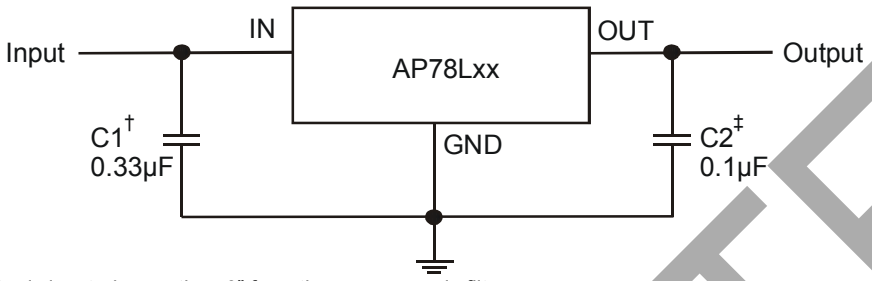
Typical Application Circuit

Fixed Output Regulator



(†) Required if the regulator is located more than 3" from the power supply filter
(‡) See Note 5 in the electrical characteristics table

Pin Descriptions

Pin Name	Description
V_{IN}	Operating Voltage Input
V_{OUT}	Voltage Output Pin
GND	Ground
NC	No Connection

Functional Block Diagram

Introduction

The AP78LXX series is a three terminal device with fixed output voltages from 5V,8V and 12V. The AP78LXX fixed voltage regulator series has built-in thermal overload protection which prevents the device from being damaged due to excessive junction temperature. The regulator also contains internal short-circuit protection which limits the maximum output current, and safe-area protection for the pass transistor which reduces the short-circuit current as the voltage across the pass transistor is increased.

Absolute Maximum Ratings (T_A = 25°C)

Symbol	Parameter		Rating	Unit
ESD HBM	Human Body Model ESD Protection		3	KV
ESD MM	Machine Model ESD Protection		250	V
V_{CC}	Supply Voltage		30	V
V_{OUT}	Output Voltage to Ground	AP78L05	5	V
		AP78L08	8	
		AP78L12	12	
T_{ST}	Storage Temperature		-65 to +150	°C
T_{OP}	Operating Junction Temperature		-20 to +125	°C
T_{MJ}	Maximum Junction Temperature		150	°C

Recommended Operating Conditions (T_A = 25°C)

Symbol	Parameter		Min	Max	Unit
V_{IN}	Input Voltage	AP78L05	7	20	V
		AP78L08	10.5	23	
		AP78L12	14.5	27	
I_{OUT}	Output Current		0	100	mA
T_A	Operating Ambient Temperature		-20	+85	°C

AP78Lxx Electrical Characteristics (All Output Voltage Versions)

Limits in standard typeface are for T_A = 25℃, **Bold typeface applies over T_J = -20°C to +125°C for TO92, SOT89 and SO-8 packages.**
Unless otherwise specified: I_O = 40mA, C_I = 0.33μF, C_O = 0.1μF.

AP78L05

Unless otherwise specified, V_{IN} = 10V

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_O	Output Voltage		4.8	5	5.2	V
		7V ≤ V_{IN} ≤ 20V 1mA ≤ I_O ≤ 40mA	**4.75**		**5.25**	
		1mA ≤ I_O ≤ 70mA	**4.75**		**5.25**	
ΔV_O	Line Regulation	7V ≤ V_{IN} ≤ 20V		18	75	mV
		8V ≤ V_{IN} ≤ 20V		10	54	
ΔV_O	Load Regulation	1mA ≤ I_O ≤ 100mA		20	60	mV
		1mA ≤ I_O ≤ 40mA		5	30	
I_Q	Quiescent Current			3	5	mA
ΔI_Q	Quiescent Current Change	8V ≤ V_{IN} ≤ 20V			**1.0**	
		1mA ≤ I_O ≤ 40mA			**0.1**	
V_N	Output Noise Voltage	f = 10Hz to 100kHz (Note 4)	-	40		μV
$\Delta V_{IN}/\Delta V_{OUT}$	Ripple Rejection	f = 120Hz 8V ≤ V_{IN} ≤ 16V	47	62		dB
I_{PK}	Peak Output Current			140		mA
$\Delta V_O/\Delta T$	Average Output Voltage Tempco	I_O = 5mA		-0.65		mV/°C
$V_{IN(MIN)}$	Minimum Value of Input Voltage Required to Maintain Line Regulation			6.7	7	V
θ_{JA}	Thermal Resistance Junction to Ambient	TO92 (Note 5)		176		°C/W
		SO-8 (Note 6)		153		
		SOT89 (Note 7)		145		
θ_{JC}	Thermal Resistance Junction to Case	TO92 (Note 5)		33		
		SO-8 (Note 6)		18		
		SOT89 (Note 7)		25		

Notes:
4. Recommend 0.01μF minimum load capacitance at output to suppress high frequency noise.
5. Test conditions for TO92: No heat sink, no air flow.
6. Test conditions for SO-8: Device mounted on 2oz copper, minimum recommended pad layout, FR-4 PCB.
7. Test conditions for SOT89: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

AP78Lxx Electrical Characteristics (cont.)

