

5A ULDO LINEAR REGULATORS FAMILY

- UP TO 5A OUTPUT CURRENT
- $\pm 2\%$ PRECISE OUTPUT VOLTAGES
- FAST TRANSIENT RESPONSE
- 0.75V TYP. DROP OUT VOLTAGE AT 5A
- OPERATING INPUT VOLTAGE FROM 4.5V
- ADJUSTABLE VERSION:
 - $V_O = 1.26V$
 - INHIBIT ($I_Q = 120\mu A$ TYP.)
 - POWER GOOD
 - PROGRAMMABLE CURRENT LIMIT
 - HEPTAWATT PACKAGE
- FIXED VERSION:
 - 3.3V, 5.1V, 12V OUTPUTS
 - VERSAWATT PACKAGE
- VERY LOW QUIESCENT CURRENT
- SHORT CIRCUIT PROTECTION (Foldback function)
- THERMAL SHUTDOWN

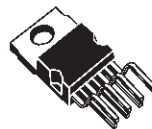
APPLICATIONS

- PENTIUM™ AND POWER PC™ SUPPLIES
- POST REGULATOR FOR SMPS
- LOW COST SOLUTION FOR 5V TO 3.3V CONVERSION
- LOW COST BATTERY CHARGER
- CONSTANT CURRENT REGULATOR
- SUITABLE FOR APPLICATION WITH STANDBY FEATURE

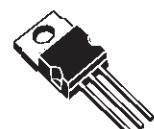
DESCRIPTION

The L4955 is a family of monolithic ultra very low drop linear regulators designed to supply the

MULTIPOWER BCD TECHNOLOGY



HEPTAWATT



VERSAWATT
(TO-220)

ORDERING NUMBERS	OUTPUT VOLTAGE	PACKAGE
L4955	1.26V ADJ	HEPTAWATT
L4955V3.3	3.3V	VERSAWATT
L4955V5.1	5.1V	VERSAWATT
L4955V12	12V	VERSAWATT

most recent microprocessors.

The dropout voltage is only 0.75V (Typ.) at 5A, directly dependent on the output current conditions.

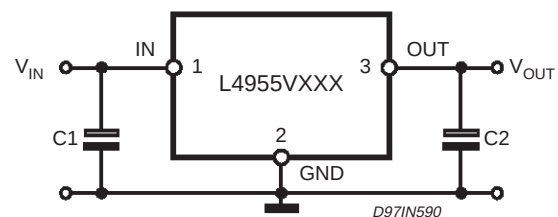
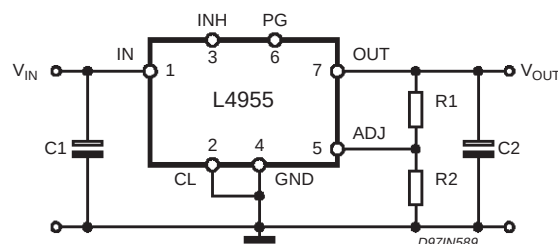
Realized in BCDII technology, it has on board a charge pump to properly drive an N-channel power mos Transistor with 150mΩ of $R_{DS(on)}$.

It operates from a 4.5V minimum supply, with a very low quiescent current irrespective of the load; a minimum of 22μF output capacitor is required for stability.

The on-chip trimming techniques improve the precision of the available output voltages to $\pm 2\%$.

Ancillary functions like power good, inhibit with

TYPICAL APPLICATIONS



low power consumption, programmable output voltage and current limiting make the flexible heptawatt version usable in applications where power management, stand-by, features, post regulation and adjustable current generators for battery chargers are important.

Symbol	Parameter	Value	Unit
V _{IN}	Supply Input Voltage	24	V
	ADJ and CL pins	-0.3 to 4	V
	PG and INH pins	0 to V _{IN}	V
P _{TOT}	Power Dissipation @ T _{amb} = 50°C	2	W
	Power Dissipation @ T _{case} = 90°C	15	W
T _{st} , T _i	Storage Temperature	-40 to +150	°C

The diagram shows the pinout for two power transistors: HEPTAWATT and VERSAWATT.

HEPTAWATT (D96IN367): A 7-pin transistor. The pins are numbered 1 to 7 from bottom to top. The pinout is as follows:

- Pin 1: IN
- Pin 2: CL
- Pin 3: INH
- Pin 4: GND
- Pin 5: ADJ
- Pin 6: PG
- Pin 7: OUT

A note indicates: "tab connected to pin 4".

VERSAWATT (D96IN369): A 3-pin transistor. The pins are numbered 1, 3, and 3 from bottom to top. The pinout is as follows:

- Pin 1: IN
- Pin 3: GND
- Pin 3: OUT

The diagram illustrates the internal circuitry of the D96IN366 power MOSFET driver. Key components include:

- Input Stage:** V_{IN} is connected to pin 1 (1). A 10 μF capacitor is connected to the input. Pin 3 (INH) is connected to a 1.26V source and an "INHIBIT ACTIVE HIGH" input.
- Control Logic:** The circuit includes a PRE REGULATOR, an error amplifier (E/A), a PROGRAM. C.L., a FIXED C.L., a FOLDBACK circuit, a CHARGE PUMP, a BUFFER, and a THERMAL SHUTDOWN block.
- Reference and Biasing:** $V_{REF} = 1.26V$ is provided. A 0.9V_{REF} source is connected to pin 4 (2). Pin 2 (CL) is connected to a load resistor R_{CL} (1/4W, 1%).
- Output Stage:** The output is connected to pin 7 (3) (OUT). A POWER DMOS 150m Ω MOSFET is used. The output is filtered by a 22 μF capacitor. Pin 5 (ADJ) is connected to a divider network (R1, R2). Pin 6 (PG) is connected to ground.

Pin connections are summarized as follows:

- PIN x = HEPTAWATT
- PIN (x) = VERSAWATT
- PIN 1 (1) = IN
- PIN 2 (2) = CL
- PIN 3 (3) = OUT
- PIN 4 (2) = GND
- PIN 5 = ADJ
- PIN 6 = PG

PIN FUNCTIONS

HW	VW	Name	Function
1	1	IN	Unregulated input voltage; this pin must be bypassed with a capacitor larger than 10 μ F.
2	–	CL	A resistor connected between this pin and ground sets the programmable current limiting value. When the programmable current limiting is not used the pin must be connected to GND.
3	–	INH	TTL-CMOS input. A logic high level on this input disables the device. An internal pull-down insures full functionality even if the pin is open.
4	2	GND	Ground.
5	–	ADJ	The output is connected directly to this terminal for 1.26V operation; it is connected to the output through a resistive divider for higher voltages.
6	–	PG	Open drain output, this signal is low when the output voltage is lower than 90%, otherwise is high.
7	3	OUT	Regulated output voltage. A minimum bypass capacitor of 22 μ F is required to insure stability.

THERMAL DATA (HEPTAWATT & VERSAWATT packages)

Symbol	Parameter	Value	Unit
$R_{th\ j-case}$	Thermal Resistance Junction-case Max.	2.5	$^{\circ}C/W$
$R_{th\ j-amb}$	Thermal Resistance Junction-ambient Max.	50	$^{\circ}C/W$
	Thermal Shutdown Typ.	150	$^{\circ}C$
	Thermal Hysteresis Typ.	20	$^{\circ}C$

L4955 - ELECTRICAL CHARACTERISTICS ($T_J = 25^{\circ}C$, $V_{in} = 12V$, unless otherwise specified).

