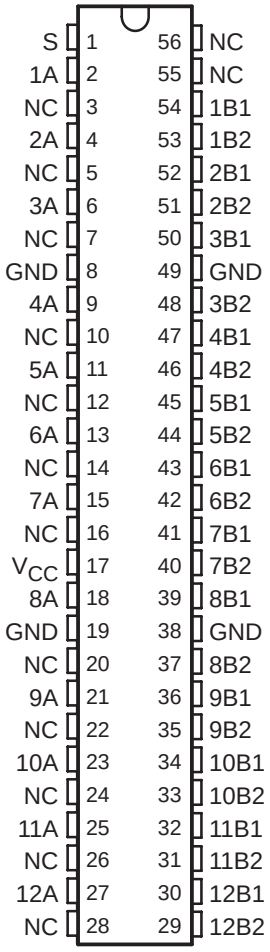
- **Member of the Texas Instruments Widebus™ Family**
- **Rail-to-Rail Switching on Data I/O Ports**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **Make-Before-Break Feature**
- **Internal 500-Ω Pulldown Resistors to Ground**
- **Input/Output Ports Have Equivalent 25-Ω Series Resistors, So No External Resistors Are Required**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**
- **ESD Protection Exceeds JESD 22**
  − 2000-V Human-Body Model (A114-A)

DGG, DGV, OR DL PACKAGE
(TOP VIEW)



NC − No internal connection

description/ordering information

The SN74CBTLVR16292 is a 12-bit 1-of-2 high-speed FET multiplexer/demultiplexer. The low on-state resistance of the switch allows connections to be made with minimal propagation delay.

When the select (S) input is low, port A is connected to port B1, and R_{INT} is connected to port B2. When S is high, port A is connected to port B2, and R_{INT} is connected to port B1.

The input/output ports include equivalent 25-Ω series resistors to reduce overshoot and undershoot.

This device is fully specified for partial-power-down applications using I_{off}. The I_{off} feature ensures that damaging current will not backflow through the device when it is powered down. The device has isolation during power off.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
−40°C to 85°C	SSOP − DL	Tube	SN74CBTLVR16292L	CBTLVR16292
		Tape and reel	SN74CBTLVR16292LR	
	TSSOP − DGG	Tape and reel	SN74CBTLVR16292GR	CBTLVR16292
	TVSOP − DGV	Tape and reel	SN74CBTLVR16292VR	CE292

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

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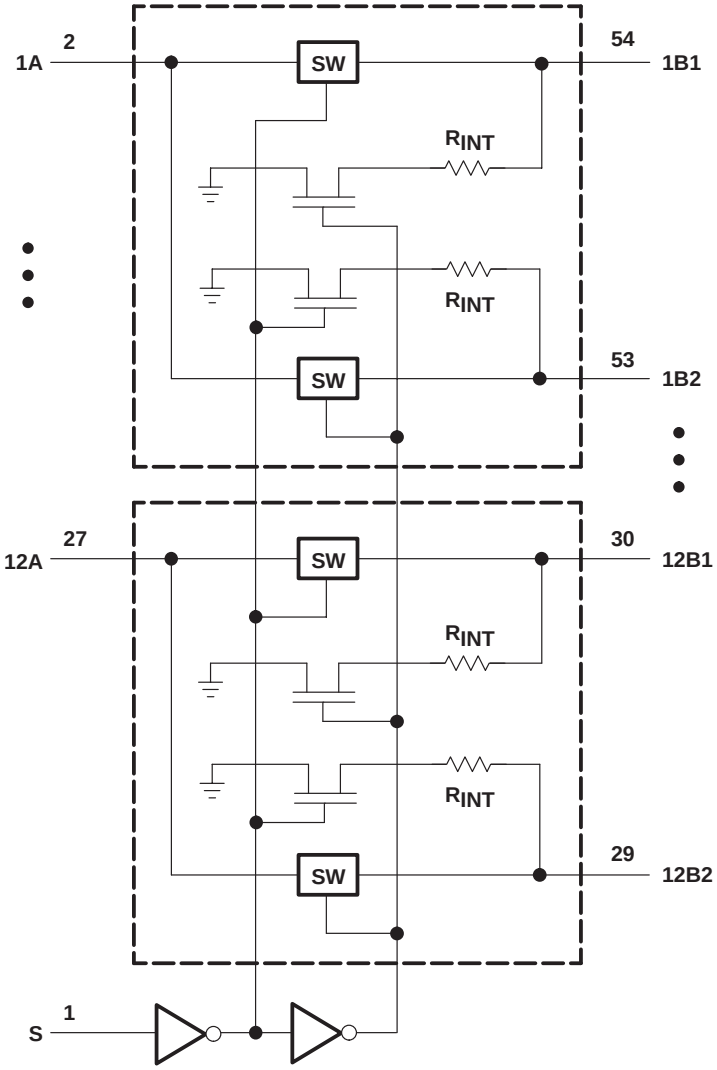
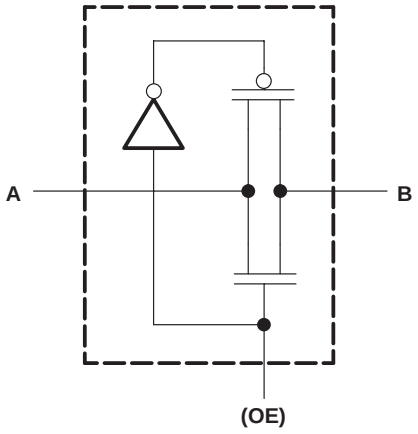
FUNCTION TABLE

