

MT3040

N-Channel Low Qg[®] MOSFET

45V, 100A, 4.5mΩ

General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low $r_{DS(ON)}$ and fast switching speed.

Features

- $r_{DS(ON)} = 4.5m\Omega$, $V_{GS} = 10V$, $I_D = 10A$
- $r_{DS(ON)} = 6.0m\Omega$, $V_{GS} = 4.5V$, $I_D = 10A$
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability
- Low gate charge

Applications

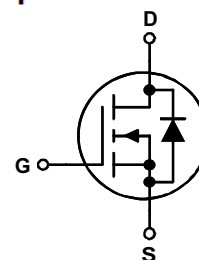
- DC/DC converters



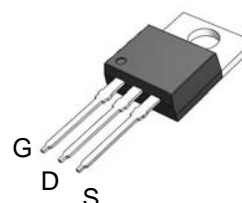
MT Semiconductor[®]

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Simplified Schematic



MARKING DIAGRAM & PIN ASSIGNMENT



TO-220FB-3L

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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain to Source Voltage	45	V
V_{GS}	Gate to Source Voltage	± 20	V
I_D	Drain Current		
	Continuous ($T_C = 25^\circ C$, $V_{GS} = 10V$) (Note 1)	100	A
	Continuous ($T_C = 25^\circ C$, $V_{GS} = 4.5V$) (Note 1)	85	A
	Continuous ($T_{amb} = 25^\circ C$, $V_{GS} = 10V$, with $R_{\theta JA} = 62^\circ C/W$)	15	A
	Pulsed	Figure 4	A
E_{AS}	Single Pulse Avalanche Energy (Note 2)	105	mJ
P_D	Power dissipation	110	W
	Derate above $25^\circ C$	0.73	W/ $^\circ C$
T_J, T_{STG}	Operating and Storage Temperature	-55 to 175	$^\circ C$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance Junction to Case TO-220	1.42	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient TO-220 (Note 3)	64	$^\circ C/W$

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
MT3040	MT3040	TO-220	Tube	N/A	50 units

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

B_{VDS}	Drain to Source Breakdown Voltage	$I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$	45	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{V}$ $V_{GS} = 0\text{V}$ $T_C = 150^\circ\text{C}$	-	-	1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(TH)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\mu\text{A}$	1.4	1.6	2.0	V
$r_{DS(ON)}$	Drain to Source On Resistance	$I_D = 10\text{A}$, $V_{GS} = 10\text{V}$	-	0.0045	0.0048	Ω
		$I_D = 10\text{A}$, $V_{GS} = 4.5\text{V}$	-	0.006	0.007	
		$I_D = 10\text{A}$, $V_{GS} = 10\text{V}$, $T_J = 175^\circ\text{C}$	-	0.009	0.01	

Dynamic Characteristics

C_{ISS}	Input Capacitance	$V_{DS} = 15\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$	-	2013	-	pF
C_{OSS}	Output Capacitance		-	452	-	pF
C_{RSS}	Reverse Transfer Capacitance		-	184	-	pF
R_G	Gate Resistance	$V_{GS} = 0.5\text{V}$, $f = 1\text{MHz}$	-	1.9	-	Ω
$Q_{g(TOT)}$	Total Gate Charge at 10V	$V_{GS} = 0\text{V}$ to 10V	-	56	72	nC
$Q_{g(5)}$	Total Gate Charge at 5V	$V_{GS} = 0\text{V}$ to 5V	-	35	39	nC
$Q_{g(TH)}$	Threshold Gate Charge	$V_{GS} = 0\text{V}$ to 1V	-	3.4	4.7	nC
Q_{gs}	Gate to Source Gate Charge	$V_{DD} = 15\text{V}$ $I_D = 40\text{A}$ $I_g = 1.0\text{mA}$	-	9.7	-	nC
Q_{gs2}	Gate Charge Threshold to Plateau		-	6.5	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	11	-	nC
			-			

Switching Characteristics ($V_{GS} = 10\text{V}$)

t_{ON}	Turn-On Time	$V_{DD} = 15\text{V}$, $I_D = 40\text{A}$ $V_{GS} = 4.5\text{V}$, $R_{GS} = 4.7\Omega$	-	-	202	ns
$t_{d(ON)}$	Turn-On Delay Time		-	12		ns
t_r	Rise Time		-	120	-	ns
$t_{d(OFF)}$	Turn-Off Delay Time		-	42	-	ns
t_f	Fall Time		-	30	-	ns
t_{OFF}	Turn-Off Time		-	-	112	ns

