

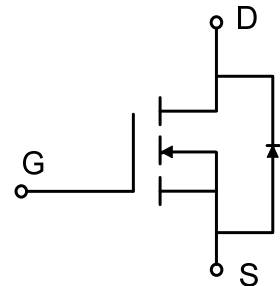
## 700V 0.35Ω Super Junction Power MOSFET

### Description

WMOS™ EM is Wayon's 3<sup>rd</sup> generation super junction MOSFET family that is utilizing charge balance technology for extremely low on-resistance and low gate charge performance. WMOS™ EM is suitable for applications which require superior power density and outstanding efficiency.

### Features

- $V_{DS} = 750V @ T_{j,max}$
- Typ.  $R_{DS(on)} = 0.35\Omega$
- 100% UIS tested
- Pb-free plating, Halogen free



### Applications

LED Lighting, Charger, Adapter, PC, LCD TV, Server

### Absolute Maximum Ratings

Parameter	Symbol	WMU13N70EM	Unit
Drain-source voltage	$V_{DSS}$	700	V
Continuous drain current <sup>1)</sup> ( $T_C = 25^\circ C$ )	$I_D$	11	A
		( $T_C = 100^\circ C$ )	6.5
Pulsed drain current <sup>2)</sup>	$I_{DM}$	35	A
Gate-source voltage	$V_{GS}$	$\pm 30$	V
Avalanche energy, single pulse <sup>3)</sup>	$E_{AS}$	145	mJ
Avalanche energy, repetitive <sup>2)</sup>	$E_{AR}$	0.21	mJ
Avalanche current, repetitive <sup>2)</sup>	$I_{AR}$	2	A
Power dissipation ( $T_C = 25^\circ C$ )	$P_D$	31	W
		- Derate above $25^\circ C$	0.25
Operating and storage temperature range	$T_i, T_{stg}$	-55 to +150	$^\circ C$
Continuous diode forward current	$I_S$	11	A
Diode pulse current	$I_{S,pulse}$	35	A
MOSFET dv/dt ruggedness	dv/dt	50	V/ns
Peak diode recovery voltage slope	dv/dt	15	V/ns

## Thermal Characteristics

Parameter	Symbol	WMU13N70EM	Unit
Thermal resistance, junction-to-case	$R_{\theta JC}$	4	$^{\circ}\text{C}/\text{W}$
Thermal resistance, junction-to-ambient	$R_{\theta JA}$	80	$^{\circ}\text{C}/\text{W}$

## Electrical Characteristics $T_c = 25^{\circ}\text{C}$ , unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>Static characteristics</b>						
Drain-source breakdown voltage	$BV_{DSS}$	$V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$	700	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=0.25\text{ mA}$	2	3	4	V
Drain cut-off current	$I_{DSS}$	$V_{DS}=700\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^{\circ}\text{C}$ $T_j = 125^{\circ}\text{C}$	-	-	1	$\mu\text{A}$
Gate leakage current, forward	$I_{GSSF}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Gate leakage current, reverse	$I_{GSSR}$	$V_{GS}=-20\text{ V}, V_{DS}=0\text{ V}$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=2\text{ A}$	--	0.35	0.39	$\Omega$
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS}=100\text{ V}, V_{GS}=0\text{ V},$	-	710	-	pF
Output capacitance	$C_{oss}$	$f = 1\text{ MHz}$	-	25	-	
Reverse transfer capacitance	$C_{rss}$		-	2	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 300\text{ V}, I_D = 5\text{ A}$ $R_G = 25\Omega, V_{GS}=10\text{ V}$	-	20	-	ns
Rise time	$t_r$		-	16	-	
Turn-off delay time	$t_{d(off)}$		-	61	-	
Fall time	$t_f$		-	17	-	
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DD}=480\text{ V}, I_D=5\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	3.4	-	nC
Gate to drain charge	$Q_{gd}$		-	10.1	-	
Gate charge total	$Q_g$		-	20.3	-	
Gate plateau voltage	$V_{plateau}$		-	4.7	-	V
<b>Reverse diode characteristics</b>						
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=2\text{ A}$	-	-	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=50\text{ V}, I_F=5\text{ A},$ $di_F/dt=100\text{ A}/\mu\text{s}$	-	213	-	ns
Reverse recovery charge	$Q_{rr}$		-	2.1	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	20	-	A

