TMT20N60 / TMF20N60
N-CHANNEL POWER MOSFET

General Description

The TMT20N60 & TMF20N60 have been fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications.By providing low $R_{DS(on)}$, C_{iss} and C_{rss} along with guaranteed avalanche capability these parts can be adopted quickly into new and existing offline power supply designs.

Product Summary

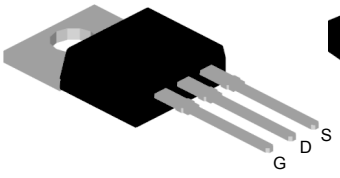
V_{DS}	600V
I_D (at V_{GS}=10V)	20A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 0.45Ω

100% UIS Tested
100% R_g Tested

RoHS Compliant

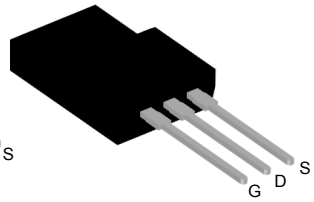
Top View

TO-220AB

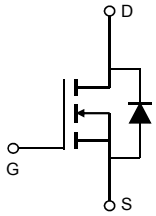


TMT20N60

TO-220F



TMF20N60



Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	TMT20N60	TMF20N60	Units
Drain-Source Voltage		V_{DS}	600		V
Gate-Source Voltage		V_{GS}	±30		V
Continuous Drain Current	T_C=25°C	I_D	20	20*	A
	T_C=100°C		14	14*	
Pulsed Drain Current [C]		I_{DM}	80		
Avalanche Current [C]		I_{AR}	6.5		A
Repetitive avalanche energy [C]		E_{AR}	630		mJ
Single plused avalanche energy [G]		E_{AS}	1260		mJ
Peak diode recovery dv/dt		dv/dt	5		V/ns
Power Dissipation [B]	T_C=25°C	P_D	250	85	W
	Derate above 25°C		2.0	0.68	W/ °C
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150		°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		T_L	300		°C

Thermal Characteristics

Parameter	Symbol	TM20N60	TMF20N60	Units
Maximum Junction-to-Ambient [A,D]	$R_{\theta JA}$	65	65	°C/W
Maximum Case-to-sink [A]	$R_{\theta CS}$	0.5	--	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	0.3	2.5	°C/W

* Drain current limited by maximum junction temperature.

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=250μA, V_{GS}=0V, T_J=25°C	600			V
BV_{DSS} /ΔTJ	Breakdown Voltage Temperature Coefficient	I_D=250μA, V_{GS}=0V		0.8		V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=600V, V_{GS}=0V			1	μA
		V_{DS}=480V, T_J=125°C			10	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±30V			±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=5V, I_D=250μA	3.2	3.8	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=10A		0.37	0.45	Ω
g_{FS}	Forward Transconductance	V_{DS}=40V, I_D=10A		25		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.69	1	V
I_S	Maximum Body-Diode Continuous Current				20	A
I_{SM}	Maximum Body-Diode Pulsed Current				80	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=25V, f=1MHz	2448	3061	3680	pF
C_{oss}	Output Capacitance		190	273	360	pF
C_{rss}	Reverse Transfer Capacitance		13	22.8	35	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	0.7	1.4	2.1	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=10V, V_{DS}=480V, I_D=20A	48	61	74	nC
Q_{gs}	Gate Source Charge		14	18	22	nC
Q_{gd}	Gate Drain Charge		12	24	36	nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=300V, I_D=20A, R_G=25Ω		57		ns
t_r	Turn-On Rise Time			125		ns
$t_{D(off)}$	Turn-Off DelayTime			128		ns
t_f	Turn-Off Fall Time			88		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=20A,dI/dt=100A/μs,V_{DS}=100V	384	480	580	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=20A,dI/dt=100A/μs,V_{DS}=100V	8	10.5	13	μC

