VOLTAGE DETECTORS

FEATURES

- **Qualified for Automotive Applications**
- **Single Voltage Detector (TPS3803): Adjustable/1.5 V**
- **Dual Voltage Detector (TPS3805): Adjustable/3.3 V**
- **High ±1.5% Threshold Voltage Accuracy**
- **Supply Current: 3 μA Typical at V_{DD} = 3.3 V**
- **Push/Pull Reset Output (TPS3805), Open-Drain Reset Output (TPS3803)**
- **Temperature Range: –40°C to 125°C**
- **5-Pin SC-70 Package**

APPLICATIONS

- **Applications Using DSPs, Microcontrollers, or Microprocessors**
- **Wireless Communication Systems**
- **Portable/Battery-Powered Equipment**
- **Programmable Controls**
- **Intelligent Instruments**
- **Industrial Equipment**
- **Notebook/Desktop Computers**
- **Automotive Systems**

DESCRIPTION

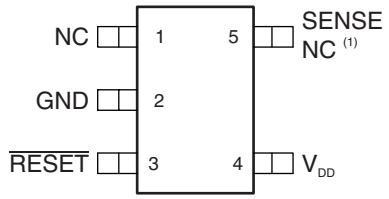
The TPS3803 and TPS3805 families of supervisory circuits provide circuit initialization and timing supervision, primarily for DSPs and processor-based systems.

The TPS3803G15 device has a fixed-sense threshold voltage V_{IT} set by an internal voltage divider, whereas the TPS3803-01 has an adjustable SENSE input that can be configured by two external resistors. In addition to the fixed sense threshold monitored at V_{DD}, the TPS3805 devices provide a second adjustable SENSE input. $\overline{\text{RESET}}$ is asserted in case either of the two voltages drops below V_{IT}.

During power on, $\overline{\text{RESET}}$ is asserted when supply voltage V_{DD} becomes higher than 0.8 V. Thereafter, the supervisory circuit monitors V_{DD} (and/or SENSE) and keeps $\overline{\text{RESET}}$ active as long as V_{DD} or SENSE remains below the threshold voltage V_{IT}. As soon as V_{DD} (SENSE) rises above the threshold voltage V_{IT}, $\overline{\text{RESET}}$ is deasserted again. The product spectrum is designed for 1.5 V, 3.3 V, and adjustable supply voltages.

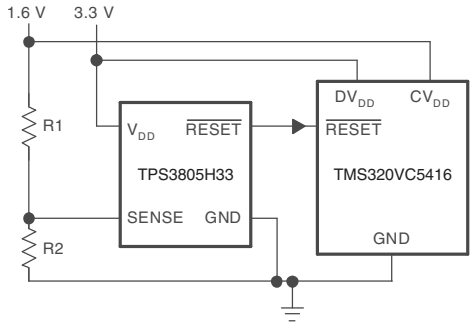
The devices are available in a 5-pin SC-70 package. The TPS3803 and TPS3805 devices are characterized for operation over a temperature range of –40°C to 125°C.

DCK PACKAGE
(TOP VIEW)



NC – No connection

(1) SENSE on TPS3803-01, TPS3805H33
NC on TPS3803G15



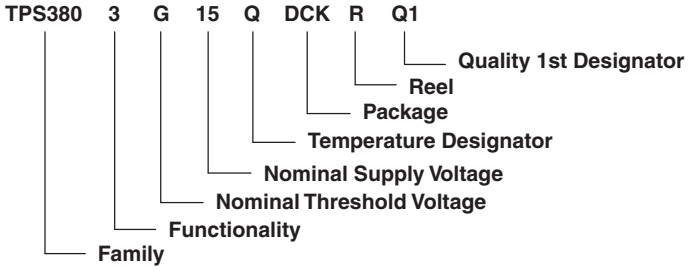
This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

ORDERING INFORMATION(1)

T_A	THRESHOLD VOLTAGE		PACKAGE(2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
	V_{DD}	SENSE				
–40°C to 125°C	NA	1.226 V	SC-70 – DCK	Reel of 3000	TPS3803-01QDCKRQ1	AWJ
	1.4 V	NA			TPS3803G15QDCKRQ1	AXU
	3.05 V	1.226 V			TPS3805H33QDCKRQ1	AWZ

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.



