

# MT3205AF

## N-Channel Power MOSFET 60V, 120A, 5.5mΩ

### General Description

This N-channel MOSFET is produced using MOS-TECH Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain superior switching performance.

### Features

- $R_{DS(on)} = 5.5m\Omega$  (Typ.) @  $V_{GS} = 10V$ ,  $I_D = 80A$
- High performance trench technology for extremely low  $R_{DS(on)}$
- High power and current handling capability
- RoHS compliant

### Applications

- Power Management in Inverter system
- Synchronous Rectification

### Absolute Maximum Ratings ( $T_A = 25^\circ C$ unless otherwise noted)

Symbol	Parameter		Ratings	Units
$V_{DSS}$	Drain to Source Voltage		60	V
$V_{GSS}$	Gate to Source Voltage		$\pm 25$	V
$I_D$	Drain Current	-Continuous ( $T_C = 25^\circ C$ ) (Note 1)	120	A
$I_{DM}$	Drain Current	- Pulsed	380	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)		320	mJ
$P_D$	Power Dissipation	( $T_C = 25^\circ C$ )	180	W
		- Derate above $25^\circ C$	1.0	W/ $^\circ C$
$T_J, T_{STG}$	Operating and Storage Temperature Range		-55 to +150	$^\circ C$

### Thermal Characteristics

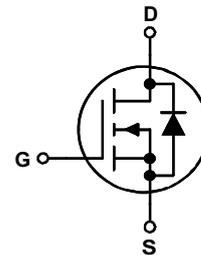
Symbol	Parameter	Ratings	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.7	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	35	



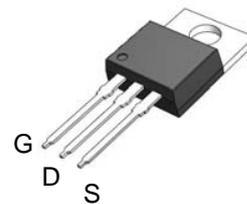
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### Simplified Schematic



### MARKING DIAGRAM & PIN ASSIGNMENT



TO-220FB-3L

**Package Marking and Ordering Information**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
MT3205AF	MT3205AF	TO-220	-	-	50units

**Electrical Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}, T_J = 25$	60	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{V}, V_{GS} = 0\text{V}$ $V_{DS} = 48\text{V}, T_C = 85^\circ\text{C}$	-	-	1 30	$\mu\text{A}$
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 25\text{V}, V_{DS} = 0\text{V}$	-	-	$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 30\text{A}$	-	5.5	6.5	m $\Omega$

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 30\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$	-	3800	4560	pF
$C_{oss}$	Output Capacitance		-	430	-	pF
$C_{rss}$	Reverse Transfer Capacitance		-	190	-	pF
$R_G$	Gate Resistance	$V_{GS} = 0\text{V}, f = 1\text{MHz}$	-	1	-	$\Omega$
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{GS} = 10\text{V}$	-	68	88	nC
$Q_{g(th)}$	Threshold Gate Charge	$V_{GS} = 4.5\text{V}$	-	33	-	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{DS} = 48\text{V}$ $I_D = 30\text{A}$ $I_g = 1\text{mA}$	-	15	-	nC
$Q_{gs2}$	Gate Charge Threshold to Plateau		-	18	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	19	-	nC

**Switching Characteristics**

$t_{ON}$	Turn-On Time	$V_{DS} = 30\text{V}, I_D = 30\text{A}$ $V_{GS} = 10\text{V}, R_{GEN} = 3.0\Omega$	-	99	137	ns
$t_{d(on)}$	Turn-On Delay Time		-	18	-	ns
$t_r$	Turn-On Rise Time		-	35	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	47	73	ns
$t_f$	Turn-Off Fall Time		-	19	49	ns
$t_{OFF}$	Turn-Off Time		-	67	89	ns

**Drain-Source Diode Characteristics**

$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 30\text{A}$	-	-	1.3	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 30\text{A}$	-	49	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100\text{A}/\mu\text{s}$	-	78	-	nC

**Notes:**

1: Calculated continuous current based on maximum allowable junction temperature. Package limited to 75A continuous, see Figure 9.

