1A & 3A Miniconverter Switching Regulators

Description

The LM2575/6 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 and the LM2576 is rated for 3A.

The LM2575/6 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. The current limit and thermal shutdown features of the LM2575/6 series fully protect the device against overstress conditions.

The LM2575/6 series offers an alternative to popular 3 terminal linear regulators by providing higher efficiency with reduced heatsink size. In many applications a heat sink will not be required.

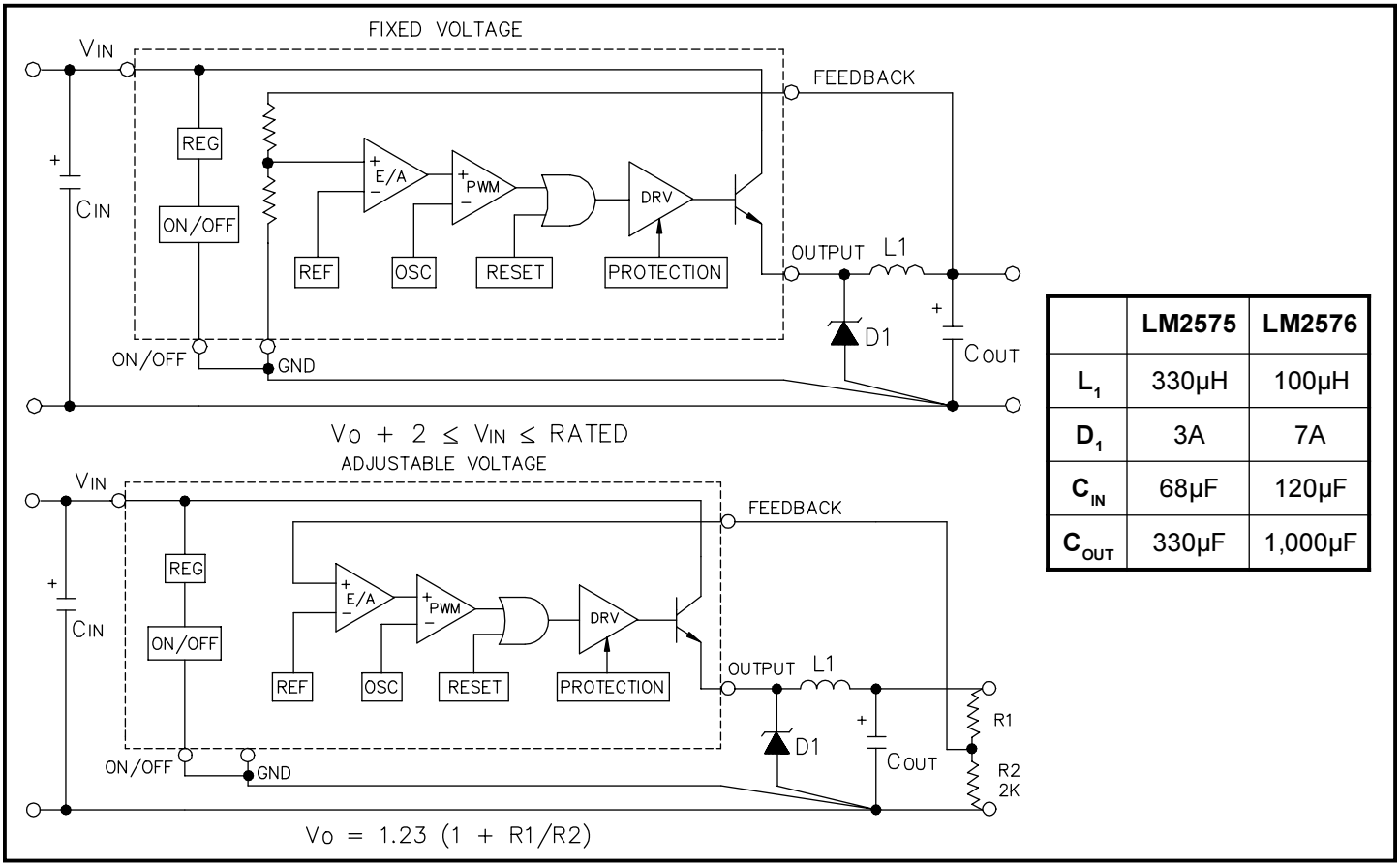
Features

- Pin for pin replacement for National’s LM2575/6 series
- DC-to-DC buck or buck/boost converter requiring only 4 support components
- Fixed or adjustable voltages
- Preset output voltages of 3.3V, 5V and 12V
- Wide output voltage range, 1.23V to 35V
- 82% typical efficiency @ 5V out
- Wide input voltage range, 4V to 40V
- Inhibit/enable control pin
- Industrial temperature range
- TO-220 and TO-263 packages

Applications

- Micro controller power supplies
- Medical equipment
- Industrial power supplies
- Instrumentation power supplies

Typical Application Circuits



	LM2575	LM2576
L_1	330µH	100µH
D_1	3A	7A
C_{IN}	68µF	120µF
C_{OUT}	330µF	1,000µF

Absolute Maximum Ratings

Parameter	Symbol	Maximum	Units
Input Voltage	V_{IN}	45	V
On/Off Pin Input Voltage	$V_{ON/OFF}$	$-0.3 \le V_{ON/OFF} \le V_{IN}$	V
Output Voltage to Common (Steady State)		-1	V
Power Dissipation	P_D	Internally Limited	W
Thermal Resistance Junction to Ambient TO-220 TO-263	θ_{JA}	 55 60	°C/W
Thermal Resistance Junction to Case TO-220 TO-263	θ_{JC}	 2.0 2.0	°C/W
Operating Junction Temperature Range	T_J	-40 to +125	°C
Storage Temperature Range	T_{STG}	-65 to +150	°C
Lead Temperature (Soldering) 10 Sec.	T_{LEAD}	300	°C
ESD Rating (Human Body Model)	V_{ESD}	2	kV

