RF Reference Design Library

The RF Sub–Micron MOSFET Line

RF Power Field-Effect Transistors

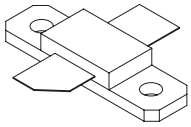
N–Channel Enhancement–Mode Lateral MOSFETs

MRF284
MRF284S
US CDMA

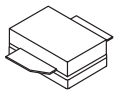
30 W, 2000 MHz, 26 V
LATERAL N–CHANNEL
BROADBAND
RF POWER MOSFETs

Designed for PCN and PCS base station applications at frequencies from 1000 to 2600 MHz. Suitable for FM, TDMA, CDMA, and multicarrier amplifier applications. To be used in class A and class AB for PCN–PCS/cellular radio and wireless local loop.

- Specified Two–Tone Performance @ 2000 MHz, 26 Volts
  Output Power = 30 Watts (PEP)
  Power Gain = 9 dB
  Efficiency = 30%
  Intermodulation Distortion = –29 dBc
- Typical Single–Tone Performance at 2000 MHz, 26 Volts
  Output Power = 30 Watts (CW)
  Power Gain = 9.5 dB
  Efficiency = 45%
- Characterized with Series Equivalent Large–Signal Impedance Parameters
- S–Parameter Characterization at High Bias Levels
- Excellent Thermal Stability
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 2000 MHz, 30 Watts (CW) Output Power



CASE 360B–01, STYLE 1
(MRF284)



CASE 360C–03, STYLE 1
(MRF284S)

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MRF284 REFERENCE DESIGN
BOARD NUMBER: PCB00050 REV 1

Designed by: TRL Technologies, Inc.

REFERENCE DESIGN

This reference design is designed to demonstrate the RF performance characteristics of the MRF284 when applied for the 1930 – 1990 MHz US CDMA frequency band. The reference design is tuned for typical performance at 30 W CW output power. Included in this package are typical performance data for this amplifier. All tests are performed at V_{DD} = 26 V with I_{DQ} = 200 mA. Two tone testing is specified with tone spacing of 100 kHz (i.e., f1 = 1930 MHz, f2= 1930.1 MHz).

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You can request a Reference Design by accessing the Internet address referenced above and completing an Application Request and the Reference Design Library Loan agreement.

HEATSINKING

When operating this fixture please provide adequate heatsinking for the device. Excessive heating of the device will prevent repeating of the included measurements.

