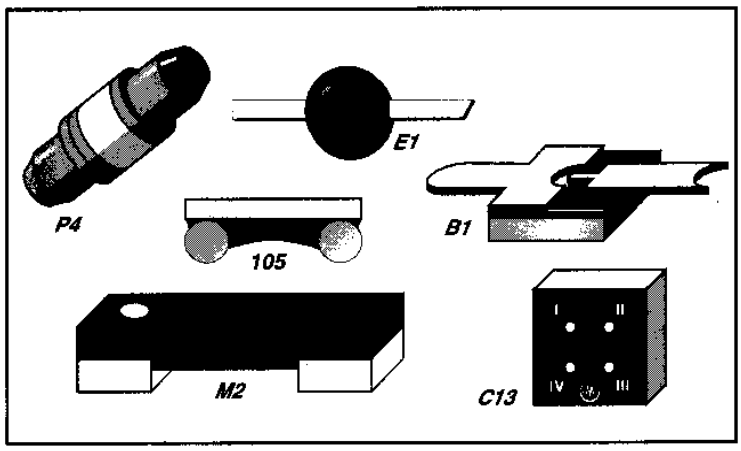
Table of Contents

Microwave Schottky Diodes

FEATURES

- High F_o – N type
- Low 1/f Noise – P Type
- Sputtered Contacts for Optimum Bondability and Reliablity
- Broad Range of Barriers



ENVIRONMENTAL RATINGS

(MAXIMUM)

Operating Temperature ..... -65°C to +200°C
Storage Temperature ..... -65°C to +200°C
Power Dissipation @ 25°C ..... 100mW. Derate ..... Linearly to zero at 150°C
Soldering Temperature ..... 230°C for 5 seconds

Electrical Specifications @ +25° C - N Type

						BARRIER	
						TYPE	METAL
MP 2001	C13	1	.29	.08	16	Low	Titanium
MP 2002	E1	1	.29	.20	16	Low	Titanium
MP 2003	BI	1	.29	.10	16	Low	Titanium
MP 2004	P4	1	.29	.25	16	Low	Titanium
MP 2005	M2	1	.29	.18	16	Low	Titanium
MP 2011	C13	3	.42	.08	15	Medium	NiCr
MP 2012	E1	3	.42	.20	15	Medium	NiCr
MP 2013	BI	3	.42	.10	15	Medium	NiCr
MP 2014	P4	3	.42	.25	15	Medium	NiCr
MP 2015	M2	3	.42	.18	15	Medium	NiCr
MP 2021	C13	4	.52	.08	14	High	Palladium
MP 2022	E1	4	.52	.20	14	High	Palladium
MP 2023	BI	4	.52	.10	14	High	Palladium
MP 2024	P4	4	.52	.25	14	High	Palladium
MP 2025	M2	4	.52	.18	14	High	Palladium
MP 2031	C13	5	.62	.08	12	Very High	Platinum
MP 2032	E1	5	.62	.20	12	Very High	Platinum
MP 2033	BI	5	.62	.10	12	Very High	Platinum
MP 2034	P4	5	.62	.25	12	Very High	Platinum
MP 2035	M2	5	.62	.18	12	Very High	Platinum

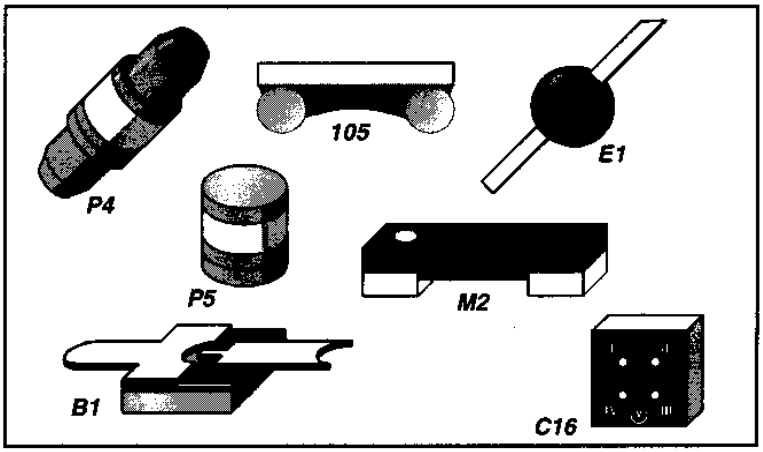
Electrical Specifications @ +25° C - P Type

						BARRIER	
						TYPE	METAL
MP 2041	C16	5	.40	.08	25	High	Titanium
MP 2042	E1	5	.40	.20	25	High	Titanium
MP 2043	BI	5	.40	.10	25	High	Titanium
MP 2044	P4	5	.40	.25	25	High	Titanium
MP 2045	M2	5	.40	.18	25	High	Titanium

Zero Bias Schottky Diodes

FEATURES

- High Sensitivity Detector Without Bias
- Broadband Operation Through 26 GHz
- Low 1/f (Flicker) Noise
- High Reliability Planar Construction



ENVIRONMENTAL RATINGS
(MAXIMUM)

Operating Temperature ..... -65°C to +200°C
Storage Temperature ..... -65°C to +200°C
Power Dissipation @ 25°C ..... 100mW. Derate
..... Linearly to zero at 150°C
Soldering Temperature ..... 230°C for 5 seconds

Electrical Specifications @ +25° C - 2050 Series

PART NUMBER	CASE STYLE						
MP 2051	C16	1	3	.10	3000	8000	26
MP 2052	E1	1	3	.27	3000	8000	18
MP 2053	B1	1	3	.10	3000	8000	40
MP 2054	P4	1	3	.32	3000	8000	12
MP 2055	P5	1	3	.28	3000	8000	18
MP 2056	M2	1	3	.15	3000	8000	18
MP 2057	105	1	3	.27	3000	8000	18

Electrical Specifications @ +25° C - 2060 Series

PART NUMBER	CASE STYLE						
MP 2061	C16	2	10	.10	5000	10,000	26
MP 2062	E1	2	10	.27	5000	10,000	18
MP 2063	B1	2	10	.10	5000	10,000	40
MP 2064	P4	2	10	.32	5000	10,000	12
MP 2065	P5	2	10	.28	5000	10,000	18
MP 2066	M2	2	10	.15	5000	10,000	18
MP 2067	105	2	10	.27	5000	10,000	18

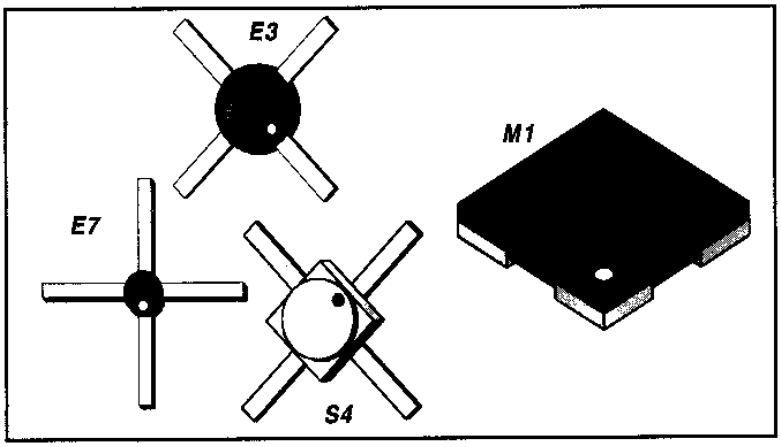
Electrical Specifications @ +25° C - 2070 Series

PART NUMBER	CASE STYLE						
MP 2071	C16	3	5	.10	8000	12,000	26
MP 2072	E1	3	5	.27	8000	12,000	18
MP 2073	B1	3	5	.10	8000	12,000	40
MP 2074	P4	3	5	.32	8000	12,000	12
MP 2075	P5	3	5	.28	8000	12,000	18
MP 2076	M2	3	5	.15	8000	12,000	18
MP 2077	105	3	5	.27	8000	12,000	18

Microwave Schottky Ring Quads

FEATURES

- Low Inductance Leadless Rings
- High Fco
- High Temperature Tri-Metal System



ENVIRONMENTAL RATINGS
(MAXIMUM)

Operating Temperature ..... -65°C to +200°C
Storage Temperature ..... -65°C to +200°C
Power Dissipation @ 25°C ..... 100mW. Derate
..... Linearly to zero at 150°C
Soldering Temperature ..... 230°C for 5 seconds

Electrical Specifications @ +25° C - Low Barrier (Titanium)

NE		(Typ)			(Typ) @	Approximate Max Operating Frequency (GHz)
MP2400	E4	290	0.10	15	20	20
MP2401	M1	290	0.10	15	20	26
MP2402	E7	290	0.15	15	20	26
MP2403	E3	290	0.20	15	20	18
MP2404	S4	290	0.30	15	20	12
MP2405	E4	270	0.15	15	15	16
MP2406	M1	270	0.15	15	15	18
MP2407	E7	270	0.20	15	15	18
MP2408	E3	270	0.25	15	15	16
MP2409	S4	270	0.35	15	15	12
MP2410	E4	240	0.25	15	10	12
MP2411	M1	240	0.25	15	10	18
MP2412	E7	240	0.30	15	10	12
MP2413	E3	240	0.35	15	10	12
MP2414	S4	240	0.45	15	10	8
MP2415	E4	220	0.50	15	8	6
MP2416	M1	220	0.50	15	8	8
MP2417	E7	220	0.55	15	8	6
MP2418	E3	220	0.60	15	8	4
MP2419	S4	220	0.70	15	8	4

Electrical Specifications @ +25° C - Intermediate Barrier (Nickel)

PART NUMBER	CASE STYLE	V_F (Typ) @ 1 mA (mV)	C_T (Max) @ 0 Volts (pF)	V_F (Max) @ 5 mA (mV)	R_S (Typ) @ 5 mA (Ohms)	Approximate Max Operating Frequency (GHz)
MP2420	E4	360	0.10	15	20	20
MP2421	M1	360	0.10	15	20	26
MP2422	E7	360	0.15	15	20	26
MP2423	E3	360	0.20	15	20	18
MP2424	S4	360	0.30	15	20	12
MP2425	E4	340	0.15	15	15	16
MP2426	M1	340	0.15	15	15	18
MP2427	E7	340	0.20	15	15	18
MP2428	E3	340	0.25	15	15	16
MP2429	S4	340	0.35	15	15	12
MP2430	E4	310	0.25	15	10	12
MP2431	M1	310	0.25	15	10	18
MP2432	E7	310	0.30	15	10	12
MP2433	E3	310	0.35	15	10	12
MP2434	S4	310	0.45	15	10	8
MP2435	E4	290	0.50	15	8	6
MP2436	M1	290	0.50	15	8	8
MP2437	E7	290	0.55	15	8	6
MP2438	E3	290	0.60	15	8	4
MP2439	S4	290	0.70	15	8	4

Electrical Specifications @ +25° C - Medium Barrier (Nichrome)

PART NUMBER	CASE STYLE	V_F (Typ) @ 1 mA (mV)	C_T (Max) @ 0 Volts (pF)	V_F (Max) @ 5 mA (mV)	R_S (Typ) @ 5 mA (Ohms)	Approximate Max Operating Frequency (GHz)
MP 2440	E4	420	0.10	15	20	20
MP 2441	M1	420	0.10	15	20	26
MP 2442	E7	420	0.15	15	20	26
MP 2443	E3	420	0.20	15	20	18
MP 2444	S4	420	0.30	15	20	12
MP 2445	E4	400	0.15	15	15	16
MP 2446	M1	400	0.15	15	15	18
MP 2447	E7	400	0.20	15	15	18
MP 2448	E3	400	0.25	15	15	16
MP 2449	S4	400	0.35	15	15	12
MP 2450	E4	380	0.25	15	10	12
MP 2451	M1	380	0.25	15	10	18
MP 2452	E7	380	0.30	15	10	12
MP 2453	E3	380	0.35	15	10	12
MP 2454	S4	380	0.45	15	10	8
MP 2455	E4	360	0.50	15	8	6
MP 2456	M1	360	0.50	15	8	8
MP 2457	E7	360	0.55	15	8	6
MP 2458	E3	360	0.60	15	8	4
MP 2459	S4	360	0.70	15	8	4

Microwave Schottky Ring Quads

Electrical Specifications @ +25° C - High Barrier (Palladium)

MP2460	E4	520	0.10	20	15	20
MP2461	M1	520	0.10	20	15	26
MP2462	E7	520	0.15	20	15	26
MP2463	E3	520	0.20	20	15	18
MP2464	S4	520	0.30	20	15	12
MP2465	E4	500	0.15	20	12	16
MP2466	M1	500	0.15	20	12	18
MP2467	E7	500	0.20	20	12	18
MP2468	E3	500	0.25	20	12	16
MP2469	S4	500	0.35	20	12	12
MP2470	E4	480	0.25	20	10	12
MP2471	M1	480	0.25	20	10	18
MP2472	E7	480	0.30	20	10	12
MP2473	E3	480	0.35	20	10	12
MP2474	S4	480	0.45	20	10	8
MP2475	E4	460	0.50	20	8	6
MP2476	M1	460	0.50	20	8	8
MP2477	E7	460	0.55	20	8	6
MP2478	E3	460	0.60	20	8	4
MP2479	S4	460	0.70	20	8	4

Microwave Schottky Ring Quads

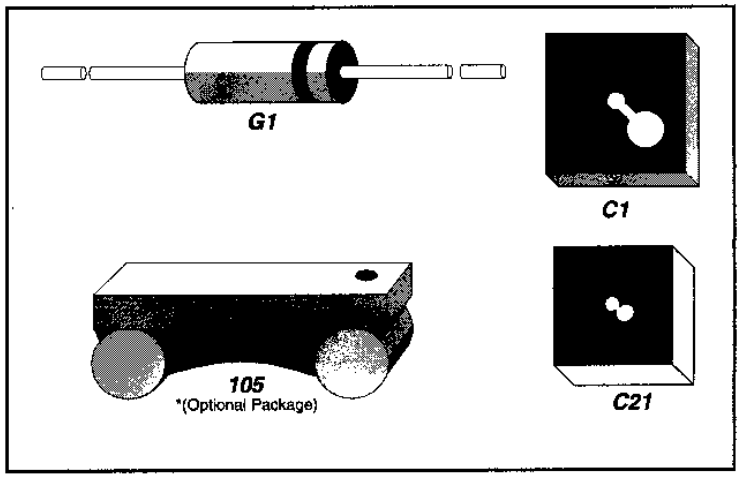
Electrical Specifications @ +25° C - Very High Barrier (Platinum)

[illegible]	CASE STYLE	V_F (Typ) @ 1 mA (mV)	Max [illegible] @ [illegible] ([illegible])	Max ΔV_F @ [illegible]	[illegible] (Typ) @ [illegible] mA ([illegible])	[illegible] Max [illegible]
MP2480	E4	620	0.10	20	20	20
MP2481	M1	620	0.10	20	20	26
MP2482	E7	620	0.15	20	20	26
MP2483	E3	620	0.20	20	20	18
MP2484	S4	620	0.30	20	20	12
MP2485	E4	600	0.15	20	15	16
MP2486	M1	600	0.15	20	15	18
MP2487	E7	600	0.20	20	15	18
MP2488	E3	600	0.25	20	15	16
MP2489	S4	600	0.35	20	15	12
MP2490	E4	580	0.25	20	10	12
MP2491	M1	580	0.25	20	10	18
MP2492	E7	580	0.30	20	10	12
MP2493	E3	580	0.35	20	10	12
MP2494	S4	580	0.45	20	10	8
MP2495	E4	560	0.50	20	8	6
MP2496	M1	560	0.50	20	8	8
MP2497	E7	560	0.55	20	8	6
MP2498	E3	560	0.60	20	8	4
MP2499	S4	560	0.70	20	8	4

General Purpose Schottky Diodes

FEATURES

- Fast switching-PSEC
- High breakdown voltage
- Low cost - H-P equivalents
- Off-set bonding pad



ENVIRONMENTAL RATINGS
(MAXIMUM)

Operating Temperature ..... -65°C to +200°C
Storage Temperature ..... -65°C to +200°C
Power Dissipation @ 25°C ..... 100mW. Derate
..... Linearly to zero at 150°C
Soldering Temperature ..... 230°C for 5 seconds

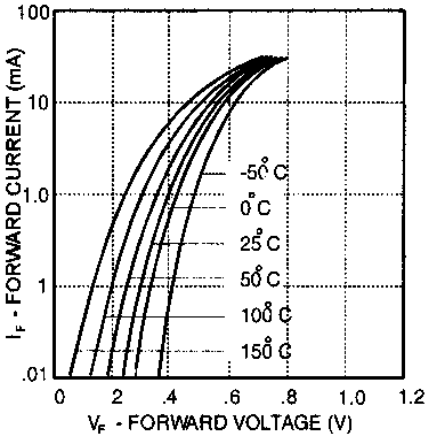
Electrical Specifications @ +25 °C - Single Diodes

PART	CASE	V_B (Min) @ 10 µA	V_F (Max) @ 1 mA	V_F (Max) @ 10 mA	C_T (Max) @ 0 V, 1 MHz (pF)	I_R (Max) @ 15 V (nA)	I_R (Max) @ 1 V (nA)	τ (Max) @ 20 mA (ps)
MP 2087	C1	20	1.1	0.41	35	100	15	100
MP2088	C1	15	0.4	0.41	35	500	10	100
MP 2097	C1	15	1.1	0.41	20	100	8	100
MP 2810	G1	20	1.2	0.41	35	100	15	100
MP 2811	G1	15	1.2	0.41	20	100	8	100
1N5712	G1	20	1.2	0.55	35	100	15	100
1N5713	G1	15	1.2	0.41	20	100	8	100
MP2835	G1	8(1)	1.0	0.34	10(2)	100	1	100
MP2836	C21	8(1)	0.9	0.34	10(2)	100	1	100
MP2800	G1	70	2.0	0.41	15	200	50	100
MP2801	C1	70	1.9	0.41	15	200	50	100
1N5711	G1	70	2.0	0.41	15	200	50	100

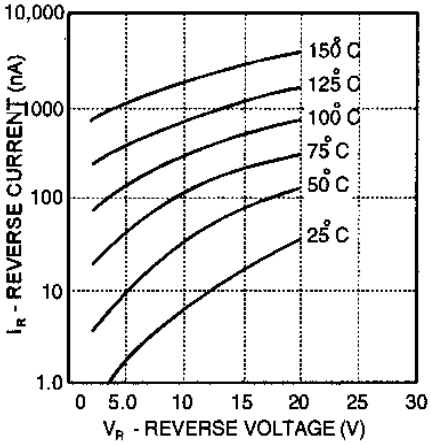
High Conductance Diodes

MP2232	G1	15	3.5(1)	.30	150	1000	5	100
MP2233	C1	15	3.5(1)	.30	150	1000	5	100

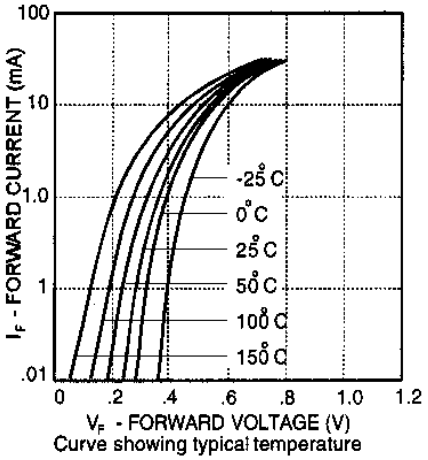
Note (1) : V_B(min) measured with I_R= 100 µA
Note (2) : I_F(min) measured withV_F = 0.45v
Note (3) : Krakauer method



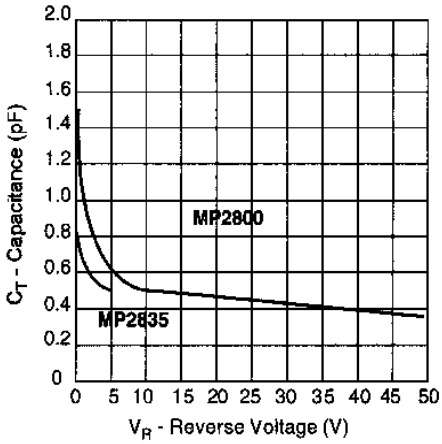
Curve showing typical temperature variation under forward bias conditions for the MP2810 or 1N5712 Schottky Diode

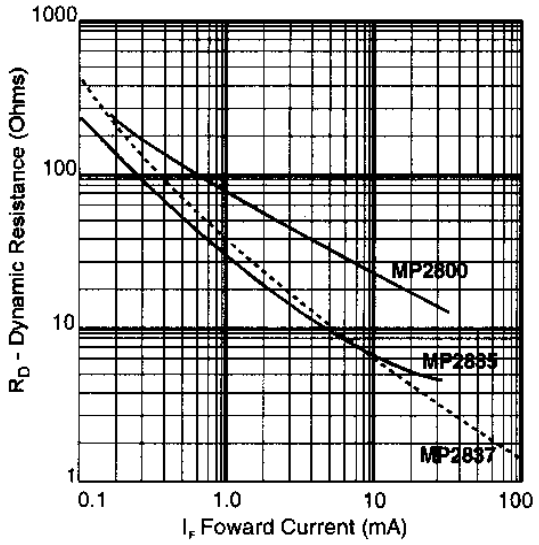


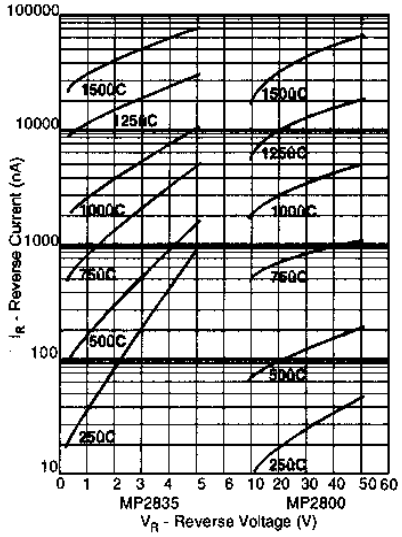
Curve showing typical variation of Reverse Current (I_R) vs. Reverse Voltage (V_R) at various temperatures for the MP2810 or 1N5712 Schottky Diode

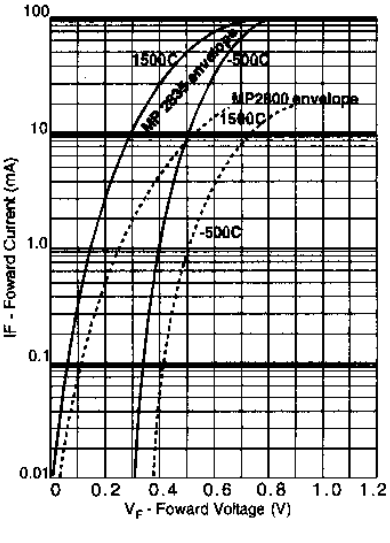


Curve showing typical temperature variation under forward bias conditions for the MP2811 Schottky Diode.





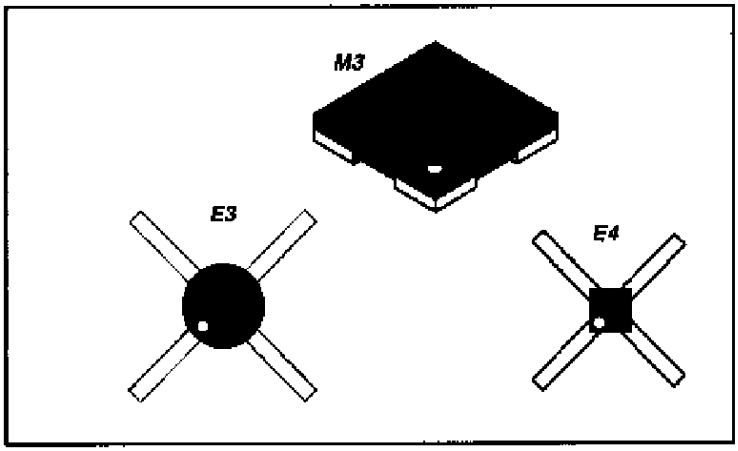




Monolithic Schottky Bridge Quad Diodes

FEATURES

- Low Leakage
- High Breakdown Voltage
- Leadless Quad Package
- Low Inductance
- For Samplers, Mixers, Modulators



ENVIRONMENTAL RATINGS
(MAXIMUM)

Operating Temperature ..... -65°C to +200°C
Storage Temperature ..... -65°C to +200°C
Power Dissipation @ 25°C ..... 100 mW
Derate Linearly to zero at 150°C
Soldering Temperature ..... 230°C for 5 seconds

Electrical Specifications @ +25 °C

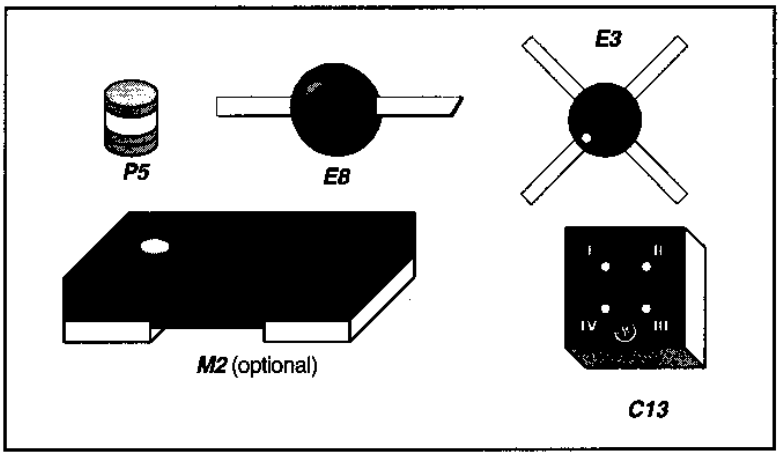
MP2601	M3	290	0.15	20	3	100
MP2602	E4	290	0.23	20	3	100
MP2603	E3	290	0.25	20	3	100
MP2604	M3	420	0.15	19	3	80
MP2605	E4	420	0.23	19	3	80
MP2606	E3	420	0.25	19	3	80
MP2607	M3	520	0.15	18	5	50
MP2608	E4	520	0.23	18	5	50
MP2609	E3	520	0.25	18	5	50
MP2610	M3	620	0.15	17	5	30
MP2611	E4	620	0.23	17	5	30
MP2612	E3	620	0.25	17	5	30

Notes:
1. Maximum ΔV_F is less than or equal to 20 mV at 1 mA.
2. Other selections available.Notes:

GaAs Schottky Mixer Diodes

FEATURES

- Low Noise Figure
- Low Capacitance
- Low Series Resistance



ENVIRONMENTAL RATINGS (MAXIMUM)	
Operating Temperature	-65°C to +150°C
Storage Temperature	-65°C to +200°C
Soldering Temperature	230°C for 10 seconds

SINGLES • Electrical Specifications @ +25°C

PART NUMBER	CASE STYLE	MAXIMUM				TYPICAL		
		C_T (pF)	R_D (Ω)	V_F (mV)	V_{BR} (V)			
MP2921	C13	0.06	8	700	5	6.0	200-400	2.0:1
MP2922*	M2	0.10	8	700	5	6.0	200-400	2.0:1
MP2923	E8	0.15	8	700	5	6.0	200-400	2.0:1
MP2924	P5	0.18	8	700	5	6.0	200-400	2.0:1
MP2925	S70	0.22	8	700	5	6.0	200-400	2.0:1
TEST CONDITIONS		V_R = 0V f = 1 MHz			I_R = 10 µA			

RING / BRIDGE QUADS • Electrical Specifications @ +25° C

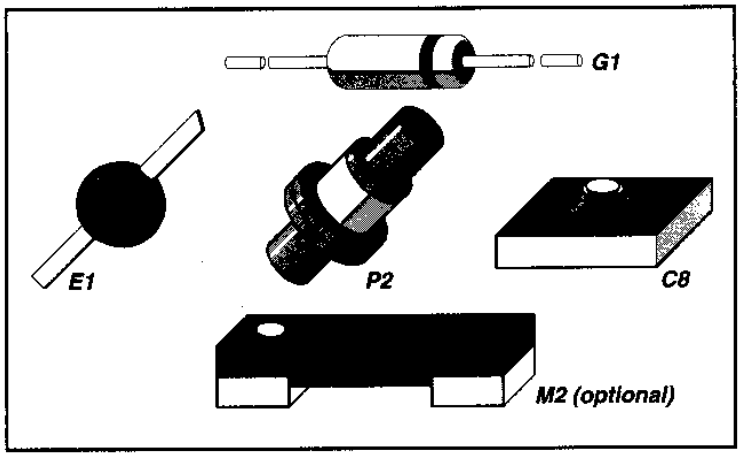
PART NUMBER	CASE STYLE	TYPE	MAXIMUM				TYPICAL	
			C_T (pF)	R_D (Ω)	V_F (mV)		V_{BR} (V)	
MP2941	E3	RING	0.20	8	20	.02	5	700
MP2962	E3	BRIDGE	0.20	8	20	.02	5	700
TEST CONDITIONS			V_R = 0V f = 1 MHz				I_R = 10 µA	

*NOTE: Optional Package Outline and Circuit Configurations Available upon Request

PIN Diodes

FEATURES

- Low Punch-through Voltage
- Low Loss
- State of the Art Performance
- High Temperature Metal System
- Glassivated for High Reliability

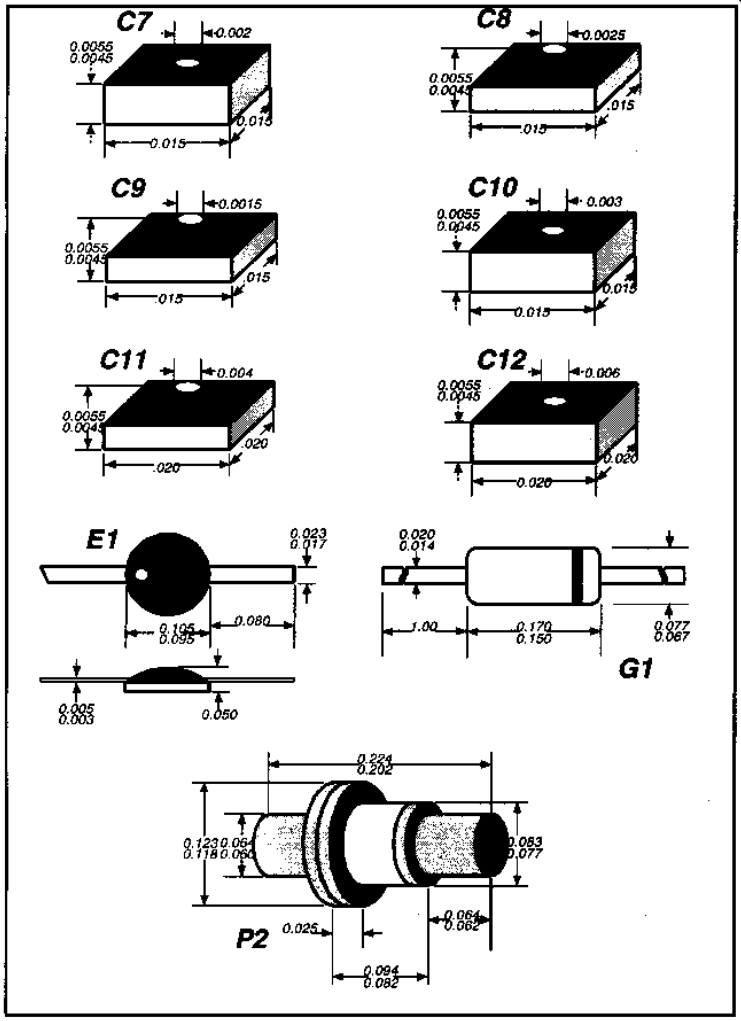


ENVIRONMENTAL RATINGS (MAXIMUM)	
Operating Temperature	-65°C to +200°C
Storage Temperature	-65°C to +200°C
Soldering Temperature	230°C for 5 seconds

Electrical Specifications @ +25° C

[illegible]	CASE STYLE	[illegible]	C_T [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	APPLICATION
MP 5021	C7	15	.12	2.0	2	B	10	Limiter
MP 5022	P2	15	.12	2.0	2	B	10	Limiter
MP 5023	G1	15	.12	2.0	2	B	10	Limiter
MP 5024	E1	15	.12	2.0	2	B	10	Limiter
MP 5031	C7	30	.08	2.0	3	B	20	Limiter
MP 5032	P2	30	.08	2.0	3	B	20	Limiter
MP 5033	G1	30	.08	2.0	3	B	20	Limiter
MP 5034	E1	30	.08	2.0	3	B	20	Limiter
MP 5041	C8	70	.12	1.0	4	B	35	Fast Switch
MP 5042	P2	70	.12	1.0	4	B	35	Fast Switch
MP 5043	G1	70	.12	1.0	4	B	35	Fast Switch
MP 5044	E1	70	.12	1.0	4	B	35	Fast Switch
MP 5201	C8	200	.12	2.0	20	A	200	General Purpose
MP 5202	P2	200	.12	2.0	20	A	200	General Purpose
MP 5203	G1	200	.12	2.0	20	A	200	General Purpose
MP 5204	E1	200	.12	2.0	20	A	200	General Purpose
MP 5081	C9	100	.08	2.0	8	A	100	High Frequency
MP 5082	P2	100	.08	2.0	8	A	100	High Frequency
MP 5084	E1	100	.08	2.0	8	A	100	High Frequency
MP 5206	C10	100	.25	1.0	20	A	300	Low Cost
MP 5207	P2	100	.25	1.0	20	A	300	Low Cost
MP 5208	G1	100	.25	1.0	20	A	300	Low Cost
MP 5209	E1	100	.25	1.0	20	A	300	Low Cost
MP 5501	C11	500	.25	3.0	30	B	500	High Power
MP 5502	P2	500	.25	3.0	30	B	500	High Power
MP 5503	G1	500	.25	3.0	30	B	500	High Power
MP 5504	E1	500	.25	3.0	30	B	500	High Power
MP 5506	C12	100	.15	5.0	30	C	200	Attenuator
MP 5507	P2	100	.15	5.0	30	C	200	Attenuator
MP 5508	G1	100	.15	5.0	30	C	200	Attenuator
MP 5509	E1	100	.15	5.0	30	C	200	Attenuator
MP 5510	105	100	.15	5.0	30	C	200	Attenuator

CASE DIMENSIONS

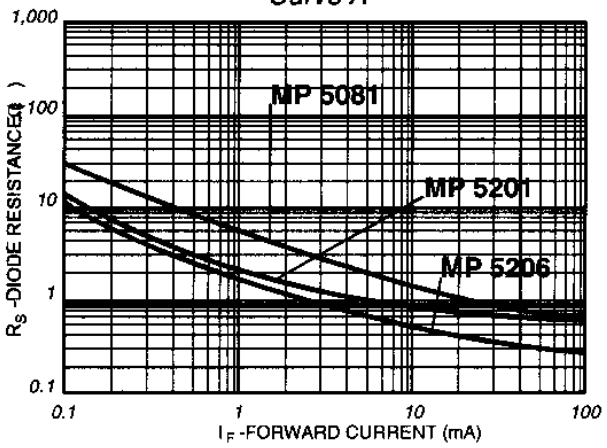


PIN Diode Application Notes

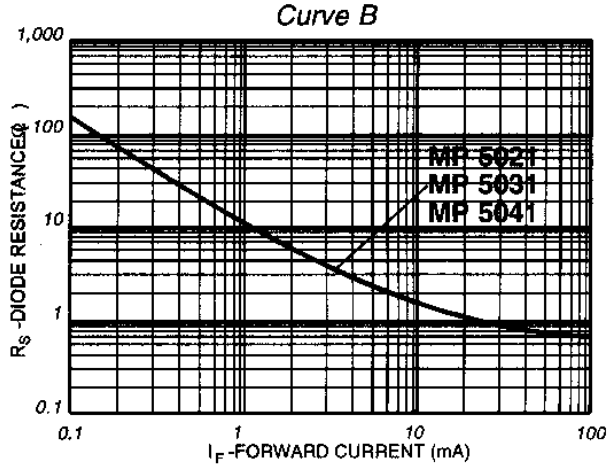
1. All Diodes are heat sink cathode. NIP polarity may be available upon request.
2. Other packages may be available upon request

Curves A, B, and C show typical RF resistance under different conditions.

