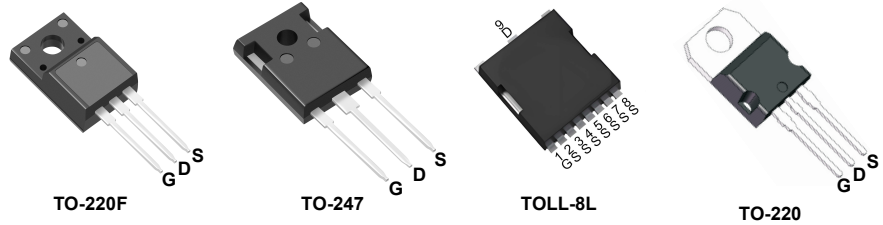


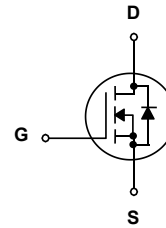
Features

- $BV_{DSS}=650V$, $I_D=30A$
- $R_{DS(on)} : 0.130\Omega$ (Max)@ $V_{GS}=10V$
- Very Low FOM($R_{DS(on)} \times Q_g$)
- Extremely low switching loss
- Excellent stability and uniformity
- 100% Avalanche Tested
- Built-in ESD Diode



Application

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- AC to DC Converters
- Telecom, Solar



Absolute Maximum Ratings $T_C=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-Source Voltage	650	V
V_{GS}	Gate-Source Voltage	± 20	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	30.0	A
	Drain Current - Continuous ($T_C = 100^\circ\text{C}$)	15.8	A
$I_{DM}^{(1)}$	Drain Current - Pulsed	80	A
$E_{AS}^{(2)}$	Single Pulsed Avalanche Energy	454	mJ
I_{AR}	Avalanche Current	3.1	A
dv/dt	MOSFET dv/dt ruggedness, $V_{DS}=0\ldots 400V$	50	V/ns
dv/dt	Reverse diode dv/dt, $V_{DS}=0\ldots 400V$, $I_{DS}\leq I_D$	15	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$) TO-247	265	W
	Power Dissipation ($T_C = 25^\circ\text{C}$) TO-220F	39	
	Power Dissipation ($T_C = 25^\circ\text{C}$) TOLL-8L	234	
	Power Dissipation ($T_C = 25^\circ\text{C}$) TO-220	196	
$V_{ESD(G-S)}$	Gate source ESD(HBM-C=100pF, R=1.5K Ω)	2000	V
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Resistance Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.7	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	$^\circ\text{C/W}$

Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
On Characteristics						
V _{GS}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 1.1 mA	2.0	-	4.0	V
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 10.2 A	-	115	130	mΩ
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 1mA	650	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0	-	-	1	μA
		V _{DS} = 650 V, T _C = 150℃	-	-	100	μA
I _{GSS}	Gate-Body Leakage Current	V _{GS} = ±20 V, V _{DS} = 0 V	-	-	±1	μA
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1.0 MHz	-	2840	-	pF
C _{oss}	Output Capacitance		-	61	-	pF
C _{rss}	Reverse Transfer Capacitance		-	3.8	-	pF
Switching Characteristics						
t _{d(on)}	Turn-On Time	V _{DS} = 325 V, I _D = 14.3 A, R _G = 25 Ω (Note 3,4)	-	56	-	ns
t _r	Turn-On Rise Time		-	31	-	ns
t _{d(off)}	Turn-Off Delay Time		-	250	-	ns
t _f	Turn-Off Fall Time		-	20	-	ns
Q _g	Total Gate Charge	V _{DS} = 520 V, I _D = 14.3 A, V _{GS} = 10 V (Note 3,4)	-	65	-	nC
Q _{gs}	Gate-Source Charge		-	12	-	nC
Q _{gd}	Gate-Drain Charge		-	19	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		-	-	30	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		-	-	80	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 14.3 A	-	-	1.3	V
t _{rr}	Reverse Recovery Time	V _R = 400 V, I _F = 14.3 A di _F /dt = 100 A/μs	-	450	-	ns
Q _{rr}	Reverse Recovery Charge		-	7.8	-	μC

Notes :

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $I_{AS}=3.1\text{ A}$ $V_{DD}=100\text{ V}$, $R_G=25\ \Omega$, Starting $T_J=25^\circ\text{C}$
3. Pulse Test : Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$
4. Essentially Independent of Operating Temperature

