



4N65

650V N-Channel Power MOSFET

Features

- $R_{DS(ON)} < 2.6\Omega @ V_{GS}=10V$
- Fast switching capability
- Lead free in compliance with EU RoHS directive.
- Green molding compound

PRODUCT SUMMARY

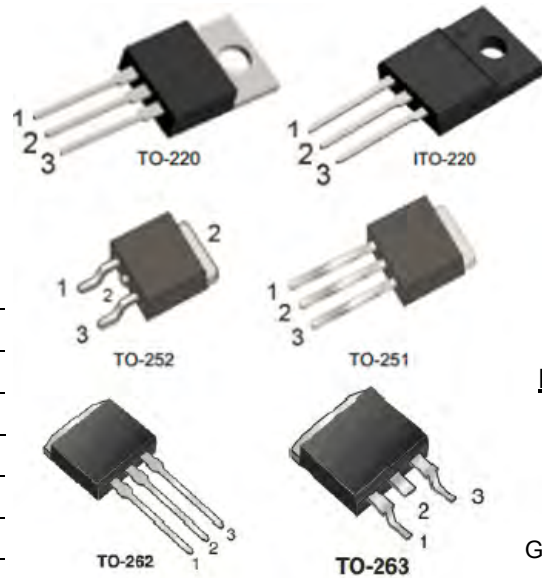
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)
650	2.6@ $V_{GS}=10V$	4

Mechanical Data

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

Ordering Information

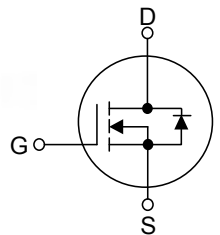
Part No.	Package	Packing
DMP4N65-TU	TO-251	75pcs / Tube
DMD4N65-TR	TO-252	2.5Kpcs / 13" Reel
DMD4N65-TU	TO-252	75pcs / Tube
DMT4N65-TU	TO-220	50pcs / Tube
DMF4N65-TU	ITO-220	50pcs / Tube
DMK4N65-TU	TO-262	50pcs / Tube
DMG4N65-TU	TO-263	50pcs / Tube
DMG4N65-TR	TO-263	800pcs / 13" Reel



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}	± 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	θ_{JA}	62.5	°C/W
	TO-251/ TO-252		110	
Junction to Case	TO-220 TO-262/TO-263	θ_{JC}	2.35	°C/W
	ITO-220		5.5	
	TO-251/ TO-252		2.9	

ELECTRICAL CHARACTERISTICS (T_c=25°C, unless otherwise specified)

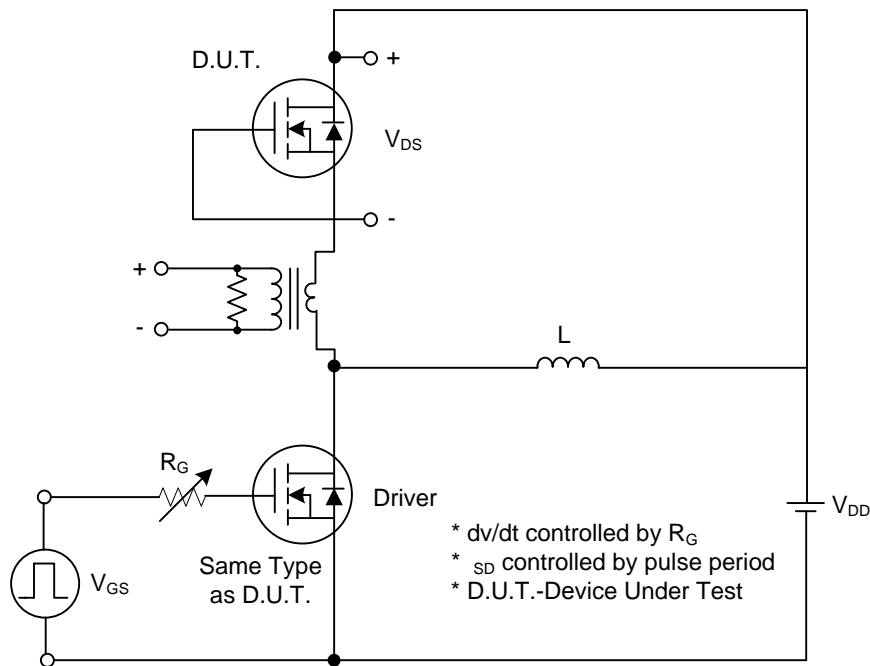
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
OFF CHARACTERISTICS								
Drain-Source Breakdown Voltage		BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	650			V	
Drain-Source Leakage Current		I_{DSS}	$V_{DS} = 650V, V_{GS} = 0V$			1	μA	
Gate-Source Leakage Current	Forward	I_{GSS}	$V_{GS} = 30V, V_{DS} = 0V$			100	nA	
	Reverse		$V_{GS} = -30V, V_{DS} = 0V$			-100	nA	
ON CHARACTERISTICS								
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		$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 2A$		2.3	2.6	Ω	
DYNAMIC CHARACTERISTICS								
Input Capacitance		C_{ISS}	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1MHz$		600		pF	
Output Capacitance		C_{OSS}				70		pF
Reverse Transfer Capacitance		C_{RSS}				23		pF
SWITCHING CHARACTERISTICS								
Turn-On Delay Time		$t_{D(ON)}$	$V_{DD} = 325V, I_D = 4.0A,$ $R_G = 25\Omega$ (Note 1, 2)		45		ns	
Turn-On Rise Time		t_R				100		ns
Turn-Off Delay Time		$t_{D(OFF)}$				200		ns
Turn-Off Fall Time		t_F				130		ns
Total Gate Charge		Q_G	$V_{DS} = 520V, I_D = 4.0A,$ $V_{GS} = 10V$ (Note 1, 2)		100		nC	
Gate-Source Charge		Q_{GS}				17		nC
Gate-Drain Charge		Q_{GD}				20		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS								
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}	$V_{GS} = 0V, I_S = 4A,$		260		ns	
Reverse Recovery Charge		Q_{RR}	$di_F/dt = 100 A/\mu s$ (Note 1)		2.5		μC	

Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$

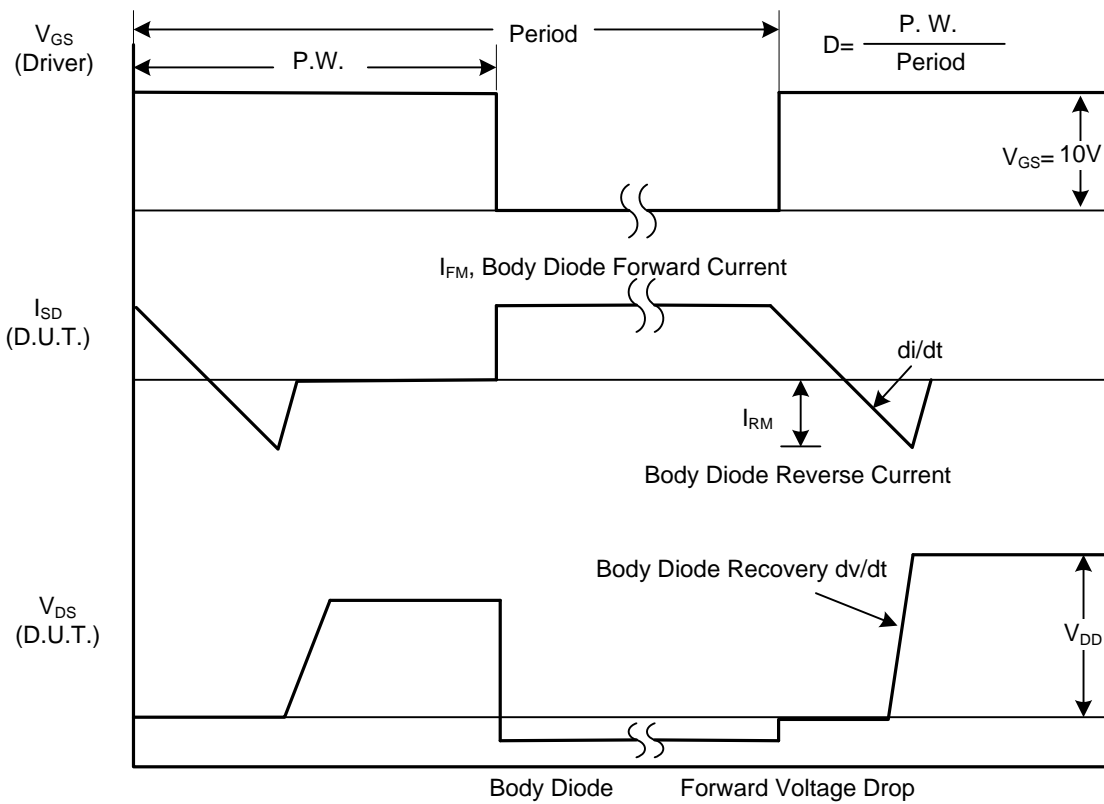
2. Essentially independent of operating temperature



