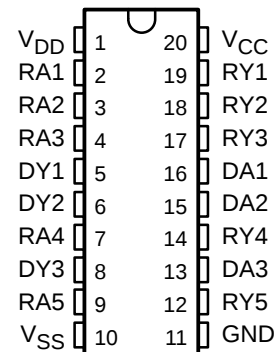


SN75LP1185 LOW-POWER MULTIPLE RS-232 DRIVERS AND RECEIVERS

SLLS335A – JANUARY 1999 – REVISED JANUARY 2001

- Single-Chip TIA/EIA-232-F Interface for IBM™ PC/AT™ Serial Port
- Designed to Transmit and Receive 4-μs Pulses (Equivalent to 256 kbit/s)
- Less Than 21-mW Power Consumption
- Wide Supply-Voltage Range . . . 4.75 V to 15 V
- Driver Output Slew Rates Are Internally Controlled to 30 V/μs Max
- Receiver Input Hysteresis . . . 1000 mV Typical
- TIA/EIA-232-F Bus-Pin ESD Protection Exceeds:
 - 15-kV, Human-Body Model
- Three Drivers and Five Receivers Meet or Exceed the Requirements of TIA/EIA-232-F and ITU V.28
- Complements the SN75LP196
- Designed to Replace the Industry-Standard SN75185 and SN75C185 With the Same Flow-Through Pinout
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Dual-In-Line (N) Packages

DB, DW, OR N PACKAGE
(TOP VIEW)



description

The SN75LP1185 is a low-power bipolar device containing three drivers and five receivers, with 15 kV of ESD protection on the bus pins with respect to each other. Bus pins are defined as those pins that tie directly to the serial-port connector, including GND. The pinout matches the flow-through design of the industry-standard SN75185 and SN75C185. The flow-through pinout of the SN75LP1185 allows easy interconnection of the UART and serial-port connector of the IBM PC/AT and compatibles. The SN75LP1185 provides a rugged, low-cost solution for this function with the combination of the bipolar processing and 15 kV of ESD protection.

The SN75LP1185 has internal slew-rate control to provide a maximum rate of change in the output signal of 30 V/μs. The driver output swing is nominally clamped at ±6 V to enable the higher data rates associated with this device and to reduce EMI emissions. Even though the driver outputs are clamped, they can handle voltages up to ±15 V without damage. All the logic inputs can accept 3.3-V or 5-V input signals.

The SN75LP1185 complies with the requirements of TIA/EIA-232-F and ITU V.28. These standards are for data interchange between a host computer and peripheral at signaling rates up to 20 kbit/s. The switching speeds of the SN75LP1185 support rates up to 256 kbit/s.

The SN75LP1185 is characterized for operation from 0°C to 70°C.



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SN75LP1185
LOW-POWER MULTIPLE RS-232 DRIVERS AND RECEIVERS

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AVAILABLE OPTIONS

T _A	PACKAGED DEVICES		
	PLASTIC SHRINK SMALL-OUTLINE (DB)	PLASTIC SMALL OUTLINE (DW)	PLASTIC DIP (N)
0°C to 70°C	SN75LP1185DBR	SN75LP1185DW	SN75LP1185N

The DB package is only available taped and reeled. The DW package also is available taped and reeled. Add the suffix R to device type (e.g., SN75LP1185DWR).

Function Tables

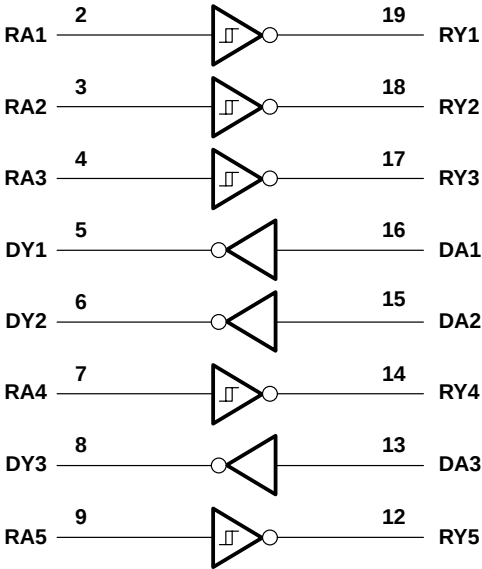
DRIVER

INPUT DA	OUTPUT DY
H	L
L	H
Open	L

RECEIVER

INPUT RA	OUTPUT RY
H	L
L	H
Open	H

logic diagram (positive logic)



SN75LP1185

LOW-POWER MULTIPLE RS-232 DRIVERS AND RECEIVERS

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

Positive supply-voltage range (see Note 1): V_{CC}	–0.5 V to 7 V
V_{DD}	–0.5 V to 15 V
Negative supply-voltage range, V_{SS} (see Note 1)	0.5 V to –15 V
Input-voltage range, V_I : Receiver (RA)	–30 V to 30 V
Driver (DA)	–0.5 V to $V_{CC} + 0.4$ V
Output-voltage range, V_O : Receiver (RY)	–0.5 V to 6 V
Driver (DY)	–15 V to 15 V
Electrostatic discharge: Bus pins (human-body model) (see Note 2)	Class 3: 15 kV
Bus pins (machine model)	500 V
All pins (human-body model) (see Note 2)	Class 3: 5 kV
All pins (machine model)	400 V
Package thermal impedance, θ_{JA} (see Note 3): DB package	70°C/W
DW package	58°C/W
N package	69°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°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 are with respect to network ground terminal, unless otherwise noted.
 2. Per MIL-STD-883, Method 3015.7
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage (see Note 4)	4.75	5	5.25	V
V_{DD}	Supply voltage (see Note 5)	9	12	15	V
V_{SS}	Supply voltage (see Note 5)	–9	–12	–15	V
V_{IH}	High-level input voltage	DA	2		V
V_{IL}	Low-level input voltage	DA		0.8	V
V_I	Receiver input voltage	RA	–25	25	V
I_{OH}	High-level output current	RY		–1	mA
I_{OL}	Low-level output current	RY		2	mA
T_A	Operating free-air temperature	0		70	°C

