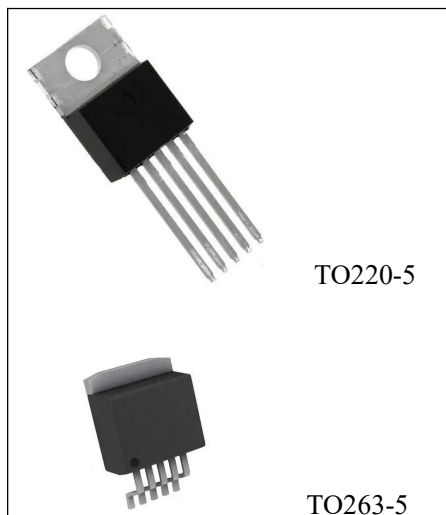


3A Step-Down Voltage Regulator

Features

- 3.3V, 5V, 12V and adjustable output versions
- High efficiency
- Guaranteed 3A output current
- Requires only 4 external components
- 52 kHz fixed frequency internal oscillator
- TTL shutdown capability, low power standby mode
- Uses readily available standard inductors
- Thermal shutdown and current limit protection
- Adjustable version output voltage range, 1.23V to 37V $\pm 4\%$ max over line and load conditions



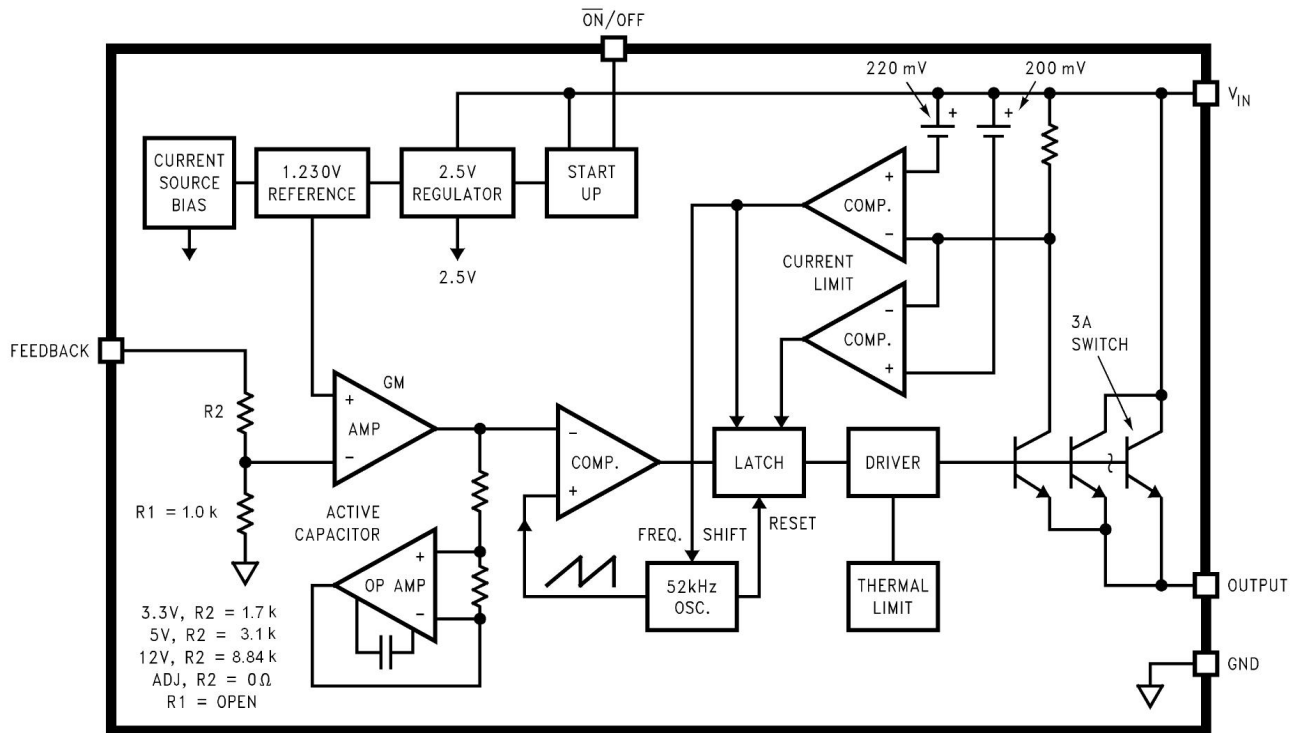
Package Information

PART NO.	ORDER NO.	PACKAG DESCRIPTION	PACKAGE MARKING	PACKAGE OPTION
LM2576S-3.3	LM2576S-3.3	TO220-5	LM2576S	50/Tube
LM2576S-3.3	LM2576S-3.3	TO263-5	LM2576S	50/Tube 800/Reel
LM2576S-5.0	LM2576S-5.0	TO220-5	LM2576S	50/Tube
LM2576S-5.0	LM2576S-5.0	TO263-5	LM2576S	50/Tube 800/Reel
LM2576S-12	LM2576S-12	TO220-5	LM2576S	50/Tube
LM2576S-12	LM2576S-12	TO263-5	LM2576S	50/Tube 800/Reel
LM2576S-ADJ	LM2576S-ADJ	TO220-5	LM2576S	50/Tube
LM2576S-ADJ	LM2576S-ADJ	TO263-5	LM2576S	50/Tube 800/Reel

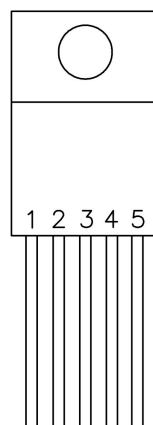
Applications

- Simple high-efficiency step-down (buck) regulator
- Efficient pre-regulator for linear regulators
- On-card switching regulators
- Positive to negative converter (Buck-Boost)

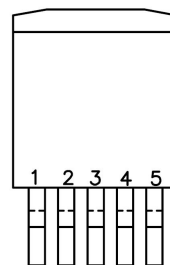
Functional Block Diagram



Pin Configuration



TO220-5



TO263-5

Pin Description

Pin Number	Pin Name	Function Description
1	VIN	This is the positive input supply for the IC switching regulator. A suitable input bypass capacitor must be present at this pin to minimize voltage transients and to supply the switching currents needed by the regulator.
2	OUTPUT	Internal switch, the voltage at this pin switches between (+V _{IN} V _{SAT}) and approximately -0.5V. To minimize coupling to sensitive circuitry, the PC board copper area connected to this pin should be kept to a minimum.
