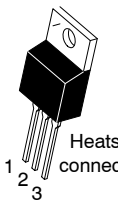
Negative-Voltage Regulators

DESCRIPTION

This series of fixed-negative voltage monolithic integrated circuit voltage regulators is designed to complement Series μA7800 in a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Each of these regulators can deliver up to 1.5A of output current. The internal limiting and termal shutdown features of these regulators make them essentially immune to overload. In addition to use as fixed-voltage regulators, these devices can be used with external components to obtain adjustable output voltages and current and also as the power pass element in precision regulators.

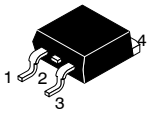
- **3-Terminal Regulators**
- **Output Current Up to 1.5 A**
- **No External Components**
- **Internal Thermal Overload Protection**
- **High Power Dissipation Capability**
- **Internal Short-Circuit Current Limiting**
- **Output Transistor Safe-Area Compensation**

Nominal output voltage	Regulator RoHS
-5V	7905A
-6V	7906A
-8V	7908A
-9V	7909A
-12V	7912A
-15V	7915A
-18V	7918A
-24V	7924A



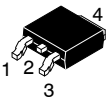
Heatsink surface connected to Pin 2.

TO-220
T SUFFIX
HT7905ATZ



Pin 1. Ground
2. Input
3. Output

TO263-3 S SUFFIX
HT7905ARSZ



TO252-3 M SUFFIX
HT7905ARMZ

Heatsink surface (shown as terminal 4 in case outline drawing) is connected to Pin 2.

Absolute maximum ratings over operating temperature range (unless otherwise noted)

		79-- A	UNIT
Input voltage	7924A	-40	V
	All others	-35	
Continuous total dissipation at 25 °C free-air temperature		2	W
Continuous total dissipation at (or bellow) 25 °C case temperature		15	
Operating free-air, case, or virtual junctions temperature range		0 to 150	°C
Storage temperature range		-65 to 150	
Lead temperature 3.2 mm (1/8 inch) from case for 10 seconds		260	

Recommended operating conditions

PARAMETER		MIN	MAX	UNIT
Input voltage V_I	7905A	-7	-25	V
	7906A	-8	-25	
	7908A	-10.5	-25	
	7912A	-14.5	-30	
	7915A	-17.5	-30	
	7918A	-21	-33	
	7924A	-27	-38	
Output current, I_O			1.5	A
Operating virtual junction temperature, T_J		0	125	°C

7905A electrical characteristics at specified virtual junction temperature, V_I= -10V, I_O=500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7905A			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	-4.8	-5	-5.2	V
	I_O= 5mA to 1A, V_I= -7V to -20V, P≤15W	0°C to 125°C	-4.75	-5	-5.25	
Input regulation	V_I= -7V to -25V	25°C		12.5	50	mV
	V_I= -8V to -12V			4	15	
Ripple rejection	V_I= -8V to -18V, f= 120Hz	0°C to 125°C	54	60		dB
Output regulation	I_O= 5mA to 1.5A	25°C		15	100	mV
	I_O= 250mA to 750mA			5	50	
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-0.4		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		125		μV
Dropout voltage	I_O= 1A	25°C		1.6		V
Bias current		25°C		1.5	2	mA
Bias current change	V_I= -7V to -25V	0°C to 125°C		0.15	0.5	
	I_O= 5mA to 1A			0.08	0.5	
Peak output current		25°C		2.1		A

7906A electrical characteristics at specified virtual junction temperature, V_I= -11V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7906A			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	-5.75	-6	-6.25	V
	I_O= 5mA to 1A, V_I= -8V to -21V, P≤15W	0°C to 125°C	-5.7	-6	-6.3	
Input regulation	V_I= -8V to -25V	25°C		12.5	120	mV
	V_I= -9V to -13V			4	60	
Ripple rejection	V_I= -9V to -19V, f= 120Hz	0°C to 125°C	54	60		dB
Output regulation	I_O= 5mA to 1.5A	25°C		15	120	mV
	I_O= 250mA to 750mA			5	60	
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-0.4		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		150		μV
Dropout voltage	I_O= 1A	25°C		1.6		V
Bias current		25°C		1.5	2	mA
Bias current change	V_I= -8V to -25V	0°C to 125°C		0.15	1.3	
	I_O= 5mA to 1A			0.08	0.5	
Peak output current		25°C		2.1		A

