

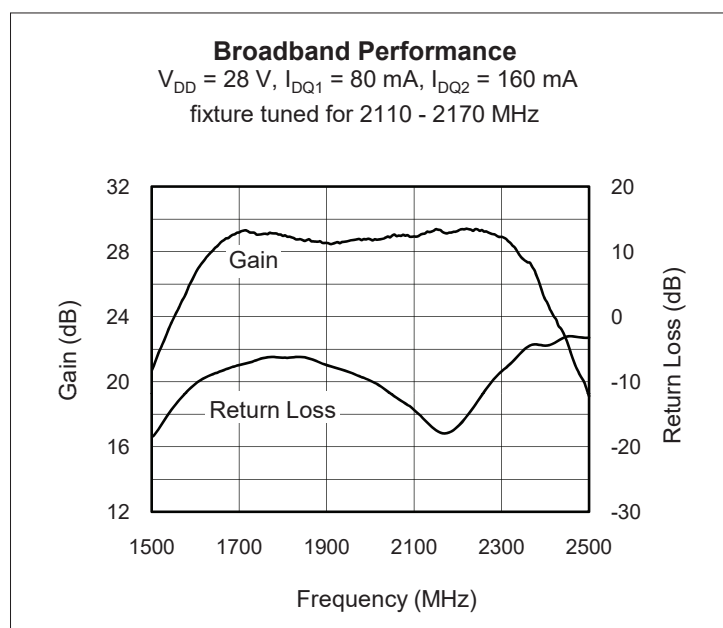
PTMA210152M

Wideband RF LDMOS Integrated Power Amplifier 15 W, 28 V, 1800 – 2200 MHz

Description

The PTMA210152M is a wideband, matched, 15-watt, 2-stage LDMOS integrated amplifier intended for wideband driver applications in the 1800 to 2200 MHz band. This device is offered in a 20-lead thermally-enhanced overmolded package for cool and reliable operation.

PTMA210152M
Package PG-DSO-20-63



Features

- Designed for wide RF bandwidth and low memory effects
- Broadband input on-chip matching
- Typical two-carrier WCDMA performance at 2140 MHz, 28 V, 7 W avg.
 - Gain = 28.5 dB
 - Power Added Efficiency = 33 %
 - IMD3 = -32 dBc
- Typical CW performance at 2140 MHz, 28 V
 - Output power at P_{1dB} ~ 20 W
 - Efficiency > 49%
- Integrated ESD protection. Meets HBM Class 1B (minimum), per JESD22-A114F.
- Capable of handling 10:1 VSWR @ 28 V, 15 W (CW) output power
- Thermally-enhanced RoHS-compliant package

RF Characteristics

Two-carrier WCDMA Specifications (not subject to production test—verified by design/characterization in Wolfspeed test fixture)
 $V_{DS} = 28\text{ V}$, $I_{DQ1} = 80\text{ mA}$, $I_{DQ2} = 160\text{ mA}$, $f = 2110 - 2170\text{ MHz}$, $P_{OUT} = 7\text{ W}$ average

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	—	28.5	—	dB
Power Added Efficiency	PAE	—	33	—	%
Input Return Loss	IRL	—	-14	—	dB
Adjacent Channel Power Ratio	ACPR	—	-36	—	dBc
Third Order Intermodulation Distortion	IMD3	—	-32	—	dBc
Spurs Load 3:1	—	—	-60	—	dBc
Gain Flatness	ΔG	—	0.43	—	dB

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 Measurement** (tested in WolfSpeed test fixture) $V_{DD} = 28\text{ V}$, $I_{DQ1} = 80\text{ mA}$, $I_{DQ2} = 160\text{ mA}$, $P_{OUT} = 8\text{ W AVG}$, $f = 2140\text{ MHz}$, tone spacing = 1 MHz

Characteristic	Symbol	Min	Typ	Max	Unit
Gain	G_{ps}	27.5	28.5	30	dB
Drain Efficiency	η_D	33	34	—	%
Third Order Intermodulation Distortion	IMD3	—	-33	-31	dBc
Input Return Loss	IRL	—	-14	-10	dB

DC Characteristics

Stage 1 Characteristic	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
On-State Resistance	$V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	3.5	—	Ω
Operating Gate Voltage	$V_{DS} = 28\text{ V}$, $I_{DQ} = 80\text{ mA}$	V_{GS}	2	2.5	3	V
Gate Leakage Current	$V_{GS} = 10\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	—	—	1.0	μA

Stage 2 Characteristic	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
On-State Resistance	$V_{GS} = 10\text{ V}$, $V_{DS} = 0.1\text{ V}$	$R_{DS(on)}$	—	0.6	—	Ω
Operating Gate Voltage	$V_{DS} = 28\text{ V}$, $I_{DQ} = 160\text{ mA}$	V_{GS}	2	2.5	3	V
Gate Leakage Current	$V_{GS} = 10\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	—	—	1.0	μA

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
Input Power	P_{IN}	15	dBm
Total Device Dissipation	P_D	70	W
Above 25°C derate by		0.4	W/°C
Storage Temperature Range	T_{STG}	-40 to +150	°C
Thermal Resistance ($T_{CASE} = 70^\circ\text{C}$, 15 W CW)	Stage 1	$R_{\theta JC}$	10.7 °C/W
	Stage 2	$R_{\theta JC}$	2.9 °C/W

