

## Description

The LM2576T 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 LM2576T has a maximum output current of 1A and the LM2576T is rated for 3A.

The LM2576T series miniconverters include as 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 LM2576T fully protect the device against overstress conditions.

The LM2576T series offers an alternative to popular 3-terminal linear regulators by providing higher efficiency with reduced heatsink size. In many applications a heatsink will not be required.

## Features

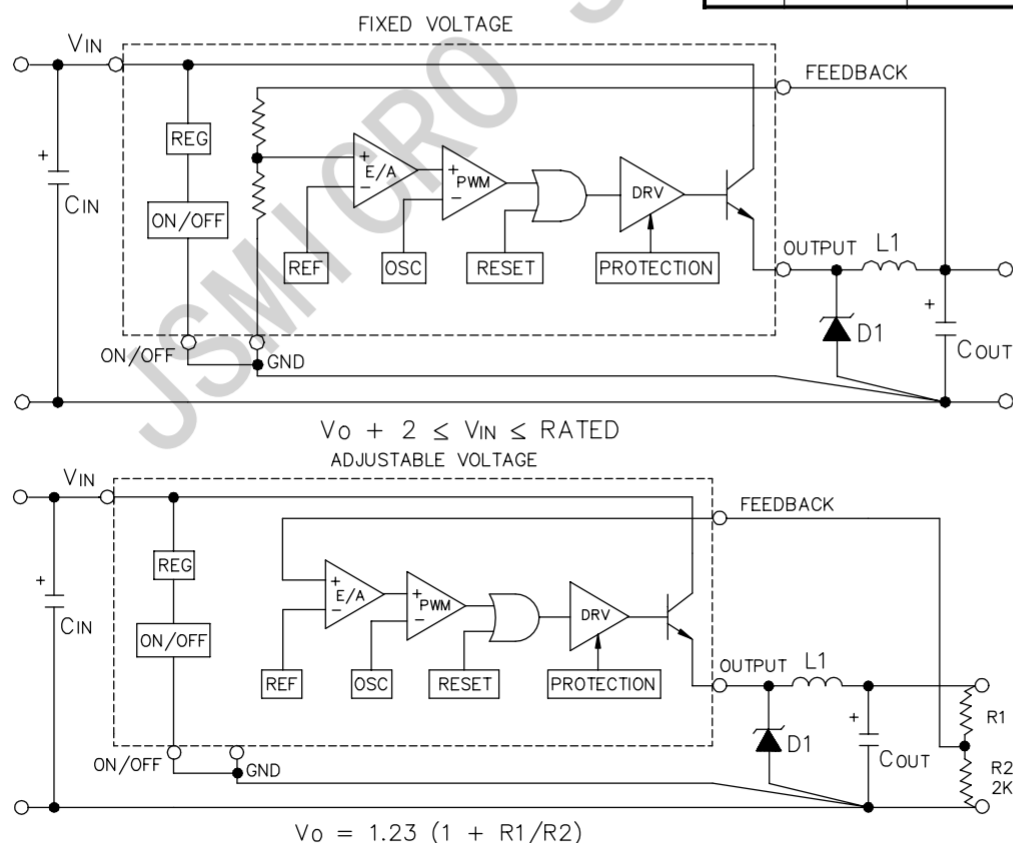
- ◆ Pin for pin replacement for National's LM2575T/6T series
- ◆ DC-to-DC buck or buck/boost converter requiring only 4 support components
- ◆ Fixed or adjustable voltages
- ◆ Preset output voltages of 3.3V, 5V and 12V
- ◆ Wide output voltage range, 1.23V to 35V
- ◆ 82% typical efficiency @ 5V out
- ◆ 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

|           | LM2575T     | LM2576T       |
|-----------|-------------|---------------|
| $L_1$     | 330 $\mu$ H | 100 $\mu$ H   |
| $D_1$     | 3A          | 7A            |
| $C_{IN}$  | 68 $\mu$ F  | 120 $\mu$ F   |
| $C_{OUT}$ | 330 $\mu$ F | 1,000 $\mu$ F |