Electrical Characteristics

Unless otherwise specified: V_{IN} = 12V for 3.3V, 5V and ADJ options and 25V for 12V option; V_{OUT} = 5V for ADJ option; T_A = 25ºC; V_{IN} rated = 40V; I_O = 0.5 to 3A (LM2576), 0.2 to 1A (LM2575). Values in **bold** apply over full operating temperature range.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Output Voltage	V_O	I_O = 0.5A	3.23	3.30	3.37	V
LM2576-3.3		8V to V_{IN} Rated	3.20		3.40	
			3.14		**3.47**	
Output Voltage	V_O	I_O = 0.5A	4.90	5.00	5.10	V
LM2576-5		8V to V_{IN} Rated	4.85		5.15	
			4.75		**5.25**	
Output Voltage	V_O	I_O = 0.5A	11.76	12.00	12.24	V
LM2576-12		15V to V_{IN} Rated	11.52		12.48	
			11.40		**12.60**	
Feedback Voltage	V_{FB}	I_O = 0.5A	1.217	1.230	1.243	V
LM2576-ADJ, V_O = 5V		8V to V_{IN} Rated	1.193		1.267	
			1.180		**1.280**	
Feedback Bias Current	I_B	V_{IN} = 12V, I_O = 0.5A		50	100	nA
LM2576-ADJ					**500**	

Electrical Characteristics (Cont.)

Unless otherwise specified: V_{IN} = 12V for 3.3V, 5V and ADJ options and 25V for 12V option; V_{OUT} = 5V for ADJ option; T_A = 25ºC; V_{IN} rated = 40V; I_O = 0.5 to 3A (LM2576), 0.2 to 1A (LM2575). Values in **bold** apply over full operating temperature range.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Output Voltage	V_O	I_O = 0.2A	3.23	3.30	3.37	V
LM2575-3.3		8V to V_{IN} Rated	3.20		3.40	
			3.14		**3.47**	
Output Voltage	V_O	I_O = 0.2A	4.90	5.00	5.10	V
LM2575-5		8V to V_{IN} Rated	4.85		5.15	
			4.75		**5.25**	
Output Voltage	V_O	I_O = 0.2A	11.76	12.00	12.24	V
LM2575-12		15V to V_{IN} Rated	11.52		12.48	
			11.40		**12.60**	
Feedback Voltage	V_{FB}	I_O = 0.2A	1.217	1.230	1.243	V
LM2575-ADJ, V_O = 5V		8V to V_{IN} Rated	1.193		1.267	
			1.180		**1.280**	
Feedback Bias Current	I_B	V_{IN} = 12V, I_O = 0.2A		50	100	nA
LM2575-ADJ					**500**	
Efficiency/Option						
3.3V	η	V_{IN} = 12V, I_O = 1A (LM2575, 3A for LM2576)		77		%
5V				82		
12V		V_{IN} = 15V, I_O = 1A (LM2575, 3A for LM2576)		88		
ADJ, V_O = 5V		V_{IN} = 12V, I_O = 1A (LM2575, 3A for LM2576)		82		
Switching Frequency	f_{SX}		47	52	58	kHz
			43		**62**	
Saturation Voltage(1)	V_{SAT}	LM2575, I_O = 1A		**0.9**	**1.2**	V
		LM2576, I_O = 3A		**0.9**	**1.4**	
Max. Duty Cycle (On)(3)	DC		93	98		%
Peak Current LM2575(1)	I_{CL}		1.7	2.2	3.0	A
			1.3		**3.2**	
Peak Current LM2576(1)	I_{CL}		4.2	5.8	6.9	A
			3.5		**7.5**	

Electrical Characteristics (Cont.)

Unless otherwise specified: V_{IN} = 12V for 3.3V, 5V and ADJ options and 25V for 12V option; V_{OUT} = 5V for ADJ option; T_A = 25ºC; V_{IN} rated = 40V; I_O = 0.5 to 3A (LM2576), 0.2 to 1A (LM2575). Values in **bold** apply over full operating temperature range.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Output Leakage Current(2)						
Output = 0V	I_L	$V_{IN} = V_{IN}$ Rated			2	mA
Output = -1V				7.5	30	
Quiescent Current(2)	I_Q			5	10	mA
					12	
Standby Quiescent Current	I_{STBY}			50		µA
(On/Off Pin = 5V)					**500**	
On/Off Pin Logic Input Level	V_{IH}		2.2	1.4		V
			2.4			
	V_{IL}			1.2	1.0	V
					0.8	
On/Off Pin Input Current	I_{IH}	$V_{ON/OFF}$ = 5V (Off)		12	30	µA
	I_{IL}	$V_{ON/OFF}$ = 0V (On)		0	10	

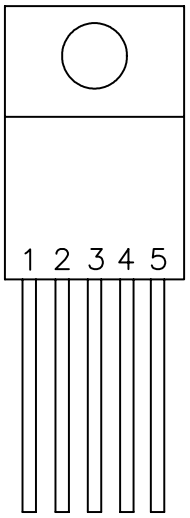
Notes:

(1) Output sourcing current, resistive load, no inductor or capacitor.

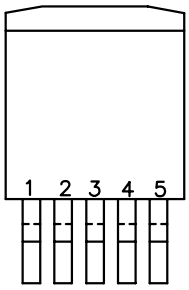
(2) Feedback = V_O + 1.0V.

