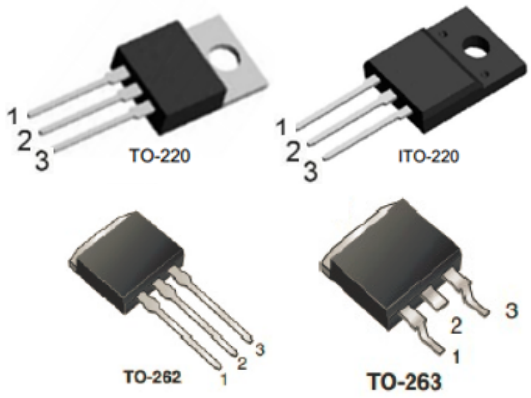
12N60 Series

N-CHANNEL POWER MOSFET

Features

- $R_{DS(ON)}$<0.80Ω @ V_{GS}=10V
- Fast switching capability
- Low gate charge
- Lead free in compliance with EU RoHS directive.
- Green molding compound



Pin Definition:

1. Gate
2. Drain
3. Source

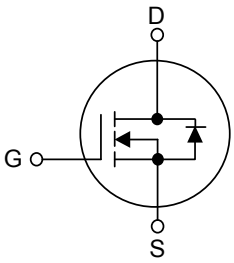
Mechanical Data

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

Ordering Information

Part No.	Package	Packing
12N60T	TO-220	50pcs / Tube
12N60F	ITO-220	50pcs / Tube
12N60K	TO-262	50pcs / Tube
12N60G	TO-263	50pcs / Tube

Block Diagram



Maximum Ratings T_A = 25°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	12	A
Pulsed Drain Current (Note 2)		I_{DM}	48	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	790	mJ
Power Dissipation	TO-220/TO-262/TO-263	P_D	225	W
	ITO-220		51	W
Junction Temperature		T_J	+150	°C
Operating Temperature		T_{OPR}	-55 ~ +150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°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 T_J
3. L = 30mH, I_{AS} = 7.1A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C

THERMAL DATA

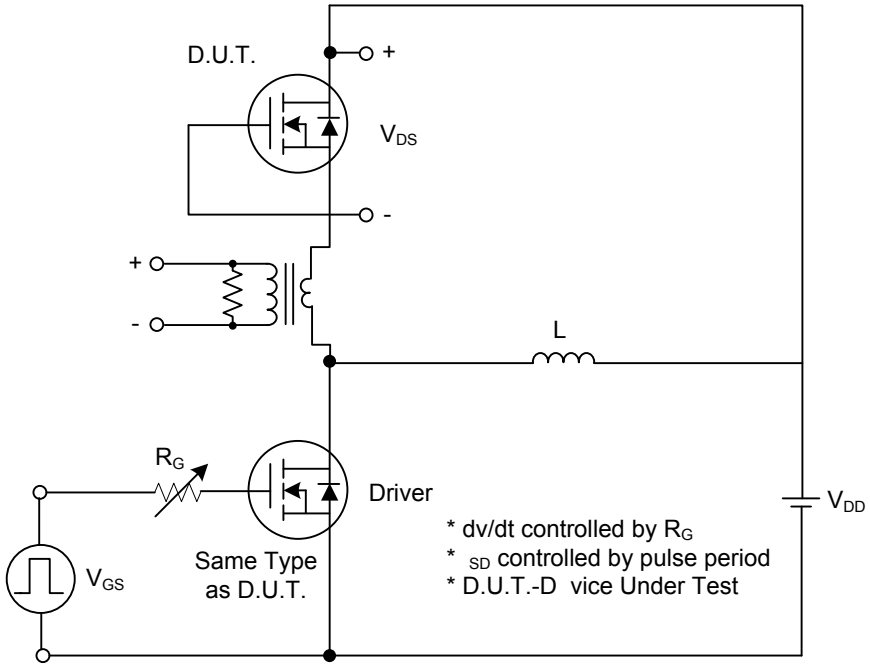
PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/ITO-220 TO-262/TO-263	θ_{JA}	62.5	°C/W
Junction to Case	TO-220/TO-262/TO-263	θ_{JC}	0.56	°C/W
	ITO-220		2.6	

