

**MNLM2941K REV 0A0**

Original Creation Date: 04/24/95

Last Update Date: 04/24/95

Last Major Revision Date: 04/24/95

## LOW DROPOUT ADJUSTABLE REGULATOR

### General Description

The LM2941 positive voltage regulator features the ability to source 1A of output current with a typical dropout voltage of 0.5V and a maximum of 1V over the entire temperature range. Furthermore, a quiescent current reduction circuit has been included which reduces the ground pin current when the differential between the input voltage and the output voltage exceeds approximately 3V. The quiescent current with 1A of output current and an input-output differential of 5V is therefore only 30mA. Higher quiescent currents only exist when the regulator is in the dropout mode ( $V_{in} - V_{out} \leq 3V$ ).

Designed also for vehicular applications, the LM2941 and all regulated circuitry are protected from reverse battery installations or two-battery jumps. During line transients, such as load dump when the input voltage can momentarily exceed the specified maximum operating voltage, the regulator will automatically shut down to protect both the internal circuits and the load. Familiar regulator features such as short circuit and thermal overload protection are also provided.

### Industry Part Number

LM2941

### NS Part Numbers

LM2941K/883

### Prime Die

LM2941

### Processing

MIL-STD-883, Method 5004

### Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	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

**Features**

- Output voltage adjustable from 5V to 20V
- Dropout voltage typically 0.5V @  $I_o = 1A$
- Output current in excess of 1A
- Trimmed reference voltage
- Reverse battery protection
- Internal short circuit current limit
- Mirror image insertion protection
- TTL, CMOS compatible ON/OFF switch

**(Absolute Maximum Ratings)**

Input Voltage (Survival Voltage $\leq 100\text{ms}$ )	60V
Internal Power Dissipation (Note 2)	Internally Limited
Maximum Junction Temperature	150 C
Storage Temperature Range	$-65\text{ C} \leq T_j \leq +150\text{ C}$
Lead Temperature (Soldering, 10 seconds)	300 C
ESD Susceptibility (Note 3)	500V

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating ratings indicate conditions for which the device is intended to be functional, but device parameter specifications may not be guaranteed under these conditions. For guaranteed specifications and test conditions, see the Electrical Characteristics.

Note 2: The maximum power dissipation is a function of  $T_j(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any ambient temperature is  $P_D = (T_j(\text{max}) - T_A) / \theta_{JA}$ . If this dissipation is exceeded, the die temperature will rise above 150 C and the LM2941 will go into thermal shutdown.  $\theta_{JA}$  is 35 C/W and  $\theta_{JC}$  is 4 C/W.

Note 3: Human body model, 100pF discharged through 1.5K Ohms

**Recommended Operating Conditions**

Maximum Input Voltage	26V
Temperature Range	$-55\text{ C} \leq T_A \leq 125\text{ C}$

## Electrical Characteristics

### DC PARAMETERS:

(The following conditions apply to all the following parameters, unless otherwise specified.)  
 DC:  $5V \leq V_o \leq 20V$ ,  $V_{in} = V_o + 5V$ ,  $C_{out} = 22\mu F$

