DS14C238 Single Supply TIA/EIA-232 4 x 4 Driver/Receiver

Check for Samples: DS14C238

FEATURES

- **Conforms to TIA/EIA-232-E and CCITT V.28**
- **Internal DC-DC Converter**
- **Operates with Single +5V Supply**
- **Low Power Requirement—I_{CC} 10 mA max**
- **Internal Driver Slew Rate Control**
- **Receiver Noise Filtering**
- **Operates Above 120 kbits/sec**
- **Direct Replacement for MAX238**

DESCRIPTION

The DS14C238 is a four driver, four receiver device which conforms to the TIA/EIA-232-E standard and CCITT V.28 recommendations. This device eliminates ±12V supplies by employing an internal DC-DC converter to generate the necessary output levels from a single +5V supply. Driver slew rate control and receiver noise filtering have also been internalized to eliminate the need for external slew rate control and noise filtering capacitors.

Connection Diagram

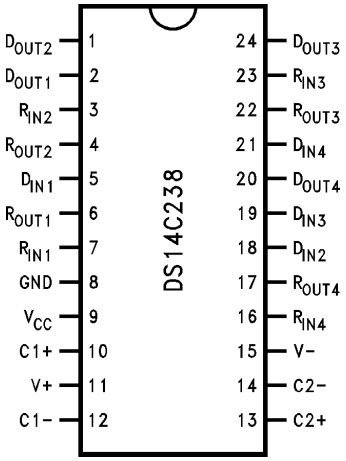
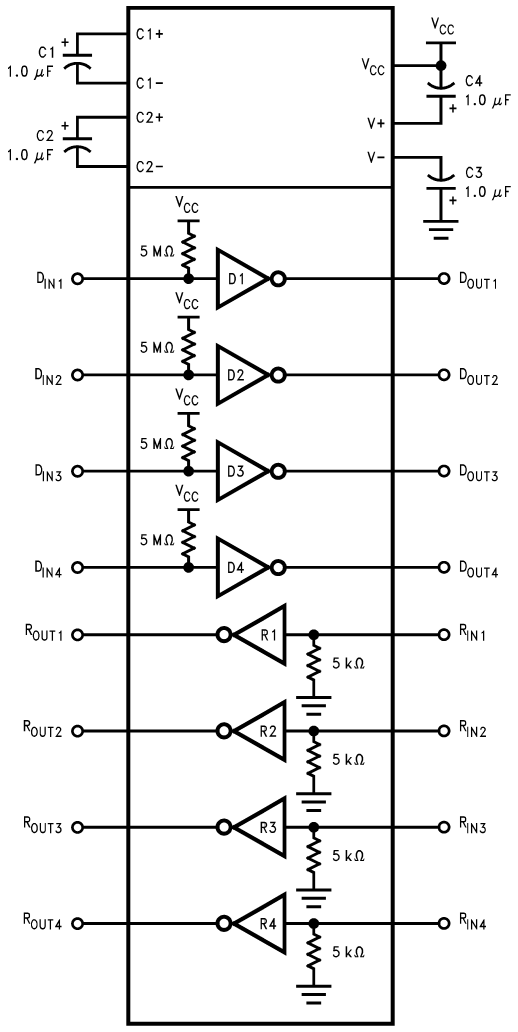


Figure 1. Top View
See Package Number DW0024B

Functional Diagram



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings[1][2]

Supply Voltage (V_{CC})		−0.3V to +6V
V+ Pin		(V_{CC} −0.3V) to +15V
V− Pin		+0.3V to −15V
Driver Input Voltage		−0.3V to (V_{CC} +0.3V)
Driver Output Voltage		(V+ +0.3V) to (V− −0.3V)
Receiver Input Voltage		±30V
Receiver Output Voltage		−0.3V to (V_{CC} +0.3V)
Junction Temperature		+150°C
Maximum Package Power Dissipation @ +25°C[3]	DW Package	1400 mW
Storage Temp. Range		−65°C to +150°C
Lead Temp. (Soldering, 4 Seconds)		+260°C
Short Circuit Duration (D_{OUT})		Continuous
ESD Rating (HBM, 1.5 kΩ, 100 pF)		≥ 2.0 kV

(1) "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics" specify conditions for device operation.
(2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/ Distributors for availability and specifications.
(3) Ratings apply to ambient temperature at +25°C. Above this temperature derate: DW package 13.5 mW/°C.

