

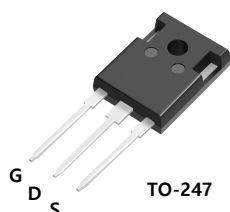
General Description

This Power MOSFET is produced using WPMtek's advanced Superjunction 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.

Features

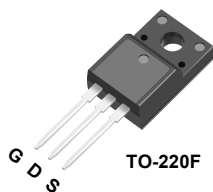
40A, 650V, $R_{DS(on)} = 78m\Omega @ V_{GS} = 10V$
Low gate charge (typ. $Q_g = 52nC$)
Ultra high ruggedness
Fast switching
100% avalanche tested
Improved dv/dt capability

WTM40N65MP



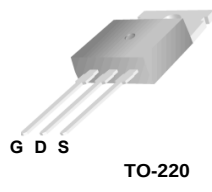
TO-247

WTM40N65F

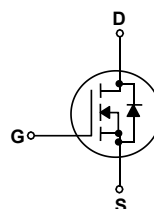


TO-220F

WTM40N65AP



TO-220



Absolute Maximum Ratings

$T_C = 25^\circ C$ unless otherwise noted

Symbol	Parameter	WTM40N65MP/F/AP	Units
V_{DSS}	Drain-Source Voltage	650	V
I_D	Drain Current - Continuous ($T_C = 25^\circ C$)	40*	A
	- Continuous ($T_C = 100^\circ C$)	20.2*	A
I_{DM}	Drain Current - Pulsed (Note 1)	114*	A
V_{GSS}	Gate-Source Voltage	± 30	V
EAS	Single Pulsed Avalanche Energy (Note 2)	199	mJ
I_{AR}	Avalanche Current (Note 1)	5.6	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	2.6	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	20	V/ns
	MOSFET dv/dt	100	
P_D	Power Dissipation ($T_C = 25^\circ C$)	43	W
	- Derate above $25^\circ C$	0.34	W/ $^\circ C$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	260	$^\circ C$

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	WTM40N65MP/F/AP	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	2.9	$^\circ C/W$
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	-	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	$^\circ C/W$

Electrical Characteristics

$T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\mu\text{A}$	650	--	--	V
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\mu\text{A}, T_J = 150^\circ\text{C}$	650	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$	--	2.1	--	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1.7\text{mA}$	2.5	--	4.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 15.3\text{ A}$	--	78	90	m Ω

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{MHz}$	--	2270	--	pF
C_{oss}	Output Capacitance		--	58	--	pF
C_{rss}	Reverse Transfer Capacitance		--	--	--	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 400\text{ V}, I_D = 15.3\text{ A}, R_G = 10\ \Omega, V_{GS} = 10\text{ V}$ (Note 4, 5)	--	17	--	ns
t_r	Turn-On Rise Time		--	10	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	86	--	ns
t_f	Turn-Off Fall Time		--	11	--	ns
Q_g	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 10\text{ A}, V_{GS} = 10\text{ V}$ (Note 4, 5)	--	52	--	nC
Q_{gs}	Gate-Source Charge		--	12.7	--	nC
Q_{gd}	Gate-Drain Charge		--	22.4	--	nC
R_G	Gate Resistance	$f = 1\text{MHz}$		1.2		Ω

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	40	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	114	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 15.3A	--	--	1.2	V
t _{rr}	Reverse Recovery Time	V _{DD} = 400 V, I _S = 15.3A,	--	346	--	ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/us (Note 4)	--	5.1	--	uC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $I_{AS} = 5.6\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 10\text{A}, dI/dt \leq 200\text{A/us}, V_{DD} \leq 400$, Starting $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
5. Essentially independent of operating temperature

