

6367254 MOTOROLA SC (XSTRS/R F)

96D 82489

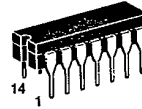
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T-43-25

MAXIMUM RATINGS

Rating	Symbol	Value		Unit
Collector-Emitter Voltage	V _{CEO}	45		Vdc
Collector-Emitter Voltage	V _{CES}	70		Vdc
Collector-Base Voltage	V _{CBO}	70		Vdc
Emitter-Base Voltage	V _{EBO}	6.0		Vdc
Collector Current — Continuous	I _C	1.5		Adc
		Each Transistor	Four Transistors Equal Power	
Total Device Dissipation @ T _A = 25°C Derate above 25°C	P _D	750 4.3	2500 14.3	mW mW/°C
Total Device Dissipation @ T _C = 25°C Derate above 25°C	P _D	1.2 6.86	4.0 22.8	Watts mW/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	-55 to +200		°C

MHQ4002A

CASE 632-02, STYLE 1
TO-116



**QUAD
MEMORY DRIVER TRANSISTOR**

NPN SILICON

Refer to MD3725 for graphs.

5

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1) (I _C = 10 mA _{dc} , I _B = 0)	V _{(BR)CEO}	45	—	—	Vdc
Collector-Emitter Breakdown Voltage (I _C = 10 μA _{dc} , V _{BE} = 0)	V _{(BR)CES}	70	—	—	Vdc
Collector-Base Breakdown Voltage (I _C = 10 μA _{dc} , I _E = 0)	V _{(BR)CBO}	70	—	—	Vdc
Emitter-Base Breakdown Voltage (I _E = 10 μA _{dc} , I _C = 0)	V _{(BR)EBO}	6.0	—	—	Vdc
Collector Cutoff Current (V _{CB} = 30 Vdc, I _E = 0)	I _{CBO}	—	—	500	nAdc
ON CHARACTERISTICS(1)					
DC Current Gain (I _C = 100 mA _{dc} , V _{CE} = 1.0 Vdc) (I _C = 500 mA _{dc} , V _{CE} = 1.0 Vdc) (I _C = 1.0 Adc, V _{CE} = 5.0 Vdc)	h _{FE}	50 30 20	100 60 45	250 — —	—
Collector-Emitter Saturation Voltage (I _C = 100 mA _{dc} , I _B = 10 mA _{dc}) (I _C = 500 mA _{dc} , I _B = 50 mA _{dc}) (I _C = 1.0 Adc, I _B = 100 mA _{dc})	V _{CE(sat)}	— — —	0.14 0.23 0.36	0.26 0.52 0.95	Vdc
Base-Emitter Saturation Voltage (I _C = 100 mA _{dc} , I _B = 10 mA _{dc}) (I _C = 500 mA _{dc} , I _B = 50 mA _{dc}) (I _C = 1.0 Adc, I _B = 100 mA _{dc})	V _{BE(sat)}	— 0.8 —	0.75 0.88 1.0	0.86 1.1 1.7	Vdc
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product(1) (I _C = 50 mA _{dc} , V _{CE} = 10 Vdc, f = 100 MHz)	f _T	200	275	—	MHz
Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, f = 1.0 MHz)	C _{obo}	—	5.0	10	pF
Input Capacitance (V _{BE} = 0.5 Vdc, I _C = 0, f = 1.0 MHz)	C _{ibo}	—	55	70	pF
SWITCHING CHARACTERISTICS					
Turn-On Time (V _{CC} = 30 Vdc, I _C = 0.5 Adc, V _{BE} = 3.8 Vdc, I _{B1} = 50 mA _{dc})	t _{on}	—	30	40	ns
Turn-Off Time (V _{CC} = 30 Vdc, I _C = 0.5 Adc, I _{B1} = I _{B2} = 50 mA _{dc})	t _{off}	—	60	75	ns

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

6367254 MOTOROLA SC (XSTRS/R F)

96D 82490 D

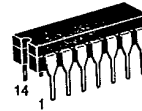
T-43-25

MAXIMUM RATINGS

Rating	Symbol	MHQ4013	MHQ4014	Unit
Collector-Emitter Voltage	V _{CEO}	40	45	V _{dc}
Collector-Emitter Voltage	V _{CES}	60	70	V _{dc}
Collector-Base Voltage	V _{CBO}	60	70	V _{dc}
Emitter-Base Voltage	V _{EBO}	6.0		V _{dc}
Collector Current — Continuous	I _C	1.5		A _{dc}
		Each Transistor	Four Transistors Equal Power	
Total Device Dissipation @ T _A = 25°C Derate above 25°C	P _D	750 4.3	2500 14.3	mW mW/°C
Total Device Dissipation @ T _C = 25°C Derate above 25°C	P _D	1.2 6.86	4.0 22.8	Watts mW/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	-55 to +200		°C

**MHQ4013
MHQ4014**

**CASE 632-02, STYLE 1
TO-116**



**QUAD
MEMORY DRIVER TRANSISTOR**

NPN SILICON

Refer to MD3725 for graphs.

