MP6205

3.3V/5V, Single-Channel 500mA Current-Limited Power Distribution Switch

The Future of Analog IC Technology

DESCRIPTION

The MP6205 Power Distribution Switch features internal current limiting to prevent damage to host devices due to faulty load conditions. The MP6205 Analog switch features 90mΩ on-resistance and operates from 2.7V to 5.5V input. It is available with a guaranteed current limit, making it ideal for load switching applications. The MP6205 has built-in protection for both over current and increased thermal stress. For over current, the device will limit the current by changing to a constant current mode.

As the temperature increases as a result of short circuit, the device will shut off. The device will recover once the device temperature reduces to approx 120°C.

The MP6205 is available in QFN8, MSOP8E, SOIC8E packages.

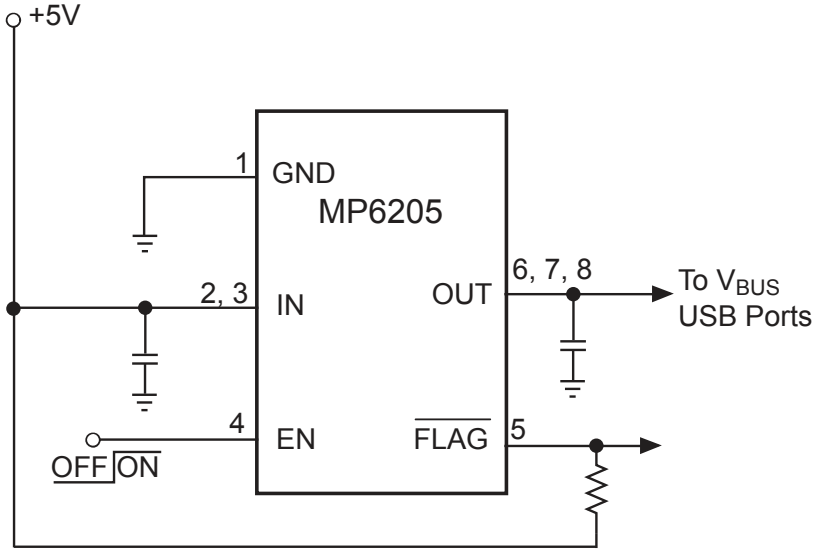
FEATURES

- 500mA Continuous Current
- Accurate Current Limit
- 2.7V to 5.5V Supply Range
- 140uA Quiescent Current
- 90mΩ MOSFET
- Thermal-Shutdown Protection
- Under-Voltage Lockout
- 8ms FLAG Deglitch Time
- No FLAG Glitch During Power Up
- Reverse Current Blocking
- QFN8, MSOP8E, SOIC8E Packages
- UL Recognized: E322138

APPLICATIONS

- Smartphone and PDA
- Portable GPS Device
- Set-top-box
- USB Power Distribution

TYPICAL APPLICATION



SINGLE-CHANNEL

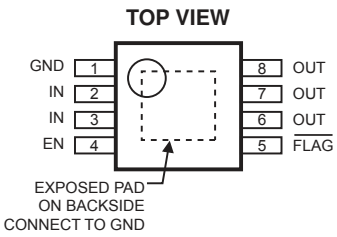
UL Recognized Component

ORDERING INFORMATION

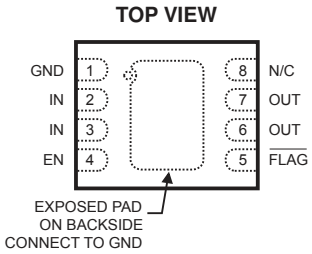
Part Number*	Enable	Switch	Maximum Continuous Load Current	Maximum Short-Circuit Current @ T_A=25°C	Package	Top Marking	Temperature
MP6205DH	Active High	Single	500mA	1100mA	MSOP8E	6205D	–40°C to +85°C
MP6205DD					QFN8 (2mm x 3mm)	7CYW	
MP6205DN					SOIC8E	MP6205DN	

* For Tape & Reel, add suffix –Z (eg. MP6205D_–Z). For RoHS Compliant Packaging, add suffix –LF. (eg. MP6205D_–LF–Z)

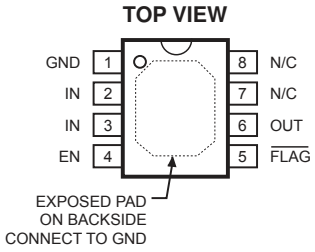
PACKAGE REFERENCE



MSOP8E



QFN8 (2mm x 3mm)



SOIC8E

ABSOLUTE MAXIMUM RATINGS (1)

IN .....-0.3V to +6.0V
EN, FLAG, OUT to GND .....-0.3V to +6.0V
Junction Temperature .....150°C
Lead Temperature .....260°C
Storage Temperature.....–65°C to +150°C
Operating Temperature.....–40°C to +85°C

Thermal Resistance (2)

	θ_{JA}	θ_{JC}	
MSOP8E	55	12	°C/W
QFN8 (2mm x 3mm)	55	12	°C/W
SOIC8E	50	10	°C/W

Notes:

1) Exceeding these ratings may damage the device.
2) Measured on JESD51-7 4-layer PCB.

