DEMO MANUAL DC1926A

Dual Ideal Diode Controller

DESCRIPTION

Demonstration circuit 1926A features the LTC4353, a dual low voltage ideal diode controller, in a typical 12A application. The LTC4353 creates two near-ideal diodes using external N-channel MOSFETs thereby replacing high power Schottky diodes and their associated heat sinks. Ideal diodes enable low loss power ORing and supply holdup applications.

Design files for this circuit board are available at http://www.linear.com/demo

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	V_{IN1} and V_{IN2} Input Voltage Operating Range	 With External V_{CC} Supply	2.9 0		18 V_{CC}	V
$V_{CC(EXT)}$	V_{CC} External Supply Operating Range	V_{IN1}, $V_{IN2} \leq V_{CC}$	2.9		6.0	V
$V_{CC(REG)}$	V_{CC} Regulated Voltage		4.5	5	5.5	V
$V_{CC(UVLO)}$	V_{CC} Undervoltage Lockout Threshold	V_{CC} Rising	2.3	2.55	2.7	V
V_{FR}	Forward Regulation Voltage ($V_{IN} - V_{OUT}$)	V_{IN} =1.2V, V_{CC} = 5V V_{IN} =12V	2 2	12 25	25 50	mV mV
ΔV_{GATE}	MOSFET Gate Drive (GATE-V_{IN})	V_{FWD} = 0.2V; I = 0, –1µA; Highest V_{IN} = 12V V_{FWD} = 0.2V; I = 0, –1µA; Highest V_{IN} = 2.9V	10 4.5	12 7	14 9	V V
I_{GATE}	GATE1, GATE2 Fast Pull-Up Current GATE1, GATE2 Fast Pull-Down Current GATE1, GATE2 Off Pull-Down Current	V_{FWD} = 0.4V, ΔV_{GATE} = 0, CPO=17V V_{FWD} = –0.8V, ΔV_{GATE} = 5V, Corresponding $\overline{EN}$ = 1V, ΔV_{GATE} = 2.5V	–0.9 0.9 65	–1.4 1.4 110	–1.9 1.9 160	A A µA
$V_{EN(TH)}$	$\overline{EN1}$, $\overline{EN2}$ Threshold Voltage	$\overline{EN}$ Falling	580	600	620	mV
$\Delta V_{GATE(ON)}$	MOSFET On-Detect Threshold (GATE-V_{IN})	$\overline{ONST}$ Pulls Low	0.28	0.7	1.1	V
I_{OUT}	Maximum Continuous Load Current for Si4126DY	Limited by 0.6W power dissipation with maximum voltage regulation 50mV			12	A

OPERATING PRINCIPLES

The LTC4353 regulates the forward voltage drop across the external MOSFETs to ensure smooth current transfer in diode-OR applications. A fast turn-on reduces the load voltage droop during supply switchover. If the input supply fails or is shorted, a fast turn-off minimizes reverse current transients. The controller operates with rail voltages from 2.9V to 18V. Operation with rail voltages below 2.9V requires an additional supply of 2.9V to 6.0V at the V_{CC} pin.

The LTC4353 indicates the on state of each MOSFET with the $\overline{ONST1}$ and $\overline{ONST2}$ pin signals, when the gate voltage is at least 0.7V higher than V_{IN}. Two enable pins ($\overline{EN1}$, $\overline{EN2}$) allow activating or blocking each MOSFET channel individually.

Green LEDs ON1 and ON2 indicate the state of the associated MOSFET.

QUICK START PROCEDURE

Demonstration circuit DC1926A is easy to set up to evaluate the performance of the LTC4353. Controller performance can be verified over the full operating range of 2.9V to 18V.

The installed MOSFETs in the SO-8 package are located on the top side of the board. Provision is made on the bottom side for using an additional SO-8 MOSFET in parallel with the MOSFET on the top side. To extend current capability the unstuffed PCB footprint (bottom side) also supports the D2PAK package.

The DC1926A test includes two parts: Ideal Diode Test and Ideal Diode-ORing test.

Ideal Diode Test

1. Connect a 12V power supply to V_{IN1}(+) and GND (–) of the DC1926A. Place a millivoltmeter between the input (V_{IN1}) and output (OUT1) turrets (refer to the diagram of Figure 1). This is the controller regulation voltage. The regulation voltage should be in the range of 2mV to 50mV.
2. LED1 should be illuminated.
3. Repeat the test with the second channel (V_{IN2}, OUT2).
4. Record regulation voltage values.

