

MOTOROLA

SEMICONDUCTOR

TECHNICAL DATA

**NOT RECOMMENDED
FOR NEW DESIGNS**

NPN SILICON ANNULAR VOLTAGE AMPLIFIER TRANSISTORS

designed for horizontal drive applications, high-voltage linear amplifiers, and high-voltage transistor regulators.

- High Collector-Emitter Breakdown Voltage —
 $V_{(BR)CEO} = 180 \text{ Vdc (Min) @ } I_C = 1 \text{ mAdc} \text{ — MPS-U03}$
- Low Collector-Emitter Saturation Voltage —
 $V_{CE(sat)} = 0.5 \text{ Vdc (Max) @ } I_C = 200 \text{ mAdc}$
- High Power Dissipation —
 $P_D = 10 \text{ W @ } T_C = 25^\circ\text{C}$

MAXIMUM RATINGS

Rating	Symbol	MPS-U03	MPS-U04	Unit
Collector-Emitter Voltage	V_{CEO}	120	180	Vdc
Collector-Base Voltage	V_{CB}	120	180	Vdc
Emitter-Base Voltage	V_{EB}	5		Vdc
Collector Current	I_C	1		Aadc
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate Above 25°C	P_D	1 8		Watts mW/ $^\circ\text{C}$
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above 25°C	P_D	10 80		Watts mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-55 to +150		$^\circ\text{C}$
Solder Temperature, 1/16" From Case for 10 Seconds	—	260		$^\circ\text{C}$

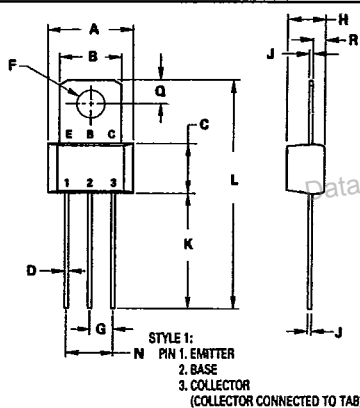
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	125	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	12.5	$^\circ\text{C/W}$

MPS-U03

MPS-U04

NPN SILICON AMPLIFIER TRANSISTORS



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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	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	0.30	0.41	0.014	0.016
K	11.63	12.20	0.458	0.480
L	24.59	25.57	0.969	1.005
M	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

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

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage (I _C = 1.0 mA, I _B = 0)	MPS-U03 MPS-U04	V _{(BR)CEO}	120 180	—	V _{dc}
Collector-Base Breakdown Voltage (I _C = 100 µA, I _E = 0)	MPS-U03 MPS-U04	V _{(BR)CBO}	120 180	— —	V _{dc}
Emitter-Base Breakdown Voltage (I _E = 100 µA, I _C = 0)		V _{(BR)EBO}	5.0	—	V _{dc}
Collector Cutoff Current (V _{CB} = 100 Vdc, I _E = 0) (V _{CB} = 150 Vdc, I _E = 0)	MPS-U03 MPS-U04	I _{CBO}	— —	0.1 0.1	µA _{dc}

ON CHARACTERISTICS (1)

DC Current Gain (I _C = 10 mA, V _{CE} = 10 Vdc)		h _{FE}	40	—	—
Collector-Emitter Saturation Voltage (I _C = 200 mA, I _B = 20 mA)		V _{CE(sat)}	—	0.5	V _{dc}
Base-Emitter On Voltage (I _C = 200 mA, V _{CE} = 1.0 Vdc)		V _{BE(on)}	—	1.0	V _{dc}

DYNAMIC CHARACTERISTICS

Current-Gain-Bandwidth Product (I _C = 50 mA, V _{CE} = 20 Vdc, f = 20 MHz)		f _T	35	—	MHz
Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, f = 100 kHz)		C _{ob}	—	12	pF
Input Capacitance (V _{BE} = 0.5 Vdc, I _C = 0, f = 100 kHz)		C _{ib}	—	110	pF

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

TYPICAL CHARACTERISTICS

FIGURE 1 – CURRENT-GAIN – BANDWIDTH PRODUCT

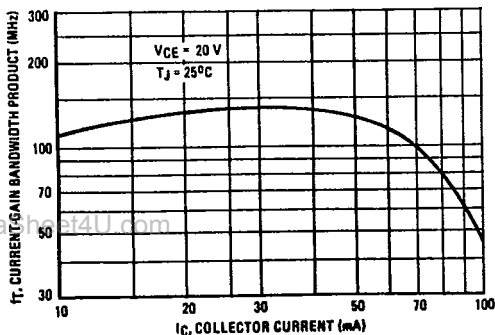
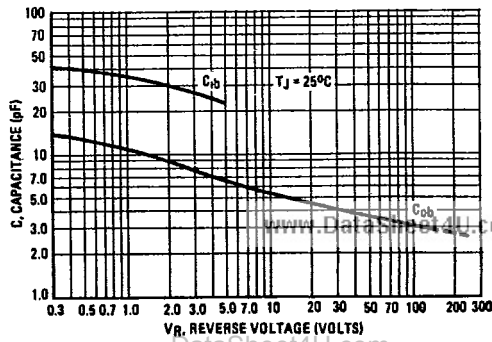


FIGURE 2 – CAPACITANCE



TYPICAL CHARACTERISTICS (Continued)

