

#### 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

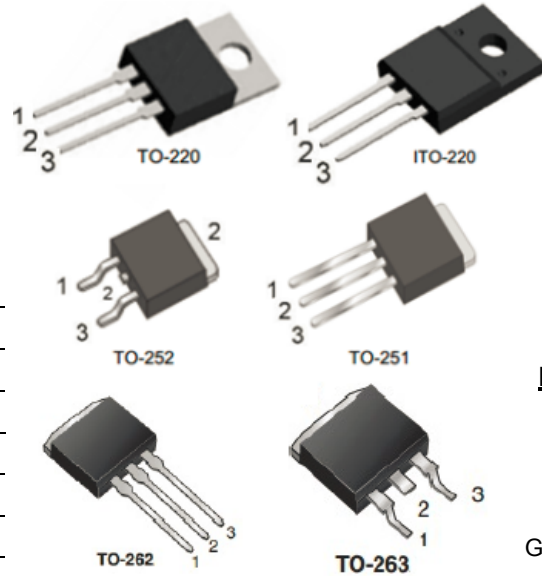
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
650	2.4 @ $V_{GS} = 10V$	4

#### Mechanical Data

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

#### Ordering Information

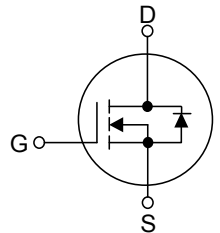
Part No.	Package	Packing
DMP4N65-TU	TO-251	75pcs / Tube
DMD4N65-TR	TO-252	2.5Kpcs / 13" Reel
DMD4N65-TU	TO-252	75pcs / Tube
DMT4N65-TU	TO-220	50pcs / Tube
DMF4N65-TU	ITO-220	50pcs / Tube
DMK4N65-TU	TO-262	50pcs / Tube
DMG4N65-TU	TO-263	50pcs / Tube
DMG4N65-TR	TO-263	800pcs / 13" Reel



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		$V_{DSS}$	650	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)	$E_{AS}$	260	mJ
Power Dissipation	TO-220/TO-262/TO-263	$P_D$	106	W
	ITO-220		35	W
	TO-251/TO-252		50	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.  $L = 30mH$ ,  $I_{AS} = 3.6A$ ,  $V_{DD} = 50V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ C$

