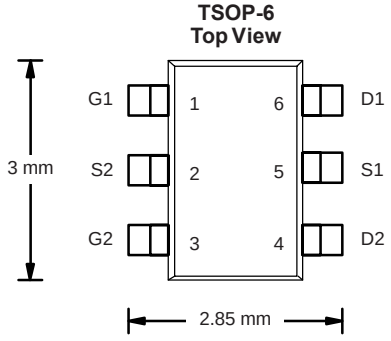
NCE2003-VB Datasheet
N- and P-Channel 20V (D-S) MOSFET

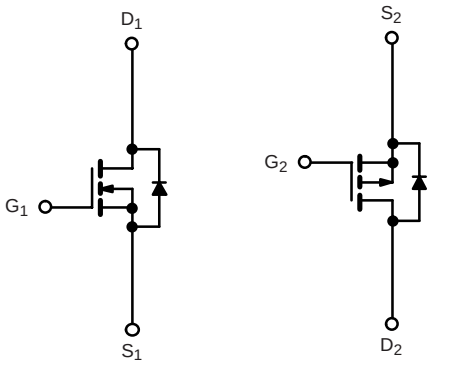
PRODUCT SUMMARY			
	V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)
N-Channel	20	0.022 at V_{GS} = 10 V	5.5
		0.030at V_{GS} = 4.5 V	4.2
P-Channel	- 20	0.055 at V_{GS} = - 10 V	- 3.4
		0.079 at V_{GS} = - 4.5 V	- 2.5

FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- Trench Power MOSFET
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC

Pb-free
RoHS COMPLIANT
HALOGEN FREE Available





N-Channel MOSFET P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted					
Parameter		**Symbol**	**N-Channel**	**P-Channel**	**Unit**
Drain-Source Voltage		V_{DS}	20	- 20	V
Gate-Source Voltage		V_{GS}	± 20	± 20	
Continuous Drain Current (T_J = 150 °C)[a, b]	T_A = 25 °C	I_D	5.5	- 3.4	A
	T_A = 70 °C		4.0	- 2.3	
Pulsed Drain Current		I_{DM}	15	10	
Continuous Source Current (Diode Conduction)[a, b]		I_S	1.05	- 1.05	
Maximum Power Dissipation[a, b]	T_A = 25 °C	P_D	1.15		W
	T_A = 70 °C		0.73		
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS					
Parameter		**Symbol**	**Typical**	**Maximum**	**Unit**
Maximum Junction-to-Ambient[a]	t ≤ 5 s	R_{thJA}	93	110	°C/W
	Steady State		130	150	
Maximum Junction-to-Lead	Steady State	R_{thJL}	75	90	

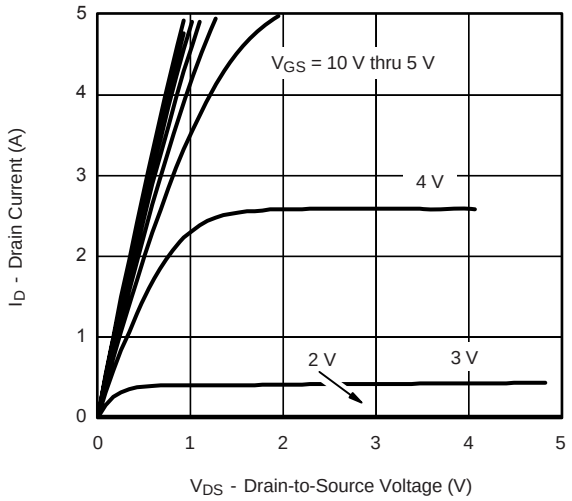
Notes:
a. Surface Mounted on FR4 board.
b. t ≤ 5 s.

