LOW NOISE, HIGH IP3

Monolithic Amplifier

PMA-5453+

50Ω   0.05 to 6 GHz

THE BIG DEAL

- Ultra Low Noise Figure, 0.6 dB
- High IP3, 35 dBm typ. 1 GHz
- Wideband, up to 6 GHz
- Single Positive Supply Voltage, 3V, Id=60mA
- Ultra Low Noise Figure, 0.6 dB typ. at 0.5 GHz
- Gain, 19 dB typ. at 1 GHz
- Output Power, up to +19.5dBm typ.
- Micro-miniature size - 3mm x 3mm
- Aqueous washable

Generic photo used for illustration purposes only

CASE STYLE: DQ849

+RoHS Compliant
The +Suffix identifies RoHS Compliance. See our web site for RoHS Compliance methodologies and qualifications

APPLICATIONS

- Cellular
- ISM
- GSM
- WCDMA
- LTE
- WiMAX
- WLAN
- UNII and HIPERLAN

PRODUCT OVERVIEW

Mini-Circuits PMA-5453+ is a E-PHEMT* based Ultra-Low Noise MMIC Amplifier operating from 50 MHz to 6 GHz with a unique combination of low noise and high IP3 making this amplifier ideal for sensitive receiver applications. This design operates on a single 3V supply at only 60 mA and is internally matched to 50 Ohms.

KEY FEATURES

Feature	Advantages
Ultra Low Noise, 0.6 dB	Outstanding Noise Figure, measured in a 50 Ohm environment without any external matching
High IP3, 35 dBm	Combining Low Noise and High IP3 makes this MMIC amplifier ideal for Low Noise Receiver Front End (RFE) because it gives the user advantages at both ends of the dynamic range: sensitivity & two-tone spur-free dynamic range
Low Current, 60 mA	At only 60mA, the PMA-5453+ is ideal for remote applications with limited available power or densely packed applications where thermal management is critical.
Broad Band	Operating over a broadband the PMA-5453+ covers the primary wireless communications bands: Cellular, PCS, LTE, WiMAX
Internally Matched	No external matching elements required to achieve the advertised noise and output power over the full band
MCLP Package	Low Inductance, repeatable transitions, excellent thermal pad
Max Input Power, +20 dBm	Ruggedized design operates up to input powers of +20dBm without the need of an external limiter
High Reliability	Low, small signal operating current of 60 mA nominal maintains junction temperatures typically below 110°C at 85°C ground lead temperature

*Enhancement mode Pseudomorphic High Electron Mobility Transistor.

Mini-Circuits

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ELECTRICAL SPECIFICATIONS[1] AT 25°C, ZO=50Ω, (REFER TO CHARACTERIZATION CIRCUIT, FIG. 1)

Parameter	Condition (GHz)	Min.	Typ.	Max.	Units
Frequency Range		0.05		6.0	GHz
DC Voltage (V_d)			3.0		V
DC Current (I_d)[6]		40	60	71	mA
DC Current (I_{Rbias})			4.0		mA
Noise Figure	0.05 0.5 1.0 2.0 3.0 4.0 5.0 6.0		1.2 0.6 0.7 0.9 1.3 1.5 1.8 2.2	— — — 1.3 — — — —	dB
Gain	0.05 0.5 1.0 2.0 3.0 4.0 5.0 6.0	— — — 12.8 — — — —	25.8 23.0 19.3 14.3 11.1 9.0 7.2 5.7	— — — 15.6 — — — —	dB
Input Return Loss	0.05-0.5 0.5-6		10.0 7.0		dB
Output Return Loss	0.05-0.1 0.1-6		16.0 18.0		dB
Output IP3	0.05 0.5 1.0 2.0 3.0 4.0 5.0 6.0		32.1 33.1 35.0 36.8 37.4 38.8 39.0 39.0		dBm
Output Power @ 1 dB compression [2]	0.05 0.5 1.0 2.0 3.0 4.0 5.0 6.0		19.4 19.2 19.1 19.4 19.6 19.8 19.9 20.0		dBm
DC Current Variation vs. Temperature [3]			-0.033		mA/°C
Thermal Resistance			128		°C/W

MAXIMUM RATINGS[4]

