

## CMOS 4-Bit D-Type Registers

### High-Voltage Types (20-Volt Rating)

■ CD4076B types are four-bit registers consisting of D-type flip-flops that feature three-state outputs. Data Disable inputs are provided to control the entry of data into the flip-flops. When both Data Disable inputs are low, data at the D inputs are loaded into their respective flip-flops on the next positive transition of the clock input. Output Disable inputs are also provided. When the Output Disable inputs are both low, the normal logic states of the four outputs are available to the load. The outputs are disabled independently of the clock by a high logic level at either Output Disable input, and present a high impedance.

The CD4076B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (M, M96, MT, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

### Features:

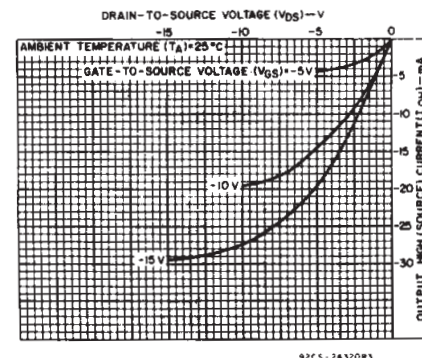
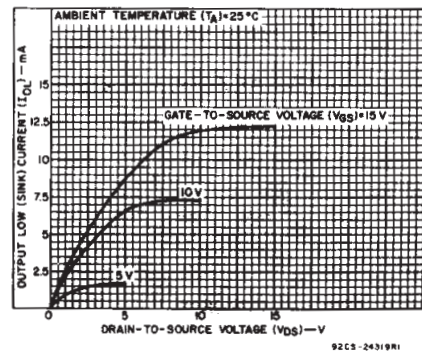
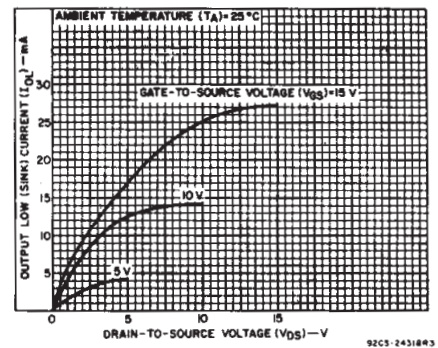
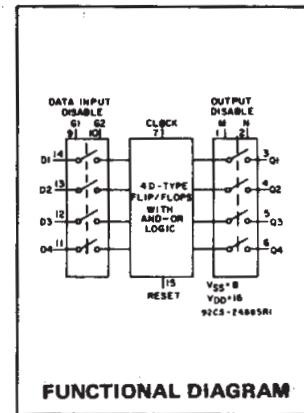
- Three-state outputs
- Input disabled without gating the clock
- Gated output control lines for enabling or disabling the outputs
- Standardized, symmetrical output characteristics
- 100% tested for quiescent current at 20 V
- Maximum input current of 1  $\mu$ A at 18 V over full package temperature range; 100 nA at 18 V and 25°C
- Noise margin over full package temperature range:
  - 1 V at  $V_{DD} = 5$  V
  - 2 V at  $V_{DD} = 10$  V
  - 2.5 V at  $V_{DD} = 15$  V
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"



TERMINAL ASSIGNMENT

**RECOMMENDED OPERATING CONDITIONS** at  $T_A = 25^\circ\text{C}$ , Except as Noted.  
For maximum reliability, normal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTIC	$V_{DD}$ (V)	LIMITS		UNITS
		Min.	Max.	
Supply Voltage Range (For $T_A$ = Full Package Temperature Range)		3	18	V
Data Setup Time, $t_s$	5	200	—	ns
	10	80	—	
	15	60	—	
Clock Pulse Width, $t_{W}$	5	200	—	ns
	10	100	—	
	15	80	—	
Clock Input Frequency, $f_{CL}$	5	—	3	MHz
	10	dc	6	
	15	—	8	
Clock Input Rise or Fall Time, $t_{rCL}, t_{fCL}$	5	—	15	$\mu$ s
	10	—	5	
	15	—	5	
Reset Pulse Width, $t_{W}$	5	120	—	ns
	10	50	—	
	15	40	—	
Data Input Disable Setup Time, $t_s$	5	180	—	ns
	10	100	—	
	15	70	—	



