

## 500V 0.108Ω Super Junction Power MOSFET

### Description

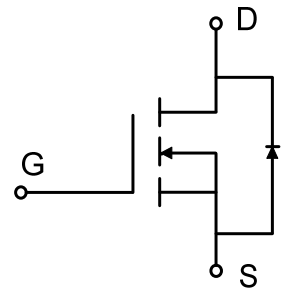
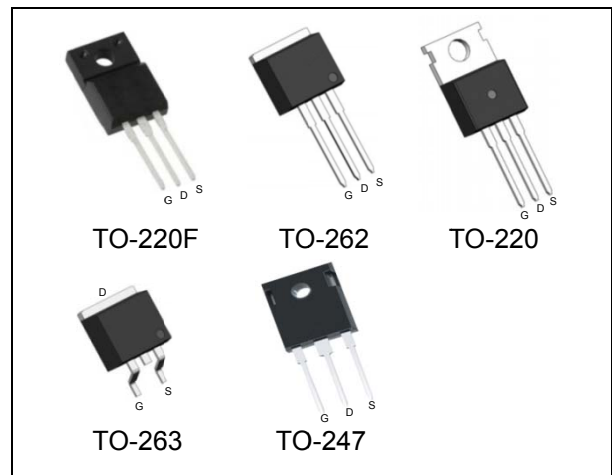
WMOS™ ES is Wayon's new generation super junction MOSFET family that is utilizing charge balance technology for extremely low on-resistance and low gate charge performance. WMOS™ ES is suitable for applications which require superior power density and outstanding efficiency.

### Features

- $V_{DS} = 550V @ T_{j,max}$
- Typ.  $R_{DS(on)} = 0.108\Omega$
- 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	$V_{DSS}$	500		V
Continuous drain current <sup>1)</sup> ( $T_C = 25^\circ C$ )	$I_D$	33		A
		20		A
Pulsed drain current <sup>2)</sup>	$I_{DM}$	120		A
Gate-source voltage	$V_{GS}$	$\pm 30$		V
Avalanche energy, single pulse <sup>3)</sup>	$E_{AS}$	415		mJ
Avalanche energy, repetitive <sup>2)</sup>	$E_{AR}$	0.5		mJ
Avalanche current, repetitive <sup>2)</sup>	$I_{AR}$	3.5		A
Power dissipation ( $T_C = 25^\circ C$ ) - Derate above $25^\circ C$	$P_D$	146	34	W
		1.18	0.27	W/°C
Operating and storage temperature range	$T_{j}, T_{stg}$	-55 to +150		°C
Continuous diode forward current <sup>1)</sup>	$I_S$	33		A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$	120		A

### Thermal Characteristics

Parameter	Symbol	WMK/WMM/WMN/WMJ	WML	Unit
Thermal resistance, junction-to-case	$R_{\theta JC}$	0.86	3.7	°C/W
Thermal resistance, junction-to-ambient	$R_{\theta JA}$	62	80	°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	$BV_{DSS}$	$V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$	500	-	-	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	$I_{DSS}$	$V_{DS}=500\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$	-	-	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	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=6\text{ A}$ $T_j = 25^\circ\text{C}$	-	0.108	0.12	$\Omega$
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS}=100\text{ V}, V_{GS}=0\text{ V},$	-	1475	-	pF
Output capacitance	$C_{oss}$	$f = 1\text{ MHz}$	-	73	-	
Reverse transfer capacitance	$C_{rss}$		-	1.2	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 300\text{ V}, I_D = 10\text{ A}$	-	22	-	ns
Rise time	$t_r$	$R_G = 25\Omega, V_{GS}=10\text{ V}$	-	28	-	
Turn-off delay time	$t_{d(off)}$		-	126	-	
Fall time	$t_f$		-	28	-	
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DD}=480\text{ V}, I_D=10\text{ A},$	-	9.3	-	nC
Gate to drain charge	$Q_{gd}$	$V_{GS}=0\text{ to }10\text{ V}$	-	11	-	
Gate charge total	$Q_g$		-	36	-	
Gate plateau voltage	$V_{plateau}$		-	5.0	-	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	$t_{rr}$	$V_R=50\text{ V}, I_F=10\text{ A},$	-	280	-	ns
Reverse recovery charge	$Q_{rr}$	$di/dt=100\text{ A}/\mu\text{s}$	-	3.1	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	22	-	A

## Notes:

- Limited by  $T_{j\text{max}}$ . Maximum duty cycle  $D=0.5$ .
- Pulse width limited by maximum junction temperature.
- $I_{AS} = 3.8\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\Omega$ , starting  $T_j = 25^\circ\text{C}$ .

