

# 650V Super Junction Power MOSFET

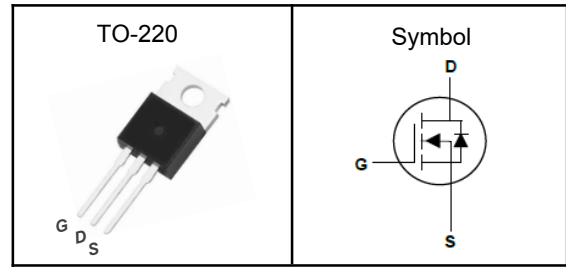
## Features

- Low drain-source on-resistance:  $R_{DS(ON)}=0.15\Omega(\text{typ})$
- Easy to control gate switching
- Enhancement mode:  $V_{th} = 2.5$  to  $4V$
- 100% avalanche tested
- RoHS compliant

## Applications

- Switch Mode Power Supply (SMPS)
- TV power & LED Lighting Power
- AC to DC Converters
- Telecom

## Pin Description



$V_{DSS}$	650	V
$R_{DS(ON)-Typ}$	150	m $\Omega$
$I_D$	21	A

## Absolute Maximum Ratings ( $T_J=25^\circ\text{C}$ , Unless Otherwise Noted)

Symbol	Parameter	N-Channel	Unit
$V_{DSS}$	Drain-Source Voltage	650	V
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$T_J$	Maximum Junction Temperature	-55 to 150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$E_{AS}$	Single Pulse Avalanche Energy <sup>③</sup>	500	mJ
$I_{DM}^{①}$	Pulse Drain Current Tested	52	A
$I_D$	Continuous Drain Current	$T_C=25^\circ\text{C}$	21 A
$P_D$	Maximum Power Dissipation	$T_C=25^\circ\text{C}$	150 W

## Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	62	$^\circ\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>①</sup>	0.83	$^\circ\text{C}/\text{W}$

Note ① : Max. current is limited by bonding wire.

Note ② : UIS tested and pulse width are limited by maximum junction temperature  $150^\circ\text{C}$ .

Note ③ : Surface Mounted on  $1\text{in}^2$  FR-4 board with 1oz.



