

## N-Channel 650 V (D-S) Super Junction Power MOSFET



**RoHS**  
COMPLIANT

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (mΩ) (Typ.)	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)
650	280 at V <sub>GS</sub> = 10 V	18	20 nC

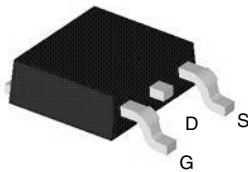
### FEATURES

- DT-SJ Power MOSFET
- 100 % R<sub>g</sub> and UIS tested
- Low on-resistance and low conduction losses
- ROHS compliant

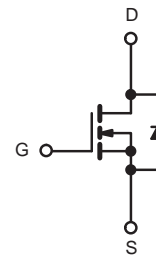
### APPLICATIONS

- Power factor correction
- Switched mode power supplies
- Uninterruptible Power Supply

TO-252 Pin Configuration



Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	V <sub>DS</sub>	650	V
Gate-Source Voltage	V <sub>GS</sub>	± 30	
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	I <sub>D</sub>	T <sub>C</sub> = 25 °C	18
		T <sub>C</sub> = 100 °C	11
Pulsed Drain Current <sup>b</sup>	I <sub>DM</sub>	54	A
Single Avalanche Energy	E <sub>AS</sub>	300	mJ
Maximum Power Dissipation <sup>c</sup>	P <sub>D</sub>	T <sub>C</sub> = 25 °C	138
		T <sub>C</sub> = 100 °C	55.5
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

THERMAL RESISTANCE RATINGS			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient (PCB Mount) <sup>d</sup>	R <sub>thJA</sub>	62	°C/W
Junction-to-Case (Drain)	R <sub>thJC</sub>	0.9	

### Notes

- Calculated continuous current based on maximum allowable junction temperature.
- Repetitive rating; pulse width limited by max. junction temperature.
- P<sub>d</sub> is based on max. junction temperature, using junction-case thermal resistance.
- The value of R<sub>thJA</sub> is measured with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with T<sub>a</sub>=25 °C.

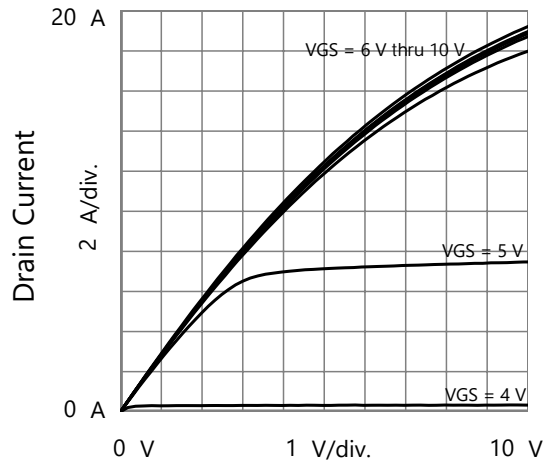
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	650	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.5	-	4.5	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	100	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	18	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 6.5\text{ A}$	-	280	360	m $\Omega$
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 5\text{ V}, I_D = 6.5\text{ A}$	-	12	-	S
<b>Dynamic <sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	-	823	-	pF
Output Capacitance	$C_{oss}$		-	811	-	
Reverse Transfer Capacitance	$C_{rss}$		-	15	-	
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{DS} = 400\text{ V}, V_{GS} = 10\text{ V}, I_D = 6.5\text{ A}$	-	20	-	nC
Gate-Source Charge <sup>c</sup>	$Q_{gs}$		-	3	-	
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$		-	7.5	-	
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	-	6.7	-	$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 6.5\text{ A}, R_g = 20\text{ }\Omega$ $V_{GS} = 10\text{ V}$	-	17	-	ns
Rise Time <sup>c</sup>	$t_r$		-	12	-	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$		-	128	-	
Fall Time <sup>c</sup>	$t_f$		-	11	-	
<b>Drain-Source Body Diode Ratings and Characteristics <sup>b</sup></b> ( $T_C = 25\text{ }^\circ\text{C}$ )						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	-	-	18	A
Pulsed Current	$I_{SM}$		-	-	54	A
Forward Voltage <sup>a</sup>	$V_{SD}$	$I_F = 6.5\text{ A}, V_{GS} = 0\text{ V}$	-	-	1.2	V
Reverse Recovery Time	$t_{rr}$	$I_F = 6.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	-	240	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	2.5	-	$\mu\text{C}$

