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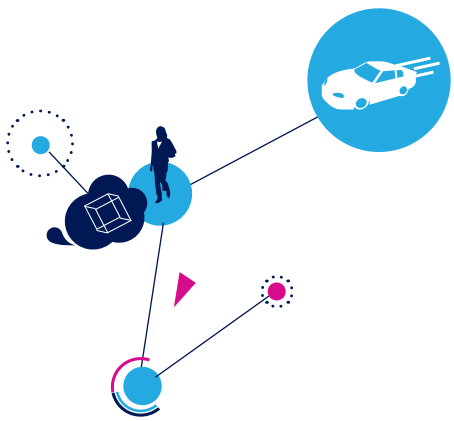
VIPower™ M0-7
Miniaturized high-side driver family

VIPower M0-7 HSD family

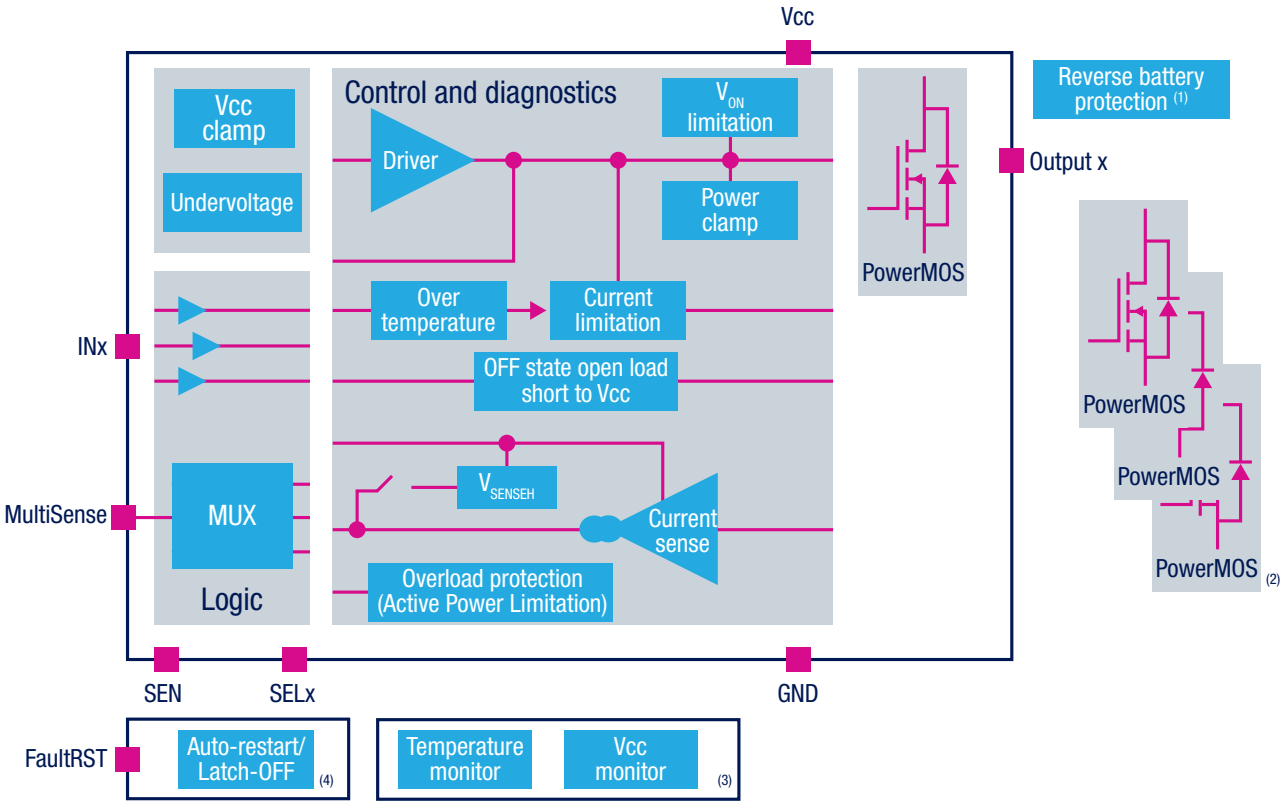
ST's new VIPower M0-7 family consists of a set of high-side drivers specifically designed for the automotive environment.
This family covers the full load range in terms of type and rated power and includes state-of-the-art embedded control and a brand new protection mechanism, making it the ideal solution 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 In addition to the Auto-restart operation during an enduring load short circuit, the device can be configured in latch-off mode simply through the fault reset pin (FaultRST). The advantage of the latch-off configuration is an immense increase in the device's lifetime under short-circuit conditions (Grade A according to the AEC-Q100-012 standard).	**New MultiSense diagnostic** In addition to analog output current sensing, it is possible to sense the supply voltage (on V_{CC} pin) as well as the chip's temperature in real time and in in On as well as Off states.