## THERMAL DATA

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

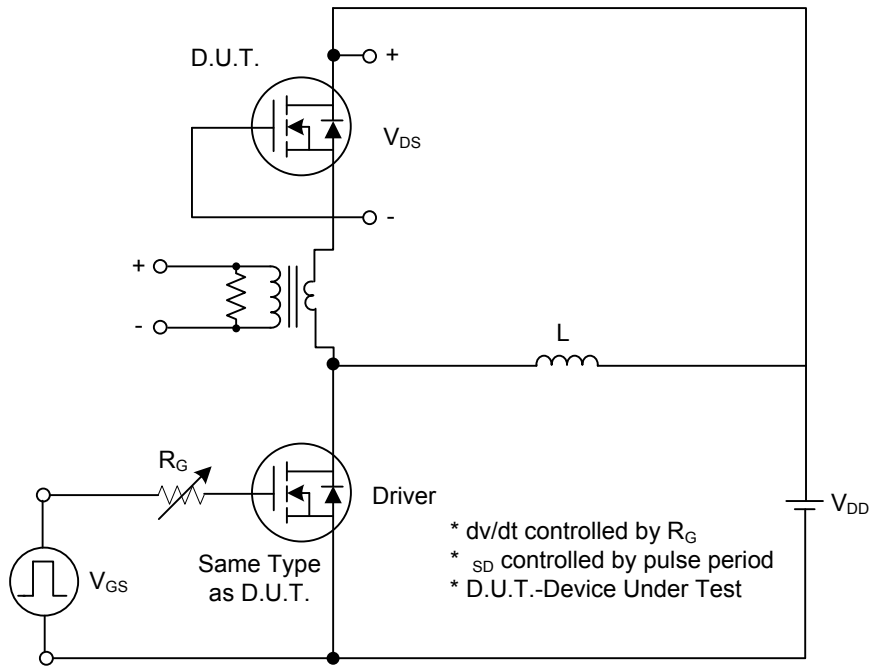
## ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
<b>OFF CHARACTERISTICS</b>								
Drain-Source Breakdown Voltage		BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	650			V	
Drain-Source Leakage Current		I <sub>DSS</sub>	V <sub>DS</sub> = 650V, V <sub>GS</sub> = 0V			1	μA	
Gate-Source Leakage Current	Forward	I <sub>GSS</sub>	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V			100	nA	
	Reverse		V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V			-100	nA	
<b>ON CHARACTERISTICS</b>								
Gate Threshold Voltage		V <sub>GS(TH)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.0		4.0	V	
Static Drain-Source On-State Resistance		R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 2A		2.0	2.4	Ω	
<b>DYNAMIC CHARACTERISTICS</b>								
Input Capacitance		C <sub>ISS</sub>	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz		670		pF	
Output Capacitance		C <sub>OSS</sub>				70		pF
Reverse Transfer Capacitance		C <sub>RSS</sub>				23		pF
<b>SWITCHING CHARACTERISTICS</b>								
Turn-On Delay Time		t <sub>D(ON)</sub>	V <sub>DD</sub> = 325V, I <sub>D</sub> = 4.0A, R <sub>G</sub> = 25Ω (Note 1, 2)		45		ns	
Turn-On Rise Time		t <sub>R</sub>				100		ns
Turn-Off Delay Time		t <sub>D(OFF)</sub>				200		ns
Turn-Off Fall Time		t <sub>F</sub>				130		ns
Total Gate Charge		Q <sub>G</sub>	V <sub>DS</sub> = 520V, I <sub>D</sub> = 4.0A, V <sub>GS</sub> = 10V (Note 1, 2)		100		nC	
Gate-Source Charge		Q <sub>GS</sub>				17		nC
Gate-Drain Charge		Q <sub>GD</sub>				20		nC
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>								
Drain-Source Diode Forward Voltage		V <sub>SD</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 4A			1.4	V	
Maximum Continuous Drain-Source Diode Forward Current		I <sub>S</sub>				4	A	
Maximum Pulsed Drain-Source Diode Forward Current		I <sub>SM</sub>				16	A	
Reverse Recovery Time		t <sub>rr</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 4A,		260		ns	
Reverse Recovery Charge		Q <sub>RR</sub>	dI <sub>F</sub> /dt = 100 A/μs (Note 1)		2.5		μC	

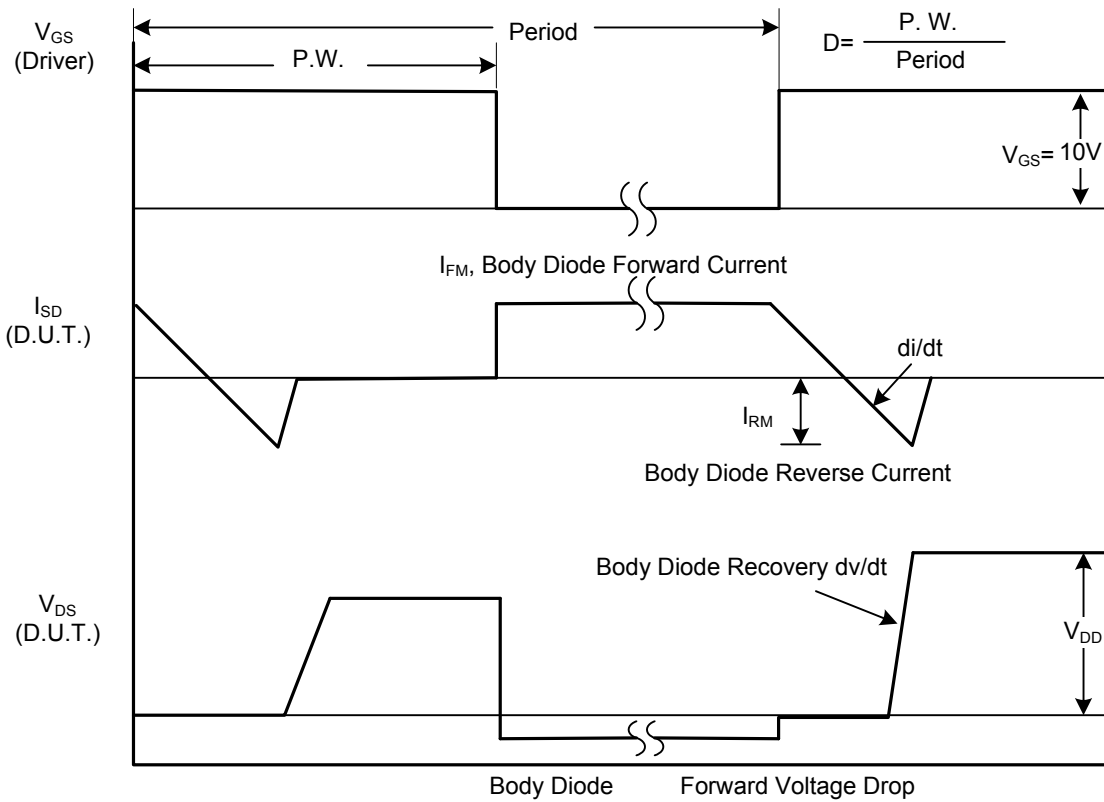
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

