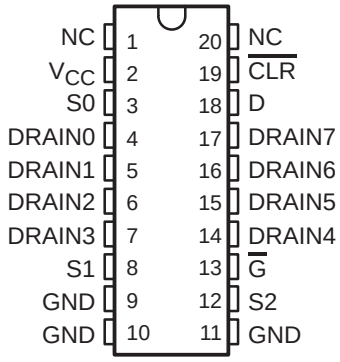
- **Low $r_{DS(on)}$ . . . 5 Ω Typical**
- **Avalanche Energy . . . 30 mJ**
- **Eight Power DMOS-Transistor Outputs of 150-mA Continuous Current**
- **500-mA Typical Current-Limiting Capability**
- **Output Clamp Voltage . . . 50 V**
- **Four Distinct Function Modes**
- **Low Power Consumption**

DW OR N PACKAGE
(TOP VIEW)



NC – No internal connection

description

This power logic 8-bit addressable latch controls open-drain DMOS-transistor outputs and is designed for general-purpose storage applications in digital systems. Specific uses include working registers, serial-holding registers, and decoders or demultiplexers. This is a multi-functional device capable of storing single-line data in eight addressable latches and 3-to-8 decoder or demultiplexer with active-low DMOS outputs.

Four distinct modes of operation are selectable by controlling the clear ($\overline{CLR}$) and enable ($\overline{G}$) inputs as enumerated in the function table. In the addressable-latch mode, data at the data-in (D) terminal is written into the addressed latch. The addressed DMOS-transistor output inverts the data input with all unaddressed DMOS-transistor outputs remaining in their previous states. In the memory mode, all DMOS-transistor outputs remain in their previous states and are unaffected by the data or address inputs. To eliminate the possibility of entering erroneous data in the latch, enable $\overline{G}$ should be held high (inactive) while the address lines are changing. In the 3-to-8 decoding or demultiplexing mode, the addressed output is inverted with respect to the D input and all other outputs are off. In the clear mode, all outputs are off and unaffected by the address and data inputs. When data is low for a given output, the DMOS-transistor output is off. When data is high, the DMOS-transistor output has sink-current capability.

FUNCTION TABLE

INPUTS			OUTPUT OF ADDRESSED DRAIN	EACH OTHER DRAIN	FUNCTION
$\overline{CLR}$	$\overline{G}$	D			
H	L	H	L	Q_{io}	Addressable Latch
H	L	L	H	Q_{io}	
H	H	X	Q_{io}	Q_{io}	Memory
L	L	H	L	H	8-Line Demultiplexer
L	L	L	H	H	
L	H	X	H	H	Clear

LATCH SELECTION TABLE

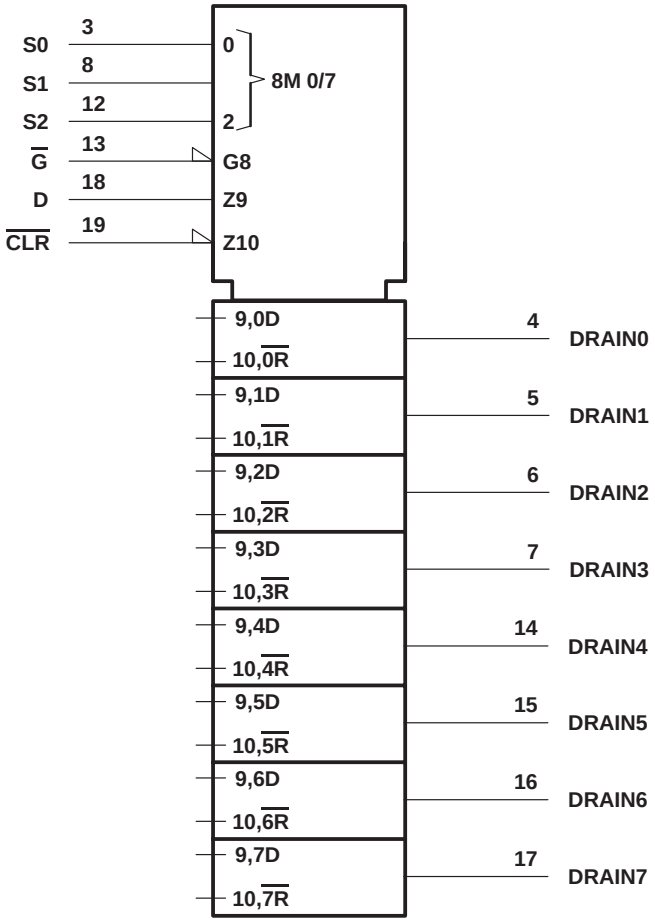
SELECT INPUTS			DRAIN ADDRESSED
S2	S1	S0	
L	L	L	0
L	L	H	1
L	H	L	2
L	H	H	3
H	L	L	4
H	L	H	5
H	H	L	6
H	H	H	7

H = high level, L = low level

Outputs are low-side, open-drain DMOS transistors with output ratings of 50 V and 150-mA continuous sink-current capability. Each output provides a 500-mA typical current limit at T_C = 25°C. The current limit decreases as the junction temperature increases for additional device protection.