**Notes**

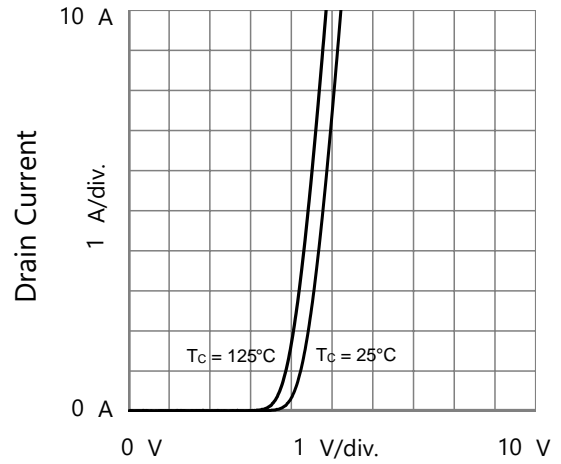
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

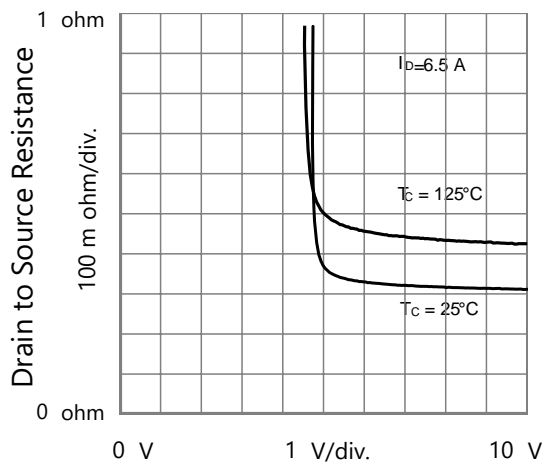
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



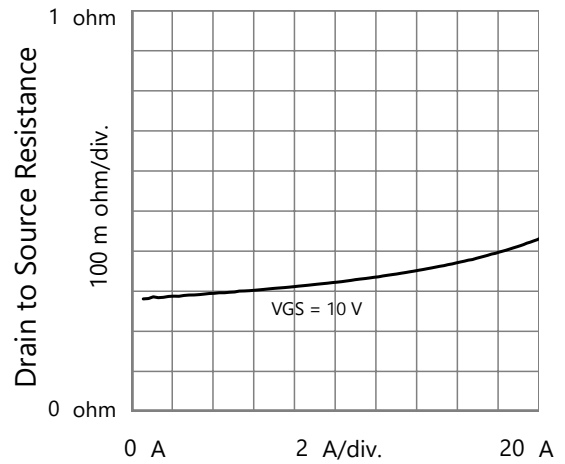
Drain to Source Voltage Output Characteristics



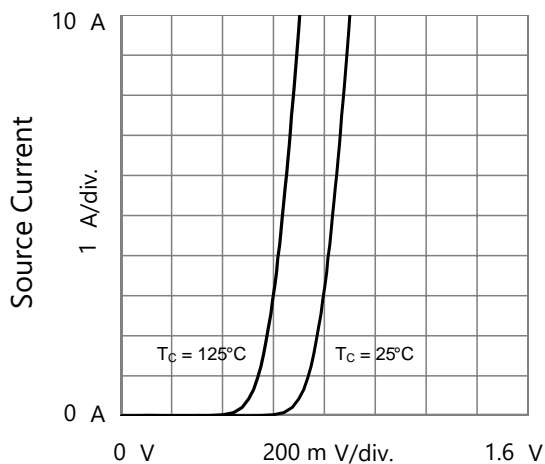
Gate to Source Voltage Transfer Characteristics



