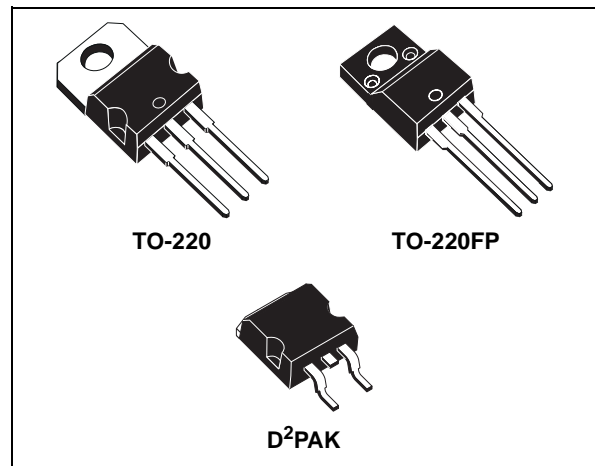


## VERY LOW DROP 1.5A REGULATORS

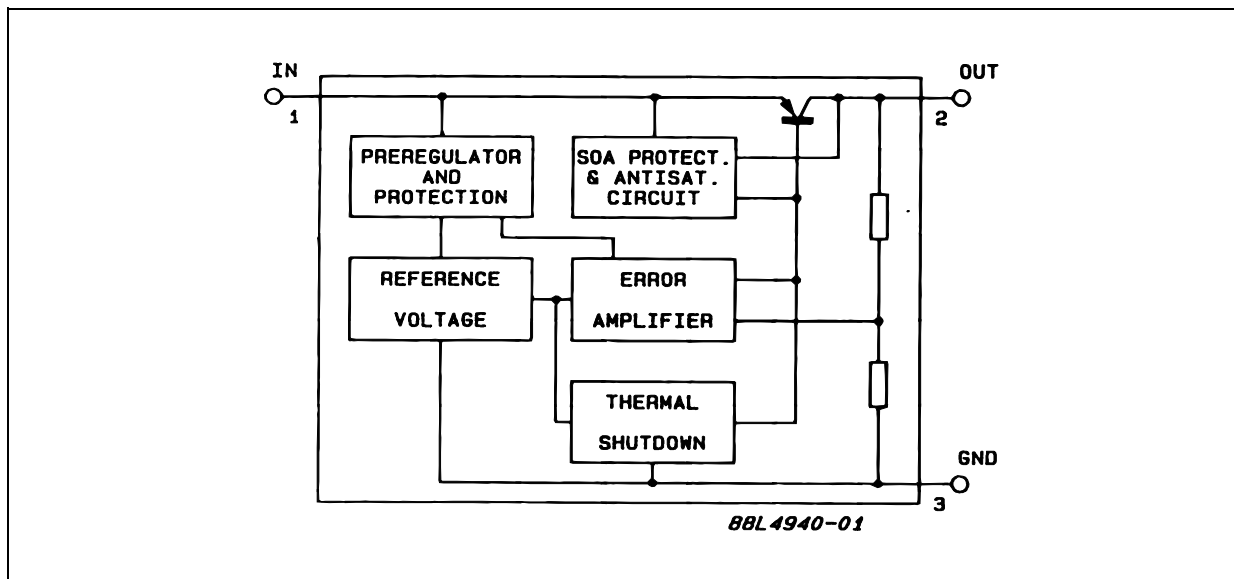
- PRECISE 5, 8.5, 10, 12V OUTPUTS
- LOW DROPOUT VOLTAGE (500mV Typ. at 1.5A)
- VERY LOW QUIESCENT CURRENT
- THERMAL SHUTDOWN
- SHORT CIRCUIT PROTECTION
- REVERSE POLARITY PROTECTION

### DESCRIPTION

The L4940 series of three terminal positive regulators is available in TO-220, TO-220FP and D<sup>2</sup>PAK packages 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



## L4940 SERIES

### ABSOLUTE MAXIMUM RATINGS

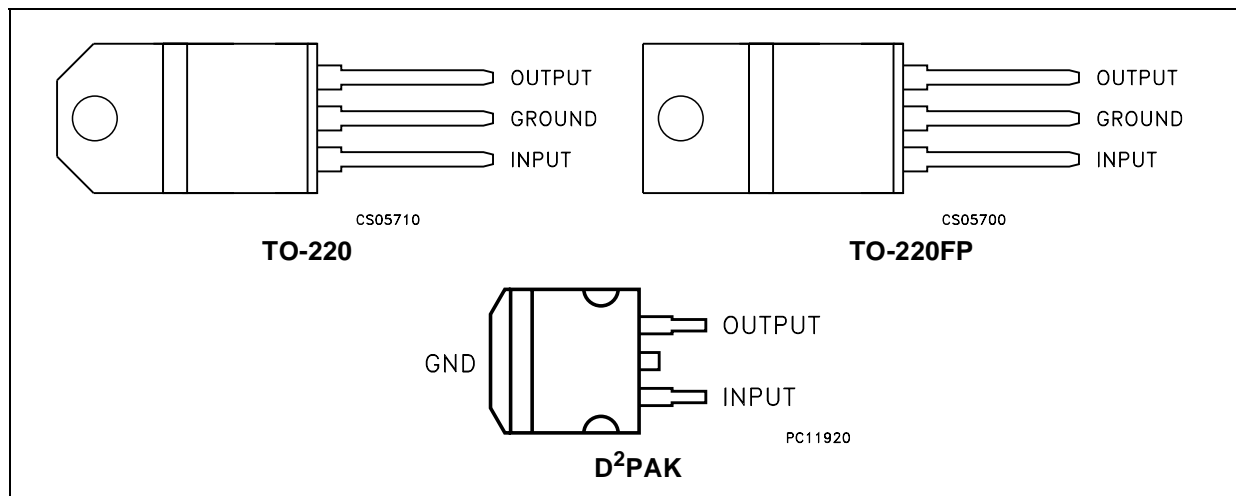
Symbol	Parameter <sup>2</sup>	Value	Unit	
$V_I$	Forward Input Voltage	30	V	
$V_{IR}$	Reverse Input Voltage	$V_O=5V$ $R_O=100\Omega$	-15	V
		$V_O=8.5V$ $R_O=180\Omega$	-15	V
		$V_O=10V$ $R_O=200\Omega$	-15	V
		$V_O=12V$ $R_O=240\Omega$	-15	V
$I_O$	Output Current	Internally Limited	mA	
$P_D$	Power Dissipation	Internally Limited	mW	
$T_{stg}$	Storage Temperature Range	-40 to +150	°C	
$T_{op}$	Operating Junction Temperature Range	-40 to +150	°C	

