

# VIpower™ M0-7

## Miniaturized high-side driver family





# VIPower M0-7 HSD family

ST's new VIPower M0-7 family consists of a set of high-side drivers specifically designed for the automotive environment.

The family covers the full load range in terms of type and rated power and includes state-of-the-art embedded control and a brand new protection mechanism, making it the ideal solution for systems such as car junction boxes. In addition, the pin-to-pin compatibility across the whole family offers flexibility and scalability when addressing several variants of the same module

## M0-7 High Side Driver key pillars

### New short circuit protection mechanism

On top of the Autorestart operation during an enduring load short circuit the device can be configured in latch-off mode simply via a pin named FaultRST.

The consequence of the latch-off configuration is an immense increase of the lifetime of the device in short circuit conditions (grade A according to AECQ100-012 standard).

### New MultiSense diagnostic

Beside the analogue Output Current Sensing it is possible to sense the supply voltage (on Vcc pin) as well as the Chip temperature in real time and in ON as well as OFF state.

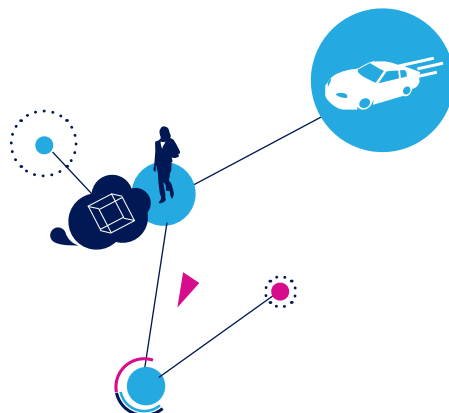
### Advanced tiny power packages

- Up to 75% of body size reduction versus previous family for PCB shrinkage and system weight reduction
- Wide offer including:
  - PowerSSO-16
  - Octapak
  - PowerSSO-36
  - SO-8