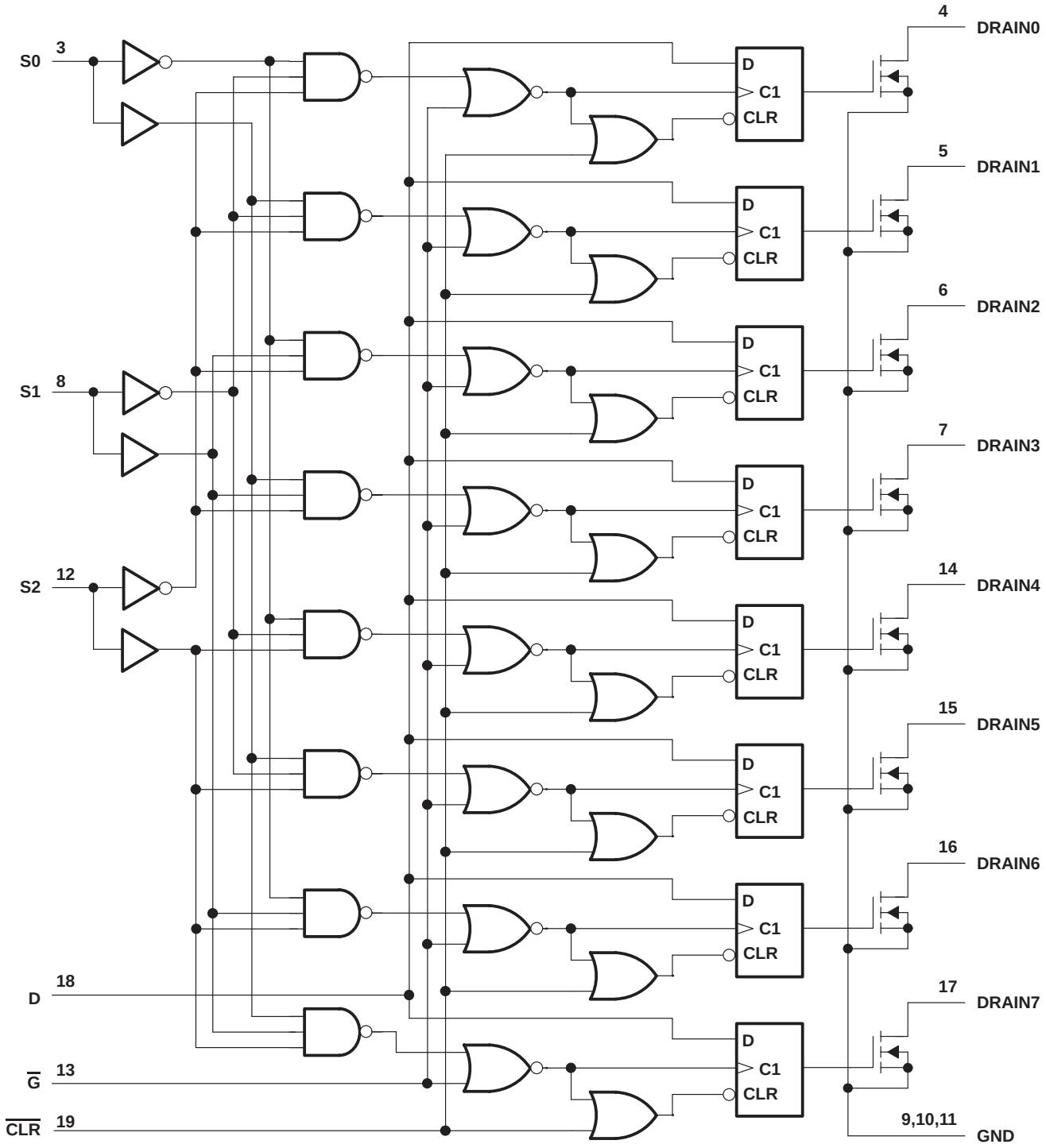
The TPIC6B259 is characterized for operation over the operating case temperature range of −40°C to 125°C.

logic symbol†

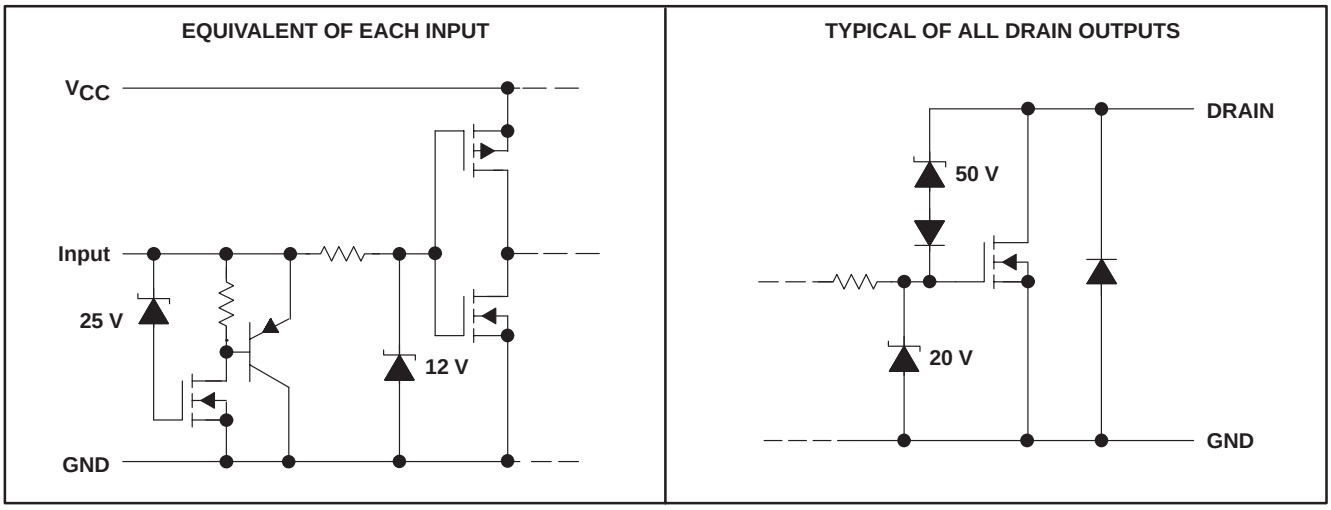


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



schematic of inputs and outputs



absolute maximum ratings over the recommended operating case temperature range (unless otherwise noted)†

Logic supply voltage, V_{CC} (see Note 1)	7 V
Logic input voltage range, V_I	–0.3 V to 7 V
Power DMOS drain-to-source voltage, V_{DS} (see Note 2)	50 V
Continuous source-to-drain diode anode current	500 mA
Pulsed source-to-drain diode anode current (see Note 3)	1 A
Pulsed drain current, each output, all outputs on, I_D, T_C = 25°C (see Note 3)	500 mA
Continuous drain current, each output, all outputs on, I_D, T_C = 25°C	150 mA
Peak drain current single output, I_{DM}, T_C = 25°C (see Note 3)	500 mA
Single-pulse avalanche energy, E_{AS} (see Figure 4)	30 mJ
Avalanche current, I_{AS} (see Note 4)	500 mA
Continuous total dissipation	See Dissipating Rating Table
Operating virtual junction temperature range, T_J	–40°C to 150°C
Operating case temperature range, T_C	–40°C to 125°C
Storage temperature range	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°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 are with respect to GND.
2. Each power DMOS source is internally connected to GND.
3. Pulse duration ≤ 100 μs and duty cycle ≤ 2%.
4. DRAIN supply voltage = 15 V, starting junction temperature (T_{JS}) = 25°C, L = 200 mH, I_{AS} = 0.5 A (see Figure 4).

