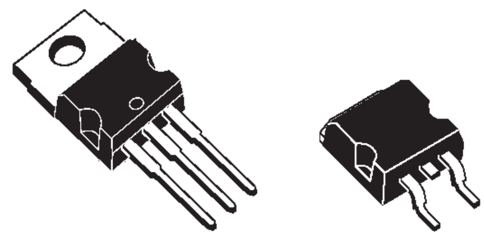
L4940 series

VERY LOW DROP 1.5 A REGULATORS

- PRECISE 5 V, 8.5 V, 10 V, 12 V OUTPUTS
- LOW DROPOUT VOLTAGE (500 mV typ at 1.5A)
- VERY LOW QUIESCENT CURRENT
- THERMAL SHUTDOWN
- SHORT CIRCUIT PROTECTION
- REVERSE POLARITY PROTECTION



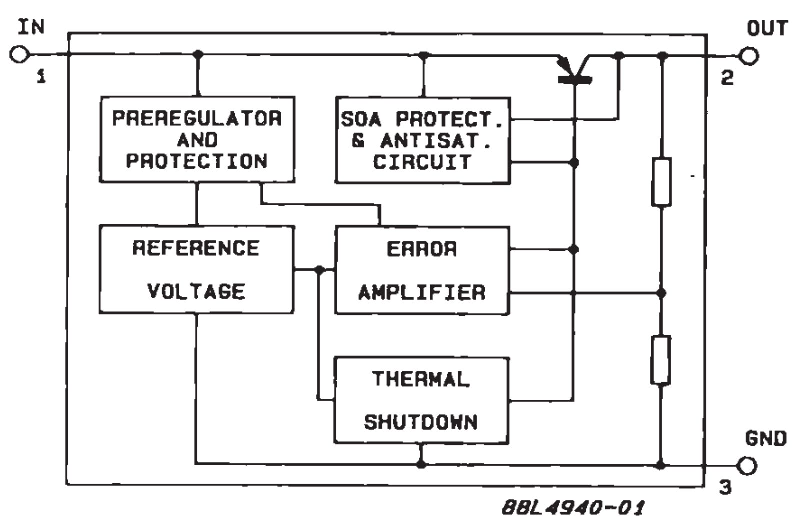
TO-220

D^2PAK
TO-263

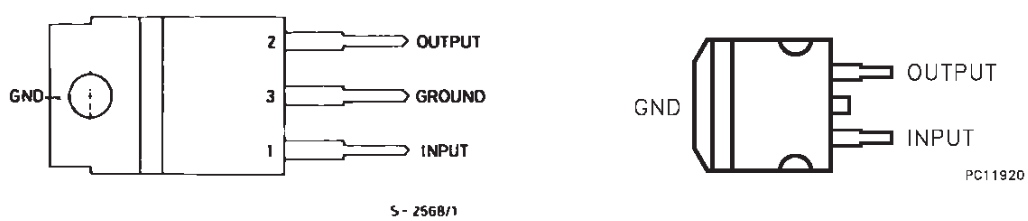
DESCRIPTION

The L4940 series of three terminal positive regulators is available in TO-220 and D^2PAK package and with several fixed output voltages, making it useful in a wide range of industrial and consumer applications. Thanks to its very low input/output voltage drop, these devices are particularly suitable for battery powered equipments, reducing consumption and prolonging battery life. Each type employs internal current limiting, antisaturation circuit, thermal shut-down and safe area protection.

BLOCK DIAGRAM



PIN CONNECTION AND ORDER CODES



ORDERING NUMBERS		OUTPUT VOLTAGE
TO-220	**D^2PAK**	
L4940V5	L4940D2T5	5V
L4940V85	L4940D2T85	8.5V
L4940V10	L4940D2T10	10V
L4940V12	L4940D2T12	12V

ABSOLUTE MAXIMUM RATING

Symbol	Description		Values	Unit
V_I	Forward Input Voltage		30	V
V_{IR}	Reverse Input Voltage	$V_O = 5$ V $R_O = 100\,\Omega$	-15	V
		$V_O = 8.5$ V $R_O = 180\,\Omega$		
		$V_O = 10$ V $R_O = 200\,\Omega$		
		$V_O = 12$ V $R_O = 240\,\Omega$		
I_O	Output Current		Internally Limited	
P_{tot}	Power Dissipation		Internally Limited	
T_j, T_{stg}	Junction and Storage Temperature		-40 to 150	^oC

THERMAL DATA

Symbol	Description	Value		Unit
		TO-220	D^2PAK	
$R_{thj-case}$ $R_{thj-amb}$	Thermal Resistance Junction-case Max Thermal Resistance Junction-ambient Max	3 50	3 62.5	$^oC/W$ $^oC/W$

TEST CIRCUITS

Figure 1 : DC Parameter.