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

7908A electrical characteristics at specified virtual junction temperature, V_I= -14V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7908A			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	-7.7	-8	-8.3	V
	I_O= 5mA to 1A, V_I= -10.5V to -23V, P≤15W	0°C to 125°C	-7.6	-8	-8.4	
Input regulation	V_I= -10.5V to -25V	25°C		12.5	160	mV
	V_I= -11V to -17V			4	80	
Ripple rejection	V_I= -11.5V to -21.5V, f= 120Hz	0°C to 125°C	54	60		dB
Output regulation	I_O= 5mA to 1.5A	25°C		15	160	mV
	I_O= 250mA to 750mA			5	80	
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-0.8		mV/°C
Output noise voltage	f= 10Hz to 100 KHz	25°C		200		μV
Dropout voltage	I_O= 1A	25°C		1.6		V
Bias current		25°C		1.5	2	mA
Bias current change	V_I= -10.5V to -25V	0°C to 125°C		0.15	1	
	I_O= 5mA to 1A			0.08	0.5	
Peak output current		25°C		2.1		A

7909A electrical characteristics at specified virtual junction temperature, V_I=-15V, I_O=500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7909A			UNIT
			MIN	TYP	MAX	
Output voltage**		**25°C**	**-8.64**	**-9**	**-9.36**	**V**
	I_O=5mA to 1A V_I=-11.5V to -25V P≤15W	**0 to 125 °C**	**-8.55**	**-9**	**-9.45**	
Input regulation	**V_I=-11.5V to -25V**	**25°C**		**12.5**	**180**	**mV**
	V_I=-12V to -22.5V			**4**	**90**	
Ripple rejection	**V_I=-12.5V to -22.5V, f=120Hz**	**25°C**	**54**	**60**		**dB**
Output regulation	**I_O=5mA to 1.5A**	**25°C**		**15**	**180**	**mV**
	I_O=250mA to 750mA			**5**	**90**	
Temperature coefficient of output voltage	**I_O=5mA**	**0 to 125 °C**		**-0.8**		**mV/°C**
Output noise voltage	**f=10Hz-100Hz**	**25°C**		**225**		**μV**
Dropout voltage	**I_O=1A**	**25°C**		**1.6**		**V**
Bias current		**25°C**		**1.5**	**2**	**mA**
Bias current change	**V_I=-11.5V to -25V**	**0 to 125 °C**		**0.15**	**1**	
	I_O=5mA to 1A			**0.08**	**0.5**	
Peak output current		**25°C**		**2.1**		**A**

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.
** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

7912A electrical characteristics at specified virtual junction temperature, V_I= -19V, I_O= 500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7912A			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	-11.5	-12	-12.5	V
	I_O= 5mA to 1A, V_I= -14.5V to -27V, P≤15W	0°C to 125°C	-11.4	-12	-12.6	
Input regulation	V_I= -14.5V to -30V	25°C		5	80	mV
	V_I= -16V to -22V			3	30	
Ripple rejection	V_I= -15V to -25V, f= 120Hz	0°C to 125°C	54	60		dB
Output regulation	I_O= 5mA to 1.5A	25°C		15	200	mV
	I_O= 250mA to 750mA			5	75	
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-0.8		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		300		μV
Dropout voltage	I_O= 1A	25°C		1.6		V
Bias current		25°C		2	3	mA
Bias current change	V_I= -14.5V to -30V	0°C to 125°C		0.04	0.5	
	I_O= 5mA to 1A			0.06	0.5	
Peak output current		25°C		2.1		A

7915A electrical characteristics at specified virtual junction temperature, V_I= -23V, I_O=500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7915A			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	-14.4	-15	-15.6	V
	I_O= 5mA to 1A, V_I= -17.5V to -30V, P≤15W	0°C to 125°C	-14.25	-15	-15.75	
Input regulation	V_I= -17.5V to -30V	25°C		5	100	mV
	V_I= -20V to -26V			3	50	
Ripple rejection	V_I= -18.5V to -28.5V, f= 120Hz	0°C to 125°C	54	60		dB
Output regulation	I_O= 5mA to 1.5A	25°C		15	200	mV
	I_O= 250mA to 750mA			5	75	
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1		mV/°C
Output noise voltage	f= 10 Hz to 100 KHz	25°C		375		μV
Dropout voltage	I_O= 1A	25°C		1.6		V
Bias current		25°C		2	3	mA
Bias current change	V_I= -17.5V to -30V	0°C to 125°C		0.04	0.5	
	I_O= 5mA to 1A			0.06	0.5	
Peak output current		25°C		2.1		A

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.
** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