## Typical Application Circuits



## Absolute Maximum Ratings

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

## Electrical Characteristics

Unless otherwise specified:  $V_{IN} = 12\text{V}$  for 3.3V, 5V and ADJ options and 25V for 12V option;  $V_{OUT} = 5\text{V}$  for ADJ option;  $T_A = 25^{\circ}\text{C}$ ;  $V_{IN}$  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<br>LM2576T-3.3        | $V_O$    | $I_O = 0.5\text{A}$                         | 3.23         | 3.30  | 3.37         | V     |
|                                      |          | 8V to $V_{IN}$ Rated                        | 3.20         |       | 3.40         |       |
|                                      |          |                                             | <b>3.14</b>  |       | <b>3.47</b>  |       |
| Output Voltage<br>LM2576T-5.0        | $V_O$    | $I_O = 0.5\text{A}$                         | 4.90         | 5.00  | 5.10         | V     |
|                                      |          | 8V to $V_{IN}$ Rated                        | 4.85         |       | 5.15         |       |
|                                      |          |                                             | <b>4.75</b>  |       | <b>5.25</b>  |       |
| Output Voltage<br>LM2576T-12         | $V_O$    | $I_O = 0.5\text{A}$                         | 11.76        | 12.00 | 12.24        | V     |
|                                      |          | 15V to $V_{IN}$ Rated                       | 11.52        |       | 12.48        |       |
|                                      |          |                                             | <b>11.40</b> |       | <b>12.60</b> |       |
| Feedback Voltage<br>LM2576T-ADJ      | $V_{FB}$ | $I_O = 0.5\text{A}$                         | 1.217        | 1.230 | 1.243        | V     |
|                                      |          | $V_O = 5\text{V}$                           | 1.193        |       | 1.267        |       |
|                                      |          | 8V to $V_{IN}$ Rate                         | <b>1.180</b> |       | <b>1.280</b> |       |
| Feedback Bias Current<br>LM2576T-ADJ | $I_B$    | $V_{IN} = 12\text{V}$ , $I_O = 0.5\text{A}$ |              | 50    | 100          | nA    |
|                                      |          |                                             |              |       | <b>500</b>   |       |

## 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;  $T_A = 25^\circ C$ ;  $V_{IN}$  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<br>LM2575T-3.3                                     | $V_o$     | $I_o = 0.2A$                                     | 3.23                                             | 3.30       | 3.37         | V     |
|                                                                   |           | 8V to $V_{IN}$ Rated                             | 3.20                                             |            | 3.40         |       |
|                                                                   |           |                                                  | <b>3.14</b>                                      |            | <b>3.47</b>  |       |
| Output Voltage<br>LM2575T-5                                       | $V_o$     | $I_o = 0.2A$                                     | 4.90                                             | 5.00       | 5.10         | V     |
|                                                                   |           | 8V to $V_{IN}$ Rated                             | 4.85                                             |            | 5.15         |       |
|                                                                   |           |                                                  | <b>4.75</b>                                      |            | <b>5.25</b>  |       |
| Output Voltage<br>LM2575T-12                                      | $V_o$     | $I_o = 0.2A$                                     | 11.76                                            | 12.00      | 12.24        | V     |
|                                                                   |           | 15V to $V_{IN}$ Rated                            | 11.52                                            |            | 12.48        |       |
|                                                                   |           |                                                  | <b>11.40</b>                                     |            | <b>12.60</b> |       |
| Feedback Voltage<br>LM2575T-ADJ, $V_o = 5V$                       | $V_{FB}$  | $I_o = 0.2A$                                     | 1.217                                            | 1.230      | 1.243        | V     |
|                                                                   |           | 8V to $V_{IN}$ Rated                             | 1.193                                            |            | 1.267        |       |
|                                                                   |           |                                                  | <b>1.180</b>                                     |            | <b>1.280</b> |       |
| Feedback Bias Current<br>LM2575T-ADJ                              | $I_B$     | $V_{IN} = 12V, I_o = 0.2A$                       |                                                  | 50         | 100          | nA    |
|                                                                   |           |                                                  |                                                  |            | <b>500</b>   |       |
| Efficiency/Option3.3V<br><br>5V<br><br>12V<br><br>ADJ, $V_o = 5V$ | $\eta$    | $V_{IN} = 12V, I_o = 1A$ (LM2575, 3A for LM2576) |                                                  | 77         |              | %     |
|                                                                   |           |                                                  |                                                  |            | 82           |       |
|                                                                   |           | $V_{IN} = 15V, I_o = 1A$ (LM2575, 3A for LM2576) |                                                  | 88         |              |       |
|                                                                   |           |                                                  | $V_{IN} = 12V, I_o = 1A$ (LM2575, 3A for LM2576) |            | 82           |       |
| Switching Frequency                                               | $f_{SX}$  |                                                  | 47                                               | 52         | 58           | kHz   |
|                                                                   |           |                                                  | <b>43</b>                                        |            | <b>62</b>    |       |
| Saturation Voltage <sup>(1)</sup>                                 | $V_{SAT}$ | LM2575, $I_o = 1A$                               |                                                  | <b>0.9</b> | <b>1.2</b>   | V     |
|                                                                   |           | LM2576, $I_o = 3A$                               |                                                  | <b>0.9</b> | <b>1.4</b>   |       |
| Max. Duty Cycle (On) <sup>(3)</sup>                               | DC        |                                                  | 93                                               | 98         |              | %     |
| Peak Current LM2575 <sup>(1)</sup>                                | $I_{CL}$  |                                                  | 1.7                                              | 2.2        | 3.0          | A     |
|                                                                   |           |                                                  | <b>1.3</b>                                       | <b>3.2</b> |              |       |
| Peak Current LM2576 <sup>(1)</sup>                                | $I_{CL}$  |                                                  | 4.2                                              | 5.8        | 6.9          | A     |
|                                                                   |           |                                                  | <b>3.5</b>                                       | <b>7.5</b> |              |       |

