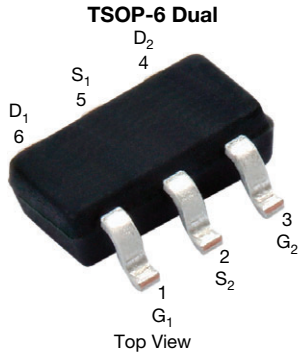
N- and P-Channel 30 V (D-S) MOSFET



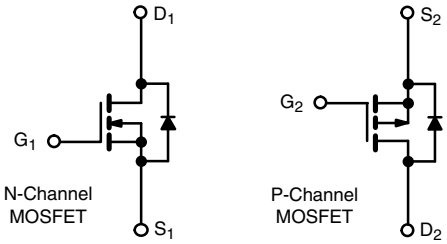
FEATURES

- TrenchFET® power MOSFET
- Ultra low $R_{DS(on)}$ n- and p-channel for high efficiency
- Optimized for high side / low side
- Minimized conduction losses
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE Available

APPLICATIONS

- Portable devices including PDAs, cellular phones, and pagers



PRODUCT SUMMARY		
	N-CHANNEL	P-CHANNEL
V_{DS} (V)	30	-30
$R_{DS(on)}$ (Ω) at V_{GS} = ± 4.5 V	0.077	0.170
$R_{DS(on)}$ (Ω) at V_{GS} = ± 2.5 V	0.120	0.300
Q_g typ. (nC)	3	3.8
I_D (A)	3	-2
Configuration	N- and p-pair	

ORDERING INFORMATION	
Package	TSOP-6
Lead (Pb)-free	Si3590DV-T1-E3
Lead (Pb)-free and halogen-free	Si3590DV-T1-GE3

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

PARAMETER		SYMBOL	N-CHANNEL		P-CHANNEL		UNIT
			10 s	STEADY STATE	10 s	STEADY STATE	
Drain-source voltage		V_{DS}	30		-30		V
Gate-source voltage		V_{GS}	± 12		± 12		
Continuous drain current (T_J = 150 °C) [a]	T_A = 25 °C	I_D	3	2.5	-2	-1.7	A
	T_A = 70 °C		2.3	2	-1.6	-1.3	
Pulsed drain current		I_{DM}	8		-8		
Continuous source current (diode conduction) [a]		I_S	1.05	0.75	-1.05	-0.75	
maximum power dissipation [a]	T_A = 25 °C	P_D	1.15	0.83	1.15	0.83	W
	T_A = 70 °C		0.70	0.53	0.70	0.53	
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +150				°C

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	N-CHANNEL		P-CHANNEL		UNIT
			TYP.	MAX.	TYP.	MAX.	
Maximum junction-to-ambient [a]	t ≤ 10 s	R_{thJA}	93	110	93	110	°C/W
	Steady state		130	150	130	150	
Maximum junction-to-foot (drain)	Steady state	R_{thJF}	75	90	75	90	

Note

a. Surface mounted on 1" x 1" FR4 board

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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	0.6	-	1.5	V
		V_{DS} = V_{GS}, I_D = -250 µA	P-Ch	-0.6	-	-1.5	
Gate-body leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 12 V	N-Ch	-	-	± 100	nA
			P-Ch	-	-	± 100	
Zero gate voltage drain current	I_{DSS}	V_{DS} = 30 V, V_{GS} = 0 V	N-Ch	-	-	1	µA
		V_{DS} = -30 V, V_{GS} = 0 V	P-Ch	-	-	-1	
		V_{DS} = 30 V, V_{GS} = 0 V, T_J = 55 °C	N-Ch	-	-	5	
		V_{DS} = -30 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} = 4.5 V	N-Ch	5	-	-	A
		V_{DS} ≤ -5 V, V_{GS} = -4.5 V	P-Ch	-5	-	-	
Drain-source on-state resistance [a]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 3 A	N-Ch	-	0.062	0.077	Ω
		V_{GS} = -4.5 V, I_D = -2 A	P-Ch	-	0.135	0.170	
		V_{GS} = 2.5 V, I_D = 2 A	N-Ch	-	0.095	0.120	
		V_{GS} = -2.5 V, I_D = -1.2 A	P-Ch	-	0.235	0.300	
Forward transconductance [a]	g_{fs}	V_{DS} = 5 V, I_D = 3 A	N-Ch	-	10	-	S
		V_{DS} = -5 V, I_D = -2 A	P-Ch	-	5	-	
Diode forward voltage [a]	V_{SD}	I_S = 1.05 A, V_{GS} = 0 V	N-Ch	-	0.8	1.1	V
		I_S = -1.05 A, V_{GS} = 0 V	P-Ch	-	-0.83	-1.1	
Dynamic [b]							
Total gate charge	Q_g	N-Channel V_{DS} = 15 V, V_{GS} = 4.5 V, I_D = 2 A P-Channel V_{DS} = -15 V, V_{GS} = -4.5 V, I_D = -2 A	N-Ch	-	3	4.5	nC
			P-Ch	-	3.8	6	
Gate-source charge	Q_{gs}		N-Ch	-	0.6	-	
			P-Ch	-	0.6	-	
Gate-drain charge	Q_{gd}		N-Ch	-	1	-	
			P-Ch	-	1.5	-	
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	-	5	8	ns
			P-Ch	-	5	8	
Rise time	t_r		N-Ch	-	12	23	
			P-Ch	-	15	23	
Turn-off delay time	$t_{d(off)}$		N-Ch	-	13	23	
			P-Ch	-	20	30	
Fall time	t_f		N-Ch	-	7	12	
			P-Ch	-	20	30	
Source-drain reverse recovery time	t_{rr}	I_F = 1.05 A, di/dt = 100 A/µs	N-Ch	-	15	25	
		I_F = -1.05 A, di/dt = 100 A/µs	P-Ch	-	18	30	