A. The value of $R_{\theta JA}$ is measured with the device in a still air environment with T_A=25° C.
B. The power dissipation P_D is based on $T_{J(MAX)}$=150° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
C. Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150° C, Ratings are based on low frequency and duty cycles to keep initial T_J =25° C.
D. The $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.
E. The static characteristics in Figures 1 to 6 are obtained using <300 μs pulses, duty cycle 0.5% max.
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.
G. L=60mH, I_{AS}=6.5A, V_{DD}=150V, R_G=25Ω, Starting T_J=25° C

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

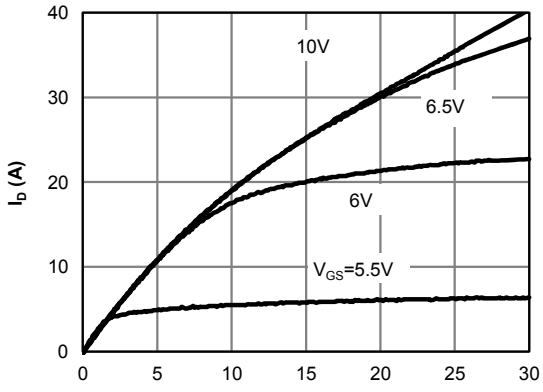


Fig 1: On-Region Characteristics

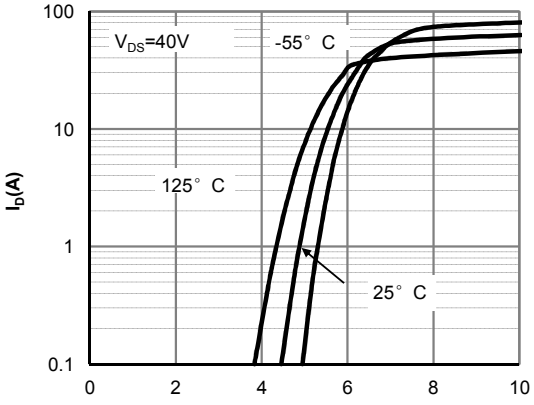


Figure 2: Transfer Characteristics

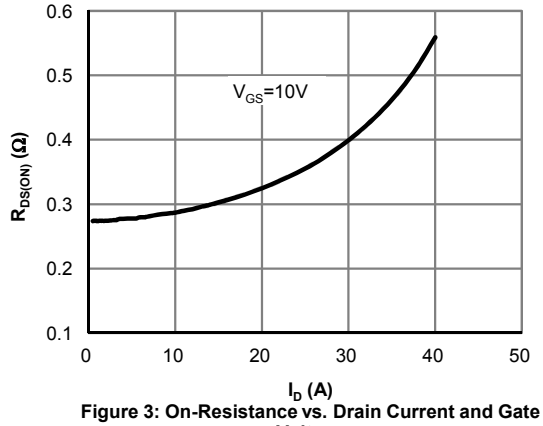


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

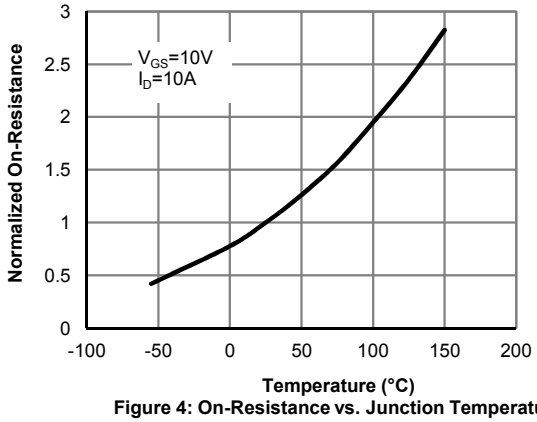


Figure 4: On-Resistance vs. Junction Temperature

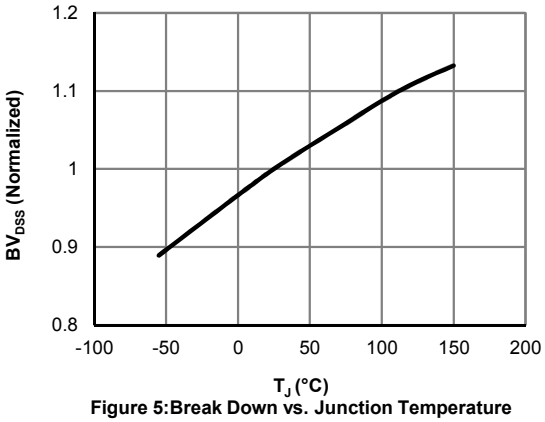


Figure 5:Break Down vs. Junction Temperature

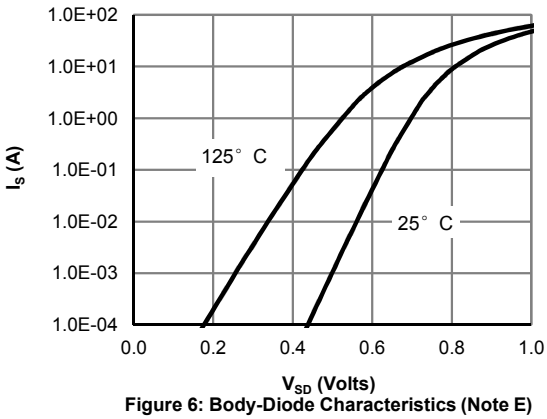


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

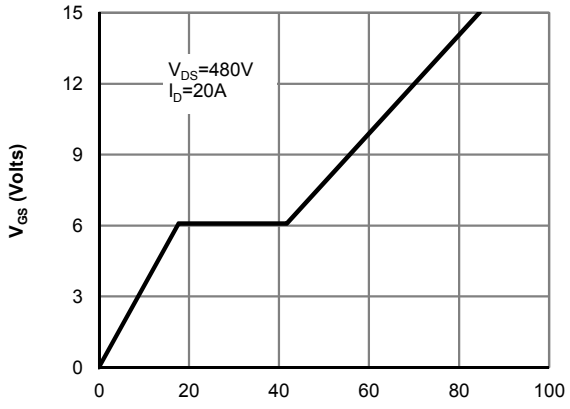


Figure 7: Gate-Charge Characteristics

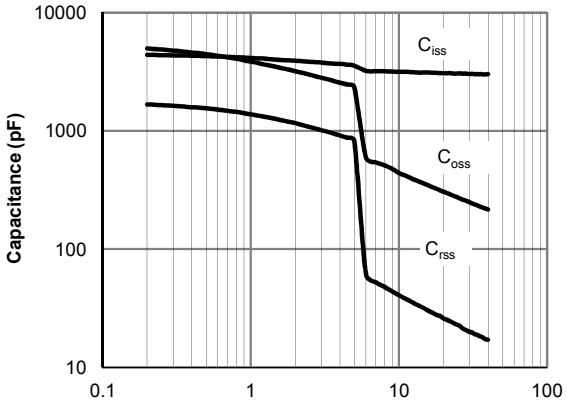


Figure 8: Capacitance Characteristics

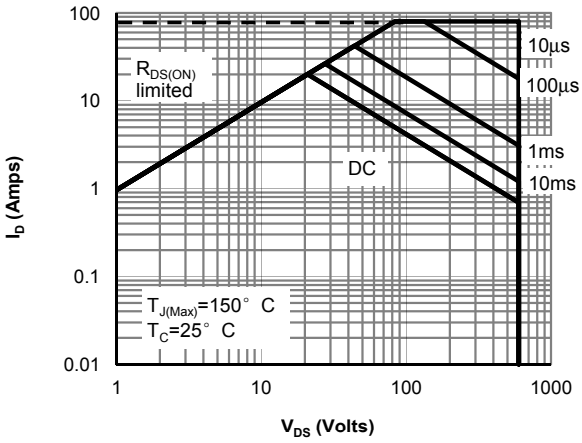


Figure 9: Maximum Forward Biased Safe Operating Area for AOT20N60 (Note F)

