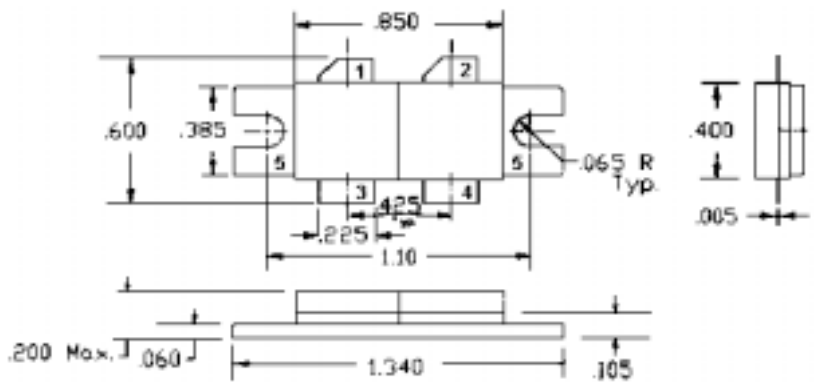
VHF POWER MOSFET

DESCRIPTION:

The **ASI BLF278** is a Dual Common Source N-Channel Enhancement-Mode MOSFET
RF Power Transistor, Designed for 175 MHz, 300 W Transmitter and Amplifier Applications.

PACKAGE STYLE .385X.850 4LFG



1 & 2 = DRAIN 3 & 4 = GATE
5 = SOURCE

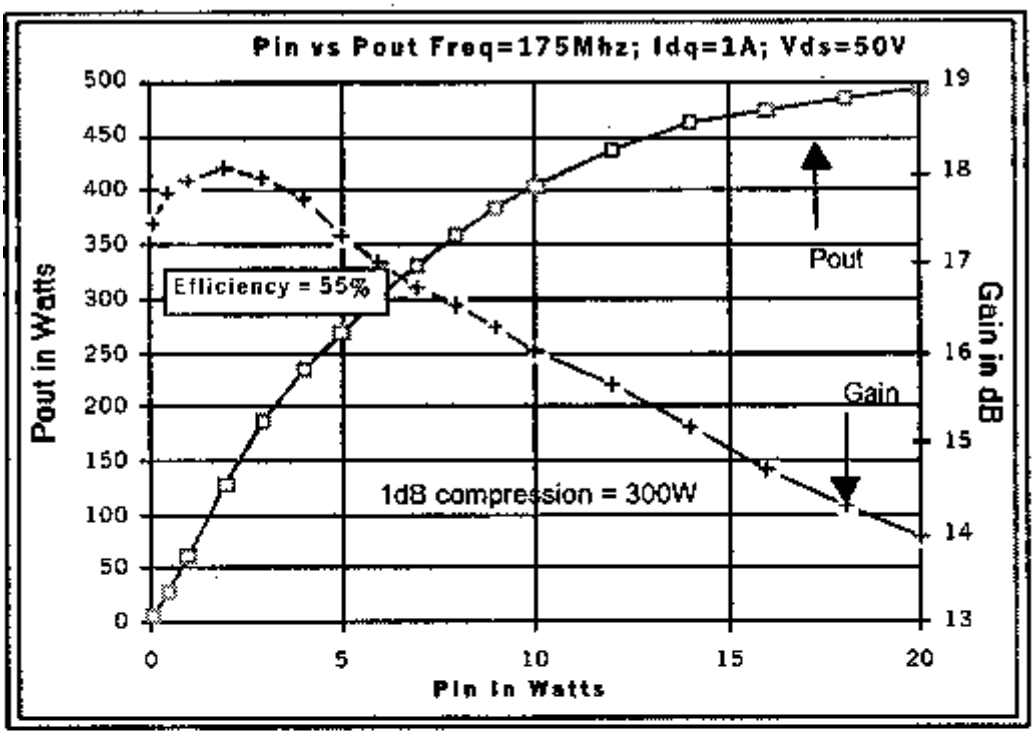
MAXIMUM RATINGS

I_D	40 A
V_{DSS}	125 V
V_{GS}	±40 V
P_{DISS}	500 W @ T_C = 25 °C
T_J	-65 °C to +200 °C
T_{STG}	-65 °C to +150 °C
θ_{JC}	0.35 °C/W

