MPSA14 is a Preferred Device

# **Darlington Transistors** NPN Silicon

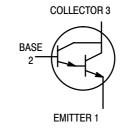
#### Features

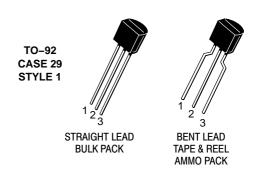
• Pb-Free Packages are Available\*



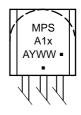
## **ON Semiconductor®**

http://onsemi.com





#### MARKING DIAGRAM



x = 3 or 4 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 2 of this data sheet.

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

Reference Manual, SOLDERRM/D.

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

# MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector – Emitter Voltage	V <sub>CES</sub>	30	Vdc
Collector-Base Voltage	V <sub>CBO</sub>	30	Vdc
Emitter-Base Voltage	V <sub>EBO</sub>	10	Vdc
Collector Current – Continuous	Ι <sub>C</sub>	500	mAdc
Total Device Dissipation @ $T_A = 25^{\circ}C$ Derate above $25^{\circ}C$	PD	625 5.0	mW mW/°C
Total Device Dissipation @ $T_C = 25^{\circ}C$ Derate above $25^{\circ}C$	PD	1.5 12	W mW/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

#### THERMAL CHARACTERISTICS

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

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.

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

Characteristic		Symbol	Min	Max	Unit
OFF CHARACTERISTICS			•		•
Collector – Emitter Breakdown Voltage $(I_C = 100 \ \mu Adc, I_B = 0)$		V <sub>(BR)CES</sub>	30	-	Vdc
Collector Cutoff Current ( $V_{CB}$ = 30 Vdc, I <sub>E</sub> = 0)		I <sub>CBO</sub>	-	100	nAdc
Emitter Cutoff Current ( $V_{EB}$ = 10 Vdc, $I_C$ = 0)		I <sub>EBO</sub>	-	100	nAdc
ON CHARACTERISTICS (Note 1)			•		•
DC Current Gain (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 5.0 Vdc) (I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 5.0 Vdc)	MPSA13 MPSA14 MPSA13 MPSA14	h <sub>FE</sub>	5,000 10,000 10,000 20,000		-
Collector – Emitter Saturation Voltage ( $I_C = 100 \text{ mAdc}, I_B = 0.1 \text{ mAdc}$ )		V <sub>CE(sat)</sub>	-	1.5	Vdc
Base – Emitter On Voltage ( $I_C = 100 \text{ mAdc}, V_{CE} = 5.0 \text{ Vdc}$ )		V <sub>BE(on)</sub>	-	2.0	Vdc
SMALL-SIGNAL CHARACTERISTICS					
Current–Gain – Bandwidth Product (Note 2) (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 5.0 Vdc, f = 100 MHz)		f <sub>T</sub>	125	-	MHz

1. Pulse Test: Pulse Width  $\leq$  300 µs; Duty Cycle  $\leq$  2.0%.

2.  $f_T = |h_{fe}| \bullet f_{test}$ .

#### **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
MPSA13	TO-92	5000 Units / Bulk
MPSA13G	TO–92 (Pb–Free)	5000 Units / Bulk
MPSA13RLRA	TO-92	2000 / Tape & Reel
MPSA13RLRAG	TO–92 (Pb–Free)	2000 / Tape & Reel
MPSA13RLRMG	TO–92 (Pb–Free)	2000 / Ammo Pack
MPSA13RLRPG	TO–92 (Pb–Free)	2000 / Ammo Pack
MPSA13ZL1G	TO–92 (Pb–Free)	2000 / Ammo Pack
MPSA14G	TO–92 (Pb–Free)	5000 Units / Bulk
MPSA14RLRAG	TO–92 (Pb–Free)	2000 / Tape & Reel
MPSA14RLRPG	TO–92 (Pb–Free)	2000 / Ammo Pack

†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.

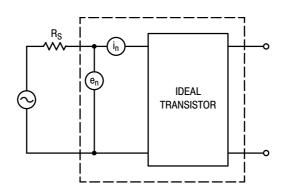
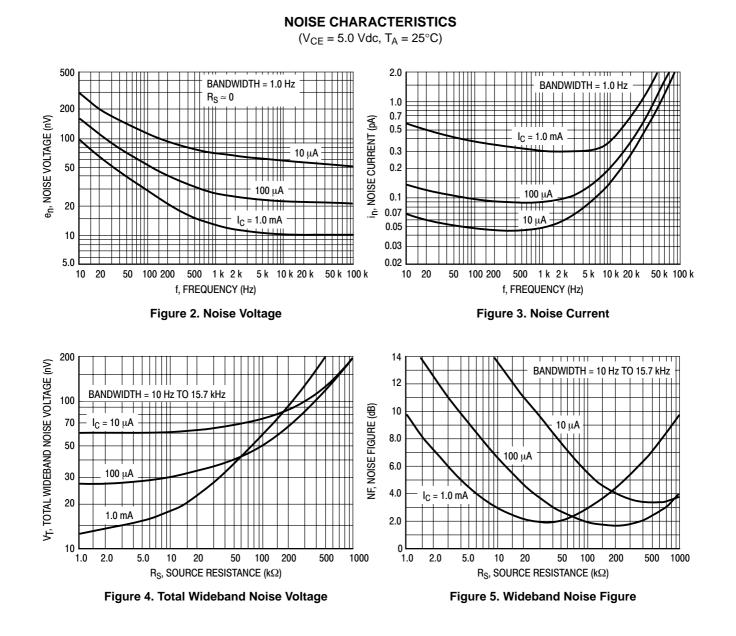


