

N-Channel Super Junction Power MOSFET III

General Description

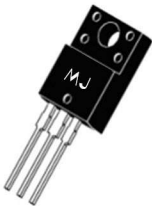
The series of devices use advanced super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

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
$R_{DS(ON)TYP}$	680	m Ω
I_D	7	A

Package Marking And Ordering Information

Device	Device Package	Marking
MJ65T680F	TO-220F	MJ65T680F

Table 1. Absolute Maximum Ratings (Tc=25℃)

Parameter	Symbol	MJ65T680F	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	650	V
Gate-Source Voltage ($V_{DS}=0V$) AC ($f>1$ Hz)	V_{GS}	± 30	V
Continuous Drain Current at Tc=25℃	I_D (DC)	7*	A
Continuous Drain Current at Tc=100℃	I_D (DC)	4.5*	A
Pulsed drain current ^(Note 1)	I_{DM} (pluse)	28*	A
Maximum Power Dissipation (Tc=25℃)	P_D	31.4	W
Derate above 25℃	P_D	0.25	W/℃
Single pulse avalanche energy ^(Note 2)	E_{AS}	101	mJ
Avalanche current ^(Note 1)	I_{AR}	1.5	A
Repetitive Avalanche energy, t_{AR} limited by T_{jmax} ^(Note 1)	E_{AR}	0.28	mJ

Parameter	Symbol	MJ65T680F	Unit
Drain Source voltage slope, $V_{DS} \leq 480$ V	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS} \leq 480$ V, $I_{SD} < I_D$	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55...+150	℃

* limited by maximum junction temperature

Table 2. Thermal Characteristic

Parameter	Symbol	MJ65T680F	Unit
Thermal Resistance, Junction-to-Case (Maximum)	R _{thJC}	3.98	°C/W
Thermal Resistance, Junction-to-Ambient (Maximum)	R _{thJA}	80	°C/W

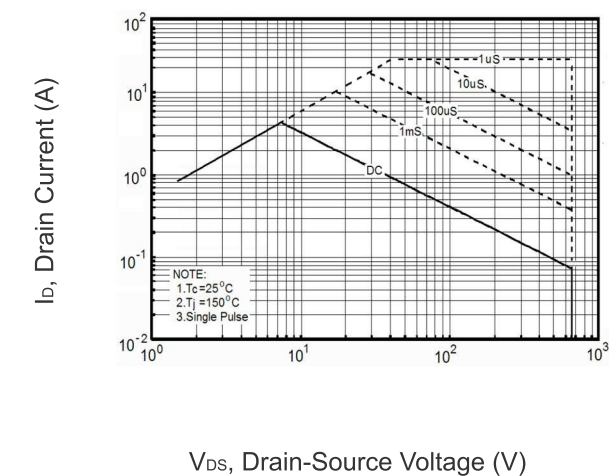
Table 3. Electrical Characteristics (T_A=25°C unless otherwise noted)

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	-	-	100	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 =3.5A	-	680	760	mΩ
Dynamic Characteristics						
Input Capacitance	C _{ies}	V _{DS} =50V,V _{GS} =0V F=1.0MHz	-	435	-	PF
Output Capacitance	C _{OSS}		-	28	-	PF
Reverse Transfer Capacitance	C _{rss}		-	3.3	-	PF
Total Gate Charge	Q _g	V _{DS} =480V,I _D =7A V _{GS} =10V	-	11	-	nC
Gate-Source Charge	Q _{gs}		-	3.5	-	nC
Gate-Drain Charge	Q _{gd}		-	5	-	nC
Switching times						
Turn-on Delay Time	t _{d(on)}	V _{DD} =380V,I _D =3.5A R _G =4.7Ω,V _{GS} =10V	-	8	-	nS
Turn-on Rise Time	t _r		-	7	-	nS
Turn-Off Delay Time	t _{d(off)}		-	58	75	nS
Turn-Off Fall Time	t _f		-	9	15	nS
Source- Drain Diode Characteristics						
Source-drain current (Body Diode)	I _{SD}	T _C =25°C	-	-	7	A
Pulsed Source-drain current (Body Diode)	I _{SDM}		-	-	28	A
Forward On Voltage	V _{SD}	T _J =25°C,I _{SD} =7A,V _{GS} =0V	-	0.9	1.2	V
Reverse Recovery Time	t _{rr}	T _J =25°C,I _F =3.5A di/dt=100A/μs	-	210	-	nS
Reverse Recovery Charge	Q _{rr}		-	0.85	-	uC
Peak reverse recovery Current	I _{rrm}		-	8	-	A

