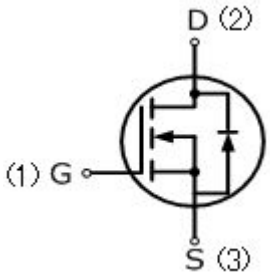
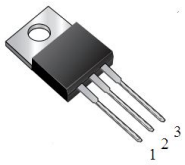
4N60(F,B,H,G,D)

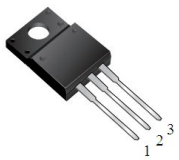
4 Amps,600 Volts N-CHANNEL MOSFET

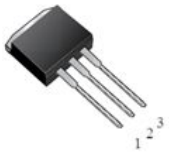
FEATURE

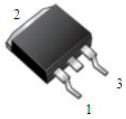
- 4A,600V,$R_{DS(ON)}$=2Ω@V_{GS}=10V/2A
- Low gate charge
- Low C_{iss}
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability




TO-220AB
4N60


ITO-220AB
4N60F


TO-262
4N60H


TO-263
4N60B


TO-252
4N60G


TO-251
4N60D

Absolute Maximum Ratings(T_C=25℃,unless otherwise noted)

Parameter		Symbol	4N60	UNIT
Drain-Source Voltage		V_{DSS}	600	V
Gate-Source Voltage		V_{GSS}	±30	
Continuous Drain Current		I_D	4	A
Pulsed Drain Current(Note1)		I_{DM}	16	
Single Pulse Avalanche Energy (Note 2)		E_{AS}	300	mJ
Avalanche Current(Note1)		I_{AR}	4	A
Repetitive Avalanche Energy (Note1)		E_{AR}	30	mJ
Reverse Diode dV/dt (Note 3)		dv/dt	4.5	V/ns
Operating Junction and Storage Temperature Range		T_J,T_{STG}	-55 to +150	℃
Maximum lead temperature for soldering purposes, 1/8″from case for 5 seconds		T_L	260	℃
Mounting Torque	6-32 or M3 screw		10	lbf • in
			1.1	N • m

Thermal Characteristics

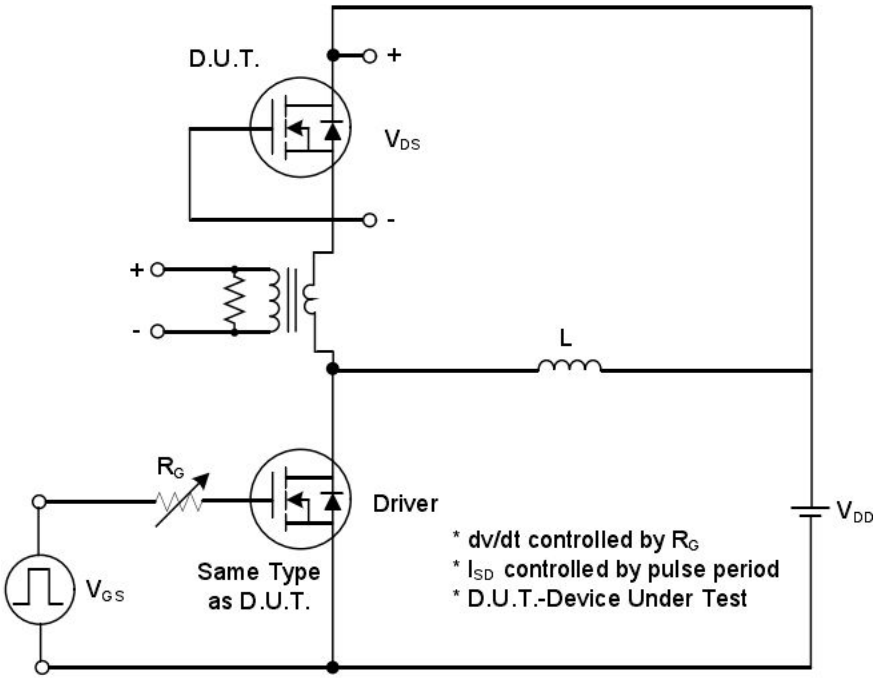
Parameter		Symbol	ITO-220	TO-220	TO-262 TO-263	TO-251 TO-252	Units
Maximum Junction-to-Case		R_{thJC}	2.2	1.8	1.8	5.7	℃/W
Maximum Power Dissipation	T_C=25℃	P_D	57	70	70	22	W

