TEL: 805-498-2111 FAX: 805-498-3804

FEATURES

- Pin for pin interchangeable with National's LM2575/LM2576 Series
- DC-to-DC buck or buck/boost converter requiring only 4 support components
- Fixed or adjustable voltages
- Preset output voltages of 3.3, 5 and 12 V
- Wide output voltage range, 1.23V to 35V 82% typical efficiency @ 5V
- Wide input voltage range, 4V to 40V
- Inhibit/enable control pin

DESCRIPTION

The LM2575/76 Series switching regulators are monolithic integrated circuits designed for use in "buck" or "buck/boost" regulator applications requiring accurate output voltages over combined variations of line, load and temperature. This unique Series greatly simplifies switching power supply design. The LM2575 has a maximum output current of 1A; the LM2576 is rated for 3A.

The LM2575/76 Series miniconverters include a switching regulator and compensation network all within the same package. Just add a choke, catch diode and two capacitors to obtain an efficient DC-to-DC converter. Current limit and thermal shutdown features of the LM2575/76 Series fully protect the device against overstress conditions.

The LM2575/76 Series offer replacement for popular 3 terminal linear regulators by providing higher efficiency with reduced heatsink size. In many applications a heat sink will not be required.

ABSOLUTE MAXIMUM RATINGS

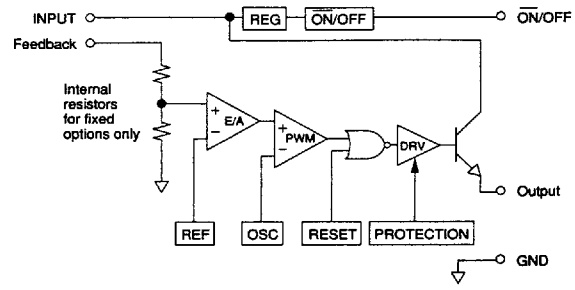
Parameter	Symbol	Maximum	Units
Input Voltage	V_{IN}	45	V
On/Off Pin Input Voltage		$-0.3 \le V \le V_{IN}$	
Output Voltage to Common (Steady State)		-1	
Power Dissipation	P_D	Internally Limited	W
Thermal Resistance Junction to Case TO-220, TO-263	θ_{JC}	2.0	°C/W
Thermal Resistance Junction to Ambient TO-263 TO-220	θ_{JA}	60 55	
Operating Junction Temperature Range TO-220, TO-263	T_J	-40 to 125	°C
Storage Temperature Range TO-220, TO-263	T_{STG}	-40 to 125	
Lead Temperature (Soldering) 10 Sec. (Plastic)	T_{LEAD}	260	
ESD Class		2	

DEVICE SELECTION GUIDE

DEVICE(1)	CURRENT	TEMP. RANGE	PACKAGE
LM2575T-XX	1A	-40 to 125°C	TO-220(2)
LM2575S-XX			TO-263
LM2576T-XX	3A		TO-220(2)
LM2576S-XX			TO-263

(1) XX = Voltage Option 3.3, 5.0, 12, ADJ (1.23V to 35V).
(2) T-XX = Straight in-line; T-XX-V = Vertical Staggered; T-XX-H = Horizontal Staggered.

BLOCK DIAGRAM



PDF Support

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ELECTRICAL CHARACTERISTICS

Unless otherwise specified, V_{IN} = 12V for 3.3V, 5V and ADJ options; 25V for 12V; V_{OUT} = 5V for ADJ, T_J = 25°C. V_{IN} rated = 40V. I_O = 0.5A to 3A (LM2576), 0.2A to 1A (LM2575).

		Test Conditions			Test Limits			
PARAMETER	**SYMBOL**	V_{IN}	I_O	T_J	**MIN**	**TYP**	**MAX**	**UNITS**
Output Voltage								
LM2576-3.3			0.5A		3.23		3.37	
		8V to		Over Temp.	3.14	3.3	3.47	
		VIN RATED			3.20		3.40	
LM2576-5	V_O		0.5A		4.90		5.10	
		8V to		Over Temp.	4.76	5.0	5.25	
		VIN RATED			4.85		5.15	V
LM2576-12			0.5A		11.76		12.24	
		15V to		Over Temp.	11.40	12.0	12.60	
		VIN RATED			11.52		12.48	
Feedback Voltage			0.5A		1.217		1.243	
VOUT = 5V	I_{FB}	8V to		Over Temp.	1.180	1.23	1.280	
LM2576-ADJ		VIN RATED			1.193		1.267	
Feedback Bias Current								
LM2576-ADJ	I_B	12V	0.5A			50	100	nA
				Over Temp.			500	
Output Voltage								
LM2575-3.3			0.2A		3.23		3.37	
		8V to		Over Temp.	3.14	3.3	3.47	
		VIN RATED			3.20		3.40	
LM2575-5	V_O		0.2A		4.90		5.10	
		8V to		Over Temp.	4.75	5.0	5.25	
		VIN RATED			4.85		5.15	V
LM2575-12			0.2A		11.76		12.24	
		15V to		Over Temp.	11.40	12.0	12.60	
		VIN RATED			11.52		12.48	
Feedback Voltage			0.2A		1.217		1.243	
VOUT = 5V	I_{FB}	8V to		Over Temp.	1.180	1.23	1.280	
LM2575-ADJ		VIN RATED			1.193		1.267	
Feedback Bias Current								
LM2575-ADJ	I_B	12V	0.2A					nA
				Over Temp.			500	

(CONTINUED NEXT PAGE)

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ELECTRICAL CHARACTERISTICS (continued)

		Test Conditions			Test Limits			
PARAMETER	**SYMBOL**	**V_{IN}**	**I_O**	**T_J**	**MIN**	**TYP**	**MAX**	**UNITS**
Efficiency/Option								
3.3	η	12V	3A			77		%
5						82		
12		15V				88		
ADJ Vo = 5V		12V				82		
Switching Frequency	F_{SX}				47	52	58	kHz
				Over Temp.	43		62	
Saturation Voltage (1)	V_{SAT}		LM2575 - 1A	Over Temp.		0.9	1.2	V
			LM2576 - 3A				1.4	
Max Duty Cycle (On) (3)	DC				93	98		%
Current Limit (1) Peak Current	I_{CL}							A
LM2576					4.2	5.8	6.9	
				Over Temp.	3.5		7.5	
Current Limit (1)					1.7	2.2	3.0	
LM2575				Over Temp.	1.3		3.2	
Output Leakage Current (2)	I_L							mA
Output = 0V		VIN RATED					2	
Output = -1V						7.5	30	
Quiescent Current (2)	I_Q					5	10	
				Over Temp.			12	
Standby Quiescent Current (On/Off Pin = 5V)	I_{STBY}					50		µA
				Over Temp.			500	
On/Off Pin Logic Input Level	V_{IH}							V
VOUT = 0V					2.2			
				Over Temp.	2.4	1.4		
VOUT = Option	V_{IL}						1.0	
				Over Temp.		1.2	0.8	
On/Off Input Current								µA
On/Off = 5V (Off)	I_{IH}		0.5A			12	30	
On/Off = 0V (On)	I_{IL}					0	10	

NOTES:
Over temperature: -40°C to 125°C
(1) Output sourcing current-resistive load, no inductor or capacitor.
(2) Feedback = Vo +1.0V.
(3) Feedback = 0V.

