

1A Ultra Low Dropout Linear Regulator**CL2940****■ General Description**

The CL2940 is a low dropout three-terminal regulator with a typical dropout of 0.28V at 1A output current. The CL2940 provides current limit and thermal shutdown. On-chip thermal shutdown provides protection against any combination of high current and ambient temperature that would create excessive junction temperatures. The CL2940 has 2.5V, 3.3V and 5.0V versions.

The CL2940 is available in the industry standard TO-220-3, TO-263-3 and TO-252-2 packages.

■ Features

- Minimum Guaranteed Output Current: 1A
- Dropout Voltage at IOUT=1A: 0.28V
- Output Accuracy: $\pm 1\%$
- Low Ground Current
- Fast Transient Response
- Internal Current Limit and Thermal Protection
- Reversed-battery and Reversed-lead Insertion Protection

■ Applications

- LCD TV
- Set Top Box
- LCD Monitor
- SMPS Post Regulator
- USB Power Supply
- Portable Instrumentation
- Laptop, Palmtop and Notebook

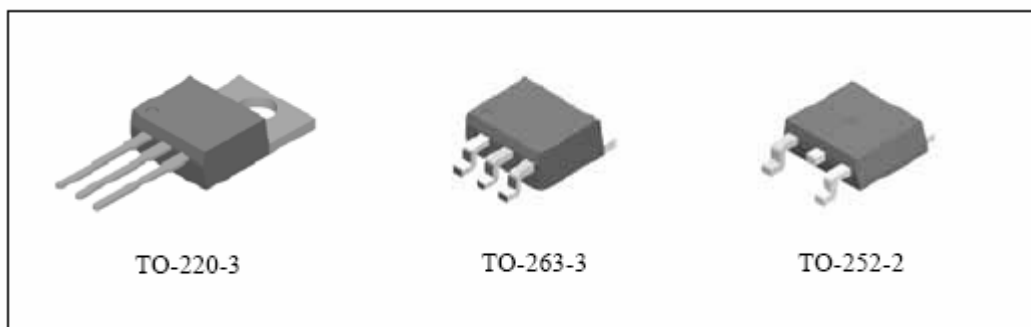


Figure 1. Package Types of CL2940

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■ Function Block

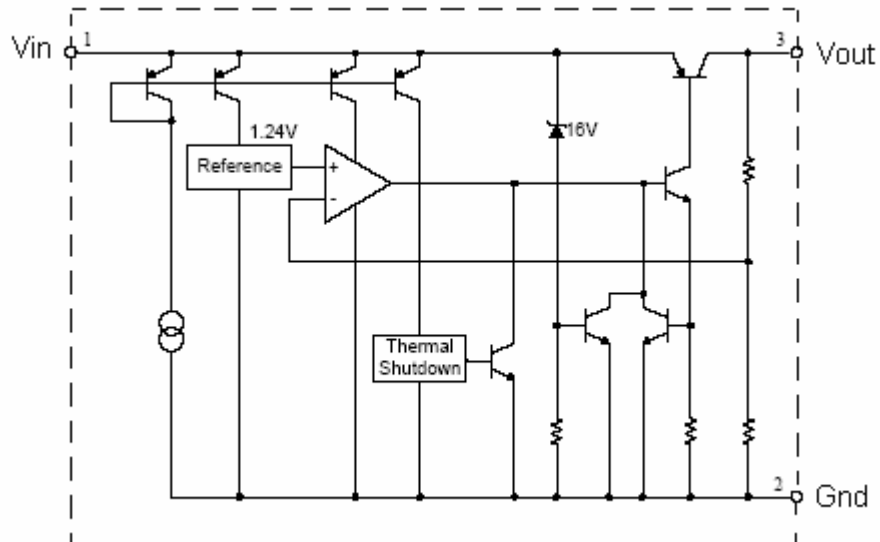


Figure 2. Functional Block Diagram of CL2940

■ Pin Descriptions

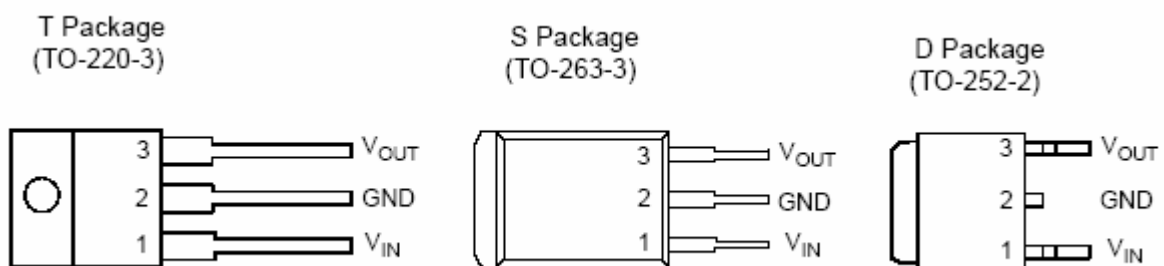


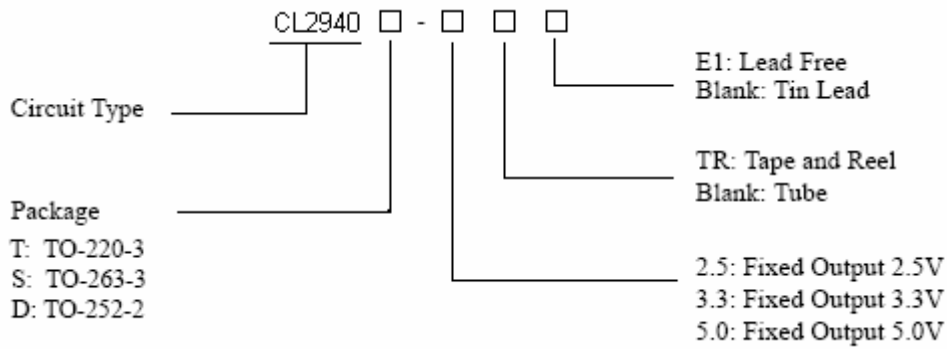
Figure 3. Pin Configuration of CL2940 (Top View)

