MIC2514

IttyBitty® Integrated High-Side Switch

General Description

The MIC2514 is an integrated high-side power switch that consists of a TTL compatible input and protected P-channel MOSFET. The MIC2514 can be used instead of a separate high-side driver and MOSFET in many low-voltage applications.

The MIC2514 switches voltage ranging from 3V to 13.5V and delivers more than 400mA continuous current. A slow turn-on feature prevents high inrush current when switching capacitive loads. The internal control circuitry is powered from the unswitched 3V to 13.5V input.

Current limiting is internally fixed at approximately 1.9A and requires no external components.

Thermal shutdown turns off the output if the die temperature exceeds approximately 170°C.

The MIC2514 is available in the 5-pin SOT-23-5 package with a temperature range of –40°C to +85°C.

Datasheets and support documentation can be found on Micrel's web site at:www.micrel.com.

Features

- MOSFET on-resistance
  - 1.5Ω typical at 5V
  - 0.95Ω typical at 12V
- 3V to 13.5V input
- 25µA typical on-state supply current at 5V
- <1µA typical off-state supply current at 5V
- Current limit
- Thermal shutdown
- Slow turn-on

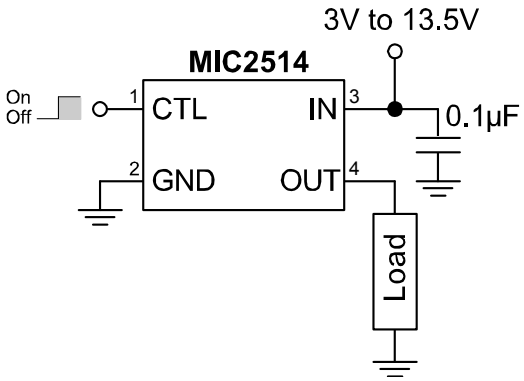
Applications

- 3.3V to 13.5V power management

Ordering Information

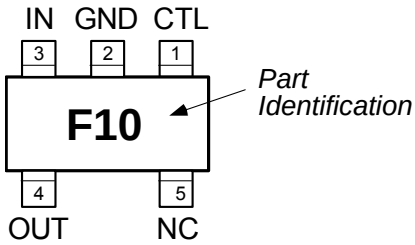
Part Number		Temp. Range	Package
Standard	Pb-Free		
MIC2514BM5	MIC2514YM5	–40° to +85°C	5-Pin SOT-23

Typical Application



High-Side Power Switch

Pin Configuration



5-Pin SOT-23 (M5)

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Pin Description

Pin Number	Pin Name	Pin Function
1	CTL	Control (Input): Non-inverting TTL compatible control input. High = on, low = off.
2	GND	Ground
3	IN	Supply Input: Output MOSFET source. Also supplies IC's internal circuitry. Connect to supply.
4	OUT	Switch Output: Output MOSFET drain. Connect to switched side of load.
5	NC	Not internally connected. Connect to ground plane for lowest package thermal resistance.

Absolute Maximum Ratings[1]

Supply Voltage (V_{IN}) ..... +20V
Output Current (I_{OUT}). ..... Internally Limited
Control Input (V_{CTL}) ..... –0.3V to 15V
Storage Temperature (T_S) ..... –65°C to +150°C

Operating Ratings[2]

Supply voltage (V_{IN}) ..... +3V to +13.5V
Ambient Temperature (T_A) ..... –40°C to +85°C
Junction Thermal Resistance
(θ_{JA}) ..... 220°C/W
(θ_{JC}) ..... 130°C/W
Control Input (V_{CTRL}) ..... -0.3V to V_{IN}

Electrical Characteristics

V_{IN} = 5V; T_A = 25°C, except **bold** values indicate –40°C≤ T_A ≤ +85°C, **Note 3**; unless noted.

