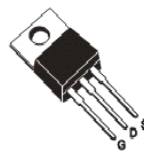


1.Features

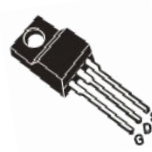
- $V_{DS(V)}=650V$
- $I_D=4A$
- $R_{DS(ON)}\leq 2.7\Omega(V_{GS}=10V)$

2.Pinning information

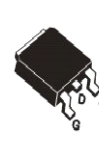
Pin	Symbol	Description
1	G	GATE
2	D	DRAIN
3	S	SOURCE



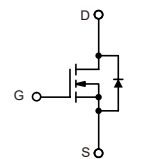
TO-220



TO-220F



TO-252



N-Channel

3.Absolute Maximum Ratings $T_c= 25^{\circ}C$

Parameter		Symbol	Rating	Units
Drain-source Voltage		V_{DS}	650	V
gate-source Voltage		V_{GS}	± 30	V
Continuous Drain Current	$T_c=25^{\circ}C$	I_D	4	A
Continuous Drain Current	$T_c=100^{\circ}C$	I_D	2.5	A
Drain Current – Pulsed ①		I_{DM}	16	A
Power Dissipation	TO-220F	P_D	32	W
	TO-252		49	W
Junction Temperature		T_J	150	$^{\circ}C$
Storage Temperature		T_{STG}	-55 to 150	$^{\circ}C$
Single Pulse Avalanche Energy ②		E_{AS}	128	mJ



4.Thermal Resistance Rating

Parameter	Symbol	MAX		Units
		TO-220	TO-220F	
Thermal Resistance Junction-case	R_{thJC}	1.25	3.79	°C/W
Thermal Resistance Junction-ambient	R_{thJA}	62.5	62.5	°C/W



