

**200V N-CHANNEL ENHANCEMENT MODE MOSFET**

**Product Summary**

$V_{(BR)DSS}$	$R_{DS(on)}$	$I_D$ $T_A = 25^\circ C$
200V	750m $\Omega$ @ $V_{GS} = 10V$	2.3A
	780m $\Omega$ @ $V_{GS} = 5V$	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.

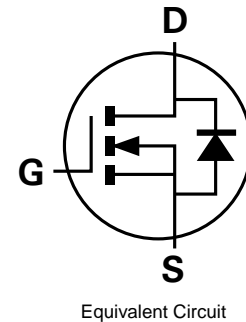
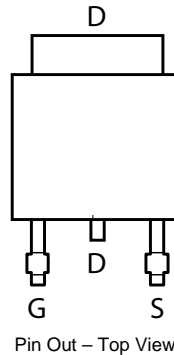
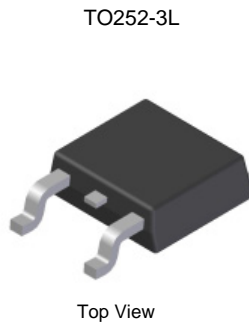
- SLIC line drivers for VoIP applications
- Transformer driving switch
- Power management functions
- Motor control
- Uninterrupted power supply

**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)

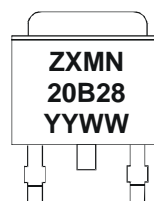


**Ordering Information** (Note 1)

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<sub>A</sub> = 25°C unless otherwise specified

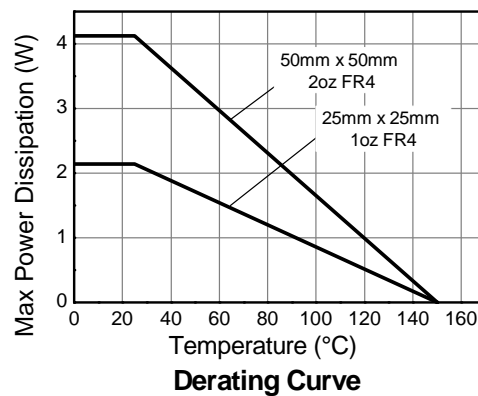
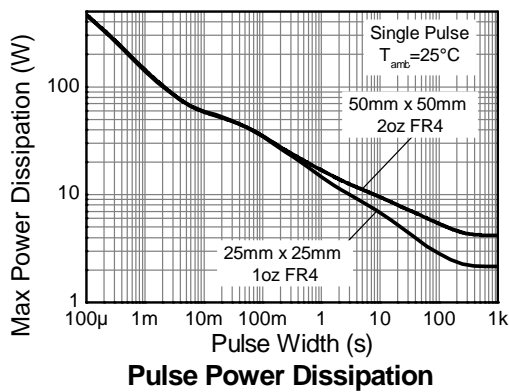
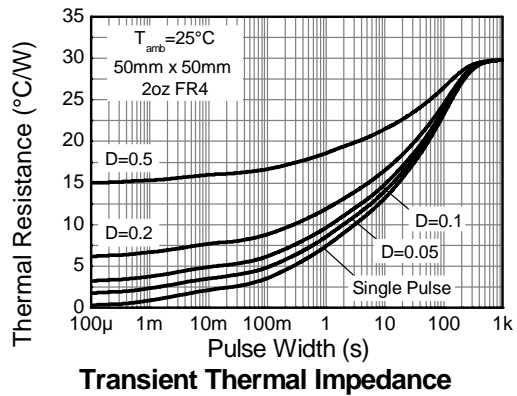
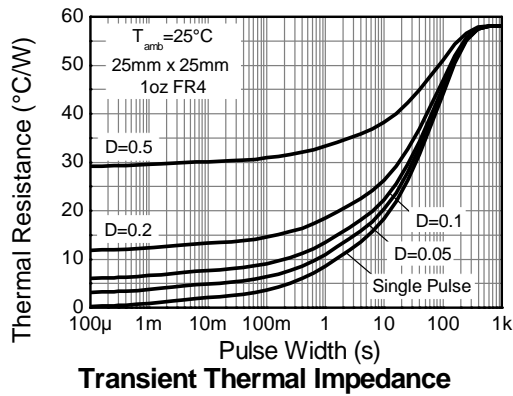
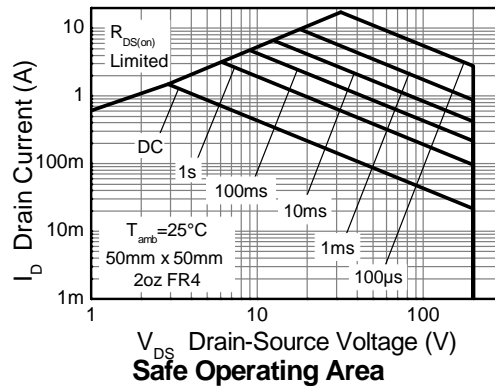
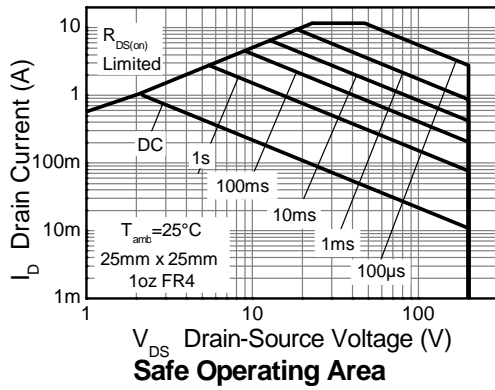
Characteristic		Symbol	Value	Unit
Drain-Source voltage		V <sub>DSS</sub>	200	V
Gate-Source voltage		V <sub>GS</sub>	±20	V
Single Pulsed Avalanche Energy	(Note 7)	E <sub>AS</sub>	73	mJ
Single Pulsed Avalanche Current	(Note 7)	I <sub>AS</sub>	5.5	A
Repetitive Avalanche Energy	(Note 4)	E <sub>AR</sub>	4.5	mJ
Repetitive Avalanche Current	(Note 4)	I <sub>AR</sub>	5.5	A
Continuous Drain current	V <sub>GS</sub> = 10V (Note 3) T <sub>A</sub> = 70°C (Note 3)	I <sub>D</sub>	2.3	A
			1.8	
Pulsed Drain current	V <sub>GS</sub> = 10V (Note 2)	I <sub>DM</sub>	17.3	A
Continuous Source current (Body diode)		I <sub>S</sub>	5.7	A
Pulsed Source current (Body diode)		I <sub>SM</sub>	17.3	A

