

Description and Applications

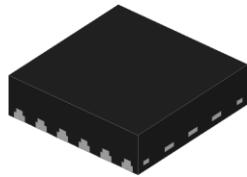
The DML3009LDC load switch provides a component and area-reducing solution for efficient power domain switching with inrush current limit via soft-start. In addition to integrated control functionality with ultra low on-resistance, this device offers system safeguards and monitoring via fault protection and power good signaling. This cost effective solution is ideal for power management and hot-swap applications requiring low power consumption in a small footprint.

- Portable Electronics and Systems
- Notebook and Tablet Computers
- Telecom, Networking, Medical, and Industrial Equipment
- Set-Top Boxes, Servers, and Gateways
- Hot-Swap Devices and Peripheral Ports

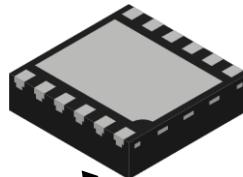
Features and Benefits

- Advanced Controller with ChargePump
- Integrated N-Channel MOSFET with Ultra Low R_{ON}
- Input Voltage Range 0.5V to 13.5V
- Soft-Start via Controlled SlewRate
- Adjustable Slew Rate Control
- Power Good Signal
- Thermal Shutdown
- V_{IN} Under-Voltage Lockout
- Short-Circuit Protection
- Extremely Low Standby Current
- Load Bleed (Quick Discharge)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

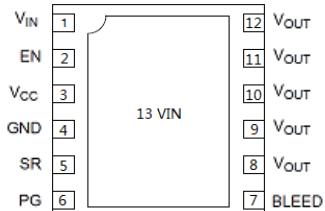
V-DFN3030-12 (Type B)



Top View



Bottom View



Top View

Ordering Information (Note 4)

Part Number	Case	Packaging
DML3009LDC-7	V-DFN3030-12 (Type B)	3,000/Tape & Reel

Notes:

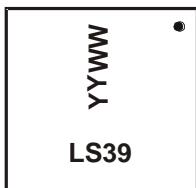
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Pin Description

Pin Number	Pin Name	Pin Function
1, 13	V _{IN}	Drain of MOSFET (0.5V to 13.5V), Pin 1 must be connected to Pin 13
2	EN	Active-high digital input used to turn on the MOSFET, pin has an internal pull down resistor to GND
3	V _{CC}	Supply voltage to controller (3.0V to 5.5V)
4	GND	Controller ground
5	SR	Slew rate adjustment; float if not used
6	PG	Active-high, open-drain output that indicates when the gate of the MOSFET is fully charged, external pull up resistor $\geq 1\text{k}\Omega$ to an external voltage source required; tie to GND if not used.
7	BLEED	Load bleed connection, must be tied to V _{OUT} either directly or through a resistor $\leq 1\text{k}\Omega$
8 to 12	V _{OUT}	Source of MOSFET connected to load

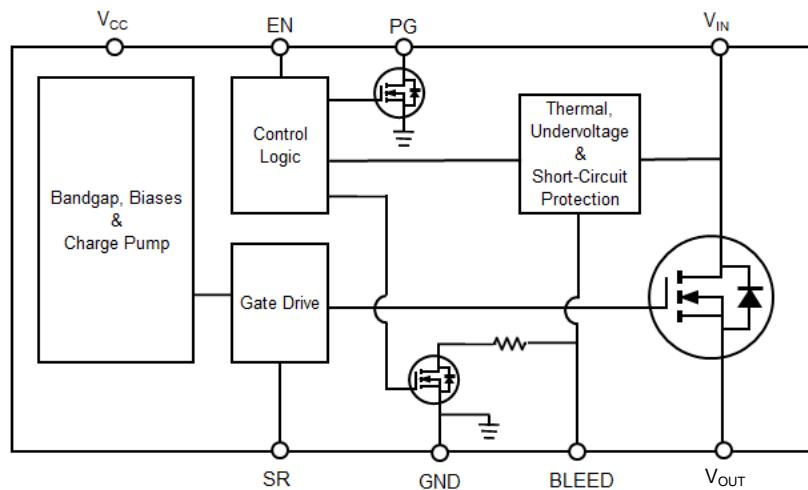
Marking Information

V-DFN3030-12 (Type B)