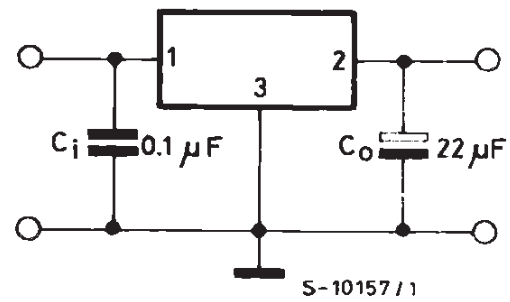


Figure 2 : Load Rejection.

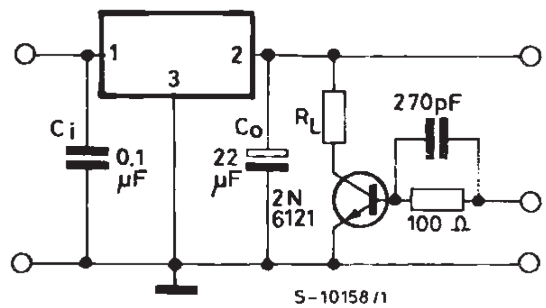
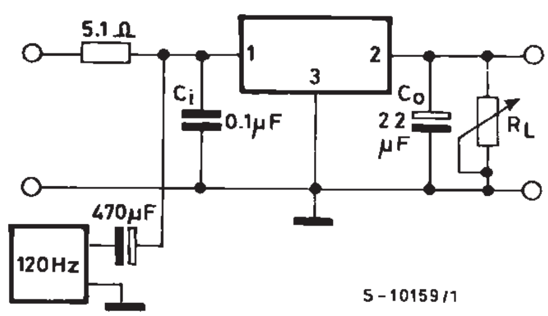


Figure 3 : Ripple Rejection.



ELECTRICAL CHARACTERISTICS FOR L4940V5 (refer to the test circuits, T_j = 25 °C, V_i = 7V, C_i = 0.1 µF, C_o = 22 µF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	I_o = 500 mA	4.9	5	5.1	V
V_o	Output Voltage	I_o = 5 mA to 1500 mA V_i = 6.5 to 16 V	4.8	5	5.2	V
V_i	Operating Input Voltage	I_o = 5 mA			17	V
ΔV_o	Line Regulation	I_o = 5 mA V_i = 6 to 17 V		4	10	mV
ΔV_o	Load Regulation	I_o = 5 to 1500 mA I_o = 500 to 1000 mA		8 5	25 15	mV
I_Q	Quiescent Current	I_o = 5 mA I_o = 1.5 A V_i = 6.5 V		5 30	8 50	mA
ΔI_Q	Quiescent Current Change	I_o = 5 mA I_o = 1.5 A V_i = 6.5 to 16 V			3 15	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			0.5		mV/°C
SVR	Supply Voltage Rejection	I_o = 1 A f = 120 Hz	58	68		dB
V_d	Dropout Voltage	I_o = 0.5 A I_o = 1.5 A		200 500	400 900	mV
I_{sc}	Short Circuit Current	V_i = 14 V V_i = 6.5 V		2 2.2	2.7 2.9	A

ELECTRICAL CHARACTERISTICS FOR L4940V85 (refer to the test circuits, T_j = 25 °C, V_i = 10.5V, C_i = 0.1 µF, C_o = 22 µF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	I_o = 500 mA	8.3	8.5	8.7	V
V_o	Output Voltage	I_o = 5 mA to 1500 mA V_i = 10.2 to 16 V	8.15	8.5	8.85	V
V_i	Operating Input Voltage	I_o = 5 mA			17	V
ΔV_o	Line Regulation	I_o = 5 mA V_i = 9.5 to 17 V		4	9	mV
ΔV_o	Load Regulation	I_o = 5 to 1500 mA I_o = 500 to 1000 mA		12 8	30 16	mV
I_Q	Quiescent Current	I_o = 5 mA I_o = 1.5 A V_i = 10.2 V		4 30	8 50	mA
ΔI_Q	Quiescent Current Change	I_o = 5 mA I_o = 1.5 A V_i = 10.2 to 16 V			2.5 15	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			0.8		mV/°C
SVR	Supply Voltage Rejection	I_o = 1 A f = 120 Hz	58	66		dB
V_d	Dropout Voltage	I_o = 0.5 A I_o = 1.5 A		200 500	400 900	mV
I_{sc}	Short Circuit Current	V_i = 14 V V_i = 10.2 V		2 2.2	2.7 2.9	A

