# 300mA CMOS LDO Regulator

HALOGEN FREE LEAD FREE™ RoHS Compliance

## FEATURES

- **Guaranteed 300mA output current**
- **Low dropout voltage of 180mV typical at 300mA**
- **Stable with 1µF ceramic output capacitor**
- **External 10nF bypass capacitor for low noise**
- **Quick-start feature**
- **No-load ground current of 55µA typical**
- **Full-load ground current of 80µA typical**
- **±1.0% initial accuracy ($V_{OUT}$ ≥ 2.0V)**
- **±2.0% accuracy over temperature ($V_{OUT}$ ≥ 2.0V)**
- **"Zero" current shutdown mode**
- **Fold-back current limit and under-voltage lockout**
- **Thermal protection**
- **Thin SOT23-5 package**

## APPLICATIONS

- **Cellular phones**
- **Battery-powered devices**
- **Consumer Electronics**

## DESCRIPTION

The CAT6218 is a 300mA CMOS low dropout regulator that provides fast response time during load current and line voltage changes.

The quick-start feature allows the use of an external bypass capacitor to reduce the overall output noise without affecting the turn-on time of just 150µs.

With zero shutdown current and low ground current of 55µA typical, the CAT6218 is ideal for battery-operated devices with supply voltages from 2.3V to 5.5V. An internal under voltage lockout circuit disables the output at supply voltages under 2.1V typical.

The CAT6218 offers 1% initial accuracy and low dropout voltage, 180mV typical at 300mA. Stable operation is provided with a small value ceramic capacitor, reducing required board space and compo–nent cost.

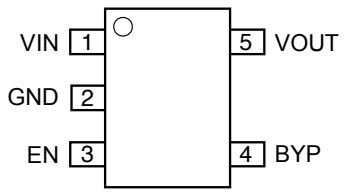
Other features include fold-back current current limit and thermal protection.

The device is available in the low profile (1mm max height) 5-lead thin SOT23 package.

**For Ordering Information details, see page 9.**

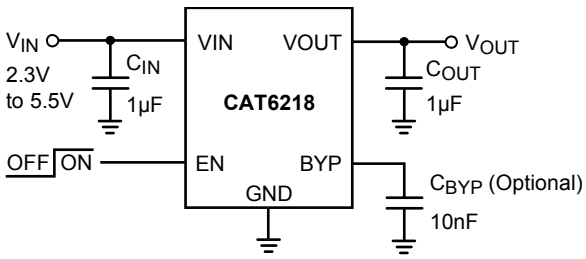
## PIN CONFIGURATION

**TSOT-23 5-Lead**
**(1mm height)**




**Top View**

## TYPICAL APPLICATION CIRCUIT



## PIN DESCRIPTIONS

| Pin # | Name | Function |
|---|---|---|
| 1 | VIN | Supply voltage input. |
| 2 | GND | Ground reference. |
| 3 | EN | Enable input (active high); a 2.5MΩ pull-down resistor is provided. |
| 4 | BYP | Optional bypass capacitor connection for noise reduction and PSRR enhancing. |
| 5 | VOUT | LDO Output Voltage. |

## BLOCK DIAGRAM

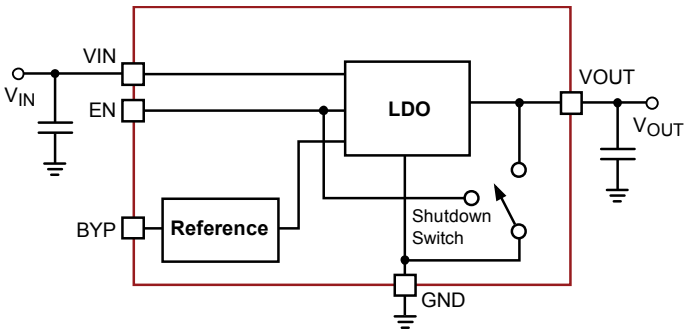



**Figure 2. CAT6218 Functional Block Diagram**

## PIN FUNCTION

**VIN** is the supply pin for the LDO. A small 1µF ceramic bypass capacitor is required between the $V_{IN}$ pin and ground near the device. When using longer connections to the power supply, $C_{IN}$ value can be increased without limit. The operating input voltage range is from 2.3V to 5.5V.

**EN** is the enable control logic (active high) for the regulator output. It has a 2.5MΩ pull-down resistor, which assures that if EN pin is left open, the circuit is disabled.