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

### THERMAL DATA

Symbol	Parameter	TO-220	TO-220FP	D <sup>2</sup> PAK	Unit
$R_{thj-case}$	Thermal Resistance Junction-case	3	5	3	°C/W
$R_{thj-amb}$	Thermal Resistance Junction-ambient	50	60	62.5	°C/W

### CONNECTION DIAGRAM (top view)



### ORDERING CODES

TO-220	TO-220FP	D <sup>2</sup> PAK (*)	OUTPUT VOLTAGE
L4940V5	L4940P5	L4940D2T5	5 V
L4940V85	L4940P85	L4940D2T85	8.5 V
L4940V10	L4940P10	L4940D2T10	10 V
L4940V12	L4940P12	L4940D2T12	12 V

(\*) Available in Tape & Reel with the suffix "-TR".

## TEST CIRCUITS

Figure 1 : DC Parameter

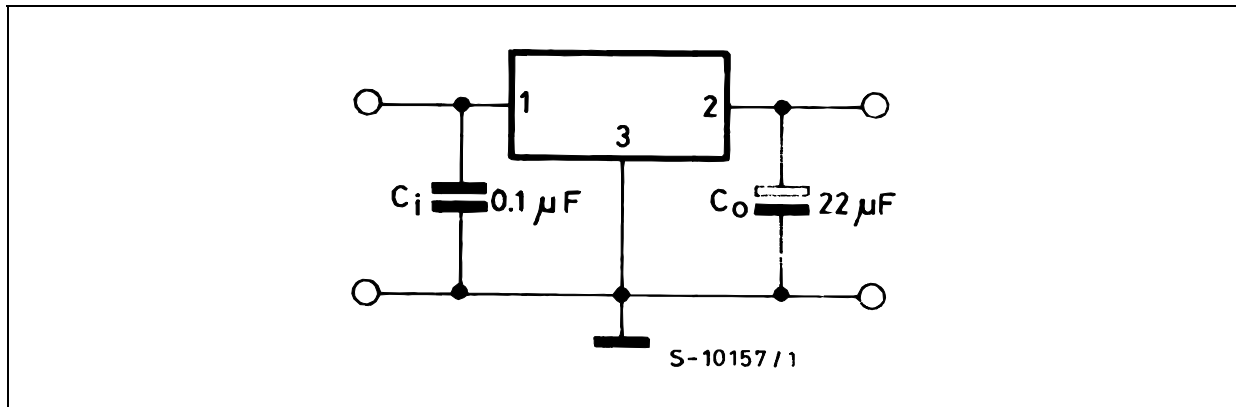


Figure 2 : Load Rejection

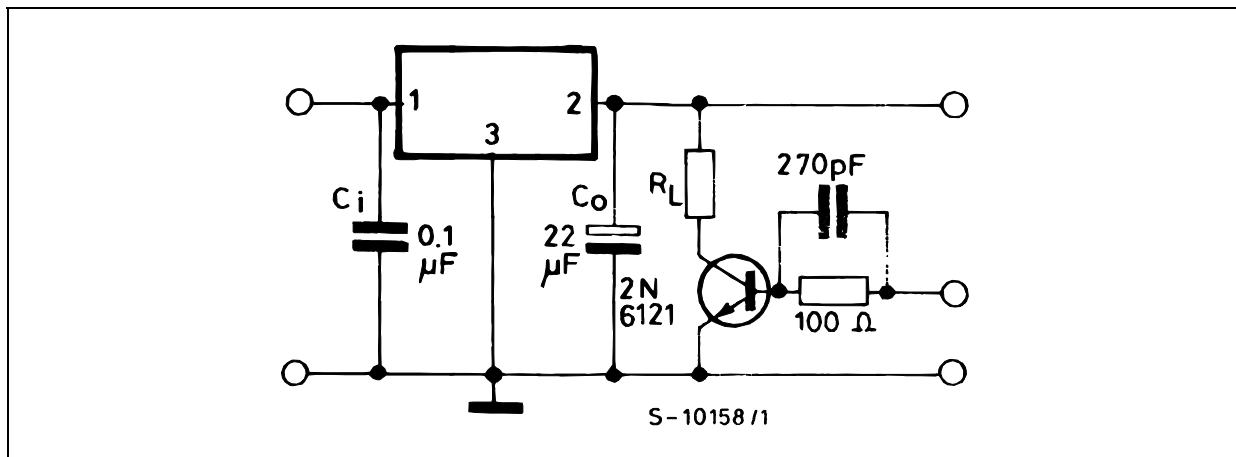
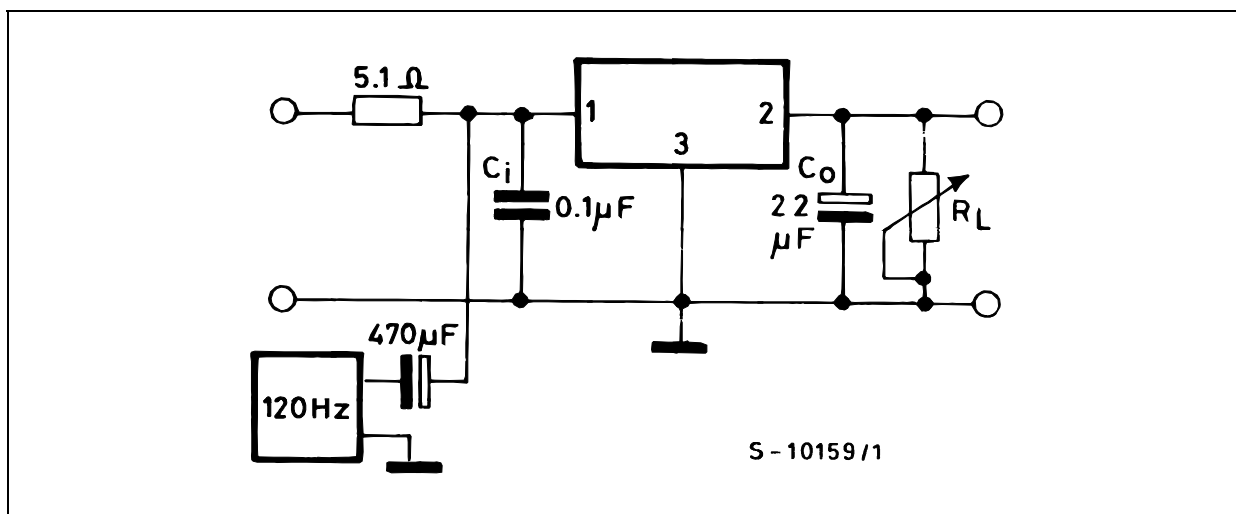


