Obsolete Device

TC1267

400mA PCI LDO

Features:

- Glitch Free Transition Between Input Sources
- Automatic Input Source Selection
- External PMOS Bypass Switch Control
- Built-in 5V Detector
- 1% Regulated Output Voltage Accuracy
- 400mA Load Current Capability
- Kelvin Sense Input
- Low Ground Current, Independent of Load

Applications:

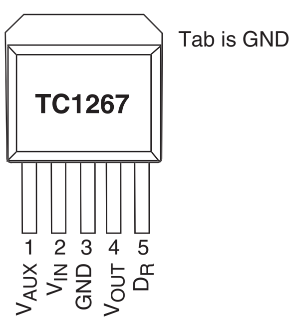
- PCMCIA
- PCI
- Network Interface Cards (NICs)
- Cardbus™ Technology
- Desktop Computers

Device Selection Table

Part Number	Package	Junction Temp. Range
TC1267VET	5-Pin DDPAK	-5°C to +95°C

Pin Configuration

5-Pin DDPAK

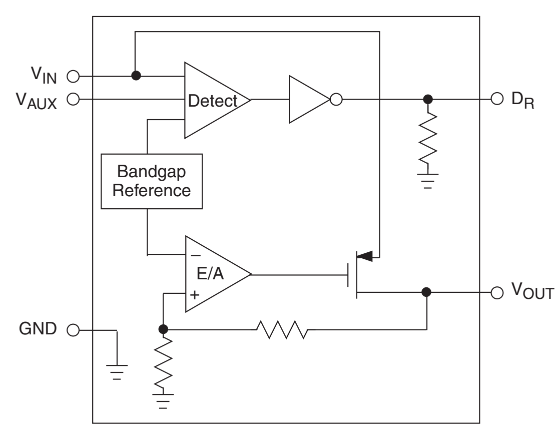


General Description:

The TC1267 is an application-specific, low dropout regulator (LDO), specifically intended for use in PCI peripheral card applications complying with PCI Power Management (PCI 2.0). It provides an uninterrupted, 3.3V output voltage when the main (5V) or auxiliary (3.3V) input voltage supplies are present.

The TC1267 consists of an LDO, a voltage threshold detector, external switchover logic and gate drive circuitry. It functions as a conventional LDO as long as the voltage on the main supply input (V_{IN}) is above the lower threshold (3.90V typical). Should the voltage on V_{IN} fall below the lower threshold, the LDO is disabled and an external P-channel MOSFET is automatically turned on, connecting the auxiliary supply input to $V_{OUT,}$ and ensuring an uninterrupted 3.3V output. The main supply is automatically selected, if both the main and auxiliary input supplies are present, and transition from one input supply to the other is ensured glitch-free. High integration, automatic secondary supply switchover, Kelvin sensing, and small size make the TC1267 the optimum LDO for PCI 2.0 applications.

Functional Block Diagram



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings*

Input Supply Voltage (V_{IN})..............-0.5V to +7V (Max)
Auxiliary Supply Voltage (V_{AUX}) .....-0.5V to +7V (Max)
LDO Output Current (I_{OUT})................................400mA
Thermal Impedance,
Junction-to-Ambient (θ_{JA}).......... 27°C/W for DDPAK
ESD Rating .... 2 KV
Operating Temperature Range (T_A)........-5°C to +70°C
Storage Temperature Range (T_{STG})...-65°C to +150°C

*Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operation sections of the specifications is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

TC1267 ELECTRICAL SPECIFICATIONS

Electrical Characteristics: T_A = +25°C, V_{IN} = 5V, V_{AUX} = 3.3V, I_{OUT} = 0.1mA, C_{OUT} = 4.7µF, unless otherwise noted. **Boldface** type specifications apply over full operating range.

