

N-Channel Super Junction Power MOSFET III

General Description

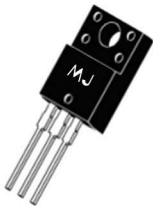
The series of devices use advanced super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

Features

- ◆ New technology for high voltage device
- ◆ Low on-resistance and low conduction losses
- ◆ Small package
- ◆ Ultra Low Gate Charge cause lower driving requirements
- ◆ 100% Avalanche Tested
- ◆ ROHS compliant



Schematic diagram



TO-220F

Application

- ◆ Power factor correction (PFC)
- ◆ Switched mode power supplies(SMPS)
- ◆ Uninterruptible Power Supply (UPS)

V_{DS}	650	V
$R_{DS(ON)TYP}$	950	mΩ
I_D	4	A

Package Marking And Ordering Information

Device	Device Package	Marking
MJ65T1K2F	TO-220F	MJ65T1K2F

Table 1. Absolute Maximum Ratings ($T_c=25^{\circ}C$)

Parameter	Symbol	MJ65T1K2F	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	650	V
Gate-Source Voltage ($V_{DS}=0V$) ,AC ($f>1\text{ Hz}$)	V_{GS}	± 30	V
Continuous Drain Current at $T_c=25^{\circ}C$	I_D (DC)	4*	A
Continuous Drain Current at $T_c=100^{\circ}C$	I_D (DC)	2.5*	A
Pulsed drain current ^(Note 1)	I_{DM} (pluse)	16*	A
Maximum Power Dissipation ($T_c=25^{\circ}C$)	P_D	28.4	W
Derate above $25^{\circ}C$	P_D	0.227	W/ $^{\circ}C$
Single pulse avalanche energy ^(Note 2)	E_{AS}	27	mJ
Avalanche current ^(Note 1)	I_{AR}	0.7	A
Repetitive Avalanche energy, t_{AR} limited by T_{jmax} ^(Note 1)	E_{AR}	0.1	mJ

Parameter	Symbol	MJ65T1K2F	Unit
Drain Source voltage slope, $V_{DS} \leq 480\text{ V}$	dv/dt	50	V/ns
Reverse diode dv/dt , $V_{DS} \leq 480\text{ V}$, $I_{SD} < I_D$	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+150	$^{\circ}C$

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	MJ65T1K2F	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R _{thJC}	4.4	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	R _{thJA}	80	°C/W

Table 3. Electrical Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250μA	650	-	-	V
Zero Gate Voltage Drain Current (Tc=25°C)	I _{DSS}	V _{DS} =650V,V _{GS} =0V	-	-	1	μA
Zero Gate Voltage Drain Current (Tc=125°C)	I _{DSS}	V _{DS} =650V,V _{GS} =0V	-	-	50	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V,V _{DS} =0V	-	-	±100	nA
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} ,I _D =250μA	3	-	4	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V,I _D =2A	-	950	1100	mΩ
Dynamic Characteristics						
Input Capacitance	C _{ies}	V _{DS} =50V,V _{GS} =0V F=1.0MHz	-	304	-	PF
Output Capacitance	C _{OSS}		-	18	-	PF
Reverse Transfer Capacitance	C _{rss}		-	0.6	-	PF
Total Gate Charge	Q _g	V _{DS} =480V,I _D =4A V _{GS} =10V	-	8.8	12	nC
Gate-Source Charge	Q _{gs}		-	2.3	-	nC
Gate-Drain Charge	Q _{gd}		-	4	-	nC
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V,I _D =2.5A R _G =5Ω,V _{GS} =10V	-	8	-	nS
Turn-on Rise Time	t _r		-	4	-	nS
Turn-Off Delay Time	t _{d(off)}		-	52	70	nS
Turn-Off Fall Time	t _f		-	9	18	nS
Source- Drain Diode Characteristics						
Source-drain current (Body Diode)	I _{SD}	T _C =25°C	-	-	4	A
Pulsed Source-drain current (Body Diode)	I _{SDM}		-	-	16	A
Forward On Voltage	V _{SD}	T _J =25°C,I _{SD} =4A,V _{GS} =0V	-	0.9	1.2	V
Reverse Recovery Time	t _{rr}	T _J =25°C,I _F =2A di/dt=100A/μs	-	200	-	nS
Reverse Recovery Charge	Q _{rr}		-	0.6	-	uC
Peak reverse recovery current	I _{rrm}		-	6	-	A

