MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MPS-U45

NOT RECOMMENDED FOR NEW DESIGNS

NPN SILICON DARLINGTON AMPLIFIER TRANSISTOR

. . . designed for amplifier and driver applications.

- High DC Current Gain —
  h_{FE} = 25,000 (Min) @ I_C = 200 mAdc
  15,000 (Min) @ I_C = 500 mAdc
- Collector-Emitter Breakdown Voltage —
  $V_{(BR)CES}$ = 40 Vdc (Min) @ I_C = 100 μAdc
- Low Collector-Emitter Saturation Voltage —
  $V_{CE(sat)}$ = 1.5 Vdc @ I_C = 1.0 Adc
- Monolithic Construction for High Reliability
- Complement to PNP MPS-U95

NPN SILICON DARLINGTON TRANSISTOR

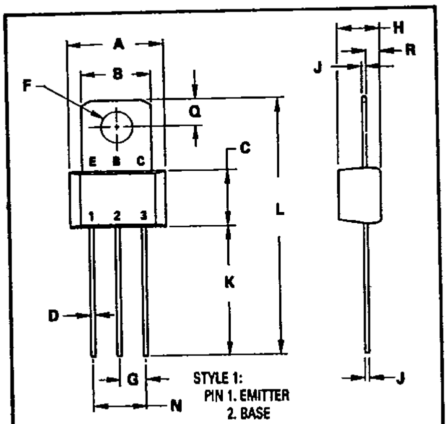
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}(1)	40	Vdc
Collector-Emitter Voltage	V_{CES}	40	Vdc
Collector-Base Voltage	V_{CB}	50	Vdc
Emitter-Base Voltage	V_{EB}	12	Vdc
Collector Current	I_C	2.0	Adc
Total Power Dissipation @ T_A = 25°C Derate above 25°C	P_D	1.0 8.0	Watt mW/°C
Total Power Dissipation @ T_C = 25°C Derate above 25°C	P_D	10 80	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	$R_{\theta JA}$	125	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	12.5	°C/W

(1) Due to the monolithic construction of this device, breakdown voltages of both transistor elements are identical. $V_{(BR)CES}$ is tested in lieu of $V_{(BR)CEO}$ in order to avoid errors caused by noise pickup. The voltage measured during the $V_{(BR)CES}$ test is the $V_{(BR)CEO}$ of the output transistor.



STYLE 1:
PIN 1. EMITTER
2. BASE
3. COLLECTOR
(COLLECTOR CONNECTED TO TAB)

NOTE:
1. LEADS WITHIN 0.15 mm(0.006) TOTAL OF TRUE POSITION AT CASE, AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.14	9.53	0.360	0.375
B	6.60	7.24	0.260	0.285
C	5.41	5.66	0.213	0.223
D	0.38	0.53	0.015	0.021
F	3.18	3.33	0.125	0.131
G	2.54 BSC		0.100 BSC	
H	3.94	4.19	0.155	0.165
J	0.36	0.41	0.014	0.016
K	11.63	12.70	0.458	0.500
L	24.58	25.53	0.968	1.005
N	5.08 BSC		0.200 BSC	
Q	2.39	2.69	0.094	0.106
R	1.14	1.40	0.045	0.055

CASE 152-02

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 100 μAdc, V_{BE} = 0)	$V_{(BR)CES}$	40	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 100 μAdc, I_E = 0)	$V_{(BR)CBO}$	50	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 μAdc, I_C = 0)	$V_{(BR)EBO}$	12	–	–	Vdc
Collector Cutoff Current (V_{CB} = 30 Vdc, I_E = 0)	I_{CBO}	–	–	100	nAdc
Emitter Cutoff Current (V_{EB} = 10 Vdc, I_C = 0)	I_{EBO}	–	–	100	nAdc
ON CHARACTERISTICS(1)					
DC Current Gain	h_{FE}				–
(I_C = 200 mAdc, V_{CE} = 5.0 Vdc)		25,000	65,000	150,000	
(I_C = 500 mAdc, V_{CE} = 5.0 Vdc)		15,000	35,000	–	
(I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)		4,000	12,000	–	
Collector-Emitter Saturation Voltage (I_C = 1.0 Adc, I_B = 2.0 mAdc)	$V_{CE(sat)}$	–	1.2	1.5	Vdc
Base-Emitter Saturation Voltage (I_C = 1.0 Adc, I_B = 2.0 mAdc)	$V_{BE(sat)}$	–	1.85	2.0	Vdc
Base-Emitter On Voltage (I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)	$V_{BE(on)}$	–	1.7	2.0	Vdc
DYNAMIC CHARACTERISTICS					
Small-Signal Current Gain (1) (I_C = 200 mAdc, V_{CE} = 5.0 Vdc, f = 100 MHz)	$\|h_{fe}\|$	1.0	3.2	–	–
Collector Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	C_{cb}	–	2.5	6.0	pF

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

Uniwatt darlington transistors can be used in any number of low power applications, such as relay drivers, motor control and as general purpose amplifiers. As an audio amplifier these devices, when used as a complementary pair, can drive 3.5 watts into a 3.2 ohm speaker using a 14 volt supply with less than one per cent distortion. Because of the high gain the base drive requirement is as low as 1 mA in this application. They are also useful as power drivers for high current application such as voltage regulators.