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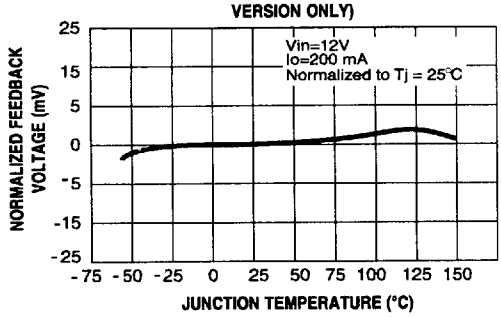
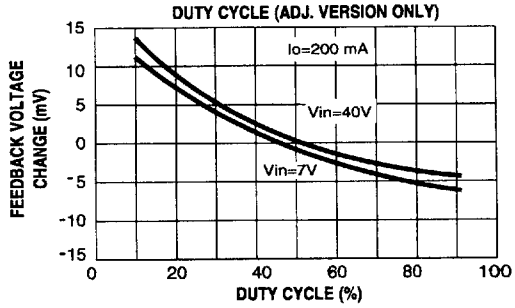
LM2575 - OPERATIONAL DATA

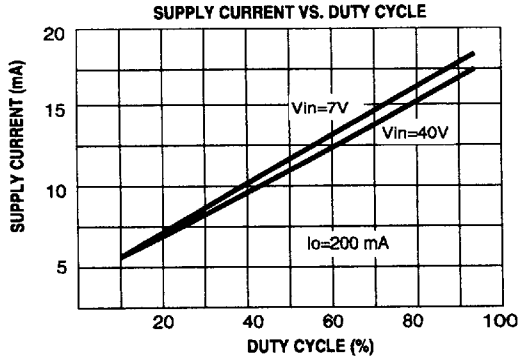
NORMALIZED FEEDBACK VOLTAGE (ADJ. VERSION ONLY)



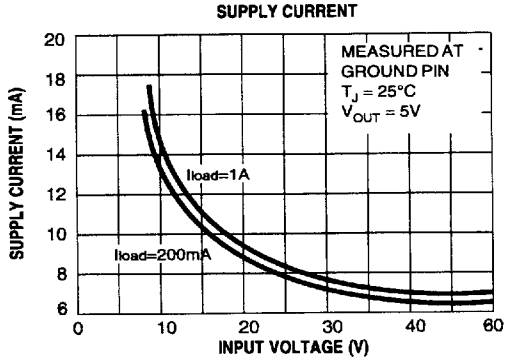
FEEDBACK VOLTAGE VS. DUTY CYCLE (ADJ. VERSION ONLY)



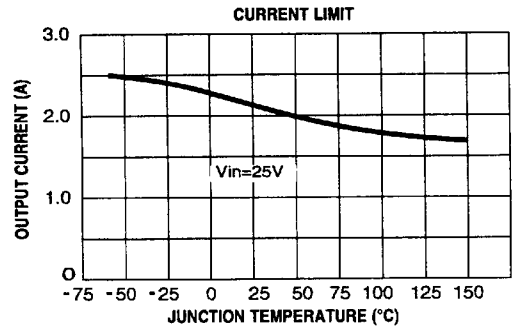
SUPPLY CURRENT VS. DUTY CYCLE



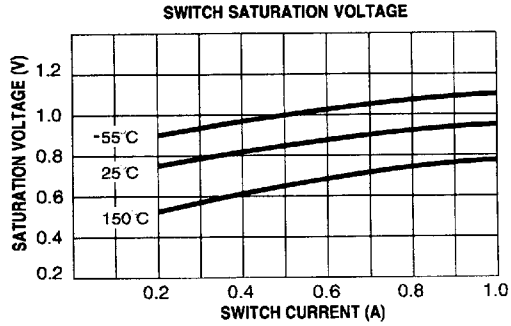
SUPPLY CURRENT



CURRENT LIMIT



SWITCH SATURATION VOLTAGE



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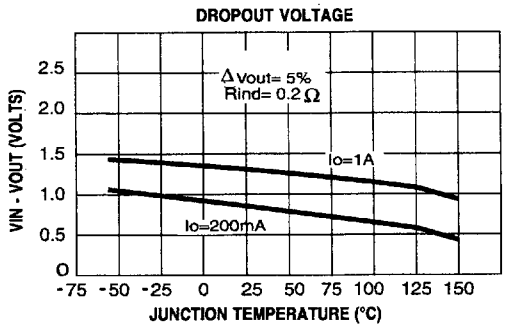

