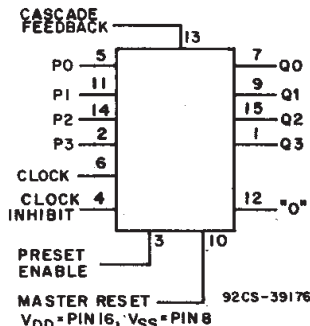


**NOT
RECOMMENDED FOR
NEW DESIGNS**

CD4522B Types

Advance Information/
Preliminary Data



FUNCTIONAL DIAGRAM

CMOS Programmable BCD Divide-by-"N" Counter

High-Voltage Types (20-Volt Rating)

Features:

- Internally synchronous for high internal and external speeds.
- Logic edge-clocked design — increments on positive Clock transition or on negative Clock Inhibit transition.
- 100% tested for quiescent current at 20-V.
- 5-V, 10-V, and 15-V parametric ratings.

- Standard symmetrical output characteristics.
- Maximum input current of 1 μ A at 18 V over full package-temperature range: 100 nA at 18 V and 25°C.
- Meets all requirements of JEDEC Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices."

■ CD4522B programmable BCD counter has a decoded "0" state output for divide-by-N applications. In single stage operation the "0" output is tied to the Preset Enable input. The Cascade Feedback allows multiple stage divide-by-N operation without the need for external gating. A HIGH on the Clock Inhibit disables the pulse-counting function. A HIGH on the Master Reset asynchronously resets the divide-by-N operation. The output is presented in BCD format.

Applications:

- Frequency synthesizers
- Phase-locked loops
- Programmable down counters
- Programmable frequency dividers

The CD4522B-series types are supplied in 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).

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})

Voltages referenced to V_{SS} Terminal) -0.5V to +20V

INPUT VOLTAGE RANGE, ALL INPUTS

..... -0.5V to V_{DD} +0.5V

DC INPUT CURRENT, ANY ONE INPUT

..... ± 10 mA

POWER DISSIPATION PER PACKAGE (P_D):

For $T_A = -55^\circ\text{C}$ to $+100^\circ\text{C}$ 500mW

For $T_A = +100^\circ\text{C}$ to $+125^\circ\text{C}$ Derate Linearly at 12mW/ $^\circ\text{C}$ to 200mW

DEVICE DISSIPATION PER OUTPUT TRANSISTOR

FOR $T_A = \text{FULL PACKAGE-TEMPERATURE RANGE (All Package Types)}$ 100mW

OPERATING-TEMPERATURE RANGE (T_A)

..... -55°C to $+125^\circ\text{C}$

STORAGE TEMPERATURE RANGE (T_{stg})

..... -65°C to $+150^\circ\text{C}$

LEAD TEMPERATURE (DURING SOLDERING):

At distance $1/16 \pm 1/32$ inch (1.59 ± 0.79 mm) from case for 10s max $+265^\circ\text{C}$

