

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

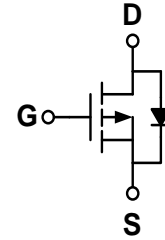
- ◆ Battery protection
- ◆ Load switch

Package

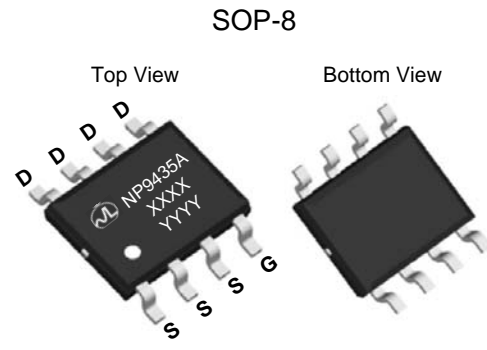
- ◆ SOP-8

100% UIS TESTED!
100% ΔV_{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}	± 20	V	
Continuous Drain Current	I_D	$T_A = 25^\circ C$	-5.5	A
		$T_A = 70^\circ C$	-4	
Pulsed Drain Current ^C	I_{DP}	-22	A	
Avalanche energy(L=0.1mH) ^C	E_{AS}	10	mJ	
Maximum power dissipation ^B	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 ^A	≤ 10s	R _{θJA}	33	40	°C/W
Maximum Junction-to-Ambient ^{A D}	Steady-State		59	75	
Maximum Junction-to-Lead ^B	Steady-State	R _{θJL}	16	24	

A: The value of R_{θJA} is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with T_A =25°C. The value in any given application depends on the user's specific board design.

B. The power dissipation P_D is based on T_{J(MAX)}=150°C, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature T_{J(MAX)}=150°C. Ratings are based on low frequency and duty cycles to keep initial T_J=25°C.

