8-Channel Source Driver with Overcurrent Protections

Discontinued Product

These parts are no longer in production The device should not be purchased for new design applications. Samples are no longer available.

Date of status change: April 28, 2006

Recommended Substitutions:

For existing customer transition, and for new customers or new applications, refer to the 2987-6.

NOTE: For detailed information on purchasing options, contact your local Allegro field applications engineer or sales representative.

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2987

8-CHANNEL SOURCE DRIVER WITH OVER-CURRENT PROTECTION
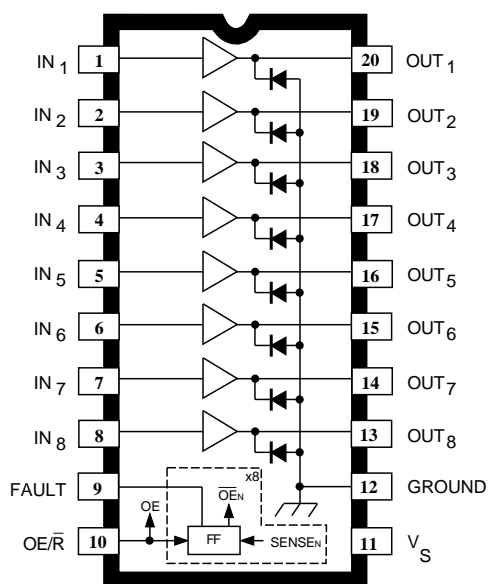
Dwg. PP-067

Note that the UDN2987A (DIP) and the UDN2987LW (SOIC) are electrically identical and share a common terminal number assignment.

ABSOLUTE MAXIMUM RATINGS
at T_A = +25°C

Driver Supply Voltage, V_S .... **35 V**

Output Sustaining Voltage, $V_{CE(sus)}$ ...... **35 V**

Continuous Output Current,
   I_{OUT} .... **-500 mA***

FAULT Output Voltage, V_{CE} .... **35 V**

FAULT Output Current, I_C .... **30 mA**

Input Voltage, V_{IN} .... **15 V**

Package Power Dissipation,
   P_D .... **See Graph**

Operating Temperature Range,
   T_A .... **-20°C to +85°C**

Storage Temperature Range,
   T_S .... **-55°C to +150°C**

* Outputs are disabled at approximately -500 mA
  per driver.

Providing over-current protection for each of its eight sourcing outputs, the UDN2987A and UDN2987LW drivers are used as an interface between standard low-level logic and relays, motors, solenoids, LEDs, and incandescent lamps. The device includes thermal shutdown and output transient protection/clamp diodes for use with sustaining voltages to 35 V.

In these drivers, each channel includes a latch to turn OFF that channel if the maximum channel current is exceeded. All channels are disabled if the thermal shutdown is activated. A common FAULT output is used to indicate either chip thermal shutdown or any over-current condition. All outputs are enabled by pulling the common OE/R input high. When OE/R is low, all outputs are inhibited and the eight latches are reset.

Under normal operating conditions, each of eight outputs will source in excess of 100 mA continuously at an ambient temperature of 25°C and a supply of 35 V. The over-current fault circuit will protect the device from short-circuits to ground with supply voltages of up to 35 V.

The inputs are compatible with 5 V and 12 V logic systems—TTL, Schottky TTL, DTL, PMOS, and CMOS. In all cases, the output is switched ON by an active high input level. The UDN2987A is supplied in a 20-pin dual in-line plastic package; the UDN2987LW is supplied in a 20-lead small-outline plastic package.
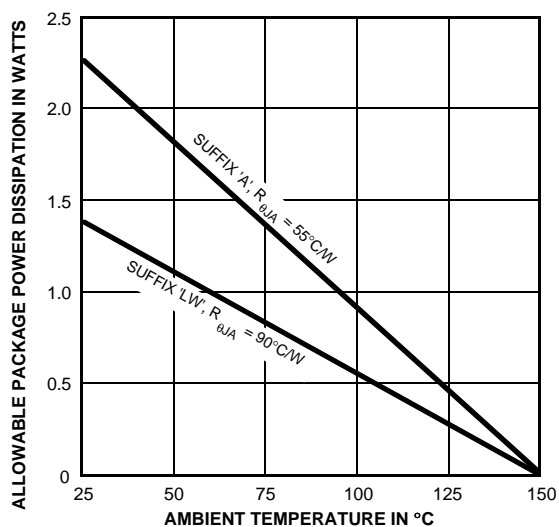
FEATURES