Pin No.	Symbol	Function
1	Vin	Unregulated Input
2	GND	Ground pin. This pin and TAB are internally connected
3	Vout	Regulated Output

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Ordering Information



Package	Temperature Range	Part number (Lead Free)	Marking ID	Packing Type
TO-220-3	-40 to 125℃	CL2940T-2.5E1	CL2940T-2.5	Tube
		CL2940T-3.3E1	CL2940T-3.3	
		CL2940T-5.0E1	CL2940T-5.0	
TO-263-3	-40 to 125℃	CL2940S-2.5E1	CL2940S-2.5	Tube
		CL2940S-2.5TRE1	CL2940S-2.5	Tape & Reel
		CL2940S-3.3E1	CL2940S-3.3	Tube
		CL2940S-3.3TRE1	CL2940S-3.3	Tape & Reel
		CL2940S-5.0E1	CL2940S-5.0	Tube
		CL2940S-5.0TRE1	CL2940S-5.0	Tape & Reel
TO-252-2	-40 to 125℃	CL2940D-2.5E1	CL2940D-2.5	Tube
		CL2940D-2.5TRE1	CL2940D-2.5	Tape & Reel
		CL2940D-3.3E1	CL2940D-3.3	Tube
		CL2940D-3.3TRE1	CL2940D-3.3	Tape & Reel
		CL2940D-5.0E1	CL2940D-5.0	Tube
		CL2940D-5.0TRE1	CL2940D-5.0	Tape & Reel

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■ Absolute Maximum Ratings (Note1)

Symbol	Parameter	Range	Unit
Vin	Supply voltage	16	V
TJ	Maximum Operating Junction Temperature	150	°C
Tstg	Storage Temperature Range	-60 ~ 150	°C
Tlead	Lead Temperature (Soldering, 10sec)	300	°C
	ESD (Machine Model)	±300	V

Note 1: Stresses greater than 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 Ratings" for extended periods may affect device reliability.

■ Recommended Operating Conditions (Ta= 25°C)

Parameter	Symbol	Range	Unit
Supply voltage	Vin	13.2	V
Operating Junction Temperature	TJ	-40 ~ 125	°C

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■ Electrical Characteristics

CL2940-2.5V Electrical Characteristics

Operating Conditions: $V_{in}=3.5V$, $I_{out}=10mA$, $C_{in}=10\mu F$, $C_{out}=10\mu F$, $T_J=25^{\circ}C$, unless otherwise specified.

The **Boldface** applies over $-40^{\circ}C \leq T_J \leq 125^{\circ}C$.

Symbol	Parameter	Test Condition	Min	Typ.	Max	Unit
V _{out}	Output voltage	$I_{out}=10mA$	2.475	2.5	2.525	V
		$10mA \leq I_{out} \leq 1A$ $3.5V \leq V_{in} \leq 13.2V$	2.45		2.55	V
V _{RLINE}	Line Regulation	$I_{out}=10mA$, $3.5V \leq V_{in} \leq 13.2V$		5.0	25	mV
V _{RLOAD}	LOAD Regulation	$V_{in} = 3.5V$, $10mA \leq I_{out} \leq 1A$		7.5	37.5	mV
$\Delta V_{out} / \Delta T$	Output Voltage Temperature Coefficient	$I_{out}=10mA$		50	250	$\mu V/^{\circ}C$
V _{DROP}	Dropout Voltage (Note 2)	$\Delta V_{out}=1\%$ $I_{out}=0.1A$		70	200	mV
		$I_{out}=1A$		280	550	mV
I _{GND}	Ground Current	$V_{in}=3.5V$ $I_{out}=0.75A$		12	25	mA
		$I_{out}=1A$		18		mA
I _{LIMIT}	Current Limit	$V_{out}=0V$ (Note 3)	1.5	2.2		A
I _{LO(min)}	Minimum Load Current			1	5	mA
V _{no}	Output Noise Voltage	10Hz to 100KHz, $I_{out}=0.1A$		400		μV_{rms}

Note 2: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at $V_{OUT} + 1V$ applied to V_{IN} .

Note 3: $V_{IN}=V_{OUT(NOMINAL)} + 1V$.

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■ Electrical Characteristics (Continued)

CL2940-3.3V Electrical Characteristics

Operating Conditions: $V_{in}=4.3V$, $I_{out}=10mA$, $C_{in}=10\mu F$, $C_{out}=10\mu F$, $T_J=25^{\circ}C$, unless otherwise specified.

The **Boldface** applies over $-40^{\circ}C \leq T_J \leq 125^{\circ}C$.