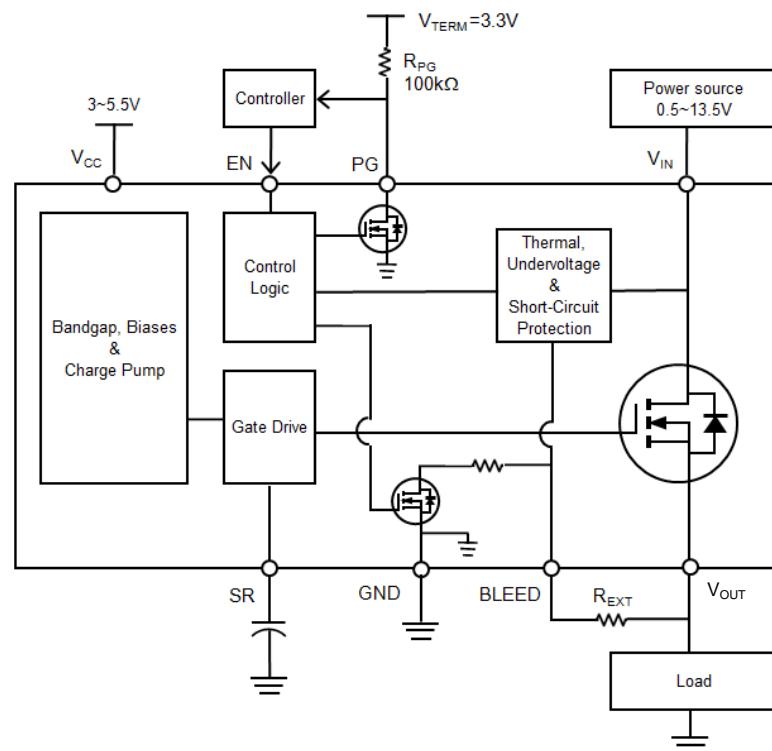


LS39 = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Last Two Digits of Year (ex: 18 = 2018)
 WW = Week Code (01 to 53)

Functional Block Diagram



Application Circuit



Absolute Maximum Ratings

Parameter	Rating
V_{IN} , BLEED, V_{OUT} to GND	-0.3V to 18V
EN, V_{CC} , SR, PG to GND	-0.3V to 6V
I_{MAX}	20A
Junction Temperature (T_J)	+150°C
Storage Temperature (T_S)	-65°C to +150°C

Recommended Operating Ranges

Parameter	Rating
Supply Voltage (V_{CC})	3V to 5.5V
Input Voltage (V_{IN})	0.5V to 13.5V
Ambient Temperature (T_A)	-40°C to +85°C
Package Thermal Resistance (θ_{JC})	3.5°C/W
Package Thermal Resistance (θ_{JA})	30°C/W

Electrical Characteristics ($T_J = +25^\circ C$, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage	—	0.5	—	13.5	V
V_{CC}	Supply Voltage	—	3.0	—	5.5	V
I_{DYN}	V _{CC} Dynamic Supply Current	$V_{EN} = V_{CC} = 3V, V_{IN} = 12V$	—	310	400	µA
		$V_{EN} = V_{CC} = 5.5V, V_{IN} = 1.8V$	—	510	750	µA
I_{STBY}	V _{CC} Shutdown Supply Current	$V_{CC} = 3V, V_{EN} = 0V$	—	0.1	1	µA
		$V_{CC} = 5.5V, V_{EN} = 0V$	—	0.1	2	µA
V_{ENH}	EN High Level Voltage	$V_{CC} = 3V$ to 5.5V	2.0	—	—	V
V_{ENL}	EN Low Level Voltage	$V_{CC} = 3V$ to 5.5V	—	—	0.8	V
R_{BLEED}	Bleed Resistance	$V_{CC} = 3V, V_{EN} = 0V$	86	108	130	Ω
		$V_{CC} = 5.5V, V_{EN} = 0V$	64	80	100	Ω
I_{BLEED}	Bleed Pin Leakage Current	$V_{CC} = V_{EN} = 3V, V_{IN} = 1.8V$	—	20	45	µA
		$V_{CC} = V_{EN} = 3V, V_{IN} = 12V$	—	50	70	µA
V_{PGL}	PG Output Low Voltage	$V_{CC} = 3V; I_{SINK} = 5mA$	—	—	0.2	V
I_{PG}	PG Output Leakage Current	$V_{CC} = 3V; V_{TERM} = 3.3V$	—	—	100	nA
Switching Device						
R_{ON}	Switch On-State Resistance	$V_{CC} = 3.3V, V_{IN} = 1.8V$	—	6.1	9	mΩ
		$V_{CC} = 3.3V, V_{IN} = 5V$	—	5.9	8	mΩ
		$V_{CC} = 3.3V, V_{IN} = 12V$	—	5.8	8	mΩ
		$V_{CC} = 5V, V_{IN} = 1.8V$	—	4.8	7	mΩ
		$V_{CC} = 5V, V_{IN} = 5V$	—	4.8	7	mΩ
		$V_{CC} = 5V, V_{IN} = 12V$	—	4.8	7	mΩ
I_{LEAK}	Input Shutdown Supply Current	$V_{EN} = 0V, V_{IN} = 13.5V$	—	—	1	µA
R_{PDEN}	EN Pull Down Resistance	—	76	100	124	kΩ
Fault Protection						
OTP	Thermal Shutdown Threshold	$V_{CC} = 3V$ to 5.5V	—	145	—	°C
OTP _{HYS}	Thermal Shutdown Hysteresis	$V_{CC} = 3V$ to 5.5V	—	20	—	°C
UVLO	V_{IN} Lockout Threshold	$V_{CC} = 3V$	0.25	0.35	0.45	V
UVLO _{HYS}	V_{IN} Lockout Hysteresis	$V_{CC} = 3V$	20	40	70	mV
SCP	Short-Circuit Protection Threshold	$V_{CC} = 3.3V; V_{IN} = 0.5V$	180	265	350	mV
		$V_{CC} = 3.3V; V_{IN} = 13.5V$	100	285	500	mV

