N & P-Channel Power MOSFETs Selector Guide

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Introduction

Vishay Siliconix Power MOSFETs – Compact and Efficient

Vishay Siliconix leads the industry in the development of power MOS silicon and packaging technologies that boost power management, power conversion efficiency and greatly reducing the board area in computers, laptops, notebooks, PDAs, cellular phones, automotive electronics, consumer electronics, and many other systems.

Vishay Siliconix continually innovates to meet the increasing demands of applications such as dc-to-dc conversion and load switching. For example, our TrenchFET® Gen II power MOSFET silicon technology enables the first power MOSFETs in the SO-8 footprint with a maximum on-resistance of less than 4 milliohms at a 4.5-V gate drive. In another breakthrough, our WFET® power MOSFETs combine the ultra low on-resistance capabilities of TrenchFET technology with extraordinarily low gate-drain capacitance to maximize dc-to-dc converter efficiency. A complete new family of p-channel power MOSFETs, built on a patent-pending TrenchFET technology, offers a reduction in on-resistance up to 45% compared with the previous state-of-the-art and signifies a new opportunity to reduce system power consumption.

Vishay Siliconix packaging innovations include the small-outline LITTLE FOOT, the thermally enhanced PowerPAK and PolarPAK, and the chipscale MICRO FOOT families, each of which provides designers with a range of surface-mount options to ensure efficient use of space in power management, power conversion, and other power MOSFET applications.

Getting the Most Out of Your Selection and Design Process

This Selector Guide is organized by functionality, packaging (largest to smallest), breakdown voltage, and on-resistance ($r_{DS(on)}$) at 4.5 V). There is also an alphanumerically ordered listing with specifications. Although this Selector Guide is a convenient way to view the entire Vishay Siliconix Power MOSFET portfolio, we highly recommend that you visit our website, that is refreshed at least weekly, for the most up to date information.

Additionally, the power of the web allows us to enhance your selection and design-in process. Besides being able to click on the function, key specifications and size of MOSFET that you are looking for, there is also a parametric search engine. Either will give you a list of possible datasheets integrated with a table of key specifications. From here you can click on any of the datasheets and “bundle” it with the related documents and drawings that you will need such as package, tape and reel and pad drawings, SPICE models, reliability information, and part marking.

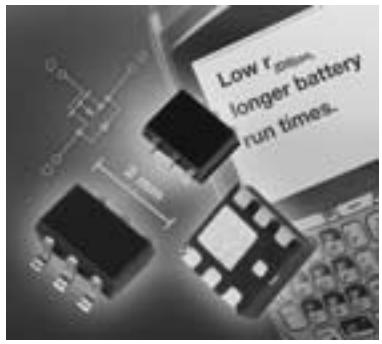
Other web information includes application notes, a list of technical papers, and Selector Guides. Further, samples can be ordered and technical questions can be asked through the website.

Please take the time to review our web features on page 10, and visit http://www.vishay.com/mosfets.

Learn more about
http:www.vishay.com/mosfets
on page 10

Note: TrenchFET WFET are registered trademarks of Siliconix incorporated.

Next-Generation P-Channel TrenchFET® Power MOSFETs Offer Industry-Low On-Resistance in Tiny Footprints to Extend Battery Life



- Industry-low on-resistance in compact footprints
- Down to 29 milliohms in the PowerPAK SC-70 package (2.05 mm by 2.05 mm)
- Down to 80 milliohms in the standard SC-70 (2 mm by 2.1 mm)
- Down to 130 milliohms in the SC-89 (1.6 mm by 1.6 mm).
- -12-V, -20-V, and -30-V devices available

Built on a new-generation TrenchFET® silicon technology, specifications for these p-channel devices represent an improvement of up to 63 % when compared to the next-best power MOSFETs on the market. The new p-channel TrenchFETs will be used for load switching, PA switching, and battery switching in portable end products including cell phones, MP3 players, PDAs, and digital still cameras, where their low conduction losses will help to extend battery run times and their miniaturized packages will help to save valuable board space, allowing increased functionality. Siliconix was the first manufacturer to supply TrenchFET power MOSFETs, and with these new-generation devices reaffirms its leadership in Trench and p-channel power MOSFET technology.

The next-generation p-channel TrenchFET power MOSFETs include the Si1065X, Si1067X, Si1071X, and Si1073X in the SC-89 package; the Si1469DH, Si1471DH, and Si1473DH in the SC-70 package; and the SiA413DJ and SiA421DJ in the PowerPAK SC-70. For latest devices in this family, visit the p-channel MOSFET gateway page www.vishay.com/mosfets/p-channel.

PowerPAK ChipFET Power MOSFETs Replace P-Channel TSOP-6 and N-Channel SO-8 Devices with Lower Thermal Resistance and Smaller Footprint

Visit http://www.vishay.com/mosfets/powerpack-chipfet-package for the most updated list of devices

- Advanced thermal performance in a compact 3-mm by 1.8-mm footprint
- 3-W maximum power dissipation for high thermal efficiency
- Available in single, dual, co-packaged n- and p-channel and MOSFET + Schottky versions
- Breakdown voltage ratings from 8 V to 20 V

PowerPAK ChipFET provides a smaller-footprint alternative to MOSFETs in the TSOP-6 and SO-8 packages.