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

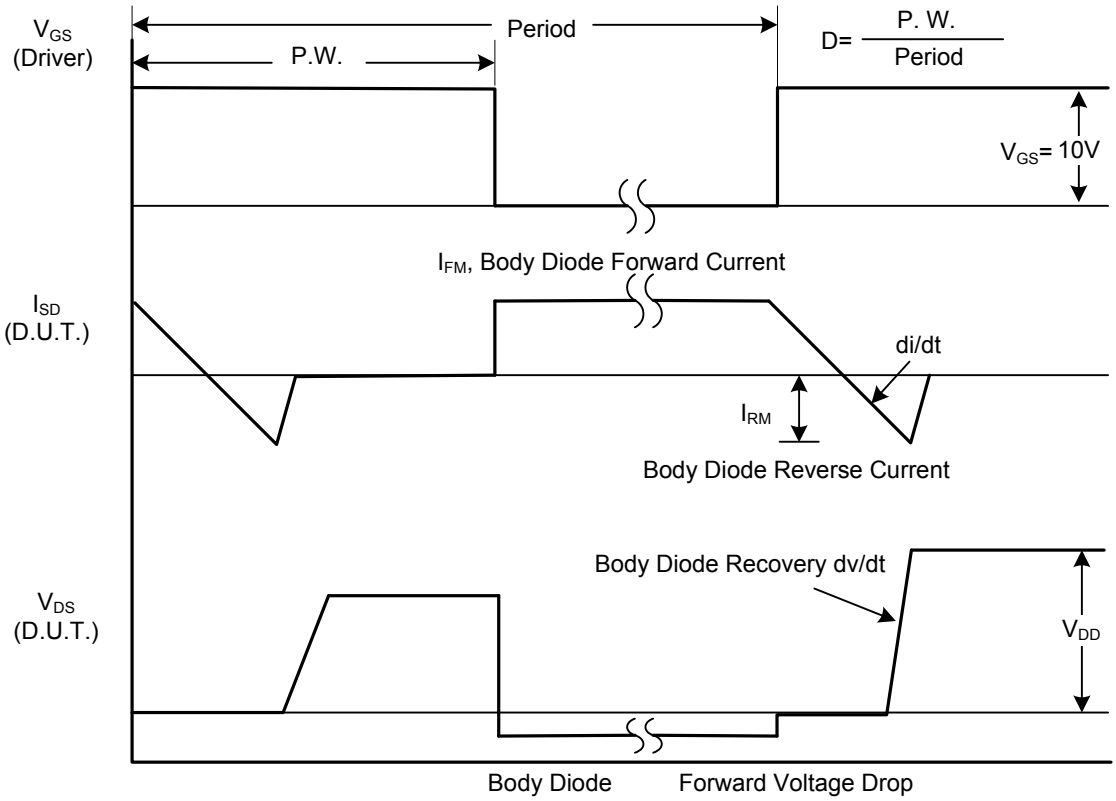
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250μA	600			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=600V, V_{GS}=0V			1	μA
Gate- Source Leakage Current	Forward	I_{GSS}	V_G=30V, V_{DS}=0V			100	nA
	Reverse		V_{GS}=-30V, 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=6A		0.60	0.80	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS}=25V, V_{GS}=0V, f=1.0 MHz		1480		pF
Output Capacitance		C_{OSS}			200		pF
Reverse Transfer Capacitance		C_{RSS}			25		pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		$t_{D(ON)}$	V_{DD} =300V, I_D =12A, R_G =25Ω (Note 1, 2)		30		ns
Turn-On Rise Time		t_R			115		ns
Turn-Off Delay Time		$t_{D(OFF)}$			95		ns
Turn-Off Fall Time		t_F			85		ns
Total Gate Charge		Q_G	V_{DS}=480V, I_D=12A, V_{GS}=10V (Note 1, 2)		42		nC
Gate-Source Charge		Q_{GS}			8.6		nC
Gate-Drain Charge		Q_{GD}			21		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS} = 0 V, I_S = 12A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current		I_S				12	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				48	A
Reverse Recovery Time		t_{rr}	V_{GS}=0V, I_S=12A, dI_F/dt =100 A/μs (Note 1)		570		ns
Reverse Recovery Charge		Q_{RR}			5.5		μC

Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

TEST CIRCUITS AND WAVEFORMS

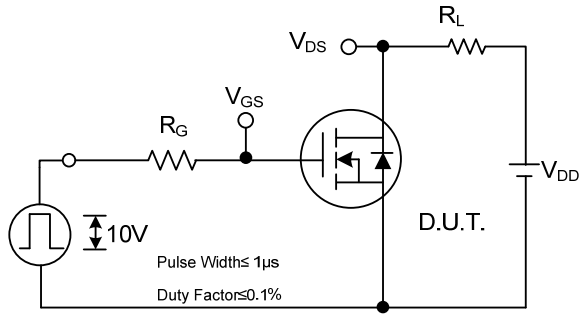


Peak Diode Recovery dv/dt Test Circuit

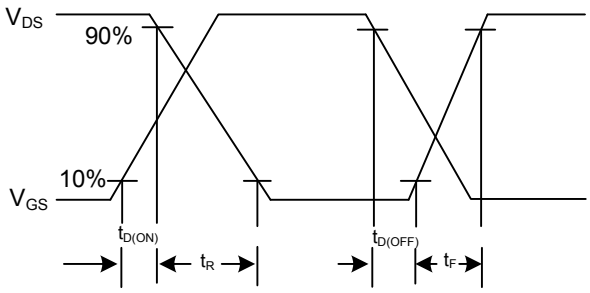


Peak Diode Recovery dv/dt Waveforms

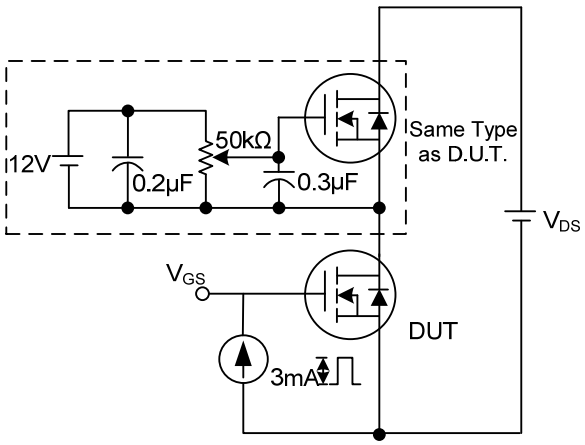
TEST CIRCUITS AND WAVEFORMS(Cont.)