**Thermal Characteristics**

Characteristic		Symbol	Value	Unit
Power dissipation Linear derating factor	(Note 2)	P <sub>D</sub>	4.3	W mW/°C
			34.4	
	(Note 3)		10.2	
	(Note 6)		76.0	
Thermal Resistance, Junction to Ambient	(Note 2)	R <sub>θJA</sub>	2.2	°C/W
	(Note 3)		17.4	
	(Note 6)		29.1	
Thermal Resistance, Junction to Lead	(Note 5)	R <sub>θJL</sub>	12.3	°C/W
Operating and storage temperature range	(Note 5)	T <sub>J</sub> , T <sub>STG</sub>	1.15	°C/W
			-55 to 150	°C

- Notes:
2. 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.
  3. Same as note 2, except the device is measured at t ≤ 10 sec.
  4. Same as note 2, except the device is operating in a repetitive state with pulse width and duty cycle limited by maximum junction temperature.
  5. Thermal resistance from junction to solder-point (at the end of the drain lead).
  6. 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.
  7. UIS in production with L = 4.83mH, I<sub>AS</sub> = 5.5A, R<sub>G</sub> = 25Ω, V<sub>DD</sub> = 100V, starting T<sub>J</sub> = 25°C.

**Thermal Characteristics**

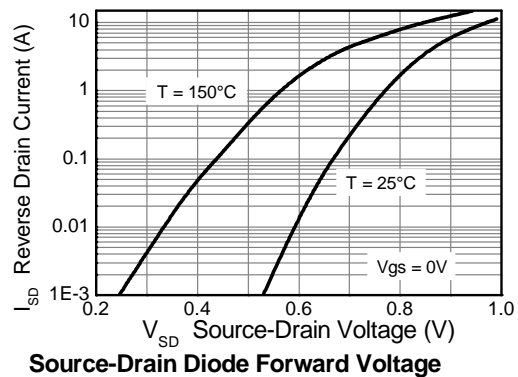
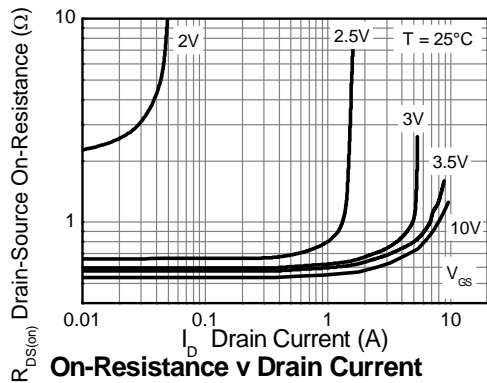
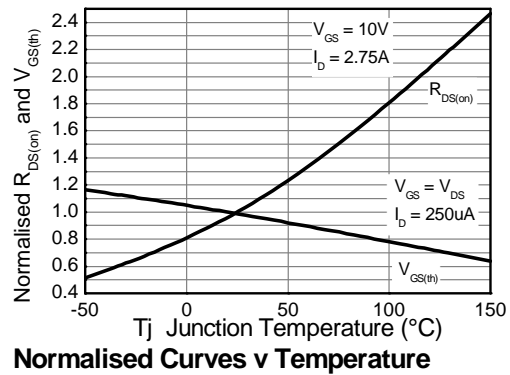
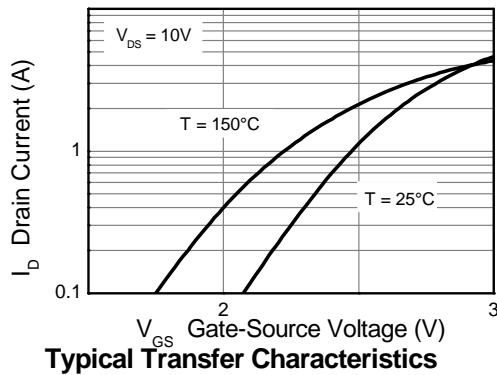
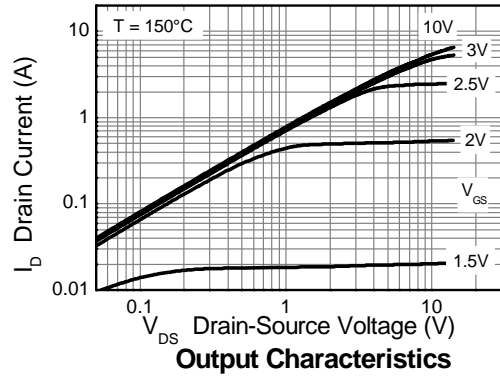
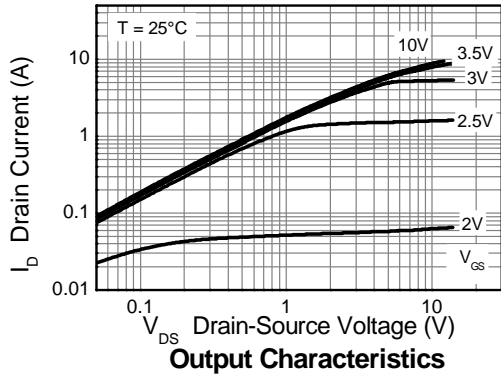


