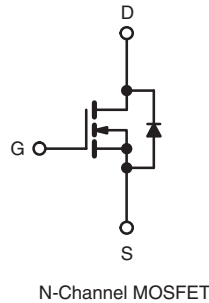
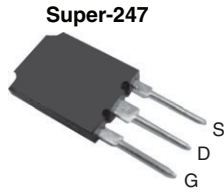


Power MOSFET



FEATURES

- Superfast body diode eliminates the need for External diodes in ZVS applications
- Lower gate charge results in simpler drive requirements
- Enhanced dV/dt capabilities offer improved ruggedness
- Higher gate voltage threshold offers improved noise immunity
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



APPLICATIONS

- Zero voltage switching SMPS
- Telecom and server power supplies
- Uninterruptible power supplies
- Motor control applications

PRODUCT SUMMARY	
V_{DS} (V)	500
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$ 0.087
Q_g (Max.) (nC)	380
Q_{gs} (nC)	80
Q_{gd} (nC)	190
Configuration	Single

ORDERING INFORMATION	
Package	Super-247
Lead (Pb)-free and halogen free	SiHFPS40N50L-GE3

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-source voltage	V_{DS}	500	V	
Gate-source voltage	V_{GS}	± 30		
Continuous drain current	V_{GS} at 10 V	$T_C = 25\text{ }^\circ\text{C}$	46	
		$T_C = 100\text{ }^\circ\text{C}$	29	
Pulsed drain current ^a	I_{DM}	180	A	
Linear derating factor		4.3	W/ $^\circ\text{C}$	
Single pulse avalanche energy ^b	E_{AS}	920	mJ	
Repetitive avalanche current ^a	I_{AR}	46	A	
Repetitive avalanche Energy ^a	E_{AR}	54	mJ	
Maximum power dissipation	$T_C = 25\text{ }^\circ\text{C}$	P_D	540	W
Peak diode recovery dV/dt ^c		dV/dt	34	V/ns
Operating junction and storage temperature range	T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$	
Soldering recommendations (peak temperature)	for 10 s	300 ^d		


Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 0.86\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 46\text{ A}$ (see fig. 12)
- $I_{SD} \leq 46\text{ A}$, $dI/dt \leq 550\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{DS}$, $T_J \leq 150\text{ }^\circ\text{C}$
- 1.6 mm from case

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient ^a	R _{thJA}	-	40	°C/W
Case-to-sink, flat, greased surface	R _{thCS}	0.24	-	
Maximum junction-to-case (drain) ^a	R _{thJC}	-	0.23	