AP78L08

Unless otherwise specified, V_{IN} = 14V

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_O	Output Voltage		7.7	8	8.3	V
		10.5V ≤ V_{IN} ≤ 23V 1mA ≤ I_O ≤ 40mA	**7.6**		**8.4**	
		1mA ≤ I_O ≤ 70mA	**7.6**		**8.4**	
ΔV_O	Line Regulation	10.5V ≤ V_{IN} ≤ 23V		42	175	mV
		11V ≤ V_{IN} ≤ 23V		36	125	
ΔV_O	Load Regulation	1mA ≤ I_O ≤ 100mA		18	80	mV
		1mA ≤ I_O ≤ 40mA		10	40	
I_Q	Quiescent Current			2	5.5	mA
ΔI_Q	Quiescent Current Change	11V ≤ V_{IN} ≤ 23V			**1.5**	
		1mA ≤ I_O ≤ 40mA			**0.1**	
V_N	Output Noise Voltage	f = 10Hz to 100kHz (Note 4)	-	54		μV
$\Delta V_{IN}/\Delta V_{OUT}$	Ripple Rejection	f = 120Hz 13V ≤ V_{IN} ≤ 23V	37	46		dB
I_{PK}	Peak Output Current			140		mA
$\Delta V_O/\Delta T$	Average Output Voltage Tempco	I_O = 5mA		-0.8		mV/°C
$V_{IN(MIN)}$	Minimum Value of Input Voltage Required to Maintain Line Regulation			9.7		V
θ_{JA}	Thermal Resistance Junction to Ambient	TO92 (Note 5)		176		°C/W
		SO-8 (Note 6)		153		
		SOT89 (Note 7)		157		
θ_{JC}	Thermal Resistance Junction to case	TO92 (Note 5)		33		°C/W
		SO-8 (Note 6)		18		
		SOT89 (Note 7)		33		

Notes: 4. Recommend 0.01μF minimum load capacitance at output to suppress high frequency noise.
5. Test conditions for TO92: No heat sink, no air flow.
6. Test conditions for SO-8: Device mounted on 2oz copper, minimum recommended pad layout, FR-4 PCB.
7. Test conditions for SOT89: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

AP78Lxx Electrical Characteristics (cont.)

AP78L12

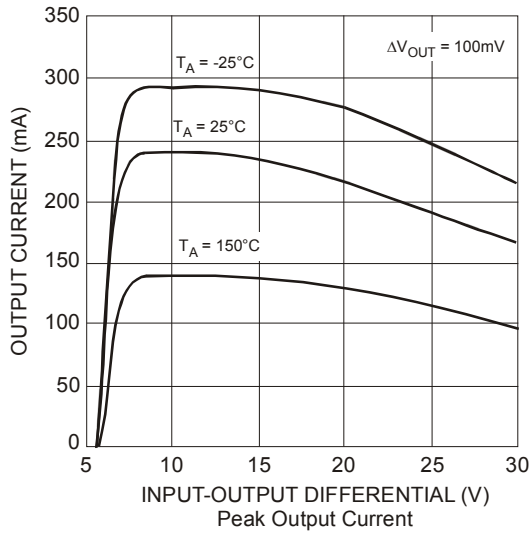
Unless otherwise specified, V_{IN} = 19V

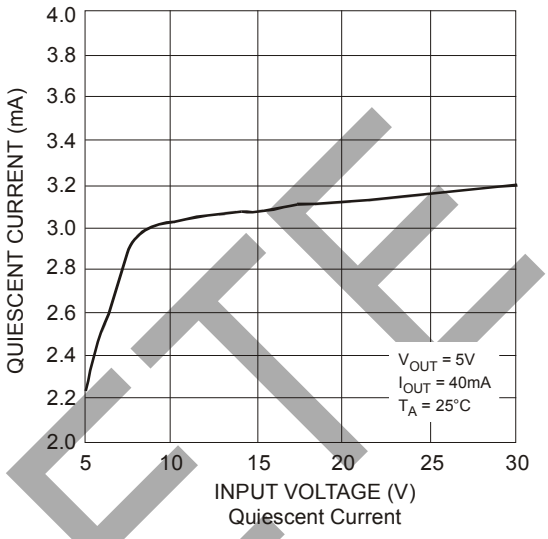
Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
V_O	Output Voltage		11.5	12	12.5	V
		14.5V ≤ V_{IN} ≤ 27V 1mA ≤ I_O ≤ 40mA	**11.4**		**12.6**	
		1mA ≤ I_O ≤ 70mA	**11.4**		**12.6**	
ΔV_O	Line Regulation	14.5V ≤ V_{IN} ≤ 27V		30	180	mV
		16V ≤ V_{IN} ≤ 27V		20	110	
ΔV_O	Load Regulation	1mA ≤ I_O ≤ 100mA		30	100	mV
		1mA ≤ I_O ≤ 40mA		10	50	
I_Q	Quiescent Current			3	5	mA
ΔI_Q	Quiescent Current Change	16V ≤ V_{IN} ≤ 27V			**1**	
		1mA ≤ I_O ≤ 40mA			**0.1**	
V_N	Output Noise Voltage			80		μV
$\Delta V_{IN}/\Delta V_{OUT}$	Ripple Rejection	f = 120Hz 15V ≤ V_{IN} ≤ 25V	40	54		dB
I_{PK}	Peak Output Current			140		mA
$\Delta V_O/\Delta T$	Average Output Voltage Tempco	I_O = 5mA		-1.0		mV/°C
$V_{IN(MIN)}$	Minimum Value of Input Voltage Required to Maintain Line Regulation			13.7	14.5	V
θ_{JA}	Thermal Resistance Junction to Ambient	TO92 (Note 5)		176		°C/W
		SO-8 (Note 6)		153		
		SOT89 (Note 7)		145		
θ_{JC}	Thermal Resistance Junction to case	TO92 (Note 5)		33		°C/W
		SO-8 (Note 6)		18		
		SOT89 (Note 7)		25		

