TEXAS INSTRUMENTS

LM317 3 端可调稳压器

1 特性

- 1.25V 至 37V 可调节输出电压范围
- 输出电流大于 1.5A
- 内部短路电流限制
- 热过载保护
- 输出安全区域补偿

2 应用

- ATCA 解决方案
- DLP：3D 生物识别、高光谱成像、光纤网络和光谱分析
- DVR 和 DVS
- 台式计算机
- 数字标牌和静物照相机
- ECG 心电图
- EV HEV 充电器：1 级、2 级和 3 级
- 电子货架标签
- 能量收集
- 以太网交换机
- Femto 基站
- 指纹识别和虹膜识别
- HVAC：暖通空调
- 高速数据采集和生成
- 液压阀
- IP 电话：有线和无线
- 智能占位感应
- 电机控制：刷式直流、无刷直流、低电压、永久磁性和步进电机
- 点对点微波回程
- 移动电源解决方案
- 电力线通信调制解调器
- 以太网供电 (PoE)
- 电能质量监测仪
- 变电站控制
- 专用分支交换机 (PBX)
- 可编程逻辑控制器
- RFID 阅读器
- 冰箱
- 信号或波形发生器
- 软件定义无线电 (SDR)
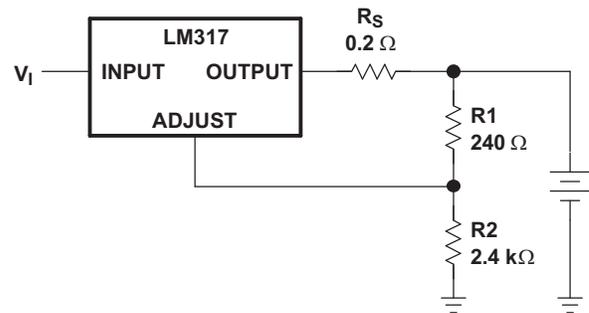- 洗衣机：高端和低端
- X 射线：行李扫描仪、医疗和牙科

3 说明

LM317 器件是一款可调节 3 端正电压稳压器，能够在 1.25V 至 37V 的输出电压范围内提供超过 1.5A 的电流。它仅需要使用两个外部电阻器来设置输出电压。此器件 具有 0.01% 的典型线性调整率和 0.1% 的典型负载调整率。它包含电流限制、热过载保护和安全工作区保护功能。即使"调节"端处于断开状态，过载保护功能仍然起作用。

器件信息[1]

器件型号	封装	封装尺寸（标称值）
LM317DCY	SOT-223 (4)	6.50mm × 3.50mm
LM317KCS	TO-220 (3)	10.16mm × 9.15mm
LM317KCT	TO-220 (3)	10.16mm × 8.59mm
LM317KTT	TO-263 (3)	10.16mm × 9.01mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。

电池充电器电路

目录

4 修订历史记录

Changes from Revision X (September 2016) to Revision Y **Page**

- Added *Device Comparison Table* 3
- Changed V_{IN} to I_{OUT} in *Load Transient Response* figures 7
- Added missing caption to second y-axis in second *Load Transient Response* figure 7
- Changed V_{OUT} and output impedance equations in *Battery-Charger Circuit* section.. 14

Changes from Revision W (January 2015) to Revision X **Page**

- 已更改 在器件信息 表中更改了 KCS TO-220 的封装尺寸 1
- 已更改 在器件信息 表中更改了 KTT TO-263 的封装尺寸... 1
- Changed V_O Output Voltage max value from 7 to 37 on *Recommended Operating Conditions* table 5
- Added min value to I_O Output Current in *Recommended Operating Conditions* table 5
- Changed values in the Thermal Information table to align with JEDEC standards 5
- Added KCT package data to *Thermal Information* table 5
- Deleted Section 9.3.6 "Adjusting Multiple On-Card Regulators with a Single Control" 14
- Updated Adjustsable 4-A Regulator Circuit graphic 16
- 已添加 添加了接收文档更新通知 部分和社区资源 部分.. 19

Changes from Revision V (February 2013) to Revision W **Page**

- 添加了 应用、器件信息 表、引脚功能 表、*ESD* 额定值 表、热性能信息 表、特性 说明 部分、器件功能模式、应用和 实施 部分、电源相关建议 部分、布局 部分、器件和文档支持 部分以及机械、封装和可订购信息 部分.............................. 1
- 已删除 删除了 订购信息 表 1

5 Device Comparison Table

I_{OUT}	PARAMETER	LM317	LM317-N	LM317A	LM317HV	UNIT
1.5 A	Input voltage range	4.25 - 40	4.25 - 40	4.25 - 40	4.25 - 60	V
	Load regulation accuracy	1.5	1.5	1	1.5	%
	PSRR (120 Hz)	64	80	80	65	dB
	Recommended operating temperature	0 to 125	0 to 125	–40 to 125	0 to 125	°C
	TO-220 (NDE) T_{JA}	23.5	23.2	23.3	23	°C/W
	TO-200 (KCT) T_{JA}	37.9	N/A	N/A		°C/W
	TO-252 T_{JA}	N/A	54	54		°C/W
	TO-263 T_{JA}	38	41	N/A		°C/W
	SOT-223 T_{JA}	66.8	59.6	59.6		°C/W
	TO-92 T_{JA}	N/A	186	186		°C/W
		LM317M				
0.5 A	Input voltage range	3.75 - 40				V
	Load regulation accuracy	1.5				%
	PSRR (120 Hz)	80				dB
	Recommended operating temperature	-40 - 125				°C
	SOT-223 T_{JA}	60.2				°C/W
	TO-252 T_{JA}	56.9				°C/W
		LM317L	**LM317L-N**			
0.1 A	Input voltage range	3.75 - 40	4.25 - 40			V
	Load regulation accuracy	1	1.5			%
	PSRR (120 Hz)	62	80			dB
	Recommended operating temperature	–40 to 125	–40 to 125			°C
	SOT-23 T_{JA}	167.8	N/A			°C/W
	SO-8 T_{JA}	N/A	165			°C/W
	DSBGA T_{JA}	N/A	290			°C/W
	TO-92 T_{JA}	N/A	180			°C/W

6 Pin Configuration and Functions

DCY Package
3-Pin SOT-223
Top View

```
ADJUST    1

OUTPUT    2        4    OUTPUT

INPUT     3
```

Not to scale

KCS or KCT Package
3-Pin TO-220
Top View

```
OUTPUT    3    INPUT
          2    OUTPUT
          1    ADJUST
```

Not to scale

KTT Package
3-Pin TO-263
Top View

```
OUTPUT    3    INPUT
          2    OUTPUT
          1    ADJUST
```

Not to scale
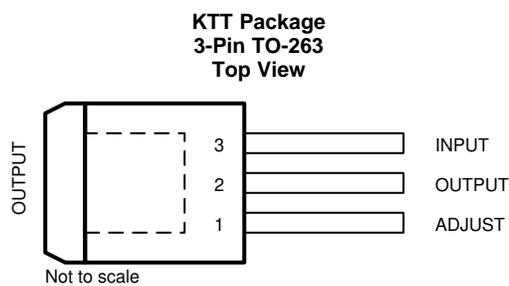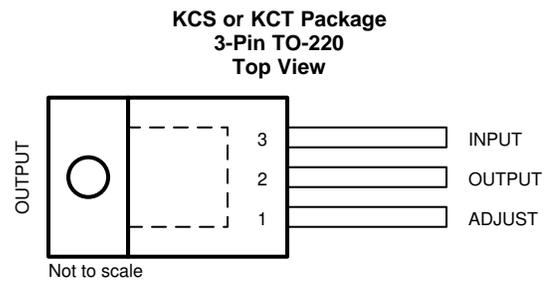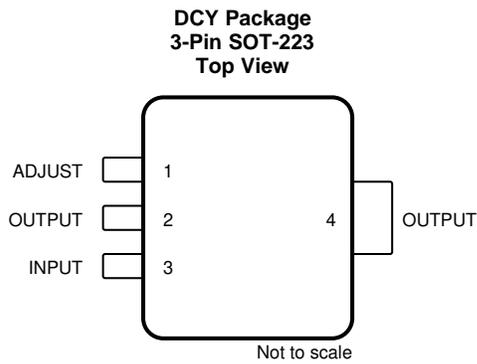
Pin Functions

PIN			I/O	DESCRIPTION
NAME	TO-263, TO-220	SOT-223		
ADJUST	1	1	I	Output voltage adjustment pin. Connect to a resistor divider to set V_O
INPUT	3	3	I	Supply input pin
OUTPUT	2	2, 4	O	Voltage output pin

7 Specifications

7.1 Absolute Maximum Ratings

over virtual junction temperature range (unless otherwise noted)[1]

		MIN	MAX	UNIT
$V_I - V_O$	Input-to-output differential voltage		40	V
T_J	Operating virtual junction temperature		150	°C
	Lead temperature 1,6 mm (1/16 in) from case for 10 s		260	°C
T_{stg}	Storage temperature	−65	150	°C

(1) Stresses beyond 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 beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

7.2 ESD Ratings

			MAX	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001[1]	2500	V
		Charged device model (CDM), per JEDEC specification JESD22-C101[2]	1000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

7.3 Recommended Operating Conditions

		MIN	MAX	UNIT
V_O	Output voltage	1.25	37	V
$V_I - V_O$	Input-to-output differential voltage	3	40	V
I_O	Output current	0.01	1.5	A
T_J	Operating virtual junction temperature	0	125	°C

7.4 Thermal Information

THERMAL METRIC[1]		LM317				UNIT
		DCY (SOT-223)	KCS (TO-220)	KCT (TO-220)	KTT (TO-263)	
		4 PINS	3 PINS	3 PINS	3 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	66.8	23.5	37.9	38.0	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	43.2	15.9	51.1	36.5	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	16.9	7.9	23.2	18.9	°C/W
ψ_{JT}	Junction-to-top characterization parameter	3.6	3.0	13.0	6.9	°C/W
ψ_{JB}	Junction-to-board characterization parameter	16.8	7.8	22.8	17.9	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	NA	0.1	4.2	1.1	°C/W

(1) For more information about traditional and new thermal metrics, see the *Semiconductor and IC package thermal metrics* application report.