- NOTES:
4. V_{CC} cannot be greater than V_{DD} .
 5. The device operates down to $V_{DD} = V_{CC}$ and $|V_{SS}| = V_{CC}$, but supply currents increase and other parameters may vary slightly from the data sheet limits.



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LOW-POWER MULTIPLE RS-232 DRIVERS AND RECEIVERS

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supply currents over the recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply current for V_{CC} , I_{CC}	$V_{DD} = 9\text{ V}$, $V_{SS} = -9\text{ V}$			1000	μA
	$V_{DD} = 12\text{ V}$, $V_{SS} = -12\text{ V}$			1000	
Supply current for V_{DD} , I_{DD}	No load, All inputs at minimum V_{OH} or maximum V_{OL} $V_{DD} = 9\text{ V}$, $V_{SS} = -9\text{ V}$			800	
	$V_{DD} = 12\text{ V}$, $V_{SS} = -12\text{ V}$			800	
Supply current for V_{SS} , I_{SS}	$V_{DD} = 9\text{ V}$, $V_{SS} = -9\text{ V}$			-625	
	$V_{DD} = 12\text{ V}$, $V_{SS} = -12\text{ V}$			-625	

driver electrical characteristics over the recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH} High-level output voltage	$V_{IL} = 0.8\text{ V}$, $R_L = 3\text{ k}\Omega$, See Figure 1 $V_{DD} = 9\text{ V}$, $V_{SS} = -9\text{ V}$	5	5.8	6.6	V
	$V_{DD} = 12\text{ V}$, $V_{SS} = -12\text{ V}$, See Note 6	5	5.8	6.6	
V_{OL} Low-level output voltage	$V_{IH} = 2\text{ V}$, $R_L = 3\text{ k}\Omega$, See Figure 1 $V_{DD} = 9\text{ V}$, $V_{SS} = -9\text{ V}$	-5	-5.8	-6.9	V
	$V_{DD} = 12\text{ V}$, $V_{SS} = -12\text{ V}$, See Note 6	-5	-5.9	-6.9	
I_{IH} High-level input current	V_I at V_{CC}			1	μA
I_{IL} Low-level input current	V_I at GND			-1	μA
$I_{OS(H)}$ Short-circuit high-level output current	$V_O = \text{GND or } V_{SS}$, See Figure 2 and Note 7		-30	-55	mA
$I_{OS(L)}$ Short-circuit low-level output current	$V_O = \text{GND or } V_{DD}$, See Figure 2 and Note 7		30	55	mA
r_o Output resistance	$V_{DD} = V_{SS} = V_{CC} = 0$, $V_O = 2\text{ V}$	300			Ω

NOTES: 6. Maximum output swing is clamped nominally at $\pm 6\text{ V}$ to enable the higher data rates associated with this device and to reduce EMI emissions. The driver outputs may slightly exceed the maximum output voltage over the full V_{CC} and temperature ranges.
7. Not more than one output should be shorted at one time.

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LOW-POWER MULTIPLE RS-232 DRIVERS AND RECEIVERS

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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
t _{PHL}	Propagation delay time, high- to low-level output	R _L = 3 kΩ to 7 kΩ, C _L = 15 pF, See Figure 1		300	800	1600	ns
t _{PLH}	Propagation delay time, low- to high-level output	R _L = 3 kΩ to 7 kΩ, C _L = 15 pF, See Figure 1		300	800	1600	ns
t _{TLH}	Transition time, low- to high-level output	V _{CC} = 5 V, V _{DD} = 12 V, V _{SS} = −12 V, R _L = 3 kΩ to 7 kΩ, See Figure 1 and Note 9	Using V _{TR} = 10%-to-90% transition region, Driver speed = 250 kbit/s, C _L = 15 pF, See Note 8	375		2240	ns
			Using V _{TR} = ±3 V transition region, Driver speed = 250 kbit/s, C _L = 15 pF	200		1500	
			Using V _{TR} = ±2 V transition region, Driver speed = 250 kbit/s, C _L = 15 pF	133		1000	
			Using V _{TR} = ±3 V transition region, Driver speed = 125 kbit/s, C _L = 2500 pF			2750	
t _{THL}	Transition time, high- to low-level output	V _{CC} = 5 V, V _{DD} = 12 V, V _{SS} = −12 V, R _L = 3 kΩ to 7 kΩ, See Figure 1 and Note 9	Using V _{TR} = 10%-to-90% transition region, Driver speed = 250 kbit/s, C _L = 15 pF, See Note 8	375		2240	ns
			Using V _{TR} = ±3 V transition region, Driver speed = 250 kbit/s, C _L = 15 pF	200		1500	
			Using V _{TR} = ±2 V transition region, Driver speed = 250 kbit/s, C _L = 15 pF	133		1000	
			Using V _{TR} = ±3 V transition region, Driver speed = 125 kbit/s, C _L = 2500 pF			2750	
SR	Output slew rate	V _{CC} = 5 V, V _{DD} = 12 V, V _{SS} = −12 V	Using V _{TR} = ±3 V transition region, Driver speed = 0 to 250 kbit/s, C _L = 15 pF	4	20	30	V/μs

NOTES: 8. Equivalent to the SN75C185. The SN75LP1185 output-voltage swing is clamped to about 70% of the typical SN75C185 output-voltage swing, and the specified limits reflect the reduced output swing.