D. The R_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} and lead to ambient.

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

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

Typical Performance Characteristics

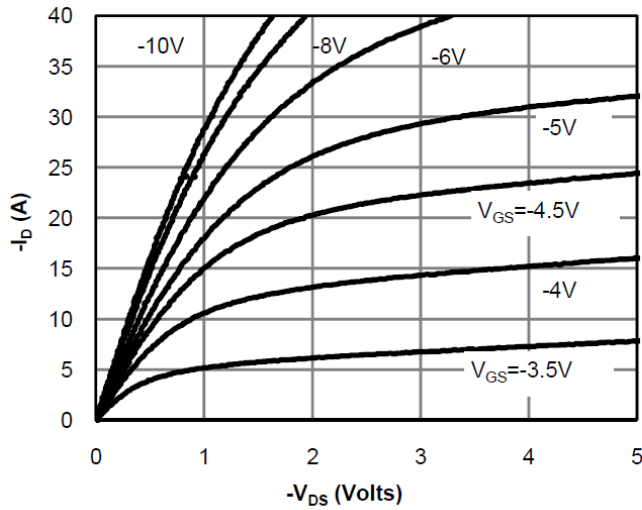


Fig 1: On-Region Characteristics

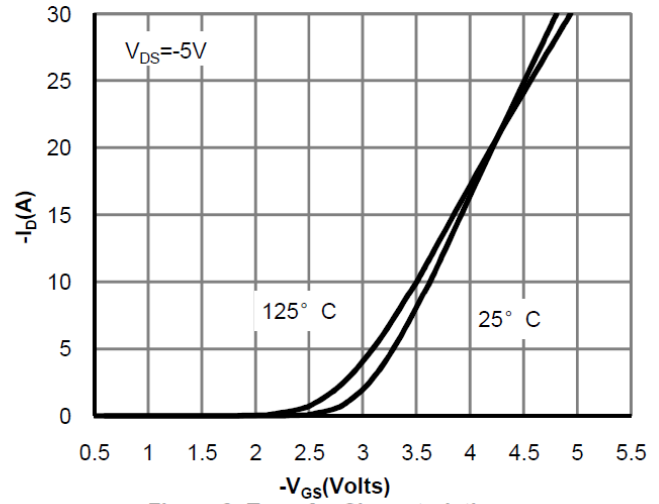