ELECTRICAL CHARACTERISTICS (3)

V_{IN}=5V, T_A=+25°C, unless otherwise noted.

Parameter	Condition	Min	Typ	Max	Units
IN Voltage Range		2.7		5.5	V
Supply Current	Single Channel		140	160	μA
Shutdown Current	Device Disable, V_{OUT}=float, V_{IN}=5.5V		1		μA
Off Switch Leakage	Device Disable, V_{IN}=5.5V		1		μA
Current Limit		550		1100	mA
Trip Current	Current Ramp (slew rate≤100A/s) on Output		1.2	1.6	A
Under-voltage Lockout	Rising Edge	1.95		2.65	V
Under-voltage Hysteresis			250		mV
FET On Resistance	I_{OUT}=100mA and-40°C<T_A< 85°C		90	130	mΩ
EN Input Logic High Voltage		2			V
EN Input Logic Low Voltage				0.8	V
FLAG Output Logic Low Voltage	I_{SINK}=5mA			0.4	V
FLAG Output High Leakage Current	V_{IN}=V_{FLAG}=5.5V			1	μA
Thermal Shutdown			140		°C
Thermal Shutdown Hysteresis			20		°C
V_{OUT} Rising Time, Tr (4)	VIN=5.5V, CL=1uF, RL=11Ω		0.9		ms
	VIN=2.7V, CL=1uF, RL=11Ω		1.7		ms
V_{OUT} Falling Time, Tf (4)	VIN=5.5V, CL=1uF, RL=11Ω			0.5	ms
	VIN=2.7V, CL=1uF, RL=11Ω			0.5	ms
Turn On Time, Ton (5)	CL=100μF, RL=11Ω			3	ms
Turn Off Time, Toff (5)	CL=100μF, RL=11Ω			10	ms
FLAG Deglitch Time		4	8	15	ms
EN Input Leakage			1		μA
Reverse Leakage Current	OUT=5.5V, IN=GND		0.2		μA

NOTE:

3) Production test at +25°C. Specifications over the temperature range are guaranteed by design and characterization.
4) Measured from 10% to 90%.
5) Measured from (50%) EN signal to (90%) output signal.

PIN FUNCTIONS

Pin # MSOP	Pin # SOIC	Pin # QFN	Name	Description
1	1	1	GND, Exposed Pad	Ground. Connect exposed pad to GND plane for optimal thermal performance
2, 3	2, 3	2, 3	IN	Input Voltage. Accepts 2.7V to 5.5V input.
4	4	4	EN	Enable Input. Active High.
5	5	5	$\overline{\text{FLAG}}$	IN-to-OUT Over-current, active-low output flag. Open-Drain.
6, 7, 8	6	6, 7	OUT	Power-Distribution Switch Output.
-	7, 8	8	N/C	

TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25ºC, unless otherwise noted.

