

VBQE165A20S Datasheet

650 V (D-S) GaN Enhancement mode transistor

PRODUCT SUMMARY

V_{DS} (V)	650	
$R_{DS(on)}$ at 25 °C (Ω)	$V_{GS} = 6\text{ V}$	0.110

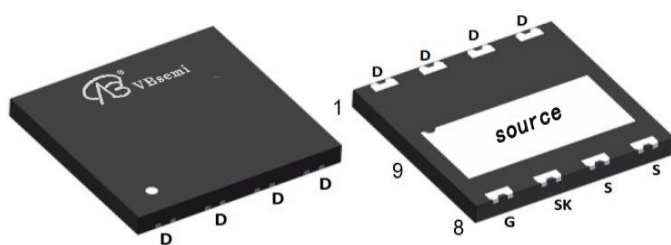
FEATURES

- Ultra High Switching Frequency
- Enhancement Mode Transistor
- No reverse-recovery charge
- Ultra low gate charge (Q_g)
- ESD Protection

APPLICATIONS

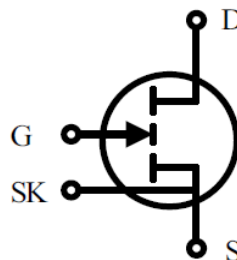
- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Fast Battery Charging

DFN8*8



Top View

Bottom View



ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)

PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			$V_{DS,max}$	650	V
Gate-Source Voltage			V_{GS}	-1.4~+7	
Continuous Drain Current ($T_J = 150\text{ }^{\circ}\text{C}$)	V_{GS} at 6 V	$T_C = 25\text{ }^{\circ}\text{C}$	I_D	20	A
		$T_C = 125\text{ }^{\circ}\text{C}$		10	
Pulsed Drain Current ^a			I_{DM}	30	
Drain-Source Voltage transient ^b			$V_{DS,transient}$	800	V
Drain-Source Voltage Pulse ^c			$V_{DS,pulse}$	750	V
Maximum Power Dissipation			P_D	119	W
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +150	$^{\circ}\text{C}$
Drain-Source Voltage Slope	$T_J = 125\text{ }^{\circ}\text{C}$		dV/dt	150	V/ns
Drain-Source Voltage Slope ^d	$T_J = 25\text{ }^{\circ}\text{C}$			200	
Soldering Recommendations (Peak Temperature) ^c	for 10 s			260	$^{\circ}\text{C}$

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- Non-repetitive events, $t_{pulse} < 200\text{ }\mu\text{s}$.
- Repetitive pulse, $t_{pulse} < 100\text{ ns}$.
- $I_{SD} \leq I_D$, $dI/dt = 100\text{ A}/\mu\text{s}$, starting $T_J = 25\text{ }^\circ\text{C}$.

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	62	°C/W
Maximum Junction-to-Case (Drain)	R_{thJC}	-	1.05	

SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Voltage	V _{DS}	-55 °C ≤ T _J ≤ 150 °C		-	-	650	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.60	-	V/°C
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 17.2 mA		1.2	-	2.5	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = 6 V		-	50	-	μA
		V _{DS} = 0 V, V _{GS} = 7 V		-	-	1	mA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 650V, V _{GS} = 0 V		-	1	25	μA
		V _{DS} = 650 V, V _{GS} = 0 V, T _J = 150°C		-	10	-	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} = 6 V	I _D =3.5A	-	0.110	-	Ω
Gate Resistance	R _g	F = 5MHz, Open drain		-	3.5	-	Ω
Dynamic							
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 400 V, f = 100 kHz		-	120	-	pF
Output Capacitance	C _{oss}			-	37	-	
Reverse Transfer Capacitance	C _{rss}			-	0.4	-	
Effective Output Capacitance, Energy Related ^a	C _{o(er)}	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		-	60	-	
Effective Output Capacitance, Time Related ^b	C _{o(tr)}			-	80	-	
Total Gate Charge	Q _g	V _{GS} = 6 V	I _D = 5 A, V _{DS} = 400 V	-	3.3	-	nC
Gate-Source Charge	Q _{gs}			-	0.3	-	
Gate-Drain Charge	Q _{gd}			-	1.2	-	
Turn-On Delay Time	t _{d(on)}	V _{DS} = 400 V, I _D = 5 A, V _{GS} = 6 V, R _g = 3 Ω		-	3	-	ns
Rise Time	t _r			-	4	-	
Turn-Off Delay Time	t _{d(off)}			-	5	-	
Fall Time	t _f			-	4	-	
Output Charge	Q _{oss}	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		-	33.5	-	pF
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	V _{GS} = 6 V		-	-	10	A
Pulsed Diode Forward Current	I _{SM}			-	-	30	
Diode Forward Voltage	V _{SD}	T _J = 25 °C, I _S = 3 A, V _{GS} = 0 V		-	2.4	-	V
Reverse Recovery Time	t _{rr}	T _J = 25 °C, I _F = I _S = 5 A, di/dt = 100 A/μs, V _R = 400 V		-	0	-	ns
Reverse Recovery Charge	Q _{rr}			-	0	-	μC

Notes

- a. $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
 b. $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .

TYPICAL CHARACTERISTICS($T_c=25^{\circ}\text{C}$, unless otherwise noted)

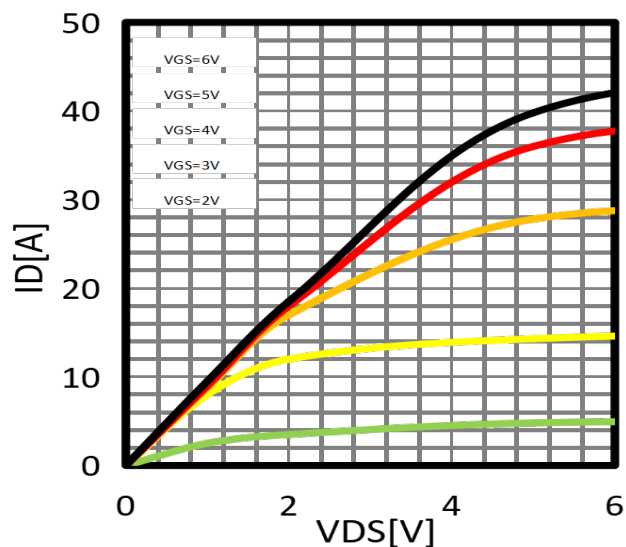


Fig.1: Output Characteristics

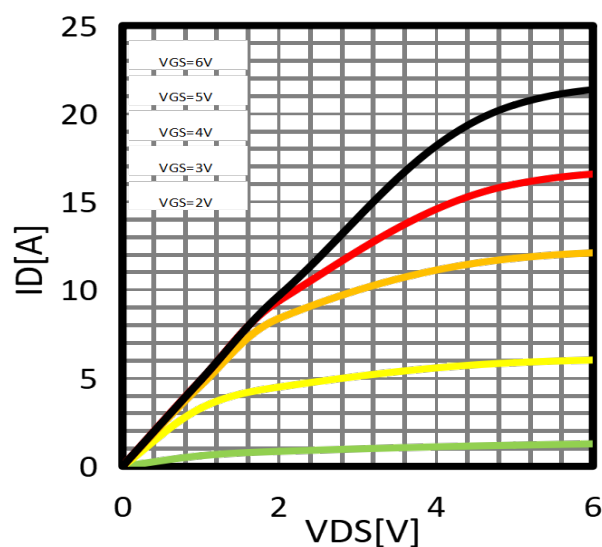


Fig.2: Output Characteristics(125°C)

