

μPD5739T7A

R09DS0002EJ0100

Rev.1.00

Jul 6, 2010

SiGe/CMOS Integrated Circuit

4 × 2 IF Switch Matrix with Gain and Tone/Voltage Controller

FEATURES

- 4 independent IF channels, integral switching to channel input to either channel output.
- 4 × 2 switch matrix with integrated IF amplifier and switch control - Tone/Voltage.
- Switch's Enable mode is linked V_{CC} external pins.
- Frequency range : $f = 950 \text{ MHz to } 2 \text{ 150 MHz}$
- High isolation : $ISL_{D/U} = 30 \text{ dB TYP. @Worst mode}$
- Power gain : $G_p = 18 \text{ dB TYP. @ } Z_S = Z_L = 50 \Omega$
- Power gain flatness : $\Delta G_p = 1.0 \text{ dB TYP.}$
- Surface mounting : 28-pin 5 × 5 mm square micro lead package (28-pin plastic QFN (0.5 mm pitch))

APPLICATIONS

- DBS IF switching
- Multiswitch, Switch box
- 4 × 2 switching application for microwave signal

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPD5739T7A-E1	μPD5739T7A-E1-A	28-pin plastic QFN (0.5 mm pitch) (Pb-Free)	D5739	<ul style="list-style-type: none"> • Embossed tape 12 mm wide • Pin 8 to 14 face the perforation side of the tape • Qty 2.5 kpcs/reel • Dry packing specification (MSL 3 Equivalent)

Remark To order evaluation samples, please contact your nearby sales office.

Part number for sample order: μPD5739T7A

CAUTION

Observe precautions when handling because these devices are sensitive to electrostatic discharge.

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C, unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Supply Voltage	V _{DD} , V _{CC1} , V _{CC2}	+4.0	V
Power Dissipation ^{Note}	P _D	1.465	W
Storage Temperature	T _{stg}	-55 to +125	°C
Operating Ambient Temperature	T _A	-40 to +85	°C
Input Power	P _{in}	+5	dBm
POLA Control Input Voltage (POLA1 and POLA2)	V _{POLA}	+25	V
TONE Signal Input Voltage	V _{TONE}	1	V _{p-p}

Note: Mounted on double-sided copper-clad 50 × 50 × 0.51 mm laminates PWB, T_A = +85°C

RECOMMENDED OPERATING RANGE (T_A = +25°C, unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage ^{Note}	V _{DD} , V _{CC1} , V _{CC2}	+3.0	+3.3	+3.6	V
Operating Ambient Temperature	T _A	-40	+25	+85	°C
POLA Control Input Voltage	V _{POLA}	0	-	21	V
TONE Signal Frequency	f _{TONE}	18	22	26	kHz
TONE Signal Input Voltage	V _{TONE}	0.4	0.6	0.8	V _{p-p}

Note: V_{CC1} = V_{CC2} = V_{DD}

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{DD} = V_{CC1} = V_{CC2} = +3.3 V, Z_S = Z_L = 50 Ω for each port, worst mode, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Total Supply Current	I _{CC}	non-RF, 2 channels active total current of I _{CC1} , I _{CC2} , and I _{DD}	33	40	50	mA
Power Gain 1	G _{p1}	P _{in} = -30 dBm, f = 0.95 GHz	15	18	21	dB
Power Gain 2	G _{p2}	P _{in} = -30 dBm, f = 2.15 GHz	14.5	17.5	20.5	dB
Isolation D/U-ratio 2 ^{Note}	ISL _{D/U} 2	P _{in} = -30 dBm, f = 2.15 GHz	25	30	-	dB
Gain 1 dB Compression Output Power 1	P _{O(1 dB)} 1	f = 0.95 GHz	5	8	-	dBm
Gain 1 dB Compression Output Power 2	P _{O(1 dB)} 2	f = 2.15 GHz	3	6	-	dBm
Output Return Loss 1	RL _{out1}	P _{in} = -30 dBm, f = 0.95 GHz	10	14	-	dB
Output Return Loss 2	RL _{out2}	P _{in} = -30 dBm, f = 2.15 GHz	10	12.5	-	dB
Noise Figure 1	NF1	f = 0.95 GHz	-	10.5	12.5	dB
Noise Figure 2	NF2	f = 2.15 GHz	-	11.5	13.5	dB
POLA Control Threshold Voltage, Channel Selection	V _{th_POLA}	OFF to ON	14	14.5	15.5	V
TONE Signal Threshold Voltage, Channel Selection	V _{th_TONE}	f _{TONE} = 22 kHz, Duty Cycle = 50%, pulse wave, OFF to ON	0.1	0.15	0.35	V _{p-p}

Note: Isolation D/U (Desire/U_n-desire) ratio = |(Signal Leakage (off-state)) - (Power Gain (on-state))| at worst mode

