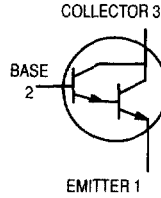


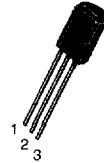
# One Watt Darlington Transistors

## NPN Silicon



**MPSW45**  
**MPSW45A\***

\*Motorola Preferred Device



CASE 29-05, STYLE 1  
TO-92 (TO-226AE)

### MAXIMUM RATINGS

Rating	Symbol	MPSW45	MPSW45A	Unit
Collector-Emitter Voltage	$V_{CES}$	40	50	Vdc
Collector-Base Voltage	$V_{CBO}$	50	60	Vdc
Emitter-Base Voltage	$V_{EBO}$	12	12	Vdc
Collector Current — Continuous	$I_C$	1.0	1.0	Adc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.0 8.0		Watts mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	2.5 20		Watts 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	$R_{\theta JA}$	125	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	50	$^\circ\text{C}/\text{W}$

### 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 ( $I_C = 100 \mu\text{Adc}$ , $V_{BE} = 0$ )	MPSW45 MPSW45A	$V_{(BR)CES}$	40 50	— —	Vdc
Collector-Base Breakdown Voltage ( $I_C = 100 \mu\text{Adc}$ , $I_E = 0$ )	MPSW45 MPSW45A	$V_{(BR)CBO}$	50 60	— —	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 10 \mu\text{Adc}$ , $I_C = 0$ )		$V_{(BR)EBO}$	12	—	Vdc
Collector Cutoff Current ( $V_{CB} = 30 \text{Vdc}$ , $I_E = 0$ ) ( $V_{CB} = 40 \text{Vdc}$ , $I_E = 0$ )	MPSW45 MPSW45A	$I_{CBO}$	— —	100 100	nAdc
Emitter Cutoff Current ( $V_{EB} = 10 \text{Vdc}$ , $I_C = 0$ )		$I_{EBO}$	—	100	nAdc

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

## MPSW45 MPSW45A

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

Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS(1)</b>				
DC Current Gain ( $I_C = 200 \text{ mA dc}$ , $V_{CE} = 5.0 \text{ V dc}$ ) ( $I_C = 500 \text{ mA dc}$ , $V_{CE} = 5.0 \text{ V dc}$ ) ( $I_C = 1.0 \text{ A dc}$ , $V_{CE} = 5.0 \text{ V dc}$ )	$h_{FE}$	25,000 15,000 4,000	150,000 — —	—
Collector–Emitter Saturation Voltage ( $I_C = 1.0 \text{ A dc}$ , $I_B = 2.0 \text{ mA dc}$ )	$V_{CE(\text{sat})}$	—	1.5	Vdc
Base–Emitter Saturation Voltage ( $I_C = 1.0 \text{ A dc}$ , $I_B = 2.0 \text{ mA dc}$ )	$V_{BE(\text{sat})}$	—	2.0	Vdc
Base–Emitter On Voltage ( $I_C = 1.0 \text{ A dc}$ , $V_{CE} = 5.0 \text{ V dc}$ )	$V_{BE(\text{on})}$	—	2.0	Vdc

### SMALL–SIGNAL CHARACTERISTICS

Current–Gain – Bandwidth Product ( $I_C = 200 \text{ mA dc}$ , $V_{CE} = 5.0 \text{ V dc}$ , $f = 100 \text{ MHz}$ )	$f_T$	100	—	MHz
Collector–Base Capacitance ( $V_{CB} = 10 \text{ V dc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{cb}$	—	6.0	pF

1. Pulse Test: Pulse Width  $\leq 300 \mu\text{s}$ ; Duty Cycle  $\leq 2.0\%$ .

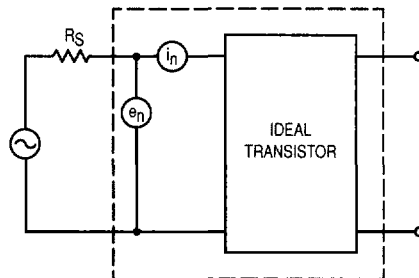
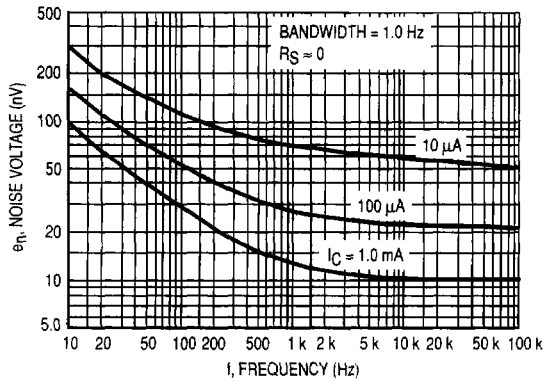


