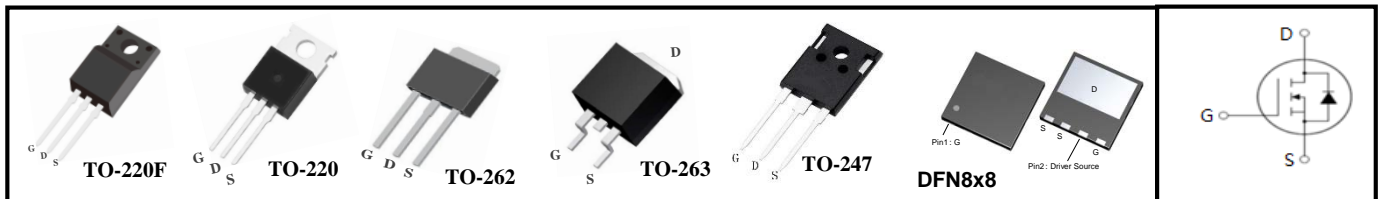


FEATURES

- $BV_{DSS}=650V, I_D=20A$
- $R_{DS(on)}:0.17\Omega(\text{Max})@V_{GS}=10V$
- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)



Device Marking and Package Information		
Ordering code	Package	Marking
WTM20N65AF	TO-220F	20N65AF XX YYWW
WTM20N65AP	TO-220	20N65AP XX YYWW
WTM20N65AZ	TO-262	20N65AZ XX YYWW
WTM20N65AT	TO-263	20N65AT XX YYWW
WTM20N65AMP	TO-247	20N65AMP XX YYWW
WTM20N65AGF	DFN 8*8	20N65AGF XX YYWW

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted				
Parameter	Symbol	Value		Unit
		TO-220F	TO-220, TO-263, TO-262, TO-247, DFN 8*8	
Drain-Source Voltage ($V_{GS} = 0V$)	V_{DSS}	650		V
Continuous Drain Current	I_D	20		A
Pulsed Drain Current (note1)	I_{DM}	60		A
Gate-Source Voltage	V_{GSS}	± 30		V
Single Pulse Avalanche Energy (note2)	E_{AS}	480		mJ
Avalanche Current (note1)	I_{AR}	3.5		A
Repetitive Avalanche Energy (note1)	E_{AR}	0.7		mJ
MOSFET dv/dt ruggedness, $V_{DS}=0 \dots 400V$	dv/dt	50		V/ns
Reverse diode dv/dt, $V_{DS}=0 \dots 400V, I_{SD} \leq I_D$	dv/dt	50		V/ns
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	34	150	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150		$^\circ\text{C}$

Thermal Resistance				
Parameter	Symbol	Value		Unit
		TO-220F	TO-220, TO-262, TO-263, TO-247, DFN 8*8	
Thermal Resistance, Junction-to-Case	R_{thJC}	4	0.83	K/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	80	62	

Specifications $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu\text{A}$	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 650V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
		$V_{DS} = 650V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	100	
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 0.25\text{mA}$	2.5	--	3.5	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 10A$	--	0.14	0.17	Ω
Gate Resistance	R_G	$f = 1.0\text{MHz}$, open drain	--	8	--	Ω
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 100V,$ $f = 1.0\text{MHz}$	--	1724	--	μF
Output Capacitance	C_{oss}		--	72	--	
Reverse Transfer Capacitance	C_{rss}		--	6	--	
Total Gate Charge	Q_g	$V_{DD} = 400V, I_D = 20A,$ $V_{GS} = 10V$	--	38.5	--	nC
Gate-Source Charge	Q_{gs}		--	8	--	
Gate-Drain Charge	Q_{gd}		--	15	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 400V, I_D = 20A,$ $V_{GS} = 10V, R_G = 25\Omega$	--	25	--	ns
Turn-on Rise Time	t_r		--	59	--	
Turn-off Delay Time	$t_{d(off)}$		--	121	--	
Turn-off Fall Time	t_f		--	44	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	$T_C = 25^\circ\text{C}$	--	--	20	A
Pulsed Diode Forward Current	I_{SM}		--	--	60	
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = 20A, V_{GS} = 0V$	--	0.9	1.2	V
Reverse Recovery Time	t_{rr}	$V_R = 400V, I_F = 20A,$ $di_F/dt = 100A/\mu\text{s}$	--	453	--	ns
Reverse Recovery Charge	Q_{rr}		--	5.1	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	22	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 3.5A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty Cycle $\leq 1\%$

Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 1. Output Characteristics

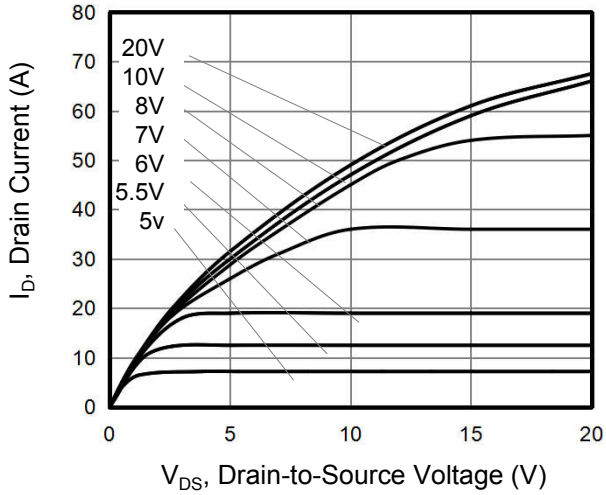


Figure 2. Transfer Characteristics

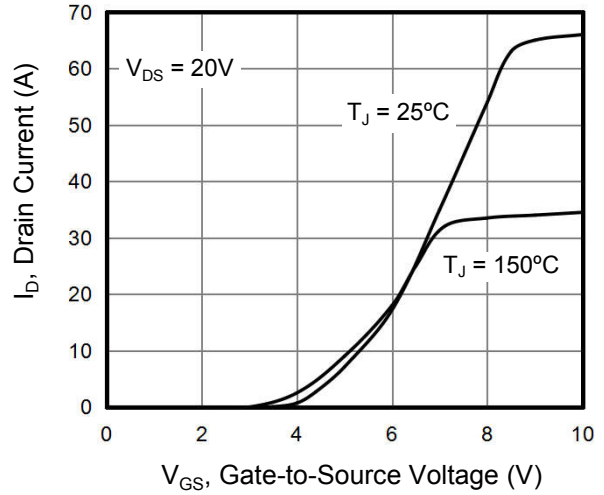


Figure 3. On-Resistance vs. Drain Current

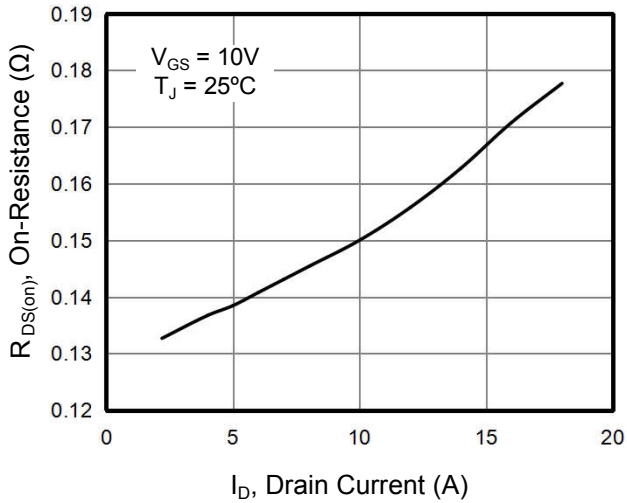


Figure 4. Capacitance

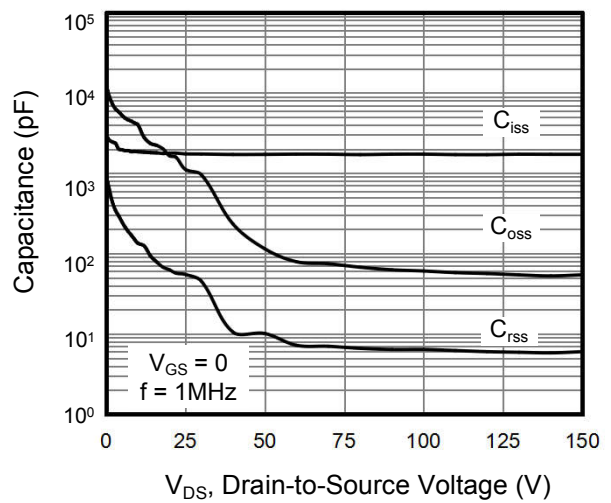


Figure 5. Gate Charge

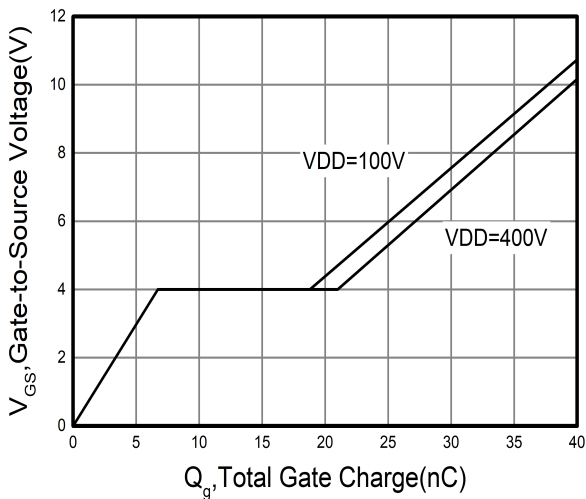
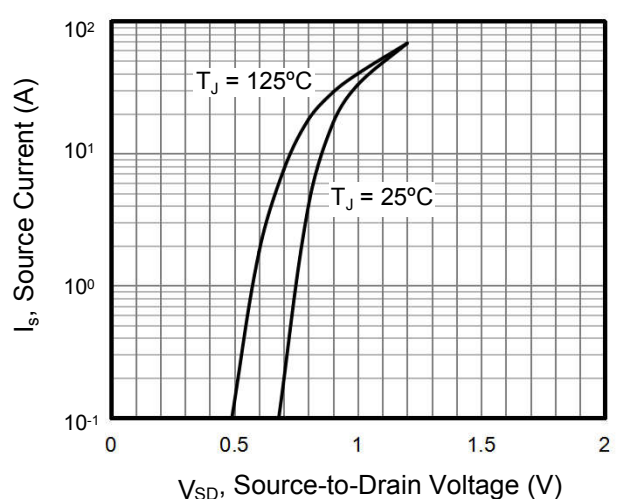


