1. General description:

The TSGaN065N010Q 650V, 164 mΩ gallium nitride GaN FET is a normally-off device , This device is a high performance and high reliability GaN HEMT built by GLC'S 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.

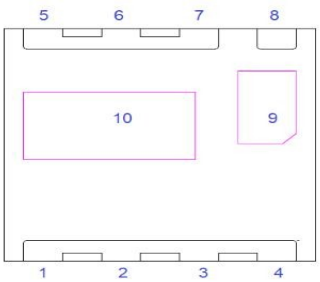
2. Features and benefits:

- 650V depletion mode power switch
- RDS(on) = 164 mΩ
- IDS=10A
- 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:



BOTTOM VIEW

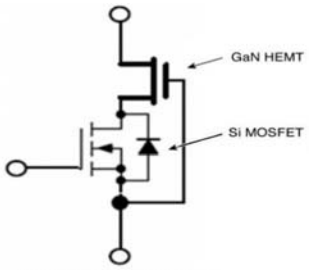
Pin 1 ~ 4: Drain

Pin 5 ~ 7: Source

Pin 8: Gate

Pin 9: NA (Need Floating), Engineering use. (this will be removed in MP)

Pin 10: NA (Need Floating)



Cascode Device structure

5. Ordering information:

Parts Number	Marking	Package	Voltage (V)	Id (A)	Pins	SPQ	Packaging
TSGaN065N010Q	TSGaN065N010Q	QFN 8X8	650V	10 A	4	3000	Tube

 All information provided in this document is subject to legal disclaimers ; 2020.All rights reserved

Table of Contents

 All information provided in this document is subject to legal disclaimers ; 2020.All rights reserved

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

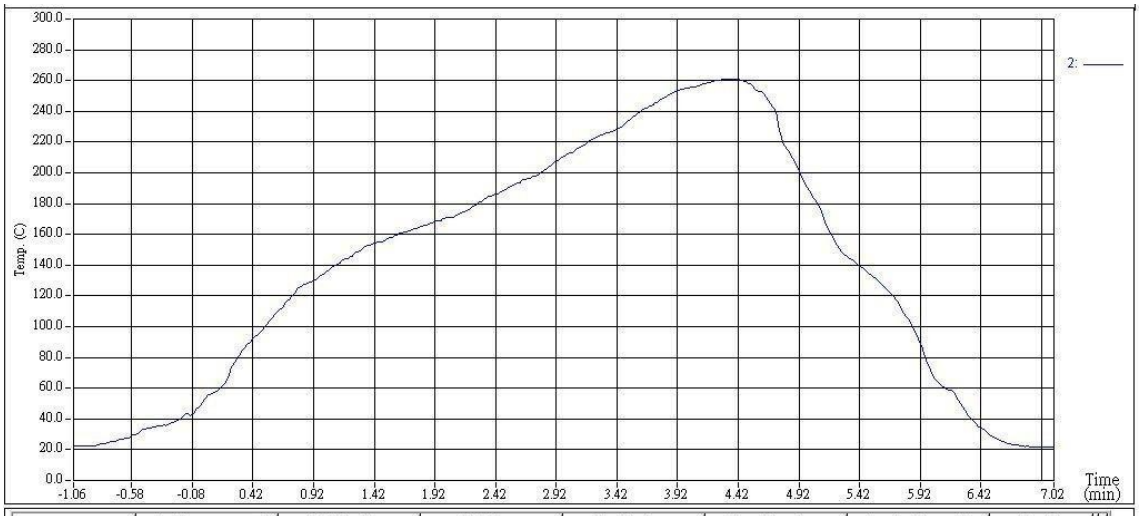
Note 2: Limited by saturation

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

7. Thermal Characteristics (Typical values unless otherwise noted)

Parameter	Symbol	Value	Unit	Remark
Thermal Resistance (junction-to-case)	$R_{\Theta JC}$	2.5	°C /W	
Thermal Resistance (junction-to-ambient) (Note 1)	$R_{\Theta JA}$	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.