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
  • PowerSSO-12
	Ultra-low power consumption
	• Maximum 0.5 µA standby current per device
	
	This keeps the device's power consumption low despite an increased number of 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 BENEFITS

- The highest package density on the market, makes your design compact and lightweight
- Ultra-low quiescent current allows extremely low battery consumption in idle mode
- 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 auto-restart or latch-off modes makes the most of native devices robust against overload, regardless of the applicative constraints
- Optimized EMC design together with extremely low switching losses allow best-in-class thermal efficiency and electromagnetic emission performance
- Low-voltage operation down to 4 V ensures critical functions are activated during cold cranking
- Minimization of external components

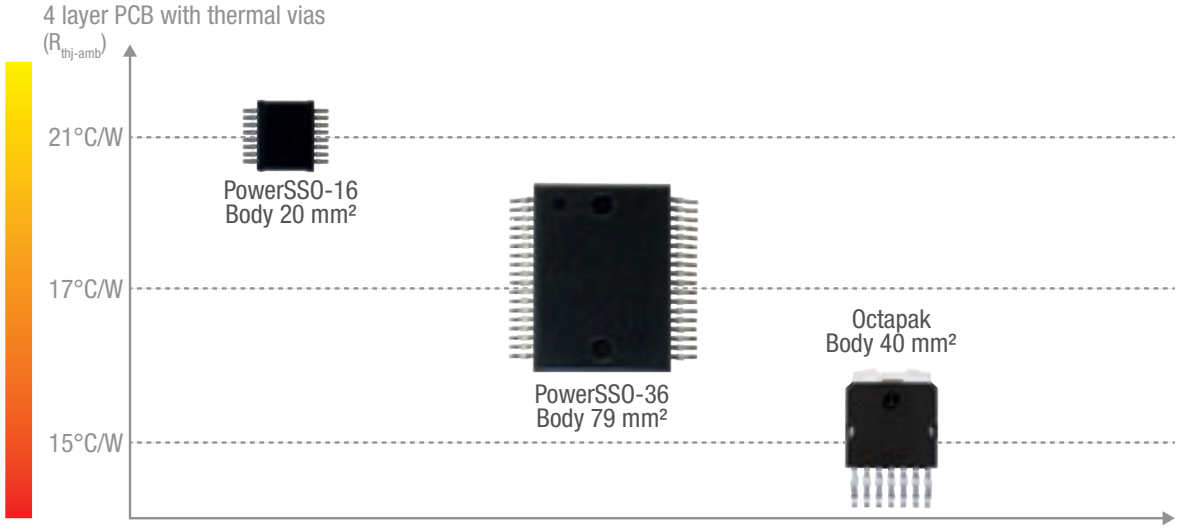
KEY FEATURES

- 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 µA standby current (maximum)

