

## 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<sub>Ambient</sub> = 25°C unless otherwise specified). PCB mounting uses the standard footprint with 70 µm copper thickness..

Symbol	Parameter	Min.	Max.	Units	Test Conditions
V <sub>ds</sub>	Maximum drain to source voltage	—	47	V	
V <sub>in</sub>	Maximum Input voltage	-0.3	7		
I <sub>in, max</sub>	Maximum IN current	-10	+10	mA	
I <sub>sd cont.</sub>	Diode max. continuous current <sup>(1)</sup> (r <sub>th</sub> =125°C/W)	—	1.4	A	
I <sub>sd pulsed</sub>	Diode max. pulsed current <sup>(1)</sup>	—	10		
P <sub>d</sub>	Maximum power dissipation <sup>(1)</sup> (r <sub>th</sub> =125°C/W)	—	1	W	
ESD1	Electrostatic discharge voltage (Human Body)	—	4	kV	C=100pF, R=1500Ω,
ESD2	Electrostatic discharge voltage (Machine Model)	—	0.5		C=200pF, R=0Ω, L=10µH
T <sub>stor.</sub>	Max. storage temperature	-55	150	°C	
T <sub>j max.</sub>	Max. junction temperature	-40	+150		

## Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
R <sub>th1</sub>	Thermal resistance with standard footprint	—	100	—	°C/W	
R <sub>th2</sub>	Thermal resistance with 1" square footprint	—	50	—		

## 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 <sub>ds (max)</sub>	Continuous drain to source voltage	—	35	V
V <sub>IH</sub>	High level input voltage	4	6	
V <sub>IL</sub>	Low level input voltage	0	0.5	
I <sub>ds</sub> T <sub>amb</sub> =85°C	Continuous drain current (T <sub>Ambient</sub> = 85°C, I <sub>N</sub> = 5V, r <sub>th</sub> = 100°C/W, T <sub>j</sub> = 125°C)	—	1.4	A
R <sub>in</sub>	Recommended resistor in series with IN pin	0.5	5	kΩ
T <sub>r-in (max)</sub>	Max recommended rise time for IN signal (see fig. 2)	—	1	µS
F <sub>r-Isc</sub> <sup>(2)</sup>	Max. frequency in short circuit condition (V <sub>cc</sub> = 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 Appl. notes.

## Static Electrical Characteristics

Standard footprint 70  $\mu\text{m}$  copper thickness.  $T_j = 25^\circ\text{C}$ , (unless otherwise specified).

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{ds(on)}$	ON state resistance $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	100 —	130 220	150 280	$\text{m}\Omega$	$V_{in} = 5\text{V}$ , $I_{ds} = 1\text{A}$
$I_{dss1}$	Drain to source leakage current	0	0.01	25	$\mu\text{A}$	$V_{cc} = 14\text{V}$ , $T_j = 25^\circ\text{C}$
$I_{dss2}$	Drain to source leakage current	0	0.1	50	$\mu\text{A}$	$V_{cc} = 40\text{V}$ , $T_j = 25^\circ\text{C}$
$V_{clamp1}$	Drain to source clamp voltage 1	48	54	56	$\text{V}$	$I_d = 20\text{mA}$ (see Fig.3 & 4)
$V_{clamp2}$	Drain to source clamp voltage 2	50	56	60		$I_d = I_{shutdown}$ (see Fig.3 & 4)
$V_{in clamp}$	IN to source clamp voltage	7	8	9.5		$I_{in} = 1\text{mA}$
$V_{th}$	IN threshold voltage	1	1.5	2		$I_d = 50\text{mA}$ , $V_{ds} = 14\text{V}$
$I_{in, -on}$	ON state IN positive current	25	90	200	$\mu\text{A}$	$V_{in} = 5\text{V}$
$I_{in, -off}$	OFF state IN positive current	50	130	250		$V_{in} = 5\text{V}$ over-current triggered

## Switching Electrical Characteristics

$V_{cc} = 14\text{V}$ , Resistive Load =  $10\Omega$ ,  $R_{input} = 50\Omega$ ,  $100\mu\text{s}$  pulse,  $T_j = 25^\circ\text{C}$ , (unless otherwise specified).