3	GND	Circuit Ground
4	FEEDBACK	Senses the regulated output voltage to complete the feedback loop
5	$\overline{ON} / OFF$	Allows the switching regulator circuit to be shut down using logic level signals.

Absolute Maximum Ratings

Parameter Name	Symbol	Value	Unit
Maximum Supply Voltage	V _{IN}	45	V
$\overline{ON} / OFF$ pin Input Voltage	$\overline{ON} / OFF$	$-0.3V \leq V \leq +V_{IN}$	V
Output Voltage to Ground (steady state)	V _{OUT}	-1	V
Power Dissipation	P _{DMAX}	Internally Limited	
Storage Temperature Range	T _{stg}	-65~+150	°C
Maximum Junction Temperature	T _{JA}	150	°C
ESD Susceptibility (Human Body Model)	ESD	2	kV
Lead Temperature (Soldering, 10 Seconds)	T _L	260	°C

Recommended Operating Conditions

Parameter Name	Symbol	Value	Unit
Supply Voltage	V _{IN}	6~40	V
Operating temperature range	T _{opr}	-40~+125	°C

Electrical Characteristics

(Unless otherwise specified: $T_J = 25^{\circ}\text{C}$)

Parameter Name	Symbol	Test Conditions	Min	Typ	Max	Units
Device Parameters						
Feedback Bias Current	I_b	Adjustable version only, $V_{OUT}=5V$		50	100	nA
Oscillator Frequency	f_o	(Note 1)	47	52	58	kHz
V_{SAT} Saturation Voltage	V_{SAT}	$I_{OUT}=3A$		1.4	1.8	V
Max. Duty Cycle(ON)	DC		93	98		%
Current Limit	I_{CL}	(Note 1)	4.2	5.8	6.9	A
Output Leakage Current	I_L	Output=0V			2	mA
		Output=-1V		7.5	30	mA
Quiescent Current	I_Q			5	10	mA
Standby Quiescent Current	I_{STBY}	$\overline{ON} / OFF$ pin=5V(OFF)		50	200	μA
$\overline{ON} / OFF$ Control						
$\overline{ON} / OFF$ Pin Logic Input Level	V_{IH}	$V_{OUT}=0V$	2.0			V
	V_{IL}	V_{OUT} =nominal output voltage			0.8	V
$\overline{ON} / OFF$ Pin Input Current	I_{IH}	$\overline{ON} / OFF$ pin=5V(OFF)		12	30	μA
	I_{IL}	$\overline{ON} / OFF$ pin=0V(ON)		0	10	μA

