

## 30V P-Channel Enhancement Mode MOSFET

### Description

The NP9435ASR uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in load switch and battery protection applications.

### General Features

- ◆  $V_{DS} = -30V$ ,  $I_D = -5.5A$   
 $R_{DS(ON)}(Typ.) = 43m\Omega$  @  $V_{GS} = -10V$   
 $R_{DS(ON)}(Typ.) = 55m\Omega$  @  $V_{GS} = -4.5V$
- ◆ High power and current handing capability
- ◆ Lead free product is acquired
- ◆ Surface mount package

### Application

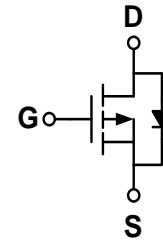
- ◆ Battery protection
- ◆ Load switch

### Package

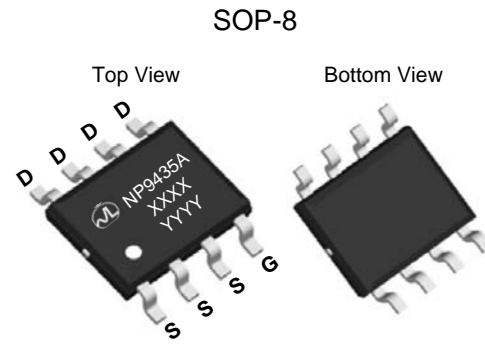
- ◆ SOP-8

*100% UIS TESTED!*  
*100%  $\Delta V_{ds}$  TESTED!*

### Schematic diagram



### Marking and pin assignment



XXXX—Wafer Lot No.  
 YYYY—Quality code



### Ordering Information

Part Number	Storage Temperature	Package	Devices Per Reel
NP9435ASR-G	-55°C to +150°C	SOP-8	4000

### Absolute Maximum Ratings (TA=25°C unless otherwise noted)

parameter	symbol	limit	unit	
Drain-source voltage	$V_{DS}$	-30	V	
Gate-source voltage	$V_{GS}$	$\pm 20$	V	
Continuous Drain Current	$I_D$	$T_A = 25^\circ C$	-5.5	A
		$T_A = 70^\circ C$	-4	
Pulsed Drain Current <sup>C</sup>	$I_{DP}$	-22	A	
Avalanche energy( L=0.1mH) <sup>C</sup>	$E_{AS}$	10	mJ	
Maximum power dissipation <sup>B</sup>	$P_D$	$T_A = 25^\circ C$	3.1	W
		$T_A = 70^\circ C$	2	
Operating junction Temperature range	$T_J$	-55—150	°C	

## Thermal Characteristics

Parameter		Symbol	Typ	Max	Unit
Maximum Junction-to-Ambient <sup>A</sup>	≤ 10s	R <sub>θJA</sub>	33	40	°C/W
Maximum Junction-to-Ambient <sup>A D</sup>	Steady-State		59	75	
Maximum Junction-to-Lead <sup>B</sup>	Steady-State	R <sub>θJL</sub>	16	24	

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub> =25°C. The value in any given application depends on the user's specific board design.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150°C, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150°C. Ratings are based on low frequency and duty cycles to keep initial T<sub>J</sub>=25°C.

D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

## Electrical Characteristics (TA=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>OFF Characteristics</b>						
Drain-source breakdown voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA	-30	-	-	V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V	-	-	-1	μA
Gate-body leakage	I <sub>GSS</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V	-	-	±100	nA
<b>ON Characteristics</b>						
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-0.8	-1.4	-2.5	V
Drain-source on-state resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-5.5A	-	43	60	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4 A	-	55	70	
Forward transconductance	gfs	V <sub>DS</sub> =-5V, I <sub>D</sub> =-5.5A	-	7	-	S
<b>Dynamic Characteristics</b>						
Input capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V f=1.0MHz	-	980	-	pF
Output capacitance	C <sub>OSS</sub>		-	390	-	
Reverse transfer capacitance	C <sub>RSS</sub>		-	135	-	
<b>Switching Characteristics</b>						
Turn-on delay time	t <sub>D(ON)</sub>	V <sub>DS</sub> =-15V I <sub>D</sub> =-1A V <sub>GS</sub> =-10V R <sub>GEN</sub> =6Ω	-	14	-	ns
Rise time	tr		-	12	-	
Turn-off delay time	t <sub>D(OFF)</sub>		-	56	-	
Fall time	tf		-	20	-	
Total gate charge	Qg(10V)	V <sub>DS</sub> =-15V, I <sub>D</sub> =-5.5A V <sub>GS</sub> =-10V	-	11	-	nC
Total gate charge	Qg(4.5V)		-	5	-	
Gate-source charge	Qgs		-	2.0	-	
Gate-drain charge	Qgd		-	2.8	-	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS</b>						
Diode forward voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-1.0A	-	-0.75	-1.0	V