Symbol	Parameter	Test Condition	Min	Typ.	Max	Unit
V _{out}	Output voltage	$I_{out}=10mA$	3.27	3.3	3.33	V
		$10mA \leq I_{out} \leq 1A$ $4.3V \leq V_{in} \leq 13.2V$	3.23		3.37	V
V _{RLINE}	Line Regulation	$I_{out}=10mA$, $4.3V \leq V_{in} \leq 13.2V$		6.6	33	mV
V _{RLOAD}	LOAD Regulation	$V_{in}=4.3V$, $10mA \leq I_{out} \leq 1A$		9.9	50	mV
$\Delta V_{out} / \Delta T$	Output Voltage Temperature Coefficient	$I_{out}=10mA$		66	330	$\mu V/^{\circ}C$
V _{DROP}	Dropout Voltage (Note 2)	$\Delta V_{out}=1\%$ $I_{out}=0.1A$		70	200	mV
		$I_{out}=1A$		280	550	mV
I _{GND}	Ground Current	$V_{in}=4.3V$ $I_{out}=0.75A$		12	25	mA
		$I_{out}=1A$		18		mA
I _{LIMIT}	Current Limit	$V_{out}=0V$ (Note 3)	1.5	2.2		A
I _{LO(min)}	Minimum Load Current			1	5	mA
V _{no}	Output Noise Voltage	10Hz to 100KHz, $I_{out}=0.1A$		400		μV_{rms}

Note 2: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at $V_{OUT}+1V$ applied to V_{IN} .

Note 3: $V_{IN}=V_{OUT(NOMINAL)}+1V$.

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■ Electrical Characteristics (Continued)

CL2940-5.0V Electrical Characteristics

Operating Conditions: $V_{in}=6V$, $I_{out}=10mA$, $C_{in}=10\mu F$, $C_{out}=10\mu F$, $T_J=25^{\circ}C$, unless otherwise specified.

The **Boldface** applies over $-40^{\circ}C \leq T_J \leq 125^{\circ}C$.

Symbol	Parameter	Test Condition	Min	Typ.	Max	Unit
V _{out}	Output voltage	$I_{out}=10mA$	4.95	5	5.05	V
		$10mA \leq I_{out} \leq 1A$ $6V \leq V_{in} \leq 13.2V$	4.90		5.10	V
V _{RLINE}	Line Regulation	$I_{out}=10mA$, $6V \leq V_{in} \leq 13.2V$		10	50	mV
V _{RLOAD}	LOAD Regulation	$V_{in}=6V$, $10mA \leq I_{out} \leq 1A$		15	75	mV
$\Delta V_{out} / \Delta T$	Output Voltage Temperature Coefficient	$I_{out}=10mA$		100	500	$\mu V/^{\circ}C$
V _{DROP}	Dropout Voltage (Note 2)	$\Delta V_{out}=1\%$ $I_{out}=0.1A$		70	200	mV
		$I_{out}=1A$		280	550	mV
I _{GND}	Ground Current	$V_{in}=6V$ $I_{out}=0.75A$		12	25	mA
		$I_{out}=1A$		18		mA
I _{LIMIT}	Current Limit	$V_{out}=0V$ (Note 3)	1.5	2.2		A
I _{LO(min)}	Minimum Load Current			1	5	mA
V _{no}	Output Noise Voltage	10Hz to 100KHz, $I_{out}=0.1A$		400		μV_{rms}

Note 2: Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at $V_{OUT}+1V$ applied to V_{IN} .

Note 3: $V_{IN}=V_{OUT(NOMINAL)}+1V$.

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■ Test Circuit

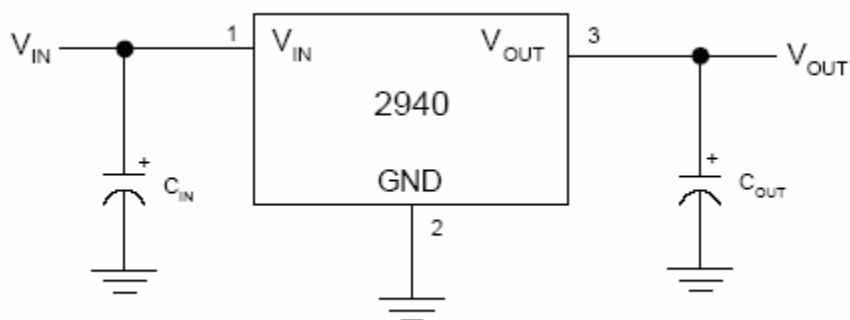


Figure 4. Test circuit of CL2940

Note: C_{IN} is required if regulator is located far from power supply filter and is recommended to be $0.47\mu F$ or greater. To maintain stability, C_{OUT} is recommended to be $2.2\mu F$ or greater. The ESR of this capacitor is critical, please see curve.

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Typical Performance Characteristics

