

APPLICATION INFORMATION

High linearity wideband driver for mobile communication systems

BGA2031 driver

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ABSTRACT

- Description of the product
The BGA2031 is a silicon Monolithic Microwave Integrated Circuit (MMIC) 2-stage variable gain amplifier in double poly silicon technology in a 5-pin SOT551A plastic SMD package.
- Application area
The BGA2031 can be used as a driver for systems like AMPS and CDMA with low component count.
- Presented application
This application note presents a driver for both the cellular band (850 MHz) and the PCS band (1900 MHz) at a supply voltage of 3.6 V and a supply current of 54 mA typically.
- Main results
The amplifier has a gain of 27 dB typically, a $V_{SWR_{IN}} < 1:1.7$, a $V_{SWR_{OUT}} < 1:1.6$, and a 1 dB compression point at 12.5 dBm for $f = 836$ MHz.

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INTRODUCTION

The BGA2031 is a 2-stage variable gain amplifier (MMIC) that can be used as a pre-driver for power amplifiers in applications that require good linearity, like CDMA, as well as applications with low component count like AMPS and CDMA.

This application presents a driver for both the cellular band (850 MHz) and the PCS band (1.9 GHz) at 3.6 V supply voltage and 54 mA current typically.

PERFORMANCE OVERVIEW

A short description of the measured data is given in Table 1.

The measurements were taken at $V_{\text{supply}} = 3.6 \text{ V}$, $f = 836 \text{ MHz}$ and $T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$.