Parameter	Condition	Min	Typ	Max	Units
Supply Current	V_{CTL} = logic 0, V_{IN} = 5V V_{CTL} = logic 0, V_{IN} = 13.5V		0.6 2.0	**10** **25**	µA µA
	V_{CTL} = logic 1, V_{IN} = 3V V_{CTL} = logic 1, V_{IN} = 5V V_{CTL} = logic 1, V_{IN} = 13.5V		10 25 95	**20** **40** **200**	µA µA µA
Control Input Voltage	V_{CTL} = logic 0, 3V ≤ V_{IN} ≤ 13.5V	**0**		**0.79**	V
	V_{CTL} = logic 1, 3V ≤ V_{IN} ≤ 5V V_{CTL} = logic 1, 5V ≤ V_{IN} ≤ 13.5V	**0.8** **0.8**	1.45 1.65	**2.0** **2.3**	V V
Output MOSFET Resistance	V_{IN} = 3V		2.4	**4.5**	Ω
	V_{IN} = 5V		1.5	2.4 **2.7**	Ω
	V_{IN} = 12V		0.95	1.5 **1.7**	Ω Ω
Current Limit Threshold	V_{IN} = 3V V_{IN} = 5V V_{IN} = 12V	 **1.0** **1.2**	0.5 1.4 1.9	**1.5** **2.0** **2.5**	A A A

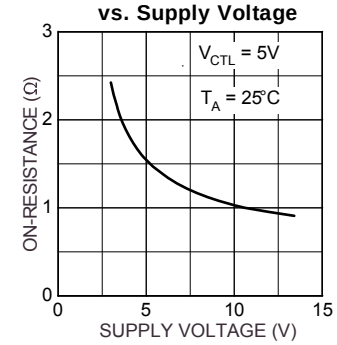
General Note: Devices are ESD sensitive. Handling precautions recommended

Notes:

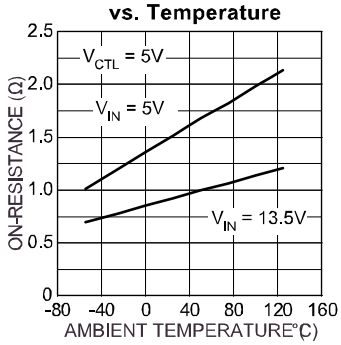
1. Exceeding the absolute maximum rating may damage the device.
2. The device is not guaranteed to function outside its operating rating.
3. Devices production tested at 25°C, but Devices guaranteed over indicated temperature range.

Typical Characteristics

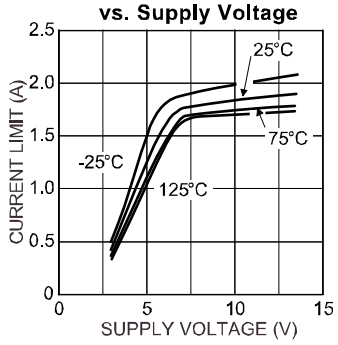
On-Resistance vs. Supply Voltage



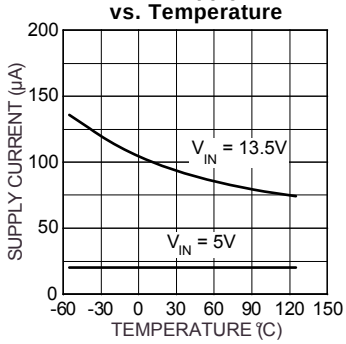
On-Resistance vs. Temperature



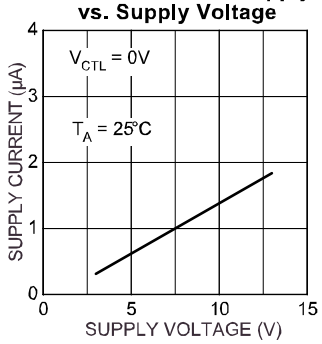
Current Limit vs. Supply Voltage



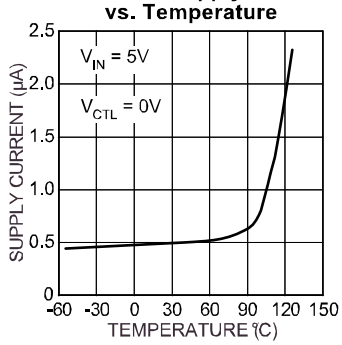
On-State SupplyCurrent vs. Temperature



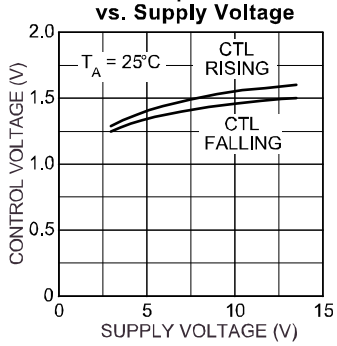
Off-State Current Supply vs. Supply Voltage



