

### Features

- $R_{DS(ON)} < 2.4\Omega$  @  $V_{GS} = 10V$
- Fast switching capability
- Lead free in compliance with EU RoHS directive.
- Green molding compound

### PRODUCT SUMMARY

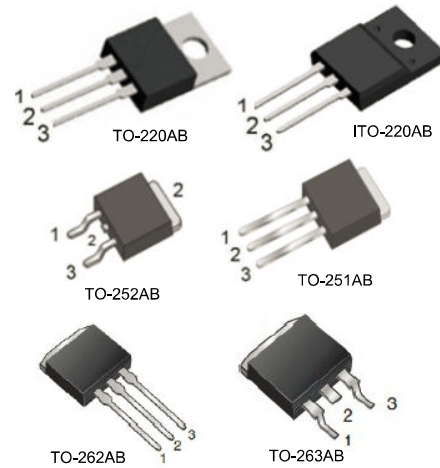
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
600	2.4 @ $V_{GS} = 10V$	4

### Mechanical Data

- Case: TO-251AB, TO-252AB, TO-220, ITO-220AB  
TO-262AB, TO-263AB Package

### Ordering Information

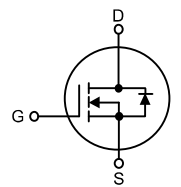
Part No.	Package	Packing
AU4N60S	TO-251AB	75pcs / Tube
AD4N60S	TO-252AB	2.5Kpcs / 13" Reel
AT4N60S	TO-220AB	50pcs / Tube
AF4N60S	ITO-220AB	50pcs / Tube
AK4N60S	TO-262AB	50pcs / Tube
AG4N60S	TO-263AB	800pcs / 13" Reel



Pin Definition:

1. Gate
2. Drain
3. Source

Block Diagram



### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ C$ , unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	600	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Continuous Drain Current		$I_D$	4.0	A
Pulsed Drain Current (Note 2)		$I_{DM}$	16	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	217	mJ
Power Dissipation	TO-220AB/TO-262AB/TO-263AB	$P_D$	106	W
	ITO-220AB		44	W
	TO-251AB/TO-252AB		77	W
Junction Temperature		$T_J$	+150	$^\circ C$
Operating Temperature		$T_{OPR}$	-55 ~ +150	$^\circ C$
Storage Temperature		$T_{STG}$	-55 ~ +150	$^\circ C$

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating : Pulse width limited by maximum junction temperature

3.  $L = 30mH$ ,  $I_{AS} = 3.7A$ ,  $V_{DD} = 50V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$

### THERMAL DATA

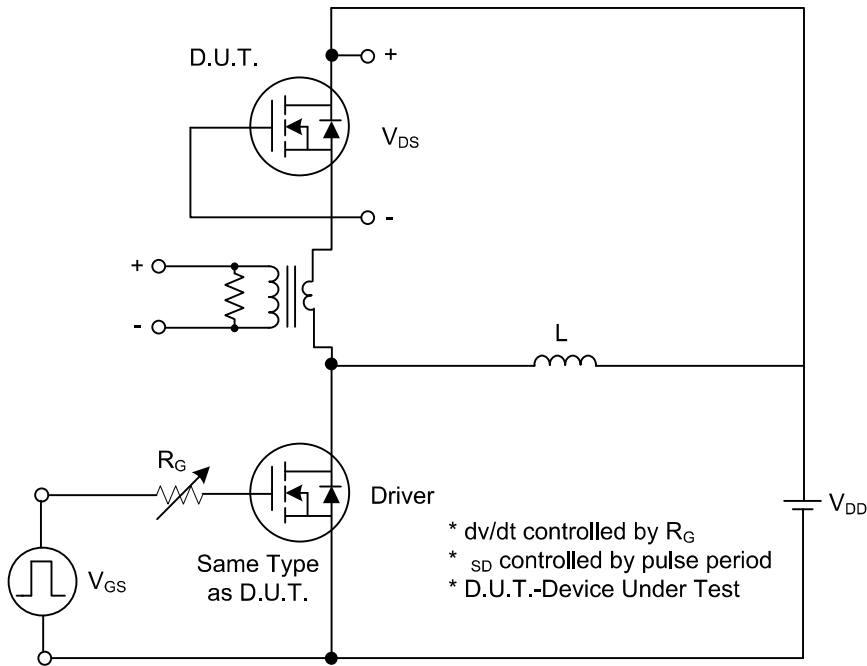
PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220AB/ITO-220AB TO-262AB/TO-263AB	$\theta_{JA}$	62.5	°C/W
	TO-251AB/TO-252AB		110	
	TO-220AB TO-262AB/TO-263AB		2.35	
Junction to Case	ITO-220AB	$\theta_{JC}$	5.5	°C/W
	TO-251AB/TO-252AB		2.9	

### ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$ , unless otherwise specified)

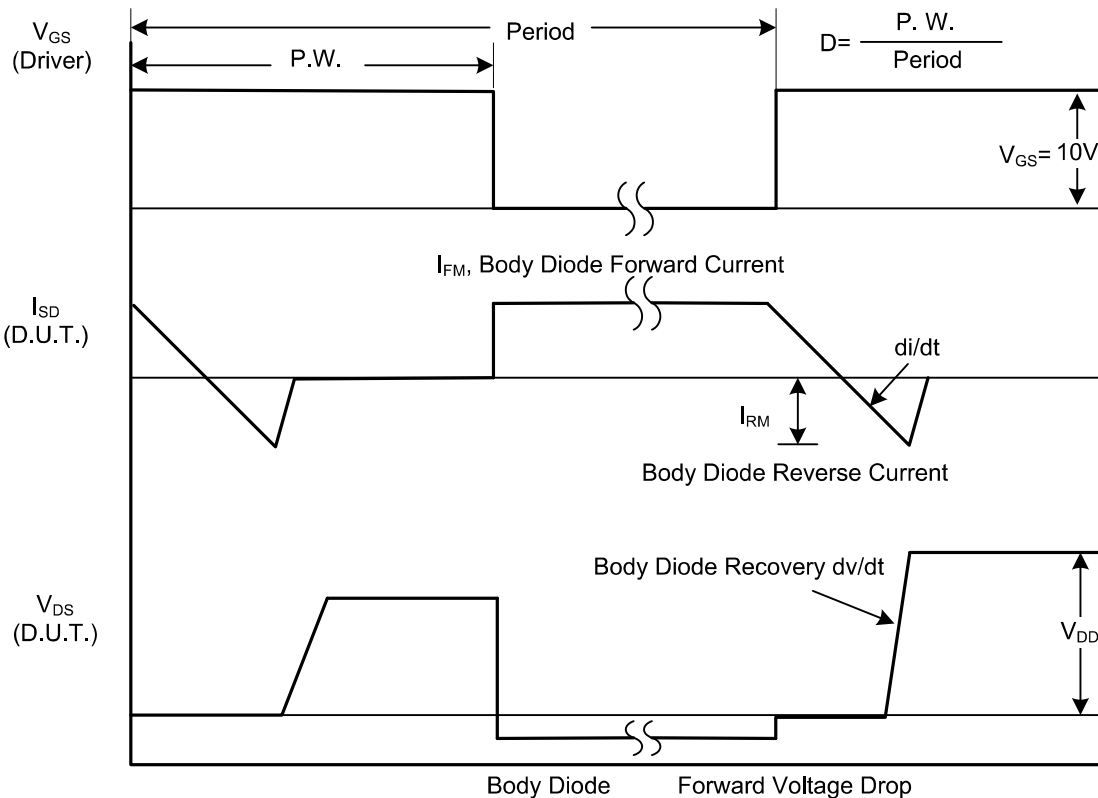
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>							
Drain-Source Breakdown Voltage		$BV_{DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	600			V
Drain-Source Leakage Current		$I_{DSS}$	$V_{DS} = 600V, V_{GS} = 0V$			1	$\mu A$
Gate-Source Leakage Current	Forward	$I_{GSS}$	$V_{GS} = 30V, V_{DS} = 0V$			100	nA
	Reverse		$V_{GS} = -30V, V_{DS} = 0V$			-100	nA
<b>ON CHARACTERISTICS</b>							
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS}=10V, I_D = 2.0A$		1.9	2.4	$\Omega$
<b>DYNAMIC CHARACTERISTICS</b>							
Input Capacitance		$C_{ISS}$	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1MHz$		550		pF
Output Capacitance		$C_{OSS}$			80		pF
Reverse Transfer Capacitance		$C_{RSS}$			30		pF
<b>SWITCHING CHARACTERISTICS</b>							
Turn-On Delay Time		$t_{D(ON)}$	$V_{DD} = 300V, I_D = 4.0A,$ $R_G = 25\Omega$ (Note 1, 2)		35		ns
Turn-On Rise Time		$t_R$			80		ns
Turn-Off Delay Time		$t_{D(OFF)}$			160		ns
Turn-Off Fall Time		$t_F$			120		ns
Total Gate Charge		$Q_G$	$V_{DS}= 480V, I_D= 4.0A,$ $V_{GS}= 10V$ (Note 1, 2)		80		nC
Gate-Source Charge		$Q_{GS}$			5		nC
Gate-Drain Charge		$Q_{GD}$			20		nC
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>							
Drain-Source Diode Forward Voltage		$V_{SD}$	$V_{GS}=0V, I_S=4A$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current		$I_S$				4	A
Maximum Pulsed Drain-Source Diode Forward Current		$I_{SM}$				16	A
Reverse Recovery Time		$t_{rr}$	$V_{GS} = 0V, I_S = 4A,$		400		ns
Reverse Recovery Charge		$Q_{RR}$	$di/dt = 100 A/\mu s$ (Note 1)		1.7		$\mu C$

Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$   
 2. Essentially independent of operating temperature

## TEST CIRCUITS AND WAVEFORMS

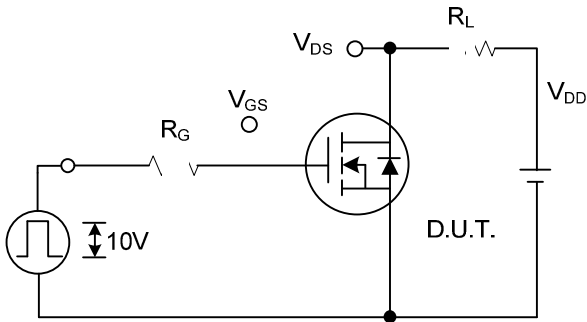


**Peak Diode Recovery dv/dt Test Circuit**

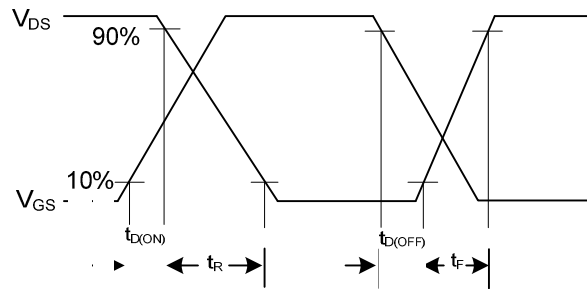


**Peak Diode Recovery dv/dt Waveforms**

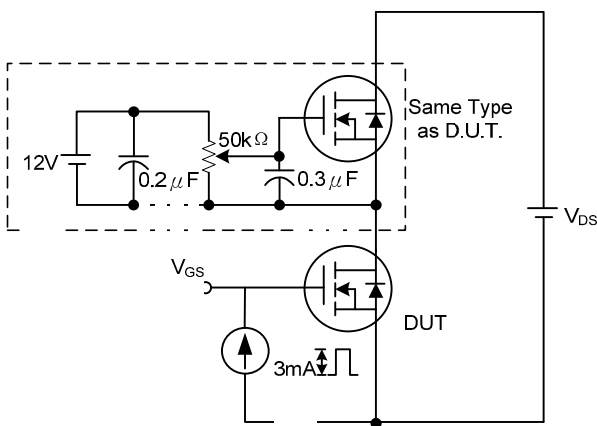
### TEST CIRCUITS AND WAVEFORMS(Cont.)