VIPOWER M0-7 HIGH-SIDE DRIVER PACKAGES

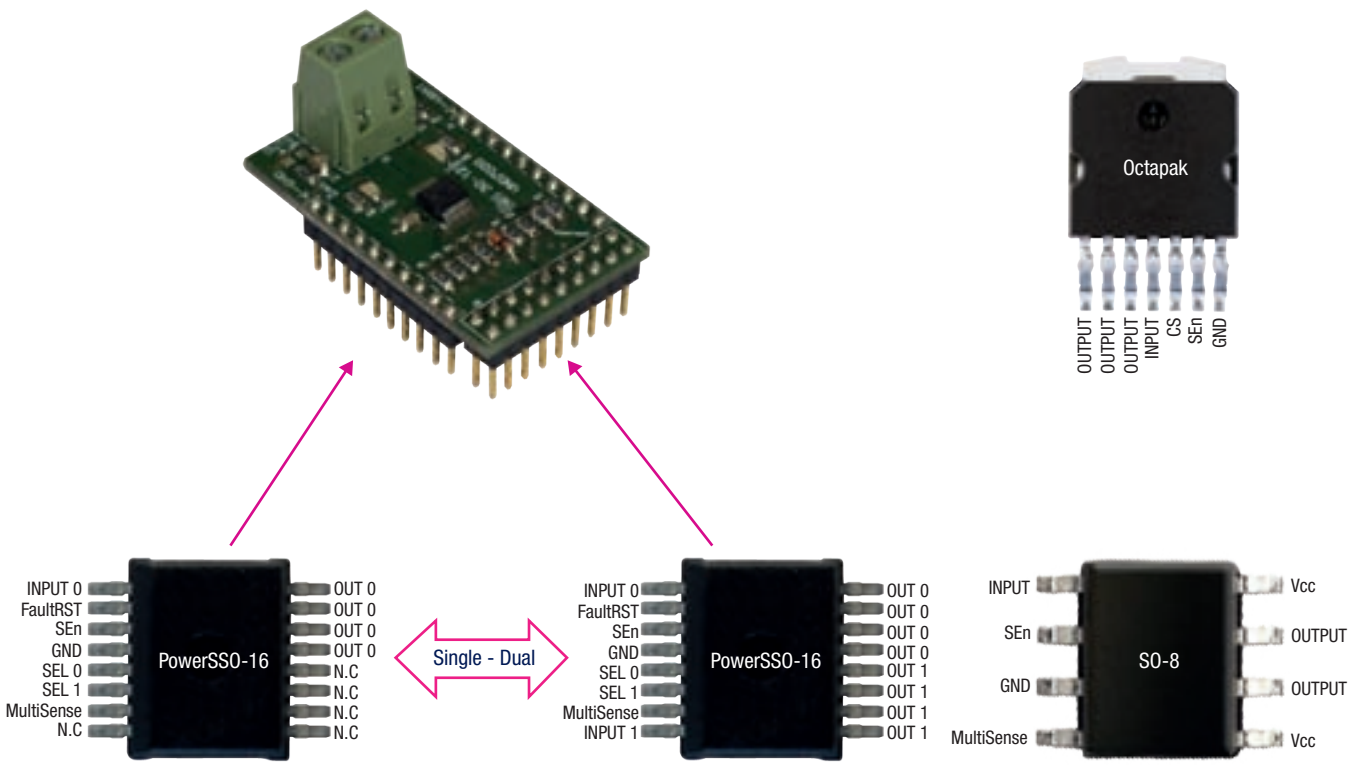
M0-7 available in tiny packages

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, $R_{thj\text{-}amb}$ = 15 °C/W for the Octapak). Thanks 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 $R_{DS(on)}$ categories and between single- and dual-channel devices housed in the same package. The hardware design can therefore match different configurations for the same PCB by replacing the device with zero effort in hardware and software.