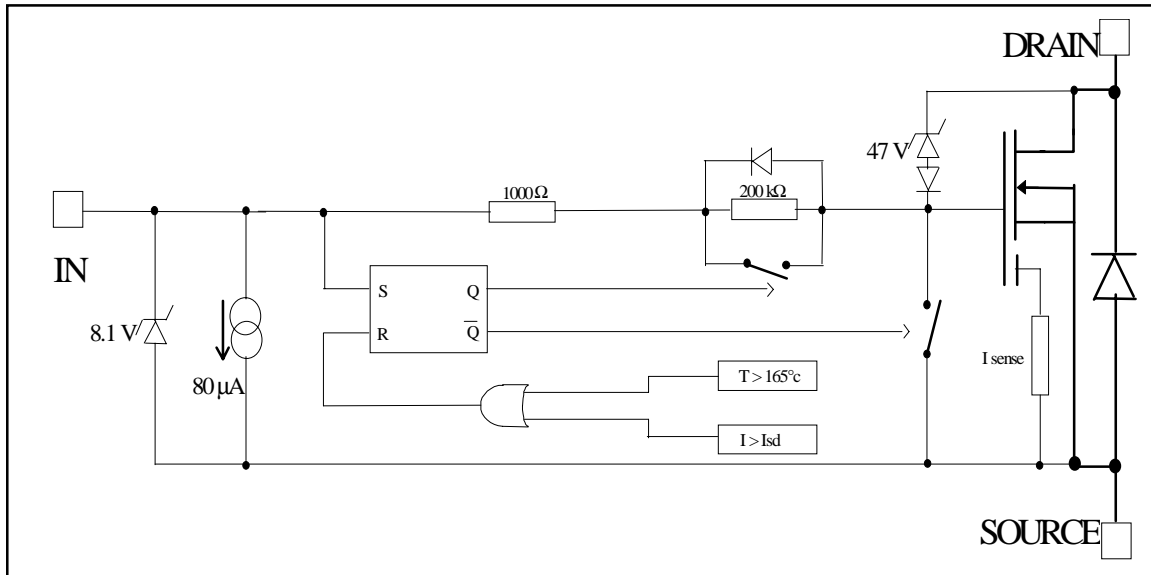
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$T_{on}$	Turn-on delay time	0.15	0.5	1	$\mu\text{s}$	See figure 2
$T_r$	Rise time	0.4	0.9	2		
$T_{rf}$	Time to 130% final $R_{ds(on)}$	2	6	12		See figure 2
$T_{off}$	Turn-off delay time	0.8	2	3.5		
$T_f$	Fall time	0.5	1.3	2.5	$\text{nC}$	$V_{in} = 5\text{V}$
$Q_{in}$	Total gate charge	—	30	—		

## Protection Characteristics

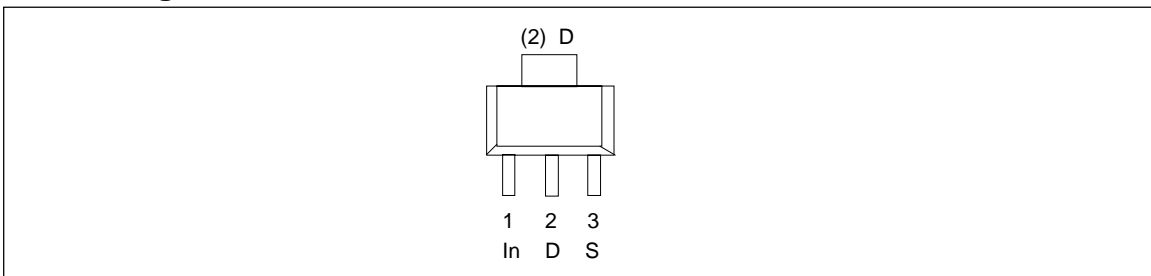
Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$T_{sd}$	Over temperature threshold	—	165	—	$^\circ\text{C}$	See fig. 1
$I_{sd}$	Over current threshold	4	5.5	7	A	See fig. 1
$V_{reset}$	IN protection reset threshold	1.5	2.3	3	V	$V_{in} = 0\text{V}$ , $T_j = 25^\circ\text{C}$
$T_{reset}$	Time to reset protection	2	10	40	$\mu\text{s}$	
$EOI_{OT}$	Short circuit energy (see application note)	—	400	—	$\mu\text{J}$	$V_{cc} = 14\text{V}$