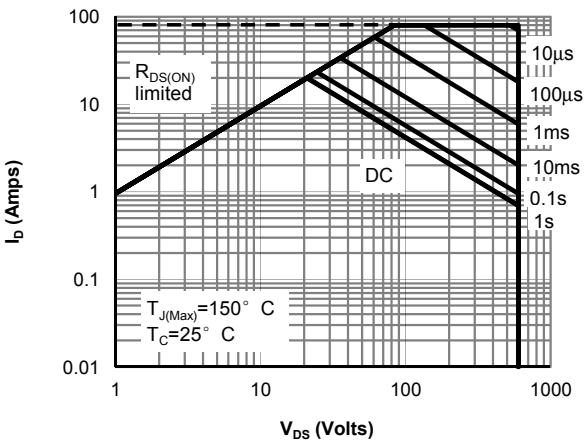


Figure 10: Maximum Forward Biased Safe Operating Area for AOTF20N60 (Note F)

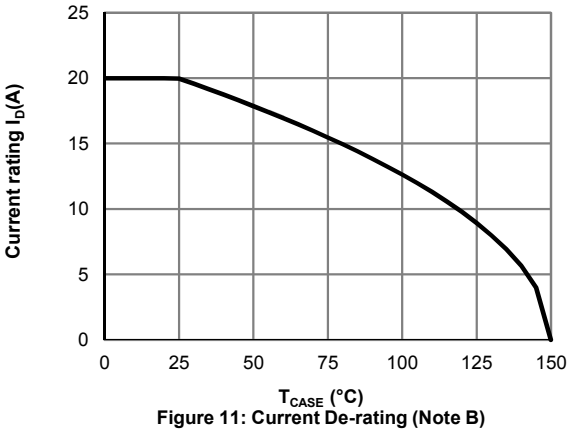


Figure 11: Current De-rating (Note B)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

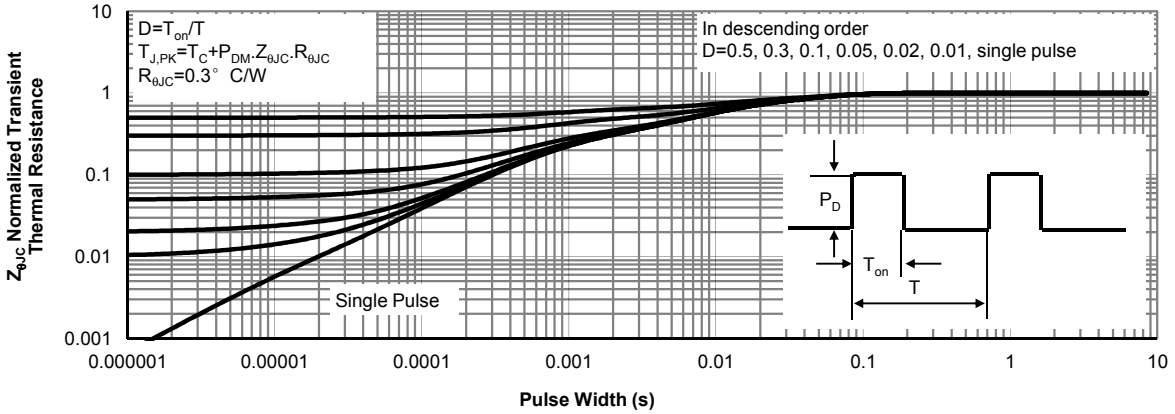


Figure 12: Normalized Maximum Transient Thermal Impedance for AOT20N60 (Note F)

