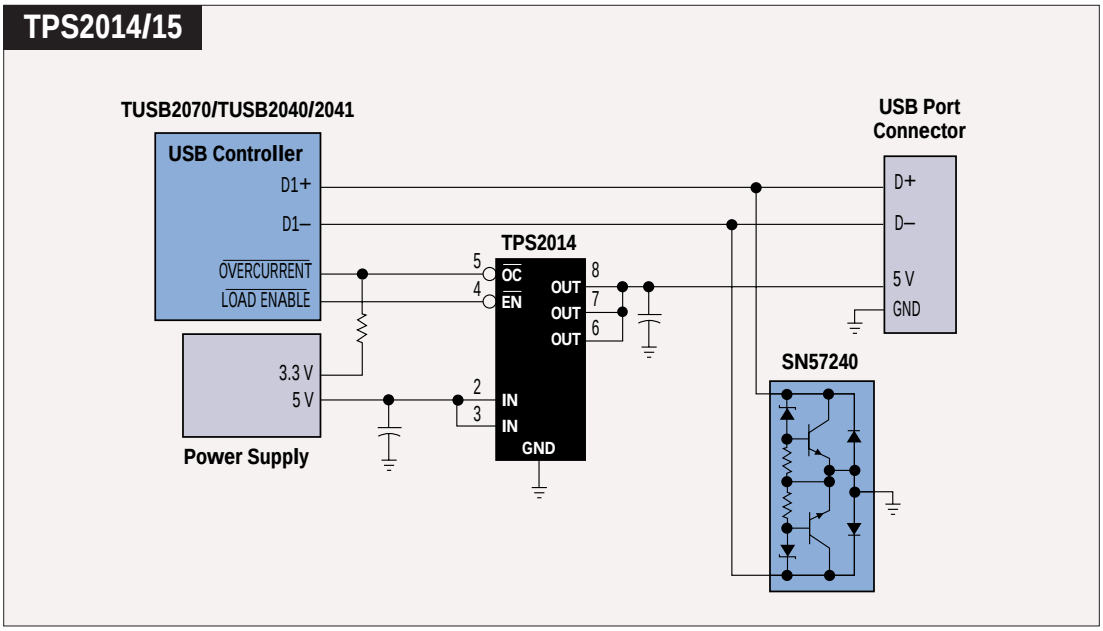
Texas Instruments

January 1998
Volume 1

Sine ON

POWER DISTRIBUTION

TPS2014/15: Meeting the USB Power Distribution Requirements



The TPS2014 and TPS2015 power-distribution devices provide an integrated power-management solution for the Universal Serial Bus (USB) voltage-bus interface. They feature the overcurrent response logic output, required by a Host controller in the USB specification. The TPS2014 and TPS2015 differ only in short-circuit current limits. The TPS2014 is designed to limit at 1.2-A load and the TPS2015 limits at 2 A. These devices include all of the discrete power MOSFETs, a logic section, current limiting, thermal protection, an undervoltage

(continued on page 2)

Inside:

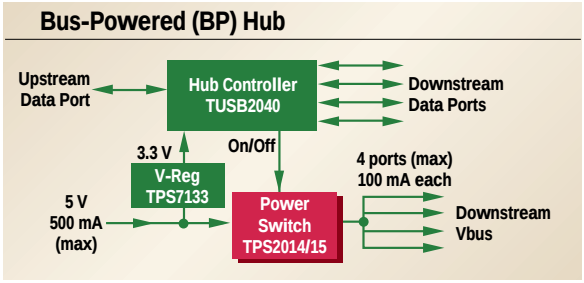
TPS2014/15: Meeting the USB Power Distribution Requirements

(continued from cover)

lockout, and an over-current logic response. They can be used as a general power distribution switch as well as a power management device for the USB interface. The current limiting and thermal shutdown features eliminate the need for discrete components such as fuses, thereby providing maintenance free fault protection. Current limit reporting helps the system isolate a power fault to a defective port in a USB application. These features reduce component count and improve system reliability.

The TPS2014 and TPS2015, designed for USB applications, are enhanced versions of Texas Instruments TPS2010 family of power distribution switches. Like their predecessors, the TPS2014 and TPS2015 do not need a V_{DD} connection. Bias current is derived from the input pins. This power distribution switch design optimizes cost and $r_{DS(on)}$ performance, while fully meeting the power regulation requirements of the USB specification.