FUNCTION/TRUTH TABLE

TPS3803-01	
SENSE > V_{IT}	$\overline{\text{RESET}}$
0	L
1	H

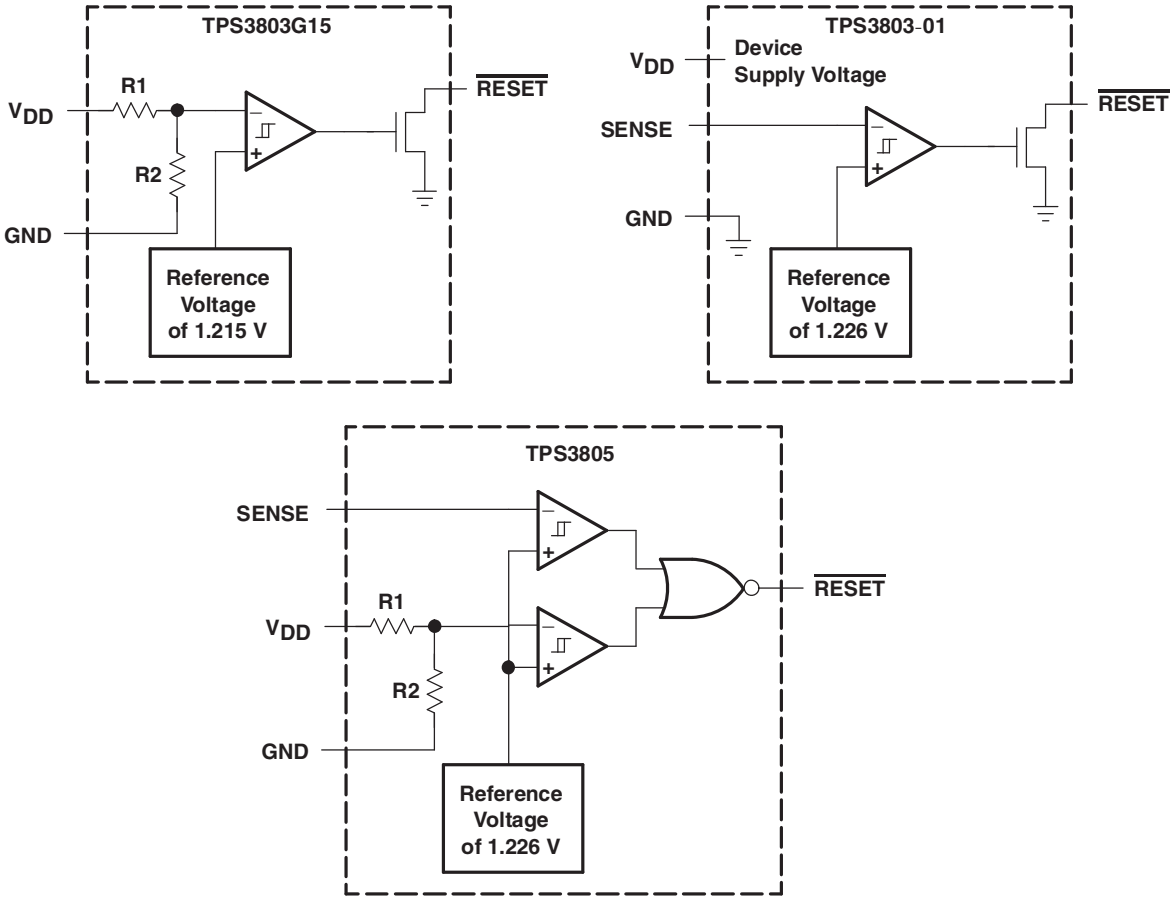
FUNCTION/TRUTH TABLE

TPS3803G15	
V_{DD} > V_{IT}	$\overline{\text{RESET}}$
0	L
1	H

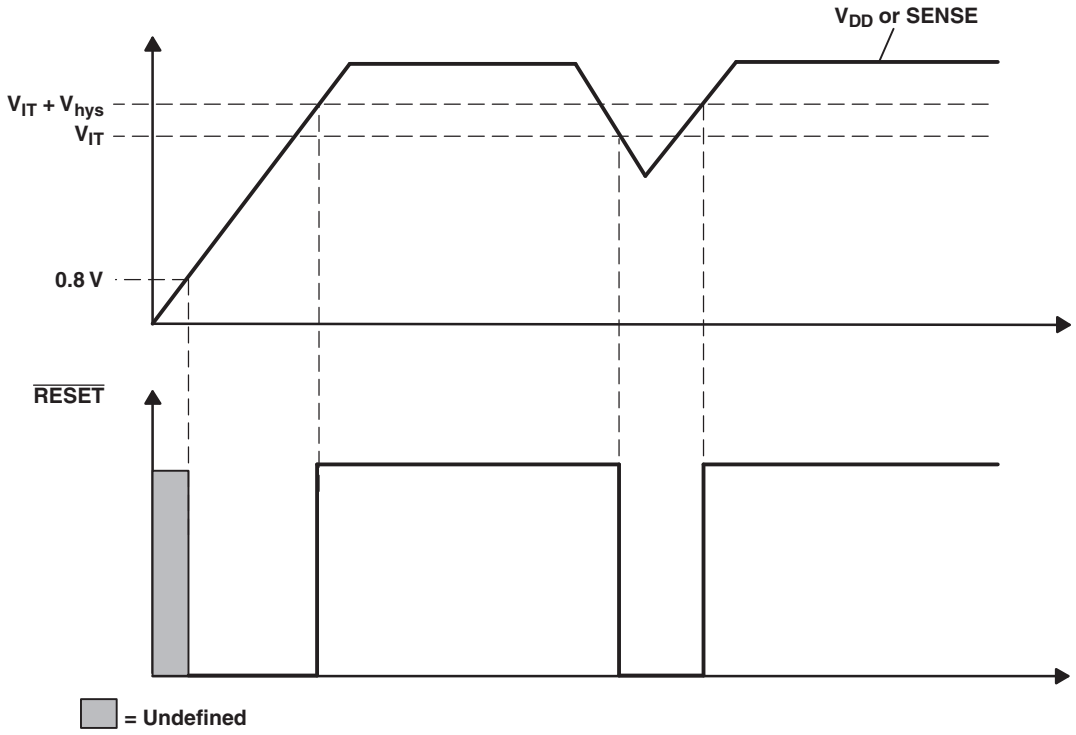
FUNCTION/TRUTH TABLE

TPS3805H33		
V_{DD} > V_{IT}	SENSE > V_{IT}	$\overline{\text{RESET}}$
0	0	L
0	1	L
1	0	L
1	1	H

FUNCTIONAL BLOCK DIAGRAM



TIMING REQUIREMENTS



TERMINAL FUNCTIONS

TERMINAL		I/O	DESCRIPTION
NAME	NO.		
GND	2	I	Ground
$\overline{\text{RESET}}$	3	O	Active-low reset output (TPS3803: open drain, TPS3805: push/pull)
SENSE	5	I	Adjustable sense input
NC	1		No internal connection
NC (TPS3803G15)	5		No internal connection
V_{DD}	4	I	Input supply voltage, fixed sense input for TPS3803G15 and TPS3805