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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(1) (I _C = 10 mA _{dc} , I _B = 0)	MHQ4013 MHQ4014 V _{(BR)CEO}	40 45	—	—	V _{dc}
Collector-Emitter Breakdown Voltage (I _C = 10 μA _{dc} , V _{BE} = 0)	MHQ4013 MHQ4014 V _{(BR)CES}	60 70	—	—	V _{dc}
Collector-Base Breakdown Voltage (I _C = 10 μA _{dc} , I _E = 0)	MHQ4013 MHQ4014 V _{(BR)CBO}	60 70	—	—	V _{dc}
Emitter-Base Breakdown Voltage (I _E = 10 μA _{dc} , I _C = 0)	V _{(BR)EBO}	6.0	—	—	V _{dc}
Collector Cutoff Current (V _{CB} = 50 V _{dc} , I _E = 0)	I _{CBO}	—	—	500	nA _{dc}
ON CHARACTERISTICS(1)					
DC Current Gain (I _C = 100 mA _{dc} , V _{CE} = 1.0 V _{dc}) (I _C = 500 mA _{dc} , V _{CE} = 1.0 V _{dc}) (I _C = 1.0 A _{dc} , V _{CE} = 5.0 V _{dc})	h _{FE}	60 35 25	100 65 50	250 — —	—
Collector-Emitter Saturation Voltage (I _C = 100 mA _{dc} , I _B = 10 mA _{dc}) (I _C = 500 mA _{dc} , I _B = 50 mA _{dc}) (I _C = 1.0 A _{dc} , I _B = 100 mA _{dc})	V _{CE(sat)}	—	0.14 0.23 0.36	0.26 0.52 0.95	V _{dc}
Base-Emitter Saturation Voltage (I _C = 100 mA _{dc} , I _B = 10 mA _{dc}) (I _C = 500 mA _{dc} , I _B = 50 mA _{dc}) (I _C = 1.0 A _{dc} , I _B = 100 mA _{dc})	V _{BE(sat)}	—	0.75 0.88 1.0	0.86 1.1 1.7	V _{dc}
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product(1) (I _C = 50 mA _{dc} , V _{CE} = 10 V _{dc} , f = 100 MHz)	f _T	200	275	—	MHz
Output Capacitance (V _{CB} = 10 V _{dc} , I _E = 0, f = 1 MHz)	C _{obo}	—	5.0	10	pF
Input Capacitance (V _{BE} = 0.5 V _{dc} , I _C = 0, f = 1 MHz)	C _{ibo}	—	50	70	pF
SWITCHING CHARACTERISTICS					
Turn-On Time (V _{CC} = 30 V _{dc} , I _C = 0.5 A _{dc} , V _{BE(off)} = 3.8 V _{dc} , I _{B1} = 50 mA _{dc})	t _{on}	—	20	35	ns
Turn-Off Time (V _{CC} = 30 V _{dc} , I _C = 0.5 A _{dc} , I _{B1} = I _{B2} = 50 mA _{dc})	t _{off}	—	50	60	ns

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

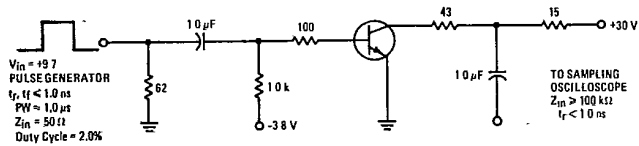
MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)
 MHQ4013, MHQ4014

96D 82491 D

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FIGURE 1 - TURN-ON AND TURN-OFF SWITCHING TIMES TEST CIRCUIT



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6367254 MOTOROLA SC (XSTRS/R F)

