

**650V SuperJunction Power MOSFET****Features**

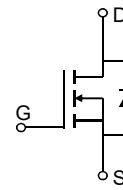
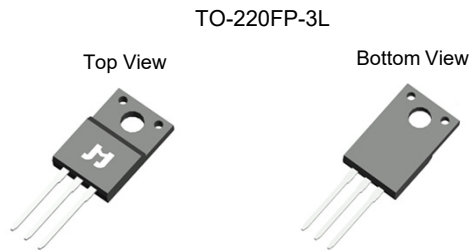
- Extremely Low Gate Charge
- Excellent Output Capacitance ( $C_{oss}$ ) Profile
- Fast Switching Capability
- 100% UIS Tested, 100% Rg Tested
- Pb-free Lead Plating
- Halogen-free and RoHS-compliant

**Product Summary**

Parameter	Value	Unit
$V_{DS}$	650	V
$V_{GS(th\_Typ)}$	3.3	V
$I_D$ (@ $V_{GS} = 10V$ ) <sup>(1)</sup>	11.0	A
$R_{DS(ON\_Typ)}$ (@ $V_{GS} = 10V$ )	320	m $\Omega$
$E_{oss@400V}$	2.5	$\mu J$

**Applications**

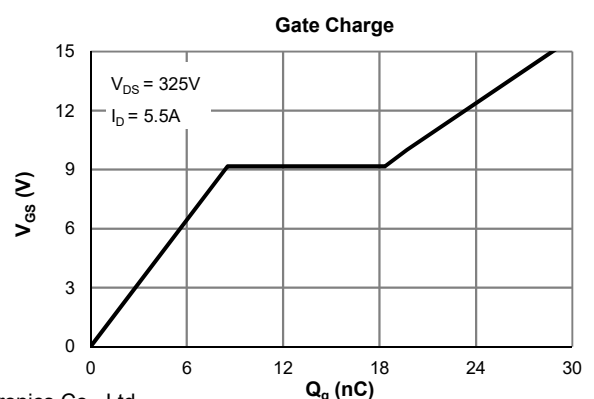
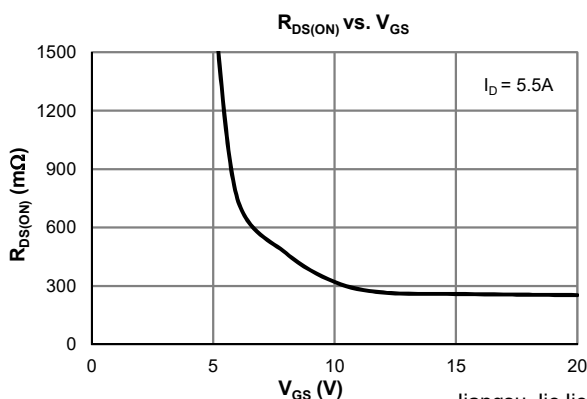
- Telecom / Server Power Supplies
- Industrial Power Supplies
- UPS / Solar
- Lighting / Charger / Adapter

**Ordering Information**

Device	Package	# of Pins	Marking	MSL	$T_J$ (°C)	Media	Quantity (pcs)
JMH65R360AF-U	TO-220FP-3L	3	H65R360A	1	-55 to 150	Tube	50

**Absolute Maximum Ratings** (@  $T_A = 25^\circ C$  unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DS}$	650	V
Gate-to-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current <sup>(1)</sup>	$I_D$	$T_C = 25^\circ C$	11.0
		$T_C = 100^\circ C$	6.5
Pulsed Drain Current <sup>(2)</sup>	$I_{DM}$	54	A
Avalanche Current <sup>(3)</sup>	$I_{AS}$	6.3	A
Avalanche Energy <sup>(3)</sup>	$E_{AS}$	198	mJ
Power Dissipation <sup>(4)</sup>	$P_D$	$T_C = 25^\circ C$	104
		$T_C = 100^\circ C$	42
Junction & Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ C$





