

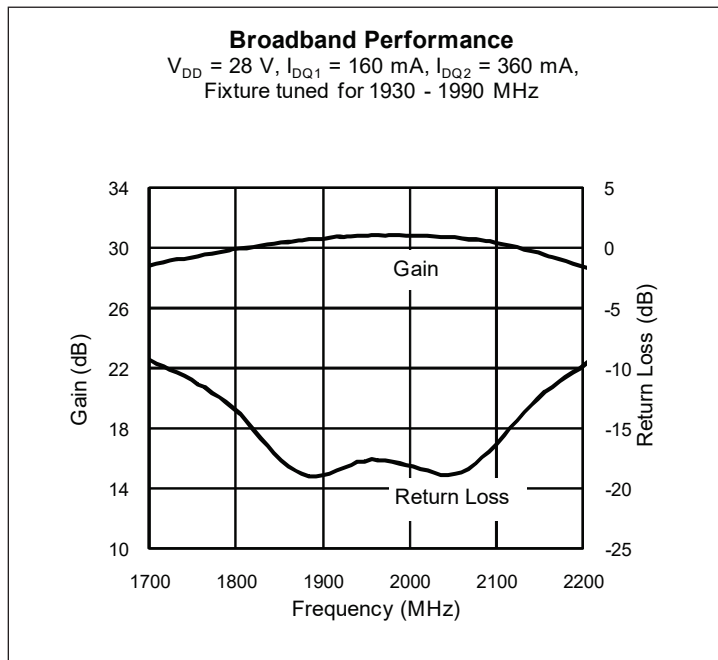
PTMA180402M

Wideband RF LDMOS Integrated Power Amplifier 40 W, 28 V, 1800 – 2100 MHz

Description

The PTMA180402M is a matched, wideband, 2-stage, 40-watt LDMOS integrated amplifier intended for base station applications in the 1800 to 2100 MHz frequency band. This device is offered in a 20-pin, thermally-enhanced, overmolded plastic package for cool and reliable operation.

PTMA180402M
Package PG-DSO-20-63



Features

- Designed for wide RF bandwidth and low memory effects
- On-chip matching, integrated input DC block, 50-ohm input and ~4-ohm output
- Typical single-carrier CDMA performance at 1960 MHz, 28 V
 - Average output power = 5 W
 - Linear gain = 30 dB
 - Efficiency = 16%
 - Adjacent channel power = -52 dBc
- Typical two-tone CW performance at 1960 MHz, 28 V
 - Output power (PEP) = 40 W at IMD3 = -30 dBc
 - Efficiency = 34%
- Capable of handling 10:1 VSWR @ 28 V, 40 W (CW) output power
- Integrated ESD protection. Meets HBM Class 1B (minimum), per JESD22-A114F
- Thermally-enhanced, RoHS-compliant package

RF Characteristics

CDMA Measurements (tested in Wolfspeed production test fixture)

$V_{DD} = 28\text{ V}$, $I_{DQ1} = 160\text{ mA}$, $I_{DQ2} = 360\text{ mA}$, $P_{OUT} = 4\text{ W}$ average, $f = 1960\text{ MHz}$, CDMA IS-95, 9 channels

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	28	30	—	dB
Drain Efficiency	η_D	14	16	—	%
Adjacent Channel Power Ratio	ACPR	—	-52	-50	dBc

RF Characteristics continued next page

All published data at $T_{CASE} = 25^\circ\text{C}$ unless otherwise indicated

ESD: Electrostatic discharge sensitive device—observe handling precautions!

RF Characteristics (cont.)

Two-tone Specifications (not subject to production test—verified by design/characterization in WolfSpeed test fixture)
 $V_{DD} = 28\text{ V}$, $I_{DQ1} = 160\text{ mA}$, $I_{DQ2} = 360\text{ mA}$, $P_{OUT} = 40\text{ W PEP}$, $f = 1960\text{ MHz}$, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	30	—	dB
Power Added Efficiency	PAE	—	34	—	%
Third Order Intermodulation Distortion	IMD3	—	-32	—	dBc

DC Characteristics

Stage 1 Characteristics	Conditions	Symbol	Min	Typ	Max	Unit
Drain Leakage Current	$V_{DS} = 28\text{ V}$, $V_{GS} = 0\text{ V}$	I_{DSS}	—	—	1.0	μA
	$V_{DS} = 63\text{ V}$, $V_{GS} = 0\text{ V}$	I_{DSS}	—	—	10.0	μA
Gate Leakage Current	$V_{GS} = 10\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	—	—	1.0	μA
On-state Resistance	$V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	1.6	—	Ω
Operating Gate Voltage	$V_{DS} = 28\text{ V}$, $I_{DQ1} = 160\text{ mA}$,	V_{GS}	2.0	2.5	3.0	V

Stage 2 Characteristics	Conditions	Symbol	Min	Typ	Max	Unit
Drain-source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_{DS} = 10\text{ mA}$	$V_{(BR)DSS}$	65	—	—	V
Drain Leakage Current	$V_{DS} = 28\text{ V}$, $V_{GS} = 0\text{ V}$	I_{DSS}	—	—	1.0	μA
	$V_{DS} = 63\text{ V}$, $V_{GS} = 0\text{ V}$	I_{DSS}	—	—	10.0	μA
Gate Leakage Current	$V_{GS} = 10\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	—	—	1.0	μA
On-state Resistance	$V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.21	—	Ω
Operating Gate Voltage	$V_{DS} = 28\text{ V}$, $I_{DQ2} = 360\text{ mA}$	V_{GS}	2.0	2.5	3.0	V

Maximum Ratings

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V_{DSS}	65	V
Gate-Source Voltage		V_{GS}	-0.5 to +12	V
Junction Temperature		T_J	200	°C
Total Device Dissipation		P_D	175	W
Above 25°C derate by			1.0	W/°C
Storage Temperature Range		T_{STG}	-40 to +150	°C
Overall Thermal Resistance ($T_{CASE} = 70^\circ\text{C}$, 40 W CW)	Stage 1, $I_{DQ1} = 160\text{ mA}$	$R_{\theta JC}$	3.6	°C/W
	Stage 2, $I_{DQ2} = 360\text{ mA}$	$R_{\theta JC}$	1.5	°C/W