96D 82492 D

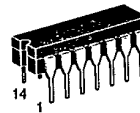
T-43-25

MAXIMUM RATINGS

Rating	Symbol	Value	Unit	
Collector-Emitter Voltage	V _{CEO}	30	Vdc	
Collector-Base Voltage	V _{CBO}	60	Vdc	
Emitter-Base Voltage	V _{EBO}	5.0	Vdc	
Collector Current — Continuous	I _C	500	mAdc	
		Each Transistor	Total Device	
Total Device Dissipation @ T _A = 25°C Derate above 25°C	P _D	0.65 3.72	1.9 10.88	Watts mW/°C
Total Device Dissipation @ T _C = 25°C Derate above 25°C	P _D	1.3 7.43	4.6 26.3	Watts mW/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	-65 to +200	°C	

**MHQ6001
MHQ6002**

CASE 632-02, STYLE 1
TO-116



**QUAD
COMPLEMENTARY TRANSISTOR**

NPN/PNP SILICON

Refer to MHQ2222 for NPN graphs.*

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage(1) (I _C = 10 mAdc, I _B = 0)	V _{(BR)CEO}	30	—	—	Vdc
Collector-Base Breakdown Voltage (I _C = 10 μAdc, I _E = 0)	V _{(BR)CBO}	60	—	—	Vdc
Emitter-Base Breakdown Voltage (I _E = 10 μAdc, I _C = 0)	V _{(BR)EBO}	5.0	—	—	Vdc
Collector Cutoff Current (V _{CB} = 50 Vdc, I _E = 0)	I _{CBO}	—	—	20	nAdc
Emitter Cutoff Current (V _{BE} = 3.0 Vdc, I _C = 0)	I _{EBO}	—	—	30	nAdc

ON CHARACTERISTICS

DC Current Gain(1) (I _C = 1.0 mAdc, V _{CE} = 10 Vdc)	MHQ6001	h _{FE}	25	—	—	—
	MHQ6002		50	—	—	—
(I _C = 10 mAdc, V _{CE} = 10 Vdc)	MHQ6001		35	—	—	—
	MHQ6002		75	—	—	—
(I _C = 150 mAdc, V _{CE} = 10 Vdc)	MHQ6001		40	—	—	—
	MHQ6002		100	—	—	—
(I _C = 300 mAdc, V _{CE} = 10 Vdc)	MHQ6001		20	—	—	—
	MHQ6002		30	—	—	—
Collector-Emitter Saturation Voltage(1) (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 300 mAdc, I _B = 30 mAdc)	V _{CE(sat)}	—	—	0.4 1.4	Vdc	
Base-Emitter Saturation Voltage(1) (I _C = 150 mAdc, I _B = 15 mAdc) (I _C = 300 mAdc, I _B = 30 mAdc)	V _{BE(sat)}	—	—	1.3 2.0	Vdc	

SMALL-SIGNAL CHARACTERISTICS

Current-Gain — Bandwidth Product(1) (I _C = 50 mAdc, V _{CE} = 20 Vdc, f = 100 kHz)	f _T	—	400	—	MHz
Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, f = 1 MHz)	C _{obo}	NPN	—	6.0	pF
		PNP	—	4.5	pF
Input Capacitance (V _{BE} = 2.0 Vdc, I _C = 0, f = 1 MHz)	C _{ibo}	NPN	—	20	pF
		PNP	—	17	pF

SWITCHING CHARACTERISTICS

Turn-On Time (V _{CC} = 30 Vdc, V _{BE} = 0.5 Vdc, I _C = 150 mAdc, I _{B1} = 15 mAdc)	t _{on}	—	30	—	ns
Turn-Off Time (V _{CC} = 30 Vdc, I _C = 150 mAdc, I _{B1} = I _{B2} = 15 mAdc)	t _{off}	—	225	—	ns

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

*Refer to MHQ2907 for PNP graphs.

MOTOROLA SMALL-SIGNAL SEMICONDUCTORS

6367254 MOTOROLA SC (XSTRS/R F)

.96D 82493 D

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CEO}	15	V _{dc}
Collector-Base Voltage	V _{CBO}	30	V _{dc}
Emitter-Base Voltage	V _{EBO}	3.0	V _{dc}
Collector Current — Continuous	I _C	-50	mAdc
		Each Transistor	Four Transistors Equal Power
Total Device Dissipation @ T _A = 25°C Derate above 25°C	P _D	500 4.0	mW mW/°C
Total Device Dissipation @ T _C = 25°C Derate above 25°C	P̄ _D	6.7 0.825	Watts mW/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	-55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Junction to Case	Junction to Ambient	Unit
Thermal Resistance Each Die	151	250	°C/W
Effective, 4 Die	52	134	°C/W
Coupling Factors Q1-Q4 or Q2-Q3	34	70	%
Q1-Q2 or Q3-Q4	2.0	26	%