	Ave Ramp up rate(T)	Holding Time	Peak Temp.	Liquidus Temp.	Time Above Temp.	Ave Cooling rate(T)	Result
Boundary	217.00-260.00 C	150.00-200.00 C	-------	217.00 C	255.00 C	260.00-217.00 C	
Range	0.00-3.00 (C/sec)	60.00-120.00 (sec)	260.00-265.00 (C)	60.00-150.00 (sec)	30.00-40.00 (sec)	6.00-0.00 (C/sec)	
sensor2	0.64	89.00	261.22	101.00	32.00	2.07	OK

 All information provided in this document is subject to legal disclaimers ; 2020.All rights reserved

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 uA, T_J = 25°C
Drain-to-Source On Resistance	$R_{DS(on)}$		164	213	mΩ	V_{GS} = 10V, I_{DS} = 4.0A, T_J = 25°C
Drain-to-Source On Resistance	$R_{DS(on)}$)		TBD		mΩ	V_{GS} = 10V, I_{DS} = 4.0A, T_J = 150°C
Gate-to-Source Threshold	$V_{GS(th)}$	1.2		2.5	V	V_{DS} = 10V, I_{DS} = 250 uA T_J = 25°C
Gate-to-Source Leakage Current	I_{GSS}	100			nA	V_{GS} = 20V, V_{DS} = 0V, T_J = 25°C
	I_{GSS}	-100			nA	V_{GS} = -20V, V_{DS} = 0V, T_J = 25°C
Drain-to-Source Leakage Current	I_{DSS}			25	uA	V_{DS} = 650V, V_{GS} = 0V, T_J = 25°C
Drain-to-Source Leakage Current	I_{DSS}		TBD		uA	V_{DS} = 650V, V_{GS} = 0V T_J = 150°C
Internal Gate Resistance	R_G		1.0		Ω	Open drain, f = 1MHz, T_J = 25°C
Input Capacitance	C_{ISS}		1920		pF	V_{DS}=400V, V_{GS}=10V, f=1MHz, T_J = 25°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 ~ 10V, V_{DS} = 400V, I_D=10A, T_J = 25°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 ~ 10V, T_J = 25°C, I_D =10A, R_g = 10Ω See Figure 9
Rise time	T_R		5		nS	
Turn-off delay	$T_{d(off)}$		65		nS	
Fall time	T_F		7		nS	

 All information provided in this document is subject to legal disclaimers ; 2020.All rights reserved

