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# MOSFET – P-Channel 30 V POWERTRENCH®

## FDT458P

### Description

This P-Channel MOSFET has been Designed Specifically to Improve the Overall Efficiency of DC/DC Converters using either Synchronous or Conventional Switching PWM Controllers, and battery chargers.

These MOSFETs Feature Faster Switching and lower gate charge than other MOSFETs with comparable  $R_{DS(ON)}$  specifications.

### Features

- 3.4 A, -30 V.
  - ◆  $R_{DS(on)} = 130\text{ m}\Omega @ V_{GS} = 10\text{ V}$
  - ◆  $R_{DS(on)} = 200\text{ m}\Omega @ V_{GS} = 4.5\text{ V}$
- Fast switching speed
- Low gate charge (2.5 nC typical)
- High Performance Trench Technology for Extremely Low  $R_{DS(on)}$
- High Power and Current Handling Capability in a Widely Used Surface Mount Package
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- Battery Chargers
- Motor Drives

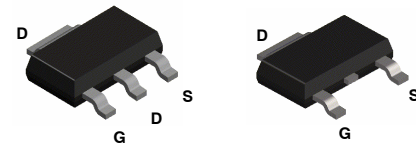
### MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain-Source Voltage	-30	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current –Continuous (Note 1a)	3.4	A
	–Pulsed	10	
$P_D$	Maximum Power Dissipation (Note 1a)	3.0	W
	(Note 1b)	1.3	
	(Note 1c)	1.1	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range.	-55 to +150	$^\circ\text{C}$

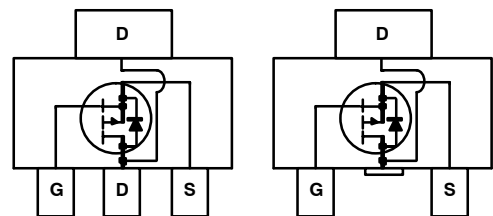
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

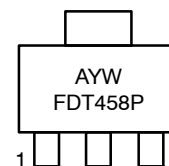
Symbol	Parameter	Value	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	42	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	12	



SOT-223  
CASE 318H



### MARKING DIAGRAM



- FDT4584P = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- = Pb Free Package

### ORDERING INFORMATION

Device	Package	Shipping†
FDT458P	SOT-223 (Pb-Free)	4000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).

# FDT458P

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### Off Characteristics

BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	-30	-	-	V
$\frac{\Delta BV_{DSS(th)}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = -250 μA, Referenced to 25°C	-	-23	-	mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -24 V, V <sub>GS</sub> = 0 V	-	-	1	μA
I <sub>GSSF</sub>	Gate-Body Leakage, Forward	V <sub>GS</sub> = 25 V, V <sub>DS</sub> = 0 V	-	-	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage, Reverse	V <sub>GS</sub> = -25 V, V <sub>DS</sub> = 0 V	-	-	-100	nA

### On Characteristics (Note 2)

V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA	-1	-1.8	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I <sub>D</sub> = -250 μA, referenced to 25°C	-	4	-	mV/°C
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -3.4 A	-	105	130	mΩ
		V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -2.7 A	-	157	200	
		V <sub>GS</sub> = -10 V, I <sub>D</sub> = -3.4 A, T <sub>J</sub> = 125°C	-	147	210	
I <sub>D(on)</sub>	On-State Drain Current	V <sub>GS</sub> = -10 V, V <sub>DS</sub> = -5 V	-5	-	-	A
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = -5 V, I <sub>D</sub> = -3.4 A	-	3	-	S

### Dynamic Characteristics

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = -15 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	-	205	-	pF
C <sub>oss</sub>	Output Capacitance		-	55	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	26	-	pF

### Switching Characteristics (Note 2)

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = -15 V, I <sub>D</sub> = -1 A, V <sub>GS</sub> = -10 V, R <sub>GEN</sub> = 6 Ω	-	4.5	9	ns
t <sub>r</sub>	Turn-On Rise Time		-	12.5	23	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	11	20	ns
t <sub>f</sub>	Turn-Off Fall Time		-	2	4	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = -15 V, I <sub>D</sub> = -3.4 A, V <sub>GS</sub> = -10 V	-	2.5	3.5	nC
Q <sub>gs</sub>	Gate-Source Charge		-	0.7	-	nC
Q <sub>gd</sub>	Gate-Drain Charge		-	1	-	nC

