SEMICONDUCTOR

4N65
650V N-Channel Power MOSFET

FEATURES

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

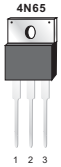
MECHANICAL DATA

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

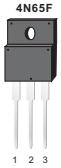
PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$(Ω)	I_D (A)
650	2.4 @ V_{GS}=10V	4

TO-220 4N65

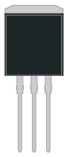


ITO-220 4N65F



TO-263 4N65D

TO-262 4N65E



TO-251 4N65N

TO-252 4N65M

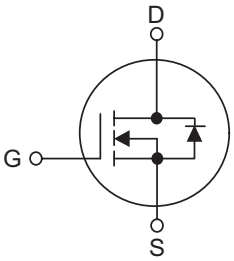
Ordering Information

Part No.	Package	Packing
4N65-TU	TO-220	50pcs / Tube
4N65F-TU	ITO-220	50pcs / Tube
4N65E-TU	TO-262	50pcs / Tube
4N65D-TU	TO-263	50pcs / Tube
4N65D-TR	TO-263	800pcs / 13"Reel
4N65N-TU	TO-251	75pcs / Tube
4N65M-TU	TO-252	75pcs / Tube
4N65M-TR	TO-252	2.5Kpcs / 13"Reel

Pin Definition:

1. Gate
2. Drain
3. Source

Block Diagram



ABSOLUTE MAXIMUM RATINGS (T_C=25 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(Note 3)		E_{AS}	260	mJ
Power Dissipation	TO-220/TO-263/TO-262	P_D	106	W
	ITO-220		35	
	TO-251/TO-252		50	
Junction Temperature		T_J	+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 maximum junction temperature

3. L=30mH, I_{AS}=4.16A,V_{DD}=50V,R_G=25Ω,Starting T_J=25 °C

4N65
650V N-Channel Power MOSFET

THERMAL DATA

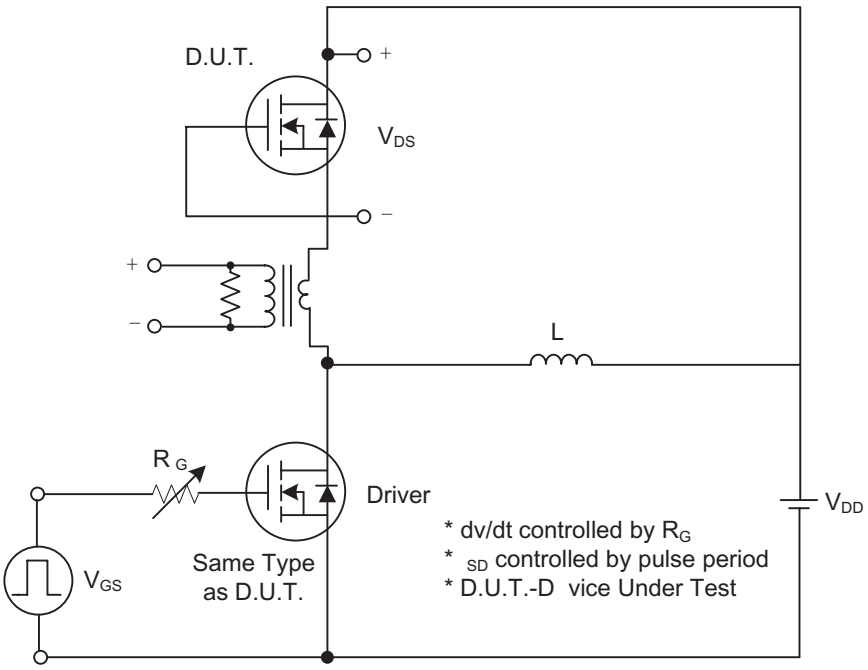
PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/ITO-220 TO-262/TO-263	$R_{\theta JA}$	62.5	°C/W
	TO-251/TO-252		110	
Junction to Case	TO-220/TO-263/TO-262	$R_{\theta JC}$	2.35	°C/W
	ITO-220		5.5	
	TO-251/TO-252		2.9	