Moisture Sensitivity Level

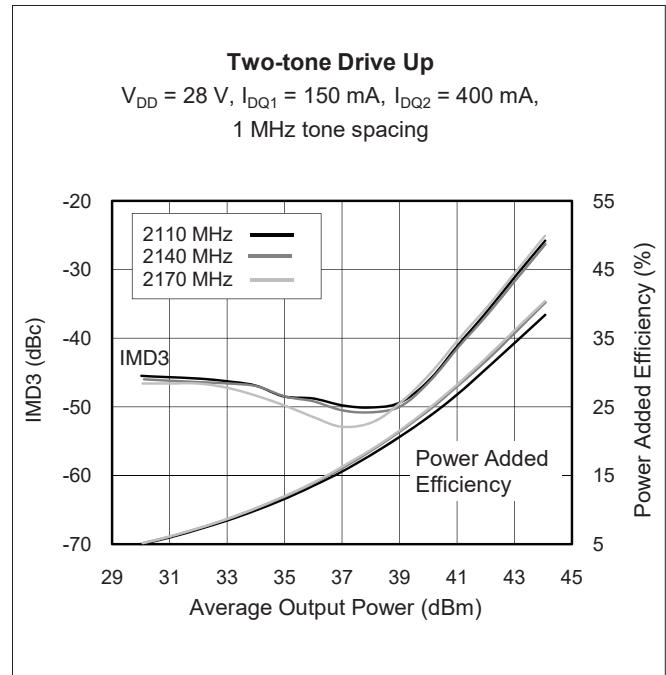
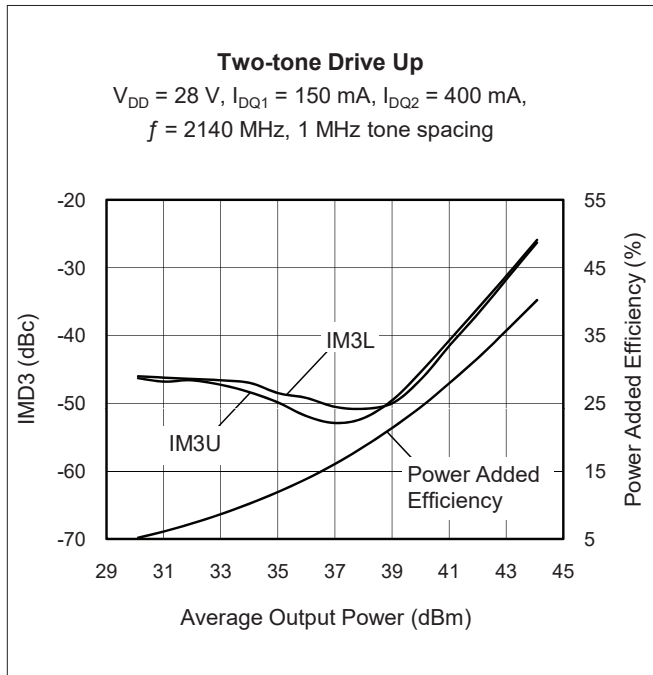
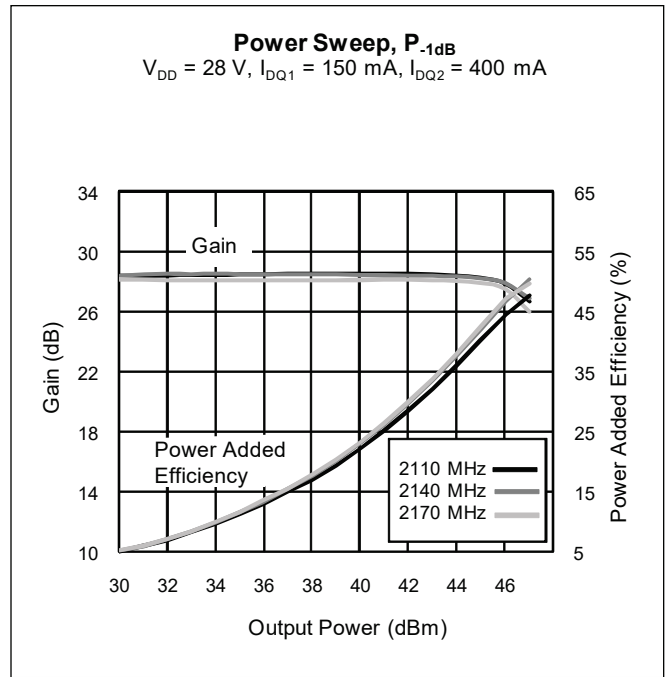
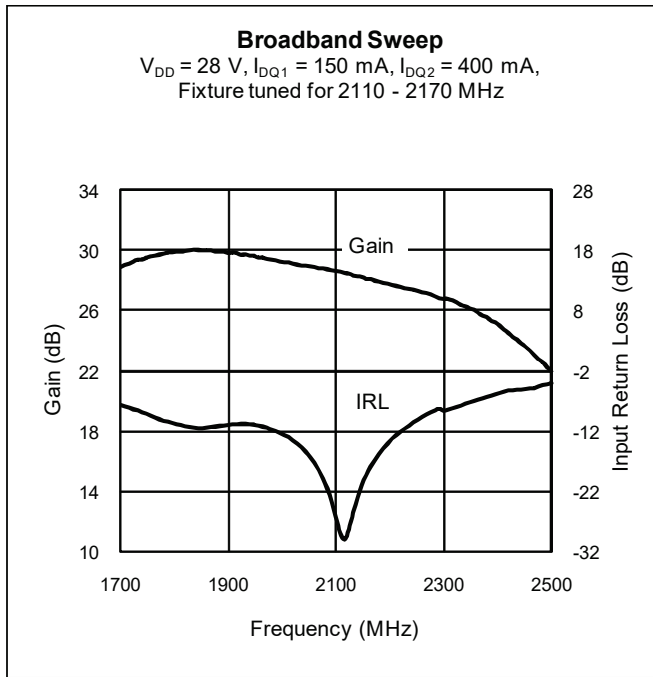
Level	Test Standard	Package Temperature	Unit
3	IPC/JEDEC J-STD-020	260	°C

Ordering Information

Type and Version	Order Code	Package and Description	Shipping
PTMA180402M V1 R500	PTMA180402M-V1-R500	PG-DSO-20-63, molded plastic	Tape & Reel, 500 pcs

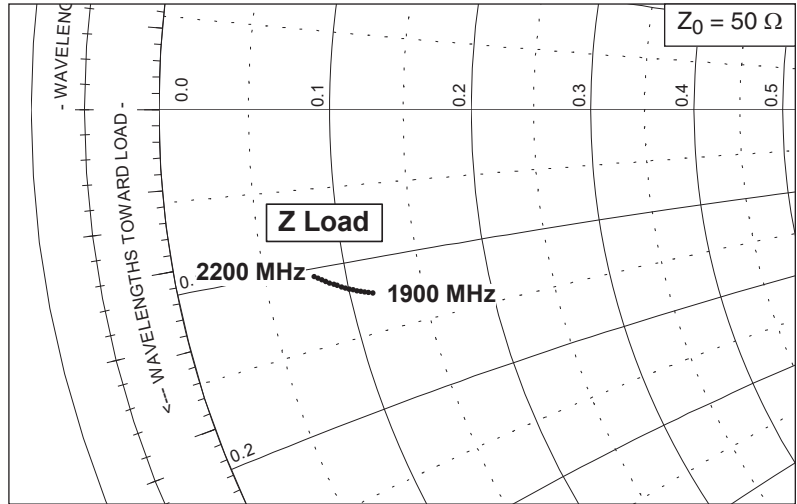
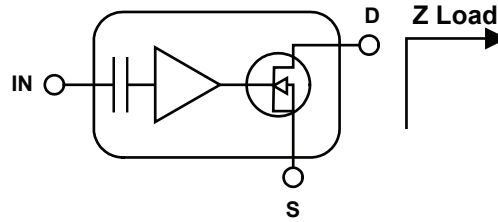


