



4N60

600V N-Channel Power MOSFET

Features

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

Mechanical Data

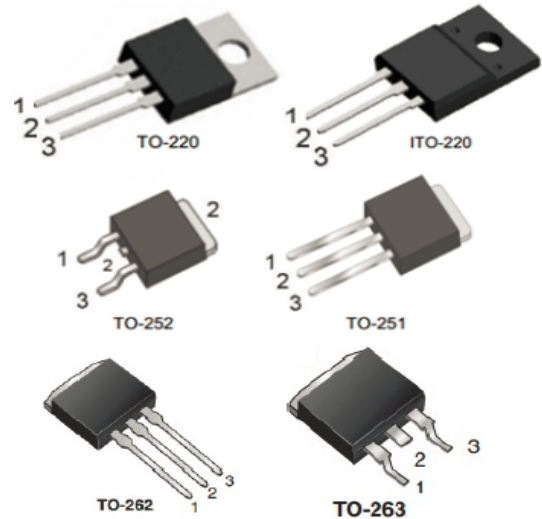
- Case: TO-251, TO-252, TO-220, ITO-220
TO-262, TO-263 Package

Ordering Information

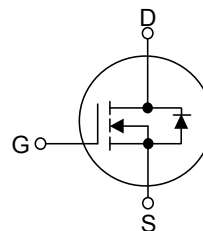
Part No.	Package	Packing
DMP4N60-TU	TO-251	75pcs / Tube
DMD4N60-TR	TO-252	2.5Kpcs / 13" Reel
DMD4N60-TU	TO-252	75pcs / Tube
DMT4N60-TU	TO-220	50pcs / Tube
DMF4N60-TU	ITO-220	50pcs / Tube
DMK4N60-TU	TO-262	50pcs / Tube
DMG4N60-TU	TO-263	50pcs / Tube
DMG4N60-TR	TO-263	800pcs / 13" Reel

PRODUCT SUMMARY

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



Block Diagram



Pin Definition:

1. Gate
2. Drain
3. Source

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}	± 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-220/TO-262/TO-263	P_D	106	W
	ITO-220		44	W
	TO-251/TO-252		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-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 ($T_C=25^{\circ}\text{C}$, unless otherwise specified)

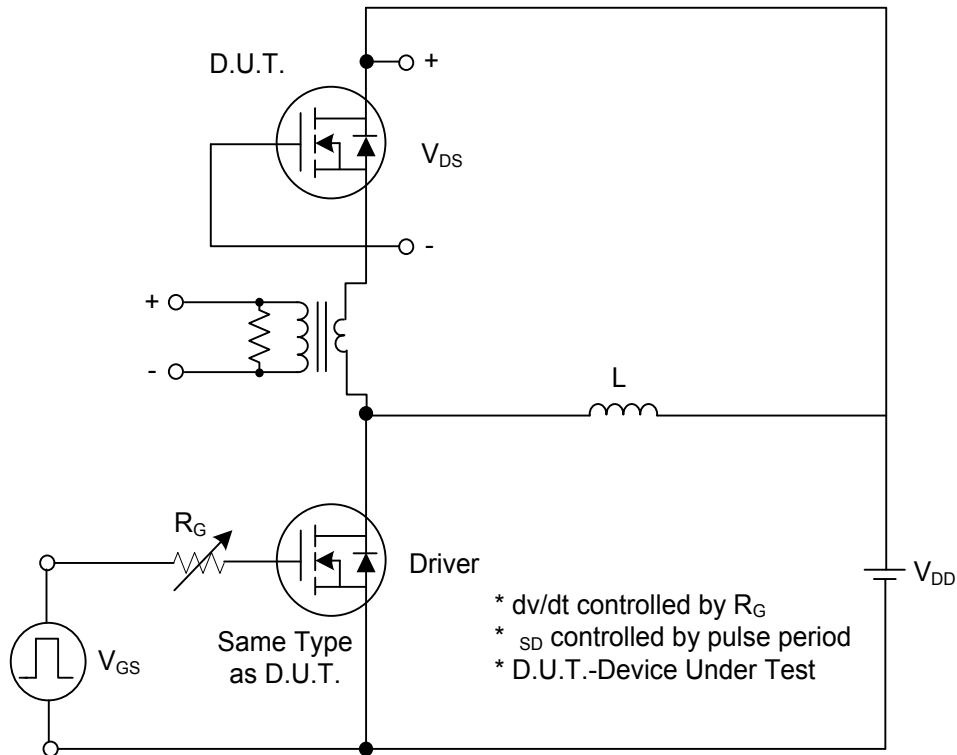
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} = 0V, I _D = 250μA	600			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} = 600V, V _{GS} = 0V			1	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} = 30V, V _{DS} = 0V			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 = 250μA	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	Ω
DYNAMIC CHARACTERISTICS							
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
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		t _{D(ON)}	V _{DD} = 300V, I _D = 4.0A, R _G = 25Ω (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
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} = 0 V, I _S = 4A,		400		ns
Reverse Recovery Charge		Q _{RR}	di _F /dt = 100 A/ μs (Note 1)		1.7		μC