9. Maximum output swing is limited to $\pm 6\text{ V}$ to enable the higher data rates associated with this device and to reduce EMI emissions.

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IT+} Positive-going input threshold voltage	See Figure 3	1.6	2	2.55	V
V_{IT-} Negative-going input threshold voltage	See Figure 3	0.6	1	1.45	V
V_{HYS} Input hysteresis, $V_{IT+} - V_{IT-}$	See Figure 3	600	1000		mV
V_{OH} High-level output voltage	$I_{OH} = -1\text{ mA}$	2.5	3.9		V
V_{OL} Low-level output voltage	$I_{OL} = 2\text{ mA}$		0.33	0.5	V
I_{IH} High-level input current	$V_I = 3\text{ V}$	0.43	0.6	1	mA
	$V_I = 25\text{ V}$	3.6	5.1	8.3	
I_{IL} Low-level input current	$V_I = -3\text{ V}$	-0.43	-0.6	-1	mA
	$V_I = -25\text{ V}$	-3.6	-5.1	-8.3	
$I_{OS(H)}$ Short-circuit high-level output current	$V_O = 0$, See Figure 5 and Note 7			-20	mA
$I_{OS(L)}$ Short-circuit low-level output current	$V_O = V_{CC}$, See Figure 5 and Note 7			20	mA
R_{IN} Input resistance	$V_I = \pm 3\text{ V}$ to $\pm 25\text{ V}$	3	5	7	k Ω

NOTE 7: Not more than one output should be shorted at one time.



SN75LP1185

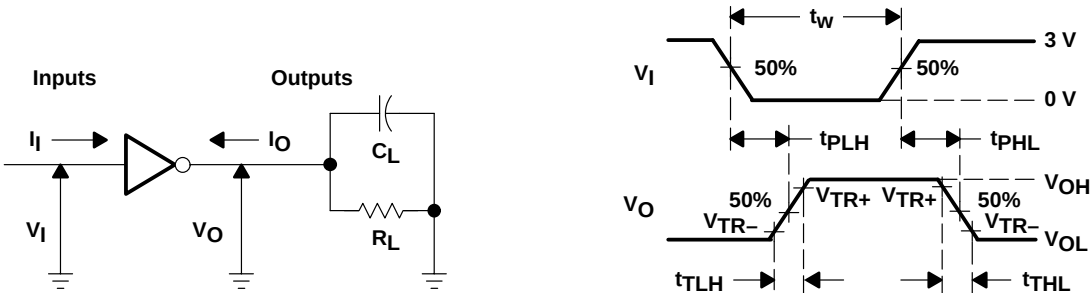
LOW-POWER MULTIPLE RS-232 DRIVERS AND RECEIVERS

SLLS335A – JANUARY 1999 – REVISED JANUARY 2001

receiver switching characteristics over recommended operating free-air temperature range, $C_L = 50\text{ pF}$ (unless otherwise noted) (see Figure 4)

PARAMETER		MIN	TYP	MAX	UNIT
t_{PHL}	Propagation delay time, high- to low-level output		400	900	ns
t_{PLH}	Propagation delay time, low- to high-level output		400	900	ns
t_{TLH}	Transition time, low- to high-level output		200	500	ns
t_{THL}	Transition time, high- to low-level output		200	400	ns
$t_{SK(p)}$	Pulse skew $ t_{PLH} - t_{PHL} $		200	425	ns

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. The pulse generator has the following characteristics:
 For $C_L < 1000\text{ pF}$: $t_W = 4\text{ }\mu\text{s}$, $\text{PRR} = 250\text{ kbit/s}$, $Z_O = 50\text{ }\Omega$, t_r and $t_f < 50\text{ ns}$.
 For $C_L = 2500\text{ pF}$: $t_W = 8\text{ }\mu\text{s}$, $\text{PRR} = 125\text{ kbit/s}$, $Z_O = 50\text{ }\Omega$, t_r and $t_f < 50\text{ ns}$.
 B. C_L includes probe and jig capacitance.