Switching Characteristics ($T_J = +25^\circ\text{C}$, $V_{TERM} = V_{CC}$; $R_{PG} = 100\text{k}\Omega$; $R_L = 10\Omega$; $C_L = 0.1\mu\text{F}$, unless otherwise specified).

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_{IN} = 1.8\text{V}$						
t_{ON}	Output Turn-On Delay time	$V_{CC}=3.3\text{V}$	—	375	—	μs
		$V_{CC}=5\text{V}$	—	370	—	
t_{OFF}	Output Turn-Off Delay time	$V_{CC}=3.3\text{V}$	—	0.5	—	μs
		$V_{CC}=5\text{V}$	—	0.5	—	
$t_{PG,ON}$	Power Good Turn-on Time	$V_{CC}=3.3\text{V}$	—	1.4	—	ms
		$V_{CC}=5\text{V}$	—	1.3	—	
$t_{PG,OFF}$	Power Good Turn-off Time	$V_{CC}=3.3\text{V}$	—	10	—	ns
		$V_{CC}=5\text{V}$	—	6	—	
SR	Output Slew Rate	$V_{CC}=3.3\text{V}$	—	9	—	kV/s
		$V_{CC}=5\text{V}$	—	9	—	
$V_{IN} = 12\text{V}$						
t_{ON}	Output Turn-On Delay time	$V_{CC}=3.3\text{V}$	—	340	—	μs
		$V_{CC}=5\text{V}$	—	330	—	
t_{OFF}	Output Turn-Off Delay time	$V_{CC}=3.3\text{V}$	—	0.5	—	μs
		$V_{CC}=5\text{V}$	—	0.4	—	
$t_{PG,ON}$	Power Good Turn-on Time	$V_{CC}=3.3\text{V}$	—	1.6	—	ms
		$V_{CC}=5\text{V}$	—	1.5	—	
$t_{PG,OFF}$	Power Good Turn-off Time	$V_{CC}=3.3\text{V}$	—	10	—	ns
		$V_{CC}=5\text{V}$	—	8	—	
SR	Output Slew Rate	$V_{CC}=3.3\text{V}$	—	30	—	kV/s
		$V_{CC}=5\text{V}$	—	31	—	