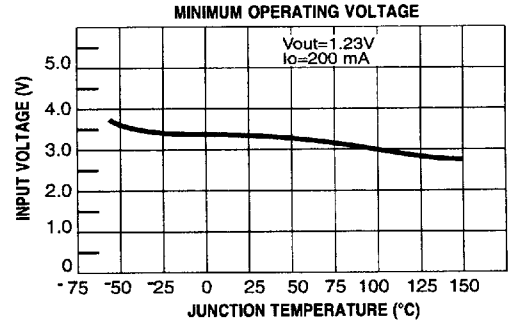

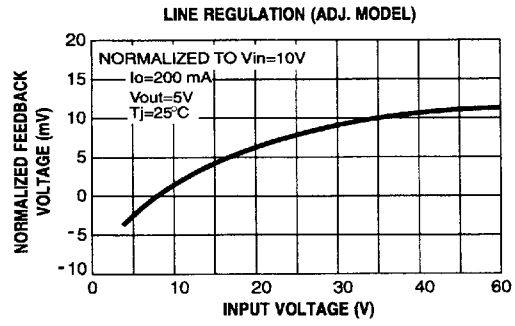

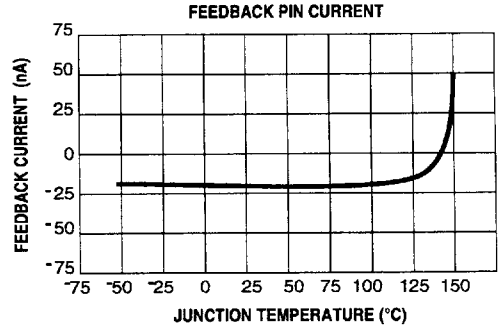

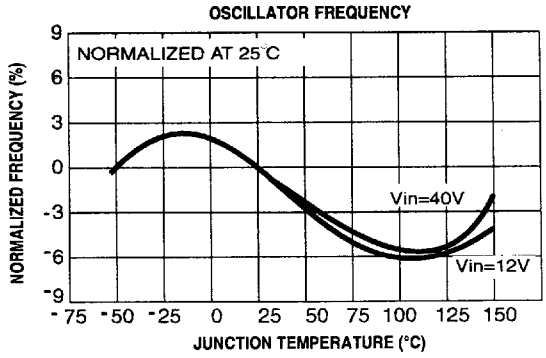

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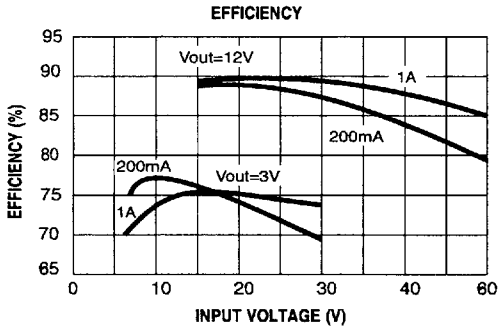

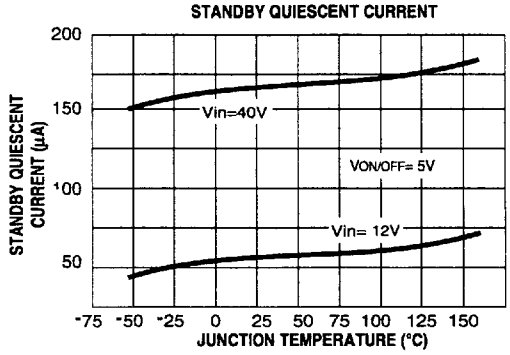

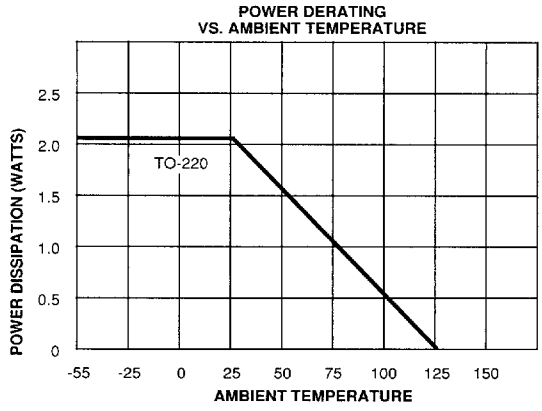

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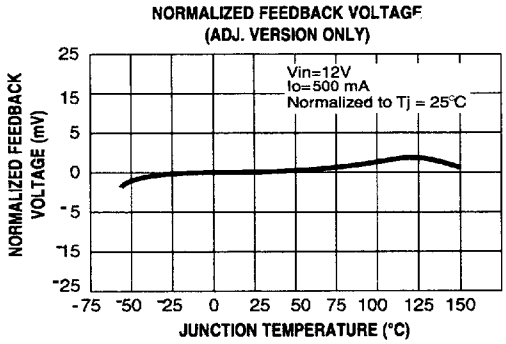
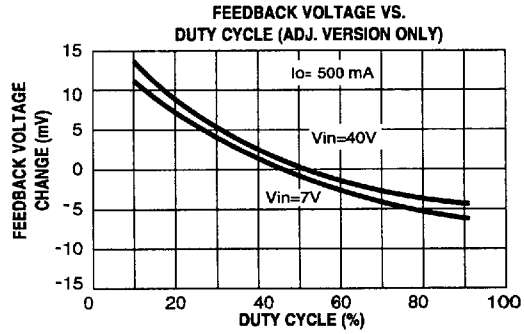
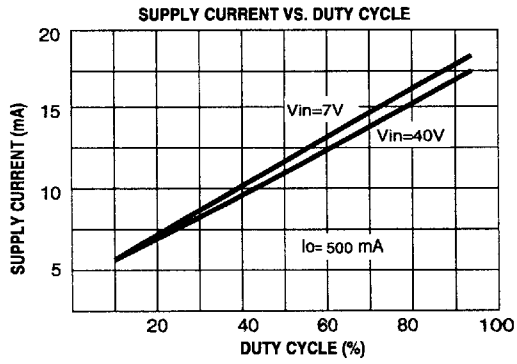
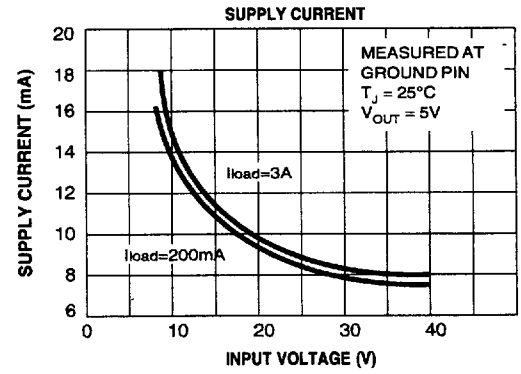
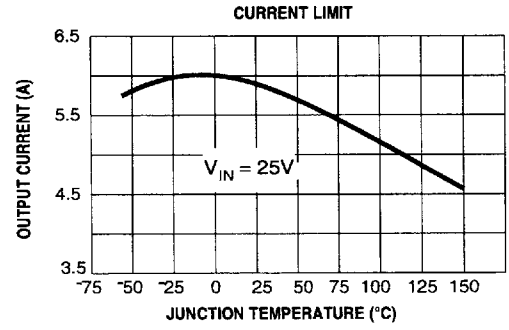
LM2576 - OPERATIONAL DATA

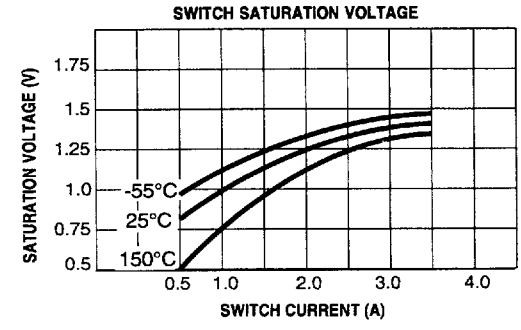












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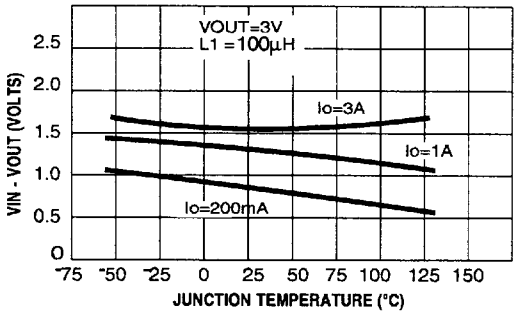
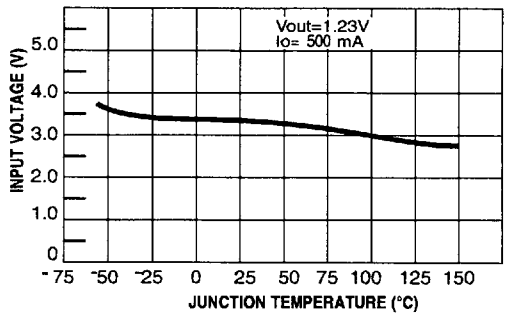
LM2576 - OPERATIONAL DATA