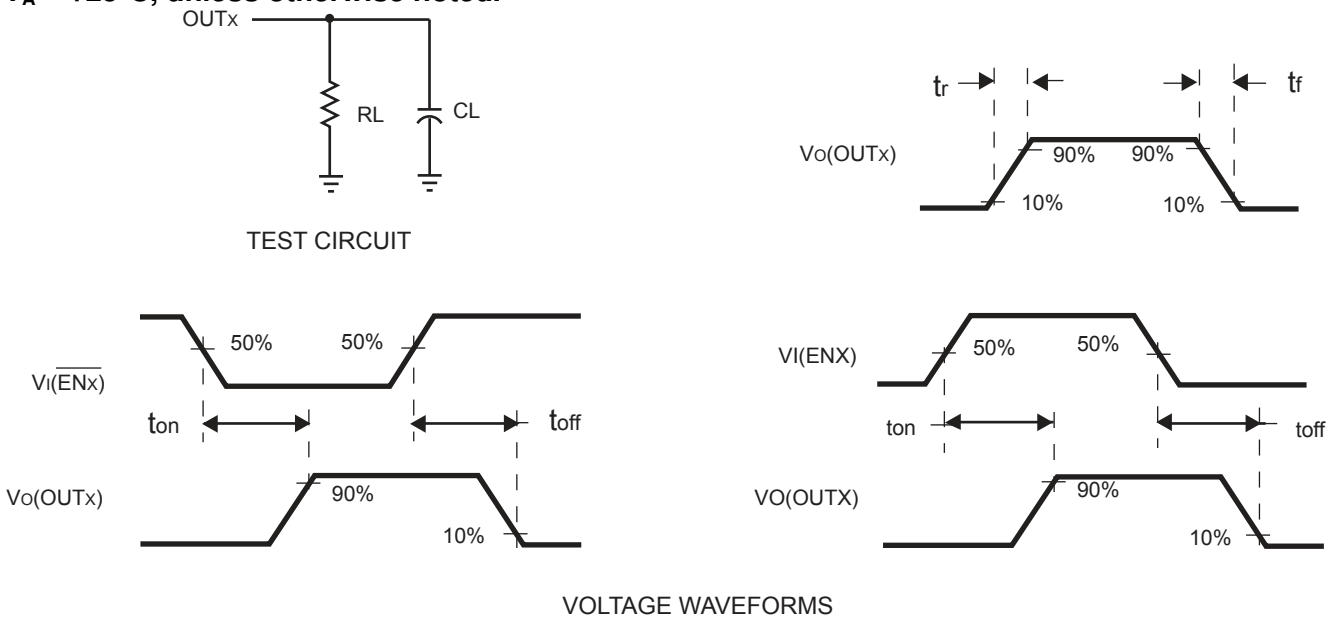


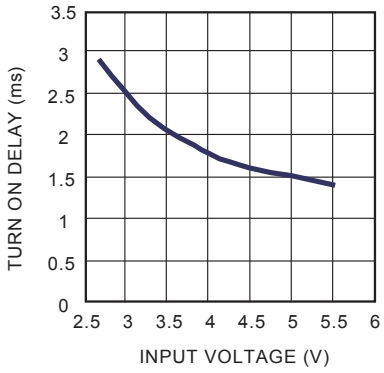
Figure 1—Test Circuit and Voltage Waveforms

TYPICAL PERFORMANCE CHARACTERISTICS

V_{IN}=5.5V, C_L = 2.2µF, T_A = +25ºC, unless otherwise noted.

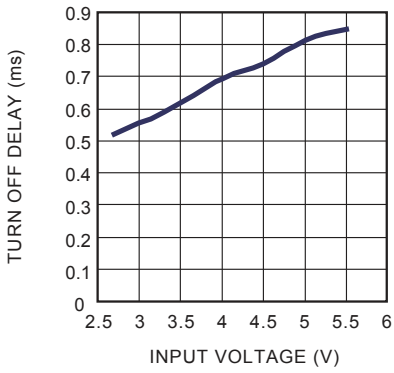
Turn on Delay vs. Input Votage

V_{EN}=5V, R_L=11Ω



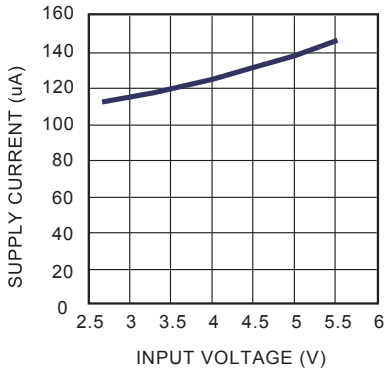
Turn off Delay vs. Input Votage

V_{EN}=5V, R_L=11Ω



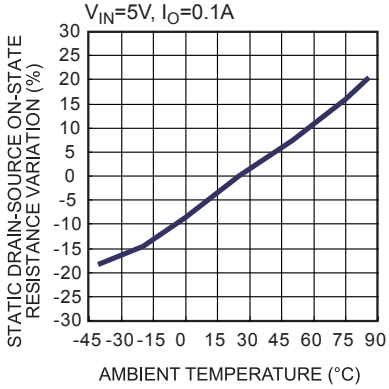
Supply Current, Output Enabled vs. Input Voltage

V_{EN}=5V



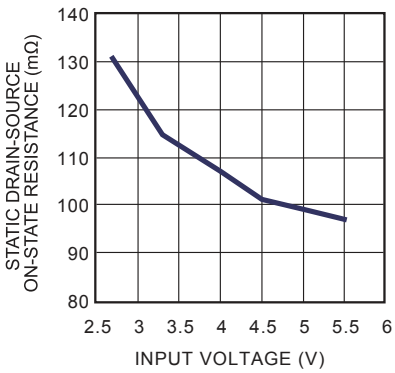
Static Drain-Source On-State Resistance Variation vs. Ambient Temperature

V_{IN}=5V, I_O=0.1A



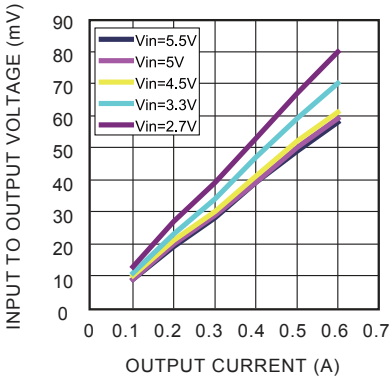
Static Drain-Source On-State Resistance vs. Input Voltage

V_{EN}=5V, I_{OUT}=0.5A



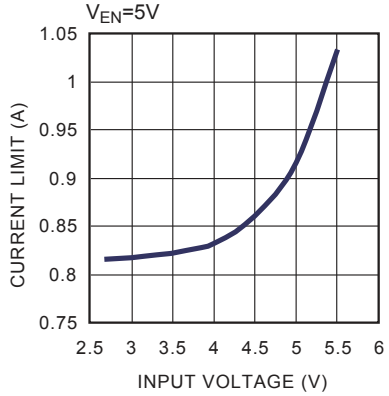
Input to Output Voltage vs. Load Current