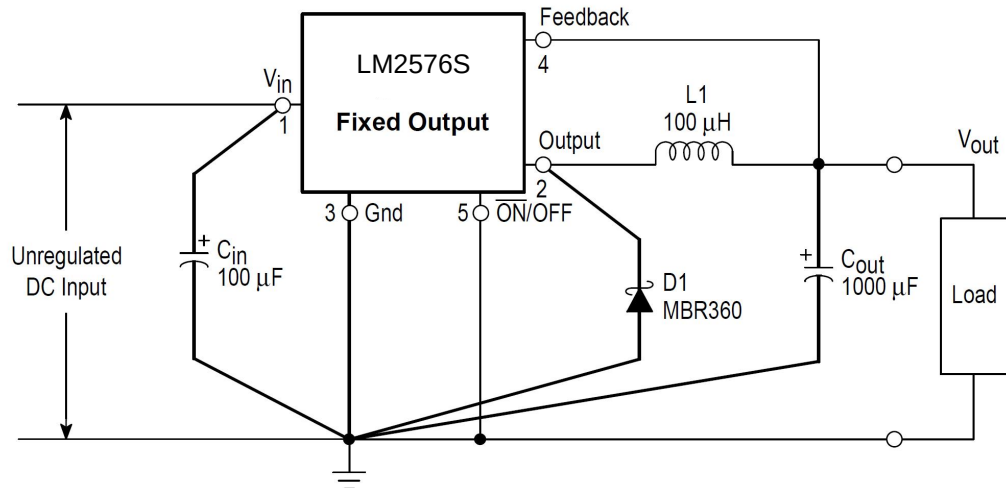
Note 1: The oscillator frequency reduces to approximately 11 kHz in the event of an output short or an overload which causes the regulated output voltage to drop approximately 40% from the nominal output voltage. This self protection feature lowers the average power dissipation of the IC by lowering the minimum duty cycle from 5% down to approximately 2%.

Output pin sourcing current. No diode, inductor or capacitor connected to output.

Parameter Name	Symbol	Test Conditions	Min	Typ	Max	Units
LM2576S-3.3						
Output Voltage	V_{OUT}	$V_{IN}=12V, I_O=500mA$	3.234	3.3	3.366	V
		$6V \leq V_{IN} \leq 40V$ $0.5A \leq I_{LOAD} \leq 3A$	3.168	3.3	3.450	V
Efficiency	η	$V_{IN}=12V, I_{LOAD}=3A$		75		%
LM2576S-5.0						
Output Voltage	V_{OUT}	$V_{IN}=12V, I_O=500mA$	4.90	5.00	5.10	V
		$8V \leq V_{IN} \leq 40V$ $0.5A \leq I_{LOAD} \leq 3A$	4.80	5.00	5.20	V
Efficiency	η	$V_{IN}=12V, I_{LOAD}=3A$		77		%
LM2576S-12						
Output Voltage	V_{OUT}	$V_{IN}=25V, I_O=500mA$	11.76	12.00	12.24	V
		$15V \leq V_{IN} \leq 40V$ $0.5A \leq I_{LOAD} \leq 3A$	11.52	12.00	12.48	V
Efficiency	η	$V_{IN}=25V, I_{LOAD}=3A$		88		%
LM2576S-ADJ						
Output Voltage	V_{OUT}	$V_{IN}=12V, I_O=500mA,$ $V_{OUT}=5V$	1.217	1.230	1.243	V
		$8V \leq V_{IN} \leq 40V, V_{OUT}=5V$ $0.5A \leq I_{LOAD} \leq 3A$	1.193	1.230	1.267	V
Efficiency	η	$V_{IN}=12V, I_{LOAD}=3A,$ $V_{OUT}=5V$		77		%