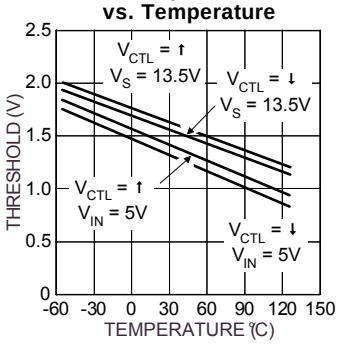
Off-State Supply Current vs. Temperature



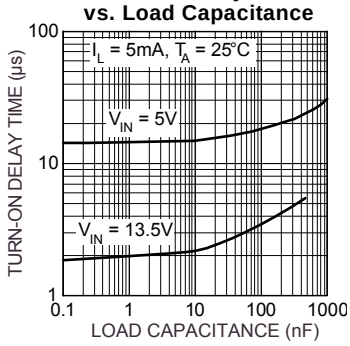
Control Input Threshold vs. Supply Voltage



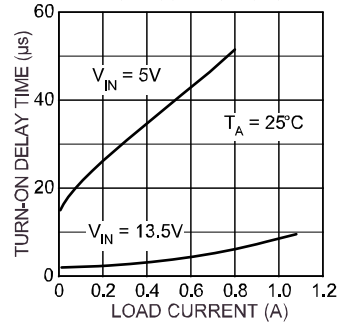
Control Input Threshold vs. Temperature



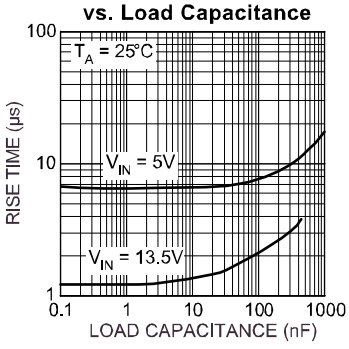
Turn-On Delay Time vs. Load Capacitance



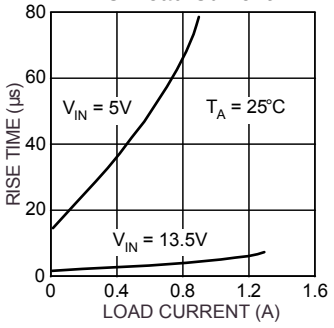
Turn-On Delay Time vs. Load Current



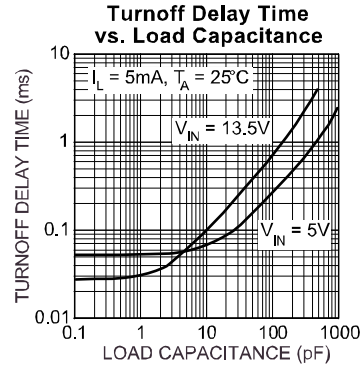
Rise Time vs. Load Capacitance

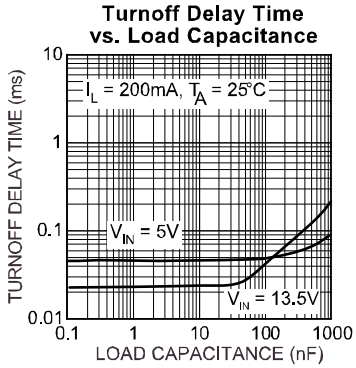


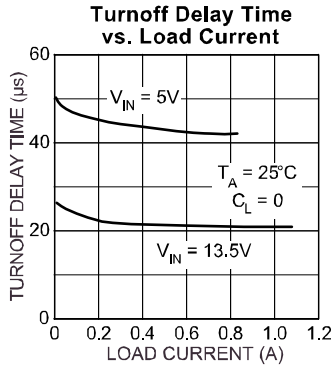
Rise Time vs. Load Current

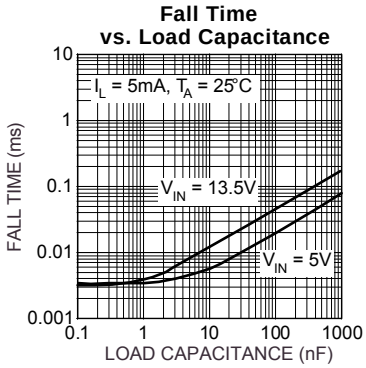


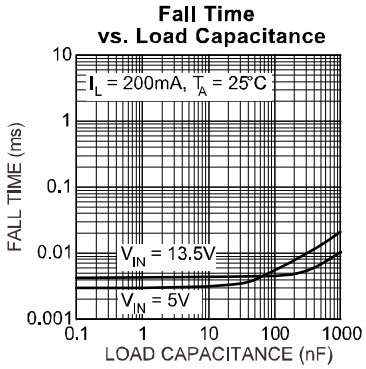
Typical Characteristics (continued)

