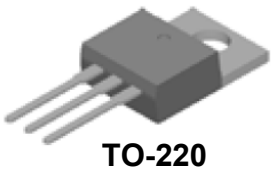
600V/2.0A Power MOSFET (N-Channel)

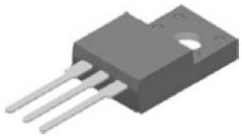
General Description

- MSU2N60 is a N-Channel enhancement mode power MOSFET with advanced technology. It is designed to have better characteristics, such as fast switching time, low gate charge, minimized on-state resistance and withstanding high energy pulse in the avalanche and commutation modes. These devices are well suited for high efficiency switching mode power supply applications.

- MSU2N60 are available in TO-220, TO-220F, DPAK (TO-252)and IPAK (TO-251) packages.

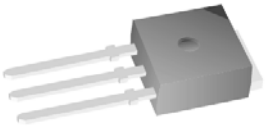


TO-220



TO-220F

DPAK (TO-252)



IPAK (TO-251)

Features

- $R_{DS(ON)}$ ≤5Ω@V_{GS}=10V
- Ultra low gate charge (Typ.9.0nC)
- Low Crss (Typ.5.0pF)
- Fast switching capability
- 100% Avalanche energy tested
- Improved dv/dt capability, high ruggedness
- RoHS Compliance and Halogen free

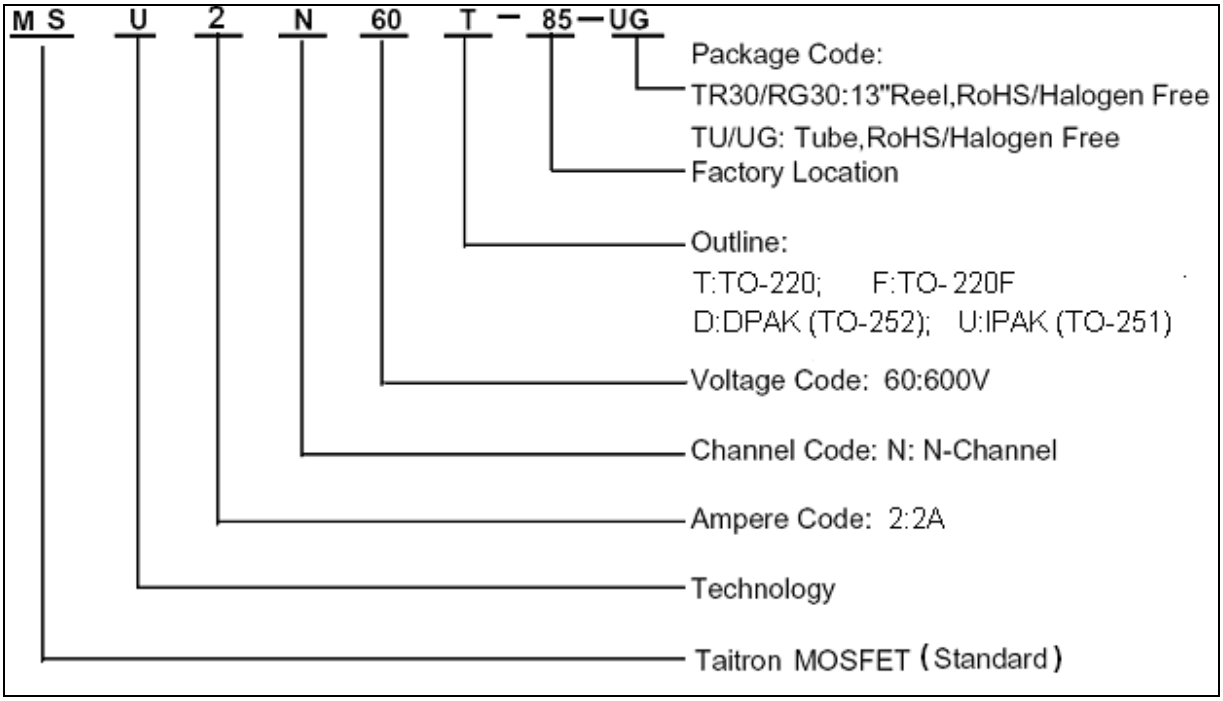
RoHS Compliant

HALOGEN FREE

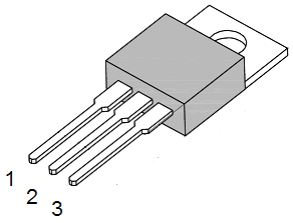
Application

- DC to DC Converter
- Adapter
- SMPS Application.

Ordering Information

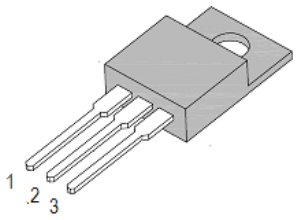


Pin Configuration and Symbol



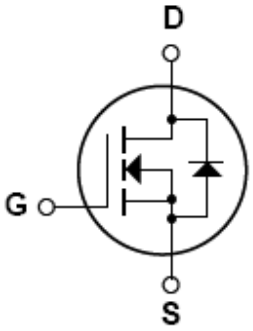
1: GATE 2: DRAIN 3: SOURCE

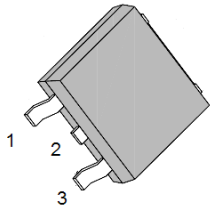
TO-220



1: GATE 2: DRAIN 3: SOURCE

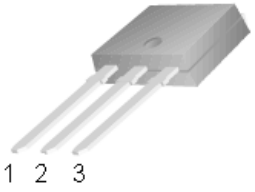
TO-220F





1: GATE 2: DRAIN 3: SOURCE

DPAK (TO-252)



1: GATE 2: DRAIN 3: SOURCE

IPAK (TO-251)

Absolute Maximum Ratings *(T_C=25ºC unless otherwise specified, Note)*

Symbol	Description		Ratings	Unit
V_{DSS}	Drain-Source Voltage		600	V
V_{GSS}	Gate-Source Voltage		± 30	V
I_D	Drain Current -Continuous		2.0	A
I_{DM}	Drain Current -Pulsed (note1)		8.0	A
E_{AS}	Avalanche Energy	Single Pulsed (Note2)	140	mJ
E_{AR}		Repetitive (Note1)	4.5	
I_{AR}	Avalanche Current (note1)		2.0	A
dv/dt	Peak Diode Recovery dv/dt (note3)		4.5	V/ns
P_D	Power Dissipation	TO-220	54	W
		TO-220F	23	
		IPAK(TO-251)/DPAK(TO-252)	44	
$R_{\theta JA}$	Thermal Resistance (Junction-to-Ambient)	TO-220/ TO-220F	62.5	°C/ W
		IPAK(TO-251)/DPAK(TO-252)	50	
$R_{\theta JC}$	Thermal Resistance (Junction-to-Case)	TO-220	2.32	°C/ W
		TO-220F	5.5	
		IPAK(TO-251)/DPAK(TO-252)	2.87	
T_J	Junction Temperature		+150	° C
T_{STG}	Storage Temperature Range		-55 to +150	° C

Note: Absolute maximum ratings indicate limits beyond which damage to the device may occur.
For guarantee specification and test conditions, see the Electrical Characteristics.
The guaranteed specification apply only for the test conditions listed.