DISSIPATION RATING TABLE

PACKAGE	$T_C \le 25°C$ POWER RATING	DERATING FACTOR ABOVE T_C = 25°C	T_C = 125°C POWER RATING
DW	1389 mW	11.1 mW/°C	278 mW
N	1050 mW	10.5 mW/°C	263 mW

recommended operating conditions

	MIN	MAX	UNIT
Logic supply voltage, V_{CC}	4.5	5.5	V
High-level input voltage, V_{IH}	0.85 V_{CC}		V
Low-level input voltage, V_{IL}		0.15 V_{CC}	V
Pulsed drain output current, T_C = 25°C, V_{CC} = 5 V (see Notes 3 and 5)	–500	500	mA
Setup time, D high before $\overline{G}\uparrow$, t_{su} (see Figure 2)	20		ns
Hold time, D high after $\overline{G}\uparrow$, t_h (see Figure 2)	20		ns
Pulse duration, t_w (see Figure 2)	40		ns
Operating case temperature, T_C	–40	125	°C

electrical characteristics, V_{CC} = 5 V, T_C = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
$V_{(BR)DSX}$	Drain-to-source breakdown voltage	I_D = 1 mA			50			V
V_{SD}	Source-to-drain diode forward voltage	I_F = 100 mA				0.85	1	V
I_{IH}	High-level input current	V_{CC} = 5.5 V,	$V_I = V_{CC}$				1	µA
I_{IL}	Low-level input current	V_{CC} = 5.5 V,	V_I = 0				–1	µA
I_{CC}	Logic supply current	V_{CC} = 5.5 V	All outputs off			20	100	µA
			All outputs on			150	300	
I_N	Nominal current	$V_{DS(on)}$ = 0.5 V, $I_N = I_D$, See Notes 5, 6, and 7		T_C = 85°C,		90		mA
I_{DSX}	Off-state drain current	V_{DS} = 40 V,	V_{CC} = 5.5 V			0.1	5	µA
		V_{DS} = 40 V,	V_{CC} = 5.5 V,	T_C = 125°C		0.15	8	
$r_{DS(on)}$	Static drain-to-source on-state resistance	I_D = 100 mA,	V_{CC} = 4.5 V	See Notes 5 and 6 and Figures 6 and 7		4.2	5.7	Ω
		I_D = 100 mA, T_C = 125°C	V_{CC} = 4.5 V,			6.8	9.5	
		I_D = 350 mA,	V_{CC} = 4.5 V			5.5	8	

switching characteristics, V_{CC} = 5 V, T_C = 25°C

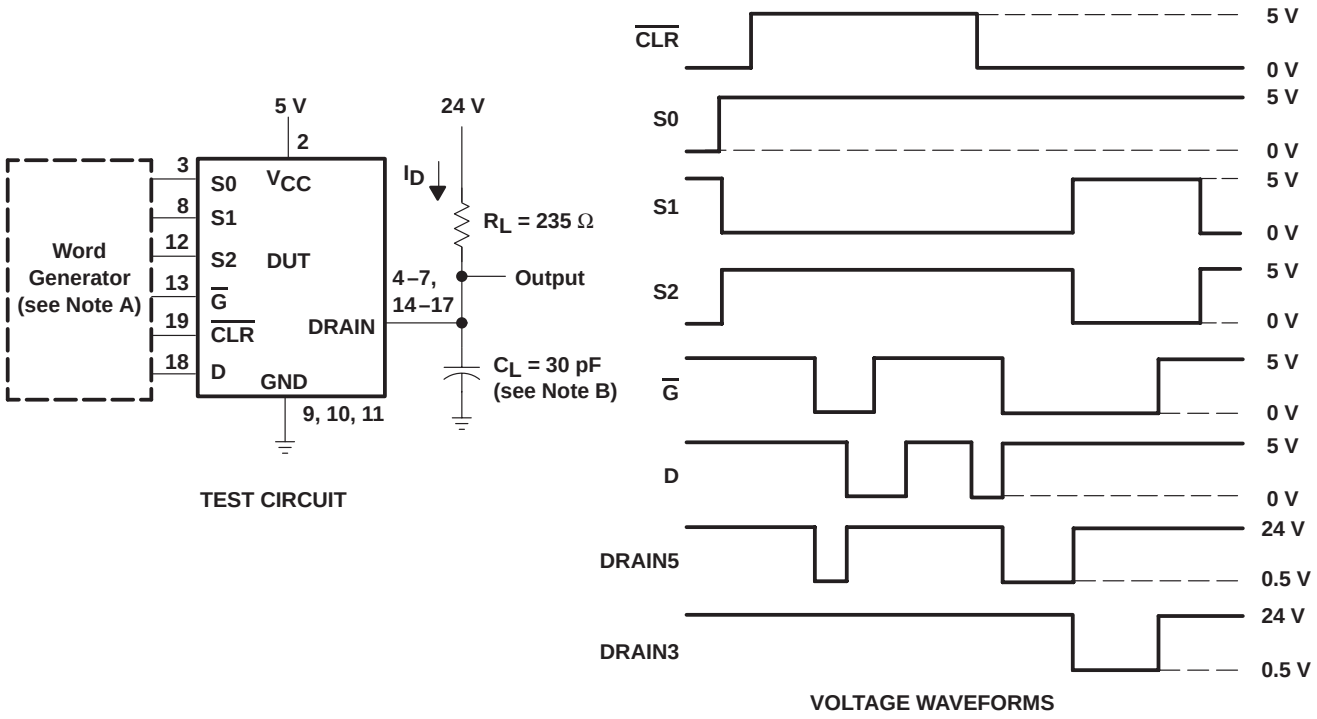
PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output from D	C_L = 30 pF, See Figures 1, 2, and 8	I_D = 100 mA,		150		ns
t_{PHL}	Propagation delay time, high-to-low-level output from D				90		ns
t_r	Rise time, drain output				200		ns
t_f	Fall time, drain output				200		ns
t_a	Reverse-recovery-current rise time	I_F = 100 mA, See Notes 5 and 6 and Figure 3	di/dt = 20 A/µs,		100		ns
t_{rr}	Reverse-recovery time				300		

NOTES: 3. Pulse duration ≤ 100 µs and duty cycle ≤ 2%.
5. Technique should limit $T_J - T_C$ to 10°C maximum.
6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.
7. Nominal current is defined for a consistent comparison between devices from different sources. It is the current that produces a voltage drop of 0.5 V at T_C = 85°C.

thermal resistance

PARAMETER			TEST CONDITIONS	MIN	MAX	UNIT
$R_{\theta JA}$	Thermal resistance junction-to-ambient	DW package	All 8 outputs with equal power		90	°C/W
		N package			95	