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

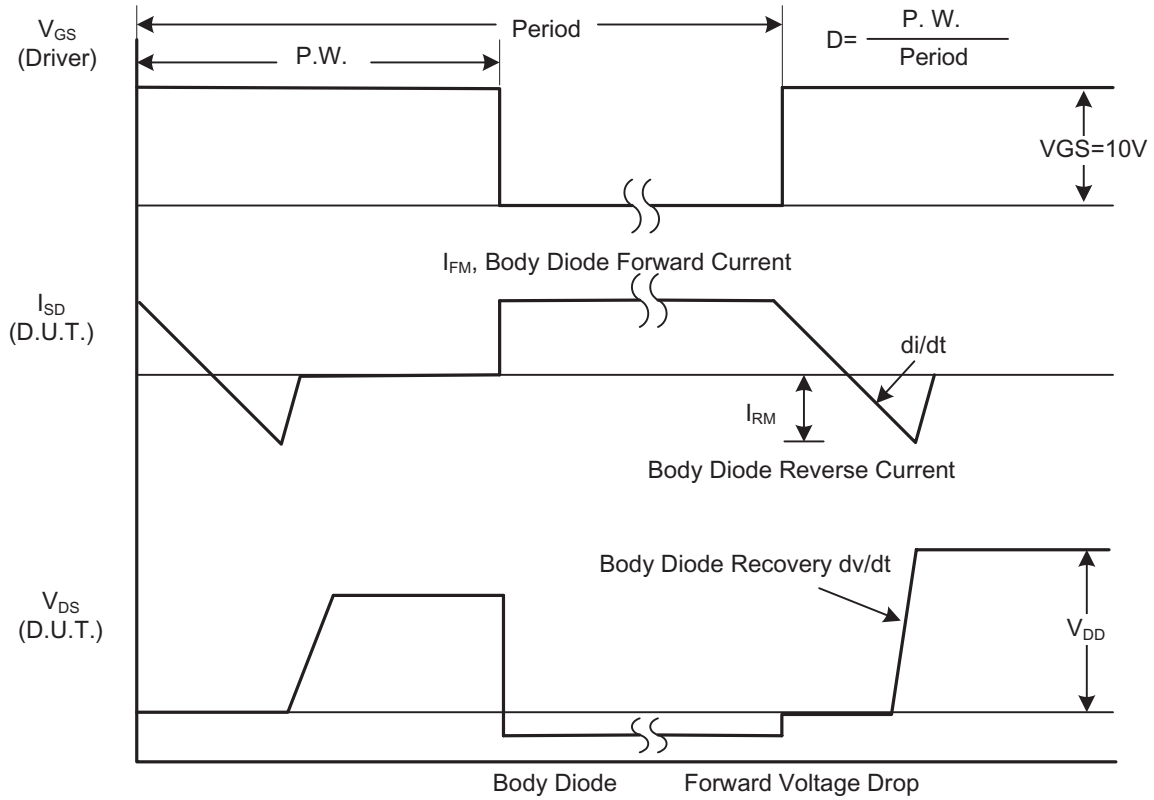
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V,I_D=250μA	650			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=650V,V_{GS}=0V			1	μA
Gate- Source Leakage Current	Forward	I_{GSS}	V_G=30V,V_{DS}=0V			100	nA
	Reverse		V_{GS}=-30V,V_{DS}=0V			-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=2.0A		2.0	2.4	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS}=25V,V_{GS}=0V,f=1MHz		700		pF
Output Capacitance		C_{OSS}			54		pF
Reverse Transfer Capacitance		C_{RSS}			3		pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		$t_{D(ON)}$	V_{DD}=325V,I_D=4.0A, R_G=25Ω(Note1, 2)		15		ns
Turn-On Rise Time		t_R			47		ns
Turn-Off Delay Time		$t_{D(OFF)}$			27		ns
Turn-Off Fall Time		t_F			38		ns
Total Gate Charge		Q_G	V_{DS}=520V,I_D=4.0A, V_{GS}=10V(Note1, 2)		15		nC
Gate-Source Charge		Q_{GS}			3.9		nC
Gate-Drain Charge		Q_{GD}			5.8		nC
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
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				4.0	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				16	A
Reverse Recovery Time		t_{rr}	V_{GS}=0V, I_S=4A dI$_F$/dt=100A/μs (Note 1)		260		ns
Reverse Recovery Charge		Q_{RR}			2.5		μC

