

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

## Product Summary

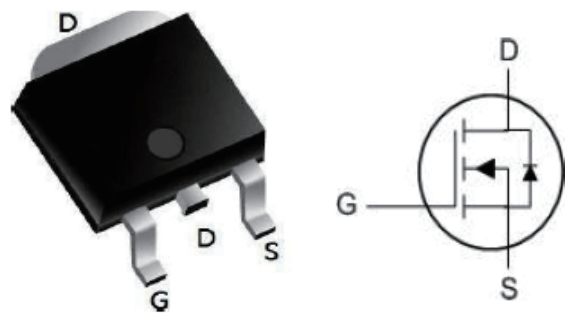
BVDSS	RDS(on)	ID
30V	6.5mΩ	60A

## Description

The 60N03 is the high cell density trenched N-ch MOSFETs, which provide excellent RDS(on) and gate charge for most of the synchronous buck converter applications.

The 60N03 meet the RoHS and Green Product, requirement 100% EAS guaranteed with full function reliability approved.

## TO252 Pin Configuration



## Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		10s	Steady State	
$V_{DS}$	Drain-Source Voltage	30		V
$V_{GS}$	Gate-Source Voltage	±20		V
$I_D@T_C=25^{\circ}C$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	60		A
$I_D@T_C=100^{\circ}C$	Continuous Drain Current, $V_{GS}$ @ 10V <sup>1</sup>	33		A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	198		A
$E_{AS}$	Single Pulse Avalanche Energy <sup>3</sup>	36		mJ
$I_{AS}$	Avalanche Current	53.8		A
$P_D@T_C=25^{\circ}C$	Total Power Dissipation <sup>4</sup>	32.5		W
$T_{STG}$	Storage Temperature Range	-55 to 175		°C
$T_J$	Operating Junction Temperature Range	-55 to 175		°C

## Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	---	3.56	°C/W

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

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250 μ A	30	-	-	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V,	-	-	1	μ A
I <sub>GSS</sub>	Gate to Body Leakage Current	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V	-	-	±100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250 μ A	1	1.5	2.5	V
R <sub>DS(on)</sub>	Static Drain-Source on-Resistance note <sup>3</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	-	6.5	7.5	m Ω
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A	-	10	14	
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =15V, V <sub>GS</sub> =0V, f=1.0MHz	-	1140	-	pF
C <sub>oss</sub>	Output Capacitance		-	175	-	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	151	-	
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =15V, I <sub>D</sub> =25A, V <sub>GS</sub> =10V	-	13.3	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	3.1	-	
Q <sub>gd</sub>	Gate-Drain( "Miller" ) Charge		-	5	-	
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DS</sub> =15V, I <sub>D</sub> =25A, R <sub>GEN</sub> =3 Ω , V <sub>GS</sub> =10V	-	15	-	ns
t <sub>r</sub>	Turn-on Rise Time		-	19	-	
t <sub>d(off)</sub>	Turn-off Delay Time		-	35	-	
t <sub>f</sub>	Turn-off Fall Time		-	21	-	
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain to Source Diode Forward Current		-	-	50	A
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		-	-	200	
V <sub>SD</sub>	Drain to Source Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =30A	-	-	1.2	V
t <sub>rr</sub>	Body Diode Reverse Recovery Time		-	25	-	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =30A, di/dt=100A/ μ s	-	26	-	nC

**Note :**

- 1.Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
- 2.EAS condition: T<sub>J</sub>=25°C, V<sub>DD</sub>=15V, V<sub>G</sub>=10V, R<sub>G</sub>=25Ω, L=0.5mH, I<sub>AS</sub>=12A
- 3.Pulse Test: Pulse Width ≤300μs, Duty Cycle ≤0.5%