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
V_{IN}	Supply Voltage	**4.4**	**5.0**	**5.5**	V	V_{AUX} = 0V
I_{GND}	Ground Current	— —	230 260	**450** **500**	µA	V_{AUX} = 0V **(Note 6)** V_{AUX} = 3.3V **(Note 6)**
I_{VIN}	Reverse Leakage from V_{AUX}	—	-0.1	**-1.0**	µA	V_{AUX} = 3.5V, V_{IN} = 0V, I_{OUT} = 0mA
V_{AUX}	Supply Voltage	**3.0**	**3.3**	**3.6**	V	
$I_{Q(AUX)}$	Quiescent Current	— —	50 —	70 **100**	µA	V_{IN} = 0V, I_{OUT} = 0mA
		— —	60 —	80 **120**	µA	V_{IN} = 5V, I_{OUT} = 0mA
I_{VAUX}	Reverse Leakage from V_{IN}	—	-0.1	**-1.0**	µA	V_{IN} = 5.5V, V_{AUX} = 0V, I_{OUT} = 0mA
$V_{TH(LO)}$	5V Detector Low Threshold Voltage	— **3.75**	3.90 —	— **4.05**	V	V_{IN} Falling **(Notes 2, 3)**
V_{HYST}	5V Detector Hysteresis Voltage	— **200**	260 —	— **300**	mV	**(Notes 2, 3)**
$V_{TH(HI)}$	5V Detector High Threshold Voltage	— **4.0**	4.15 —	— **4.30**	V	V_{IN} Rising **(Notes 2, 3)**
V_{OUT}	LDO Output Voltage	—	3.300	—	V	I_{OUT} = 20mA
		3.201	—	**3.366**	V	4.4V ≤ V_{IN} ≤ 5.5V, 0mA ≤ I_{OUT} ≤ 400mA
		3.000	—	—	V	0mA ≤ I_{OUT} ≤ 400mA **(Note 4)**
I_{OUT}	Output Current	400	—	—	mA	
$REG_{(LINE)}$	Line Regulation	— **-0.5**	0.05 —	— **+0.5**	%	V_{IN} = 4.3V to 5.5V
$REG_{(LOAD)}$	Load Regulation	— **-1.5**	-0.1 —	— **+0.5**	%	I_{OUT} = 0.1mA to 400mA
V_{DR}	Drive Voltage	V_{IN} - 0.2 **V_{IN} - 0.3**	V_{IN} - 0.1 —	— —	V	4.3V ≤ V_{IN} ≤ 5.5V, I_{DR} = 200µA
		— —	35 —	150 **200**	mV	V_{IN} < $V_{TH(LO)}$, I_{DR} = 200µA

Note 1: Ensured by design.
2: See 5V Detect Thresholds, Figure 4-1.
3: Recommended source impedance for 5V supply: ≤ 0.25Ω. This will ensure that I_{OUT} x R_{SOURCE} < V_{HYST}, thus avoiding D_R toggling during 5V detect threshold transitions.
4: In Application Circuit, Figure 3-1.
5: See Timing Diagram, Figure 4-2.
6: Ground Current is independent of I_{LOAD}.

TC1267 ELECTRICAL SPECIFICATIONS (CONTINUED)

Electrical Characteristics: T_A = +25°C, V_{IN} = 5V, V_{AUX} = 3.3V, I_{OUT} = 0.1mA, C_{OUT} = 4.7µF, unless otherwise noted. **Boldface** type specifications apply over full operating range.

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$I_{DR(PK)}$	Peak Drive Current	7 **6**	— —	— —	mA	Sinking: V_{IN} = 3.75V, V_{DR} = 1V; Sourcing: V_{IN} = 4.3V, $V_{IN} - V_{OR}$ = 2V
t_{DH}	Drive High Delay **(Notes 1, 5)**	— —	4 —	— **8**	µsec	C_{DR} = 1.2nF, V_{IN} ramping up, measured from $V_{IN} = V_{TH(HI)}$ to V_{DR} = 2V
t_{DL}	Drive Low Delay **(Notes 1, 5)**	— —	0.6 —	1.5 **3.0**	µsec	C_{DR} = 1.2nF, V_{IN} ramping down, measured from $V_{IN} = V_{TH(LO)}$ to V_{DR} = 2V

Note 1: Ensured by design.
2: See 5V Detect Thresholds, Figure 4-1.
3: Recommended source impedance for 5V supply: ≤ 0.25Ω. This will ensure that $I_{OUT} \times R_{SOURCE} < V_{HYST}$, thus avoiding D_R toggling during 5V detect threshold transitions.
4: In Application Circuit, Figure 3-1.
5: See Timing Diagram, Figure 4-2.
6: Ground Current is independent of I_{LOAD}.