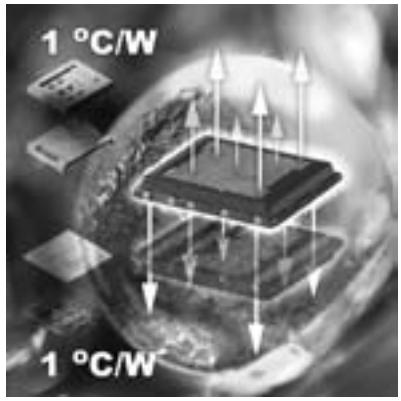
Compared to devices in the TSOP-6, new PowerPAK ChipFETs feature 75 % lower thermal resistance values, a 33 % smaller footprint area, and a 25 % thinner height profile (0.8 mm). Enabling longer on-times in portable devices, p-channel PowerPAK ChipFETs will be used to replace load, PA, charger, and battery MOSFET switches in the TSOP-6.

The 3-W maximum power dissipation of the PowerPAK ChipFET package is actually the same as the much larger SO-8, allowing n-channel PowerPAK ChipFETs to replace SO-8 MOSFETs in certain point-of load, fixed telecom synchronous rectification, and low-power computer dc-to-dc conversion applications. Additionally, the p-channel plus Schottky diode version will be used in asynchronous dc-to-dc applications, such as those found in hard disk drives and game consoles, to replace devices in the SO-8.

With their low conduction losses and enhanced thermal efficiency, power MOSFETs in Vishay's new PowerPAK ChipFET family are pin-compatible with products in the standard ChipFET package.

PowerPAK ChipFET MOSFETs can be identified with Si5xxxDU part numbers.

Breakthrough PolarPAK Package Brings High Reliability to Double-Sided Cooling



Visit http://www.vishay.com/ref/polarpak-package for the most updated list of devices

- Dual thermal paths
  - Top (1 °C/W) and bottom (1 °C/W) cooling provides dual heat dissipation paths for forced air applications
  - Double the current density (>60 A) of the SO-8 in same footprint area for space and cost savings
- Leadframe-based surface-mount packaging
  - Easy handling enables high assembly yield
  - Plastic encapsulation provides good die protection and reliability
  - Fixed footprint and pad layout, independent of die size, across range of family

PolarPAK is the first power MOSFET package to combine double-sided cooling with an industry-standard leadframe and plastic encapsulation construction. Easy handling and mounting onto the PCB provides high assembly yields in mass-volume production. With multiple sources available, PolarPAK is well on its way to becoming an industry standard.

PolarPAK devices can be identified with the SiExxx prefix.

Industry's First Load Switches Designed for On-Resistance Ratings at 1.2 V and 1.5 V

- Optimized for use with the low-voltage core ICs in portable electronic systems
- Allow the driver voltage to turn on the switch from a lower output voltage than 1.8 V, reducing the need for level shift circuitry
- Help reduce power consumption and increase battery life
- Offer choice of on-resistance and package options with footprints as small as 1.5 mm by 1.5 mm

To help minimize power consumption and increase battery life, many of the ASICs found in portable electronics systems are designed to operate at core supply voltages between 1.5 and 1.65 V. Until now, however, the lack of power MOSFETs with guaranteed turn-on operation below 1.8 V has made it difficult for designers to take advantage of these low core supply voltages without the use of level-shifting circuitry, which adds complexity while increasing power consumption.

Vishay addresses this problem with breakthrough power MOSFETs that work directly from 1.2-V and 1.5-V core supply voltages with on-resistance as low as 43 milliohms. With their low threshold voltage and guaranteed specifications at a 1.2-V or 1.5-V gate drive, the new devices eliminate the need for level-shifting circuitry and maximize the power-saving benefits of low operating voltages in battery-operated systems.

Vishay's 1.2-V and 1.5-V MOSFET families include n-channel and p-channel devices in packages as small as SC-70 packages, as well as in the chipscale MICRO FOOT format. For device selection, see www.vishay.com/mosfets.

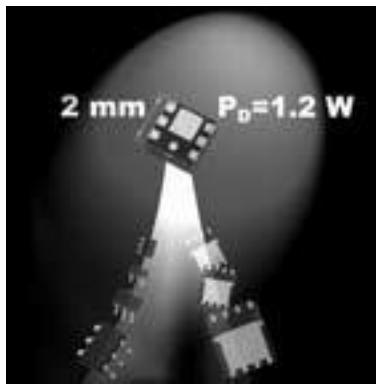
New ThermaSim™ is First On-Line Thermal Simulation Tool to Use Finite Element Analysis Models for Increased Accuracy

- Available on http://www.vishay.com/thermal-modelling with exhaustive library of Vishay Siliconix MOSFET models
- Can include effects of other heat dissipating components
- Allows user to configure:
  - Power dissipation profiles
  - Heat sink size, material, and attachment method
  - PCB size, layers, material, copper spreading, vias, etc.
  - Component placements and solder quality
  - System temperature and air flow
- Simulation results are emailed directly to the designer and can be downloaded into Excel.

