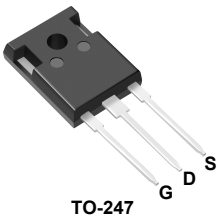
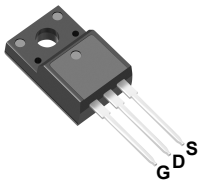
Features

- 20A, 650V, $R_{DS(on)}$ =190mΩ@V_{GS} = 10 V
- Low gate charge(typ. Qg = 30.2nC)
- High ruggedness Ultra
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



TO-247

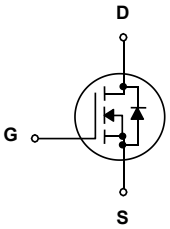


TO-220F

TO-220

General Description

This Power MOSFET is produced using WPMtek's advanced Super-Junction MOSFET technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies.



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter		WTM20N65AMP/AF/AP	Units
V_{DSS}	Drain-Source Voltage		650	V
I_D	Drain Current - Continuous (T_C = 25℃)		20	A
	Drain Current - Continuous (T_C = 100℃)		12	A
I_{DM}	Drain Current - Pulsed	(Note 1)	57	A
V_{GSS}	Gate-Source Voltage		±30	V
EAS	Single Pulsed Avalanche Energy	(Note 2)	384	mJ
I_{AR}	Avalanche Current	(Note 1)	4	A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	1.62	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	20	V/ns
	MOSFET dv/dt		100	
P_D	Power Dissipation (T_C = 25℃) TO-220F		36	W
	Power Dissipation (T_C = 25℃) TO-247		151	
	Power Dissipation (T_C = 25℃) TO-220		130	
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	℃
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	℃

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	WTM20N65AMP/AF/AP	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3.5	℃/W
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	-	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	℃/W

Electrical Characteristics

T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 0.25mA	650	--	--	V
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 0.25mA,TJ = 150℃	650	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 650 V, V_{GS} = 0 V	--	--	1	uA
		V_{DS} =480 V, T_C = 125℃	--	2	--	uA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 0.25mA	2.5	--	4.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 10 A	--	160	190	mΩ
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 400 V, V_{GS} = 0 V, f = 1MHz	--	1240	--	pF
C_{oss}	Output Capacitance		--	34	--	pF
C_{rss}	Reverse Transfer Capacitance		--	--	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 400 V, I_D = 10 A, R_G = 10 Ω,VGS = 10 V (Note 4, 5)	--	12	--	ns
t_r	Turn-On Rise Time		--	8	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	53	--	ns
t_f	Turn-Off Fall Time		--	10	--	ns
Q_g	Total Gate Charge	V_{DS} = 400 V, I_D = 10 A, V_{GS} = 10 V (Note 4, 5)	--	30.2	--	nC
Q_{gs}	Gate-Source Charge		--	5.8	--	nC
Q_{gd}	Gate-Drain Charge		--	15.4	--	nC
R_G	Gate Resistance	f = 1MHz		1.3		Ω
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	20	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	57	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 10 A	--	--	1.2	V
t_{rr}	Reverse Recovery Time	V_{DD} = 400 V, I_S = 10A, dI_F / dt = 100 A/us (Note 4)	--	274	--	ns
Q_{rr}	Reverse Recovery Charge		--	3.33	--	uC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. I_{AS} = 4A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 10A, di/dt ≤ 200A/us, V_{DD} ≤400 Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300us, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

