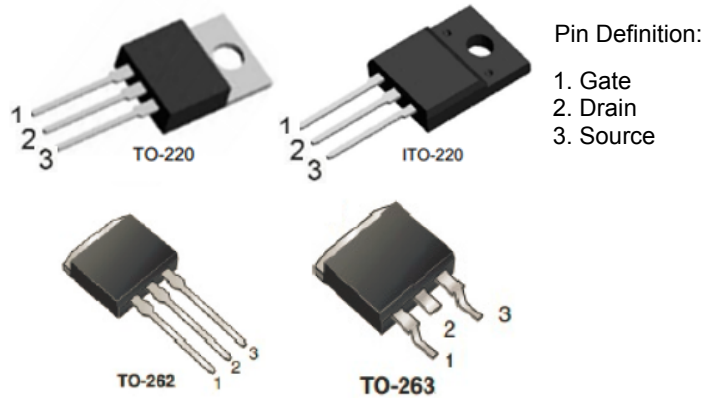


Features

- $R_{DS(ON)} < 0.9\Omega$ @ $V_{GS} = 10V$
- Fast switching capability
- Low gate charge
- Lead free in compliance with EU RoHS directive.
- Green molding compound

Mechanical Data

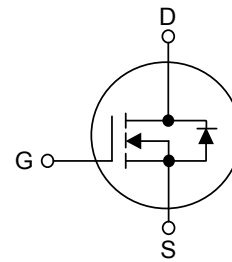
- Case: TO-220, ITO-220, TO-262, TO-263 Package



Ordering Information

Part No.	Package	Packing
10N60T	TO-220	50pcs / Tube
10N60F	ITO-220	50pcs / Tube
10N60K	TO-262	50pcs / Tube
10N60G	TO-263	50pcs / Tube

Block Diagram



Maximum Ratings $T_A = 25^\circ C$ 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	10	A
Pulsed Drain Current (Note 2)		I_{DM}	38	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	700	mJ
Power Dissipation	TO-220/TO-262/TO-263	P_D	156	W
	ITO-220		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 T_J

3. $L = 30mH$, $I_{AS} = 6.4A$, $V_{DD} = 50V$, $R_G = 25\Omega$, Starting $T_J = 25^\circ C$