Vishay's new ThermaSim™ is a free tool that helps designers speed time to market by allowing detailed thermal simulations of Vishay Siliconix power MOSFETs to be performed before prototyping. Applicable to any power MOSFET application, ThermaSim will be especially useful in high-current, high-temperature applications such as automotive, fixed telecom, desktop and laptop computers, and industrial systems.

Simulation results are emailed directly to the designer and can be downloaded into Excel. Multiple results with varying product, package, or other input data can be merged within Excel to compare and examine trends. Thermal images are provided, and a MPEG video clip of the thermal image with transient simulation is also available. Simulations can be saved for modifications at a later date.

Combining Advanced Thermal Conductivity, Excellent Electrical Performance and Ultimate Miniaturization



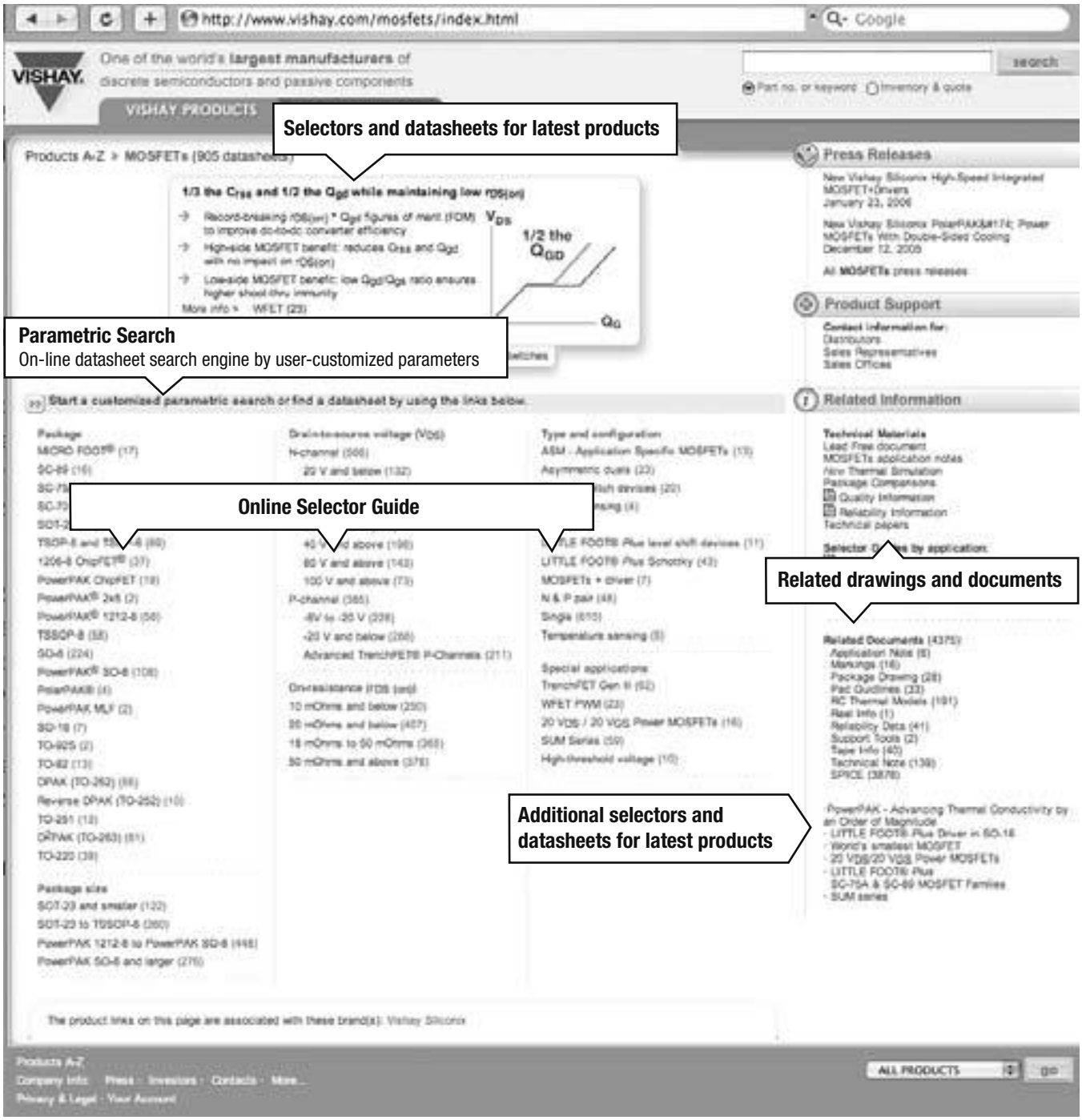
Visit http://www.vishay.com/powerpak-sc70-package for the most updated list of devices
Visit http://www.vishay.com/powerpak-sc75-package for the most updated list of devices