■ 350 mA Output Source Current
■ Over-Current Protected
■ Internal Ground Clamp Diodes
■ Output Breakdown Voltage 35 V, Minimum
■ TTL, DTL, PMOS, or CMOS Compatible Inputs
■ Internal Thermal Shutdown
■ Automotive Capable

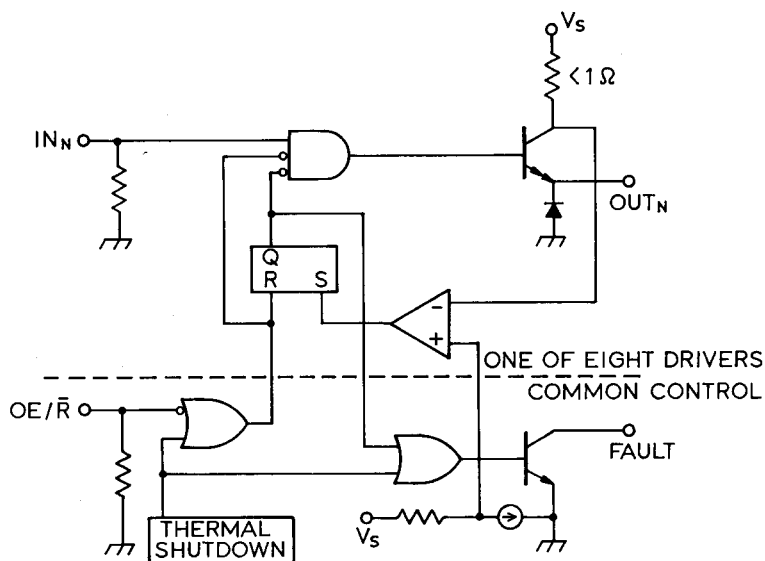Always order by complete part number:

Part Number	Package
UDN2987A	**20-Pin DIP**
UDN2987LW	**20-Lead Wide-Body SOIC**

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Allowable package power dissipation in watts vs. ambient temperature in °C graph:

- SUFFIX 'A', $R_{\theta JA} = 55°C/W$
- SUFFIX 'LW', $R_{\theta JA} = 90°C/W$

Dwg. GS-004B

Functional Block Diagram labels: V_S, < 1 Ω, IN_N, OUT_N, Q R S, ONE OF EIGHT DRIVERS, COMMON CONTROL, OE/R̄, FAULT, THERMAL SHUTDOWN, V_S

Dwg. No. A-13,286

OVER-CURRENT FAULT SENSE

Labels: V_S, +, +, V_{REF}, MATCHED, V_{SENSE}, −, −, SENSE, REF, I_{LOAD}, I_{REF}, TO FAULT LATCH
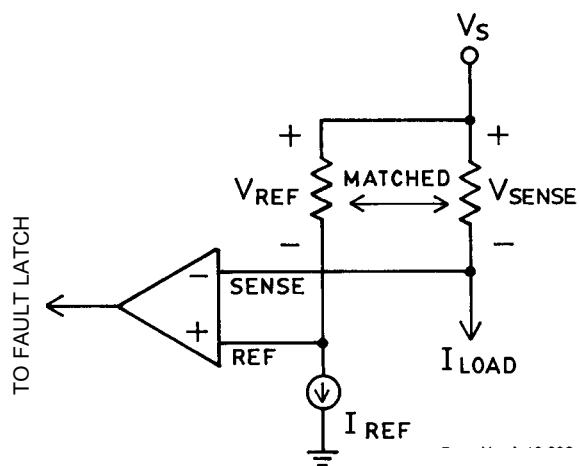
Dwg. No. A-13,292

OUTPUT CURRENT WAVESHAPES

Labels: $V_{IN-A} = V_{IN-B}$, t_{PLH}, t_{PHL}, OE/R̄, I_M, OUTPUT A SHORTED, I_{OUT-A}, I_M, I_{OUT-B}, MOMENTARY FAULT (< 1 μs)