**Electrical Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

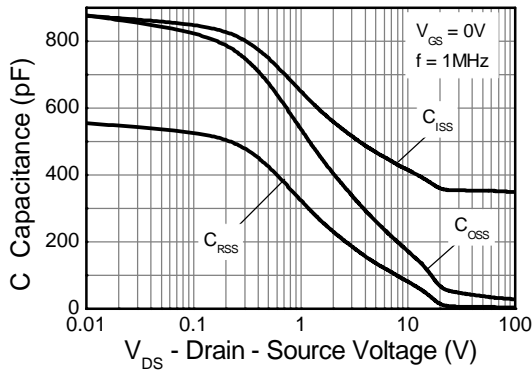
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	200	—	—	V	I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	500	nA	V <sub>DS</sub> = 200V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	1	1.6	2.5	V	I <sub>D</sub> = 250μA, V <sub>DS</sub> = V <sub>GS</sub>
Static Drain-Source On-Resistance (Note 8)	R <sub>DS(ON)</sub>	—	0.650	0.750	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 2.75A
			0.670	0.780		V <sub>GS</sub> = 5V, I <sub>D</sub> = 2.75A
Forward Transconductance (Notes 8 & 9)	g <sub>fs</sub>	—	6.13	—	S	V <sub>DS</sub> = 30V, I <sub>D</sub> = 2.75A
Diode Forward Voltage (Note 8)	V <sub>SD</sub>	—	0.860	0.950	V	I <sub>S</sub> = 5.5A, V <sub>GS</sub> = 0V
Reverse recovery time (Note 9)	t <sub>rr</sub>	—	177	—	ns	I <sub>S</sub> = 6.5A, V <sub>GS</sub> = 0V,
Reverse recovery charge (Note 9)	Q <sub>rr</sub>	—	1.4	—	μC	di/dt = 100A/μs
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	358	—	pF	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V f = 1MHz
Output Capacitance	C <sub>oss</sub>	—	50	—	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	6.1	—	pF	
Total Gate Charge	Q <sub>g</sub>	—	8.1	—	nC	V <sub>DS</sub> = 120V, V <sub>GS</sub> = 5V I <sub>D</sub> = 6.5A
Gate-Source Charge	Q <sub>gs</sub>	—	1.4	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	3.9	—	nC	
Turn-On Delay Time (Note 10)	t <sub>D(on)</sub>	—	17.8	—	ns	V <sub>DD</sub> = 100V, V <sub>GS</sub> = 5V I <sub>D</sub> = 6.5A, R <sub>G</sub> ≅ 25Ω
Turn-On Rise Time (Note 10)	t <sub>r</sub>	—	76.9	—	ns	
Turn-Off Delay Time (Note 10)	t <sub>D(off)</sub>	—	44.7	—	ns	
Turn-Off Fall Time (Note 10)	t <sub>f</sub>	—	57.1	—	ns	

- Notes:
8. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%
  9. For design aid only, not subject to production testing.
  10. Switching characteristics are independent of operating junction temperatures.