Parameter	Ratings
Operating Temperature [5]	-40°C to 85°C
Storage Temperature	-55°C to 100°C
Channel Temperature	150°C
DC Voltage (Pad 6)	5V
Power Dissipation	500mW
DC Current (Pad 6)	130mA
Bias Current (Pad 7)	10mA
Input Power [7]	20dBm

(1) Measured on Mini-Circuits Characterization test board TB-502+
    See Characterization Test Circuit (Fig. 1)
(2)P1dB specified with external current limiting of 70mA; Capable of higher P1dB at higher current
    (see Fig. 2)
(3) (Current at 85°C - Current at -45°C)/130
(4) Permanent damage may occur if any of these limits are exceeded. These maximum ratings are
    not intended for continuous normal operation.
(5) Defined with reference to ground pad temperature.
(6) Specified DC current consumption is under small signal conditions. Current will increase with
    input RF Power. To maintain maximum current consumption, external DC current limiting
    circuits are required on Vd line.
(7) Maximum input power is specified based upon external Vd current limiting of 80 mA. Maximum
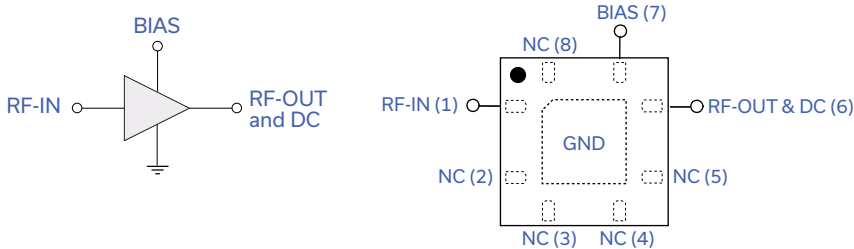   input power will degrade without external current limiting.

Monolithic Amplifier PMA-5453+

SIMPLIFIED SCHEMATIC AND PAD DESCRIPTION

BIAS

RF-IN ○——▷——○ RF-OUT and DC

BIAS (7)

NC (8)

RF-IN (1) ○   ○ RF-OUT & DC (6)

GND

NC (2)   NC (5)

NC (3)   NC (4)

Function	Pad Number	Description (See Application Circuit, Fig. 3)
RF-IN	1	RF input pad
RF-OUT & DC	6	RF output pad (connected to RF-OUT via blocking external cap C2, and Supply voltage Vs via RF Choke L1)
BIAS	7	Bias pad (connected to Vs via Rbias)
GND	paddle in center of bottom	Connected to ground
NOT USED	2,3,4,5,8	No internal connection; recommended use: per PCB Layout PL-299

CHARACTERIZATION TEST CIRCUIT

Vs (Supply voltage)

I_{Rbias} I_d

Rbias 681Ω

390nH

I_{ds}

RF-IN   1 7 6   +3V Vd   RF-OUT

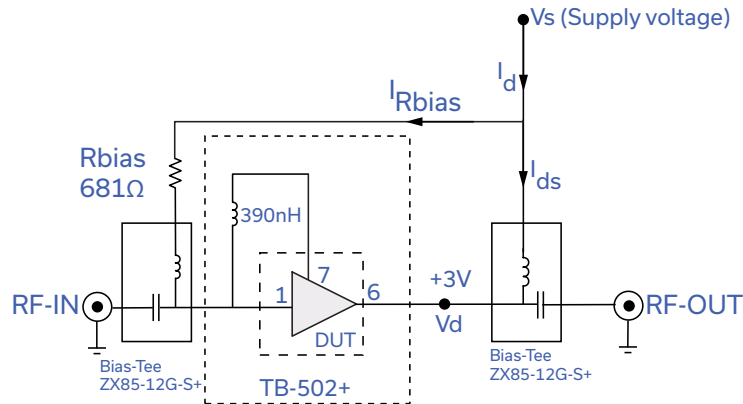DUT

Bias-Tee ZX85-12G-S+   TB-502+   Bias-Tee ZX85-12G-S+

Fig 1. Block Diagram of Test Circuit used for characterization. (DUT soldered on Mini-Circuits Characterization Test Board TB-502+) Gain, Output power at 1dB compression (P1dB), Output IP3 (OIP3) and Noise Figure measured using Agilent's N5242A PNA-X Microwave network analyzer.

Conditions:
1. Gain: Pin=-25 dBm
2. Output IP3 (OIP3): Two tones, spaced 1 MHz apart, 5 dBm/tone at output.
3. Vs adjusted for 3V at device (Vd), compensating loss of bias tee.