# CD4076B Types

## MAXIMUM RATINGS, Absolute-Maximum Values:

### DC SUPPLY-VOLTAGE RANGE, (V<sub>DD</sub>)

Voltages referenced to V<sub>SS</sub> Terminal ..... -0.5V to +20V

INPUT VOLTAGE RANGE, ALL INPUTS ..... -0.5V to V<sub>DD</sub> +0.5V

DC INPUT CURRENT, ANY ONE INPUT ..... ±10mA

### POWER DISSIPATION PER PACKAGE (P<sub>D</sub>):

For T<sub>A</sub> = -55°C to +100°C ..... 500mW

For T<sub>A</sub> = +100°C to +125°C ..... Derate Linearly at 12mW/°C to 200mW

### DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR T<sub>A</sub> = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) ..... 100mW

OPERATING-TEMPERATURE RANGE (T<sub>A</sub>) ..... -55°C to +125°C

STORAGE TEMPERATURE RANGE (T<sub>stg</sub>) ..... -65°C to +150°C

### LEAD TEMPERATURE (DURING SOLDERING):

At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max ..... +265°C

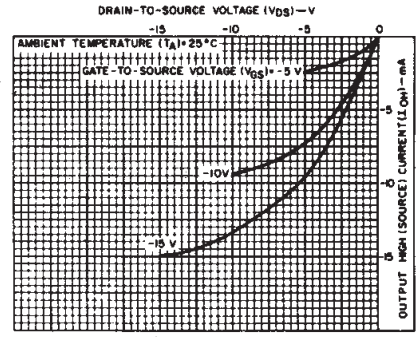
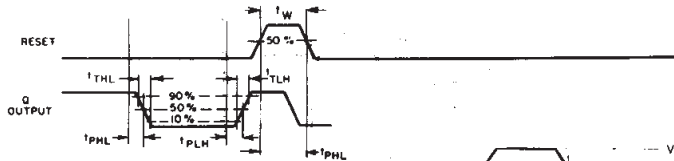
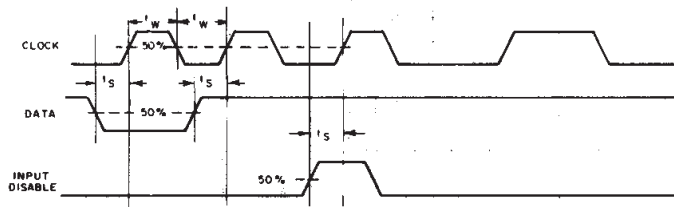
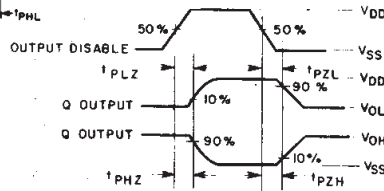


Fig.4 - Minimum output high (source) current characteristics.



92CM-24889R2

(a)

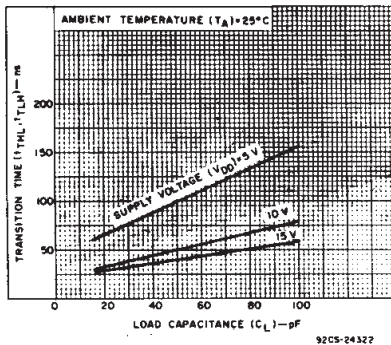


CHAR.	TEST VOLT.	AT D	AT Q
t <sub>PHZ</sub>	V <sub>DD</sub>	V <sub>SS</sub>	
t <sub>PLZ</sub>	V <sub>SS</sub>	V <sub>DD</sub>	
t <sub>PZH</sub>	V <sub>DD</sub>	V <sub>SS</sub>	

92CS-29299

(b)

Fig.5 - Functional waveforms for CD4076B.



92CS-24322

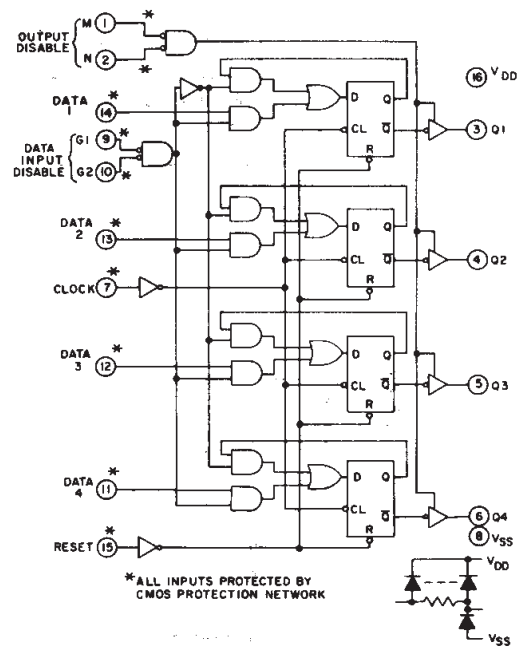
Fig.7 - Typical transition time vs. load capacitance.