TEST CIRCUITS AND WAVEFORMS



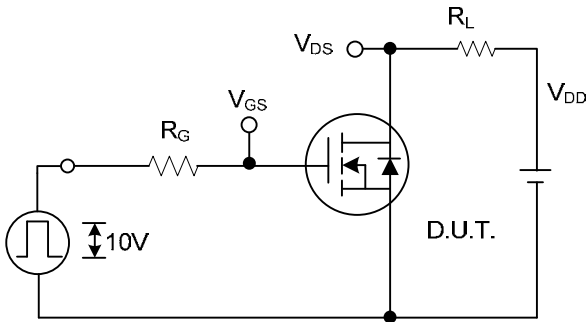
Peak Diode Recovery dv/dt Test Circuit



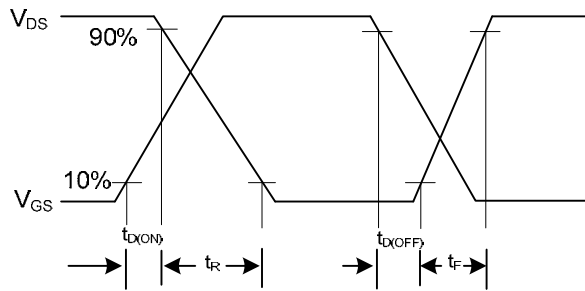
Peak Diode Recovery dv/dt Waveforms



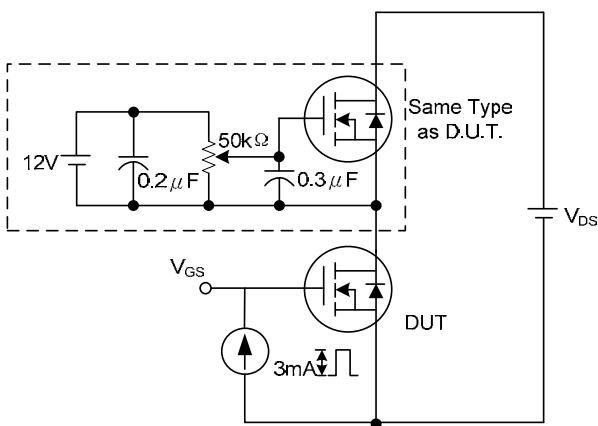
TEST CIRCUITS AND WAVEFORMS(Cont.)