Note

a. R_{th} is measured at T_J approximately 90 °C

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)								
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT	
Static								
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		500	-	-	V	
V _{DS} temperature coefficient	ΔV _{DS} /T _J	Reference to 25 °C, I _D = 1 mA		-	0.60	-	V/°C	
Gate-source threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		3.0	-	5.0	V	
Gate-source leakage	I _{GSS}	V _{GS} = ± 30 V		-	-	± 100	nA	
Zero gate voltage drain current	I _{DSS}	V _{DS} = 500 V, V _{GS} = 0 V		-	-	50	μA	
		V _{DS} = 400 V, V _{GS} = 0 V, T _J = 125 °C		-	-	2.0	mA	
Drain-source on-state resistance	R _{DS(on)}	V _{GS} = 10 V	I _D = 28 A ^b	-	0.087	0.100	Ω	
Forward transconductance	g _{fs}	V _{DS} = 50 V, I _D = 46 A		21	-	-	S	
Dynamic								
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5		-	8110	-	pF	
Output capacitance	C _{oss}			-	960	-		
Reverse transfer capacitance	C _{rss}			-	130	-		
Output capacitance	C _{oss}	V _{GS} = 0 V		V _{DS} = 1.0 V, f = 1.0 MHz	-	11200	-	
				V _{DS} = 400 V, f = 1.0 MHz	-	240	-	
Effective output capacitance	C _{oss eff.}	V _{GS} = 0 V		V _{DS} = 0 V to 400 V ^c		-	440	-
Effective output capacitance (energy related)	C _{oss eff. (ER)}					-	310	-
Total gate charge	Q _g	V _{GS} = 10 V		I _D = 46 A, V _{DS} = 400 V, see fig. 7 and 15 ^b		-	-	380
Gate-source charge	Q _{gs}					-	-	80
Gate-drain charge	Q _{gd}					-	-	190
Internal gate resistance	R _g	f = 1 MHz, open drain		-	0.90	-	Ω	
Turn-on delay time	t _{d(on)}	V _{DD} = 250 V, I _D = 46 A, R _g = 0.85 Ω, V _{GS} = 10 V, see fig. 14a and 14b ^b		-	27	-	ns	
Rise time	t _r			-	170	-		
Turn-off delay time	t _{d(off)}			-	50	-		
Fall time	t _f			-	69	-		
Drain-source body diode characteristics								
Continuous source-drain diode current	I _S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	46	A	
Pulsed diode forward current ^a	I _{SM}			-	-	180		
Body diode voltage	V _{SD}	T _J = 25 °C, I _S = 46 A, V _{GS} = 0 V ^b		-	-	1.5	V	
Body diode reverse recovery time	t _{rr}	T _J = 25 °C, I _F = 46 A		-	170	250	ns	
		T _J = 125 °C, dI/dt = 100 A/μs ^b		-	220	330		
Body diode reverse recovery charge	Q _{rr}	T _J = 25 °C, I _S = 46 A, V _{GS} = 0 V ^b		-	705	1060	nC	
		T _J = 125 °C, dI/dt = 100 A/μs ^b		-	1.3	2.0		
Reverse recovery current	I _{RRM}	T _J = 25 °C		-	9.0	-	A	
Forward turn-on time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D)						

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
 b. Pulse width ≤ 400 μs; duty cycle ≤ 2 %
 c. C_{oss eff.} is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}
 C_{oss eff. (ER)} is a fixed capacitance that stores the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DS}

