Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

Data Sheet No.PD 60150-J

International
IOR Rectifier

IPS031(S)

FULLY PROTECTED POWER MOSFET SWITCH

Features
- Over temperature shutdown
- Over current shutdown
- Active clamp
- Low current & logic level input
- E.S.D protection

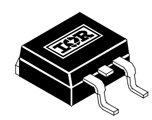
Product Summary

$R_{ds(on)}$	60mΩ (max)
V_{clamp}	50V
$I_{shutdown}$	12A
T_{on}/T_{off}	1.5μs

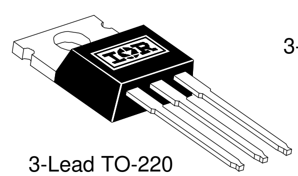
Description

The IPS031/IPS031S are fully protected three terminal SMART POWER MOSFETs that feature over-current, over-temperature, ESD protection and drain to source active clamp.These devices combine a HEXFET® POWER MOSFET and a gate driver. They offer full protection and high reliability required in harsh environments. The driver allows short switching times and provides efficient protection by turning OFF the power MOSFET when the temperature exceeds 165°C or when the drain current reaches 12A. The device restarts once the input is cycled. The avalanche capability is significantly enhanced by the active clamp and covers most inductive load demagnetizations.

Packages

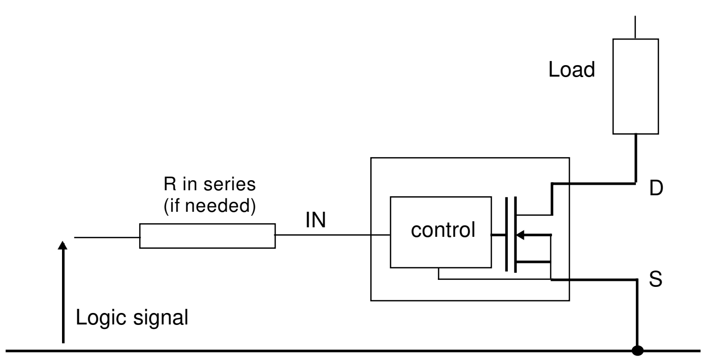


3-Lead D^{2}Pak
IPS031S



3-Lead TO-220
IPS031

Typical Connection



(Refer to lead assignment for correct pin configuration)

Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are referenced to SOURCE lead. ($T_{Ambient}$ = 25°C unless otherwise specified). PCB mounting uses the standard footprint with 70 µm copper thickness.

Symbol	Parameter	Min.	Max.	Units	Test Conditions
V_{ds}	Maximum drain to source voltage	—	47	V	
V_{in}	Maximum input voltage	-0.3	7	V	
$I_{in, max}$	Maximum IN current	-10	+10	mA	
$I_{sd\ cont.}$	Diode max. continuous current (1)			A	
	rth=62°C/W IPS031	—	2.8		TO220 free air
	rth=5°C/W IPS031	—	18		TO220 with Rth=5°C/W
	rth=80°C/W IPS031S	—	2.2		SMD220 Std. footprint
$I_{sd\ pulsed}$	Diode max. pulsed current (1)	—	18	A	
P_d	Maximum power dissipation(1)			W	
	(rth=62°C/W) IPS031	—	2		
	(rth=80°C/W) IPS031S	—	1.56		
ESD1	Electrostatic discharge voltage (Human Body)	—	4	kV	C=100pF, R=1500Ω,
ESD2	Electrostatic discharge voltage (Machine Model)	—	0.5	kV	C=200pF, R=0Ω, L=10µH
$T_{stor.}$	Max. storage temperature	-55	150	°C	
T_j max.	Max. junction temperature	-40	+150	°C	
T_{lead}	Lead temperature (soldering, 10 seconds)	—	300	°C	

Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
R_{th} 1	Thermal resistance free air	—	60	—	°C/W	TO-220
R_{th} 2	Thermal resistance junction to case	—	3	—	°C/W	TO-220
R_{th} 1	Thermal resistance with standard footprint	—	80	—	°C/W	D^2PAK (SMD220)
R_{th} 2	Thermal resistance with 1" square footprint	—	60	—	°C/W	D^2PAK (SMD220)
R_{th} 3	Thermal resistance junction to case	—	3	—	°C/W	D^2PAK (SMD220)

Recommended Operating Conditions

These values are given for a quick design. For operation outside these conditions, please consult the application notes.