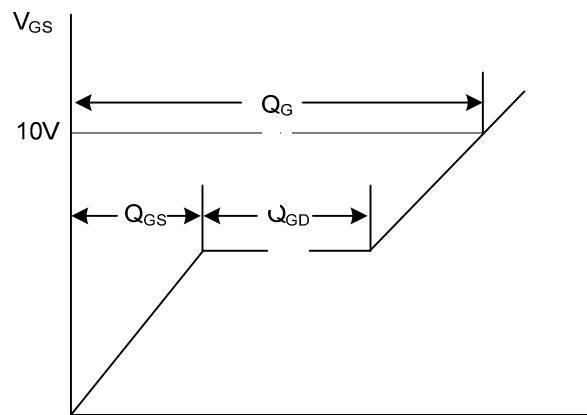
**Switching Test Circuit**



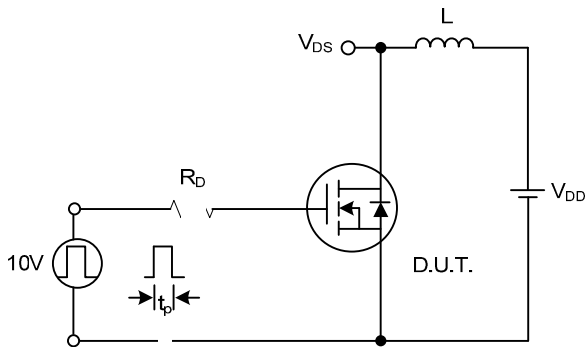
**Switching Waveforms**



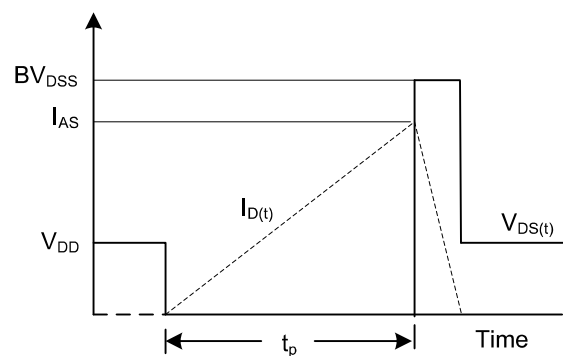
**Gate Charge Test Circuit**



**Gate Charge Waveform**



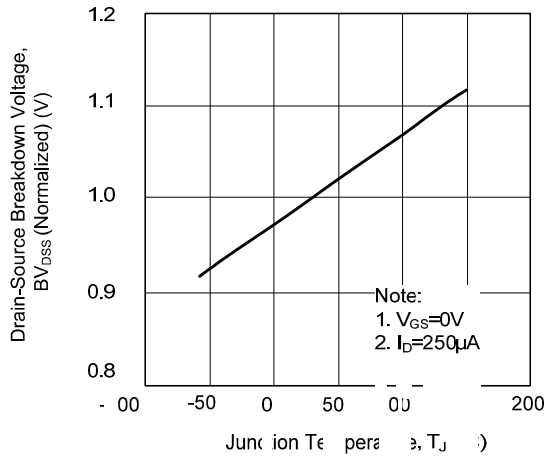
**Unclamped Inductive Switching Test Circuit**



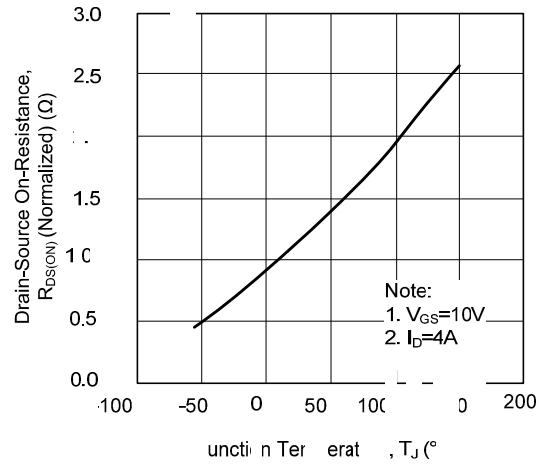
**Unclamped Inductive Switching Waveforms**

### TYPICAL CHARACTERISTICS

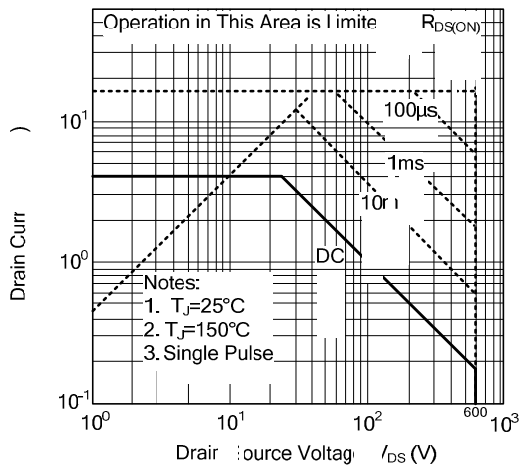
Breakdown Voltage Variation vs. Temperature



