VOLTAGE REGULATOR WITH ON/OFF SWITCH

FEATURES

- Low Dropout Voltage
- Electronic ON/OFF Switch
- Very Low Standby Current (ON, No Load)
- Internal Thermal Shutdown
- Short Circuit Protection
- Very Low (<100 nA) Current in OFF Mode
- 100 mA Load Capability
- Customized Versions Are Available

APPLICATIONS

- Battery Powered Systems
- Cellular Telephones
- Pagers
- Personal Communications Equipment
- Portable Instrumentation
- Portable Consumer Equipment
- Radio Control Systems
- Toys
- Low Voltage Systems

DESCRIPTION

The TK114xx is a low power, linear regulator with a built-in electronic switch. The internal electronic switch can be controlled by an external pull-up resistor and an open drain or open collector transistor. The device is in the OFF state when the control pin is biased from V_{IN} through the pull-up resistor.

An internal PNP pass-transistor is used in order to achieve low dropout voltage (typically 200 mV at 50 mA load current). The device has very low quiescent current (500 µA) in the ON mode with no load and 2 mA with 30 mA load. The quiescent current is typically 4 mA at 60 mA load. An internal thermal shutdown circuit limits the junction temperature to below 150 °C. The load current is internally monitored and the device will shut down (no load current) in the presence of a short circuit at the output. The regulated output voltage may be specified in 0.5 V increments between 2.0 to 5.5 V. Additionally, 3.25 V, 6.0 V and 8.0 V versions are also available. Separate data sheets are provided for the various options.

The device is available in a plastic SOT-23L package. Tape and reel mounted devices are also available.

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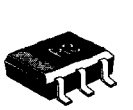
ORDERING INFORMATION

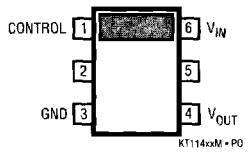
TK114 □□ □ □ □□

- Voltage Code
- Temp. Range
- Tape/Reel Code
- Package Code

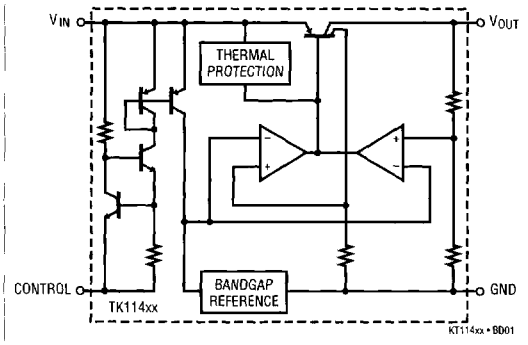
VOLTAGE CODE		PACKAGE CODE	TAPE/REEL CODE
20 = 2.0 V	40 = 4.0 V	M : Surface Mount	BX : Bulk/Bag
25 = 2.5 V	45 = 4.5 V		TX : Paper Tape
30 = 3.0 V	50 = 5.0 V	TEMP. RANGE	TR : Tape Right
32 = 3.25 V	60 = 6.0 V	C : -20 - 70 °C	TL : Tape Left
35 = 3.5 V	80 = 8.0 V	I : -40 - 85 °C	

TK114xxM





BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... 14 V
Output Voltage ..... V_{OUT}x1.15 V
Load Current ..... 180 mA
Power Dissipation (Note 1) ..... 200 mW

Storage Temperature Range ..... -55 to +150 °C
Operating Temperature Range (I Version) . -40 to +85 °C
Operating Temperature Range (C Version) -20 to +70 °C
Lead Soldering Temp. (10 sec.) ..... 240 °C
Junction Temperature ..... 150 °C

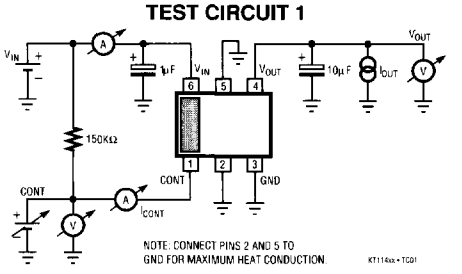
ELECTRICAL CHARACTERISTICS

Due to the common format used here, some specifications may not apply to all versions of output voltages. Detailed specifications are available for each version.

SYMBOL	PARAMETER	TEST CONDITION	-20 to +70 °C			-40 to +85 °C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{IN}	Supply Voltage Range		2.5		14	2.5		14	V
I_{IN1}	Supply Current 1	$V_{IN} = V_O + 1$ V, $I_O = 0$ mA		500	900		500	900	µA
I_{IN2}	Supply Current 2	$V_{IN} = V_O$ -(1 V to 0.1 V), $I_O = 0$ mA		1.0	2.5		1.0	2.5	mA
I_{IN3}	Supply Current 3	$V_{IN} = 10$ V, V_{OUT} = Off mode		0.1	2		0.1	3	mA
V_O	Regulated Output Voltage	$V_{IN} = V_O + 1$V, $I_O = 30$ mA, $T_A = 25$	±3.5% or ±100						mV
V_O	Regulated Output Voltage	$V_{IN} = V_O + 1$V, $I_O = 30$ mA	±4.5% or 130			±5% or 140			mV
V_{DROP1}	Dropout Voltage 1	$I_O = 30$ mA		0.12	0.3		0.12	0.3	V
I_O	Output Current			110			100		mA
I_{OR}	Recommended Output Current				70			70	mA
LI_{REG}	Line Regulation	$V_{OUT} + 1$ V ≤ V_{IN} ≤ $V_{OUT} + 6$ V		2	20		2	20	mV
LD_{REG}	Load Regulation	$V_{IN} = V_O + 1$ V, $I_O = 0$ to 60 mA		35	110		35	110	mV
I_{CONT}	Control Pin Current			35	120		35	120	µA
V_{Coff}	Control Pin Voltage	Off Mode	V_{IN}-0.2		V_{IN}	V_{IN}-0.2		V_{IN}	V
V_{Con}	Control Pin Voltage	On Mode	0		V_{IN}-1.0	0		V_{IN}-1.0	V
RR	Ripple Rejection	100 mV(rms), f = 400 Hz $V_{IN} = V_O + 1.5$ V, $I_O = 10$ mA		55			55		dB
$\Delta V/\Delta T$	V_O Temperature Coefficient	$V_{IN} = V_O + 1.5$ V, $I_O = 10$ mA		0.6			0.6		mV/°C
V_N	Output Noise Voltage	$V_{IN} = V_O + 1.5$ V, $I_O = 10$ mA $C_L = 10$ µF		180			180		µV(rms)

Note 1: Power dissipation must be derated at the rate of 1.6 mW/ °C for operation at $T_A = 25$ °C and above. Power dissipation = 400 mW when mounted as recommended.

