



Burr-Brown Products  
from Texas Instruments



**BUF07703**  
**BUF06703**  
**BUF05703**

SBOS269A – MARCH 2003 – REVISED JUNE 2003

## MULTI-CHANNEL LCD GAMMA CORRECTION BUFFER

### FEATURES

- Gamma Correction Channels: 6, 4
- Integrated  $V_{COM}$  Buffer
- Excellent Output Current Drive:
  - Gamma Channels: > 10mA
  - $V_{COM}$ : > 100mA typ
- Large Capacitive Load Drive Capability
- Rail-to-Rail Output
- PowerPAD Package: BUF07703
- Low-Power/Channel: < 250 $\mu$ A
- Wide Supply Range: 4.5V to 16V
- Specified for 0°C to 85°C
- High ESD Rating: 4kV HBM, 1.5kV CDM

### APPLICATIONS

- LCD Flat Panel Displays
- LCD Television Displays

MODEL	GAMMA CHANNELS	VCOM CHANNELS
BUF07703	6	1
BUF06703	6	0
BUF05703	4	1

### RELATED PRODUCTS

MODEL	GAMMA CHANNELS	VCOM CHANNELS
BUF11702	10	1
BUF04701	4	—
TLV2374	4	—

### DESCRIPTION

The BUFxx703 are a series of multi-channel buffers targeted towards gamma correction in high-resolution liquid crystal display (LCD) panels. The number of gamma correction channels required depends on a variety of factors and differs greatly from design to design. Therefore, various channel options are offered. For additional space and cost savings, a  $V_{COM}$  channel with higher current drive capability is integrated in the BUF07703 and BUF05703.

A flow through pin out has been adopted to allow simple PCB routing and maintain the cost effectiveness of this solution. All inputs and outputs of the BUFxx703 incorporate internal ESD protection circuits that prevent functional failures at voltages up to 4kV HBM and 1.5kV CDM.

The various buffers within the BUFxx703 are carefully matched to the voltage I/O requirements for the gamma correction application. Each buffer is capable of driving heavy capacitive loads and offers fast load current switching. The  $V_{COM}$  channel has increased output drive of > 100mA and can handle even larger capacitive loads.

The BUF07703 is available in the HTSSOP PowerPAD™ package for dramatically increased power dissipation capability. The BUF06703 and BUF05703 are available in standard TSSOP-16 and TSSOP-14 packages.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

**ABSOLUTE MAXIMUM RATINGS**

over operating free-air temperature range unless otherwise noted<sup>(1)</sup>

PARAMETERS	BUFXX703	UNIT
Supply, $V_{DD}$ <sup>(2)</sup>	16.5	V
Input Voltage Range, $V_I$	$V_{DD}$	V
Continuous Total Power Dissipation	See Dissipation Rating Table	
Operating Free-Air Temperature Range, $T_A$	0 to +85	°C
Maximum Junction Temperature, $T_J$	150	°C
Storage Temperature Range, $T_{STG}$	-65 to 150	°C
Lead Temperature 1.6mm (1/16 inch) from Case for 10s	260	°C

(1) Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltage values are with respect to GND.

**ORDERING INFORMATION**

PRODUCT	PACKAGE-LEAD	PACKAGE DESIGNATOR <sup>(1)</sup>	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	TRANSPORT MEDIA, QUANTITY
BUF07703	HTSSOP-20	PWP	0°C to +85°C	BUF07703PWP	Tube, 70
				BUF07703PWR	Reels, 2000
BUF06703	TSSOP-16	PW	0°C to +85°C	BUF06703PW	Tube, 90
				BUF06703PWR	Reels, 2000
BUF05703	TSSOP-14	PW	0°C to +85°C	BUF05703PW	Tube, 90
				BUF05703PWR	Reels, 2000

(1) For the most current specification and package information, refer to our web site at