### Notes:

- Limited by  $T_{j\text{max}}$ . Maximum duty cycle  $D=0.5$ .
- Repetitive rating: pulse width limited by maximum junction temperature.
- $I_{AS} = 2\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\Omega$ , starting  $T_j = 25^{\circ}\text{C}$ .

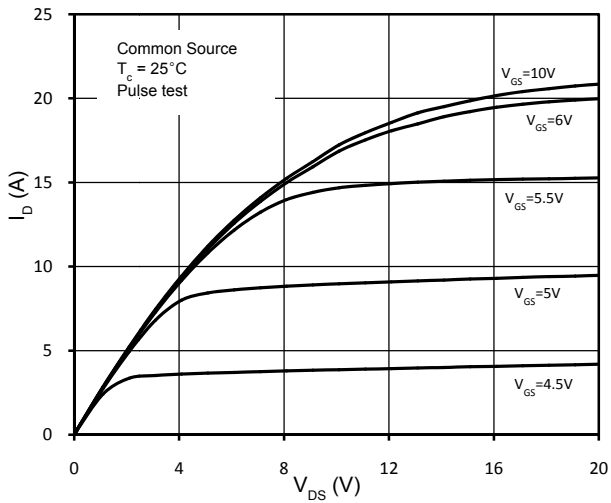


Figure 1. On-Region Characteristics

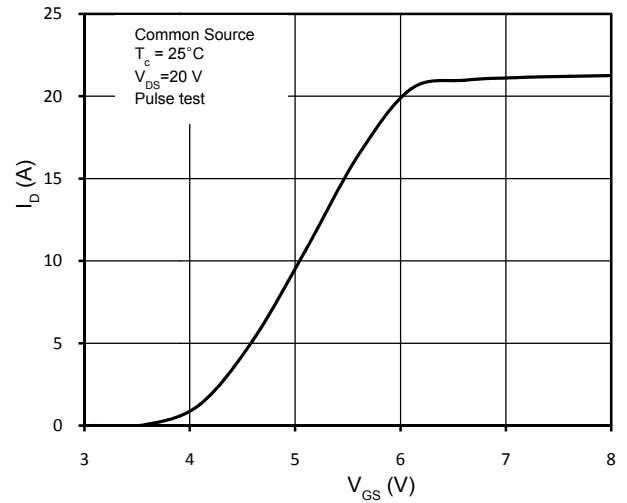


Figure 2. Transfer Characteristics

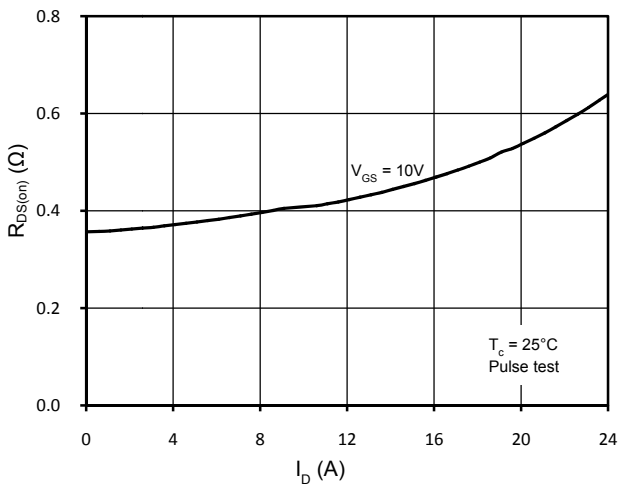