Typical Characteristics

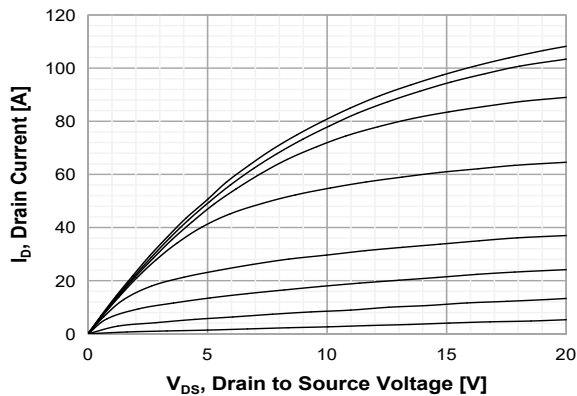


Figure 1. On-Region Characteristics

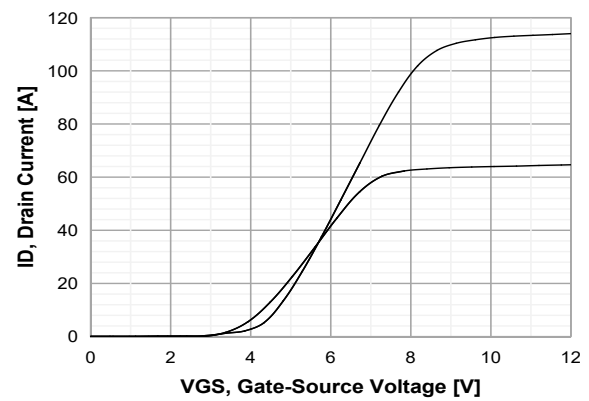


Figure 2. Transfer Characteristics

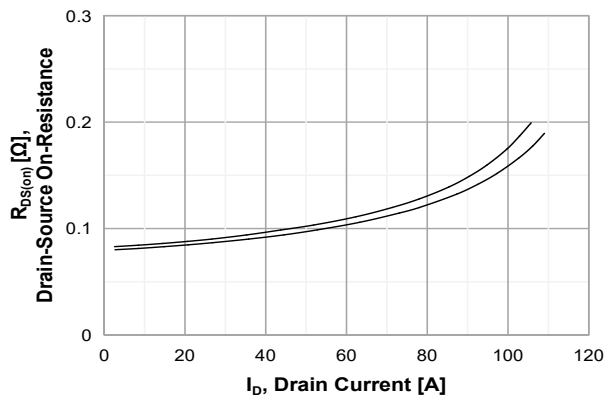


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

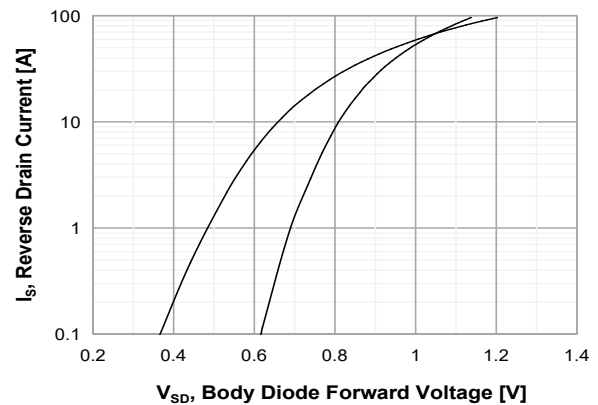


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

