Power Products Division

Advance Information

SELF-OSCILLATING HALF-BRIDGE DRIVER

MPIC2151

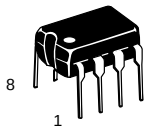
SELF–OSCILLATING HALF–BRIDGE DRIVER

The MPIC2151 is a high voltage, high speed, self–oscillating power MOSFET and IGBT driver with both high side and low side referenced output channels. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The front–end features a programmable oscillator which is similar to the 555 timer. The output drivers feature a high pulse current buffer stage and an internal deadtime designed for minimum driver cross–conduction. Propagation delays for the two channels are matched to simplify use in 50% duty cycle applications. The floating channel can be used to drive an N–channel power MOSFET or IGBT in the high side configuration that operates off a high voltage rail from 10 to 600 volts.

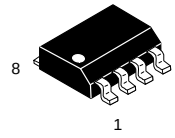
- Floating Channel Designed for Bootstrap Operation
- Fully Operational to +600 V
- Tolerant to Negative Transient Voltage
- dV/dt Immune
- Undervoltage Lockout
- Programmable Oscillator Frequency:

$$f = \frac{1}{1.4\ (RT + 75\Omega)\ CT}$$

- Matched Propagation Delay for Both Channels
- Low Side Output In Phase with RT



P SUFFIX
PLASTIC PACKAGE
CASE 626–05

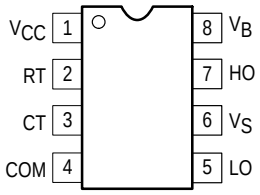


D SUFFIX
PLASTIC PACKAGE
CASE 751–05
(SO–8)

PRODUCT SUMMARY

V_{OFFSET}	600 V MAX
Duty Cycle	50%
V_{OUT}	10 – 20 V
$t_{r/f}$ (typical)	120 & 60 ns
Deadtime (typical)	1.2 μs

PIN CONNECTIONS



(TOP VIEW)

ORDERING INFORMATION

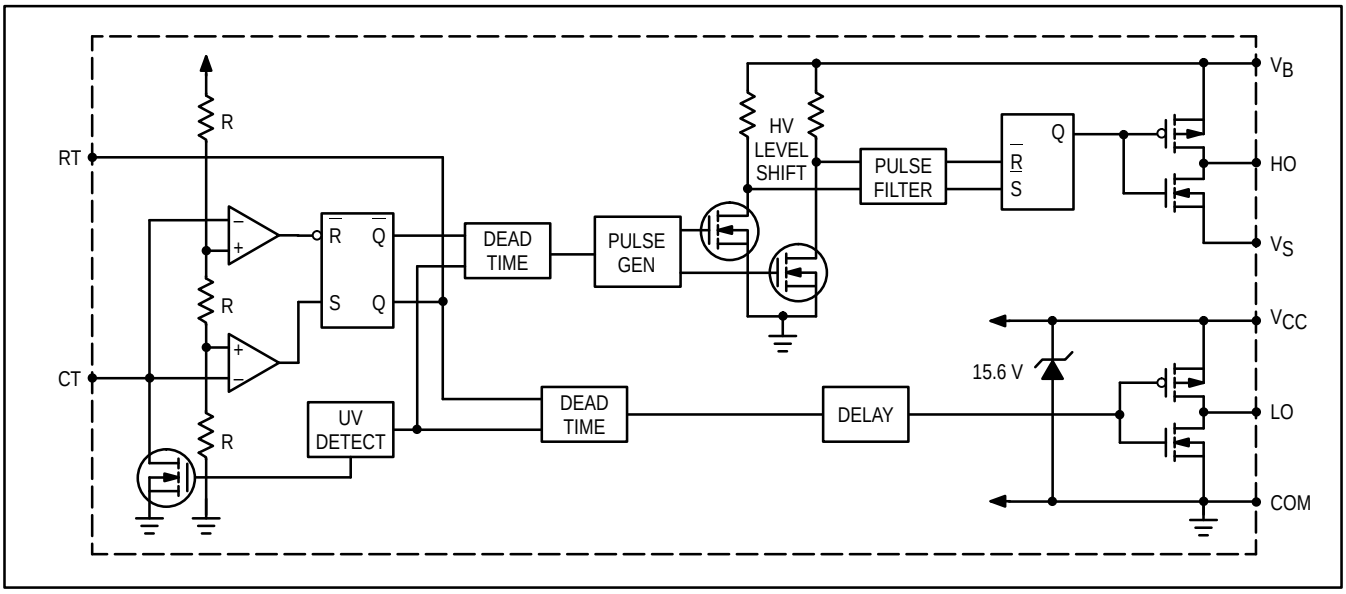
Device	Package
MPIC2151D	SOIC
MPIC2151P	PDIP

This document contains information on a new product. Specifications and information herein are subject to change without notice.