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.

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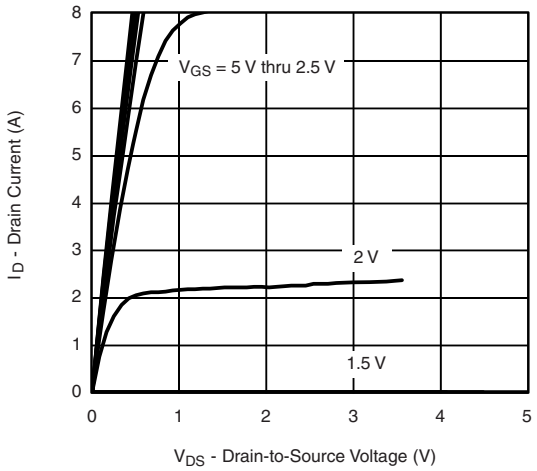
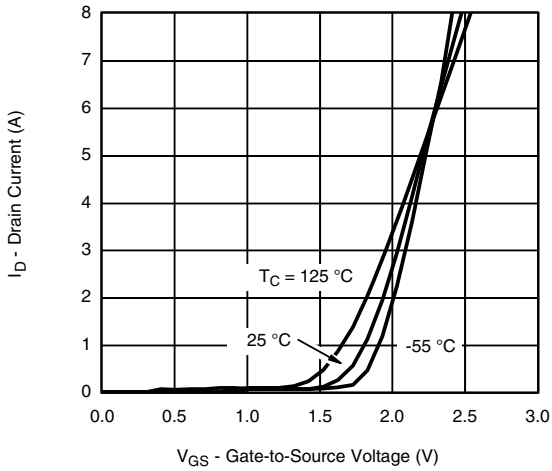
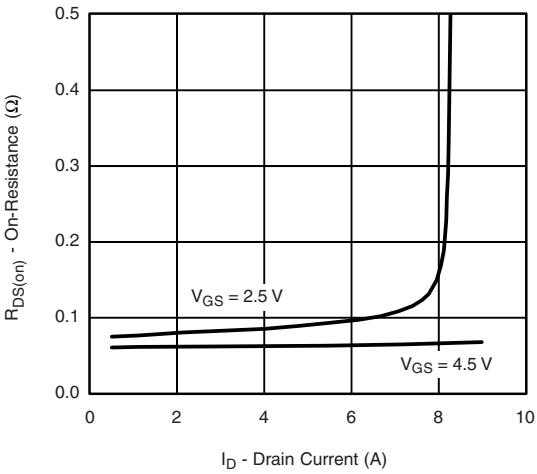
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