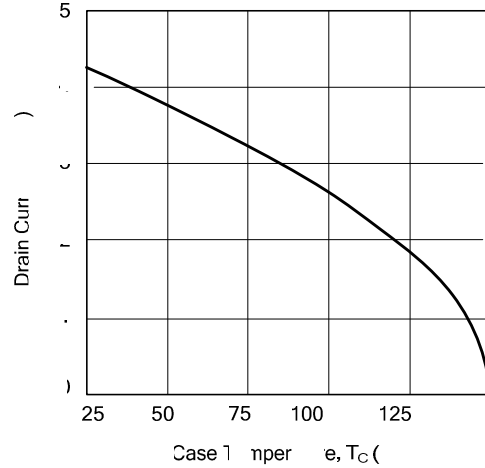
On-Resistance Junction Temperature



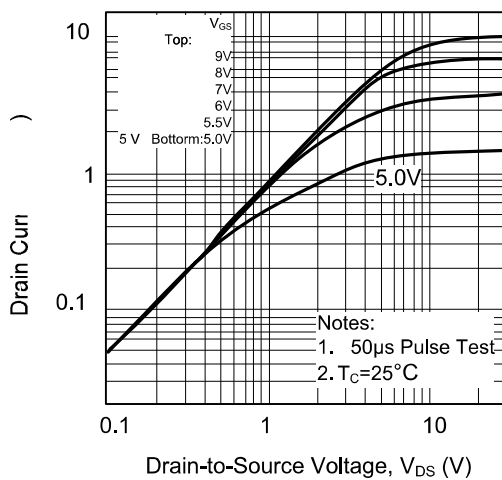
Safe Operating Area - 600V



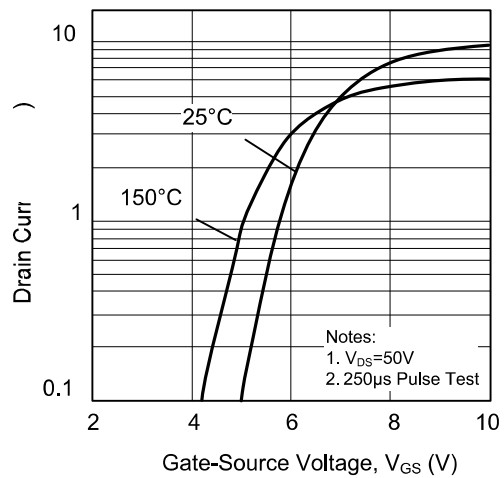
Maximum Drain Current vs. Case Temperature



On-State Characteristics

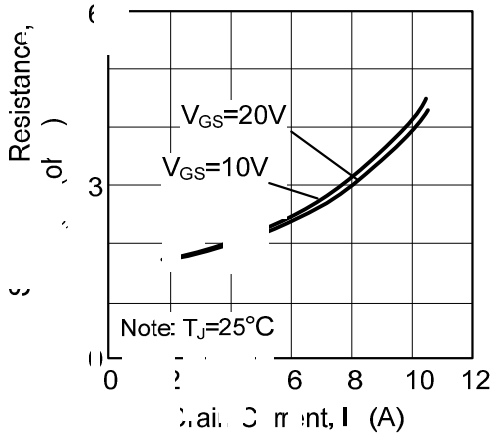


Transfer Characteristics

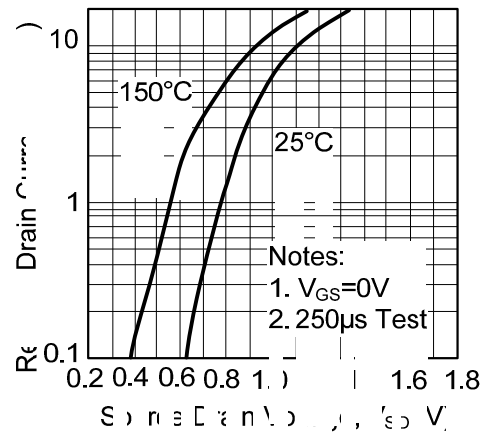


### TYPICAL CHARACTERISTICS(Cont.)

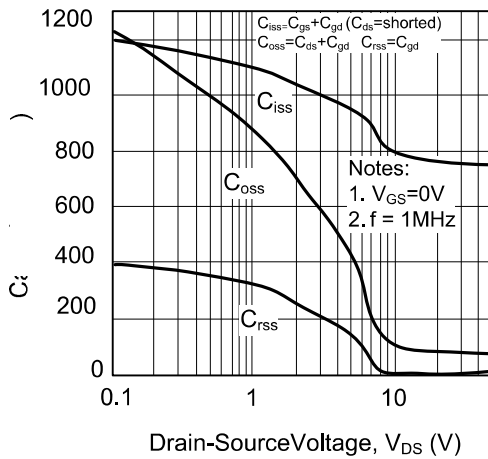
On-Resistance Variation vs. Drain Current and Gate Voltage



