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A Product Line of
Diodes Incorporated



ZXMN20B28K

200V N-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

V _{(BR)DSS}	R _{DS(on)}	I _D T _A = 25°C
200V	750mΩ @ V _{GS} = 10V	2.3A
	780mΩ @ V _{GS} = 5V	2.3A

Description and Applications

This MOSFET features low on-resistance, fast switching and a high avalanche withstand capability, making it ideal for high efficiency power management applications.

- SLIC line drivers for VoIP applications
- Transformer driving switch
- Power management functions
- Motor control
- Uninterrupted power supply

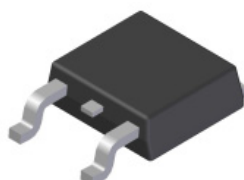
Features and Benefits

- 100% Unclamped Inductive Switch (UIS) test in production
- High avalanche energy pulse withstand capability
- Low gate drive voltage (Logic level capable)
- Low input capacitance
- Low on-resistance
- Fast switching speed
- "Green" Component and RoHS compliant (Note 1)
- Qualified to AEC-Q101 Standards for High Reliability

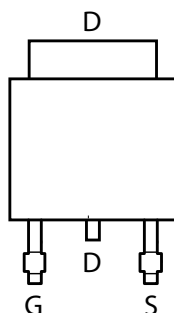
Mechanical Data

- Case: TO252-3L
- Case Material: Molded Plastic "Green" Molding Compound, UL Flammability Classification Rating 94V-0 (Note 1)
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Matte Tin Finish annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.33 grams (approximate)

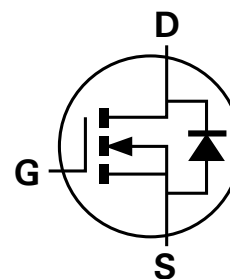
TO252-3L



Top View



Pin Out - Top View



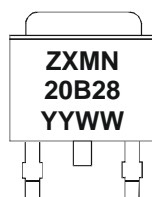
Equivalent Circuit

Ordering Information (Note 1)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMN20B28KTC	See below	13	16	2,500

Note: 1. Diodes, Inc. defines "Green" products as those which are Eu RoHS compliant and contain no halogens or antimony compounds; further information about Diodes Inc.'s "Green" Policy can be found on our website. For packaging details, go to our website.

Marking Information



ZXMN = Product Type Marking Code, Line 1
 20B28 = Product Type Marking Code, Line 2
 YYWW = Date Code Marking
 YY = Year (ex: 09 = 2009)
 WW = Week (01-52)