Figure 3. Static Drain-Source On Resistance

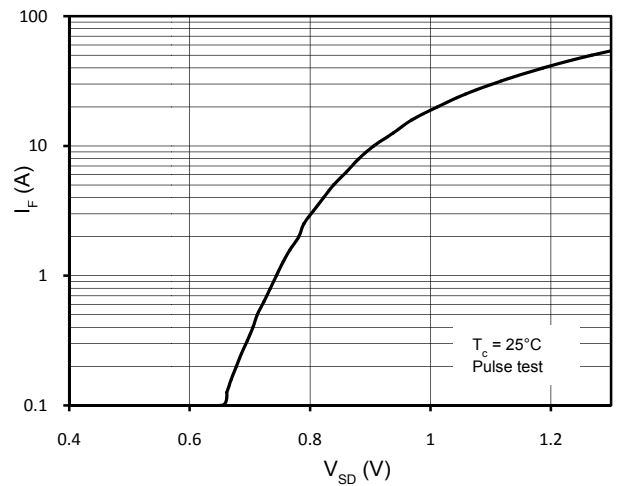


Figure 4. Body-Diode Forward Characteristics

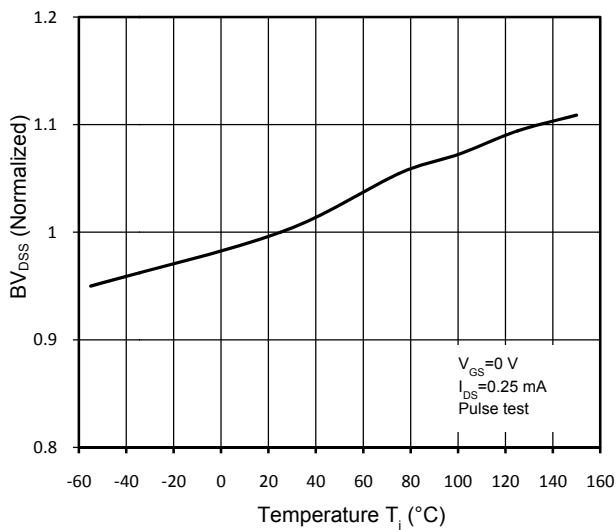


Figure 5. Normalized  $BV_{DS}$  vs. Temperature

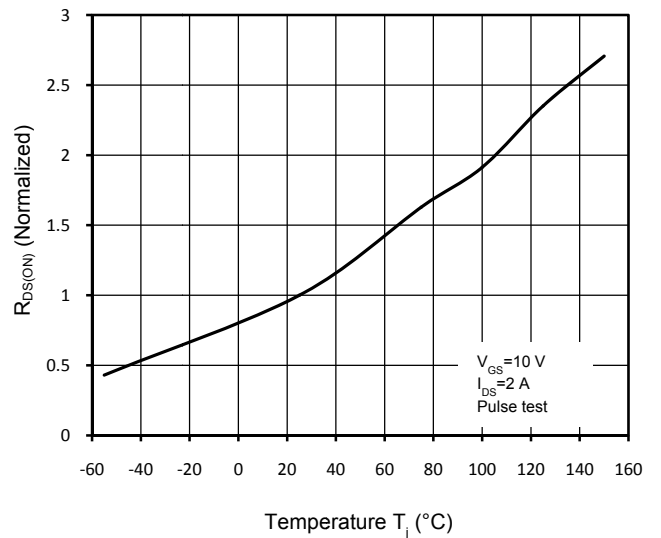


Figure 6. Normalized  $R_{DS(on)}$  vs. Temperature

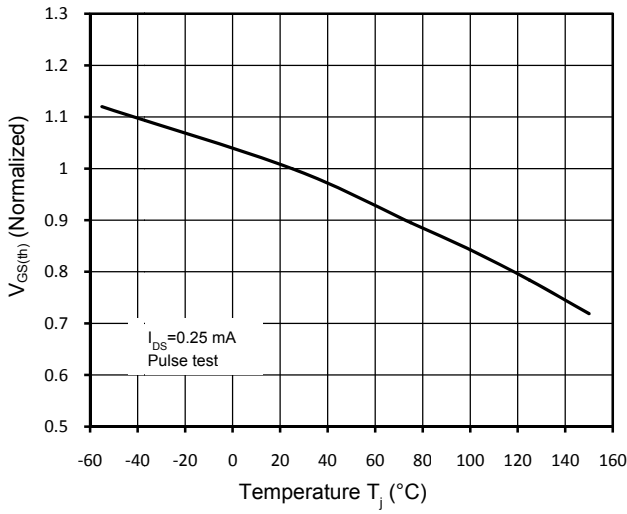


Figure 7. Threshold Voltage vs. Temperature

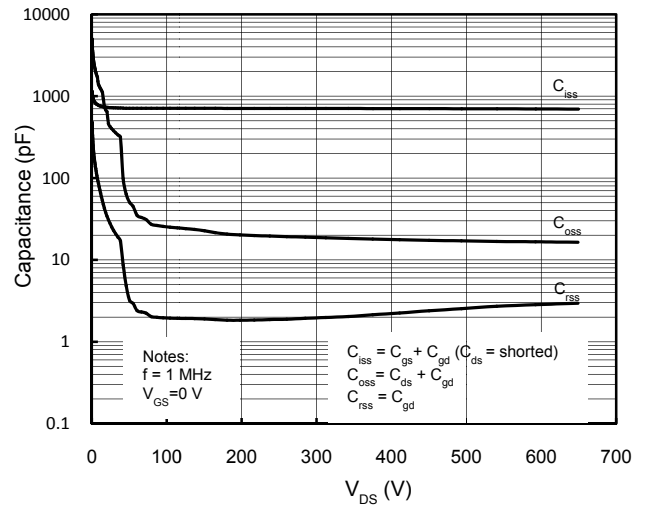