Full pin-to-pin compatibility

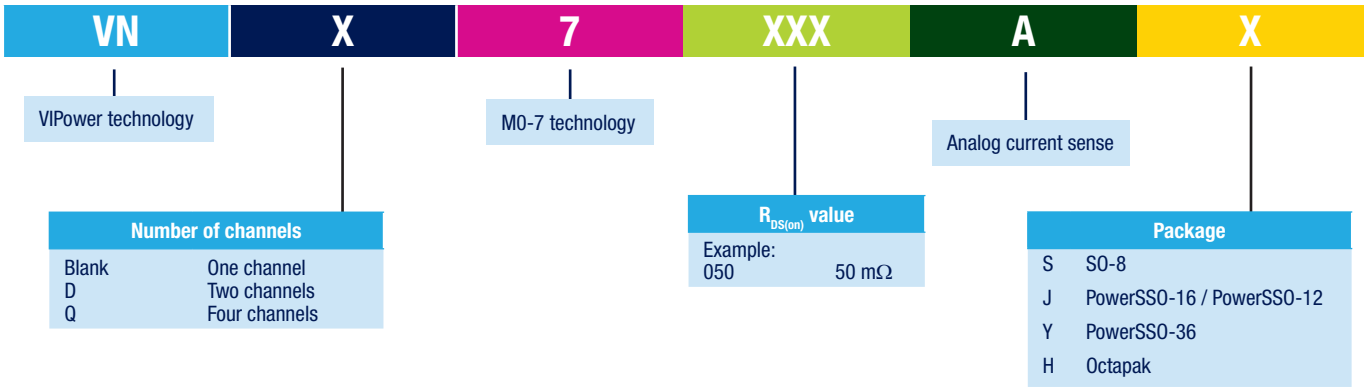
VIPOWER M0-7 HIGH-SIDE DRIVER PRODUCT PORTFOLIO

Part number	Package	Operating range V_{CC} (V)	Max supply voltage V_{CC} max (V)	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								
VN7004CH (*)	Octapak	4 - 28	38	4	100		Current sense	•
VN7004CLH (*)	Octapak	4 - 28	38	4	100	•	Current sense	•
VN7007AH	Octapak	4 - 28	38	7	100		Current sense	•
VN7007ALH	Octapak	4 - 28	38	7	100	•	Current sense	•
VN7008AJ (*)	PowerSSO-16	4 - 28	38	8.5	96	•	Current sense	External components
VN7010AJ	PowerSSO-16	4 - 28	38	10	91	•	•	External components
VN7016AJ	PowerSSO-16	4 - 28	38	16	77	•	•	External components
VN7020AJ	PowerSSO-16	4 - 28	38	20	63	•	•	External components
VN7040AS	SO-8	4 - 28	38	40	34		Current sense	External components
VN7040AJ	PowerSSO-16	4 - 28	38	40	34	•	•	External components
VN7050AS	SO-8	4 - 28	38	50	30		Current sense	External components
VN7050AJ	PowerSSO-16	4 - 28	38	50	30	•	•	External components
VN7140AS	SO-8	4 - 28	38	140	12		Current sense	External components
VN7140AJ	PowerSSO-16	4 - 28	38	140	12	•	•	External components
Double-channel devices								
VND7004AY (*)	PowerSSO-36	4 - 28	38	4	100	•	•	•
VND7012AY (*)	PowerSSO-36	4 - 28	38	12	75	•	•	•
VND7020AJ	PowerSSO-16	4 - 28	38	20	63	•	•	External components
VND7030AJ	PowerSSO-16	4 - 28	38	30	56	•	•	External components
VND7040AJ	PowerSSO-16	4 - 28	38	40	34	•	•	External components
VND7050AJ	PowerSSO-16	4 - 28	38	50	30	•	•	External components
VND7050AJ12	PowerSSO-12	4 - 28 (1)	38	50	30		Current sense	External components
VND7140AJ	PowerSSO-16	4 - 28	38	140	12	•	•	External components
VND7140AJ12	PowerSSO-12	4 - 28 (1)	38	140	12		Current sense	External components
Quad-channel devices								
VNQ7040AY (*)	PowerSSO-36	4 - 28	38	40	34	•	•	•
VNQ7050AJ	PowerSSO-16	4 - 28	38	50	27	•	Current sense	External components
VNQ7140AJ	PowerSSO-16	4 - 28	38	140	12	•	•	External components

(*) In development

(1) Extended operating range down to 2.85 V for deep cold cranking applications (compliant with LV124, revision 2013)

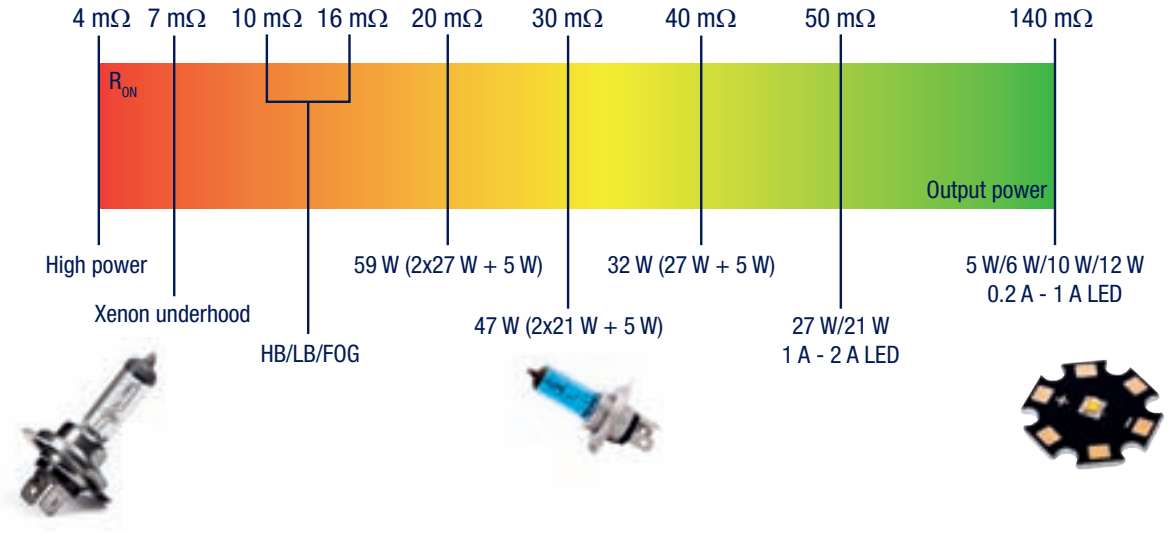
VIPOWER M0-7 HIGH-SIDE DRIVER PART NUMBERING



