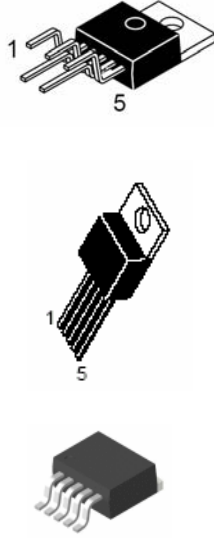


## 3.0 A, 15 V, Step-Down Switching Regulator

IL2576-xx

The IL2576 series of regulators are monolithic integrated circuits ideally suited for easy and convenient design of a step-down switching regulator (buck converter). All circuits of this series are capable of driving a 3.0 A load with excellent line and load regulation. These devices are available in fixed output voltages of 3.3 V, 5.0 V, 12 V, 15 V, and an adjustable output version. These regulators were designed to minimize the number of external components to simplify the power supply design. Standard series of inductors optimized for use with the IL2576 are offered by several different inductor manufacturers. Since the IL2576 converter is a switch-mode power supply, its efficiency is significantly higher in comparison with popular three-terminal linear regulators, especially with higher input voltages. In many cases, the power dissipated is so low that no heatsink is required or its size could be reduced dramatically. A standard series of inductors optimized for use with the IL2576 are available from several different manufacturers. This feature greatly simplifies the design of switch-mode power supplies. The IL2576 features include a guaranteed 4% tolerance on output voltage within specified input voltages and output load conditions, and 10% on the oscillator frequency (2% over 0°C to 125°C). External shutdown is included, featuring 80 mA (typical) standby current. The output switch includes cycle-by-cycle current limiting, as well as thermal shutdown for full protection under fault conditions.



TO-220-5L

TO-220-5L

TO-263-5L

**ORDERING INFORMATION**

<b>IL2576Q</b>	TO-220-5L
<b>IL2576S</b>	TO-220-5L
<b>IL2576D2</b>	TO-263-5L

$T_A = -40^\circ$  to  $125^\circ$  C for all packages

### Features

- 3.3 V, 5.0 V, 12 V, 15 V, and Adjustable Output Versions
- Adjustable Version Output Voltage Range, 1.23 to 37 V  $\pm$ 4% Maximum Over Line and Load Conditions
- Guaranteed 3.0 A Output Current
- Wide Input Voltage Range
- Requires Only 4 External Components
- 52 kHz Fixed Frequency Internal Oscillator
- TTL Shutdown Capability, Low Power Standby Mode
- High Efficiency
- Uses Readily Available Standard Inductors
- Thermal Shutdown and Current Limit Protection

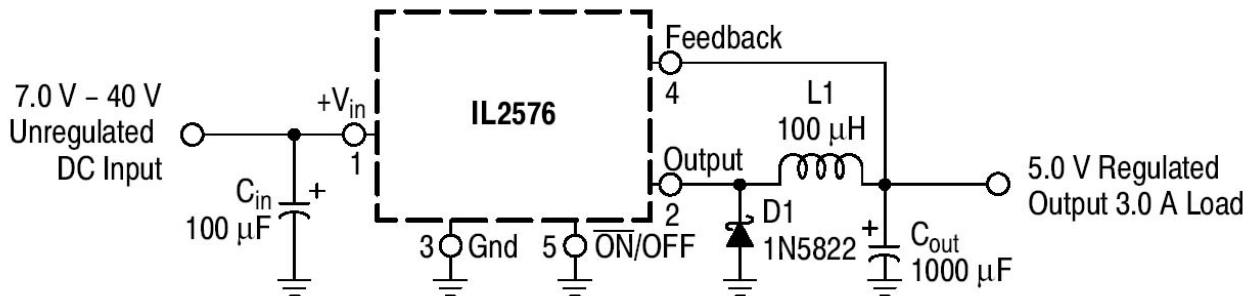
### Applications

- Simple High-Efficiency Step-Down (Buck) Regulator
- Efficient Pre-Regulator for Linear Regulators
- On-Card Switching Regulators
- Positive to Negative Converter (Buck-Boost)
- Negative Step-Up Converters
- Power Supply for Battery Chargers