Figure 8. Capacitance Characteristics

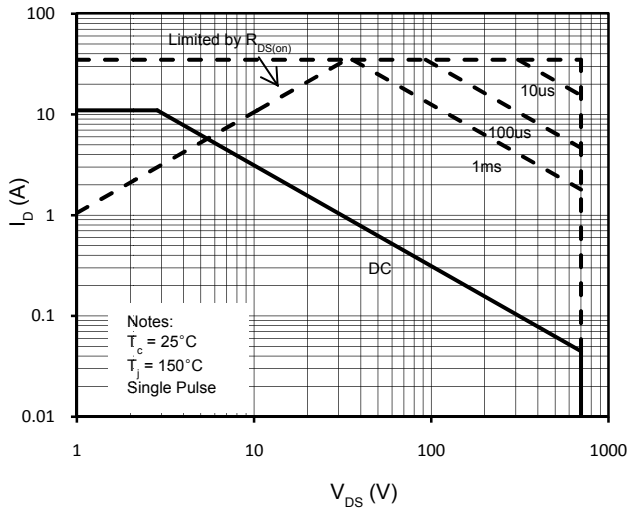


Figure 9. Maximum Safe Operating Area

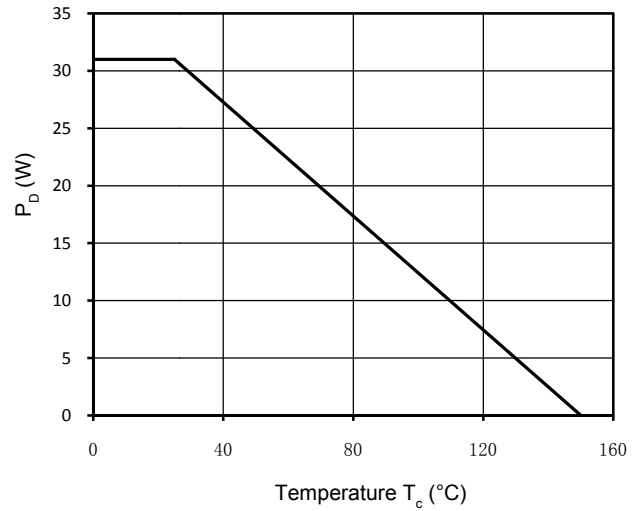


Figure 10. Power Dissipation

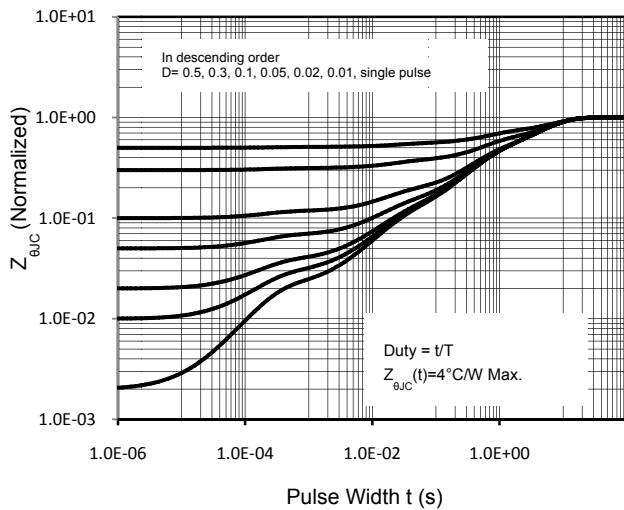


Figure 11. Transient Thermal Response Curve

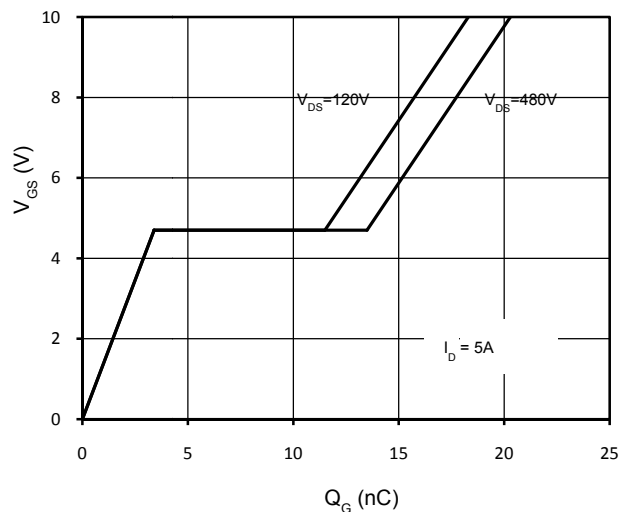


Figure 12. Gate Charge Characteristics

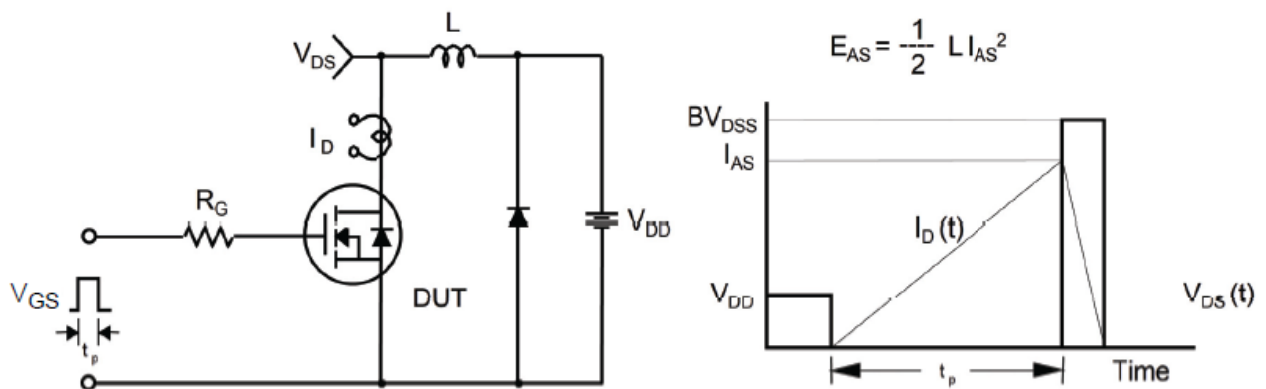
### Gate Charge Test Circuit & Waveform



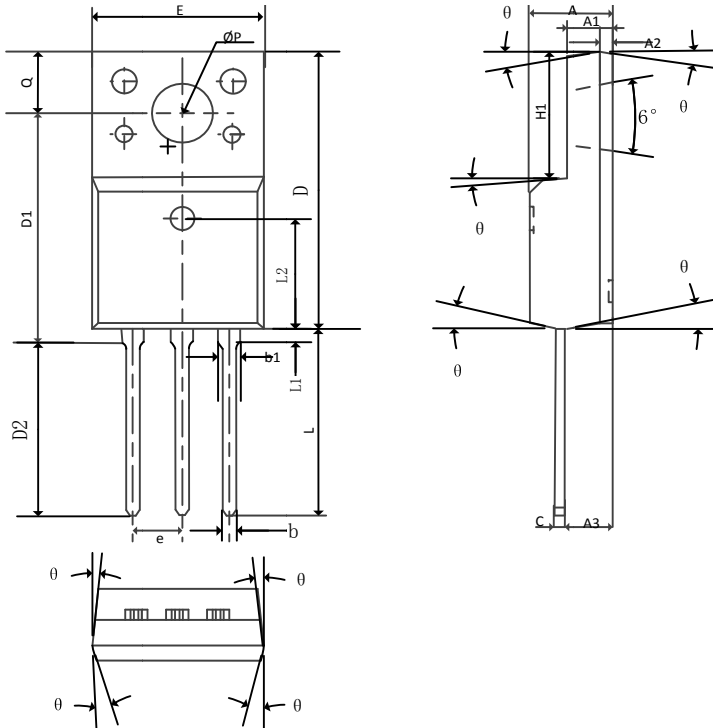
### Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms



Mechanical Dimensions for TO-220F NL

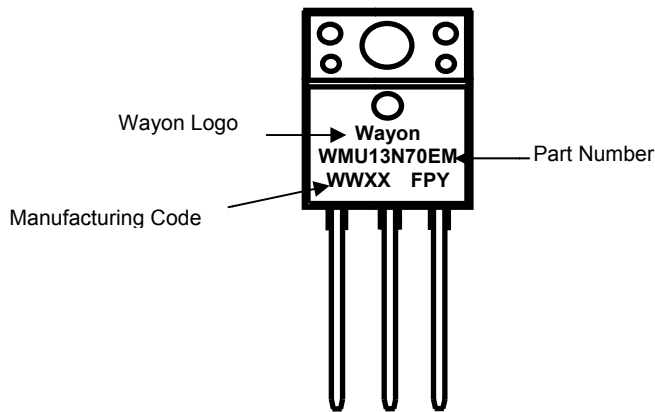


COMMON DIMENSIONS			
SYMBOL	MM		
	MIN	NOM	MAX
A	4.5	4.7	4.9
A1	2.34	2.54	2.74
A2	0.7REF		
A3	2.56	2.76	2.96
b	0.58	-	0.82
b1	0.85	-	1.15
c	0.4	0.5	0.65
D	15.5	15.9	16.3
D1	12.7	13.1	13.4
D2	12.2	12.4	12.8
E	9.9	10.2	10.5
e	2.54BSC		
H1	6.4	6.7	7.0
L	12.6	12.9	13.3
L1	-	-	0.9
L2	6.50REF		
$\varnothing P$	3.0	3.2	3.4
Q	3.1	-	3.5
$\theta$	1°	3°	5°

### Ordering Information

Part	Package	Marking	Packing method
WMU13N70EM	TO-220F NL	WMU13N70EM	Tube

### Marking Information



### Contact Information

No.1001, Shiwan(7) Road, Pudong District, Shanghai, P.R.China.201202

Tel: 86-21-50310888 Fax: 86-21-50757680 Email: market@way-on.com

WAYON website: <http://www.way-on.com>

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