2.0 PIN DESCRIPTIONS

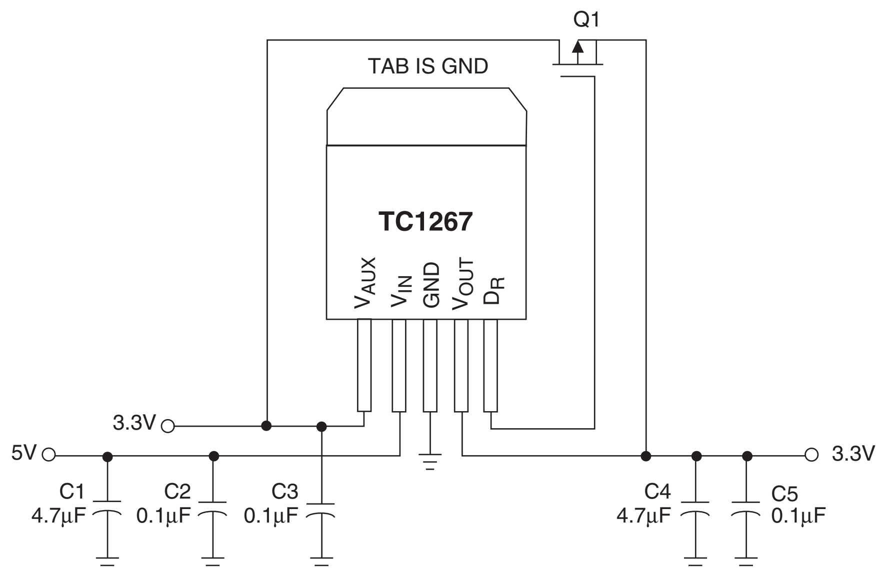
The descriptions of the pins are listed in Table 2-1.

TABLE 2-1: PIN FUNCTION TABLE

Pin No.	Symbol	Description
1	V_{AUX}	Auxiliary input supply, nominally 3.3V.
2	V_{IN}	Main input supply for the TC1267, nominally 5V.
3	GND	Logic and power ground.
4	V_{OUT}	LDO 3.3V output.
5	D_R	Driver output for external P-channel MOSFET pass element.

3.0 DETAILED DESCRIPTION

FIGURE 3-1: APPLICATION CIRCUIT



NOTE: External switch (Q1): use Motorola MGSF1P02ELT1 or equivalent
(PMOS, typical Gate Threshold Voltage = 1V, typical $R_{DS(ON)}$ = 0.4Ω at VGS = 2.5V)

4.0 THERMAL CONSIDERATIONS

4.1 Thermal Shutdown

Integrated thermal protection circuitry shuts the regulator off when die temperature exceeds 160°C. The regulator remains off until the die temperature drops to approximately 150°C.

4.2 Power Dissipation

The amount of power the regulator dissipates is primarily a function of input and output voltage, and output current. The following equation is used to calculate worst case actual power dissipation:

EQUATION 4-1:

$$P_D \approx (V_{INMAX} - V_{OUTMIN})I_{LOADMAX}$$

Where:

P_D = Worst case actual power dissipation
V_{INMAX} = Maximum voltage on V_{IN}
V_{OUTMIN} = Minimum regulator output voltage
$I_{LOADMAX}$ = Maximum output (load) current

The maximum allowable power dissipation (Equation 4-2) is a function of the maximum ambient temperature (T_{AMAX}), the maximum allowable die temperature (T_{JMAX}) and the thermal resistance from junction-to-air (θ_{JA}).

EQUATION 4-2:

$$P_{DMAX} = \frac{(T_{JMAX} - T_{AMAX})}{\theta_{JA}}$$

Where all terms are previously defined.

Table 4-1 shows various values of θ_{JA} for the TC1267 packages.