Typical Performance Characteristics

Figure 1: Output Characteristics

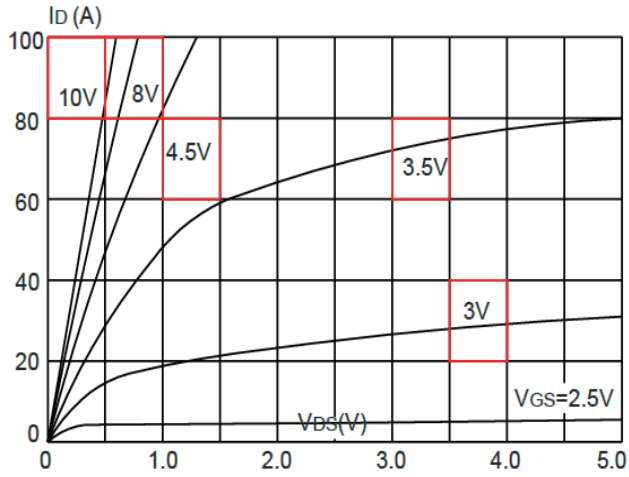


Figure 2: Typical Transfer Characteristics

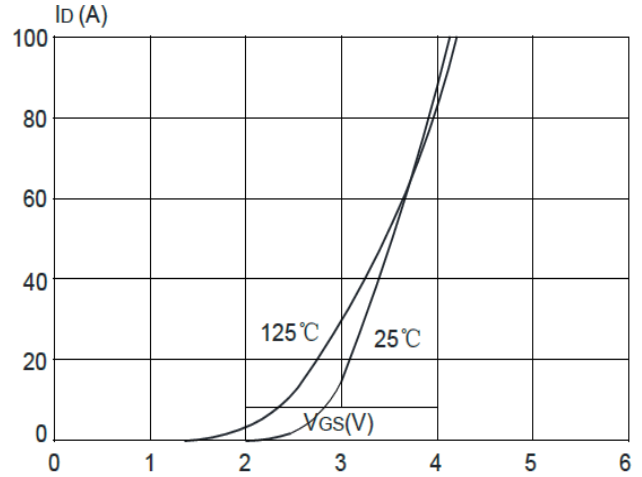


Figure 3: On-resistance vs. Drain Current