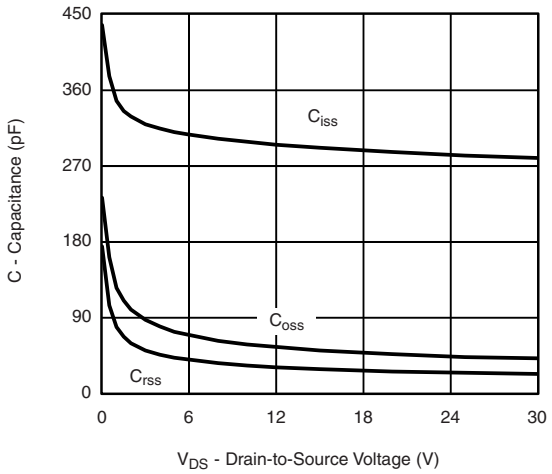
Output Characteristics



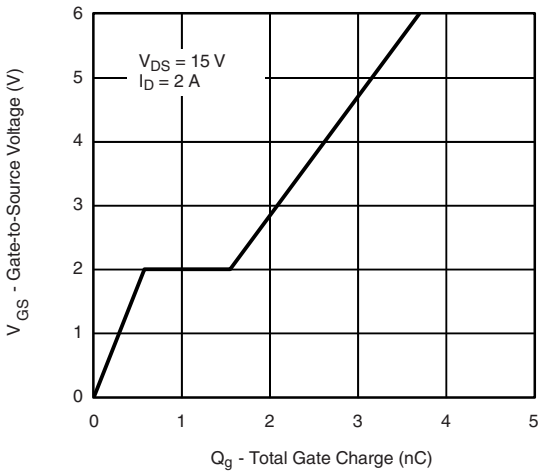
Transfer Characteristics



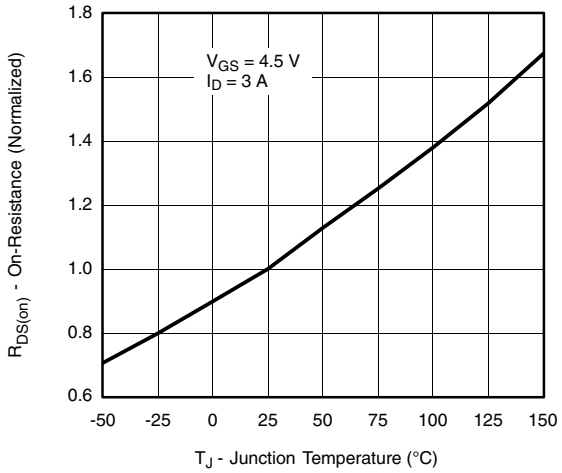
On-Resistance vs. Drain Current



Capacitance



Gate Charge



On-Resistance vs. Junction Temperature

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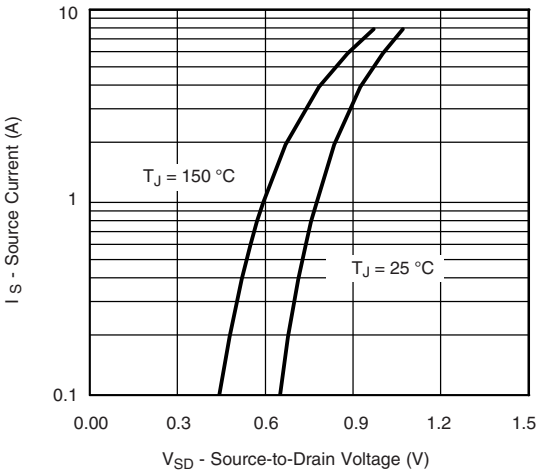
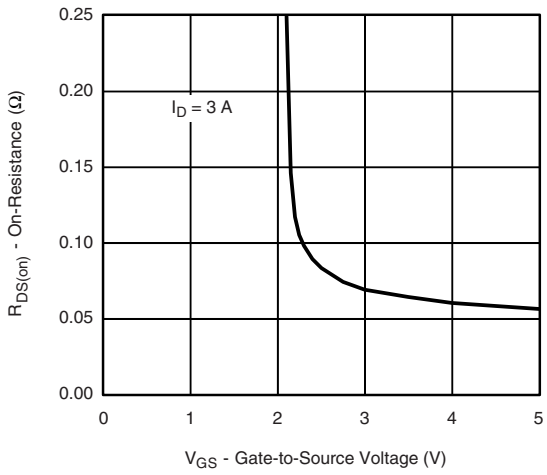
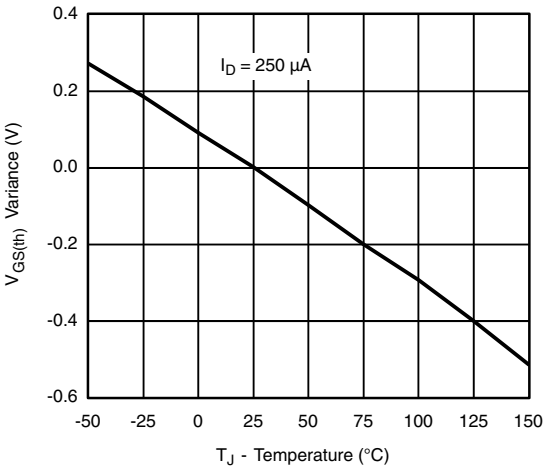