INPUT S	FUNCTION
L	A port = B1 port R_{INT} = B2 port
H	A port = B2 port R_{INT} = B1 port

logic diagram (positive logic)



simplified schematic, each FET switch



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} . . . . . −0.5 V to 4.6 V
Input voltage range, V_I (see Note 1) . . . . . −0.5 V to 4.6 V
Continuous channel current . . . . . 128 mA
Input clamp current, I_{IK} ($V_I < 0$) . . . . . −50 mA
Package thermal impedance, θ_{JA} (see Note 2): DGG package . . . . . 64°C/W
DGV package . . . . . 48°C/W
DL package . . . . . 56°C/W
Storage temperature range, T_{stg} . . . . . −65°C to 150°C

† 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.

NOTES: 1. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 3)

			MIN	MAX	UNIT
V_{CC}	Supply voltage		2.3	3.6	V
V_{IH}	High-level control input voltage	V_{CC} = 2.3 V to 2.7 V	1.7		V
		V_{CC} = 2.7 V to 3.6 V	2		
V_{IL}	Low-level control input voltage	V_{CC} = 2.3 V to 2.7 V		0.7	V
		V_{CC} = 2.7 V to 3.6 V		0.8	
T_A	Operating free-air temperature		−40	85	°C

NOTE 3: All unused control inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP†	MAX	UNIT
V_{IK}		V_{CC} = 3 V,	I_I = −18 mA				−1.2	V
I_I		V_{CC} = 3.6 V,	V_I = V_{CC} or GND				±1	μA
I_{off}		V_{CC} = 0,	V_I or V_O = 0 to 3.6 V				10	μA
I_{CC}		V_{CC} = 3.6 V,	I_O = 0,	V_I = V_{CC} or GND			10	μA
ΔI_{CC}‡	Control input	V_{CC} = 3.6 V,	One input at 3 V,	Other inputs at V_{CC} or GND			300	μA
C_i	Control input	V_I = 3.3 V or 0				3.5		pF
C_{io}	A or B port	V_O = 3.3 V or 0				23		pF
r_{on}§		V_{CC} = 2.3 V, TYP at V_{CC} = 2.5 V	V_I = 0	I_I = 64 mA		30	47	Ω
				I_I = 24 mA		30	47	
			V_I = 1.7 V,	I_I = 15 mA		36	80	
		V_{CC} = 3 V	V_I = 0	I_I = 64 mA		30	42	
				I_I = 24 mA		30	42	
			V_I = 2.4 V,	I_I = 15 mA		32	47	

† All typical values are at V_{CC} = 3.3 V (unless otherwise noted), T_A = 25°C.
‡ This is the increase in supply current for each input that is at the specified voltage level, rather than V_{CC} or GND.
§ Measured by the voltage drop between the A and B terminals at the indicated current through the switch. On-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC} = 2.5 V ± 0.2 V		V_{CC} = 3.3 V ± 0.3 V		UNIT
			MIN	MAX	MIN	MAX	
t_{pd}¶	A or B	B or A		0.15		0.25	ns
t_{pd}#	S	A	3.2	8.5	3.2	8	ns
t_{en}	S	B	1	6.5	1	5.8	ns
t_{dis}	S	B	1	5.3	1	4.6	ns