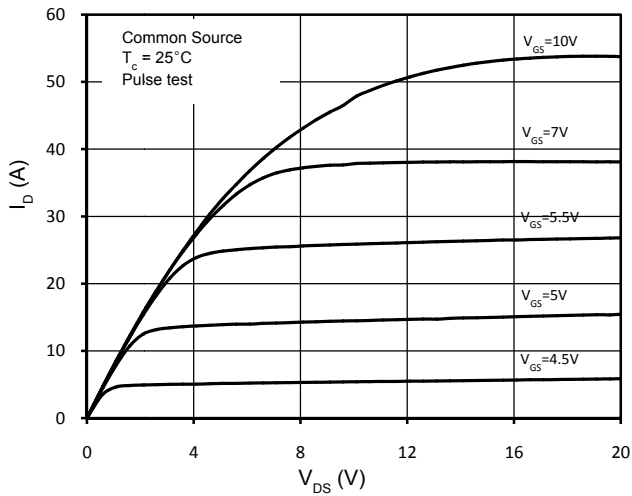


Figure 1. On-Region Characteristics

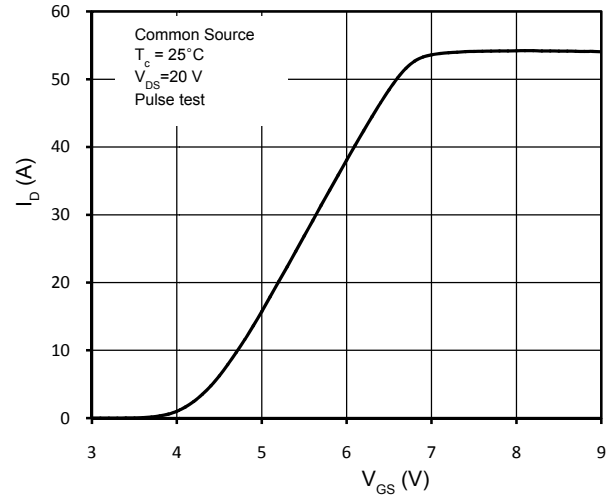


Figure 2. Transfer Characteristics

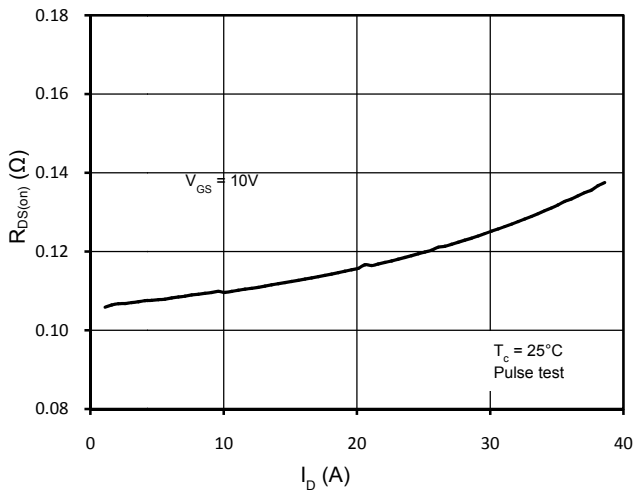


Figure 3. Static Drain-Source On Resistance

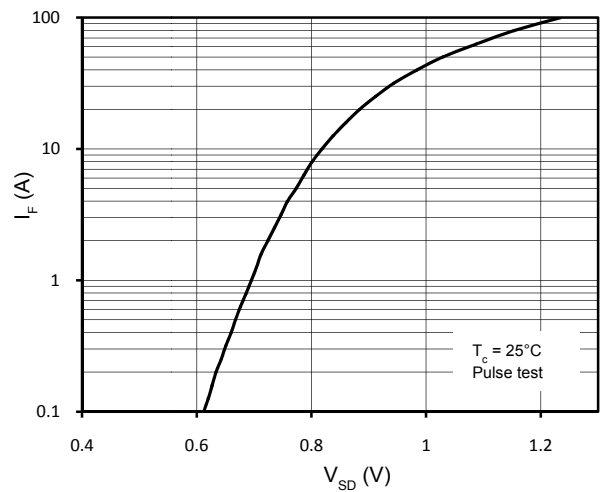