Recommended Operating Conditions

		Min	Max	Units
Supply Voltage, V_{CC}		4.5	5.5	V
Operating Free Air Temp. (T_A)	DS14C238	0	+70	°C

Electrical Characteristics[1]

Over recommended operating conditions, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ[2]	Max	Units
DEVICE CHARACTERISTICS						
V+	Positive Power Supply	R_L = 3 kΩ, C1–C4 = 1.0 µF, D_{IN} = 0.8V		9.0		V
V−	Negative Power Supply	R_L = 3 kΩ, C1–C4 = 1.0 µF, D_{IN} = 2.0V		−8.0		V
I_{CC}	Supply Current (V_{CC})	No Load		7.0	10	mA
DRIVER CHARACTERISTICS						
V_{IH}	High Level Input Voltage		2.0		V_{CC}	V
V_{IL}	Low Level Input Voltage		GND		0.8	V
I_{IH}	High Level Input Current	V_{IN} ≥ 2.0V	−10		+10	µA
I_{IL}	Low Level Input Current	V_{IN} ≤ 0.8V	−10		+10	µA
V_{OH}	High Level Output Voltage	R_L = 3 kΩ	5.0	7.4		V
V_{OL}	Low Level Output Voltage			−6.3	−5.0	V
I_{OS}+	Output High Short Circuit Current	V_O = 0V, V_{IN} = 0.8V	[3]−30	−15	−5.0	mA
I_{OS}−	Output Low Short Circuit Current	V_O = 0V, V_{IN} = 2.0V	5.0	12	30	mA
R_O	Output Resistance	−2V ≤ V_O ≤ +2V, V_{CC} = GND = 0V	300			Ω
RECEIVER CHARACTERISTICS						
V_{TH}	Input High Threshold Voltage			1.9	2.4	V
V_{TL}	Input Low Threshold Voltage		0.8	1.5		V
V_{HY}	Hysteresis		0.2	0.4	1.0	V
R_{IN}	Input Resistance		3.0	4.5	7.0	kΩ
I_{IN}	Input Current	V_{IN} = +15V	2.14	3.8	5.0	mA
		V_{IN} = +3V	0.43	0.6	+1.0	mA
		V_{IN} = −3V	−1.0	−0.6	−0.43	mA
		V_{IN} = −15V	−5.0	−3.8	−2.14	mA
V_{OH}	High Level Output Voltage	V_{IN} = −3V, I_O = −3.2 mA	3.5	4.5		V
		V_{IN} = −3V, I_O = −20 µA	4.0	4.9		V
V_{OL}	Low Level Output Voltage	V_{IN} = +3V, I_O = +2.0 mA		0.25	0.4	V

(1) Current into device pins is defined as positive. Current out of device pins is defined as negative. All voltages are referenced to ground unless otherwise specified.
(2) All typicals are given for V_{CC} = 5.0V and T_A = +25°C.
(3) I_{OS}+ and I_{OS}− values are for one output at a time. If more than one output is shorted simultaneously, the device power dissipation may be exceeded.

Switching Characteristics[1]

Over recommended operating conditions, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ[2]	Max	Units
DRIVER CHARACTERISTICS						
t_{PLH}	Propagation Delay LOW to HIGH	R_L = 3 kΩ		0.7	4.0	µs
t_{PHL}	Propagation Delay HIGH to LOW	C_L = 50 pF		0.6	4.0	µs
t_{sk}	Skew $\lvert t_{PLH} - t_{PHL} \rvert$	(Figure 2, Figure 3)		0.1	1.0	µs
SR1	Output Slew Rate	R_L = 3kΩ to 7 kΩ, C_L = 50 pF	4.0	15	30	V/µs
SR2	Output Slew Rate	R_L = 3 kΩ, C_L = 2500 pF	3.0	5.0		V/µs
RECEIVER CHARACTERISTICS						
t_{PLH}	Propagation Delay LOW to HIGH	Input Pulse Width > 10 µs		2.0	6.5	µs
t_{PHL}	Propagation Delay HIGH to LOW	C_L = 50 pF		2.8	6.5	µs
t_{SK}	Skew $\lvert t_{PLH} - t_{PHL} \rvert$	(Figure 4, Figure 5)		0.8	2.0	µs
t_{NW}	Noise Pulse Width Rejected	(Figure 4, Figure 5)		2.5	1.0	µs

(1) Receiver AC input waveform for test purposes: $t_r = t_f$ = 200 ns, V_{IH} = 3V, V_{IL} = −3V, f = 64 kHz (128 kbits/sec). Driver AC input waveform for test purposes: $t_r = t_f \leq$ 10 ns, V_{IH} = 3V, V_{IL} = 0V, f = 64 kHz (128 kbits/sec).
(2) All typicals are given for V_{CC} = 5.0V and T_A = +25°C.