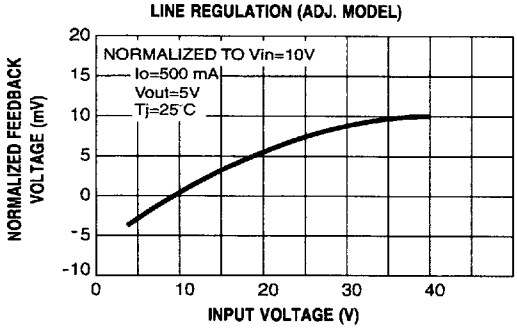
DROPOUT VOLTAGE



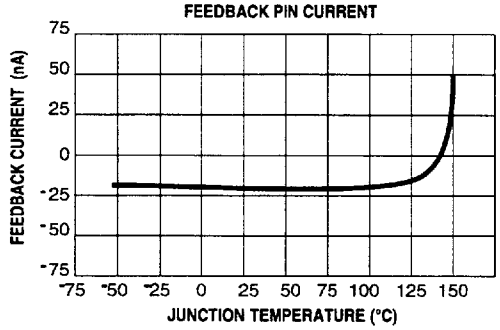
MINIMUM OPERATING VOLTAGE



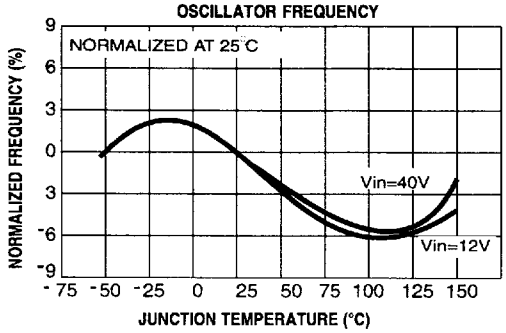
LINE REGULATION (ADJ. MODEL)



FEEDBACK PIN CURRENT



OSCILLATOR FREQUENCY



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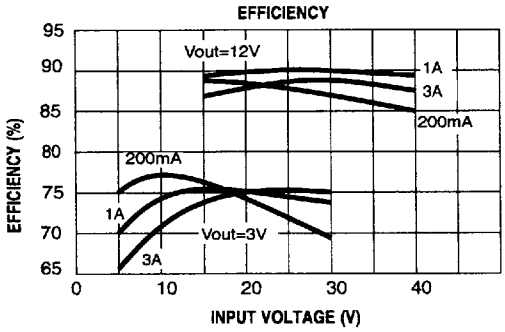
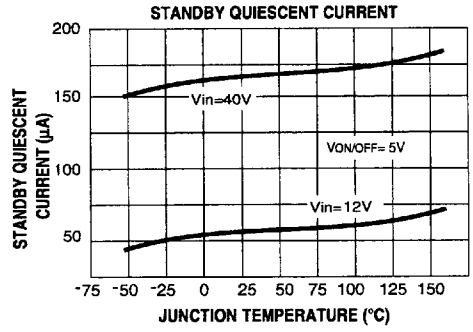
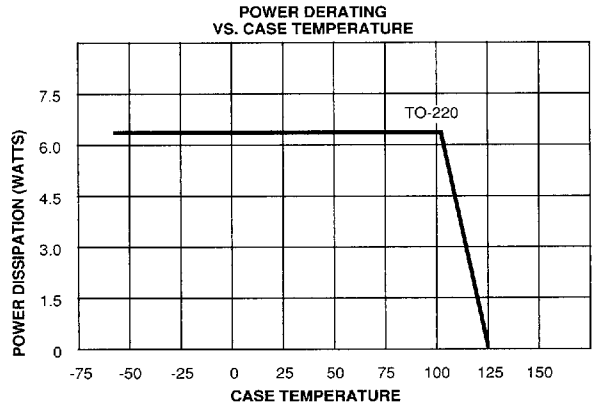
LM2576 - OPERATIONAL DATA







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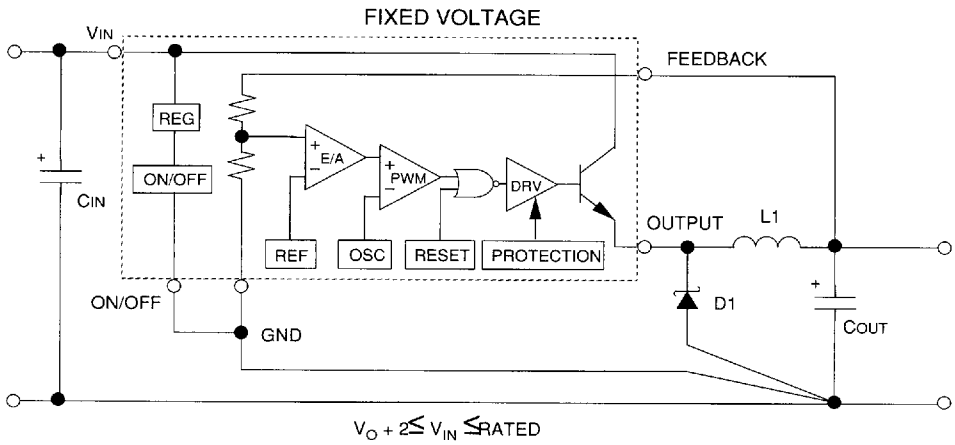
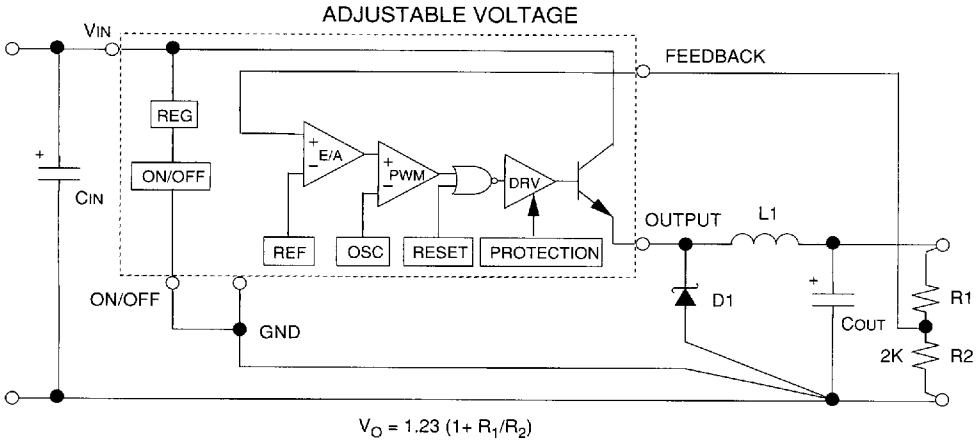
TYPICAL APPLICATION - BUCK MODE



	LM2575	LM2576
L1	330µH	100µH
D1	3A	7A
CIN	68µF	120µF
COUT	330µF	1,000µF



	LM2575	LM2576
L1	330µH	100µH
D1	3A	7A
CIN	68µF	120µF
COUT	330µF	1,000µF

The above component selections will be adequate for most applications for output currents from 250mA to 3.0A (LM2576) or 150mA to 1.0A (LM2575). Applications of VOUTS below 5V or above 24V may require component adjustment for maximum performance; please contact factory for application assistance.