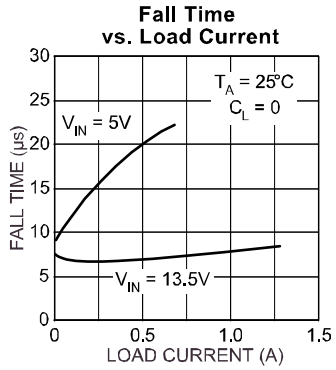




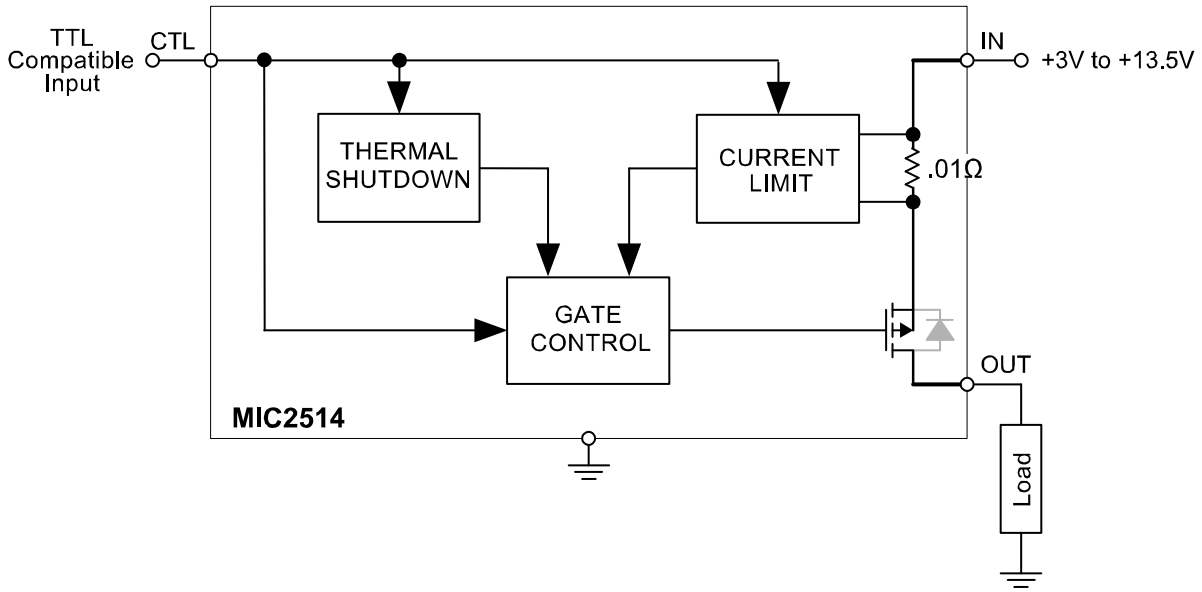








Functional Diagram



Functional Description

The MIC2514 is a non-inverting high-side switch. A logic-high control input turns on the output transistor, and a logic-low turns off the output transistor. Fault conditions turn off the output transistor.

Control Input

Applying a logic-high input to CTL (control input) activates the thermal shutdown and gate control circuits. If there are no fault conditions, the output MOSFET turns on.

Gate Control

The gate control circuit applies the supply voltage to the output MOSFET gate, turning it off, or forces the MOSFET gate below the supply voltage, turning it on, as determined by CTL and thermal shutdown.

Input and Output

IN (input) is the supply connection to the logic circuitry and the source of the output MOSFET. OUT (output) is the drain of the output MOSFET. In a typical circuit; current flows through the switch from IN to OUT toward the load.

The output MOSFET has an intrinsic body diode which will conduct if OUT is forced to a higher voltage than IN.