Figure 4. Body-Diode Forward Characteristics

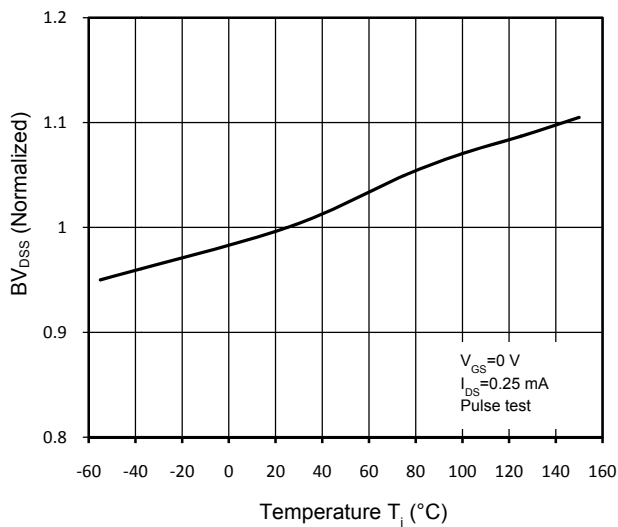


Figure 5. Normalized  $BV_{DS(s)}$  vs. Temperature

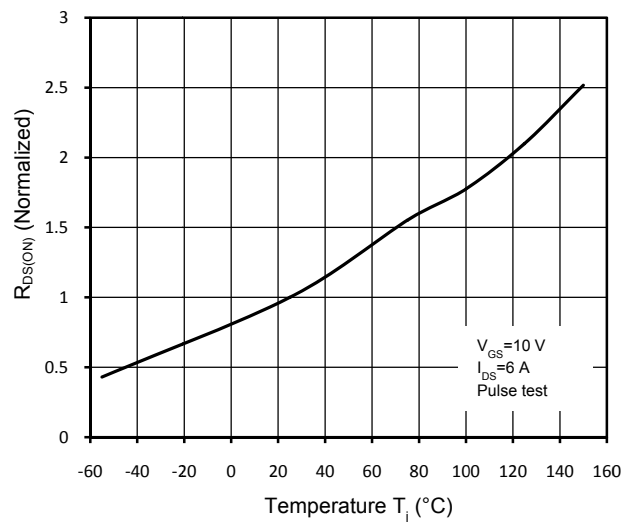


Figure 6. Normalized  $R_{DS(on)}$  vs. Temperature

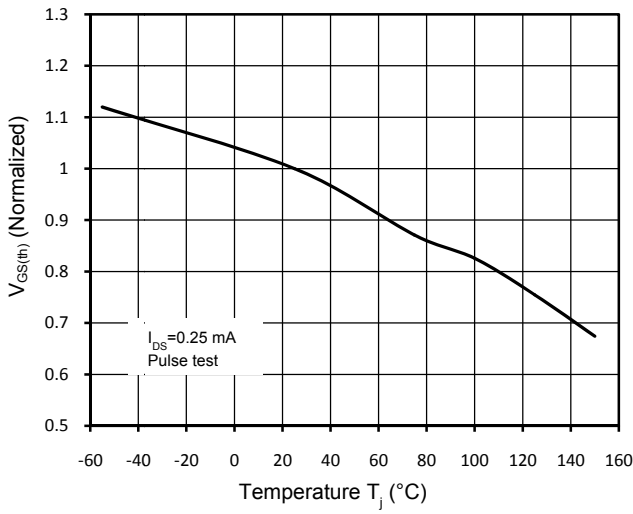