1. DEVICE SELECTION. Select an appropriate device from the "Selection Guide" based upon voltage option, temperature range and package.

2. THERMAL CONDITIONS. Most applications will not require a heatsink for the TO-220 package. Approximate power dissipation is:

$$P = \frac{VoloVSAT}{VIN} + \frac{VO}{VIN}\ (20mA)$$

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3. CATCH DIODE. If the output must be capable of a sustained short, the IF rating must be above 3A for the LM2575 and 7A for the LM2576. The use of an ultra fast diode with soft recovery characteristics or a Schottky will be adequate. The major impact on Schottky versus an ultra fast is efficiency. Schottkys will provide approximately 4% to 5% improvement for VOUTS below 12V, whereas above 12V the difference will become less significant. Breakdown rating must be in excess of VIN for margin.

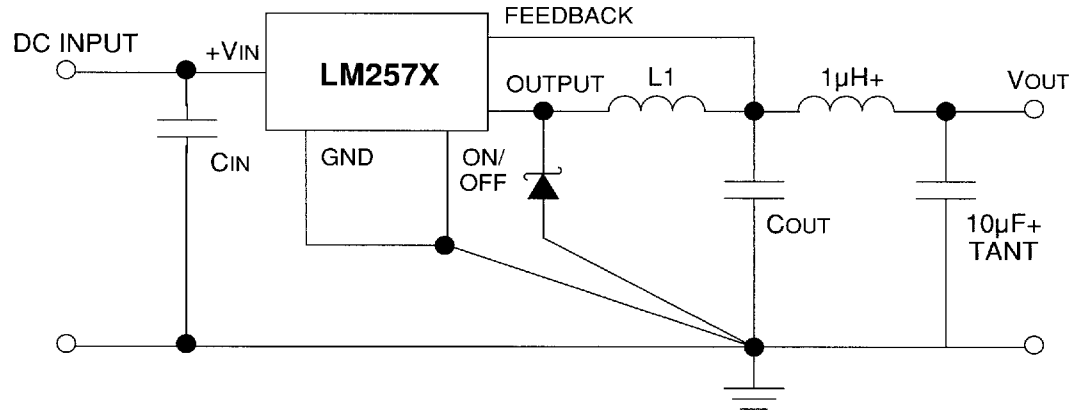
4. INPUT CAPACITOR. The value shown will be adequate for most applications. Ripple voltage at the switching frequency is caused by the input capacitor supplying load current during the on time of the power switch. The use of a low ESR switching type capacitor will minimize ripple to an acceptable level.

5. LAYOUT. Use short connections with a central point ground to prevent improper operation caused by stray inductance and ground loops.

6. OUTPUT CAPACITOR. Ripple voltage on VOUT is directly related to the value of COUT and the internal resistance ESR of COUT. Output noise can be lowered by increasing COUT or by selecting a capacitor with a lower ESR. ESR must be approximately 0.03 Ω for the LM2576 or 0.07Ω for the LM2575, or above to maintain stability, otherwise raise value of COUT.

7. SWITCHING SPIKES. Switching spikes will also occur due to distributive capacitance across turns of the inductor when combined with output capacitor series inductance (ESL). Reduction to a level at or below the switching ripple can be achieved by using a post filter as shown.

SWITCHING SPIKE REDUCTION



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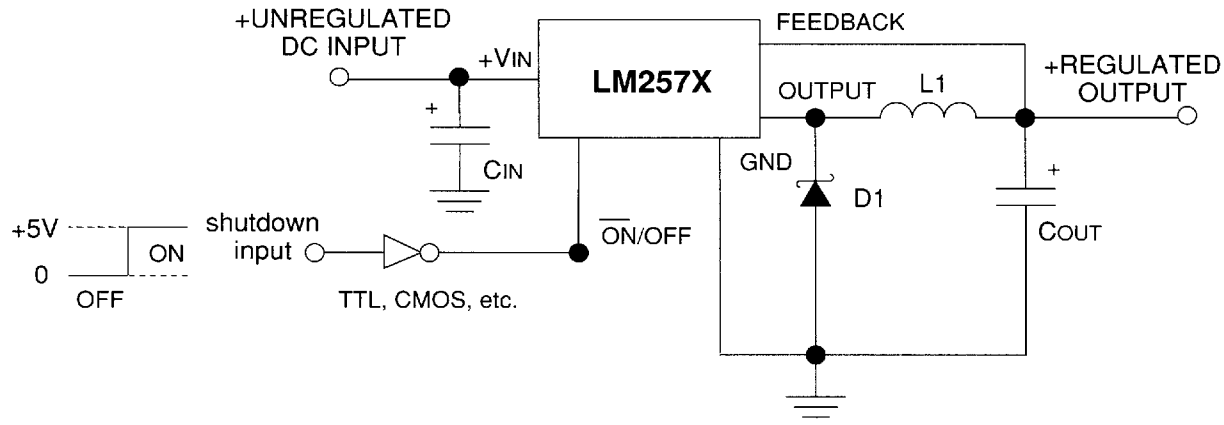
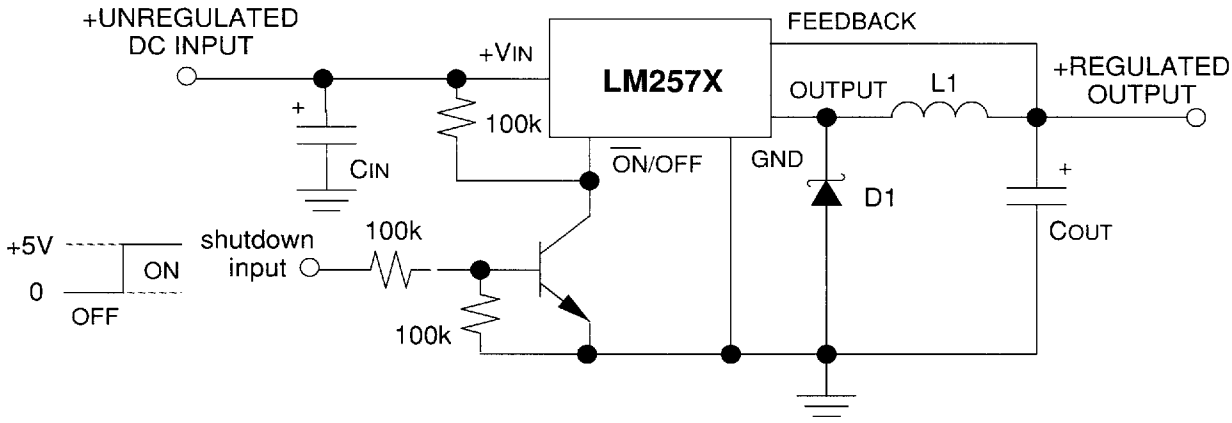
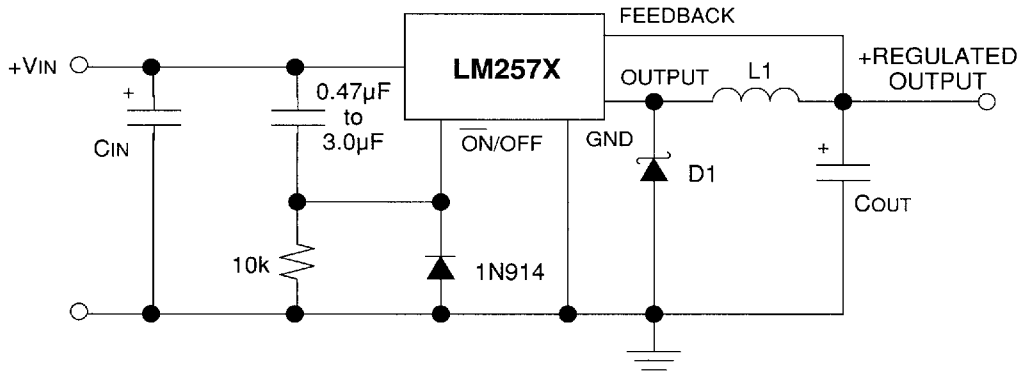
TYPICAL BUCK SHUTDOWN