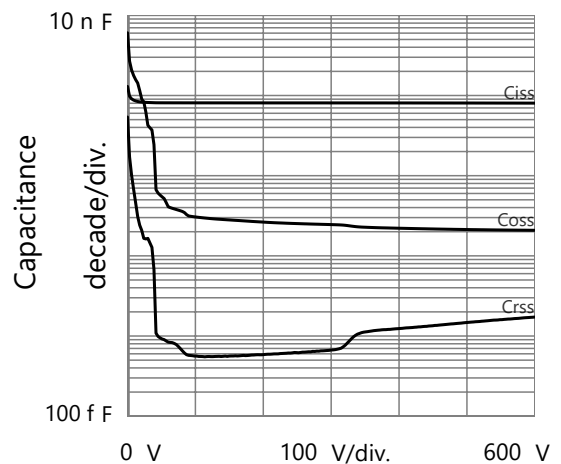
Gate to Source Voltage Drain to Source Resistance vs. Gate to Source Voltage



Drain Current Drain to Source Resistance vs. Drain Current

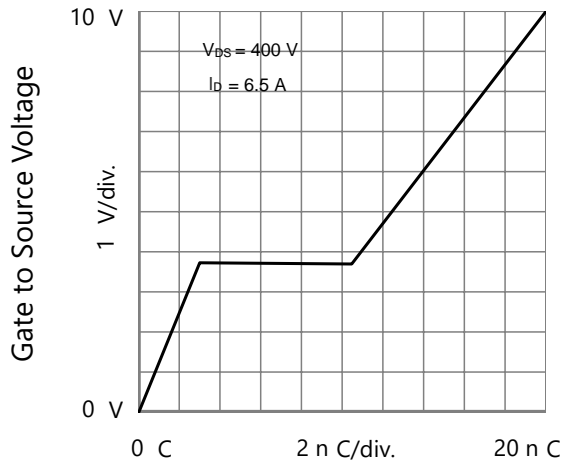


Source to Drain Voltage Body Diode Forward Characteristics

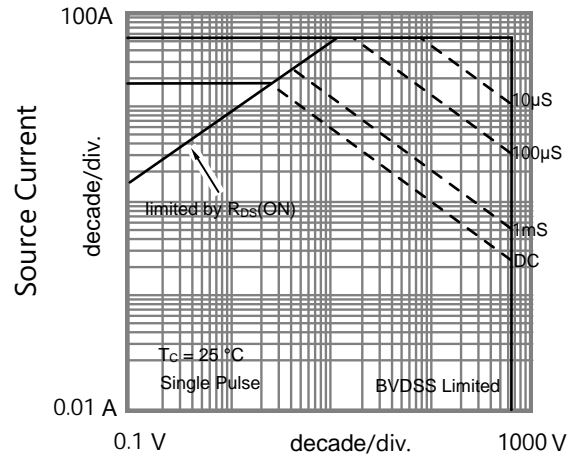


Drain to Source Voltage Capacitances

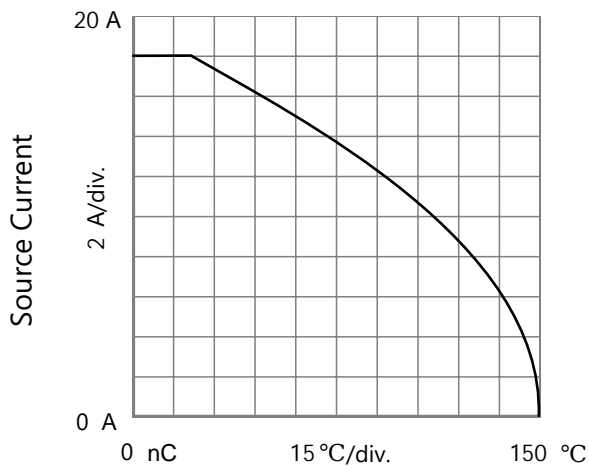
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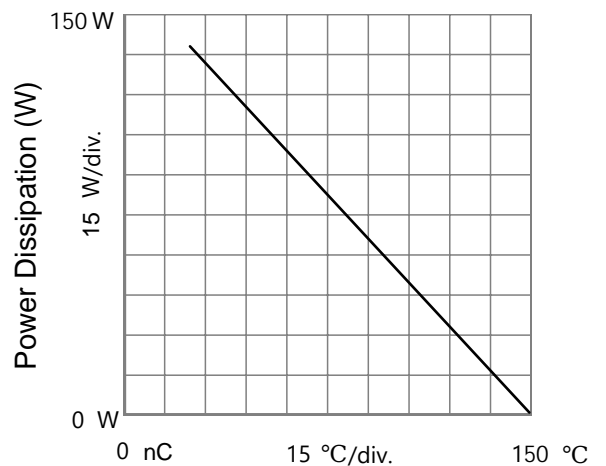
**Gate Charge**  
Gate to Source Voltage vs. Gate Charge