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

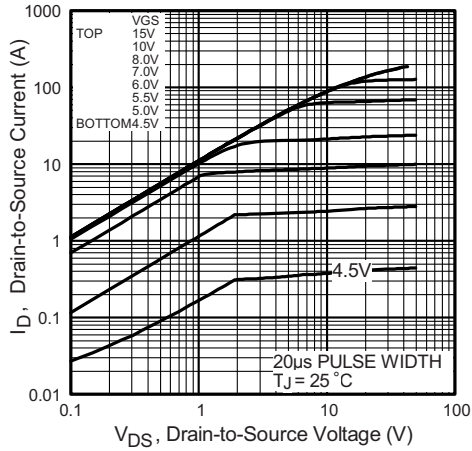


Fig. 1 - Typical Output Characteristics

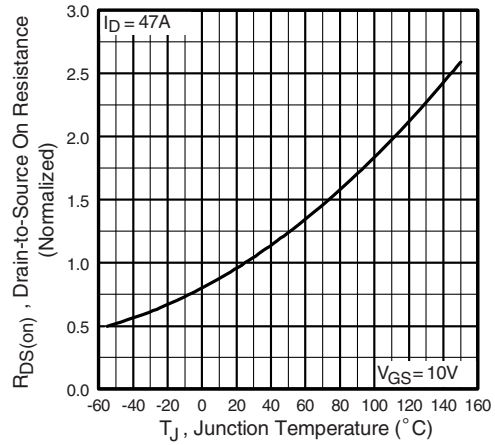


Fig. 4 - Normalized On-Resistance vs. Temperature

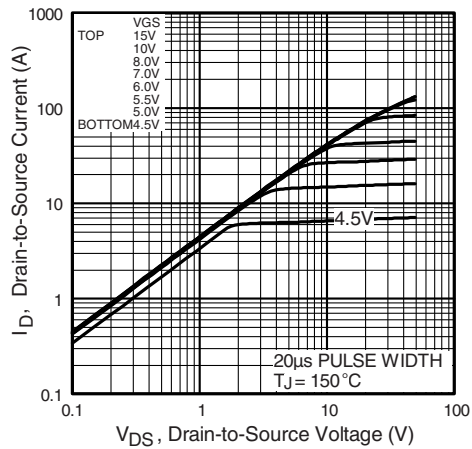


Fig. 2 - Typical Output Characteristics

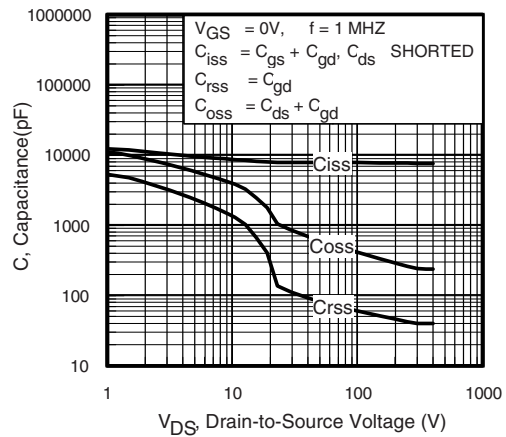


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

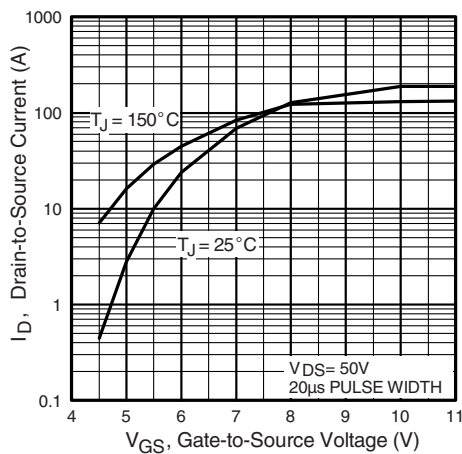


Fig. 3 - Typical Transfer Characteristics

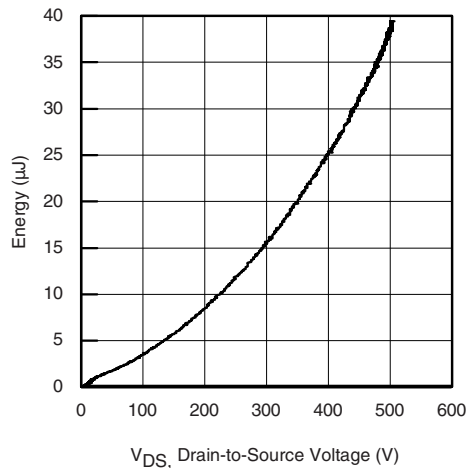


