

LMV331 SINGLE, LMV393 DUAL, LMV339 QUAD GENERAL-PURPOSE LOW-VOLTAGE COMPARATORS

SLCS136L – AUGUST 1999 – REVISED JULY 2004

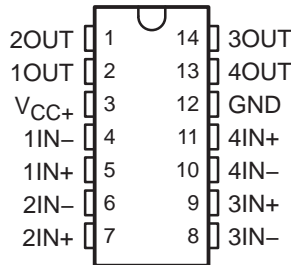
- **2.7-V and 5-V Performance**
- **Low Supply Current:**
LMV331 . . . 60 μ A Typ
LMV393 . . . 100 μ A Typ
LMV339 . . . 170 μ A Typ
- **Input Common-Mode Voltage Range Includes Ground**
- **Low Output Saturation Voltage . . . 200 mV Typ**
- **Open-Collector Output for Maximum Flexibility**

description/ordering information

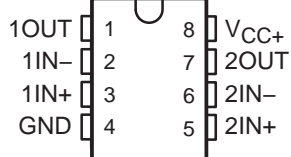
The LMV393 and LMV339 devices are low-voltage (2.7 V to 5.5 V) versions of the dual and quad comparators, LM393 and LM339, which operate from 5 V to 30 V. The LMV331 is the single-comparator version.

The LMV331, LMV339, and LMV393 are the most cost-effective solutions for applications where low-voltage operation, low power, space saving, and price are the primary specifications in circuit design for portable consumer products. These devices offer specifications that meet or exceed the familiar LM339 and LM393 devices at a fraction of the supply current.

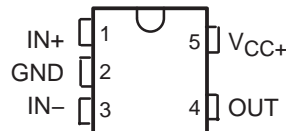
LMV339 . . . D OR PW PACKAGE
(TOP VIEW)



LMV393 . . . D, DDU, DGK, OR PW PACKAGE
(TOP VIEW)



LMV331 . . . DBV OR DCK PACKAGE
(TOP VIEW)



ORDERING INFORMATION

T _A		PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING‡
-40°C to 85°C	Single	SC-70 (DCK)	Reel of 3000	LMV331DCKR	R2_
			Reel of 250	LMV331DCKT	
		SOT23-5 (DBV)	Reel of 3000	LMV331DBVR	R11_
			Reel of 250	LMV331DBVT	
	Dual	MSOP/VSSOP (DGK)	Reel of 2500	LMV393DGKR	R9R
			Tube of 75	LMV393ID	MV393I
		SOIC (D)	Reel of 2500	LMV393IDR	
			TSSOP (PW)	Tube of 90	LMV393IPW
		Reel of 2000		LMV393IPWR	
		VSSOP (DDU)	Reel of 2000	LMV393IDDUR	RABR
	Quad	SOIC (D)	Tube of 50	LMV339ID	LMV339I
			Reel of 2500	LMV339IDR	
TSSOP (PW)		Tube of 150	LMV339IPW	MV339I	
		Reel of 2000	LMV339IPWR		

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

‡ DBV/DCK: The actual top-side marking has one additional character that designates the assembly/test site.

