



JMP(C.F.H.K.I)4N60A

Description

JMP N-channel MOSFET

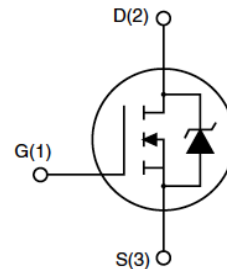
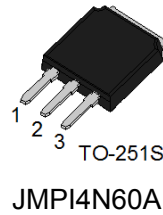
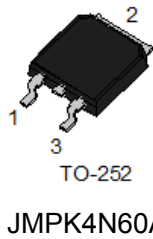
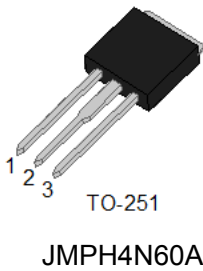
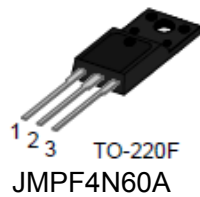
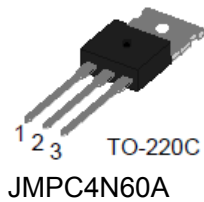
Features

- 600V, 4A
- $R_{DS(ON)} = 1.95\Omega$ (Typ.) @ $V_{GS} = 10V, I_D = 2A$
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability

Application

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

Package



Absolute Maximum Ratings ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Max.			Units
		TO-220F	TO-220C	TO-251/TO-252/ TO-251S	
V_{DSS}	Drain-Source Voltage	600			V
V_{GSS}	Gate-Source Voltage	± 30			V
I_D	Continuous Drain Current	$T_C = 25^\circ\text{C}$			A
		$T_C = 100^\circ\text{C}$			A
I_{DM}	Pulsed Drain Current ^{note1}	16			A
E_{AS}	Single Pulsed Avalanche Energy ^{note2}	120			mJ
P_D	Power Dissipation	$T_C = 25^\circ\text{C}$			W
		31	72		
$R_{\theta JC}$	Thermal Resistance, Junction to Case	4	1.74		$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	60		$^\circ\text{C}/\text{W}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150			$^\circ\text{C}$



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Electrical Characteristics ($T_C=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
Off Characteristic						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	600	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600V,$ $V_{GS} = 0V, T_J = 25^\circ\text{C}$	-	-	1	μA
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 30V$	-	-	± 100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-Source On-Resistance <small>note3</small>	$V_{GS} = 10V, I_D = 2A$	-	1.95	2.3	Ω
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$	-	512	-	pF
C_{oss}	Output Capacitance		-	61	-	pF
C_{riss}	Reverse Transfer Capacitance		-	10	-	pF
Q_g	Total Gate Charge	$V_{DD} = 480V, I_D = 4A,$ $V_{GS} = 10V$	-	13.5	-	nC
Q_{gs}	Gate-Source Charge		-	2	-	nC
Q_{gd}	Gate-Drain("Miller") Charge		-	6	-	nC
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300V, I_D = 4A,$ $R_G = 25\Omega$	-	11	-	ns
t_r	Turn-On Rise Time		-	24	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	45	-	ns
t_f	Turn-Off Fall Time		-	50	-	ns
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain to Source Diode Forward Current		-	-	4	A
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current		-	-	16	A
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0V, I_{SD} = 4A,$ $T_J = 25^\circ\text{C}$	-	-	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0V, I_S = 4A,$ $di/dt = 100A/\mu s$	-	220	-	ns
Q_{rr}	Reverse Recovery Charge		-	3.1	-	μC

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. $I_{AS} = 3.5A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$