APPLICATIONS

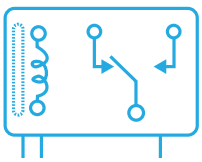
Exterior and interior lighting

VIPower™ M0-7 HSDs are designed to drive different car lights, including headlights, blinkers, position, fog, or brake lights, regardless of their type (incandescent bulbs, HID lamps or LED clusters).
The availability of different classes of $R_{DS(on)}$ 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 of 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.



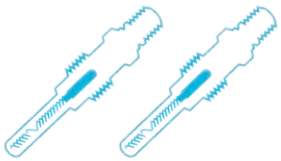
Inductive loads

The VIPower™ M0-7 family is able to drive inductive loads such as DC motors and relay coils from a few µH to hundreds of mH, and the power stage can switch them off through the activation of their 46 V power clamp allowing for fast demagnetization. The integrated chip temperature reading via the MultiSense function 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

Other 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

TwisterSIM

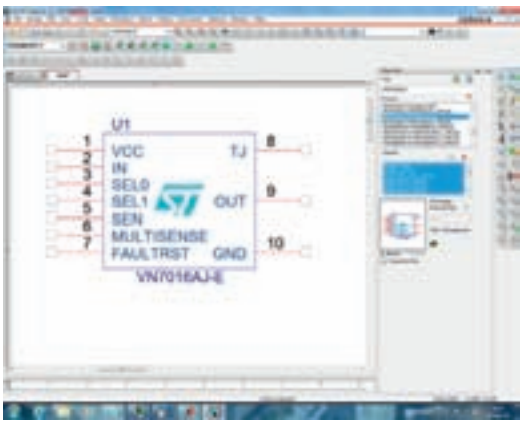
TwisterSIM is a unique Electro-Thermal simulator that helps shorten the design solution cycle by enabling complex engineering evaluations. TwisterSIM is available for download at www.st.com/twistersim.

FEATURES

- Accurate dynamic simulations of load compatibility
- Writing hairness optimization
- Fault condition impact analysis
- Diagnostic behavior analysis
- Dynamic thermal performance

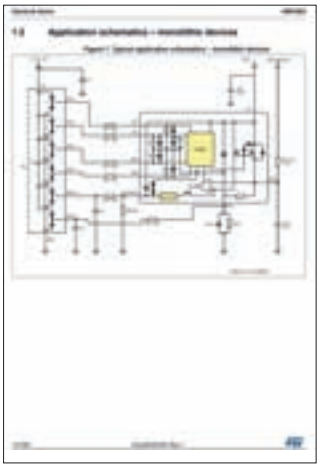
Easy board

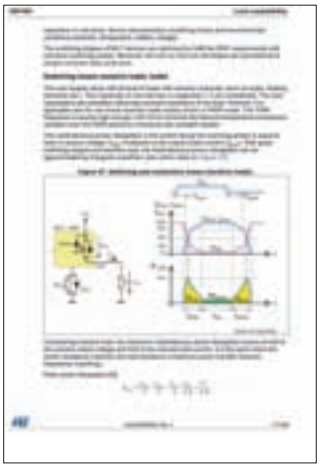
Orcad models



User manual

The user manual presents applications hints, device functionality, choice of components given a certain load, paralleling of pins, MultiSense usage, among other features.





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