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

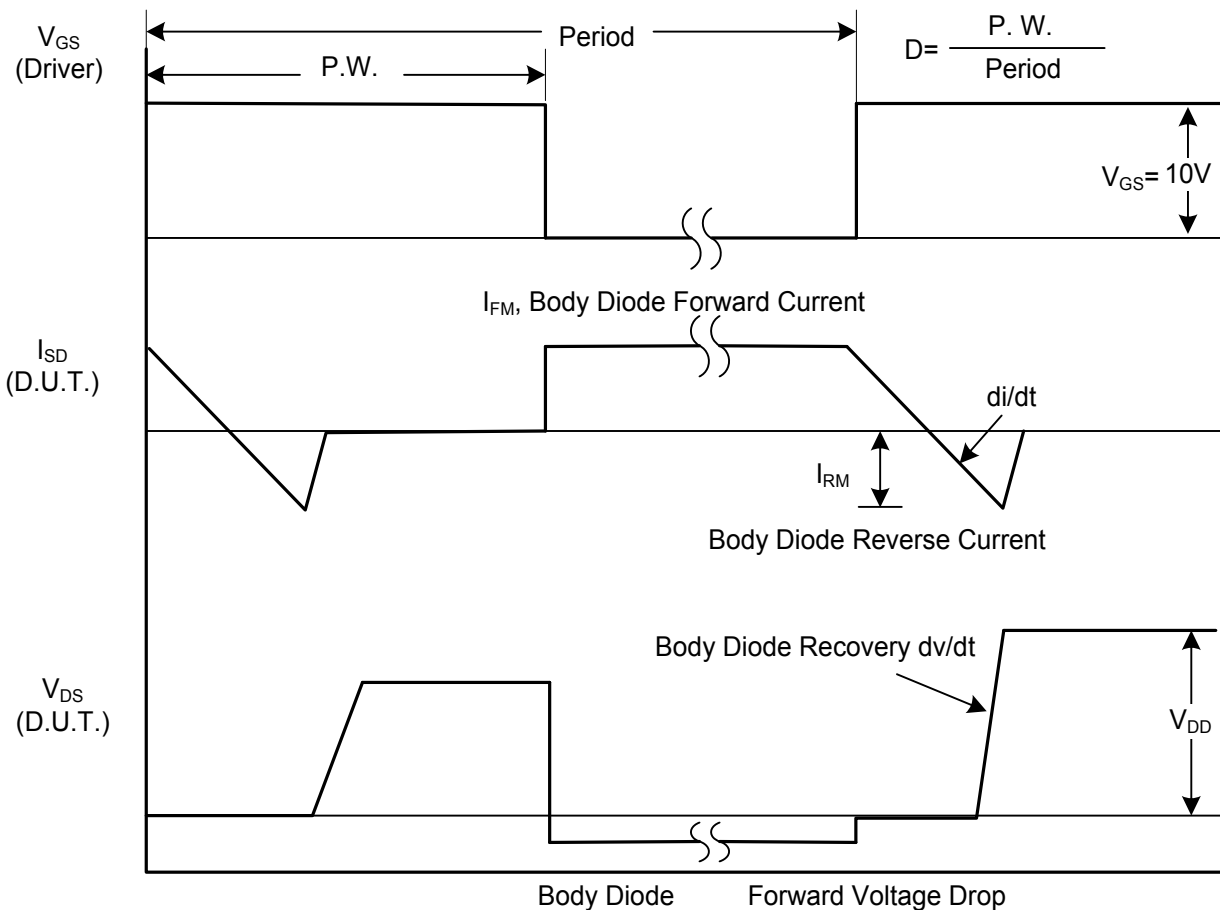
2. Essentially independent of operating temperature