ELECTRICAL CHARACTERISTICS FOR L4940V10 (refer to the test circuits, T_j = 25 ^oC, V_i = 12V, C_i = 0.1 μF, C_o = 22 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	I_o = 500 mA	9.8	10	10.2	V
V_o	Output Voltage	I_o = 5 mA to 1500 mA V_i = 11.7 to 16 V	9.6	10	10.4	V
V_i	Operating Input Voltage	I_o = 5 mA			17	V
ΔV_o	Line Regulation	I_o = 5 mA V_i = 11 to 17 V		3	8	mV
ΔV_o	Load Regulation	I_o = 5 to 1500 mA I_o = 500 to 1000 mA		15 10	35 20	mV
I_Q	Quiescent Current	I_o = 5 mA I_o = 1.5 A V_i = 11.7 V		4 30	8 50	mA
ΔI_Q	Quiescent Current Change	I_o = 5 mA I_o = 1.5 A V_i = 11.7 to 16 V			2 13	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			1		mV/^oC
SVR	Supply Voltage Rejection	I_o = 1 A f = 120 Hz	56	62		dB
V_d	Dropout Voltage	I_o = 0.5 A I_o = 1.5 A		200 500	400 900	mV
I_{sc}	Short Circuit Current	V_i = 14 V V_i = 11.7 V		2 2.2	2.7 2.9	A A

ELECTRICAL CHARACTERISTICS FOR L4940V12 (refer to the test circuits, T_j = 25 ^oC, V_i = 14V, C_i = 0.1 μF, C_o = 22 μF unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_o	Output Voltage	I_o = 500 mA	11.75	12	12.25	V
V_o	Output Voltage	I_o = 5 mA to 1500 mA V_i = 13.8 to 17 V	11.5	12	12.5	V
V_i	Operating Input Voltage	I_o = 5 mA			17	V
ΔV_o	Line Regulation	I_o = 5 mA V_i = 13 to 17 V		3	7	mV
ΔV_o	Load Regulation	I_o = 5 to 1500 mA I_o = 500 to 1000 mA		15 10	35 25	mV
I_Q	Quiescent Current	I_o = 5 mA I_o = 1.5 A V_i = 13.8 V		4 30	8 50	mA
ΔI_Q	Quiescent Current Change	I_o = 5 mA I_o = 1.5 A V_i = 13.8 to 16 V			1.5 10	mA
$\frac{\Delta V_o}{\Delta T}$	Output Voltage Drift			1.2		mV/^oC
SVR	Supply Voltage Rejection	I_o = 1 A f = 120 Hz	55	61		dB
V_d	Dropout Voltage	I_o = 0.5 A I_o = 1.5 A		200 500	400 900	mV
I_{sc}	Short Circuit Current	V_i = 14 V		2	2.7	A
Z_o	Output Impedance	f = 1KHz I_o = 0.5A		40		mΩ

Figure 4 : Dropout voltage vs. Output Current.

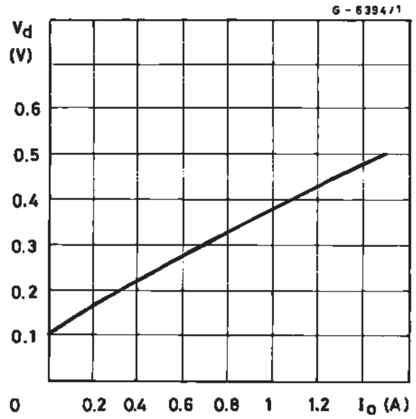


Figure 5 : Dropout Voltage vs. Temperature.

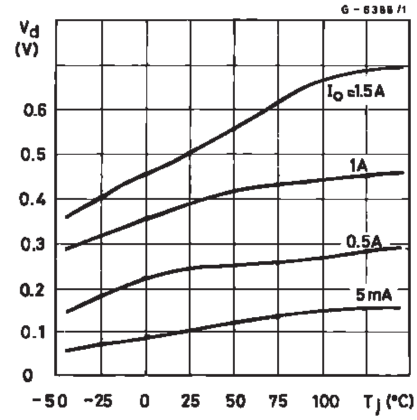


Figure 6 : Output voltage vs. Temperature (L4940V5).

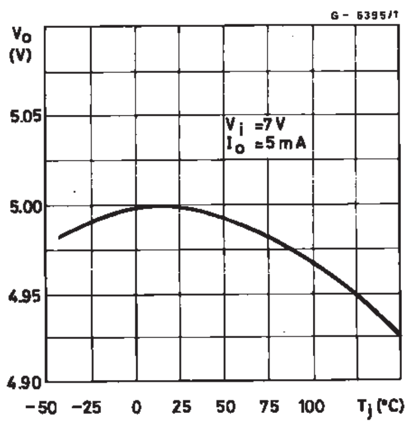


Figure 7 : Output Voltage vs. Temperature (L4940V85).