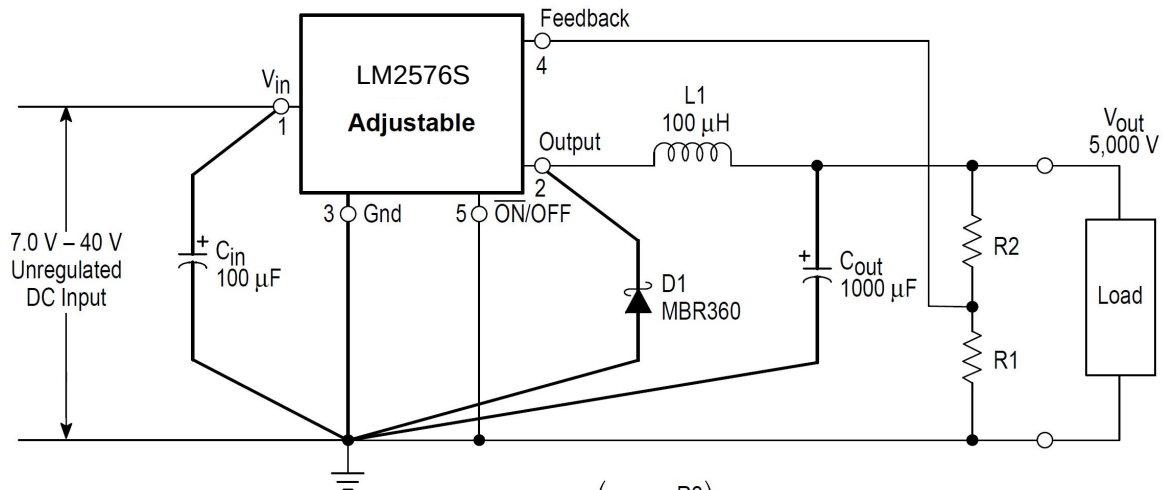
Test Circuit

Fixed Output Voltage Versions



- C_{in} - 100 µF, 75 V, Aluminium Electrolytic
- C_{out} - 1000 µF, 25 V, Aluminium Electrolytic
- D1 - Schottky, MBR360
- L1 - 100 µH, Pulse Eng. PE-92108
- R1 - 2.0 k, 0.1%
- R2 - 6.12 k, 0.1%

Adjustable Output Voltage Versions

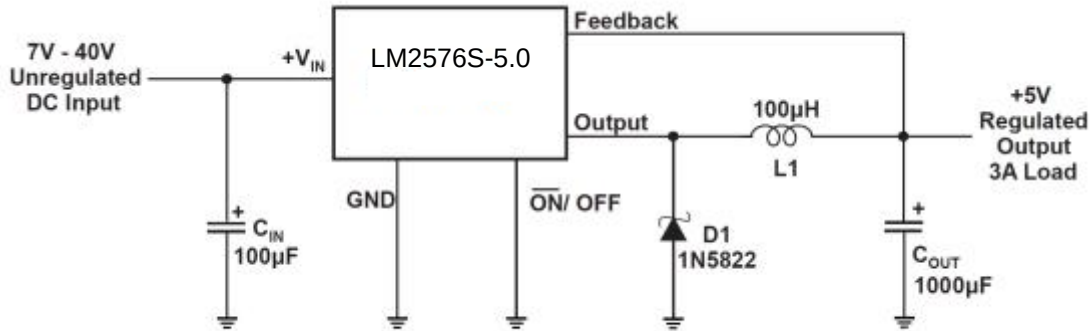


$$V_{out} = V_{ref} \left(1.0 + \frac{R2}{R1} \right)$$

$$R2 = R1 \left(\frac{V_{out}}{V_{ref}} - 1.0 \right)$$

Where $V_{ref} = 1.23$ V, R1
between 1.0 k and 5.0 k

Typical Application



Application Information

Input Capacitor (C_{IN})