3. Pulse Test: Pulse width $\leq 300\mu s, \text{Duty Cycle } \leq 1\%$



Typical Performance Characteristics

Figure 1: Output Characteristics

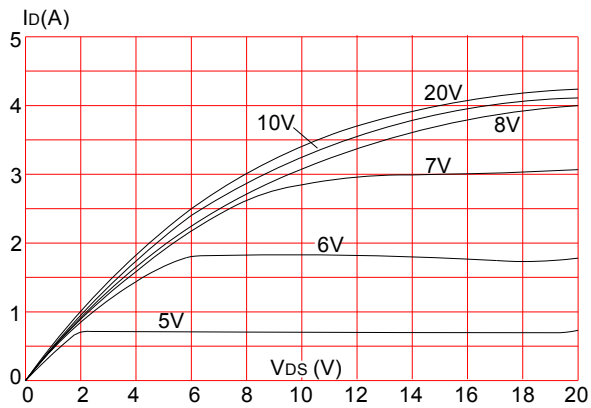


Figure 2: Typical Transfer Characteristics

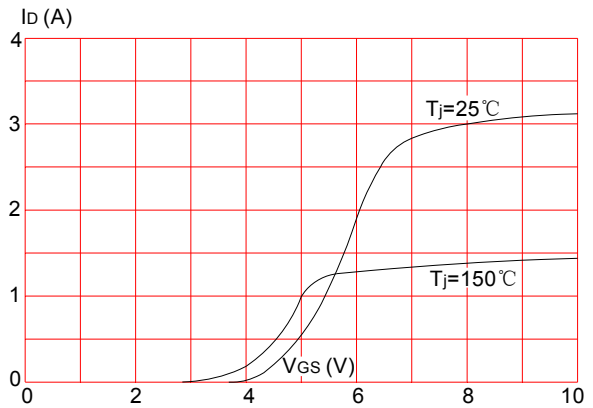


Figure 3: On-resistance vs. Drain Current

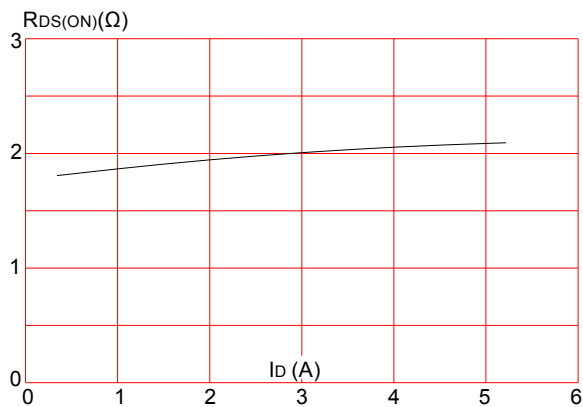


Figure 4: Body Diode Characteristics

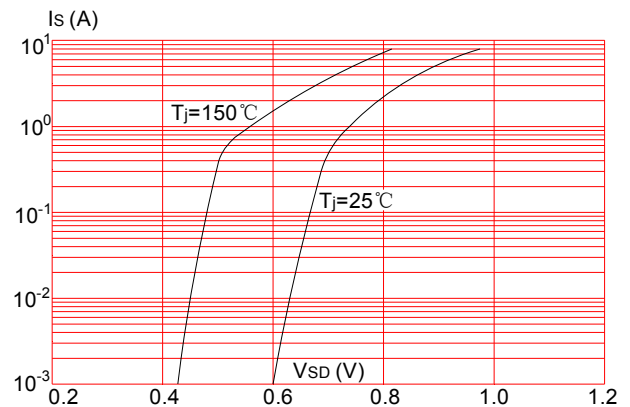


Figure 5: Gate Charge Characteristics

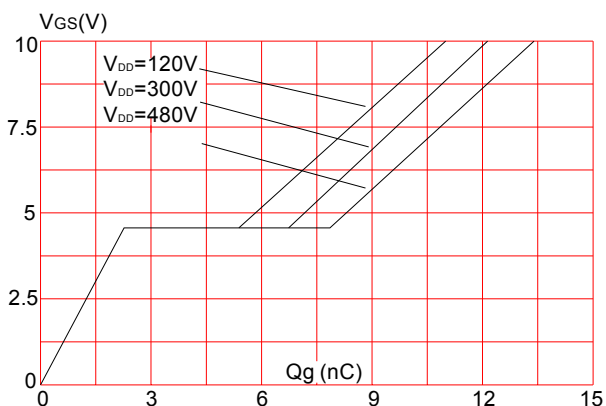
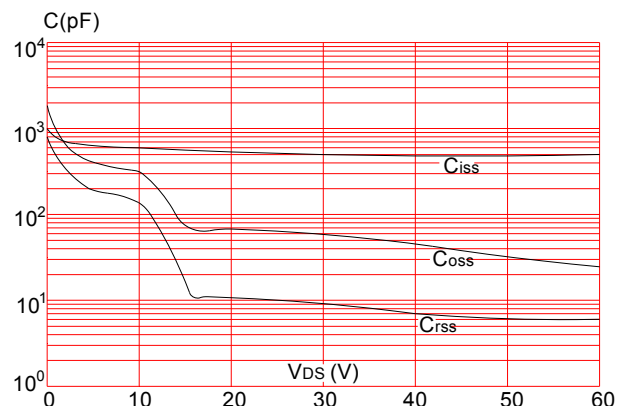