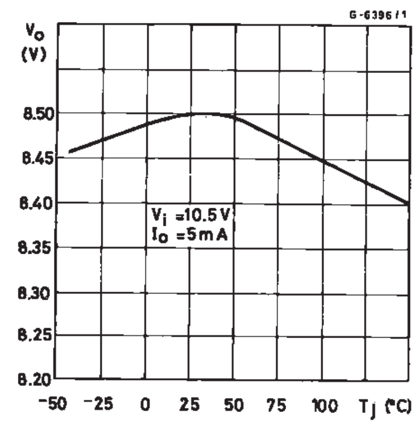


Figure 8 : Output voltage vs. Temperature (L4040V10).

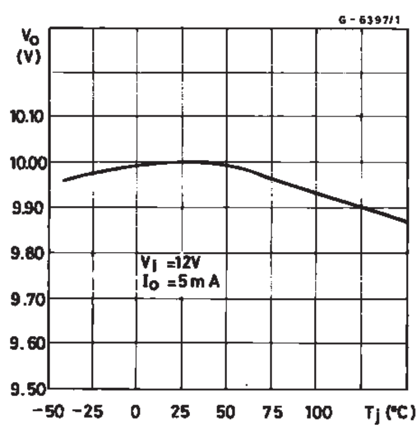


Figure 9 : Output Voltage vs. Temperature (L4940V12).

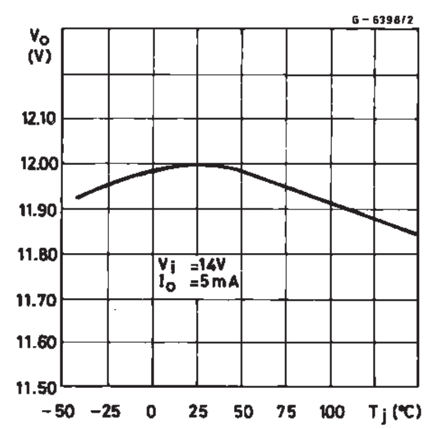


Figure 10 : Quiescent Current vs. Temperature (L4940V5).

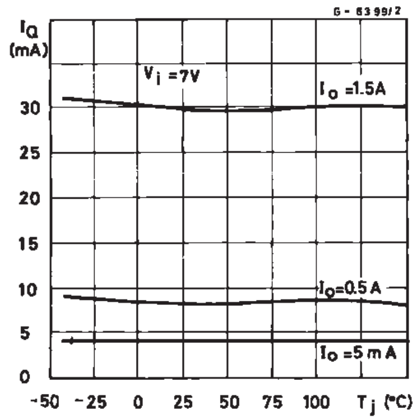


Figure 11 : Quiescent Current vs. Input Voltage (L4940V5).

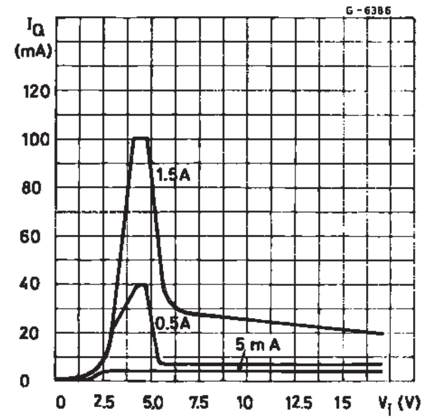


Figure 12 : Quiescent Current vs. Output Current (L4940V5).

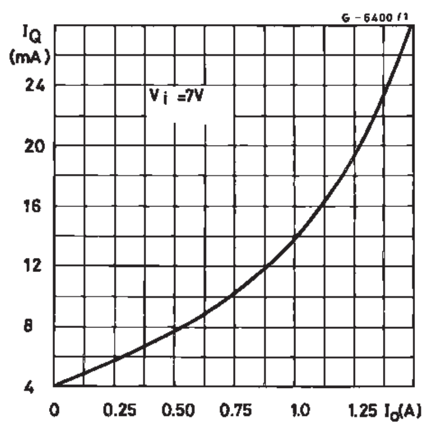


Figure 13 : Short-circuit Current vs. Temperature (L4940V5).

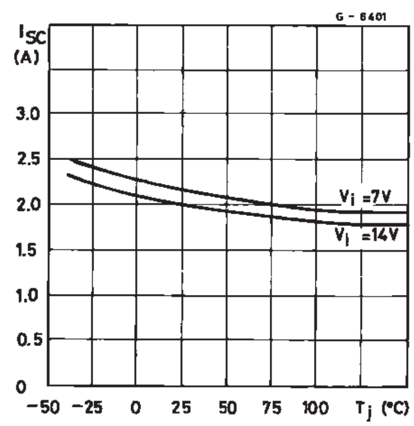


Figure 14 : Peak Output Current vs. Input/Output Differential Voltage (L4940V5).