### Typical Performance Characteristics

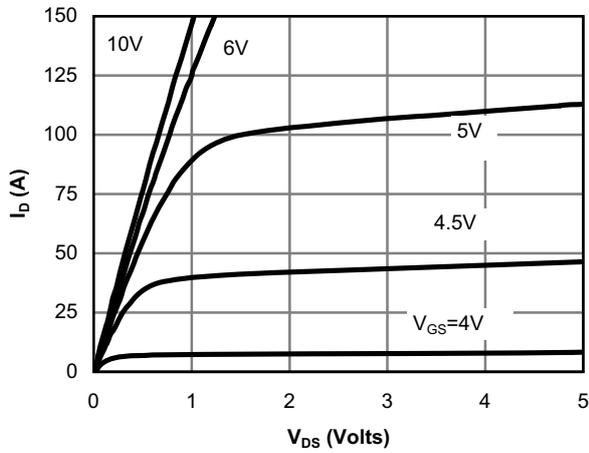


Figure 1: On-Region Characteristics

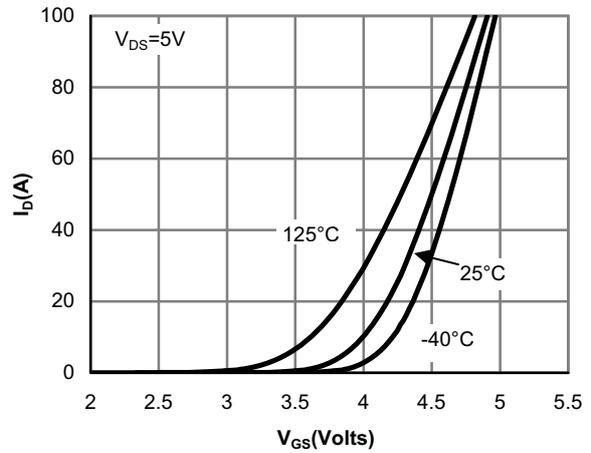


Figure 2: Transfer Characteristics

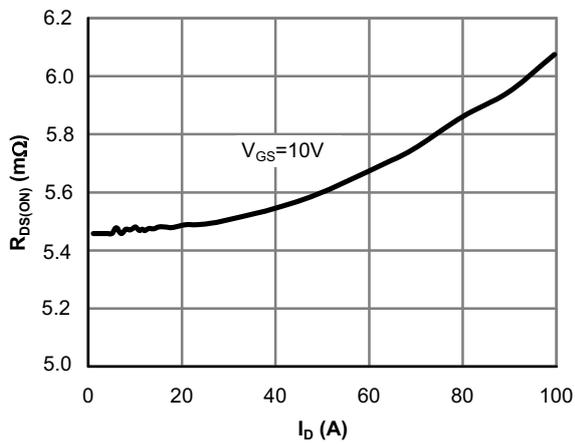


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