MOTOROLA

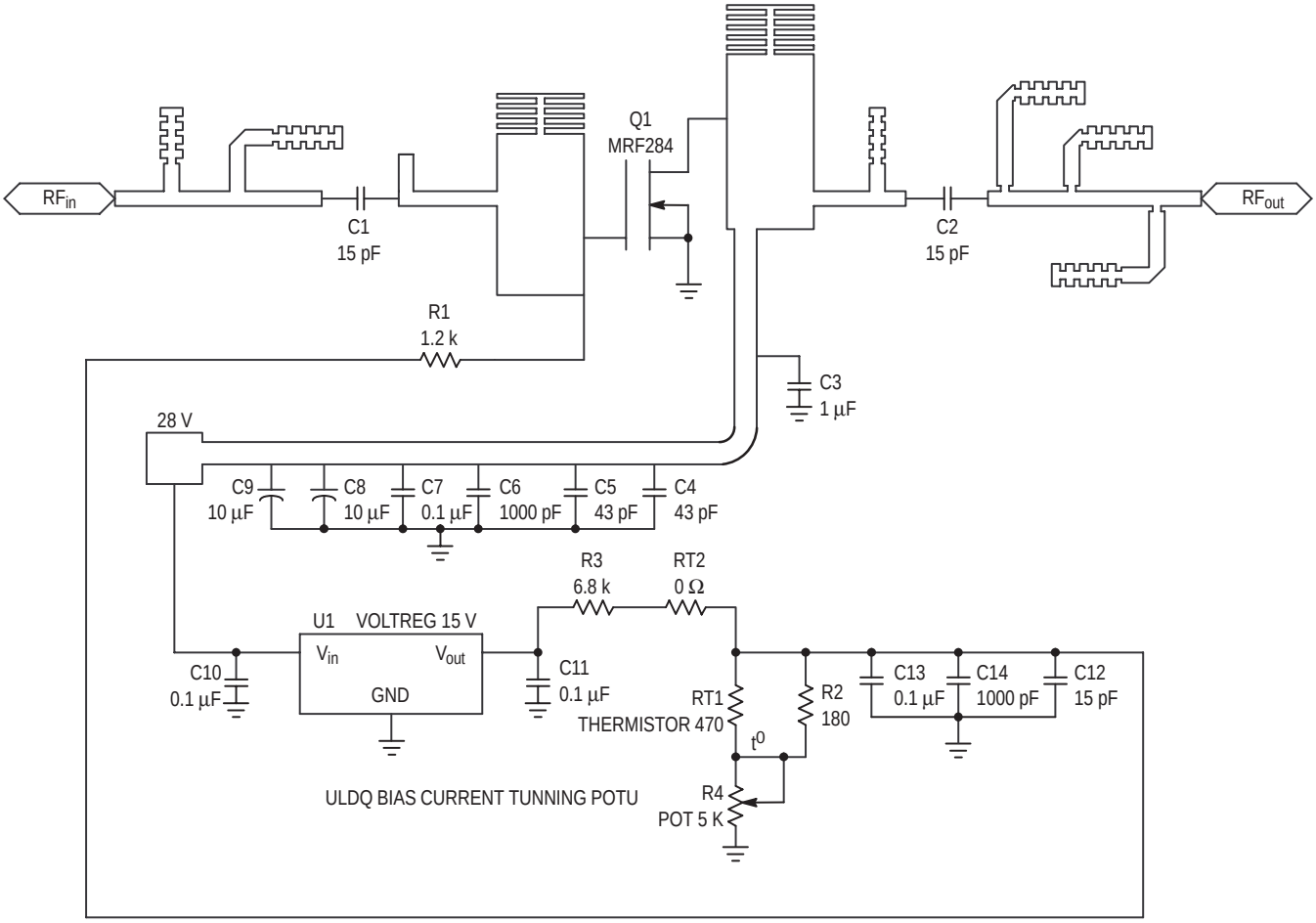


Figure 1. MRF284 US CDMA Reference Design Schematic

BILL OF MATERIALS

Motorola MRF284 Reference Module, CDMA – 3.5 W Avg, 1930–1990 MHz
REV 1, 12/3/97

Qty	Reference	Value	Part Name	Description	Vendor	Vendor #
1	C14	15 pF	C?–1206	Capacitor 15 pF, 10% Tolerance, 50 V, Size 0805	Digikey	PCC150CCT–ND
2	C8, C9	10 μF	C10UF–35V–TANT	Capacitor Tantalum, 10 μF, 10% Tolerance, 35 V, Size D	Digikey	PCS6106CT–ND
2	C6, C12	1000 pF	C1000PF–1206	Capacitor 1000 pF, 10% Tolerance, 50 V, Size 1206	Digikey	PCC102CCT–ND
4	C7, C10, C11, C13	0.1 μF	C.1UF–1206	Capacitor 0.1 μF, 10% Tolerance, 50 V, Size 1206	Digikey	PCC104BCT–ND
1	C3	1 μF	C1UF–TANT	Capacitor Tantalum, 1 μF, 10% Tolerance, Size 2515	Murata	GRM43–4X7R10 5K050B
3	C1, C2, C4	13 pF	C?–1111	Capacitor 15 pF, 10% Tolerance, 500 V, Size 1111	ATC	175B130JW500X
1	C5	43 pF	C?–1111	Capacitor 43 pF, 10% Tolerance, 500 V, Size 1111	ATC	100B430JW500X
1	Q1		MRF284	Motorola LDMOS MRF284, 30 W	Motorola	MRF284
1	R1	1.2 k	R?–1206	Resistor 1.2 kΩ, 5% Tolerance, 1/4 W, Size 1206	Digikey	P1.2KECT–ND
1	R3	6.8 K	R?–1206	Resistor 6.8 kΩ, 5% Tolerance, 1/4 W, Size 1206	Digikey	P6.8KECT–ND
1	R4	5 k	RV500–SMT	Potentiometer 5 kΩ, Size J, SMD	Digikey	3314J–502E
1	R2	180	R?–1206	Resistor 180 Ω, 5% Tolerance, 1/4 W, Size 1206	Digikey	P180ECT–ND
1	RT1	470	R?–1206	Thermistor 470 Ω, 5% Tolerance, 1/4 W, Size 1206	KOA	NT732BT471J
1	RT2	0	R?–1206	0 Ω, 5% Tolerance, 1/4 W, Size 1206	KOA	RM73Z2BT
1	U1	7825	LM7815	15 V Regulator	Motorola	LM78L15ACM
1			PCB00050 Rev 1	Circuit Board, RO4350 ε = 3.48 30 mil	Anyone	