Dwg. No. A-13,293

Allegro® MicroSystems, Inc.
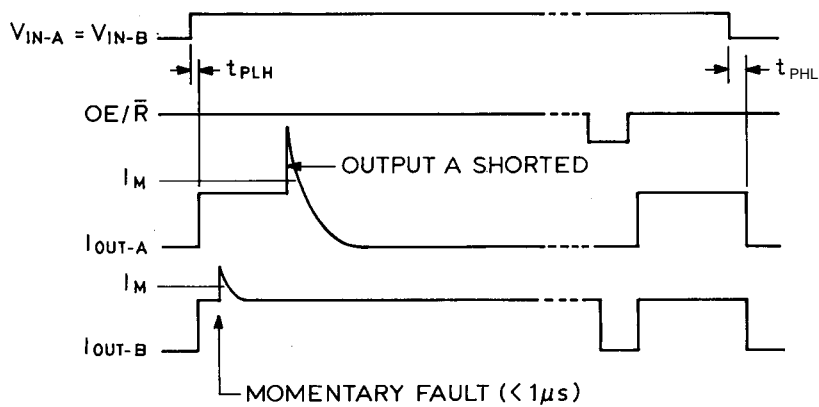
ELECTRICAL CHARACTERISTICS at T_A = 25°C, V_{OE} = 2.4 V, V_S = 35 V (unless otherwise noted).

Characteristic	Symbol	Test Conditions	Limits Min.	Typ.	Max.	Units
Functional Supply Range	V_S		7.0	—	35	V
Output Leakage Current	I_{CEX}	V_{IN} = 0.4 V*	—	<-5.0	-200	µA
Output Sustaining Voltage	$V_{OUT(sus)}$	I_{OUT} = -350 mA, L = 2.0 mH	35	—	—	V
Output Saturation Voltage	$V_{OUT(SAT)}$	V_{IN} = 2.4 V, I_{OUT} = -100 mA	—	1.6	1.8	V
		V_{IN} = 2.4 V, I_{OUT} = -225 mA	—	1.7	1.9	V
		V_{IN} = 2.4 V, I_{OUT} = -350 mA	—	1.8	2.0	V
Channel Shutdown Threshold	I_M	V_{IN} = 2.4 V	-370	-500	—	mA
FAULT Leakage Current	I_{CEX}	V_{CC} = 35 V	—	<1.0	100	µA
FAULT Saturation Voltage	$V_{CE(SAT)}$	I_C = 30 mA	—	0.3	0.8	V
Input Voltage	$V_{IN(ON)}$		2.4	—	—	V
	$V_{IN(OFF)}$		—	—	0.4	V
Input Current	$I_{IN(ON)}$	V_{IN} = 2.4 V	—	125	170	µA
		V_{IN} = 5.0 V	—	840	1020	µA
		V_{IN} = 12 V	—	1500	1800	µA
	$I_{IN(OFF)}$	V_{IN} = 0.4 V	—	—	15	µA
Clamp Diode Leakage Current	I_R	V_R = 35 V, T_A = 70°C	—	—	50	µA
Clamp Diode Forward Voltage	V_F	I_F = 350 mA	—	1.5	1.8	V
Supply Current	$I_{S(ON)}$	V_{IN} = 2.4 V*, Outputs Open	—	13	18	mA
	$I_{S(OFF)}$	V_{IN} = 0.4 V*	—	8.0	12	mA
Thermal Shutdown	T_J		—	165	—	°C
Thermal Hysteresis	ΔT_J		—	15	—	°C
Propagation Delay Time	t_{PLH}	R_L = 100Ω	—	0.3	0.6	µs
	t_{PHL}	R_L = 100Ω	—	2.0	4.0	µs
Dead Time	t_d		—	1.0	—	µs

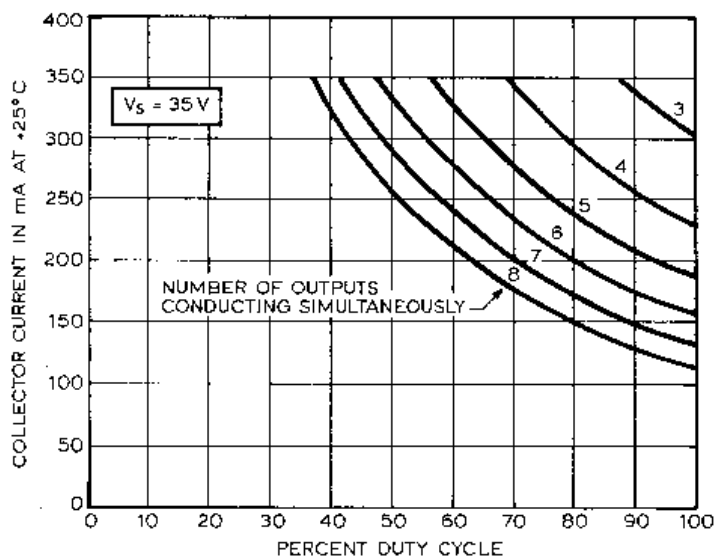*All inputs simultaneously.