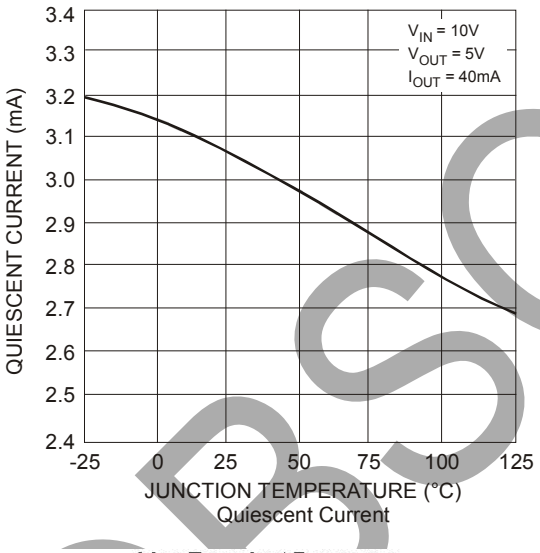
Notes: 5. Test conditions for TO92: No heat sink, no air flow.
6. Test conditions for SO-8: Device mounted on 2oz copper, minimum recommended pad layout, FR-4 PCB.
7. Test conditions for SOT89: Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

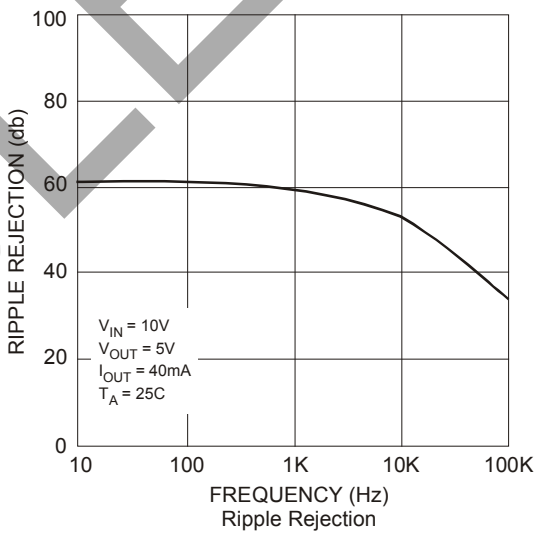
Typical Performance Characteristics

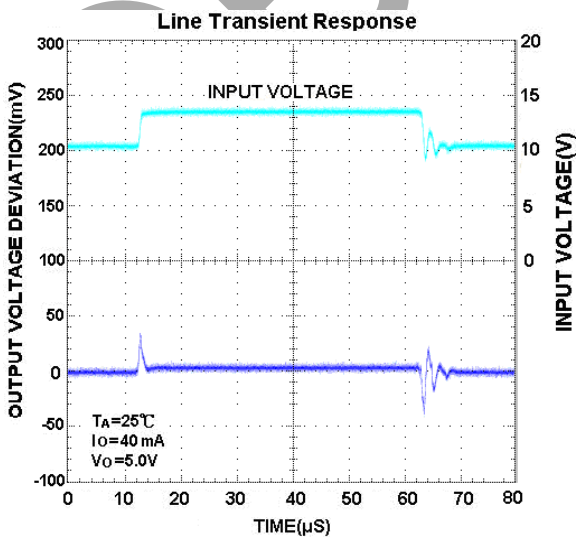
For AP78L05

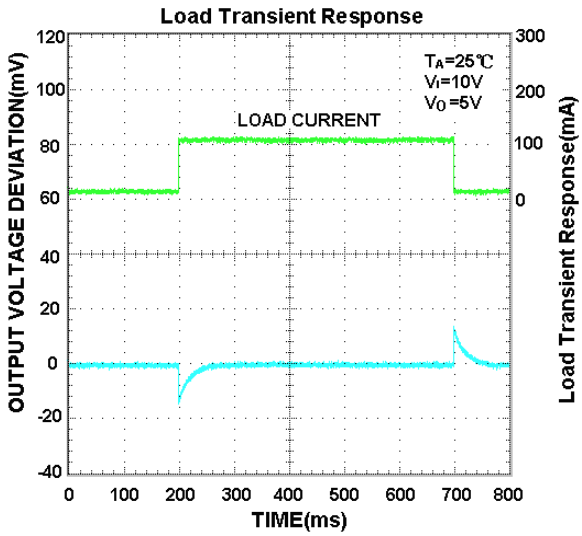






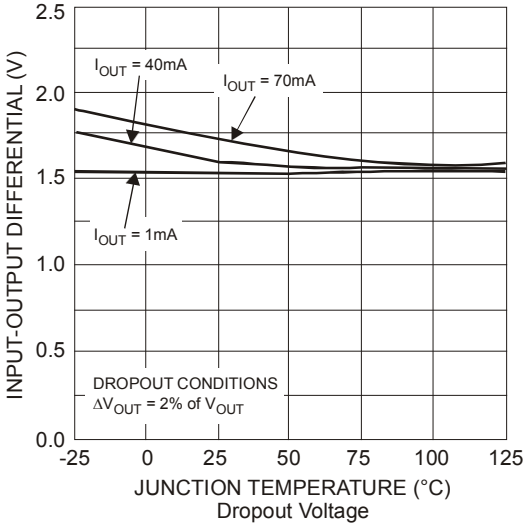






Typical Performance Characteristics (cont.)