## Typical Performance Characteristics

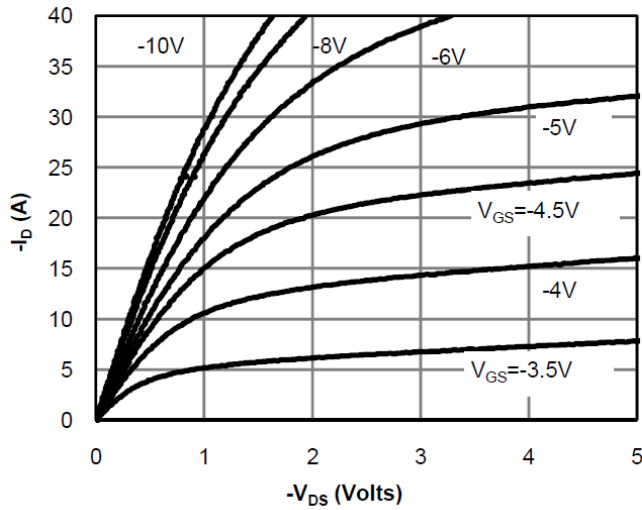


Fig 1: On-Region Characteristics

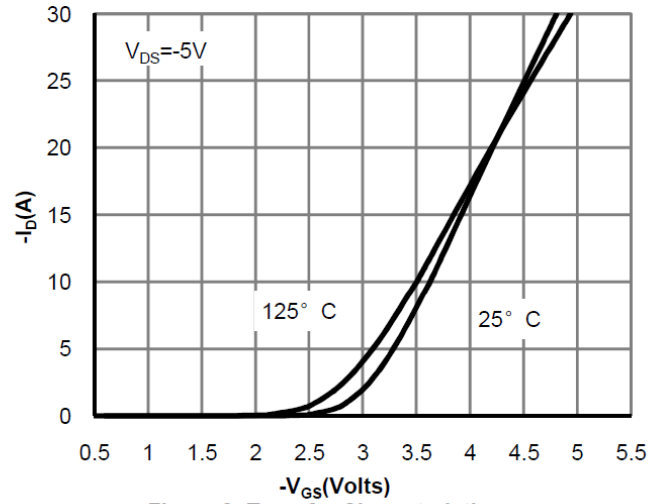


Figure 2: Transfer Characteristics

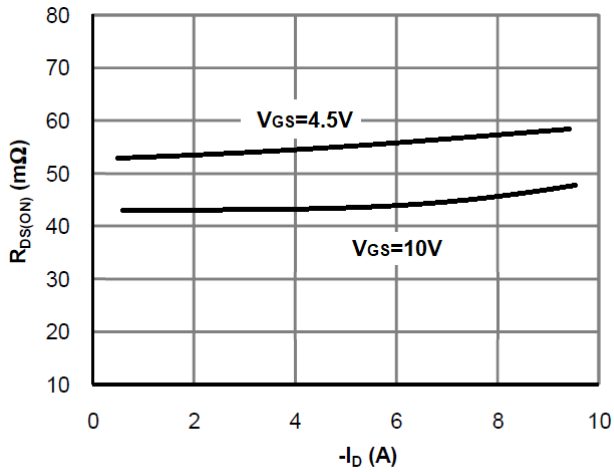


