

## N-channel 250V 295mΩ Power MOSFET

### Description

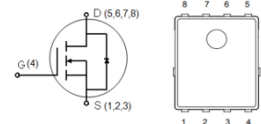
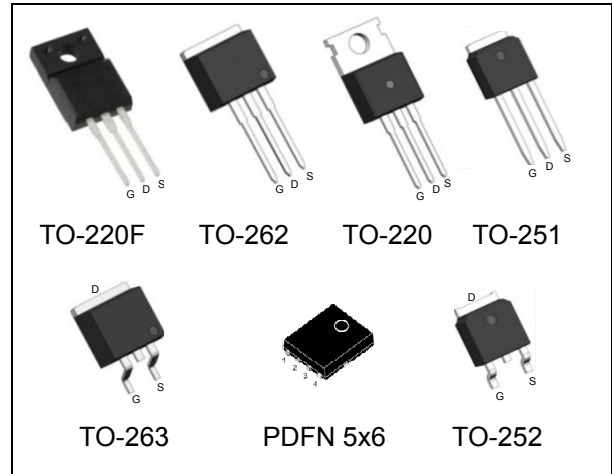
WMOS<sup>TM</sup> JN is suitable for applications which require superior power density and outstanding efficiency.

### Features

- Gate charge minimized
- Typ.  $R_{DS(on)} = 295\text{ m}\Omega$
- 100% UIS tested
- Pb-free plating, Halogen free

### Applications

Switching applications



PDFN 5x6

### Absolute Maximum Ratings

Parameter	Symbol	WMx09N25JN	WML09N25JN	Unit
Drain-source voltage	$V_{DSS}$	250		V
Continuous drain current <sup>1)</sup> ( $T_C = 25^\circ\text{C}$ )	$I_D$	7		A
		4.2		A
Pulsed drain current <sup>2)</sup>	$I_{DM}$	21		A
Gate-source voltage	$V_{GS}$	$\pm 20$		V
Avalanche energy, single pulse <sup>3)</sup>	$E_{AS}$	50		mJ
Avalanche energy, repetitive <sup>2)</sup>	$E_{AR}$	0.1		mJ
Avalanche current, repetitive <sup>2)</sup>	$I_{AR}$	0.9		A
Power dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	$P_D$	31	17	W
		0.25	0.14	W/ $^\circ\text{C}$
Operating and storage temperature range	$T_j, T_{stg}$	-55 to +150		$^\circ\text{C}$
Continuous diode forward current	$I_S$	7		A
Diode pulse current	$I_{S,pulse}$	21		A

### Thermal Characteristics

Parameter	Symbol	WMx09N25JN	WML09N25JN	Unit
Thermal resistance, junction-to-case	$R_{\theta JC}$	4	7	$^\circ\text{C}/\text{W}$
Thermal resistance, junction-to-ambient	$R_{\theta JA}$	62	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	$BV_{DSS}$	$V_{GS}=0\text{ V}, I_D=1\text{ mA}$	250	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=0.25\text{mA}$	2.5	3.5	4.5	V
Drain cut-off current	$I_{DSS}$	$V_{DS}=250\text{ V}, V_{GS}=0\text{V},$ $T_j = 25^\circ\text{C}$ $T_j = 125^\circ\text{C}$	-	-	1	$\mu\text{A}$
			-	30	-	
Gate leakage current, forward	$I_{GSSF}$	$V_{GS}=20\text{V}, V_{DS}=0\text{V}$	-	-	500	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=3\text{A}$ $T_j = 25^\circ\text{C}$	-	-	-	m $\Omega$
			-	295	360	
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS}= 100\text{V}, V_{GS}= 0\text{V},$ $f = 1\text{ MHz}$	-	191	-	pF
Output capacitance	$C_{oss}$		-	8	-	
Reverse transfer capacitance	$C_{rss}$		-	0.4	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 100\text{V}, I_D = 3\text{A}$ $R_G = 4.7\Omega, V_{GS}=10\text{V}$	-	3	-	ns
Rise time	$t_r$		-	4	-	
Turn-off delay time	$t_{d(off)}$		-	8	-	
Fall time	$t_f$		-	3	-	
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DD}=160\text{V}, I_D=3\text{A},$ $V_{GS}=0\text{ to }10\text{V}$	-	1.7	-	nC
Gate to drain charge	$Q_{gd}$		-	0.8	-	
Gate charge total	$Q_g$		-	3.9	-	
Gate plateau voltage	$V_{plateau}$		-	5.5	-	V
<b>Reverse diode characteristics</b>						
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=3\text{A}$	-	-	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=50\text{V}, I_F=3\text{A},$ $di_F/dt=100\text{A}/\mu\text{s}$	-	75	-	ns
Reverse recovery charge	$Q_{rr}$		-	0.2	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	5.7	-	A