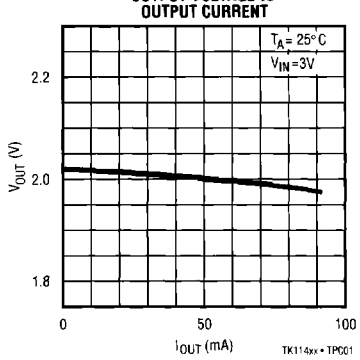
TEST CIRCUIT 1



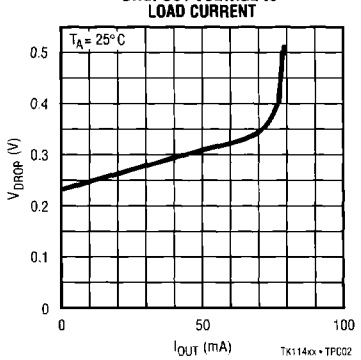
TYPICAL PERFORMANCE CHARACTERISTICS

TK11420

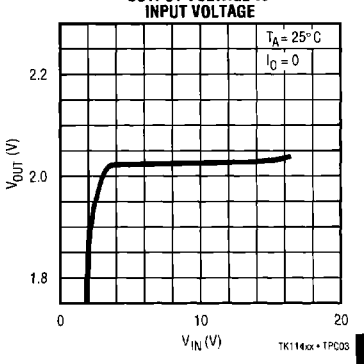
OUTPUT VOLTAGE vs OUTPUT CURRENT



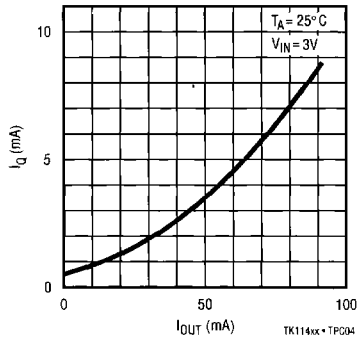
DROPOUT VOLTAGE vs LOAD CURRENT



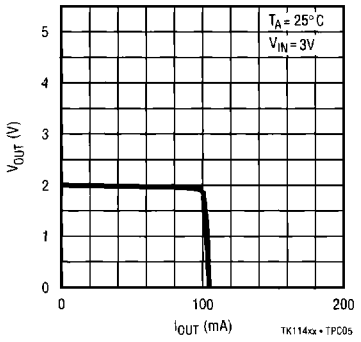
OUTPUT VOLTAGE vs INPUT VOLTAGE



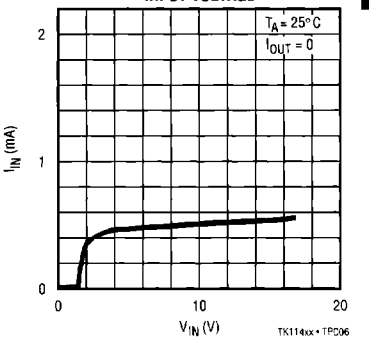
QUIESCENT CURRENT vs LOAD CURRENT



SHORT CIRCUIT PROTECTION

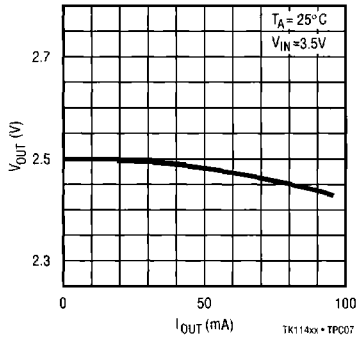


INPUT CURRENT vs INPUT VOLTAGE

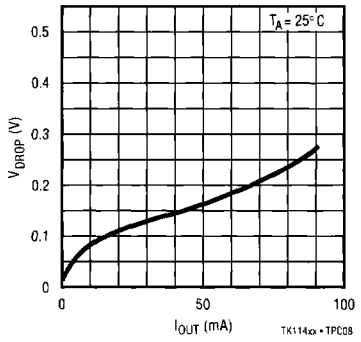


TK11425

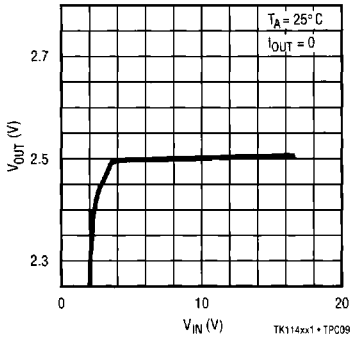
OUTPUT VOLTAGE vs OUTPUT CURRENT



DROPOUT VOLTAGE vs LOAD CURRENT



OUTPUT VOLTAGE vs INPUT VOLTAGE



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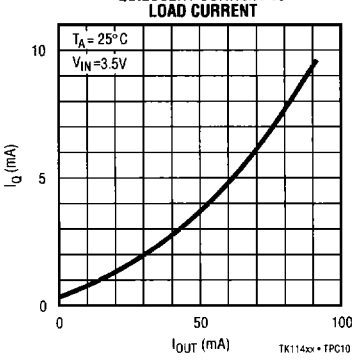
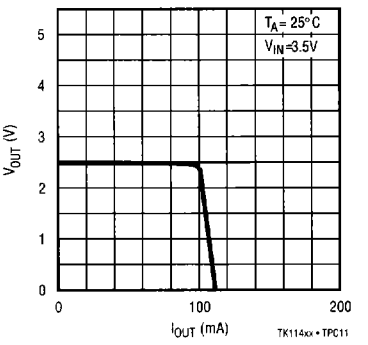
TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

TK11425 (CONT.)