## Functional Block Diagram

All values are typical



## Lead Assignments



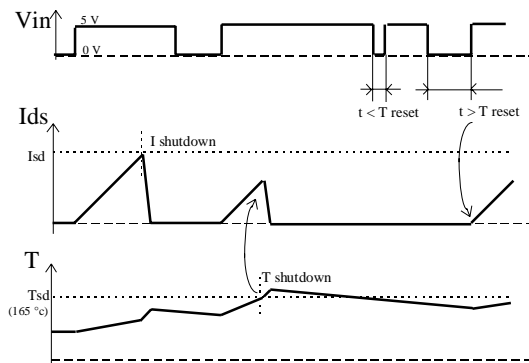


Figure 1 - Timing diagram

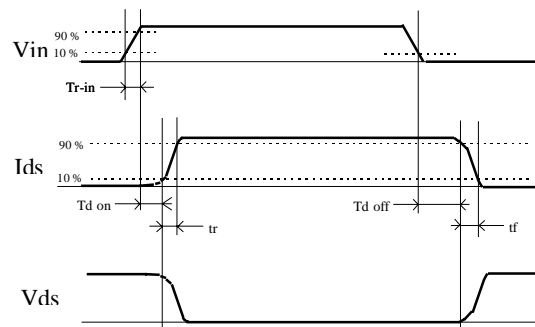


Figure 2 - IN rise time & switching time definitions

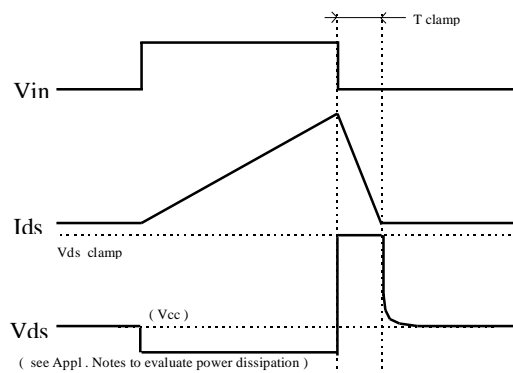


Figure 3 - Active clamp waveforms

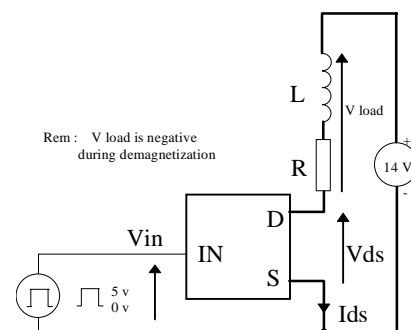


Figure 4 - Active clamp test circuit

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

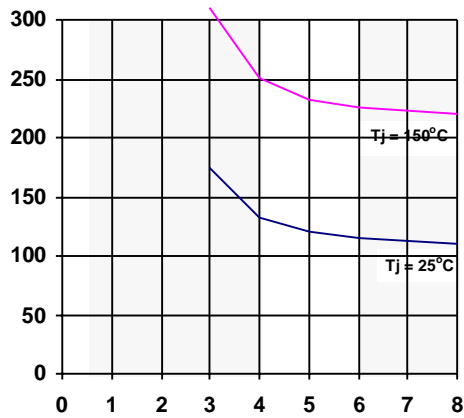


Figure 5 -  $R_{ds(on)}$  (mΩ) Vs Input Voltage (V)