TEST CIRCUITS AND WAVEFORMS



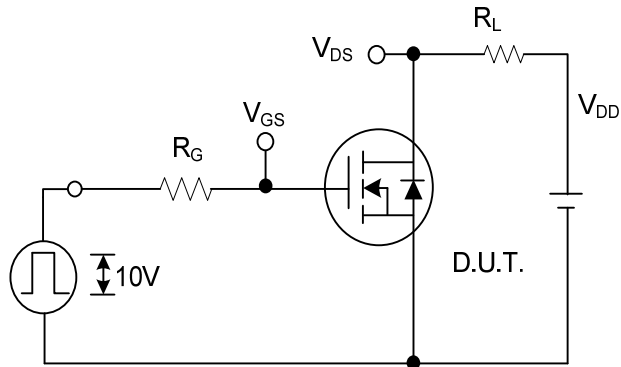
Peak Diode Recovery dv/dt Test Circuit



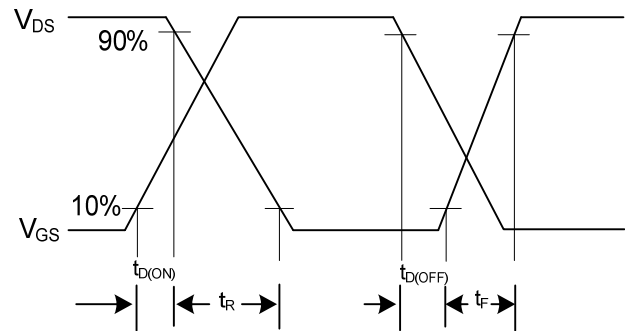
Peak Diode Recovery dv/dt Waveforms



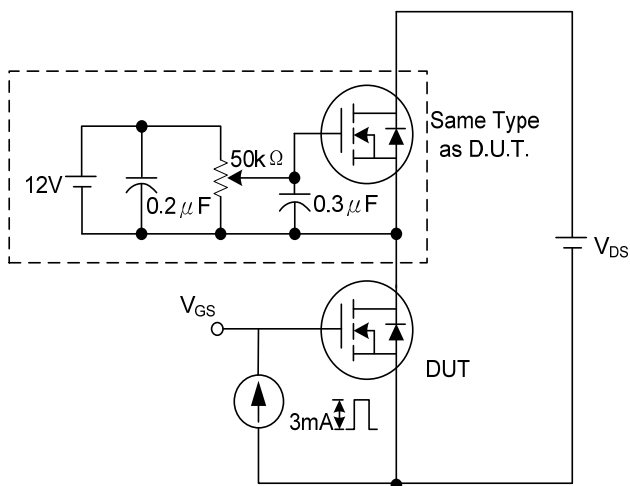
TEST CIRCUITS AND WAVEFORMS(Cont.)



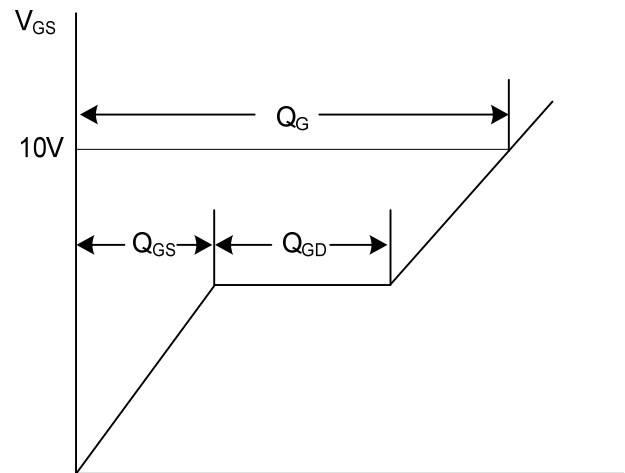
Switching Test Circuit



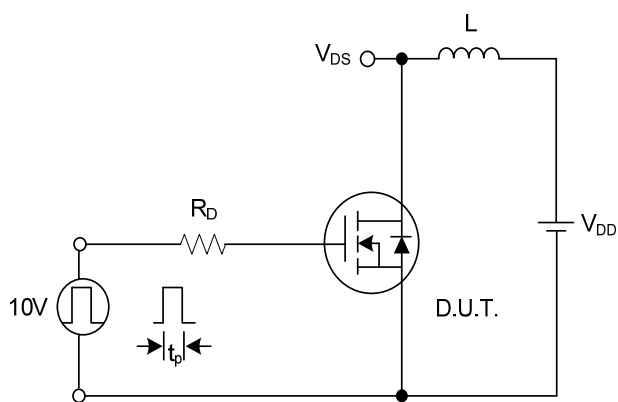
Switching Waveforms



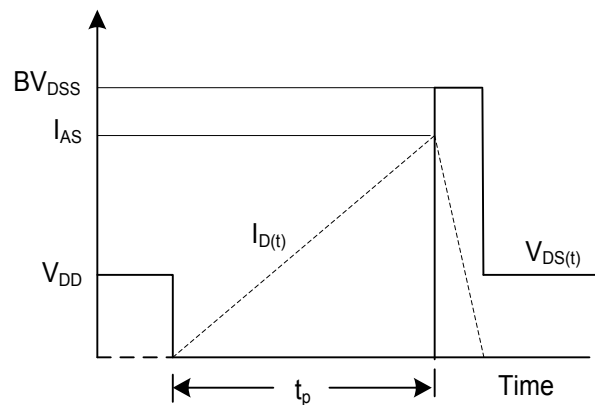
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit

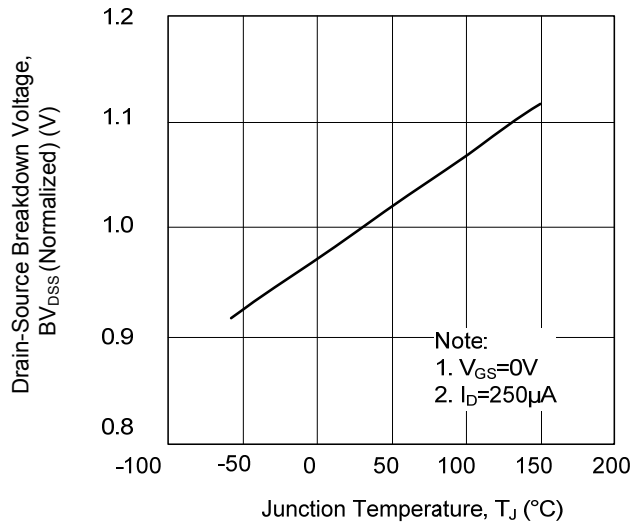


Unclamped Inductive Switching Waveforms

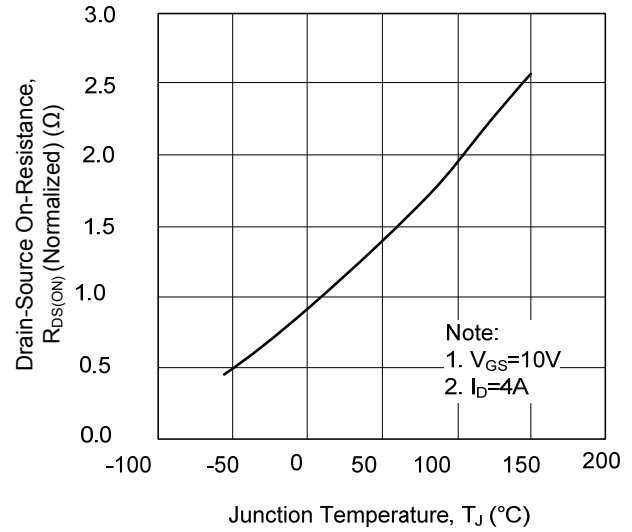


TYPICAL CHARACTERISTICS

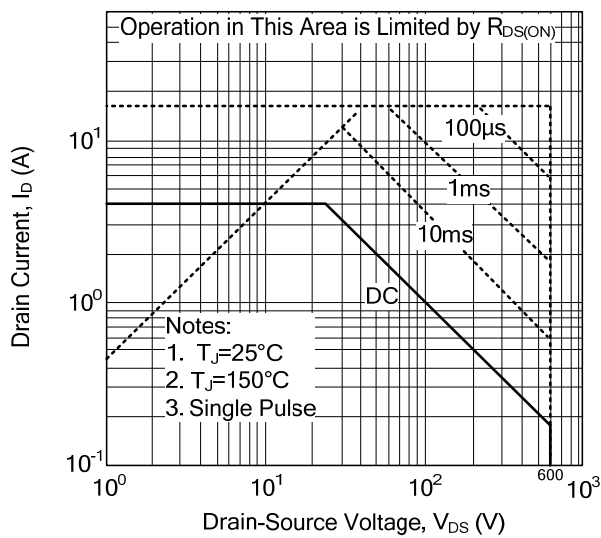
Breakdown Voltage Variation vs. Temperature