5. Electrical Characteristic ($T_c=25^\circ\text{C}$ unless otherwise noted)

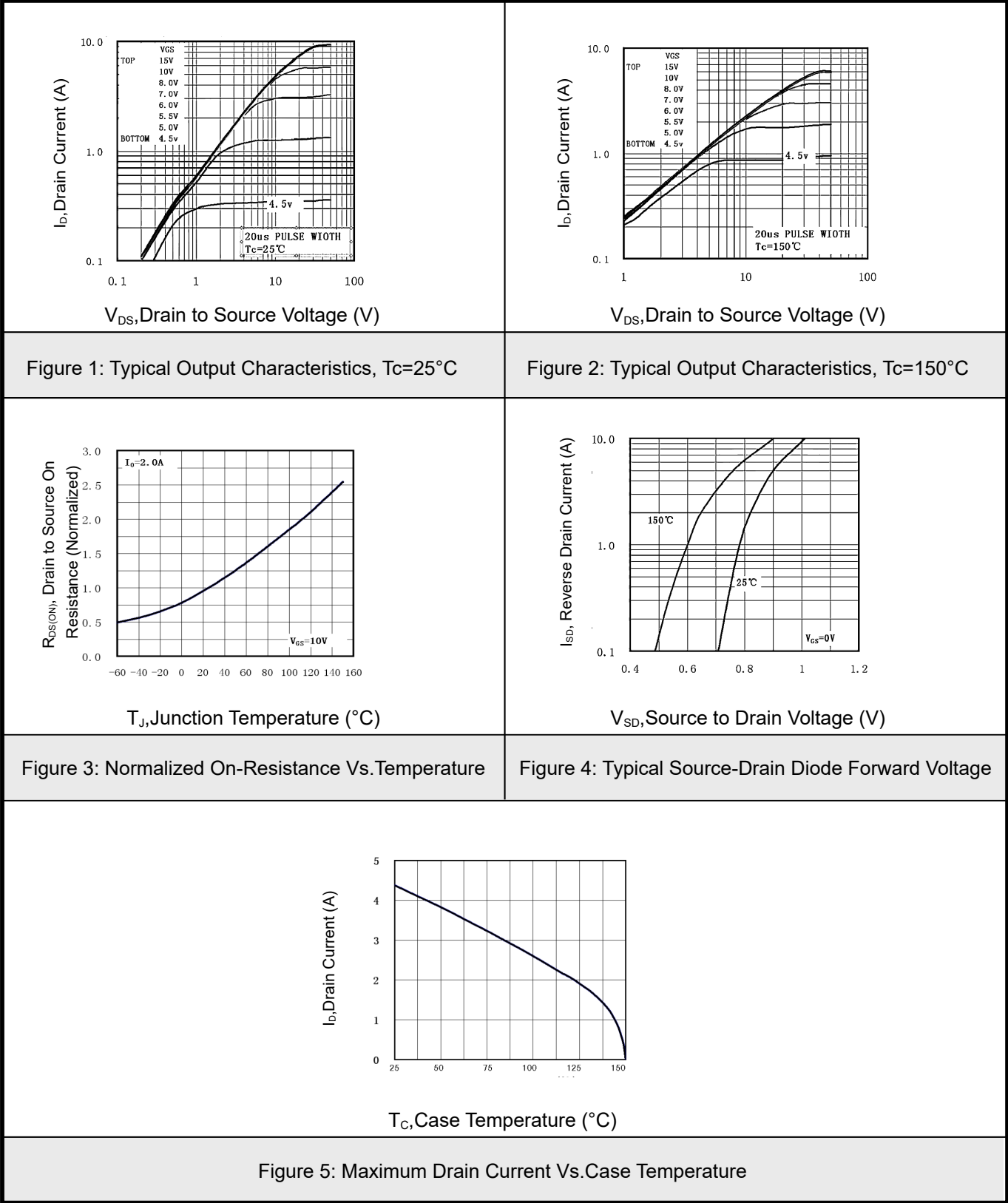
Parameter	Symbol	Conditions	Min	Typ	Max	Units
Drain-source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	650			V
Breakdown Voltage Temperature Coefficient	$\frac{\Delta BV_{DSS}}{\Delta T_J}$	$I_D=250\mu A$ Referenced to 25°C		0.6		$V/^\circ\text{C}$
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2		4	V
Drain-source Leakage Current	I_{DSS}	$V_{DS}=650V, V_{GS}=0V, T_J=25^\circ\text{C}$			1	μA
		$V_{DS}=520V, V_{GS}=0V, T_J=125^\circ\text{C}$			10	μA
Forward Transconductance	g_{fs}	$V_{DS}=40V, I_D=2A$ ③		2.5		S
Gate-body Leakage Current ($V_{DS}=0$)	I_{GSS}	$V_{GS}=\pm 30V$			± 100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=2A$ ③		2.3	2.7	Ω
Input capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$		500		pF
Turn -Off Delay Time	$t_{D(off)}$	$V_{DD}=325V, I_D=4A, R_G=25\Omega$ ③		40		ns
Total Gate Charge	Q_g	$I_D=4A, V_{DS}=520V, V_{GS}=10V$ ③		15.8		nC
Gate-to-Source Charge	Q_{gs}			3.5		nC
Gate-to-Drain Charge	Q_{gd}			6		nC
Continuous Diode Forward Current	I_S				4	A
Diode Forward Voltage	V_{SD}	$T_J=25^\circ\text{C}, I_S=4A, V_{GS}=0V$ ③			1.4	V
Reverse Recovery Time	t_{rr}	$T_J=25^\circ\text{C}, I_F=4A$		390		ns
Reverse Recovery Charge	Q_{rr}	$di/dt=100A/\mu s$ ③		1.5		μC

Notes:

- ① Repetitive rating: Pulse width limited by maximum junction temperature.
- ② Starting $T_J=25^\circ\text{C}$, $V_{DD}=50V$, $L=25\text{mH}$, $R_G=25\Omega$, $I_{AS}=4A$.
- ③ Pulse Test : Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