V_{EN}=5V

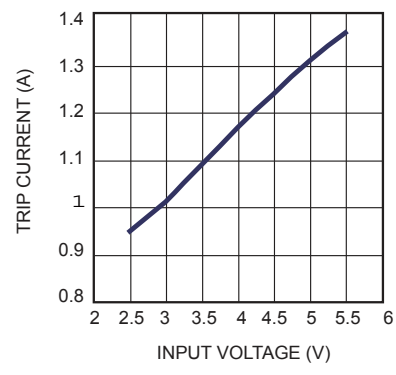


Current Limit vs. Input Voltage

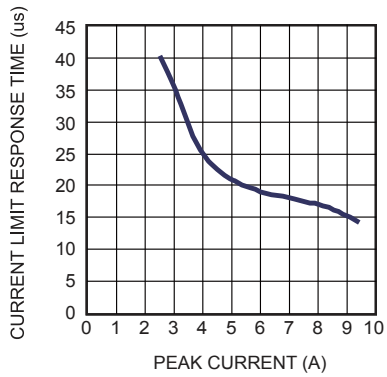
V_{EN}=5V



Threshold Trip Current vs. Input Voltage



Current Limit Response Time vs. Peak Current

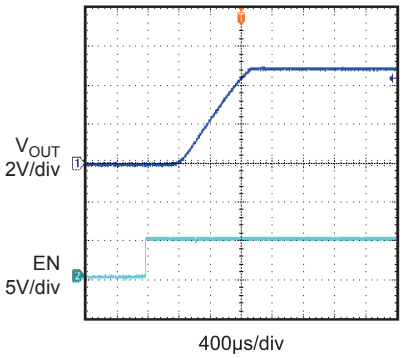


TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

V_{IN}=5.5V, C_L = 2.2µF, T_A = +25ºC, unless otherwise noted.

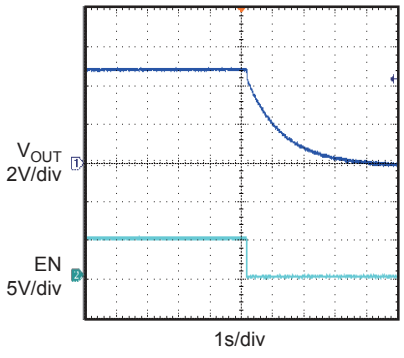
Turn On Delay and Rise Time with 0.1uF Load

V_{EN}=5V, C_L=0.1uF



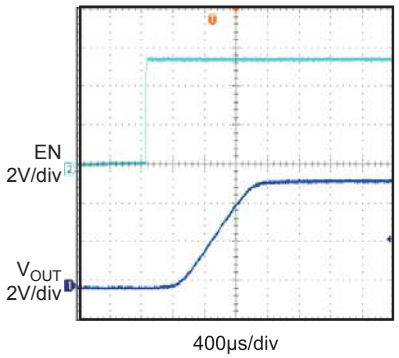
Turn Off Delay and Fall Time with 0.1uF Load