7.5 Electrical Characteristics

over recommended ranges of operating virtual junction temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS[1]			MIN	TYP	MAX	UNIT
Line regulation[2]	$V_I - V_O$ = 3 V to 40 V		T_J = 25°C		0.01	0.04	%/V
			T_J = 0°C to 125°C		0.02	0.07	
Load regulation	I_O = 10 mA to 1500 mA	C_{ADJ}[3] = 10 μF, T_J = 25°C	V_O ≤ 5 V			25	mV
			V_O ≥ 5 V		0.1	0.5	%V_O
		T_J = 0°C to 125°C	V_O ≤ 5 V		20	70	mV
			V_O ≥ 5 V		0.3	1.5	%V_O
Thermal regulation	20-ms pulse, T_J = 25°C				0.03	0.07	%V_O/W
ADJUST terminal current					50	100	μA
Change in ADJUST terminal current	$V_I - V_O$ = 2.5 V to 40 V, P_D ≤ 20 W, I_O = 10 mA to 1500 mA				0.2	5	μA
Reference voltage	$V_I - V_O$ = 3 V to 40 V, P_D ≤ 20 W, I_O = 10 mA to 1500 mA			1.2	1.25	1.3	V
Output-voltage temperature stability	T_J = 0°C to 125°C				0.7		%V_O
Minimum load current to maintain regulation	$V_I - V_O$ = 40 V				3.5	10	mA
Maximum output current	$V_I - V_O$ ≤ 15 V, P_D < P_{MAX}[4]			1.5	2.2		A
	$V_I - V_O$ ≤ 40 V, P_D < P_{MAX}[4], T_J = 25°C			0.15	0.4		
RMS output noise voltage (% of V_O)	f = 10 Hz to 10 kHz, T_J = 25°C				0.003		%V_O
Ripple rejection	V_O = 10 V, f = 120 Hz	C_{ADJ} = 0 μF[3]			57		dB
		C_{ADJ} = 10 μF[3]		62	64		
Long-term stability	T_J = 25°C				0.3	1	%/1k hr

(1) Unless otherwise noted, the following test conditions apply: $|V_I - V_O|$ = 5 V and I_{OMAX} = 1.5 A, T_J = 0°C to 125°C. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.
(2) Line regulation is expressed here as the percentage change in output voltage per 1-V change at the input.
(3) C_{ADJ} is connected between the ADJUST terminal and GND.
(4) Maximum power dissipation is a function of T_J(max), $θ_{JA}$, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is P_D = (T_J(max) − T_A) / $θ_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.

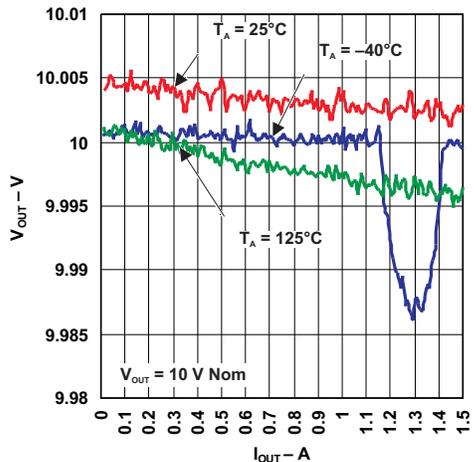## 7.6 Typical Characteristics

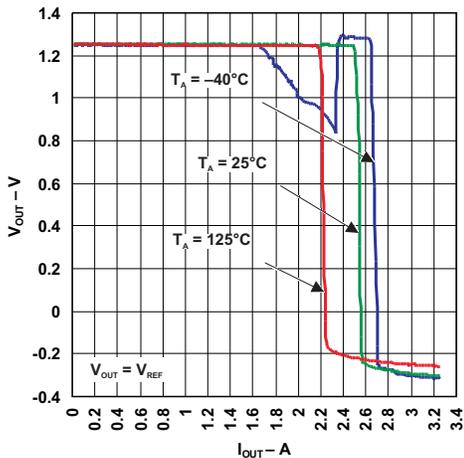
Figure 1. Load Regulation

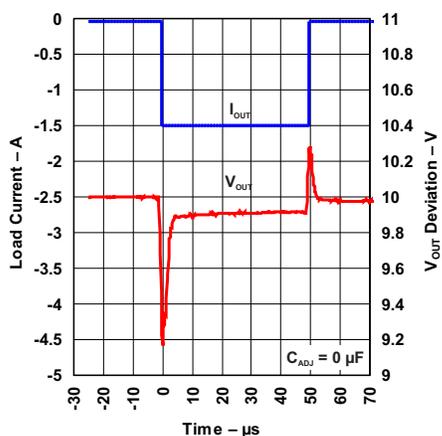Figure 2. Load Regulation

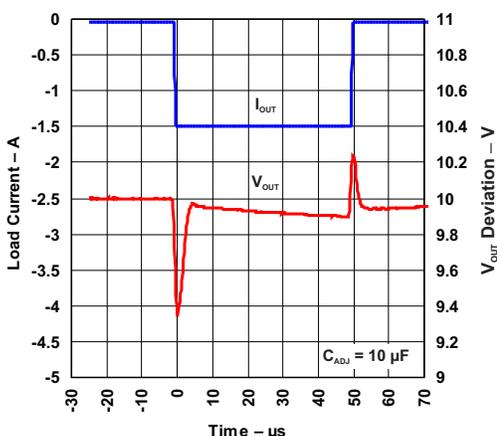Figure 3. Load Transient Response
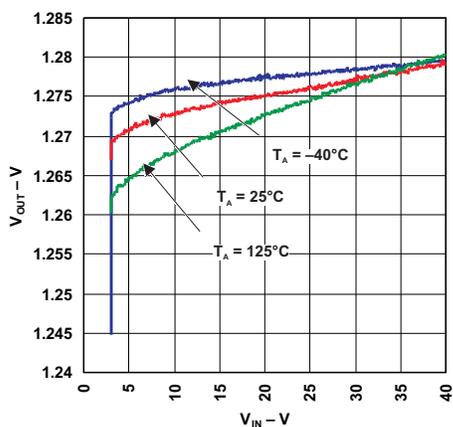

Figure 4. Load Transient Response
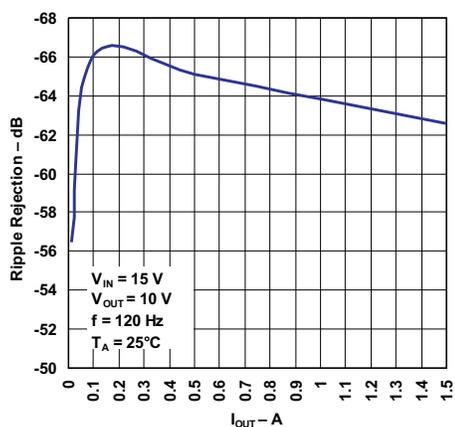

Figure 5. Line Regulation

Figure 6. Ripple Rejection
vs Output Current

Typical Characteristics (continued)
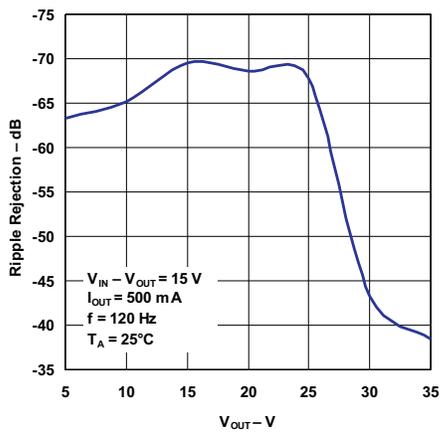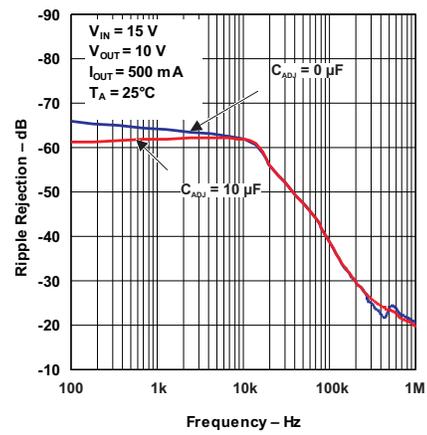

Figure 7. Ripple Rejection
vs Output Voltage

**Figure 8. Ripple Rejection**
vs Frequency

8 Detailed Description

8.1 Overview

The LM317 device is an adjustable three-terminal positive-voltage regulator capable of supplying up to 1.5 A over an output-voltage range of 1.25 V to 37 V. It requires only two external resistors to set the output voltage. The device features a typical line regulation of 0.01% and typical load regulation of 0.1%. It includes current limiting, thermal overload protection, and safe operating area protection. Overload protection remains functional even if the ADJUST terminal is disconnected.

The LM317 device is versatile in its applications, including uses in programmable output regulation and local on-card regulation. Or, by connecting a fixed resistor between the ADJUST and OUTPUT terminals, the LM317 device can function as a precision current regulator. An optional output capacitor can be added to improve transient response. The ADJUST terminal can be bypassed to achieve very high ripple-rejection ratios, which are difficult to achieve with standard three-terminal regulators.

8.2 Functional Block Diagram
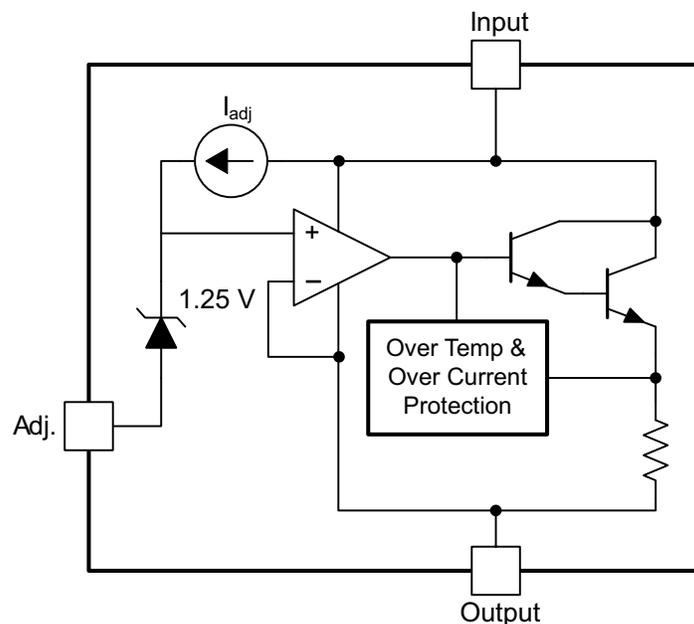
8.3 Feature Description

8.3.1 NPN Darlington Output Drive

NPN Darlington output topology provides naturally low output impedance and an output capacitor is optional. 3-V headroom is recommended ($V_I – V_O$) to support maximum current and lowest temperature.