THERMAL DATA

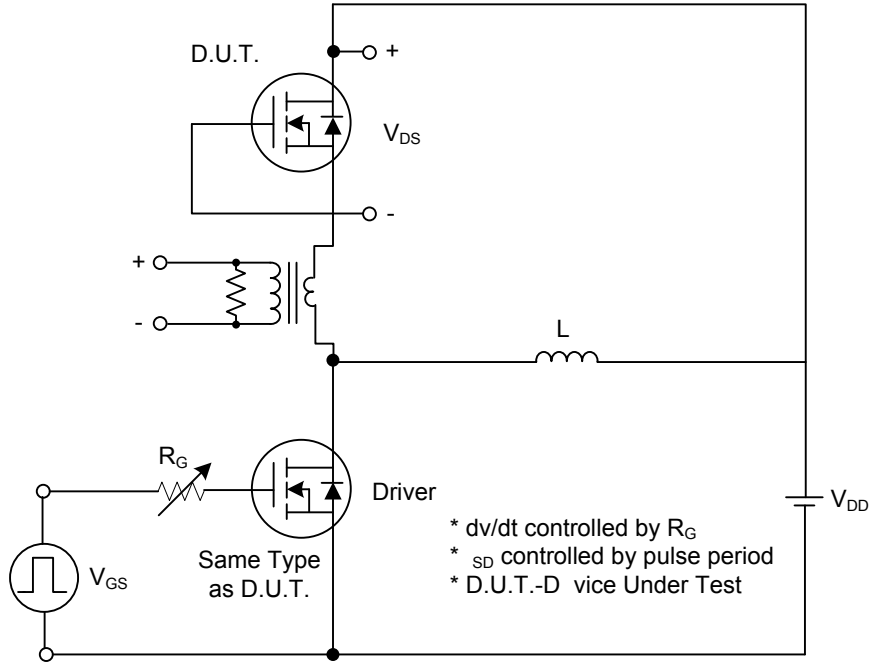
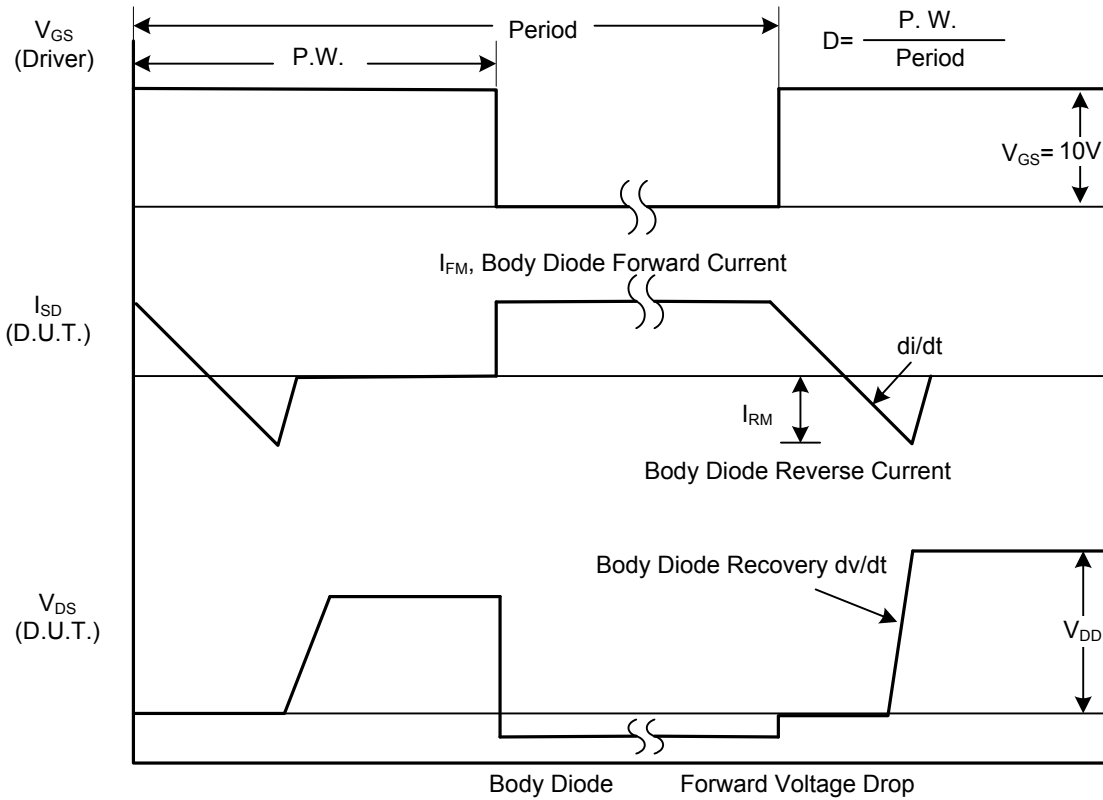
PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/ITO-220 TO-262/TO-263	θ_{JA}	62.5	$^{\circ}\text{C/W}$
Junction to Case	TO-220	θ_{JC}	0.85	$^{\circ}\text{C/W}$
	ITO-220		2.6	