Symbol	Parameter	Min.	Max.	Units
$V_{ds\ (max)}$	Continuous drain to source voltage	—	35	V
V_{IH}	High level input voltage	4	6	V
V_{IL}	Low level input voltage	0	0.5	V
I_{ds} Tamb=85°C	Continuous drain current			A
	(TAmbient = 85°C, IN = 5V, rth = 60°C/W, Tj = 125°C) IPS031	—	3.1	
	(TAmbient = 85°C, IN = 5V, rth = 80°C/W, Tj = 125°C) IPS031S	—	2.8	
R_{in}	Recommended resistor in series with IN pin	0.2	5	kΩ
$T_{r\text{-}in(max)}$	Max recommended rise time for IN signal (see fig. 2)	—	1	µS
$F_{r\text{-}Isc}$ (2)	Max. frequency in short circuit condition (Vcc = 14V)	0	1	kHz

(1) Limited by junction temperature (pulsed current limited also by internal wiring)
(2) Operations at higher switching frequencies is possible. See Application. Notes.

Static Electrical Characteristics

(T_j = 25°C unless otherwise specified.)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{ds(on)}$	ON state resistance T_j = 25°C	20	45	60	mΩ	V_{in} = 5V, I_{ds} = 1A
$R_{ds(on)}$	ON state resistance T_j = 150°C	—	75	100		
I_{dss} @Tj=25°C	Drain to source leakage current	0	0.5	25	µA	V_{CC} = 14V, T_j = 25°C
I_{dss2} @Tj=25°C	Drain to source leakage current	0	5	50		V_{CC} = 40V, T_j = 25°C
V clamp 1	Drain to source clamp voltage 1	47	52	56	V	I_d = 20mA (see Fig.3 & 4)
V clamp 2	Drain to source clamp voltage 2	50	53	60		I_d=$I_{shutdown}$ (see Fig.3 & 4)
$V_{in\ clamp}$	IN to source clamp voltage	7	8.1	9.5		I_{in} = 1 mA
V_{th}	IN threshold voltage	1	1.6	2		I_d = 50mA, Vds = 14V
$I_{in,\ -on}$	ON state IN positive current	25	90	200	µA	V_{in} = 5V
$I_{in,\ -off}$	OFF state IN positive current	50	130	250		V_{in} = 5V over-current triggered

Switching Electrical Characteristics

V_{CC} = 14V, Resistive Load = 5Ω , Rinput = 50Ω, 100µs pulse,T_j = 25°C, (unless otherwise specified).