REV 1

MOTOROLA

SIMPLIFIED BLOCK DIAGRAM



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.

Rating		Symbol	Min	Max	Unit
High Side Floating Supply Absolute Voltage High Side Floating Supply Offset Voltage High Side Floating Output Voltage Low Side Output Voltage RT Voltage CT Voltage		V_B V_S V_{HO} V_{LO} V_{RT} V_{CT}	–0.3 V_B–25 V_S–0.3 –0.3 –0.3 –0.3	625 V_B+0.3 V_B+0.3 V_{CC}+0.3 V_{CC}+0.3 V_{CC}+0.3	V_{DC}
Supply Current (Note 1) High Side Output Current Low Side Output Current RT Output Current		I_{CC} I_{HO} I_{LO} I_{RT}	– –500 –500 –5.0	25 500 500 5.0	mA_{DC}
Allowable Offset Supply Voltage Transient		dV_S/dt	–	50	V/ns
*Package Power Dissipation @ $T_C \leq +25°C$	(8 Lead DIP) (8 Lead SOIC)	P_D –	– –	1.0 0.625	Watt
Operating and Storage Temperature		T_j, T_{stg}	–55	150	°C
Thermal Resistance, Junction to Ambient	(8 Lead DIP) (8 Lead SOIC)	$R_{\theta JA}$	– –	125 200	°C/W
Lead Temperature for Soldering Purposes, 10 seconds		T_L	–	260	°C

RECOMMENDED OPERATING CONDITIONS

The Input/Output logic timing Diagram is shown in Figure 1. For proper operation the device should be used within the recommended conditions.

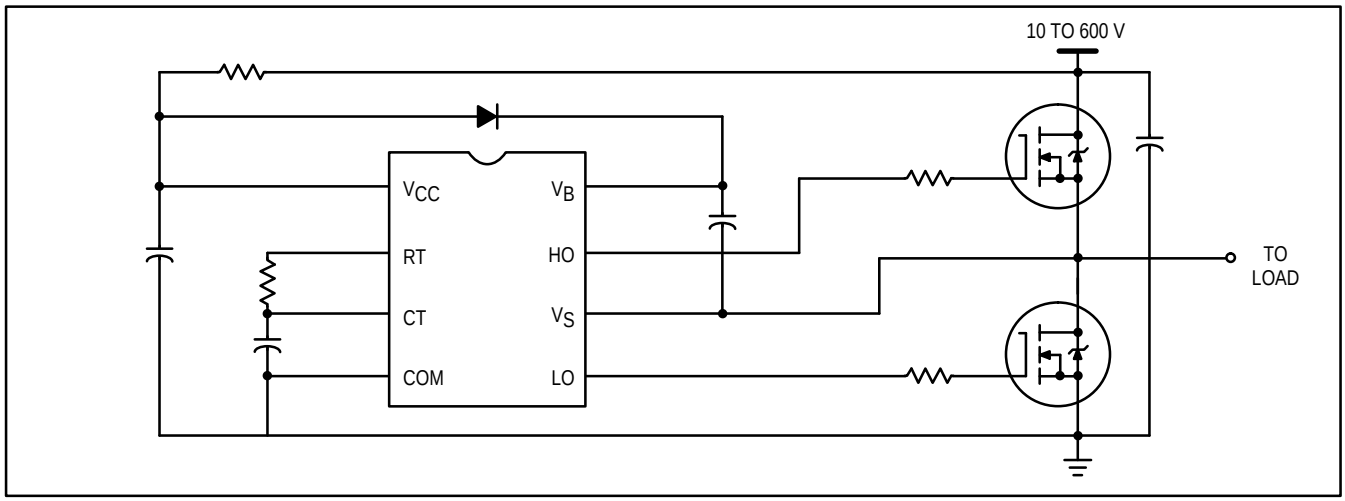
High Side Floating Supply Absolute Voltage	V_B	V_S+10	V_S+V_{clamp}	V
High Side Floating Supply Offset Voltage	V_S	–	600	
High Side Floating Output Voltage	V_{HO}	V_S	V_B	
Low Side Output Voltage	V_{LO}	0	V_{CC}	
Supply Current (Note 1)	I_{CC}	–	5.0	mA
Ambient Temperature	T_A	–40	125	°C

