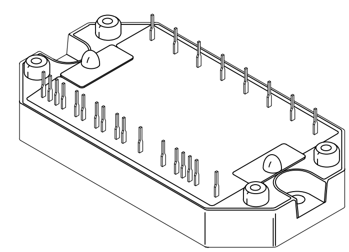
Hybrid Power Module

Integrated Power Stage for 1.0 hp Motor Drives

(This device is not recommended for new designs)
(This device is replaced by MHPM7A5S120DC3)

MHPM7A8A120A

8.0 AMP, 1200 VOLT
HYBRID POWER MODULE



PLASTIC PACKAGE
CASE 440-02, Style 1

This module integrates a 3–phase input rectifier bridge, 3–phase output inverter, brake transistor/diode, current sense resistor and temperature sensor in a single convenient package. The output inverter utilizes advanced insulated gate bipolar transistors (IGBT) matched with free–wheeling diodes to give optimal dynamic performance. It has been configured for use as a three–phase motor drive module or for many other power switching applications. The top connector pins have been designed for easy interfacing to the user's control board.

- DC Bus Current Sense Resistor Included
- Short Circuit Rated 10 µs @ 25°C, 600V
- Temperature Sensor Included
- Pin-to-Baseplate Isolation Exceeds 2500 Vac (rms)
- Convenient Package Outline
- UL Recognized
- Access to Positive and Negative DC Bus
- Visit our website at http://www.mot–sps.com/tsg/

MAXIMUM DEVICE RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
INPUT RECTIFIER BRIDGE			
Peak Repetitive Reverse Voltage (T_J = 125°C)	V_{RRM}	1200	V
Average Output Rectified Current	I_O	8.0	A
Peak Non-repetitive Surge Current (1/2 cycle)(1)	I_{FSM}	200	A
OUTPUT INVERTER			
IGBT Reverse Voltage	V_{CES}	1200	V
Gate-Emitter Voltage	V_{GES}	± 20	V
Continuous IGBT Collector Current	I_{Cmax}	8.0	A
Peak Repetitive IGBT Collector Current(2)	$I_{C(pk)}$	16	A
Continuous Free-Wheeling Diode Current	I_{Fmax}	8.0	A
Peak Repetitive Free-Wheeling Diode Current(2)	$I_{F(pk)}$	16	A
IGBT Power Dissipation per die (T_C = 95°C)	P_D	50	W
Free-Wheeling Diode Power Dissipation per die (T_C = 95°C)	P_D	30	W
Junction Temperature Range	T_J	– 40 to +125	°C
Short Circuit Duration (V_{CE} = 600V, T_J = 25°C)	t_{sc}	10	µs

(1) 1 cycle = 50 or 60 Hz
(2) 1 ms = 1.0% duty cycle

MAXIMUM DEVICE RATINGS (continued) (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
BRAKE CIRCUIT			
IGBT Reverse Voltage	V_{CES}	1200	V
Gate-Emitter Voltage	V_{GES}	± 20	V
Continuous IGBT Collector Current	I_{Cmax}	8.0	A
Peak Repetitive IGBT Collector Current(2)	$I_{C(pk)}$	16	A
IGBT Power Dissipation (T_C = 95°C)	PD	50	W
Peak Repetitive Output Diode Reverse Voltage (T_J = 125°C)	V_{RRM}	1200	V
Continuous Output Diode Current	I_{Fmax}	8.0	A
Peak Output Diode Current(2)	$I_{F(pk)}$	16	A
TOTAL MODULE			
Isolation Voltage (47–63 Hz, 1.0 Minute Duration)	V_{ISO}	2500	Vac
Operating Case Temperature Range	T_C	– 40 to + 90	°C
Storage Temperature Range	T_{stg}	– 40 to +125	°C
Mounting Torque	–	6.0	lb–in