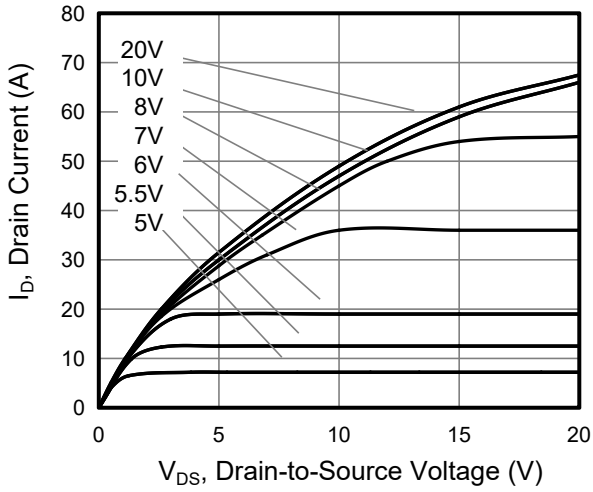
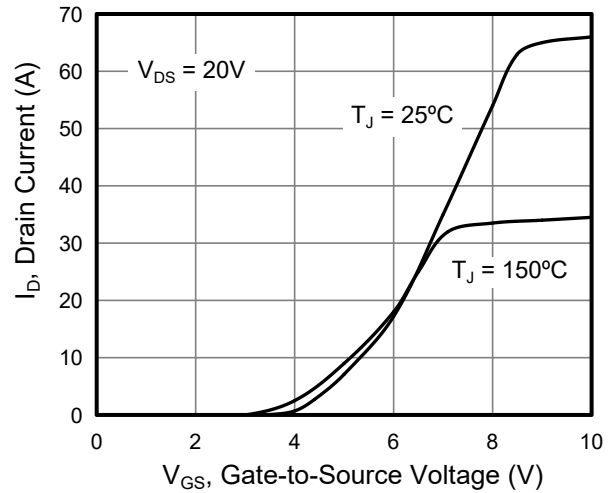
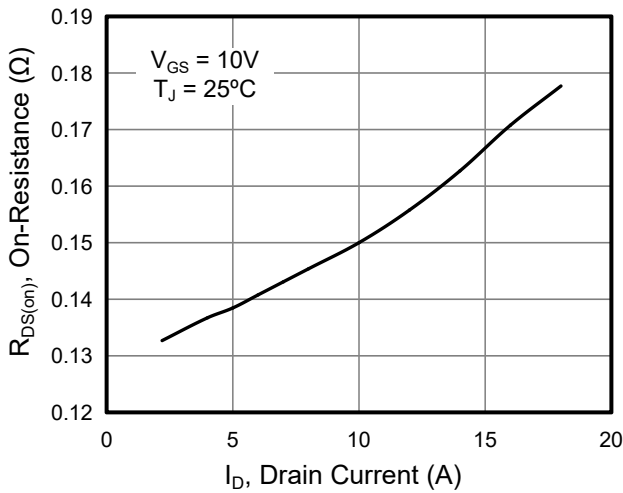
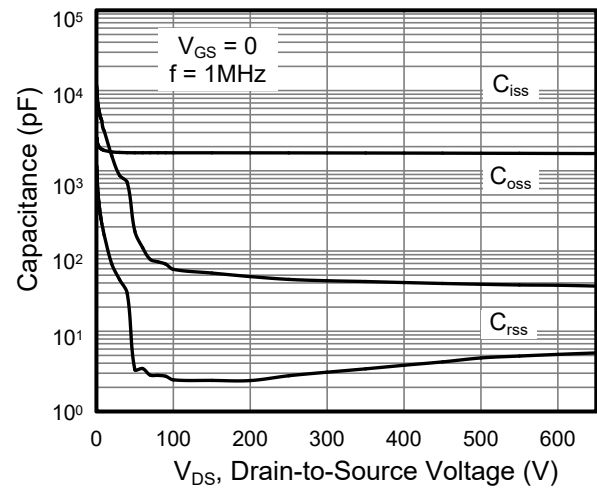
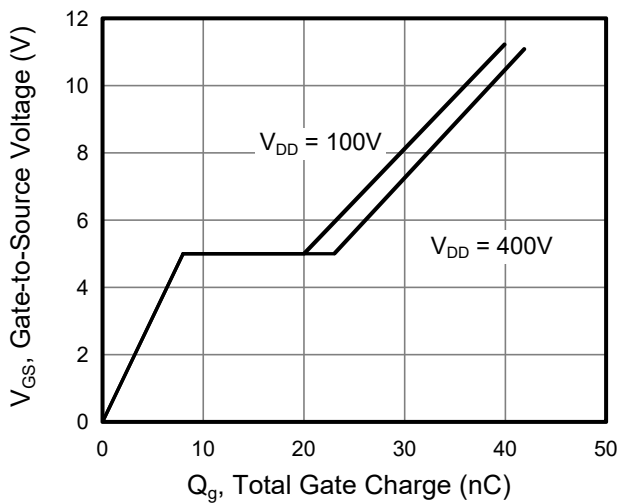
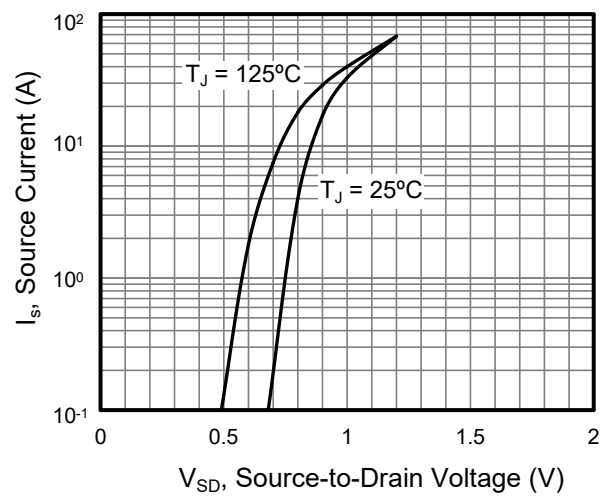
**650V Super Junction Power MOSFET**