## Electrical Characteristics (Cont.)

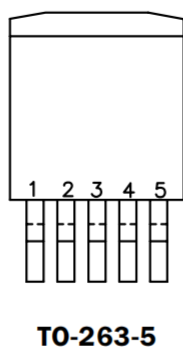
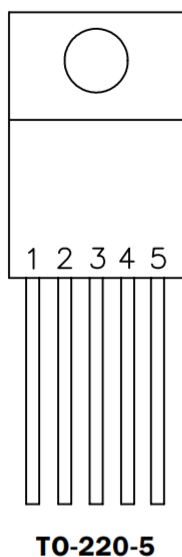
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| Parameter                             | Symbol     | Test Conditions             | Min        | Typ | Max        | Units   |
|---------------------------------------|------------|-----------------------------|------------|-----|------------|---------|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

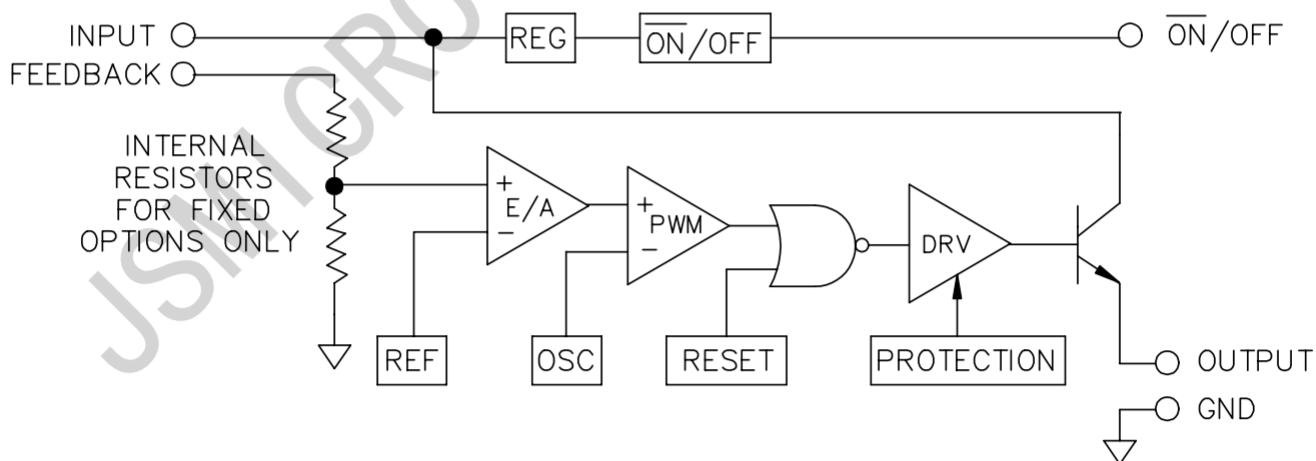


| Pin           | Function |
|---------------|----------|
| 1             | $V_{IN}$ |
| 2             | OUTPUT   |
| 3             | COMMON   |
| 4             | FEEDBACK |
| 5             | ON/OFF   |
| TAB is COMMON |          |