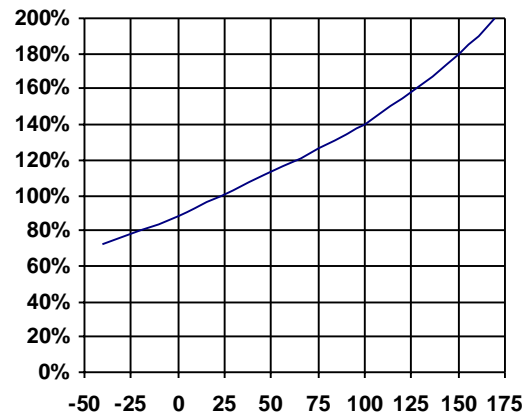


Figure 6 - Normalised  $R_{ds(on)}$  (%) Vs  $T_j$  (°C)

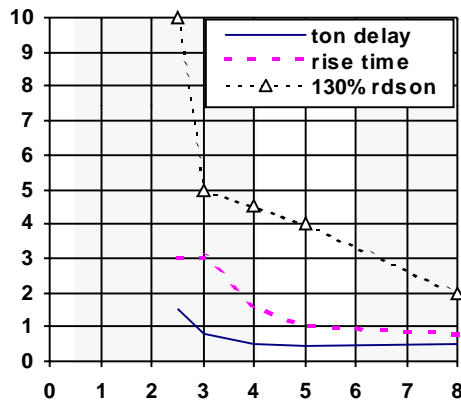


Figure 7 - Turn-ON Delay Time, Rise Time & Time to 130% final  $R_{ds(on)}$  (us) Vs Input Voltage (V)

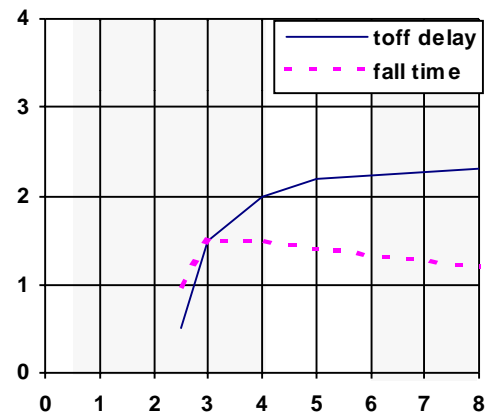


Figure 8 - Turn-OFF Delay Time & Fall Time (us) Vs Input Voltage (V)

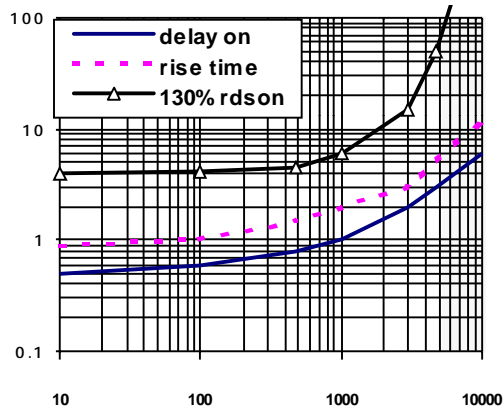


Figure 9 - Turn-ON Delay Time, Rise Time & Time to 130% final  $R_{ds(on)}$  (us) Vs IN Resistor ( $\Omega$ )

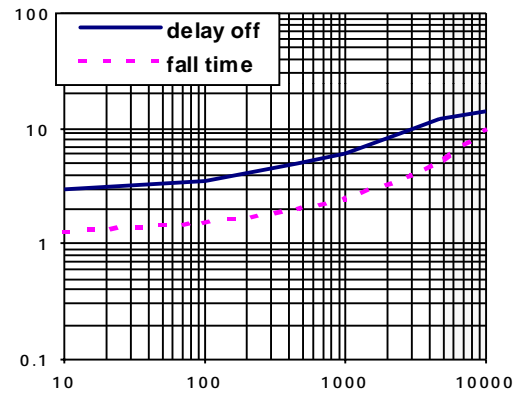


Figure 10 - Turn-OFF Delay Time & Fall Time (us) Vs IN Resistor ( $\Omega$ )