Typical Characteristics

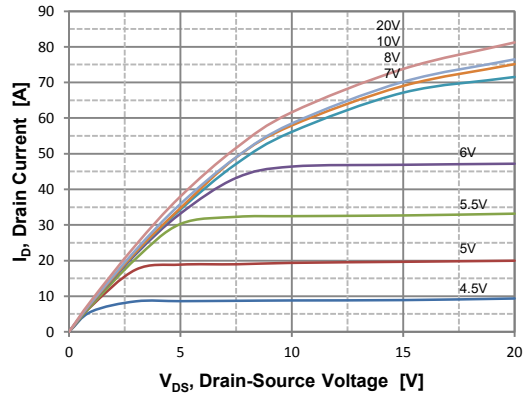


Figure 1. On Region Characteristics

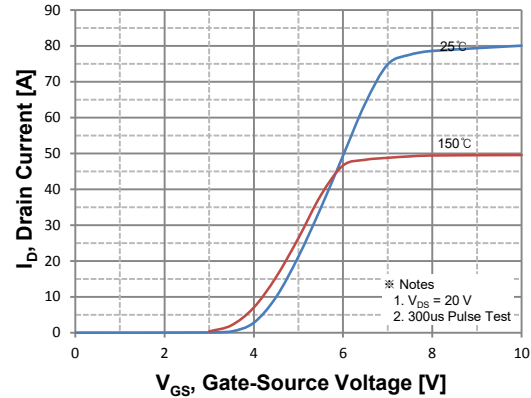


Figure 2. Transfer Characteristics

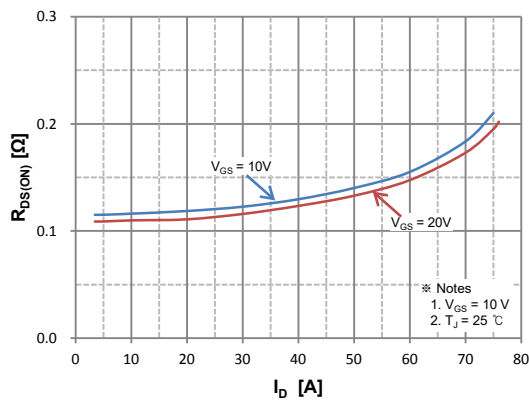


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

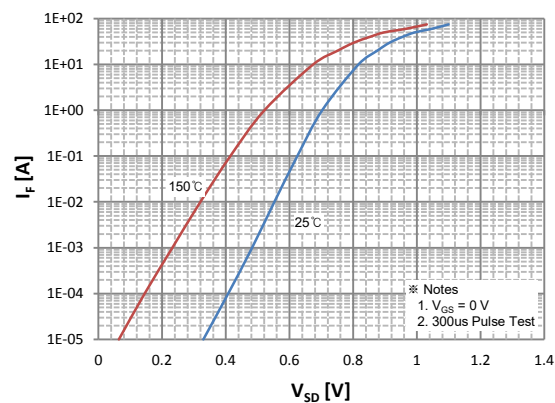