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

Characteristic	Symbol	Min	Typ	Max	Unit
INPUT RECTIFIER BRIDGE					
Reverse Leakage Current (V_{RRM} = 1200 V)	I_R	–	5.0	50	µA
Forward Voltage (I_F = 8.0 A)	V_F	–	0.95	1.5	V
Thermal Resistance (Each Die)	$R_{\theta JC}$	–	–	2.9	°C/W
OUTPUT INVERTER					
Gate-Emitter Leakage Current (V_{CE} = 0 V, V_{GE} = ± 20 V)	I_{GES}	–	–	± 20	µA
Collector-Emitter Leakage Current (V_{CE} = 1200 V, V_{GE} = 0 V) T_J = 25°C T_J = 125°C	I_{CES}	 – –	 6.0 2000	 100	µA
Gate-Emitter Threshold Voltage (V_{CE} = V_{GE}, I_C = 1.0 mA)	$V_{GE(th)}$	4.0	6.0	8.0	V
Collector-Emitter Breakdown Voltage (I_C = 10 mA, V_{GE} = 0)	$V_{(BR)CES}$	1200	–	–	V
Collector-Emitter Saturation Voltage (V_{GE} = 15 V, I_C = 8.0 A)	$V_{CE(SAT)}$	–	2.5	3.5	V
Input Capacitance (V_{GE} = 0 V, V_{CE} = 25 V, f = 1.0 MHz)	C_{ies}	–	930	–	pF
Input Gate Charge (V_{CE} = 600 V, I_C = 8.0 A, V_{GE} = 15 V)	Q_T	–	35	–	nC
Fall Time – Inductive Load (V_{CE} = 600 V, I_C = 8.0 A, V_{GE} = 15 V, $R_{G(off)}$ = 20 Ω)	t_f	–	290	500	ns
Turn-On Energy (V_{CE} = 600 V, I_C = 8.0 A, V_{GE} = 15 V, $R_{G(on)}$ = 270 Ω)	E_{on}	–	–	1.5	mJ
Turn-Off Energy (V_{CE} = 600 V, I_C = 8.0 A, V_{GE} = 15 V, $R_{G(off)}$ = 20 Ω)	E_{off}	–	–	1.0	mJ
Free Wheeling Diode Forward Voltage (I_F = 8.0 A, V_{GE} = 0 V)	V_F	–	1.8	2.2	V
Free Wheeling Diode Reverse Recovery Time (I_F = 8.0 A, V = 600 V, di/dt = 100 A/µs)	t_{rr}	–	130	200	ns
Free Wheeling Diode Stored Charge (I_F = 8.0 A, V = 600 V, di/dt = 100 A/µs)	Q_{rr}	–	–	900	nC
Thermal Resistance – IGBT (Each Die)	$R_{\theta JC}$	–	–	2.2	°C/W
Thermal Resistance – Free-Wheeling Diode (Each Die)	$R_{\theta JC}$	–	–	3.7	°C/W

(2) 1.0 ms = 1.0% duty cycle

ELECTRICAL CHARACTERISTICS (continued) (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
BRAKE CIRCUIT					
Gate-Emitter Leakage Current (V_{CE} = 0 V, V_{GE} = ± 20 V)	I_{GES}	–	–	± 20	µA
Collector-Emitter Leakage Current (V_{CE} = 1200 V, V_{GE} = 0 V) T_J = 25°C T_J = 125°C	I_{CES}	– –	6.0 2000	100	µA
Gate-Emitter Threshold Voltage (V_{CE} = V_{GE}, I_C = 1.0 mA)	$V_{GE(th)}$	4.0	6.0	8.0	V
Collector-Emitter Breakdown Voltage (I_C = 10 mA, V_{GE} = 0)	$V_{(BR)CES}$	1200	–	–	V
Collector-Emitter Saturation Voltage (V_{GE} = 15 V, I_C = 8.0 A)	$V_{CE(SAT)}$	–	2.5	3.5	V
Input Capacitance (V_{GE} = 0 V, V_{CE} = 10 V, f = 1.0 MHz)	C_{ies}	–	930	–	pF
Input Gate Charge (V_{CE} = 600 V, I_C = 8.0 A, V_{GE} = 15 V)	Q_T	–	35	–	nC
Fall Time – Inductive Load (V_{CE} = 600 V, I_C = 8.0 A, V_{GE} = 15 V, $R_{G(off)}$ = 20 Ω)	t_f	–	290	500	ns
Turn-On Energy (V_{CE} = 600 V, I_C = 8.0 A, V_{GE} = 15 V, $R_{G(on)}$ = 270 Ω)	E_{on}	–	–	1.5	mJ
Turn-Off Energy (V_{CE} = 600 V, I_C = 8.0 A, V_{GE} = 15 V, $R_{G(off)}$ = 20 Ω)	E_{off}	–	–	1.0	mJ
Output Diode Forward Voltage (I_F = 8.0 A)	V_F	–	1.8	2.2	V
Output Diode Reverse Leakage Current	I_R	–	–	50	µA
Thermal Resistance – IGBT	$R_{\theta JC}$	–	–	2.2	°C/W
Thermal Resistance – Output Diode	$R_{\theta JC}$	–	–	3.7	°C/W
SENSE RESISTOR					
Resistance	R_{sense}	–	10	–	mΩ
Resistance Tolerance	R_{tol}	–1.0	–	+1.0	%
TEMPERATURE SENSE DIODE					
Forward Voltage (@ I_F = 1.0 mA)	V_F	–	0.660	–	V
Forward Voltage Temperature Coefficient (@ I_F = 1.0 mA)	TC_{VF}	–	–1.95	–	mV/°C