To maintain stability, the regulator input pin must be bypassed with at least a 100 µF electrolytic capacitor. The capacitor's leads must be kept short, and located near the regulator. If the operating temperature range includes temperatures below -25°C, the input capacitor value may need to be larger. With most electrolytic capacitors, the capacitance value decreases and the ESR increases with lower temperatures and age. Paralleling a ceramic or solid tantalum capacitor will increase the regulator stability at cold temperatures. For maximum capacitor operating lifetime, the capacitor's RMS ripple current rating should be greater than

$$1.2 \times \left(\frac{t_{ON}}{T} \right) \times I_{LOAD}$$

Where $\frac{t_{ON}}{T} = \frac{V_{OUT}}{V_{IN}}$ for a buck regulator

and $\frac{t_{ON}}{T} = \frac{|V_{OUT}|}{|V_{OUT}| + V_{IN}}$ for a buck-boost regulator.

Inductor Code	Inductor Value	Schott	Pulse Eng.	Renco
L47	47 μ H	671 26980	PE-53112	RL2442
L68	68 μ H	671 26990	PE-92114	RL2443
L100	100 μ H	671 27000	PE-92108	RL2444
L150	150 μ H	671 27010	PE-53113	RL1954
L220	220 μ H	671 27020	PE-52626	RL1953
L330	330 μ H	671 27030	PE-52627	RL1952
L470	470 μ H	671 27040	PE-53114	RL1951
L680	680 μ H	671 27050	PE-52629	RL1950
H150	150 μ H	671 27060	PE-53115	RL2445
H220	220 μ H	671 27070	PE-53116	RL2446
H330	330 μ H	671 27080	PE-53117	RL2447
H470	470 μ H	671 27090	PE-53118	RL1961
H680	680 μ H	671 27100	PE-53119	RL1960
H1000	1000 μ H	671 27110	PE-53120	RL1959
H1500	1500 μ H	671 27120	PE-53121	RL1958
H2200	2200 μ H	671 27130	PE-53122	RL2448

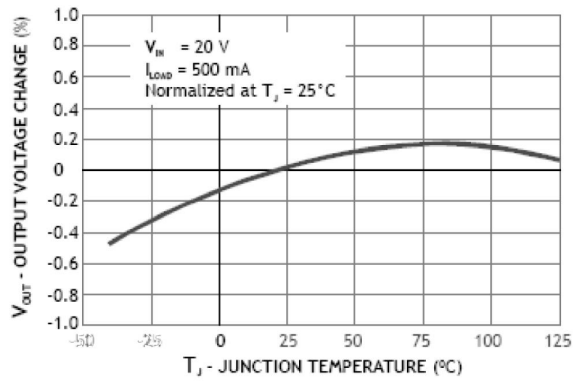
Inductor Selection Guide

V_R	Schottky		Fast Recovery	
	3A	4A-6A	3A	4A-6A
20V	1N5820 MBR320P SR302	1N5823	The following diodes are all rated to 100V 31DF1 HER302	The following diodes are all rated to 100V 50WF10 MUR410 HER602
30V	1N5821 MBR330 31DQ03 SR303	50WQ03 1N5824		
40V	1N5822 MBR340 31DQ04 SR304	MBR340 50WQ04 1N5825		
50V	MBR350 31DQ05 SR305	50WQ05		
60V	MBR360 DQ06 SR306	50WR06 50SQ060		