Note1: Repetitive Rating: Pulse width limited by maximum junction temperature
2: L=64mH, I_{AS}=2.0A, V_{DD}=50V, R_G=25Ω, Starting T_J=25°C
3: Isd≤2.4A, di/dt≤200A/us, V_{DD}≤$V_{BR(DSS)}$, Starting T_J=25°C

Electrical Characteristics *(T_C=25ºC unless otherwise specified)*

Symbol	Description		Min.	Typ.	Max.	Unit	Conditions
OFF CHARACTERISTICS							
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage		600	-	-	V	V_{GS}=0V, I_D=250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient		-	0.4	-	V/°C	I_D=250uA, referenced to 25°C
I_{DSS}	Drain-Source leakage Current		-	-	10	μA	V_{DS}=600V, V_{GS}=0V
I_{GSS}	Gate-Source leakage Current	Forward	-	-	100	nA	V_{GS}=30V, V_{DS}=0V
		Reverse	-	-	-100	nA	V_{GS}=-30V, V_{DS}=0V
ON CHARACTERISTICS							
$V_{GS(th)}$	Gate-Source Threshold Voltage		2.0	-	4.0	V	V_{DS}=V_{GS}, I_D=250uA
$R_{DS(ON)}$	Static Drain-Source On-State Resistance		-	3.8	5.0	Ω	V_{GS}=10.0V, I_D=1.0A
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance		-	270	350	pF	V_{DS}=25V, V_{DS}=0V, f=1.0MHz
C_{oss}	Output Capacitance		-	40	50	pF	
C_{rss}	Reverse Transfer Capacitance		-	5	7	pF	
SWITCHING CHARACTERISTICS							
$t_d(on)$	Turn-on Delay Time		-	10	30	nS	V_{DD} =300V, I_D=2.4A, R_G=25Ω (Note 4, 5)
t_r	Turn-on Rise Time		-	25	60	nS	
$t_d(off)$	Turn-off Delay Time		-	20	50	nS	
t_f	Turn-off Fall Time		-	25	60	nS	
Qg	Total Gate Charge		-	9.0	11	nC	V_{DS} =480V, I_D=2.4A, V_{GS} =10V (Note 4, 5)
Qgs	Gate-Source Charge		-	1.6	-	nC	
Qgd	Gate-Drain Charge		-	4.3	-	nC	
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
V_{SD}	Drain-Source Diode Forward Voltage		-	-	1.4	V	V_{GS} =0V, I_S=2.0A
I_S	Maximum Continuous Drain-Source Diode Forward Current		-	-	2.0	A	-
I_{SM}	Maximum Pulse Drain-Source Diode Forward Current		-	-	8.0	A	-
t_{rr}	Reverse Recovery Time		-	180	-	nS	V_{GS} =0V, I_S=2.4A dI_F/dt=100A/us (Note4)
Q_{rr}	Reverse Recovery Charge		-	0.72	-	uC	

Note 4: Pulse test: Pulse width ≤300us, Duty cycle≤2%
5: Essentially independent of operating temperature