- PowerPAK SC-70 & PowerPAK SC-75 provide performances of bigger packages in smaller footprints
  - 55% smaller than TSOP-6 with better thermal performance and similar on-resistance
- Footprint compatible to TSOP-6 and SC-70 (PowerPAK SC-70), SC-75 and SC-89 (PowerPAK SC-75)
- Better performance than existing small footprints
  - Half the thermal impedance while more than half the on-resistance of the industry standard SC-70 and SC-75
  - Higher current density, higher power dissipation, increased junction temperature
- Capable of larger die sizes
- Ultra-compact, leadless 2.0 mm x 2.1 mm (PowerPAK SC-70) and 1.6 mm x 1.6 mm (PowerPAK SC-75) outline and low 0.7 mm profile are ideal for space-constrained portable devices
- Single and dual configurations
- For load switches in portable devices such as mobile phones, notebooks and computers, PDAs, digital cameras, MP3 players

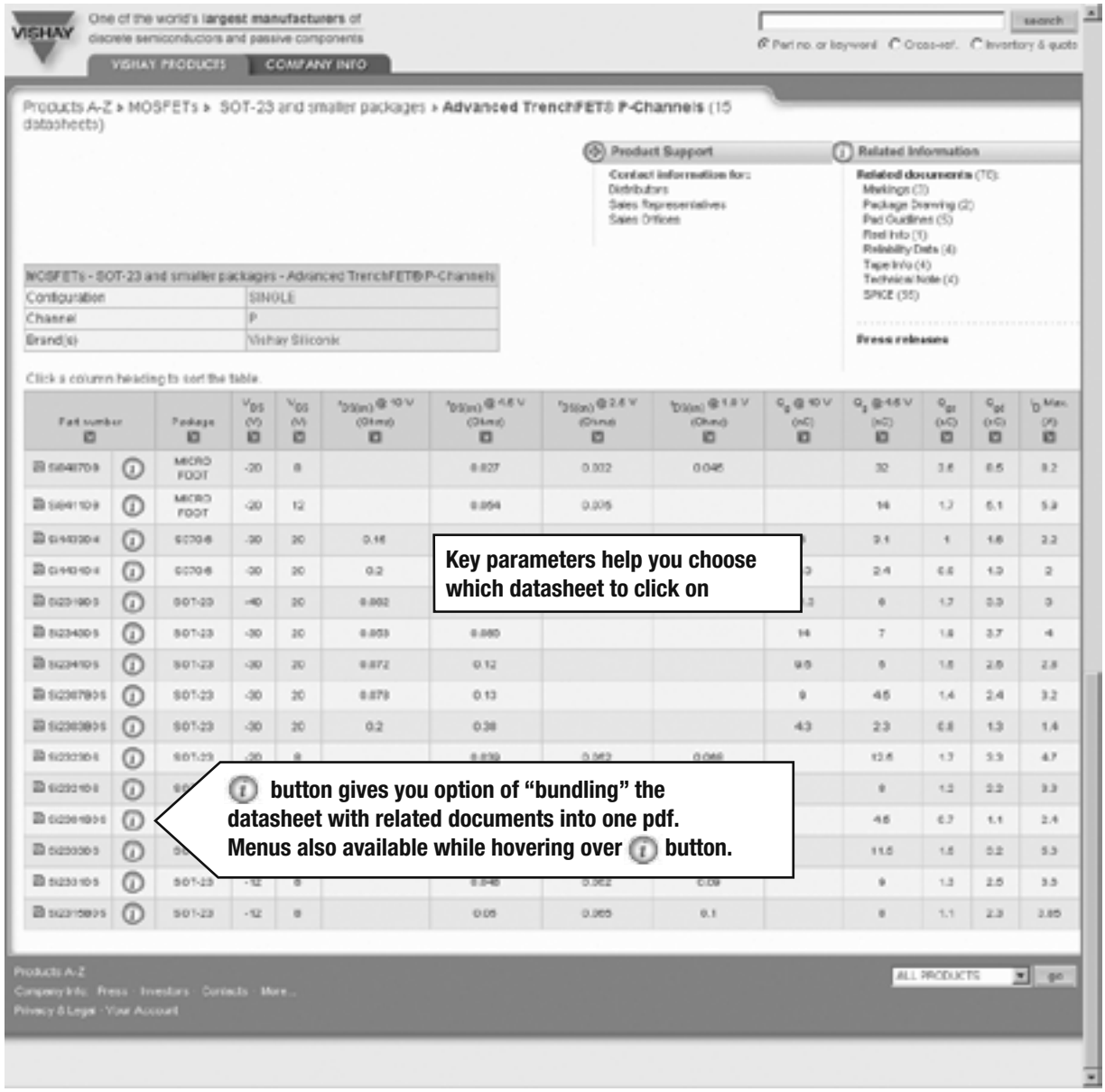
Overview of Website

Check out http://www.vishay.com/mosfets:

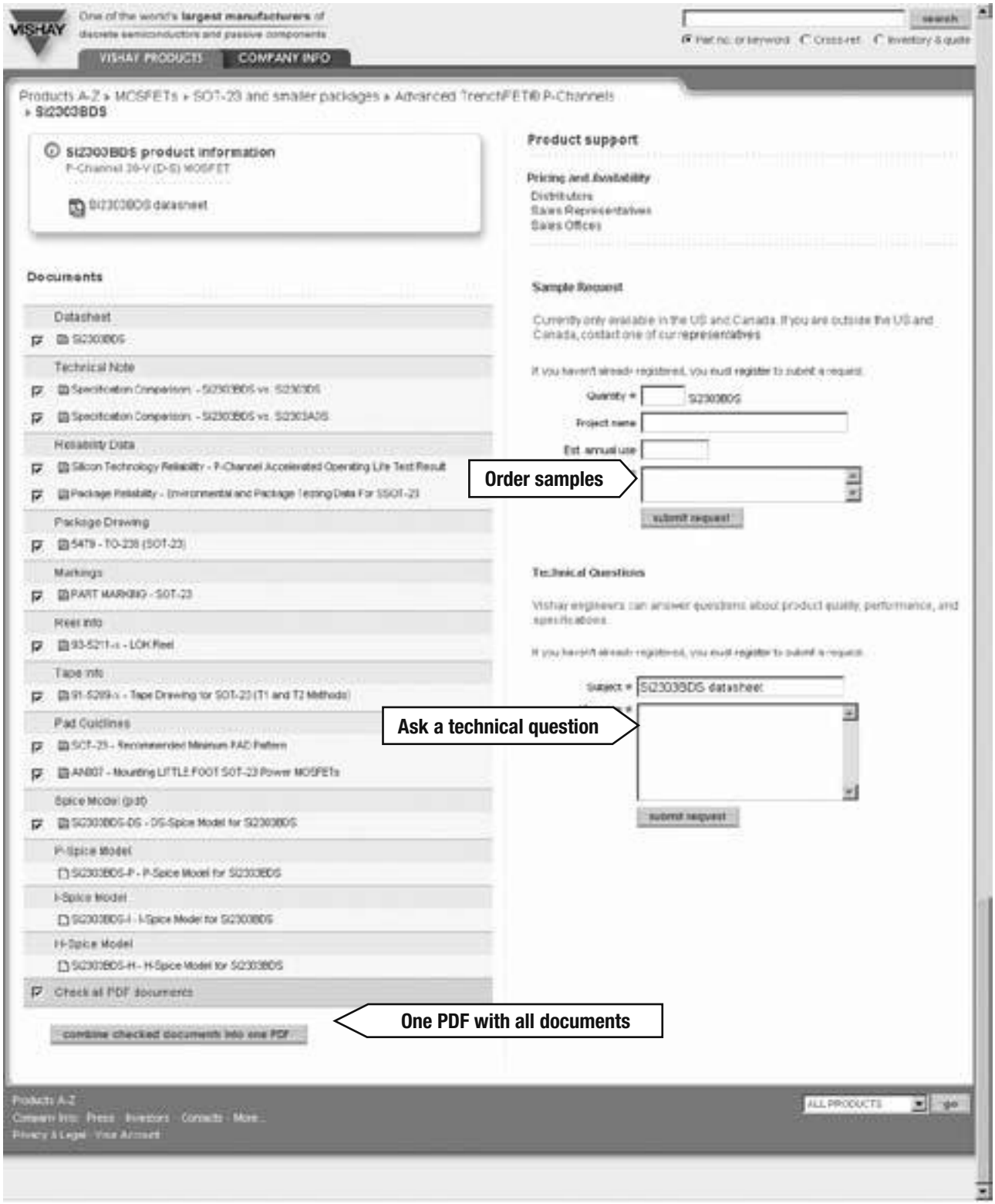
- New features
- More content
- Refreshed weekly