## TEST CIRCUITS AND WAVEFORMS

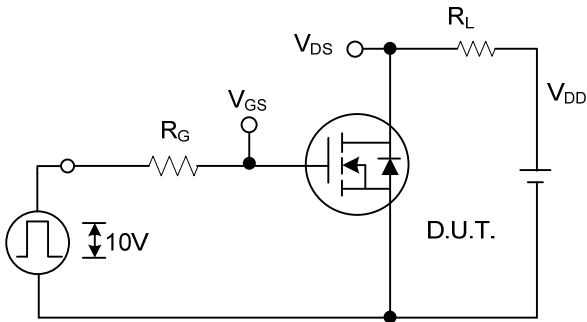


**Peak Diode Recovery  $dv/dt$  Test Circuit**

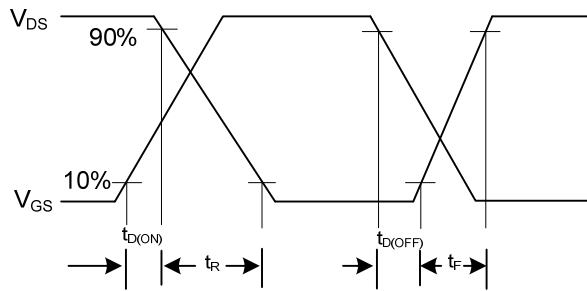


**Peak Diode Recovery  $dv/dt$  Waveforms**

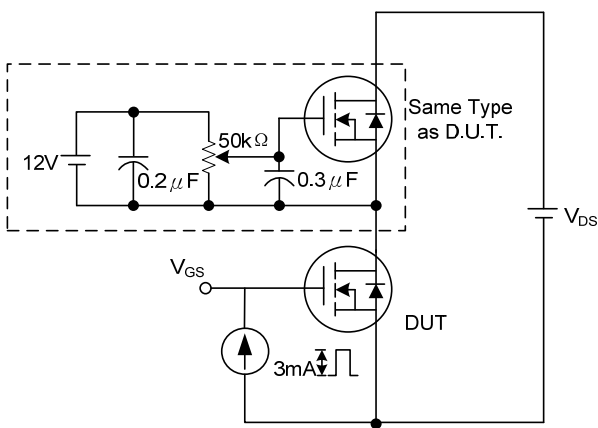
## TEST CIRCUITS AND WAVEFORMS(Cont.)



