National Semiconductor

February 1995

LM710 Voltage Comparator

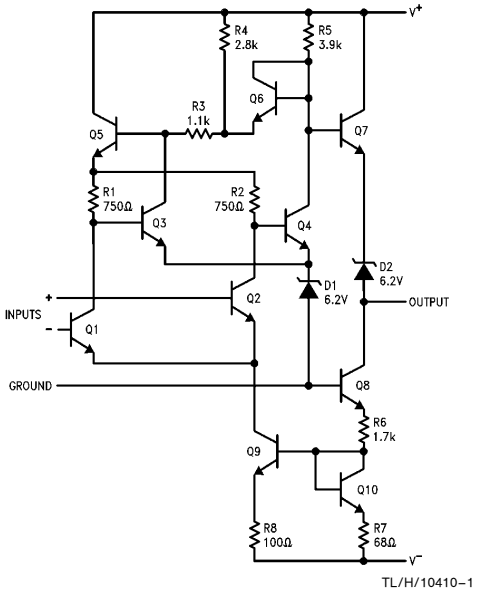
General Description

The LM710 series are high-speed voltage comparators intended for use as an accurate, low-level digital level sensor or as a replacement for operational amplifiers in comparator applications where speed is of prime importance. The circuit has a differential input and a single-ended output, with saturated output levels compatible with practically all types of integrated logic.

The device is built on a single silicon chip which insures low offset and thermal drift. The use of a minimum number of stages along with minority-carrier lifetime control (gold doping) makes the circuit much faster than operational amplifiers in saturating comparator applications. In fact, the low stray and wiring capacitances that can be realized with monolithic construction make the device difficult to duplicate with discrete components operating at equivalent power levels.

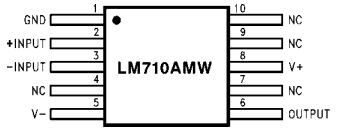
The LM710 series are useful as pulse height discriminators, voltage comparators in high-speed A/D converters or go, no-go detectors in automatic test equipment. They also have applications in digital systems as an adjustable-threshold line receiver or an interface between logic types. In addition, the low cost of the units suggests them for applications replacing relatively simple discrete component circuitry.

Schematic and Connection Diagrams



TL/H/10410–1

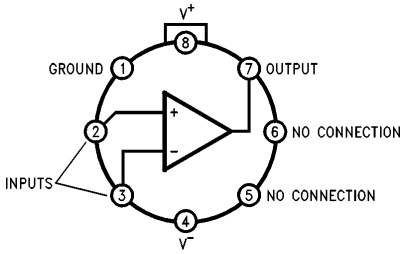
Ceramic Flatpak Package



TL/H/10410–9

Order Number LM710AMW/883*
See NS Package Number W10A

Metal Can Package



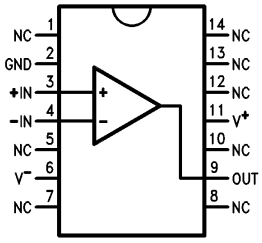
TL/H/10410–2

Top View

Note: Pin 4 is connected to case.

Order Number LM710AMH/883*, LM710H, LM710H/883 or LM710CH
See NS Package Number H08C

Dual-In-Line Package



TL/H/10410–3

Top View

Order Number LM710AMJ/883* or LM710CN
See NS Package Number N14A or J14A

*Also available per JM38510/10301

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Positive Supply Voltage	+14V
Negative Supply Voltage	−7V
Peak Output Current	10 mA
Output Short Circuit Duration	10 seconds
Differential Input Voltage	±5V
Input Voltage	±7V

Power Dissipation	
TO-99 (Note 1)	700 mW
Plastic Dual-In-Line Package (Note 2)	950 mW
Operating Temperature Range	
LM710	−55°C to +125°C
LM710C	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	260°C

Electrical Characteristics (Note 3)