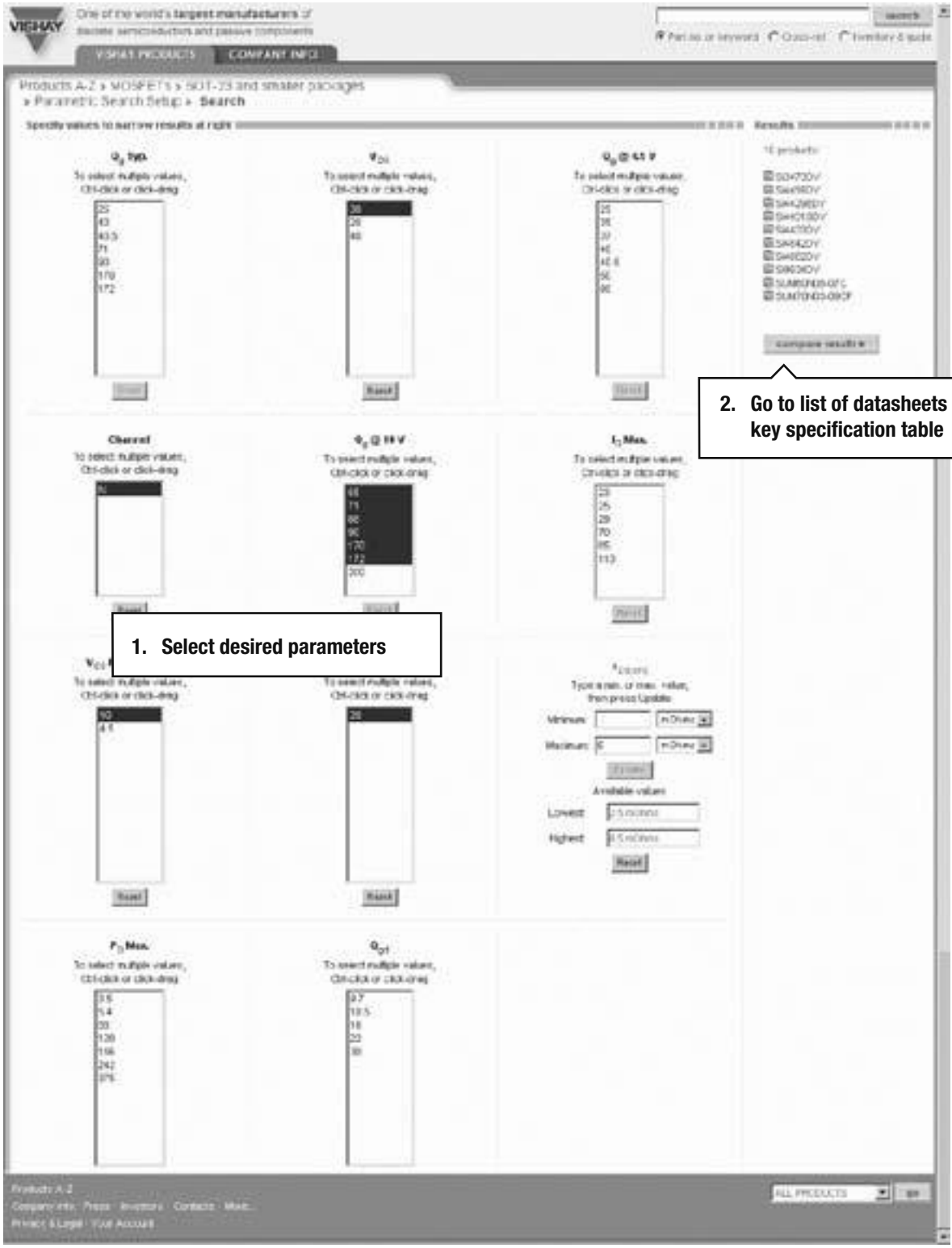
Sample Datasheet List



Sample of Datasheet with Related Documents



Example of Parametric Search



N & P Channel

Part Number	V_{DS} (V)	V_{GS} (V)	$r_{DS(on)}$ Ω					Footnote	I_D (A)	Q_g (nC)		P_D (W)
			V_{GS} = 10 V	V_{GS} = 4.5 V	V_{GS} = 3.3 V	V_{GS} = 2.5 V	V_{GS} = 1.8 V			V_{GS} = 10 V	V_{GS} = 4.5 V	
N&P PAIR												
DPAK (TO-252-4)												
SUD50NP04-62	40	16	0.03	0.034					8	21	9.6	15.6
	-40	16	0.032	0.041					8	41	21	23.5
SUD50NP04-94	40	12	0.041	0.045					8	18	8	13.2
	-40	16	0.053	0.072					8	18.5	9	15.6
PowerPAK SO-8												
Si7540DP	12	8		0.017		0.025			11.8		11.5	3.5
	-12	8		0.032		0.053			8.9		13	3.5
Si7530DP	60	20	0.075	0.1					4.6	12		3.3
	-60	20	0.064	0.08					5	26		3.5
SO-8												
Si4501ADY	30	20	0.018	0.027					8.8		11.5	2.5
	-8	8		0.042		0.06			5.7		13.5	2.5
Si4511DY	20	16	0.0145	0.017					9.6		11.5	2
	-20	12		0.033		0.05			6.2		17	2
Si4500BDY	20	12		0.02		0.03			9.1		11	2.5
	-20	12		0.06		0.1			5.3		6	2.5
Si4563DY	40	16	0.016	0.019					8	56	26	3.25
	-40	16	0.025	0.032					8	52	25.5	3.25
Si4569DY	40	16	0.027	0.032					7.6	21	9.6	3.1
	-40	16	0.029	0.039					7.9	41	21	3.2
Si4565ADY	40	16	0.039	0.05					6.6	14.4	6.6	3.1
	-40	16	0.054	0.072					5.6	18.5	9	3.1
Si4567DY	40	16	0.06	0.07					5	8	3.7	2.75
	-40	16	0.085	0.122					4.4	12	6	2.95
Si4559ADY	60	20	0.058	0.072					5.3	13	6	3.1
	-60	20	0.12	0.15					3.9	14.5	8	3.4
TSSOP-8												
Si6562DQ	20	12		0.03		0.04			4.5		13	1
	-20	12		0.05		0.085			3.5		14.5	1
Si6544BDQ	30	20	0.032	0.046					4.3	9.5		1.14
	-30	20	0.043	0.073					3.8	16		1.14