ABSOLUTE MAXIMUM RATINGS(1)

over operating free-air temperature range (unless otherwise noted)

			VALUE
V_{DD}	Supply voltage(2)		7 V
	Voltage applied to all other pins(2)		–0.3 V to 7 V
I_{OL}	Maximum low-level output current		5 mA
I_{OH}	Maximum high-level output current		–5 mA
I_{IK}	Input clamp current	$V_I < 0$ or $V_I > V_{DD}$	±10 mA
I_{OK}	Output clamp current	$V_O < 0$ or $V_O > V_{DD}$	±10 mA
P_D	Continuous total power dissipation		See Dissipation Rating Table
T_A	Operating free-air temperature range		–40°C to 125°C
T_{stg}	Storage temperature range		–65°C to 150°C
T_{solder}	Soldering temperature		260°C

(1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltage values are with respect to GND. For reliable operation, the device should not be continuously operated at 7 V for more than t = 1000 h.

DISSIPATION RATINGS

PACKAGE	POWER RATING T_A < 25°C	DERATING FACTOR ABOVE T_A = 25°C	POWER RATING T_A = 70°C	POWER RATING T_A = 85°C
DCK	321 mW	2.6 mW/°C	206 mW	167 mW

RECOMMENDED OPERATING CONDITIONS

		MIN	MAX	UNIT
V_{DD}	Supply voltage	1.3	6	V
V_I	Input voltage	0	V_{DD} + 0.3	V
T_A	Operating free-air temperature	–40	125	°C

ELECTRICAL CHARACTERISTICS

over operating free-air temperature range (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage (TPS3805 only)		V_{DD} = 1.5 V, I_{OH} = –0.5 mA	$0.8 \times V_{DD}$			V
			V_{DD} = 3.3 V, I_{OH} = –1 mA				
			V_{DD} = 6 V, I_{OH} = –1.5 mA				
V_{OL}	Low-level output voltage		V_{DD} = 1.5 V, I_{OL} = 1 mA				V
			V_{DD} = 3.3 V, I_{OL} = 2 mA			0.3	
			V_{DD} = 6 V, I_{OL} = 3 mA				
	Power-up reset voltage(1)		V_{IT} > 1.5 V, T_A = 25°C	0.8			V
			V_{IT} ≤ 1.5 V, T_A = 25°C	1			
V_{IT}	Negative-going input threshold voltage(2)	SENSE		1.2	1.226	1.244	V
		TPS3803G15		1.379	1.4	1.421	
		TPS3805H33		3.004	3.05	3.096	
V_{hys}	Hysteresis		1.2 V < V_{IT} < 2.5 V		15		mV
			2.5 V < V_{IT} < 3.5 V		30		
I_I	Input current	SENSE		–25		25	nA
I_{OH}	High-level output current at $\overline{\text{RESET}}$	Open drain only	V_{DD} = V_{IT} + 0.2 V, V_{OH} = V_{DD}			300	nA
I_{DD}	Supply current	TPS3803-01	V_{DD} = 3.3 V, Output unconnected		2	4	µA
		TPS3805, TPS3803G15			3	5	
		TPS3803-01	V_{DD} = 6 V, Output unconnected		2	4	
		TPS3805, TPS3803G15			4	6	
C_I	Input capacitance		V_I = 0 V to V_{DD}		1		pF

(1) The lowest supply voltage at which $\overline{\text{RESET}}$ (V_{OL}(max) = 0.2 V, I_{OL} = 50 µA) becomes active. $t_r(V_{DD})$ ≥ 15 µs/V.
(2) To ensure the best stability of the threshold voltage, place a bypass capacitor (ceramic, 0.1 µF) near the supply terminals.

TIMING REQUIREMENTS

R_L = 1 MΩ, C_L = 50 pF, T_A = –40°C to 125°C (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	MAX	UNIT
t_w	Pulse duration	V_{DD}	V_{IH} = 1.05 × V_{IT}, V_{IL} = 0.95 × V_{IT}	5.5		µs
		SENSE				

SWITCHING CHARACTERISTICS

R_L = 1 MΩ, C_L = 50 pF, T_A = –40°C to 125°C (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PHL}	Propagation (delay) time, high-to-low-level output	V_{DD} to $\overline{\text{RESET}}$ delay	V_{IH} = 1.05 × V_{IT}, V_{IL} = 0.95 × V_{IT}		5	100	µs
		SENSE to $\overline{\text{RESET}}$ delay					
t_{PLH}	Propagation (delay) time, low-to-high-level output	V_{DD} to $\overline{\text{RESET}}$ delay	V_{IH} = 1.05 × V_{IT}, V_{IL} = 0.95 × V_{IT}		5	100	µs
		SENSE to $\overline{\text{RESET}}$ delay					

TYPICAL CHARACTERISTICS

TPS3805H33
SUPPLY CURRENT
vs
SUPPLY VOLTAGE

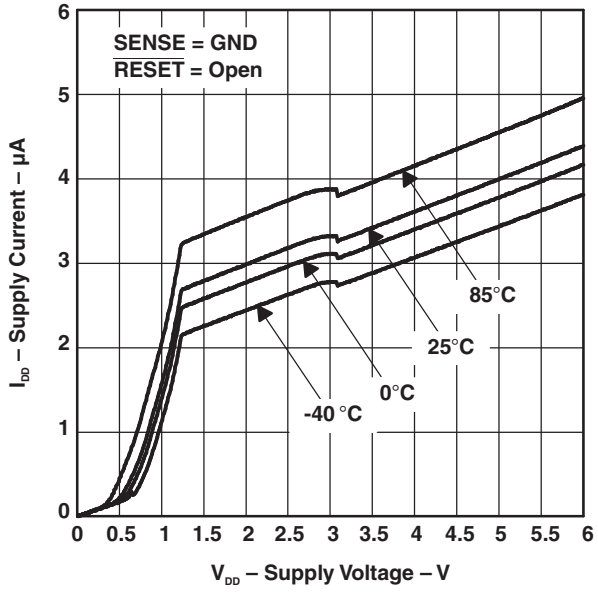


Figure 1.