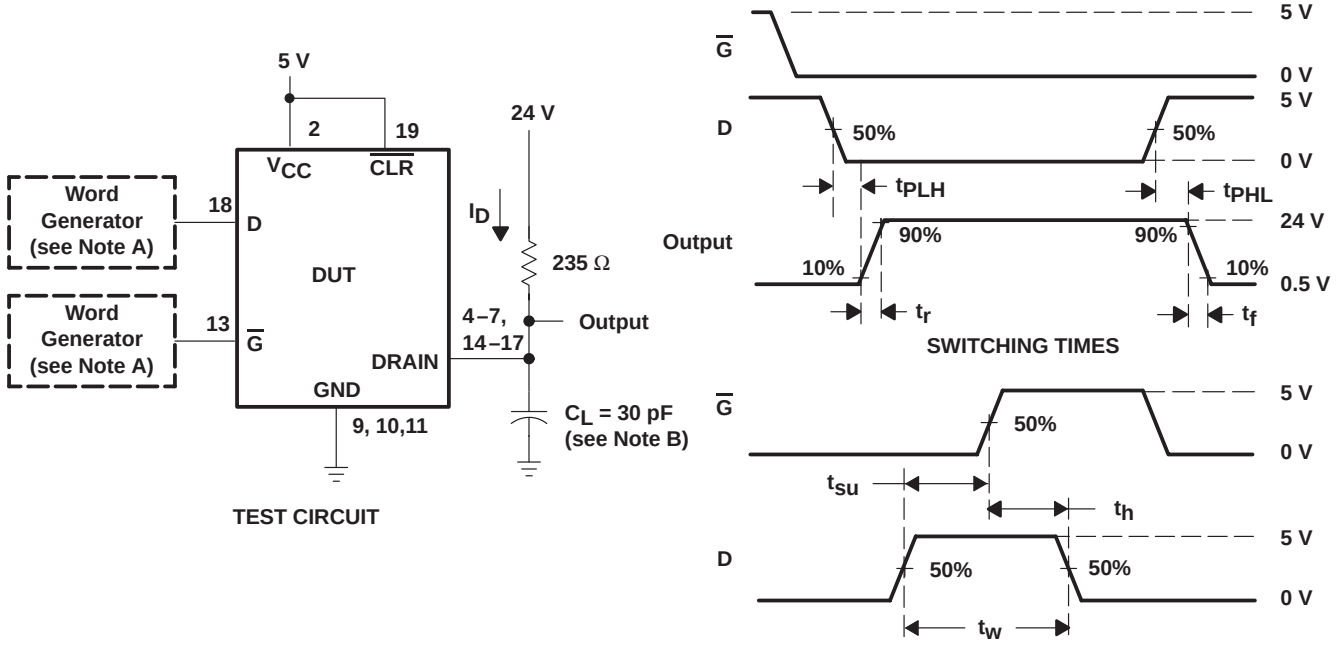
PARAMETER MEASUREMENT INFORMATION



NOTES: A. The word generator has the following characteristics: $t_r \le 10$ ns, $t_f \le 10$ ns, $t_W = 300$ ns, pulsed repetition rate (PRR) = 5 kHz, $Z_O = 50\ \Omega$.
B. C_L includes probe and jig capacitance.

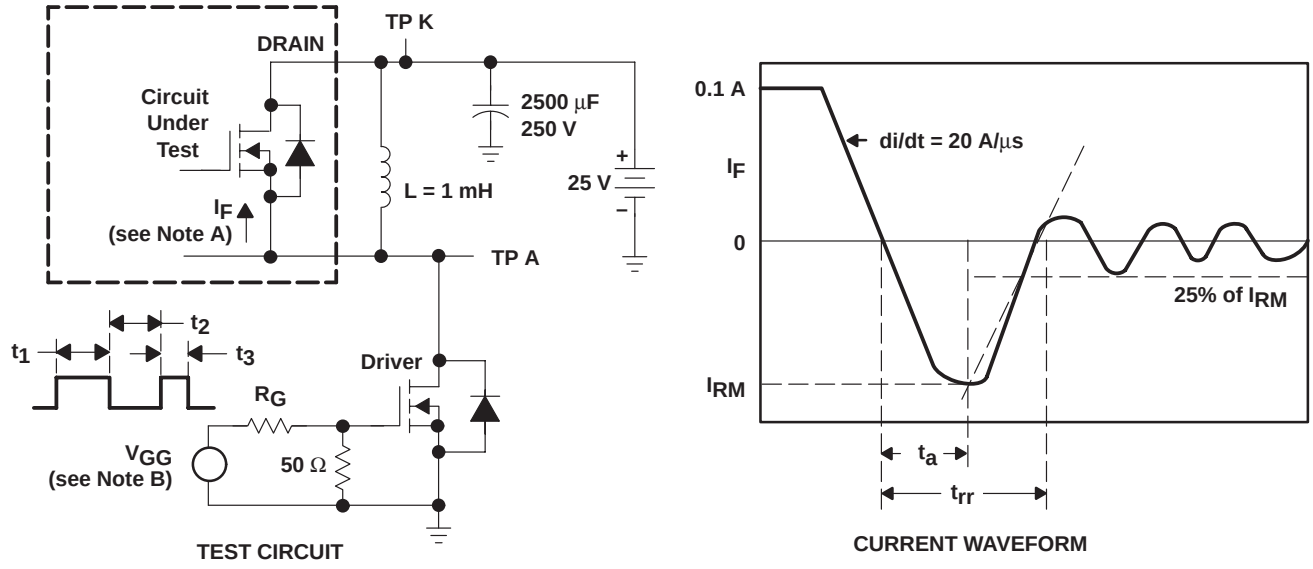
Figure 1. Resistive-Load Test Circuit and Voltage Waveforms

PARAMETER MEASUREMENT INFORMATION



NOTES: A. The word generator has the following characteristics: $t_r \le 10$ ns, $t_f \le 10$ ns, $t_w = 300$ ns, pulsed repetition rate (PRR) = 5 kHz, $Z_O = 50\ \Omega$.
B. C_L includes probe and jig capacitance.