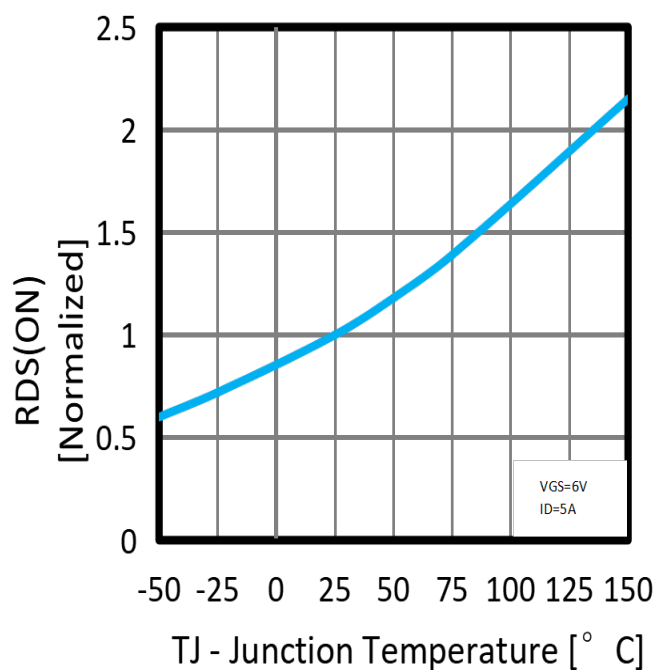


Fig.3: Drain-source on-state resistance

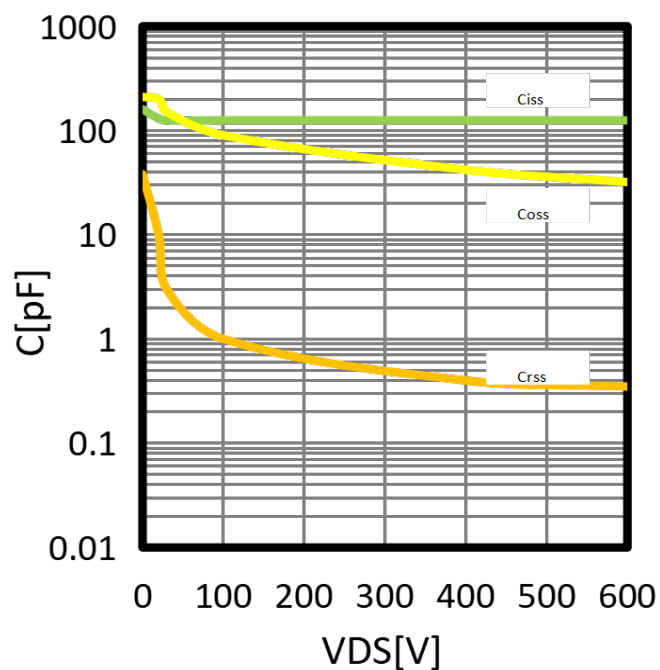