**VOUT** is the LDO regulator output. A small 1µF ceramic bypass capacitor is required between the $V_{OUT}$ pin and ground for stability. For better transient response, its value can be increased to 4.7µF. The capacitor should be located near the device. ESR domain is 5mΩ to 500mΩ. $V_{OUT}$ can deliver a maximum guaranteed current of 300mA. For input-to-output voltages higher than 1V, a continuous 300mA output current might turn-on the thermal protection. A 250Ω internal shutdown switch discharges the output capacitor in the no-load condition.

**GND** is the ground reference for the LDO. The pin must be connected to the ground plane on the PCB.

**BYP** is the reference bypass pin. An optional 0.01µF capacitor can be connected between BYP pin and GND to reduce the output noise and enhance the PSRR at high frequency.

## ABSOLUTE MAXIMUM RATINGS (1)

| Parameter | Rating | Unit |
|---|---|---|
| $V_{IN}$ | 0 to 6.5 | V |
| $V_{EN}$, $V_{OUT}$ | -0.3 to $V_{IN}$ + 0.3 | V |
| Junction Temperature, $T_J$ | +150 | °C |
| Power Dissipation, $P_D$ | Internally Limited (2) | mW |
| Storage Temperature Range, $T_S$ | -65 to +150 | °C |
| Lead Temperature (soldering, 5 sec.) | 260 | °C |
| ESD Rating (Human Body Model) | 3 | kV |

## RECOMMENDED OPERATING CONDITIONS (3)

| Parameter | Range | Unit |
|---|---|---|
| $V_{IN}$ | 2.3 to 5.5 | V |
| $V_{EN}$ | 0 to $V_{IN}$ | V |
| Junction Temperature Range, $T_J$ | -40 to +125 | °C |
| Package Thermal Resistance (SOT23-5), $\theta_{JA}$ | 235 | °C/W |

Typical application circuit with external components is shown on page 1.

**Notes:**

(1) Exceeding maximum rating may damage the device

(2) The maximum allowable power dissipation at any $T_A$ (ambient temperature) is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown.

(3) The device is not guaranteed to work outside its operating rating.

## ELECTRICAL OPERATING CHARACTERISTICS (1)

$V_{IN}$ = $V_{OUT}$ + 1.0V, $V_{EN}$ = High, $I_{OUT}$ = 100µA, $C_{IN}$ = $C_{OUT}$ = 1µF, ambient temperature of 25ºC (over recommended operating conditions unless specified otherwise). **Bold numbers** apply for the entire junction temperature range.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{OUT-ACC}$ | Output Voltage Accuracy | Initial accuracy for $V_{OUT} \geq 2.0V$ (4) | -1.0 | | +1.0 | % |
| | | | **-2.0** | | **+2.0** | |
| $TC_{OUT}$ | Output Voltage Temp. Coefficient | | | 40 | | ppm/ºC |
| $V_{R-LINE}$ | Line Regulation | $V_{IN}$ = $V_{OUT}$ + 1.0V to 5.5V | -0.2 | ±0.1 | +0.2 | %/V |
| | | | **-0.4** | | **+0.4** | |
| $V_{R-LOAD}$ | Load Regulation | $I_{OUT}$ = 100µA to 300 mA | | 0.7 | 1.2 | % |
| | | | | | **1.5** | |
| $V_{DROP}$ | Dropout Voltage (2) | $I_{OUT}$ = 300mA | | 180 | 250 | mV |
| | | | | | **300** | |
| $I_{GND}$ | Ground Current | $I_{OUT}$ = 0µA | | 55 | 75 | µA |
| | | | | | **90** | |
| | | $I_{OUT}$ = 300mA | | 80 | | |
| $I_{GND-SD}$ | Shutdown Ground Current | $V_{EN}$ < 0.4V | | | 1 | µA |
| | | | | | **2** | |
| PSRR | Power Supply Rejection Ratio | f = 1kHz, $C_{BYP}$ = 10nF | | 64 | | dB |
| | | f = 20kHz, $C_{BYP}$ = 10nF | | 54 | | |
| $I_{SC}$ | Output short circuit current limit | $V_{OUT}$ = 0V | | 180 | | mA |
| $T_{ON}$ | Turn-On Time | $C_{BYP}$ = 10nF | | 150 | | µs |
| $e_N$ | Output Noise Voltage (3) | BW = 10Hz to 100kHz | | 45 | | µVrms |
| $R_{OUT-SH}$ | Shutdown Switch Resistance | | | 250 | | Ω |
| $R_{EN}$ | Enable pull-down resistor | | | 2.5 | | MΩ |
| $V_{UVLO}$ | Under-voltage lock out (UVLO) threshold | | | 2.1 | | V |
| ESR | $C_{OUT}$ equivalent series resistance | | 5 | | 500 | mΩ |
| **Enable Input** | | | | | | |
| $V_{HI}$ | Logic High Level | $V_{IN}$ = 2.3 to 5.5V | **1.8** | | | V |
| | | $V_{IN}$ = 2.3 to 5.5V, 0ºC to +125ºC junction temperature | 1.6 | | | |
| $V_{LO}$ | Logic Low Level | $V_{IN}$ = 2.3 to 5.5V | | | **0.4** | V |
| $I_{EN}$ | Enable Input Current | $V_{EN}$ = 0.4V | | 0.15 | **1** | µA |
| | | $V_{EN}$ = $V_{IN}$ | | 1.5 | **4** | |
| **Thermal Protection** | | | | | | |
| $T_{SD}$ | Thermal Shutdown | | | 160 | | ºC |
| $T_{HYS}$ | Thermal Hysteresis | | | 10 | | ºC |