Parameter Measurement Information

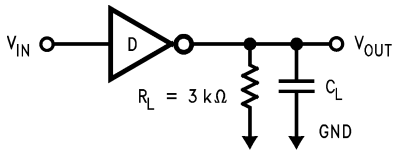


Figure 2. Driver Load Circuit

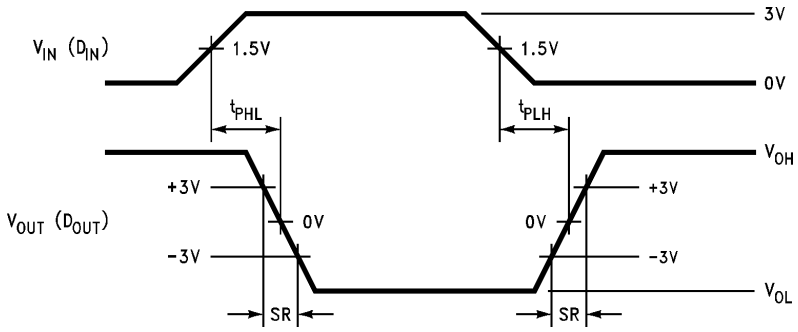


Figure 3. Driver Switching Waveform

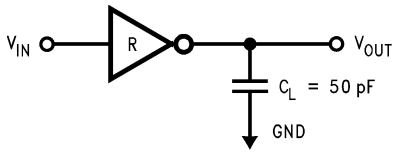


Figure 4. Receiver Load Circuit

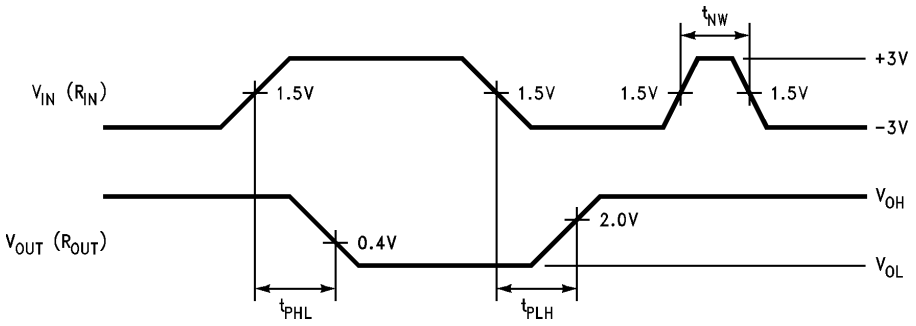


Figure 5. Receiver Propagation Delays and Noise Rejection

PIN DESCRIPTIONS

V_{CC} (pin 9)— Power supply pin for the device,

+5V (±10%).

V+ (pin 11)—Positive supply for TIA/EIA-232-E drivers. Recommended external capacitor: C4 = 1.0 µF (6.3V). This supply is not intended to be loaded externally.

V− (pin 15)—Negative supply for TIA/EIA-232-E drivers. Recommended external capacitor: C3 = 1.0 µF (16V). This supply is not intended to be loaded externally.

C1+, C1− (pins 10 and 12)— External capacitor connection pins. Recommended capacitor – 1.0 µF (6.3V).

C2+, C2− (pins 13 and 14)— External Capacitor connection pins. Recommended capacitor – 1.0 µF (16V).

D_{IN} 1–4 (pins 5, 18, 19, and 21)— Driver input pins are TTL/CMOS compatible. Inputs of unused drivers may be left open, an internal pull-up resistor (500 kΩ minimum, typically 5 MΩ) pulls input to V_{CC}. Output will be LOW for open inputs.

D_{OUT} 1–4 (pins 2, 1, 24, and 20)— Driver output pins conform to TIA/EIA-232-E levels.

R_{IN1} 1–4 (pins 3, 7, 23, and 16)— Receiver input pins accept TIA/EIA-232-E input voltages (±15V). Receivers feature a noise filter and guaranteed hysteresis of 200 mV. Unused receiver input pins may be left open. Internal input resistor (5 kΩ) pulls input LOW, providing a failsafe HIGH output.