Figure 2: Transfer Characteristics

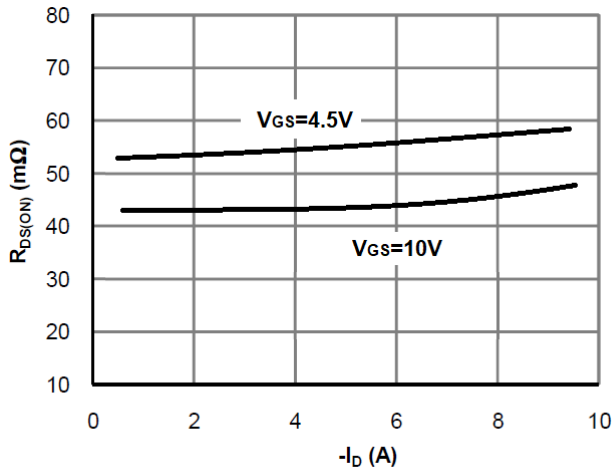


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

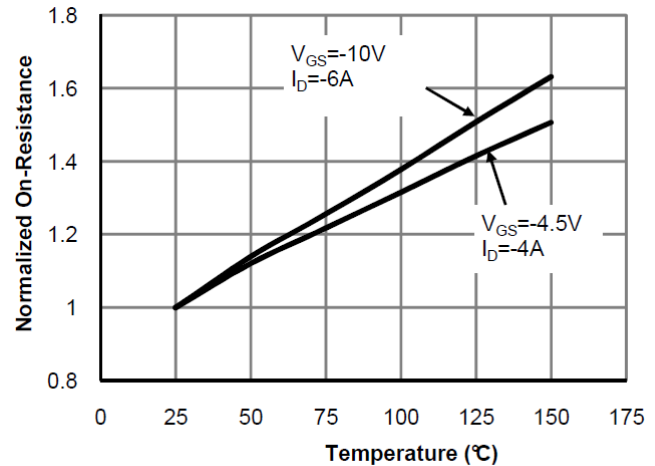


Figure 4: On-Resistance vs. Junction Temperature

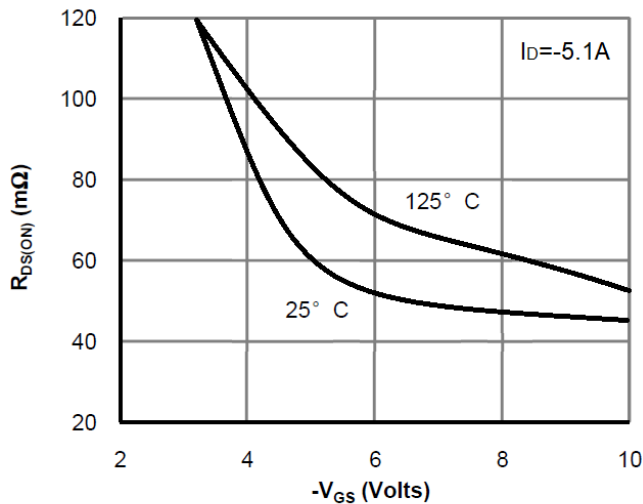


Figure 5: On-Resistance vs. Gate-Source Voltage

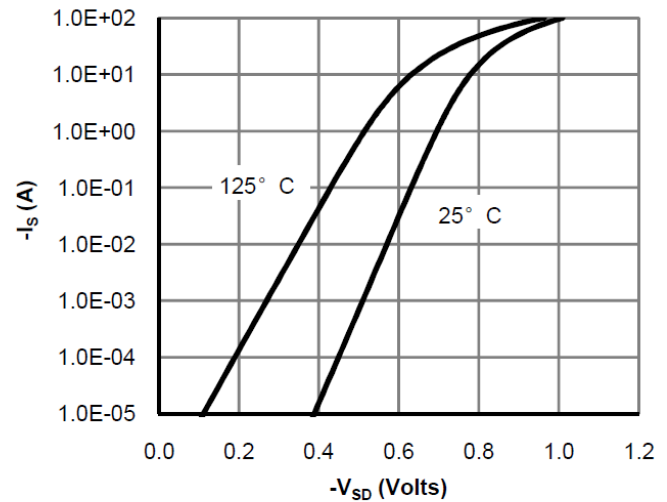