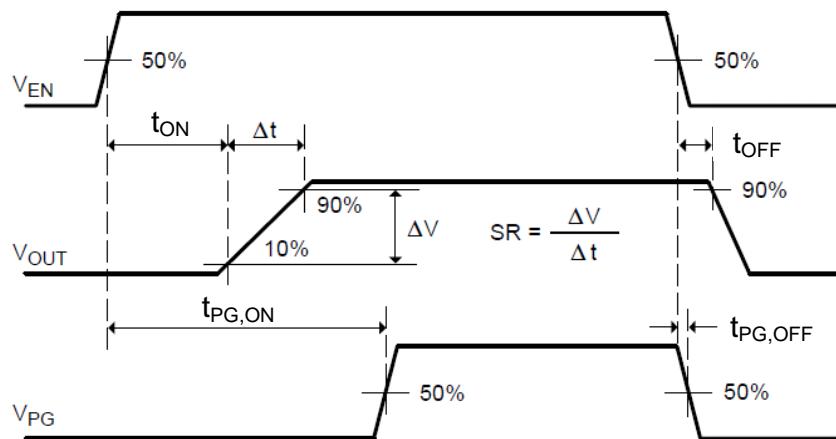
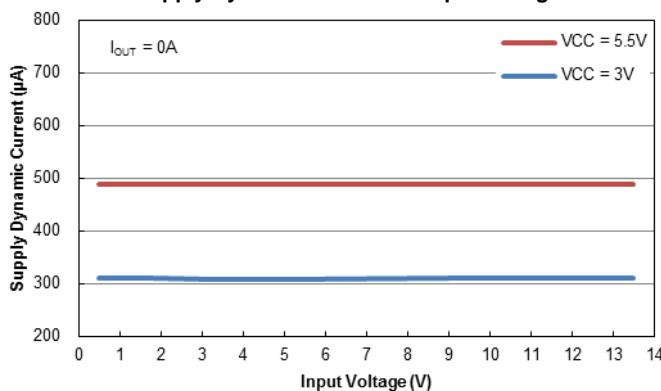


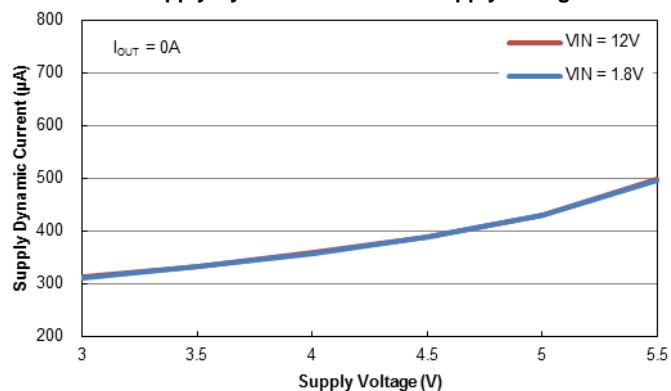
Figure 1 Timing Diagram

Performance Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

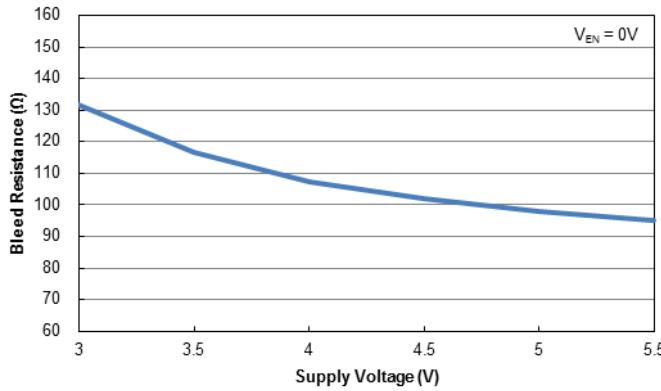
Supply Dynamic Current vs. Input Voltage



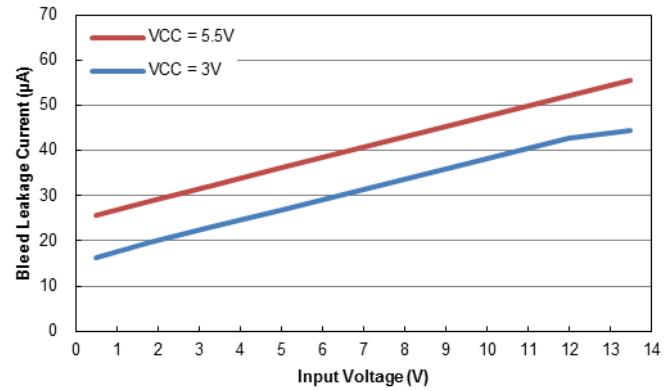
Supply Dynamic Current vs. Supply Voltage