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS
INSTRUMENTS**

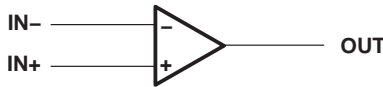
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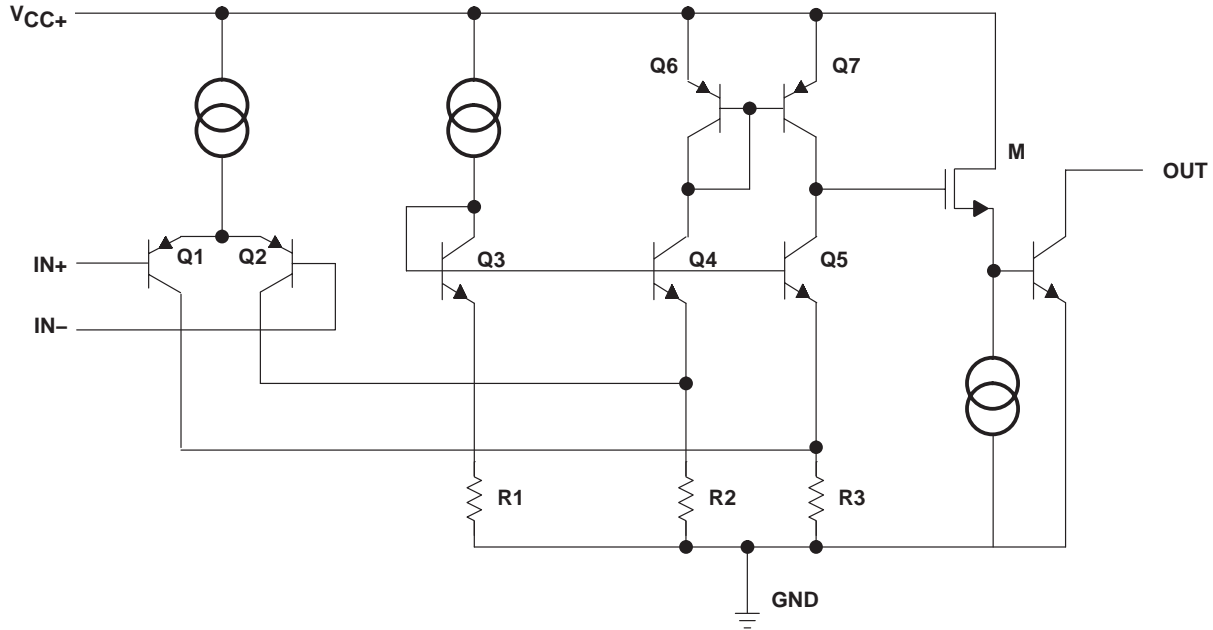
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symbol (each comparator)



simplified schematic



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

Supply voltage, V_{CC+} (see Note 1)	5.5 V
Differential input voltage, V_{ID} (see Note 2)	± 5.5 V
Input voltage range, V_I (either input)	0 V to 5.5 V
Package thermal impedance, θ_{JA} (see Notes 3 and 4):	
D (8-pin) package	97°C/W
D (14-pin) package	86°C/W
DBV package	206°C/W
DCK package	252°C/W
DDU package	TBD°C/W
DGK package	172°C/W
PW (8-pin) package	149°C/W
PW (14-pin) package	113°C/W
Operating virtual junction temperature, T_J	150°C
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. All voltage values (except differential voltages and V_{CC+} specified for the measurement of I_{OS}) are with respect to the network GND.
 2. Differential voltages are at $IN+$ with respect to $IN-$.
 3. Maximum power dissipation is a function of $T_J(\max)$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\max) - T_A)/\theta_{JA}$. Selecting the maximum of 150°C can affect reliability.
 4. The package thermal impedance is calculated in accordance with JESD 51-7.

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recommended operating conditions

	MIN	MAX	UNIT
V _{CC+} Supply voltage (single-supply operation)	2.7	5.5	V
V _{OUT} Output voltage	V _{CC+} + 0.3		V
T _A Operating free-air temperature	-40	85	°C

electrical characteristics at specified free-air temperature, V_{CC+} = 2.7 V, GND = 0 V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T _A	MIN	TYP	MAX	UNIT
V _{IO} Input offset voltage		25°C		1.7	7	mV
α _{V_{IO}} Average temperature coefficient of input offset voltage		-40°C to 85°C		5		μV/°C
I _{IB} Input bias current		25°C		10	250	nA
		-40°C to 85°C			400	
I _{IO} Input offset current		25°C		5	50	nA
		-40°C to 85°C			150	
I _O Output current (sinking)	V _O ≤ 1.5 V	25°C	5	23		mA
Output leakage current		25°C		0.003		μA
		-40°C to 85°C			1	
V _{ICR} Common-mode input voltage range		25°C	-0.1 to 2			V
V _{SAT} Saturation voltage	I _O ≤ 1 mA	25°C		200		mV
I _{CC} Supply current	LMV331	25°C		40	100	μA
	LMV393 (both comparators)	25°C		70	140	
	LMV339 (all four comparators)	25°C		140	200	