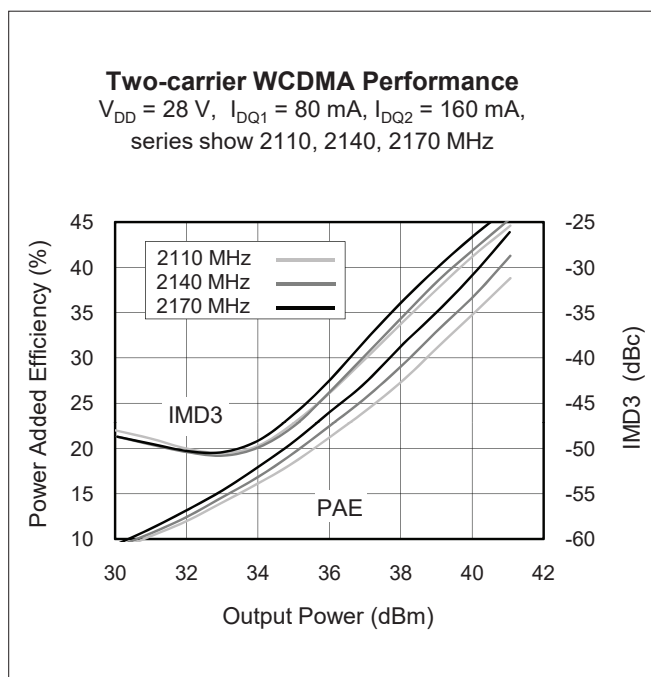
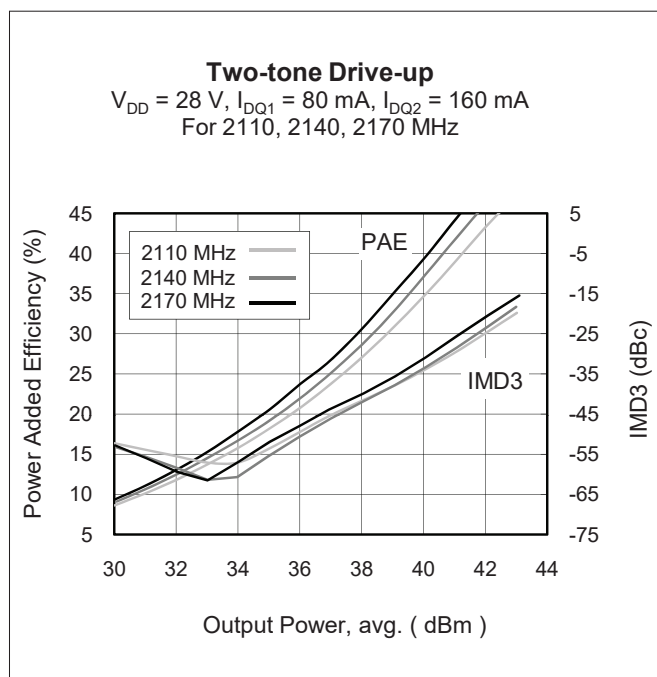
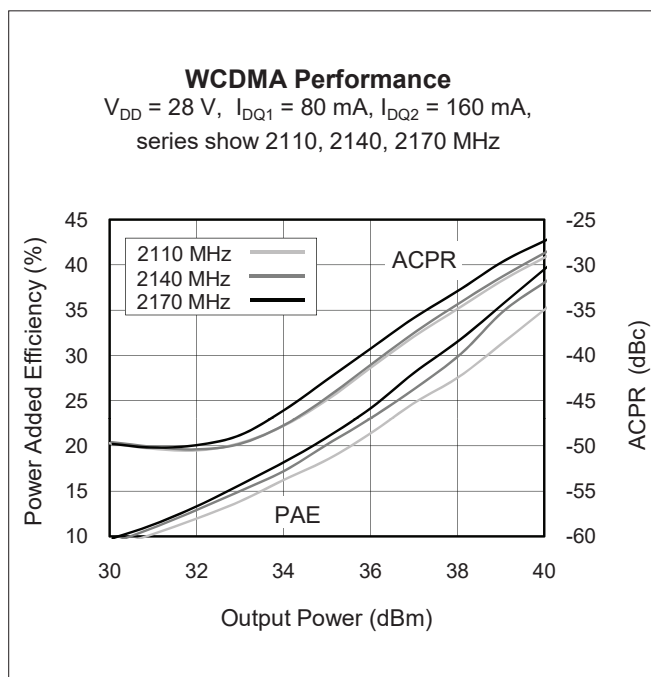
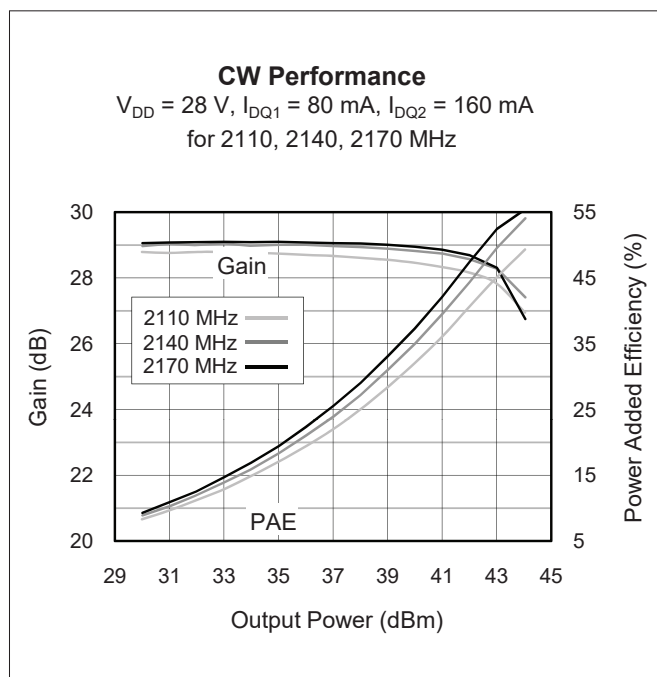
Moisture Sensitivity Level

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
PTMA210152M V1 R500	PTMA210152M-V1-R500	PG-DSO-20-63, molded plastic	Tape & Reel, 500 pcs

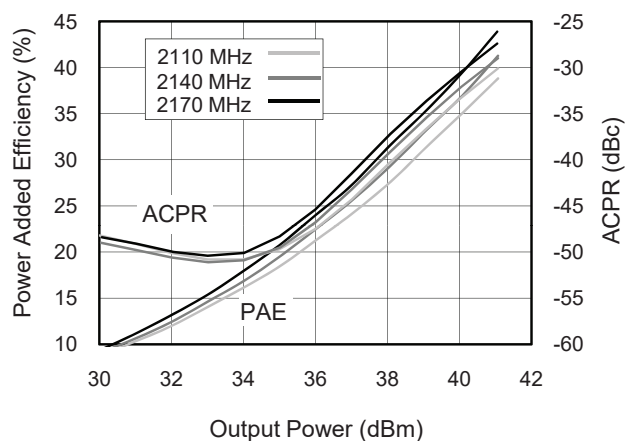
Typical Performance, circuit tuned for 2140 MHz (data taken in a production test fixture)



Typical Performance—2140 MHz (cont.)

