National Semiconductor

August 2002

LM2941/LM2941C
1A 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 30 mA. Higher quiescent currents only exist when the regulator is in the dropout mode ($V_{IN} - V_{OUT} \leq 3V$).

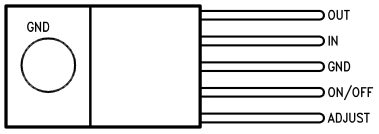
Designed also for vehicular applications, the LM2941 and all regulated circuitry are protected from reverse battery installations or two-battery jumps. During line transients, such as load dump when the input voltage can momentarily exceed the specified maximum operating voltage, the regulator will automatically 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.

Features

- LLP space saving package
- 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
- P^+ Product Enhancement tested
- TTL, CMOS compatible ON/OFF switch

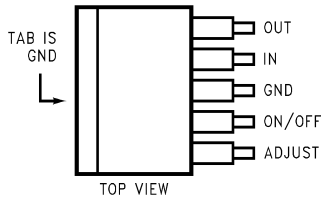
Connection Diagram and Ordering Information

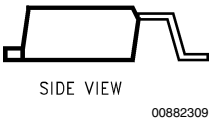
TO-220 Plastic Package



Tep View
Order Number LM2941T or LM2941CT
See NS Package Number TO5A

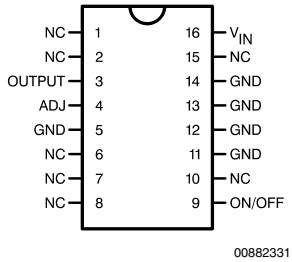
TO-263 Surface-Mount Package





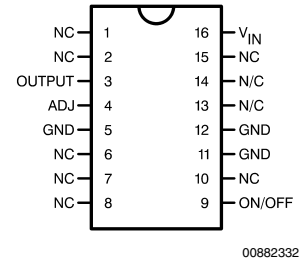
Order Number LM2941S, LM2941SX or LM2941CS, LM2941CSX
See NS Package Number TS5B

16-Lead Ceramic Dual-in-Line Package



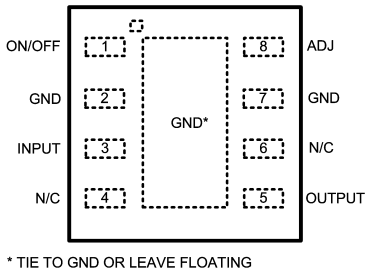
Top View
Order Number LM2941J/883 LM2941J-QMLV, 5962-9166701QEA
See NS Package Number J16A

16-Lead Ceramic Surface Mount Package



Top View
Order Number LM2941WG/883 LM2941WG-QMLV, 5962-9166701QYA
See NS Package Number WG16A

8-Lead LLP Surface Mount Package



Top View
Ordering Number LM2941LD, LM2941LDX
See NS Package Number LDC08A

Absolute Maximum Ratings (Note 1)

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

Input Voltage (Survival Voltage, ≤ 100ms)	
LM2941T, LM2941S, LM2941LD	60V
LM2941CT, LM2941CS	45V
Internal Power Dissipation (Note 3)	Internally Limited
Maximum Junction Temperature	150˚C
Storage Temperature Range	$-65˚C \le T_J \le +150˚C$
Lead Temperature	
(Soldering, 10 seconds)	
TO-220 (T) Package	260˚C
TO-263 (S) Package	260˚C

ESD susceptibility to be determined.

Operating Ratings

Maximum Input Voltage	26V
Temperature Range	
LM2941T	$-40˚C \le T_J \le 125˚C$
LM2941CT	$0˚C \le T_J \le 125˚C$
LM2941S	$-40˚C \le T_J \le 125˚C$
LM2941CS	$0˚C \le T_J \le 125˚C$
LM2941J	$-55˚C \le T_J \le 125˚C$
LM2941WG	$-55˚C \le T_J \le 125˚C$
LM2941LD	$-40˚C \le T_J \le 125˚C$

Electrical Characteristics—LM2941T, LM2941S, LM2941J, LM2941WG, LM2941LD

$5V \le V_O \le 20V$, $V_{IN} = V_O + 5V$, $C_O = 22\mu F$, unless otherwise specified. Specifications in standard typeface apply for $T_J = 25˚C$, while those in **boldface type** apply over the full **Operating Temperature Range.**

Parameter	Conditions	Typ	LM2941J LM2941WG Limit (Note 2) (Note 4)	LM2941T LM2941S LM2941LD Limit (Note 5)	Units (Limits)
Reference Voltage	$5mA \le I_O \le 1A$ (Note 6)	1.275	1.237/**1.211** 1.313/**1.339**	1.237/**1.211** 1.313/**1.339**	V(min) V(max)
Line Regulation	$V_O + 2V \le V_{IN} \le 26V$, $I_O = 5mA$	4	10/**10**	10/**10**	mV/V(max)
Load Regulation	$50mA \le I_O \le 1A$	7	10/**10**	10/**10**	mV/V(max)
Output Impedance	100 mADC and 20 mArms $f_O = 120Hz$	7			mΩ/V
Quiescent Current	$V_O + 2V \le V_{IN} < 26V$, $I_O = 5mA$	10	15/**20**	15/**20**	mA(max)
	$V_{IN} = V_O + 5V$, $I_O = 1A$	30	45/**60**	45/**60**	mA(max)
RMS Output Noise, % of V_{OUT}	10Hz–100kHz $I_O = 5mA$	0.003			%
Ripple Rejection	$f_O = 120Hz$, 1 Vrms, $I_L = 100mA$	0.005	0.02/**0.04**	0.02/**0.04**	%/V(max)
Long Term Stability		0.4			%/1000 Hr
Dropout Voltage	$I_O = 1A$	0.5	0.8/**1.0**	0.8/**1.0**	V(max)
	$I_O = 100mA$	110	200/**200**	200/**200**	mV(max)
Short Circuit Current	V_{IN} Max = 26V (Note 7)	1.9	1.6/**1.3**	1.6	A(min)
Maximum Line Transient	V_O Max 1V Above Nominal V_O $R_O = 100$, $T \le 100ms$	75	60/**60**	60/**60**	V(min)
Maximum Operational Input Voltage		31	26/**26**	26/**26**	V_{DC}
Reverse Polarity DC Input Voltage	$R_O = 100$, $V_O \ge -0.6V$	–30	–15/**–15**	–15/**–15**	V(min)
Reverse Polarity Transient Input Voltage	$T \le 100ms$, $R_O = 100\Omega$	–75	–50/**–50**	–50/**–50**	V(min)
ON/OFF Threshold Voltage ON	$I_O \le 1A$	1.30	0.80/**0.80**	0.80/**0.80**	V(max)
ON/OFF Threshold Voltage OFF	$I_O \le 1A$	1.30	2.00/**2.00**	2.00/**2.00**	V(min)
ON/OFF Threshold Current	$V_{ON/OFF} = 2.0V$, $I_O \le 1A$	50	100/**300**	100/**300**	μA(max)