Typical Characteristics

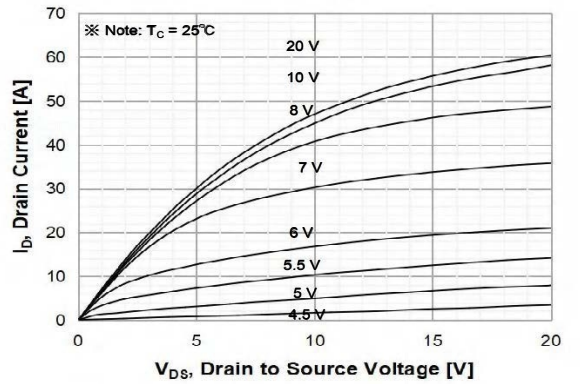


Figure 1. On-Region Characteristics

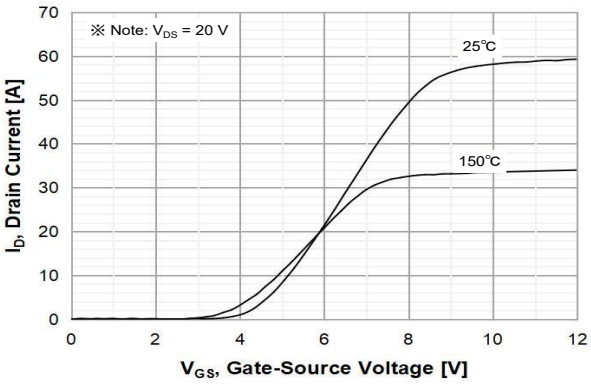


Figure 2. Transfer Characteristics

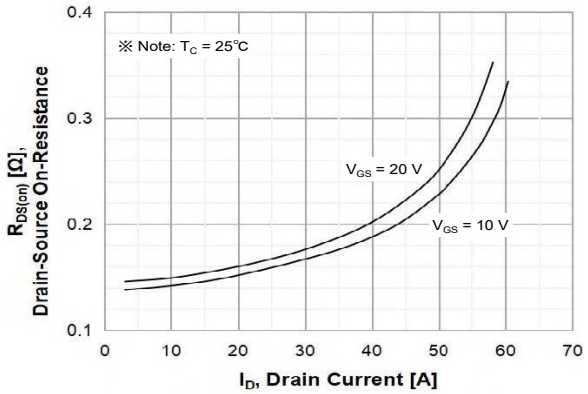


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

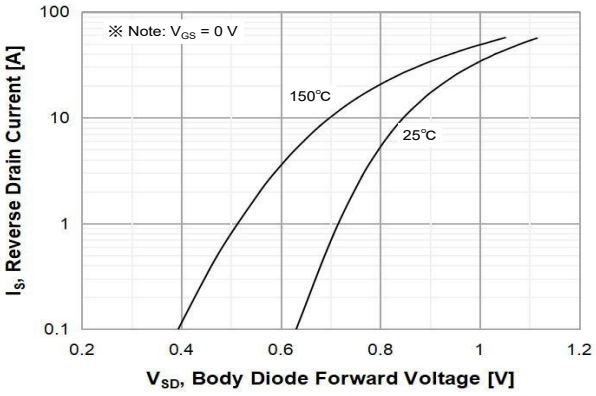


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

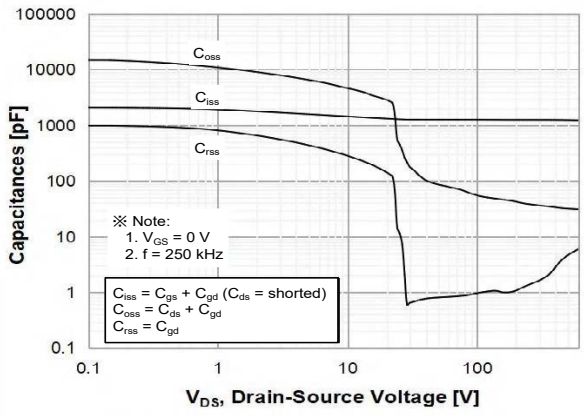


Figure 5. Capacitance Characteristics