Figure 7. Threshold Voltage vs. Temperature

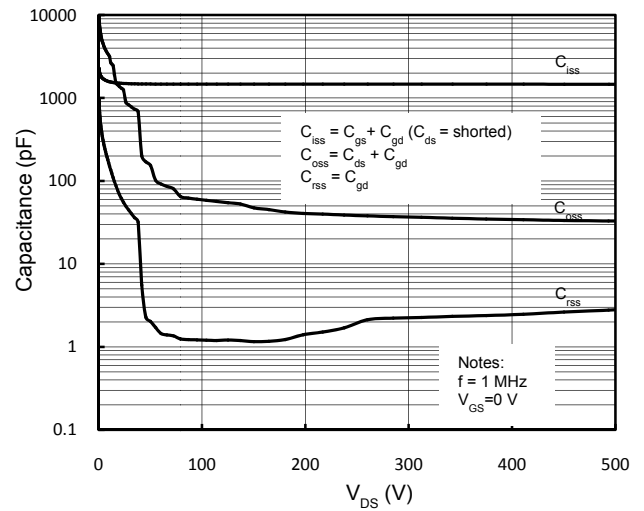


Figure 8. Capacitance Characteristics

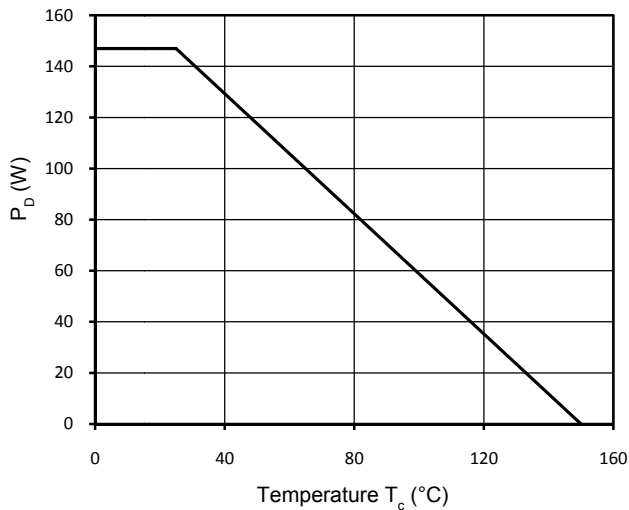


Figure 9. Power Dissipation

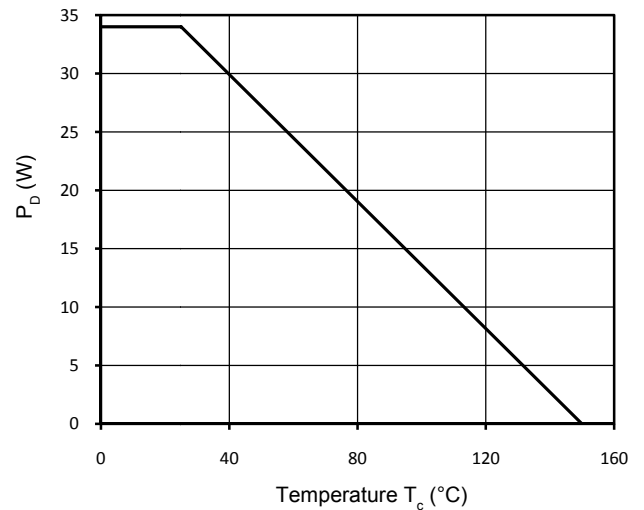


Figure 10. Power Dissipation (TO-220F)