Typical Performance, circuit tuned for 2140 MHz (data taken in Wolfspeed test fixture)

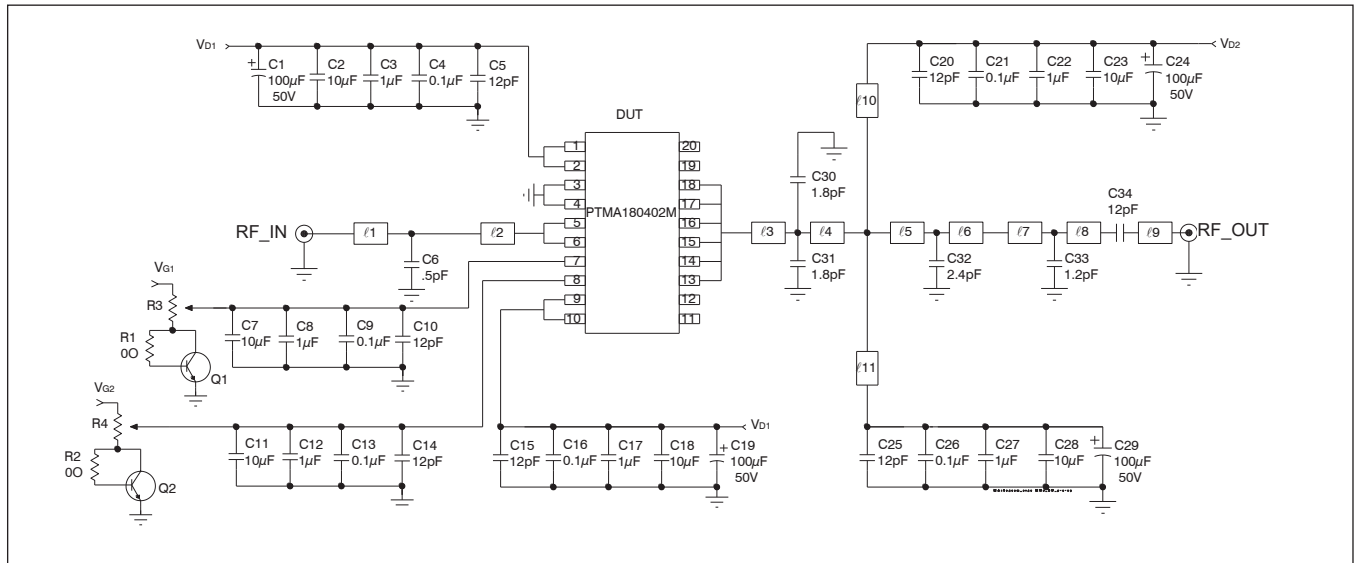


Broadband Circuit Impedance — 2140 MHz

Frequency MHz	Z Load Ω	
	R	jX
1900	5.76	-6.18
1920	5.63	-6.13
1940	5.51	-6.09
1960	5.39	-6.04
1980	5.27	-5.99
2000	5.15	-5.93
2020	5.03	-5.88
2040	4.92	-5.82
2060	4.80	-5.76
2080	4.68	-5.69
2100	4.57	-5.63
2120	4.45	-5.56
2140	4.34	-5.49
2160	4.23	-5.41
2180	4.12	-5.34
2200	4.01	-5.26



Reference Circuit, tuned for 2140 MHz



Reference circuit schematic for $f = 2140 \text{ MHz}$

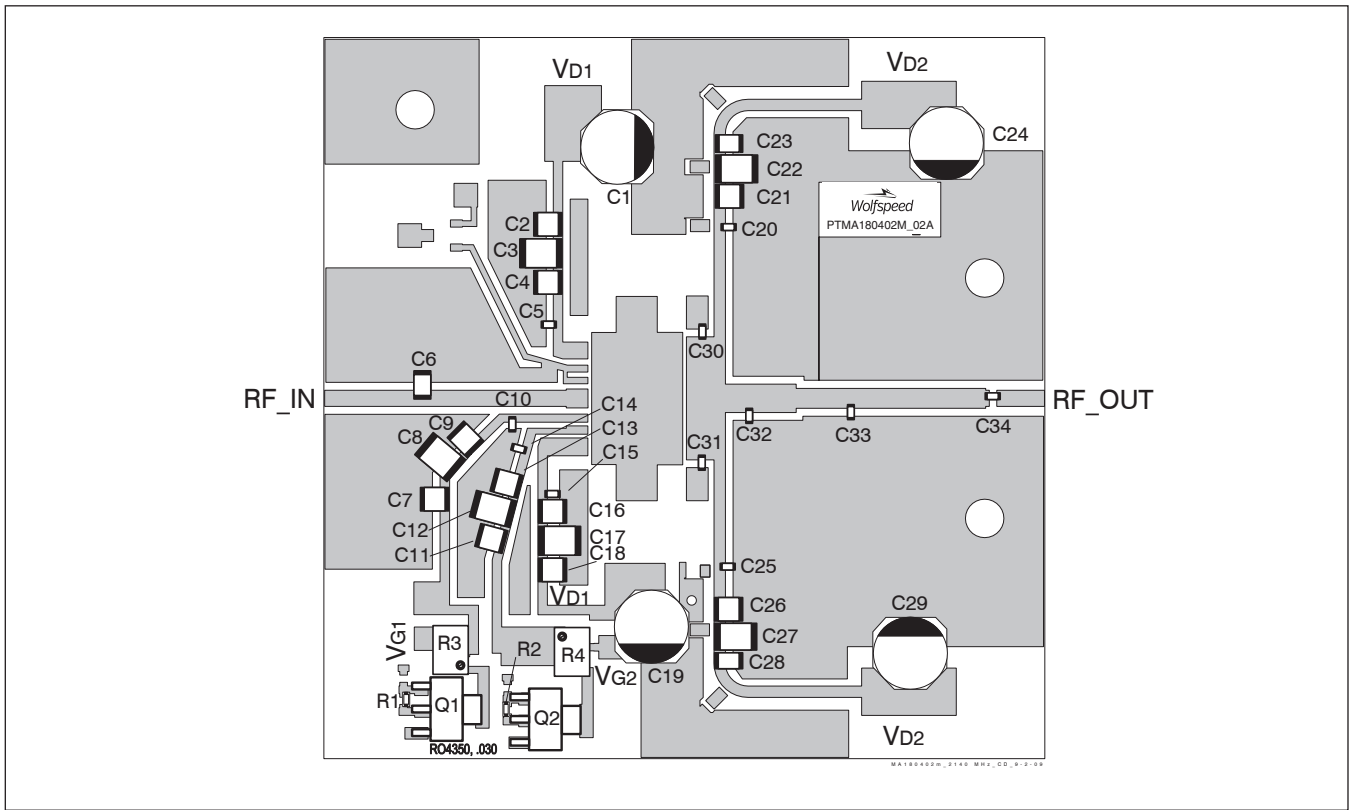
Circuit Description

DUT	PTMA180402M, LDMOS IC
PCB	Rogers RO4350, 0.76 mm [.030"] thick, $\epsilon_r = 3.48$, 1 oz. copper
Test fixture part no.	LTN/PTMA180402M-21
Find Gerber files for this test fixture on the Wolfspeed Web site at (www.wolfspeed.com/RF)	