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Voltage	$I_{SD} = 40\text{A}$	-	-	1.25	V
		$I_{SD} = 20\text{A}$	-	-	1.0	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 40\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	32	ns
Q_{RR}	Reverse Recovered Charge	$I_{SD} = 40\text{A}$, $dI_{SD}/dt = 100\text{A}/\mu\text{s}$	-	-	18	nC

Notes:

- 1: Package current limitation is 80A.
- 2: Starting $T_J = 25^\circ\text{C}$, $L = 51\mu\text{H}$, $I_{AS} = 64\text{A}$, $V_{DD} = 37\text{V}$, $V_{GS} = 10\text{V}$.
- 3: Pulse width = 100s.

Typical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

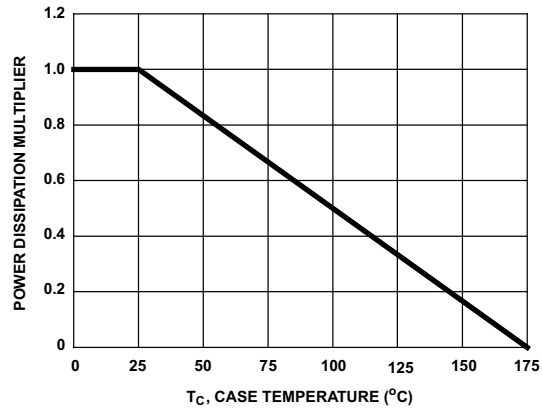


Figure 1. Normalized Power Dissipation vs Case Temperature

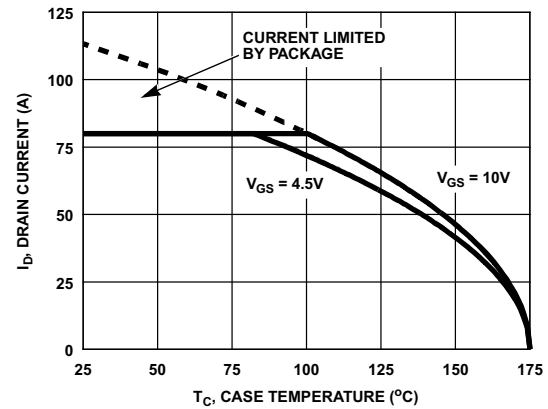


Figure 2. Maximum Continuous Drain Current vs Case Temperature

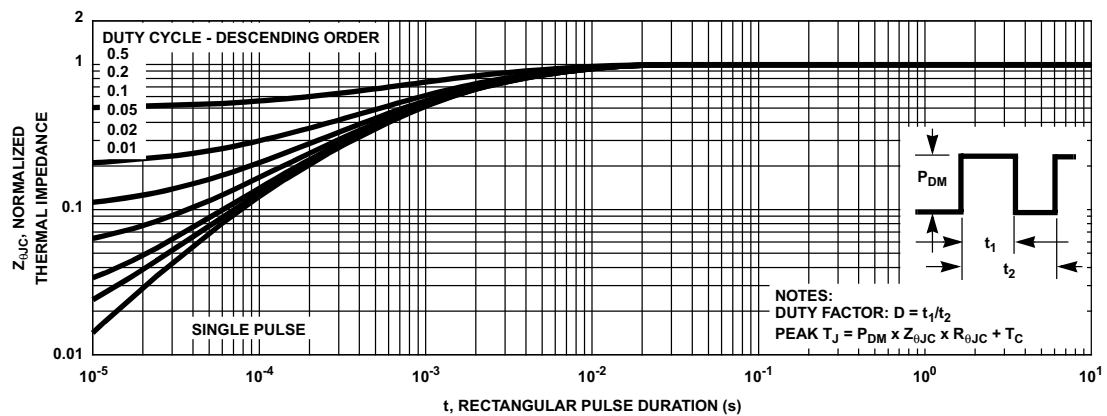


Figure 3. Normalized Maximum Transient Thermal Impedance

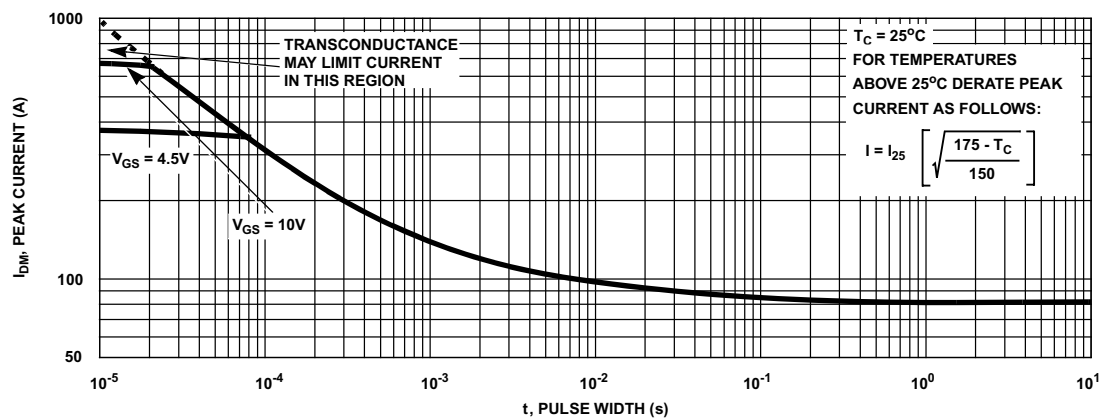


Figure 4. Peak Current Capability

Typical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

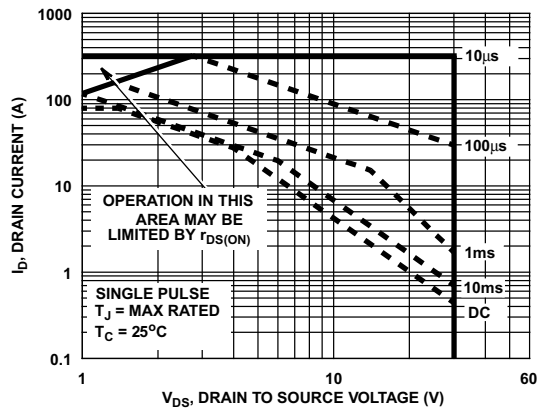
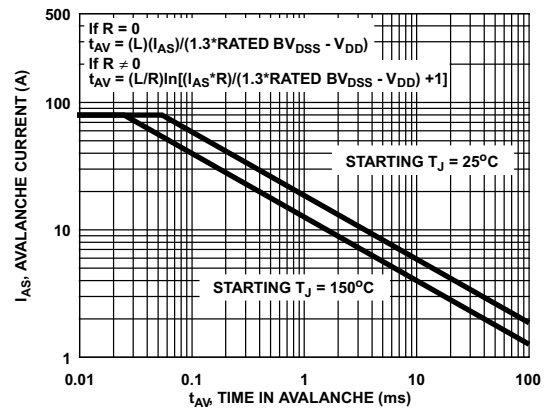