FIGURE 1 – DC CURRENT GAIN

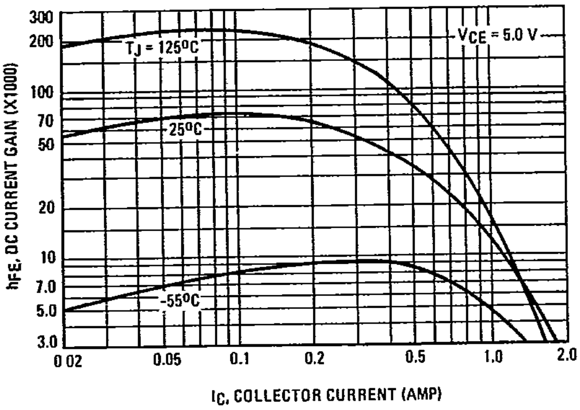

FIGURE 2 – SMALL-SIGNAL CURRENT GAIN

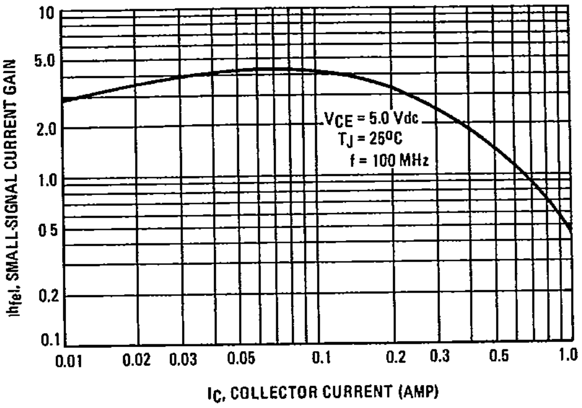

FIGURE 3 – "ON" VOLTAGES

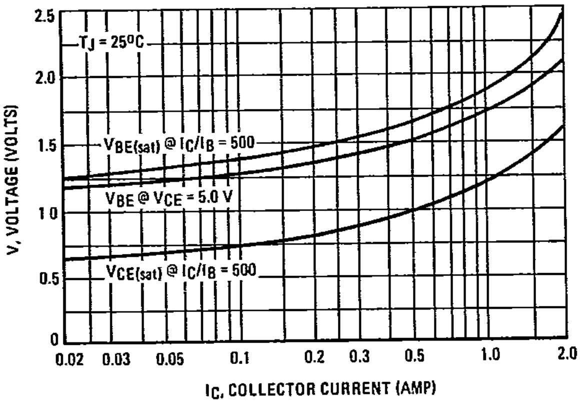

FIGURE 4 – TEMPERATURE COEFFICIENT

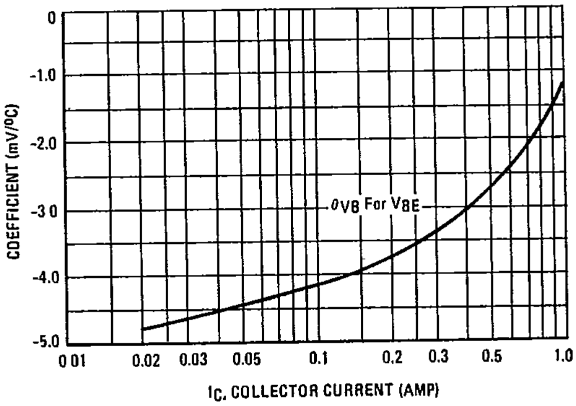

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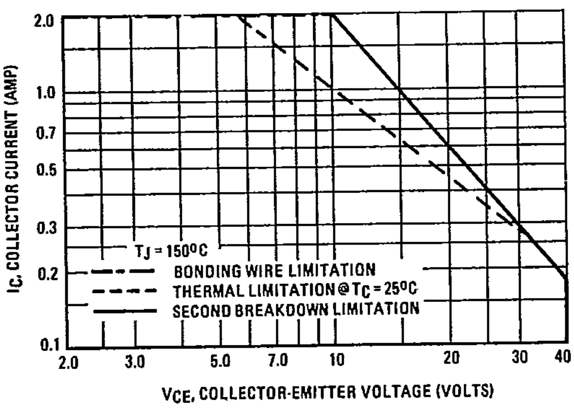
FIGURE 5 – DC SAFE OPERATING AREA



There are two limitations on the power handling ability of a transistor: junction temperature and second breakdown. Safe operating area curves indicate I_C–V_{CE} limits of the transistor that must be observed for reliable operation; i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 5 is based on $T_{J(pk)}$ = 150°C; T_C is variable depending on conditions. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second-breakdown.