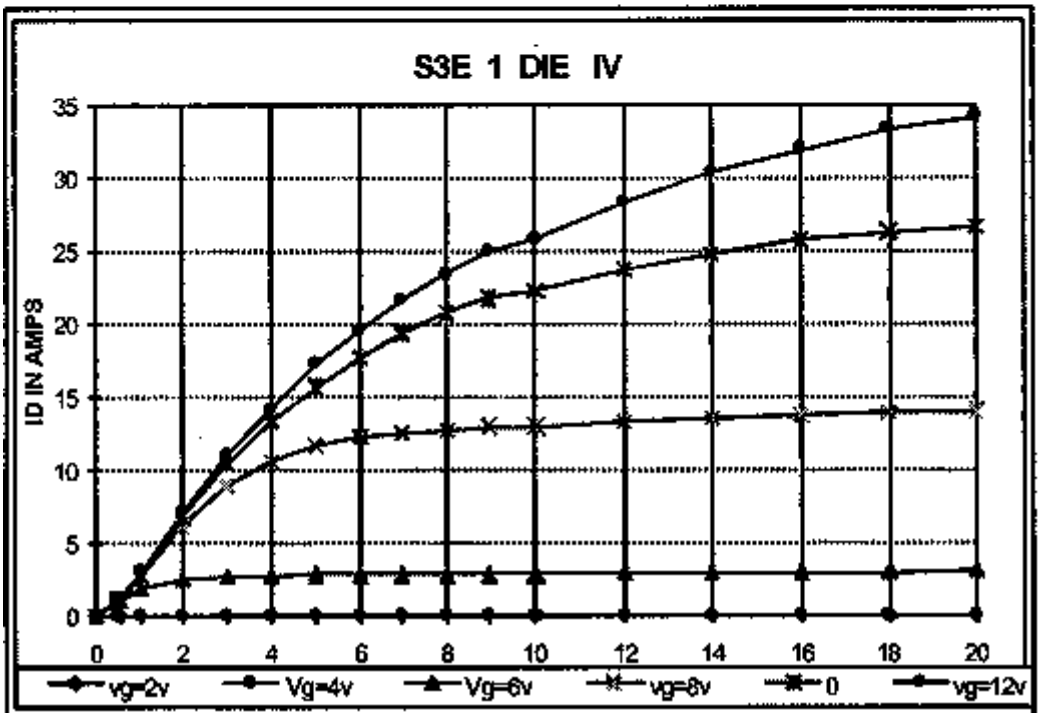
CHARACTERISTICS T_C = 25 °C

SYMBOL	TEST CONDITIONS	MINIMUM	TYPICAL	MAXIMUM	UNITS
BV_{DSS}	I_D = 100 mA	125			V
I_{DSS}	V_{DS} = 50 V V_{GS} = 0 V			5.0	mA
I_{GSS}	V_{DS} = 0 V V_{GS} = 20 V			1.0	µA
$V_{GS(th)}$	I_D = 100 mA V_{DS} = 10 V	1.0		5.0	V
$V_{DS(on)}$	I_D = 10 A V_{GS} = 10 V			5	V
g_{fs}	I_D = 5.0 A V_{DS} = 10 V	5.0			mhos
C_{iss} C_{oss} C_{rss}	V_{DS} = 50 V V_{GS} = 0 V f = 1.0 MHz		350 250 15		pF
G_{ps} η	V_{DD} = 50 V I_{DQ} = 500 mA P_{out} = 300 W f = 175 MHz	14 50	16 55		dB %
ψ	V_{SWR} = 5:1 AT ALL PHASE ANGLES	NO DEGRADATION IN OUTPUT POWER			