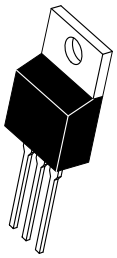
7918A electrical characteristics at specified virtual junction temperature, V_I= -27V, I_O=500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7918A			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	-17.3	-18	-18.7	V
	I_O= 5mA to 1A, V_I= -21V to -33V, P≤15W	0°C to 125°C	-17.1	-18	-18.9	
Input regulation	V_I= -21V to -33V	25°C		5	360	mV
	V_I= -24V to -30V			3	180	
Ripple rejection	V_I= -22V to -32V, f= 120Hz	0°C to 125°C	54	60		dB
Output regulation	I_O= 5mA to 1.5A	25°C		30	360	mV
	I_O= 250mA to 750mA			10	180	
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1.0		mV/°C
Output noise voltage	f= 10Hz to 100 KHz	25°C		450		μV
Dropout voltage	I_O= 1A	25°C		1.6		V
Bias current		25°C		2	3	mA
Bias current change	V_I= -21V to -33V	0°C to 125°C		0.04	1	
	I_O= 5mA to 1A			0.06	0.5	
Peak output current		25°C		2.1		A

7924A electrical characteristics at specified virtual junction temperature, V_I= -33V, I_O=500mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS*		7924A			UNIT
			MIN	TYP	MAX	
Output voltage**		25°C	-23	-24	-25	V
	I_O= 5mA to 1A, V_I= -27V to -38V, P≤15W	0°C to 125°C	-22.8	-24	-25.2	
Input regulation	V_I= -27V to -38V	25°C		5	480	mV
	V_I= -30V to -36V			3	240	
Ripple rejection	V_I= -28V to -38V, f= 120Hz	0°C to 125°C	54	60		dB
Output regulation	I_O= 5mA to 1.5A	25°C		85	480	mV
	I_O= 250mA to 750mA			25	240	
Temperature coefficient of output voltage	I_O= 5mA	0°C to 125°C		-1		mV/°C
Output noise voltage	f= 10Hz to 100 KHz	25°C		600		μV
Dropout voltage	I_O= 1A	25°C		1.6		V
Bias current		25°C		2	3	mA
Bias current change	V_I= -27V to -38V	0°C to 125°C		0.04	1	
	I_O= 5mA to 1A			0.06	0.5	
Peak output current		25°C		2.1		A

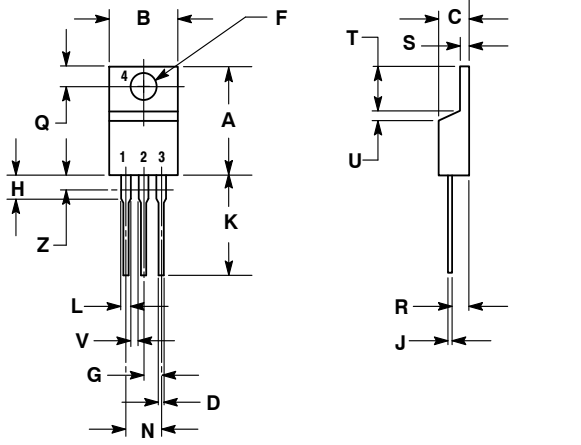
* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.
** This specification applies only for dc power dissipation permitted by absolute maximum ratings.



SCALE 1:1

TO−220, SINGLE GAUGE
CASE 221AB−01
ISSUE A

DATE 16 NOV 2010



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.
4. PRODUCT SHIPPED PRIOR TO 2008 HAD DIMENSIONS S = 0.045 − 0.055 INCHES (1.143 − 1.397 MM)

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.020	0.024	0.508	0.61
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. EMITTER

STYLE 3:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

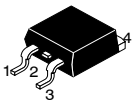
STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

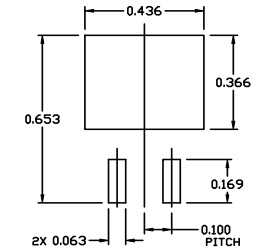
STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE



(TO-263, 3-LEAD) CASE
418AJ
ISSUE E



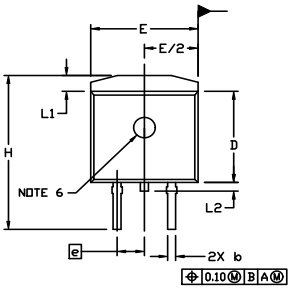
RECOMMENDED
MOUNTING FOOTPRINT

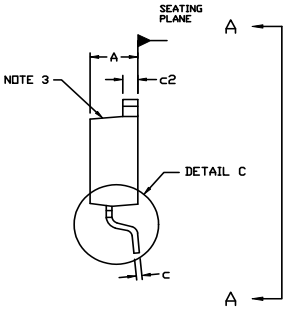
* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