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

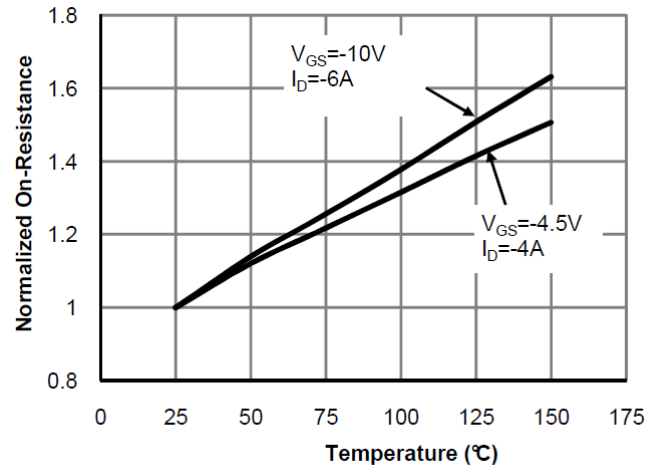


Figure 4: On-Resistance vs. Junction Temperature

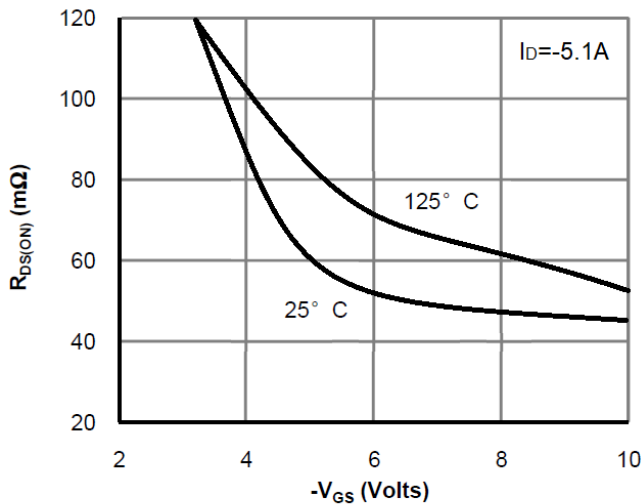


Figure 5: On-Resistance vs. Gate-Source Voltage