switching characteristics, T_A = 25°C, V_{CC+} = 2.7 V, R_L = 5.1 kΩ, GND = 0 V (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TYP	UNIT
t _{PHL} Propagation delay, high- to low-level output switching	Input overdrive = 10 mV	1000	ns
	Input overdrive = 100 mV	350	
t _{PLH} Propagation delay, low- to high-level output switching	Input overdrive = 10 mV	500	ns
	Input overdrive = 100 mV	400	



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electrical characteristics at specified free-air temperature, $V_{CC+} = 5\text{ V}$, $GND = 0\text{ V}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage		25°C		1.7	7	mV
			-40°C to 85°C			9	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage		25°C		5		$\mu\text{V}/^\circ\text{C}$
I_{IB}	Input bias current		25°C		25	250	nA
			-40°C to 85°C			400	
I_{IO}	Input offset current		25°C		2	50	nA
			-40°C to 85°C			150	
I_O	Output current (sinking)	$V_O \leq 1.5\text{ V}$	25°C	10	84		mA
	Output leakage current		25°C		0.003		μA
			-40°C to 85°C			1	
V_{ICR}	Common-mode input voltage range		25°C	-0.1 to 4.2			V
A_{VD}	Large-signal differential voltage gain		25°C	20	50		V/mV
V_{SAT}	Saturation voltage	$I_O \leq 4\text{ mA}$	25°C		200	400	mV
			-40°C to 85°C			700	
I_{CC}	Supply current	LMV331	25°C		60	120	μA
			-40°C to 85°C			150	
		LMV393 (both comparators)	25°C		100	200	
			-40°C to 85°C			250	
		LMV339 (all four comparators)	25°C		170	300	
			-40°C to 85°C			350	

switching characteristics, $T_A = 25^\circ\text{C}$, $V_{CC+} = 5\text{ V}$, $R_L = 5.1\text{ k}\Omega$, $GND = 0\text{ V}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	TYP	UNIT
t_{PHL}	Propagation delay, high- to low-level output switching	Input overdrive = 10 mV	600	ns
		Input overdrive = 100 mV	200	
t_{PLH}	Propagation delay, low- to high-level output switching	Input overdrive = 10 mV	450	ns
		Input overdrive = 100 mV	300	



PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
LMV331IDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV331IDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV331IDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV331IDCKT	ACTIVE	SC70	DCK	5	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-260C-UNLIM
LMV339ID	ACTIVE	SOIC	D	14	50	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LMV339IDR	ACTIVE	SOIC	D	14	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LMV339IPW	ACTIVE	TSSOP	PW	14	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LMV339IPWR	ACTIVE	TSSOP	PW	14	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LMV393ID	ACTIVE	SOIC	D	8	75	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LMV393IDDUR	ACTIVE	VSSOP	DDU	8	3000	Pb-Free (RoHS)	CU NIPDAU	Level-1-260C-UNLIM
LMV393IDGKR	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
LMV393IDR	ACTIVE	SOIC	D	8	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
LMV393IPW	ACTIVE	TSSOP	PW	8	150	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
LMV393IPWR	ACTIVE	TSSOP	PW	8	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM

⁽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.