## Notes:

- Limited by  $T_{j\text{max}}$ . Maximum duty cycle  $D=0.5$ .
- Repetitive rating: pulse width limited by maximum junction temperature.
- $I_{AS} = 0.9\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , starting  $T_j = 25^\circ\text{C}$ .

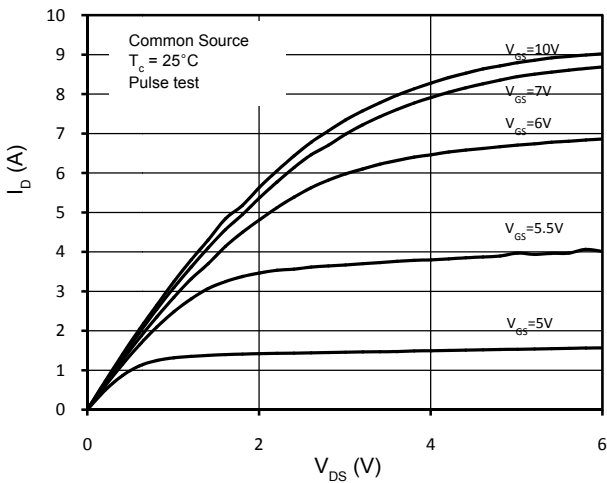


Figure 1. On-Region Characteristics

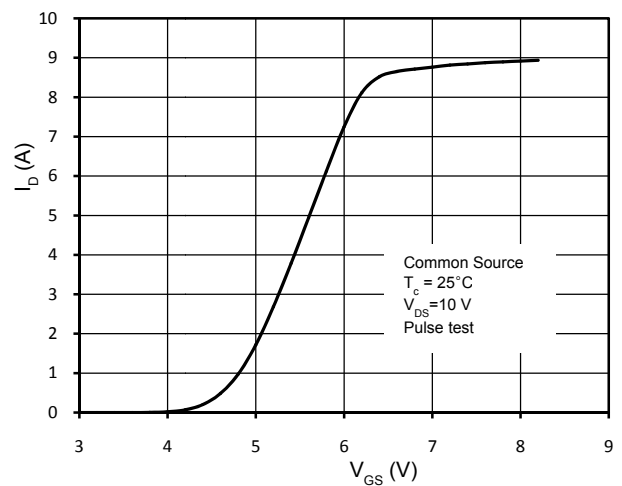