Table 1 Pre-driver performance summary

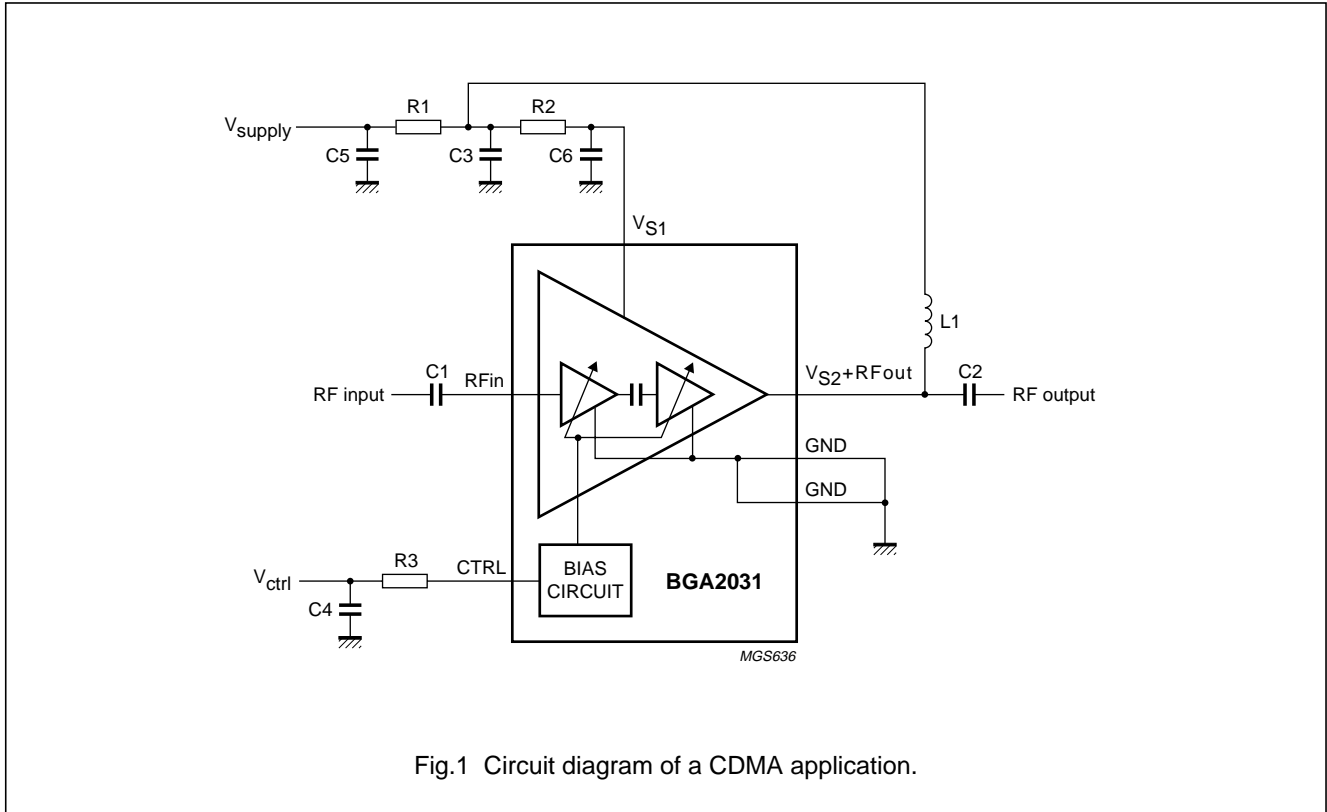
SYMBOL	PARAMETER	CONDITION	VALUE	UNIT
P_L	load power	$V_{\text{ctrl}} = 2.7 \text{ V}$; at 1 dB compression point	12.5	dBm
G_P	power gain	$V_{\text{ctrl}} = 2.7 \text{ V}$; $P_D = -30 \text{ dBm}$	27	dB
$V_{\text{SWR}_{\text{IN}}}$	input voltage standing wave ratio	$V_{\text{ctrl}} = 2.7 \text{ V}$; $P_D = -30 \text{ dBm}$	1:1.7	
$V_{\text{SWR}_{\text{OUT}}}$	output voltage standing wave ratio	$V_{\text{ctrl}} = 2.7 \text{ V}$; $P_D = -30 \text{ dBm}$	1:1.6	
$ACPR_{\pm 885\text{kHz}}$	adjacent channel power rejection	$V_{\text{ctrl}} = 2.7 \text{ V}$; $P_D = -18 \text{ dBm}$; $P_L = 8 \text{ dBm}$; $\pm 885 \text{ kHz}$ offset	-51	dBc
		$V_{\text{ctrl}} = 2.7 \text{ V}$; $P_D = -27 \text{ dBm}$; $P_L = 0 \text{ dBm}$; $\pm 885 \text{ kHz}$ offset	-68	dBc
$ACPR_{\pm 1.96\text{MHz}}$	adjacent channel power rejection	$V_{\text{ctrl}} = 2.7 \text{ V}$; $P_D = -18 \text{ dBm}$; $P_L = 8 \text{ dBm}$; $\pm 1.96 \text{ MHz}$ offset	-84	dBc
		$V_{\text{ctrl}} = 2.7 \text{ V}$; $P_D = -27 \text{ dBm}$; $P_L = 0 \text{ dBm}$; $\pm 1.96 \text{ MHz}$ offset	-85	dBc
I_{supply}	supply current	$V_{\text{ctrl}} = 2.7 \text{ V}$; $P_D = -30 \text{ dBm}$	54	mA
I_{ctrl}	control current	$V_{\text{ctrl}} = 2.7 \text{ V}$; $P_D = -30 \text{ dBm}$	835	μA

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CIRCUIT DIAGRAM

Figure 1 shows the circuit diagram of a CDMA application with the BGA2031 circuit.