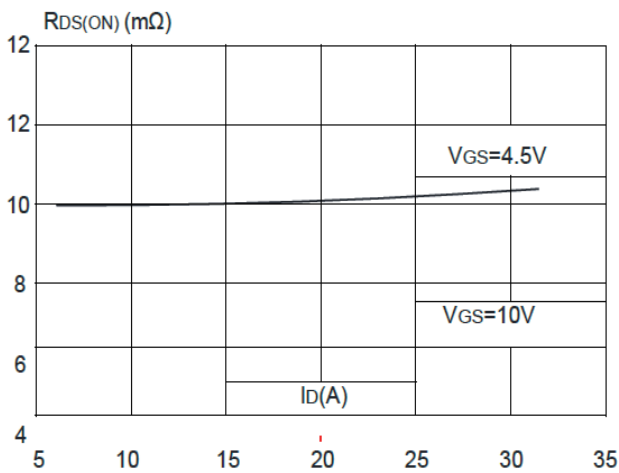


Figure 4: Body Diode Characteristics

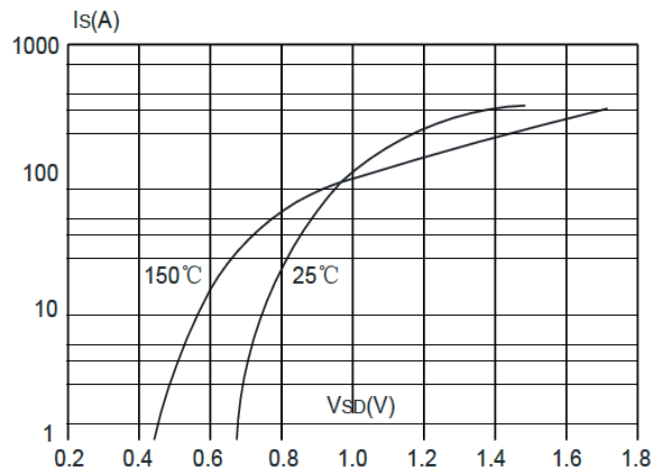


Figure 5: Gate Charge Characteristics

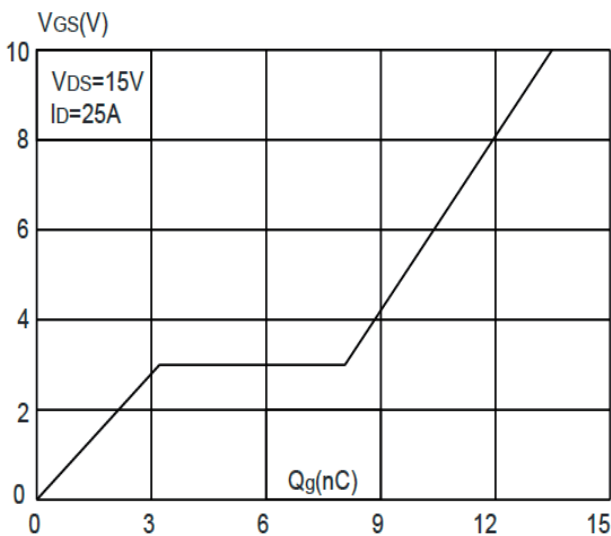
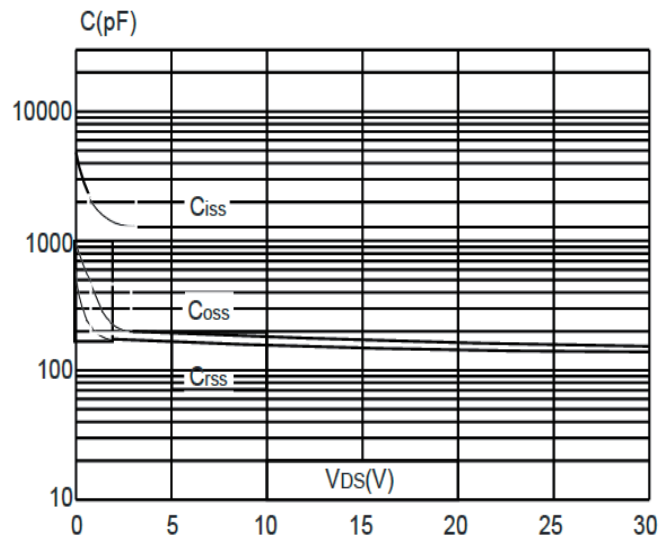