Fig. 6 - Typical Output Capacitance Stored Energy vs. VDS

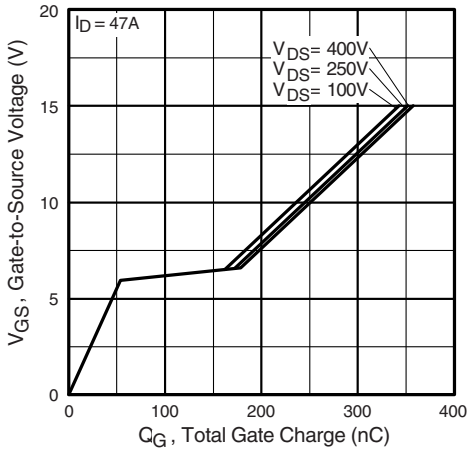


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

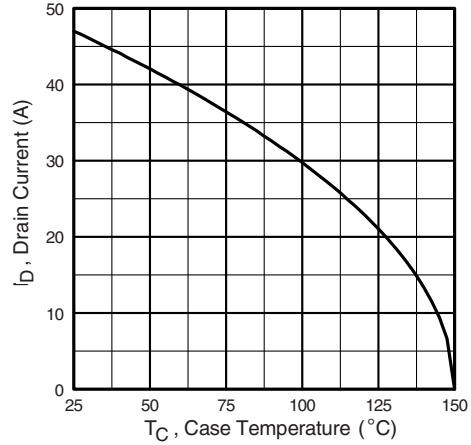


Fig. 9 - Maximum Drain Current vs. Case Temperature

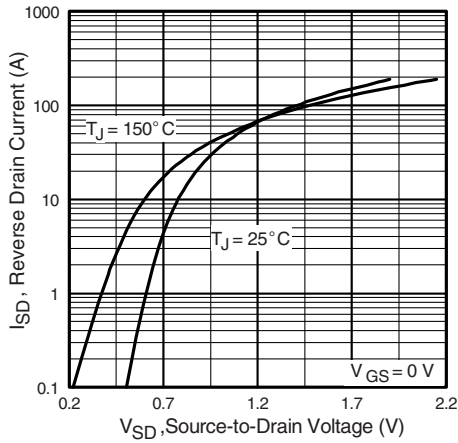


Fig. 8 - Typical Source Drain Diode Forward Voltage

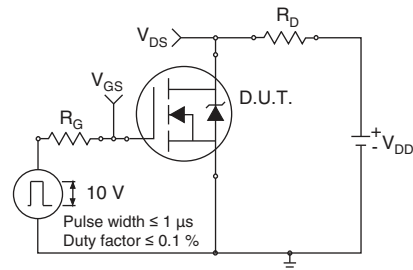


Fig. 10a - Switching Time Test Circuit

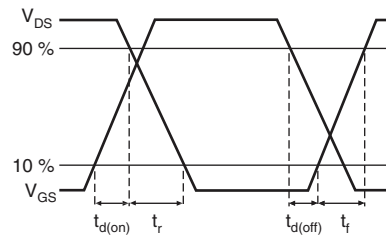


Fig. 10b - Switching Time Waveforms

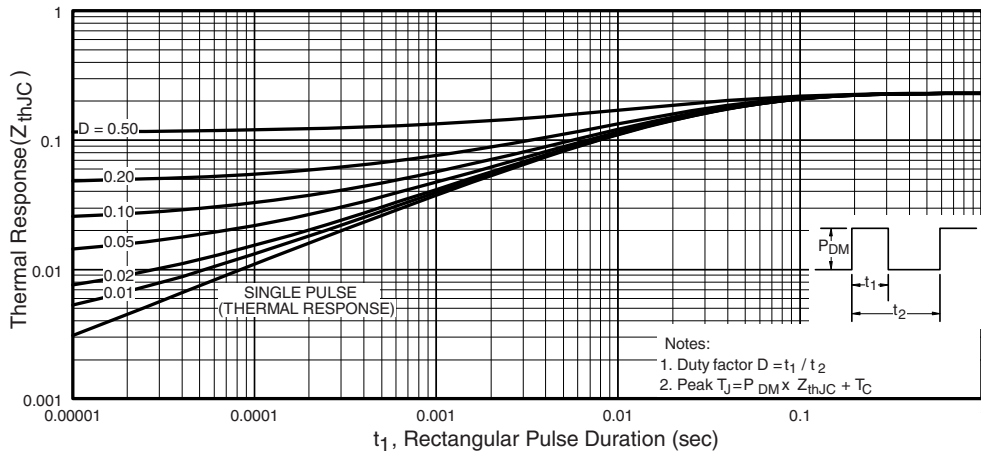


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