Electrical Characteristics (T_c=25℃,unless otherwise noted)						
Parameter	**Symbol**	**Test Conditions**	**Min**	**Typ**	**Max**	**Units**
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V,I_D=250uA	600	—	—	V
Breakdown Temperature Coefficient	ΔBV_{DSS} /ΔT_J	Reference to 25℃, I_D=250uA	—	0.6	—	V/℃
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=600V,V_{GS}=0V	—	—	1	μA
Gate-Body Leakage Current,Forward	I_{GSSF}	V_{GS}=30V,V_{DS}=0V	—	—	10	μA
Gate-Body Leakage Current,Reverse	I_{GSSR}	V_{GS}=-30V,V_{DS}=0V	—	—	-10	μA
On Characteristics						
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250uA	2	—	4	V
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS}=10V,I_D=2A	—	—	2.5	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{DS}=25V,V_{GS}=0V, f=1.0MHZ	—	520	670	pF
Output Capacitance	C_{oss}		—	70	90	pF
Reverse Transfer Capacitance	C_{rss}		—	8	11	pF
Switching Characteristics						
Turn-On Delay Time	$t_{d(on)}$	V_{DD}=300V,I_D=4A, R_G=25Ω (Note4,5)	—	13	2835	ns
Turn-On Rise Time	t_r		—	45	400	ns
Turn-Off Delay Time	$t_{d(off)}$		—	25	60	ns
Turn-Off Fall Time	t_f		—	35	80	ns
Total Gate Charge	Qg	V_{DS}=480V,I_D=4A, V_{GS}=10V, (Note4,5)	—	15	20	nC
Gate-Source Charge	Qgs		—	3.4	—	nC
Gate-Drain Charge	Qgd		—	7.1	—	nC
Drain-Source Body Diode Charcteristics and Maximum Ratings						
Continuous Diode Forward Current	I_S		—	—	4	A
Pulsed Diode Forward Current	I_{SM}		—	—	16	A
Diode Forward Voltage	V_{SD}	I_S=4A,V_{GS}=0V	—	—	1.5	V
Reverse Recovery Time	t_{rr}	V_{GS}=0V,I_S=4A, dI_F/dt=100A/us, (Note4)	—	250	—	ns
Reverse Recovery Charge	Q_{rr}		—	1.5	—	μC

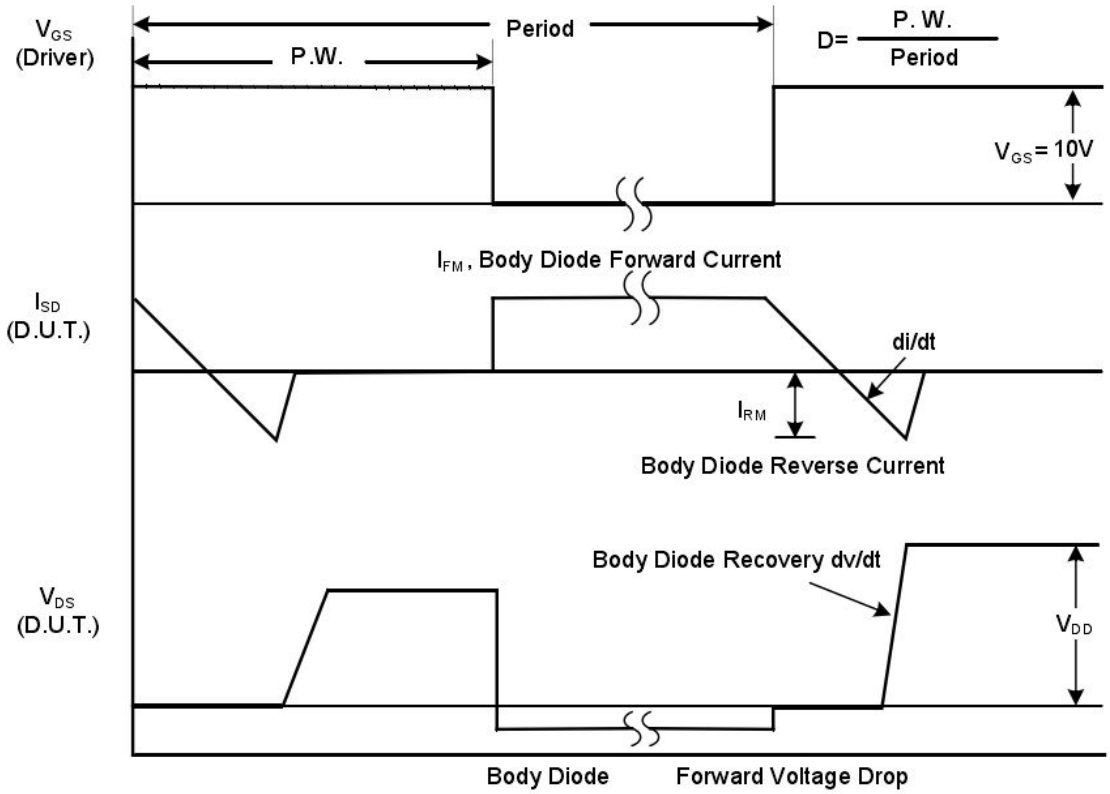
Notes

1. Repetitive Rating:pulse width limited by maximum junction temperature.
2. V_{DD}=50V,L=36mH,R_g=25Ω,I_{AS}=4A , starling T_J=25℃.
3. I_{SD}≤I_D,dI/dt=200A/us,V_{DD}≤BV_{DSS},starting T_J=25℃.
4. Pulse width≤300us;duty cycle≤2%.
5. Repetitive rating; pulse width limited by maximum junction temperature.