COMPONENT LIST

Table 2 Component list for the BGA2031 demo board

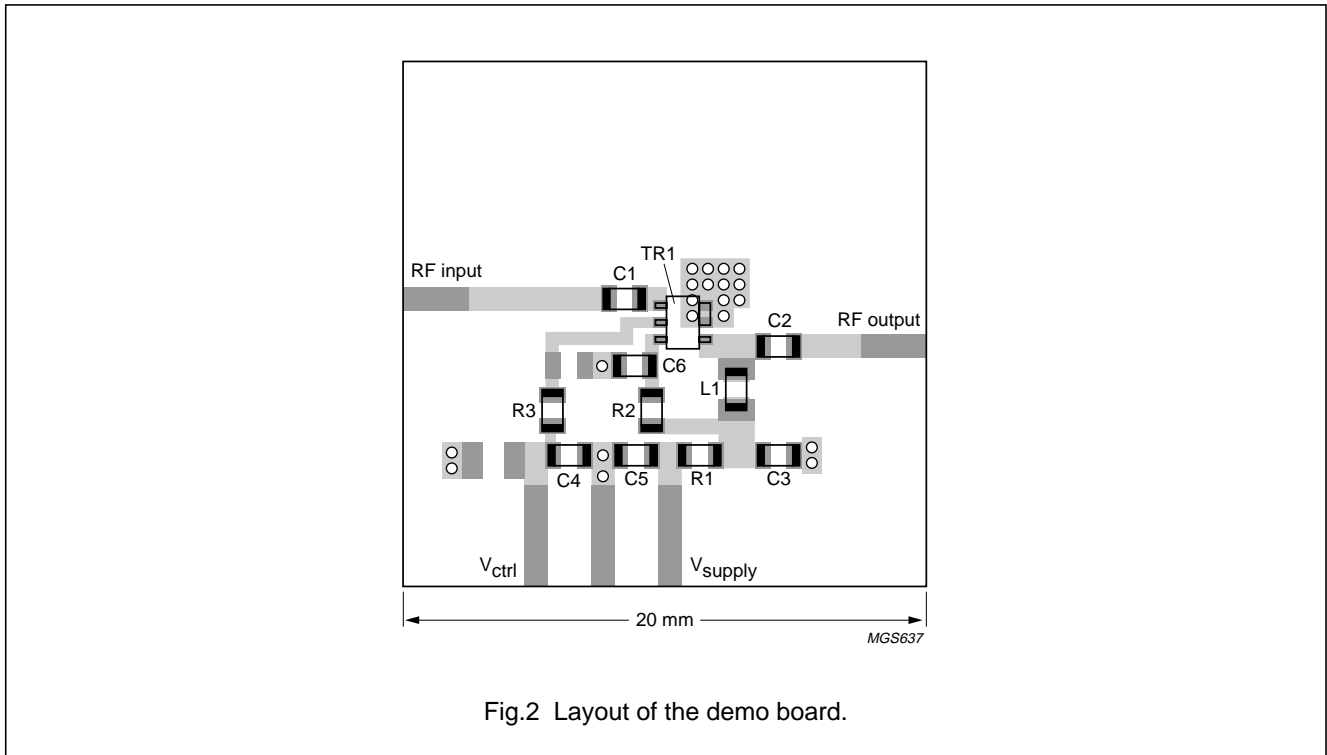
COMPONENT	VALUE	UNIT	SIZE - MANUFACTURER	PURPOSE, COMMENT
TR1	BGA2031		SOT551 Philips	variable gain amplifier
R1	2.4	Ω	0603 Philips	determines dissipation
R2	2.4	Ω	0603 Philips	LF decoupling for V_{supply}
R3	22	Ω	0603 Philips	LF decoupling for V_{ctrl}
C1	82	pF	0603 Philips	input match, DC decoupling
C2	120	pF	0603 Philips	output match, DC decoupling
C3	15	pF	0603 Philips	output match
C4	22	nF	0603 Philips	LF decoupling for V_{ctrl}
C5	22	nF	0603 Philips	LF decoupling for V_{supply}
C6	1.5	nF	0603 Philips	interstage match (broadband)
L1	27	nH	0603 TDK type MLG1608	output match, DC feed
PCB	—		FR4	$\epsilon_r \approx 4.6$; d = 0.5 mm

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BOARD LAYOUT

Figure 2 shows the layout of the demo board. The ground pin should be connected to the system ground (ground plane) with minimum inductance. This can be achieved with a number of vias close to the solder point. All other ground connections should be placed as close to the component as possible.

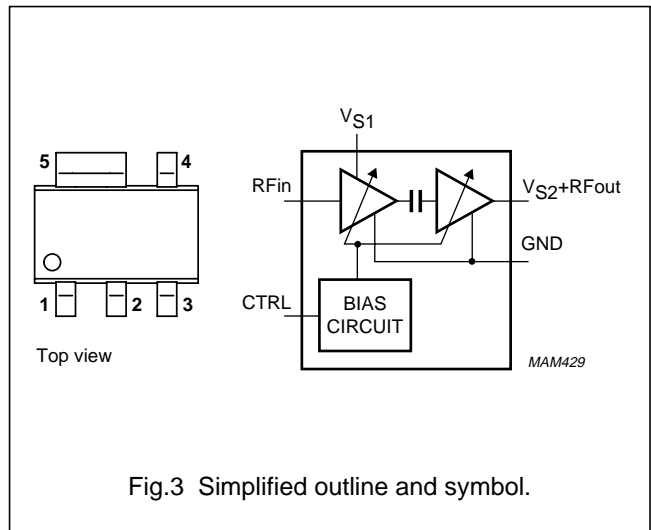


PINNING AND PACKAGE

Table 3 Pinning of the BGA2031

PIN	SYMBOL	DESCRIPTION
1	RFin	RF input 50 Ω
2	CTRL	control voltage
3	VS1	supply voltage 1
4	VS2 + RFout	supply voltage 2 + RF output 50 Ω
5	GND	ground

The BGA2031 is packed in a 5-pin SOT551A plastic SMD package.