Circuit Assembly Information

Microstrip	Electrical Characteristics at 2140 MHz	Dimensions: L x W (mm)	Dimensions: L x W (in.)
l1	0.150 λ , 50.0 Ω	12.73 x 1.70	0.501 x 0.067
l2	0.177 λ , 50.0 Ω	15.04 x 1.70	0.592 x 0.067
l3	0.026 λ , 10.4 Ω	2.01 x 13.00	0.079 x 0.512
l4	0.026 λ , 10.4 Ω	2.06 x 13.00	0.081 x 0.512
l5	0.026 λ , 34.2 Ω	2.13 x 3.00	0.084 x 0.118
l6	0.054 λ , 34.2 Ω	4.45 x 3.00	0.175 x 0.118
l7	0.066 λ , 43.5 Ω	5.56 x 2.11	0.219 x 0.083
l8	0.178 λ , 43.5 Ω	14.96 x 2.11	0.589 x 0.083
l9	0.059 λ , 50.0 Ω	5.03 x 1.70	0.198 x 0.067
l10, l11	0.137 λ , 47.8 Ω	11.56 x 1.83	0.455 x 0.072

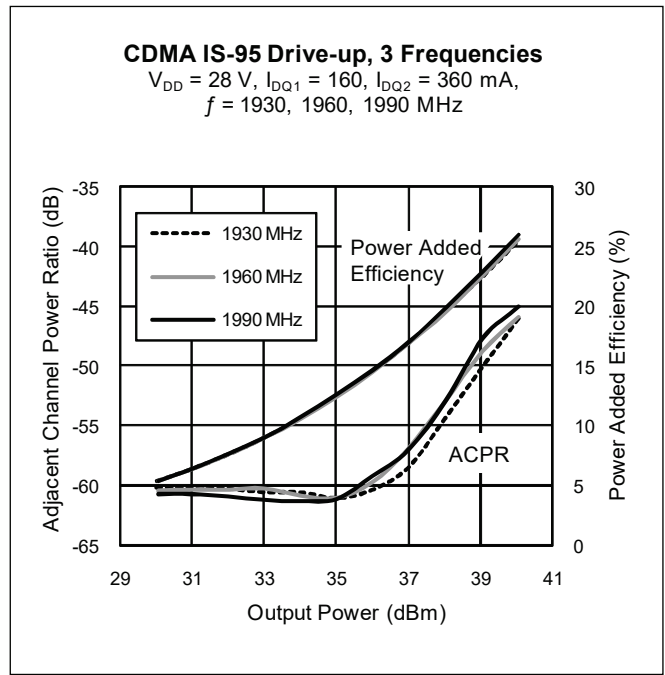
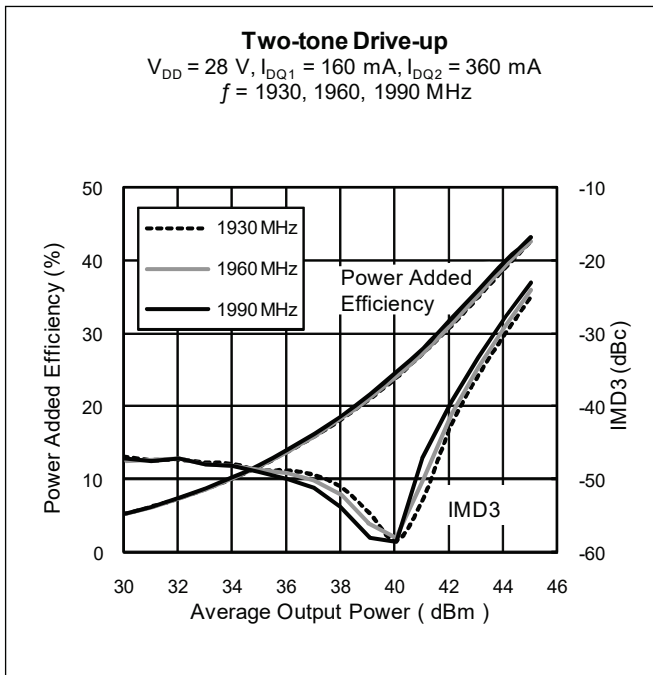
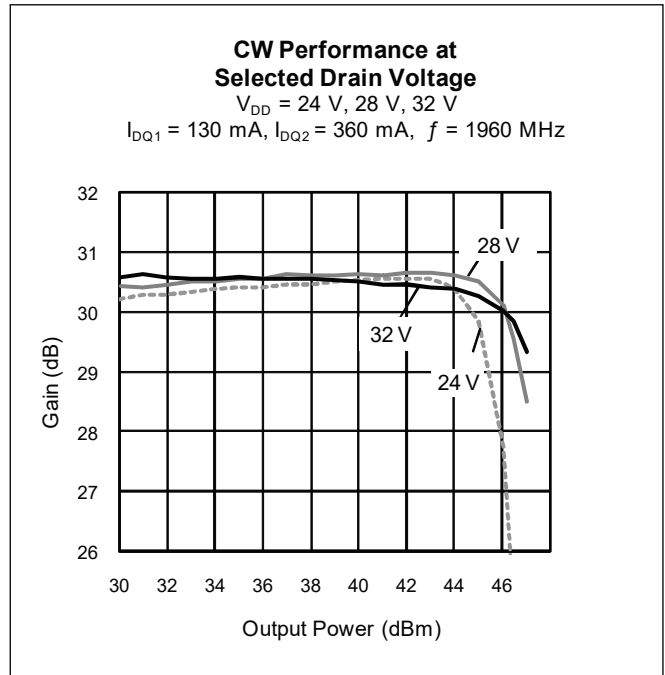
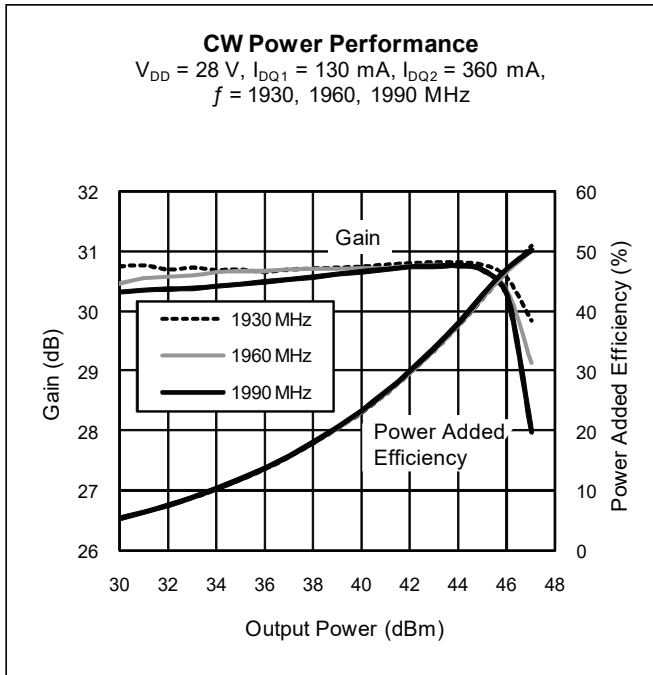
Reference Circuit — 2140 MHz (cont.)