The enhancements made in the TPS2014 and TPS2015 include an undervoltage lockout (UVLO), which ensures the device will power up in the off state, and an over-current logic output, which enables the device to report faults on a power bus back to a host controller. These new features coupled with controlled switching times, which minimize the current surges during switching, makes them ideal for USB power distribution applications.



TPS2014/TPS2015

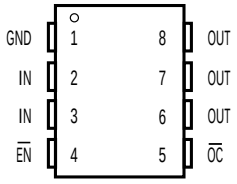
- $0.86 in quantities of 1000
- Available in an 8-pin SOIC package

SAMPLE PACK

AT A GLANCE

- 95-mΩ maximum (5-V input) high-side MOSFET switch
- Controlled rise and fall times limit current surges to minimize EMI
- 4-V to 7-V operating range
- Short-circuit and thermal protection w/logic OC output
- Undervoltage lockout ensures that switch is off at start-up
- Characterized for operation from 0°C to 85°C

D Package
Top View



Available Options

T_A	Recommended Maximum Continuous Load Current	Typical Short-Circuit Current Limit at 25°C	Packaged Devices *SOIC (D)*	*PDIP (P)*	Chip Form (Y)
0°C to 85°C	0.6 A	1.2 A	TPS2014D	TPS2014P	TPS2014Y
	1 A	2 A	TPS2015D	TPS2015P	TPS2015Y

For technical support, call 972-644-5580

To order documentation, call 1-800-477-8924, ext.3228

TPS2205/06 High Performance Dual-Slot PC Card Power Interface Switches

TPS2205IDBLE

- $3.01 in quantities of 1000
- 30-pin SSOP (DB&DF)

TPS2206IDBLE

- $3.21 in quantities of 1000
- 30-pin SSOP (DB&DF)

TPS2205IDAPR

- $3.22 in quantities of 1000
- 32-pin TSSOP

TPS2206IDAPR

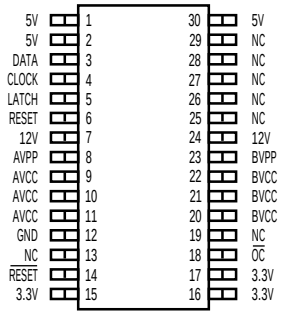
- $3.43 in quantities of 1000
- 32-pin TSSOP

The TPS2205 parallel interface and TPS2206 serial (Cardbus) power interface switches provide an integrated power-management solution for interfacing to dual PC Card applications. The discrete power MOSFETs, logic section, current limit, and thermal protection for PC Card applications are combined into a single integrated circuit using Texas Instruments LinBiCMOS™ process. Each device allows the distribution of 3.3 V, 5 V, and/or 12 V, and each is compatible with many existing PCMCIA controllers. The current limit feature eliminates the need for fuses. This reduces component count and system cost.

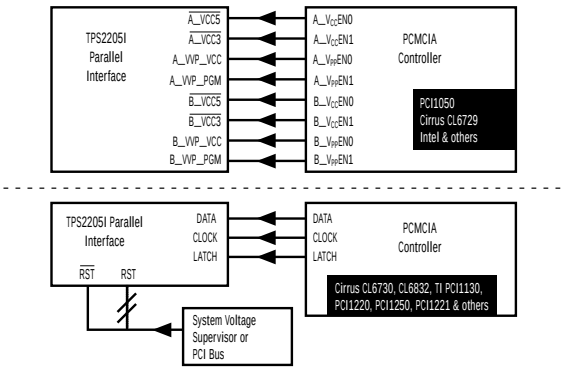
Both the TPS2205 and TPS2206 feature a 3.3-V low-voltage mode that allows for 3.3-V switching without applying 5 V to the device. The TPS2205/06 devices are suitable for a variety of applications that include notebook/desktop computers, personal digital assistants, digital cameras, hand terminals, bar-code scanners, and instrumentation devices.