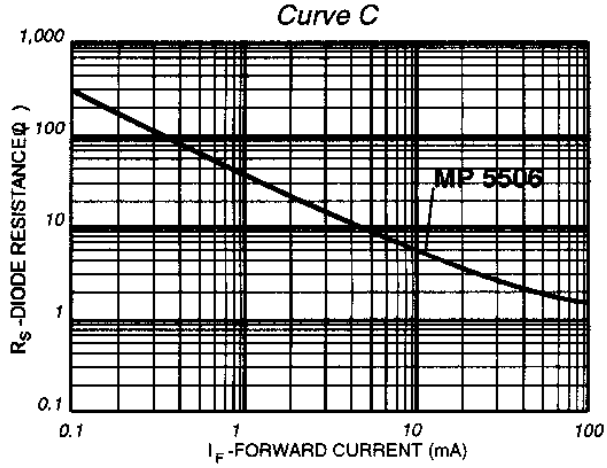
Curve A



Curve B



Curve C

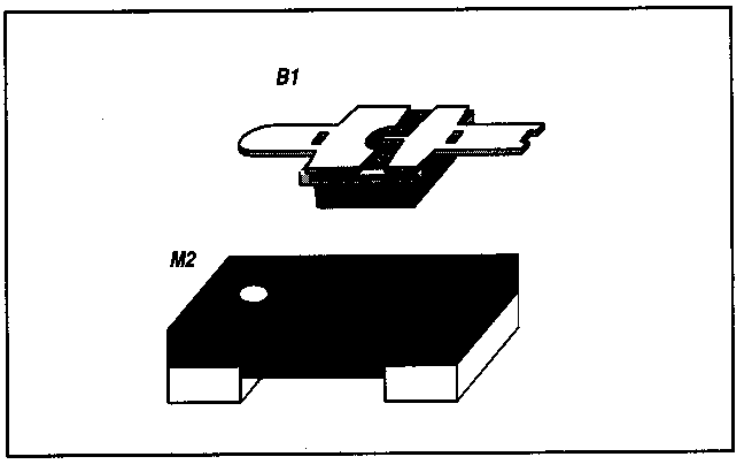


1. C_{JD} is depleted capacitance when measured at 1 MHz. Junction capacitance at and above 1 GHz does not change with bias and is equal to the 1 MHz depleted capacitance. Minimum loss is obtained when the junction is fully depleted. All M-pulse switching PIN diodes are essentially depleted in the 0 to 5 volt bias region providing minimum loss with approximately 5 Volts reverse bias.

Series PIN Switching Elements

FEATURES

- High RF Power Handling
- Easy Assembly
- High Reliability Metal System
- Very Low Inductance

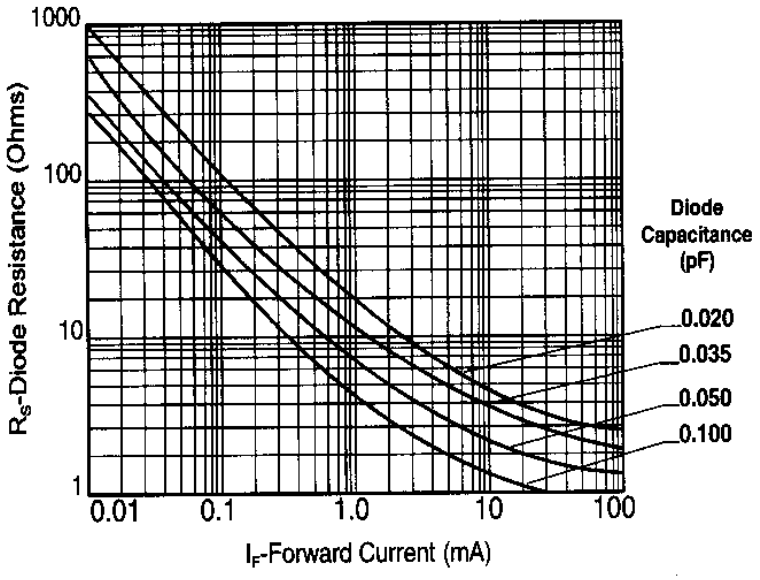


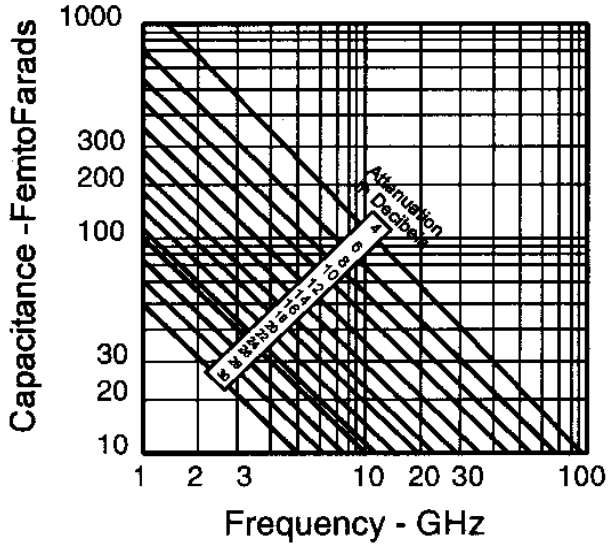
ENVIRONMENTAL RATINGS
(MAXIMUM)

Operating Temperature ..... -65°C to +200°C
Storage Temperature ..... -65°C to +200°C
Soldering Temperature ..... 230°C for 5 seconds

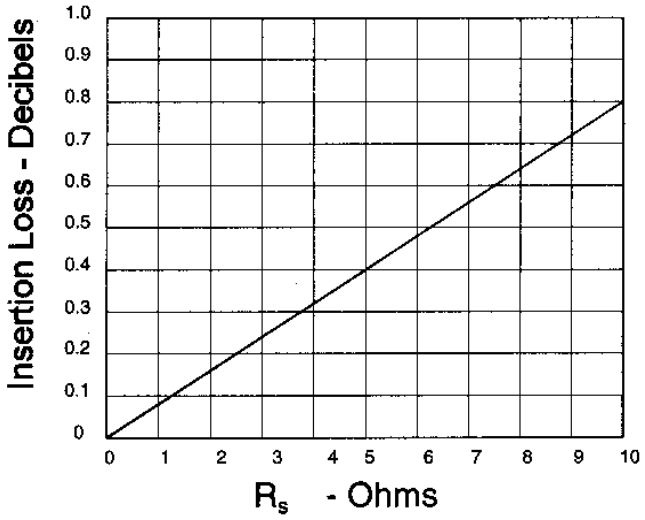
HIGH ISOLATION • Electrical Specifications @ +25° C

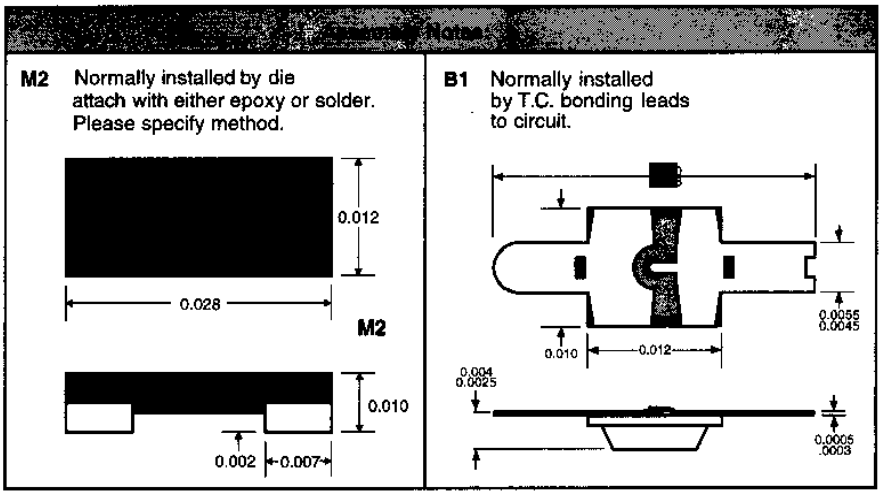
MP5220	B1	70	0.020	6	30
MP5221	B1	70	0.025	5	50
MP5222	B1	70	0.035	4	60
MP5230	M2	70	0.045	6	30
MP5232	M2	70	0.055	4	60





Single Series Element Isolation
(50 Ohm System)





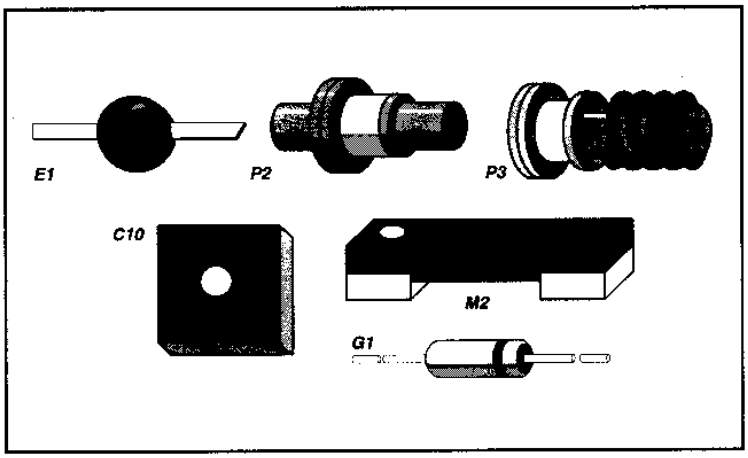
Notes :

1. Dimensions are in inches.
2. Unless otherwise specified dimensions are nominal.

Step Recovery Diodes

FEATURES

- Low RS
- Long Lifetime
- Fast Transition Time
- High Temperature Metal System

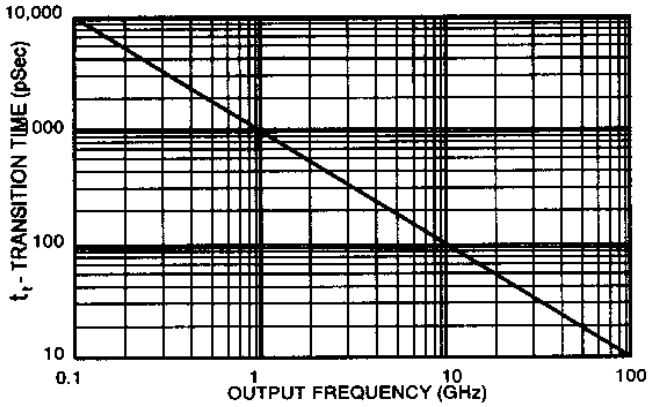


ENVIRONMENTAL RATINGS (MAXIMUM)	
Operating Temperature	-65°C to +175°C
Storage Temperature	-65°C to +200°C
Soldering Temperature	+230°C for 5 seconds

Electrical Specifications @ +25° C

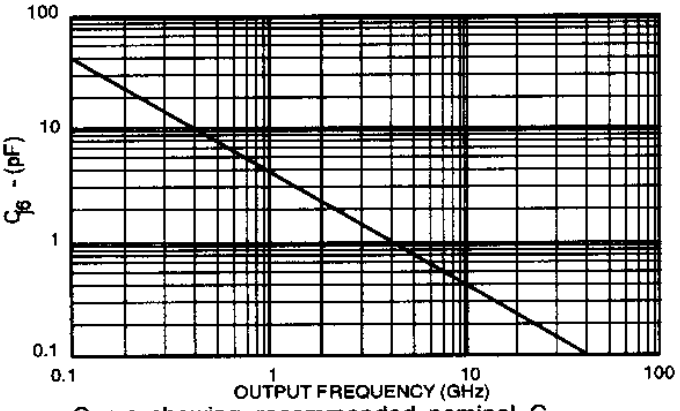
PART NUMBER				R_s (typ @ 100mA) (Ohms)	t_t (typ) (psec)	t_{rr} (typ) (nSec)	θ_{jc} (°C/W)	Max Output Frequency (GHz)
MP4021	C14	20	0.2 - 0.5	0.8	50	15	60	20
MP4022	P2	20	0.2 - 0.5	0.8	50	15	60	20
MP4023	E1	20	0.2 - 0.5	0.8	50	15	60	20
MP4024	M2	20	0.2 - 0.5	0.8	50	15	60	18
MP4025	G1	20	0.2 - 0.5	0.8	50	15	60	18
MP4031	C10	30	0.5 - 1.0	0.6	70	30	45	14
MP4032	P2	30	0.5 - 1.0	0.6	70	30	45	14
MP4033	E1	30	0.5 - 1.0	0.6	70	30	45	14
MP4034	M2	30	0.5 - 1.0	0.6	70	30	45	12
MP4035	G1	30	0.5 - 1.0	0.6	70	30	45	12
MP4041	C10	40	1.0 - 2.0	0.5	120	60	25	8
MP4042	P2	40	1.0 - 2.0	0.5	120	60	25	8
MP4043	E1	40	1.0 - 2.0	0.5	120	60	25	8
MP4044	M2	40	1.0 - 2.0	0.5	120	60	25	8
MP4045	G1	40	1.0 - 2.0	0.5	120	60	25	8
MP4061	C15	60	2.0 - 4.0	0.3	240	120	15	4
MP4062	P2	60	2.0 - 4.0	0.3	240	120	15	4
MP4063	E1	60	2.0 - 4.0	0.3	240	120	15	4
MP4064	M2	60	2.0 - 4.0	0.3	240	120	15	4
MP4065	G1	60	2.0 - 4.0	0.3	240	120	15	4

FIGURE 1



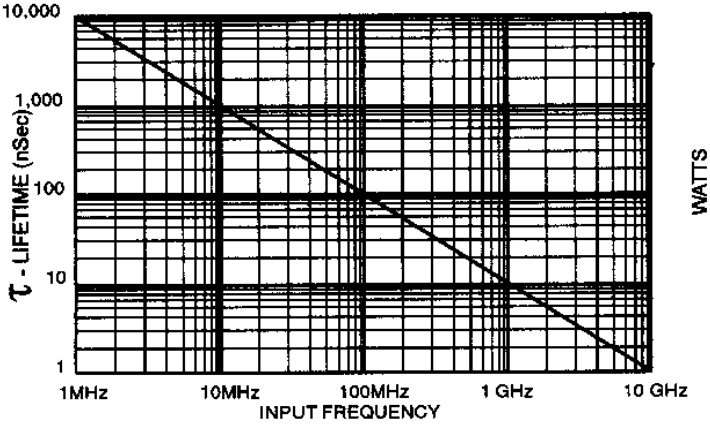
Curve showing Transition Time (t_t) versus Output Frequency for best efficiency.

FIGURE 2



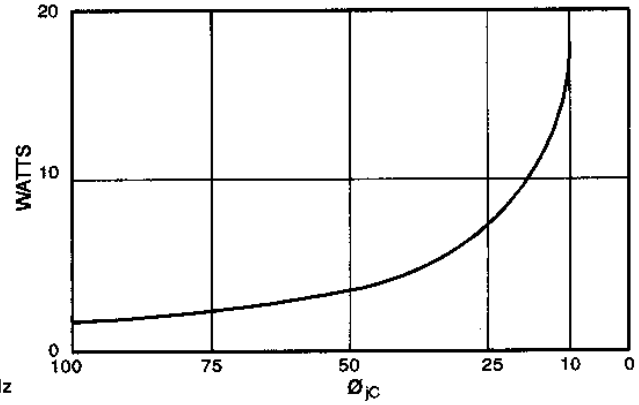
Curve showing recommended nominal C_{J0} versus Output Frequency for good impedance match and stability.

FIGURE 3

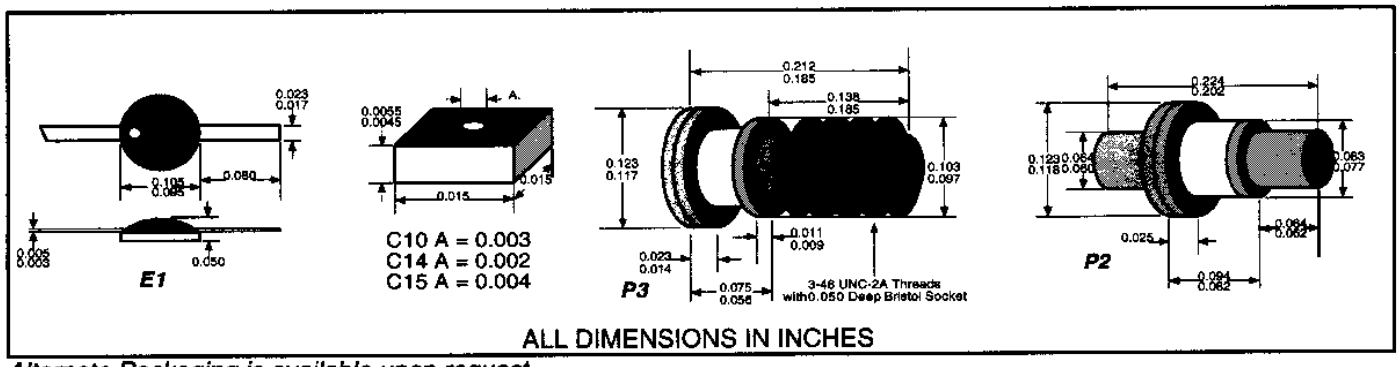


Curve showing minimum Lifetime (τ) versus input frequenct for maximum efficiency.

FIGURE 4



Curve showing maximum recommended Power In versus Thermal Resistance (Θ_{jc}) for Ambient Temperature (T_A) at 25°C.



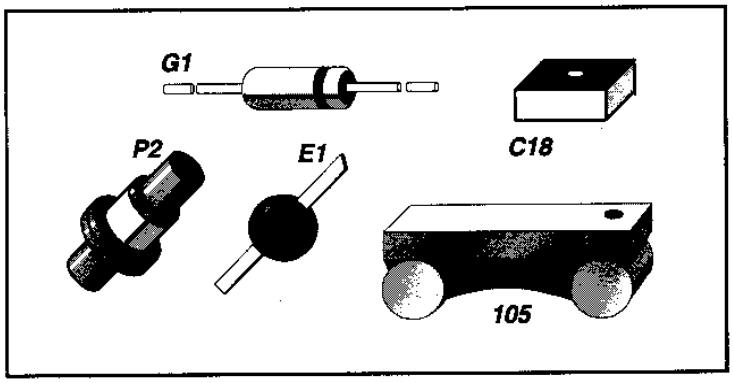
Alternate Packaging is available upon request.

M-pulse Microwave

Abrupt Tuning Varactor Diodes • 30 VOLT SERIES

FEATURES

- High Q
- Low Leakage
- ±10% Standard Tolerance
- Glassivated for High Reliability



ENVIRONMENTAL RATINGS
(MAXIMUM)

Operating Temperature ..... -65°C to +175°C
Storage Temperature ..... -65°C to +200°C
Soldering Temperature ..... 230°C for 5 seconds

Electrical Specifications @ 25° C

Part Number	Package	C_T @ 4 V, 1 MHz (pF) Nominal	C_T @ 4 V, 1 MHz (pF) Typical	Q_R @ 4 V, 50 MHz Minimum	Ratio C_T @ 4 V / C_T @ 30 V, 1 MHz
MP 6301	C17	0.4	5.0	5000	10 - 12
MP 6302	P2	0.6	2.9	5000	10 - 12
MP 6303	G1	0.5	3.6	5000	10 - 12
MP 6304	E1	0.5	3.6	5000	10 - 12
MP 6305	C17	0.8	5.0	4800	8 - 10
MP 6306	P2	1.0	3.6	4800	8 - 10
MP 6307	G1	0.9	4.2	4800	8 - 10
MP 6308	E1	0.9	4.2	4800	8 - 10
MP 6309	C17	1.3	5.0	4400	6 - 8
MP 6310	P2	1.5	4.0	4400	6 - 8
MP 6311	G1	1.4	4.4	4400	6 - 8
MP 6312	E1	1.4	4.4	4400	6 - 8
MP 6313	C17	2.0	5.0	4000	5 - 7
MP 6314	P2	2.2	4.2	4000	5 - 7
MP 6315	G1	2.1	4.6	4000	5 - 7
MP 6316	E1	2.1	4.6	4000	5 - 7
MP 6317	C18	3.1	5.0	3600	4 - 6
MP 6318	P2	3.3	4.4	3600	4 - 6
MP 6319	G1	3.2	4.7	3600	4 - 6
MP 6420	E1	3.2	4.7	3600	4 - 6
MP 6321	C18	4.5	5.0	3200	3 - 5
MP 6322	P2	4.7	4.6	3200	3 - 5
MP 6323	G1	4.6	4.8	3200	3 - 5
MP 6324	E1	4.6	4.8	3200	3 - 5
MP 6325	C18	6.6	5.0	2800	2 - 4
MP 6326	P2	6.8	4.7	2800	2 - 4
MP 6327	G1	6.7	4.9	2800	2 - 4
MP 6328	E1	6.7	4.9	2800	2 - 4
MP 6329	C18	9.8	5.0	2400	1 - 2
MP 6330	P2	10.0	4.8	2400	1 - 2
MP 6331	G1	9.9	4.9	2400	1 - 2
MP 6332	E1	9.9	4.9	2400	1 - 2

M-pulse Microwave ▪ 576 Charcot Avenue, San Jose, CA 95131 ▪ (408) 432-1480 ▪ Fax (408) 432-3440 ▪ www.mpulsemw.com

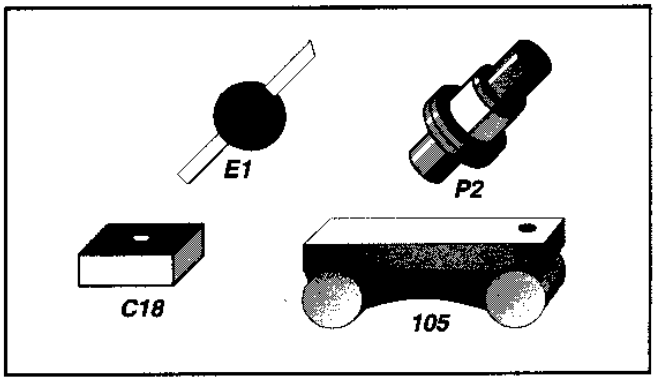
Hyperabrupt Tuning Varactor Diodes

FEATURES

- Broad Tuning Range
- High Frequency Operation
- ±10% Standard Tolerance
- Glassivated For High Reliability

ENVIRONMENTAL RATINGS
(MAXIMUM)

Operating Temperature ..... -65°C to +175°C
Storage Temperature ..... -65°C to +200°C
Soldering Temperature ..... 230°C for 5 seconds



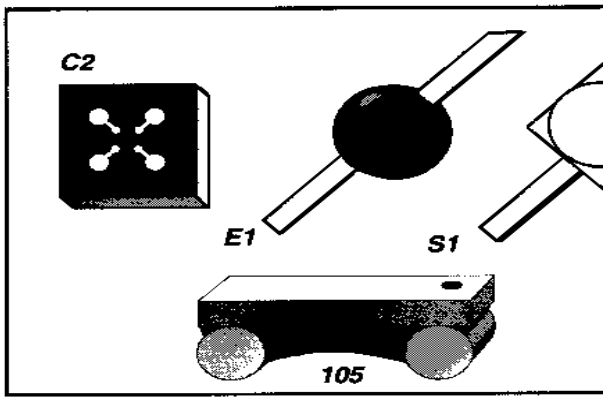
Electrical Specifications @ +25° C • 22 VOLT SILICON SERIES

PART NUMBER	CASE STYLE		CT4 (pF)		CT20 (pF)		
			MIN		MIN	MAX	
MP 6501	C17	2.0	0.70	0.90	0.13	0.25	500
MP 6502	P2	2.2	0.90	1.10	0.35	0.45	500
MP 6503	M2	2.1	0.80	1.00	0.25	0.35	500
MP 6504	E1	2.1	0.80	1.00	0.25	0.35	500
MP 6505	S1	2.2	0.90	1.10	0.35	0.45	500
MP 6506	C17	3.2	1.15	1.45	0.25	0.35	500
MP 6507	P2	3.4	1.35	1.65	0.45	0.55	500
MP 6508	M2	3.3	1.25	1.55	0.35	0.45	500
MP 6509	E1	3.3	1.25	1.55	0.35	0.45	500
MP 6510	S1	3.4	1.35	1.65	0.45	0.55	500
MP 6511	C17	4.7	1.60	2.00	0.35	0.50	400
MP 6512	P2	4.9	1.80	2.20	0.55	0.70	400
MP 6513	M2	4.8	1.70	2.10	0.45	0.60	400
MP 6514	E1	4.8	1.70	2.10	0.45	0.60	400
MP 6515	S1	4.9	1.80	2.20	0.55	0.70	400
MP 6516	C17	7.0	2.50	3.10	0.50	0.70	400
MP 6517	P2	7.2	2.70	3.30	0.70	0.90	400
MP 6518	M2	7.1	2.60	3.20	0.60	0.80	400
MP 6519	E1	7.1	2.60	3.20	0.60	0.80	400
MP 6520	S1	7.2	2.70	3.30	0.70	0.90	400
MP 6521	C18	13.8	4.30	5.30	0.80	1.10	400
MP 6522	P2	14.0	4.50	5.50	1.00	1.30	400
MP 6523	M2	13.9	4.40	5.40	0.90	1.20	400
MP 6524	E1	13.9	4.40	5.40	0.90	1.20	400
MP 6525	S1	14.0	4.50	5.50	1.00	1.30	400
Test Conditions		V_R =			V_R =		V_R = -4V, 50MHz

Microwave Tunnel Diodes

FEATURES

- Planar Construction
- Zero Bias Detector Operation
- Low Impedance
- Stable Vout vs. Temperature



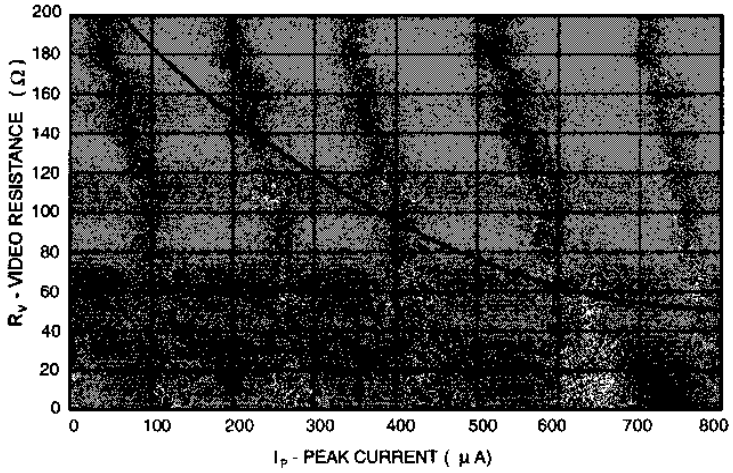
ENVIRONMENTAL RATINGS

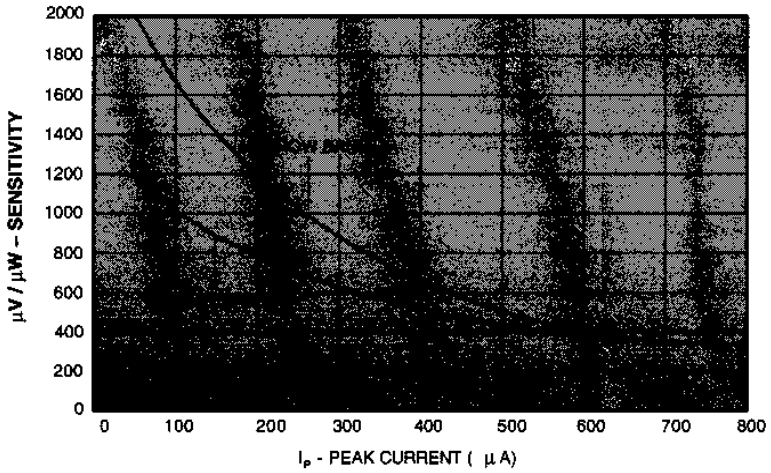
(MAXIMUM)

Operating Temperature	-65°C	to	+125°C
Storage Temperature	-65°C	to	+150°C
Storage Temperature S1 Case	-65°C	to	+125°C

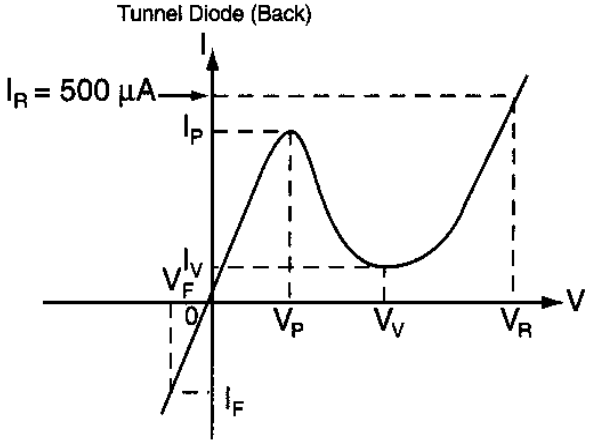
Electrical Specifications @ +25° C

MP1101	C2	0-100	40	425	150
MP1100	C2	0-100	40	425	145
MP1102	C2	0-100	40	425	145
MP1103	E1	0-100	40	425	145
MP1104	S1	0-100	40	425	145
MP1105	P1	0-100	40	425	145
MP1201	C2	100-200	80	425	135
MP1200	C2	100-200	80	425	130
MP1202	C2	100-200	80	425	125
MP1203	E1	100-200	80	425	130
MP1204	S1	100-200	80	425	130
MP1205	P1	100-200	80	425	130
MP1301	C2	200-300	100	425	125
MP1300	C2	200-300	100	425	125
MP1302	C2	200-300	100	425	120
MP1303	E1	200-300	100	425	120
MP1304	S1	200-300	100	425	120
MP1305	P1	200-300	100	425	120
MP1451	C2	300-450	150	425	120
MP1450	C2	300-450	150	425	120
MP1452	C2	300-450	150	425	120
MP1453	E1	300-450	150	425	115
MP1454	S1	300-450	150	425	115
MP1455	P1	300-450	150	425	115
MP1601	C2	450-600	225	425	115
MP1600	C2	450-600	225	420	110
MP1602	C2	450-600	225	420	105
MP1603	E1	450-600	225	420	110
MP1604	S1	450-600	225	420	110
MP1605	P1	450-600	225	420	110

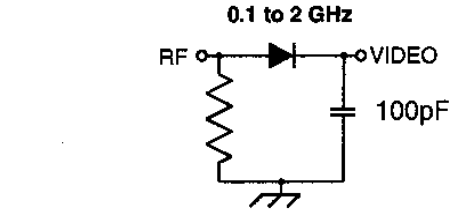


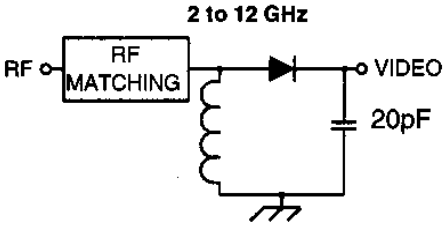


Characteristic Curve



Typical Detector Circuits





Chip (C2) Assembly Notes

ThermoCompression Wedge Bonding:
1. Use 0.7 mil gold wire.
2. Tip temperature = 180°C MAX.
3. Stage temperature =160°C MAX.