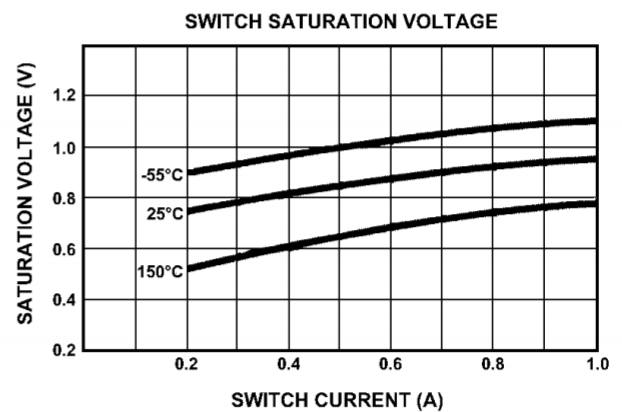
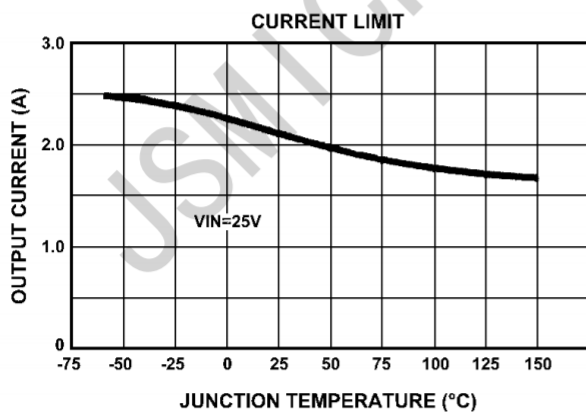
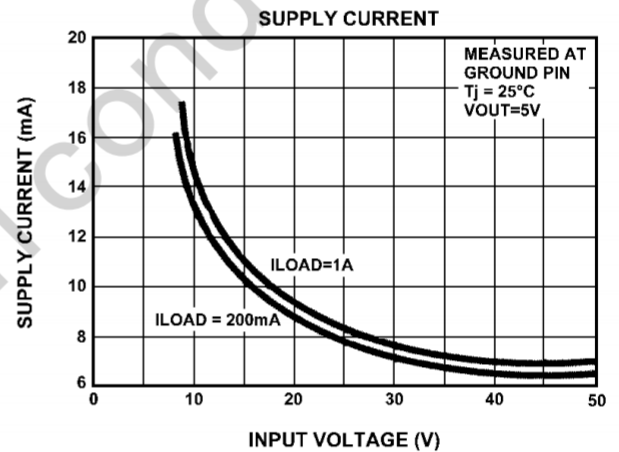
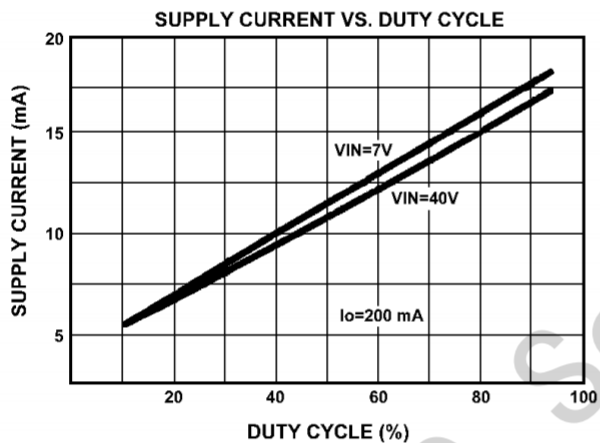
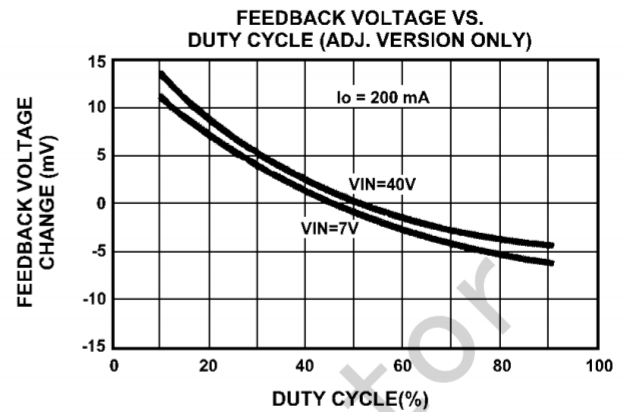
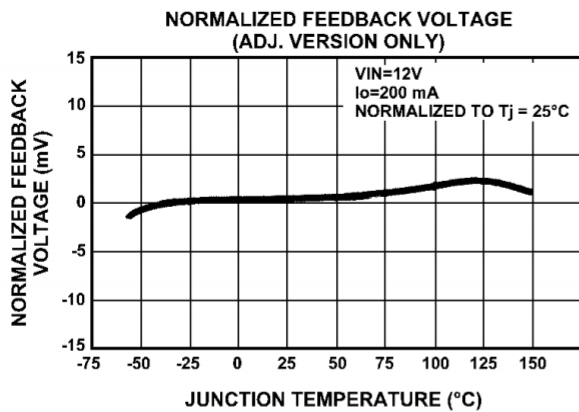
## Ordering Information

(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.

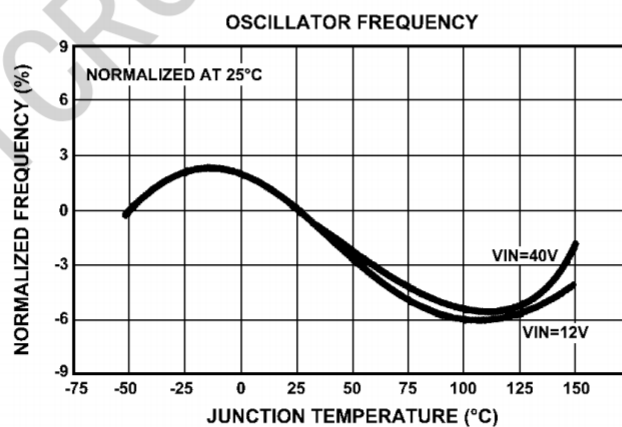
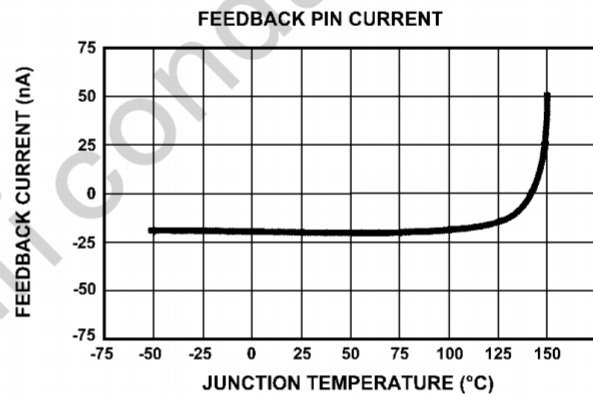
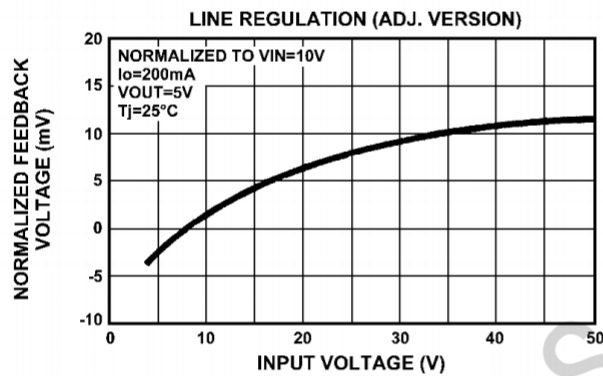
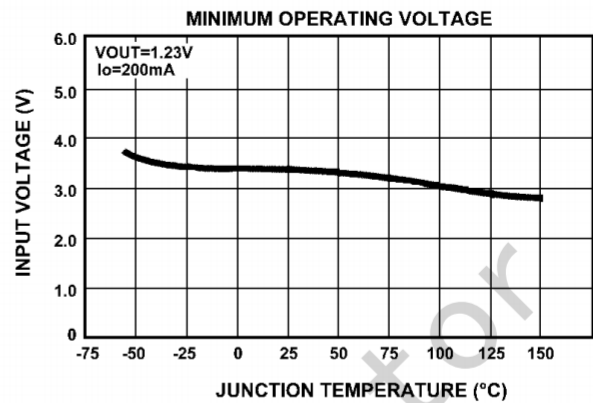
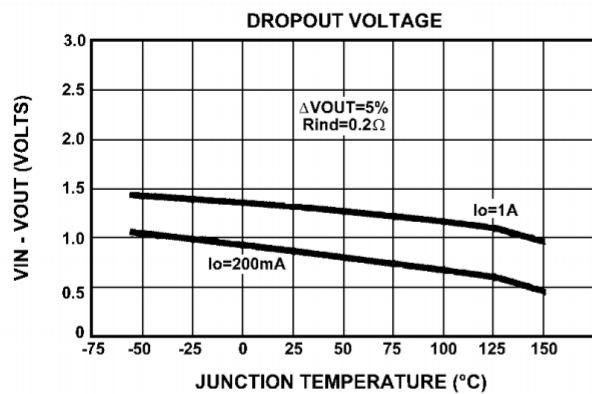
## Block Diagram