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

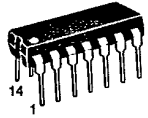
Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1) (I _C = 3.0 mAdc, I _B = 0)	V _{(BR)CEO}	15	—	—	V _{dc}
Collector-Base Breakdown Voltage (I _C = 1.0 μAdc, I _E = 0)	V _{(BR)CBO}	30	—	—	V _{dc}
Emitter-Base Breakdown Voltage (I _E = 10 μAdc, I _C = 0)	V _{(BR)EBO}	3.0	—	—	V _{dc}
Collector Cutoff Current (V _{CB} = 15 V _{dc} , I _E = 0)	I _{CBO}	—	—	10	nAdc
ON CHARACTERISTICS(1)					
DC Current Gain (I _C = 0.1 mAdc, V _{CE} = 1.0 V _{dc}) (I _C = 3.0 mAdc, V _{CE} = 1.0 V _{dc}) (I _C = 10 mAdc, V _{CE} = 1.0 V _{dc})	h _{FE}	— 20 —	110 80 50	— — —	—
Collector-Emitter Saturation Voltage (I _C = 10 mAdc, I _B = 1.0 mAdc)	V _{CE(sat)}	—	0.11	0.4	V _{dc}
Base-Emitter Saturation Voltage (I _C = 10 mAdc, I _B = 1.0 mAdc)	V _{BE(sat)}	—	0.84	1.0	V _{dc}
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product (I _C = 4.0 mAdc, V _{CE} = 10 V _{dc} , f = 100 MHz)	f _T	600	850	—	MHz
Output Capacitance (V _{CB} = 10 V _{dc} , I _E = 0, f = 1 MHz)	C _{obo}	—	0.75	1.7	pF
Input Capacitance (V _{BE} = 0.5 V _{dc} , I _C = 0, f = 1 MHz)	C _{ibo}	—	1.1	2.0	pF
Noise Figure (I _C = 1.0 mAdc, V _{CE} = 6.0 V _{dc} , R _G = 400 Ohms, f = 60 MHz)	NF	—	4.0	6.0	dB

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

T-43-25

MPQ918

CASE 646-06, STYLE 1
TO-116



**QUAD
AMPLIFIER TRANSISTOR**

NPN SILICON

Refer to MD918 for graphs.



6367254 MOTOROLA SC (XSTRS/R F)

96D 82494 D

T-43-25

MAXIMUM RATINGS

Rating	Symbol	Value		Unit
Collector-Emitter Voltage	V _{CEO}	20		V _{dc}
Collector-Base Voltage	V _{CBO}	40		V _{dc}
Emitter-Base Voltage	V _{EBO}	4.0		V _{dc}
Collector Current — Continuous	I _C	500		mAdc
		Each Transistor	Four Transistors Equal Power	
Total Device Dissipation @ T _A = 25°C Derate above 25°C	P _D	650 5.18	1250 10	mW mW/°C
Total Device Dissipation @ T _C = 25°C Derate above 25°C	P _D	1.0 8.0	3.0 24	Watts mW/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	-55 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Junction to Case	Junction to Ambient	Unit
Thermal Resistance(1) Each Die	125	193	°C/W
Effective, 4 Die	41.6	100	°C/W
Coupling Factors Q1-Q4 or Q2-Q3	30	60	%
Q1-Q2 or Q3-Q4	2.0	24	%

(1) R_{θJA} is measured with the device soldered into a typical printed circuit board.

