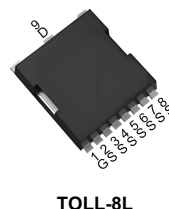
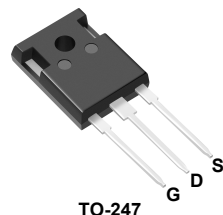
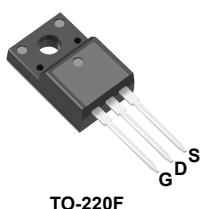


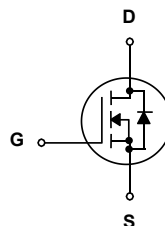
Features

- 40A, 650V, $R_{DS(on)Typ} = 89m\Omega$ @ $V_{GS} = 10V$
- Low gate charge (typ. $Q_g = 57.7nC$)
- High ruggedness
- Ultra fast switching
- 100% avalanche tested
- Improved dv/dt capability



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.



Absolute Maximum Ratings

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

Symbol	Parameter	WTM40N65AF/AMP/ATL	Units
V_{DSS}	Drain-Source Voltage	650	V
I_D	Drain Current - Continuous ($T_C = 25^\circ C$)	40	A
	- Continuous ($T_C = 100^\circ C$)	23	A
I_{DM}	Drain Current - Pulsed (Note 1)	110	A
V_{GSS}	Gate-Source Voltage	± 30	V
EAS	Single Pulsed Avalanche Energy (Note 2)	636	mJ
I_{AR}	Avalanche Current (Note 1)	5.4	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	2.6	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	50	V/ns
	MOSFET dv/dt	100	
P_D	Power Dissipation ($T_C = 25^\circ C$) TO-247	306	W
	Power Dissipation ($T_C = 25^\circ C$) TO-220F	42	
	Power Dissipation ($T_C = 25^\circ C$) TOLL-8L	257	
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	WTM40N65AF/AMP/ATL		Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3.6	0.48	$^\circ C/W$
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	-	-	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	-	62.5	$^\circ C/W$

Package Marking

Part Number	Marking	Package	Packing Method	MOQ	QTY
WTM40N65AF	40N65AF	T0-220F	Tube	1000pcs	
WTM40N65AMP	40N65AMP	T0-247	Tube	600pcs	
WTM40N65ATL	40N65ATL	TOLL-8L	Tube	2000pcs	

Electrical Characteristics

(T_C = 25°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 V, I _D = 1mA	650	--	--	V
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 1mA, T _J = 150°C	650	--	--	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V	--	--	10	uA
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 480 V, T _C = 125°C	--	60	--	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 = 250uA	3.0	--	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 15.3A	--	89	105	mΩ

Dynamic Characteristics

C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 250KHz	--	2303	--	pF
C _{oss}	Output Capacitance		--	55	--	pF
C _{rss}	Reverse Transfer Capacitance		--	--	--	pF

Switching Characteristics

t _{d(on)}	Turn-On Delay Time	V _{DS} = 400 V, I _D = 15.3A, R _G = 10Ω, V _{GS} = 10 V (Note 4, 5)	--	23	--	ns
t _r	Turn-On Rise Time		--	12	--	ns
t _{d(off)}	Turn-Off Delay Time		--	80	--	ns
t _f	Turn-Off Fall Time		--	9	--	ns
Q _g	Total Gate Charge	V _{DS} = 400 V, I _D = 15.3 A, V _{GS} = 10 V (Note 4, 5)	--	57.7	--	nC
Q _{gs}	Gate-Source Charge		--	14	--	nC
Q _{gd}	Gate-Drain Charge		--	29.3	--	nC
R _G	Gate Resistance	f = 1MHz		1.1		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	--	--	110	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 21.5A	--	1.2	V
t _{rr}	Reverse Recovery Time	V _{DD} = 400 V, I _S = 21.5A,	--	139	ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/us (Note 4)	--	0.91	uC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. I_{AS} = 5.4A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 15.3A, di/dt ≤ 100A/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