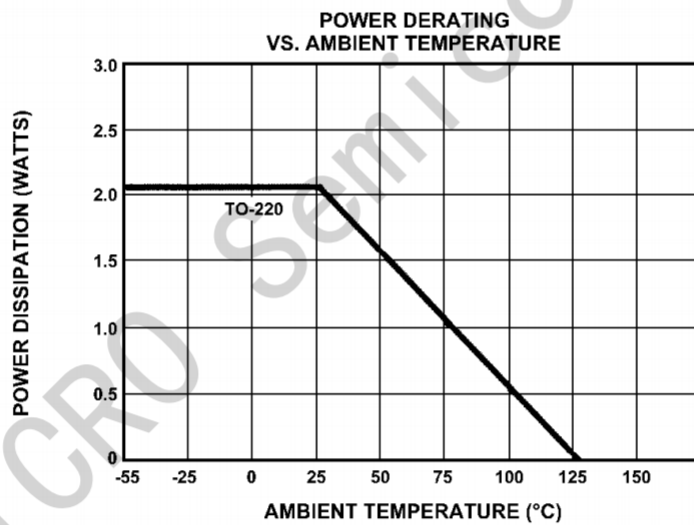
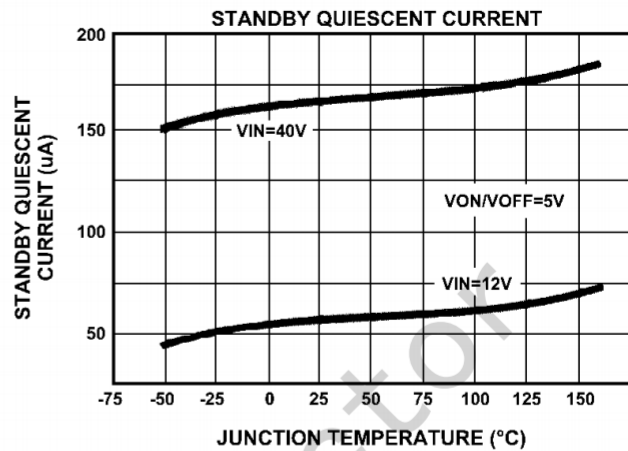
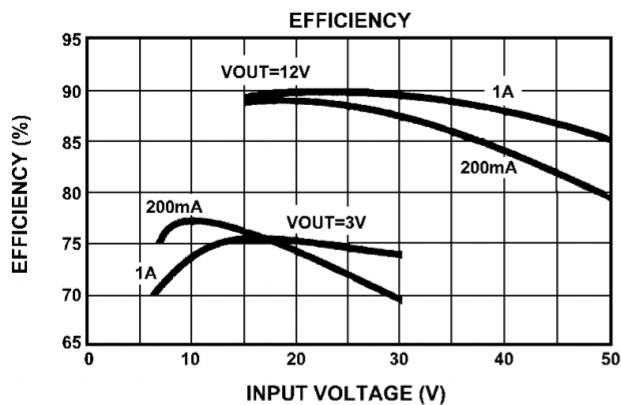
## Typical Characteristics - LM2575T