Figure 6: Capacitance Characteristics





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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

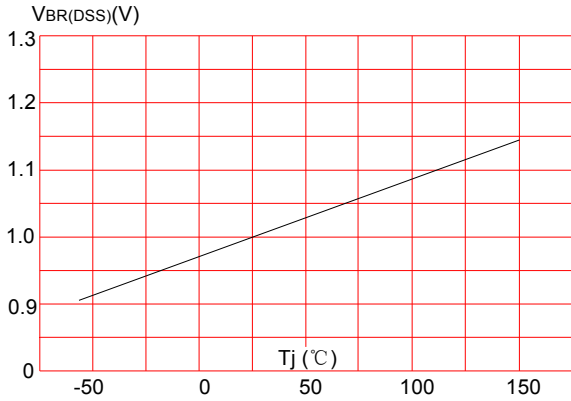


Figure 8: Normalized on Resistance vs. Junction Temperature

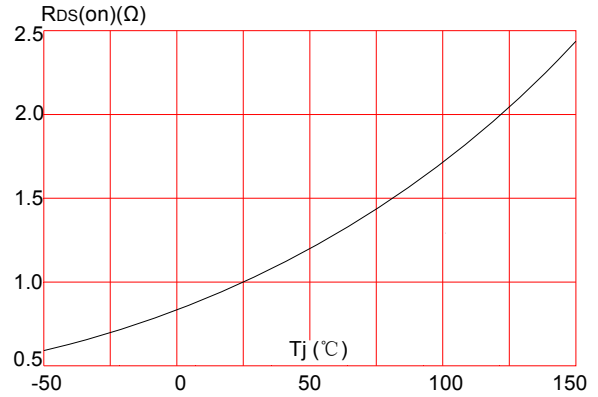


Figure 9: Maximum Safe Operating Area

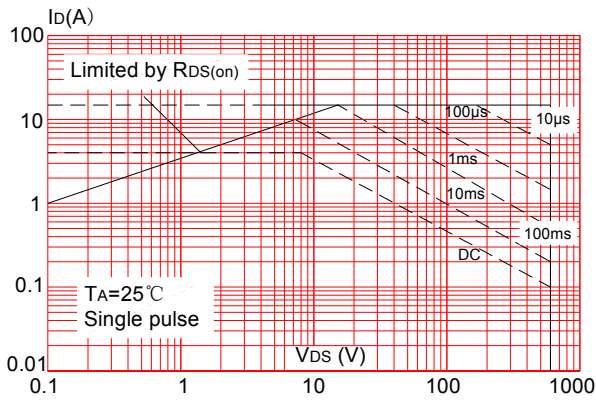


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

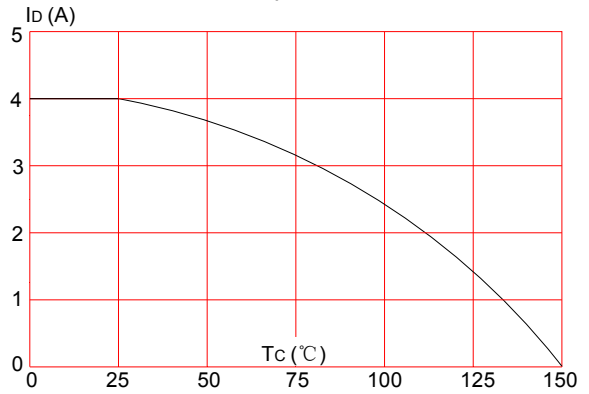


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Case (TO-220C,TO-251,TO-251S,TO-252)

