

# 650V Super Junction Power MOSFET

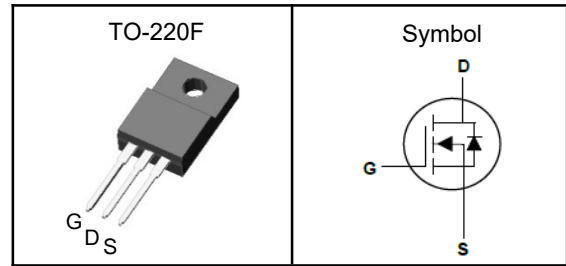
## Features

- Low drain-source on-resistance:  $R_{DS(ON)}=0.52\Omega(\text{typ})$
- Easy to control gate switching
- Enhancement mode:  $V_{th} = 2.5$  to  $4.5V$
- 100% avalanche tested
- RoHS compliant

## Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- Charger, Lighting

## Pin Description



$V_{DSS}$	650	V
$R_{DS(ON)-Typ}$	520	m $\Omega$
$I_D$	8	A

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

Symbol	Parameter	Rating	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>	156	mJ
$I_{DM}^{①}$	Pulse Drain Current Tested	24	A
$I_D$	Continuous Drain Current	$T_c=25^\circ\text{C}$ 8	A
$P_D$	Maximum Power Dissipation	$T_c=25^\circ\text{C}$ 24	W

## Thermal Characteristics

Symbol	Parameter	Rating	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	62.5	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	5.2	$^\circ\text{C/W}$

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

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

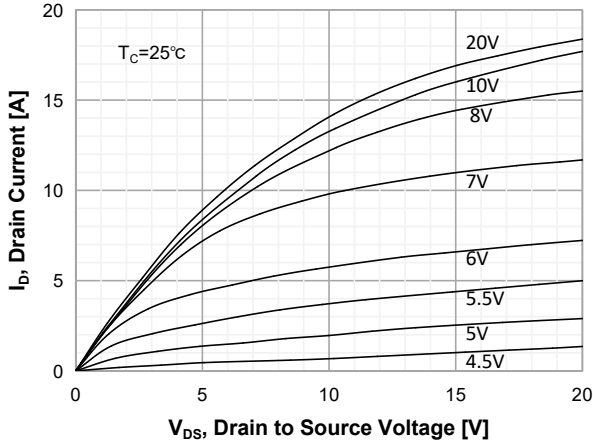
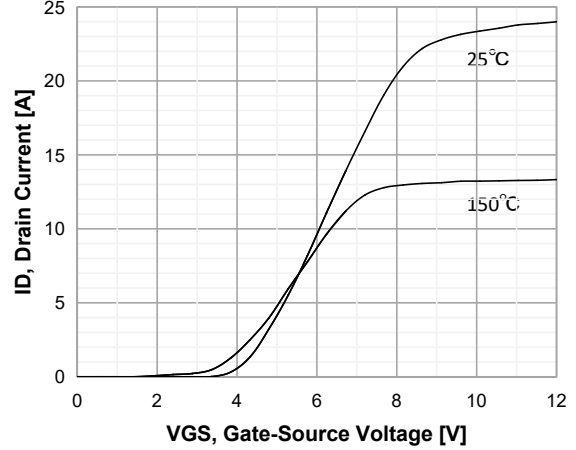
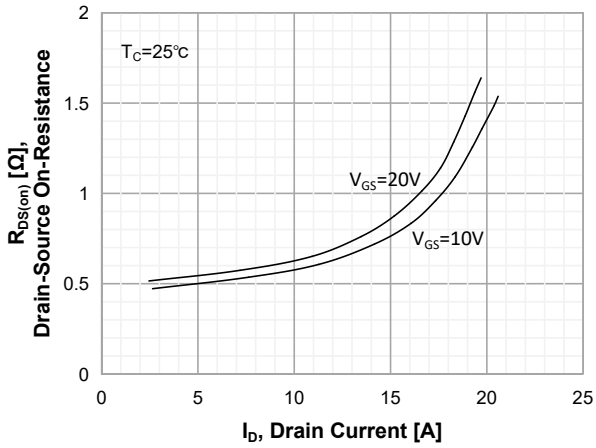
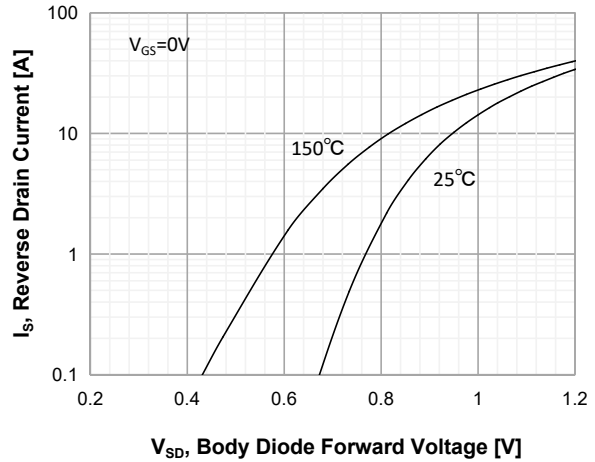
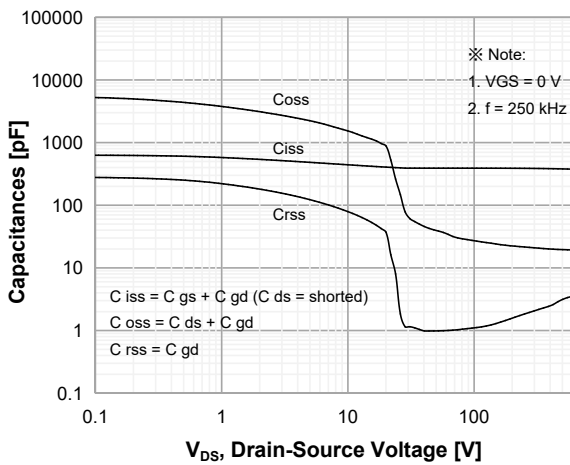
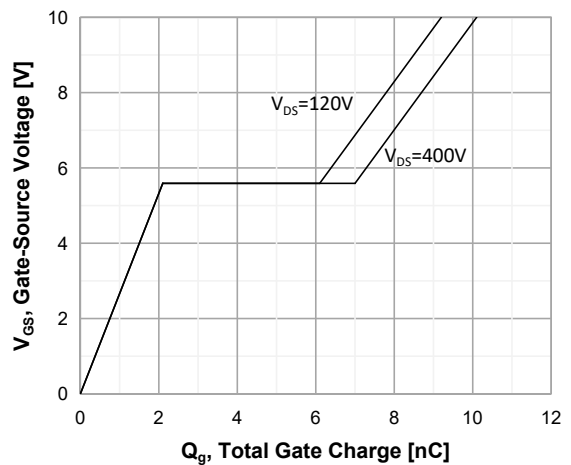
Note ③ : Surface Mounted on  $1\text{in}^2$  FR-4 board with 1oz.

