MICRO POWER SYSTEMS

MP3954A • 3954 • 3955 3956 • 3958

LOW LEAKAGE LOW DRIFT MONOLITHIC DUAL SILICON NITROX® FIELD EFFECT TRANSISTORS

DIFFUSED ISOLATED

LOW DRIFT ..... $\left|\frac{\Delta V_{GS_{1-2}}}{\Delta T}\right| = 5\mu V/°C$ max.

LOW LEAKAGE ..... I_G = 50pA max.

LOW NOISE ..... $e_n = 25\frac{nV}{\sqrt{Hz}}$ TYP.

LOW PINCHOFF ..... Vp = 2V TYP.

ABSOLUTE MAXIMUM RATINGS (Note 1)
@ 25°C (unless otherwise noted)

Maximum Temperatures

Storage Temperature	-65°	to	+150°C
Operating Junction Temperature			+150°C
Lead Temperature (Soldering, 10 second time limit)			+300°C

Maximum Power Dissipation

Device Dissipation @ Free Air	400mW	@ 25°C

Maximum Voltage and Current for Each Transistor

$-V_{GSS}$	Gate to Drain or Source Voltage	60V
$-I_{G(f)}$	Gate Forward Current	50mA
$-V_{DSO}$	Drain to Source Voltage	60V

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP 3954A	MP 3954	MP 3955	MP 3956	MP 3958	UNITS	CONDITIONS
$\left\|\frac{\Delta V_{GS_{1-2}}}{\Delta T}\right\|_{max.}$	Drift vs Temperature	5	10	25	50	100	µV/°C	V_{DG} = 20V, I_D = 200µA T_A = -55°C to +25° to +125°C
$\|V_{GS_{1-2}}\|$ max.	Offset Voltage	10	10	25	25	25	mV	V_{DG} = 20V, I_D = 200µA
TDN typ.	Temp Drift Nonlinearity	±1	±1	±1	±1	±5	µV/°C	V_{DG} = 20V, I_D = 200µA
TDN max.		±5	±5	±5	±5	—		T_A = -55°C to +25°C to +125°C

Notes and Additional Electrical Characteristics on next page.

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
	Transconductance					
Y_{fss}	Full Conduction	1000	2000	3000	μmho	V_{DG} = 20V, V_{GS} = 0, f = 1kHz
Y_{fs}	Typical Operation	500	700	1000	μmho	V_{DG} = 20V, I_D = 200μA
$\left\|\frac{Y_{fs_{1-2}}}{Y_{fs}}\right\|$	Mismatch	–	0.6	3	%	V_{DG} = 20V, I_D = 200μA
	Drain Current					
I_{DSS}	Full Conduction	0.5	2	5	mA	V_{DG} = 20V, V_{GS} = 0
$\left\|\frac{I_{DSS_{1-2}}}{I_{DSS}}\right\|$	Mismatch at Full Conduction	–	1	5	%	V_{DG} = 20V, V_{GS} = 0
	Gate Current					
$-I_G$	Operating	–	20	50	pA	V_{DG} = 20V, I_D = 200μA
$-I_G$	High Temperature	–	–	50	nA	V_{DG} = 20V, I_D = 200μA, T_A = +125°C
$-I_G$	Reduced V_{DG}	–	5	–	pA	V_{DG} = 10V, I_D = 200μA
I_G (f) D*	Forward Current	–	–	50	mA	Any Condition
$-I_{GSS}$	At Full Conduction	–	–	100	pA	V_{DG} = 20V, V_{DS} = 0
	Output Conductance					
Y_{oss}	Full Conduction	–	–	5	μmho	V_{DG} = 20V, V_{GS} = 0
Y_{os}	Operating	–	0.1	1	μmho	V_{DG} = 20V, I_D = 200μA
$\left\|Y_{os_{1-2}}\right\|$	Differential	–	0.01	0.1	μmho	V_{DG} = 20V, I_D = 200μA
	Common Mode Rejection					
CMR	$-20 \log \left\|\frac{\Delta V_{GS_{1-2}}}{\Delta V_{DS}}\right\|$	–	100	–	dB	ΔV_{DS} = 10 to 20V, I_D = 200μA
CMR		–	75	–	dB	ΔV_{DS} = 5 to 10V, I_D = 200μA
	Gate Voltage					
V_{GS} (off) or V_P	Pinchoff Voltage	1	2	4.5	V	V_{DS} = 20V, I_D = 1nA
V_{GS}	Operating Range	0.5	–	4	V	V_{DS} = 20V, I_D = 200μA
BV_{GSS}	Breakdown Voltage	60	–	–	V	V_{DS} = 0, I_D = 1nA
V_{GSS} D*	To Source or Drain	–	–	60	V	Any Condition
V_{GGO}	Gate-to-Gate Breakdown	60	–		V	I_G = 1nA, I_D = 0, I_S = 0
V_{DSO} D*	Drain-Source Voltage	–	–	40	V	Any Condition
	Noise					
NF	Figure	–	–	0.5	dB	V_{DS} = 20V, V_{GS} = 0, R_G = 10MΩ f = 100Hz, NBW = 6Hz
e_n	Voltage	–	25	70	nV/√Hz	V_{DS} = 20V, I_D = 200μA, f = 10Hz NBW = 1Hz
	Capacitance					
C_{iss}	Input	–	–	6	pF	V_{DS} = 20V, V_{GS} = 0, f = 1MHz
C_{rss}	Reverse Transfer	–	–	2	pF	V_{DS} = 20V, V_{GS} = 0, f = 1MHz
C_{dd}	Drain to Drain	–	0.1	–	pF	V_{DG} = 20V, I_D = 200μA
	Temperature					
T_S D*	Storage	-65	–	+150	°C	Any Condition
T_J D*	Junction	–	–	+150	°C	Any Condition
T_L D*	Lead	–	–	+300	°C	10 sec. max.-1/16" or more from case
P_D D*	Dissipation - both sides	–	–	400	mW	T_A = +25°C, Derate 3.3mW/°C