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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
<b>STATIC PARAMETERS</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	650			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650\text{V}, V_{GS} = 0\text{V}$			1.0	$\mu\text{A}$
Gate-Body Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{V}, V_{GS} = \pm 30\text{V}$			$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	2.5	3.3	4.5	V
Static Drain-Source ON-Resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{V}, I_D = 5.5\text{A}$		320	360	$\text{m}\Omega$
Diode Forward Voltage	$V_{SD}$	$I_S = 1\text{A}, V_{GS} = 0\text{V}$		0.75	1.0	V
Diode Continuous Current	$I_S$	$T_C = 25^\circ\text{C}$			104	A

**DYNAMIC PARAMETERS** <sup>(5)</sup>

Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{V}, V_{DS} = 100\text{V}, f = 1\text{MHz}$		821		pF
Output Capacitance	$C_{oss}$			31		pF
Reverse Transfer Capacitance	$C_{rss}$			2.2		pF
Effective output capacitance, energy related	$C_{o(er)}$	$V_{GS} = 0\text{V}, V_{DS} = 0 \text{ to } 400\text{V}$		32		pF
Effective output capacitance, time related	$C_{o(tr)}$			134		pF
Gate Resistance	$R_g$	$V_{GS} = 0\text{V}, V_{DS} = 0\text{V}, f = 1\text{MHz}$		8.6		$\Omega$