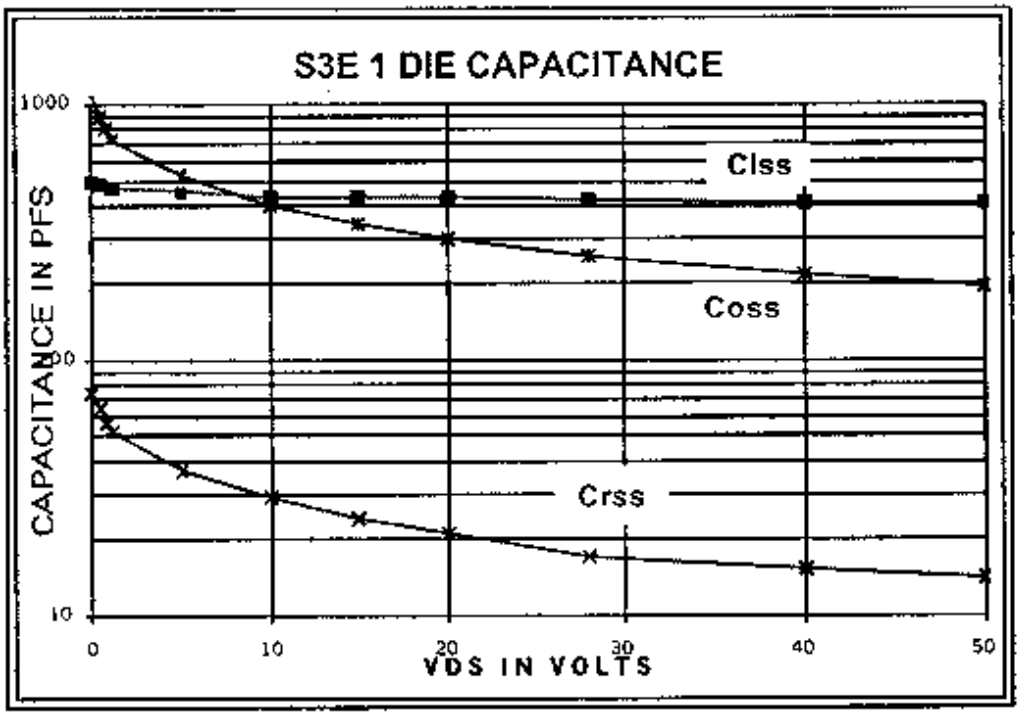
POUT VS PIN GRAPH



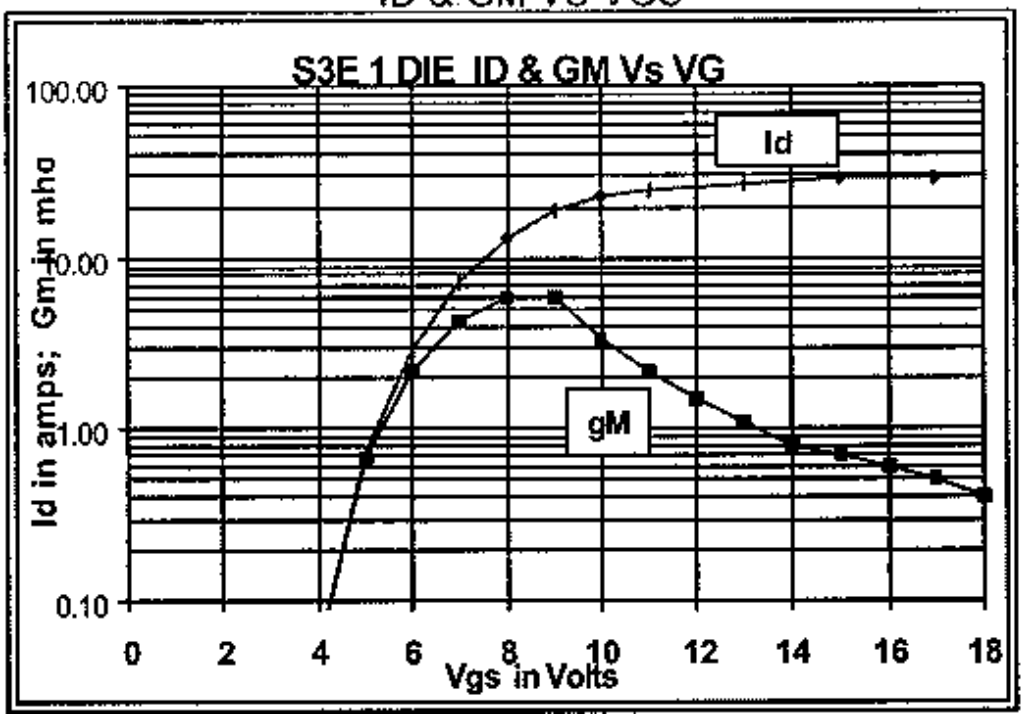
IV CURVE



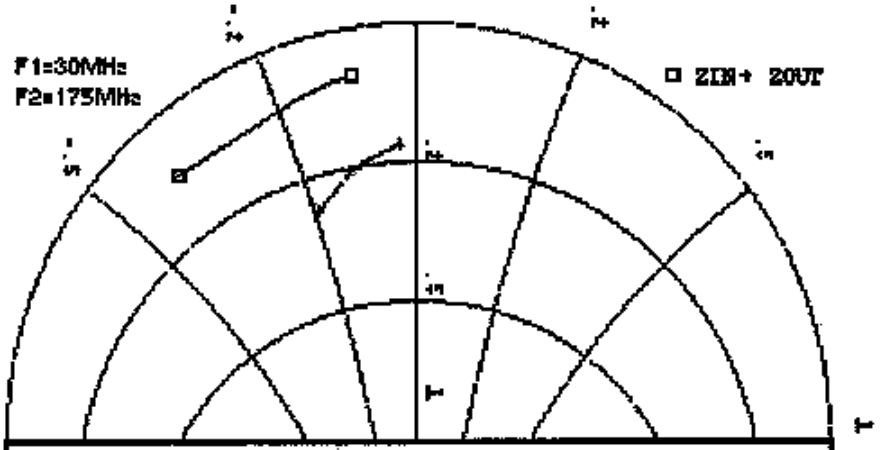
CAPACITANCE VS VOLTAGE



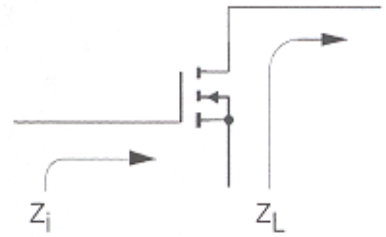
ID & GM VS VGS



Zin Zout



Vdd=50V Idq=800mA Pout=300W				
Freq(MHz)	30	90	125	175
Zin	4.4	3.8	3.0	3.0
	-j19.2	-j9.0	-j5.6	-J4.4
Zout	13.2	10.2	9.4	8.4
	-j9.6	-j5.6	-J4	-J1.4