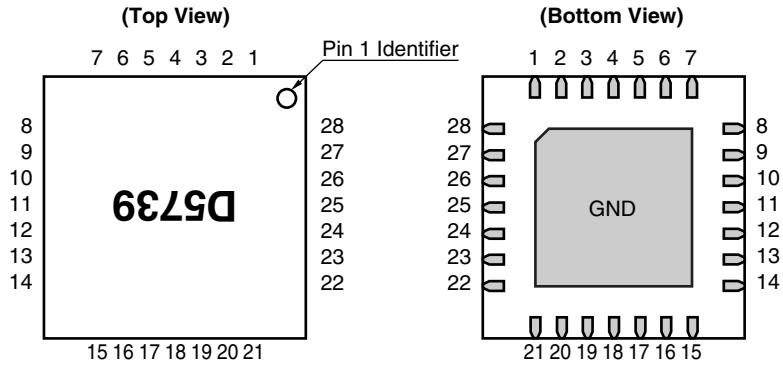
STANDARD CHARACTERISTICS FOR REFERENCE

($T_A = +25^\circ\text{C}$, $V_{DD} = V_{CC1} = V_{CC2} = +3.3\text{ V}$, $Z_S = Z_L = 50\ \Omega$ for each port, worst mode, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Supply Current of V_{CC1} , V_{CC2}	I_{CC1} , I_{CC2}		19	mA
Supply Current of V_{DD}	I_{DD}		2.0	mA
Gain Flatness	ΔG_{P1}	$P_{in} = -30\text{ dBm}$, $f = 0.95\text{ GHz to }2.15\text{ GHz}$	1.0	dB
Differential Gain Between Active Channels	ΔG_{P2}		1.0	dB
Gain Change, selected channel	ΔG_{P3}		1.0	dB
Isolation D/U Ratio 1 ^{Note}	$ISL_{D/U\ 1}$	$P_{in} = -30\text{ dBm}$, $f = 0.95\text{ GHz}$	30	dB
Input Return Loss 1	RL_{in1}	$P_{in} = -30\text{ dBm}$, $f = 0.95\text{ GHz}$	13	dB
Input Return Loss 2	RL_{in2}	$P_{in} = -30\text{ dBm}$, $f = 2.15\text{ GHz}$	10	dB
Output 3rd Order Intercept Point 1	OIP_{31}	$f1 = 950\text{ MHz}$, $f2 = 951\text{ MHz}$	19	dBm
Output 3rd Order Intercept Point 2	OIP_{32}	$f1 = 2\ 150\text{ MHz}$, $f2 = 2\ 151\text{ MHz}$	15	dBm
2nd Order Intermodulation Distortion	IM_2	$f1 = 950\text{ MHz}$, $f2 = 951\text{ MHz}$, $P_{out} = -5\text{ dBm/ tone}$	44	dBc
2nd Harmonics	$2f_0$	$f_0 = 1.0\text{ GHz}$, $P_{out} = -15\text{ dBm}$	60	dBc
K factor 1	K1	$P_{in} = -30\text{ dBm}$, $f = 0.95\text{ GHz}$	2.5	–
K factor 2	K2	$P_{in} = -30\text{ dBm}$, $f = 2.15\text{ GHz}$	2.5	–
POLA Control Current	I_{POLA}	$V_{POLA} = 21\text{ V}$	50	μA
POLA Switching Time	T_{POLA}	$V_{POLA} = 18\text{ V}$, OFF to ON	1.0	μs
TONE Switching Time	T_{TONE}	$f_{TONE} = 22\text{ kHz}$, Duty Cycle = 50%, pulse wave, $V_{TONE} = 600\text{ mV}_{p-p}$, OFF to ON	250	μs

Note: Isolation D/U (Desire/Un-desire) ratio = |(Signal Leakage (off-state)) – (Power Gain (on-state))| at worst mode

PIN CONNECTIONS



Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	V _{CC} 1	8	GND	15	IN-D	22	GND
2	OUT1	9	IN-B	16	GND	23	POLA2
3	GND	10	GND	17	GND	24	TONE2
4	GND	11	GND	18	GND	25	V _{DD}
5	GND	12	GND	19	GND	26	TONE1
6	GND	13	IN-C	20	OUT2	27	POLA1
7	IN-A	14	GND	21	V _{CC} 2	28	GND

