LM195QML Ultra Reliable Power Transistors

FEATURES

- **Internal Thermal Limiting**
- **Greater Than 1.0A Output Current**
- **3.0 µA Typical Base Current**
- **500 ns Switching Time**
- **2.0V Saturation**
- **Base Can be Driven up to 40V Without Damage**
- **Directly Interfaces with CMOS or TTL**
- **100% Electrical Burn-in**

DESCRIPTION

The LM195 is a fast, monolithic power integrated circuit with complete overload protection. This device, which acts as a high gain power transistor, has included on the chip, current limiting, power limiting, and thermal overload protection making it virtually impossible to destroy from any type of overload.

The inclusion of thermal limiting, a feature not easily available in discrete designs, provides virtually absolute protection against overload. Excessive power dissipation or inadequate heat sinking causes the thermal limiting circuitry to turn off the device preventing excessive heating.

The LM195 offers a significant increase in reliability as well as simplifying power circuitry. In some applications, where protection is unusually difficult, such as switching regulators, lamp or solenoid drivers where normal power dissipation is low, the LM195 is especially advantageous.

The LM195 is easy to use and only a few precautions need be observed. Excessive collector to emitter voltage can destroy the LM195 as with any power transistor. When the device is used as an emitter follower with low source impedance, it is necessary to insert a 5.0k resistor in series with the base lead to prevent possible emitter follower oscillations. Although the device is usually stable as an emitter follower, the resistor eliminates the possibility of trouble without degrading performance. Finally, since it has good high frequency response, supply bypassing is recommended.

Connection Diagram

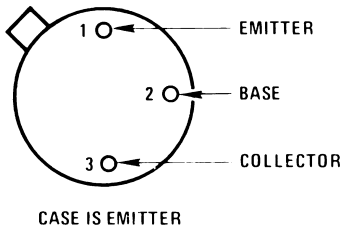
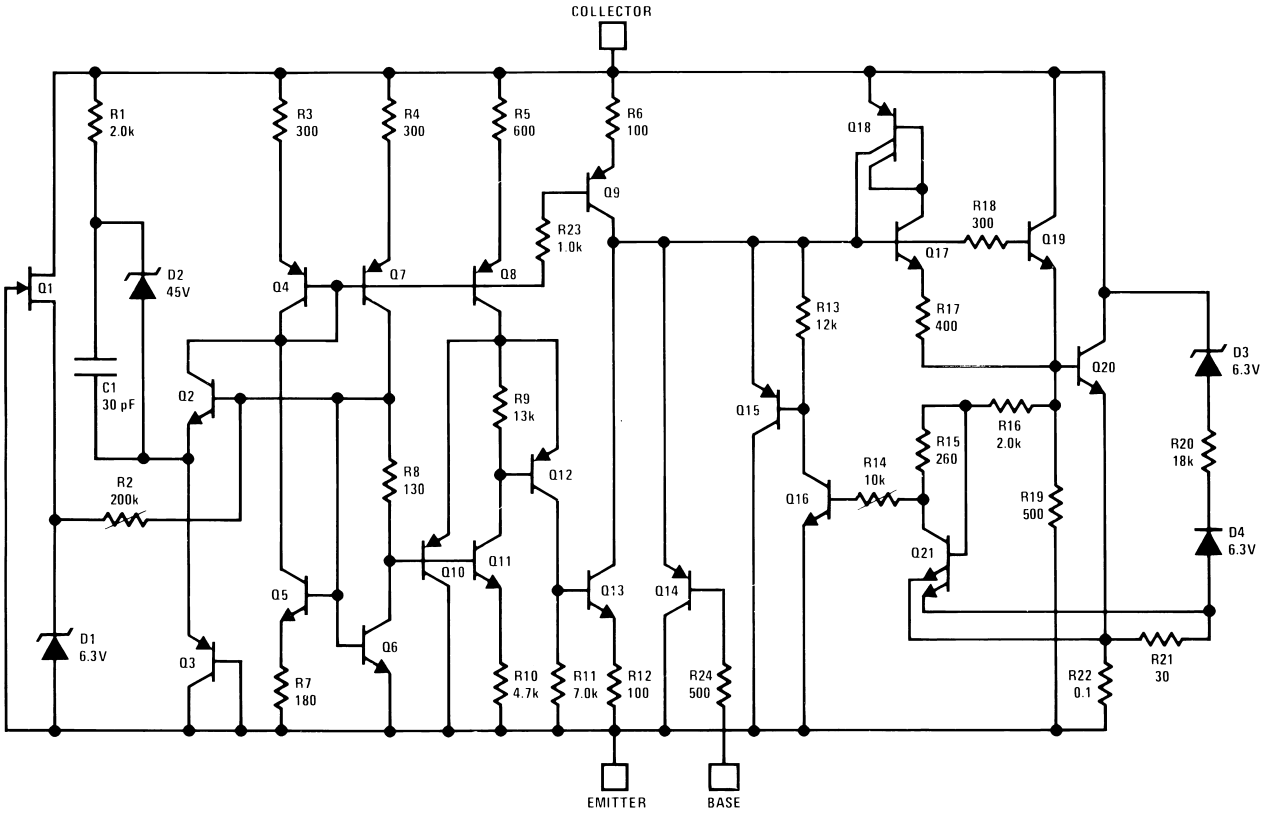
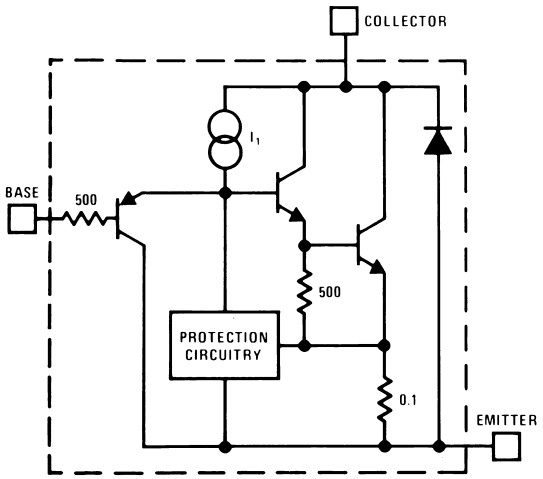