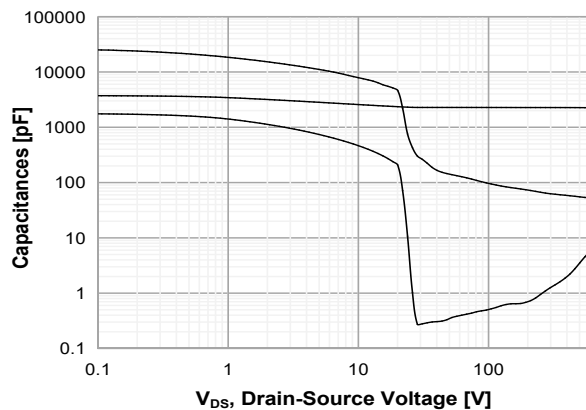


Figure 5. Capacitance Characteristics

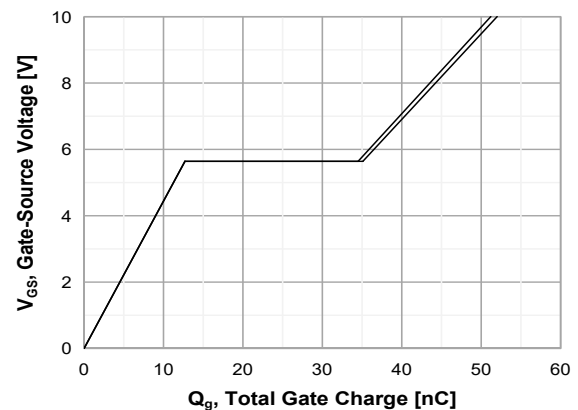


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

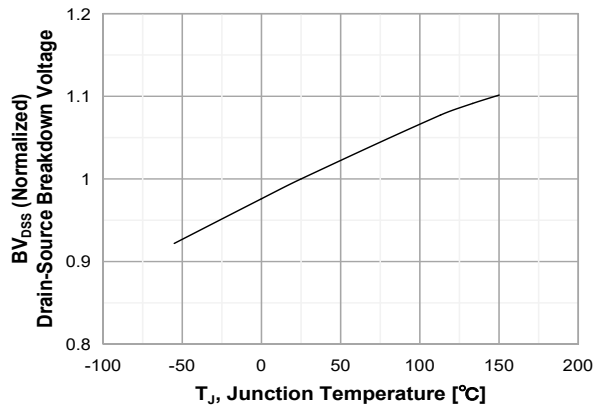


Figure 7. Breakdown Voltage Variation vs Temperature

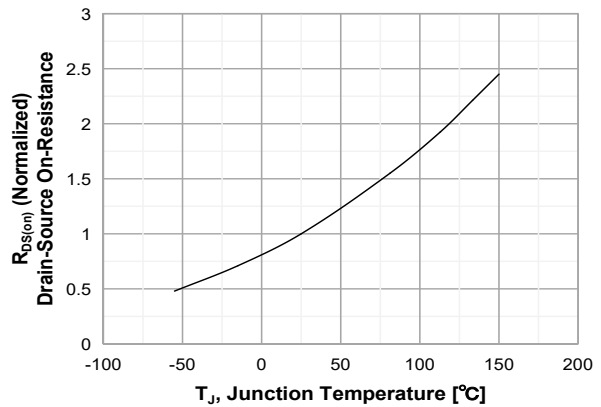


Figure 8. On-Resistance Variation vs Temperature