Notes

- 1.Repetitive Rating: Pulse width limited by maximum junction temperature
2. $T_J=25^{\circ}\text{C}$, $V_{DD}=50\text{V}$, $V_G=10\text{V}$, $R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

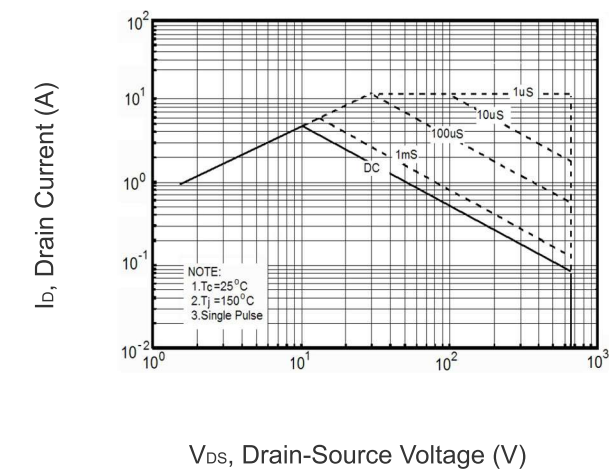


Figure 1 Safe operating area

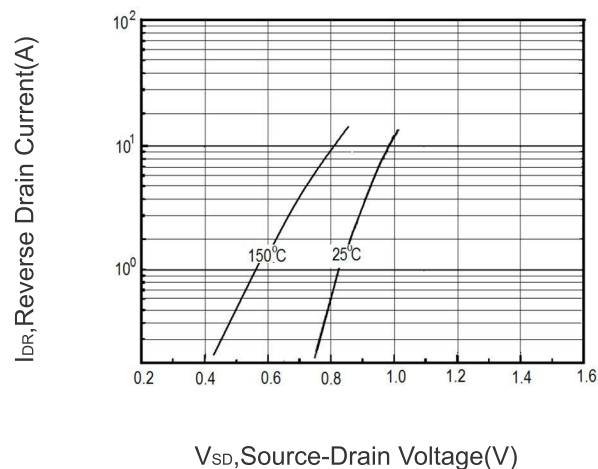


Figure 2 Source-Drain Diode Forward Voltage