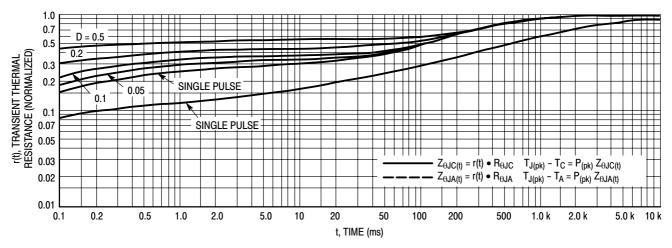
Figure 1. Transistor Noise Model

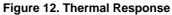


#### 20 4.0 V<sub>CE</sub> = 5.0 V SMALL-SIGNAL CURRENT GAIN f = 100 MHz $T_J = 25^{\circ}C$ $T_J=25^\circ C$ 2.0 10 Ш C, CAPACITANCE (pF) 7.0 Cibo 1.0 Cobo 0.8 5.0 0.6 3.0 0.4 hfel, 2.0 0.2 2.0 20 2.0 0.5 100 200 0.1 0.2 0.4 4.0 10 1.0 10 20 50 500 0.04 1.0 40 0.5 V<sub>B</sub>, REVERSE VOLTAGE (VOLTS) Ic, COLLECTOR CURRENT (mA) Figure 6. Capacitance Figure 7. High Frequency Current Gain 200 k COLLECTOR-EMITTER VOLTAGE (VOLTS) 3.0 T<sub>.1</sub> = 125°C 25°C 100 k 2.5 70 k 50 mA 250 mA 500 mA hFE, DC CURRENT GAIN I<sub>C</sub> = 10 mA 25°C 50 k 2.0 30 k 20 k 1.5 10 k 7.0 k -55 °C 1.0 5.0 k V<sub>CE</sub> = 5.0 V 3.0 k Ś K 2.0 k 0.5 0.5 30 200 300 500 0.2 2.0 5.0 20 50 100 200 500 1000 5.0 7.0 10 20 50 70 100 0.1 1.0 10 I<sub>C</sub>, COLLECTOR CURRENT (mA) I<sub>B</sub>, BASE CURRENT (μA) Figure 8. DC Current Gain **Figure 9. Collector Saturation Region** 1.6 -1.0 TEMPERATURE COEFFICIENTS (mV/°C) \*APPLIES FOR I<sub>C</sub>/I<sub>B</sub> $\leq$ h<sub>FE</sub>/3.0 25°C TO 125°C T<sub>J</sub> = 25°C 1 | || \*R<sub>0VC</sub> FOR V<sub>CE(sat)</sub> 1.4 -2.0 V, VOLTAGE (VOLTS) V<sub>BE(sat)</sub> @ I<sub>C</sub>/I<sub>B</sub> = 1000 -55 °C TO 25°C -3.0 1.2 V<sub>BE(on)</sub> @ V<sub>CE</sub> = 5.0 V 25°C TO 125°C 1.0 -4.0 ŤΤΙ $\theta_{\text{VB}}$ FOR $\text{V}_{\text{BE}}$ 0.8 -5.0 -55 °C TO 25°C V<sub>CE(sat)</sub> @ I<sub>C</sub>/I<sub>B</sub> = 1000 R<sub>θ</sub>ý, 0.6 -6.05.0 7.0 50 70 100 200 300 5.0 7.0 10 10 20 30 500 20 30 50 70 100 200 300 500 I<sub>C</sub>, COLLECTOR CURRENT (mA) I<sub>C</sub>, COLLECTOR CURRENT (mA)

#### SMALL-SIGNAL CHARACTERISTICS

Figure 10. "On" Voltages





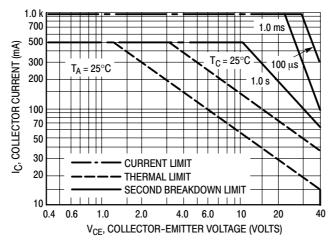
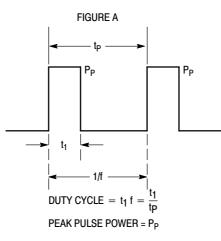


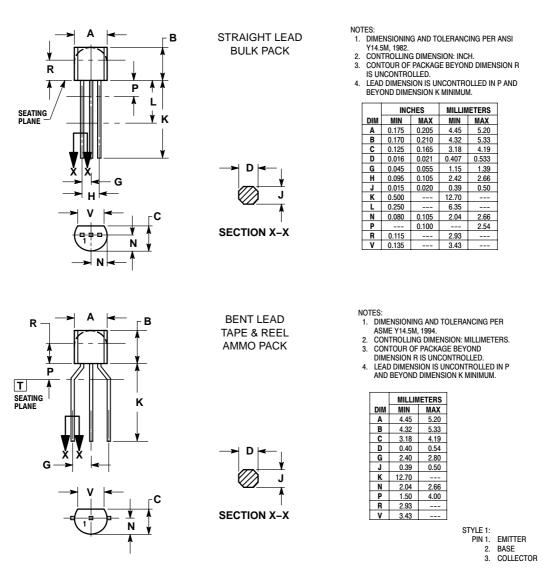
Figure 13. Active Region Safe Operating Area



Design Note: Use of Transient Thermal Resistance Data

#### PACKAGE DIMENSIONS

TO-92 (TO-226) CASE 29-11 **ISSUE AM** 



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