● = Specifications referred to T_J from $0^{\circ}C$ to $+125^{\circ}C$.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{IN}	Operating Supply Voltage		4.5		22	V
V_O	Output Voltage (1)	$0.1A < I_O < 5A$; $4.5V < V_{IN} < 12V$	1.235	1.26	1.285	V
		$4.5V < V_{IN} < 12V$; $0.1A < I_O < 5A$ ●	1.222	1.26	1.298	V
ΔV_O	Line regulation (1)	$4.5V < V_{IN} < 22V$; $I_O = 10mA$		2	10	mV
ΔV_O	Load regulation (1)	$0.1A < I_O < 5A$		2	10	mV
V_O	Dropout Voltage	$I_O = 5A$ $V_{IN} \geq 4.5V$		0.75	1.1	V
		●		1.1	1.5	V
		$I_O = 2A$ ●		0.55	0.75	V
I_O	Current Limiting	●	5.1	6.3	7.5	A
	Short Circuit Current	$V_O = 0V$ ●		1.8		A
	Programmable Current Limiting	$R_{lim} = 13k\Omega$ ●	2.55	3	3.45	A
		$R_{lim} = 47k\Omega$ ●	0.70	0.85	1.00	A
I_Q	Quiescent Current	$0.1A < I_O < 5A$ $C_L = 0$		2	3	mA
		$C_L = 13k$		2.7	4	mA
	Stand By Current	$INH = 5V$		120	200	μA
	Inhibit Threshold	Rising Edge ●	1.1	1.26	1.42	V
	Inhibit Hysteresis			0.2		V
	Inhibit Bias Sink Current	$INH = 5V$ or $0.8V$		20	60	μA
	Power Good Threshold	Rising Edge		$0.9 \times V_O$		V
	Power Good Hysteresis	●		0.2		V
	Power Good Saturation	$I_{PG} = 4mA$ ●		0.1	0.4	V
	Ripple Rejection	$f = 120Hz$, $I_O = 5A$ $V_{IN} = 6V$ $\Delta V_{IN} = 2V_{PP}$	60	75		dB

(1) Output voltage connected to ADJ.

L4955

L4955V3.3 - ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$, $V_{in} = 5\text{V}$, unless otherwise specified)

● = Specifications referred to T_J from 0°C to $+125^\circ\text{C}$.

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
V_{IN}	Operating Input Voltage			4.5		22	V
V_O	Output Voltage	$4.75\text{V} < V_{IN} < 12\text{V}; 0.1\text{A} < I_O < 5\text{A}$		3.234	3.300	3.366	V
		$4.75\text{V} < V_{IN} < 12\text{V}; 0.1\text{A} < I_O < 5\text{A}$	●	3.201	3.300	3.399	V
ΔV_O	Line regulation	$4.5\text{V} < V_{IN} < 12\text{V}; I_O = 10\text{mA}$			2	10	mV
ΔV_O	Load regulation	$0.1\text{A} < I_O < 5\text{A}$			3	15	mV
I_O	Current Limiting		●	5.1	6.3	7.5	A
	Short Circuit Current	$V_O = 0\text{V}$	●		1.8		A
I_Q	Quiescent Current	$0.1\text{A} < I_O < 5\text{A}$			2	3	mA
	Ripple Rejection	$f = 120\text{Hz}, I_O = 5\text{A}$ $V_{IN} = 6\text{V} \Delta V_{IN} = 2V_{PP}$		57	70		dB

L4955V5.1 - ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$, $V_{in} = 8\text{V}$, unless otherwise specified)

● = Specifications referred to T_J from 0°C to $+125^\circ\text{C}$.

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
V_{IN}	Operating Input Voltage			$V_O + V_D$		22	V
V_O	Output Voltage	$6.75\text{V} < V_{IN} < 15\text{V}; 0.1\text{A} < I_O < 5\text{A}$		5.000	5.100	5.200	V
		$6.75\text{V} < V_{IN} < 15\text{V}; 0.1\text{A} < I_O < 5\text{A}$	●	4.950	5.100	5.250	V
V_D	Drop-out Voltage	$I_O = 5\text{A}$			0.75	1.1	V
			●		1.1	1.5	V
		$I_O = 2\text{A}$	●		0.55	0.75	V
ΔV_O	Line regulation	$6.5\text{V} < V_{IN} < 15\text{V}; I_O = 10\text{mA}$			2	10	mV
ΔV_O	Load regulation	$0.1\text{A} < I_O < 5\text{A}$			5	20	mV
I_O	Current Limiting		●	5.1	6.3	7.5	A
	Short Circuit Current	$V_O = 0\text{V}$	●		1.8		A
I_Q	Quiescent Current	$0.1\text{A} < I_O < 5\text{A}$			2	3	mA
	Ripple Rejection	$f = 120\text{Hz}, I_O = 5\text{A}$ $V_{IN} = 8\text{V} \Delta V_{IN} = 2V_{PP}$		55	65		dB

L4955V12 - ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$, $V_{in} = 15\text{V}$, unless otherwise specified)

● = Specifications referred to T_J from 0°C to $+125^\circ\text{C}$.

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
V_{IN}	Operating Input Voltage			$V_O + V_D$		22	V
V_{OUT}	Output Voltage	$15\text{V} < V_{IN} < 22\text{V}; 0.1\text{A} < I_O < 5\text{A}$		11.760	12.00	12.240	V
		$15\text{V} < V_{IN} < 22\text{V}; 0.1\text{A} < I_O < 5\text{A}$	●	11.640	12.00	13.360	V
V_D	Drop-out Voltage	$I_O = 5\text{A}$			0.75	1.1	V
			●		1.1	1.5	V
		$I_O = 2\text{A}$	●		0.55	0.75	V
ΔV_O	Line regulation	$13.5\text{V} < V_{IN} < 22\text{V}; I_O = 10\text{mA}$			10	40	mV
ΔV_O	Load regulation	$0.1\text{A} < I_O < 5\text{A}$			10	40	mV
I_O	Current Limiting		●	5.1	6.3	7.5	A
	Short Circuit Current	$V_O = 0\text{V}$	●		1.8		A
I_Q	Quiescent Current	$0.1\text{A} < I_O < 5\text{A}$			2	3	mA
	Ripple Rejection	$f = 120\text{Hz}, I_O = 5\text{A}$ $V_{IN} = 15\text{V} \Delta V_{IN} = 2V_{PP}$		50	60		dB