Typical Characteristics

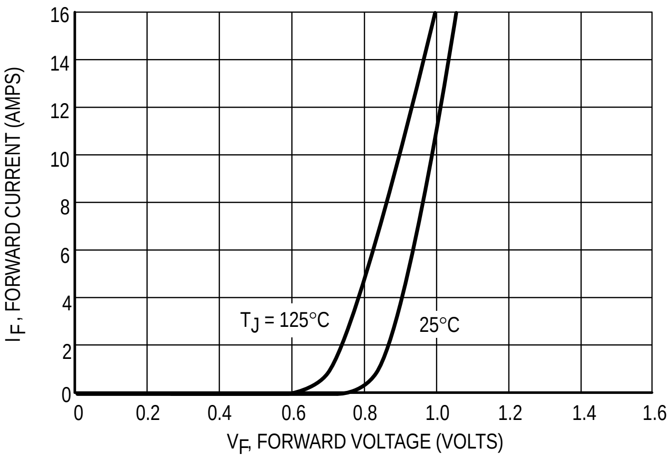


Figure 1. Forward Characteristics – Input Rectifier

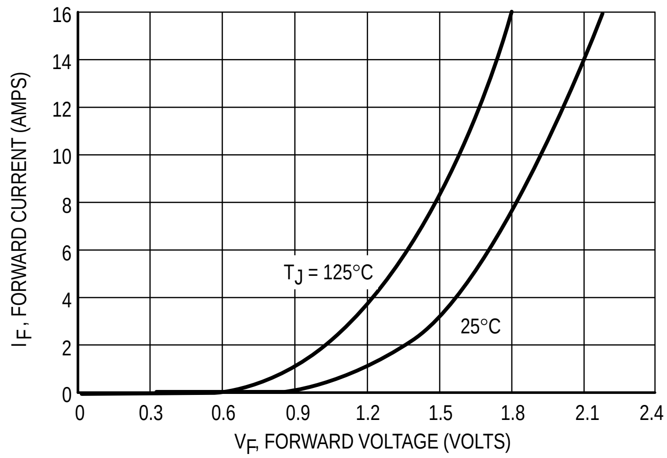


Figure 2. Forward Characteristics – Free–Wheeling Diode

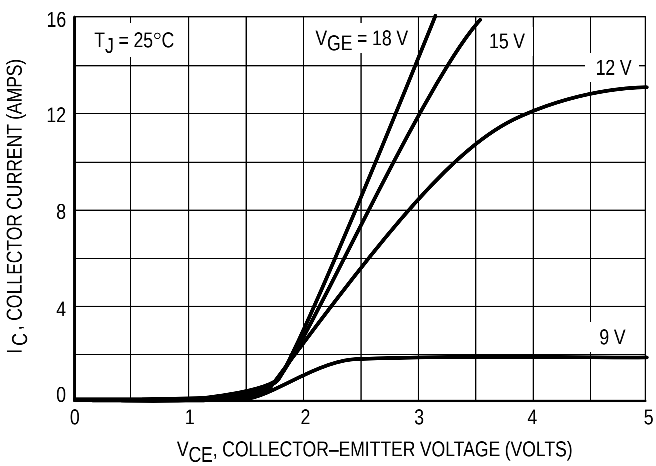


Figure 3. Forward Characteristcs, T_J = 25°C

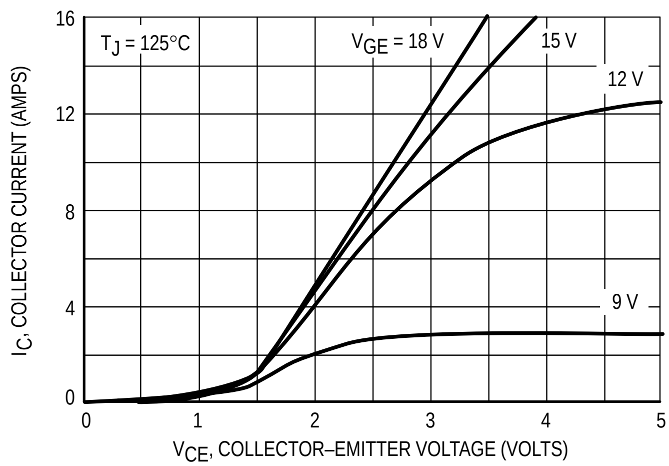


Figure 4. Forward Characteristcs, T_J = 125°C

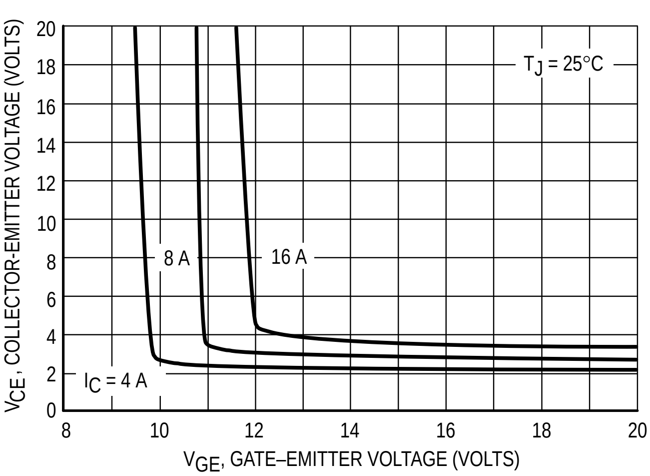


Figure 5. Collector–Emitter Voltage versus Gate–Emitter Voltage

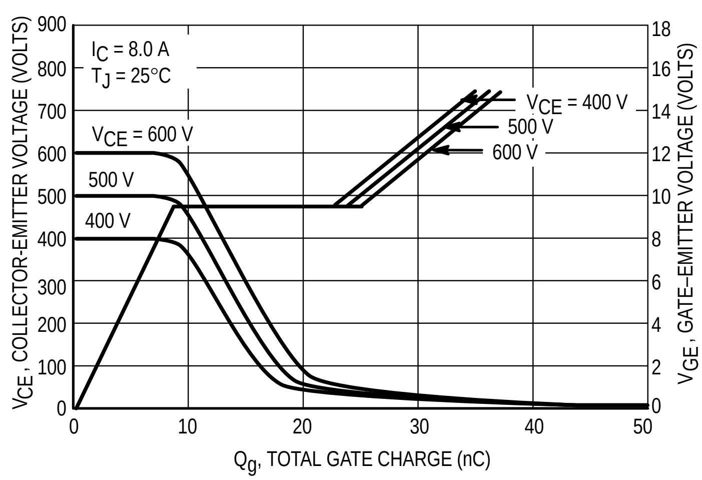


Figure 6. Collector–Emitter and Gate–Emitter Voltages versus Total Gate Charge