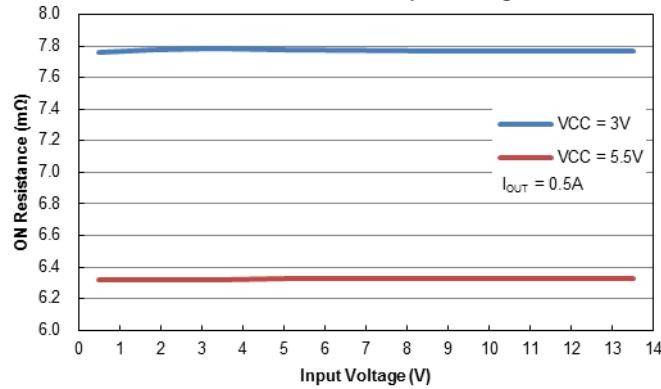
Bleed Resistance vs. Supply Voltage



Bleed Leakage Current vs. Input Voltage



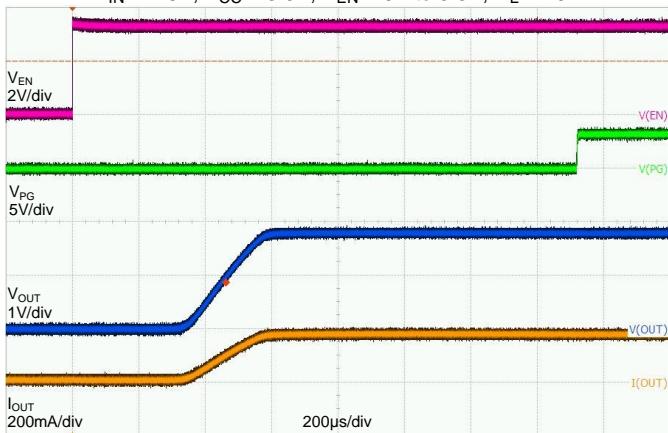
ON Resistance vs. Input Voltage



Performance Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified. Cont.)

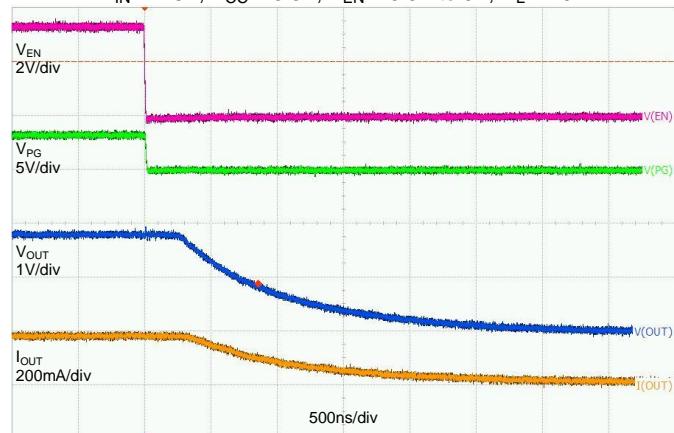
Turn ON Response

$V_{IN} = 1.8\text{V}$, $V_{CC} = 3.3\text{V}$, $V_{EN} = 0\text{V}$ to 3.3V , $R_L = 10\Omega$



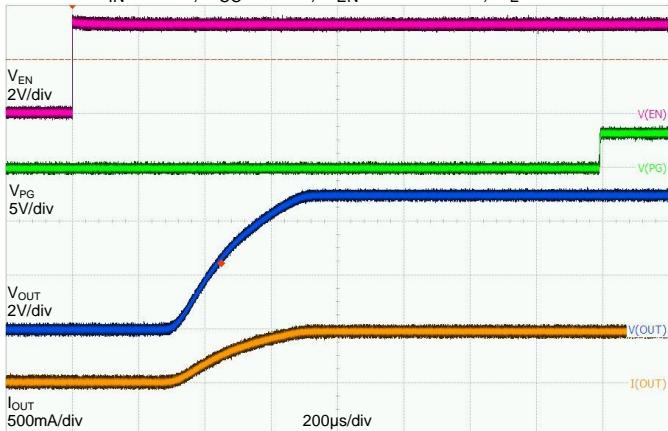
Turn OFF Response

$V_{IN} = 1.8\text{V}$, $V_{CC} = 3.3\text{V}$, $V_{EN} = 3.3\text{V}$ to 0V , $R_L = 10\Omega$



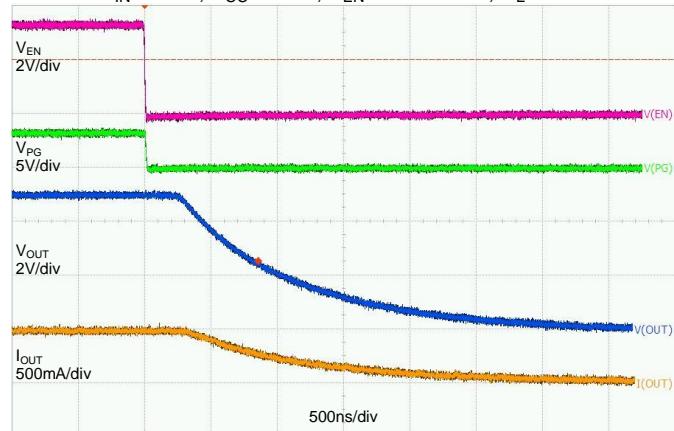
Turn ON Response

$V_{IN} = 5.0\text{V}$, $V_{CC} = 3.3\text{V}$, $V_{EN} = 0\text{V}$ to 3.3V , $R_L = 10\Omega$



