

MOSFET – Power, Single, N-Channel

40 V, 3.7 mΩ, 87 A

NTMFS5C456NL

Features

- Small Footprint (5x6 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Q_G and Capacitance to Minimize Driver Losses
- These Devices are Pb-Free and are RoHS Compliant

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DSS}	40	V
Gate-to-Source Voltage			V_{GS}	± 20	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 3)	Steady State	$T_C = 25^\circ\text{C}$	I_D	87	A
		$T_C = 100^\circ\text{C}$		61	
Power Dissipation $R_{\theta JC}$ (Note 1)		$T_C = 25^\circ\text{C}$	P_D	55	W
		$T_C = 100^\circ\text{C}$		27	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	Steady State	$T_A = 25^\circ\text{C}$	I_D	22	A
		$T_A = 100^\circ\text{C}$		16	
Power Dissipation $R_{\theta JA}$ (Notes 1 & 2)		$T_A = 25^\circ\text{C}$	P_D	3.6	W
		$T_A = 100^\circ\text{C}$		1.8	
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$		I_{DM}	520	A
Operating Junction and Storage Temperature			T_J, T_{stg}	-55 to $+175$	$^\circ\text{C}$
Source Current (Body Diode)			I_S	61	A
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 5 \text{ A}$)			E_{AS}	202	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			T_L	260	$^\circ\text{C}$

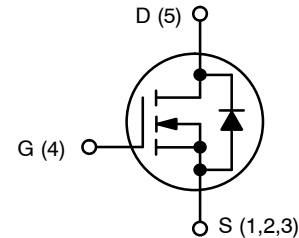
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

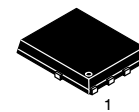
Parameter	Symbol	Value	Unit
Junction-to-Case – Steady State	$R_{\theta JC}$	2.7	$^\circ\text{C/W}$
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	42	

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	3.7 mΩ @ 10 V	87 A
	6.0 mΩ @ 4.5 V	

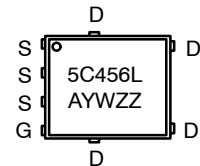


N-CHANNEL MOSFET



DFN5
(SO-8FL)
CASE 488AA
STYLE 1

MARKING DIAGRAM



5C456L = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

NTMFS5C456NL

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		40	–	–	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			–	22	–	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V},$ $V_{DS} = 40\text{ V}$	$T_J = 25\text{ }^{\circ}\text{C}$	–	–	10	μA
			$T_J = 125^{\circ}\text{C}$	–	–	250	
Gate-to-Source Leakage Current	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = 20\text{ V}$		–	–	100	nA

ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _D = 50 μA		1.2	–	2.0	V
Threshold Temperature Coefficient	V _{GS(TH)} /T _J			–	–5.1		mV/°C
Drain-to-Source On Resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 20 A	–	3.1	3.7	mΩ
		V _{GS} = 4.5 V	I _D = 20 A	–	4.8	6.0	
Forward Transconductance	g _{FS}	V _{DS} = 15 V, I _D = 40 A		–	80	–	S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C _{ISS}	V _{GS} = 0 V, f = 1 MHz, V _{DS} = 25 V	–	1600	–	pF
Output Capacitance	C _{OSS}		–	590	–	
Reverse Transfer Capacitance	C _{RSS}		–	21	–	
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 10 V, V _{DS} = 20 V; I _D = 40 A	–	28.8	–	nC
Total Gate Charge	Q _{G(TOT)}	V _{GS} = 4.5 V, V _{DS} = 20 V; I _D = 40 A	–	13.5	–	
Threshold Gate Charge	Q _{G(TH)}		–	2.6	–	
Gate-to-Source Charge	Q _{GS}		–	5.3	–	
Gate-to-Drain Charge	Q _{GD}		–	4.9	–	
Plateau Voltage	V _{GP}		–	3.3	–	V

SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	t _{d(ON)}	V _{GS} = 4.5 V, V _{DS} = 20 V, I _D = 40 A, R _G = 1.0 Ω	–	9.3	–	ns
Rise Time	t _r		–	100	–	
Turn-Off Delay Time	t _{d(OFF)}		–	17	–	
Fall Time	t _f		–	4.0	–	

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V _{SD}	V _{GS} = 0 V, I _S = 40 A	T _J = 25°C	–	0.86	1.2	V
			T _J = 125°C	–	0.75	–	
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 40 A		–	29	–	ns
Charge Time	t _a			–	14	–	
Discharge Time	t _b			–	15	–	
Reverse Recovery Charge	Q _{RR}			–	20	–	nC

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.

4. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

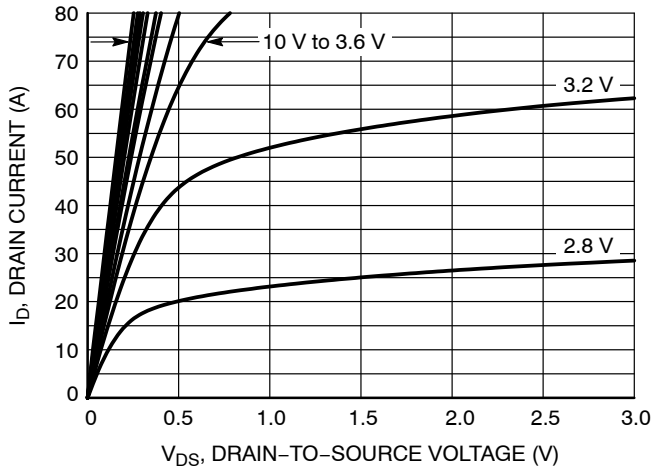


Figure 1. On-Region Characteristics

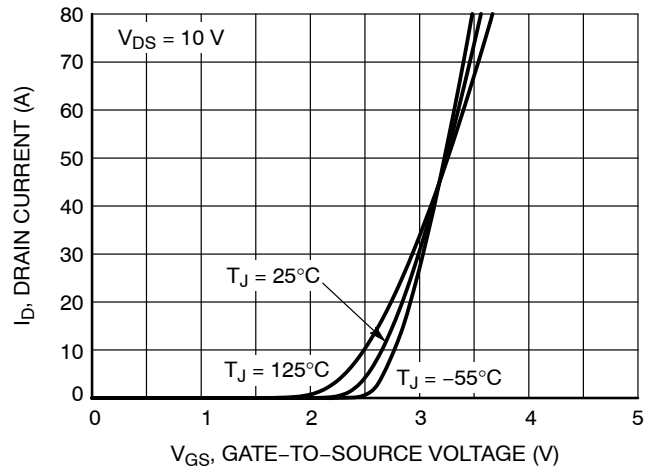


Figure 2. Transfer Characteristics

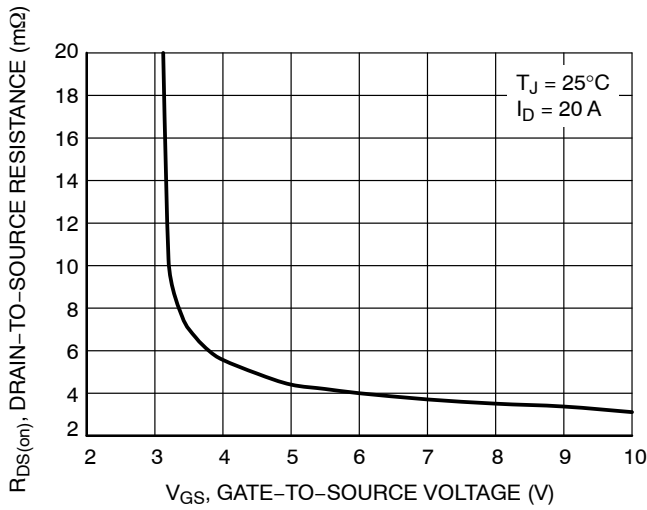


Figure 3. On-Resistance vs. Gate-to-Source Voltage

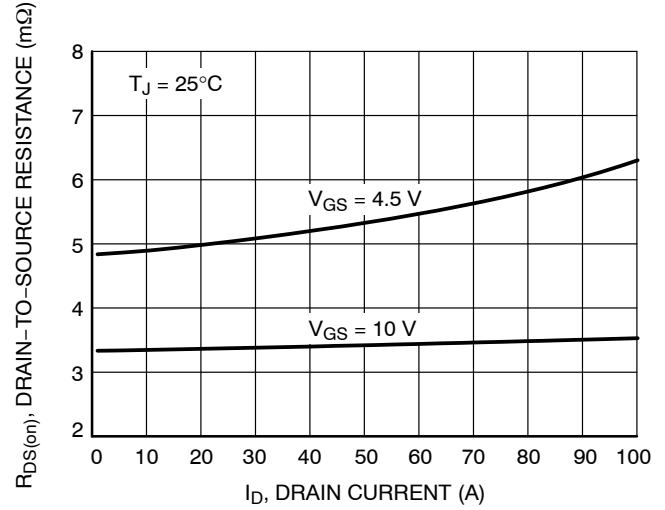


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

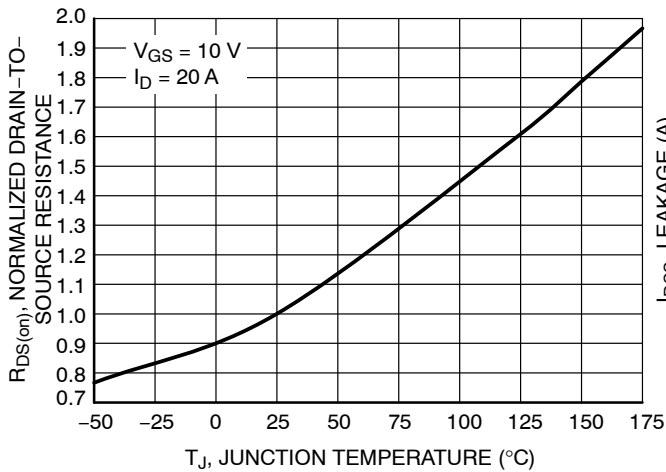


Figure 5. On-Resistance Variation with Temperature

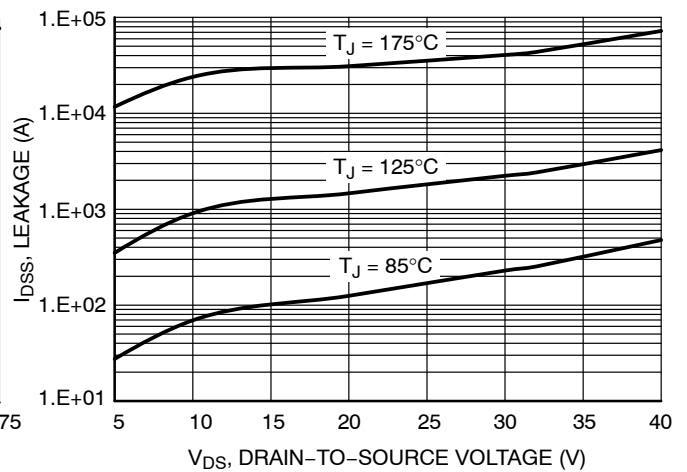


Figure 6. Drain-to-Source Leakage Current vs. Voltage

NTMFS5C456NL

TYPICAL CHARACTERISTICS

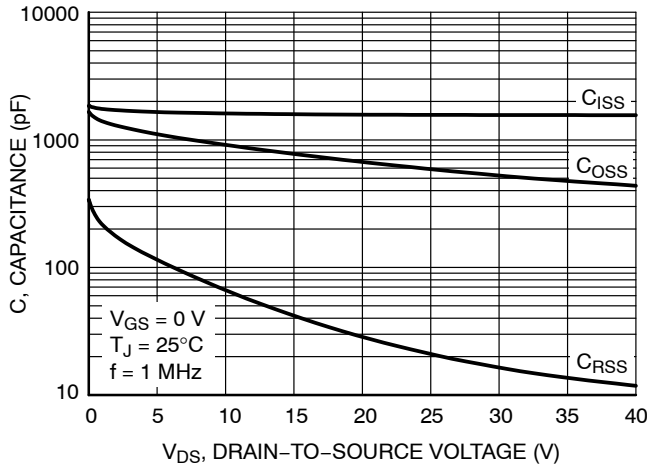


Figure 7. Capacitance Variation

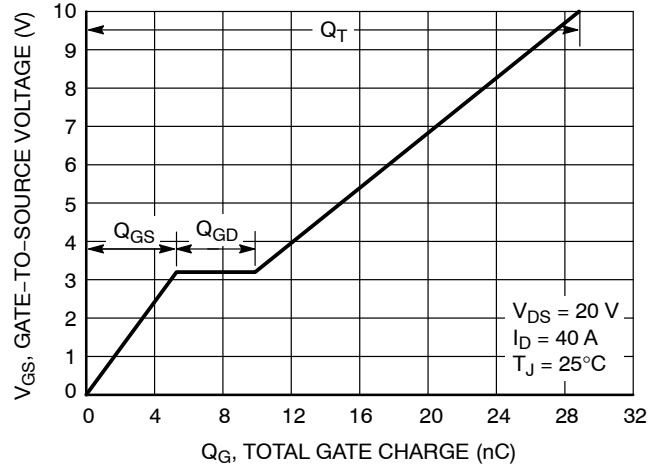


Figure 8. Gate-to-Source Voltage vs. Total Charge

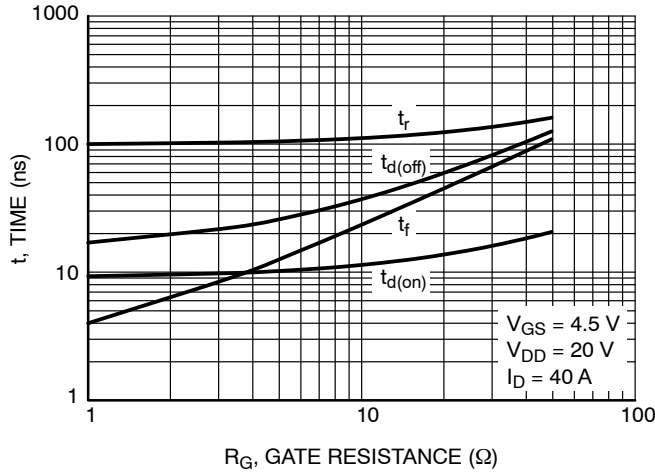


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

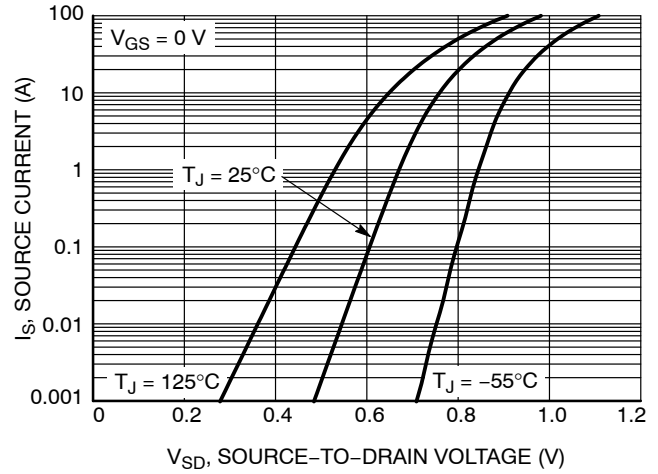


Figure 10. Diode Forward Voltage vs. Current

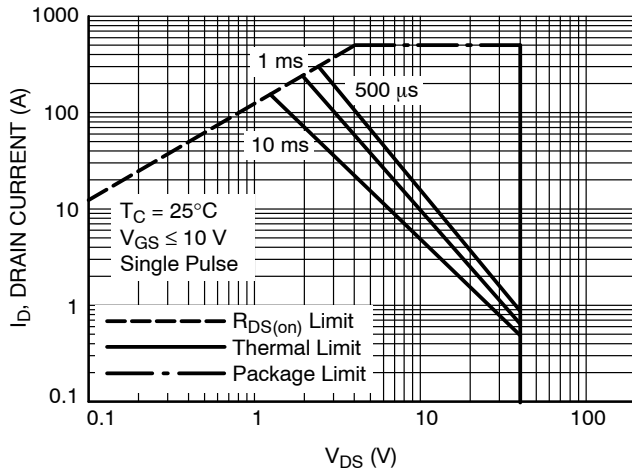


Figure 11. Safe Operating Area

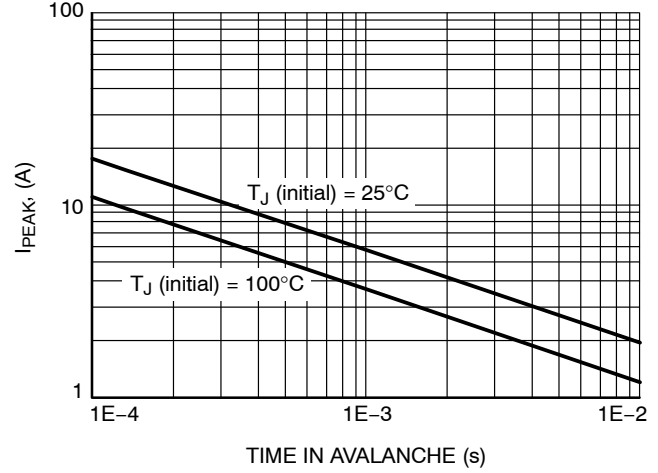


Figure 12. I_{PEAK} vs. Time in Avalanche

NTMFS5C456NL

TYPICAL CHARACTERISTICS

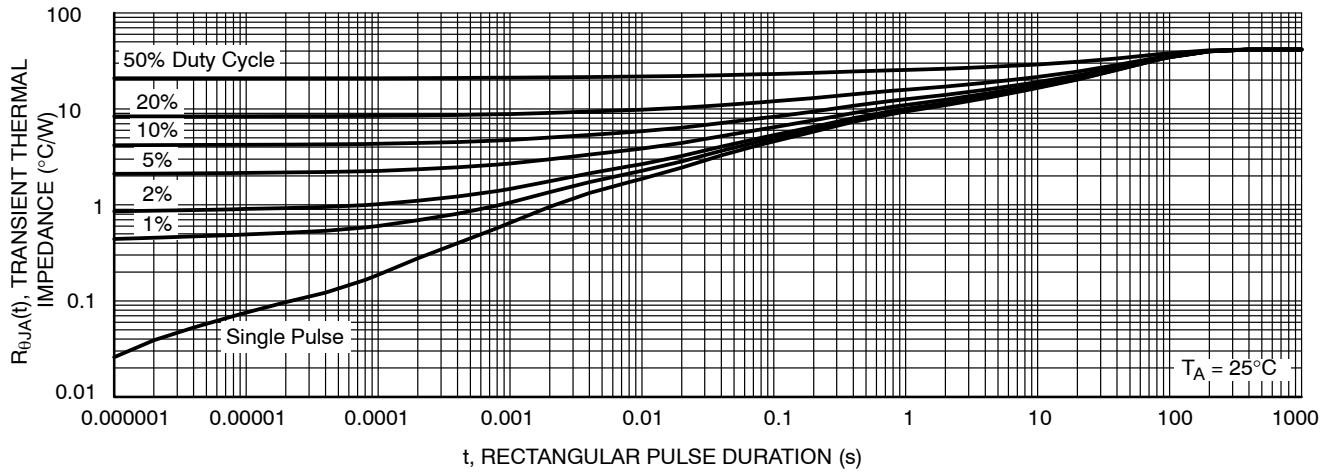


Figure 13. Thermal Response

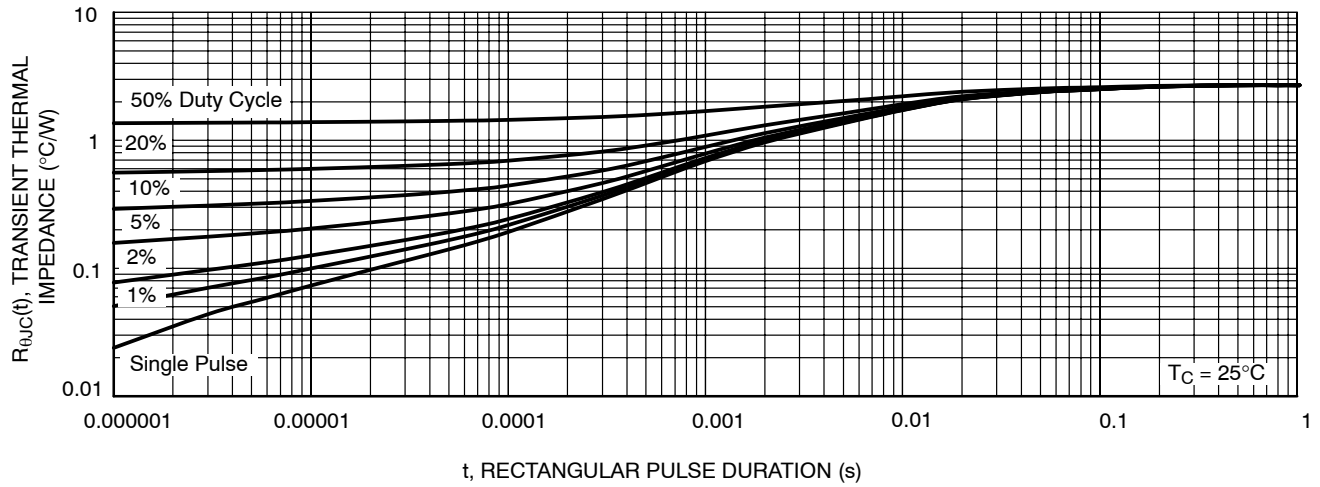


Figure 14. Thermal Response

DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping†
NTMFS5C456NLT1G	5C456L	DFN5 (Pb-Free)	1500 / Tape & Reel
NTMFS5C456NLT3G	5C456L	DFN5 (Pb-Free)	5000 / 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](#).



SCALE 2:1

DFN5 5x6, 1.27P
(SO-8FL)
CASE 488AA
ISSUE N

DATE 25 JUN 2018



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
θ	0°	---	12°

GENERIC
MARKING DIAGRAM*


XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

*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.



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

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