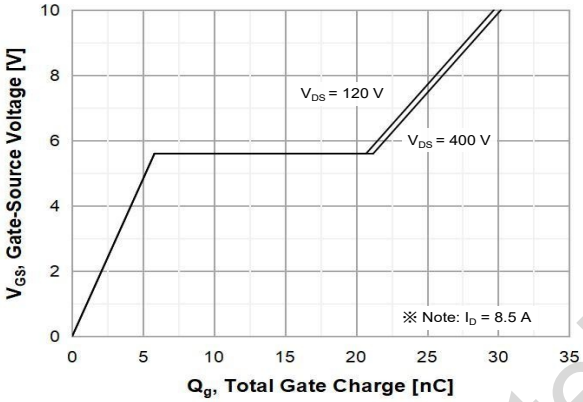


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

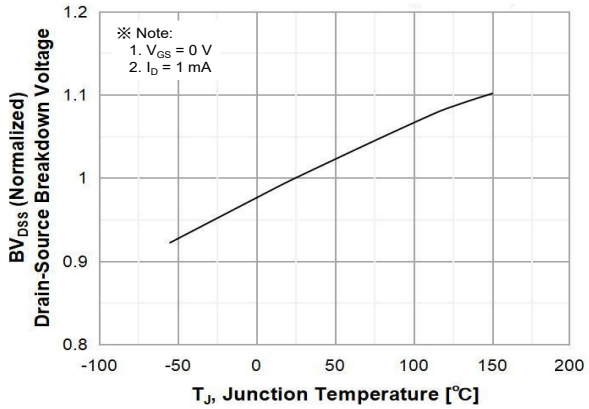


Figure 7. Breakdown Voltage Variation vs Temperature

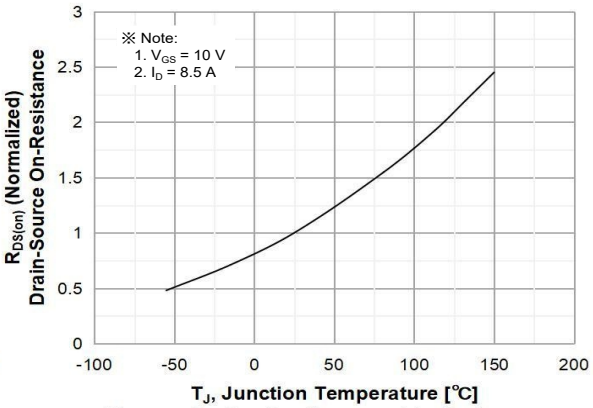


Figure 8. On-Resistance Variation vs Temperature

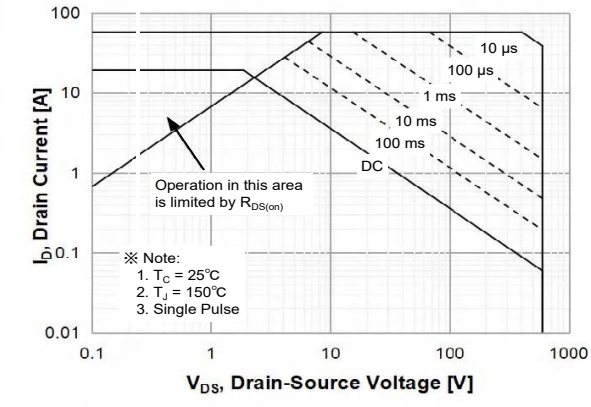


Figure 9. Maximum Safe Operating Area

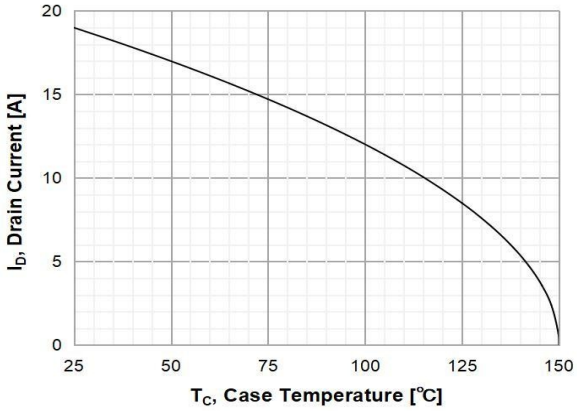


Figure 10. Maximum Drain Current vs. Case Temperature

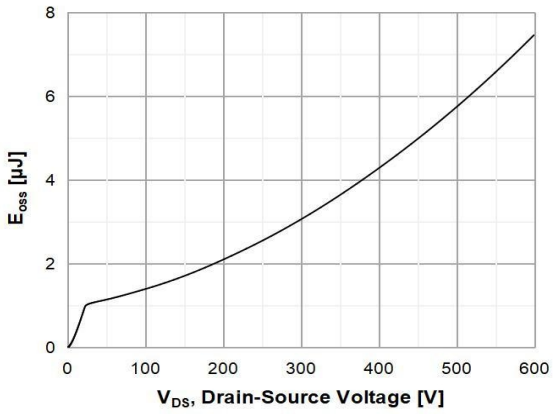