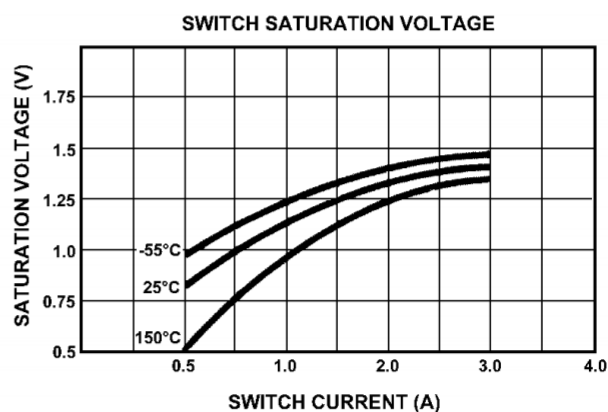
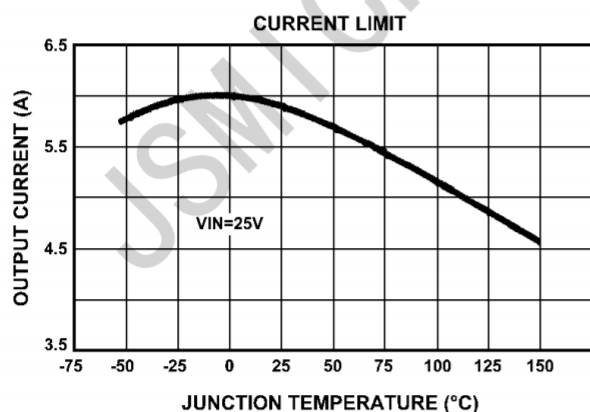
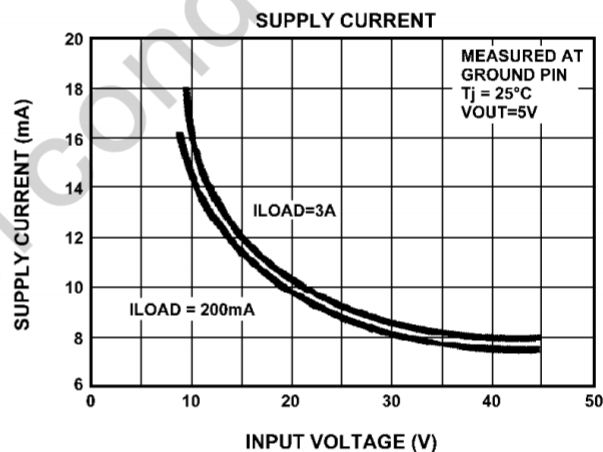
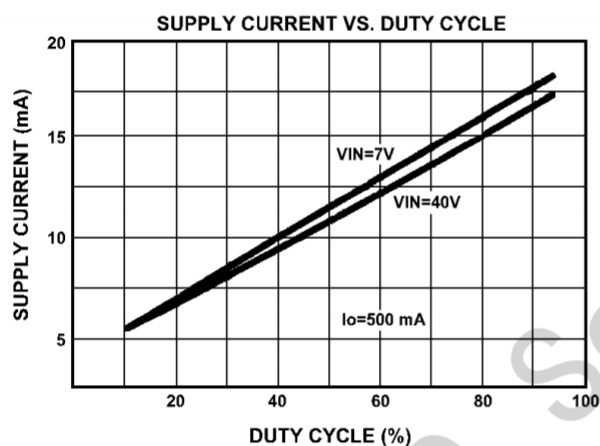
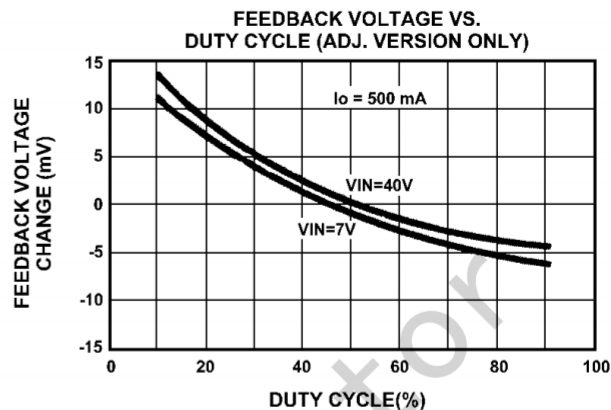
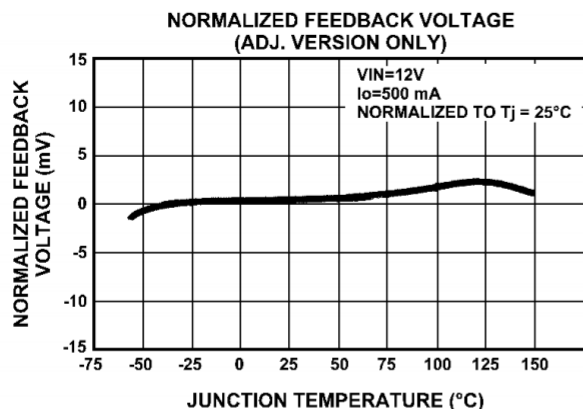
Typical Characteristics - LM2575T (Cont.)