3
COMMERCIAL CMOS
HIGH VOLTAGE ICs

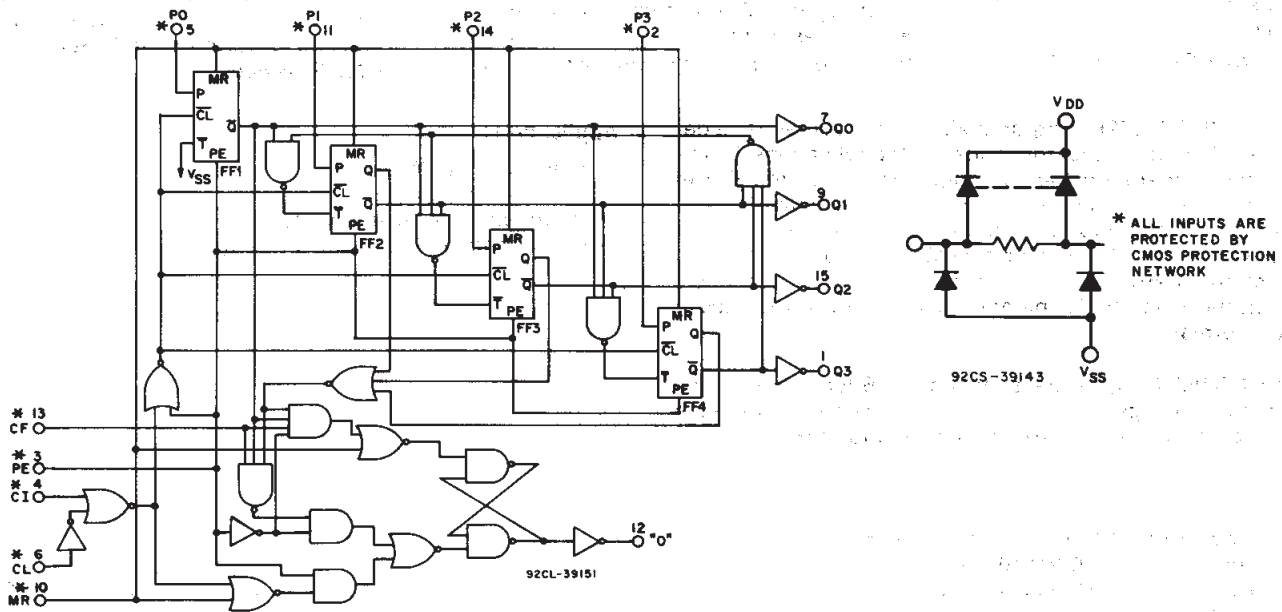
CD4522B Types

TRUTH TABLES

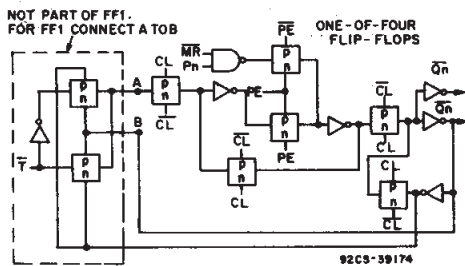
CLOCK	CLOCK INHIBIT	PRESET ENABLE	MASTER RESET	ACTION
0	0	0	0	No Count
1	0	0	0	Count Down
X	1	0	0	No Count
1	1	0	0	Count Down
X	X	1	0	Preset
X	X	X	1	Reset

X = Don't Care

Count	OUTPUTS			
	Q ₀	Q ₁	Q ₂	Q ₃
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1



a. Basic diagram.



b. Flip-flop detail.

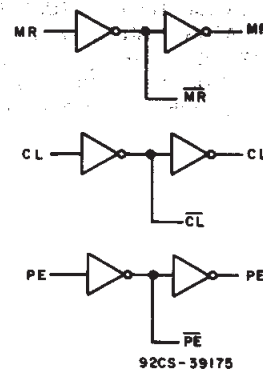


Fig. 1 - Logic diagram for the CD4522B.

CD4522B Types

RECOMMENDED OPERATING CONDITIONS at $T_A = 25^\circ\text{C}$, except as noted.

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

CHARACTERISTICS	V_{DD} (V)	LIMITS		UNITS
		Min.	Max.	
Supply-Voltage Range (For T_A = Full Package-Temperature Range)		3	18	V
Pulse Width:	5	250	—	ns
	10	100	—	
	15	80	—	
Clock, $t_{w(cc)}$	5	250	—	ns
	10	100	—	
	15	80	—	
Preset Enable, $t_{w(cc)}$	5	250	—	ns
	10	100	—	
	15	80	—	
Master Reset, $t_{w(MR)}$	5	350	—	ns
	10	250	—	
	15	200	—	
Clock Frequency, f_{CL}	5	—	1.5	MHz
	10	—	3.0	
	15	—	4.0	
Clock Rise and Fall Time t_{rCL} , t_{fCL}	5	—	15	μs
	10	—	15	
	15	—	15	
Preset Enable Set-up Time, t_{su}	5	0	—	ns
	10	0	—	
	15	0	—	
Preset Enable Hold Time, t_h	5	75	—	ns
	10	25	—	
	15	20	—	
Master Reset Removal Time, t_{rem}	5	130	—	ns
	10	50	—	
	15	30	—	

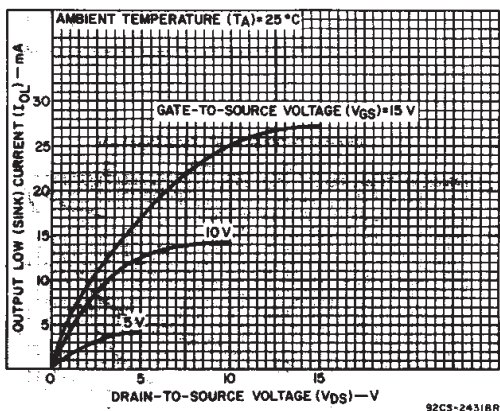


Fig. 2 — Typical output low (sink) current characteristics.

