

**P-Ch 40V Fast Switching MOSFETs**

- ★ 100% EAS Guaranteed
- ★ Green Device Available
- ★ Super Low Gate Charge
- ★ Excellent CdV/dt effect decline
- ★ Advanced high cell density Trench technology

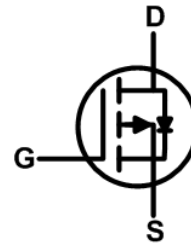
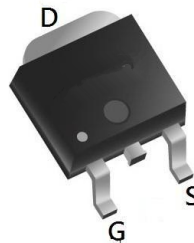
**Product Summary**

BVDSS	R <sub>DS(on)</sub>	I <sub>D</sub>
-40V	13.5mΩ	-40A

**Description**

The SM4185 is the high cell density trenched P-ch MOSFETs, which provide excellent R<sub>DS(on)</sub> and gate charge for most of the synchronous buck converter applications.

The SM4185 meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

**TO252 Pin Configuration**

**Absolute Maximum Ratings (T<sub>A</sub> = 25°C, unless otherwise noted)**

Parameter		Symbol	Value	Unit
Drain-Source Voltage		V <sub>DS</sub>	-40	V
Gate-Source Voltage		V <sub>GS</sub>	±20	V
Continuous Drain Current	T <sub>C</sub> =25°C	I <sub>D</sub>	-40	A
	T <sub>C</sub> =100°C		-22	
Pulsed Drain Current <sup>1</sup>		I <sub>DM</sub>	-140	A
Single Pulse Avalanche Energy <sup>2</sup>		EAS	57.8	mJ
Total Power Dissipation	T <sub>C</sub> =25°C	P <sub>D</sub>	40.3	W
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C

**Thermal Characteristics**

Parameter	Symbol	Value	Unit
Thermal Resistance from Junction-to-Ambient <sup>3</sup>	R <sub>θJA</sub>	66	°C/W
Thermal Resistance from Junction-to-Case	R <sub>θJC</sub>	3.1	°C/W

**Electrical Characteristics (T<sub>J</sub> = 25°C, unless otherwise noted)**

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
Drain-Source Breakdown Voltage	<b>V<sub>(BR)DSS</sub></b>	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	-40	-	-	V
Gate-body Leakage current	<b>I<sub>GSS</sub></b>	V <sub>DS</sub> = 0V, V <sub>GS</sub> = ±20V	-	-	±100	nA
Zero Gate Voltage Drain Current	T <sub>J</sub> =25°C	I <sub>DSS</sub> V <sub>DS</sub> = -40V, V <sub>GS</sub> = 0V	-	-	-1	μA
	T <sub>J</sub> =100°C		-	-	-100	
Gate-Threshold Voltage	<b>V<sub>GS(th)</sub></b>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	-1.0	-1.5	-2.2	V
Drain-Source On-Resistance <sup>4</sup>	<b>R<sub>DS(on)</sub></b>	V <sub>GS</sub> = -10V, I <sub>D</sub> = -20A	-	13.5	19	mΩ
		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -15A	-	19.5	25	
Forward Transconductance <sup>4</sup>	<b>g<sub>fs</sub></b>	V <sub>DS</sub> = -10V, I <sub>D</sub> = -20A	-	44	-	S
<b>Dynamic Characteristics<sup>5</sup></b>						
Input Capacitance	<b>C<sub>iss</sub></b>	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V, f = 1MHz	-	2525	-	pF
Output Capacitance	<b>C<sub>oss</sub></b>		-	190	-	
Reverse Transfer Capacitance	<b>C<sub>rss</sub></b>		-	172	-	
Gate Resistance	<b>R<sub>g</sub></b>	f = 1MHz	-	10	-	Ω
<b>Switching Characteristics<sup>5</sup></b>						
Total Gate Charge	<b>Q<sub>g</sub></b>	V <sub>GS</sub> = -10V, V <sub>DS</sub> = -20V, I <sub>D</sub> = -20A	-	35	-	nC
Gate-Source Charge	<b>Q<sub>gs</sub></b>		-	5.5	-	
Gate-Drain Charge	<b>Q<sub>gd</sub></b>		-	8	-	
Turn-On Delay Time	<b>t<sub>d(on)</sub></b>	V <sub>GS</sub> = -10V, V <sub>DD</sub> = -20V, R <sub>G</sub> = 3Ω, I <sub>D</sub> = -20A	-	14.5	-	ns
Rise Time	<b>t<sub>r</sub></b>		-	20.2	-	
Turn-Off Delay Time	<b>t<sub>d(off)</sub></b>		-	32	-	
Fall Time	<b>t<sub>f</sub></b>		-	10	-	
<b>Drain-Source Body Diode Characteristics</b>						
Diode Forward Voltage <sup>4</sup>	<b>V<sub>SD</sub></b>	I <sub>S</sub> = -20A, V <sub>GS</sub> = 0V	-	-	-1.2	V
Continuous Source Current	T <sub>C</sub> =25°C	<b>I<sub>S</sub></b>	-	-	-40	A