Figure 6: Capacitance Characteristics



## Typical Performance Characteristics

Figure 7: Normalized Breakdown Voltage

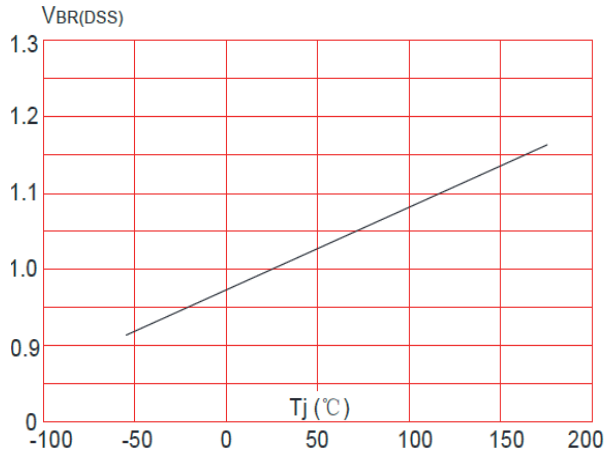


Figure 8: Normalized on Resistance vs. Junction Temperature

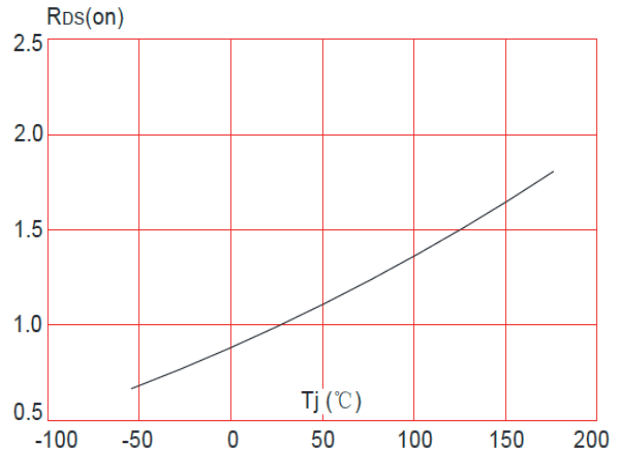


Figure 9: Maximum Safe Operating Area

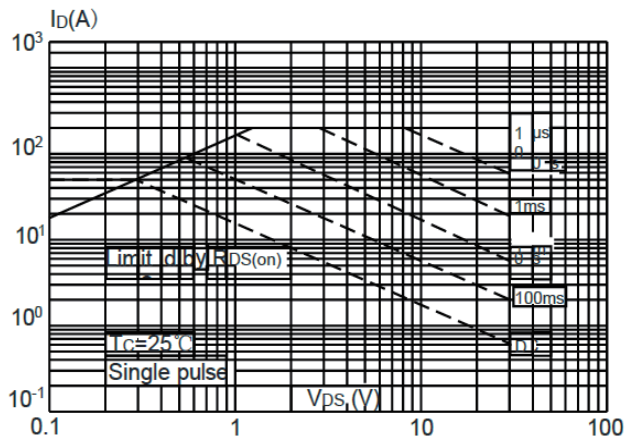


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

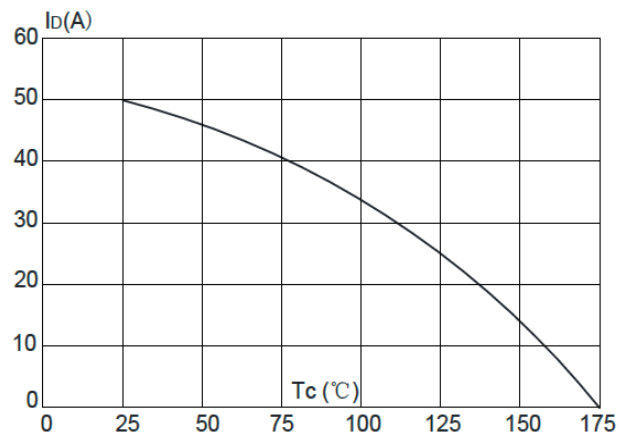
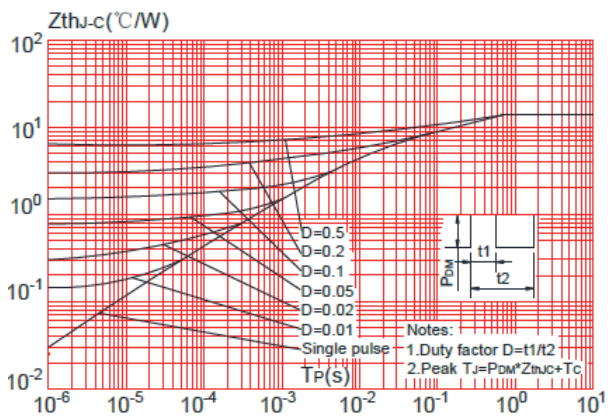