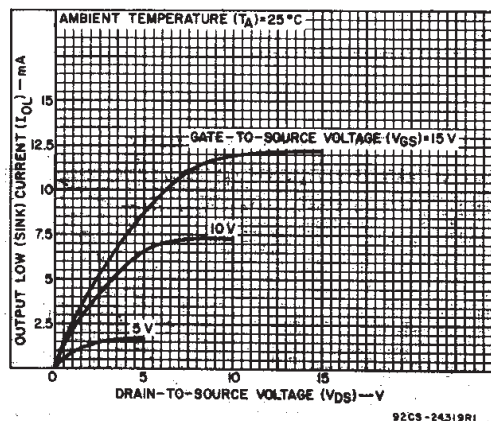


Fig. 3 — Minimum output low (sink) current characteristics.

CD4522B Types

STATIC ELECTRICAL CHARACTERISTICS

CHARACTER- ISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V _O (V)	V _{IN} (V)	V _{DD} (V)					+25			
				-55	-40	+85	+125	Min.	Typ.	Max.	
Quiescent Device Current, I _{DD} 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 _{OL} 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 _{OH} Min.	4.6	0, 5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1	—	
	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 _{OL} 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 _{OH} Min.	—	0, 5	5	4.95				4.95	5	—	
	—	0, 10	10	9.95				9.95	10	—	
	—	0, 15	15	14.95				14.95	15	—	
Input low Voltage, V _{IL} Max.	0.5, 4.5	—	5	1.5				—	—	1.5	
	1, 9	—	10	3				—	—	3	
	1.5, 13.5	—	15	4				—	—	4	
Input High Voltage, V _{IH} Min.	0.5, 4.5	—	5	3.5				3.5	—	—	
	1, 9	—	10	7				7	—	—	
	1.5, 13.5	—	15	11				11	—	—	
Input Current, I _{IN} Max.	—	0, 18	18	±0.1	±0.1	±1	±1	—	±10 ⁻⁵	±0.1	μA

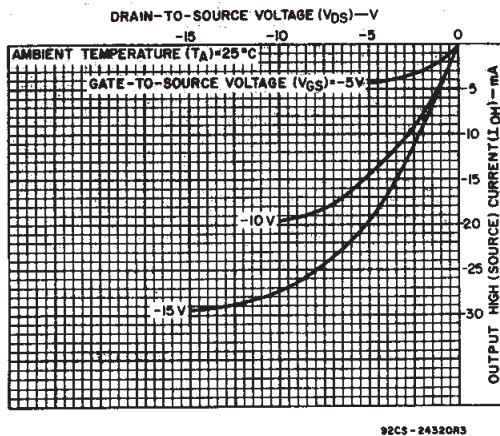


Fig. 4 — Typical output high (source) current characteristics.

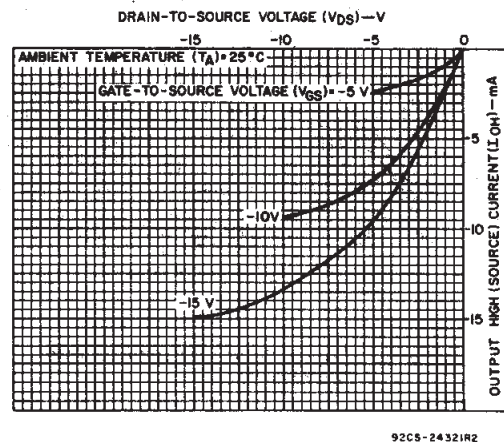


Fig. 5 — Minimum output high (source) current characteristics.

CD4522B Types

DYNAMIC ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$, Input $t_r, t_f = 20\text{ ns}$, $C_i = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$