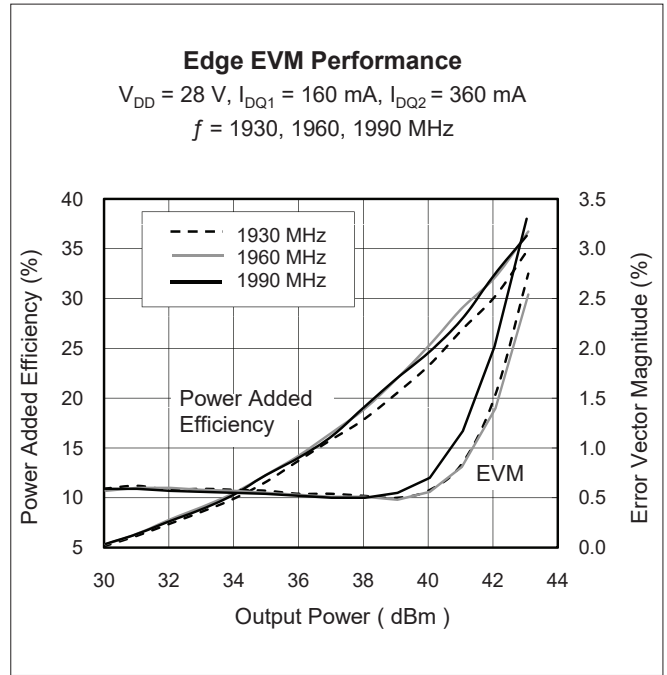
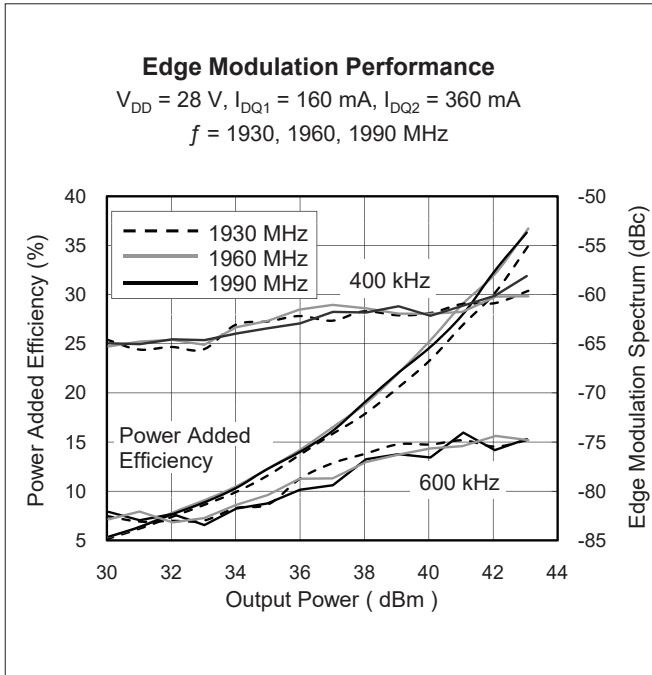
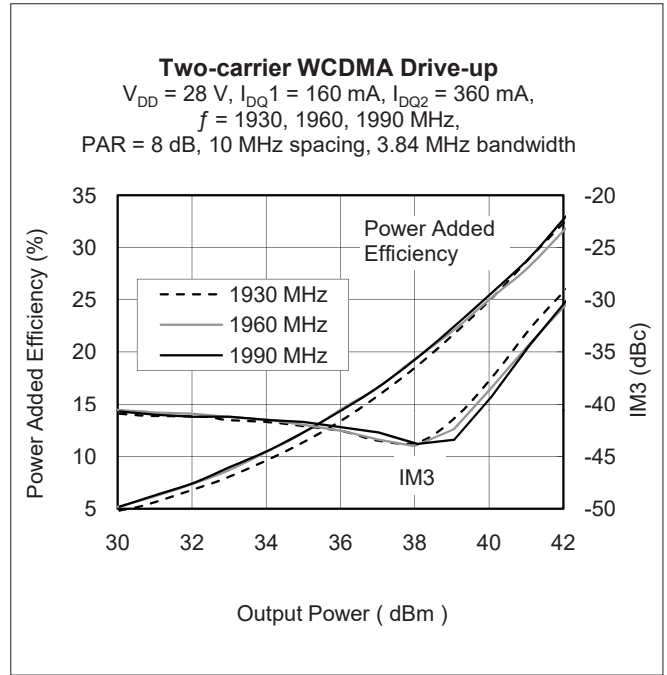
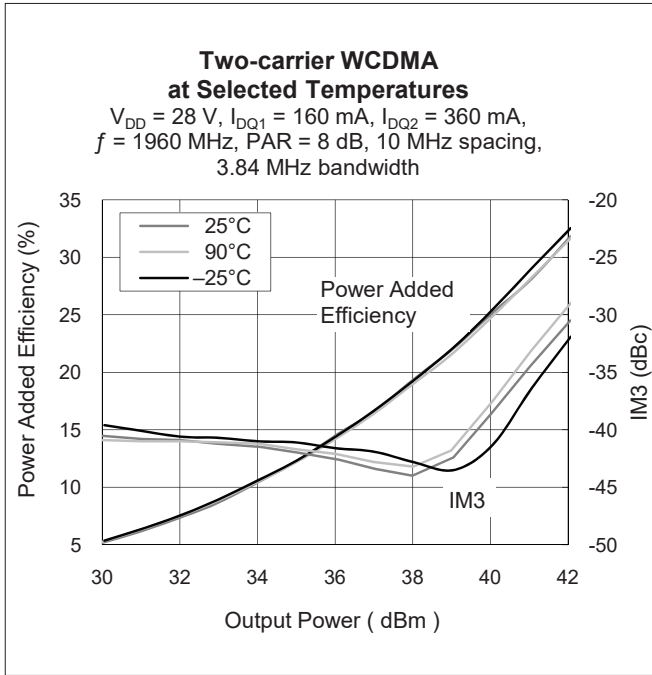
Assembly diagram for 2140 MHz reference circuit (not to scale)