Figure 2. Transfer Characteristics

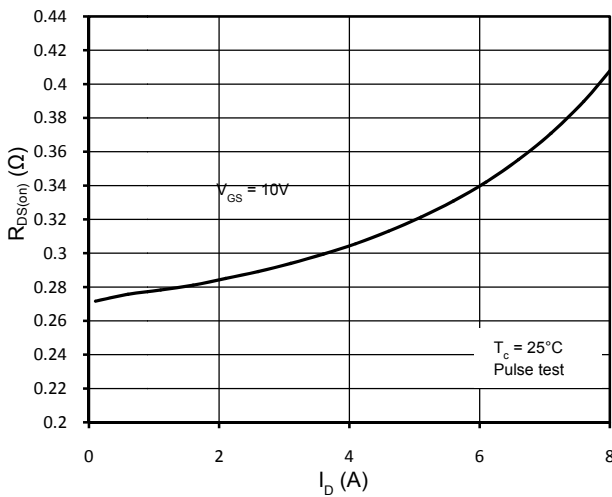


Figure 3. Static Drain-Source On Resistance

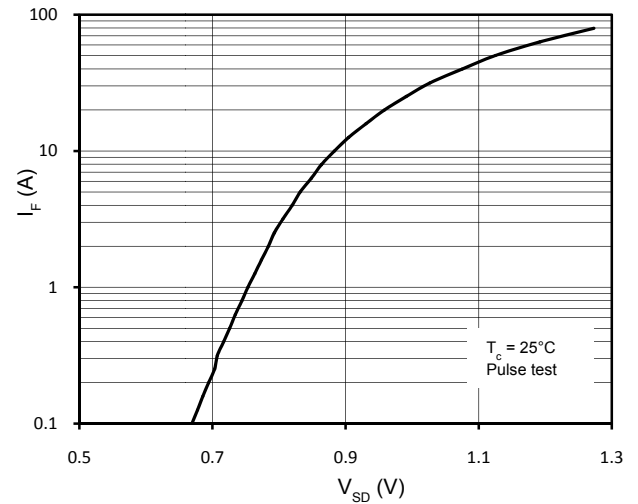


Figure 4. Body-Diode Forward Characteristics

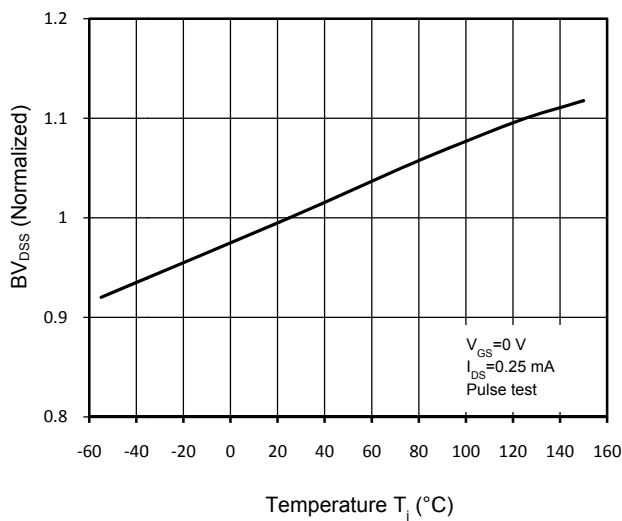


Figure 5. Normalized  $BV_{DS(s)}$  vs. Temperature

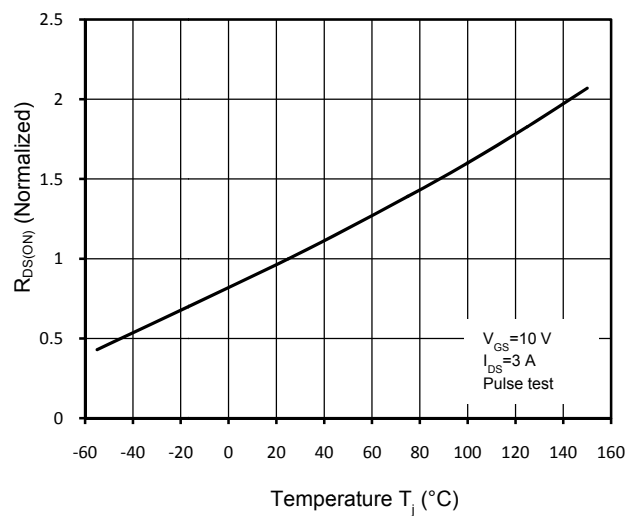