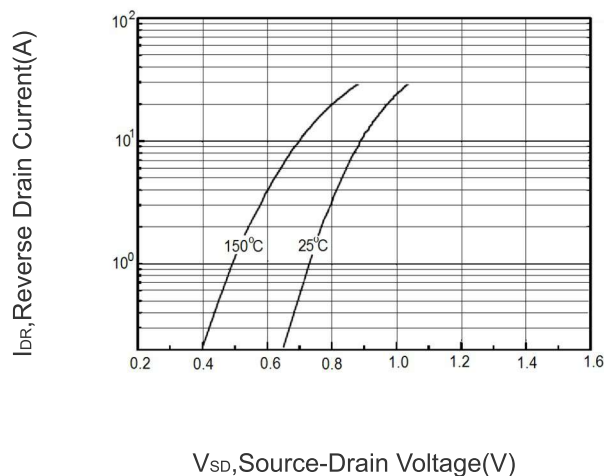
Notes

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

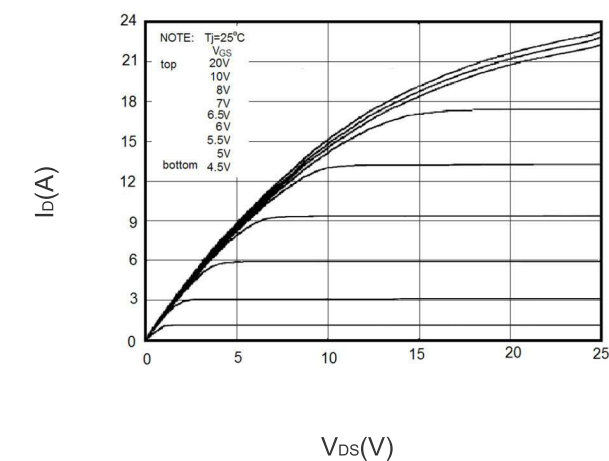
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)



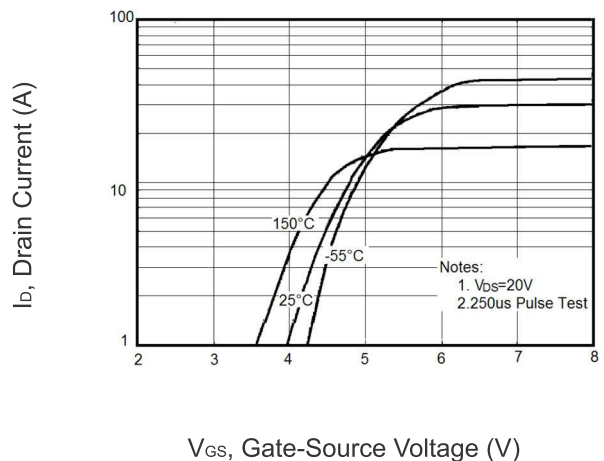
V_{DS} , Drain-Source Voltage (V)
Figure 1 Safe operating area