ASI RF DEVICES
!
! BLF278 (Each side)
!
! S PARAMETERS
!
! VDS=50V, IDQ=400mA
!
MHZ S MA R 50

! Freq=Mhz	Mag[s11]	Ang[s11]	Mag[s21]	Ang[s21]	Mag[s12]	Ang[s12]	Mag[s22]	Ang[s22]
10.0000	0.83747	-151.063	27.3956	94.1661	0.01705	8.72886	0.58986	-142.841
15.0000	0.84031	-158.633	18.7280	85.9160	0.01628	-0.96378	0.60251	-150.026
20.0000	0.84723	-162.908	13.8120	79.8023	0.01616	-5.92879	0.62064	-153.163
25.0000	0.85287	-165.197	10.8614	74.7640	0.01559	-12.5836	0.64215	-154.551
30.0000	0.86258	-166.662	8.80371	70.1601	0.01546	-14.0670	0.66315	-155.623
35.0000	0.87300	-167.708	7.31926	66.2638	0.01422	-15.2201	0.68657	-156.454
40.0000	0.87885	-168.313	6.20180	62.4688	0.01355	-21.7797	0.71127	-156.911
45.0000	0.88779	-168.889	5.33086	59.0794	0.01310	-22.1195	0.73435	-157.702
50.0000	0.89448	-169.583	4.62723	55.9900	0.01266	-23.4078	0.75375	-158.189
55.0000	0.90299	-170.078	4.04324	53.3573	0.01120	-24.5177	0.77229	-158.969
60.0000	0.90882	-170.598	3.57797	50.8563	0.01064	-28.1139	0.79081	-159.728
65.0000	0.91539	-170.945	3.17462	48.6080	0.01003	-27.6968	0.80771	-160.420
70.0000	0.92222	-171.452	2.83402	46.2563	0.00986	-29.2237	0.82084	-160.996
75.0000	0.92639	-171.760	2.54871	44.4224	0.00850	-28.0810	0.83260	-161.649
80.0000	0.93150	-171.996	2.30691	42.6712	0.00817	-32.6804	0.85175	-162.239
85.0000	0.93589	-172.523	2.09657	40.9265	0.00775	-31.0442	0.85892	-163.014
90.0000	0.94214	-172.742	1.90687	39.4646	0.00770	-29.1611	0.86738	-163.709
95.0000	0.94487	-173.065	1.74744	38.0245	0.00655	-26.9029	0.87574	-164.155
100.000	0.94613	-173.318	1.60882	36.9997	0.00624	-26.4073	0.88477	-164.816
115.000	0.95430	-174.193	1.27120	33.7465	0.00494	-22.0092	0.90443	-166.111
130.000	0.96370	-174.772	1.03082	31.0149	0.00405	-8.62124	0.91904	-167.411
145.000	0.96577	-175.445	0.85053	28.5008	0.00345	15.2775	0.93060	-168.612
160.000	0.97354	-176.090	0.71706	26.9099	0.00406	18.2489	0.94317	-169.671
175.000	0.97232	-176.684	0.60905	24.9097	0.00396	34.6921	0.94921	-170.411
190.000	0.97373	-176.941	0.52601	23.6811	0.00442	60.9895	0.95349	-171.191
205.000	0.97665	-177.305	0.45427	22.8048	0.00512	67.5609	0.96082	-171.773
220.000	0.98025	-177.663	0.39996	22.0539	0.00648	73.2592	0.96150	-172.405
235.000	0.98177	-178.142	0.35799	21.1790	0.00691	76.8913	0.96810	-172.973
250.000	0.98017	-178.354	0.31865	20.4965	0.00758	81.4188	0.97058	-173.557
265.000	0.98152	-178.702	0.28756	20.6230	0.00858	83.5928	0.97094	-173.979
280.000	0.98349	-178.836	0.26320	19.8483	0.00980	86.7674	0.97233	-174.400
295.000	0.98441	-179.154	0.23858	19.3588	0.01042	86.3890	0.97668	-174.574
310.000	0.98361	-179.471	0.21519	19.1929	0.01098	89.5518	0.97479	-175.077
325.000	0.98561	-179.718	0.19819	18.4377	0.01229	91.7969	0.97746	-175.505
340.000	0.98501	-179.869	0.18099	19.6530	0.01308	92.2737	0.97940	-175.953
355.000	0.98692	179.859	0.16810	18.6449	0.01349	91.3383	0.98188	-175.897
370.000	0.98555	179.752	0.16137	20.5312	0.01418	91.9241	0.98041	-176.189
385.000	0.98822	179.511	0.15027	19.7641	0.01560	92.4536	0.98073	-176.588
400.000	0.98829	179.336	0.13766	20.8798	0.01620	92.0722	0.98261	-176.808