Parameter	Conditions	LM710			LM710C			Units
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$R_S \le 200\Omega$, $V_{CM} = 0V$, $T_A = 25°C$		0.6	2.0		1.6	5.0	mV
Input Offset Current	$V_{OUT} = 1.4V$, $T_A = 25°C$		0.75	3.0		1.8	5.0	μA
Input Bias Current	$T_A = 25°C$		13	20		16	25	μA
Voltage Gain	$T_A = 25°C$	1250	1700		1000	1500		
Output Resistance	$T_A = 25°C$		200			200		Ω
Output Sink Current	$V_{OUT} = 0$, $T_A = 25°C$ $\Delta V_{IN} \ge 5$ mV $\Delta V_{IN} \ge 10$ mV	2.0	2.5		 1.6	 2.5		 mA mA
Response Time	$T_A = 25°C$ (Note 4)		40			40		ns
Input Offset Voltage	$R_S \le 200\Omega$, $V_{CM} = 0V$			3.0			6.5	mV
Average Temperature Coefficient of Input Offset Voltage	$T_{MIN} \le T_A \le T_{MAX}$ $R_S \le 50\Omega$		3.0	10		5.0	20	μV/°C
Input Offset Current	$T_A = T_{A\,MAX}$ $T_A = T_{A\,MIN}$		0.25 1.8	3.0 7.0			7.5 7.5	μA μA
Average Temperature Coefficient of Input Offset Current	$25°C \le T_A \le T_{MAX}$ $T_{MIN} \le T_A \le 25°C$		5.0 15	25 75		15 24	50 100	nA/°C nA/°C
Input Bias Current	$T_A = T_{MIN}$		27	45		25	40	μA
Input Voltage Range	$V^- = -7V$	±5.0			±5.0			V
Common-Mode Rejection Ratio	$R_S \le 200\Omega$	80	100		70	98		dB
Differential Input Voltage Range		±5.0			±5.0			V
Voltage Gain		1000			800			V/V
Positive Output Level	-5 mA $\le I_{OUT} \le 0$ $V_{IN} \ge 5$ mV $V_{IN} \ge 10$ mV	2.5	3.2	4.0	 2.5	 3.2	 4.0	 V V
Negative Output Level	$V_{IN} \ge 5$ mV $V_{IN} \ge 10$ mV	−1.0	−0.5	0	 −1.0	 −0.5	 0	V V
Output Sink Current	$V_{IN} \ge 5$ mV, $V_{OUT} = 0$ $T_A = 125°C$ $T_A = -55°C$	 0.5 1.0	 1.7 2.3					 mA mA
	$V_{IN} \ge 10$ mV, $V_{OUT} = 0$ $0°C \le T_A \le +70°C$				0.5			mA

Electrical Characteristics (Note 3) (Continued)

Parameter	Conditions	LM710			LM710C			Units
		Min	Typ	Max	Min	Typ	Max	
Positive Supply Current	$V_{IN} \geq 5$ mV		5.2	9.0				mA
	$V_{IN} \geq 10$ mV					5.2	9.0	mA
Negative Supply Current	$V_{IN} \geq 5$ mV		4.6	7.0				mA
	$V_{IN} \geq 10$ mV					4.6	7.0	mA
Power Consumption	$I_{OUT} = 0$							
	$V_{IN} \geq 5$ mV		90	150				mW
	$V_{IN} \geq 10$ mV						150	mW

Note 1: Rating applies for ambient temperatures of 25°C; derate linearly at 5.6 mW/°C for ambient temperatures above 25°C.

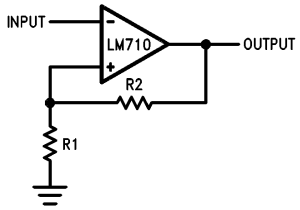
Note 2: Derate linearly at 9.5 mW/°C for ambient temperatures above 25°C.