Figure 6. Body Diode Forward Voltage



Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 7. On-Resistance vs. Junction Temperature

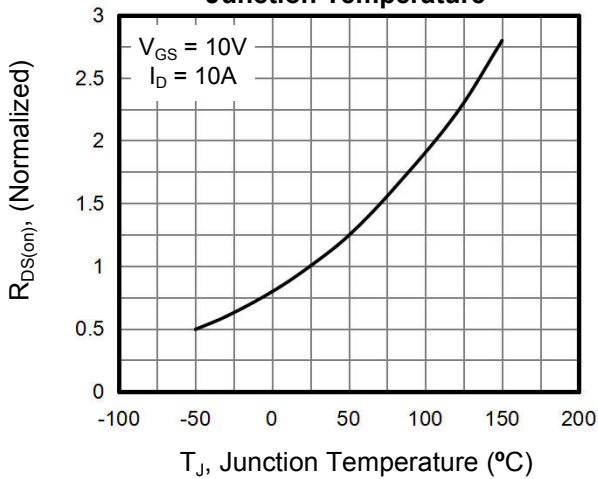


Figure 8. Threshold Voltage vs. Junction Temperature

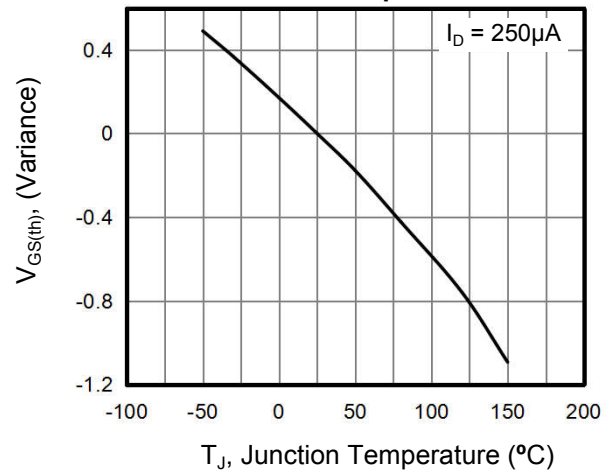


Figure 9. Transient Thermal Impedance TO-220/TO-263/TO-262/TO-247/DFN 8*8

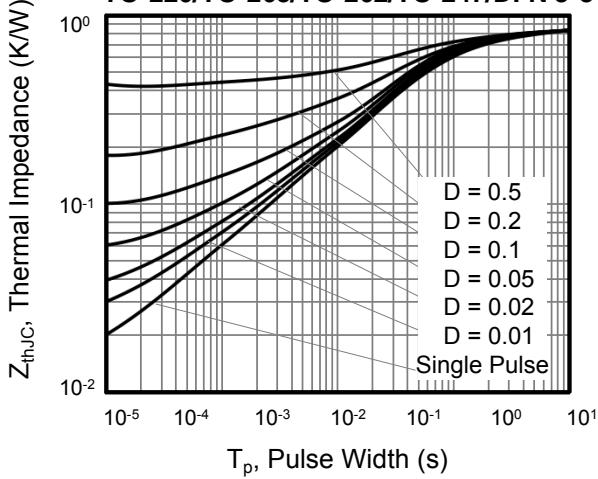