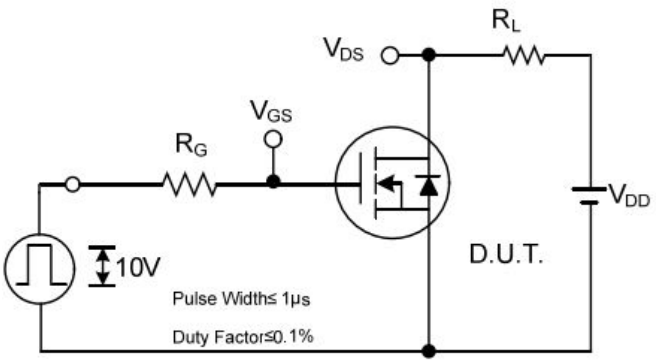
TEST CIRCUIT AND WAVEFORM



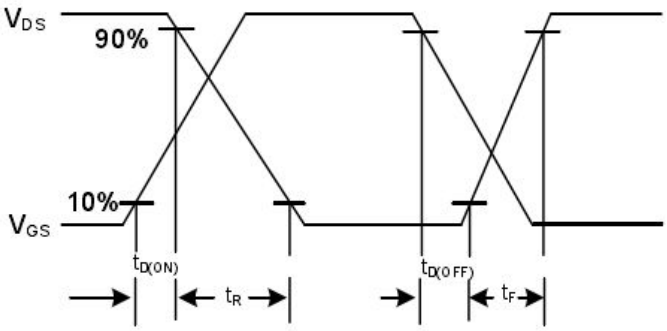
Peak Diode Recovery dv/dt Test Circuit



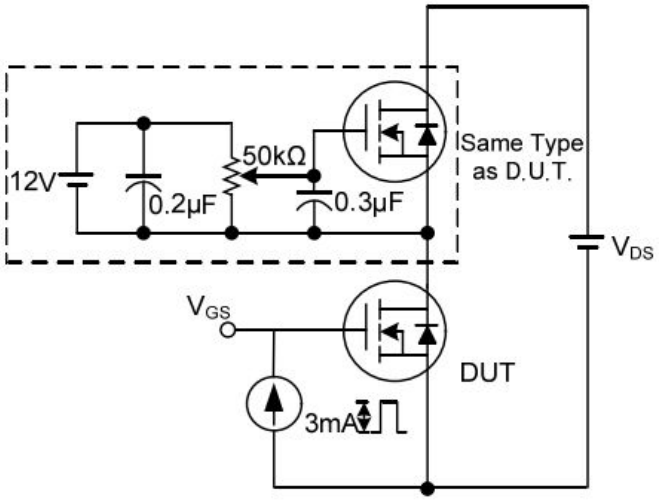
Peak Diode Recovery dv/dt Waveforms



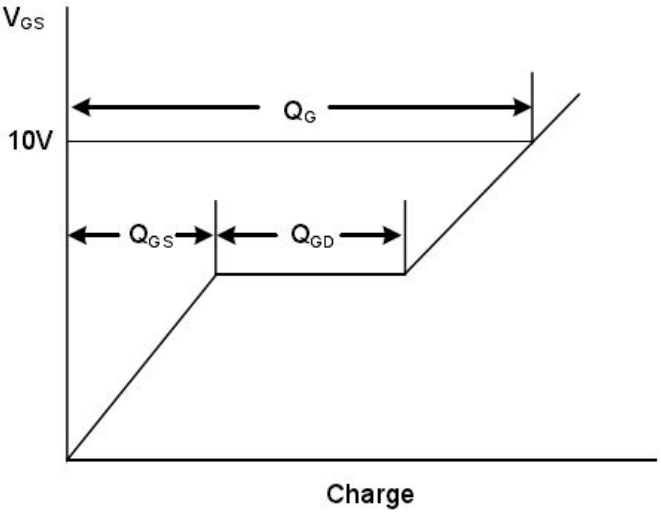
Switching Test Circuit



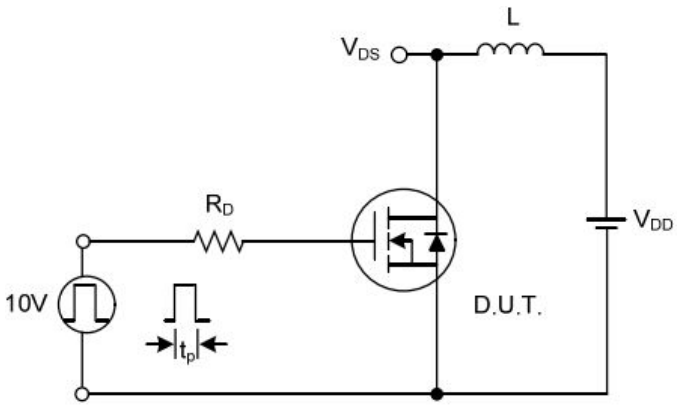
Switching Waveforms