CHARACTERISTIC	TEST CONDITIONS	LIMITS			UNITS
		V_{DD} (V)	Min.	Typ.	Max.
Propagation Delay Time; t_{PHL}, t_{PLH} : Clock to "Q" outputs		5	—	550	1100
		10	—	225	450
		15	—	160	320
Clock to "0" output		5	—	420	710
		10	—	160	270
		15	—	110	190
Clock inhibit to "Q" outputs		5	—	270	540
		10	—	100	200
		15	—	70	140
Master reset to "Q" outputs		5	—	270	540
		10	—	100	200
		15	—	70	140
Preset Enable Setup Time, t_{su}		5	—	0	0
		10	—	0	0
		15	—	0	0
Preset Enable Hold Time, t_h		5	—	75	150
		10	—	25	50
		15	—	20	40
Master Reset Removal Time, t_{rem}		5	—	130	260
		10	—	50	100
		15	—	30	60
Transition Time, t_{THL}, t_{TLH}		5	—	100	200
		10	—	50	100
		15	—	40	80
Minimum Pulse Width Clock, t_{WICL}		5	—	125	250
		10	—	50	100
		15	—	40	80
Preset Enable, t_{WPE}		5	—	125	250
		10	—	50	100
		15	—	40	80
Master Reset, t_{WMR}		5	—	175	350
		10	—	125	250
		15	—	100	200
Max Clock Freq, f_{CL}		5	—	3	1.5
		10	—	6	3.0
		15	—	8	4.0
Max Clock or Clock Inhibit Rise & Fall Time, t_{TLH}, t_{THL}		5	—	—	15
		10	—	—	15
		15	—	—	15
Input Capacitance, C_{IN}	Any Input		—	5	7.5
					pF

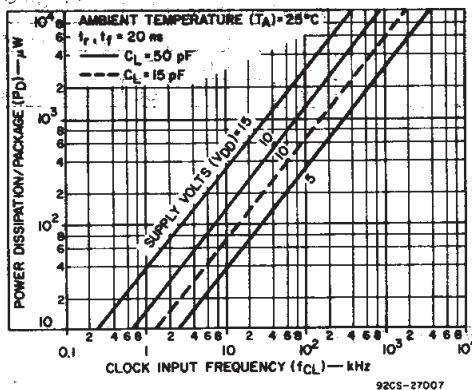
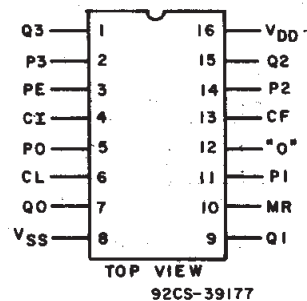


Fig. 6 — Typical dynamic power dissipation vs. frequency.



TERMINAL ASSIGNMENT

CD4522B Types

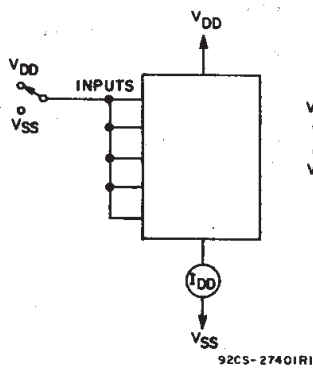


Fig. 7 — Quiescent device current test circuit.

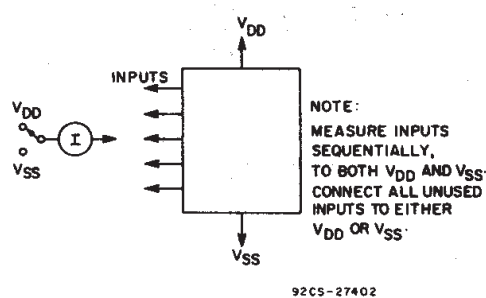


Fig. 8 — Input current test circuit.

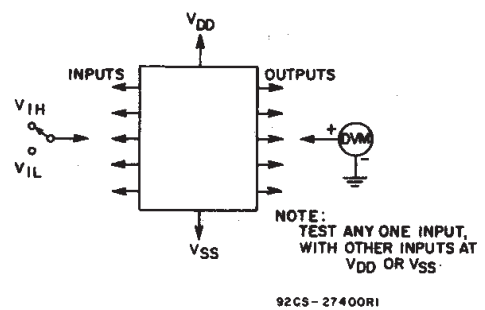


Fig. 9 — Input voltage test circuit.

APPLICATION CIRCUITS

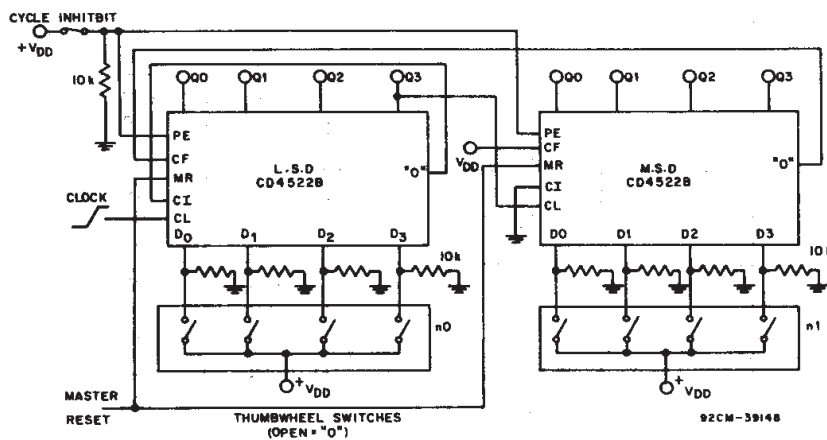


Fig. 10 — 2-Stage Programmable Down Counter (One Cycle)