Figure 1. 5-Pin TO - Bottom View
See NDT0003A Package

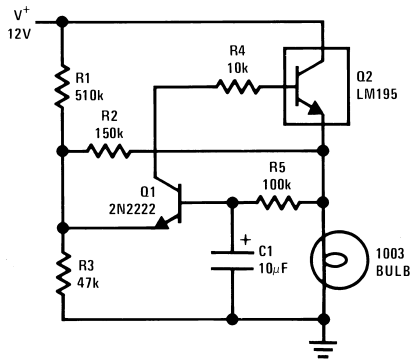
Schematic Diagram



Simplified Circuit



1.0 Amp Lamp Flasher



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings[1]

Collector to Emitter Voltage			42V
Collector to Base Voltage			42V
Base to Emitter Voltage (Forward)			42V
Base to Emitter Voltage (Reverse)			20V
Collector Current			Internally Limited
Power Dissipation[2]			Internally Limited
Operating Temperature Range	TO package		$-55°C \le T_A \le +125°C$
Storage Temperature Range			$-65°C \le T_A \le +150°C$
Lead Temperature (Soldering, 10 sec.)			260°C
Thermal Resistance	θ_{JA}	TO package; Still Air at 0.5W	192°C/W
		TO package; 500LF/Min Air Flow at 0.5W	66°C/W
	θ_{JC}	TO package at 1.0W	29°C/W

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

(2) The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), θ_{JA} (package junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

Quality Conformance Inspection

Table 1. Mil-Std-883, Method 5005 - Group A

Subgroup	Description	Temp (°C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55
12	Settling time at	+25
13	Settling time at	+125
14	Settling time at	-55

LM195H/883 Electrical Characteristics DC Parameter Collector to Emitter

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_{CE}	Operating Voltage	$I_C \le I_{Max}$	See[1]		42	V	1, 2, 3

(1) Parameter tested go−no−go only.

LM195H/883 Electrical Characteristics DC Parameter Base to Emitter

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
BV_{BE}	Breakdown Voltage	$V_{CE} \leq 42V$	See(1)	42		V	1, 2, 3
I_{SC}	Collector Current	$V_{CE} \leq 7V$		1.2		A	1
				1		A	2, 3
V_{Sat}	Saturation Voltage	$I_C = 1A$			2	V	1, 2
					2.5	V	3
I_B	Base Current	$0 \leq V_{BE} \leq 42V$, $I_C \leq I_{Max}$			5	µA	1, 2, 3
I_Q	Quiescent Current	$V_{CE} = 42V$, $V_{BE} = 0V$			5	mA	1, 2, 3
V_{Bk}	Breakdown Delta V_{BE}	V_C = 46-42V, I_L = 50mA		-0.03	0.01	V	1
		V_C = 46-38V		-0.03	0.01	V	1
		V_C = 50-42V		-0.03	0.01	V	1
Thr	Thermal Response	100µS		-10	100	mV	1
		500µS		-10	70	mV	1
		2mS		-10	50	mV	1
		20mS		-10	10	mV	1

(1) Parameter tested go−no−go only.