Figure 6. Normalized  $R_{DS(on)}$  vs. Temperature

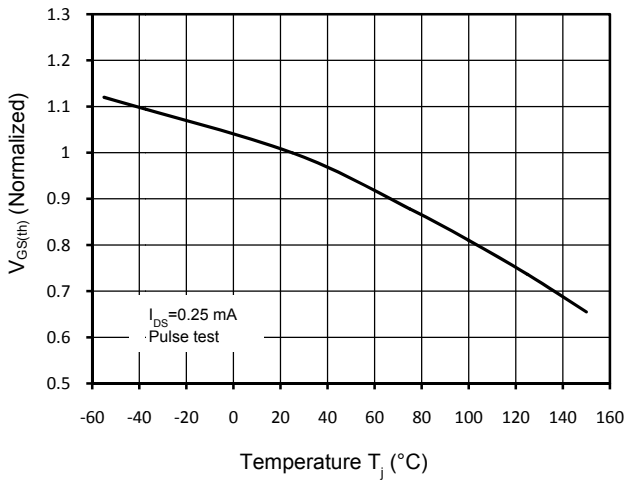


Figure 7. Threshold Voltage vs. Temperature

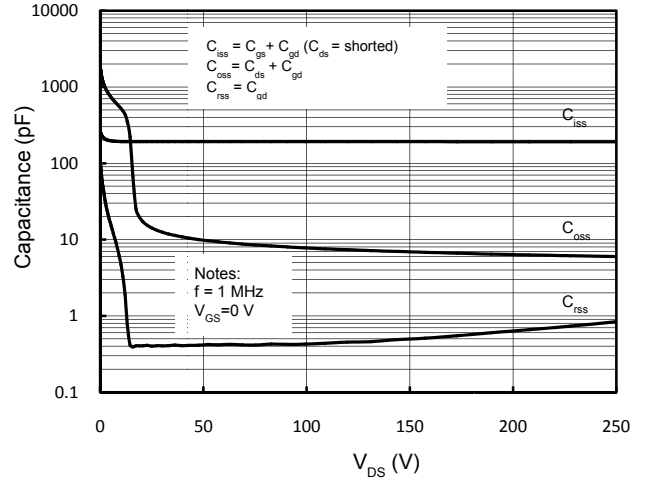


Figure 8. Capacitance Characteristics

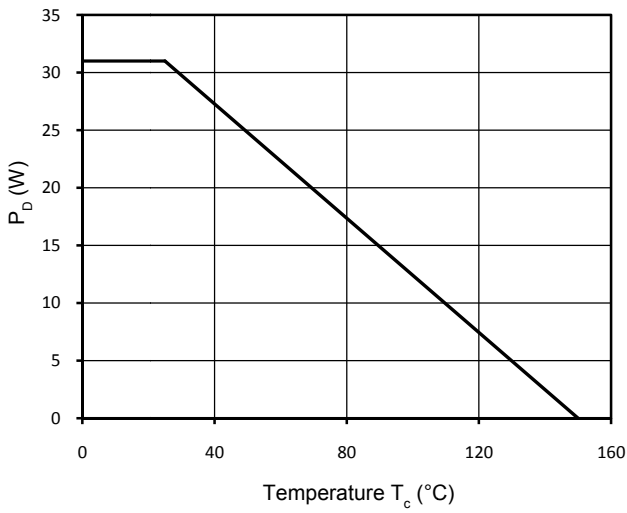


Figure 9. Power Dissipation

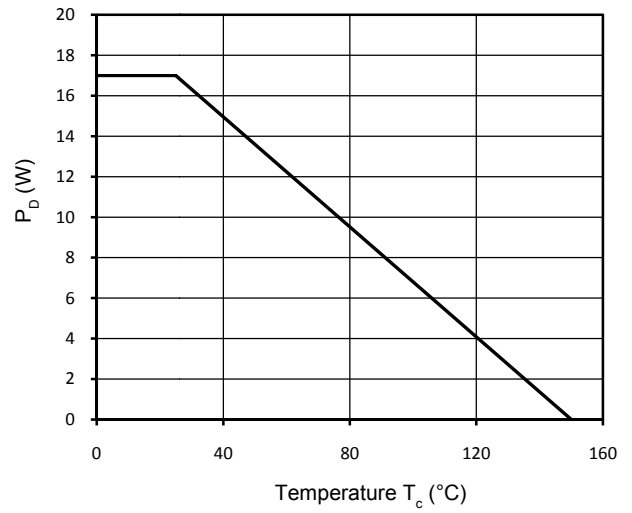


Figure 10. Power Dissipation (TO-220F)