Typical Characteristics

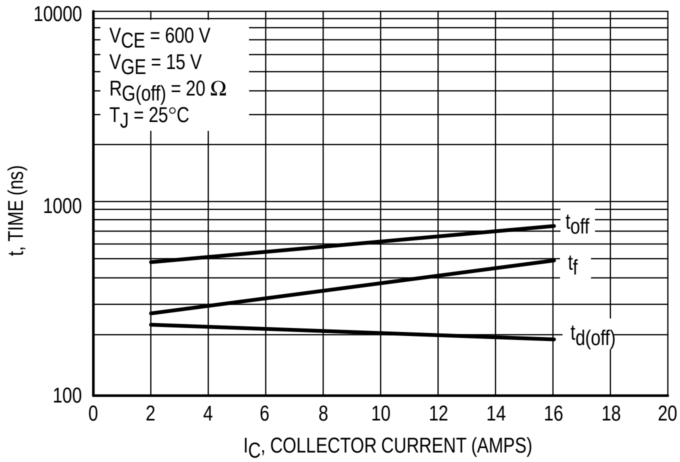


Figure 7. Inductive Switching Times versus Collector Current, T_J = 25°C

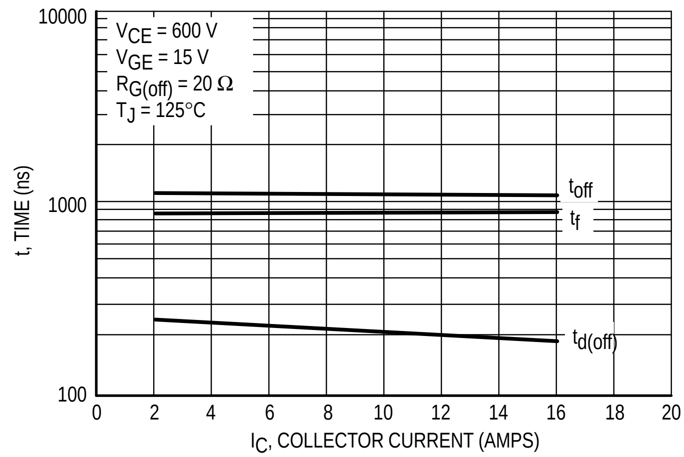


Figure 8. Inductive Switching Times versus Collector Current, T_J = 125°C

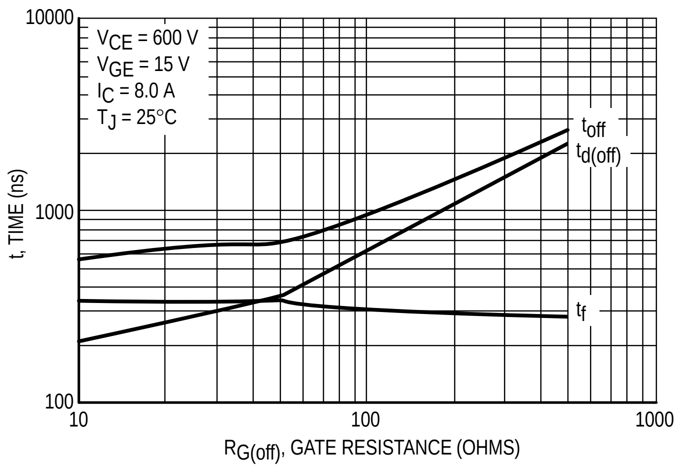


Figure 9. Inductive Switching Times versus Gate Resistance, T_J = 25°C

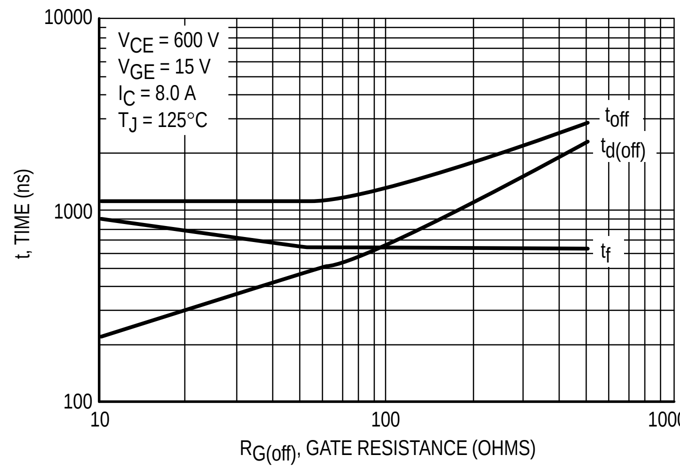


Figure 10. Inductive Switching Times versus Gate Resistance, T_J = 125°C

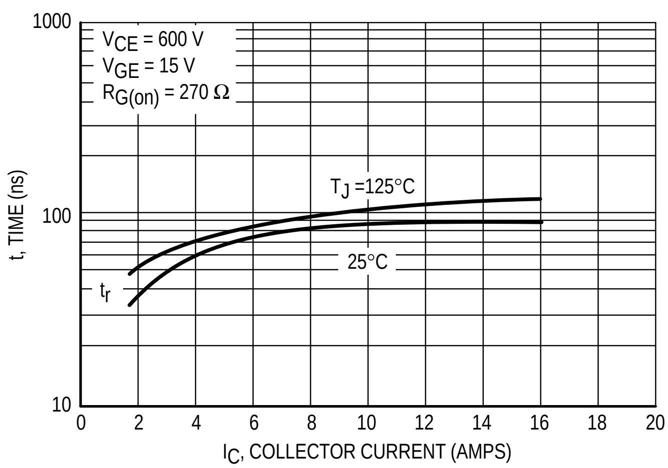


Figure 11. Inductive Switching Times versus Collector Current