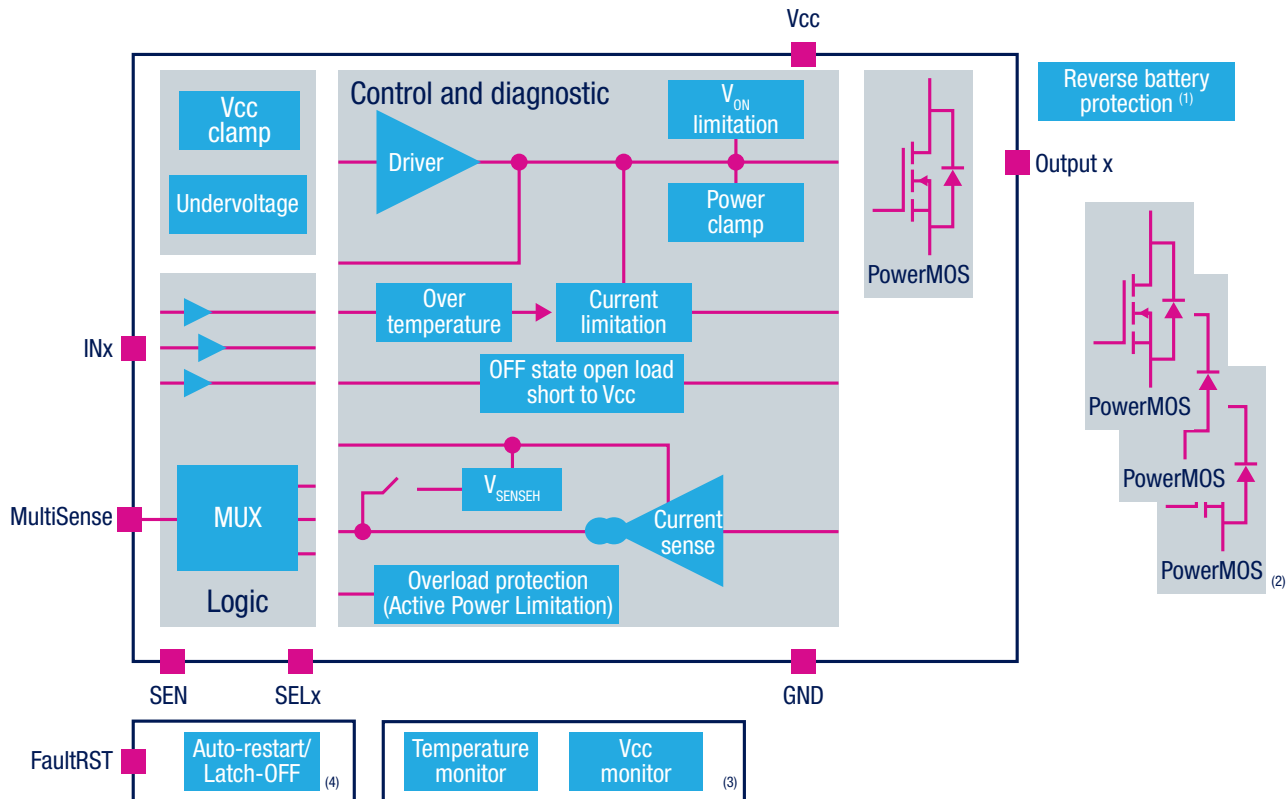
### Ultra low power consumption

- Maximum 0.5  $\mu$ A standby current per device

This allows to keep the power consumption of the module low in spite of the increased electronic components on board.



## VIPOWER M0-7 HIGH-SIDE DRIVER BLOCK DIAGRAMS



Note: (1) Built-in reverse battery protection, allowing self turn-on of the output power MOSFETs, available on selected devices

(2) One to four integrated power MOSFETs, depending on the number of channels

(3) Features available on selected devices

(4) Configurable auto-restart or latch-off functionality available on selected devices

## VIPOWER M0-7 HIGH-SIDE DRIVER HIGHLIGHTS

### KEY FEATURES

- Optimized for LED driving
- Integrated sense multiplexer: provides feedback on analog load current, temperature and  $V_{CC}$
- Off-state open load detection
- Output short to  $V_{CC}$  detection
- Current limitation, power limitation and over-temperature shutdown
- Configurable autorestart or latch off protection against overload and short-circuit conditions by means of fault reset pin
- Reverse polarity protection
- ESD integrated protection according to human body model and charge device model standards
- 0.5  $\mu\text{A}$  max standby current

### KEY BENEFITS

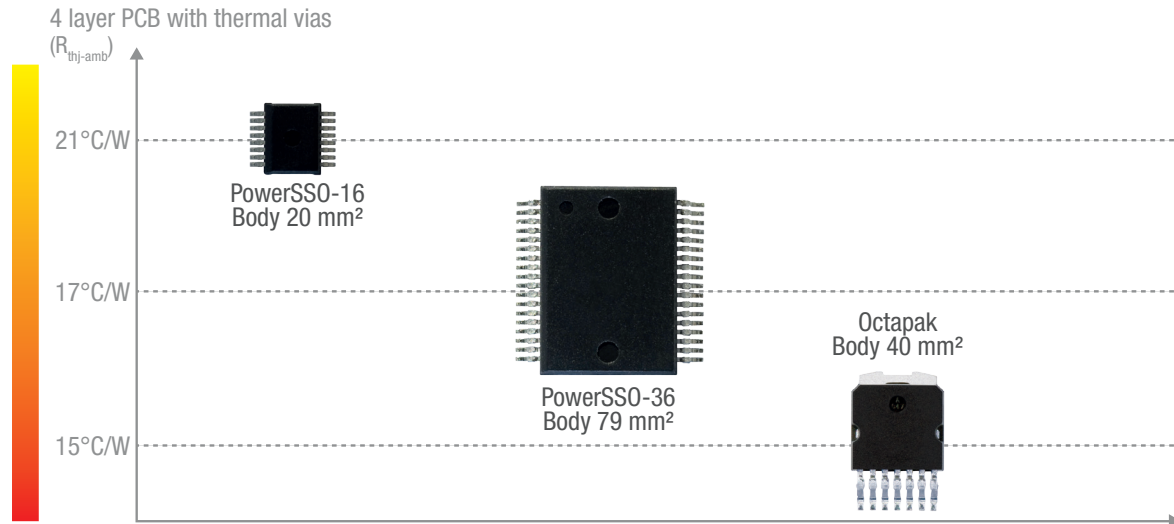
- The high-precision analog current sensing allows currents to be monitored for different load types, such as bulbs and LEDs
- Chip temperature reading in on and off states allows detection of smooth overloads
- Battery line reading allows setting of correct PWM duty cycle without additional microcontroller I/Os
- Configurable autorestart or latch off makes the most of native devices robust against overload, whatever the applicative constraints
- Optimized EMC design together with extremely low switching losses allow best-in-class thermal efficiency and electromagnetic emission performances
- Low-voltage operation down to 4 V ensures critical functions are activated during cold cranking
- Minimization of external components
- Ultra low quiescent current allows extremely low battery consumption in idle mode
- The highest package density in the market, in terms of number of channels housed in one tiny package, makes your design compact and lightweight