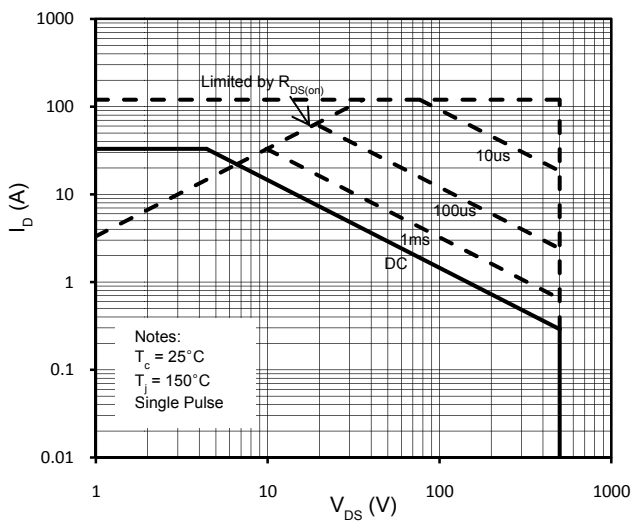


Figure 11. Maximum Safe Operating Area

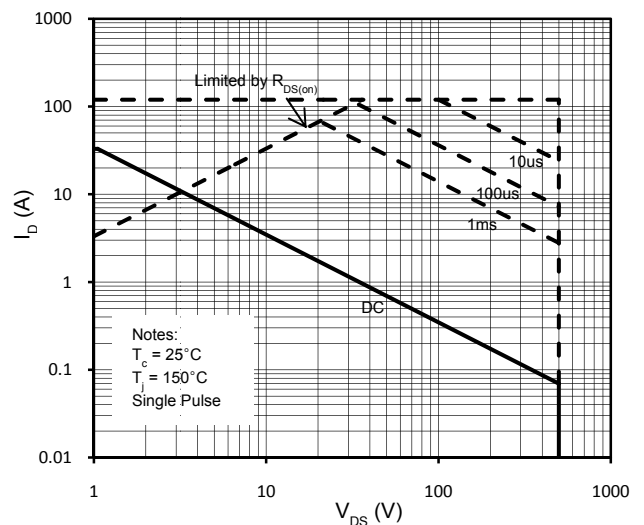


Figure 12. Maximum Safe Operating Area (TO-220F)

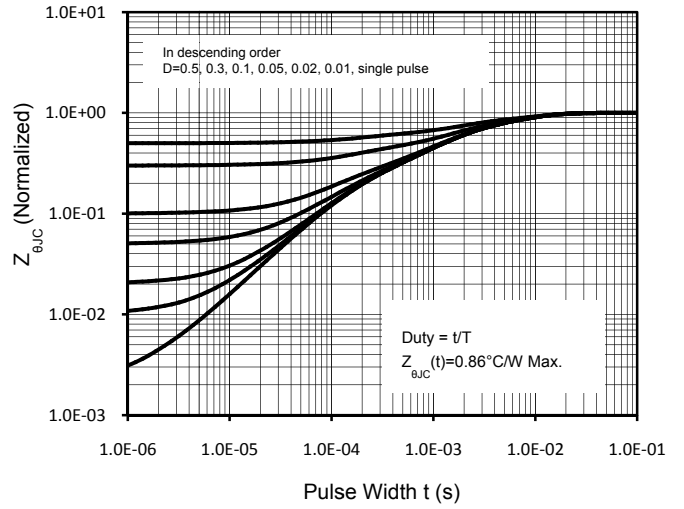
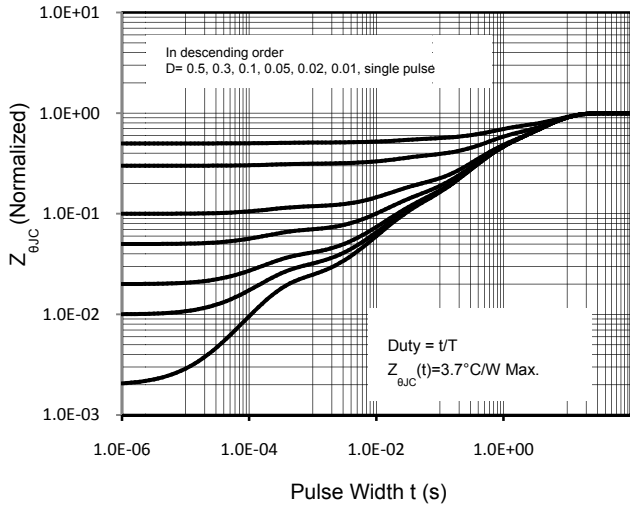


Figure 13. Transient Thermal Response Curve (TO-220F) Figure 14. Transient Thermal Response Curve