Note :

1. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150°C.
2. The EAS data shows Max. rating . The test condition is V<sub>DD</sub>= -25V, V<sub>GS</sub>= -10V, L= 0.1mH, I<sub>AS</sub>= -34A.
3. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper, The value in any given application depends on the user's specific board design.
4. The data tested by pulsed , pulse width ≤ 300us , duty cycle ≤ 2%.
5. This value is guaranteed by design hence it is not included in the production test.

Typical Characteristics

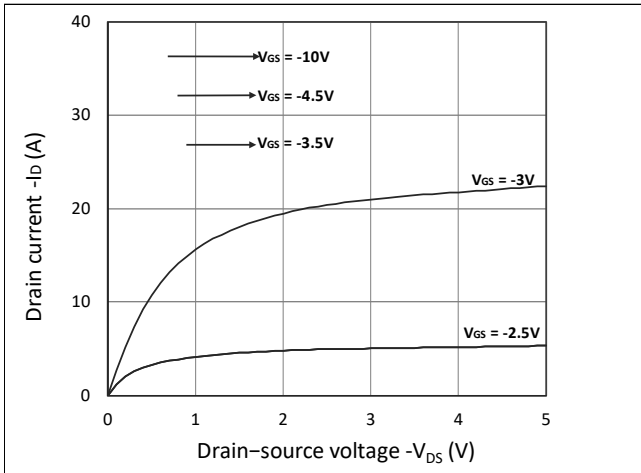


Figure 1. Output Characteristics

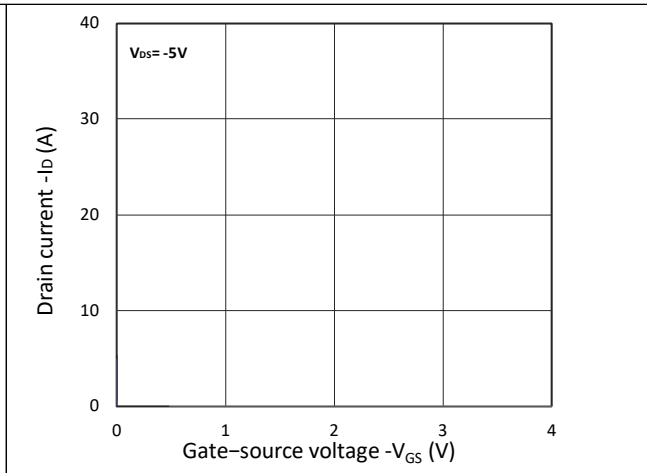


Figure 2. Transfer Characteristics