From		To		Range of N
Stage	Pin	Stage	Pin	
LSD	"0"	All	PE	$LSD < N < MSD$
N	"0"	N-1	CF	$LSD + 1 < N < MSD$
N	"0"	N+1	CL	$LSD < N < MSD-1$

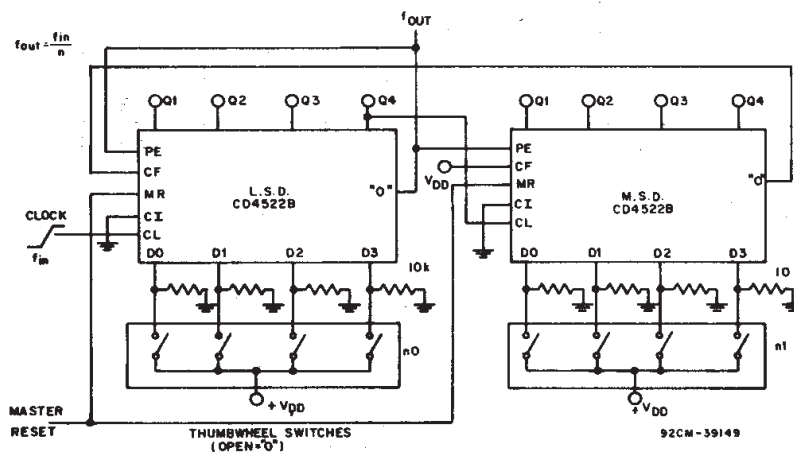
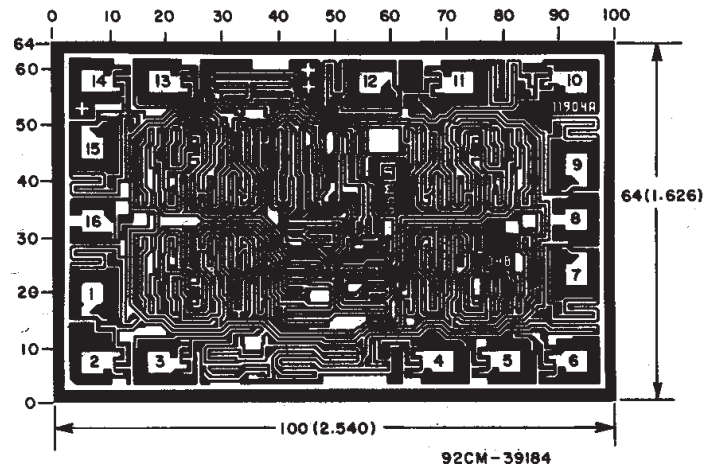


Fig. 11 — 2-Stage Programmable Frequency Divider

From		To		Range of N
Stage	Pin	Stage	Pin	
LSD	"0"	All	PE	$LSD < N < MSD$
N	"0"	N-1	CF	$LSD + 1 < N < MSD$
N	"0"	N+1	CL	$LSD < N < MSD-1$

CD4522B Types



Dimensions and pad layout for CD4522BH.

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).

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
CD4522BE	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD4522BE	Samples
CD4522BEE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-55 to 125	CD4522BE	Samples
CD4522BM	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4522BM	Samples
CD4522BME4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4522BM	Samples
CD4522BMG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4522BM	Samples
CD4522BMT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4522BM	Samples
CD4522BMTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4522BM	Samples
CD4522BMTG4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4522BM	Samples
CD4522BPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM522B	Samples
CD4522BPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM522B	Samples
CD4522BPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM522B	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.

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.

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

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N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
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	AA	BB	AC	AD



14/18 Pin Only
20 Pin vendor option

4040049/E 12/2002

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

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- $\triangle C$ 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.
- $\triangle D$ 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:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - 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 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- 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

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4211284-3/F 12/12

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

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