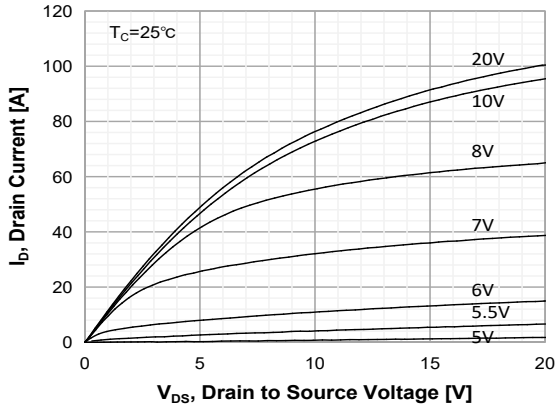


Figure 1. On-Region Characteristics

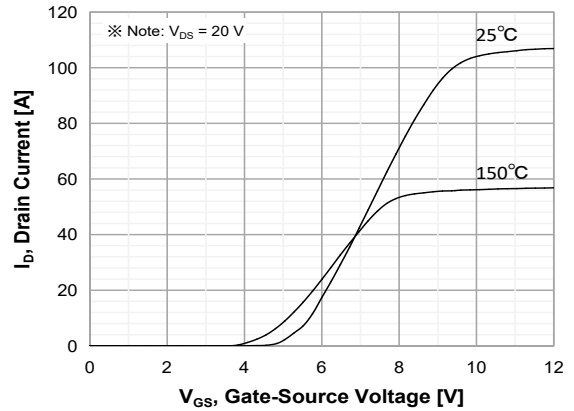


Figure 2. Transfer Characteristics

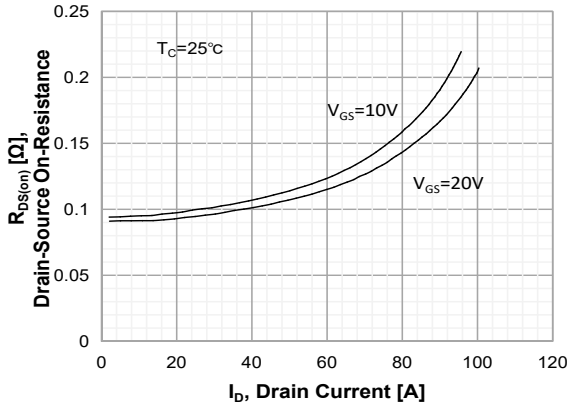


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

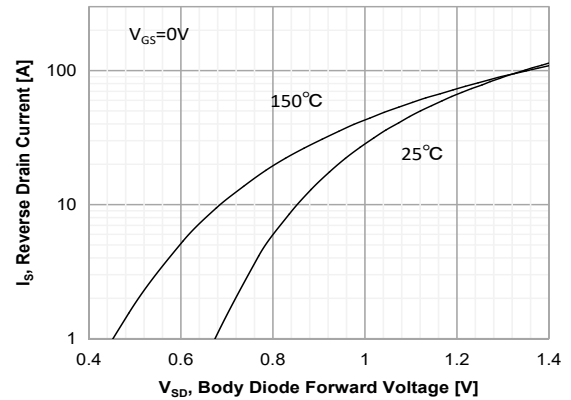


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

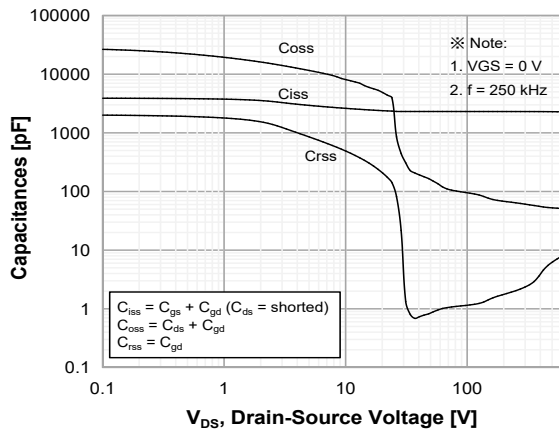


