

### Features

- Low drain-source on-resistance:  $R_{DS(ON)}=0.33\Omega$  (typ)
- Very Low FOM ( $R_{DS(on)} \times Q_g$ )
- Extremely low switching loss
- Excellent stability and uniformity
- 100% avalanche tested

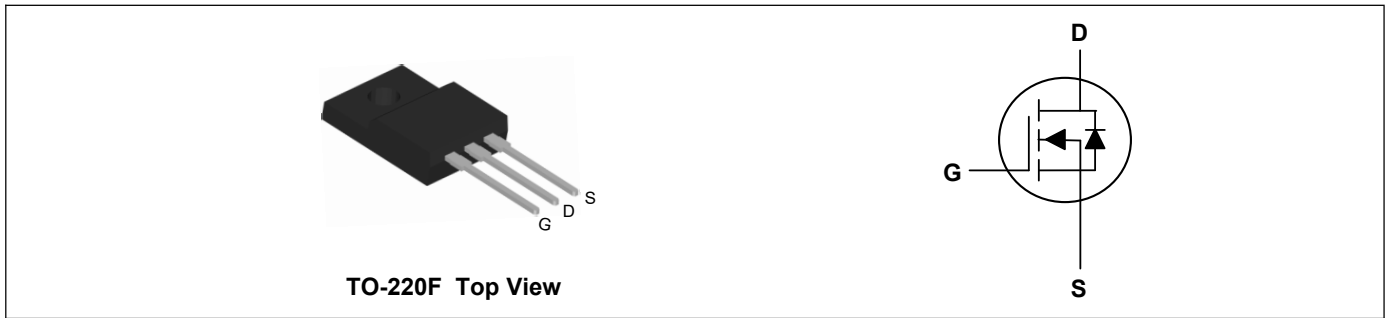
### Key Performance Parameters



Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(ON),max}$	380	m $\Omega$
$I_D$	13	A
$Q_{g,typ}$	22.6	nC
$I_{DM}$	29	A

### Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- TV power & LED Lighting Power



### Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ , unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	650	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current <sup>1</sup>	$I_D @ T_C=25^\circ\text{C}$	13	A
Continuous Drain Current <sup>1</sup>	$I_D @ T_C=100^\circ\text{C}$	6.6	A
Pulsed Drain Current <sup>2</sup>	$I_{DM}$	29	A
Single Pulse Avalanche Energy <sup>4</sup>	EAS	140	mJ
Avalanche Current	$I_{AS}$	1.8	A
MOSFET dv/dt ruggedness, $V_{DS} = 0 \dots 520\text{V}$	dv/dt	50	V/ns
Reverse diode dv/dt <sup>3</sup> $V_{DS}=0 \dots 520\text{V}, I_{DS} \leq I_D$		15	
Total Power Dissipation ( $T_C=25^\circ\text{C}$ )	$P_D$	30	W
Storage Temperature Range	$T_{STG}$	-55 to 150	$^\circ\text{C}$
Operating Junction Temperature Range	$T_J$	-55 to 150	$^\circ\text{C}$

### Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance Junction-Ambient (Max)	$R_{\theta JA}$	62.5	$^\circ\text{C/W}$
Thermal Resistance Junction-Case (Max)	$R_{\theta JC}$	4.1	$^\circ\text{C/W}$

**Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=1mA$	650	---	---	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=3.4A$	---	330	380	m $\Omega$
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=370\mu A$	2.0	---	4.0	V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=650V, V_{GS}=0V,$	---	---	1	$\mu A$
		$V_{DS}=650V, V_{GS}=0V, T_C=150^\circ\text{C}$	---	---	100	$\mu A$
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 1$	$\mu A$
Total Gate Charge	$Q_g$	$V_{DD}=520V, V_{GS}=10V, I_D=4.8A$	---	23	---	nC
Gate-Source Charge	$Q_{gs}$		---	4.6	---	
Gate-Drain Charge	$Q_{gd}$		---	6.4	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD}=325V, R_G=25\Omega, I_D=4.8A$	---	30	---	ns
Rise Time	$T_r$		---	23	---	
Turn-Off Delay Time	$T_{d(off)}$		---	190	---	
Fall Time	$T_f$		---	20	---	
Input Capacitance	$C_{iss}$	$V_{DS}=100V, V_{GS}=0V, f=1MHz$	---	1001	---	pF
Output Capacitance	$C_{oss}$		---	40	---	
Reverse Transfer Capacitance	$C_{rss}$		---	2.3	---	