**Notes:**

(1 Specification for 2.85V output version unless specified otherwise.

(2) Dropout voltage is defined as the input-to-output differential at which the output voltage drops 2% below its nominal value measured at 1V differential. During test, the input voltage stays always above the minimum 2.3V.

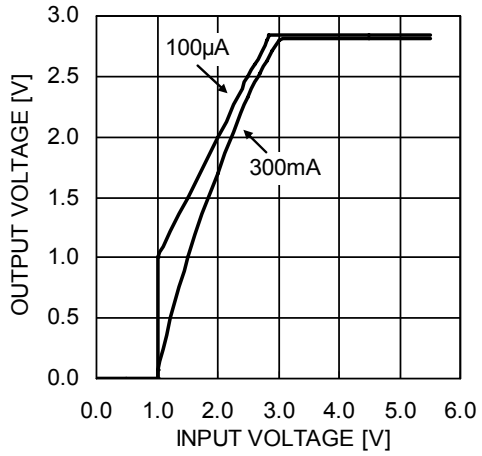
(3) Specification for 1.8V output version.

(4) For $V_{OUT}$ < 2.0V, the initial accuracy is ±2% and across temperature ±3%.

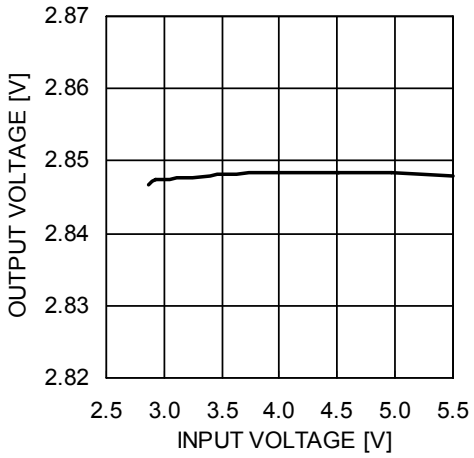
## TYPICAL CHARACTERISTICS (shown for 2.85V output version)

$V_{IN}$ = 3.85V, $I_{OUT}$ = 100µA, $C_{IN}$ = $C_{OUT}$ = 1µF, $C_{BYP}$ = 10nF, $T_A$ = 25°C unless otherwise specified.