DB or DF Package
Top View

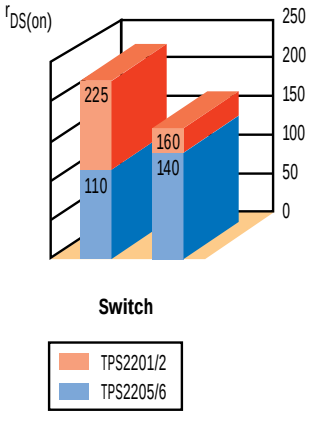
TPS2206



Parallel Interface



Serial P^2C Interface



Switch

AT A GLANCE

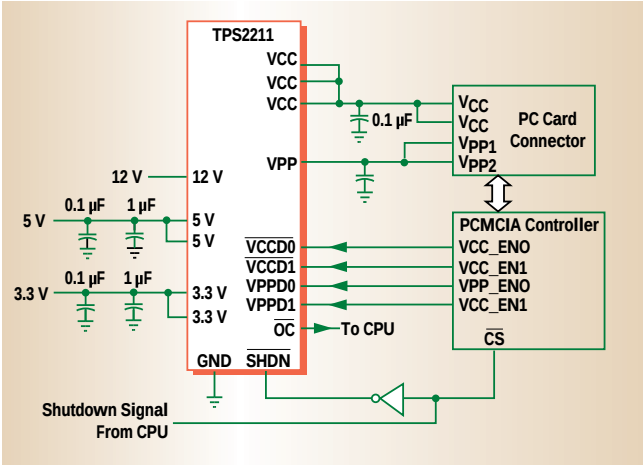
- Fully integrated V_{CC} and Vpp switching for a dual-slot PC Card interface
- 140 mΩ 5-V and 110 mΩ 3-V switch $r_{DS(on)}$
- Compatible with industry standard controllers
- Compatible with 3.3-V, 5-V, 12-V PC Cards
- Break-before-make switching
- 3.3-V low-voltage mode
- 12-V supply can be disabled except during 12-V flash programming
- Short circuit and thermal protection
- Characterized for operation from –40°C to 85°C

Read Sine-On online and download datasheets at: www.ti.com/sc/sine-on

Fully Integrated Single Channel PCMCIA Power Distribution Switch

TPS2211IDBLE

- $2.02 in quantities of 1000
- Available in 16-pin SSOP (DB)



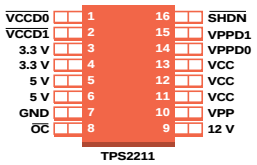
The TPS2211 PC Card power-interface switch provides an integrated power-management solution for interface to PC Cards. It features a single slot parallel control interface that is compatible with PC Card controllers from Texas Instruments, Cirrus Logic, and Intel. The TPS2211 includes all of the discrete power MOSFETs, a logic section, current limiting, thermal protection, and a 3.3-V low-voltage mode required for PC Card applications, all combined in a single integrated circuit. This device allows the distribution of 3.3-V, 5-V, and/or 12-V power to PC Cards. The current limiting and thermal shutdown features eliminate the need for discrete components such as fuses. These features improve reliability and reduce component count. Current limit reporting can help the user isolate a power fault to a defective PC Card.

The TPS2211 is a high performance version of Texas Instruments TPS2205 parallel dual slot power interface device. Like the predecessor, the TPS2211 does not require a V_{DD} connection. Bias current is derived from either the 3.3-V or 5-V input pins. This power switch is optimized for the best cost and $r_{DS(on)}$ performance for this application, while fully meeting the power requirements of the PCMCIA specification. Both the 3.3-V and 5-V switches are capable of driving 1 A and maintaining the required voltage regulation.

Like the TPS2205, the TPS2211 features a 3.3-V low-voltage mode of operation that allows 3.3-V switching without the need for 5 V or 12 V. This facilitates low power system designs such as sleep mode or pager mode where only 3.3 V is available or required.

AT A GLANCE

- Single-slot device
- Meets PC Card standards set by the PCMCIA committee
- Low $r_{DS(on)}$: 90 mΩ at 5 V and 3 V
- 3.3-V low-voltage mode
- 12-V supply can be disabled except during 12-V flash programming
- Short circuit and thermal protection
- Characterized for operation from –40°C to 85°C



Intelligence and Protection in High-Side Switches

TPS201xD

- $0.97 in quantities of 1000

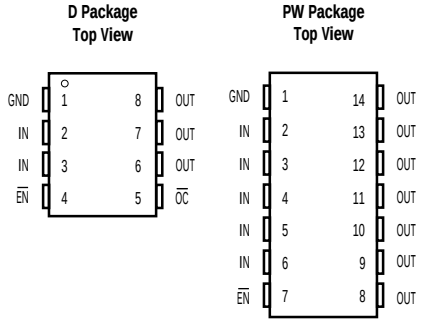
TPS201xPWLE

- $1.11 in quantities of 1000
- Small 8-pin SOIC and ultra-low-profile TSSOP options fit tight spaces