V_{EN}=5V, C_L=0.1uF



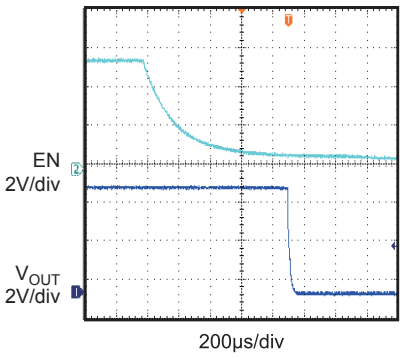
Turn On Delay and Rise Time

R_L=11Ω, C_L=1uF

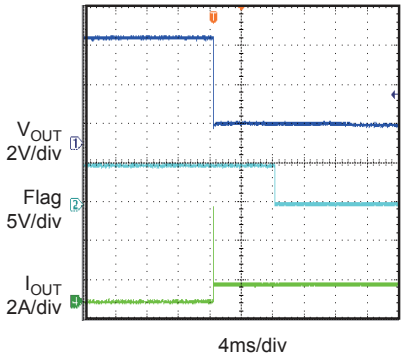


Turn Off Delay and Fall Time

R_L=11Ω, C_L=1uF

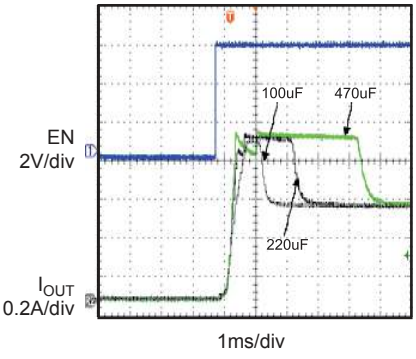


1Ω Load Connected to Enabled Device

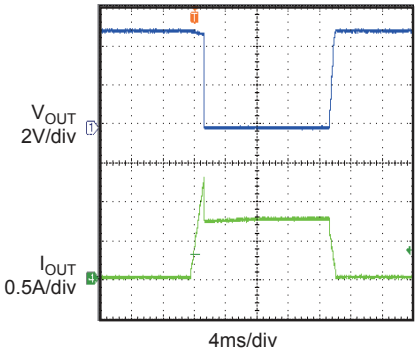


Inrush Current with Different Load Capacitance

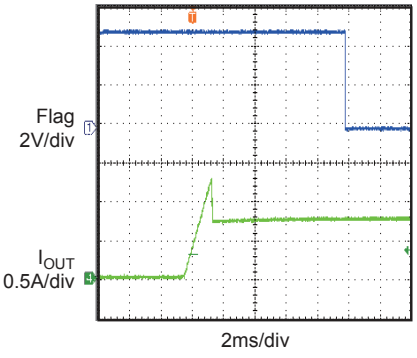
R_L=11Ω, Start up by EN



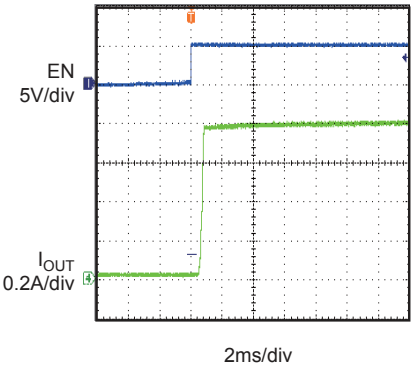
Threshold Trip Current with Ramped Load on Enabled Device



Ramped Load on Enabled Device



Short Circuit Current, Device Enabled into Short



FUNCTION BLOCK DIAGRAM

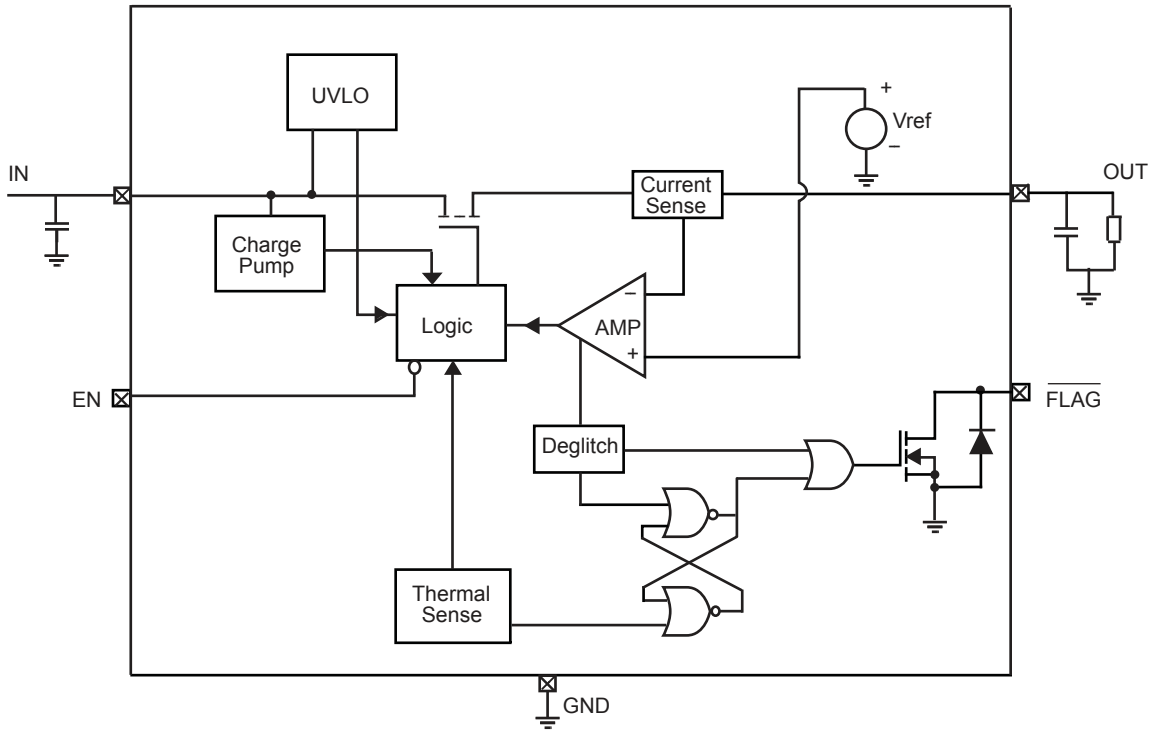


Figure 2—Functional Block Diagram

DETAILED DESCRIPTION

Over Current

When the load exceeds trip current (minimum threshold current triggering constant-current mode) or a short is present, MP6205 switches into to a constant-current mode (current limit value). MP6205 will be shutdown only if the overcurrent condition stays long enough to trigger thermal protection.

