

1. General description:

The TSGaN065S025Q 650V, 202 mΩ gallium nitride GaN FET is a normally-off device , This device is a high performance and high reliability GaN HEMT built by Thrivesemi GaN EPI process and approved technology platform. It combines a state-of-the-art high voltage GaN HEMT with a low voltage silicon MOSFET to offer superior reliability and performance. simplify manufacturability while improving efficiency over silicon via lower gate charge, output capacitance, crossover loss, and reverse recovery charge.



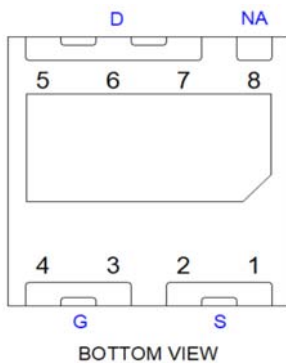
2. Features and benefits:

- 650V depletion mode power switch
- $R_{DS(on)} = 202\text{ m}\Omega$
- $I_{DS} = 25\text{A}$
- Transient tolerant gate drive (-20V to 20V)
- Footprint as 8mm x 8mm
- Improves power density
- Enables higher operating frequency
- System cost reduction savings
- Improves system efficiency
- Easy to drive with commonly used gate drivers

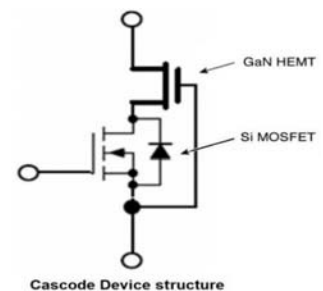
3. Applications:

- AC-DC Power supply
- USB Charger
- PFC application
- Solar inverter

4. Typical Performance Diagrams and Package:



- Pin 1 ~ 2: Source
- Pin 3 ~ 4: Gate
- Pin 5 ~ 7: Drain
- Pin 8: NA(Need Floating)



5. Ordering information:

Parts Number	Marking	Package	Voltage (V)	Id (A)	Pins	SPQ	Packaging
TSGaN065S025Q	TSGaN065S025Q	PDFN 8X8	650V	25 A	4	3000	Tube

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6. Absolute Maximum Ratings (Tc= 25 °C except as noted)

Parameter	Symbol	Value	Unit	Remark
Operating Junction Temperature	T _J	-55 to +150	°C	
Storage Temperature Range	T _S	-55 to +150	°C	
Drain-to-Source Voltage	V _{DS}	650	V	
Drain-to-Source Voltage - transient (Note 1)	V _{DS (transient)}	TBD	V	
Gate-to-Source Voltage	V _{GS}	-20 ~20	V	
Gate-to-Source Voltage - transient (Note 1)	V _{GS (transient)}	TBD	V	
Continuous Drain Current (Tcase = 25 °C) (Note 2)	I _{DS}	10	A	
Continuous Drain Current (Tcase = 100 °C) (Note 2)	I _{DS}	6.5	A	
Pulse Drain Current (Pulse width 10 us) (Note 3)	I _{DS, Pulse}	30	A	