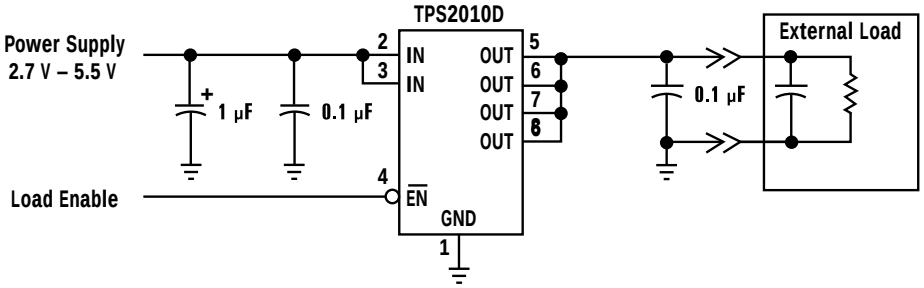
Texas Instruments TPS201x family of protected high-side switches combine "smart" protection with low-loss high-side switches. Their maximum 95-mΩ $r_{DS(on)}$ competes with some of the best PMOS switches available today. Operation down to 2.7 V and a logic-compatible ENABLE make them suitable for 3-V and 5-V systems. The TPS201xD in 8-pin SOIC drops into the same footprint as Siliconix LittleFoot™ switches with the addition of GND on PIN1. Applications requiring lower profile can take advantage of the TPS201xPWLE in TSSOP, with a maximum height of just 1.15 mm.

In addition to efficient power switching, the TPS201x features built-in current limiting which prevents damage in the event of a short circuit. The four devices in the TPS201x family feature a range of overcurrent thresholds suitable for a variety of applications from barcode scanners to laptop computers. The TPS201x high performance high-side switches go a step beyond the competition. For the price of a simple switch, they protect against short circuits, thermal runaway, ESD, and reduce the effects of switching transients. Current ranges from 200 mA (TPS2010) to 1.5 A (TPS2013).

Device	Current Limit (A)
TPS2010	0.4
TPS2011	1.2
TPS2012	2.0
TPS2013	2.6



Application Information



Typical Application

AT A GLANCE

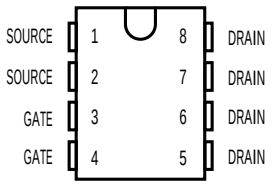
- 95-mΩ max (5.5-V input) high-side MOSFET switch with logic compatible enable input
- Short circuit and thermal protection
- Controlled rise and fall times to limit current surges and minimize EMI
- 2.7-V to 5.5-V operating range
- 10-µA maximum standby current
- Characterized for operation from –40°C to 125°C

Read Sine-On online and download datasheets at: www.ti.com/sc/sine-on

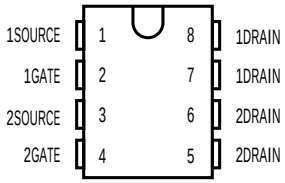
Ultra-Small, PMOS High-Side Switches, for Better Efficiency

Texas Instruments TPS11xx family of high-side switches lets you manage power with loads up to 6 A. These ultra small switches give you a more cost effective way to extend battery life and decrease power consumption in the end product. For improved efficiency and reduced switching losses, the TPS11xx family feature low gate capacitance and on-resistance. They all have low leakage currents and have built in ESD circuitry for added protection against ESD up to 2 kV per MIL-STD-833C.

D or PW Package
Top View



D Package
Top View



TPS1100D
➤ $0.37 in quantities of 1000

TPS1101D
➤ $0.63 in quantities of 1000

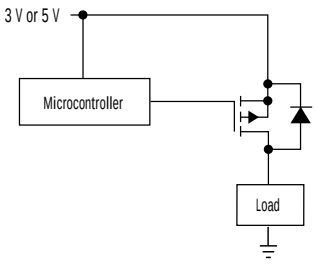
TPS1110D
➤ $0.55 in quantities of 1000

TPS1120D
➤ $0.57 in quantities of 1000

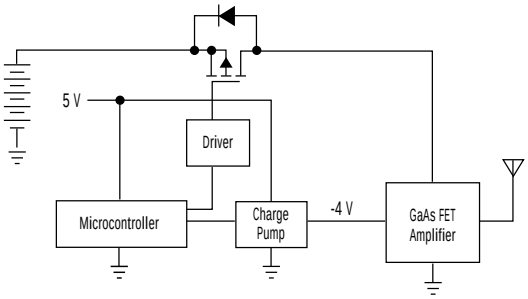
AT A GLANCE

- 3 V compatible
- Requires no external V_{CC}
- TTL and CMOS compatible inputs
- $V_{GS(th)}$ = –1.5 V max
- ESD protection up to 2 kV per MIL-STD-833C, method 3015

