THE DATASHEET OF

SN75LBC784DWG4

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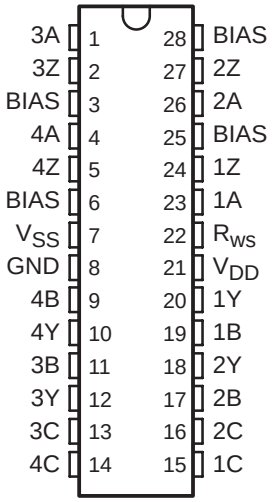
QUADRUPLE RS-423-B DRIVER/RECEIVER

FEATURES

- **Four Independent Drivers and Receivers**
- **Driver Slew Rate Controlled by a Single Resistor**
- **Fast Driver Transition Times Down to 1.5 μs and Receiver Transition Times of 20 ns Typ**
- **Internal Thermal-Overload Protection**
- **RS-423-B Inputs and Outputs Designed to Withstand ±25 V**
- **ESD Protection Exceeds 2000 V Per MIL-STD-833C Method 3015**
- **LinBICMOS™ Process Technology**

DW PACKAGE
(TOP VIEW)



DESCRIPTION

The SN75LBC784 performs as four independent RS-423-B driver/receiver pairs designed to interface data terminal equipment (DTE) with data circuit-terminating equipment (DCE) at rates up to 120 kbps and distances to 1.2 km. The SN75LBC784 provides an upgrade to the RS-232 serial interface and can be backwards-compatible with existing serial ports while offering the higher performance required by new faster peripherals, such as v.34 (v.fast) modems. The RS-232 standard, and subsequent revisions, only supports data rates up to 20 kbps over about 15 meters of cable. For RS-423-B the data rate is increased to 120 kbps and transmission distance to 1.2 km by reducing the maximum output signal swing, increasing the driver output current, and reducing the receiver input voltage thresholds.

FUNCTION TABLE

INPUTS			OUTPUTS	
A	**B**	**C**	**Z**	**Y**
L	L	H	H	H
H	L	H	H	L
L	H	L	L	H
H	H	L	L	L
L	L	L	?	H
H	L	L	?	L
L	H	H	?	H
H	H	H	?	L

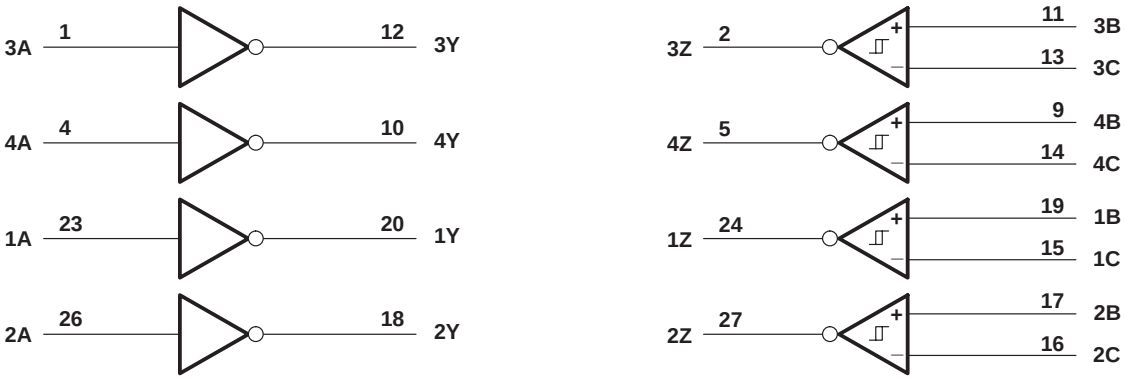
H = high level, L = low level,
X = irrelevant, Z = high impedance (off)
? = indeterminate

The receivers consist of differential comparators with hysteresis and resistive attenuation on the inputs. The resistive attenuation improves the input common-mode range and also provides additional protection from ESD and over-voltage stress. The differential and common-mode input impedances are sufficiently high to meet RS-423-B. When a differential voltage input of 500 mV is applied across the entire common-mode range (see Figure 5), the receiver characteristics and bias voltage allow the receiver to remain in its intended binary state.