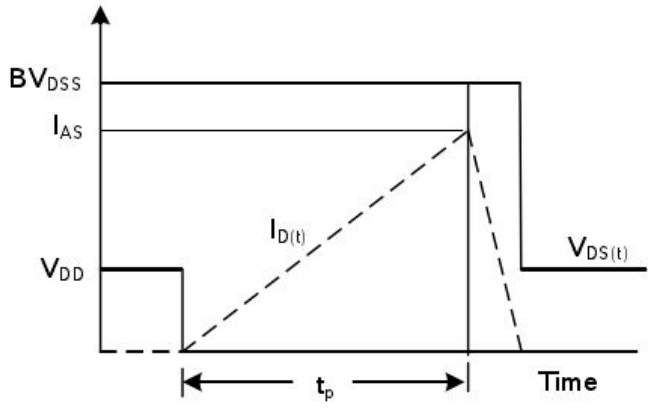
Gate Charge Test Circuit



Gate Charge Waveform



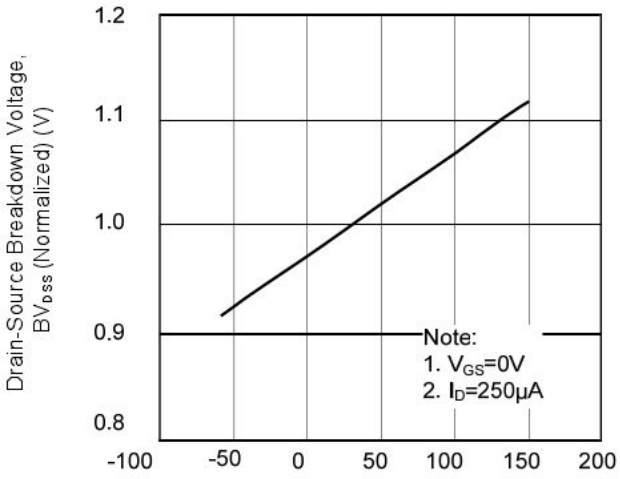
Unclamped Inductive Switching Test Circuit



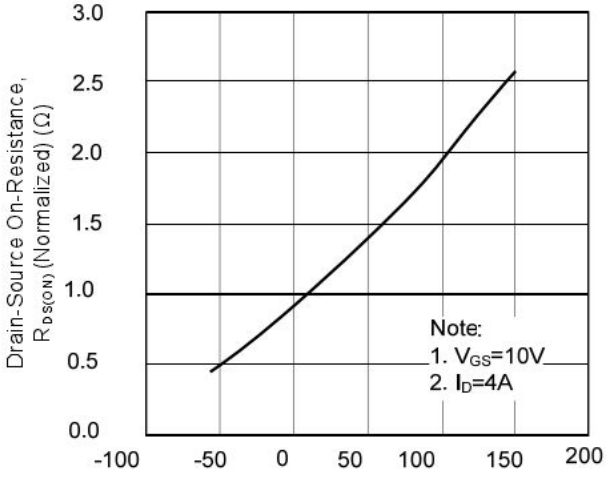
Unclamped Inductive Switching Waveforms

RATINGAND CHARACTERISTIC CURVES

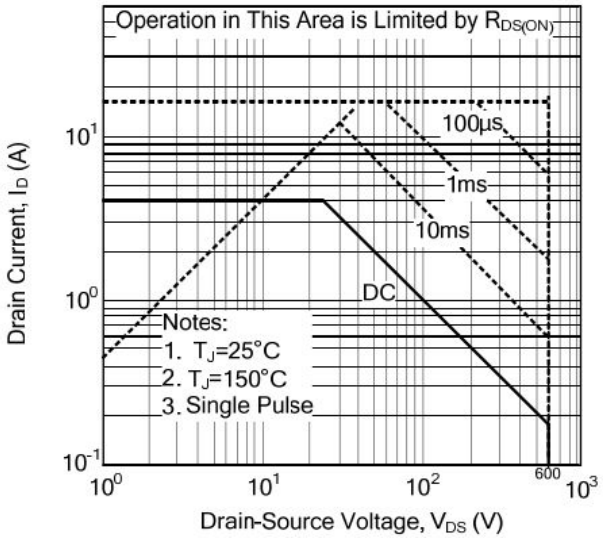
Breakdown Voltage Variation vs. Temperature