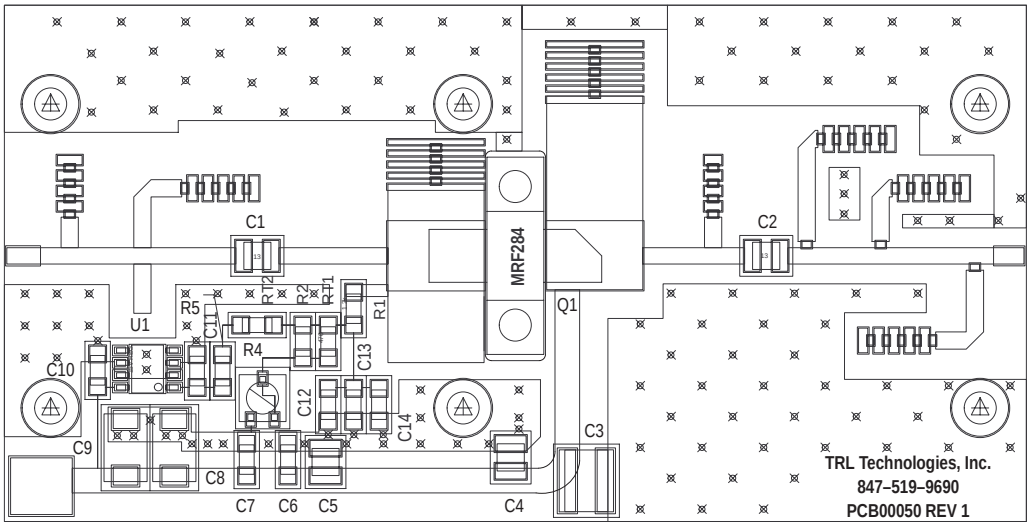
PERFORMANCE DATA

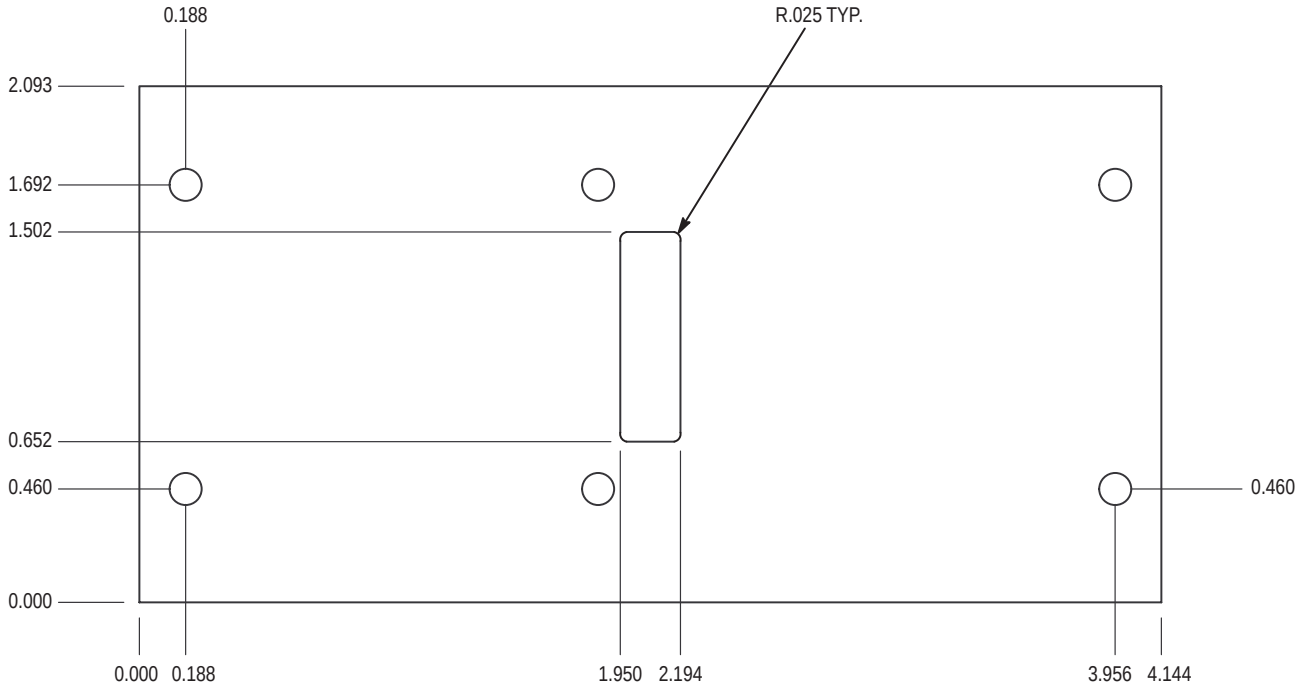
Table 1. Drive–up Data A+ = 26 V, I_{DQ} = 200 mA

Freq (MHz)	Avg P_{in} (W)	Avg P_{out} (W)	Gain (dB)	I (A)	Eff (%)	IMD (dBc)	Gain Flat (dB)
1930 & 1931	0.03	0.50	11.67	0.43	4.47	–44.00	
	0.22	2.50	10.59	0.85	11.31	–45.00	
	0.45	5.00	10.46	1.18	16.30	–42.00	
	0.67	7.50	10.48	1.43	20.17	–40.00	
	0.93	10.00	10.32	1.66	23.17	–37.17	
	1.18	12.50	10.24	1.86	25.85	–34.50	
	1.47	15.00	10.09	2.05	28.14	–31.50	
	1.81	17.50	9.85	2.24	30.05	–28.50	
	2.21	20.00	9.57	2.41	31.92	–25.67	
1960 & 1961	0.03	0.50	11.80	0.43	4.47	–42.50	0.50
	0.21	2.50	10.78	0.81	11.87	–46.00	0.18
	0.42	5.00	10.75	1.13	17.02	–45.50	0.29
	0.64	7.50	10.68	1.38	20.90	–43.00	0.22
	0.88	10.00	10.55	1.59	24.19	–39.00	0.24
	1.13	12.50	10.46	1.76	27.32	–35.17	0.24
	1.42	15.00	10.24	1.96	29.43	–31.50	0.24
	1.72	17.50	10.08	2.13	31.60	–28.50	0.32
	2.12	20.00	9.75	2.30	33.44	–25.50	0.30
1990 & 1991	0.04	0.50	11.31	0.41	4.69	–41.50	
	0.22	2.50	10.59	0.79	12.17	–45.00	
	0.45	5.00	10.51	1.09	17.64	–47.00	
	0.68	7.50	10.46	1.31	22.02	–46.00	
	0.92	10.00	10.35	1.53	25.14	–40.50	
	1.19	12.50	10.21	1.71	28.12	–35.50	
	1.50	15.00	10.00	1.89	30.53	–31.33	
	1.85	17.50	9.76	2.05	32.83	–28.00	
	2.27	20.00	9.45	2.21	34.81	–25.00	