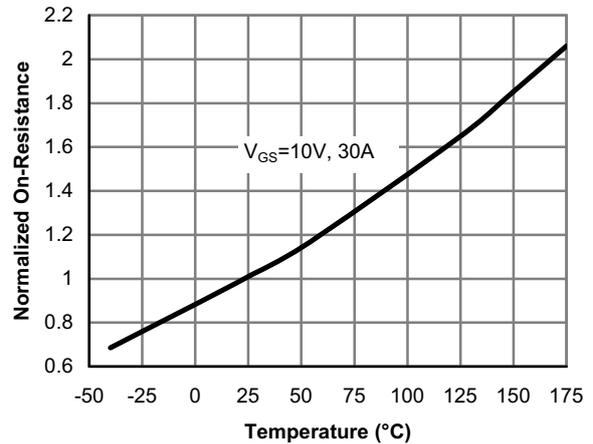


Figure 4: On-Resistance vs. Junction Temperature

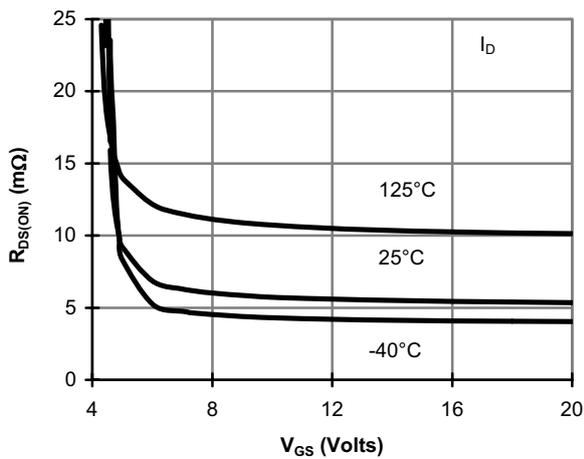


Figure 5: On-Resistance vs. Gate-Source Voltage

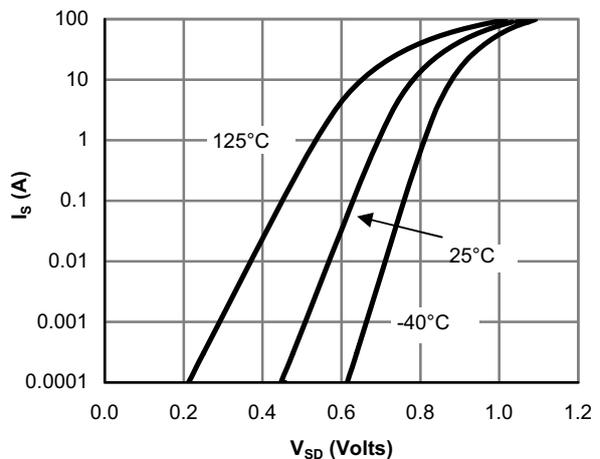


Figure 6: Body-Diode Characteristics

Typical Performance Characteristics (Continued)