Component	Description	Manufacturer	P/N or Comment
C1, C19, C24, C29	Electrolytic capacitor, 100 μ F, 50 V	Panasonic Electronic Components	EEV-FK1H101GP
C2, C7, C11, C18, C23, C28	Ceramic capacitor, 10 μ F	Murata	GRM422Y5V106Z050AL
C3, C8, C12, C17, C22, C27	Ceramic capacitor, 1 μ F	TDK Corporation	C4532X7R2A105M230KA
C4, C9, C13, C16, C21, C26	Capacitor, 0.1 μ F	Kemet	C1210C104K5RACTU
C5, C10, C12, C15, C20, C25, C34	Ceramic capacitor, 12 pF	ATC	600S120JT
C6	Ceramic capacitor, 0.5 pF	ATC	100B 0R5
C30, C31	Ceramic capacitor, 1.8 pF	ATC	600S1R8CT
C32	Ceramic capacitor, 2.4 pF	ATC	100B 2R4
C33	Ceramic capacitor, 1.2 pF	ATC	100B 1R2
Q1, Q2	Transistor	Infineon Technologies	BCP56
R1, R2	Resistor, 0 Ω	Panasonic Electronic Components	ERJ-3GEY0R00V
R3, R4	Potentiometer, 2k Ω	Bourns, Inc.	3224W-1-202E

Typical Performance, circuit tuned for 1960 MHz (data taken in a production test fixture)

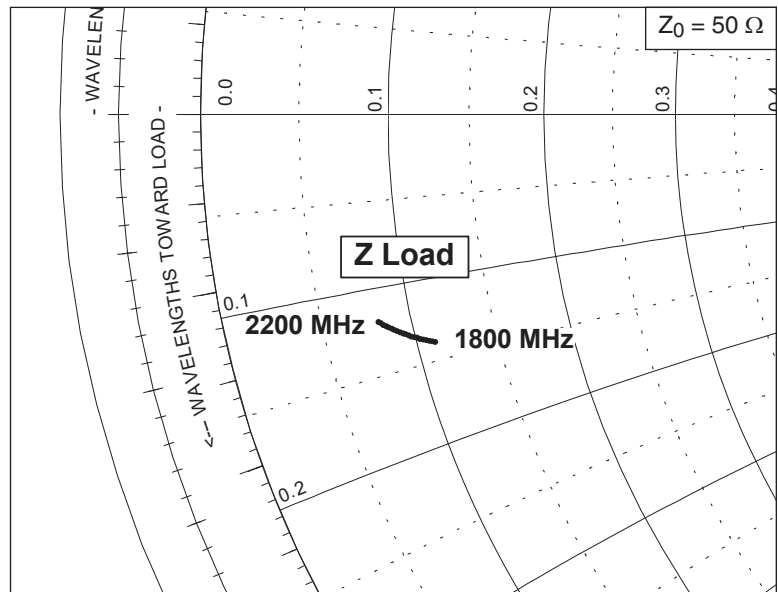
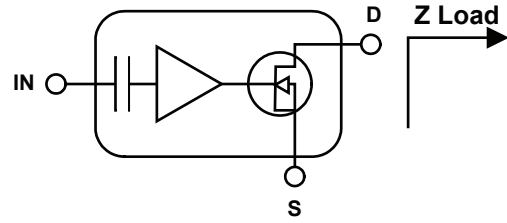


Typical Performance —1960 MHz (cont.)

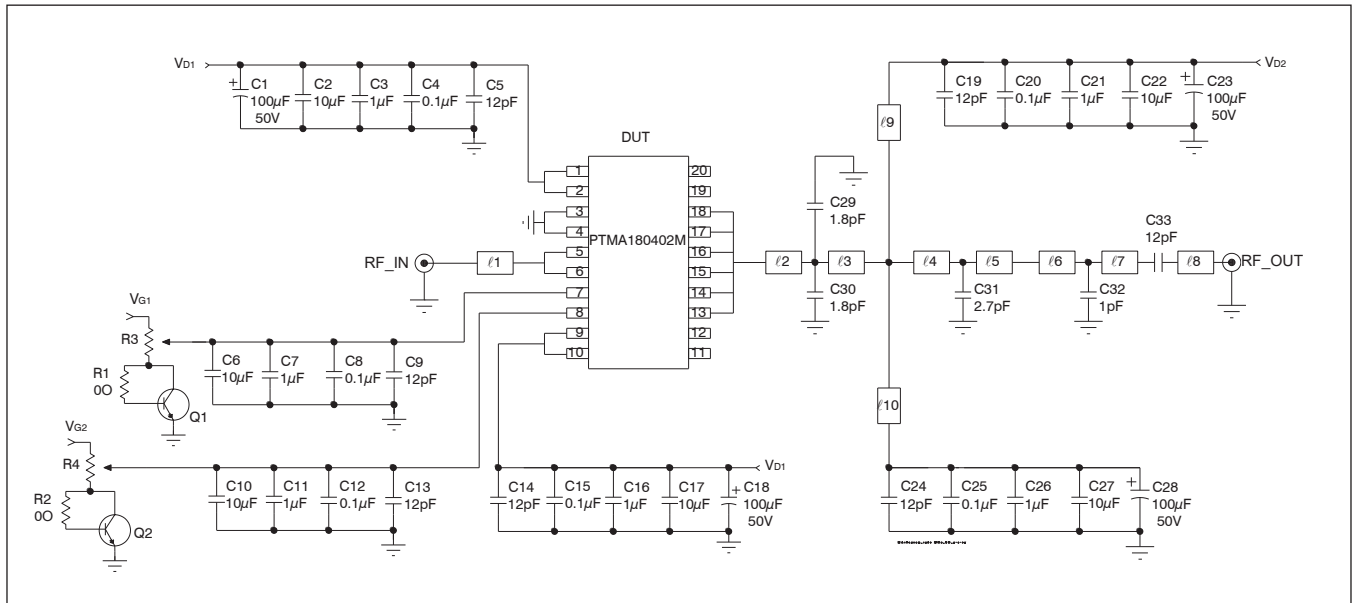


Broadband Circuit Impedance — 1960 MHz

Frequency MHz	Z Load Ω	
	R	jX
1800	5.56	-6.95
1810	5.48	-6.91
1820	5.39	-6.87
1830	5.31	-6.83
1840	5.23	-6.79
1850	5.15	-6.75
1860	5.07	-6.70
1870	4.99	-6.66
1880	4.91	-6.61
1890	4.84	-6.56
1900	4.76	-6.51
1910	4.69	-6.47
1920	4.61	-6.42
1930	4.54	-6.36
1940	4.47	-6.31
1950	4.40	-6.26
1960	4.33	-6.21
1970	4.26	-6.15
1980	4.19	-6.10
1990	4.12	-6.04
2000	4.06	-5.99