Trigger overcurrent protection for different overload conditions occurring in applications:

1) The output has been shorted or overloaded before the device is enabled or input applied. MP6205 detects the short or overload and immediately switches into a constant-current mode.
2) A short or an overload occurs after the device is enabled. After the current-limit circuit has been tripped (reached the trip current threshold), the device switches into constant-current mode. However, high current may flow for a short period of time before the current-limit circuit can react.
3) Output current has been gradually increased beyond the recommended operating current. The load current rises until the trip current threshold is reached or until the thermal limit of the device is exceeded. The MP6205 is capable of delivering current up to the trip current threshold without damaging the device. Once the trip threshold has been reached, the device switches into its constant-current mode.

Flag Response

The FLAG pin is an open drain configuration. This FAULT will report a fail mode after an 8ms deglitch timeout. This is used to ensure that no false fault signals are reported. This internal deglitch circuit eliminates the need for extend components. The FLAG pin is not deglitched during an over temp. or a voltage lockout.

Thermal Protection

The purpose of thermal protection is to prevent damage in the IC by allowing exceptive current to flow and heating the junction. The die temperature is internally monitored until the thermal limit is reached. Once this temperature is reached, the switch will turn off and allow the chip to cool. The switch has a built-in hysteresis.

Under-voltage Lockout (UVLO)

This circuit is used to monitor the input voltage to ensure that the MP6205 is operating correctly. This UVLO circuit also ensures that there is no operation until the input voltage reaches the minimum spec.

Enable

The logic pin disables the chip to reduce the supply current. The device will operate once the enable signal reaches the appropriate level. The input is compatible with both COMS and TTL.

APPLICATION INFORMATION

Power-Supply Considerations

Over 10µF capacitor between IN and GND is recommended. This precaution reduces power-supply transients that may cause ringing on the input and improves the immunity of the device to short-circuit transients.

In order to achieve smaller output load transient, placing a high-value electrolytic capacitor on the output pin(s) is recommended when the output load is heavy.

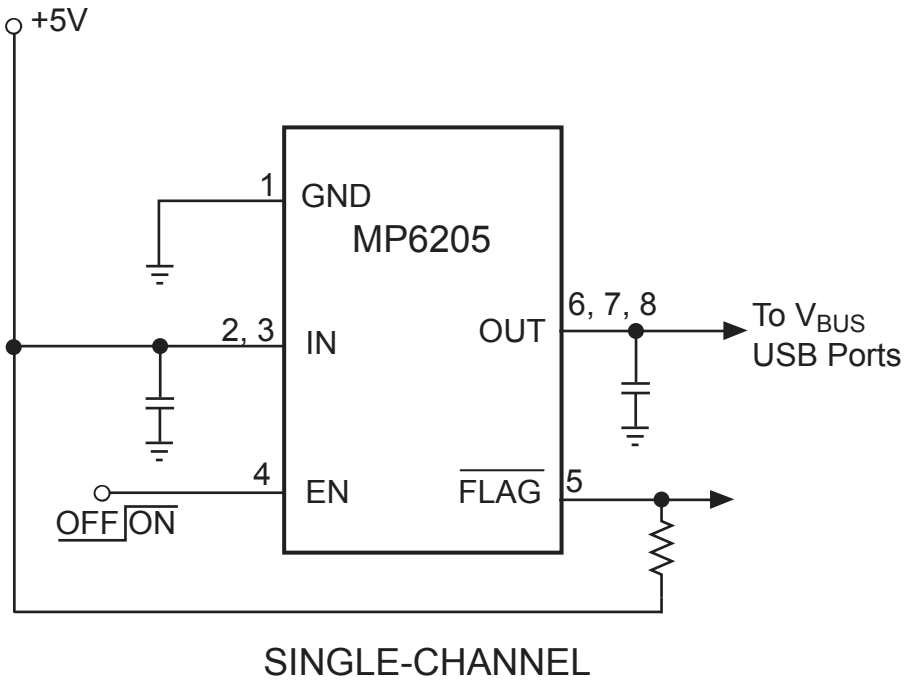
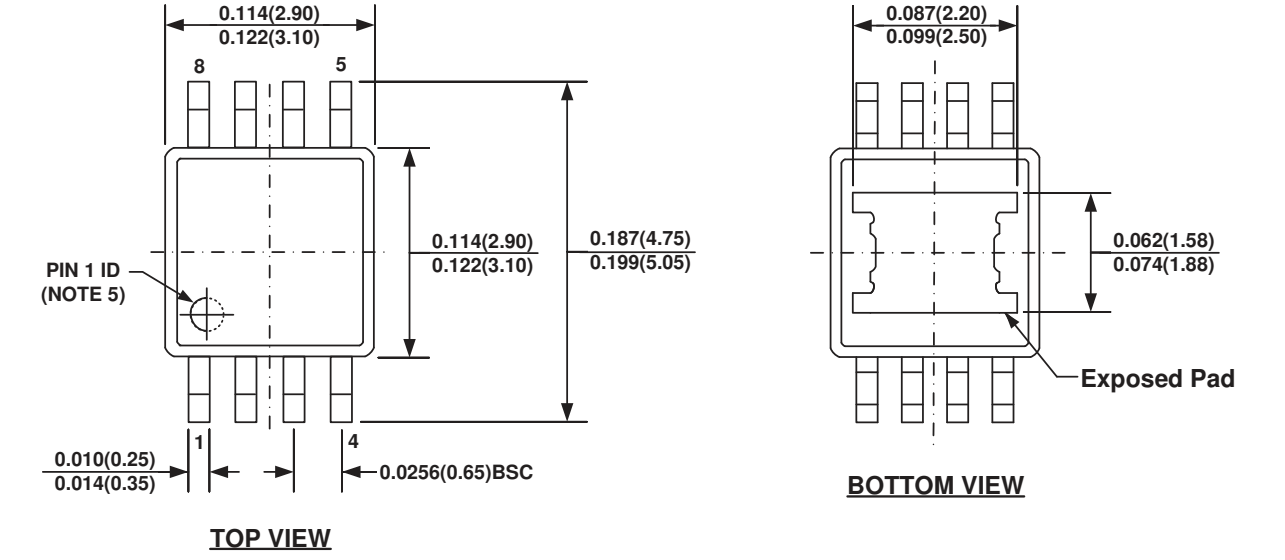
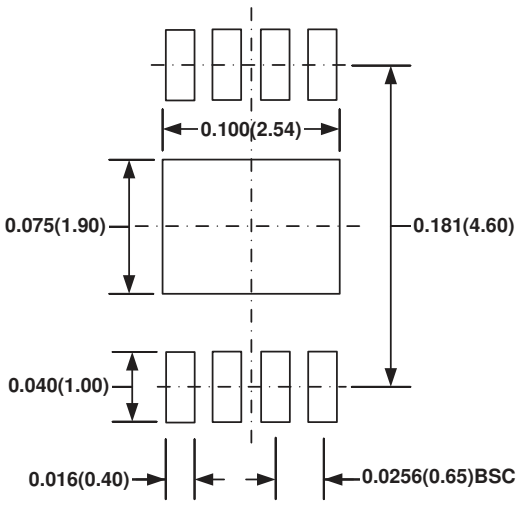