Figure 5. Capacitance Characteristics

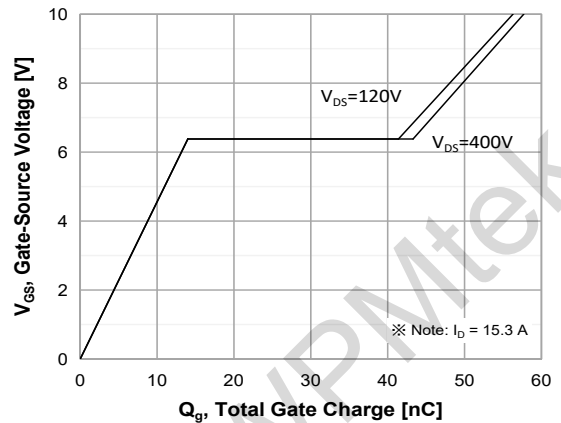


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

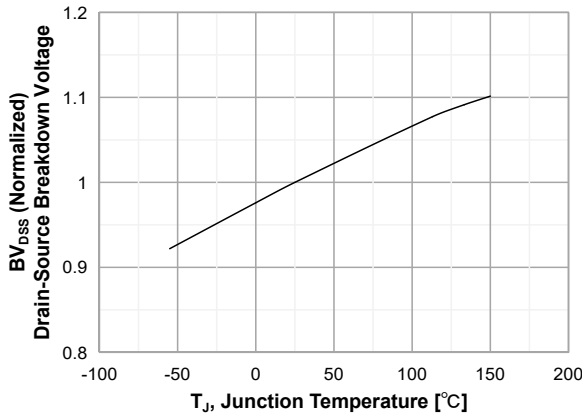


Figure 7. Breakdown Voltage Variation vs Temperature

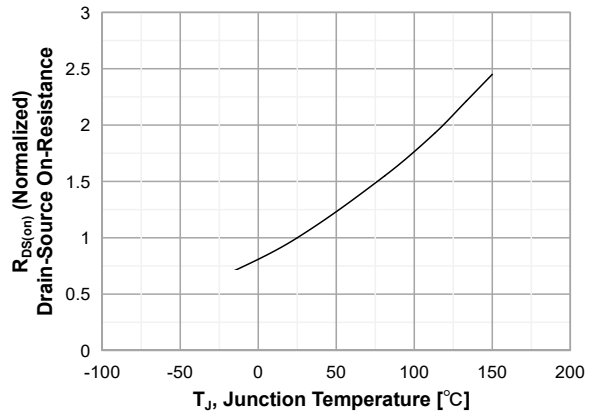


Figure 8. On-Resistance Variation vs Temperature

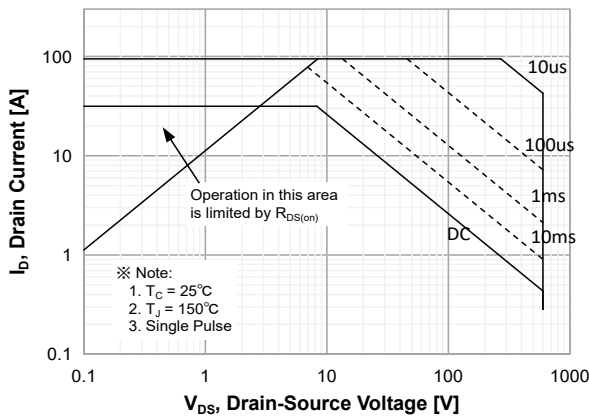


Figure 9. Maximum Safe Operating Area

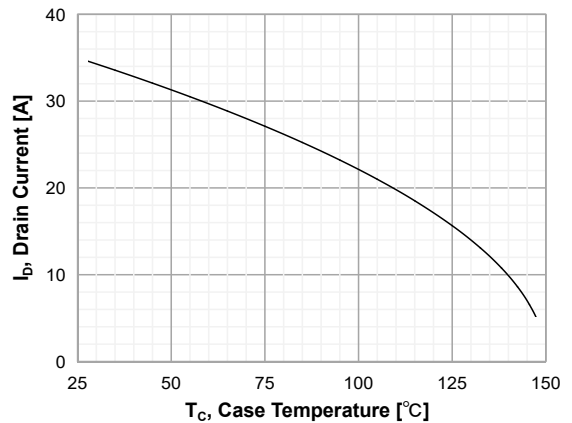