TPS3803-01
SUPPLY CURRENT
vs
SUPPLY VOLTAGE

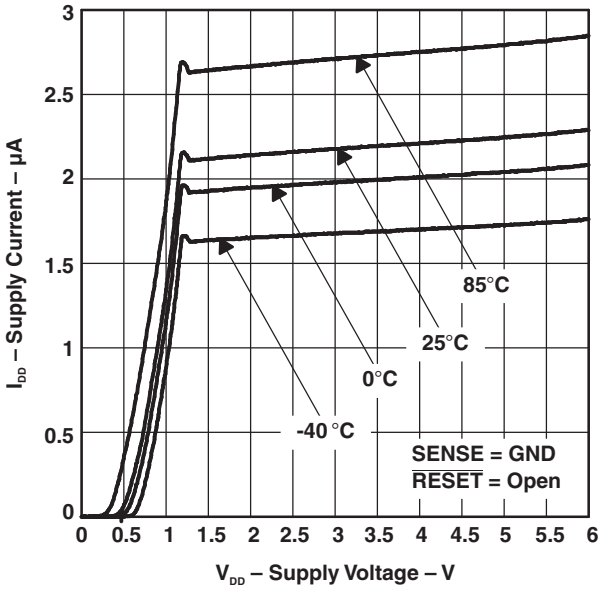


Figure 2.

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

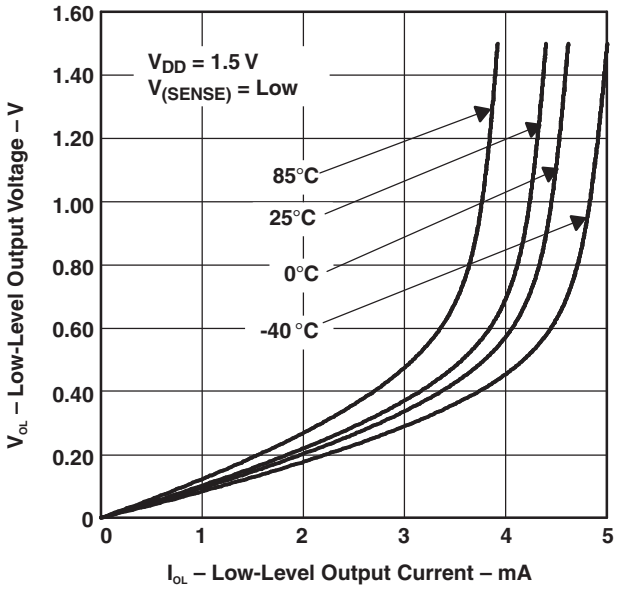


Figure 3.

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

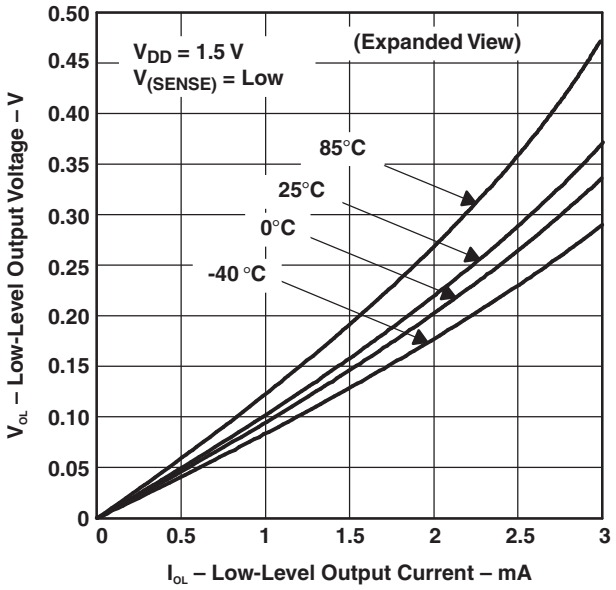


Figure 4.

TYPICAL CHARACTERISTICS (continued)

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

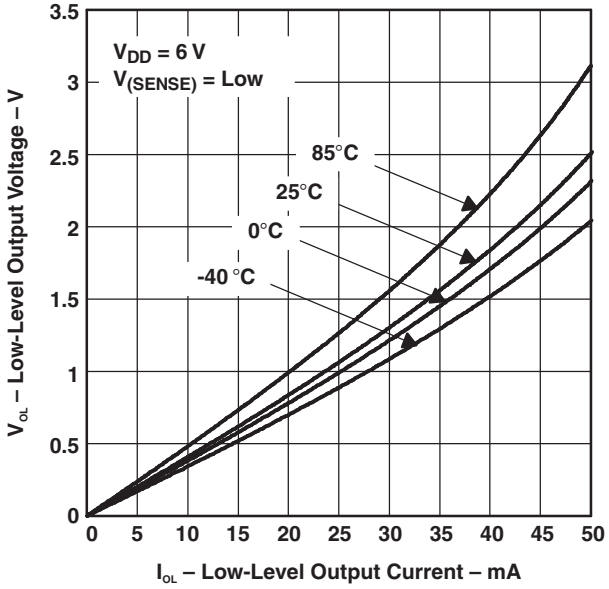


Figure 5.

