ON Semiconductor®

FDS6681Z

30 Volt P-Channel PowerTrench® MOSFET

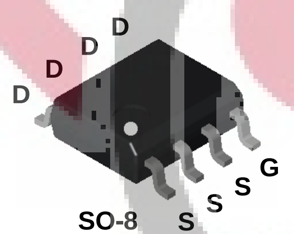
General Description

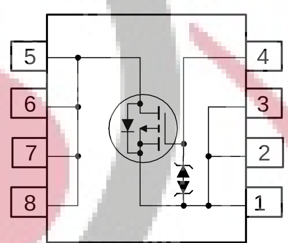
This P-Channel MOSFET is produced using ON Semiconductor's advanced PowerTrench® process that has been especially tailored to minimize the on-state resistance.

This device is well suited for Power Management and load switching applications common in Notebook Computers and Portable Battery Packs.

Features

- –20 A, –30 V. $R_{DS(ON)}$ = 4.6 mΩ @ V_{GS} = –10 V
  $R_{DS(ON)}$ = 6.5 mΩ @ V_{GS} = –4.5 V
- Extended V_{GSS} range (–25V) for battery applications
- HBM ESD protection level of 8kV typical (note 3)
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability
- Termination is Lead-free and RoHS Compliant





Absolute Maximum Ratings
T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		–30	V
V_{GSS}	Gate-Source Voltage		±25	V
I_D	Drain Current – Continuous	(Note 1a)	–20	A
	– Pulsed		–105	
P_D	Power Dissipation for Single Operation	(Note 1a)	2.5	W
		(Note 1b)	1.2	
		(Note 1c)	1.0	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150	°C

Thermal Characteristics

$R_{θJA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	50	°C/W
$R_{θJC}$	Thermal Resistance, Junction-to-Case	(Note 1)	25	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS6681Z	FDS6681Z	13''	12mm	2500 units

Electrical Characteristics

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = –250 µA	–30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = –250 µA, Referenced to 25°C		–26		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = –24 V, V_{GS} = 0 V			–1	µA
I_{GSS}	Gate–Body Leakage	V_{GS} = ±25 V, V_{DS} = 0 V			±10	µA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = –250 µA	–1	–1.8	–3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = –250 µA, Referenced to 25°C		6		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = –10 V, I_D = –20 A V_{GS} = –4.5 V, I_D = –17 A V_{GS} = –10 V, I_D = –20 A, T_J=125°C		3.8 5.2 5.0	4.6 6.5 6.3	mΩ
g_{FS}	Forward Transconductance	V_{DS} = –5 V, I_D = –20 A		79		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = –15 V, V_{GS} = 0 V, f = 1.0 MHz		7540		pF
C_{oss}	Output Capacitance			1400		pF
C_{rss}	Reverse Transfer Capacitance			1120		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = –15 V, I_D = –1 A, V_{GS} = –10 V, R_{GEN} = 6 Ω		20	35	ns
t_r	Turn–On Rise Time			9	18	ns
$t_{d(off)}$	Turn–Off Delay Time			660	1060	ns
t_f	Turn–Off Fall Time			380	610	ns
$Q_{g(TOT)}$	Total Gate Charge at V_{GS} = –10V	V_{DS} = –15 V, I_D = –20 A		185	260	nC
$Q_{g(TOT)}$	Total Gate Charge at V_{GS} = –5V			105	150	nC
Q_{gs}	Gate–Source Charge			26		nC
Q_{gd}	Gate–Drain Charge			47		nC

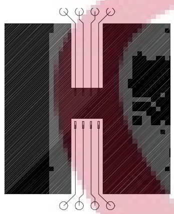
Electrical Characteristics

T_A = 25°C unless otherwise noted

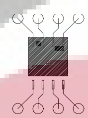
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				–2.1	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = –2.1 A (Note 2)		–0.7	–1.2	V
t_{RR}	Reverse Recovery Time	I_F = –20 A,		125		ns
Q_{RR}	Reverse Recovery Charge	dI_F/dt = 100 A/µs (Note 2)		94		nC

Notes:

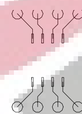
1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 50°C/W (10 sec) 62.5°C/W steady state when mounted on a 1in^2 pad of 2 oz copper



b) 105°C/W when mounted on a .04 in^2 pad of 2 oz copper



c) 125°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%

3. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

Typical Characteristics

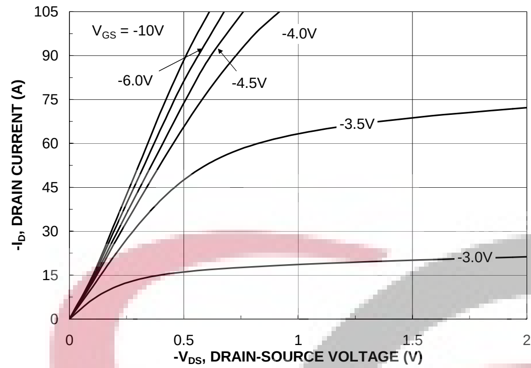


Figure 1. On-Region Characteristics.

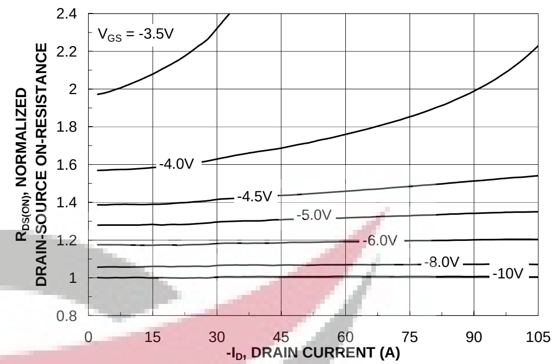


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

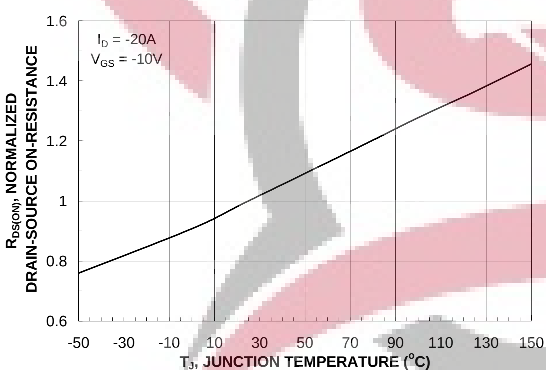


Figure 3. On-Resistance Variation with Temperature.

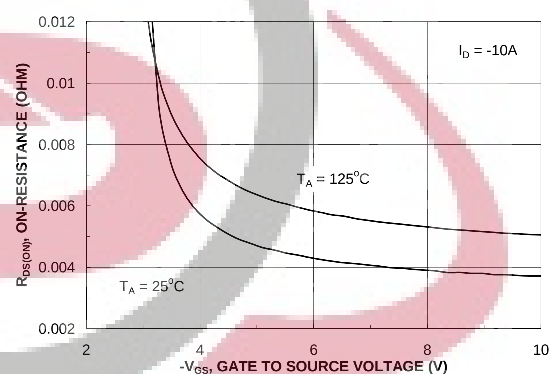


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

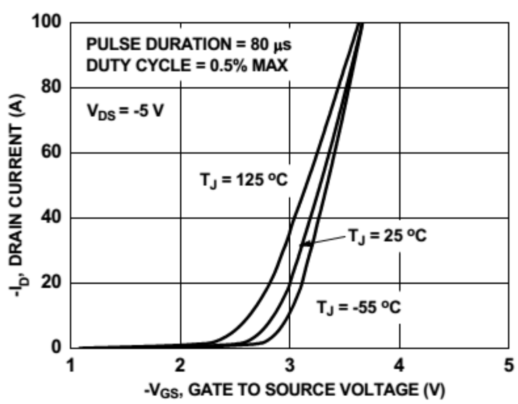


Figure 5. Transfer Characteristics.