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ALLOWABLE OUTPUT CURRENT
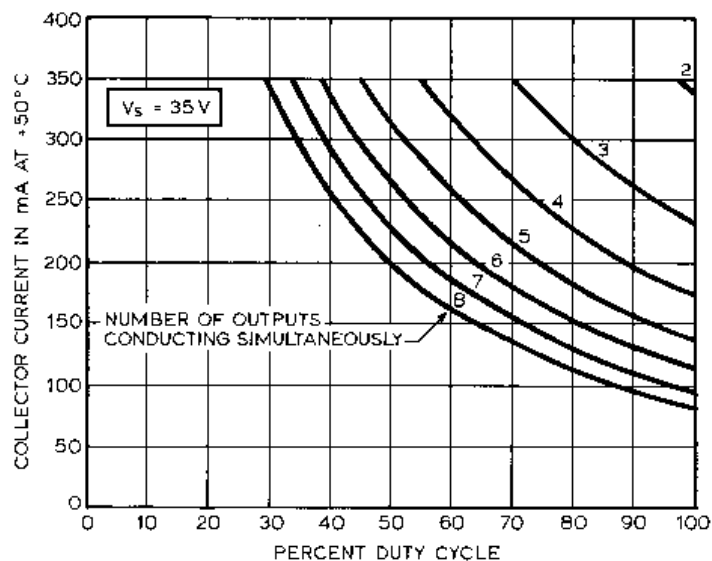## AS A FUNCTION OF DUTY CYCLE
(UDN2987A shown, multiply by 78% for UDN2987LW)

At +25°C

Dwg. No. A-13,288

At +50°C

Dwg. No. A-13,289

APPLICATIONS INFORMATION
AND CIRCUIT DESCRIPTION

As with all power integrated circuits, the UDN2987A and UDN2987LW have a maximum allowable output current rating. The 500 mA rating does not imply that operation at that value is permitted or even obtainable. The channel output current trip point is specified as -370 mA, minimum; therefore, attempted operation at current levels greater than -370 mA may cause a fault indication and channel shutdown. The device is tested at a maximum of -350 mA and that is the recommended maximum output current per driver. It provides protection for current overloads or shorted loads up to 35 V.

All outputs are enabled by pulling the OE/R input high. When OE/R is low or allowed to float (internal pull-down), all outputs are inhibited and the latches are reset. Note that the RESET pulse duration (OE/R low) should be at least 1 μs. This will ensure safe operation under attempted RESET conditions with a shorted load. The latches are also reset during power up, regardless of the state of the OE/R input.

The load current causes a small voltage drop across the internal low-value sense resistor. This voltage is compared to the voltage drop across a reference resistor with a constant current. The two resistors are matched to eliminate errors due to manufacturing tolerances or temperature effects. Each channel includes a comparator and its own latch. An over-current fault ($V_{SENSE} > V_{REF}$) will set the affected latch and shut down only that channel. All other channels will continue to operate normally. The latch includes a 1 μs delay (t_d) to prevent unwanted triggering due to crossover currents generated when switching inductive loads. For an abrupt short circuit, the delay and output switching times will allow a brief, permissable current in excess of the trip current before the output driver is turned OFF.
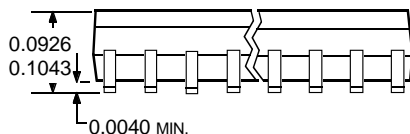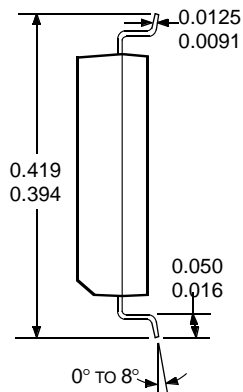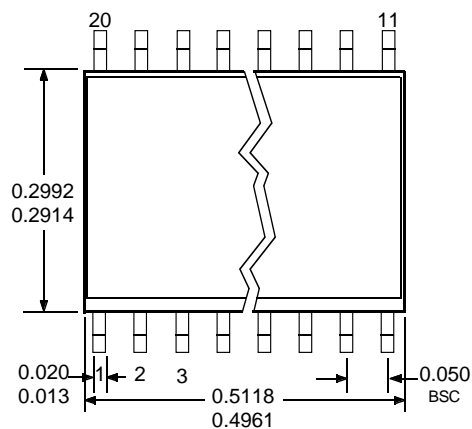
A common thermal shutdown disables all outputs if the chip temperature exceeds +165°C. At thermal shutdown, all latches are reset. The outputs are disabled until the chip cools down to about +150°C (thermal hysteresis).