Maximum Ratings @ $T_A = 25^\circ\text{C}$ unless otherwise specified

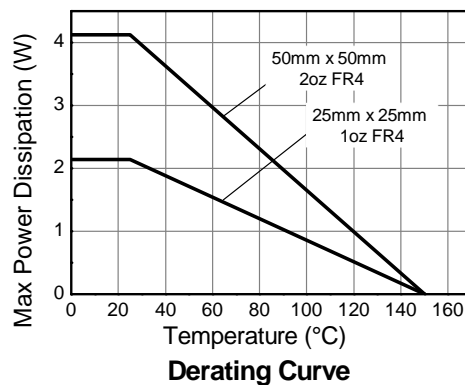
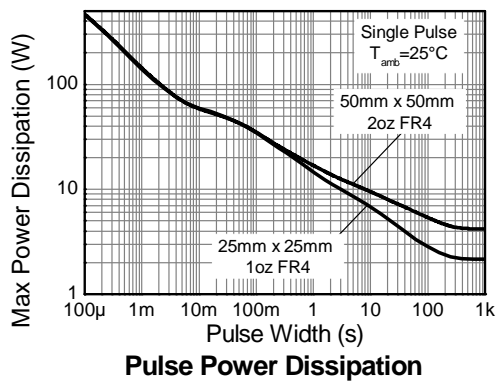
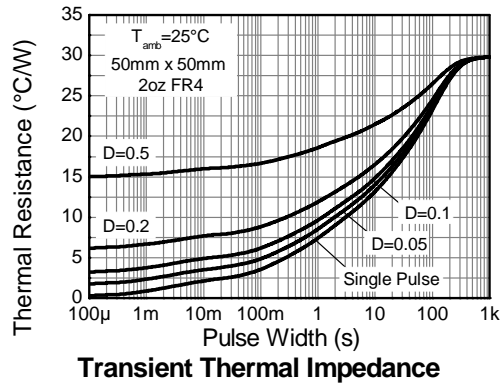
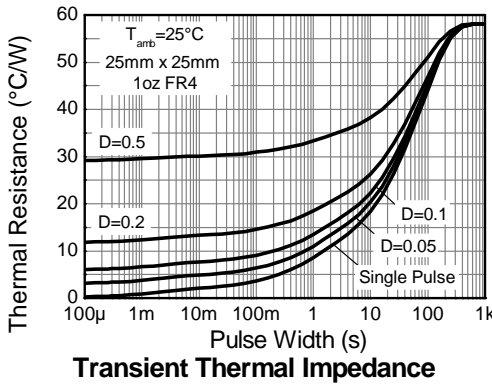
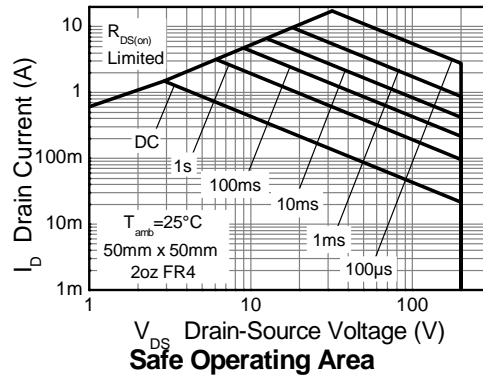
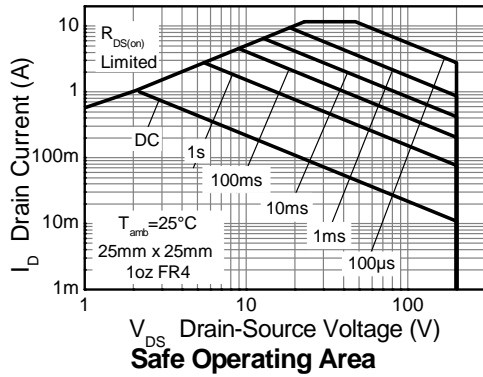
Characteristic		Symbol	Value	Unit	
Drain-Source voltage		V_{DSS}	200	V	
Gate-Source voltage		V_{GS}	± 20	V	
Single Pulsed Avalanche Energy	(Note 7)	E_{AS}	73	mJ	
Single Pulsed Avalanche Current	(Note 7)	I_{AS}	5.5	A	
Repetitive Avalanche Energy	(Note 4)	E_{AR}	4.5	mJ	
Repetitive Avalanche Current	(Note 4)	I_{AR}	5.5	A	
Continuous Drain current	$V_{GS} = 10\text{V}$	$T_A = 70^\circ\text{C}$ (Note 3)	(Note 3)	2.3	A
				1.8	
			(Note 2)	1.5	
Pulsed Drain current	$V_{GS} = 10\text{V}$	(Note 4)	I_{DM}	17.3	A
Continuous Source current (Body diode)		(Note 2)	I_S	5.7	A
Pulsed Source current (Body diode)		(Note 4)	I_{SM}	17.3	A

Thermal Characteristics

Characteristic		Symbol	Value	Unit	
Power dissipation Linear derating factor	(Note 2)	P_D	4.3	W mW/ $^\circ\text{C}$	
			34.4		
	(Note 3)		10.2		
			76.0		
Thermal Resistance, Junction to Ambient	(Note 6)	$R_{\theta JA}$	2.2	$^\circ\text{C/W}$	
			17.4		
	(Note 2)		29.1		
	(Note 3)		12.3		
	(Note 6)		57.3		
Thermal Resistance, Junction to Lead		(Note 5)	$R_{\theta JL}$	1.15	$^\circ\text{C/W}$
Operating and storage temperature range		T_J, T_{STG}	-55 to 150	$^\circ\text{C}$	