(3) Feedback = 0V.

Pin Configurations



TO-220-5



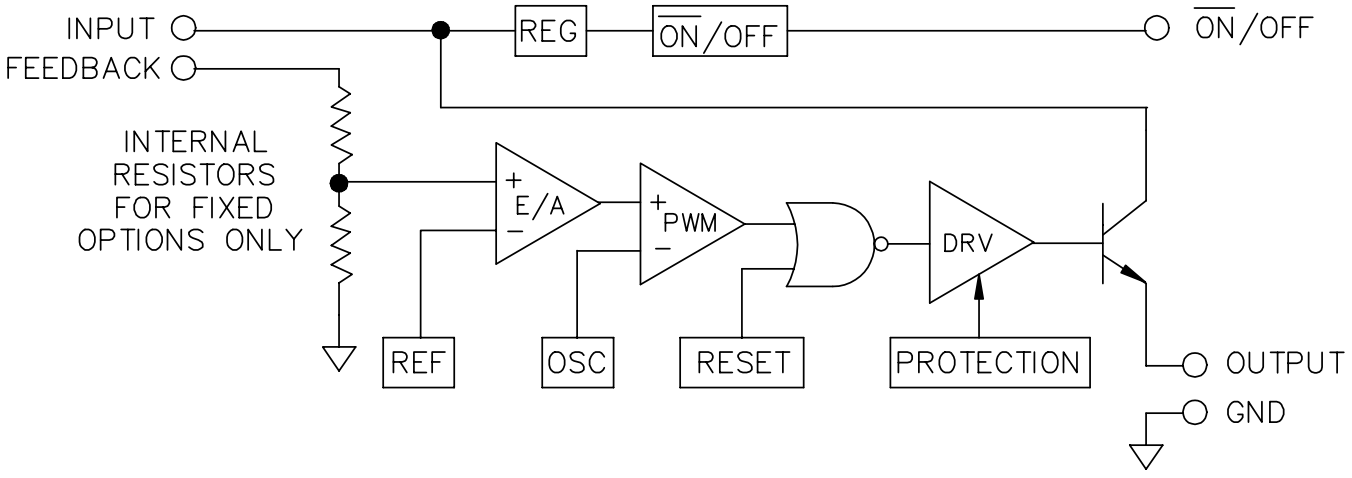
TO-263-5

LM2575, LM2576	
Pin	**Function**
1	V_{IN}
2	OUTPUT
3	COMMON
4	FEEDBACK
5	ON/OFF
TAB is COMMON	

Ordering Information

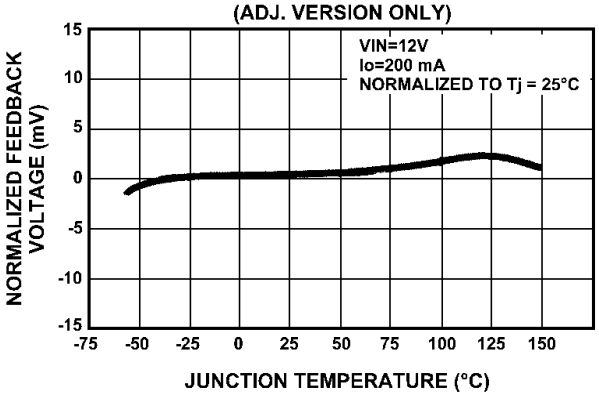
(1) -XX = Voltage Option. Available voltages are 3.3V (-3.3), 5V (-5.0), 12V (-12), and ADJ (-ADJ), which is adjustable between 1.23V and 35V.

Block Diagram

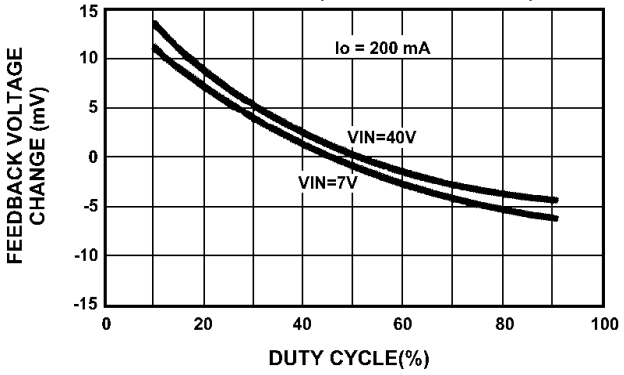


Typical Characteristics - LM2575

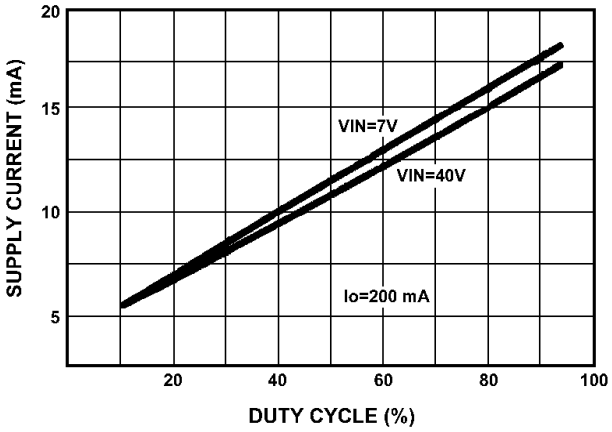
NORMALIZED FEEDBACK VOLTAGE
(ADJ. VERSION ONLY)