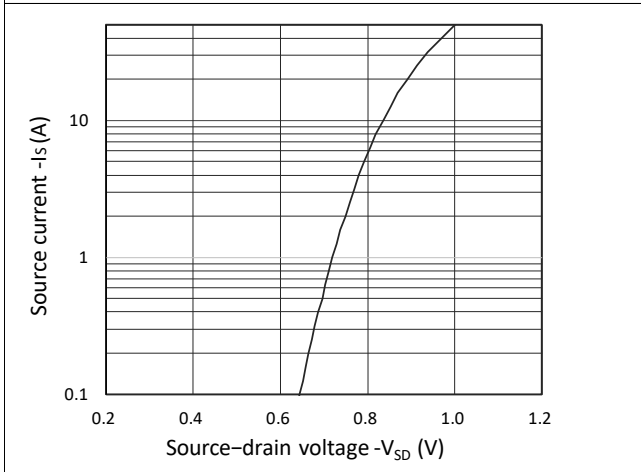


Figure 3. Forward Characteristics of Reverse

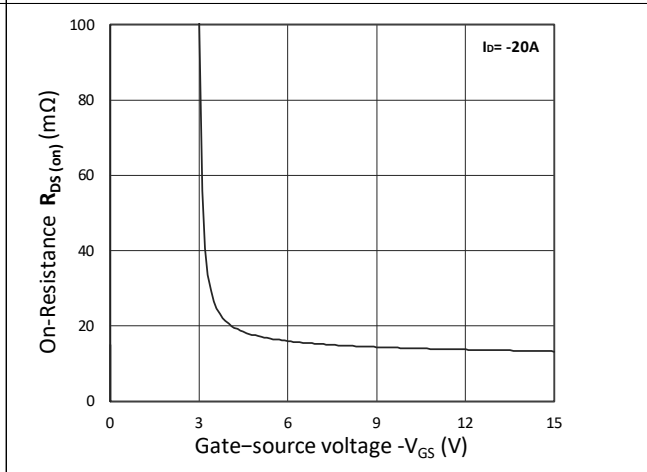


Figure 4.  $R_{DS(ON)}$  vs.  $V_{GS}$

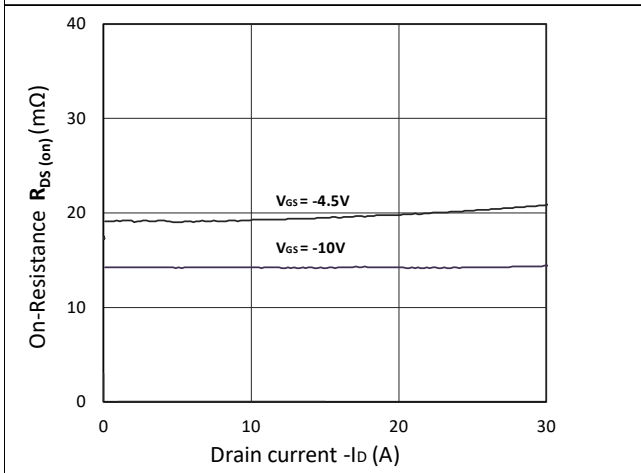


Figure 5.  $R_{DS(ON)}$  vs.  $I_D$

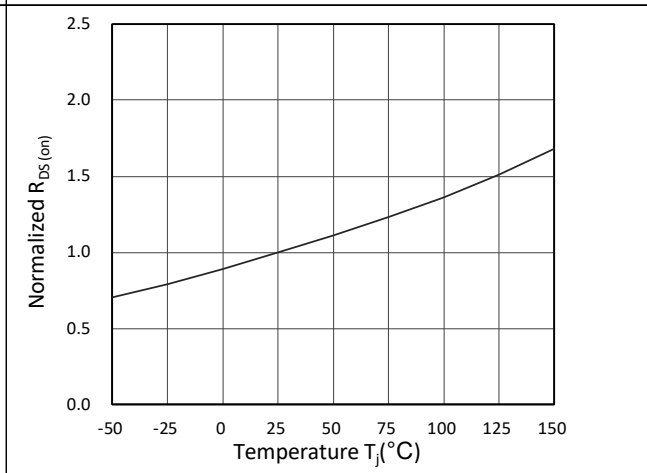


Figure 6. Normalized  $R_{DS(ON)}$  vs. Temperature