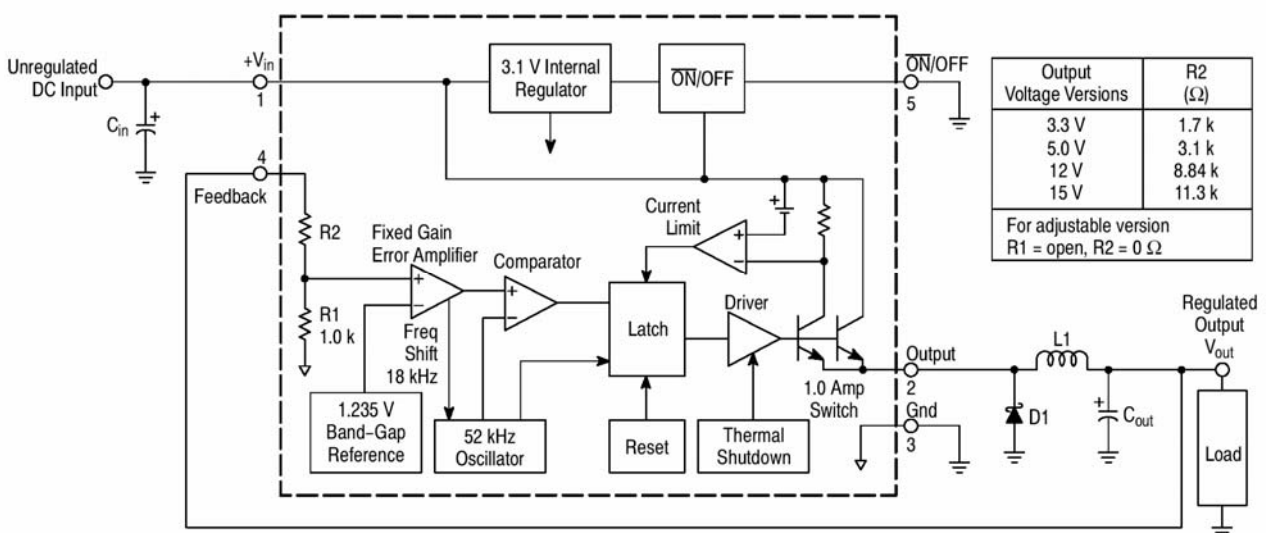
### Pin connections

1. Vin
2. Output
3. Ground
4. Feedback
5. ON/OFF

**Typical Application (Fixed Output Voltage Versions)**



**Representative Block Diagram and Typical Application**



This device contains 162 active transistors.

**ABSOLUTE MAXIMUM RATINGS**

(Absolute Maximum Ratings indicate limits beyond which damage to the device may occur.)

Rating	Symbol	Value	Unit
Maximum Supply Voltage	V <sub>in</sub>	45	V
ON/OFF Pin Input Voltage	–	-0.3 V ≤ V ≤ +V <sub>in</sub>	V
Output Voltage to Ground (Steady-State)	–	-1.0	V
Power Dissipation	PD	Internally Limited	W
Case 314B and 314D (TO-220, 5-Lead)	R JA	65	C/W
Thermal Resistance, Junction-to-Ambient	R JC	5.0	C/W
Case 936A (D2PAK)	PD	Internally Limited	W
Thermal Resistance, Junction-to-Ambient	R JA	70	C/W
Thermal Resistance, Junction-to-Case	R JC	5.0	C/W
Storage Temperature Range	T <sub>stg</sub>	-65 to +150	C
Minimum ESD Rating (Human Body Model: C = 100 pF, R = 1.5 k )	–	2.0	kV
Lead Temperature (Soldering, 10 seconds)	–	260	C
Maximum Junction Temperature	T <sub>J</sub>	150	C

## OPERATING RATINGS

(Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics.)