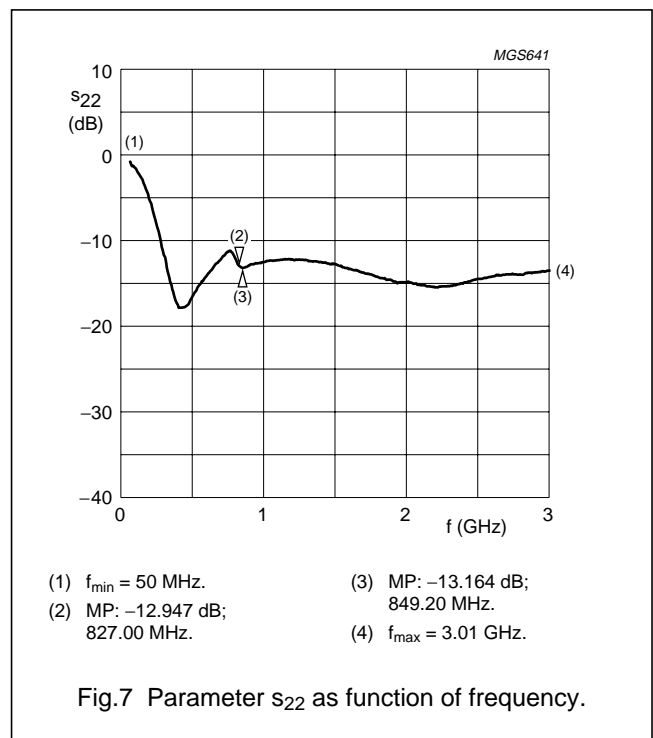
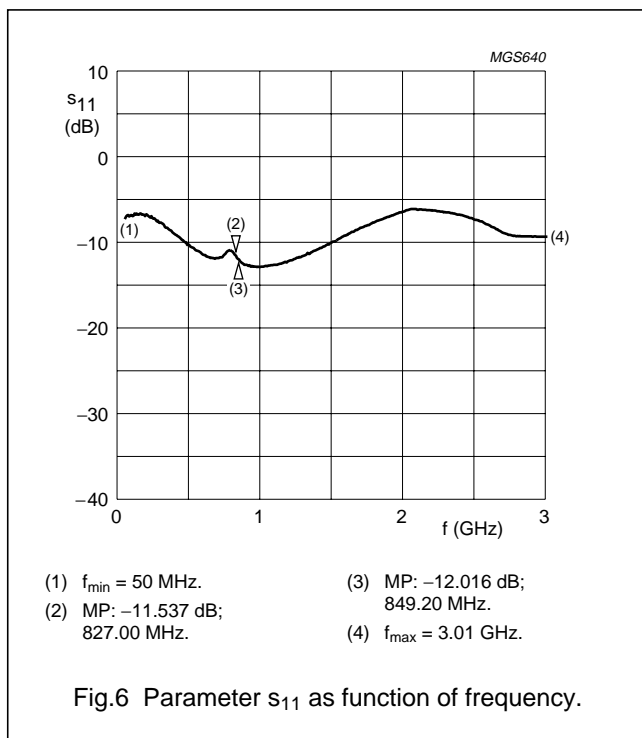
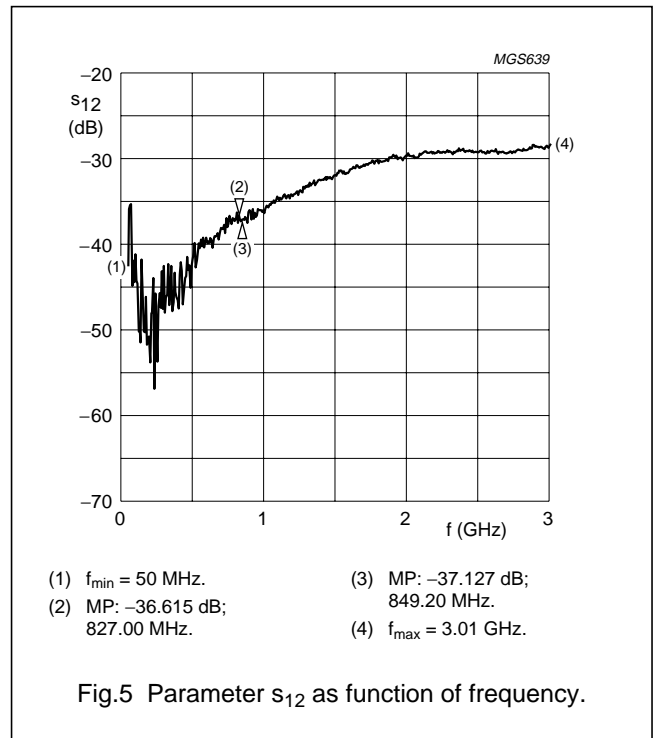
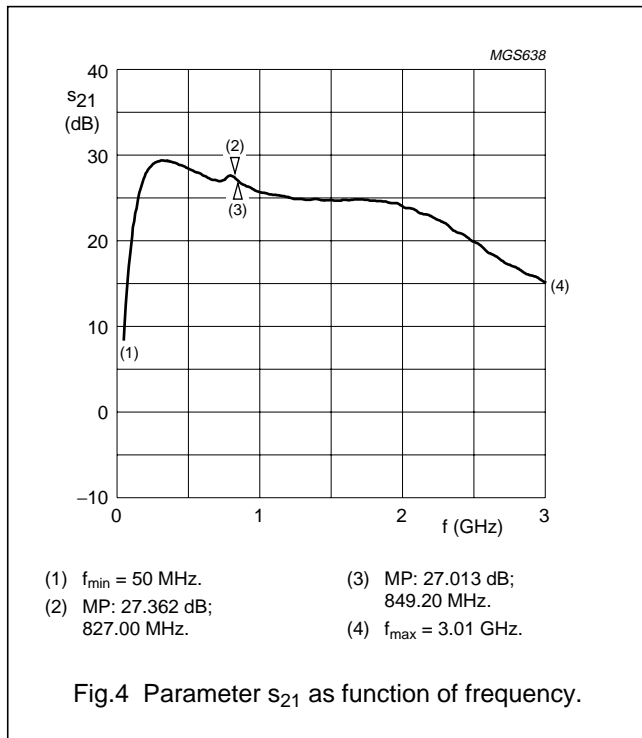