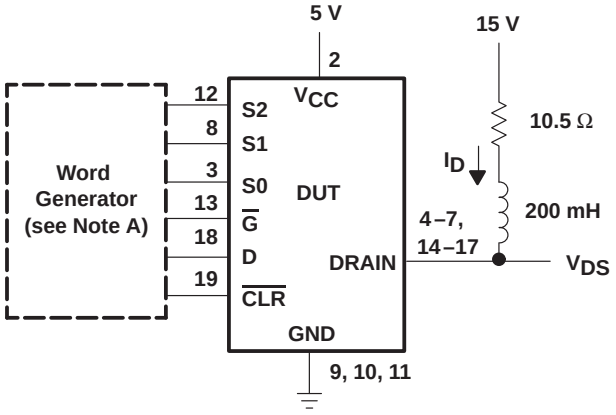
Figure 2. Test Circuit, Switching Times, and Voltage Waveforms



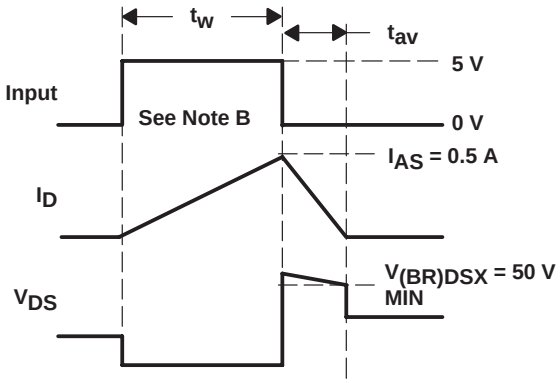
NOTES: A. The DRAIN terminal under test is connected to the TP K test point. All other terminals are connected together and connected to the TP A test point.
B. The V_{GG} amplitude and R_G are adjusted for di/dt = 20 A/μs. A V_{GG} double-pulse train is used to set I_F = 0.1 A, where t_1 = 10 μs, t_2 = 7 μs, and t_3 = 3 μs.

Figure 3. Reverse-Recovery-Current Test Circuit and Waveforms of Source-to-Drain Diode

PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT



VOLTAGE AND CURRENT WAVEFORMS

NOTES: A. The word generator has the following characteristics: $t_r \le 10$ ns, $t_f \le 10$ ns, $Z_O = 50\ \Omega$.
B. Input pulse duration, t_w, is increased until peak current $I_{AS} = 0.5$ A.
Energy test level is defined as $E_{AS} = I_{AS} \times V_{(BR)DSX} \times t_{av}/2 = 30$ mJ.

Figure 4. Single-Pulse Avalanche Energy Test Circuit and Waveforms

TYPICAL CHARACTERISTICS

PEAK AVALANCHE CURRENT vs TIME DURATION OF AVALANCHE

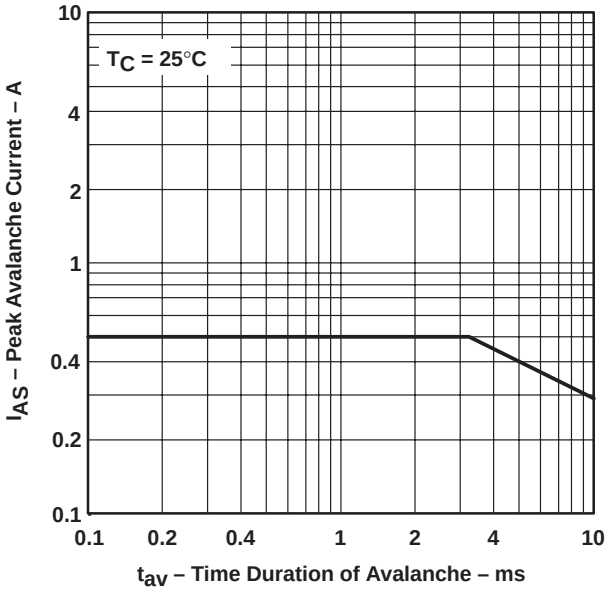
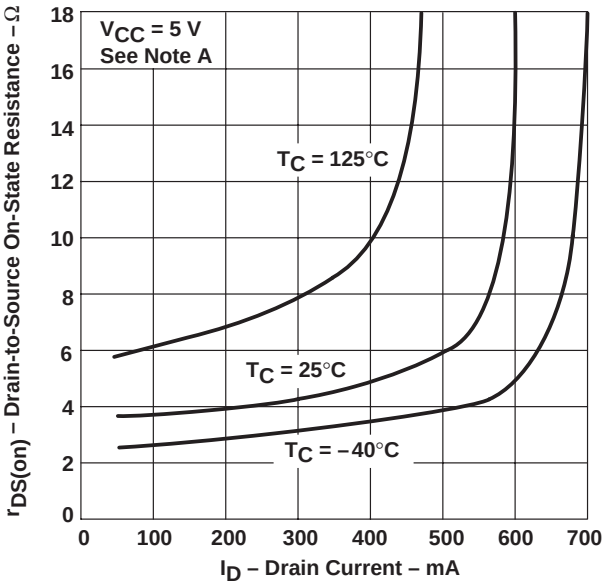


Figure 5

DRAIN-TO-SOURCE ON-STATE RESISTANCE vs DRAIN CURRENT



NOTE C: Technique should limit $T_J - T_C$ to 10°C maximum.