Figure 1. Driver Parameter Test Circuit and Waveform

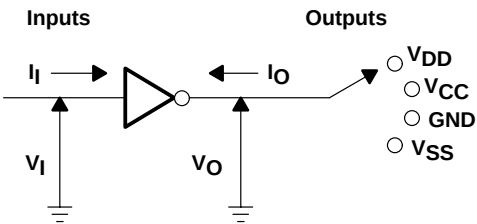


Figure 2. Driver I_{OS} Test

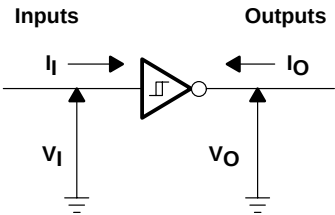
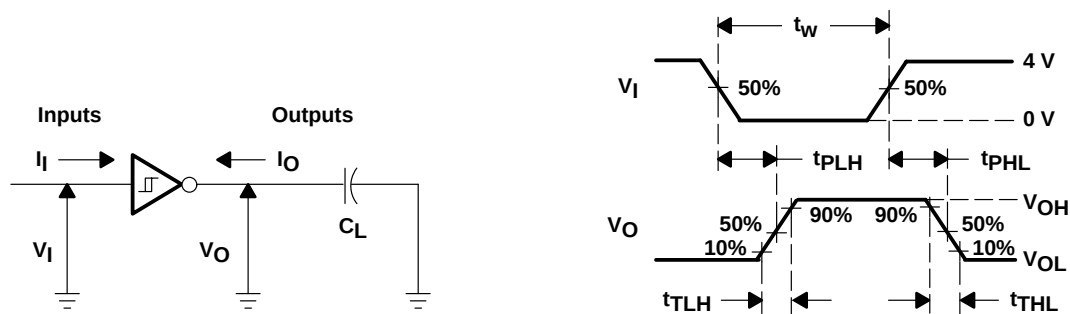


Figure 3. Receiver V_{IT} Test

PARAMETER MEASUREMENT INFORMATION



NOTES: A. The pulse generator has the following characteristics: $t_W = 4 \mu s$, PRR = 250 kbit/s, $Z_O = 50 \Omega$, t_r and $t_f < 50 ns$.
 B. C_L includes probe and jig capacitance.

Figure 4. Receiver Parameter Test Circuit and Waveform

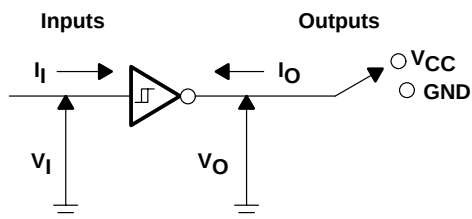


Figure 5. Receiver I_{OS} Test

APPLICATION INFORMATION

Diodes placed in series with the V_{DD} and V_{SS} leads protect the SN75LP1185 in the fault condition when the device outputs are shorted to $\pm 15 V$ and the power supplies are at low voltage and provide low-impedance paths to ground (see Figure 6).

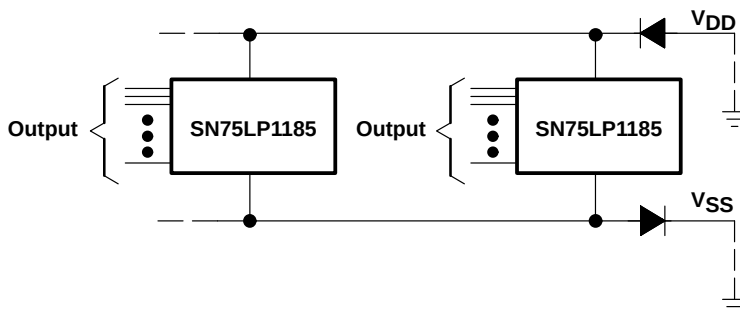


Figure 6. Power-Supply Protection to Meet Power-Off Fault Conditions of TIA/EIA-232-F

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN75LP1185DBR	Active	Production	SSOP (DB) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	5LP1185
SN75LP1185DBR.A	Active	Production	SSOP (DB) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	5LP1185
SN75LP1185DW	Active	Production	SOIC (DW) 20	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75LP1185
SN75LP1185DW.A	Active	Production	SOIC (DW) 20	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75LP1185
SN75LP1185DWR	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75LP1185
SN75LP1185DWR.A	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	75LP1185