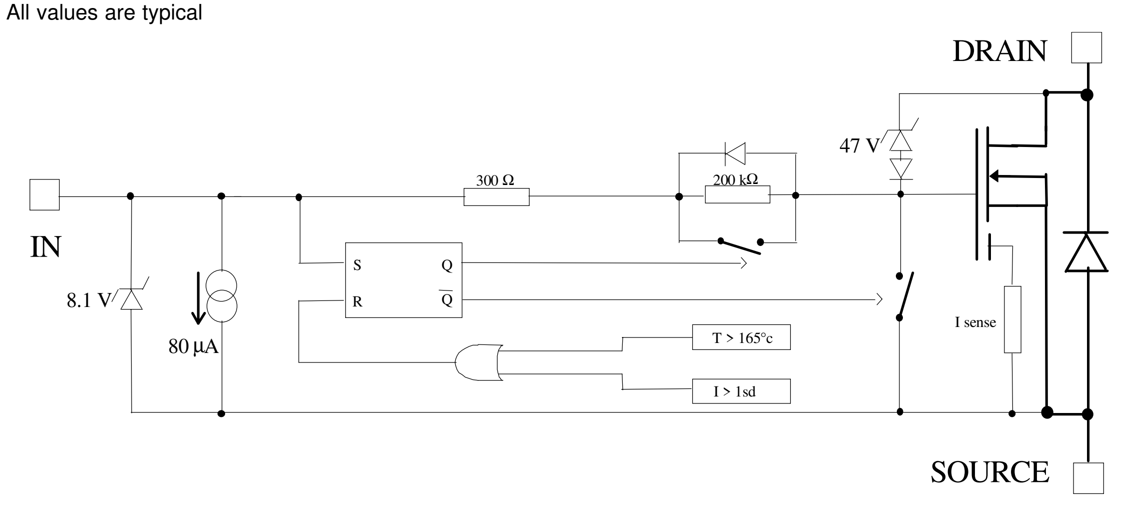
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
T_{on}	Turn-on delay time	0.05	0.3	0.6	µs	See figure 2
T_r	Rise time	0.4	1	2		
T_{rf}	Time to 130% final $R_{ds(on)}$	—	8	—		
T_{off}	Turn-off delay time	0.8	2	3.5		See figure 2
T_f	Fall time	0.5	1.5	2.5		
Q_{in}	Total gate charge	—	11	—	nC	V_{in} = 5V

Protection Characteristics

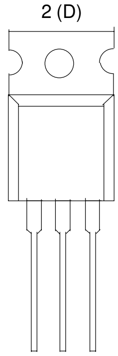
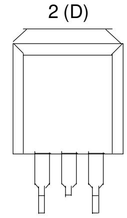
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
T_{sd}	Over temperature threshold	—	165	—	°C	See fig. 1
I_{sd}	Over current threshold	10	14	18	A	See fig. 1
V_{reset}	IN protection reset threshold	1.5	2.3	3	V	
T_{reset}	Time to reset protection	2	10	40	µs	V_{in} = 0V, Tj = 25°C
EOI_OT	Short circuit energy (see application note)	—	400	—	µJ	V_{CC} = 14V

Functional Block Diagram

All values are typical



Lead Assignments

2 (D)  1 2 3 In D S TO-220	2 (D)  1 3 In D S D^2PAK (SMD220)
IPS031	**IPS031S**
Part Number	

