

- ★ Super_Junction technology
- ★ Much lower $R_{on} \cdot A$ performance for On-state efficiency
- ★ Better efficiency due to very low FOM
- ★ Qualified for industrial grade applications according to JEDEC

650V Super Junction Power MOSFET

Product Summary



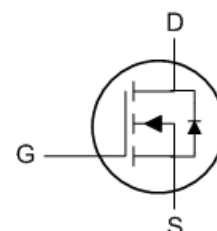
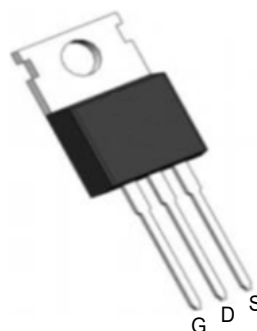
BVDSS	R _{DS(on)}	I _D
650V	0.38 Ω	11A

Description

The UD65R380T use super junction technology and design to provide excellent $R_{DS(on)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

The UD65R380T meet the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

TO220 Pin Configuration



Absolute Maximum Ratings

Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	650	V
V_{GS}	Gate-Source Voltage	± 30	V
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^{1,6}$	11	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^{1,6}$	7	A
I_{DM}	Pulsed Drain Current ²	44	A
EAS	Single Pulse Avalanche Energy ³	120	mJ
I_{AS}	Avalanche Current	11	A
$P_D @ T_C = 25^\circ C$	Total Power Dissipation ⁴	29	W
T_{STG}	Storage Temperature Range	-55 to 150	$^\circ C$
T_J	Operating Junction Temperature Range	-55 to 150	$^\circ C$

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	---	78	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	---	4.3	$^\circ C/W$

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Electrical Characteristics ($T_J=25^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V$, $I_D=250\mu A$	650	---	---	V
$\Delta BV_{DSS} / \Delta T_J$	BV_{DSS} Temperature Coefficient	Reference to 25°C , $I_D=1mA$	---	---	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=10V$, $I_D=5.5A$	---	0.38	0.45	$\text{m}\Omega$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}$, $I_D=250\mu A$	3.5	---	4.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	---	---	$\text{mV}/^\circ\text{C}$
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=650V$, $V_{GS}=0V$, $T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=650V$, $V_{GS}=0V$, $T_J=100^\circ\text{C}$	---	---	100	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 30V$, $V_{DS}=0V$	---	---	± 80	nA
g_{fs}	Forward Transconductance	$V_{DS}=20V$, $I_D=5.5A$	---	12	---	S
R_g	Gate Resistance	$V_{DS}=0V$, $V_{GS}=0V$, $f=1MHz$	---	2	---	Ω
Q_g	Total Gate Charge	$V_{DS}=480V$, $V_{GS}=10V$, $I_D=5.5A$	---	22	---	nC
Q_{gs}	Gate-Source Charge		---	5.3	---	
Q_{gd}	Gate-Drain Charge		---	8.8	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{GS}=10V$, $V_{DD}=400V$, $R_G=25\Omega$, $I_D=5.5A$	---	20	---	ns
T_r	Rise Time		---	15	---	
$T_{d(off)}$	Turn-Off Delay Time		---	74	---	
T_f	Fall Time		---	43	---	
C_{iss}	Input Capacitance	$V_{DS}=100V$, $V_{GS}=0V$, $f=1MHz$	---	790	---	pF
C_{oss}	Output Capacitance		---	32	---	
C_{rss}	Reverse Transfer Capacitance		---	2	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,4}	$V_G=V_D=0V$, Force Current	---	---	11	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V$, $I_S=5.5A$, $T_J=25^\circ\text{C}$	---	---	1.2	V
t_{rr}	Reverse Recovery Time	$I_F=5.5A$, $di/dt=100A/\mu s$, $T_J=25^\circ\text{C}$	---	218	---	nS
Q_{rr}	Reverse Recovery Charge		---	2.35	---	nC

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is $T_J = 25^\circ\text{C}$, $V_{DD}=200V$, $V_{GS}=10V$, $L=60mH$
- 4.The power dissipation is limited by 150°C junction temperature
- 5.The data is theoretically the same as I_D and I_{DM} , in real applications , should be limited by total power dissipation.

