**Burr-Brown Products
from Texas Instruments**

OPA3690

Triple, Wideband, Voltage-Feedback
OPERATIONAL AMPLIFIER With Disable

FEATURES

- **FLEXIBLE SUPPLY RANGE:**
  +5V to +12V Single Supply
  ±2.5V to ±6V Dual Supply
- **WIDEBAND +5V OPERATION: 220MHz (G = +2)**
- **HIGH OUTPUT CURRENT: 190mA**
- **OUTPUT VOLTAGE SWING: ±4.0V**
- **HIGH SLEW RATE: 1800V/μs**
- **LOW SUPPLY CURRENT: 5.5mA/ch**
- **LOW DISABLED CURRENT: 100μA/ch**

APPLICATIONS

- **VIDEO LINE DRIVING**
- **HIGH-SPEED IMAGING CHANNELS**
- **ADC BUFFERS**
- **PORTABLE INSTRUMENTS**
- **TRANSIMPEDANCE AMPLIFIERS**
- **ACTIVE FILTERS**

DESCRIPTION

The OPA3690 represents a major step forward in unity-gain stable, voltage-feedback op amps. A new internal architecture provides slew rate and full power bandwidth previously found only in wideband current-feedback op amps. A new output stage architecture delivers high currents with a minimal headroom requirement. These give exceptional single-supply operation. Using a single +5V supply, the OPA3690 can deliver a 1V to 4V output swing with over 100mA drive current and 150MHz bandwidth. This combination of features makes the OPA3690 an ideal RGB line driver or single-supply Analog-to-Digital Converter (ADC) input driver.

The OPA3690's low 5.5mA/ch supply current is precisely trimmed at 25°C. This trim, along with low temperature drift, ensures lower maximum supply current than competing products. System power may be reduced further using the optional disable control pin. Leaving this disable pin open, or holding it HIGH, will operate the OPA3690 normal. If pulled LOW, the OPA3690 supply current drops to less than 100μA/ch while the output goes into a high impedance state. This feature may be used for power savings.

OPA3690 RELATED PRODUCTS

	SINGLES	DUALS	TRIPLES
Voltage Feedback	OPA690	OPA2690	OPA3680
Current Feedback	OPA691	OPA2691	OPA3691
Fixed Gain	OPA692	OPA2682	OPA3692
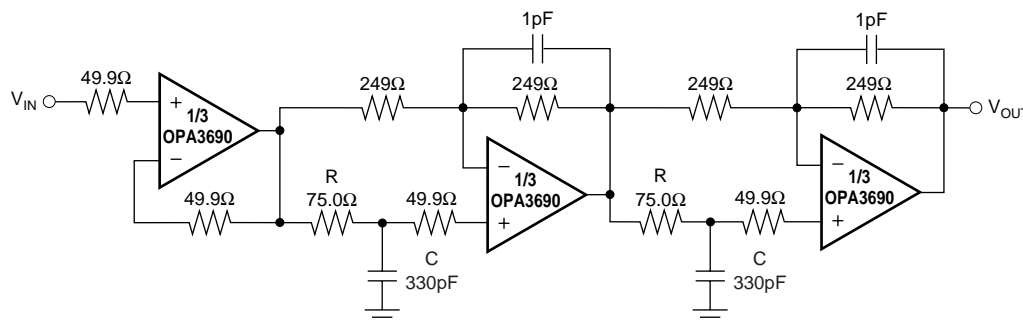
Buffered Analog Delay Line

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ABSOLUTE MAXIMUM RATINGS[(1)]

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Power Supply ............................................................... ±6.5VDC
Internal Power Dissipation ............................... See Thermal Information
Differential Input Voltage .................................................... ±1.2V
Input Voltage Range ......................................................... ±V_S
Storage Temperature Range: D, DBQ.......................... −40°C to +125°C
Lead Temperature (soldering, 10s) .............................................. +300°C
Junction Temperature (T_J) ...................................................... +175°C
ESD Resistance: HBM ....................................................... 2kV
               MM ............................................................... 200V
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NOTE: (1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