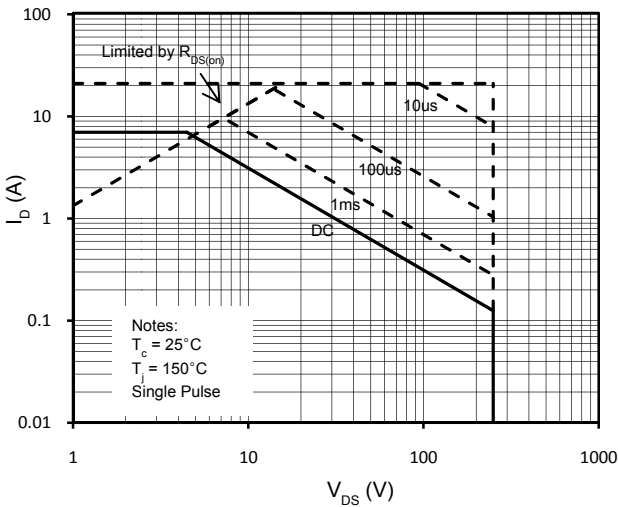


Figure 11. Maximum Safe Operating Area

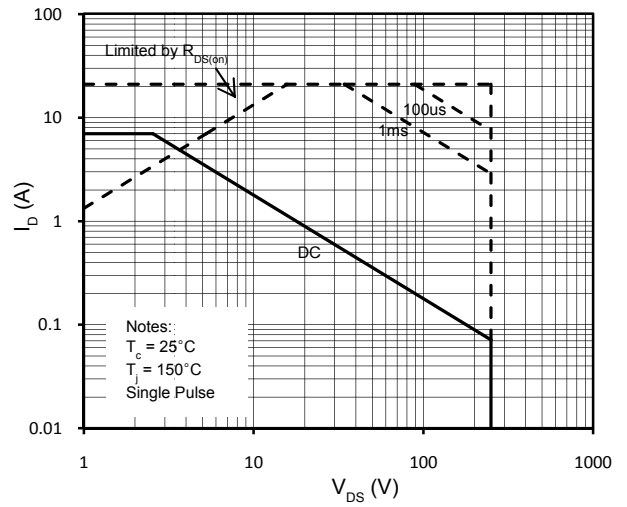


Figure 12. Maximum Safe Operating Area (TO-220F)

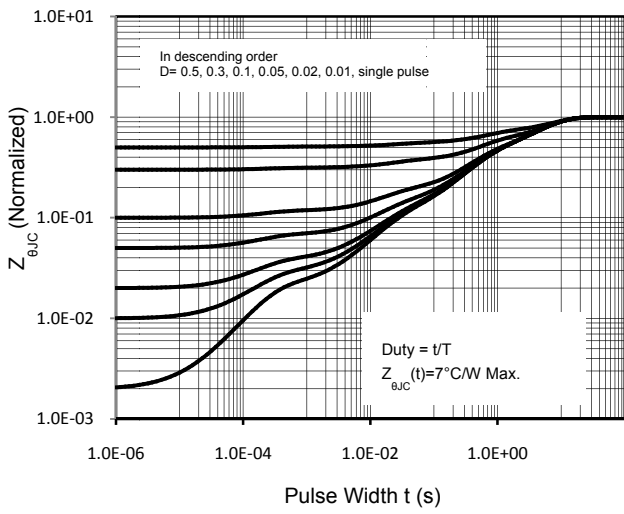


Figure 13. Transient Thermal Response Curve (TO-220F)