9. Electrical Performance Graphs

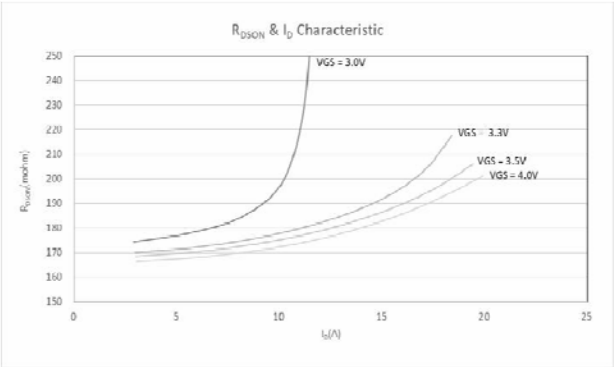


Figure 1: Typical RDSON vs. IDS @ T_J = 25 °C

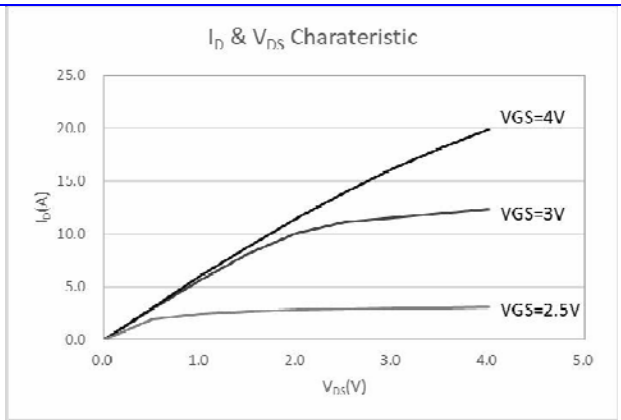


Figure 2: I_{DS} vs. V_{DS} @ T_J = 25 °C

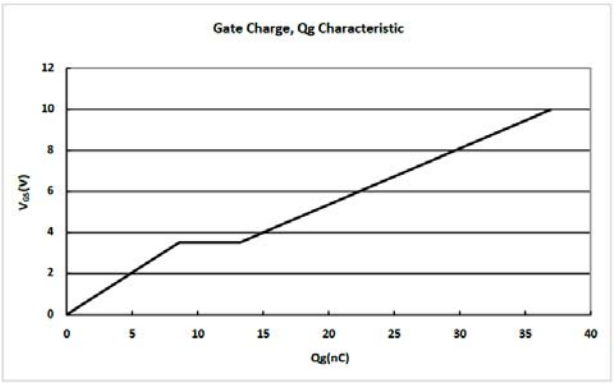


Figure 3: Typical V_{GS} vs. Q_G @ V_{DS}=400 V T_J=25 °C

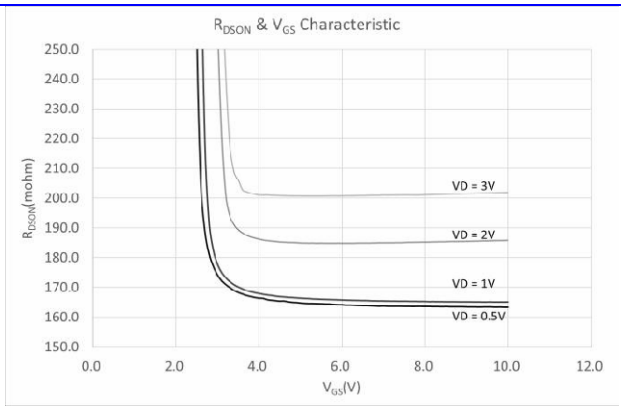


Figure 4: R_{DSON} vs. V_{GS} Characteristic @ T_J = 25 °C

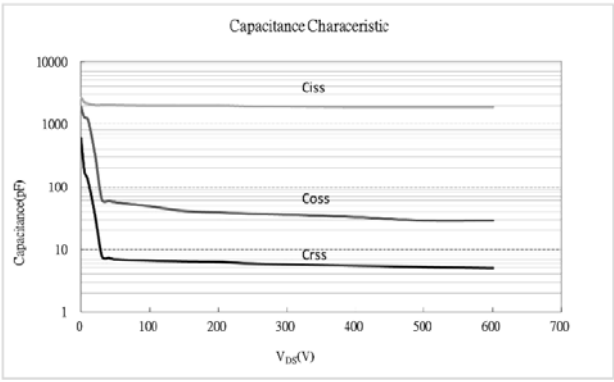


Figure 5: Typical C_{ISS}, C_{OSS}, C_{RSS}, vs. V_{DS} @ T_J=25 °C

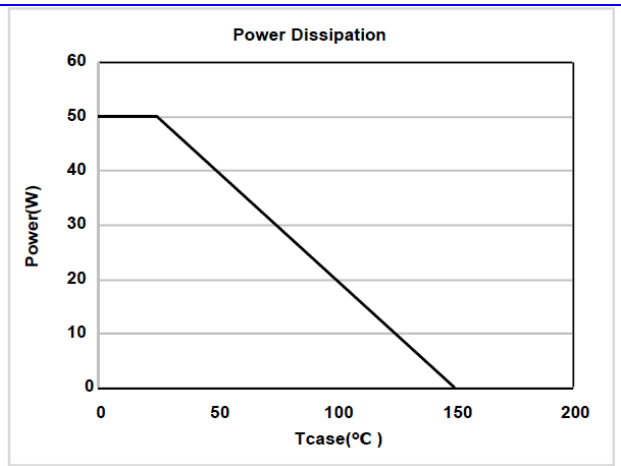


Figure 6: Power Derating vs. T_{case}

 All information provided in this document is subject to legal disclaimers ; 2020.All rights reserved