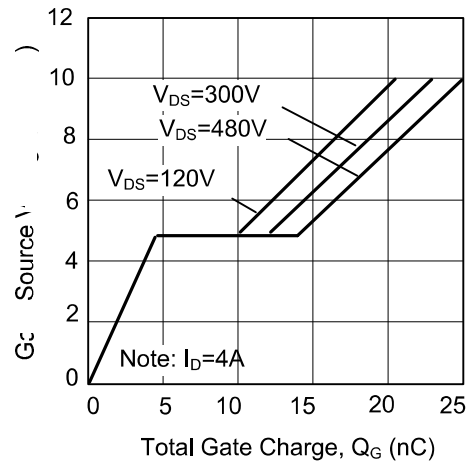
On State Current vs. Allowable Case Temperature



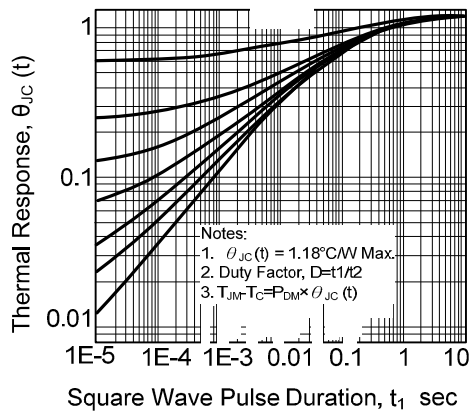
Capacitance Characteristics (Non-Repetitive)