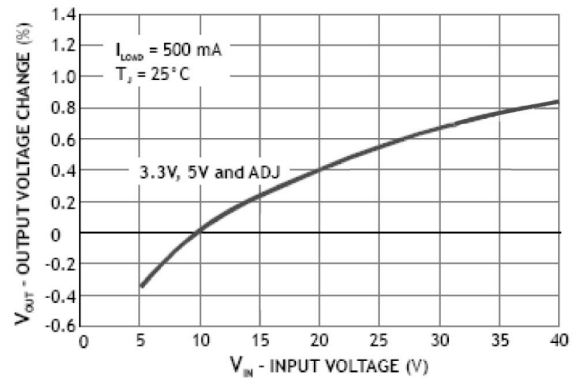
Diode Selection Guide

Characteristic Curves

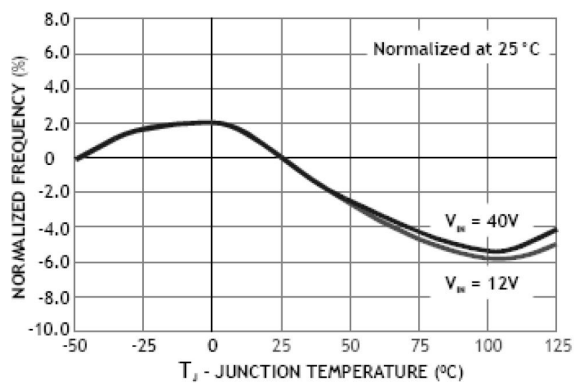
NORMALIZED OUTPUT VOLTAGE



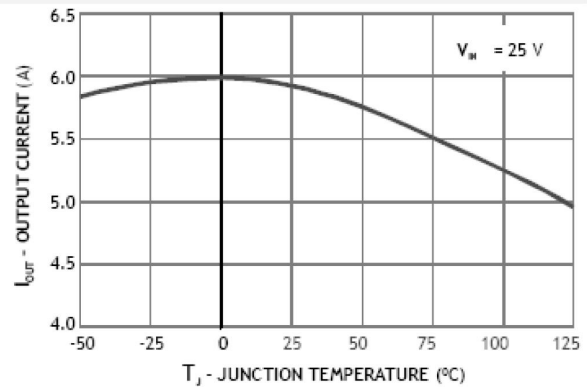
LINE REGULATION



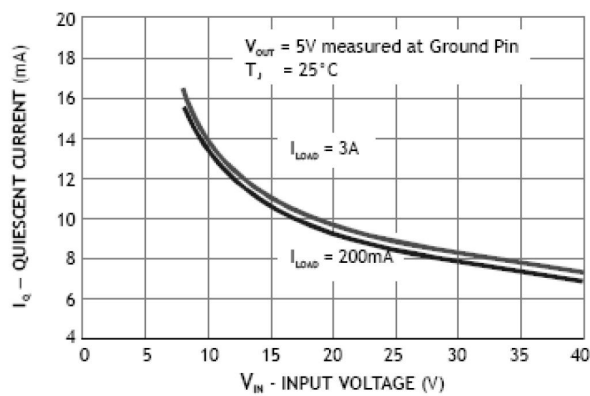
OSCILLATOR FREQUENCY



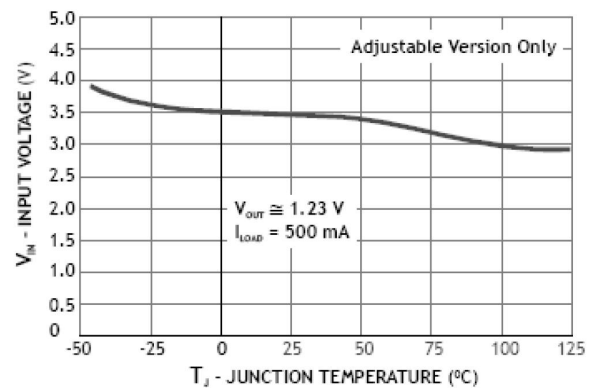
CURRENT LIMIT



QUIESCENT CURRENT

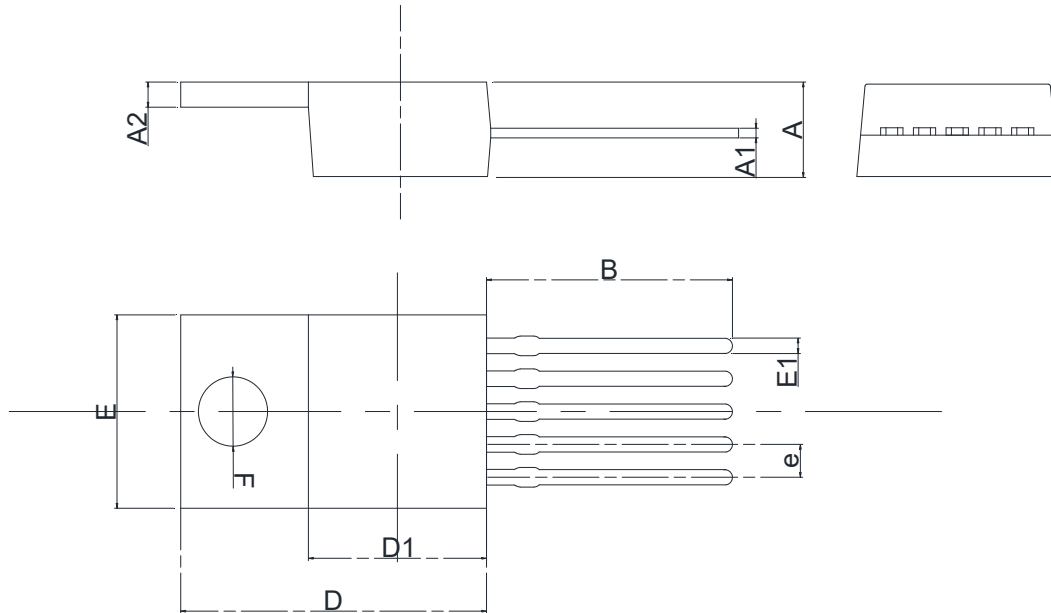


MINIMUM OPERATING VOLTAGE



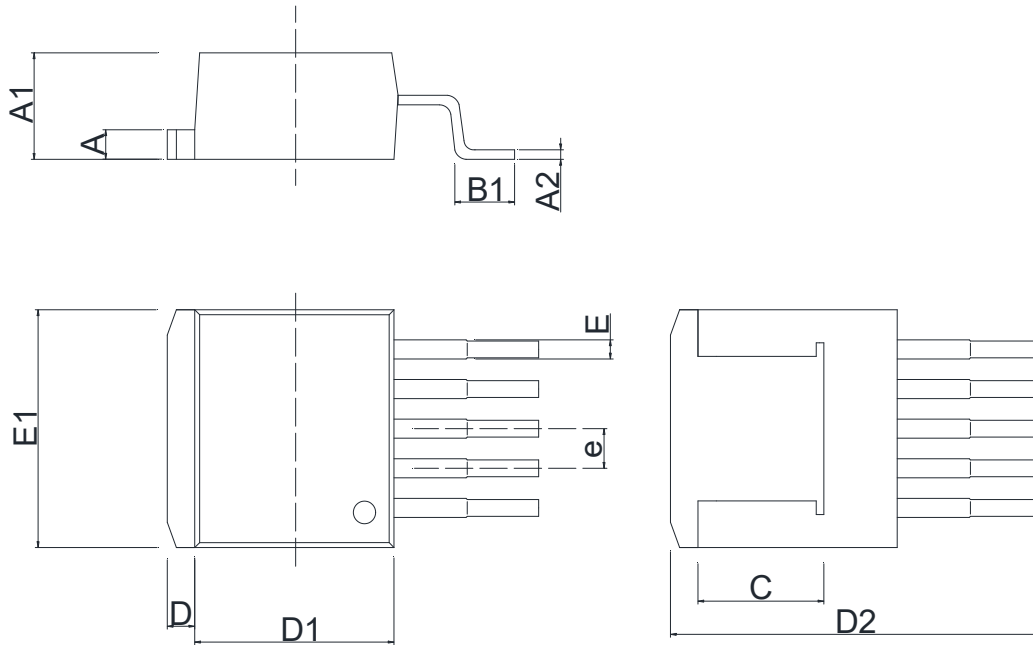
Outline Dimensions

TO220-5 :



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.300	4.700	0.169	0.185
A1	0.450	0.600	0.017	0.023
A2	1.250	1.400	0.049	0.055
B	12.880	13.380	0.507	0.527
D	15.500	15.900	0.610	0.626
D1	9.000	9.400	0.354	0.370
E	9.700	10.100	0.381	0.398
E1	0.660	0.914	0.025	0.036
e	1.702 (BSC)		0.670 (BSC)	
F	Φ 3.500	Φ 3.700	Φ 0.137	Φ 0.146

TO263-5:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.150	1.400	0.045	0.055
A1	4.350	4.750	0.171	0.187
A2	0.310	0.530	0.012	0.021
B1	1.300	2.740	0.051	0.108
C	5.080 REF		0.200 REF	
D	0.900	1.700	0.035	0.067
D1	8.100	8.900	0.318	0.350
D2	13.900	15.550	0.547	0.612
E	0.660	0.970	0.025	0.038
E1	9.800	10.400	0.385	0.409
e	1.700 (BSC)		0.067 (BSC)	