8.3.2 Overload Block

Over-current and over-temperature shutdown protects the device against overload or damage from operating in excessive heat.

8.3.3 Programmable Feedback

Op amp with 1.25-V offset input at the ADJUST terminal provides easy output voltage or current (not both) programming. For current regulation applications, a single resistor whose resistance value is 1.25 V/I_O and power rating is greater than $(1.25\ V)^2/R$ should be used. For voltage regulation applications, two resistors set the output voltage.

8.4 Device Functional Modes

8.4.1 Normal Operation

The device OUTPUT pin will source current necessary to make OUTPUT pin 1.25 V greater than ADJUST terminal to provide output regulation.

8.4.2 Operation With Low Input Voltage

The device requires up to 3-V headroom ($V_I - V_O$) to operate in regulation. The device may drop out and OUTPUT voltage will be INPUT voltage minus drop out voltage with less headroom.

8.4.3 Operation at Light Loads

The device passes its bias current to the OUTPUT pin. The load or feedback must consume this minimum current for regulation or the output may be too high. See the *Electrical Characteristics* table for the minimum load current needed to maintain regulation.

8.4.4 Operation In Self Protection

When an overload occurs the device shuts down Darlington NPN output stage or reduces the output current to prevent device damage. The device will automatically reset from the overload. The output may be reduced or alternate between on and off until the overload is removed.

9 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The flexibility of the LM317 allows it to be configured to take on many different functions in DC power applications.
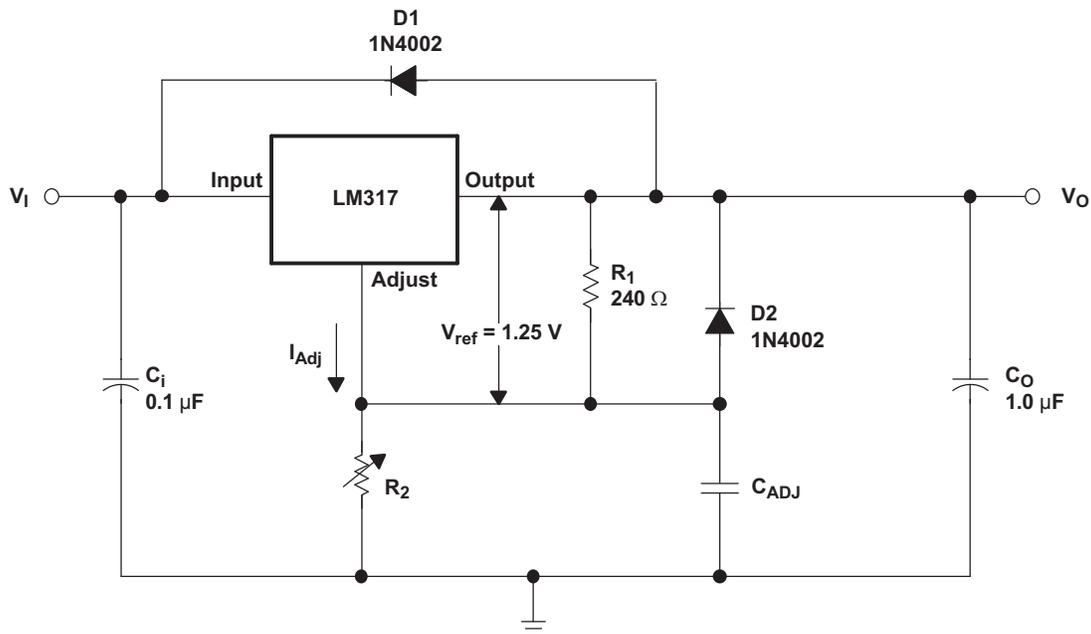
9.2 Typical Application

Figure 9. Adjustable Voltage Regulator

9.2.1 Design Requirements

- R1 and R2 are required to set the output voltage.
- C_{ADJ} is recommended to improve ripple rejection. It prevents amplification of the ripple as the output voltage is adjusted higher.
- C_i is recommended, particularly if the regulator is not in close proximity to the power-supply filter capacitors. A 0.1-µF or 1-µF ceramic or tantalum capacitor provides sufficient bypassing for most applications, especially when adjustment and output capacitors are used.
- C_O improves transient response, but is not needed for stability.
- Protection diode D2 is recommended if C_{ADJ} is used. The diode provides a low-impedance discharge path to prevent the capacitor from discharging into the output of the regulator.
- Protection diode D1 is recommended if C_O is used. The diode provides a low-impedance discharge path to prevent the capacitor from discharging into the output of the regulator.
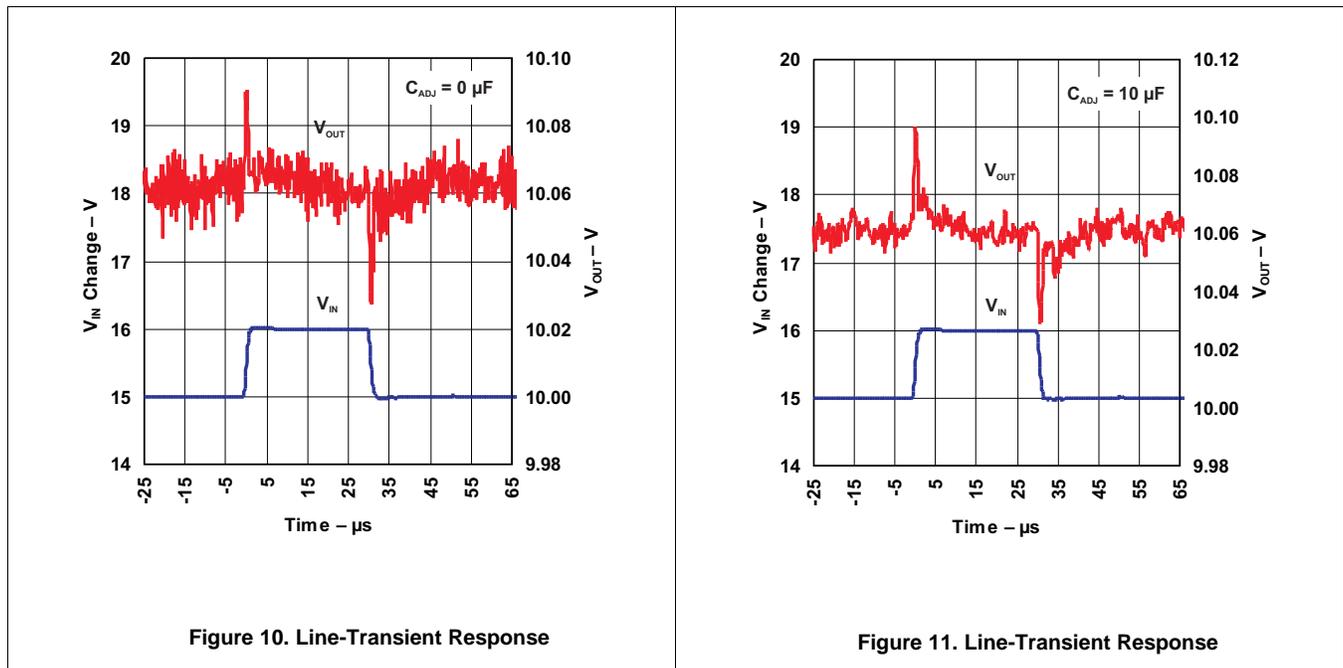
9.2.2 Detailed Design Procedure

V_O is calculated as shown in Equation 1. I_{ADJ} is typically 50 µA and negligible in most applications.

$$V_O = V_{REF} (1 + R2 / R1) + (I_{ADJ} \times R2) \tag{1}$$

Typical Application (continued)

9.2.3 Application Curves

Figure 10. Line-Transient Response

Figure 11. Line-Transient Response

9.3 System Examples

9.3.1 0-V to 30-V Regulator Circuit

$$V_{OUT} = V_{REF}\left(1 + \frac{R_2 + R_3}{R_1}\right) - 10\,V$$

Here, the voltage is determined by
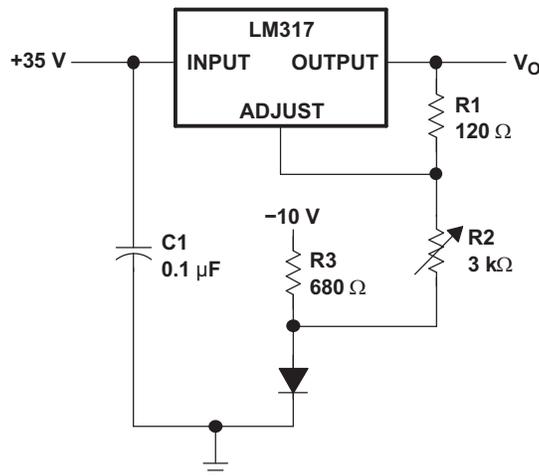
Figure 12. 0-V to 30-V Regulator Circuit

System Examples (continued)

9.3.2 Adjustable Regulator Circuit With Improved Ripple Rejection

C2 helps to stabilize the voltage at the adjustment pin, which helps reject noise. Diode D1 exists to discharge C2 in case the output is shorted to ground.
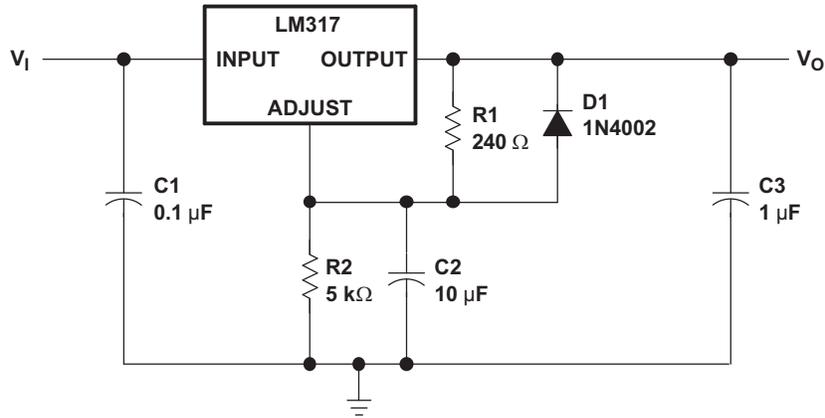
Figure 13. Adjustable Regulator Circuit with Improved Ripple Rejection

9.3.3 Precision Current-Limiter Circuit

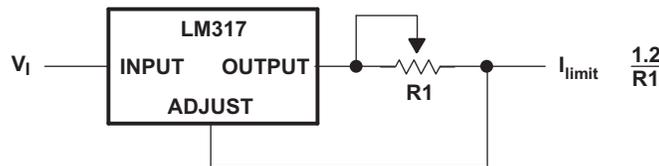This application limits the output current to the I_{LIMIT} in the diagram.