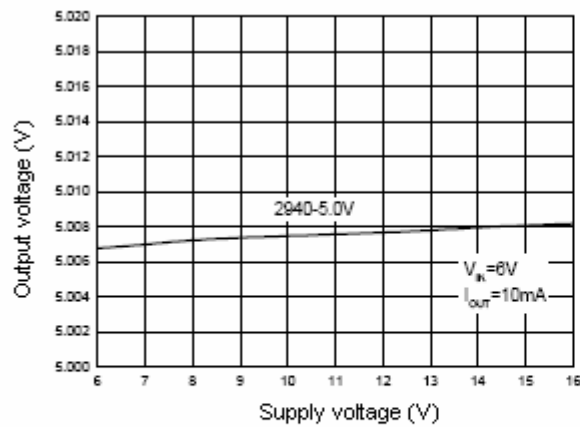


Figure 5. Line regulation

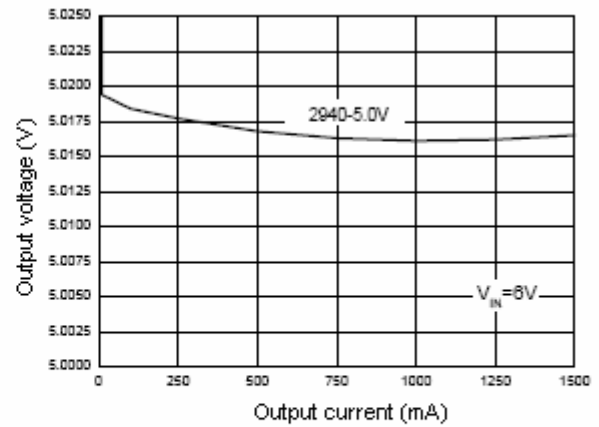


Figure 6. Load regulation

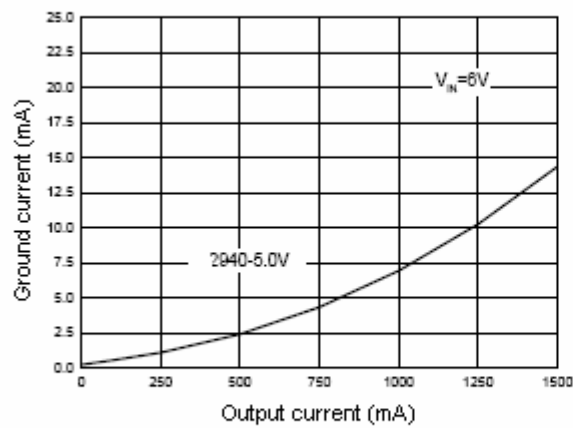


Figure 7. Ground current vs. Output current

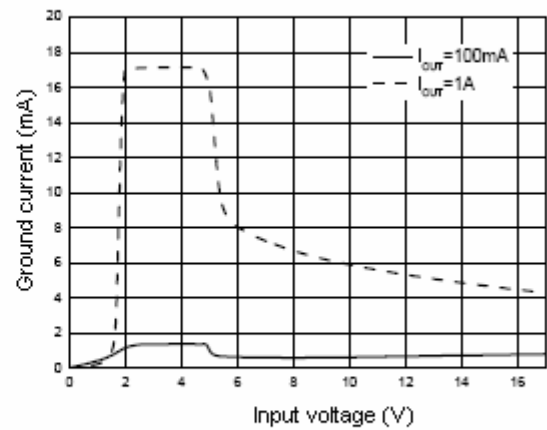


Figure 8. Ground current vs. Input voltage

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Typical Performance Characteristics (Continued)

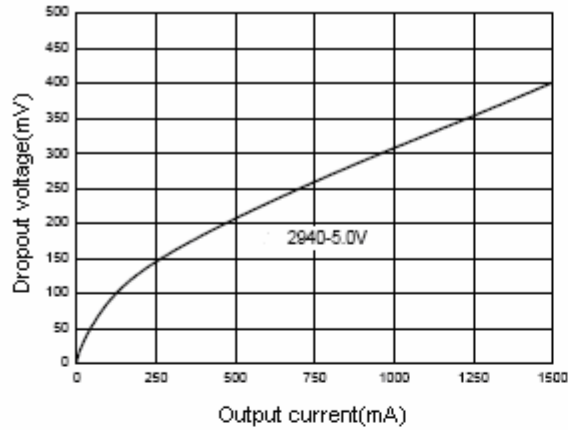


Figure 9. Dropout voltage vs. Output current

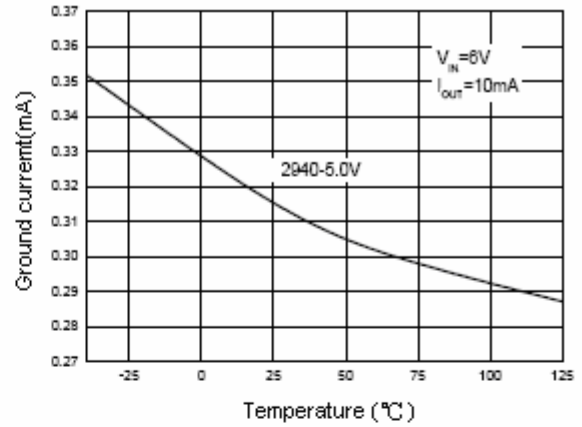


Figure 10. Ground current vs. Temperature

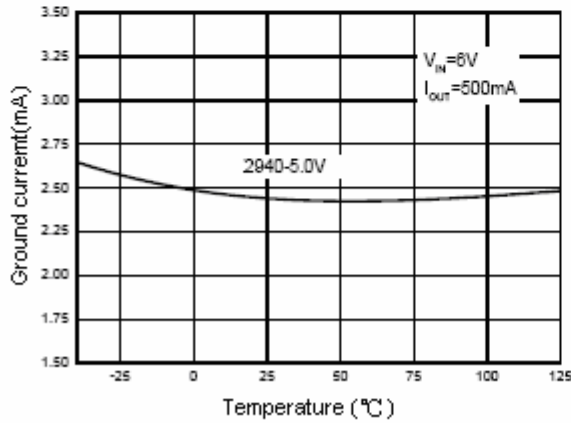


Figure 11. Ground current vs. Temperature

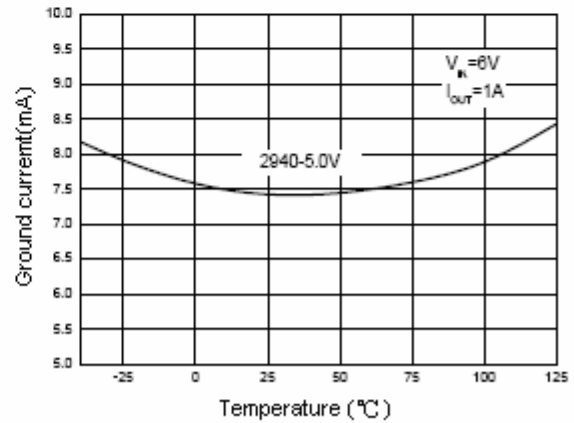


Figure 12. Ground current vs. Temperature

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Typical Performance Characteristics (Continued)