Typical Characteristics Curves

Fig.1- On-Region Characteristics

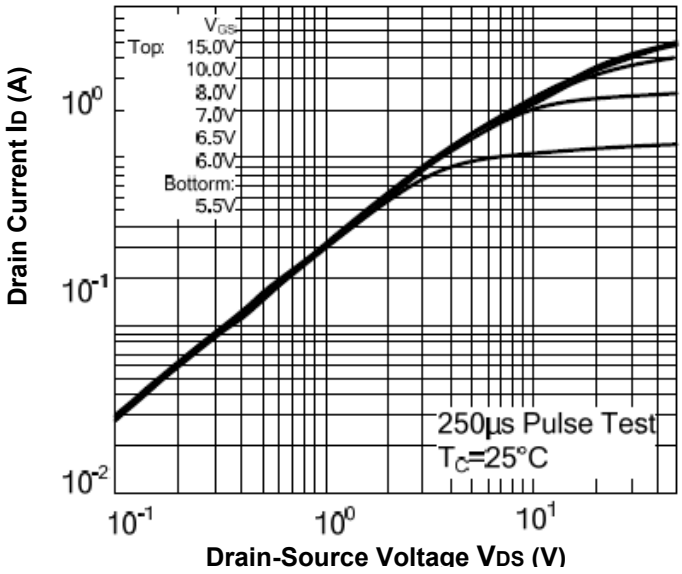


Fig.2- Transfer Characteristics

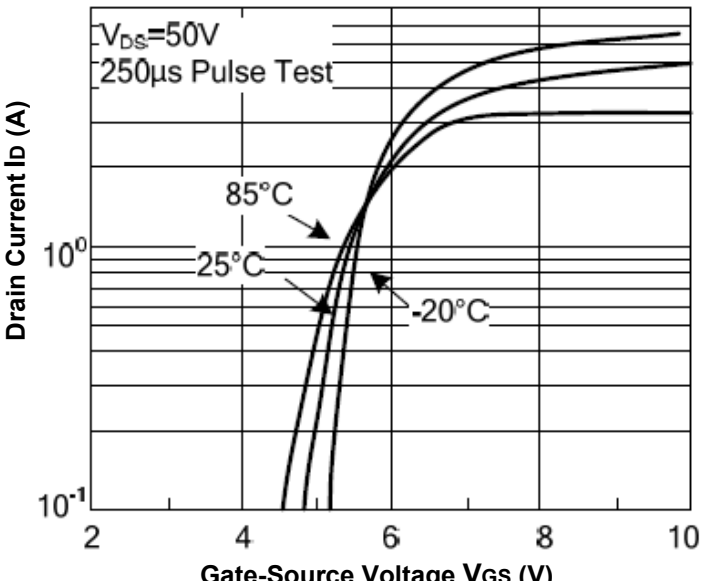


Fig.3- On-Resistance Variation Vs. Drain Current and Gate Voltage

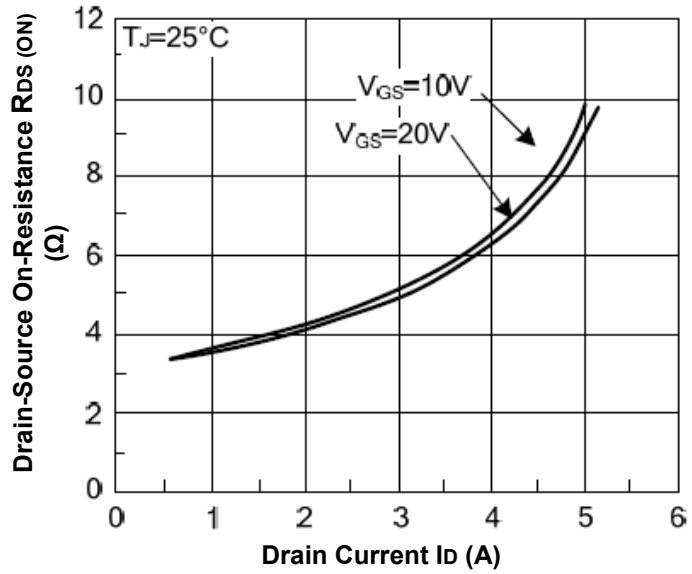


Fig.4- Body Diode Forward Voltage Variation Vs. Source Current and Temperature

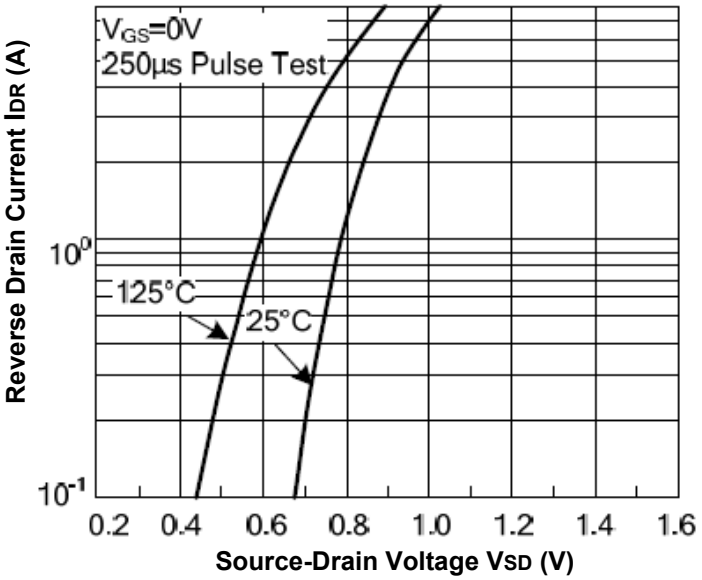


Fig.5- Capacitance Characteristics

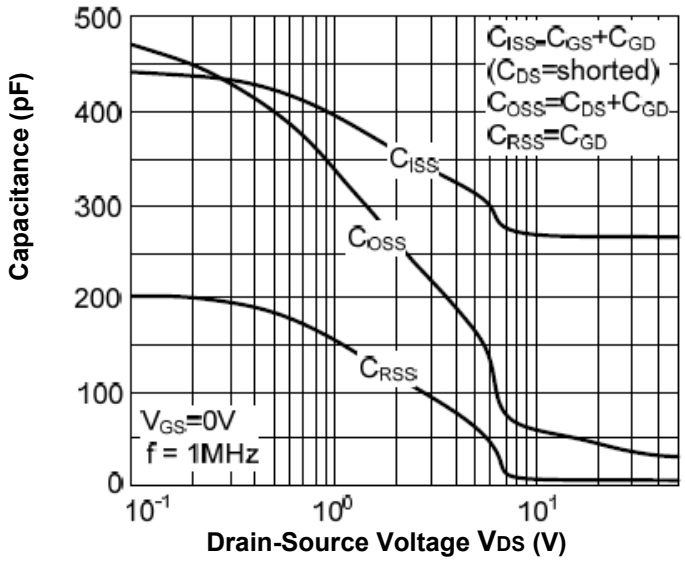


