TMT12N65 / TMTF12N65 / TMB12N65
N-CHANNEL POWER MOSFET

General Description

The TMT12N65 & TMTF12N65 & TMB12N65 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

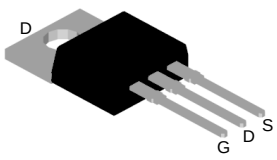
V_{DS}	650V
I_D (at V_{GS}=10V)	12A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 0.72Ω

100% UIS Tested
100% R_g Tested

RoHS Compliant

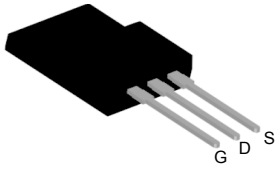
Top View

TO-220AB



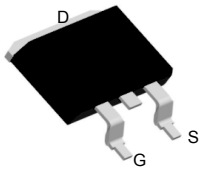
TMT12N65

TO-220F

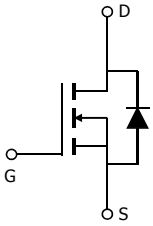


TMTF12N65

TO-263
D²PAK



TMB12N65



Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	TMT(B)12N65	TMTF12N65	Units
Drain-Source Voltage		V_{DS}	650		V
Gate-Source Voltage		V_{GS}	±30		V
Continuous Drain Current	T_C=25°C	I_D	12	12*	A
	T_C=100°C		7.7	7.7*	
Pulsed Drain Current [C]		I_{DM}	48		
Avalanche Current [C]		I_{AR}	5		A
Repetitive avalanche energy [C]		E_{AR}	375		mJ
Single plused avalanche energy [G]		E_{AS}	750		mJ
MOSFET dv/dt ruggedness		dv/dt	30		V/ns
Peak diode recovery dv/dt			5		
Power Dissipation [B]	T_C=25°C	P_D	278	50	W
	Derate above 25°C		2.2	0.4	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	TMT(B)12N65	TMTF12N65	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	$R_{\theta JC}$	0.45	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	650			V
BV_{DSS} /ΔTJ	Breakdown Voltage Temperature Coefficient	I_D=250µA, V_{GS}=0V		0.72		V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=650V, V_{GS}=0V			1	µA
		V_{DS}=520V, 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	3.9	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=6A		0.57	0.72	Ω
g_{FS}	Forward Transconductance	V_{DS}=40V, I_D=6A		17		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.71	1	V
I_S	Maximum Body-Diode Continuous Current				12	A
I_{SM}	Maximum Body-Diode Pulsed Current				48	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=25V, f=1MHz	1430	1792	2150	pF
C_{oss}	Output Capacitance		120	152	185	pF
C_{rss}	Reverse Transfer Capacitance		9	11.5	18	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	1.7	3.5	5.3	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=10V, V_{DS}=520V, I_D=12A	32	39.8	48	nC
Q_{gs}	Gate Source Charge		7.5	9.2	11	nC
Q_{gd}	Gate Drain Charge		13.5	16.8	20	nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=325V, I_D=12A, R_G=25Ω		36		ns
t_r	Turn-On Rise Time			77		ns
$t_{D(off)}$	Turn-Off DelayTime			120		ns
t_f	Turn-Off Fall Time			63		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=12A,dI/dt=100A/µs,V_{DS}=100V	300	375	450	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=12A,dI/dt=100A/µs,V_{DS}=100V	6	7.5	9	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 impedence 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 impedence 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}=5A, V_{DD}=150V, R_G=25Ω, Starting T_J=25° C