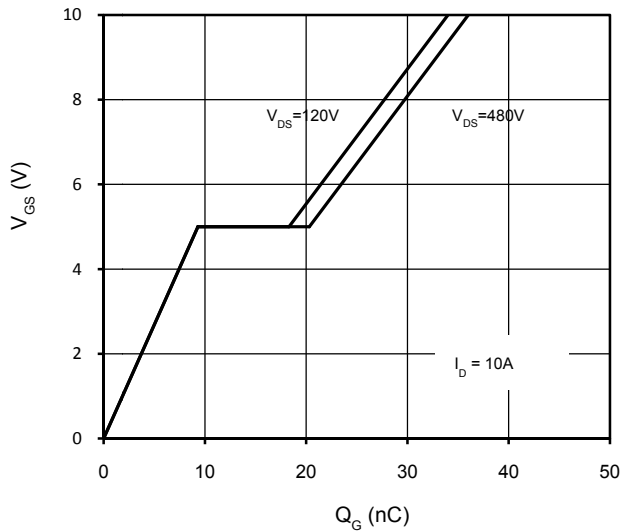
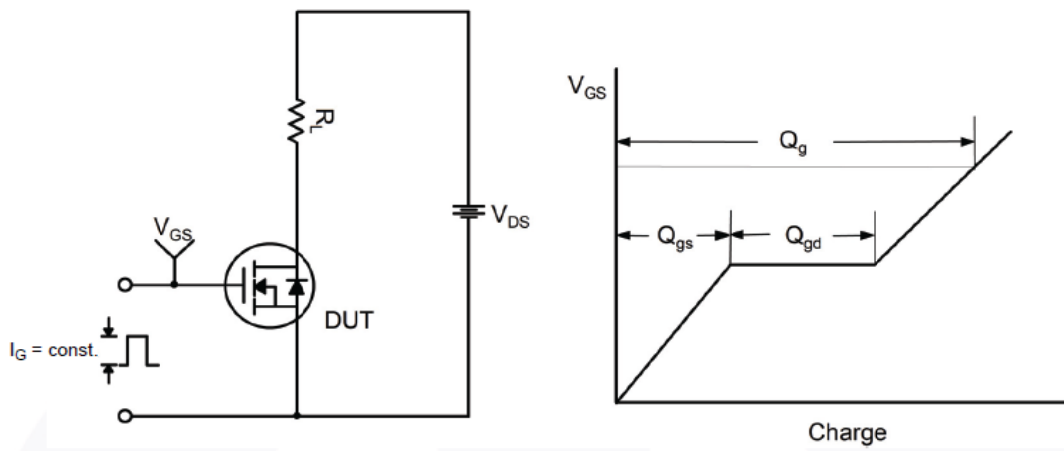
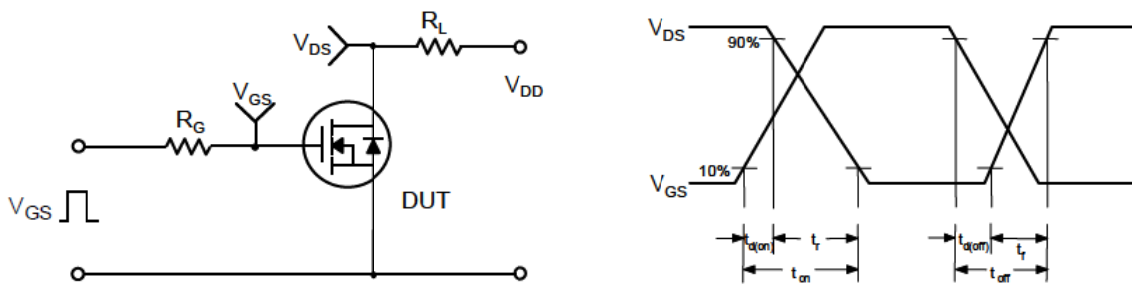