Application Information



Notebook Load Management

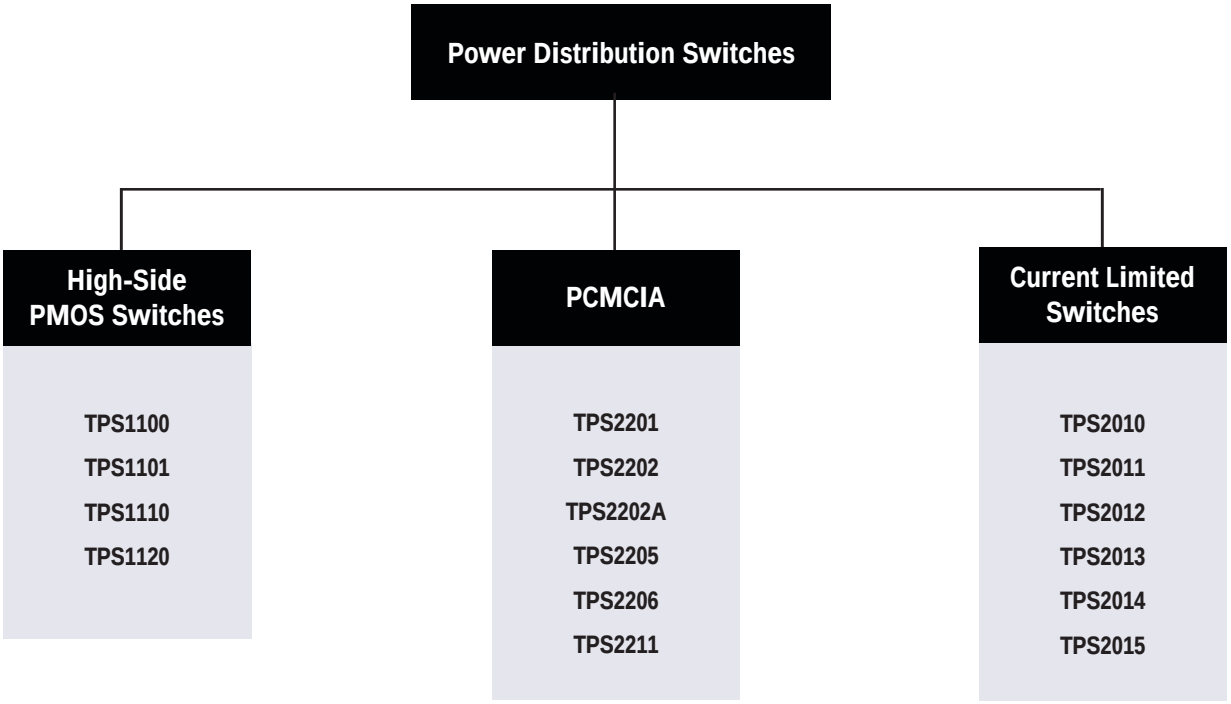


Cellular Phone Output Device

Selection Guide for P-Channel Enhancement-Mode MOFSETs

Device Type	Single/Dual	V_{DS} (V)	I_D (max) (V_{GS}= –10 V) (A)	$r_{DS\ (on)}$ (typ) (mΩ)	1 k Price
TPS1100 (D,PWLE)	Single	–15	–1.6	180 at V_{GS} = –10 V	$0.37
TPS1101 (D,PWLE)	Single	–15	–2.3	90 at V_{GS} = –10 V	$0.63
TPS1110 (D)	Single	–7	–6*	65 at V_{GS} = –4.5 V	$0.55
TPS1120 (D)	Dual	–15	–1.7**	180 at V_{GS} = –10 V	$0.57