Note 1: Because the MPIC2151 is designed specifically for off–line supply systems, this IC contains a zener clamp structure between the chip V_{CC} and COM which has a nominal breakdown voltage of 15.6 V. Therefore, the IC supply voltage is normally derived by forcing current into the supply lead (typically by means of a high value resistor connected between the chip V_{CC} and the rectified line voltage and a local decoupling capacitor from V_{CC} to COM) and allowing the internal zener clamp circuit to determine the nominal supply voltage. Therefore, this circuit should not be driven by a DC, low impedance power source of greater than V_{CLAMP}.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)

Characteristic	Symbol	Min	Typ	Max	Unit
STATIC ELECTRICAL CHARACTERISTICS					
Supply Characteristics					
V_{BIAS} (V_{CC}, V_{BS}) = 12 V, V_{SS} = COM and C_L = 1000 pF unless otherwise specified.					
V_{CC} Supply Undervoltage Positive Going Threshold	V_{CCUV+}	–	8.4	–	V_{DC}
V_{CC} Supply Undervoltage Negative Going Threshold	$V_{CCUV–}$	–	8.0	–	
Quiescent V_{CC} Supply Current	I_{QCC}	–	400	–	µA
V_{CC} Zener Shunt Clamp Voltage @ I_{OC} = 5 mA	V_{CLAMP}	–	15.6	–	V_{DC}
Floating Supply Characteristics					
Offset Supply Leakage Current @ V_B = V_S = 600 V	I_{LK}	–	–	50	µA$_{DC}$
Quiescent V_{BS} Supply Current	I_{QBS}	–	10	–	
Oscillator I/O Characteristics					
Oscillator Frequency @ RT = 35.7 KΩ, CT = 1 nF	f_{OSC}	–	20	–	kHz
Oscillator Frequency @ RT = 7.04 KΩ, CT = 1 nF	f_{OSC}	–	100	–	
CT Input Current	I_{CT}	–	0.001	1.0	µA
CT Undervoltage Lockout @ 2.5 V < V_{CC} < V_{CCUV+}	V_{CTUV}	–	0	–	mV
RT High Level Output Voltage, V_{CC} – RT @ IRT = –100 µA @ IRT = –1 mA	V_{RT+} V_{RT+}	– –	20 200	– –	
RT Low Level Output Voltage, V_{CC} + RT @ IRT = 100 µA @ IRT = 1 mA	$V_{RT–}$ $V_{RT–}$	– –	20 200	– –	
RT Undervoltage Lockout, V_{CC} – RT @ 2.5 V < V_{CC} < V_{CCUV+}	V_{RTUV}	–	0	–	
2/3 V_{CC} Threshold	V_{CT+}	–	8.0	–	V_{DC}
1/3 V_{CC} Threshold	$V_{CT–}$	–	4.0	–	
Output Characteristics					
High Level Output Voltage, V_{BIAS}–V_O @ I_O = 0 A	V_{OH}	–	–	100	mV
Low Level Output Voltage, V_O @ I_O = 0 A	V_{OL}	–	–	100	
Dynamic Electrical Characteristics					
V_{BIAS} (V_{CC}, V_{BS}) = 12 V and C_L = 1000 pF unless otherwise specified. T_A = 25°C.					
Turn–On Rise Time	t_r	–	120	–	ns
Turn–Off Fall Time	t_f	–	60	–	
Deadtime, LS Turn–Off to HS Turn–On & HS Turn–Off to LS Turn–On	DT	–	1.2	–	µA
RT Duty Cycle, f_{OSC} = 20 kHz	DC	–	50	–	%

TYPICAL CONNECTION



LEAD DEFINITIONS

Symbol	Lead Description
RT	Oscillator timing resistor input; a resistor is connected from RT to CT. RT is in phase with LO for normal IC operation.
CT	Oscillator timing capacitor input; a capacitor is connected from CT to COM in order to program the oscillator frequency according to the following equation: $f = \frac{1}{1.4\ (RT + 75\Omega)\ CT}$ where 75Ω is the effective impedance of the R_T output stage.
V_B	High Side Floating Supply
HO	High Side Gate Drive Output
V_S	High Side Floating Supply Return
V_{CC}	Logic and Low Side Fixed Supply
LO	Low Side Gate Drive Output
COM	Logic and Low Side Return