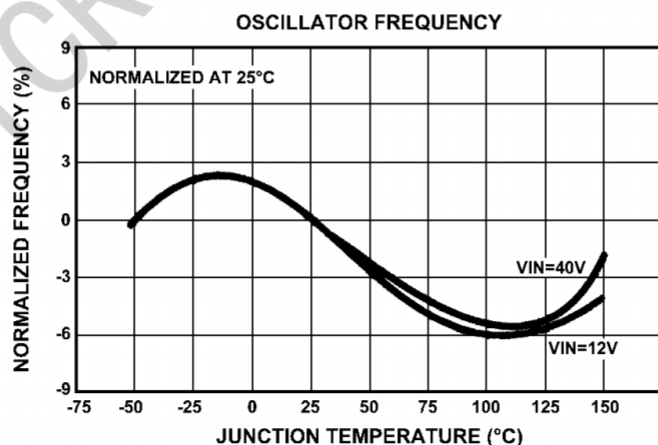
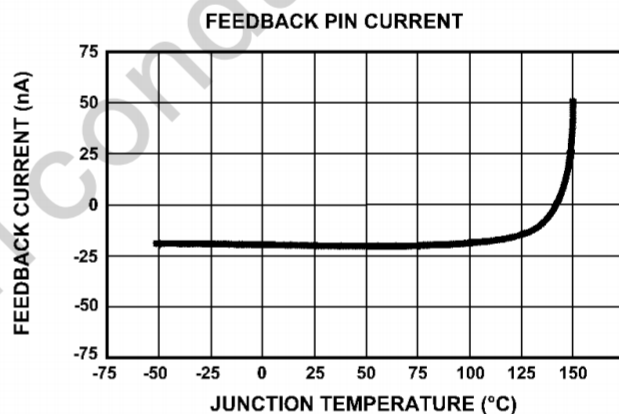
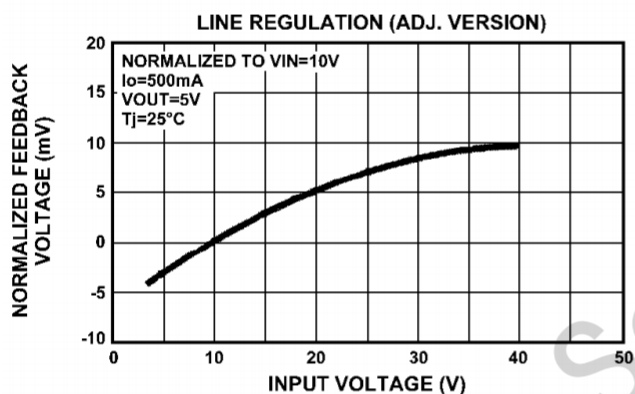
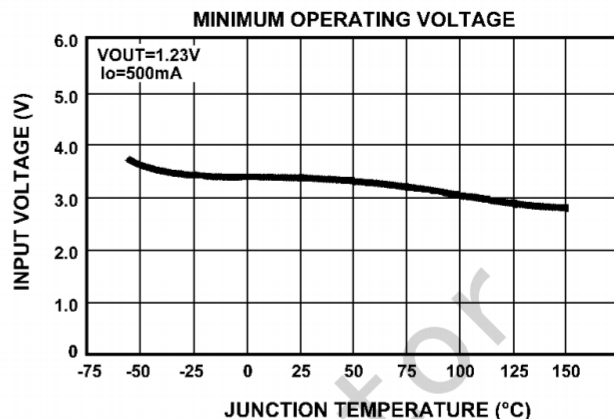
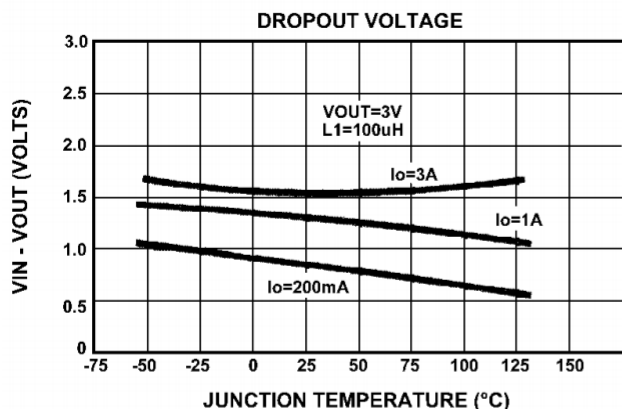
Typical Characteristics - LM2575T (Cont.)