LM195H/883 Electrical Characteristics AC Parameter

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
t_{ON}	Response Time	V_I = 0-2V, $R_L = 36\Omega$, V+ = 36V			1.8	µS	9, 10, 11
t_{OFF}	Response Time	V_I = 2-0V, $R_L = 36\Omega$, V+ = 36V			1.8	µS	9, 10, 11

Typical Performance Characteristics

Bias Current

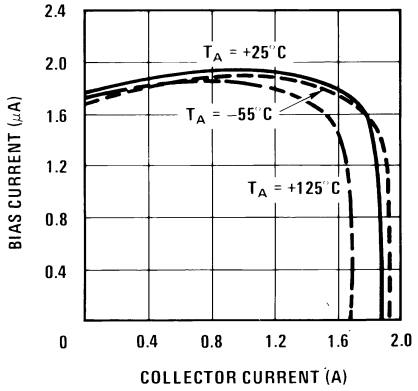


Figure 2.

Quiescent Current

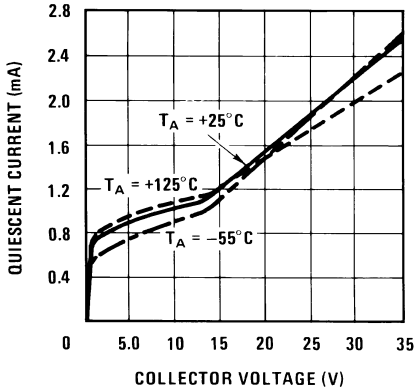


Figure 3.

Base Emitter Voltage

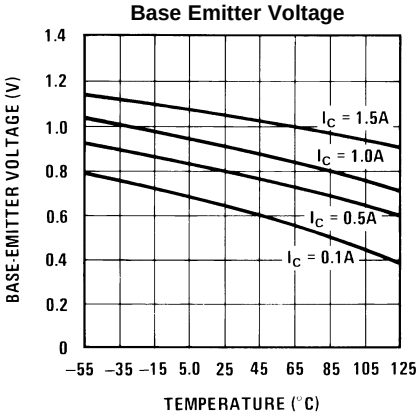


Figure 4.

Base Current

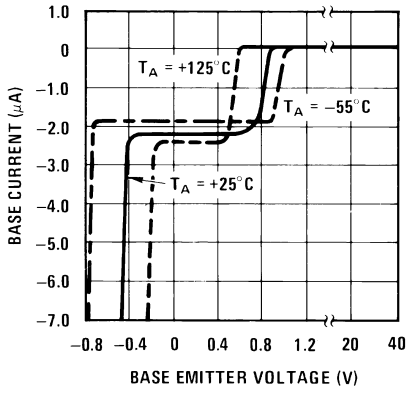


Figure 5.

Saturation Voltage

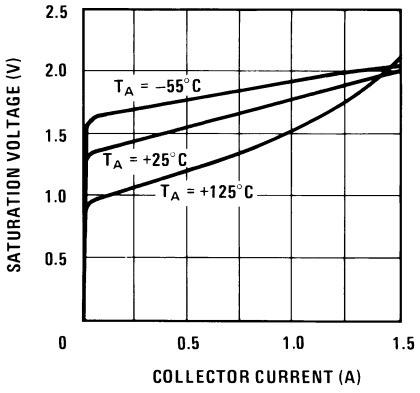


Figure 6.

Response Time

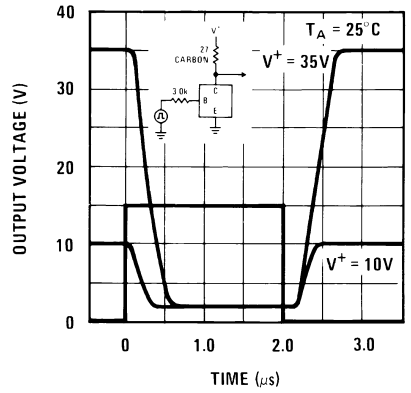


Figure 7.

Typical Performance Characteristics (continued)

Response Time

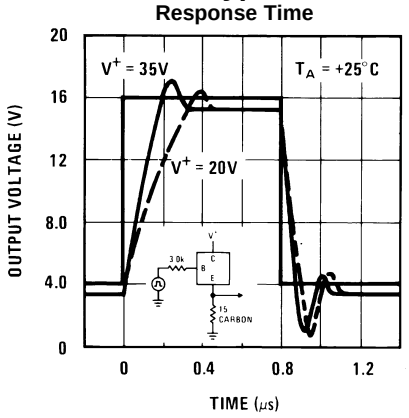


Figure 8.