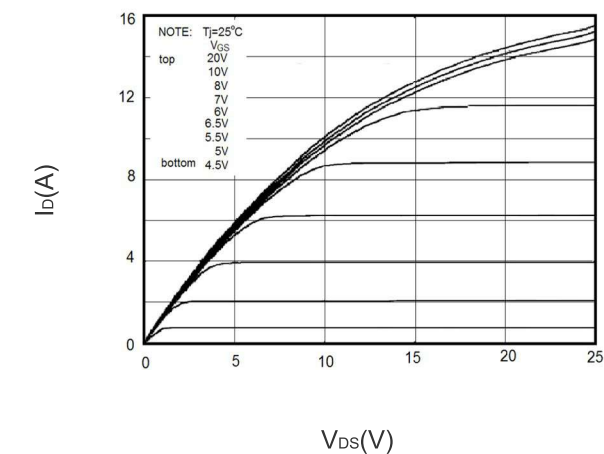


Figure 3 Output characteristics

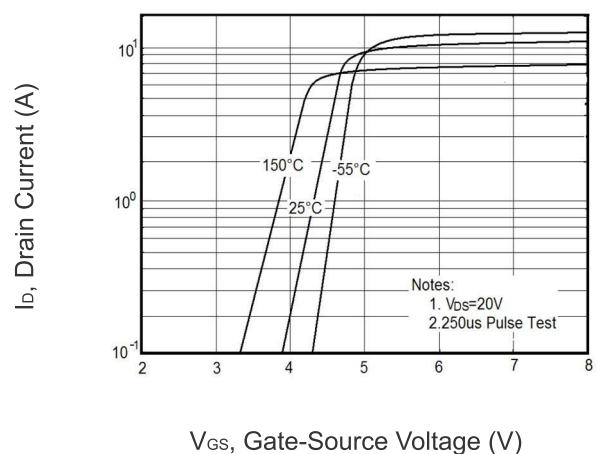


Figure 4 Transfer characteristics

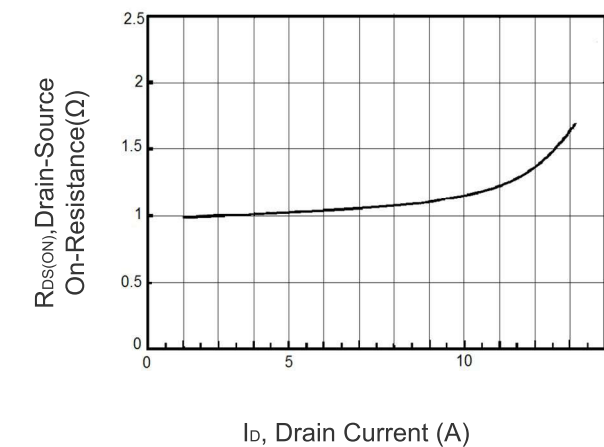


Figure 5 Static drain-source on resistance

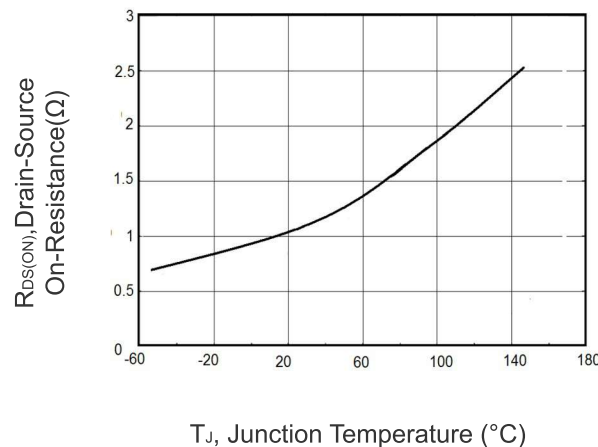


Figure 6 $R_{DS(ON)}$ vs Junction Temperature

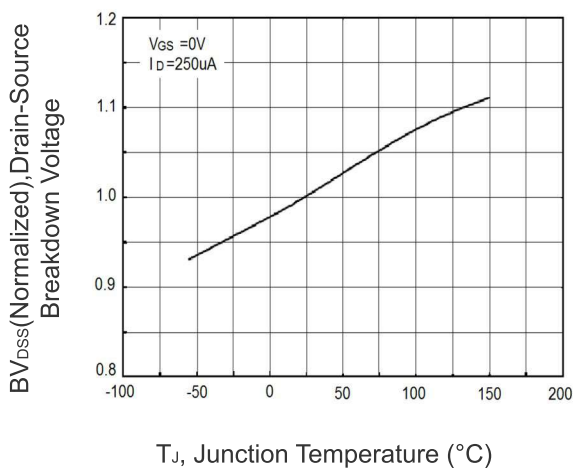