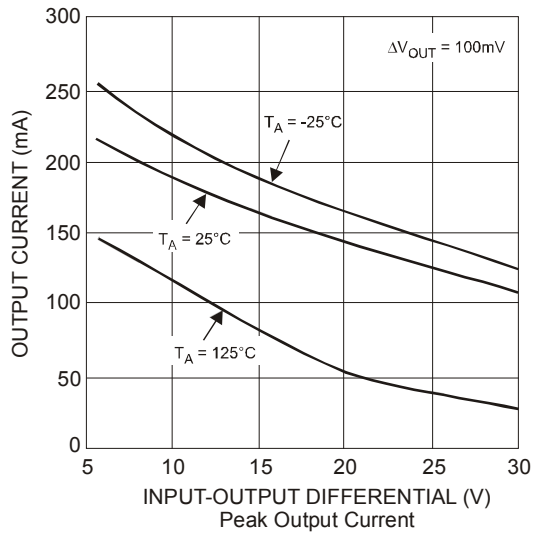
For AP78L05

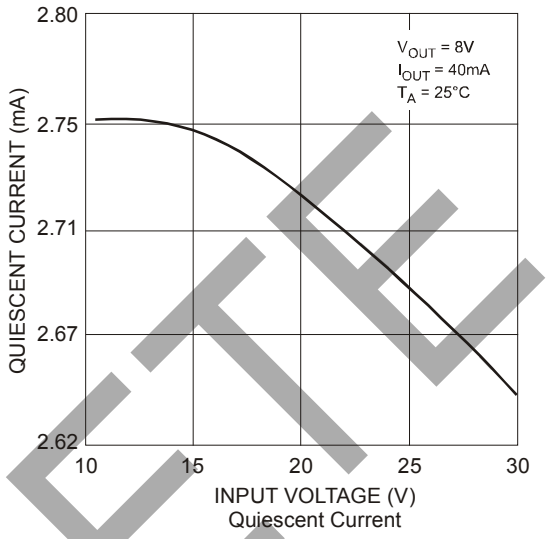


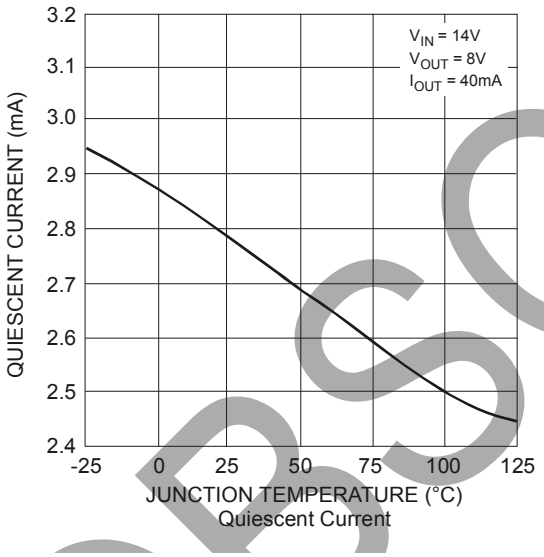
Dropout Voltage

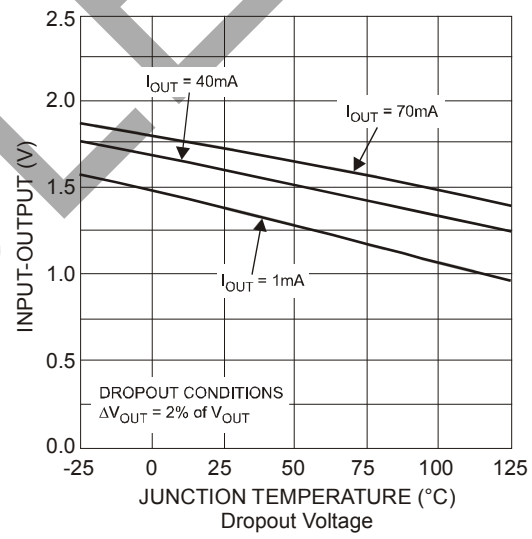