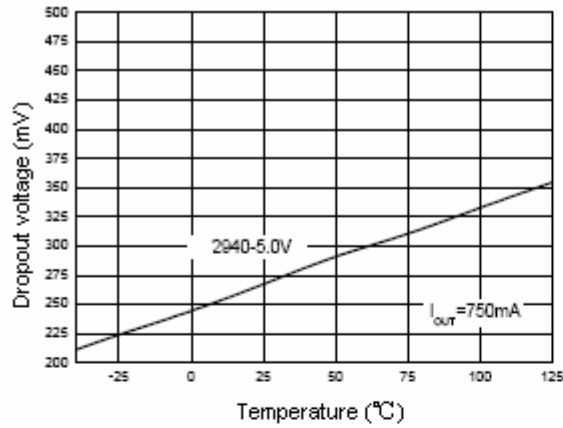


Figure 13. Dropout voltage vs. Temperature

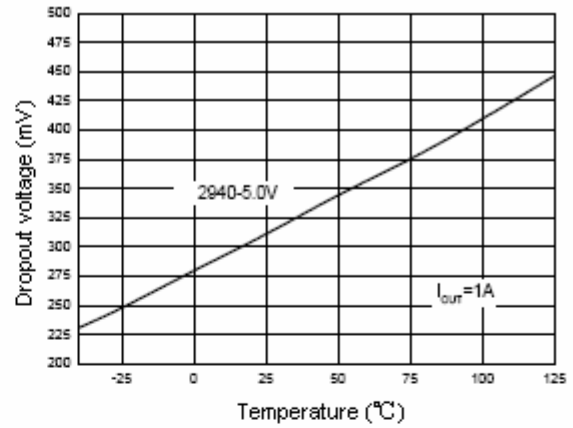


Figure 14. Dropout voltage vs. Temperature

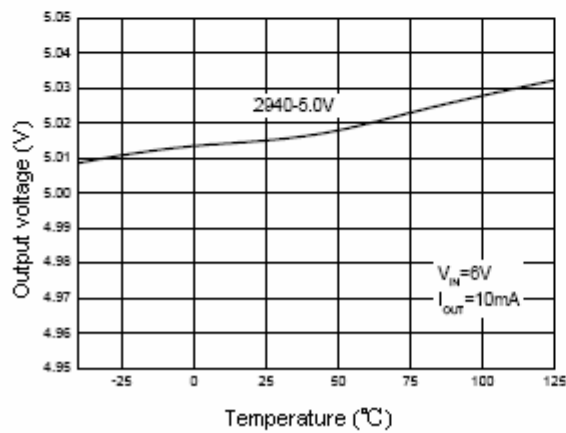


Figure 15. Output voltage vs. Temperature

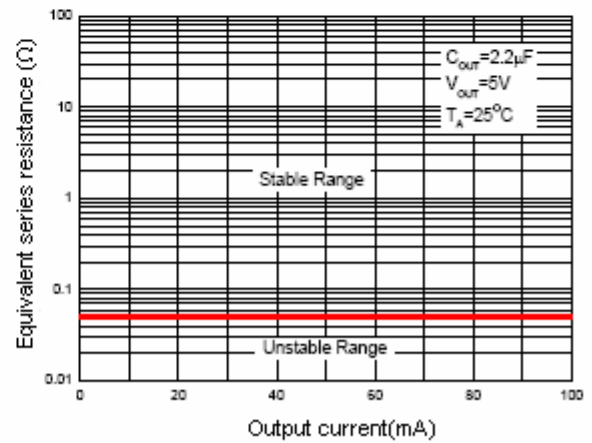


Figure 16. Output capacitor ESR

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Typical Performance Characteristics (Continued)