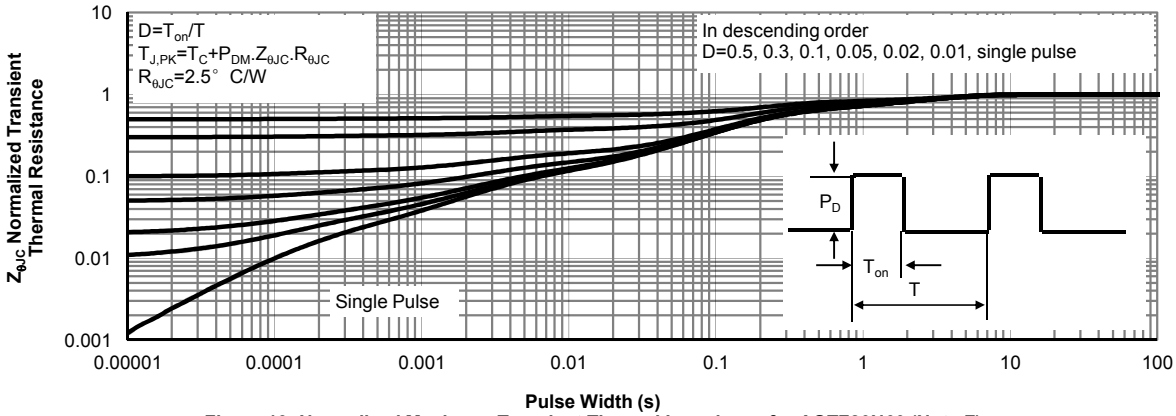
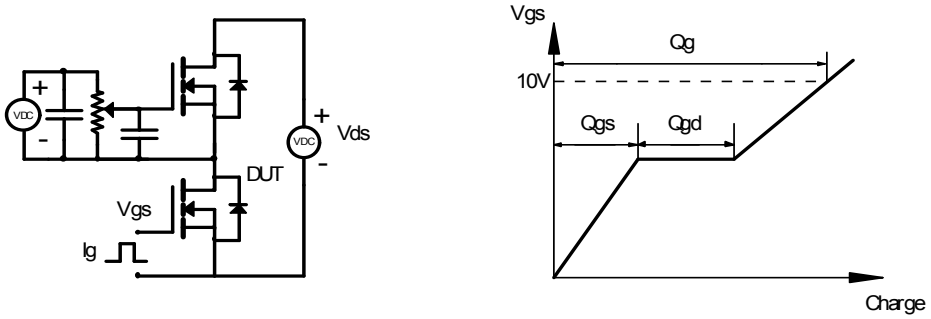
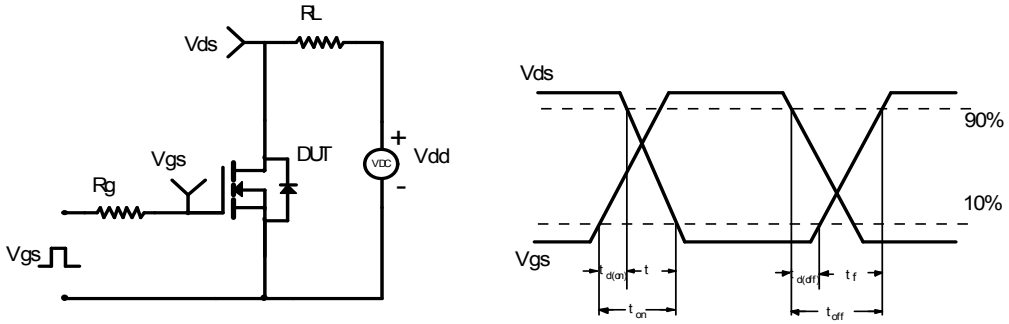


Figure 13: Normalized Maximum Transient Thermal Impedance for AOTF20N60 (Note F)