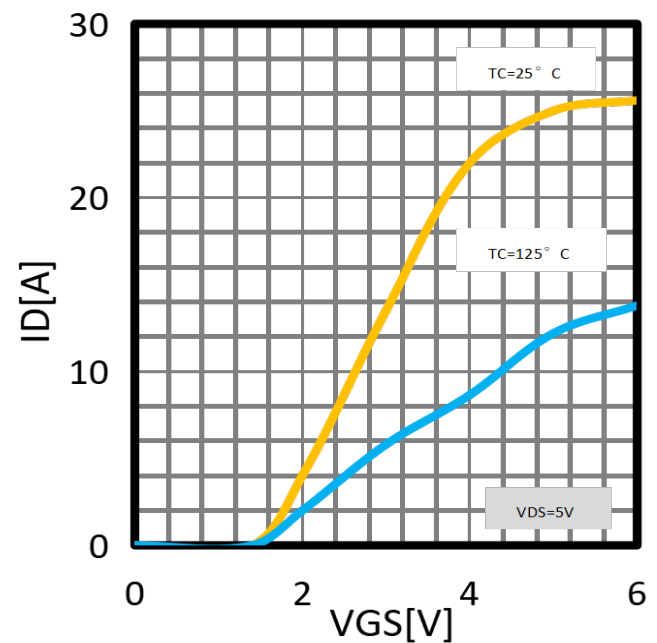
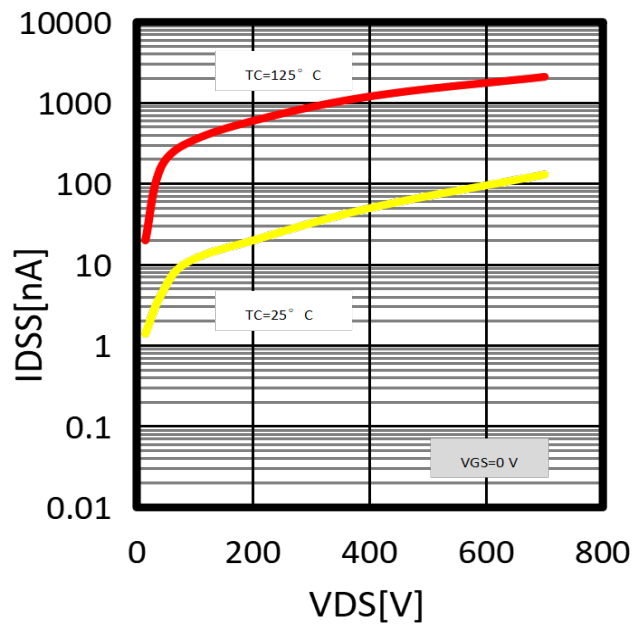
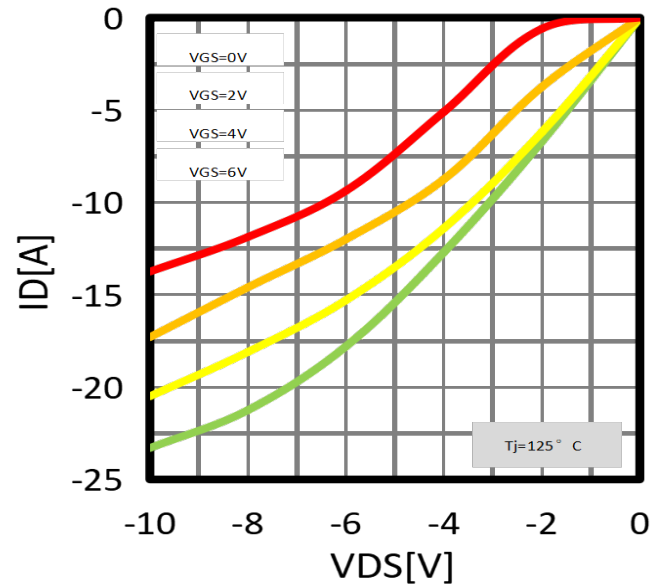
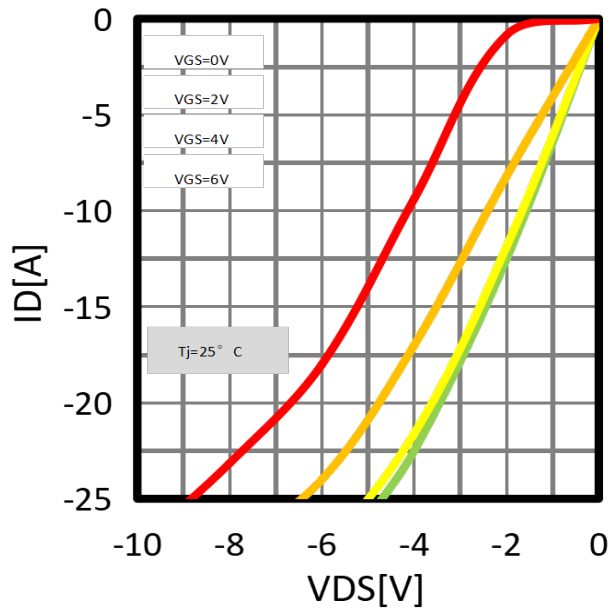