**Drain-Source Diode Characteristics**

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Continuous Source Current	$I_S$	$T_C=25^\circ\text{C}$	---	---	13	A
Pulsed Source Current	$I_{SM}$		---	---	29	A
Diode Forward Voltage	$V_{SD}$	$V_G=0V, I_S=4.8A, T_J=25^\circ\text{C}$	---	---	1.3	V
Reverse Recovery Time	$t_{rr}$	$V_G=0V, I_S=4.8A, di_f/dt=100A/\mu s$	---	240	---	ns
Reverse Recovery Charge	$Q_{rr}$		---	2.1	---	$\mu C$

**Note:**

- Limited by  $T_{J,max}$ . Maximum Duty Cycle  $D = 0.50$
- Pulse width  $t_p$  limited by  $T_{J,max}$
- Identical low side and high side switch with identical  $R_G$
- $V_{DD}=50V, R_G=25\Omega, I_{AS}=1.8A, \text{Starting } T_J=25^\circ\text{C}$

Handwritten text: Hnd]WU 7\ UFUWYf]gh]Vg

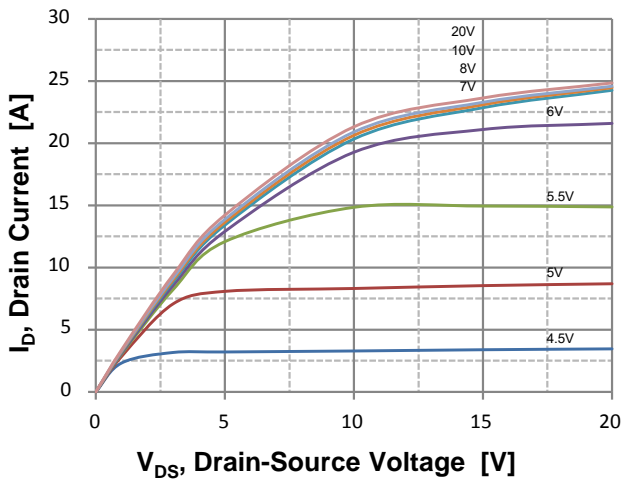


Figure 1. On Region Characteristics

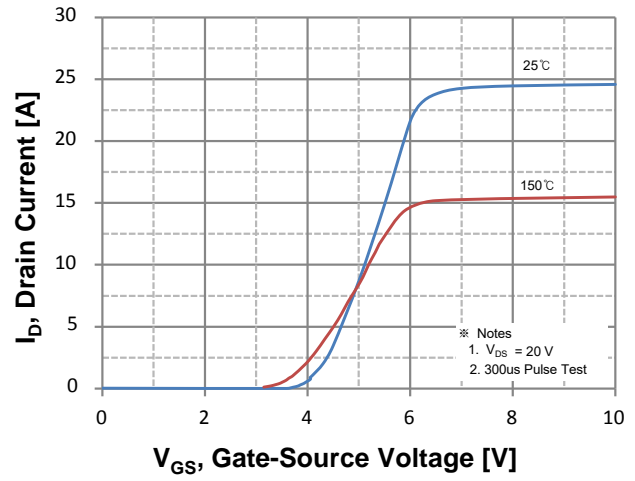


Figure 2. Transfer Characteristics

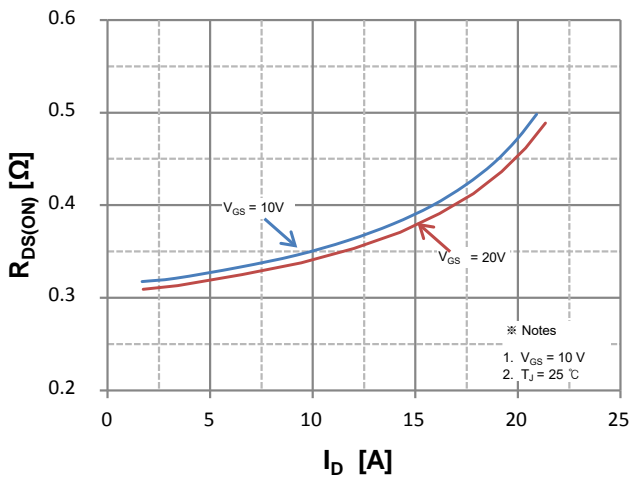


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

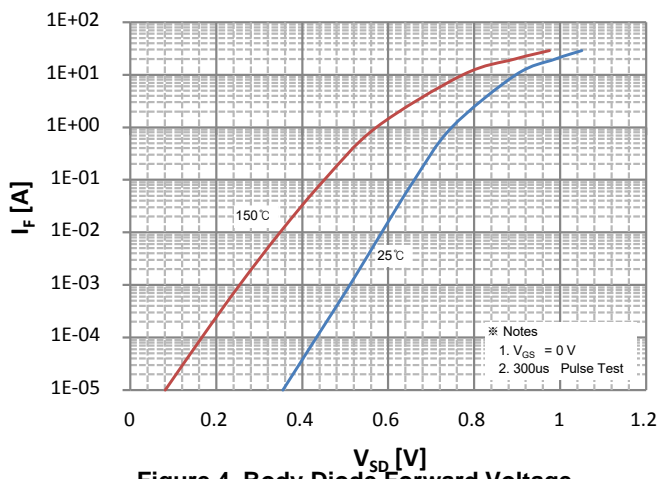


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

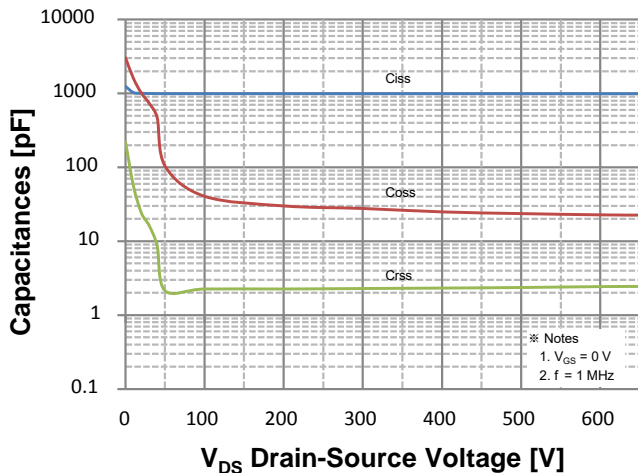


Figure 5. Capacitance Characteristics

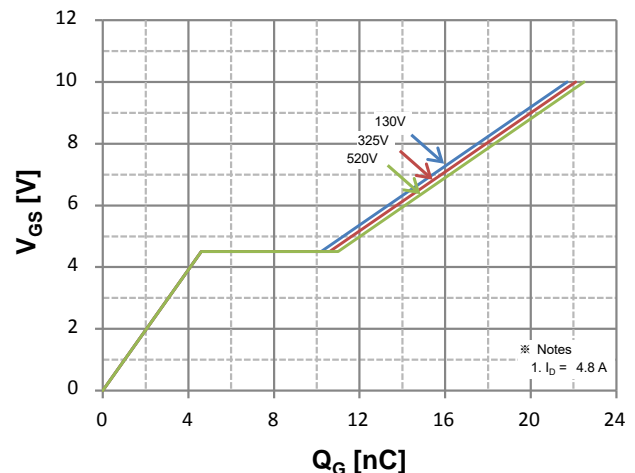
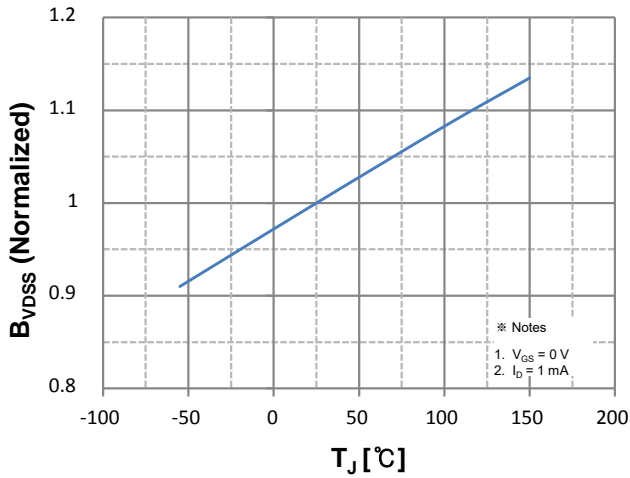
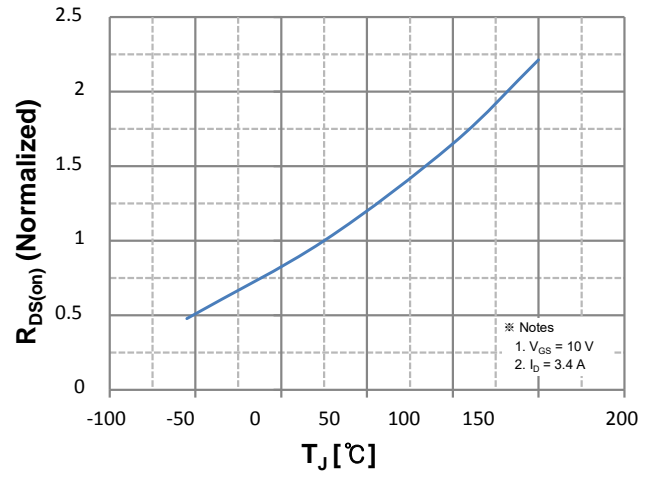