The drivers meet all RS-423-B specifications with built-in current limits and thermal overload protection. Slew-rate controlling circuitry is included in the design, which is adjusted to suit the application by means of an external resistor (R_{WS}). The slew rate controlling circuitry also has a default mode—if the R_{WS} pin is shorted to 5 V externally, the transistion time defaults to approximately 1.5 ms. The BIAS input, when shorted to 5 V externally, provides the internal node voltages. The receiver is compatible to RS-232 with the use of external input resistors to meet the RS-232 input resistance specification of 3 kΩ to 7 kΩ.

The SN75LBC784 is characterized for operation over the temperature range of 0°C to +70°C.

logic diagram (positive logic)



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

Positive supply voltage, V_{DD}(1) . . . . . 14 V
Negative supply voltage, V_{SS} . . . . . −14 V
Bias voltage, V_{bias} . . . . . 5.75 V
Receiver input voltage range . . . . . −30 V to 30 V
Driver input voltage range . . . . . −0.5 V to 5.75 V
Driver output voltage range (supplies at 0 V) . . . . . −30 V to 30 V
Driver output voltage range (supplies at ±12 V) . . . . . −25 V to 25 V
Continuous power dissipation . . . . . See Dissipation Rating Table
Operating free-air temperature range, T_A . . . . . 0°C to +70°C
Storage temperature range . . . . . −65°C to +150°C
Case temperature 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.

(1) All voltages are with respect to network ground terminal.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le +25°C$ POWER RATING	DERATING FACTOR† ABOVE $T_A = +25°C$	$T_A = +70°C$ POWER RATING
DW	1348 mW	10.8 mW/°C	862 mW

† Derating factors are the inverse of the junction-to-ambient thermal resistance when board-mounted with no air flow.

recommended operating conditions

		MIN	NOM	MAX	UNIT
Supply voltage, V_{DD}		10.8	12	13.2	V
Supply voltage, V_{SS}		−10.8	−12	−13.2	V
Bias voltage, V_{bias}		2	5	5.5	V
High-level input voltage, V_{IH}	Driver	2			V
Low-level input voltage, V_{IL}	Driver			0.8	V
High-level output current, I_{OH}	Receiver			−4	mA
Low-level output current, I_{OL}	Receiver			4	mA
Rws slew rate control resistor		20	82	820	kΩ
Operating free-air temperature, T_A		0		+70	°C

DRIVER SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature, V_{DD} = 10.8 V to 13.2 V, V_{SS} = −10.8 V to −13.2 V, T_A = 0°C to +70°C (unless otherwise noted).

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage	Open circuit or R_L = 450 Ω		4	5.5	6	V
V_{OL}	Low-level output voltage	Open circuit or R_L = 450 Ω		−6	−5.5	−4	V
I_{IH}	High-level input current	V_I = 2.4 V to 5.5 V				100	µA
I_{IL}	Low-level input current	V_I = 0 V to 0.8 V		−100			µA
I_O	Output leakage current	V_{DD} = V_{SS} = 0,	V_O = ±6 V	−100		100	µA
$I_{OS(H)}$	High-level short circuit output current	V_I = 5 V,	V_O = 0	15		45	mA
$I_{OS(L)}$	Low-level short circuit output current	V_I = 0,	V_O = 0	−45		−15	mA
I_{DD}	Supply current	No load			10	12	mA
		R_L = 450 Ω			60	70	
I_{SS}	Supply current	No load			−10	−12	mA
		R_L = 450 Ω			−60	−70	
I_{bias}	Bias current					400	µA

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, V_{DD} = 10.8 V to 13.2 V, V_{SS} = −10.8 V to −13.2 V, T_A = 0°C to +70°C (unless otherwise noted).

