

## 650V 0.13Ω Super Junction Power MOSFET

### Description

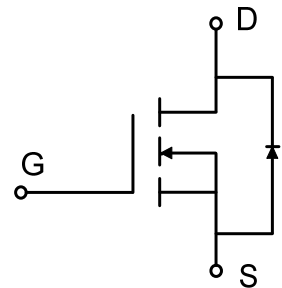
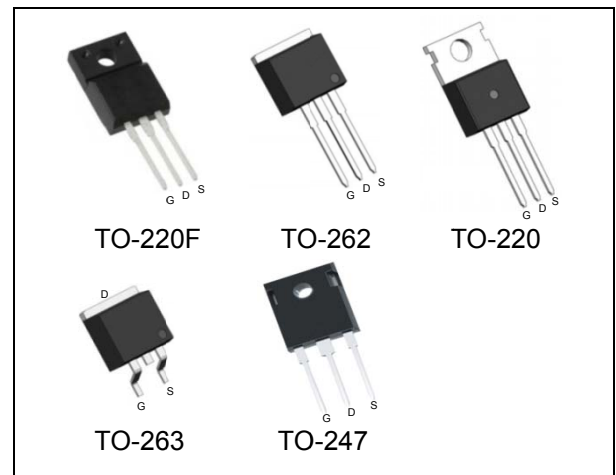
WMOS™ C4 is Wayon's 4<sup>th</sup> generation super junction MOSFET family that is utilizing charge balance technology for extremely low on-resistance and low gate charge performance. WMOS™ C4 is suitable for applications which require superior power density and outstanding efficiency.

### Features

- $V_{DS} = 700V @ T_{j,max}$
- Typ.  $R_{DS(on)} = 0.13\Omega$
- 100% UIS tested
- Pb-free plating, Halogen free

### Applications

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



### Absolute Maximum Ratings

Parameter	Symbol	WMK/WMM/WMN/WMJ	WML	Unit
Drain-source voltage	$V_{DSS}$	650		V
Continuous drain current <sup>1)</sup> ( $T_C = 25^\circ C$ )	$I_D$	23		A
		13		A
Pulsed drain current <sup>2)</sup>	$I_{DM}$	65		A
Gate-source voltage	$V_{GS}$	$\pm 30$		V
Avalanche energy, single pulse <sup>3)</sup>	$E_{AS}$	210		mJ
Avalanche energy, repetitive <sup>2)</sup>	$E_{AR}$	0.3		mJ
Avalanche current, repetitive <sup>2)</sup>	$I_{AR}$	2.5		A
Power dissipation ( $T_C = 25^\circ C$ ) - Derate above $25^\circ C$	$P_D$	160	31	W
		1.28	0.25	W/ $^\circ C$
Operating and storage temperature range	$T_{j}, T_{stg}$	-55 to +150		$^\circ C$
Continuous diode forward current	$I_S$	23		A
Diode pulse current	$I_{S,pulse}$	65		A

### Thermal Characteristics

Parameter	Symbol	WMK/WMM/WMN/WMJ	WML	Unit
Thermal resistance, junction-to-case	$R_{\theta JC}$	0.9	4	$^\circ C/W$
Thermal resistance, junction-to-ambient	$R_{\theta JA}$	62	80	$^\circ C/W$

**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	$BV_{DSS}$	$V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$	650	-	-	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	$I_{DSS}$	$V_{DS}=650\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$	-	-	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	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=6\text{ A}$ $T_j = 25^\circ\text{C}$	-	0.13	0.16	$\Omega$
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS}=100\text{ V}, V_{GS}=0\text{ V},$	-	1775	-	pF
Output capacitance	$C_{oss}$	$f = 1\text{ MHz}$	-	64	-	
Reverse transfer capacitance	$C_{rss}$		-	1.8	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 300\text{ V}, I_D = 15\text{ A}$	-	47	-	ns
Rise time	$t_r$	$R_G = 25\Omega, V_{GS}=10\text{ V}$	-	48	-	
Turn-off delay time	$t_{d(off)}$		-	106	-	
Fall time	$t_f$		-	26	-	
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DD}=480\text{ V}, I_D=15\text{ A},$	-	9.7	-	nC
Gate to drain charge	$Q_{gd}$	$V_{GS}=0\text{ to }10\text{ V}$	-	7.3	-	
Gate charge total	$Q_g$		-	27.3	-	
Gate plateau voltage	$V_{plateau}$		-	5.6	-	V
<b>Reverse diode characteristics</b>						
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=6\text{ A}$	-	-	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=50\text{ V}, I_F=15\text{ A},$	-	255	-	ns
Reverse recovery charge	$Q_{rr}$	$di/dt=100\text{ A}/\mu\text{s}$	-	3.8	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	27.8	-	A