R_{OUT} 1–4 (pins 4, 6, 22, and 17)— Receiver output pins are TTL/CMOS compatible. Receiver output HIGH voltage is specified for both CMOS and TTL load conditions.

GND (pin 8)—Ground Pin.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
DS14C238WMX	ACTIVE	SOIC	DW	24	1000	TBD	Call TI	Call TI	0 to 70	DS14C238WM	Samples
DS14C238WMX/NOPB	ACTIVE	SOIC	DW	24	1000	Green (RoHS & no Sb/Br)	CU SN	Level-3-260C-168 HR	0 to 70	DS14C238WM	Samples

(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), Pb-Free (RoHS Exempt), 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.
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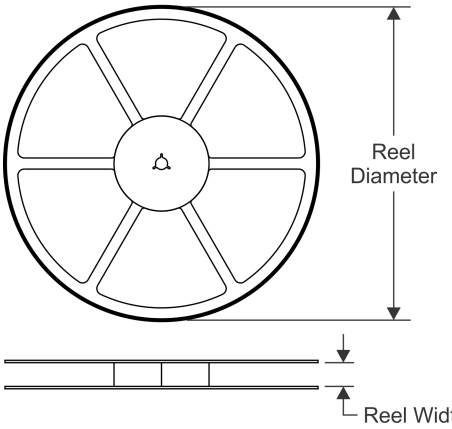
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & 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.

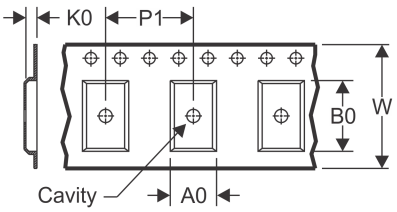
(4) Only one of markings shown within the brackets will appear on the physical device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

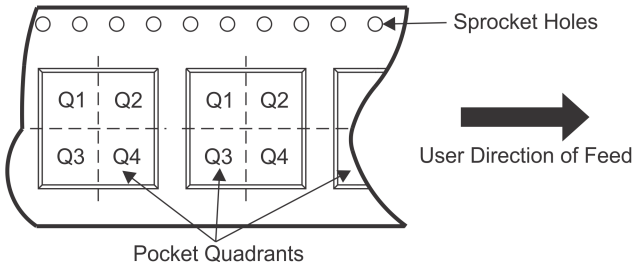


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

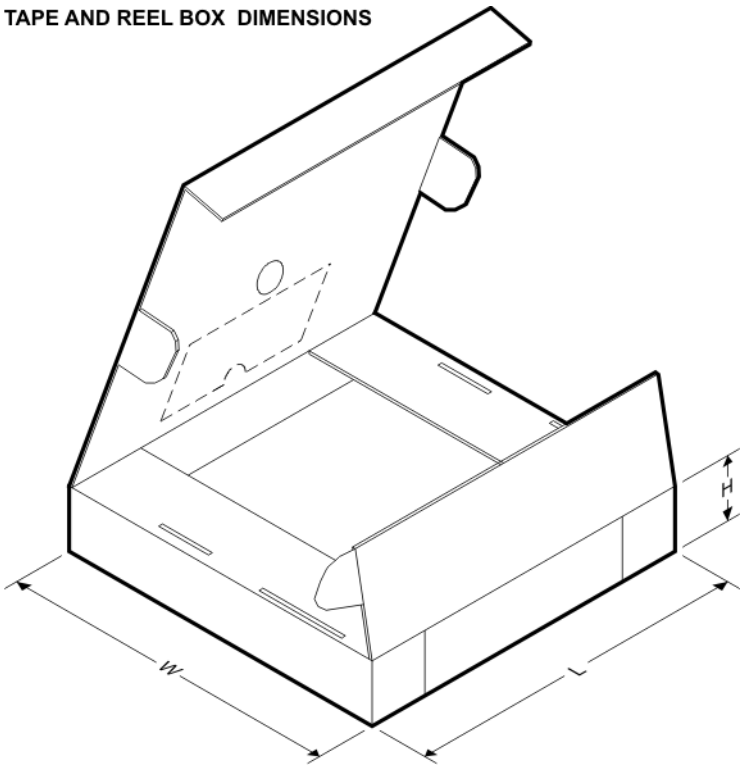
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DS14C238WMX	SOIC	DW	24	1000	330.0	24.4	10.8	15.9	3.2	12.0	24.0	Q1
DS14C238WMX/NOPB	SOIC	DW	24	1000	330.0	24.4	10.8	15.9	3.2	12.0	24.0	Q1