Typical Performance Characteristics

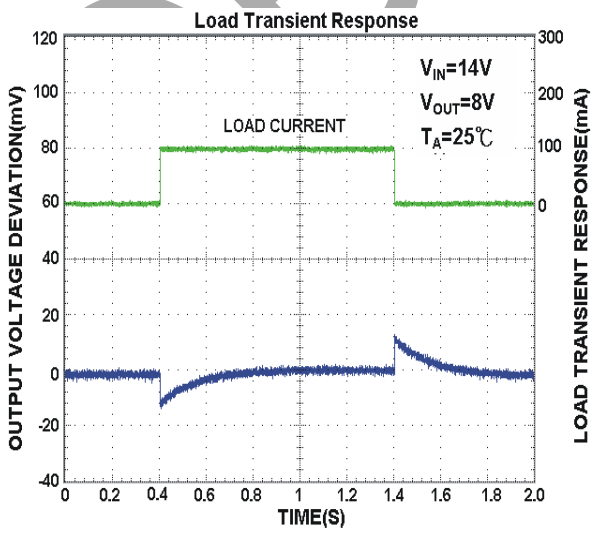
For AP78L08





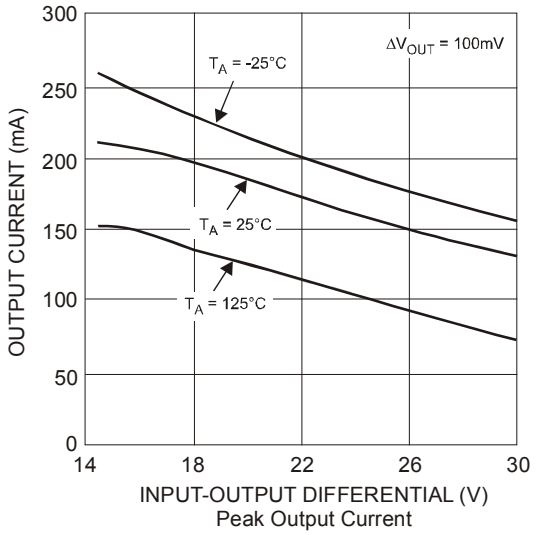




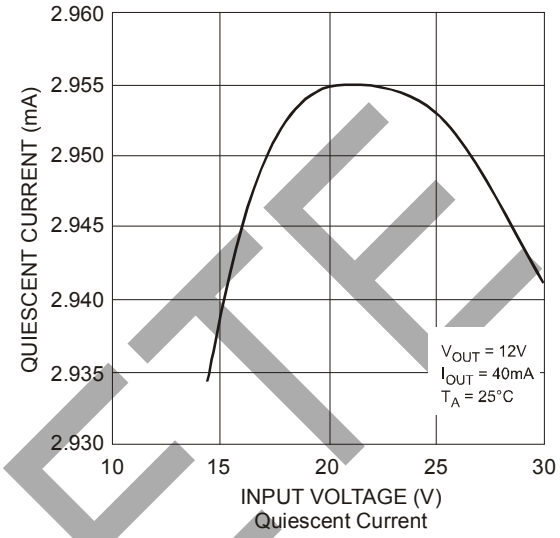


Typical Performance Characteristics (cont.)

