IR2154

SELF-OSCILLATING HALF-BRIDGE DRIVER

Features

- Integrated 600V half-bridge gate driver
- 15.6V zener clamp on Vcc
- True micropower start up
- Tighter initial deadtime control
- Low temperature coefficient deadtime
- Shutdown feature (1/6th Vcc) on C_T pin
- Increased undervoltage lockout Hysteresis (1V)
- Lower power level-shifting circuit
- Constant LO, HO pulse widths at startup
- Lower di/dt gate driver for better noise immunity
- High side output in phase with RT
- Excellent latch immunity on all inputs and outputs
- ESD protection on all leads

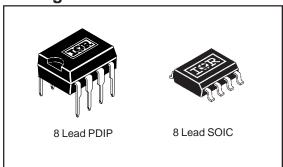
Description

The IR2154 is an improved version of the popular IR2152 gate driver IC, and incorporates a high voltage half-bridge gate driver with a front end oscillator similar to the industry standard CMOS 555 timer. The IR2154 provides more functionality and is easier to use than previous ICs. A shutdown feature has been designed into the C_T pin, so that both gate driver outputs can be disabled using a low voltage control signal. In addition, the gate driver output pulse widths are the same once the rising undervoltage lockout threshold on VCC has been reached, resulting in a more stable profile of frequency vs time at startup. Noise immunity has been improved significantly, both by lowering the peak di/dt of the gate drivers, and by increasing the undervoltage lockout hysteresis to 1V. Finally, special attention has been payed to maximizing the latch immunity of the device, and providing comprehensive ESD protection on all pins.

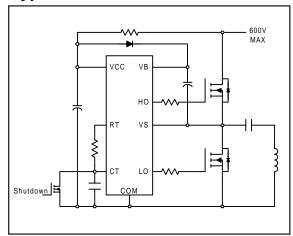
Product Summary

| Voffset | 600V max. |
|--------------------------------|-----------|
| Duty Cycle | 50% |
| T _r /T _p | 80/40ns |
| V_{clamp} | 15.6V |
| Deadtime (typ.) | 1.2 µs |

Packages



Typical Connection



Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM, all currents are defined positive into any lead. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

| Symbol | Definition | Min. | Max. | Units | |
|---------------------|--|---------------|---------------------|-----------------------|--------|
| V _B | High side floating supply voltage | | -0.3 | 625 | |
| Vs | High side floating supply offset voltage | | V _B - 25 | V _B + 0.3 | |
| Vно | High side floating output voltage | | Vs - 0.3 | V _B + 0.3 | ., |
| V _{LO} | Low side output voltage | | -0.3 | V _{CC} + 0.3 | V |
| V _{RT} | R _T pin voltage | | -0.3 | V _{CC} + 0.3 | |
| V _{CT} | C _T pin voltage | | -0.3 | V _{CC} + 0.3 | |
| Icc | Supply current (note 1) | | _ | 25 | mA |
| I _{RT} | R _T pin current | | -5 | 5 | i iiiA |
| dV _S /dt | Allowable offset voltage slew rate | | -50 | 50 | V/ns |
| PD | Maximum power dissipation @ T _A ≤ +25°C | (8 Lead DIP) | _ | 1.0 | W |
| | | (8 Lead SOIC) | _ | 0.625 | , vv |
| RthJA | Thermal resistance, junction to ambient (8 Lead DIP) (8 Lead SOIC) | | _ | 125 | 90044 |
| | | | _ | 200 | °C/W |
| TJ | Junction temperature | | -55 | 150 | |
| TS | Storage temperature | | -55 | 150 | °C |
| TL | Lead temperature (soldering, 10 seconds) | | _ | 300 | |

Recommended Operating Conditions

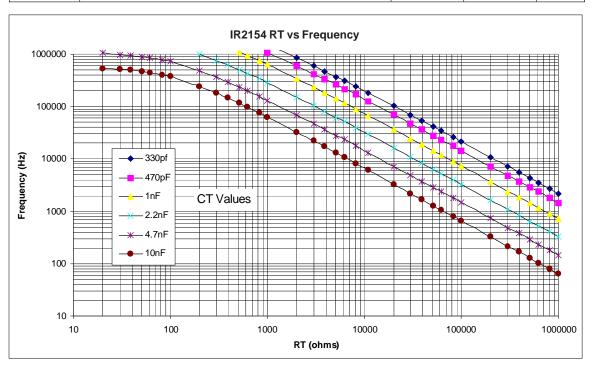
For proper operation the device should be used within the recommended conditions.

| Symbol | Definition | Min. | Max. | Units |
|-----------------|---|-----------------------|--------------------|-------|
| V _{Bs} | High side floating supply voltage | V _{CC} - 0.7 | V _{CLAMP} | |
| Vs | Steady state high side floating supply offset voltage | -3.0 (note 2) | 600 | V |
| Vcc | Supply voltage | 10 | VCLAMP | |
| Icc | Supply current | (note 3) | 5 | mA |
| TJ | Junction temperature | -40 | 125 | °C |

- Note 1: This IC contains a zener clamp structure between the chip V_{CC} and COM which has a nominal breakdown voltage of 15.6V. Please note that this supply pin should not be driven by a DC, low impedance power source greater than the V_{CLAMP} specified in the Electrical Characteristics section.
- Note 2: Care should be taken to avoid output switching conditions where the V_S node flies inductively below ground by more than 5V.
- Note 3: Enough current should br supplied to the V_{CC} pin of the IC to keep the internal 15.6V zener diode clamping the voltage at this pin.