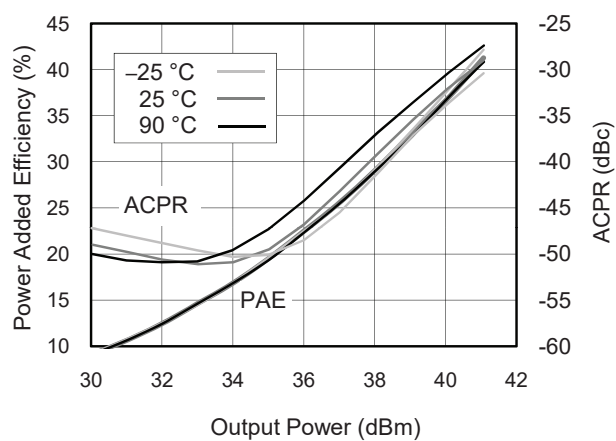
Two-carrier WCDMA Performance

$V_{DD} = 28\text{ V}$, $I_{DQ1} = 80\text{ mA}$, $I_{DQ2} = 160\text{ mA}$,
series show 2110, 2140, 2170 MHz



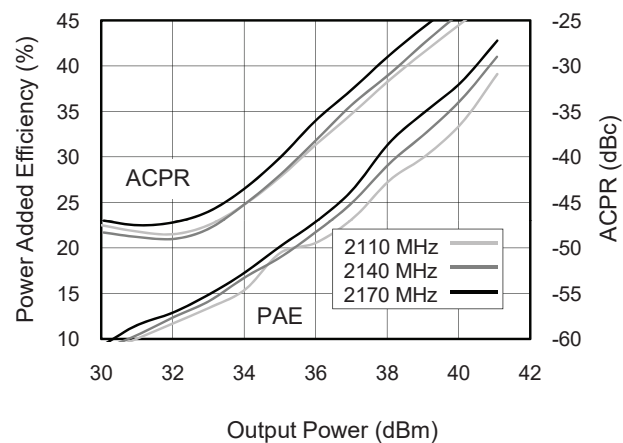
Two-carrier WCDMA Performance

$V_{DD} = 28\text{ V}$, $I_{DQ1} = 80\text{ mA}$, $I_{DQ2} = 160\text{ mA}$,
 $f = 2140\text{ MHz}$



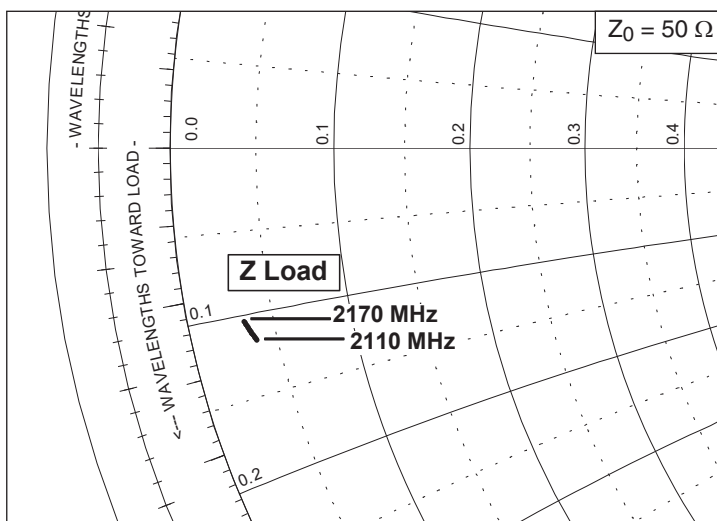
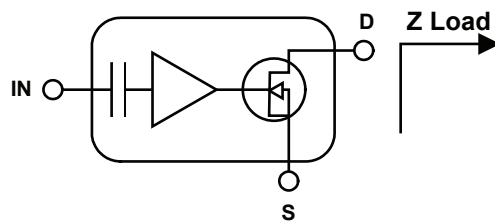
Six-carrier TD-SCDMA Performance