Figure 3—Application Circuit

PACKAGE INFORMATION

MSOP8E (EXPOSED PAD)



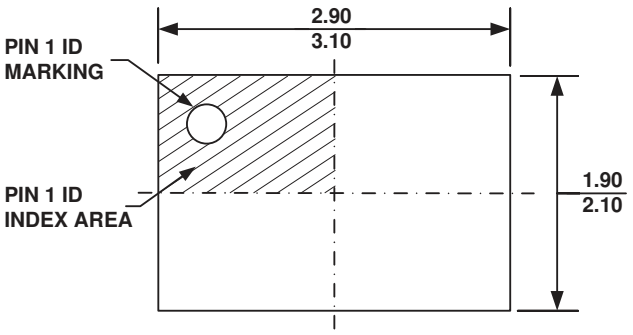


RECOMMENDED LAND PATTERN

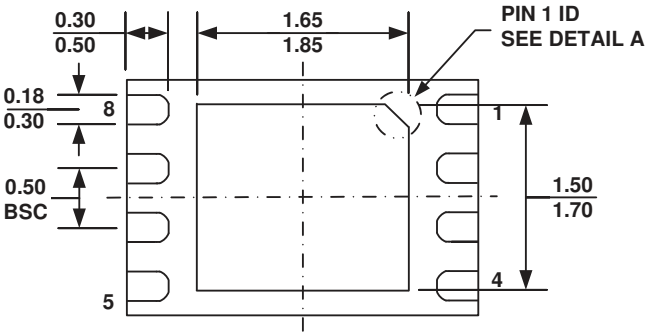
NOTE:

1) CONTROL DIMENSION IS IN INCHES. DIMENSION IN BRACKET IS IN MILLIMETERS.
2) PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR.
3) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.
4) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.004" INCHES MAX.
5) PIN 1 IDENTIFICATION HAS HALF OR FULL CIRCLE OPTION.
6) DRAWING MEETS JEDEC MO-187, VARIATION AA-T.
7) DRAWING IS NOT TO SCALE.