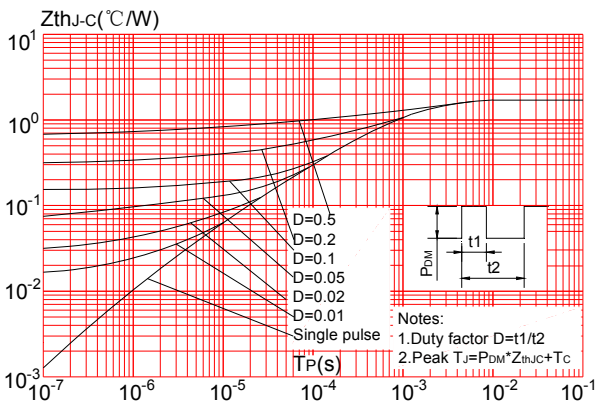
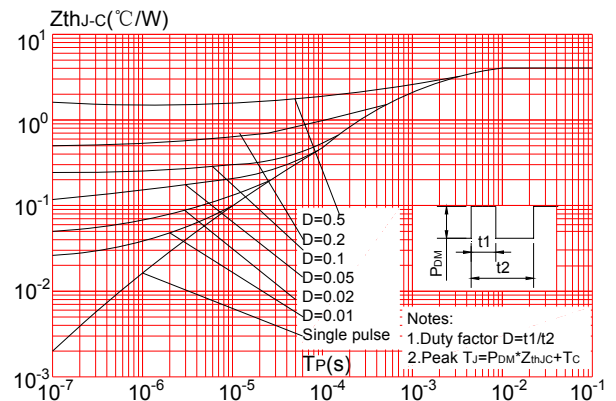


Figure.12: Maximum Effective Transient Thermal Impedance, Junction-to-Case (TO-220F)