Figure 14. Precision Current-Limiter Circuit

9.3.4 Tracking Preregulator Circuit

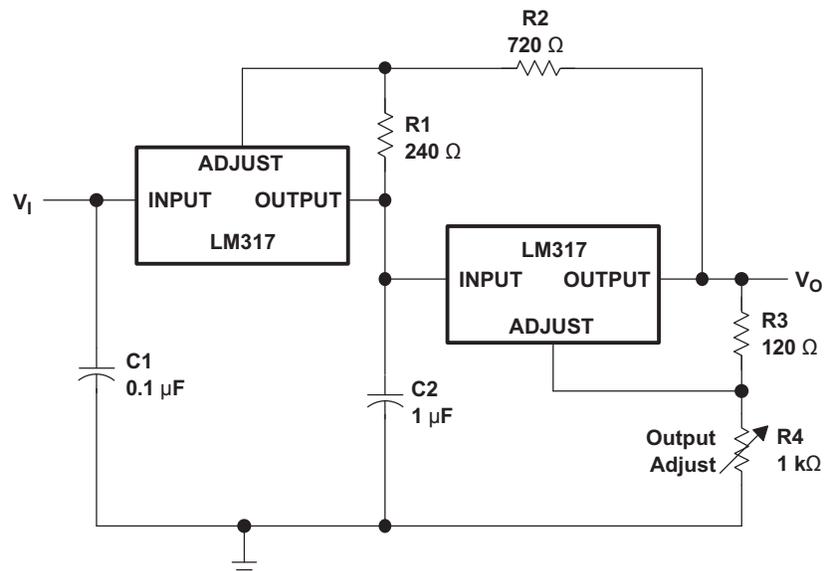This application keeps a constant voltage across the second LM317 in the circuit.

Figure 15. Tracking Preregulator Circuit

System Examples (continued)

9.3.5 1.25-V to 20-V Regulator Circuit With Minimum Program Current

Because the value of V_{REF} is constant, the value of R1 determines the amount of current that flows through R1 and R2. The size of R2 determines the IR drop from ADJUSTMENT to GND. Higher values of R2 translate to higher V_{OUT}.

$$V_{OUT} = V_{REF}\left(1 + \frac{R_2 + R_3}{R_1}\right) - 10\,V \tag{2}$$
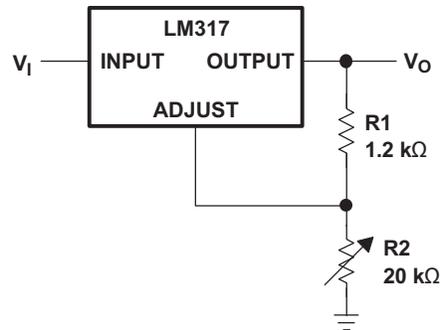
$$(R1 + R2)min = Vo\,I_{reg(min)} \tag{3}$$

Figure 16. 1.25-V to 20-V Regulator Circuit With Minimum Program Current

9.3.6 Battery-Charger Circuit

The series resistor limits the current output of the LM317, minimizing damage to the battery cell.

$$V_{OUT} = 1.25\,V \times \left(1 + \frac{R2}{R1}\right) \tag{4}$$

$$I_{OUT}(short) = \frac{1.25V}{RS} \tag{5}$$

$$Output\ Impedance = RS \times \left(1 + \frac{R2}{R1}\right) \tag{6}$$
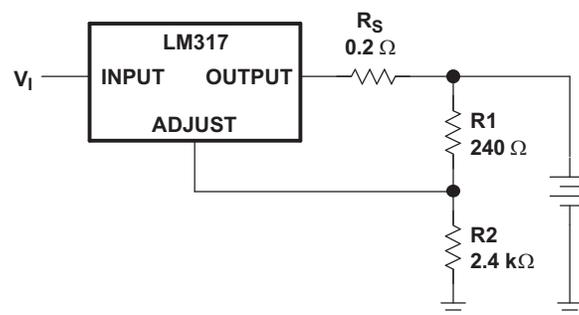

Figure 17. Battery-Charger Circuit

System Examples (continued)

9.3.7 50-mA Constant-Current Battery-Charger Circuit

The current limit operation mode can be used to trickle charge a battery at a fixed current. I_{CHG} = 1.25 V ÷ 24 Ω. V_I should be greater than V_{BAT} + 4.25 V. (1.25 V [V_{REF}] + 3 V [headroom])
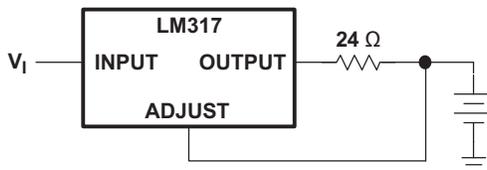
Figure 18. 50-mA Constant-Current Battery-Charger Circuit

9.3.8 Slow Turn-On 15-V Regulator Circuit

The capacitor C1, in combination with the PNP transistor, helps the circuit to slowly start supplying voltage. In the beginning, the capacitor is not charged. Therefore output voltage starts at V_{C1}+ V_{BE} + 1.25 V = 0 V + 0.65 V + 1.25 V = 1.9 V. As the capacitor voltage rises, V_{OUT} rises at the same rate. When the output voltage reaches the value determined by R1 and R2, the PNP will be turned off.
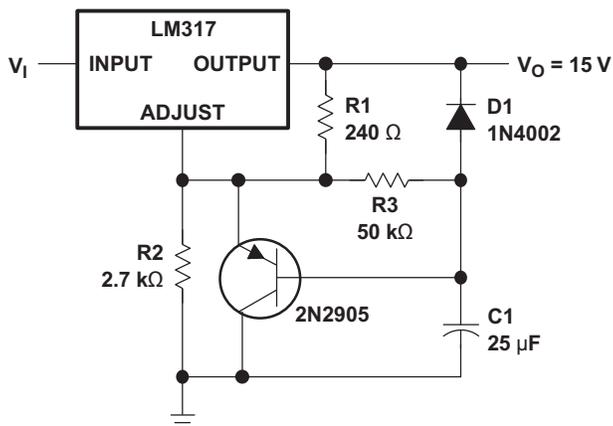
Figure 19. Slow Turn-On 15-V Regulator Circuit

9.3.9 AC Voltage-Regulator Circuit

These two LM317s can regulate both the positive and negative swings of a sinusoidal AC input.
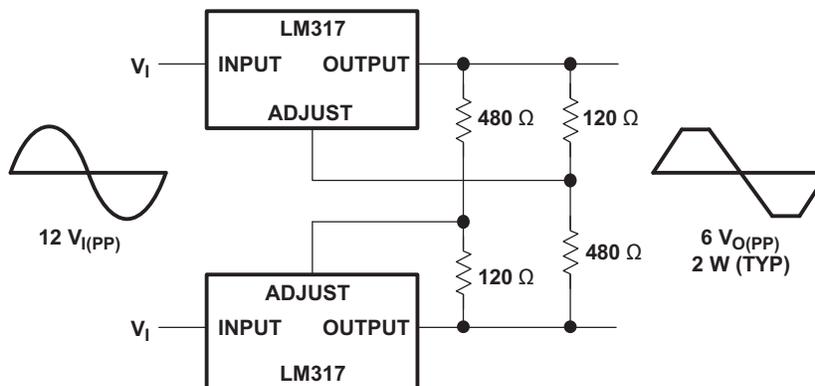
Figure 20. AC Voltage-Regulator Circuit

System Examples (continued)

9.3.10 Current-Limited 6-V Charger Circuit

As the charge current increases, the voltage at the bottom resistor increases until the NPN starts sinking current from the adjustment pin. The voltage at the adjustment pin drops, and consequently the output voltage decreases until the NPN stops conducting.
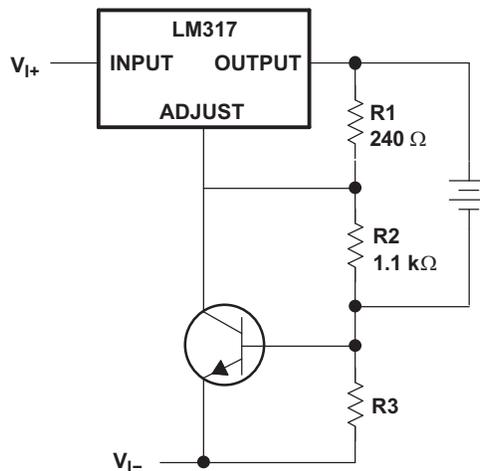
Figure 21. Current-Limited 6-V Charger Circuit

9.3.11 Adjustable 4-A Regulator Circuit

This application keeps the output current at 4 A while having the ability to adjust the output voltage using the adjustable (1.5 kΩ in schematic) resistor.
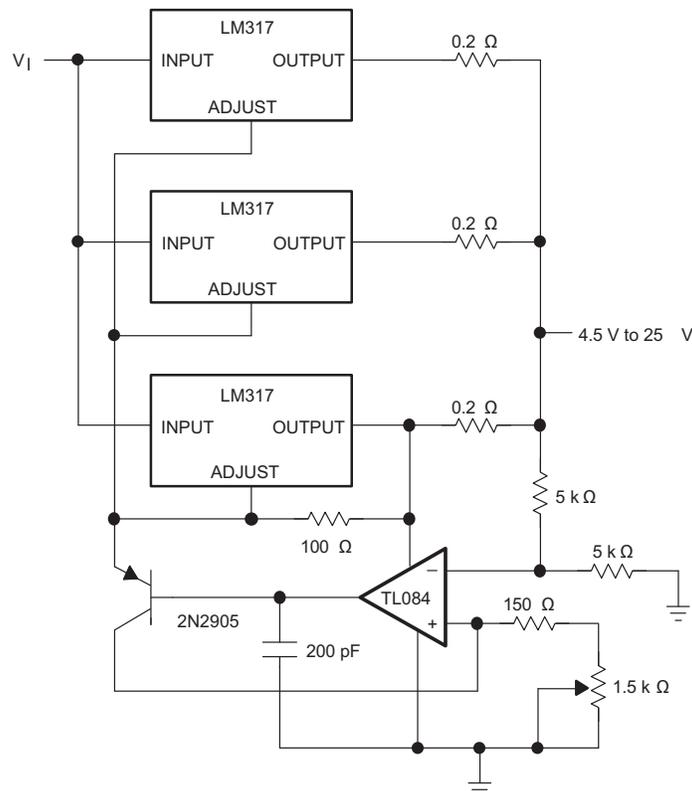
Figure 22. Adjustable 4-A Regulator Circuit