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Typical Performance Characteristics

Fig 1. Output Characteristics ($T_J=25^\circ\text{C}$)

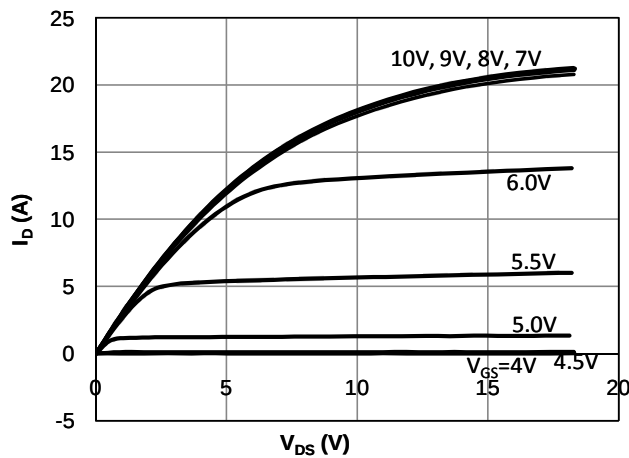


Fig 2. Output Characteristics ($T_J=150^\circ\text{C}$)

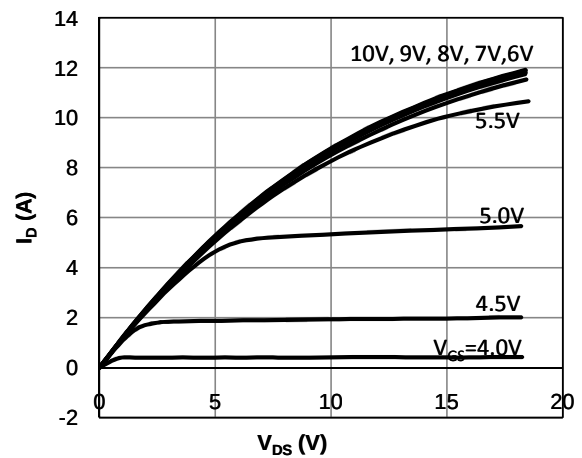


Fig 3: Transfer Characteristics

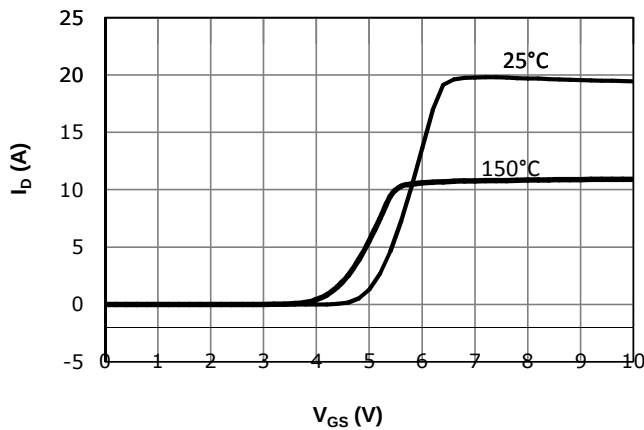


Fig 4: V_{TH} Vs T_J Temperature Characteristics

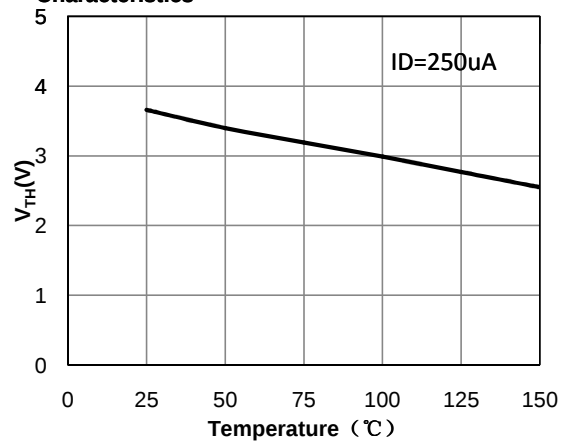


Fig 5: $R_{DS(on)}$ Vs I_{DS} Characteristics ($T_C=25^\circ\text{C}$)