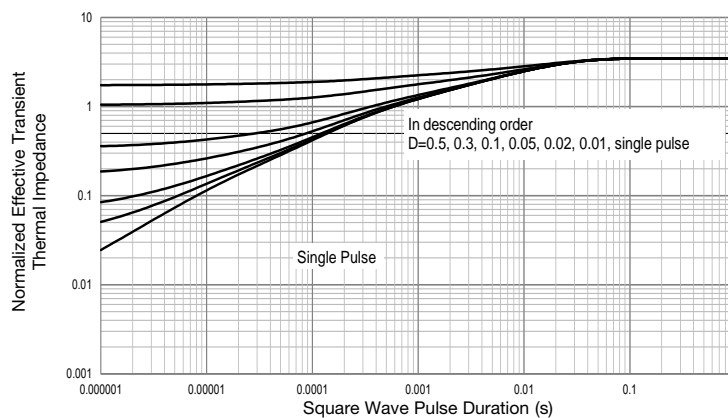
**Source to Drain Voltage**  
Safe Operating Area, Junction-to-Ambient



**T<sub>C</sub> - Case Temperature**

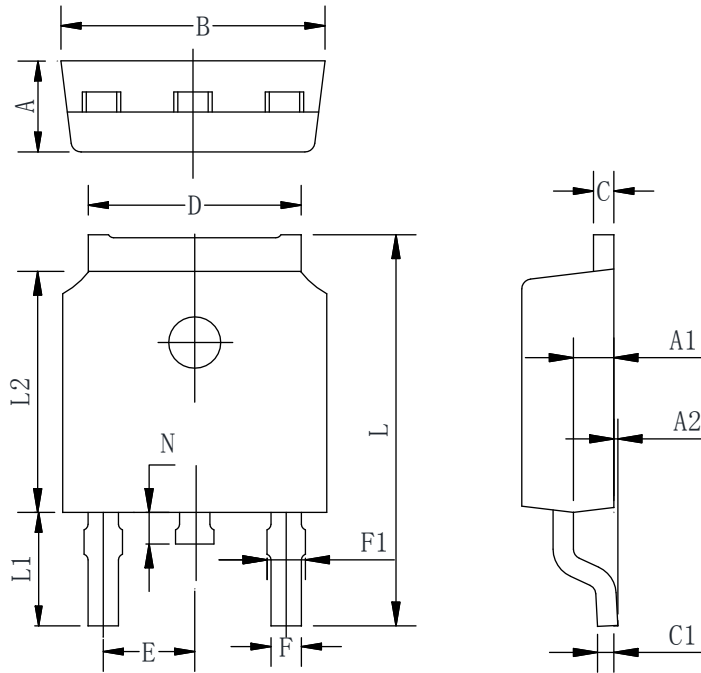


**T<sub>C</sub> - Case Temperature**



**Normalized Thermal Transient Impedance, Junction-to-Case**

**TO-252-2L PACKAGE OUTLINE**



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

Symbol	Min	Typ	Max
A	2.10	2.30	2.50
A1	0.88	1.01	1.16
A2	0.00	0.15	0.28
B	6.40	6.60	6.80
C	0.42	0.50	0.63
C1	0.42	0.50	0.63
D	5.08	5.32	5.65
E	2.286 TYP		
F	0.63	0.76	0.89
F1	0.64	0.86	1.08
L	9.30	9.90	10.80
L1	2.4	2.8	3.6
L2	5.90	6.10	6.55
N	0.57	0.80	1.05

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