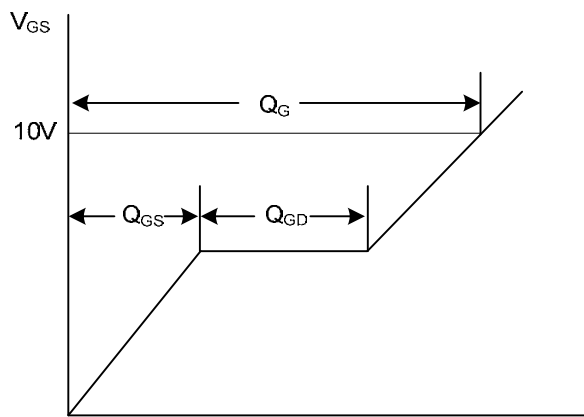
Switching Test Circuit



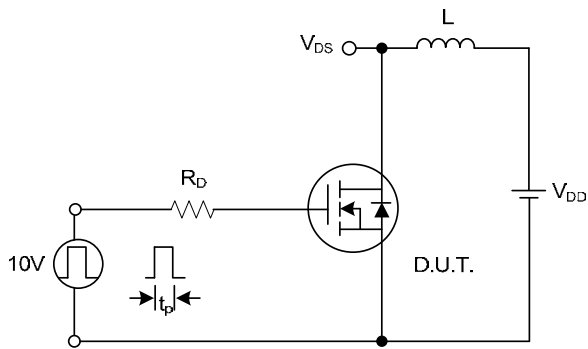
Switching Waveforms



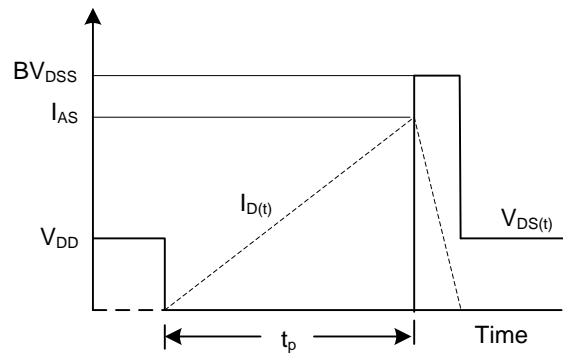
Gate Charge Test Circuit



Charge
Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



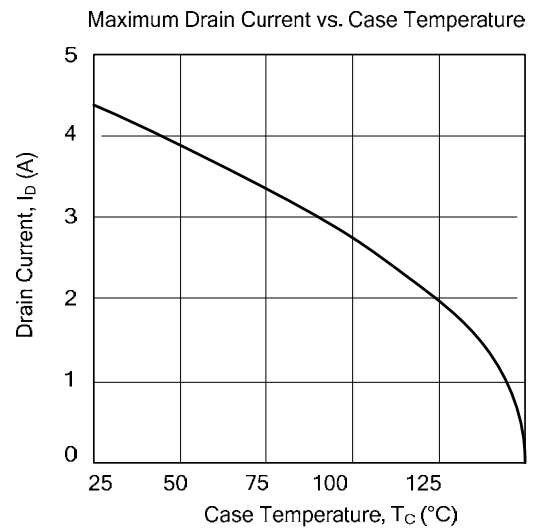
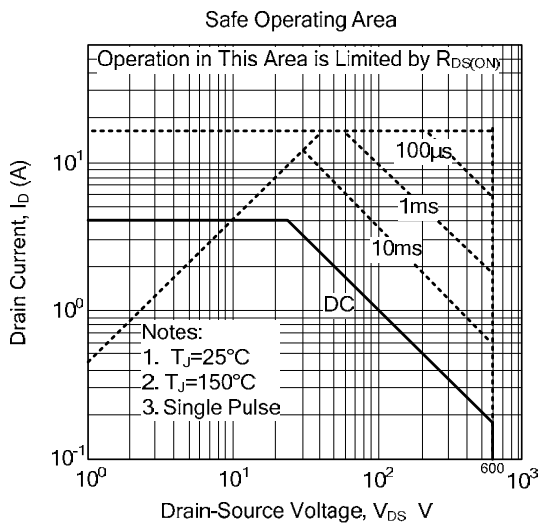
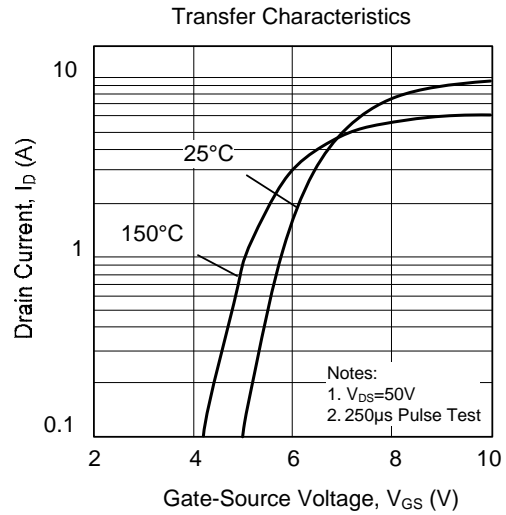
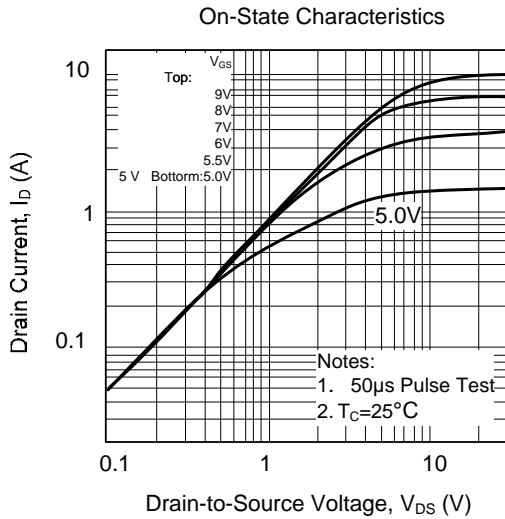
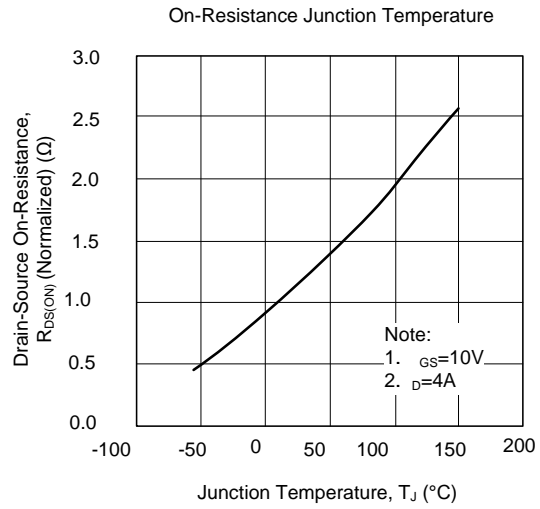
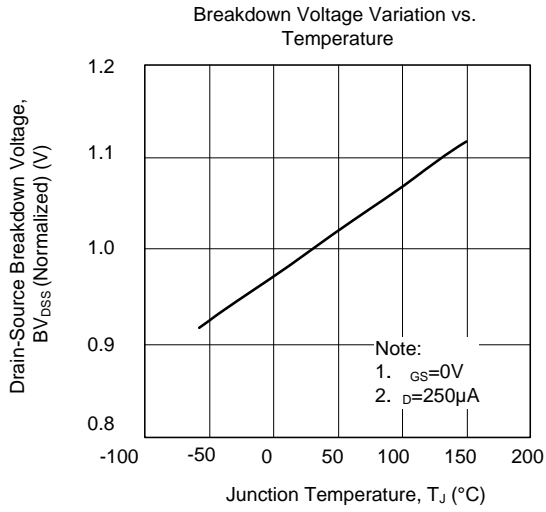
Unclamped Inductive Switching Waveforms