Note 3: These specifications appy for $V^+ = 12V$, $V^- = -6V$, $-55°C \leq T_A \leq +125°C$ for LM710 and $0°C \leq T_A \leq +70°C$ for LM710C unless otherwise specified: The input offset voltage and input offset current (see definitions) are specified for a logic threshold voltage of 1.8V at −55°C, 1.4V at 25°C, and 1V at 125°C for LM710 and 1.5V at 0°C, 1.4V at 25°C, and 1.2V at 70°C for LM710C.

Note 4: The response time specified (see definitions) is for a 100 mV input step with 5 mV overdrive (LM710) or a 10 mV overdrive (LM710C).

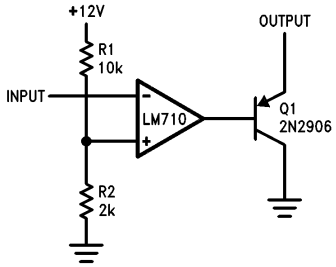
Typical Applications

Schmitt Trigger



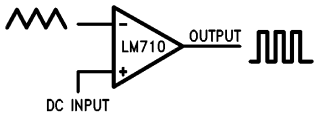
TL/H/10410–4

Line Receive with Increased Output Sink Current



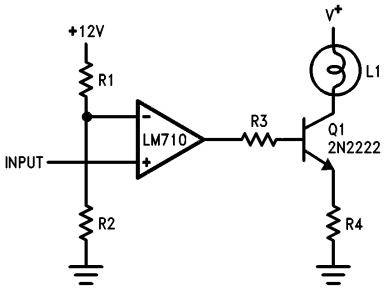
TL/H/10410–5

Pulse Width Modulator



TL/H/10410–6

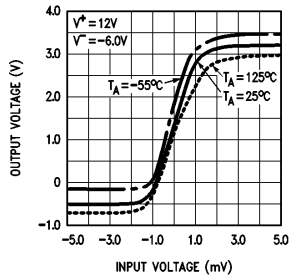
Level Detector with Lamp Driver



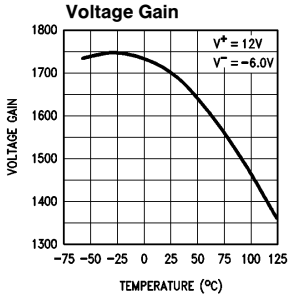
TL/H/10410–7

Typical Performance Characteristics

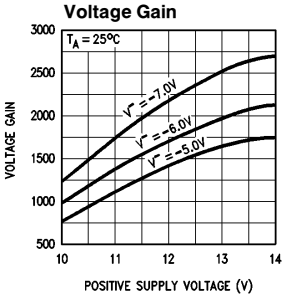
Transfer Function



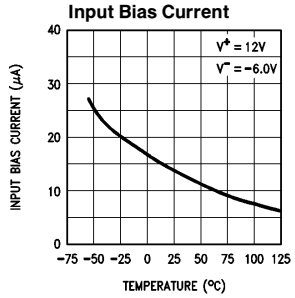
Voltage Gain



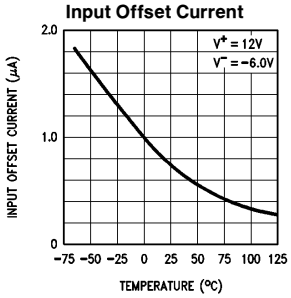
Voltage Gain



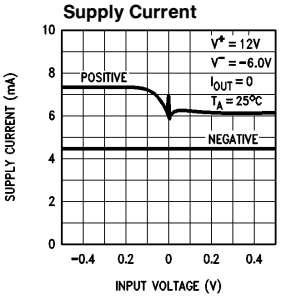
Input Bias Current



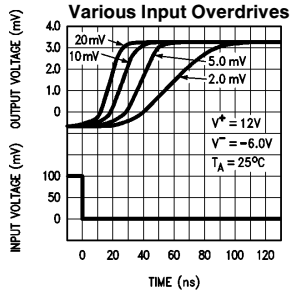
Input Offset Current



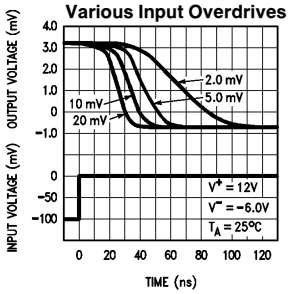
Supply Current



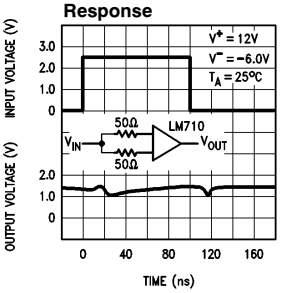
Response Time for Various Input Overdrives



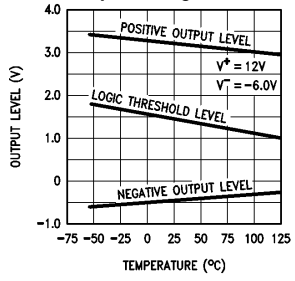
Response Time for Various Input Overdrives