Figure 6

TYPICAL CHARACTERISTICS

STATIC DRAIN-TO-SOURCE ON-STATE RESISTANCE vs LOGIC SUPPLY VOLTAGE

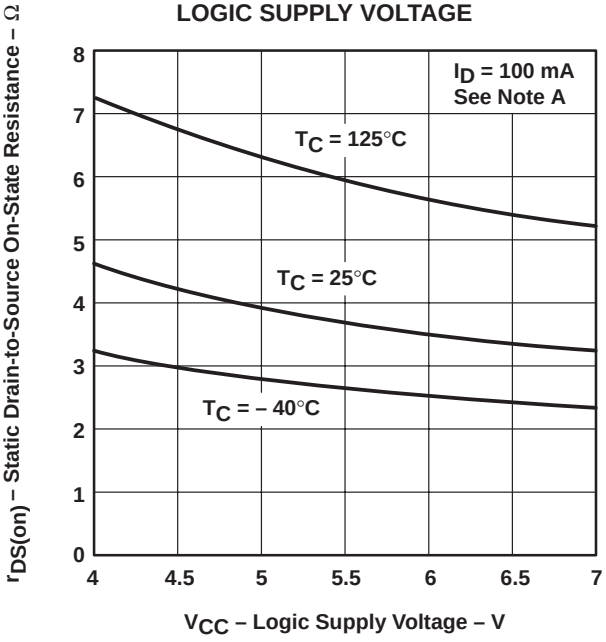


Figure 7

SWITCHING TIME vs CASE TEMPERATURE

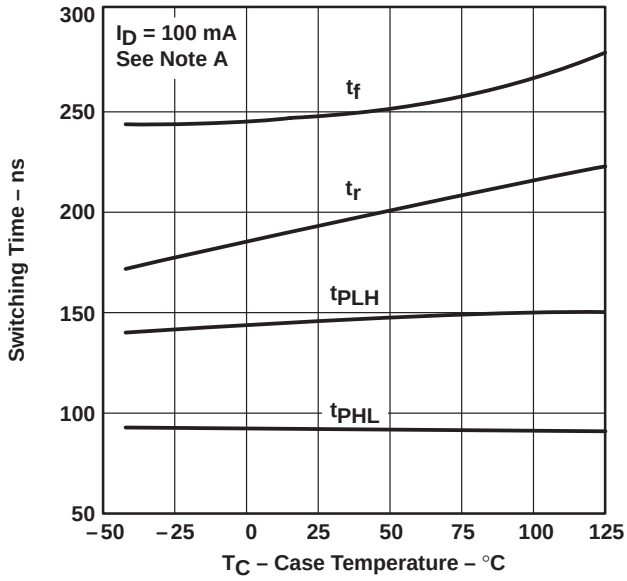


Figure 8

NOTE D: Technique should limit $T_J - T_C$ to 10°C maximum.

THERMAL INFORMATION

MAXIMUM CONTINUOUS DRAIN CURRENT OF EACH OUTPUT vs NUMBER OF OUTPUTS CONDUCTING SIMULTANEOUSLY

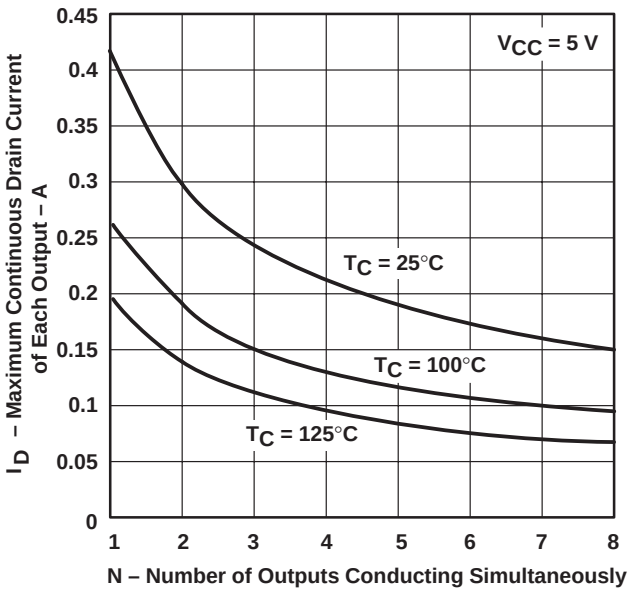


Figure 9

MAXIMUM PEAK DRAIN CURRENT OF EACH OUTPUT vs NUMBER OF OUTPUTS CONDUCTING SIMULTANEOUSLY

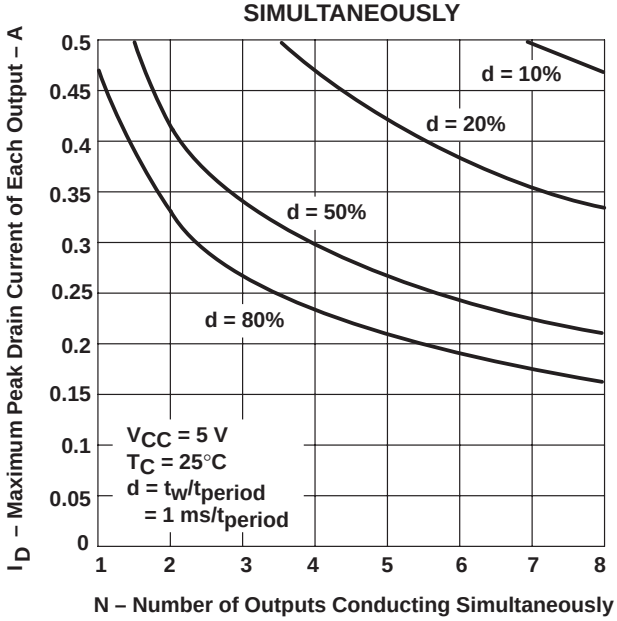


Figure 10

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TPIC6B259DW	ACTIVE	SOIC	DW	20	25	TBD	CU NIPDAU	Level-1-220C-UNLIM
TPIC6B259DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPIC6B259DWR	ACTIVE	SOIC	DW	20	2000	TBD	CU NIPDAU	Level-1-220C-UNLIM
TPIC6B259DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPIC6B259N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type

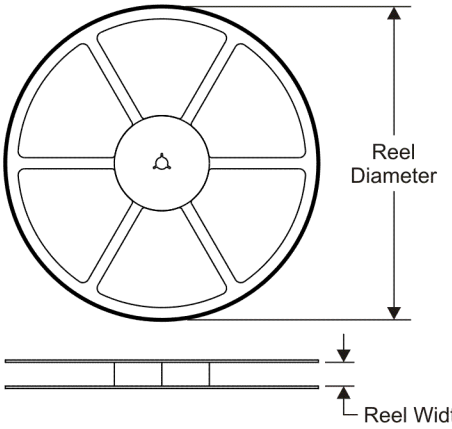
(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers,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

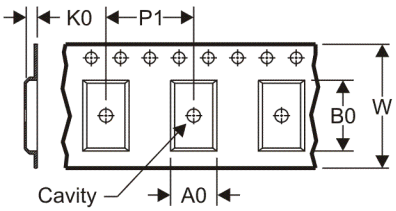
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