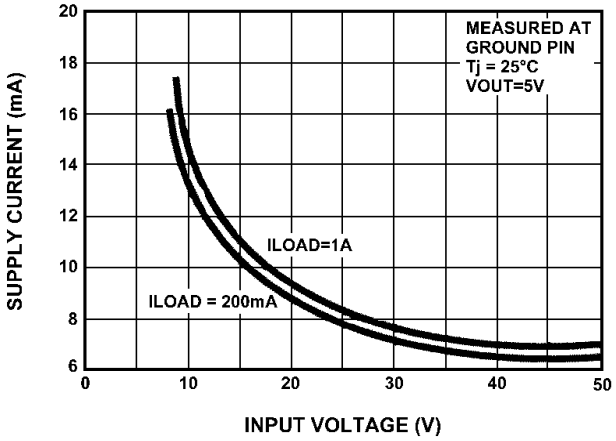
FEEDBACK VOLTAGE VS.
DUTY CYCLE (ADJ. VERSION ONLY)



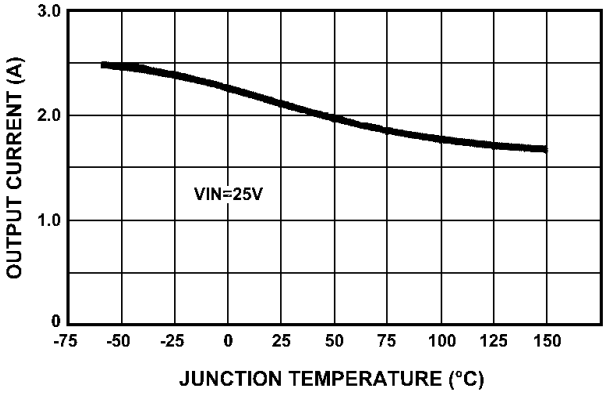
SUPPLY CURRENT VS. DUTY CYCLE



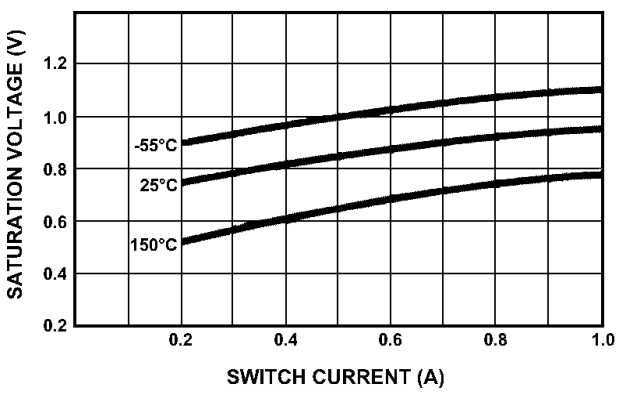
SUPPLY CURRENT



CURRENT LIMIT

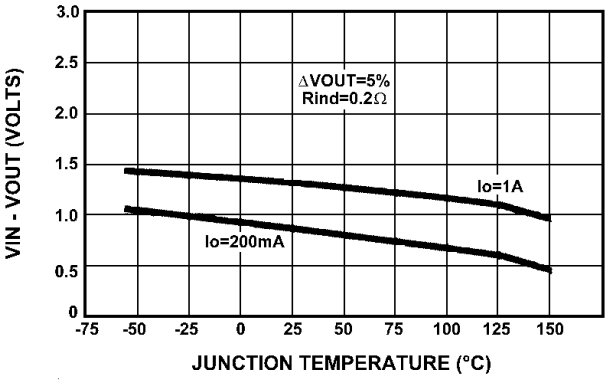


SWITCH SATURATION VOLTAGE

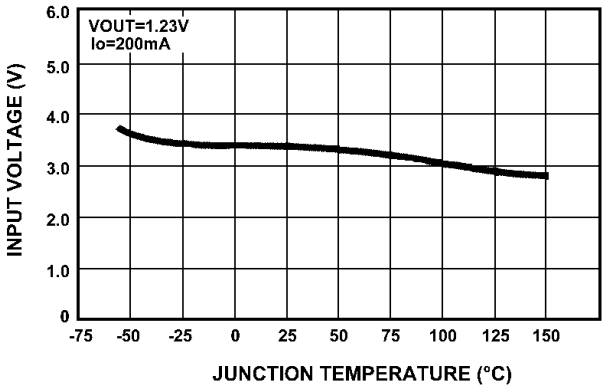


Typical Characteristics - LM2575 (Cont.)