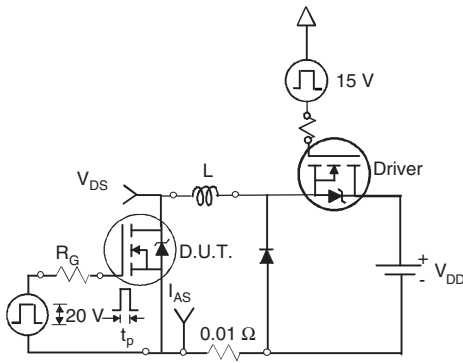


Fig. 12a - Unclamped Inductive Test Circuit

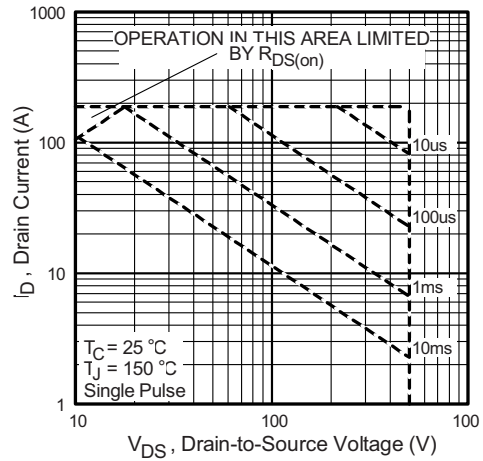


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

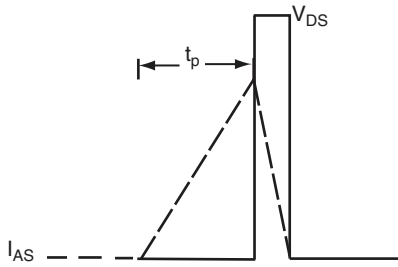


Fig. 12b - Unclamped Inductive Waveforms

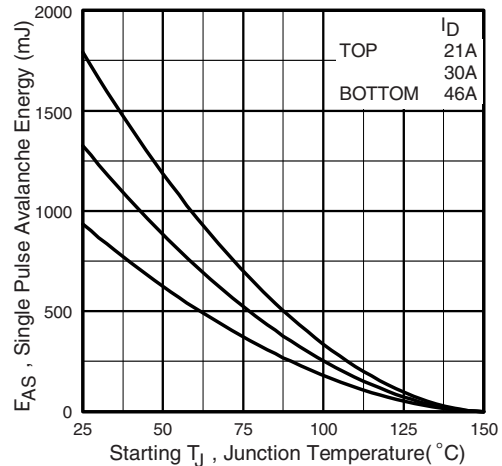


Fig. 12d - Maximum Safe Operating Area

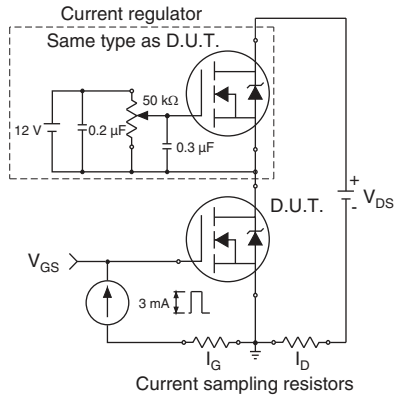


Fig. 13a - Gate Charge Test Circuit

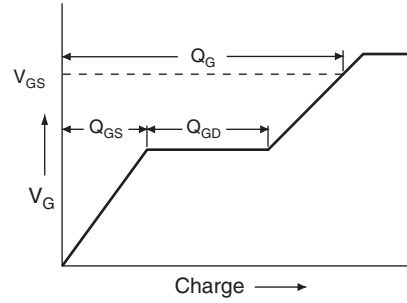
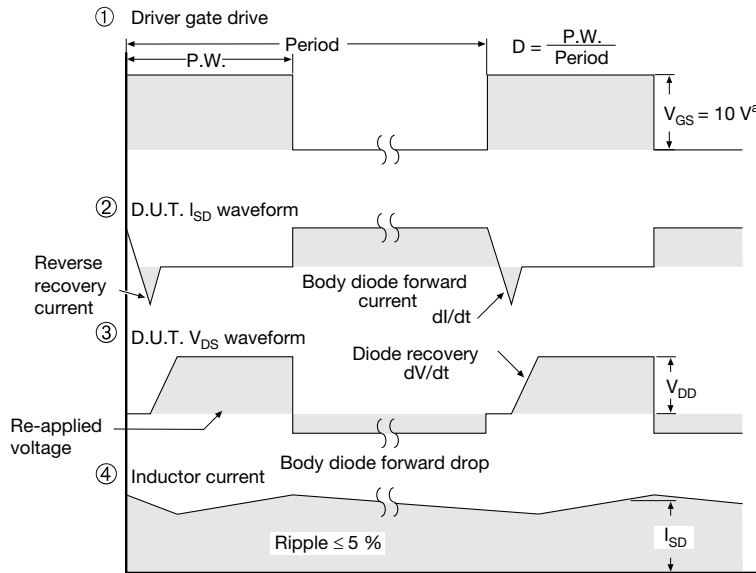
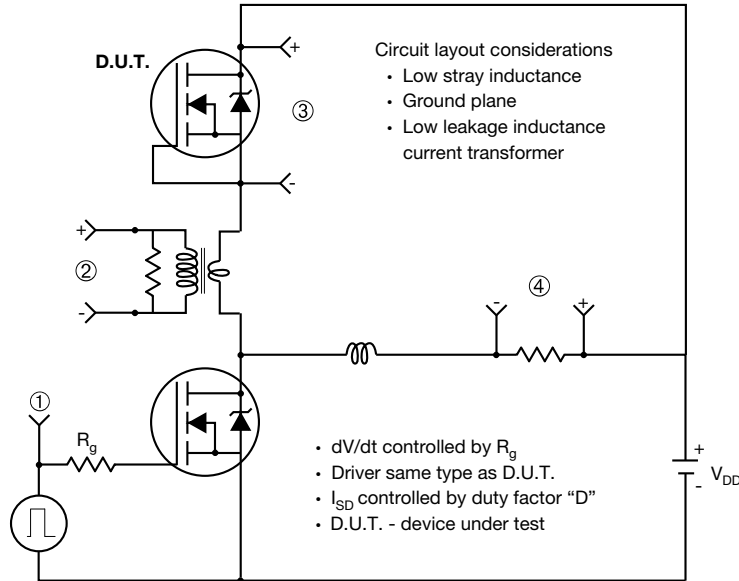