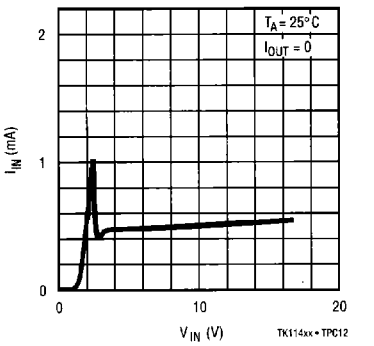
QUIESCENT CURRENT vs LOAD CURRENT



SHORT CIRCUIT PROTECTION

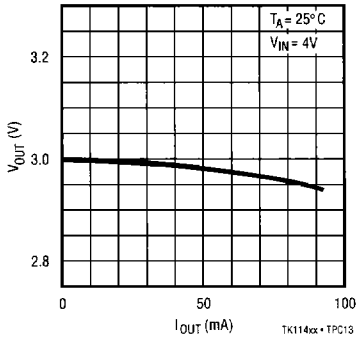


INPUT CURRENT vs INPUT VOLTAGE

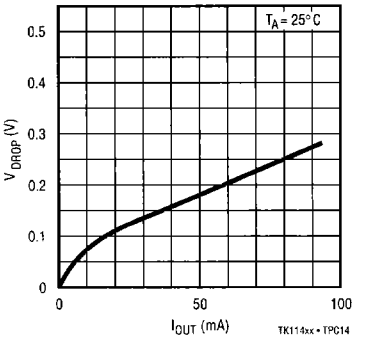


TK11430

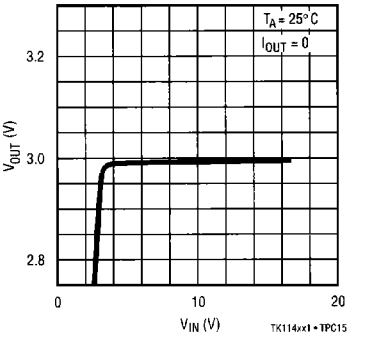
OUTPUT VOLTAGE vs OUTPUT CURRENT



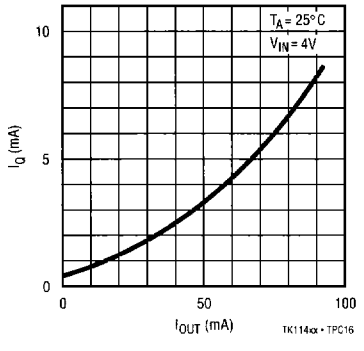
DROPOUT VOLTAGE vs LOAD CURRENT



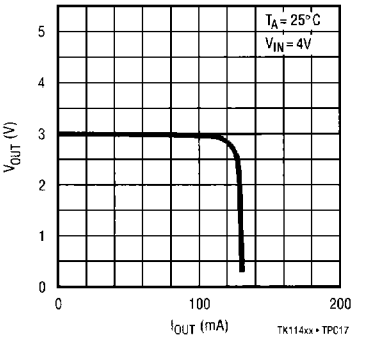
OUTPUT VOLTAGE vs INPUT VOLTAGE



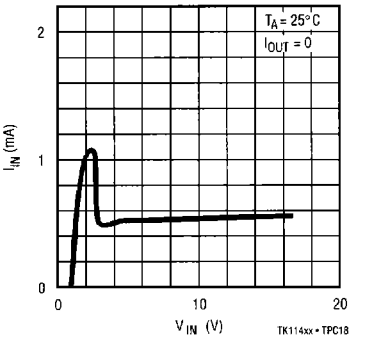
QUIESCENT CURRENT vs LOAD CURRENT



SHORT CIRCUIT PROTECTION



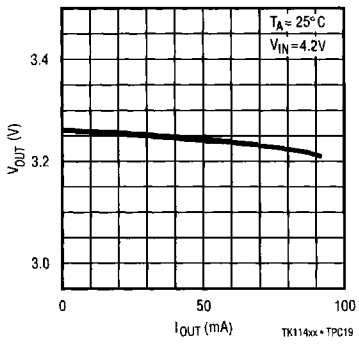
INPUT CURRENT vs INPUT VOLTAGE



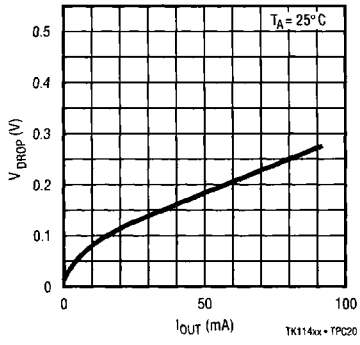
TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

TK11432

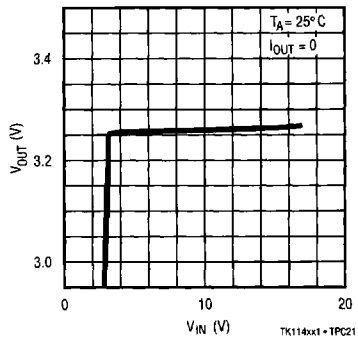
OUTPUT VOLTAGE vs OUTPUT CURRENT



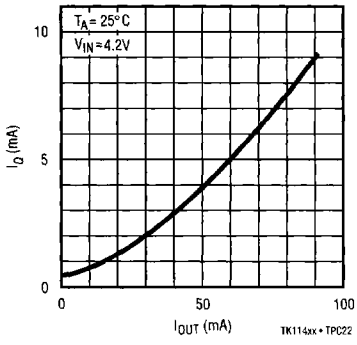
DROPOUT VOLTAGE vs LOAD CURRENT



OUTPUT VOLTAGE vs INPUT VOLTAGE



QUIESCENT CURRENT vs LOAD CURRENT



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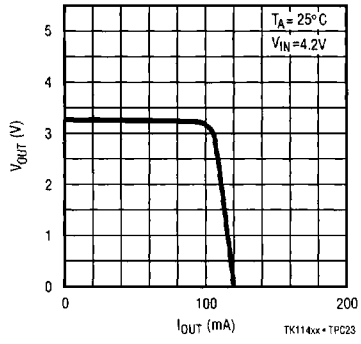
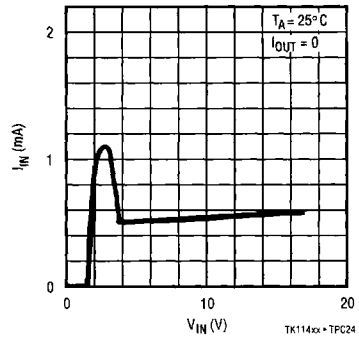
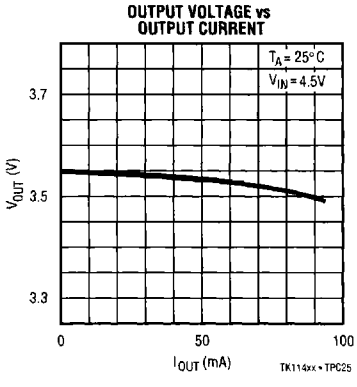


INPUT CURRENT vs INPUT VOLTAGE

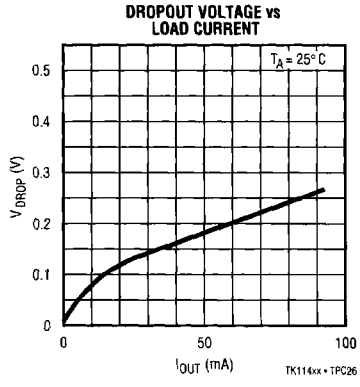


TK11435

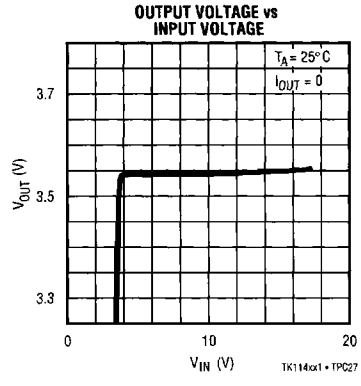
OUTPUT VOLTAGE vs OUTPUT CURRENT



DROPOUT VOLTAGE vs LOAD CURRENT



OUTPUT VOLTAGE vs INPUT VOLTAGE



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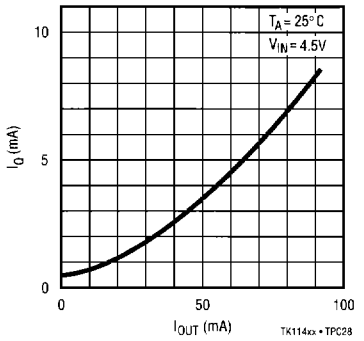
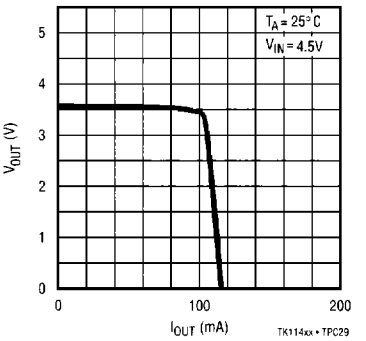
TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

TK11435 (CONT.)