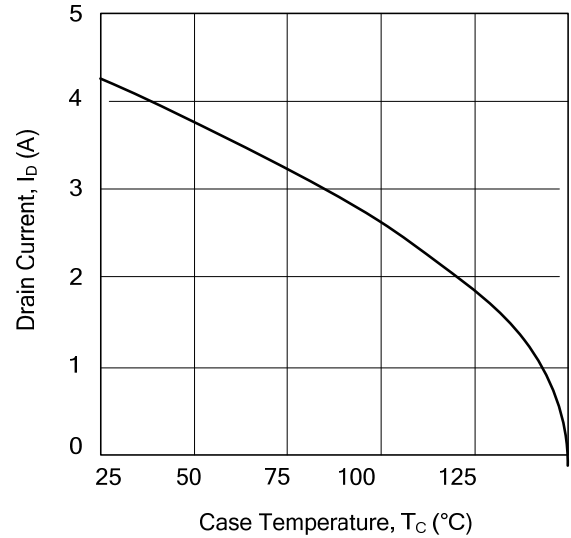
On-Resistance Junction Temperature



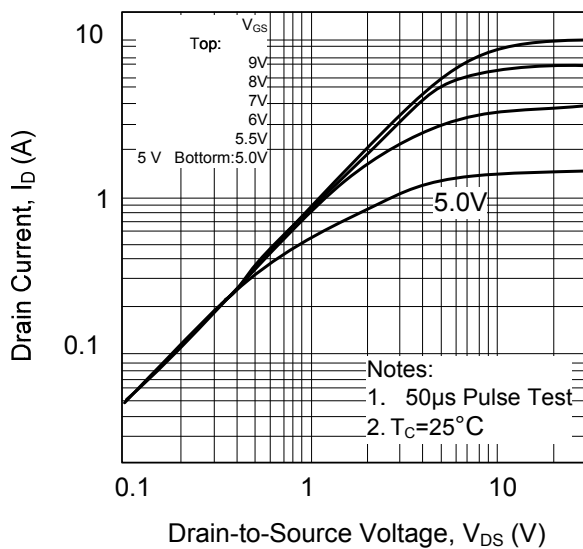
Safe Operating Area - 600V



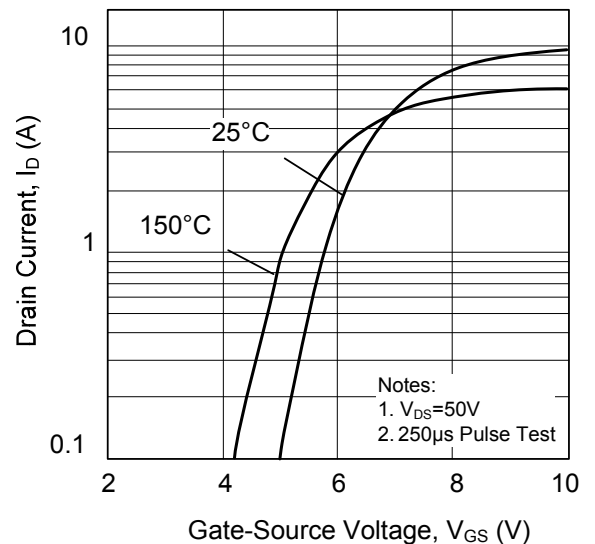
Maximum Drain Current vs. Case Temperature



On-State Characteristics



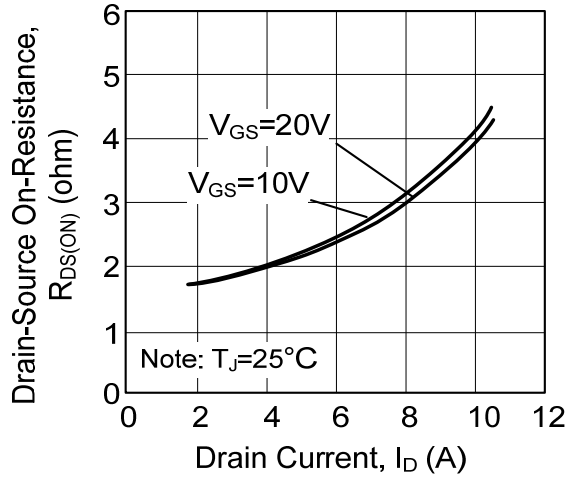
Transfer Characteristics



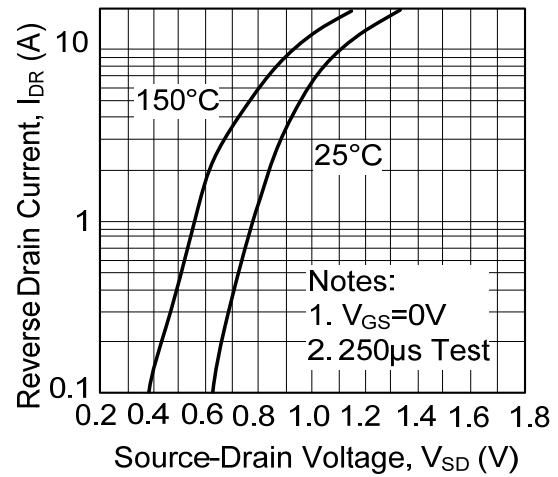


TYPICAL CHARACTERISTICS(Cont.)