**DISSIPATION RATING TABLE**

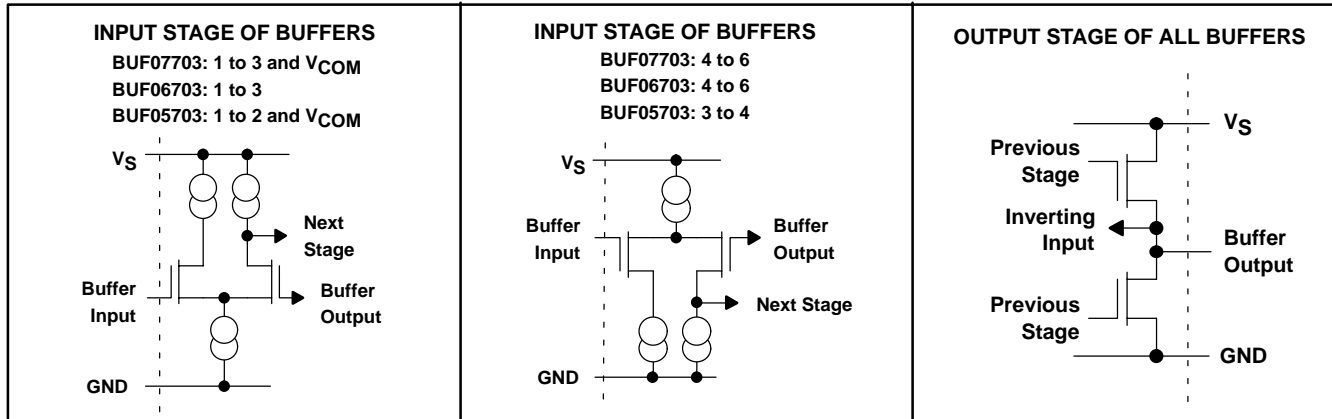
PACKAGE TYPE	PACKAGE DESIGNATOR	$\theta_{JC}$ (C/W)	$\theta_{JA}$ (C/W)	$T_A \leq 25^\circ\text{C}$ POWER RATING
TSSOP-20 PowerPAD	PWP (20)	1.40 <sup>(1)</sup>	32.63 <sup>(1)</sup>	3.83W <sup>(1)</sup>
TSSOP-16	PW (16)	—	108	1.15W
TSSOP-14	PW (14)	—	112	1.11W

(1) Thermal specifications assume 2oz trace and copper pad with solder.

**RECOMMENDED OPERATING CONDITIONS**

		MIN	NOM	MAX	UNIT
Supply Voltage, $V_{DD}$		4.5		16	V
Operating Free-Air Temperature, $T_A$		0		+85	°C
Junction Temperature	TSSOP-20 PowerPAD			+125	°C
	TSSOP-16, 14			+150	°C

EQUIVALENT SCHEMATICS OF INPUTS AND OUTPUTS



ELECTRICAL CHARACTERISTICS

over operating free-air temperature range,  $V_{DD} = 4.5V$  to  $16V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

PARAMETER		TEST CONDITIONS	$T_A^\dagger$	MIN	TYP	MAX	UNIT
$V_{IO}$	Input offset voltage	$V_I = V_{DD}/2$ , $R_S = 50 \Omega$	25°C		1.5	12	mV
			Full Range(1)			15	
$I_{IB}$	Input bias current	$V_I = V_{DD}/2$	25°C		1		pA
			Full Range(1)		200		
kSVR	Supply voltage rejection ratio ( $\Delta V_{DD}/\Delta V_{IO}$ )	$V_{DD} = 4.5V$ to $16V$	25°C	62	80		dB
			Full Range(1)	60			
Buffer gain		$V_I = 5V$	25°C	0.9995			V/V
BW_3dB	3dB Bandwidth	Gamma Buffers $V_{COM}$ Buffer	$C_L = 100pF$ , $R_L = 2k\Omega$	25°C	0.8	0.7	MHz
SR	Slew Rate	Gamma Buffers $V_{COM}$ Buffer	$C_L = 100pF$ , $R_L = 2k\Omega$ $V_{IN} = 2V$ to $8V$	25°C	1	0.7	V/ $\mu s$
	Transient Load Regulation		$I_O = 0$ to $\pm 5mA$ , $V_O = 5V$ $C_L = 100pF$ , $t_T = 0.1\mu s$	25°C	900		mV
	Transient Load Response		See Figure 2	25°C	160		mV
$t_S$ (I-sink)	Settling Time–Current		$I_O = 0$ to $-5mA$ , $V_O = 5V$ $C_L = 100pF$ , $R_L = 2k\Omega$	Full Range(1)	1		$\mu s$
$t_S$ (I-src)	Settling Time–Current		$I_O = 0$ to $+5mA$ , $V_O = 5V$ $C_L = 100pF$ , $R_L = 2k\Omega$	Full Range(1)	2		$\mu s$
$t_S$	Settling Time–Voltage	Gamma Buffers	$V_I = 4.5V$ to $5.5V$ 0.1% $V_I = 5.5V$ to $4.5V$ 0.1%	25°C	6	4.6	$\mu s$
		$V_{COM}$ Buffer	$V_I = 4.5V$ to $5.5V$ 0.1% $V_I = 5.5V$ to $4.5V$ 0.1%		5.8	5.6	$\mu s$
$V_n$	Noise Voltage	Gamma Buffers $V_{COM}$ Buffer	$V_I = 5V$ , $f = 1kHz$	25°C	45	40	$nv/\sqrt{Hz}$
	Crosstalk		$V_{IP-P} = 6V$ , $f = 1kHz$	25°C	85		dB