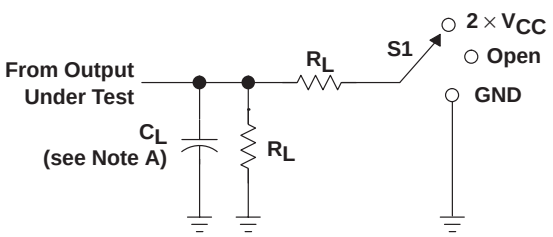
¶ The propagation delay is the calculated RC time constant of the typical on-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).
# This propagation delay was measured by observing the change of voltage on the A output introduced by static levels equal to 3-V or 0 for 3.3 V ± 0.3 V or V_{CC} or 0 for 2.5 V ± 0.2 V on B1 and B2 to achieve the desired transition.

switching characteristics over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER	DESCRIPTION	V_{CC} = 2.5 V ± 0.2 V		V_{CC} = 3.3 V ± 0.3 V		UNIT
		MIN	MAX	MIN	MAX	
t_{mbb}‖	Make-before-break time	0	2	0	2	ns

‖ The make-before-break time is the time interval between make and break, during the transition from one selected port to the other.

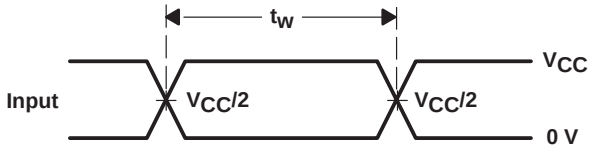
PARAMETER MEASUREMENT INFORMATION



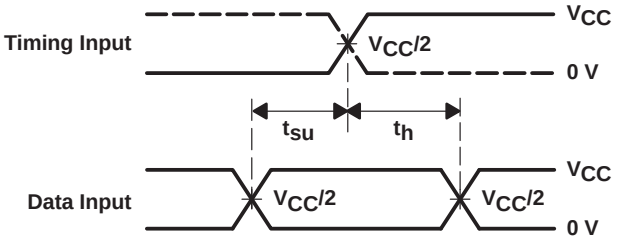
LOAD CIRCUIT

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND

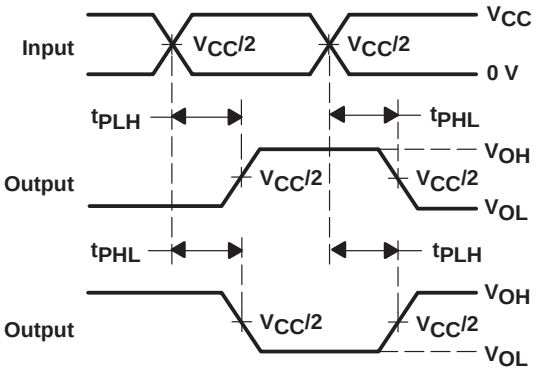
V_{CC}	C_L	R_L	V_Δ
2.5 V ±0.2 V	30 pF	500 Ω	0.15 V
3.3 V ±0.3 V	50 pF	500 Ω	0.3 V



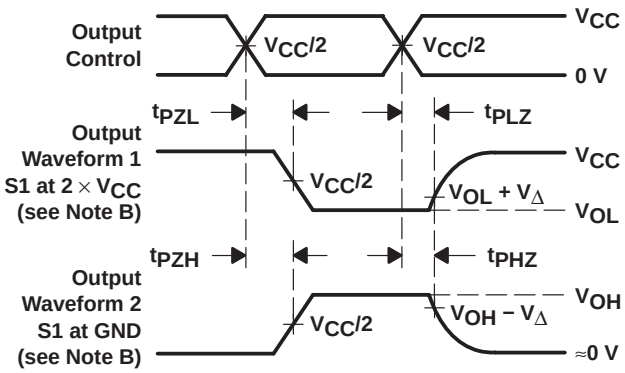
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2 ns, t_f ≤ 2 ns.
D. The outputs are measured one at a time with one transition per measurement.
E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
F. t_{PZL} and t_{PZH} are the same as t_{en}.
G. t_{PLH} and t_{PHL} are the same as t_{pd}.
H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
SN74CBTLVR16292DL	ACTIVE	SSOP	DL	56		TBD	Call TI	Call TI
SN74CBTLVR16292GR	ACTIVE	TSSOP	DGG	56		TBD	Call TI	Call TI
SN74CBTLVR16292LR	ACTIVE	SSOP	DL	56		TBD	Call TI	Call TI
SN74CBTLVR16292VR	ACTIVE	TVSOP	DGV	56		TBD	Call TI	Call TI