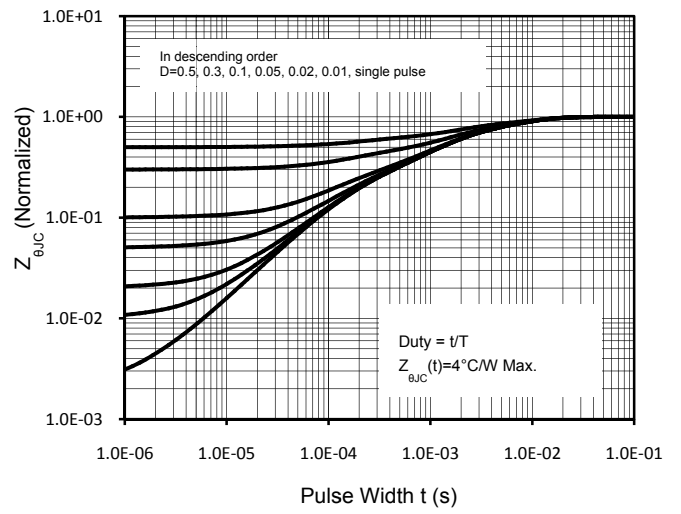


Figure 14. Transient Thermal Response Curve

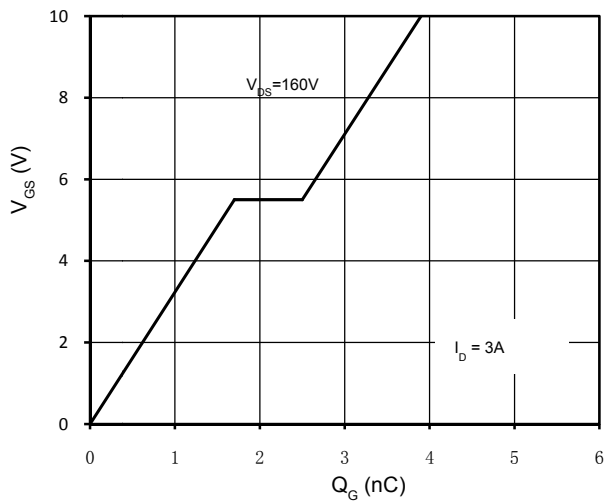
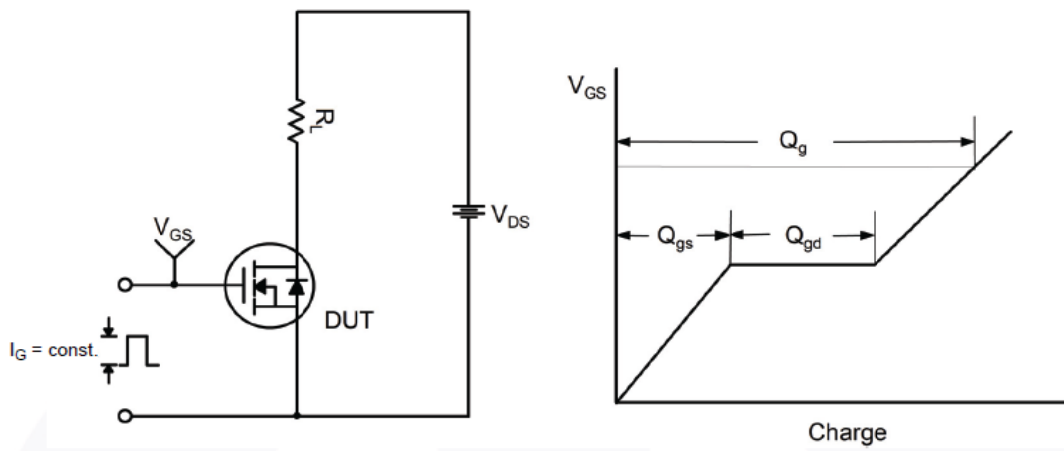


