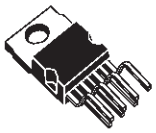
# L4955

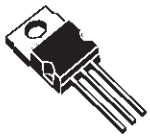
## 5A ULDO LINEAR REGULATORS FAMILY

- UP TO 5A OUTPUT CURRENT
- ±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 ($I_Q$ = 120µA TYP.)
  - POWER GOOD
  - PROGRAMMABLE CURRENT LIMIT
  - HEPTAWATT PACKAGE
- FIXED VERSION:
  - 3.3V, 5.1V OUTPUTS
  - VERSAWATT PACKAGE
- VERY LOW QUIESCENT CURRENT
- SHORT CIRCUIT PROTECTION (Foldback function)
- THERMAL SHUTDOWN

**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 |

### 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 most recent microprocessors.

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

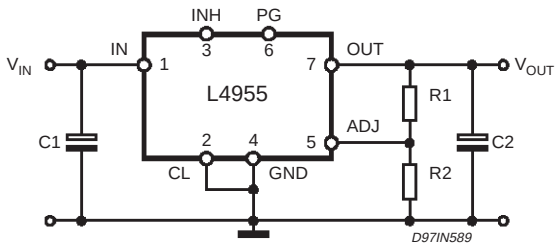
Realized in BCDII technology, it has on board a charge pump to properly drive an N-channel power mos Transistor with 150mΩ of $R_{DSON}$.

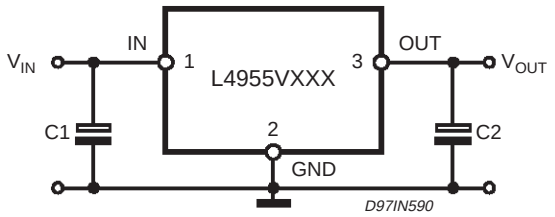
It operates from a 4.5V minimum supply, with a very low quiescent current irrespective of the load; a minimum of 22µF output capacitor is required for stability.

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

Ancillary functions like power good, inhibit with 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.

### TYPICAL APPLICATIONS

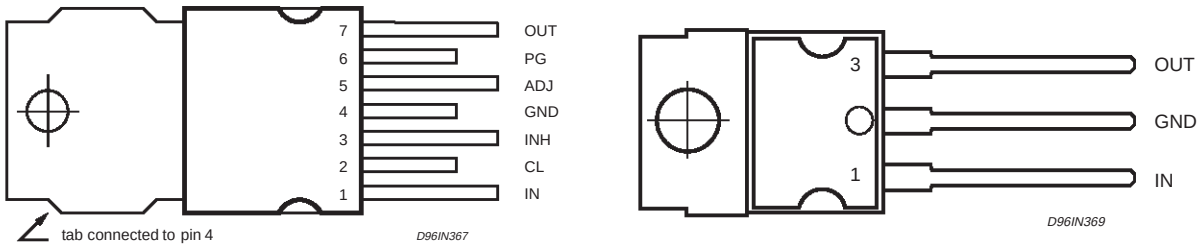


## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{IN}$ | Supply Input Voltage | 24 | V |
| | ADJ and CL pins<br>PG and INH pins | -0.3 to 4<br>0 to $V_{IN}$ | V<br>V |
| $P_{TOT}$ | Power Dissipation @ $T_{amb}$ = 50°C<br>Power Dissipation @ $T_{case}$ = 90°C | 2<br>15 | W<br>W |
| $T_{st}$, $T_j$ | Storage Temperature | -40 to +150 | °C |

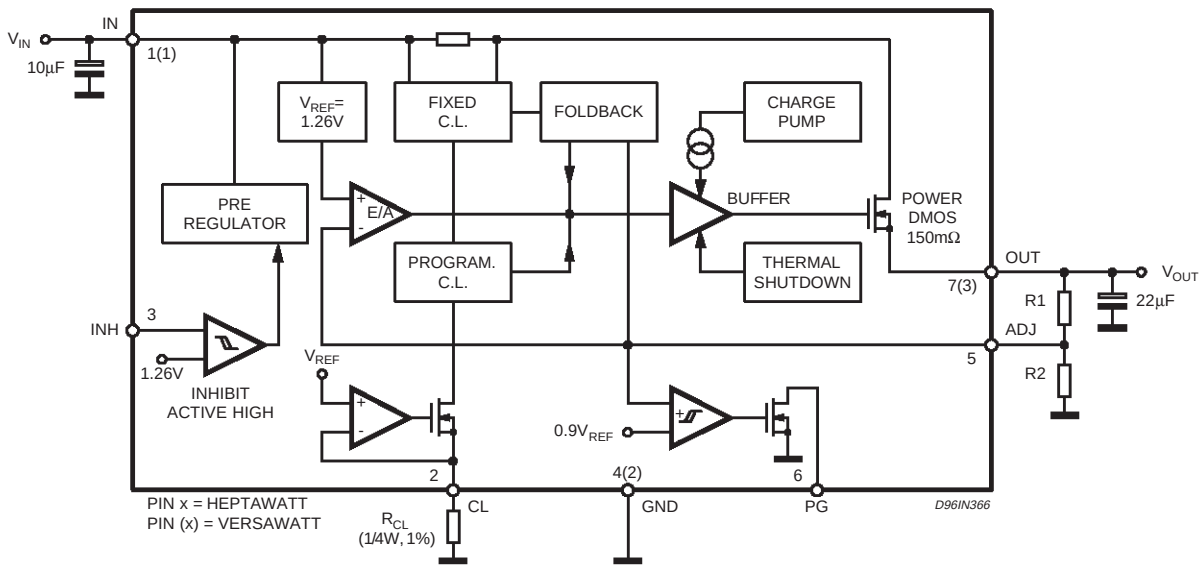
## PIN CONNECTIONS (Top views)




**HEPTAWATT**

**VERSAWATT (TO220)**

## BLOCK DIAGRAM



## PIN FUNCTIONS

| HW | VW | Name | Function |
|---|---|---|---|
| 1 | 1 | IN | Unregulated input voltage; this pin must be bypassed with a capacitor larger than 10µF. |
| 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 functionally 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 22µF is required to insure stability. |

## THERMAL DATA (HEPTAWATT & VERSAWATT packages)

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

## L4955 - ELECTRICAL CHARACTERISTICS ($T_j$ = 25°C, $V_{in}$ = 12V, unless otherwise specified).

● = Specifications referred to $T_J$ from 0°C to +125°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 |
| $\Delta V_O$ | Line regulation (1) | $4.5V < V_{IN} < 22V$; $I_O$ = 10mA | | | 2 | 10 | mV |
| $\Delta V_O$ | Load regulation (1) | $0.1A < IO < 5A$ | | | 2 | 10 | mV |
| $V_O$ | Dropout Voltage | $I_O$ = 5A<br>$V_{IN} \geq 4.5V$ | | | 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 | $R_{lim}$ = 13kΩ<br>$R_{lim}$ = 47kΩ | ●<br>● | 2.55<br>0.70 | 3<br>0.85 | 3.45<br>1.00 | A<br>A |
| $I_Q$ | Quiescent Current | $0.1A < I_O < 5A$ $C_L$ = 0<br>$C_L$ = 13k | | | 2<br>2.7 | 3<br>4 | mA<br>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<br>$V_{IN}$ = 6V $\Delta V_{IN} = 2V_{PP}$ | | 60 | 75 | | dB |

(1) Output voltage connected to ADJ.