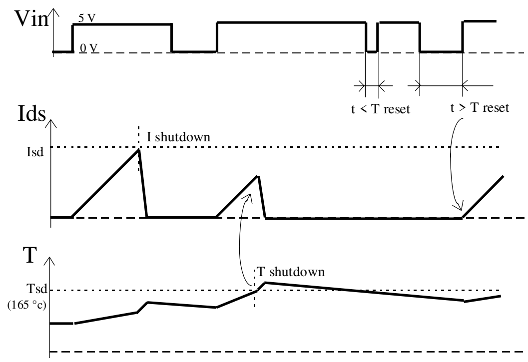


Figure 1 - Timing diagram

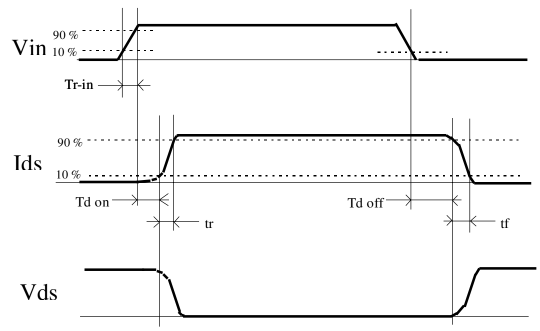


Figure 2 - IN rise time & switching time definitions

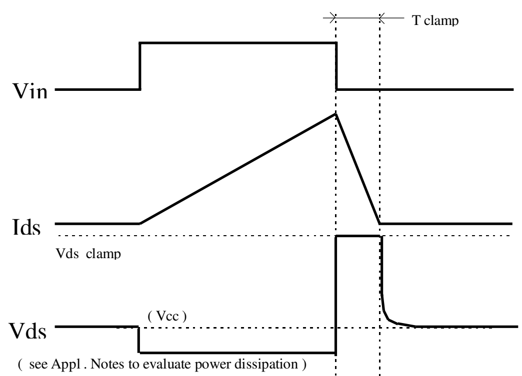


Figure 3 - Active clamp waveforms

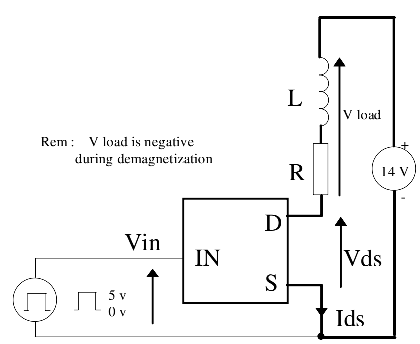


Figure 4 - Active clamp test circuit

All curves are typical values with standard footprints. Operating in the shaded area is not recommended.

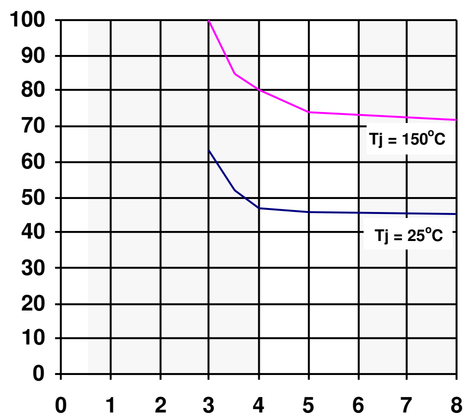


Figure 5 - Rds ON (mΩ) Vs Input Voltage (V)

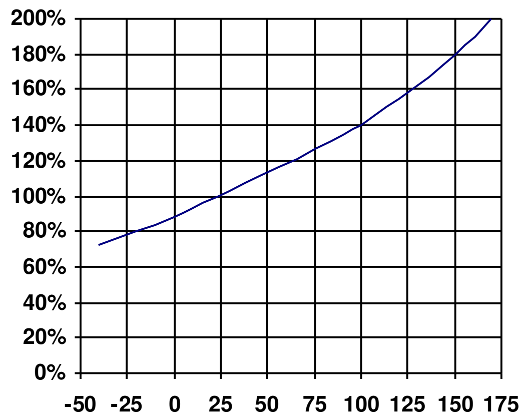


Figure 6 - Normalised Rds ON (%) Vs Tj (°C)

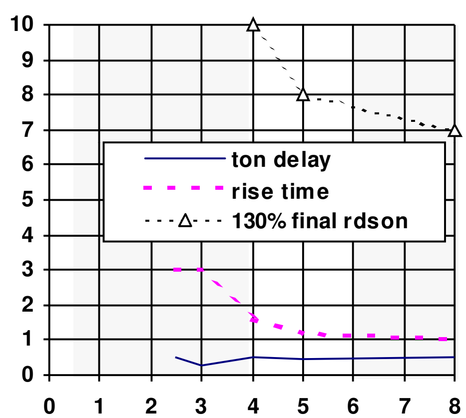


Figure 7 - Turn-ON Delay Time, Rise Time & Time to 130% final $R_{ds(on)}$ (us) Vs Input Voltage (V)

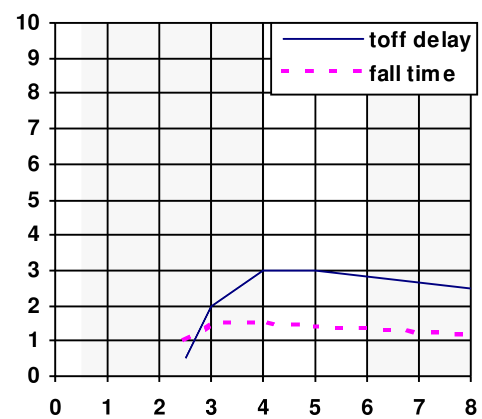


Figure 8 - Turn-OFF Delay Time & Fall Time (us) Vs Input Voltage (V)