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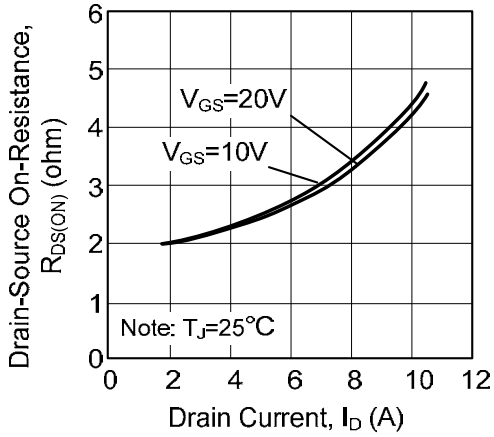
TYPICAL CHARACTERISTICS



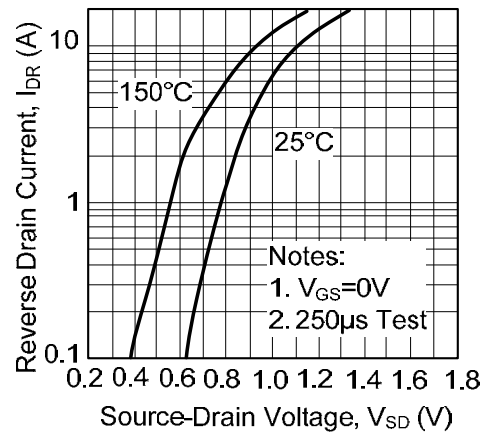


TYPICAL CHARACTERISTICS(Cont.)

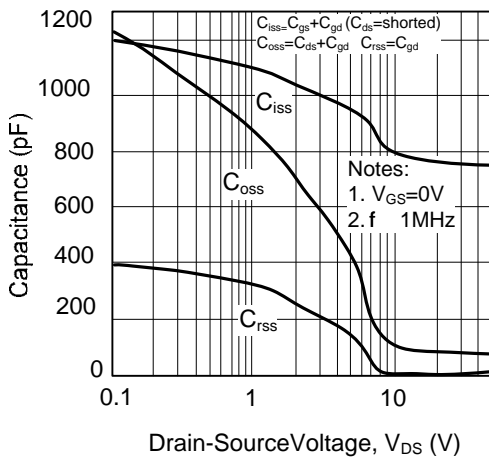
On-Resistance Variation vs. Drain Current and Gate Voltage