- Notes:
- For a device surface mounted on 50mm x 50mm x 1.6mm FR4 PCB with high coverage of single sided 2oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
 - Same as note 2, except the device is measured at $t \leq 10$ sec.
 - Same as note 2, except the device is operating in a repetitive state with pulse width and duty cycle limited by maximum junction temperature.
 - Thermal resistance from junction to solder-point (at the end of the drain lead).
 - For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with the high coverage single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
 - UIS in production with $L = 4.83\text{mH}$, $I_{AS} = 5.5\text{A}$, $R_G = 25\Omega$, $V_{DD} = 100\text{V}$, starting $T_J = 25^\circ\text{C}$.

Thermal Characteristics

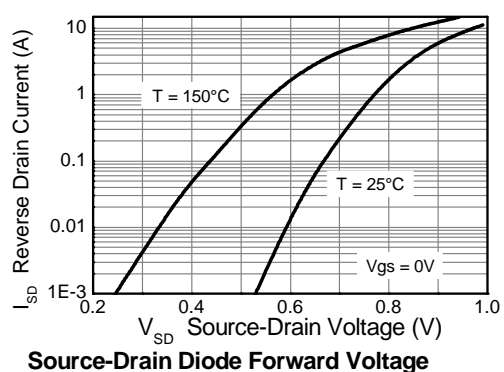
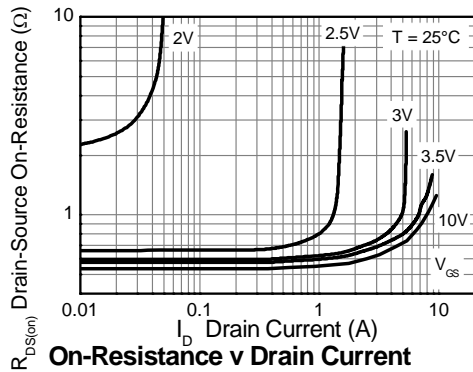
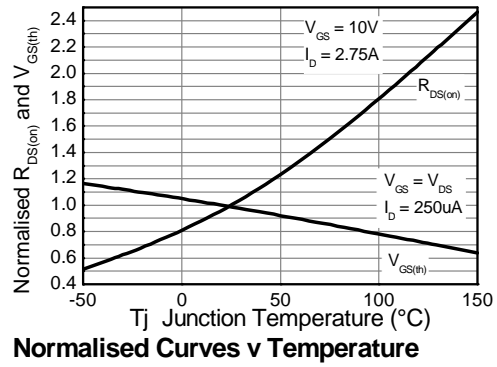
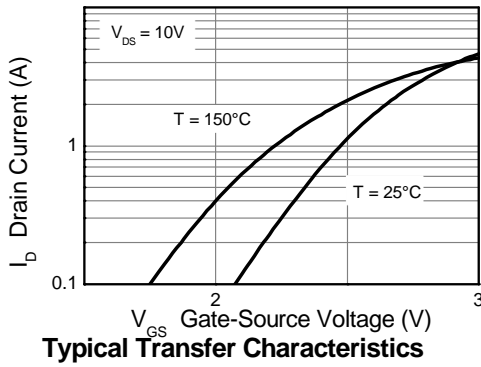
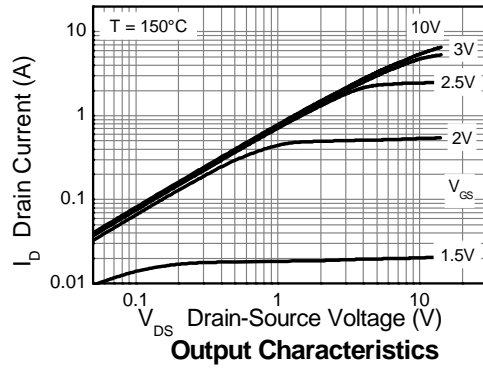
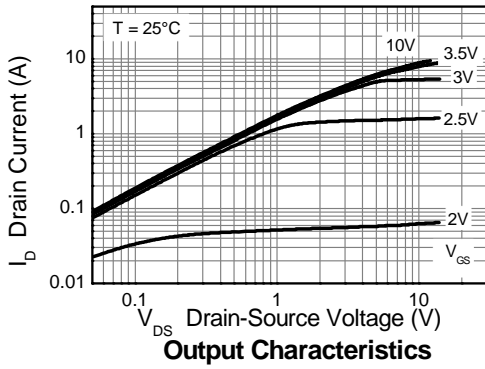