Figure 11.E_{oss} vs. Drain to Source Voltage

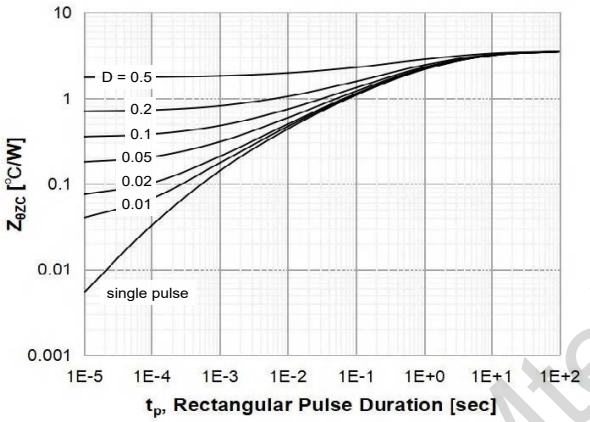
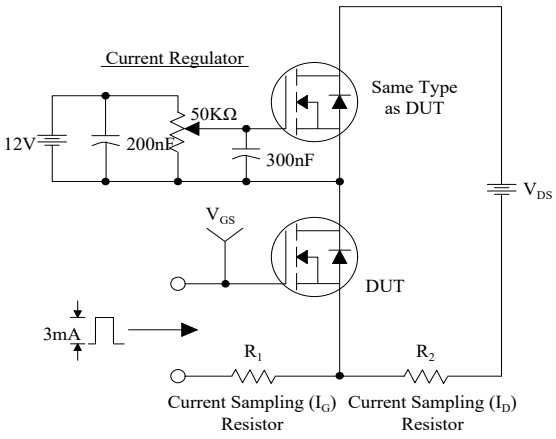
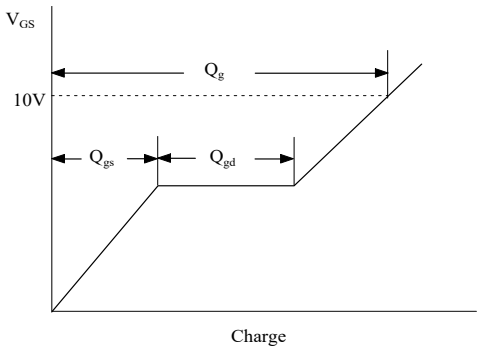


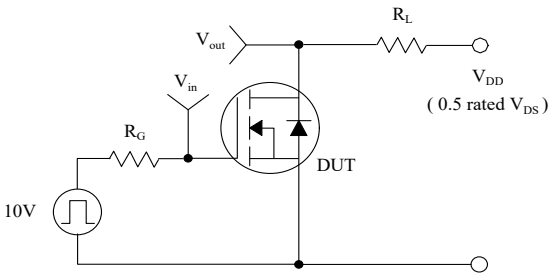
Figure 12.Transient Thermal Response Curve

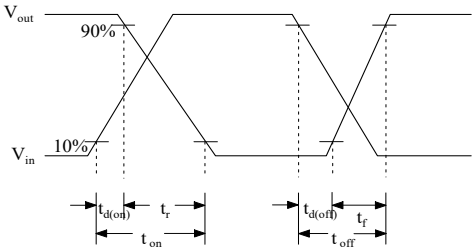
Gate Charge Test Circuit & Waveform



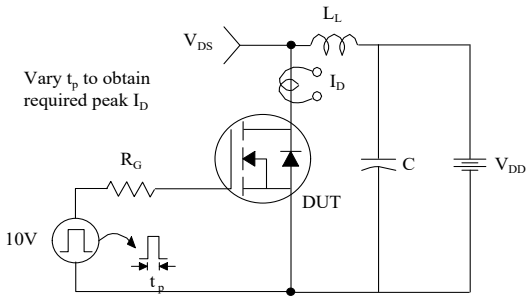


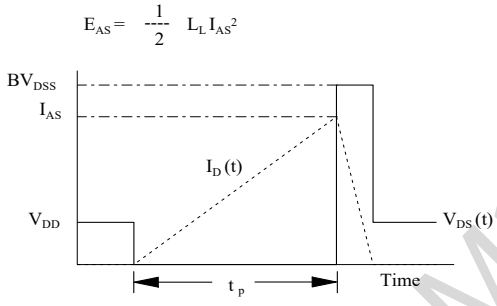
Resistive Switching Test Circuit & Waveforms



