8-BIT PARALLEL IN/OUT DARLINGTON SOURCE DRIVER WITH LATCH

Check for Samples: TLC59213, TLC59213A

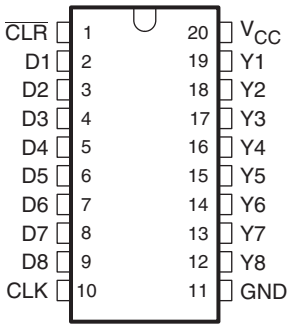
FEATURES

- **Output Current on Each Channel (I_{OUT} Max = –500 mA)**
- **$V_{CE(sus)}$ = 13.2 V**
- **Input Compatible With TTL/5-V CMOS**
- **Clear ($\overline{CLR}$) and Clock (CLK) TTL/CMOS Control Inputs**
- **CLR Control Input to Off the Output**
- **Darlington Source Driver**
- **Clock Input Up to 1 MHz**
- **Enhanced Hold Time (t_h) on TLC59213A**
- **Temperature Range: –40°C to 85°C**

APPLICATIONS

- **Lamp and Display (LED)**
- **Hammer**
- **Relay**

N OR PW PACKAGE
(TOP VIEW)



DESCRIPTION

The TLC59213 and TLC59213A are 8-bit source drivers with input latch with CLK input and $\overline{CLR}$ to set the output OFF. The TLC59213 and TLC59213A have large output source currents up to 500 mA with Darlington transistor and collectors tied to V_{CC}. These feature make the device optimum level of driving the matrix of ink jet printer head, LEDs, and the scan-side of resistor's matrix. The TLC59213 and TLC59213A differ only in the Data Hold Time Specification (t_h).

The clamp diode is between output and ground for switching inductive load.

All inputs are TTL/CMOS, which enable to any logic-level inputs such as MCU, CPU or SN74LV594 (serial to parallel) and the output enable LED matrix display. It can also be used with another device sink driver such as TLC59210, TLC59211 and TLC59212.

ORDERING INFORMATION(1)

T_A	PACKAGE(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube of 20	TLC59213IN	TLC59213IN
	TSSOP – PW	Reel of 2000	TLC59213IPWR	Y59213
	PDIP – N	Tube of 20	TLC59213AIN	TLC59213AIN
	TSSOP – PW	Reel of 2000	TLC59213AIPWR	Y59213A
		Reel of 250	TLC59213AIPWT	

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.

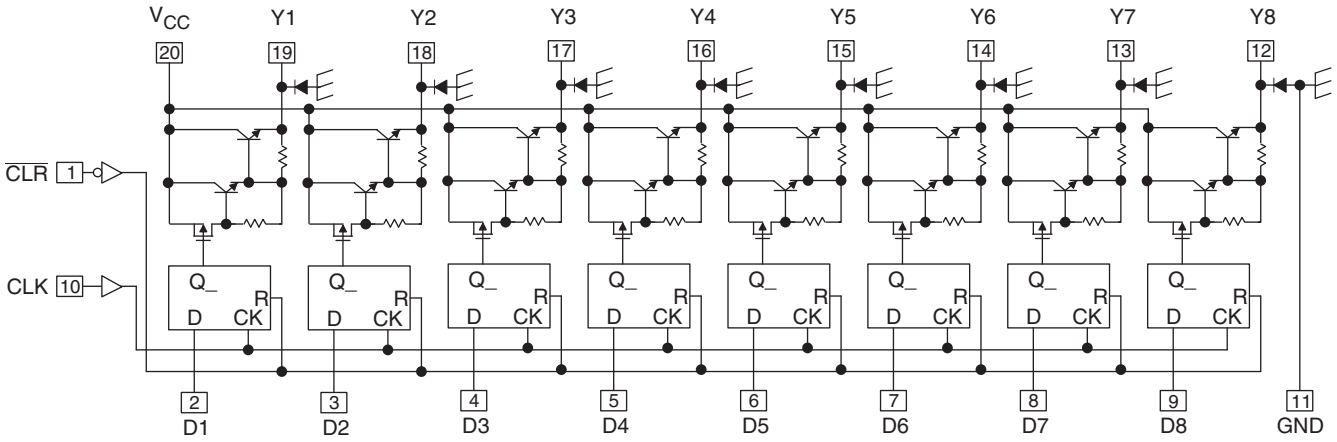
(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

FUNCTION TABLE (EACH LATCH)(1)