Figure 15. Gate Charge Characteristics

### Gate Charge Test Circuit & Waveform



### Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms



Mechanical Dimensions for TO-220F

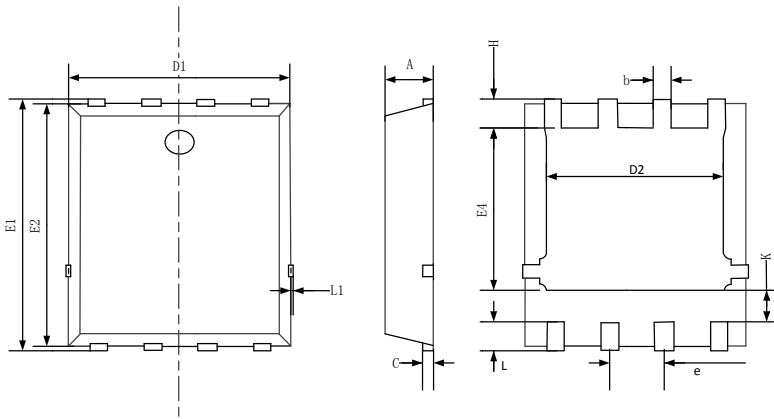


COMMON DIMENSIONS

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 PDFN 5x6

COMMON DIMENSIONS

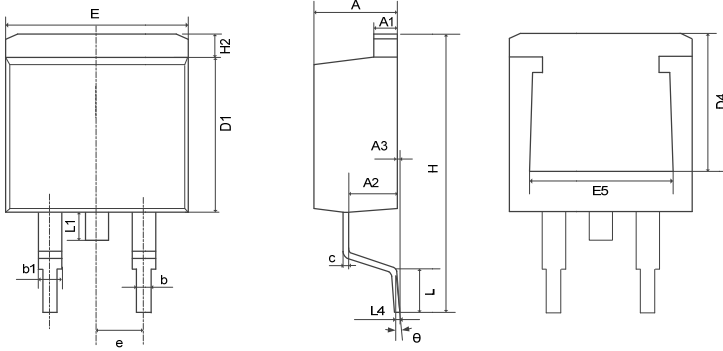


SYMBOL	MM	
	MIN	MAX
A	1.0	1.2
b	0.3	0.5
C	0.15	0.35
D1	5.0	5.4
D2	3.8	4.3
E1	5.95	6.35
E2	5.66	6.06
E4	3.52	3.92
e	1.17	1.37
H	0.4	0.6
K	1.15	1.6
L	0.3	0.7
L1		0.12