## Notes:

- Limited by  $T_{j\text{max}}$ . Maximum duty cycle  $D=0.5$ .
- Repetitive rating: pulse width limited by maximum junction temperature.
- $I_{AS} = 2.5\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\Omega$ , starting  $T_j = 25^\circ\text{C}$ .

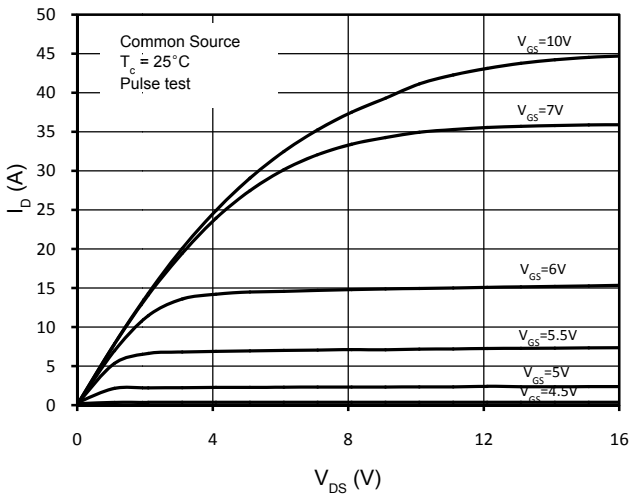


Figure 1. On-Region Characteristics

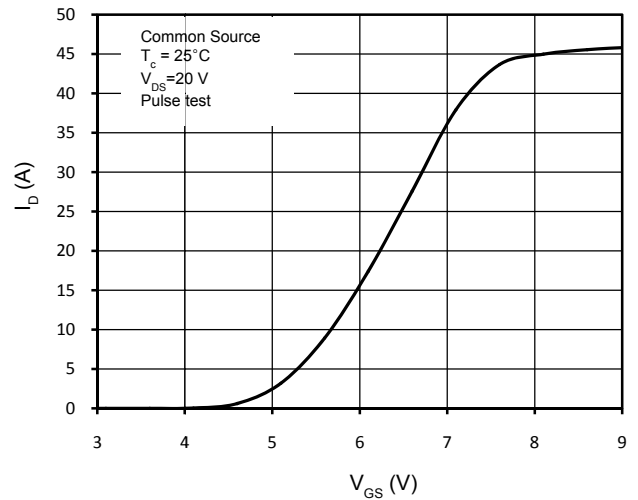