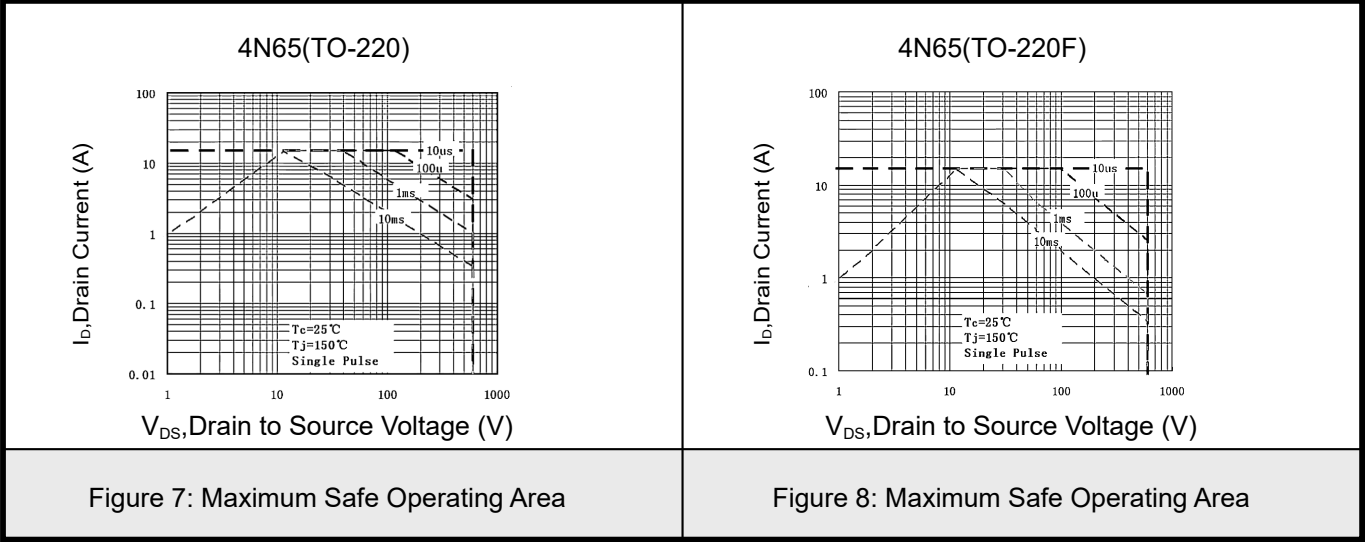


6.1 Typical Characteristic



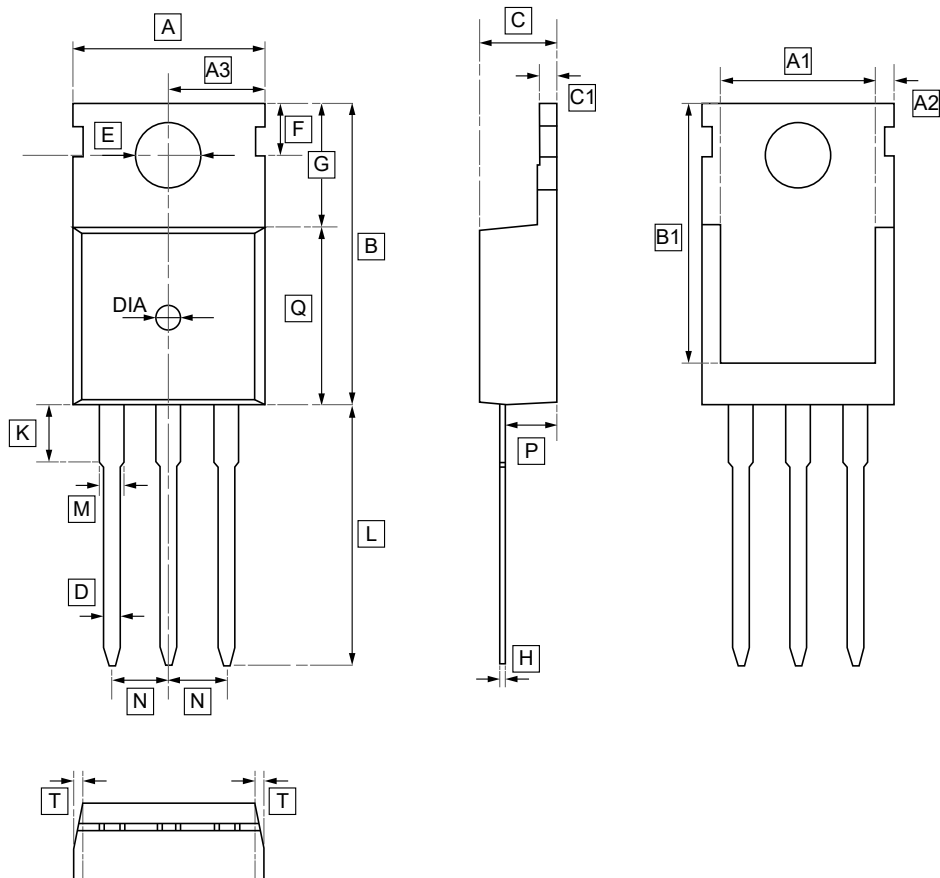


6.2 Typical Characteristic





7.1 TO-220 Package Outline Dimensions



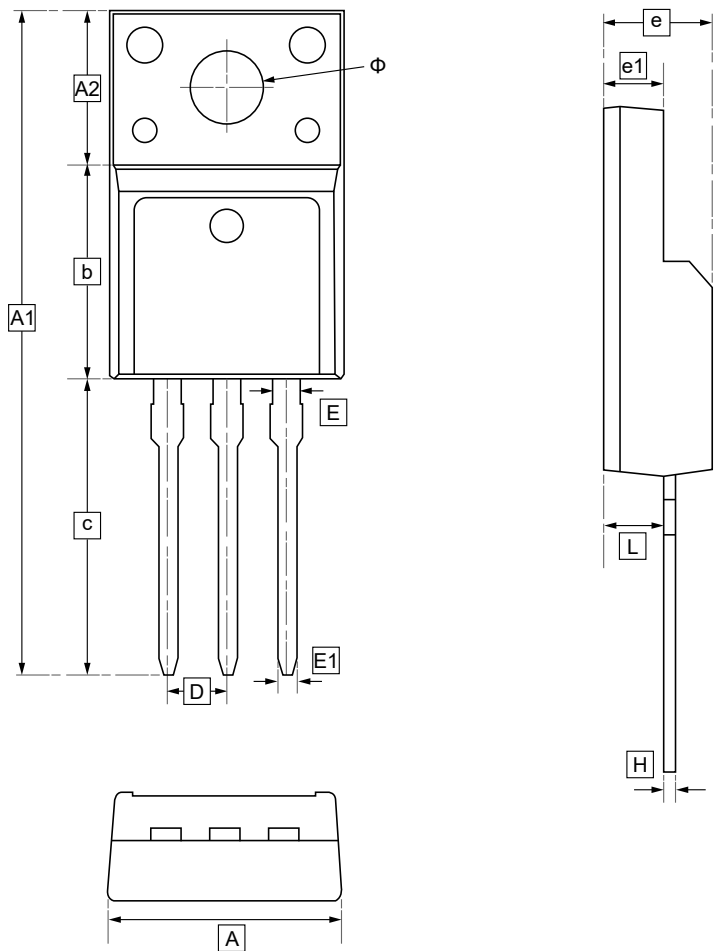
DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	A3	B	B1	C	C1	D	E	F	G
Min	9.7	8.44	1.05	4.8	15.4	12.9	4.28	1.1	0.6	3.4	2.65	5.2
Max	10.3	8.84	1.25	5.2	16.2	13.5	4.68	1.5	1.0	3.8	3.25	5.8

Symbol	H	K	L	L1	M	N	P	Q	T	DIA
Min	0.4	2.9	12.8	2.7	1.15	2.49	2.1	8.7	W:0.35	⌀1.5
Max	0.6	3.3	13.6	3.3	1.35	2.59	2.7	9.3		(deep 0.2)