Figure 3 : Ripple Rejection



## L4940 SERIES

**ELECTRICAL CHARACTERISTICS OF L4940V5** (Refer to test circuit,  $V_I=7V$ ,  $C_I = 0.1\mu F$ ,  $C_O = 22\mu F$ ,  $T_J = 25^\circ C$ , unless otherwise specified.)

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

**ELECTRICAL CHARACTERISTICS OF L4940V85** (Refer to test circuit,  $V_I=10.5V$ ,  $C_I = 0.1\mu F$ ,  $C_O = 22\mu F$ ,  $T_J = 25^\circ C$ , unless otherwise specified.)

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

**ELECTRICAL CHARACTERISTICS OF L4940V10** (Refer to test circuit,  $V_I=12V$ ,  $C_I = 0.1\mu F$ ,  $C_O = 22\mu F$ ,  $T_J = 25^\circ C$ , unless otherwise specified.)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_O$	Output Voltage	$I_O = 500 \text{ mA}$	9.8	10	10.2	V
$V_O$	Output Voltage	$I_O = 5\text{mA to } 1.5\text{A}$ $V_I = 11.7 \text{ to } 15\text{V}$	9.6	10	10.4	V
$V_I$	Input Voltage	$I_O = 5 \text{ mA}$			17	V
$\Delta V_O$	Line Regulation	$V_I = 11 \text{ to } 17\text{V}$ $I_O = 5 \text{ mA}$		3	8	mV
$\Delta V_O$	Load Regulation	$I_O = 5\text{mA to } 1.5\text{A}$		15	35	mV
		$I_O = 0.5\text{A to } 1\text{A}$		10	20	mV
$I_q$	Quiescent Current	$I_O = 5 \text{ mA}$		5	8	mA
		$I_O = 1.5\text{A}$ $V_I = 11.7\text{V}$		30	50	mA
$\Delta I_q$	Quiescent Current Change	$I_O = 5 \text{ mA}$			2	mA
		$I_O = 1.5\text{A}$ $V_I = 11.7 \text{ to } 16\text{V}$			13	mA
$\Delta V_O/\Delta T$	Output Voltage Drift			1		mv/ $^\circ C$
SVR	Supply Voltage Rejection	$f = 120\text{Hz}$ $I_O = 1\text{A}$	56	62		dB
$V_d$	Dropout Voltage	$I_O = 0.5\text{A}$		200	400	mV
		$I_O = 1.5\text{A}$		500	900	mV
$I_{sc}$	Short Circuit Current	$V_I = 14\text{V}$		2	2.7	A
		$V_I = 11.7\text{V}$		2.2	2.9	

**ELECTRICAL CHARACTERISTICS OF L4940V12** (Refer to test circuit,  $V_I=14V$ ,  $C_I = 0.1\mu F$ ,  $C_O = 22\mu F$ ,  $T_J = 25^\circ C$ , unless otherwise specified.)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_O$	Output Voltage	$I_O = 500 \text{ mA}$	11.75	12	12.25	V
$V_O$	Output Voltage	$I_O = 5\text{mA to } 1.5\text{A}$ $V_I = 13.8 \text{ to } 15\text{V}$	11.5	12	12.5	V
$V_I$	Input Voltage	$I_O = 5 \text{ mA}$			17	V
$\Delta V_O$	Line Regulation	$V_I = 13 \text{ to } 17\text{V}$ $I_O = 5 \text{ mA}$		3	7	mV
$\Delta V_O$	Load Regulation	$I_O = 5\text{mA to } 1.5\text{A}$		15	35	mV
		$I_O = 0.5\text{A to } 1\text{A}$		10	25	mV
$I_q$	Quiescent Current	$I_O = 5 \text{ mA}$		4	8	mA
		$I_O = 1.5\text{A}$ $V_I = 13.8\text{V}$		30	50	mA
$\Delta I_q$	Quiescent Current Change	$I_O = 5 \text{ mA}$			1.5	mA
		$I_O = 1.5\text{A}$ $V_I = 13.8 \text{ to } 16\text{V}$			10	mA
$\Delta V_O/\Delta T$	Output Voltage Drift			1.2		mv/ $^\circ C$
SVR	Supply Voltage Rejection	$f = 120\text{Hz}$ $I_O = 1\text{A}$	55	61		dB
$V_d$	Dropout Voltage	$I_O = 0.5\text{A}$		200	400	mV
		$I_O = 1.5\text{A}$		500	900	mV
$I_{sc}$	Short Circuit Current	$V_I = 14\text{V}$		2	2.7	A
$Z_O$	Output Impedance	$f = 120\text{Hz}$ $I_O = 0.5\text{A}$		40		m $\Omega$