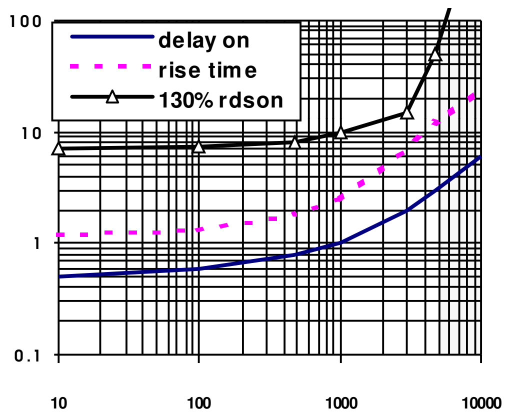


Figure 9 - Turn-ON Delay Time, Rise Time & Time to 130% final $R_{ds(on)}$ (us) Vs IN Resistor (Ω)

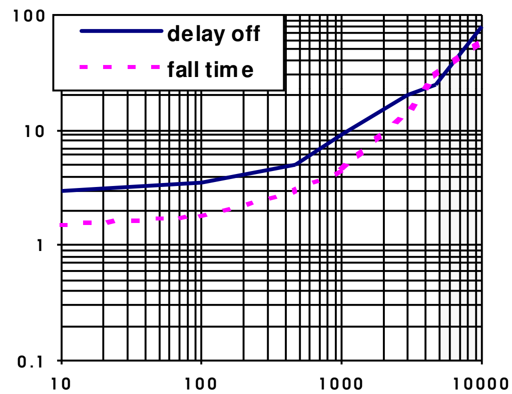


Figure 10 - Turn-OFF Delay Time & Fall Time (us) Vs IN Resistor (Ω)

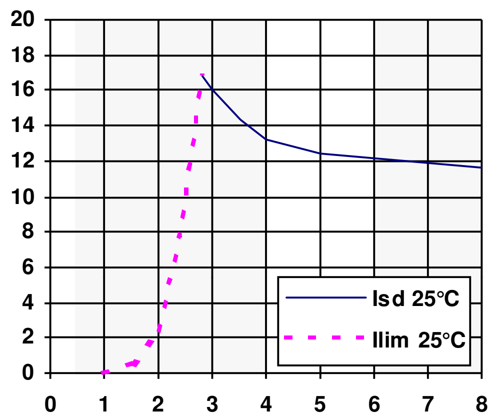


Figure 11 - Current limitation & I shutdown (A) Vs Vin (V)

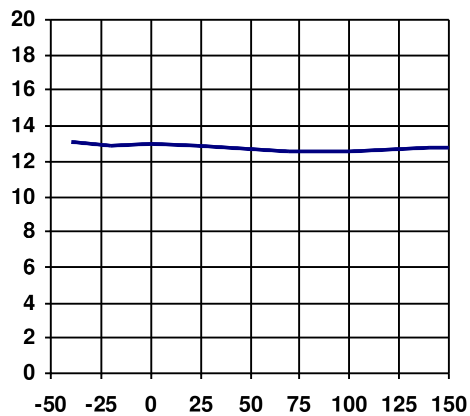


Figure 12 - I shutdown (A) Vs Temperature (°C)

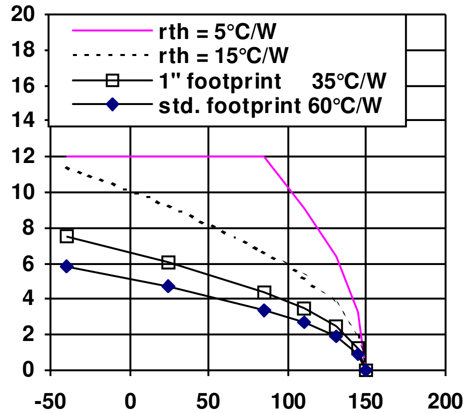


Figure 13 - Max.Cont. Ids (A) Vs Amb. Temperature (ºC)