Output Power and Id vs. Input Power
Id Current Limited: 70mA and 80mA
Frequency=2 GHz

- P Out Cur.Lim=70mA
- P Out Cur.Lim=80mA
- Id Cur.Lim=70mA
- Id Cur.Lim=80mA

Output Power at 1dB Compression vs. Frequency
Id Current Limited: 70mA and 80mA
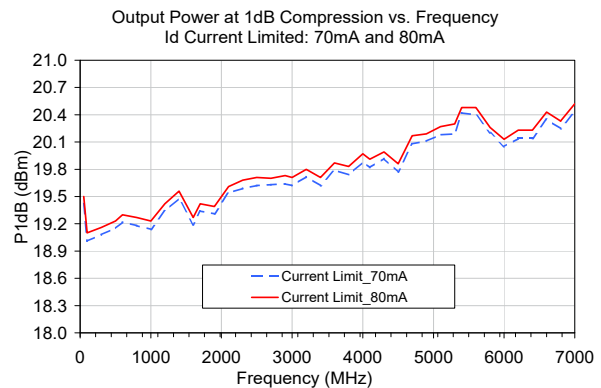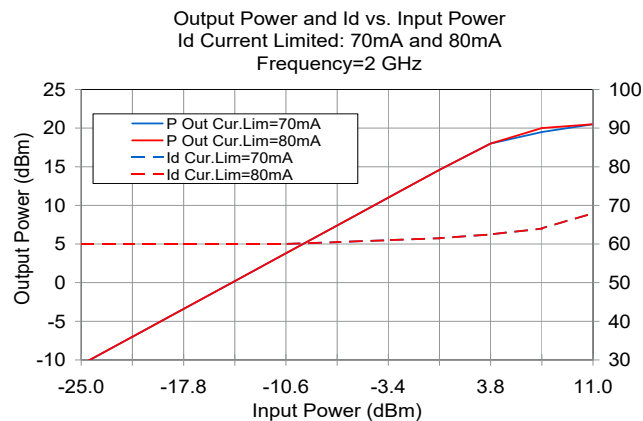
- Current Limit_70mA
- Current Limit_80mA

Fig 2. Output Power and Id vs. Input Power and Frequency.
Performance measured on Mini-Circuits Characterization test board TB-502+. See Characterization Test Circuit (Fig. 1). Measurements performed with current (Id) limited as noted.

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RECOMMENDED APPLICATION CIRCUIT
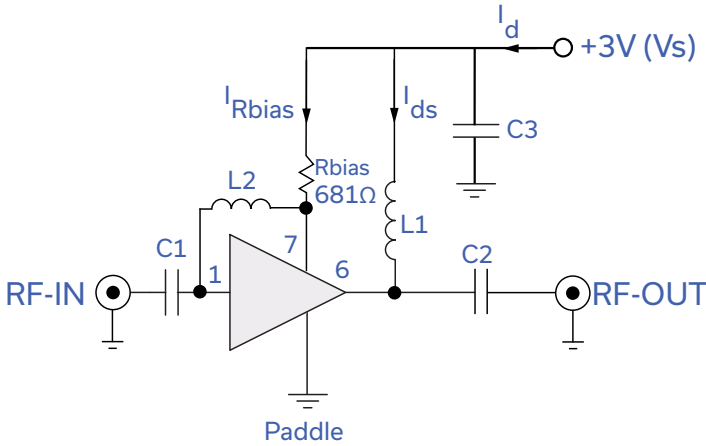(refer to evaluation board for PCB Layout and component values)

Fig 3. Recommended Application Circuit
Note: Resistance of L1, 0.1-0.2Ω typically
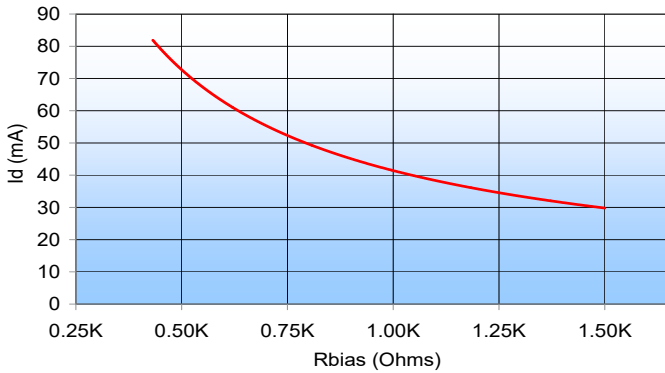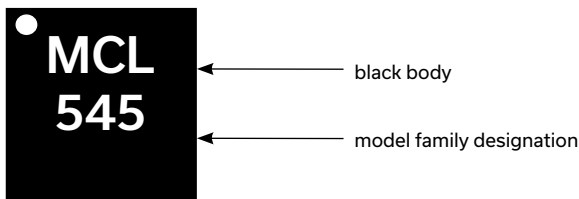