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
V <sub>ref</sub>	Reference Voltage	$5mA \leq I_o \leq 1A$			1.237	1.313	V	1
		$5mA \leq I_o \leq 1A$			1.211	1.339	V	2, 3
V <sub>rline</sub>	Line Regulation	$V_o + 2V \leq V_{in} \leq 26V$ , $I_o = 5mA$	3			10	mV/V	1, 2, 3
V <sub>rload</sub>	Load Regulation	$50mA \leq I_o \leq 1A$	3			10	mV/V	1, 2, 3
I <sub>q</sub>	Quiescent Current	$V_o + 2V \leq V_{in} \leq 26V$ , $I_o = 5mA$				15	mA	1
		$V_o + 2V \leq V_{in} \leq 26V$ , $I_o = 5mA$				20	mA	2, 3
		$V_{in} = V_o + 5V$ , $I_o = 1A$				45	mA	1
						60	mA	2, 3
V <sub>do</sub>	Dropout Voltage	$I_o = 1A$				0.8	V	1
						1.00	V	2, 3
		$I_o = 100mA$				200	mV	1, 2, 3
I <sub>sc</sub>	Short Circuit Current	$V_{in} \text{ max} = 26V$			1.6	3.3	A	1
					1.3	3.5	A	2, 3
	Maximum Operational Input Voltage		2			26	VDC	1, 2, 3
	Reverse Polarity DC Input Voltage	$R_o = 100 \text{ Ohms}$ , $V_o \geq -0.6V$	1		-15		V	1, 2, 3
V(TO)	ON/OFF Threshold Voltage ON	$I_o \leq 1A$	1			0.8	V	1, 2, 3
V(TO)	ON/OFF Threshold Voltage OFF	$I_o \leq 1A$	1		2.00		V	1, 2, 3
	ON/OFF Threshold Current	$V \text{ ON/OFF} = 2.0V$ , $I_o \leq 1A$				100	uA	1
		$V \text{ ON/OFF} = 2.0V$ , $I_o \leq 1A$				300	uA	2, 3

## Electrical Characteristics

### AC PARAMETERS:

(The following conditions apply to all the following parameters, unless otherwise specified.)

AC:  $5V \leq V_o \leq 20V$ ,  $V_{in} = V_o + 5V$ ,  $C_{out} = 22\mu F$

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
	Maximum Line Transient	$V_o$ max 1V above nominal $V_o$ , $R_o = 100 \text{ Ohms}$ , $T \leq 100\text{mS}$	4		60		V	7, 8A, 8B
	Reverse Polarity Transient Input Voltage	$T \leq 100\text{mS}$ , $R_o = 100 \text{ Ohms}$	4		-50		V	7, 8A, 8B
RR	Ripple Rejection	$f_o = 1\text{KHz}$ , $1 \text{ Vrms}$ , $I_L = 100\text{mA}$	4			0.02	%/V	4
			4			0.04	%/V	5, 6