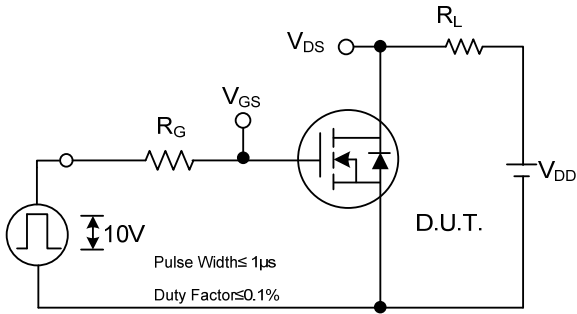
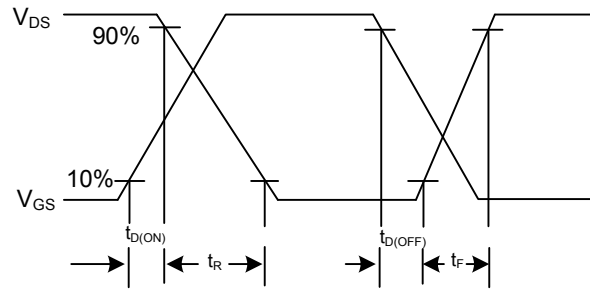
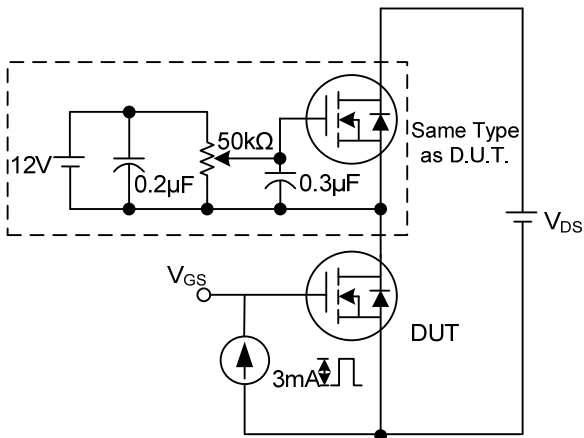
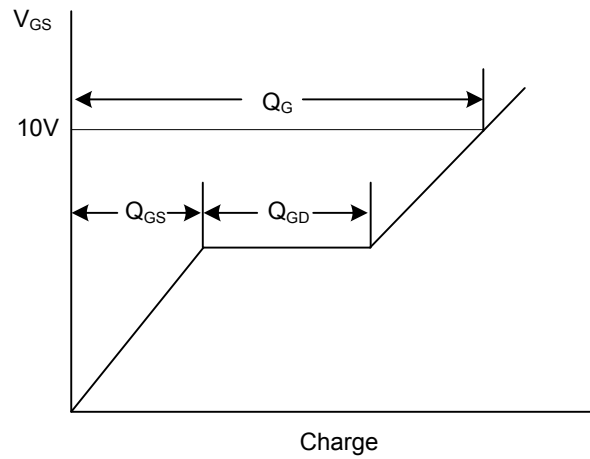
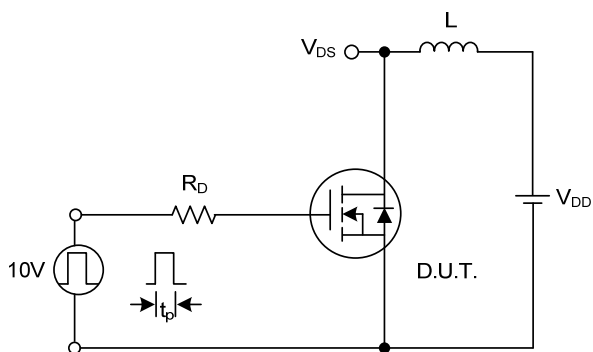
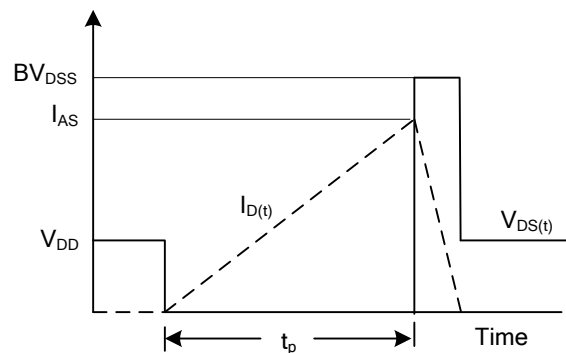
ELECTRICAL CHARACTERISTICS ($T_C=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
OFF CHARACTERISTICS								
Drain-Source Breakdown Voltage		BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	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		$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0		4.0	V	
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS}=10V, I_D=5A$		0.76	0.9	Ω	
DYNAMIC CHARACTERISTICS								
Input Capacitance		C_{ISS}	$V_{DS}=25V, V_{GS}=0V, f=1.0\text{ MHz}$		1570		pF	
Output Capacitance		C_{OSS}				166		pF
Reverse Transfer Capacitance		C_{RSS}				18		pF
SWITCHING CHARACTERISTICS								
Turn-On Delay Time		$t_{D(ON)}$	$V_{DD}=300V, I_D=10A, R_G=25\Omega$ (Note 1, 2)		23		ns	
Turn-On Rise Time		t_R				69		ns
Turn-Off Delay Time		$t_{D(OFF)}$				144		ns
Turn-Off Fall Time		t_F				77		ns
Total Gate Charge		Q_G	$V_{DS}=480V, I_D=10A, V_{GS}=10V$ (Note 1, 2)		44		nC	
Gate-Source Charge		Q_{GS}				6.7		nC
Gate-Drain Charge		Q_{GD}				18.5		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS								
Drain-Source Diode Forward Voltage		V_{SD}	$V_{GS}=0V, I_S=10A$			1.4	V	
Maximum Continuous Drain-Source Diode Forward Current		I_S				10	A	
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				40	A	
Reverse Recovery Time		t_{rr}	$V_{GS}=0V, I_S=10A,$		450		ns	
Reverse Recovery Charge		Q_{RR}	$di_F/dt=100\text{ A}/\mu s$ (Note 1)		4.2		μC	