Reference Circuit, tuned for 1960 MHz



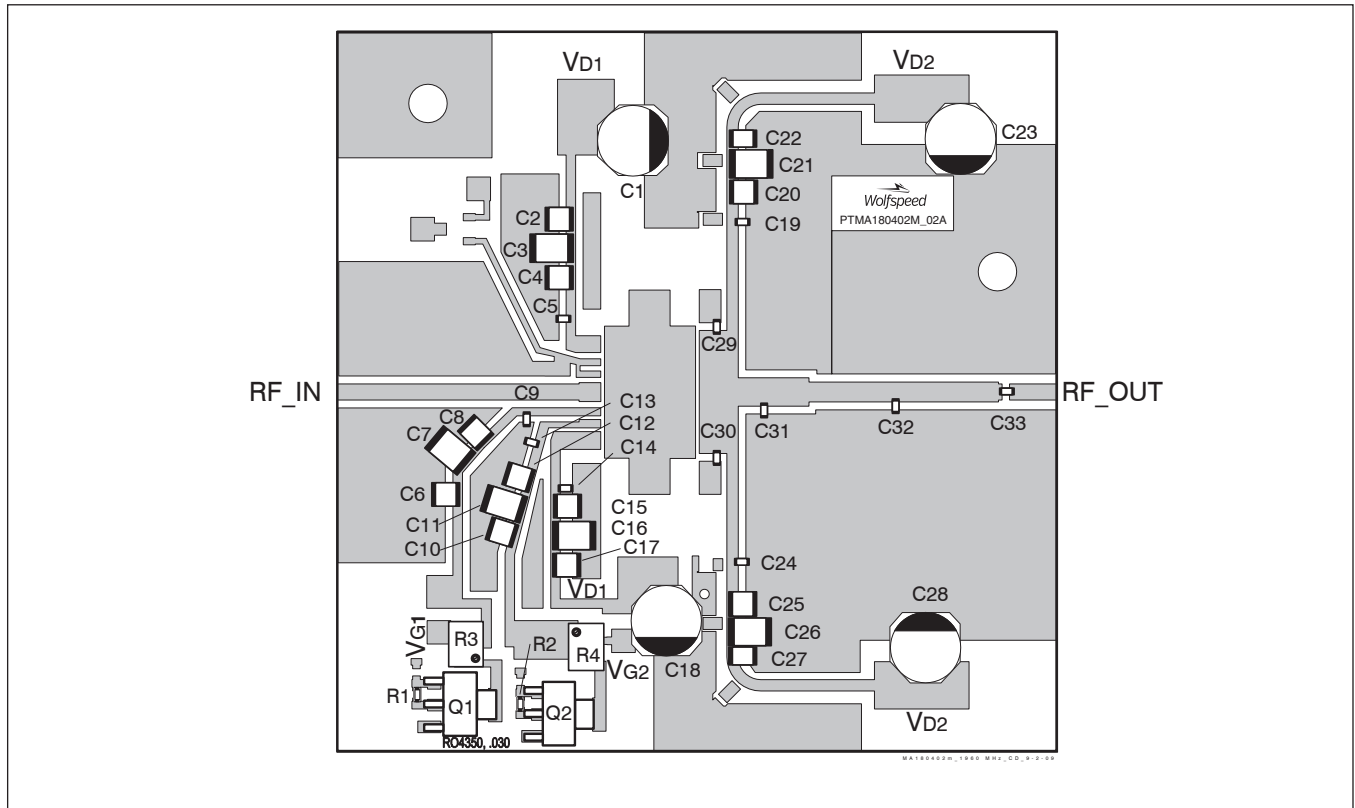
Reference circuit schematic for $f = 1960$ MHz

Circuit Description

DUT	PTMA180402M, LDMOS IC
PCB	Rogers RO4350, 0.76 mm [.030"] thick, $\epsilon_r = 3.48$, 1 oz. copper
Test Fixture Part No.	LTN/PTMA180402M
Find Gerber files for this test fixture on the Wolfspeed Web site at (www.wolfspeed.com/RF)	

Microstrip	Electrical Characteristics at 1960 MHz	Dimensions: L x W (mm)	Dimensions: L x W (in.)
l1	$0.300 \lambda, 50.0 \Omega$	27.76 x 1.70	1.093 x 0.067
l2	$0.024 \lambda, 10.4 \Omega$	2.01 x 13.00	0.079 x 0.512
l3	$0.024 \lambda, 10.4 \Omega$	2.06 x 13.00	0.081 x 0.512
l4	$0.037 \lambda, 34.2 \Omega$	3.35 x 3.00	0.132 x 0.118
l5	$0.046 \lambda, 34.2 \Omega$	4.11 x 3.00	0.162 x 0.118
l6	$0.097 \lambda, 34.2 \Omega$	8.76 x 3.00	0.345 x 0.118
l7	$0.127 \lambda, 43.6 \Omega$	11.63 x 2.11	0.458 x 0.083
l8	$0.054 \lambda, 50.0 \Omega$	5.03 x 1.70	0.198 x 0.067
l9, l10	$0.125 \lambda, 47.8 \Omega$	11.56 x 1.83	0.455 x 0.072

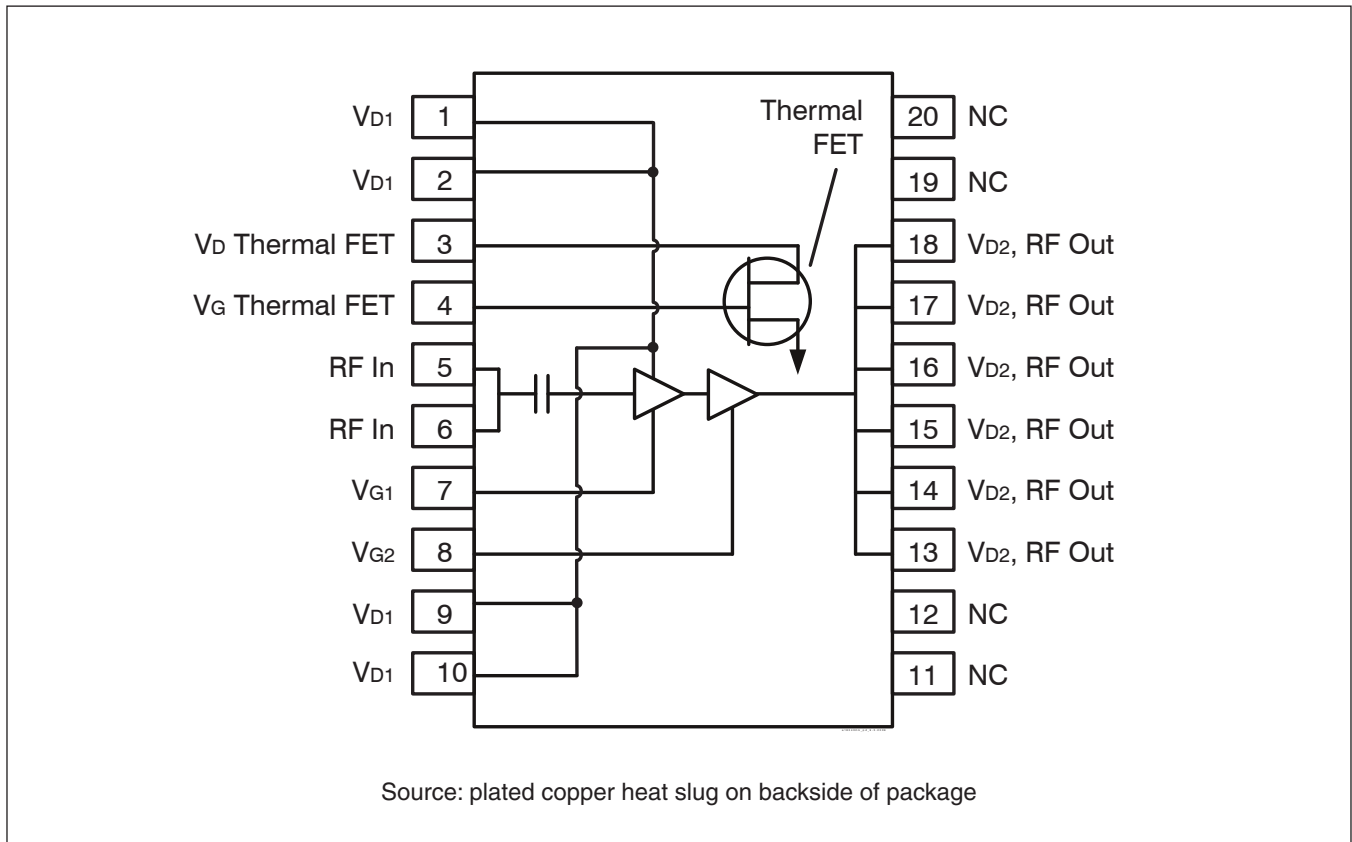
Reference Circuit — 1960 MHz (cont.)