FIGURE 3 — DC CURRENT GAIN

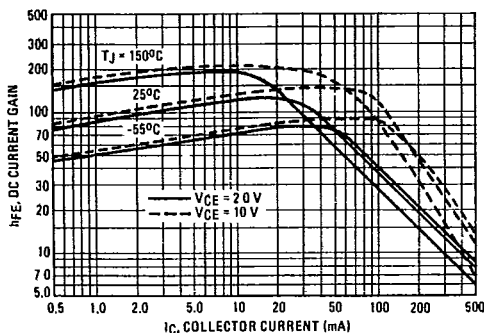


FIGURE 4 — "ON" VOLTAGE

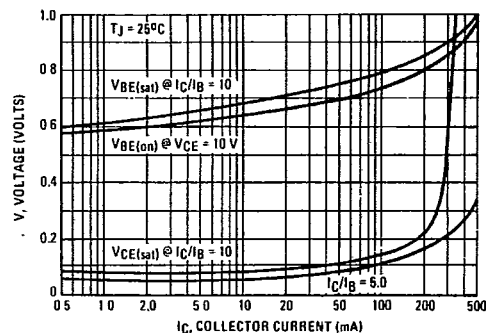


FIGURE 5 — COLLECTOR SATURATION REGION

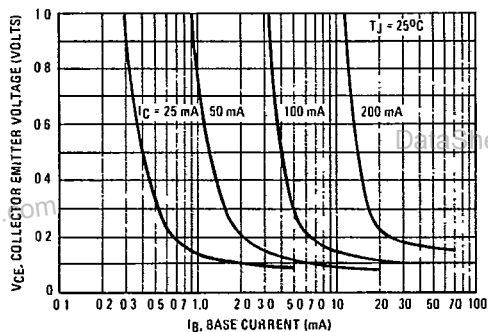


FIGURE 6 — TEMPERATURE COEFFICIENTS

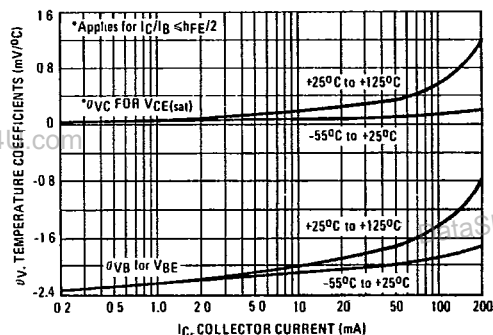


FIGURE 7 — COLLECTOR CHARACTERISTICS

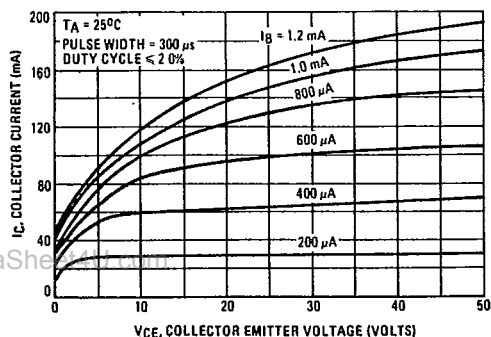


FIGURE 8 — COLLECTOR CUTOFF REGION

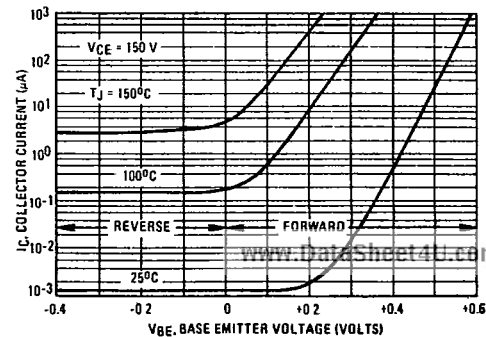


FIGURE 9 – THERMAL RESPONSE

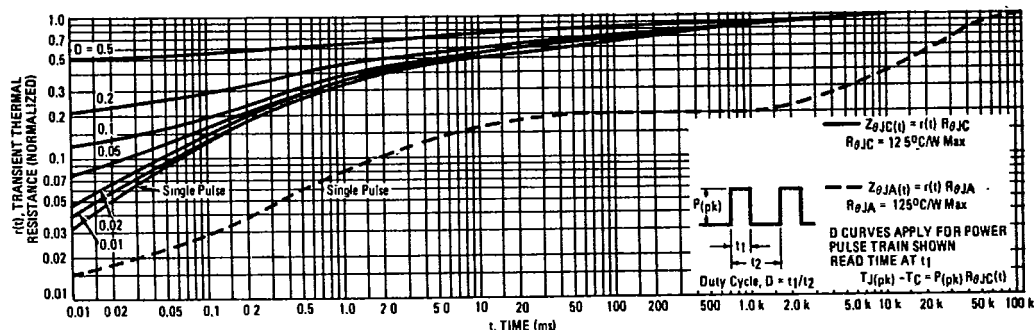
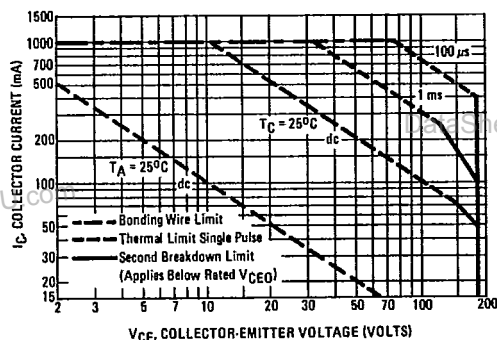


FIGURE 10 – ACTIVE REGION SAFE-OPERATING AREA



There are two limitations on the power handling ability of a transistor: average 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 10 is based on $T_C = 25^\circ\text{C}$; $T_J(pk)$ is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated when $T_C \geq 25^\circ\text{C}$. Second breakdown limitations do not derate the same as thermal limitations. Allowable current at the voltages shown on Figure 10 may be found at any case temperature by using the appropriate curve on Figure 11.

$T_J(pk)$ may be calculated from the data in Figure 9. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

FIGURE 11 – POWER DERATING