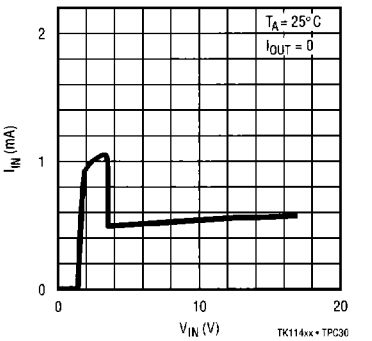
QUIESCENT CURRENT vs LOAD CURRENT



SHORT CIRCUIT PROTECTION

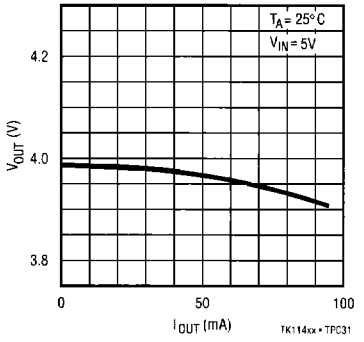


INPUT CURRENT vs INPUT VOLTAGE

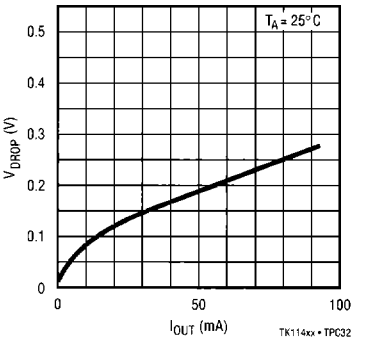


TK11440

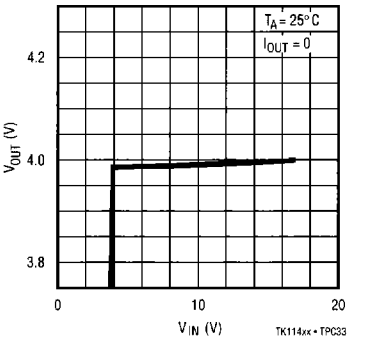
OUTPUT VOLTAGE vs OUTPUT CURRENT



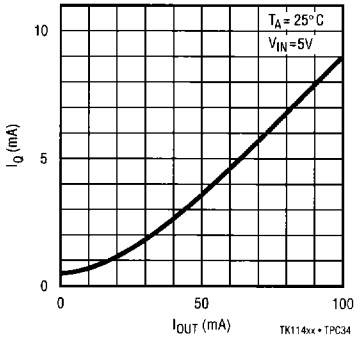
DROPOUT VOLTAGE vs LOAD CURRENT



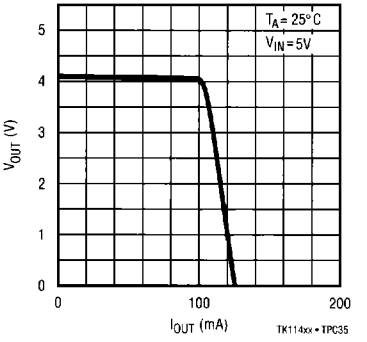
OUTPUT VOLTAGE vs INPUT VOLTAGE



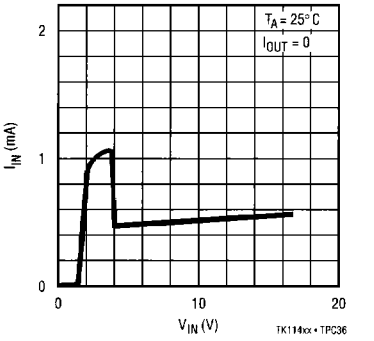
QUIESCENT CURRENT vs LOAD CURRENT



SHORT CIRCUIT PROTECTION



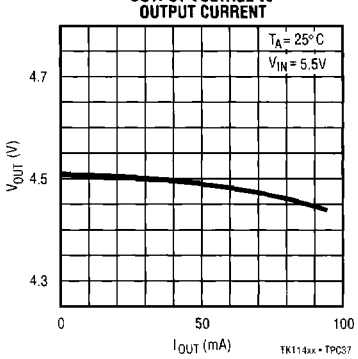
INPUT CURRENT vs INPUT VOLTAGE



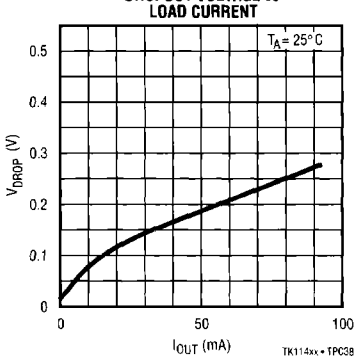
TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