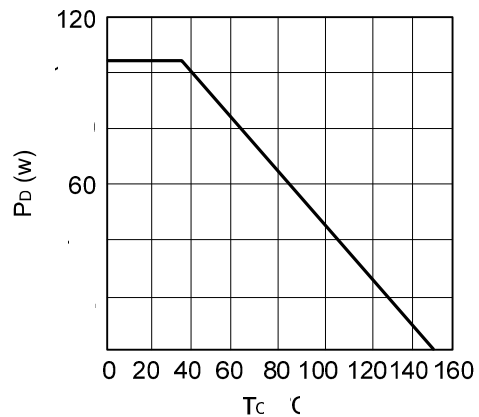
Gate Charge Characteristics



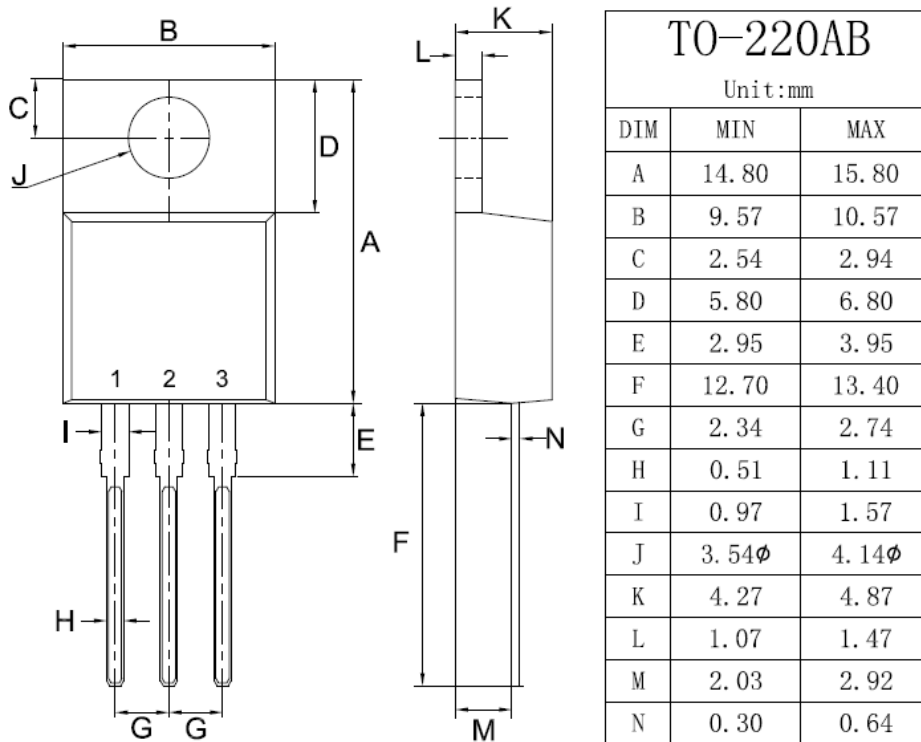
Transient Thermal Response Curve



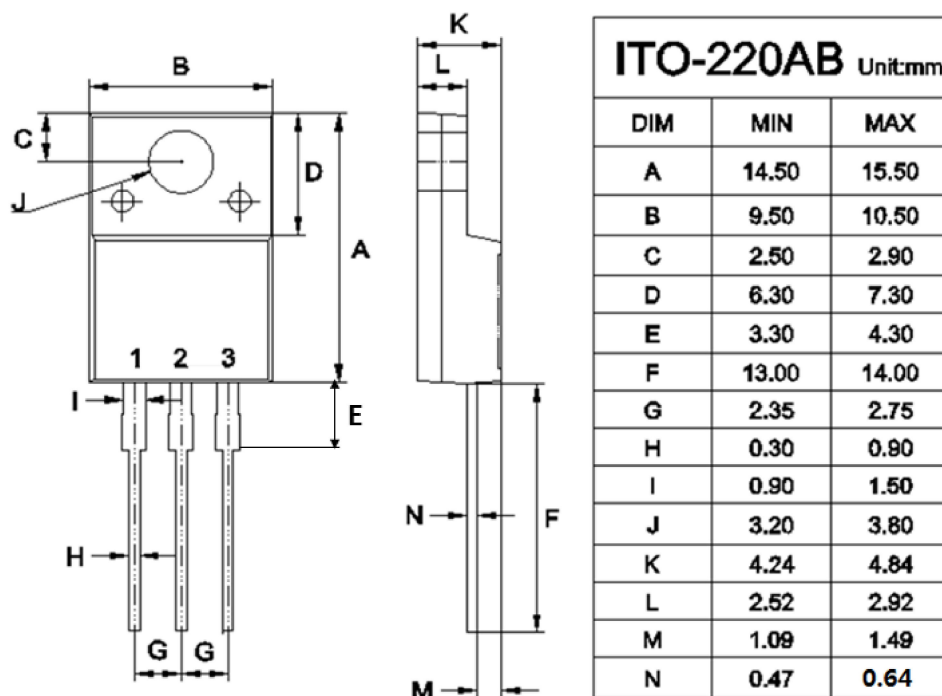
Power Dissipation



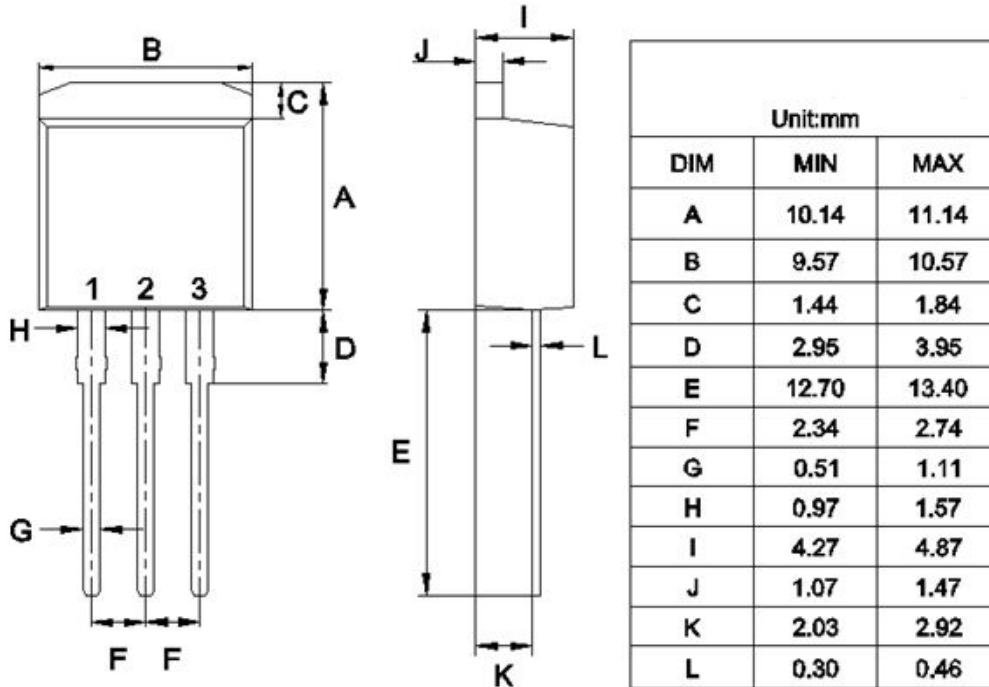