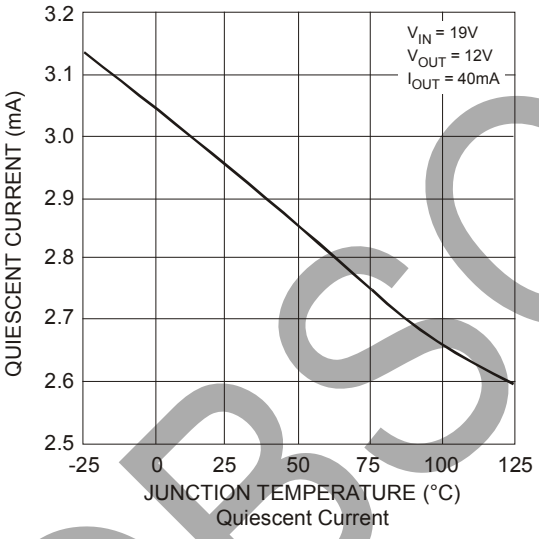
For AP78L12



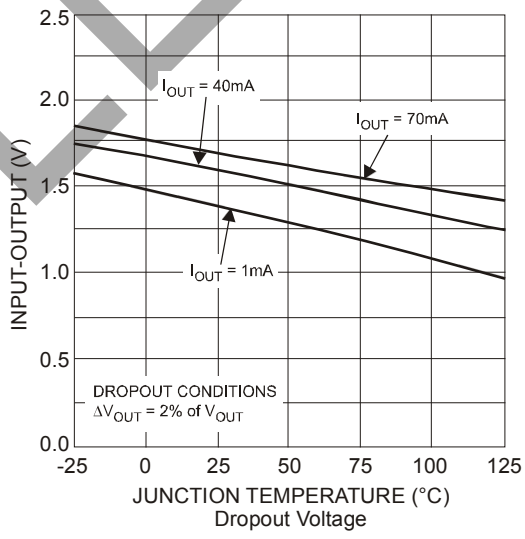
Peak Output Current



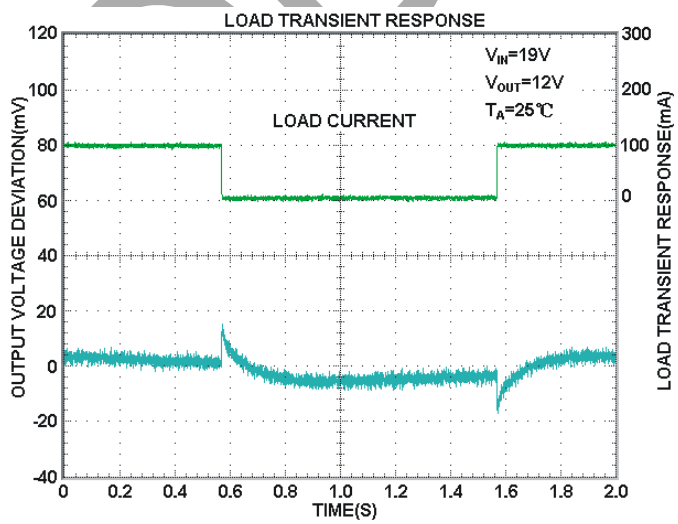
Quiescent Current



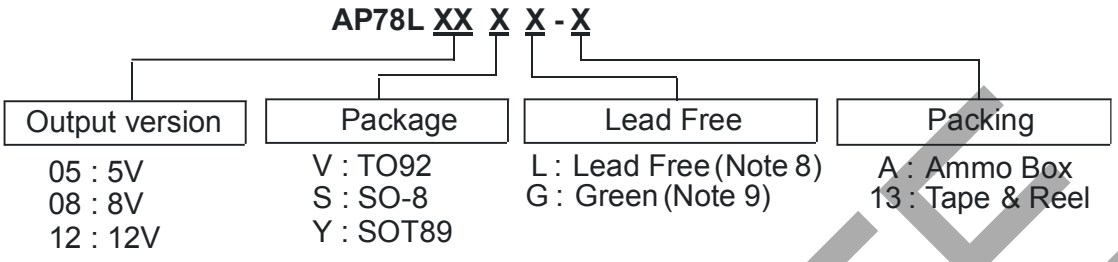
Quiescent Current



Dropout Voltage



Ordering Information

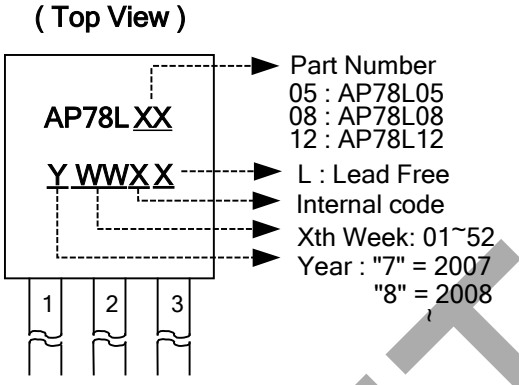


Device	Package Code	Packaging (Note 10)	Ammo Box / Tube		13" Tape and Reel	
			Quantity	Part Number Suffix	Quantity	Part Number Suffix
AP78LXXVL-A	V	TO92	2000/Box	-A	NA	NA
AP78LXXSG-13	S	SO-8	NA	NA	2500/Tape & Reel	-13
AP78LXXYG-13	Y	SOT89	NA	NA	2500/Tape & Reel	-13

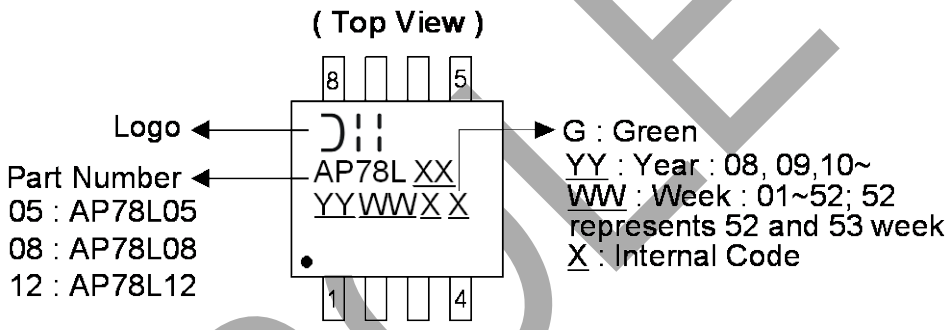
Notes: 8. TO92 is available in "Lead Free" product only.
9. SO-8 and SOT89 are available in "Green" products only.
10. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com/datasheets/ap02001.pdf.