$V_{DD} = 28\text{ V}$, $I_{DQ1} = 80\text{ mA}$, $I_{DQ2} = 160\text{ mA}$



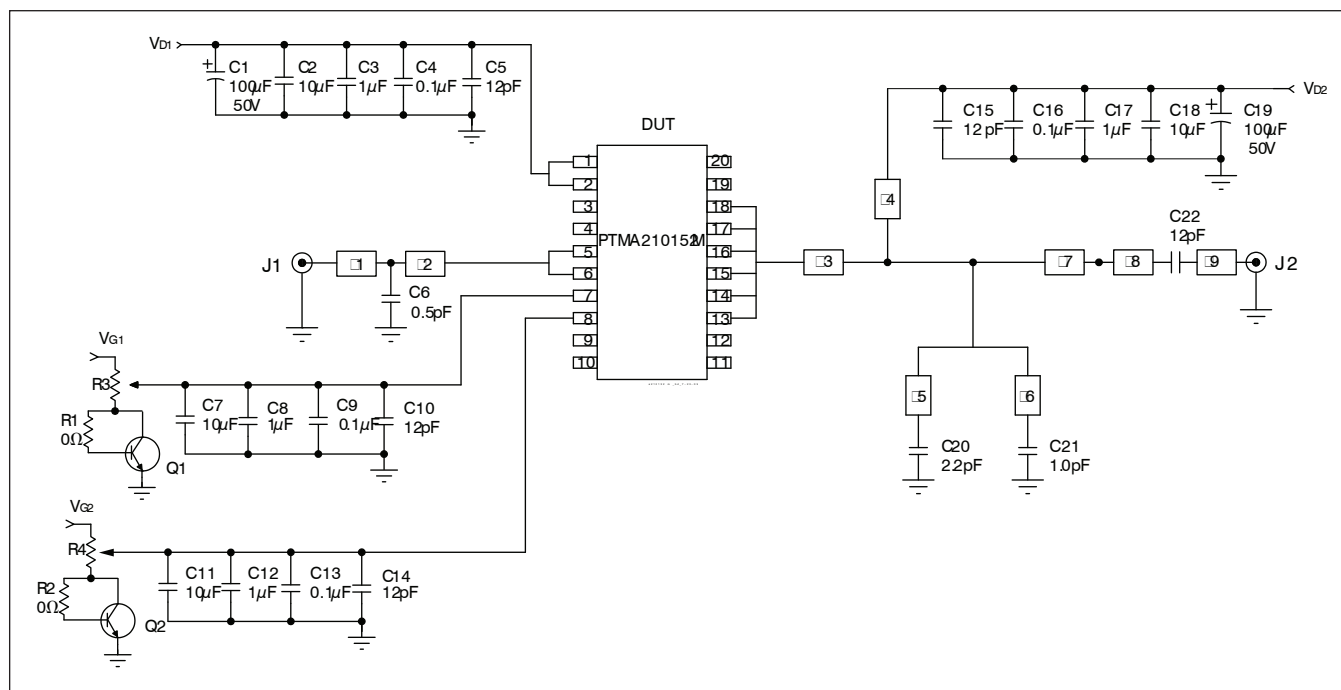
Broadband Circuit Impedance—2140 MHz

Frequency MHz	Z Load Ω	
	R	jX
2110	1.89	-5.84
2114	1.87	-5.80
2118	1.85	-5.76
2122	1.84	-5.72
2126	1.82	-5.67
2130	1.80	-5.63
2134	1.78	-5.60
2138	1.77	-5.55
2142	1.75	-5.51
2146	1.73	-5.47
2150	1.71	-5.42
2154	1.70	-5.38
2158	1.68	-5.34
2162	1.66	-5.30
2166	1.65	-5.25
2170	1.63	-5.21



See next page for reference circuit information

Reference Circuit—tuned for 2140 MHz

Reference circuit schematic for $f = 2140$ MHz

Circuit Assembly Information

DUT PTMA210152M, LDMOS IC

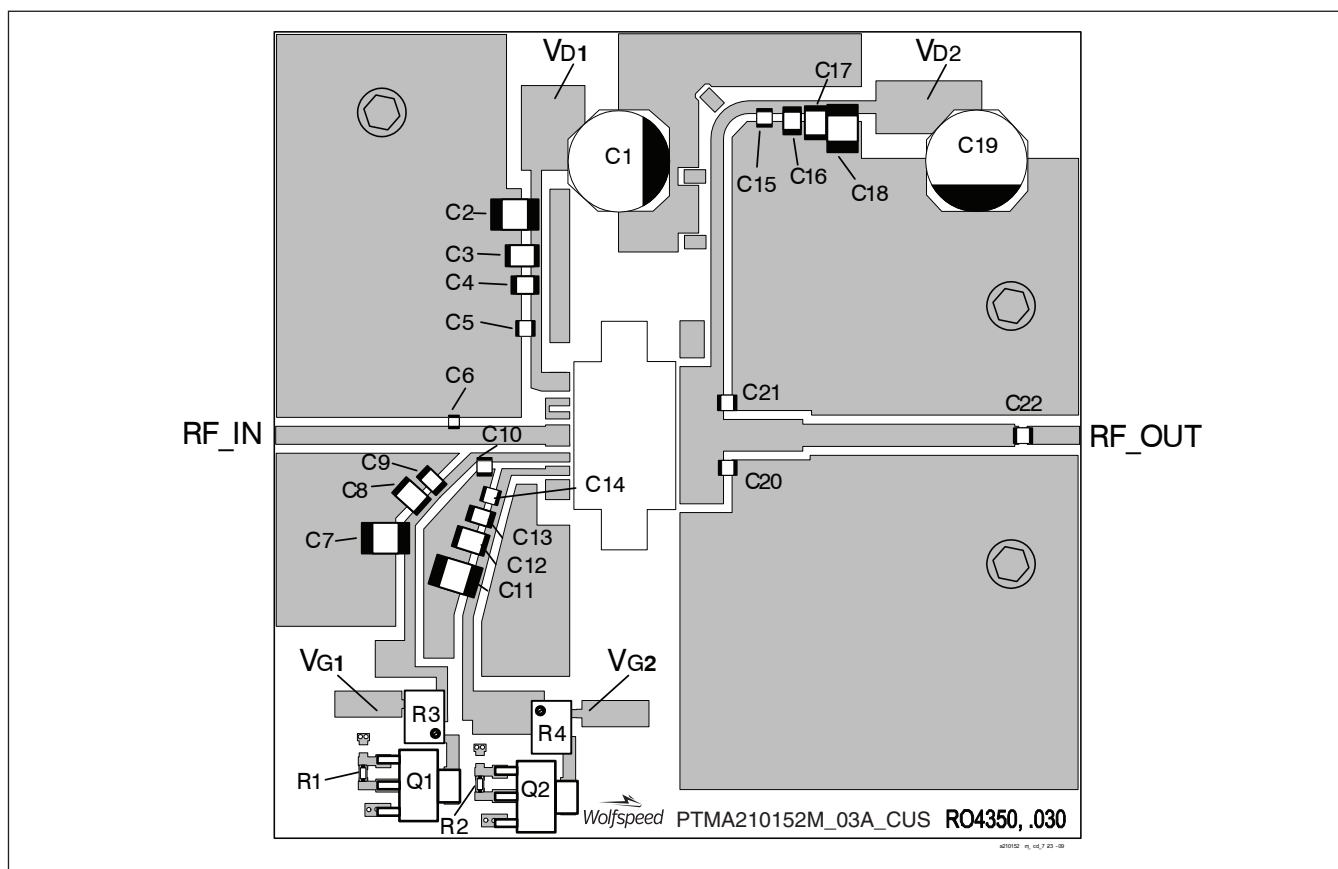
Reference Fixture Part No. LTN/PTMA210152M

PCB Rogers RO4350: 0.76 mm [.030"] thick, $\epsilon_r = 3.48$, 1 oz. copperFind Gerber files for this reference fixture on the Wolfspeed Web site at (www.wolfspeed.com/RF)

Microstrip	Electrical Characteristics at 2140 MHz	Dimensions: L x W (mm)	Dimensions: L x W (in.)
ℓ_1	0.206λ , 50Ω	17.48 x 1.70	0.688 x 0.067
ℓ_2	0.111λ , 50Ω	9.40 x 1.70	0.370 x 0.067
ℓ_3	0.052λ , $11 \Omega^*$	4.09 x 12.83	0.161 x 0.505
ℓ_4	0.301λ , 61Ω	25.91 x 1.19	1.020 x 0.047
ℓ_5	0.004λ , 71Ω	0.38 x 0.89	0.015 x 0.035
ℓ_6	0.004λ , 71Ω	0.38 x 0.89	0.015 x 0.035
ℓ_7	0.090λ , 34Ω	7.47 x 3.00	0.294 x 0.118
ℓ_8	0.243λ , 44Ω	20.40 x 2.11	0.803 x 0.083
ℓ_9	0.058λ , 50Ω	4.95 x 1.70	0.195 x 0.067

*Calculated at 10.5

Reference Circuit—2140 MHz (cont.)