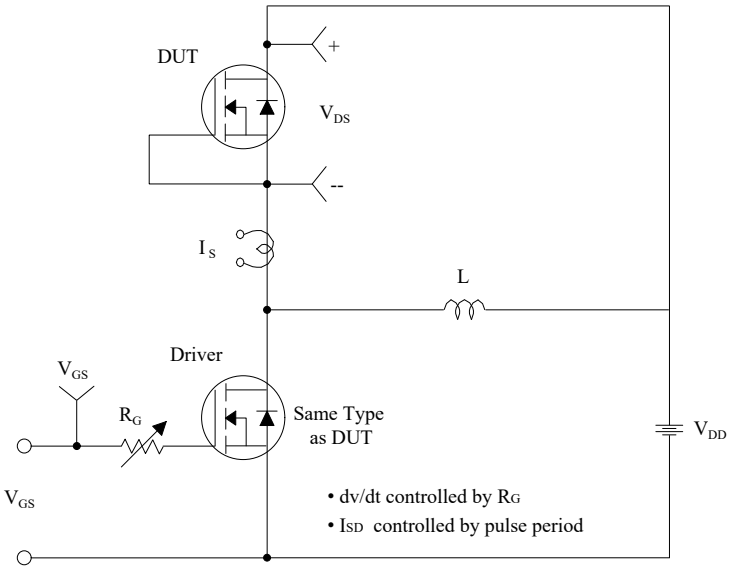


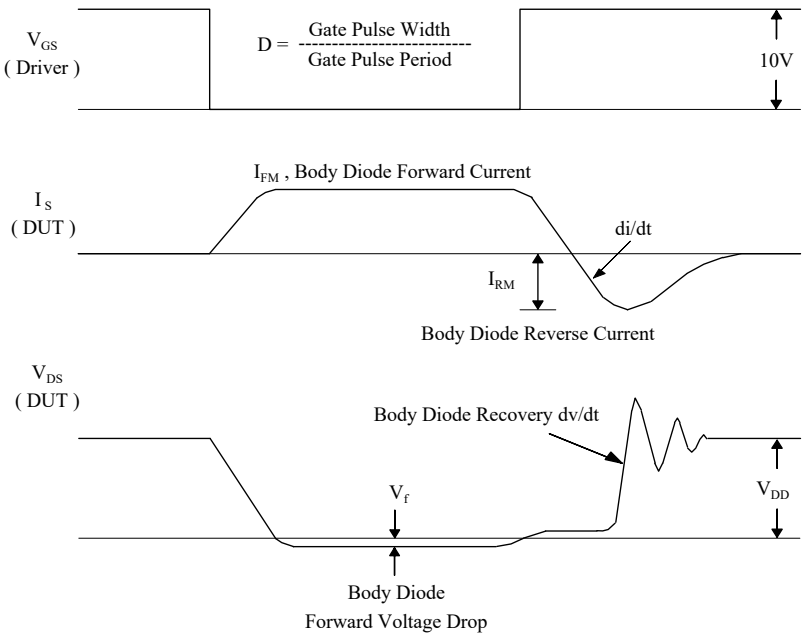
Unclamped Inductive Switching Test Circuit & Waveforms





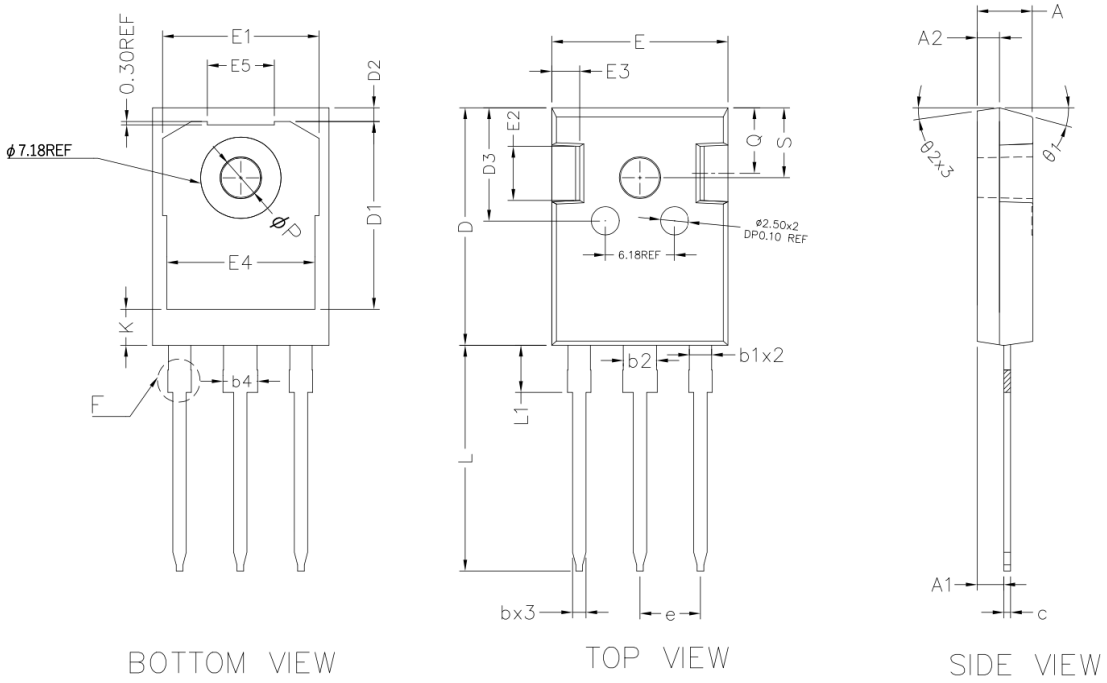
Peak Diode Recovery dv/dt Test Circuit & Waveforms