Typical Current (Id) as a function of Rbias
(Vd = 3V)

Fig 4. Id varies as a function of Rbias. The Id current range is defined based upon the specific Rbias value noted in the Application Circuit (Fig 3). Rbias may be adjusted to optimize Id for a customers' application. RF performance will vary accordingly.

PRODUCT MARKING

MCL
545

black body

model family designation

Marking may contain other features or characters for internal lot control

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ADDITIONAL DETAILED TECHNICAL INFORMATION IS AVAILABLE ON OUR DASH BOARD. TO ACCESS **CLICK HERE**

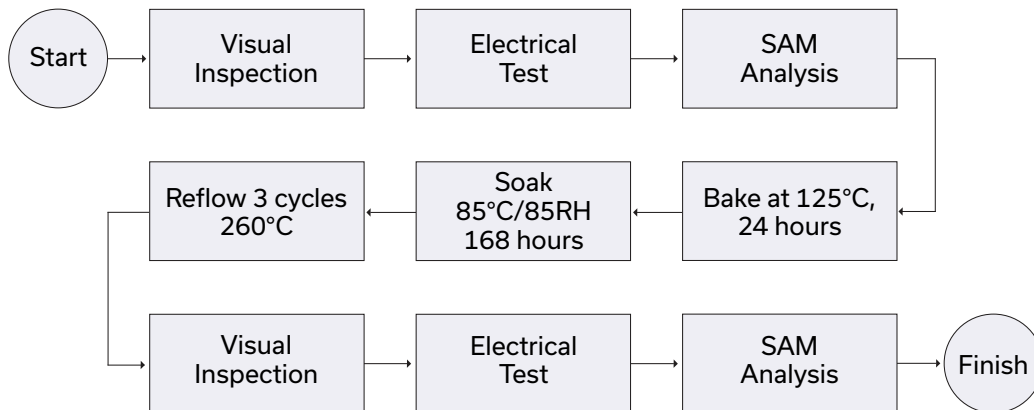|	
Performance Data	Graphs, s-parameter data set (.zip file)
Case Style	DQ849 Plastic package, exposed paddle, lead finish: tin-silver over nickel
Tape & Reel	F104
Standard quantities available on reel	7″ reels with 20, 50, 100, 200, 500, 1K or 2K devices
Suggested Layout for PCB Design	PL- 299
Evaluation Board	TB-501-3+ (50-5000 MHz)
Environmental Ratings	ENV08T1

ESD RATING
Human Body Model (HBM): Class 1A (250V to <500V) in accordance with ANSI/ESD STM 5.1 - 2001

Machine Model (MM): Class M1 (<100V) in accordance with ANSI/ESD STM5.2-1999; passes 40V

MSL RATING
Moisture Sensitivity: MSL1 in accordance with IPC/JEDEC J-STD-020D

MSL TEST FLOW CHART

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Start → Visual Inspection → Electrical Test → SAM Analysis
                                                    ↓
Reflow 3 cycles 260°C ← Soak 85°C/85RH 168 hours ← Bake at 125°C, 24 hours
        ↓
Visual Inspection → Electrical Test → SAM Analysis → Finish
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NOTES
A. Performance and quality attributes and conditions not expressly stated in this specification document are intended to be excluded and do not form a part of this specification document.
B. Electrical specifications and performance data contained in this specification document are based on Mini-Circuit's applicable established test performance criteria and measurement instructions.
C. The parts covered by this specification document are subject to Mini-Circuits standard limited warranty and terms and conditions (collectively, "Standard Terms"); Purchasers of this part are entitled to the rights and benefits contained therein. For a full statement of the standard. Terms and the exclusive rights and remedies thereunder, please visit Mini-Circuits' website at www.minicircuits.com/MCLStore/terms.jsp