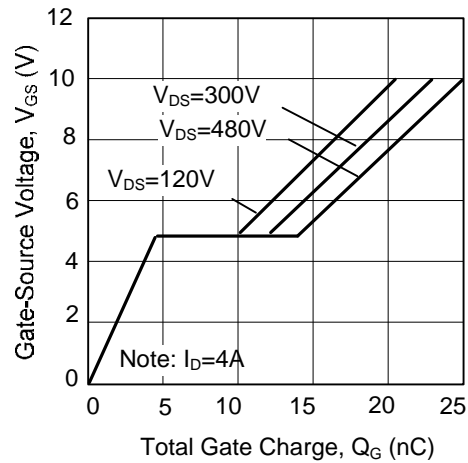
On State Current vs. Allowable Case Temperature



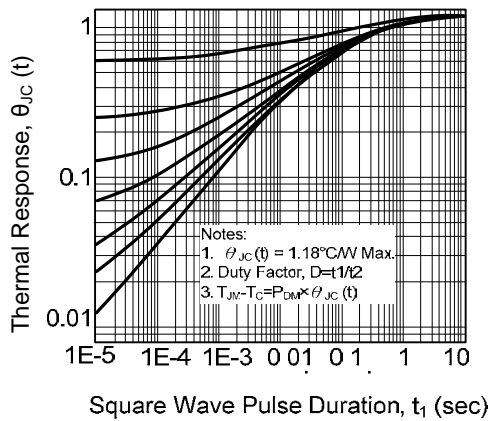
Capacitance Characteristics (Non-Repetitive)