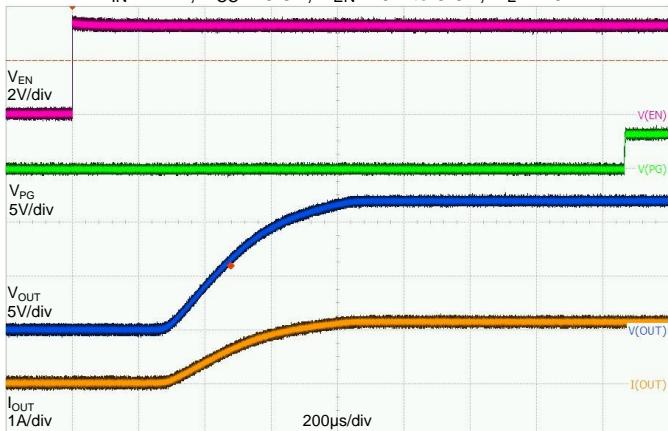
Turn OFF Response

$V_{IN} = 5.0\text{V}$, $V_{CC} = 3.3\text{V}$, $V_{EN} = 3.3\text{V}$ to 0V , $R_L = 10\Omega$



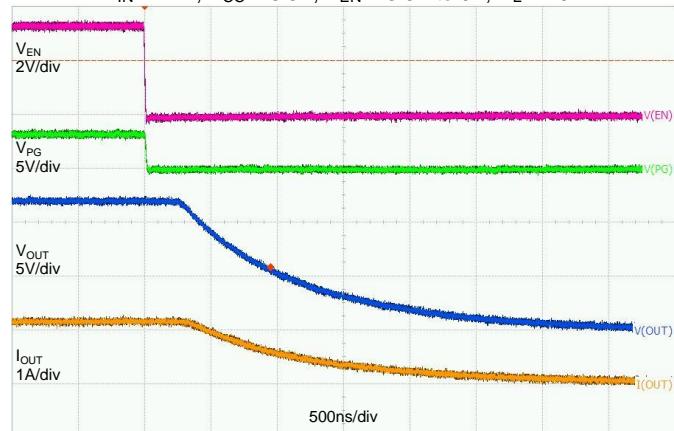
Turn ON Response

$V_{IN} = 12\text{V}$, $V_{CC} = 3.3\text{V}$, $V_{EN} = 0\text{V}$ to 3.3V , $R_L = 10\Omega$



Turn OFF Response

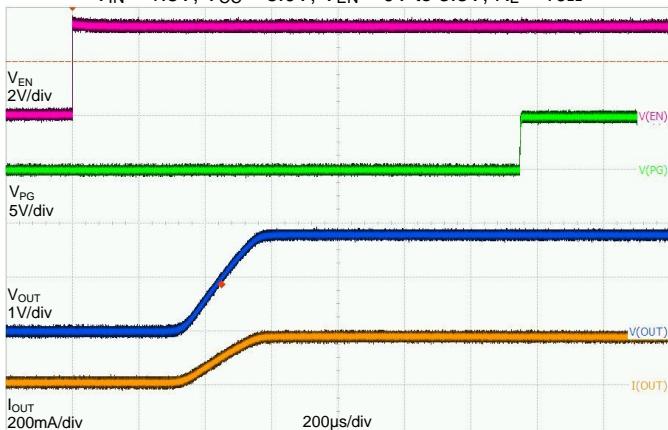
$V_{IN} = 12\text{V}$, $V_{CC} = 3.3\text{V}$, $V_{EN} = 3.3\text{V}$ to 0V , $R_L = 10\Omega$



Performance Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified. Cont.)