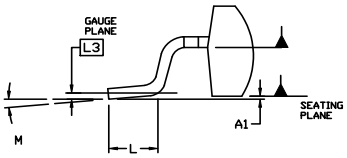
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. CHAMFER OPTIONAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
5. THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
6. OPTIONAL MOLD FEATURE.
7. ①, ② ... OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

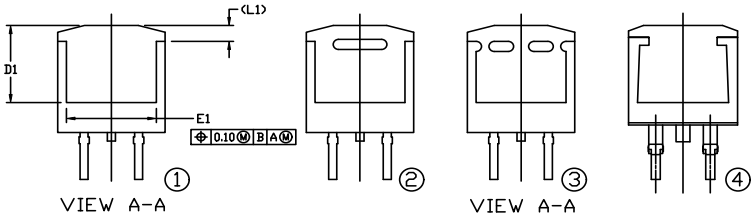
DIM	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.160	0.190	4.06	4.83
A1	0.000	0.010	0.00	0.25
b	0.020	0.039	0.51	0.99
c	0.012	0.029	0.30	0.74
c2	0.045	0.065	1.14	1.65
D	0.330	0.380	8.38	9.65
D1	0.260	---	6.60	---
E	0.380	0.420	9.65	10.67
E1	0.245	---	6.22	---
e	0.100 BSC		2.54 BSC	
H	0.575	0.625	14.60	15.88
L	0.070	0.110	1.78	2.79
L1	---	0.066	---	1.68
L2	---	0.070	---	1.78
L3	0.010 BSC		0.25 BSC	
M	-8°	8°	-8°	8°





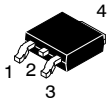


DETAIL C
TIP LEADFORM
ROTATED 90° CW



VIEW A-A

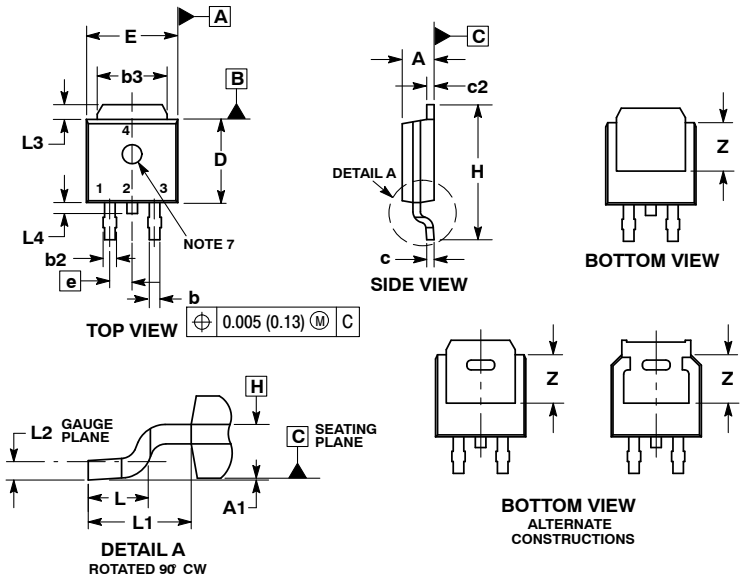
VIEW A-A
OPTIONAL CONSTRUCTIONS



SCALE 1:1

TO252 (SINGLE GAUGE) CASE 369C
ISSUE F

DATE 21 JUL 2015



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.086	0.094	2.18	2.38
A1	0.000	0.005	0.00	0.13
b	0.025	0.035	0.63	0.89
b2	0.028	0.045	0.72	1.14
b3	0.180	0.215	4.57	5.46
c	0.018	0.024	0.46	0.61
c2	0.018	0.024	0.46	0.61
D	0.235	0.245	5.97	6.22
E	0.250	0.265	6.35	6.73
e	0.090 BSC		2.29 BSC	
H	0.370	0.410	9.40	10.41
L	0.055	0.070	1.40	1.78
L1	0.114 REF		2.90 REF	
L2	0.020 BSC		0.51 BSC	
L3	0.035	0.050	0.89	1.27
L4	---	0.040	---	1.01
Z	0.155	---	3.93	---

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

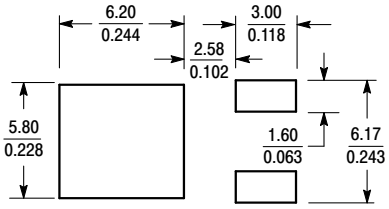
STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 8:
PIN 1. N/C
2. CATHODE
3. ANODE
4. CATHODE

STYLE 9:
PIN 1. ANODE
2. CATHODE
3. RESISTOR ADJUST
4. CATHODE

STYLE 10:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

SOLDERING FOOTPRINT*



SCALE 3:1 (mm / inches)

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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