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

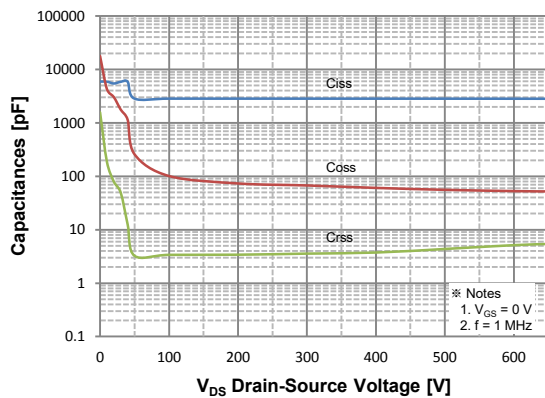


Figure 5. Capacitance Characteristics

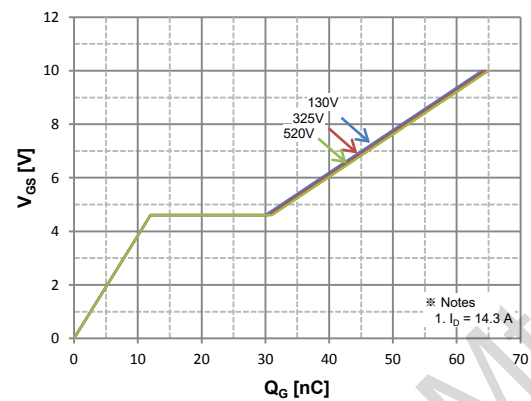


Figure 6. Gate Charge Characteristics

Typical Characteristics

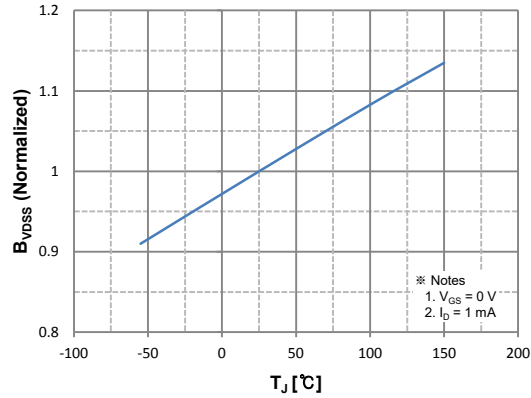


Figure 7. Breakdown Voltage Variation vs. Temperature

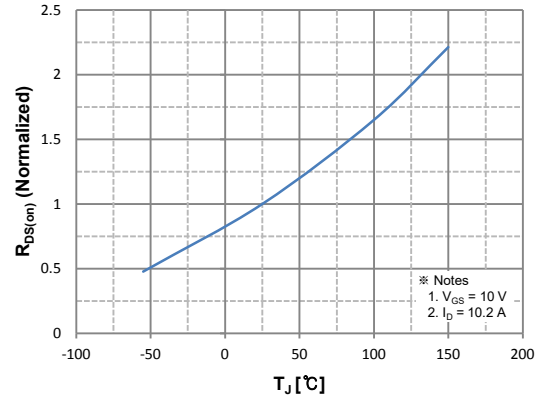