# FDT458P

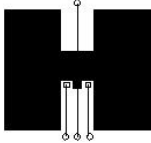
## ELECTRICAL CHARACTERISTICS (continued) ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Drain–Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain–Source Diode Forward Current		–	–	–2.5	A
$V_{SD}$	Drain–Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = -2.5\text{ A}$ (Note 2)	–	–0.8	–1.2	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

### NOTES:

- $R_{\theta JA}$  is the sum of the junction–to–case and case–to–ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user’s board design.



a).  $42^\circ\text{C/W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b).  $95^\circ\text{C/W}$  when mounted on a 0.0066 in<sup>2</sup> pad of 2 oz copper.



c).  $110^\circ\text{C/W}$  when mounted on a minimum pad.

- Pulse Test : Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%

TYPICAL CHARACTERISTICS  $T_J = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED

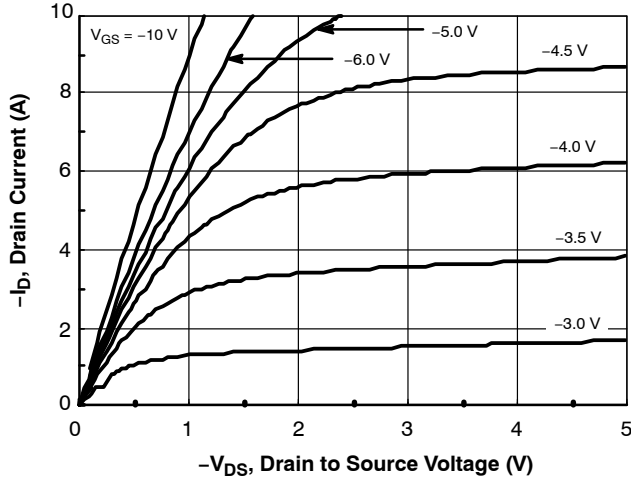


Figure 1. On-Region Characteristics

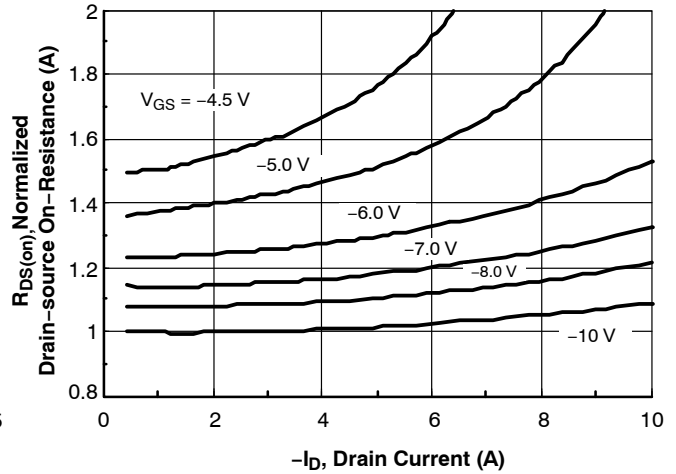


Figure 2. On-Resistance Variation With Drain Current and Gate Voltage

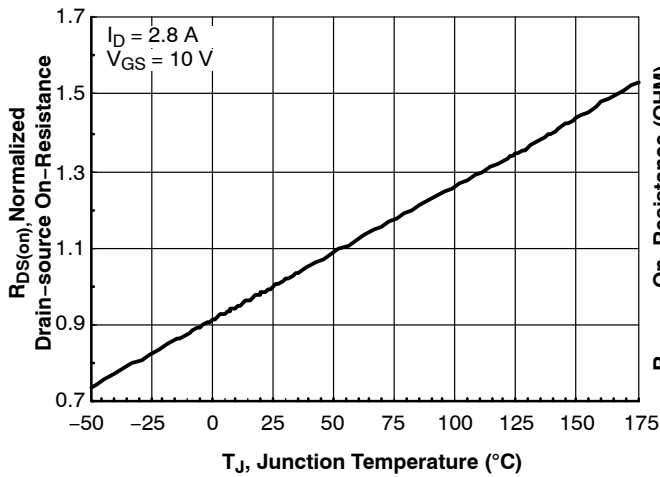


Figure 3. On-Resistance Variation With Temperature

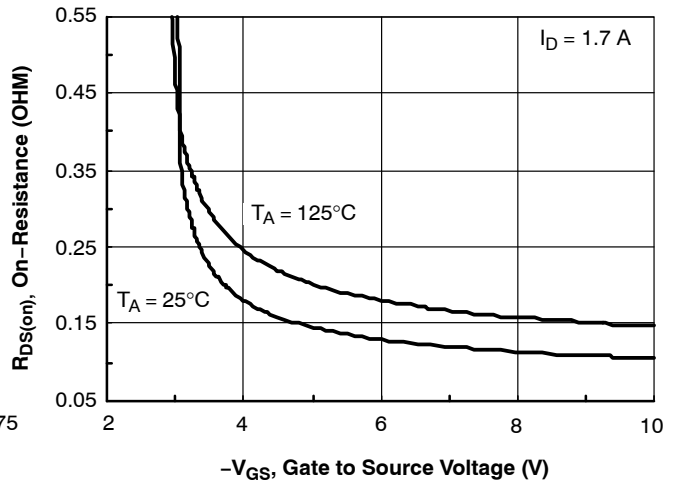


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

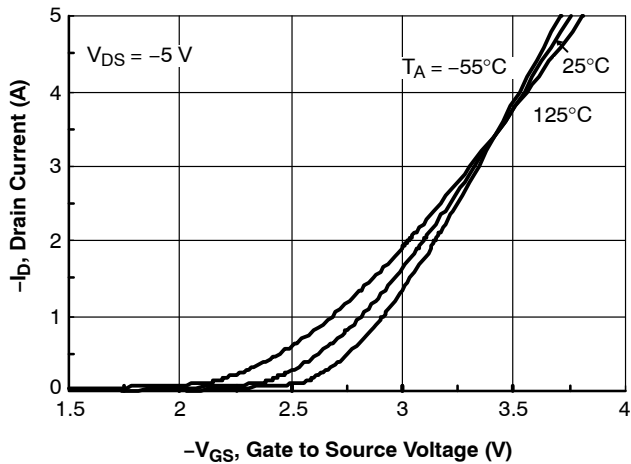


Figure 5. Transfer Characteristics

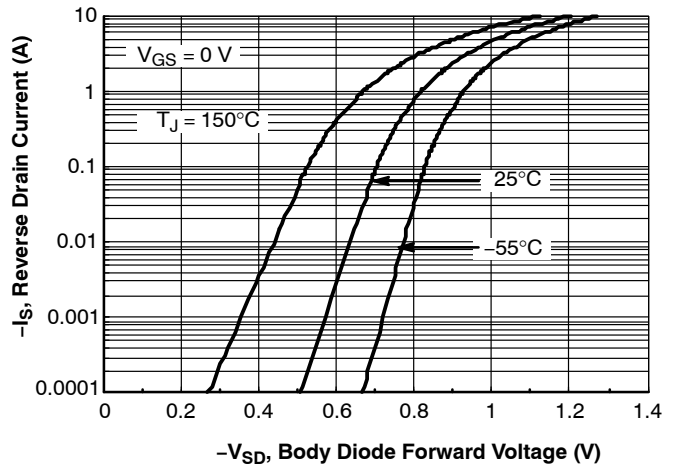


Figure 6. Body Diode Forward Voltage Variation With Source Current and Temperature

TYPICAL CHARACTERISTICS (CONTINUED)  $T_J = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED

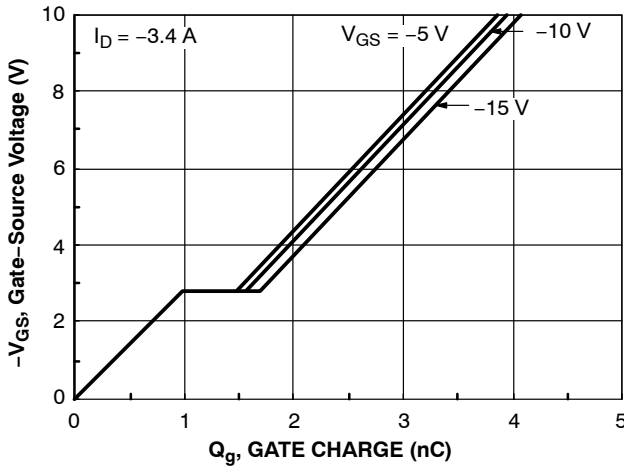


Figure 7. Gate Charge Characteristics

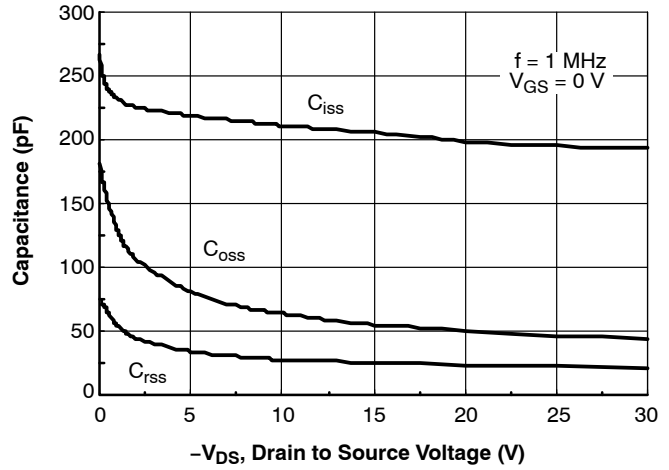


Figure 8. Capacitance Characteristics

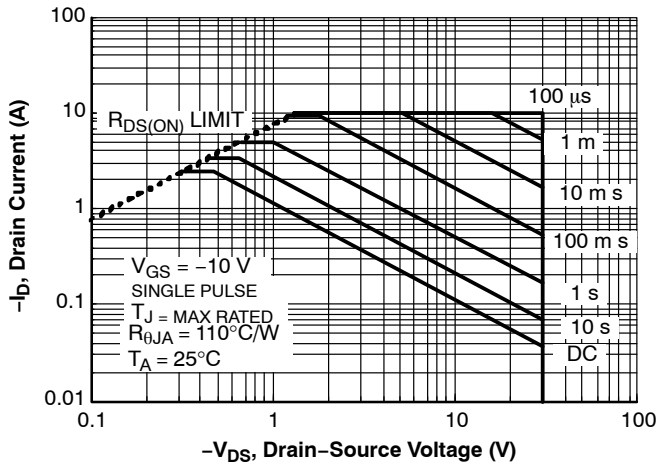


Figure 9. Maximum Safe Operating Area

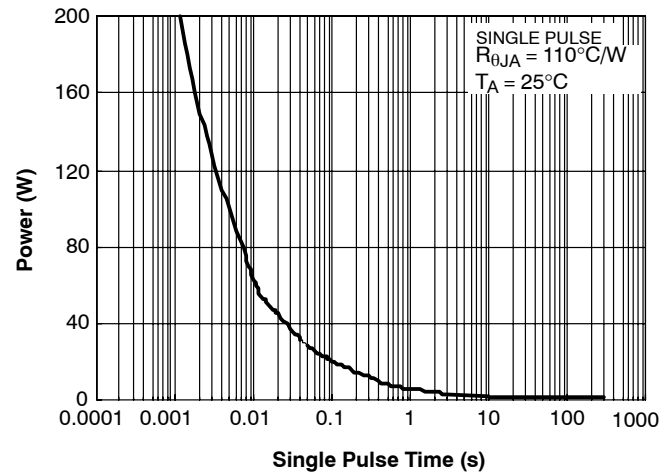


Figure 10. Single Pulse Maximum Power Dissipation.

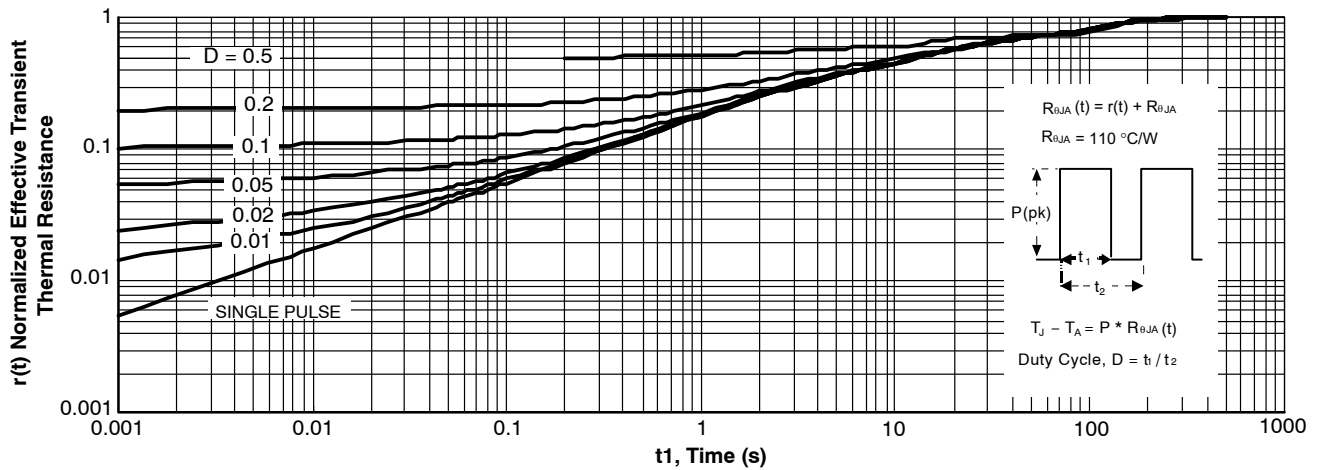
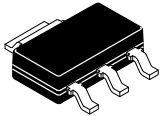