Die attach
1. Silver epoxy with a maximum cure temperature of 125°C is recommended.

Package Assembly Notes

Lead Attach
1. 230°C Solder attach for 5 sec MAX.

CAUTION — Extremely Static Sensitive Devices

Notes

1. Chip top contact is cathode.
2. Detected output will be negative from the cathode.

Sampling Phase Detector

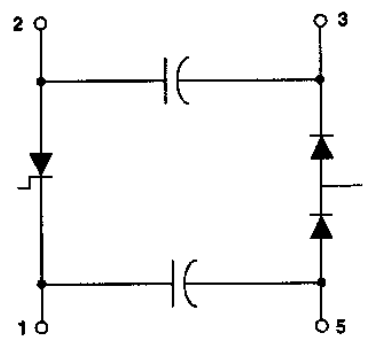
FEATURES

- Broad Band
- Phase Locking to 18 GHz
- Surface Mount Option

ENVIRONMENTAL RATINGS
(MAXIMUM)

Operating Temperature ..... -65°C to +150°C
Storage Temperature ..... -65°C to +150°C
Soldering Temperature ..... 230°C for 10 seconds

ELECTRICAL SCHEMATIC

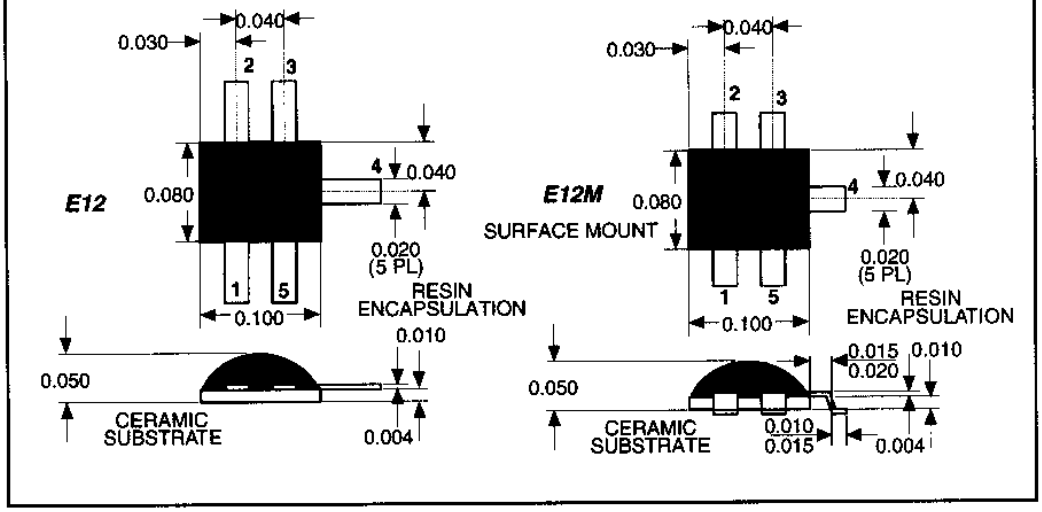


Electrical Specifications @ +25° C

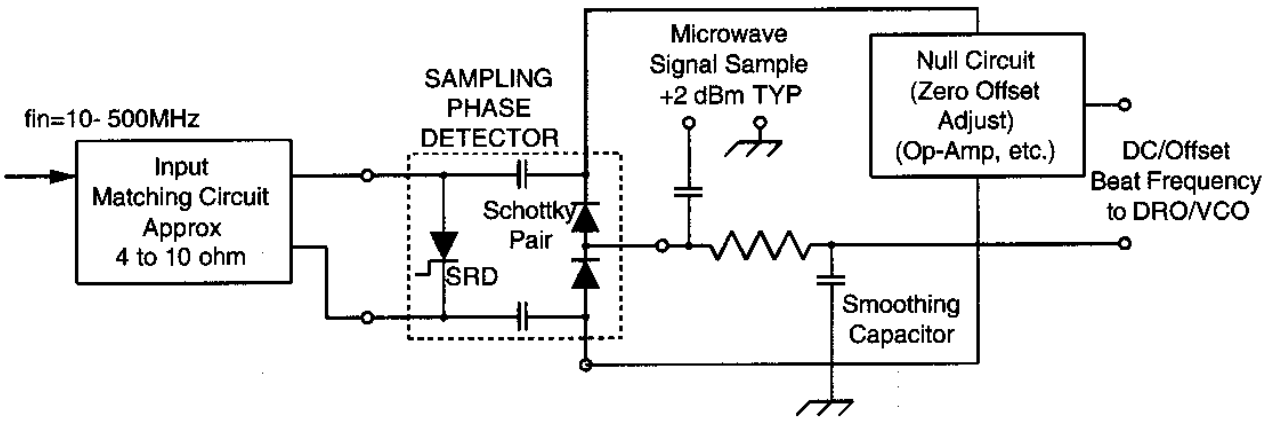
									Maximum Output Frequency (GHz)
MP7100	E12	300	0.10	16	0.5	0.3	25	50	18
MP7100M	E12M	300	0.10	16	0.5	0.3	25	50	18
MP7200	E12	400	0.10	16	0.5	0.3	25	50	18
MP7200M	E12M	400	0.10	16	0.5	0.3	25	50	18
MP7300	E12	600	0.10	16	0.5	0.3	25	50	18
MP7300M	E12M	600	0.10	16	0.5	0.3	25	50	18

NOTE: All devices are broad-band in operation. Different device values may be selected to optimize circuit performance.

PACKAGE OUTLINES
(dimensions in inches)

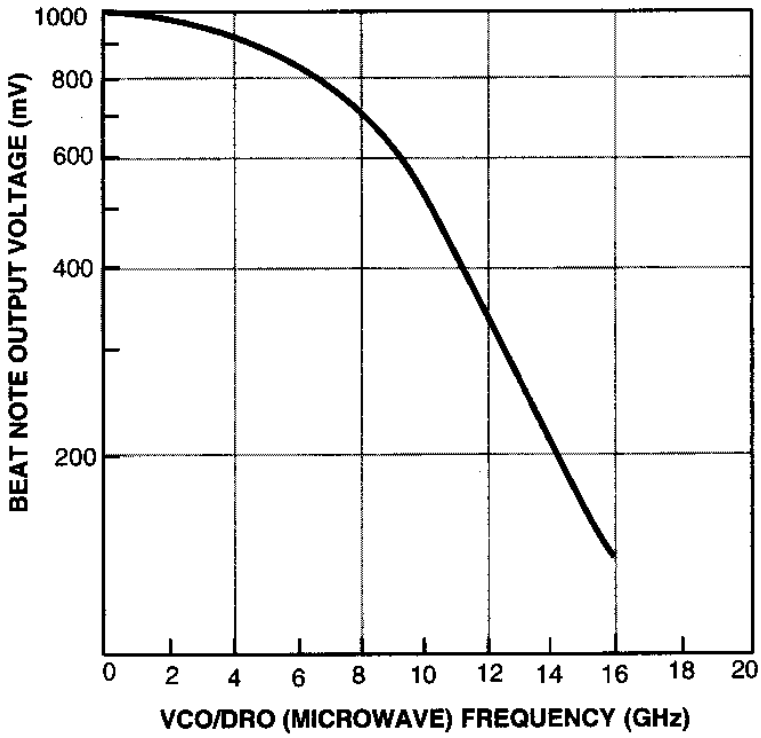


TYPICAL CIRCUIT APPLICATION



All units are broadband in capability

TYPICAL OUTPUT CHARACTISTICS
MP7100

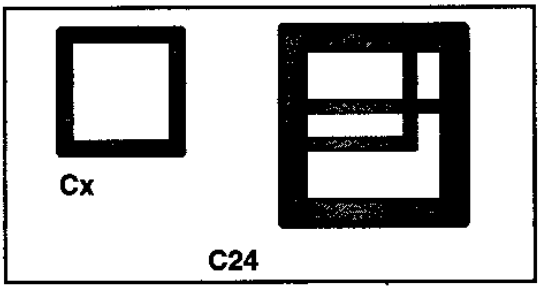


REF. FREQUENCY = 100 MHz
REF. INPUT POWER = +17dBm
DRO.VCO POWER = 0 dBm

MIS Chip Capacitors

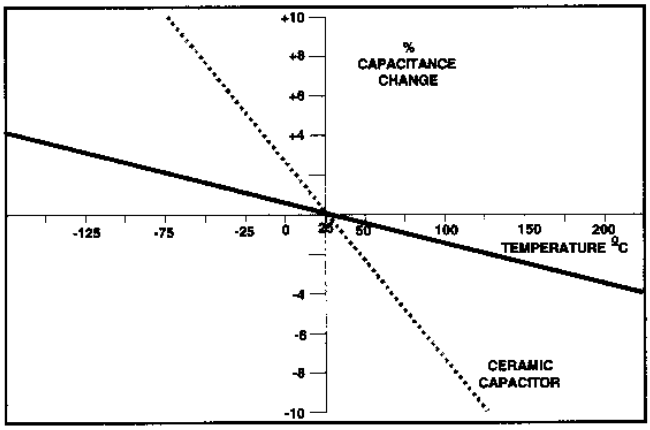
FEATURES

- High Reliability
- Low-Loss - ≤0.06 dB
- Temperature Stable ≤50 ppm
- Custom values and sizes available



Single MIS Chip Capacitors
Electrical Specifications @ +25° C

PART NUMBER	Capacitance C (1) (pF)	Chip Outline
MP0001	1	C3
MP0002	2	
MP0003	3	
MP0004	4	
MP0005	5	
MP0010	10	
MP0015	15	C4
MP0022	22	
MP0033	33	
MP0047	47	
MP0068	68	C5
MP0100	100	C6



Typical Capacitance Change for MIS vs. Ceramic Capacitor with Temperature

Binary Chip MIS Capacitors • Electrical Specifications @ +25° C

PART NUMBER	Capacitance Values (pF)	Max. Available Capacitance (pF)	Standoff Voltage (V)	Chip Outline
MP0402	0.25, 0.50 1.0, 2.0	3.75	100	C24
MP0404	0.5, 1.0 2.0, 4.0	7.5		
MP0408	1.0, 2.0 4.0, 8.0	15		
MP0416	2.0, 4.0 8.0, 16.0	30		

NOTE: [1] Custom capacitor values and sizes are available upon request. These devices are suitable for thermocompression wedge or ball bonding. Thermosonic bonding is not recommended. Please specify methof of die attach; epoxy or eutectic.

[2] Standard Capacitance Tolerance is ±10%
Binary Capacitance Tolerance is ±20%

Silicon Bipolar High f_T Low Noise Medium Power 12 Volt Transistors

MP4T243 Series

Features

- Low Phase Noise Oscillator Transistor
- 200 mW Driver Amplifier Transistor
- Operation to 8 GHz
- Available as Chip
- Available in Hermetic Surface Mount Packages

Description

The MP4T24300 series of high f_T NPN medium power bipolar transistors are designed for usage in oscillators to 8 GHz and for moderate power driver amplifiers through 3 GHz with noise figure below 4 dB.

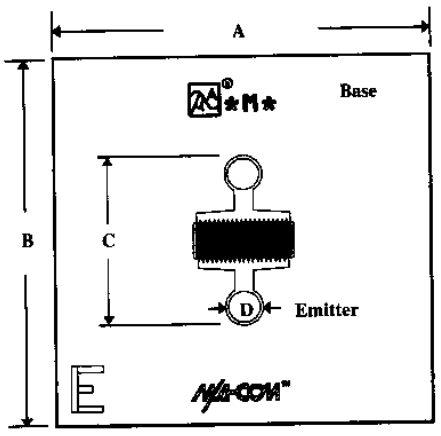
This industry standard transistor is available as a chip for hybrid oscillator circuits or in hermetic ceramic packages for military usage. The chip and hermetic packages may be screened to JANTXV equivalent levels.

The MP4T243 transistors utilize sub-micron photolithography and locos oxidation techniques to minimize parasitic capacitances. It also reduces shot noise enabling improved low noise characteristics. These transistors use a high temperature refractory barrier/gold metalization process. The MP4T243 transistor is emitter ballasted using ion implanted polysilicon resistors to prevent emitter current hot spots at high current operation.

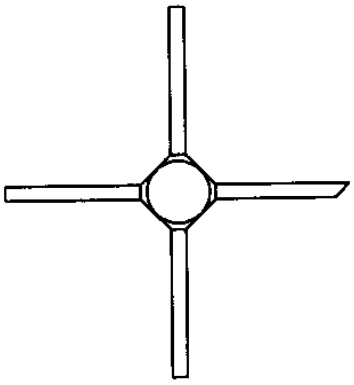
MP4T24300

A	0.013	0.325
B	0.013	0.325
C	0.007	0.18
D (Dia.)	0.002	0.030
E (Chip Thickness)	0.0045	0.114

Case Styles



Chip



Micro-X

Silicon Bipolar High f_T Low Noise Medium Power 12 Volt Transistors M

Absolute Maximum Ratings @ +25°C

Collector-Base Voltage [1]	V_{CBO}	Volts	25
Collector-Emitter Voltage [1]	V_{CEO}	Volts	12
Emitter-Base Voltage [1]	V_{EBO}	Volts	1.5
Collector Current [1]	I_C	mA	110
Junction Temperature	T_J	°C	200
Storage Temperature	T_{STG}	°C	-65 to +200
Power Dissipation [1,3]	P_T	mW	1000
Operating Temperature [2]	T_{CP}	°C	150

1. At 25°C case temperature (packaged transistors) or 25 °C mounting surface temperature (chip transistors).
2. Case or bonding surface temperature. Derate maximum power dissipation rating to zero watts at maximum operating temperature.
3. The thermal resistance of the MP4T24300 junction/case is 50 °C/watt nominal.

Electrical Specifications @ +25°C

Gain Bandwidth Product	V_{CE} = 12 volts I_C = 40 mA	f_T	GHz	7 typ
Insertion Power Gain	V_{CE} = 12 volts I_C = 40 mA f = 1 GHz f = 2 GHz	$\|S_{21E}\|^2$	dB	 12 min 8 typ
Noise Figure	V_{CE} = 12 volts I_C = 20 mA f = 1 GHz	NF	dB	 3 typ
Unilateral Gain	V_{CE} = 12 volts I_C = 40 mA f = 2 GHz	GTU (max)	dB	 11 typ
Maximum Available Gain	V_{CE} = 12 volts I_C = 40 mA f = 2 GHz	MAG	dB	 15 typ
Power Out at 1 dB Compression	V_{CE} = 12 volts I_C = 40 mA f = 1 GHz f = 2 GHz	P_{1dB}	dBm	 24 typ 22 typ

Moderate Power High f_T NPN Silicon Transistor — MP4T243 Series

Electrical Specifications @ +25°C

Parameter	Conditions	Symbol	Min.	Typical	Max.	Units
Collector Cut-off Current	V_{CB} = 15 volts I_E = 0 µA	I_{CBO}	—	—	10	µA
Emitter Cut-off Current	V_{EB} = 1 volt I_C = 0 µA	I_{EBO}	—	—	1	µA
Forward Current Gain	V_{CE} = 8 volts I_C = 50 mA	h_{FE}	20	90	250	—
Collector Base Junction Capacitance	V_{CB} = 10 volts I_E = 0 µA f = 1 MHz	C_{CB}	—	0.60	0.08	pF

Typical Scattering Parameters in the Micro-X Package
MP4T24335

V_{CE} = 12 Volts, I_C = 10 mA

Frequency (MHz)	S_{11E} Mag.	S_{11E} Ang.	S_{21E} Mag.	S_{21E} Angle	S_{12E} Mag.	S_{12E} Ang.	S_{22E} Mag.	S_{22E} Angle
1000	0.598	-157	3.610	84.4	0.114	27.6	0.378	-73.4
2000	0.612	177	2.373	64.6	0.127	27.3	0.286	-90.7
3000	0.549	153	1.658	44.2	0.146	29.4	0.253	-113.2
4000	0.709	133	1.355	26.1	0.173	30.9	0.269	-138.5
5000	0.794	115	1.182	9.1	0.207	30.2	0.314	-162.2
6000	0.899	96	1.063	-7.4	0.246	27.1	0.367	170.8
7000	1.013	75	0.973	-24.0	0.296	21.5	0.439	157.0
8000	1.108	53	0.878	-41.0	0.360	13.4	0.559	135.6
9000	1.161	30	0.773	-58.8	0.438	2.5	0.757	116.4
10000	1.161	13	0.677	-73.2	0.500	9.2	0.949	103.4
11000	1.161	13	0.677	-73.2	0.500	9.4	0.949	103.6

V_{CE} = 12 Volts, I_C = 20 mA

Frequency (MHz)	S_{11E} Mag.	S_{11E} Ang.	S_{21E} Mag.	S_{21E} Ang.	S_{12E} Mag.	S_{12E} Ang.	S_{22E} Mag.	S_{22E} Angle
1000	0.574	-153	4.510	90.3	0.103	32.1	0.330	-78.0
2000	0.591	170	2.433	64.3	0.126	30.1	0.239	-100.4
3000	0.635	147	1.777	45.3	0.150	32.9	0.205	-126.2
4000	0.696	128	1.465	27.5	0.181	32.1	0.217	-151.3
5000	0.788	110	1.298	11.1	0.215	29.4	0.262	-169.0
6000	0.890	51	1.180	-5.3	0.246	25.8	0.301	-167.7
7000	1.018	72	1.090	-23.1	0.285	19.6	0.366	156.2
8000	1.106	50	1.000	-40.9	0.347	12.1	0.457	134.3
9000	1.165	27	0.875	-60.0	0.399	6.3	0.625	115.1
10000	1.147	6	0.723	-79.5	0.485	13.5	0.847	101.7
11000	1.147	6	0.723	-79.5	0.485	13.5	0.847	101.7

Typical Scattering Parameters in the Micro-X Package
MP4T24335 (Continued)

V_{CE} = 12 Volts, I_C = 40 mA

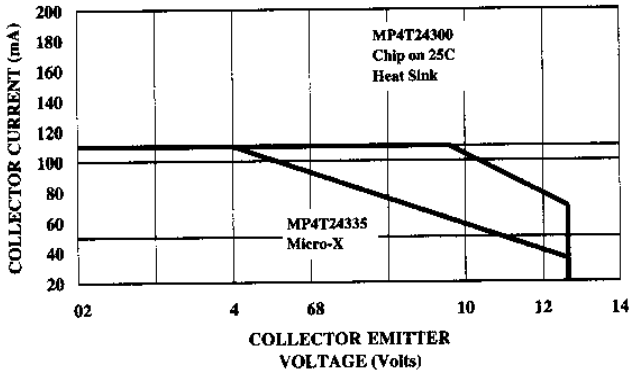
1000	0.571	-164	4.410	88.2	0.092	35.3	0.282	-83.2
2000	0.603	166	2.533	65.6	0.118	35.2	0.196	-105.6
3000	0.650	141	1.875	44.5	0.146	35.2	0.176	-127.1
4000	0.701	123	1.485	27.0	0.178	33.4	0.183	-147.4
5000	0.788	104	1.305	10.2	0.210	31.2	0.216	-169.0
6000	0.879	86	1.163	-6.0	0.247	26.3	0.255	171.8
7000	0.982	66	1.065	-23.1	0.290	21.4	0.317	153.6
8000	1.057	46	0.932	-40.8	0.333	14.6	0.391	135.8
9000	1.101	25	0.815	-57.8	0.389	5.8	0.502	116.6
10000	1.097	5	0.675	-76.6	0.450	-8.5	0.656	96.7

V_{CE} = 12 Volts, I_C = 60 mA

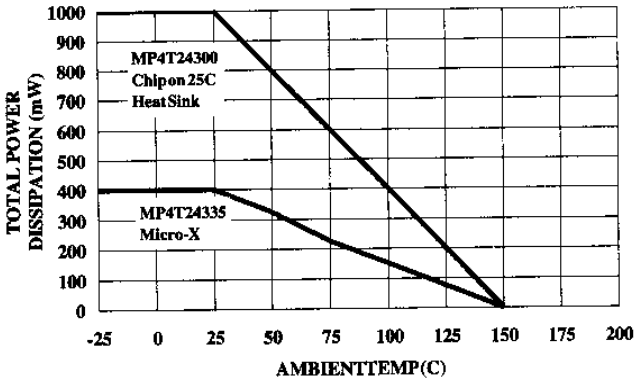
1000	0.577	-168	4.055	86.4	0.084	35.1	0.268	-72.9
2000	0.608	165	2.330	64.7	0.111	37.7	0.200	-88.8
3000	0.652	140	1.728	44.4	0.140	38.0	0.185	-108.3
4000	0.701	123	1.382	27.1	0.171	36.5	0.192	-127.9
5000	0.786	105	1.215	10.6	0.204	34.6	0.218	-147.4
6000	0.874	86	1.085	-5.6	0.242	29.8	0.254	-160.4
7000	0.972	67	0.990	-22.0	0.288	5.0	0.320	-161.7
8000	1.045	46	0.873	-39.4	0.334	18.1	0.396	-145.7
9000	1.086	25	0.760	-55.6	0.394	9.7	0.508	125.8
10000	1.084	7	0.638	-73.3	0.462	-4.7	0.668	105.7

Typical Performance Curves

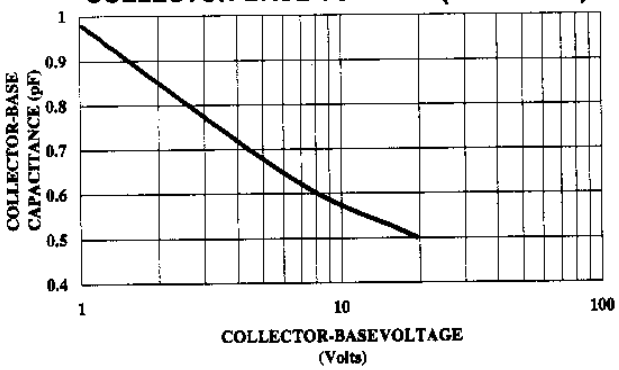
DC SAFE OPERATING RANGE AT 25°C



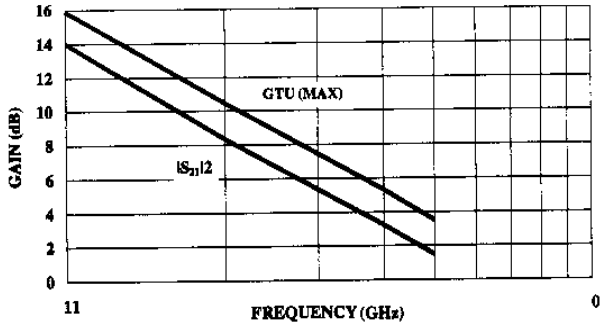
POWER DERATING CURVES



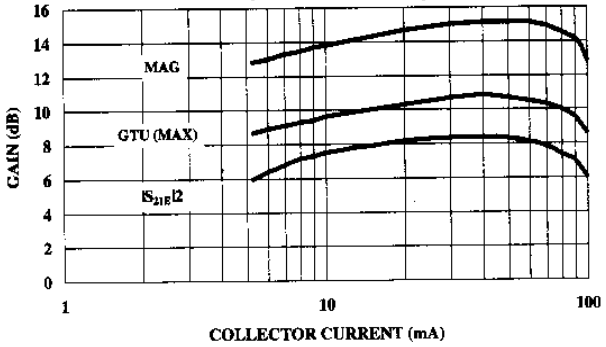
NOMINAL COLLECTOR-BASE CAPACITANCE vs COLLECTOR-BASE VOLTAGE (MP4T24335)



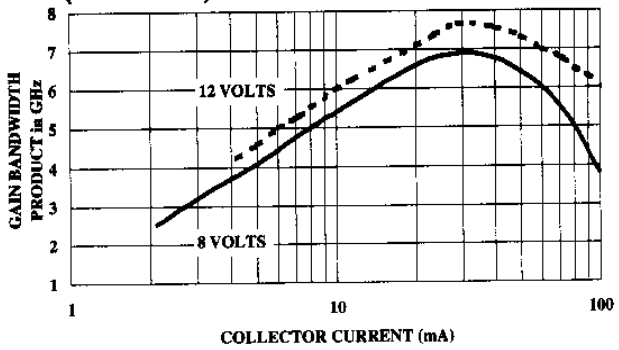
NOMINAL GAIN vs FREQUENCY at V_{CE} = 12 Volts and I_C = 20 mA (MA4T24335)



NOMINAL GAIN vs COLLECTOR CURRENT at F = 2 GHz and V_{CE} = 12 VOLTS (MP4T24335)

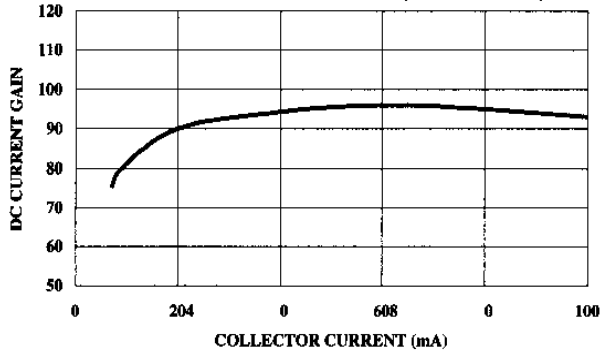


NOMINAL GAIN BANDWIDTH PRODUCT (f_T) vs COLLECTOR CURRENT at V_{CE} = 8 and 12 VOLTS (MP4T24335)

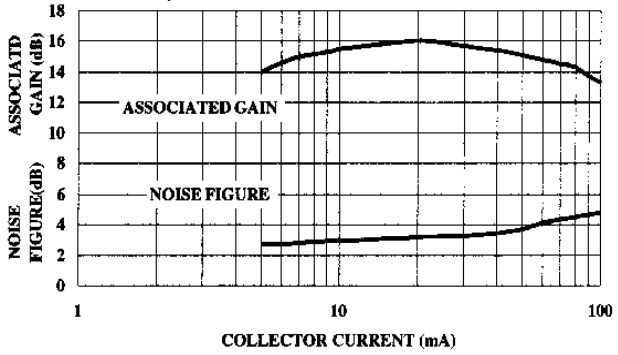


Typical Performance Curves (Contd)

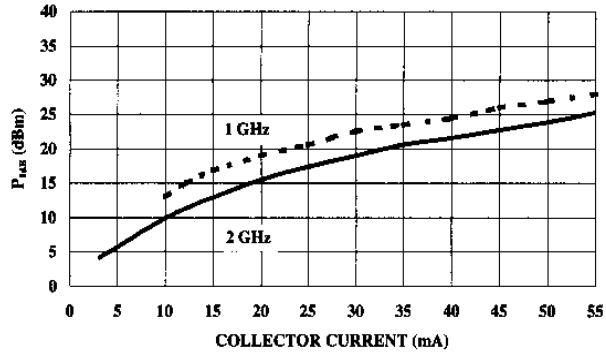
NOMINAL DC CURRENT GAIN (h_{FE}) vs COLLECTOR CURRENT at V_{CE} = 8 VOLTS (MP4T24335)



NOMINAL NOISE FIGURE and ASSOCIATED GAIN vs COLLECTOR CURRENT at 1 GHz and V_{CE} = 12 VOLTS (MP4T24335)



NOMINAL OUTPUT POWER at the 1dB COMPRESSION POINT vs COLLECTOR CURRENT at F = 1 and 2 GHz, V_{CE} = 8 VOLTS (MP4T24335)

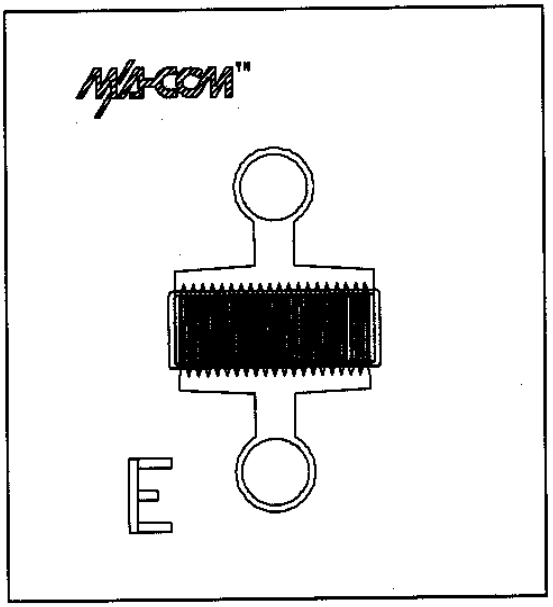


Medium Power, 12 Volt, High f_T NPN Silicon Bipolar Transistor

MP4T56800

Features

- High Output Power, 23 dBm P_{1dB} @ 1 GHz
- High Gain-Bandwidth Product, 4 GHz f_T
- High Power Gain, $|S_{21E}|^2$ = 12 dB @ 1 GHz
  GTU (max.) = 11 dB @ 2 GHz



Description

The MP4T568 is a medium power, high f_T silicon NPN transistor designed to work at 8 - 12 volts V_{CC} and with collector currents up to 150 mA.

It is offered as a chip, MP4T56800, for use in hybrid applications as an amplifier or moderate power oscillator. It can also be supplied in a common collector ceramic package.

This chip transistor is designed for use in medium power amplifiers through 3 GHz and oscillators operating from VHF through 5 GHz. A refractory barrier/gold metalization system utilized to provide maximum device reliability and ease of chip and wire assembly. This transistor series is also manufactured with silicon oxide and silicon nitride passivation to assure reliability and low 1/f noise.

MP4T56800

A	0.013	0.35
B	0.013	0.35
C	0.0020	0.05
D	0.0045	0.11

Electrical Specifications @ +25°C

Gain Bandwidth Product	V_{CE} = 10 V I_C = 60 mA	f_T	GHz	4.2 typ.
Insertion Power Gain	V_{CE} = 10 V I_C = 60 mA f = 1 GHz	$\|S_{21E}\|^2$	dB	12 typ.
Unilateral Gain	V_{CE} = 10 V I_C = 60 mA f = 1 GHz	GTU (max)	dB	16 typ.
Power Out @ 1 dB Compression	V_{CE} = 10 V I_C = 100 mA f = 1 GHz	P_{1dB}	dBm	22.5 typ.