Figure 8. On-Resistance Variation vs. Temperature

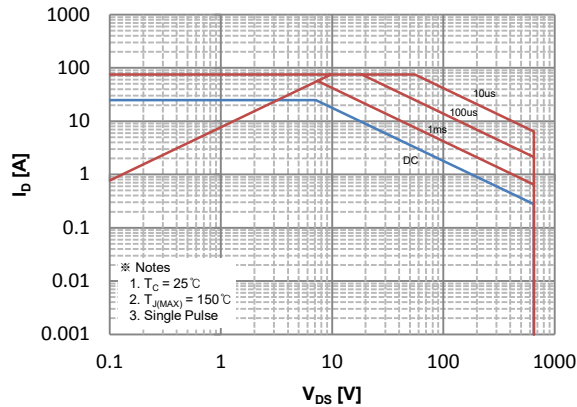


Figure 9. Maximum Safe Operating Area

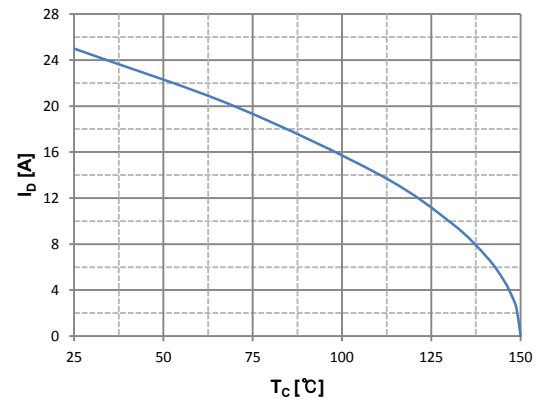


Figure 10. Maximum Drain Current vs. Case Temperature

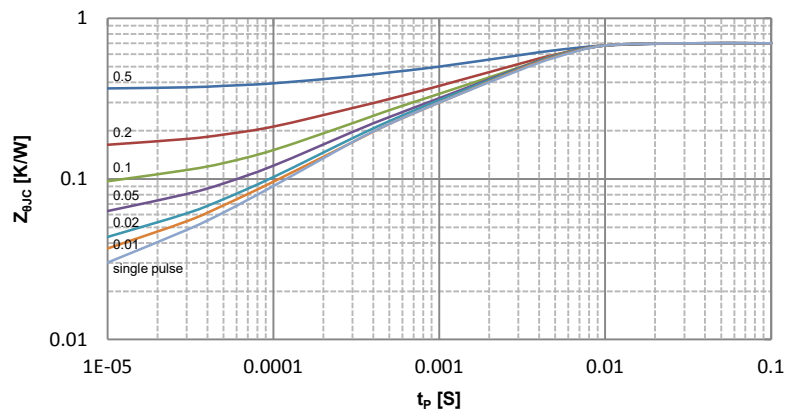


Figure 11. Transient Thermal Response Curve