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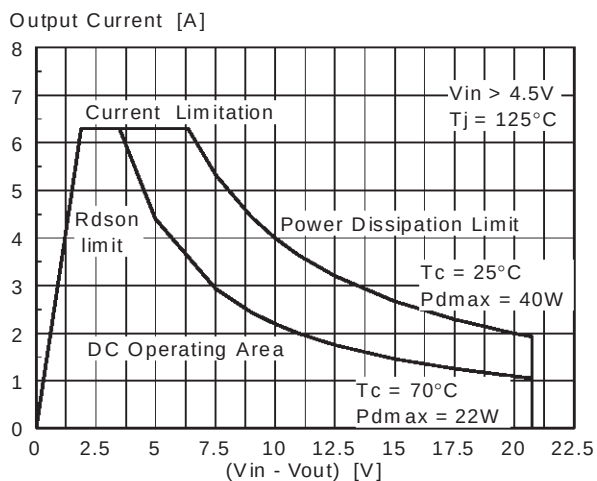
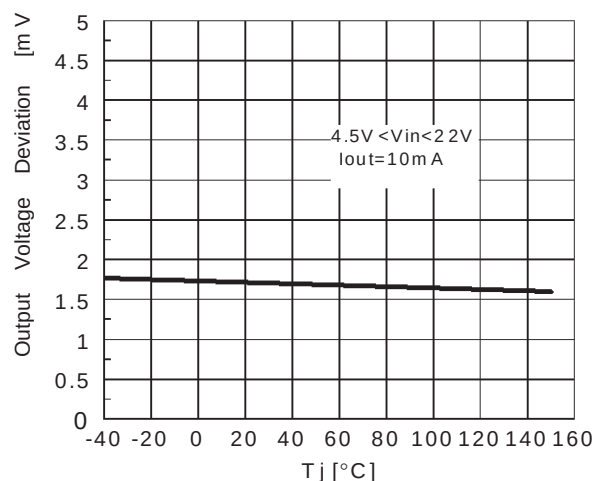
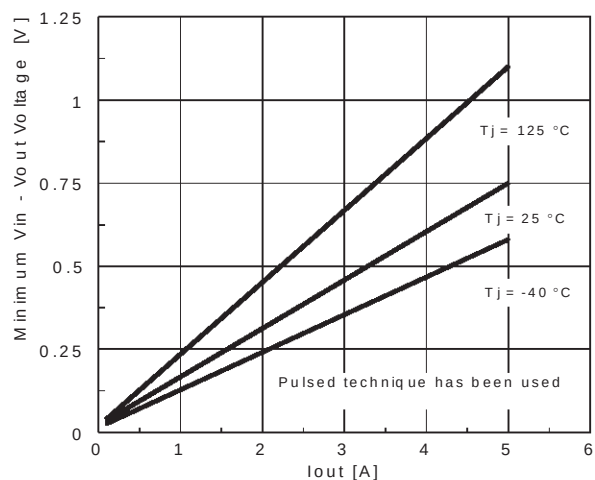
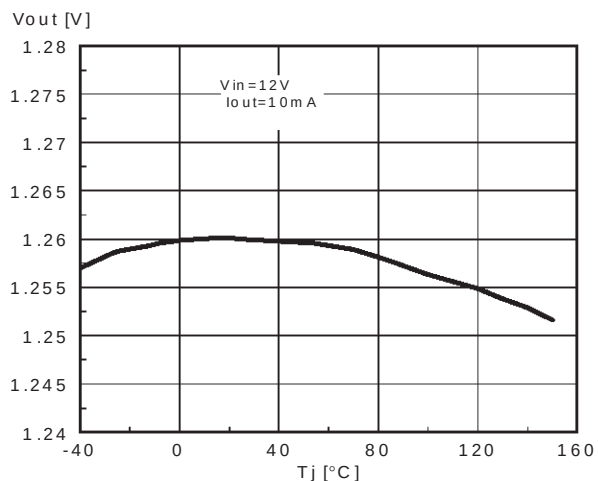
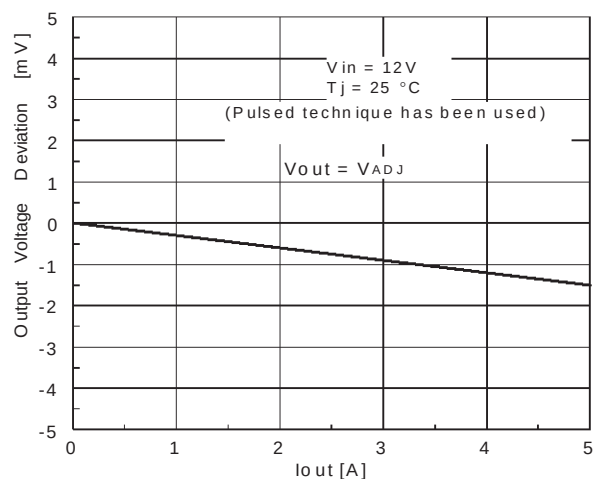
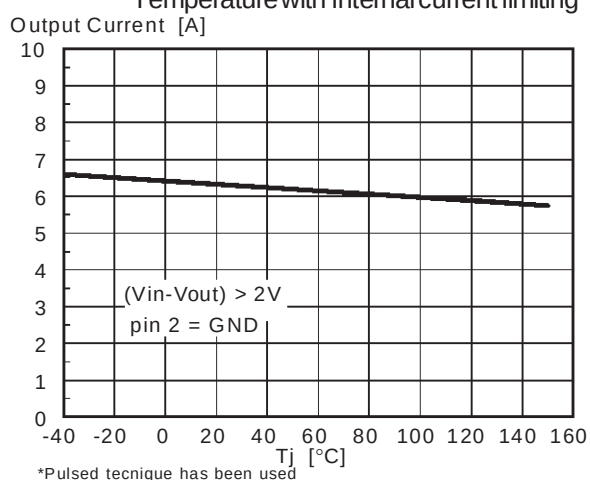
Figure 1: L4955 DC Operating Area**Figure 3: Line Regulation vs. Junction Temperature****Figure 5: Dropout Voltage****Figure 2: Output Voltage Stability vs. Junction Temperature****Figure 4: Load Regulation****Figure 6: Maximum Output Current vs. Junction Temperature with internal current limiting**

Figure 7: Short-circuit Current vs. Junction Temperature with Programmable Current Limiting

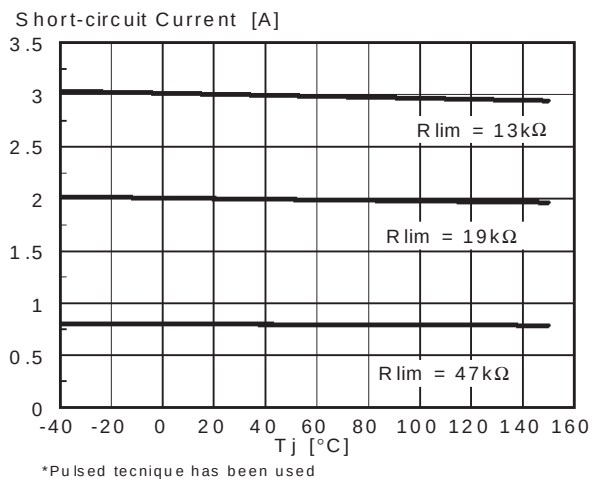


Figure 9: Quiescent Current vs. Supply voltage (CL = 0V)

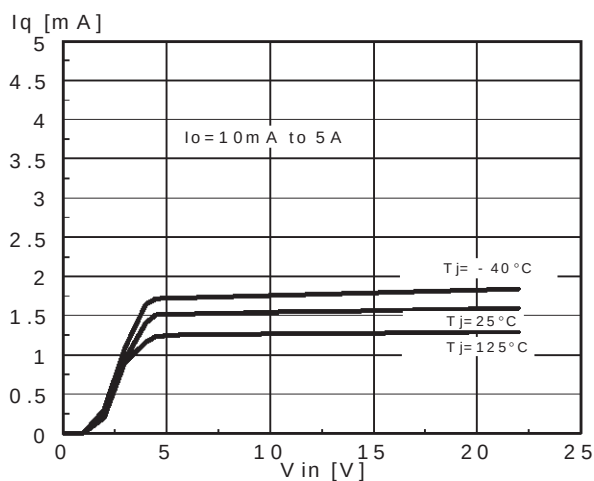


Figure 11: Stand-by Current vs. Supply Voltage with INH = LOGIC HIGH

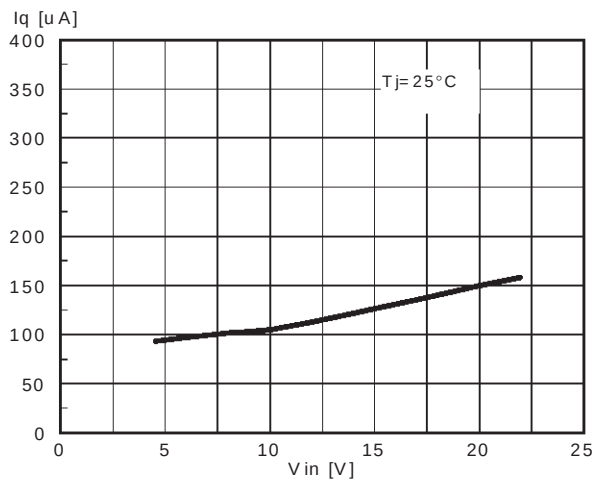


Figure 8: Quiescent Current vs. Temperature (CL = 0V)

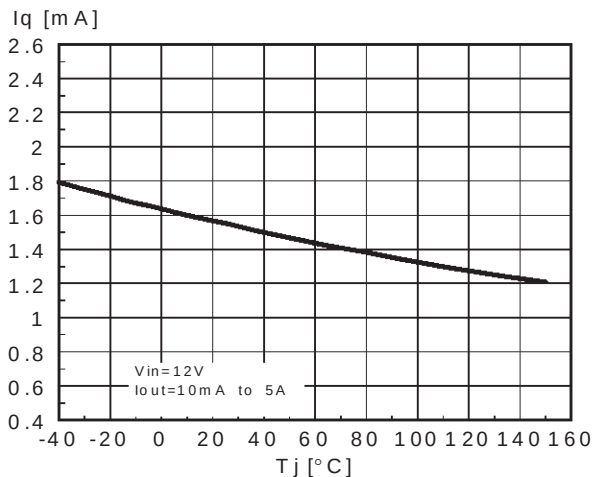


Figure 10: Quiescent Current vs. Supply Voltage with Programmable Current Limiting