⚠ ELECTROSTATIC DISCHARGE SENSITIVITY

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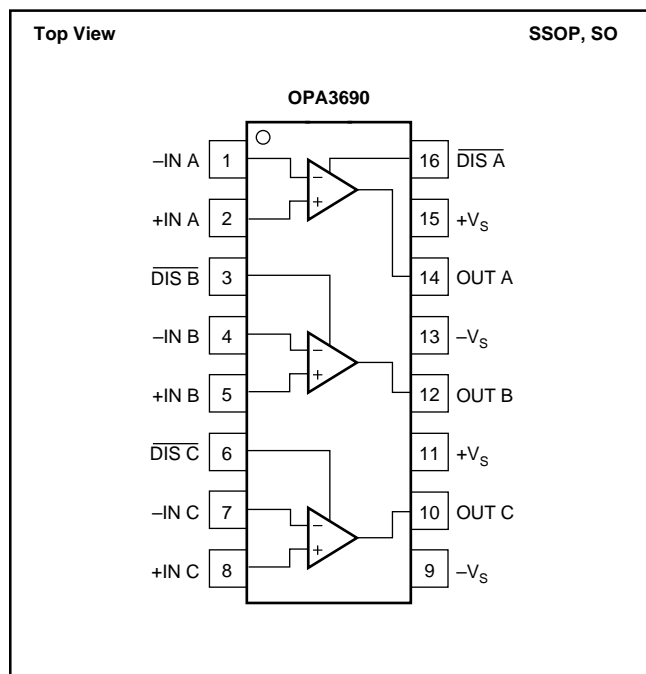
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE/ORDERING INFORMATION

PRODUCT	PACKAGE-LEAD	PACKAGE DESIGNATOR[(1)]	TEMPERATURE RANGE	SPECIFIED PACKAGE MARKING	ORDERING NUMBER	TRANSPORT MEDIA
OPA3690IDBQ	SSOP-16 Surface-Mount	DBQ	−40°C to +85°C	OPA3690	OPA3690IDBQT	Tape and Reel, 250
"	"	"	"	"	OPA3690IDBQR	Tape and Reel, 2.5K
OPA3690ID	SO-16 Surface-Mount	D	−40°C to +85°C	OPA3690	OPA3690ID	Rails, 48
"	"	"	"	"	OPA3690IDR	Tape and Reel, 2.5K

NOTE: (1) For the most current specifications and package information, refer to our web site at www.ti.com.

PIN CONFIGURATION

Top View   **SSOP, SO**

OPA3690

−IN A	1	16	$\overline{\text{DIS A}}$
+IN A	2	15	+V_S
$\overline{\text{DIS B}}$	3	14	OUT A
−IN B	4	13	−V_S
+IN B	5	12	OUT B
$\overline{\text{DIS C}}$	6	11	+V_S
−IN C	7	10	OUT C
+IN C	8	9	−V_S

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OPA3690
SBOS237A

ELECTRICAL CHARACTERISTICS: $V_S = \pm 5V$

Boldface limits are tested at **25°C.**

$R_F = 402\Omega$, $R_L = 100\Omega$, G = +2, (see Figure 1 for AC performance only), and $R_F = 25\Omega$ for G = +1, unless otherwise noted.