## VIPOWER M0-7 HIGH-SIDE DRIVER PACKAGES

### M0-7 available in tiny packages

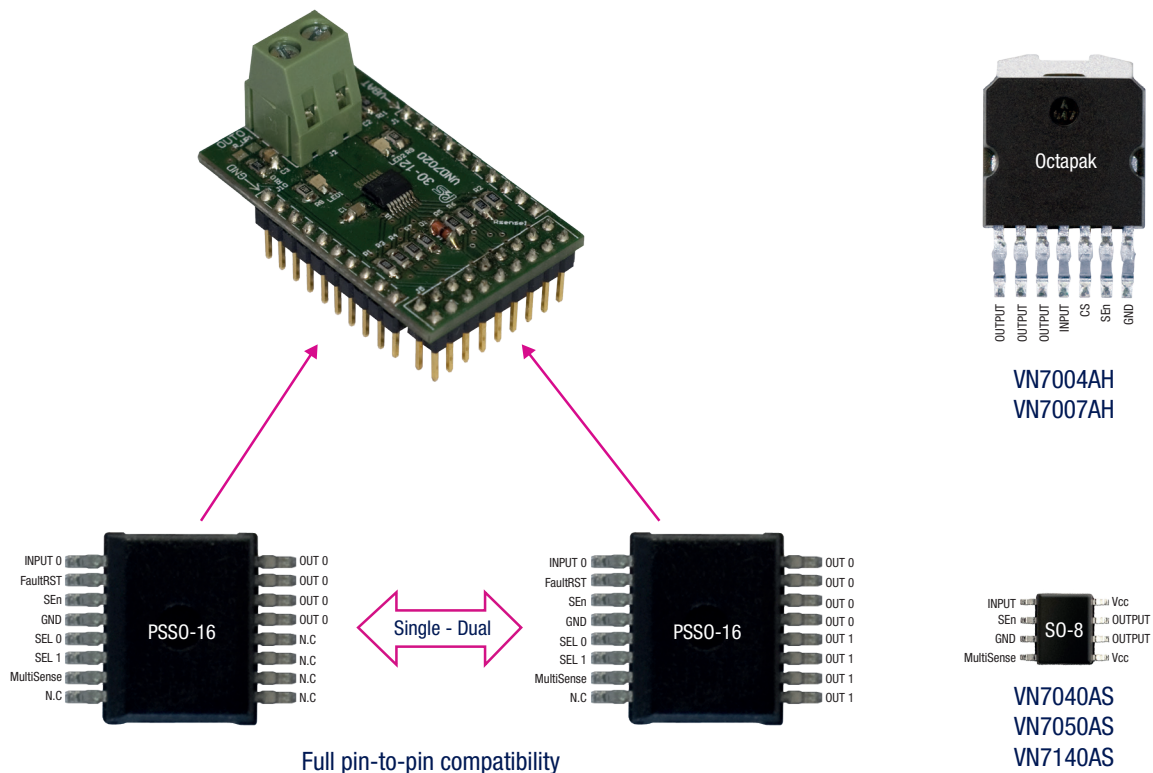
Smaller and smaller module sizes and weight reduction is a must nowadays, in order to increase the overall energy efficiency in the car. To meet these requirements, the VIPower™ M0-7 family offers an eco-friendly product portfolio of lead-free packages ensuring outstanding thermal performance in really tiny SMD packages (for example,  $R_{thj-amb} = 15\text{ }^{\circ}\text{C/W}$  for the Octapak). Due to the outstanding M0-7 die size shrinking versus previous technologies, a 10 mΩ HSD can be housed in the tiny PowerSSO-16 package.