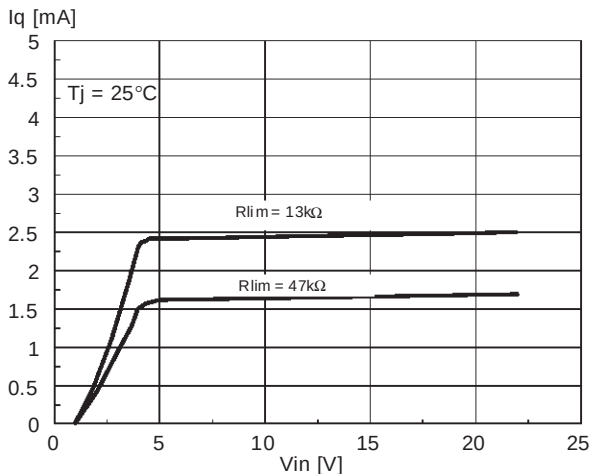
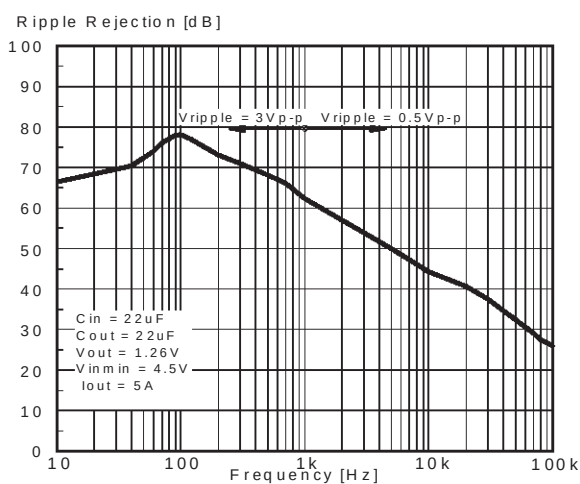


Figure 12: Ripple Rejection vs. Frequency



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Figure 13: Ripple Rejection vs. Output Current

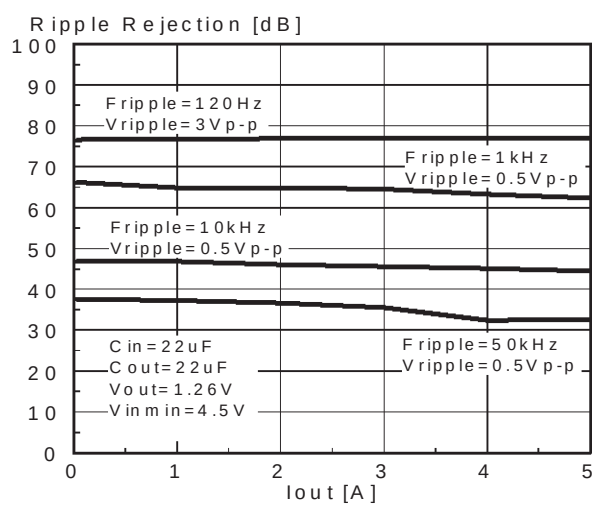


Figure 14: Power Good Function

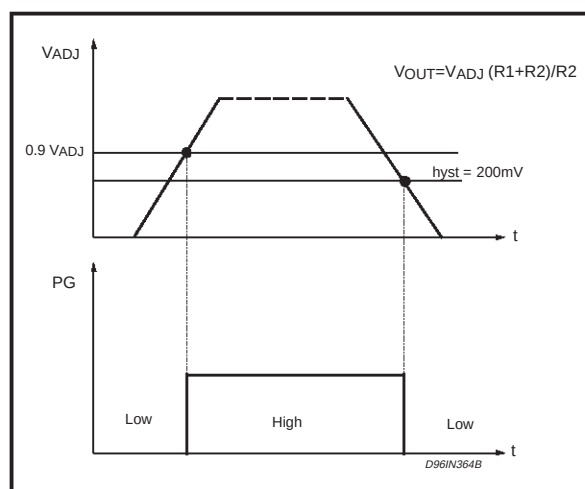
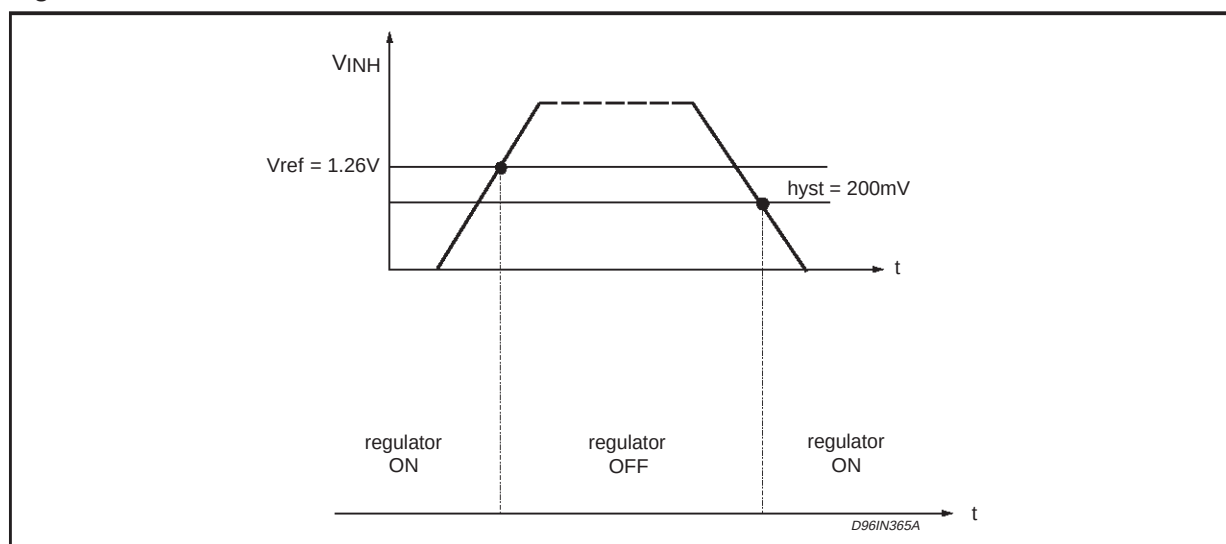


Figure 15: Inhibit Function



LINE TRANSIENT RESPONSE

Figure 16.

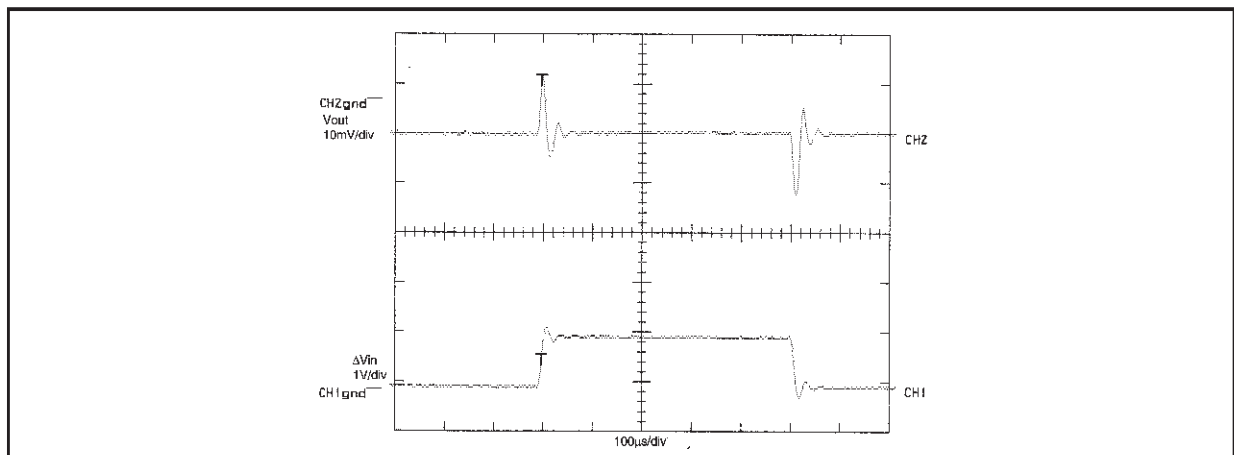


Figure 17.