10V Transfer Function

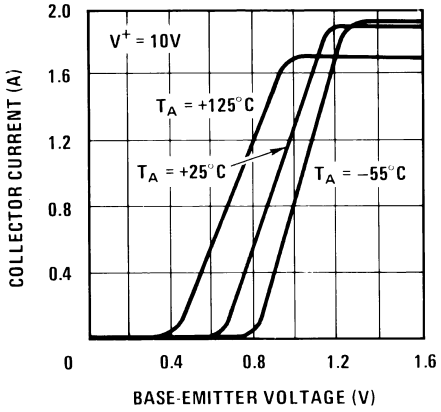


Figure 9.

36V Transfer Function

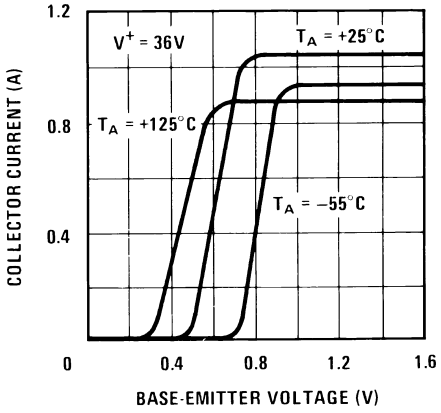


Figure 10.

Transconductance

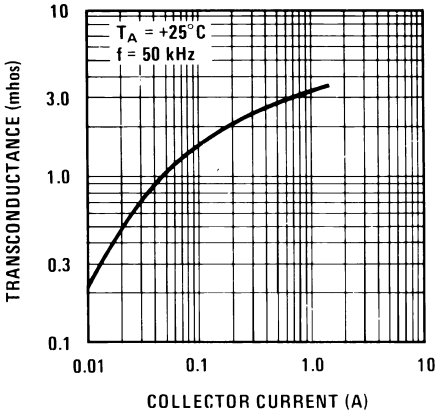


Figure 11.

Small Signal Frequency Response

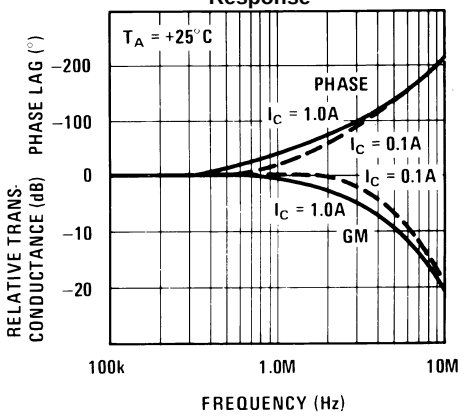
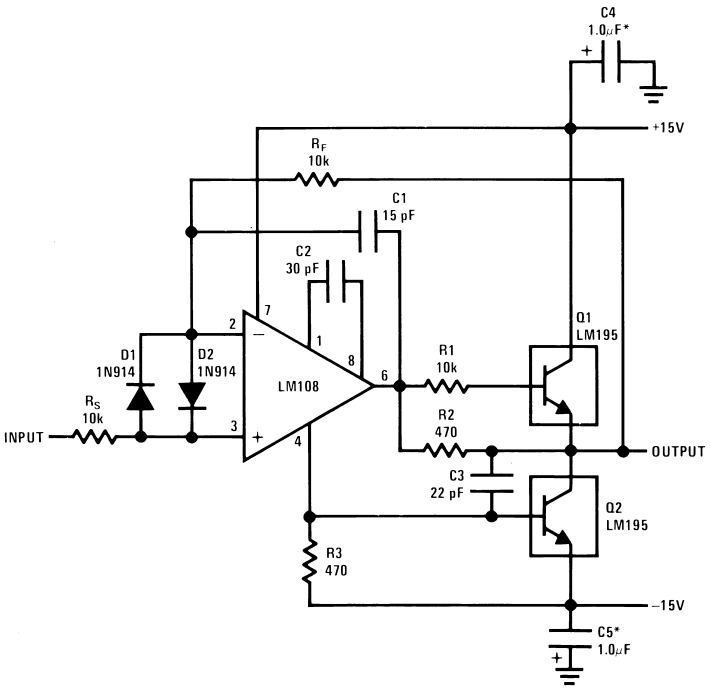


Figure 12.