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
t_{TLH}	Transition time, low-to-high level (see Figure 1)	R_L = 450 Ω, V_{WS} = 5 V	C_L = 50 pF,	R_{WS} = 0 kΩ		1.5		µs
				R_{WS} = 20 kΩ	1.5	2.1	2.7	
				R_{WS} = 82 kΩ	5	8	11	
				R_{WS} = 820 kΩ		80		
t_{THL}	Transition time, high-to-low level (see Figure 1)			R_{WS} = 0 kΩ		1.5		µs
				R_{WS} = 20 kΩ	1.5	2.1	2.7	
				R_{WS} = 82 kΩ	5	8	11	
				R_{WS} = 820 kΩ		80		
SR	Output slew rate			Rws = 20 kΩ			15	V/µs
t_{sk}	Output skew (see Figure 4) $\lvert t_{PHL} - t_{PLH} \rvert$			R_{WS} = 82 kΩ			1	µs

RECEIVER SECTION

electrical characteristics over recommended ranges of supply voltage and operating free-air temperature, V_{DD} = 10.8 V to 13.2 V, V_{SS} = −10.8 V to −13.2 V, T_A = 0°C to +70°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{IT+}	Positive input threshold voltage					200	mV
		With 500 Ω series resistor				400	
V_{IT-}	Negative input threshold voltage					−200	mV
		With 500 Ω series resistor				−400	
I_I	Input current	V_I = 10 V	Other input to GND		1.3	3.25	mA
		V_I = −10 V		−3.25	−1.3		
V_{hys}	Hysteresis ($V_{IT+} - V_{IT-}$)			20	40	150	mV
V_{OH}	High-level output voltage (1)	I_O = −20 μA		3.5		5	V
		I_O = −4 mA		2.4		5	
V_{OL}	Low-level output voltage	I_O = 20 μA to 4 mA				0.4	V
I_{RX}	RX short circuit current					50	mA
V_{ID}	Differential input voltage	Receiver inputs open circuit		1.6	2.1	2.6	V
V_{ofs}	Fail safe output voltage	See Note 2		3.5			V

(1) Device has an internal RX supply regulator. Maximum RX logic output voltage under no load is thus defined by an internal voltage value. This is nominally set to 4.5 V with a tolerance of ±5%.

(2) One input at ground, other input open circuit, I_O = −20 μA, or both open circuit.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)

test conditions: V_{DD} = 10.8 V to 13.2 V, V_{SS} = −10.8 V to −13.2 V, T_A = 0°C to +70°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	NOM	MAX	UNIT
t_{PLH}	Propagation delay time low-to-high (see Figure 2)	C_L = 50 pF		0.15	1	μs
t_{PHL}	Propagation delay time high-to-low (see Figure 2)					
t_{THL}	Transition time high-to-low (see Figure 3)			20	200	ns
t_{TLH}	Transition time low-to-high (see Figure 3)					