Figure 10. Transient Thermal Impedance TO-220F

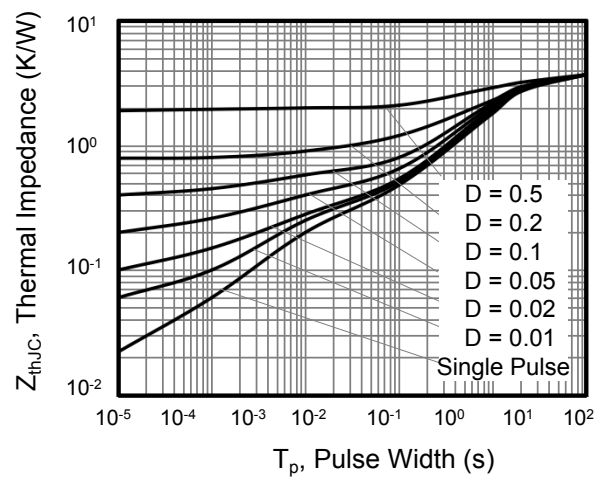


Figure A: Gate Charge Test Circuit and Waveform

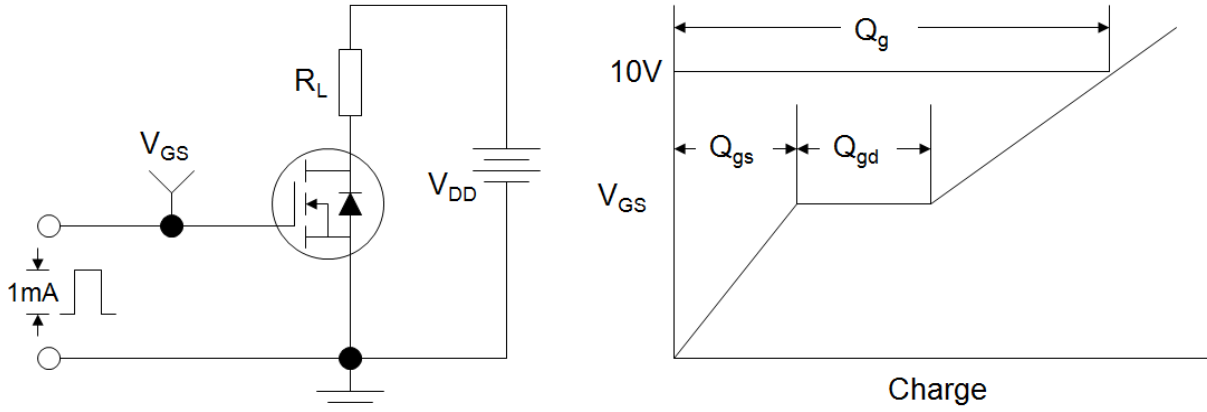


Figure B: Resistive Switching Test Circuit and Waveform

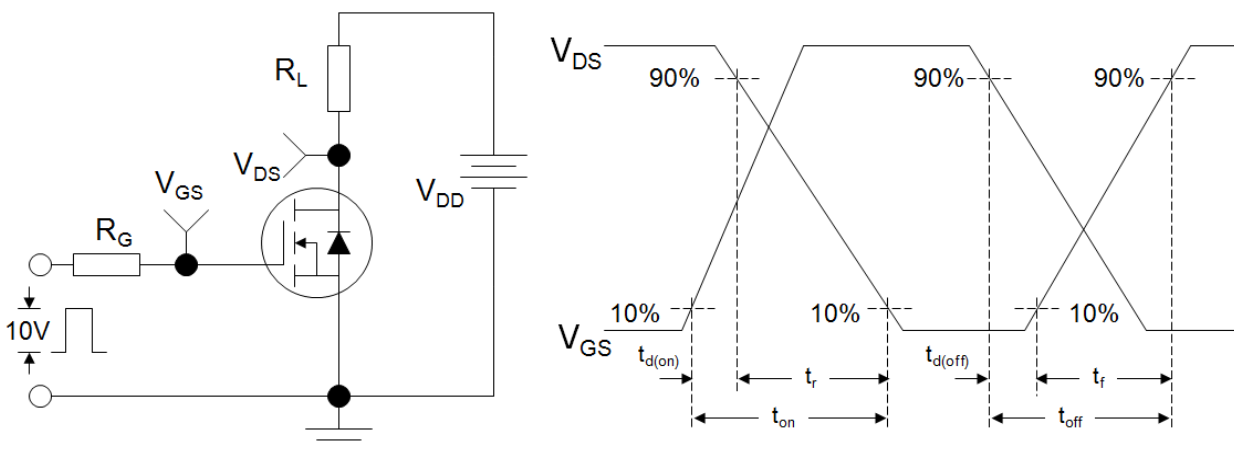
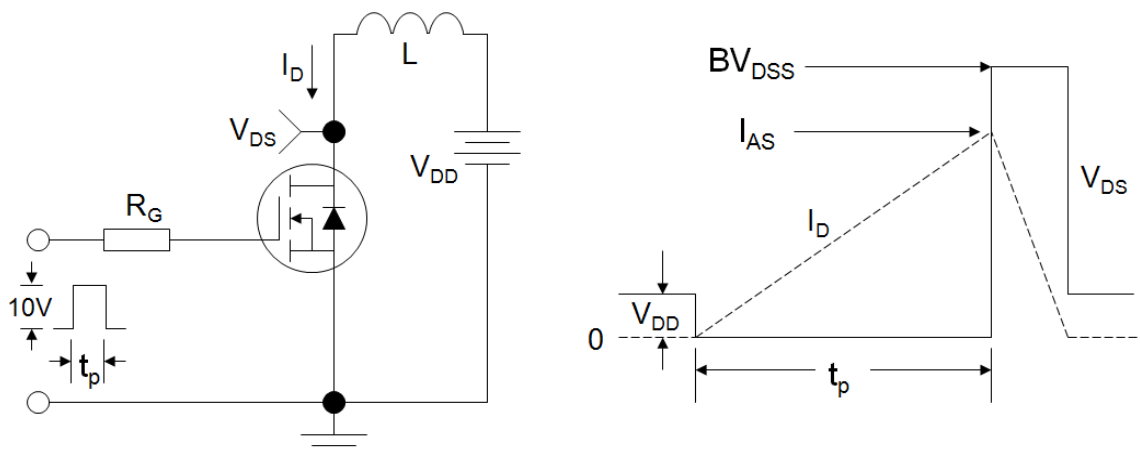
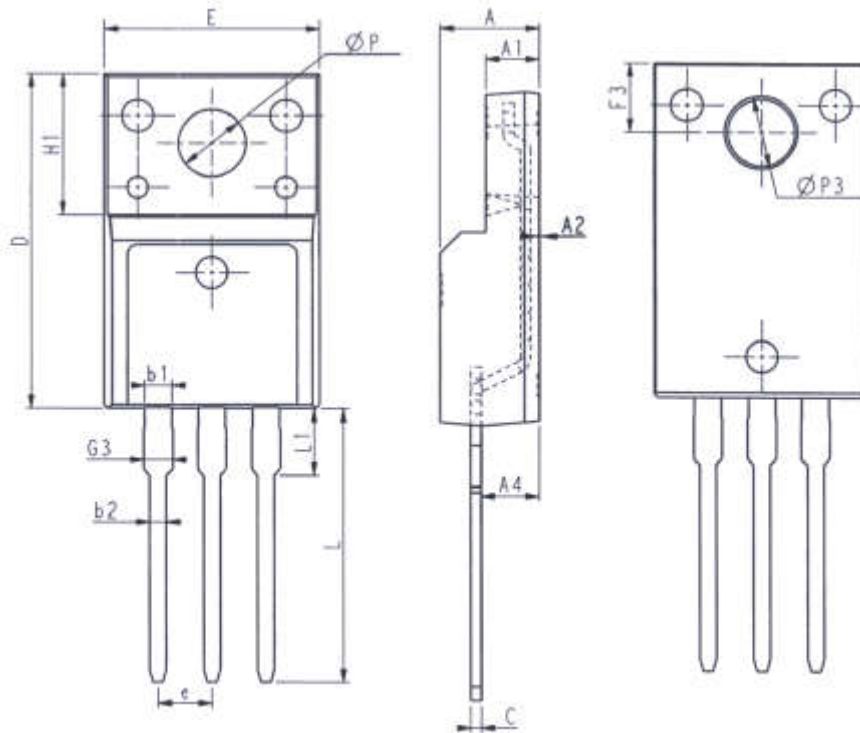