Maximum Ratings @ +25°C

Collector-Base Voltage	V_{CBO}	25 V
Collector-Emitter Voltage	V_{CEO}	15 V
Emitter-Base Voltage	V_{EBO}	3 V
Collector Current	I_C	150 mA
Junction Temperature	T_j	200 °C
Storage Temperature	T_S	-65°C to 200°C
Power Dissipation [1]	P_D	1500 mW
Thermal Resistance	$R_{TH(J-C)}$	40°C/W

1. See figure 1 for power derating.

Typical Scattering Parameters, V_{CE} = 10 Volts, I_C = 40 mA
MP4T56800

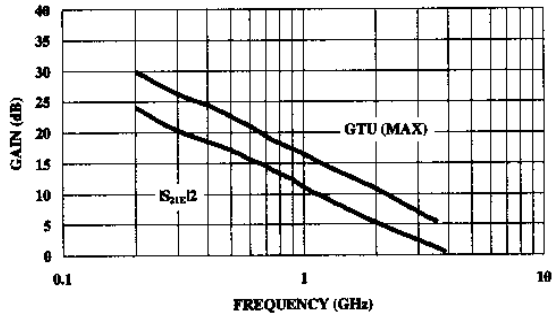
400	0.794	-141.2	8.75	104.8	0.081	24.3	0.478	-106.0
600	0.795	-157.1	6.08	94.4	0.085	19.6	0.417	-122.0
800	0.796	-166.5	4.64	87.2	0.087	17.8	0.392	-131.1
1000	0.796	-173.2	3.76	81.3	0.089	16.7	0.383	-136.6
1500	0.794	174.3	2.55	69.7	0.094	17.5	0.382	-142.6
2000	0.794	166.7	1.93	59.5	0.098	17.9	0.396	-144.7
2500	0.793	159.4	1.58	50.6	0.102	19.6	0.408	-145.6
3000	0.794	153.0	1.32	42.0	0.108	20.7	0.421	-144.8
3500	0.791	146.5	1.15	33.7	0.115	21.5	0.437	-143.3
4000	0.789	141.2	1.02	26.7	0.123	20.6	0.460	-141.7

Typical Scattering Parameters, V_{CE} = 10 Volts, I_C = 80 mA
MP4T56800

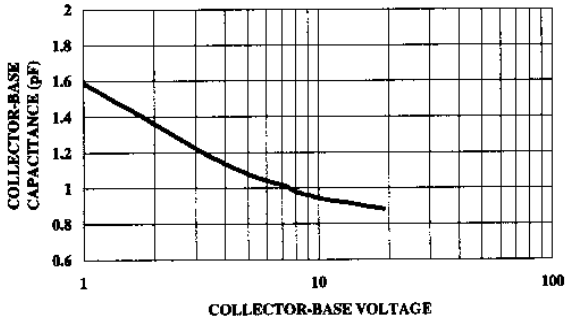
400	0.798	-144.6	8.94	103.2	0.077	23.3	0.476	-113.3
600	0.800	-159.6	6.17	93.2	0.080	19.4	0.425	-128.9
800	0.800	-168.5	4.70	86.4	0.082	18.3	0.403	-137.4
1000	0.800	-175.0	3.80	80.7	0.084	17.7	0.395	-142.5
1500	0.798	174.1	2.58	69.5	0.090	19.0	0.394	-147.9
2000	0.797	165.8	1.95	59.7	0.095	20.1	0.405	-149.6
2500	0.796	158.7	1.70	50.9	0.099	21.7	0.415	-150.0
3000	0.797	152.3	1.34	42.4	0.107	22.8	0.425	-149.0
3500	0.794	146.3	1.16	34.6	0.115	23.3	0.437	-147.2
4000	0.791	140.6	1.03	27.3	0.122	22.5	0.456	-145.2

Typical Performance Curves @ +25°C

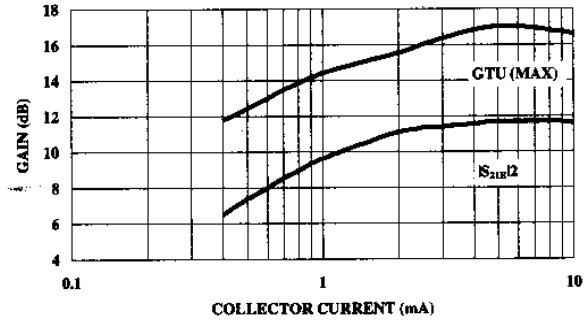
GAIN vs FREQUENCY
V_{CE} = 10 V, I_C = 80 mA



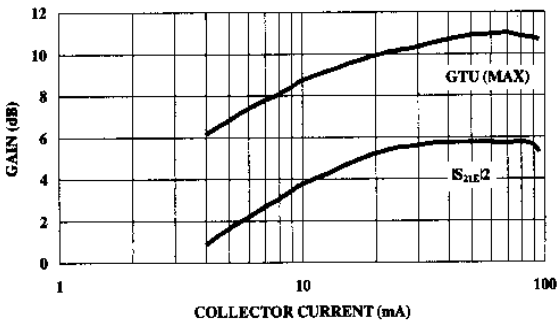
CAPACITANCE vs COLLECTOR-BASE VOLTAGE



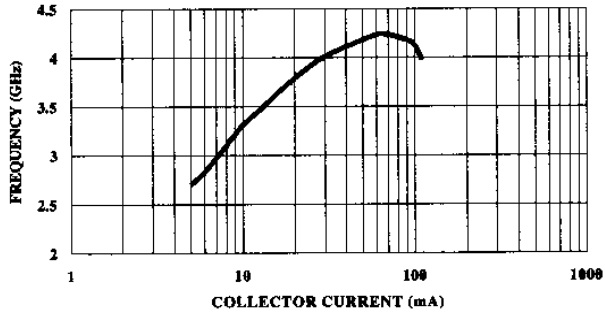
GAIN vs COLLECTOR CURRENT
V_{CE} = 10 V, f = 1 GHz



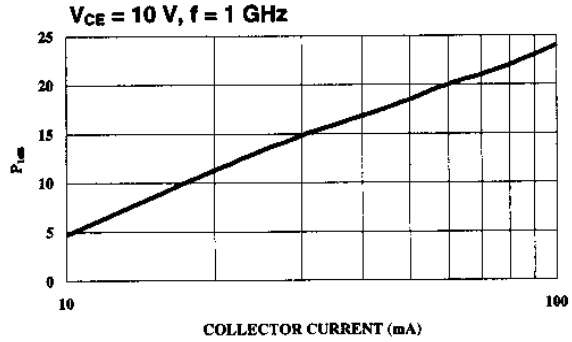
GAIN vs COLLECTOR CURRENT
V_{CE} = 10 V, f = 2 GHz



FREQUENCY WHERE S_{21} = 0 (F_S)
V_{CE} = 10 V



POWER OUTPUT @ 1 dB COMPRESSION
V_{CE} = 10 V, f = 1 GHz



Low Current 8 Volt, Low Noise High f_T Silicon Transistor

MP4T6825 Series

Features

- Low Current Operation
- High f_T (8 GHz)
- Low Noise Figure with 1-5 mA Current
- Low Phase Noise
- Inexpensive
- Available on Tape and Reel

Description

The MP4T6825 series of low current silicon bipolar transistors provide low noise figure at a bias of 5-10 volts and collector current of 1-5 mA. These inexpensive surface mount transistors are useful for low noise amplifiers and VCOs from VHF through 2.5 GHz.

The MP4T6825 series has high f_T (8 GHz) and provides approximately 1.5 dB noise figure with 1-3 mA current. These transistors also have low phase noise when used in 5-10 volt low current VCOs through 3 GHz.

The MP4T6825 series are inexpensive transistors designed for RF systems that require low current drain. This family of transistors is available in chip (MP4T682500), SOT-23 (MP4T682533), SOT-143 (MP4T682539), and in the Micro-X (MP4T682535) packages. Surface mount packages are available on tape and reel.

MP4T682500

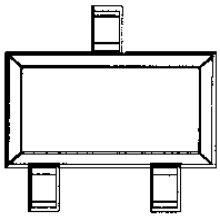
A	0.013	0.35
B	0.013	0.35
C	0.0016	0.040
D	0.0045	0.11

Absulote Maximum Ratings at +25°C

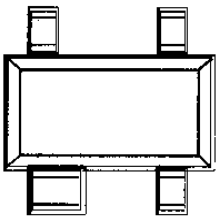
Parameter	
Collector-Base Voltage	20V
Collector-Emitter Voltage	12 V
Emitter-Base Voltage	1.5 V
Collector Current	25 mA
Junction Temperature	+200°C[2]
Storage Temperature	
Chips or Ceramic Packages	-65°C to +200°C
Plastic Packages	-65°C to +150°C
Power Dissipation[1]	

1. See power derating curves.
2. Die or ceramic packages -150°C for plastic pacakges.

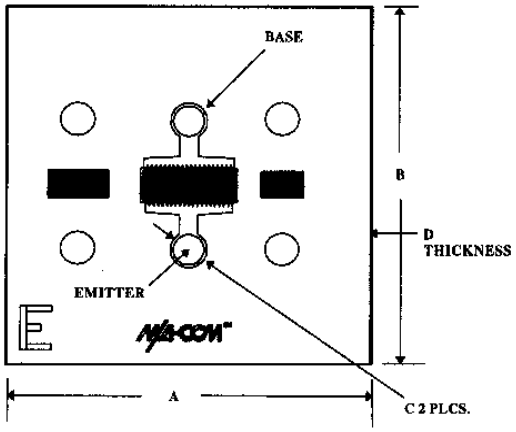
SOT-23



SOT-143



Chip



Electrical Specifications at +25°C

Symbol	Parameter	Test Conditions	Units	MP4T6825	MP4T6825-BLK	MP4T6825-TR	MP4T6825-TR1
f_T	Gain Bandwidth Product	V_{CE} = 8V I_C = 8 mA	GHz	8 typ.	8 typ.	8 typ.	8 typ.
$\|S_{21E}\|^2$	Insertion Power Gain	V_{CE} = 8V I_C = 8 mA f = 1 GHz f = 2 GHz	dB	 15 typ. 8 typ.	 14 typ. 7 typ.	 15 typ. 8 min.	 14 typ. 7 typ.
NF	Noise Figure	V_{CE} = 8V I_C = 2 mA f = 1 GHz f = 2 GHz	dB	 1.8 max. 2.1 typ.	 1.9 max. 2.2 typ.	 1.8 max. 2.1 typ.	 1.9 max. 2.2 typ.
GTU (max)	Unilateral Gain	V_{CE} = 8V I_C = 8 mA f = 1 GHz f = 2 GHz	dB	 17 typ. 11 typ.	 16 typ. 10 typ.	 17 typ. 11 typ.	 16 typ. 10 typ.
MAG	Maximum Available Gain	V_{CE} = 8V I_C = 8 mA f = 1 GHz f = 2 GHz	dB	 18 typ. 13 typ.	 17 typ. 12 typ.	 18 typ. 13 typ.	 17 typ. 12 typ.
P_{1dB}	Power Out at 1dB Compression	V_{CE} = 8V I_C = 15 mA f = 1 GHz f = 2 GHz	dBm	 15 typ. 13.5 typ.	 14 typ. 12.5 typ.	 14 typ. 12.5 typ.	 15 typ. 13.5 typ.
$R_{TH\ (J-A)}$	Thermal Resistance	Junction/ Ambient (Free Air)	°C	—	650 typ.	500 typ.	625 typ.
$R_{TH\ (J-C)}$	Thermal Resistance	Junction/ Case	°C/W	70 max.[1]	200 typ.	200 typ.	200 typ.

1. Junction to infinite heat sink.

Electrical Specifications at +25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Collector Cut-off Current	V_{CB} = 8 V I_E = 0	I_{CBO}	—	—	100	nA
Emitter Cut-off Current	V_{EB} = 1 V I_C = 0	I_{EBO}	—	—	1	µA
Forward Current Gain	V_{CE} = 8 V I_C = 5 mA	h_{FE}	30	110	250	—
Collector-Base Junction Capacitance	V_{CB} = 8 V I_E = 0 f = 1 MHz	C_{OB}	—	0.25	0.40	pF

MP4T852535

Typical Scattering Parameters in the Micro-X Package

V_{CE} = 8 Volts, I_C = 5 mA

Frequency (MHz)	S_{11E} Mag	S_{11E} Ang	S_{21E} Mag	S_{21E} Ang	S_{12E} Mag	S_{12E} Ang	S_{22E} Mag	S_{22E} Ang
100	0.66	-15.7	12.95	164.7	0.01	86.0	0.97	-6.7
300	0.54	-42.2	10.74	139.8	0.02	71.9	0.88	-16.8
500	0.41	-61.2	8.54	122.7	0.03	66.4	0.79	-22.4
700	0.32	-75.3	6.91	110.8	0.04	64.7	0.73	-25.9
900	0.25	-86.9	5.74	101.8	0.05	63.8	0.69	-28.5
1500	0.14	-115.2	3.75	83.3	0.08	62.0	0.63	-35.5
1900	0.11	-142.6	3.10	73.1	0.10	59.1	0.61	-42.1
2500	0.09	143.9	2.46	60.6	0.12	55.6	0.58	-50.5
2900	0.10	128.4	2.15	52.1	0.14	53.0	0.56	-55.7
3300	0.10	108.0	1.95	47.2	0.15	51.1	0.56	-61.2
3900	0.15	92.4	1.72	35.9	0.17	46.7	0.53	-69.6
4500	0.17	79.4	1.56	26.4	0.20	45.0	0.53	-79.6
4900	0.20	69.5	1.50	19.4	0.21	42.2	0.52	-85.3
5500	0.23	58.8	1.35	9.9	0.23	37.9	0.50	-92.9

V_{CE} = 8 Volts, I_C = 10 mA

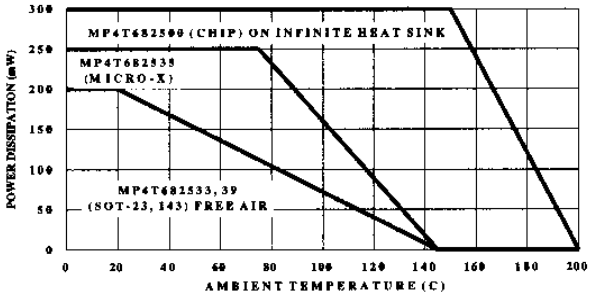
100	0.49	-22.0	17.06	160.4	0.01	87.0	0.96	-7.9
300	0.36	-55.9	12.71	131.5	0.02	71.9	0.83	-17.6
500	0.26	-78.4	9.37	114.5	0.03	68.8	0.74	-21.5
700	0.20	-96.0	7.28	103.5	0.04	68.8	0.70	-24.0
900	0.13	-125.3	4.93	88.8	0.06	67.8	0.65	-28.6
1500	0.10	-152.7	3.76	78.7	0.07	65.9	0.63	-33.4
1900	0.11	160.2	3.07	69.0	0.09	63.6	0.61	-40.0
2500	0.13	134.4	2.43	57.3	0.12	59.2	0.58	-48.9
2900	0.14	115.4	2.12	49.2	0.13	56.7	0.57	-54.4
3300	0.15	102.3	1.92	44.2	0.15	54.4	0.57	-60.7
3900	0.20	90.5	1.70	33.3	0.17	50.2	0.54	-69.3
4500	0.27	79.2	1.53	23.4	0.19	47.8	0.54	-80.0
4900	0.25	70.0	1.48	16.4	0.21	45.0	0.53	-86.0
5500	0.29	59.3	1.32	6.8	0.23	40.5	0.51	-94.2

V_{CE} = 8 Volts, I_C = 20 mA

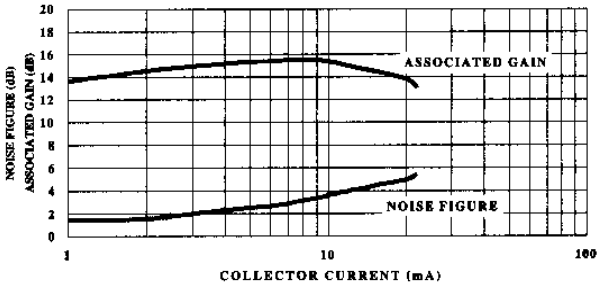
100	0.26	-48.6	17.16	154.3	0.01	84.7	0.93	-0.8
300	0.22	-105.7	10.98	122.3	0.02	72.6	0.80	-14.8
500	0.20	-136.0	7.55	106.7	0.02	71.5	0.75	-17.3
700	0.20	-155.8	5.70	97.0	0.03	72.3	0.72	-19.8
900	0.20	-169.8	4.56	89.8	0.04	72.5	0.70	-22.4
1500	0.22	161.3	2.88	74.1	0.06	70.7	0.68	-31.3
1900	0.24	146.4	2.34	64.4	0.08	68.6	0.67	-38.4
2500	0.27	126.6	1.86	53.1	0.10	65.6	0.64	-48.2
2900	0.29	115.1	1.63	45.1	0.12	64.1	0.63	-54.5
3300	0.31	104.4	1.49	39.5	0.14	61.9	0.63	-61.5
3900	0.36	92.3	1.33	29.7	0.16	58.3	0.61	-70.7
4500	0.39	79.7	1.20	18.5	0.19	55.5	0.59	-81.0
4900	0.42	70.1	1.15	11.5	0.20	52.7	0.58	-88.0
5500	0.46	57.6	1.02	2.9	0.23	48.2	0.56	-96.7

Typical Performance Curves (MP4T682535)

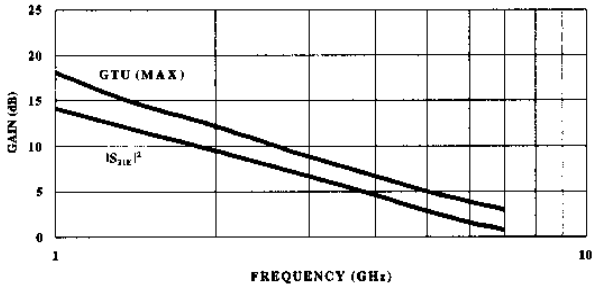
POWER DERATING CURVES



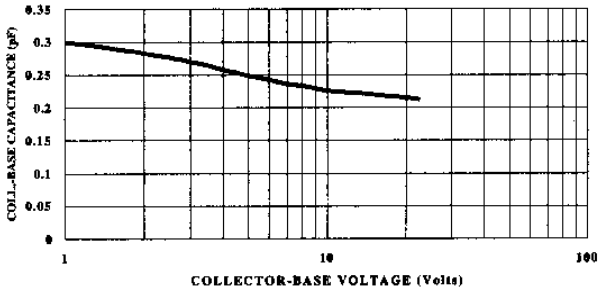
NOISE FIGURE and ASSOCIATED GAIN at VCE = 8 V, 1 GHz vs COLLECTOR CURRENT



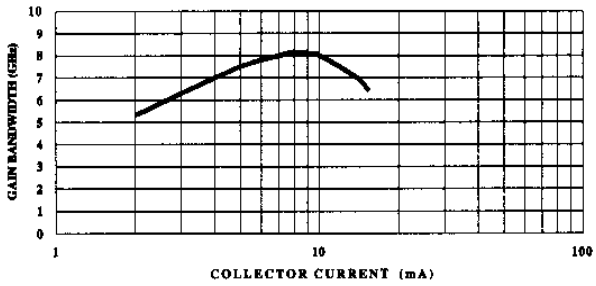
GAIN vs FREQUENCY at VCE=8 V and IC = 5 mA



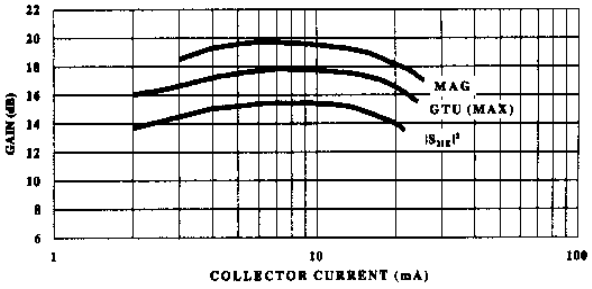
COLLECTOR-BASE CAPACITANCE (C_{OB}) vs COLLECTOR-BASE VOLTAGE



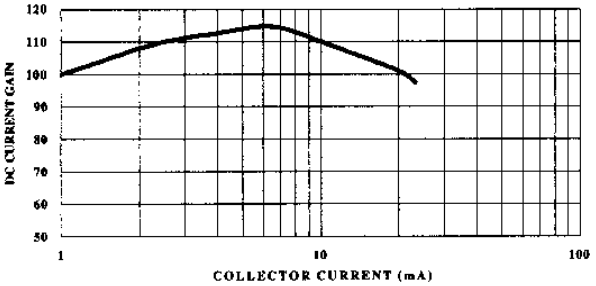
GAIN BANDWIDTH PRODUCT (f_T) vs COLLECTOR CURRENT at VCE=8 V



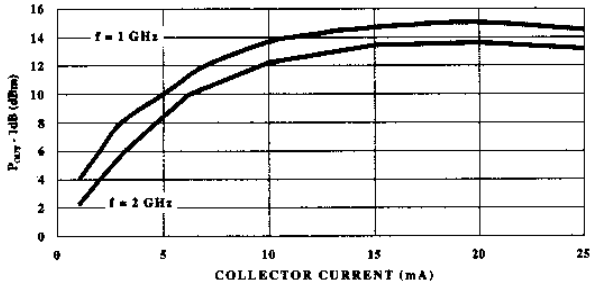
GAIN vs COLLECTOR CURRENT at 1 GHz, VCE=8 V



DC CURRENT GAIN (h_{FE}) vs COLLECTOR CURRENT at VCE = 8 V



OUTPUT POWER at 1 dB COMPRESSION POINT vs COLLECTOR CURRENT VCE=8V



Moderate Power High f_T NPN Silicon Transistor

MP4T856 Series

Features

- High Output Power
  - 16 dBm P_{1dB} @ 1 GHz
  - 10 dBm P_{1dB} @ 2 GHz
- High Gain Bandwidth Product
- 8-9 GHz f_T
- High Power Gain
  - $|S_{21E}|^2$ = 15 dB @ 1 GHz
  - $|S_{21E}|^2$ = 9 dB @ 2 GHz
- Low Noise Figure
  - 1.5 dB @ 1.5 GHz

Description

The MP4T856 series of moderate power NPN transistors provides low noise at 5-10 volts operating voltage. These transistors are designed to optimize gain at moderate collector currents (20 - 60 mA).

They are useful as moderate power (+23-24 dBm) low noise amplifiers at 0.5-2 GHz or as low noise VCO transistors from 100 MHz to 5.0 GHz.

These inexpensive transistors are available in the SOT-23 (MP4T85633), the SOT-143 (MP4T85639), and the Micro-X (MP4T85635) packages. They are also available as chips (MP4T85600) for hybrid circuits. The plastic packages SOT-23 and SOT-143 are normally supplied on tape and reel.

MP4T85600

A	0.013	0.35
B	0.013	0.35
C	0.0012	0.03
D	0.0045	0.11

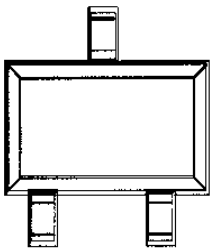
Absolute Maximum Ratings[1]

Collector-Base Voltage	20 V
Collector-Emitter Voltage	12 V
Emitter-Base Voltage	3.0 V
Collector Current	100 mA
Junction Temperature	
Chip or Ceramic Package	+200°C
Plastic Package	+150°C
Storage Temperature	
Chip or Ceramic Package	-65°C to +200°C
Plastic Package	-65°C to +200°C
Power Dissipation (die)	1200 mW[1]

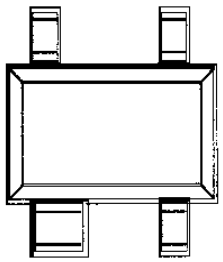
1. See power derating curves.

Package Outline

SOT-23

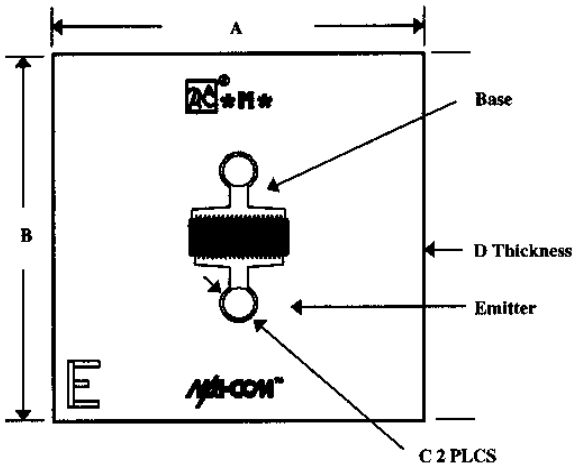


SOT-143



Case Styles

Chip (MP4T85600)



MP4T856 Series
Electrical Specifications @ +25°C

	[illegible]	[illegible]		[illegible] Chips	[illegible] SOT-3	[illegible]	[illegible] SOT-323
f_T	Gain Bandwidth Product	V_{CE}=8V, I_C=30mA	GHz	7.0 typ.	7.0 typ.	7.0 typ.	7.0 typ.
$\|S_{21E}\|^2$	Insertion Power Gain	V_{CE}=8V, I_C=20MA, f=1GHz	dB	13.5 min.	12 min.	13.0 min.	12 min.
NF	Noise Figure	V_{CE}=8V, I_C=10mA, f=1GHz	dB	1.6 max.	1.7 max.	1.6 max.	1.7 max.
GA	Associated Gain	V_{CE}=8V, I_C=10mA, f=1GHz	dB	16 typ.	15 typ.	16 typ.	15 typ.
P_{1dB}	Output Power at 1 dB Compression	V_{CE}=8V, I_C=40mA, f=1GHz, f=2GHz	dBm	16 typ. 10 typ.	13 typ. 10 typ.	16 typ. 10 typ.	13 typ. 10 typ.
$R_{TH(J-A)}$	Thermal Resistance	Junction/Ambient (Free Air)	°C/W	-	600 max.	550 max	600 max.
$R_{TH(J-C)}$	Thermal Resistance	Junction/Case	°C/W	60 max.[1]	200 typ.	200 typ.	200 typ.

1 See power derating curves.

Electrical Specifications @ +25°C

I_{CBO}	Collector Cut-off Current	V_{CB} = 8V, I_E = 0	µA	-	-	1.0
I_{EBO}	Emitter Cut-off Current	V_{EB} = 1V, I_C = 0	µA	-	-	1
h_{FE}	Forward Current Gain	V_{CE} = 8V, I_C = 20mA	-	20	100	250
C_{OB}	Collector-Base Junction Capacitance	V_{CB} = 8 V, f = 1 MHz	pF	-	0.62	0.75

MP4T85635
Typical Scattering Parameters in the Micro-X Package
V_{CE} = 8 Volts, I_C = 10 mA

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
200	0.581	-97.9	16.95	117.1	0.033	44.9	0.685	-46.4
400	0.516	-151.1	10.72	83.5	0.045	27.8	0.481	-65.0
600	0.496	177.1	7.59	60.3	0.054	17.9	0.396	-79.0
800	0.487	153.4	5.84	40.7	0.064	8.6	0.355	-91.6
1000	0.483	133.2	4.74	22.7	0.074	1.0	0.334	-105.0
1200	0.481	114.9	3.99	5.6	0.085	11.4	0.324	-118.0
1400	0.479	97.7	3.46	-11.0	0.097	22.2	0.317	-132.0
1600	0.478	81.2	3.06	-27.3	0.109	33.6	0.311	-147.0
1800	0.478	65.1	2.74	-43.4	0.121	45.4	0.311	-162.0
2000	0.476	49.4	2.49	-59.3	0.133	57.3	0.315	-177.0
2200	0.475	33.9	2.29	-75.0	0.145	69.5	0.314	168.4
2400	0.475	18.4	2.12	-90.6	0.158	82.0	0.311	152.6
2600	0.474	3.9	1.98	-106.1	0.170	94.7	0.317	136.0
2800	0.473	-12.2	1.86	-121.5	0.183	107.3	0.324	121.0
3000	0.472	-27.4	1.76	-136.7	0.197	120.1	0.323	107.0
4000	0.472	-103.3	1.39	148.1	0.267	174.4	0.336	28.5
5000	0.476	-176.5	1.17	74.8	0.340	107.1	0.367	-49.0
6000	0.484	104.4	1.03	3.1	0.415	38.2	0.375	-126.0

MP4T85635
Typical Scattering Parameters in the Micro-X Package
V_{CE} = 8 Volts, I_C = 20 mA

200	0.469	-124.6	21.56	107.4	0.026	47.0	0.546	-53.6
400	0.456	-170.4	12.34	77.1	0.037	36.6	0.363	-69.8
600	0.453	163.3	8.50	56.0	0.050	28.2	0.298	-81.1
800	0.452	142.9	6.48	37.7	0.062	18.5	0.269	-92.9
1000	0.451	124.9	5.23	20.5	0.075	7.5	0.254	-105.6
1200	0.451	108.1	4.40	3.9	0.089	4.1	0.247	-119.2
1400	0.449	91.9	3.80	-12.3	0.102	16.2	0.244	-133.0
1600	0.448	76.2	3.35	-28.2	0.116	28.8	0.242	-147.8
1800	0.450	60.8	3.01	-44.0	0.130	41.5	0.243	-163.0
2000	0.448	45.5	2.73	-59.6	0.143	54.3	0.246	-177.5
2200	0.448	30.6	2.51	-75.2	0.157	67.3	0.246	167.9
2400	0.448	15.7	2.32	-90.6	0.170	80.4	0.246	152.4
2600	0.446	1.5	2.17	-105.9	0.184	93.6	0.251	136.5
2800	0.445	-14.0	2.04	-121.1	0.198	106.9	0.258	121.9
3000	0.442	-29.1	1.92	-136.3	0.212	120.1	0.260	107.2
4000	0.443	-104.0	1.52	148.8	0.281	172.7	0.275	29.1
5000	0.442	-177.9	1.29	75.3	0.351	104.5	0.307	-48.5
6000	0.456	105.2	1.13	3.2	0.419	35.6	0.318	-126.1

MP4T85635
Typical Scattering Parameters in the Micro-X Package
V_{CE} = 8 Volts, I_C = 40 mA

200	0.426	-147.7	23.88	99.9	0.021	51.7	0.443	-56.7
400	0.438	175.6	12.94	72.7	0.034	43.8	0.296	-68.7
600	0.441	153.3	8.80	52.9	0.048	34.7	0.250	-79.0
800	0.442	134.9	6.67	35.3	0.062	23.9	0.230	-90.5
1000	0.442	118.0	5.38	18.5	0.076	11.9	0.222	-103.3
1200	0.442	101.9	4.51	2.2	0.090	0.5	0.219	-117.1
1400	0.441	86.1	3.90	-13.8	0.105	13.4	0.218	-131.1
1600	0.441	70.6	3.43	-29.6	0.119	26.4	0.218	-146.0
1800	0.443	55.3	3.08	-45.3	0.133	39.7	0.221	-161.3
2000	0.443	40.2	2.79	-60.8	0.147	52.9	0.225	-175.9
2200	0.443	25.3	2.56	-76.3	0.161	66.2	0.226	169.6
2400	0.443	10.6	2.37	-91.6	0.174	79.6	0.227	154.1
2600	0.442	-4.7	2.21	-106.8	0.188	93.1	0.233	138.3
2800	0.441	-19.2	2.07	-122.0	0.202	106.5	0.242	123.8
3000	0.440	-34.3	1.95	-137.2	0.216	120.0	0.244	109.4
4000	0.446	-109.5	1.54	148.1	0.283	172.3	0.264	32.3
5000	0.447	174.0	1.30	74.7	0.351	104.0	0.297	-43.8
6000	0.466	100.3	1.13	2.9	0.414	35.3	0.307	-119.7

MP4T85639
Typical Scattering Parameters in the SOT-143 Package
V_{CE} = 3 Volts, I_C = 20 mA

200	0.471	-118.4	19.14	115.5	0.034	56.7	0.492	-54.8
400	0.457	-152.6	10.70	97.7	0.048	57.2	0.297	-66.2
600	0.458	-168.7	7.33	88.2	0.064	60.7	0.219	-71.4
800	0.461	-178.9	5.57	81.4	0.079	61.1	0.183	-75.3
1000	0.466	173.0	4.48	75.7	0.095	62.3	0.168	-80.1
1200	0.471	166.0	3.76	70.3	0.110	60.7	0.158	-85.0
1400	0.476	160.2	3.24	65.5	0.128	60.1	0.156	-89.3
1600	0.480	155.0	2.86	61.1	0.144	59.0	0.154	-94.0
1800	0.485	150.1	2.56	56.7	0.158	56.9	0.157	-98.3
2000	0.491	144.8	2.32	52.3	0.172	56.3	0.157	-101.4
2200	0.488	141.5	2.12	48.8	0.190	55.7	0.167	-104.8
2400	0.496	137.1	1.97	44.7	0.207	53.2	0.172	-108.7
2600	0.499	132.9	1.83	40.8	0.220	50.6	0.180	-111.6
2800	0.510	129.4	1.71	37.3	0.233	48.8	0.183	-115.9
3000	0.513	125.8	1.62	34.0	0.249	46.8	0.184	-118.5

MP4T85639
Typical Scattering Parameters in the SOT-143 Package
V_{CE} = 3 Volts, I_C = 40 mA