(1) Full Range is  $0^\circ C$  to  $+85^\circ C$ .

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**ELECTRICAL CHARACTERISTICS: BUF07703**

over operating free-air temperature range,  $V_{DD} = 4.5V$  to  $16V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

PARAMETER		TEST CONDITIONS	$T_A^{(1)}$	MIN	TYP	MAX	UNIT
$I_{DD}$	Supply Current	ALL	$V_O = V_{DD}/2$ , $V_I = V_{DD}/2$ $V_{DD} = 10V$	25°C	1.7	2	mA
				Full Range			3
Common Mode Input Range	Buffers 1–3		25°C	1		$V_{DD}$	V
	Buffers 4–6			0		$V_{DD}-1$	
	$V_{COM}$ Buffer			1		$V_{DD}$	
Load regulation	$V_{COM}$ buffer sinking	$V_{DD} = 10V$ , $I_O = 1mA$ to $30mA$	25°C	1		1.2	mV/mA
			Full Range			2.5	
	$V_{COM}$ buffer sourcing	$V_{DD} = 10V$ , $I_O = -1mA$ to $-30mA$	25°C	1		1.2	
			Full Range			2.5	
	Buffers 1–6 sinking	$V_{DD} = 10V$ , $I_O = 1mA$ to $10mA$	25°C	0.85		1	
			Full Range			1.5	
Buffers 1–6 sourcing	$V_{DD} = 10V$ , $I_O = -1mA$ to $-10mA$	25°C	0.85		1		
		Full Range			1.5		
$V_{OSH1}$	High-level saturated output voltage	Buffer 1	$V_{DD} = 16V$ , $V_I = 16V$ , $I_O = -5mA$	25°C	15.85	15.9	V
				Full range	15.8		
$V_{OSL6}$	Low-level saturated output voltage	Buffer 6	$V_{DD} = 16V$ , $V_I = 0V$ , $I_O = 5mA$	25°C	0.1	0.15	V
				Full range			
$V_{OH1}$	High-level output voltage	Buffer 1	$V_{DD} = 10V$ , $V_I = 9.8V$ , $I_O = -10mA$	25°C	9.75	9.8	V
				Full range	9.7		
$V_{OH2/3}$		Buffer 2/3	$V_{DD} = 10V$ , $V_I = 9.5V$ , $I_O = -10mA$	25°C	9.45	9.5	V
				Full range	9.4		
$V_{OH4/5}$		Buffer 4/5	$V_{DD} = 10V$ , $V_I = 8V$ , $I_O = -10mA$	25°C	7.95	8	V
				Full range	7.9		
$V_{OH6}$		Buffer 6	$V_{DD} = 10V$ , $V_I = 8V$ , $I_O = -10mA$	25°C	7.95	8	V
				Full range	7.9		
$V_{OHCOM}$		$V_{COM}$ Buffer	$V_{DD} = 10V$ , $V_I = 8V$ , $I_O = -30mA$	25°C	7.95	8	V
				Full range	7.9		
$V_{OL1}$	Low-level output voltage	Buffer 1	$V_{DD} = 10V$ , $V_I = 2V$ , $I_O = 10mA$	25°C	2	2.05	V
				Full range			
$V_{OL2/3}$		Buffer 2/3	$V_{DD} = 10V$ , $V_I = 2V$ , $I_O = 10mA$	25°C	2	2.05	V
				Full range			
$V_{OL4/5}$		Buffer 4/5	$V_{DD} = 10V$ , $V_I = 0.5V$ , $I_O = 10mA$	25°C	0.5	0.55	V
				Full range			
$V_{OL6}$		Buffer 6	$V_{DD} = 10V$ , $V_I = 0.2V$ , $I_O = 10mA$	25°C	0.2	0.25	V
				Full range			
$V_{OLCOM}$		$V_{COM}$ Buffer	$V_{DD} = 10V$ , $V_I = 2V$ , $I_O = 30mA$	25°C	2	2.05	V
				Full range			

(1) Full Range is 0°C to +85°C.