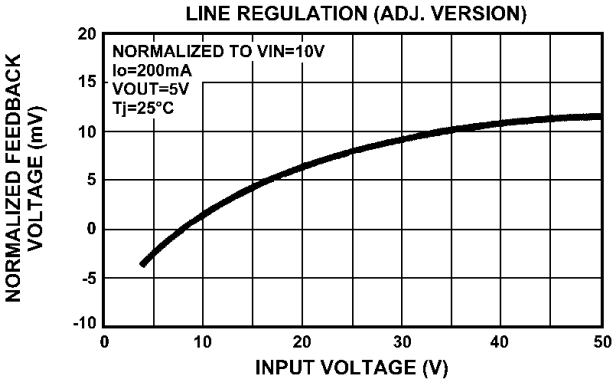
DROPOUT VOLTAGE



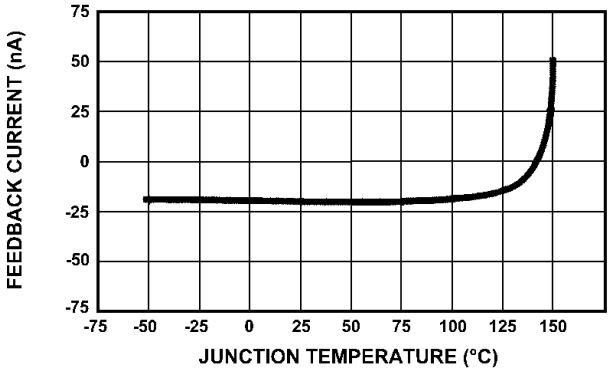
MINIMUM OPERATING VOLTAGE



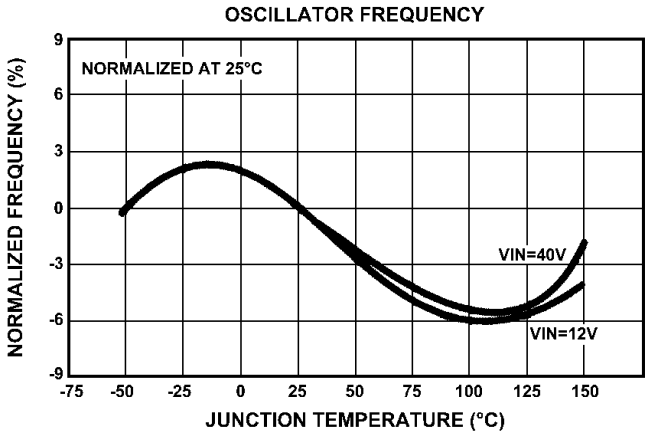
LINE REGULATION (ADJ. VERSION)



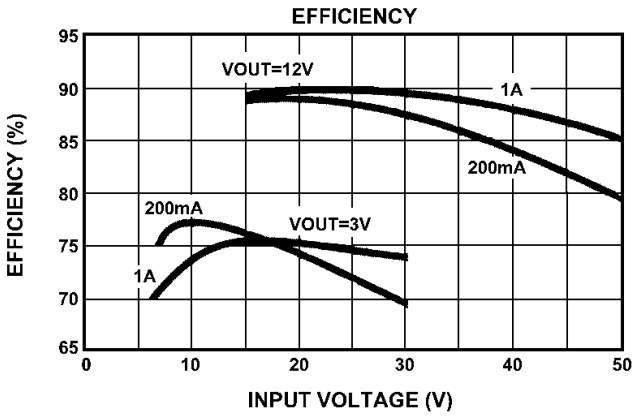
FEEDBACK PIN CURRENT

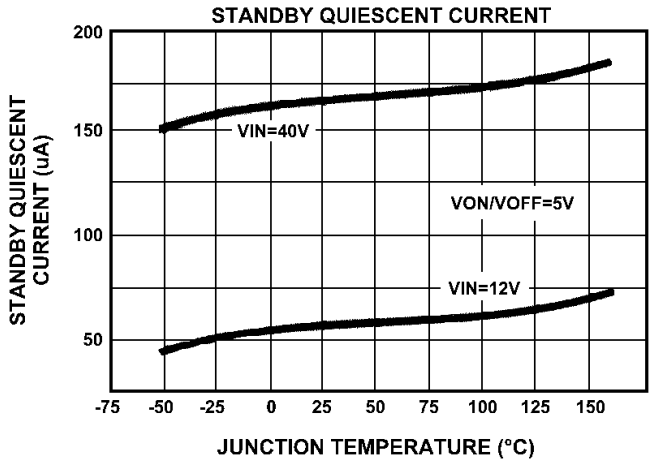


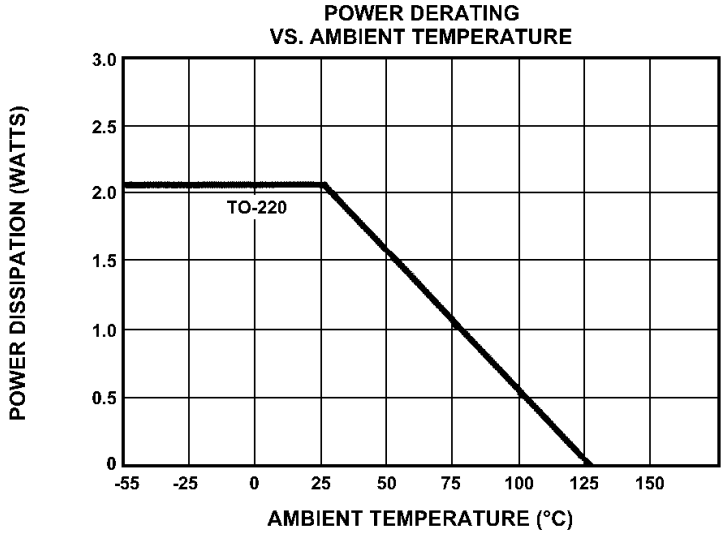
OSCILLATOR FREQUENCY



Typical Characteristics - LM2575 (Cont.)