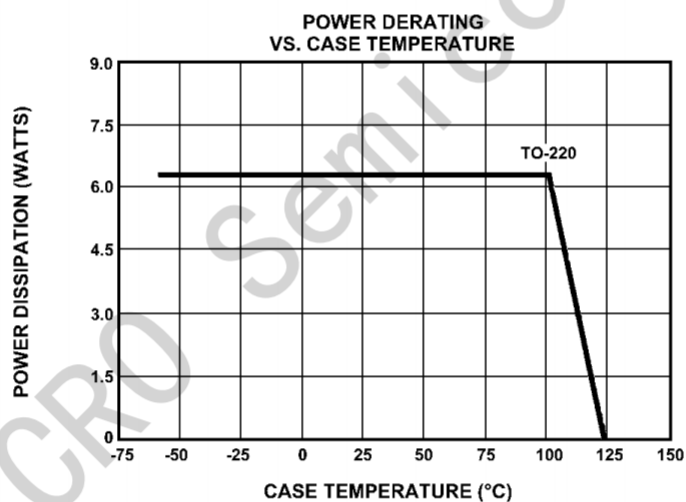
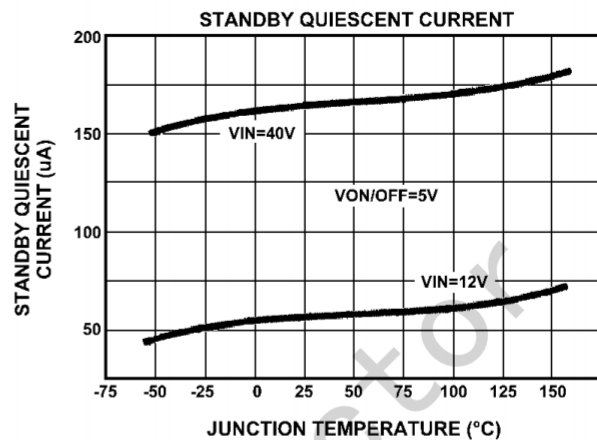
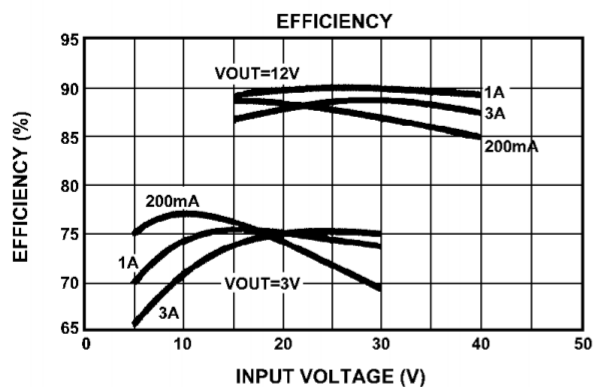
## Typical Characteristics - LM2576T



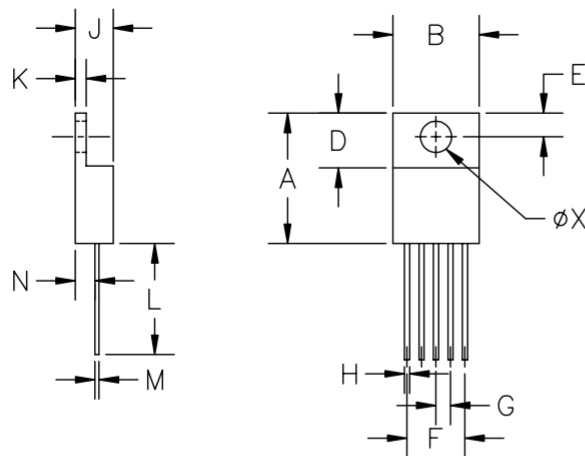
Typical Characteristics - LM2576T (Cont.)



Typical Characteristics - LM2576T (Cont.)



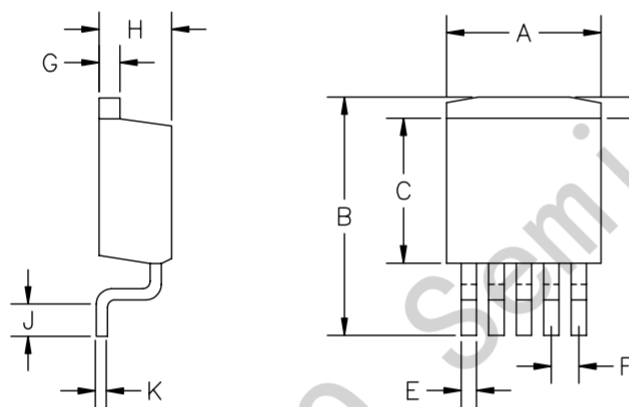
## Outline Drawing - TO-220-5



| DIM <sup>N</sup> | 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  | —    |
| $\phi X$         | .139   | .161 | 3.53  | 4.09  | —    |

JEDEC TO-220

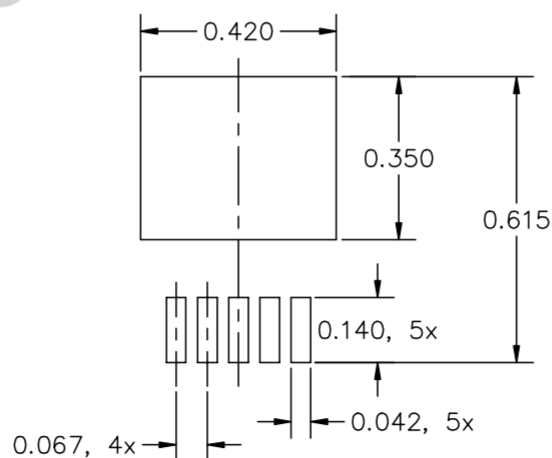
## Outline Drawing - TO-263-5



| DIM <sup>N</sup> | 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