On-Resistance Junction Temperature

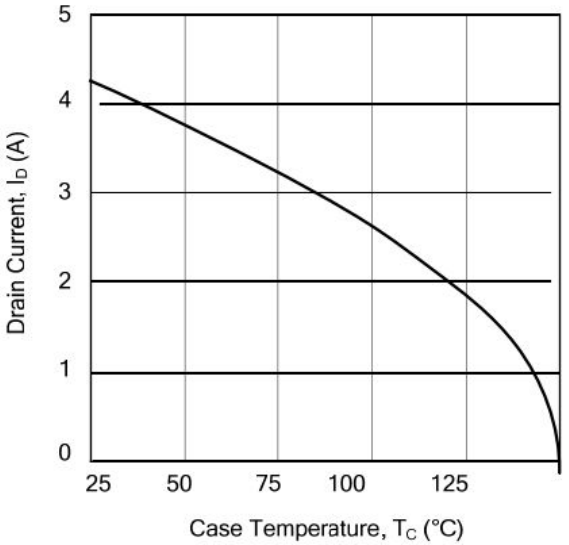


Safe Operating Area - 600V

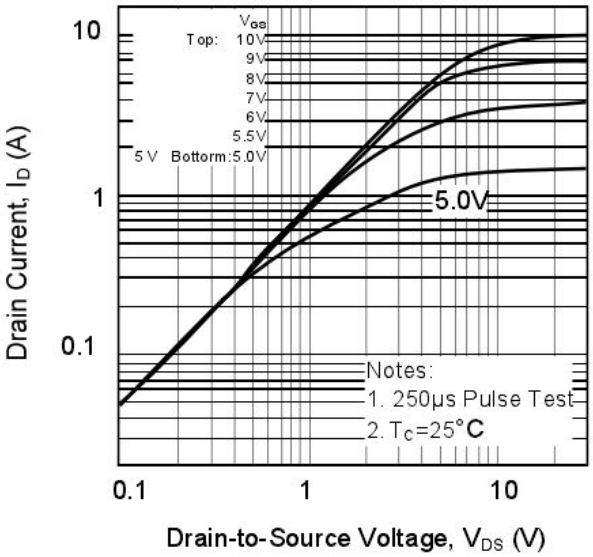


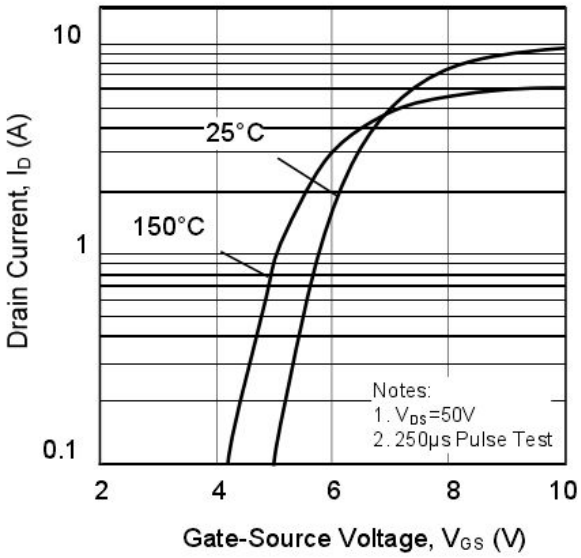
On-State Characteristics

Maximum Drain Current vs. Case Temperature

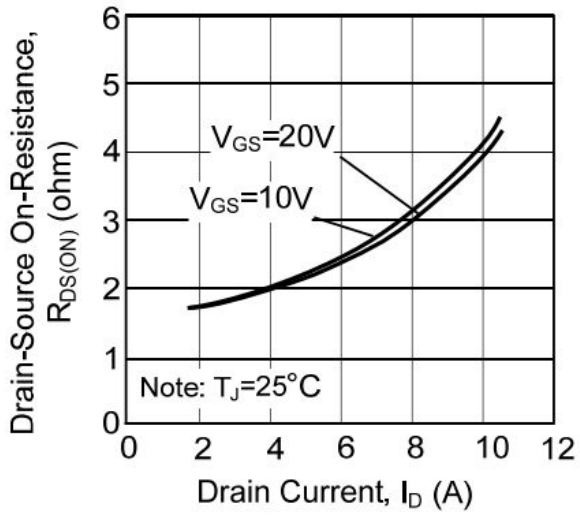


Transfer Characteristics