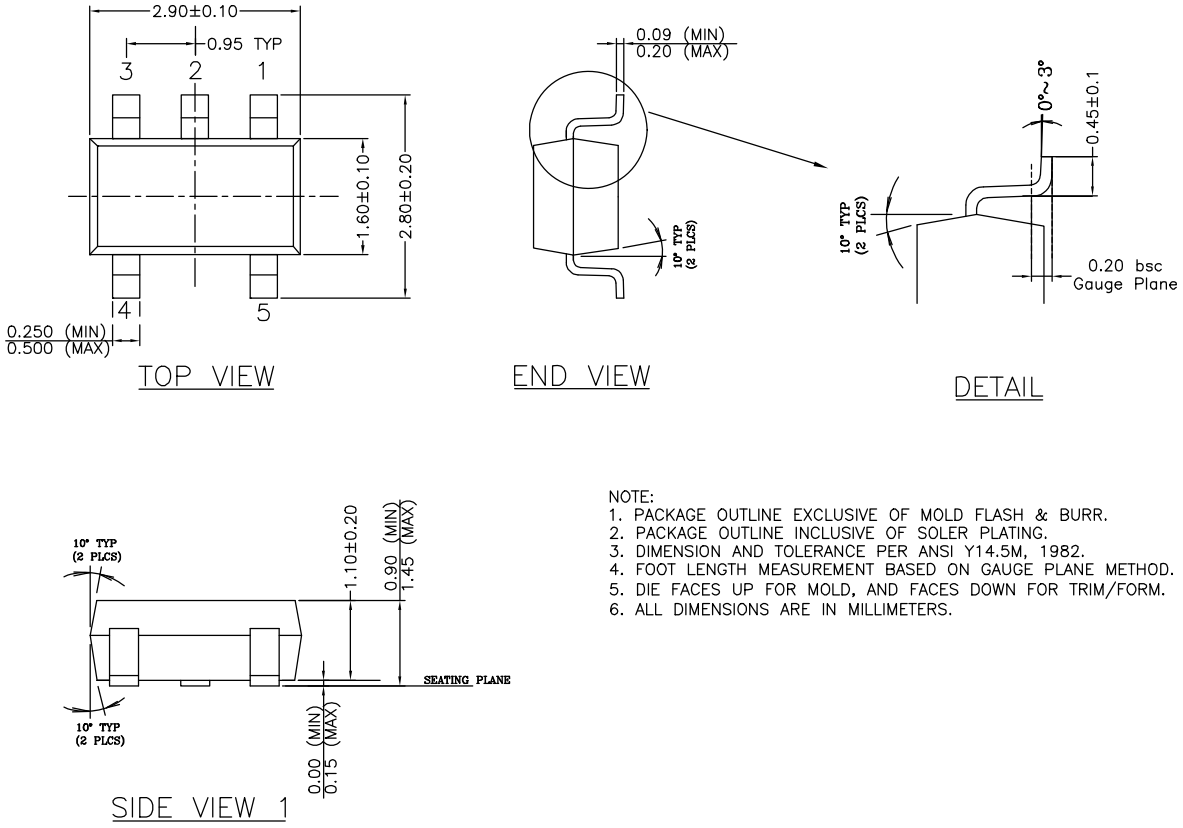
Thermal Shutdown

Thermal shutdown turns off the output MOSFET if the die temperature exceeds approximately 170°C. Thermal shut-down releases the output after the die temperature decreases 10°C.

Current Limit

The current limit is preset internally. The preset level prevents damage to the output MOSFET but allows a typical current of 1.9A through the output MOSFET for the MIC2514. This current limit is sufficient to protect the bond wire and the output device from instantaneous high current. Package thermal ratings and power dissipation should be considered when determining safe continuous operating current. Output current is monitored by sensing the voltage drop across the output MOSFET source metal resistance.

Package Information



NOTE:
1. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH & BURR.
2. PACKAGE OUTLINE INCLUSIVE OF SOLER PLATING.
3. DIMENSION AND TOLERANCE PER ANSI Y14.5M, 1982.
4. FOOT LENGTH MEASUREMENT BASED ON GAUGE PLANE METHOD.
5. DIE FACES UP FOR MOLD, AND FACES DOWN FOR TRIM/FORM.
6. ALL DIMENSIONS ARE IN MILLIMETERS.

5-Pin SOT-23 (M5)

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