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

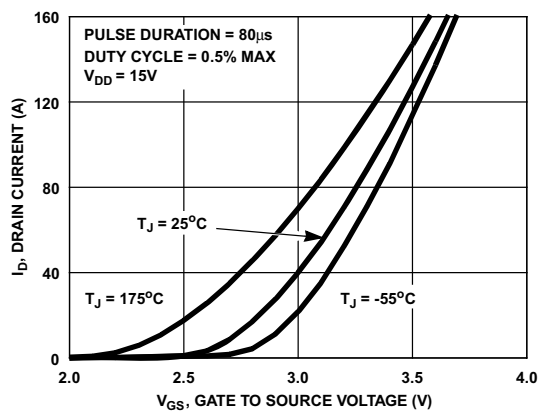


Figure 7. Transfer Characteristics

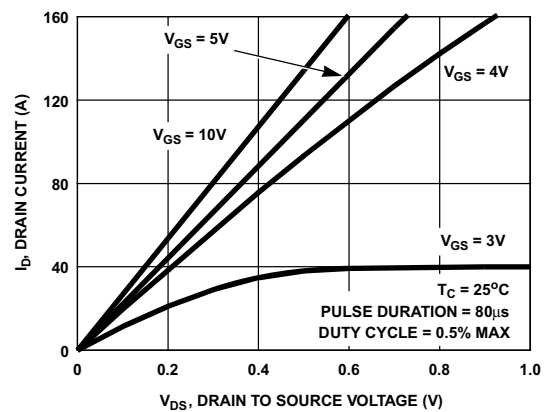


Figure 8. Saturation Characteristics

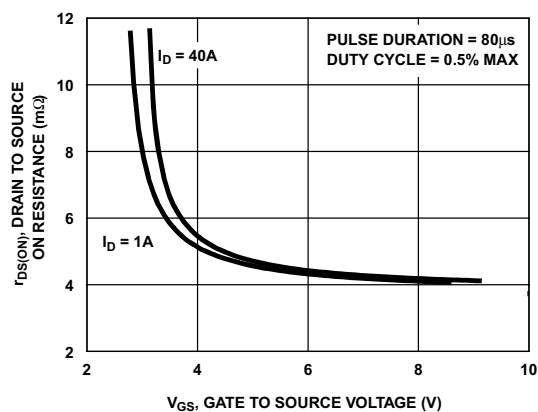


Figure 9. Drain to Source On Resistance vs Gate Voltage and Drain Current

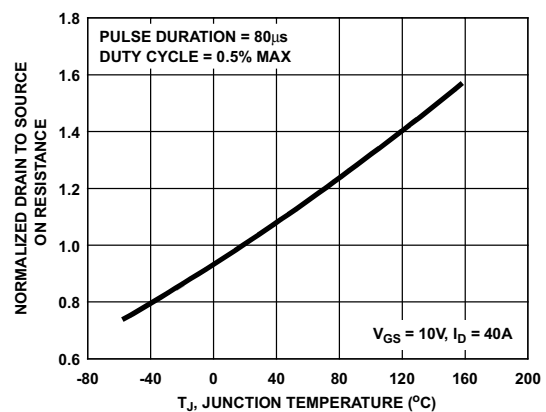


Figure 10. Normalized Drain to Source On Resistance vs Junction Temperature

Typical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

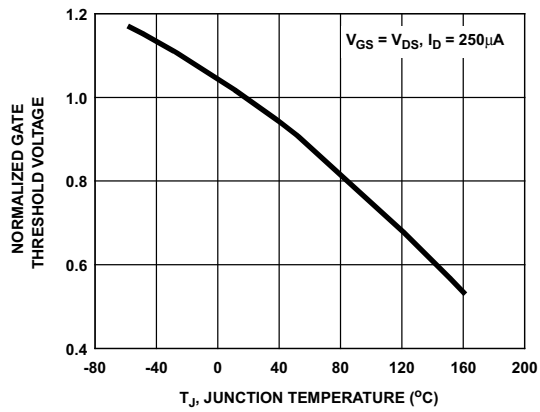


Figure 11. Normalized Gate Threshold Voltage vs Junction Temperature