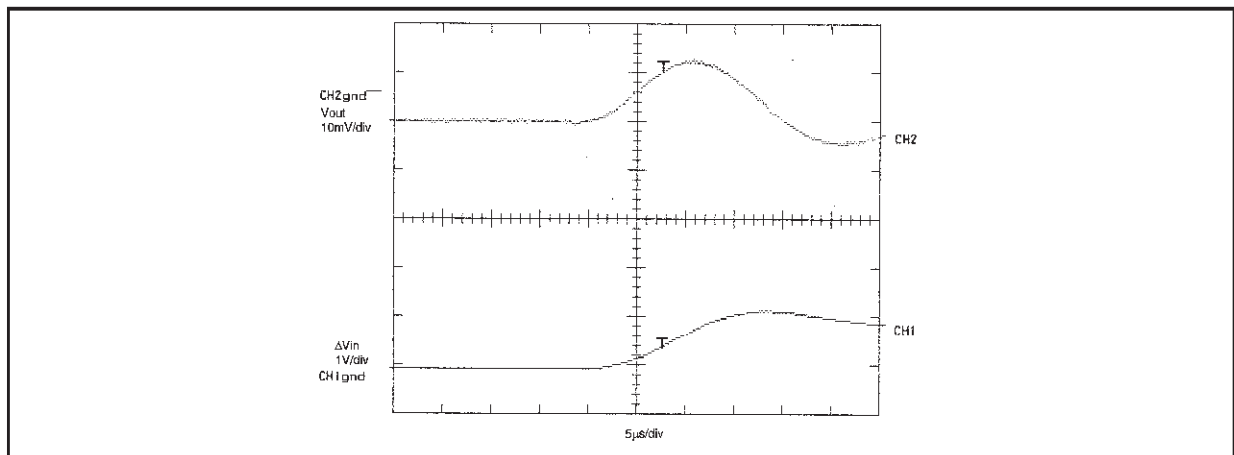
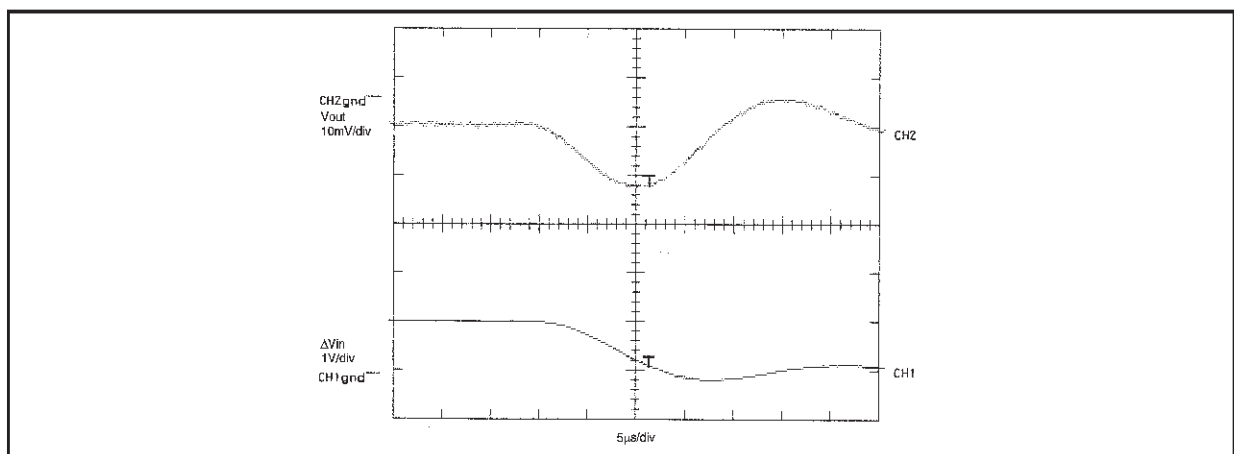


Figure 18.



Test condition: $V_{IN} = 12V$; $\Delta V_{IN} = 1V$; $V_O = 3.3V$; $I_O = 200mA$; $C_{IN} = 10\mu F$ (electrolytic capacitor);
 $C_{out} = 22\mu F$ (electrolytic capacitor); $dV/dt = 0.1 V/\mu s$; $T_J = 25^\circ C$

LOAD TRANSIENT RESPONSE

Figure 19.

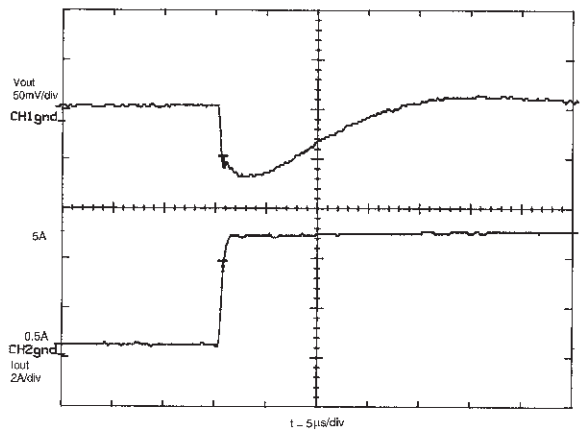


Figure 20.

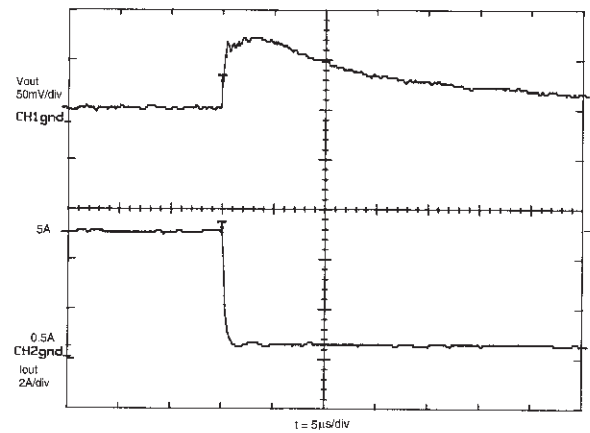
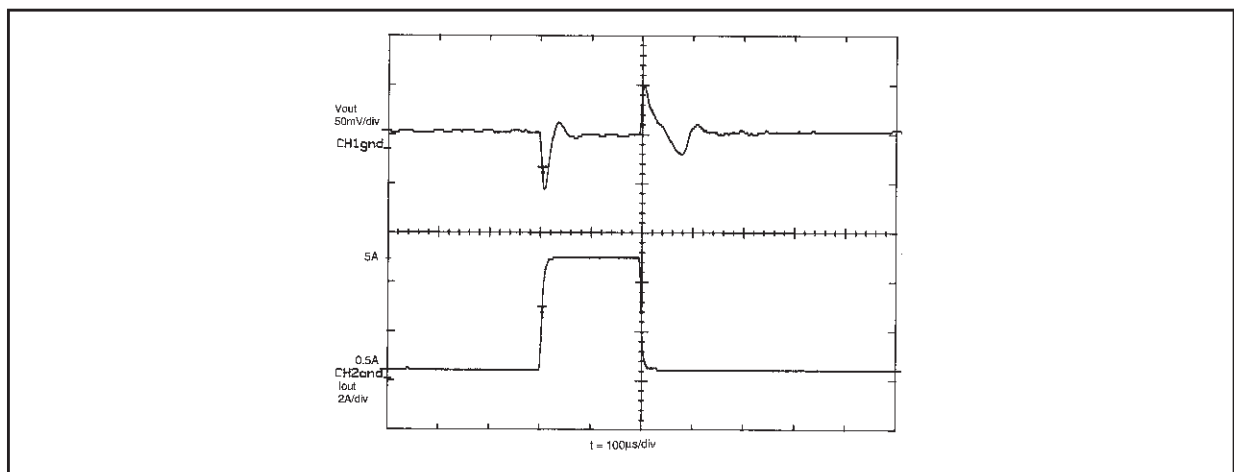


Figure 21.