**L4955V3.3 - ELECTRICAL CHARACTERISTICS** ($T_j$ = 25°C, $V_{in}$ = 5V, unless otherwise specified)
● = Specifications referred to $T_J$ from 0°C to +125°C.

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

**L4955V5.1 - ELECTRICAL CHARACTERISTICS** ($T_j$ = 25°C, $V_{in}$ = 8V, unless otherwise specified)
● = Specifications referred to $T_J$ from 0°C to +125°C.

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

L4955

**Figure 1:** L4955 DC Operating Area

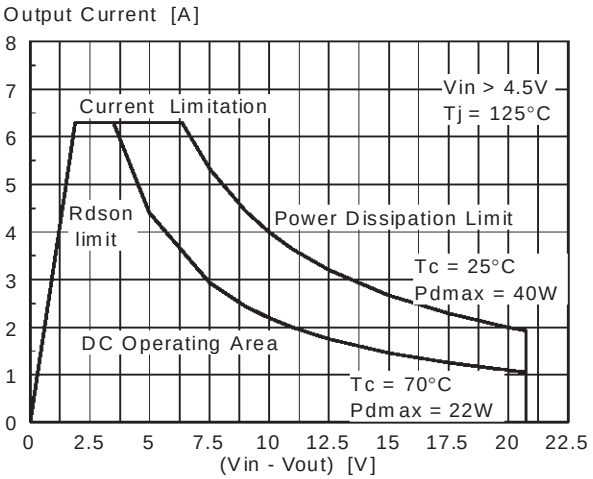



**Figure 2:** Output Voltage Stability vs. Junction Temperature

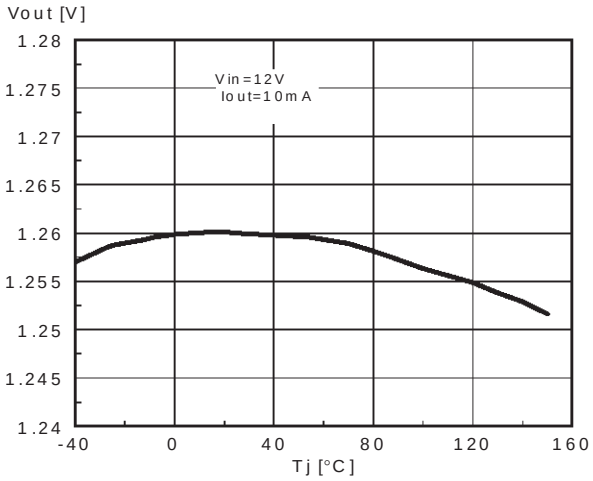



**Figure 3:** Line Regulation vs. Junction Temperature

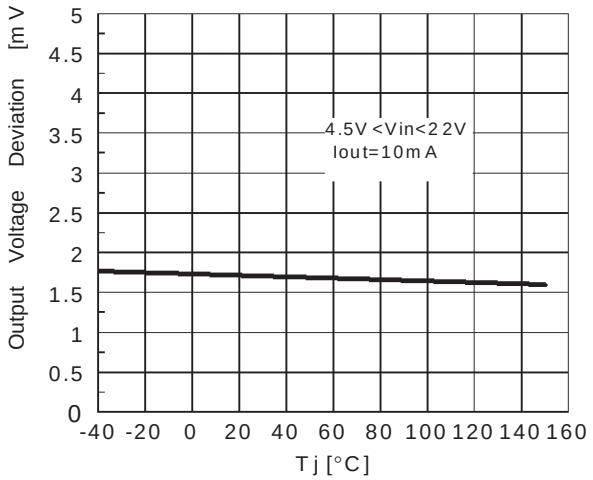



**Figure 4:** Load Regulation

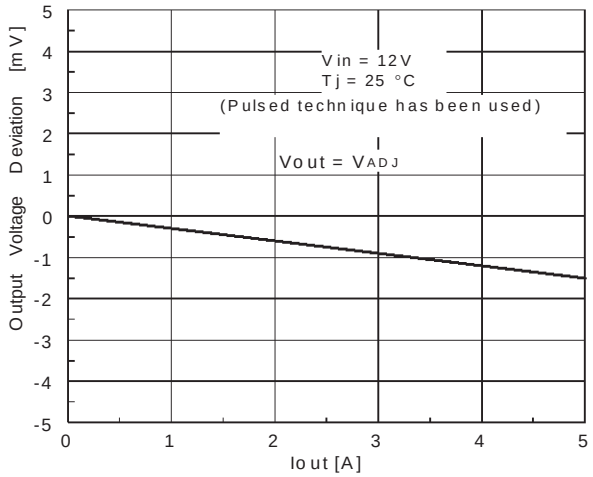