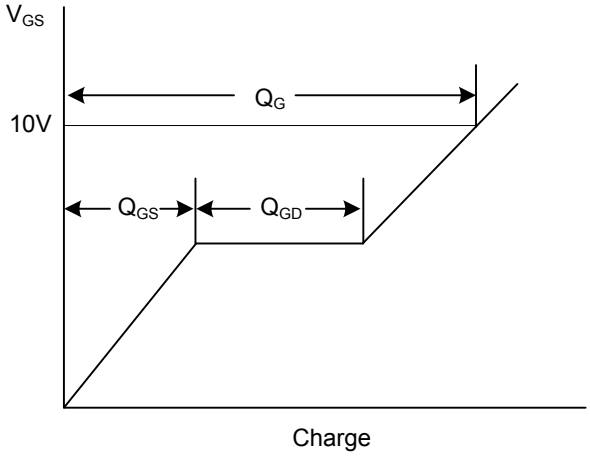
Switching Test Circuit



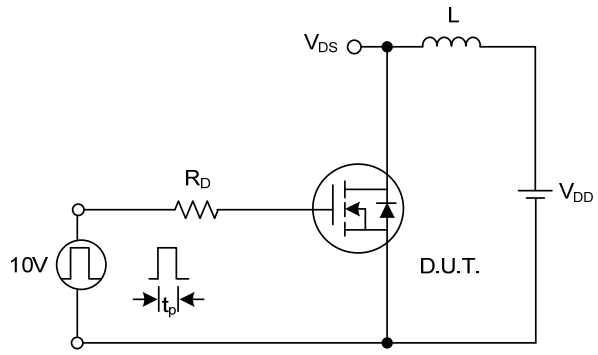
Switching Waveforms



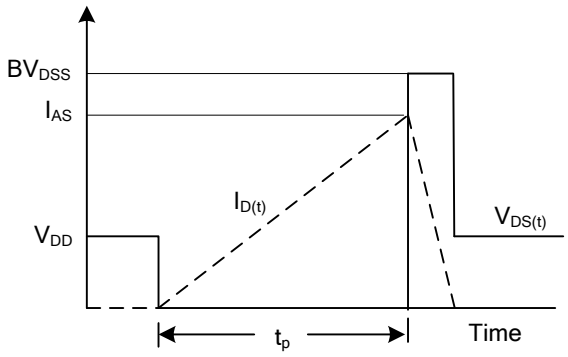
Gate Charge Test Circuit



Gate Charge Waveform



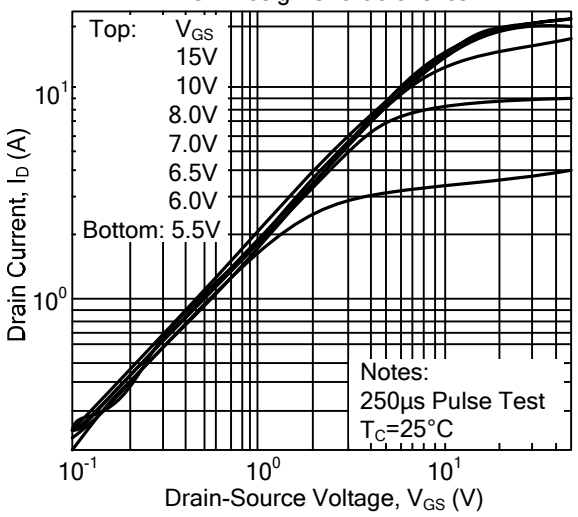
Unclamped Inductive Switching Test Circuit



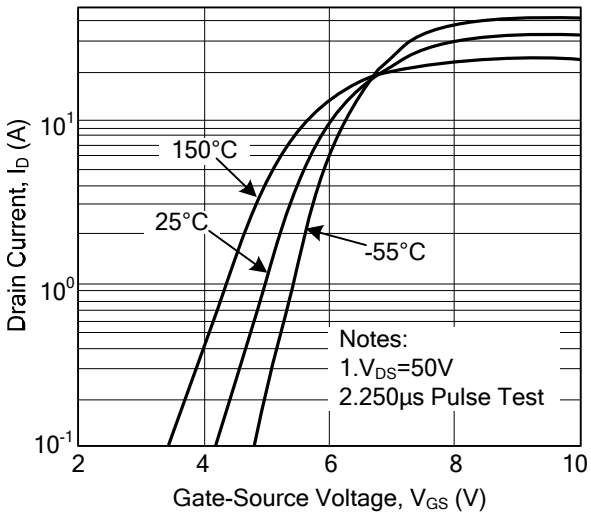
Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