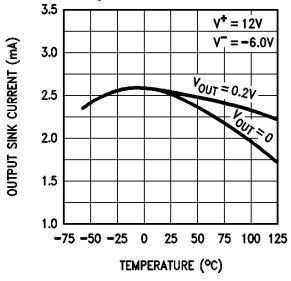
Common Mode Pulse Response



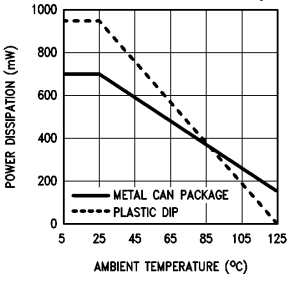
Output Voltage Level



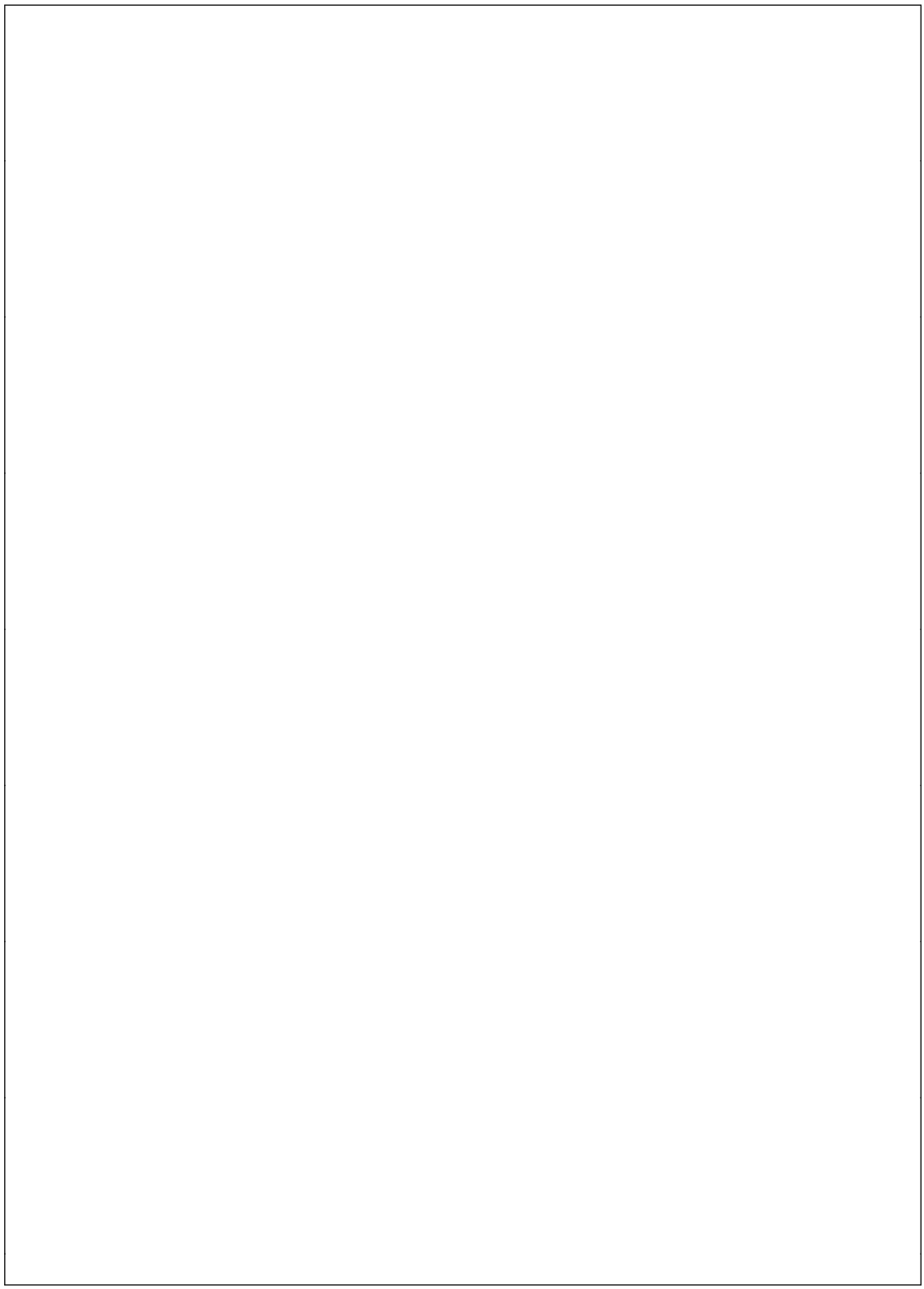
Output Sink Current



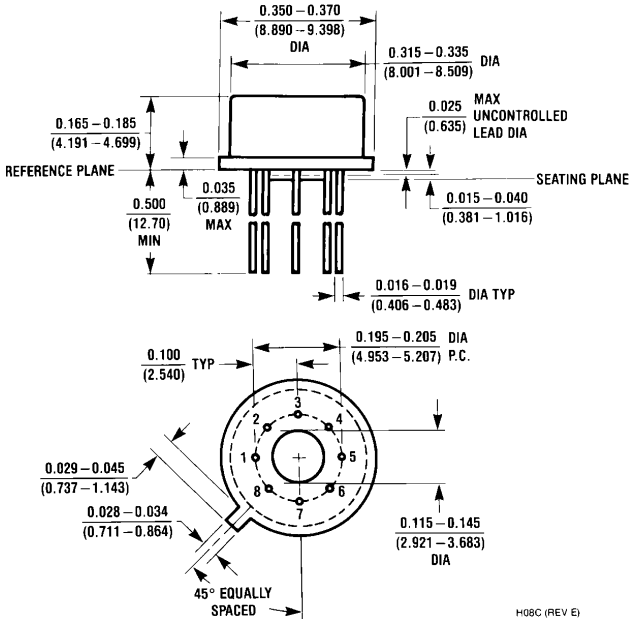
Maximum Power Dissipation



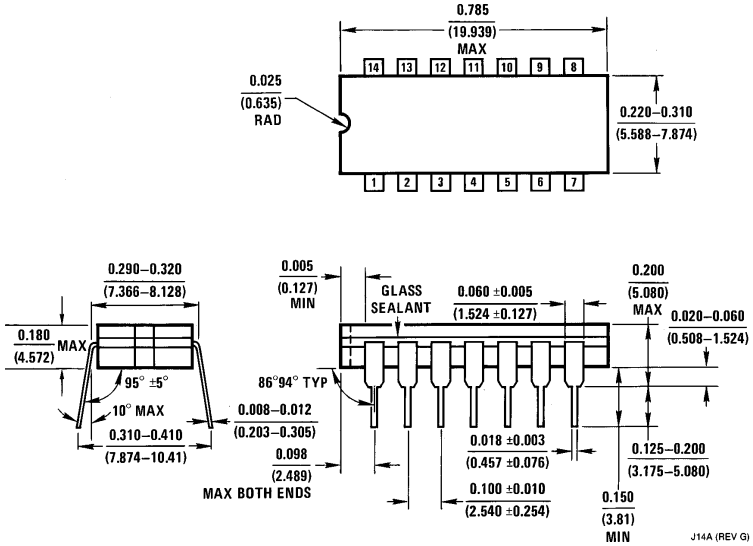