Figure 2. Transfer Characteristics

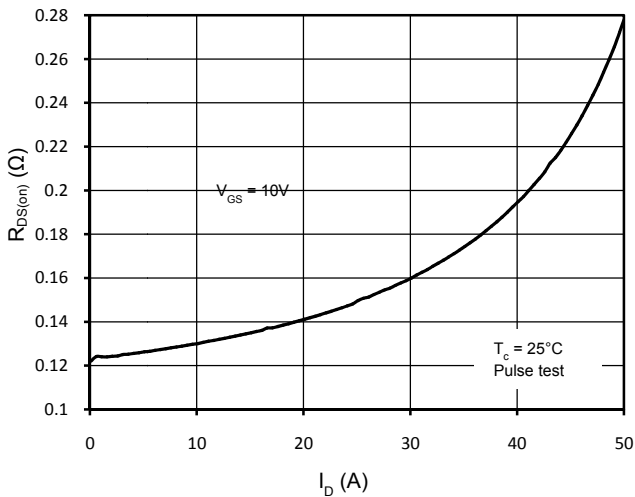


Figure 3. Static Drain-Source On Resistance

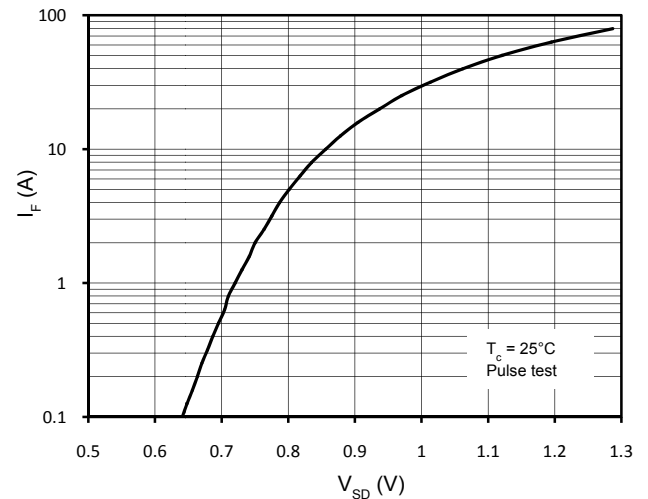


Figure 4. Body-Diode Forward Characteristics

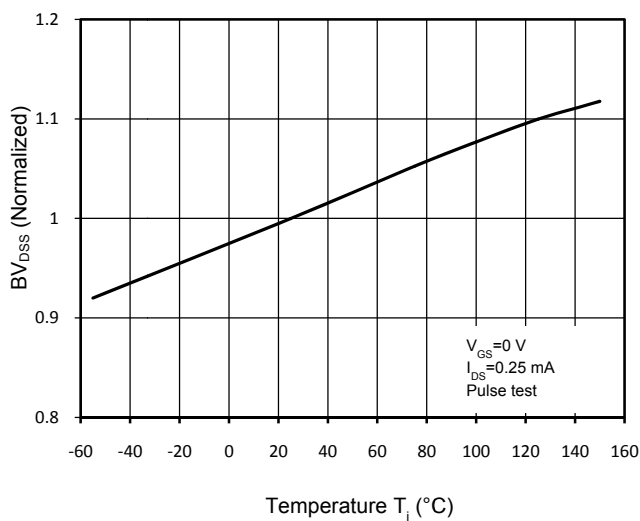


Figure 5. Normalized  $BV_{DSS}$  vs. Temperature

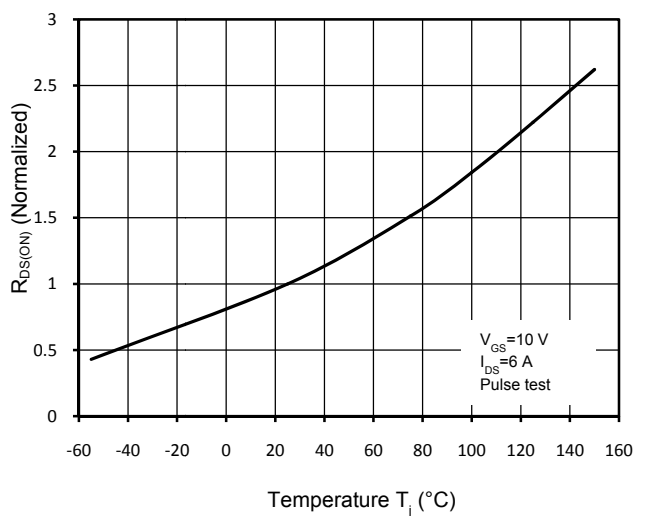