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

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" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

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

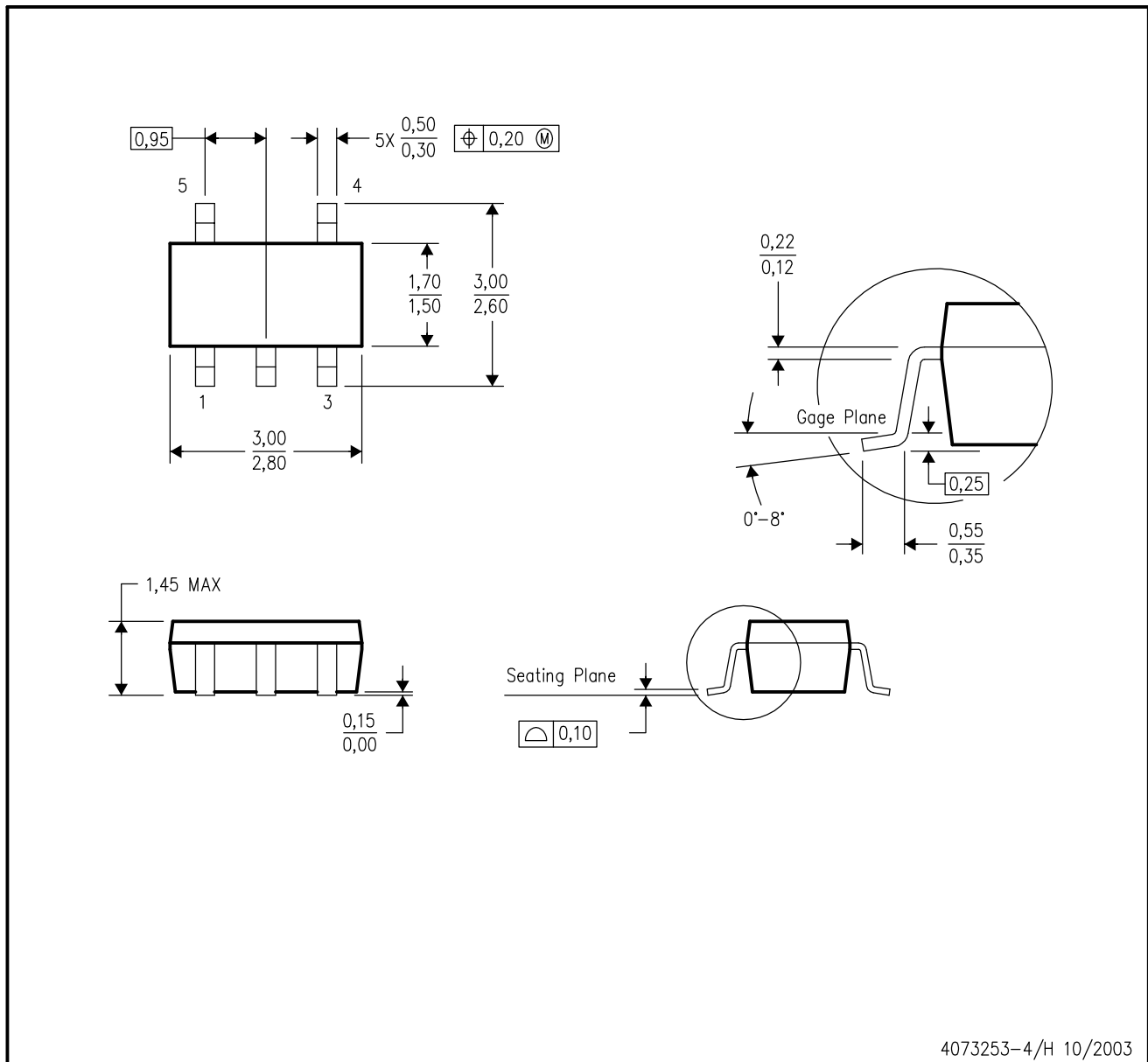
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DBV (R-PDSO-G5)