*Note: These ratings are limiting values above which the serviceability of any semiconductor may be impaired.

MICRO POWER SYSTEMS

MP5905 • 5906 • 5907 • 5908 • 5909

LOW LEAKAGE LOW DRIFT MONOLITHIC DUAL SILICON NITROX® FIELD EFFECT TRANSISTORS

DIFFUSED ISOLATED

LOW DRIFT ..... $\left|\frac{\Delta V_{GS_{1-2}}}{\Delta T}\right|$ = 5μV/°C max.

LOW LEAKAGE ..... I_G = 1pA max.

LOW PINCHOFF ..... V_P=2V TYP.

ABSOLUTE MAXIMUM RATINGS (Note 1)

@ 25°C (unless otherwise noted)

Maximum Temperatures

Storage Temperature	-65°	to	+150°C
Operating Junction Temperature			+150°C
Lead Temperature (Soldering, 10 second time limit)			+300°C

Maximum Power Dissipation

Device Dissipation @ Free Air - Total — 40mW @ +125°C

Maximum Voltage and Current for Each Transistor

$-V_{GSS}$	Gate Voltage to Source or Drain	40V
$-V_{DSO}$	Drain to Source Voltage	40V
$-I_{G(f)}$	Gate Forward Current	10mA
$-I_G$	Gate Reverse Current	10μA

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MP 5906	MP 5907	MP 5908	MP 5909	MP 5905	UNITS	CONDITIONS
$\left\|\frac{\Delta V_{GS_{1-2}}}{\Delta T}\right\|_{max.}$	Drift vs Temperature	5	10	20	40	75	μV/°C	V_{DG} = 10V, I_D = 30μA T_A = -55°C to +25°C to +125°C
$\|V_{GS_{1-2}}\|$ max.	Offset Voltage	25	25	25	25	25	mV	V_{DG} = 10V, I_D = 30μA
TDN	Temperature Drift	±1	±1	±1	±1	±5	μV/°C	V_{DG} = 10V, I_D = 30μA
TDN max.	Nonlinearity	±5	±5	±5	±5	–	μV/°C	T_A = -55°C to +25°C to +125°C
$-I_G$ max.	Gate Leakage Current Operating	1	1	1	1	3	pA	V_{DG} = 10V, I_D = 30μA
$-I_G$ max.	T_A = +125°C	1	1	1	1	3	nA	V_{DG} = 10V, I_D = 30μA
$-I_{GSS}$ max.	Full Conduction	2	2	2	2	5	pA	V_{DS} = 0, V_{GS} = -20V
$-I_{GSS}$ max.	T_A = +125°C	5	5	5	5	10	nA	V_{DS} = 0, V_{GS} = -20V

Notes and Additional Electrical Characteristics on next page.