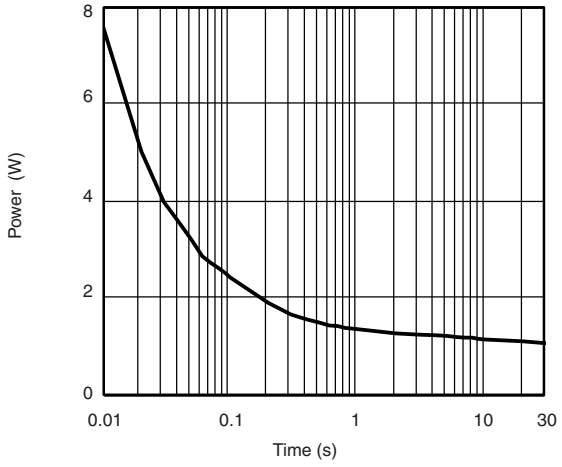
Source-Drain Diode Forward Voltage



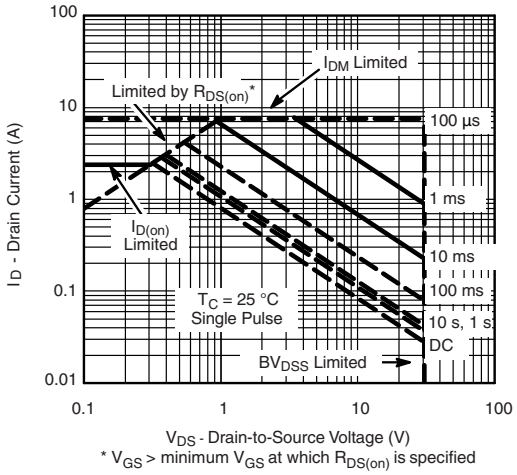
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient



Safe Operating Area, Junction-to-Case

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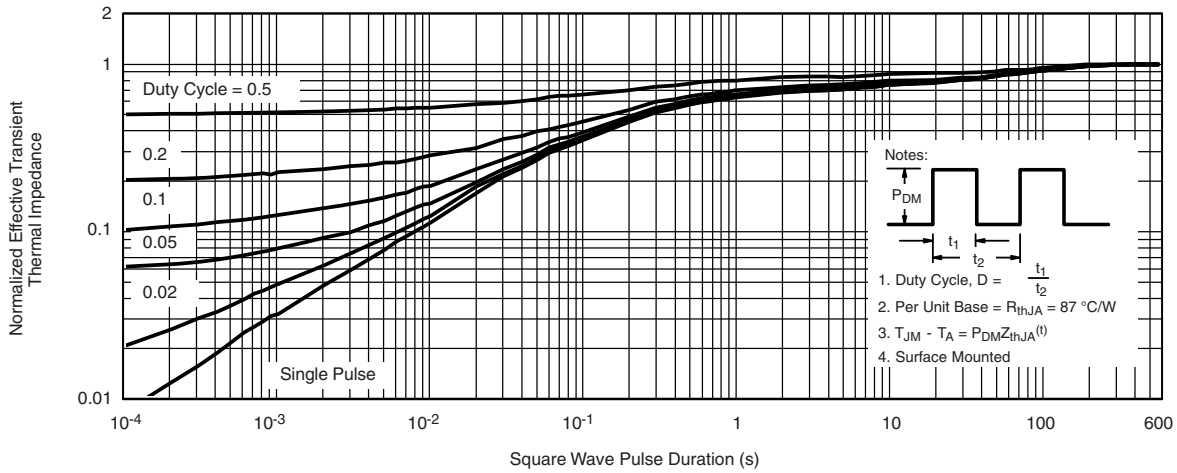
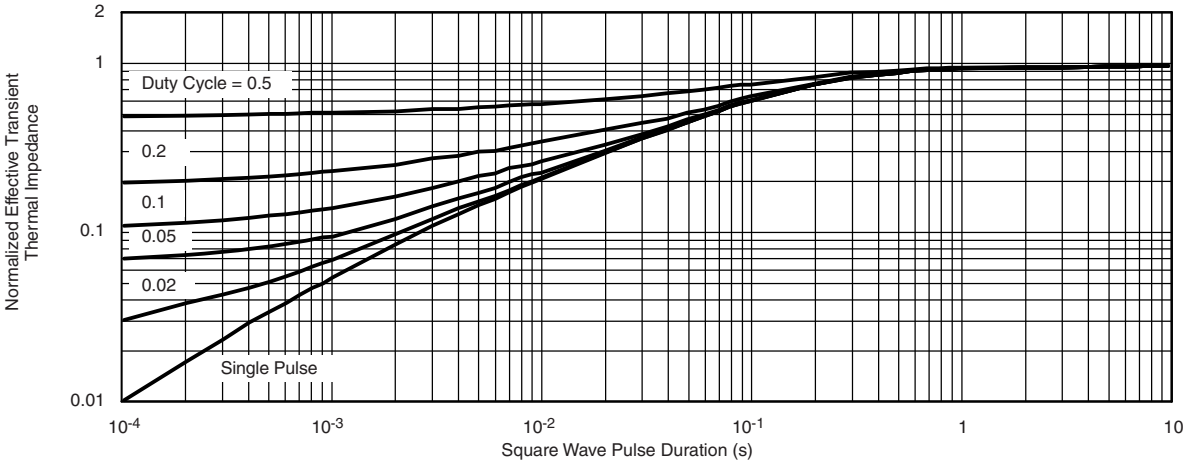


Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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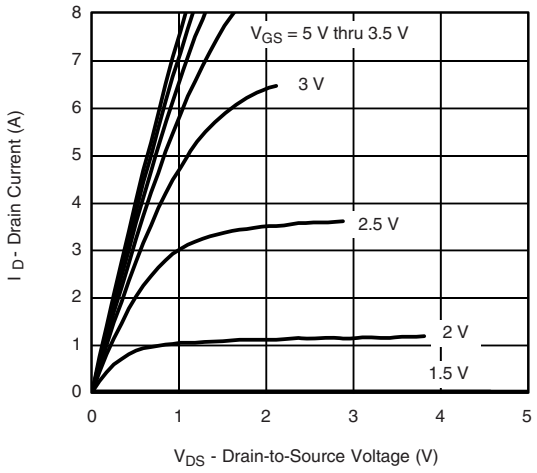
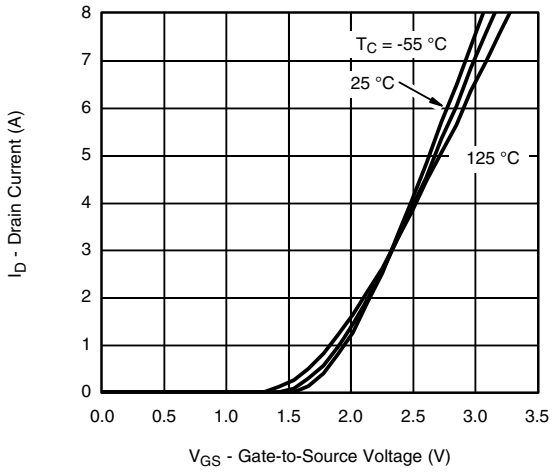
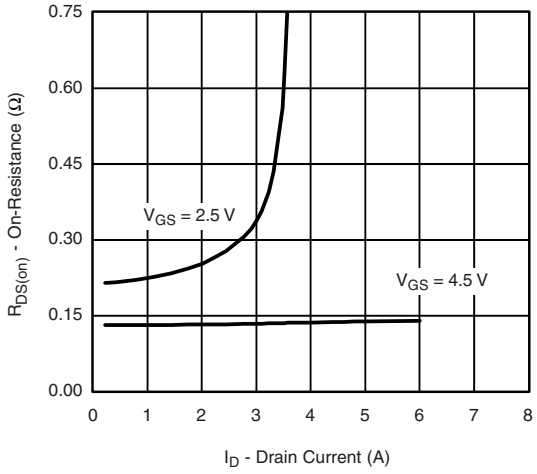
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