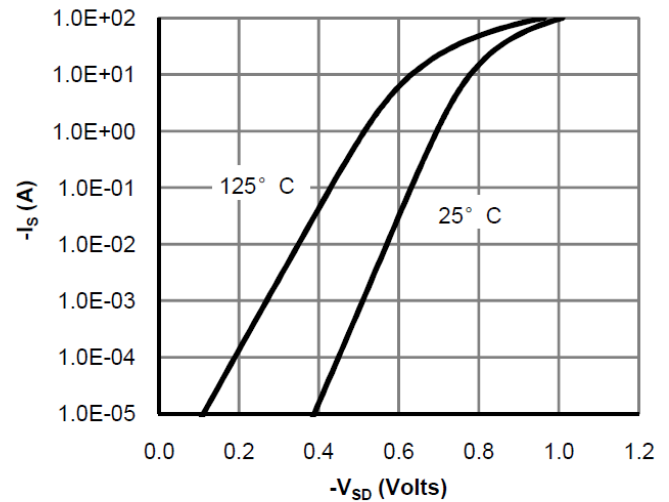
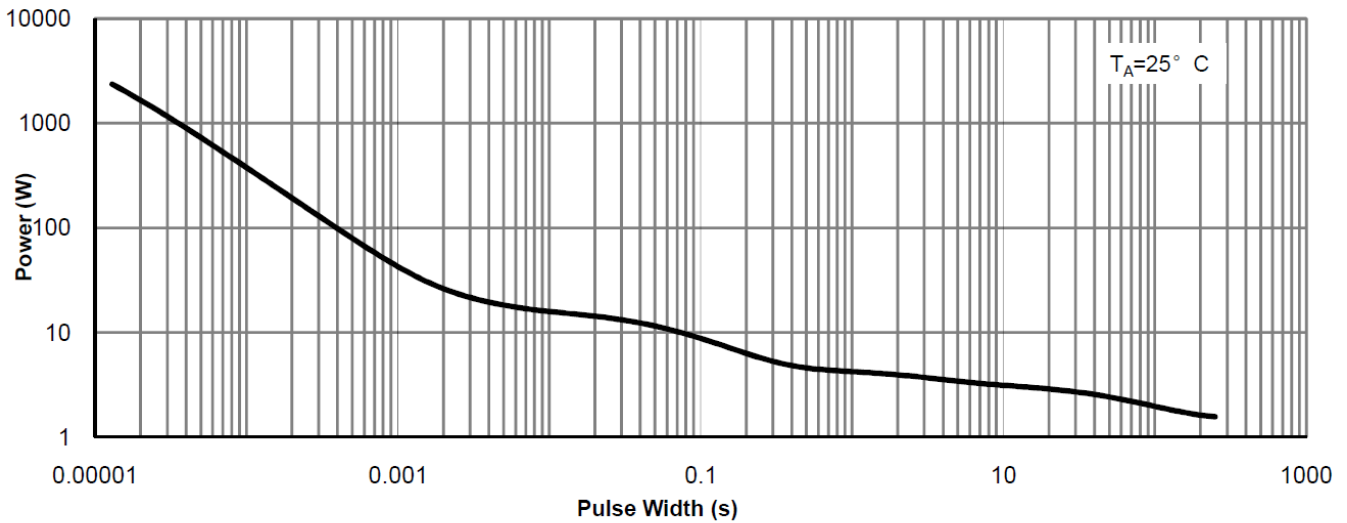
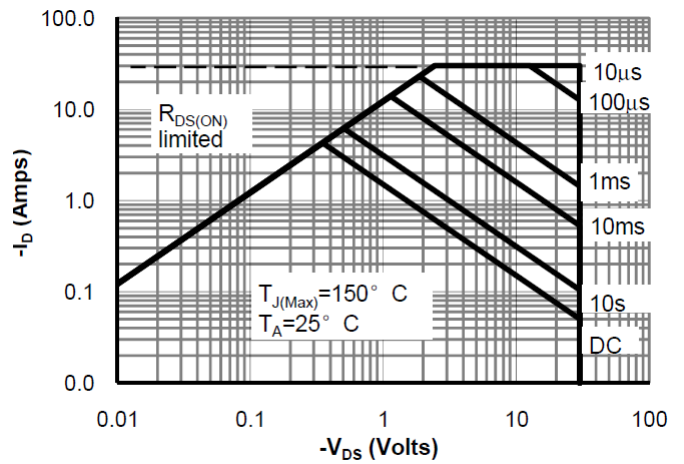
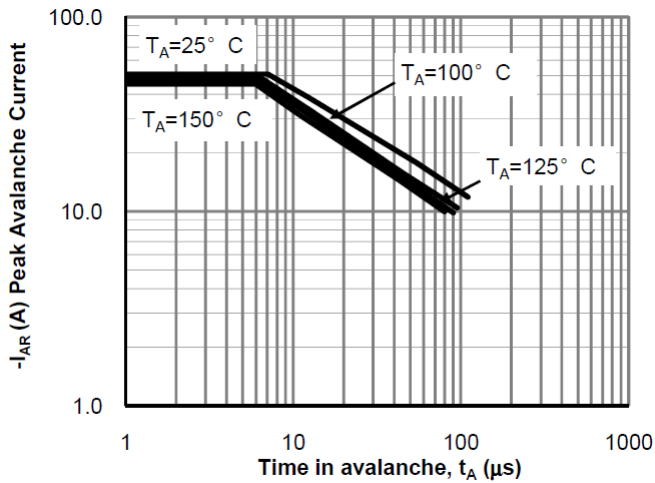
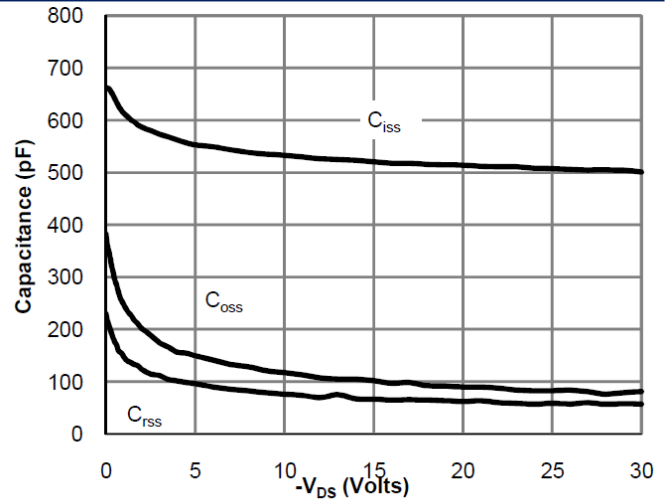
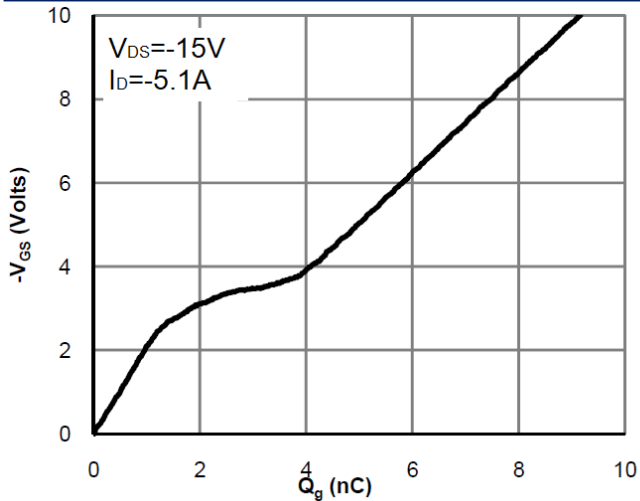