### M0-7 power of scalability

VIPOWER™ M0-7 HSDs feature scalability between different RDS(on) categories and between single- and dual-channel devices housed in the same package. The HW design can therefore match different configurations for the same PCB by replacing the device with zero effort in hardware and software.

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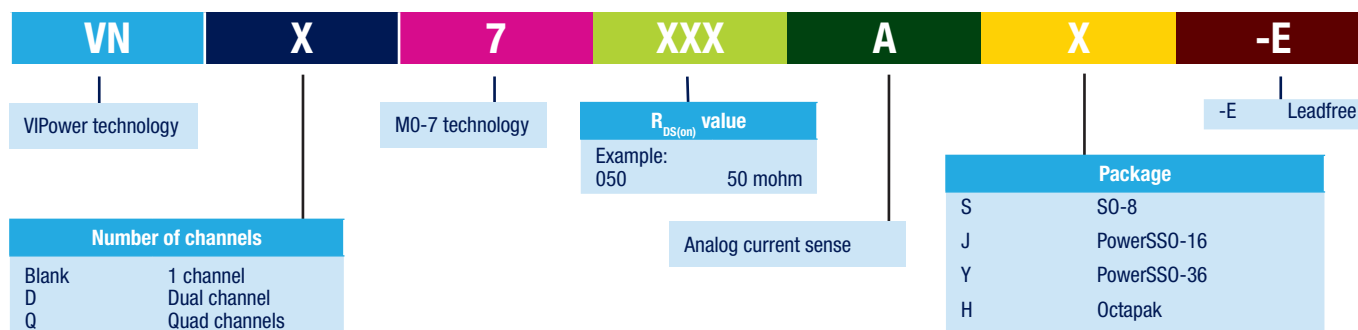


## VIPOWER M0-7 HIGH-SIDE DRIVER PRODUCT PORTFOLIO

Part number	Package	Operating range $V_{CC}$ (V)	Max supply voltage $V_{CC}$ max (mΩ)	Max on-state resistance $R_{DS(ON)}$ typ (mΩ)	Current limitation $I_{lim}$ typ (A)	Configurable auto-restart or latch-OFF	Multisense	Reverse battery
Single channel devices								
VN7004AH-E (*)	Octapak	4 - 28	38	4	130		Current sense	•
VN7007AH-E (*)	Octapak	4 - 28	38	7	91		Current sense	•
VN7010AJ-E	PowerSSO-16	4 - 28	38	10	91	•	•	External components
VN7016AJ-E	PowerSSO-16	4 - 28	38	16	77	•	•	External components
VN7020AJ-E	PowerSSO-16	4 - 28	38	20	63	•	•	External components
VN7040AS-E	S0-8	4 - 28	38	40	34		Current sense	External components
VN7040AJ-E	PowerSSO-16	4 - 28	38	40	34	•	•	External components
VN7050AS-E	S0-8	4 - 28	38	50	30		Current sense	External components
VN7050AJ-E	PowerSSO-16	4 - 28	38	50	30	•	•	External components
VN7140AS-E	S0-8	4 - 28	38	140	12		Current sense	External components
VN7140AJ-E	PowerSSO-16	4 - 28	38	140	12	•	•	External components
Double channel devices								
VND7004AY-E (*)	PowerSSO-36	4 - 28	38	4	100	•	•	•
VND7012AY-E (*)	PowerSSO-36	4 - 28	38	12	75	•	•	•
VND7020AJ-E	PowerSSO-16	4 - 28	38	20	63	•	•	External components
VND7030AJ-E	PowerSSO-16	4 - 28	38	30	56	•	•	External components
VND7040AJ-E	PowerSSO-16	4 - 28	38	40	34	•	•	External components
VND7050AJ-E	PowerSSO-16	4 - 28	38	50	30	•	•	External components
VND7140AJ-E	PowerSSO-16	4 - 28	38	140	12	•	•	External components
Quad channel devices								
VNQ7040AY-E (*)	PowerSSO-36	4 - 28	38	40	34	•	•	•
VNQ7050AJ-E	PowerSSO-16	4 - 28	38	50	27	•	Current sense	External components
VNQ7140AJ-E	PowerSSO-16	4 - 28	38	140	12	•	•	External components