Table 2. Network Analyzer Data at Output Power ~7 W

Freq (MHz)	$\lvert S_{11} \rvert$ (dB)	$\lvert S_{21} \rvert$ (dB)	Gain Flat (dB)	Delay (ns)	Linear Phase (deg)
869.00	–13.6610	10.2710		1.8997	–161.5100
881.00	–18.6650	10.5680	0.2970	2.2997	–163.1900
894.00	–11.5580	10.3890		2.1035	–165.1400





Notes: (Unless otherwise specified)

1.0 No change shall be allowed on production material, regardless of whether such change affects characteristics specified.

2.0 Raw material
Core material: Rogers RO4350
Plating: 1 ounce copper (plate up to 2 oz.)
Thickness: 0.030

3.0 Treatment
Hot air leveled.
Solder mask over bare copper, top side only.

4.0 Part number
Included on artwork.

5.0 Mechanical characteristics.

5.1 Parts shall be clean and free of all foreign material

5.2 A "( )" dimension is a reference dimension without tolerance and is for information purposes only.

5.3 All dimensions apply after treatment.

5.4 All holes and slots to be free of burrs. Burrs shall not exceed 5% of the material thickness in all remaining areas. No beveled edges.

6.0 Packaging
Part shall be adequately packaged to prevent damage in shipment and handling.