200	0.447	-140.1	20.11	108.5	0.028	59.4	0.376	-60.8
400	0.460	-165.5	10.77	93.6	0.043	65.0	0.221	-69.4
600	0.467	-177.5	7.30	85.3	0.062	67.1	0.166	-74.5
800	0.473	174.3	5.53	79.2	0.079	66.6	0.141	-78.2
1000	0.478	167.7	4.44	73.9	0.096	66.4	0.130	-84.2
1200	0.484	161.8	3.72	68.8	0.112	64.5	0.127	-89.1
1400	0.490	156.6	3.21	64.1	0.128	63.7	0.127	-93.9
1600	0.492	151.9	2.83	59.8	0.148	61.9	0.128	-98.7
1800	0.499	147.4	2.53	55.6	0.163	59.3	0.134	-103.4
2000	0.504	142.4	2.30	51.3	0.177	57.6	0.138	-106.8
2200	0.501	139.3	2.10	47.9	0.195	57.0	0.151	-109.4
2400	0.509	135.3	1.94	43.8	0.210	54.7	0.151	-113.5
2600	0.511	131.0	1.81	39.9	0.225	51.5	0.160	-115.6
2800	0.521	127.3	1.70	36.4	0.238	49.9	0.164	-119.3
3000	0.527	124.2	1.60	33.1	0.255	47.5	0.170	-123.7

MP4T85639
Typical Scattering Parameters in the SOT-143 Pacakge
V_{CE} = 8 Volts, I_C = 20 mA

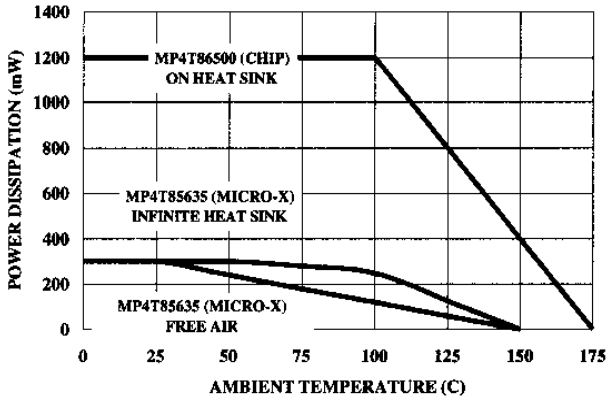
	Mag.	Angle	Mag.	Angle	Mag.	Angle	Mag.	Angle
200	0.500	-98.3	20.35	119.5	0.030	59.3	0.580	-38.8
400	0.423	-137.3	11.71	100.4	0.042	57.3	0.394	-43.0
600	0.406	-157.4	8.09	90.4	0.055	61.6	0.322	-42.7
800	0.404	-170.3	6.17	83.2	0.068	62.8	0.290	-43.0
1000	0.406	-179.7	4.97	77.3	0.081	62.4	0.272	-45.2
1200	0.409	172.1	4.17	71.7	0.096	61.1	0.264	-47.8
1400	0.416	165.6	3.59	66.8	0.109	61.5	0.257	-50.9
1600	0.418	159.7	3.16	62.2	0.123	60.5	0.254	-54.1
1800	0.425	154.5	2.83	57.9	0.134	58.3	0.255	-57.9
2000	0.431	149.0	2.57	53.2	0.144	58.4	0.254	-61.7
2200	0.431	145.3	2.33	49.7	0.163	57.8	0.264	-65.6
2400	0.439	140.9	2.16	45.6	0.175	56.8	0.265	-69.2
2600	0.446	136.5	2.01	41.7	0.188	54.2	0.268	-72.9
2800	0.457	132.4	1.88	38.0	0.199	52.3	0.273	-76.4
3000	0.463	129.3	1.77	34.5	0.212	50.7	0.271	-80.0

MP4T85639
Typical Scattering Parameters in the SOT-143 Package
V_{CE} = 8 Volts, I_C = 40 mA

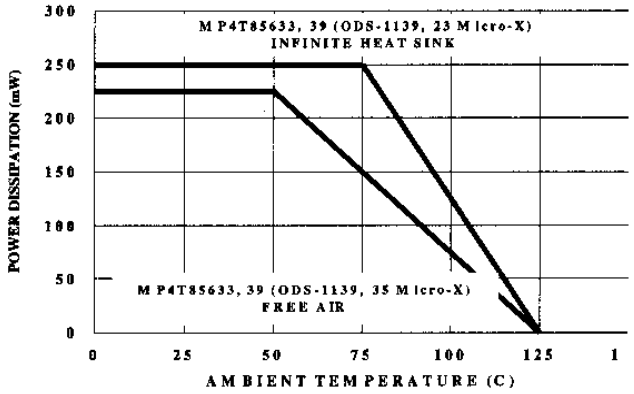
	Mag.	Angle	Mag.	Angle	Mag.	Angle	Mag.	Angle
200	0.455	-116.2	21.21	112.3	0.026	58.5	0.492	-38.2
400	0.414	-150.6	11.59	95.8	0.038	61.8	0.350	-37.6
600	0.410	-166.9	7.90	87.0	0.052	64.9	0.303	-36.0
800	0.412	-177.6	5.98	80.4	0.66	64.4	0.282	-36.7
1000	0.417	174.6	4.82	74.9	0.079	67.4	0.268	-39.3
1200	0.422	167.4	4.04	69.6	0.092	65.2	0.265	-42.4
1400	0.429	161.8	3.48	64.8	0.109	64.3	0.263	-45.7
1600	0.432	156.4	3.06	60.4	0.123	63.1	0.260	-49.7
1800	0.439	151.7	2.74	56.1	0.136	60.6	0.260	-54.2
2000	0.447	146.4	2.48	51.5	0.146	60.1	0.260	-58.0
2200	0.444	143.0	2.25	48.0	0.163	59.1	0.272	-62.0
2400	0.455	138.8	2.09	43.8	0.177	57.4	0.272	-66.1
2600	0.460	134.5	1.94	39.8	0.188	54.8	0.276	-69.7
2800	0.472	131.0	1.82	36.1	0.199	52.4	0.282	-73.7
3000	0.479	127.7	1.70	32.7	0.211	51.4	0.279	-77.3

Typical Performance Curves

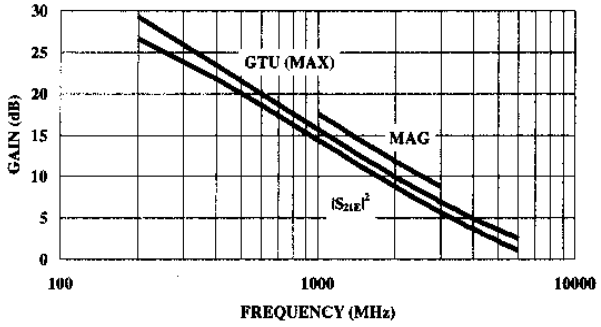
MP4T856 SERIES POWER DISSIPATION



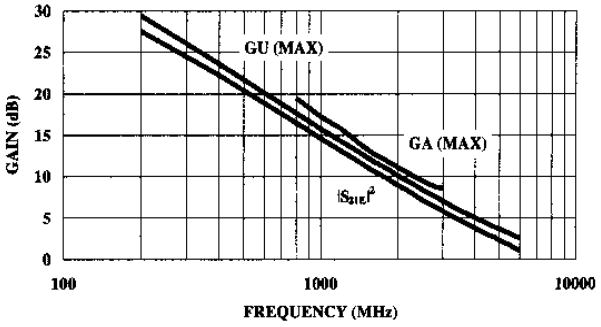
MP4T856 SERIES POWER DISSIPATION



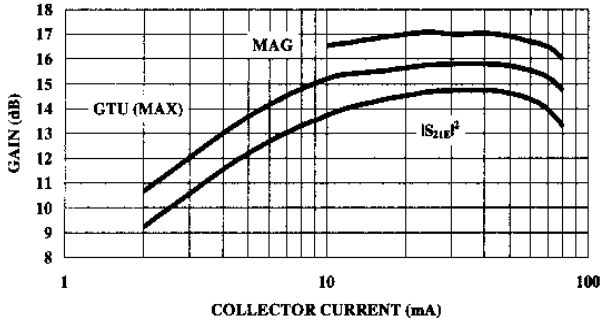
MP4T85635
NOMINAL GAIN vs FREQUENCY
at V_{CE} - 8 VOLTS and I_C = 20mA



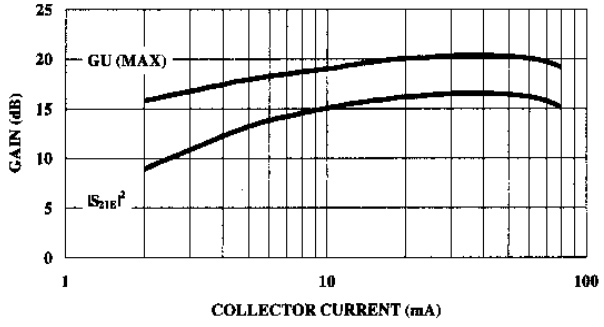
MP4T85635
NOMINAL GAIN vs FREQUENCY
at V_{CE} - 8 VOLTS and I_C = 40mA



MP4T85635
NOMINAL GAIN vs COLLECTOR CURRENT
at F = 1GHz and V_{CE} = 8 VOLTS

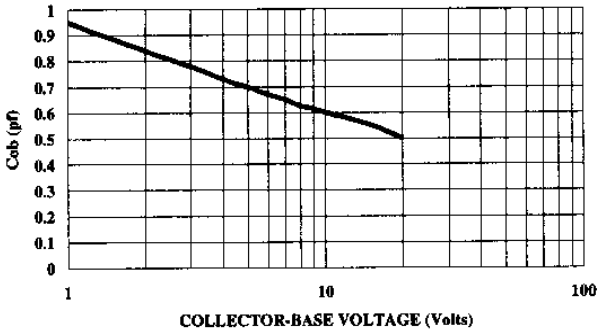


MP4T85600
NOMINAL GAIN vs COLLECTOR CURRENT
at F = 1GHz and V_{CE} = 8 VOLTS

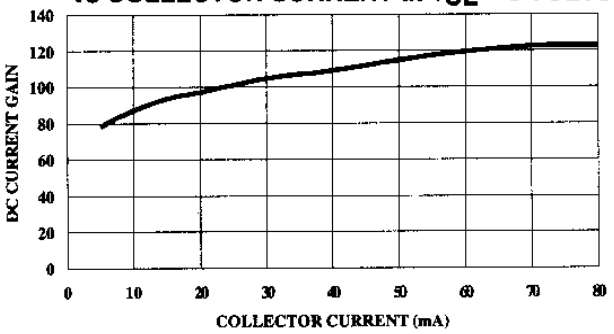


Typical Performance Curves (Contd)

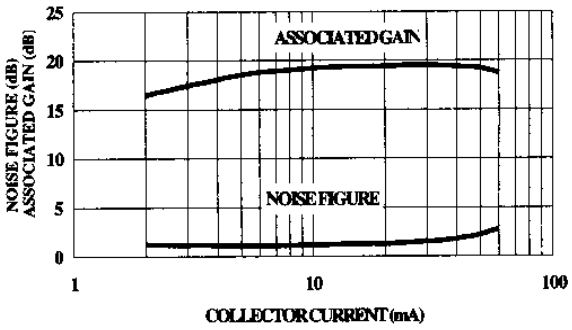
MP4T85600 CAPACITANCE vs COLLECTOR-BASE VOLTAGE



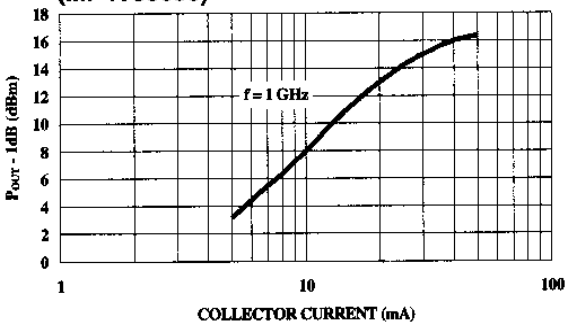
NOMINAL DC CURRENT GAIN (hFE) vs COLLECTOR CURRENT at V_{CE} = 8 VOLTS



NOMINAL NOISE FIGURE and ASSOCIATED GAIN at F = 1 GHz COLLECTOR CURRENT at V_{CE} = 8 VOLTS (MP4T85635)



NOMINAL POWER OUTPUT at the 1dB COMPRESSION POINT vs COLLECTOR CURRENT at F=1 and 2 GHz and V_{CE} = 8 VOLTS (MP4T85635)



Silicon Bipolar High f_T Low Noise Microwave Transistors

MP4T645

Features

- f_T to 9 GHz
- Low Noise Figure
- High Associated Gain
- Hermetic and Surface Mount Packages Available
- Can be Screened to JANTX, JANTXV Equivalent Levels
- Industry Standard

Description

The MP4T645 family of high gain-bandwidth, small signal silicon bipolar transistors is well suited for use in amplifiers to approximately 4 GHz, and in oscillators to approximately 10 GHz. These industry standard transistors freature low noise figure at high collector current, which produces very good associated gain and wide dynamic range. The MP4T645 series transistors are available in a hermetic microstrip package (MP4T64535), in the plastic SOT-23 package (MP4T64533), in chip form (MP4T64500), and in the SOT-143 package (MP4T64539). The MP4T645 series is available in other plastic and hermetic packages as well. The chip and hermetically packaged transistors can be screened to a JANTXV equivalent level.

Applications

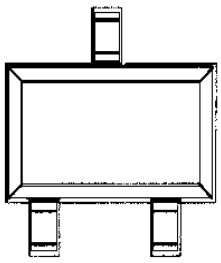
The MP4T645 family of bipolar NPN transistors can be used for low noise, high associated gain. large dynamic range amplifiers up to approximately 4 GHz. These transistors can also be used as preamplifier or driver stages in the same frequency range.

The MP4T645 family of bipolar NPN transistors can also be used for oscillators or VCOs up to approximately 10 GHz. The passivation consists of silicon dioxide, commonly known as thermal oxide, and silicon nitride to produce very low 1/f noise in both amplifiers and oscillators.

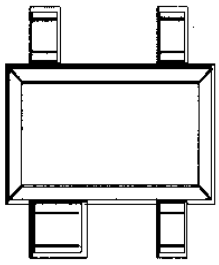
MP4T64500

A	0.013	0.325
B	0.013	0.325
C	0.004	0.110
D	0.0005	0.013
E (Dia.)	0.0012	0.030
F (chip thickness)	0.0045	0.114

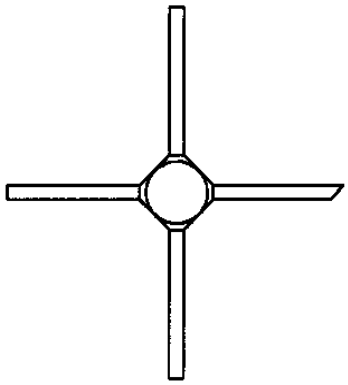
Case Styles



SOT-23

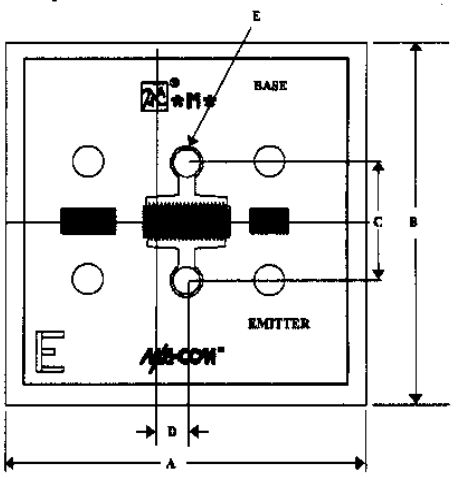


SOT-143



Micro-X

Chip



Absolute Maximum Ratings

MP4T645 Series

Collector-Base Voltage	V_{CBO}	25 V
Collector-Emitter Voltage	V_{CEO}	12 V
Emitter-Base Voltage	V_{EBO}	1.5 V
Collector Current	I_C	65 mA
Junction Operating Temperature	T_j	200°C
Storage Temperature Chip or Ceramic Packages Plastic Packages		 -65°C to +200°C -65°C to +125°C
Total Power Dissipation at 25 °C Derate Linearly to: +150°C Chip +125°C Plastic Package (SOT-23) +150°C Ceramic Package (Micro-X)		 400 mW 200 mW 300 mW

Electrical Specifications @ +25 °C

MP4T645 Series

Gain Bandwidth Product	V_{CE} = 8 volts I_C = 20 mA	f_T	GHz	10 typ	8 typ	9 typ
Insertion Power Gain	V_{CE} = 8 volts I_C = 20 mA f = 1 GHz f = 2 GHz f = 4 GHz	$\|S_{21E}\|^2$	dB	 18 typ 11 min 7 typ	 16 typ 10 min	 17 typ 10 min 6.5 typ
Noise Figure	V_{CE} = 8 volts I_C = 7 mA f = 1 GHz f = 2 GHz	NF	dB	 1.7 max 2.0 typ	 1.7 max 2.5 typ	 1.7 max 2.0 typ
Unilateral Gain	V_{CE} = 8 volts I_C = 7 mA f = 1 GHz f = 2 GHz	GTU (max)	dB	 18 typ 11 typ	 16 typ 10 typ	 17 typ 11 typ
Maximum Available Gain	V_{CE} = 8 volts I_C = 10 mA f = 2 GHz f = 4 GHz	MAG	dB	 14 typ 12 typ	 13 typ 10 typ	 14 typ 11.5 typ
Power Out at 1 dB Compression	V_{CE} = 8 volts I_C = 10 mA f = 1 GHz f = 4 GHz	P_{1dB}	dBm	 16 typ 11 typ	 16 typ 11 typ	 16 typ 11 typ

Note: The electrical characteristics of the MP4T64539 (SOT-143) are very similar to those of the MP4T64533 (SOT-23).

Electrical Specifications @ +25°C
MP4T645 Series

Parameter	Conditions	Symbol	Min	Typ	Max	Units
Collector Cut-off Current	V_{CB} = 8 volts I_E = 0 µA	I_{CBO}	—	—	100	nA
Emitter Cut-off Current	V_{EB} = 1 volt I_C = 0 µA	I_{EBO}	—	—	1	µA
Forward Current Gain	V_{CE} = 8 volts I_C = 7 mA	h_{FE}	30	125	250	—
Collector-Base Junction Capacitance	V_{CB} = 10 volts I_E = 0 µA f = 1 MHz	C_{CO}	—	0.3	0.6	pF

Typical Scattering Parameters in the Micro-X Package
MP4T64535, V_{CE} = 8 Volts, I_C = 7 mA

Freq	S11E Mag	S11E Angle	S21E Mag	S21E Angle	S12E Mag	S12E Angle	S22E Mag	S22E Angle
500	0.583	-114	9.315	116.1	0.052	43.6	0.573	-42.6
1000	0.569	-153	5.399	94.7	0.063	39.0	0.406	-53.0
1500	0.573	-173	3.807	82.0	0.072	40.0	0.357	-57.1
2000	0.587	170	2.980	72.0	0.082	42.5	0.313	-61.8
2500	0.598	159	2.479	62.7	0.092	44.0	0.299	-71.7
3000	0.616	150	2.132	54.8	0.103	45.2	0.304	-78.5
3500	0.645	142	1.935	47.0	0.118	45.5	0.289	-86.5
4000	0.675	132	1.782	38.5	0.130	45.7	0.281	-96.6
4500	0.705	124	1.631	29.6	0.143	45.5	0.292	-105.5
5000	0.749	115	1.538	22.0	0.159	44.5	0.281	-114.1
5500	0.791	106	1.445	14.4	0.176	43.6	0.283	-125.7
6000	0.832	96	1.395	6.1	0.188	42.3	0.306	-135.0

MP4T64535, V_{CE} = 8 Volts, I_C = 10 mA

Freq	S11E Mag	S11E Angle	S21E Mag	S21E Angle	S12E Mag	S12E Angle	S22E Mag	S22E Angle
500	0.562	-128	10.477	111.9	0.044	44.5	0.515	-46.2
1000	0.564	-161	5.845	92.1	0.056	44.0	0.358	-53.8
1500	0.575	176	4.088	80.5	0.068	46.5	0.313	-57.2
2000	0.592	166	3.185	70.9	0.080	49.0	0.276	-62.3
2500	0.601	156	2.638	62.0	0.092	49.7	0.268	-71.7
3000	0.618	148	2.266	54.5	0.105	50.1	0.272	-78.3
3500	0.648	139	2.053	46.9	0.122	49.4	0.259	-87.0
4000	0.677	130	1.892	38.6	0.136	48.7	0.253	-96.9
4500	0.706	122	1.734	29.8	0.150	47.9	0.264	-106.0
5000	0.749	113	1.634	22.3	0.167	46.1	0.257	-115.1
5500	0.790	104	1.532	14.8	0.184	44.4	0.259	-126.3
6000	0.831	95	1.482	6.4	0.196	42.6	0.278	-136.0

Typical Scattering Parameters in the Micro-X Package (Contd)

MP4T64535, V_{CE} = 8 Volts, I_C = 20 mA

500	0.536	-154	11.788	104.0	0.033	49.6	0.390	-46.8
1000	0.565	-177	6.309	87.5	0.046	55.7	0.284	-53.2
1500	0.579	170	4.350	77.0	0.062	57.7	0.270	-54.6
2000	0.592	160	3.368	68.6	0.077	59.3	0.237	-57.5
2500	0.612	151	2.798	60.1	0.093	58.0	0.226	-70.0
3000	0.630	142	2.390	52.6	0.108	56.5	0.243	-77.2
3500	0.660	134	2.156	45.4	0.126	54.4	0.231	-84.4
4000	0.691	125	1.984	37.2	0.141	52.6	0.223	-95.8
4500	0.719	117	1.809	28.4	0.155	50.9	0.240	-105.2
5000	0.760	109	1.697	21.3	0.173	48.5	0.229	-112.6
5500	0.803	101	1.594	13.8	0.192	46.0	0.229	-112.3
6000	0.844	92	1.540	6.0	0.210	44.2	0.258	-136.2

Typical Scattering Parameters in the SOT-23 Package

MP4T64533, V_{CE} = 8 Volts, I_C = 7 mA

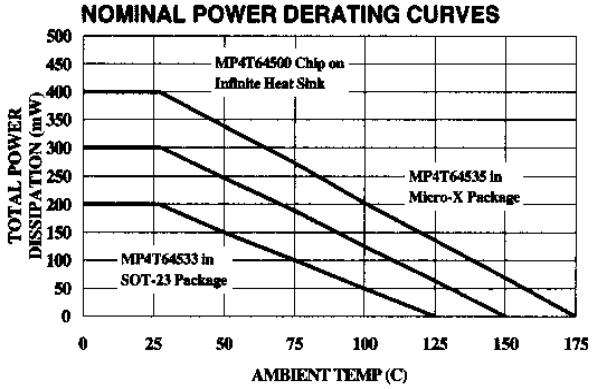
500	0.421	-95	7.378	126.4	0.062	77.9	0.519	-36.3
1000	0.257	-149	4.384	118.9	0.100	97.9	0.402	-36.9
1500	0.232	-176	3.082	123.3	0.140	116.2	0.368	-39.6
2000	0.238	157	2.408	129.2	0.183	130.9	0.354	-44.7
2500	0.256	140	2.005	136.3	0.224	145.7	0.346	-51.6
3000	0.279	126	1.734	143.2	0.274	160.8	0.339	-58.8
3500	0.310	116	1.498	153.3	0.308	172.0	0.331	-68.5
4000	0.338	106	1.367	163.5	0.350	173.6	0.320	-80.1
4500	0.359	97	1.284	173.8	0.402	161.0	0.327	-90.6

MP4T64533, V_{CE} = 8 Volts, I_C = 10 mA

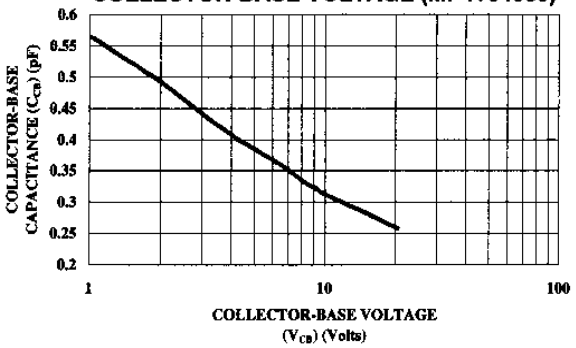
500	0.299	-116	8.385	119.4	0.057	82.1	0.451	-33.9
1000	0.216	-161	4.558	116.9	0.099	102.3	0.354	-33.2
1500	0.215	172	3.185	122.7	0.142	119.5	0.332	-37.7
2000	0.230	151	2.487	129.0	0.188	132.9	0.332	-44.0
2500	0.247	134	2.064	136.4	0.230	146.9	0.332	-50.1
3000	0.267	123	1.783	143.8	0.281	161.5	0.322	-56.1
3500	0.299	114	1.548	153.9	0.315	172.5	0.310	-66.4
4000	0.328	104	1.410	164.0	0.357	173.6	0.299	-79.2
4500	0.352	96	1.320	174.5	0.408	161.3	0.310	-90.1

MP4T645 Series
Typical Performance Curves

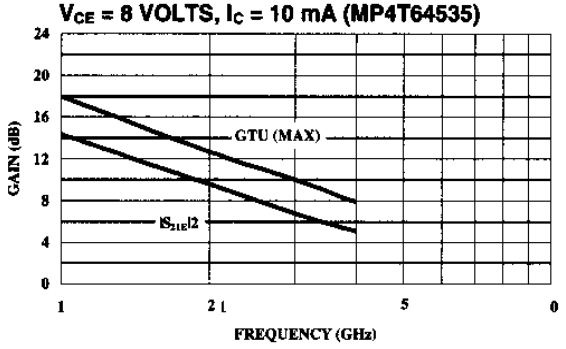
NOMINAL POWER DERATING CURVES



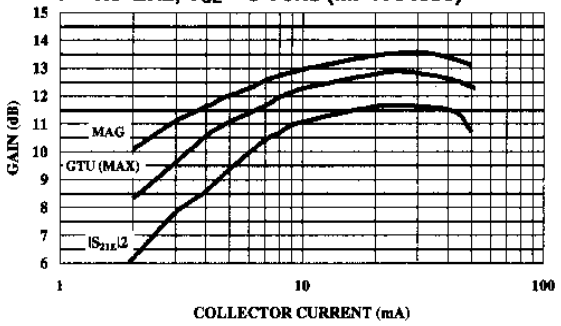
NOMINAL COLLECTOR-BASE CAPACITANCE vs COLLECTOR-BASE VOLTAGE (MP4T64535)



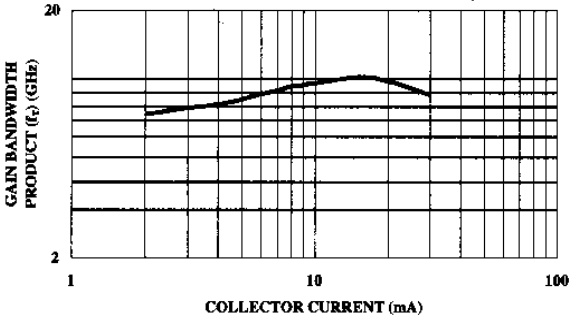
NOMINAL GAIN vs FREQUENCY at V_{CE} = 8 VOLTS, I_C = 10 mA (MP4T64535)



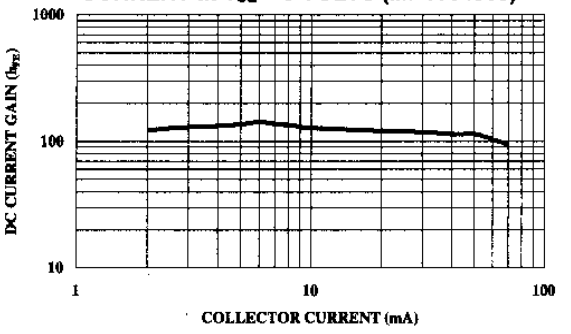
NOMINAL GAIN vs COLLECTOR CURRENT at f = 1.5 GHz, V_{CE} = 8 Volts (MP4T64535)



NOMINAL GAIN BANDWIDTH PRODUCT vs COLLECTOR CURRENT (MP4T64535)



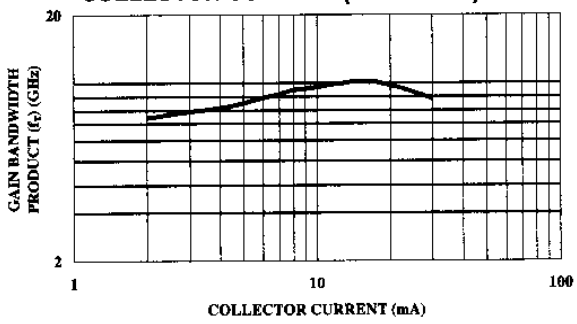
NOMINAL DC CURRENT GAIN vs COLLECTOR CURRENT at V_{CE} = 8 VOLTS (MP4T64535)



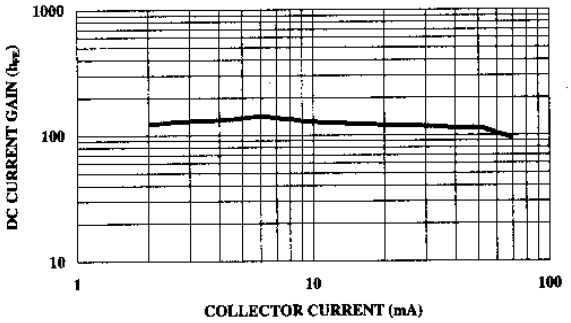
TRANSISTORS

Typical Performance Curves (Contd)

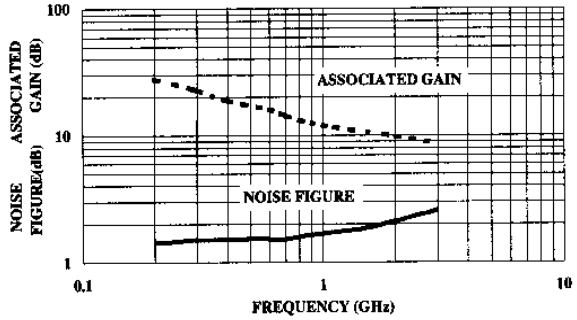
NOMINAL GAIN BANDWIDTH PRODUCT vs COLLECTOR CURRENT (MP4T64535)



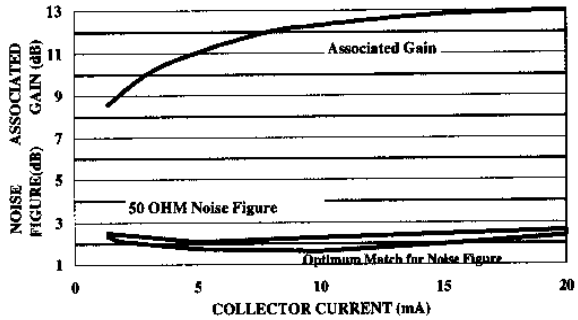
NOMINAL DC CURRENT GAIN vs COLLECTOR CURRENT at V_{CE} = 8 VOLTS (MP4T64535)



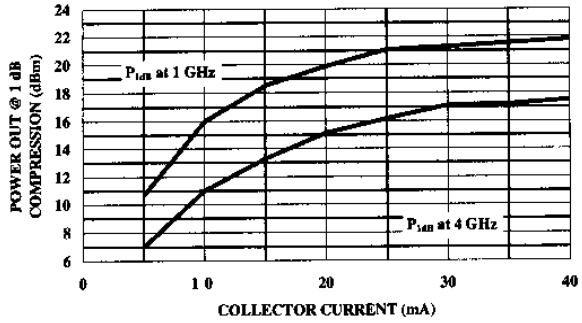
NOMINAL NOISE FIGURE and ASSOCIATED GAIN vs FREQUENCY at V_{CE} = 8 VOLTS, COLLECTOR CURRENT = 7 mA (MP4T64535)



NOMINAL NOISE FIGURE and ASSOCIATED GAIN vs COLLECTOR CURRENT at f = 1 GHz and V_{CE} = 8 VOLTS(MP4T64535)



NOMINAL OUTPUT POWER at the 1dB COMPRESSION POINT vs COLLECTOR CURRENT at f = 1 and 4 GHz, V_{CE} = 8 VOLTS (MP4T64535)



Bipolar High f_T Low Voltage NPN Silicon Transistors

MP4T3243 Series

Features

- Designed for 3-5 Volt Operation
- Useable to 6 GHz in Oscillators
- Useable for Low Noise, Low Voltage Driver Amplifiers Through 3 GHz
- Useful for Class C Amplifiers
- Available as Chips and in Hermetic and Surface Mount Packages
- Can be Screened to JANTX, JANTXV Equivalent Levels (ceramic pacakges)
- Tape and Reel Packaging Available for packaged devices.