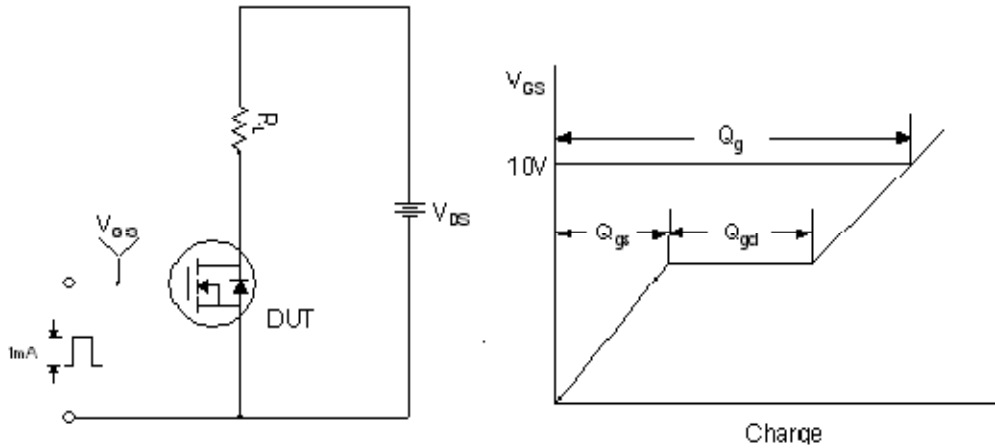


Figure 13. Gate Charge Test Circuit & Waveform

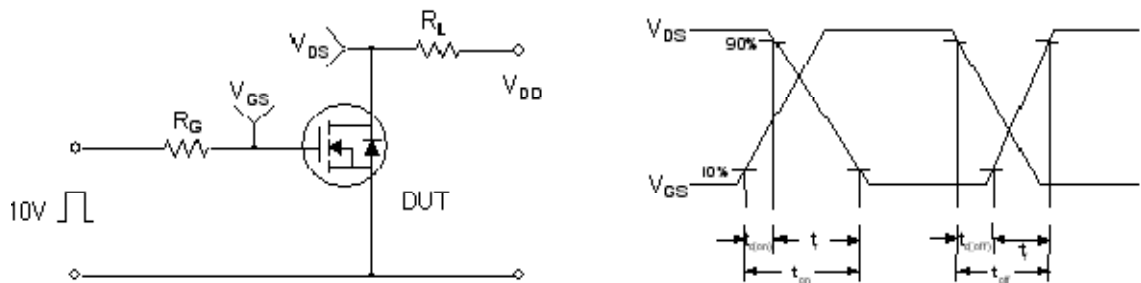


Figure 14. Resistive Switching Test Circuit & Waveforms

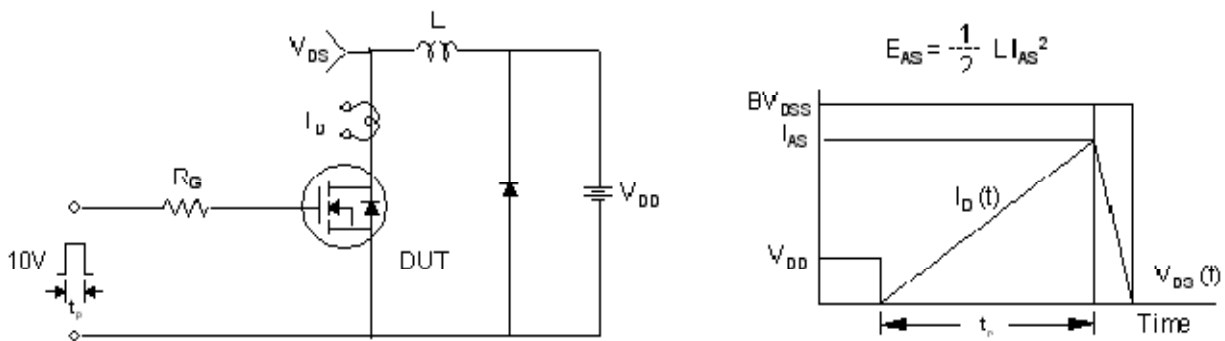


Figure 15. Unclamped Inductive Switching Test Circuit & Waveforms

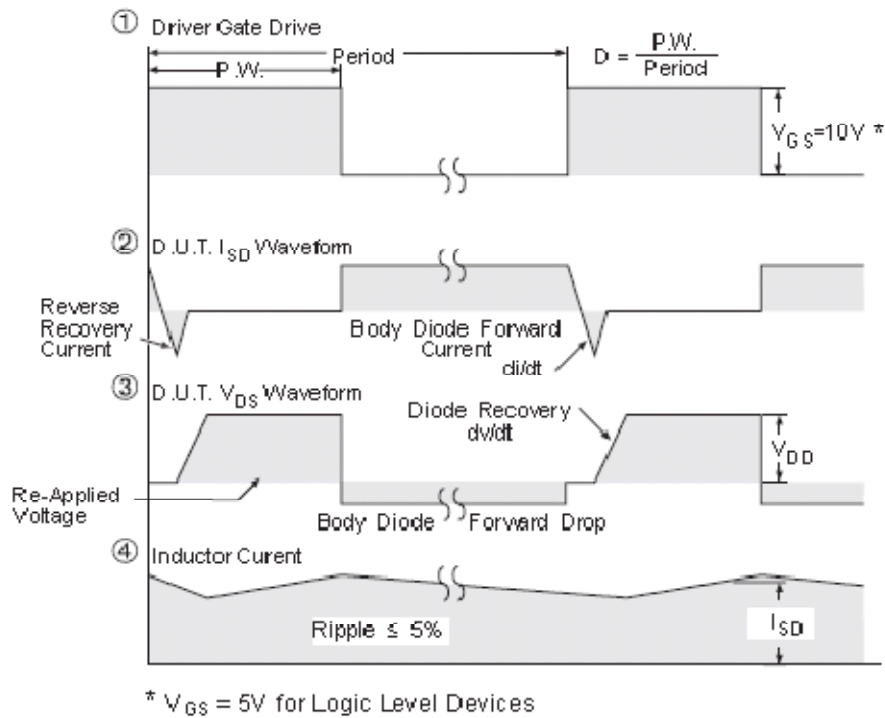
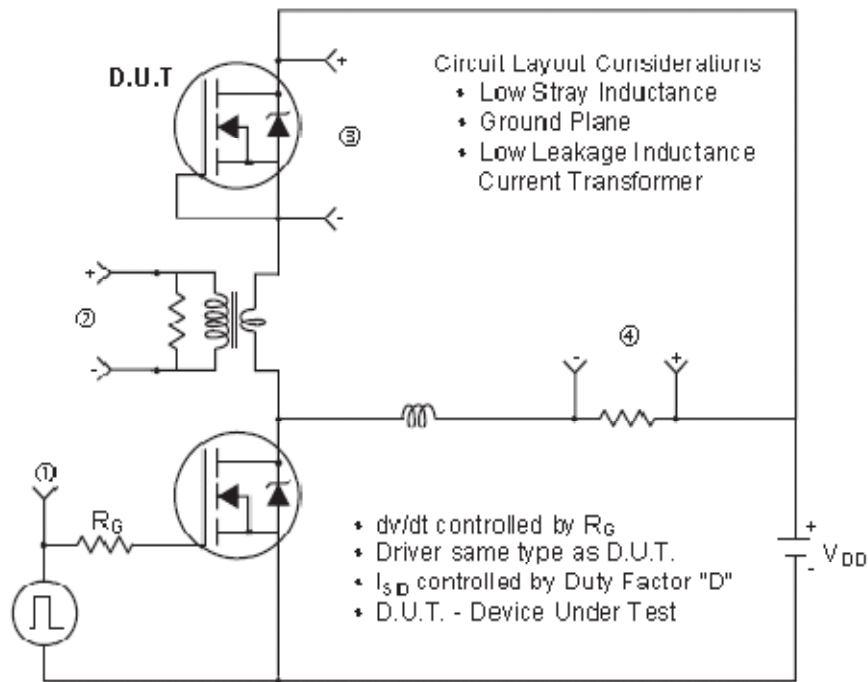
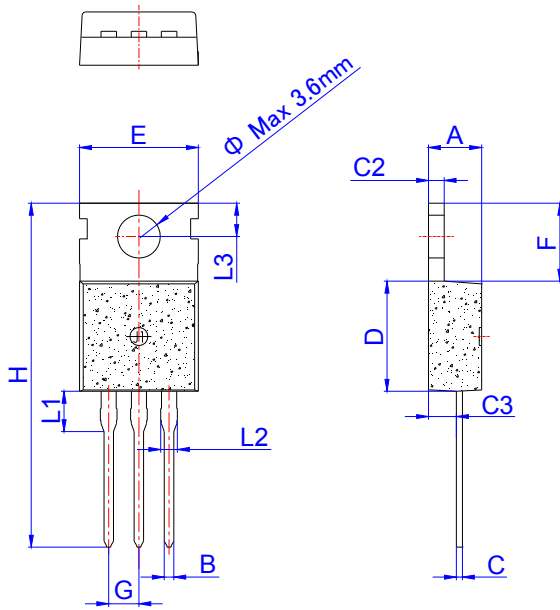


Figure 16. Peak Diode Recovery dv/dt Test Circuit & Waveforms (For N-channel)