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SMALL SIGNAL s-PARAMETER MEASUREMENTS

The measuring results of the s-parameters of the CDMA application board are given in the Figs 4 to 7. The measurements were taken at $V_{supply} = 3.6\text{ V}$, $V_{ctrl} = 2.7\text{ V}$, $f = 836\text{ MHz}$ and $T_{amb} = 25\text{ }^{\circ}\text{C}$.



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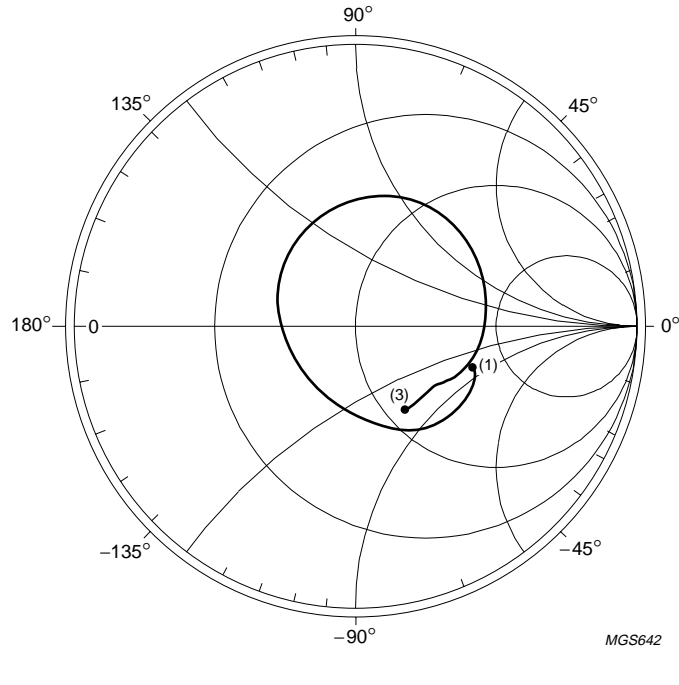


Fig.8 Input reflection coefficient s_{11} .