System Examples (continued)

9.3.12 High-Current Adjustable Regulator Circuit

The NPNs at the top of the schematic allow higher currents at V_{OUT} than the LM317 can provide, while still keeping the output voltage at levels determined by the adjustment pin resistor divider of the LM317.
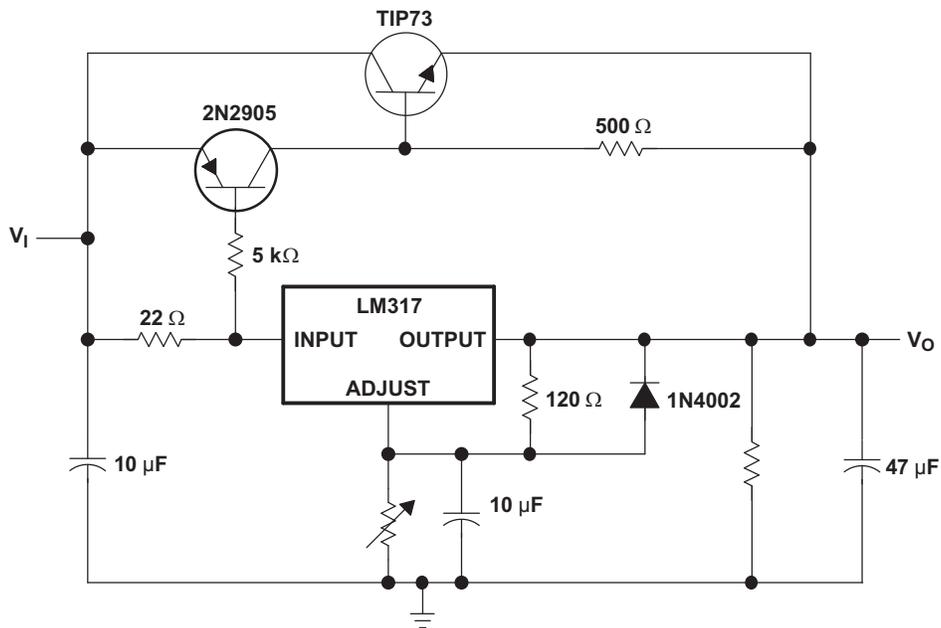
Figure 23. High-Current Adjustable Regulator Circuit

10 Power Supply Recommendations

The LM317 is designed to operate from an input voltage supply range between 1.25 V to 37 V greater than the output voltage. If the device is more than six inches from the input filter capacitors, an input bypass capacitor, 0.1 μF or greater, of any type is needed for stability.

11 Layout

11.1 Layout Guidelines

- TI recommends that the input terminal be bypassed to ground with a bypass capacitor.
- The optimum placement is closest to the input terminal of the device and the system GND. Take care to minimize the loop area formed by the bypass-capacitor connection, the input terminal, and the system GND.
- For operation at full rated load, TI recommends to use wide trace lengths to eliminate I × R drop and heat dissipation.

11.2 Layout Example
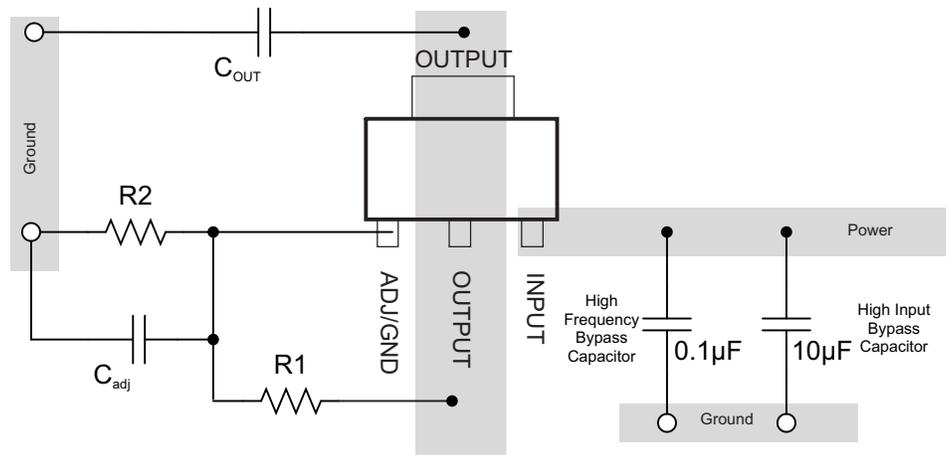
Figure 24. Layout Example

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12 器件和文档支持

12.1 接收文档更新通知

要接收文档更新通知，请导航至 ti.com.cn 上的器件产品文件夹。单击右上角的*通知我*进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

12.2 支持资源

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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12.3 商标

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12.4 静电放电警告

ESD 可能会损坏该集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理措施和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

12.5 Glossary

SLYZ022 — *TI Glossary*.
This glossary lists and explains terms, acronyms, and definitions.

13 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。如需获取此数据表的浏览器版本，请查阅左侧的导航栏。

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LM317DCY	ACTIVE	SOT-223	DCY	4	80	RoHS & Green	SN	Level-2-260C-1 YEAR	0 to 125	L3	Samples
LM317DCYG3	ACTIVE	SOT-223	DCY	4	80	RoHS & Green	SN	Level-2-260C-1 YEAR	0 to 125	L3	Samples
LM317DCYR	ACTIVE	SOT-223	DCY	4	2500	RoHS & Green	SN	Level-2-260C-1 YEAR	0 to 125	L3	Samples
LM317DCYRG3	ACTIVE	SOT-223	DCY	4	2500	RoHS & Green	SN	Level-2-260C-1 YEAR	0 to 125	L3	Samples
LM317KCS	ACTIVE	TO-220	KCS	3	50	RoHS & Green	SN	N / A for Pkg Type	0 to 125	LM317	Samples
LM317KCSE3	ACTIVE	TO-220	KCS	3	50	RoHS & Green	SN	N / A for Pkg Type	0 to 125	LM317	Samples
LM317KCT	ACTIVE	TO-220	KCT	3	50	RoHS & Non-Green	SN	N / A for Pkg Type	0 to 125	LM317	Samples
LM317KTTR	ACTIVE	DDPAK/ TO-263	KTT	3	500	RoHS & Green	SN	Level-3-245C-168 HR	0 to 125	LM317	Samples
LM317KTTRG3	ACTIVE	DDPAK/ TO-263	KTT	3	500	RoHS & Green	SN	Level-3-245C-168 HR	0 to 125	LM317	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
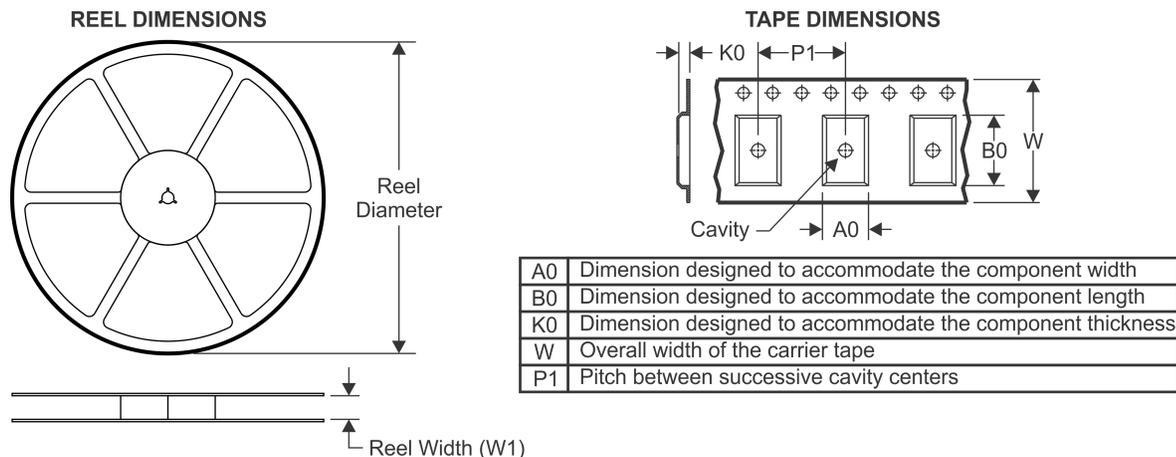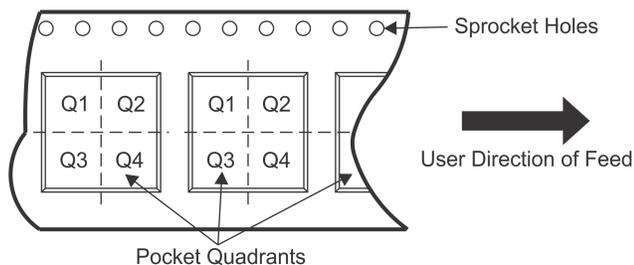
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
LM317DCYR	SOT-223	DCY	4	2500	330.0	12.4	6.55	7.25	1.9	8.0	12.0	Q3
LM317DCYR	SOT-223	DCY	4	2500	330.0	12.4	7.05	7.4	1.9	8.0	12.0	Q3
LM317DCYR	SOT-223	DCY	4	2500	330.0	12.4	7.0	7.42	2.0	8.0	12.0	Q3
LM317KTTR	DDPAK/ TO-263	KTT	3	500	330.0	24.4	10.8	16.1	4.9	16.0	24.0	Q2