Figure 7 BV_{DSS} vs Junction Temperature

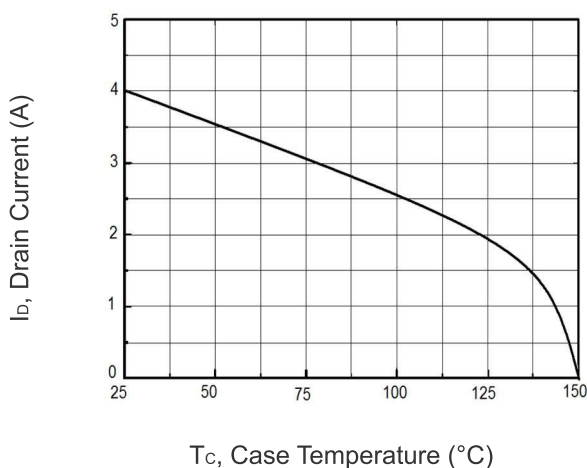


Figure 8 Maximum I_D vs Junction Temperature

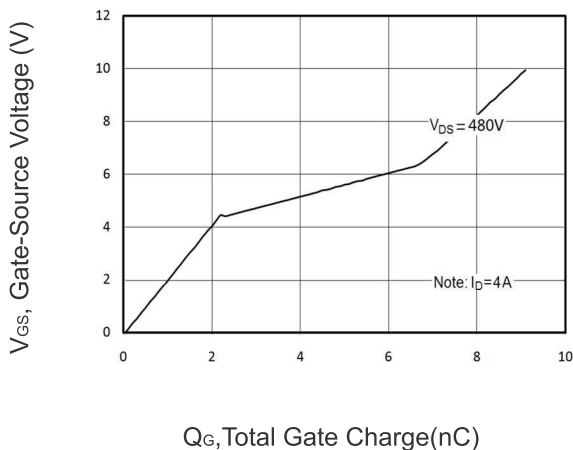


Figure 9 Gate charge waveforms

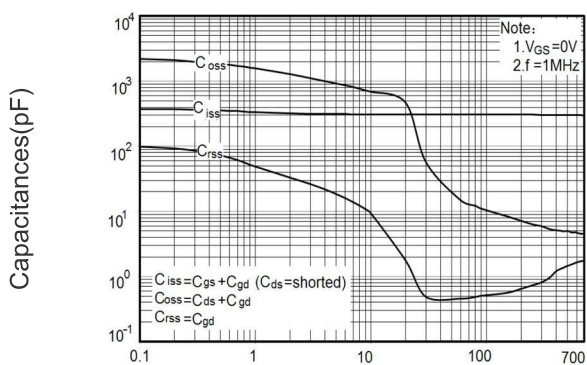


Figure 10 Capacitance

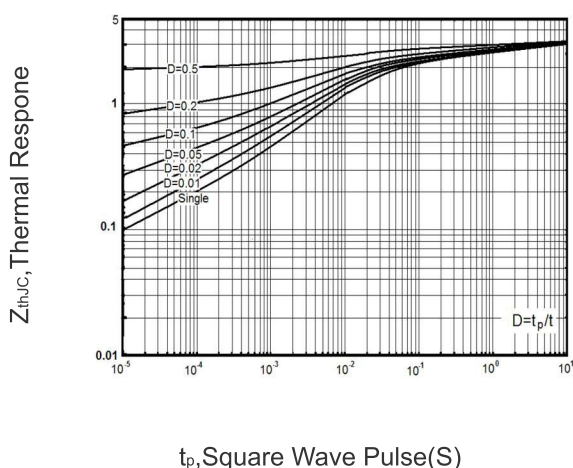
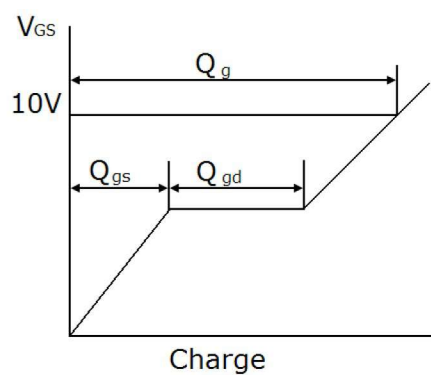
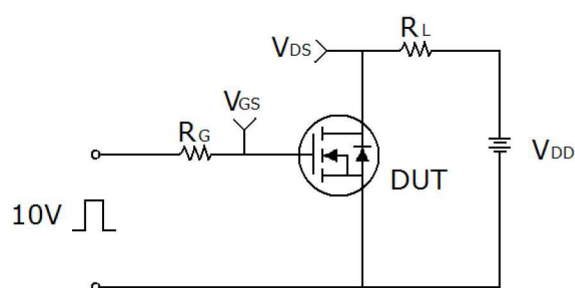