Description

The MP4T3243 series of high f_t low voltage NPN medium power silicon bipolar transistors is designed for usage in battery operated systems with 3-5 volt collector bias. They are useful as low phase noise oscillator transistors through 6 GHz and as moderate power driver amplifiers through 3 GHz.

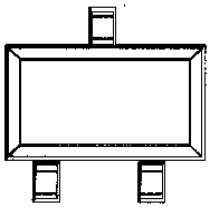
These transistors are available as chips for hybrid oscillators or in ceramic packages for military or commercial usage. Both the chips and hermetic packages can be screened to JANTX equivalent levels.

These transistors use high temperature gold, platinum, titanium metalization with silicon dioxide and silicon nitride passivation. The chip is emitter ballasted with polysilicon resistors to prevent current concentration at high current operation.

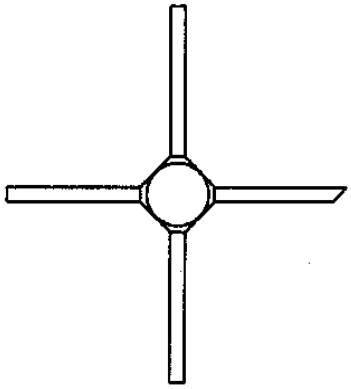
MP4T324300

NOMINAL DIM.	[illegible]	[illegible]
A	0.013	0.330
B	0.013	0.330
C	0.005	0.127
D (Dia.)	0.002	0.050
E (Chip Thickness)	0.0045	0.114

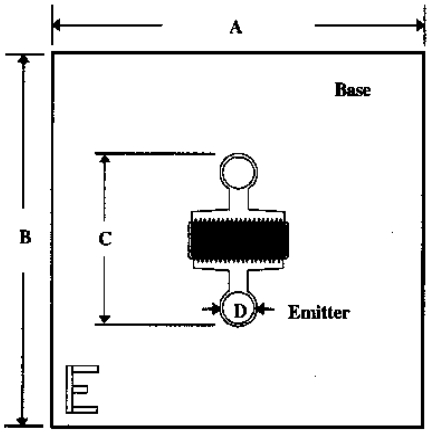
Case Style



SOT-23



Micro-X



MP4T324300 (Chip)

TRANSISTORS

Maximum Ratings

Parameter	Symbol	Units	MP4T324300 Chip	MP4T324300 SOT-23	MP4T324300 Micro-X
Collector-Base Voltage[1]	V_{CBO}	Volts	8	8	8
Collector-Emitter Voltage[1]	V_{CE}	Volts	6	6	6
Emitter-Base Voltage[1]	V_{EB}	Volts	1.5	1.5	1.5
Collector Current[1]	I_C	mA	110	110	110
Junction Temperature	T_j	°C	200	125	200
Storage Temperature	T_{STG}	°C	-65 to +175°C	-65 to +125°C	-65 to +175°C
Power Dissipation[1,3]	P_T	mW	600	250	400
Operating Temperature[2]	T_{CP}	°C	150	125	150

1. At 25°C case temperature (packaged transistors) or 25°C mounting surface temperature (chip transistors).
2. Case or bonding surface temperature. Derate maximum power dissipation rating linearly to zero watts at maximum operating temperature.
3. The thermal resistance of the MP4T324300 junction/case is 50°C/watt nominal.

Electrical Specifications @ +25°C

Parameter	Test Conditions	Symbol	Units	MP4T324300 Chip	MP4T324300 SOT-23	MP4T324300 Micro-X
Gain Bandwidth Product	V_{CE} = 3 volts I_C = 50 mA	f_T	GHz	6 typ	6 typ	6 typ
Insertion Power Gain	V_{CE} = 3 volts I_C = 40 mA f = 1 GHz f = 2 GHz	$\|S_{21E}\|^2$	dB	 7 min 3 typ	 6 min 2.5 typ	 7 min 3 typ
Noise Figure	V_{CE} = 3 volts I_C = 10 mA f = 1 GHz	NF	dB	 2.2 max	 2.4 max	 2.2 max
Unilateral Gain	V_{CE} = 3 volts I_C = 40 mA f = 1 GHz f = 2 GHz	GTU (max)	dB	 10 typ 6 typ	 9 typ 4 typ	 10 typ 6 typ
Maximum Available Gain	V_{CE} = 3 volts I_C = 40 mA f = 2 GHz	MAG	dB	 8.5 typ	 7 typ	 8.5 typ
Power Out at 1 dB Compression	V_{CE} = 3 volts I_C = 50 mA f = 2 GHz f = 3 GHz	P_{1dB}	dBm	 20 typ 15 typ	 19 typ 15 typ	 20 typ 15 typ

Electrical Specifications @ +25°C

MP4T3243 Series

Collector Cut-off Current	V_{CB} = 4 volts I_E = 0 µA	I_{CBO}	—	—	10	µA
Emitter Cut-off Current	V_{EB} = 1 volt I_C = 0 µA	I_{EBO}	—	—	1	µA
Forward Current Gain	V_{CE} = 3 volts I_C = 20 mA	h_{FE}	20	125	250	—
Collector Base Junction Capacitance	V_{CB} = 3 volts I_E = 0 µA f = 1 MHz	C_{OB}	—	0.8	1.0	pF

Typical Scattering Parameters in the Micro-X Package

MP4T324335

V_{CE} = 3 Volts, I_C = 10 mA

	S_{11}		S_{21}		S_{12}		S_{22}	
1000	0.647	172	2.480	73.2	0.137	51.4	0.311	-165.8
2000	0.666	149	1.408	51.2	0.225	49.0	0.365	172.5
3000	0.694	128	1.135	34.1	0.336	43.8	0.366	156.0
4000	0.714	109	1.005	17.3	0.427	32.1	0.412	142.1
5000	0.748	90	0.948	4.0	0.507	22.8	0.453	127.2
6000	0.772	70	0.930	-9.1	0.605	11.8	0.499	111.9

MP4T324335

V_{CE} = 3 Volts, I_C = 20 mA

	S_{11}		S_{21}		S_{12}		S_{22}	
1000	0.661	168	2.632	73.3	0.137	60.8	0.373	178.5
2000	0.677	146	1.493	53.1	0.238	53.0	0.421	161.3
3000	0.697	125	1.210	36.5	0.359	44.8	0.415	144.6
4000	0.715	107	1.067	19.3	0.451	31.0	0.450	130.3
5000	0.744	89	1.007	5.4	0.525	20.7	0.480	115.5
6000	0.762	69	0.990	-8.5	0.619	9.1	0.510	101.6

Typical Scattering Parameters in the Micro-X Package (Contd)

MP4T324335
V_{CE} = 3 Volts, I_C = 40 mA

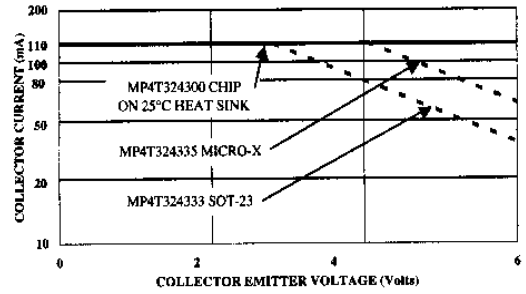
Freq.	S_{11E}		S_{21E}		S_{12E}		S_{22E}	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
1000	0.675	164	2.678	73.3	0.139	66.2	0.424	176.6
2000	0.692	143	1.528	54.1	0.244	55.0	0.470	158.6
3000	0.707	121	1.230	37.7	0.368	45.9	0.455	141.6
4000	0.719	104	1.095	20.8	0.463	31.5	0.481	128.1
5000	0.749	86	1.035	6.5	0.537	20.4	0.504	113.3
6000	0.763	66	1.017	-7.8	0.629	8.4	0.523	99.2

MP4T324335
V_{CE} = 3 Volts, I_C = 60 mA

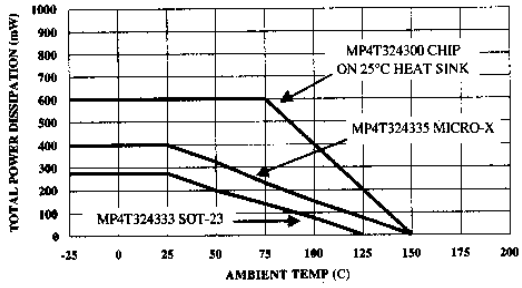
Freq.	S_{11E}		S_{21E}		S_{12E}		S_{22E}	
	Mag	Angle	Mag	Angle	Mag	Angle	Mag	Angle
1000	0.685	164	2.678	73.1	0.140	68.1	0.446	173.9
2000	0.698	143	1.528	54.2	0.251	56.1	0.492	156.8
3000	0.719	122	1.245	37.7	0.380	45.6	0.480	139.4
4000	0.727	104	1.103	20.7	0.474	31.0	0.502	125.4
5000	0.754	86	1.045	6.5	0.549	19.8	0.520	110.6
6000	0.767	67	1.025	-7.9	0.641	7.4	0.540	96.0

Typical Performance Curves

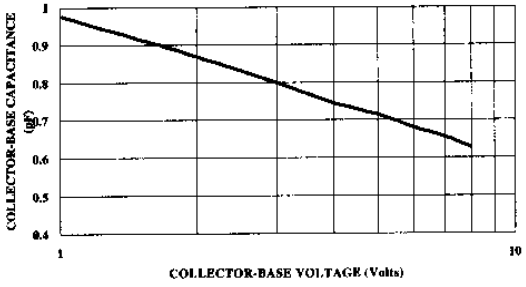
DC SAFE OPERATING RANGE at 25°c



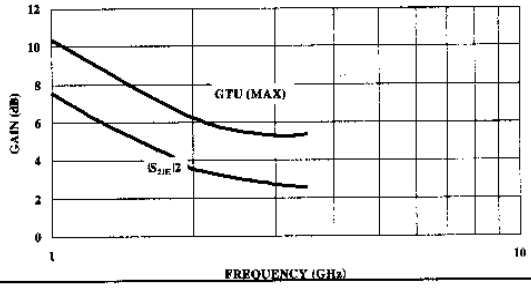
NOMINAL POWER DERATING CURVES



NOMINAL COLLECTOR-BASE CAPACITANCE (C_{OB}) vs COLLECTOR-BASE VOLTAGE (MP4T324335)

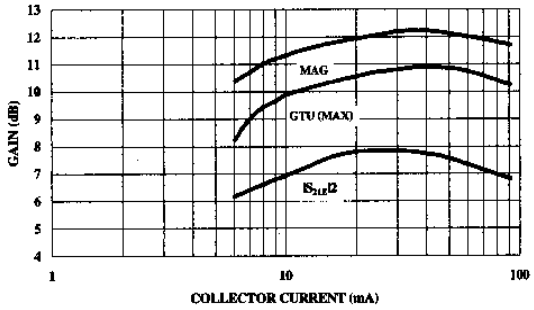


NOMINAL GAIN vs FREQUENCY at V_{CE} = 3 VOLTS AND I_C = 20 mA (MP4T324335)

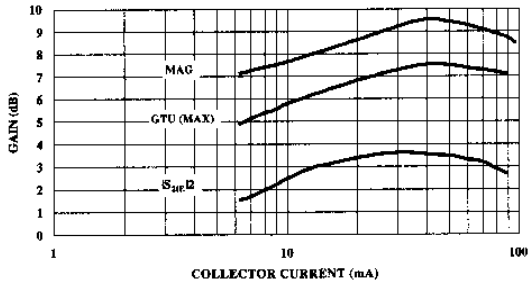


Typical Performance Curves (Contd)

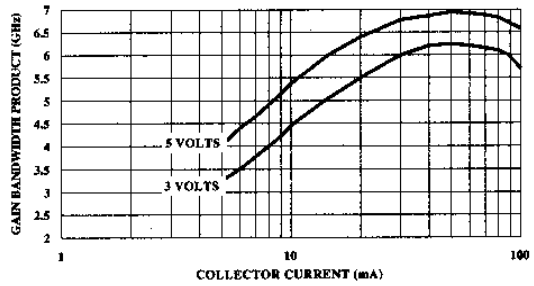
NOMINAL GAIN vs COLLECTOR CURRENT at f=1 GHz and V_{CE} = 3 VOLTS (MP4T324335)



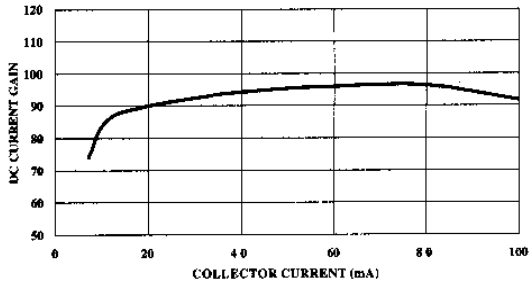
NOMINAL GAIN vs COLLECTOR CURRENT AT f=2 GHz and V_{CE} = 3 VOLTS (MP4T324335)



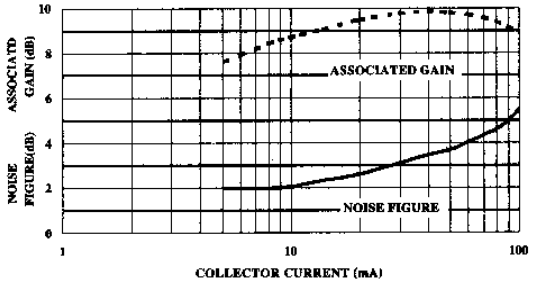
NOMINAL GAIN BANDWIDTH PRODUCT (f_T) vs COLLECTOR CURRENT at V_{CE} = 3 and 5 VOLTS (MP4T324335)



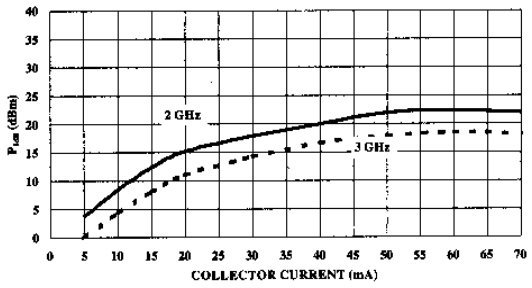
NOMINAL DC CURRENT GAIN (h_{FE}) vs COLLECTOR CURRENT at V_{CE} = 3 VOLTS (MP4T324335)



NOMINAL NOISE FIGURE and ASSOCIATED GAIN at 1 GHz at V_{CE} = 3 VOLTS vs COLLECTOR CURRENT in mA (MP4T324335)



NOMINAL OUTPUT POWER at the 1 dB COMPRESSION POINT vs COLLECTOR CURRENT at f = 2 and 3 GHz and V_{CE} = 3 VOLTS (MP4T324335)



3 Volt, Low Noise High f_T Silicon Transistor

MP4T6310 Series

Features

- High Performance at V_{CE} = 3V
- Low Noise Figure at Small Currents (0.3-2 mA)
- High Gain (14 dB) at 1mA Collector Current
- High f_T (14 GHz)
- Available on Tape and Reel

Description

The MP4T6310 series of low current, high f_T silicon NPN bipolar transistors provides low noise figure at a bias of 3 volts and small collector current. These inexpensive surface mount NPN transistors are well suited for usage in protable battery operated wireless systems from 500 MHz through 2.5 GHz where low noise figure at small current is important.

The MP4T6310 transistors series has high f_T and low noise when operated with 0.3 to 2.0 milliamperes current, and 3 volt bias. The associated gain is approximately 14 dB at 1 GHz with 1 mA collector current. The MP4T6310 also has low phase noise while operating in a low power 3-5 volt battery operated VCO in the frequency range of 0.5 to 3 GHz.

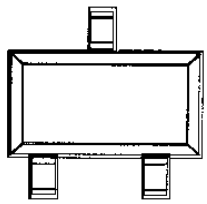
The MP4T6310 transistor is designed for wireless communication systems from VHF through L-band where good noise figure and high gain at 3 volt bias and low DC current are key system requirements. Suggested uses include, 900 MHz portable phones, pagers, PCN subscriber phones and 2.4 GHz cordless and cellular hand held receivers.

The MP4T6310 family of transistors is available in chip (MP4T631000), SOT-23 (MP4T631033), SOT-143 (MP4T631039), and in Micro-X (MP4T631035) packages. Surface mount packages are available on tape and reel.

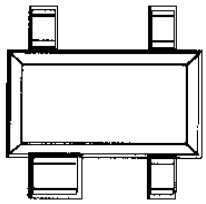
MP4T6310500

A	0.013	0.35
B	0.013	0.35
C	0.0016	0.040
D	0.0045	0.11

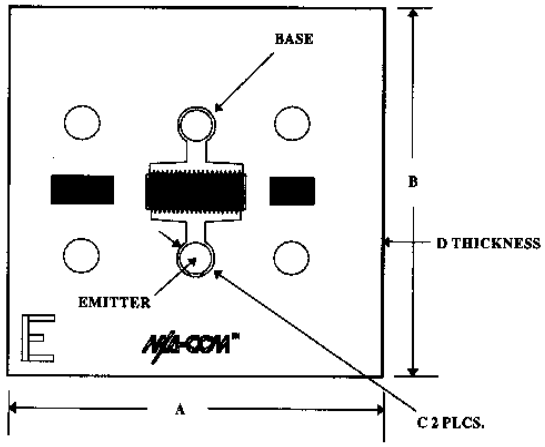
SOT-23



SOT-143



Chip



3 Volt, Low Noise High f_T Silicon Transistor — MP4T6310 Series

Electrical Specifications at +25°C

		Test Conditions		MP4T6310	MP4T6310 SOT-23	MP4T6311	MP4T6311 SOT-23
f_T	Gain Bandwidth Product	V_{CE} = 3V I_C = 6 mA	GHz	14 typ.	12 typ.	14 typ.	12 typ.
$\|S_{21E}\|^2$	Insertion Power Gain	V_{CE} = 3V I_C = 4 mA f = 1 GHz f = 2 GHz	dB	 12 typ. 8 typ.	 11 typ. 7 typ.	 12 typ. 8 typ.	 11 typ. 7 typ.
NF	Noise Figure	V_{CE} = 3V I_C = 0.5 mA I_C = 1 mA f = 1 GHz	dB	 1.5 typ.	 1.5 typ.	 1.5 typ.	 1.5 typ.
GTU (max)	Unilateral Gain	V_{CE} = 3V I_C = 4 mA f = 1 GHz f = 2 GHz	dB	 14.5 typ. 9 typ.	 13 typ. 8 typ.	 14.5 typ. 9 typ.	 13 typ. 8 typ.
MAG	Maximum Available Gain	V_{CE} = 3V I_C = 4 mA f = 2 GHz	dB	 10 typ.	 10 typ.	 10 typ.	 10 typ.
P_{1dB}	Power Out at 1dB Compression	V_{CE} = 3V I_C = 8 mA f = 1 GHz	dBm	 1.5 typ.	 1.5 typ.	 1.5 typ.	 1.5 typ.
$R_{TH\ (J-A)}$	Thermal Resistance	Junction/ Ambient	°C/W	75 max[1]	700 typ.[2]	600 typ.[2]	700 typ.[2]

1. Junction/Heat Sink R_{TH} (J-C)
2. Free Air

Maximum Ratings at +25°C

	Symbol	
Collector Base Voltage	V_{CBO}	8 V
Collector-Emitter Voltage	V_{CEO}	6 V
Emitter-Base Voltage	V_{EBO}	1.5 V
Collector Current	I_C	10 mA
Junction Temperature	T_J	200°C
Storage Temperature Chips or Ceramic Packages Plastic Packages	T_{STG}	 -65°C to +200°C -65°C to +125°C
Power Dissipation	P_D	-60mW[1]

1. See Typical Performance Curves for power derating.

Electrical Specifications at +25°C

	Test Conditions	Symbol				
Collector Cut-off Current	V_{CB} = 3 V I_E = 0	I_{CBO}	—	—	100	nA
Emitter Cut-off Current	V_{EB} = 1 V I_C = 0	I_{EBO}	—	—	1	µA
Forward Current Gain	V_{CE} = 3 V I_C = 3 mA	h_{FE}	20	100	200	—
Collector Base Junction Capacitance	V_{CB} = 3 V I_E = 0 f = 1 MHz	C_{OB}	—	0.42	0.55	pF

MP4T631035

Typical Scattering Parameters in the Micro-X Package

V_{CE} = 3 Volts, I_C = 2 mA

Frequency (MHz)	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
500	0.744	-37.9	4.174	137.0	0.088	63.8	0.841	-31.2
1000	0.524	-69.7	3.435	109.7	0.136	51.4	0.645	-48.2
1500	0.357	-94.3	2.771	89.9	0.169	45.5	0.531	-57.9
2000	0.255	-118.6	2.308	75.0	0.201	41.2	0.463	-67.5
2500	0.188	-142.6	1.977	62.3	0.228	37.3	0.415	-75.2
3000	0.139	-171.1	1.709	51.5	0.254	33.8	0.393	-81.9
3500	0.130	168.9	1.587	41.9	0.281	29.1	0.360	91.2
4000	0.133	140.6	1.448	33.1	0.299	25.8	0.342	-97.9
4500	0.156	122.4	1.369	23.1	0.323	21.8	0.324	-107.8
5000	0.180	105.0	1.296	15.5	0.342	17.9	0.308	-115.4
5500	0.204	89.7	1.239	7.9	0.362	14.3	0.299	-123.5
6000	0.228	78.9	1.194	0.7	0.379	10.7	0.292	-132.8

V_{CE} = 3 Volts, I_C = 4 mA

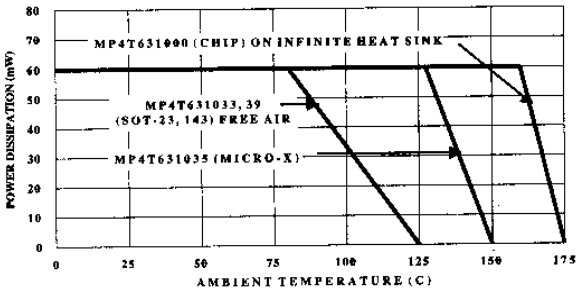
Frequency (MHz)	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
500	0.558	-54.5	6.582	127.1	0.074	61.9	0.727	-37.0
1000	0.324	-92.2	4.537	98.8	0.114	54.8	0.523	-49.9
1500	0.217	-119.0	3.299	82.1	0.149	51.4	0.437	-56.5
2000	0.169	-150.7	2.635	69.2	0.184	47.4	0.387	-65.3
2500	0.147	172.8	2.204	58.0	0.215	43.3	0.353	-72.2
3000	0.141	148.6	1.888	48.1	0.244	39.4	0.330	-78.6
3500	0.145	134.2	1.719	39.3	0.274	34.5	0.315	-88.4
4000	0.167	115.0	1.562	30.9	0.296	30.7	0.305	-95.7
4500	0.196	103.5	1.465	21.3	0.322	26.2	0.288	-106.1
5000	0.223	90.9	1.381	13.9	0.343	22.0	0.275	-114.0
5500	0.251	79.0	1.314	6.4	0.365	17.8	0.267	-122.7
6000	0.275	69.7	1.260	-1.4	0.383	14.1	0.262	-132.5

V_{CE} = 3 Volts, I_C = 6 mA

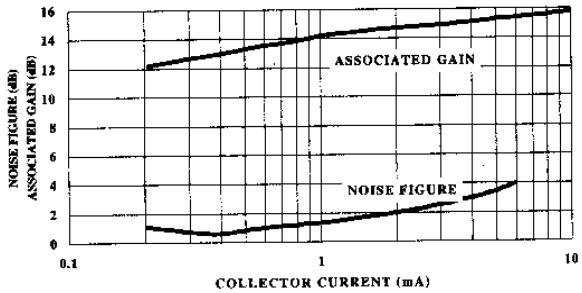
Frequency (MHz)	S11 Mag	S11 Ang	S21 Mag	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
500	0.429	-67.5	7.855	120.2	0.067	62.5	0.656	-39.5
1000	0.244	-107.3	4.871	93.9	0.107	57.9	0.466	-49.4
1500	0.178	-136.4	3.445	78.8	0.144	54.7	0.397	-54.9
2000	0.160	-168.7	2.722	66.7	0.179	50.3	0.354	-63.5
2500	0.158	163.5	2.264	56.0	0.212	45.9	0.326	-70.3
3000	0.166	138.7	1.933	46.4	0.241	41.5	0.306	-76.9
3500	0.170	126.8	1.753	37.9	0.273	36.5	0.295	-87.3
4000	0.192	109.9	1.584	29.8	0.294	32.8	0.289	-94.3
4500	0.221	100.9	1.490	20.2	0.322	28.1	0.275	-106.0
5000	0.250	89.2	1.403	13.0	0.344	23.8	0.263	-114.7
5500	0.280	77.8	1.333	5.3	0.367	19.4	0.255	-124.2
6000	0.304	68.6	1.276	-2.4	0.385	15.7	0.254	-134.7

Typical Performance Curves (MP4T631035)

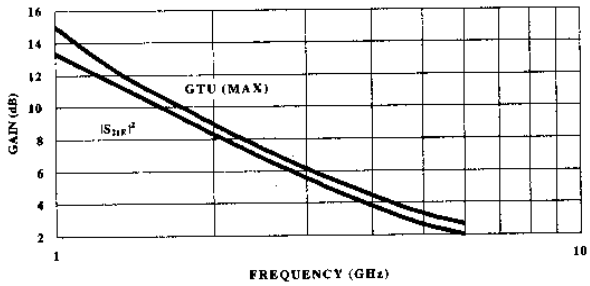
POWER DERATING CURVES



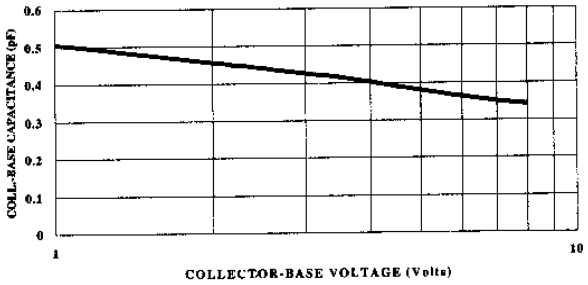
NOISE FIGURE and ASSOCIATED GAIN at VCE = 3 V, 1 GHz vs COLLECTOR CURRENT



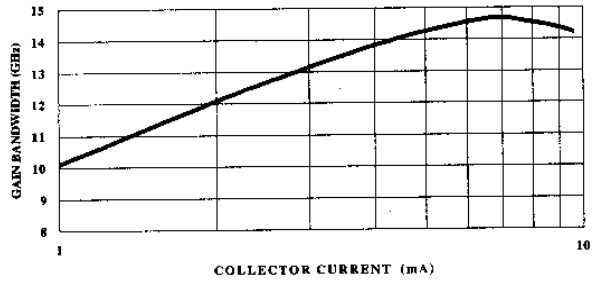
GAIN vs FREQUENCY at VCE=3 V and IC = 4 mA



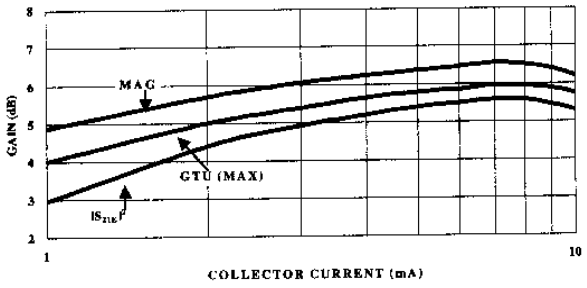
COLLECTOR-BASE CAPACITANCE (C_{OB}) vs COLLECTOR-BASE VOLTAGE



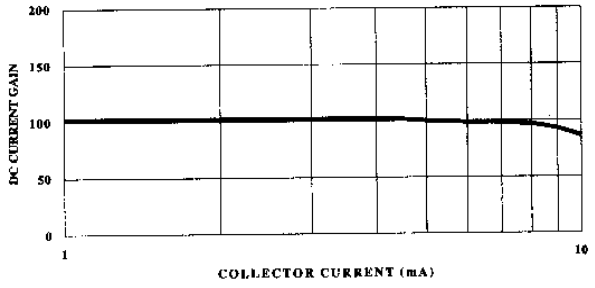
GAIN BANDWIDTH PRODUCT (f_T) vs COLLECTOR CURRENT at VCE=3 V



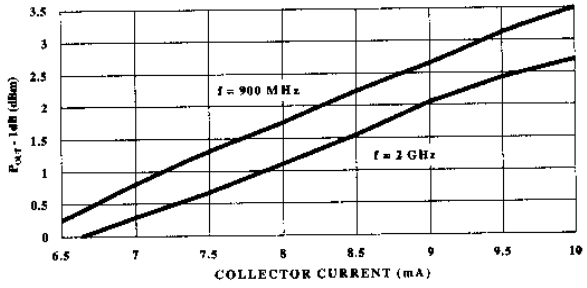
GAIN vs COLLECTOR CURRENT at 3 GHz, VCE=3 V



DC CURRENT GAIN (h_{FE}) vs COLLECTOR CURRENT at VCE = 3 V



OUTPUT POWER at 1 dB COMPRESSION POINT vs COLLECTOR CURRENT VCE=3V



3 Volt, General Purpose Low Noise High f_T Silicon Transistor

MP4T6325 Series

Features

- Low Voltage Operation (3 - 5V)
- High fT (11 GHz)
- Low Noise Figure with 1-5 mA Current
- Inexpensive
- Available on Tape and Reel

Description

The MP4T6325 series of low voltage silicon bipolar transistors provide low noise figure at a bias of 3-5 volts and collector current of 1 to 5 mA. These inexpensive surface mount transistors are useful for low noise amplifiers and VCOs in portable battery operated RF systems from VHF through 2.5 GHz.

The MP4T6325 series has high f_T (11 GHz) and provides 1.5 dB noise figure with 1-5 mA current and 3 volts bias at 1 GHz. These transistors also have low phase noise when used in 3-5 volt low power battery operated VCOs through 2.5 GHz.

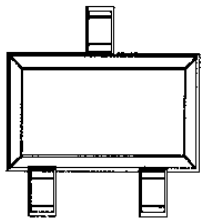
The MP4T6325 series are inexpensive transistors useful for portable battery operated RF systems that require low current drain from 3-5 volts DC supplies.

The MP4T6325 family of transistors is available in chip (MP4T632500), SOT-23 (MP4T632533), SOT-143 (MP4T632539) and in Micro-X (MP4T632535) packages. Surface mount packages are available on tape and reel.

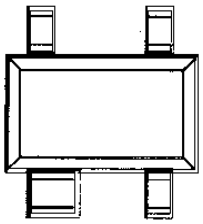
MP4T632500

A	0.013	0.35
B	0.013	0.35
C	0.0016	0.040
D	0.0045	0.11

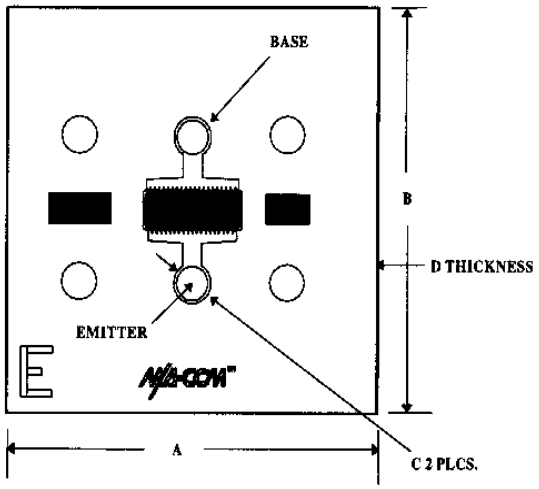
SOT-23



SOT-143



Chip



Electrical Specifications at +25°C

Symbol	Parameter	Test Conditions	Units	Die	Package 34	Package 35	Package 37
f_T	Gain Bandwidth Product	V_{CE} = 3V I_C = 10 mA	GHz	11 typ.	10 typ.	11 typ.	11 typ.
$\|S_{21E}\|^2$	Insertion Power Gain	V_{CE} = 3V I_C = 10 mA f = 1 GHz f = 2 GHz	dB	 12 typ. 8 typ.	 11 typ. 7 typ.	 12 typ. 8 typ.	 11 typ. 7 typ.
NF	Noise Figure	V_{CE} = 3V I_C = 2 mA f = 1 GHz	dB	1.5 typ.	1.6 typ.	1.5 typ.	1.6 typ.
GTU (max)	Unilateral Gain	V_{CE} = 3V I_C = 10 mA f = 1 GHz f = 2 GHz	dB	 14.5 typ. 9 typ.	 13 typ. 8 typ.	 14.5 typ. 9 typ.	 13 typ. 8 typ.
MAG	Maximum Available Gain	V_{CE} = 3V I_C = 10 mA f = 2 GHz	dB	10 typ.	9 typ.	10 typ.	9 typ.
P_{1dB}	Power Out at 1dB Compression	V_{CE} = 3V I_C = 15 mA f = 900MHz	dBm	8 typ.	8 typ.	8 typ.	8 typ.
$R_{TH\ (J-A)}$	Thermal Resistance	Junction/ Ambient	°C/W	—	650 typ.	500 typ.	625 typ.
$R_{TH\ (J-C)}$	Thermal Resistance	Junction/ Case	°C/W	70 max.[1]	200 typ.	200 typ.	200 typ.