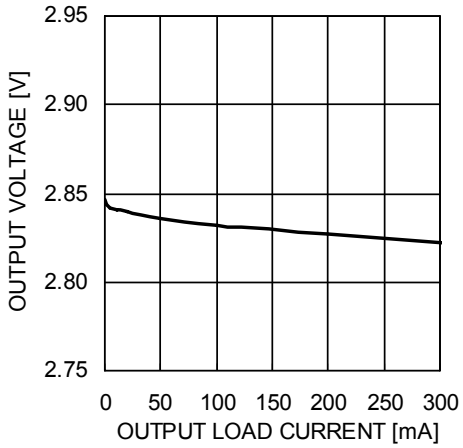
**Dropout Characteristics**



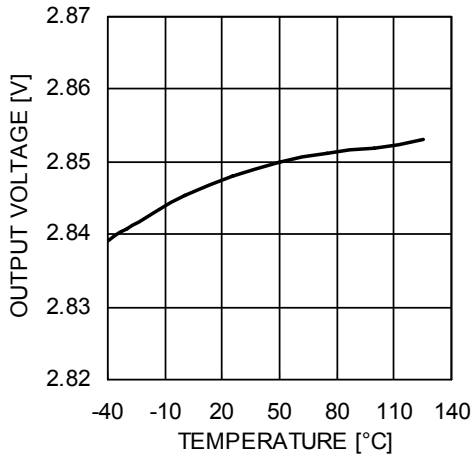

**Line Regulation**



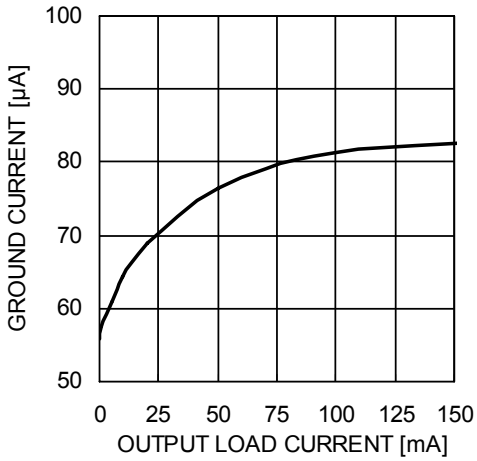

**Load Regulation**



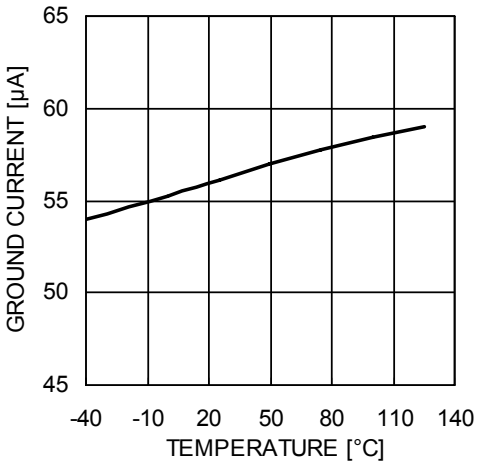

**Output Voltage vs. Temperature**




**Ground Current vs. Load Current**



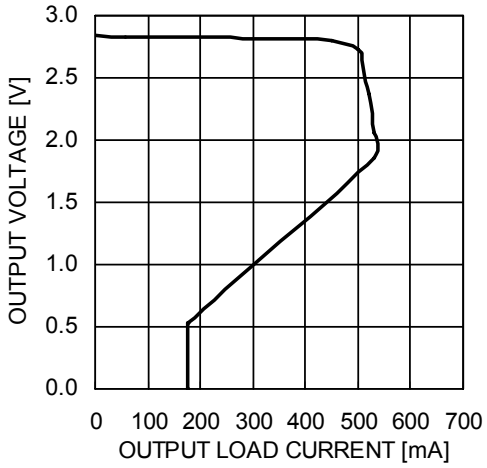

**Ground Current vs. Temperature**



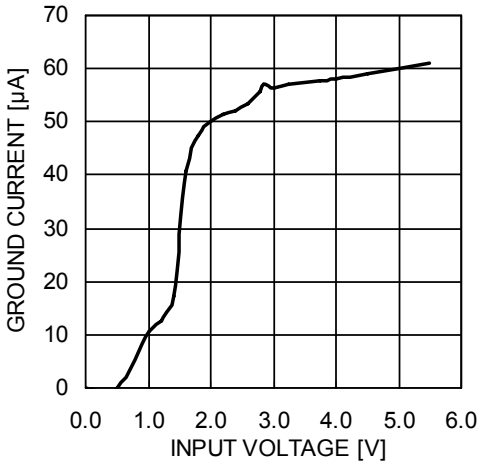
## TYPICAL CHARACTERISTICS (shown for 2.85V output option)

$V_{IN}$ = 3.85V, $I_{OUT}$ = 100µA, $C_{IN}$ = $C_{OUT}$ = 1µF, $C_{BYP}$ = 10nF, $T_A$ = 25°C unless otherwise specified.