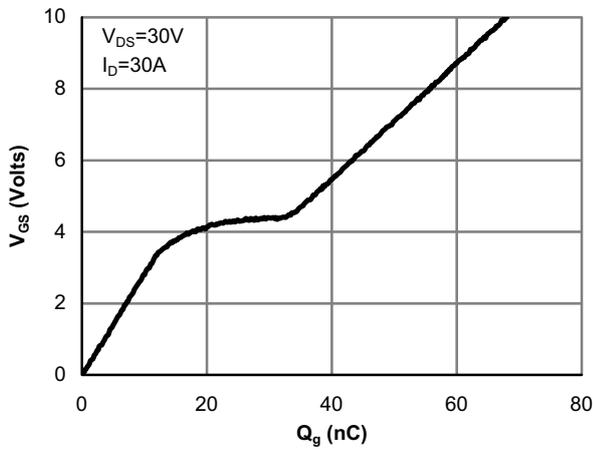


Figure 7: Gate-Charge Characteristics

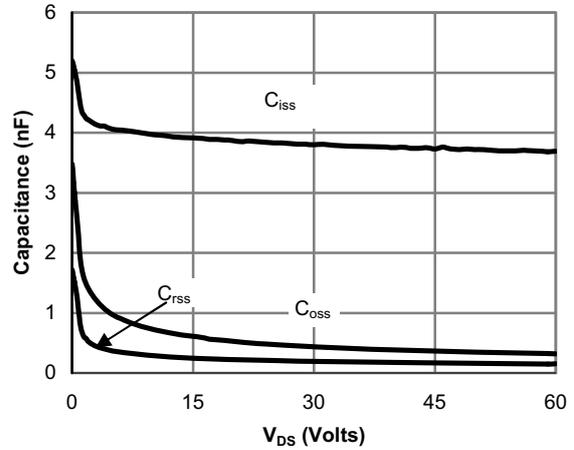


Figure 8: Capacitance Characteristics

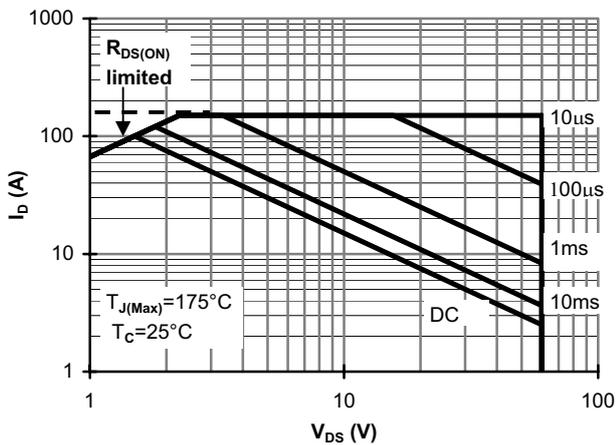


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