Test condition: $V_{IN} = 5V$, $V_{OUT} = 3.3V$; Load Transient from 0.5A to 5A; $\frac{dI_{out}}{dt} = 20A/\mu s$; $T_J = 25^\circ C$

Figure 22: Load transient test circuit.

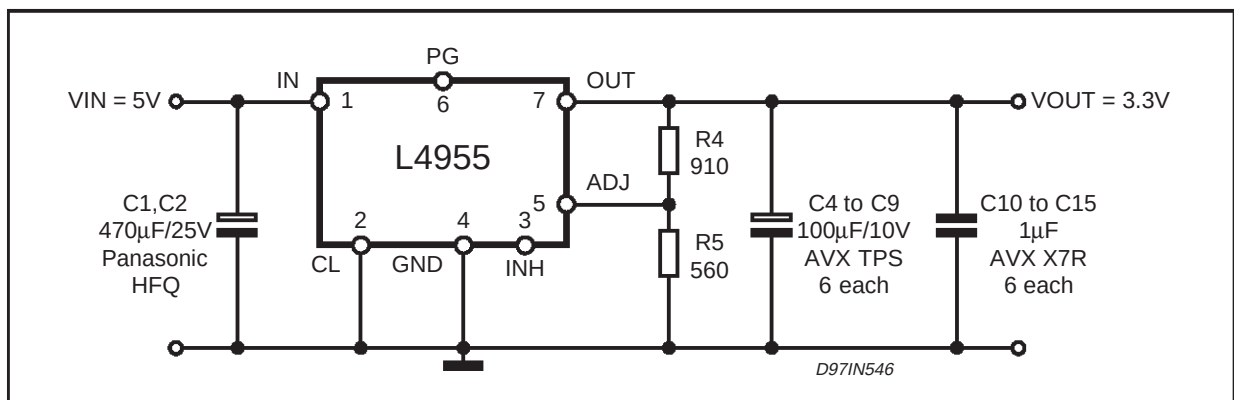
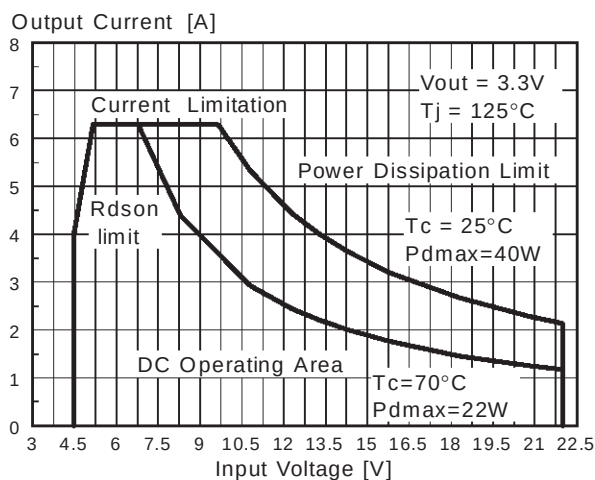
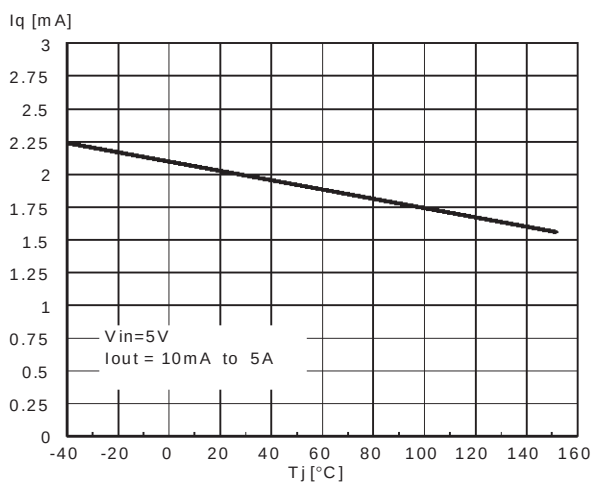
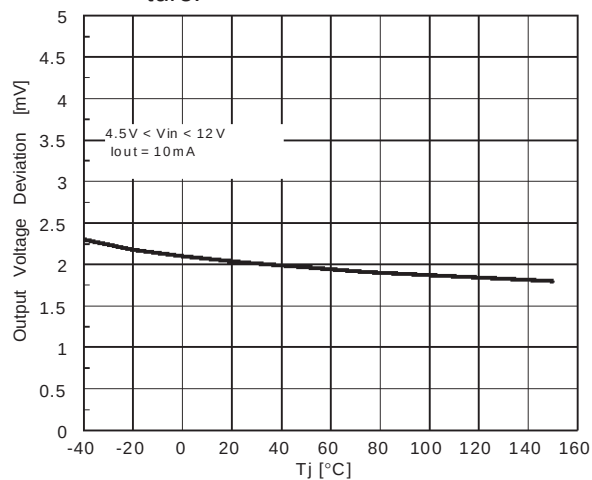
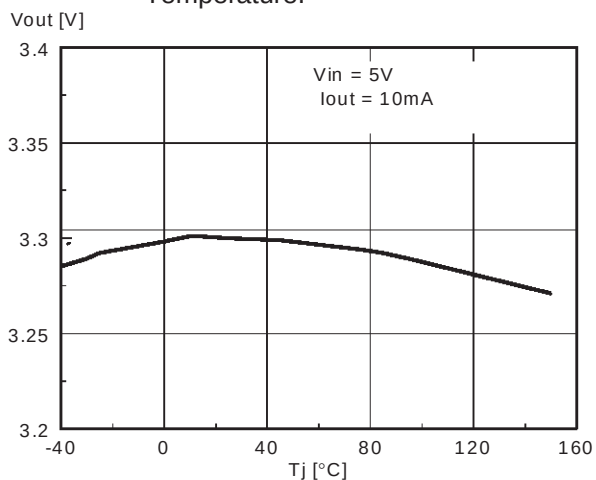
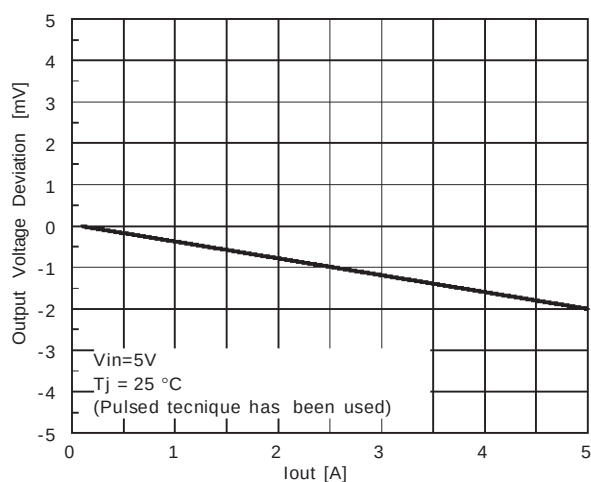
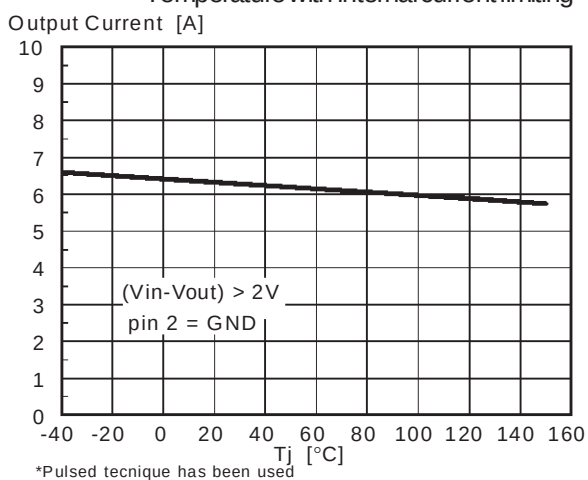


Figure 23: DC operating area.**Figure 25:** Quiescent Current vs. Temperature.**Figure 27:** Line regulation vs. Junction Temperature.**Figure 24:** Output Voltage Stability vs. Junction Temperature.**Figure 26:** Load Regulation**Figure 28:** Maximum Output Current vs. Junction Temperature with internal current limiting