Remark Heat Sink (Bottom side) : GND

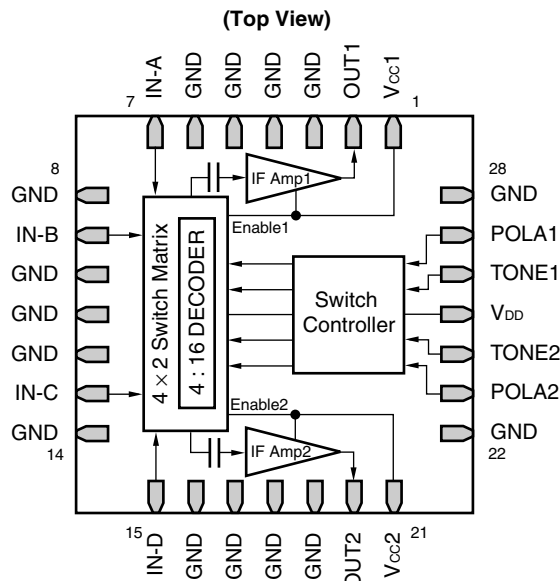
TRUTH TABLE OF SWITCHING BY CONDITION OF CONTROL VOLTAGE

State		Output to Input State		Control Pins						
No.	Mode	OUT1	OUT2	TONE1	POLA1	TONE2	POLA2	V _{cc1} (Enable1)	V _{cc2} (Enable2)	
1	Both OUTs Enabled	AA	IN-A	IN-A	22 kHz	Low	22 kHz	Low	3.3 V	3.3 V
2		AB		IN-B	22 kHz	Low	0	Low	3.3 V	3.3 V
3		AC		IN-C	22 kHz	Low	0	High	3.3 V	3.3 V
4		AD		IN-D	22 kHz	Low	22 kHz	High	3.3 V	3.3 V
5		BA	IN-B	IN-A	0	Low	22 kHz	Low	3.3 V	3.3 V
6		BB		IN-B	0	Low	0	Low	3.3 V	3.3 V
7		BC		IN-C	0	Low	0	High	3.3 V	3.3 V
8		BD		IN-D	0	Low	22 kHz	High	3.3 V	3.3 V
9		CA	IN-C	IN-A	0	High	22 kHz	Low	3.3 V	3.3 V
10		CB		IN-B	0	High	0	Low	3.3 V	3.3 V
11		CC		IN-C	0	High	0	High	3.3 V	3.3 V
12		CD		IN-D	0	High	22 kHz	High	3.3 V	3.3 V
13		DA	IN-D	IN-A	22 kHz	High	22 kHz	Low	3.3 V	3.3 V
14		DB		IN-B	22 kHz	High	0	Low	3.3 V	3.3 V
15		DC		IN-C	22 kHz	High	0	High	3.3 V	3.3 V
16		DD		IN-D	22 kHz	High	22 kHz	High	3.3 V	3.3 V
17	OUT1 Disabled	NA	None	IN-A	Any ^{Note}	Any ^{Note}	22 kHz	Low	0	3.3 V
18		NB		IN-B	Any ^{Note}	Any ^{Note}	0	Low	0	3.3 V
19		NC		IN-C	Any ^{Note}	Any ^{Note}	0	High	0	3.3 V
20		ND		IN-D	Any ^{Note}	Any ^{Note}	22 kHz	High	0	3.3 V
21	OUT2 Disabled	AN	IN-A	None	22 kHz	Low	Any ^{Note}	Any ^{Note}	3.3 V	0
22		BN	IN-B		0	Low	Any ^{Note}	Any ^{Note}	3.3 V	0
23		CN	IN-C		0	High	Any ^{Note}	Any ^{Note}	3.3 V	0
24		DN	IN-D		22 kHz	High	Any ^{Note}	Any ^{Note}	3.3 V	0
25	Both OUTs Disabled	None	None	Any ^{Note}	Any ^{Note}	Any ^{Note}	Any ^{Note}	0	0	