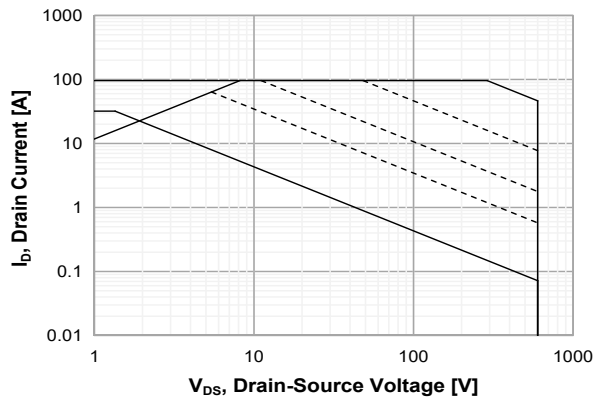


Figure 9. Maximum Safe Operating Area

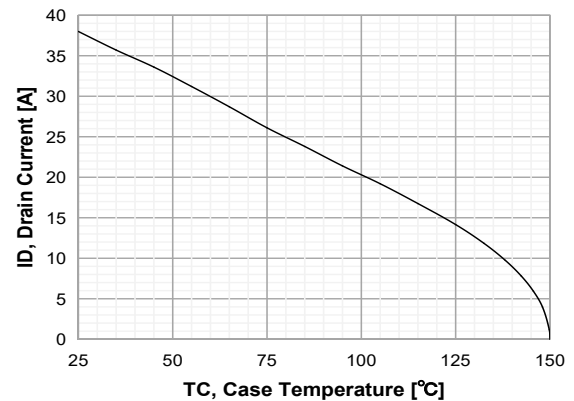


Figure 10. Maximum Drain Current vs. Case Temperature

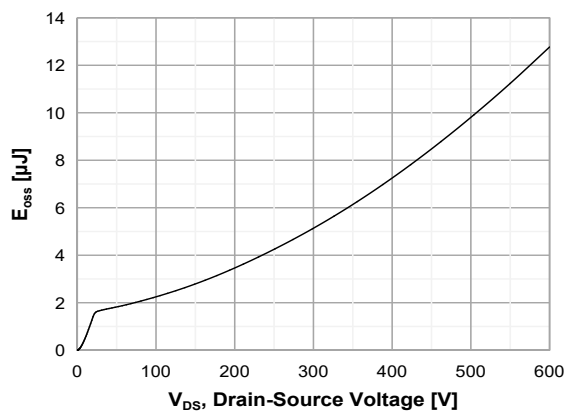


Figure 11. E_{OSS} vs. Drain to Source Voltage

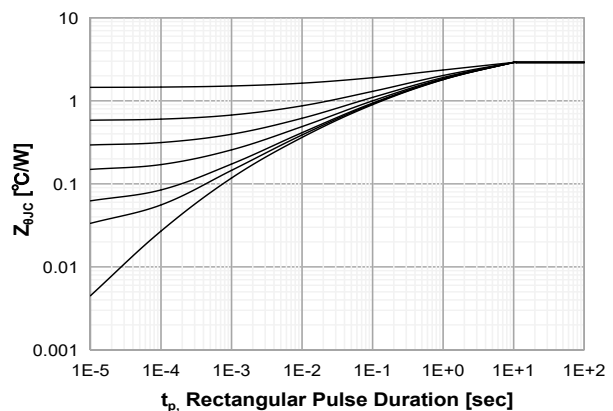
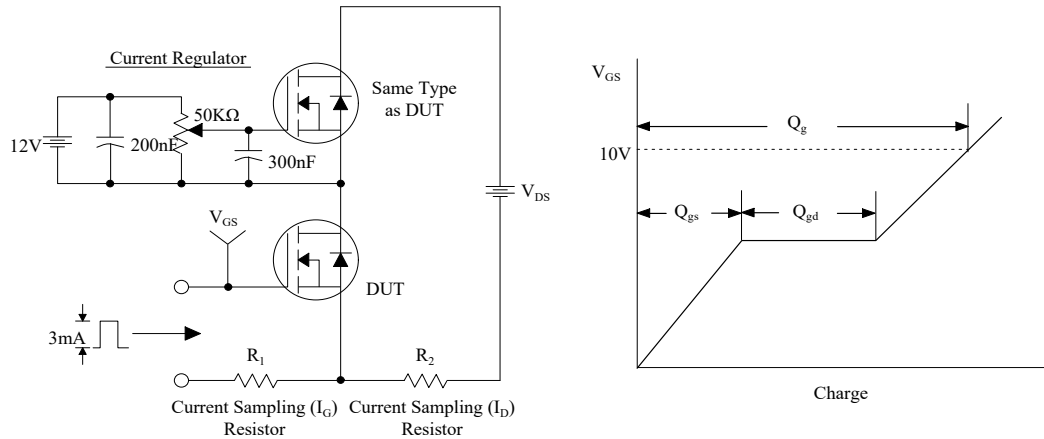
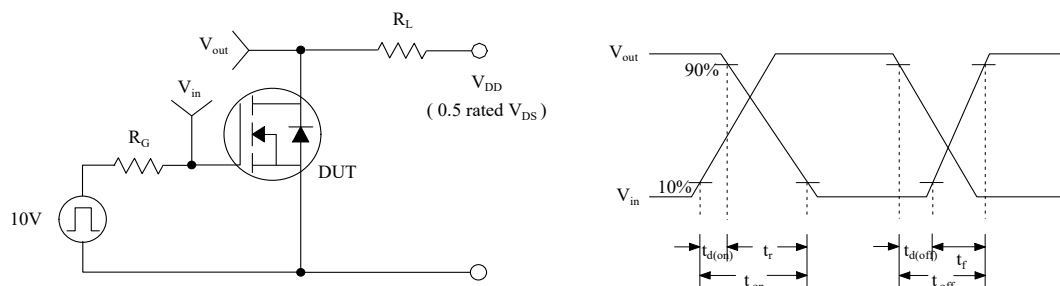