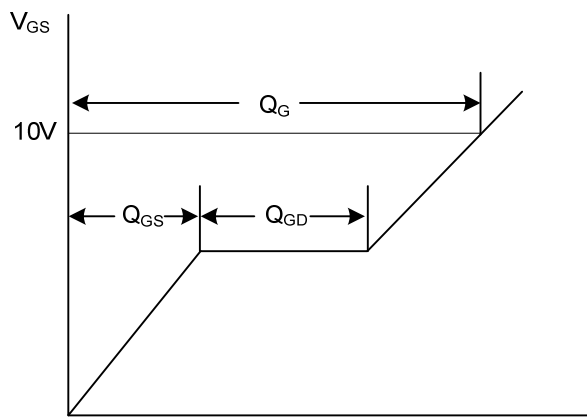
Switching Test Circuit



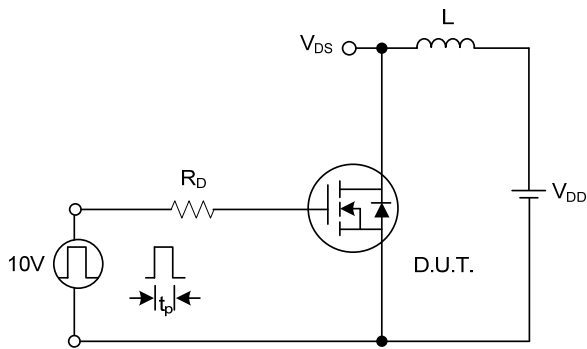
Switching Waveforms



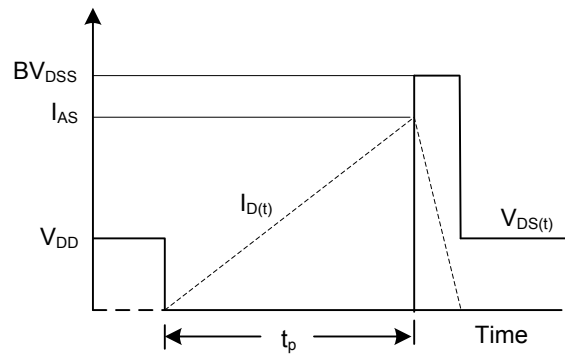
Gate Charge Test Circuit



Charge  
Gate Charge Waveform

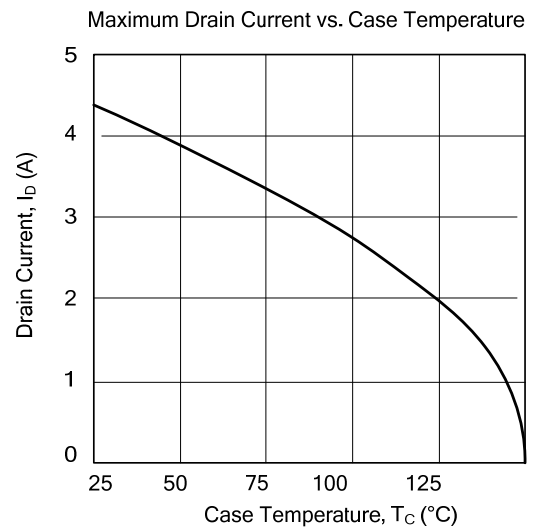
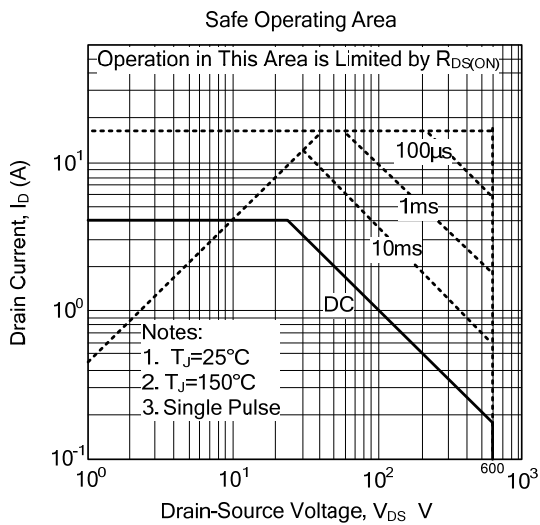
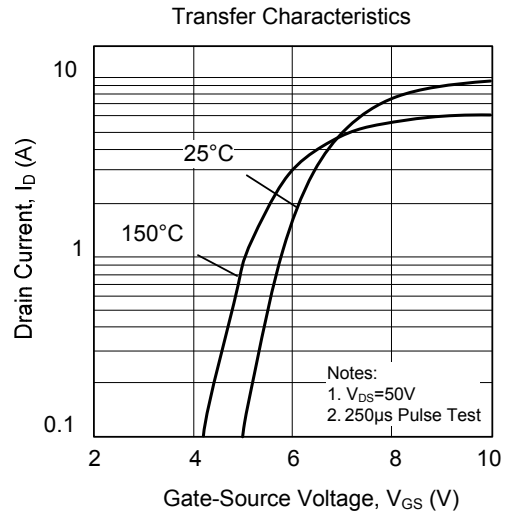
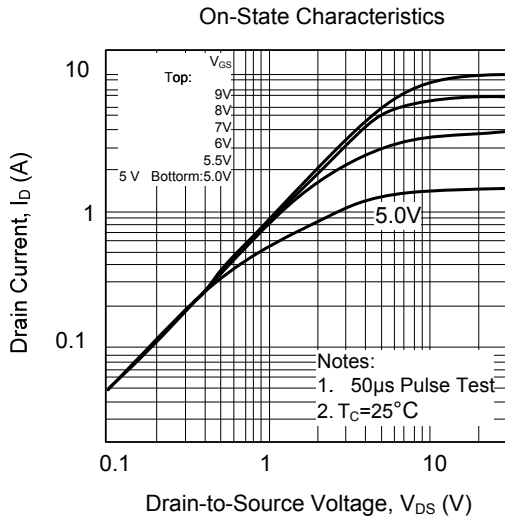
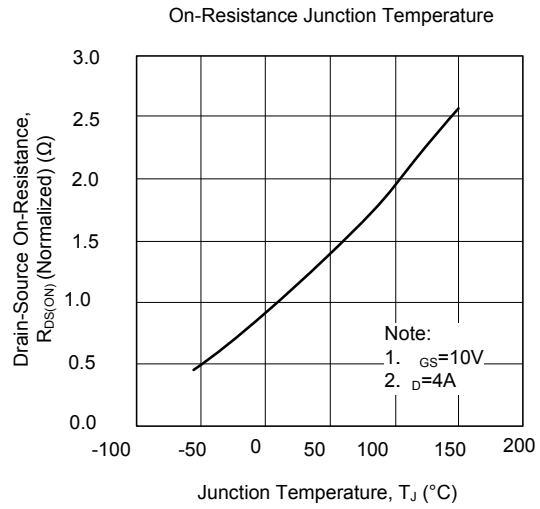
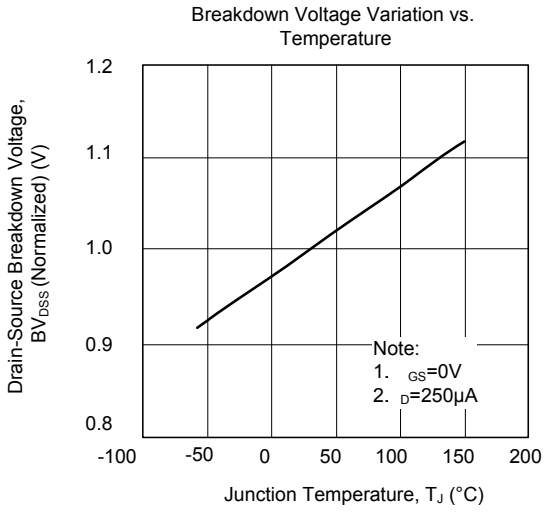