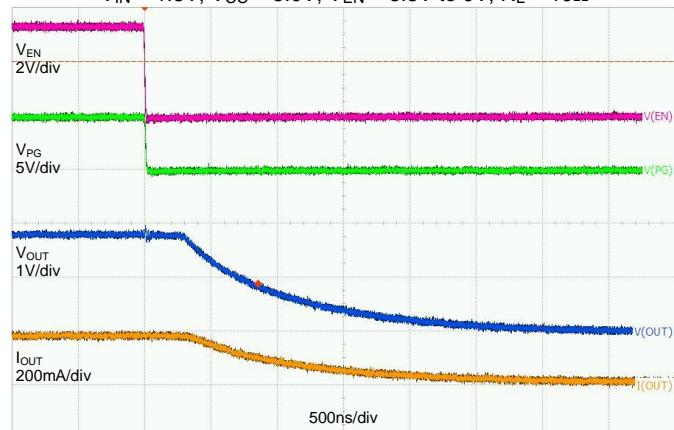
Turn ON Response

$V_{IN} = 1.8\text{V}$, $V_{CC} = 5.0\text{V}$, $V_{EN} = 0\text{V}$ to 3.3V , $R_L = 10\Omega$



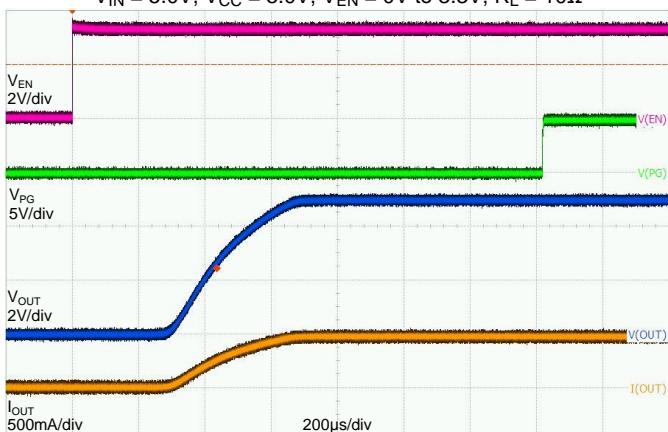
Turn OFF Response

$V_{IN} = 1.8\text{V}$, $V_{CC} = 5.0\text{V}$, $V_{EN} = 3.3\text{V}$ to 0V , $R_L = 10\Omega$



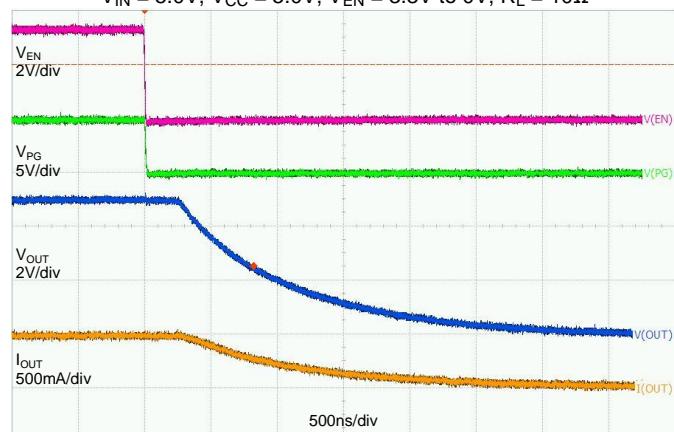
Turn ON Response

$V_{IN} = 5.0\text{V}$, $V_{CC} = 5.0\text{V}$, $V_{EN} = 0\text{V}$ to 3.3V , $R_L = 10\Omega$



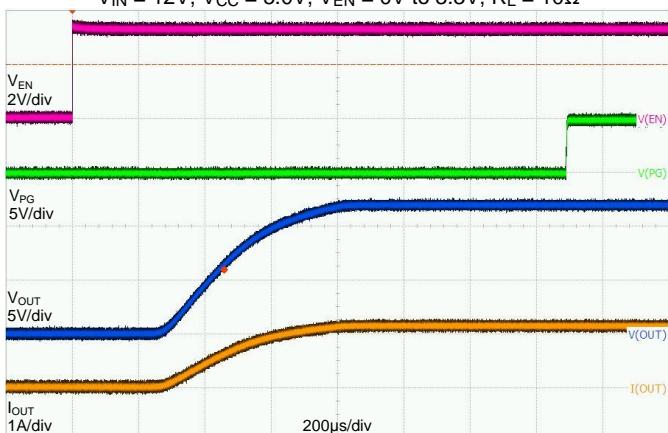
Turn OFF Response

$V_{IN} = 5.0\text{V}$, $V_{CC} = 5.0\text{V}$, $V_{EN} = 3.3\text{V}$ to 0V , $R_L = 10\Omega$