Electrical Characteristics @ $T_A = 25^\circ\text{C}$ unless otherwise specified

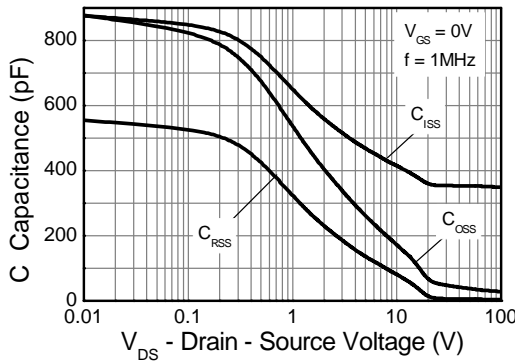
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	200	—	—	V	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$
Zero Gate Voltage Drain Current	I_{DSS}	—	—	500	nA	$V_{DS} = 200\text{V}$, $V_{GS} = 0\text{V}$
Gate-Source Leakage	I_{GSS}	—	—	± 100	nA	$V_{GS} = \pm 20\text{V}$, $V_{DS} = 0\text{V}$
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(th)}$	1	1.6	2.5	V	$I_D = 250\mu\text{A}$, $V_{DS} = V_{GS}$
Static Drain-Source On-Resistance (Note 8)	$R_{DS(on)}$	—	0.650	0.750	Ω	$V_{GS} = 10\text{V}$, $I_D = 2.75\text{A}$
			0.670	0.780		$V_{GS} = 5\text{V}$, $I_D = 2.75\text{A}$
Forward Transconductance (Notes 8 & 9)	g_{fs}	—	6.13	—	S	$V_{DS} = 30\text{V}$, $I_D = 2.75\text{A}$
Diode Forward Voltage (Note 8)	V_{SD}	—	0.860	0.950	V	$I_S = 5.5\text{A}$, $V_{GS} = 0\text{V}$
Reverse recovery time (Note 9)	t_{rr}	—	177	—	ns	$I_S = 6.5\text{A}$, $V_{GS} = 0\text{V}$, $di/dt = 100\text{A}/\mu\text{s}$
Reverse recovery charge (Note 9)	Q_{rr}	—	1.4	—	μC	
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C_{iss}	—	358	—	pF	$V_{DS} = 25\text{V}$, $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
Output Capacitance	C_{oss}	—	50	—	pF	
Reverse Transfer Capacitance	C_{rss}	—	6.1	—	pF	
Total Gate Charge	Q_g	—	8.1	—	nC	$V_{DS} = 120\text{V}$, $V_{GS} = 5\text{V}$ $I_D = 6.5\text{A}$
Gate-Source Charge	Q_{gs}	—	1.4	—	nC	
Gate-Drain Charge	Q_{gd}	—	3.9	—	nC	
Turn-On Delay Time (Note 10)	$t_{D(on)}$	—	17.8	—	ns	$V_{DD} = 100\text{V}$, $V_{GS} = 5\text{V}$ $I_D = 6.5\text{A}$, $R_G \cong 25\Omega$
Turn-On Rise Time (Note 10)	t_r	—	76.9	—	ns	
Turn-Off Delay Time (Note 10)	$t_{D(off)}$	—	44.7	—	ns	
Turn-Off Fall Time (Note 10)	t_f	—	57.1	—	ns	

- Notes:
8. Measured under pulsed conditions. Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$
 9. For design aid only, not subject to production testing.
 10. Switching characteristics are independent of operating junction temperatures.