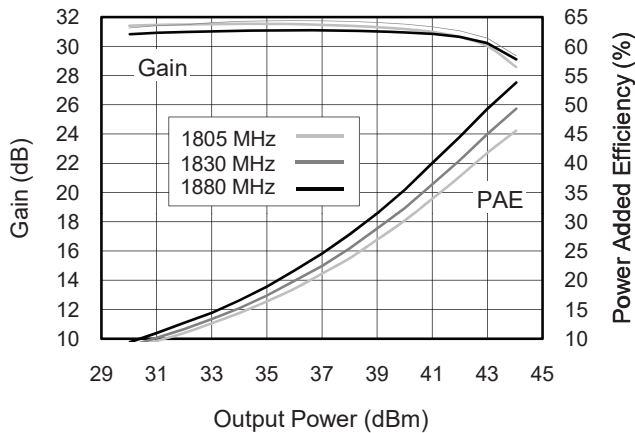
Reference circuit assembly diagram (not to scale)

Component	Description	Suggested Manufacturer	P/N or Comment
C3, C8, C12, C17	Ceramic capacitor, 1 μ F	Digi-Key	445-1411-2-ND
C4, C9, C13, C16	Capacitor, 0.1 μ F	Digi-Key	PCC104BCT-ND
C2, C7, C11, C18	Tantalum capacitor, 10 μ F, 50 V	Digi-Key	P5571-ND
C1, C19	Electrolytic capacitor, 100 μ F, 50 V	Digi-Key	PCE3718CT-ND
C6	Ceramic capacitor, 0.5 pF	ATC	600S 0R5 CT
C20	Ceramic capacitor, 2.2 pF	ATC	600S 2R2 CT
C21	Ceramic capacitor, 1.0 pF	ATC	600S 1R0 CT
C5, C10, C14, C15, C22	Ceramic capacitor, 12 pF	ATC	600S 120 JT
Q1, Q2	Transistor	Infineon Technologies	BCP56
R1, R2	Chip resistor, 0 ohms	Digi-Key	P00ECT-ND
R3, R4	Potentiometer, 2 k ohms	Digi-Key	3224W-202ETR-ND

Typical Performance, circuit tuned for 1840 MHz (data taken in a production test fixture)

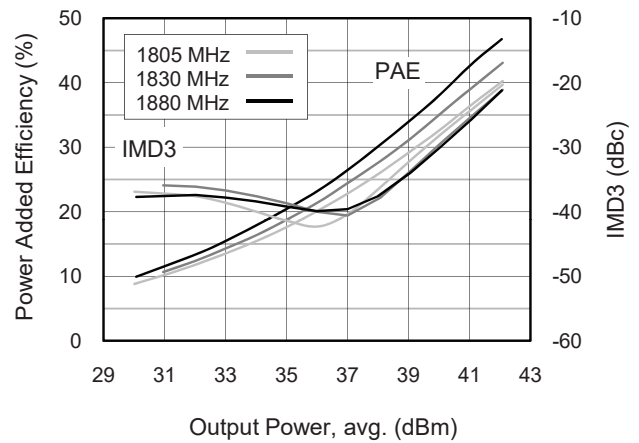
CW Performance

$V_{DD} = 28\text{ V}$, $I_{DQ1} = 70\text{ mA}$, $I_{DQ2} = 120\text{ mA}$,
 $f = 1805, 1830, 1880\text{ MHz}$



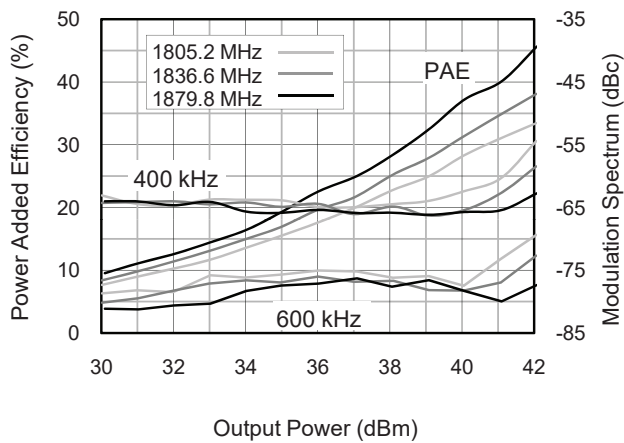
Two-tone Drive-up

$V_{DD} = 28\text{ V}$, $I_{DQ1} = 70\text{ mA}$, $I_{DQ2} = 120\text{ mA}$,
 $f = 1805, 1830, 1880\text{ MHz}$



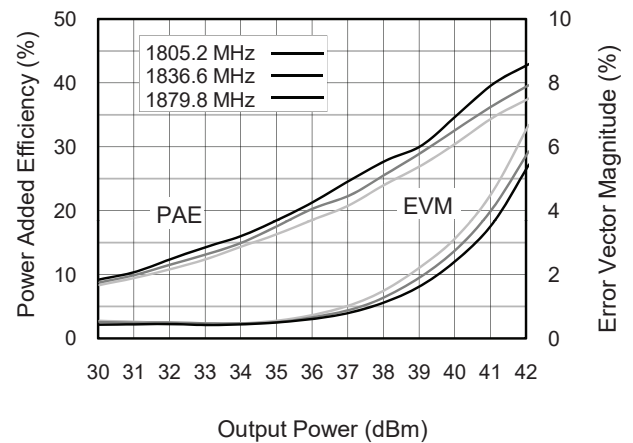
Edge Modulation Spectrum Performance

$V_{DD} = 28\text{ V}$, $I_{DQ1} = 70\text{ mA}$, $I_{DQ2} = 160\text{ mA}$,
 series are at selected frequencies