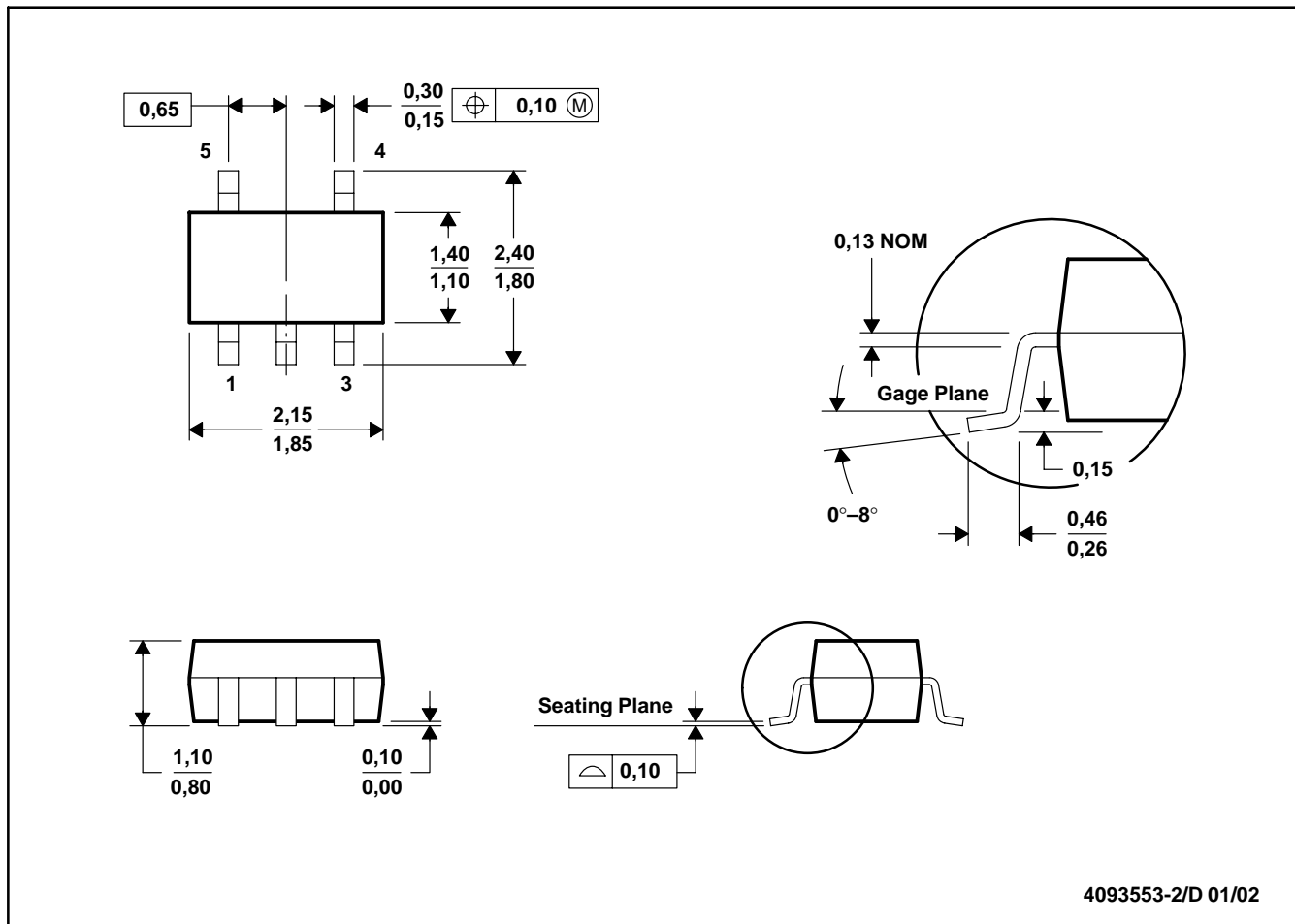
PLASTIC SMALL-OUTLINE PACKAGE



- 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.
 - D. Falls within JEDEC MO-178 Variation AA.