PARAMETER	CONDITIONS	TYP +25°C	MIN/MAX OVER TEMPERATURE +25°C[1]	0°C to 70°C[2]	−40°C to +85°C[2]	UNITS	MIN/MAX	TEST LEVEL[3]
AC PERFORMANCE (see Figure 1)								
Small-Signal Bandwidth	G = +1, V_O = 0.5Vp-p, R_F = 25Ω	400				MHz	typ	C
	G = +2, V_O = 0.5Vp-p	220				MHz	min	C
	G = +10, V_O = 0.5Vp-p	30				MHz	min	C
Gain Bandwidth Product	G $\geq$ 10	300				MHz	min	C
Bandwidth for 0.1dB Gain Flatness	G = +2, V_O < 0.5Vp-p	30				MHz	typ	C
Peaking at a Gain of +1	V_O < 0.5Vp-p	4				dB	typ	C
Large-Signal Bandwidth	G = +2, V_O = 5Vp-p	175				MHz	typ	C
Slew Rate	G = +2, 4V Step	1800				V/μs	min	C
Rise-and-Fall Time	G = +2, V_O = 0.5V Step	1.4				ns	max	C
	G = +2, V_O = 4V Step	2.8				ns	max	C
Settling Time to 0.02%	G = +2, V_O = 2V Step	12				ns	typ	C
0.1%	G = +2, V_O = 2V Step	8				ns	typ	C
Harmonic Distortion	G = +2, f = 5MHz, V_O = 2Vp-p							
2nd Harmonic	R_L = 100Ω	−72				dBc	typ	C
	$R_L \geq$ 500Ω	−83				dBc	typ	C
3rd Harmonic	R_L = 100Ω	−74				dBc	typ	C
	$R_L \geq$ 500Ω	−85				dBc	typ	C
Crosstalk	Input Referred, f = 5MHz, All Hostile	−58				dBc	typ	C
Input Voltage Noise	f > 1MHz	4.5				nV/$\sqrt{Hz}$	max	C
Input Current Noise	f > 1MHz	2.3				pA/$\sqrt{Hz}$	max	C
Differential Gain	G = +2, NTSC, V_O = 1.4Vp, R_L = 150	0.06				%	typ	C
Differential Phase	G = +2, NTSC, V_O = 1.4Vp, R_L = 150	0.01				deg	typ	C
DC PERFORMANCE[4]								
Open-Loop Voltage Gain (A_{OL})	V_{OL} = 0V, R_L = 100Ω	65	**58**	56	54	dB	min	A
Input Offset Voltage	V_{CM} = 0V	±1.0	**±4.5**	±5	±5.2	mV	max	A
Average Offset Voltage Drift	V_{CM} = 0V			±12	±12	μV/°C	max	B
Input Bias Current	V_{CM} = 0V	+5	**±10**	±11	±12	μA	max	A
Average Bias Current Drift (magnitude)	V_{CM} = 0V			±20	±40	nA/°C	max	B
Input Offset Current	V_{CM} = 0V	±0.1	**±1.0**	±1.4	±1.6	μA	max	A
Average Offset Current Drift	V_{CM} = 0V			±7	±9	nA°C	max	B
INPUT								
Common-Mode Input Range (CMIR)[5]		±3.5	**±3.4**	±3.3	±3.2	V	min	A
Common-Mode Rejection Ratio (CMRR)	V_{CM} = ±1.0V	65	**60**	57	56	dB	min	A
Input Impedance								
Differential Mode		190 || 0.6				kΩ || pF	typ	C
Common Mode		3.2 || 0.9				MΩ || pF	typ	C
OUTPUT								
Voltage Output Swing	No Load	±4.0	**±3.8**	±3.7	±3.6	V	min	A
	100Ω Load	±3.9	**±3.7**	±3.6	±3.3	V	min	A
Current Output, Sourcing	V_O = 0	+190	**+160**	+140	+100	mA	min	A
Sinking	V_O = 0	−190	**−160**	−140	−100	mA	min	A
Short-Circuit Current	V_O = 0	±250				mA	typ	C
Closed-Loop Output Impedance	G = +2, f = 100kHz	0.03					typ	C

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ELECTRICAL CHARACTERISTICS: $V_S = \pm5V$ (Cont.)

Boldface limits are tested at **25°C.**

$R_F = 402\Omega$, $R_L = 100\Omega$, G = +2, (see Figure 1 for AC performance only), and $R_F = 25\Omega$ for G = +1, unless otherwise noted.

PARAMETER	CONDITIONS	TYP +25°C	+25°C	0°C to 70°C	−40°C to +85°C	UNITS	MIN/ MAX	TEST LEVEL[2]
			MIN/MAX OVER TEMPERATURE[1]					
DISABLE	Disable Low							
Power-Down Supply Current (+V_S)	$V_{\overline{DIS}}$ = 0V, All Channels	−300	**−600**	−720	−780	µA	max	A
Disable Time		200				ns	typ	C
Enable Time		25				ns	typ	C
Off Isolation	G = +2, 5MHz	70				dB	typ	C
Output Capacitance in Disable		4				pF	typ	C
Turn On Glitch	G = +2, R_L = 150Ω, V_{IN} = 0	±50				mV	typ	C
Turn Off Glitch	G = +2, R_L = 150Ω, V_{IN} = 0	±20				mV	typ	C
Enable Voltage		3.3	**3.5**	3.6	3.7	V	min	A
Disable Voltage		1.8	**1.7**	1.6	1.5	V	max	A
Control Pin Input Bias Current	$V_{\overline{DIS}}$ = 0V, Each Channel	75	**130**	150	160	µA	max	A
POWER SUPPLY								
Specified Operating Voltage		±5				V	typ	C
Maximum Operating Voltage Range			**±6**	±6	±6	V	max	A
Max Quiescent Current (3 Channels)	$V_S = \pm5V$	16.5	**17.4**	18	18.6	mA	max	A
Min Quiescent Current (3 Channels)	$V_S = \pm5V$	16.5	**15.9**	15.3	14.1	mA	min	A
Power-Supply Rejection Ratio (+PSRR)	Input Referred	75	**68**	66	64	dB	min	A
THERMAL CHARACTERISTICS								
Specified Operating Range D, DBQ Package		−40 to +85				°C	typ	C
Thermal Resistance, θ_{JA}								
D SO-16		100				°C/W	typ	C
DBQ SSOP-16		100				°C/W	typ	C