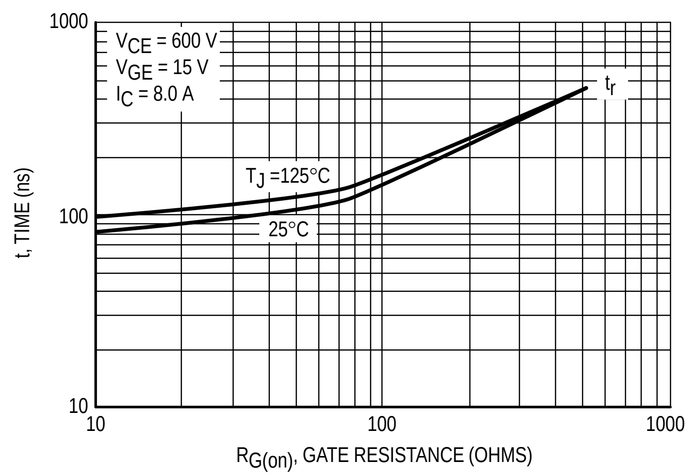


Figure 12. Inductive Switching Times versus Gate Resistance

Typical Characteristics

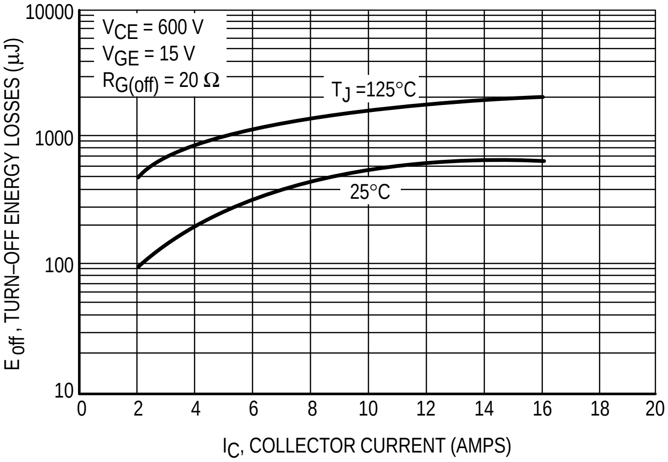


Figure 13. Turn–Off Energy Losses versus Collector Current

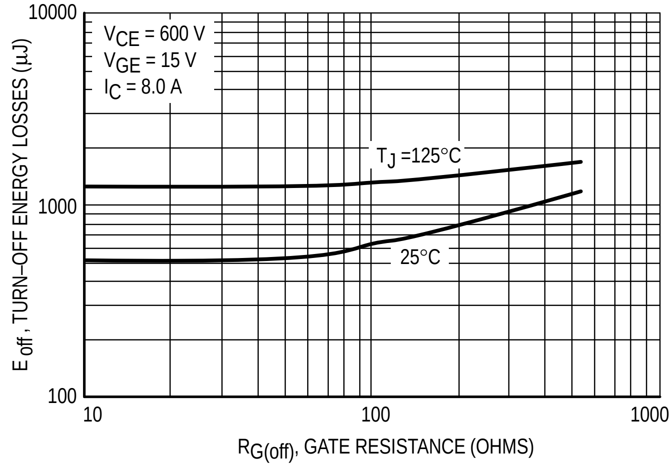


Figure 14. Turn–Off Energy Losses versus Gate Resistance

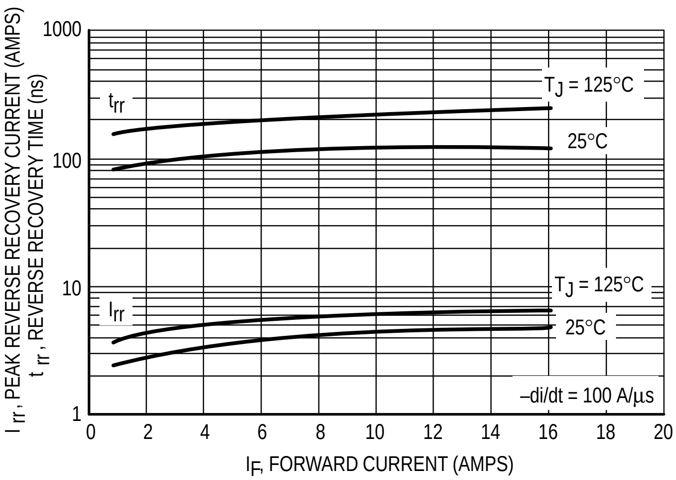


Figure 15. Reverse Recovery Characteristics – Free–Wheeling Diode

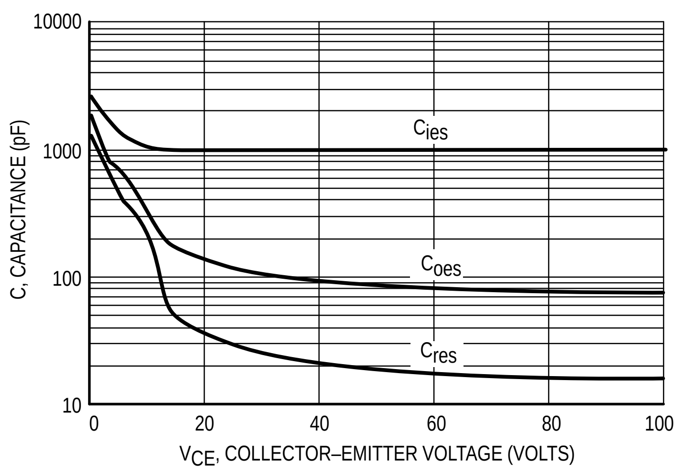


Figure 16. Capacitance Variation

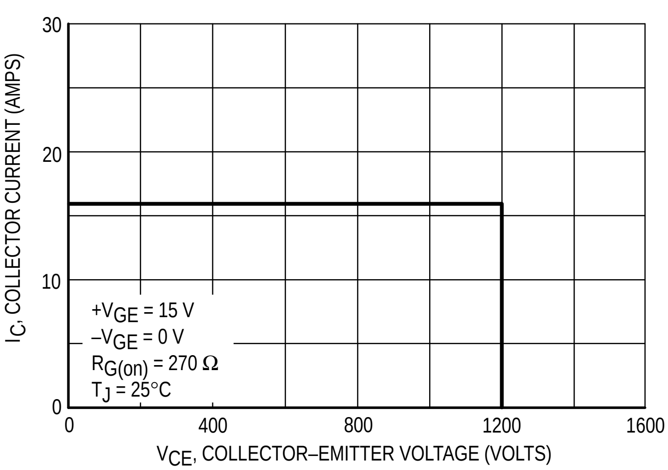


Figure 17. Reversed Biased Safe Operating Area (RBSOA)