**Figure 5:** Dropout Voltage

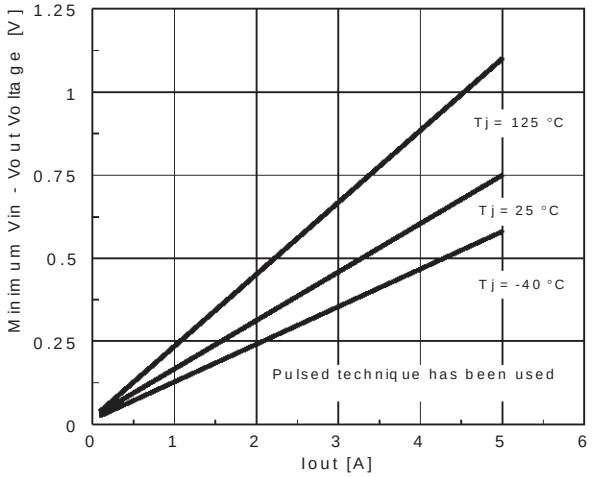
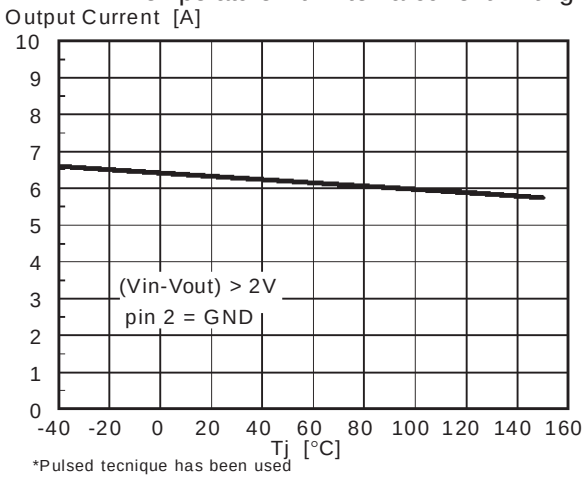
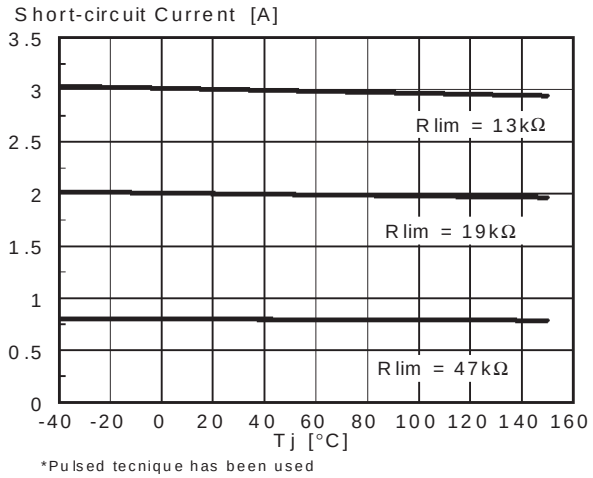



**Figure 6:** Maximum Output Current vs. Junction Temperature with internal current limiting




*Pulsed tecnique has been used

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




*Pulsed tecnique has been used

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

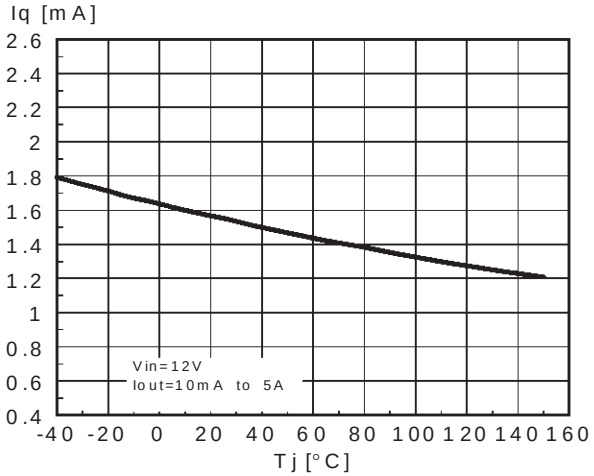



**Figure 9:** Quiescent Current vs. Supply voltage (CL = 0V)

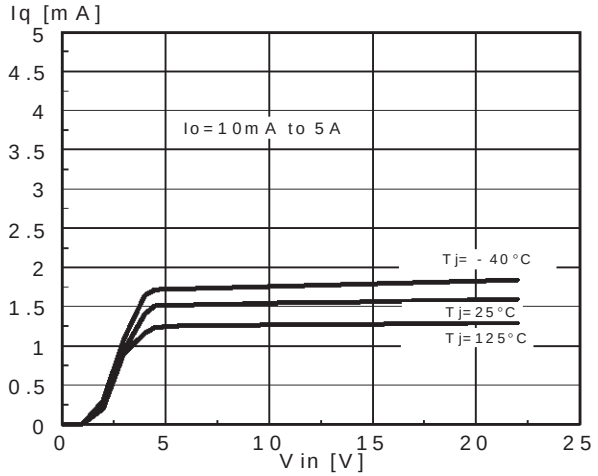



**Figure 10:** Quiescent Current vs. Supply Voltage with Programmable Current Limiting

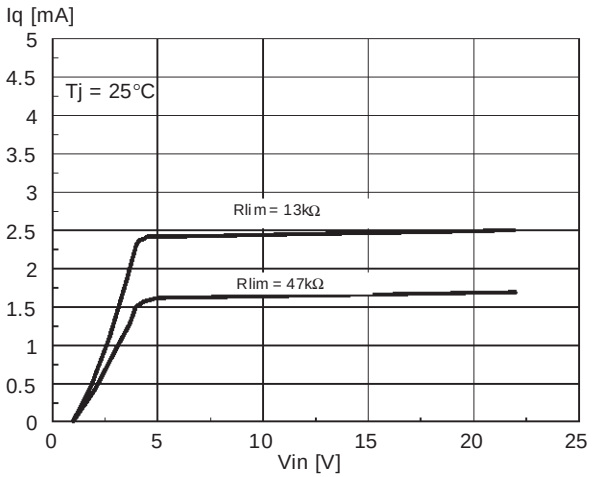



**Figure 11:** Stand-by Current vs. Supply Voltage with INH = LOGIC HIGH

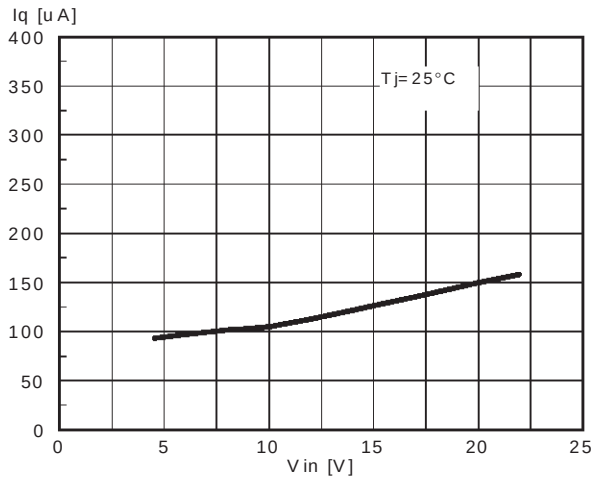
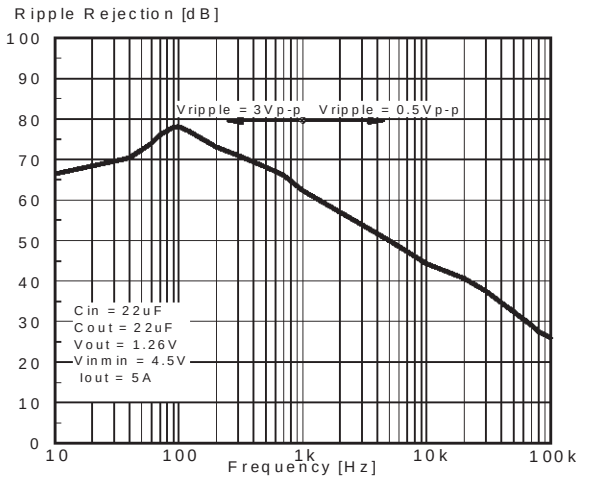