TAPE AND REEL BOX DIMENSIONS
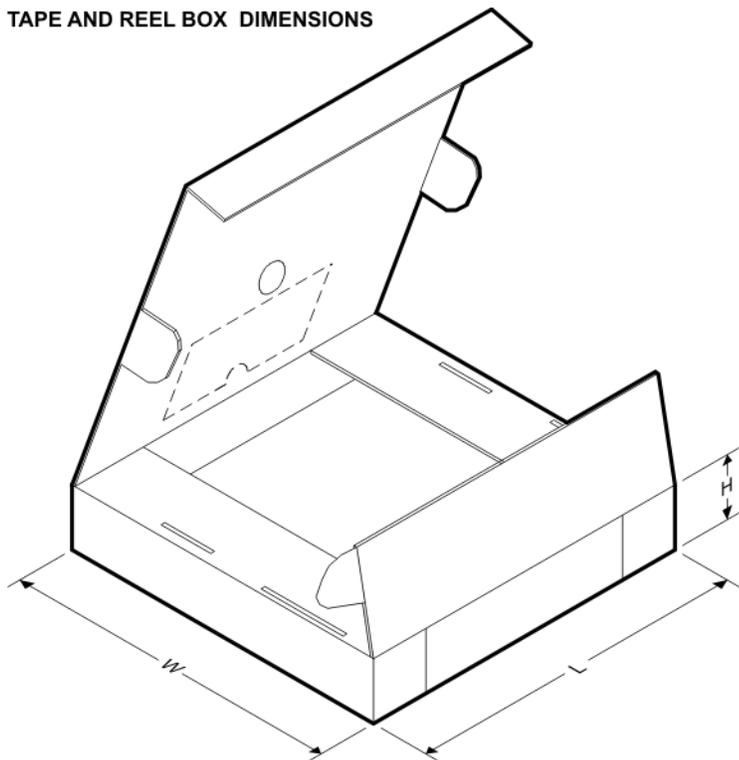
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LM317DCYR	SOT-223	DCY	4	2500	336.0	336.0	48.0
LM317DCYR	SOT-223	DCY	4	2500	340.0	340.0	38.0
LM317DCYR	SOT-223	DCY	4	2500	350.0	334.0	47.0
LM317KTTR	DDPAK/TO-263	KTT	3	500	350.0	334.0	47.0

TUBE

T - Tube height

L - Tube length

W - Tube width

B - Alignment groove width
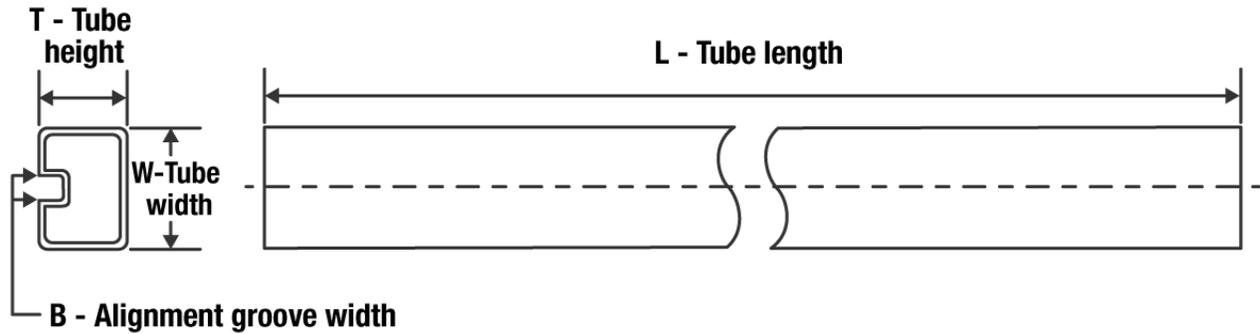
*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
LM317DCY	DCY	SOT-223	4	80	542.9	8.6	3606	2.67
LM317DCY	DCY	SOT-223	4	80	559	8.6	500	3.6
LM317DCYG3	DCY	SOT-223	4	80	559	8.6	500	3.6
LM317DCYG3	DCY	SOT-223	4	80	542.9	8.6	3606	2.67
LM317KCS	KCS	TO-220	3	50	532	34.1	700	9.6
LM317KCS	KCS	TO-220	3	50	532	34.1	700	9.6
LM317KCSE3	KCS	TO-220	3	50	532	34.1	700	9.6
LM317KCSE3	KCS	TO-220	3	50	532	34.1	700	9.6
LM317KCT	KCT	TO-220	3	50	534.5	33	7000	3.4