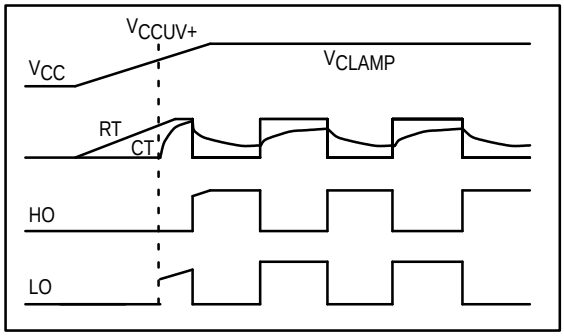


Figure 1. Input / Output Timing Diagram

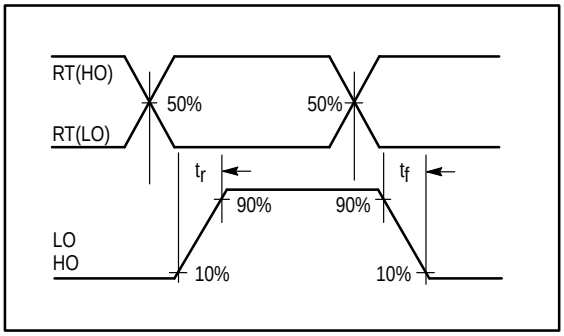


Figure 2. Switching Time Waveform Definitions

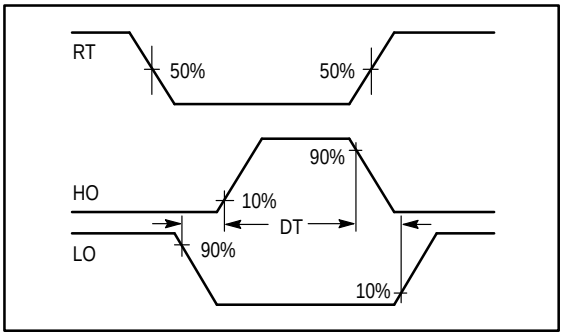
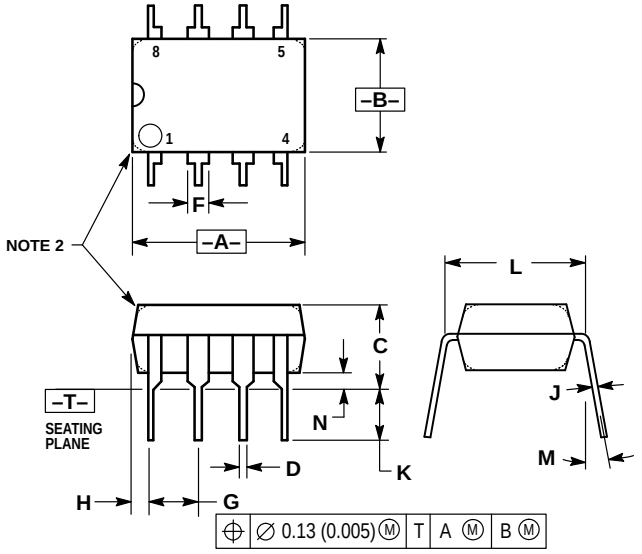


Figure 3. Deadtime Waveform Definitions

PACKAGE DIMENSIONS

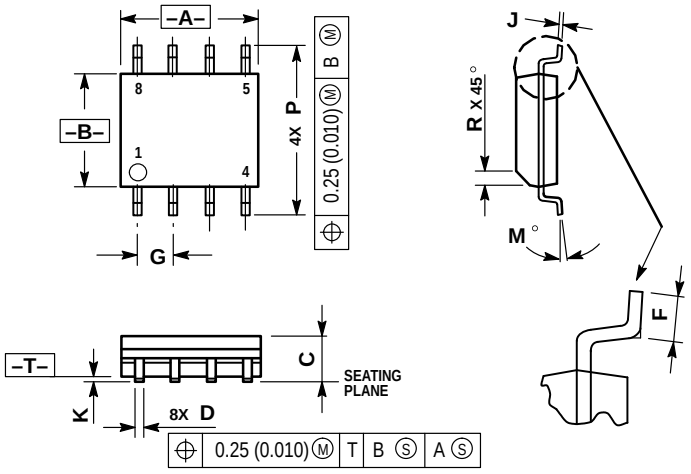


NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10°	—	10°
N	0.76	1.01	0.030	0.040

STYLE 1:
PIN 1. AC IN
2. DC + IN
3. DC – IN
4. AC IN
5. GROUND
6. OUTPUT
7. AUXILIARY
8. V_{CC}

CASE 626–05
ISSUE K



NOTES:
1. DIMENSIONS A AND B ARE DATUMS AND T IS A DATUM SURFACE.
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
3. DIMENSIONS ARE IN MILLIMETER.
4. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
6. DIMENSION D DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	4.80	5.00
B	3.80	4.00
C	1.35	1.75
D	0.35	0.49
F	0.40	1.25
G	1.27 BSC	
J	0.18	0.25
K	0.10	0.25
M	0°	7°
P	5.80	6.20
R	0.25	0.50

CASE 751–05
ISSUE P

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