Unclamped Inductive Switching Test Circuit



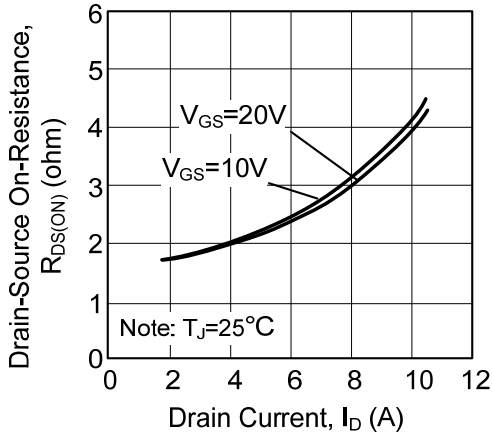
Unclamped Inductive Switching Waveforms

## TYPICAL CHARACTERISTICS

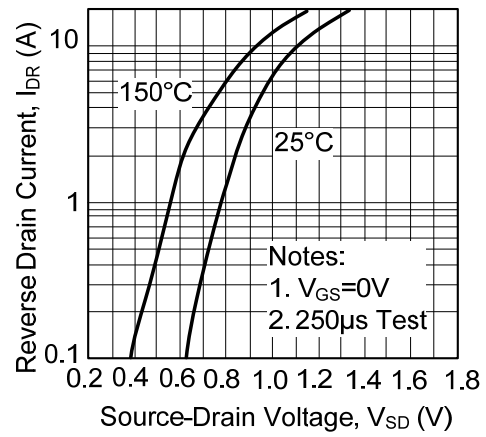


## TYPICAL CHARACTERISTICS(Cont.)

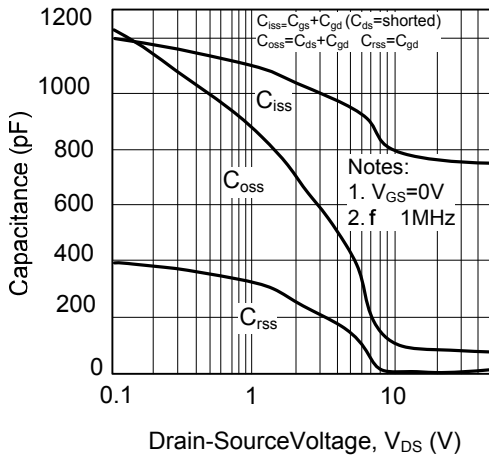
On-Resistance Variation vs. Drain Current and Gate Voltage