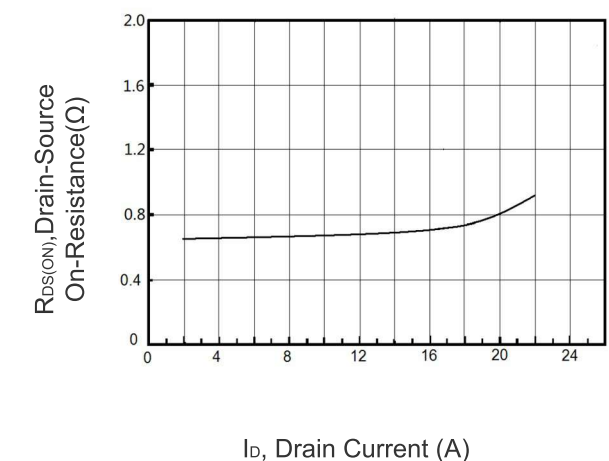
V_{SD} , Source-Drain Voltage(V)
Figure 2 Source-Drain Diode Forward Voltage



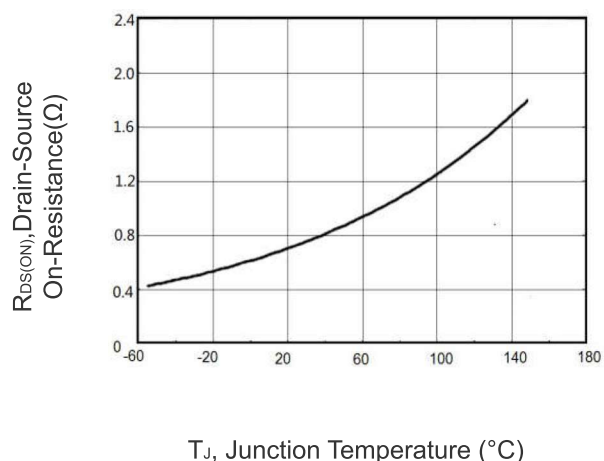
V_{DS} (V)
Figure 3 Output characteristics



V_{GS} , Gate-Source Voltage (V)
Figure 4 Transfer characteristics



I_D , Drain Current (A)
Figure 5 Static drain-source on resistance



T_J , Junction Temperature ($^{\circ}\text{C}$)
Figure 6 $R_{DS(ON)}$ vs Junction Temperature