Rating	Symbol	Value	Unit
Operating Junction Temperature Range	TJ	-40 to +125	C
Supply Voltage	Vin	40	V

## SYSTEM PARAMETERS [Note 1]

### ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, Vin = 12 V for the 3.3 V, 5.0 V, and Adjustable version, Vin = 25 V for the 12 V version, and Vin = 30 V for the 15 V version. ILoad = 500 mA, TJ = 25 °C, for min/max values TJ is the operating junction temperature range that applies [Note 2], unless otherwise noted.)

Characteristics	Symbol	Min	Max	Unit
<b>IL2576-3.3</b> [Note 1] Test Circuit Figure 15)				
Output Voltage	Vout	3.234	3.366	V
Output Voltage (6.0 V ≤ Vin ≤ 40 V, 0.5 A ≤ ILoad ≤ 3.0 A) TJ = 25 °C TJ = -40 to +125 °C	Vout	3.168 3.135	3.432 3.465	V
Efficiency (Vin = 12 V, ILoad = 3.0 A)		-	-	%
<b>IL2576-5</b> [Note 1]				
Output Voltage	Vout	4.9	5.1	V
Output Voltage (6.0 V ≤ Vin ≤ 40 V, 0.5 A ≤ ILoad ≤ 3.0 A) TJ = 25 °C TJ = -40 to +125 °C	Vout	4.8 4.75	5.2 5.25	V
Efficiency (Vin = 12 V, ILoad = 3.0 A)		-	-	%
<b>IL2576-12</b> [Note 1]				
Output Voltage	Vout	11.76	12.24	V
Output Voltage (15.0 V ≤ Vin ≤ 40 V, 0.5 A ≤ ILoad ≤ 3.0 A) TJ = 25 °C TJ = -40 to +125 °C	Vout	11.52 11.4	12.48 12.6	V
Efficiency (Vin = 12 V, ILoad = 3.0 A)		-	-	%
<b>IL2576-15</b> [Note 1]				
Output Voltage	Vout	14.7	15.3	V
Output Voltage (18 V ≤ Vin ≤ 40 V, 0.5 A ≤ ILoad ≤ 3.0 A) TJ = 25 °C TJ = -40 to +125 °C	Vout	14.4 14.25	15.6 15.75	V
Efficiency (Vin = 12 V, ILoad = 3.0 A)		-	-	%
<b>IL2576 ADJUSTABLE VERSION</b> [Note 1]				
Feedback Voltage (Vin = 12 V, ILoad = 0.5 A, Vout = 5.0 V, TJ = 25 °C)	Vout	1.217	1.243	V
Feedback Voltage (8.0 V ≤ Vin ≤ 40 V, 0.5 A ≤ ILoad ≤ 3.0 A, Vout = 5.0 V) TJ = 25 °C TJ = -40 to +125 °C	Vout	1.193 1.18	1.267 1.28	V
Efficiency (Vin = 12 V, ILoad = 3.0 A, Vout = 5.0 V)		-	-	%

1. External components such as the catch diode, inductor, input and output capacitors can affect switching regulator system performance.

When the IL2576 is used as shown in the test circuit, system performance will be as shown in system parameters section .

2. Tested junction temperature range for the IL2576: Tlow = -40 °C Thigh = +125 °C

## DEVICE PARAMETERS

### ELECTRICAL CHARACTERISTICS

(Unless otherwise specified,  $V_{in} = 12\text{ V}$  for the 3.3 V, 5.0 V, and Adjustable version,  $V_{in} = 25\text{ V}$  for the 12 V version, and  $V_{in} = 30\text{ V}$  for the 15 V version.  $I_{Load} = 500\text{ mA}$ ,  $T_J = 25\text{ }^\circ\text{C}$ , for min/max values  $T_J$  is the operating junction temperature range that applies [Note 2], unless otherwise noted.)