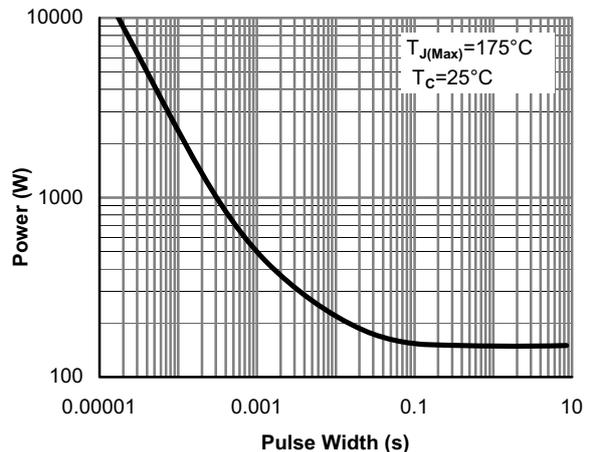


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

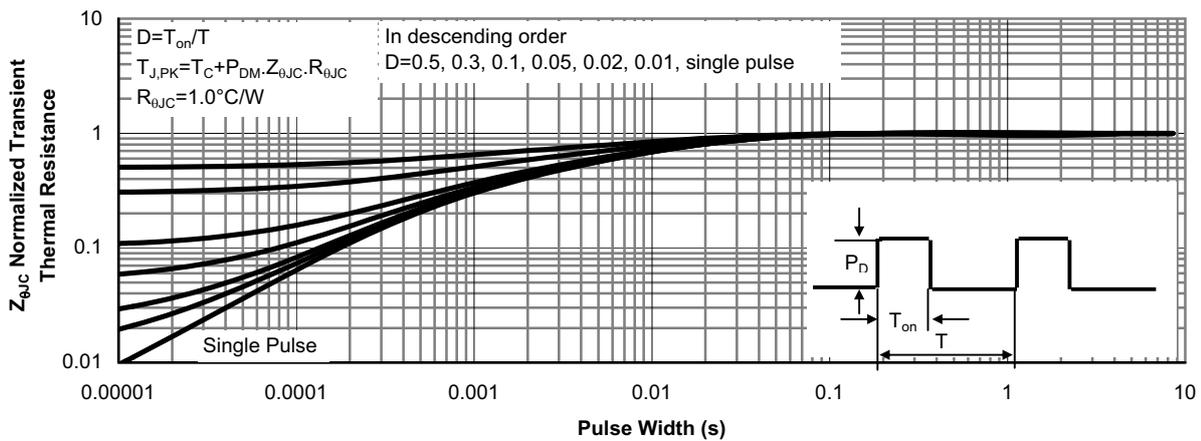
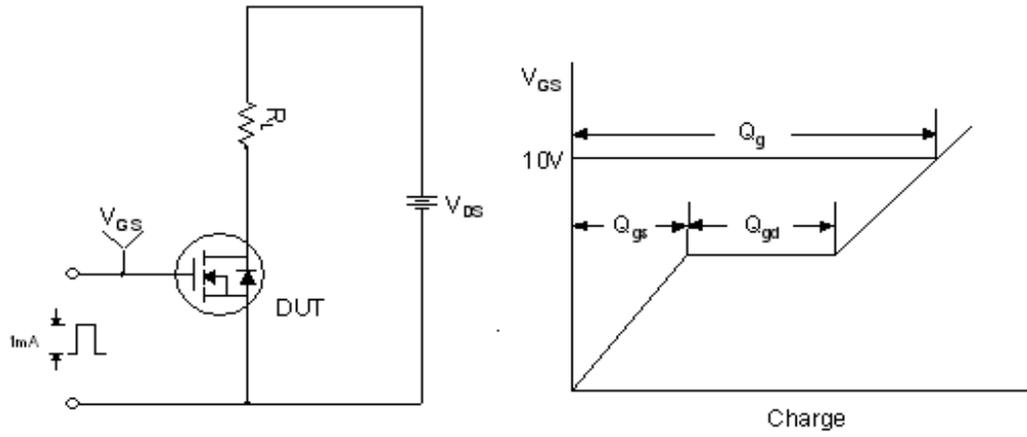
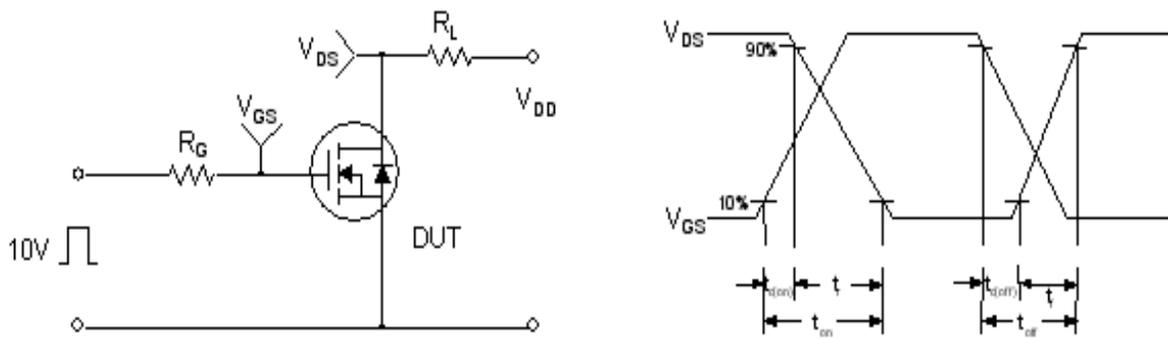