TYPICAL CHARACTERISTICS

Figure 4 : Dropout Voltage vs Output Current

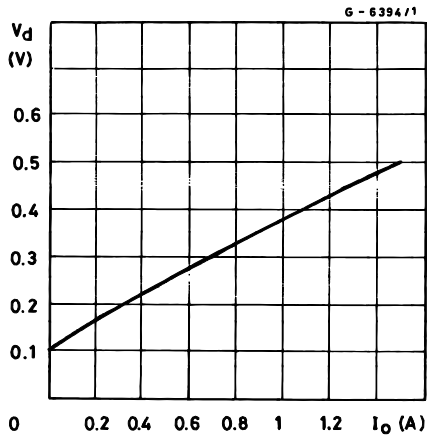


Figure 7 : Output Voltage vs Temperature (L4940V85)

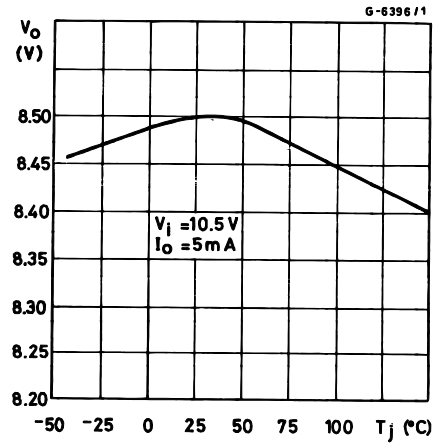


Figure 5 : Dropout Voltage vs Temperature

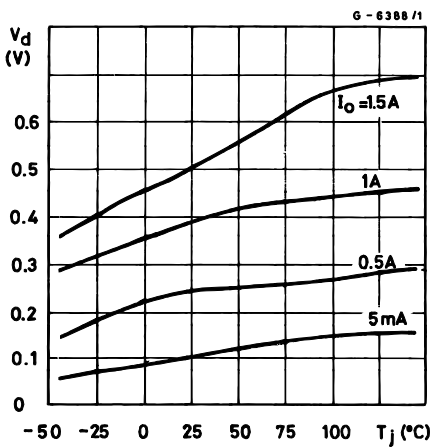


Figure 8 : Output Voltage vs Temperature (L4940V10)

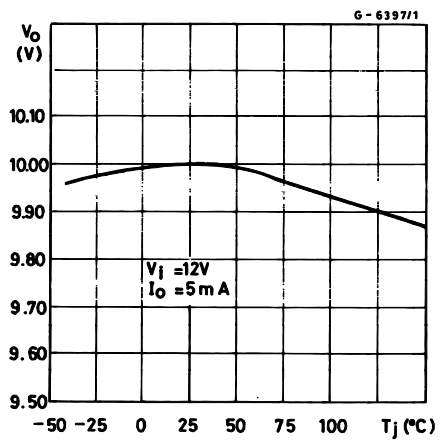


Figure 6 : Output Voltage vs Temperature (L4940V5)

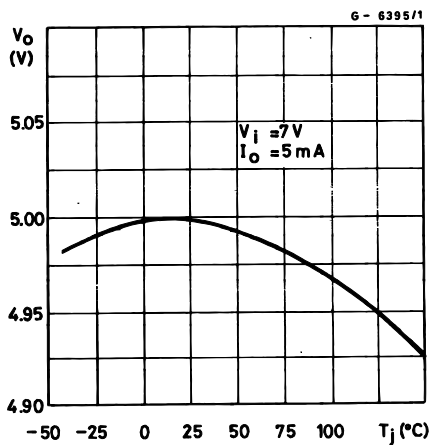
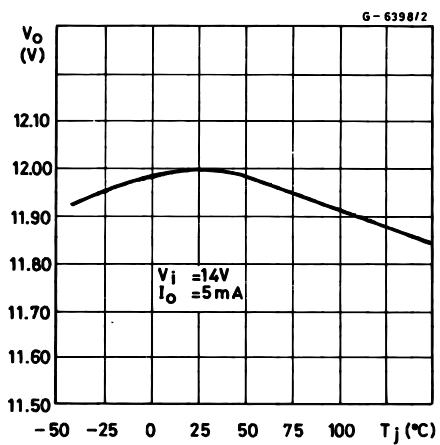
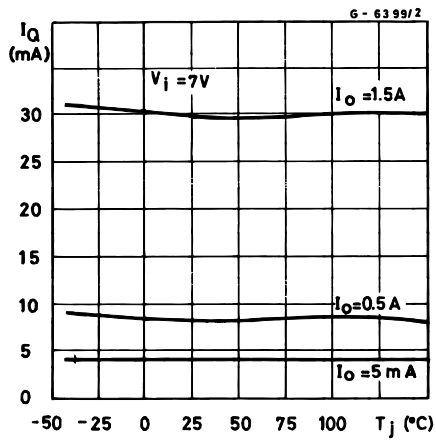