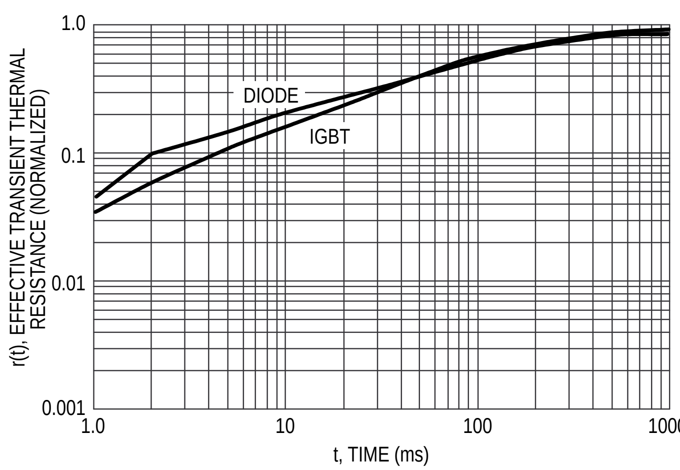


Figure 18. Thermal Response

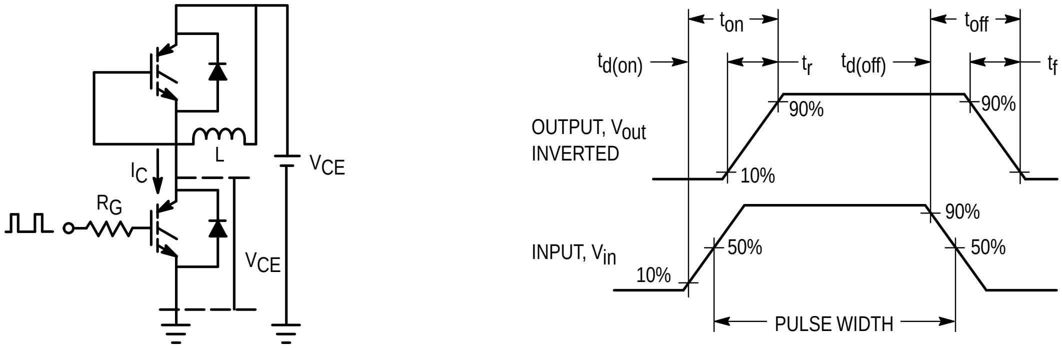


Figure 19. Inductive Switching Time Test Circuit and Timing Chart