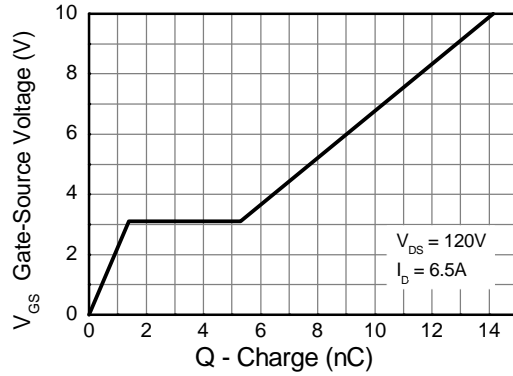
**Typical Characteristics**



**Typical Characteristics - continued**

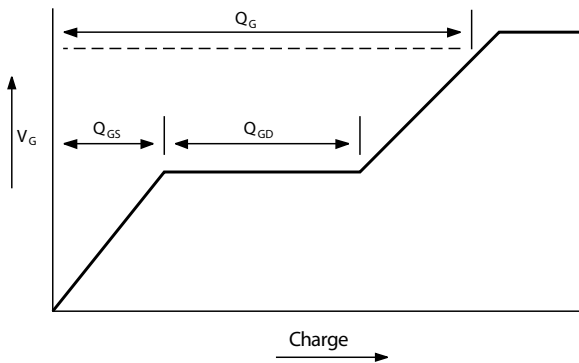


**Capacitance v Drain-Source Voltage**

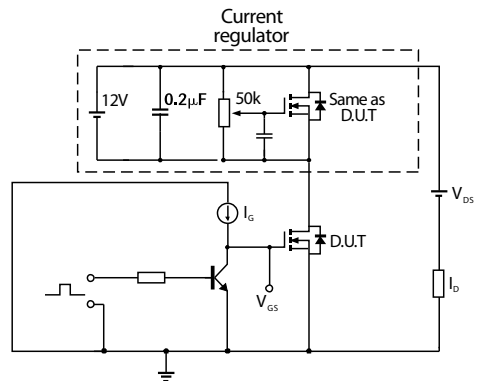


**Gate-Source Voltage v Gate Charge**

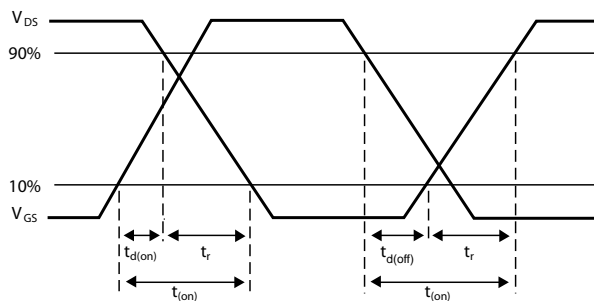
**Test Circuits**



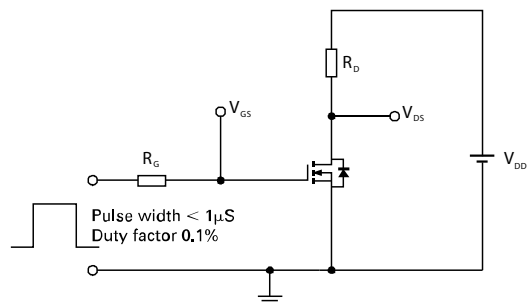