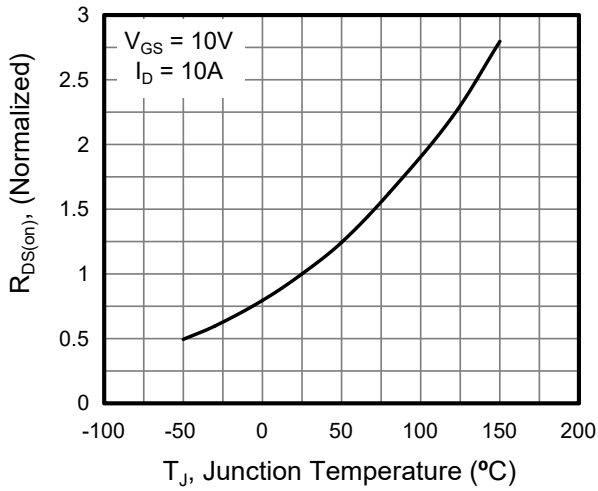
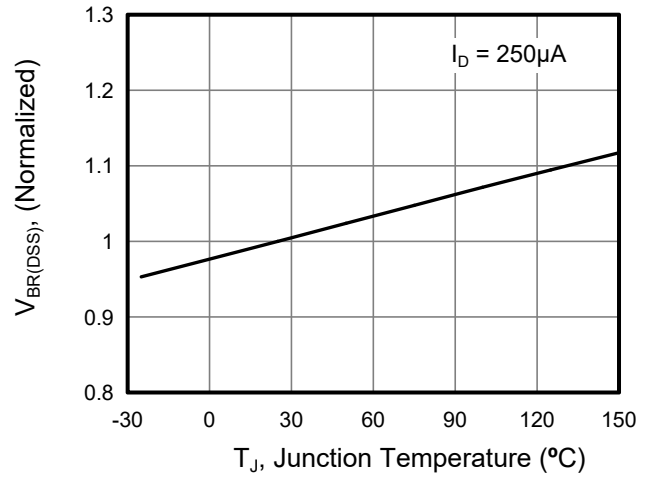
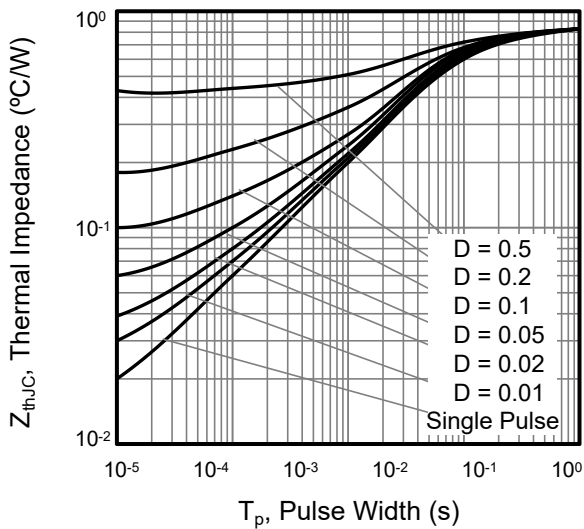
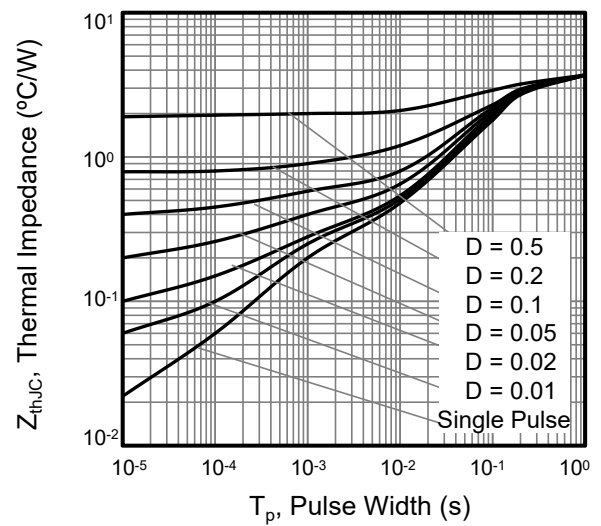
**Electrical Characteristics** (T<sub>J</sub>=25°C, Unless Otherwise Noted)