(\*) In development

## VIPOWER M0-7 HIGH-SIDE DRIVER PART NUMBERING

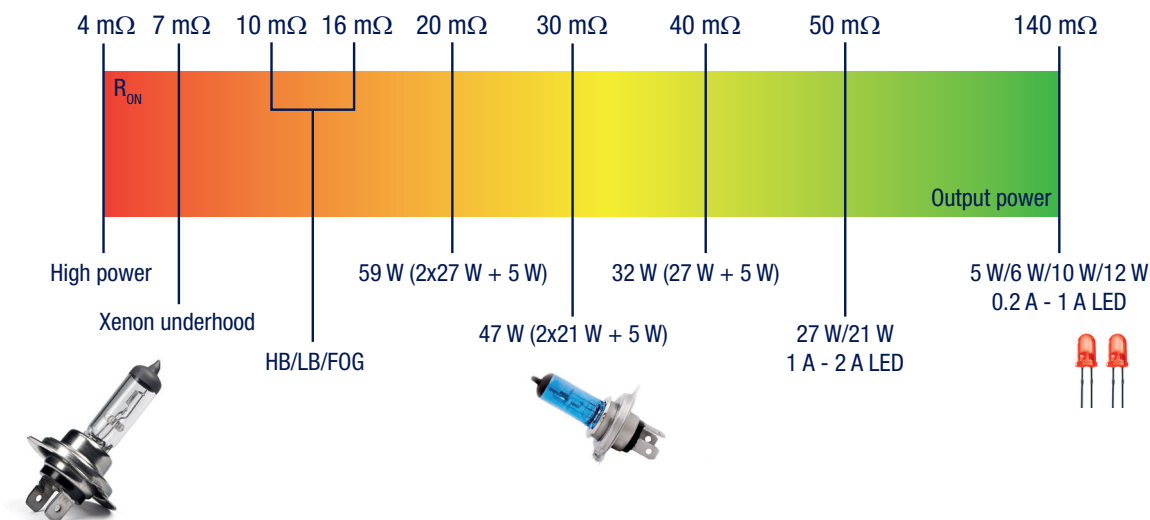


## APPLICATIONS

### Exterior and interior lighting

VIpower™ M0-7 HSDs are designed to drive different car lights, including headlights, blinkers, position, fog, or brake lights, whatever their type (incandescent bulbs, HID lamps or LED clusters).

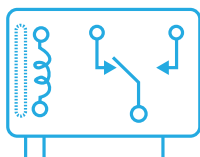
The availability of different classes of RDS(on) makes the M0-7 the right solution for each standalone light or combination of paralleled lights. The embedded current limitation circuitry ensures that the lamp is correctly turned on at each extreme condition (in hot or cold ambient temperature). Moreover, the high-precision current sensing makes it possible to diagnose different failure conditions, including the detection of the disconnection of a single bulb out two or three paralleled bulbs or a complete open load condition. In case of a LED cluster, the ultra low leakage of the power stage ensures no glowing effect of the LED during idle mode.



### Inductive loads

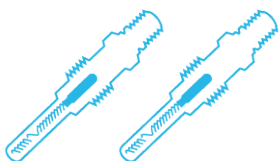
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The VIpower™ M0-7 family is able to drive inductive loads such as DC motors and relay coils from a few  $\mu\text{H}$  to hundreds of mH, and the power stage can switch them off through the activation of their 46 V power clamp allowing fast demagnetization. The integrated chip temperature reading via MultiSense can support the designer by giving advance warning of, for example, how many sequential motor activations the device can manage without over-heating.