Figure 6. Normalized  $R_{DS(on)}$  vs. Temperature

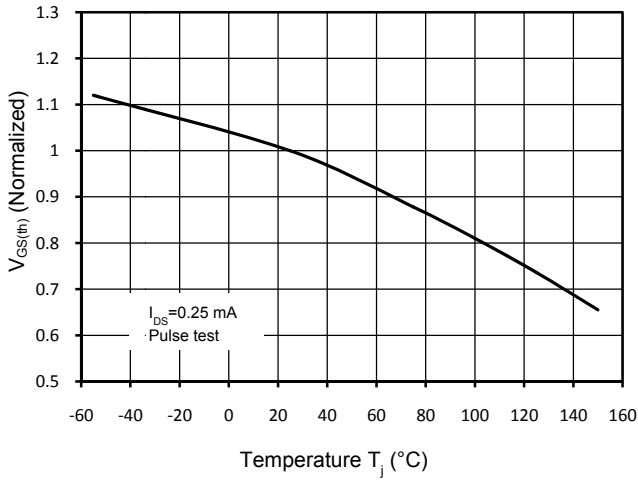


Figure 7. Threshold Voltage vs. Temperature

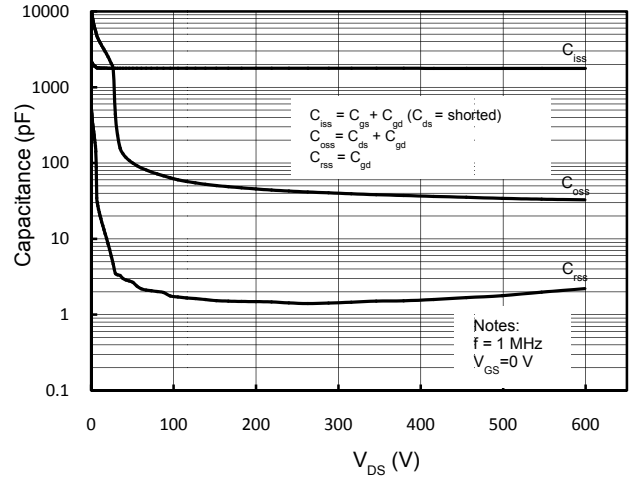


Figure 8. Capacitance Characteristics

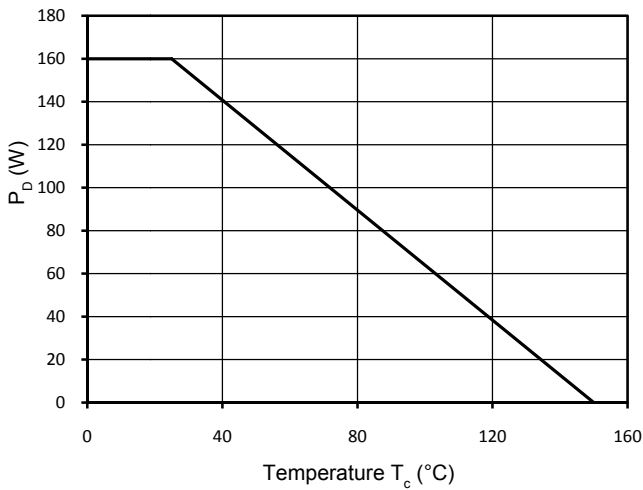


Figure 9. Power Dissipation

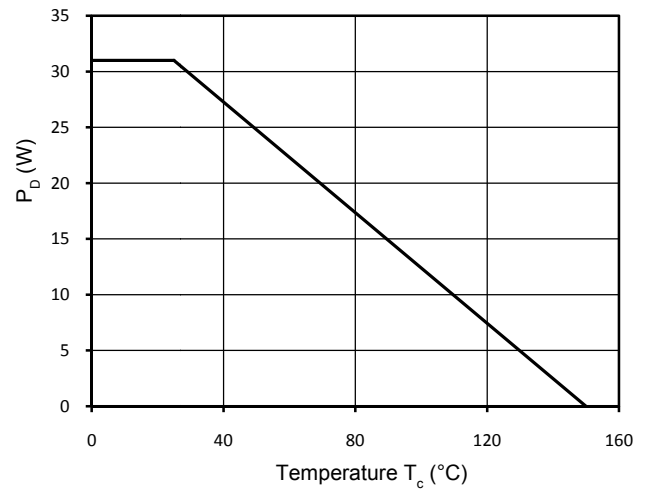


Figure 10. Power Dissipation (TO-220F)