INPUTS			OUTPUT
$\overline{CLR}$	CLK	D	Y
L	X	X	Z (OFF)
H	↑	L	Z (OFF)
H	↑	H	H (ON)
H	L	X	Y_0
H	↓	X	Y_0

(1) L: Low-level
H: High-level
X: Irrelevant
↑: Rising edge
↓: Falling edge
Z : High-impedance (off)

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS(1)

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

			MIN	MAX	UNIT
V_{DD}	Supply voltage range		–0.5	15	V
V_I	Input voltage range		–0.5	V_{CC} + 0.5	V
	Collector-emitter voltage		–0.5	15	V
I_O	Peak output current			–500	mA
I_{IK}	Input clamp current	V_I < 0 V		–20	mA
I_{OK}	Output clamp current	V_O < 0 V		–500	mA
θ_{JA}	Package thermal impedance(2)	N package		69	°C/W
		PW package		83	
T_{stg}	Storage temperature range		–65	150	°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) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS

		CONDITIONS		MIN	MAX	UNIT
V_{CC}	Supply voltage			4.5	13.2	V
V_{IH}	High-level input voltage			2		V
V_{IL}	Low-level input voltage				0.8	V
I_O	Output current (8 channel)	N package	Duty cycle < 10%		400	mA
			Duty cycle < 50%		200	
		PW package	Duty cycle < 10%		350	
			Duty cycle < 50%		170	
T_A	Operating free-air temperature			–40	85	°C

ELECTRICAL CHARACTERISTICS

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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
I_{CEX}	Output leakage current	V_{CC} = 13.2 V, Outputs off				2	µA
$V_{CE(sus)}$	Output saturation voltage	I_{OUT} = –350 mA				2.35	V
		I_{OUT} = –225 mA				2.15	
		I_{OUT} = –100 mA				1.96	
I_I	Input current	V_{CC} = 13.2 V, V_I = 0 or 13.2 V				1	µA
V_f	Clamp forward voltage	I_f = –350 mA		–2			V
I_{CC}	Supply current	V_{CC} = 13.2 V, V_I = 0 or 13.2 V	All outputs OFF		4.6	13	mA
			All outputs ON		4.8	13	
C_I	Input capacitance					10	pF

TIMING REQUIREMENTS

over recommended operating free-air temperature range (unless otherwise noted), see Figure 3

PARAMETER				TEST CONDITIONS	MIN	MAX	UNIT
t_{su}	Setup time	D before CLK ↑			50		ns
		$\overline{CLR}$ high before CLK ↑			50		ns
t_h	Hold time	D after CLK ↑	TLC59213, TLC59213A	T_A = -40°C to 85°C	50		ns
			TLC59213	T_A = 0°C to 70°C	25		
			TLC59213A	T_A = 0°C to 70°C, V_{CC} = 4.5 V to 5.5 V	15		
				T_A = 0°C to 70°C, V_{CC} = 10.8 V to 13.2 V	19		
t_w	Pulse width	CLK, $\overline{CLR}$			100		ns

SWITCHING CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted), see Figure 3

PARAMETER		FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	T_A = 25°C			T_A = –40°C to 85°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
t_{PLH}	Propagation delay time, low-to-high level output	CLK	Y	RL = 25 Ω, C_L = 15 pF		107	200		250	ns
t_{PHL}	Propagation delay time, high-to-low level output	CLK	Y	RL = 25 Ω, C_L = 15 pF		111	200		250	ns
t_{PHLR}		$\overline{CLR}$	Y			104	200		250	