Characteristics	Symbol	Min	Max	Unit
<b>ALL OUTPUT VOLTAGE VERSIONS</b>				
Feedback Bias Current ( $V_{out} = 5.0\text{ V}$ [Adjustable Version Only]) $T_J = 25\text{ }^\circ\text{C}$ $T_J = -40\text{ to }+125\text{ }^\circ\text{C}$	$I_b$	– –	100 500	nA
Oscillator Frequency [Note 3] $T_J = 25\text{ }^\circ\text{C}$ $T_J = -40\text{ to }+125\text{ }^\circ\text{C}$	$f_{osc}$	– 42	– 63	kHz
Saturation Voltage ( $I_{out} = 3.0\text{ A}$ [Note 4]) $T_J = 25\text{ }^\circ\text{C}$ $T_J = -40\text{ to }+125\text{ }^\circ\text{C}$	$V_{sat}$	– –	1.8 2.0	V
Max Duty Cycle (“on”) [Note 5]	DC	93	–	%
Current Limit (Peak Current [Notes 3 and 4]) $T_J = 25\text{ }^\circ\text{C}$ $T_J = -40\text{ to }+125\text{ }^\circ\text{C}$	$I_{CL}$	4.2 3.5	6.9 7.5	A
Output Leakage Current [Notes 6 and 7], $T_J = 25\text{ }^\circ\text{C}$ Output = 0 V Output = –1.0 V	$I_L$	– –	2.0 30	mA
Quiescent Current [Note 6] $T_J = 25\text{ }^\circ\text{C}$ $T_J = -40\text{ to }+125\text{ }^\circ\text{C}$	$I_Q$	– –	10 11	mA
Standby Quiescent Current (ON/OFF Pin = 5.0 V (“off”)) $T_J = 25\text{ }^\circ\text{C}$	$I_{stby}$	–	200	A
ON/OFF Pin Logic Input Level $V_{out} = 0\text{ V}$ $T_J = 25\text{ }^\circ\text{C}$ $T_J = -40\text{ to }+125\text{ }^\circ\text{C}$ $V_{out} = \text{Nominal Output Voltage}$ $T_J = 25\text{ }^\circ\text{C}$ $T_J = -40\text{ to }+125\text{ }^\circ\text{C}$	$V_{IH}$  $V_{IL}$	2.2 2.4 – –	– – 1.0 0.8	V
ON/OFF Pin Input Current ON/OFF Pin = 5.0 V (“off”), $T_J = 25\text{ }^\circ\text{C}$ ON/OFF Pin = 0 V (“on”), $T_J = 25\text{ }^\circ\text{C}$	$I_{IH}$ $I_{IL}$	– –	30 1.0	A

3. The oscillator frequency reduces to approximately 18 kHz in the event of an output short or an overload which causes the regulated output voltage to drop approximately 40% from the nominal output voltage. This self protection feature lowers the average dissipation of the IC by lowering the minimum duty cycle from 5% down to approximately 2%.

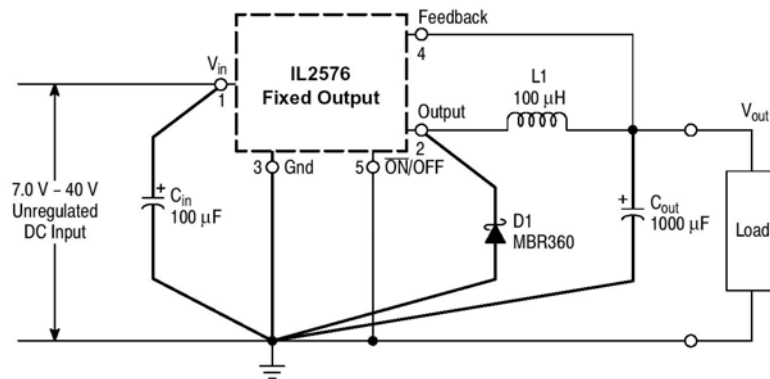
4. Output (Pin 2) sourcing current. No diode, inductor or capacitor connected to output pin.