Note 1: Pulse < 1 us

Note 2: Limited by saturation

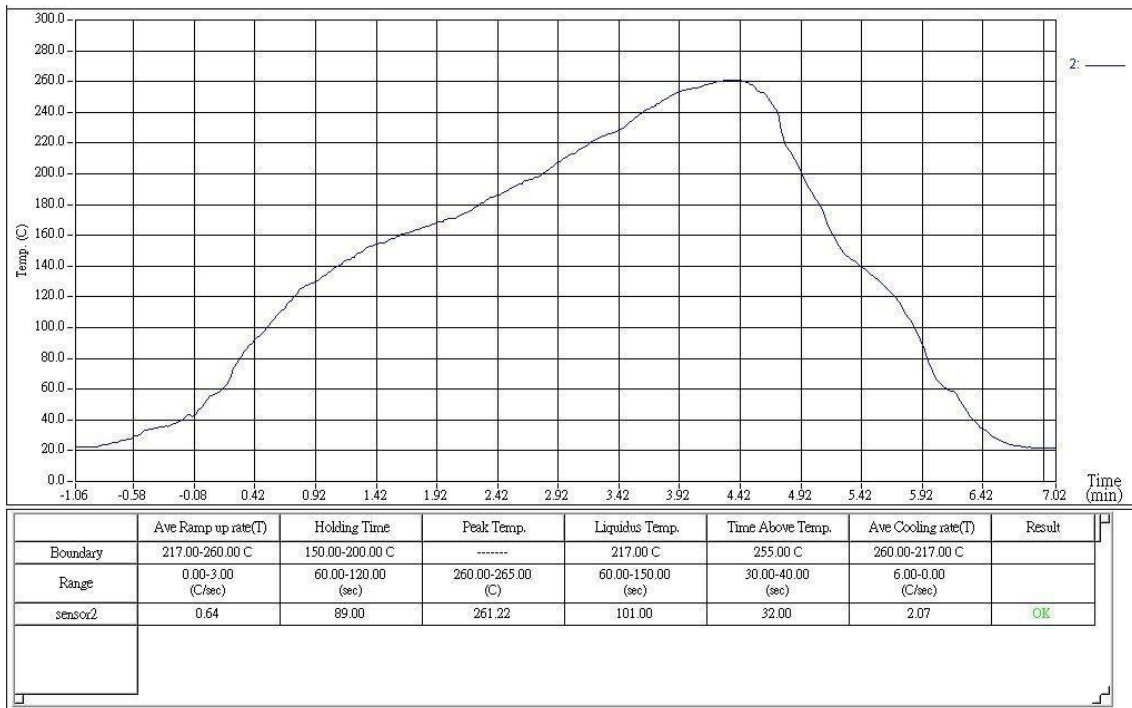
Note 3: VGS = 10V, VDS < 100V

7. Thermal Characteristics (Typical values unless otherwise noted)

Parameter	Symbol	Value	Unit	Remark
Thermal Resistance (junction-to-case)	R _{θJC}	2.5	°C /W	
Thermal Resistance (junction-to-ambient) (Note 1)	R _{θJA}	60	°C /W	
Maximum Soldering Temperature (MSL1 rated)	T _{SOLD}	260	°C	

Note 1: Device mounted on 1.6 mm PCB thickness FR4, 4-layer PCB with 2 oz. copper on each layer.

The recommendation for thermal vias under the thermal pad is 0.3 mm diameter (12 mil) with 0.635 mm pitch (25 mil). The copper layers under the thermal pad and drain pad are 25 x 25 mm² each. The PCB is mounted in horizontal position without air stream cooling.



8. Electrical Characteristics (Unless otherwise noted)

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
Drain-to-Source Blocking Voltage	BV_{DS}	650			V	$V_{GS}=0V, I_{DSS} = 250 \mu A, T_J = 25^\circ C$
Drain-to-Source On Resistance	$R_{DS(on)}$	184	202	349	m Ω	$V_{GS} = 10V, I_{DS} = 3.0A, T_J = 25^\circ C$
Drain-to-Source On Resistance	$R_{DS(on)}$		TBD		m Ω	$V_{GS} = 10V, I_{DS} = 4.0A, T_J = 150^\circ C$
Gate-to-Source Threshold	$V_{GS(th)}$	1.2		2.5	V	$V_{DS} = 10V, I_{DS} = 250 \mu A, T_J = 25^\circ C$
Gate-to-Source Leakage Current	I_{GSS}	100			nA	$V_{GS} = 20V, V_{DS} = 0V, T_J = 25^\circ C$
	I_{GSS}	-100			nA	$V_{GS} = -20V, V_{DS} = 0V, T_J = 25^\circ C$
Drain-to-Source Leakage Current	I_{DSS}	50	403	999	μA	$V_{DS} = 650V, V_{GS} = 0V, T_J = 25^\circ C$
Drain-to-Source Leakage Current	I_{DSS}		TBD		μA	$V_{DS} = 650V, V_{GS} = 0V, T_J = 150^\circ C$
Internal Gate Resistance	R_G		1.0		Ω	Open drain, $f = 1MHz, T_J = 25^\circ C$
Input Capacitance	C_{ISS}		1920		pF	$V_{DS}=400V, V_{GS}=10V, f=1MHz, T_J = 25^\circ C$ See Figure 5
Output Capacitance	C_{OSS}		29		pF	
Reverse Transfer Capacitance	C_{RSS}		5.5		pF	
Total Gate Charge	Q_G		37		nC	$V_{GS} = 0 \sim 10V, V_{DS} = 400V, I_D=10A, T_J = 25^\circ C$ See Figure 3
Gate-to-Source Charge	Q_{GS}		8.46		nC	
Gate-to-Drain Charge	Q_{GD}		4.14		nC	
Turn-on delay	$T_{d(on)}$		18		nS	$V_{DS}=400V, V_{GS}=0V \sim 10V, T_J = 25^\circ C, I_D = 10A, R_g = 10\Omega$ See Figure 9
Rise time	T_R		5		nS	
Turn-off delay	$T_{d(off)}$		65		nS	
Fall time	T_F		7		nS	