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

2. Essentially independent of operating temperature.

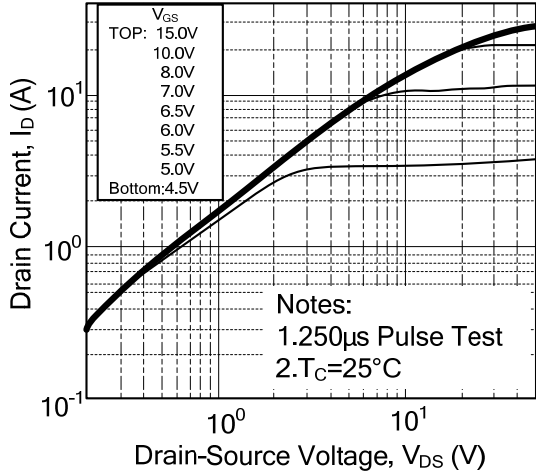
TEST CIRCUITS AND WAVEFORMS

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

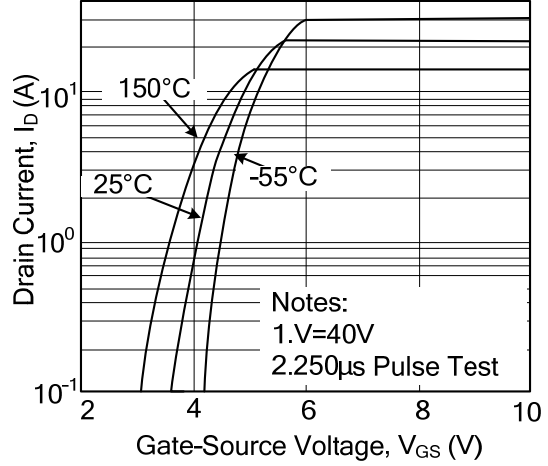


TYPICAL CHARACTERISTICS

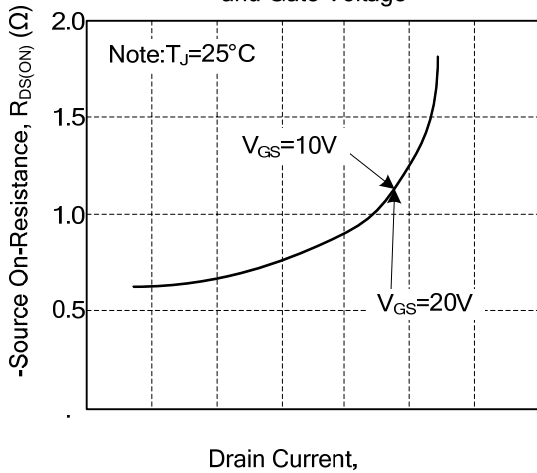
On-Region Characteristics



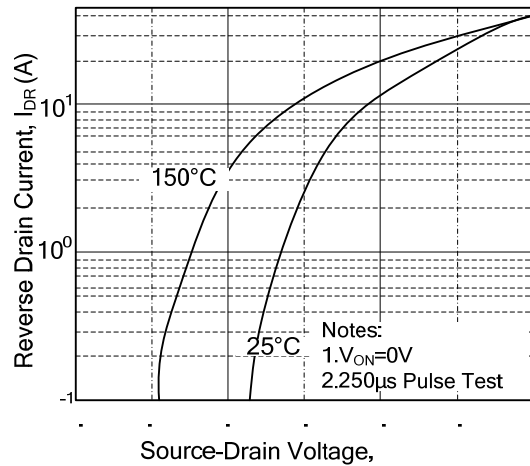
Transfer Characteristics



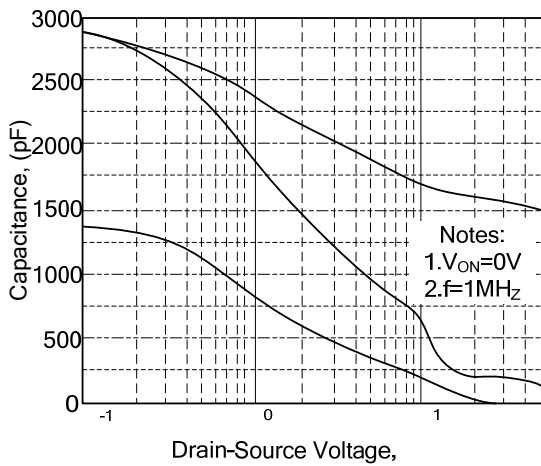
On-Resistance Variation vs. Drain Current and Gate Voltage



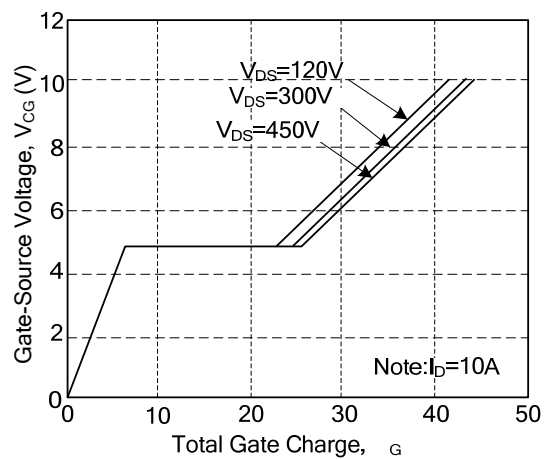
Body Diode Forward Voltage Variation with Source Current and Temperature