THERMAL INFORMATION

MAXIMUM OUTPUT CURRENT vs DUTY CYCLE

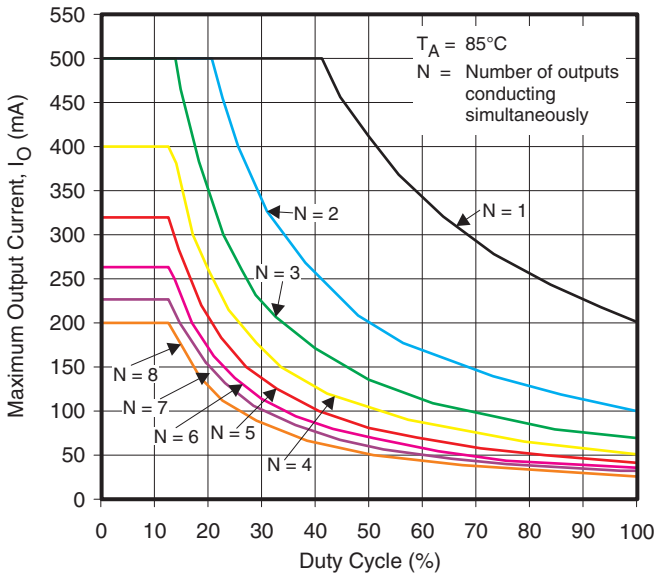


Figure 1. TSSOP (PW) PACKAGE

MAXIMUM OUTPUT CURRENT vs DUTY CYCLE

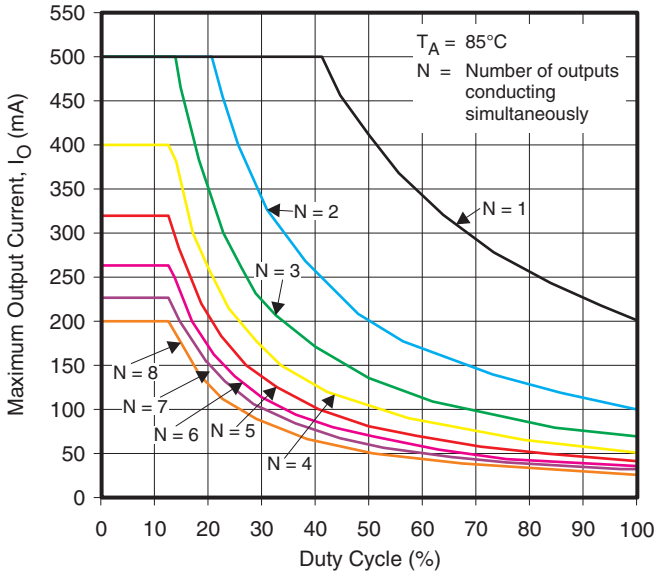
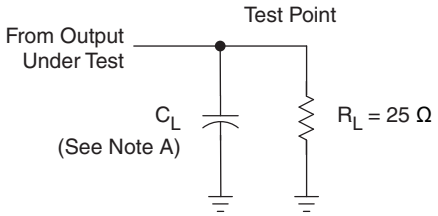
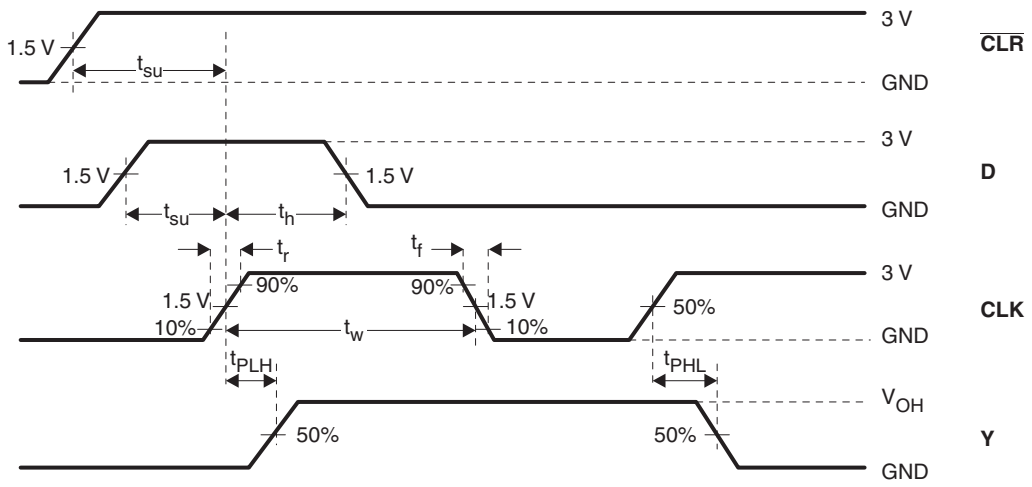


Figure 2. DIP (N) PACKAGE

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE WAVEFORMS

A. C_L includes probe and jig capacitance.

B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, and t_f ≤ 3 ns.