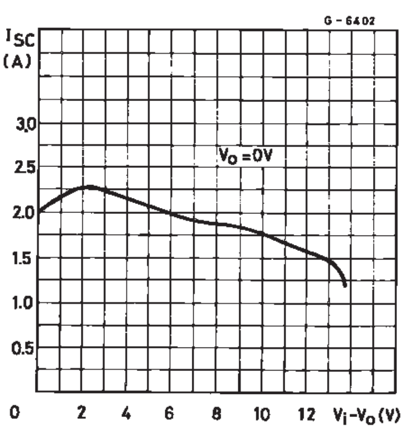


Figure 15 : Low Voltage Behavior (L4940V5).

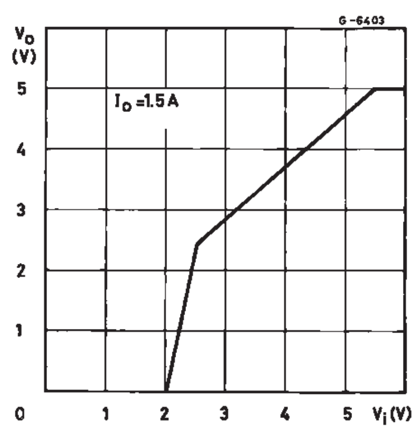


Figure 16 : Low Voltage Behavior (L4940V85).

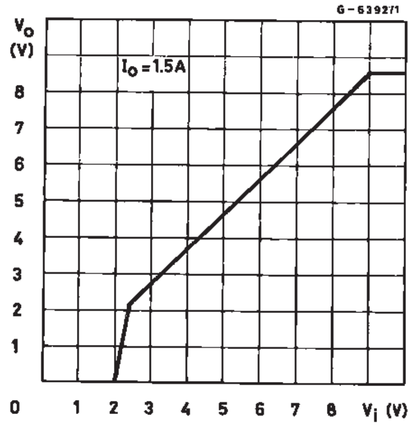


Figure 17 : Low Voltage Behavior (L4940V10).

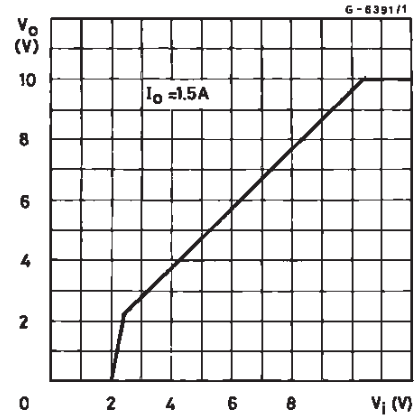


Figure 18 : Low Voltage Behavior (L4940V12).

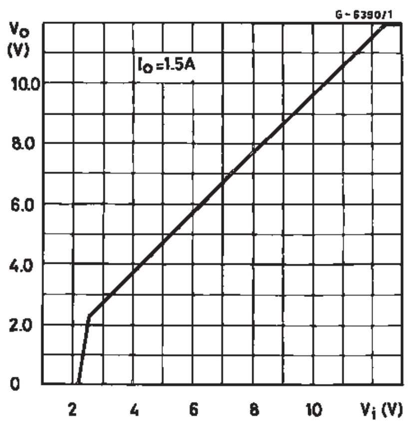


Figure 19 : Supply Voltage Rejection vs. Frequency (L4940V5).

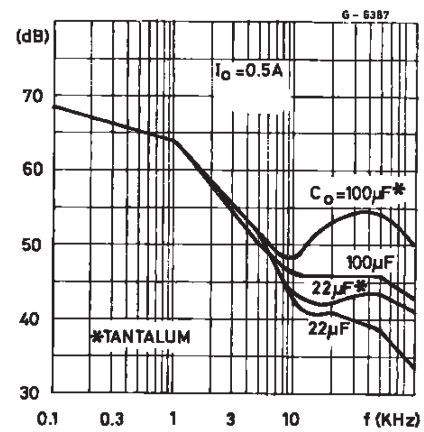


Figure 20 : Supply Voltage Rejection vs. output Current.

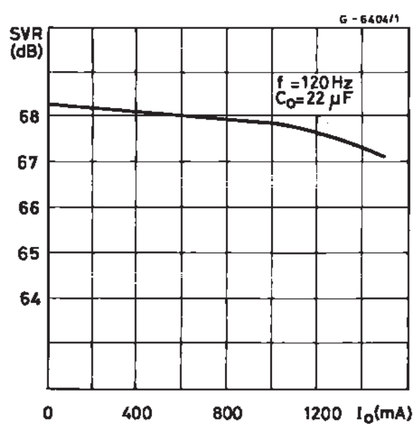


Figure 21 : Load Dump Characteristics (L4940V5).