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

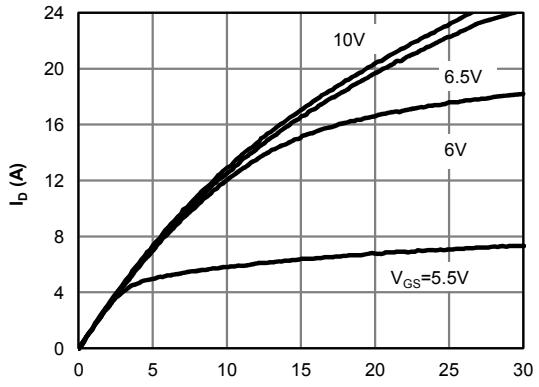


Fig 1: On-Region Characteristics

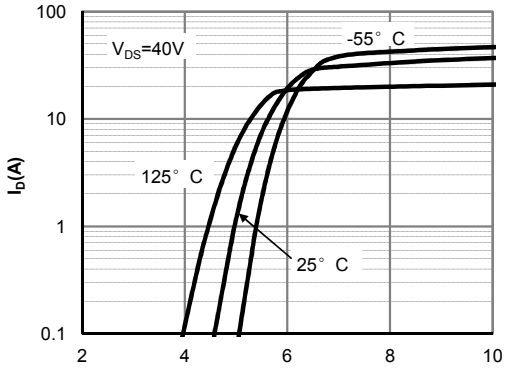


Figure 2: Transfer Characteristics

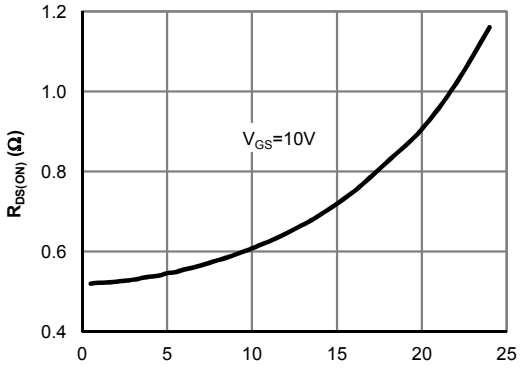


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

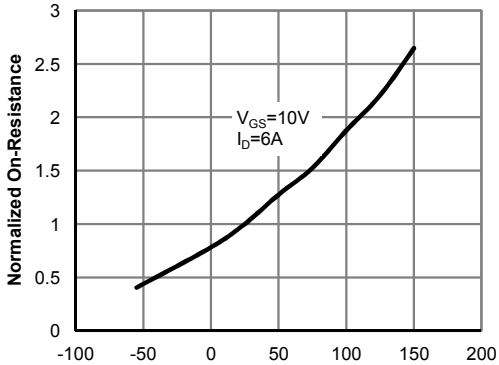


Figure 4: On-Resistance vs. Junction Temperature

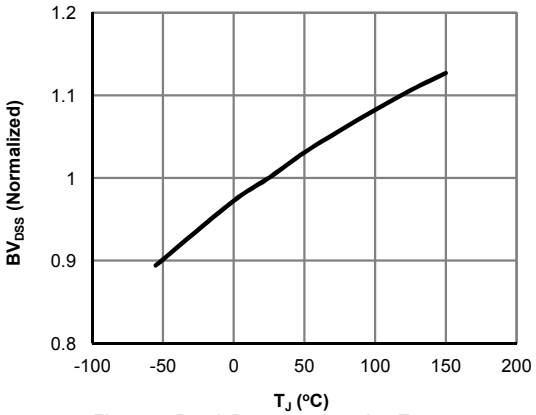


Figure 5: Break Down vs. Junction Temperature

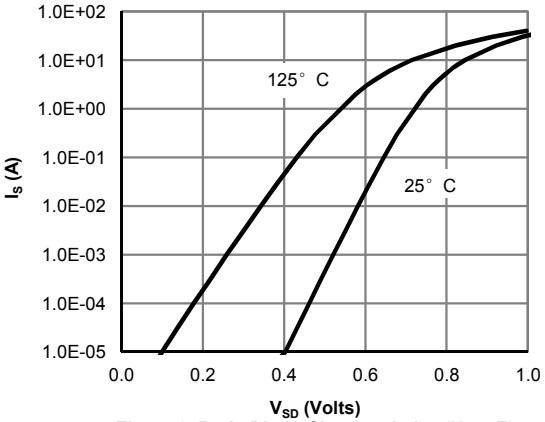


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

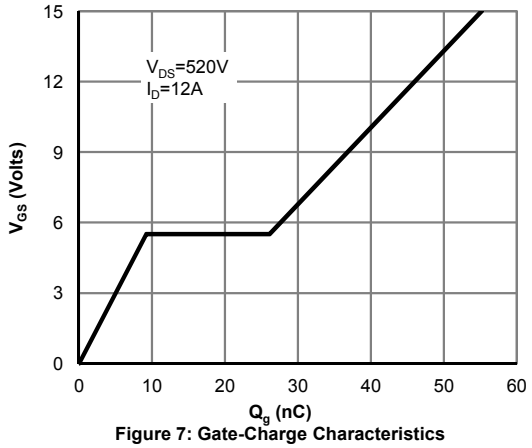


Figure 7: Gate-Charge Characteristics

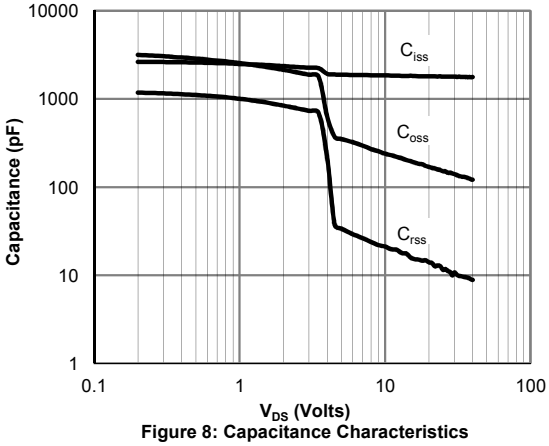


Figure 8: Capacitance Characteristics

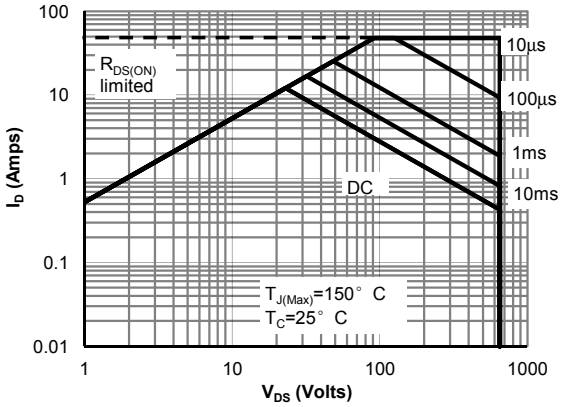


Figure 9: Maximum Forward Biased Safe Operating Area for AOT(B)12N65 (Note F)

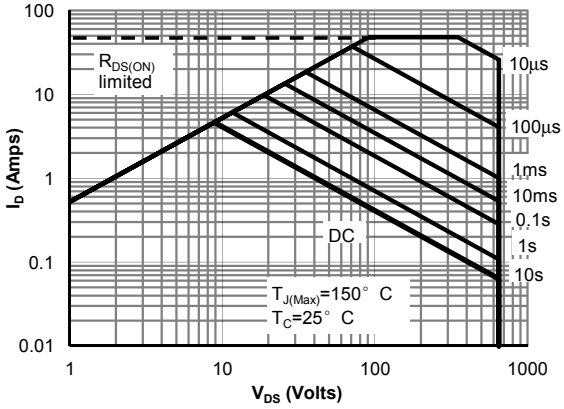


Figure 10: Maximum Forward Biased Safe Operating Area for AOTF12N65 (Note F)

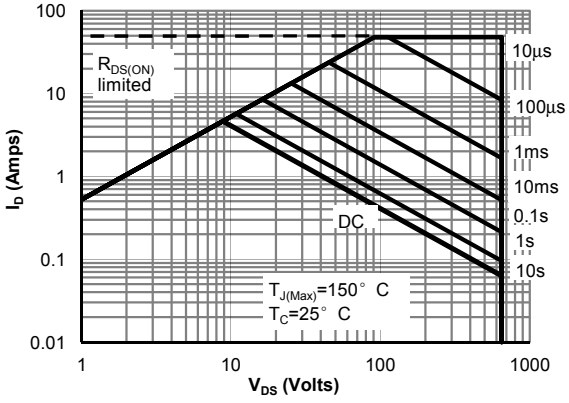


Figure 11: Maximum Forward Biased Safe Operating Area for AOTF12N65L (Note F)

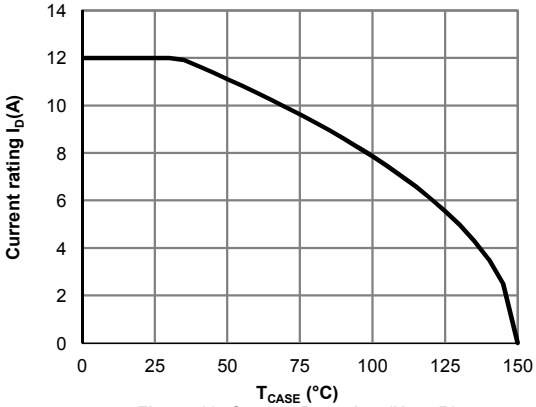


Figure 12: Current De-rating (Note B)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

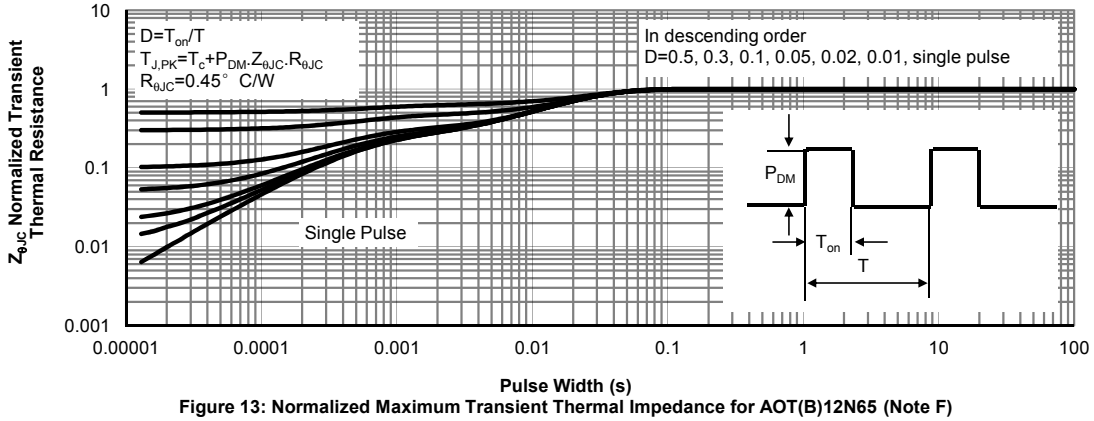


Figure 13: Normalized Maximum Transient Thermal Impedance for AOT(B)12N65 (Note F)

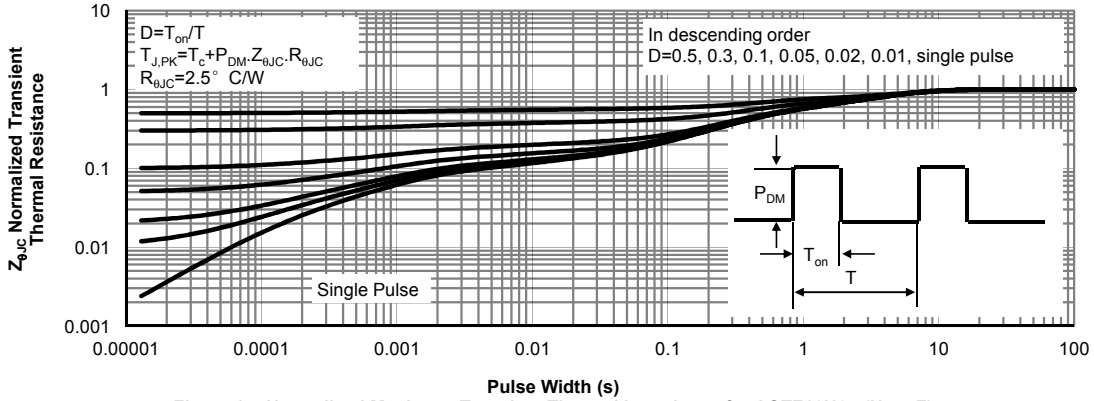


Figure 14: Normalized Maximum Transient Thermal Impedance for AOTF12N65 (Note F)