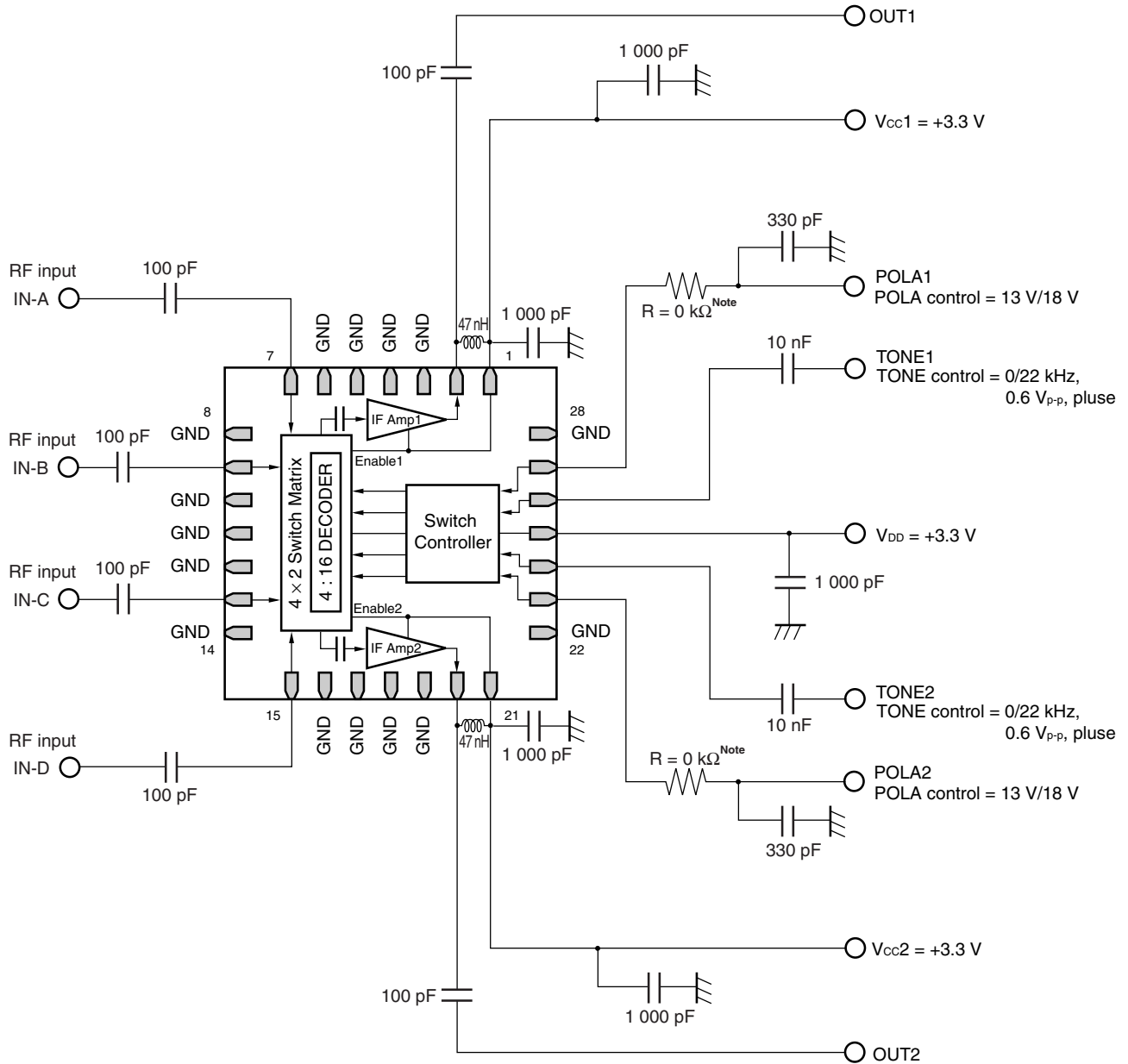
Note: Any means High or Low, 22 kHz or 0.

Remark Low : under +14 Vdc, High : +15.5 to +19.0 Vdc, V_{DD} = +3.3 Vdc

FUNCTIONAL DIAGRAM



EVALUATION CIRCUIT



Note: R = 0 kΩ (at POLA control = 13 V/18 V)
= 5.6 kΩ (at POLA control = 14 V/18 V)

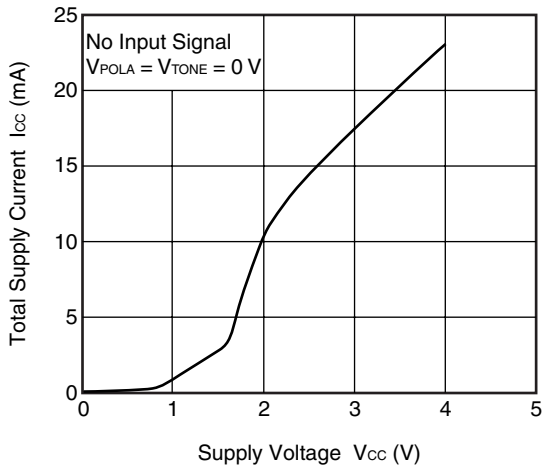
Remark Low : under +14 Vdc, High : +15.5 to +19.0 Vdc, V_{DD} = +3.3 Vdc

The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

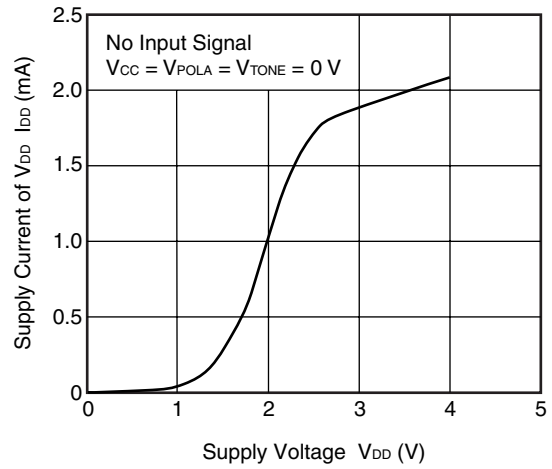
TYPICAL CHARACTERISTICS

($T_A = +25^\circ\text{C}$, $V_{DD} = V_{CC1} = V_{CC2} = +3.3\text{ V}$, $Z_S = Z_L = 50\ \Omega$ for each port, worst mode, unless otherwise specified)