SPECIFICATIONS T_J = 25 °C, unless otherwise noted							
Parameter	**Symbol**	**Test Conditions**		**Min.**	**Typ.**	**Max.**	**Unit**
Static							
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	N-Ch	0.5	0.8	1.5	V
		V_{DS} = V_{GS}, I_D = - 250 µA	P-Ch	- 0.5	-0.8	-1.5	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 8 V	N-Ch			± 100	nA
			P-Ch			± 100	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 16 V, V_{GS} = 0 V	N-Ch			1	µA
		V_{DS} = - 16 V, V_{GS} = 0 V	P-Ch			- 1	
		V_{DS} = 16 V, V_{GS} = 0 V, T_J = 55 °C	N-Ch			5	
		V_{DS} = - 16 V, V_{GS} = 0 V, T_J = 55 °C	P-Ch			- 5	
On-State Drain Current[a]	$I_{D(on)}$	V_{DS} = 5 V, V_{GS} = 10 V	N-Ch	3.7			A
		V_{DS} = - 5 V, V_{GS} = - 10 V	P-Ch	- 3			
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 2.5 A	N-Ch		0.022		Ω
		V_{GS} = - 10 V, I_D = - 1.8 A	P-Ch		0.055		
		V_{GS} = 4.5 V, I_D = 2.0 A	N-Ch		0.030		
		V_{GS} = - 4.5 V, I_D = - 1.2 A	P-Ch		0.079		
Forward Transconductance[a]	g_{fs}	V_{DS} = 10 V, I_D = 2.5 A	N-Ch		4.3		S
		V_{DS} = - 15 V, I_D = - 1.8 A	P-Ch		2.4		
Diode Forward Voltage[a]	V_{SD}	I_S = 1.05 A, V_{GS} = 0 V	N-Ch		0.81	1.10	V
		I_S = - 1.05 A, V_{GS} = 0 V	P-Ch		- 0.83	- 1.10	
Dynamic[b]							
Total Gate Charge	Q_g	N-Channel V_{DS} = 15 V, V_{GS} = 5 V, I_D = 1.8 A P-Channel V_{DS} = - 15 V, V_{GS} = - 5 V, I_D = - 1.8 A	N-Ch		2.1	3.2	nC
			P-Ch		2.4	3.6	
Gate-Source Charge	Q_{gs}		N-Ch		0.7		
			P-Ch		0.9		
Gate-Drain Charge	Q_{gd}		N-Ch		0.7		
			P-Ch		0.8		
Gate Resistance	R_g		N-Ch	0.5		2.4	Ω
			P-Ch	3		11	
Turn-On Delay Time	$t_{d(on)}$	N-Channel V_{DD} = 15 V, R_L = 15 Ω I_D ≅ 1 A, V_{GEN} = 10 V, R_g = 6 Ω P-Channel V_{DD} = - 15 V, R_L = 15 Ω I_D ≅ - 1 A, V_{GEN} = - 10 V, R_g = 6 Ω	N-Ch		7	11	ns
			P-Ch		8	12	
Rise Time	t_r		N-Ch		9	14	
			P-Ch		12	18	
Turn-Off Delay Time	$t_{d(off)}$		N-Ch		13	20	
			P-Ch		12	18	
Fall Time	t_f		N-Ch		5	8	
			P-Ch		7	11	
Source-Drain Reverse Recovery Time	t_{rr}	I_F = 1.05 A, dI/dt = 100 A/µs	N-Ch		35	60	
		I_F = - 1.05 A, dI/dt = 100 A/µs	P-Ch		30	60	

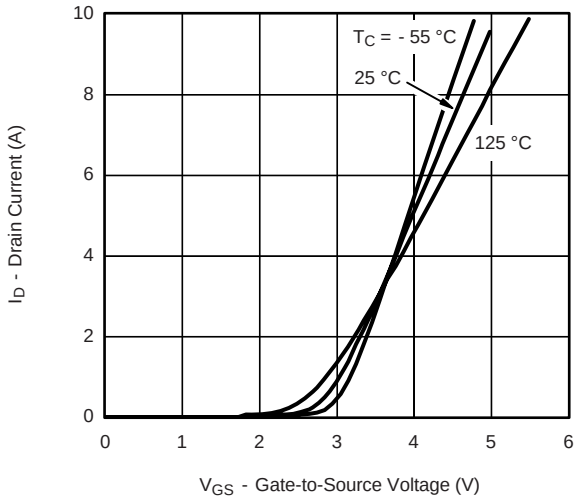
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

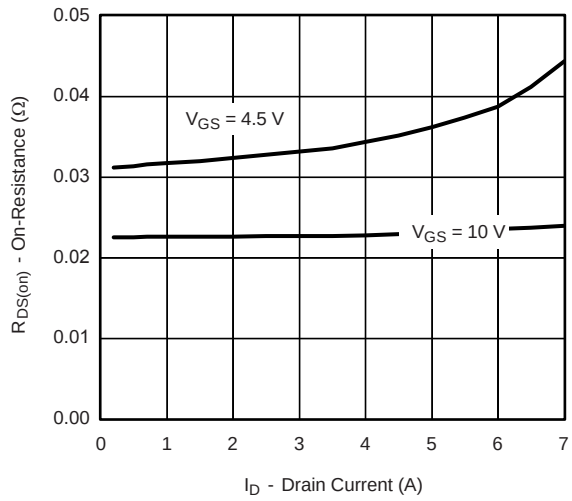
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