Capacitance Characteristics

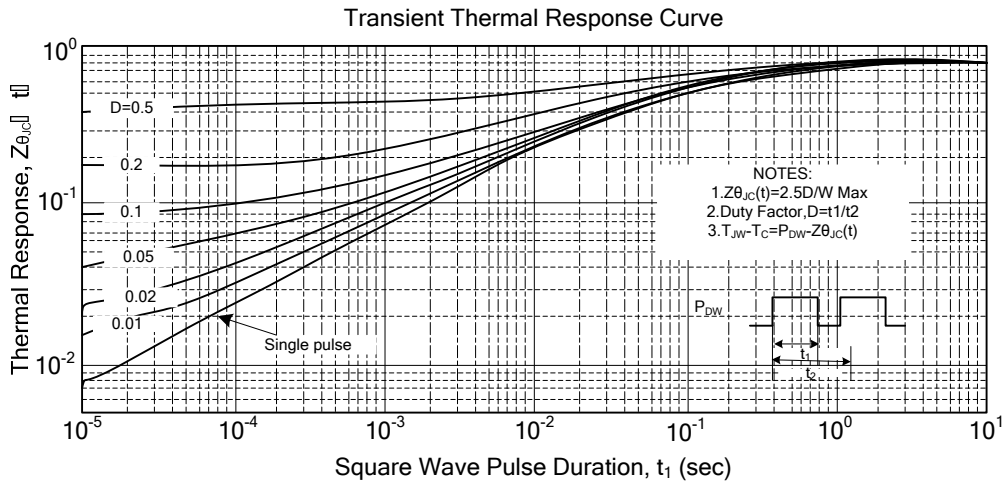
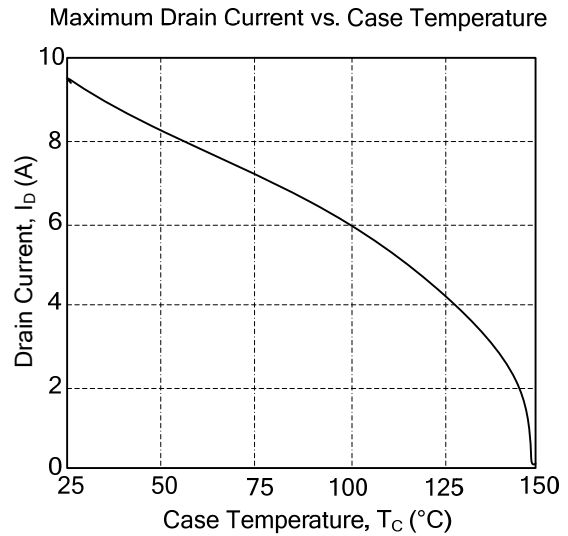
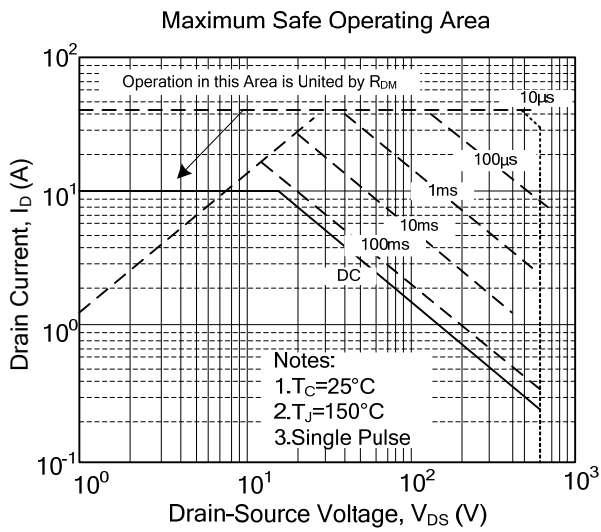
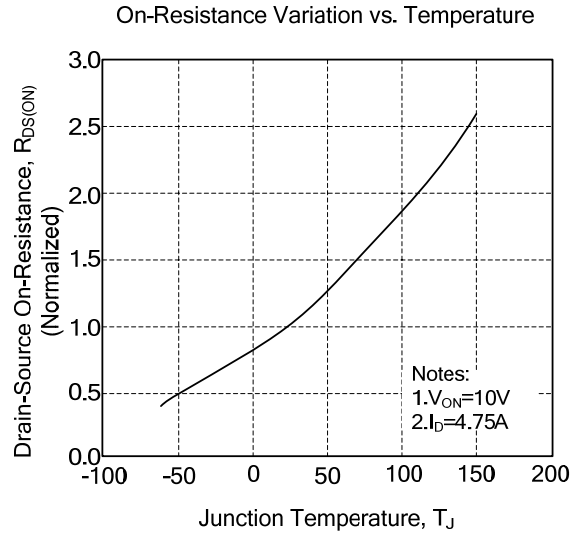
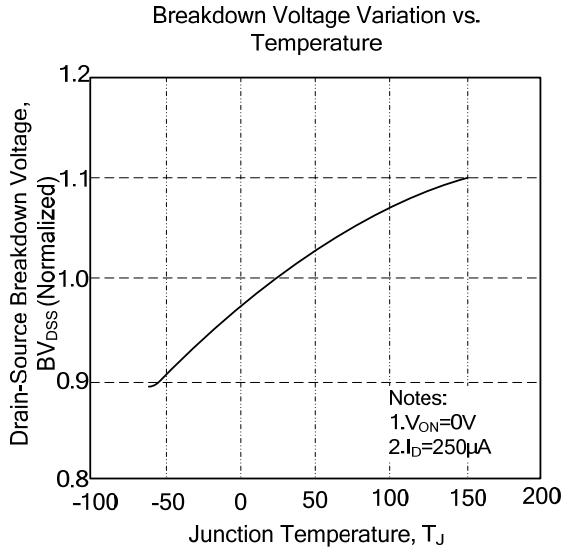