5. Feedback (Pin 4) removed from output and connected to 0 V.

6. Feedback (Pin 4) removed from output and connected to +12 V for the Adjustable, 3.3 V, and 5.0 V versions, and +25 V for the 12 V and 15 V versions, to force the output transistor “off”.

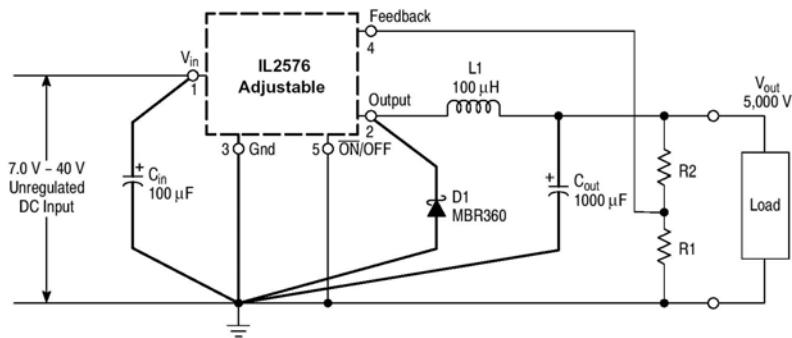
7.  $V_{in} = 40\text{ V}$ .

### Fixed Output Voltage Versions



- Cin – 100 mF, 75 V, Aluminium Electrolytic
- Cout – 1000 mF, 25 V, Aluminium Electrolytic
- D1 – Schottky, MBR360
- L1 – 100 mH, Pulse Eng. PE-92108
- R1 – 2.0 k, 0.1%
- R2 – 6.12 k, 0.1%

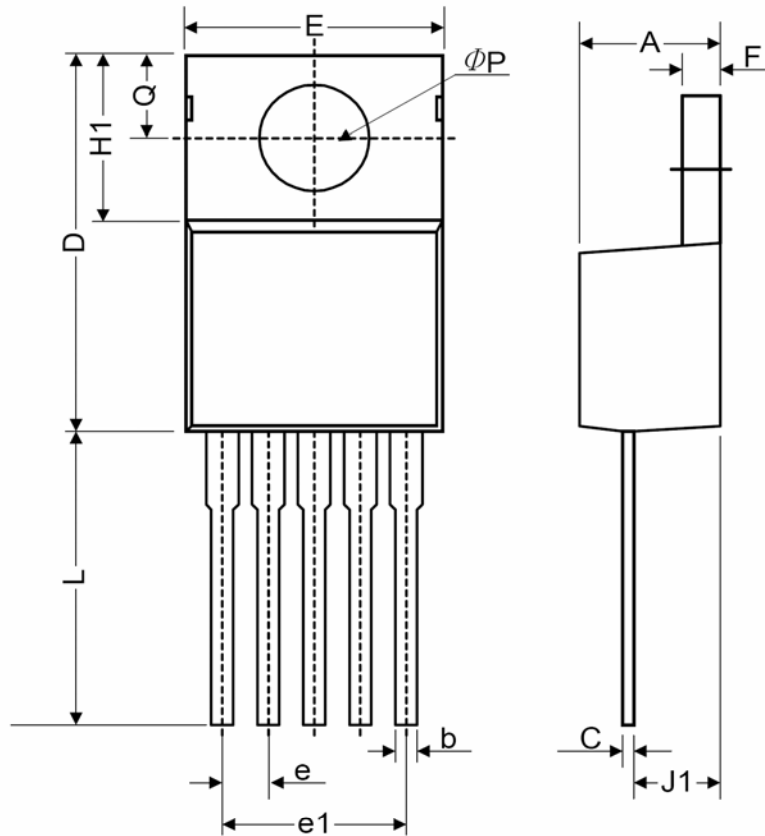
### Adjustable Output Voltage Versions



$$V_{out} = V_{ref} \left( 1.0 + \frac{R_2}{R_1} \right), \quad R_2 = R_1 \left( \frac{V_{out}}{V_{ref}} - 1.0 \right)$$