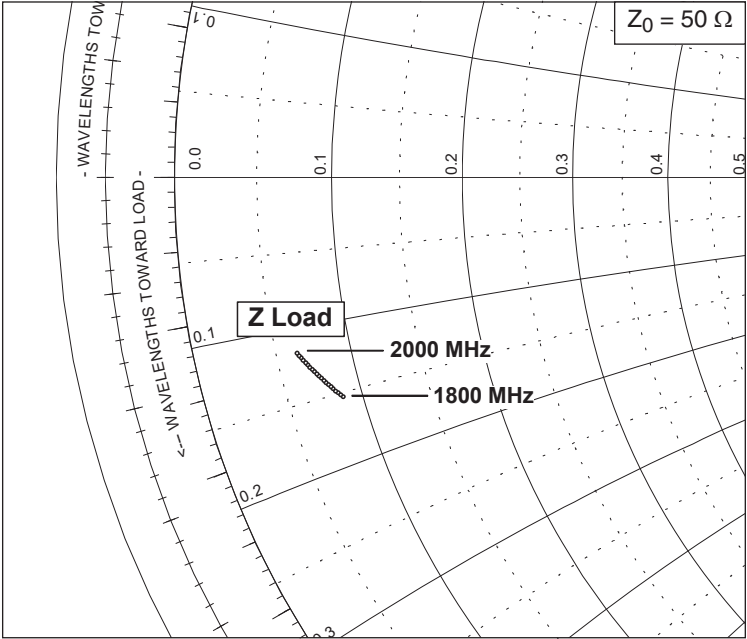
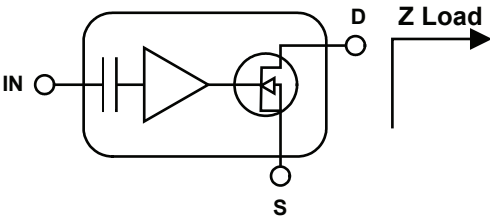
Edge - EVM

$V_{DD} = 28\text{ V}$, $I_{DQ1} = 70\text{ mA}$, $I_{DQ2} = 160\text{ mA}$,
 series are at selected frequencies

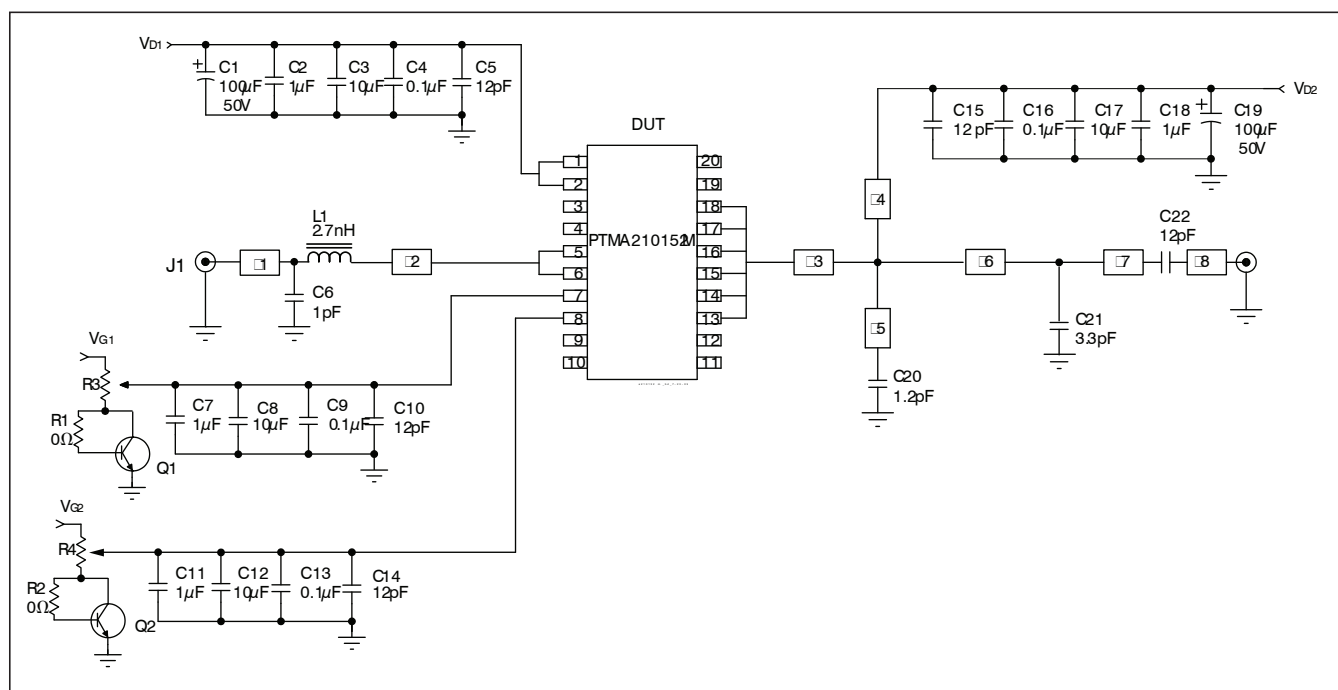


Broadband Circuit Impedance—1840 MHz

Frequency MHz	Z Load Ω	
	R	jX
1800	4.34	-7.66
1810	4.28	-7.57
1820	4.21	-7.48
1830	4.15	-7.40
1840	4.09	-7.30
1850	4.03	-7.21
1860	3.96	-7.12
1870	3.90	-7.03
1880	3.85	-6.94
1890	3.79	-6.85
1900	3.73	-6.76
1910	3.67	-6.67
1920	3.62	-6.57
1930	3.56	-6.48
1940	3.50	-6.39
1950	3.45	-6.30
1960	3.40	-6.21
1970	3.34	-6.11
1980	3.29	-6.02
1990	3.24	-5.93
2000	3.19	-5.84