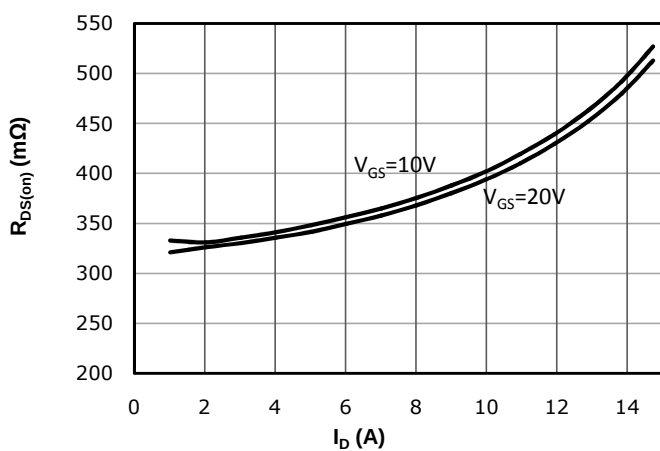
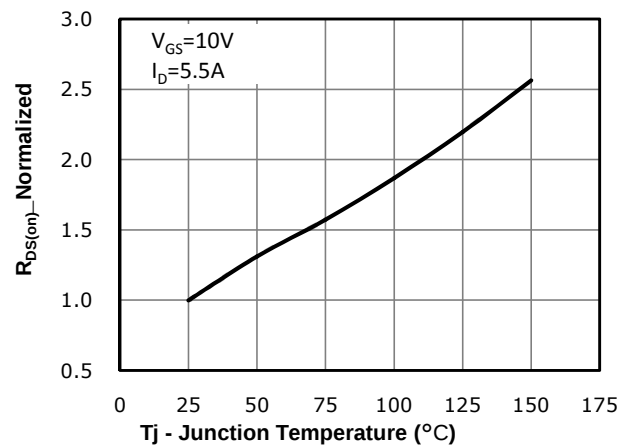


Fig 6: $R_{DS(on)}$ vs. Temperature



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Fig 7: BVDSS vs. Temperature