Figure 12. Transient Thermal Response Curve

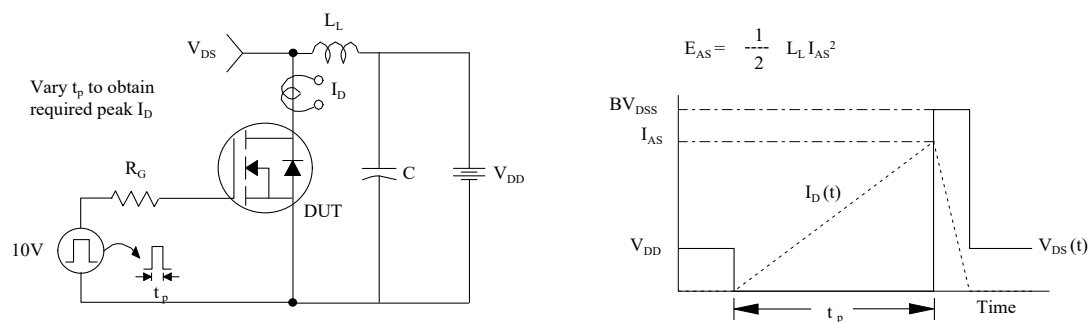
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



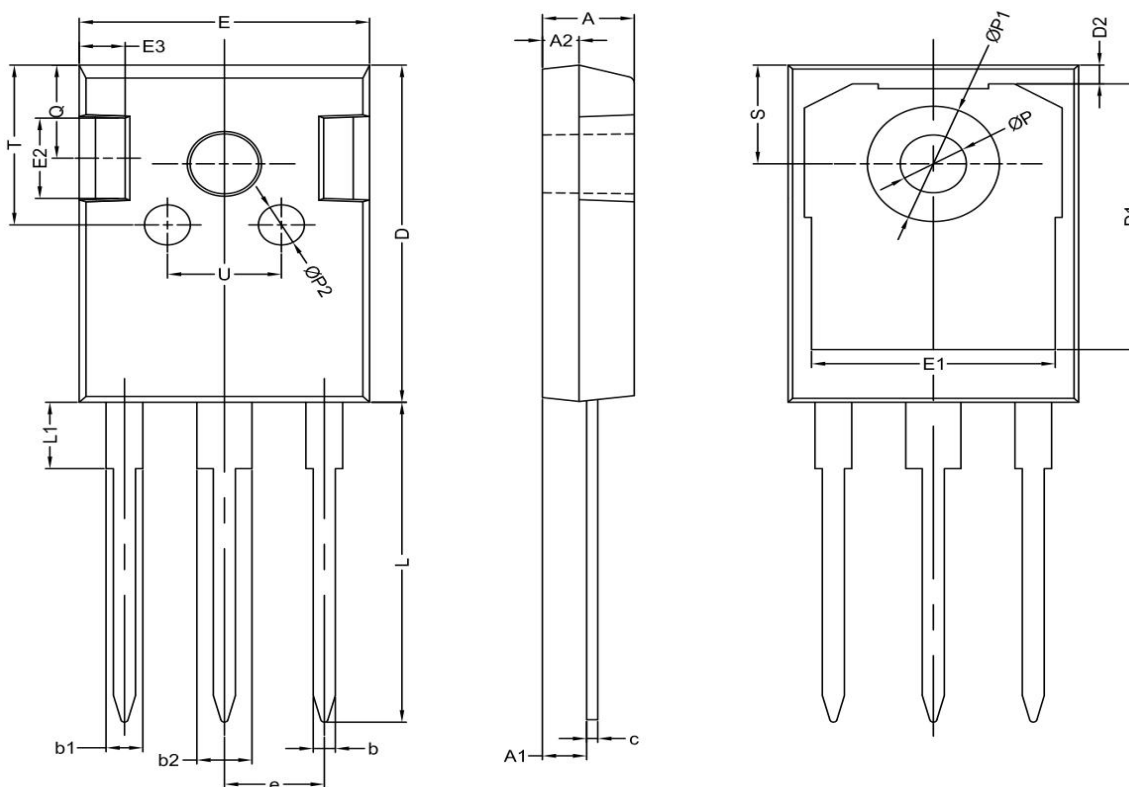
Unclamped Inductive Switching Test Circuit & Waveforms



[illegible]