### Other applications

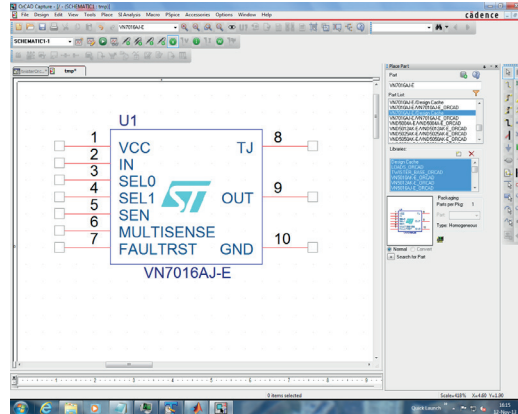
Further applications where VIpower™ M0-7 HSDs are particularly suitable are heaters, glow plugs and power distribution boxes. In this latter case, the HSD, as well as driving one or more ECUs, can be used as an overload protection for the downstream power tracks, thus replacing the fuse function.



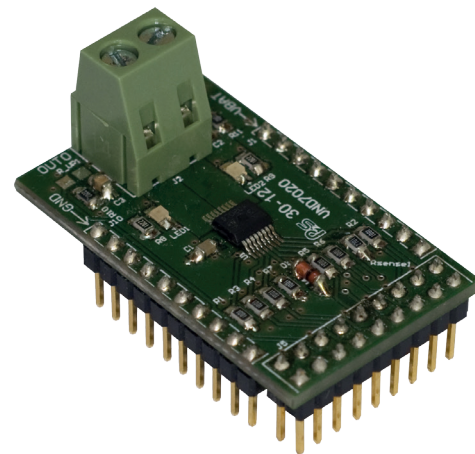
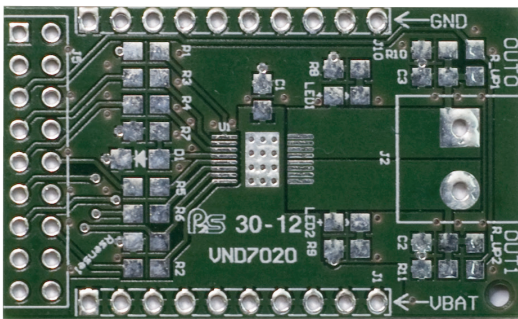
# DEVELOPMENT SUPPORT TOOLS

The support tools are available at: [www.st.com/vipower\\_m07](http://www.st.com/vipower_m07)

## Orcad models

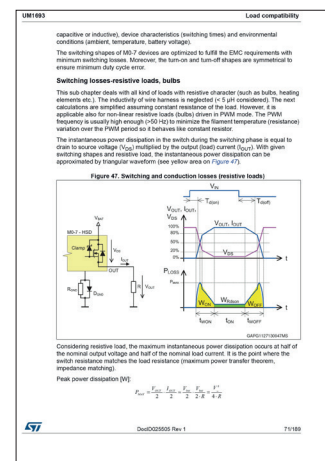
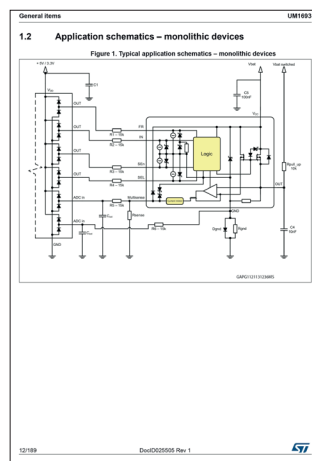
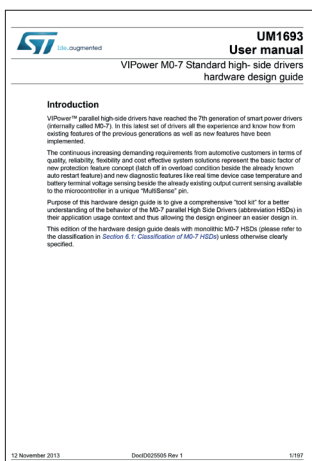


## Easy board



## User manual

The user manual presents applications hints, device functionality, choice of components given a certain load, paralleling of pins, MultiSense usage, and so on.



# life.augmented



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