TABLE 4-1: THERMAL RESISTANCE GUIDELINES FOR TC1267 IN 5-PIN DDPAK

Copper Area (Topside)*	Copper Area (Backside)	Board Area	Thermal Resistance (θ_{JA})
2500 sq mm	2500 sq mm	2500 sq mm	25°C/W
1000 sq mm	2500 sq mm	2500 sq mm	27°C/W
125 sq mm	2500 sq mm	2500 sq mm	35°C/W

*Tab of device attached to topside copper.

Equation 4-1 can be used in conjunction with Equation 4-2 to ensure regulator thermal operation is within limits. For example:

Given:

V_{INMAX} = 5V ± 5%
V_{OUTMIN} = 3.217V
$I_{LOADMAX}$ = 400mA
T_{JMAX} = 95°C
T_{AMAX} = 70°C
θ_{JA} = 27°C/W (DDPAK mounted on 1000 sq mm topside copper area)

Find: 1. Actual power dissipation
2. Maximum allowable dissipation

Actual power dissipation:

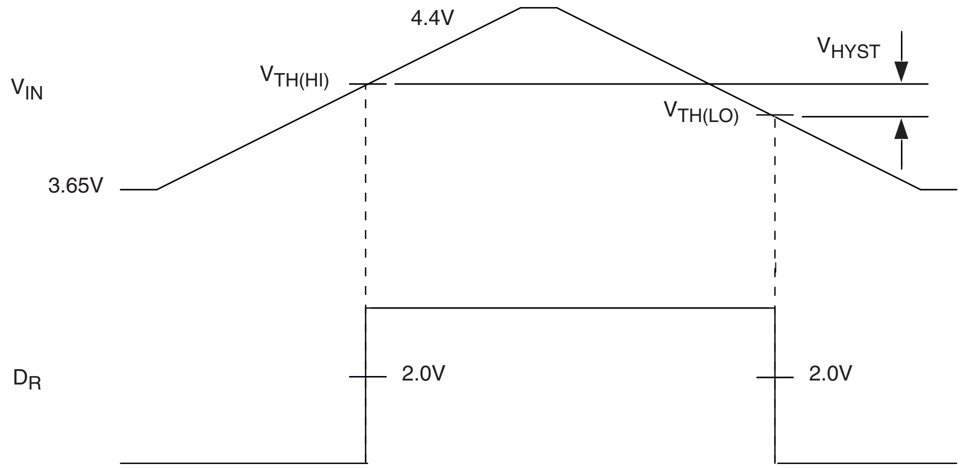
$$P_D \approx (V_{INMAX} - V_{OUTMIN})I_{LOADMAX}$$
$$= (5.25V - 3.217V)\ 400mA$$
$$= 813mW$$

Maximum allowable power dissipation:

$$P_{DMAX} = \frac{(T_{JMAX} - T_{AMAX})}{\theta_{JA}}$$
$$= \frac{(95 - 70)}{27}$$
$$= 423mW$$

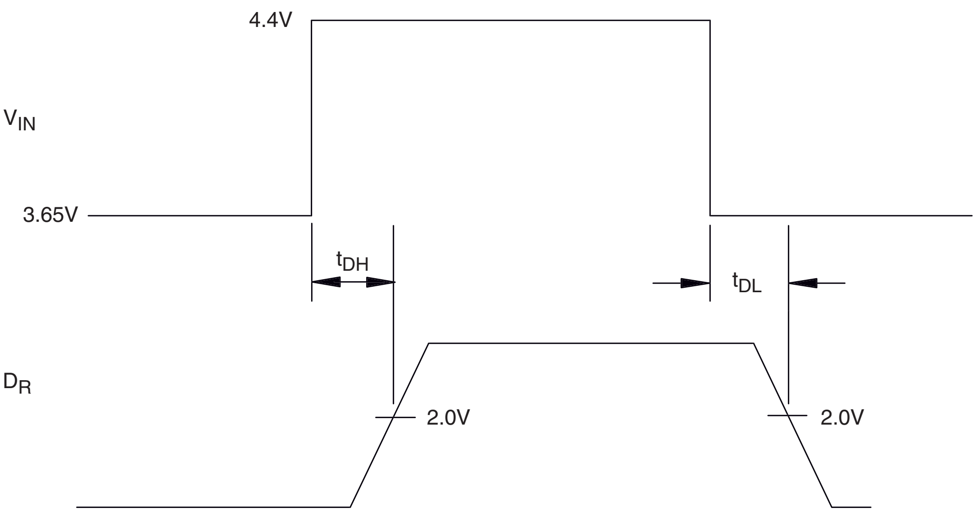
In this example, the TC1267 dissipates a maximum of 813mW; below the allowable limit of 926mW.