TK11445

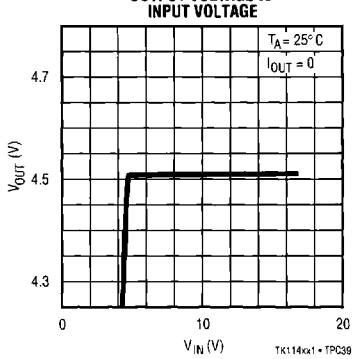
OUTPUT VOLTAGE vs OUTPUT CURRENT



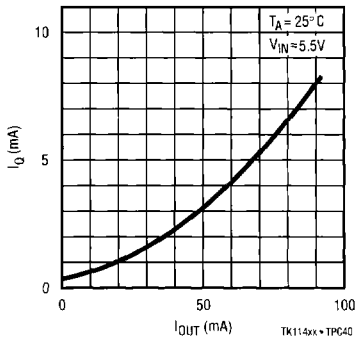
DROPOUT VOLTAGE vs LOAD CURRENT



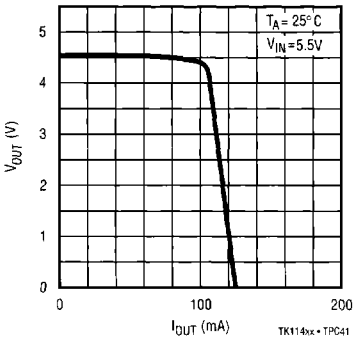
OUTPUT VOLTAGE vs INPUT VOLTAGE



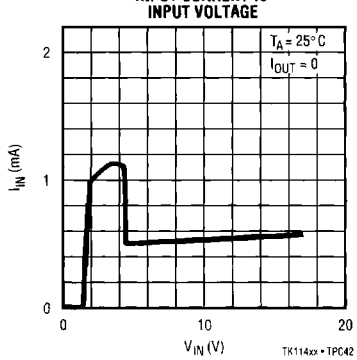
QUIESCENT CURRENT vs LOAD CURRENT



SHORT CIRCUIT PROTECTION

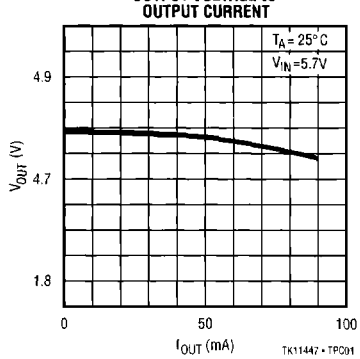


INPUT CURRENT vs INPUT VOLTAGE

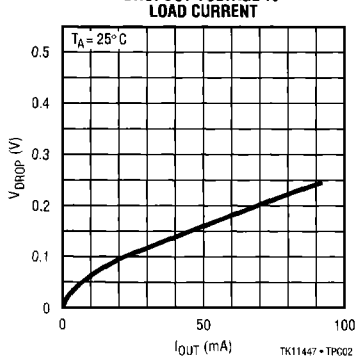


TK11447

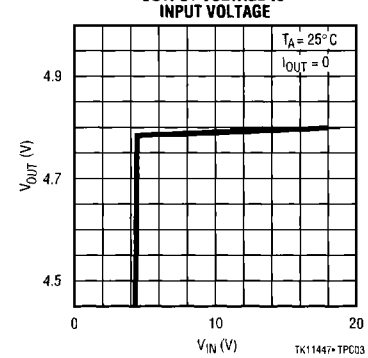
OUTPUT VOLTAGE vs OUTPUT CURRENT



DROPOUT VOLTAGE vs LOAD CURRENT



OUTPUT VOLTAGE vs INPUT VOLTAGE



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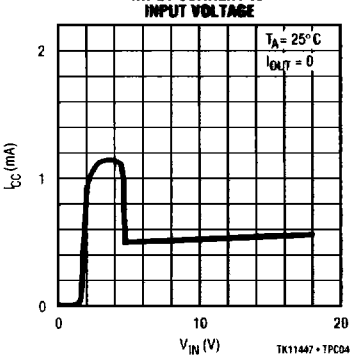
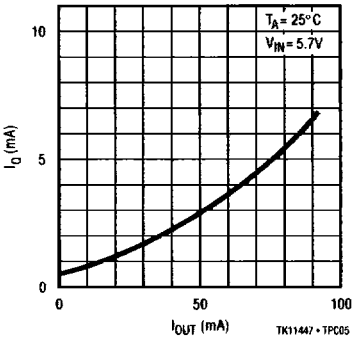
TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

TK11447 (CONT.)