C. The outputs are measured one at a time with one transition per measurement.

Figure 3. Test Circuit and Voltage Waveforms

APPLICATION INFORMATION

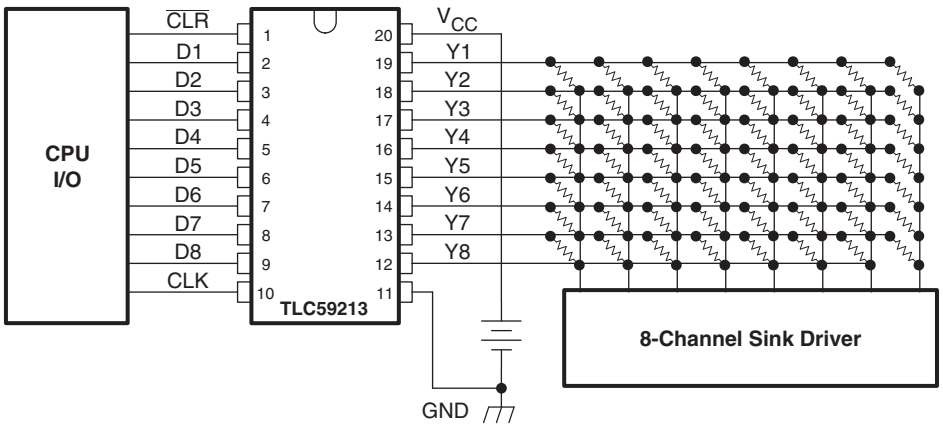


Figure 4. Example of LED Display Connection

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TLC59213AIN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC59213AIPWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLC59213AIPWT	PREVIEW	TSSOP	PW	20	250	TBD	Call TI	Call TI
TLC59213IN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
TLC59213IPWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

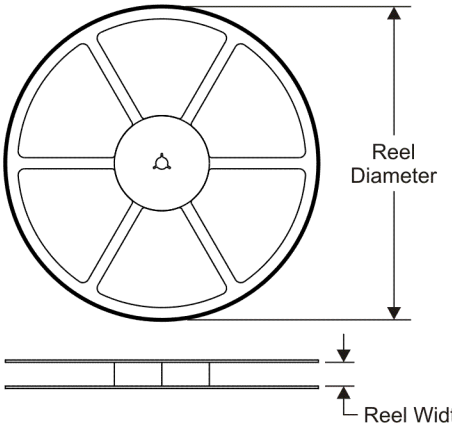
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, 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.
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.
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.
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)

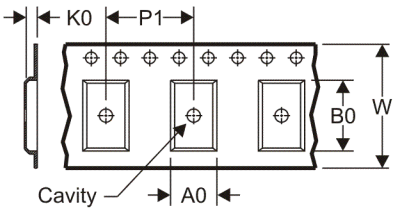
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

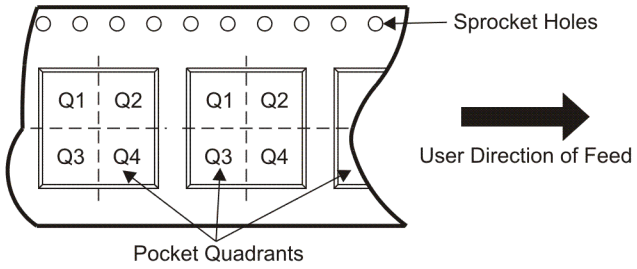


TAPE DIMENSIONS



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

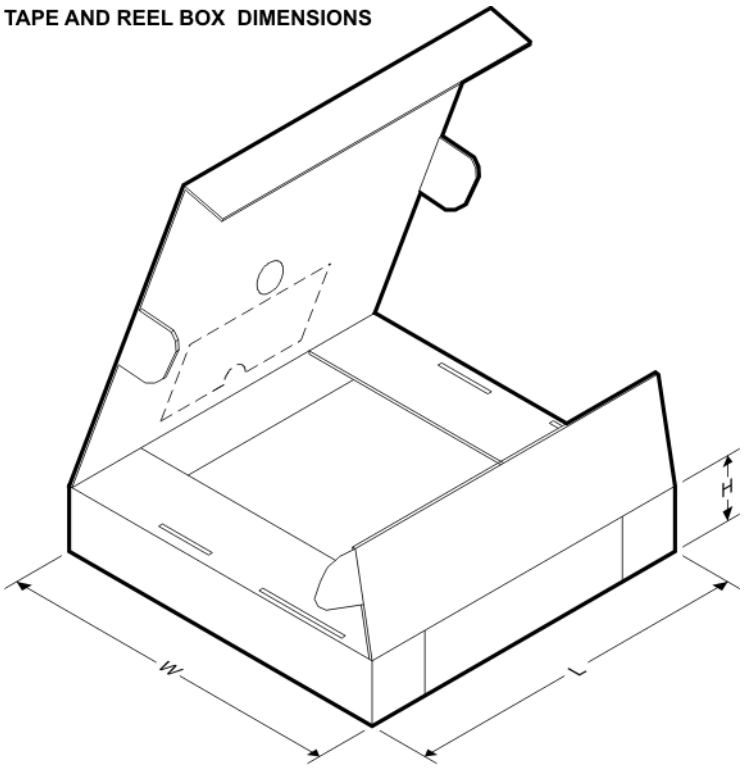
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TLC59213AIPWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
TLC59213AIPWT	TSSOP	PW	20	250	180.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
TLC59213IPWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