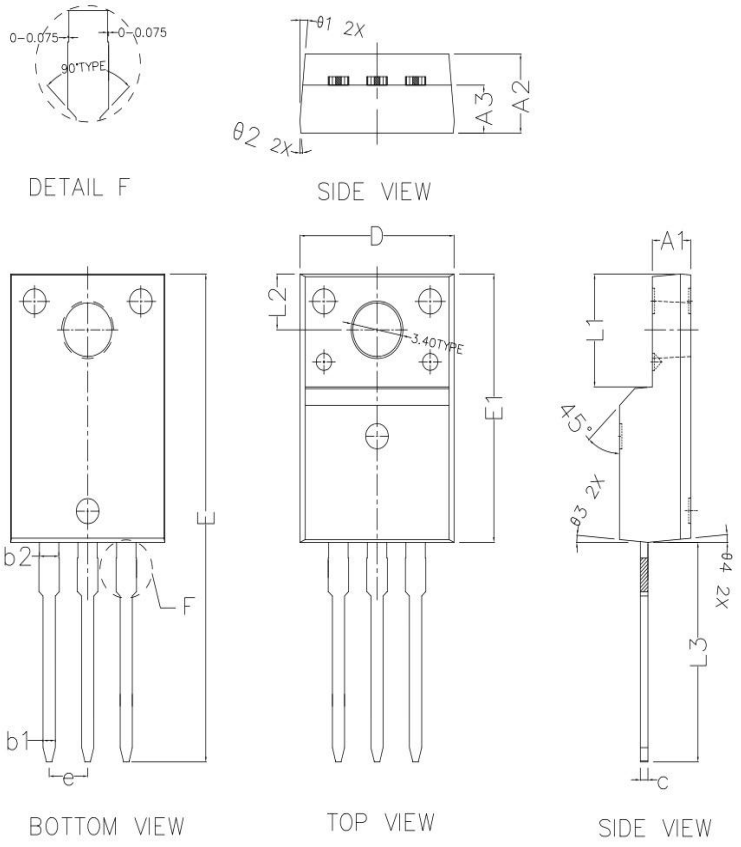
Package Outline

TO-247 Outline



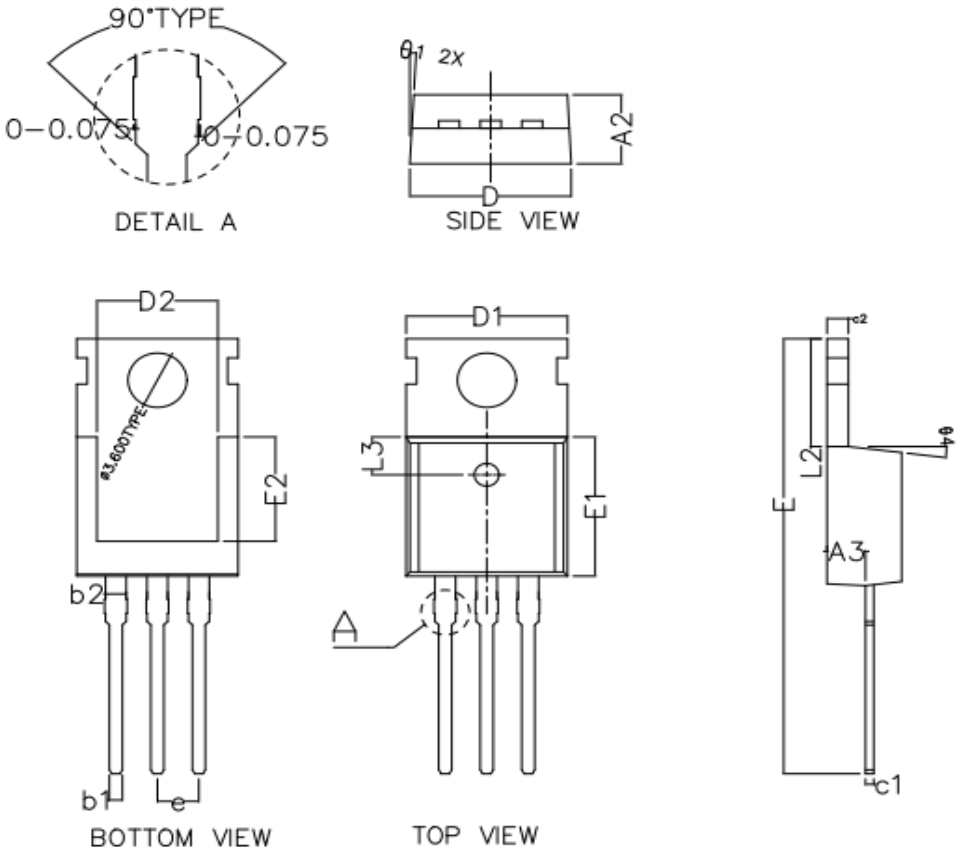
COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A	4.900	5.000	5.100
A1	2.300	2.400	2.500
A2	1.900	2.000	2.100
b	1.070	1.200	1.330
b1	1.910	2.000	2.160
b2	2.870	3.000	3.160
b3	1.910	2.100	2.410
b4	2.870	3.000	3.380
c	0.550	0.600	0.680
D	20.000	21.000	21.100
D1	16.250	16.950	17.650
D2		1.200REF	
D3		10.000REF	
E	15.700	15.800	15.900
E1	13.100	14.020	14.150
E2	3.680	–	5.100
E3	1.000	–	1.900
E4	12.380	13.260	13.430
E5		5.990REF	
e		5.440BSC	
L	19.810	19.950	20.320
L1	4.100	–	4.400
ϕP	3.500	–	3.650
Q	5.490	–	6.000
S	6.040	–	6.300
θ1		15.0°REF	
θ2		8.0°REF	
θ3		8.0°REF	
K		3.190REF	

TO-220F Outline



COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A1	2.440	2.540	2.640
A2	4.600	4.700	4.800