*V_{GS}=–4.5 V
** Per device



PMOS High-side Power Distribution Switches Selection Guide

Device	Attributes	Number of FETs	$r_{DS(on)}$ (typ) (V_{GS} = – 4.5 V) (mΩ)	V_{DS} (max) (V)	I_D (max) (A)	ESD Circuitry	Description
TPS1100	High-Side PMOS	1	291	15	–1	✓	Single P-Channel enhancement-mode MOFSET
TPS1101	High-Side PMOS	1	134	15	–1.1	✓	Single P-Channel enhancement-mode MOFSET
TPS1110	High-Side PMOS	1	65	7	–6	✓	Single P-Channel logic level MOFSET
TPS1120	High-Side PMOS	2	291	15	–0.7*	✓	Dual P-Channel enhancement-mode MOFSET

Note: ACC values @ V_{GS} = –4.5 V * Per device

PCMCIA Controller Power Distribution Switches Selection Guide

Device	Control Inputs	3 V $r_{DS(on)}$ (typ) (m Ω)	5 V $r_{DS(on)}$ (typ) (m Ω)	12-V Supply Required	Current and Temp Protection	VPP_Good & OC Reporting	Description
TPS2201	8 Line Parallel	225	160	No	Yes	Yes	Dual PC card power I/F switch with parallel interface
TPS2202	3 Line Serial	225	160	No	Yes	Yes	Dual PC card power I/F switch with serial interface
TPS2202A	3 Line Serial w/ Reset	225	160	No	Yes	Yes	Dual PC card power I/F switch with reset for serial interface
TPS2205	8 Line Parallel	110	140	No	Yes	N/Y	Dual PC card power I/F switch with parallel interface
TPS2206	8 Line Serial w/ Reset	110	140	No	Yes	N/Y	Dual PC card power I/F switch with serial interface
TPS2211	4 Line Parallel	90	90	No	Yes	N/Y	Single PC card power I/F switch with parallel interface

Current-Limited Power Distribution Switches Selection Guide

Device	Attributes	Output Current (max) (A)	SC Current (typ) (A)	$r_{DS\ (on)}$ (typ) (mΩ)	ESD Circuitry	V_{IN} (max) (V)	Description
TPS2010	Current-Limited	0.2	0.4	95		5.5	Power Distribution Switch
TPS2011	Current-Limited	0.6	1.2	95		5.5	Power Distribution Switch
TPS2012	Current-Limited	1	2	95		5.5	Power Distribution Switch
TPS2013	Current-Limited	1.5	2.6	95		5.5	Power Distribution Switch
TPS2014	Current-Limited, USB	0.6	1.2	95	✓	5.5	Power Distribution Switch
TPS2015	Current-Limited, USB	1	2	95	✓	5.5	Power Distribution Switch