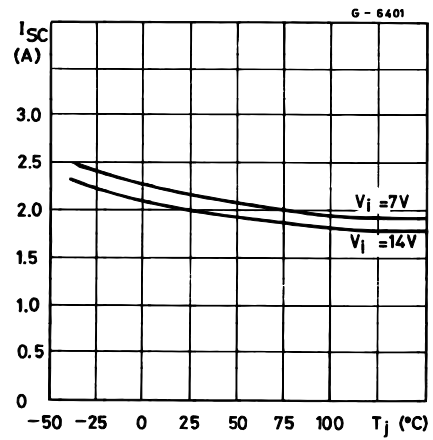
Figure 9 : Output Voltage vs Temperature (L4940V12)



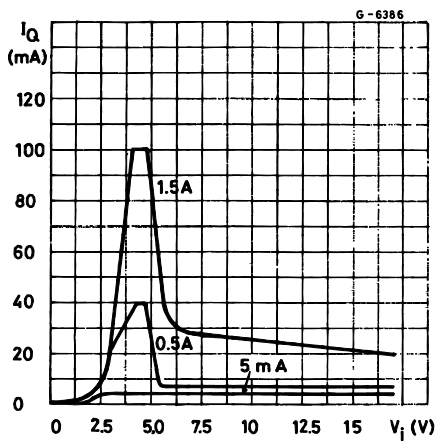
**Figure 10 : Quiescent Current vs Temperature (L4940V5)**



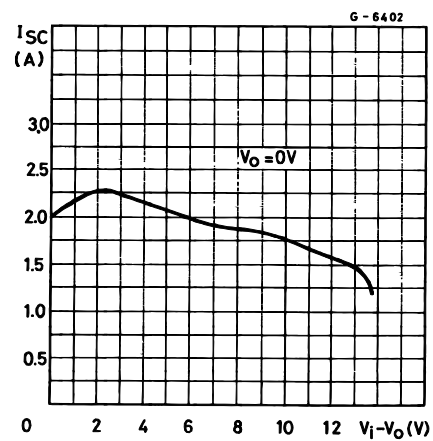
**Figure 13 : Short Circuit Current vs Temperature (L4940V5)**



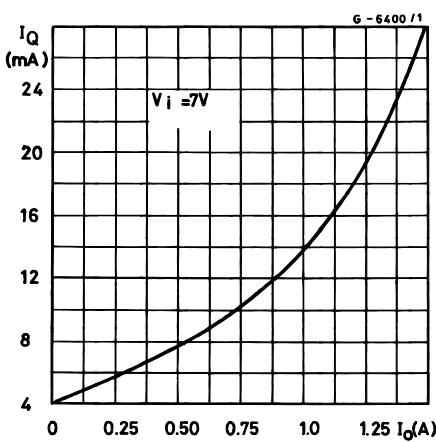
**Figure 11 : Quiescent Current vs Input Voltage (L4940V5)**



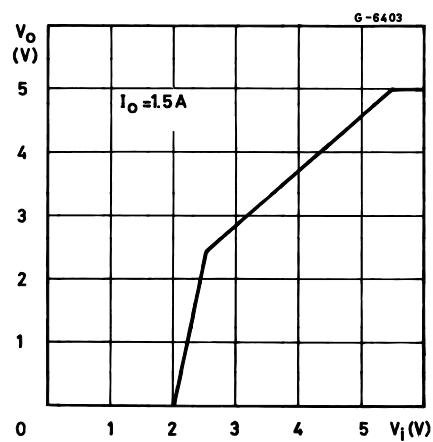
**Figure 14 : Peak Output Current vs Input/Output Differential Voltage (L4940V5)**



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

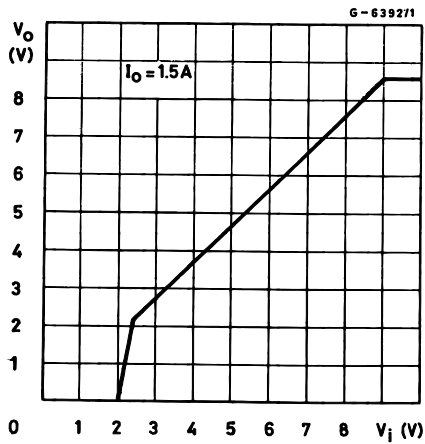


**Figure 15 : Low Voltage Behavior (L4940V5)**

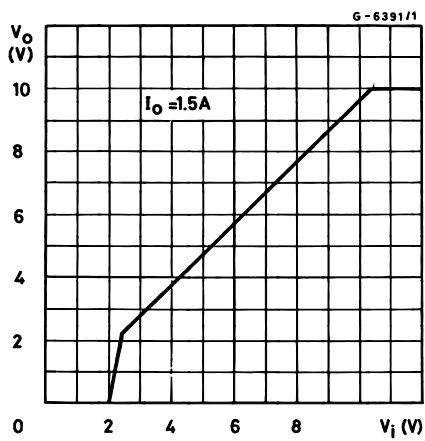


# L4940 SERIES

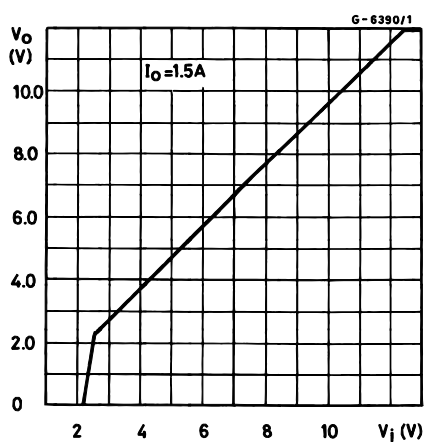
**Figure 16 : Low Voltage Behavior (L4940V85)**