Figure C: Unclamped Inductive Switching Test Circuit and Waveform

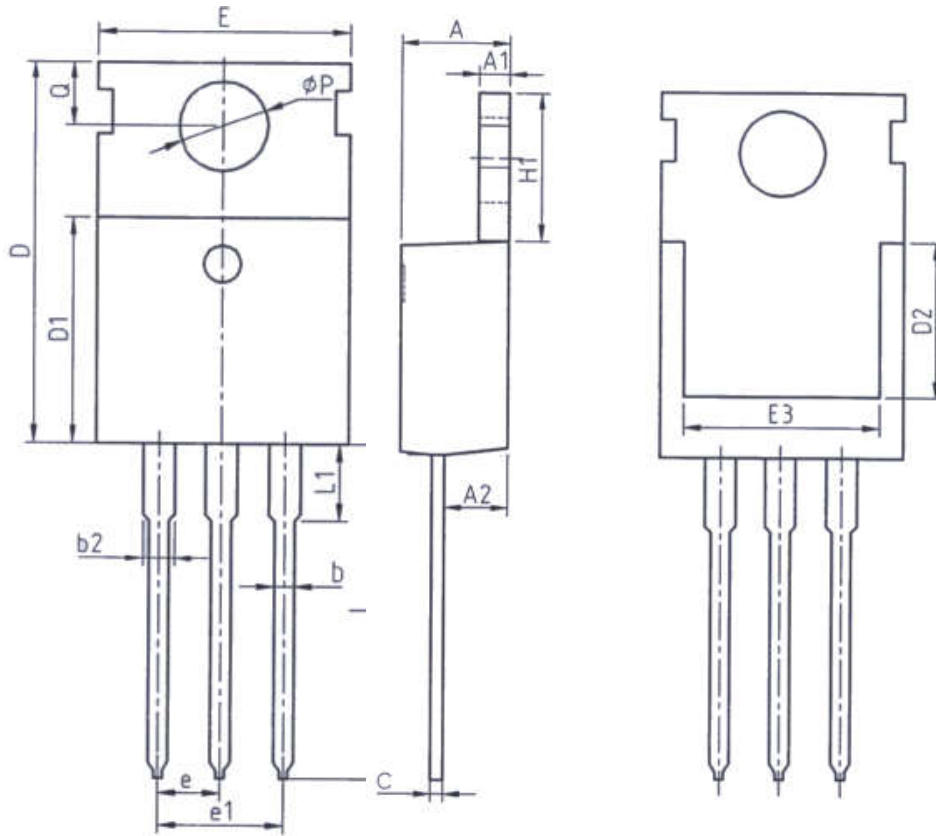


TO-220F



Unit: mm			Unit: mm		
Symbol	Min.	Max.	Symbol	Min.	Max.
E	9.96	10.36	L	12.68	13.28
A	4.50	4.90	L1	2.93	3.13
A1	2.34	2.74	P	3.03	3.38
A2	0.30	0.60	P3	3.15	3.65
A4	2.56	2.96	F3	3.15	3.45
c	0.40	0.65	G3	1.25	1.55
D	15.57	16.17	b1	1.18	1.43
H1	6.70REF		b2	0.70	0.95
e	2.54BSC				