Texas Instruments Power Distribution Cross Reference

Part No	Suggested TI Replacement	Vendor	Replacement Type
IRF7104	TPS1100	International Rectifier	S
IRF7104	TPS1101	International Rectifier	S
IRF7104	TPS1110	International Rectifier	S
IRF7104	TPS1120	International Rectifier	Q
IRF7202	TPS1100	International Rectifier	S
IRF7202	TPS1101	International Rectifier	S
IRF7202	TPS1110	International Rectifier	S
IRF7202	TPS1120	International Rectifier	S
IRF7204	TPS1100	International Rectifier	S
IRF7204	TPS1101	International Rectifier	S
IRF7204	TPS1110	International Rectifier	S
IRF7204	TPS1120	International Rectifier	S
IRF7205	TPS1100	International Rectifier	S
IRF7205	TPS1101	International Rectifier	S
IRF7205	TPS1110	International Rectifier	S
IRF7205	TPS1120	International Rectifier	S
LT1158	TPS2010	Linear Technology	S
LT1158	TPS2011	Linear Technology	S
LT1158	TPS2012	Linear Technology	S
LT1158	TPS2014	Linear Technology	S
LT1312	TPS2211	Linear Technology	S
LT1313	TPS2202	Linear Technology	S
LT1313	TPS2202A	Linear Technology	S
LTC1314	TPS2211	Linear Technology	S
LTC1315	TPS2211	Linear Technology	S
LTC1470	TPS2211	Linear Technology	S
LTC1471	TPS2211	Linear Technology	S
LTC1472	TPS2211	Linear Technology	S
LTC1477	TPS2010	Linear Technology	Q
LTC1477	TPS2011	Linear Technology	Q
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LTC1478	TPS2015	Linear Technology	S
MAX1600	TPS2201	Maxim	S
MAX1600	TPS2202	Maxim	S
MAX1600	TPS2202A	Maxim	S
MAX1600	TPS2205	Maxim	S
MAX1600	TPS2206	Maxim	S
MAX1601	TPS2201	Maxim	S
MAX1601	TPS2202	Maxim	S
MAX1601	TPS2202A	Maxim	S
MAX1601	TPS2205	Maxim	S
MAX1601	TPS2206	Maxim	S
MAX1603	TPS2201	Maxim	S
MAX1603	TPS2202	Maxim	S
MAX1603	TPS2202A	Maxim	S
MAX1604	TPS2201	Maxim	S
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MAX613	TPS2201	Maxim	S
MAX613	TPS2202	Maxim	S
MAX613	TPS2202A	Maxim	S
MAX614	TPS2201	Maxim	S
MAX614	TPS2202	Maxim	S
MAX614	TPS2202A	Maxim	S
MAX780	TPS2201	Maxim	S
MAX780	TPS2202	Maxim	S
MAX780	TPS2202A	Maxim	S
MAX780	TPS2205	Maxim	S
MAX780	TPS2206	Maxim	S
MIC2505	TPS2010	Micrel	S
MIC2505	TPS2011	Micrel	S
MIC2505	TPS2012	Micrel	S
MIC2505	TPS2013	Micrel	S
MIC2505	TPS2014	Micrel	S
MIC2505	TPS2015	Micrel	S
MIC2506	TPS2010	Micrel	S
MIC2506	TPS2011	Micrel	S
MIC2506	TPS2012	Micrel	S
MIC2506	TPS2013	Micrel	S
MIC2506	TPS2014	Micrel	S
MIC2506	TPS2015	Micrel	S
MIC2557	TPS2211	Micrel	S
LTC1478	TPS2015	Linear Technology	S
MAX1600	TPS2201	Maxim	S
MAX1600	TPS2202	Maxim	S
MAX1600	TPS2202A	Maxim	S
MAX1600	TPS2205	Maxim	S
MAX1600	TPS2206	Maxim	S
MAX1601	TPS2201	Maxim	S
MAX1601	TPS2202	Maxim	S
MAX1601	TPS2202A	Maxim	S
MAX1601	TPS2205	Maxim	S
MAX1601	TPS2206	Maxim	S
MAX1603	TPS2201	Maxim	S
MAX1603	TPS2202	Maxim	S
MAX1603	TPS2202A	Maxim	S
MAX1604	TPS2201	Maxim	S
MAX1604	TPS2202	Maxim	S
MAX1604	TPS2202A	Maxim	S
MAX613	TPS2201	Maxim	S
MAX613	TPS2202	Maxim	S
MAX613	TPS2202A	Maxim	S
MAX614	TPS2201	Maxim	S
MAX614	TPS2202	Maxim	S
MAX614	TPS2202A	Maxim	S
MAX780	TPS2201	Maxim	S
MAX780	TPS2202	Maxim	S
MAX780	TPS2202A	Maxim	S
MAX780	TPS2205	Maxim	S
MAX780	TPS2206	Maxim	S
MIC2505	TPS2010	Micrel	S
MIC2505	TPS2011	Micrel	S
MIC2505	TPS2012	Micrel	S
MIC2505	TPS2013	Micrel	S
MIC2505	TPS2014	Micrel	S
MIC2505	TPS2015	Micrel	S
MIC2506	TPS2010	Micrel	S
MIC2506	TPS2011	Micrel	S
MIC2506	TPS2012	Micrel	S
MIC2506	TPS2013	Micrel	S
MIC2506	TPS2014	Micrel	S
MIC2506	TPS2015	Micrel	S
MIC2557	TPS2211	Micrel	S