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

TEST CIRCUITS AND WAVEFORMS

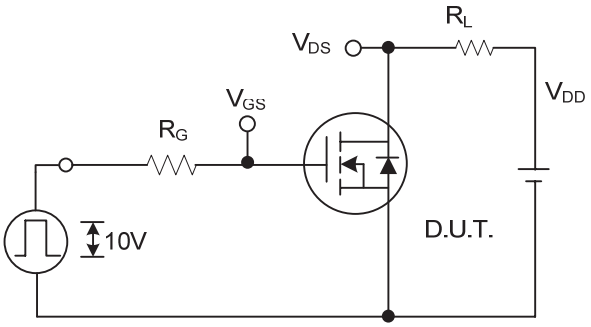


Peak Diode Recovery dv/dt Test Circuit

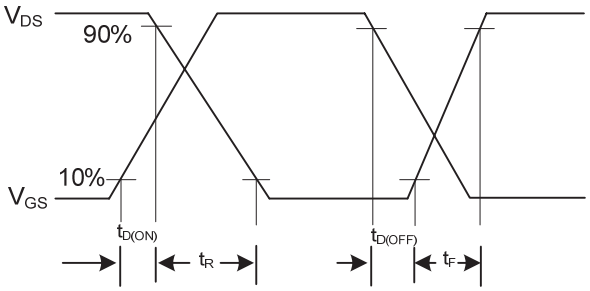


Peak Diode Recovery dv/dt Waveforms

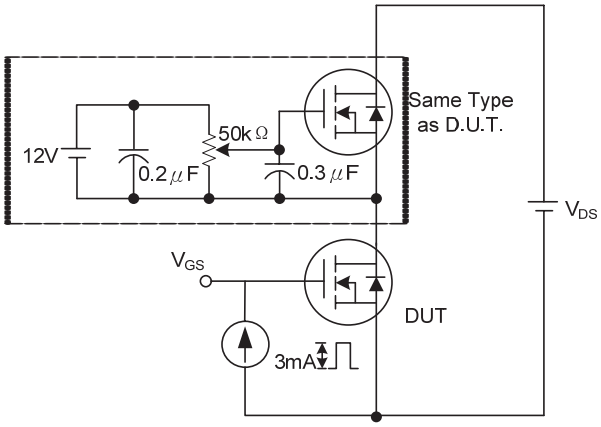
TEST CIRCUITS AND WAVEFORMS(Cont.)