FIGURE 4-1: 5V DETECT THRESHOLD



NOTE: V_{IN} rise and fall times (10% to 90%) to be ≥ 100µsec.

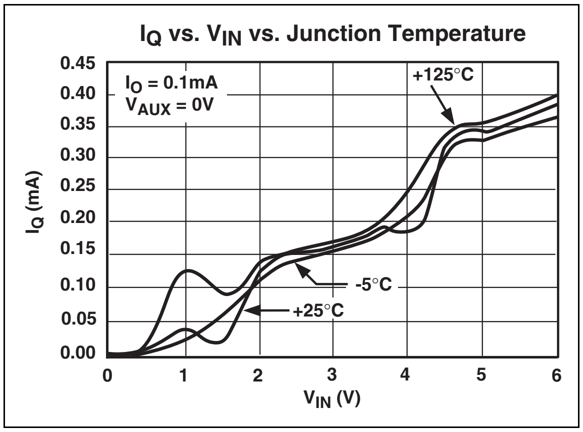
FIGURE 4-2: TIMING DIAGRAM

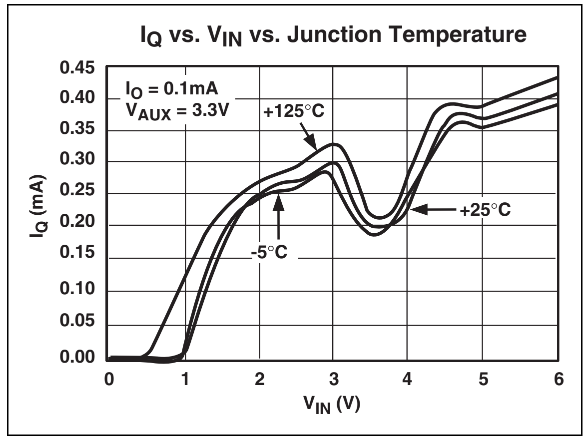


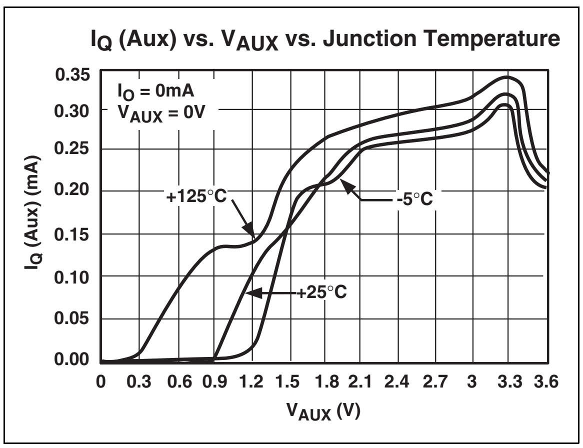
NOTE: V_{IN} rise and fall times (10% to 90%) to be ≤ 0.1µsec.