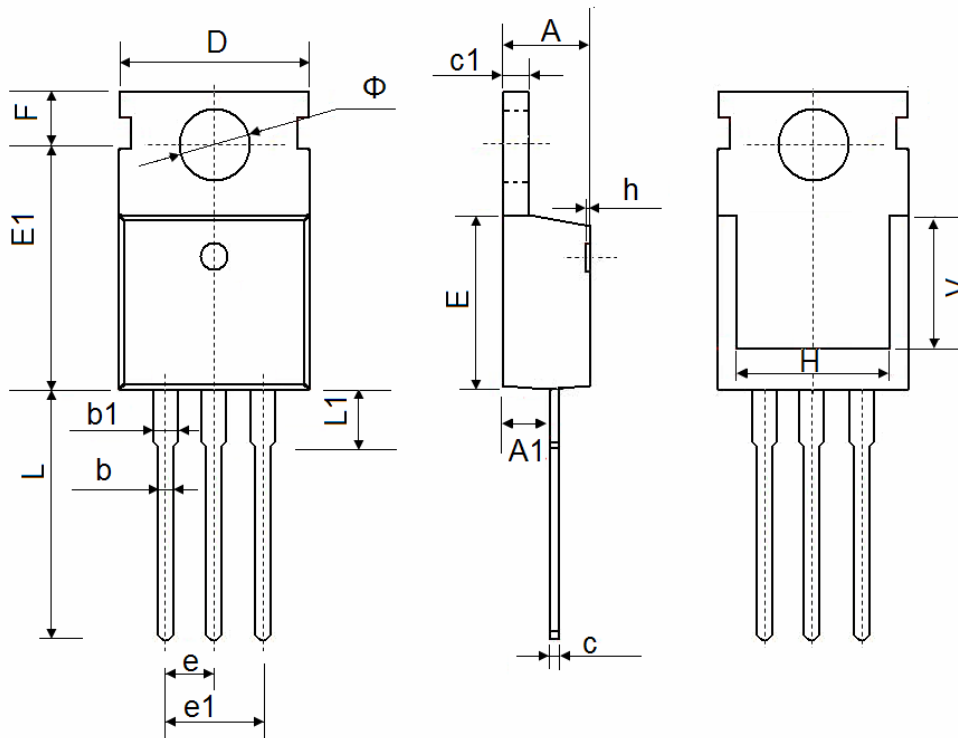
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Static Electrical Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	650	---	---	V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V	---	---	1	uA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA	2.5	---	4.0	V
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V	---	---	±100	nA
R <sub>DS(ON)</sub>	Drain-Source On-state Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =10A	---	150	190	mΩ
<b>Dynamic Characteristics</b> <sup>⑤</sup>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =100V, Freq.=1MHz	---	1524	---	pF
C <sub>oss</sub>	Output Capacitance		---	65	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	8	---	
T <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> =400V, V <sub>GS</sub> =10V, R <sub>G</sub> =25Ω, I <sub>D</sub> =20A	---	25	---	nS
T <sub>r</sub>	Turn-on Rise Time		---	59	---	
T <sub>d(off)</sub>	Turn-off Delay Time		---	121	---	
T <sub>f</sub>	Turn-off Fall Time		---	44	---	
R <sub>g</sub>	Gate Resistance	f = 1.0MHz, open drain	---	8	---	Ω
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =400V, V <sub>GS</sub> =10V, I <sub>D</sub> =20A	---	40.5	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	8	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	15	---	
<b>Source-Drain Characteristics</b> (T <sub>J</sub> =25°C)						
V <sub>SD</sub> <sup>④</sup>	Diode Forward Voltage	I <sub>S</sub> =20A, V <sub>GS</sub> =0V	---	0.9	1.2	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>R</sub> =400V, I <sub>F</sub> =20 A, di/dt=100A/μs, T <sub>J</sub> =25°C	---	453	---	nS
Q <sub>rr</sub>	Reverse Recovery Charge		---	5.1	---	nC

Note ④ : Pulse test (pulse width≤300us, duty cycle≤2%).

Note ⑤ : Guaranteed by design, not subject to production testing.

**650V Super Junction Power MOSFET**
**Typical Characteristics**

**Figure 1. Output Characteristics**

**Figure 2. Transfer Characteristics**

**Figure 3. On-Resistance vs. Drain Current**

**Figure 4. Capacitance**

**Figure 5. Gate Charge**

**Figure 6. Body Diode Forward Voltage**

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**Figure 7. On-Resistance vs. Junction Temperature**

**Figure 8. Breakdown voltage vs. Junction Temperature**

**Figure 9. Transient Thermal Impedance TO-220/TO-263**

**Figure 10. Transient Thermal Impedance TO-220F**

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**TO-220 Package Outline Data**


Symbol	Dimensions In Millimeters	
	Min.	Max.
A	4.350	4.650
A1	2.250	2.550
b	0.710	0.910
b1	1.170	1.400
c	0.330	0.650
c1	1.200	1.400
D	9.910	10.250
E	8.9500	9.750
E1	12.650	12.950
e	2.540 TYP.	
e1	4.980	5.180
F	2.650	2.950
H	7.900	8.100
h	0.000	0.300
L	12.700	13.500
L1	2.850	3.250
V	7.500 REF.	
Φ	3.400	3.800