Reference Circuit, tuned for 1840 MHz

Reference circuit schematic for $f = 1840$ MHz

Circuit Assembly Information

DUT PTMA210152M, LDMOS IC

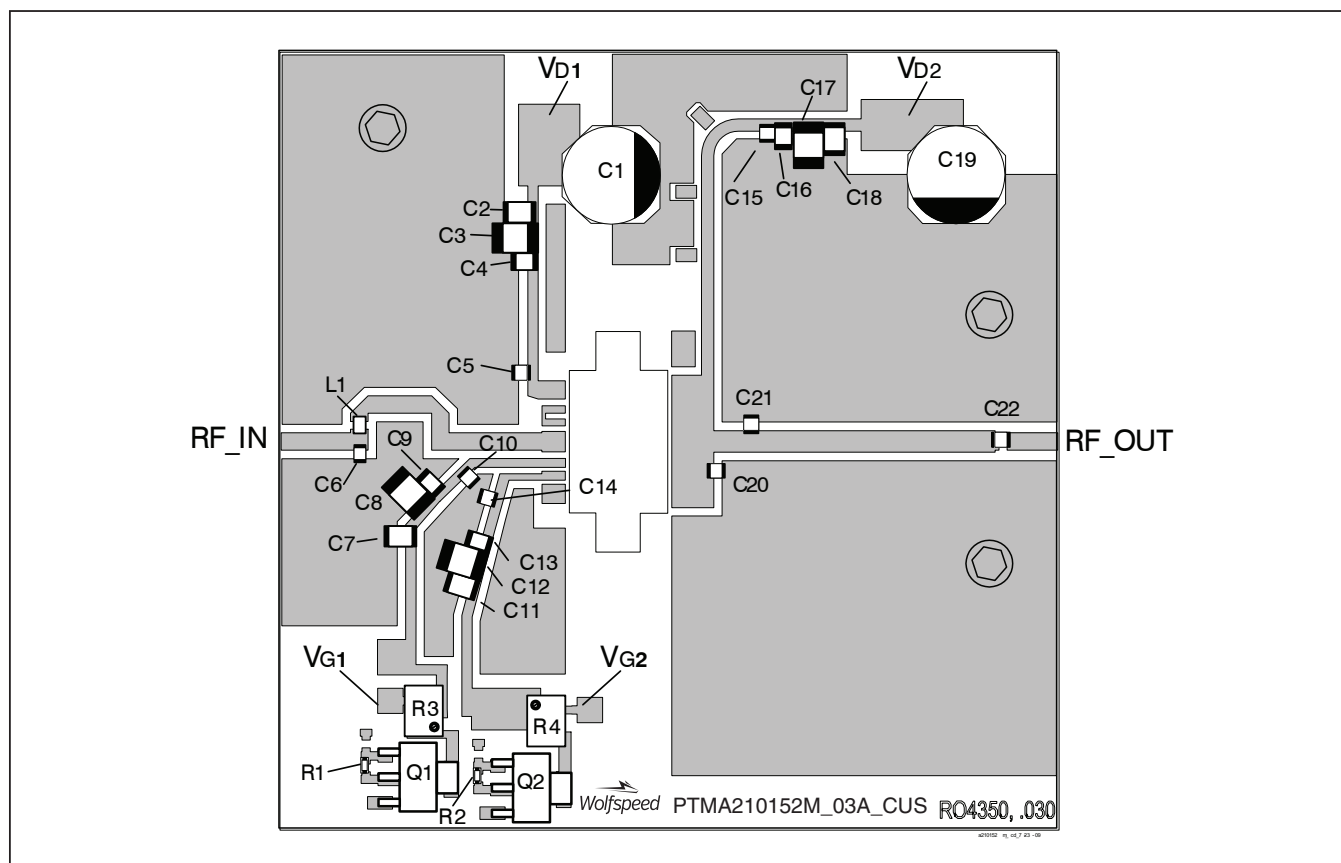
Test Fixture Part No. LTN/PTMA210152M-18

PCB Rogers RO4350: 0.76 mm [.030"] thick, $\epsilon_r = 3.48$, 1 oz. copperFind Gerber files for this test fixture on the Wolfspeed Web site at (www.wolfspeed.com/RF)

Microstrip	Electrical Characteristics at 1840 MHz	Dimensions: L x W (mm)	Dimensions: L x W (in.)
ℓ_1	0.077λ , 50Ω	7.59 x 1.70	0.299 x 0.067
ℓ_2	0.250λ , 50Ω	24.66 x 1.70	0.971 x 0.067
ℓ_3	0.045λ , $11 \Omega^*$	4.09 x 12.83	0.161 x 0.505
ℓ_4	0.259λ , 61Ω	25.91 x 1.19	1.020 x 0.047
ℓ_5	0.004λ , 71Ω	0.38 x 0.89	0.015 x 0.035
ℓ_6	0.018λ , 44Ω	1.73 x 2.08	0.068 x 0.082
ℓ_7	0.268λ , 44Ω	26.16 x 2.08	1.030 x 0.082
ℓ_8	0.050λ , 50Ω	4.95 x 1.70	0.195 x 0.067

*Calculated at 10.5

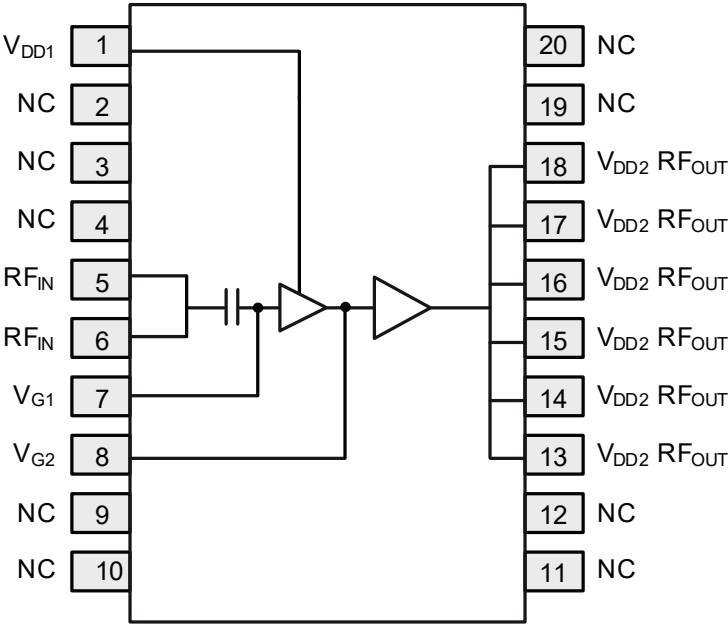
Reference Circuit—1840 MHz (cont.)