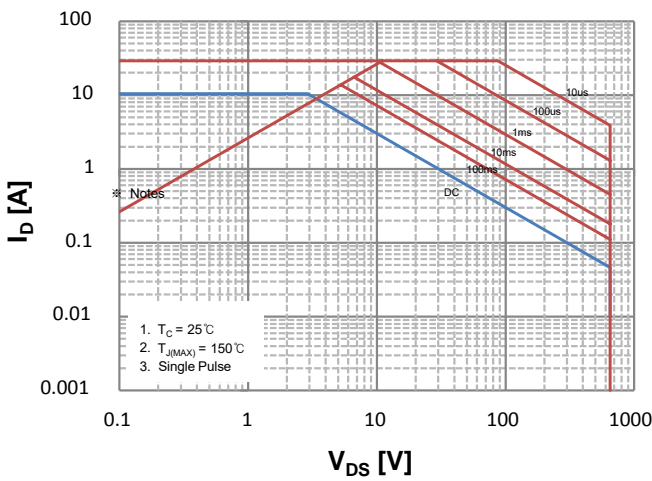
Figure 6. Gate Charge Characteristics



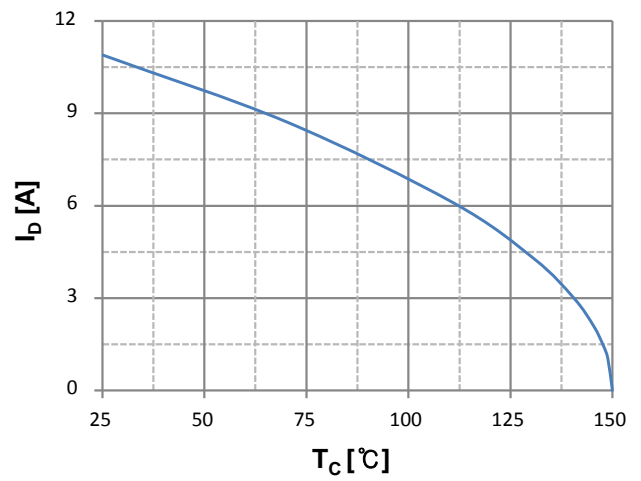
**Figure 7. Breakdown Voltage Variation vs. Temperature**



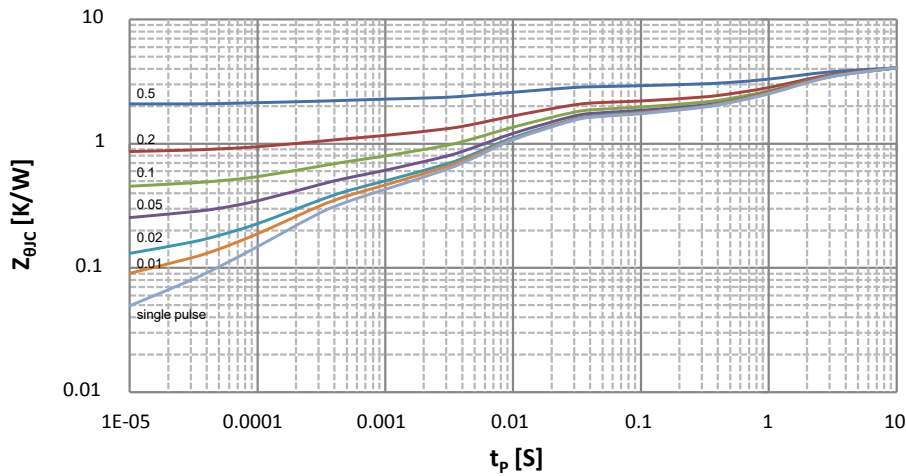
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