9. Electrical Performance Graphs

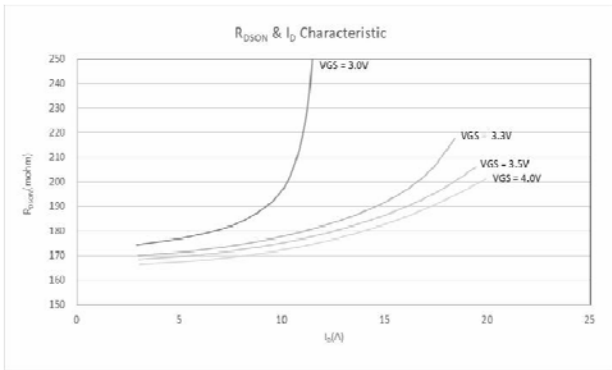


Figure 1: Typical RDSON vs. IDS @ $T_J = 25\text{ }^\circ\text{C}$

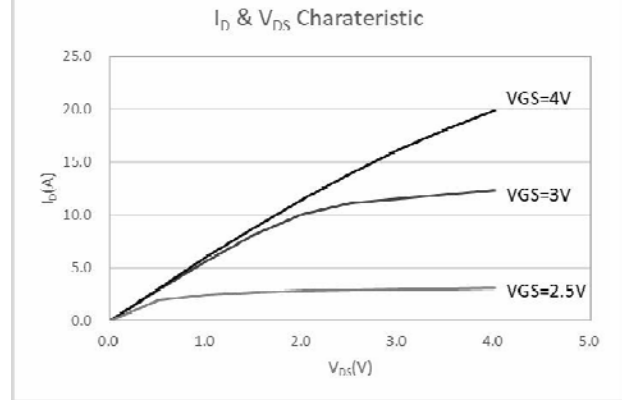


Figure 2: I_{DS} vs. V_{DS} @ $T_J = 25\text{ }^\circ\text{C}$

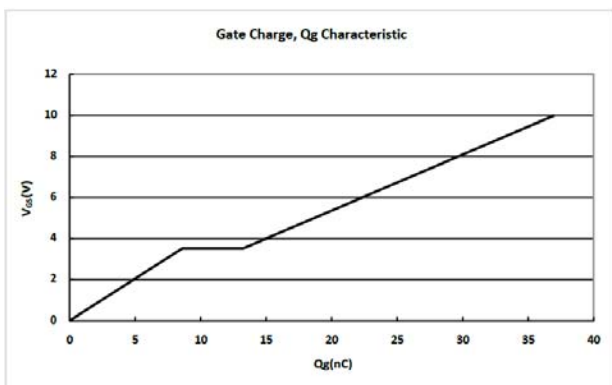


Figure 3: Typical V_{GS} vs. Q_G @ $V_{DS}=400\text{ V}$ $T_J=25\text{ }^\circ\text{C}$