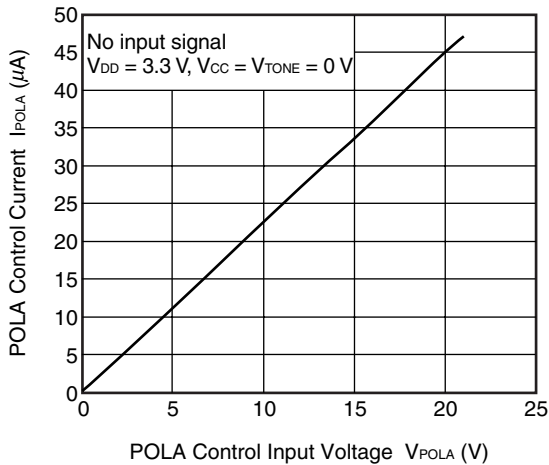
TOTAL SUPPLY CURRENT vs. SUPPLY VOLTAGE (IF-Amplifier part)



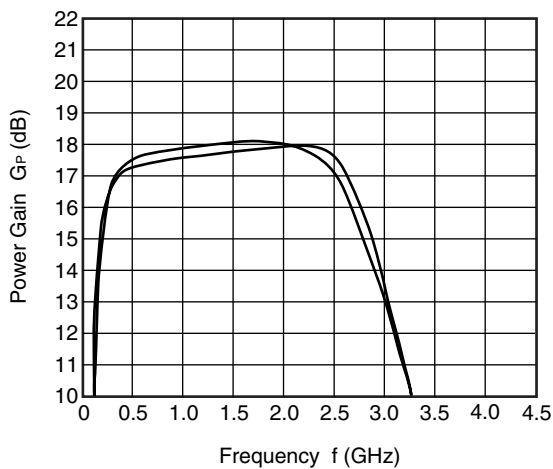
SUPPLY CURRENT OF V_{DD} vs. SUPPLY VOLTAGE (Control part)



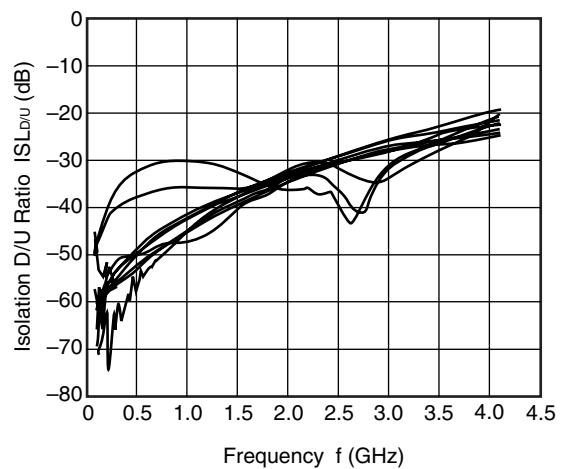
POLA CONTROL CURRENT vs. POLA CONTROL INPUT VOLTAGE (Control part)



POWER GAIN vs. FREQUENCY

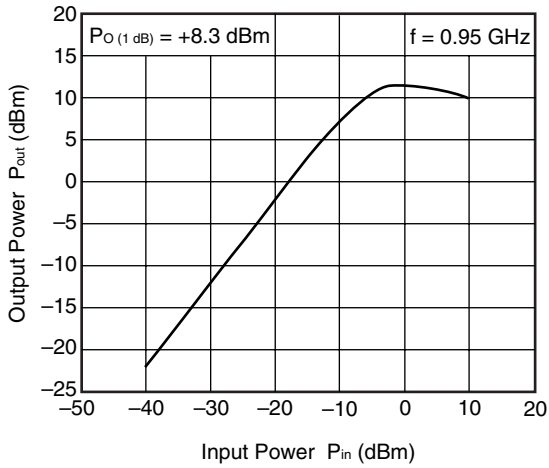


ISOLATION D/U RATIO vs. FREQUENCY

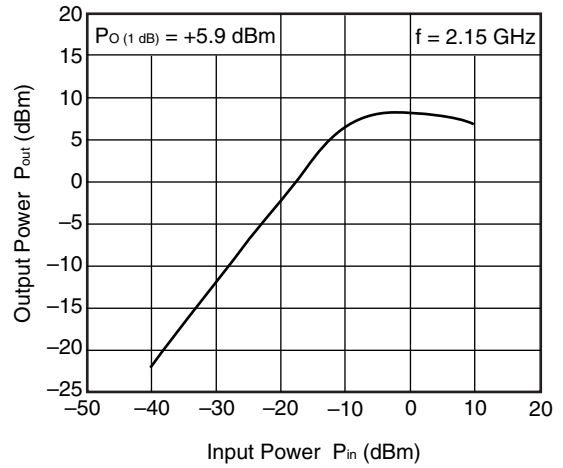


Remark The graphs indicate nominal characteristics.