Fig.6- Gate Charge Characteristics

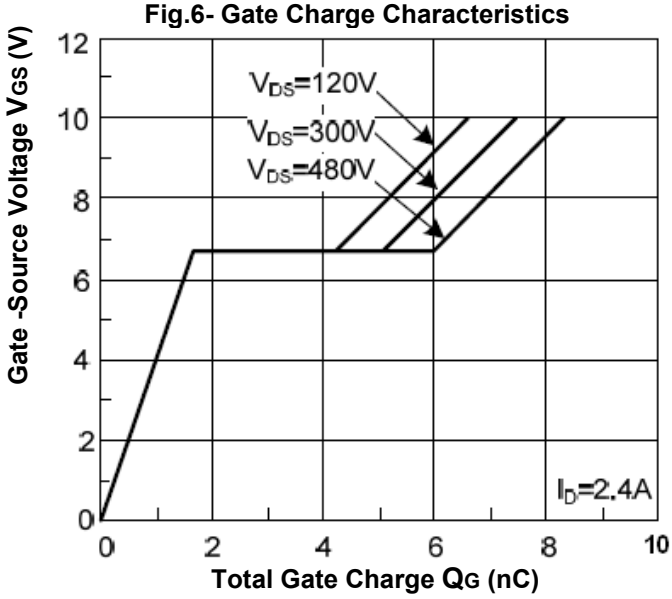


Fig.7- Breakdown Voltage Variation Vs. Temperature

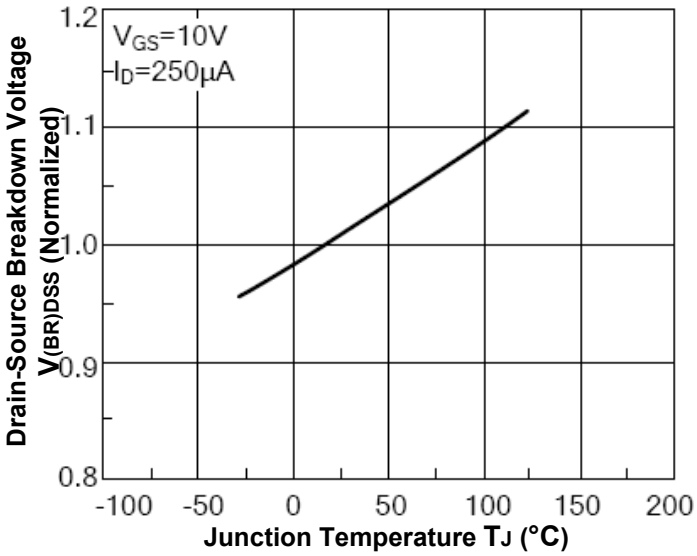


Fig.8- On Resistance Variation Vs. Temperature

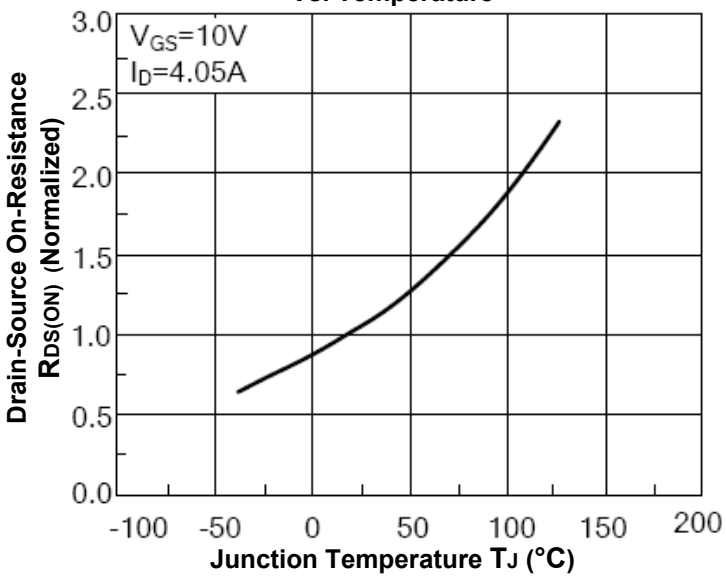


Fig.9- Max. Safe Operation Area Vs. Temperature

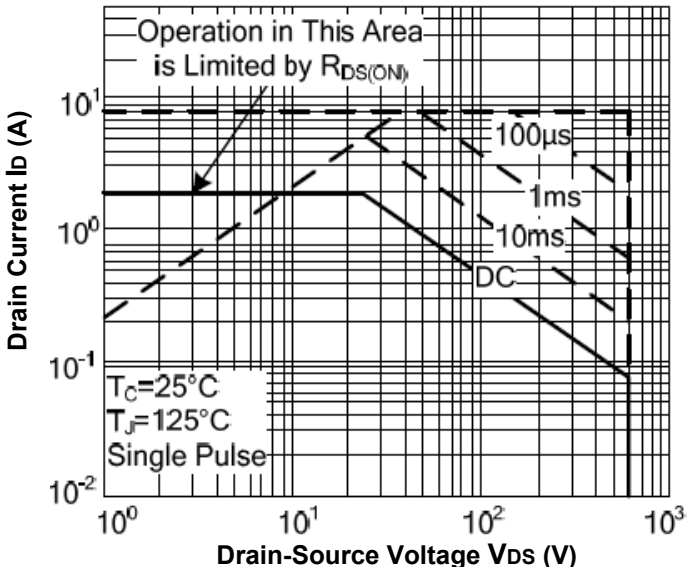


Fig.10- Max. Drain Current Vs. Case Temperature

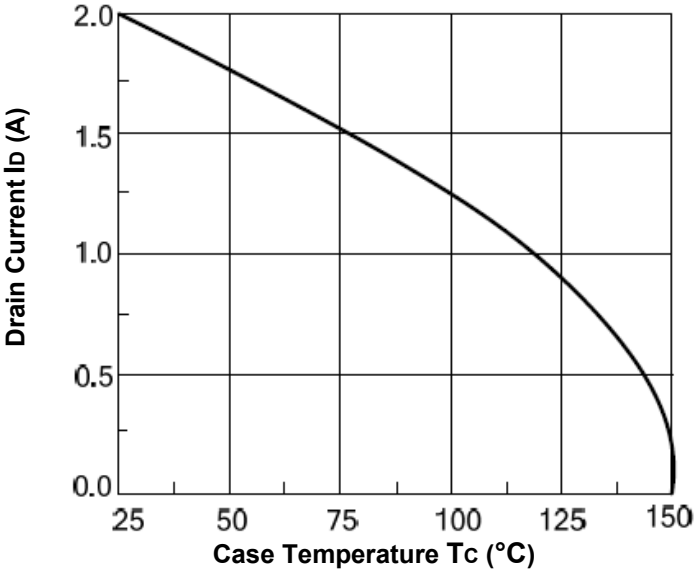
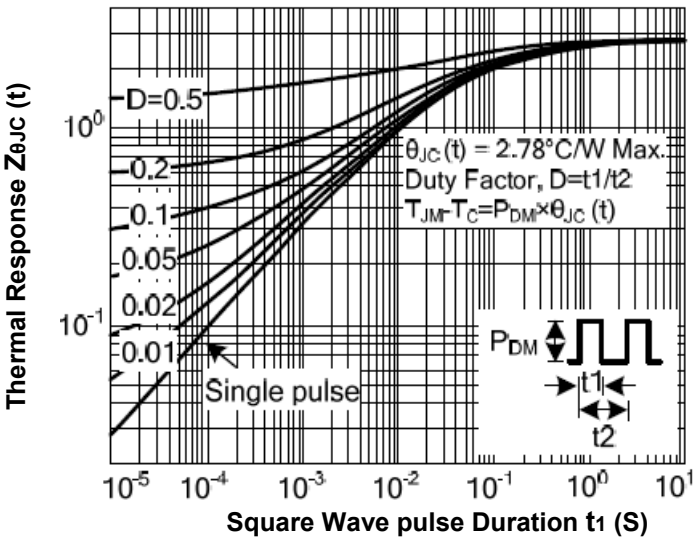