### Truth Table

Reset	Clock	Data Input Disable G1	Data Input Disable G2	Data D	Next State Output Q
1	X	X	X	X	0
0	0	X	X	X	Q
0	1	X	X	X	Q
0	0	X	1	X	Q
0	0	0	0	1	1
0	0	0	0	0	0
0	1	X	X	X	Q
0	0	X	X	X	Q

When either Output Disable M or N is high, the outputs are disabled (high impedance state), however sequential operation of the flip flops is not affected.

1 = High Level  
0 = Low Level  
X = Don't Care  
NC = No Change



92CS-24889R2

Fig.8 - CD4076B logic diagram.

COMMERCIAL CMOS HIGH VOLTAGE ICs

# CD4076B Types

**DYNAMIC ELECTRICAL CHARACTERISTICS** at  $T_A = 25^\circ\text{C}$ , Input  $t_r, t_f = 20 \text{ ns}$ ,  $C_L = 50 \text{ pF}$ ,  $R_L = 200 \text{ k}\Omega$  (Unless otherwise noted)

CHARACTERISTIC	TEST CONDITIONS	LIMITS			UNITS	
		$V_{DD}$ V	Min.	Typ.		Max.
Propagation Delay Time: Clock to Q Output, $t_{PHL}$ , $t_{PLH}$		5		300	600	
		10		125	250	
		15		90	180	
Reset, $t_{PHL}$		5		230	460	ns
		10		100	200	
		15		75	150	
3-State Output 1 or 0 to High Impedance, $t_{PHZ}$ , $t_{PLZ}$	$R_L = 1 \text{ k}\Omega$	5		150	300	
		10		75	150	
		15		60	120	
3-State High Impedance to 1 or 0 Output, $t_{PZH}$ , $t_{PZL}$	$R_L = 1 \text{ k}\Omega$	5		150	300	
		10		75	150	
		15		60	120	
Transition Time, $t_{THL}$ , $t_{TLH}$		5		100	200	ns
		10		50	100	
		15		40	80	
Maximum Clock Input Frequency, $f_{CL}$		5	3	6		MHz
		10	6	12		
		15	8	16		
Minimum Clock Pulse Width, $t_W$		5		100	200	ns
		10		50	100	
		15		40	80	
Maximum Clock Input Rise or Fall Time, $t_{rcl}$ , $t_{fcl}$		5	15	-	-	$\mu\text{s}$
		10	5	-	-	
		15	5	-	-	
Minimum Reset Pulse With, $t_W$		5	-	60	120	ns
		10	-	25	50	
		15	-	20	40	
Minimum Data Setup Time, $t_S$		5	-	100	200	ns
		10	-	40	80	
		15	-	30	60	
Minimum Data Input Disable Setup Time, $t_S$		5	-	90	180	ns
		10	-	50	100	
		15	-	35	70	
Input Capacitance, $C_{IN}$	Any Input	-	-	5	7.5	pF

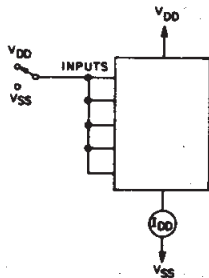


Fig. 11 - Quiescent device current test circuit.

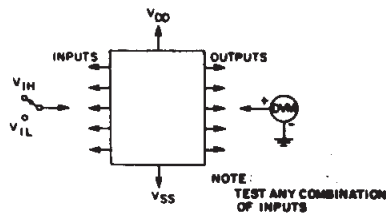


Fig. 12 - Input voltage test circuit.

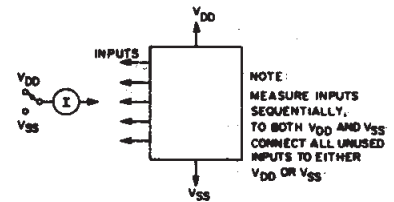


Fig. 13 - Input current test circuit.