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Package Mechanical Data



TO-220C

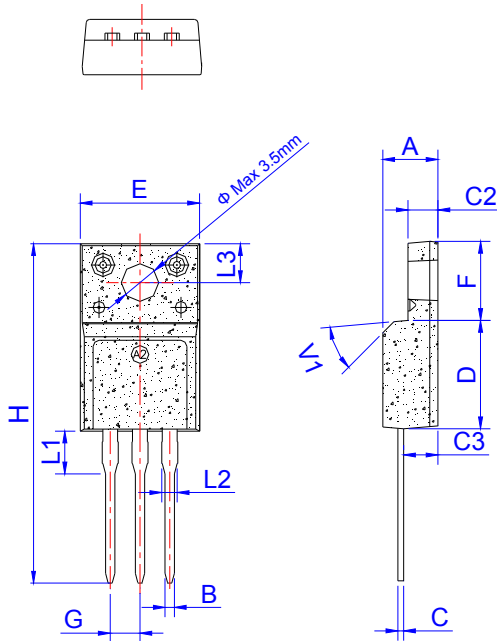
Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
B	0.70		0.90	0.028		0.035
C	0.45		0.60	0.018		0.024
C2	1.23		1.32	0.048		0.052
C3	2.20		2.60	0.087		0.102
D	8.90		9.90	0.350		0.390
E	9.90		10.3	0.390		0.406
F	6.30		6.90	0.248		0.272
G		2.54			0.1	
H	28.0		29.8	1.102		1.173
L1		3.39			0.133	
L2	1.14		1.70	0.045		0.067
L3	2.65		2.95	0.104		0.116
Φ		3.6			0.142	