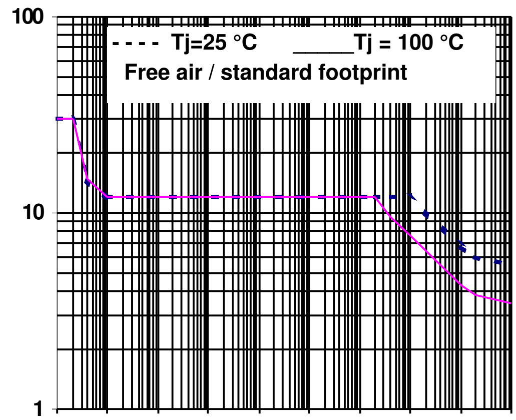


Figure 14 - Ids (A) Vs Protection Resp. Time (s) IPS031 & IPS031S

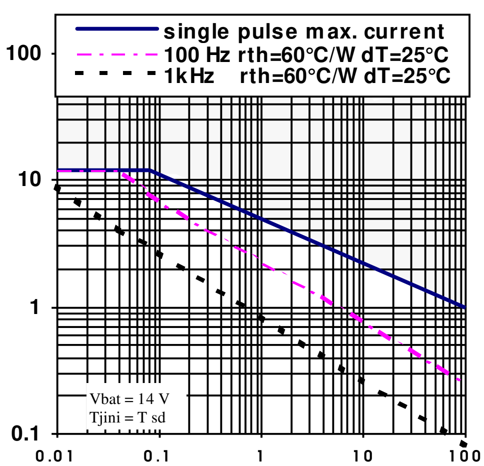


Figure 15 - Iclamp (A) Vs Inductive Load (mH)

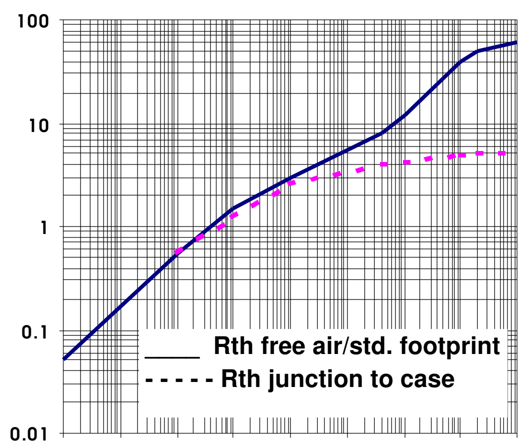


Fig.16 - Transient Thermal Impedance (ºC/W) Vs Time (s) - IPS031/IPS031S

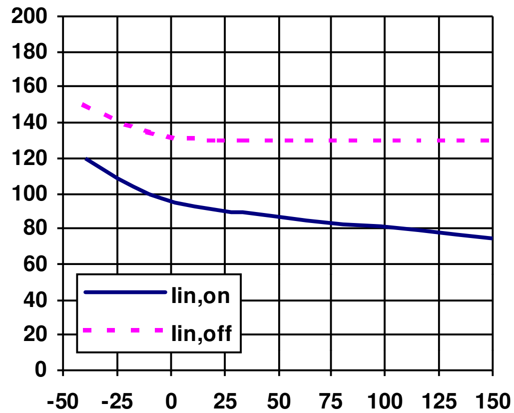


Figure 17 - Input current (µA) Vs Junction (ºC)

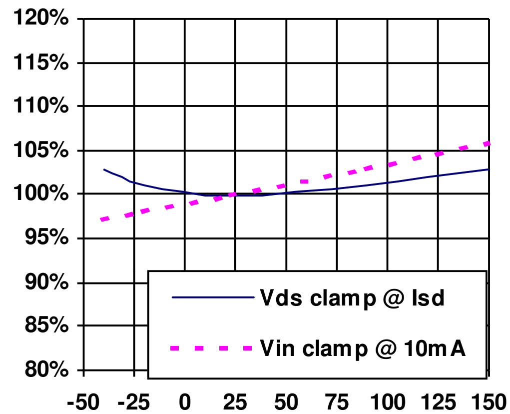


Figure 18 - Vin clamp and V clamp2 (%)
Vs Tj (ºC)