Figure 6: Body-Diode Characteristics

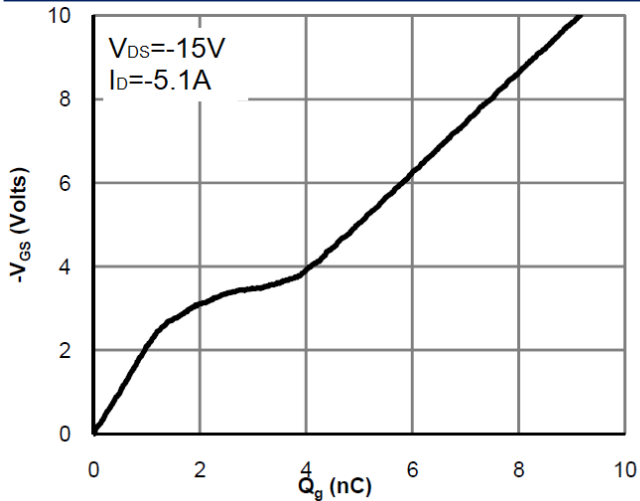


Figure 7: Gate-Charge Characteristics

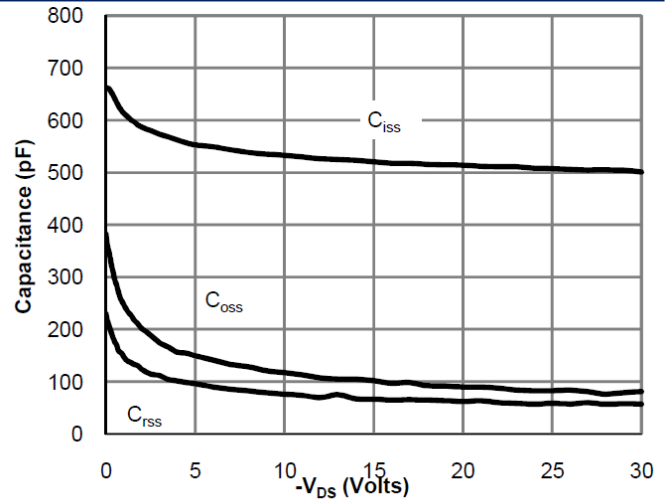


Figure 8: Capacitance Characteristics

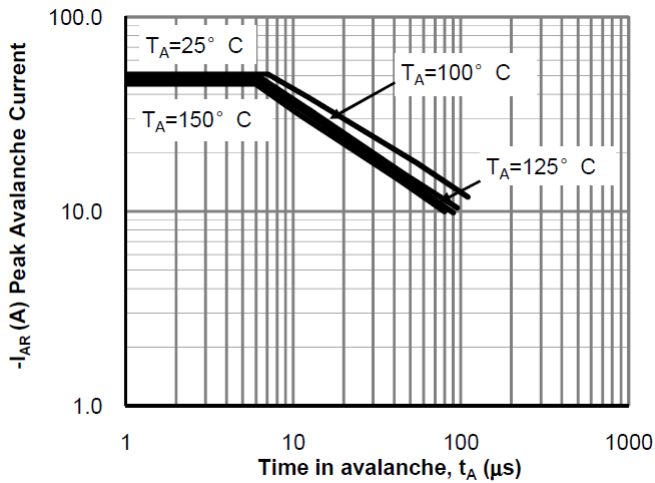


Figure 9: Single Pulse Avalanche capability

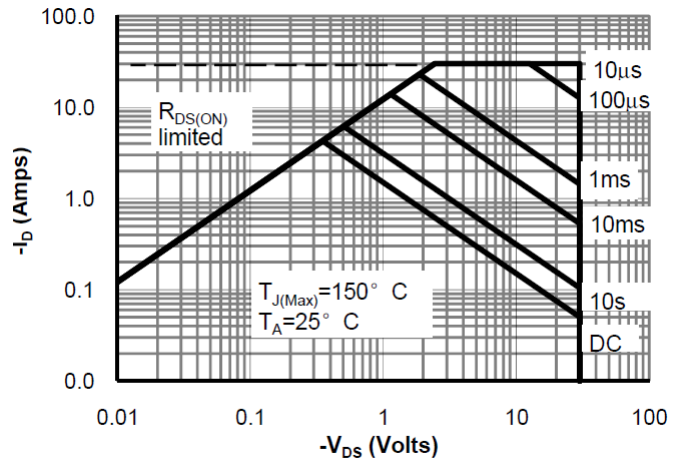