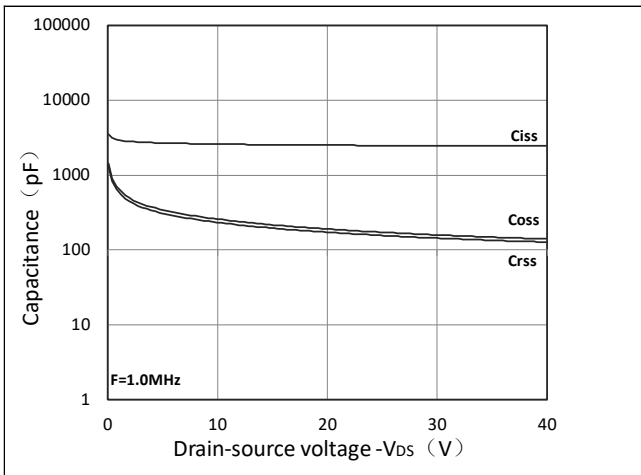


Figure 7. Capacitance Characteristics

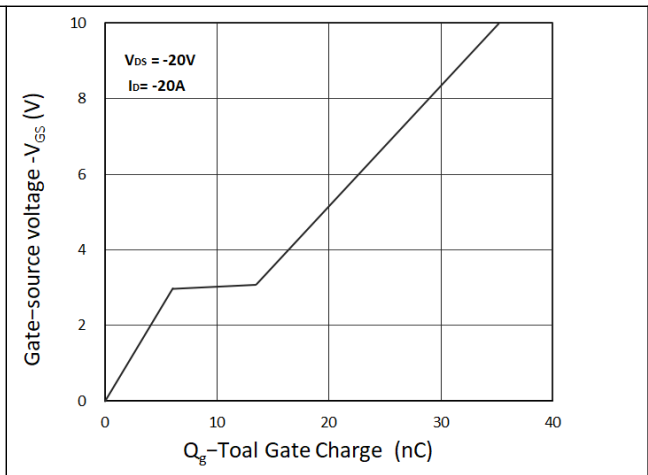


Figure 8. Gate Charge Characteristics

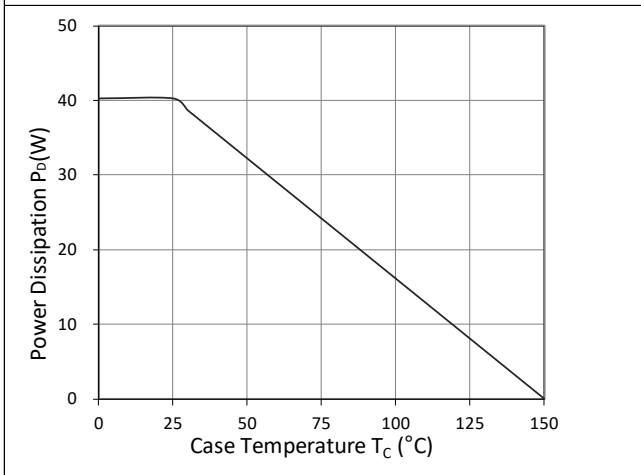


Figure 9. Power Dissipation

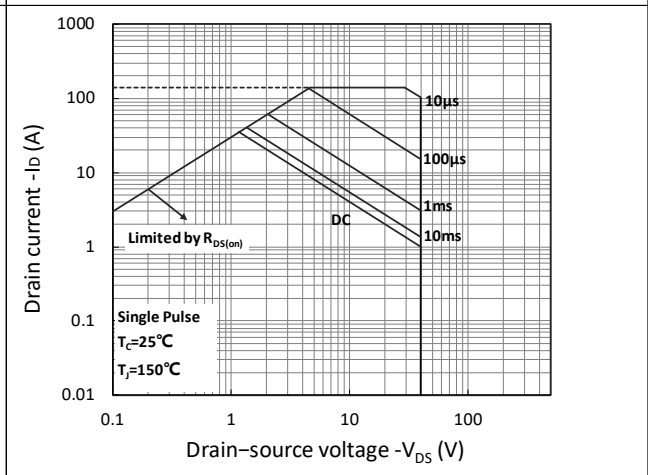


Figure 10. Safe Operating Area

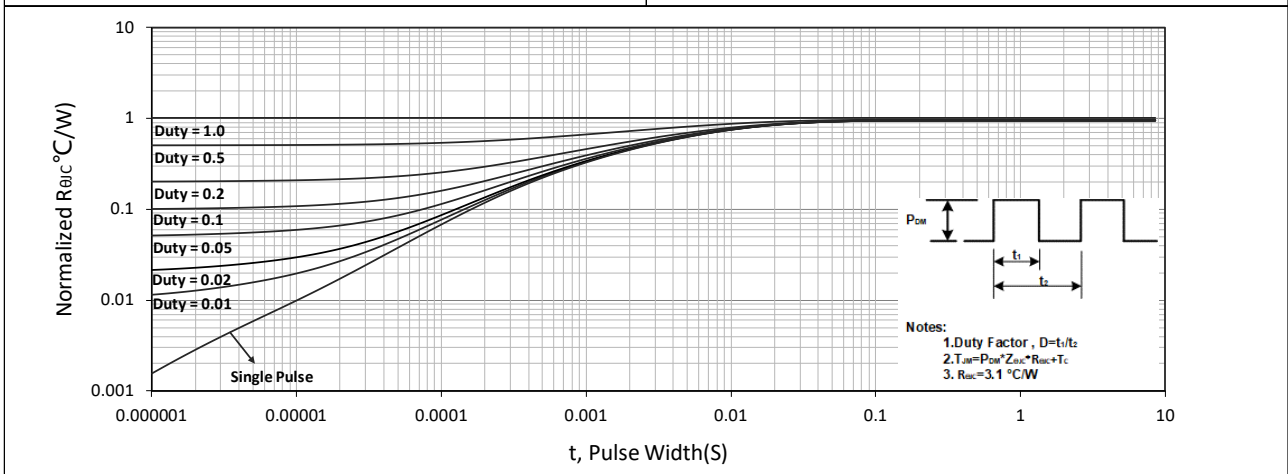