[1] The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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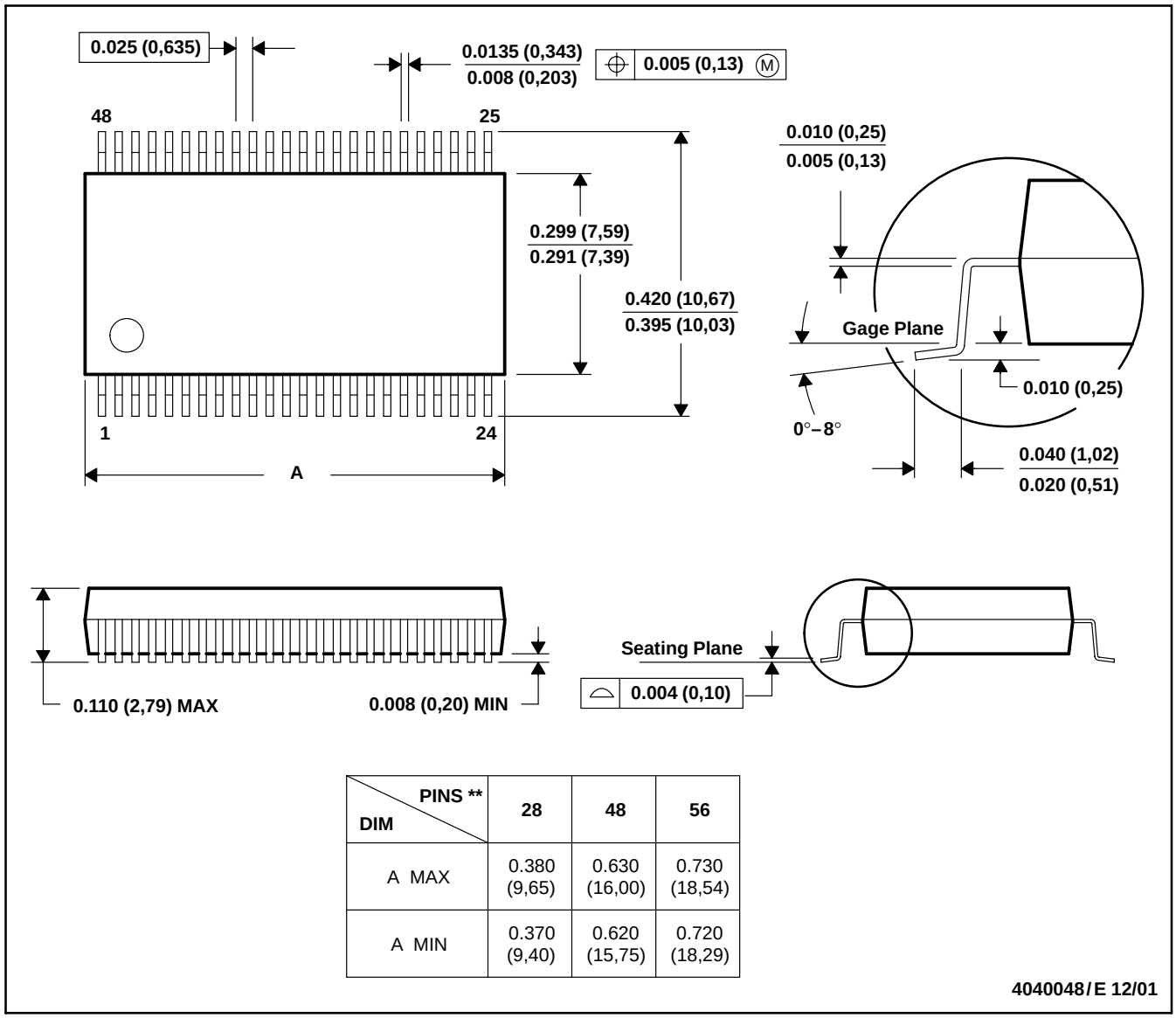
DL (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