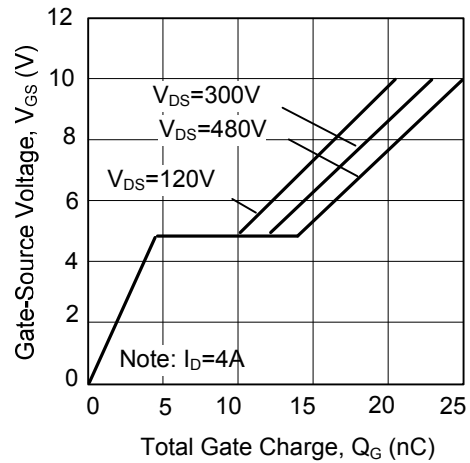
On State Current vs. Allowable Case Temperature



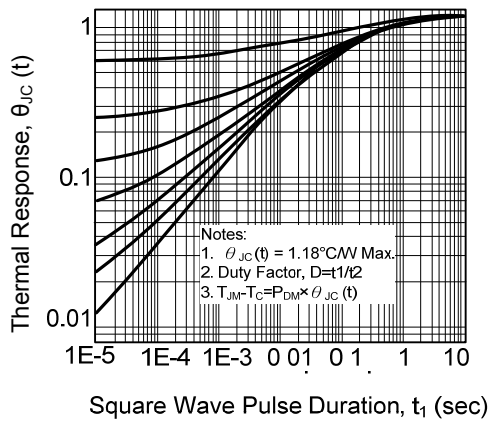
Capacitance Characteristics (Non-Repetitive)