Figure 15. Gate Charge Characteristics

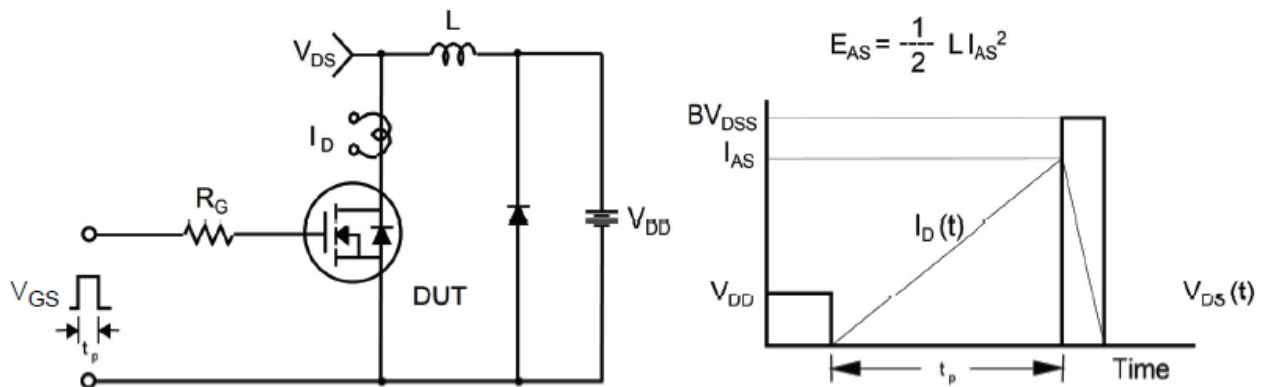
### Gate Charge Test Circuit & Waveform



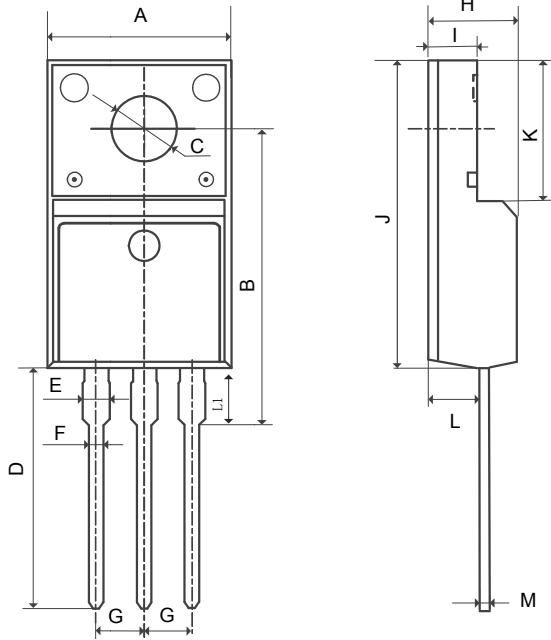
### Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms



Mechanical Dimensions for TO-220F

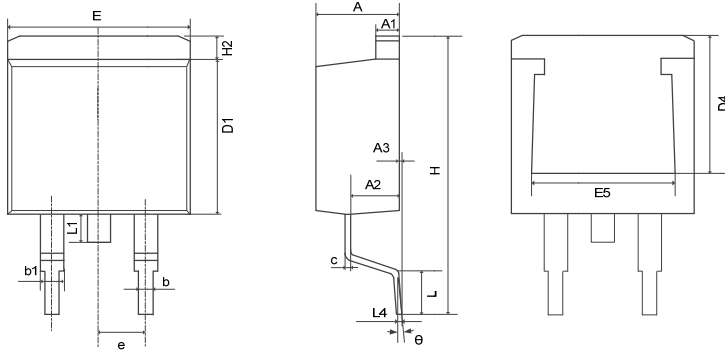


COMMON DIMENSIONS

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

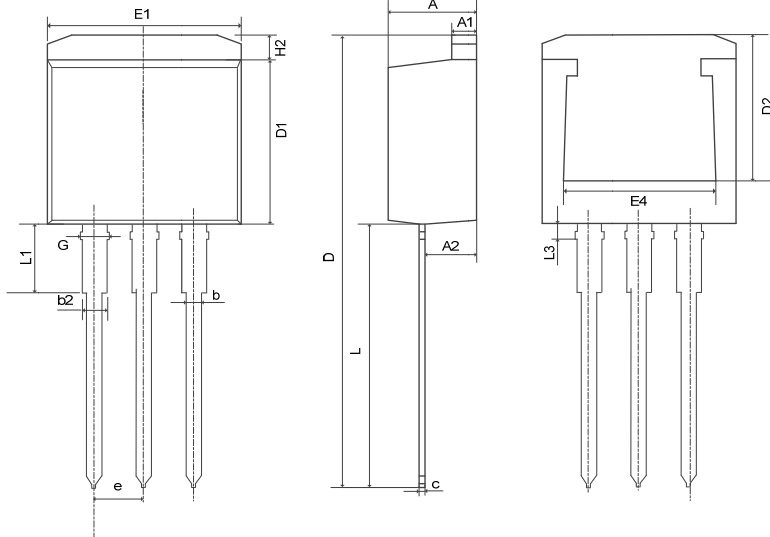
COMMON DIMENSIONS



SYMBOL	MM	
	MIN	MAX
A	4.37	4.89
A1	1.17	1.42
A2	2.19	2.89
b	0.70	0.96
b1	1.17	1.47
c	0.30	0.60
D1	8.45	9.35
D4	6.60	—
E	9.80	10.40
E5	7.06	—
e	2.54BSC	
H	14.70	16.00
H2	1.07	1.47
L	2.00	2.70
L1	1.15	1.75
L4	0.25BSC	
θ	0°	9°