48 PINS SHOWN



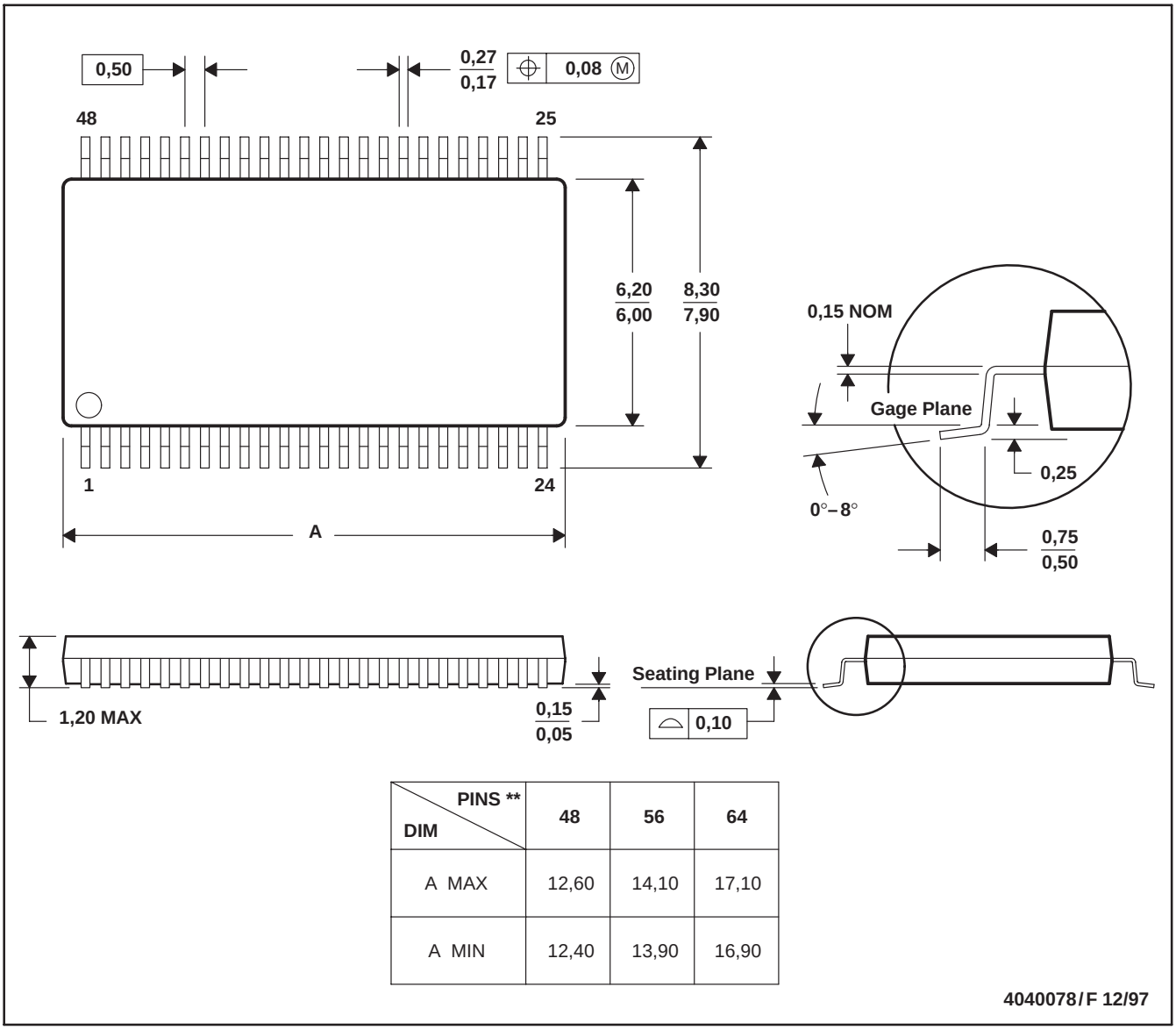
DIM \ PINS **	28	48	56
A MAX	0.380 (9,65)	0.630 (16,00)	0.730 (18,54)
A MIN	0.370 (9,40)	0.620 (15,75)	0.720 (18,29)