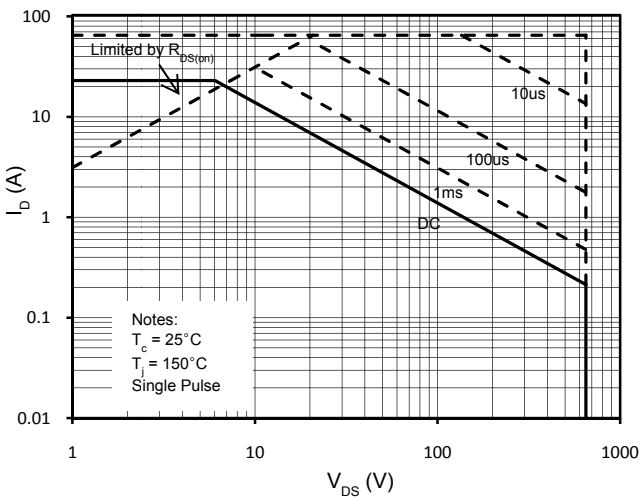


Figure 11. Maximum Safe Operating Area

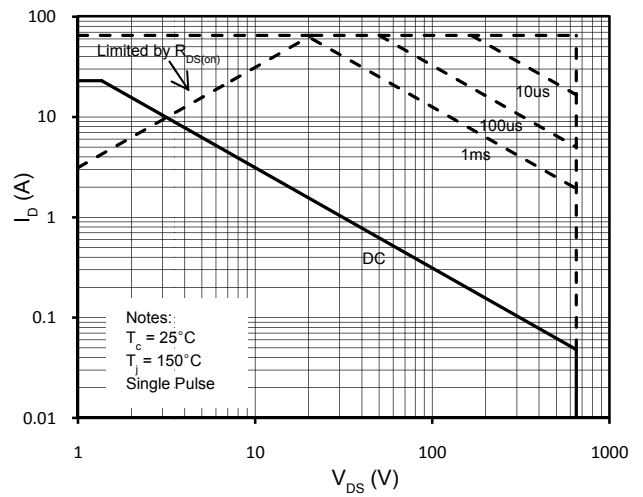


Figure 12. Maximum Safe Operating Area (TO-220F)

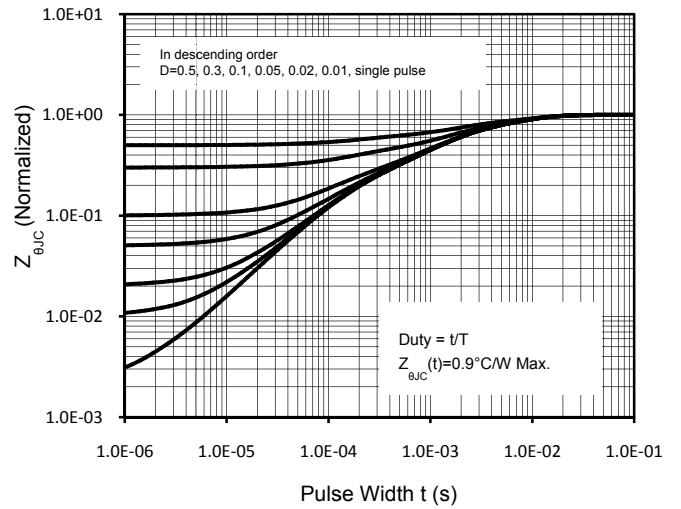
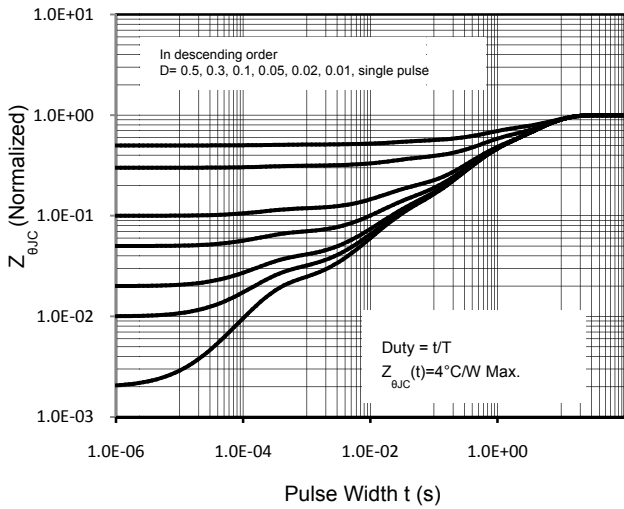


Figure 13. Transient Thermal Response Curve (TO-220F) Figure 14. Transient Thermal Response Curve