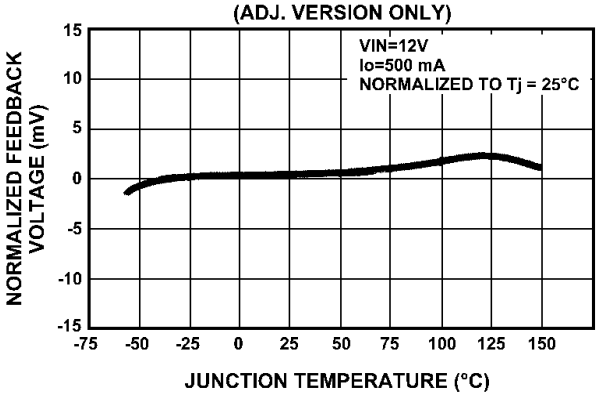




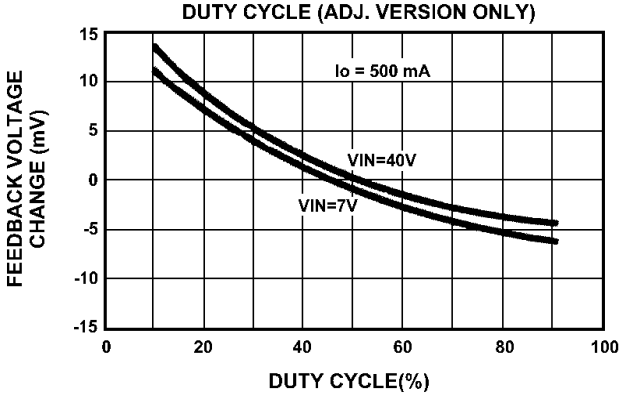


Typical Characteristics - LM2576

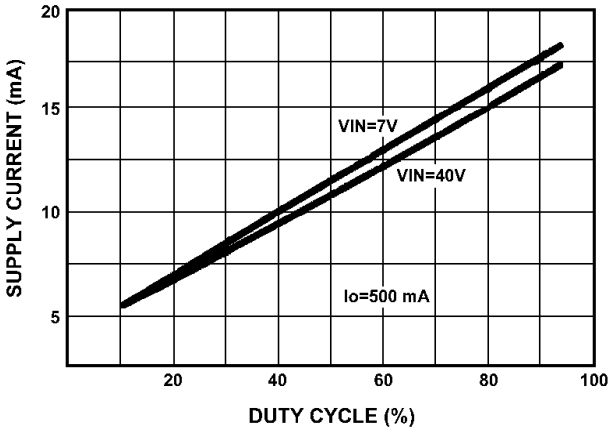
NORMALIZED FEEDBACK VOLTAGE
(ADJ. VERSION ONLY)



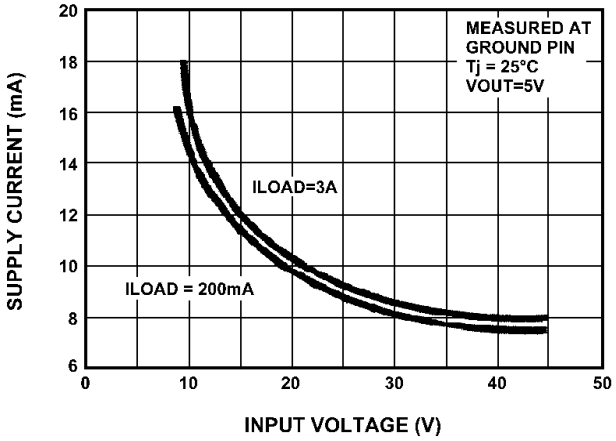
FEEDBACK VOLTAGE VS.
DUTY CYCLE (ADJ. VERSION ONLY)