Package Information -TO-220C

OUTLINE	TUBE (PCS)	INNER BOX (PCS)	PER CARTON (PCS)
TUBE	50	1,000	8,000



Package Mechanical Data



TO-220F

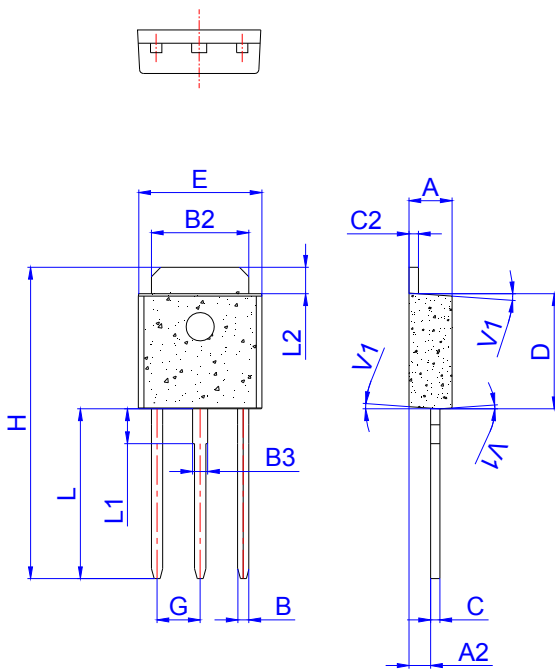
Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.50		4.90	0.177		0.193
B	0.74	0.80	0.83	0.029	0.031	0.033
C	0.47		0.65	0.019		0.026
C2	2.45		2.75	0.096		0.108
C3	2.60		3.00	0.102		0.118
D	8.80		9.30	0.346		0.366
E	9.80		10.4	0.386		0.410
F	6.40		6.80	0.252		0.268
G		2.54			0.1	
H	28.0		29.8	1.102		1.173
L1		3.63			0.143	
L2	1.14		1.70	0.045		0.067
L3		3.30			0.130	
V1		45°			45°	

Package Information -TO-220F

OUTLINE	TUBE (PCS)	INNER BOX (PCS)	PER CARTON (PCS)
TUBE	50	1,000	8,000



Package Mechanical Data



TO-251

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.20		2.40	0.086		0.095
A2	0.90		1.20	0.035		0.047
B	0.55		0.65	0.022		0.026
B2	5.10		5.40	0.200		0.213
B3	0.76		0.85	0.030		0.033
C	0.45		0.62	0.018		0.024
C2	0.48		0.62	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.70	0.252		0.264
G		2.30			0.091	
H	16.0		17.0	0.630		0.669
L	8.90		9.40	0.350		0.370
L1	1.80		1.90	0.071		0.075
L2	1.37		1.50	0.054		0.059
V1		4°			4°	