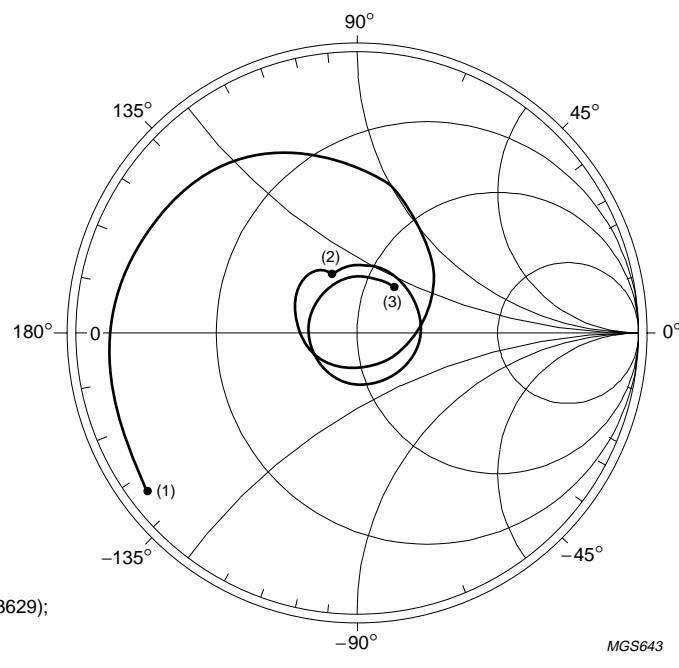


Fig.9 Output reflection coefficient s_{22} .

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LARGE SIGNAL MEASUREMENTS

The results of the large signal measurements of the CDMA application board are given in Figs 10, 11 and 12. The measurements were taken at $V_{\text{supply}} = 3.6 \text{ V}$, $f = 836 \text{ MHz}$ and $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$.