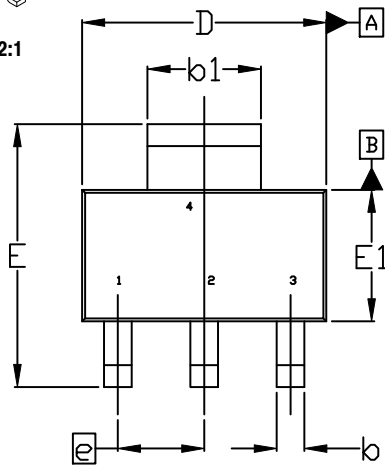
Figure 11. Transient Thermal Response Curve.



SCALE 2:1

SOT-223  
CASE 318H  
ISSUE B

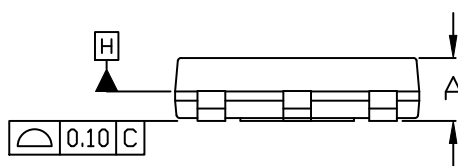
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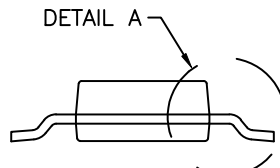
TOP VIEW

$\text{C} \text{ A} \text{ B}$

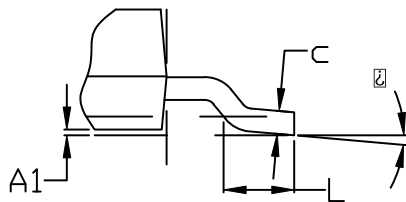
NOTE 7



SIDE VIEW



END VIEW



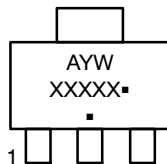
DETAIL A

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D & E1 ARE DETERMINED AT DATUM H. DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. SHALL NOT EXCEED 0.23mm PER SIDE.
4. LEAD DIMENSIONS b AND b1 DO NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION IS 0.08mm PER SIDE.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. A1 IS DEFINED AS THE VERTICAL DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT OF THE PACKAGE BODY.
7. POSITIONAL TOLERANCE APPLIES TO DIMENSIONS b AND b1.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	---	---	1.80
A1	0.02	0.06	0.11
b	0.60	0.74	0.88
b1	2.90	3.00	3.10
c	0.24	---	0.35
D	6.30	6.50	6.70
E	6.70	7.00	7.30
E1	3.30	3.50	3.70
e	2.30 BSC		
L	0.25	---	---
$\text{C}$	0°	---	10°

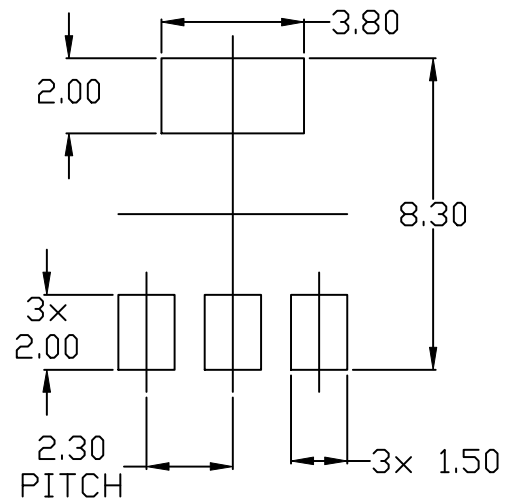
GENERIC MARKING DIAGRAM\*



- A = Assembly Location
- Y = Year
- W = Work Week
- XXXXX = Specific Device Code
- = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



RECOMMENDED MOUNTING FOOTPRINT

\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERM/D.

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