Recommended Component Values

| Symbol | Component | Min. | Max. | Units |
|----------------|------------------------------------|------|------|-------|
| R _T | Timing resistor value | 10 | _ | kΩ |
| C _T | C _T pin capacitor value | 330 | _ | pF |



Electrical Characteristics

 V_{BIAS} (V_{CC} , V_{BS}) = 12V, C_L = 1000 pF, C_T = 1 nF and T_A = 25°C unless otherwise specified. The V_{IN} , V_{TH} and I_{IN} parameters are referenced to COM. The V_O and I_O parameters are referenced to COM and are applicable to the respective output leads: HO or LO.

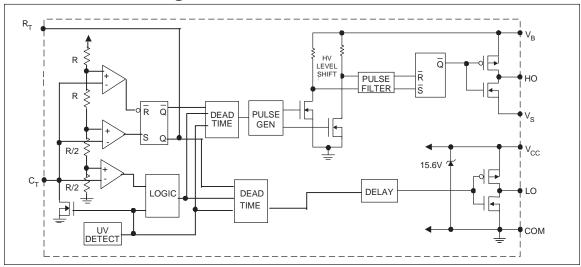
| Low Voltage Supply Characteristics | | | | | | |
|------------------------------------|--|------|------|------|-------|------------------------|
| Symbol | Definition | Min. | Тур. | Max. | Units | Test Conditions |
| V _{CCUV+} | Rising V _{CC} undervoltage lockout threshold | 8.1 | 9.0 | 9.9 | | |
| V _{CCUV} - | Falling V _{CC} undervoltage lockout threshold | 7.2 | 8.0 | 8.8 | V | |
| VCCUVH | V _{CC} undervoltage lockout Hysteresis | 0.5 | 1.0 | 1.5 | Ī | |
| IQCCUV | Micropower startup V _{CC} supply current | _ | 75 | 150 | μА | Vcc ≤ Vccuv- |
| IQCC | Quiescent V _{CC} supply current | _ | 500 | 950 | - μΛ | |
| VCLAMP | V _{CC} zener clamp voltage | 14.4 | 15.6 | 16.8 | V | I _{CC} = 5mA |

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Electrical Characteristics (cont.)

| Floating | Floating Supply Characteristics | | | | | | |
|--------------------|--|------------|-------|------|--------|--|--|
| Symbol | Definition | Min. | Тур. | Max. | Units | Test Conditions | |
| I _{QBSUV} | Micropower startup V _{BS} supply current | _ | 0 | 10 | ^ | V _{CC} ≤ V _{CCUV} - | |
| I _{QBS} | Quiescent VBS supply current | <u> </u> | 30 | 50 | μΑ | | |
| V _{BSMIN} | Minimum required V _{BS} voltage for proper | _ | 4.0 | 5.0 | V | V _{CC} =V _{CCUV+} + 0.1V | |
| | functionality from R _T to HO | | | | | | |
| I _{LK} | Offset supply leakage current | _ | _ | 50 | μΑ | $V_{B} = V_{S} = 600V$ | |
| | tor I/O Characteristics | | | | | | |
| Symbol | Definition | Min. | Тур. | Max. | Units | Test Conditions | |
| fosc | Oscillator frequency | 19.4 | 20 | 20.6 | kHz | $R_T = 36.9k\Omega$ | |
| | | 94 | 100 | 106 | KIZ | $RT = 7.43k\Omega$ | |
| d | RT pin duty cycle | 48 | 50 | 52 | % | fo < 100kHz | |
| I _{CT} | C _T pin current | _ | 0.001 | 1.0 | uA | | |
| I _{CTUV} | UV-mode CT pin pulldown current | 0.30 | 0.70 | 1.2 | mA | V _{CC} = 7V | |
| VcT+ | Upper CT ramp voltage threshold | _ | 8.0 | _ | | | |
| Vст- | Lower C _T ramp voltage threshold | _ | 4.0 | _ | V | | |
| VCTSD | CT voltage shutdown threshold | 1.8 | 2.1 | 2.4 | Ī | | |
| V _{RT+} | High-level RT output voltage, VCC - VRT | _ | 10 | 50 | | I _{RT} = 100μA | |
| | | _ | 100 | 300 | | $I_{RT} = 1mA$ | |
| V _{RT} - | Low-level R _T output voltage | _ | 10 | 50 | | I _{RT} = 100μA | |
| | | - | 100 | 300 | mV | $I_{RT} = 1mA$ | |
| VRTUV | UV-mode R⊤ output voltage | _ | 0 | 100 |] IIIV | V _{CC} ≤ V _{CCUV} - | |
| VRTSD | SD-Mode RT output voltage, VCC - VRT | _ | 10 | 50 | | $I_{RT} = 100 \mu A$, | |
| | | | | | | $V_{CT} = 0V$ | |
| | | _ | 10 | 300 | | $I_{RT} = 1mA$, | |
| | | | | | | $V_{CT} = 0V$ | |
| Gate Di | river Output Characteristics | | | | | | |
| Symbol | Definition | Min. | Тур. | Max. | Units | Test Conditions | |
| V _{OH} | High level output voltage, V _{BIAS} -V _O | _ | 0 | 100 | | I _O = OA | |
| VOL | Low-level output voltage, VO | <u> </u> | 0 | 100 | \/ | I _O = OA | |
| VOL_UV | UV-mode output voltage, VO | _ | 0 | 100 | mV | I _O = OA | |
| | | | | | | Vcc ≤ Vccuv- | |
| tr | Output rise time | † – | 80 | 150 | | | |
| tf | Output fall time | † – | 45 | 100 | nsec | | |
| t _{sd} | Shutdown propogation delay | † – | 660 | T — | 7 | | |
| td | Output deadtime (HO or LO) | 0.35 | 0.60 | 0.85 | μsec | | |