PARAMETER MEASUREMENT INFORMATION

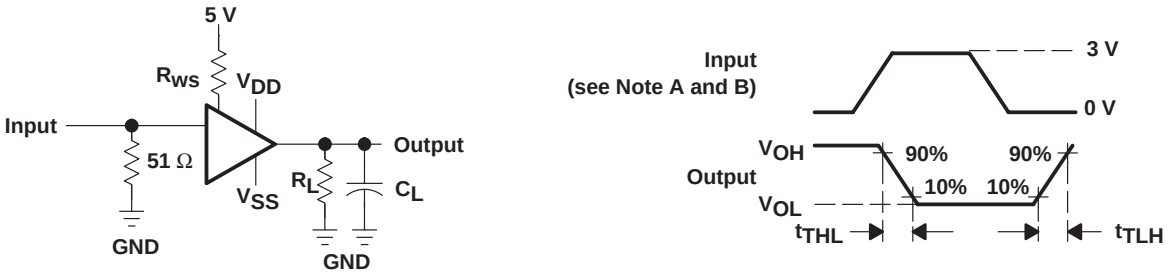


Figure 1. Driver Transition Times

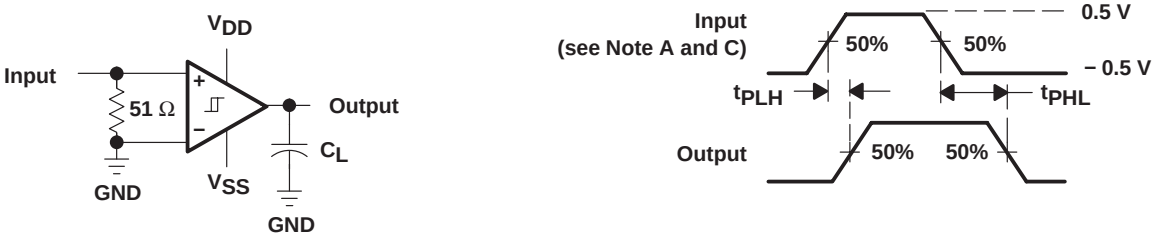


Figure 2. Receiver Propagation Delay Times

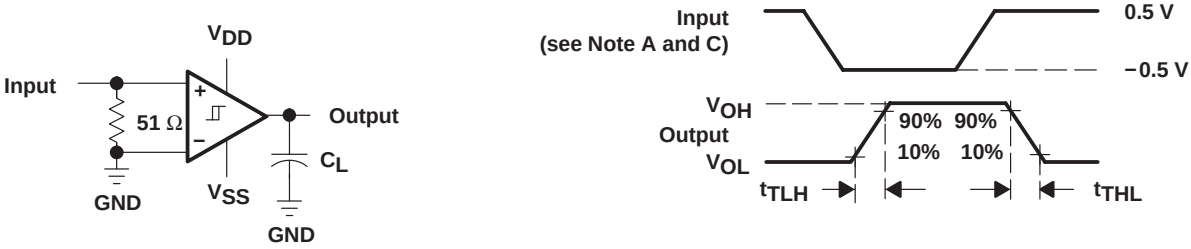


Figure 3. Receiver Transition Times

NOTES:A. C_L includes probe and jig capacitance.

B. The input pulse is supplied by a generator having the following characteristics: $t_r \le 10$ nS, $t_f < 10$ nS, $Z_O = 50\ \Omega$, PRR ≥ 5 kHz, duty cycle 50%, $V_{max} = 3$ V, $V_{min} = 0$ V.

C. The input pulse is supplied by a generator having the following characteristics: $t_r \le 10$ nS, $t_f < 10$ nS, $Z_O = 50\ \Omega$, PRR ≥ 5 kHz, duty cycle 50%, $V_{max} = 0.5$ V, $V_{min} = -0.5$ V.

PARAMETER MEASUREMENT INFORMATION, CONTINUED

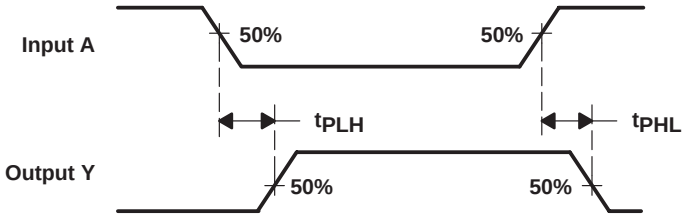


Figure 4. Skew Definition Times

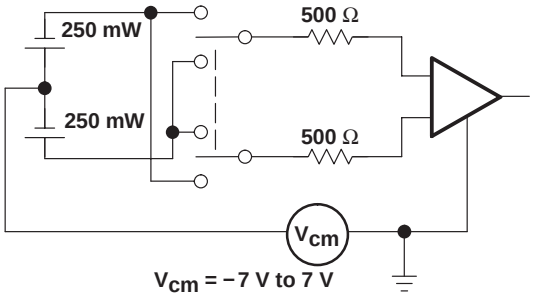


Figure 5. Receiver Input Balance Test

Revision History

DATE	REV	PAGE	SECTION	DESCRIPTION
6/07	B	Front Page	—	Updated front page.
		2	—	Corrected pin references in positive logic diagram (receiver 1, receiver 2).