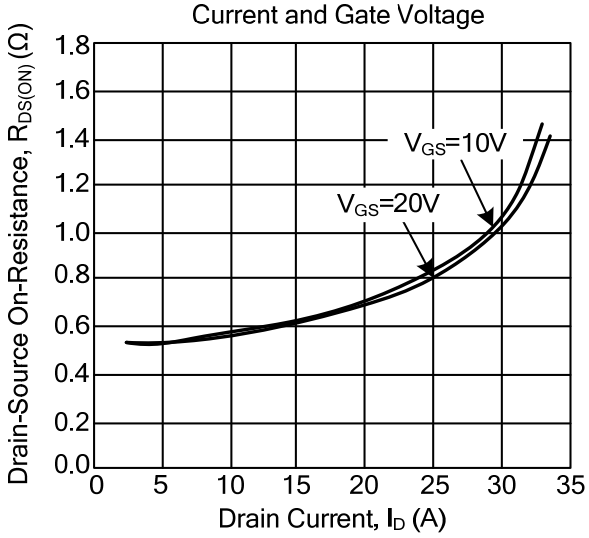
On-Resign Characteristics



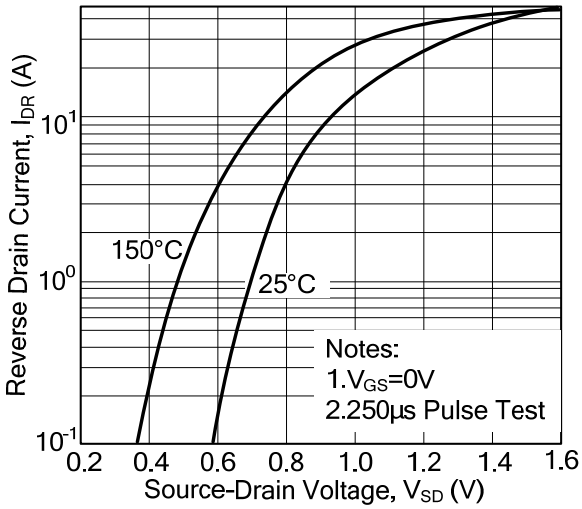
Transfer Characteristics



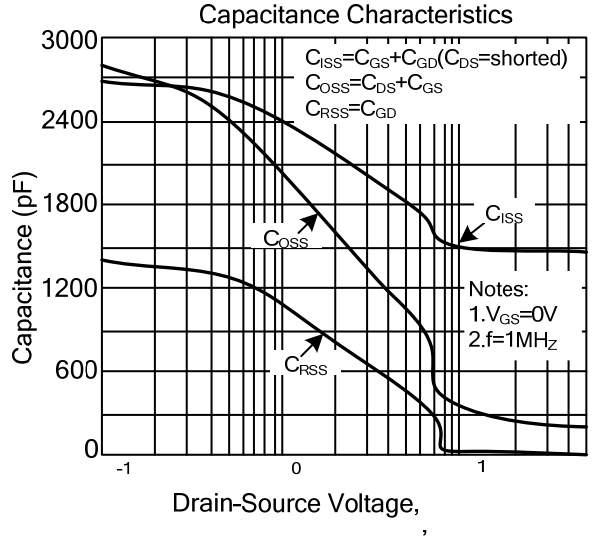
On-Resistance Variation vs.Drain Current and Gate Voltage



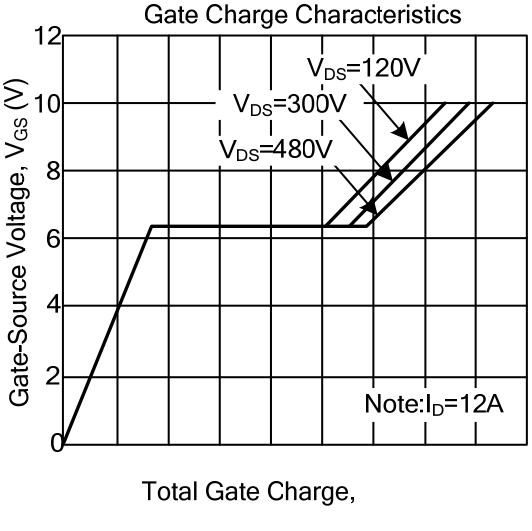
Body Diode Forward Voltage Variation vs. Source Current and Temperature