Mechanical Dimensions for TO-262

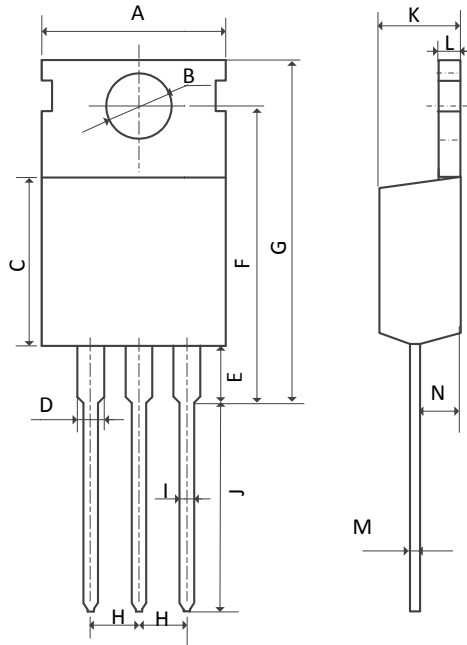
COMMON DIMENSIONS



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

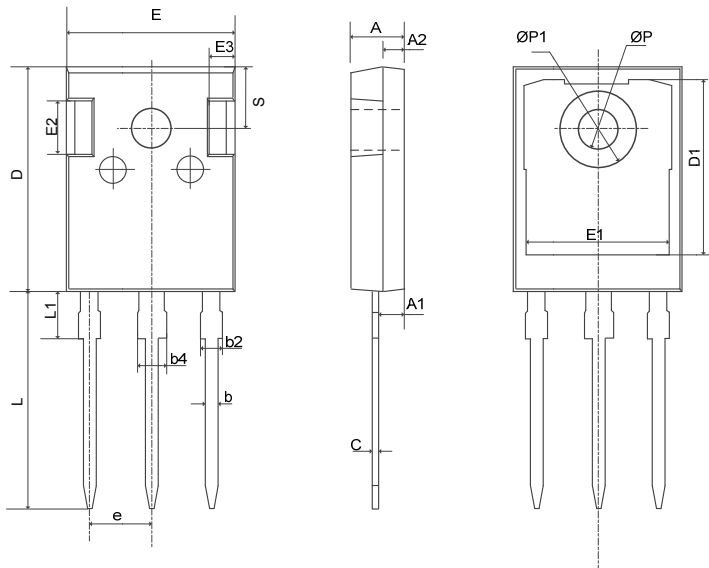
COMMON DIMENSIONS



SYMBOL	MM	
	MIN	MAX
A	9.70	10.30
B	3.40	3.80
C	8.80	9.40
D	1.17	1.47
E	2.60	3.50
F	15.10	16.90
G	19.60MAX	
H	2.54REF	
I	0.70	0.95
J	9.25	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

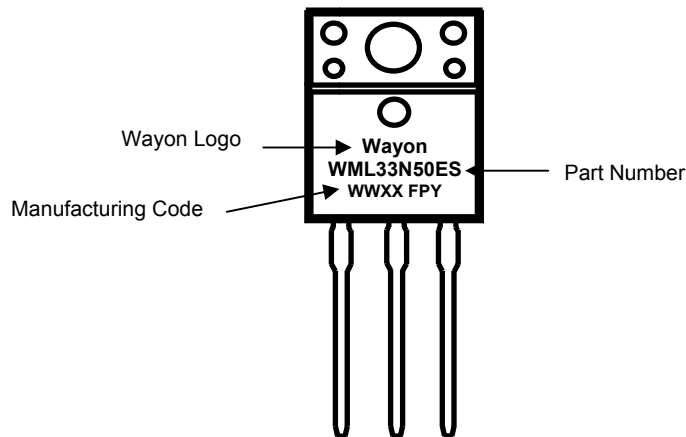


SYMBOL	MM	
	MIN	MAX
A	4.80	5.21
A1	2.21	2.61
A2	1.85	2.16
b	1.07	1.36
b2	1.91	2.41
b4	2.87	3.38
c	0.51	0.75
D	20.70	21.30
D1	16.25	17.65
E	15.50	16.13
E1	12.38	13.60
E2	3.68	5.20
E3	1.00	2.70
e	5.44BSC	
L	19.62	20.32
L1	—	4.40
ØP	3.40	3.80
ØP1	—	7.30
S	6.15BSC	

## Ordering Information

Part	Package	Marking	Packing method
WML33N50ES	TO-220F	WML33N50ES	Tube
WMK33N50ES	TO-220	WMK33N50ES	Tube
WMN33N50ES	TO-262	WMN33N50ES	Tube
WMM33N50ES	TO-263	WMM33N50ES	Tape and Reel
WMJ33N50ES	TO-247	WMJ33N50ES	Tube

## Marking Information



## Contact Information

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

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