In the event of any channel over-current condition or chip thermal shutdown, the FAULT open-collector output is pulled low (turned ON).
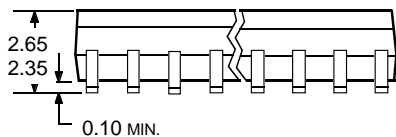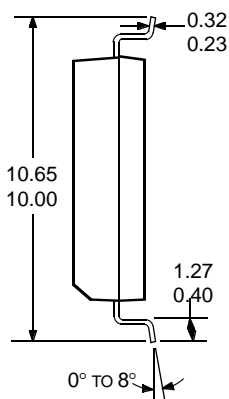
UDN2987A

Dimensions in Inches
(controlling dimensions)

Dwg. MA-001-20 in

Dimensions in Millimeters
(for reference only)

Dwg. MA-001-20 mm

NOTES: 1. Exact body and lead configuration at vendor's option within limits shown.
2. Lead spacing tolerance is non-cumulative.
3. Lead thickness is measured at seating plane or below.
4. Shipped in sticks/tubes of 18 devices.

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UDN2987LW

Dimensions in Inches
(for reference only)

20   11

0.2992
0.2914

0.020   1 2   3   0.050
0.013   BSC
              0.5118
              0.4961

0.0125
0.0091

0.419
0.394

0.050
0.016

0° TO 8°

0.0926
0.1043

0.0040 MIN.

Dwg. MA-008-20 in

Dimensions in Millimeters
(controlling dimensions)

20   11

7.60
7.40

0.51   1 2   3   1.27
0.33   BSC
            13.00
            12.60

0.32
0.23

10.65
10.00

1.27
0.40

0° TO 8°

2.65
2.35

0.10 MIN.
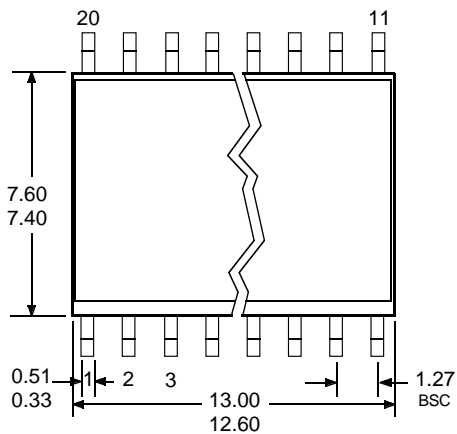
Dwg. MA-008-20 mm

NOTES: 1. Exact body and lead configuration at vendor's option within limits shown.
2. Lead spacing tolerance is non-cumulative.
3. Shipped in sticks/tubes of 37 devices or add "TR" to part number for tape and reel.

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POWER SOURCE DRIVERS

IN ORDER OF 1) OUTPUT CURRENT, 2) OUTPUT VOLTAGE, 3) NUMBER OF DRIVERS

Output Ratings *			Features					Part Number[†]
mA	V	#	Serial Input	Latched Drivers	Diode Clamp	Saturated Outputs	Internal Protection	
-25	60	8	–	X	–	–	–	5815
	60	10	X	X	active pull-down	–	–	6810
	60	12	X	X	active pull-down	–	–	5811
	60	20	X	X	active pull-down	–	–	6812
	60	32	X	X	active pull-down	–	–	6818
	85	8	–	–	–	–	–	6118
-120	-25	8	–	–	X	X	–	2585
	30	8	–	–	X	X	–	2985
	50	8	X	X	X	X	–	5895
-350	35	8	–	–	X	–	X	2987
	50	8	–	–	X	–	–	2981 and 2982
	50	8	X	X	X	–	–	5891
	80	8	–	–	X	–	–	2983
	80	8	X	X	X	–	–	5890
-500	6	1	–	–	–	MOSFET	X	2525 and 2535
	6	2	–	–	–	MOSFET	X	2535 and 2536

* Current is maximum specified test condition, voltage is maximum rating. See specification for sustaining voltage limits or over-current protection voltage limits.

† Complete part number includes additional characters to indicate operating temperature range and package style.

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