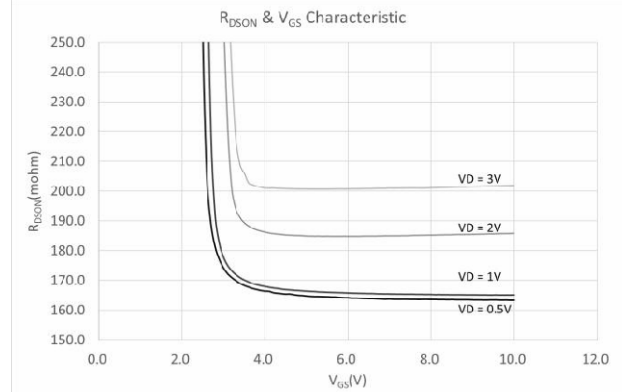


Figure 4: R_{DSON} vs. V_{GS} Characteristic @ $T_J = 25\text{ }^\circ\text{C}$

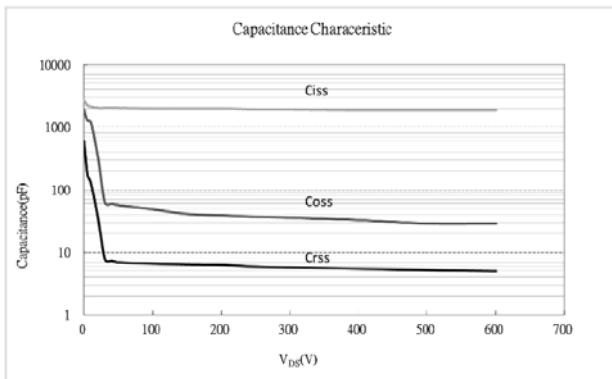


Figure 5: Typical C_{ISS} , C_{OSS} , C_{RSS} , vs. V_{DS} @ $T_J=25\text{ }^\circ\text{C}$