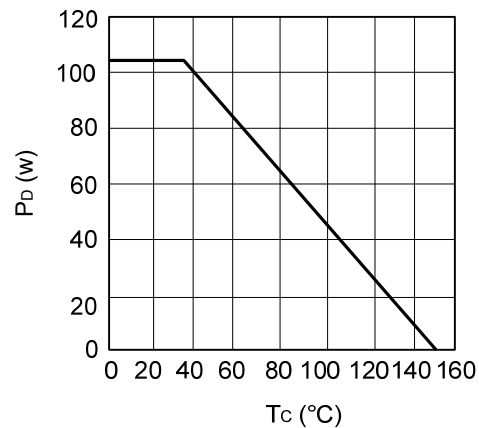
Gate Charge Characteristics



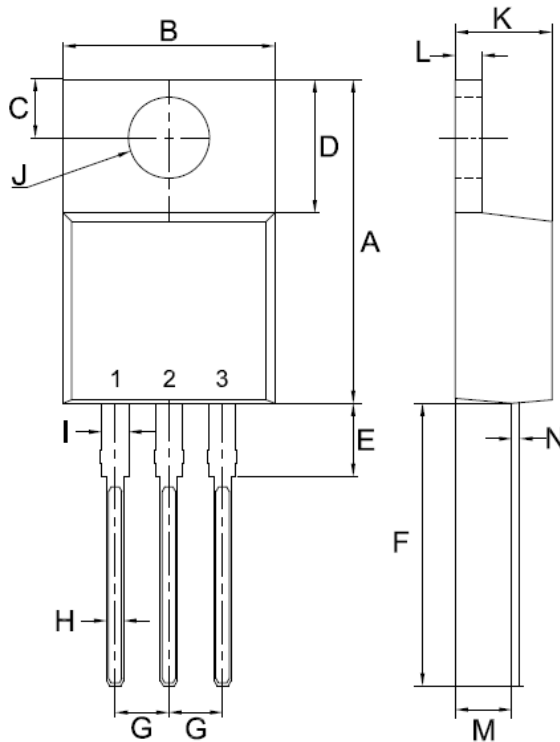
Transient Thermal Response Curve



Power Dissipation

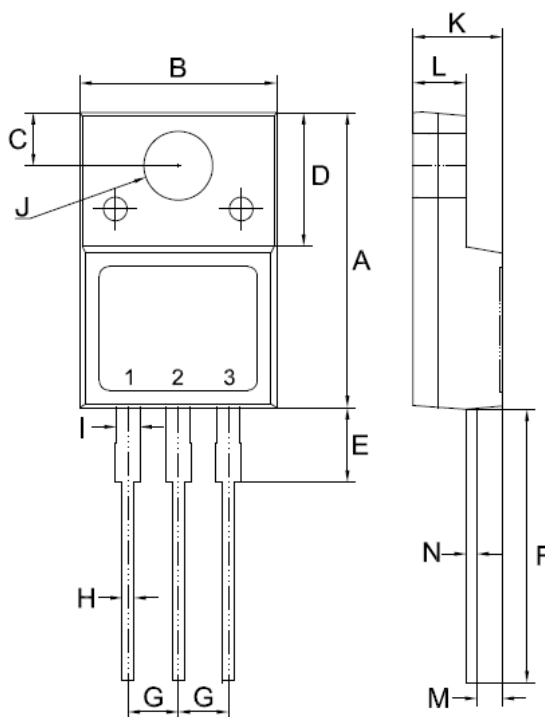


## TO-220 Mechanical Drawing



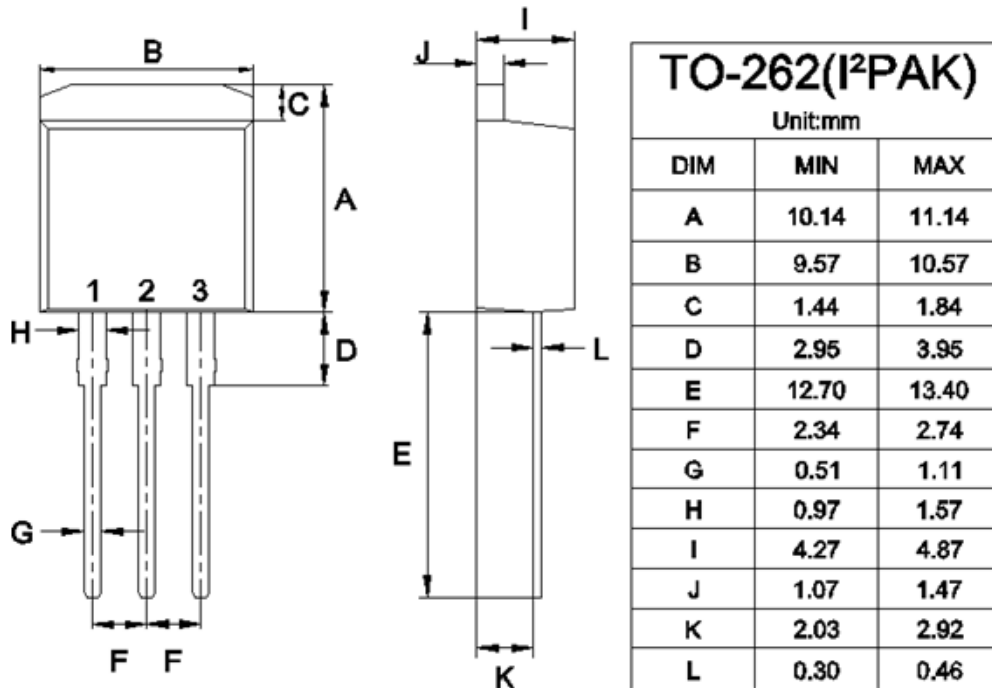
TO-220AB		
Unit:mm		
DIM	MIN	MAX
A	14.80	15.80
B	9.57	10.57
C	2.54	2.94
D	5.80	6.80
E	2.95	3.95
F	12.70	13.40
G	2.34	2.74
H	0.51	1.11
I	0.97	1.57
J	3.54 $\phi$	4.14 $\phi$
K	4.27	4.87
L	1.07	1.47
M	2.03	2.92
N	0.30	0.64