Figure 6: Body-Diode Characteristics



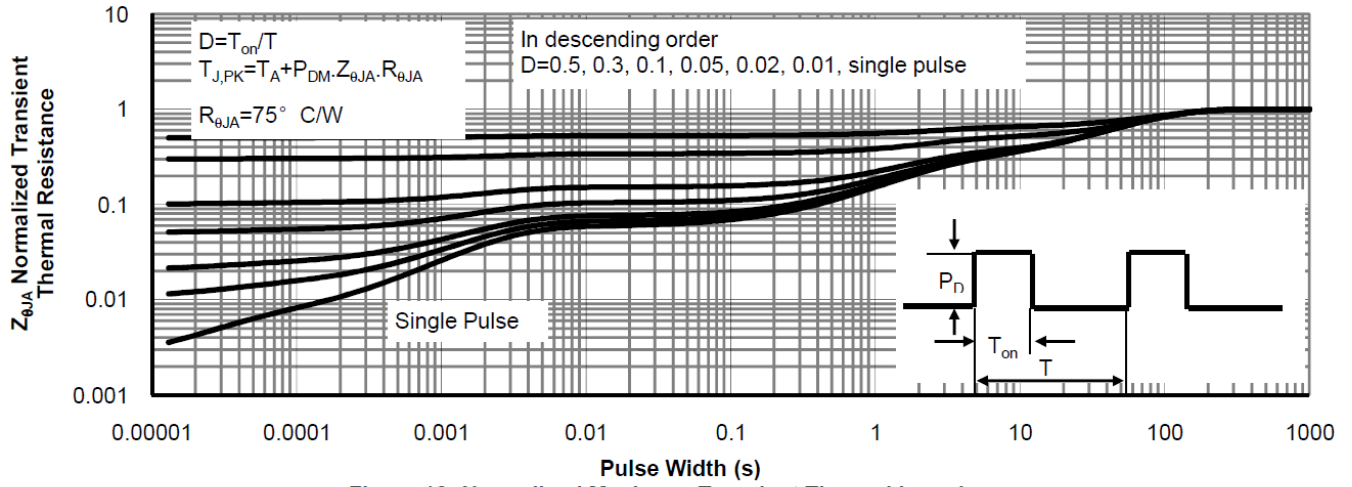
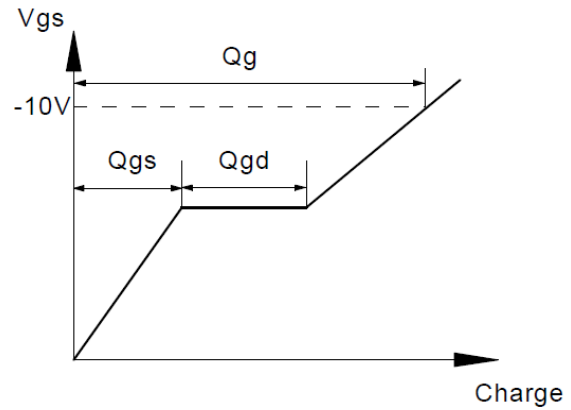
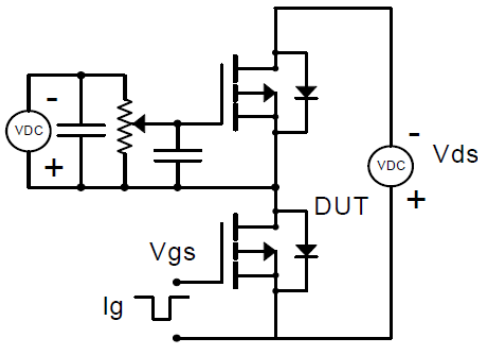
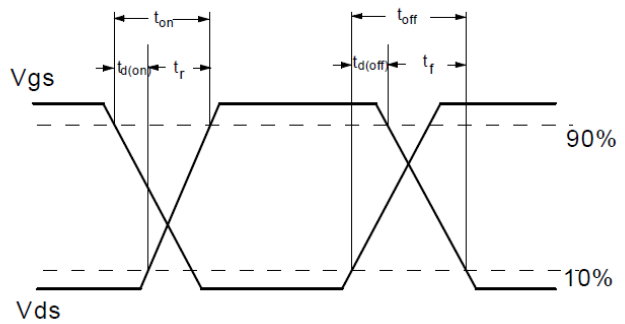
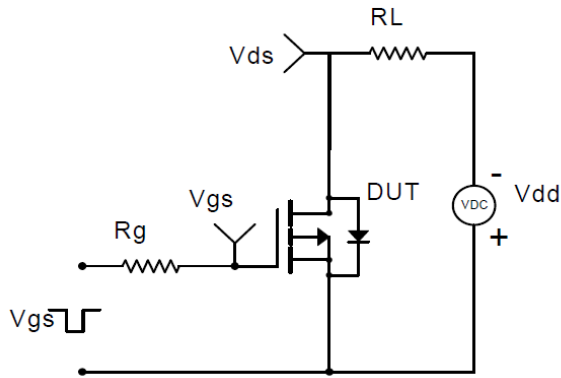