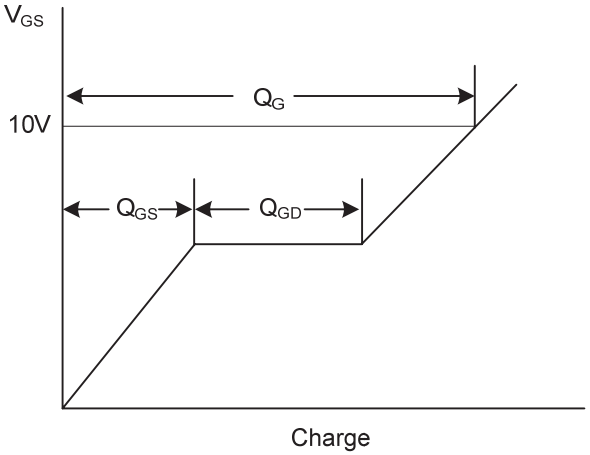
Switching Test Circuit



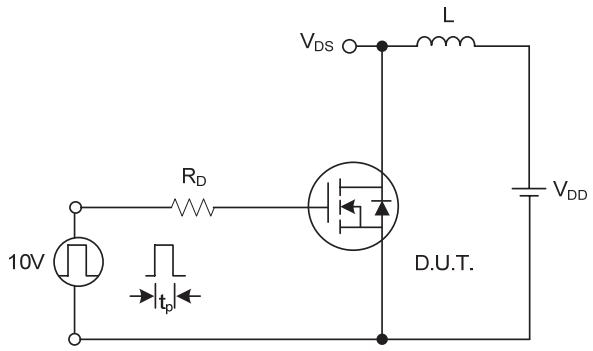
Switching Waveforms



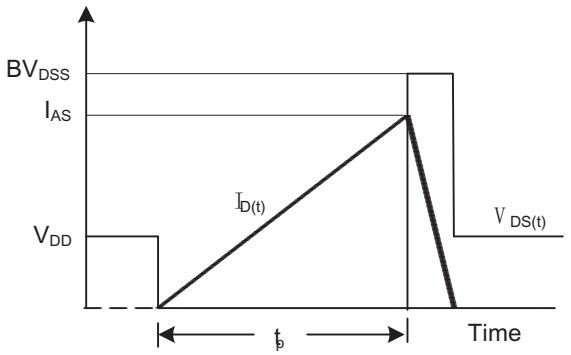
Gate Charge Test Circuit



Gate Charge Waveform



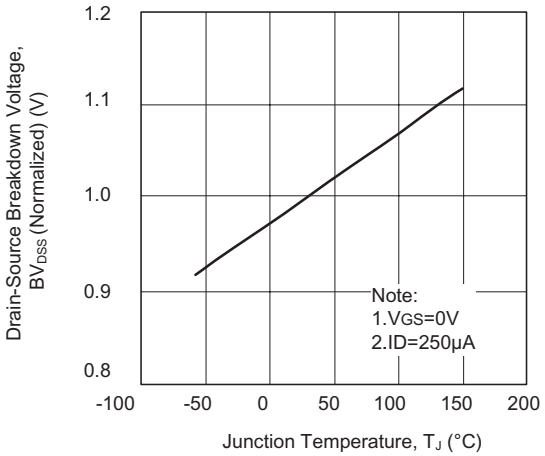
Unclamped Inductive Switching Test Circuit



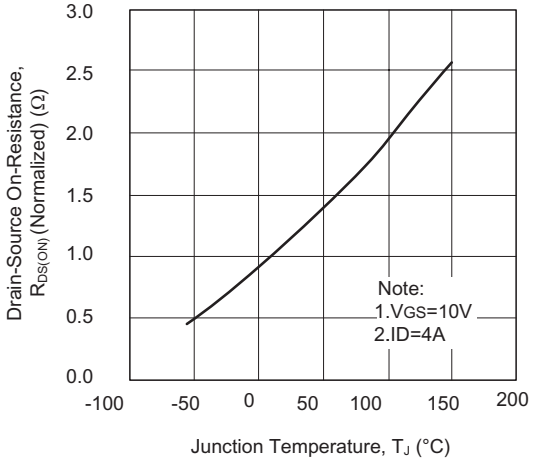
Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS

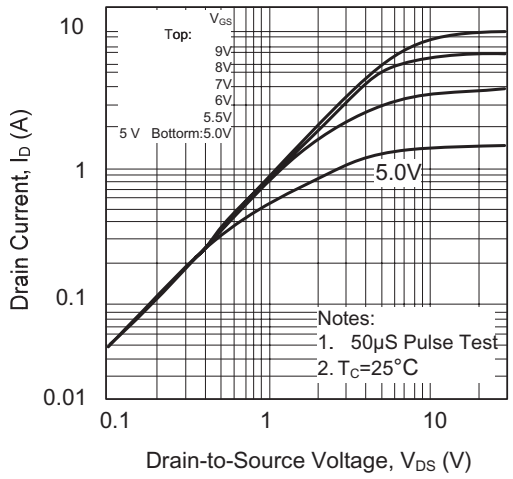
Breakdown Voltage Variation vs. Temperature