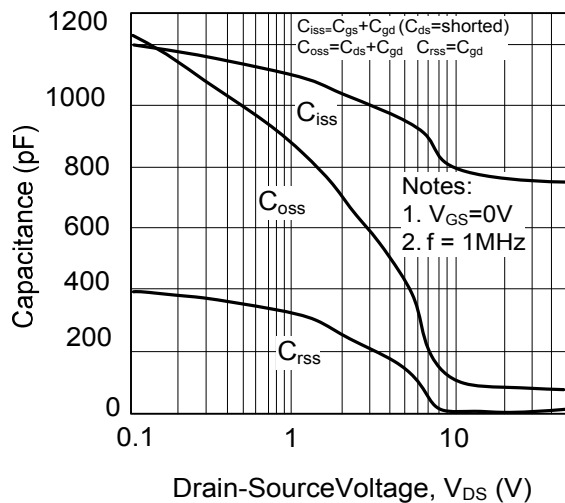
On-Resistance Variation vs. Drain Current and Gate Voltage



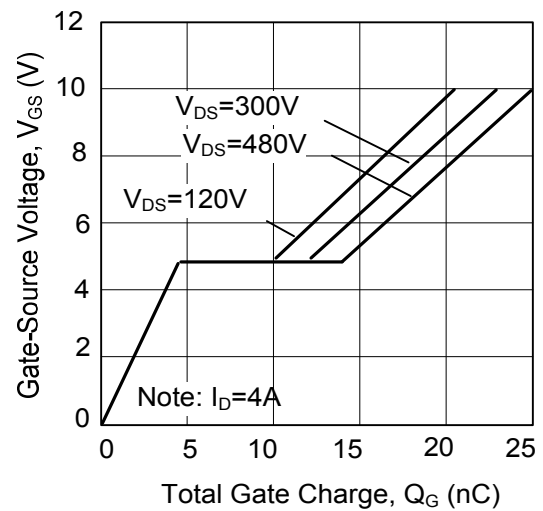
On State Current vs. Allowable Case Temperature



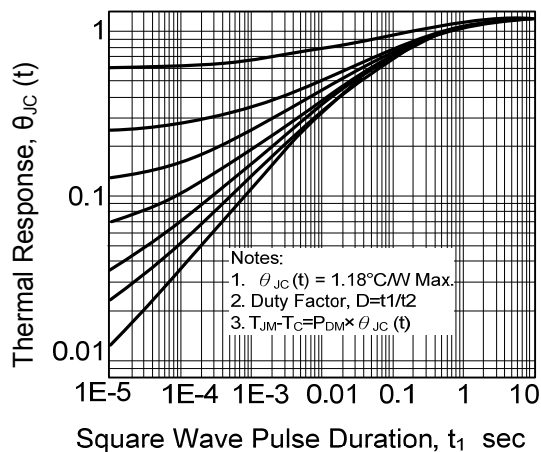
Capacitance Characteristics (Non-Repetitive)