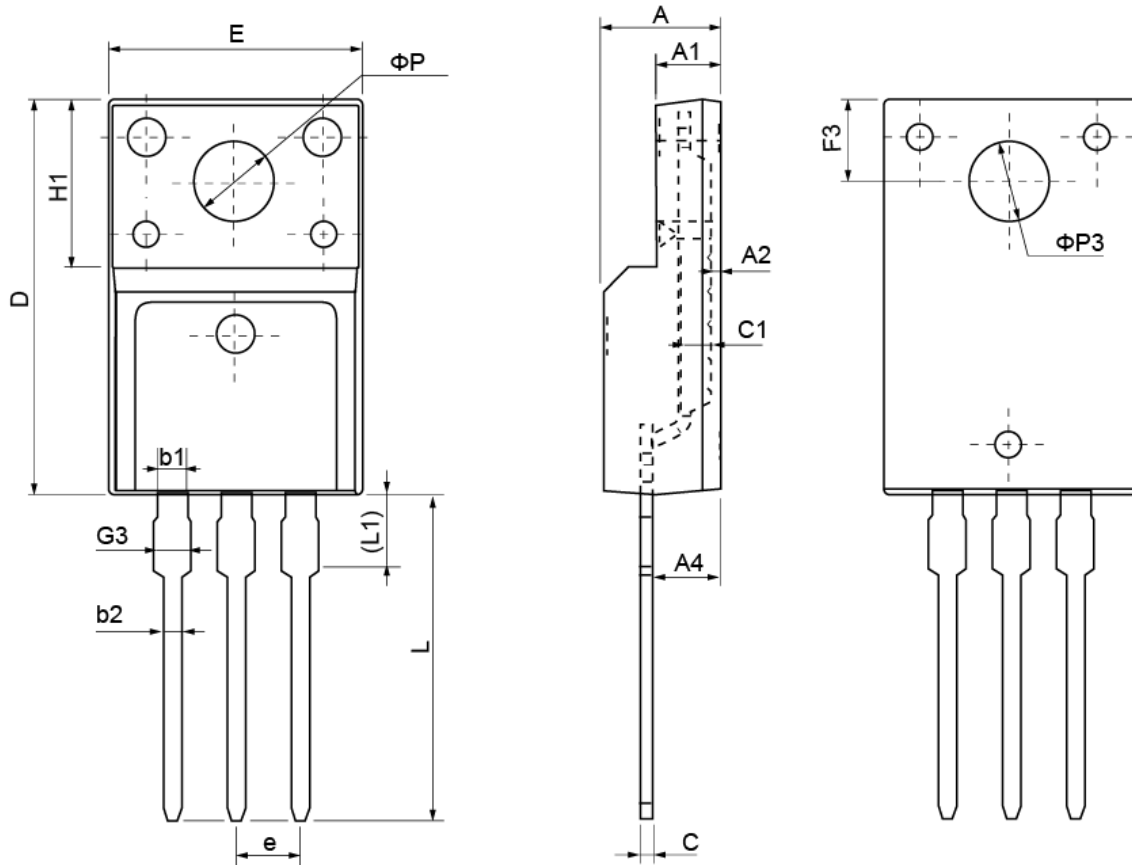


**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Transient Thermal Response Curve**

**TO-220F Package Outline Dimensions**



Symbol	Dimensions (unit:mm)			Symbol	Dimensions (unit:mm)		
	Min	Typ	Max		Min	Typ	Max
<b>A</b>	4.40	4.70	5.00	<b>H1</b>	6.70 REF		
<b>A1</b>	2.30	2.55	2.80	<b>L</b>	12.30	12.98	13.30
<b>A2</b>	0.30	0.50	0.70	<b>L1</b>	2.95	3.10	3.50
<b>A4</b>	2.45	2.80	3.05	<b>φ P</b>	3.03	3.20	3.50
<b>c</b>	0.30	0.50	0.70	<b>φ P3</b>	3.15	3.45	3.65
<b>c1</b>	1.20	1.30	1.40	<b>b1</b>	1.10	1.30	1.45
<b>D</b>	15.40	15.90	16.40	<b>b2</b>	0.60	0.80	1.00
<b>E</b>	9.86	10.16	10.46	<b>F3</b>	3.05	3.30	3.55
<b>e</b>	2.54 BSC			<b>G3</b>	1.15	1.35	1.55