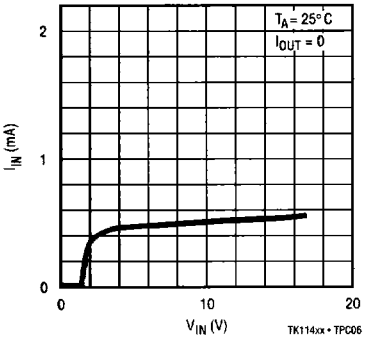
INPUT CURRENT vs INPUT VOLTAGE



QUIESCENT CURRENT vs LOAD CURRENT

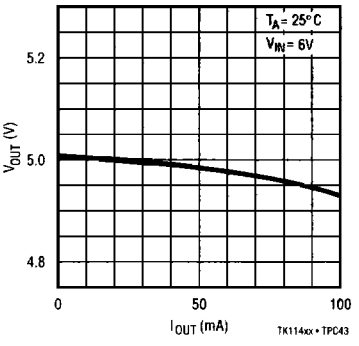


INPUT CURRENT vs INPUT VOLTAGE

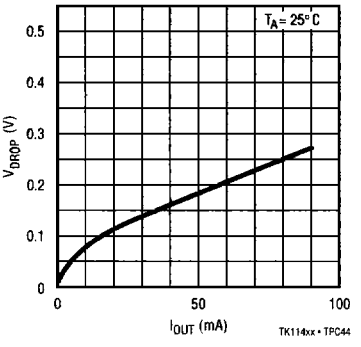


TK11450

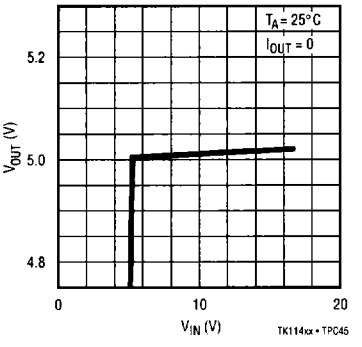
OUTPUT VOLTAGE vs OUTPUT CURRENT



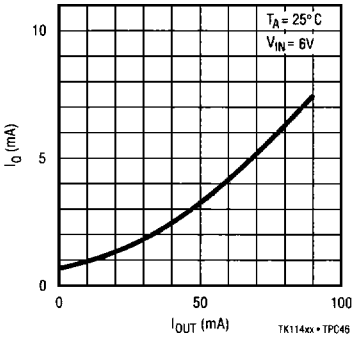
DROPOUT VOLTAGE vs LOAD CURRENT



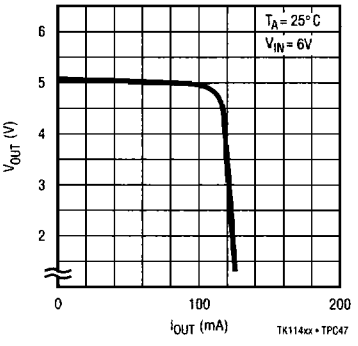
OUTPUT VOLTAGE vs INPUT VOLTAGE



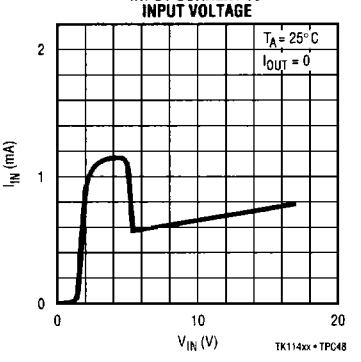
QUIESCENT CURRENT vs LOAD CURRENT



SHORT CIRCUIT PROTECTION

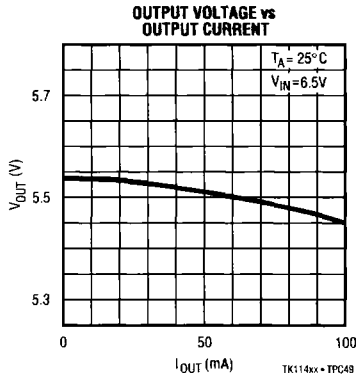


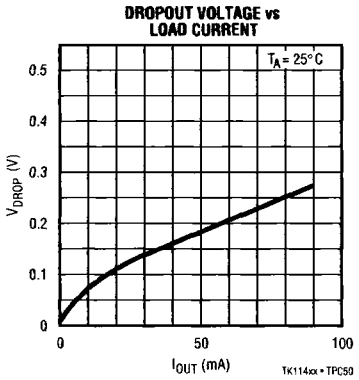
INPUT CURRENT vs INPUT VOLTAGE

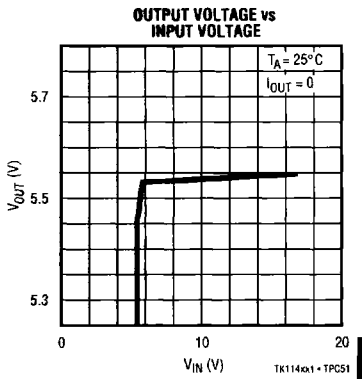


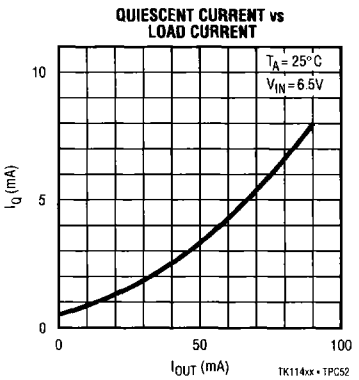
TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

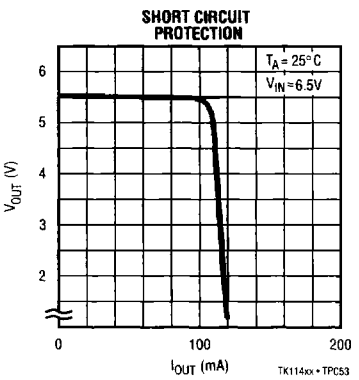
TK11455

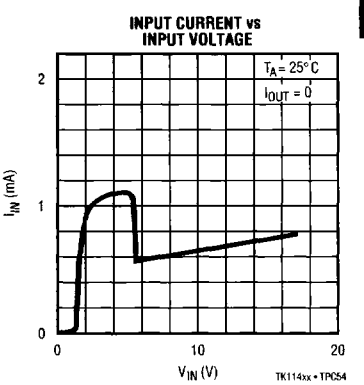




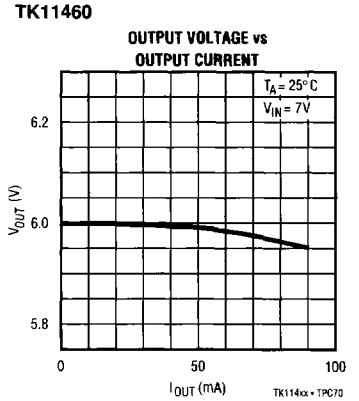


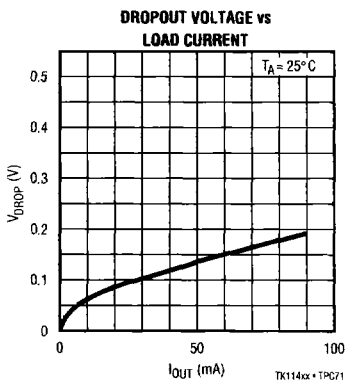


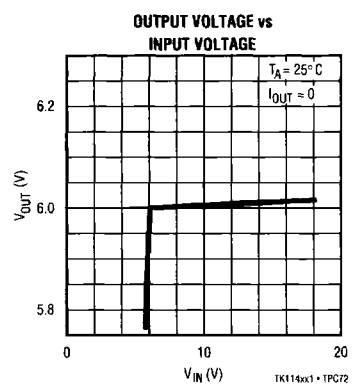




TK11460







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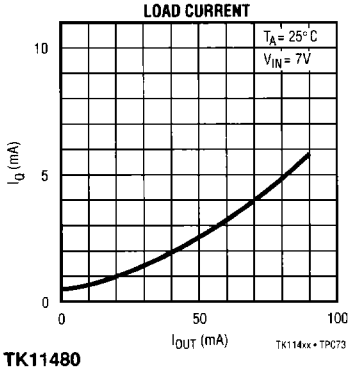
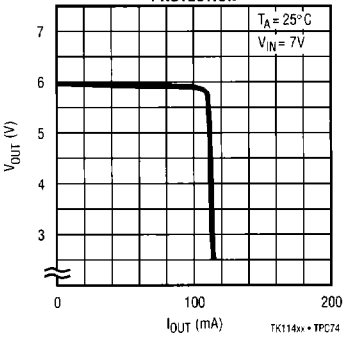
TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

TK11460 (CONT.)