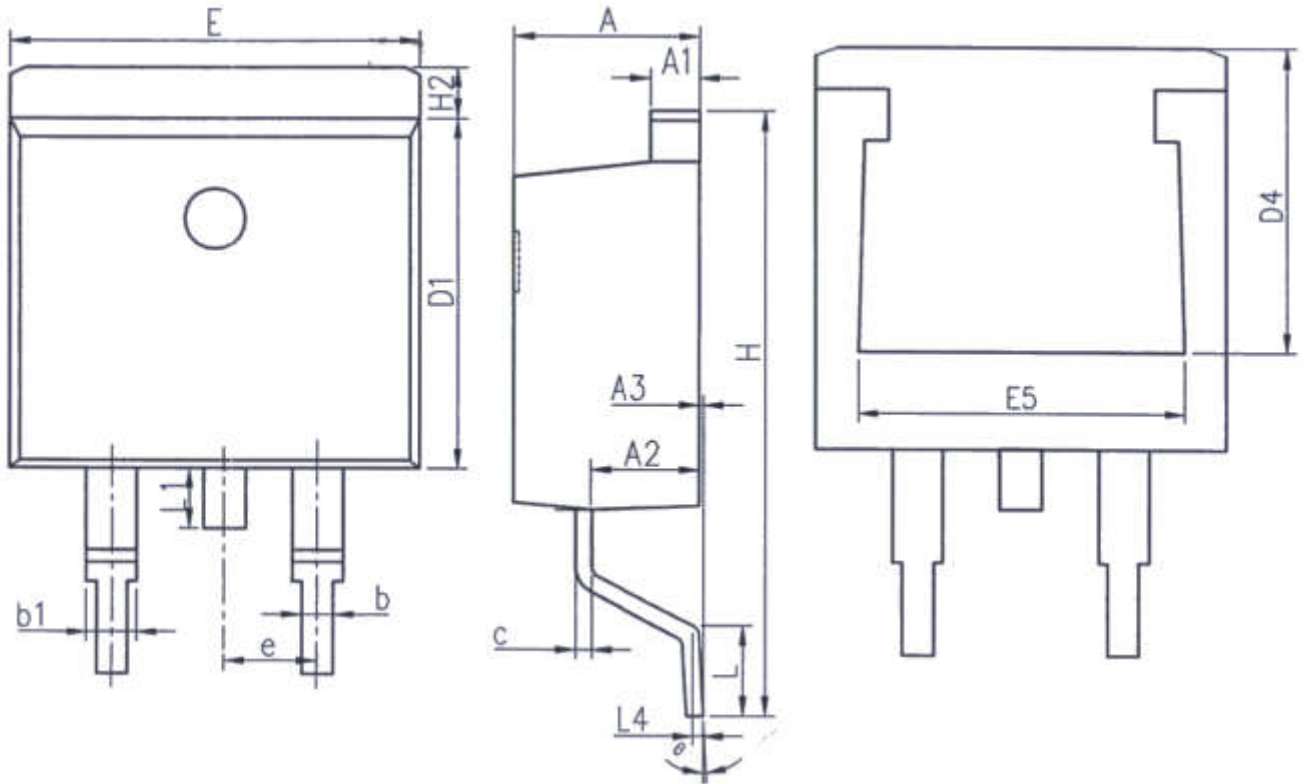
TO-220



Unit: mm		
Symbol	Min.	Max.
A	4.37	4.77
A1	1.25	1.45
A2	2.20	2.60
b	0.70	0.95
b2	1.17	1.47
c	0.40	0.65
D	15.10	16.10
D1	8.80	9.40
D2	5.50	-

Unit: mm		
Symbol	Min.	Max.
E	9.70	10.30
E3	7.00	-
e	2.54BSC	
e1	5.08BSC	
H1	6.25	6.85
L	12.75	13.80
L1	-	3.40
P	3.40	3.80
Q	2.60	3.00