**ELECTRICAL CHARACTERISTICS: BUF06703**

over operating free-air temperature range,  $V_{DD} = 4.5V$  to  $16V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

PARAMETER		TEST CONDITIONS	$T_A$ (1)	MIN	TYP	MAX	UNIT
$I_{DD}$	Supply Current	ALL	$V_O = V_{DD}/2$ , $V_I = V_{DD}/2$ $V_{DD} = 10V$	25°C	1.7	2	mA
				Full Range			3
Common Mode Input Range		Buffers 1–3	25°C	1		$V_{DD}$	V
		Buffers 4–6		0		$V_{DD}-1$	
Load regulation		Buffers 1–6 sinking	$V_{DD} = 10V$ , $I_O = 1mA$ to $10mA$	25°C	0.85	1	mV/mA
				Full Range			
		Buffers 1–6 sourcing	$V_{DD} = 10V$ , $I_O = -1mA$ to $-10mA$	25°C	0.85	1	
				Full Range			
$V_{OSH1}$	High-level saturated output voltage	Buffer 1	$V_{DD} = 16V$ , $V_I = 16V$ , $I_O = -5mA$	25°C	15.85	15.9	V
				Full range	15.8		
$V_{OSL6}$	Low-level saturated output voltage	Buffer 6	$V_{DD} = 16V$ , $V_I = 0V$ , $I_O = 5mA$	25°C		0.1 0.15	V
				Full range		0.2	
$V_{OH1}$	High-level output voltage	Buffer 1	$V_{DD} = 10V$ , $V_I = 9.8V$ , $I_O = -10mA$	25°C	9.75	9.8	V
				Full range	9.7		
$V_{OH2/3}$		Buffer 2/3	$V_{DD} = 10V$ , $V_I = 9.5V$ , $I_O = -10mA$	25°C	9.45	9.5	V
				Full range	9.4		
$V_{OH4/5}$		Buffer 4/5	$V_{DD} = 10V$ , $V_I = 8V$ , $I_O = -10mA$	25°C	7.95	8	V
				Full range	7.9		
$V_{OH6}$	Buffer 6	$V_{DD} = 10V$ , $V_I = 8V$ , $I_O = -10mA$	25°C	7.95	8	V	
				Full range	7.9		
$V_{OL1}$	Low-level output voltage	Buffer 1	$V_{DD} = 10V$ , $V_I = 2V$ , $I_O = 10mA$	25°C		2 2.05	V
						Full range	
$V_{OL2/3}$		Buffer 2/3	$V_{DD} = 10V$ , $V_I = 2V$ , $I_O = 10mA$	25°C		2 2.05	V
						Full range	
$V_{OL4/5}$		Buffer 4/5	$V_{DD} = 10V$ , $V_I = 0.5V$ , $I_O = 10mA$	25°C		0.5 0.55	V
						Full range	
$V_{OL6}$		Buffer 6	$V_{DD} = 10V$ , $V_I = 0.2V$ , $I_O = 10mA$	25°C		0.2 0.25	V
						Full range	

(1) Full Range is 0°C to +85°C.