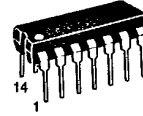
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(2) (I _C = 10 mAdc, I _B = 0)	V _{(BR)CEO}	20	—	—	V _{dc}
Collector-Base Breakdown Voltage (I _C = 10 μAdc, I _E = 0)	V _{(BR)CBO}	40	—	—	V _{dc}
Emitter-Base Breakdown Voltage (I _E = 10 μAdc, I _C = 0)	V _{(BR)EBO}	4.0	—	—	V _{dc}
Collector Cutoff Current (V _{CB} = 30 Vdc, I _E = 0)	I _{CBO}	—	—	50	nAdc
Emitter Cutoff Current (V _{EB} = 2.0 Vdc, I _C = 0)	I _{EBO}	—	—	50	nAdc
ON CHARACTERISTICS(2)					
DC Current Gain (I _C = 10 mAdc, V _{CE} = 10 Vdc) (I _C = 50 mAdc, V _{CE} = 10 Vdc) (I _C = 150 mAdc, V _{CE} = 10 Vdc)	h _{FE}	50 50 40	—	—	—
Collector-Emitter Saturation Voltage (I _C = 150 mAdc, I _B = 15 mAdc)	V _{CE(sat)}	—	—	0.5	V _{dc}
Base-Emitter Saturation Voltage (I _C = 150 mAdc, I _B = 15 mAdc)	V _{BE(sat)}	—	—	1.3	V _{dc}
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product (I _C = 20 mAdc, V _{CE} = 20 Vdc, f = 100 MHz)	f _T	175	—	—	MHz
Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, f = 1 MHz)	C _{obo}	—	—	8.0	pF
Input Capacitance (V _{BE} = 0.5 Vdc, I _C = 0, f = 1 MHz)	C _{ibo}	—	—	30	pF

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

MPQ1000

CASE 646-06, STYLE 1
TO-116



**QUAD
AMPLIFIER TRANSISTOR**

NPN SILICON

Refer to MD2218 for graphs.

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6367254 MOTOROLA SC (XSTRS/R F)

96D 82495 D

T-43-25

MAXIMUM RATINGS

Rating	Symbol	Value		Unit
Collector-Emitter Voltage	V _{CEO}	20		Vdc
Collector-Base Voltage	V _{CBO}	40		Vdc
Emitter-Base Voltage	V _{EBO}	4.0		Vdc
Collector Current — Continuous	I _C	500		mAdc
		Each Transistor	Four Transistors Equal Power	
Total Device Dissipation @ T _A = 25°C Derate above 25°C	P _D	0.65 5.18	1.25 8.0	Watts mW/°C
Total Device Dissipation @ T _C = 25°C Derate above 25°C	P _D	1.0 8.0	3.0 24	Watts mW/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	-55 to +150		°C

THERMAL CHARACTERISTICS

Characteristic	Junction to Case	Junction to Ambient	Unit
Thermal Resistance(1) Each Die Effective, 4 Die	125 41.6	193 100	°C/W
Coupling Factor Q1-Q4 or Q2-Q3 Q1-Q2 or Q3-Q4	30 2.0	60 24	%

(1) Junction to ambient data applies for typical printed circuit board mounting.

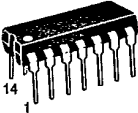
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1) (I _C = 10 mAdc, I _E = 0)	V _{(BR)CEO}	20	—	—	Vdc
Collector-Base Breakdown Voltage (I _C = 10 μAdc, I _E = 0)	V _{(BR)CBO}	40	—	—	Vdc
Emitter-Base Breakdown Voltage (I _E = 10 μAdc, I _C = 0)	V _{(BR)EBO}	4.0	—	—	Vdc
Collector Cutoff Current (V _{CB} = 30 Vdc, I _E = 0)	I _{CBO}	—	—	50	nAdc
Emitter Cutoff Current (V _{EB} = 2.0 Vdc, I _C = 0)	I _{EBO}	—	—	50	nAdc
ON CHARACTERISTICS(1)					
DC Current Gain (I _C = 10 mAdc, V _{CE} = 10 Vdc) (I _C = 50 mAdc, V _{CE} = 10 Vdc) (I _C = 150 mAdc, V _{CE} = 10 Vdc)	h _{FE}	50 50 40	100 120 80	—	—
Collector-Emitter Saturation Voltage (I _C = 150 mAdc, I _B = 15 mAdc)	V _{CE(sat)}	—	0.22	0.5	Vdc
Base-Emitter Saturation Voltage (I _C = 150 mAdc, I _B = 15 mAdc)	V _{BE(sat)}	—	0.89	1.3	Vdc
SMALL-SIGNAL CHARACTERISTICS					
Current-Gain — Bandwidth Product(1) (I _C = 20 mAdc, V _{CE} = 20 Vdc, f = 100 MHz)	f _T	150	300	—	MHz
Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, f = 1 MHz)	C _{obo}	—	4.5	8.0	pF
Input Capacitance (V _{BE} = 0.5 Vdc, I _C = 0, f = 1 MHz)	C _{ibo}	—	17	30	pF

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

MPQ1500

CASE 646-06, STYLE 1
TO-116



**QUAD
TRANSISTOR**

PNP SILICON

Refer to MPQ2907 for graphs.

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