TL/H/10410–8



Physical Dimensions inches (millimeters)

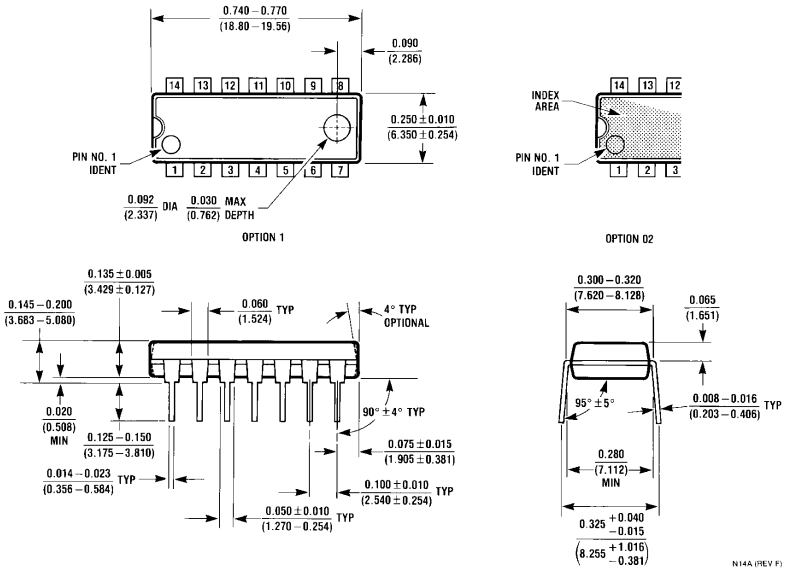


Metal Can Package
Order Number LM710AMH/883, LM710H, LM710H/883 or LM710CH
NS Package Number H08C



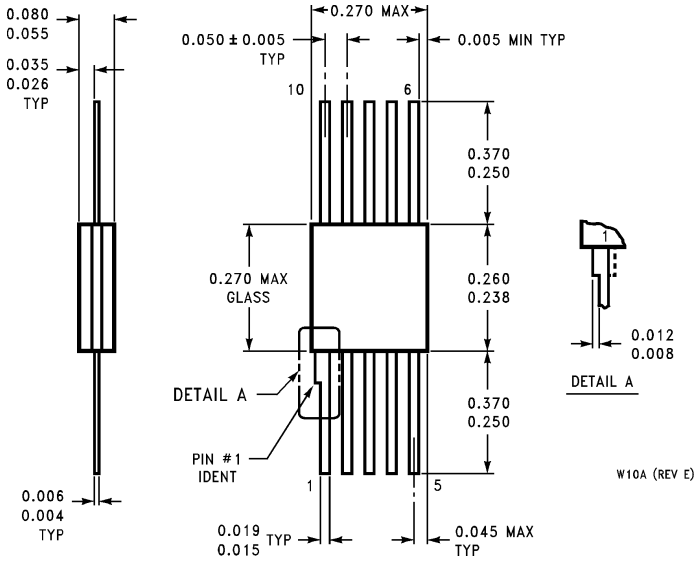
Ceramic Dual-In-Line Package
Order Number LM710AMJ/883
NS Package Number J14A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number LM710CN
NS Package Number N14A

Physical Dimensions inches (millimeters) (Continued)



Ceramic Flatpak
Order Number LM710AMW/883
NS Package Number W10A

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