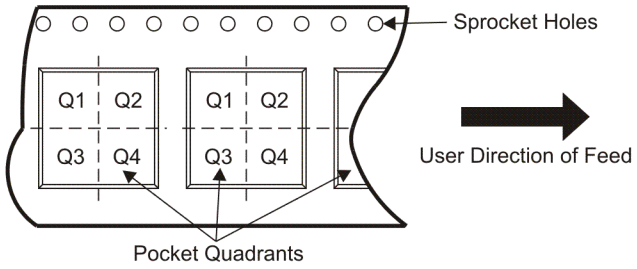


TAPE DIMENSIONS



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

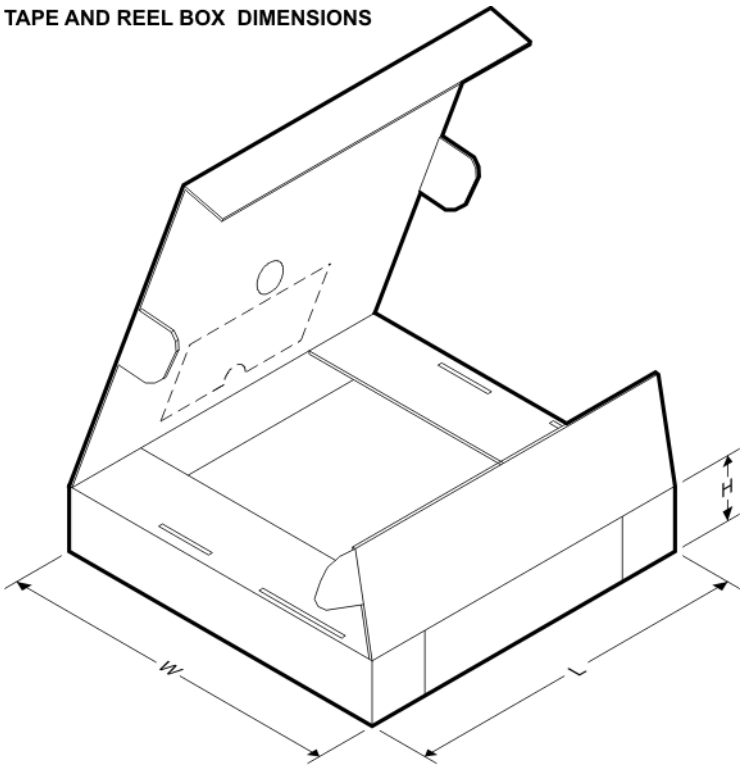
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TPIC6B259DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.1	2.65	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS



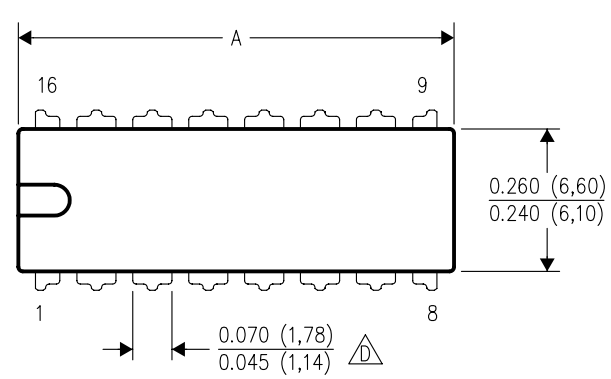
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPIC6B259DWR	SOIC	DW	20	2000	346.0	346.0	41.0

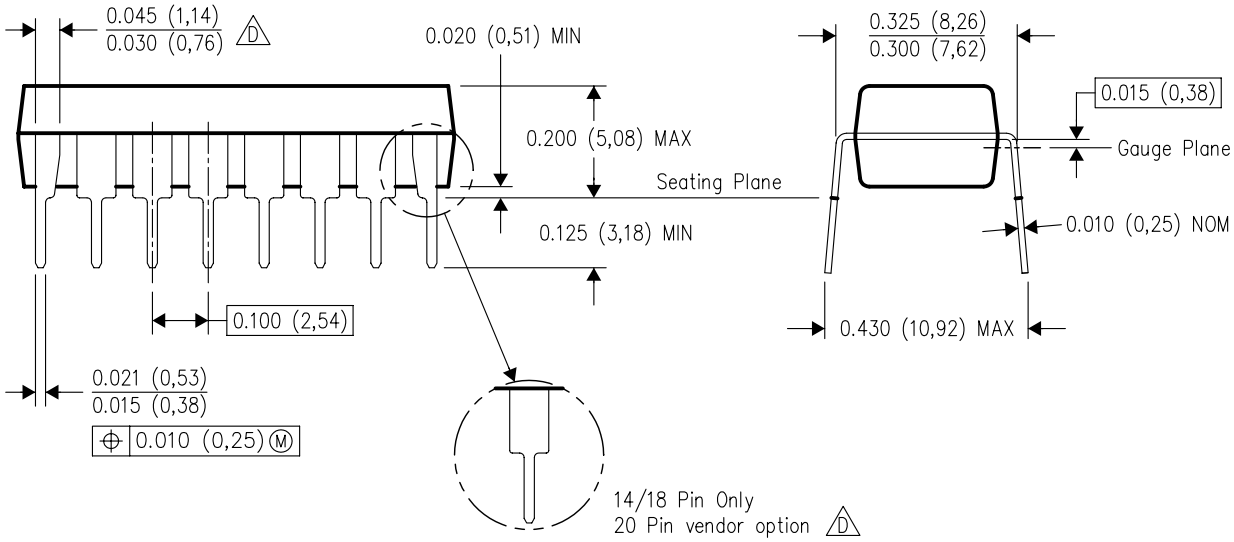
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