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

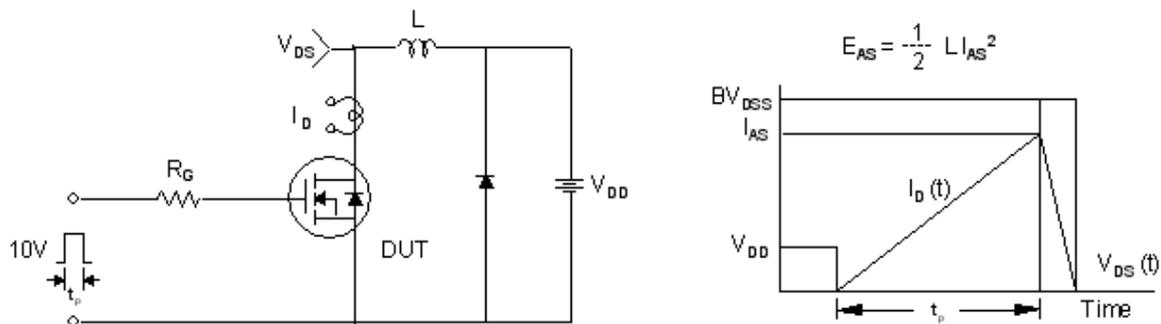
**Gate Charge Test Circuit & Waveform**



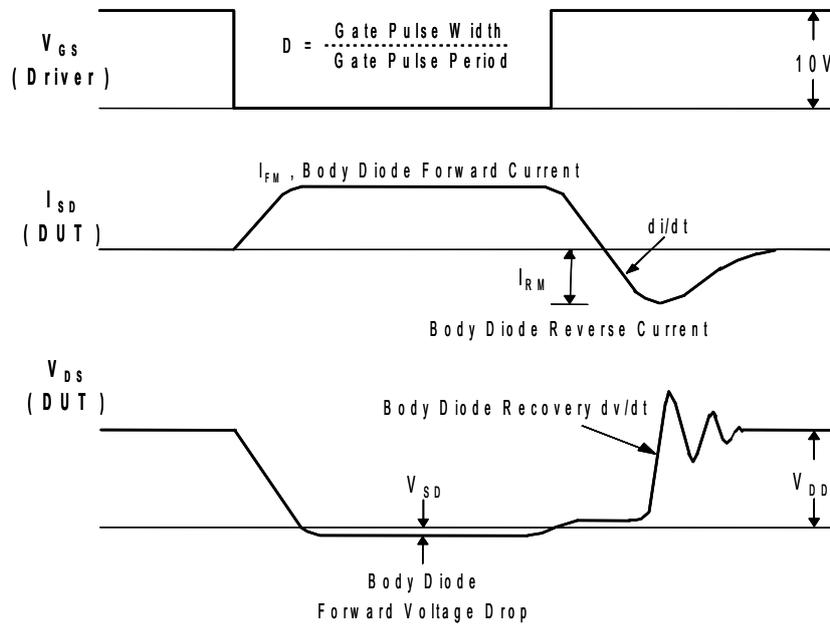
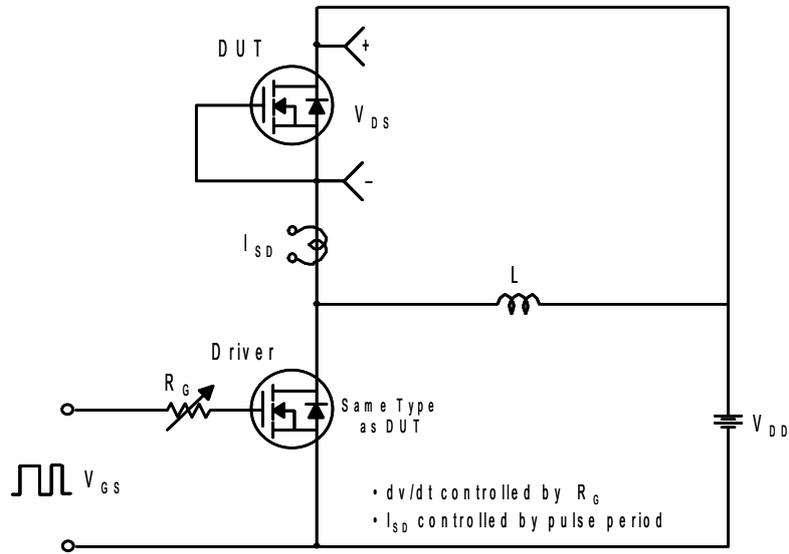
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