Figure 10. Maximum Drain Current vs. Case Temperature

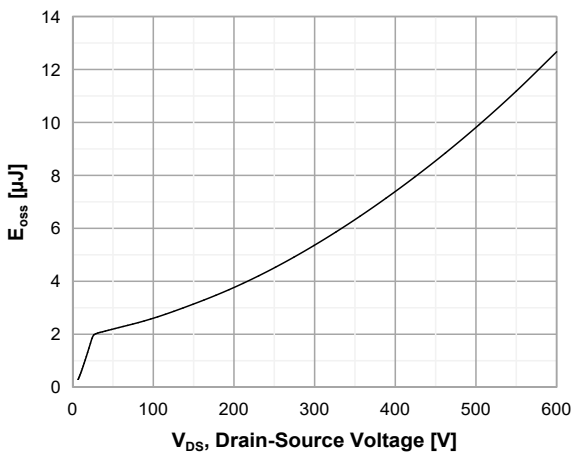


Figure 11. E_{oss} vs. Drain to Source Voltage

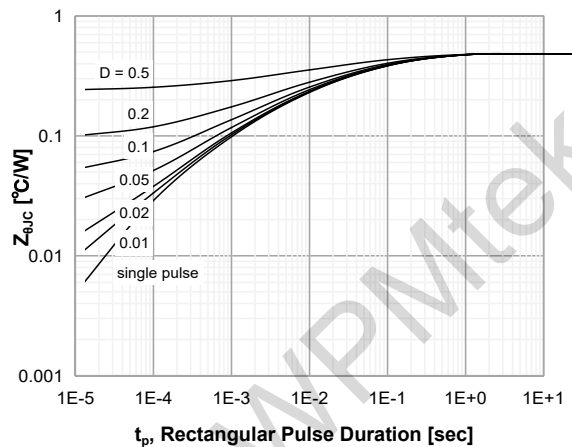
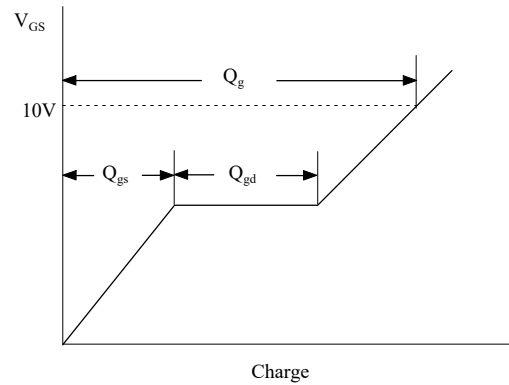
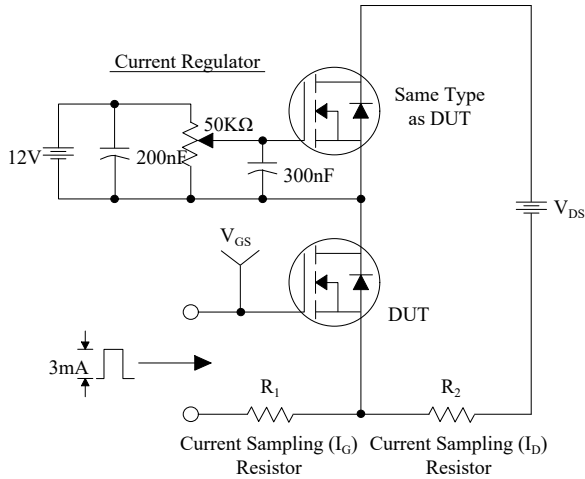


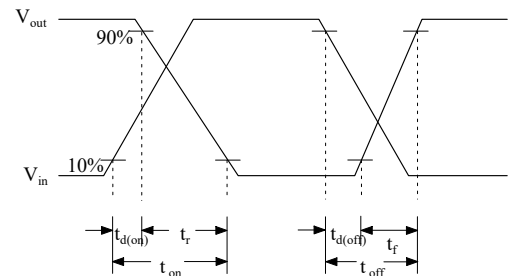
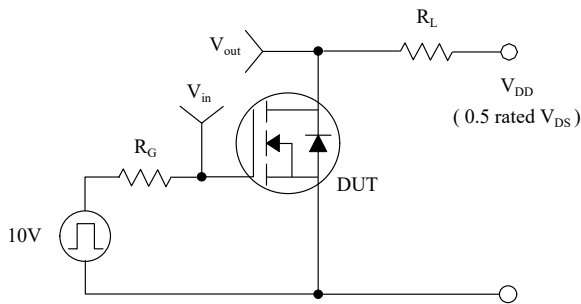
Figure 12. Transient Thermal Response Curve