# CD4076B Types

## STATIC ELECTRICAL CHARACTERISTICS

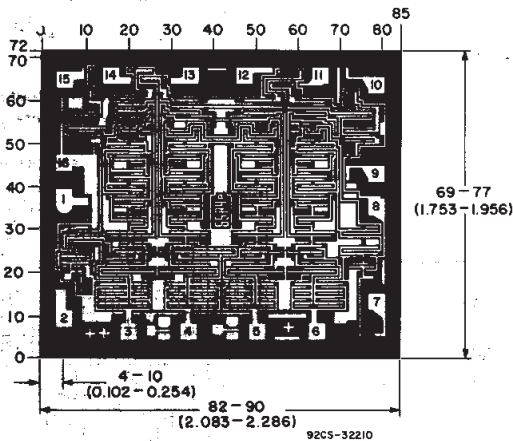
CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V <sub>O</sub> (V)	V <sub>IN</sub> (V)	V <sub>DD</sub> (V)	-55	-40	+85	+125	+25			
								Min.	Typ.	Max.	
Quiescent Device Current, I <sub>DD</sub> Max.	—	0,5	5	5	5	150	150	—	0.04	5	μA
	—	0,10	10	10	10	300	300	—	0.04	10	
	—	0,15	15	20	20	600	600	—	0.04	20	
	—	0,20	20	100	100	3000	3000	—	0.08	100	
Output Low (Sink) Current I <sub>OL</sub> Min.	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1	—	mA
	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	—	
	1.5	0,15	15	4.2	4	2.8	2.4	3.4	6.8	—	
Output High (Source) Current, I <sub>OH</sub> Min.	4.6	0,5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1	—	mA
	2.5	0,5	5	-2	-1.8	-1.3	-1.15	-1.6	-3.2	—	
	9.5	0,10	10	-1.6	-1.5	-1.1	-0.9	-1.3	-2.6	—	
	13.5	0,15	15	-4.2	-4	-2.8	-2.4	-3.4	-6.8	—	
Output Voltage: Low-Level, V <sub>OL</sub> Max.	—	0,5	5	0.05				—	0	0.05	V
	—	0,10	10	0.05				—	0	0.05	
	—	0,15	15	0.05				—	0	0.05	
Output Voltage: High-Level, V <sub>OH</sub> Min.	—	0,5	5	4.95				4.95	5	—	V
	—	0,10	10	9.95				9.95	10	—	
	—	0,15	15	14.95				14.95	15	—	
Input Low Voltage, V <sub>IL</sub> Max.	0.5, 4.5	—	5	1.5				—	—	1.5	V
	1.9	—	10	3				—	—	3	
	1.5, 13.5	—	15	4				—	—	4	
Input High Voltage, V <sub>IH</sub> Min.	0.5, 4.5	—	5	3.5				3.5	—	—	V
	1.9	—	10	7				7	—	—	
	1.5, 13.5	—	15	11				11	—	—	
Input Current I <sub>IN</sub> Max.	—	0,18	18	±0.1	±0.1	±1	±1	—	±10 <sup>-5</sup>	±0.1	μA
3-State Output Leakage Current I <sub>OUT</sub> Max.	0,18	0,18	18	±0.4	±0.4	±12	±12	—	±10 <sup>-4</sup>	±0.4	μA



Fig.9 — Typical maximum clock input frequency vs. supply voltage.



Fig.10 — Typical dynamic power dissipation vs. frequency.



Dimensions and pad layout for CD4076BH

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10<sup>-3</sup> inch).

3  
COMMERCIAL CMOS  
HIGH VOLTAGE ICs

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
CD4076BE	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
CD4076BEE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
CD4076BF	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	<a href="#">Purchase Samples</a>
CD4076BF3A	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	<a href="#">Purchase Samples</a>
CD4076BM	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
CD4076BME4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
CD4076BMG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
CD4076BMT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
CD4076BMTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
CD4076BMTG4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
CD4076BPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
CD4076BPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
CD4076BPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>

<sup>(1)</sup> 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.

<sup>(2)</sup> 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):** 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)

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

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**OTHER QUALIFIED VERSIONS OF CD4076B, CD4076B-MIL :**

- Catalog: [CD4076B](#)
- Military: [CD4076B-MIL](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.

4040049/E 12/2002



D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - 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 0.006 (0,15) each side.
  -  D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - 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 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040064-4/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.
  -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  -  Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - 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 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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