**SWITCHING PARAMETERS** <sup>(5)</sup>

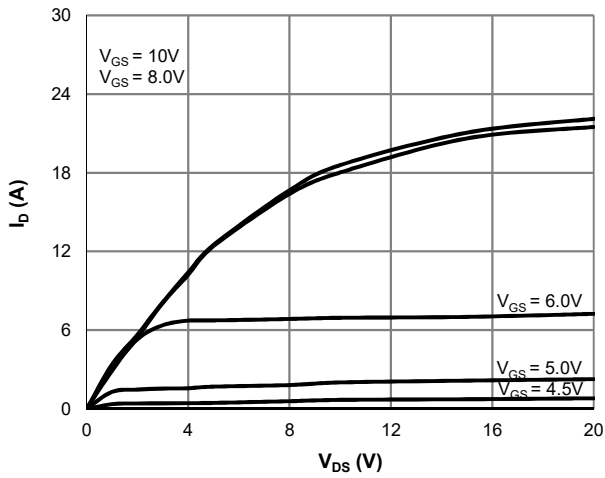
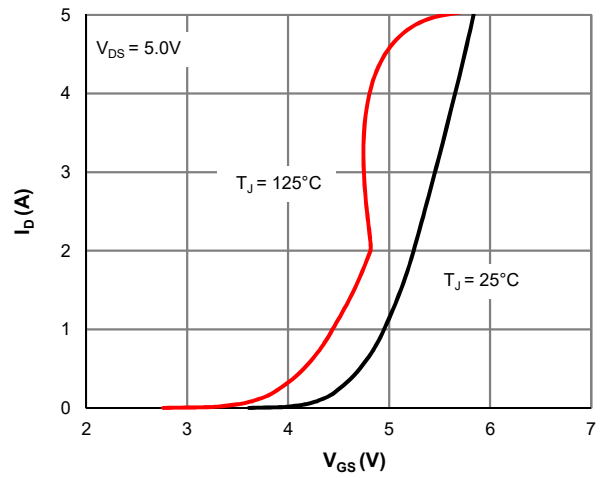
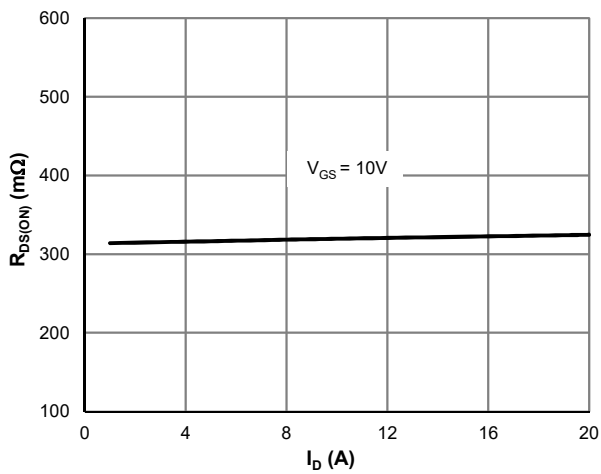
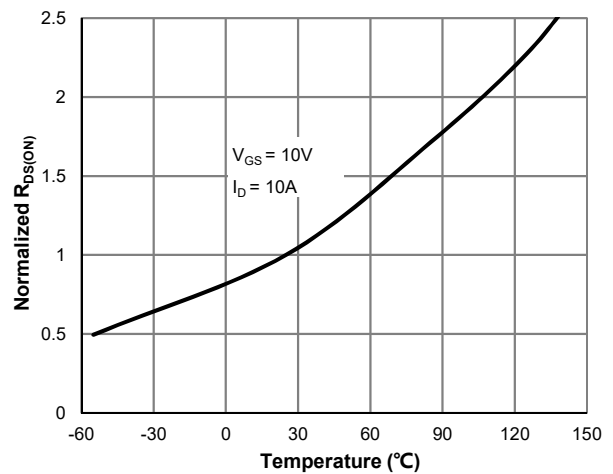
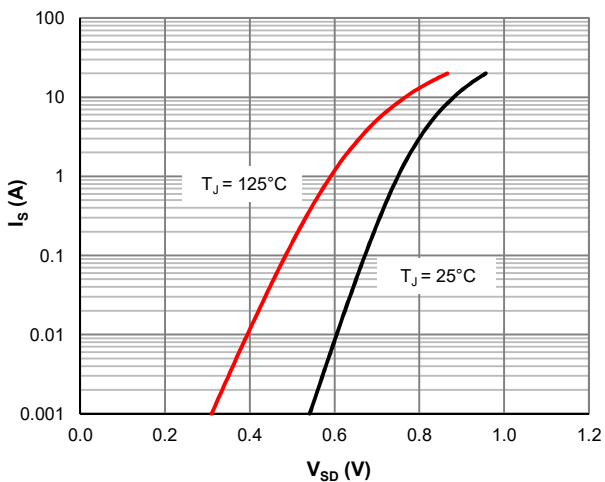
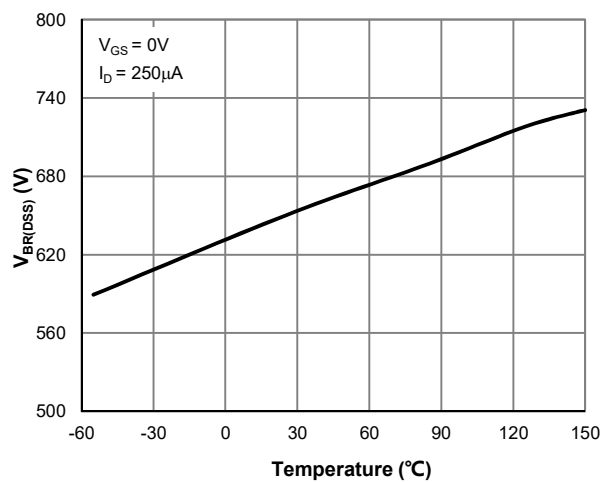
Total Gate Charge (@ $V_{GS} = 10\text{V}$ )	$Q_g$	$V_{GS} = 0 \text{ to } 10\text{V}$ $V_{DS} = 325\text{V}, I_D = 5\text{A}$		19.7		nC
Total Gate Charge (@ $V_{GS} = 6.0\text{V}$ )	$Q_g$			5.2		nC
Gate Source Charge	$Q_{gs}$			8.5		nC
Gate Drain Charge	$Q_{gd}$			9.8		nC
Turn-On DelayTime	$t_{D(on)}$	$V_{GS} = 10\text{V}, V_{DS} = 325\text{V}$ $R_L = 65\Omega, R_{GEN} = 6\Omega$		14.0		ns
Turn-On Rise Time	$t_r$			73		ns
Turn-Off DelayTime	$t_{D(off)}$			27		ns
Turn-Off Fall Time	$t_f$			33		ns
Body Diode Reverse Recovery Time	$t_{rr}$		$I_F = 5\text{A}, di/dt = 100\text{A}/\mu\text{s}$		460	
Body Diode Reverse Recovery Charge	$Q_{rr}$	$I_F = 5\text{A}, di/dt = 100\text{A}/\mu\text{s}$		6851		nC
Peak Diode Recovery Voltage Slope	$dv/dt$	$I_F \leq 10\text{A}, di/dt = 200\text{A}/\mu\text{s}, V_{DS} = 400\text{V}$		50		V/ns
MOSFET $dv/dt$ Ruggedness	$dv/dt$	$V_{DS} = 0 \dots 400\text{V}$		50		V/ns