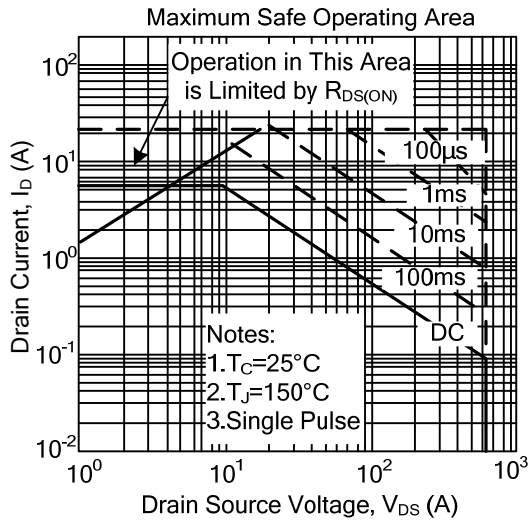
Capacitance Characteristics

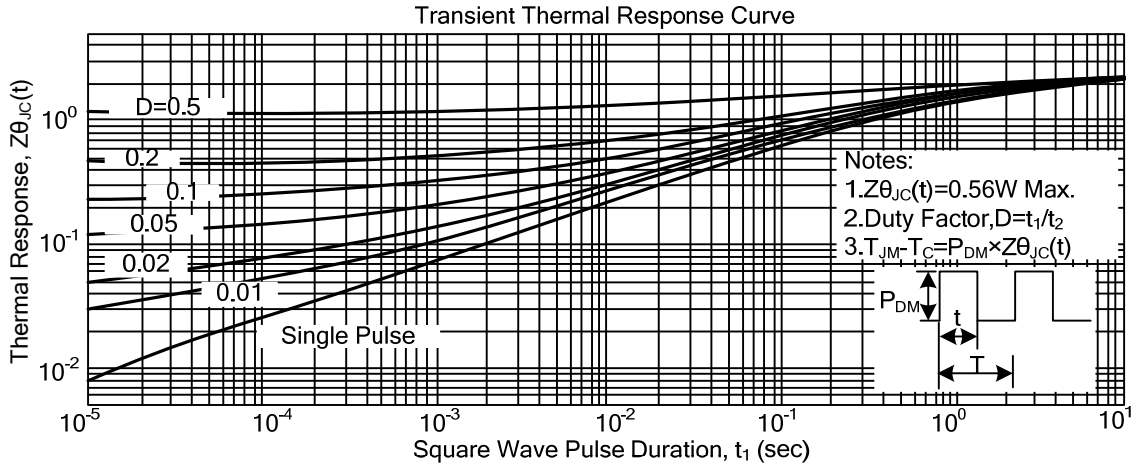


Gate Charge Characteristics

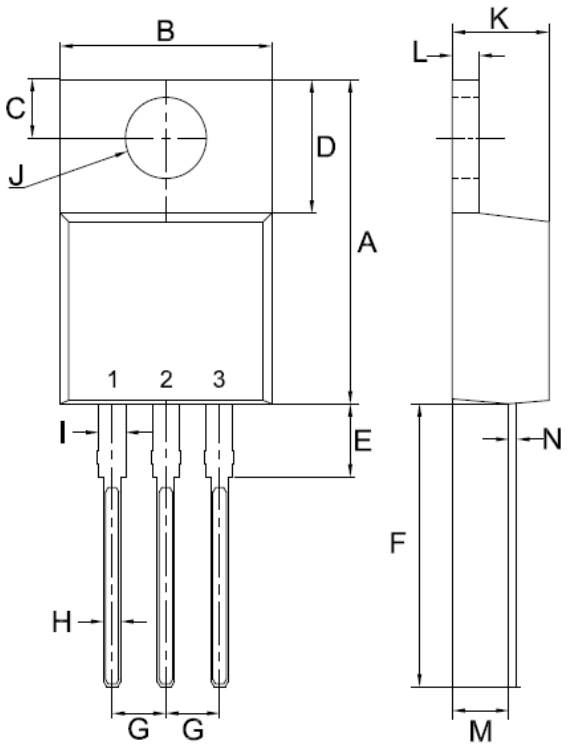


TYPICAL CHARACTERISTICS



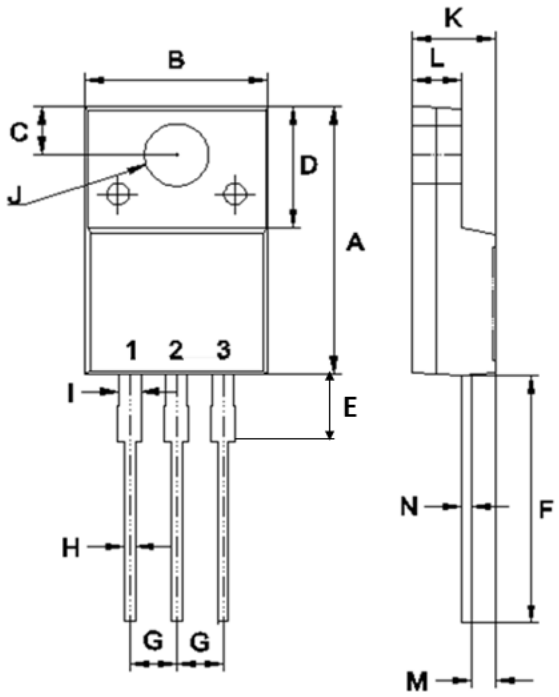


TO-220 Mechanical Drawing



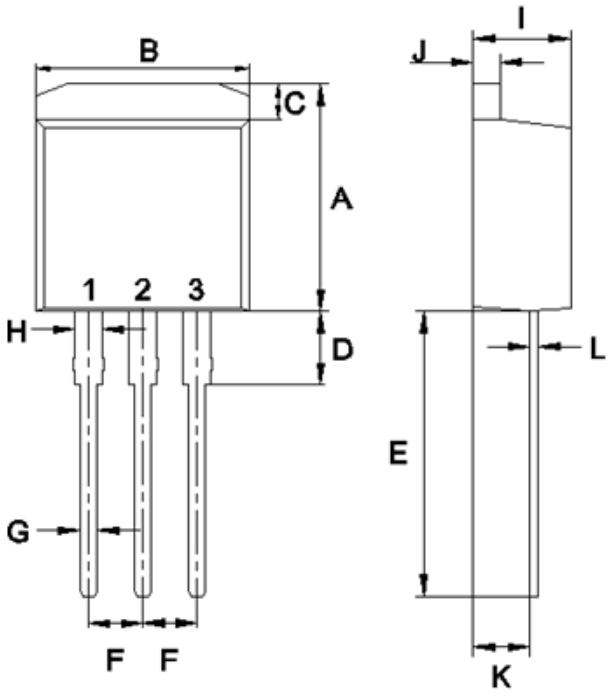
TO-220AB Unit:mm		
DIM	MIN	MAX
A	14.80	15.80
B	9.57	10.57
C	2.54	2.94
D	5.80	6.80
E	2.95	3.95
F	12.70	13.40
G	2.34	2.74
H	0.51	1.11
I	0.97	1.57
J	3.54ϕ	4.14ϕ