Assembly diagram for 1960 MHz reference circuit (not to scale)

Component	Description	Manufacturer	P/N or Comment
C1, C18, C23, C28	Electrolytic capacitor, 100 μ F, 50 V	Panasonic Electronic Components	EEV-FK1H101GP
C2, C6, C10, C17, C22, C27	Ceramic capacitor, 10 μ F	Murata	GRM422Y5V106Z050AL
C3, C7, C11, C16, C21, C26	Ceramic capacitor, 1 μ F	TDK Corporation	C4532X7R2A105M230KA
C4, C8, C12, C15, C20, C25	Capacitor, 0.1 μ F	Kemet	C1210C104K5RACTU
C5, C9, C13, C14, C19, C24, C33	Ceramic capacitor, 12 pF	ATC	600S120JT
C29, C30, C31	Ceramic capacitor, 1.8 pF	ATC	600S1R8CT
C32	Ceramic capacitor, 1.0 pF	ATC	100B 1R0
Q1, Q2	Transistor	Infineon Technologies	BCP56
R1, R2	Resistor, 0 Ω	Panasonic Electronic Components	ERJ-3GEY0R00V
R3, R4	Potentiometer, 2k Ω	Bourns, Inc.	3224W-1-202E

Pinout Diagram



Package Outline Specifications

Package PG-DSO-20-63

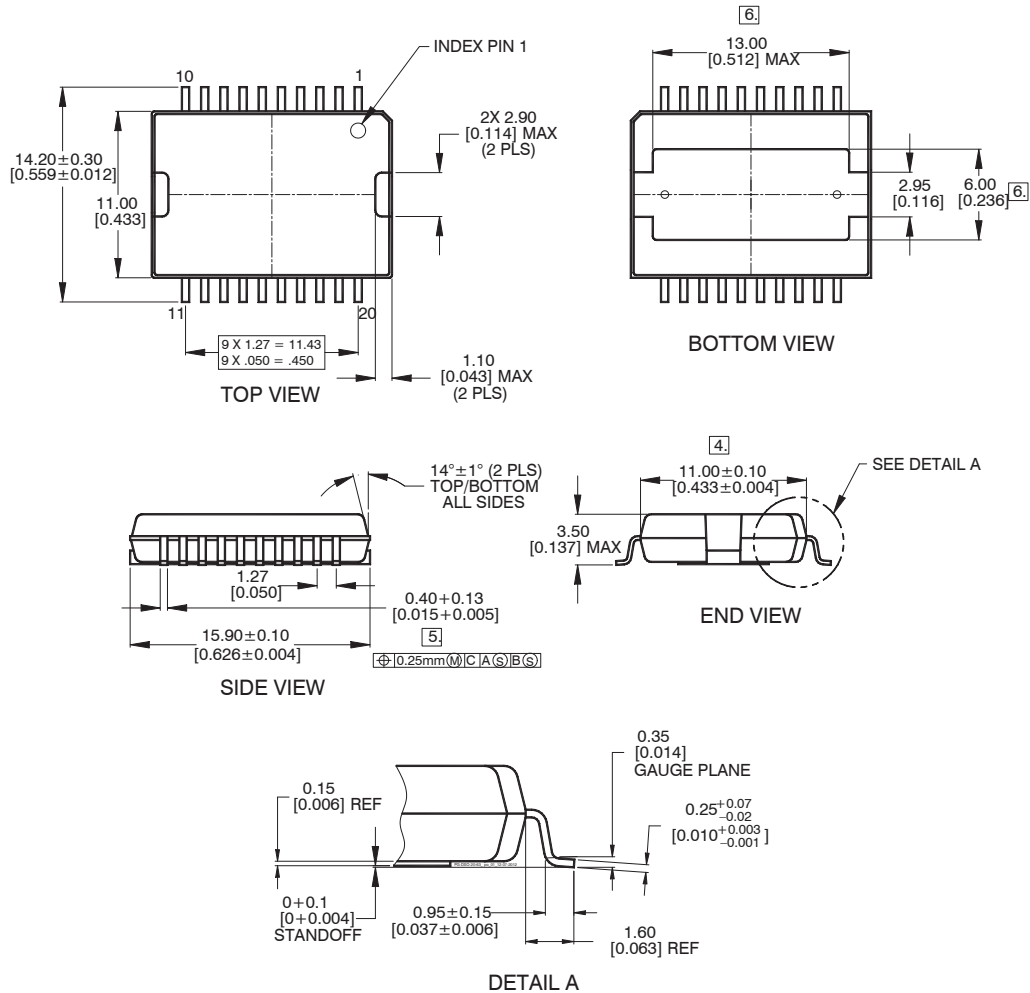


Diagram Notes—unless otherwise specified:

1. Interpret dimensions and tolerances per ASME Y14.5M-1994.
2. Package dimensions: 11.0 mm by 15.9 mm by 3.35 mm.
3. JEDEC drawing number: MO-166.
4. Does not include plastic or metal protrusion of 0.15 mm max per side.
5. Does not include dambar protrusion; maximum allowable dambar protrusion shall be 0.08 mm.
6. Bottom metallization. Sn plating (matte): 5 – 15 micron [196.85 – 590.55 microinch].

Revision History

01	2008-12-23	Production	all	First information about this product
02	2009-01-22	Production	10	Revised pinout diagram
03	2009-03-03	Production	9	Package outline updated
04	2009-07-28	Production	1	Frequencies of operation changed.
05	2009-10-13	Production	3-12	Added 2100 MHz information and revised 1900 MHz characterization and circuit information
06	2010-04-16	Production	3, 14	Moisture sensitivity level table added; package outline notes updated
07	2010-11-02	Production	5, 11	Recalculate electrical characteristics
07.1	2011-03-17	Production	9, 11	Removed graph; corrected typo
08	2011-08-10	Production	1-2	Updates to and clarification for RF and DC tables.
09	2014-05-27	Production	3	Shipping option added.
10	2018-05-19	Production	All	Converted to Wolfspeed Data Sheet

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Notes

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