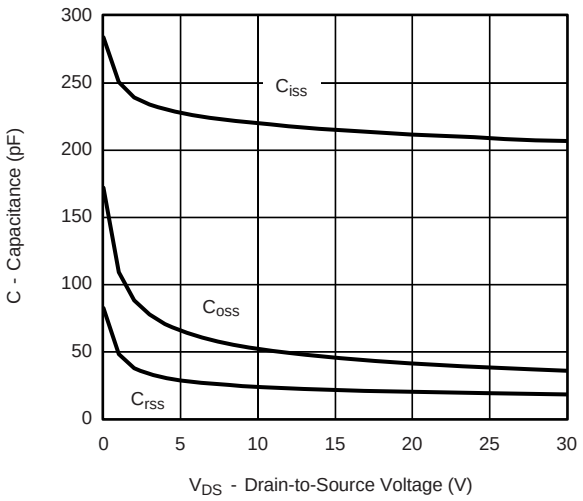
Output Characteristics



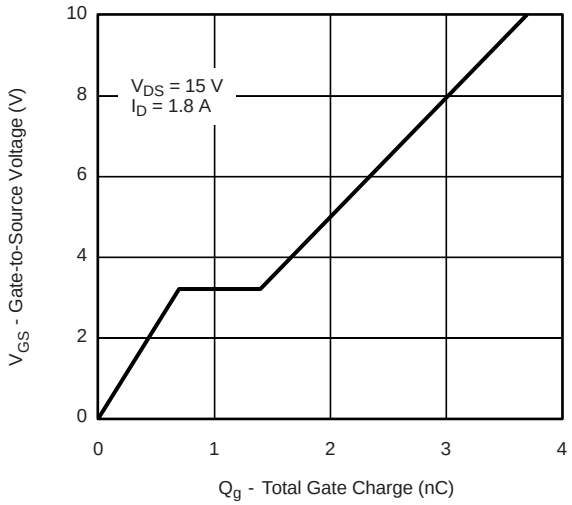
Transfer Characteristics



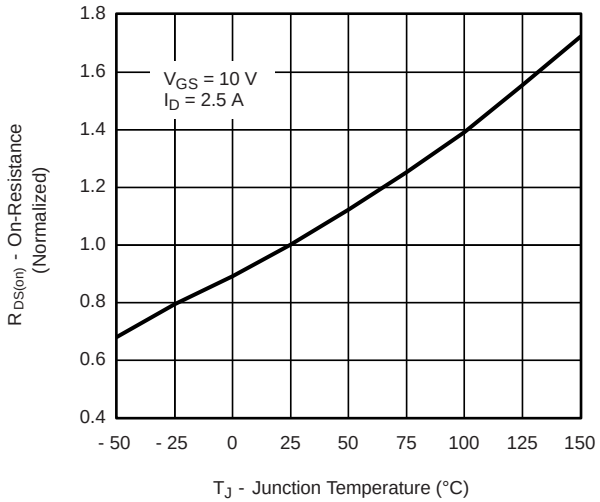
On-Resistance vs. Drain Current



Capacitance

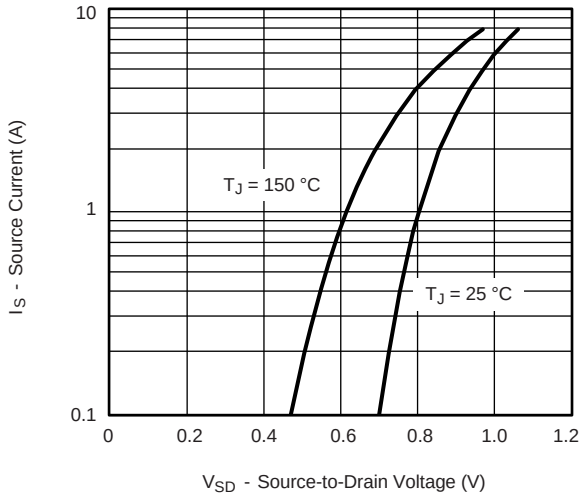


Gate Charge

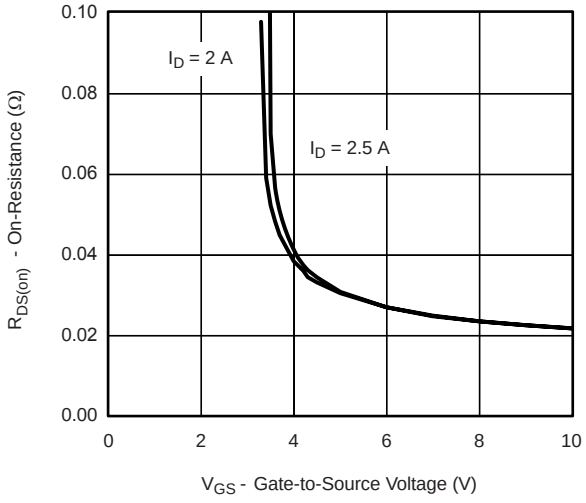


On-Resistance vs. Junction Temperature

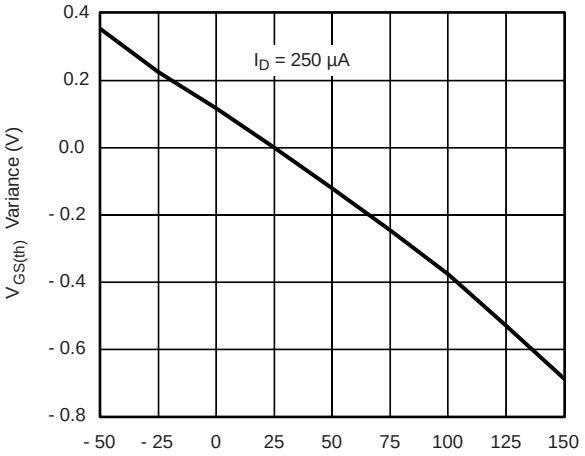
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



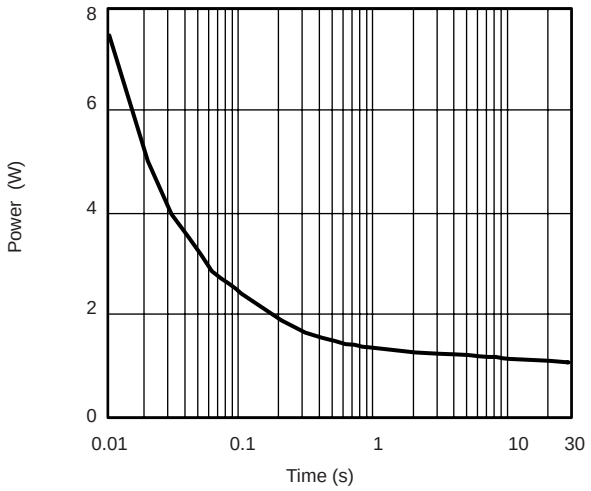
Source-Drain Diode Forward Voltage



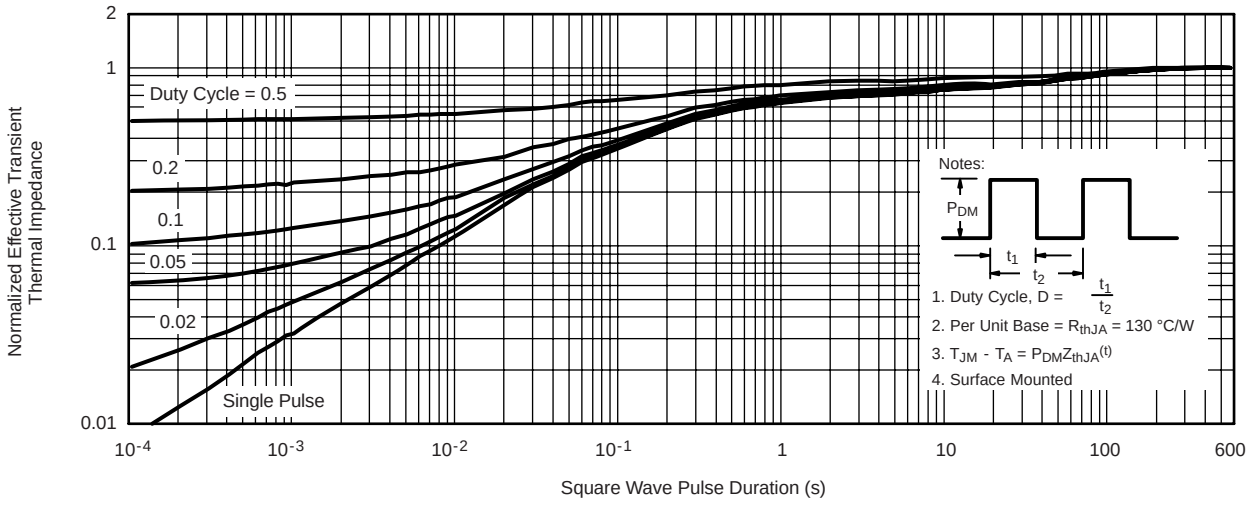
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

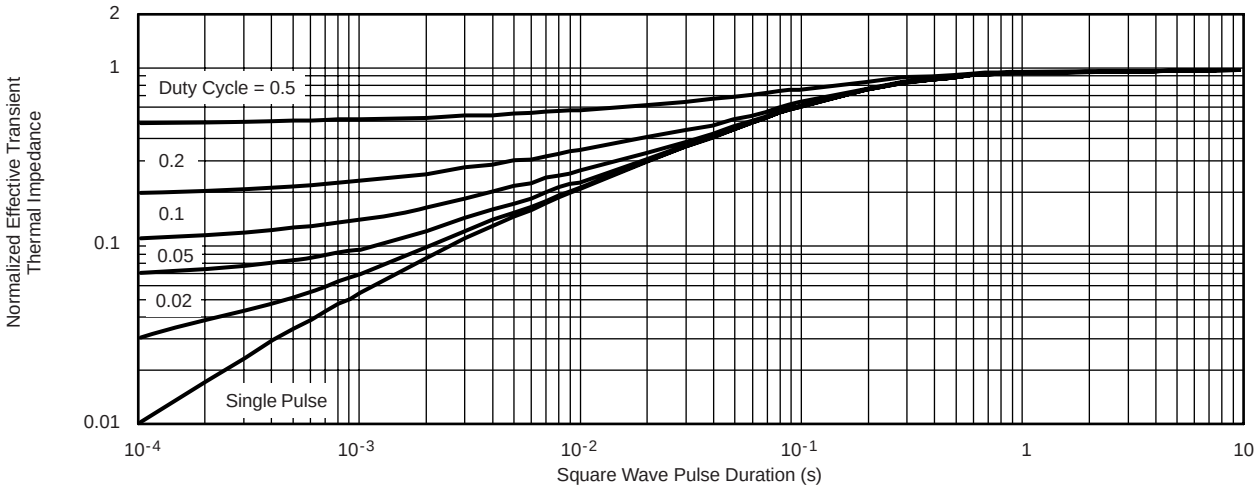


Single Pulse Power (Junction-to-Ambient)



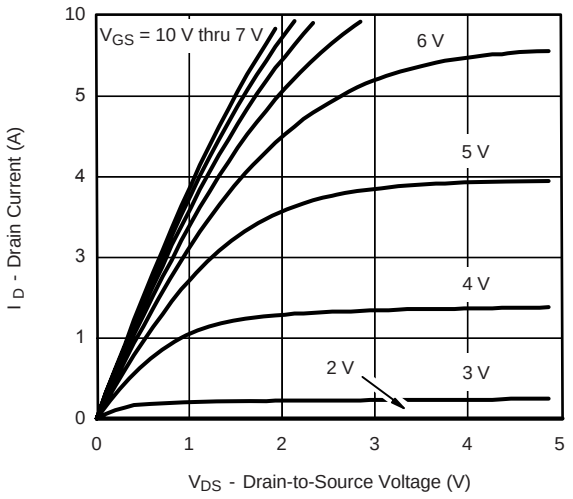
Normalized Thermal Transient Impedance, Junction-to-Ambient

N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

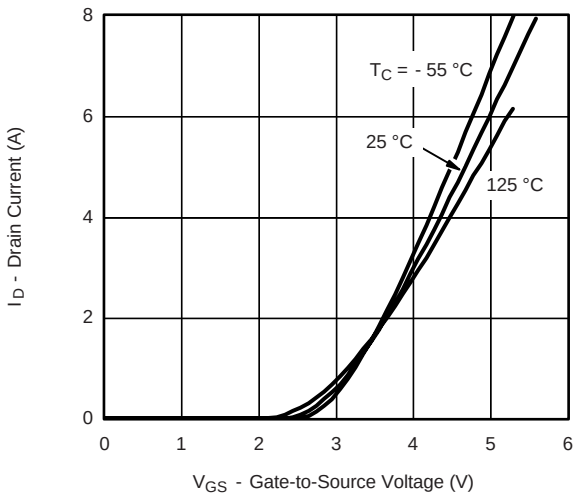


Normalized Thermal Transient Impedance, Junction-to-Foot

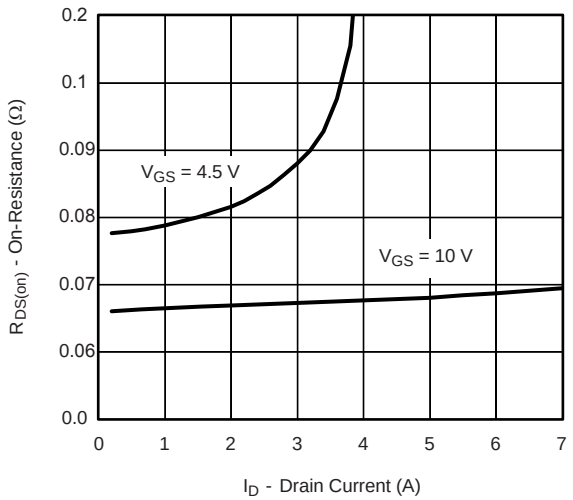
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



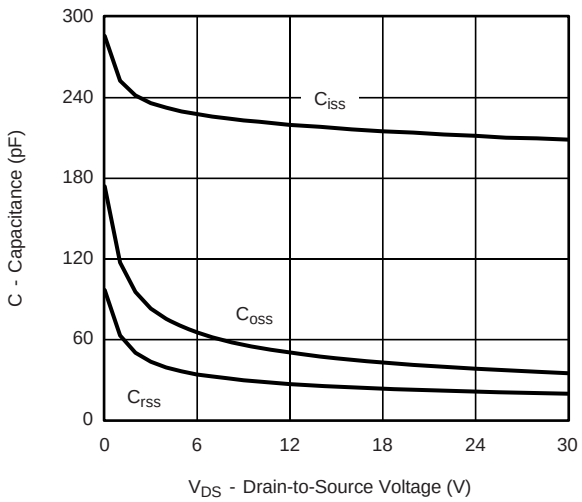
Output Characteristics



Transfer Characteristics

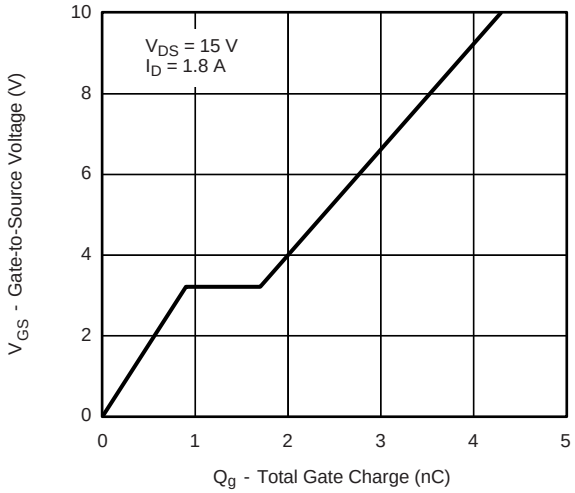


On-Resistance vs. Drain Current

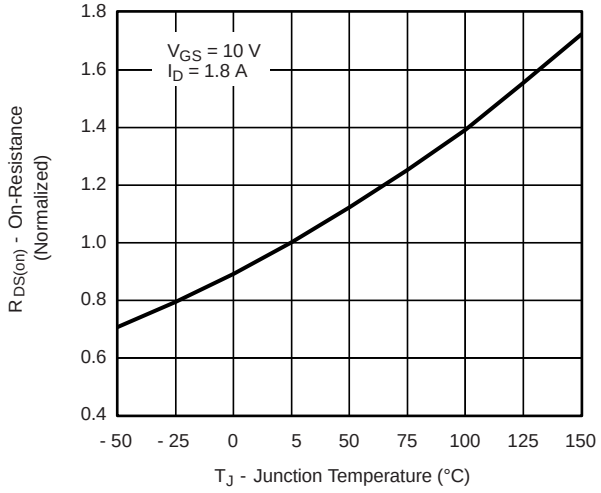


Capacitance

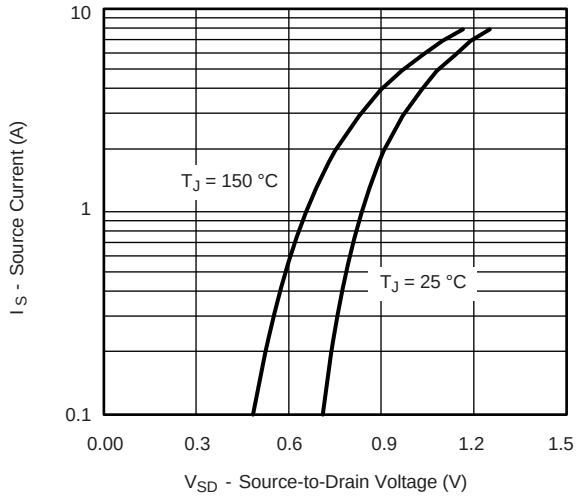
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



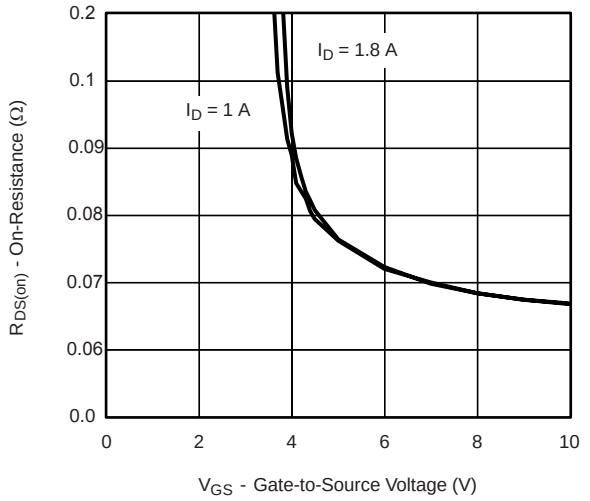
Gate Charge



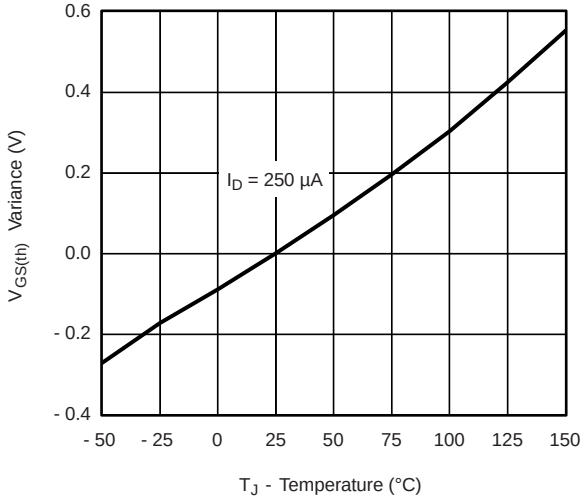
On-Resistance vs. Junction Temperature



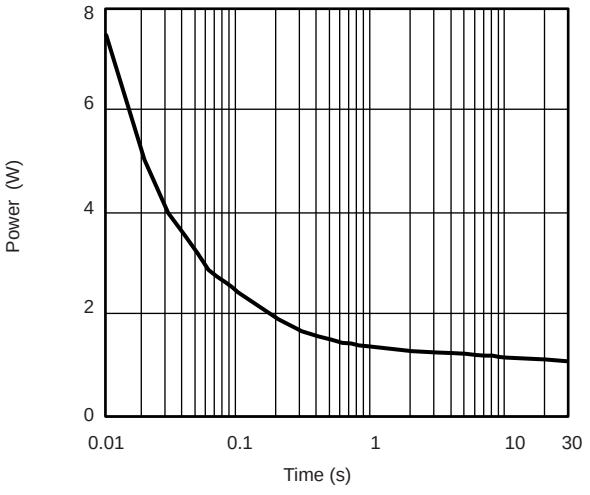
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage

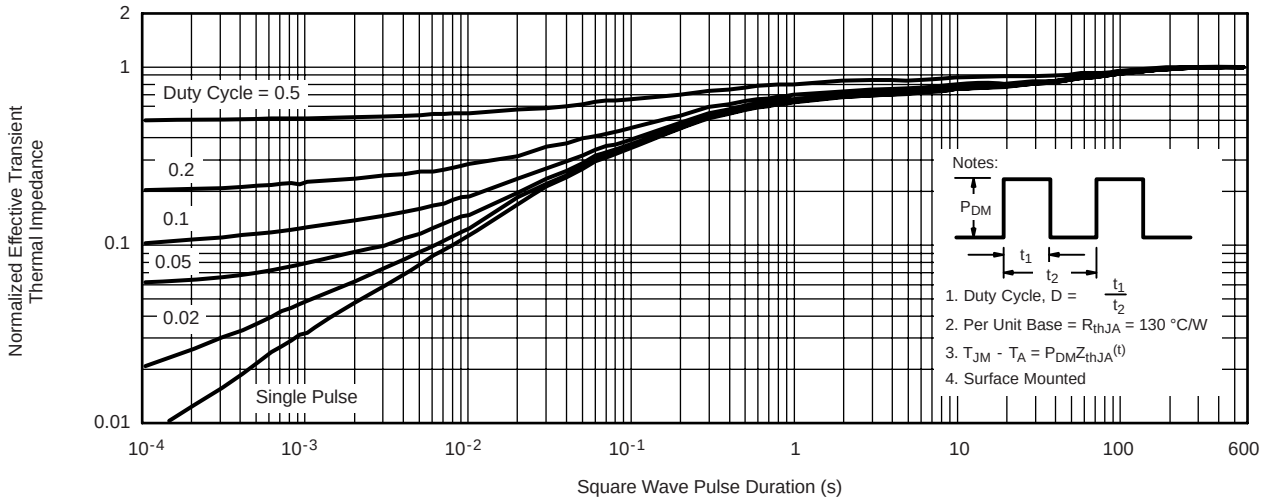


Threshold Voltage

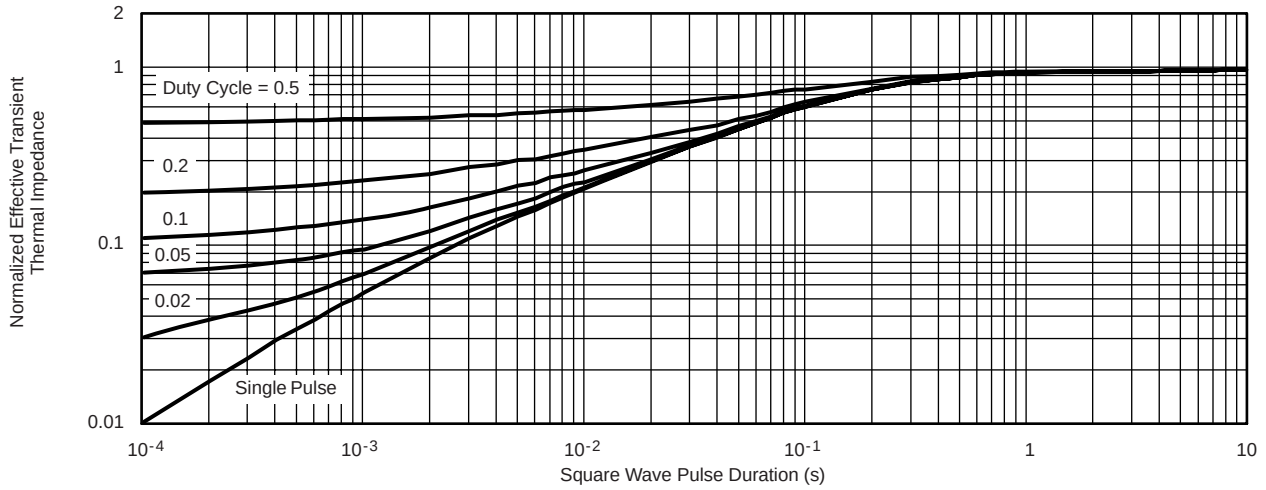


Single Pulse Power (Junction-to-Ambient)

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



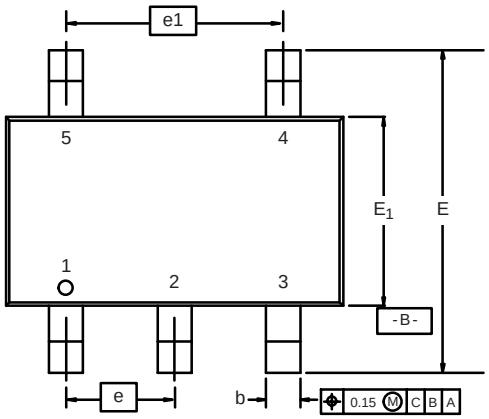
Normalized Thermal Transient Impedance, Junction-to-Ambient



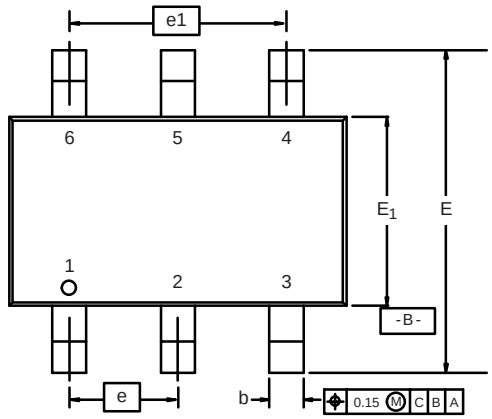
Normalized Thermal Transient Impedance, Junction-to-Foot

TSOP: 5/6−LEAD

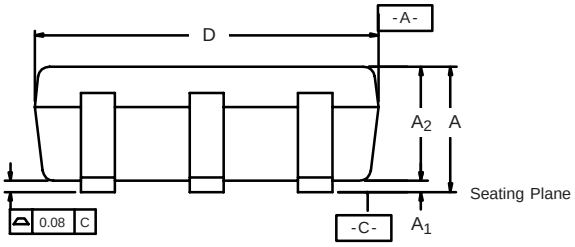
JEDEC Part Number: MO-193C

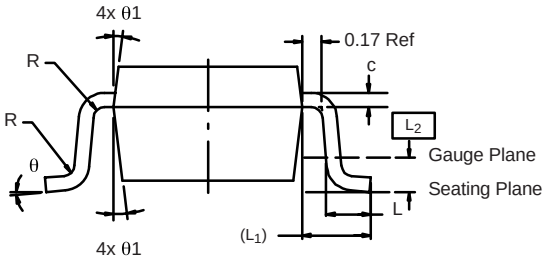


5-LEAD TSOP



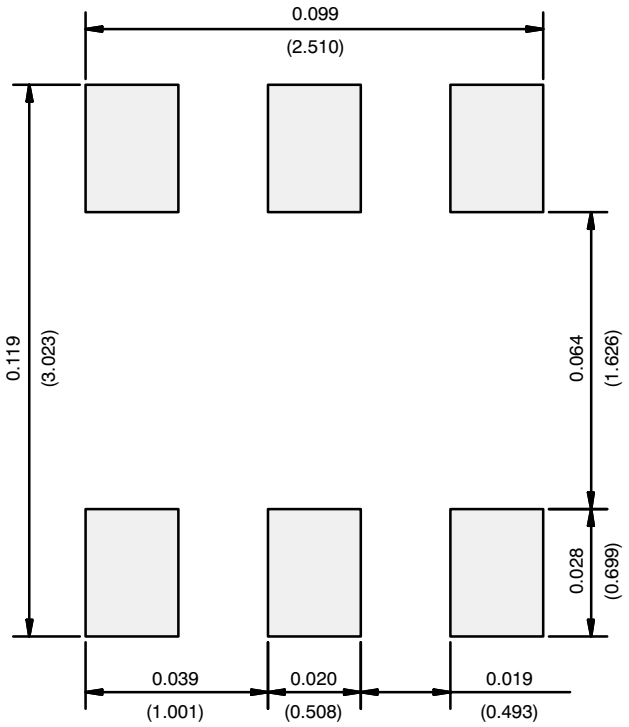
6-LEAD TSOP





Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	-	1.10	0.036	-	0.043
A_1	0.01	-	0.10	0.0004	-	0.004
A_2	0.90	-	1.00	0.035	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E_1	1.55	1.65	1.70	0.061	0.065	0.067
e	0.95 BSC			0.0374 BSC		
e_1	1.80	1.90	2.00	0.071	0.075	0.079
L	0.32	-	0.50	0.012	-	0.020
L_1	0.60 Ref			0.024 Ref		
L_2	0.25 BSC			0.010 BSC		
R	0.10	-	-	0.004	-	-
θ	0°	4°	8°	0°	4°	8°
$θ_1$	7° Nom			7° Nom		
ECN: C-06593-Rev. I, 18-Dec-06 DWG: 5540						

RECOMMENDED MINIMUM PADS FOR TSOP-6



Recommended Minimum Pads
Dimensions in Inches/(mm)

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