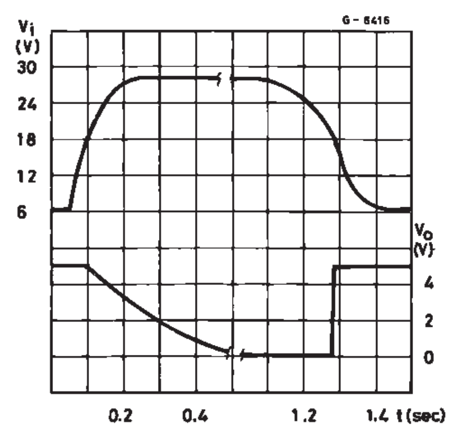


Figure 22 : Line Transient Response (L4940V5).

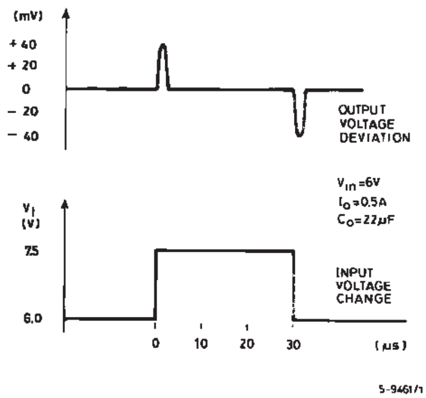


Figure 23 : Load Transient Response.

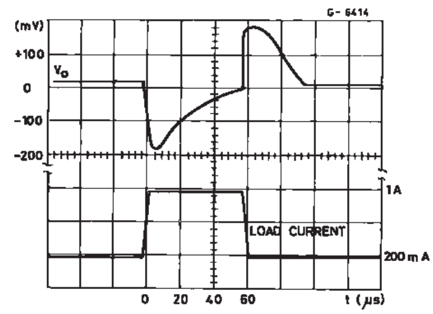


Figure 24 : Total Power Dissipation.

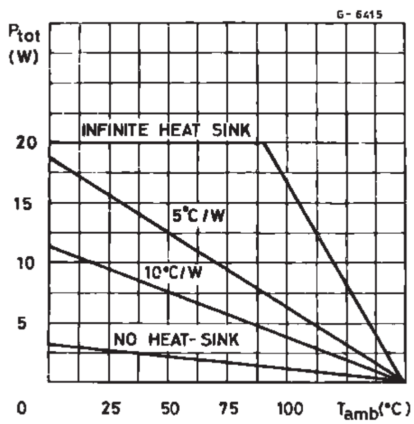


Figure 25 : Distributed Supply with On-card L4940 and L4941 Low-drop Regulators.