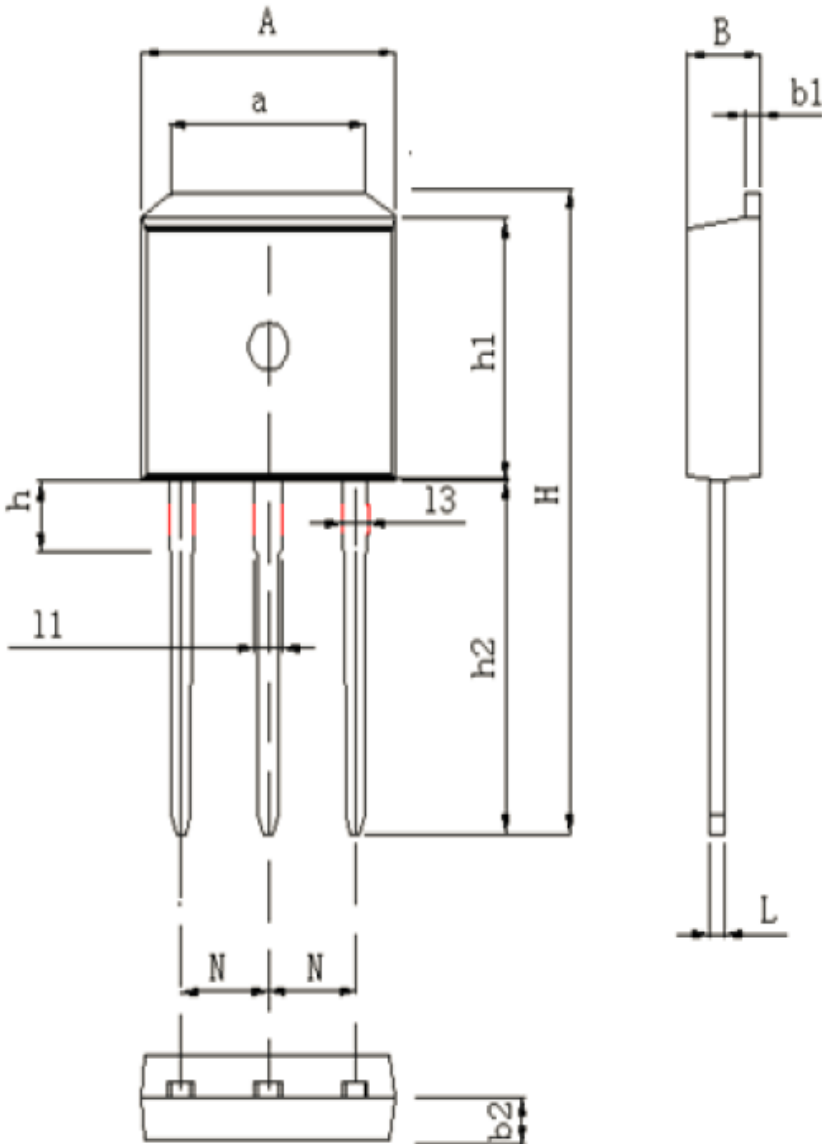
TO-263



Unit: mm		
Symbol	Min.	Max.
A	4.37	4.77
A1	1.22	1.42
A2	2.49	2.89
A3	0.00	0.25
b	0.70	0.96
b1	1.17	1.47
c	0.30	0.53
D1	8.50	8.90
D4	6.60	-

Unit: mm		
Symbol	Min.	Max.
E	9.86	10.36
E5	7.06	-
e	2.54BSC	
H	14.70	15.50
H2	1.07	1.47
L	2.00	2.60
L1	1.40	1.70
L4	0.25BSC	
θ	0°	9°

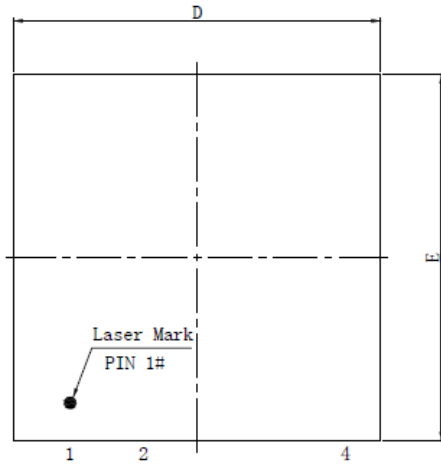
TO-262



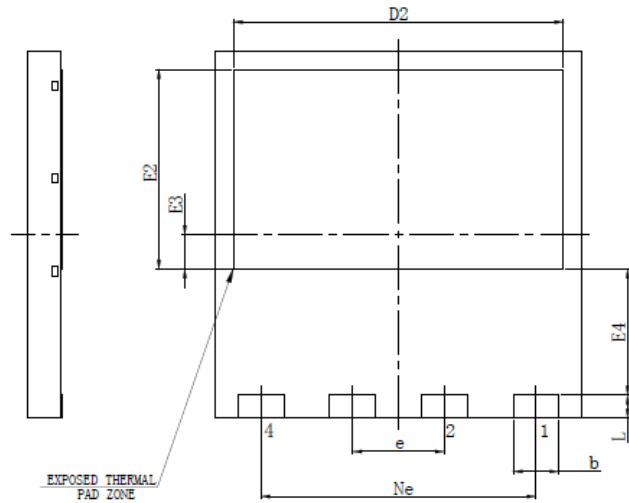
DIM	MILLIMETERS
A	9.98 ± 0.2
a	7.4 ± 0.4
B	4.5 ± 0.2
b1	1.3 ± 0.05
b2	2.4 ± 0.2
H	23.9 ± 0.3
h	3.1 ± 0.2
h1	9.16 ± 0.2
h2	13.2 ± 0.2
L	0.5 ± 0.1
11	1.3 ± 0.1
12	0.8 ± 0.1
N	2.45 ± 0.1