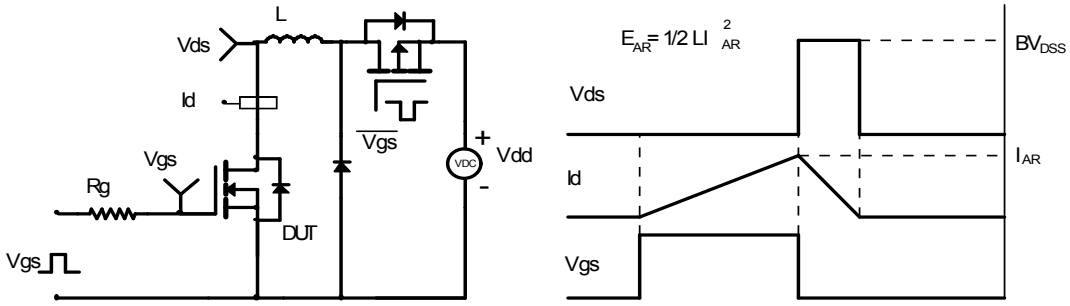
Gate Charge Test Circuit & Waveform



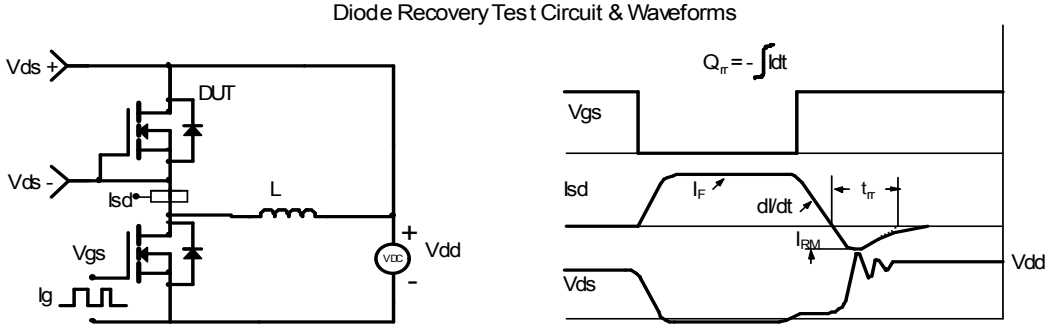
Resistive Switching Test Circuit & Waveforms



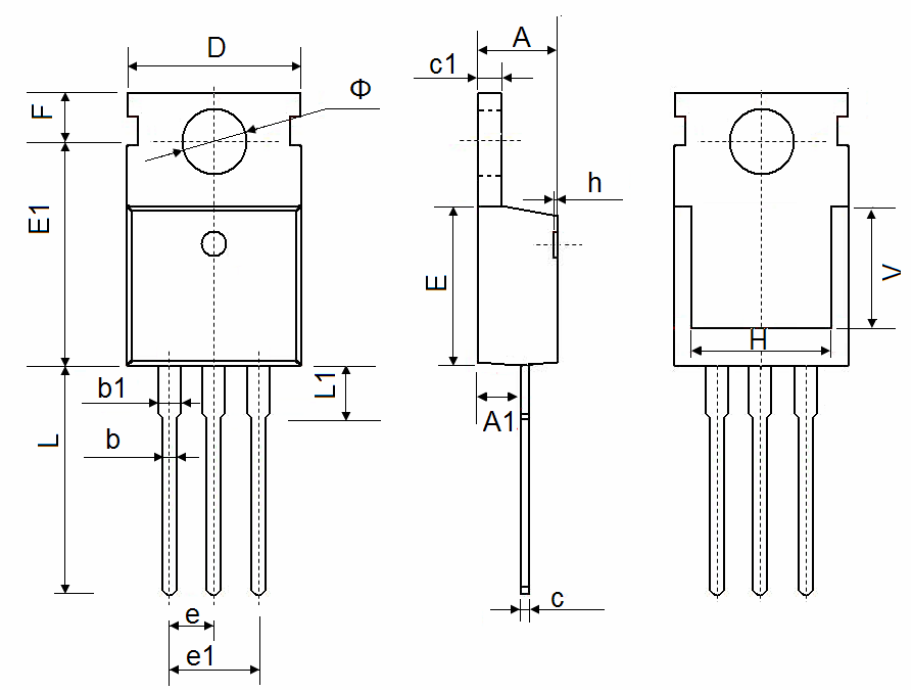
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