1. Junction/Heat Sink R_{TH} (J-C)

Maximum Ratings at +25 °C

Parameter	Symbol	Value
Collector Base Voltage	V_{CBO}	8 V
Collector-Emitter Voltage	V_{CEO}	6 V
Emitter-Base Voltage	V_{EBO}	1.5 V
Collector Current	I_C	25 mA
Junction Temperature	T_j	200°C
Storage Temperature Chips or Ceramic Packages Plastic Packages	T_{STG}	 -65°C to +200°C -65°C to +125°C
Power Dissipation	P_D	150mW[1]

1. See Typical Performance Curves for power derating.

Electrical Specifications at 25°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Collector Cut-off Current	V_{CB} = 5 V I_E = 0	I_{CBO}	—	—	100	nA
Emitter Cut-off Current	V_{EB} = 1 V I_C = 0	I_{EBO}	—	—	1	µA
Forward Current Gain	V_{CE} = 3 V I_C = 3 mA	h_{FE}	20	90	200	—
Collector Base Junction Capacitance	V_{CB} = 3 V I_E = 0 f = 1 MHz	C_{OB}	—	0.52	0.70	pF

MP4T632535

Typical Scattering Parameters in the Micro-X Package

V_{CE} = 3 Volts, I_C = 5 mA

Frequency (MHz)	S_{11E} Mag	S_{11E} Angle	S_{21E} Mag	S_{21E} Angle	S_{12E} Mag	S_{12E} Angle	S_{22E} Mag	S_{22E} Angle
500	0.486	-80.5	7.164	119.8	0.077	56.6	0.628	-45.8
1000	0.338	-128.0	4.508	93.4	0.112	51.9	0.424	-58.8
1500	0.294	-156.3	3.219	78.1	0.144	50.2	0.345	-65.9
2000	0.284	169.8	2.533	66.1	0.179	47.8	0.305	-74.9
2500	0.283	160.9	2.123	55.5	0.210	44.7	0.280	-83.1
3000	0.281	144.6	1.835	46.3	0.240	41.8	0.266	-90.8
3500	0.290	132.5	1.678	36.8	0.272	36.7	0.256	-103.7
4000	0.320	119.4	1.546	28.3	0.301	33.2	0.254	-113.8
4500	0.333	106.6	1.434	18.9	0.323	29.0	0.245	-125.4
5000	0.358	94.9	1.354	11.5	0.349	25.1	0.241	-135.9
5500	0.382	82.7	1.290	4.0	0.375	21.4	0.246	-146.1
6000	0.405	72.7	1.238	-4.0	0.397	17.7	0.255	-158.0

V_{CE} = 3 Volts, I_C = 10 mA

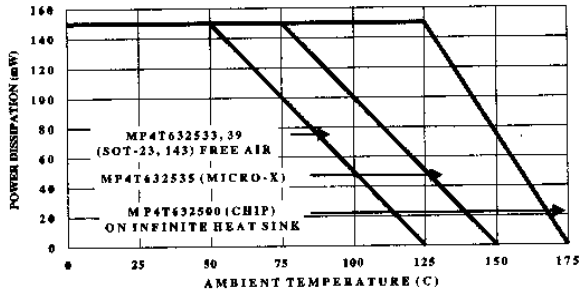
Frequency (MHz)	S_{11E} Mag	S_{11E} Angle	S_{21E} Mag	S_{21E} Angle	S_{12E} Mag	S_{12E} Angle	S_{22E} Mag	S_{22E} Angle
500	0.326	-116.9	8.628	108.6	0.060	60.9	0.505	-48.5
1000	0.288	-158.6	4.808	86.7	0.098	60.0	0.351	-56.2
1500	0.288	174.6	3.337	73.4	0.135	57.7	0.302	-61.8
2000	0.305	160.8	2.608	62.3	0.170	53.7	0.275	-71.7
2500	0.319	145.8	2.172	52.2	0.204	49.7	0.256	-80.2
3000	0.330	131.0	1.863	43.2	0.234	45.8	0.245	-88.1
3500	0.335	121.4	1.696	34.5	0.268	41.0	0.245	-101.8
4000	0.372	110.2	1.559	25.9	0.299	36.8	0.245	-112.9
4500	0.385	99.4	1.444	16.9	0.322	32.7	0.240	-125.3
5000	0.417	88.6	1.361	9.4	0.350	28.3	0.237	-136.8
5500	0.445	77.1	1.294	3.2	0.379	24.1	0.242	-148.0
6000	0.468	67.4	1.236	-6.0	0.401	20.3	0.253	-160.2

V_{CE} = 3 Volts, I_C = 15 mA

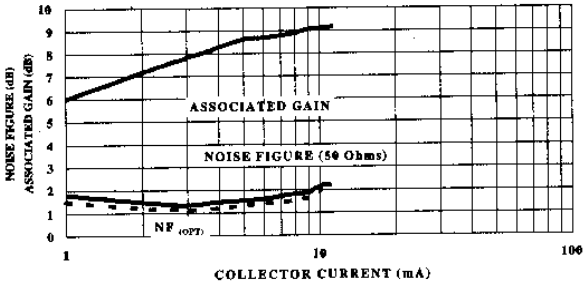
Frequency (MHz)	S_{11E} Mag	S_{11E} Angle	S_{21E} Mag	S_{21E} Angle	S_{12E} Mag	S_{12E} Angle	S_{22E} Mag	S_{22E} Angle
500	0.286	-136.7	9.912	104.1	0.053	65.0	0.428	-50.5
1000	0.278	-173.6	5.355	84.5	0.092	64.6	0.295	-55.5
1500	0.287	168.5	3.679	72.6	0.132	60.8	0.263	-60.3
2000	0.317	149.8	2.875	61.7	0.165	56.6	0.236	-70.3
2500	0.334	135.8	2.377	52.0	0.200	52.2	0.222	-77.5
3000	0.354	121.6	2.029	43.0	0.230	47.7	0.215	-84.3
3500	0.355	112.4	1.834	34.6	0.265	42.7	0.218	-97.2
4000	0.382	100.2	1.653	26.7	0.290	38.9	0.220	-103.8
4500	0.408	92.3	1.552	17.3	0.317	34.1	0.218	-117.6
5000	0.440	82.1	1.456	10.0	0.344	29.7	0.213	-127.1
5500	0.471	71.3	1.377	2.2	0.372	25.2	0.212	-137.0
6000	0.492	62.2	1.312	-5.5	0.392	21.3	0.218	-147.9

Typical Performance Curves (MP4T632535)

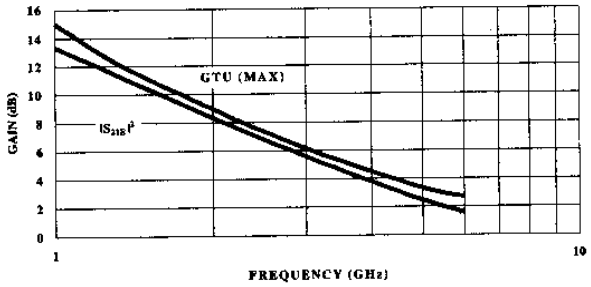
POWER DERATING CURVES



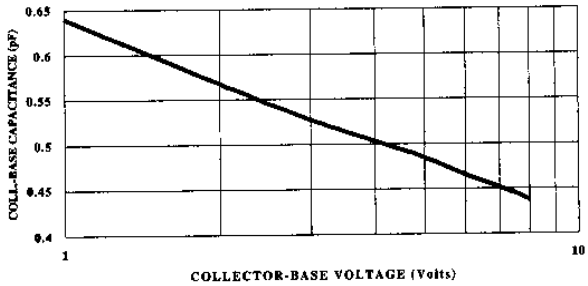
NOISE FIGURE and ASSOCIATED GAIN at VCE = 3 V, 1 GHz vs COLLECTOR CURRENT



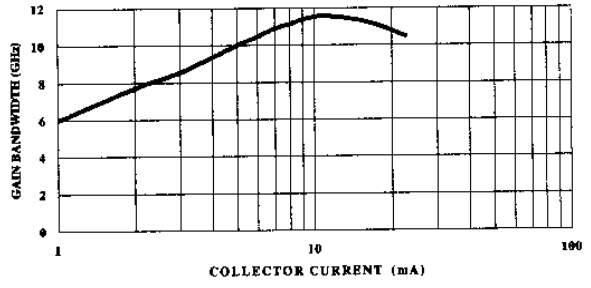
GAIN vs FREQUENCY at VCE=3 V and IC = 10 mA



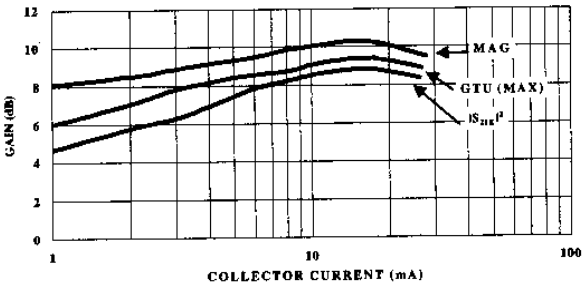
COLLECTOR-BASE CAPACITANCE (C_{OB}) vs COLLECTOR-BASE VOLTAGE



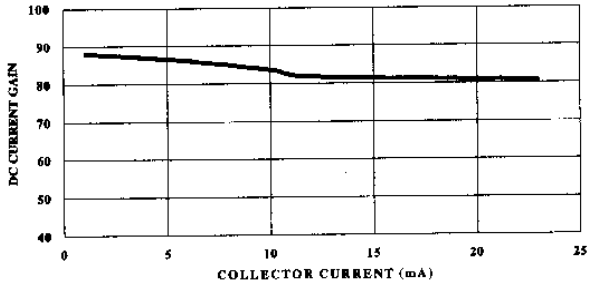
GAIN BANDWIDTH PRODUCT (f_T) vs COLLECTOR CURRENT at VCE=3 V



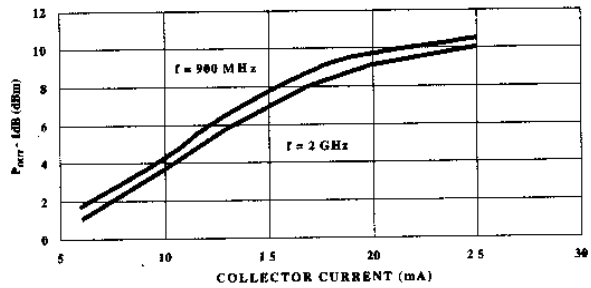
GAIN vs COLLECTOR CURRENT at 2 GHz, VCE=3 V



DC CURRENT GAIN (h_{FE}) vs COLLECTOR CURRENT at VCE = 3 V



OUTPUT POWER at 1 dB COMPRESSION POINT vs COLLECTOR CURRENT VCE=3V



Low OperatingVoltage, High f_T Bipolar Microwave Transistors

MP4T6365

Features

- Designed for Battery Operation
- f_T to 10 GHz
- Low Voltage Oscillator and Amplifier
- Low Phase Noise and Noise Figure
- Hermetic and Surface Mount Packages and Chips Available
- Can be Screened to JANTX, JANTXV Equivalent Levels

Description

The MP4T6365 family of low voltage, high gain bandwidth silicon NPN bipolar transistors provides low noise figure and high gain at low bias voltages. These transistors are especially attractive for low operating voltage low noise amplifiers or driver amplifiers at frequencies to 4 GHz. They are also useful for low phase noise local oscillators and VCOs in battery operated equipment to 10 GHz.

The MP4T6365 family was designed to have low noise figure at operating voltages as low as 3 volts. These transistors also exhibit low phase noise in VCOs operating at 5 volts or less.

Because this transistor family was specifically designed to perate from low bias voltage, it has superior phase noise in comparison to similar current bipolar transistors with higher collector breakdown voltage when operating under the same low voltage conditions.

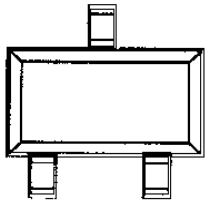
The MP4T6365 series transistors are available in hermetic Micro-X packages, the SOT-23, the SOT-143, and in chip form (MP4T636500). Other stripline and hermetic packages are available. The chip and hermetic packages can be screened to JANTX, JANTXV equivalent levels. The plastic parts can be supplied on tape and reel.

All of M-Pulse's silicon bipolar transistor families use silicon dioxide and silicon nitride passivation to assure low 1/F noise for amplifier and oscillator applications.

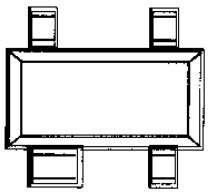
MP4T636500

A	0.013	0.325
B (Dia.) 2 plcs.	0.0012	0.030
C	0.004	0.110
D	0.0005	0.013
E	0.013	0.325
F (chip thickness)	0.0045	0.114

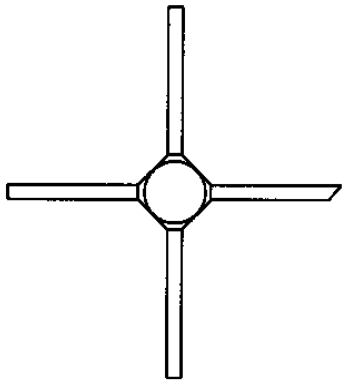
Case Styles



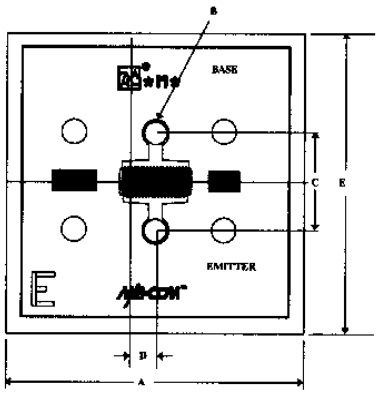
SOT-23



SOT-143



Micro-X



Chip

Maximum Ratings (T_A = +25 °C)
MP4T6365 Series

Collector-Base Voltage	V_{CBO}	10 V
Collector-Emitter Voltage	V_{CE}	6 V
Emitter-Base Voltage	V_{EB}	1.5 V
Collector Current	I_C	65 mA
Junction Operating Temperature	T_j	200°C
Storage Temperature Chip or Ceramic Packages Plastic Packages	T_S	 -65°C to +200°C -65°C to +125°C
Power Dissipation		
Package Type	Maximum Dissipation @ 25°C	Maximum Operating Temperature
Chip (MP4T636500)	400 mW	175°C
SOT-23 (MP4T636533)	200 mW	125°C
Micro-X Package (MP4T636535)	300 mW	150°C
SOT-143 (MP4T636539)	225 mW	125°C

Electrical Specifications @ +25°C
MP4T6365 Series

Gain Bandwidth Product	V_{CE} = 3 V I_C = 20 mA	f_T	GHz	10 typ	10 typ	10 typ	10 typ
Insertion Power Gain	V_{CE} = 3 V I_C = 10 mA f = 1 GHz f = 2 GHz	$\|S_{21E}\|^2$	dB	 14 typ 7.0 min	 13 typ 7.0 min	 13 typ 7.0 min	 13 typ 7.0 min
Noise Figure	V_{CE} = 3 V I_C = 5 mA f = 1 GHz f = 2 GHz	NF	dB	 1.3 typ 1.6 typ	 1.3 typ 1.6 typ	 1.4 typ 1.7 typ	 1.4 typ 1.7 typ
Unilateral Gain	V_{CE} = 3 V I_C = 5 mA f = 1 GHz f = 2 GHz	GTU (max)	dB	 15 typ 10 typ	 15 typ 10 typ	 14 typ 9 typ	 14 typ 9 typ
Maximum Available Gain	V_{CE} = 3 V I_C = 20 mA f = 1 GHz f = 2 GHz	MAG	dB	 16 typ 12 typ	 16 typ 11 typ	 16 typ 10 typ	 16 typ 10 typ
Output Power at 1 dB Compression	V_{CE} = 3 V I_C = 20 mA f = 2 GHz f = 4 GHz	P_{1dB}	dBm	 16 typ 12 typ	 17 typ 13 typ	 16 typ 12 typ	 16 typ 12 typ

Electrical Specifications @ +25 °C

Collector Cut-off Current	V_{CB} = 3 volts I_E = 0 µA	I_{CBO}	—	—	100	µA
Emitter Cut-off Current	V_{EB} = 1 volt I_C = 0 µA	I_{EBO}	—	—	1	µA
Forward Current Gain	V_{CE} = 3 volts I_C = 5 mA	h_{FE}	30	75	200	—
Collector-Base Junction Capacitance	V_{CB} = 5 volts I_E = 0 µA f = 1 MHz	C_{OB}	—	0.50	0.70	pF

Typical Common Emitter Scattering Parameters in the Micro-X Package

MP4T636535, V_{CE} = 3 Volts, I_C = 5 mA

500	0.640	-103	6.343	116.9	0.103	38.7	0.534	-75.2
1000	0.580	-153	3.984	91.5	0.123	29.0	0.346	-103.0
1500	0.571	-175	2.813	77.9	0.135	27.7	0.250	-124.9
2000	0.590	168	2.214	67.0	0.146	26.8	0.242	-140.4
2500	0.597	155	1.853	57.9	0.159	27.3	0.211	-150.2
3000	0.622	144	1.632	48.2	0.174	27.3	0.227	-164.1
3500	0.646	134	1.460	40.1	0.190	26.8	0.229	-168.0
4000	0.676	124	1.341	31.7	0.205	25.6	0.238	170.7
4500	0.712	115	1.241	23.7	0.218	24.1	0.255	167.9
5000	0.750	106	1.191	16.4	0.238	22.2	0.277	157.8
5500	0.793	96	1.130	8.4	0.257	20.2	0.310	153.0
6000	0.833	88	1.081	2.5	0.272	17.3	0.323	145.0

MP4T636535, V_{CE} = 3 Volts, I_C = 10 mA

500	0.580	-142	8.562	104.6	0.066	39.1	0.389	-102.8
1000	0.589	-175	4.641	85.8	0.086	40.5	0.274	-132.0
1500	0.592	170	3.200	75.1	0.106	42.9	0.228	-158.1
2000	0.617	157	2.480	65.9	0.125	43.0	0.243	-169.4
2500	0.625	146	2.069	57.9	0.150	42.7	0.220	171.9
3000	0.652	136	1.811	48.9	0.172	40.8	0.250	166.9
3500	0.676	127	1.613	41.3	0.195	38.3	0.251	161.4
4000	0.707	118	1.479	33.3	0.218	35.1	0.270	150.2
4500	0.741	109	1.366	25.6	0.234	31.9	0.281	146.1
5000	0.776	100	1.311	18.5	0.259	28.1	0.311	135.9
5500	0.817	91	1.240	10.6	0.281	24.9	0.342	132.5
6000	0.855	82	1.118	3.0	0.298	20.5	0.351	125.1

Typical Common Emitter Scattering Parameters in the Micro-X Package (Cont'd)
MP4T636535, V_{CE} = 3 Volts, I_C = 20 mA

Frequency (MHz)	S_{11E} Mag.	S_{11E} Angle	S_{21E} Mag.	S_{21E} Angle	S_{12E} Mag.	S_{12E} Angle	S_{22E} Mag	S_{22E} Angle
500	0.551	-160	9.374	99.1	0.048	40.7	0.321	-111.2
1000	0.557	177	4.816	84.2	0.071	62.6	0.238	-130.6
1500	0.577	164	3.373	74.7	0.094	54.2	0.217	-161.0
2000	0.599	153	2.613	66.4	0.117	53.9	0.223	-171.4
2500	0.611	143	2.174	58.9	0.144	52.0	0.214	168.4
3000	0.633	133	1.898	50.6	0.169	49.2	0.232	163.6
3500	0.659	125	1.690	49.4	0.194	45.9	0.242	159.2
4000	0.689	116	1.532	35.0	0.219	42.1	0.256	140.4
4500	0.721	107	1.441	28.4	0.233	38.3	0.274	144.3
5000	0.758	99	1.378	21.4	0.253	33.9	0.294	135.8
5500	0.800	90	1.309	13.5	0.267	30.0	0.319	130.4
6000	0.842	82	1.252	6.0	0.304	25.8	0.339	124.2

VP4T636535, V_{CE} = 3 Volts, I_C = 40 mA

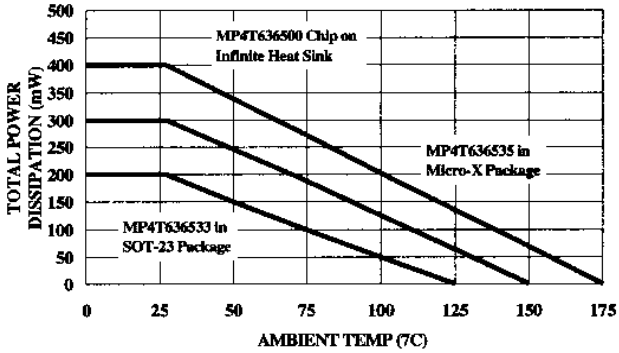
Frequency (MHz)	S_{11E} Mag.	S_{11E} Angle	S_{21E} Mag.	S_{21E} Angle	S_{12E} Mag.	S_{12E} Angle	S_{22E} Mag	S_{22E} Angle
500	0.589	-173	9.190	93.5	0.044	56.7	0.275	-120.9
1000	0.604	171	5.262	80.3	0.067	56.2	0.220	-147.2
1500	0.620	58	3.605	70.5	0.094	56.6	0.210	-164.9
2000	0.648	148	2.665	62.2	0.115	56.4	0.210	174.5
2500	0.666	138	2.219	54.1	0.145	55.8	0.212	171.6
3000	0.691	128	1.935	45.9	0.170	54.6	0.220	168.5
3500	0.704	118	1.710	37.8	0.195	46.0	0.234	161.2
4000	0.738	110	1.560	29.8	0.216	41.9	0.246	153.7
4500	0.777	101	1.445	22.3	0.240	37.8	0.265	147.0
5000	0.819	92	1.365	14.5	0.262	33.7	0.290	140.6
5500	0.858	82	1.300	6.7	0.281	29.9	0.301	134.6
6000	0.896	73	1.238	-1.4	0.305	25.5	0.323	128.5

MP4T636535, V_{CE} = 3 Volts, I_C = 60 mA

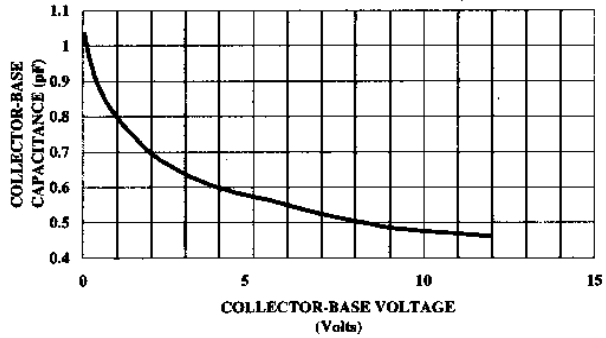
Frequency (MHz)	S_{11E} Mag.	S_{11E} Angle	S_{21E} Mag.	S_{21E} Angle	S_{12E} Mag.	S_{12E} Angle	S_{22E} Mag	S_{22E} Angle
500	0.604	-179	9.503	92.9	0.040	60.9	0.242	-112.0
1000	0.614	167	4.750	80.5	0.064	63.6	0.183	-139.1
1500	0.631	156	3.220	69.9	0.091	61.8	0.182	-155.9
2000	0.655	146	2.460	60.6	0.116	59.0	0.181	-168.3
2500	0.681	135	2.046	51.9	0.141	55.6	0.182	-172.5
3000	0.697	125	1.776	43.3	0.166	51.9	0.190	-174.3
3500	0.721	115	1.590	34.9	0.189	47.9	0.204	-170.6
4000	0.758	107	1.480	26.8	0.211	43.9	0.217	-164.7
4500	0.798	97	1.395	19.3	0.232	40.0	0.234	-158.5
5000	0.843	88	1.255	11.4	0.254	36.2	0.253	-152.9
5500	0.883	79	1.190	3.3	0.272	32.4	0.279	-46.6
6000	0.922	69	1.125	-5.2	0.295	27.6	0.303	-138.5

MP4T6365
Typical Performance Curves

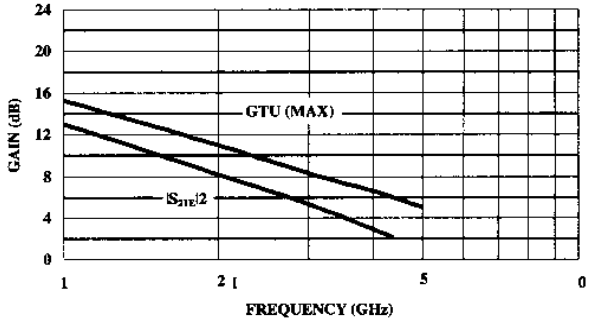
POWER DERATING CURVES



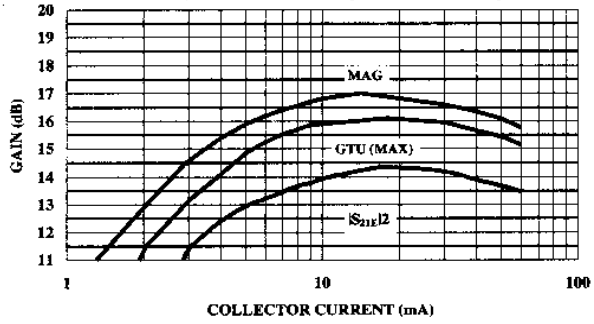
NOMINAL COLLECTOR-BASE CAPACITANCE (C vs COLLECTOR-BASE VOLTAGE (MP4T636535)



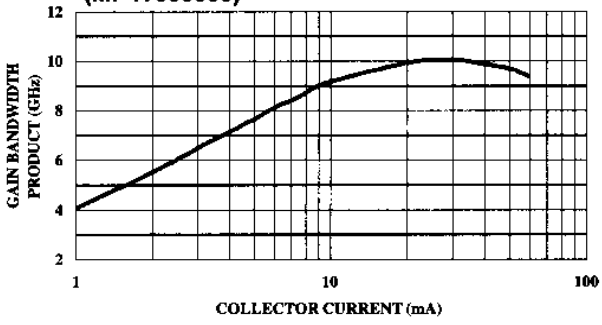
NOMINAL GAIN vs FREQUENCY at V_{CE} = 3 Volts, I_C = 10 mA (MP4T636535)



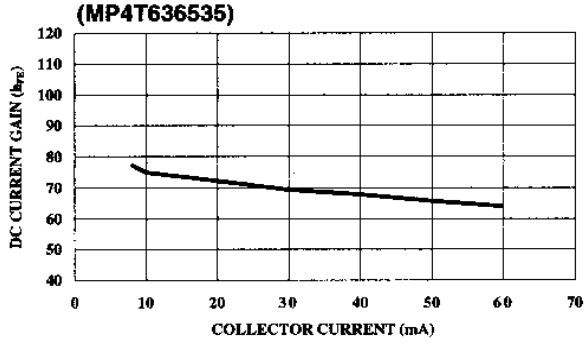
NOMINAL GAIN vs COLLECTOR CURRENT at f = 1.0 GHz, V_{CE} = 3 Volts (MP4T636535)



NOMINAL GAIN BANDWIDTH PRODUCT (f_T) vs COLLECTOR CURRENT at V_{CE} = 3 VOLTS (MP4T636535)

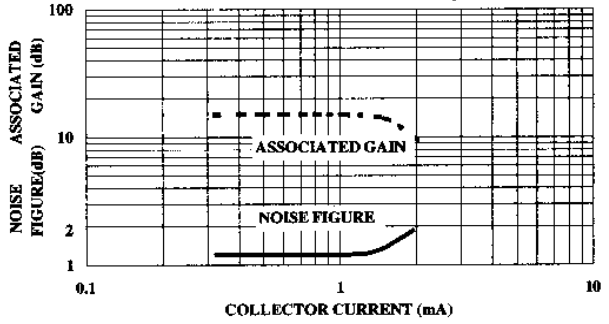


NOMINAL DC CURRENT GAIN (h_{FE}) vs COLLECTOR CURRENT at V_{CE} = 3 VOLTS (MP4T636535)

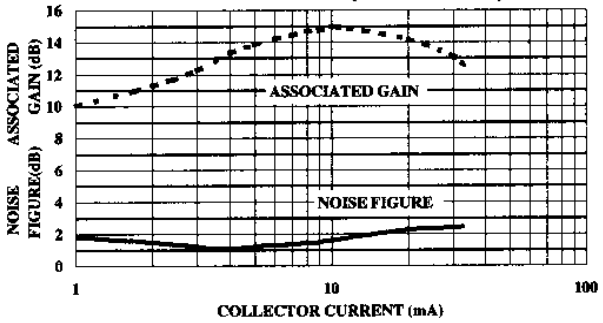


Typical Performance Curves (Contd)

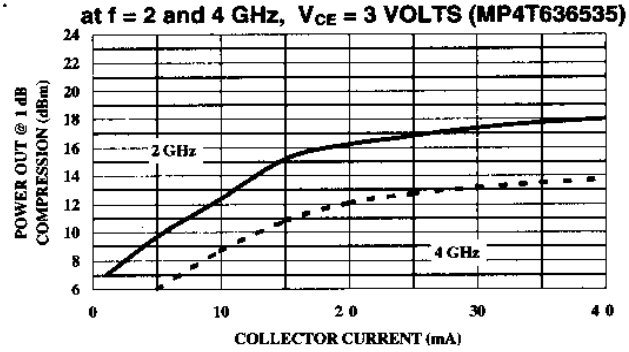
NOMINAL NOISE FIGURE and ASSOCIATED GAIN vs FREQUENCY at V_{CE} = 3 VOLTS, COLLECTOR CURRENT = 5 mA (MP4T636535)



NOMINAL NOISE FIGURE and ASSOCIATEI GAIN at V_{CE} = 3 VOLTS, and 1 GHz vs th COLLECTOR CURRENT (MP4T636535)



NOMINAL OUTPUT POWER at the 1dB COMPRESSION POINT vs COLLECTOR CURRENT at f = 2 and 4 GHz, V_{CE} = 3 VOLTS (MP4T636535)



Silicon Bipolar Low Noise Microwave Transistors

MP42001

Features

- Low Noise Figure (.8Db Typical @ 60 MHz)
- Large Dynamic Range (+25dBm @ 1Db Compression Point)
- Gold Metalization
- Hermetic and Surface Mount Packages Available
- Can be Screened to JANTX, JANTXV Equivalent Levels
- Low 1/f Noise (1.0dB Typical @ 10 KHz)

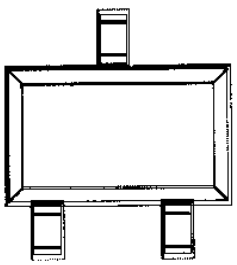
Description

This series of NPN silicon transistors is designed to provide the low noise figure at frequencies from 10 to 1000 MHz. These transistors exhibit excellent noise figure vs. current characteristics which results in extremely low noise and wide dynamic range performance. These transistors find wide application in sophisticated radar and communications equipment at VHF/UHF.

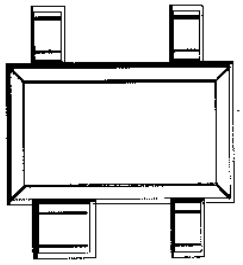
Applications

The MP42001 family of bipolar NPN transistors can be used for low noise, high associated gain. large dynamic range amplifiers up to approximately 1.0 GHz. These transistors can also be used as preamplifier or driver stages in the same frequency range.