## TO-220AB Mechanical Drawing



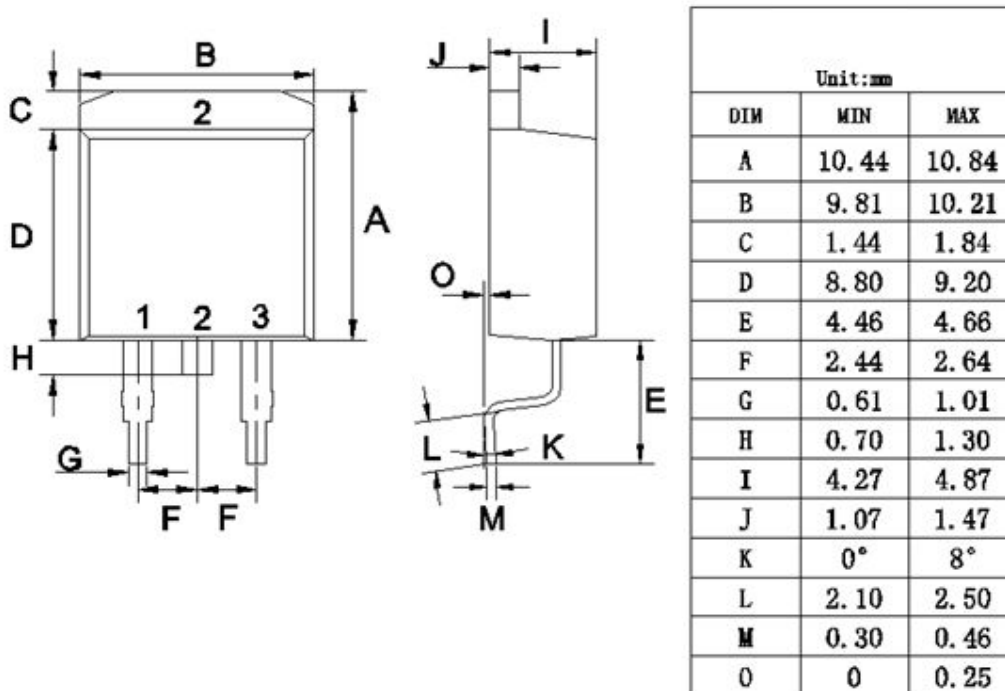
## ITO-220AB Mechanical Drawing



## TO-262AB Mechanical Drawing

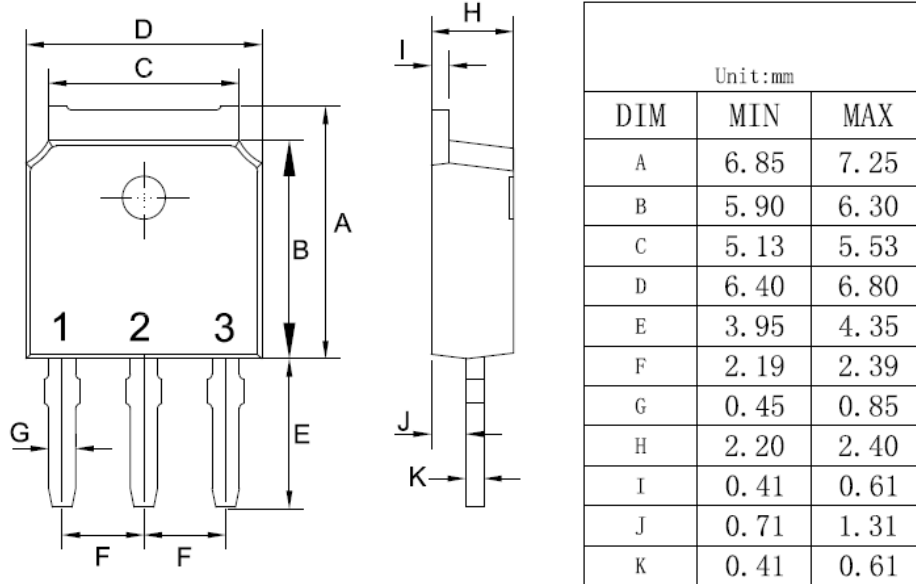


## TO-263AB Mechanical Drawing





## TO-251AB Mechanical Drawing



## TO-252AB Mechanical Drawing