Unit :mm

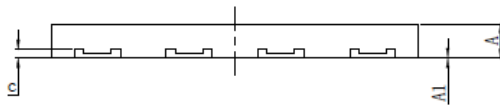
DFN 8x8



TOP VIEW



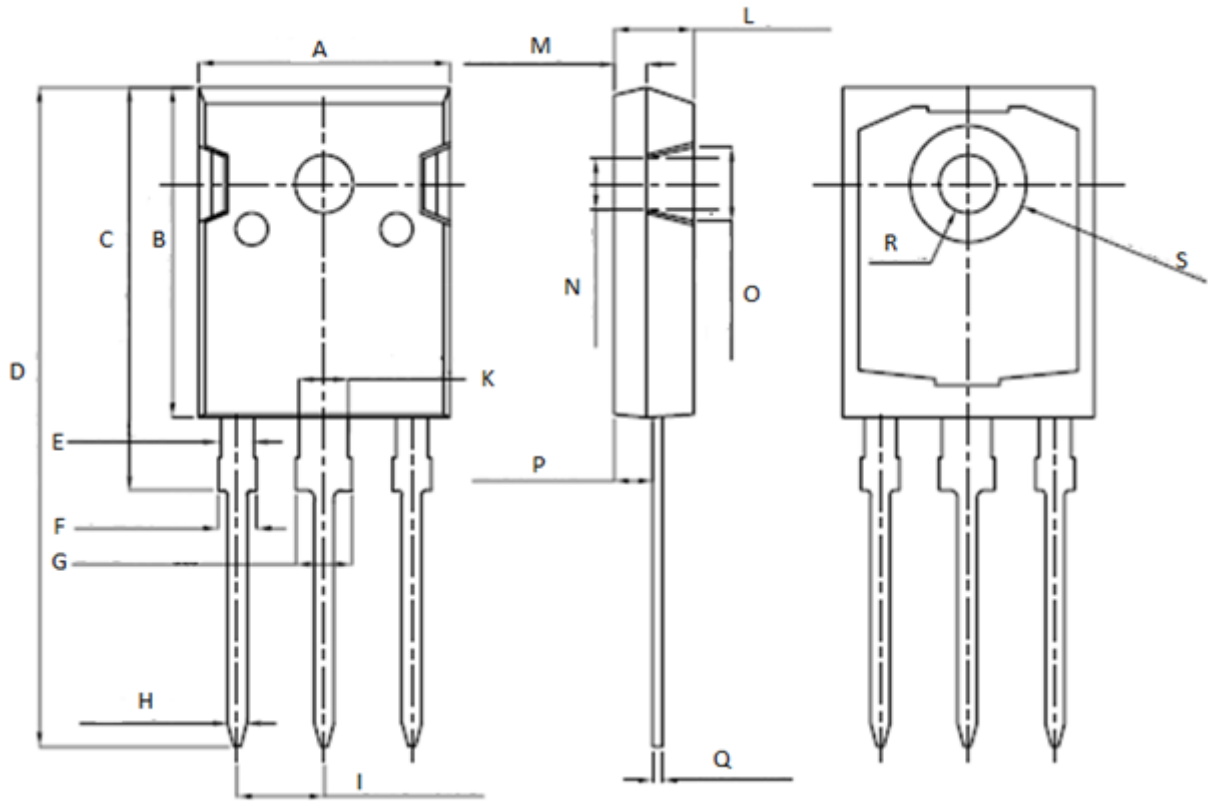
BOTTOM VIEW



SIDE VIEW

SYMBOL	MILLIMETER		
	MEN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.95	1.00	1.05
c	0.18	0.20	0.25
D	7.90	8.00	8.10
Ne	6.00BSC		
e	2.00BSC		
E	7.90	8.00	8.10
D2	7.10	7.20	7.30
E2	4.25	4.35	4.45
E3	0.75REF		
E4	2.75REF		
L	0.45	0.50	0.55
载体尺寸	7.60*5.15		

TO-247



Unit: mm		
Symbol	Min.	Max.
A	15.95	16.25
B	20.85	21.25
C	20.95	21.35
D	40.5	40.9
E	1.9	2.1
F	2.1	2.25
G	3.1	3.25
H	1.1	1.3
I	5.40	5.50

Unit: mm		
Symbol	Min.	Max.
K	2.90	3.10
L	4.90	5.30
M	1.90	2.10
N	4.50	4.70
O	5.40	5.60
P	2.29	2.49
Q	0.51	0.71
R	φ 3.5	φ 3.7
S	φ 7.1	φ 7.3