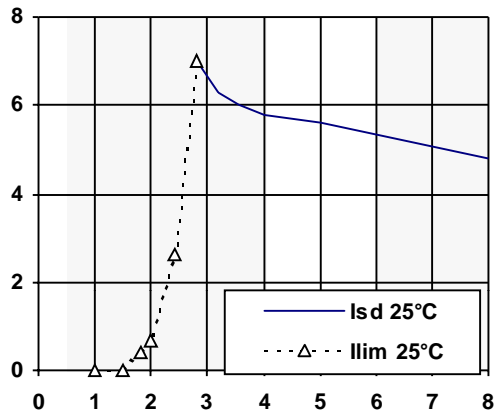


Figure 11 - Current lim. & I shutdown (A) Vs  $V_{in}$  (V)

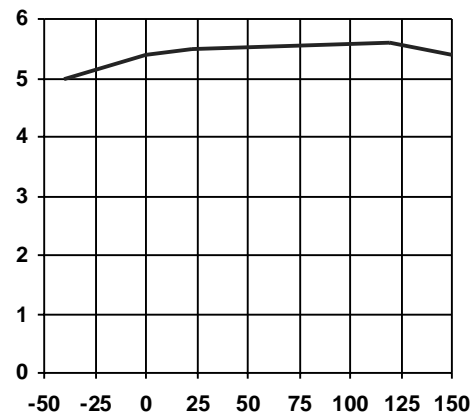


Figure 12 - I shutdown (A) Vs Temperature ( $^{\circ}\text{C}$ )

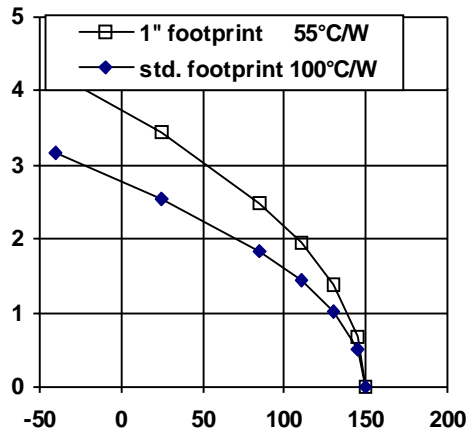


Figure 13 - Max.Cont. Ids (A) Vs Amb. Temperature (°C)

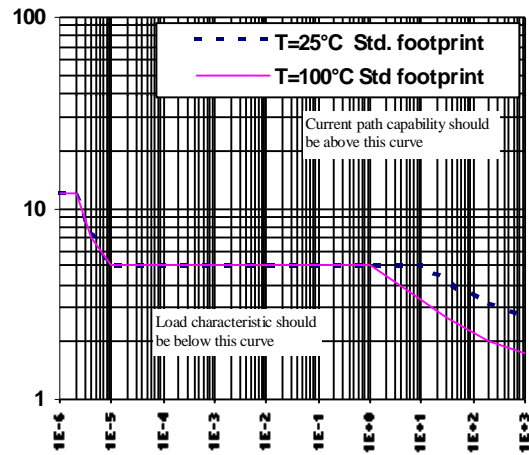


Figure 14 - Ids (A) Vs Protection Resp. Time (s)