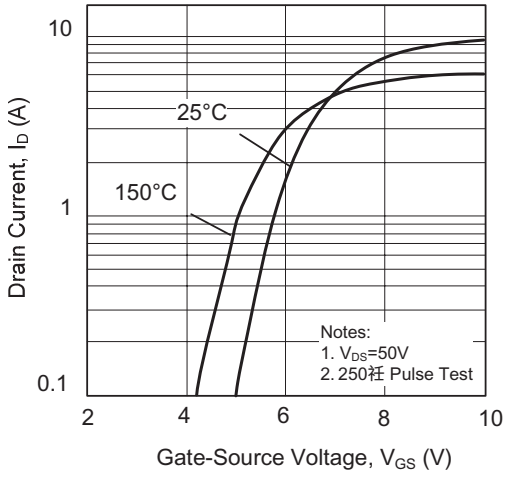
On-Resistance Junction Temperature



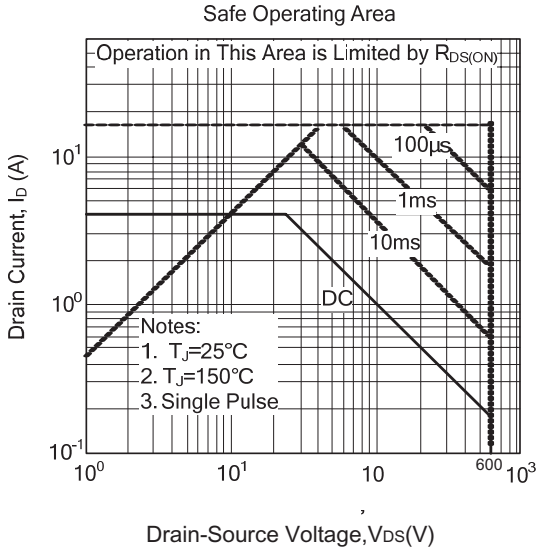
On-State Characteristics



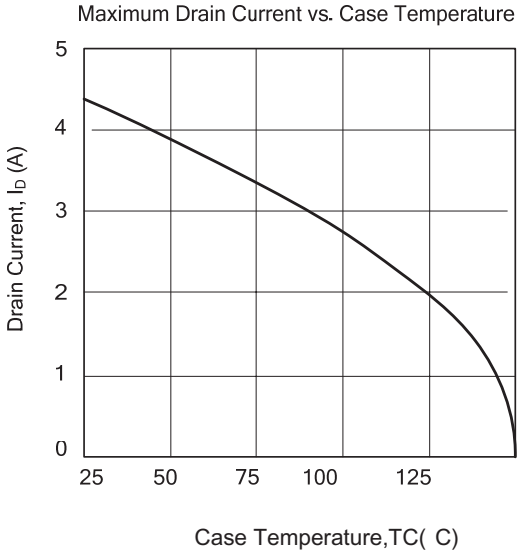
Transfer Characteristics



Safe Operating Area

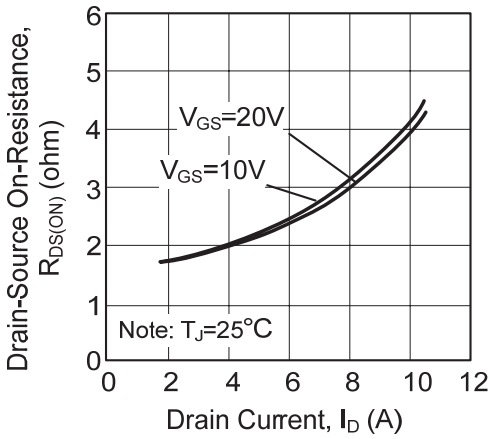


Maximum Drain Current vs. Case Temperature

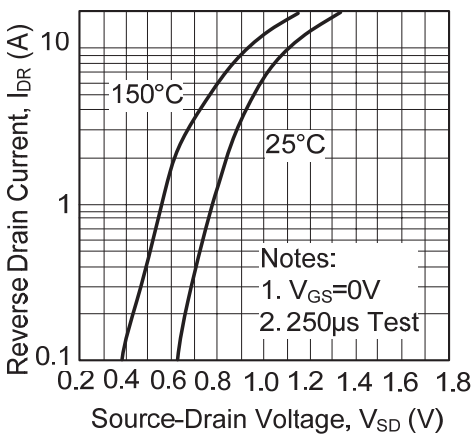


TYPICAL CHARACTERISTICS

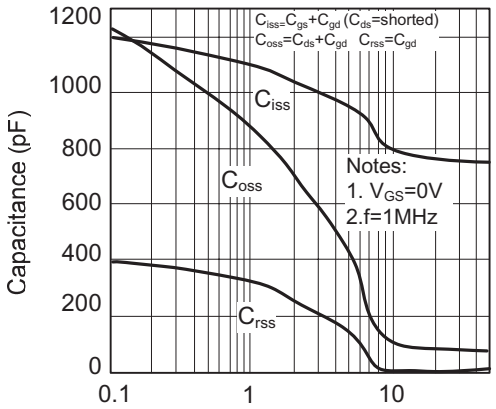
On-Resistance Variation vs. Drain Current and Gate Voltage



