IR21541

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

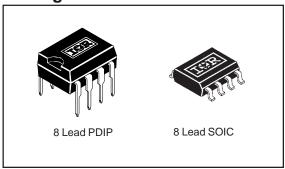
Description

The IR21541 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 IR21541 provides more functionality and is easier to use than previous ICs. A shutdown feature has been designed into the CT 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 V_{CC} 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.

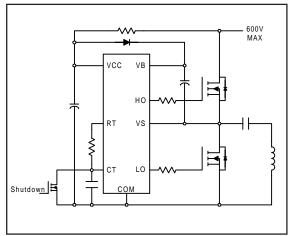
Product Summary

Voffset	600V max.
Duty Cycle	50%
T _r /T _p	80/40ns
V_{clamp}	15.6V
Deadtime (typ.)	0.6 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	
V _{HO}	High side floating output voltage		V _S - 0.3	V _B + 0.3	.,
V _{LO}	Low side output voltage		-0.3	V _{CC} + 0.3	V
V _R T	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	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
Rth _{JA}	Thermal resistance, junction to ambient (8 Lead DIP) (8 Lead SOIC)		_	125	°C/W
			_	200	10/00
TJ	Junction temperature		-55	150	
TS	Storage temperature		-55	150	°C
TL	Lead temperature (soldering, 10 seconds)		_	300	

Recommended Operating Conditions

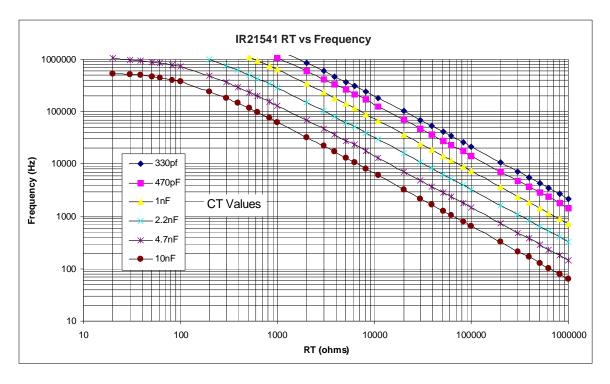
For proper operation the device should be used within the recommended conditions.

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	V _{CLAMP}	·
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
RT	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.

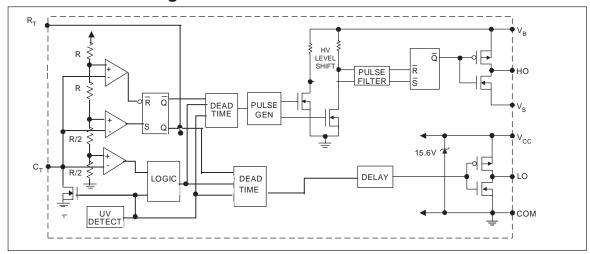
Low Voltage Supply Characteristics						
Symbol	Definition	Min.	Тур.	Max.	Units	Test Conditions
V _{CCUV+}	Rising V _{CC} undervoltage lockout threshold	8.1	9.0	9.9		
Vccuv-	Falling V _{CC} undervoltage lockout threshold	7.2	8.0	8.8	V	
Vссиvн	V _{CC} undervoltage lockout Hysteresis	0.5	1.0	1.5		
IQCCUV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

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Electrical Characteristics (cont.)

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	_	30	50	μΑ	
V _{BSMIN}	Minimum required V _{BS} voltage for proper functionality from R _T to HO	_	4.0	5.0	V	V _{CC} =V _{CCUV+} + 0.1V
I _{LK}	Offset supply leakage current	T -	_	50	μΑ	$V_{B} = V_{S} = 600V$
Oscillat	or 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	KIIZ	$RT = 7.43k\Omega$
d	RT pin duty cycle	48	50	52	%	fo < 100kHz
I _{CT}	CT pin current	_	0.001	1.0	uA	
	UV-mode C _T pin pulldown current	0.30	0.70	1.2	mA	V _{CC} = 7V
VCT+	Upper CT ramp voltage threshold	_	8.0	_		
VCT-	Lower CT ramp voltage threshold	_	4.0	_	V	
	CT voltage shutdown threshold	1.8	2.1	2.4		
V _{RT+}	High-level RT output voltage, VCC - VRT	_	10	50		I _{RT} = 100μA
		_	100	300		I _{RT} = 1mA
VRT-	Low-level RT output voltage	_	10	50	1	I _{RT} = 100μA
		-	100	300	mV	$I_{RT} = 1mA$
VRTUV	UV-mode RT output voltage	_	0	100] IIIV	VCC ≤ VCCUV-
VRTSD	SD-Mode RT output voltage, VCC - VRT	_	10	50		I _{RT} = 100μA, V _{CT} = 0V
		_	10	300		I _{RT} = 1mA, V _{CT} = 0V
Gate Dr	iver 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
						V _{CC} ≤ V _{CCUV} -
tr	Output rise time	<u> </u>	80	150		
tf	Output fall time	<u> </u>	45	100	nsec	-
t _{sd}	Shutdown propogation delay	<u> </u>	660	1 —		
t _d	Output deadtime (HO or LO)	0.35	0.60	0.85	μsec	