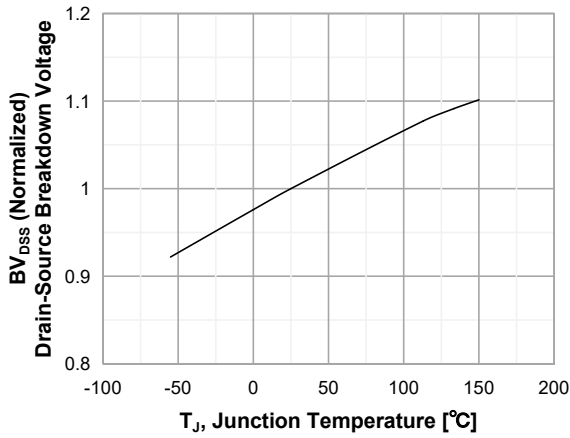
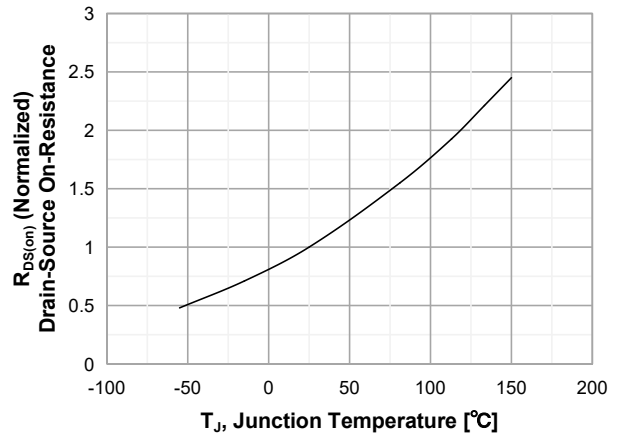
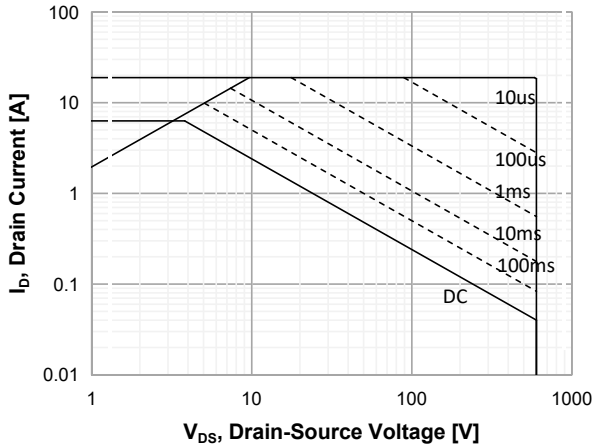
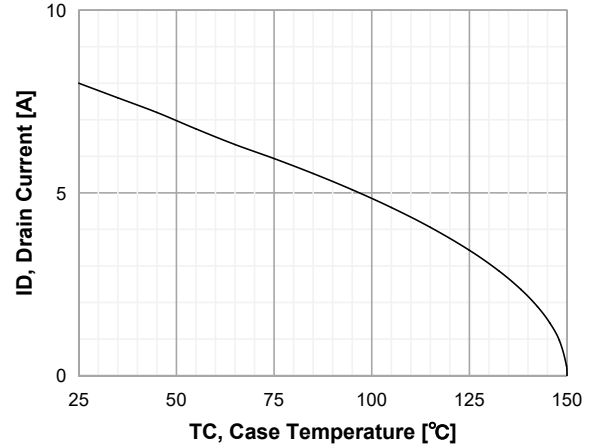
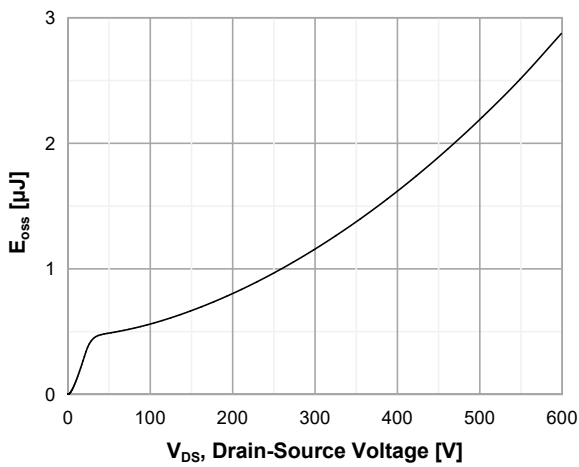
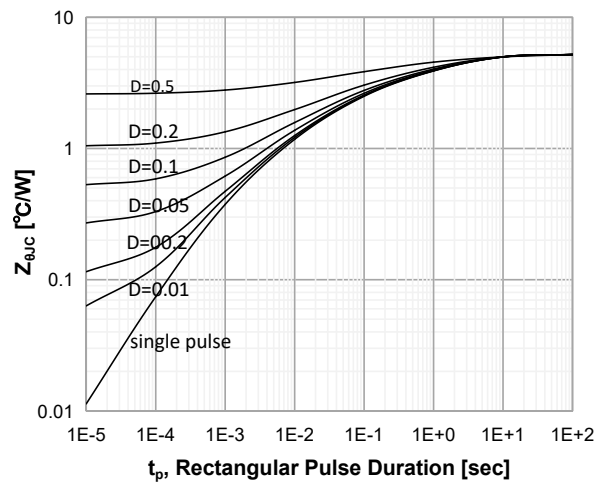
**650V Super Junction Power MOSFET****Electrical Characteristics** ( $T_J=25^\circ\text{C}$ , Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Static Electrical Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	650	---	---	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=650V, V_{GS}=0V$	---	---	1	$\mu A$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5	---	4.5	V
$I_{GSS}$	Gate Leakage Current	$V_{GS}=\pm 30V, V_{DS}=0V$	---	---	$\pm 100$	nA
$R_{DS(ON)}$	Drain-Source On-state Resistance	$V_{GS}=10V, I_D=2.5A$	---	520	600	m $\Omega$
<b>Dynamic Characteristics</b> <sup>⑤</sup>						
$C_{iss}$	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=400V,$ Freq.=1MHz	---	390	---	pF
$C_{oss}$	Output Capacitance		---	15.2	---	
$C_{rss}$	Reverse Transfer Capacitance		---	4.43	---	
$T_{d(on)}$	Turn-on Delay Time	$V_{DS}=400V,$ $R_G=10\Omega, I_D=2.5A$	---	7	---	nS
$T_r$	Turn-on Rise Time		---	8	---	
$T_{d(off)}$	Turn-off Delay Time		---	27	---	
$T_f$	Turn-off Fall Time		---	14	---	
$Q_g$	Total Gate Charge	$V_{DD}=400V, V_{GS}=10V,$ $I_D=2.5A$	---	10.5	---	nC