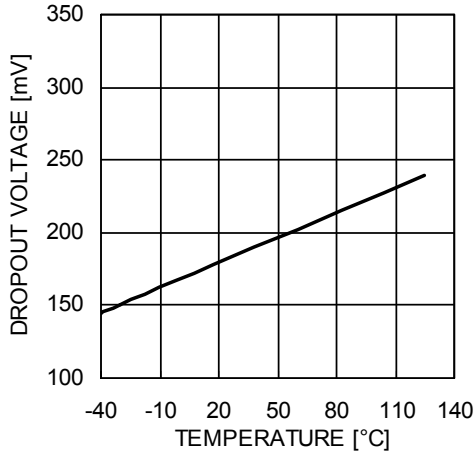
**Output Voltage vs. Load Current**



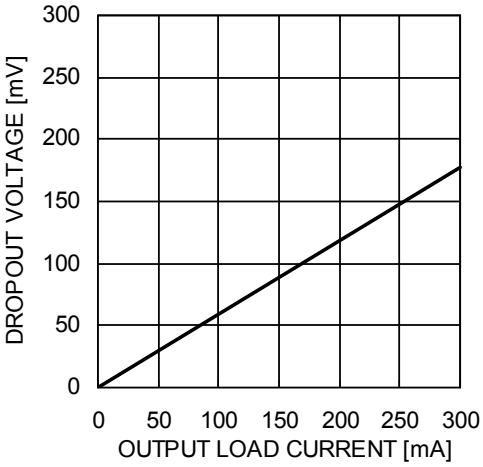

**Ground Current vs. Input Voltage**



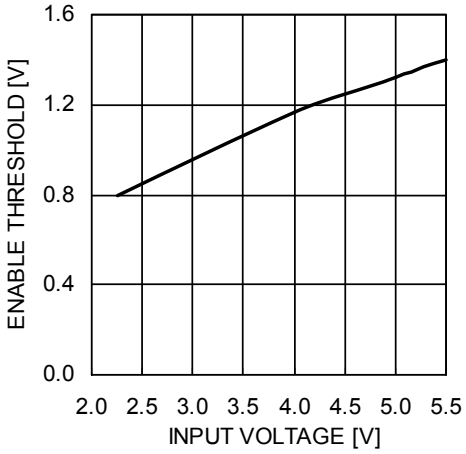

**Dropout vs. Temperature (300mA Load)**



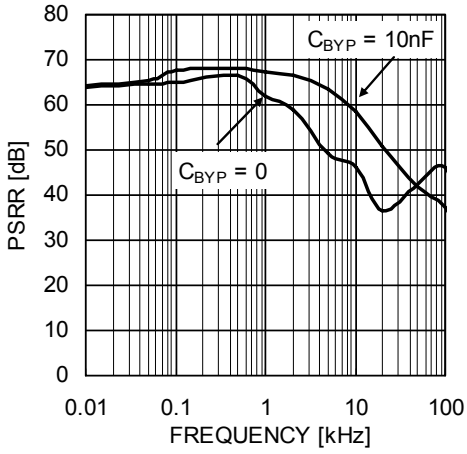

**Dropout vs. Load Current**




**Enable Threshold vs. Input Voltage**



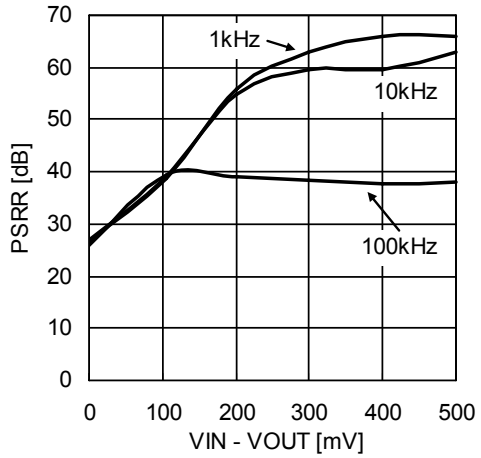

**PSRR vs. Frequency (10mA Load)**



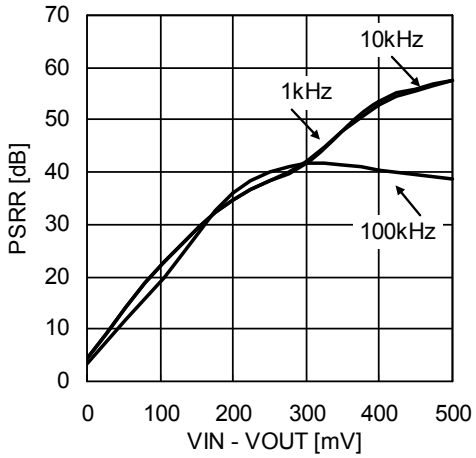
## TYPICAL CHARACTERISTICS (shown for 2.85V output option)

$V_{IN}$ = 3.85V, $I_{OUT}$ = 100µA, $C_{IN}$ = $C_{OUT}$ = 1µF, $C_{BYP}$ = 10nF, $T_A$ = 25°C unless otherwise specified.