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

PACKAGING INFORMATION

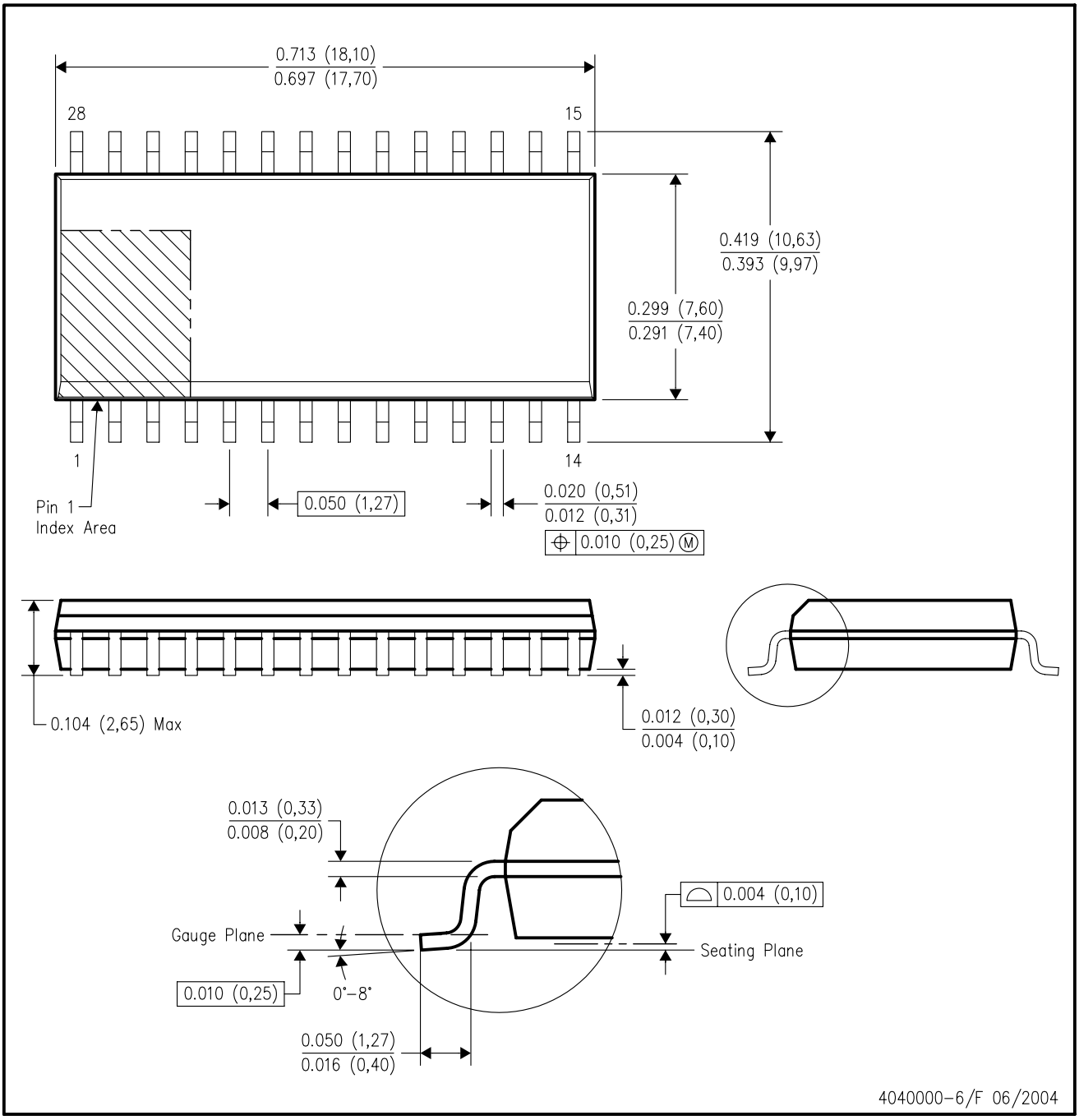
Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
SN75LBC784DW	OBSOLETE	SOIC	DW	28		TBD	Call TI	Call TI
SN75LBC784DWG4	OBSOLETE	SOIC	DW	28		TBD	Call TI	Call TI
SN75LBC784DWR	OBSOLETE	SOIC	DW	28		TBD	Call TI	Call TI
SN75LBC784DWRG4	OBSOLETE	SOIC	DW	28		TBD	Call TI	Call TI

(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.

DW (R–PDSO–G28) PLASTIC SMALL–OUTLINE PACKAGE



NOTES:
A. All linear dimensions are in inches (millimeters).
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 AE.

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