NOTES: (1) Junction temperature = ambient for 25°C specifications. (2) Junction temperature = ambient at low temperature limit: junction temperature = Ambient +20°C at high temperature limit for over temperature specifications. (3) Test Levels: (A) 100% tested at 25°C. Over temperature limits by characterization and simulation. (B) Limits set by characterization and simulation. (C) Typical value only for information. (4) Current is considered positive out-of-node. V_{CM} is the input common-mode voltage. (5) Tested < 3dB below minimum CMRR specification at ±CMIR limits.

ELECTRICAL CHARACTERISTICS: V_S = +5V

Boldface limits are tested at **25°C.**

R_F = 402Ω, R_L = 100Ω to V_S/2, G = +2, (see Figure 2 for AC performance only), and R_F = 25Ω for G = +1, unless otherwise noted.

PARAMETER	CONDITIONS	TYP +25°C	MIN/MAX OVER TEMPERATURE +25°C[1]	0°C to 70°C[2]	−40°C to +85°C[2]	UNITS	MIN/ MAX	TEST LEVEL[3]
AC PERFORMANCE (see Figure 2)								
Small-Signal Bandwidth	G = +1, V_O < 0.5Vp-p	330				MHz	typ	C
	G = +2, V_O < 0.5Vp-p	220				MHz	min	C
	G = +10, V_O < 0.5Vp-p	25				MHz	min	C
Gain Bandwidth Product	G ≥ 10	250				MHz	min	C
Bandwidth for 0.1dB Gain Flatness	G = +2, V_O < 0.5Vp-p	20				MHz	typ	C
Peaking at a Gain of +1	V_O < 0.5Vp-p	5				dB	typ	C
Large-Signal Bandwidth	G = +2, V_O = 2Vp-p	175				MHz	typ	C
Slew Rate	G = +2, 2V Step	1000				V/µs	min	C
Rise Time	G = +2, V_O = 0.5V Step	1.6				ns	typ	C
Fall Time	G = +2, V_O = 2V Step	2.0				ns	typ	C
Settling Time to 0.02%	G = +2, V_O = 2V Step	12				ns	typ	C
0.1%	G = +2, V_O = 2V Step	8				ns	typ	C
Harmonic Distortion	G = +2, f = 5MHz, V_O = 2Vp-p							
2nd Harmonic	R_L = 100Ω	−71				dBc	typ	C
	R_L ≥ 500Ω	−79				dBc	typ	C
3rd Harmonic	R_L = 100Ω	−72				dBc	typ	C
	R_L ≥ 500Ω	−77				dBc	typ	C
Input Voltage Noise	f > 1MHz	4.7				nV/√Hz	max	C
Input Current Noise	f > 1MHz	2.5				pA/√Hz	max	C
Differential Gain	G = +2, NTSC, V_O = 1.4Vp, R_L = 150 to V_S/2	0.06				%	typ	C
Differential Phase	G = +2, NTSC, V_O = 1.4Vp, R_L = 150 to V_S/2	0.02				deg	typ	C
DC PERFORMANCE[4]								
Open-Loop Voltage Gain (A_{OL})	V_O = 0V, R_L = 100Ω	63	**56**	54	52	dB	min	A
Input Offset Voltage	V_{CM} = 2.5V	±1.0	**±4.5**	±4.8	±5.2	mV	max	A
Average Offset Voltage Drift	V_{CM} = 2.5V			±10	±10	µV/°C	max	B
Input Bias Current	V_{CM} = 2.5V	+5	**±10**	±11	±12	µA	max	A
Average Bias Current Drift (magnitude)	V_{CM} = 2.5V			±20	±40	nA/°C	max	B
Input Offset Current	V_{CM} = 2.5V	±0.3	**±1**	±1.4	±1.6	µA	max	A
Average Offset Current Drift	V_{CM} = 2.5V			±7	±9	nA/°C	max	B
INPUT								
Least Positive Input Voltage[5]		1.5	**1.6**	1.7	1.8	V	min	A
Most Positive Input Voltage[5]		3.5	**3.4**	3.3	3.2	V	max	A
Common-Mode Rejection Ratio (CMRR)	V_{CM} = 2.5V	63	**58**	56	54	dB	min	A
Input Impedance								
Differential Mode		92 ‖ 1.4				kΩ ‖ pF	typ	C
Common Mode		2.2 ‖ 1.5				MΩ ‖ pF	typ	C
OUTPUT								
Most Positive Output Voltage	No Load	4	**3.8**	3.6	3.5	V	min	A
	R_L = 100Ω, 2.5V	3.9	**3.7**	3.5	3.4	V	min	A
Least Positive Output Voltage	No Load	1	**1.2**	1.4	1.5	V	min	A
	R_L = 100Ω, 2.5V	1.1	**1.3**	1.5	1.7	V	min	A
Current Output, Sourcing		+160	**+120**	+100	+80	mA	min	A
Sinking		−160	**−120**	−100	−80	mA	min	A
Short-Circuit Current	V_O = V_S/2	±250				mA	typ	C
Closed-Loop Output Impedance	G = +2, f = 100kHz	0.03					typ	C