**Figure 12:** Ripple Rejection vs. Frequency



L4955

**Figure 13:** Ripple Rejection vs. Output Current

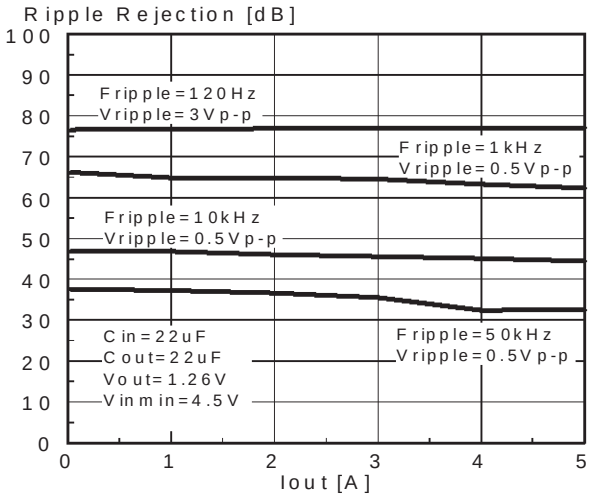



**Figure 14:** Power Good Function

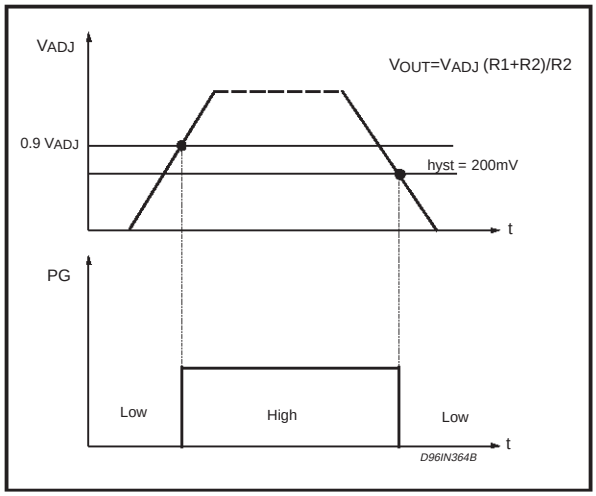
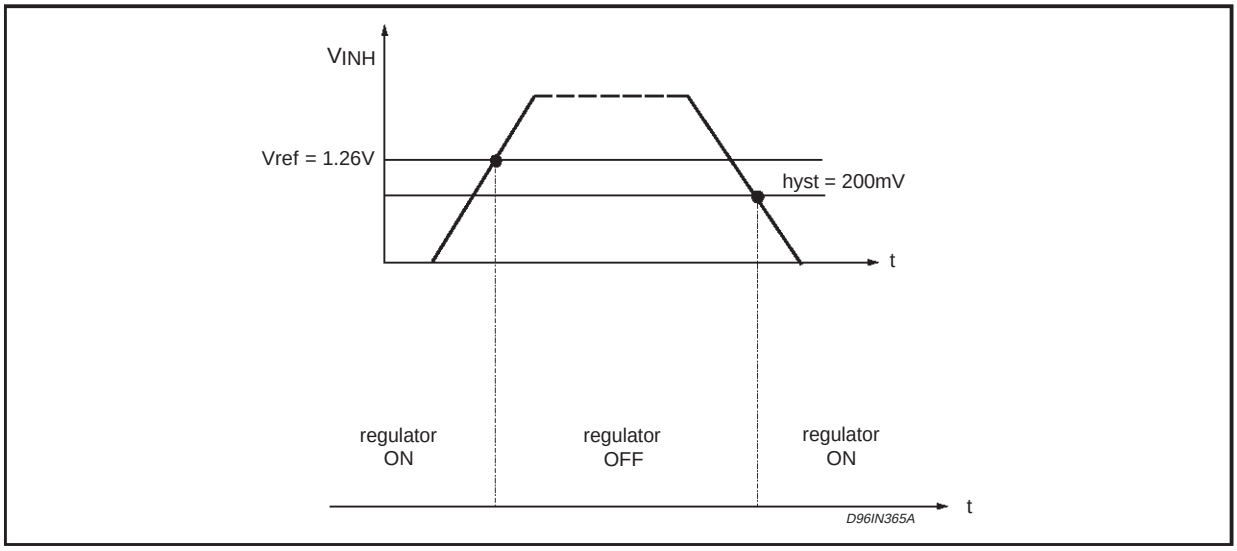