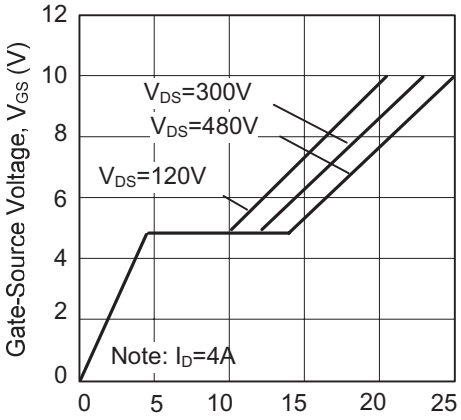
On State Current vs. Allowable Case Temperature



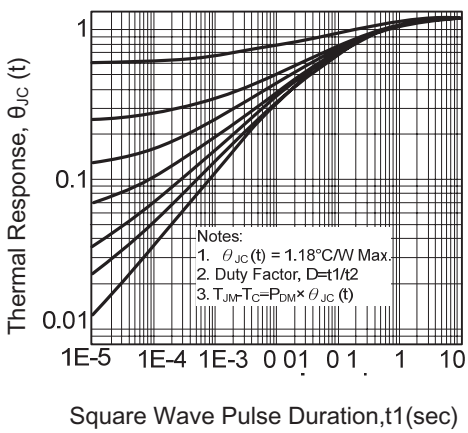
Capacitance Characteristics (Non-Repetitive)