**PSRR (30mA Load)**




**PSRR (200mA Load)**

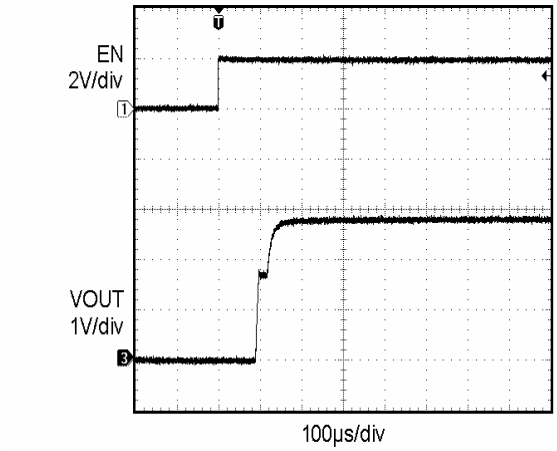


## TRANSIENT CHARACTERISTICS (shown for 2.85V output option)

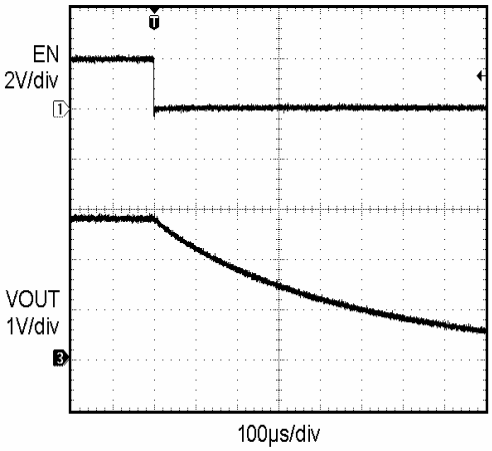
$V_{IN}$ = 3.85V, $I_{OUT}$ = 100µA, $C_{IN}$ = $C_{OUT}$ = 1µF, $C_{BYP}$ = 10nF, $T_A$ = 25°C unless otherwise specified.