Figure 11: Maximum Effective Transient Thermal Impedance



Test Circuit

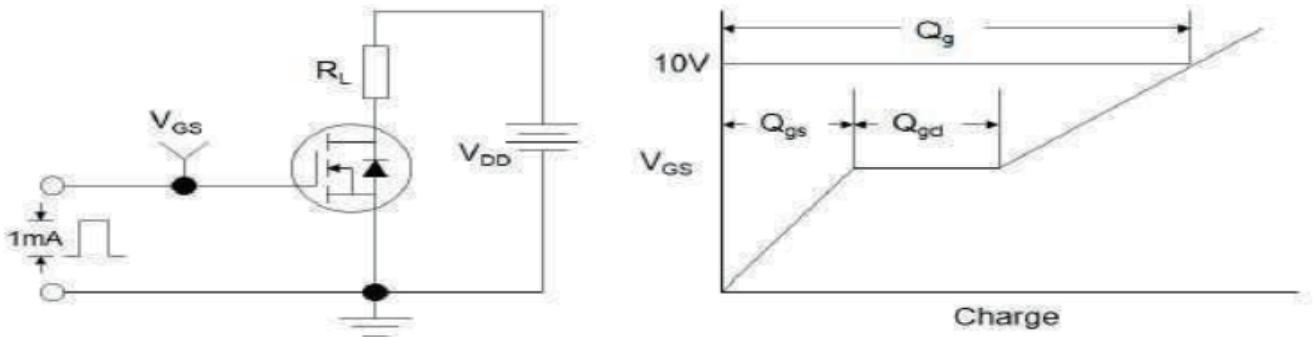


Figure1: Gate Charge Test Circuit & Waveform

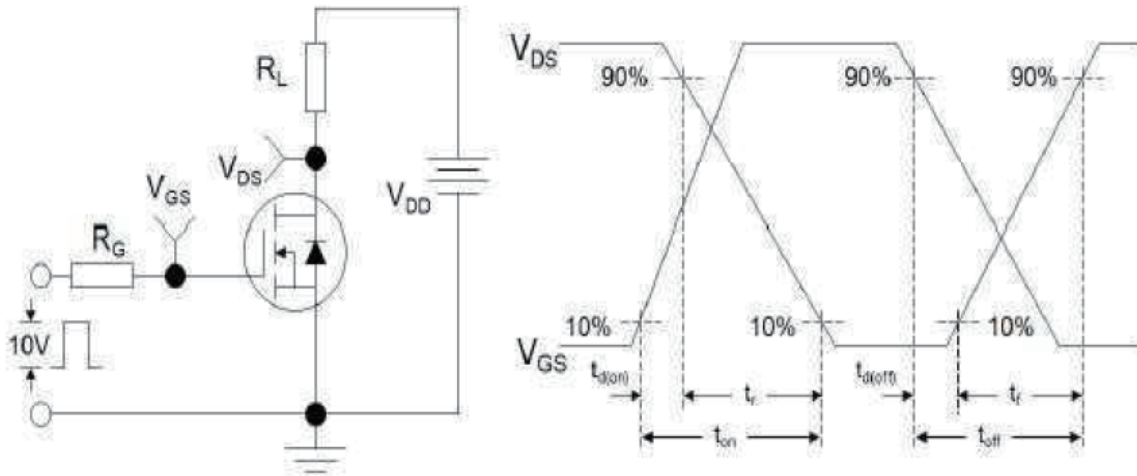


Figure 2: Resistive Switching Test Circuit & Waveforms

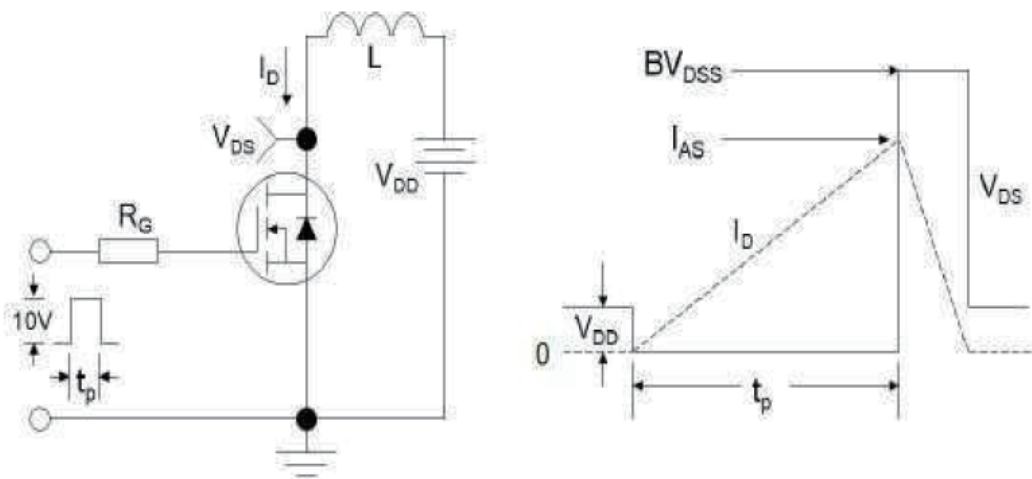
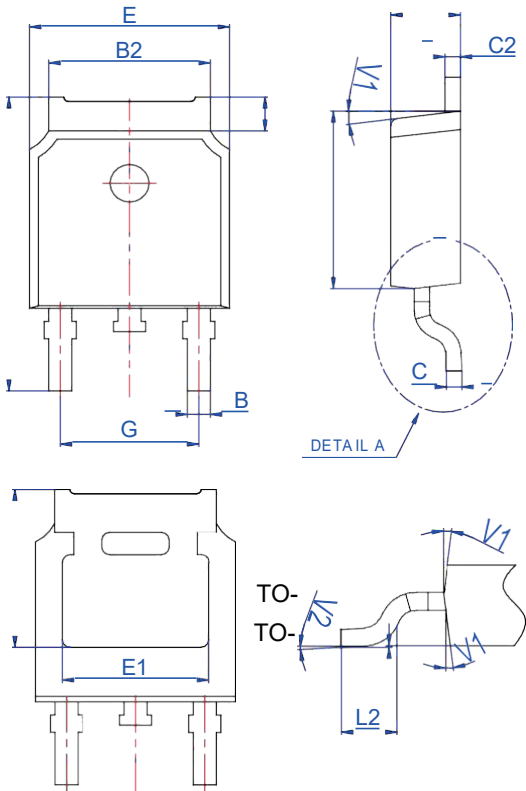