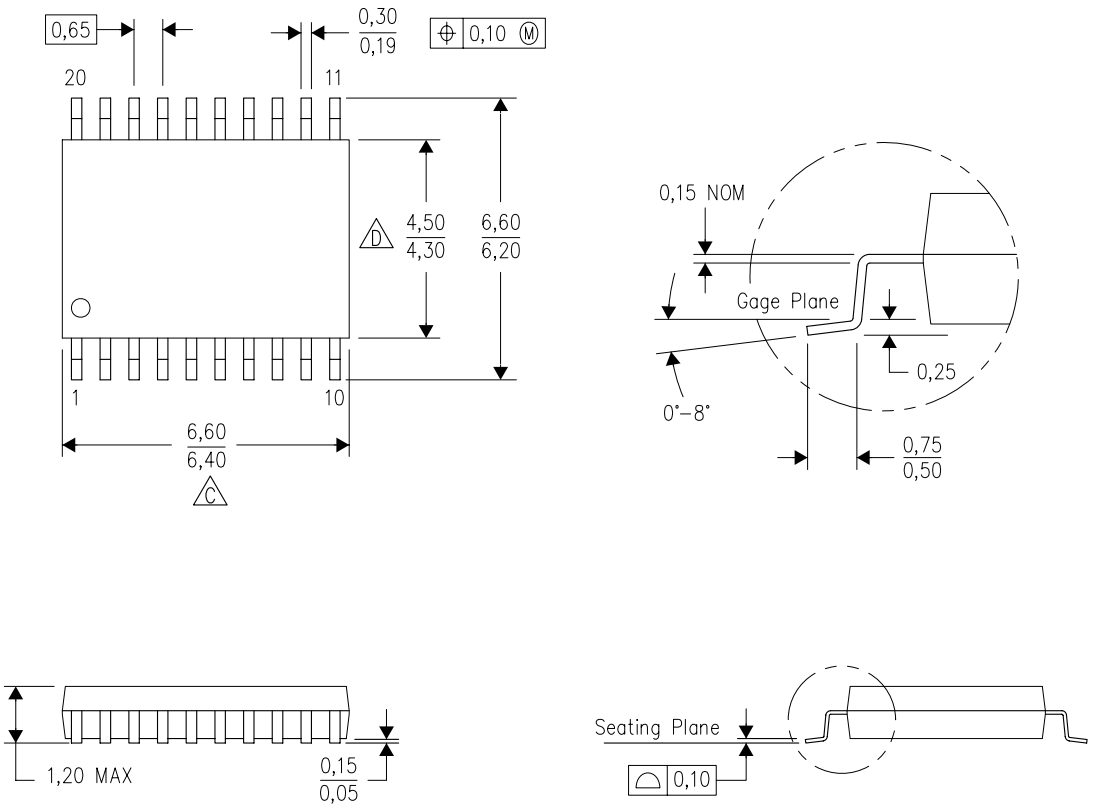
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLC59213AIPWR	TSSOP	PW	20	2000	346.0	346.0	33.0
TLC59213AIPWT	TSSOP	PW	20	250	190.5	212.7	31.8
TLC59213IPWR	TSSOP	PW	20	2000	346.0	346.0	33.0

PW (R–PDSO–G20) PLASTIC SMALL OUTLINE



4040064–5/G 02/11

NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
E. Falls within JEDEC MO–153

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Audio	www.ti.com/audio	Communications and Telecom	www.ti.com/communications
Amplifiers	amplifier.ti.com	Computers and Peripherals	www.ti.com/computers
Data Converters	dataconverter.ti.com	Consumer Electronics	www.ti.com/consumer-apps
DLP® Products	www.dlp.com	Energy and Lighting	www.ti.com/energy
DSP	dsp.ti.com	Industrial	www.ti.com/industrial
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Security	www.ti.com/security
Logic	logic.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Power Mgmt	power.ti.com	Transportation and Automotive	www.ti.com/automotive
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com	Wireless	www.ti.com/wireless-apps
RF/IF and ZigBee® Solutions	www.ti.com/lprf		
	TI E2E Community Home Page		e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265