**Basic gate charge waveform**



**Gate charge test circuit**

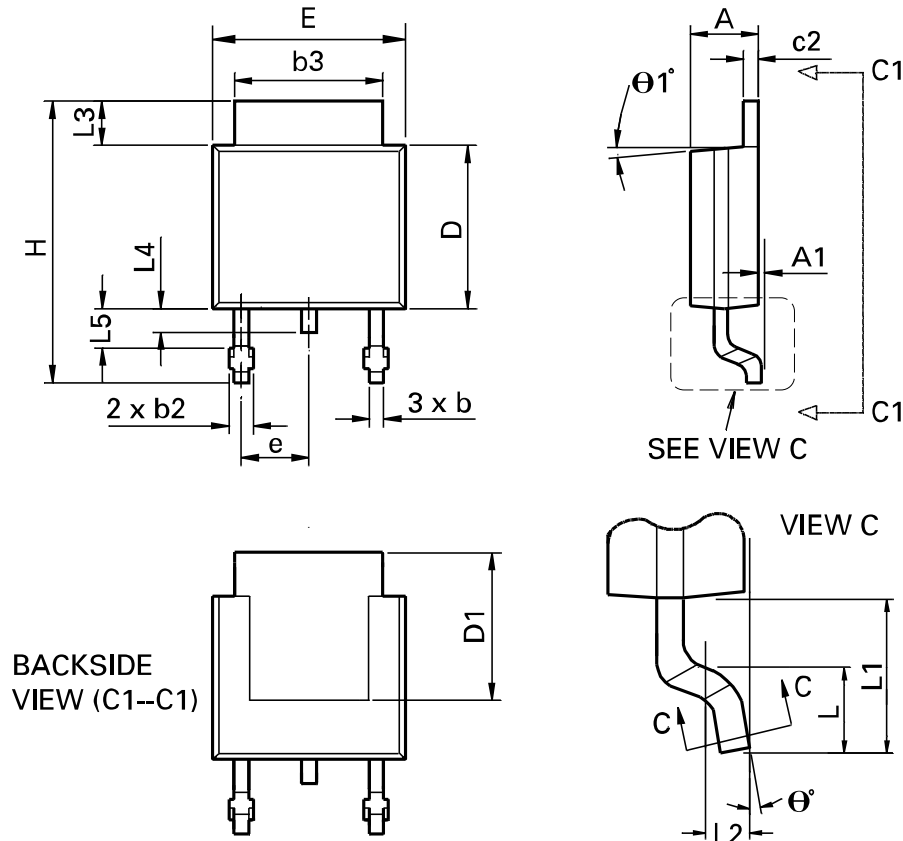


**Switching time waveforms**



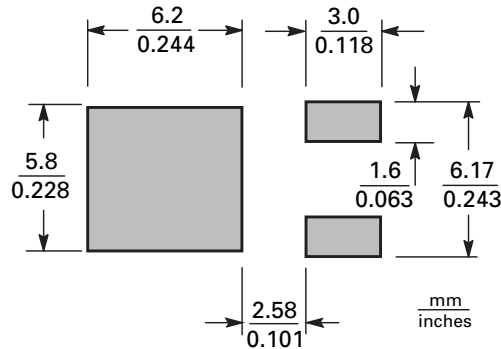
**Switching time test circuit**

**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	-	$\theta_1^\circ$	0°	10°	0°	10°
E	0.250	0.265	6.35	6.73	$\theta^\circ$	0°	15°	0°	15°
E1	0.170	-	4.32	-	-	-	-	-	-

## Suggested Pad Layout



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