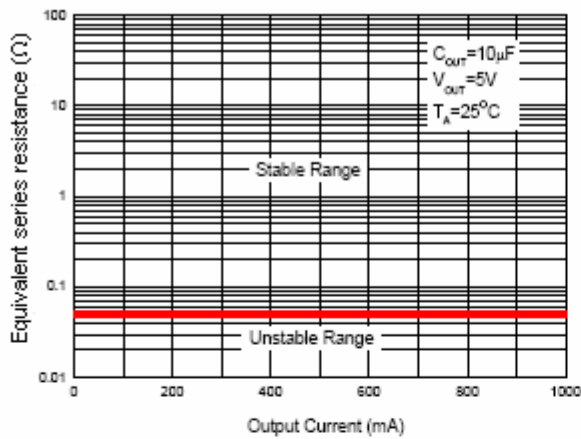


Figure 17. Output Capacitor ESR

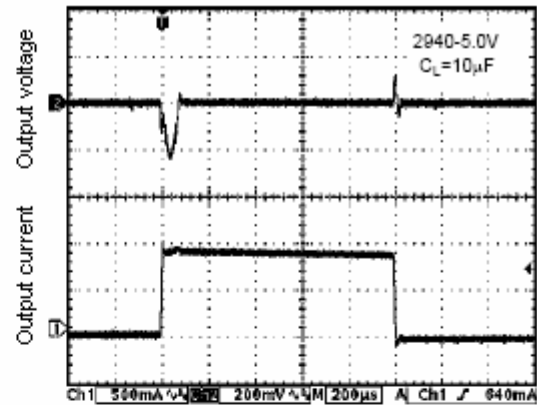


Figure 18. Load Transient

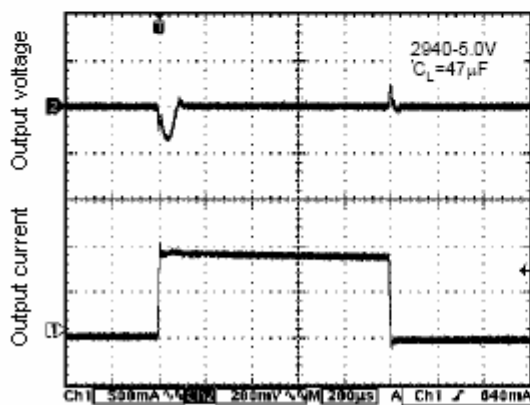


Figure 19. Load Transient

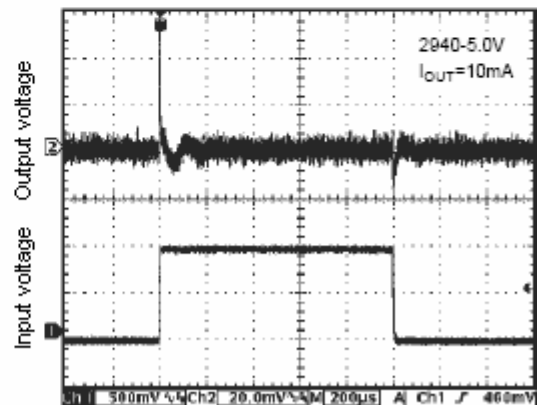


Figure 20. Line Transient

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Typical Performance Characteristics (Continued)