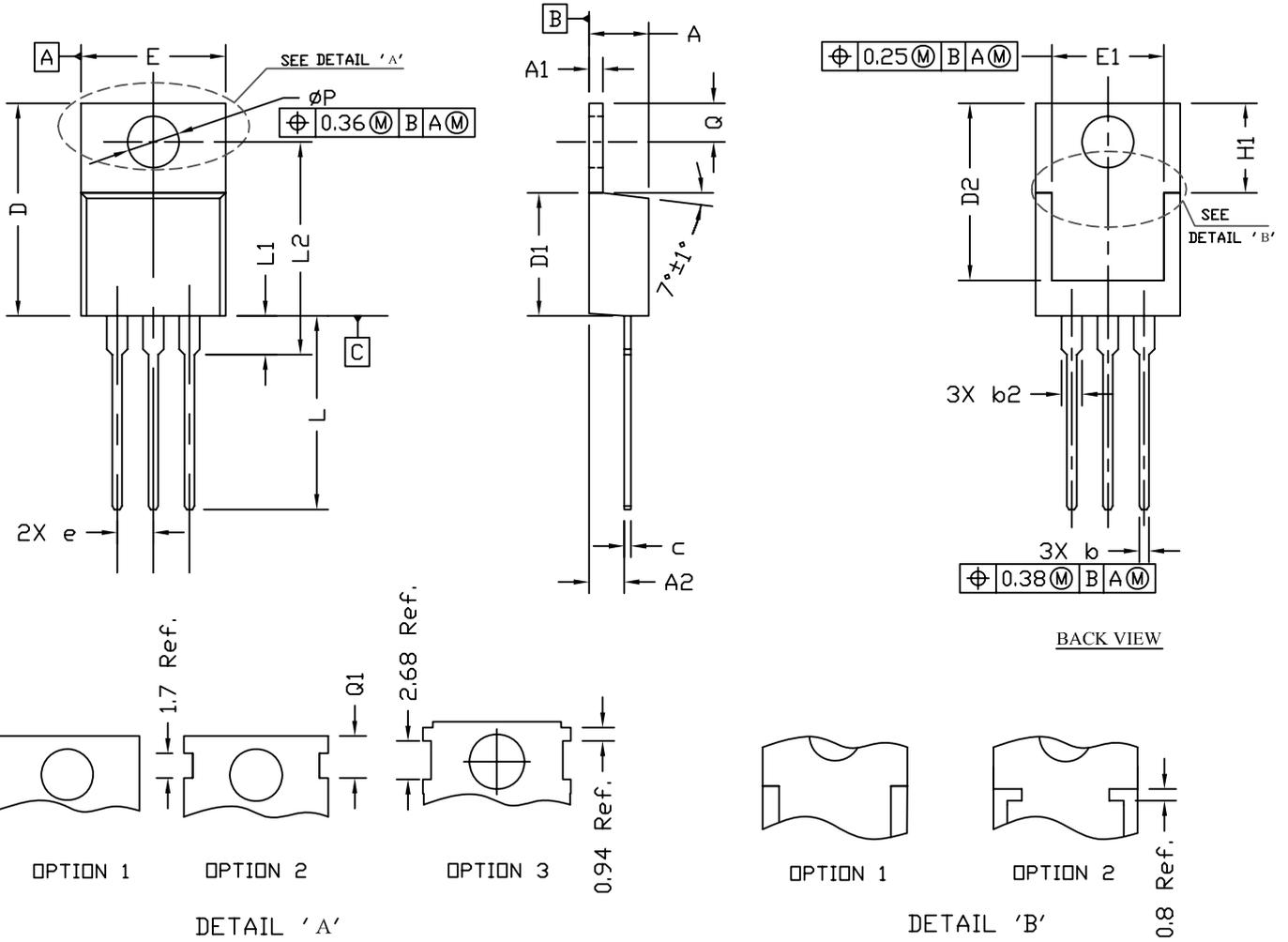


Peak Diode Recovery dv/dt Test Circuit & Waveforms

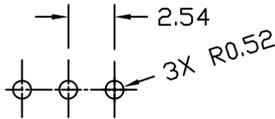


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Version	L

T0220 PACKAGE OUTLINE



RECOMMENDATION OF HOLE PATTERN



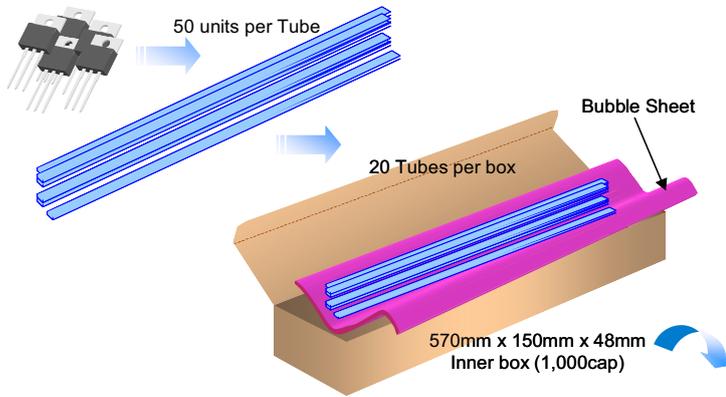
UNIT: mm

- NOTE
1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS. MOLD FLASH SHOULD BE LESS THAN 6 MIL.
  2. TOLERANCE 0.100 MILLIMETERS UNLESS OTHERWISE SPECIFIED.
  3. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.30	4.45	4.72	0.169	0.175	0.186
A1	1.15	1.27	1.40	0.045	0.050	0.055
A2	2.20	2.67	2.90	0.087	0.105	0.114
b	0.69	0.81	0.95	0.027	0.032	0.037
b2	1.17	1.37	1.45	0.046	0.050	0.068
c	0.36	0.38	0.60	0.014	0.015	0.024
D	14.50	15.44	15.80	0.571	0.608	0.622
D1	8.59	9.14	9.65	0.338	0.360	0.380
D2	11.43	11.73	12.48	0.450	0.462	0.491
e	2.54 BSC			0.100 BSC		
E	9.66	10.03	10.54	0.380	0.395	0.415
E1	6.22	---	---	0.245	---	---
H1	6.10	6.30	6.50	0.240	0.248	0.256
L	12.27	12.82	14.27	0.483	0.505	0.562
L1	2.47	---	3.90	0.097	---	0.154
L2	---	---	16.70	---	---	0.657
Q	2.59	2.74	2.89	0.102	0.108	0.114
$\phi P$	3.50	3.84	3.89	0.138	0.151	0.153
Q1	2.70	---	2.90	0.106	---	0.114