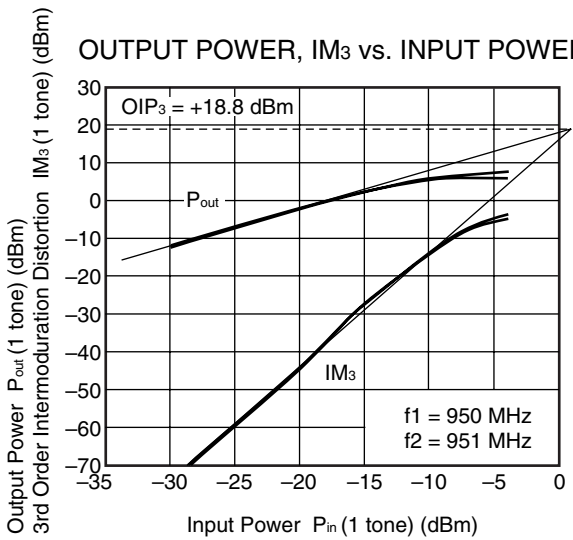
OUTPUT POWER vs. INPUT POWER



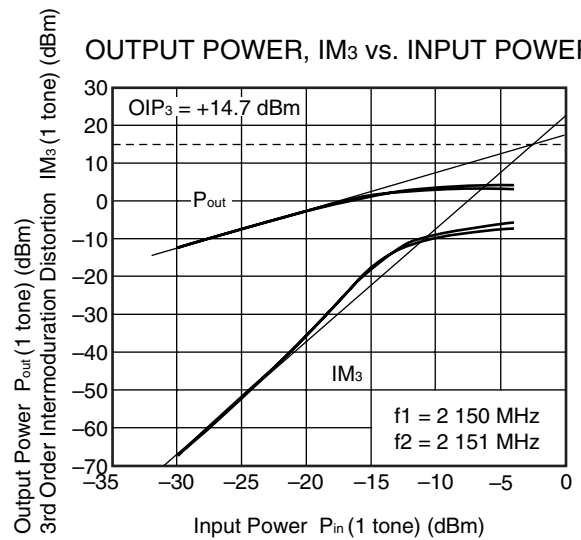
OUTPUT POWER vs. INPUT POWER



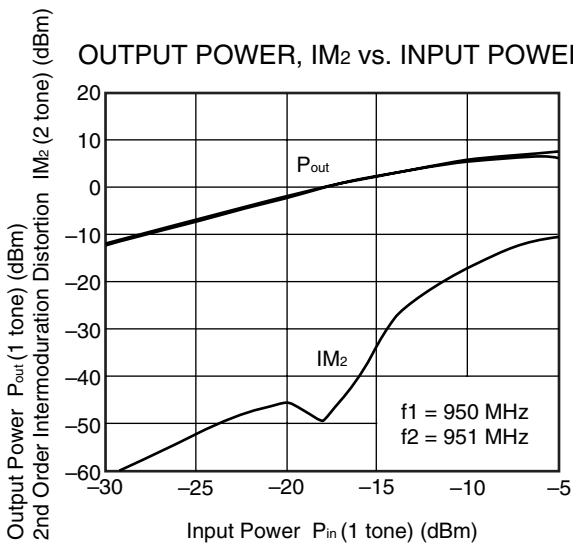
OUTPUT POWER, IM₃ vs. INPUT POWER



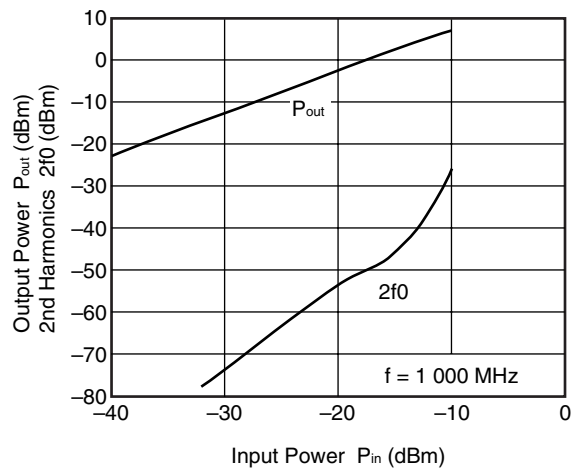
OUTPUT POWER, IM₃ vs. INPUT POWER



OUTPUT POWER, IM₂ vs. INPUT POWER

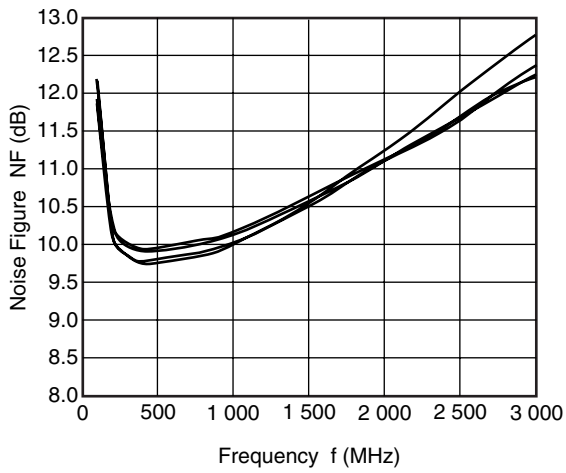