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

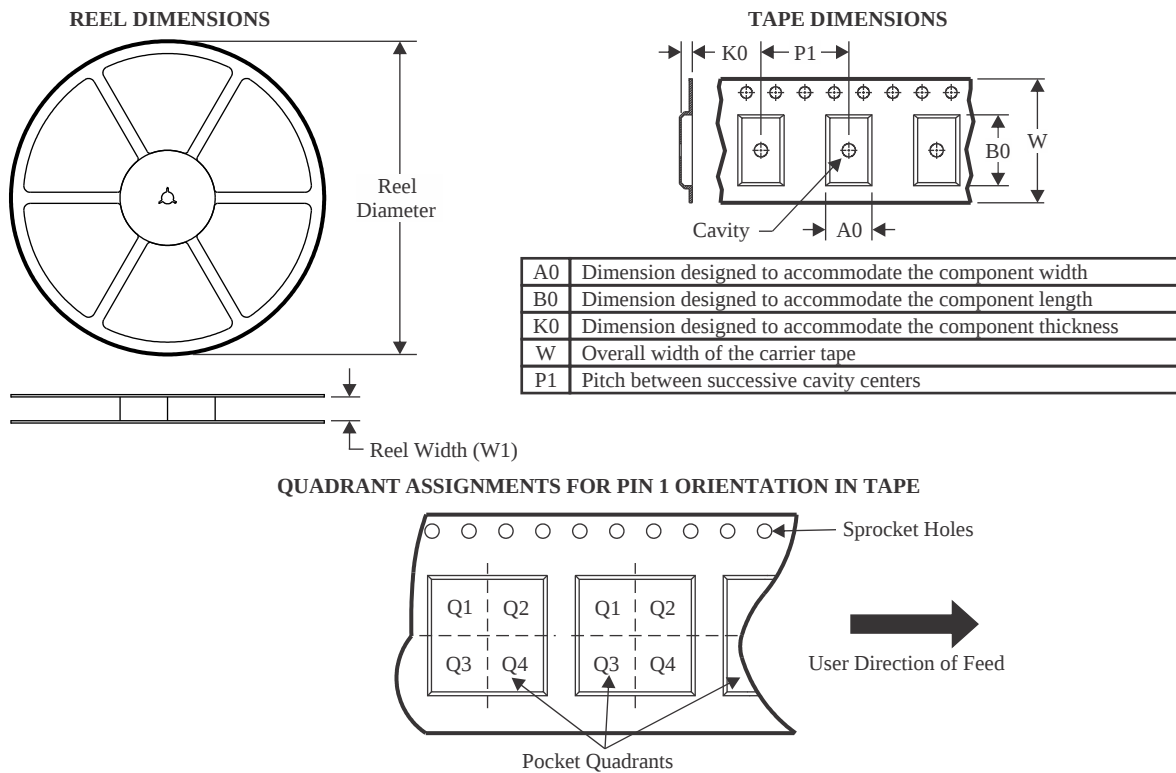
⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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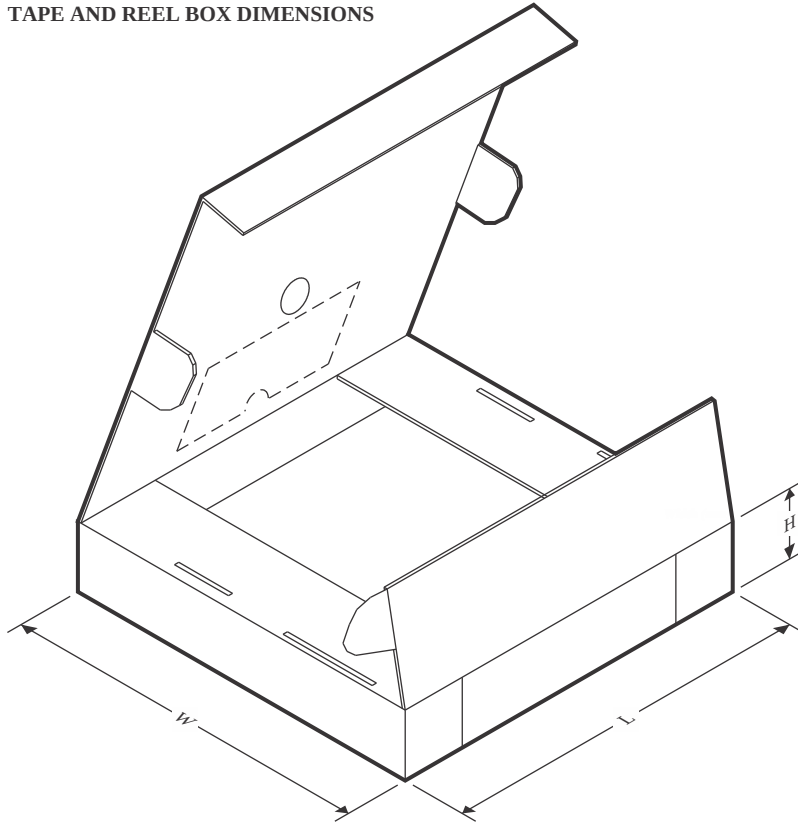
TAPE AND REEL INFORMATION



*All dimensions are nominal

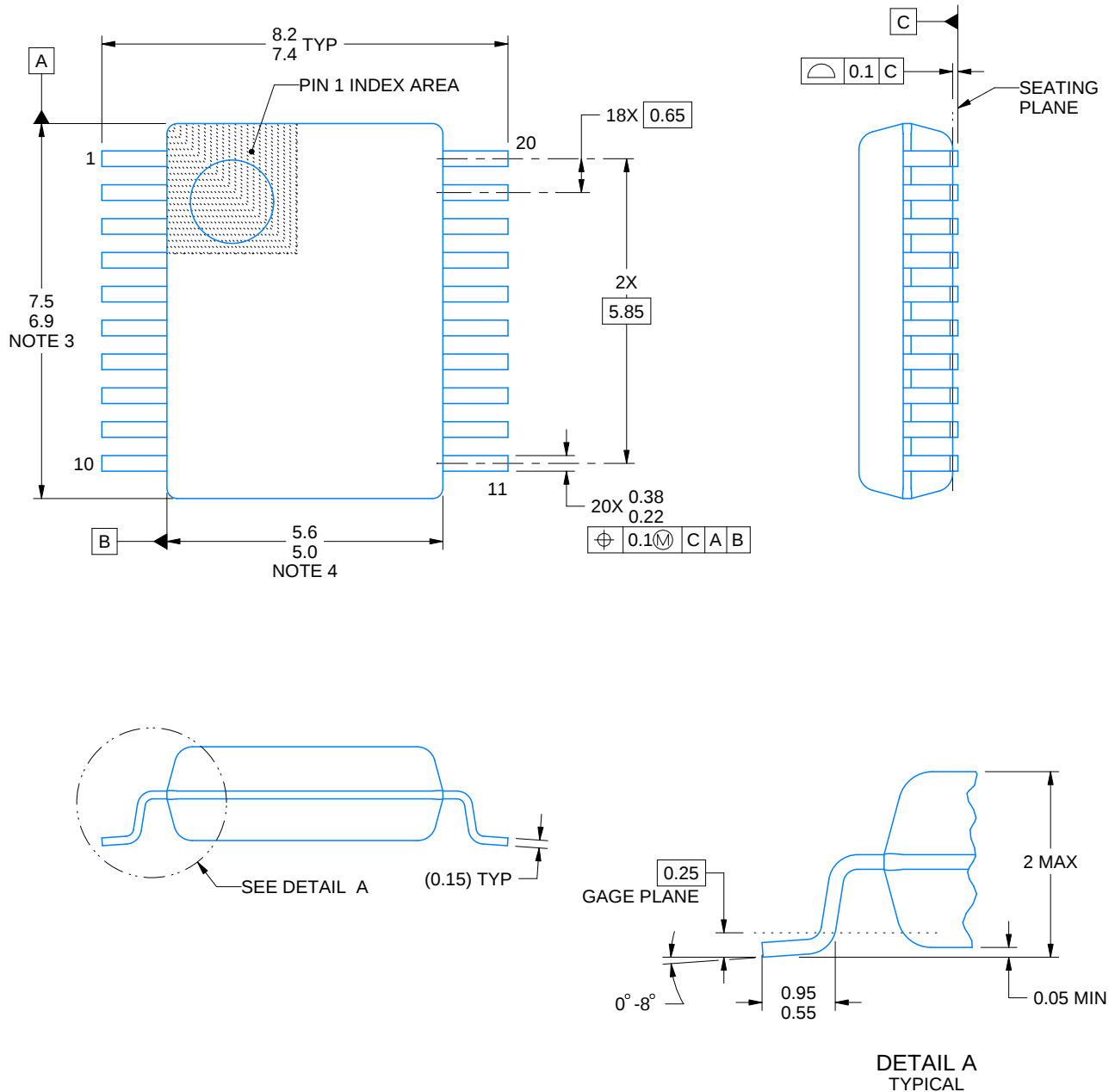
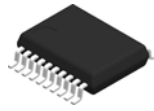
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN75LP1185DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN75LP1185DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN75LP1185DBR	SSOP	DB	20	2000	353.0	353.0	32.0
SN75LP1185DWR	SOIC	DW	20	2000	356.0	356.0	45.0