TURN-ON DELAY



Circuit allows for CIN to be fully charged before start-up, provides CIN to supply hi-peak current instead of input supply.

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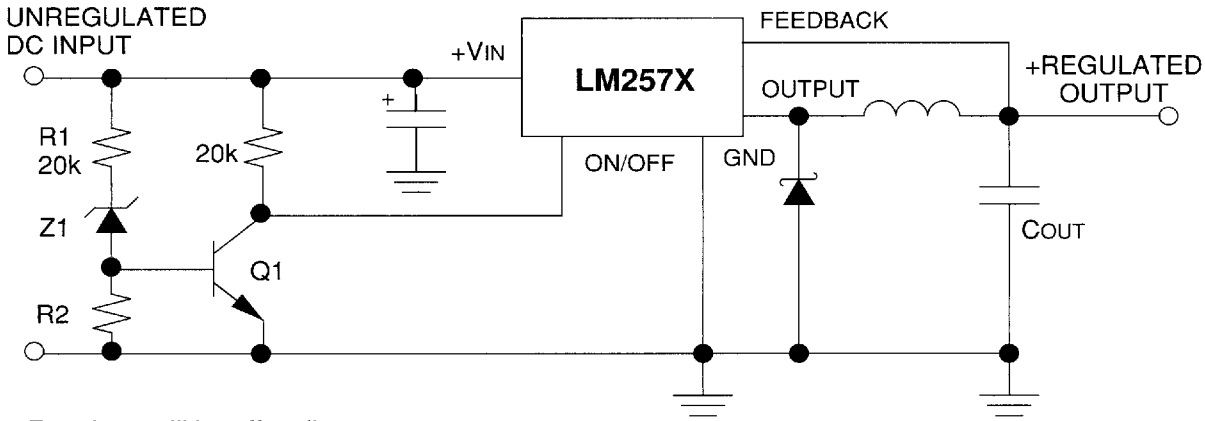
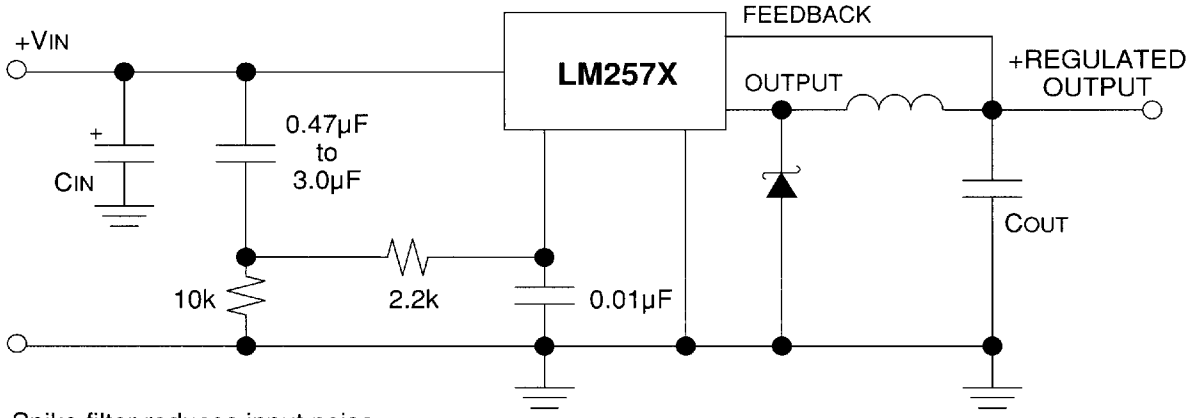
UNDER VOLTAGE LOCKOUT



Regulator will be off until a V_{IN} set point is reached.

$V_{O\,(ON)} \cong V_Z + 3V_{BE\,Q1}$

TURN-ON DELAY WITH SPIKE FILTER



Spike filter reduces input noise, causing false triggering of delay.