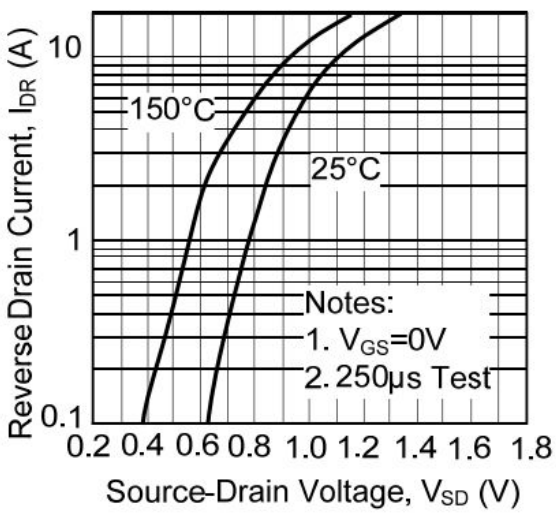




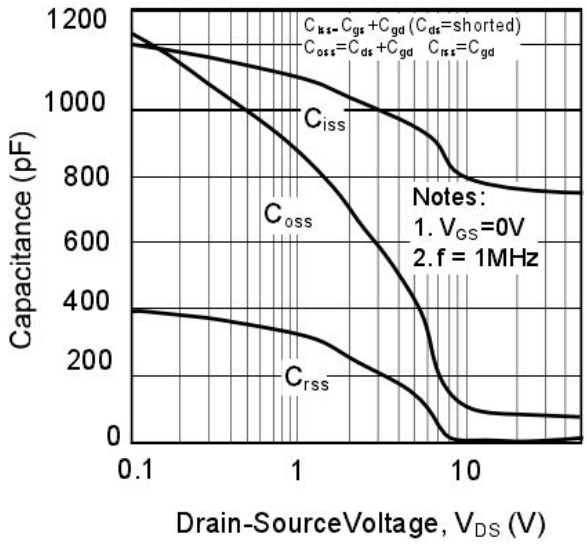
On-Resistance Variation vs. Drain Current and Gate Voltage



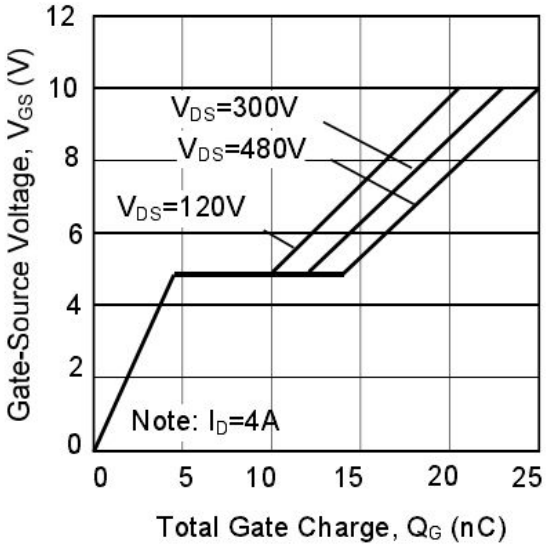
On State Current vs. Allowable Case Temperature



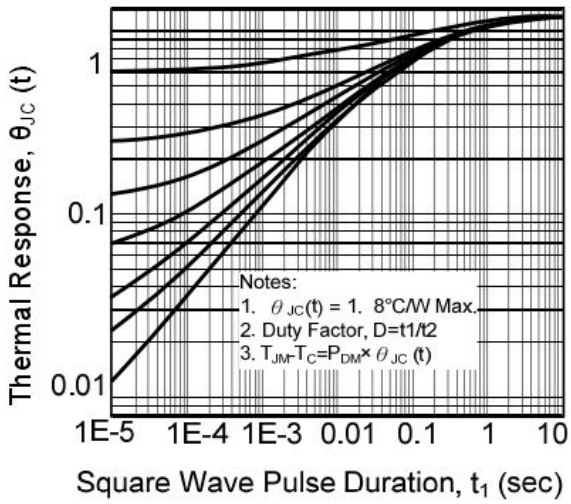
Capacitance Characteristics (Non-Repetitive)