4214851/B 08/2019

NOTES:

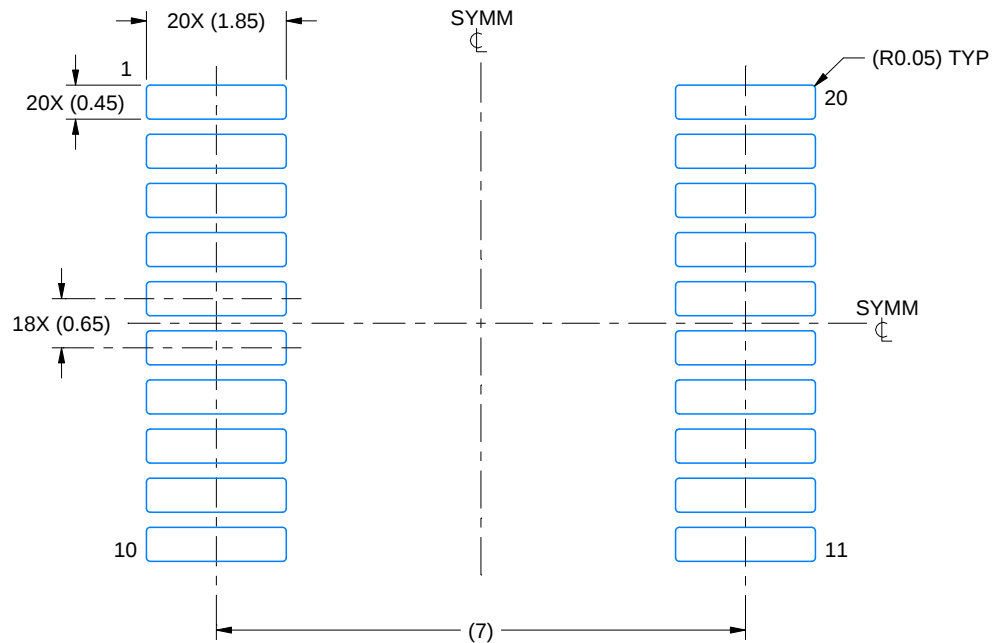
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.

EXAMPLE BOARD LAYOUT

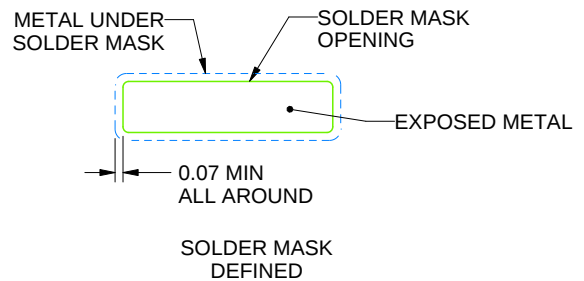
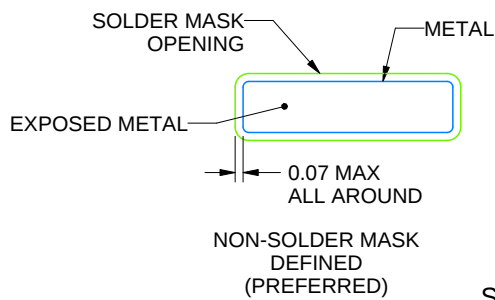
DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4214851/B 08/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