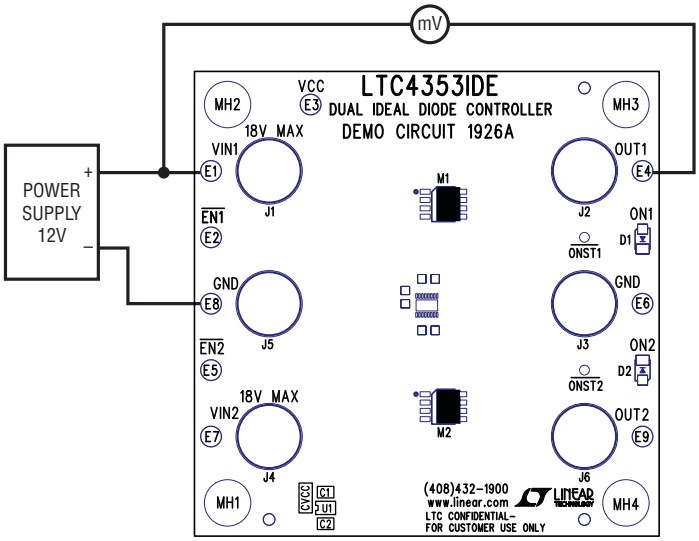


Figure 1. Ideal Diode Regulation Voltage Measurement

QUICK START PROCEDURE

Ideal Diode-ORing Test

1. Connect two identical power supplies adjusted to +12V to V_{IN1} and V_{IN2} inputs and provide a load to the parallel connected OUT1 and OUT2 turrets (refer to the diagram of Figure 2). The output load current should not exceed 12A for continuous operation.
2. The steady state operation of the Ideal Diode ORing circuit is defined by the following parameters:

   $-V_{DS(ON)}$ is the voltage drop of the MOSFET $R_{DS(ON)}$ under maximum load current. This is measured by using only the power supply of the channel under test with the load connected and the measurement between V_{IN} and OUTPUT. Record $V_{DS(ON)}$;

   $-\Delta V_{REG}$ is the absolute value of the differences in voltage recorded in step 4 above;

   $-\Delta_{SUPPLIES}$ is the difference of the power supply output voltages.
3. Adjust the voltage of the power supply connected to $[\Delta_{SUPPLIES}-\Delta V_{REG}] > V_{DS(ON)} > 0$. The power supply will provide all of the current to the load. The LED associated with this channel will be illuminated
4. Adjust the voltage of the power supply to $V_{DS(ON)} > [\Delta_{SUPPLIES}-\Delta V_{REG}] > 0$. The supply with the higher voltage will supply most of the current to the load, while the supply with the lower voltage will supply less current. Both LEDs diodes will be illuminated because both channels are providing current to the load.