Test Circuit

Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

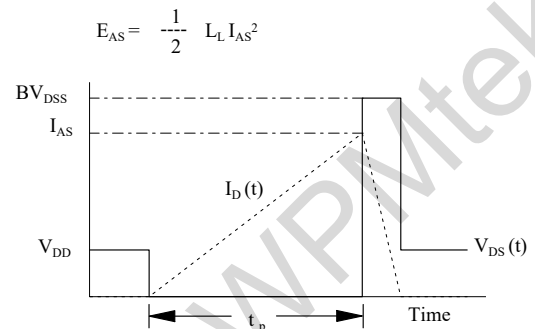
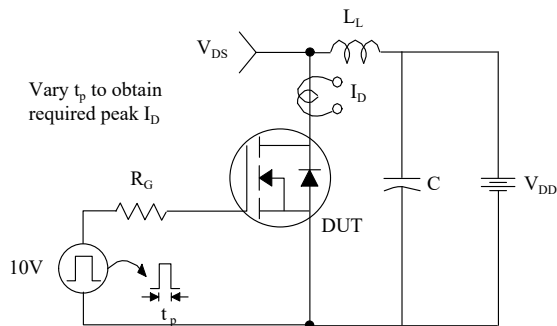


Diagram illustrating a switching transient test setup for a MOSFET (DUT).

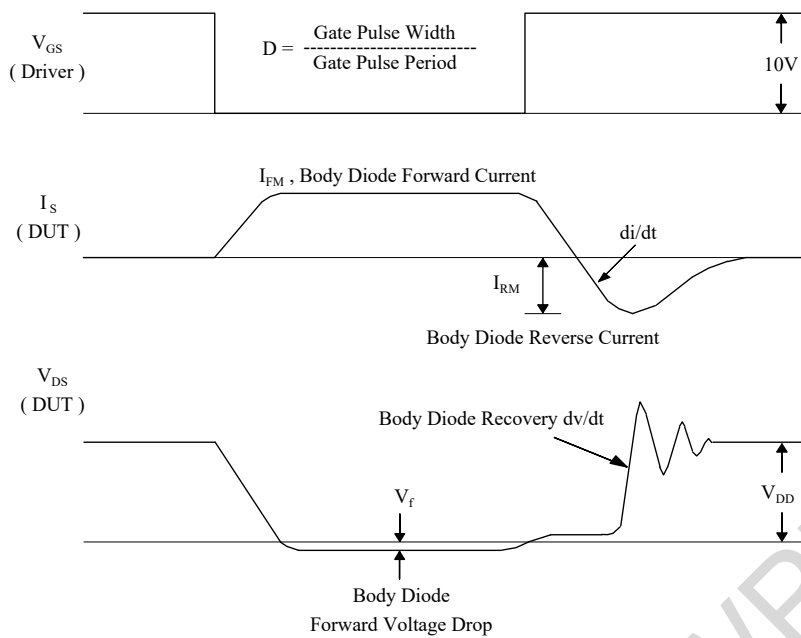
The circuit includes a Driver MOSFET (Same Type as DUT) and a Load Inductor (L).

Key components and connections:

- Driver MOSFET:** Its gate is driven by a voltage source V_{GS} through a resistor R_G . Its drain is connected to the gate of the DUT.
- DUT (Device Under Test):** Its gate is connected to the driver's drain. Its drain is connected to the load inductor L , which is then connected to the supply voltage V_{DD} . Its source is connected to ground.
- Currents and Voltages:**
 - I_S is the current through the DUT.
 - V_{DS} is the drain-source voltage of the DUT.
 - V_{GS} is the gate-source voltage of the driver.
 - V_{DD} is the supply voltage.