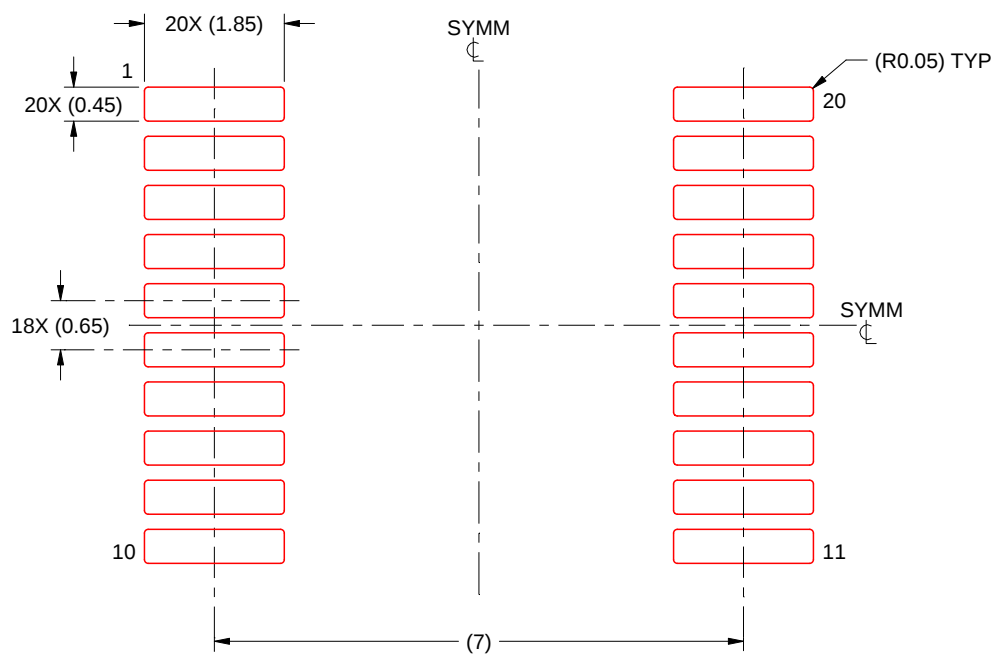
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE

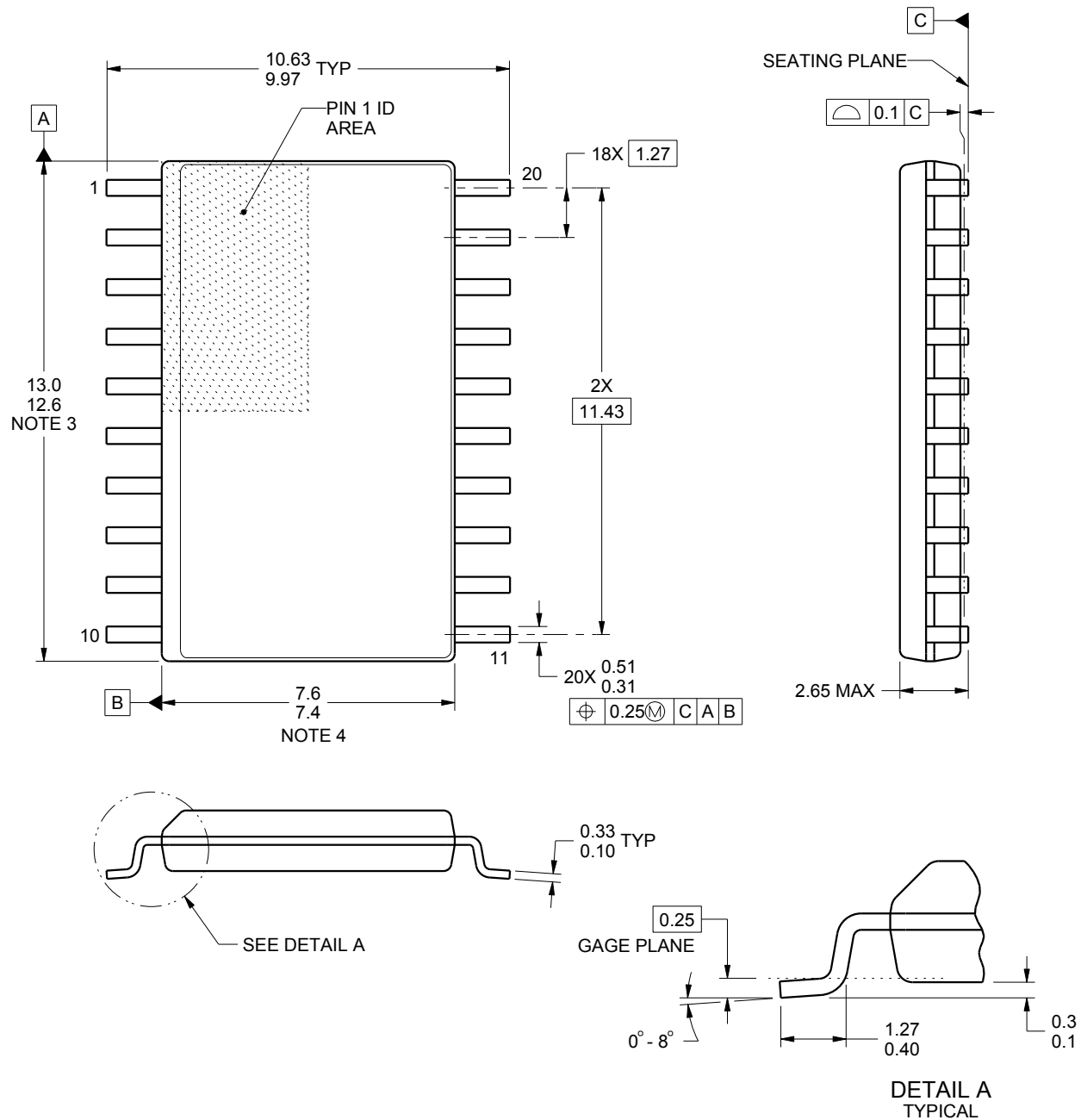
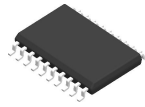


SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4214851/B 08/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.