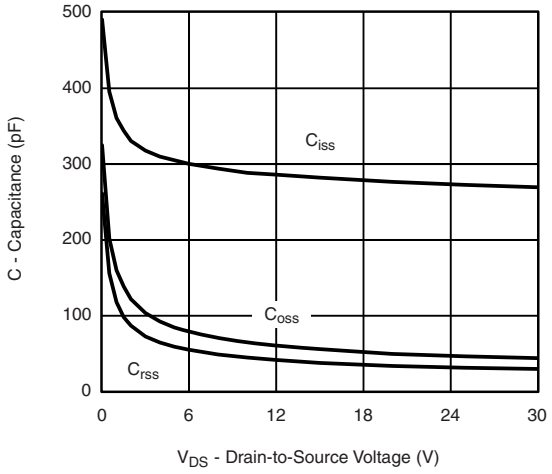
Output Characteristics



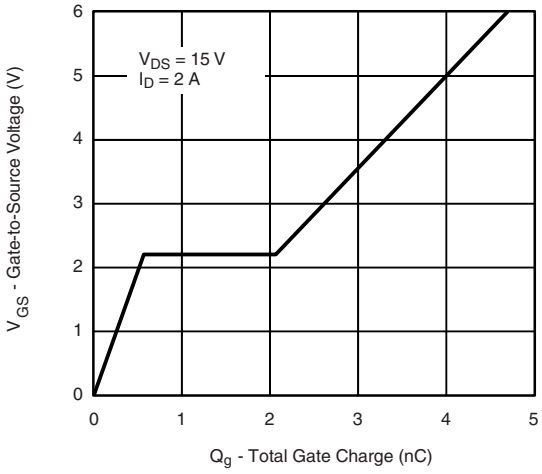
Transfer Characteristics



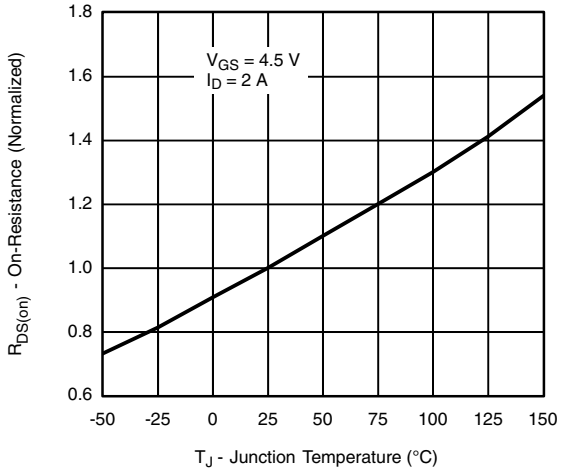
On-Resistance vs. Drain Current



Capacitance



Gate Charge



On-Resistance vs. Junction Temperature

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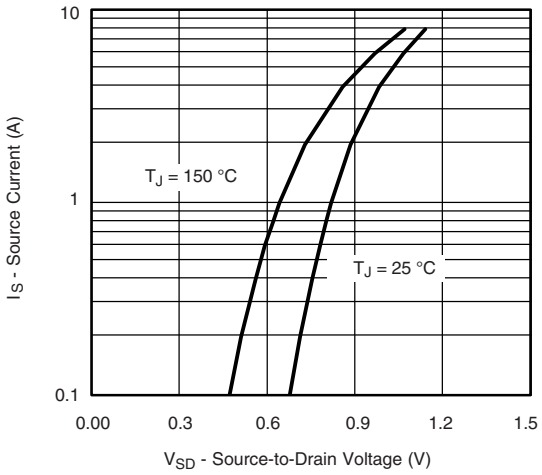
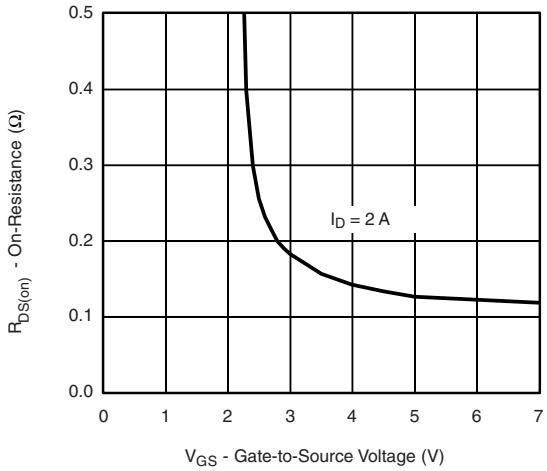
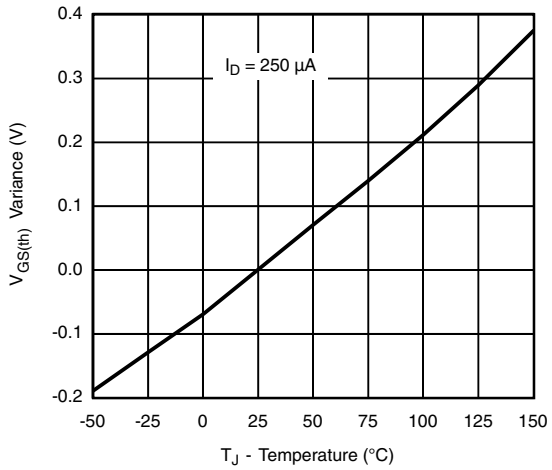


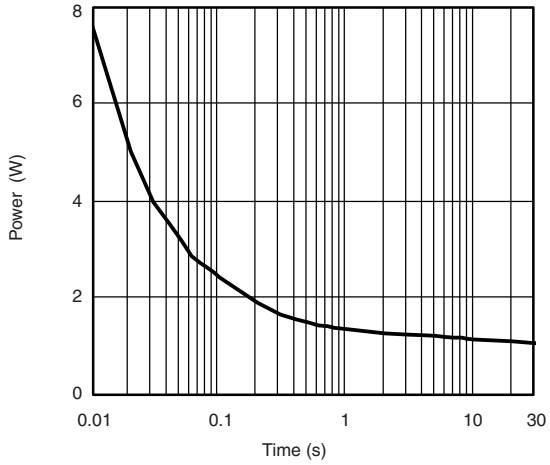
Source-Drain Diode Forward Voltage



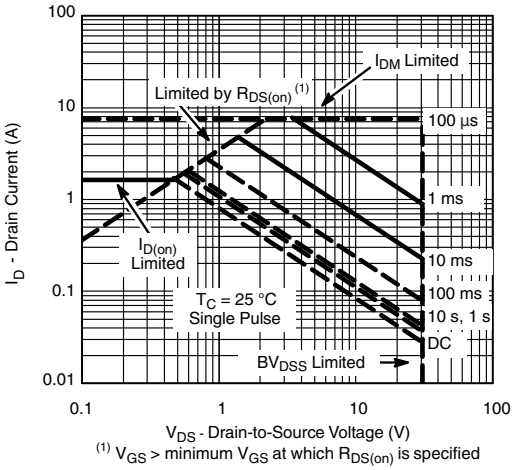
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient



Safe Operating Area, Junction-to-Case

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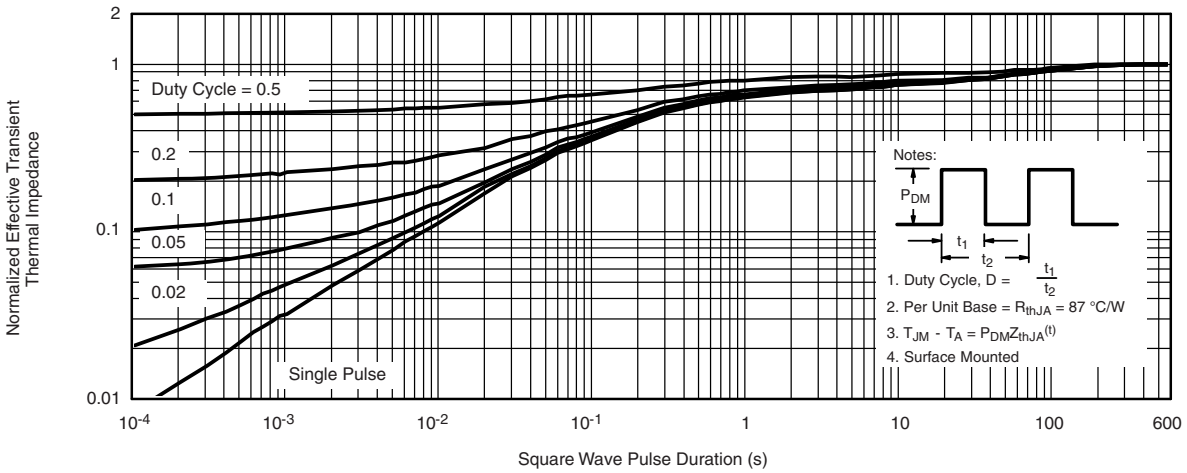
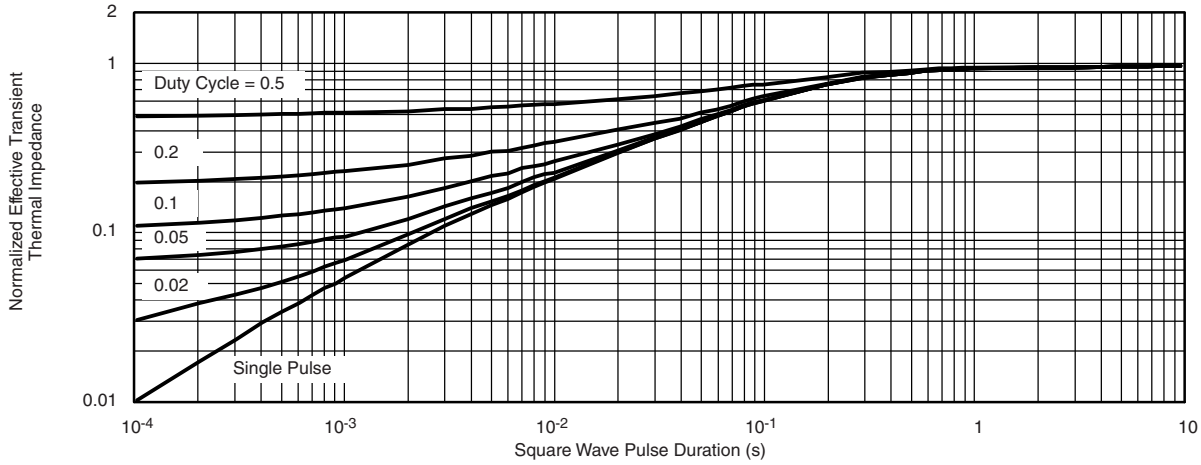


Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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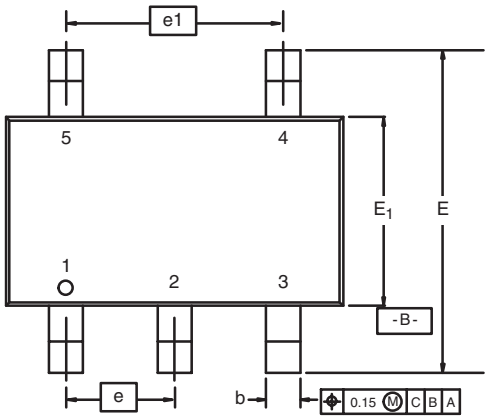
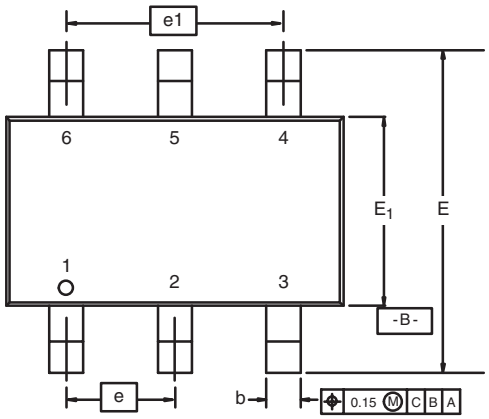
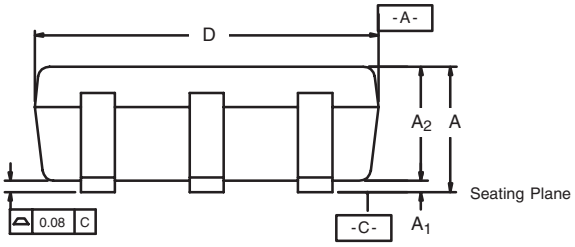
TSOP: 5/6–LEAD
JEDEC Part Number: MO-193C