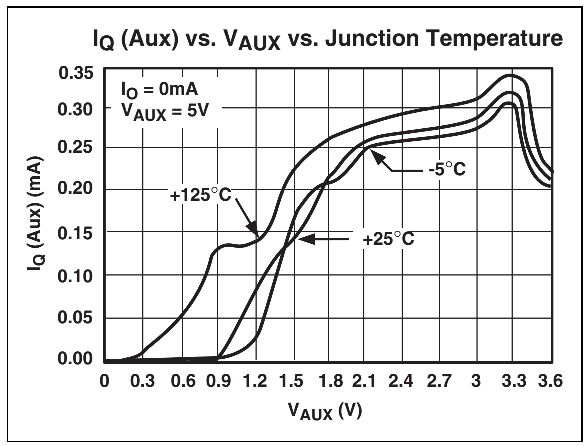
5.0 TYPICAL CHARACTERISTICS

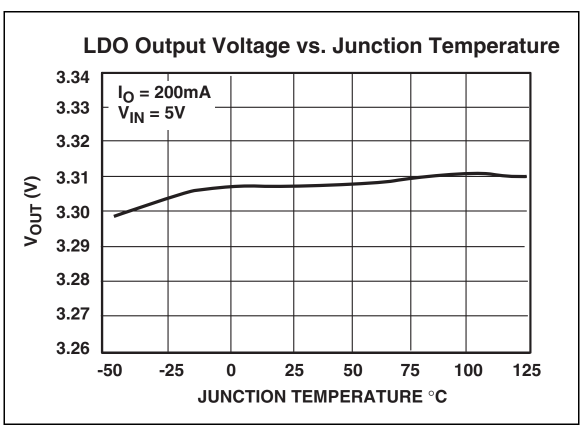
Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.





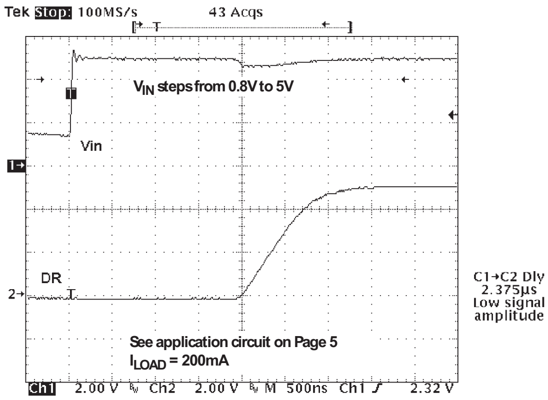






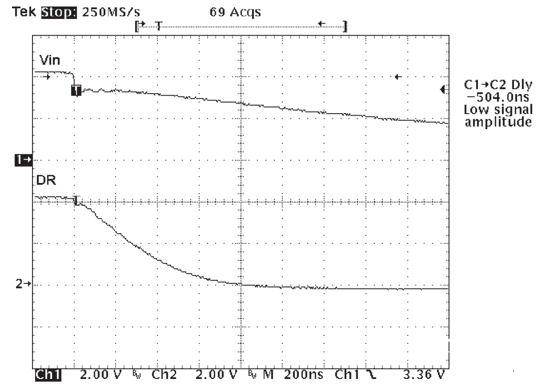
5.0 TYPICAL CHARACTERISTICS (CONTINUED)

Drive High Delay



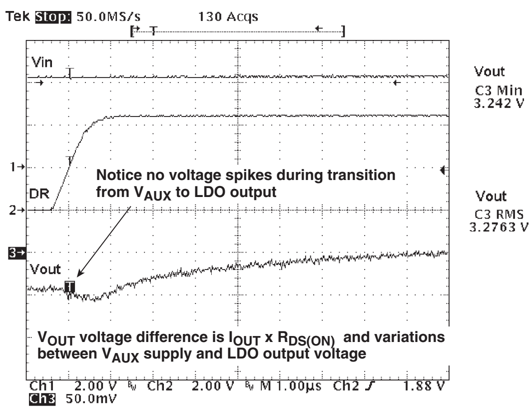
Trace 1: V_{IN} stepping for 0.8V to 5V
Trace 2: D_R going high at $V_{TH(HI)}$
TDH = < 4µS

Drive Low Delay



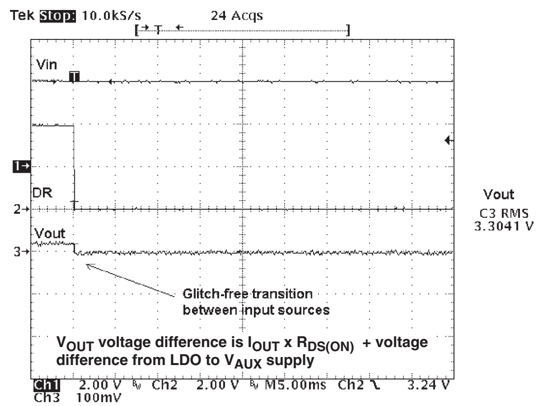
Trace 1: V_{IN} stepping for 5.5V to 0V
Trace 2: D_R going low
TDL = < 600nS