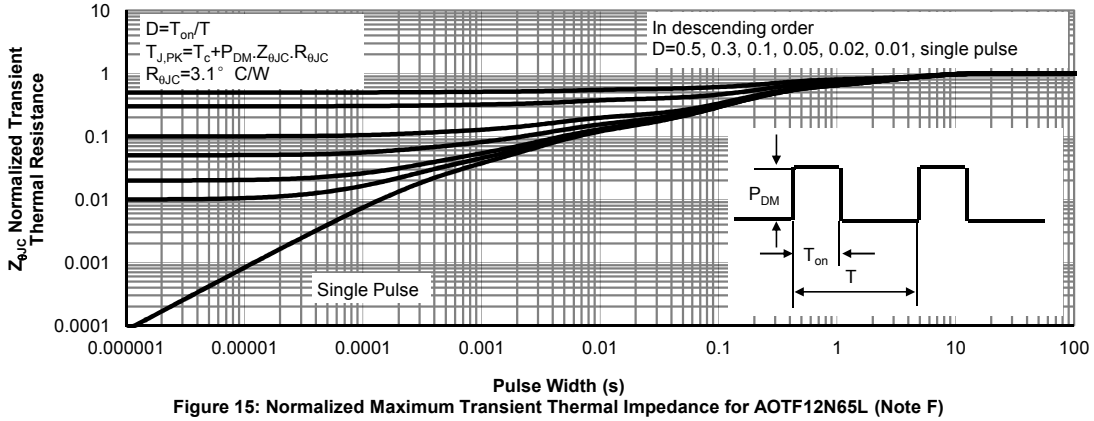
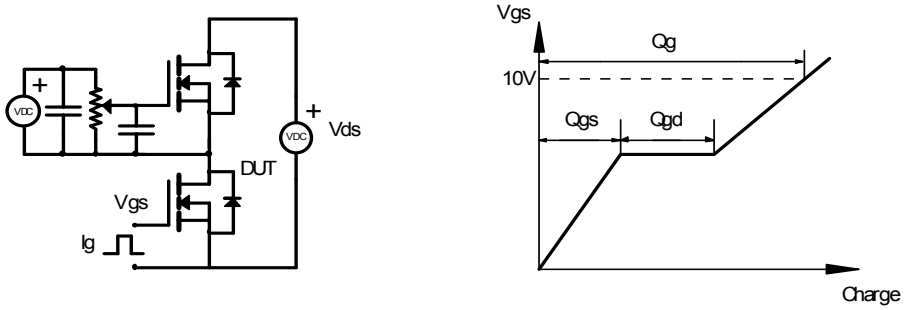
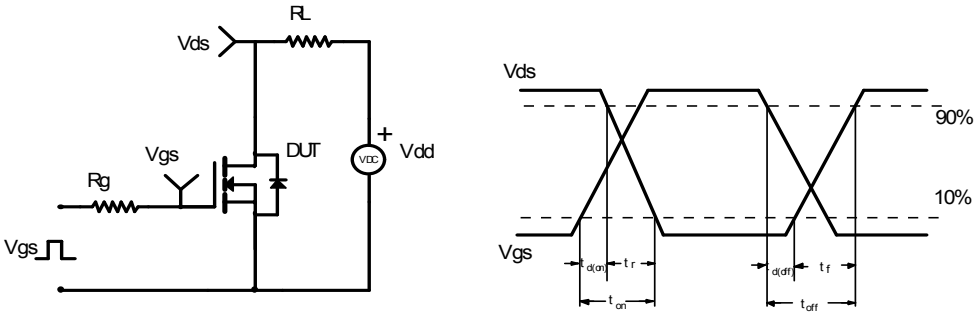


Figure 15: Normalized Maximum Transient Thermal Impedance for AOTF12N65L (Note F)

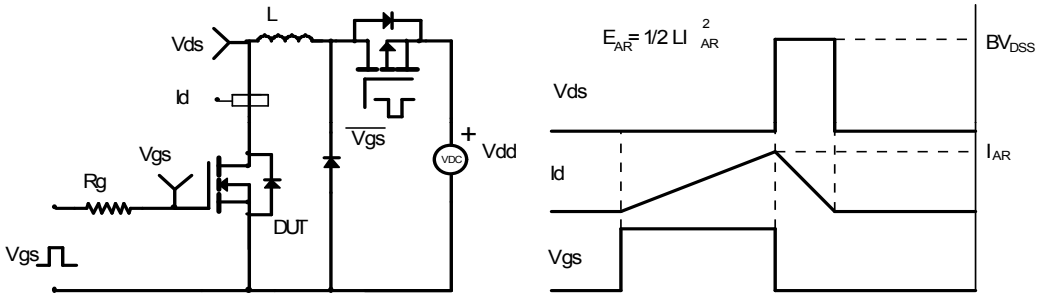
Gate Charge Test Circuit & Waveform



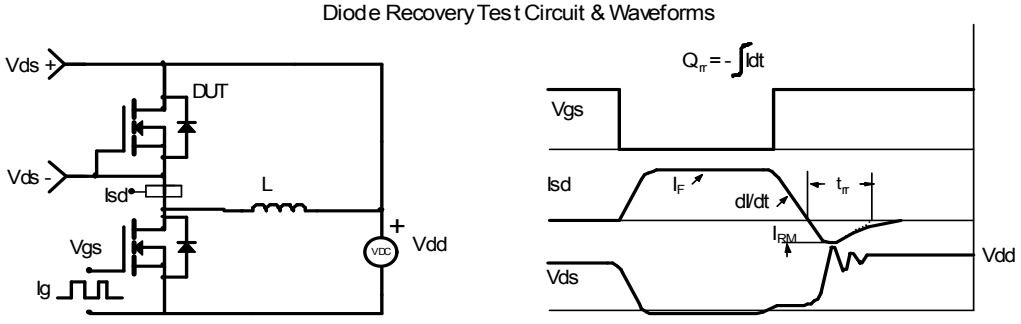
Resistive Switching Test Circuit & Waveforms



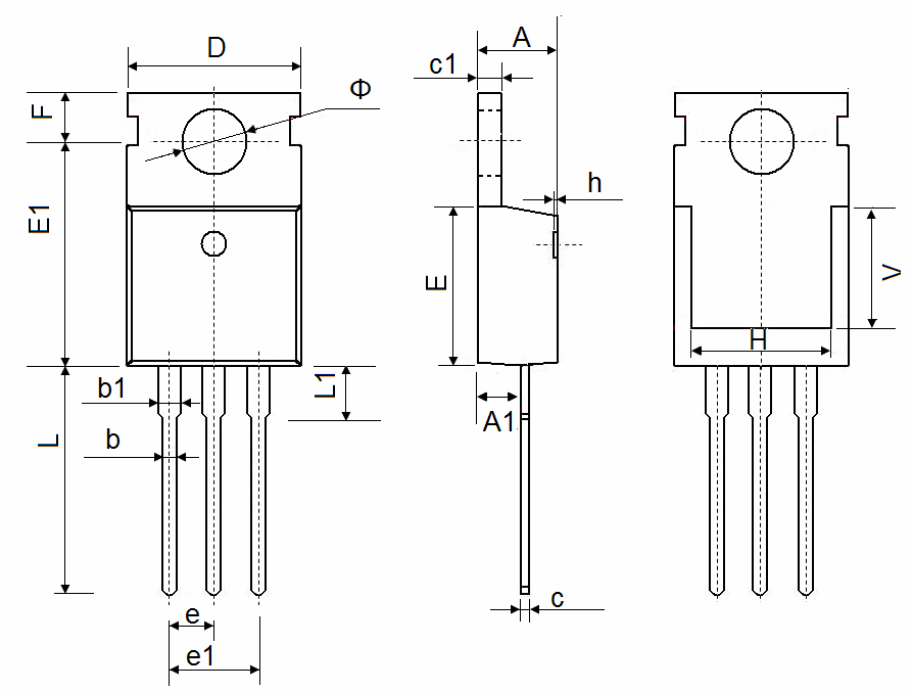
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



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

TO-263 Package Information

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.170	1.370	0.046	0.054
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
L	15.050	15.450	0.593	0.608
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108
L3	1.300	1.700	0.051	0.067
V	5.600 REF		0.220 REF	