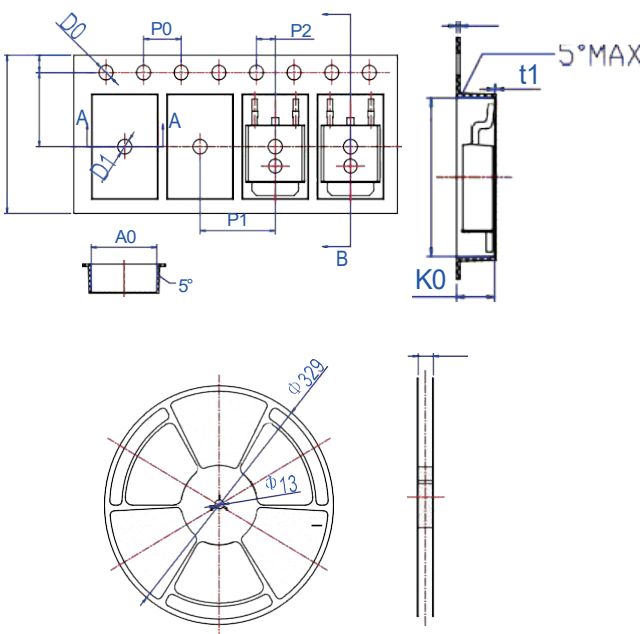
Figure 3: Unclamped Inductive Switching Test Circuit & Waveforms

## Package Mechanical Data-TO-252-4R



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.1		2.5	0.083		0.098
A2	0		0.1	0		0.004
B	0.66		0.86	0.026		0.034
B2	5.18		5.48	0.202		0.216
C	0.4		0.6	0.016		0.024
C2	0.44		0.58	0.017		0.023
D	5.9		6.3	0.232		0.248
D1	5.30REF			0.209REF		
E	6.4		6.8	0.252		0.268
E1	4.63			0.182		
G	4.47		4.67	0.176		0.184
H	9.5		10.7	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°

## Reel Specification-TO-252-4R



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
W	15.9	16	16.1	0.626	0.63	0.634
E	1.65	1.75	1.85	0.065	0.069	0.073
F	7.4	7.5	7.6	0.291	0.295	0.299
D0	1.4	1.5	1.6	0.055	0.059	0.063
D1	1.4	1.5	1.6	0.055	0.059	0.063
P0	3.9	4	4.1	0.154	0.157	0.161
P1	7.9	8	8.1	0.311	0.315	0.319
P2	1.9	2	2.1	0.075	0.079	0.083
A0	6.85	6.9	7	0.27	0.271	0.276
B0	10.45	10.5	10.6	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	0.1			0.004		
10P0	39.8	40	40.2	1.567	1.575	1.583

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