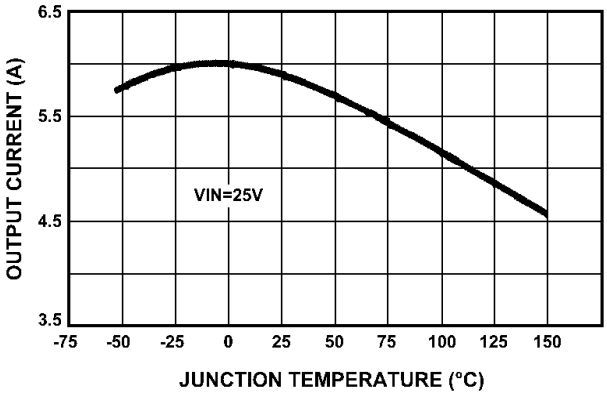
SUPPLY CURRENT VS. DUTY CYCLE



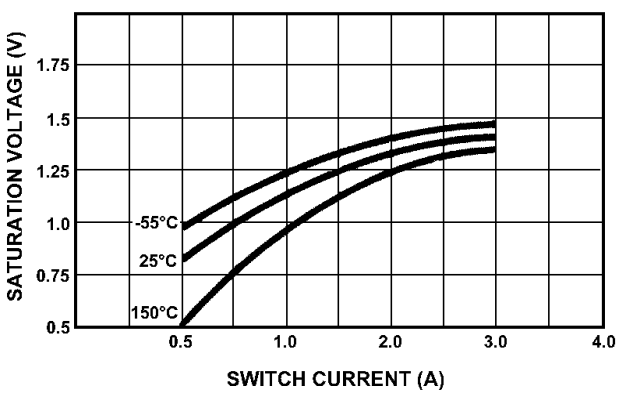
SUPPLY CURRENT



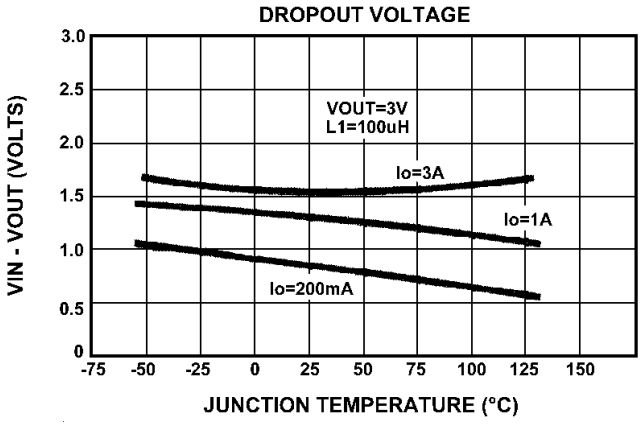
CURRENT LIMIT

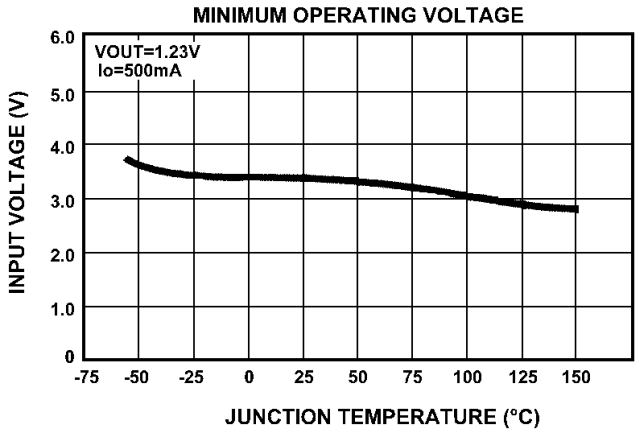


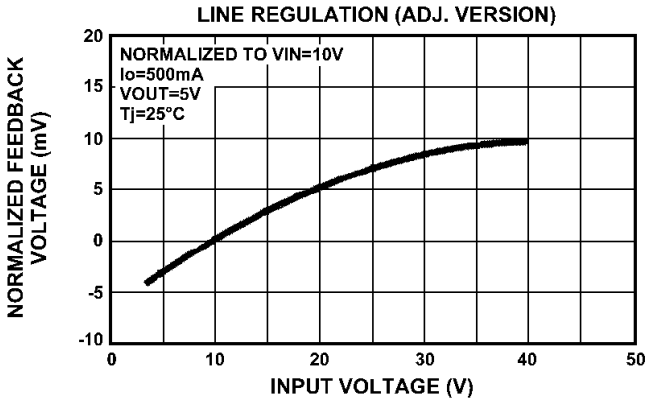
SWITCH SATURATION VOLTAGE

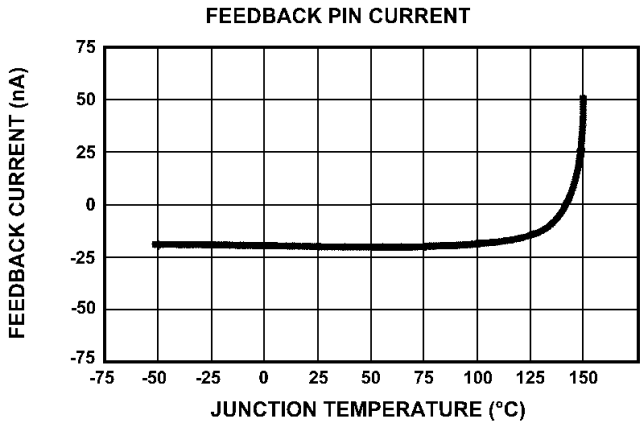


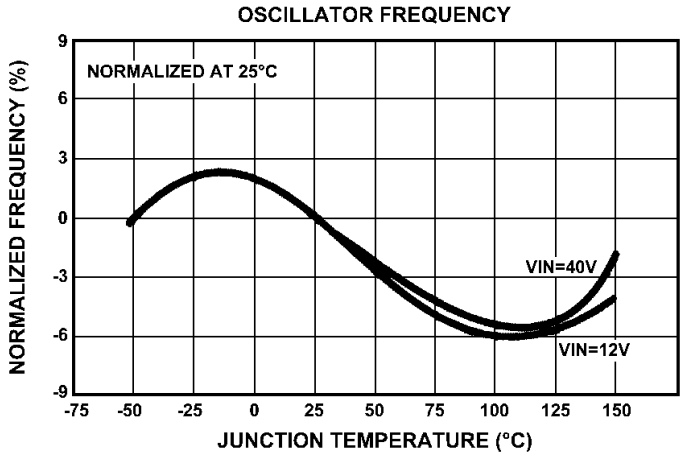
Typical Characteristics - LM2576 (Cont.)