Fig.11- Transient Thermal Response



TEST CIRCUIT AND WAVEFORMS

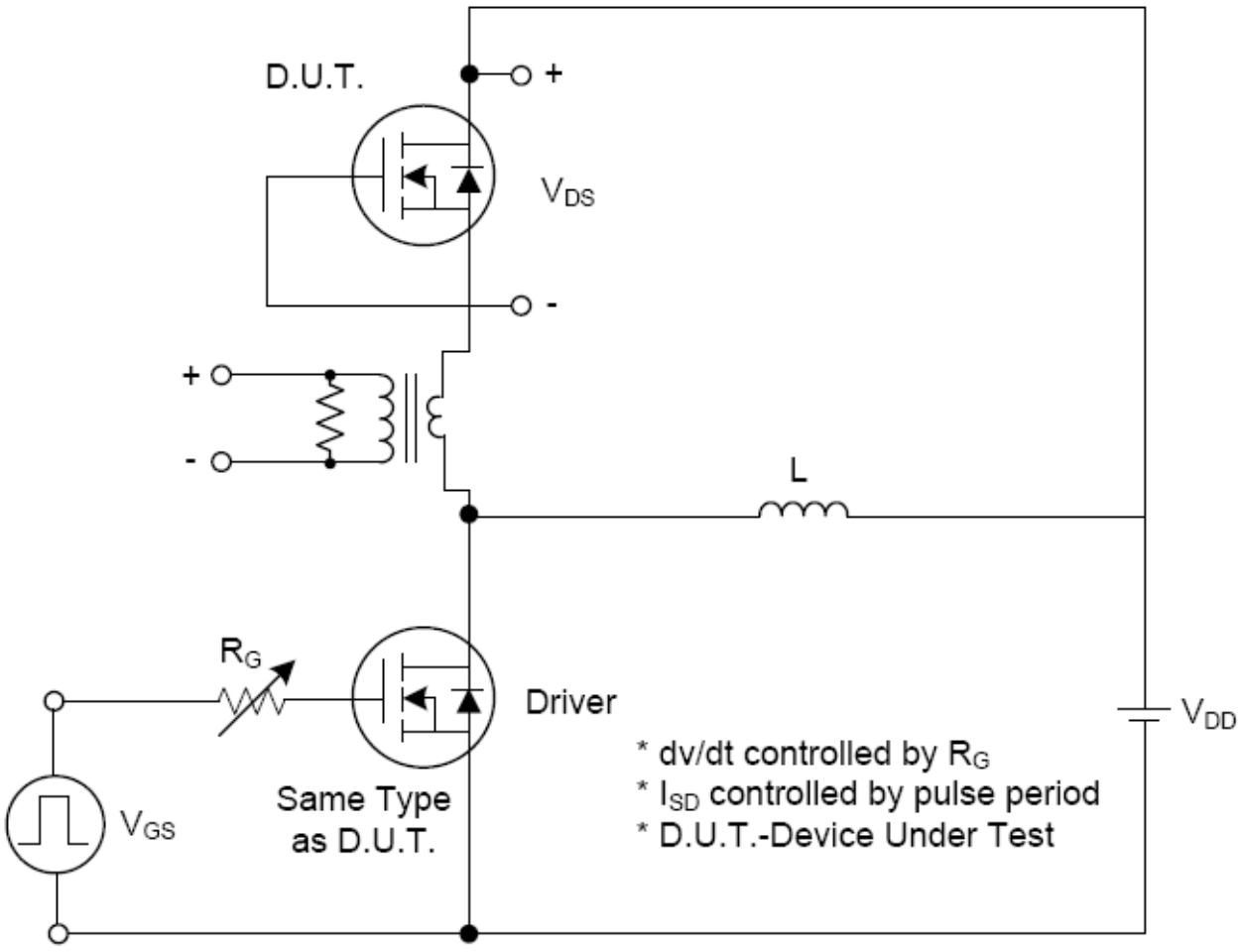


Fig.12- Peak Diode Recovery dv/dt Test Circuit

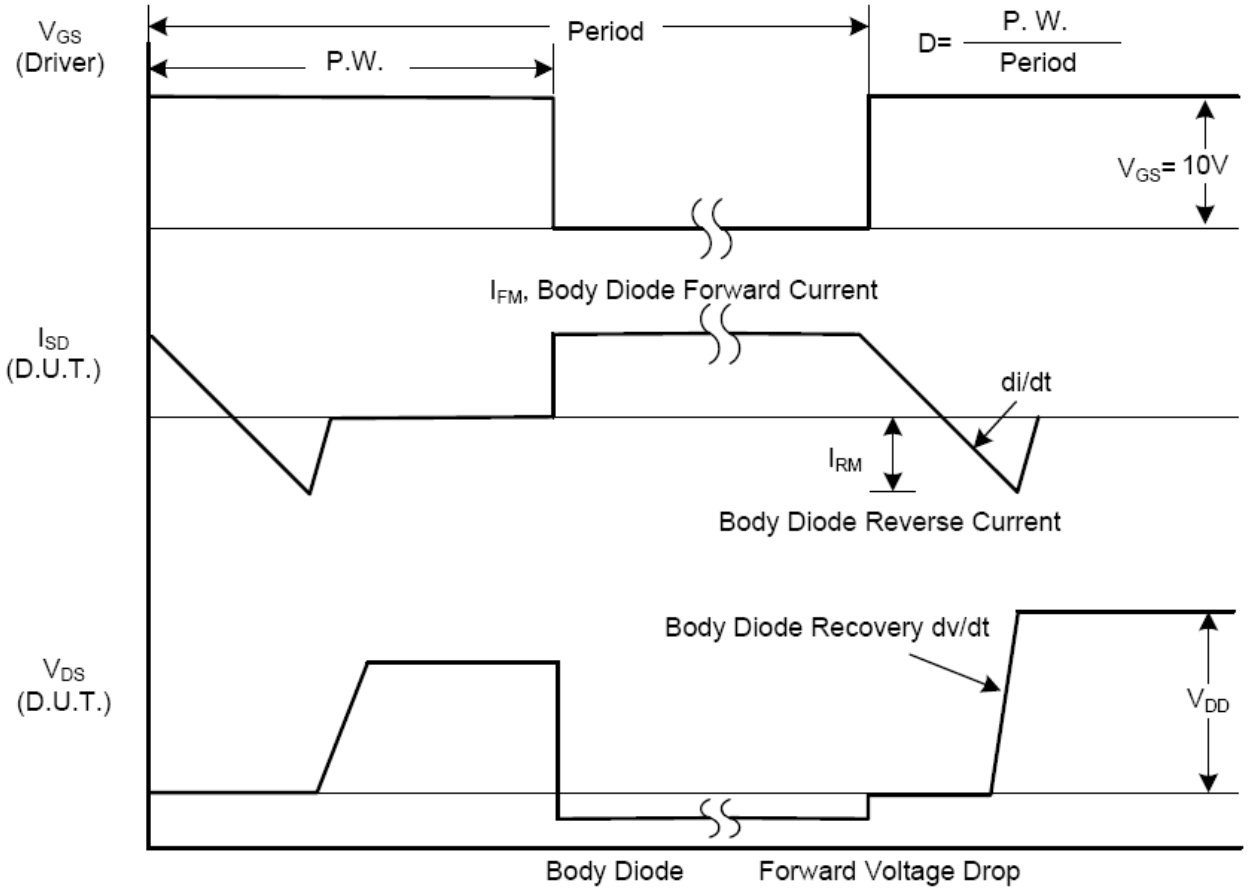


Fig.13- Peak diode Recovery dv/dt Waveform

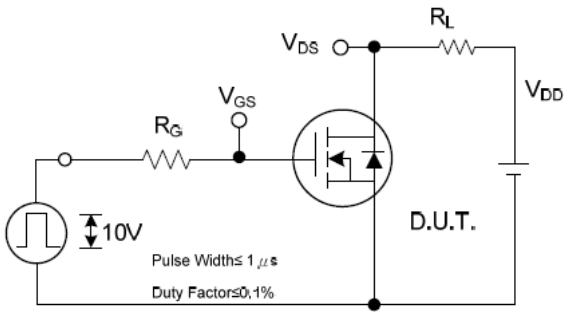