KTT (R−PSFM−G3)   PLASTIC FLANGE−MOUNT PACKAGE
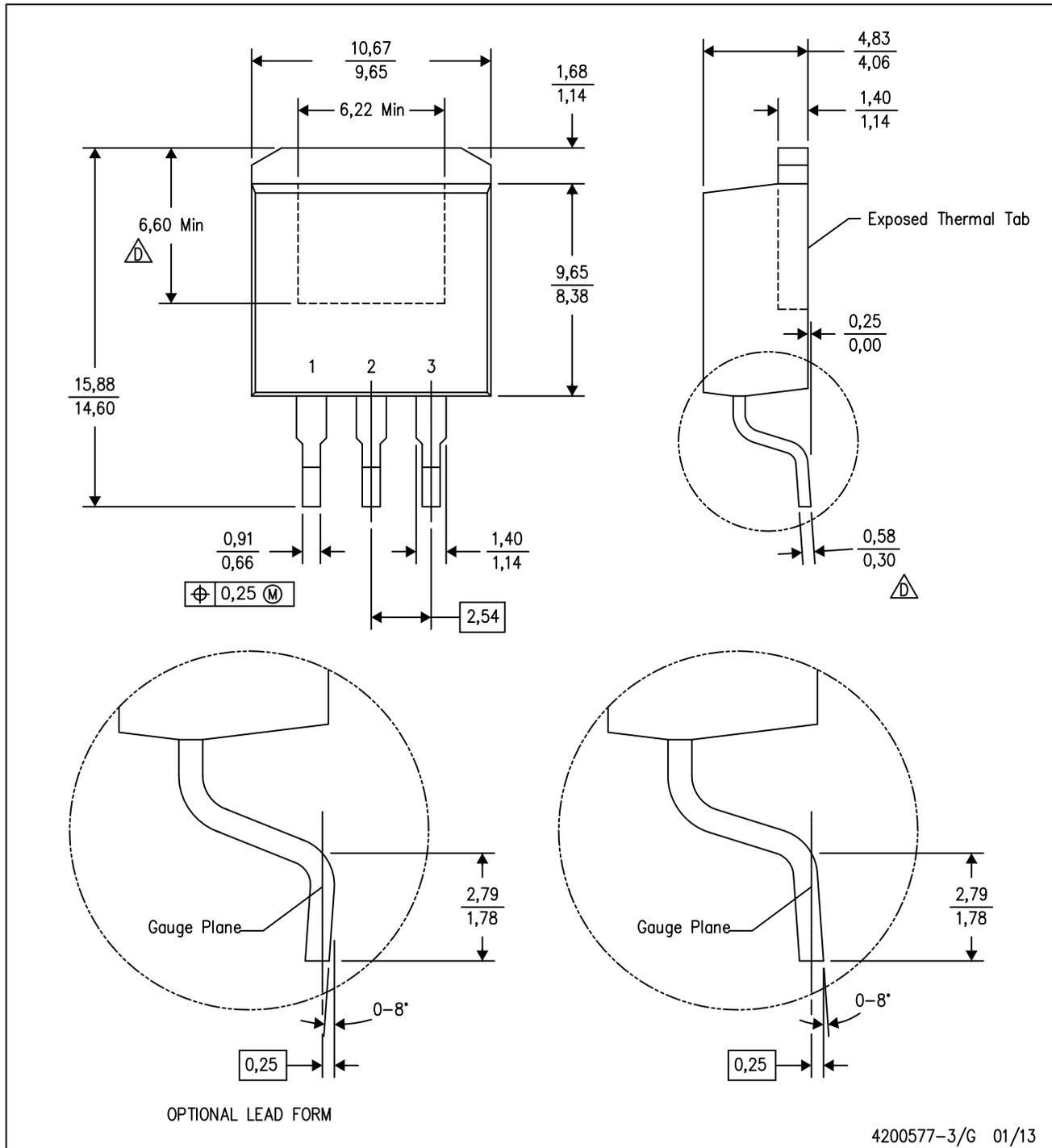
10,67 / 9,65

1,68 / 1,14

6,22 Min

4,83 / 4,06

1,40 / 1,14

6,60 Min

Exposed Thermal Tab

9,65 / 8,38

15,88 / 14,60

1   2   3

0,25 / 0,00

0,91 / 0,66

1,40 / 1,14

⊕ 0,25 Ⓜ

2,54

0,58 / 0,30

2,79 / 1,78

Gauge Plane

0−8°

0,25

2,79 / 1,78

Gauge Plane

0−8°

0,25

OPTIONAL LEAD FORM

4200577−3/G 01/13
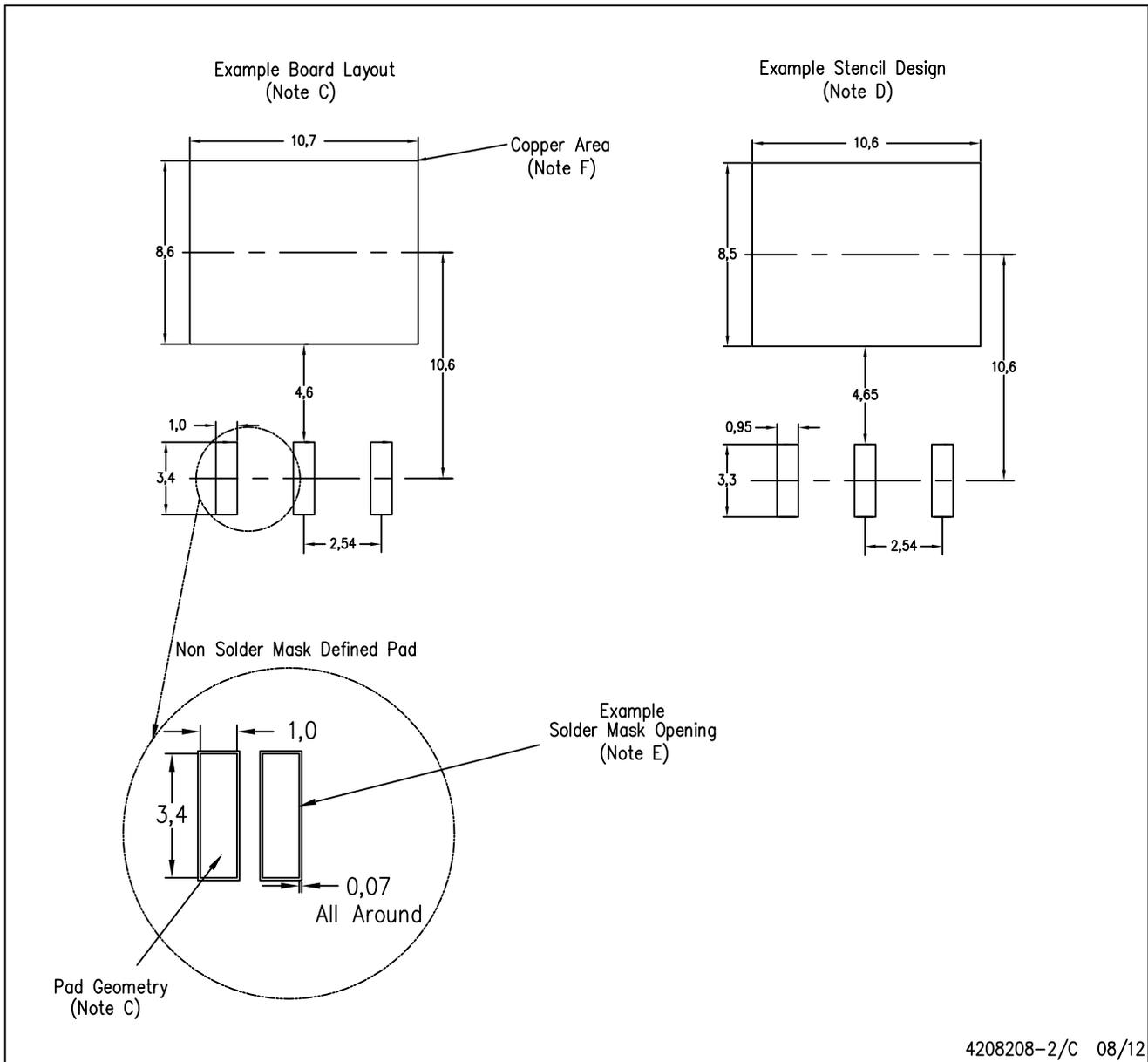
NOTES: A. All linear dimensions are in millimeters.
         B. This drawing is subject to change without notice.
         C. Body dimensions do not include mold flash or protrusion. Mold flash or protrusion not to exceed 0.005 (0,13) per side.
         D. Falls within JEDEC TO−263 variation AA, except minimum lead thickness and minimum exposed pad length.

KTT (R−PSFM−G3)   PLASTIC FLANGE−MOUNT PACKAGE

Example Board Layout
(Note C)

10,7

8,6

10,6

Copper Area
(Note F)

4,6

1,0

3,4

2,54

Example Stencil Design
(Note D)

10,6

8,5

10,6

4,65

0,95

3,3

2,54

Non Solder Mask Defined Pad

1,0

3,4

0,07
All Around

Example
Solder Mask Opening
(Note E)

Pad Geometry
(Note C)

4208208−2/C   08/12

NOTES: A.   All linear dimensions are in millimeters.
         B.   This drawing is subject to change without notice.
         C.   Publication IPC−SM−782 is recommended for alternate designs.
         D.   Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release.
              Customers should contact their board assembly site for stencil design recommendations. Refer to IPC−7525.
         E.   Customers should contact their board fabrication site for solder mask tolerances between and around
              signal pads.
         F.   This package is designed to be soldered to a thermal pad on the board. Refer to the Product Datasheet
              for specific thermal information, via requirements, and recommended thermal pad size. For thermal pad
              sizes larger than shown a solder mask defined pad is recommended in order to maintain the solderable
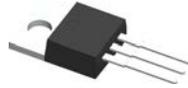   pad geometry while increasing copper area.

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DCY (R-PDSO-G4)   **PLASTIC SMALL-OUTLINE**

4202506/B 06/2002
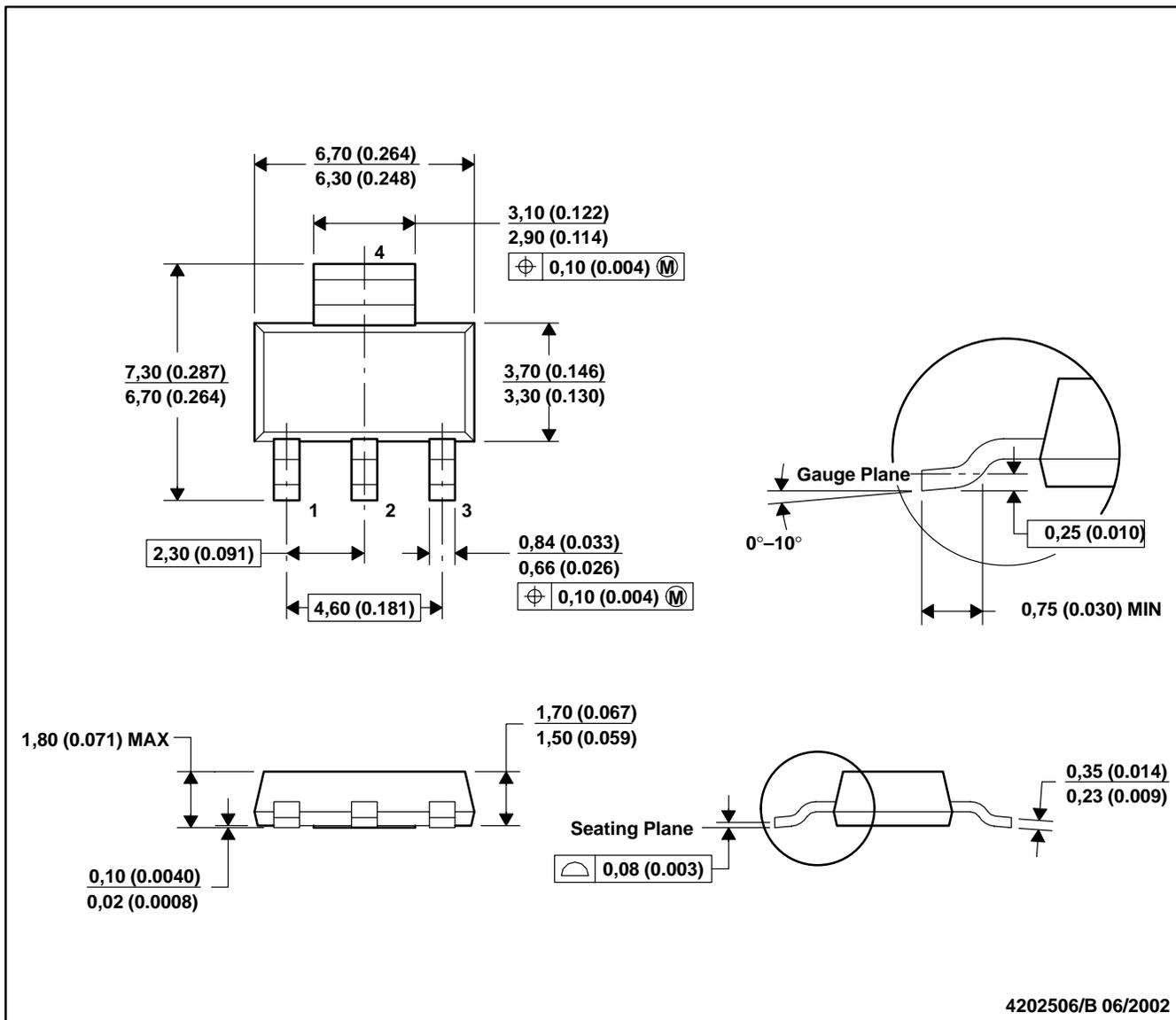
NOTES: A. All linear dimensions are in millimeters (inches).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
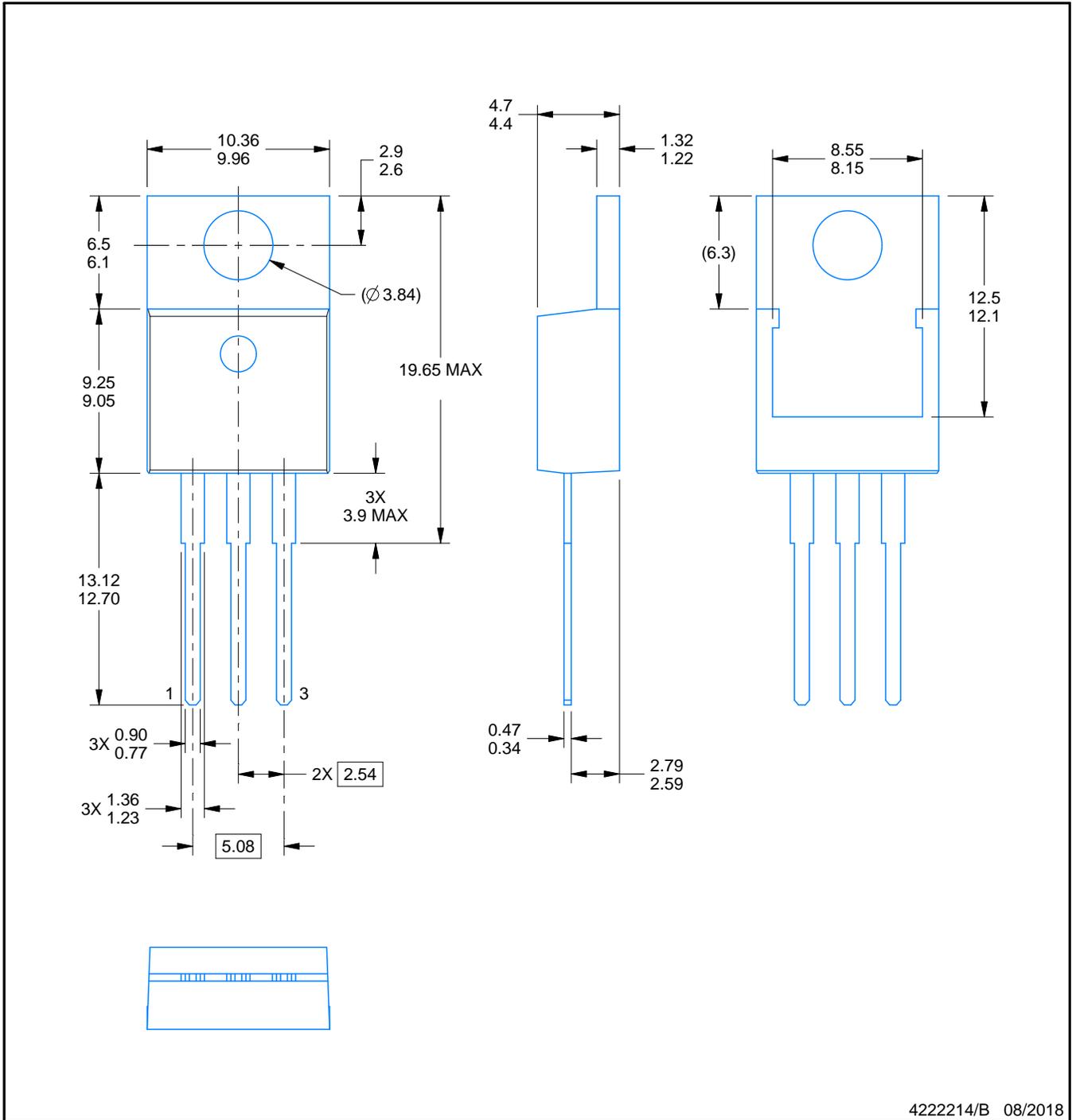D. Falls within JEDEC TO-261 Variation AA.
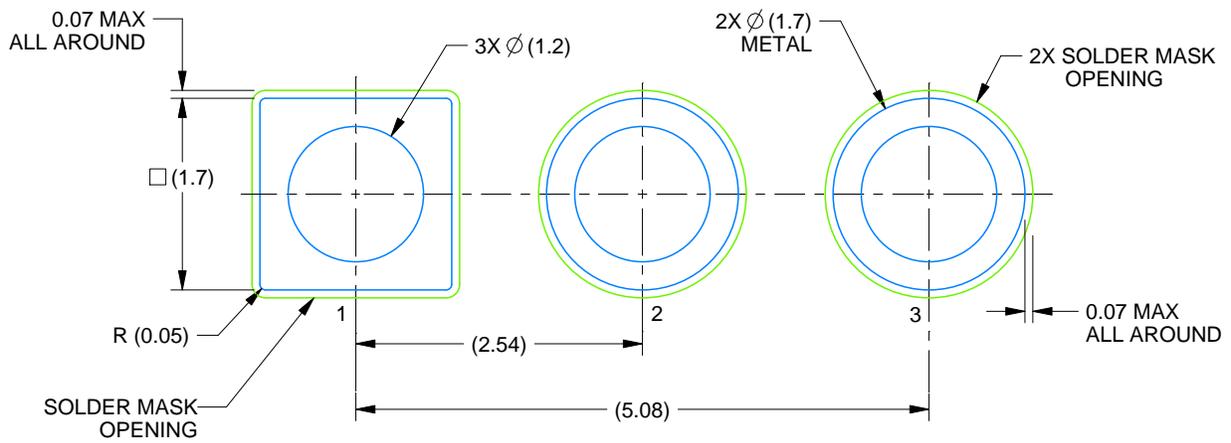
4222214/B   08/2018