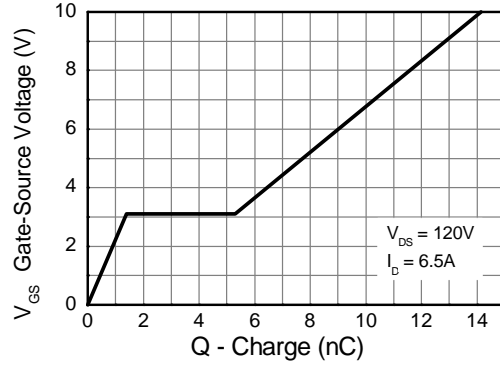
Typical Characteristics



Typical Characteristics - continued

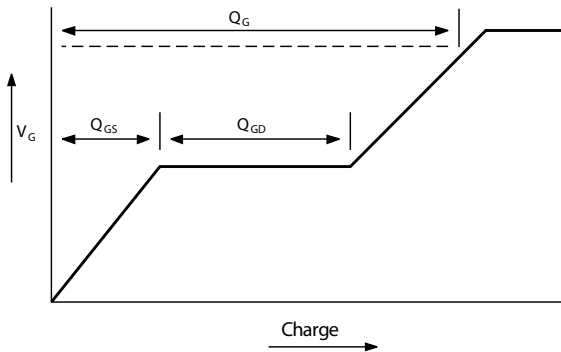


Capacitance v Drain-Source Voltage

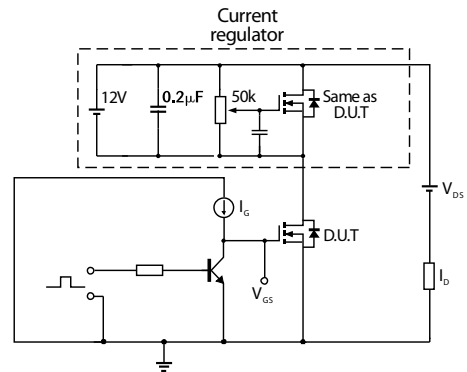


Gate-Source Voltage v Gate Charge

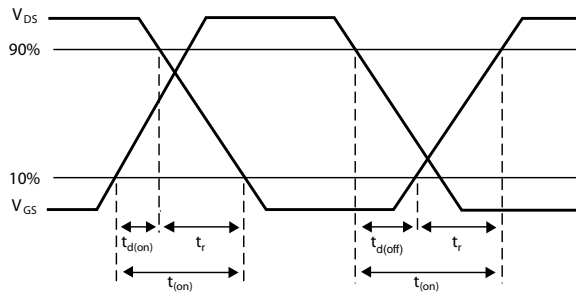
Test Circuits



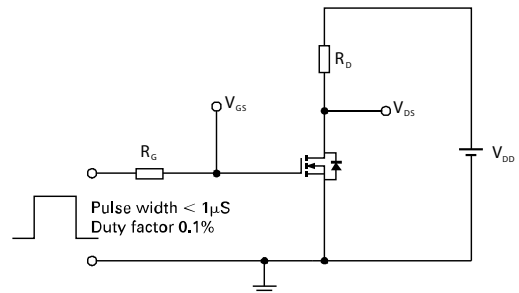
Basic gate charge waveform



Gate charge test circuit

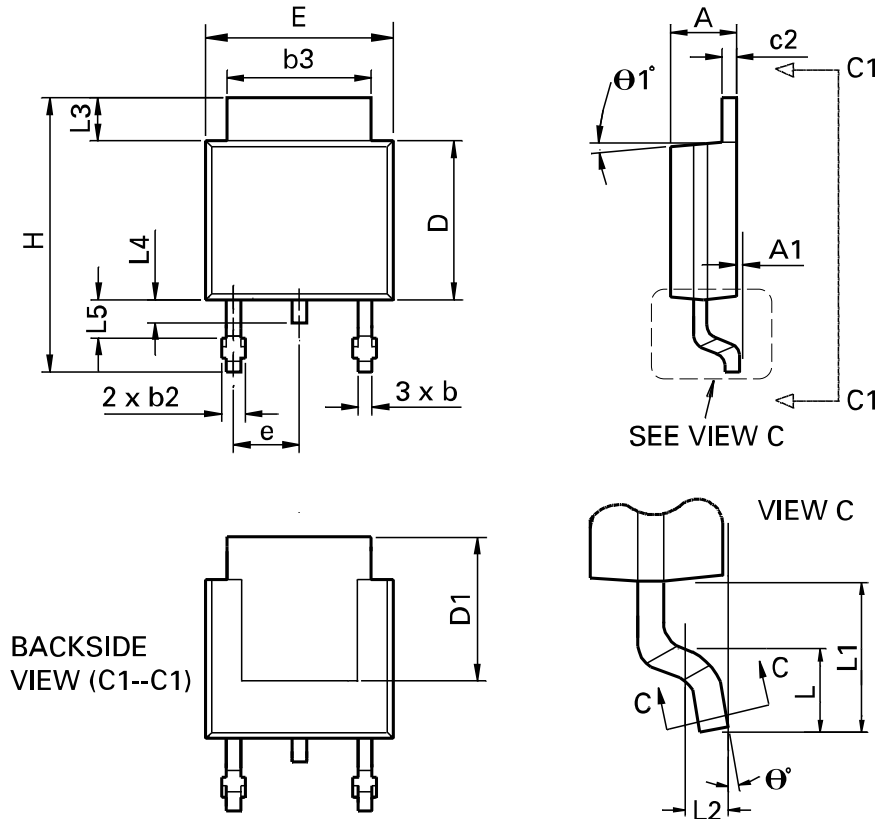


Switching time waveforms



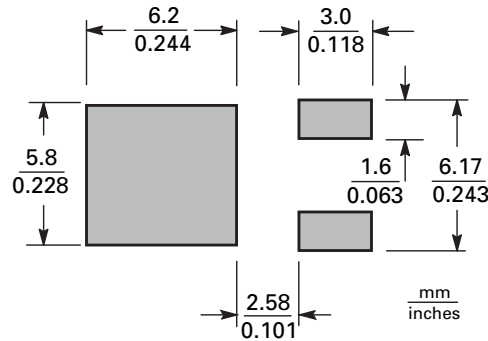
Switching time test circuit

Package Outline Dimensions



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
A	0.086	0.094	2.18	2.39	e	0.090 BSC		2.29 BSC	
A1	-	0.005	-	0.127	H	0.370	0.410	9.40	10.41
b	0.020	0.035	0.508	0.89	L	0.055	0.070	1.40	1.78
b2	0.030	0.045	0.762	1.14	L1	0.108 REF		2.74 REF	
b3	0.205	0.215	5.21	5.46	L2	0.020 BSC		0.508 BSC	
c	0.018	0.024	0.457	0.61	L3	0.035	0.065	0.89	1.65
c2	0.018	0.023	0.457	0.584	L4	0.025	0.040	0.635	1.016
D	0.213	0.245	5.41	6.22	L5	0.045	0.060	1.14	1.52
D1	0.205	-	5.21	-	theta 1°	0°	10°	0°	10°
E	0.250	0.265	6.35	6.73	theta°	0°	15°	0°	15°
E1	0.170	-	4.32	-	-	-	-	-	-

Suggested Pad Layout



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