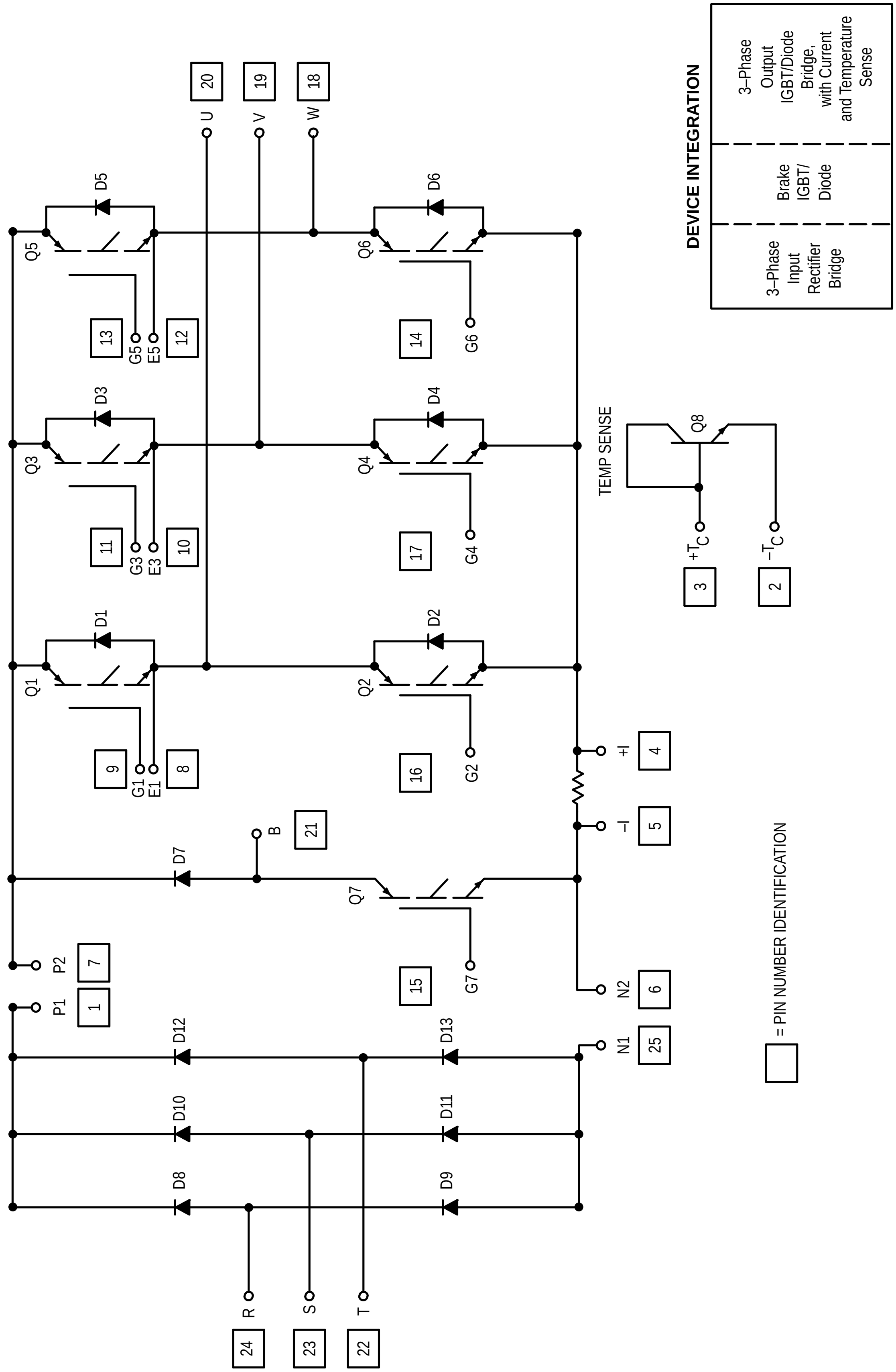
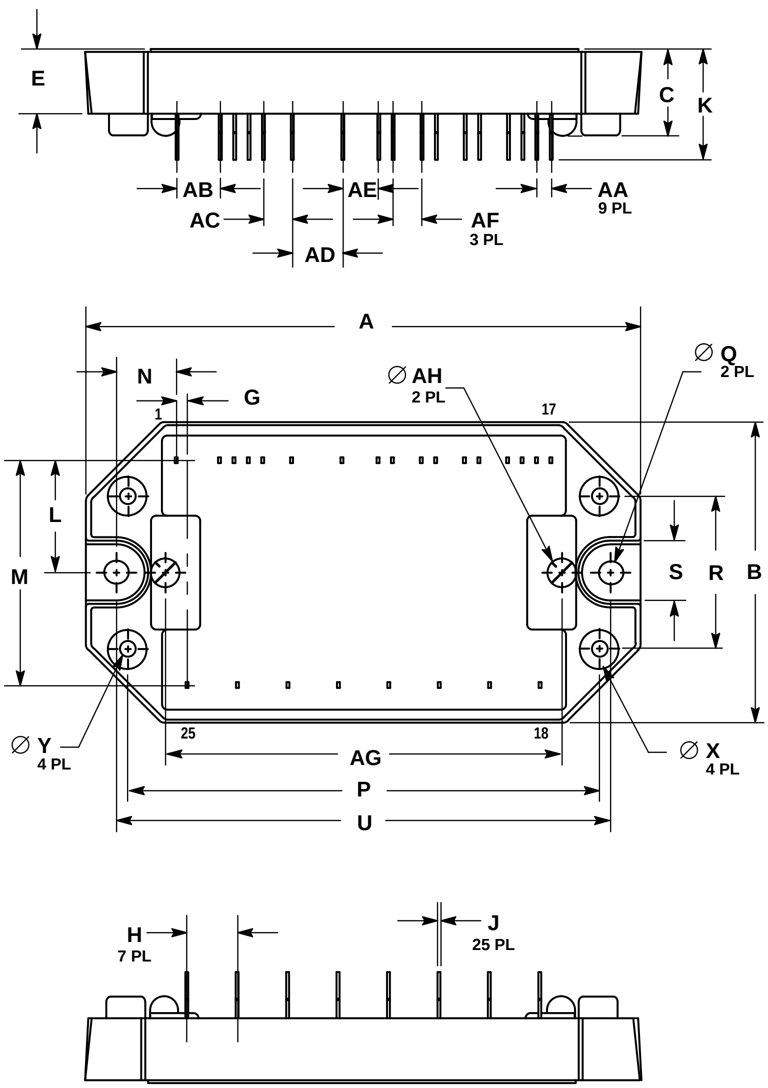
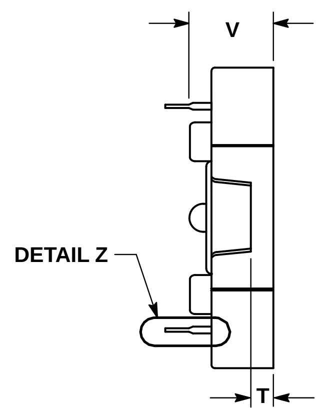
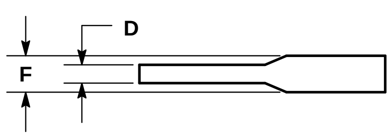


Figure 20. Integrated Power Stage Schematic

PACKAGE DIMENSIONS







DETAIL Z

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. LEAD LOCATION DIMENSIONS (ie: M, G. AA...) ARE TO THE CENTER OF THE LEAD.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	97.54	98.55	3.840	3.880
B	52.45	53.47	2.065	2.105
C	14.60	15.88	0.575	0.625
D	0.43	0.84	0.017	0.033
E	10.80	12.06	0.425	0.475
F	0.94	1.35	0.037	0.053
G	1.60	2.21	0.063	0.087
H	8.58	9.19	0.338	0.362
J	0.30	0.71	0.012	0.028
K	18.80	20.57	0.74	0.81
L	19.30	20.32	0.760	0.800
M	38.99	40.26	1.535	1.585
N	9.78	11.05	0.385	0.435
P	82.55	83.57	3.250	3.290
Q	4.01	4.62	0.158	0.182
R	26.42	27.43	1.040	1.080
S	12.06	12.95	0.475	0.515
T	4.32	5.33	0.170	0.210
U	86.36	87.38	3.400	3.440
V	14.22	15.24	0.560	0.600
X	6.55	7.16	0.258	0.282
Y	2.49	3.10	0.098	0.122
AA	2.24	2.84	0.088	0.112
AB	7.32	7.92	0.288	0.312
AC	4.78	5.38	0.188	0.212
AD	8.58	9.19	0.338	0.362
AE	6.05	6.65	0.238	0.262
AF	4.78	5.38	0.188	0.212
AG	69.34	70.36	2.730	2.770
AH	——	5.08	——	0.200

CASE 440-02
ISSUE A

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