Fig.4: Typical Capacitance



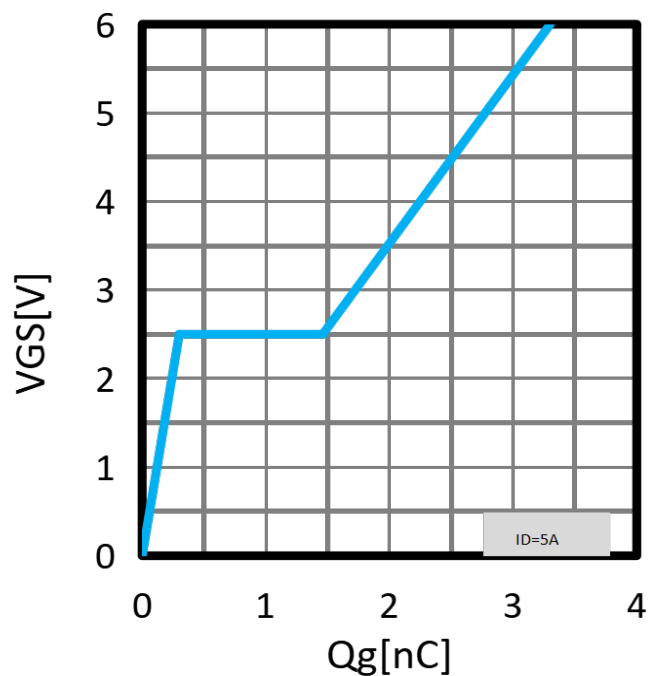


Fig.9:Gate Charge

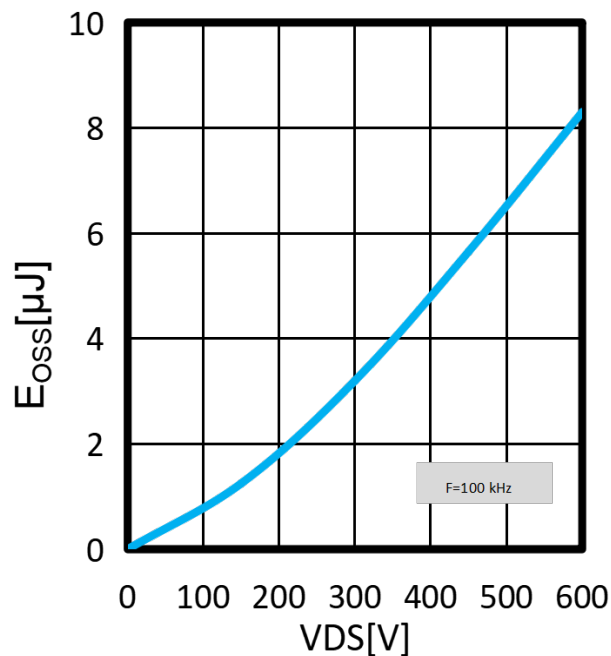


Fig.10:Typical Coss Stored Energy

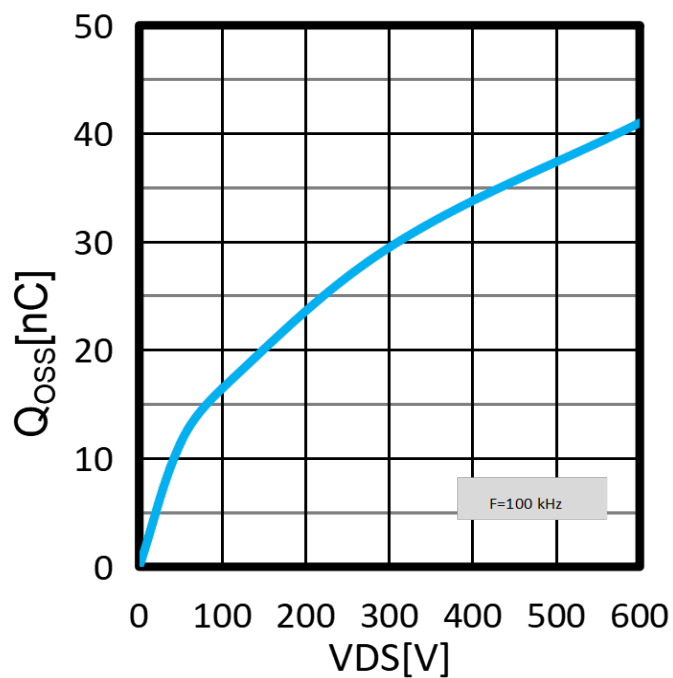


Fig.11:Typical Output Charge