Gate Charge Characteristics

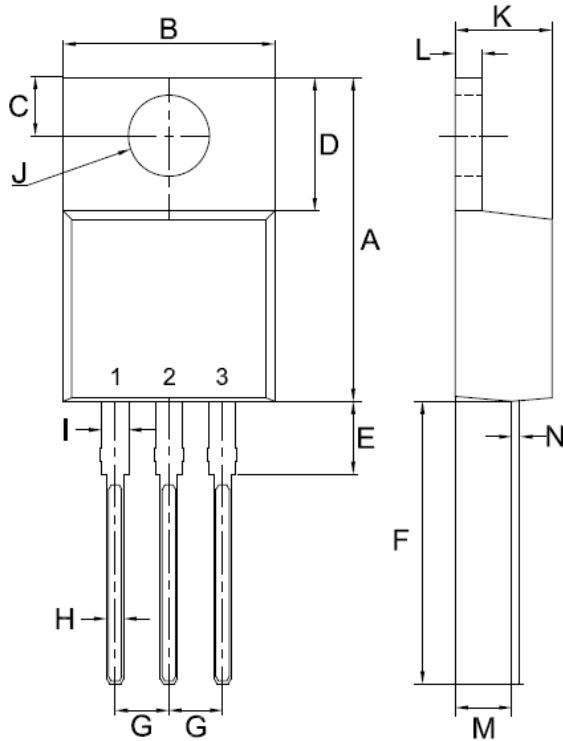




TYPICAL CHARACTERISTICS

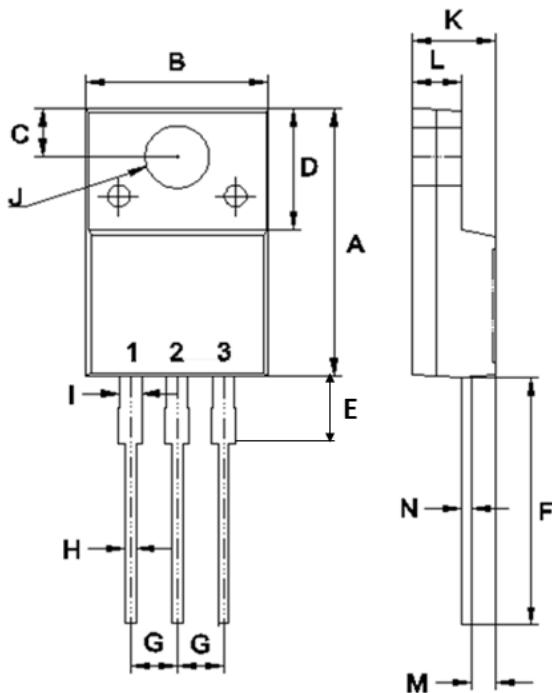


TO-220 Mechanical Drawing



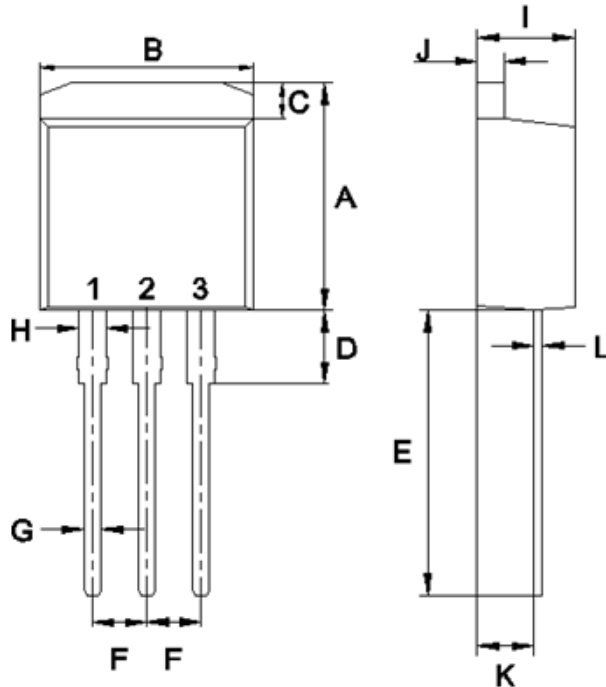
TO-220AB		
Unit:mm		
DIM	MIN	MAX
A	14.80	15.80
B	9.57	10.57
C	2.54	2.94
D	5.80	6.80
E	2.95	3.95
F	12.70	13.40
G	2.34	2.74
H	0.51	1.11
I	0.97	1.57
J	3.54 ϕ	4.14 ϕ
