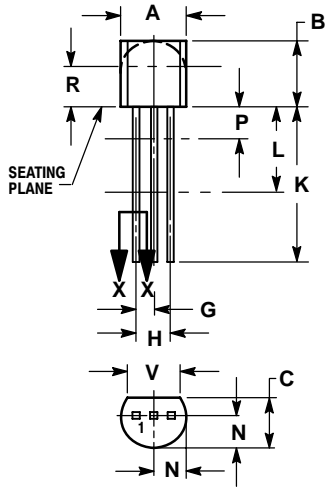
Device	Package	Shipping†
MPS6601	TO-92 (TO-226)	5000 Units / Box
MPS6601G	TO-92 (TO-226) (Pb-Free)	
MPS6601RLRA	TO-92 (TO-226)	2000 Units / Tape & Reel
MPS6601RLRAG	TO-92 (TO-226) (Pb-Free)	
MPS6602	TO-92 (TO-226)	5000 Units / Box
MPS6602G	TO-92 (TO-226) (Pb-Free)	
MPS6602RLRA	TO-92 (TO-226)	2000 Units / Tape & Reel
MPS6602RLRAG	TO-92 (TO-226) (Pb-Free)	
MPS6651	TO-92 (TO-226)	5000 Units / Box
MPS6651G	TO-92 (TO-226) (Pb-Free)	
MPS6652	TO-92 (TO-226)	5000 Units / Box
MPS6652G	TO-92 (TO-226) (Pb-Free)	
MPS6652RLRA	TO-92 (TO-226)	2000 Units / Tape & Reel
MPS6652RLRAG	TO-92 (TO-226) (Pb-Free)	
MPS6652RLRP	TO-92 (TO-226)	2000 Units / Tape & Ammo Box
MPS6652RLRPG	TO-92 (TO-226) (Pb-Free)	

†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.

# MPS6601, MPS6602 (NPN) MPS6651, MPS6652 (PNP)

## PACKAGE DIMENSIONS

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



### 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

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5773-3850

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative