

# MTB55N06Z

Preferred Device

## Power MOSFET 55 Amps, 60 Volts N-Channel D<sup>2</sup>PAK

This Power MOSFET is designed to withstand high energy in the avalanche mode and switch efficiently. This high energy device also offers a drain-to-source diode with fast recovery time. Designed for high voltage, high speed switching applications in power supplies, PWM motor controls and other inductive loads, the avalanche energy capability is specified to eliminate the guesswork in designs where inductive loads are switched and offer additional safety margin against unexpected voltage transients.

- Avalanche Energy Capability Specified at Elevated Temperature
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Low Stored Gate Charge for Efficient Switching
- Internal Source-to-Drain Diode Designed to Replace External Zener Transient Suppressor—Absorbs High Energy in the Avalanche Mode
- ESD Protected. Designed to Typically Withstand 400 V Machine Model and 4000 V Human Body Model.

### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V <sub>DSS</sub>	60	Vdc
Drain-to-Gate Voltage (R <sub>GS</sub> = 1.0 MΩ)	V <sub>DGR</sub>	60	Vdc
Gate-to-Source Voltage	V <sub>GS</sub>	±20	Vdc
– Continuous	V <sub>GSM</sub>	±40	Vpk
– Non-Repetitive (t <sub>p</sub> ≤ 10 ms)			
Drain Current	I <sub>D</sub>	55	Adc
– Continuous @ T <sub>C</sub> = 25°C	I <sub>D</sub>	35.5	
– Continuous @ T <sub>C</sub> = 100°C	I <sub>DM</sub>	165	Apk
– Single Pulse (t <sub>p</sub> ≤ 10 μs)			
Total Power Dissipation @ T <sub>C</sub> = 25°C	P <sub>D</sub>	113	Watts
Derate above 25°C		0.91	W/°C
Total Power Dissipation @ T <sub>A</sub> = 25°C (Note NO TAG)		2.5	
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	– 55 to 150	°C
Single Pulse Drain-to-Source Avalanche Energy – Starting T <sub>J</sub> = 25°C (V <sub>DD</sub> = 25 Vdc, V <sub>DS</sub> = 60 Vdc, V <sub>GS</sub> = 10 Vdc, Peak I <sub>L</sub> = 55 Apk, L = 0.3 mH, R <sub>G</sub> = 25 Ω)	E <sub>AS</sub>	454	mJ
Thermal Resistance	R <sub>θJC</sub>	1.1	°C/W
– Junction to Case	R <sub>θJC</sub>	62.5	
– Junction to Ambient	R <sub>θJA</sub>	50	
– Junction to Ambient (Note NO TAG)			
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	T <sub>L</sub>	260	°C

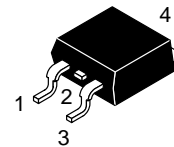
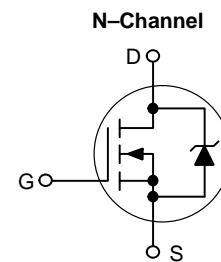
1. When surface mounted to an FR4 board using the minimum recommended pad size.



ON Semiconductor™

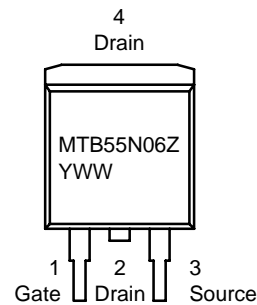
<http://onsemi.com>

**55 AMPERES**  
**60 VOLTS**  
**RDS(on) = 18 mΩ**



**D<sup>2</sup>PAK**  
**CASE 418B**  
**STYLE 2**

### MARKING DIAGRAM & PIN ASSIGNMENT



MTB55N06Z = Device Code  
Y = Year  
WW = Work Week

### ORDERING INFORMATION

Device	Package	Shipping
MTB55N06Z	D <sup>2</sup> PAK	50 Units/Rail
MTB55N06ZT4	D <sup>2</sup> PAK	800/Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

# MTB55N06Z

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Drain-to-Source Breakdown Voltage (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 μAdc) Temperature Coefficient (Positive)	V <sub>(BR)DSS</sub>	60 –	– 53	– –	Vdc mV/°C
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 60 Vdc, V <sub>GS</sub> = 0 Vdc) (V <sub>DS</sub> = 60 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	I <sub>DSS</sub>	– –	– –	1.0 10	μAdc
Gate-Body Leakage Current (V <sub>GS</sub> = ±20 Vdc, V <sub>DS</sub> = 0 Vdc)	I <sub>GSS</sub>	–	–	100	nAdc

## ON CHARACTERISTICS (Note 2.)

Gate Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc) Threshold Temperature Coefficient (Negative)	V <sub>GS(th)</sub>	2.0 –	3.0 6.0	4.0 –	Vdc mV/°C
Static Drain-to-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 27.5 Adc)	R <sub>DS(on)</sub>	–	14	18	mΩ
Drain-to-Source On-Voltage (V <sub>GS</sub> = 10 Vdc) (I <sub>D</sub> = 55 Adc) (I <sub>D</sub> = 27.5 Adc, T <sub>J</sub> = 125°C)	V <sub>DS(on)</sub>	– –	0.825 0.74	1.2 1.0	Vdc
Forward Transconductance (V <sub>DS</sub> = 4.0 Vdc, I <sub>D</sub> = 27.5 Adc)	g <sub>FS</sub>	12	15	–	Mhos

## DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = 25 Vdc, V <sub>GS</sub> = 0 Vdc, f = 1.0 MHz)	C <sub>iss</sub>	–	1390	1950	pF
Output Capacitance		C <sub>oss</sub>	–	520	730	
Transfer Capacitance		C <sub>rss</sub>	–	119	238	

## SWITCHING CHARACTERISTICS (Note 3.)

Turn-On Delay Time	(V <sub>DD</sub> = 30 Vdc, I <sub>D</sub> = 55 Adc, V <sub>GS(on)</sub> = 10 Vdc, R <sub>G</sub> = 9.1 Ω)	t <sub>d(on)</sub>	–	27	54	ns
Rise Time		t <sub>r</sub>	–	157	314	
Turn-Off Delay Time		t <sub>d(off)</sub>	–	116	232	
Fall Time		t <sub>f</sub>	–	126	252	
Gate Charge (See Figure 8)	(V <sub>DS</sub> = 48 Vdc, I <sub>D</sub> = 55 Adc, V <sub>GS</sub> = 10 Vdc)	Q <sub>T</sub>	–	40	56	nC
		Q <sub>1</sub>	–	7.0	–	
		Q <sub>2</sub>	–	18	–	
		Q <sub>3</sub>	–	15	–	

## SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage	(I <sub>S</sub> = 55 Adc, V <sub>GS</sub> = 0 Vdc) (I <sub>S</sub> = 55 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	V <sub>SD</sub>	– –	0.93 0.82	1.1 –	Vdc
Reverse Recovery Time	(I <sub>S</sub> = 55 Adc, V <sub>GS</sub> = 0 Vdc, dI <sub>S</sub> /dt = 100 A/μs)	t <sub>rr</sub>	–	57	–	ns
		t <sub>a</sub>	–	32	–	
		t <sub>b</sub>	–	25	–	
Reverse Recovery Stored Charge		Q <sub>RR</sub>	–	0.11	–	μC

## INTERNAL PACKAGE INDUCTANCE

Internal Drain Inductance (Measured from contact screw on tab to center of die) (Measured from drain lead 0.25" from package to center of die)	L <sub>D</sub>	– –	3.5 4.5	– –	nH
Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad)	L <sub>S</sub>	–	7.5	–	

- Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
- Switching characteristics are independent of operating junction temperature.

# MTB55N06Z

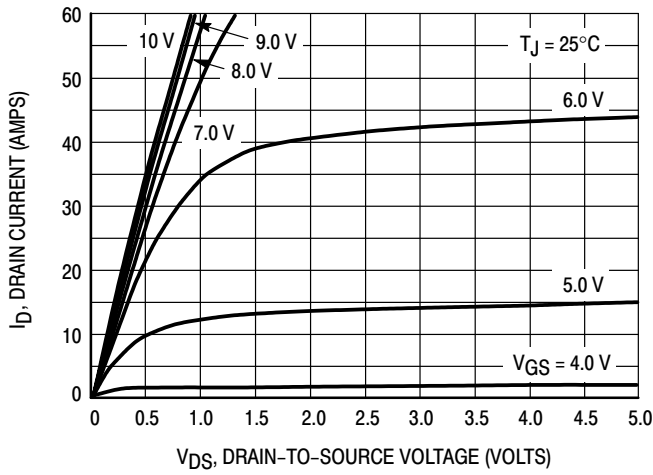


Figure 1. On-Region Characteristics

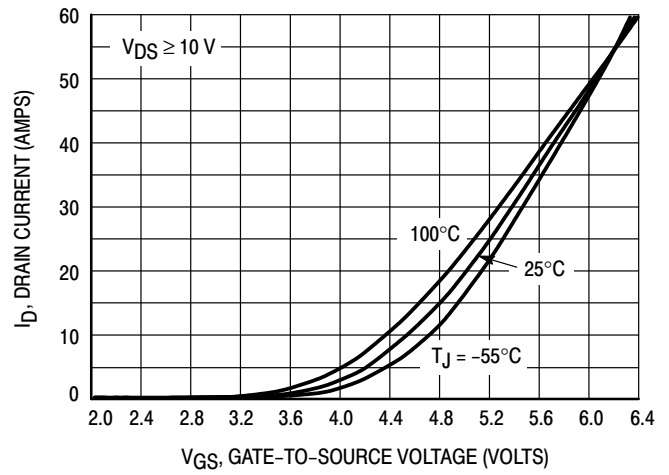


Figure 2. Transfer Characteristics

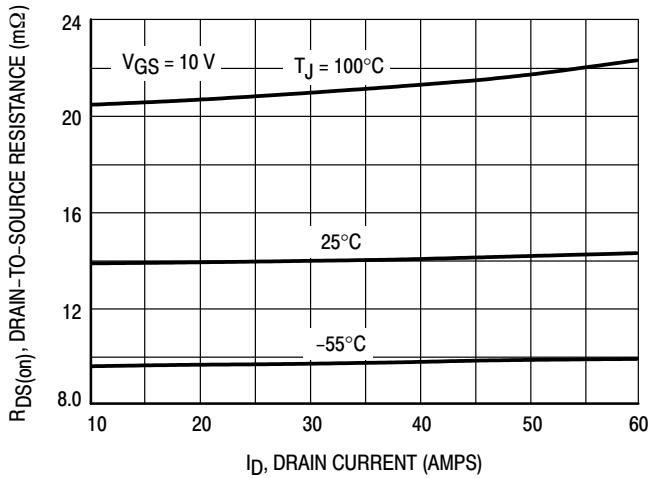


Figure 3. On-Resistance versus Drain Current and Temperature

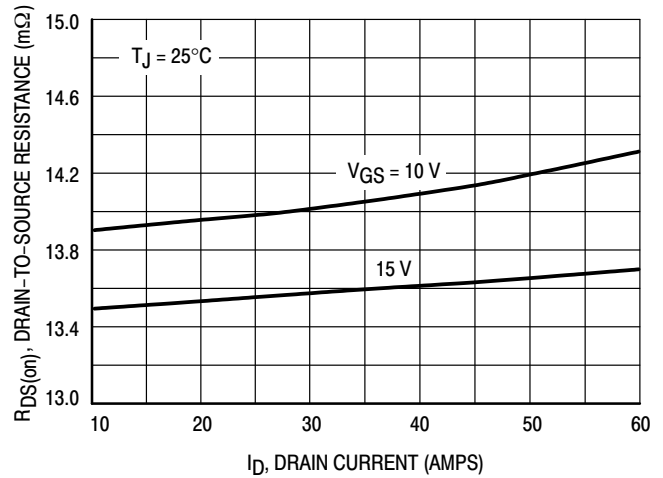


Figure 4. On-Resistance versus Drain Current and Gate Voltage

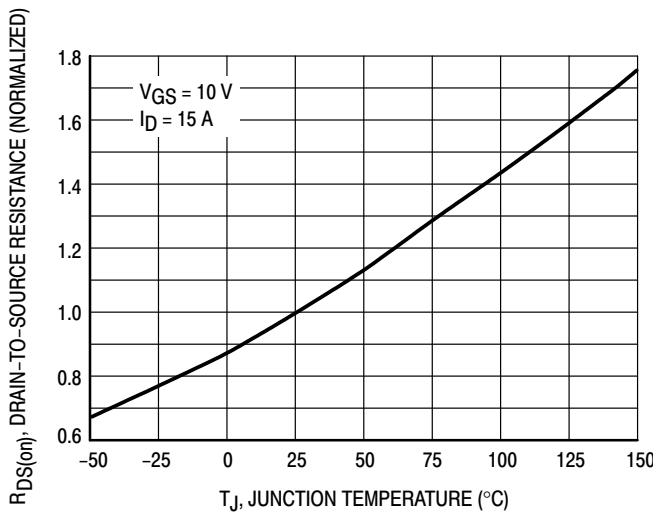


Figure 5. On-Resistance Variation with Temperature

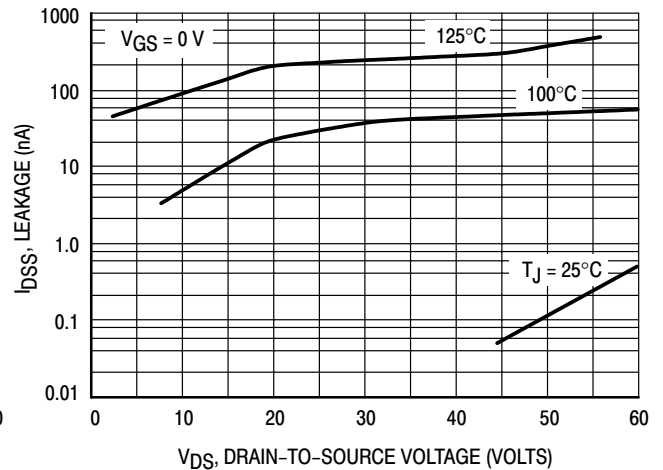


Figure 6. Drain-to-Source Leakage Current versus Voltage

MTB55N06Z

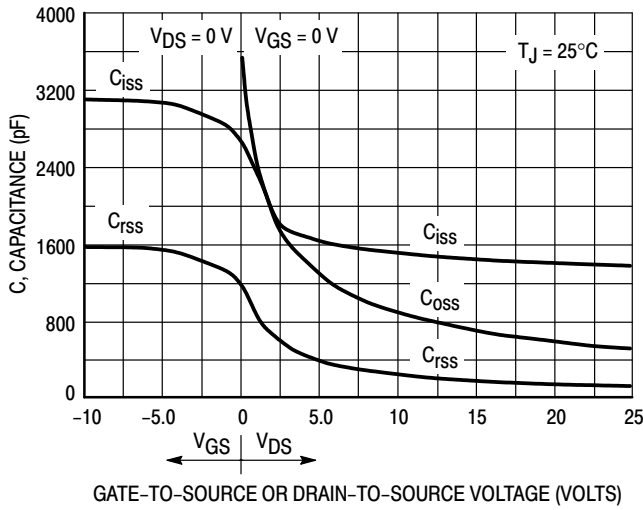


Figure 7. Capacitance Variation

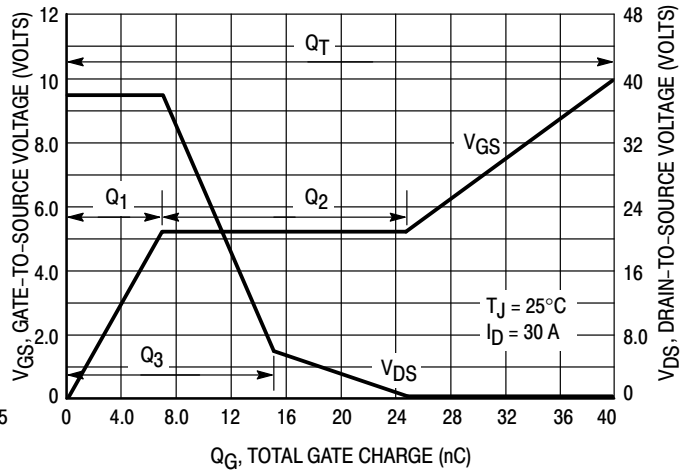


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

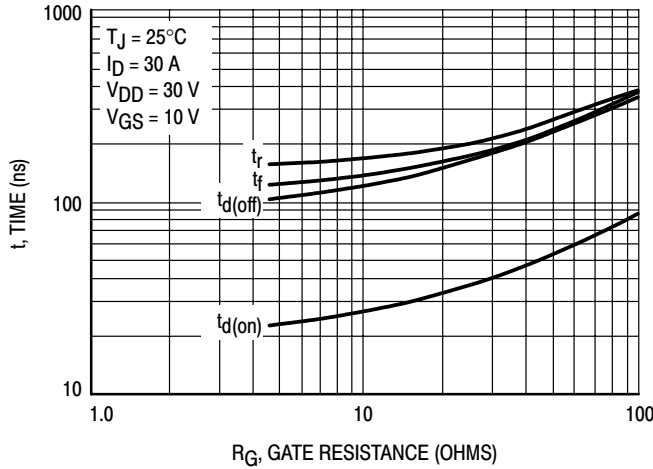


Figure 9. Resistive Switching Time Variation versus Gate Resistance

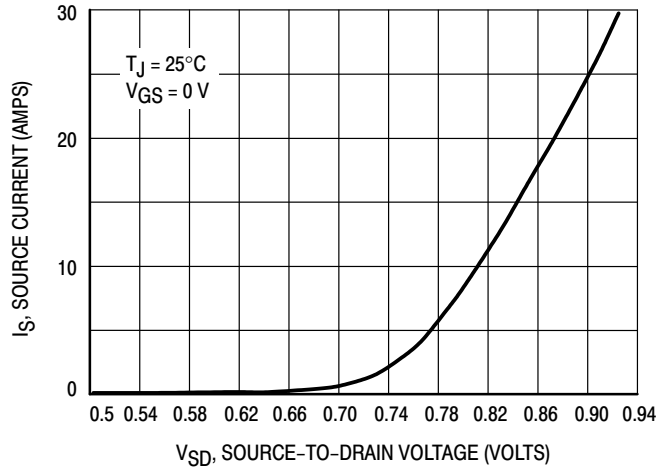


Figure 10. Diode Forward Voltage versus Current

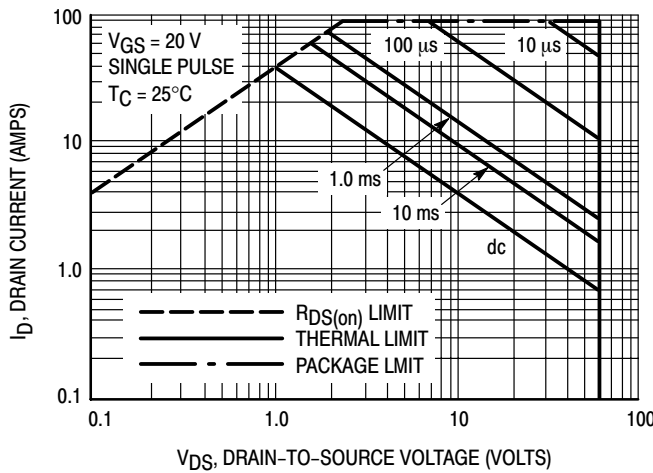


Figure 11. Maximum Rated Forward Biased Safe Operating Area

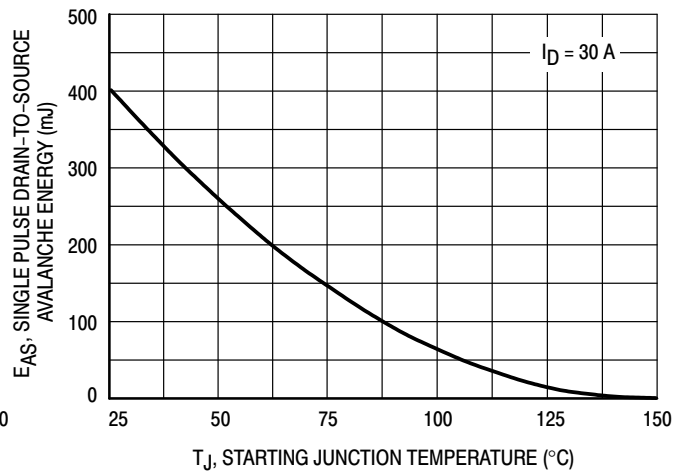


Figure 12. Maximum Avalanche Energy versus Starting Junction Temperature

# MTB55N06Z

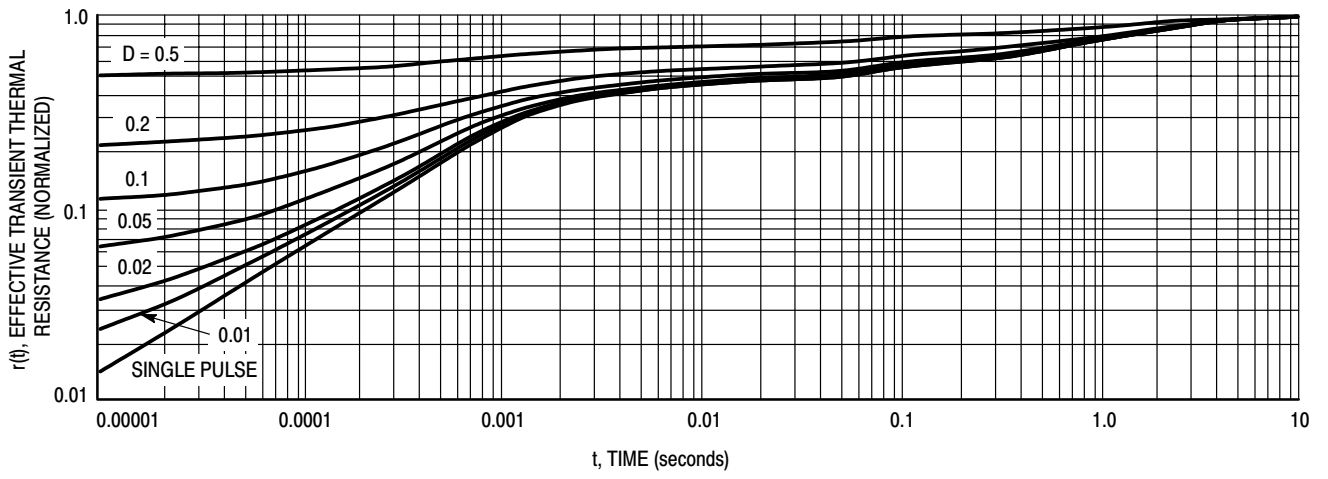
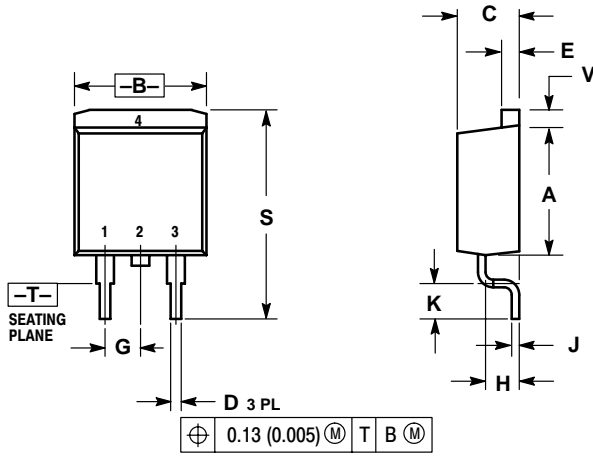


Figure 13. Thermal Response

# MTB55N06Z

## PACKAGE DIMENSIONS

**D2PAK**  
CASE 418B-03  
ISSUE D



- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

- STYLE 2:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

**Notes**

**ON Semiconductor** and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

## PUBLICATION ORDERING INFORMATION

### **NORTH AMERICA Literature Fulfillment:**

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** ONlit@hibbertco.com  
Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

**EUROPE:** LDC for ON Semiconductor – European Support

**German Phone:** (+1) 303-308-7140 (Mon-Fri 2:30pm to 7:00pm CET)  
**Email:** ONlit-german@hibbertco.com  
**French Phone:** (+1) 303-308-7141 (Mon-Fri 2:00pm to 7:00pm CET)  
**Email:** ONlit-french@hibbertco.com  
**English Phone:** (+1) 303-308-7142 (Mon-Fri 12:00pm to 5:00pm GMT)  
**Email:** ONlit@hibbertco.com

**EUROPEAN TOLL-FREE ACCESS\*: 00-800-4422-3781**

\*Available from Germany, France, Italy, UK, Ireland

### **CENTRAL/SOUTH AMERICA:**

**Spanish Phone:** 303-308-7143 (Mon-Fri 8:00am to 5:00pm MST)  
**Email:** ONlit-spanish@hibbertco.com  
**Toll-Free from Mexico:** Dial 01-800-288-2872 for Access –  
then Dial 866-297-9322

**ASIA/PACIFIC:** LDC for ON Semiconductor – Asia Support

**Phone:** 303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)  
**Toll Free from Hong Kong & Singapore:**  
**001-800-4422-3781**

**Email:** ONlit-asia@hibbertco.com

**JAPAN:** ON Semiconductor, Japan Customer Focus Center

4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031  
**Phone:** 81-3-5740-2700  
**Email:** r14525@onsemi.com

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local Sales Representative.