Texas Instruments Power Distribution Cross Reference

Part No	Suggested TI Replacement	Vendor	Replacement Type	Part No	Suggested TI Replacement	Vendor	Replacement Type
MIC2558	TPS2211	Micrel	S	NDS9430	TPS1100	Nat'l Semiconductor	Q
MIC2559	TPS2211	Micrel	S	NDS9430	TPS1101	Nat'l Semiconductor	Q
MIC2560	TPS2211	Micrel	S	NDS9430	TPS1110	Nat'l Semiconductor	Q
MIC2561	TPS2211	Micrel	S	NDS9953	TPS1120	Nat'l Semiconductor	Q
MIC2562A	TPS2211	Micrel	S	Si9400	TPS1100	Siliconix	Q
MIC2563A	TPS2201	Micrel	S	Si9400	TPS1101	Siliconix	Q
MIC2563A	TPS2202	Micrel	S	Si9400	TPS1110	Siliconix	Q
MIC2563A	TPS2202A	Micrel	S	Si9405	TPS1100	Siliconix	Q
MIC94001	TPS1100	Micrel	Q	Si9405	TPS1101	Siliconix	Q
MIC94001	TPS1101	Micrel	Q	Si9405	TPS1110	Siliconix	Q
MIC94001	TPS1110	Micrel	Q	Si9430	TPS1100	Siliconix	Q
MIC94002	TPS1120	Micrel	Q	Si9430	TPS1101	Siliconix	Q
MXDG411	TPS2013	Maxim	S	Si9430	TPS1110	Siliconix	Q
MXDG412	TPS2013	Maxim	S	Si9433	TPS1100	Siliconix	Q
MXDG413	TPS2013	Maxim	S	Si9433	TPS1101	Siliconix	Q
ND9405	TPS1100	Nat'l Semiconductor	Q	Si9433	TPS1110	Siliconix	Q
ND9405	TPS1101	Nat'l Semiconductor	Q	Si9434	TPS1100	Siliconix	Q
ND9405	TPS1110	Nat'l Semiconductor	Q	Si9434	TPS1101	Siliconix	Q
ND9430	TPS1100	Nat'l Semiconductor	Q	Si9434	TPS1110	Siliconix	Q
ND9430	TPS1101	Nat'l Semiconductor	Q	Si9706	TPS2211	Siliconix	S
ND9430	TPS1110	Nat'l Semiconductor	Q	Si9707	TPS2211	Siliconix	S
NDS9400	TPS1100	Nat'l Semiconductor	Q	Si9710	TPS2211	Siliconix	S
NDS9400	TPS1101	Nat'l Semiconductor	Q	Si9711	TPS2211	Siliconix	S
NDS9400	TPS1110	Nat'l Semiconductor	Q	Si9712	TPS2211	Siliconix	S
NDS9405	TPS1100	Nat'l Semiconductor	Q	Si9933	TPS1120	Siliconix	Q
NDS9405	TPS1101	Nat'l Semiconductor	Q	Si9953	TPS1120	Siliconix	Q
NDS9405	TPS1110	Nat'l Semiconductor	Q				

Replacement Types

F The device an EXACT EQUIVALENT in functionality and parametrics to the competitors device

P The device has the SAME FUNCTIONALITY AND PINOUT as the competitors device but is NOT an exact equivalent

Q The device has the SAME FUNCTIONALITY as the competitors device, but is not pin-for-pin and/or parametrically equivalent

S The device has SIMILAR FUNCTIONALITY but is not functionally equivalent to the competitors device

This cross reference to TI's Mixed Signal and Analog Products lists suggested replacements for many other manufacturers' devices. It is intended to be a guide only. It is the designer's responsibility to compare specifications as they relate to an application to determine if the TI device suggested is an acceptable substitute.

For technical support, call 972-644-5580

To order documentation, call 1-800-477-8924, ext.3228

Texas Instruments Power Distribution Switch Ordering Guide

TPS 2202 A I PW LE

Prefix	**LM, LT,MC, SG,TL,TLC, TLE, TLV, TPS,UA,UC**	
Device Number		
Optional Suffix	**A**	
Temperature Suffix	**C:** 0° to 70°C	**Q:** 0° to 70°C
	I: –40° to 85°C	**Y:** 0° to 70°C
	M: –55° to 125°C	
Package Suffix	**D, DW:**	Small-Outline Package (SOIC)
	DB, DBV:	Shrink, Small-Outline Package (SSOP)
	DF:	Palstic Small-Outline Package (SOP)
	FK:	Leadless Ceramic Chip-Carries Package (LCCC)
	J:	Ceramic Dual-In-Line Package (CDIP)
	JG:	Glass-Sealed Ceramic Dual-In-Line Package (CERDIP)
	KC, KTE, KTG:	Plastic Flanged Mount Package (PFM)
	KTP:	P-Flex, Plastic Flanged Mount Package
	LP:	Plastic Cylindrical Package (TO/SOT)
	N, P:	Plastic Dual-In-Line Package (PDIP)
	PK:	Plastic Thermally Enhanced Single-In-Line Package (HSIP)
	PW, PWP	Thin Shrink Small-Outline Package (TSSOP)
	U:	Ceramic Flat Package (CFP)
	Y:	Unpackaged Chip
Optional Carrier Suffix	**LE:**	Left-End Taped and Reeled
	R:	Taped and Reeled