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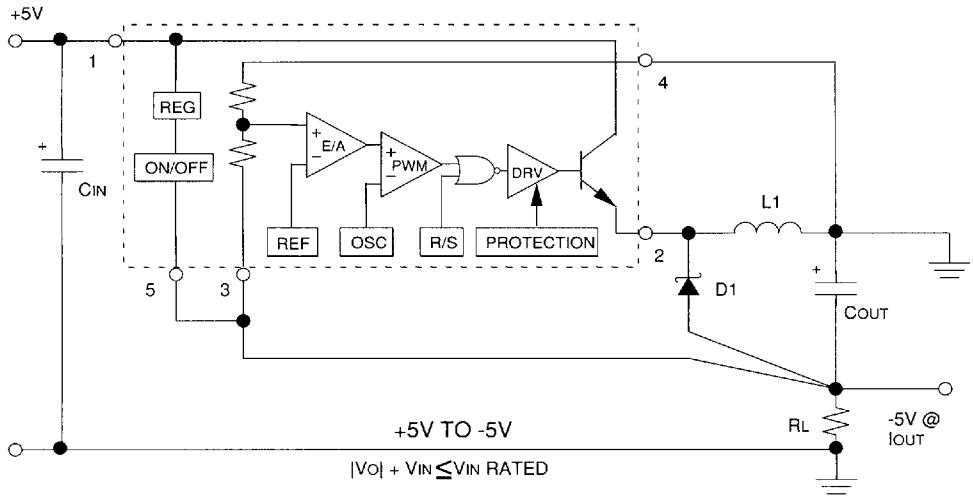
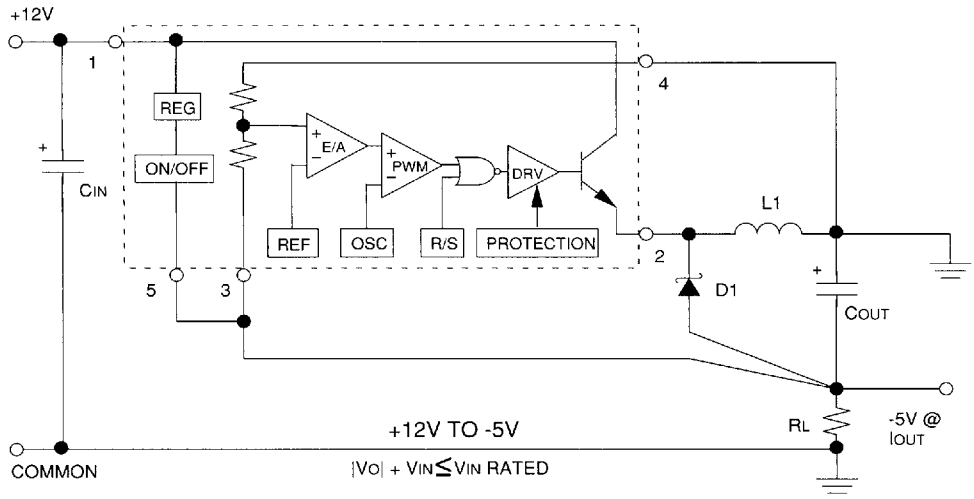
TYPICAL APPLICATION - INVERTING BUCK/BOOST



	LM2575	LM2576
CIN	47µF	100µF
D1	3A	7A
L1	100µH	68µH
COUT	2,700µF	6,800µF
IOUT	250mA	500mA



	LM2575	LM2576
CIN	47µF	100µF
D1	3A	7A
L1	100µH	68µH
COUT	470µF	2,700µF
IOUT	100mA	750mA

Inverting buck/boost operation is a different topology of operation than buck. This difference reduces the output current capability of the device, in that the inductor must supply all of the load current during the time the power switch is off. Maximum output current is approximately:

$I_{OUT} \approx 3.5 / (2\,(1 + |V_O| / V_{IN}))$ **LM2576**

$I_{OUT} \approx 1.3 / (2\,(1 + |V_O| / V_{IN}))$ **LM2575**

Component requirement stress is very similar to the buck with a few exceptions:

- catch diode breakdown V_{BR} must be greater than $V_{IN} + |V_{OUT}|$
- input capacitor is larger due to the increased peak current during switch turn on. Power dissipation is approximately:

$$P_D \approx [|V_O| / (|V_O| + V_{IN})]\, I_O X$$

$$(1 + |V_O| / V_{IN})\, V_{SAT} + 0.02\, |V_O| / V_{IN}$$

Please contact factory for additional assistance when using the buck/boost topology.

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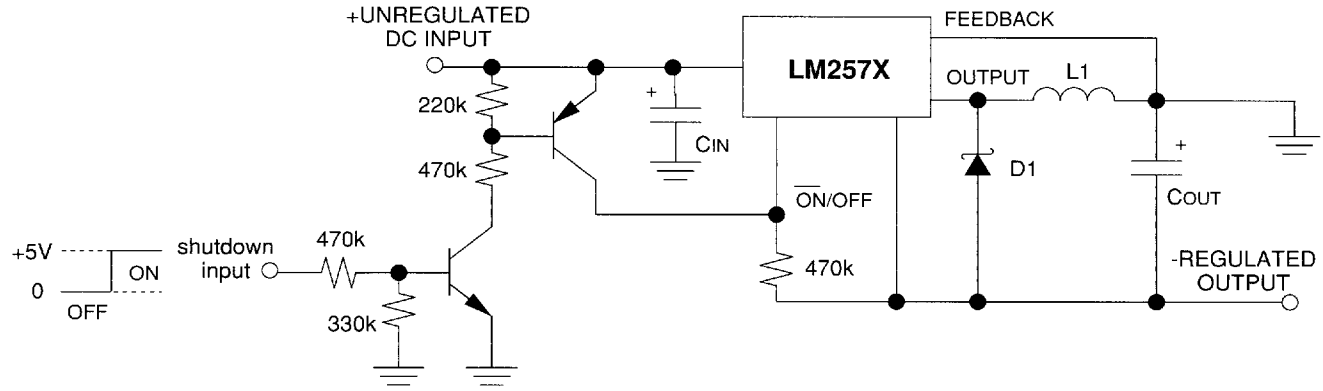
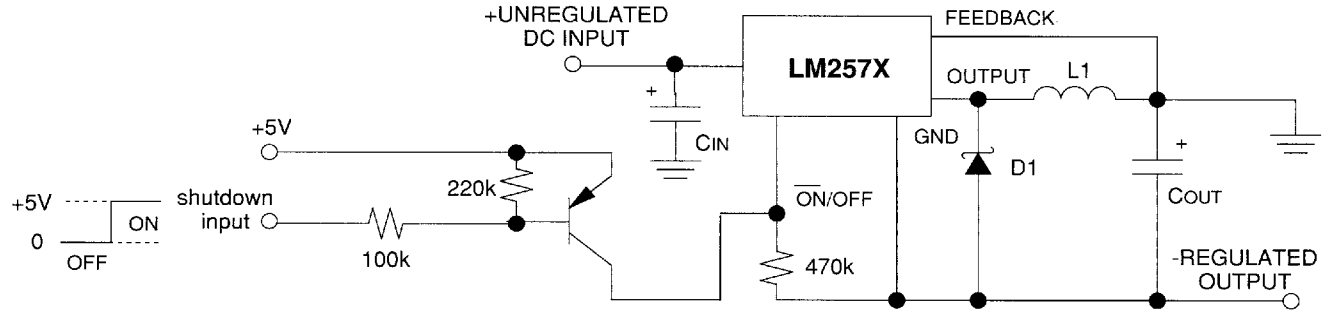
INVERTING BUCK/BOOST SHUTDOWN