Figure 11. Normalized Maximum Transient Thermal Impedance

Test Circuit

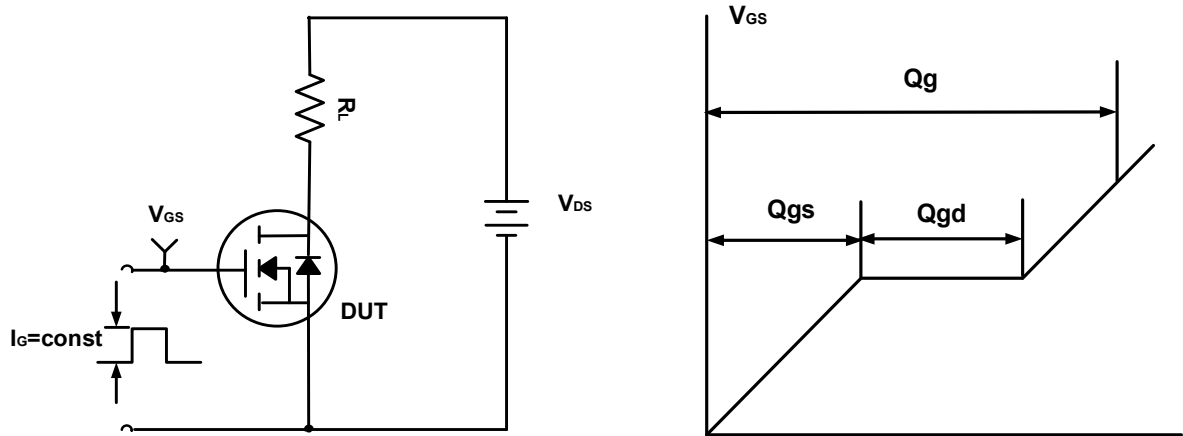


Figure A. Gate Charge Test Circuit & Waveforms

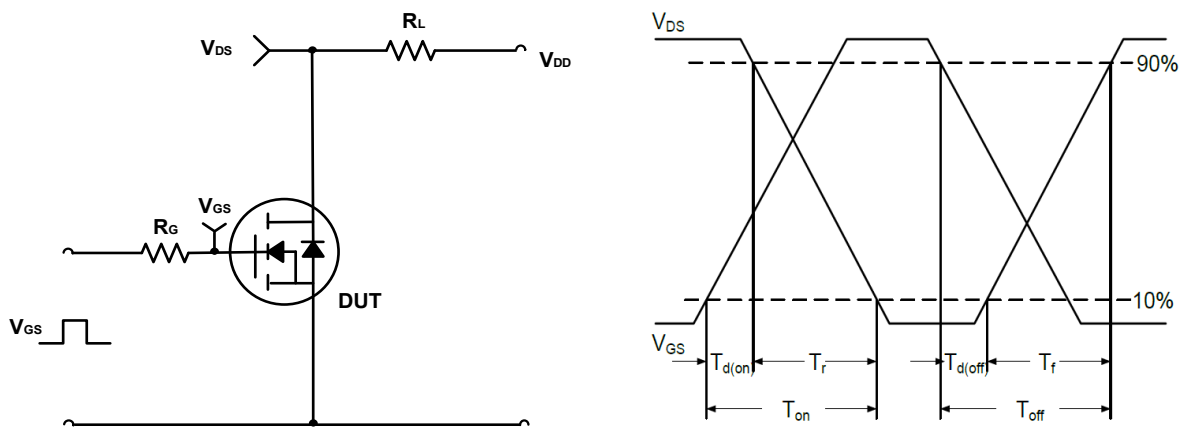


Figure B. Switching Test Circuit & Waveforms

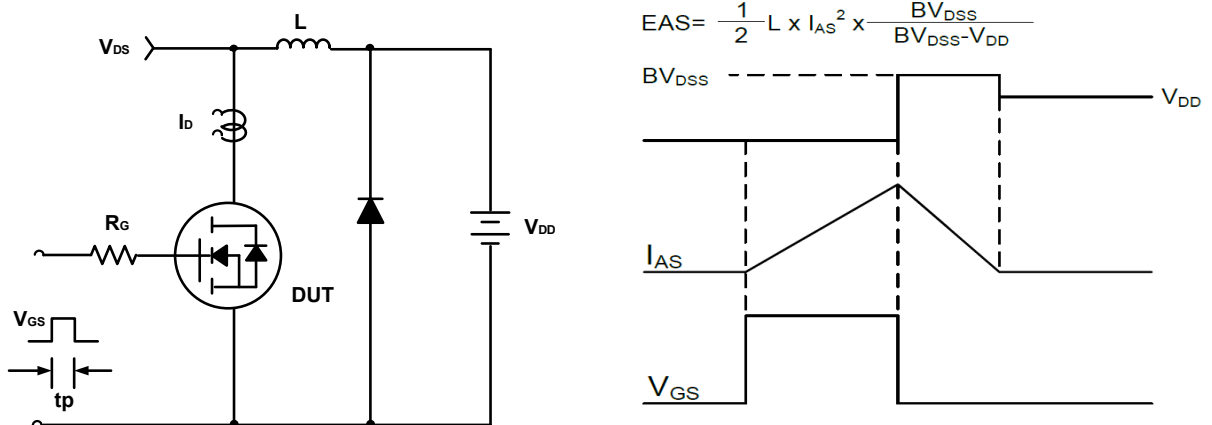
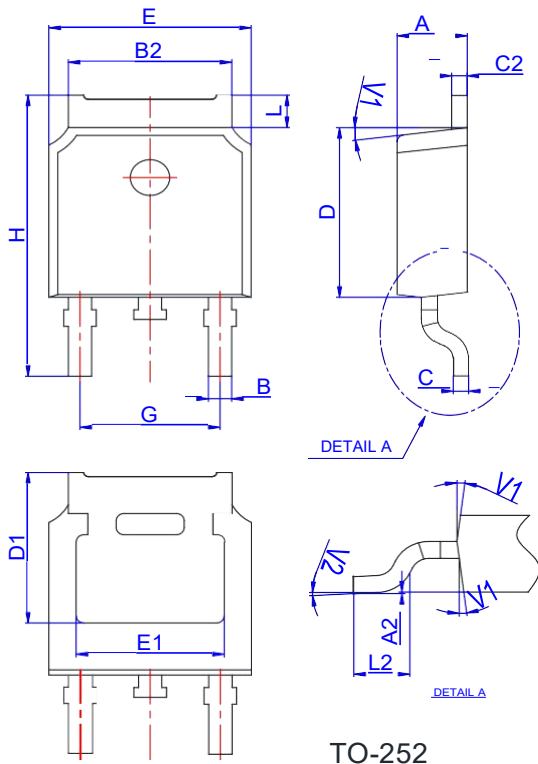