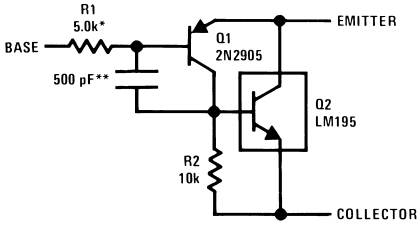
Typical Applications

1.0 Amp Voltage Follower



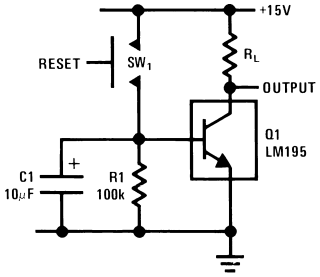
*Solid Tantalum

Power PNP

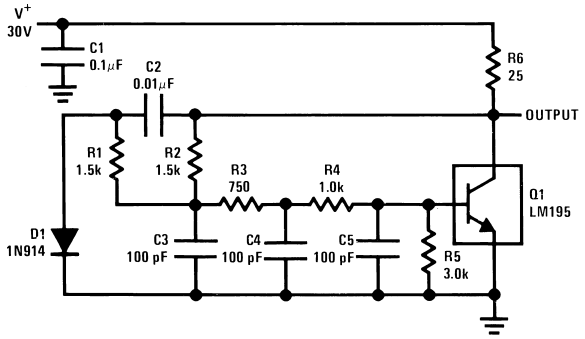


*Protects against excessive base drive
**Needed for stability

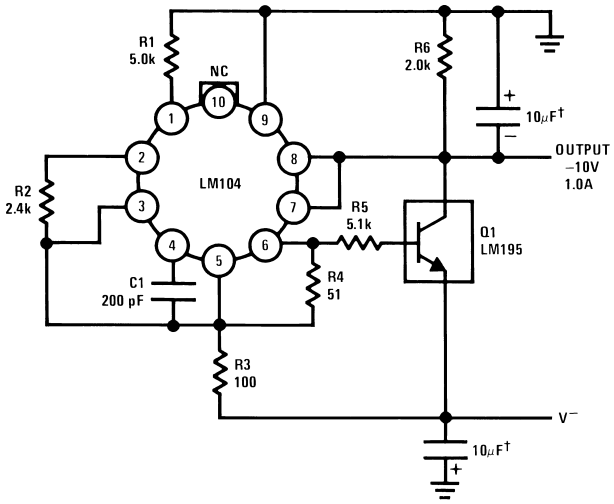
Time Delay



1.0 MHz Oscillator

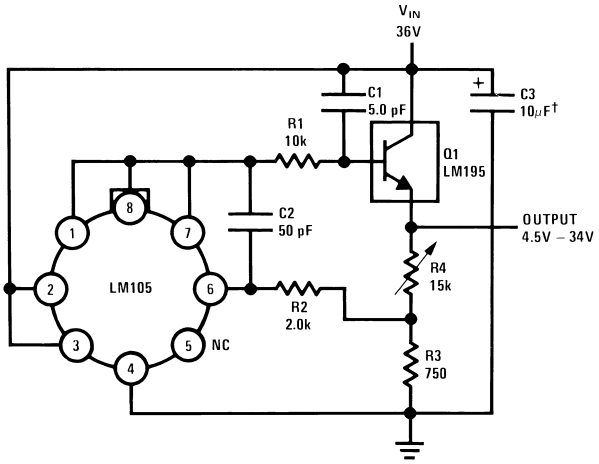


1.0 Amp Negative Regulator



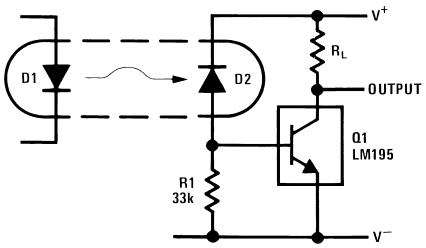
†Solid Tantalum

1.0 Amp Positive Voltage Regulator

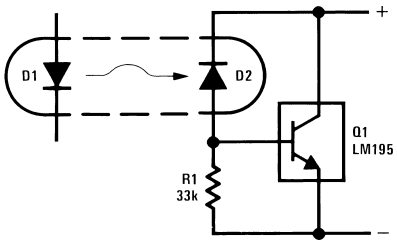


†Solid Tantalum

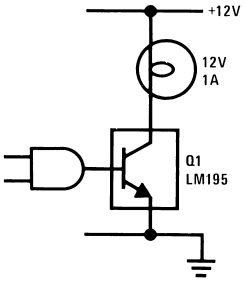
Fast Optically Isolated Switch



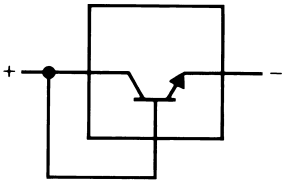
Optically Isolated Power Transistor



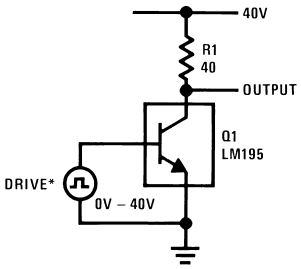
CMOS or TTL Lamp Interface



Two Terminal Current Limiter