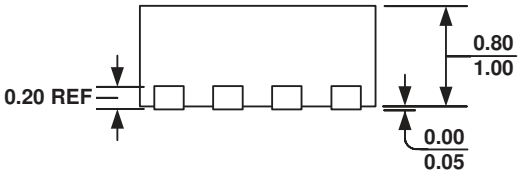
QFN8 (2mm x 3mm)



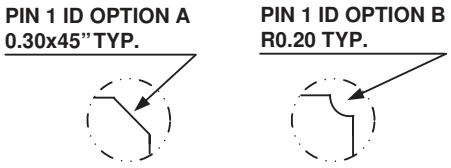
TOP VIEW



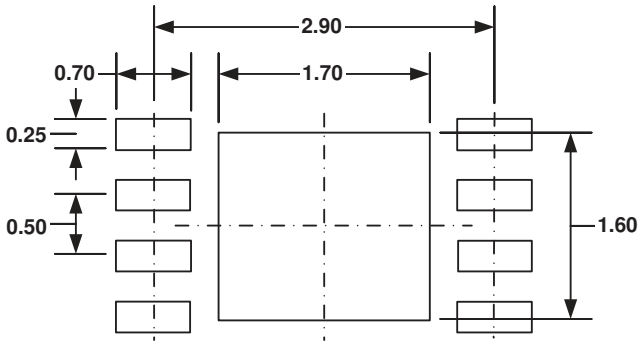
BOTTOM VIEW



SIDE VIEW



DETAIL A

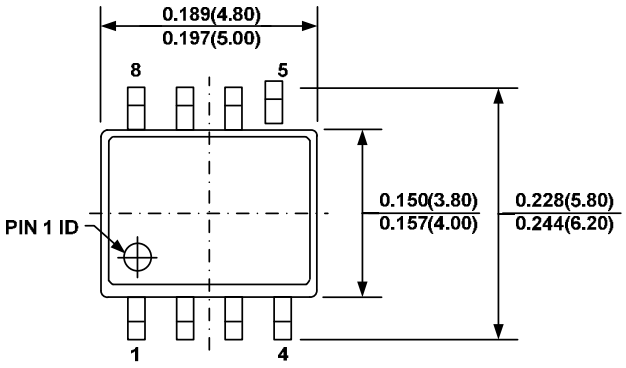


RECOMMENDED LAND PATTERN

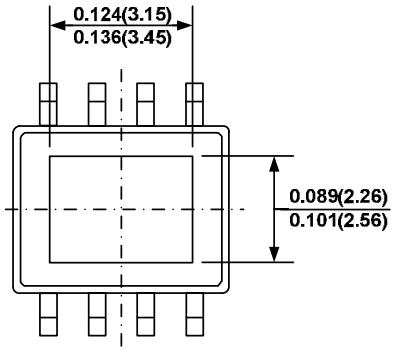
NOTE:

1) ALL DIMENSIONS ARE IN MILLIMETERS.
2) EXPOSED PADDLE SIZE DOES NOT INCLUDE MOLD FLASH.
3) LEAD COPLANARITY SHALL BE 0.10 MILLIMETER MAX.
4) DRAWING CONFORMS TO JEDEC MO-229, VARIATION VCED-2.
5) DRAWING IS NOT TO SCALE.

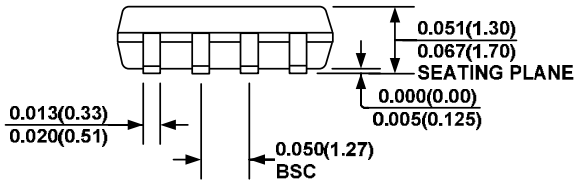
SOIC8E (EXPOSED PAD)



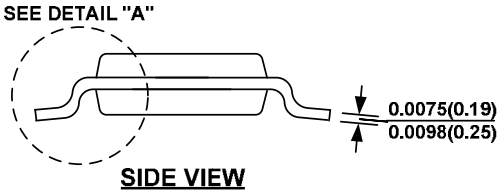
TOP VIEW



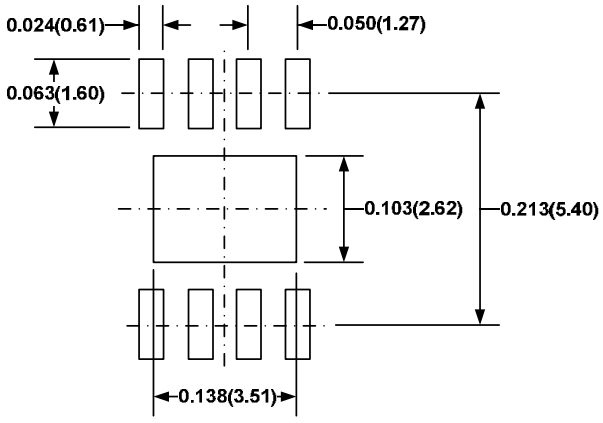
BOTTOM VIEW



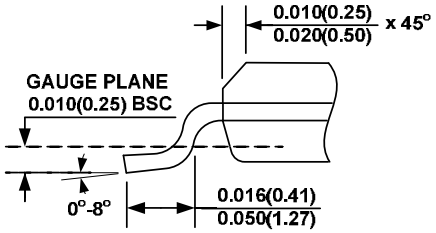
FRONT VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN



DETAIL "A"

NOTE:

1) CONTROL DIMENSION IS IN INCHES. DIMENSION IN BRACKET IS IN MILLIMETERS.
2) PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
3) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
4) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.004" INCHES MAX.
5) DRAWING CONFORMS TO JEDEC MS-012, VARIATION BA.
6) DRAWING IS NOT TO SCALE.