Marking Information

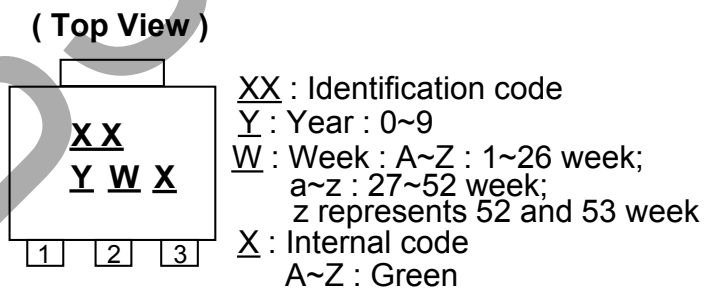
(1) TO92



(2) SO-8



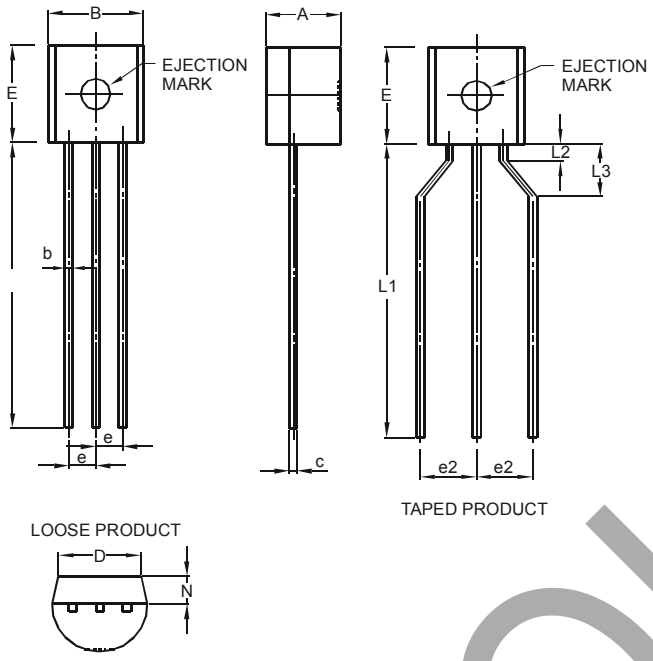
(3) SOT89



Device	Package	Identification Code
AP78L05	SOT89	V2
AP78L08	SOT89	V3
AP78L12	SOT89	V4

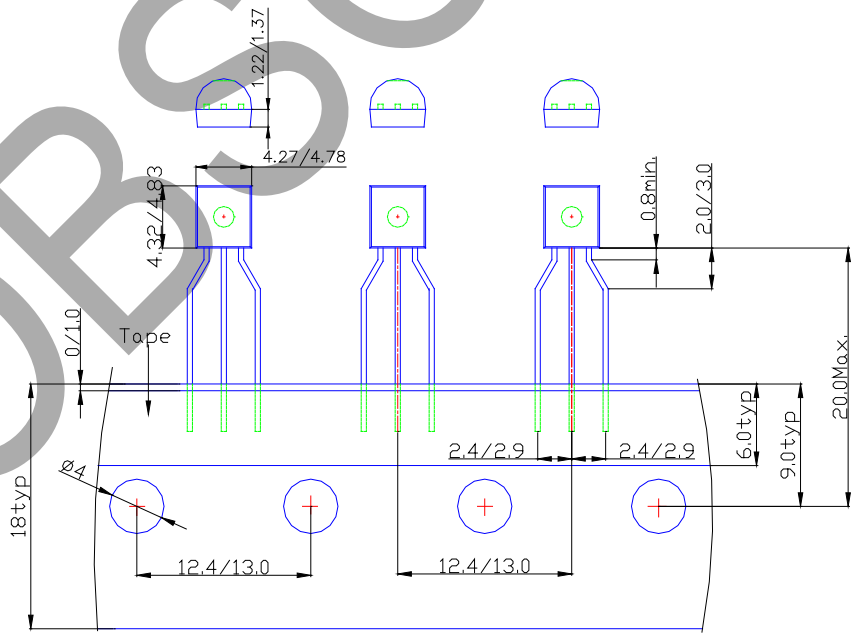
Package Outline Dimensions (All Dimensions in mm)