OUTPUT POWER, 2f₀ vs. INPUT POWER

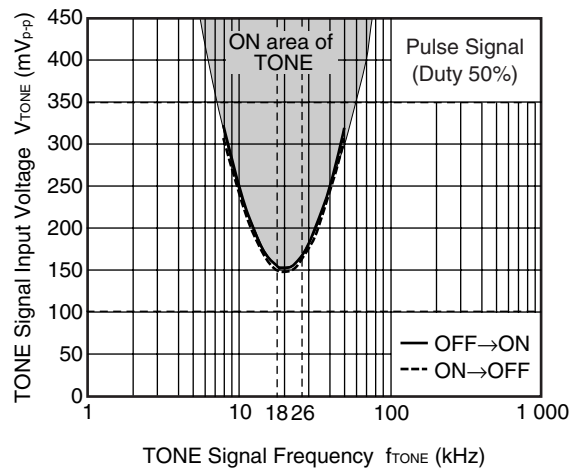


Remark The graphs indicate nominal characteristics.

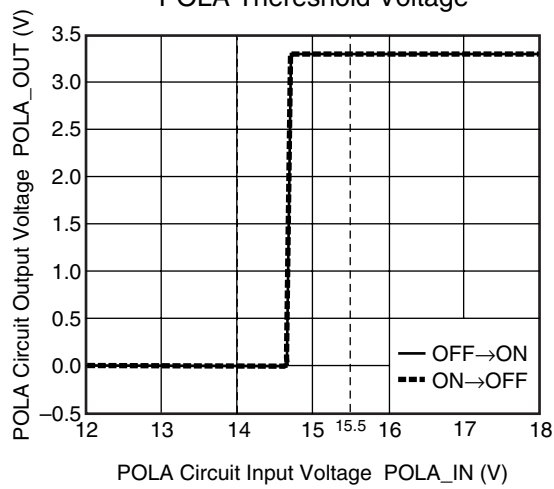
NOISE FIGURE vs. FREQUENCY



ON AREA OF TONE



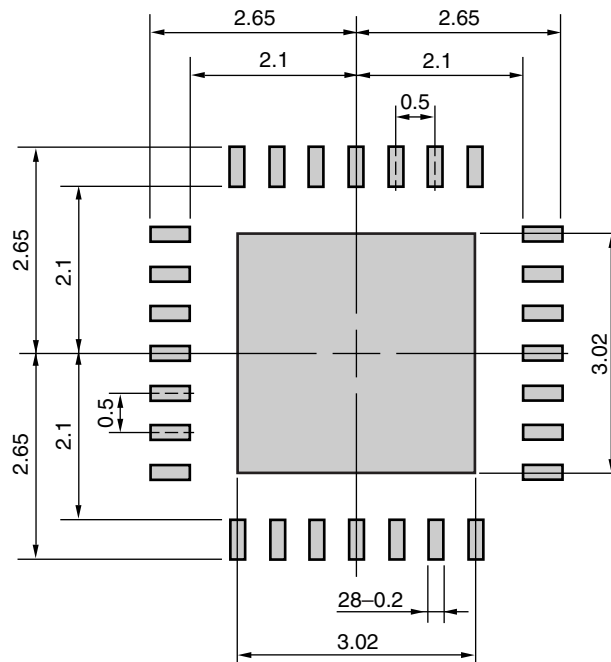
POLA Thershold Voltage



Remark The graphs indicate nominal characteristics.