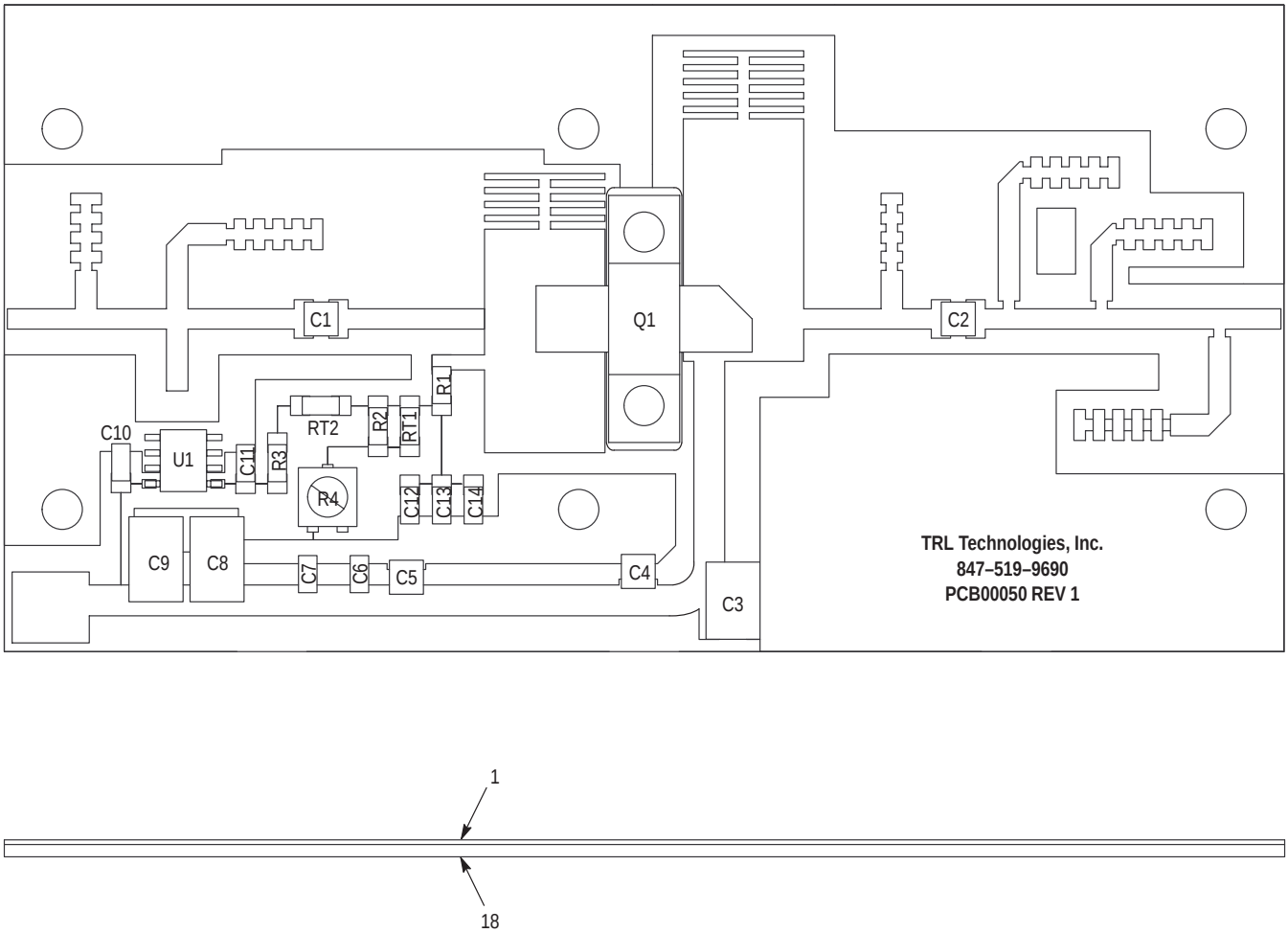
7.0 Legend color: white

8.0 Green solder mask.

9.0 All holes are plated through.

10. Filled areas in files TOP.GBR and BTM.GBR are copper. Filled areas in file SMT.GBR are no mask.

Figure 2. MRF284 US CDMA Reference Design – Assembly Details



Item #	Qty	Part #	Reference Design	Description
18	1	PLT00010		Copper Plate
17	1		C12	Capacitor, 39 pF, 10%, 50 V, 1206
16	2		C8, C9	Capacitor, Tant, 10 μF, 10%, 35 V, D Size
15	2		C6, C14	Capacitor, 1000 pF, 10%, 50 V, 1206
14	4		C7, C10, C11, C13	Capacitor, 0.1 μF, 10%, 50 V, 1206
13	1		C3	Capacitor, Tant, 1 μF, 10%, 500 V, 2515
12	3		C1, C2, C4	Capacitor, 15 pF, 10%, 500 V, 1111
11	1		C5	Capacitor, 43 pF, 10%, 500 V, 1111
10	3		C3, C4, C5	Capacitor, 1 pF, 10%, 500 V, 1111
9	1		Q1	Motorola LDMOS MRF284, 30 W
8	1		R1	Resistor, 1.2 kΩ, 5%, 1/4 W, 1206
7	1		R3	Resistor, 6.8 kΩ, 5%, 1/4 W, 1206
6	1		R4	Potentiometer, 5 kΩ, J Size, SMD
5	1		R2	Resistor, 180 Ω, 5%, 1/4 W, 1206
4	1		RT1	Thermistor 470 Ω, 5%, 1/4 W, 1206
3	1		RT2	0 Ω, 5%, 1/4 W, 1206
2	1		U1	15 V Regulator
1	1	PCB00050		Printed Circuit Board