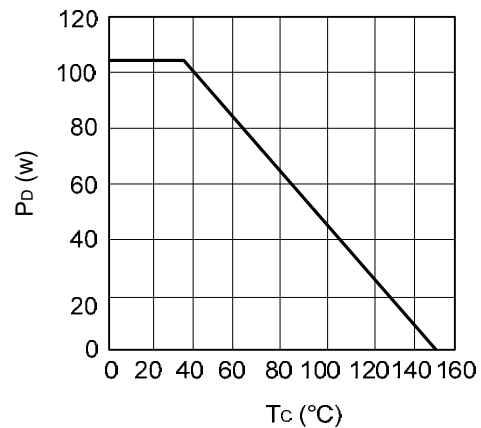
Gate Charge Characteristics



Transient Thermal Response Curve

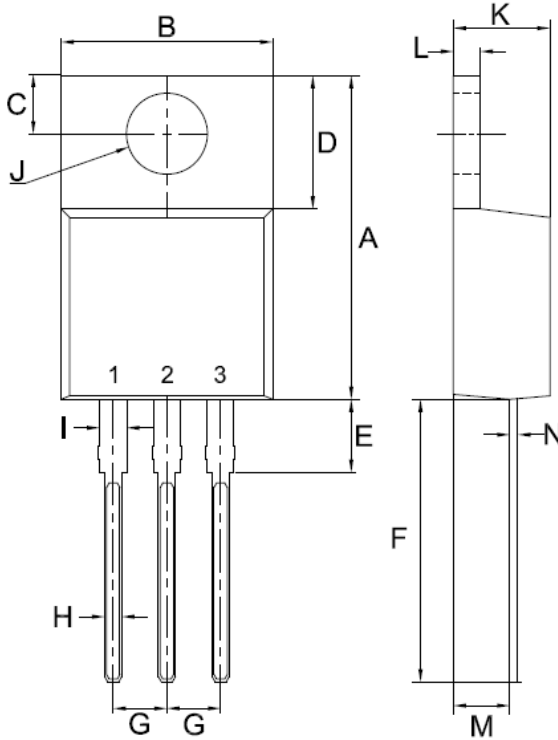


Power Dissipation



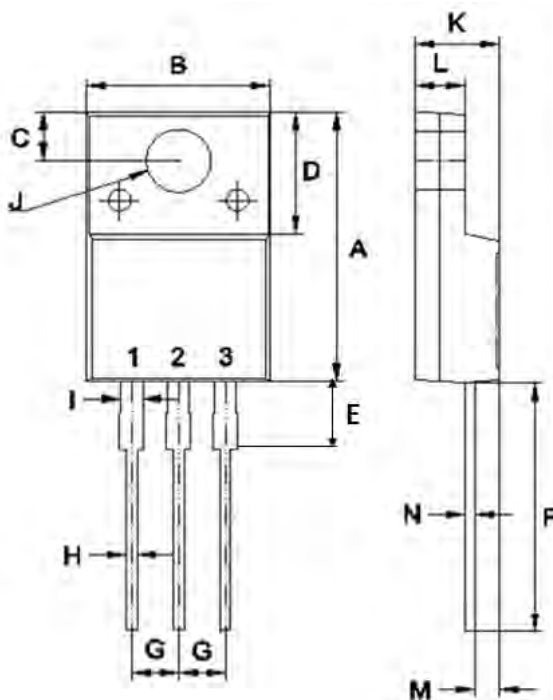


TO-220 Mechanical Drawing



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 ϕ	4.14 ϕ
K	4.27	4.87
L	1.07	1.47
M	2.03	2.92
N	0.30	0.64