Fig. 13b - Basic Gate Charge Waveform

Peak Diode Recovery dV/dt Test Circuit



Note

a. $V_{GS} = 5 V$ for logic level devices

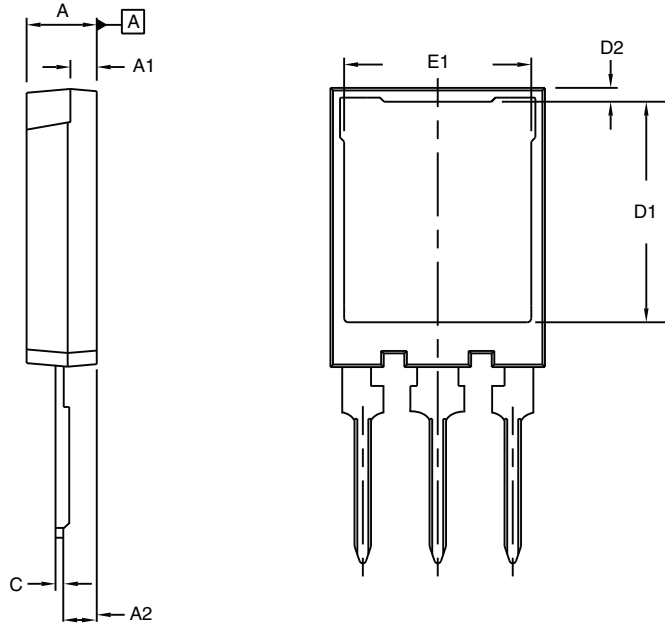
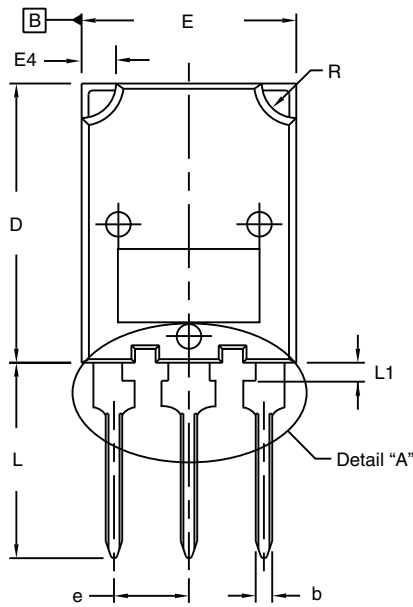
Fig. 14 - For N-Channel