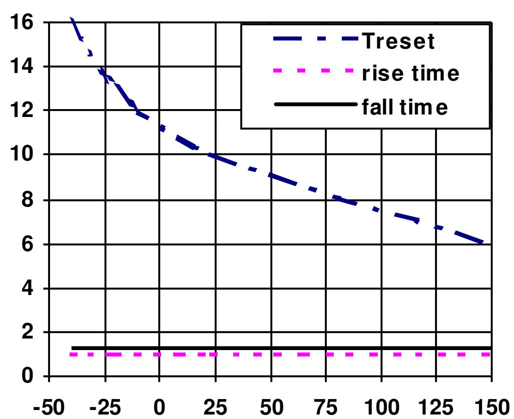
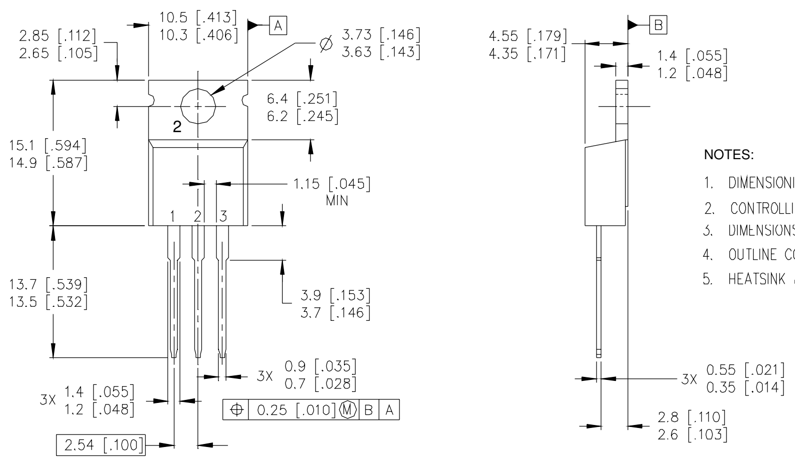


Figure 19 - Turn-on, Turn-off, and treset (µs)
Vs Tj (ºC)

Case Outline

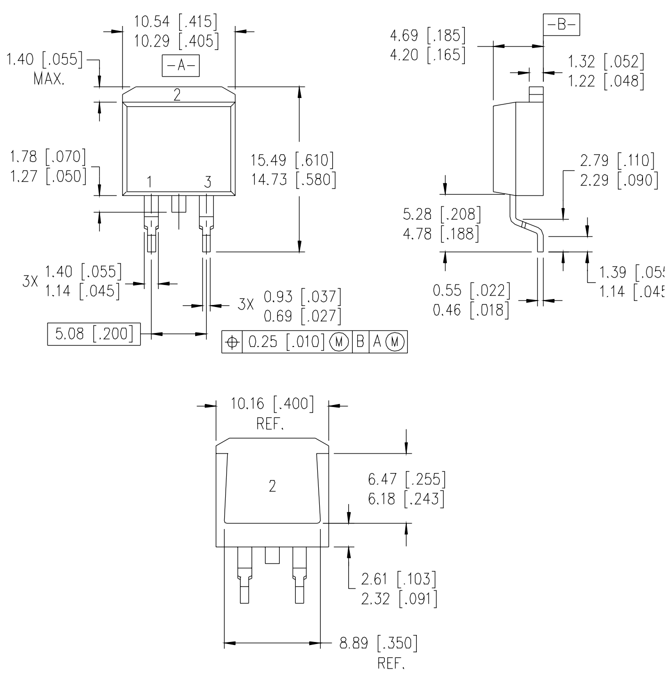


NOTES:

1. DIMENSIONING & TOLERANCING PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: MILLIMETER
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
5. HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

3-Lead TO-220AB

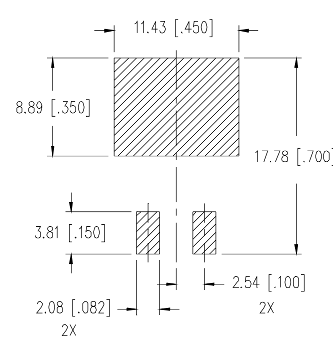
01-6024 00
IRGB 01-3026 01 (TO-220AB)



NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. DIMENSIONS AFTER SOLDER DIP.
5. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.

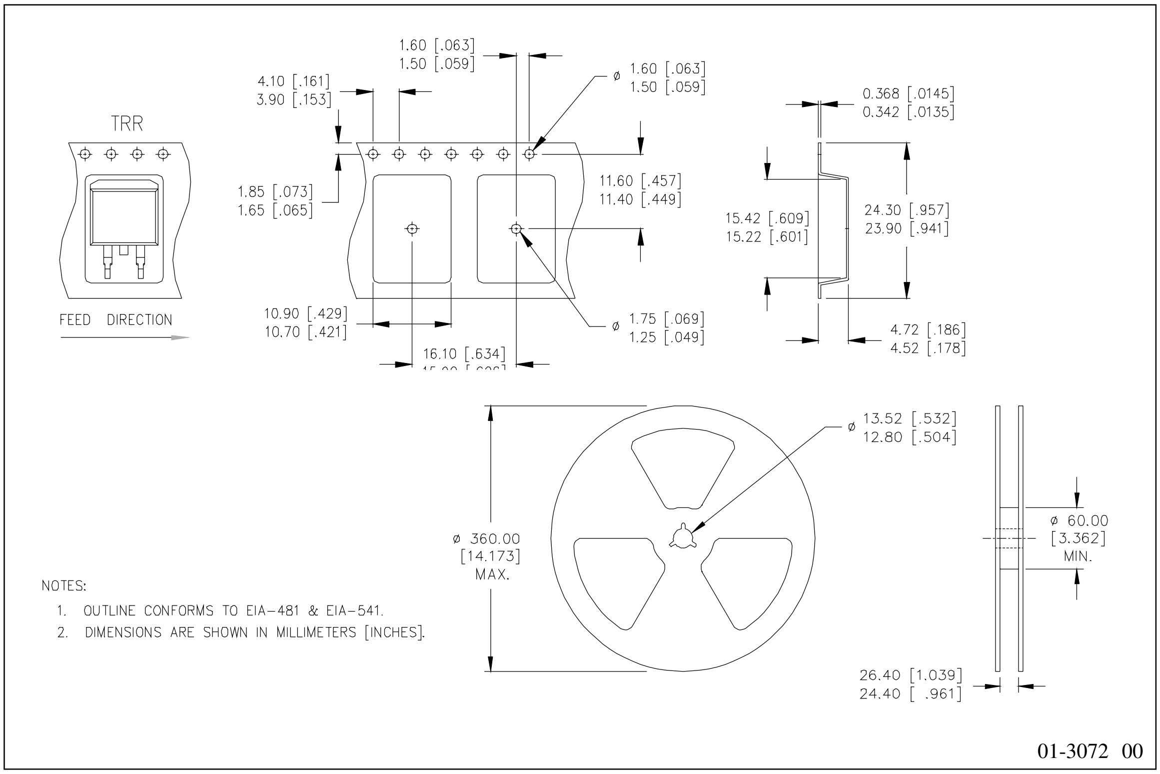
MINIMUM RECOMMENDED FOOTPRINT



3-Lead D²PAK

01-6022 00
01-0016 05 (TO-263AB)

Tape & Reel - D²PAK (SMD220)



IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245 Tel: (310) 252-7105

Note: For the most current drawings please refer to the IR website at:
http://www.irf.com/package/