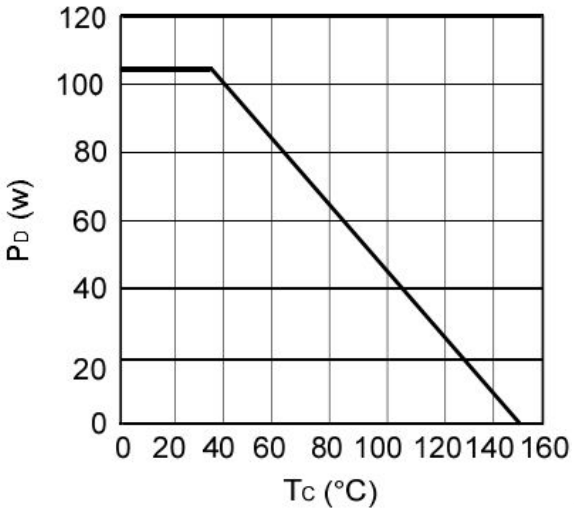
Gate Charge Characteristics



Transient Thermal Response Curve

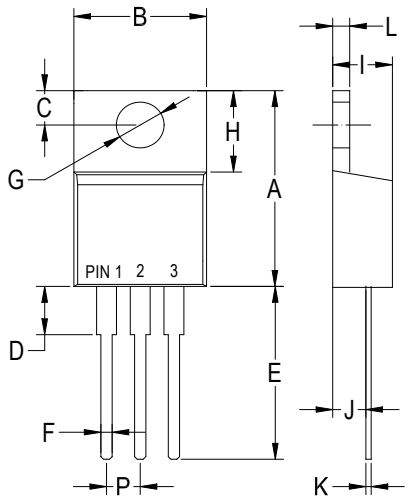


Power Dissipation



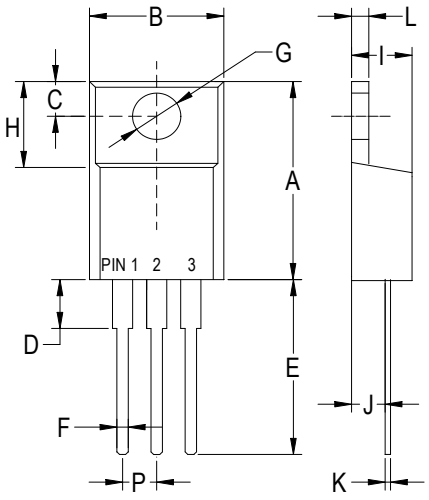
PACKAGE OUTLINE DIMENSIONS

TO-220AB



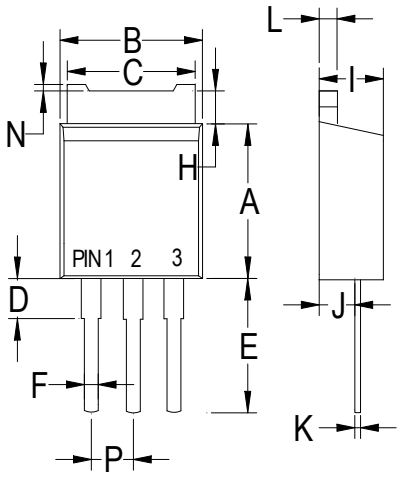
TO-220AB		
Dim	Min	Max
A	.573(14.55)	.603(15.32)
B	——	.412(10.5)
C	.103(2.62)	.113(2.87)
D	.140(3.56)	.160(4.06)
E	.510(13.0)	.560(14.3)
F	.027(0.68)	.037(0.94)
G	.148(3.74)	.154(3.91)
H	.230(5.84)	.270(6.86)
I	.175(4.44)	.185(4.86)
J	.100(2.54)	.110(2.79)
K	.014(0.35)	.025(0.64)
L	.045(1.14)	.055(1.40)
P	.095(2.41)	.105(2.67)

ITO-220AB



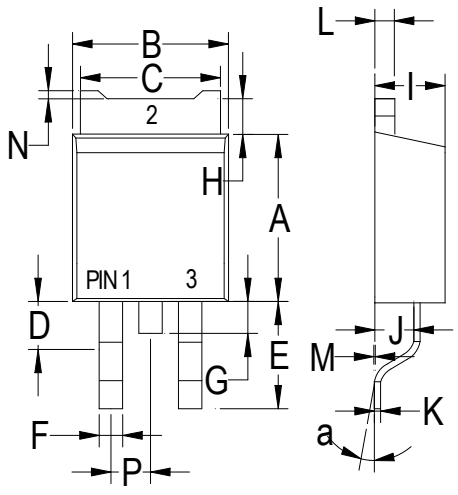
ITO-220AB		
Dim	Min	Max
A	.571(14.5)	.610(15.5)
B	.383(9.72)	.406(10.3)
C	.110(2.80)	.126(3.20)
D	.133(3.38)	.162(4.10)
E	.512(13.0)	.551(14.0)
F	.028(0.70)	.035(0.90)
G	.114(2.90)	.138(3.50)
H	.268(6.80)	.291(7.40)
I	.162(4.10)	.185(4.70)
J	.102(2.60)	.110(2.80)
K	.018(0.45)	.026(0.65)
L	.097(2.46)	.113(2.86)
P	.890(2.25)	.113(2.85)