Fig.14- Switching Test Circuit

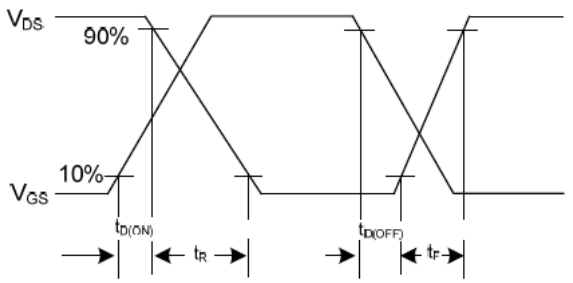


Fig.15- Switching Waveform

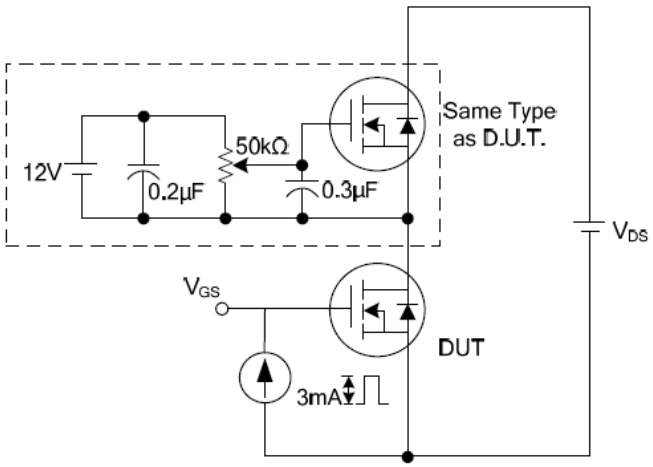


Fig.16- Gate Charge Test Circuit

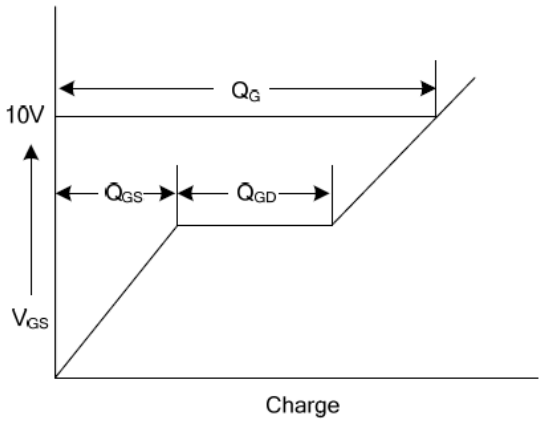


Fig.17- Gate Charge Waveform

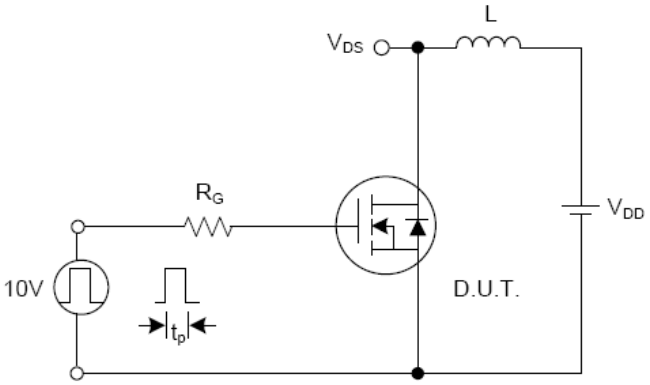