4040048/E 12/01

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 MO-118

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

48 PINS SHOWN

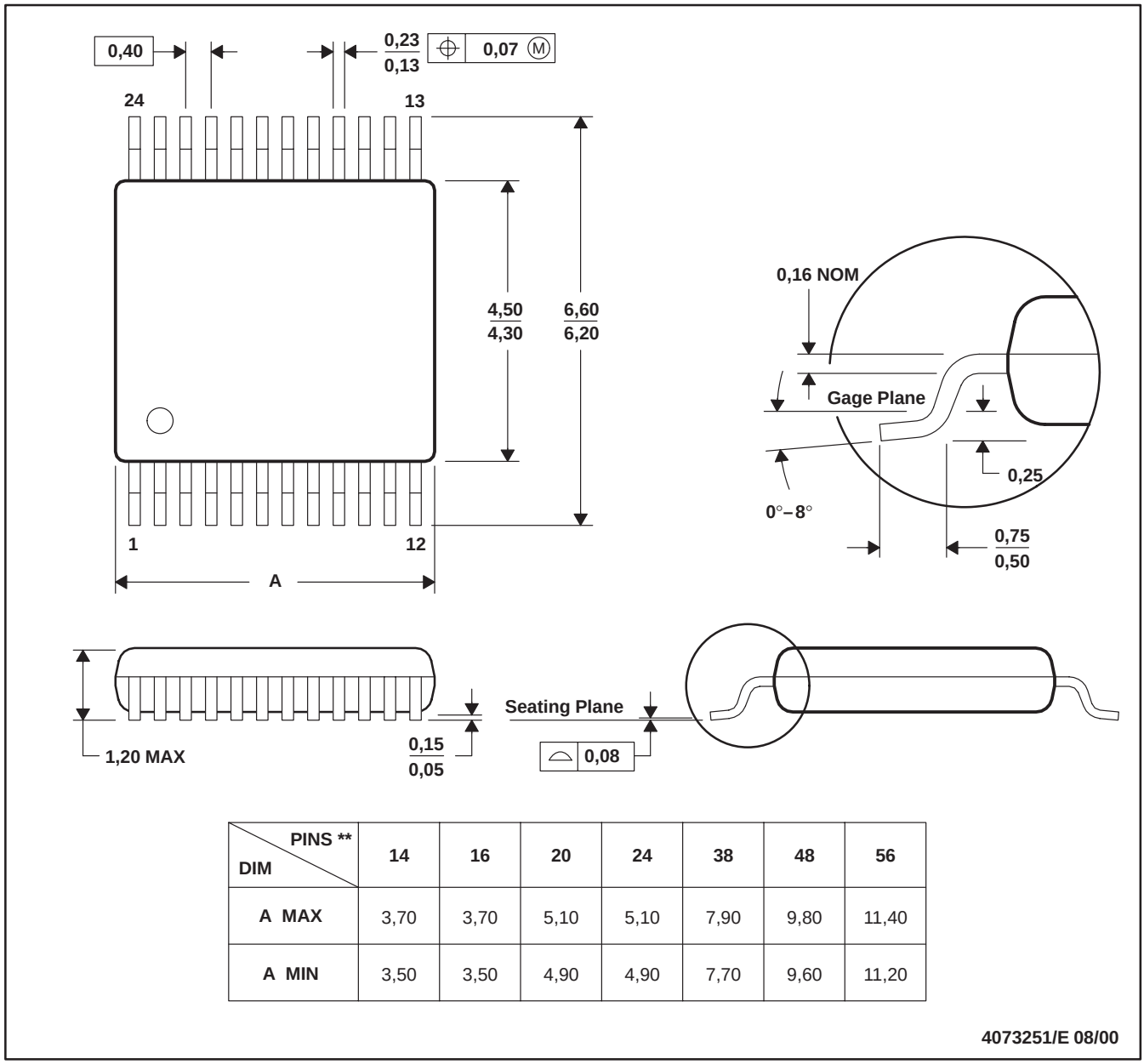


DIM \ PINS **	48	56	64
A MAX	12,60	14,10	17,10
A MIN	12,40	13,90	16,90

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold protrusion not to exceed 0,15.
D. Falls within JEDEC MO-153

DGV (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

24 PINS SHOWN



DIM \ PINS **	14	16	20	24	38	48	56
A MAX	3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	7,70	9,60	11,20

4073251/E 08/00

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

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