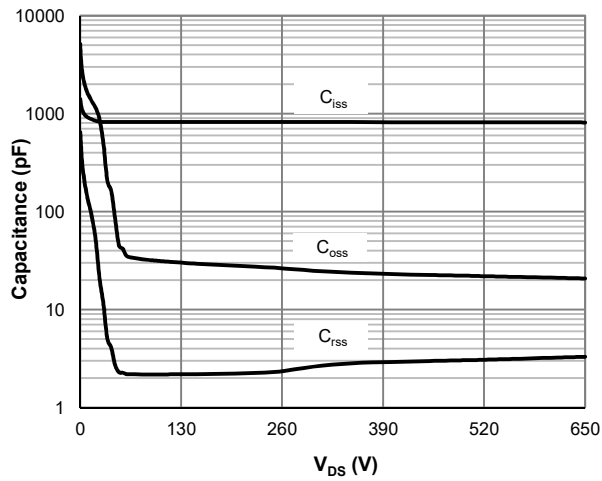
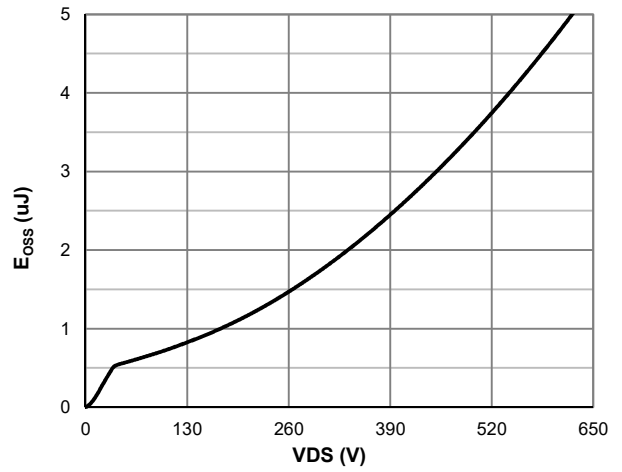
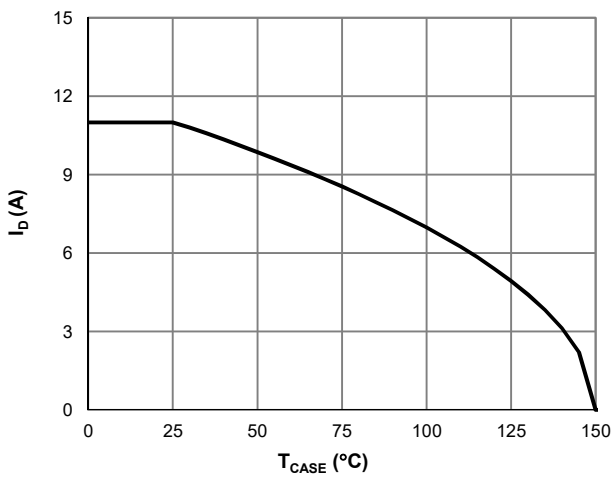
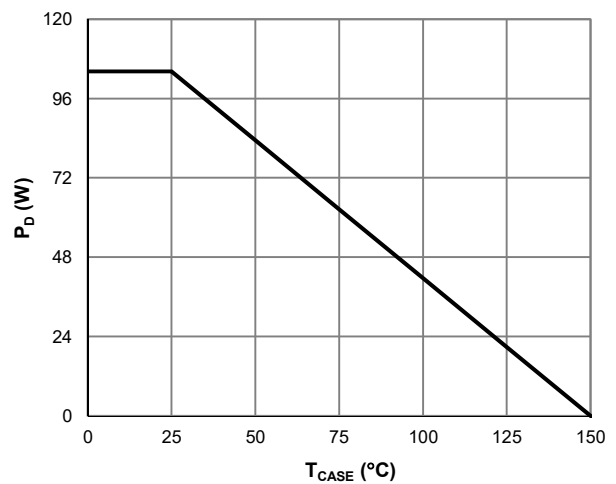
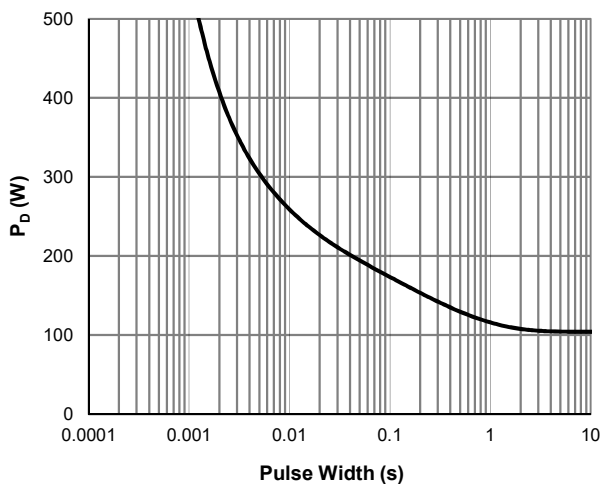
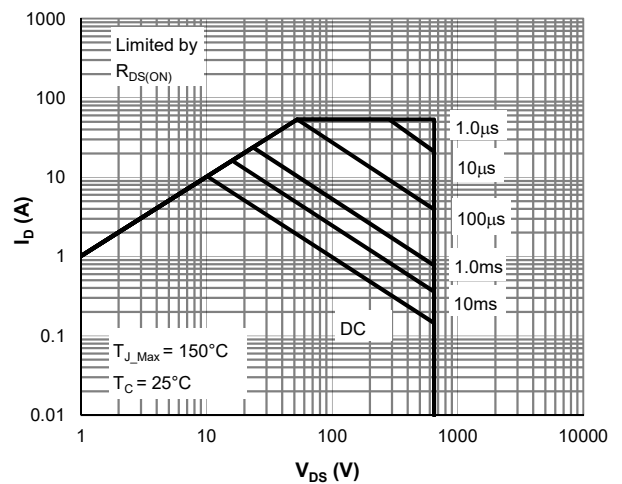
**Thermal Performance**