DCK (R-PDSO-G5)

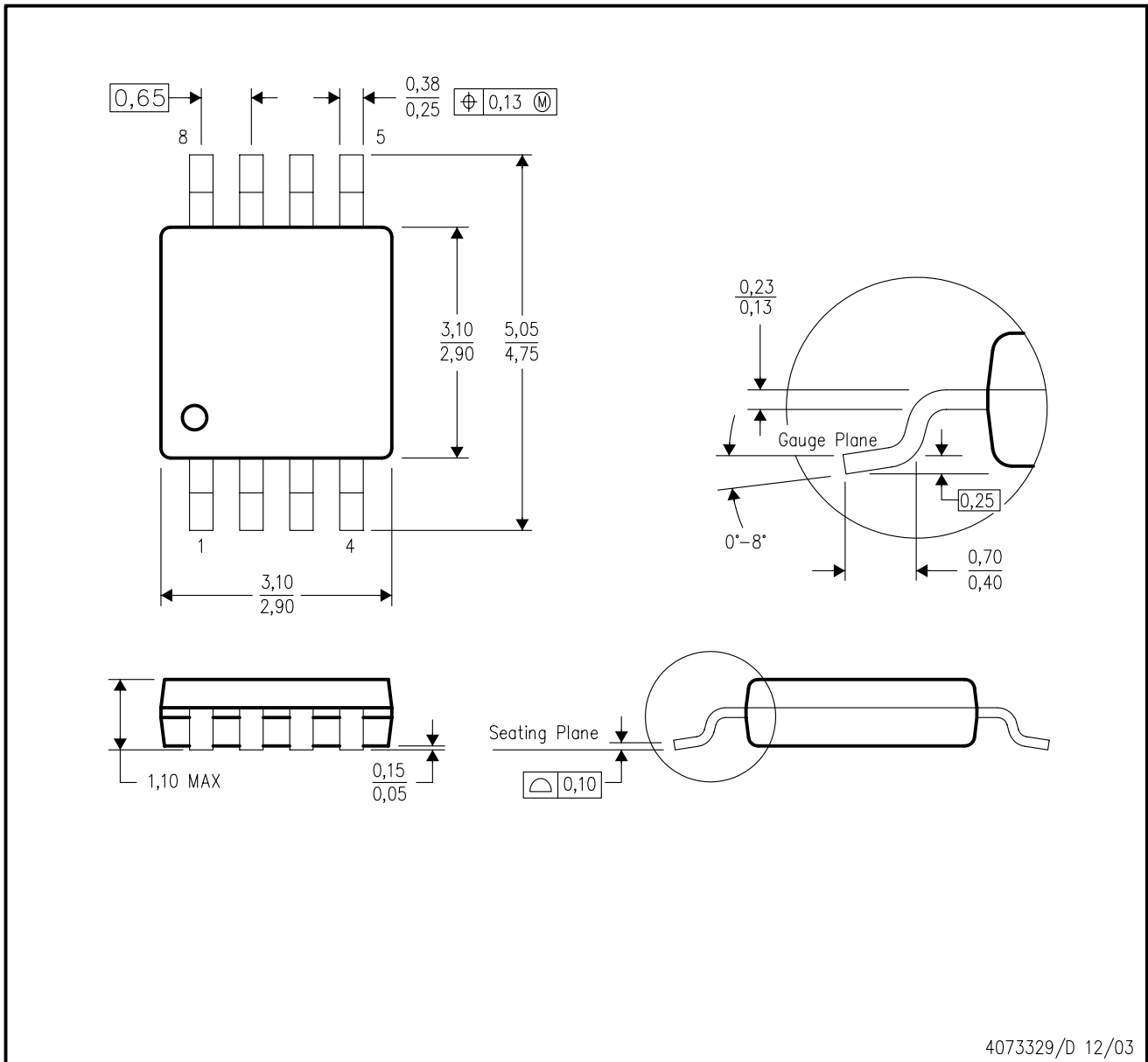
PLASTIC SMALL-OUTLINE PACKAGE



- 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.
 D. Falls within JEDEC MO-203

DGK (S-PDSO-G8)