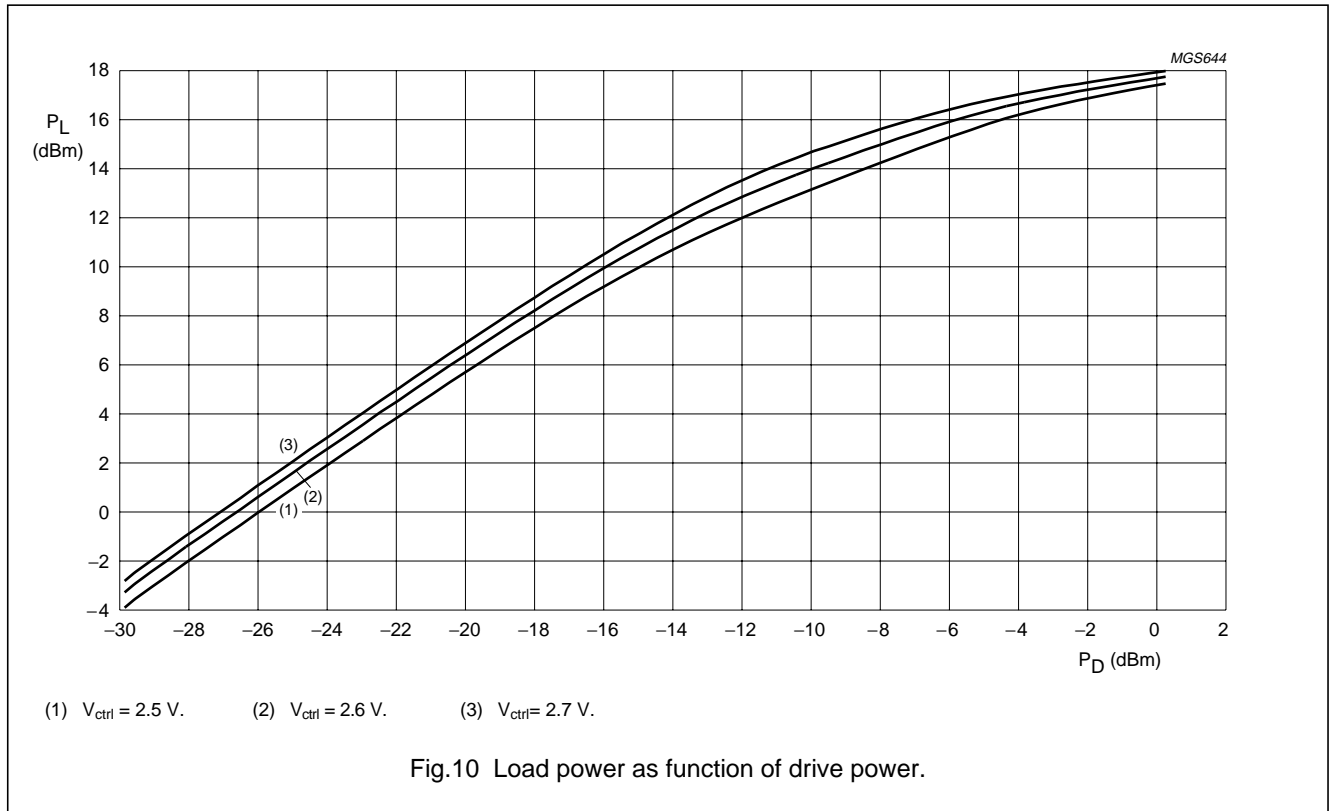
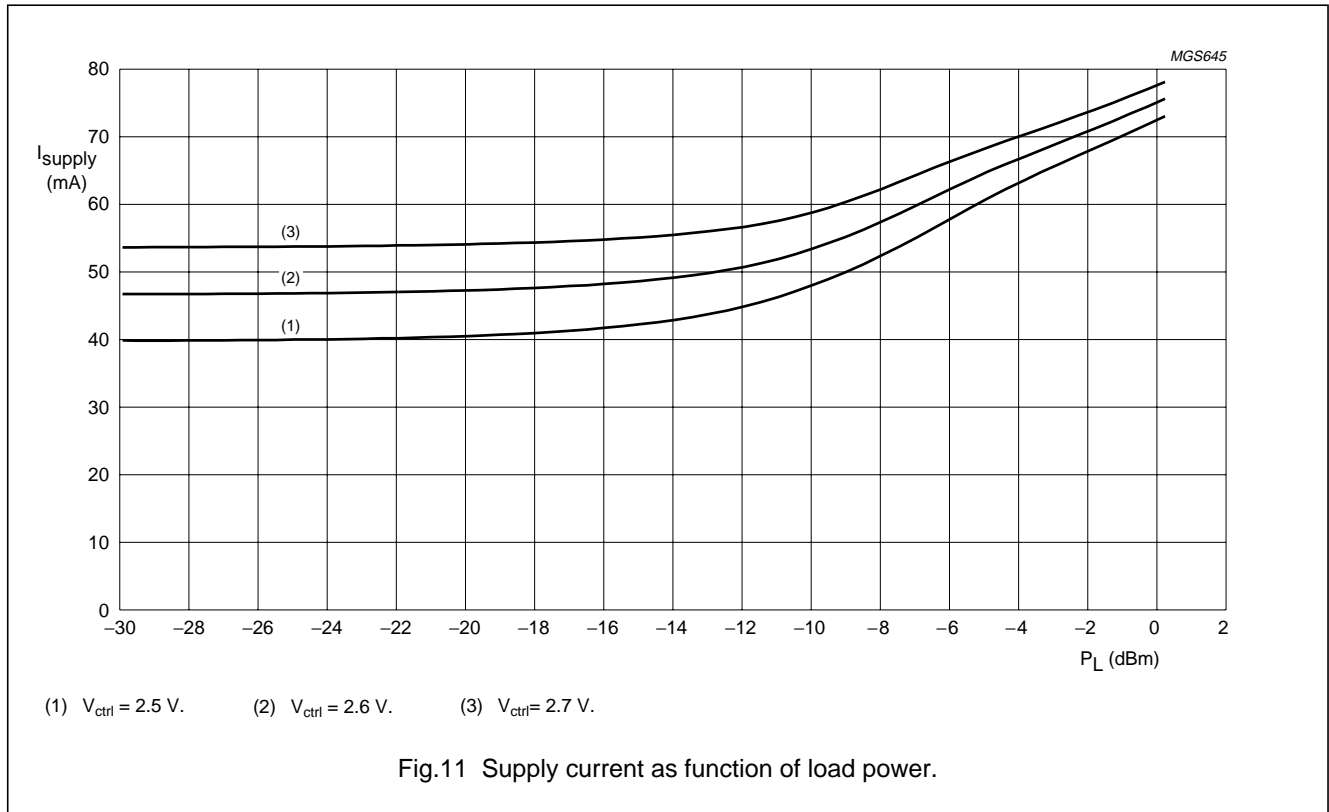


Fig.10 Load power as function of drive power.