4220724/A 05/2016

NOTES:

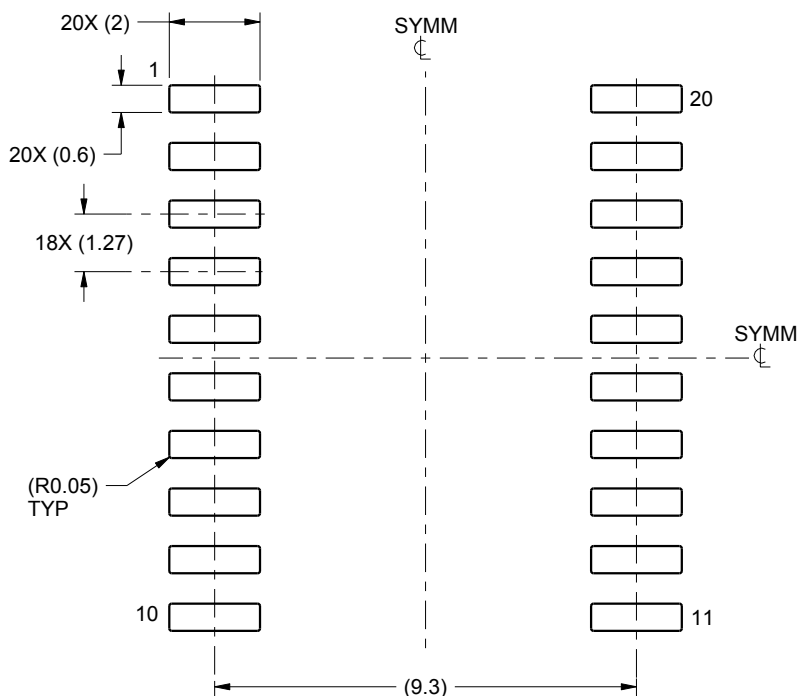
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

EXAMPLE BOARD LAYOUT

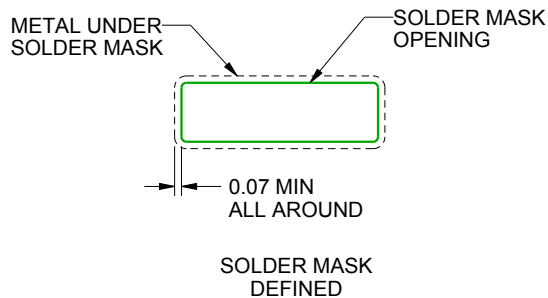
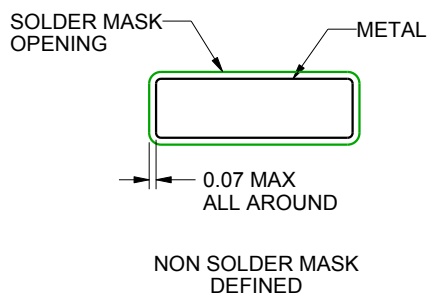
DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

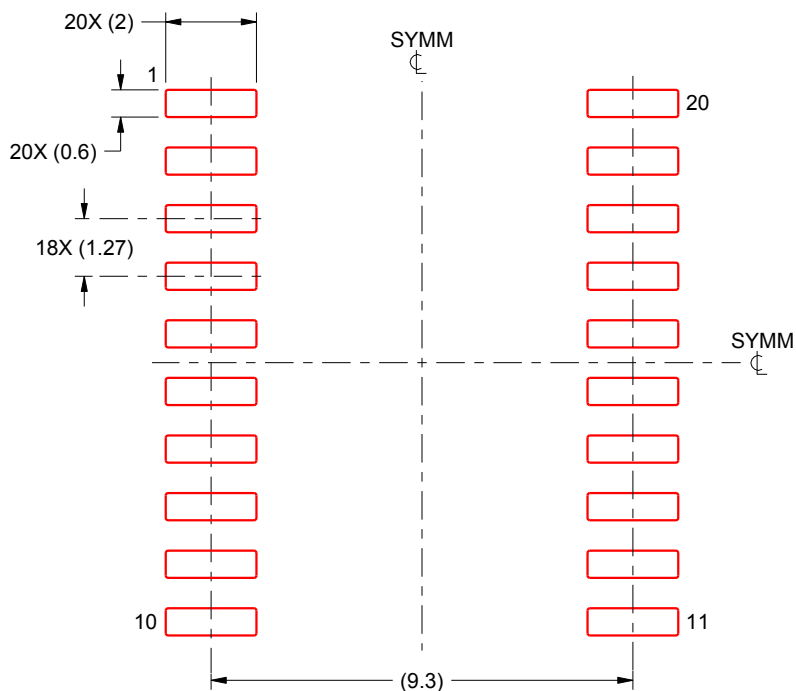
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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