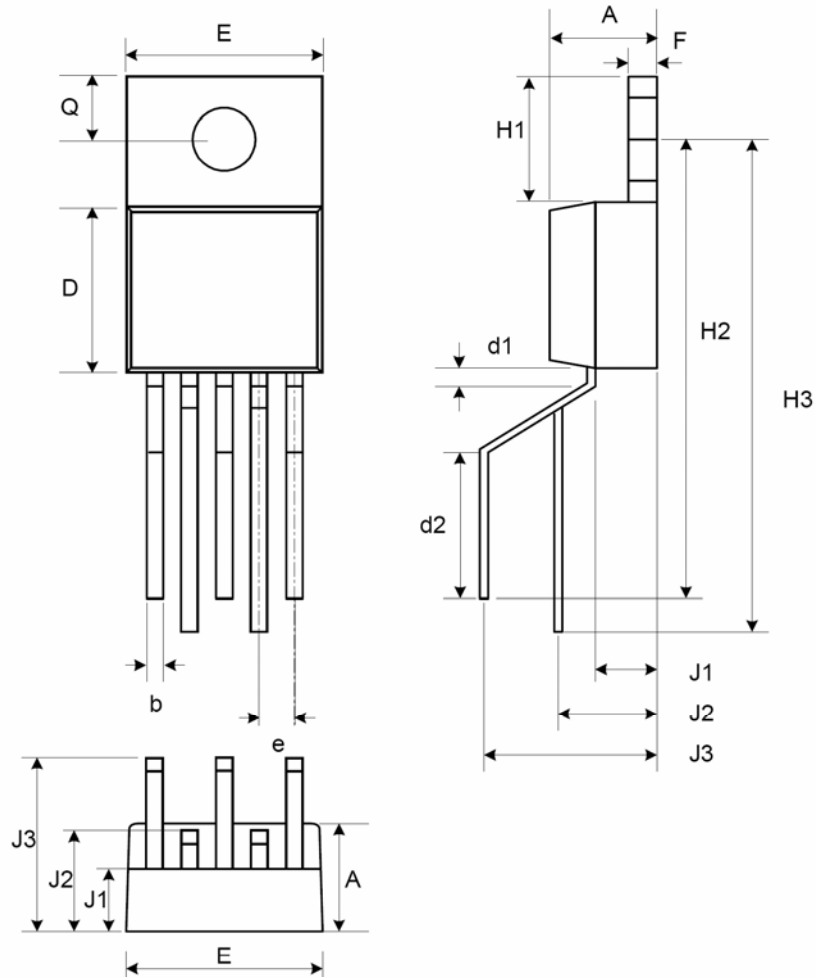
Where Vref = 1.23 V, R1 between 1.0 k and 5.0 k