Figure 10: Maximum Forward Biased Safe Operating Area

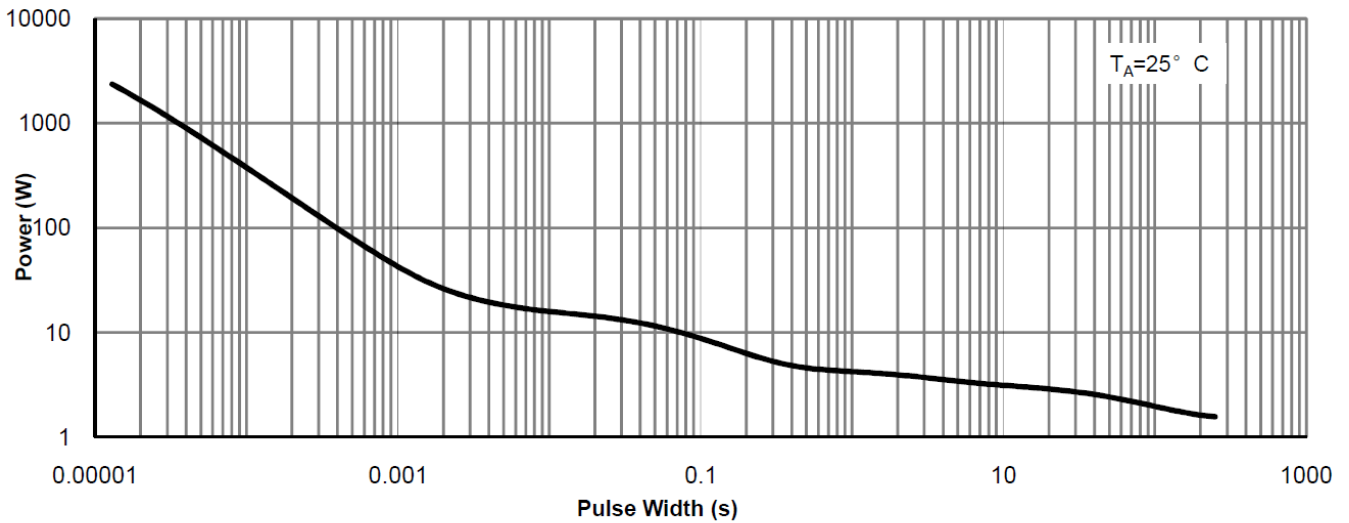


Figure 11: Single Pulse Power Rating Junction-to-Ambient

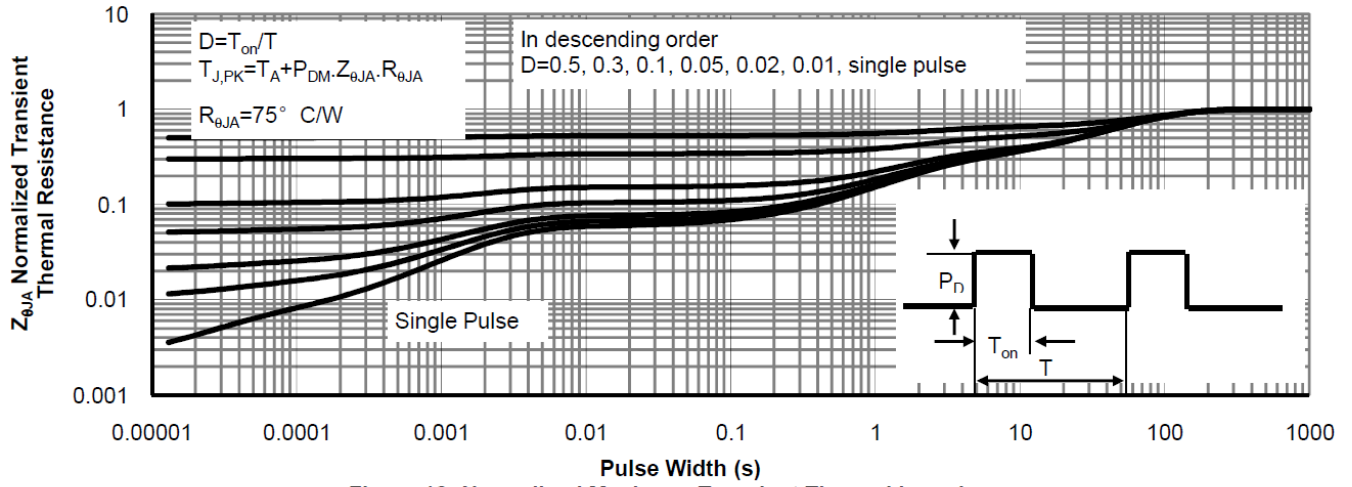
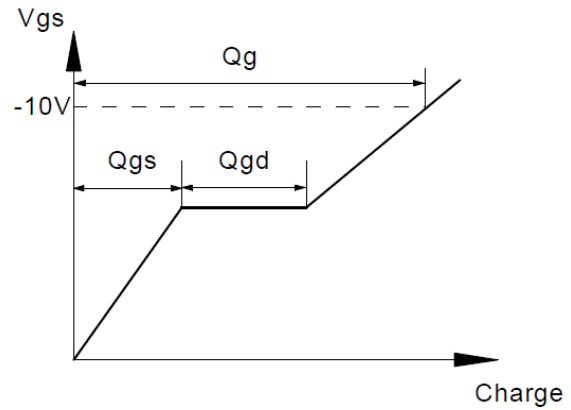
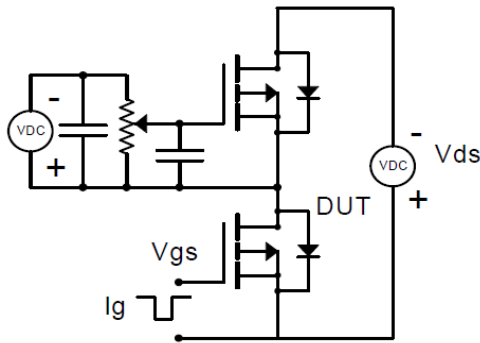
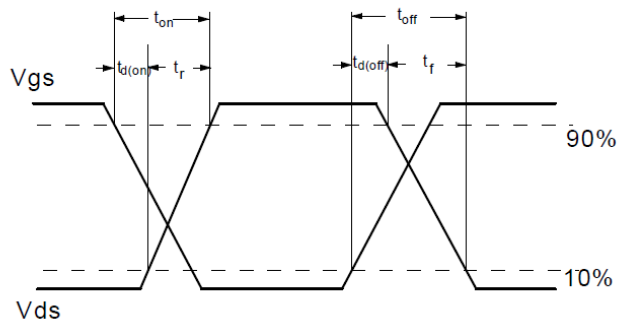
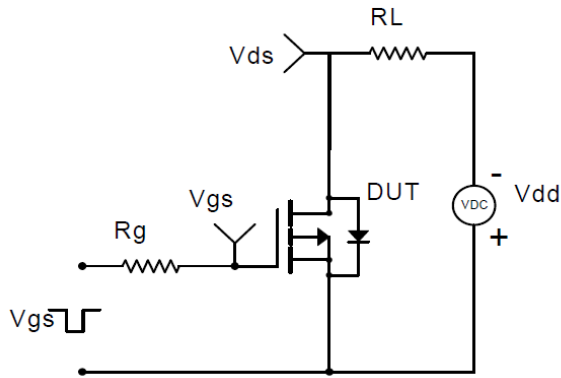