Package Outline

TO-247 OUTLINE

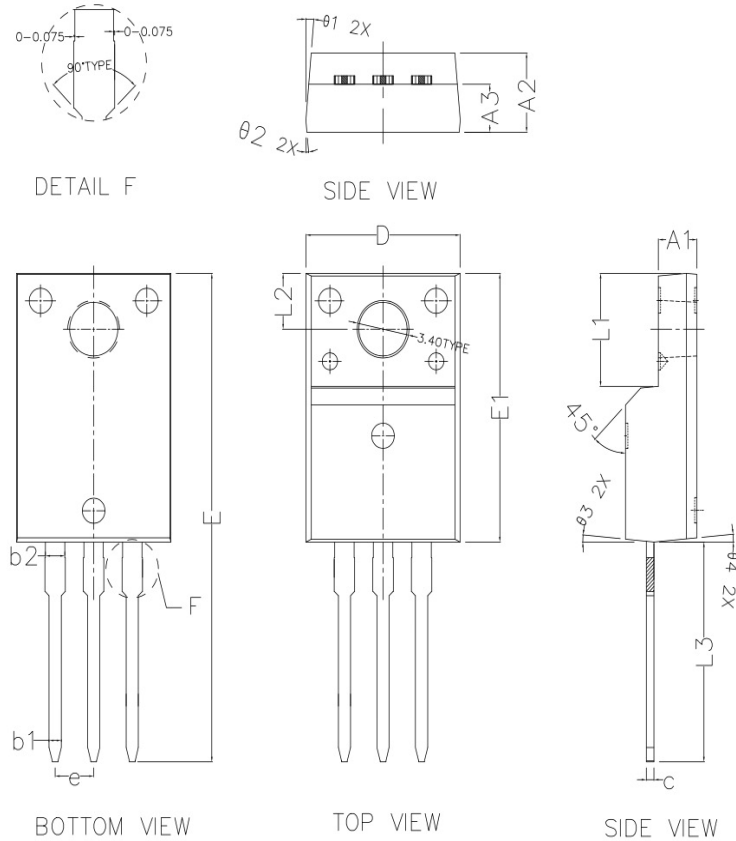


SYMBOL	Mechanical Dimensions/mm			SYMBOL	Mechanical Dimensions/mm			SYMBOL	Mechanical Dimensions/mm		
	MIN	NOM	MAX						MIN	NOM	MAX
A	4.80	5.00	5.20	D	20.80	21.00	21.20	L1	-	4.13	-
A1	2.21	2.41	2.61	D1	-	16.55	-	Ø P	3.5	3.6	3.7
A2	1.90	2.00	2.10	E	15.60	15.80	16.0	Ø P1	-	-	7.40
b	1.10	1.20	1.35	E1		13.3		Ø P2	-	2.50	-
b1	-	2.00	-	E2		5.0		Q	-	5.8	-
b2	-	3.00	-	e	5.44			S	6.05	6.15	6.25
c	0.55	0.60	0.75	L	19.42	19.92	20.42	T	-	10.0	-

NOTE:

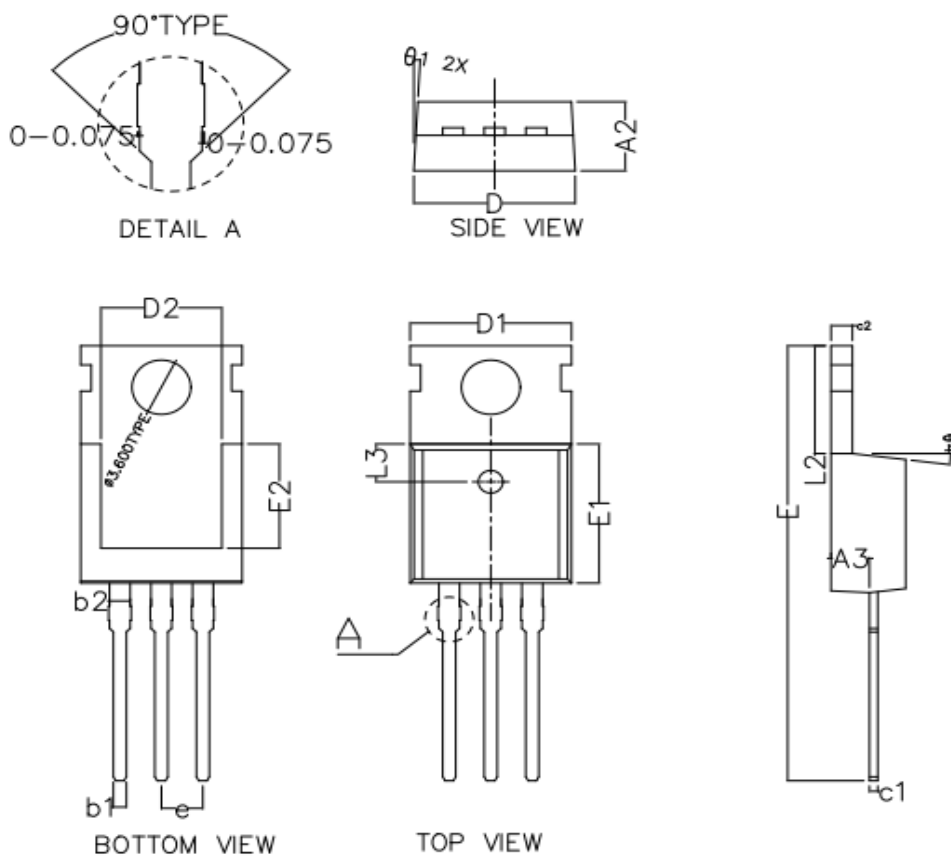
- 1The plastic package is not marked as smooth surfaceRa=0.1;Subglossy surfaceRa=0.8
- 2.Undeclared tolerance ± 0.25 , Unmarked filletRmax=0.25

TO-220F Outline



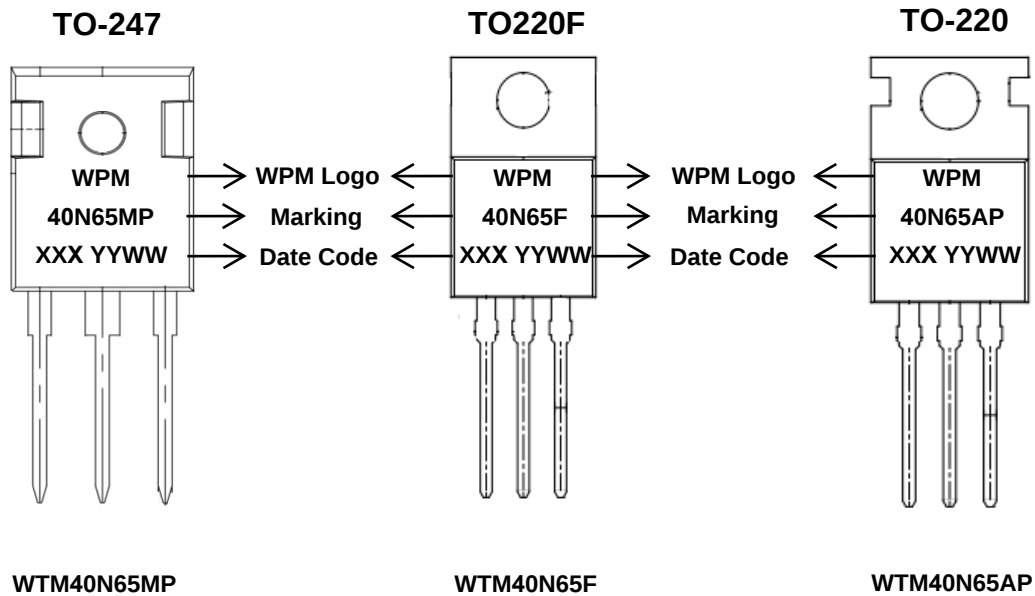
COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A1	2.440	2.540	2.640
A2	4.600	4.700	4.800
A3	2.730	2.830	2.930
b1	0.750	0.800	0.850
b2	1.230	1.280	1.330
c	0.450	0.500	0.550
D	10.060	10.160	10.260
E	28.650	28.850	29.050
E1	15.770	15.870	15.970
e	2.54TYPE		
L1	6.68REF		
L2	3.30REF		
L3	12.830	12.980	13.130
$\theta 1$	5° TYPE		
$\theta 2$	5° TYPE		
$\theta 3$	5° TYPE		
$\theta 4$	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



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