TO-251



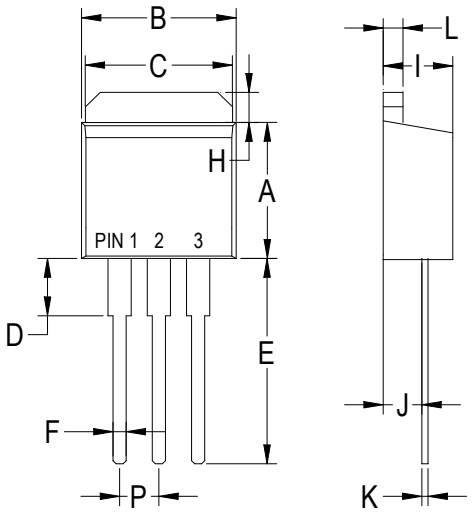
TO-251		
Dim	Min	Max
A	.230(5.85)	.246(6.25)
B	.250(6.35)	.266(6.75)
C	.207(5.27)	.218(5.54)
D	.037(0.93)	.045(1.14)
E	.173(4.40)	.205(5.20)
F	.028(0.72)	.033(0.84)
H	.028(0.70)	.043(1.10)
I	.085(2.15)	.096(2.45)
J	.037(0.95)	.047(1.20)
K	.018(0.45)	.026(0.65)
L	.018(0.45)	.024(0.60)
N	--	.008(0.20)
P	.081(2.05)	.094(2.40)

TO-252



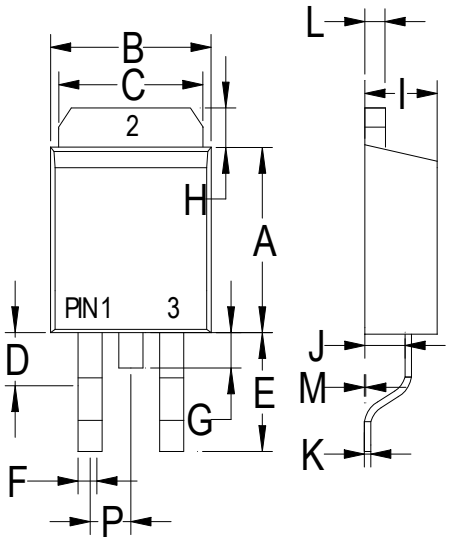
TO-252		
Dim	Min	Max
A	.230(5.85)	.246(6.25)
B	.250(6.35)	.264(6.75)
C	.207(5.27)	.218(5.54)
D	.037(0.93)	.045(1.14)
E	.106(2.70)	.138(3.50)
F	.028(0.72)	.033(0.84)
G	.024(0.60)	.041(1.05)
H	.028(0.72)	.043(1.10)
I	.085(2.15)	.096(2.45)
J	.037(0.95)	.047(1.20)
K	.018(0.45)	.026(0.65)
L	.018(0.45)	.024(0.60)
P	.081(2.05)	.094(2.40)
M	.000(0.00)	.006(0.15)
N	--	.008(0.20)
a	0°	10°

TO-262



TO-262		
Dim	Min	Max
A	.323(8.20)	.348(8.85)
B	.394(10.0)	.413(10.5)
C	.394(10.0)	.402(10.2)
D	.140(3.56)	.160(4.06)
E	.510(13.0)	.560(14.3)
F	.027(0.68)	.037(0.94)
H	.046(1.17)	.053(1.34)
I	.175(4.44)	.185(4.86)
J	.100(2.54)	.110(2.79)
K	.014(0.35)	.025(0.64)
L	.045(1.14)	.055(1.40)
P	.095(2.41)	.105(2.67)

TO-263



TO-263		
Dim	Min	Max
A	.323(8.20)	.348(8.85)
B	.394(10.0)	.413(10.5)
C	.394(10.0)	.402(10.2)
D	.077(1.95)	.100(2.55)
E	.204(5.17)	.227(5.77)
F	.027(0.68)	.037(0.94)
G	--	.067(1.70)
H	.046(1.17)	.053(1.34)
I	.175(4.44)	.191(4.86)
J	.100(2.54)	.110(2.79)
K	.014(0.35)	.025(0.64)
L	.047(1.20)	.055(1.40)
M	.000(0.00)	.010(0.25)
P	.095(2.41)	.105(2.67)

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