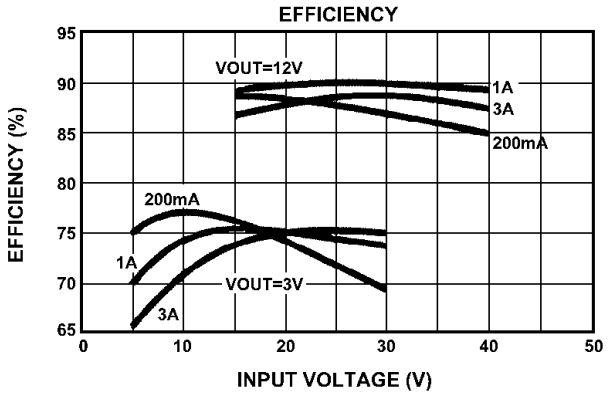


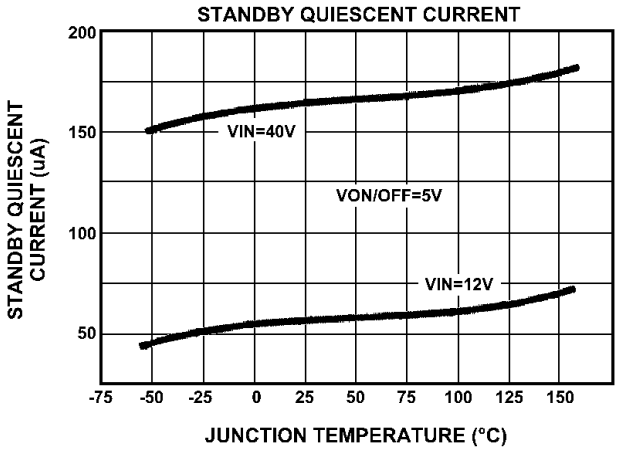


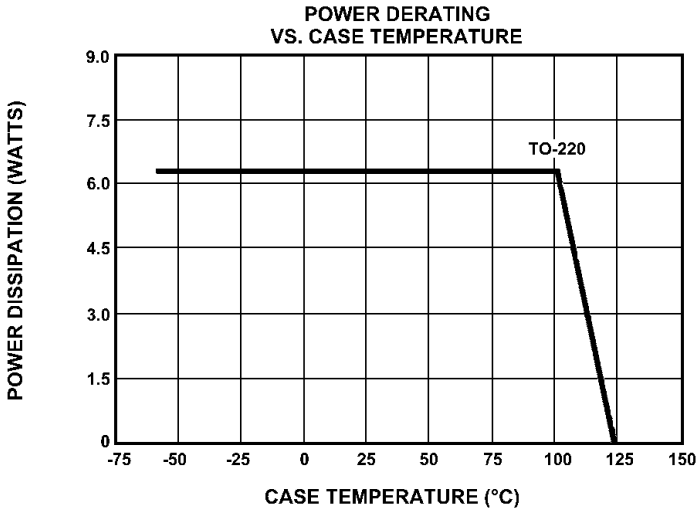




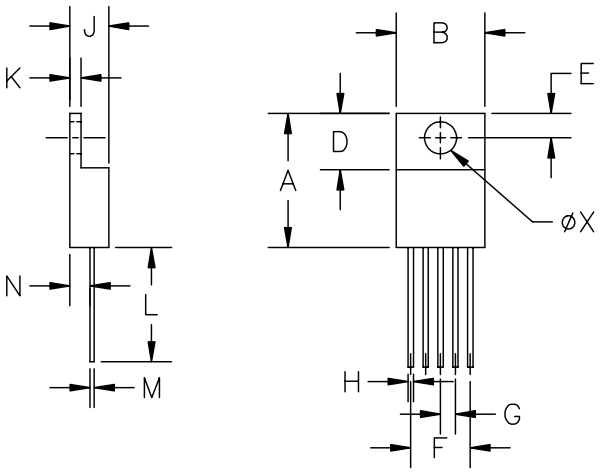
Typical Characteristics - LM2576 (Cont.)







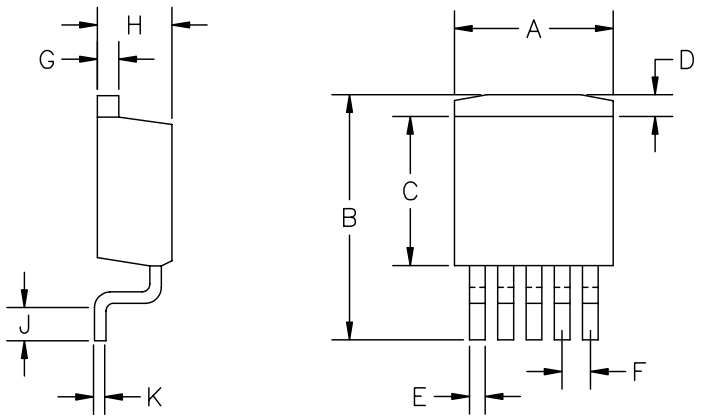
Outline Drawing - TO-220-5



DIMENSIONS					
DIMN	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.560	.650	14.22	16.51	—
B	.380	.420	9.65	10.67	—
D	.230	.260	5.84	6.60	—
E	.100	.135	2.54	3.43	—
F	.263	.273	6.68	6.94	—
G	.062	.072	1.57	1.83	—
H	.025	.040	.63	1.02	—
J	.140	.190	3.55	4.83	—
K	.045	.055	1.14	1.40	—
L	.540	.560	13.72	14.22	—
M	.014	.022	.35	.56	—
N	.080	.120	2.03	3.05	—
øX	.139	.161	3.53	4.09	—

JEDEC TO-220

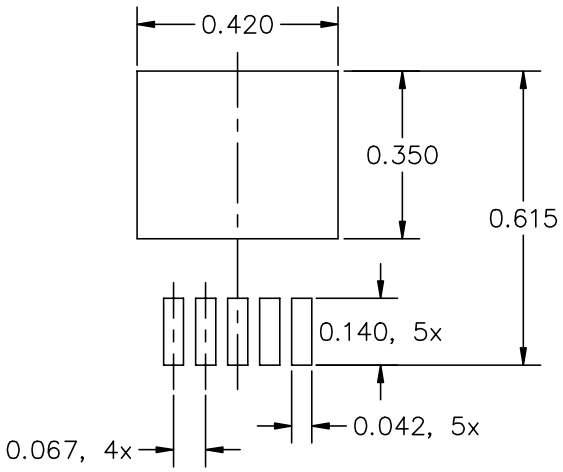
Outline Drawing - TO-263-5



DIMENSIONS					
DIMN	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.380	.405	9.65	10.29	—
B	.575	.625	14.60	15.88	—
C	.325	.380	8.25	9.66	—
D	—	.055	—	1.40	—
E	.020	.039	.50	.99	—
F	.060	.072	1.52	1.83	—
G	.045	.055	1.14	1.40	—
H	.160	.190	4.06	4.83	—
J	.090	.110	2.28	2.80	—
K	.018	.029	.457	.736	—

JEDEC TO-263

Minimum Land Pattern - TO-263-5



NOTE: ALL DIMENSIONS ARE IN INCHES

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