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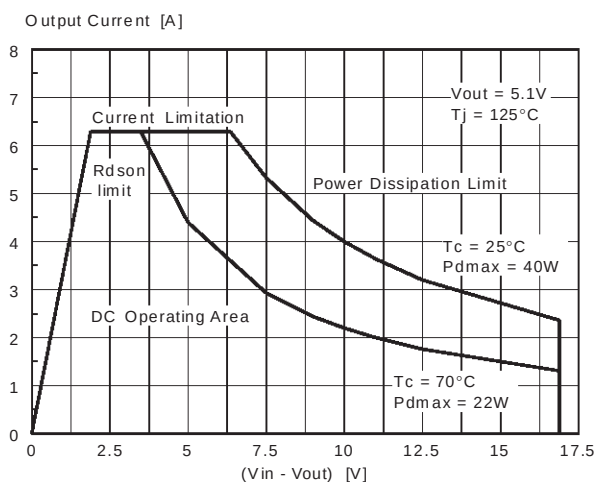
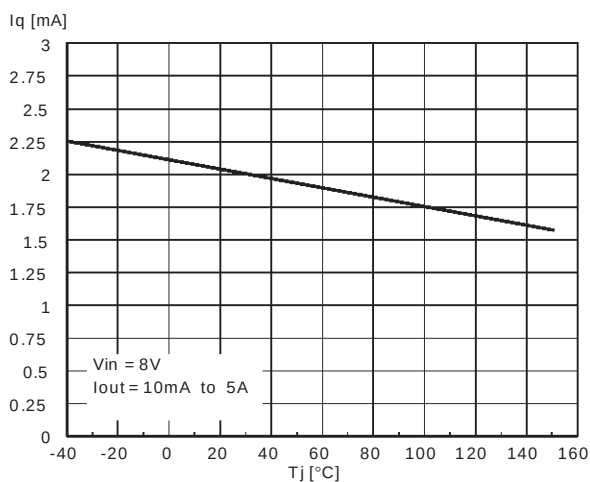
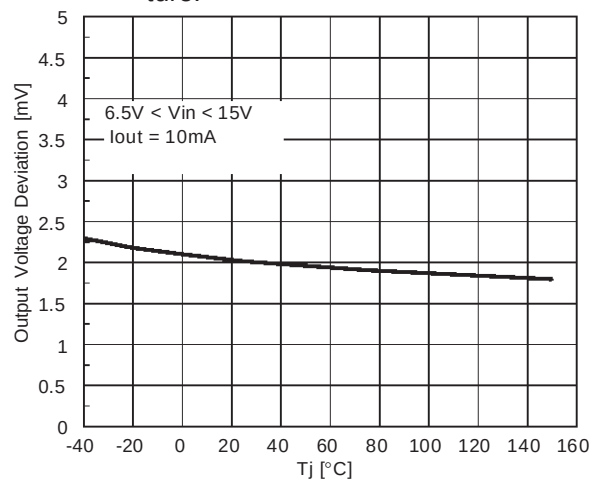
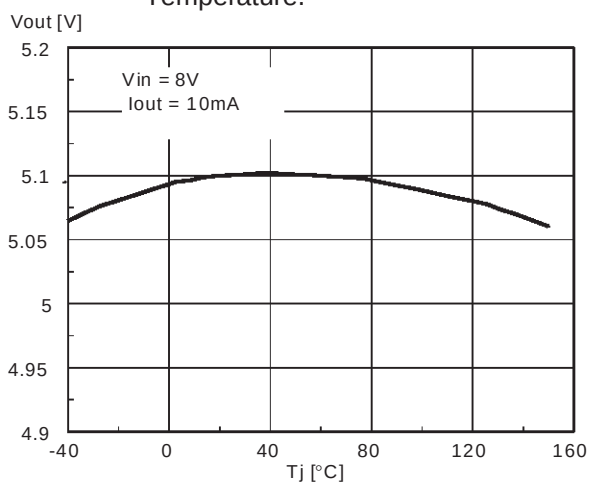
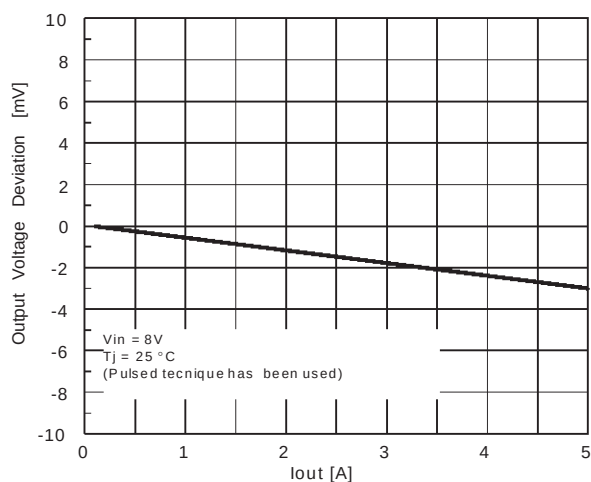
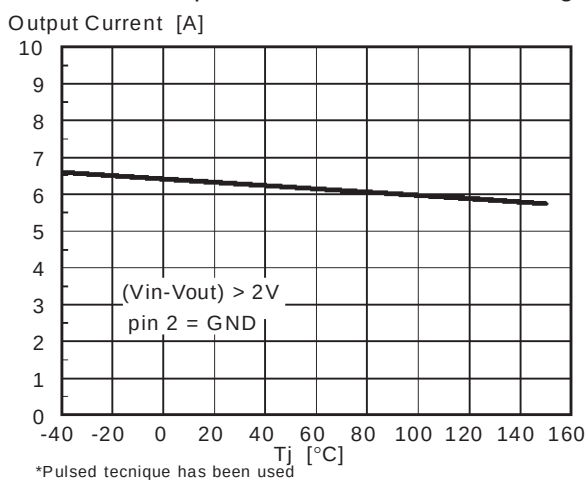
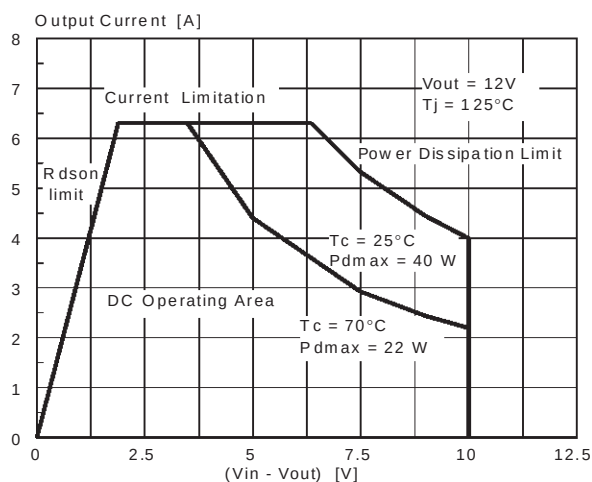
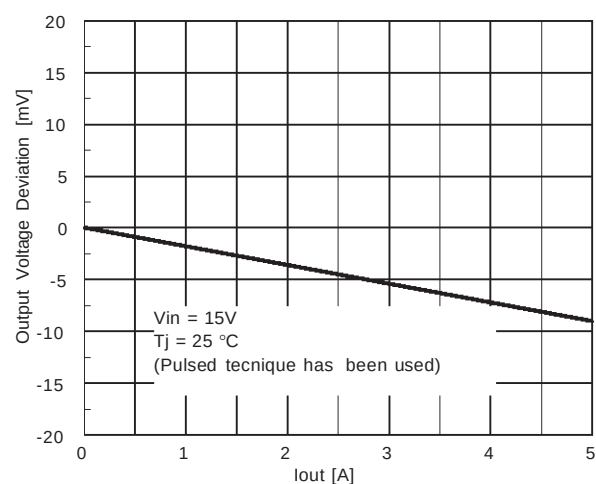
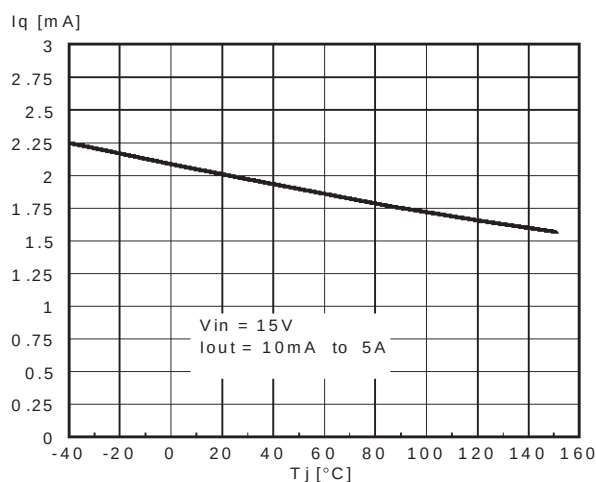
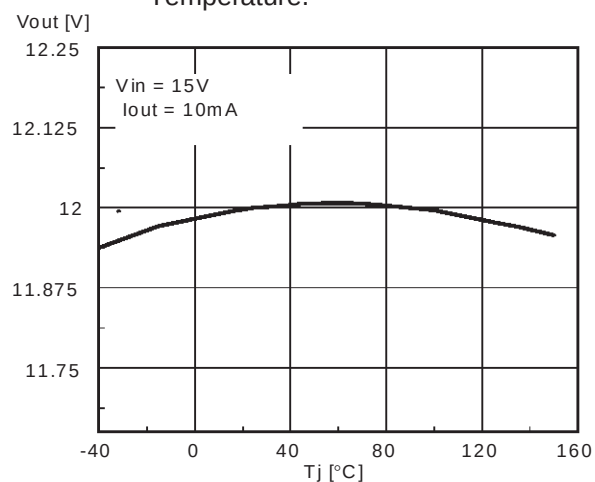
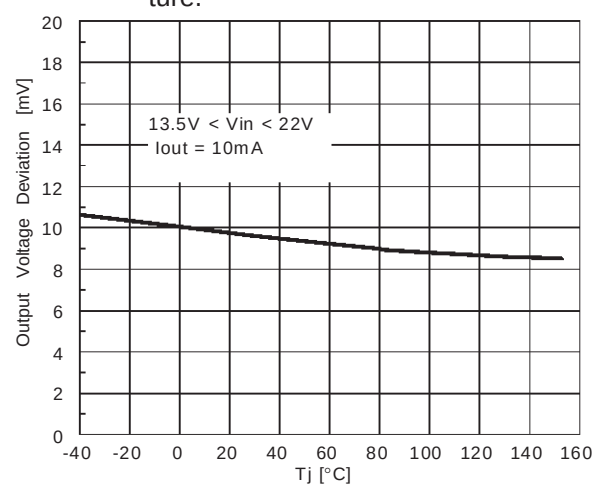
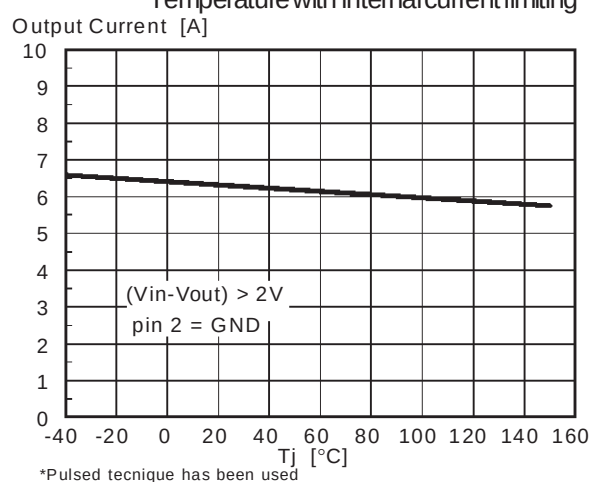
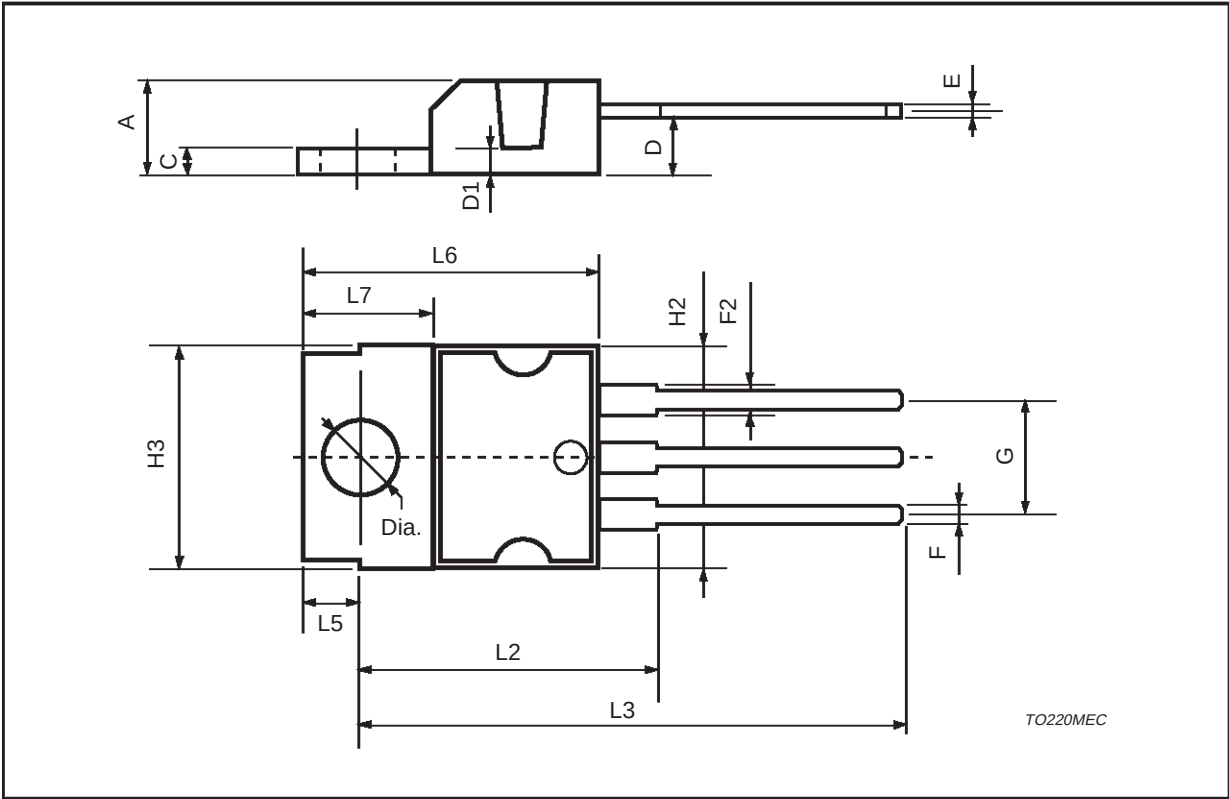
Figure 29: DC operating area.**Figure 31:** Quiescent Current vs. Temperature.**Figure 33:** Line regulation vs. Junction Temperature.**Figure 30:** Output Voltage Stability vs. Junction Temperature.**Figure 32:** Load Regulation**Figure 34:** Maximum Output Current vs. Junction Temperature with internal current limiting

Figure 35: DC operating area.**Figure 37:** Load Regulation**Figure 39:** Quiescent Current vs. Temperature.**Figure 36:** Output Voltage Stability vs. Junction Temperature.**Figure 38:** Line regulation vs. Junction Temperature.**Figure 40:** Maximum Output Current vs. Junction Temperature with internal current limiting

VERSAWATT PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			4.8			0.189
C			1.37			0.054
D	2.4		2.8	0.094		0.110
D1	1.2		1.35	0.047		0.053
E	0.35		0.55	0.014		0.022
F	0.8		1.05	0.031		0.041
F2	1.15		1.4	0.045		0.055
G	4.95	5.08	5.21	0.195	0.200	0.205
H2			10.4			0.409
H3	10.05		10.4	0.396		0.409
L2		16.2			0.638	
L3	26.3	26.7	27.1	1.035	1.051	1.067
L5	2.6		3	0.102		0.118
L6	15.1		15.8	0.594		0.622
L7	6		6.6	0.236		0.260
Dia	3.65		3.85	0.144		0.152



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