## ITO-220 Mechanical Drawing

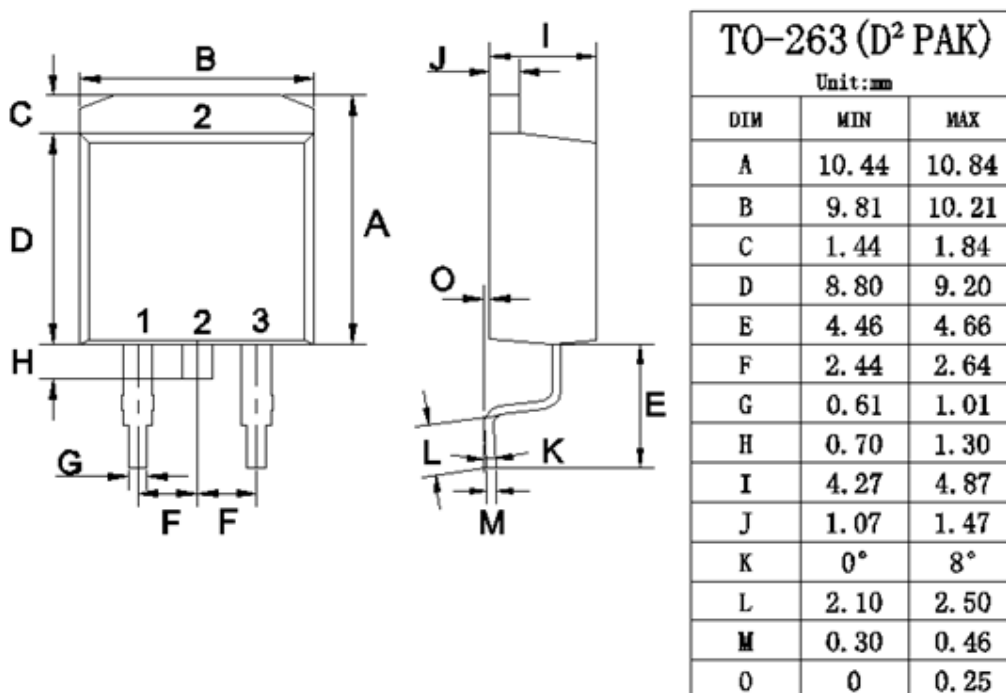


ITO-220AB		
Unit:mm		
DIM	MIN	MAX
A	14.50	15.50
B	9.50	10.50
C	2.50	2.90
D	6.30	7.30
E	3.30	4.30
F	13.00	14.00
G	2.35	2.75
H	0.30	0.90
I	0.90	1.50
J	3.20	3.80
K	4.24	4.84
L	2.52	2.92
M	1.09	1.49
N	0.47	0.64

## TO-262 Mechanical Drawing

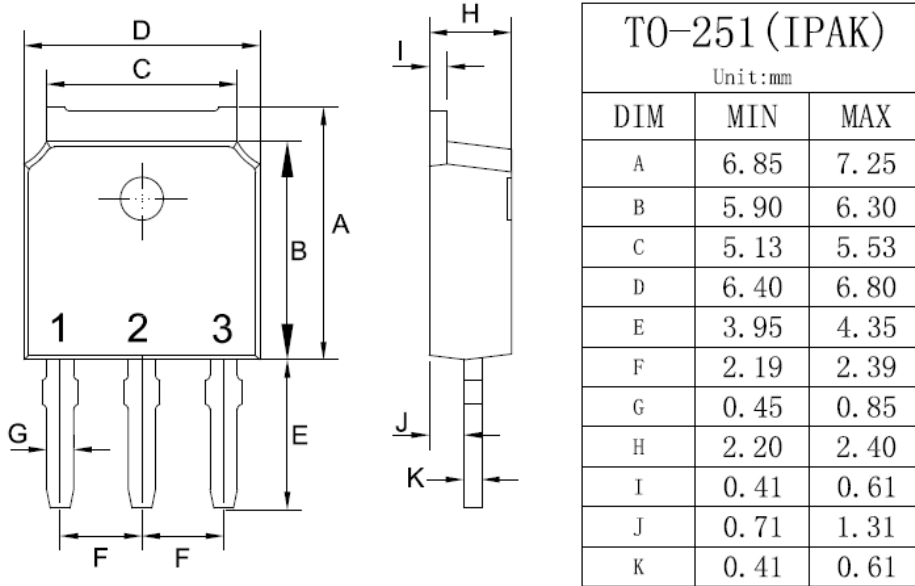


## TO-263 Mechanical Drawing





## TO-251 Mechanical Drawing



## TO-252 Mechanical Drawing