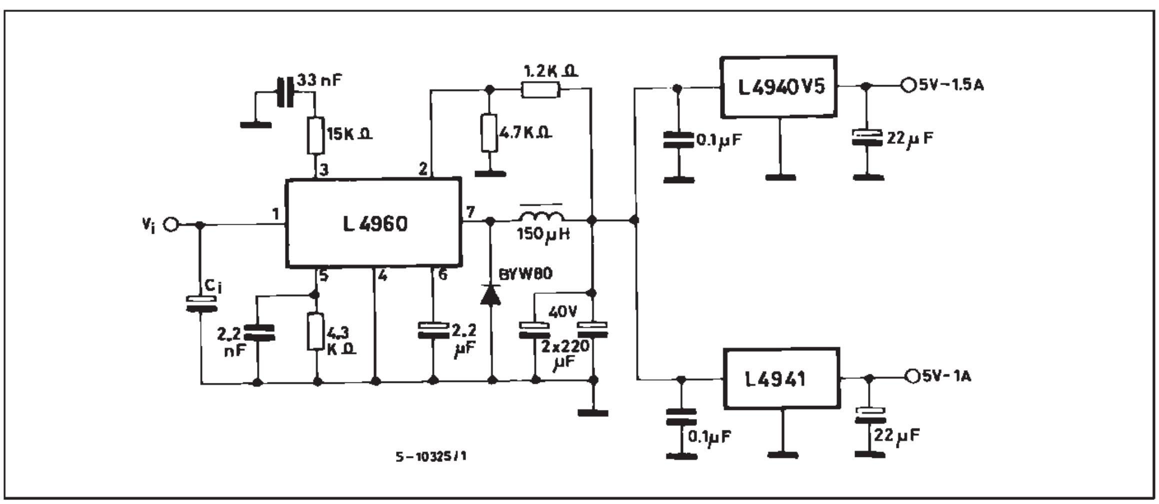
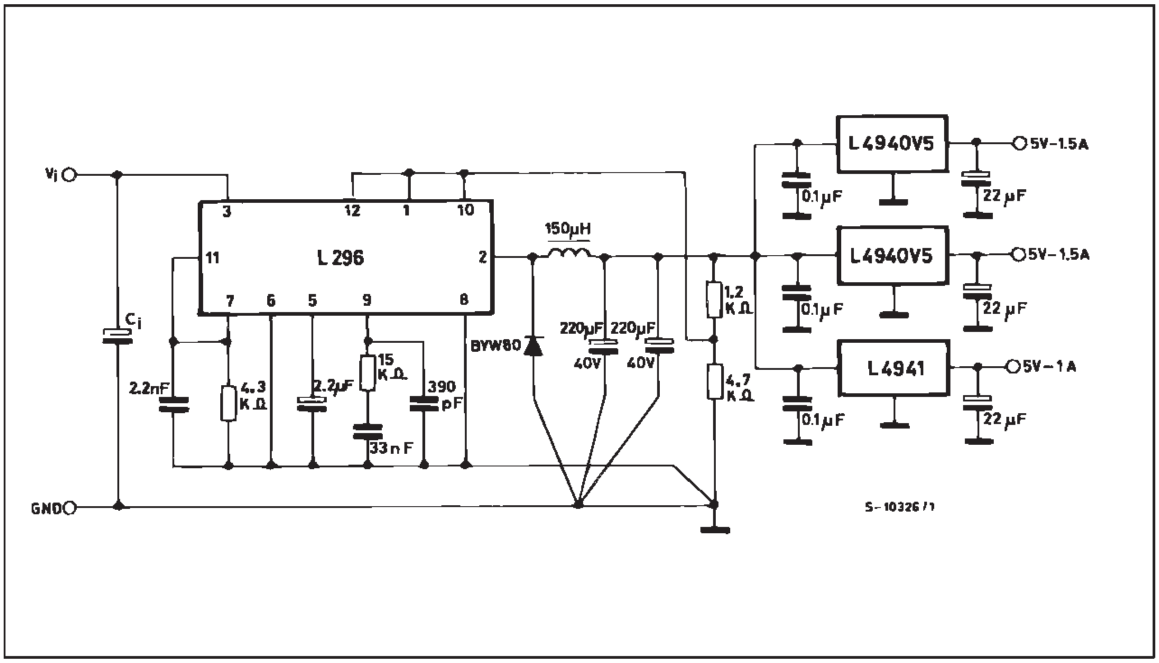


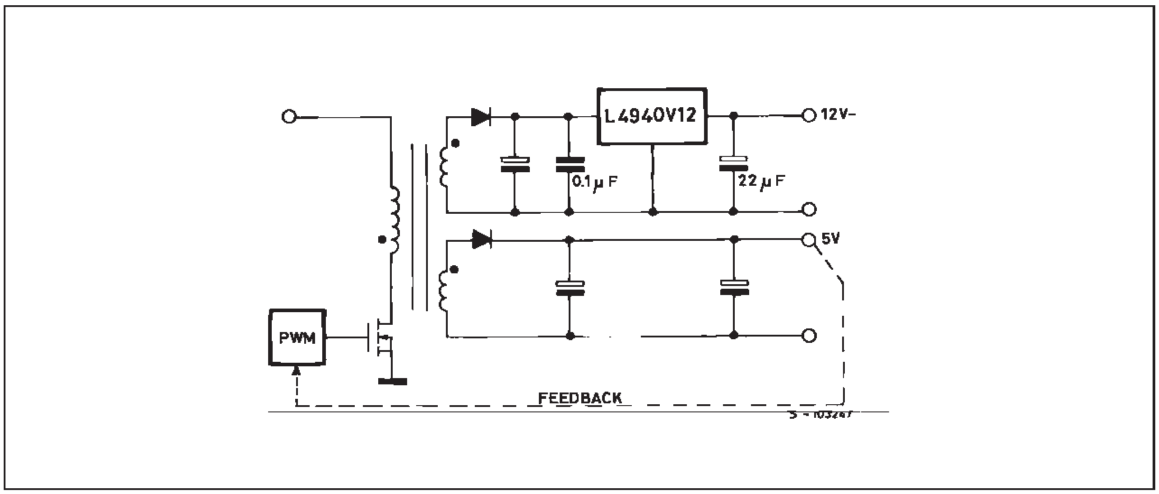
Figure 26 : Distributed Supply with On-card L4940 and L4941 Low-drop Regulators.



ADVANTAGES OF THESE APPLICATIONS ARE :

On card regulation with short-circuit and thermal protection on each output.
Very high total system efficiency due to the switching preregulation and very low-drop postregulations.

Figure 27.