**Figure 15:** Inhibit Function



## LINE TRANSIENT RESPONSE

**Figure 16.**

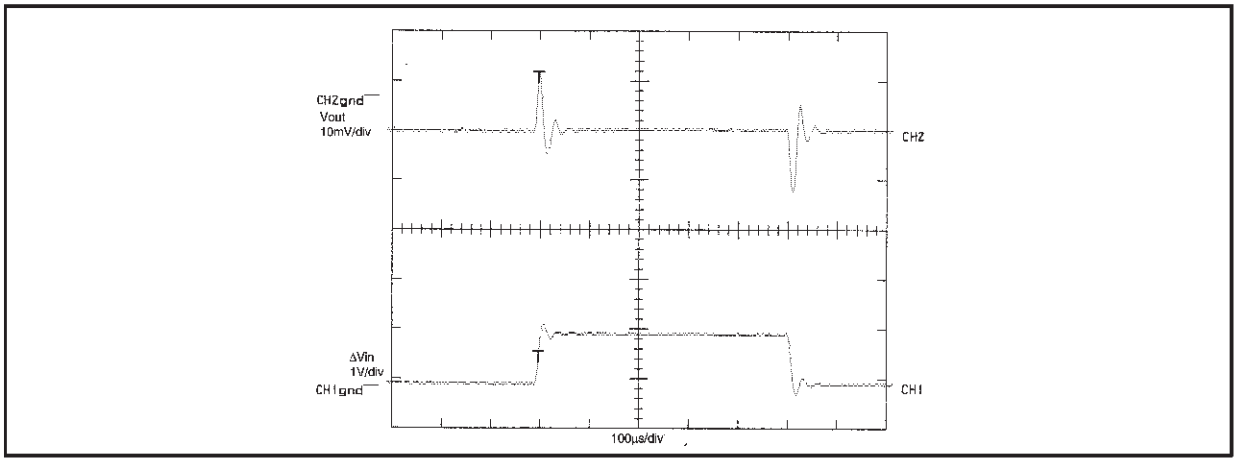



**Figure 17.**

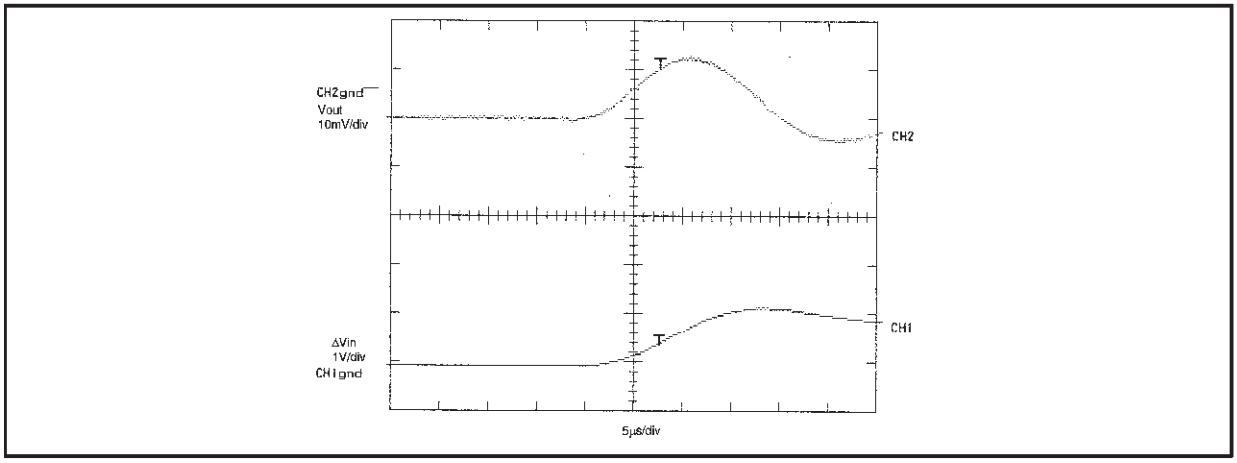
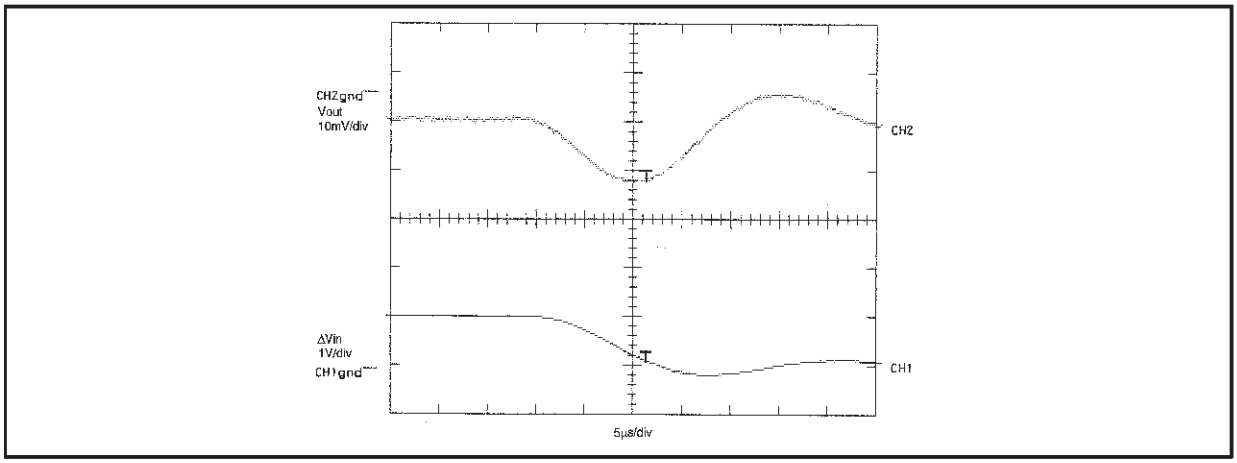



**Figure 18.**




**Test condition**: $V_{IN}$ = 12V; $\Delta V_{IN}$ = 1V; $V_O$ = 3.3V; $I_O$ = 200mA; $C_{IN}$ = 10µF (electrolytic capacitor); $C_{out}$ = 22µF (electrolytic capacitor); dV/dt = 0.1 V/µs; $T_J$ = 25°C

## LOAD TRANSIENT RESPONSE

**Figure 19.**

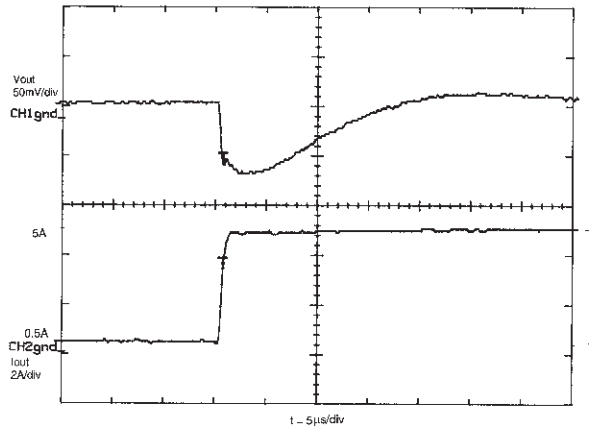



**Figure 20.**

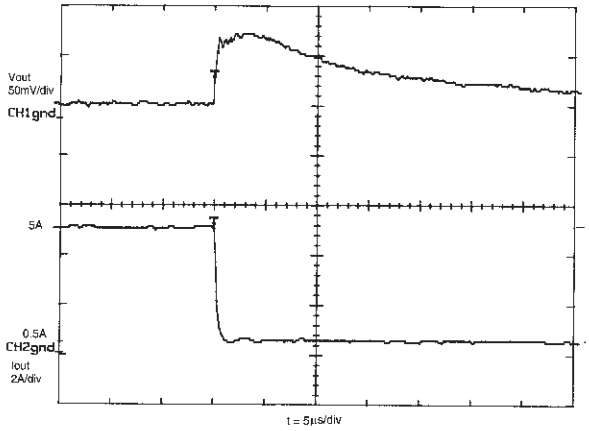
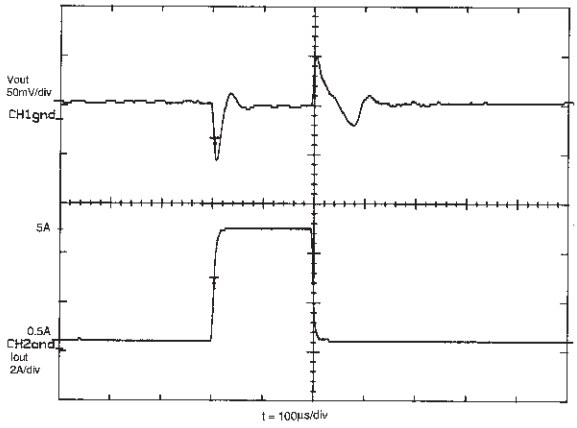
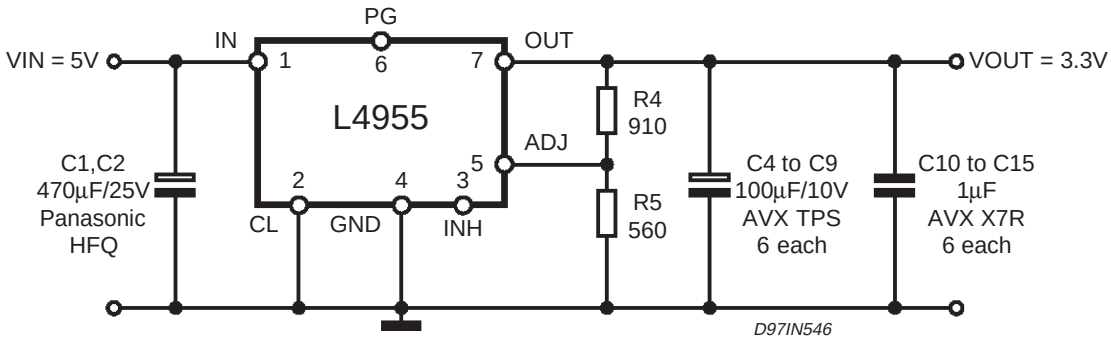