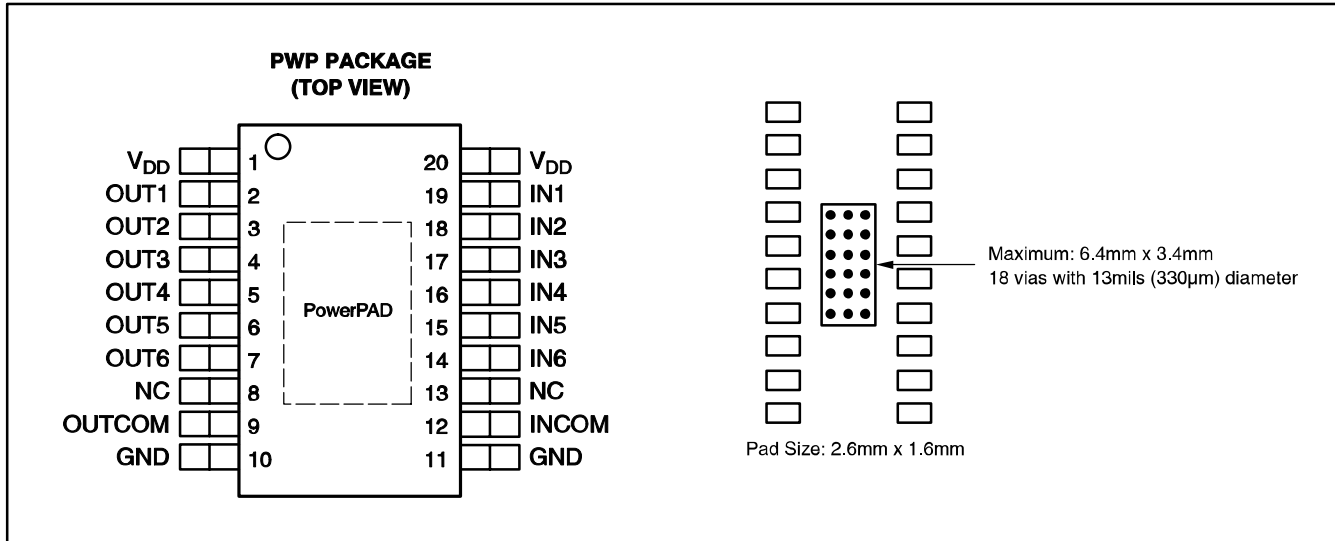
**ELECTRICAL CHARACTERISTICS: BUF05703**

over operating free-air temperature range,  $V_{DD} = 4.5V$  to  $16V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