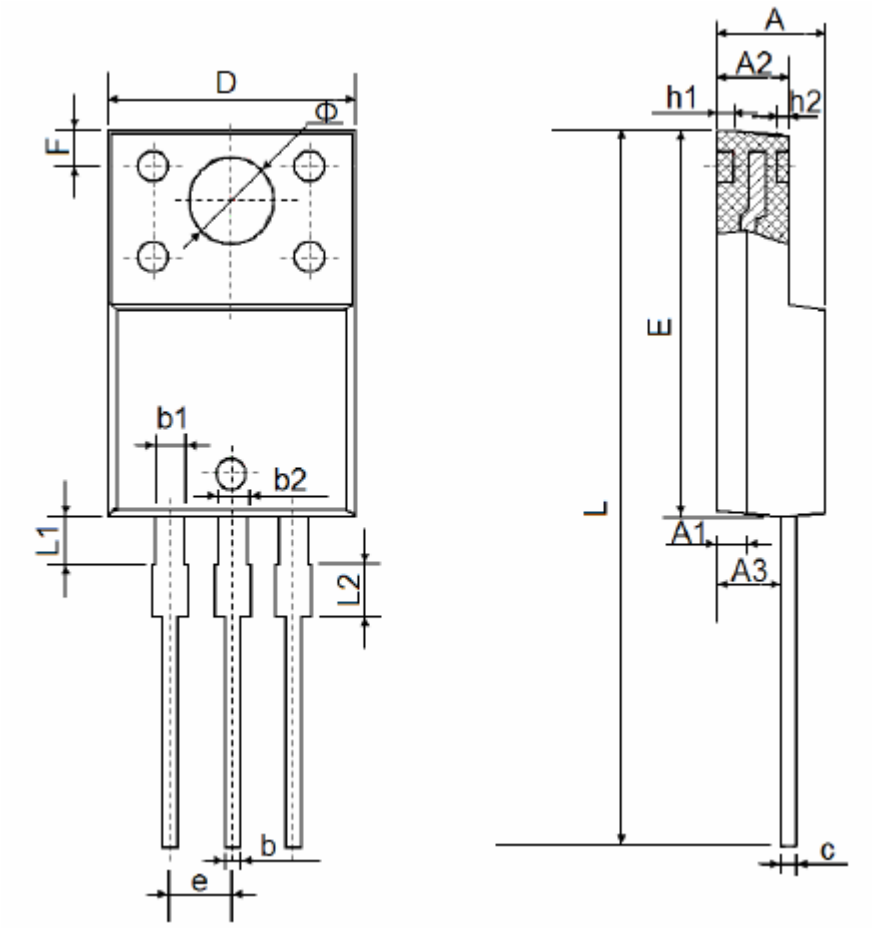


TO-220AB Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	7.500 REF.		0.295 REF.	
Φ	3.400	3.800	0.134	0.150

TO-220F Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	1.300REF		0.051REF	
A2	2.800	3.200	0.110	0.126
A3	2.500	2.900	0.098	0.114
b	0.500	0.750	0.020	0.030
b1	1.100	1.350	0.043	0.053
b2	1.500	1.750	0.059	0.069
c	0.500	0.750	0.020	0.030
D	9.960	10.360	0.392	0.408
E	14.800	15.200	0.583	0.598
e	2.540TYP.		0.100TYP	
F	2.700REF		0.106REF	
Φ	3.500REF		0.138REF	
h1	0.800REF		0.031REF	
h2	0.500REF		0.020REF	
L	28.000	28.400	1.102	1.118
L1	1.700	1.900	0.067	0.075
L2	1.900	2.100	0.075	0.083