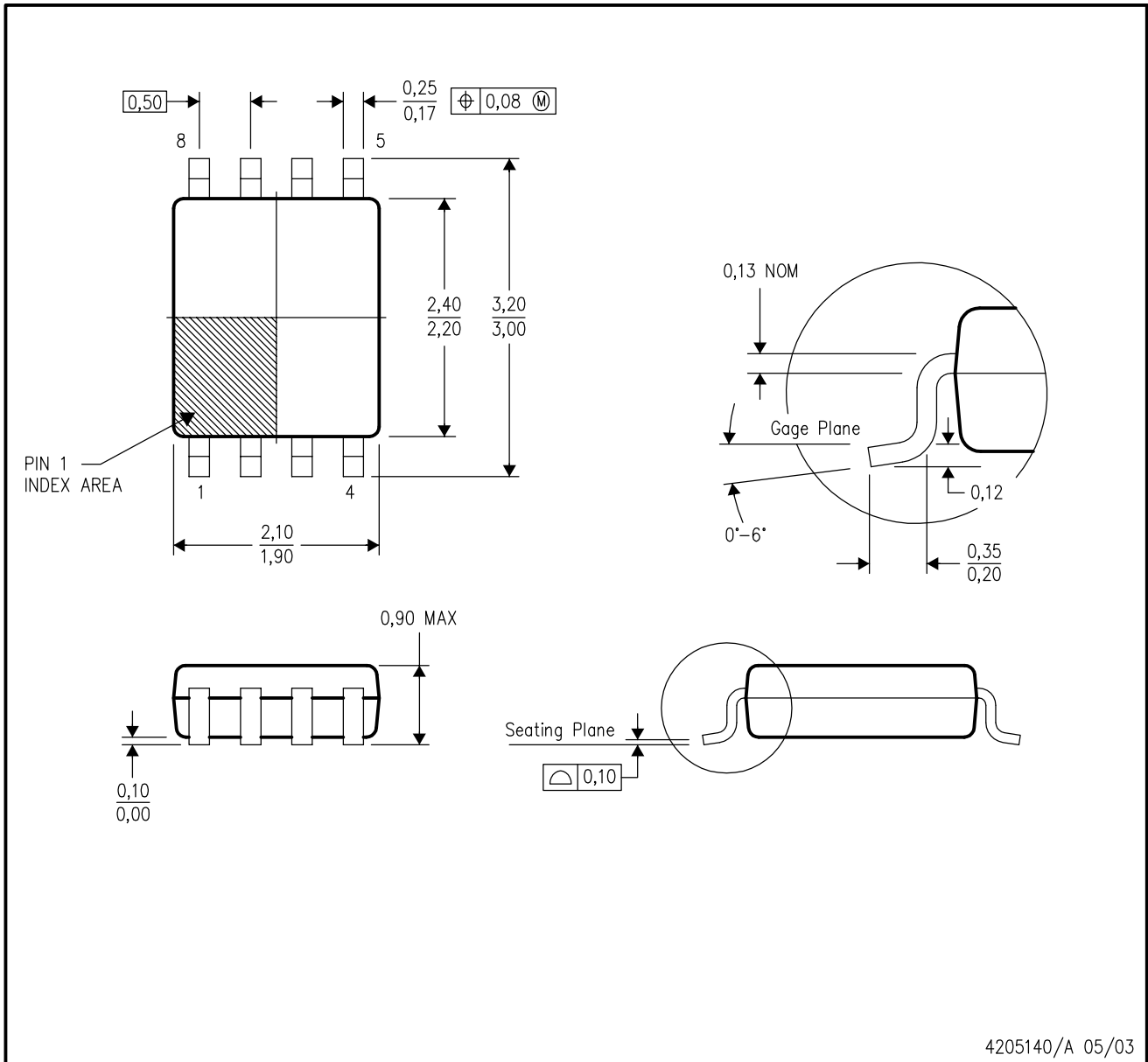
PLASTIC SMALL-OUTLINE PACKAGE



- 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.
 - D. Falls within JEDEC MO-187 variation AA.

DDU (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- 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.
 - D. Falls within JEDEC MO-187 variation CA.