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

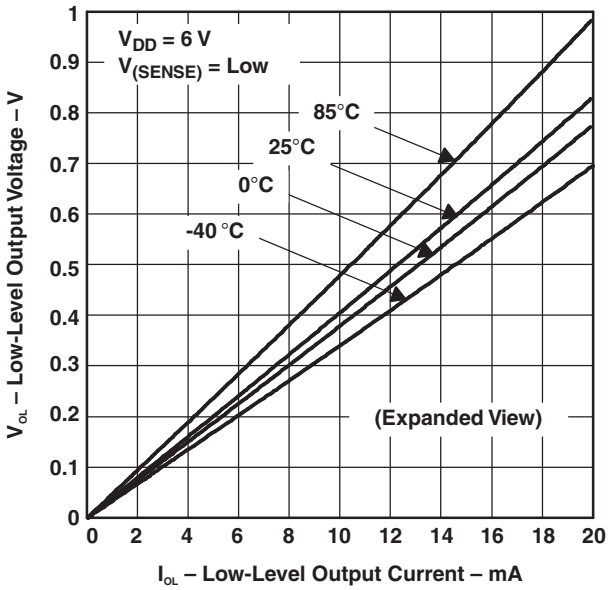


Figure 6.

TPS3805H33
HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

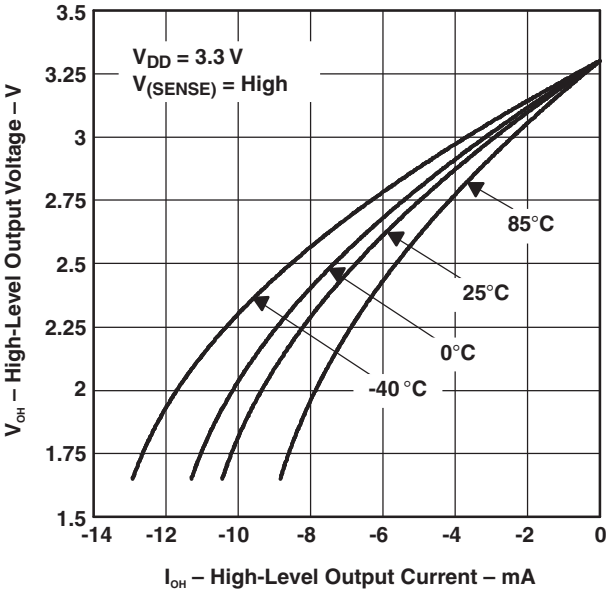


Figure 7.

TPS3805H33
HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

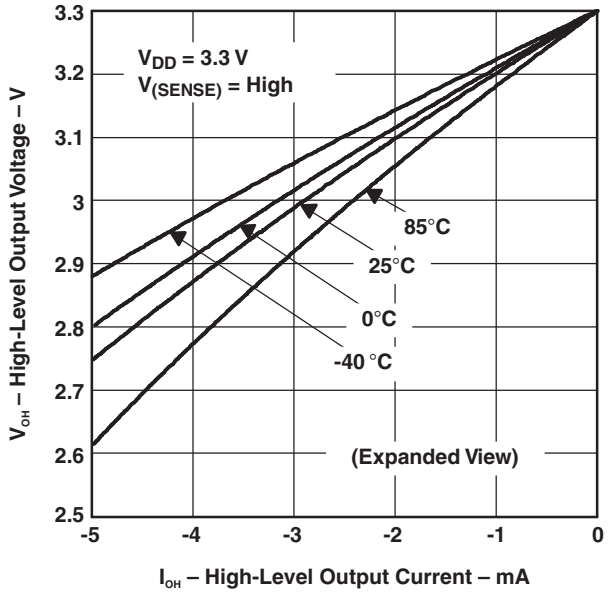


Figure 8.

TYPICAL CHARACTERISTICS (continued)

TPS3805H33
HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

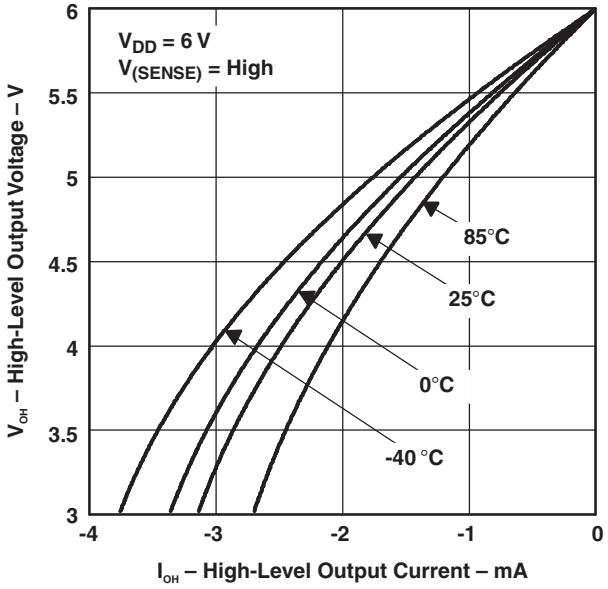


Figure 9.

TPS3805H33
HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

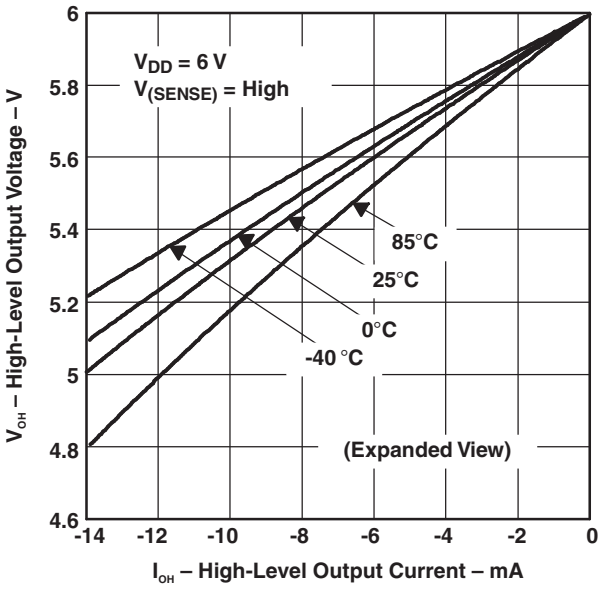


Figure 10.