MP5905 • 5906 • 5907 • 5908 • 5909

ELECTRICAL CHARACTERISTICS @ 25°C (unless otherwise noted)

SYMBOL	CHARACTERISTICS	MIN.	TYP.	MAX.	UNITS	CONDITIONS
	Transconductance					
Y_{fss}	Full Conduction	70	300	500	μmho	V_{DG} = 10V, V_{GS} = 0, f = 1kHz
Y_{fs}	Typical Operation	50	100	200	μmho	
$\left\|\frac{Y_{fs_{1-2}}}{Y_{fs}}\right\|$	Mismatch	–	1	5	%	V_{DG} = 10V, I_D = 30μA, f = 1kHz
	Drain Current					
I_{DSS}	Full Conduction	60	400	1000	μA	V_{DG} = 10V, V_{GS} = 0
$\left\|\frac{I_{DSS_{1-2}}}{I_{DSS}}\right\|$	Mismatch at Full Conduction	–	2	5	%	
	Output Conductance					
Y_{oss}	Full Conduction	–	–	5	μmho	V_{DG} = 10V, V_{GS} = 0
Y_{os}	Operating	–	–	0.5	μmho	V_{DG} = 10V, I_D = 30μA
$\left\|Y_{os_{1-2}}\right\|$	Differential	–	–	0.1	μmho	
	Common Mode Rejection					
CMR	$-20 \log \left\|\frac{\Delta V_{GS_{1-2}}}{\Delta V_{DS}}\right\|$	–	90	–	dB	ΔV_{DS} = 10 to 20V, I_D = 30μA
CMR		–	90	–	dB	ΔV_{DS} = 5 to 10V, I_D = 30μA
V_{GS} (off)	Gate Voltage					
or V_P	Pinchoff Voltage	0.6	2	4.5	V	V_{DS} = 10V, I_D = 1nA
V_{GS}	Operating Range	–	–	4	V	V_{DG} = 10V, I_D = 30μA
BV_{GSS}	Breakdown Voltage	-40	-60	–	V	V_{DS} = 0, I_D = 1nA
V_{GSS} D*	To Source or Drain	–	–	40	V	Either V_{GS} or V_{GD}
BV_{GGO}	Gate-to-Gate Breakdown	40	–	–	V	I_G = 1nA, I_D = 0, I_S = 0
	Gate Current					
I_{GGO}	Gate-to-Gate Leakage	–	1	–	pA	V_{GG} = 20V
$-I_G$ D*	Gate Reverse Current	–	–	10	μA	Any Condition
I_G (f) D*	Gate Forward Current	–	–	10	mA	Any Condition
V_{DSO} D*	Drain to Source Voltage	–	–	40	V	
	Noise					
NF	Figure	–	–	1	dB	V_{DS} = 10V, V_{GS} = 0, R_G = 10MΩ f = 100Hz, NBW = 6Hz
e_n	Spot Voltage	–	70	–	$nV/\sqrt{Hz}$	V_{DG} = 10V, I_D = 30μA NBW = 1Hz, f = 10Hz
	Capacitance					
C_{iss}	Input	–	–	3	pF	V_{DS} = 10V, V_{GS} = 0, f = 1MHz
C_{rss}	Reverse Transfer	–	–	1.5	pF	V_{DG} = 10V, I_D = 30μA
C_{dd}	Drain to Drain	–	–	0.1	pF	
	Temperature					
T_S D*	Storage	-65	–	+150	°C	
T_J D*	Junction	–	–	+150	°C	
T_L D*	Lead	–	–	+300	°C	10 sec. max. - 1/16" or more from case
P_D D*	Dissipation - Both Sides	–	–	40	mW	T_A = +125°C

*Note: These ratings are limiting values above which the serviceability of any semiconductor may be impaired.