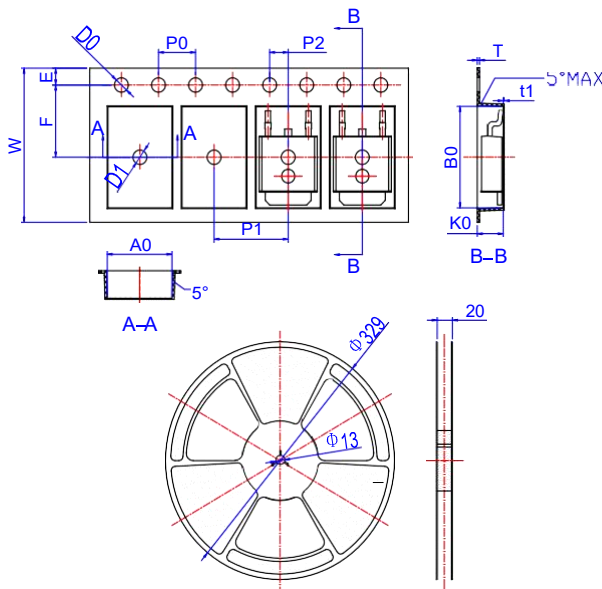
Figure C. Unclamped Inductive Switching Circuit & Waveforms

### Package Mechanical Data-TO-252



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.10		2.50	0.083		0.098
A2	0		0.10	0		0.004
B	0.66		0.86	0.026		0.034
B2	5.18		5.48	0.202		0.216
C	0.40		0.60	0.016		0.024
C2	0.44		0.58	0.017		0.023
D	5.90		6.30	0.232		0.248
D1	5.30REF			0.209REF		
E	6.40		6.80	0.252		0.268
E1	4.63			0.182		
G	4.47		4.67	0.176		0.184
H	9.50		10.70	0.374		0.421
L	1.09		1.21	0.043		0.048
L2	1.35		1.65	0.053		0.065
V1		7°			7°	
V2	0°		6°	0°		6°

### Lead Specification-TO-252



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
W	15.90	16.00	16.10	0.626	0.630	0.634
E	1.65	1.75	1.85	0.065	0.069	0.073
F	7.40	7.50	7.60	0.291	0.295	0.299
D0	1.40	1.50	1.60	0.055	0.059	0.063
D1	1.40	1.50	1.60	0.055	0.059	0.063
P0	3.90	4.00	4.10	0.154	0.157	0.161
P1	7.90	8.00	8.10	0.311	0.315	0.319
P2	1.90	2.00	2.10	0.075	0.079	0.083
A0	6.85	6.90	7.00	0.270	0.271	0.276
B0	10.45	10.50	10.60	0.411	0.413	0.417
K0	2.68	2.78	2.88	0.105	0.109	0.113
T	0.24		0.27	0.009		0.011
t1	0.10			0.004		
10P0	39.80	40.00	40.20	1.567	1.575	1.583

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