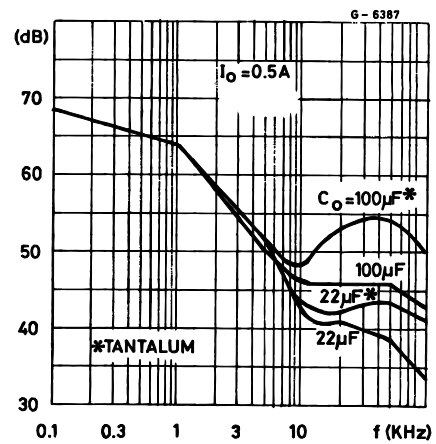
**Figure 17 : Low Voltage Behavior (L4940V10)**



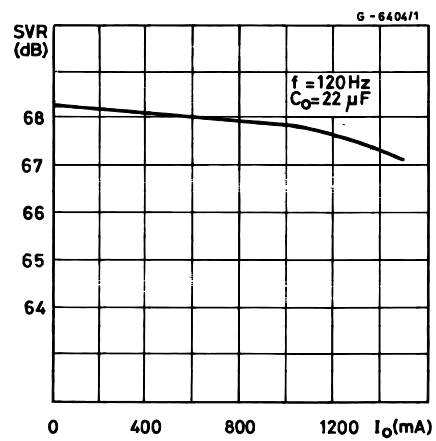
**Figure 18 : Low Voltage Behavior (L4940V12)**



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



**Figure 20 : Supply Voltage Rejection vs Output Current (L4940V5)**



**Figure 21 : Lad Dump Characteristics (L4940V5)**

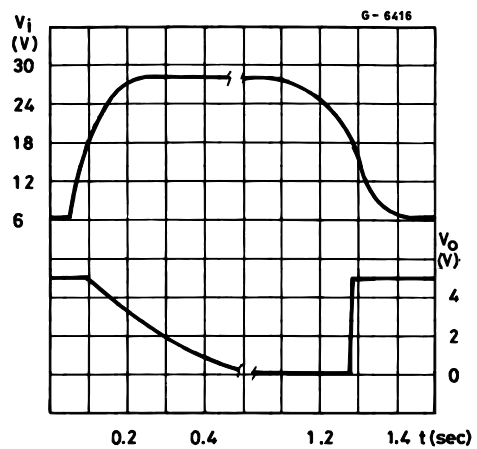




Figure 22 : Line Transient Response (L4940V5)

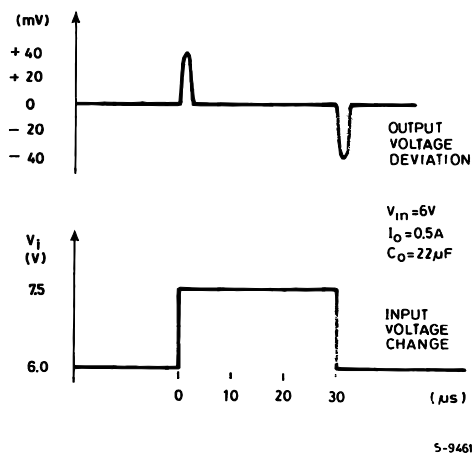


Figure 24 : Load transient Response

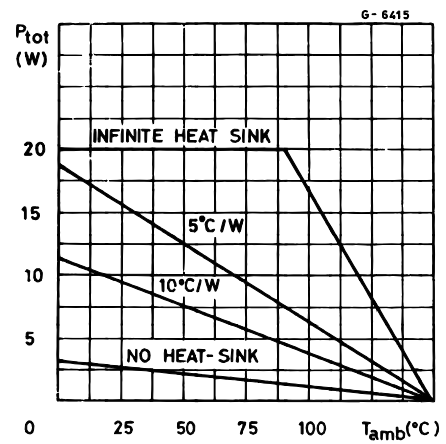
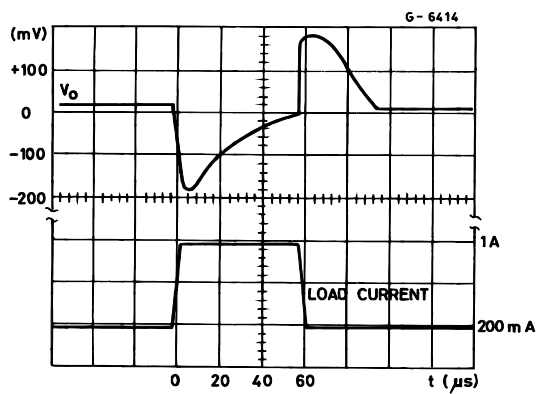