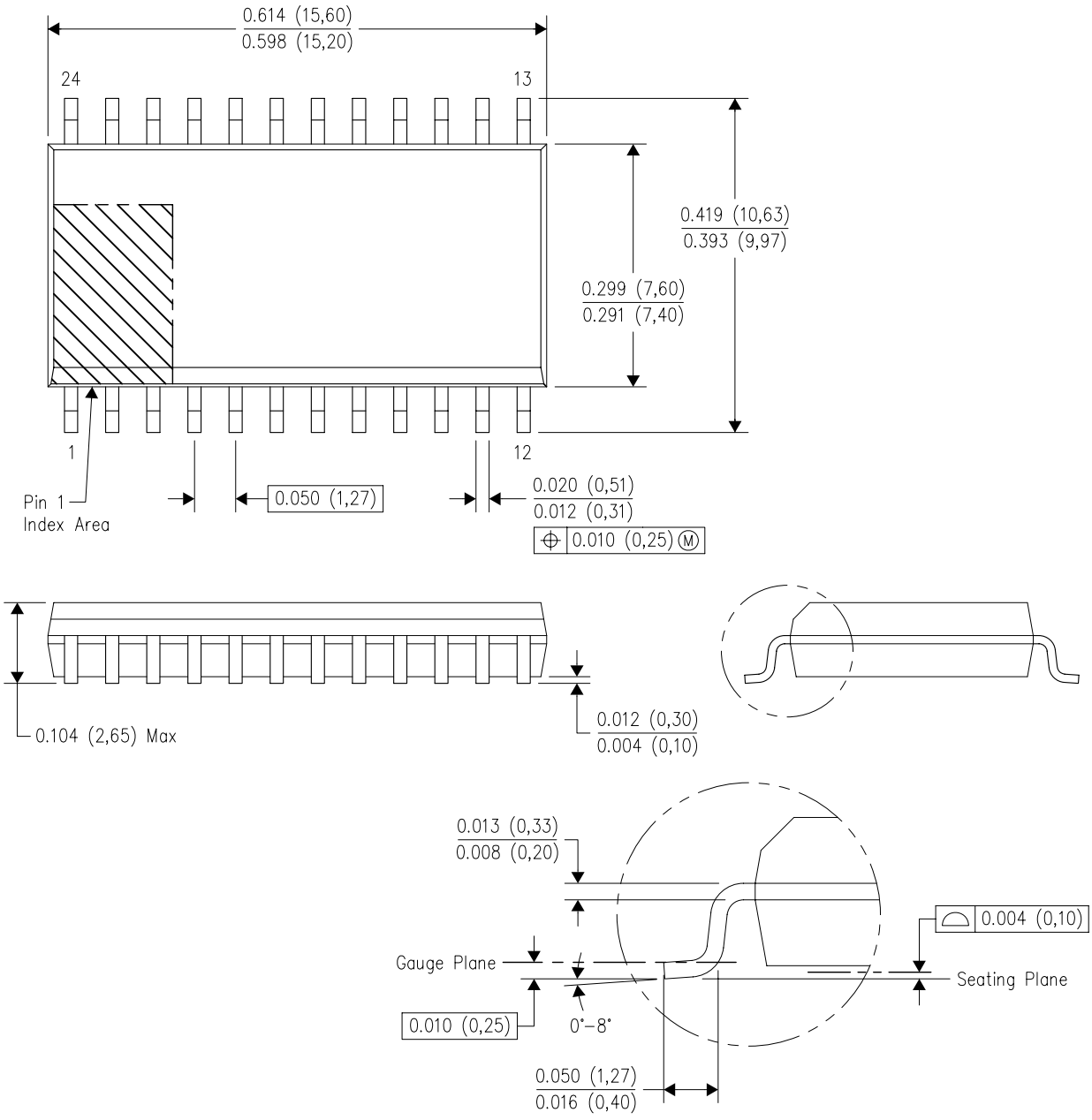
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DS14C238WMX	SOIC	DW	24	1000	367.0	367.0	45.0
DS14C238WMX/NOPB	SOIC	DW	24	1000	367.0	367.0	45.0

DW (R–PDSO–G24) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M–1994.
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–013 variation AD.

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