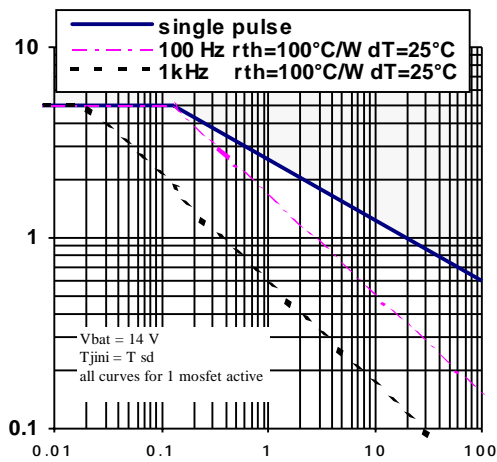


Figure 15 - I clamp (A) Vs Inductive Load (mH)

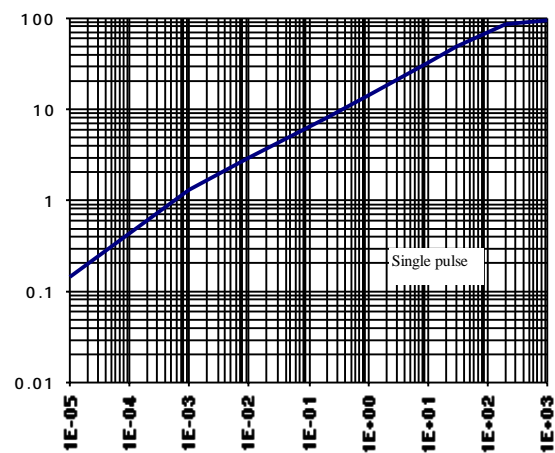


Figure 16 - Transient Thermal Imped. (°C/W) Vs Time (s)

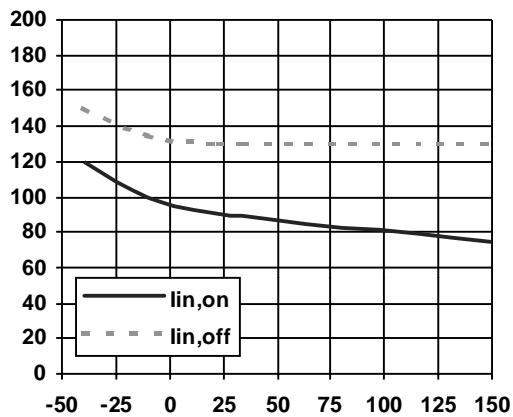


Figure 17 - Input Current (uA) Vs Junction Temperature (°C)

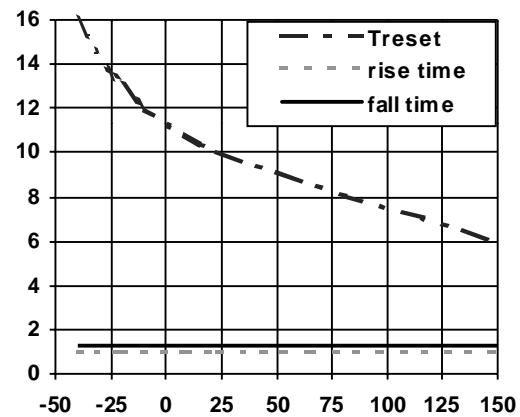


Figure 18 - Rise Time, Fall Time and Treset (μs) Vs Tj (°C)