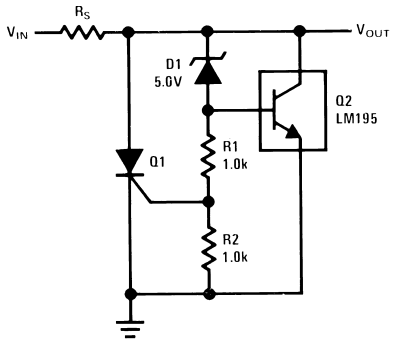


40V Switch

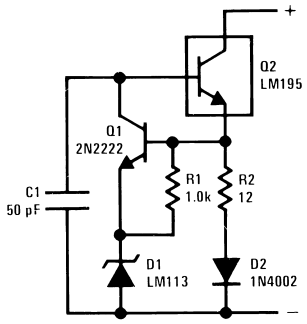


*Drive Voltage 0V to ≥ 10V ≤ 42V

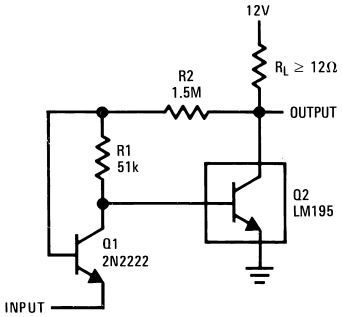
6.0V Shunt Regulator with Crowbar



Two Terminal 100 mA Current Regulator

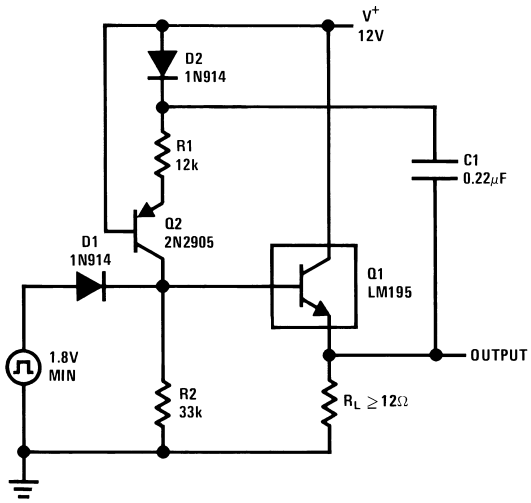


Low Level Power Switch



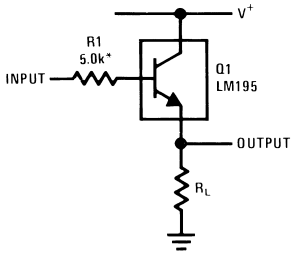
Turn ON = 350 mV
Turn OFF = 200 mV

Power One-Shot



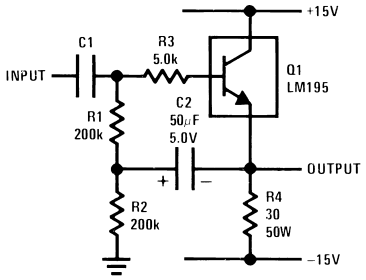
T = R1C
R2 = 3R1
R2 ≤ 82k

Emitter Follower

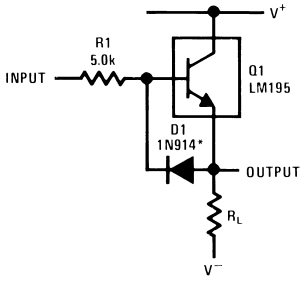


*Need for Stability

High Input Impedance AC Emitter Follower

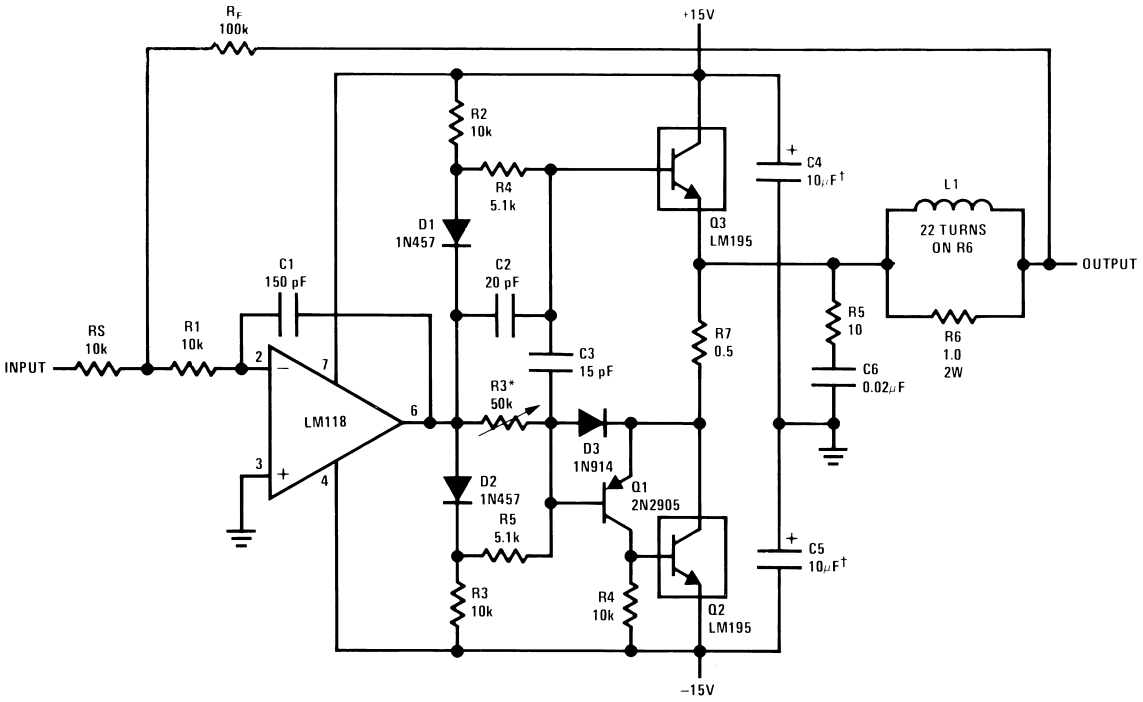


Fast Follower



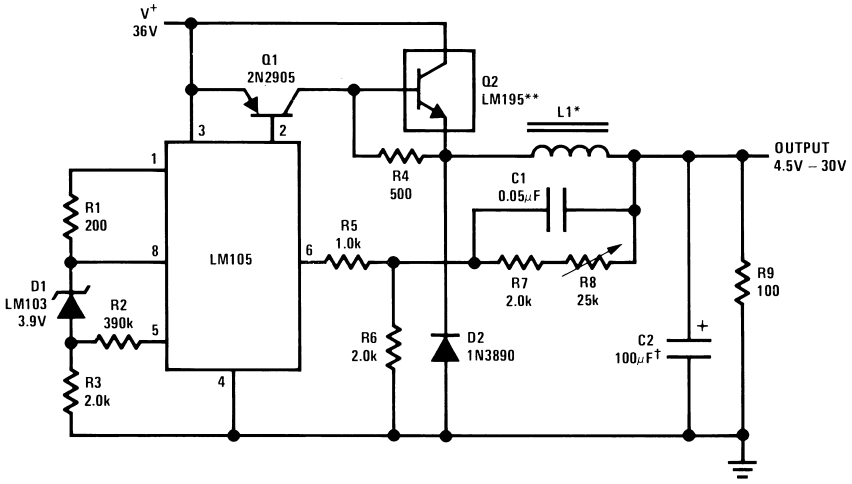
*Prevents storage with fast fall time square wave drive

Power Op Amp



*Adjust for 50 mA quiescent current
†Solid Tantalum

6.0 Amp Variable Output Switching Regulator



*Sixty turns wound on Arnold Type A-083081-2 core.
**Four devices in parallel
†Solid tantalum

REVISION HISTORY SECTION

Released	Revision	Section	Changes
11/30/2010	A	New Release, Corporate format	1 MDS data sheets converted into one Corp. data sheet format. MNLM195-H Rev 0BL will be archived.
03/20/2013	A	All	Changed layout of National Data Sheet to TI format

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-8777801XA	ACTIVE	TO	NDT	3	20	RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	LM195H/883 5962-8777801XA Q A CO 5962-8777801XA Q > T	Samples
LM195H/883	ACTIVE	TO	NDT	3	20	RoHS & Green	Call TI	Level-1-NA-UNLIM	-55 to 125	LM195H/883 5962-8777801XA Q A CO 5962-8777801XA Q > T	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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