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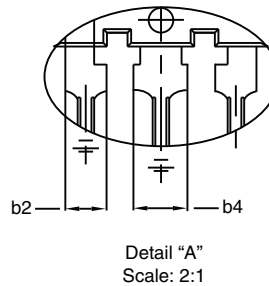


TO-274AA (High Voltage)

VERSION 1: FACILITY CODE = Y



⊕ 0.10 (0.25) ⊖ B A ⊕



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.70	5.30	0.185	0.209
A1	1.50	2.50	0.059	0.098
A2	2.25	2.65	0.089	0.104
b	1.30	1.60	0.051	0.063
b2	1.80	2.20	0.071	0.087
b4	3.00	3.25	0.118	0.128
c ⁽¹⁾	0.38	0.89	0.015	0.035
D	19.80	20.80	0.780	0.819

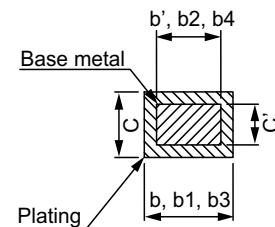
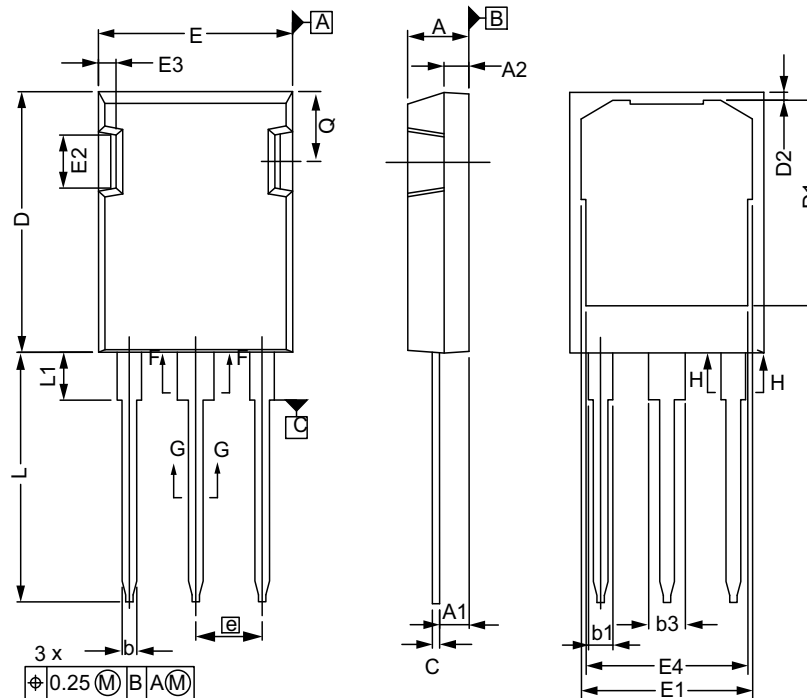
DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D1	15.50	16.10	0.610	0.634
D2	0.70	1.30	0.028	0.051
E	15.10	16.10	0.594	0.634
E1	13.30	13.90	0.524	0.547
e	5.45 BSC		0.215 BSC	
L	13.70	14.70	0.539	0.579
L1	1.00	1.60	0.039	0.063
R	2.00	3.00	0.079	0.118

Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outer extremes of the plastic body
- Outline conforms to JEDEC® outline to TO-274AA
- (1) Dimension measured at tip of lead



VERSION 2: FACILITY CODE = N



SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

DIM.	MILLIMETERS	
	MIN.	MAX.
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	1.91	2.41
b2	1.91	2.16
b3	2.87	3.38
b4	2.87	3.13
c'	0.55	0.65
c	0.55	0.68
D	20.80	21.10

DIM.	MILLIMETERS	
	MIN.	MAX.
D1	16.25	17.65
D2	0.50	0.80
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	5.44 BSC	
N	3	
L	19.81	20.32
L1	3.70	4.00
Q	5.49	6.00

ECN: E20-0538-Rev. C, 19-Oct-2020
DWG: 5975

Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Outline conforms to JEDEC® outline to TO-274AD
- Dimensions are measured in mm, angles are in degree
- Metal surfaces are tin plated, except area of cut



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