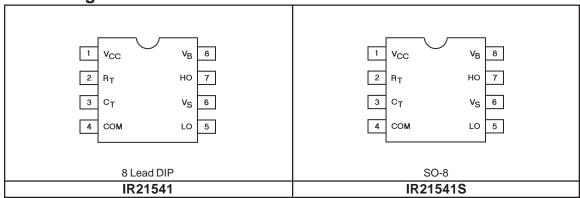
Functional Block Diagram



Lead Definitions

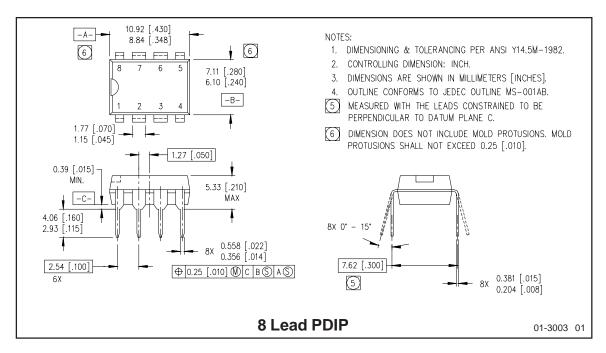
Symbol	Description
V _{CC}	Logic and internal gate drive supply voltage
RT	Oscillator timing resistor input
C _T	Oscillator timing capacitor input
COM	IC power and signal ground
LO	Low side gate driver output
Vs	High voltage floating supply return
НО	High side gate driver output
V _B	High side gate driver floating supply

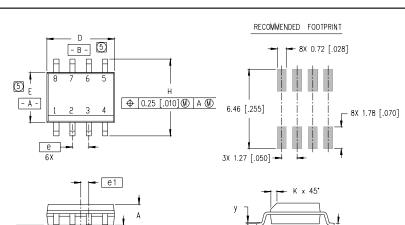
Lead Assignments



IR21541

International TOR Rectifier





0.10 [.004]

	INCHES		MILLIME	TERS	
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	
E	.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.	



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

Α1

→ 8X B

♦ 0.25 [.010] W C A S B S

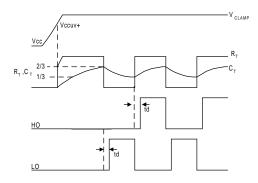
- 3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
- 4. OUTLINE CONFORMS TO JEDEC OUTLINE MS-012AA.
- DIMENSION DOES NOT INCLUDE MOLD PROTRUSIONS.

 MOLD PROTRUSIONS NOT TO EXCEED 0.25 [.006],
- DIMENSION IS THE LENGTH OF LEAD FOR SOLDERING TO A SUBSTRATE.

8 Lead SOIC

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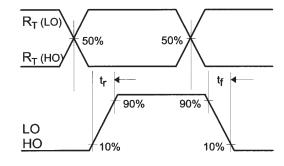


Figure 1. Input/Output Timing Diagram

Figure 2. Switching Time Waveform Definitions

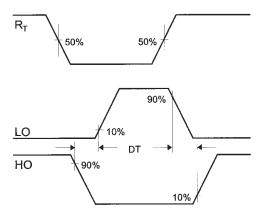


Figure 3. Deadtime Waveform Definitions

International Rectifier

WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245 Tel: (310) 322 3331
IR GREAT BRITAIN: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020
IR CANADA: 15 Lincoln Court, Brampton, Ontario L6T 3Z2 Tel: (905) 453-2200
IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590
IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111
IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo, Japan 171 Tel: 81 3 3983 0086

IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo, Japan 171 Tel: 81 3 3983 0086
IR SOUTHEAST ASIA: 1 Kim Seng Promenade, Great World City West Tower, 13-11, Singapore 237994 Tel: 65 838 4630
IR TAIWAN: 16 Fl. Suite D..207, Sec.2, Tun Haw South Road, Taipei, 10673, Taiwan Tel: 886-2-2377-9936

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