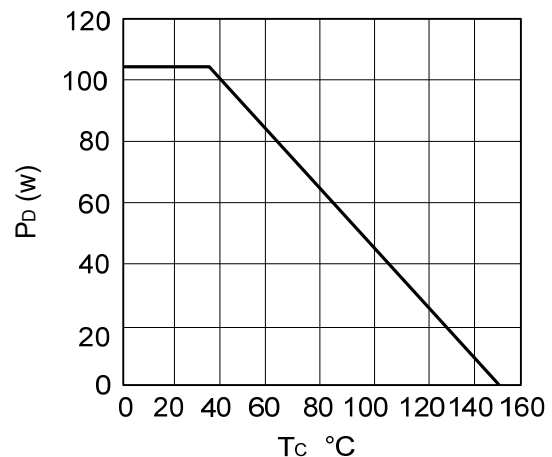
Gate Charge Characteristics



Transient Thermal Response Curve

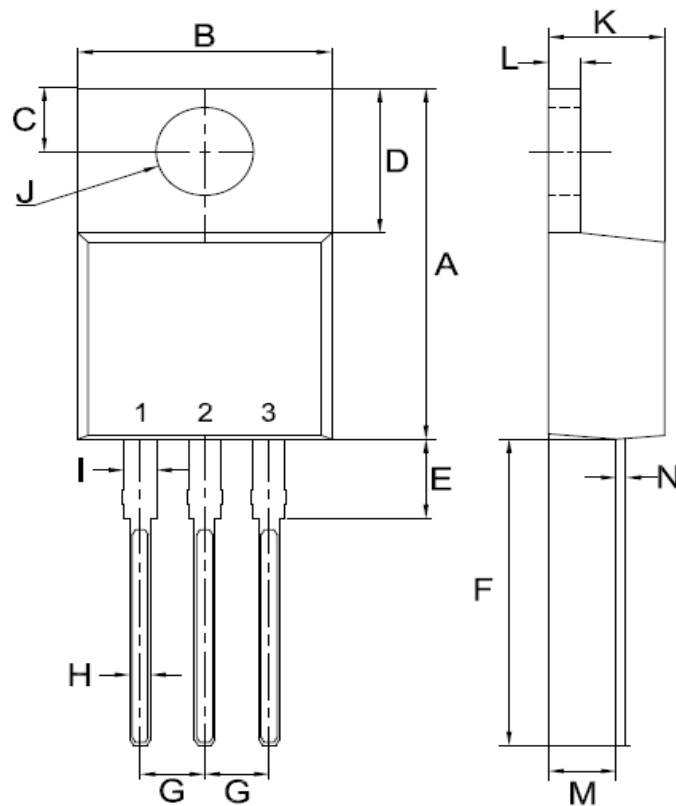


Power Dissipation



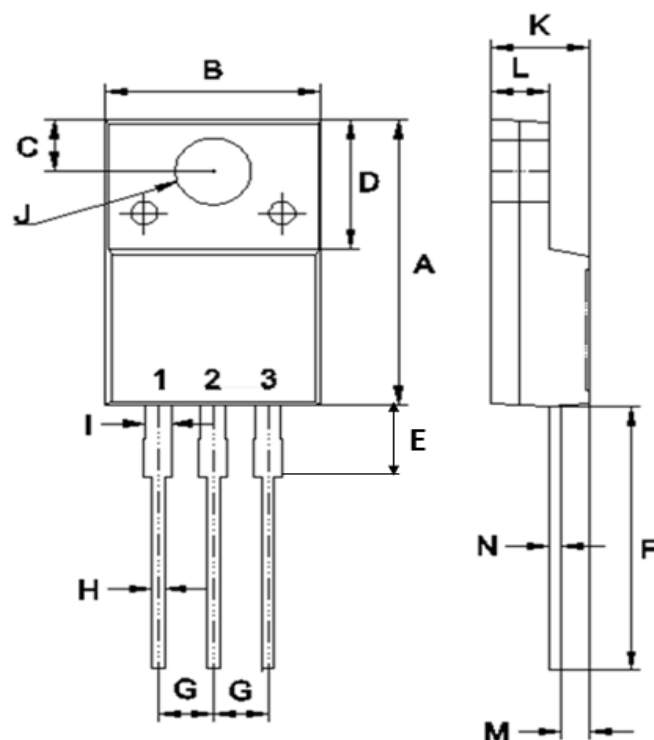


TO-220 Mechanical Drawing



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

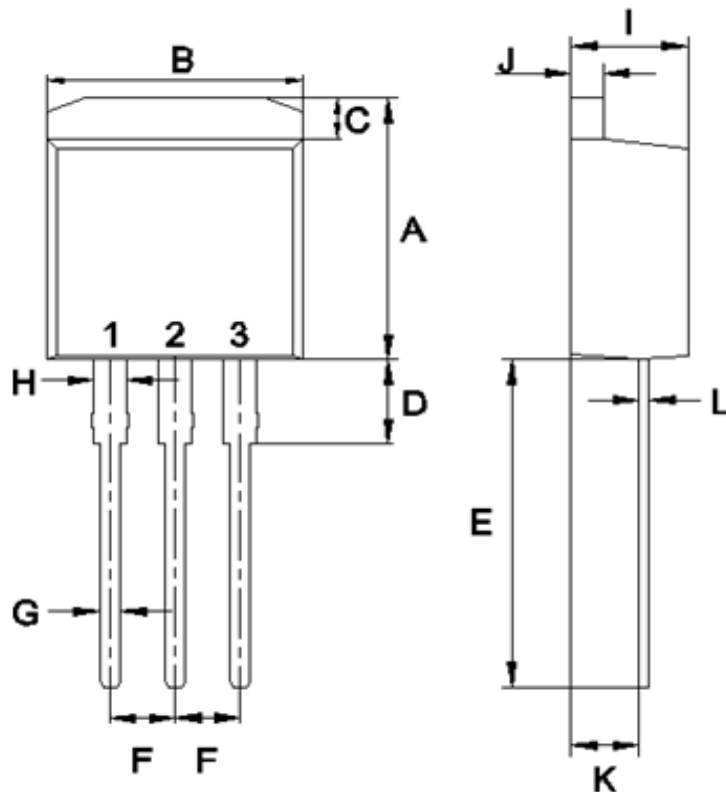
ITO-220 Mechanical Drawing



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

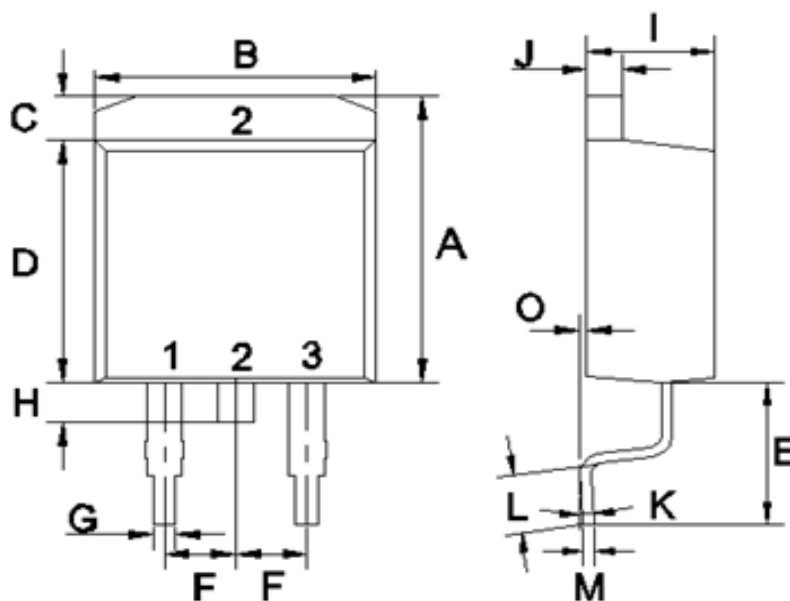


TO-262 Mechanical Drawing



TO-262(I ² PAK)		
Unit:mm		
DIM	MIN	MAX
A	10.14	11.14