Figure 12: Normalized Maximum Transient Thermal Impedance

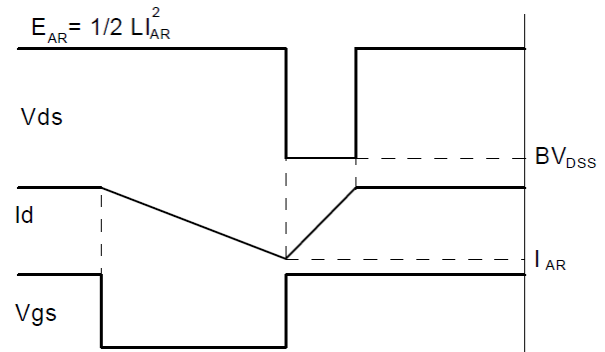
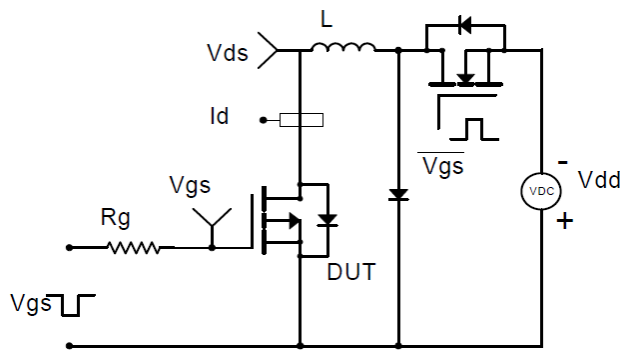
Gate Charge Test Circuit & Waveform



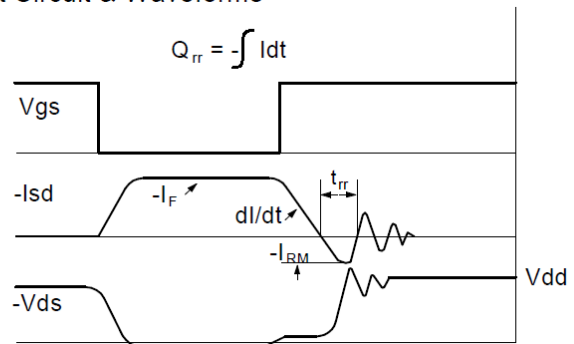
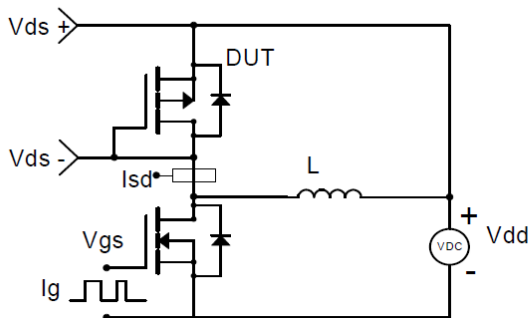
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