Figure 12: Normalized Maximum Transient Thermal Impedance

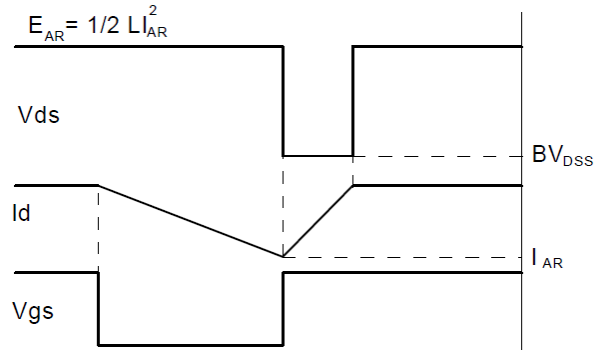
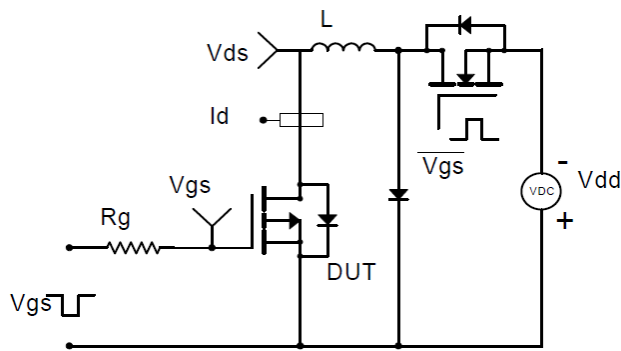
Gate Charge Test Circuit & Waveform



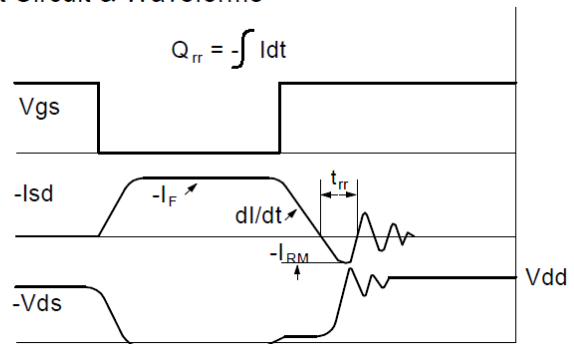
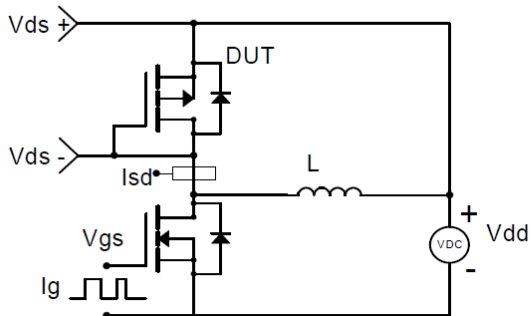
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