Parameter	Symbol	Typ.	Max.	Unit
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	50	60	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.2	1.5	$^\circ\text{C}/\text{W}$

**Notes:**

1. Computed continuous current assumes the condition of  $T_{J\_Max}$  while the actual continuous current depends on the thermal & electro-mechanical application board design.
2. This single-pulse measurement was taken under  $T_{J\_Max} = 150^\circ\text{C}$ .
3. This single-pulse measurement was taken under the following condition [ $L = 10\text{mH}, V_{GS} = 10\text{V}, V_{DS} = 50\text{V}$ ] while its value is limited by  $T_{J\_Max} = 150^\circ\text{C}$ .
4. The power dissipation  $P_D$  is based on  $T_{J\_Max} = 150^\circ\text{C}$ .
5. This value is guaranteed by design hence it is not included in the production test.

**Typical Electrical & Thermal Characteristics**

**Figure 1: Saturation Characteristics**

**Figure 2: Transfer Characteristics**

**Figure 3:  $R_{DS(ON)}$  vs. Drain Current**

**Figure 4:  $R_{DS(ON)}$  vs. Junction Temperature**

**Figure 7: Body-Diode Characteristics**

**Figure 6:  $V_{BR(DSS)}$  vs. Junction Temperature**

**Typical Electrical & Thermal Characteristics**

**Figure 8: Capacitance Characteristics**

**Figure 8: Coss Stoted Energy**

**Figure 9: Current De-rating**

**Figure 10: Power De-rating**

**Figure 11: Single Pulse Power Rating, Junction-to-Case**

**Figure 12: Maximum Safe Operating Area**



### Typical Electrical & Thermal Characteristics

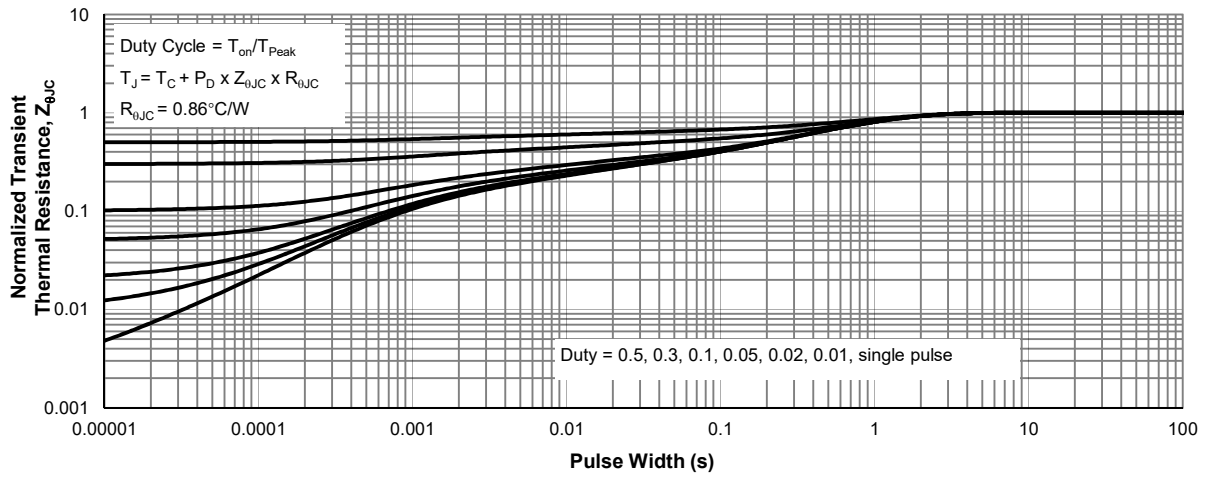
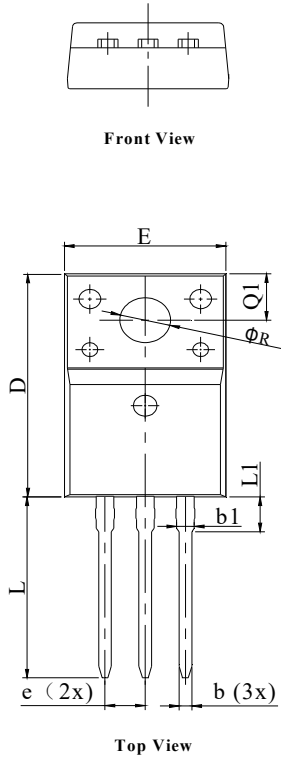


Figure 13: Normalized Maximum Transient Thermal Impedance

**TO-220FP-3L Package Information**
**Package Outline**


DIM.	MILLIMETER		
	MIN.	NOM.	MAX.
A	4.50	4.70	4.90
D	15.20	15.87	16.10
D1	8.80	--	9.50
E	9.70	10.10	10.40
F	2.44	--	2.75
b	0.70	0.80	0.91
b1	1.10	1.35	1.55
c	0.45	0.50	0.65
e	2.54 BSC		
G	6.40	6.70	6.90
L	12.00	13.10	14.50
L1	3.13	--	3.57
Q	2.60	2.75	2.85
Q1	3.20	3.30	3.40
R	3.05	--	3.28