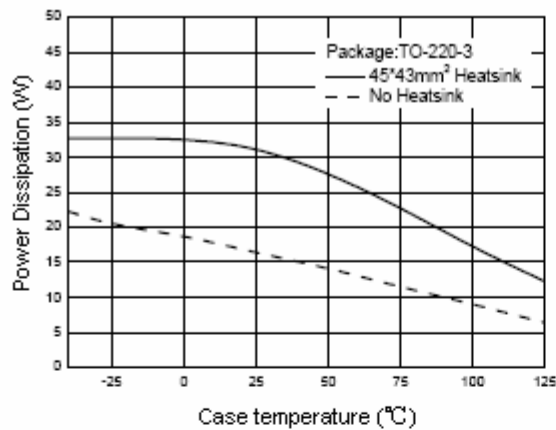


Figure 21. Power dissipation vs. Case temperature

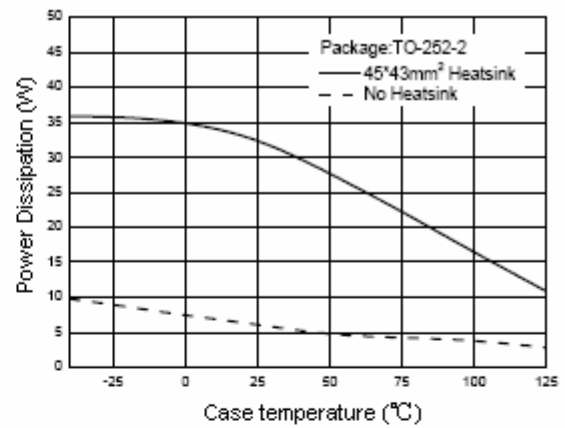


Figure 22. Power dissipation vs. Case temperature

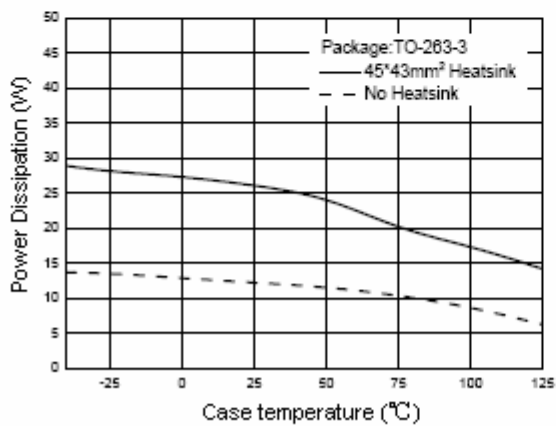


Figure 23. Power dissipation vs. Case temperature

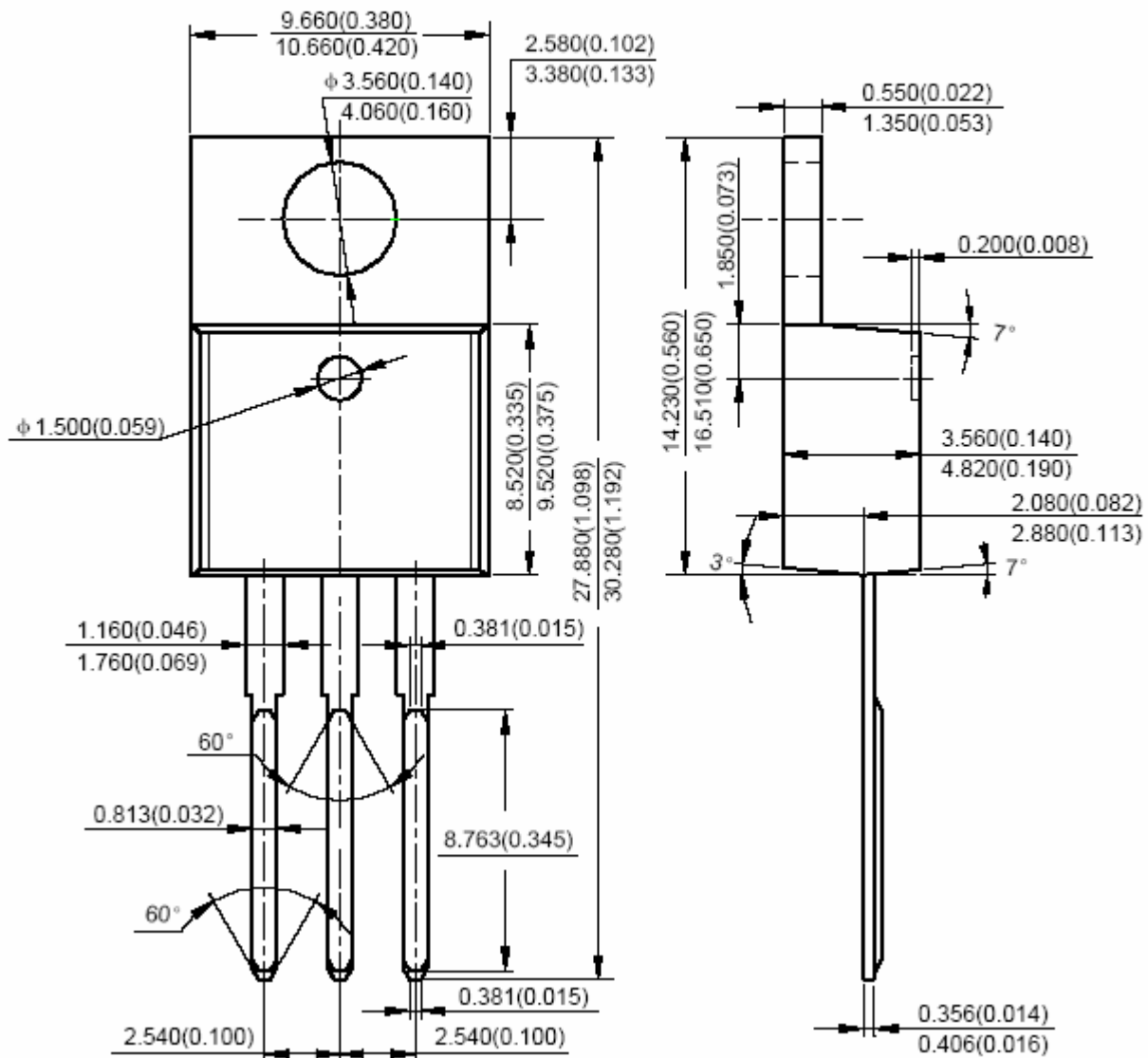
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■ Package Mechanical Data

TO-220-3

Unit: mm(inch)



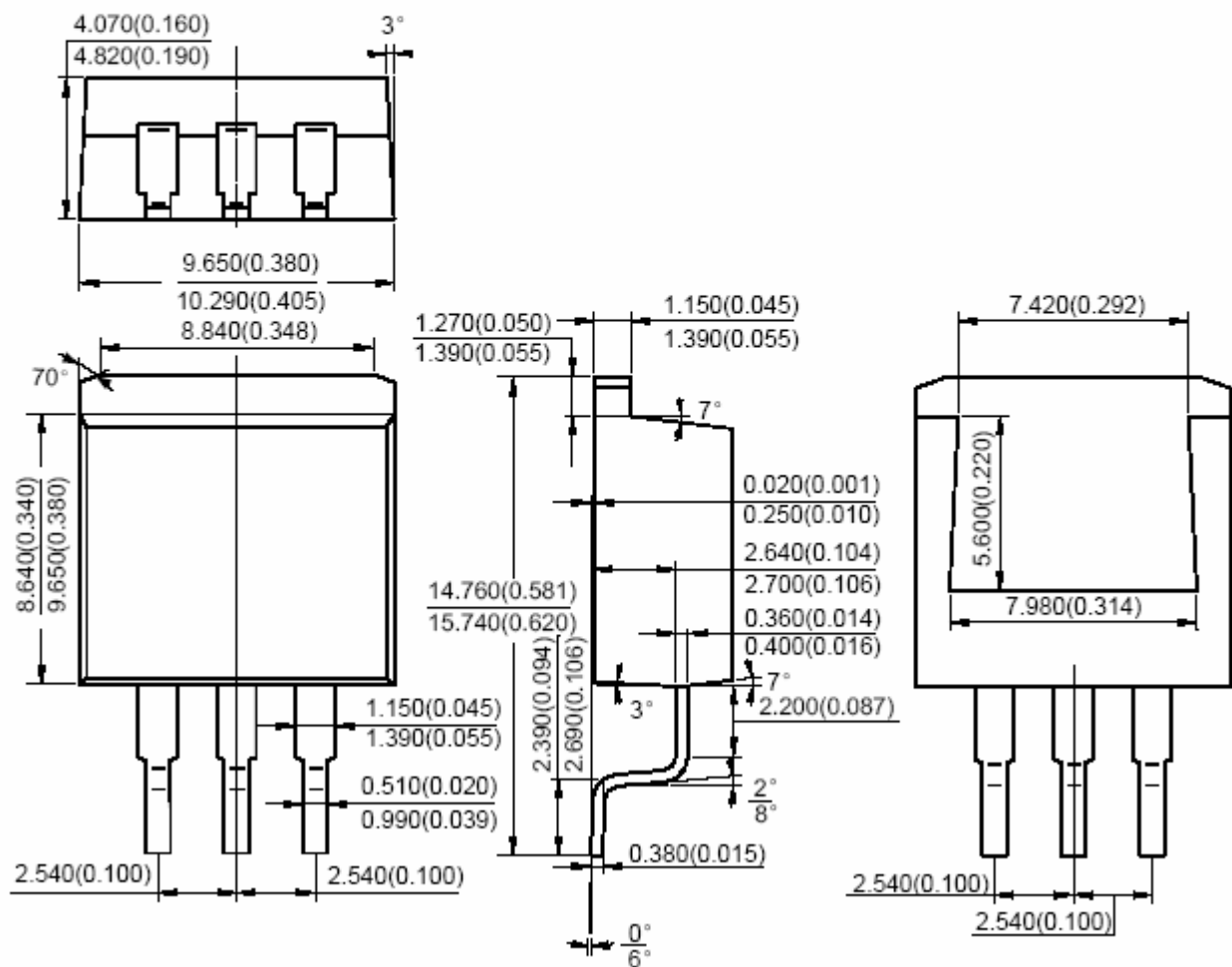
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■ Package Mechanical Data (Continued)