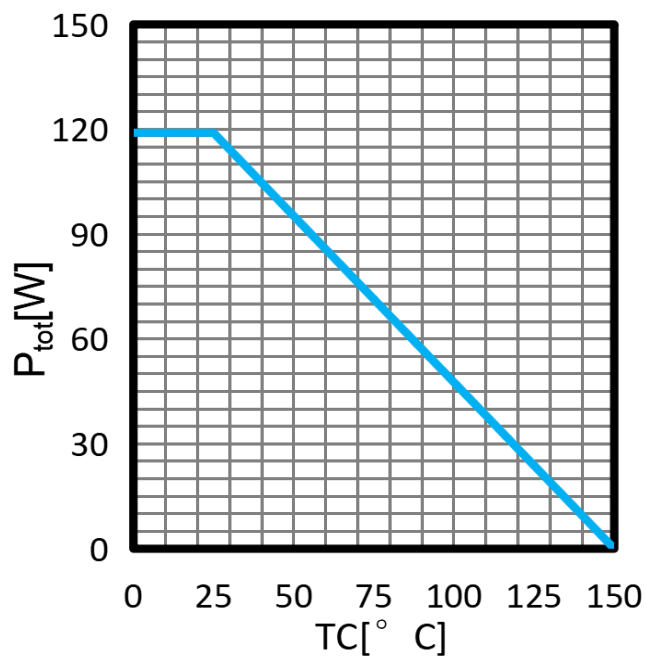


Fig.12:Power Dissipation

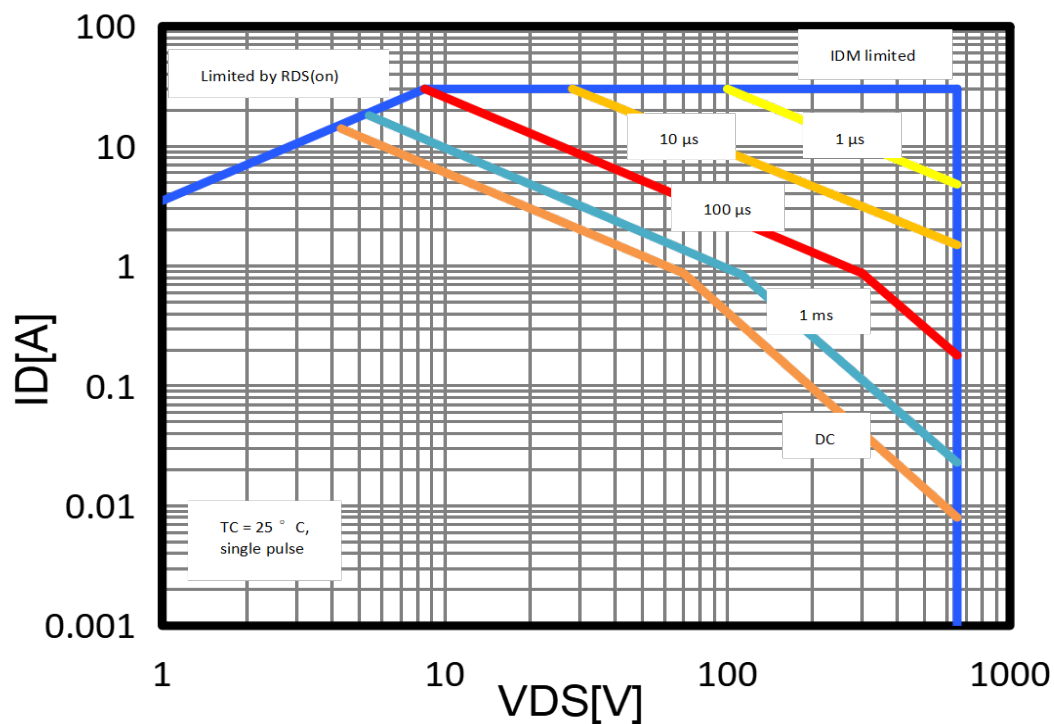


Fig.13: Safe Operating Area

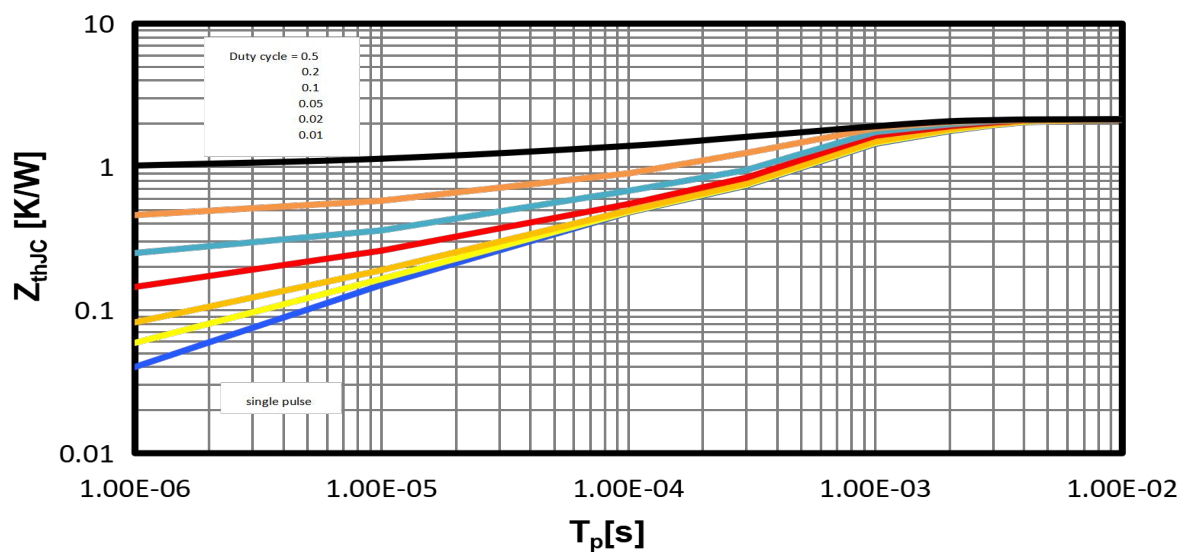
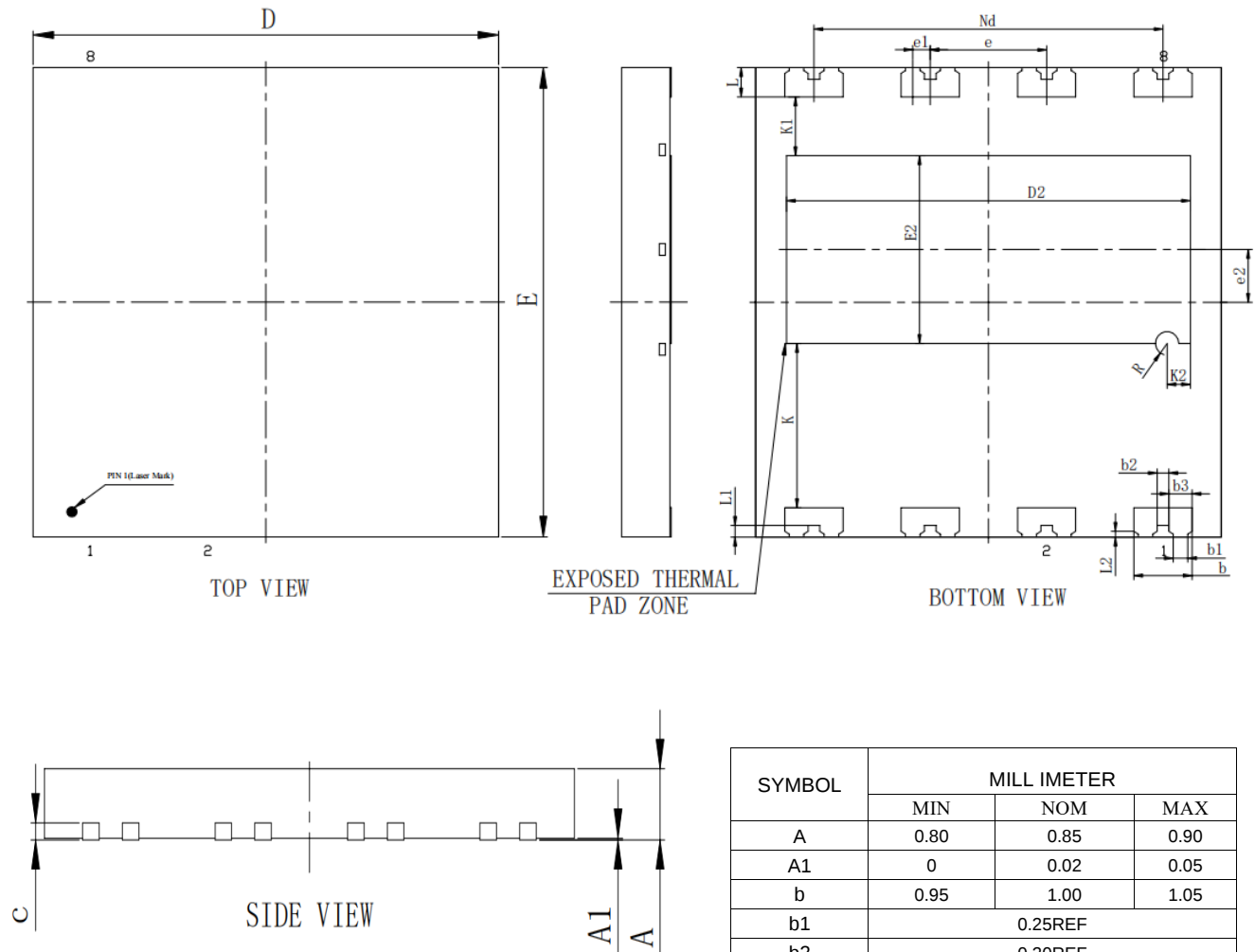


Fig.14: Transient Thermal Impedance

DFN 8x8 Package Information



SYMBOL	MILL IMETER		
	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0	0.02	0.05
b	0.95	1.00	1.05
b1	0.25REF		
b2	0.20REF		
b3	0.35	0.40	0.45
C	0.203REF		
D	7.90	8.00	8.10
D2	6.84	6.94	7.04
Nd	6.00BSC		
e	2.00BSC		
e1	0.30BSC		
e2	0.90BSC		
E	7.90	8.00	8.10
E2	3.10	3.20	3.30
L	0.45	0.50	0.55
L1	0.20REF		
L2	0.10REF		
K	2.80REF		
K1	1.00REF		
K2	0.40REF		
R	0.15	0.20	0.25

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