TPS3803-01
NORMALIZED INPUT THRESHOLD VOLTAGE
vs
FREE-AIR TEMPERATURE AT SENSE

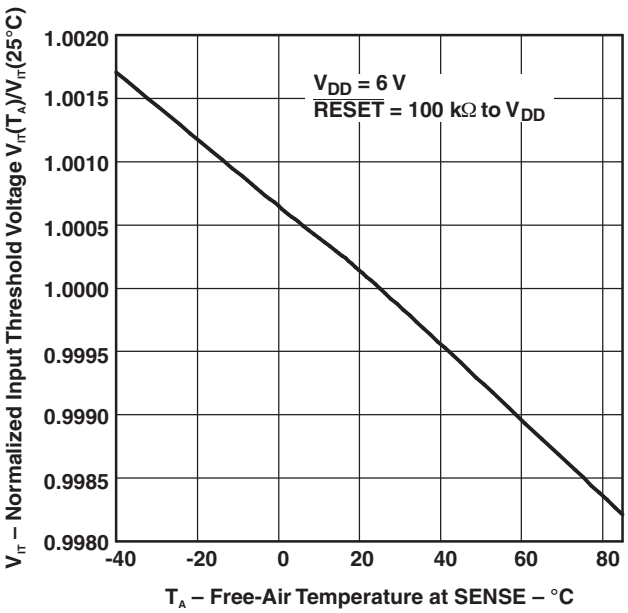


Figure 11.

MINIMUM PULSE DURATION AT V_{DD}
vs
V_{DD} THRESHOLD OVERDRIVE VOLTAGE

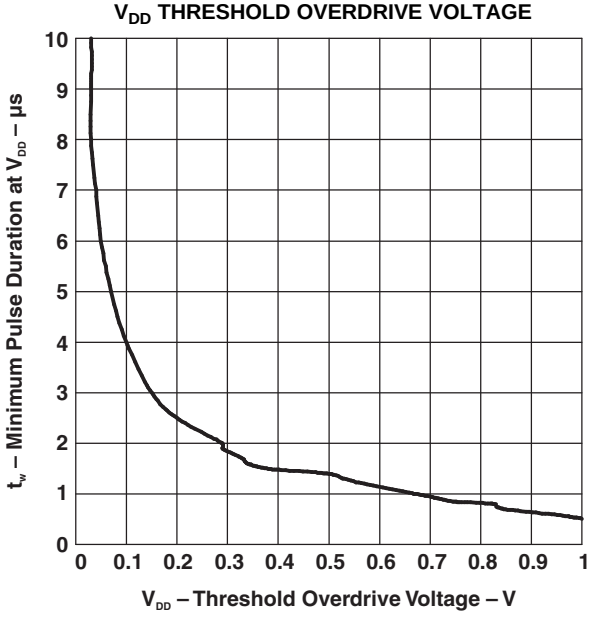


Figure 12.

TYPICAL CHARACTERISTICS (continued)

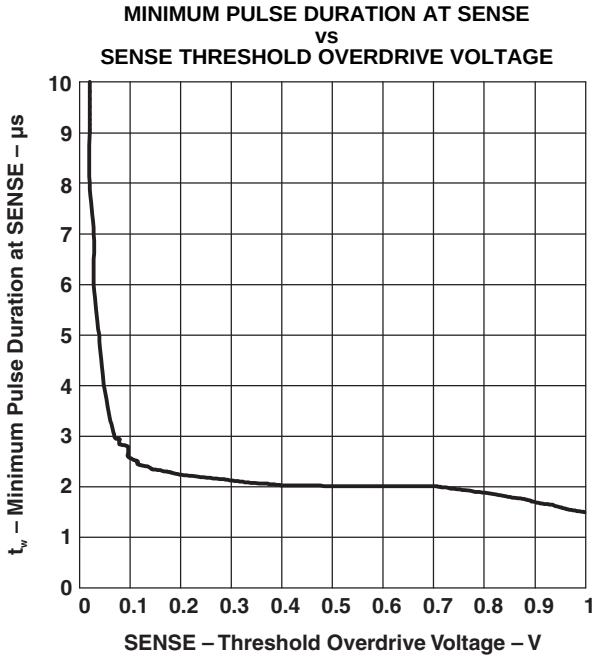


Figure 13.

Revision History

REVISION	PAGE(1)	DESCRIPTION
SGLS228		Initial release
SGLS228A	1	Update features and description
	3	Update functional block diagram
SGLS228B	1	Update features

(1) Page numbers for previous revitions may differ from page numbers in the current version.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
2T03-01QDCKRG4Q1	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	AWJ	Samples
2T03G15QDCKRG4Q	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	AXU	Samples
2T05H33QDCKRG4Q	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU | CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	AWZ	Samples
TPS3803-01QDCKRQ1	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	AWJ	Samples
TPS3803G15QDCKRQ1	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU | CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	AXU	Samples
TPS3805H33QDCKRQ1	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU | CU NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	AWZ	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

OTHER QUALIFIED VERSIONS OF TPS3803-01-Q1, TPS3803G15-Q1, TPS3805H33-Q1 :