Fig 12. Gate Charge Test Circuit & Waveform

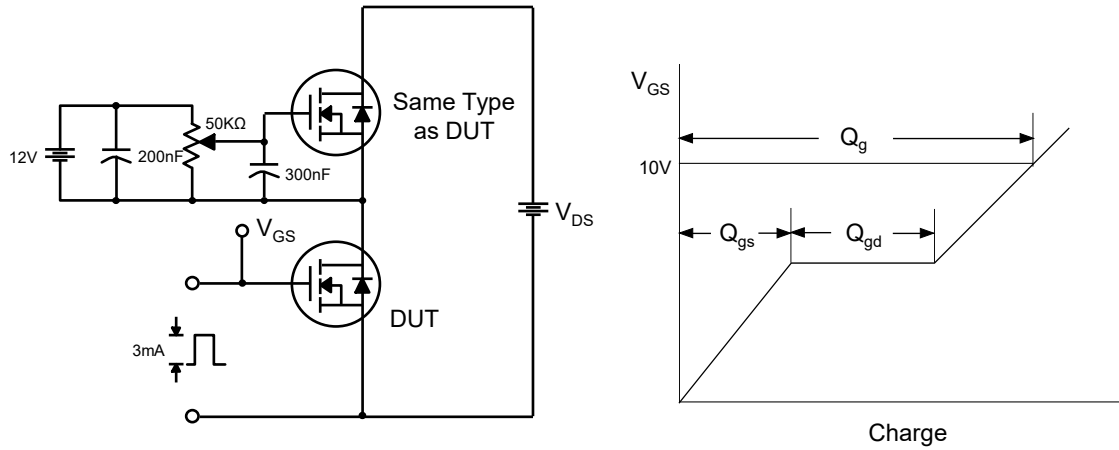


Fig 13. Resistive Switching Test Circuit & Waveforms

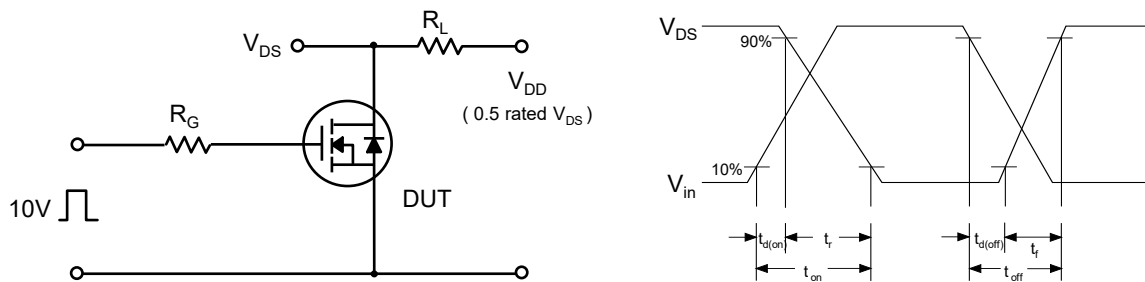


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

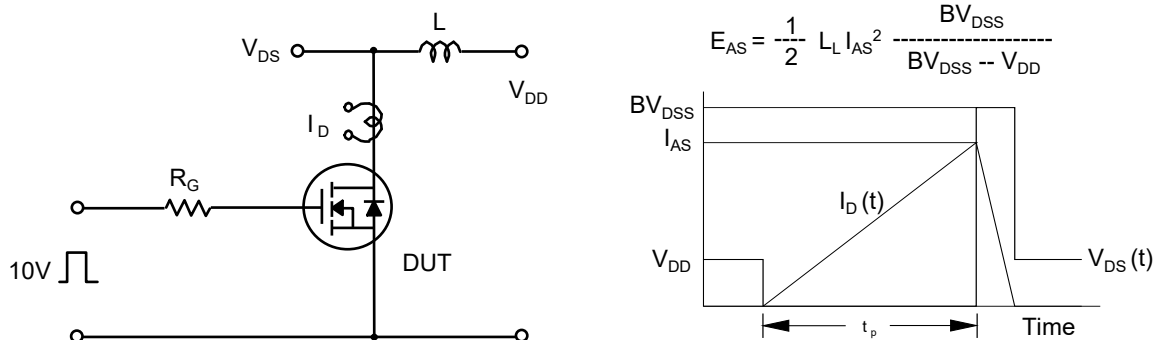
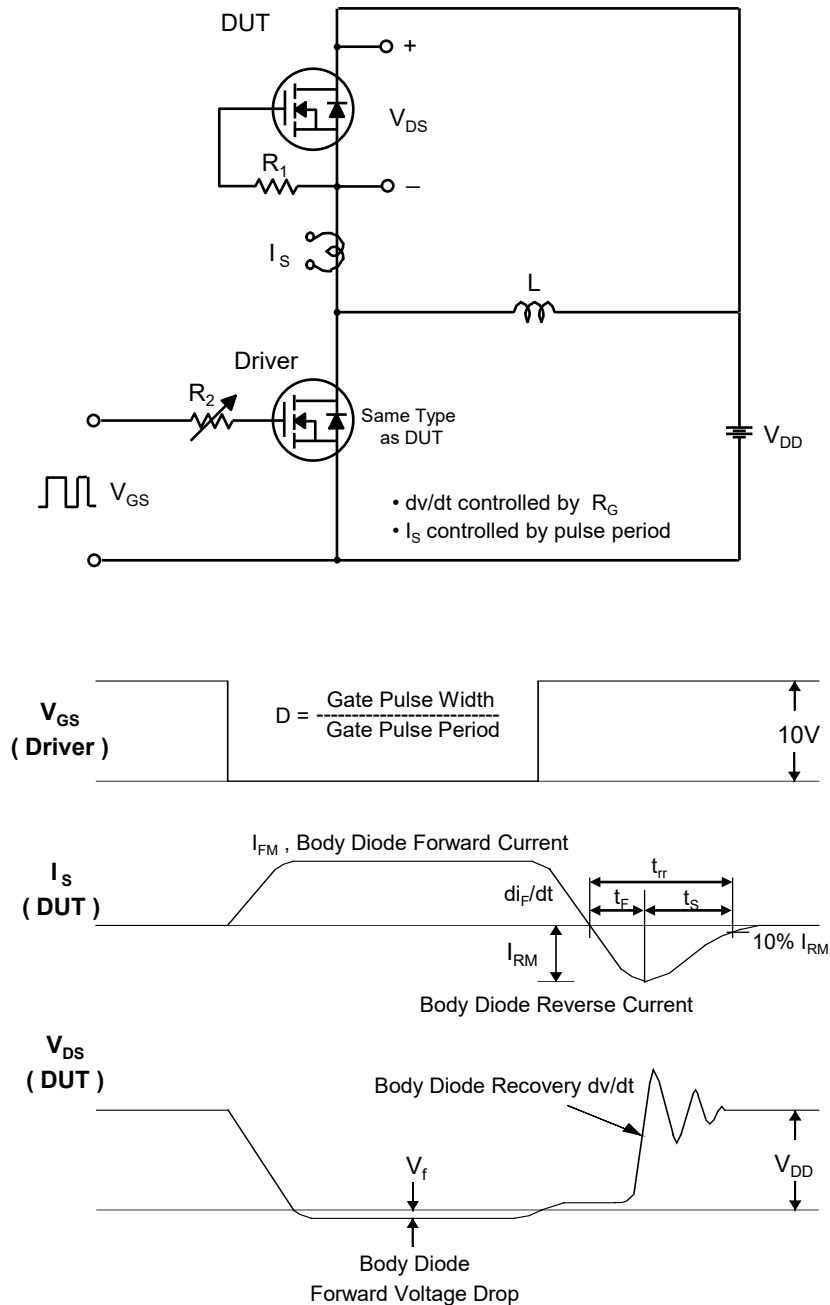
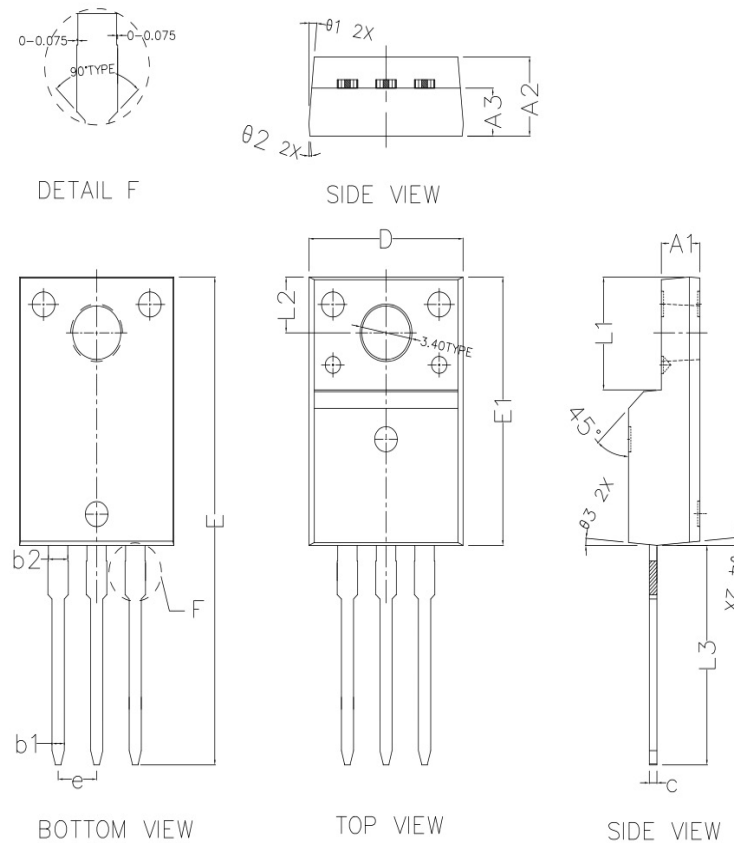