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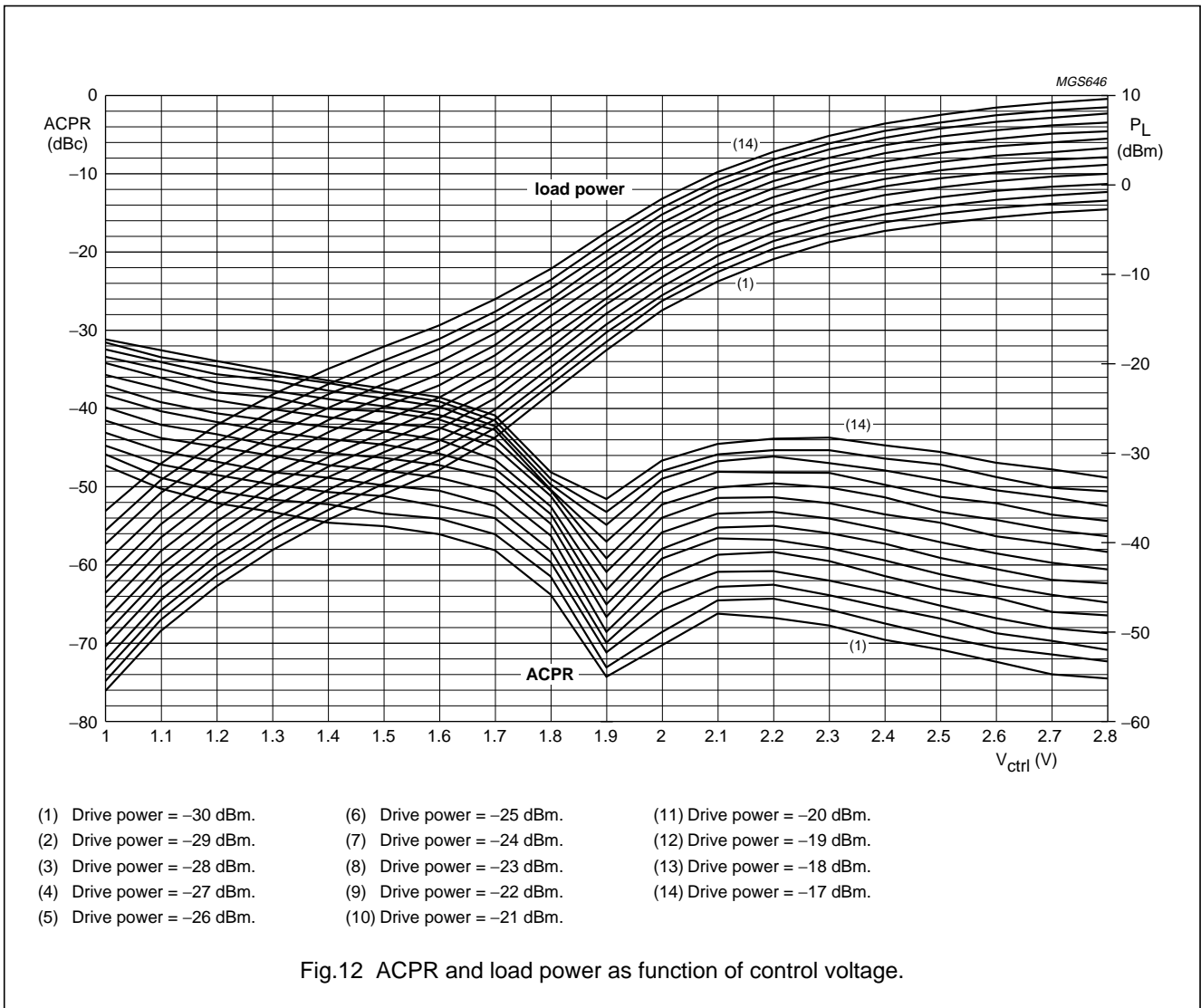


Fig.12 ACPR and load power as function of control voltage.

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