Notes:

a. Q_g @ V_{GS} = 15 V (vs. 10 V)
b. Q_g @ V_{GS} = 5 V (vs. 4.5 V)
c. $r_{DS} = r_{SS}/2$
d. $r_{DS(ON)}$ @ V_{GS} = 6 V (vs. 4.5 V)
e. $r_{DS(ON)}$ @ V_{GS} = 3 V (vs. 3.3 V)
f. $r_{DS(ON)}$ @ V_{GS} = 3.7 V (vs. 3.3 V)
g. $r_{DS(ON)}$ @ V_{GS} = 4.75 V (vs. 4.5 V)
h. $r_{DS(ON)}$ @ V_{GS} = 2.7 V (vs. 2.5 V or 3.3 V)
i. Not used
j. $r_{DS(ON)}$ @ V_{GS} = 3.1 V (vs. 3.3 V)
k. S1 and D2 connected
l. Not used
m. Schottky connected to channel 1
n. Half-bridge
o. Not used
p. $r_{DS(ON)}$ @ V_{GS} = 3.6 V (vs. 3.3 V)
q. Q_g @ V_{GS} = 6 V (vs. 4.5 V)
r. $r_{DS(ON)}$ @ V_{GS} = 8 V (vs. 4.5 V)
s. $r_{DS\ (on)}$ @ V_{GS} = 15 V (vs. 10 V)
t. $r_{DS\ (on)}$ @ V_{GS} = 5 V (vs. 4.5 V)

N & P-channel, continued

Part Number	V_{DS} (V)	V_{GS} (V)	$r_{DS(on)}$ Ω					Footnote	I_D (A)	Q_g (nC)		P_D (W)
			V_{GS} = 10 V	V_{GS} = 4.5 V	V_{GS} = 3.3 V	V_{GS} = 2.5 V	V_{GS} = 1.8 V			V_{GS} = 10 V	V_{GS} = 4.5 V	
PowerPAK 1212-8												
Si7501DN	30	20	0.035	0.05					7.7	9		3.1
	-30	25	0.051	0.075				d	6.4	12.5		3.1
TSOP-6												
Si3586DV	20	8		0.06		0.07	0.1		3.4		4.1	1.15
	-20	8		0.11		0.145	0.22		2.5		5	1.15
Si3588DV	20	8		0.08		0.1	0.128		3		5	1.15
	-20	8		0.145		0.2	0.3		2.2		5	1.15
Si3585DV	20	12		0.2		0.34			2.4		2.1	1.15
	-20	12		0.125		0.2			1.8		2.7	1.15
Si3850ADV	20	12		0.3		0.41			1.4		0.95	1.08
	-20	12		0.64		0.98			0.96		1.1	1.08
Si3590DV	30	12		0.077		0.12			3		3	1.15
	-30	12		0.17		0.3			2		3.8	1.15
Si3552DV	30	20	0.105	0.175					2.5		2.1	1.15
	-30	20	0.2	0.36					1.8		2.4	1.15
PowerPAK ChipFET												
Si5519DU	20	12		0.036		0.063			6	11.65	5.4	10.4
	-20	12		0.064		0.095			6	11.7	6	10.4
Si5517DU	20	8		0.039		0.045	0.055		6		6	8.3
	-20	8		0.072		0.1	0.131		6		5.5	8.3
1206-8 ChipFET												
Si5515DC	20	8		0.04		0.045	0.052		5.9		5	2.1
	-20	8		0.086		0.121	0.171		4.1		5.5	2.1
Si5509DC	20	12		0.052		0.084			6.1		3.8	4.5
	-20	12		0.09		0.16			4.8		3.9	4.5
Si5513DC	20	12		0.075		0.134			4.2		4	2.1
	-20	12		0.155		0.26			2.9		3	2.1
Si5511DC	30	12		0.055		0.09			4		4.2	3.1
	-30	12		0.15		0.256			3.6		3.8	2.6
Si5504BDC	30	20	0.065	0.1					4	4.5	2	3.12
	-30	20	0.14	0.235					3.7	4.5	2.2	3.1

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f. $r_{DS(ON)}$ @ V_{GS} = 3.7 V (vs. 3.3 V)
g. $r_{DS(ON)}$ @ V_{GS} = 4.75 V (vs. 4.5 V)
h. $r_{DS(ON)}$ @ V_{GS} = 2.7 V (vs. 2.5 V or 3.3 V)
i. Not used
j. $r_{DS(ON)}$ @ V_{GS} = 3.1 V (vs. 3.3 V)
k. S1 and D2 connected
l. Not used
m. Schottky connected to channel 1
n. Half-bridge
o. Not used
p. $r_{DS(ON)}$ @ V_{GS} = 3.6 V (vs. 3.3 V)
q. Q_g @ V_{GS} = 6 V (vs. 4.5 V)
r. $r_{DS(ON)}$ @ V_{GS} = 8 V (vs. 4.5 V)
s. $r_{DS\ (on)}$ @ V_{GS} = 15 V (vs. 10 V)
t. $r_{DS\ (on)}$ @ V_{GS} = 5 V (vs. 4.5 V)