**Figure 21.**




**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°C

**Figure 22:** Load transient test circuit.



## L4955V3.3

**Figure 23:** DC operating area.

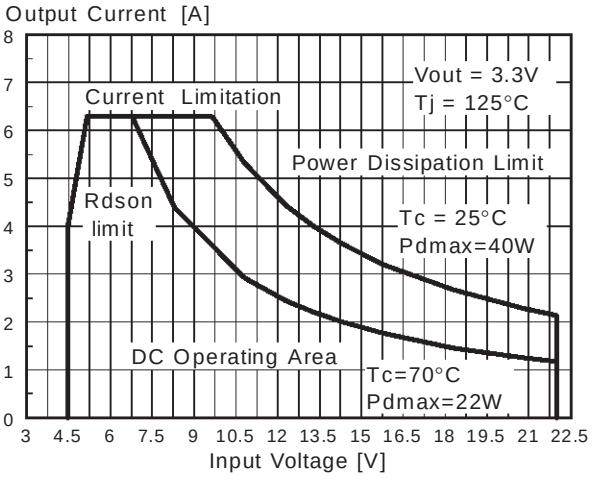



**Figure 24:** Output Voltage Stability vs. Junction Temperature.

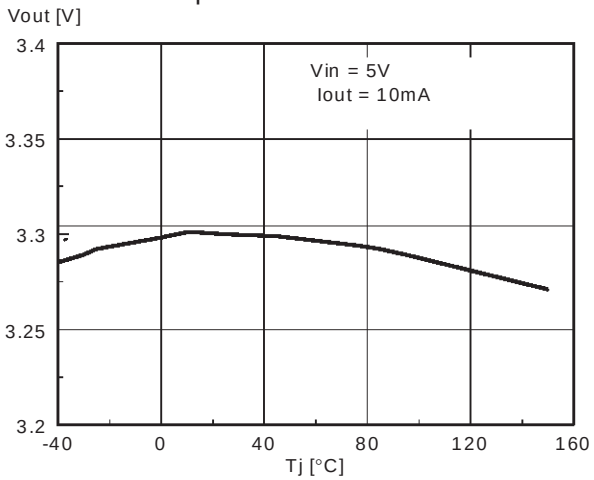



**Figure 25:** Quiescent Current vs. Temperature.

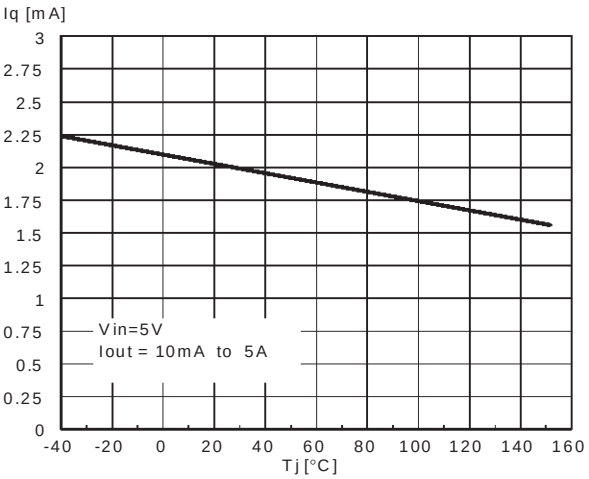



**Figure 26:** Load Regulation

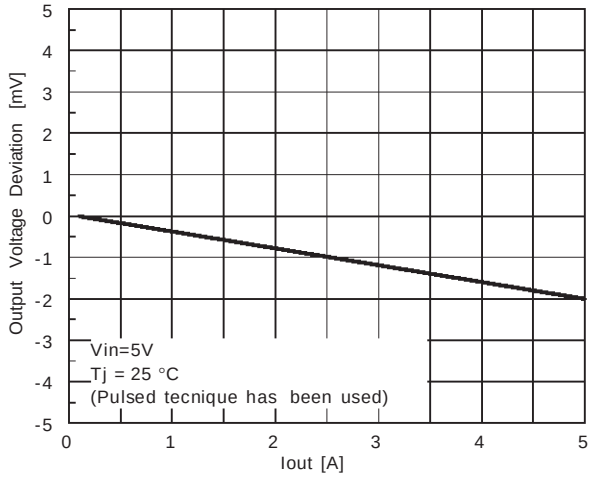



**Figure 27:** Line regulation vs. Junction Temperature.

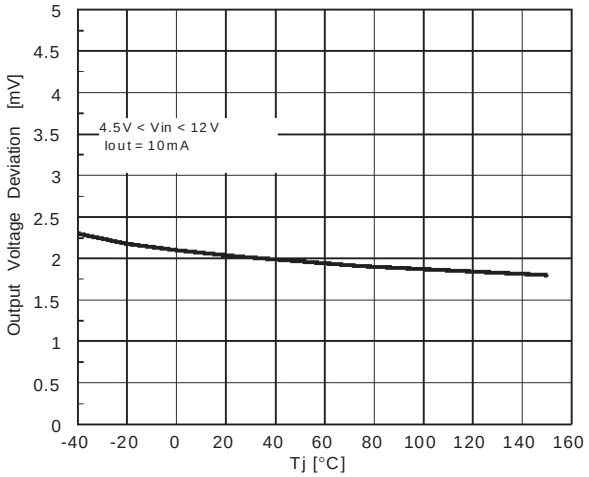
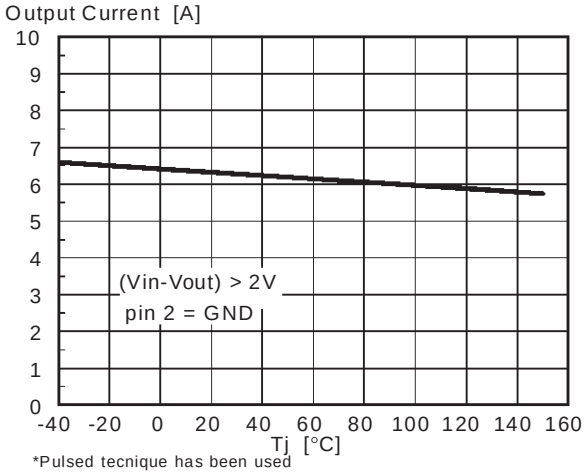