Reference circuit assembly diagram (not to scale)

Component	Description	Suggested Manufacturer	P/N or Comment
C3, C8, C12, C17	Ceramic capacitor, 1 μ F	Digi-Key	445-1411-2-ND
C4, C9, C13, C16	Capacitor, 0.1 μ F	Digi-Key	PCC104BCT-ND
C2, C7, C11, C18	Tantalum capacitor, 10 μ F, 50 V	Digi-Key	P5571-ND
C1, C19	Electrolytic capacitor, 100 μ F, 50 V	Digi-Key	PCE3718CT-ND
C6	Ceramic capacitor, 1.0 pF	ATC	600S 1R0 CT
C20	Ceramic capacitor, 1.2 pF	ATC	600S 1R2 CT
C21	Ceramic capacitor, 3.3 pF	ATC	600S 3R3 CT
C5, C10, C14, C15, C22	Ceramic capacitor, 12 pF	ATC	600S 120 JT
Q1, Q2	Transistor	Infineon Technologies	BCP56
R1, R2	Chip resistor, 0 ohms	Digi-Key	P00ECT-ND
R3, R4	Potentiometer, 2 k ohms	Digi-Key	3224W-202ETR-ND
L1	Inductor, 2.7 nH	Digi-Key	PCD1287CT-ND

Pinout Diagram (top view)



Source/ground: plated copper heatslug on backside of package

Package Outline Specifications

Package PG-DSO-20-63

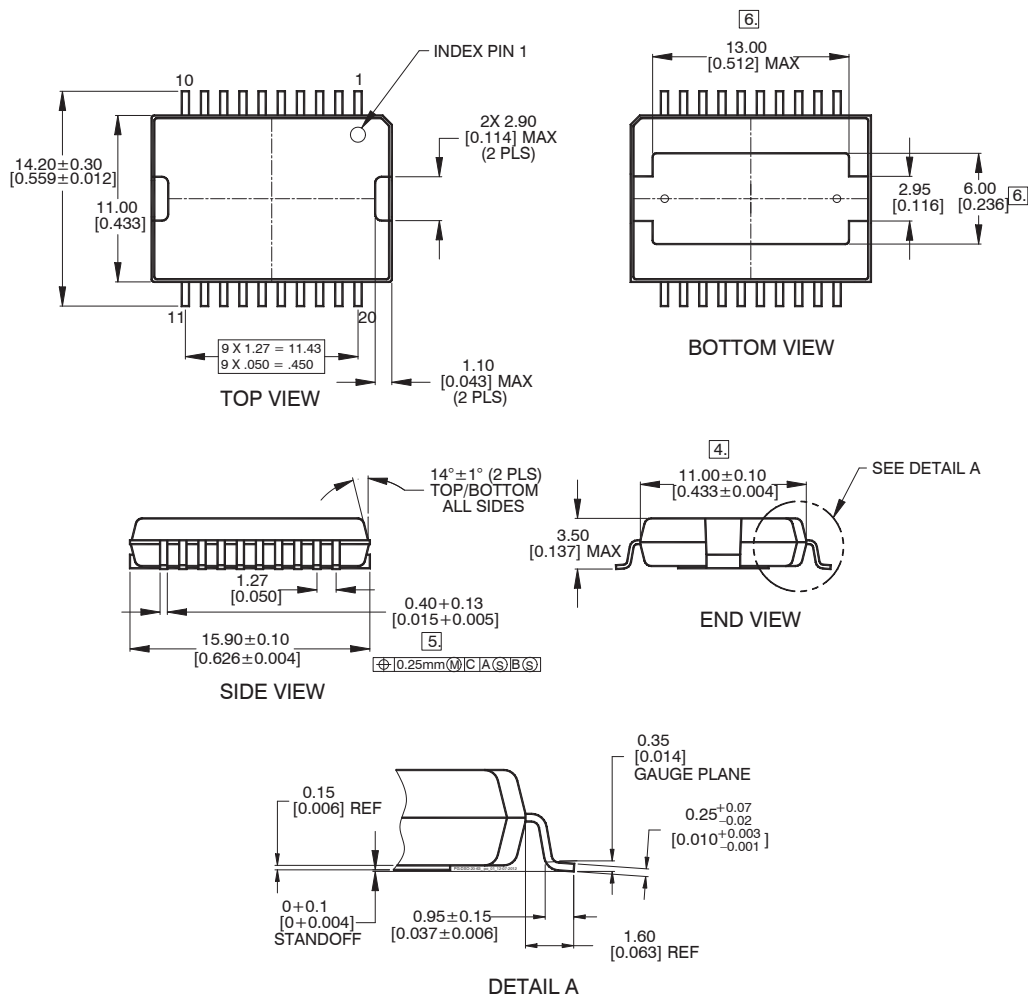


Diagram Notes—unless otherwise specified:

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.
7. Sn plating (matte): 5 – 15 micron [196.85 – 590.55 microinch].

Revision History

01	2009-06-15	Preliminary	all	Preliminary specification for new product in development.
02	2009-08-11	Production	all	Add 1840 MHz characterization.
03	2009-09-02	Production	14	Update pinout diagram.
04	2010-04-16	Production	3; 14	Add moisture sensitivity information; update package outline notes.
05	2010-10-28	Production	6, 11	Recalculate electrical characteristics.
06	2011-04-25	Production	4, 6	Removed graphs.
07	2011-06-10	Production	2	Clarify DC characteristics per stage
08	2011-06-11	Production	2	Revise RF table to better reflect test specifications.
09	2014-05-07	Production	3	Add shipping option.
10	2018-05-19	Production	All	Converted to Wolfspeed Data Sheet

For more information, please contact:

4600 Silicon Drive
Durham, North Carolina, USA 27703
www.wolfspeed.com/RF

Sales Contact
RFSales@wolfspeed.com

RF Product Marketing Contact
RFMarketing@wolfspeed.com
919.407.7816

Notes

Disclaimer

Specifications are subject to change without notice. Cree, Inc. believes the information contained within this data sheet to be accurate and reliable. However, no responsibility is assumed by Cree for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Cree. Cree makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. "Typical" parameters are the average values expected by Cree in large quantities and are provided for information purposes only. These values can and do vary in different applications and actual performance can vary over time. All operating parameters should be validated by customer's technical experts for each application. Cree products are not designed, intended or authorized for use as components in applications intended for surgical implant into the body or to support or sustain life, in applications in which the failure of the Cree product could result in personal injury or death or in applications for planning, construction, maintenance or direct operation of a nuclear facility.