(1) Package Type: TO92



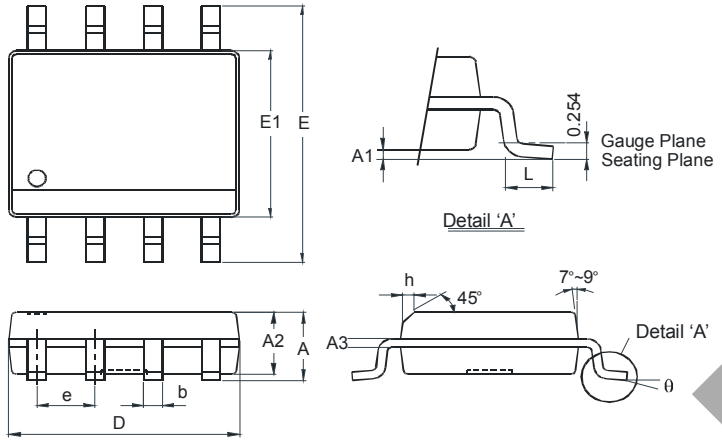
TO92-3L			
Dim	Min	Max	Typ
A	3.45	3.66	-
B	4.27	4.78	-
b	-	-	0.38
c	-	-	0.38
D	-	-	3.87
E	4.32	4.83	□
e	-	-	1.27
e2	2.40	2.90	-
L	12.98	15.00	-
L1	12.80	15.00	-
L2	0.80	-	-
L3	2.00	3.00	-
N	1.22	1.37	-
All Dimensions in mm			

(2) TO92 for Ammo pack



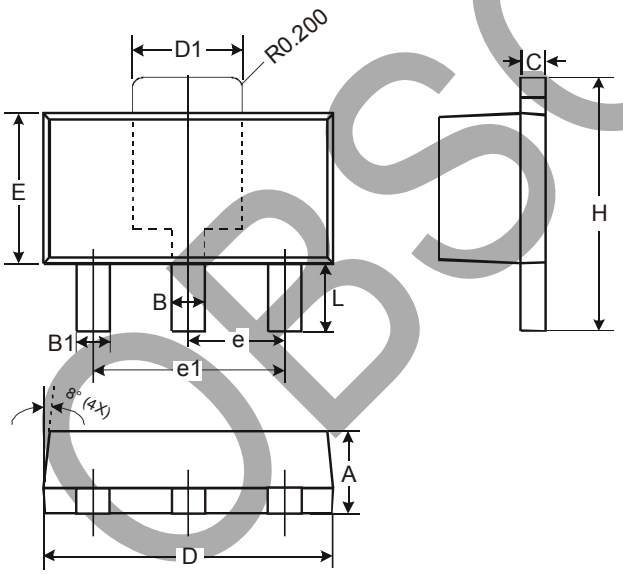
Package Outline Dimensions (cont.) (All Dimensions in mm)

(3) Package Type: SO-8



SO-8		
Dim	**Min**	**Max**
A	-	1.75
A1	0.10	0.20
A2	1.30	1.50
A3	0.15	0.25
b	0.3	0.5
D	4.85	4.95
E	5.90	6.10
E1	3.85	3.95
e	1.27 Typ	
h	-	0.35
L	0.62	0.82
θ	0°	8°
All Dimensions in mm		

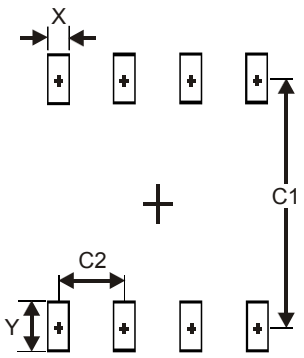
(4) Package Type: SOT89



SOT89		
Dim	**Min**	**Max**
A	1.40	1.60
B	0.44	0.62
B1	0.35	0.54
C	0.35	0.43
D	4.40	4.60
D1	1.52	1.83
E	2.29	2.60
e	1.50 Typ	
e1	3.00 Typ	
H	3.94	4.25
L	0.89	1.20
All Dimensions in mm		

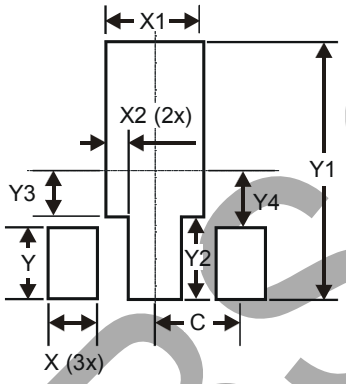
Suggested Pad Layout (All Dimensions in mm)

(1) Package Type: SO-8



Dimensions	Value (in mm)
X	0.60
Y	1.55
C1	5.4
C2	1.27

(2) Package Type: SOT89



Dimensions	Value (in mm)
X	0.900
X1	1.733
X2	0.416
Y	1.300
Y1	4.600
Y2	1.475
Y3	0.950
Y4	1.125
C	1.500

IMPORTANT NOTICE

1. DIODES INCORPORATED AND ITS SUBSIDIARIES ("DIODES") MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes products. Diodes products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of the Diodes products for their intended applications, (c) ensuring their applications, which incorporate Diodes products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5. Diodes products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6. Diodes products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

www.diodes.com