Fig.18- Unclamped Inductive Switching Test Circuit

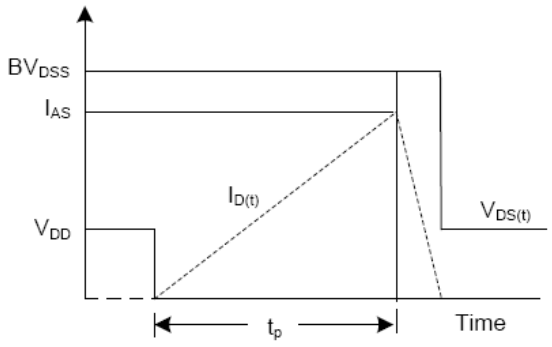
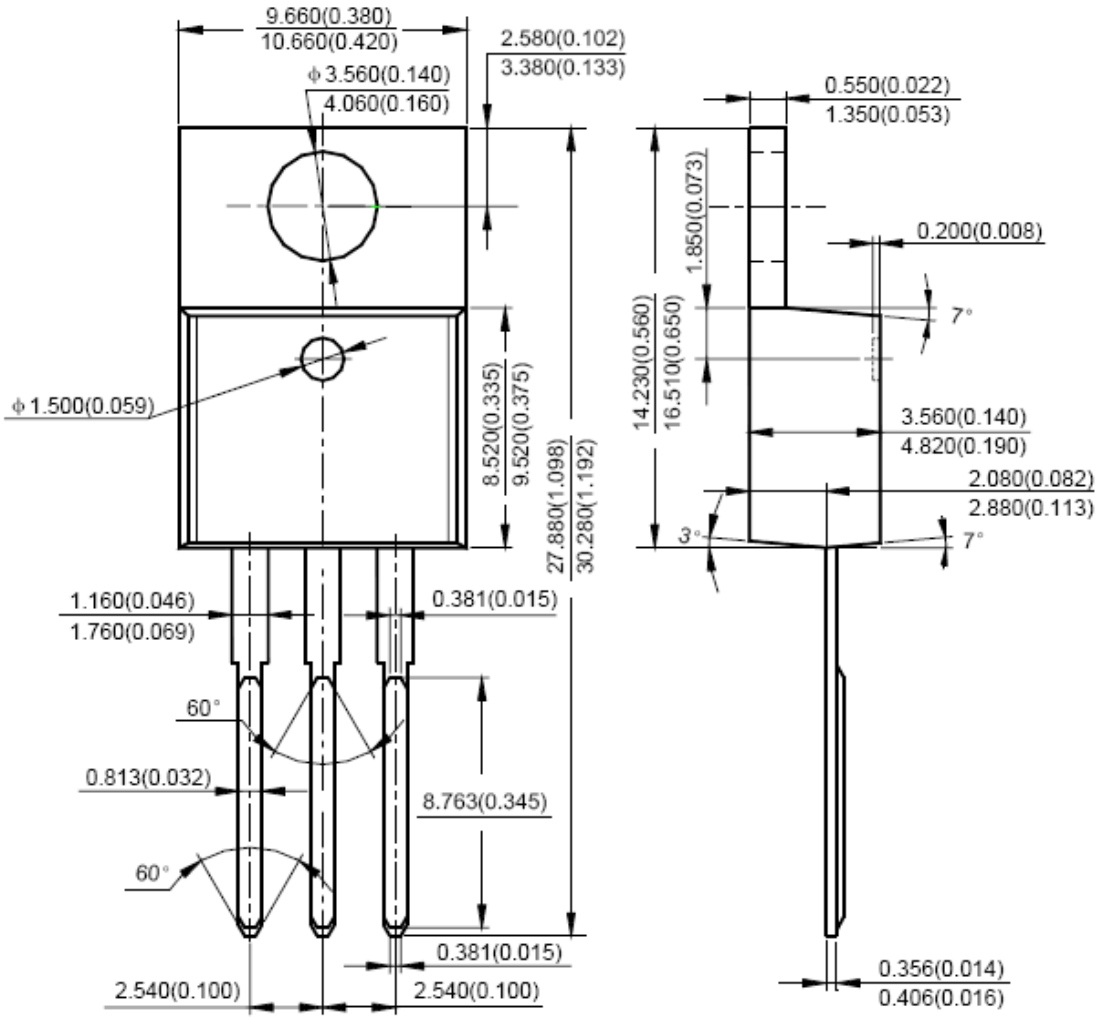
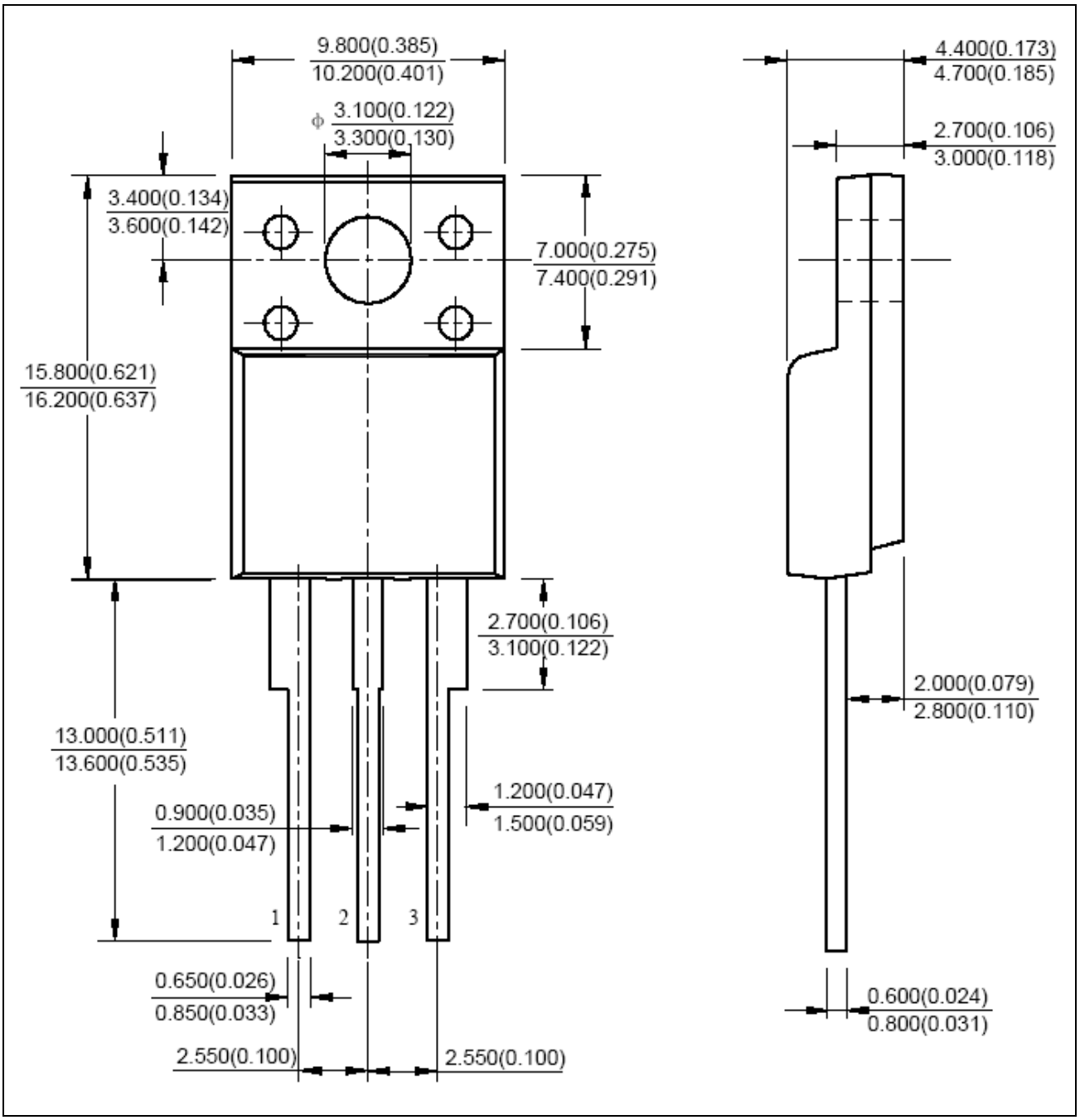


Fig.19- Unclamped Inductive Switching Waveform

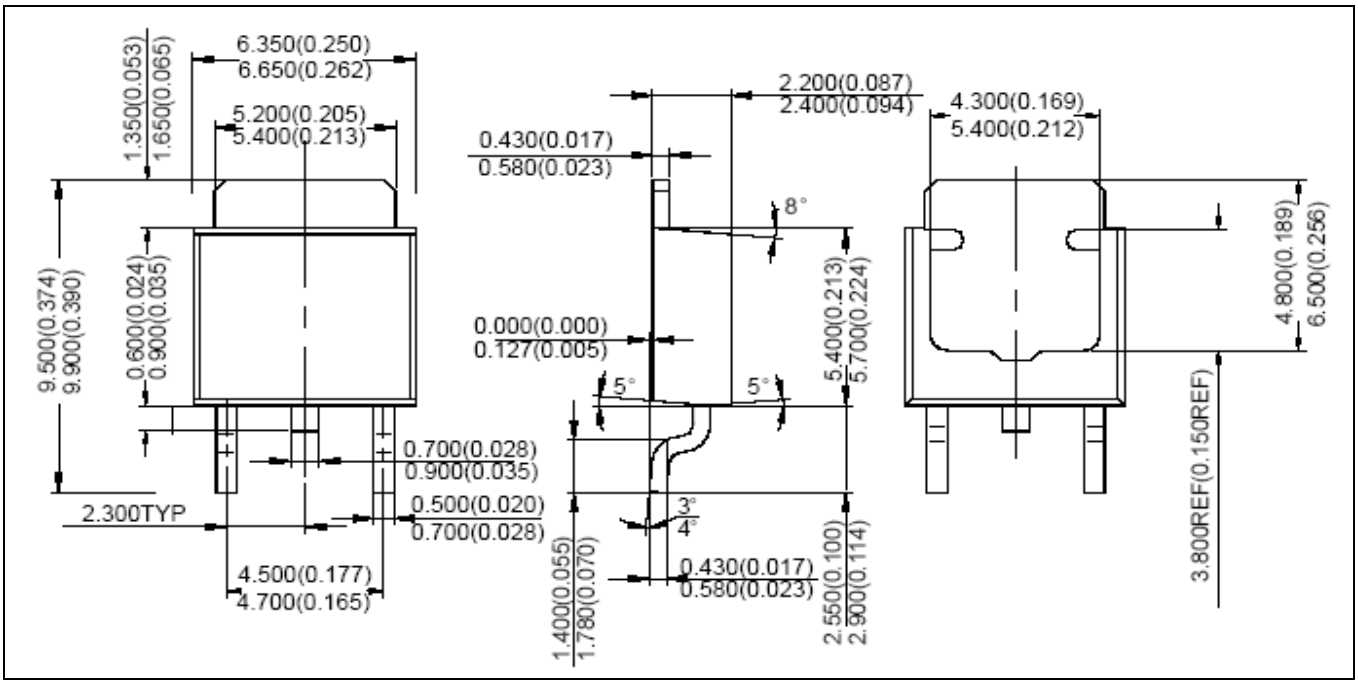
Dimensions in mm (inch)