Note 1: Functional test go no go only

Note 2: Condition for  $V_{in}$

Note 3: Limit = mV per Volt of  $V_{out}$

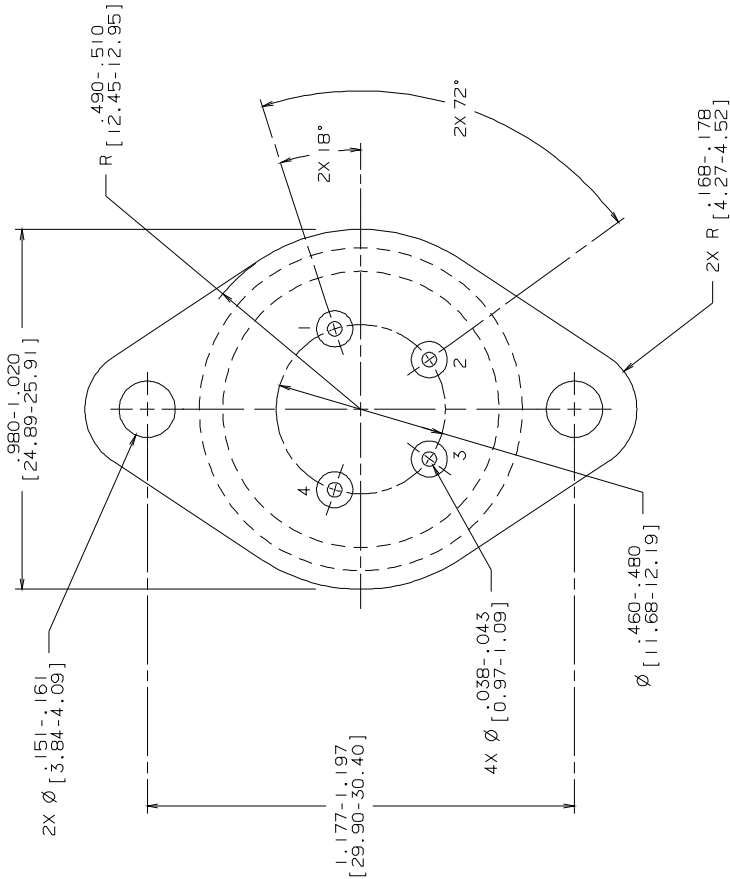
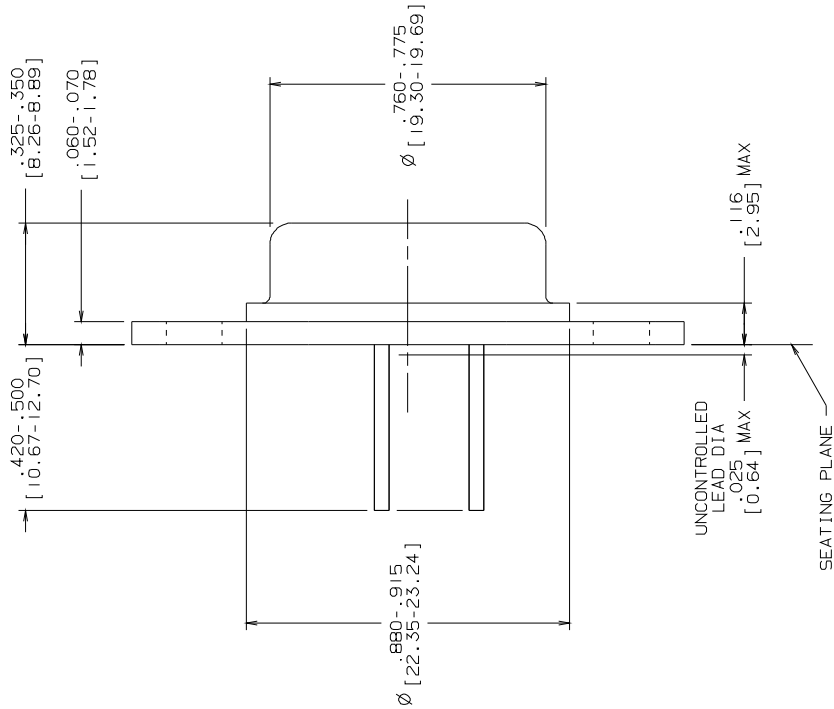
Note 4: %/V = % of  $V_{in}$  per Volt of  $V_{out}$

## Graphics and Diagrams

GRAPHICS#	DESCRIPTION
K04ARF	METAL CAN(KA), TO-3, 4 LEAD (P/P DWG)

See attached graphics following this page.

R E V I S I O N S			
LTR	DESCRIPTION	E.C.N.	DATE
F	REVISE & REDRAW ADD NOTE 4; .420-.500 WAS .420-.480	08B25	10/28/91
			TL/



NOTES: UNLESS OTHERWISE SPECIFIED

1. STANDARD HEADER TYPE SOLID BASE.
2. STANDARD LEAD FINISH:  
Sn/Pb SOLDER OVER 100 MICRONS/  
2.54 MICROMETERS MINIMUM NICKEL PLATED  
ON ALLOY 52.
3. LEAD TIPS LOCATED WITHIN  $\pm .080$  [2.03]  
OF LEAD POSITION AT BASE.
4. DIMENSIONS BASED ON JEDEC STANDARD TO-3,  
PUBLICATION 95, PAGE 98.

CONTROLLING DIMENSION: INCH

APPROVALS	DATE	NATIONAL SEMICONDUCTOR CORPORATION			
DRAWN: <b>LEQUANG</b>	10/28/91	2900 Semiconductor Drive, Santa Clara, CA 95052-8090			
DTG: CHK.					
ENGR: CHK.					
APPROVAL					
PROJECTION		SCALE	SIZE	DRAWING NUMBER	REV
		N/A	C	MKT-K04A	F
		DO NOT SCALE DRAWING		SHEET	OF
				1	1