**Figure 28:** Maximum Output Current vs. Junction Temperature with internal current limiting




*Pulsed tecnique has been used

## L4955V5.1

**Figure 29:** DC operating area.

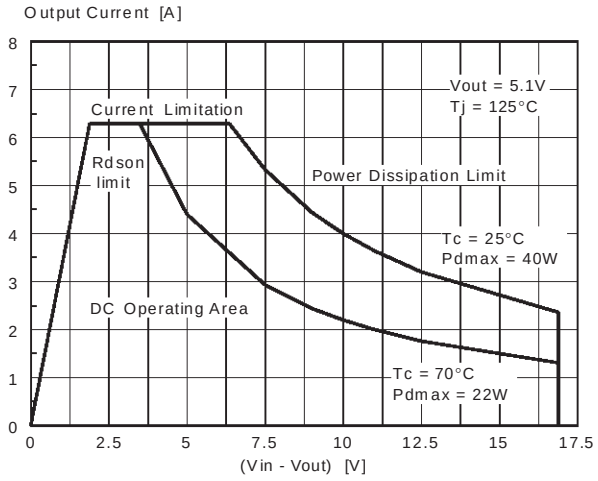



**Figure 30:** Output Voltage Stability vs. Junction Temperature.

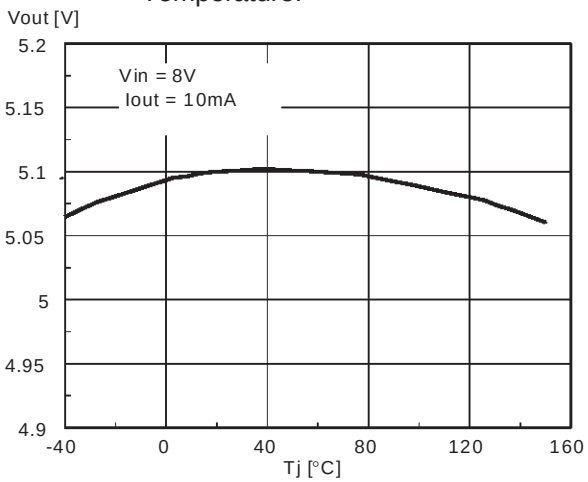



**Figure 31:** Quiescent Current vs. Temperature.

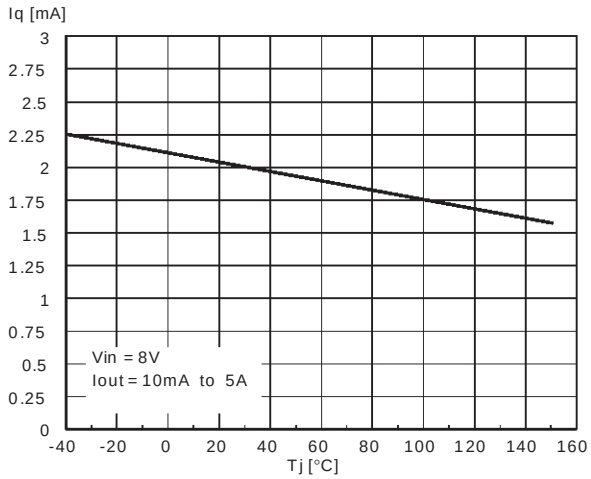



**Figure 32:** Load Regulation

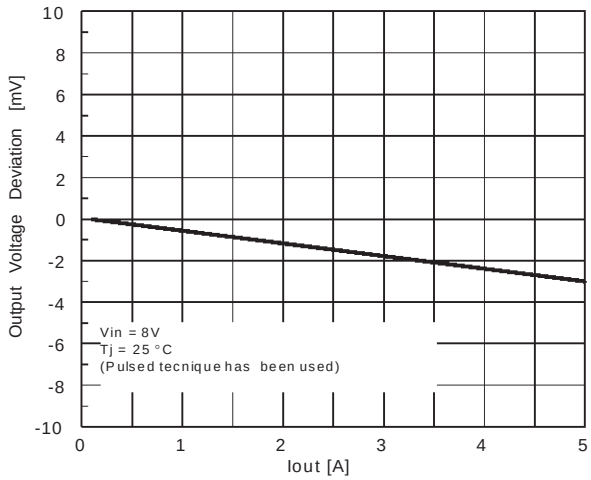



**Figure 33:** Line regulation vs. Junction Temperature.

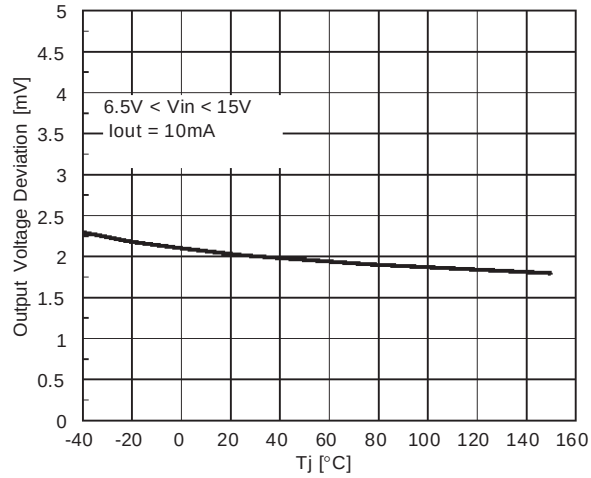
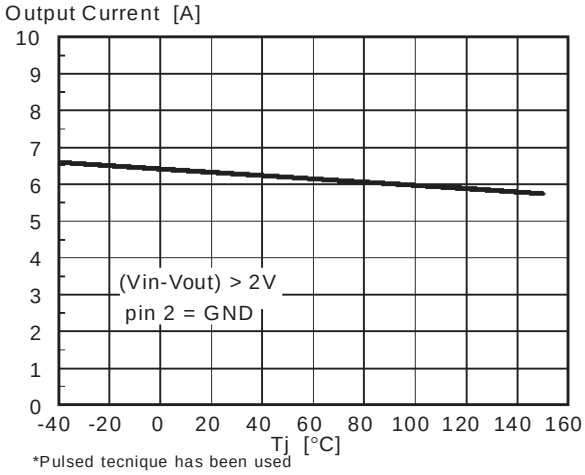