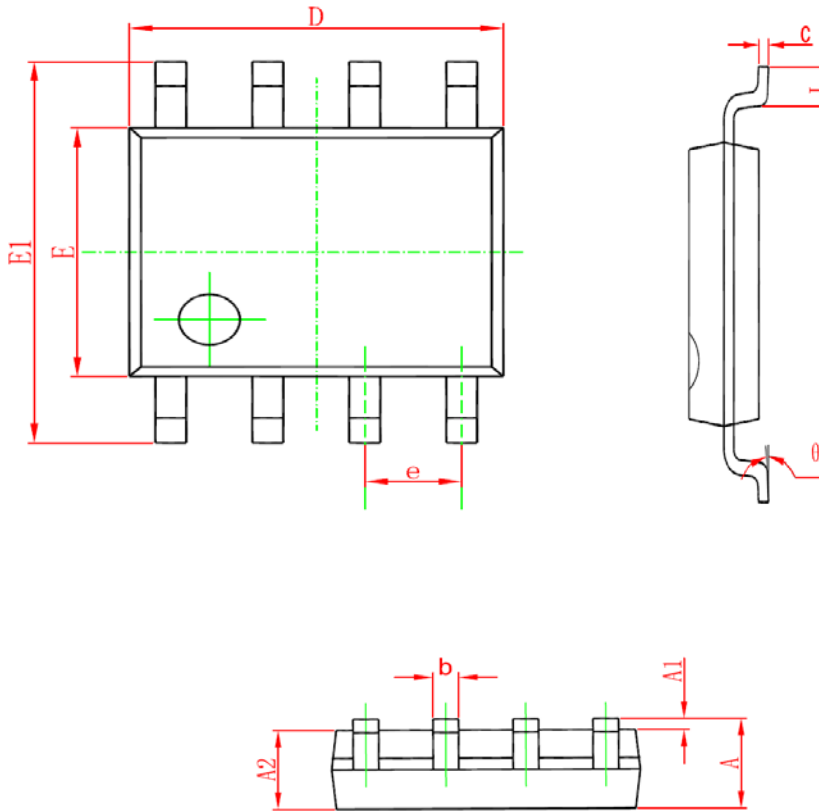


Diode Recovery Test Circuit & Waveforms



**Package Information**

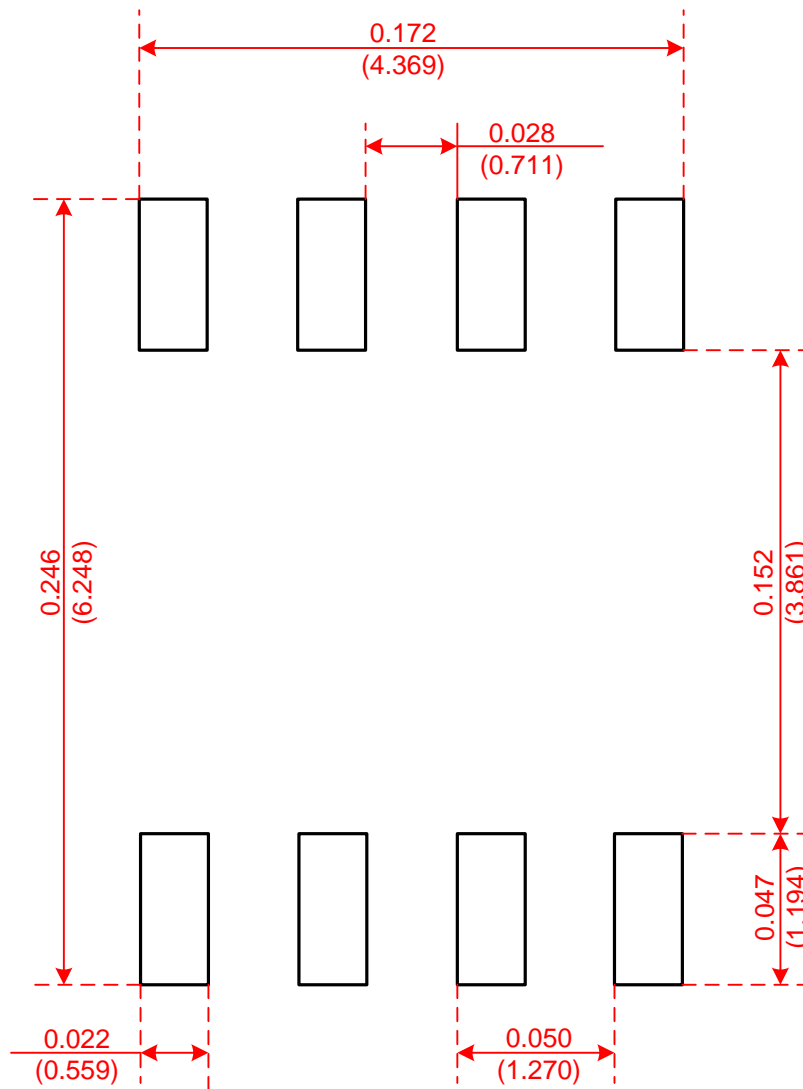
- SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