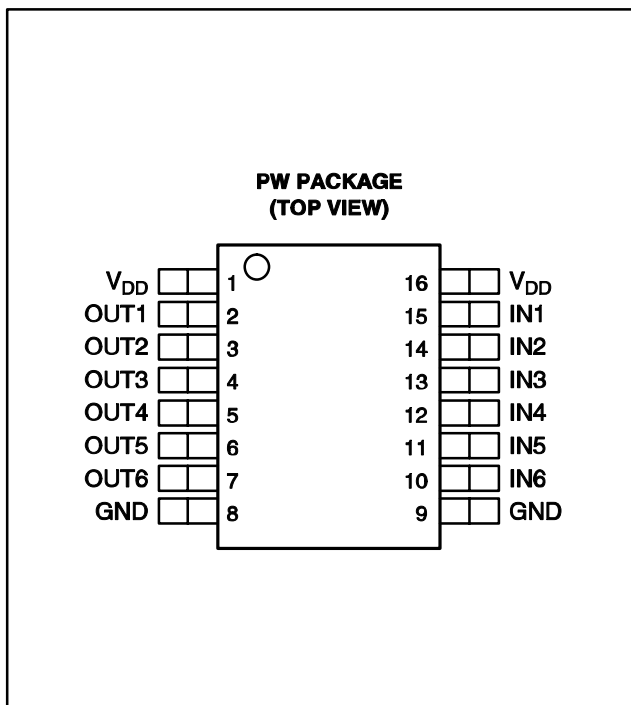
PARAMETER		TEST CONDITIONS	$T_A^{(1)}$	MIN	TYP	MAX	UNIT
$I_{DD}$	Supply Current	ALL	$V_O = V_{DD}/2$ , $V_I = V_{DD}/2$ $V_{DD} = 10V$	25°C	1.7	2	mA
				Full Range			3
Common Mode Input Range	Buffers 1–2		25°C	1		$V_{DD}$	V
	Buffers 3–4			0		$V_{DD}-1$	
	$V_{COM}$ Buffer			1		$V_{DD}$	
Load regulation	$V_{COM}$ buffer sinking	$V_{DD} = 10V$ , $I_O = 1mA$ to $30mA$	25°C	1		1.2	mV/mA
			Full Range			2.5	
	$V_{COM}$ buffer sourcing	$V_{DD} = 10V$ , $I_O = -1mA$ to $-30mA$	25°C	1		1.2	
			Full Range			2.5	
	Buffers 1–4 sinking	$V_{DD} = 10V$ , $I_O = 1mA$ to $10mA$	25°C	0.85		1	
			Full Range			1.5	
Buffers 1–4 sourcing	$V_{DD} = 10V$ , $I_O = -1mA$ to $-10mA$	25°C	0.85		1		
		Full Range			1.5		
$V_{OSH1}$	High-level saturated output voltage	Buffer 1	$V_{DD} = 16V$ , $V_I = 0V$ , $I_O = -5mA$	25°C	15.85	15.9	V
				Full range	15.8		
$V_{OSL4}$	Low-level saturated output voltage	Buffer 4	$V_{DD} = 16V$ , $V_I = 16V$ , $I_O = 5mA$	25°C	0.1	0.15	V
				Full range			
$V_{OH1}$	High-level output voltage	Buffer 1	$V_{DD} = 10V$ , $V_I = 9.8V$ , $I_O = -10mA$	25°C	9.75	9.8	V
				Full range	9.7		
$V_{OH2}$		Buffer 2	$V_{DD} = 10V$ , $V_I = 9.5V$ , $I_O = -10mA$	25°C	9.45	9.5	V
				Full range	9.4		
$V_{OH3}$		Buffer 3	$V_{DD} = 10V$ , $V_I = 8V$ , $I_O = -10mA$	25°C	7.95	8	V
				Full range	7.9		
$V_{OH4}$	Buffer 4	$V_{DD} = 10V$ , $V_I = 8V$ , $I_O = -10mA$	25°C	7.95	8	V	
			Full range	7.9			
$V_{OHCOM}$	$V_{COM}$ Buffer	$V_{DD} = 10V$ , $V_I = 8V$ , $I_O = -30mA$	25°C	7.95	8	V	
			Full range	7.9			
$V_{OL1}$	Low-level output voltage	Buffer 1	$V_{DD} = 10V$ , $V_I = 2V$ , $I_O = 10mA$	25°C	2	2.05	V
				Full range			
$V_{OL2}$		Buffer 2	$V_{DD} = 10V$ , $V_I = 2V$ , $I_O = 10mA$	25°C	2	2.05	V
				Full range			
$V_{OL3}$		Buffer 3	$V_{DD} = 10V$ , $V_I = 0.5V$ , $I_O = 10mA$	25°C	0.5	0.55	V
				Full range			
$V_{OL4}$	Buffer 4	$V_{DD} = 10V$ , $V_I = 0.2V$ , $I_O = 10mA$	25°C	0.2	0.25	V	
			Full range				0.3
$V_{OLCOM}$	$V_{COM}$ Buffer	$V_{DD} = 10V$ , $V_I = 2V$ , $I_O = 30mA$	25°C	2	2.05	V	
			Full range				2.1

(1) Full Range is 0°C to +85°C.

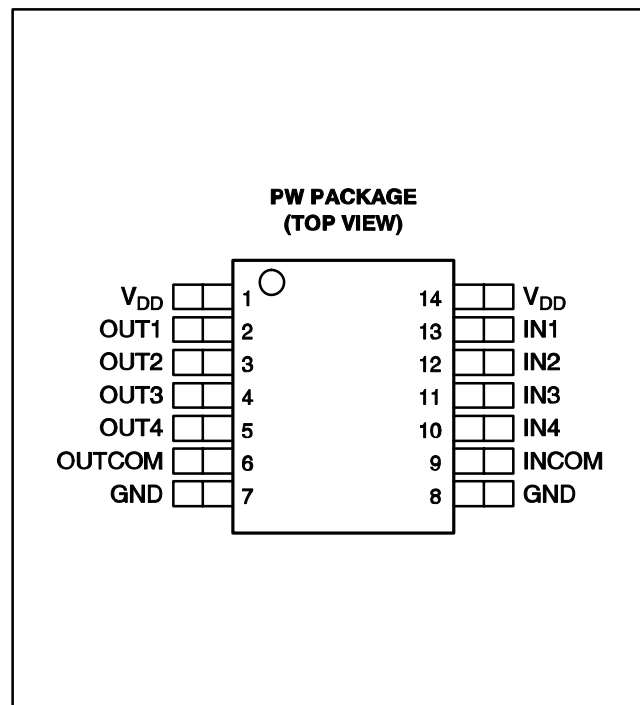
BUF07703 Pin Configuration and Landing Pattern



BUF06703 Pin Configuration



BUF05703 Pin Configuration



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