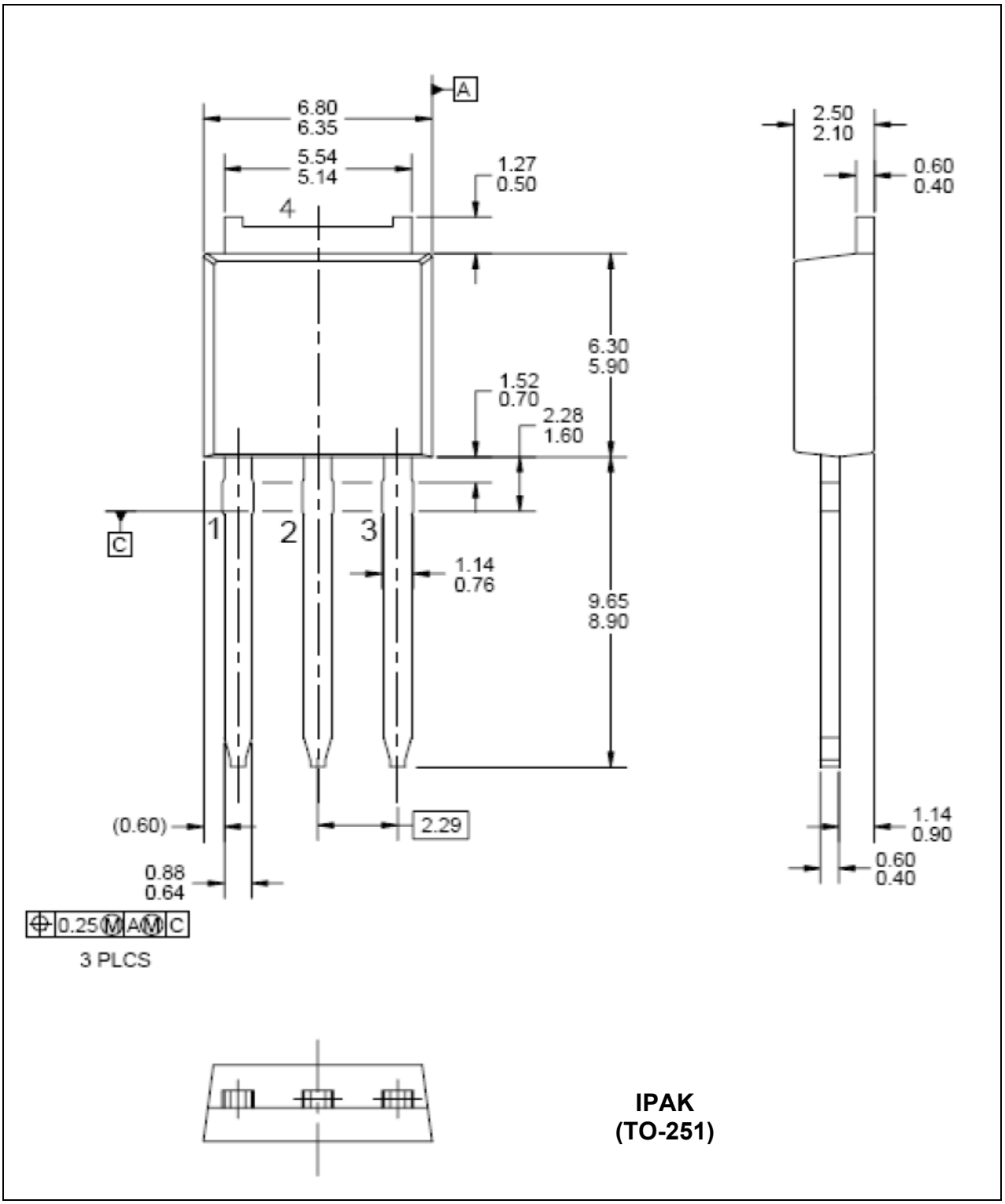
TO-220


9.800(0.385)
10.200(0.401)
ϕ 3.100(0.122)
3.300(0.130)
3.400(0.134)
3.600(0.142)
7.000(0.275)
7.400(0.291)
15.800(0.621)
16.200(0.637)
2.700(0.106)
3.100(0.122)
13.000(0.511)
13.600(0.535)
1.200(0.047)
1.500(0.059)
0.900(0.035)
1.200(0.047)
1
2
3
0.650(0.026)
0.850(0.033)
2.550(0.100)
2.550(0.100)
4.400(0.173)
4.700(0.185)
2.700(0.106)
3.000(0.118)
2.000(0.079)
2.800(0.110)
0.600(0.024)
0.800(0.031)

TO-220F


6.350(0.250)
6.650(0.262)
1.350(0.053)
1.650(0.065)
5.200(0.205)
5.400(0.213)
9.500(0.374)
9.900(0.390)
0.600(0.024)
0.900(0.035)
0.700(0.028)
0.900(0.035)
2.300TYP
0.500(0.020)
0.700(0.028)
4.500(0.177)
4.700(0.165)
2.200(0.087)
2.400(0.094)
0.430(0.017)
0.580(0.023)
8°
0.000(0.000)
0.127(0.005)
5°
5°
5.400(0.213)
5.700(0.224)
3°
4°
1.400(0.055)
1.780(0.070)
0.430(0.017)
0.580(0.023)
2.550(0.100)
2.900(0.114)
4.300(0.169)
5.400(0.212)
4.800(0.189)
6.500(0.256)
3.800REF(0.150REF)

DPAK
(TO-252)


A
6.80
6.35
5.54
5.14
1.27
0.50
4
6.30
5.90
1.52
0.70
2.28
1.60
C
1
2
3
1.14
0.76
9.65
8.90
(0.60)
2.29
0.88
0.64
0.25 M A M C
3 PLCS
2.50
2.10
0.60
0.40
1.14
0.90
0.60
0.40

IPAK
(TO-251)

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