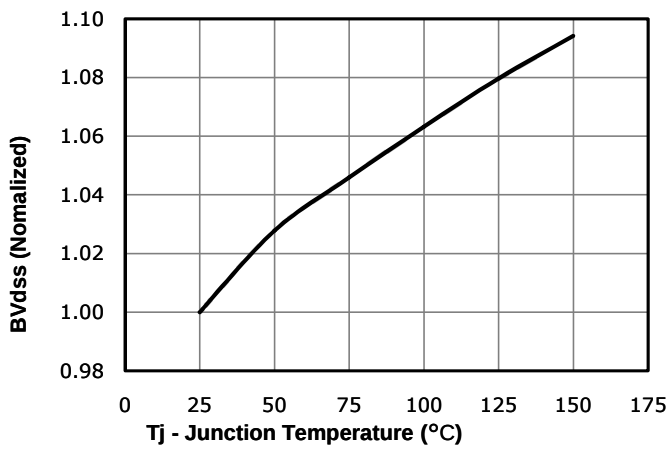


Fig 8: Rds(on) vs Gate Voltage

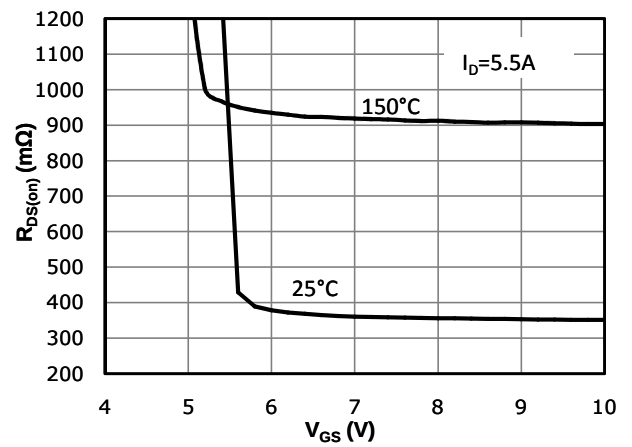


Fig 9: Body-diode Forward Characteristics

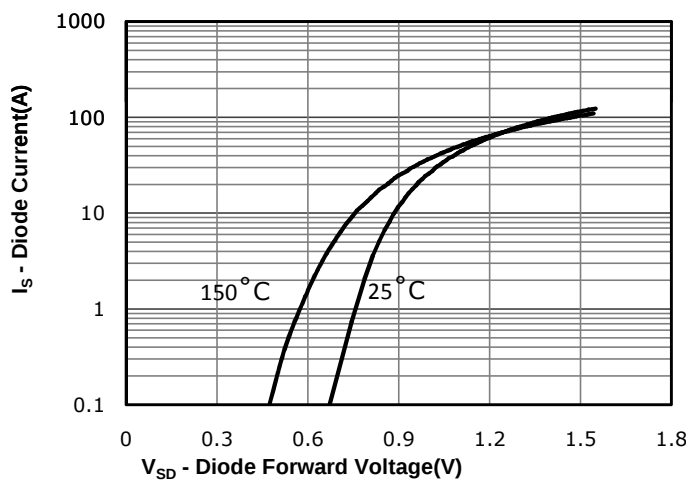


Fig 10: Gate Charge Characteristics

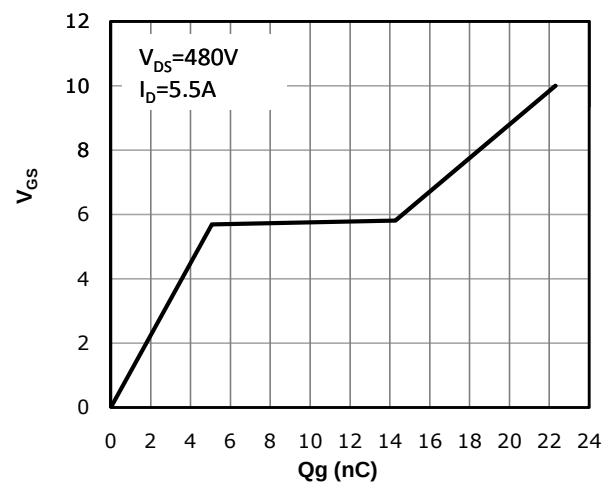


Fig 11: Capacitance Characteristics

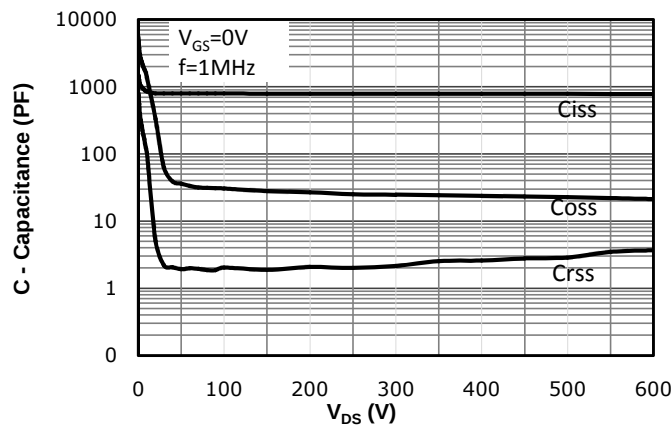
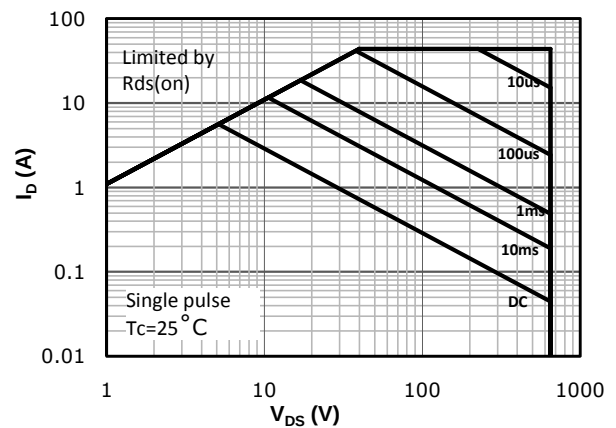
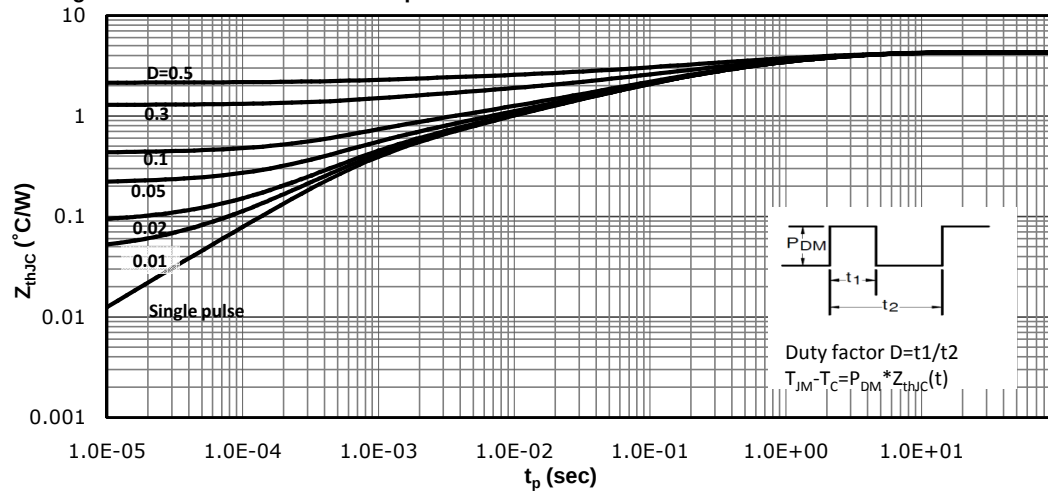


Fig 12: Safe Operating Area



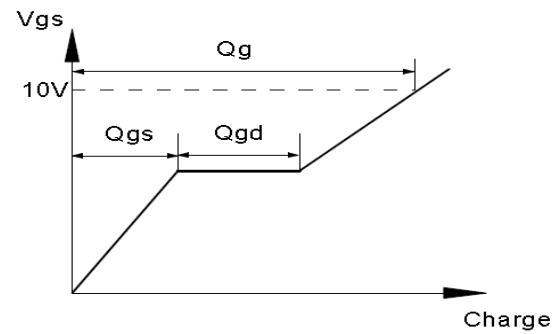
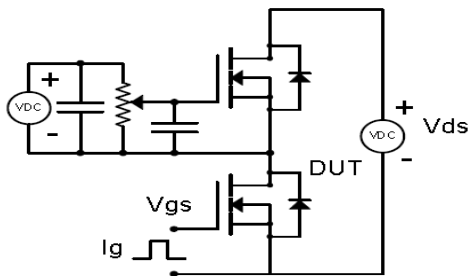
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Fig 13: Max. Transient Thermal Impedance

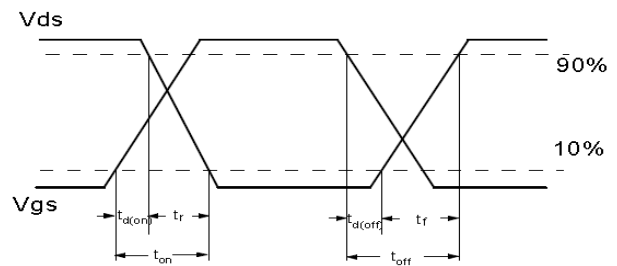
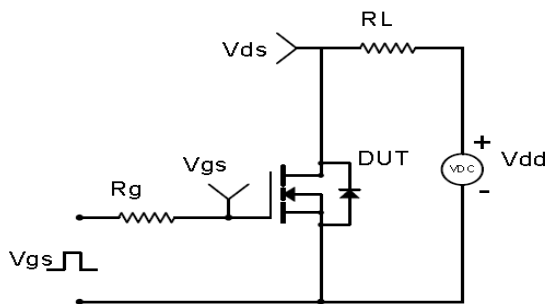


Test Circuit & Waveform

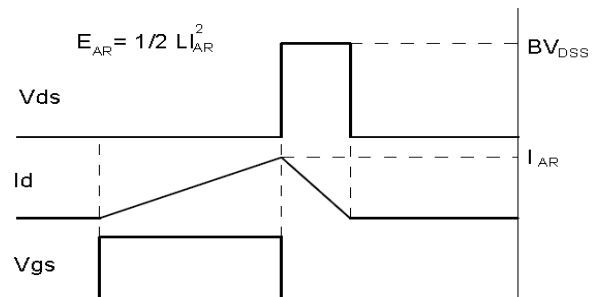
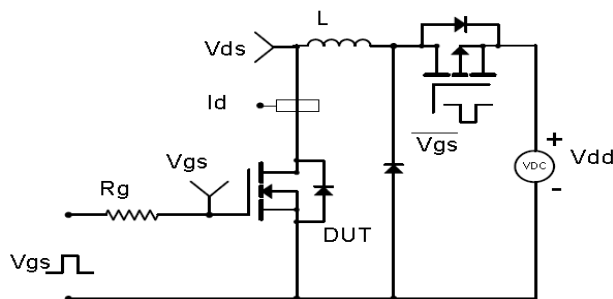
Gate Charge Test Circuit & Waveform



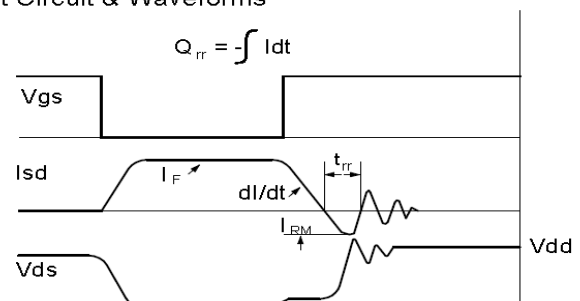
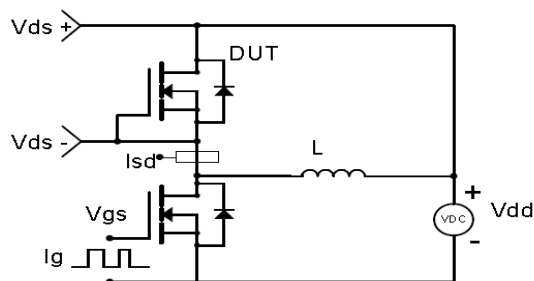
Resistive Switching Test Circuit & Waveforms



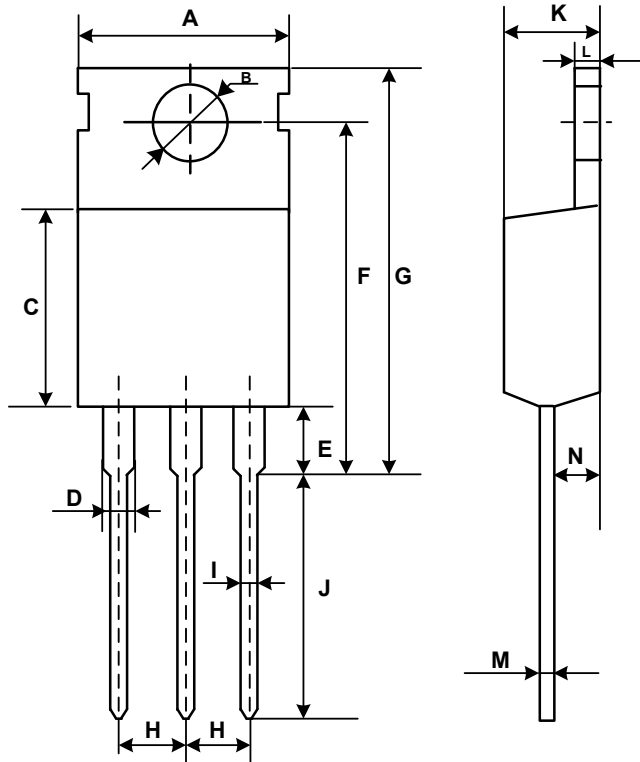
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Mechanical Dimensions for TO-220



COMMON DIMENSIONS

SYMBOL	MM	
	MIN	MAX
A	9.70	10.30
B	3.40	3.80
C	8.80	9.40
D	1.17	1.47
E	2.60	3.50
F	15.10	16.70
G	19.55MAX	
H	2.54REF	
I	0.70	0.95
J	9.35	11.00
K	4.30	4.77
L	1.20	1.45
M	0.40	0.65
N	2.20	2.60