K	4.27	4.87
L	1.07	1.47
M	2.03	2.92
N	0.30	0.64

ITO-220 Mechanical Drawing



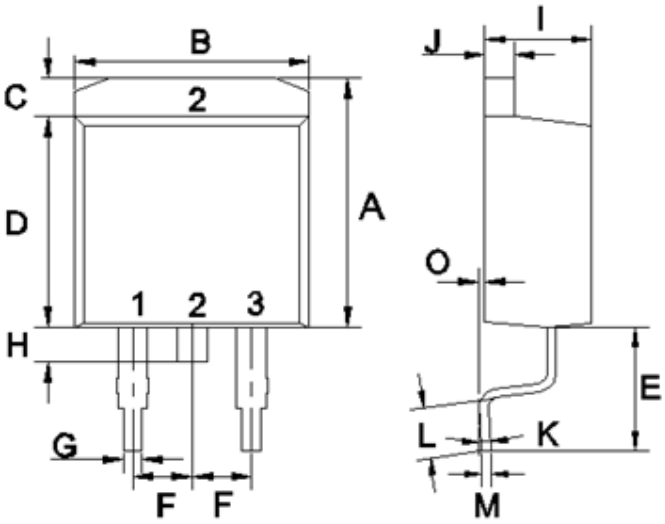
ITO-220AB Unit:mm		
DIM	MIN	MAX
A	14.50	15.50
B	9.50	10.50
C	2.50	2.90
D	6.30	7.30
E	3.30	4.30
F	13.00	14.00
G	2.35	2.75
H	0.30	0.90
I	0.90	1.50
J	3.20	3.80
K	4.24	4.84
L	2.52	2.92
M	1.09	1.49
N	0.47	0.64

TO-262 Mechanical Drawing



TO-262(I²PAK) 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 (D² 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