Figure 23 : Total Power Dissipation



## L4940 SERIES

Figure 25 : Distributed Supply with On-card L4940 and L4941 low drop regulator

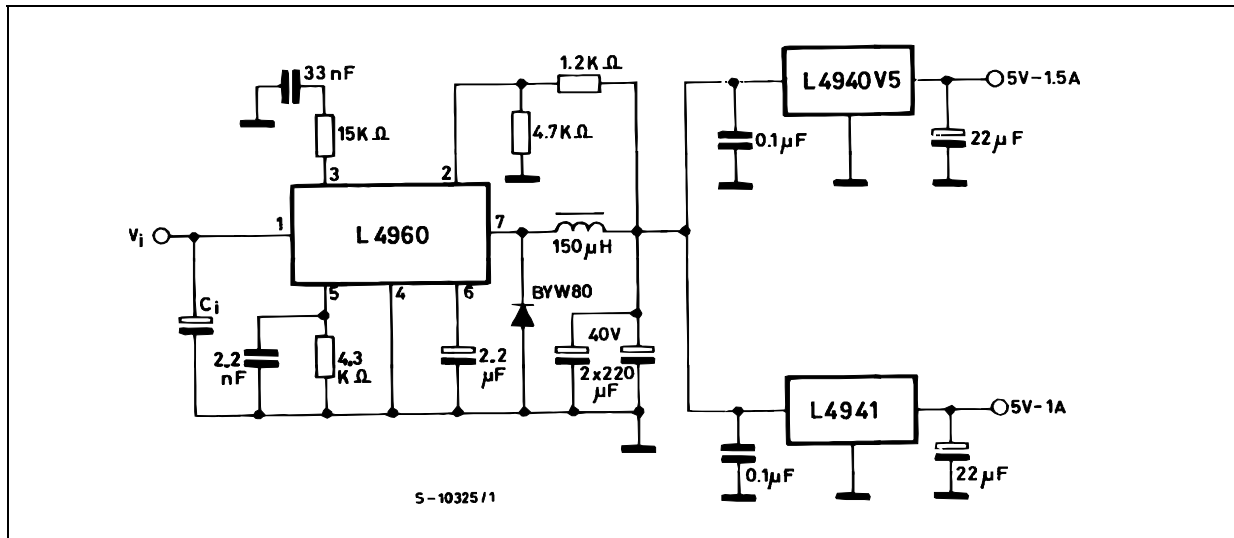
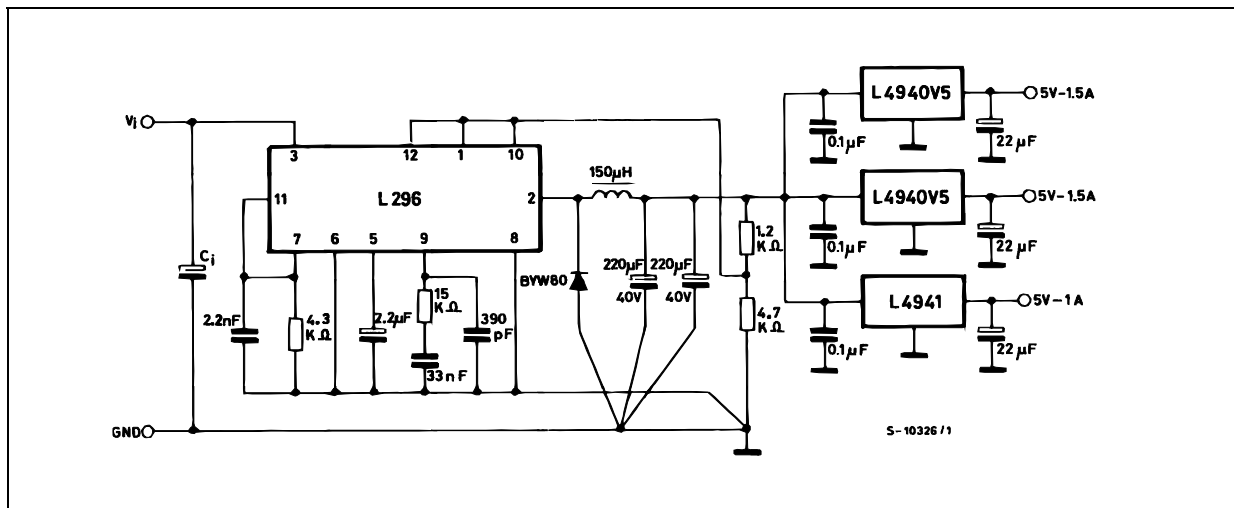


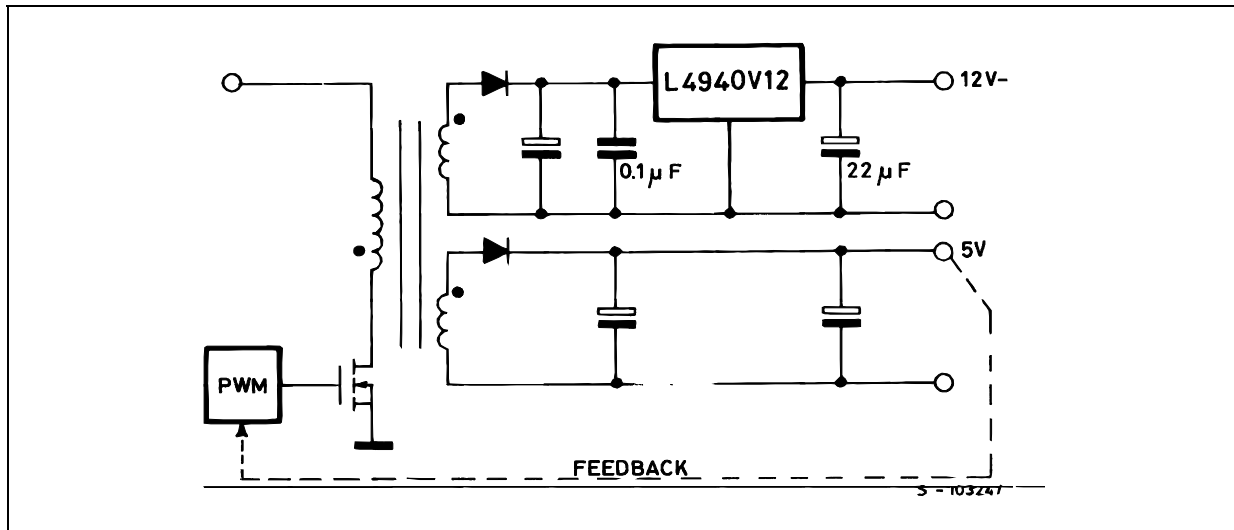
Figure 26 : Distributed Supply with On-card L4940 and L4941 low drop regulator



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 postregulation

**Figure 27** : Distributed Supply with On-card L4940 and L4941 low drop regulator**ADVANTAGES OF THIS CONFIGURATION ARE:**