**Note:** All transient characteristics are generated using the evaluation board CAT621XEVAL1.

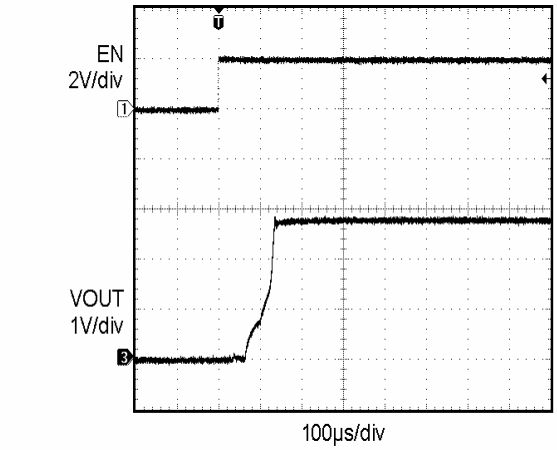
**Enable Turn-On (100µA Load)**



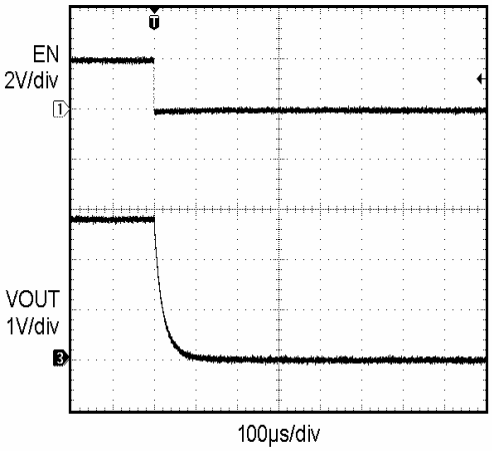

**Enable Turn-Off (100µA Load)**



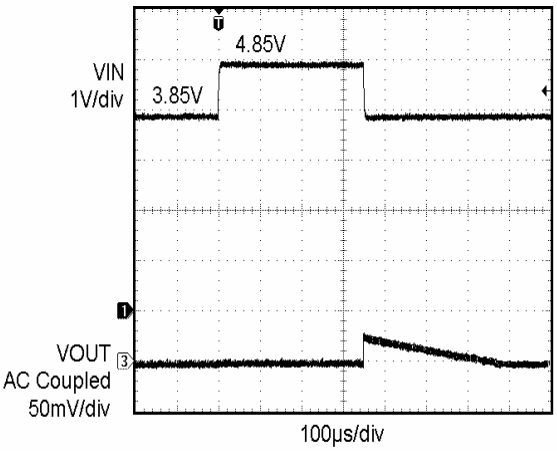

**Enable Turn-On (300mA Load)**



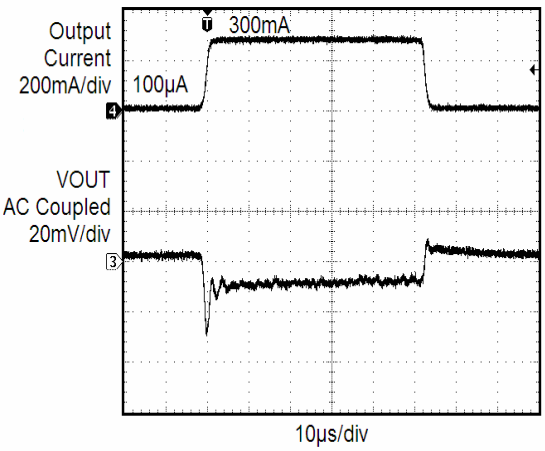

**Enable Turn-Off (300mA Load)**




**Line Transient Response (3.85V to 4.85V)**

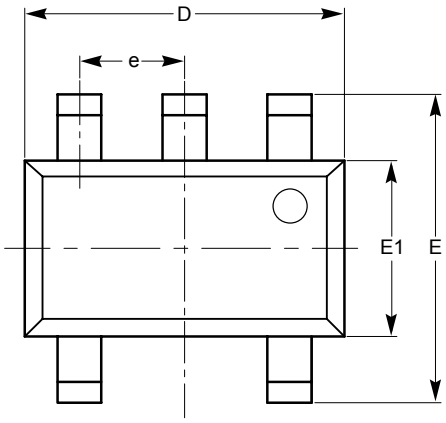



**Load Transient Response (0.1mA to 300mA)**



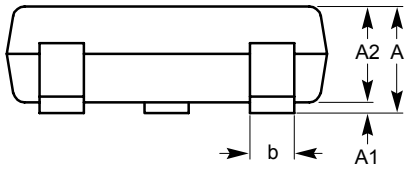
## PACKAGE OUTLINE DRAWING

### 5-LEAD TSOT-23 (1)(2)

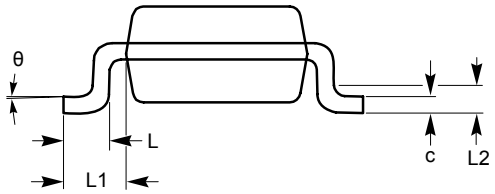



TOP VIEW

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | | | 1.00 |
| A1 | 0.01 | 0.05 | 0.10 |
| A2 | 0.80 | 0.87 | 0.90 |
| b | 0.30 | | 0.45 |
| c | 0.12 | 0.15 | 0.20 |
| D | | 2.90 BSC | |
| E | | 2.80 BSC | |
| E1 | | 1.60 BSC | |
| e | | 0.95 TYP | |
| L | 0.30 | 0.40 | 0.50 |
| L1 | | 0.60 REF | |
| L2 | | 0.25 BSC | |
| θ | 0° | | 8° |