A3	2.730	2.830	2.930
b1	0.750	0.800	0.850
b2	1.230	1.280	1.330
c	0.450	0.500	0.550
D	10.060	10.160	10.260
E	28.650	28.850	29.050
E1	15.770	15.870	15.970
e	2.54TYPE		
L1	6.68REF		
L2	3.30REF		
⚠L3	12.830	12.980	13.130
θ1	5° TYPE		
θ2	5° TYPE		
θ3	5° TYPE		
θ4	5° TYPE		

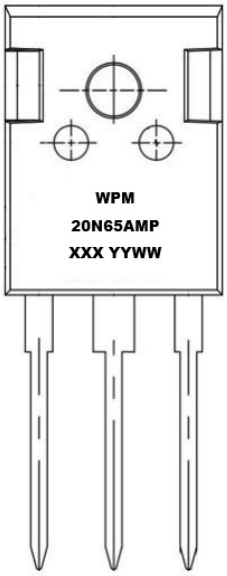
TO220 Outline



COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A2	4.470	4.570	4.670
A3	2.300	2.350	2.400
b1	0.750	0.800	0.850
b2		1.27 TYPE	
c1	0.450	0.500	0.550
c2	1.250	1.300	1.380
▲ D	9.900	10.000	10.100
▲ D1		10.000TYPE	
▲ D2		8.000TYPE	
▲ E	28.660	28.860	29.060
▲ E1	9.000	9.100	9.200
▲ E2		7.000TYPE	
e		2.540TYPE	
L2	6.350	6.500	6.650
L3		2.50TYPE	
θ1		3° TYPE	
θ2		3° TYPE	
θ3		7° TYPE	
θ4		7° TYPE	

Marking Information

TO-247



TO-220F

TO-220

WPM=WPMtek's Logo
20N65AP=Marking
XXX YYWW=Date Code