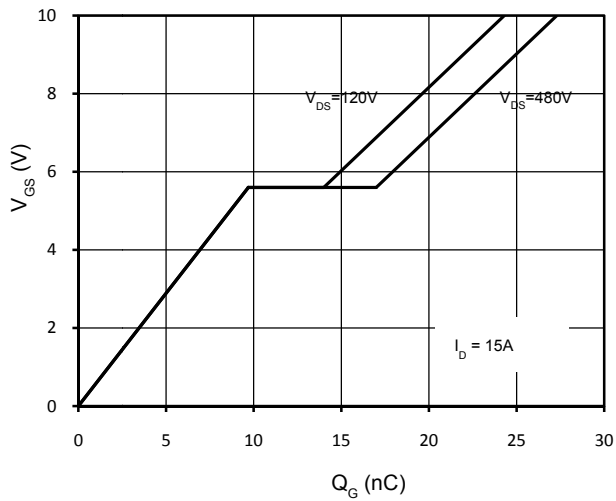
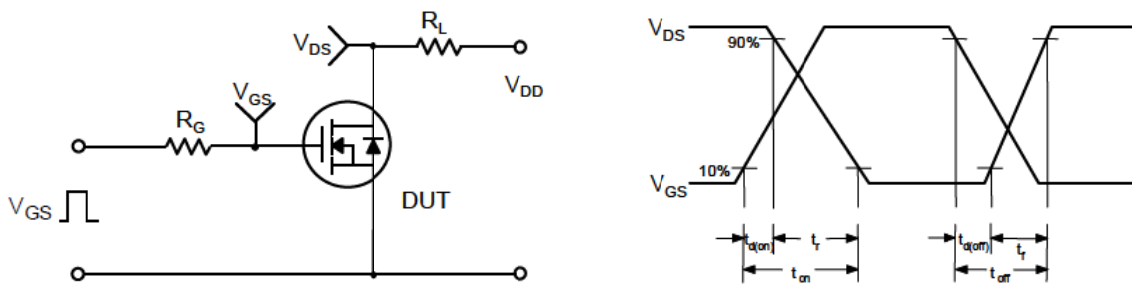


Figure 15. Gate Charge Characteristics

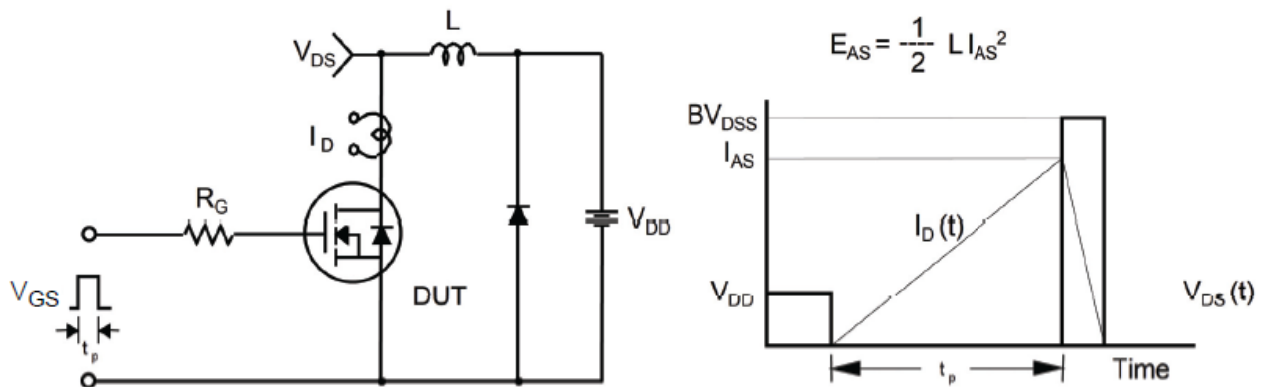
**Gate Charge Test Circuit & Waveform**



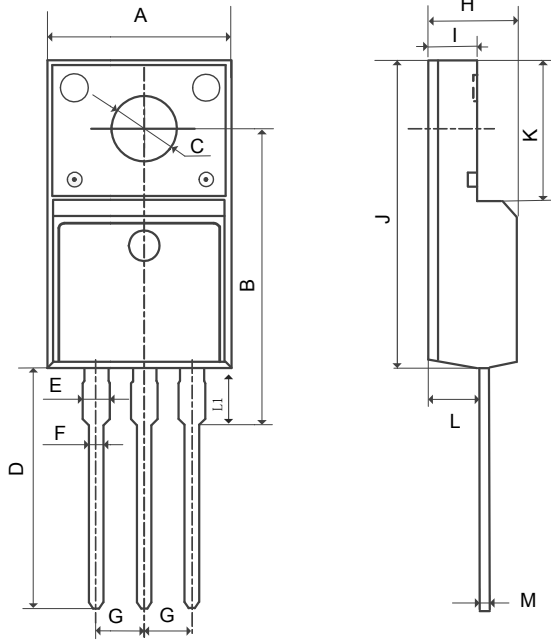
**Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**