MOUNTING PAD LAYOUT DIMENSIONS

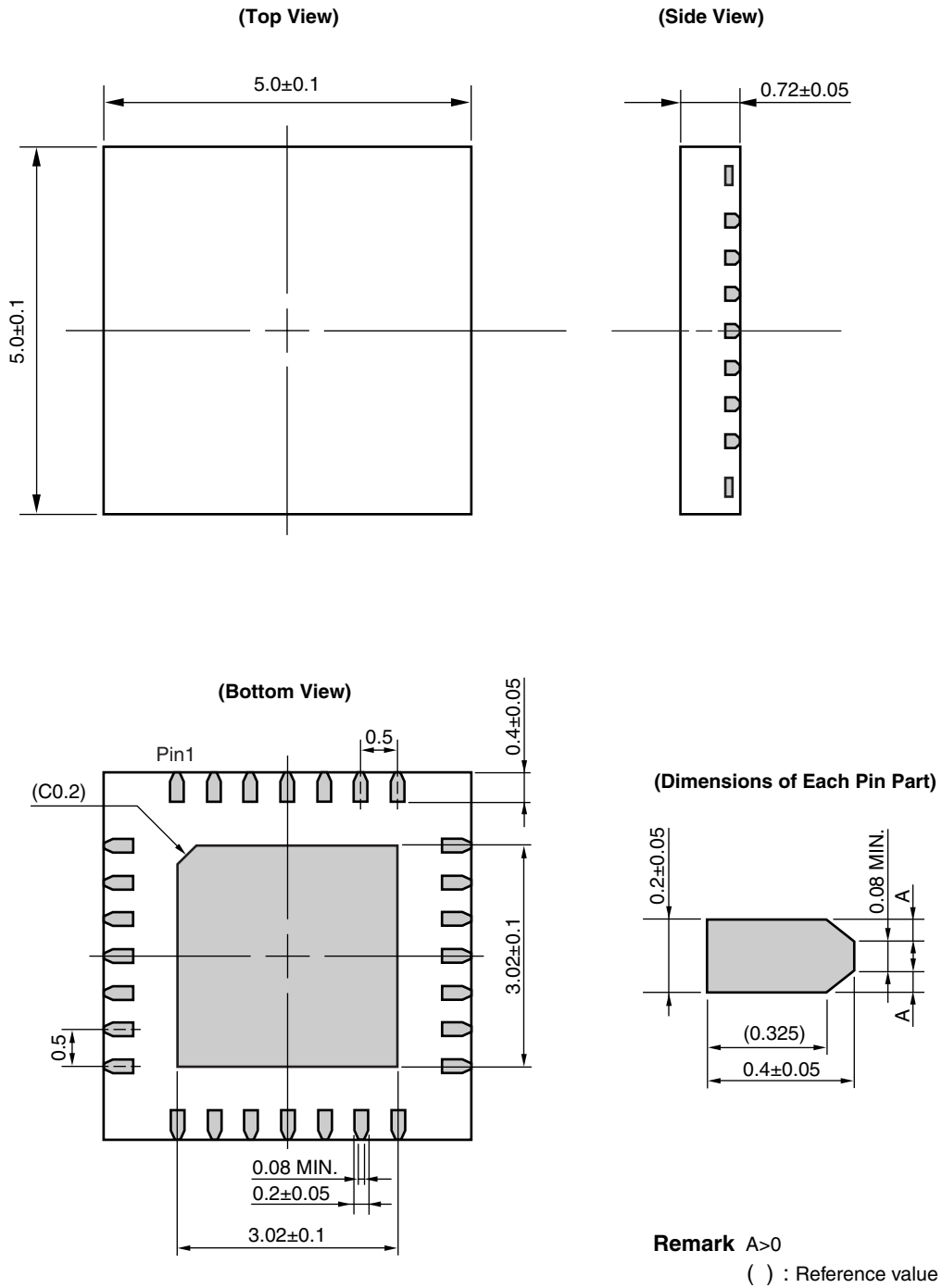
28-PIN 5 × 5 mm SQUARE MICRO LEAD PACKAGE (28-PIN PLASTIC QFN (0.5 mm pitch))
(UNIT: mm)



Remark The mounting pad layout in this document is for reference only.

PACKAGE DIMENSIONS

28-PIN 5 × 5 mm SQUARE MICRO LEAD PACKAGE (28-PIN PLASTIC QFN (0.5 mm pitch))
(UNIT: mm)



RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

Soldering Method	Soldering Conditions	Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature) : 260°C or below Time at peak temperature : 10 seconds or less Time at temperature of 220°C or higher : 60 seconds or less Preheating time at 120 to 180°C : 120±30 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	IR260
Partial Heating	Peak temperature (terminal temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	HS350

CAUTION

Do not use different soldering methods together (except for partial heating).

Revision History	μPD5739T7A Data Sheet
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Rev.	Date	Description	
		Page	Summary
1.00	Jul 6, 2010	–	First edition issued

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