415.000	0.98773	179.166	0.12974	19.0245	0.01724	93.8917	0.98610	-177.114
430.000	0.98886	178.743	0.11997	19.9215	0.01812	94.8087	0.98610	-177.171
445.000	0.98952	178.735	0.11662	19.8737	0.01928	93.0825	0.98659	-177.573
460.000	0.99223	178.652	0.10659	20.2039	0.02015	93.6649	0.98513	-177.605
475.000	0.99217	178.525	0.10291	22.3386	0.02032	93.8780	0.98815	-177.706
490.000	0.99093	178.328	0.09499	23.5854	0.02087	95.3520	0.98734	-178.180

```
505.000  0.98904  177.900  0.09288  24.3178  0.02253  95.5649  0.98953 -178.261
520.000  0.98753  177.826  0.08876  24.1062  0.02288  95.4464  0.98714 -178.215
535.000  0.98584  177.697  0.08378  27.3328  0.02415  97.1222  0.99400 -178.628
550.000  0.99250  177.572  0.08247  29.3983  0.02494  96.0530  0.99166 -178.778
565.000  0.99413  177.257  0.07822  27.2453  0.02571  97.8381  0.99387 -178.902
580.000  0.99245  177.031  0.07467  27.8200  0.02530  97.2712  0.98799 -179.373
595.000  0.98715  176.735  0.07101  32.0492  0.02706  96.9025  0.98797 -179.626
610.000  0.98797  176.550  0.06786  31.2308  0.02796  96.6285  0.98858 -179.785
625.000  0.98881  176.455  0.06254  32.4249  0.02841  97.4609  0.99071 -179.900
640.000  0.98908  176.285  0.06360  36.9496  0.02939  97.4627  0.98654 -179.575
655.000  0.98753  176.016  0.06277  37.0072  0.02935  98.2586  0.98868 -179.929
670.000  0.98643  175.910  0.06004  40.0063  0.03090  98.6724  0.99076  179.932
685.000  0.98840  175.782  0.06111  37.8170  0.03147  99.1738  0.98962  179.695
700.000  0.98846  175.800  0.05886  44.3227  0.03158  100.273  0.99068  179.587
710.000  0.98530  175.570  0.05697  43.3396  0.03291  100.088  0.99163  179.411
! Unit: BLF278
! S1E 1+1Die in an AR pkg.
!
! Meas: 110L#24
! Vds=50Vdc, Idq=400ma, Vgsth=4.10Vdc, wafer=00712-17
!
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SPICE MODEL

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*HIGH POWER, HIGH FREQUENCY, RF N-CHANNEL VERTICAL DMOS MOSFET
*TO GENERATE S PARAMETER MATCHING DATA SHHET, SET VG = 4.3 V FOR IDQ = 455 Ma
*MODEL APPLICABLE FOR BLF278
*NOTE:- HP/EESOF USES 'GATE DRAIN SOURCE' ORDER
*                      ( ;D   G   S)
.SUBCKT BLF278/PF     20  10  30
LG              10      11      0.29n
RGATE   11      12      0.73
CG              10      30      0.01P
CRSS            12      17      15.3P
CISS            12      14      490P
LS              14      30      0.2N
CS              14      30      0.02P
LD              17      20      0.1N
CD              20      30      2.9P
R_RC            16      17      2.2
C_RC            14      16      31.2P
MOS             13      12      14      14 BLF278 MOS L = 1.1 U W = 0.778 ;D G S B LEVEL1
JFET            17      14      13         BLF278 JF                      ;D G S
DBODY           14      17                 BLF278 DB                     ;P N

MODEL BLF278 MOS       NMOS    (VTO =4 KP = 0.9 E-5 LAMBDA = 0.15 RD = 0.065 RS = 0.07)
MODEL BLF278 JF        NJF     (VTO = 6.8 BETA = 1 LAMBDA =1)
MODEL BLF278 DB        D       (CJO = 1100 P RS = 0.25 VJ = 0.6 M = 0.4 BV = 13)
ENDS
S
```
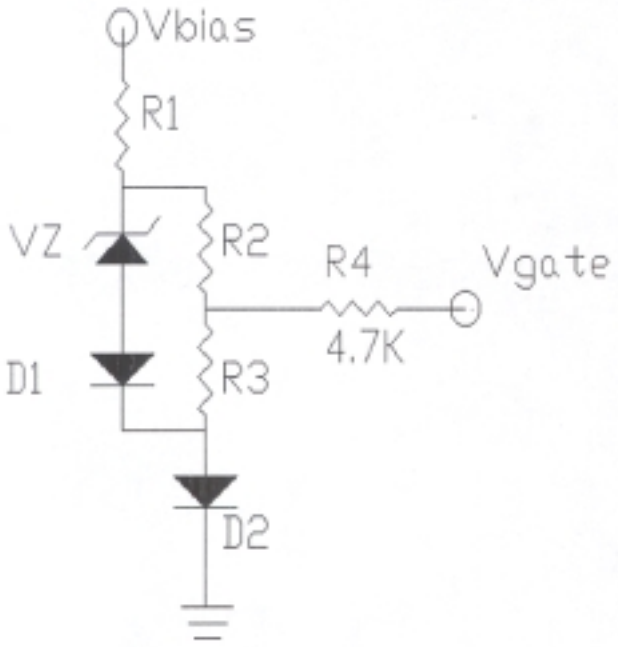