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SUPPORT COMPONENTS INFORMATION

PRE-WOUND INDUCTORS:
Hurricane Electronics Lab
P.O. Box 1280, Hurricane Industrial Park
Hurricane, UT 84737 (801) 635-2003

CORE SOURCE:
Micro Metals, Inc.
1190 N. Hawk Circle
Anaheim, CA 92807 (714) 630-7420

CAPACITORS:
VPR Series
Mallory Capacitor Co.
4760 Kentucky Avenue
Indianapolis, IN 46241 (317) 856-3731

511D & 673 Series
Sprague Electric Co.
North Adams, MA (413) 664-4411

HFQ, HFZ Series
Panasonic Industrial Co.
2 Panasonic Way
Secaucus, NJ 07094 (201) 392-6142

PF, PL Series
Nichicon Corp.
927 E. State Pkwy.
Schaumburg, IL 60195 (708) 843-7600

LXF Series
United Chemi-con
9801 West Higgins Road
Rosemont, IL 60018 (708) 696-2000

HEAT SINKS:
AAVID Engineering Co.
P.O. Box 400, One Kool Path
Laconia, NH 03247 (603) 528-3400

Thermalloy, Inc.
2021 W. Valley View Lane
Dallas, TX 76381 (214) 243-4321

DIODES - CATCH
Ultra Fast/Soft Recovery
Semtech Corporation
652 Mitchell Road
Newbury Park, CA 91320 (805) 498-2111

SCHOTTKY
Fuji/Collmer Semiconductor
14368 Proton Road
Dallas, TX 76244 (800) 527-0521

Micro Quality
1000 N. Shiloh
Garland, TX 76046 (214) 272-7811

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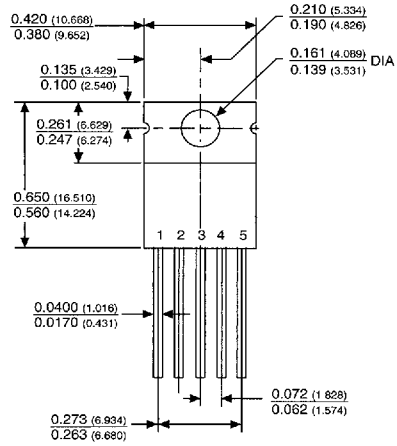
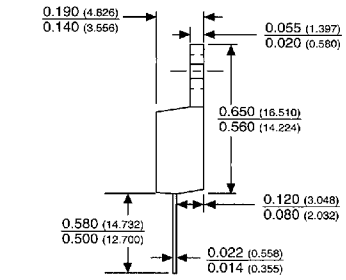
TO-220 DEVICE OUTLINES

(T-XX Option)

(Front View)



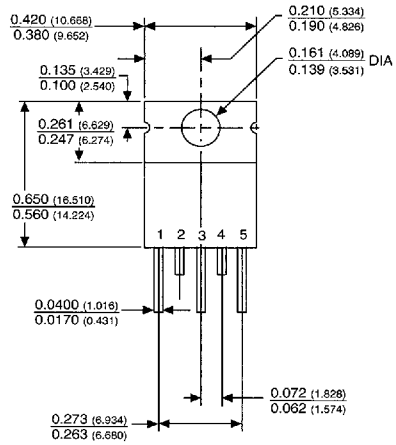
(Side View)



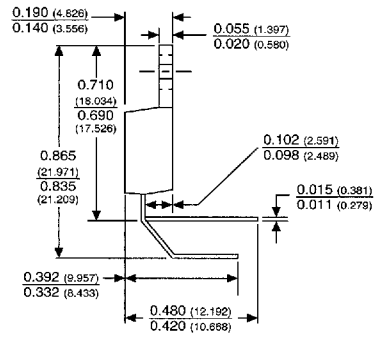
UNIT: Inch (mm)

(T-XXH Option)

(Front View)



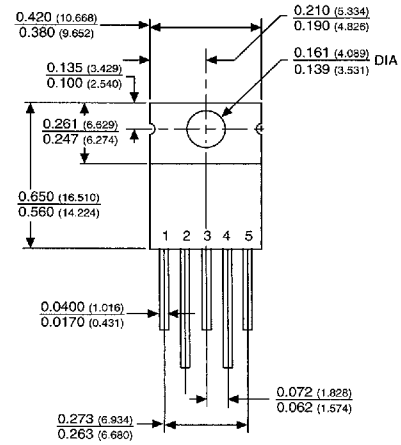
(Side View)



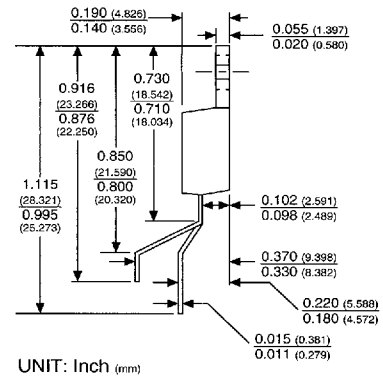
UNIT: Inch (mm)

(T-XXV Option)

(Front View)



(Side View)



UNIT: Inch (mm)

LM2575T, LM2576T	
PIN	**FUNCTION**
1	V_{IN}
2	OUTPUT
3	COMMON
4	FEEDBACK
5	ON/OFF
TAB IS COMMON	

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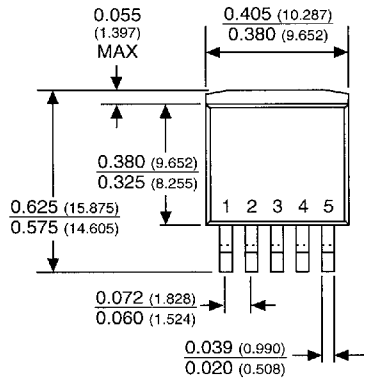
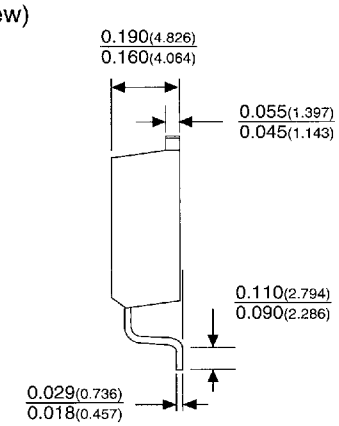
TO-263 DEVICE OUTLINE

(Front View)



(Side View)



UNIT: Inch (mm)

LM2575S, LM2576S	
PIN	**FUNCTION**
1	V_{IN}
2	OUTPUT
3	COMMON
4	FEEDBACK
5	ON/OFF
CASE IS COMMON	

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