TO-220-5L



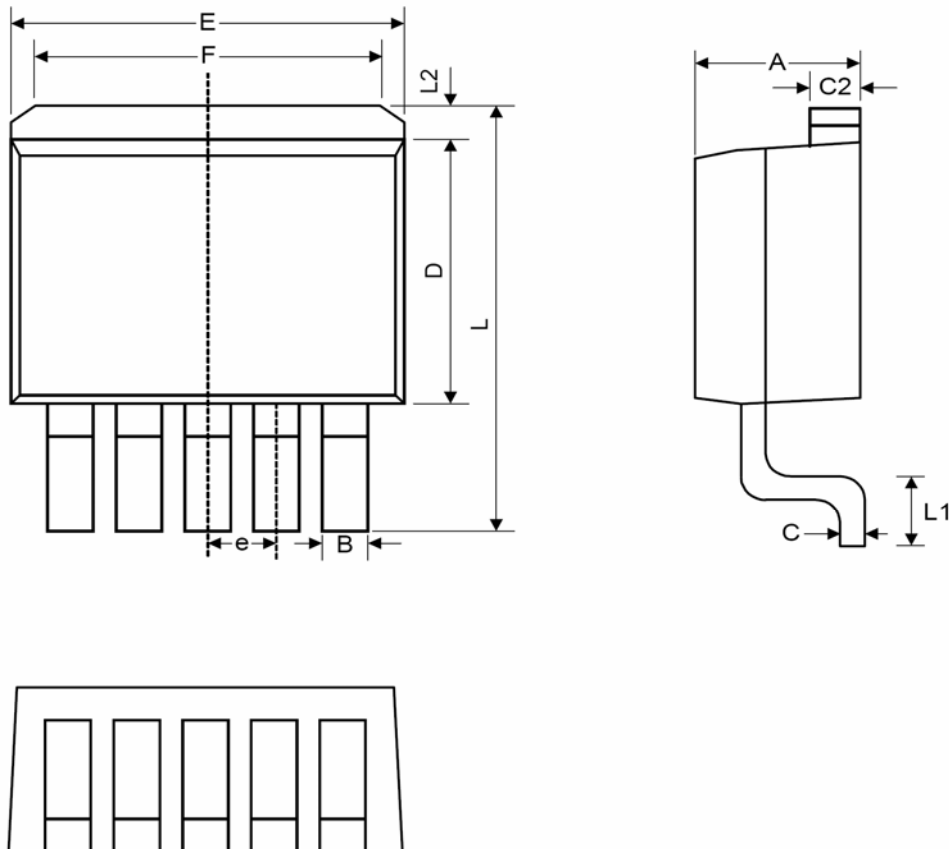
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.07	4.45	4.82	0.160	0.175	0.190
b	0.76	0.89	1.02	0.030	0.035	0.040
C	0.36	0.50	0.64	0.014	0.020	0.025
D	14.22	14.86	15.50	0.560	0.585	0.610
E	9.78	10.16	10.54	0.385	0.400	0.415
e	1.57	1.71	1.85	0.062	0.067	0.073
e1	6.68	6.81	6.93	0.263	0.268	0.273
F	1.14	1.27	1.40	0.045	0.050	0.055
H1	5.46	6.16	6.86	0.215	0.243	0.270
J1	2.29	2.74	3.18	0.090	0.108	0.125
L	13.21	13.97	14.73	0.520	0.550	0.580
$\phi p$	3.68	3.81	3.94	0.145	0.150	0.155
Q	2.54	2.73	2.92	0.100	0.107	0.115

**TO-220-5L (Bent Staggered)**



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.4	4.6	4.7	0.175	0.180	0.185
b	0.7	0.8	0.9	0.027	0.032	0.037
D	8.4	8.7	8.9	0.330	0.340	0.350
d1	1.0			0.039		
d2	6.3			0.248		
E	9.91	10.16	10.41	0.390	0.400	0.410
e	1.6	1.7	1.8	0.062	0.067	0.072
F	1.2	1.25	1.3	0.048	0.050	0.052
H1	6.4			0.250		
H2	20.8	21.6	22.4	0.820	0.850	0.880
H3	23.9	24.7	25.5	0.942	0.972	1.002
J1	2.7			0.105		
J2	3.7	4.5	5.3	0.147	0.177	0.207
J3	8.4			0.331		
Q	2.5	2.8	3.0	0.100	0.110	0.120

## TO-263-5L



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	4.07	4.46	4.85	0.160	0.176	0.191
B	0.66	0.84	1.02	0.026	0.033	0.040
C	0.36	0.50	0.64	0.014	0.020	0.025
C2	1.14	1.27	1.40	0.045	0.050	0.055
D	8.65	9.15	9.65	0.341	0.360	0.380
E	9.78	10.16	10.54	0.385	0.400	0.415
e	1.57	1.71	1.85	0.062	0.068	0.073
F	6.60	6.86	7.11	0.260	0.270	0.280
L	14.61	15.24	15.88	0.575	0.600	0.625
L1	2.29	2.54	2.79	0.090	0.100	0.110
L2	-	-	2.92	-	-	0.115