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ELECTRICAL CHARACTERISTICS: V_S = +5V (Cont.)

Boldface limits are tested at **25°C.**

R_F = 250Ω, R_L = 100Ω to V_S/2, G = +2, (see Figure 2 for AC performance only), and R_F = 25Ω for G = +1, unless otherwise noted.

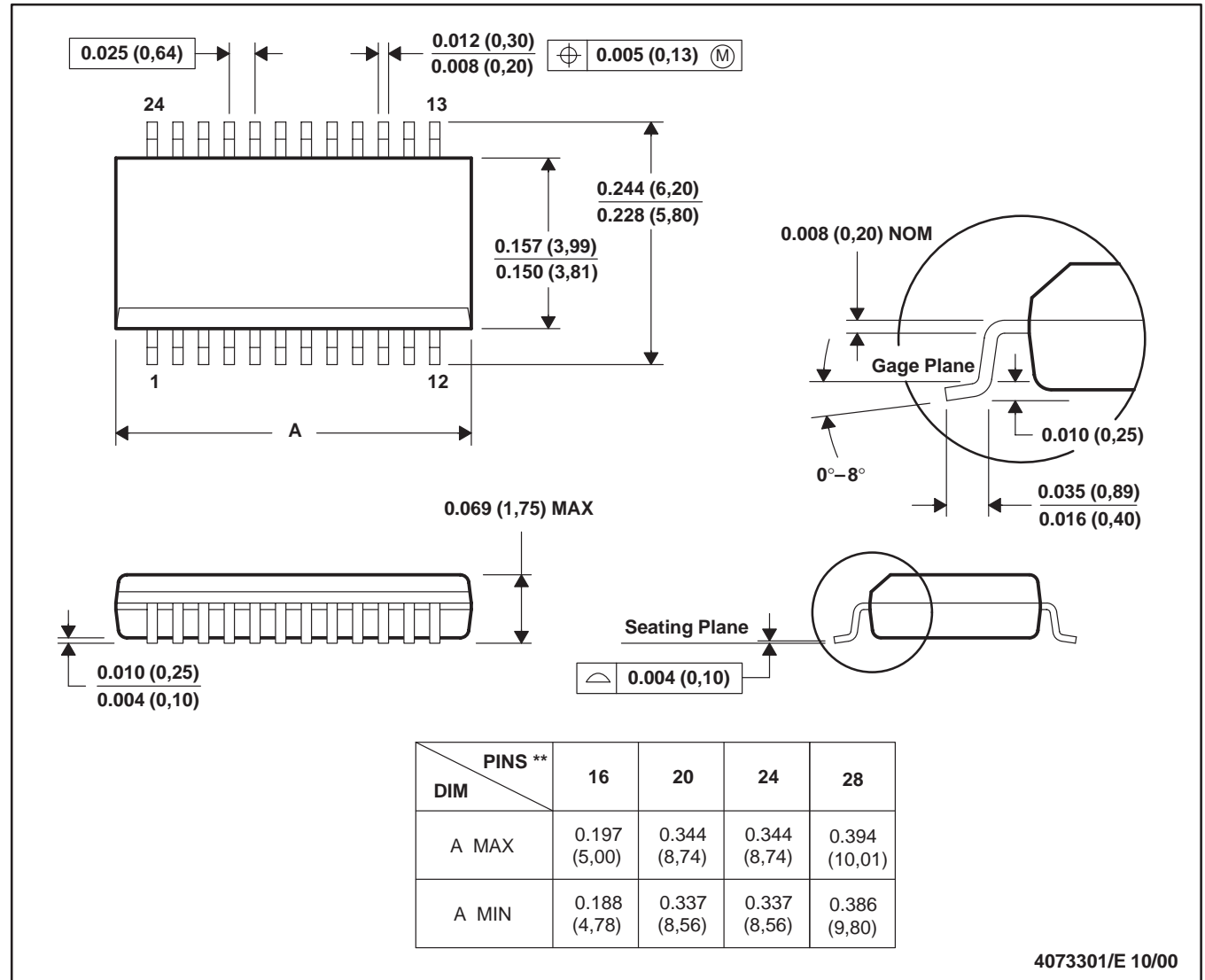| PARAMETER	CONDITIONS	TYP +25°C	MIN/MAX OVER TEMPERATURE[1]			UNITS	MIN/MAX	TEST LEVEL[2]
			+25°C	0°C to 70°C	−40°C to +85°C			
DISABLE	Disable Low							
Power-Down Supply Current (+V_S)	$V_{\overline{DIS}}$ = 0V, All Channels	−300	**−600**	−720	−780	µA	max	A
Disable Time		200				ns	typ	C
Enable Time		25				ns	typ	C
Off Isolation	G = +2, 5MHz	65				dB	typ	C
Output Capacitance in Disable		4				pF	typ	C
Turn On Glitch	G = +2, R_L = 150Ω, V_{IN} = V_S/2	±50				mV	typ	C
Turn Off Glitch	G = +2, R_{LP} = 150Ω, V_{IN} = V_S/2	±20				mV	typ	C
Enable Voltage		3.3	**3.5**	3.6	3.7	V	min	A
Disable Voltage		1.8	**1.7**	1.6	1.5	V	max	A
Control Pin Input Bias Current	$V_{\overline{DIS}}$ = 0V, Each Channel	75	**130**	150	160	µA	typ	C
POWER SUPPLY								
Specified Single-Supply Operating Voltage		5				V	typ	C
Maximum Single-Supply Operating Voltage			**12**	12	12	V	max	A
Max Quiescent Current (3 Channels)	V_S = +5V	14.7	**15.6**	16.2	16.8	mA	max	A
Min Quiescent Current (3 Channels)	V_S = +5V	14.7	**14.1**	13.2	12.0	mA	min	A
Power-Supply Rejection Ratio (+PSRR)	Input Referred	72				dB	typ	C
TEMPERATURE RANGE								
Specification: D, DBQ		−40 to +85				°C	typ	C
Thermal Resistance, θ_{JA}								
D SO-16		100				°C/W	typ	C
DBQ SSOP-16		100				°C/W	typ	C

NOTES: (1) Junction temperature = ambient for 25°C specifications. (2) Junction temperature = ambient at low temperature limit: junction temperature = Ambient +20°C at high temperature limit for over temperature specifications. (3) Test Levels: (A) 100% tested at 25°C. Over temperature limits by characterization and simulation. (B) Limits set by characterization and simulation. (C) Typical value only for information. (4) Current is considered positive out-of-node. V_{CM} is the input common-mode voltage. (5) Tested < 3dB below minimum CMRR specification at ±CMIR limits.