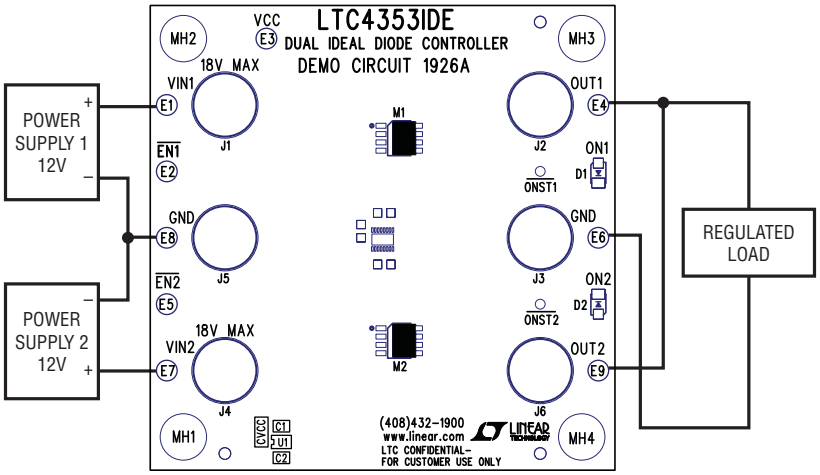
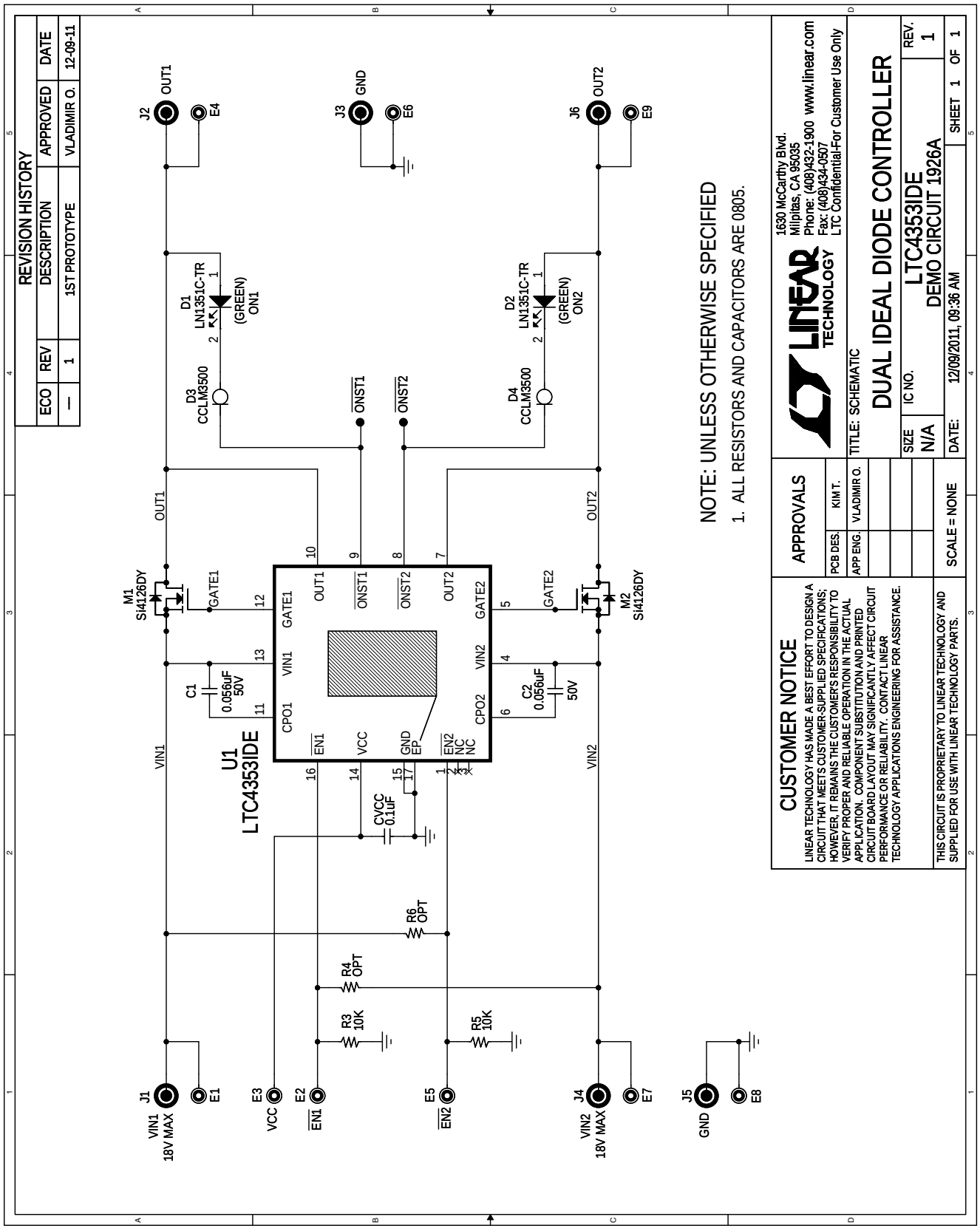


Figure 2. Ideal Diode ORing Operation

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	CVCC	Cap., X7R, 0.1µF 50V 10%, 0805	AVX, 08055C104KAT2A
2	2	C1, C2	Cap., X7R, 0.056µF 50V 10%, 0805	AVX, 08055C563KAT2A
3	2	D1, D2	LED, GREEN	Panasonic, LN1351C-TR
4	2	D3, D4	Diode, Current Limiting, 3.2V, SOD-80	Central Semi. Corp., CMJ3500-TR
5	9	E1-E9	Turret, 0.064"	Mill Max, 2308-2-00-80-00-00-07-0
6	6	J1, J2, J3, J4, J5, J6	Connector, Banana Jack	Keystone, 575-4
7	2	M1, M2	MOSFET, N-Channel, 30V, SO8-POWERPAK	Vishay, Si4126DY
8	2	R3, R5	Resistor, Chip 10k 0.1W 5%,0805	Vishay, CRCW080510K0JNEA
9	0	R4, R6	Resistor, 0805	TBD
10	1	U1	I.C., Dual Ideal Diode, DFN16DE-4 × 3	Linear Technology, LTC4353IDE

SCHEMATIC DIAGRAM



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