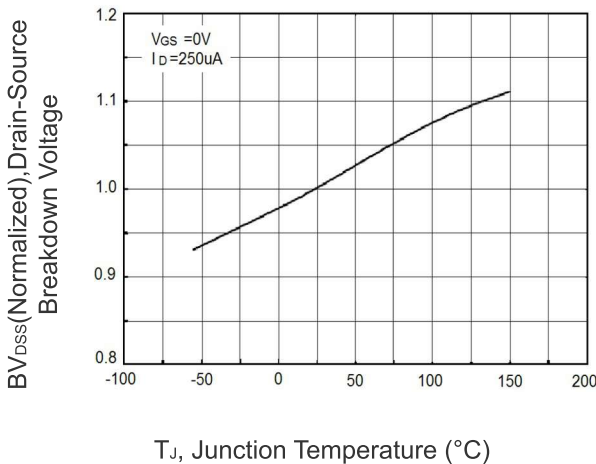


Figure 7 BV_{DSS} vs Junction Temperature

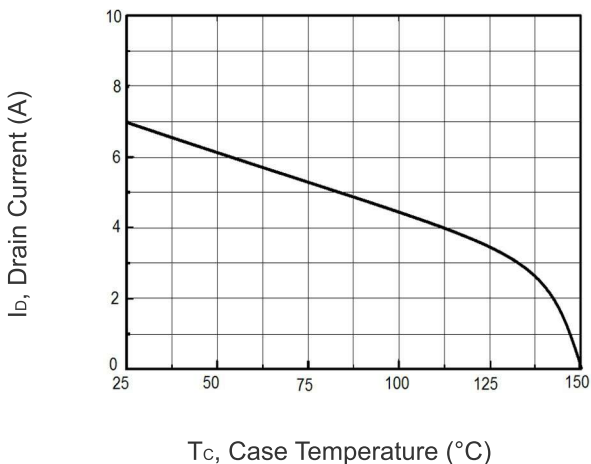


Figure 8 Maximum I_D vs Junction Temperature

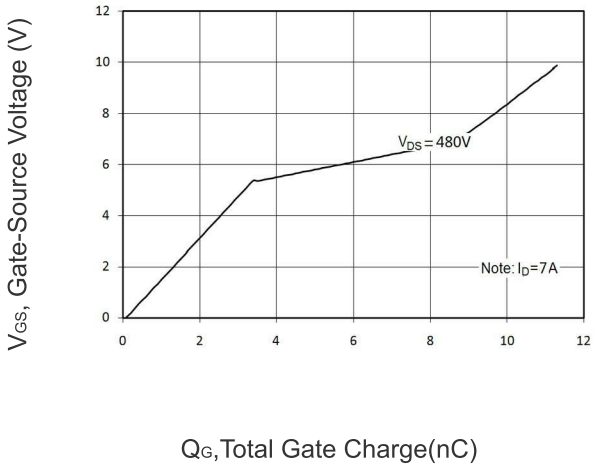


Figure 9 Gate charge waveforms

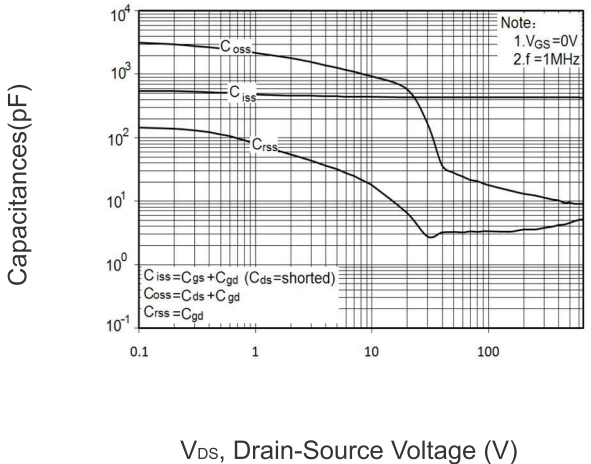


Figure 10 Capacitance

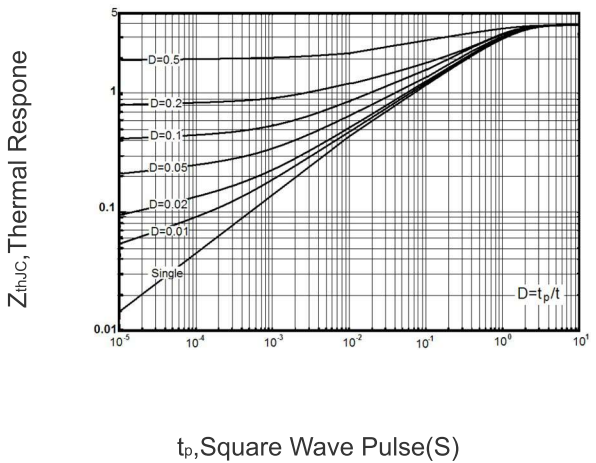
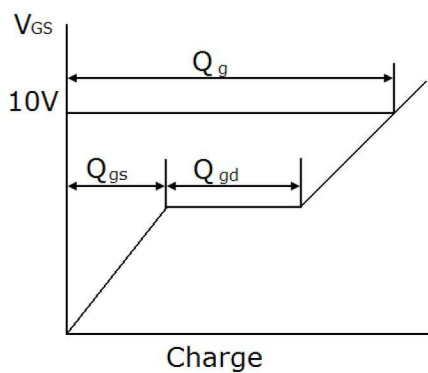
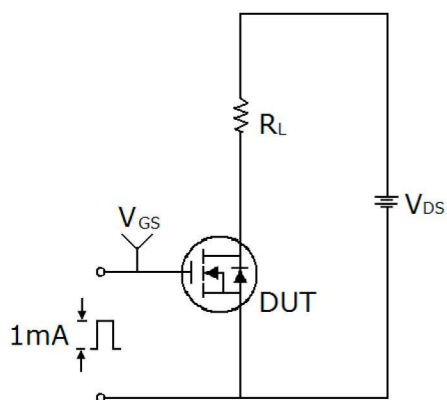
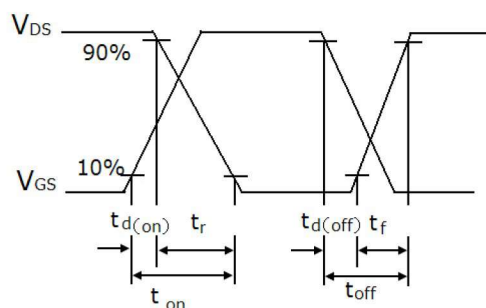