DBQ (R-PDSO-G)**

PLASTIC SMALL-OUTLINE

24 PINS SHOWN

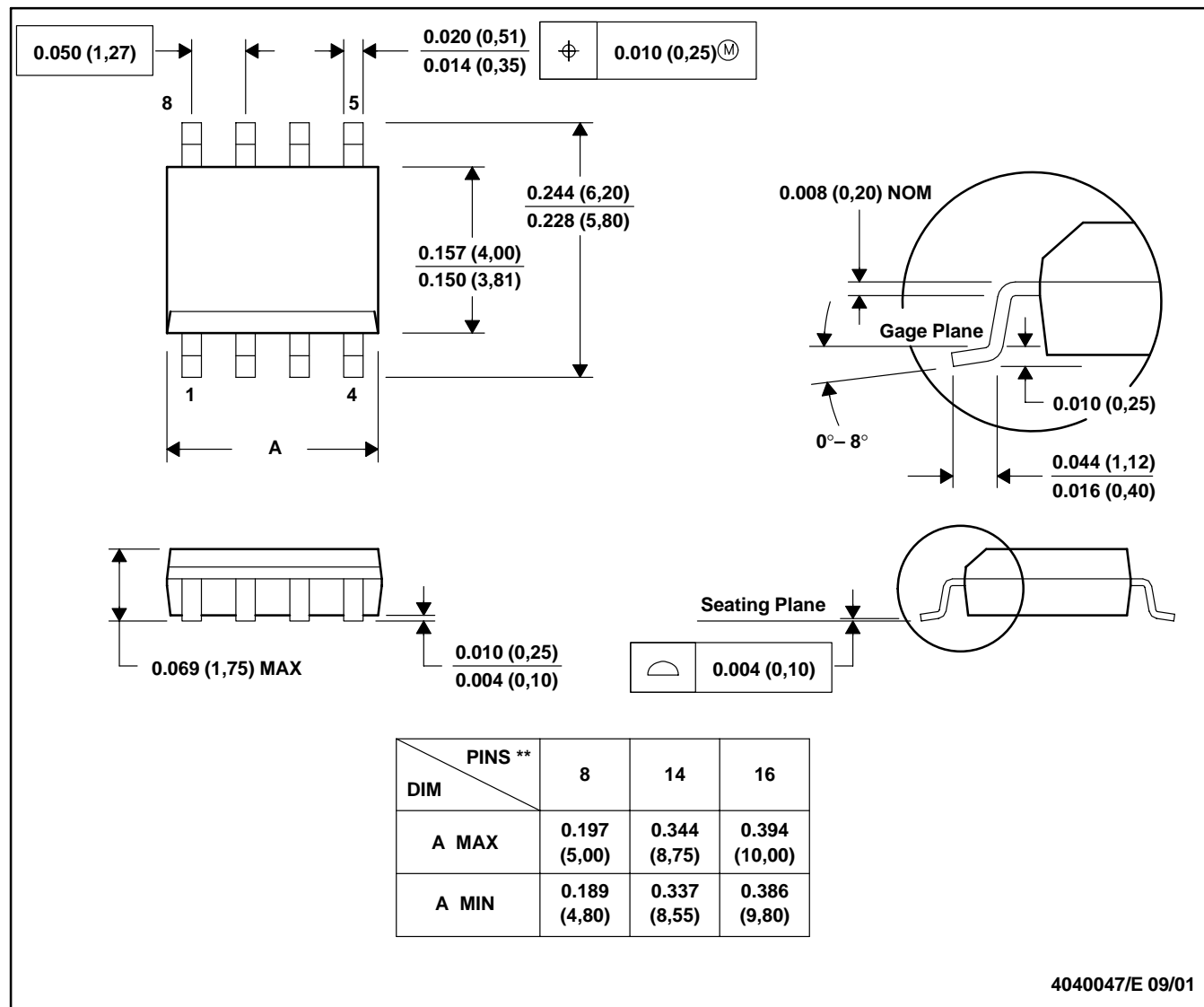| PINS ** DIM	16	20	24	28
A MAX	0.197 (5,00)	0.344 (8,74)	0.344 (8,74)	0.394 (10,01)
A MIN	0.188 (4,78)	0.337 (8,56)	0.337 (8,56)	0.386 (9,80)

4073301/E 10/00

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MO-137

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D (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE PACKAGE**

8 PINS SHOWN

PINS ** DIM	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

4040047/E 09/01

NOTES: A. All linear dimensions are in inches (millimeters).
        B. This drawing is subject to change without notice.
        C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
        D. Falls within JEDEC MS-012

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