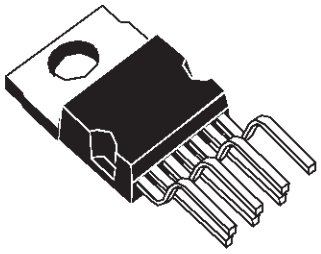

**Figure 34:** Maximum Output Current vs. Junction Temperature with internal current limiting



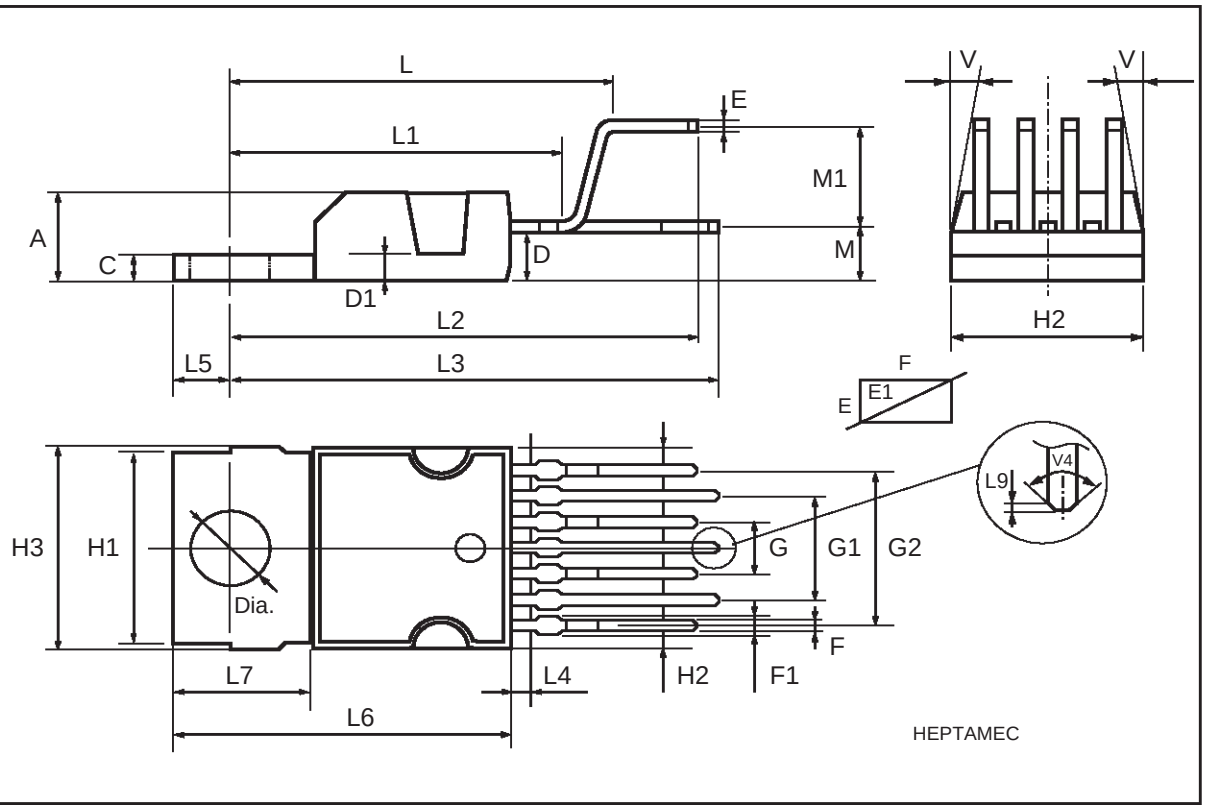

*Pulsed tecnique has been used

| 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 |
| E1 | 0.7 | | 0.97 | 0.028 | | 0.038 |
| F | 0.6 | | 0.8 | 0.024 | | 0.031 |
| F1 | | | 0.9 | | | 0.035 |
| G | 2.34 | 2.54 | 2.74 | 0.095 | 0.100 | 0.105 |
| G1 | 4.88 | 5.08 | 5.28 | 0.193 | 0.200 | 0.205 |
| G2 | 7.42 | 7.62 | 7.82 | 0.295 | 0.300 | 0.307 |
| H2 | | | 10.4 | | | 0.409 |
| H3 | 10.05 | | 10.4 | 0.396 | | 0.409 |
| L | 16.7 | 16.9 | 17.1 | 0.657 | 0.668 | 0.673 |
| L1 | | 14.92 | | | 0.587 | |
| L2 | 21.24 | 21.54 | 21.84 | 0.386 | 0.848 | 0.860 |
| L3 | 22.27 | 22.52 | 22.77 | 0.877 | 0.891 | 0.896 |
| L4 | | | 1.29 | | | 0.051 |
| L5 | 2.6 | 2.8 | 3 | 0.102 | 0.110 | 0.118 |
| L6 | 15.1 | 15.5 | 15.8 | 0.594 | 0.610 | 0.622 |
| L7 | 6 | 6.35 | 6.6 | 0.236 | 0.250 | 0.260 |
| L9 | | 0.2 | | | 0.008 | |
| M | 2.55 | 2.8 | 3.05 | 0.100 | 0.110 | 0.120 |
| M1 | 4.83 | 5.08 | 5.33 | 0.190 | 0.200 | 0.210 |
| V4 | 40° (typ.) | | | | | |
| Dia | 3.65 | | 3.85 | 0.144 | | 0.152 |

## OUTLINE AND MECHANICAL DATA

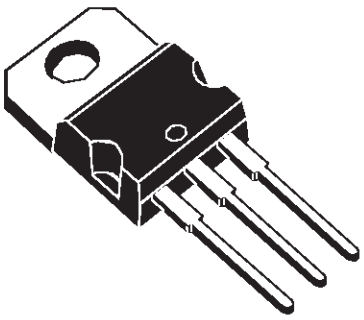


**Heptawatt V**



| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| G | 4.95 | | 5.15 | 0.194 | | 0.203 |
| G1 | 2.40 | | 2.70 | 0.094 | | 0.106 |
| H2 | 10.0 | | 10.4 | 0.393 | | 0.409 |
| L2 | | 16.4 | | | 0.645 | |
| L4 | 13.0 | | 14.0 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.20 | | 6.60 | 0.244 | | 0.260 |
| L9 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| M | | 2.6 | | | 0.102 | |
| Dia | 3.75 | | 3.85 | 0.147 | | 0.151 |

## OUTLINE AND MECHANICAL DATA



**Versawatt (TO220)**