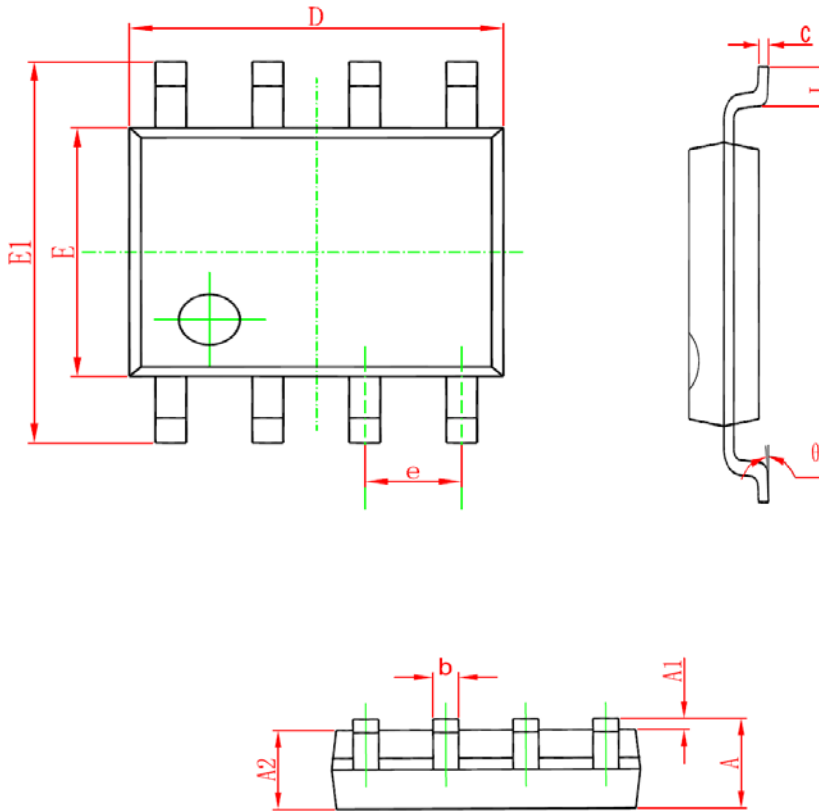


Diode Recovery Test Circuit & Waveforms



Package Information

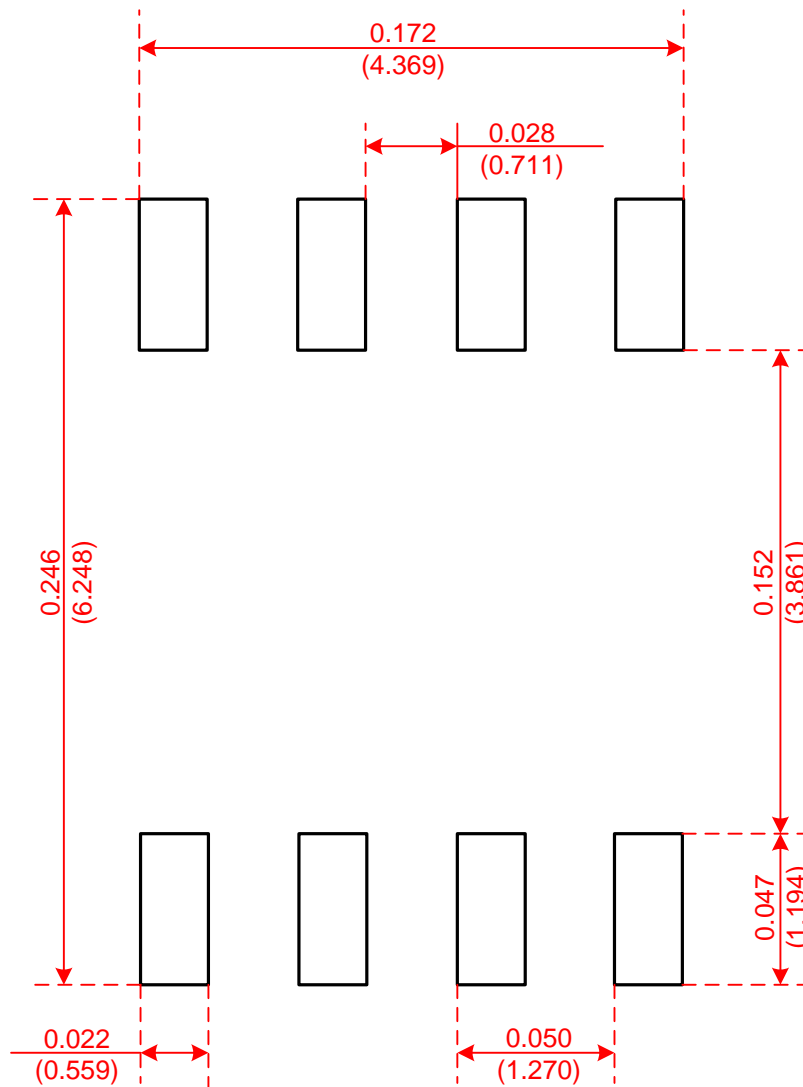
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Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	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