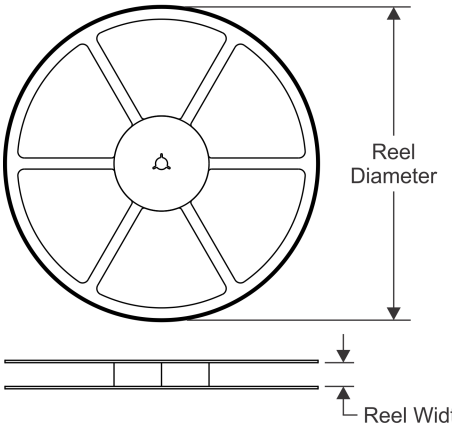
- Catalog: TPS3803-01, TPS3803G15, TPS3805H33
- Enhanced Product: TPS3803-01-EP, TPS3803G15-EP, TPS3805H33-EP

NOTE: Qualified Version Definitions:

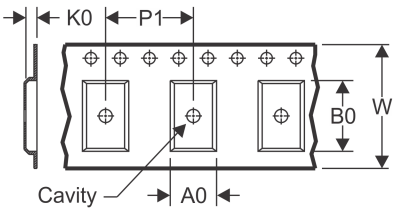
- Catalog - TI's standard catalog product
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

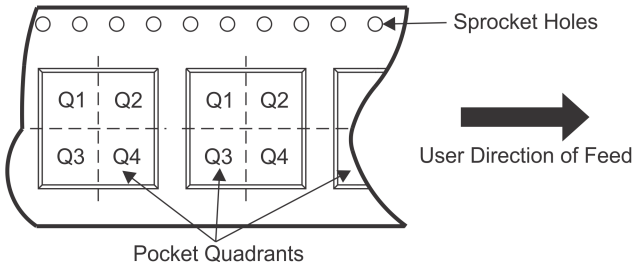


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

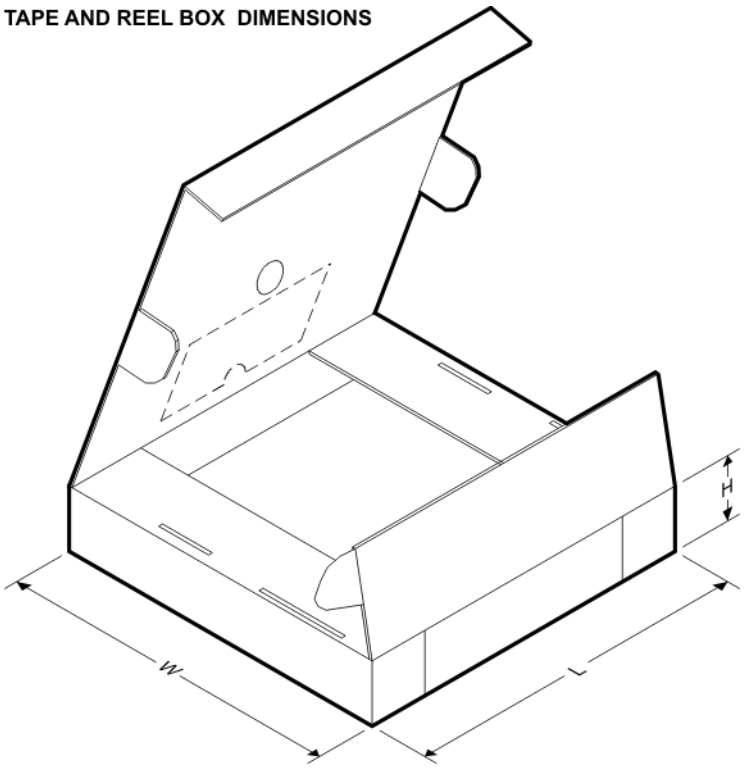
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TPS3803G15QDCKRQ1	SC70	DCK	5	3000	180.0	8.4	2.47	2.3	1.25	4.0	8.0	Q3

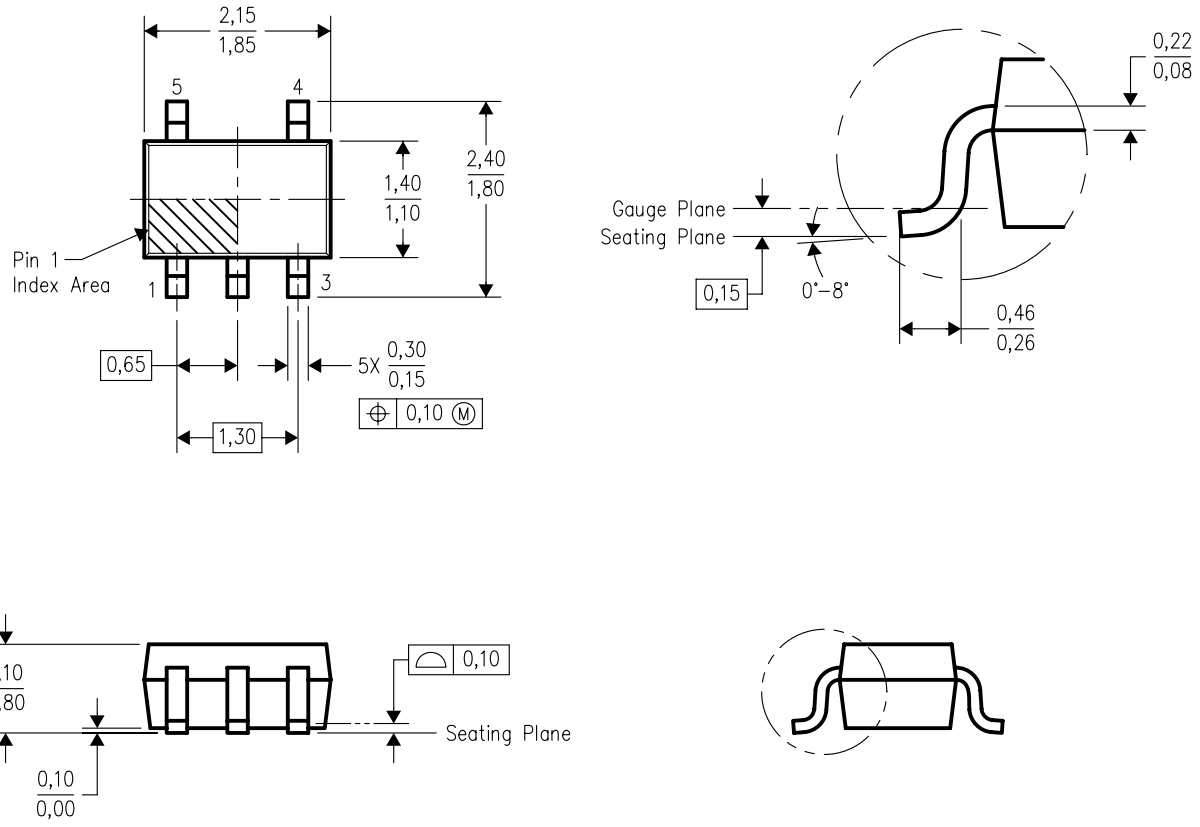
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS3803G15QDCKRQ1	SC70	DCK	5	3000	202.0	201.0	28.0