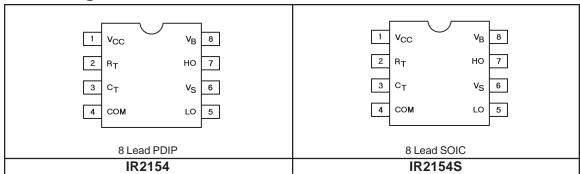
Functional Block Diagram



Lead Definitions

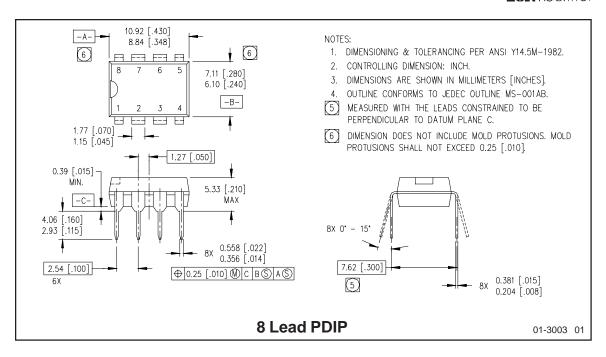
| Symbol | Description | | |
|----------------|--|--|--|
| Vcc | Logic and internal gate drive supply voltage | | |
| R _T | Oscillator timing resistor input | | |
| C _T | Oscillator timing capacitor input | | |
| COM | IC power and signal ground | | |
| LO | Low side gate driver output | | |
| Vs | High voltage floating supply return | | |
| НО | High side gate driver output | | |
| V _B | High side gate driver floating supply | | |

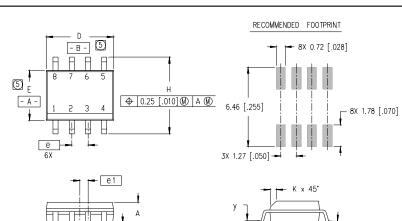
Lead Assignments



IR2154

International TOR Rectifier





0.10 [.004]

| D.I.I | INCHES | | MILLIMETERS | | |
|-------|------------|-------|-------------|-------|--|
| DIM | MIN | MAX | MIN | MAX | |
| Α | .0532 | .0688 | 1,35 | 1,75 | |
| A1 | .0040 | .0098 | 0.10 | 0.25 | |
| В | .014 | .018 | 0.36 | 0.46 | |
| С | .0075 | .0098 | 0.19 | 0.25 | |
| D | .189 | .196 | 4.80 | 4.98 | |
| Ε | .150 | .157 | 3.81 | 3.99 | |
| е | .050 BASIC | | 1.27 BASIC | | |
| e 1 | .025 BASIC | | 0.635 | BASIC | |
| Н | .2284 | .2440 | 5.80 | 6.20 | |
| K | .011 | .019 | 0.28 | 0.48 | |
| L | .016 | .050 | 0.41 | 1.27 | |
| у | 0, | 8* | 0. | 8" | |

NOTES:

- 1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
- 2. CONTROLLING DIMENSION: MILLIMETER.

A1

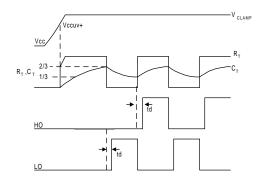
8X R

- 3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- 4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
- (5) DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS.
 MOLD PROTRUSIONS NOT TO EXCEED 0.25 [.006].
- 6 DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

8 Lead SOIC

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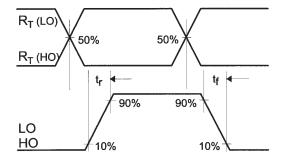


Figure 1. Input/Output Timing Diagram

Figure 2. Switching Time Waveform Definitions

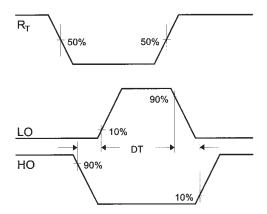


Figure 3. Deadtime Waveform Definitions

International Rectifier

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