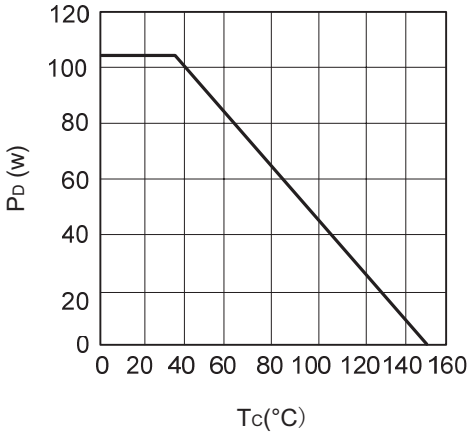
Gate Charge Characteristics



Transient Thermal Response Curve

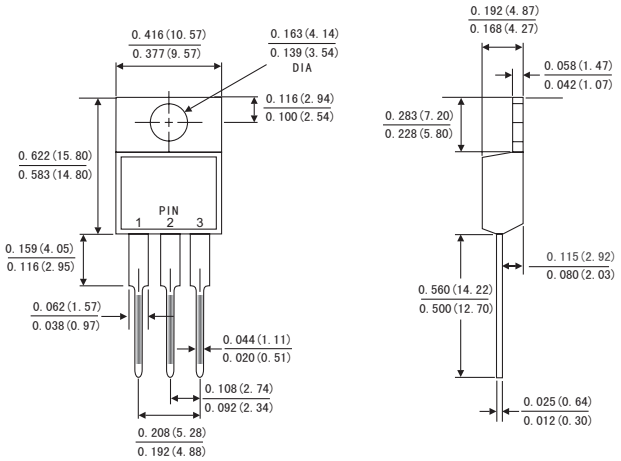


Power Dissipation

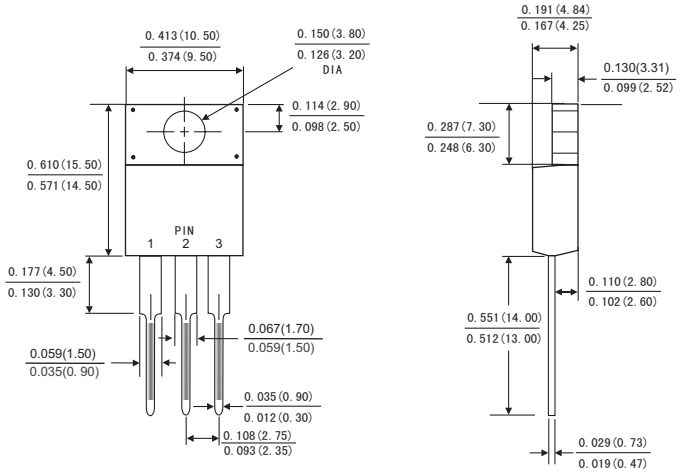


4N65
650V N-Channel Power MOSFET

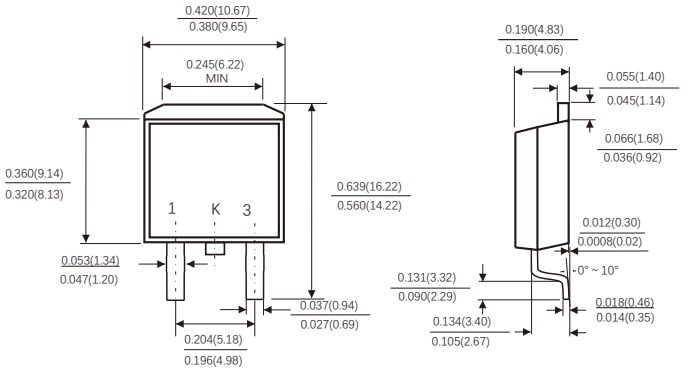
TO-220AB



ITO-220AB



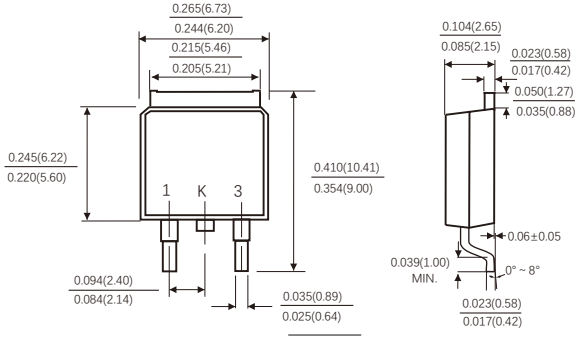
TO-263



Dimensions in inches and (millimeters)

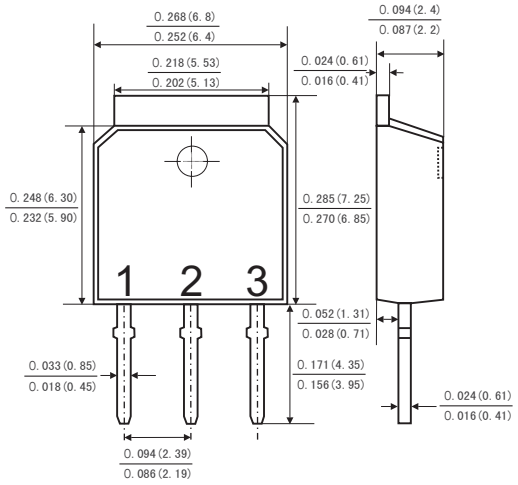
TO-252

(DPAK)



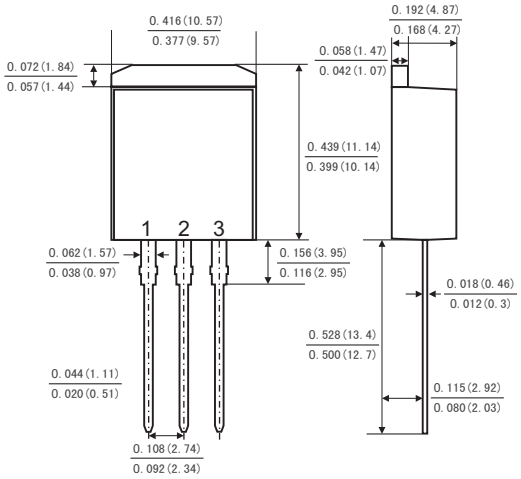
Dimensions in inches and (milimeters)

TO-251



Dimensions in inches and (milimeters)

TO-262



Dimensions in inches and (milimeters)