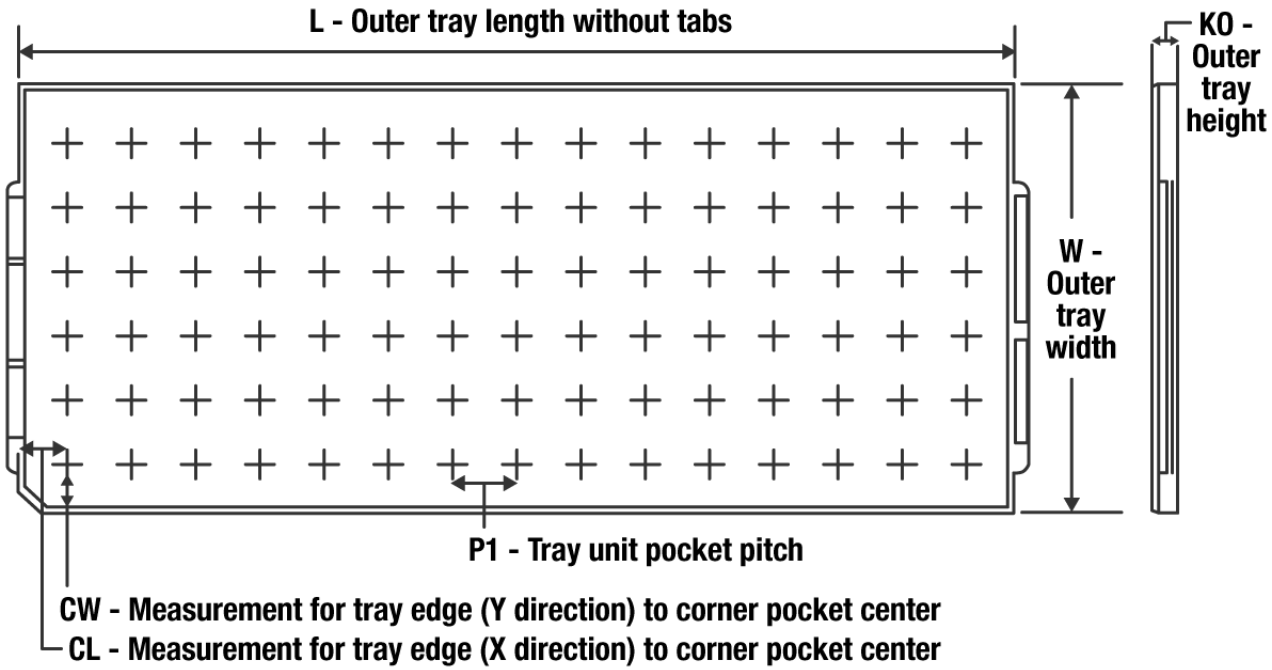
(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TRAY

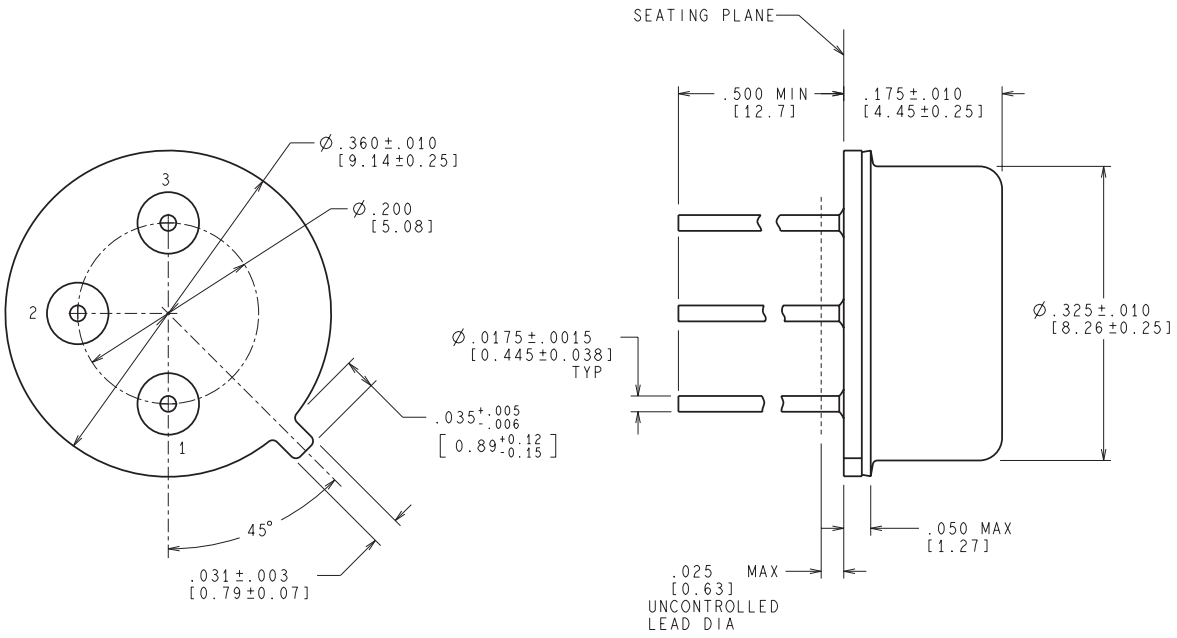


Chamfer on Tray corner indicates Pin 1 orientation of packed units.

*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (µm)	P1 (mm)	CL (mm)	CW (mm)
5962-8777801XA	NDT	TO-CAN	3	20	2 X 10	150	126.49	61.98	8890	11.18	12.95	18.54
LM195H/883	NDT	TO-CAN	3	20	2 X 10	150	126.49	61.98	8890	11.18	12.95	18.54

NDT0003A



CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

MIL-PRF-38535
CONFIGURATION CONTROL

H03A (Rev D)

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