NOTES:

1. Dimensions are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-220.

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0.07 MAX
ALL AROUND

3X ∅ (1.2)

2X ∅ (1.7)
METAL

2X SOLDER MASK
OPENING

□ (1.7)

R (0.05)

SOLDER MASK
OPENING

0.07 MAX
ALL AROUND

1

2

3

(2.54)

(5.08)

LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE:15X

4222214/B 08/2018

10.67
9.65

3.05
2.54

6.86
5.84

⌀ 3.60-3.96

8.79
8.39

20.55
MAX

(3.18)
NOTE 3

4.04 MAX

14.73
12.70

OPTIONAL

1   3

3X 0.91
0.71

2X 2.54

3X 1.78
1.14

5.08

4.65
4.25

0.61
0.46

(6.35)

OPTIONAL
CHAMFER

0.61
0.46

2.92
2.03

OPTIONAL
2X

8.74
8.14
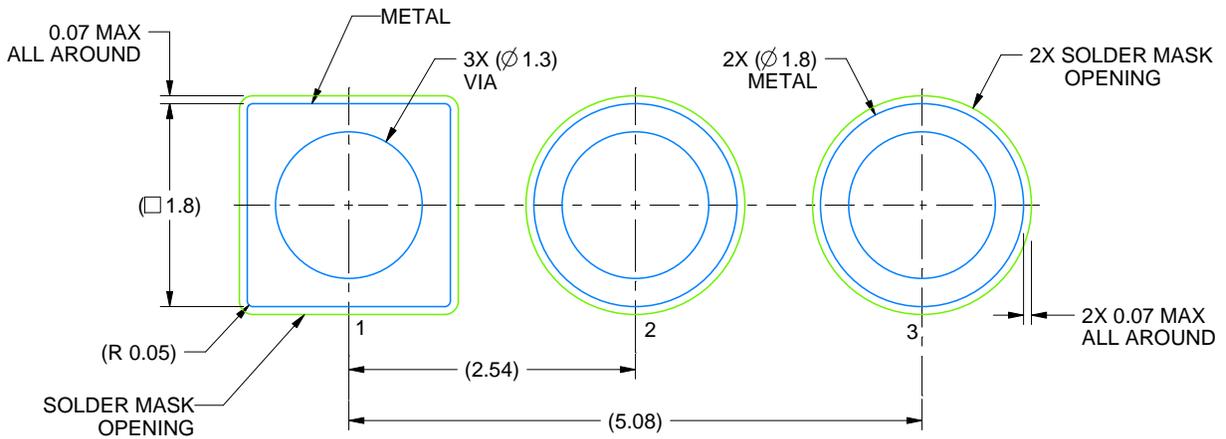
12.8
12.2
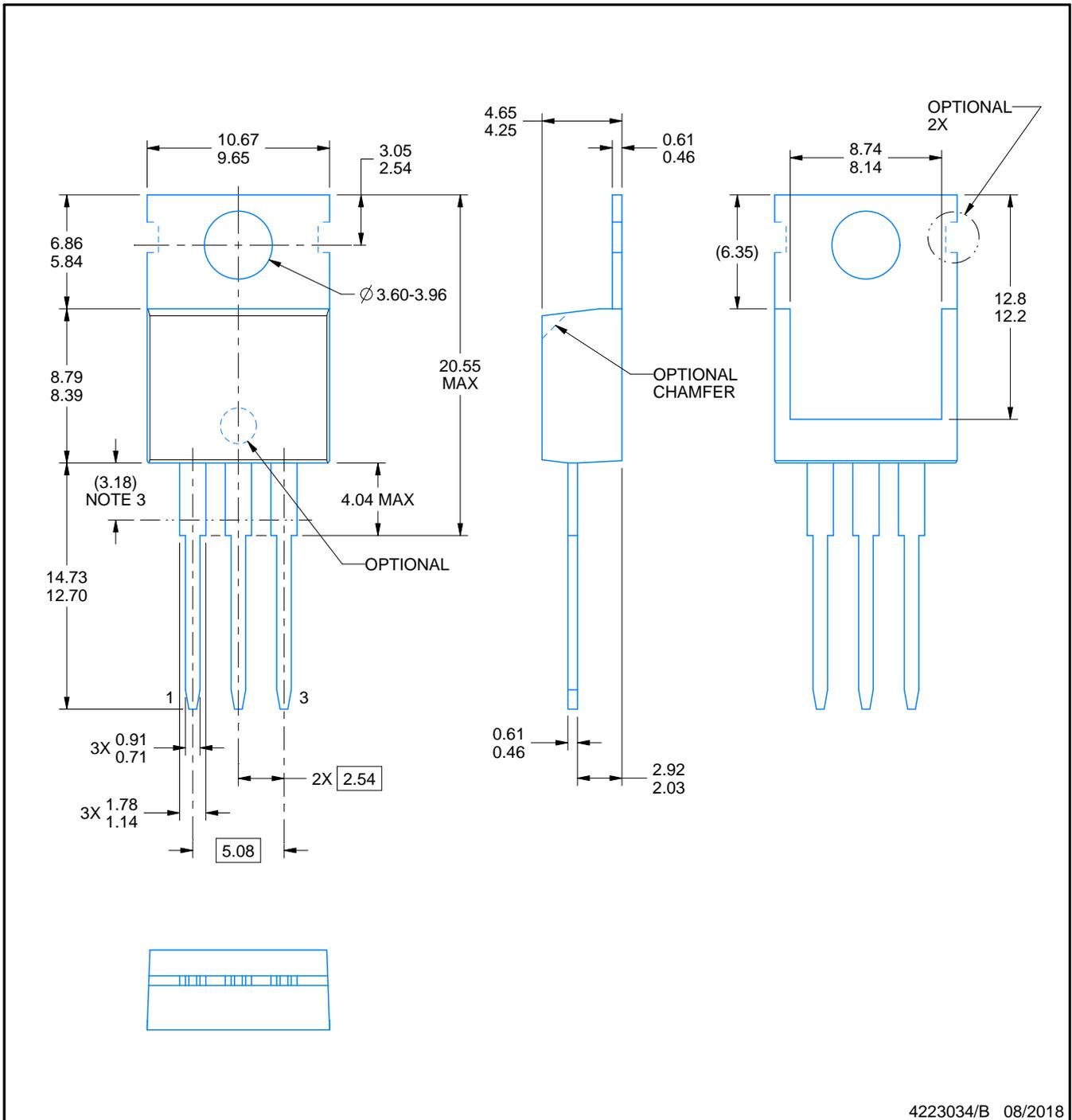
4223034/B   08/2018

NOTES:

1. Dimensions are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing
   per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Lead dimensions are not controlled within this area.
4. Reference JEDEC registration TO-220.

0.07 MAX
ALL AROUND

METAL

3X (∅ 1.3)
VIA

2X (∅ 1.8)
METAL

2X SOLDER MASK
OPENING

(☐ 1.8)

(R 0.05)

SOLDER MASK
OPENING

1

2

3

2X 0.07 MAX
ALL AROUND

(2.54)

(5.08)

LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE:15X

4223034/B   08/2018

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