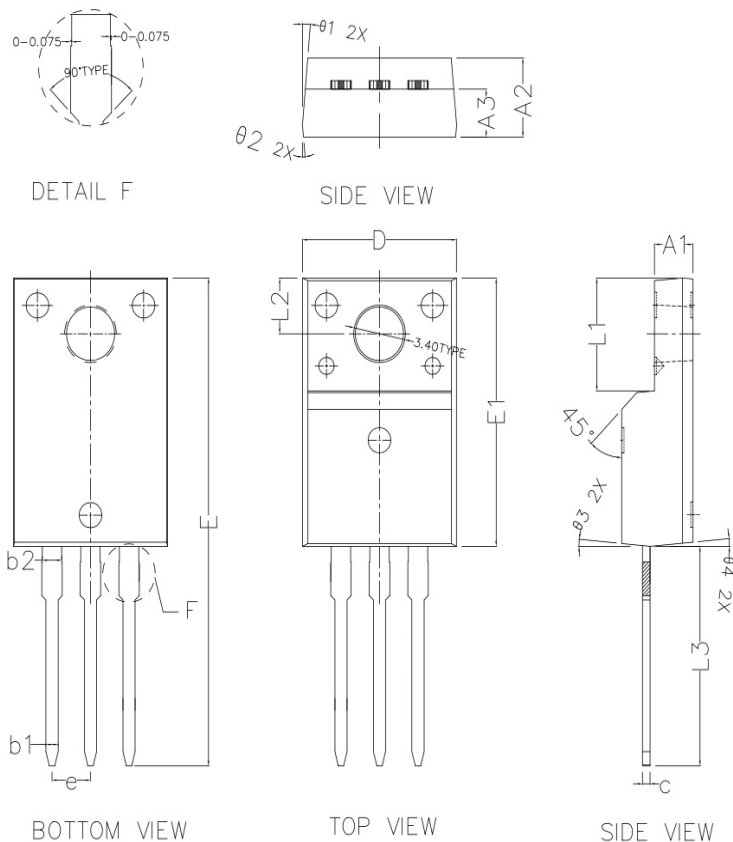
Notes:

- dv/dt is controlled by R_G .
- I_{SD} is controlled by pulse period.



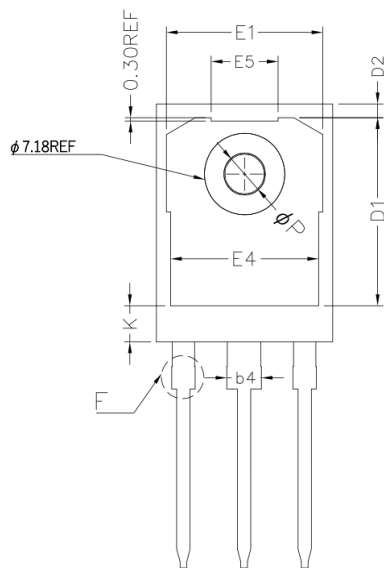
Package Outline

TO-220F Outline

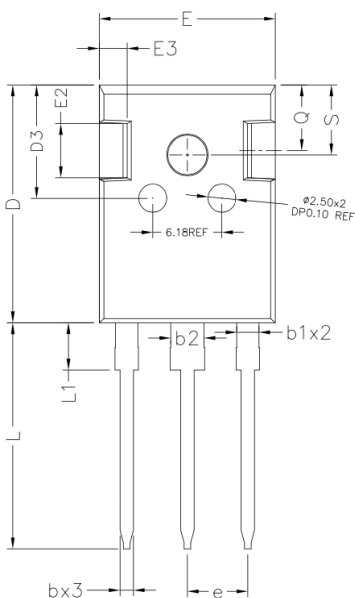


COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A1	2.440	2.540	2.640
A2	4.600	4.700	4.800
A3	2.730	2.830	2.930
b1	0.750	0.800	0.850
b2	1.230	1.280	1.330
c	0.450	0.500	0.550
D	10.060	10.160	10.260
E	28.650	28.850	29.050
E1	15.770	15.870	15.970
e	2.54 TYPE		
L1	6.68 REF		
L2	3.30 REF		
L3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