TO-263-3

Unit: mm(inch)



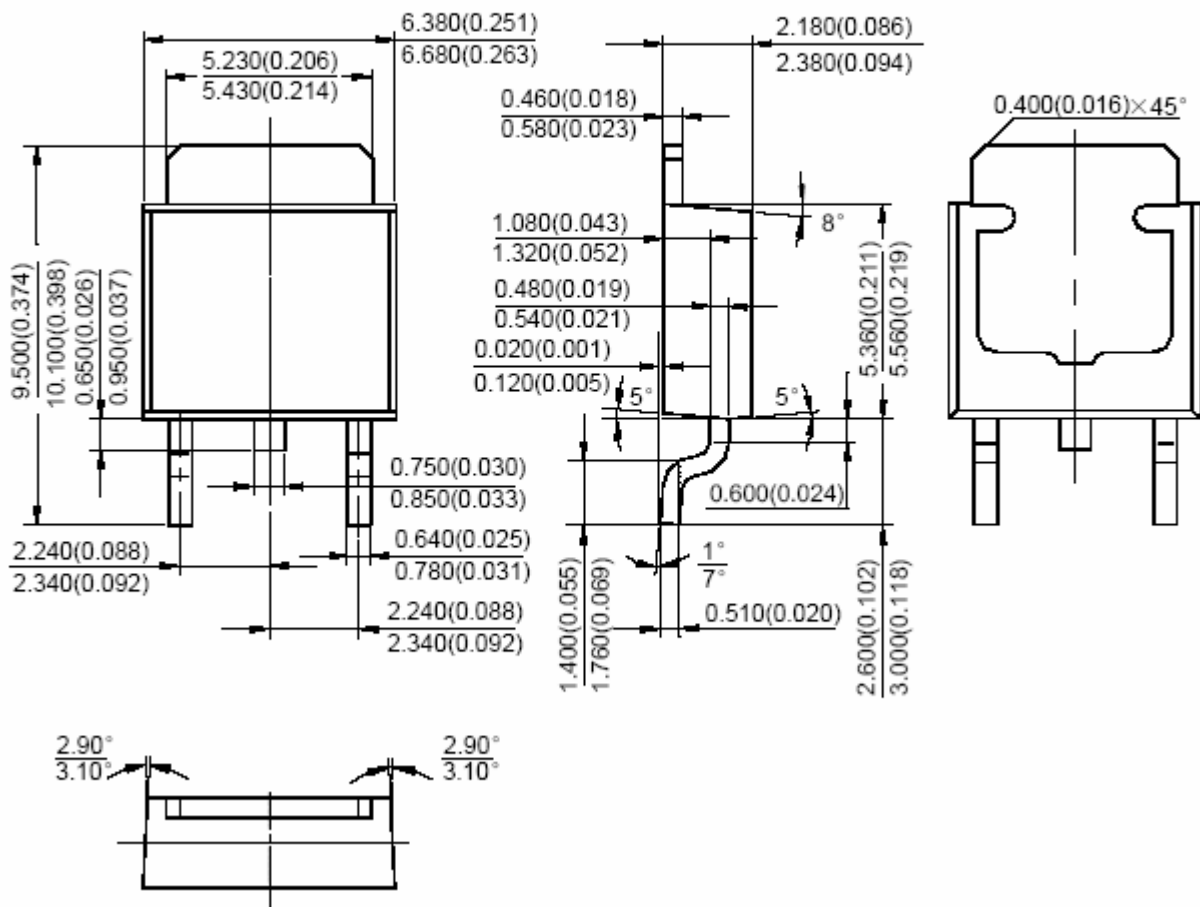
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■ Package Mechanical Data (Continued)

TO-252-2

Unit: mm(inch)



1A Ultra Low Dropout Linear Regulator**CL2940****IMPORTANT NOTICE**

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