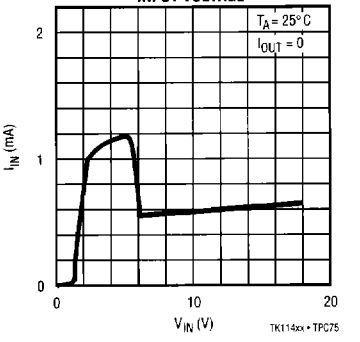
QUIESCENT CURRENT vs LOAD CURRENT



SHORT CIRCUIT PROTECTION

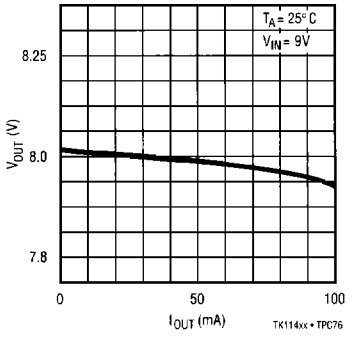


INPUT CURRENT vs INPUT VOLTAGE

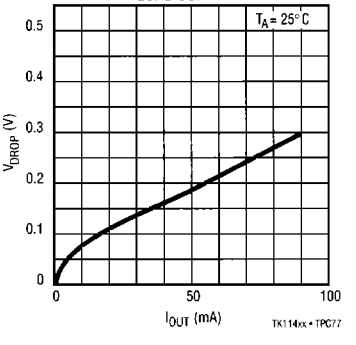


TK11480

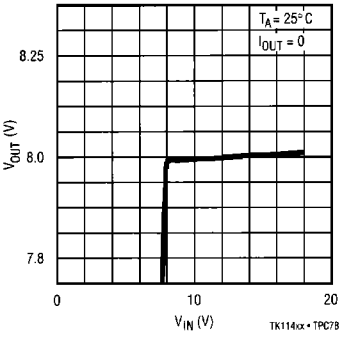
OUTPUT VOLTAGE vs OUTPUT CURRENT



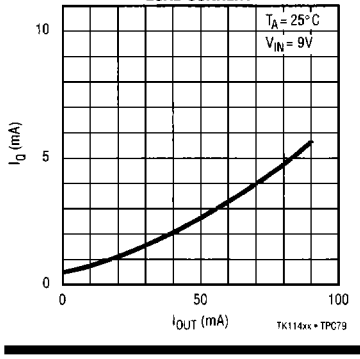
DROPOUT VOLTAGE vs LOAD CURRENT



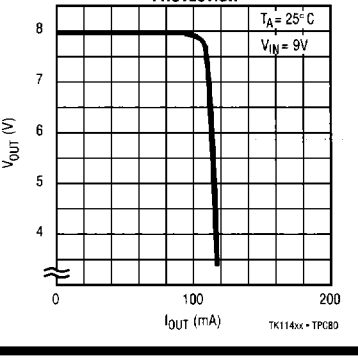
OUTPUT VOLTAGE vs INPUT VOLTAGE



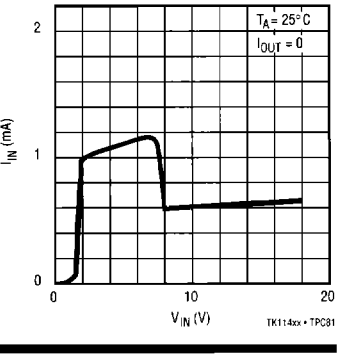
QUIESCENT CURRENT vs LOAD CURRENT



SHORT CIRCUIT PROTECTION

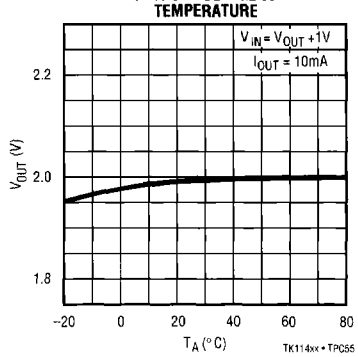


INPUT CURRENT vs INPUT VOLTAGE

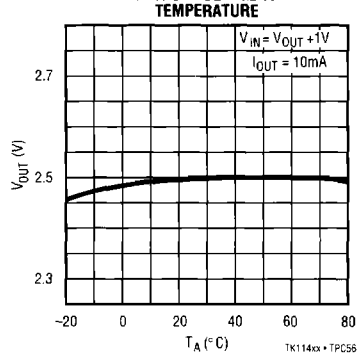


TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

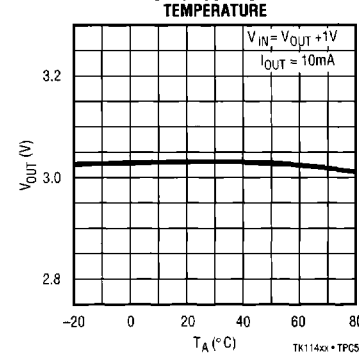
TK11420
OUTPUT VOLTAGE vs TEMPERATURE



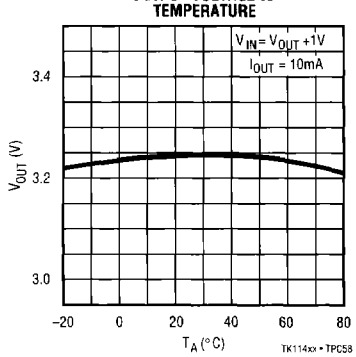
TK11425
OUTPUT VOLTAGE vs TEMPERATURE



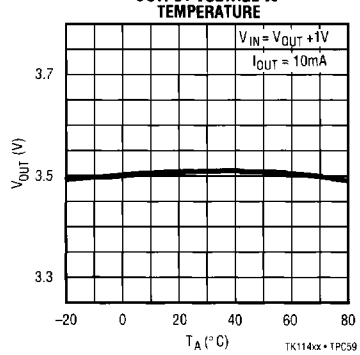
TK11430
OUTPUT VOLTAGE vs TEMPERATURE



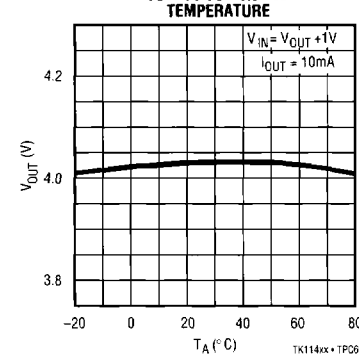
TK11432
OUTPUT VOLTAGE vs TEMPERATURE



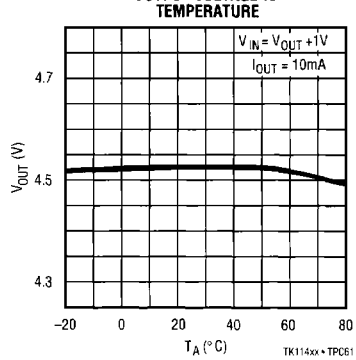
TK11435
OUTPUT VOLTAGE vs TEMPERATURE



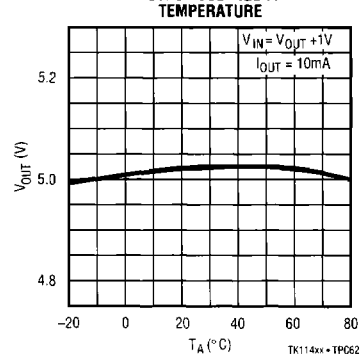
TK11440
OUTPUT VOLTAGE vs TEMPERATURE



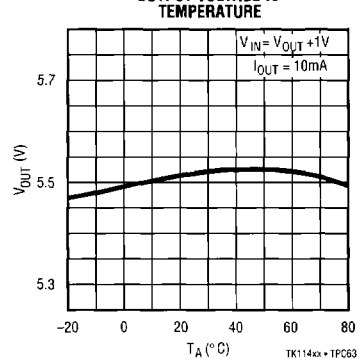
TK11445
OUTPUT VOLTAGE vs TEMPERATURE



TK11450
OUTPUT VOLTAGE vs TEMPERATURE



TK11455
OUTPUT VOLTAGE vs TEMPERATURE



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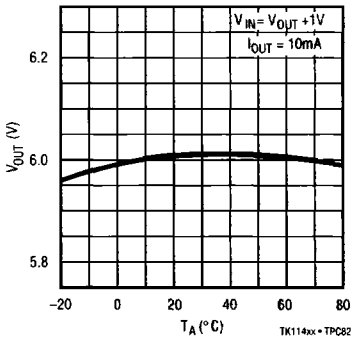
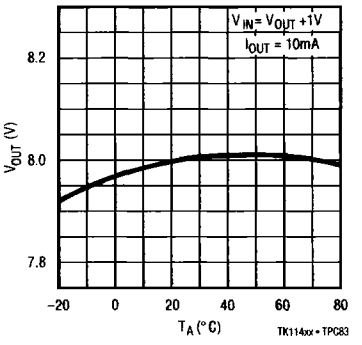
TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