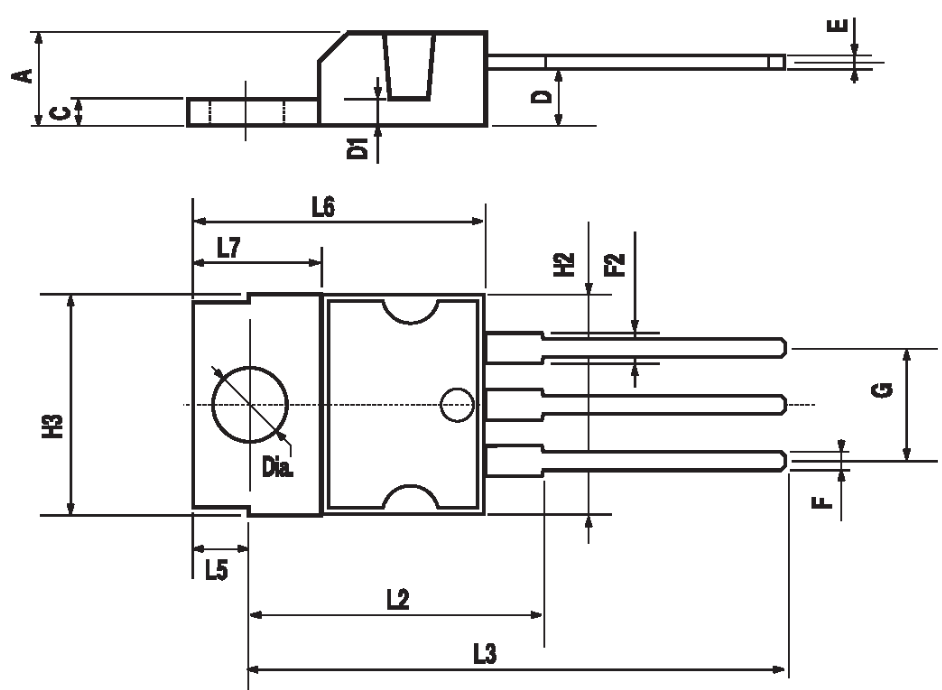


ADVANTAGES OF THIS CONFIGURATION ARE :

Very high regulation (line and load) on both the output voltages.
12 V output short-circuit and thermally protected.
Very high efficiency on the 12 V output due to the very low drop regulator.

TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
F	0.61		0.94	0.024		0.037
F2	1.15		1.4	0.045		0.055
G	4.95	5.08	5.21	0.195	0.200	0.205
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L2		16.2			0.638	
L3	26.3	26.7	27.1	1.035	1.051	1.067
L5	2.6		3	0.102		0.118
L6	15.1		15.8	0.594		0.622
L7	6		6.6	0.236		0.260
Dia.	3.65		3.85	0.144		0.152



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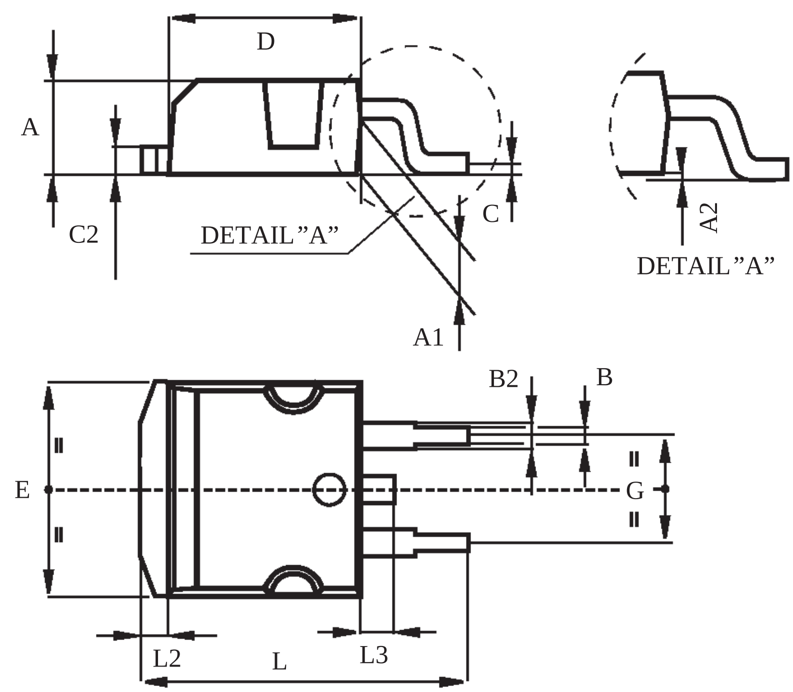
TO-263 (D^2PAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
E	10		10.4	0.393		0.409
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.624
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068



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