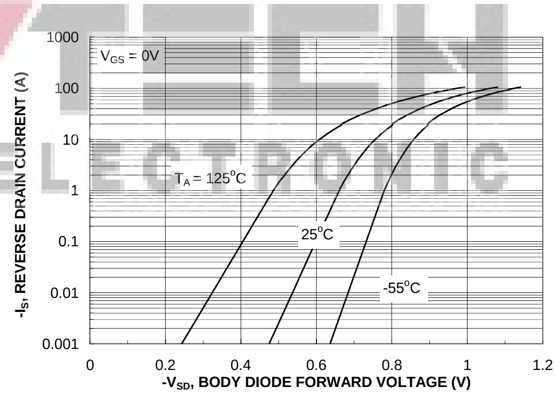


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

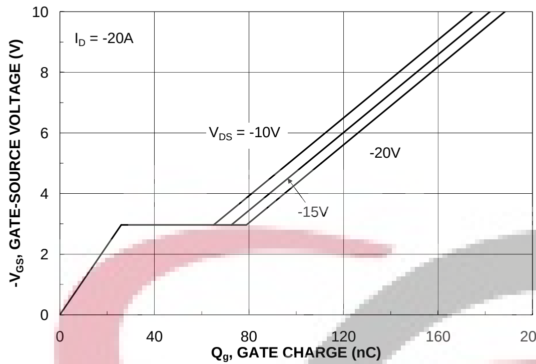


Figure 7. Gate Charge Characteristics.

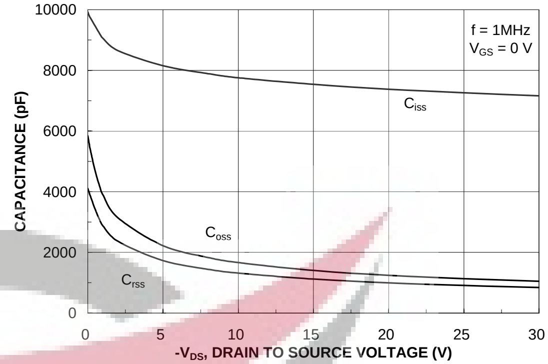


Figure 8. Capacitance Characteristics.

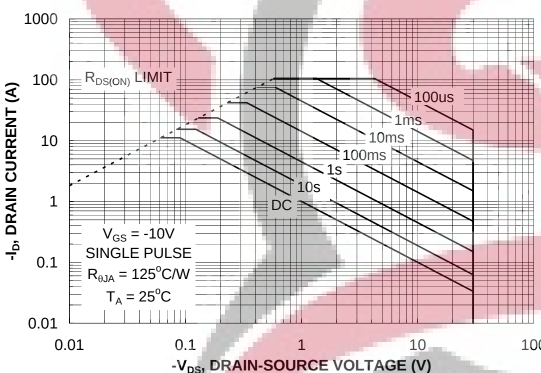


Figure 9. Maximum Safe Operating Area.

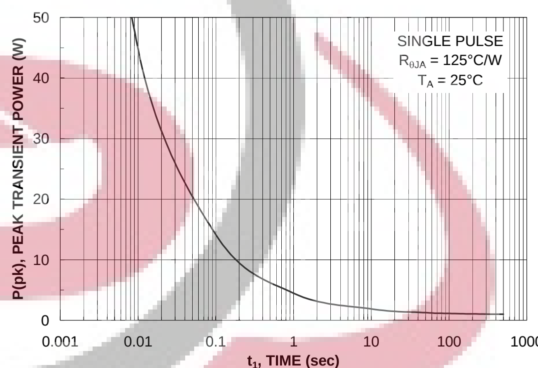


Figure 10. Single Pulse Maximum Power Dissipation.

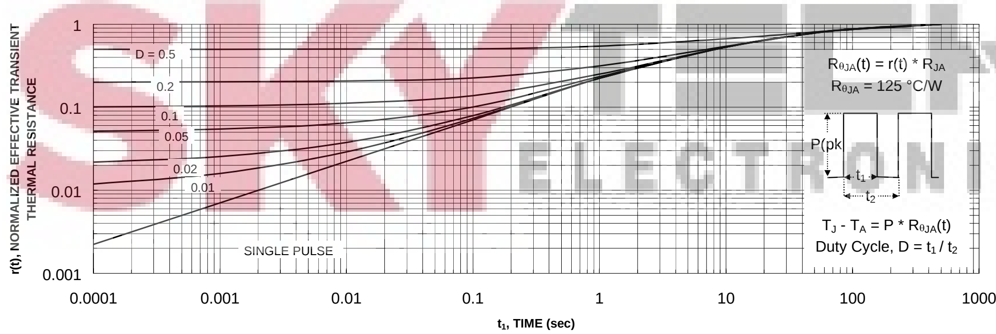


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1c.
Transient thermal response will change depending on the circuit board design.

PUBLICATION ORDERING INFORMATION

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