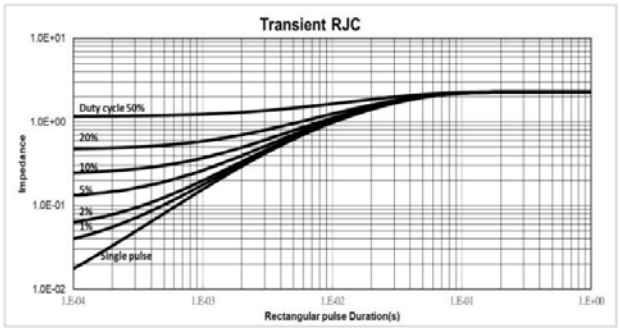


Figure 7: Transient R_{JC}

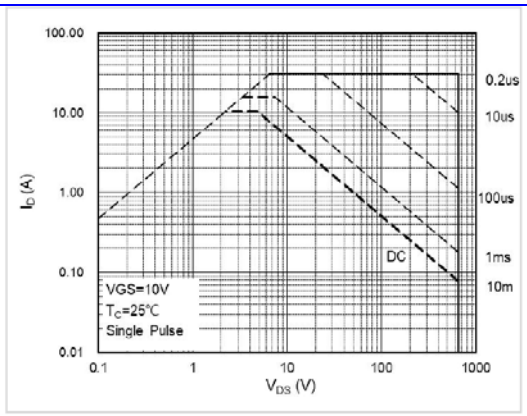


Figure 8: I_{DS} vs. V_{DS} SOA @ T_C = 25 °C

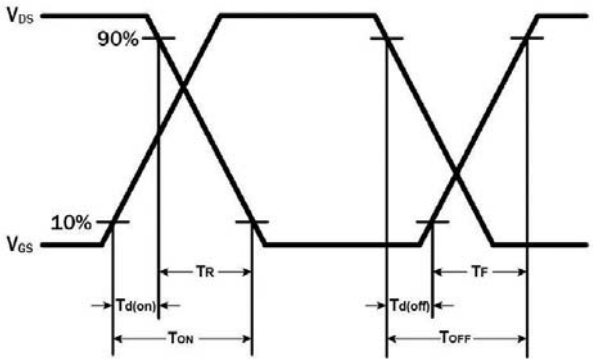
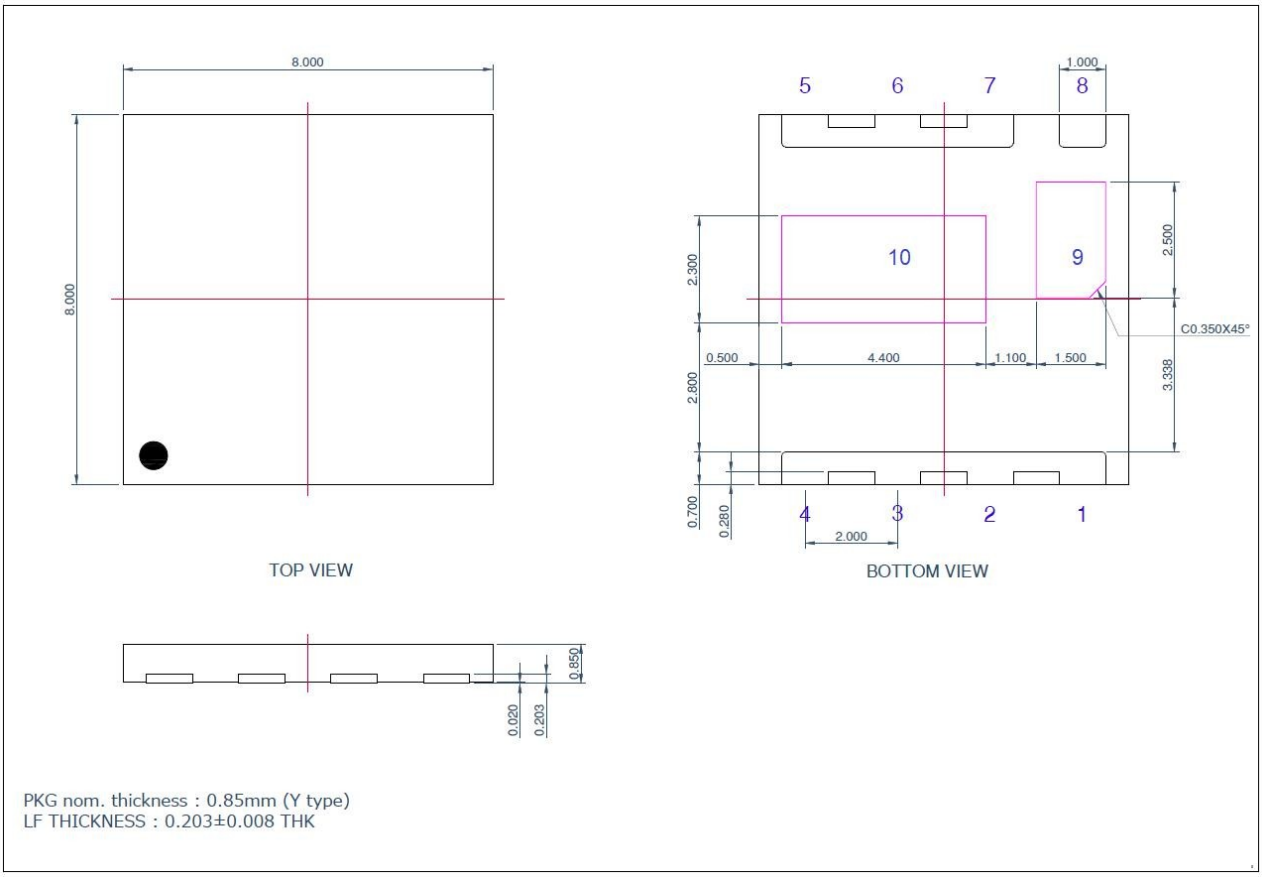


Figure 9: Switching times waveform @ T_J = 25 °C

10. Package Dimensions



 All information provided in this document is subject to legal disclaimers ; 2020.All rights reserved

11. Ordering Information

Ordering code	Package type	Packing method	Qty	Reel Diameter	Reel Width
TSGaN065N010Q- TR	QFN 8L 8x8	Tape-and-Reel	3000	TBD	TBD
TSGaN065N010Q -Tray	QFN 8L 8x8	Tray	260	TBD	TBD

 All information provided in this document is subject to legal disclaimers ; 2020.All rights reserved