Figure 11 Transient Thermal Impedance

Test circuit



Gate charge test circuit & Waveform

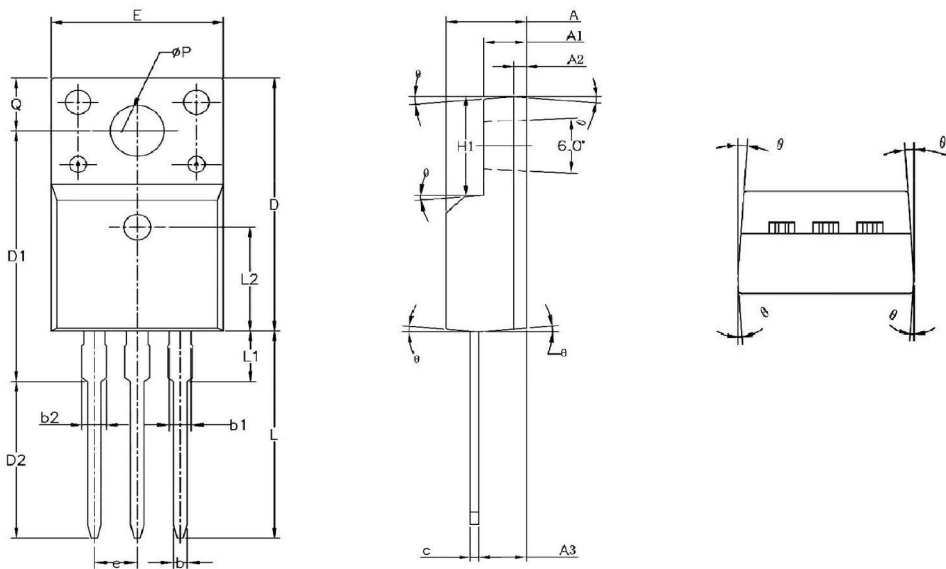


Switch Time Test Circuit



Unclamped Inductive Switching Test Circuit & Waveforms

TO-220F Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.500	4.830	0.177	0.190
A1	2.340	2.740	0.092	0.108
A2	0.700 REF.		0.028 REF.	
A3	2.560	2.930	0.101	0.115
b	0.700	0.900	0.028	0.035
b1	1.180	1.380	0.046	0.054
b2	-	1.47	-	0.058
c	0.450	0.600	0.018	0.024
D	15.670	16.070	0.617	0.633
D1	15.550	15.950	0.612	0.628
D2	9.600	10.000	0.378	0.394
E	9.960	10.360	0.392	0.408
e	2.540 TYP.		0.100 TYP.	
H1	6.480	6.880	0.255	0.271
L	12.680	13.280	0.499	0.523
L1	-	3.500	-	0.138
L2	6.500 REF.		0.256 TYP.	
ΦP	3.080	3.280	0.121	0.129
Q	3.200	3.400	0.126	0.134
Θ1	1°	5°	1°	5°

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