SIDE VIEW




END VIEW

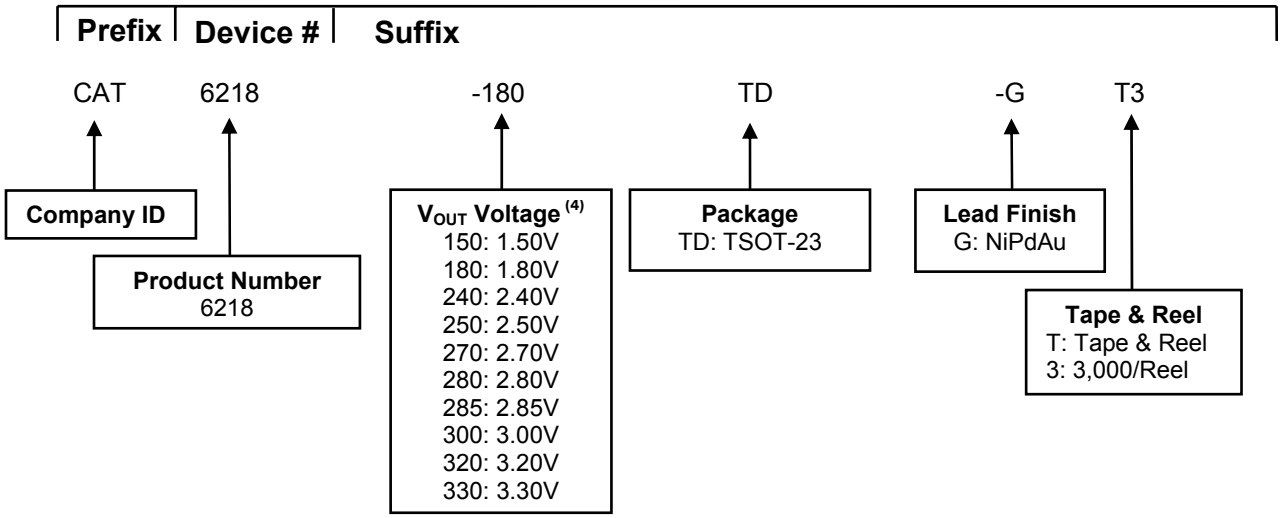
**For current Tape and Reel information, download the PDF file from: http://www.catsemi.com/documents/tapeandreel.pdf.**

**Notes:**

(1) All dimensions are in millimeters, angles in degrees.

(2) Refer JEDEC MO-193.

## EXAMPLE OF ORDERING INFORMATION




## ORDERING INFORMATION

| Part Number | $V_{OUT}$ Voltage | Package | Quantity per Reel |
|---|---|---|---|
| CAT6218-150TD-GT3(4) | 1.50V | TSOT-23 | 3,000 |
| CAT6218-180TD-GT3 | 1.80V | TSOT-23 | 3,000 |
| CAT6218-240TD-GT3 | 2.40V | TSOT-23 | 3,000 |
| CAT6218-250TD-GT3(4) | 2.50V | TSOT-23 | 3,000 |
| CAT6218-270TD-GT3 | 2.70V | TSOT-23 | 3,000 |
| CAT6218-280TD-GT3(4) | 2.80V | TSOT-23 | 3,000 |
| CAT6218-285TD-GT3(4) | 2.85V | TSOT-23 | 3,000 |
| CAT6218-300TD-GT3 | 3.00V | TSOT-23 | 3,000 |
| CAT6218-320TD-GT3(4) | 3.20V | TSOT-23 | 3,000 |
| CAT6218-330TD-GT3 | 3.30V | TSOT-23 | 3,000 |

**For Product Top Mark Codes, click here:**
**http://www.catsemi.com/techsupport/producttopmark.asp**

**Notes:**
(1) All packages are RoHS-compliant (Lead-free, Halogen-free).
(2) The standard finish is NiPdAu.
(3) The device used in the above example is a CAT6218-180 TD-GT3 ($V_{OUT}$ = 1.8V, in an TSOT-23 package, NiPdAu, Tape and Reel, 3,000/Reel).
(4) Standard voltages are 1.8V, 2.4V, 2.7V, 3.0V, and 3.3V. For other voltage options, please contact your nearest Catalyst Semiconductor Sales office.
(5) Top marking for CAT6218 is RU.

## REVISION HISTORY

| Date | Rev. | Reason |
|---|---|---|
| 06/19/2007 | A | Preliminary Revision |
| 02/11/2008 | B | Update Electrical Operating Characteristics<br>Update Package Outline Drawing<br>Change Document Number from MD-4010 to MD-10010 |
| 21-May-08 | C | Add other voltage options<br>Add link to Top Mark Codes |



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Issue date: 05/21/08