## TO-220 Short Lead Tube Packing Data

### TO-220 Short Lead Tube Packing Configuration: Figure 1.0



#### Packaging Description:

TO-220 parts are shipped normally in tube. The tube is made of PVC plastic treated with an anti-static agent. These tubes in standard option are placed inside a dissipative plastic bubble sheet, barcode labeled, and placed inside a box made of recyclable corrugated paper. One box contains twenty tubes maximum (see fig. 1.0). And one or several of these boxes are placed inside a labeled shipping box which comes in different sizes depending on the number of parts shipped. The units in this option are placed inside a small box laid with anti-static bubble sheet. These larger boxes then will be placed finally inside a labeled shipping box which still comes in different sizes depending on the number of units shipped.



### TO-220 Short Lead Packaging Information: Figure 2.0

TO-220 Packaging Information	
Packaging Option	Standard (no flow code)
Packaging type	Rail/Tube
Qty per Tube/ Inner Box	50
Inner Box Dimension (mm)	570x150x48
Max qty per Box	1,000
Outer Box Dimension (mm)	590x330x245
Max qty per Box	8,000
Weight per unit (gm)	1.9588
Note/Comments	

#### Inner Box Barcode Label Sample

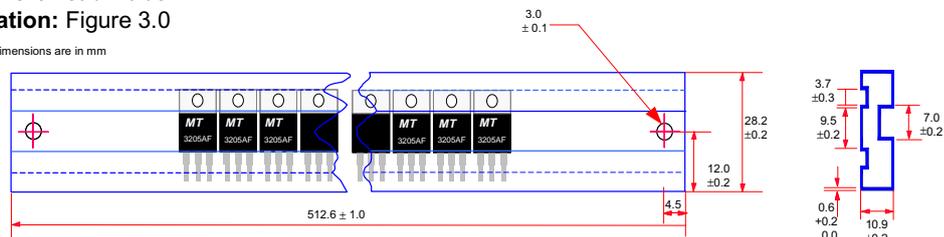


#### Outer Box Barcode Label Sample



### TO-220 Short Lead Tube Configuration: Figure 3.0

Note: All dimensions are in mm



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