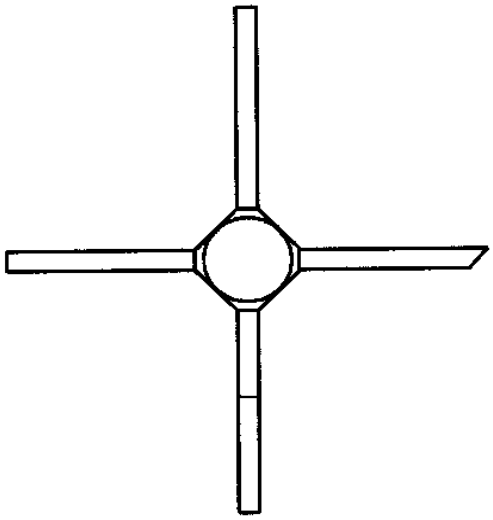
Case Styles



SOT-23



SOT-143



Micro-X

Absolute Maximum Ratings
MP42001 Series

Collector-Base Voltage	V_{CBO}	20 V
Collector-Emitter Voltage	V_{CEO}	15 V
Emitter-Base Voltage	V_{EBO}	1.5 V
Collector Current	I_C	125 mA
Junction Operating Temperature	T_J	200°C
Storage Temperature Chip or Ceramic Packages Plastic Packages		 -65°C to +200°C -65°C to +125°C
Total Power Dissipation at 25 °C 509 Case Style 510 Case Style 35 Case Style		 450 mW 1.2 W 750 mW

Electrical Specifications @ 25°C
MP42001 Series

Gain Bandwidth Product	V_{CE} = 10 volts I_C = 35 mA	f_T	GHz	2.3 typ	1.5 typ	1.5 typ
Insertion Power Gain	V_{CE} = 10 volts I_C = 28 mA f = 100 MHz f = 450 MHz	$\|S_{21E}\|^2$	dB	 30 typ 16 typ	 29 typ 14 min	 26 typ 12 min
Noise Figure	V_{CE} = 10 volts I_C = 5 mA f = 60 MHz f = 450 GHz	NF	dB	 1.2 typ 1.7 typ	 1.4 typ 1.9 typ	 1.5 typ 2.3 typ
Unilateral Gain	V_{CE} = 10 volts I_C = 5 mA f = 60 MHz	GTU (max)	dB	 30 typ	 28 typ	 28 typ
Power Out at 1 dB Compression Z=50 Ohms	V_{CE} = 10 volts I_C = 10 mA f = 60 MHz f = 450 MHz	P_{1dB}	dBm	 N/A N/A	 +5 typ +2 typ	 +7 typ +4 typ

Electrical Specifications @ +25 °C
MP42001 Series

Collector Cut-off Current	V_{CB} = 10 volts I_E = 0 µA	I_{CBO}	—	—	10	nA
Emitter Cut-off Current	V_{EB} = 1 volt I_C = 0 µA	I_{EBO}	—	—	1	µA
Forward Current Gain	V_{CE} = 8 volts I_C = 7 mA	h_{FE}	30	125	250	—
Collector-Base Junction Capacitance	V_{CB} = 15 volts f = 1 MHz	C_{CB}	—	----	1.7 1.3 1.2	pF (509) pF (510) pF (511)

Typical Scattering Parameters in the TO-72 Can Package
MP42001-509, V_{CE} = 10 Volts, I_C = 5 mA

110	0.667	-83	8.74	122.6	0.040	48.9	0.765	-21.7
200	0.551	-116	6.02	104.7	0.054	45.7	0.649	-25.8
300	0.496	-138	4.32	92.4	0.064	48.1	0.597	-28.4
400	0.475	-155	3.45	83.1	0.070	50.9	0.578	-30.7
500	0.466	-167	2.79	75.0	0.080	55.8	0.570	-32.4
600	0.467	-178	2.38	69.1	0.088	59.9	0.551	-35.6
700	0.470	174	2.13	62.1	0.098	63.3	0.528	-38.6
800	0.474	167	1.87	57.3	0.114	65.4	0.511	-44.3
900	0.469	161	1.72	52.4	0.127	67.1	0.506	-50.4
1000	0.464	153	1.58	46.3	0.145	70.0	0.503	-56.4

MP42001-510, V_{CE} = 10 Volts, I_C = 60 mA

100	0.76	-143	30.01	111	0.01	45	0.49	-30
200	0.80	-164	14.54	96	0.01	43	0.34	-22
300	0.81	-174	8.81	86	0.02	46	0.32	-20
400	0.82	-178	6.38	80	0.02	50	0.31	-21
500	0.84	178	4.92	75	0.02	56	0.31	-23
600	0.82	174	4.11	68	0.03	59	0.32	-26
700	0.82	172	3.38	63	0.03	63	0.32	-29
800	0.85	168	2.82	58	0.03	61	0.33	-33
900	0.92	172	2.32	59	0.03	64	0.34	-37
1000	0.83	162	2.28	49	0.04	64	0.35	-40

M-pulse Microwave offers chip components which are intended for microwave hybrid assembly. These chip components are supplied in waffle or gel packages that must be opened with care. It is recommended that a vacuum pickup be used for removing the chip component from the waffle package. CAUTION: The vacuum needle must be sufficiently small to avoid possible passage of the chip into the needle. If a vacuum pickup is not available, the die can be picked up by using very sharp tweezers or a sharpened wooden stick dipped in alcohol. For higher than ambient room temperatures the vacuum pickup or tweezers is recommended.

Die Attachment

The recommended method for attaching chip components for high reliability and high power devices is with a eutectic solder preform such as Au/Sn (80%/20%) in a reducing atmosphere (N_2+H_2 Forming gas). For some applications, such as experimental work or heat sensitive devices such as Tunnel or Back diodes, the recommended die attachment medium is EPO-TEK H31D Single Component from Epoxy Technologies Inc., or equivalent.

Eutectic Preform Die Attachment

Place the substrate on a heater strip, a hot plate, or use other means that will provide the necessary heat for the required time. For Au/Sn (80%/20%) the temperature and time to be applied to the chip component should be 300° C for 5 seconds. If other preforms such as Au/Ge (88%/12%), the temperature and time may have to be arrived at by experimentation, or by following the vendor's recommended schedule.
When the preform has melted, place the chip component on top of the melted preform and lightly scrub to assure solder flow onto the chip backing. Remove the substrate from the heat source as soon as the die attachment has been completed. Extended exposure to extremes in temperature versus time may cause component degradation or failure.

Conductive Epoxy Die Attachment

Place a small amount of conductive epoxy (EPO-TEK H31D) onto the substrate where the chip component is to be attached. The exact amount of epoxy to be used may be determined by experimantation. Place the chip component on the epoxy and press the chip flat onto the substrate. This will result in some of the epoxy oozing out on the sides of the chip. This is acceptable providing the epoxy does not creep up the side of the chip, contaminate the face of the chip and interfere with the junction contacts. Bake the substrate assembly in a oven at 150° C for 1 hour or any other curing schedule that does't exceed the storage temperature limit of the chip or component.

Standard Screening Procedures

COMMERCIAL SCREENING
(100% TESTING)

	MIL-STD-750 METHOD	REQUIRED CONDITION
Wafer Electrical	4011, 4016	
Bond Pull	2037	
Die Shear	2017	
Internal Visual Inspection	2073, 2074	As Applicable.
High Temperature Storage	1032	Minimum 24 hours at maximum rated temperature.
Gross Leak	1071	Condition C, no bubbles.
Final Electrical Data Attribute		PDA=10%.

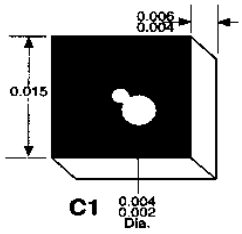
TVX SCREENING
MIL-S-19500
(100% TESTING)

	MIL-STD-750 METHOD	REQUIRED CONDITION
Wafer Electrical	4011, 4016	
Bond Pull	2037	
Die Shear	2017	
Internal Visual Inspection	2073, 2074	As Applicable.
High Temperature Storage	1032	Minimum 24 hours at maximum rated temperature.
Thermal Shock	1051	20 temperature cycles, test condition C.
Constant Acceleration	2006	Y1 axis at 20,000 G minimum.
Fine Leak	1071	Condition H.
Gross Leak	1071	Condition C, no bubbles.
Initial Electrical Data (Attributes)	4016 4011	I_R V_F
Burn-in	1038	HTRB minimum 48 hours, condition A.
Interim Electrical Data (Variables)	4016 4011	I_R V_F
Burn-in	1038	96 hours minimum, Condition B.
(Variables)	4016 4011	ΔI_R max =100% of intial value or 25% of limit, whichever is greater ΔV_F max = ±10%
External Visual Examination	2071	PDA = 10%
Final Acceptance		

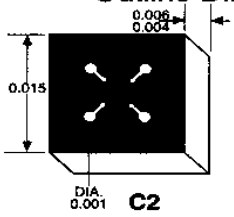
Notes:
1. S level equivalent screening available on all products.
2. Bond pull and die shear tests performed per MIL-STD-750 methods 2037 and 2017 on all wafers.

Package Dimensions

Outline Dimensions (in inches)



C1



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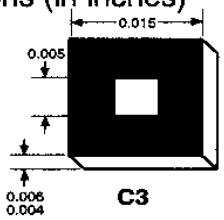

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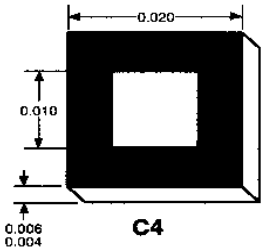
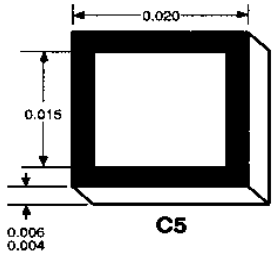
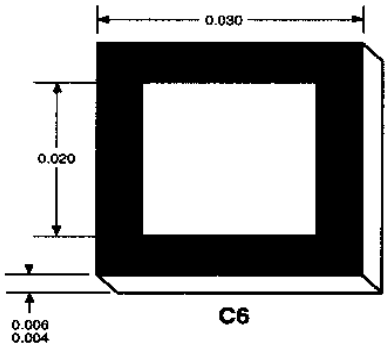


C4



C5



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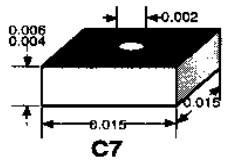
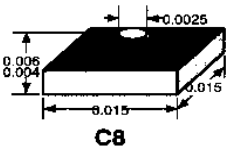
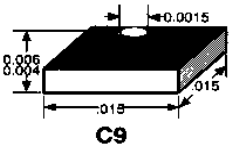


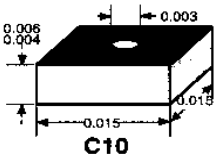
C7



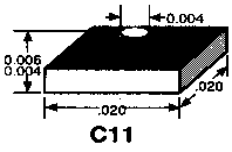
C8



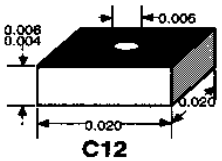
C9



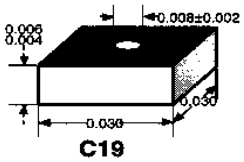
C10



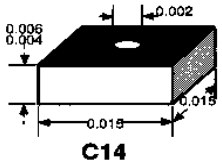
C11



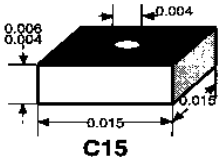
C12



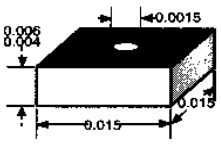
C19



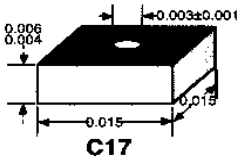
C14



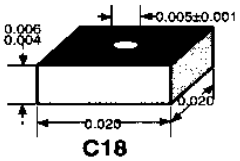
C15



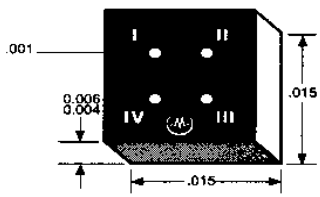
C22



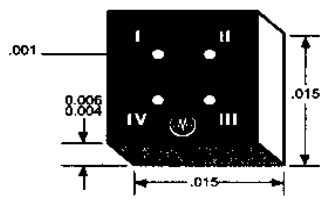
C17



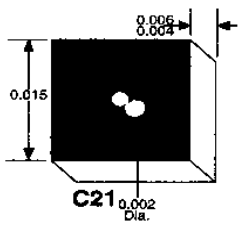
C18



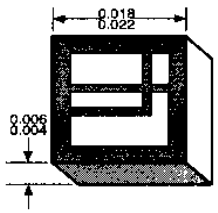
C13 - N Type
Top Contact Anode



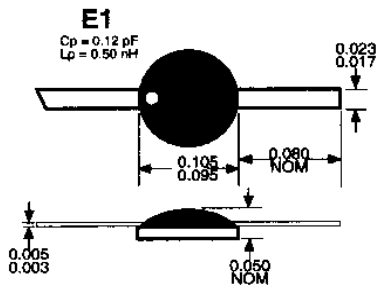
C16 - P Type
Top Contact Cathode

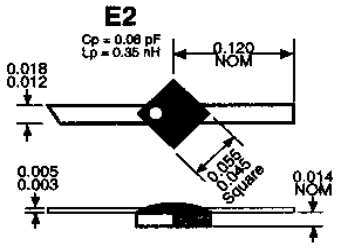


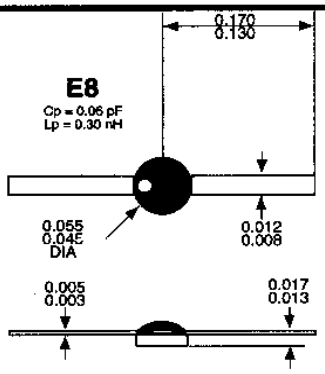
C21

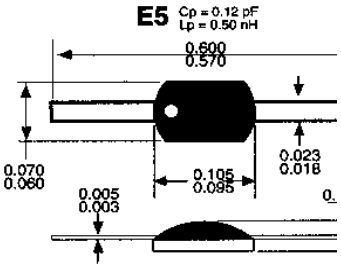


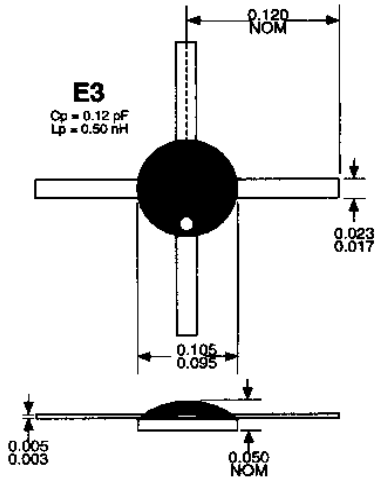
Package Dimensions (in inches)

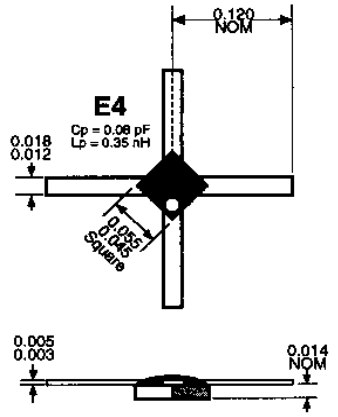


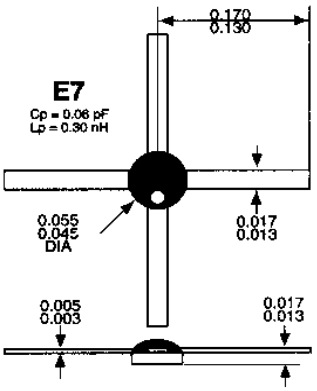


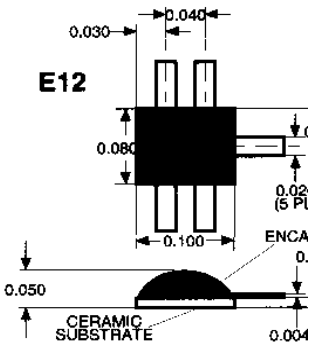


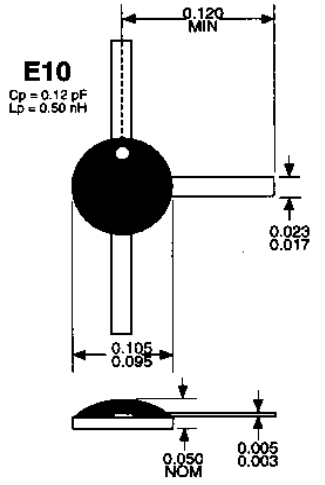


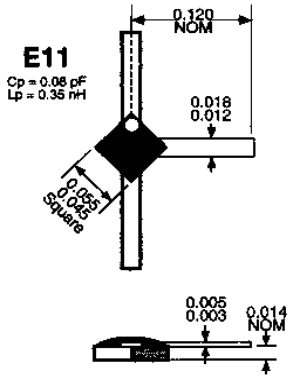


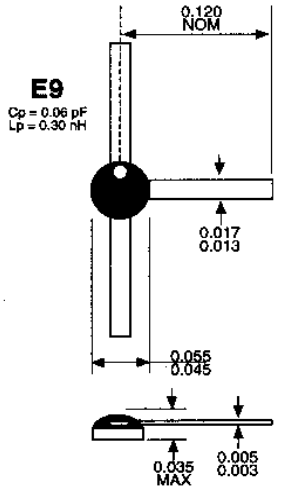


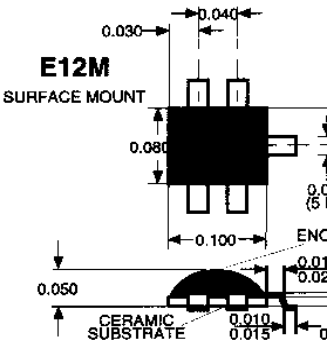


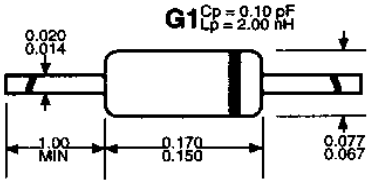


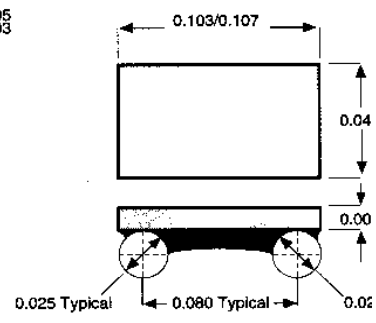




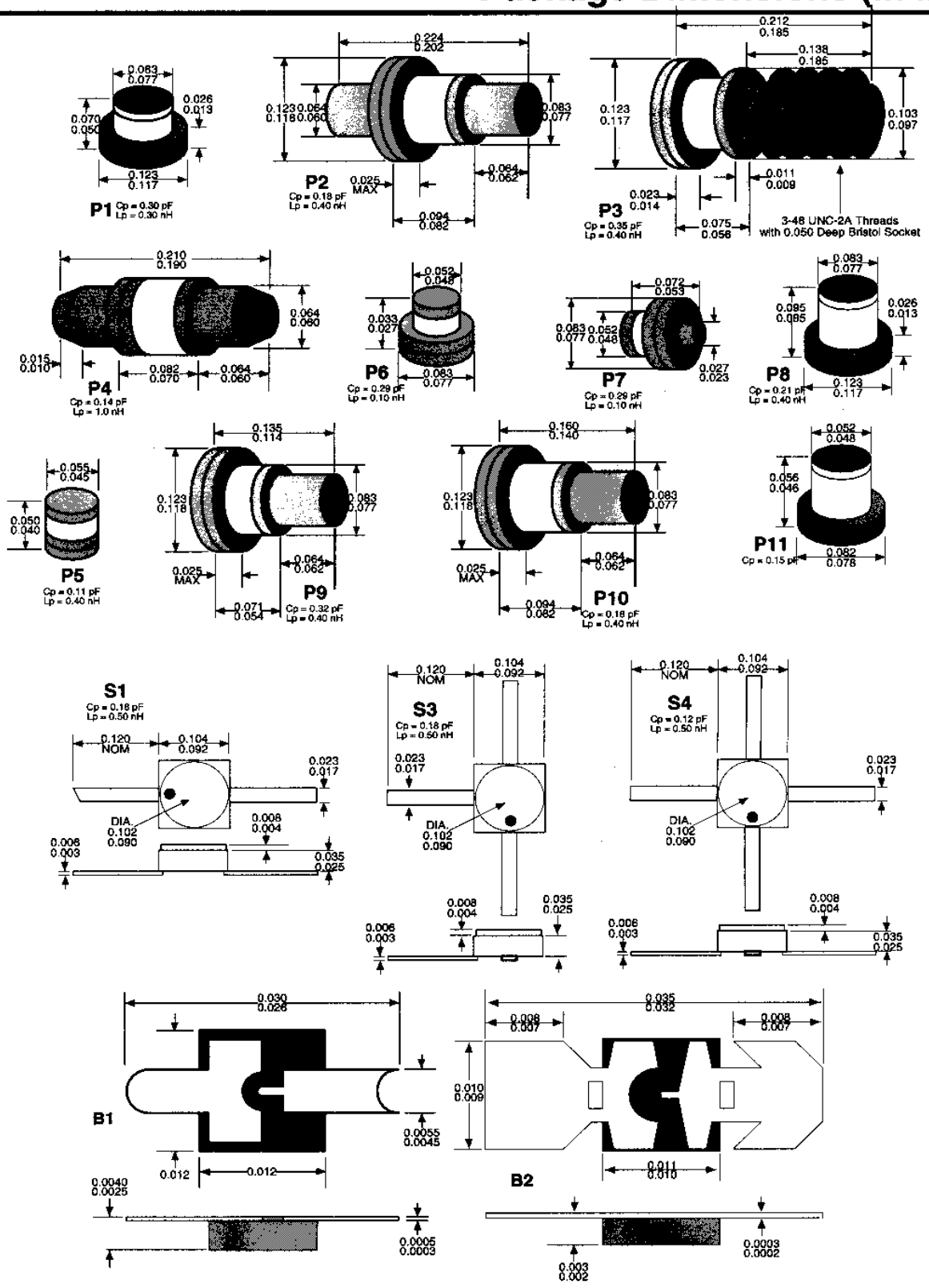




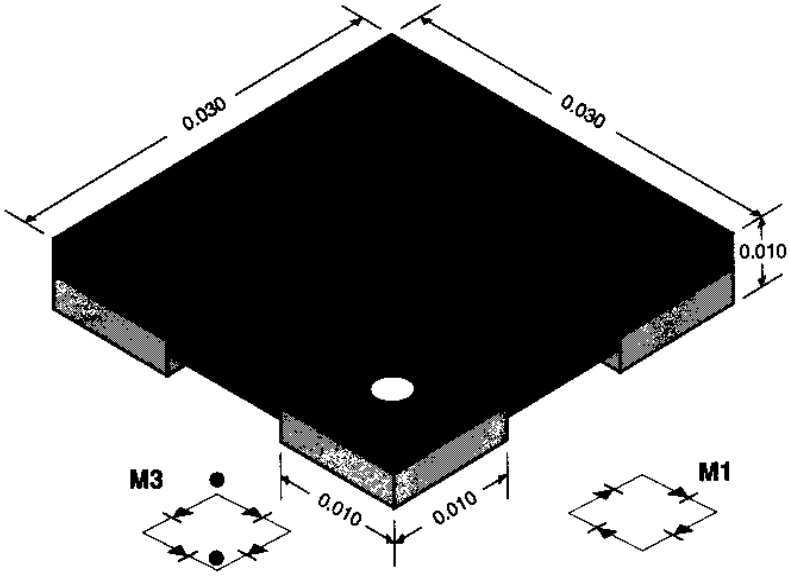


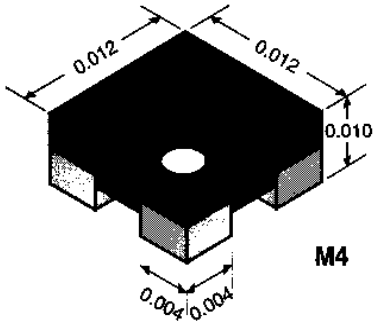


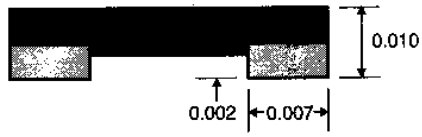
Package Dimensions (in inches)

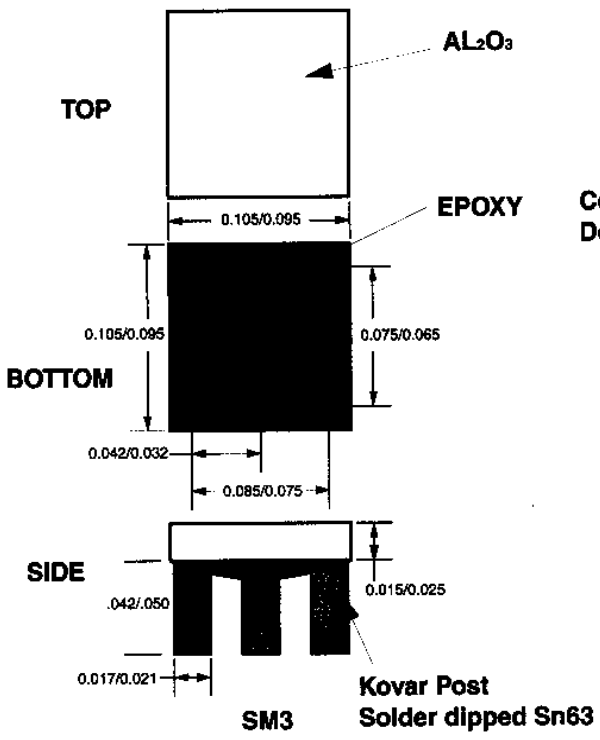


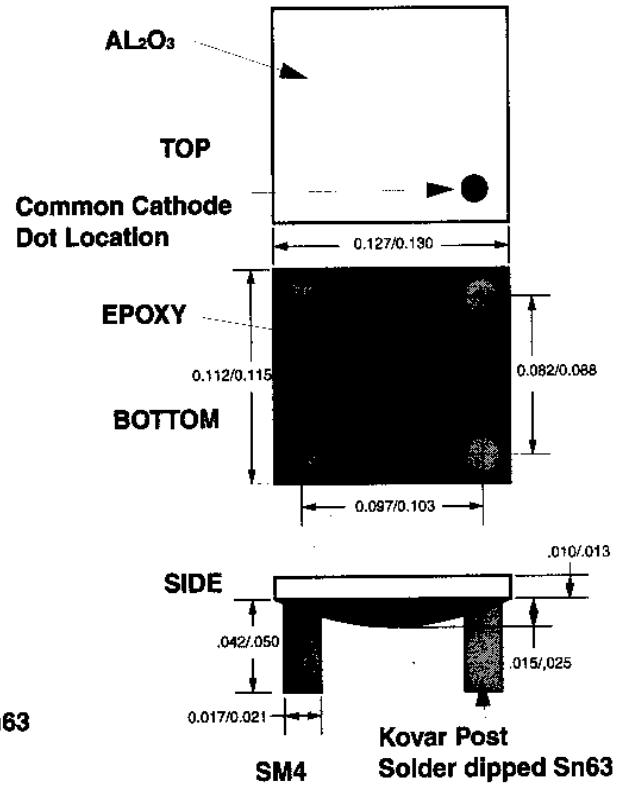
Package Dimensions (in inches)





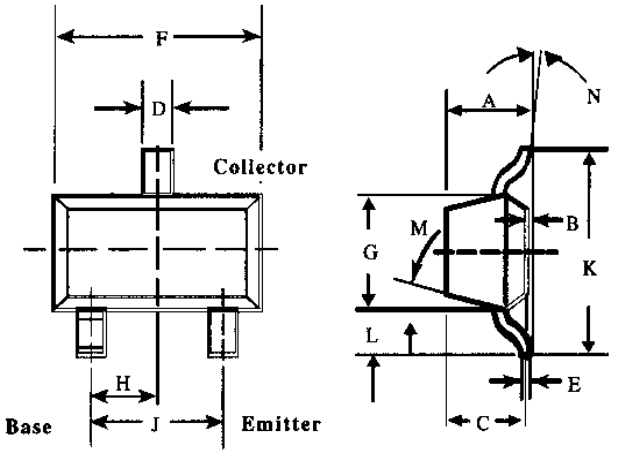






Transistor Case Styles

SOT-23

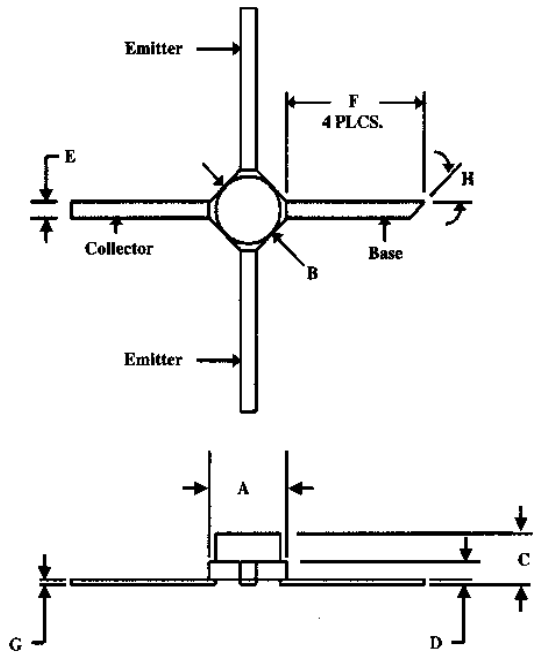


A	—	0.044	—	1.12
B	—	0.004	—	0.10
C	—	0.040	—	1.00
D	0.013	0.020	0.35	0.50
E	0.003	0.006	0.08	0.15
F	0.110	0.119	2.80	3.00
G	0.047	0.056	1.20	1.40
H	0.037 typical		0.95 typical	
J	0.075 typical		1.90 typical	
K	—	0.103	—	2.60
L	—	0.024	—	0.60

M	10° max. [1]
N	2° . . . 30°

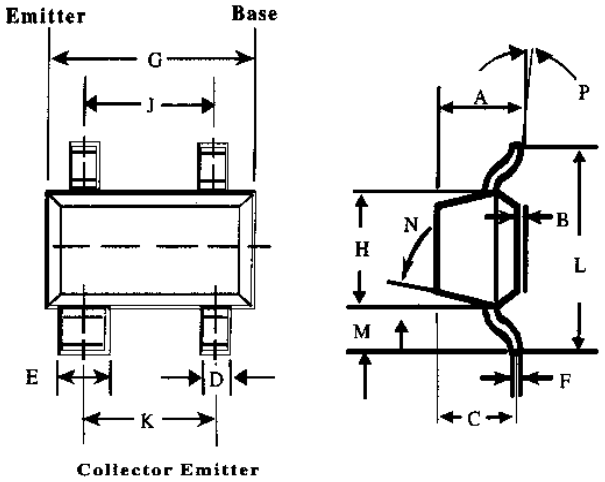
NOTE:
1 Applicable on all sides

Micro-X (MP4T85635)



A	0.092	0.108	2.34	2.74
B	0.079	0.087	2.01	2.21
C	—	0.070	—	1.78
D	0.019	0.025	0.48	0.64
E	0.018	0.022	0.046	0.56
F	0.150	—	3.81	—
G	0.003	0.006	0.08	0.15
H	45°		45°	

SOT-143 (MP4T85639)



A	—	0.044	—	1.10
B	—	0.044	—	1.10
C	—	0.040	—	1.00
D	0.030	0.035	0.75	0.90
E	0.013	0.020	0.35	0.50
F	0.003	0.006	0.08	0.15
G	0.110	0.119	2.80	3.00
H	0.047	0.056	1.20	1.40
J	0.075 typical		1.90 typical	
K	0.075 typical		1.90 typical	
L	—	0.103	—	2.6
M	—	0.024	—	0.6

N	10° max. [1]
P	2° . . . 30°

NOTE:
1. Applicable on all sides

Background
Founded in 1987, M-pulse Microwave has been and continues to be a technological leader and innovator in the RF and microwave semiconductor industry. Located in two custom designed manufacturing facilities covering 15,000 square feet in San Jose, CA, M-pulse manufactures and processes Silicon and GaAs diodes for medical, commercial, consumer and defense applications. M-pulse specializes in custom and semi-custom applications and is noted for our quick response ability. In 1998, M-pulse Microwave aquired M/A-Com's silicon, small-signal bipolar transistor line.

This Guide
This Guide lists all of the standard products offered by M-pulse Microwave as of this printing. This guide is divided into product sections and are tabbed for easy location. Product information in this guide is current and accurate at the time of printing, M-pulse reserves the right to update, modify and/or correct any information presented herein.

How to Order
Orders may be placed with any of our local Manufacturers Representatives (call for list) or placed directly with the factory at:

M-pulse Microwave
576 Charcot Avenue
San Jose, CA 95131

Tel: (408) 432-1480
Fax: (408)432-3440
E-mail: Sales@mpulsemw.com
Web: www.mpulsemw.com
FSCM: 0C7W7

Terms and Conditions
The minimum order accepted by M-pulse is $250.00 per line-item. Payment is due 30 days after date of shipment. Shipments are billed F.O.B. San Jose, CA.

Warranty
M-pulse Microwave devices are warranted against defects in material and workmanship for a period of one year from the date of shipment. M-pulse will repair or, at its option, replace devices that prove to be defective under proper use during the warranty period.

Returns must be authorized by and routed through the Sales Department. Complete information regarding original P.O. number, date of purchase and reason for return are helpful in expediting a quick turn-around.

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