V_O (min) with V_{IN} Rising



Trace 1: V_{IN} – 3A charging a 1500 F capacitor
Trace 2: D_R going high at $V_{TH(HI)}$
Trace 3: V_{OUT}, offset 3.3V. $V_{OUT(min)}$ = 3.24V
I_{LOAD} = 20mA

V_O (min) with V_{IN} Falling



Trace 1: V_{IN} – discharging a 1500 F capacitor
Trace 2: D_R going low at $V_{TH(LO)}$
Trace 3: V_{OUT}, offset 3.3V. $V_{OUT(min)}$ = 3.14V
I_{LOAD} = 20mA

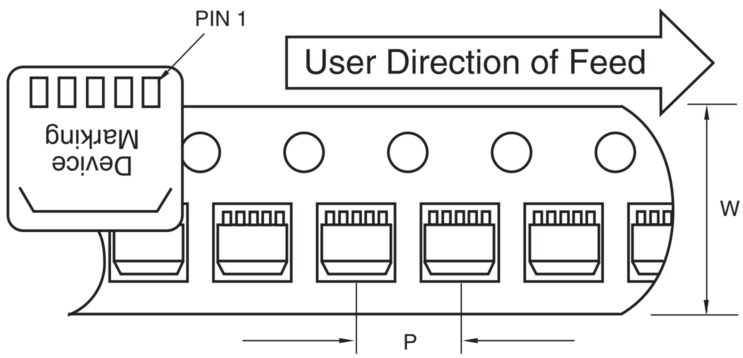
6.0 PACKAGING INFORMATION

6.1 Package Marking Information

Package marking data not available at this time.

6.2 Taping Form

Component Taping Orientation for 5-Pin DDPAK Devices



Standard Reel Component Orientation
for TR Suffix Device
(Mark Right Side Up)

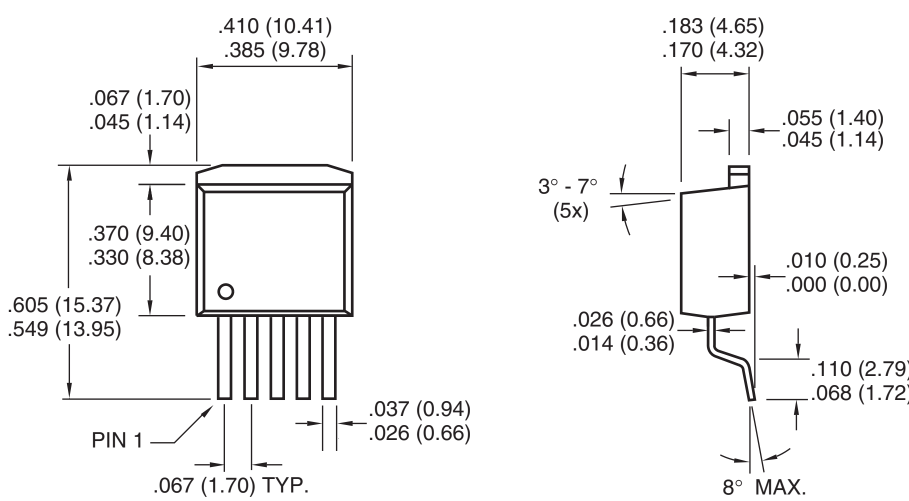
Carrier Tape, Number of Components Per Reel and Reel Size

Package	Carrier Width (W)	Pitch (P)	Part Per Full Reel	Reel Size
5-Pin DDPAK	24 mm	16 mm	750	13 in

6.3 Package Dimensions

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging

5-Pin DDPAK



Dimensions: inches (mm)

7.0 REVISION HISTORY

Revision C (November 2012)

Added a note to each package outline drawing.

Revision D (December 2014)

Added “Obsolete” note box to header.

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ISBN: 978-1-63276-850-6

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