## Mechanical Dimensions for TO-220F

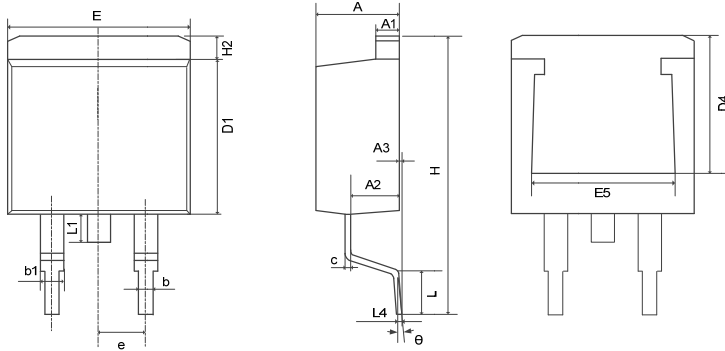


## COMMON DIMENSIONS

SYMBOL	MM	
	MIN	MAX
A	9.96	10.36
B	15.10	16.10
C	3.03	3.38
D	12.64	13.28
E	1.18	1.58
F	0.70	0.95
G	2.54REF	
H	4.50	4.90
I	2.34	2.74
J	15.57	16.17
K	6.70REF	
L	2.56	2.96
M	0.40	0.65
L1	2.85	3.45

## Mechanical Dimensions for TO-263

## COMMON DIMENSIONS

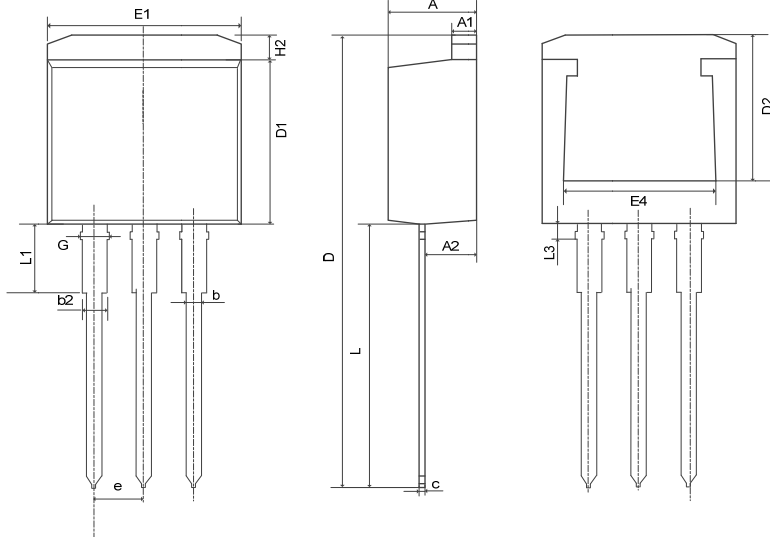


SYMBOL	MM	
	MIN	MAX
A	4.37	4.89
A1	1.17	1.42
A2	2.49	2.89
b	0.70	0.96
b1	1.17	1.47
c	0.30	0.53
D1	8.45	8.90
D4	6.60	—
E	9.86	10.40
E5	7.06	—
e	2.54BSC	
H	14.70	15.50
H2	1.07	1.47
L	2.00	2.70
L1	1.40	1.70
L4	0.25BSC	
θ	0°	9°



## Mechanical Dimensions for TO-262

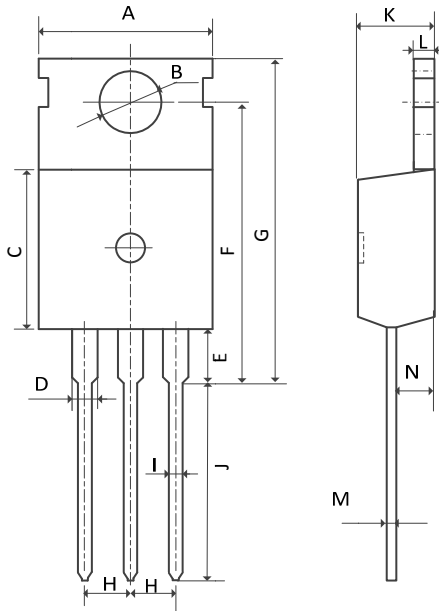
## COMMON DIMENSIONS



SYMBOL	MM	
	MIN	MAX
A	4.37	4.90
A1	1.17	1.42
A2	2.49	2.89
b	0.71	0.96
b2	1.07	1.47
c	0.28	0.53
D	23.20	24.02
D1	8.45	8.90
D2	6.00	—
E1	9.86	10.40
E4	7.06	—
e	2.54BSC	
G	1.25	1.50
H2	—	1.50
L	13.33	14.16
L1	3.50	4.00
L3	1.28	1.58