D (R-PDSO-G14)

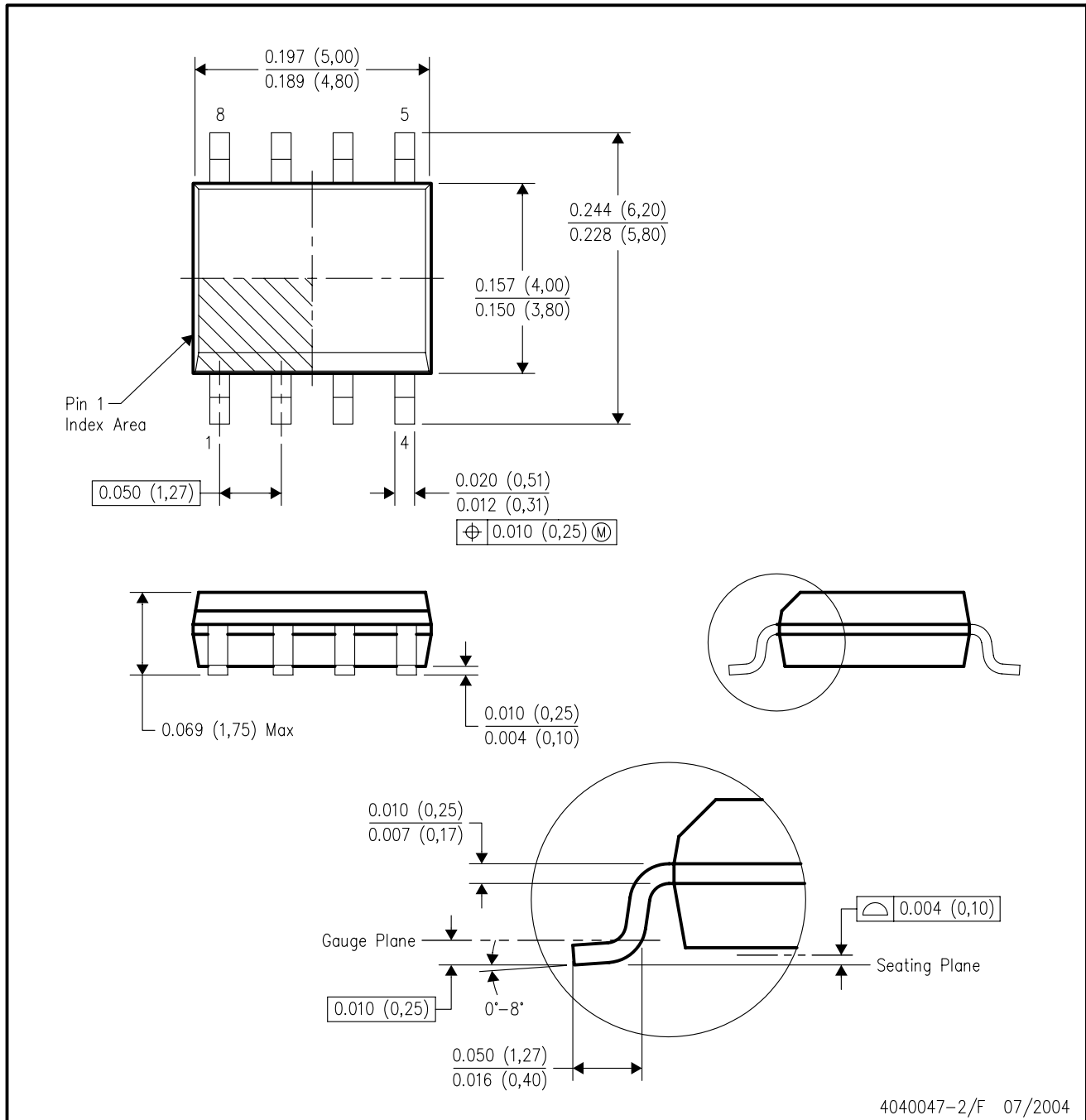
PLASTIC SMALL-OUTLINE PACKAGE



- 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 variation AB.

D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- 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 variation AA.

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



- 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.
 D. Falls within JEDEC MO-153

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