B	9.57	10.57
C	1.44	1.84
D	2.95	3.95
E	12.70	13.40
F	2.34	2.74
G	0.51	1.11
H	0.97	1.57
I	4.27	4.87
J	1.07	1.47
K	2.03	2.92
L	0.30	0.46

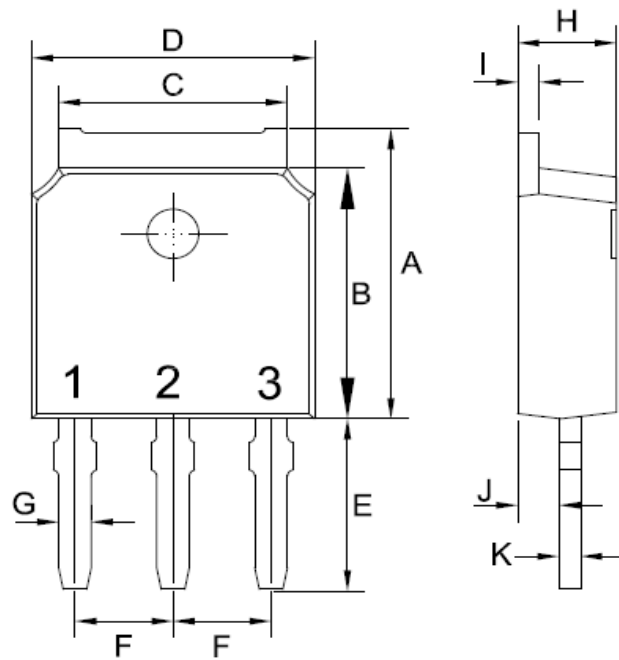
TO-263 Mechanical Drawing



TO-263 (D ² PAK)		
Unit:mm		
DIM	MIN	MAX
A	10.44	10.84
B	9.81	10.21
C	1.44	1.84
D	8.80	9.20
E	4.46	4.66
F	2.44	2.64
G	0.61	1.01
H	0.70	1.30
I	4.27	4.87
J	1.07	1.47
K	0°	8°
L	2.10	2.50
M	0.30	0.46
O	0	0.25

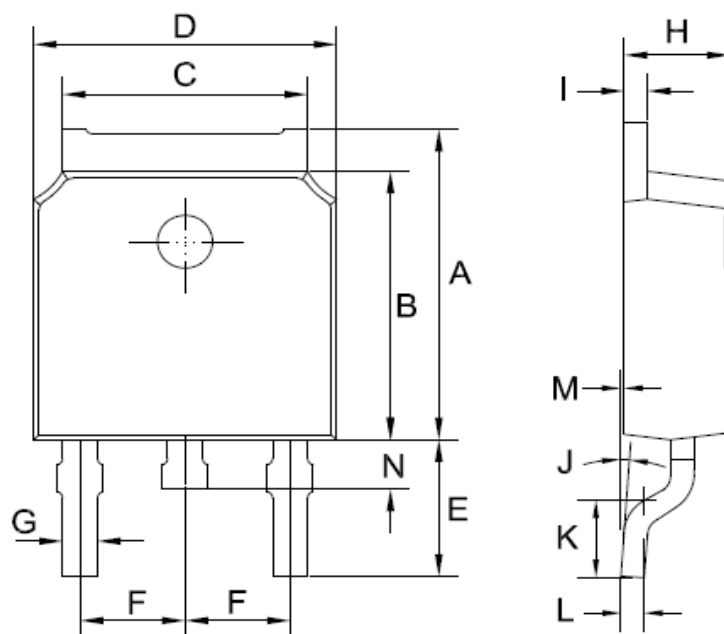


TO-251 Mechanical Drawing



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