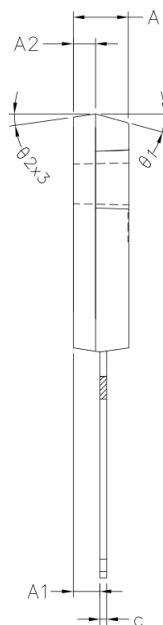
TO-247 Outline



BOTTOM VIEW



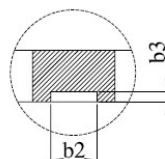
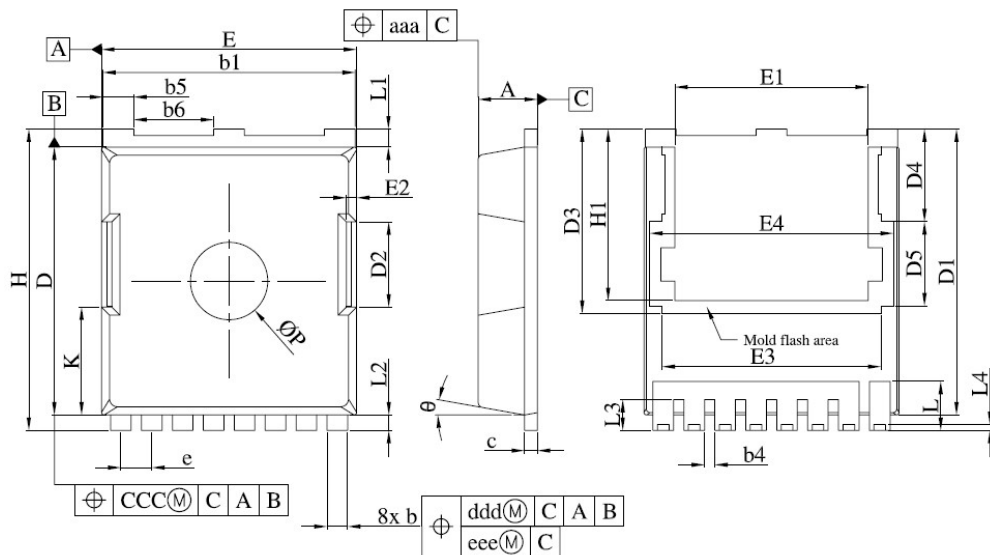
TOP VIEW



SIDE VIEW

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
phi P	3.500	—	3.650
Q	5.490	—	6.000
S	6.040	—	6.300
theta 1	15.0°REF		
theta 2	8.0°REF		
theta 3	8.0°REF		
K	3.190REF		

TOLL-8L Outline

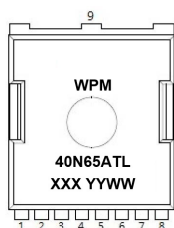


Symbol	Dimensions In Millimeters	
	MIN.	MAX.
A	2.20	2.40
b	0.70	0.90
b1	9.70	9.90
b2	0.36	0.55
b3	0.05	/
b4	0.30	0.50
b5	1.10	1.30
b6	3.00	3.20
c	0.40	0.60
D	10.28	10.55
D1	10.98	11.18
D2	3.20	3.40
D3	7.15	
D4	3.59	
D5	3.26	
e	1.10	1.30
E	9.80	10.00
E1	7.40	7.60

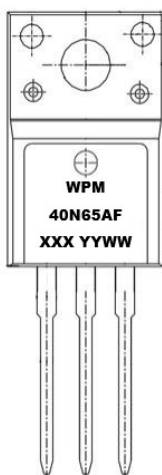
Symbol	Dimensions In Millimeters	
	MIN.	MAX.
E2	7.40	7.60
E3	8.50	
E4	9.46	
H	11.50	11.85
H1	6.55	6.75
K	4.08	4.28
L	1.60	2.10
L1	0.50	0.90
L2	0.50	0.70
L3	1.00	1.30
L4	0.13	0.33
P	2.85	3.15
θ	10°REF	
aaa	0.20	
ccc	0.20	
ddd	0.25	
eee	0.20	

Marking Information

TOLL-8L

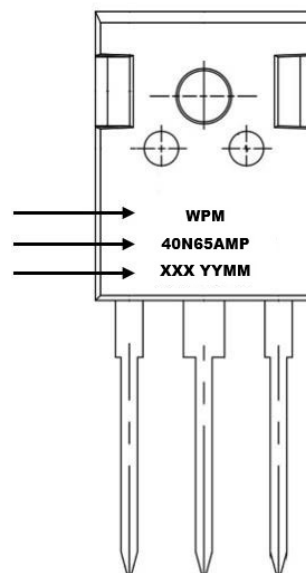


TO-220F



WPM Logo
Marking
Date Code

TO-247



WPM=WPMtek's Logo
40N65ATL=Marking
XXX YYWW=Date Code

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