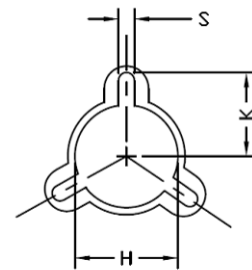
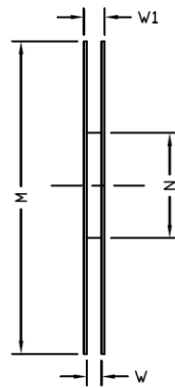
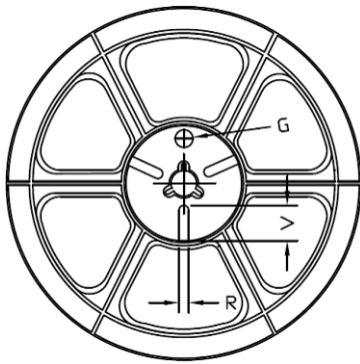
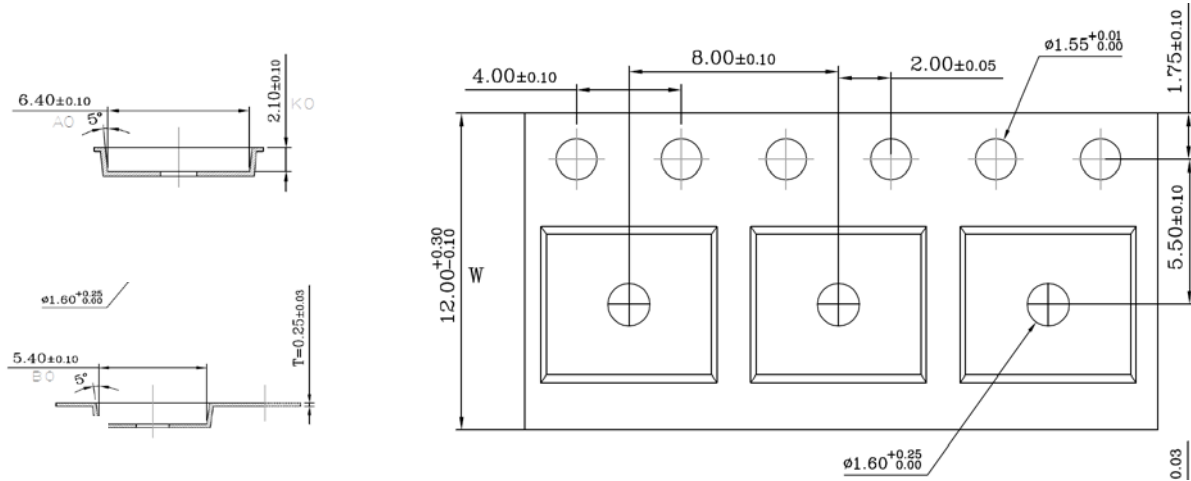
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**Recommended Minimum Pads
Dimensions in Inches/(mm)**

Tape and Reel

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Tape Size	Reel Size	M	N	W	W1	H	K	S	G	R	V
12mm	Φ330	Φ330.00 ±0.50	Φ97.00 ±0.30	13.00 ±0.30	17.40 ±1.00	Φ13.00 ±0.5	10.6	2.00 ±0.50	—	—	—

Unit Per Reel:
4000pcs