TK11460
OUTPUT VOLTAGE vs TEMPERATURE



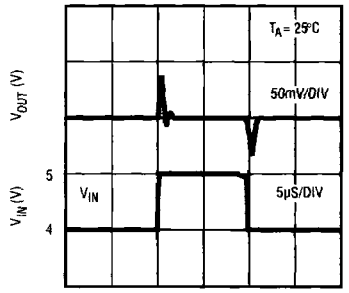
TK11480
OUTPUT VOLTAGE vs TEMPERATURE



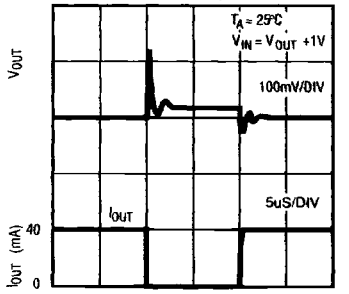
TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)

COMMON CHARACTERISTICS

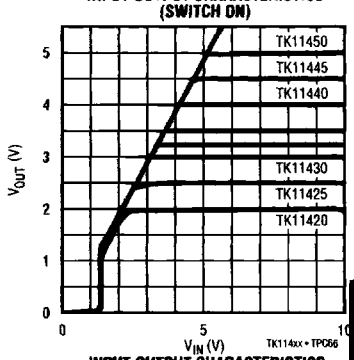
LINE TRANSIENT RESPONSE



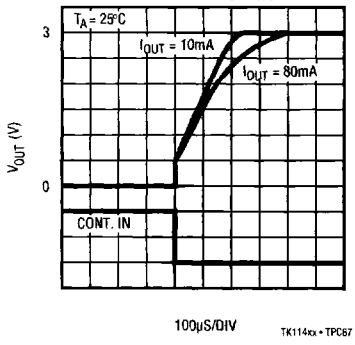
LOAD TRANSIENT RESPONSE



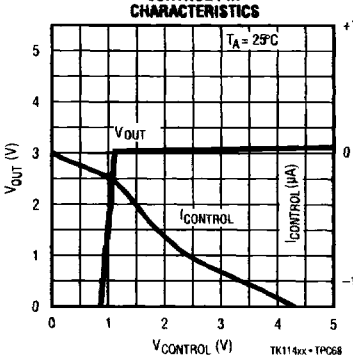
INPUT OUTPUT CHARACTERISTICS (SWITCH ON)



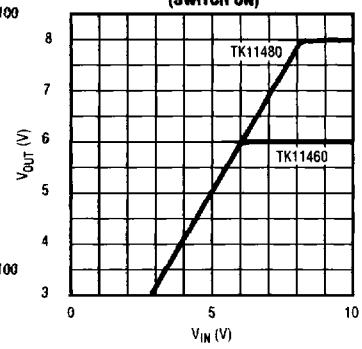
TURN ON TRANSIENT RESPONSE



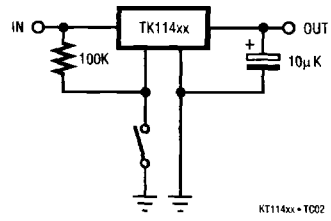
CONTROL PIN CHARACTERISTICS



INPUT OUTPUT CHARACTERISTICS (SWITCH ON)

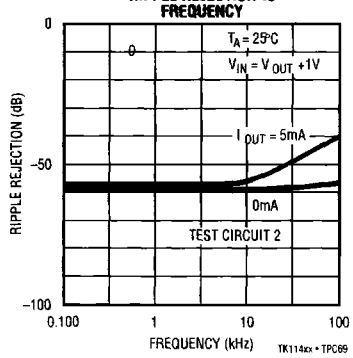


TEST CIRCUIT 2

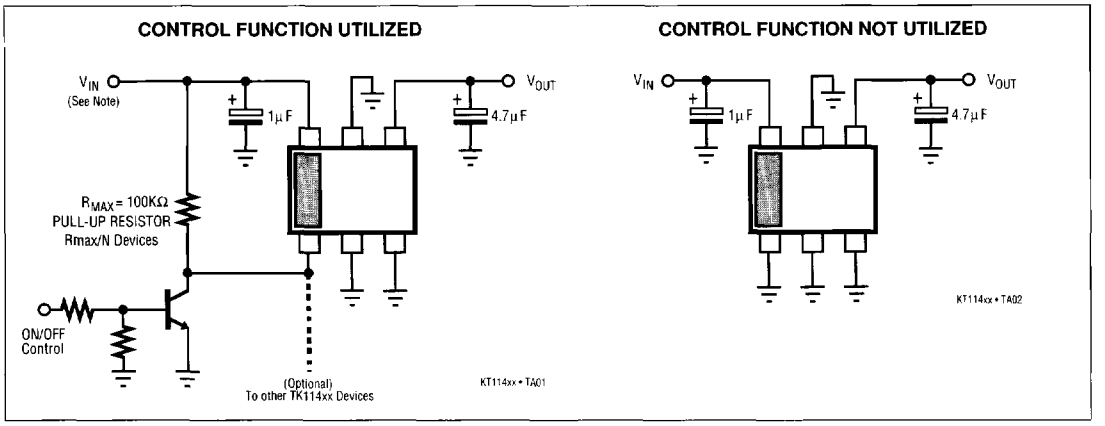


RIPPLE REJECTION TEST CIRCUIT

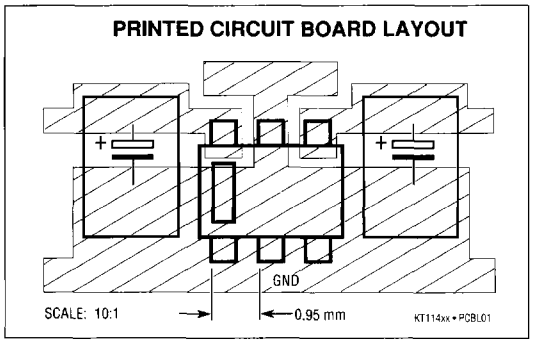
RIPPLE REJECTION vs FREQUENCY



TYPICAL APPLICATIONS



Note: Parallel connection of control pins is allowed if all devices use identical input voltage.



Application Hints

Maximize copper foil area connecting to all IC pins for optimum performance. Place input and output bypass capacitors close to the GND pin. For best transient behavior and lowest output impedance, use as large a capacitor value as possible. The temperature coefficient of the capacitance and Equivalent Series Resistance (ESR) should be taken into account. These parameters can influence power supply noise and ripple rejection. In extreme cases, oscillation may occur. In order to maintain stability, the output bypass capacitor value should be minimum 2.2 µF for a Tantalum electrolytic or 4.7 µF for an Aluminum electrolytic.

Handling Molded Resin Packages

All plastic molded packages absorb some moisture from the air. If moisture absorption occurs prior to soldering the device into the printed circuit board, increased separation of the lead from the plastic molding may occur, degrading the moisture barrier characteristics of the device.

This property of plastic molding compounds should not be overlooked, particularly in the case of very small packages, where the plastic is very thin.

In order to preserve the original moisture barrier properties of the package, devices are stored and shipped in moisture proof bags, filled with dry air. The bags should not be opened or damaged prior to the actual use of the devices. If this is unavoidable, the devices should be stored in a low relative humidity environment (40 to 65%) or in an enclosed environment with desiccant.