## Recommended Minimum Pads

- SOP-8

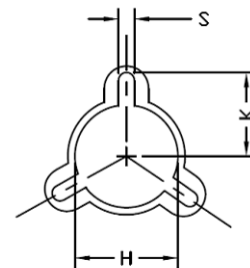
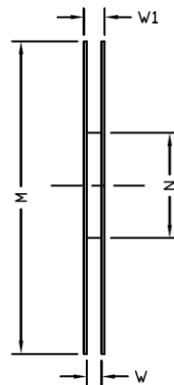
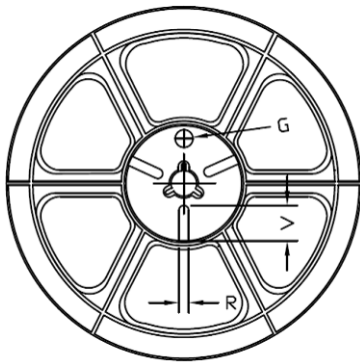
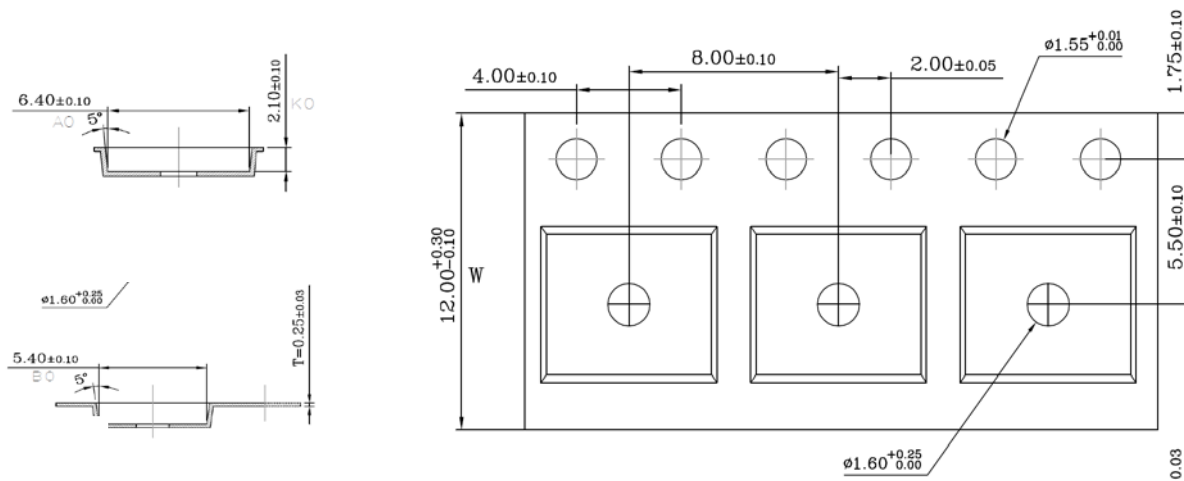


Recommended Minimum Pads  
Dimensions in Inches/(mm)



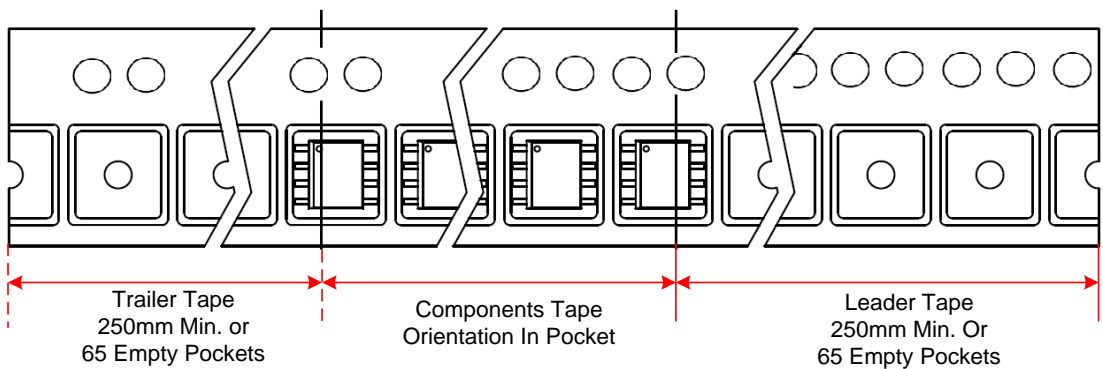
### Tape and Reel

- SOP-8



Tape Size	Reel Size	M	N	W	W1	H	K	S	G	R	V
12mm	$\phi 330$	$\phi 330.00$ $\pm 0.50$	$\phi 97.00$ $\pm 0.30$	$13.00$ $\pm 0.30$	$17.40$ $\pm 1.00$	$\phi 13.00$ $\pm 0.5$	$10.6$	$2.00$ $\pm 0.50$	—	—	—

Unit Per Reel:  
4000pcs



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