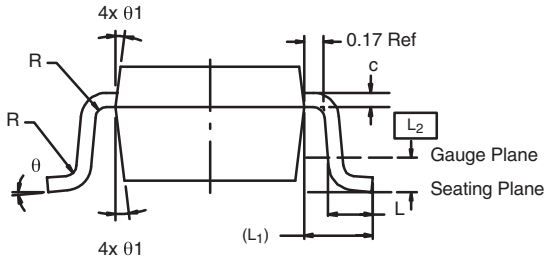


5-LEAD TSOP



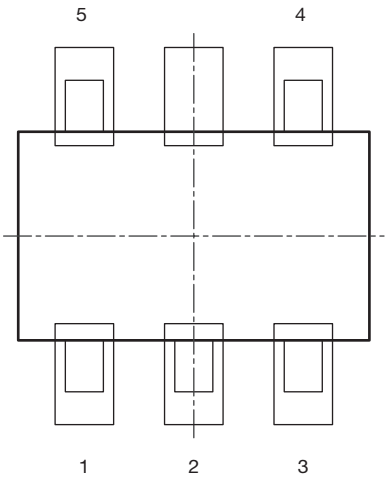
6-LEAD TSOP



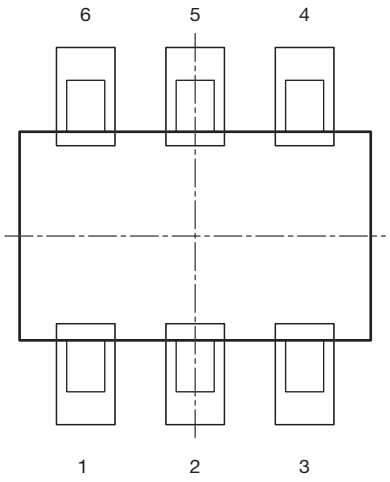


Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	-	1.10	0.036	-	0.043
A_1	0.01	-	0.10	0.0004	-	0.004
A_2	0.90	-	1.00	0.035	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E_1	1.55	1.65	1.70	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						

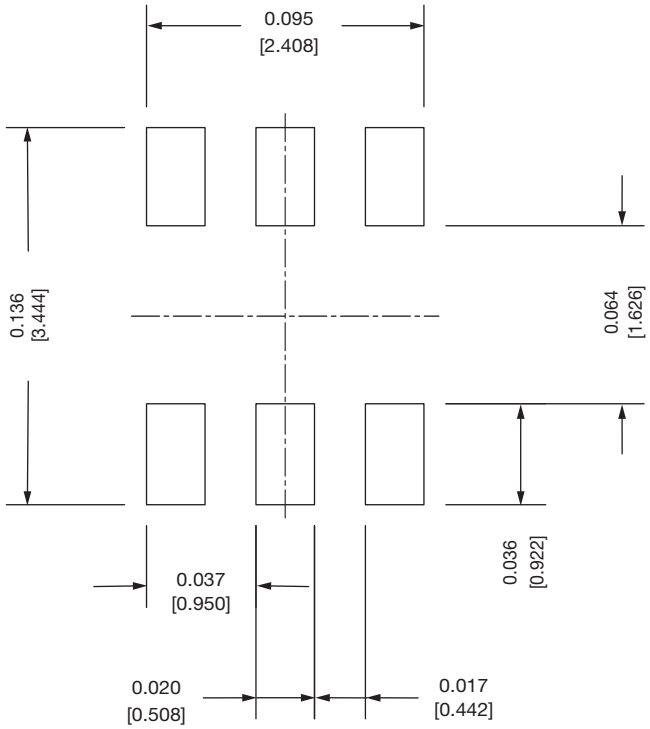
Recommended Land Pattern For TSOP-5L / TSOP-6L



TSOP 5L



TSOP 6L



Note

- All dimensions are in inches (millimeter)

ECN: C22-0860-Rev. B, 24-Oct-2022 DWG: 3010

For technical questions, contact: pmostechsupport@vishay.com

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