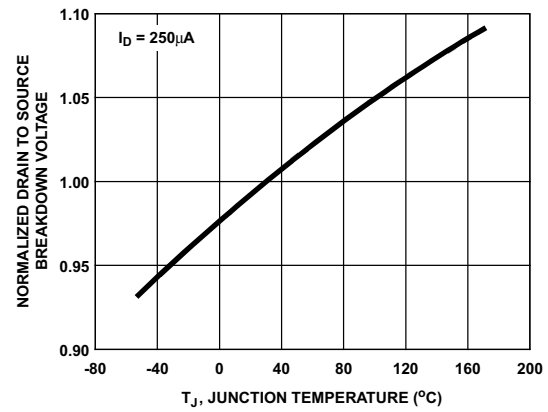


Figure 12. Normalized Drain to Source Breakdown Voltage vs Junction Temperature

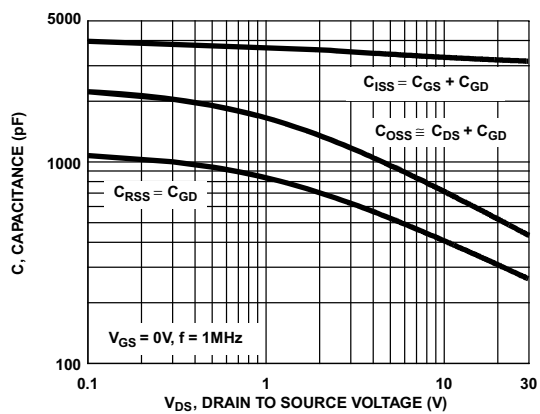


Figure 13. Capacitance vs Drain to Source Voltage

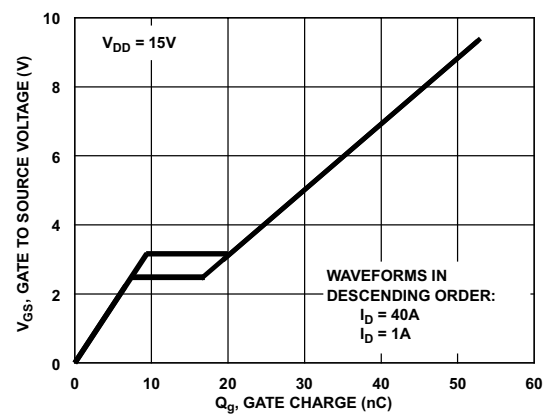


Figure 14. Gate Charge Waveforms for Constant Gate Current

Test Circuits and Waveforms

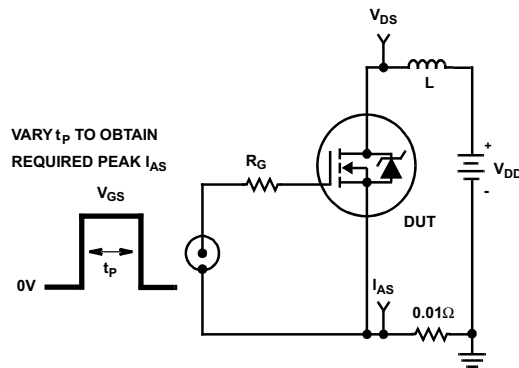


Figure 15. Unclamped Energy Test Circuit

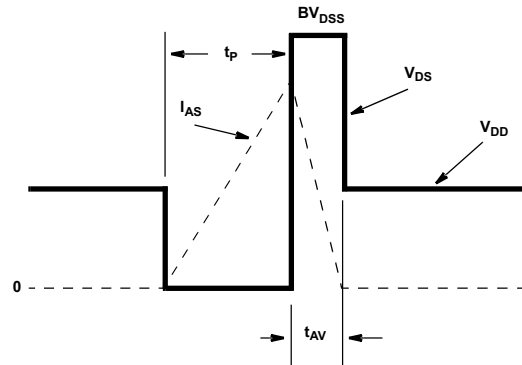


Figure 16. Unclamped Energy Waveforms

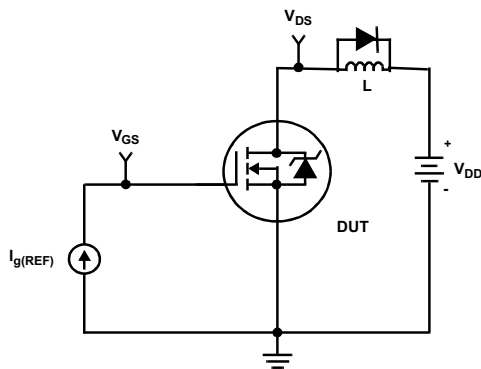