Very high regulation (line and load) on both the output voltage

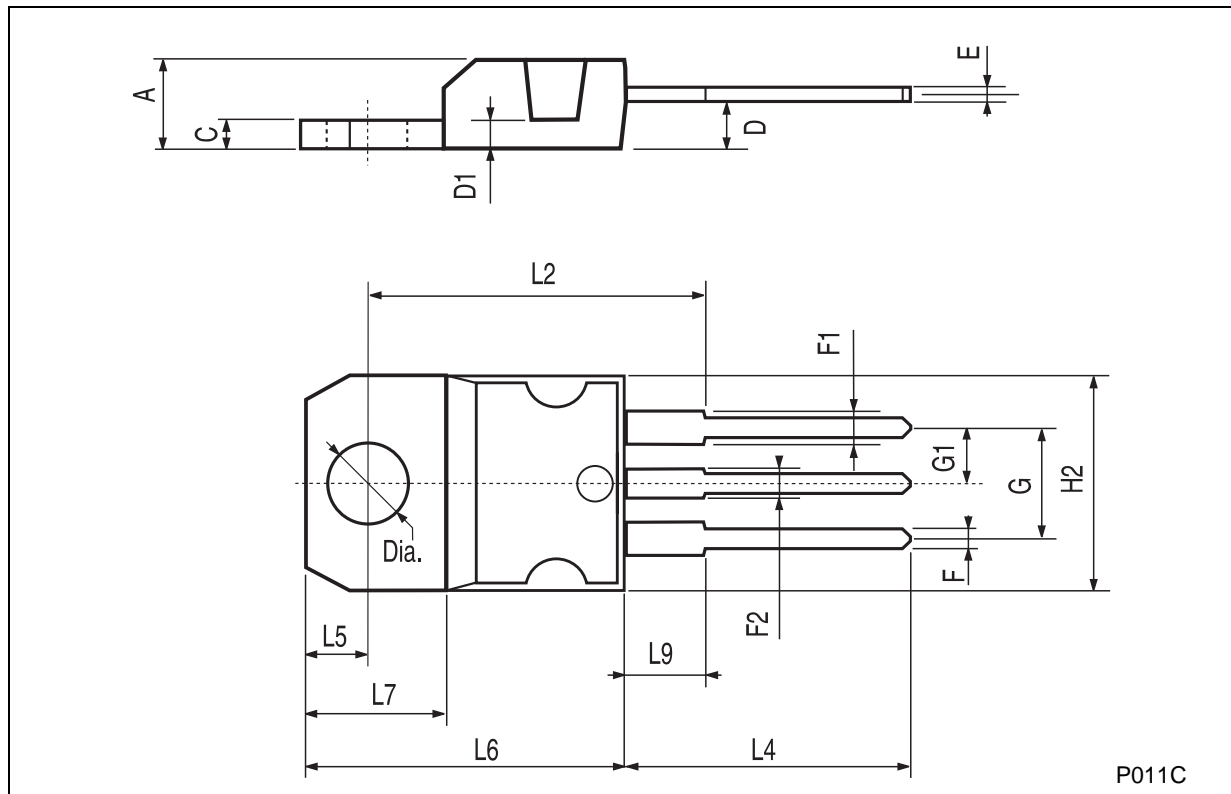
12V output short circuit and thermally protected

Very high efficiency on the 12 V output due to the low drop regulator

**L4940 SERIES**

**TO-220 MECHANICAL DATA**

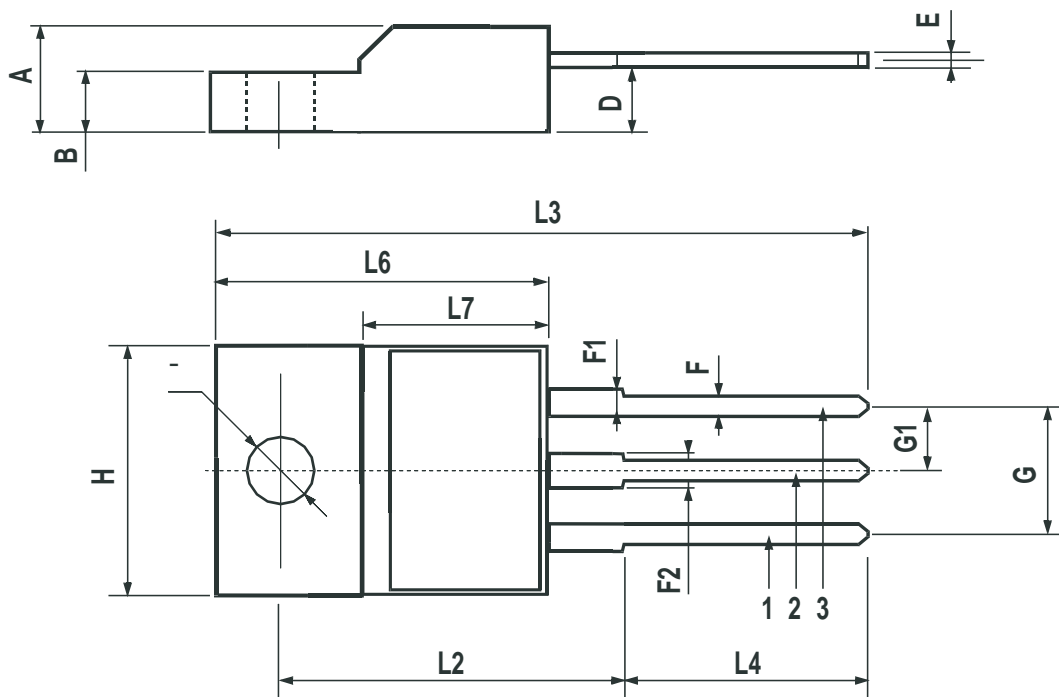
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



P011C

## TO-220FP MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.70	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.50	0.045		0.059
F2	1.15		1.50	0.045		0.059
G	4.95		5.2	0.194		0.204
G1	2.4		2.7	0.094		0.106
H	10.0		10.40	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
DIA.	3		3.2	0.118		0.126



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