N & P-channel, continued

Part Number	V_{DS} (V)	V_{GS} (V)	$r_{DS(on)}$ Ω					Footnote	I_D (A)	Q_g (nC)		P_D (W)
			V_{GS} = 10 V	V_{GS} = 4.5 V	V_{GS} = 3.3 V	V_{GS} = 2.5 V	V_{GS} = 1.8 V			V_{GS} = 10 V	V_{GS} = 4.5 V	
SC70												
Si1563DH	20	8		0.28		0.36	0.45		1.28		1.25	0.74
	-20	8		0.49		0.75	1.1		1		1.2	0.3
Si1563EDH	20	12		0.28		0.36	0.45		1.28		0.65	0.74
	-20	12		0.49		0.75	1.1		1		1.2	0.3
Si1555DL	20	12		0.385		0.63			0.7		0.8	0.3
	-8	8		0.6		0.85	1.2		0.6		1.5	0.3
Si1553DL	20	12		0.385		0.63			0.7		0.8	0.3
	-20	12		0.995		1.8			0.44		1.2	0.3
Si1551DL	20	12		1.9		4.2			0.3		0.72	0.3
	-20	12		0.995		1.8			0.44		0.52	0.3
Si1539DL	30	20	0.48	0.7					0.63	0.86		0.3
	-30	20	0.94	1.7					0.45	0.9		0.3
PowerPAK SC-70												
SiA511DJ	12	8		0.04		0.048	0.063		4.5		4.5	6.5
	-12	8		0.07		0.1	0.14		4.5		5	6.5
SiA513DJ	20	12		0.06		0.092			4.5	7.5	3.5	6.5
	-20	12		0.11		0.185			4.5	6	3	6.5
SC89												
Si1016X	20			0.7		0.85	1.25		0.5		1.5	0.3
	-20			1.2		1.6	2.7		0.4		0.75	0.3
Si1035X	20			5		7	9		0.14		0.75	0.2
	-20			8		12	15		0.16		1.5	0.3
Si1029X	60		1.25	3					0.33		0.75	0.25
	-60		5	10					0.16		1.7	0.3

Notes:

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f. $r_{DS(ON)}$ @ V_{GS} = 3.7 V (vs. 3.3 V)
g. $r_{DS(ON)}$ @ V_{GS} = 4.75 V (vs. 4.5 V)
h. $r_{DS(ON)}$ @ V_{GS} = 2.7 V (vs. 2.5 V or 3.3 V)
i. Not used
j. $r_{DS(ON)}$ @ V_{GS} = 3.1 V (vs. 3.3 V)
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q. Q_g @ V_{GS} = 6 V (vs. 4.5 V)
r. $r_{DS(ON)}$ @ V_{GS} = 8 V (vs. 4.5 V)
s. $r_{DS\ (on)}$ @ V_{GS} = 15 V (vs. 10 V)
t. $r_{DS\ (on)}$ @ V_{GS} = 5 V (vs. 4.5 V)

Packaging Information

Power MOSFET Packages*		Max Length (mm)	Max Width (mm)	Max Footprint Area (mm^2)	Max Height (mm)	Max Current (A)	Max Temp (°C)	R_{thJF} or R_{thJC} (°C/W)
TO-220		10.41	4.7	48.93	29.71	85	175	0.6
TO-262		10.41	4.7	48.93	25.27	85	175	0.6
D^2PAK		15.88	10.41	165.37	4.83	110	175	0.4
						85	175	0.6
D^2PAK-5						60	175	0.5
DPAK		10.41	6.73	70.06	2.38	70	175	1.2
TO-92/TO-92S		4.7	3.68	17.30	19.94	0.67	150	1.2
PolarPAK		6.3	5.31	33.45	0.85	45	150	1.0 + 1.0
PowerPAK SO-8		6.2	5.26	32.61	1.2	29	150	1.5
SO-16		10	6.2	62.00	1.75	13.5	150	20
SO-8		5	6.2	31.00	1.75	25	150	16
TSSOP-8		3.1	6.6	20.46	1.2	11	150	52
PowerPAK 1212-8		3.4	3.4	11.56	1.2	14.4	150	2.4
PowerPAK 2 x 5		5.10	2.15	10.97	0.84	7	150	6
TSOP-6		3.1	2.98	9.24	1.1	6.8	150	30
PowerPAK ChipFET		3.08	1.98	6.10	0.85	11.6	150	4
ChipFET 1206-8		3.1	1.915	5.58	1.1	9.5	150	20
SOT-23		3.04	2.64	8.03	1.12	4.9	150	50
PowerPAK SC-70		2.15	2.15	4.62	0.8	12	150	6.5
SC-70		2.2	2.4	5.28	1.1	3.9	150	45

* To view drawings of any of the products above in PDF form, go to ***http://www.vishay.com/mosfets/related#pkgdrw***

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Packaging Information, continued

Power MOSFET Packages*		Max Length (mm)	Max Width (mm)	Max Footprint Area (mm^2)	Max Height (mm)	Max Current (A)	Max Temp (°C)	R_{thJF} or R_{thJC} (°C/W)
MICRO FOOT		See individual datasheet			0.65	7	150	20
PowerPAK SC-75		1.7	1.7	2.89	0.8	8	150	9.5
SC-75A		1.6	1.7	2.72	0.8	0.5	150	
SC-89		1.7	1.7	2.89	0.6	0.5	150	

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