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



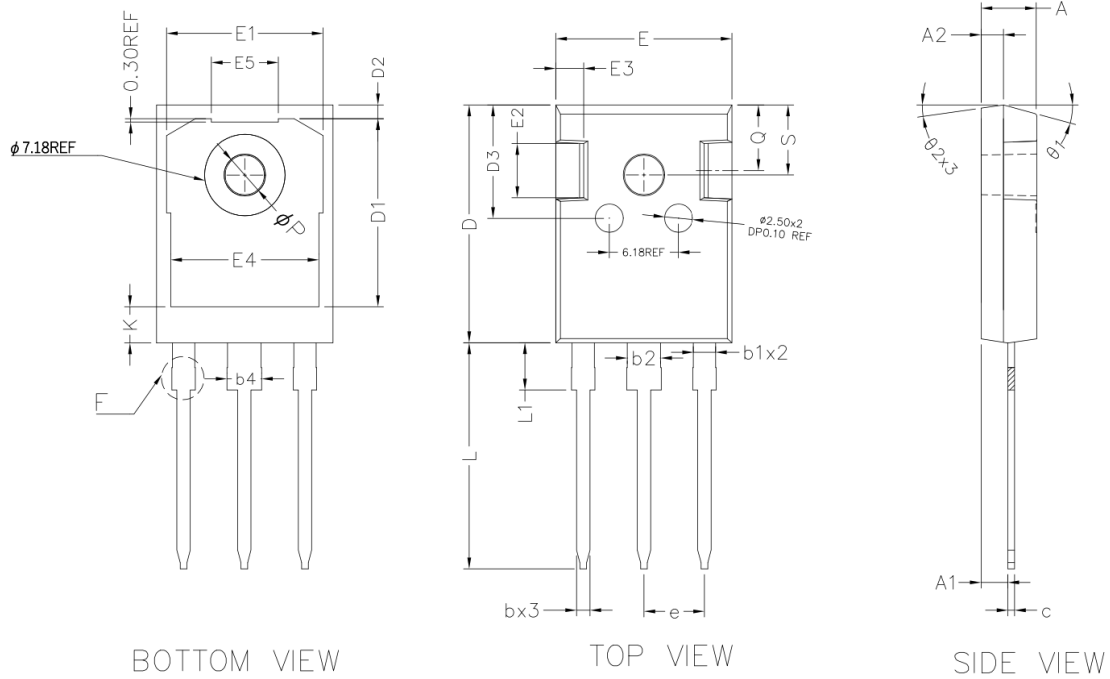
Package Outline

TO-220F Outline



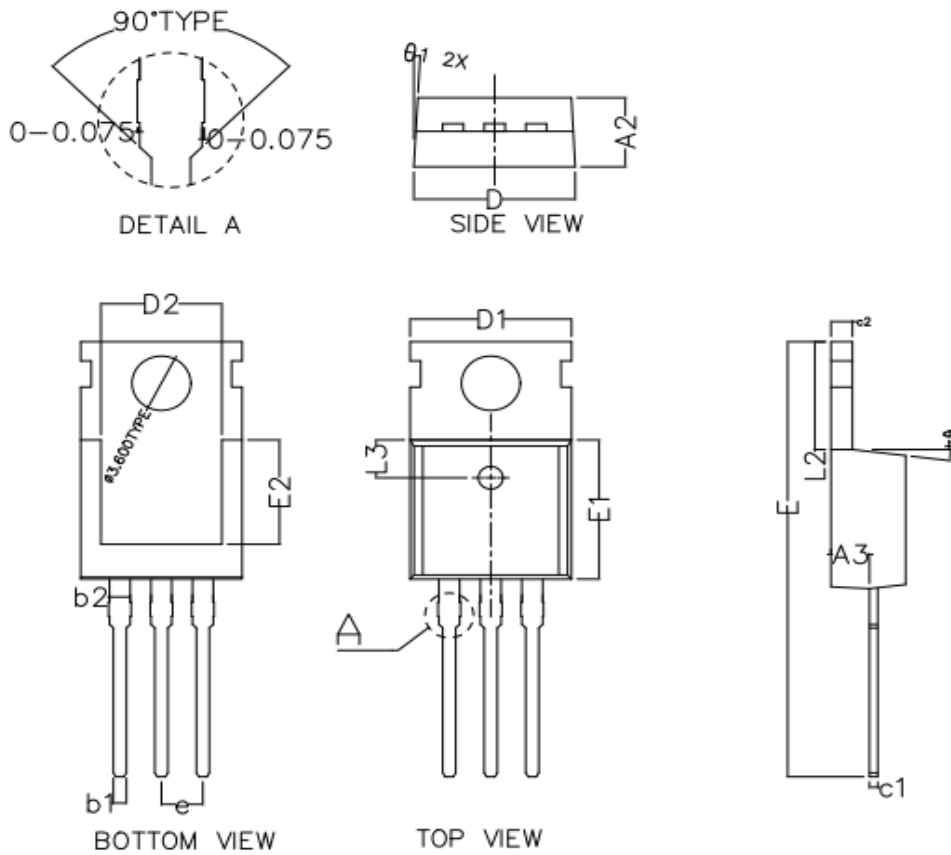
COMMON DIMENSIONS (UNITS OF MEASURE IS mm)			
	MIN	NORMAL	MAX
A1	2.440	2.540	2.640
A2	4.600	4.700	4.800
A3	2.730	2.830	2.930
b1	0.750	0.800	0.850
b2	1.230	1.280	1.330
c	0.450	0.500	0.550
D	10.060	10.160	10.260
E	28.650	28.850	29.050
E1	15.770	15.870	15.970
e	2.54TYPE		
L1	6.68REF		
L2	3.30REF		
L3	12.830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

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
ϕQ	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		

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

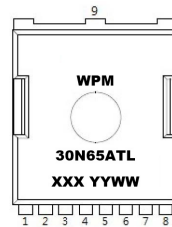
TO-220F



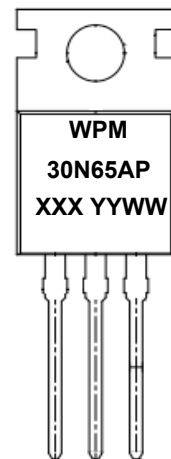
TO-247



TOLL-8L



TO-220



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30N65ATL=Marking
XXX YYWW=Date Code

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