Figure 11 Transient Thermal Impedance

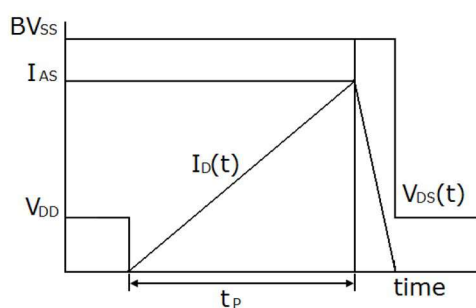
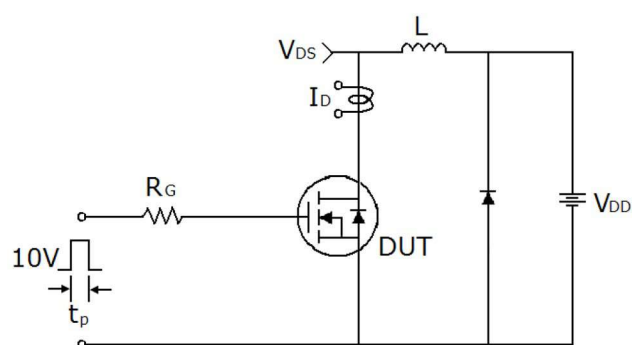
Test circuit



Gate charge test circuit & Waveform

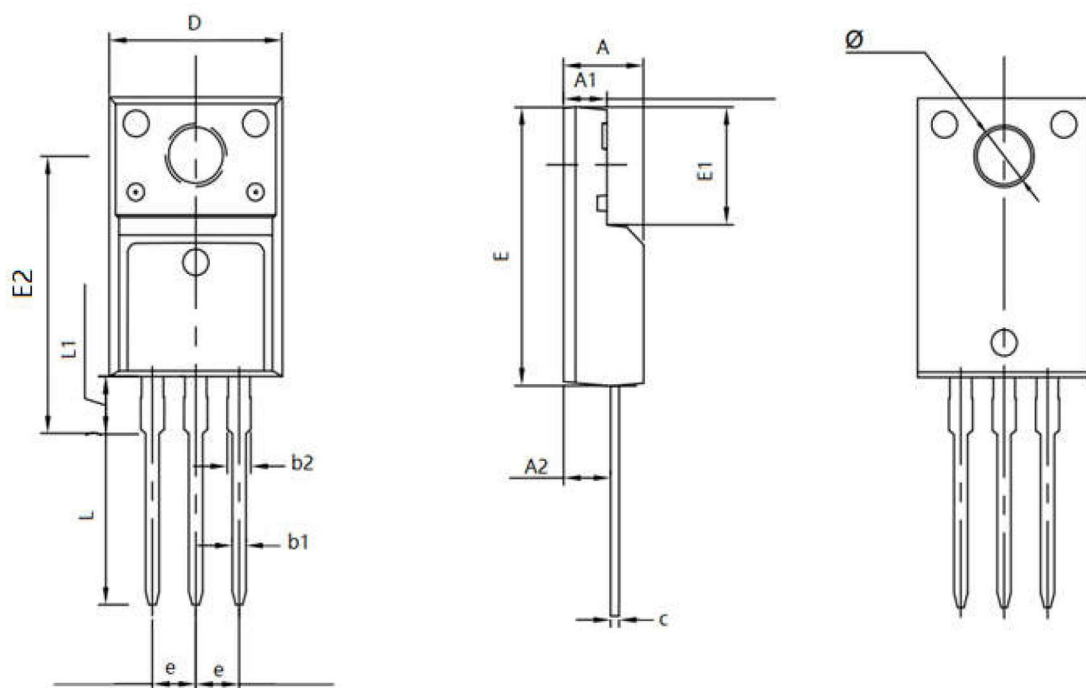


Switch Time Test Circuit



Unclamped Inductive Switching Test Circuit & Waveforms

TO-220F Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.500	4.900	0.177	0.193
A1	2.340	2.740	0.092	0.108
A2	2.560	2.960	0.101	0.117
b1	0.700	0.900	0.028	0.035
b2	1.180	1.580	0.046	0.062
c	0.400	0.600	0.016	0.024
D	9.960	10.360	0.392	0.408
E	15.670	15.970	0.617	0.629
E1	6.500	6.900	0.256	0.272
E2	15.500	16.100	0.610	0.634
e	2.540 TYP		0.100 TYP	
Φ	3.080	3.280	0.121	0.129
L	12.640	13.240	0.498	0.521
L1	3.030	3.430	0.119	0.135

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