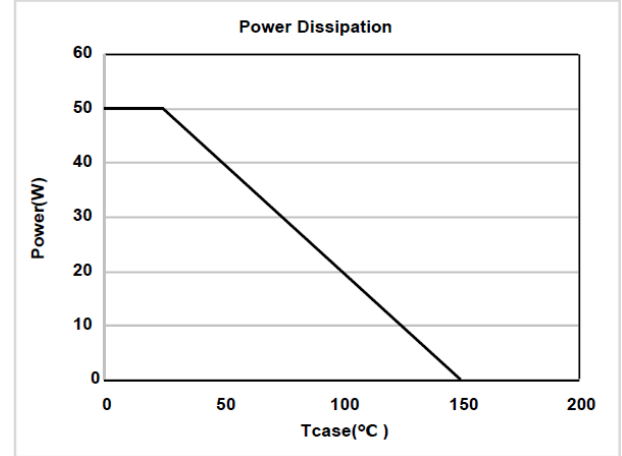


Figure 6: Power Derating vs. T_{case}

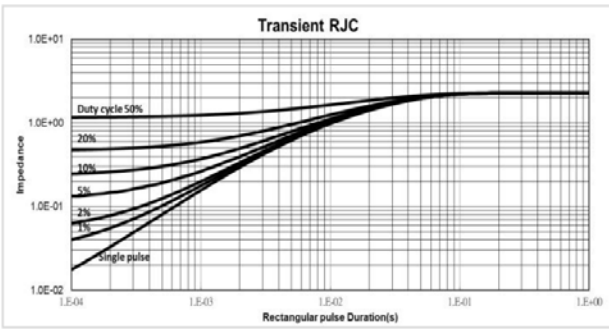


Figure 7: Transient R_{Jc}

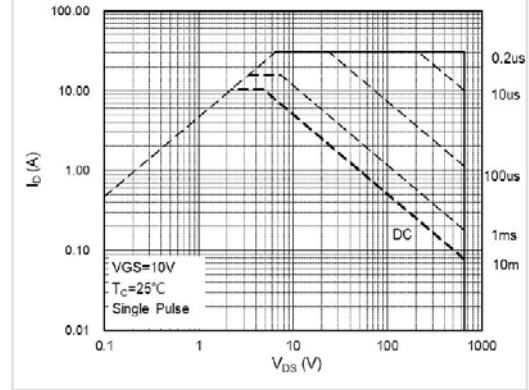


Figure 8: I_{DS} vs. V_{DS} SOA @ T_c = 25 °C

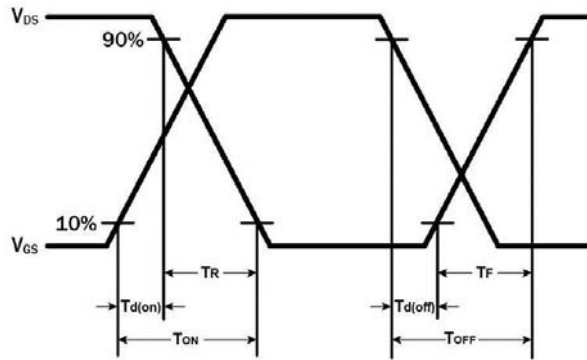
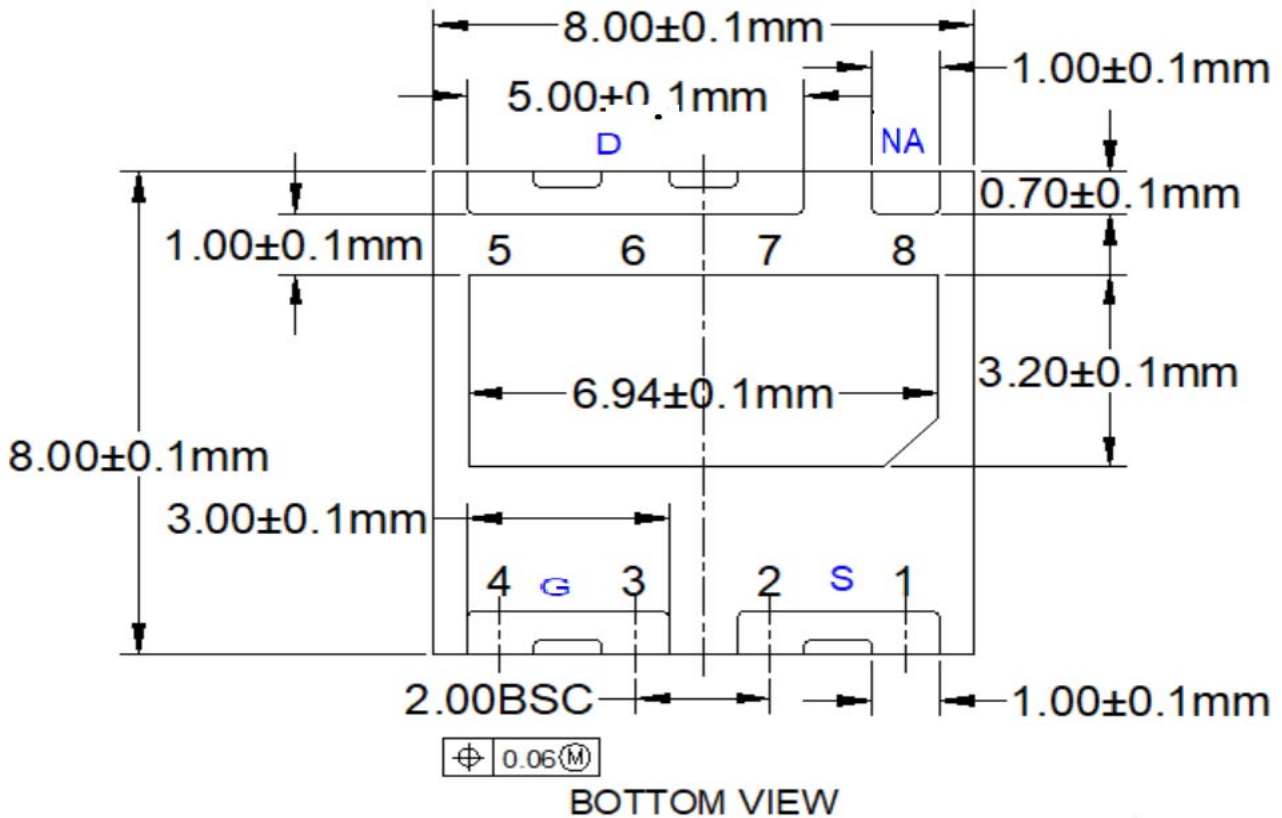


Figure 9: Switching times waveform @ T_J = 25 °C

10. Package Dimensions



11. Ordering Information

Ordering code	Package type	Packing method	Qty	Reel Diameter	Reel Width
TSGaN065S025Q- TR	PDFN 8x8	Tape-and-Reel	3000	TBD	TBD
TSGaN065S025Q -Tray	PDFN 8x8	Tray	260	TBD	TBD