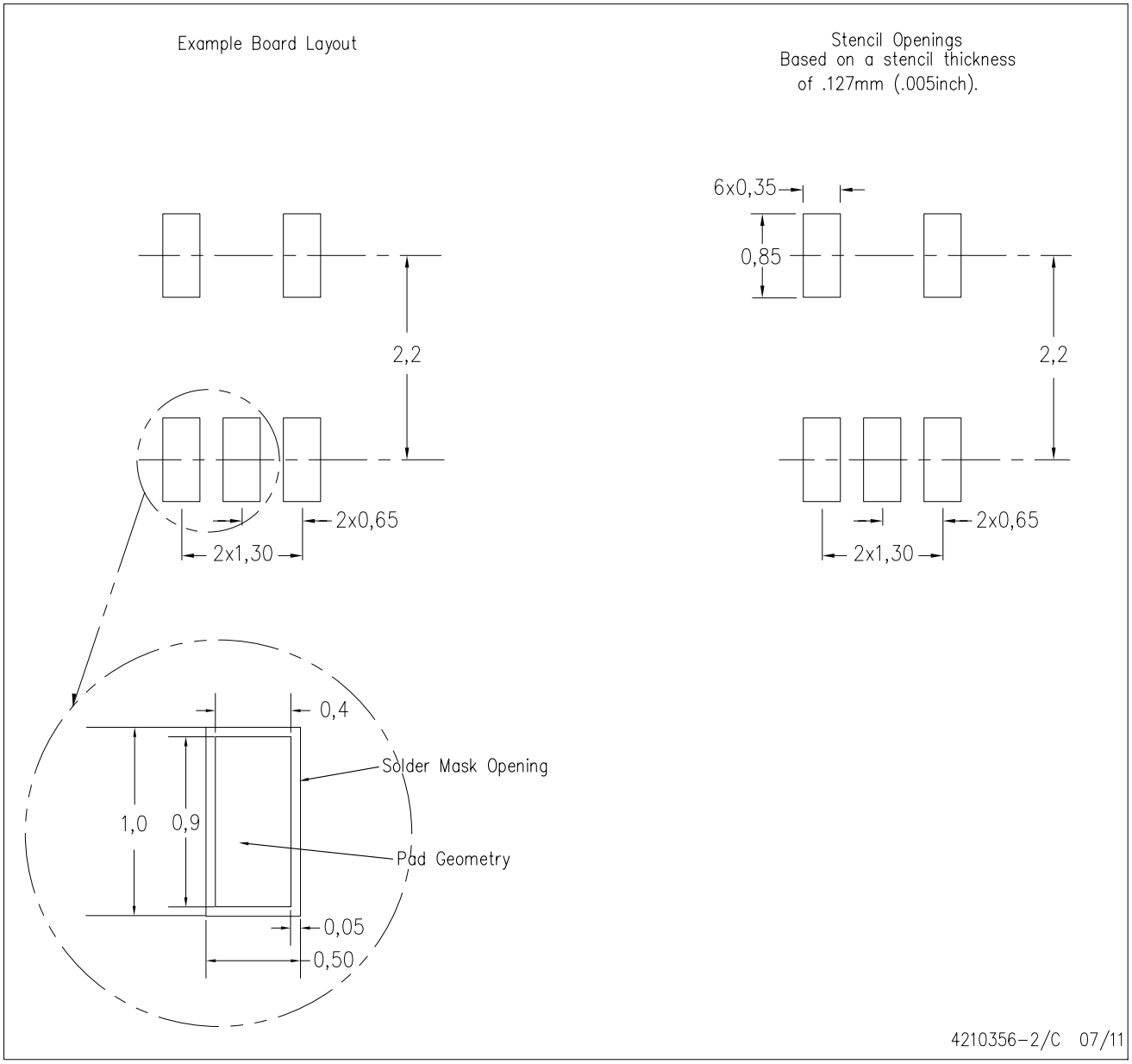
DCK (R–PDSO–G5) PLASTIC SMALL–OUTLINE PACKAGE



4093553–3/G 01/2007

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–203 variation AA.

DCK (R–PDSO–G5) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC–7351 is recommended for alternate designs.
E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC–7525 for other stencil recommendations.

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