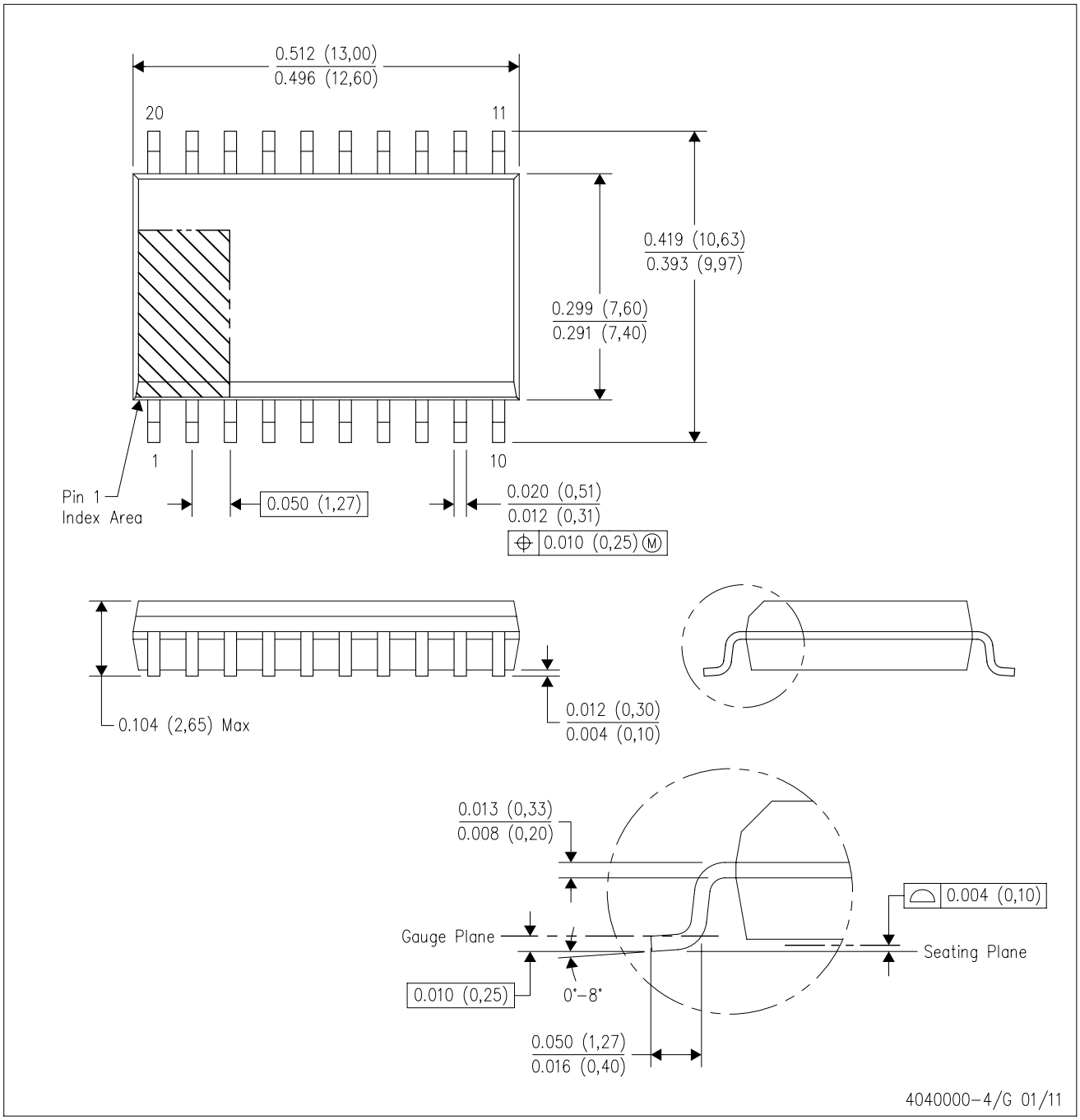
DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

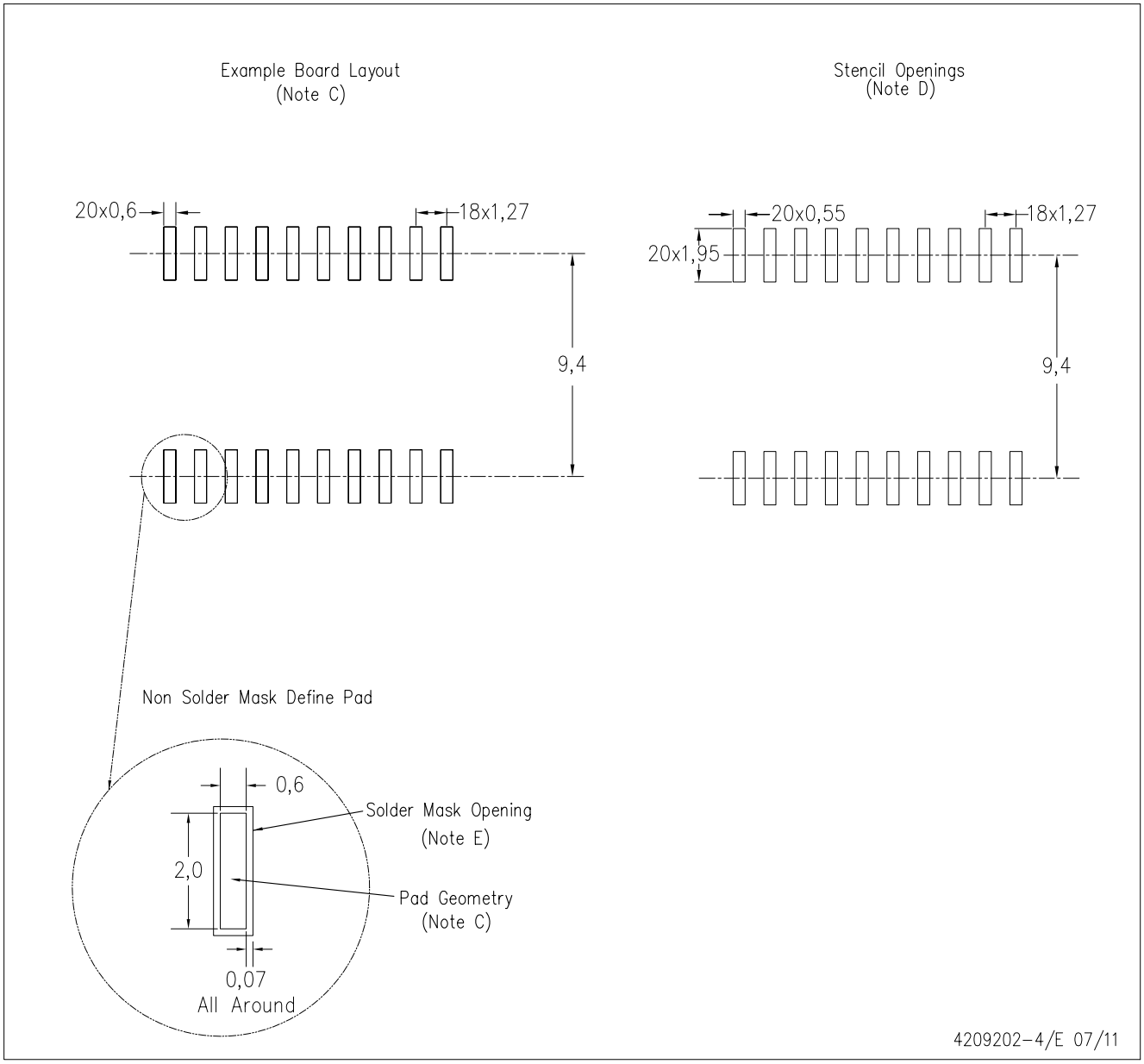
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

DW (R–PDSO–G20) 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 AC.

DW (R–PDSO–G20) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Refer to IPC7351 for alternate board design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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