$Q_{gs}$	Gate-Source Charge		---	2.4	---	
$Q_{gd}$	Gate-Drain Charge		---	5.1	---	
<b>Source-Drain Characteristics</b> ( $T_J=25^\circ\text{C}$ )						
$V_{SD}$	Diode Forward Voltage <sub>z</sub>	$V_{GS}=0V,$ $I_S=2.5A, T_J=25^\circ\text{C}$	---	---	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_S=2.5A,$ $di/dt=100A/\mu s, T_J=25^\circ\text{C}$	---	172	---	nS
$Q_{rr}$	Reverse Recovery Charge		---	1.2	---	$\mu C$

Note ④ : Pulse test (pulse width $\leq 300\mu s$ , duty cycle $\leq 2\%$ ).

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

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

**Figure 1. On-Region Characteristics**

**Figure 2. Transfer Characteristics**

**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**

**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**

**Figure 5. Capacitance Characteristics**

**Figure 6. Gate Charge Characteristics**

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**Figure 7. Breakdown Voltage Variation vs Temperature**

**Figure 8. On-Resistance Variation vs Temperature**

**Figure 9. Maximum Safe Operating Area**

**Figure 10. Maximum Drain Current vs. Case Temperature**

**Figure 11.  $E_{oss}$  vs. Drain to Source Voltage**

**Figure 12. Transient Thermal Response Curve**

**650V Super Junction Power MOSFET**
**TO-220F Package Outline Data**