BIASING ASI RF TRANSISTORS

ASI RF Mosfets are enhancement mode devices. In order to cause drain current to flow, positive voltage of about 3 V needs to be applied to the Gate terminal. The higher the gate voltage applied the higher the drain current. The Mosfet transistor drain current will change with temperature. As the temperature goes up, so will the drain current. In order to prevent a runway situation, the gate voltage needs to have negative temperature coefficient. The following circuit describes a means to achieve a –2mv/ °C coefficient at the gate terminal.



$$Vg = Vd + (Vz + Vd) * (R3/(R3 + R2))$$

$$\Delta Vg = \Delta Vd + (\Delta Vz + Vd) * (R3/(R3 + R2))$$

$$\Delta Vz = -\Delta Vd$$

$$\Delta Vg = -\Delta Vd = -2mv/C$$

- The temperature coefficient of a 6.8V zener is about + 2mv/ °C and the diode is about –2mv/ °C
- The gate of a transistor draws no current, so there is no current flow in R4. R4 is used as a RF isolation resistor.
- R1 is adjusted to cause about 10ma of current flow into the circuit.
- R2 and R3 can be a potentiometer to adjust for the desired gate voltage. The total value of R2 and R3 should be high enough so that the current drawn in R2 and R3 is substantially less than 10ma. Recommend around 2ma.

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