Mechanical Dimensions for TO-263

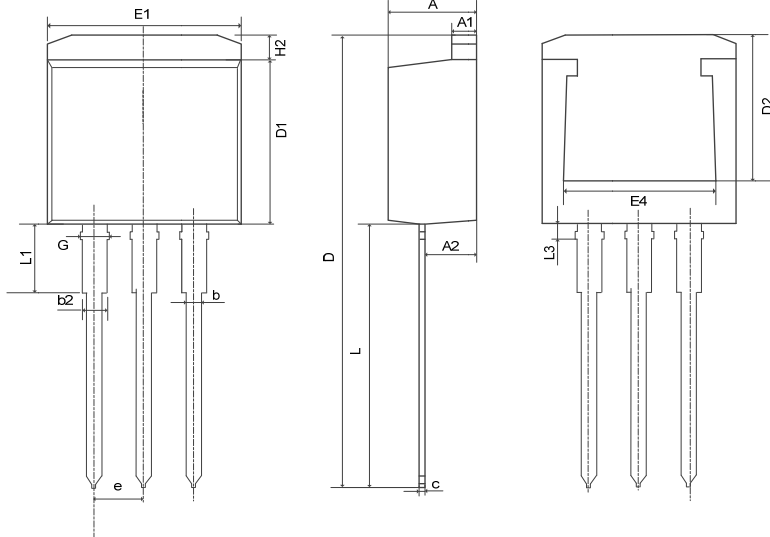
COMMON DIMENSIONS



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

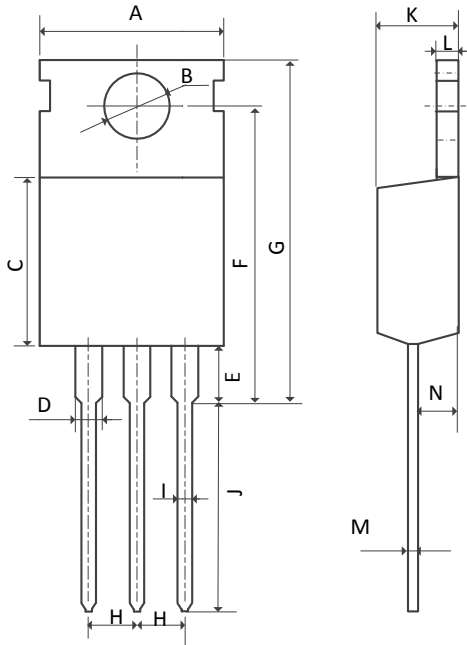
## COMMON DIMENSIONS



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

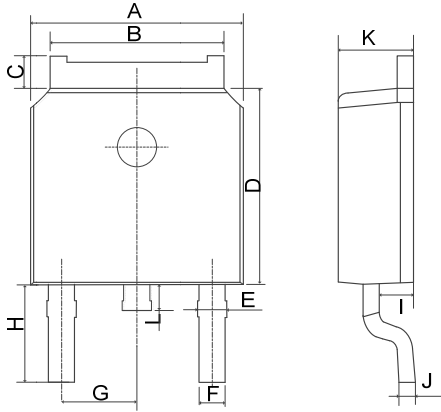
COMMON DIMENSIONS



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-252

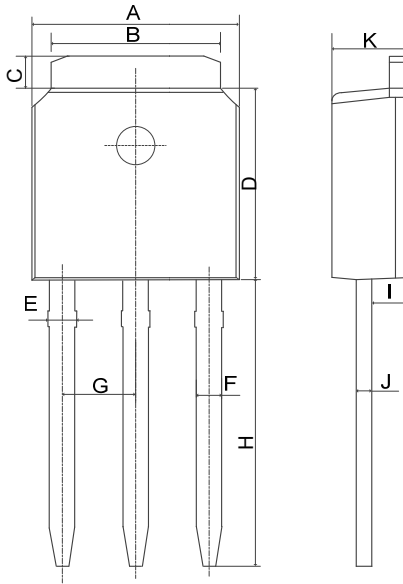
COMMON DIMENSIONS



SYMBOL	MM	
	MIN	MAX
A	6.40	6.80
B	5.13	5.50
C	0.88	1.28
D	5.90	6.22
E	0.68	1.10
F	0.68	0.91
G	2.29REF	
H	2.90REF	
I	0.85	1.17
J	0.51REF	
K	2.10	2.50
L	0.40	1.00

## Mechanical Dimensions for TO-251

## COMMON DIMENSIONS

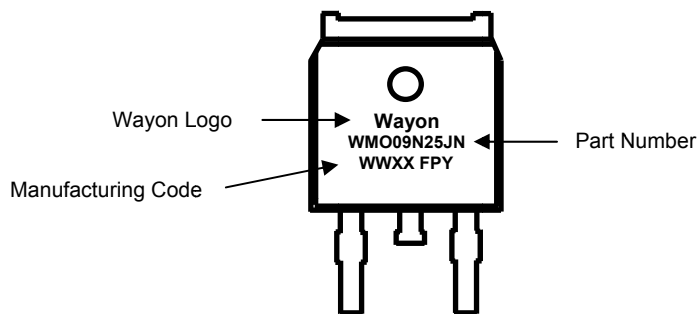


SYMBOL	MM	
	MIN	MAX
A	6.40	6.80
B	5.13	5.50
C	0.88	1.28
D	5.90	6.22
E	0.68	1.10
F	0.68	0.91
G	2.29REF	
H	9.00	9.65
I	0.85	1.17
J	0.40	0.61
K	2.10	2.50

## Ordering Information

Part	Package	Marking	Packing method
WML09N25JN	TO-220F	WML09N25JN	Tube
WMK09N25JN	TO-220	WMK09N25JN	Tube
WMN09N25JN	TO-262	WMN09N25JN	Tube
WMM09N25JN	TO-263	WMM09N25JN	Tape and Reel
WMO09N25JN	TO-252	WMO09N25JN	Tape and Reel
WMB09N25JN	PDFN 5x6	WMB09N25JN	Tape and Reel
WMP09N25JN	TO-251	WMP09N25JN	Tube

## Marking Information




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