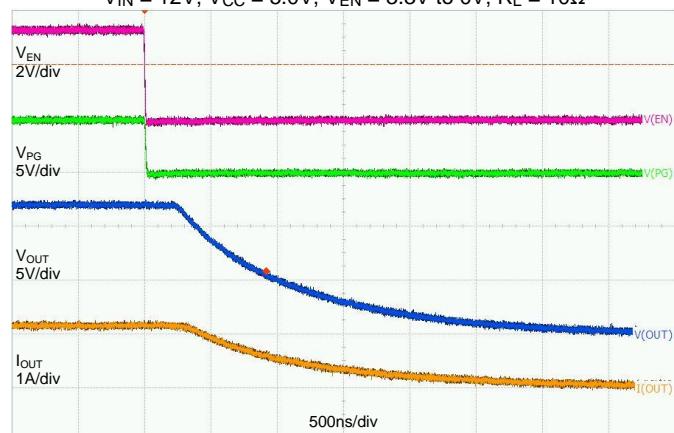
Turn ON Response

$V_{IN} = 12\text{V}$, $V_{CC} = 5.0\text{V}$, $V_{EN} = 0\text{V}$ to 3.3V , $R_L = 10\Omega$



Turn OFF Response

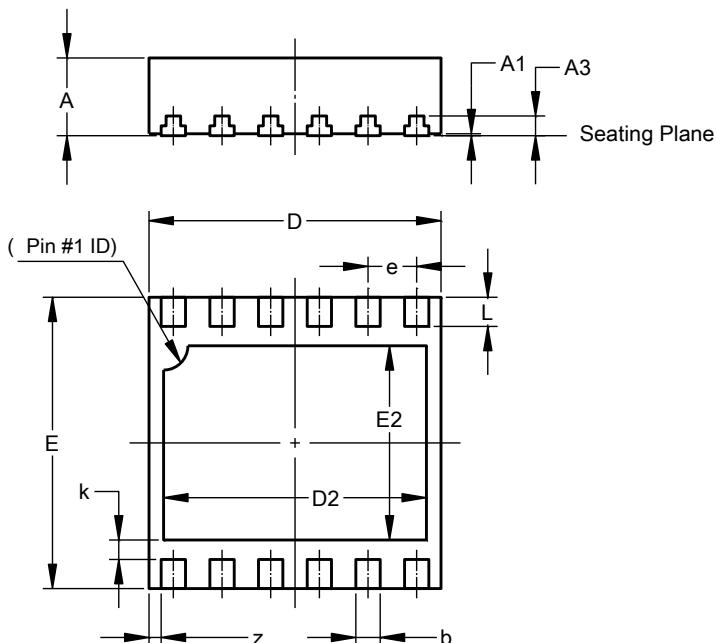
$V_{IN} = 12\text{V}$, $V_{CC} = 5.0\text{V}$, $V_{EN} = 3.3\text{V}$ to 0V , $R_L = 10\Omega$



Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

V-DFN3030-12 (Type B)



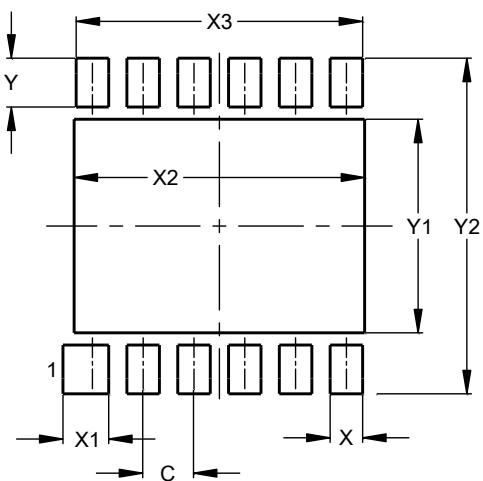
V-DFN3030-12 Type B			
Dim	Min	Max	Typ
A	0.77	0.85	0.80
A1	0.00	0.05	0.02
A3	--	--	0.203
b	0.20	0.30	0.25
D	2.95	3.05	3.00
D2	2.60	2.80	2.70
E	2.95	3.05	3.00
E2	1.90	2.10	2.00
e	0.50BSC		
k	--	--	0.20
L	0.25	0.35	0.30
z	--	--	0.125

All Dimensions in mm

Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

V-DFN3030-12 (Type B)



Dimensions	Value (in mm)
C	0.50
X	0.32
X1	0.45
X2	2.86
X3	2.82
Y	0.48
Y1	2.10
Y2	3.30

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