Figure 17. Gate Charge Test Circuit

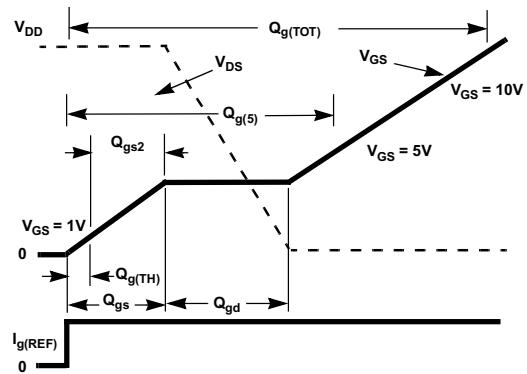


Figure 18. Gate Charge Waveforms

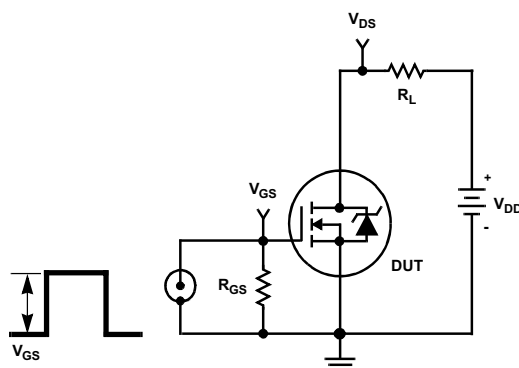


Figure 19. Switching Time Test Circuit

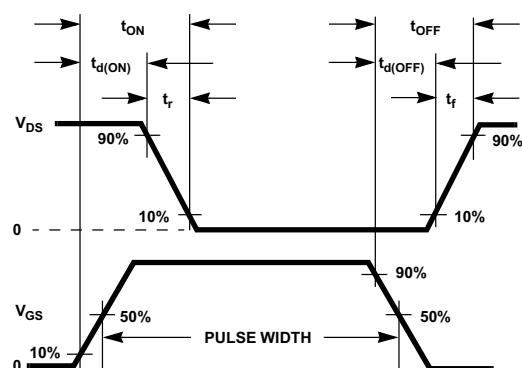


Figure 20. Switching Time Waveforms

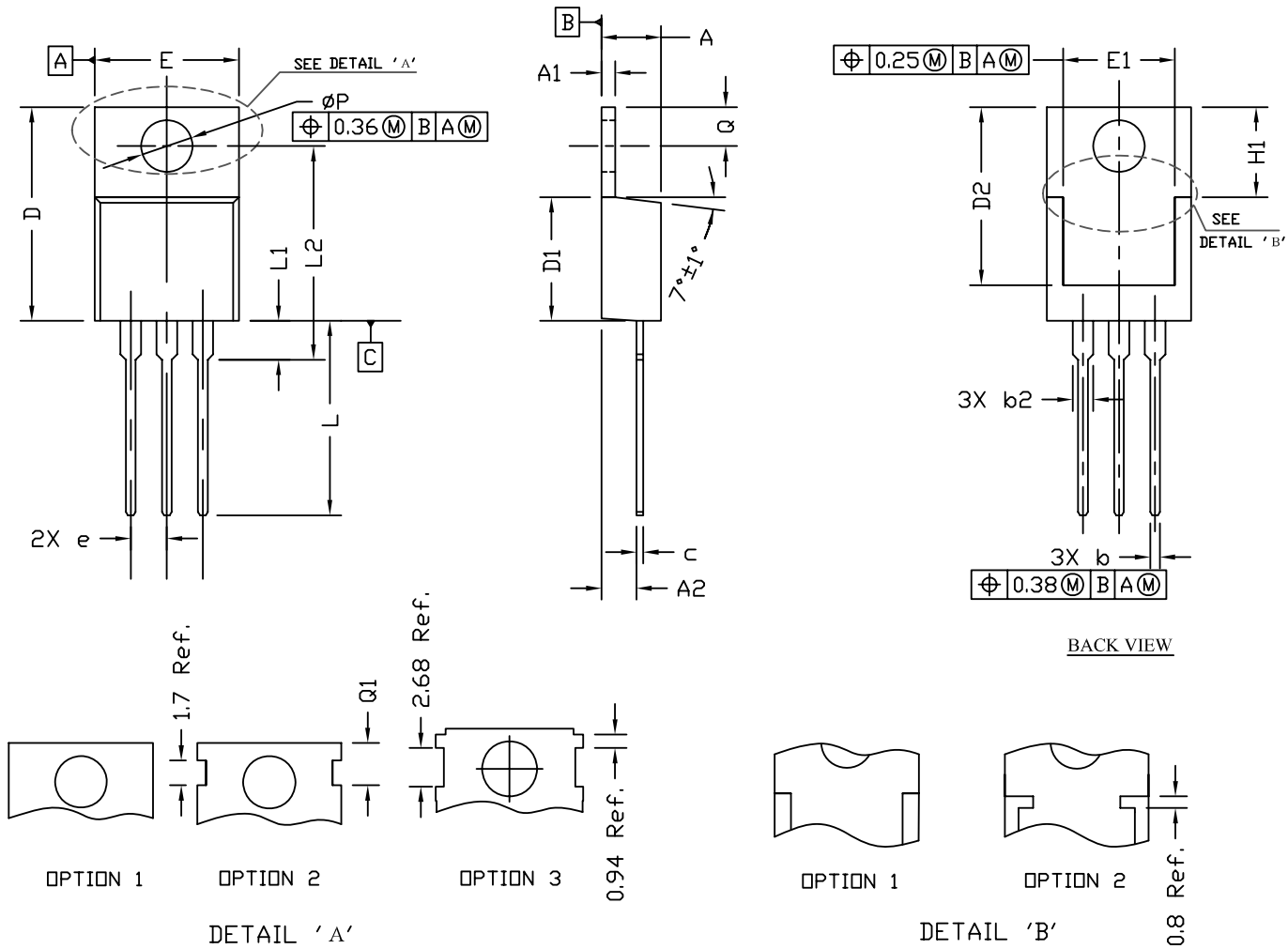
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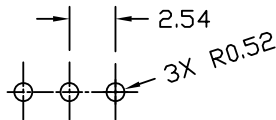
Version

L

TO220 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
ϕP	3.50	3.84	3.89	0.138	0.151	0.153
Q1	2.70	---	2.90	0.106	---	0.114

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