7.2 TO-220F Package Outline Dimensions



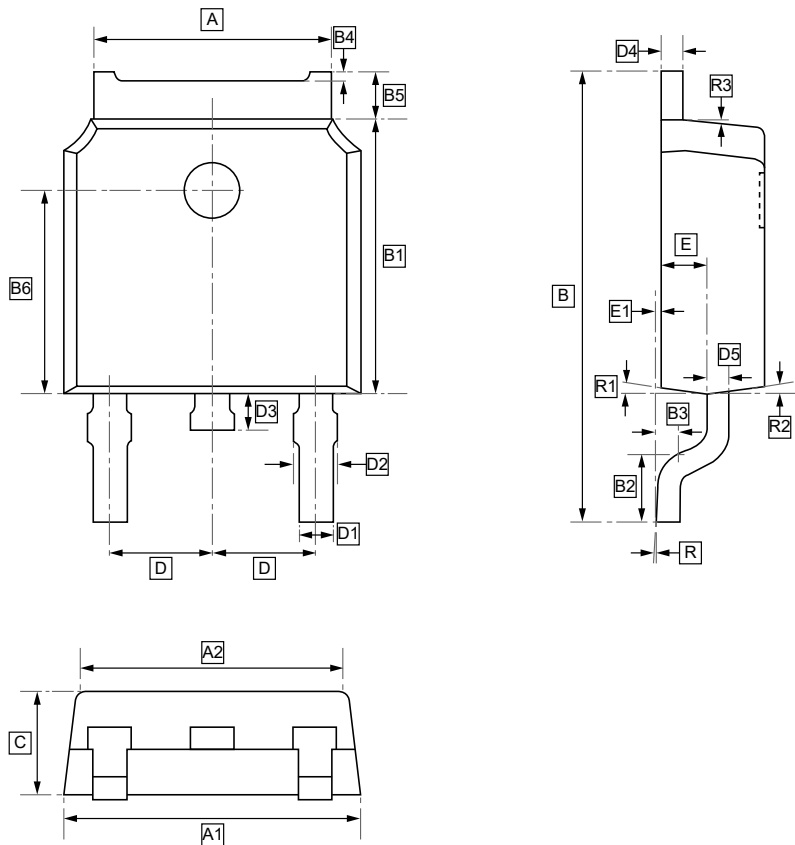
DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	Φ	e	e1	L
Min	10.00	28.80	6.58	9.12	12.95	2.54	1.15	0.75	3.13	4.50	2.40	2.50
Max	10.20	29.20	6.78	9.32	13.25		1.25	0.85	3.23	4.70	2.60	2.70

Symbol	H
Min	0.45
Max	0.55



7.3 TO-252 Package Outline Dimensions



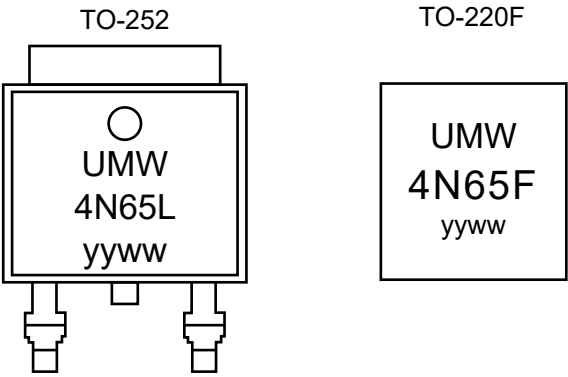
DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	B	B1	B2	B3	B4	B5	B6	C	D
Min	5.1	6.4	5.6	9.5	5.9	1.35	0.4	0.1	0.85	4.35	2.15	2.286
Max	5.5	6.8	6.0	10.3	6.3	1.65	0.6	(typ.)	1.05	4.65	2.45	(typ.)

Symbol	D1	D2	D3	D4	D5	E	E1	R	R1	R2	R3
Min	0.66	0.81	0.65	0.42	0.42	0.86	0.05	0°	7°	7°	7°
Max	0.86	1.01	0.95	0.58	0.58	1.16	0.05	6°	(typ.)	(typ.)	(typ.)



8.Ordering Information



yy: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW 4N65L	4N65L	TO-252	2500	Tape and reel
UMW 4N65F	4N65F	TO-220F	1000	Tape and box
UMW 4N65	4N65	TO-220	1000	Tape and box



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