## Mechanical Dimensions for TO-220

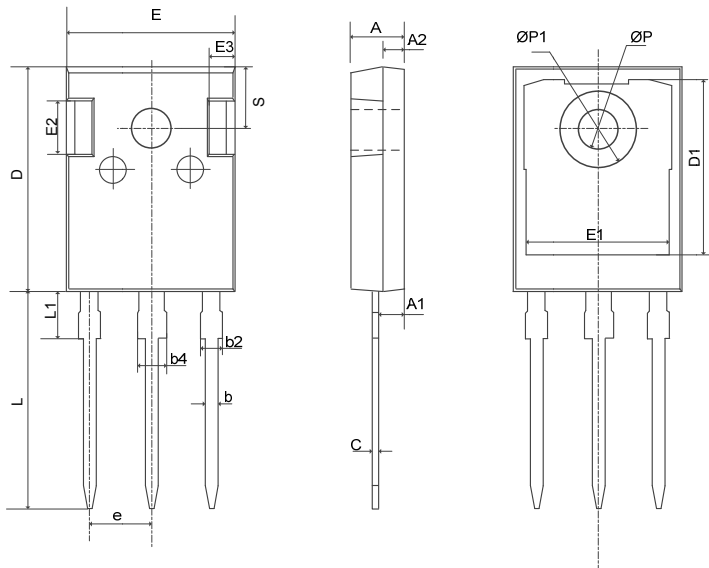
## COMMON DIMENSIONS



SYMBOL	MM	
	MIN	MAX
A	9.70	10.20
B	3.40	3.80
C	8.90	9.40
D	1.17	1.47
E	2.60	3.40
F	15.10	16.70
G	19.55MAX	
H	2.54REF	
I	0.70	0.95
J	9.35	11.00
K	4.30	4.77
L	1.20	1.45
M	0.40	0.65
N	2.20	2.60

## Mechanical Dimensions for TO-247

## COMMON DIMENSIONS

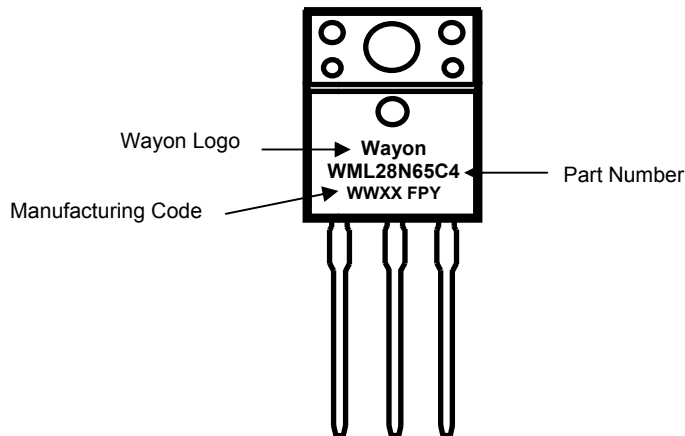


SYMBOL	MM	
	MIN	MAX
A	4.80	5.20
A1	2.21	2.61
A2	1.85	2.15
b	1.11	1.36
b2	1.91	2.21
b4	2.91	3.21
c	0.51	0.75
D	20.70	21.30
D1	16.25	16.85
E	15.50	16.10
E1	13.00	13.60
E2	4.80	5.20
E3	2.30	2.70
e	5.44BSC	
L	19.62	20.22
L1	—	4.30
ØP	3.40	3.80
ØP1	—	7.30
S	6.15BSC	

## Ordering Information

Part	Package	Marking	Packing method
WML28N65C4	TO-220F	WML28N65C4	Tube
WMK28N65C4	TO-220	WMK28N65C4	Tube
WMN28N65C4	TO-262	WMN28N65C4	Tube
WMM28N65C4	TO-263	WMM28N65C4	Tape and Reel
WMJ28N65C4	TO-247	WMJ28N65C4	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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