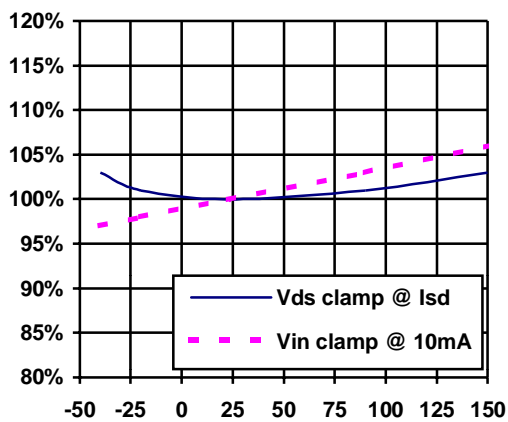
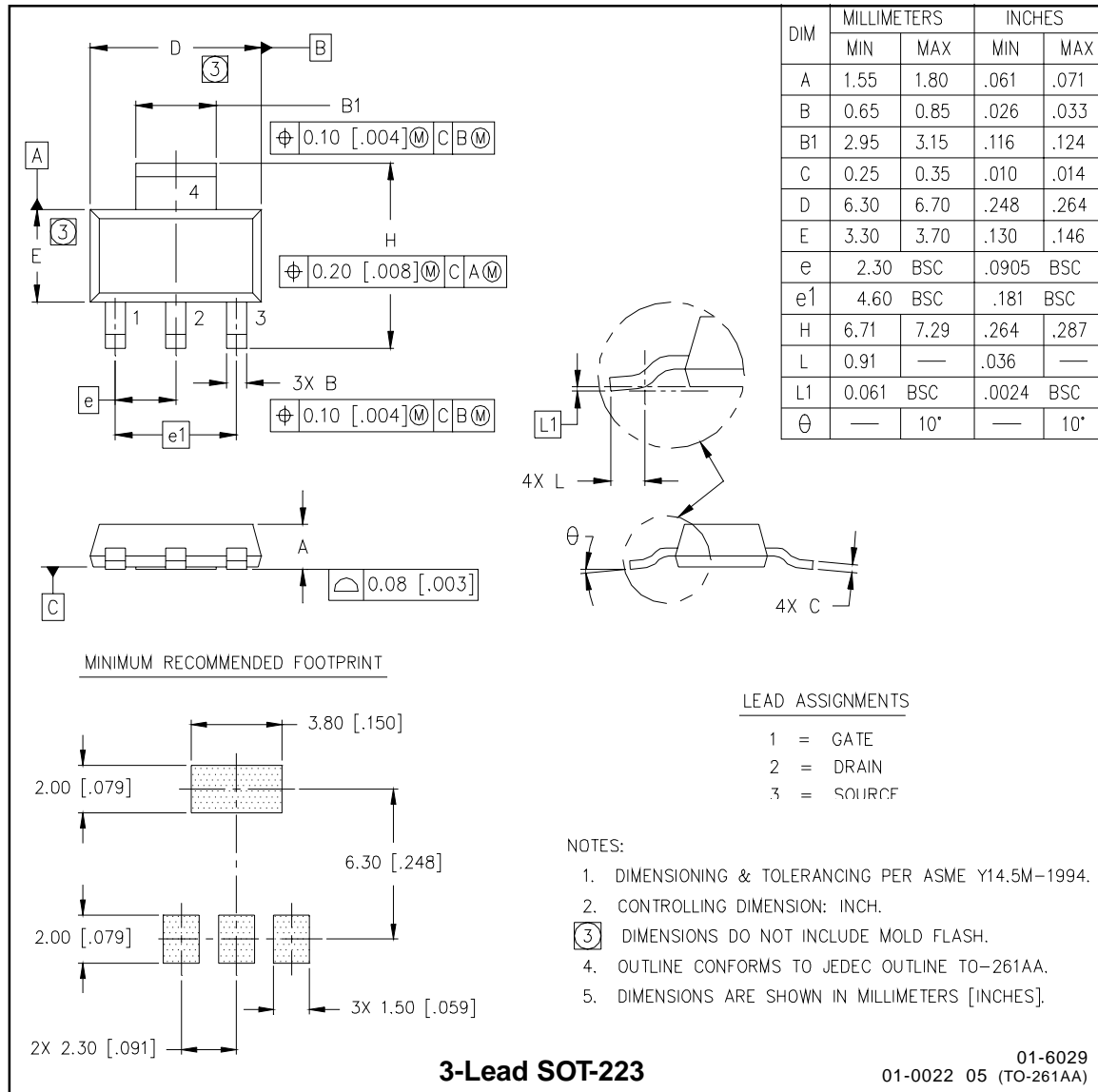


Figure 19 - Vin clamp and Vds clamp Vs Tj (°C)



Case Outline



## Tape & Reel - SOT223