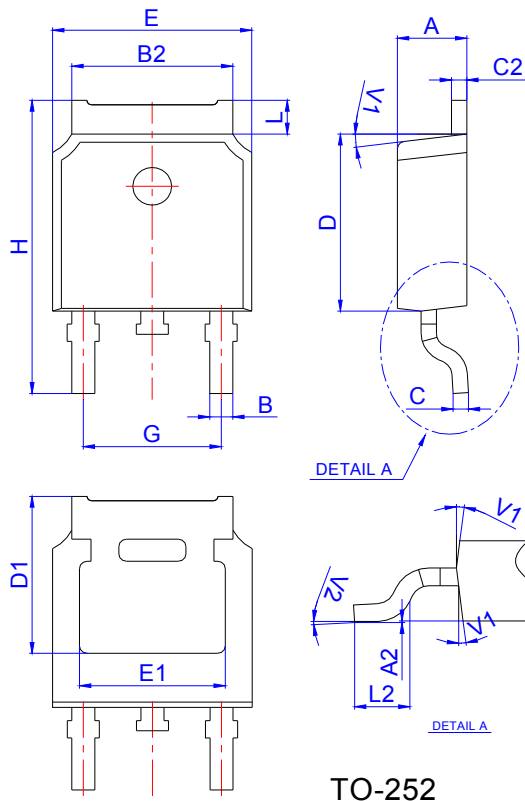
Package Information -TO-251

OUTLINE	TUBE (PCS)	INNER BOX (PCS)	PER CARTON (PCS)
TUBE	80	4,000	32,000



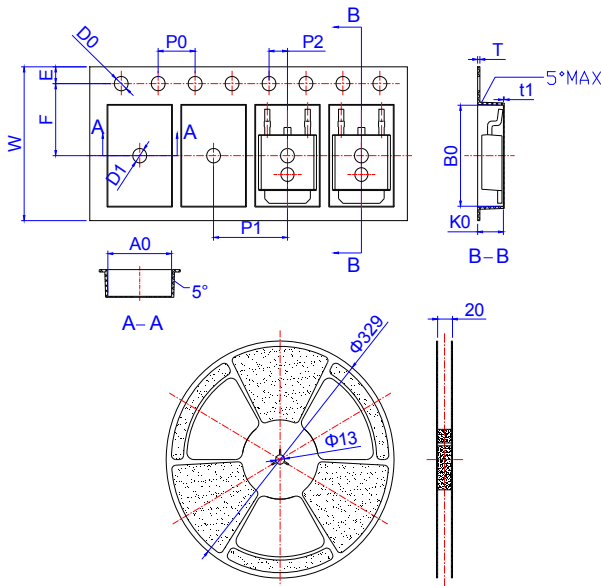
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Package Mechanical Data



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°

Reel Specification-TO-252



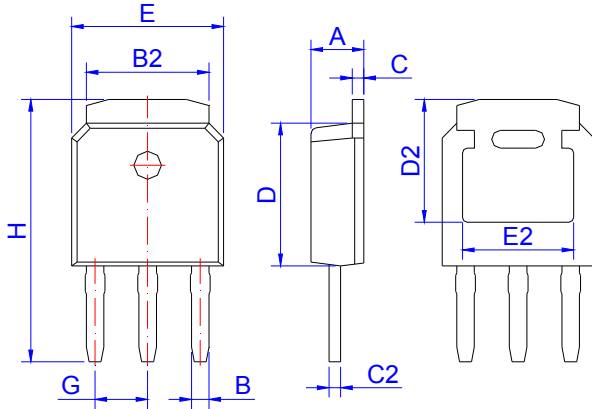
Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
W	15.90	16.00	16.10	0.626	0.630	0.634
E	1.65	1.75	1.85	0.065	0.069	0.073
F	7.40	7.50	7.60	0.291	0.295	0.299
D0	1.40	1.50	1.60	0.055	0.059	0.063
D1	1.40	1.50	1.60	0.055	0.059	0.063
P0	3.90	4.00	4.10	0.154	0.157	0.161
P1	7.90	8.00	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

OUTLINE	REEL (PCS)	PER CARTON (PCS)	TAPE & REEL
TAPING	2,500	25,000	13inch



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Package Mechanical Data



TO-251S

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.10	2.30	2.50	0.083	0.091	0.098
B	0.66	0.76	0.86	0.026	0.030	0.034
B2	5.15	5.33	5.48	0.203	0.210	0.216
C	0.44	0.51	0.58	0.017	0.020	0.023
C2	0.44	0.51	0.58	0.017	0.020	0.023
D	5.90	6.10	6.30	0.232	0.240	0.248
D2	5.30 REF			0.209 REF		
E	6.40	6.60	6.80	0.252	0.260	0.268
E2	4.83 REF			0.190 REF		
G	2.19	2.29	2.39	0.086	0.090	0.094
H	10.60	11.20	11.80	0.417	0.441	0.465

Package Information-TO-251S

OUTLINE	TUBE (PCS)	INNER BOX (PCS)	PER CARTON (PCS)
TUBE	80	4,000	32,000

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