K	4.27	4.87
L	1.07	1.47
M	2.03	2.92
N	0.30	0.64

ITO-220 Mechanical Drawing



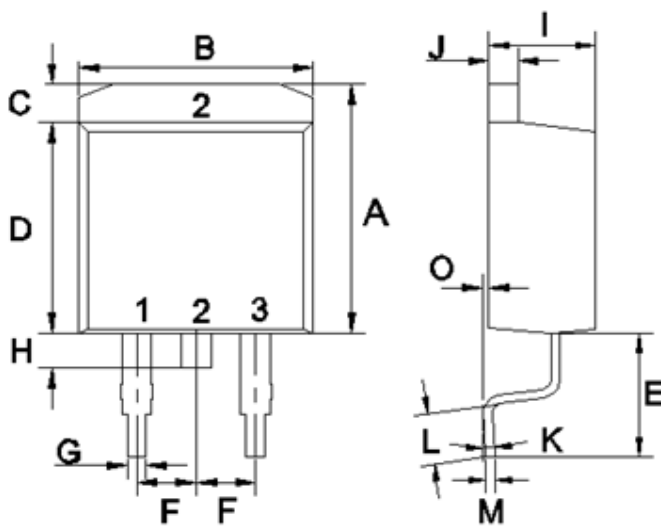
ITO-220AB Unit:mm		
DIM	MIN	MAX
A	14.50	15.50
B	9.50	10.50
C	2.50	2.90
D	6.30	7.30
E	3.30	4.30
F	13.00	14.00
G	2.35	2.75
H	0.30	0.90
I	0.90	1.50
J	3.20	3.80
K	4.24	4.84
L	2.52	2.92
M	1.09	1.49
N	0.47	0.64

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