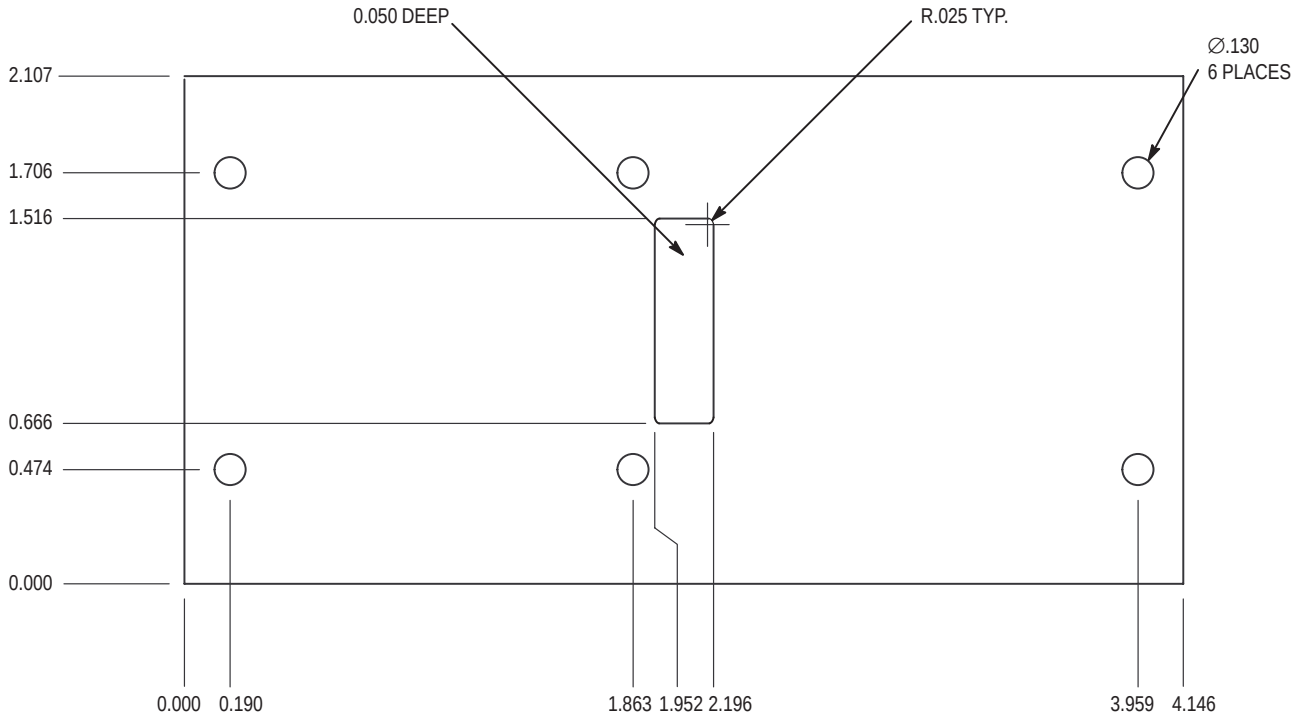
Figure 3. MRF284 US CDMA Reference Design – PCB Details

PCB ASSEMBLY DETAILS

MRF284 LDMOS – Linear Amplifier for Cellular (1930–1990 MHz, V_{DD} = 26 V, I_{DQ} = 200 mA)
Board # PCB00050 REV 1, RO4350 30 mil, Reference Module #1, KTC 12/11/97

Table 3.

Stub#	Cut
1.00	3.00
2.00	7.00
3.00	None
4.00	None
5.00	6.00
6.00	1.00
7.00	All
8.00	All
9.00	All



Notes: (Unless otherwise specified)

1.0 No change shall be allowed on production material, regardless of whether such change affects characteristics specified.

2.0 Raw material
Copper 0.080 thick

3.0 Treatment
Timesave

4.0 Part number
MMP part number and revision letter or number shall be permanently and legibly placed on the container of these parts.

5.0 Mechanical characteristics.

5.1 Parts shall be clean and free of all foreign material.

5.2 A "( )" dimension is a reference dimension without tolerance and is for information purposes only.

5.3 All dimensions apply after treatment.

5.4 All holes and slots to be free of burrs. Burrs shall not exceed 5% of the material thickness in all remaining areas. No beveled edges.

5.5 Use drill artwork for hole locations.

5.6 Machining RADII: 0.050

6.0 Packaging
Part shall be adequately packaged to prevent damage in shipment and handling.

Figure 4. MRF284 US CDMA Reference Design – Pallet Details

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