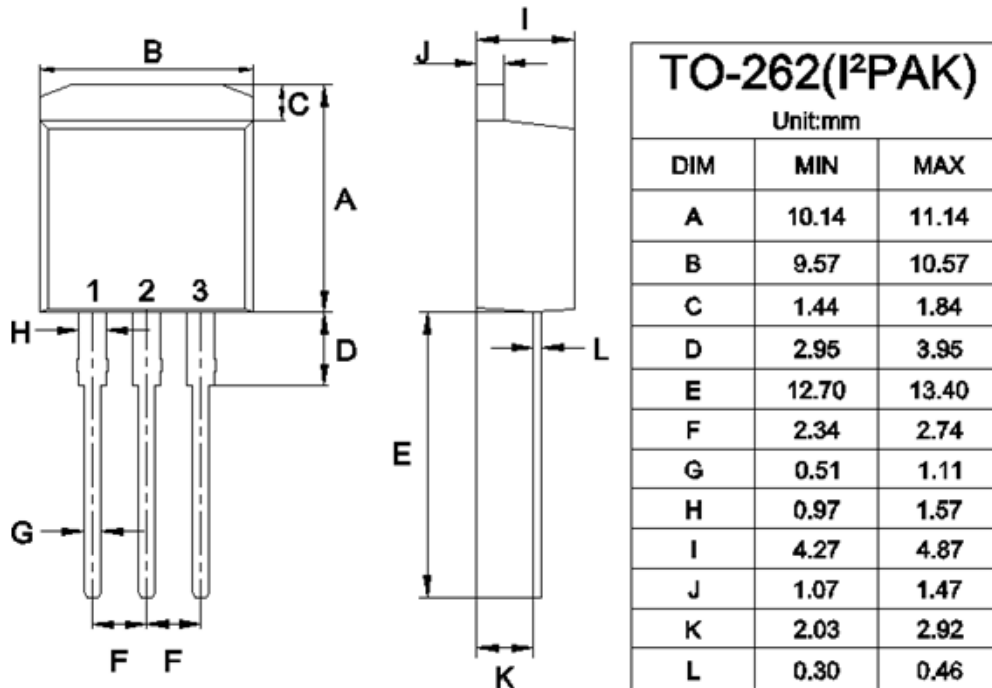
ITO-220 Mechanical Drawing



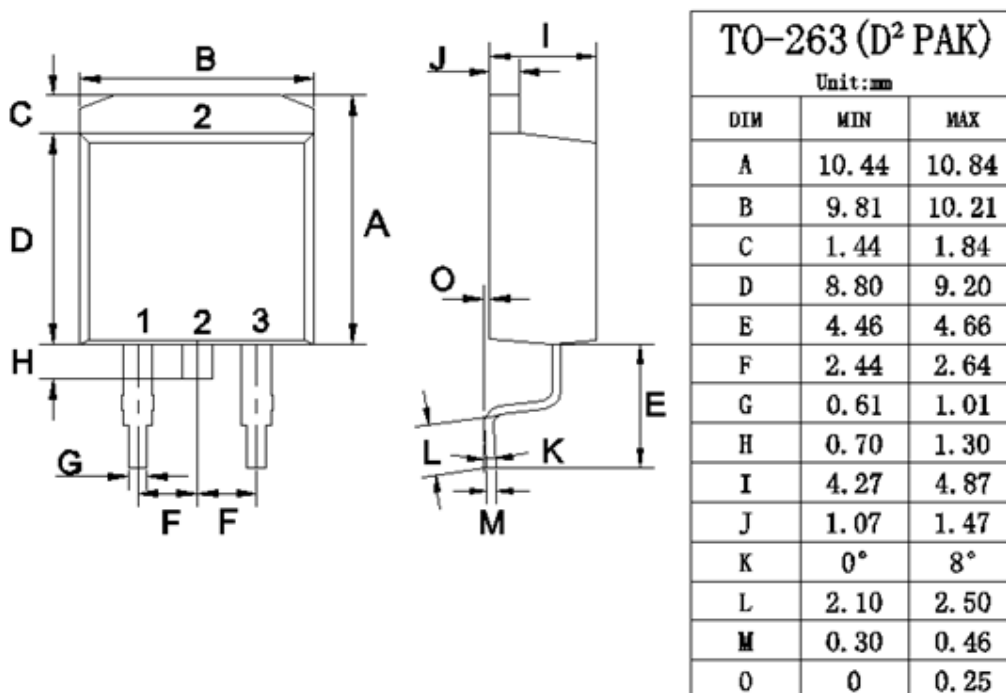
ITO-220AB Unit:mm		
DIM	MIN	MAX
A	14.50	15.50
B	9.50	10.50
C	2.50	2.90
D	6.30	7.30
E	3.30	4.30
F	13.00	14.00
G	2.35	2.75
H	0.30	0.90
I	0.90	1.50
J	3.20	3.80
K	4.24	4.84
L	2.52	2.92
M	1.09	1.49
N	0.47	0.64



TO-262 Mechanical Drawing

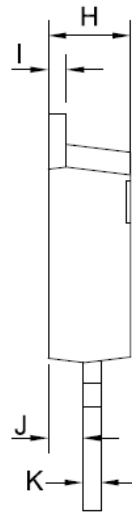
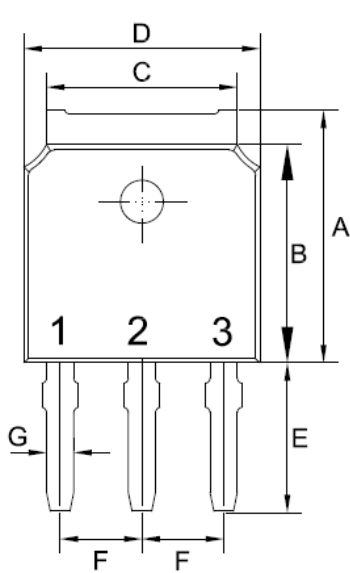


TO-263 Mechanical Drawing



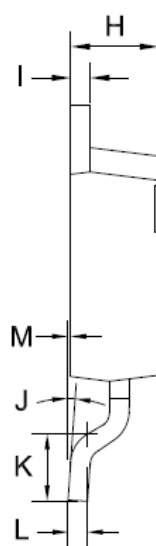
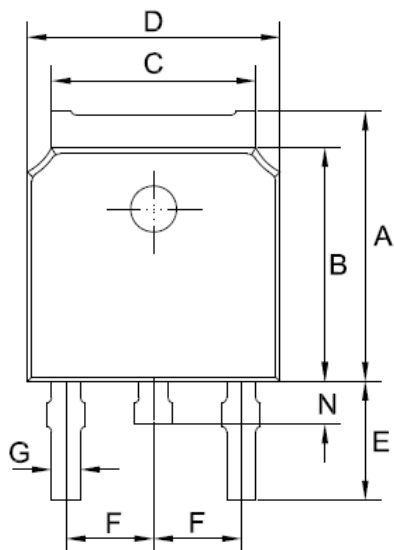


TO-251 Mechanical Drawing



TO-251 (IPAK)		
Unit:mm		
DIM	MIN	MAX
A	6.85	7.25
B	5.90	6.30
C	5.13	5.53
D	6.40	6.80
E	3.95	4.35
F	2.19	2.39
G	0.45	0.85
H	2.20	2.40
I	0.41	0.61
J	0.71	1.31
K	0.41	0.61

TO-252 Mechanical Drawing



TO-252 (DPAK)		
Unit:mm		
DIM	MIN	MAX
A	6.85	7.25
B	5.90	6.30
C	5.13	5.53
D	6.40	6.80
E	2.90	3.30
F	2.19	2.39
G	0.45	0.85
H	2.20	2.40
I	0.41	0.61
J	0°	8°
K	1.45	1.85
L	0.41	0.61
M	0.00	0.12
N	0.60	1.00