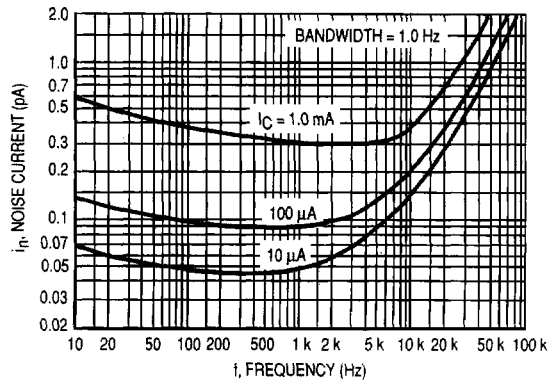
Figure 1. Transistor Noise Model

**NOISE CHARACTERISTICS**

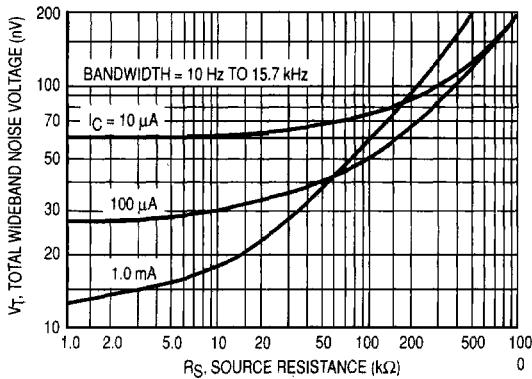
( $V_{CE} = 5.0 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ )



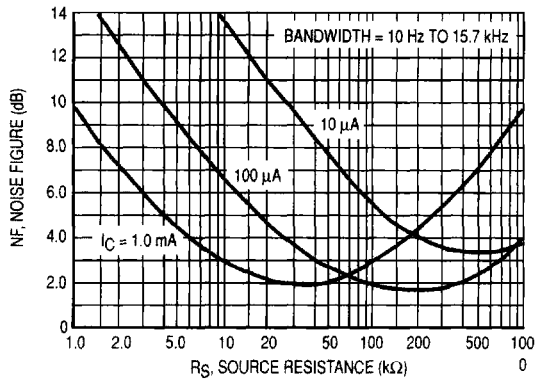
**Figure 2. Noise Voltage**



**Figure 3. Noise Current**



**Figure 4. Total Wideband Noise Voltage**



**Figure 5. Wideband Noise Figure**

SMALL-SIGNAL CHARACTERISTICS

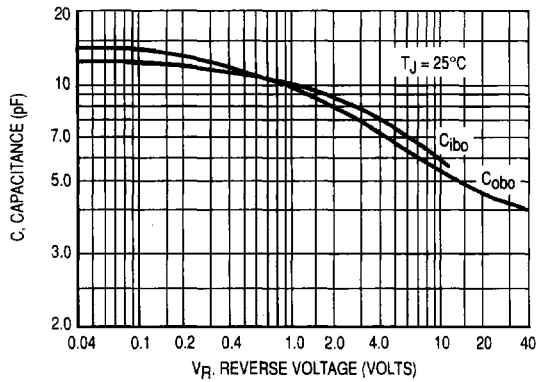


Figure 6. Capacitance

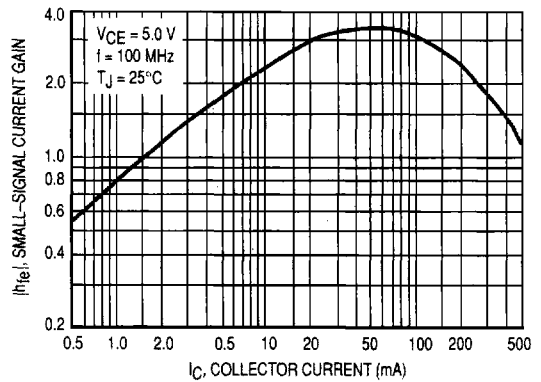


Figure 7. High Frequency Current Gain

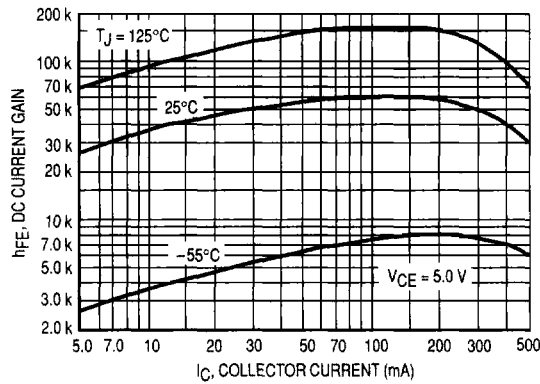


Figure 8. DC Current Gain

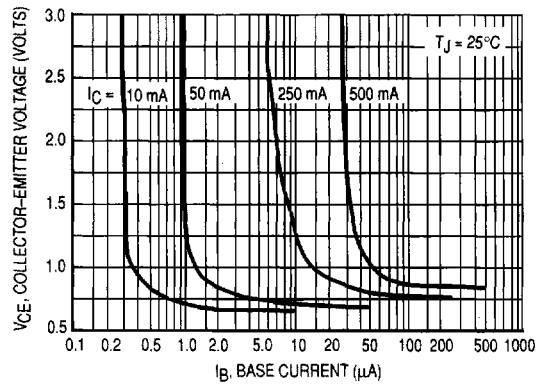


Figure 9. Collector Saturation Region

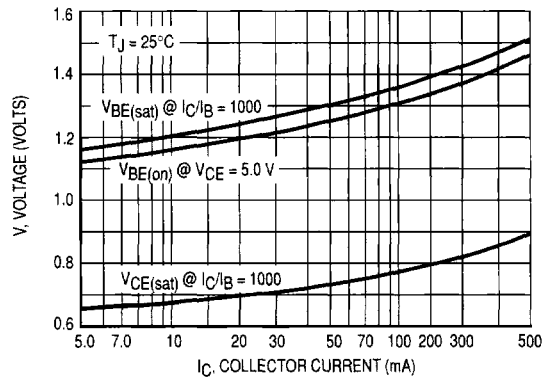


Figure 10. "On" Voltages

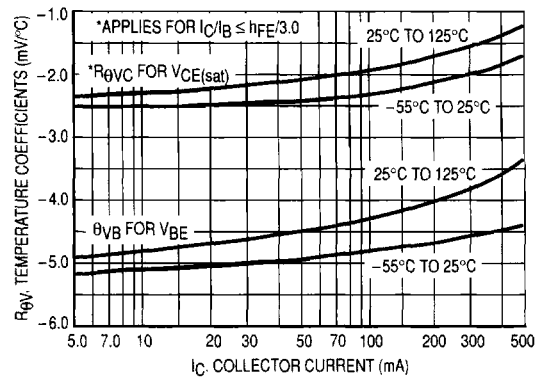


Figure 11. Temperature Coefficients

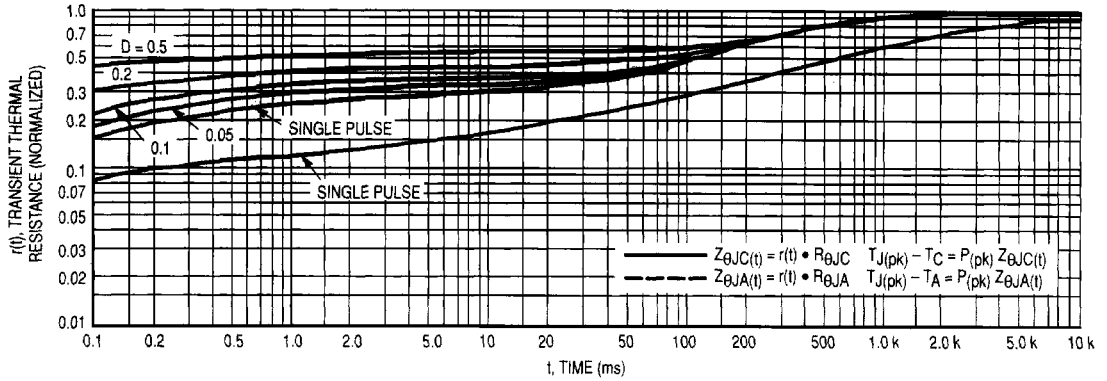


Figure 12. Thermal Response

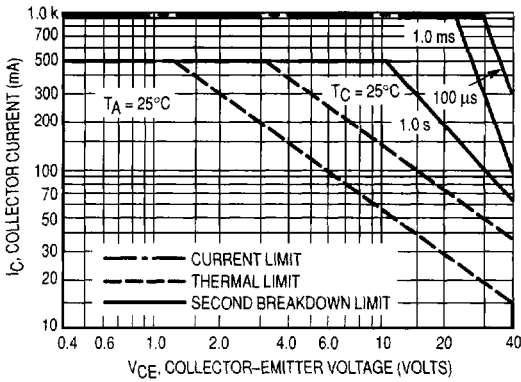
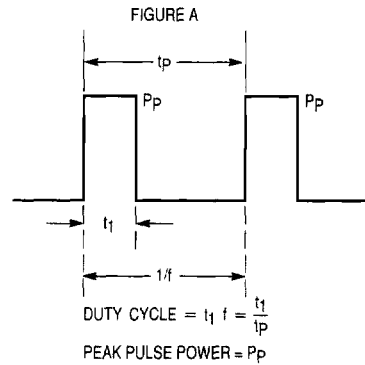


Figure 13. Active Region Safe Operating Area



Design Note: Use of Transient Thermal Resistance Data